ATTACHMENT NO. 2

TO

AEP:NRC:0514W

FORM N-2493

WHITING CORPORATION
PRODUCTION ENGINEERING DEPT.
HARVEY, ILLINOIS 60426 U.S.A.
AREA CODE 312 331-4000

CUSTOMER AMERICAN ELECTRIC POWER
C.O. NO. C6884 REQN. 79604
DATE 8-21-87 BY MJM
PAGE i R1 OF iii

Rev 1 MJM/ASZ 9-15-87 chkd RGG
(PP 3-7, 3-22, 4-111, A-1, C-3) 1

Attachment No. 2 to AEP:NRC:0514W

CRANE SEISMIC REPORT

CASK HANDLING CRANE
150 TON CAPACITY

EXISTING BRIDGE, S/N 10038

NEW TROLLEY S/N 12124

CUSTOMER: AMERICAN ELECTRIC POWER CORP.
COLUMBUS, OHIO
INDIANA & MICHIGAN ELECTRIC CO.
FOR: DONALD C COOK FACILITY
BRIDGMAN, MICHIGAN
P.O. NO.: C6884
SPECIFICATION: DCC-MH-105-QCN Rev. 0 1
DCCNE-101-QCN Rev. 0

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ABSTRACT

The equipment reviewed in this report is an 'Electric Overhead Crane.' The crane is designed and rated for a capacity load of 150 tons on the main hook.

The crane was analyzed for the resistance to the specified Operational Base Earthquake (OBE) and the specified Safe Shutdown Earthquake (SSE). This was done with a load of 50 tons and no load on the main hook with the trolley at mid-span, quarter span, and end of span.

The crane was mathematically modeled as a multi-degree of freedom system of node points, interconnected by various finite elements. "ANSYS", a large scale general purpose computer program was used to perform a static and a reduced modal analysis. It was found that excitations parallel to the runway (Y direction) would produce slip. This excitation was then proportioned to produce a maximum Y reaction that would not produce slip. Those components not directly analyzed by the computer program were manually analyzed with loadings from the computer program.

It was found that the stresses in the principal structural components did not exceed the allowable stresses with a 50 ton load on the main hook.

TABLE OF CONTENTS

SECTION

ANALYSIS DESCRIPTION

The crane was analyzed to determine the effect of seismic excitations. For this analysis, the matrix displacement method was used based upon finite element techniques. The crane was mathematically modeled as a system of node points interconnected by various finite elements representing straight beams. All masses and inertias were distributed among the nodes whose degrees of freedom characterize the response of the structure. The interconnecting finite elements were assigned stiffnesses equivalent to that of the actual structure.

The mathematical model represents as accurately as possible the flexibility of the bridge girders, hoist rope, and girder end connection. The trolley, the drive units and the bridge trucks were represented as rigid bodies.

The crane was analyzed with the trolley positioned at mid-span quarter span and end of span. This was done with a load of 50 tons in the high and low position. The crane was also analyzed with an unloaded trolley at mid-span, quarter span and end of span.

The dynamic analysis was of the mode frequency (MODAL) type, solving for the resonant frequencies and the mode shapes that characterize the crane. The modes with meaningful participation in a given direction are directly expanded by the computer program to yield the expanded mode shapes, the element stresses and the reaction values. This type of analysis is linear and plastic deformation, sliding, friction, and slack rope are not taken into account.

The amplified response spectra used in the analysis are shown in Appendix 'A'. These include the three orthogonal excitations for the specified earthquakes. Also included in this Appendix are the mode coefficients and natural frequencies for mode shapes considered.

Impact factors for wheel flange to rail contact, etc., have been considered negligible. The state of the art today is such that these impacts cannot rigorously be studied; however, independent time history analyses have been run in many cases, all indicating slow relative motion between the rail and the wheel. This is because of the time dependency of the forcing function coming from the building into the crane. Note that the only coupling through which these forces can be transmitted is dynamic friction. Upon reaching the rail the wheel will first rise through the corner radius and then contact the rail. During this period, the structure is starting to deflect as the end of the crane in this direction is flexible.

The computer analysis was performed using ANSYS, a large scale finite element program.

FORM N-2494

WHITING REQN. 79604 DATE 6-11-87
BY MJM PAGE 1-4 OF 4

TABLE 1-1

MODE COEFFICIENT SIGNIFICANCE

CASES	TROLLEY	EXCITATION DIRECTION		
		X	Y	Z
LOADED	MID	.005	.0005	.0005
	1/4	.005	.001	.001
	END	.005	.002	.002
NO LOAD	MID	.005	.0005	.001
	1/4	.005	.001	.002
	END	.005	.002	.004

SUMMARY OF RESULTS

The crane was mathematically modeled using finite elements. On the basis of preliminary runs, the number of degrees of freedom and the significance criteria for modal expansion were adjusted. Static and three load step reduced modal runs were made and the results summed. Because slip occurs, the y excitation was proportioned and these results summed again.

The crane was analyzed with the new trolley at mid-span, quarter span and end of span. For these positions the analysis was done with a 50 ton load on the main hook and with no load.

Tables 2-1 and 2-2 summarize the maximum stresses in the members from the finite element model. Tables 2-3 and 2-4 summarize the maximum stresses from the manual calculations using the loadings from the finite element model. All stresses are within the allowables required by the job specification with a 50 ton load. Table 2-5 summarizes the buckling stability of the girder web which is also within the allowables required by the job specification.

Table 2-6 summarizes the rope load from the finite element model. Because of the seismic acceleration a slack rope condition was found to exist under certain conditions. This cannot be truly simulated with a linear modal analysis. However our experience with time history analyses shows that a modal analysis tends to produce conservative results. The rope load predicted by the modal analysis is well below the allowable rope load.

Table 2-7 summarizes the maximum crane bridge wheel loads. When the excess dynamic rope load (that which produces a slack rope) is deducted, a small upkick is produced by the loading conditions examined. When the wheel loads parallel to the runway are compared with the vertical wheel load times the coefficient of friction, it is found that the crane bridge will tend to slide under certain loading conditions examined. This sliding is oscillatory in nature and the loadings predicted by a modal analysis are conservative. The reported wheel loads have been adjusted to account for frictional effects.

Although some non-linearities are produced by the specified excitations the specified linear analysis will conservatively predict the behavior of the crane during a seismic excitation.

Additional information on the response of the crane may be found in Appendix 'A'.

The crane was found to meet the job specification requirements for a seismic excitation with a 50 ton load on the main hook.

TABLE 2-1 OBE
SUMMARY OF MAXIMUM STRESS
FROM COMPUTER OUTPUT

COMPONENT	TROLLEY	LOAD	ELEMENT	NODE	STRESS KSI	ALLOW KSI	STRESS / ALLOW
GIRDER A	MID	50 DN	28	312	21.8	24.0	.91
GIRDER B	MID	50 DN	52	361	21.5	24.0	.90
END TIE RHE	MID	50 UP	17	154	13.4	24.0	.56
END TIE LHE	END	NO	75	254	13.3	24.0	.55

FOR ADDITIONAL DETAILS SEE TABLES B1 TO B18.

TABLE 2-2 SSE
SUMMARY OF MAXIMUM STRESS
FROM COMPUTER OUTPUT

COMPONENT	TROLLEY	LOAD	ELEMENT	NOTE	STRESS KSI	ALLOW KSI	STRESS / ALLOW
GIRDER A	MID	50 DN	28	312	31.5	32.7	.96
GIRDER B	MID	50 DN	52	361	30.9	32.7	.94
END TIE RHE	MID	50 UP	17	154	20.3	32.7	.62
END TIE LHE	END	NO	75	254	23.6	32.7	.72

FOR ADDITIONAL DETAILS SEE TABLES B1 TO B18.

TABLE 2-3 OBE

SUMMARY OF MAXIMUM STRESS FROM SUPPLEMENTARY CALCULATION (FOR ADDITIONAL DETAILS SEE REFERENCED PAGES)

COMPONENT	DETAIL	PAGE	STRESS (KSI)	ALLOW. (KSI)	STRESS / ALLOW.
BRIDGE WHEEL	FLANGE SHEAR	4-14	1.3	21.2	0.06
BRIDGE AXLE	SHEAR	4-15	6.8	24.0	0.28
BRIDGE TRUCK SEISMIC					
LUGS: LUG PLATE	SHEAR	4-18	1.1	14.4	0.08
	TENSION	4-19	5.5	24.0	0.23
LUG PIN	SHEAR	4-22	1.5	12.0	0.13
	WELDS	4-24	3.8	20.4	0.19
	BOLTS TENSION	4-26	10.8	61.3	0.18
	BOLTS SHEAR	4-26	6.9	36.8	0.19
BRIDGE TRUCK	TENSION	4-29	11.5	24.0	0.48
	SHEAR	4-29	8.1	14.4	0.56
TRUCK TO GIRDER	BOLTS	4-46	28.1	36.8	0.76
	WELDS	4-61	7.9	20.0	0.40
GIRDER TO END TIE	BOLTS	4-79	28.7	36.8	0.78
	WELDS	4-88	14.0	20.0	0.70
GIRDER	WELDS	4-104	10.5	20.0	0.53
GIRDER END	SHEAR	4-105	10.2	14.4	0.71
	WELDS	4-105	12.0	20.0	0.60

[illegible]

TABLE 2-4 SSE

SUMMARY OF MAXIMUM STRESS FROM SUPPLEMENTARY CALCULATION (FOR ADDITIONAL DETAILS SEE REFERENCED PAGES)

COMPONENT		DETAIL	PAGE	STRESS (KSI)	ALLOW. (KSI)	STRESS / ALLOW.
BRIDGE WHEEL		FLANGE SHEAR	4-14	2.4	28.9	0.08
BRIDGE AXLE		SHEAR	4-15	9.9	32.7	0.30
BRIDGE TRUCK SEISMIC						
LUGS:	LUG PLATE	SHEAR	4-18	2.9	19.6	0.15
	LUG PLATE	TENSION	4-19	15.1	32.7	0.46
	LUG PIN	SHEAR	4-22	4.0	16.4	0.24
		WELDS	4-24	10.5	27.8	0.38
		BOLTS TENSION	4-26	29.7	83.6	0.36
		BOLTS SHEAR	4-26	19.0	50.2	0.38
BRIDGE TRUCK		TENSION	4-33	16.8	32.7	0.51
		SHEAR	4-33	11.8	19.6	0.60
TRUCK TO GIRDER		BOLTS	4-52	46.2	50.2	0.92
		WELDS	4-70	13.2	27.3	0.48
GIRDER TO END TIE		BOLTS	4-84	47.7	50.2	0.95
		WELDS	4-92	23.2	27.3	0.85
GIRDER		WELDS	4-104	15.1	27.3	0.55
GIRDER END		SHEAR	4-105	13.8	19.6	0.70
		WELDS	4-105	16.3	27.3	0.60

TABLE 2-5

SUMMARY OF BUCKLING STABILITY FROM SUPPLEMENTARY CALCULATIONS.

COMPONENT		PAGE	STABILITY FACTOR	ALLOW. FACTOR	STABILITY / ALLOW.
GIRDER WEB	OBE	4-103	0.597	0.667	0.90
	SSE	4-103	0.876	0.909	0.96

FOR ADDITIONAL DETAILS SEE REFERENCED PAGES.

TABLE 2-6

SUMMARY OF MAXIMUM ROPE LOAD

(KIPS)

	TROLLEY	LOAD	STATIC	SUM	DIFFER.
OBE	MID.	DN	120.0	367.3	-127.3
SSE	MID	DN	120.0	583.7	-343.6

FOR ADDITIONAL DETAILS SEE TABLES B61 TO B64

TABLE 2-7

SUMMARY OF MAXIMUM WHEEL LOADS

(KIPS)

		W_X MAX AT 1/4-DN	W_Y MAX AT END-DN	MAX. W_Z		SEISMIC LUG LOAD
				W_A MAX AT END-DN	W_B* AT 1/4-DN	
OBE	DRIVER 101,201	5.88	44.9	179.6	71.2	13.3 AT MID-DN
	IDLER 102,202	5.88	—	138.1	106.0	2.7 AT END-NO
SSE	DRIVER 101,201	11.1	64.2	256.8	97.1	36.6 AT END-DN
	IDLER 102,202	11.1	—	195.2	147.1	15.3 AT END-NO

* W_B IS LOAD ON OTHER WHEEL WHEN W_A IS MAX.

FOR ADDITIONAL DETAILS SEE TABLES 4-4 AND 4-5.

GEOMETRY SECTION

The equipment analyzed in this report is an 'Electric Overhead Crane' which is designed and rated for a capacity load of 150 tons on the main hook. This is based on using the new SFP design trolley (S/N 12124) on the existing bridge (S/N 10038) after recommended field modifications. For this analysis the lifted load is limited to 50 tons and a hook approach of 10'-3-1/4" when loaded.

The mathematical model of the crane with node numbering and global global coordinates is illustrated on pages 3-7 through 3-10.

The boundary conditions tabulated in table 3-1 are selected to provide the most realistic linear approximation to actual conditions in a seismic event as follows:

NODES - 101, 102, 201, 202

UZ: Simulates wheel to rail contact in the vertical direction.

NODES - 101, 201

UY: Simulates the drive brake which is automatically set and which provides stability parallel the runway.

NODES - 101, 102, 201, 202

ROTX: Simulates the differential wheel loads of a fixed bogie truck subject to overturning.

NODE - 124

UX: Simulates wheel to rail contact perpendicular to the runway.

The other restraints of nodes 123 and 124 were selected to simplify the analysis.

Those nodes which are coupled have the same displacement in the indicated directions only. Their displacements in all other directions are independent (released). This coupling is used to simulate load transfer between various components and is tabulated in table 3-2.

BRIDGE TRUCK

NODES - 101-121, 102-122

UX: Simulates the load transfer from the bridge wheels to the runway rail perpendicular the runway.

TROLLEY

NODES - 391-401, 392-402, 393-403, 394-404

UZ: Simulates wheel to rail contact in the vertical direction.

NODES - 393-403, 394-404

UX: Simulates the drive brake which is automatically set and which provides stability parallel the girders.

NODES - 392-402, 393-403

UY: Simulates wheel to rail contact perpendicular to the girders.

The master dynamic degrees of freedom for a reduced modal analysis tabulated in table 3-3 are selected to obtain those modal shapes which characterize the principal vibrations of the structure. Placement is such as to include coupled modal shapes due to eccentricities. Higher degrees of freedom were not included because they will not contribute significantly to the system response. This can be justified by the responses obtained.

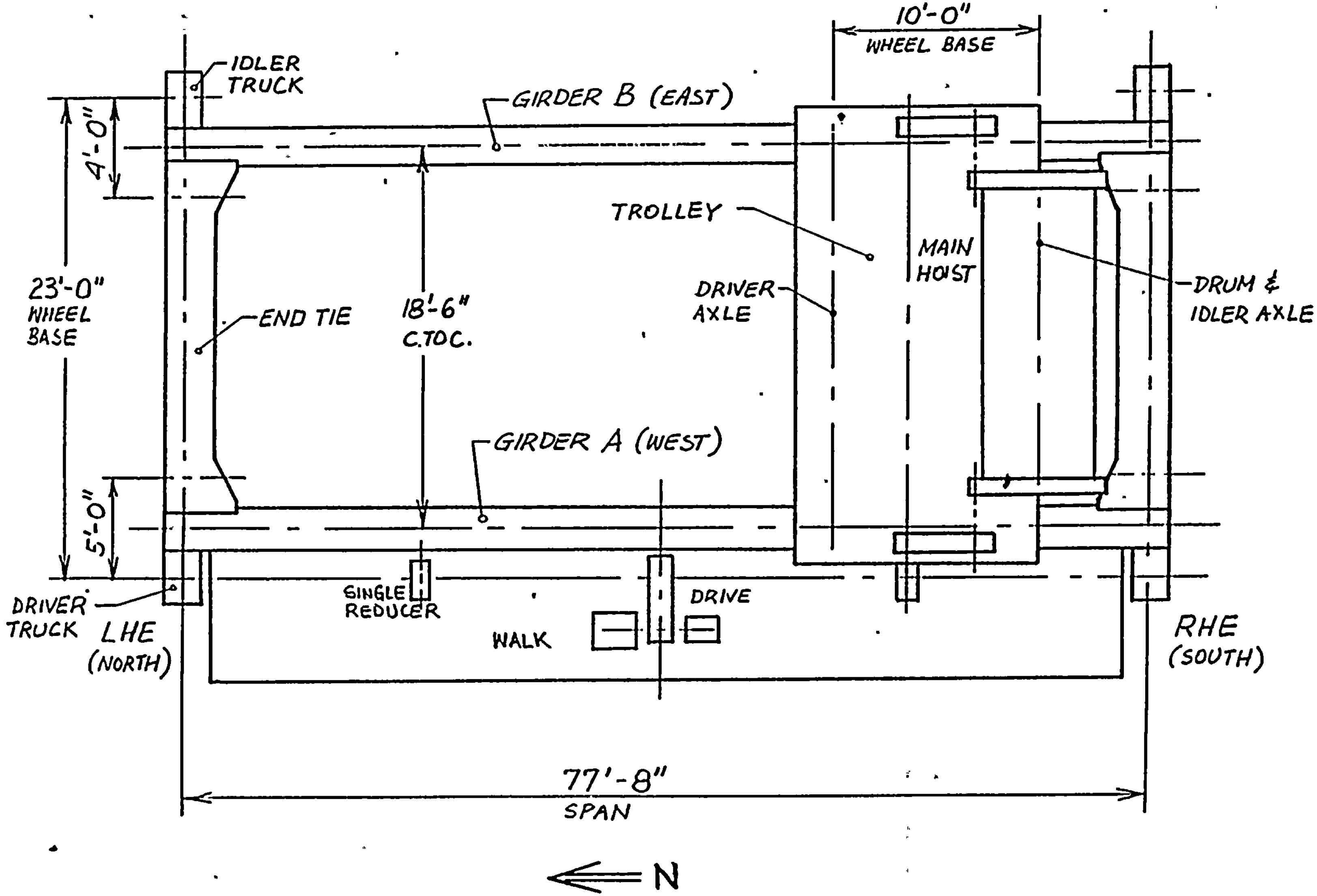
The girders, and the girder end connections are modeled as uniform beams. The rope is modeled as a spar element which is capable of supporting axial loads only. These elements have the properties of the corresponding parts of the actual crane. The trolley, the drive, and certain short connections are modeled as rigid members capable of transmitting loads only. The bridge trucks are simulated with a beam to simplify the wheel load analysis. Lumped masses were assigned to represent the masses of the trolley, the bridge trucks, the drive and the wheels. Additionally the beam members were assigned distributed masses.

The trolley and drives were modeled as rigid members because past experience shows that components of this type are very stiff structures with high natural frequencies in excess of 40 Hz.

The simulation of the restraint of the crane perpendicular to the runway is modeled on only one side consisting of a linear spring and two rigid beams capable of transmitting the load to the bridge wheels. The spring stiffness is selected so that the resulting frequency of the x mode yields an acceleration value from the high frequency region of the response spectrum curve. The resulting loads are distributed to the two runway rails by the 2/3, 1/3 method. The reason for the 2/3, 1/3 distribution is to account for manufacturing tolerances in which case one end of the crane would tend to contact the runway rail before the other end. The other end would however carry a portion of the reaction due to frictional resistance to sliding before flanging of the wheels.

Although certain simplifications are employed in making the linear mathematical model, these simplifications are in accordance with accepted practice. Such simplifications are employed to provide a model solveable with available resources while predicting the seismic response with reasonable accuracy.

CRANE PLAN VIEW

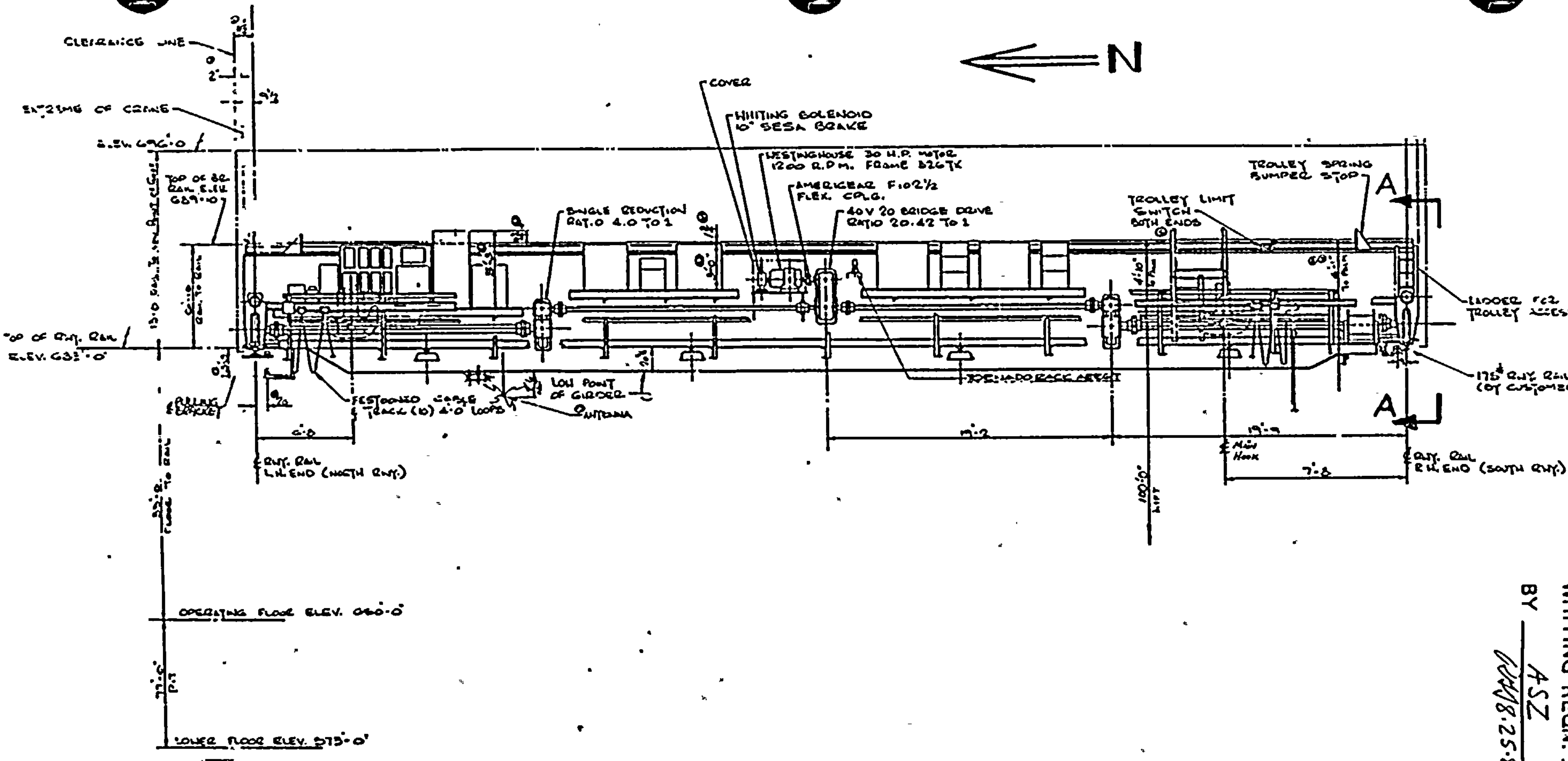


WHITING REQN. 79604 DATE 6-15-87

BY ASZ PAGE 3-4 OF 24

8-25-87

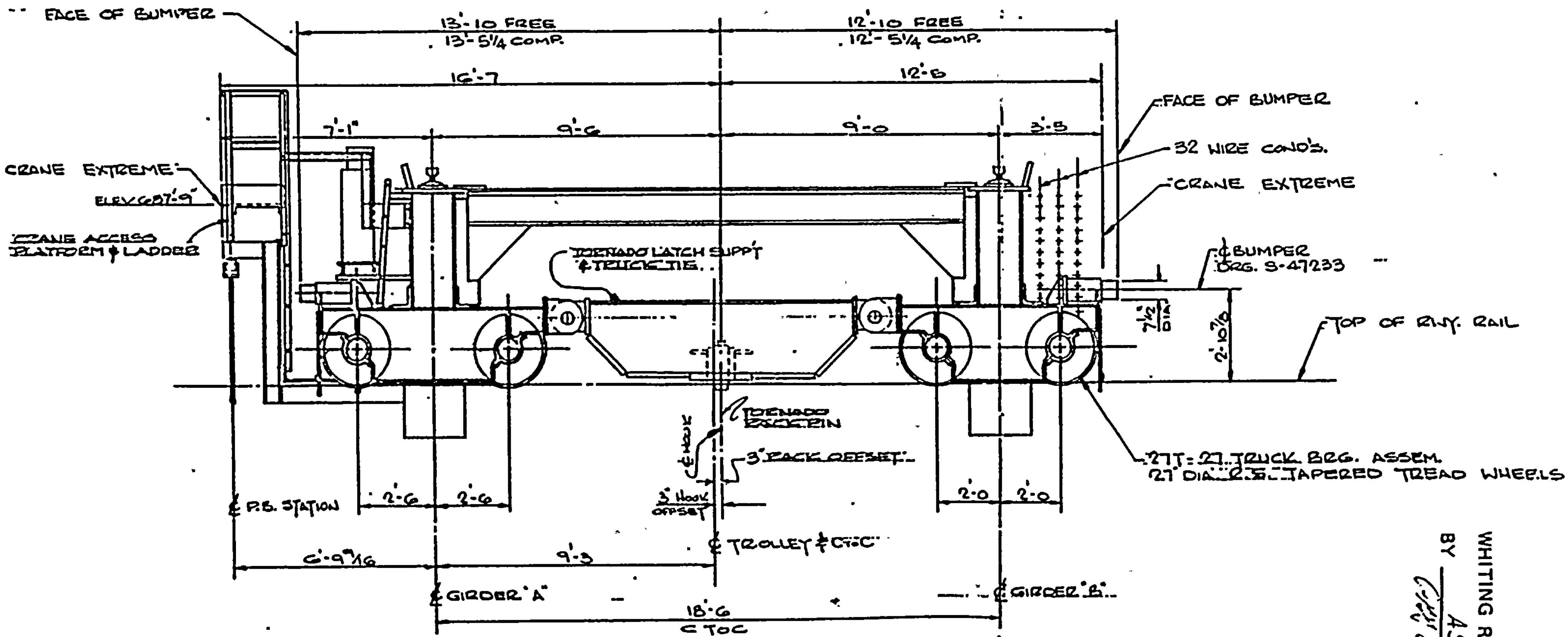
FORM N-2494



GENERAL ARRANGEMENT OF ONE MOTOR BRIDGE
FRONT ELEVATION.

WHITING REQN. 79604 DATE 6-16-87
BY ASZ PAGE 3-5 OF 24
WH/8.25.87

FORM N-2494

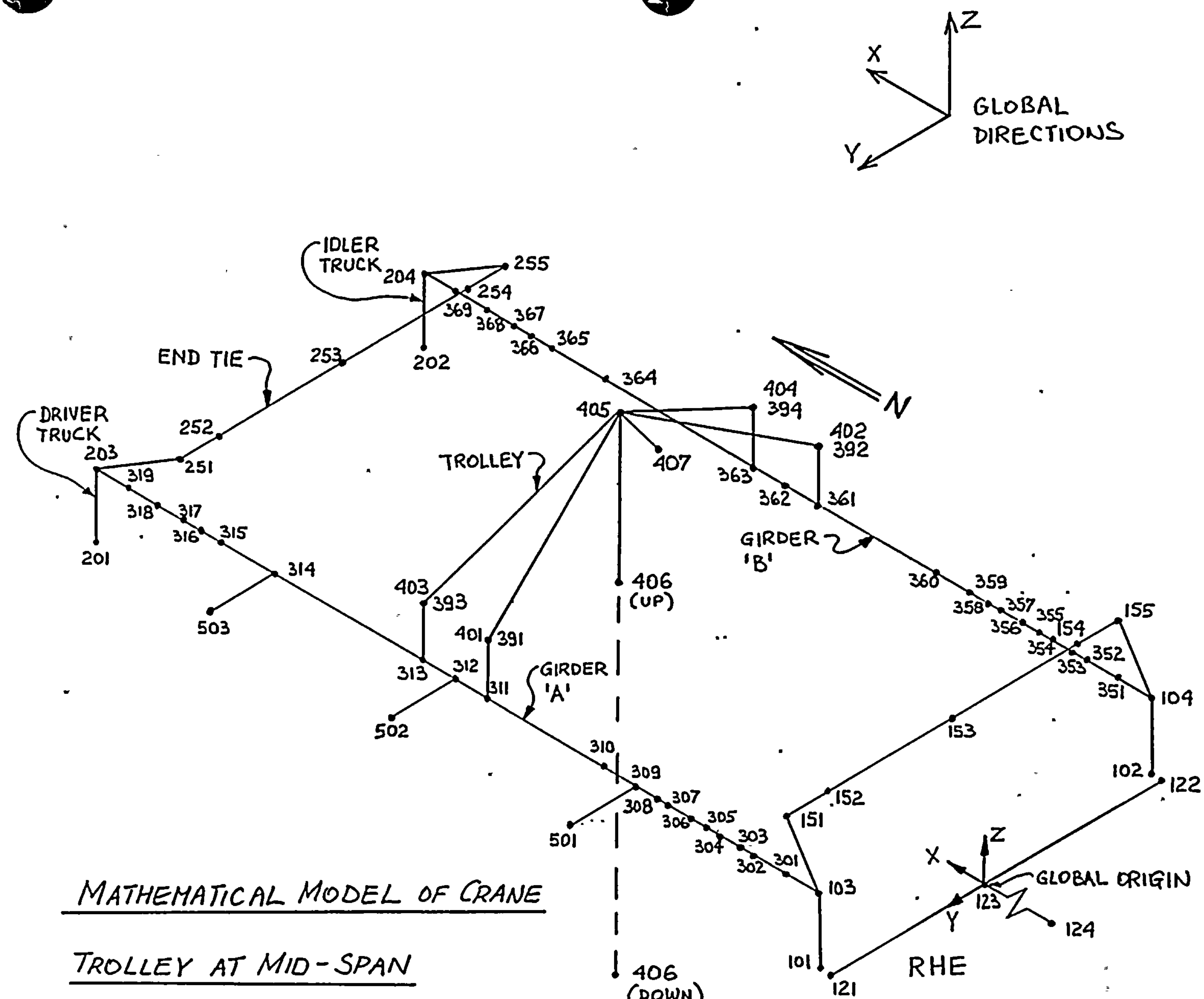


VIEW "A-A"

BRIDGE END ELEVATION

WHITING REQN. 79604 DATE 6-16-87
BY ASZ PAGE 3-6 OF 24

FORM N-2494



MATHEMATICAL MODEL OF CRANE

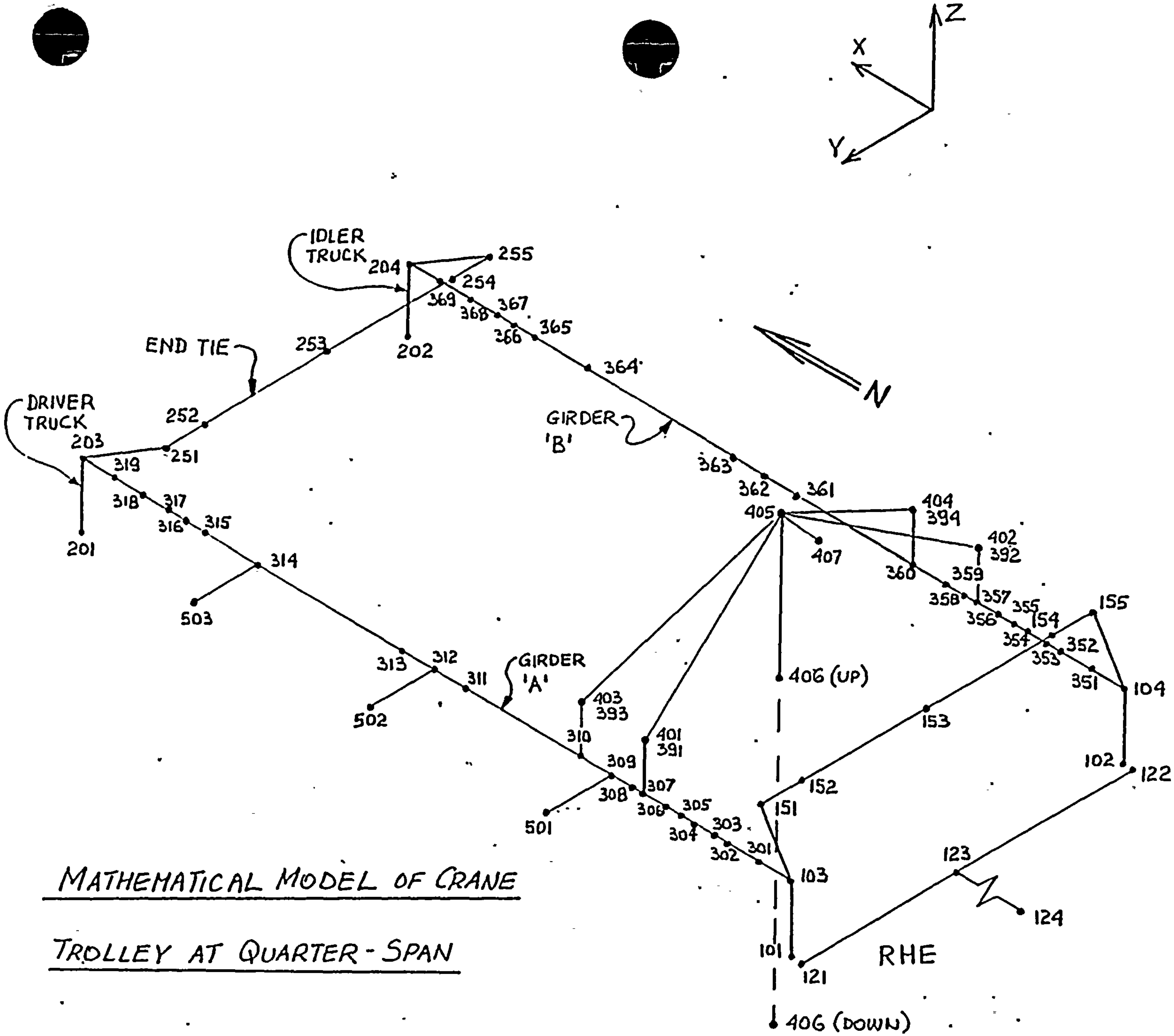
TROLLEY AT MID-SPAN

WHITING REQN. 79604 DATE 6-16-87

BY ASZ 8-25-87 PAGE 3-7R1 OF 24

REV. ASZ 9-14-87 9-14-87

FORM N-2494



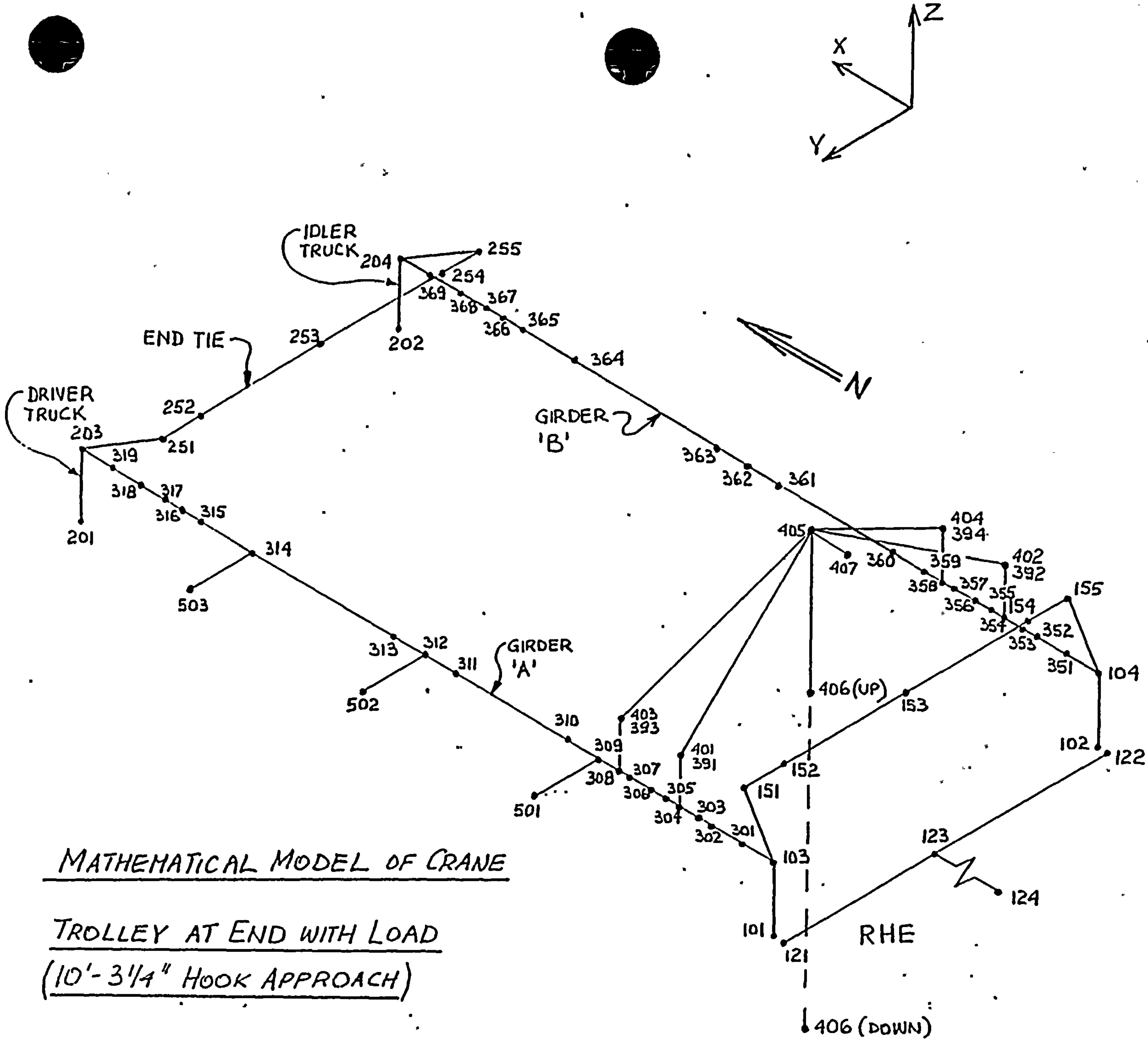
MATHEMATICAL MODEL OF CRANE

TROLLEY AT QUARTER-SPAN

WHITING REQN. 79 604 DATE 6-16-87

BY ASZ PAGE 3-8 OF 24

CWH 8-25-87



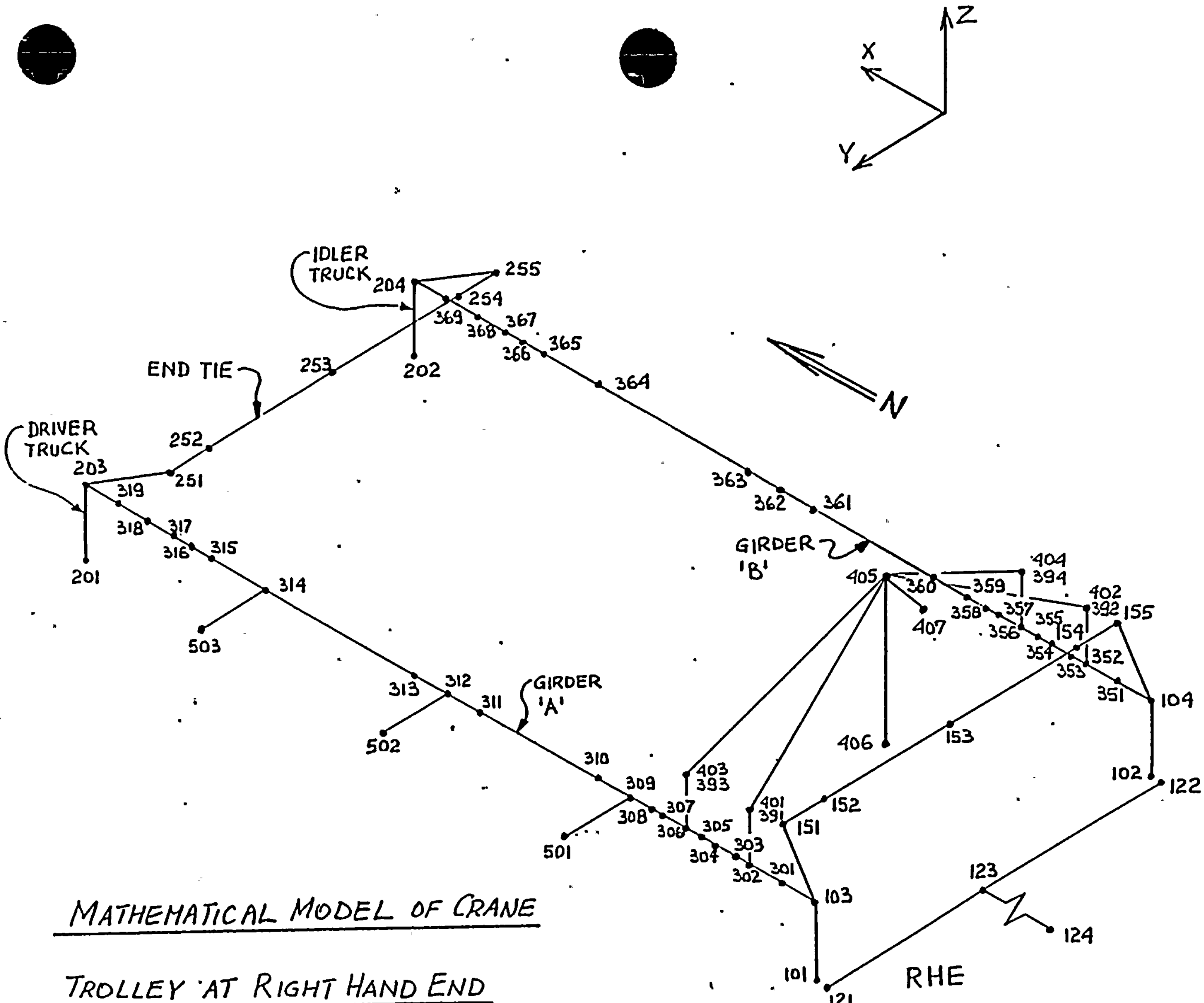
MATHEMATICAL MODEL OF CRANE

TROLLEY AT END WITH LOAD

(10'-3 1/4" HOOK APPROACH)

WHITING REQN. 79604 DATE 6-16-87

BY ASZ PAGE 3-9 OF 24



MATHEMATICAL MODEL OF CRANE

TROLLEY AT RIGHT HAND END

WITHOUT LOAD (7'-8" HOOK APPROACH)

WHITING REQN. 79604 DATE 6-16-87

BY ASZ PAGE 3-10 OF 24

C.W. 8-25-87

TABLE 3-1

BOUNDARY CONDITIONS

NODES WITH ZERO DISPLACEMENT IN THE INDICATED DIRECTIONS

LOCATION	NODE	TRANSLATION			ROTATION		
		UX	UY	UZ	ROT X	ROT Y	ROT Z
BR SPRING	124	X	X	X	X	X	X
BR SPRING	123		X	X	X	X	
TRUCK, O, R	101		X	X	X		
, I R	102			X	X		
TRUCK, O, L	201		X	X	X		
, I, L	202			X	X		

TABLE 3-2

COUPLED NODES

NODES WITH EQUAL DISPLACEMENT IN THE INDICATED DIRECTIONS

LOCATION	NODES		TRANSLATION			ROTATION		
			UX	UY	UZ	ROTX	ROTY	ROTZ
BR SPRING	101	121	X					
	102	122	X					
TROLLEY	401	391			X			
	402	392		X	X			
	403	393	X	X	X			
	404	394	X		X			

FORM N-2494

WHITING REQN. 79604 DATE 6-9-87

BY MJM PAGE 3-12 OF 24

[illegible] 8·25·87

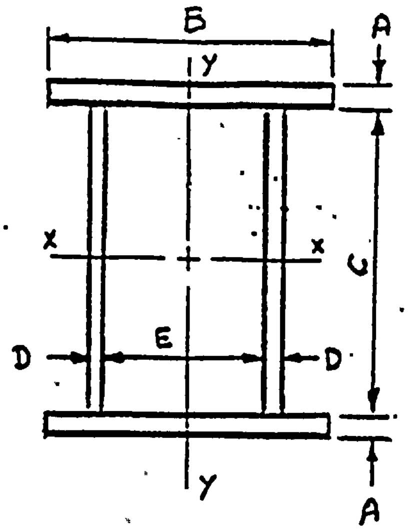
TABLE 3-3

DYNAMIC DEGREES OF FREEDOM

MASTER NODES FOR REDUCED MODAL ANALYSIS
FREE IN INDICATED DIRECTION

LOCATION	NODE	TRANSLATION		
		UX	UY	UZ
GIRDER A	309		×	×
	312	×	×	×
	314		×	×
GIRDER B	359		×	×
	362	×	×	×
	364		×	×
END CONN R	153	×		×
L	253	×		×
TROLLEY	407	×	×	×
LOAD	406			×
DRIVE MACH	501	×		×
	502	×		×
	503	×		×

SYMMETRICAL BOX GIRDER PROPERTIES



PROGRAM 107 PROGRAM ID 1-A-1-09(019)
WHITING REQN 79604 DATE 6-8-87
BY MJM PAGE 3-13 OF 24
OWN 8·25·87
ORIGINAL GIRDER

....
107.
....

		READ	ENTER
1.2500	--------	1	A 1.25
21.0000	--------	2	B 21.
93.0000	--------	3	C 93.
0.3125	--------	4	D .3125
17.0000	--------	5	E 17.

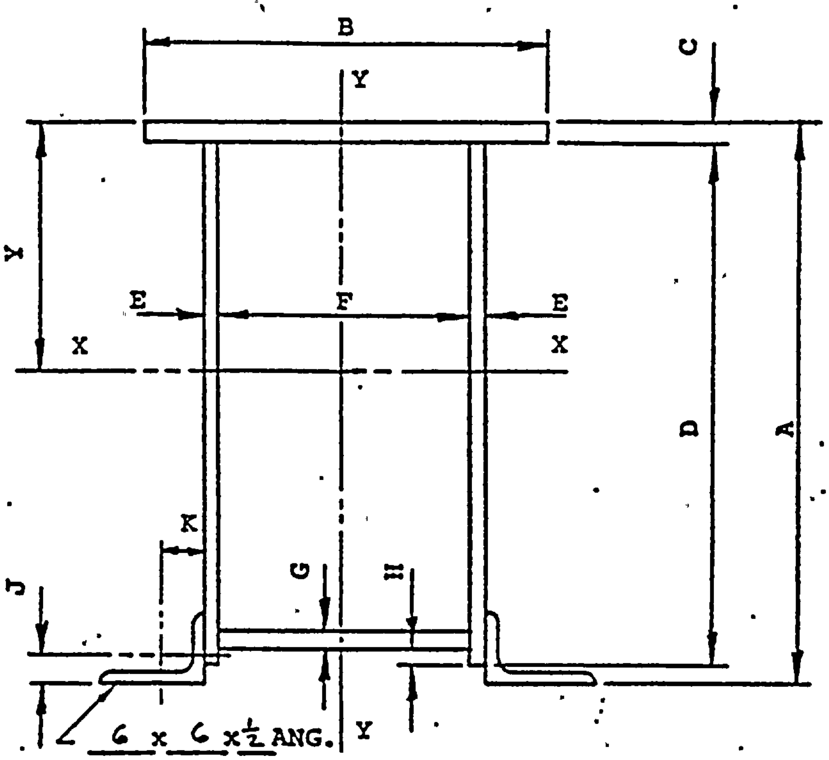
....

158,490.6250	--------	Ixx
3,319.1753	--------	Sxx
6,285.1928	--------	Iyy
598.5897	--------	Syy
110.6250	--------	AREA
16,880.3619	--------	TORSIONAL CONSTANT (K)

....

GIRDER END SECTION PROPERTIES SECTION "cc"

PROGRAM 117 PROGRAM ID 1-A-2-06 (046)
WHITING REQN 79604 DATE 6-8-87
BY MJM PAGE 3-14 OF 24
WO 82587 ORIGINAL GIRDER



$A = 1.25(17) + 1.25(21) + 2(.3125)(70.5) + 2(5.75) = 103.1 \text{ in}^2$

117.

GIVEN DATA

1.	72.25	= DIMENSION A (IN.)	72.2500
2.	21.	= DIMENSION B (IN.)	21.0000
3.	1.25	= DIMENSION C (IN.)	1.2500
4.	70.5	= DIMENSION D (IN.)	70.5000
5.	.3125	= DIMENSION E (IN.)	0.3125
6.	17.	= DIMENSION F (IN.)	17.0000
7.	1.25	= DIMENSION G (IN.)	1.2500
8.	.5	= DIMENSION H (IN.)	0.5000
9.	1.68	= DIMENSION J (IN.) ($\bar{Y}$ OF ANGLE)	1.6800
10.	1.68	= DIMENSION K (IN.) ($\bar{X}$ OF ANGLE)	1.6800
11.	5.75	= AREA OF ANGLE (IN.^{2})	5.7500
12.	19.9	= MOMENT OF INERTIA OF ANGLE (IN.^{4}) (VERT.)	19.9000
13.	19.9	= MOMENT OF INERTIA OF ANGLE (IN^4) (HORIZ)	19.9000

COMPUTED DATA

I_{y-y} (IN.^{4}) (MOMENT OF INERTIA OF SECTION)	6,084.3136
$\bar{Y}$ (IN.)	38.2003
I_{x-x} (IN.^{4}) (MOMENT OF INERTIA OF SECTION)	84,877.0612

EFFECTIVE TORSIONAL PROPERTIES AT "CC" (REF 4 p 293 TABLE 20 CASE 16)

$$J = \frac{2(.3125)(1.25)(17.3125)^2(70)^2}{71.25(1.25)+17.625(.3125)-1.25^2-.3125^2} = 12350 \text{ in}^4$$

EFFECTIVE PROPERTIES IN TRANSITION (REF 1 pp 4.44.2-4.44.3)

$$A = (110.6 + \sqrt{110.6(103.1)} + 103.1)/3 = 106.8 \text{ in}^2$$

$$I_{xx} = \frac{158500 + \sqrt[4]{(158500)^3(89880)} + \sqrt{(158500)(89880)} + \sqrt[4]{(158500)(89880)^3} + 89880}{5}$$

$$= 121800 \text{ in}^4$$

$$I_{yy} = \frac{6285 + \sqrt[4]{(6285)^3(6084)} + \sqrt{(6285)(6084)} + \sqrt[4]{(6285)(6084)^3} + 6084}{5}$$

$$= 6184 \text{ in}^4$$

$$J = \frac{16880 + \sqrt[4]{(16880)^3(12350)} + \sqrt{(16880)(12350)} + \sqrt[4]{(16880)(12350)^3} + 12350}{5}$$

$$= 14530 \text{ in}^4$$

SECTIONAL PROPERTIES

(BUILT UP OF ROLLED & RECTANGULAR SECTIONS)

PROGRAM 116 PROGRAM ID 1-A-2-5(044)

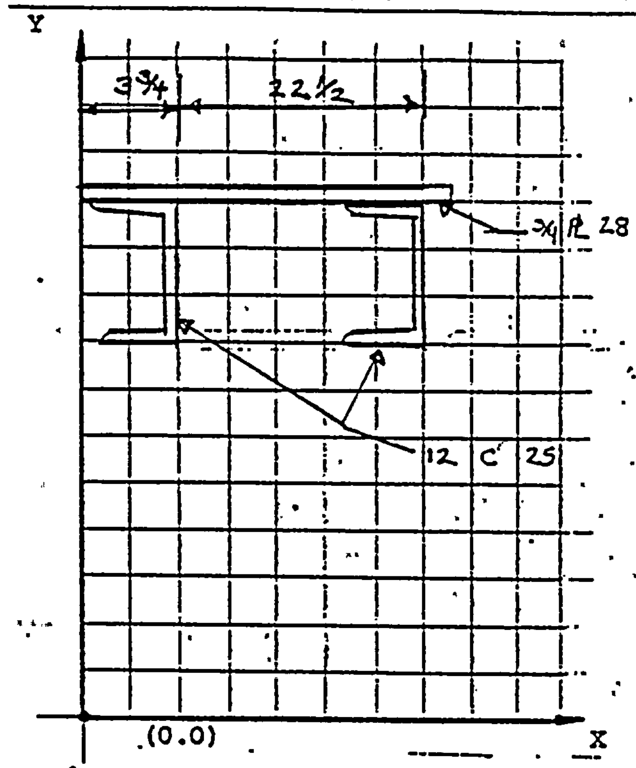
WHITING REQN 79604 DATE 6-8-37

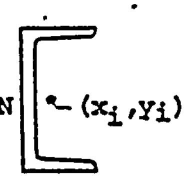
BY MJM PAGE 3-16 OF 24

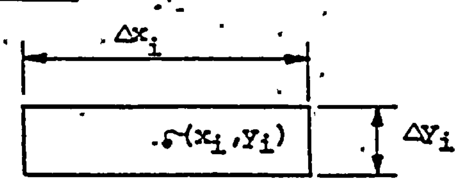
GIRDER END CONNECTION THRU MID

ELEMENT NO. (i)	ELEMENT PROPERTIES/ DIMENSIONS			ELEMENT CENTROID	
ROLLED (i)	A_i	Ix_i	Iy_i	x_i	y_i
1	7.35	144.	4.47	3.076	30.
2	7.35	144.	4.47	25.576	30.
	1000.				

RECT. (1000+i)	Δx_i	Δy_i	x_i	y_i
1003	28.	.75	14.	36.375
	-1			







All rolled sections must be entered before rectangular sections. To enter rectangular sections, end rolled sections with A_i = 1000.

In order to execute program enter a negative value for 'A_i' or 'Δx_i'.

COMPUTED DATA

14•1342	$\bar{x}$	- Distance from the 'y' axis to the centroid of the section.
33•7500	$\bar{y}$	- Distance from the 'x' axis to the centroid of the section.
35•7000	A	- Area of the section.
640•4062	Ix	- Moment of inertia about the section's neutral axis which is parallel to the 'x' axis.
3,242•3277	Iy	- Moment of inertia about the section's neutral axis which is parallel to the 'y' axis.

•••••••••••

SECTIONAL PROPERTIES

(BUILT UP OF ROLLED & RECTANGULAR SECTIONS)

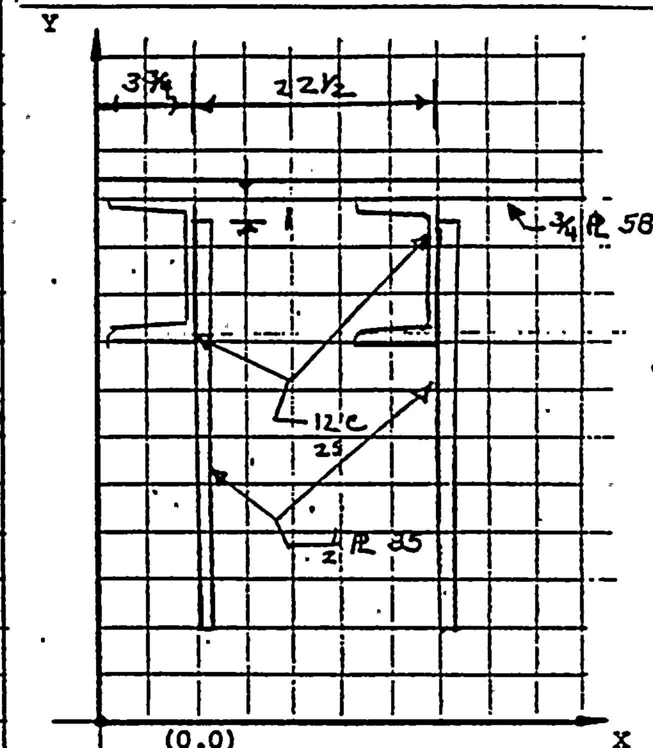
PROGRAM 116 PROGRAM ID 1-A-2-5(044)
WHITING REQN 79604 DATE 6-8-87
BY MJM PAGE 3-17 OF 24

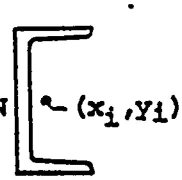
MJM 8-25-87

GIRDER END CONNECTION AT ENDS

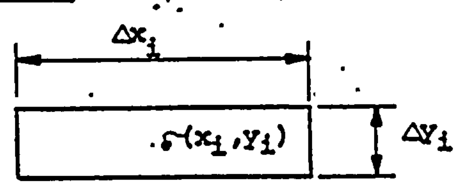
ELEMENT NO. (i) ROLLED (i)	ELEMENT PROPERTIES/ DIMENSIONS			ELEMENT CENTROID	
	A_i	Ix_i	Iy_i	x_i	y_i
1	7.35	144.	4.47	3.076	30.
2	7.35	144.	4.47	25.576	30.
	1000.				

RECT. (1000+i)	Δx_i	Δy_i	x_i	y_i
1003	58	.75	29.	36.375
1004	.5	35.	4.	17.5
1005	.5	35.	26.5	17.5
	-1.			





ROLLED SECTION



RECT. SECTION

All rolled sections must be entered before rectangular sections. To enter rectangular sections, end rolled sections with A_i = 1000.

In order to execute program enter a negative value for 'A_i' or 'Δx_i'.

COMPUTED DATA

21.5219 ______ $\bar{x}$ - Distance from the 'y' axis to the centroid of the section.

28.2812 ______ $\bar{y}$ - Distance from the 'x' axis to the centroid of the section.

93.2000 ______ A - Area of the section.

10,824.2506 ______ Ix - Moment of inertia about the section's neutral axis which is parallel to the 'x' axis.

23,064.8974 ______ Iy - Moment of inertia about the section's neutral axis which is parallel to the 'y' axis.

....

EFFECTIVE PROPERTIES
GIRDER END CONNECTION
AT ENDS

(REF. 1, pp 4.44.2-4.44.3)

$$A = \left(33.75 + \sqrt{33.75(93.20)} + 93.20\right)/3 = 61.01 \ in^2$$

$$I_{xx} = \frac{\left(640.4 + \sqrt[4]{(640.4)^3(10820)} + \sqrt{(640.4)(10820)} + \sqrt[4]{(640.4)(10820)^3} + 10820\right)}{5}$$

$$= 4146 \ in^4$$

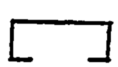
$$I_{yy} = \frac{\left(3242 + \sqrt[4]{(3242)^3(23060)} + \sqrt{(3242)(23060)} + \sqrt[4]{(3242)(23060)^3} + 23060\right)}{5}$$

$$= 10870 \ in^4$$

EFFECTIVE TORSIONAL PROPERTIES

$$J = 2(.541) + 14(.375)^3\left[\frac{16}{3} - 3.36\frac{.375}{14}\left(1 - \frac{.375^4}{12(14)^4}\right)\right]$$

$$= 4.953 \ in^4$$ (REF 4, p 290, TABLE 20, CASE 4)



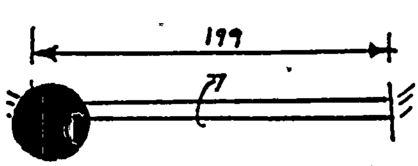
(REF 4, p300, table 21, case 2)

$$e = 12\ \frac{3(22)^2(12) + 6(22)^2(3) - 8(3)^3}{22^3 + 6(22)^2(12) + 6(22)^2(3) + 8(3)^3 - 12(22)(3)^2} = 5.976 \ in$$

$$C_w = .625\left[\frac{(22)^2(12)^2}{2}\left(3 + \frac{12}{3} - 5.976 - \frac{2(5.976)(3)}{12} + \frac{2(3)^2}{22}\right) + \frac{(22)^2(5.976)^2}{2}\left(12 + 3 + \frac{22}{6} - \frac{2(3)^2}{22}\right) + \frac{2(3)^3}{3}(12 + 5.976)^2\right]$$

$$= 75090 \ in^6$$

$$\beta = \left(\frac{4.953\ (11.2\times10^6)}{75090\ (29\times10^6)}\right)^{1/2} = .005047 \ in^{-1}$$

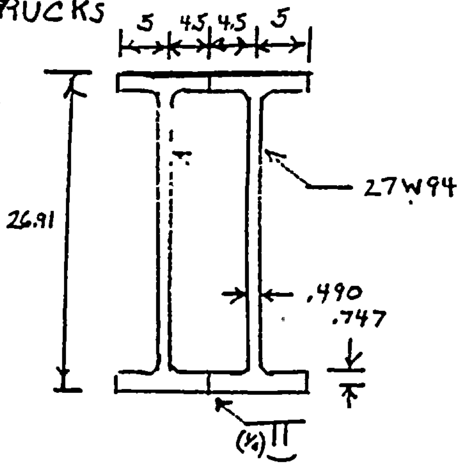


NO TWIST OR WARP AT ENDS
(REF 4, p 298-316)

$$J_{eff} = 4.953\ \frac{\frac{1}{2}(199)(.005047)}{\left[\frac{.005047(199)}{4} - Tanh\left[\frac{.005047(199)}{4}\right]\right]}$$

$$= 483.3 \ in^4$$

TRUCKS



$A = 2(27.7) - 4(.5)(.747) = 53.91 \text{ in}^2$

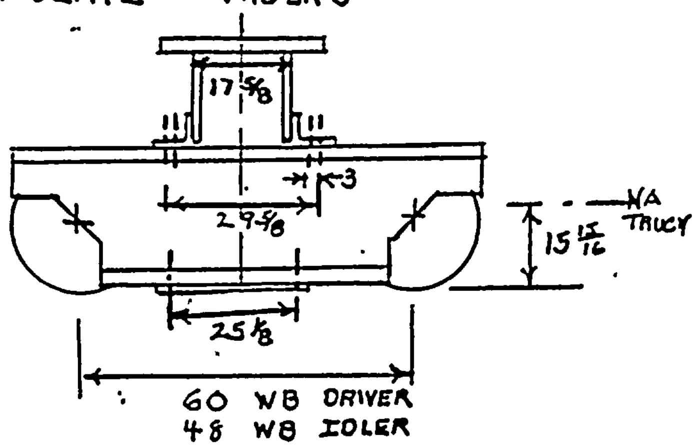
$I_{xx} = 2(3270) - 4(.5)(.747)(13.08)^2$
$= 6284 \text{ in}^4$

$I_{yy} = 2\{[124 - 2(.5)(.747)(4.75)^2] + [27.7 - 2(.5)(.747)][4.5]^2\}$
$= 1306 \text{ in}^4$

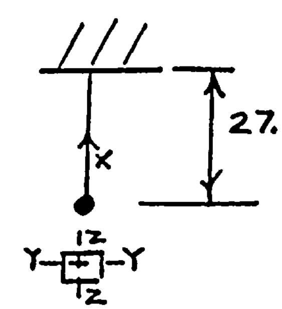
$$J_z = \frac{2(.490)(.747)(26.163)^2(9)^2}{26.91(.747) + 9.49(.49) - (.747)^2 - (.49)^2} = 1694 \text{ in}^4$$

(REF 4, p 293, TABLE 20, CASE 16)

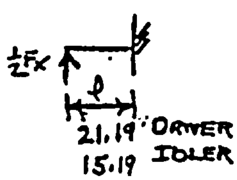
EFFECTIVE PROPERTIES OF BEAMS TO SIMULATE TRUCKS



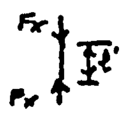
SIMULATE W/ BEAM



FOR FORCE IN X DIRECTION
(REF 3, p 104, TABLE III, CASE 1 & p 80)



$$\Delta x = \frac{\frac{1}{2}F_x \ell^3}{3EI_{XTR}}$$



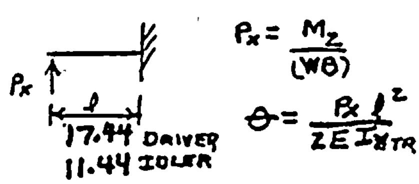
$$\Delta x = \frac{F_x \ell'}{AE}$$

$$A = \frac{6\, I_{xx} \ell'}{\ell^3}$$

$$A_{DRIVER} = \frac{6\,(6284)(27)}{(21.19)^3} = 107.0 \text{ in}^2$$

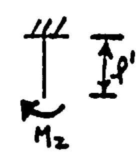
$$A_{IDLER} = \frac{6\,(6284)(27)}{(15.19)^3} = 290.5 \text{ in}^2$$

FOR MOMENT ABOUT Z AXIS
(REF 3, p 104, TABLE III, CASE 1 & 9)



$$P_x = \frac{M_z}{(WB)}$$

$$\theta = \frac{P_x \ell^2}{2EI_{ZTR}}$$



$$\theta = \frac{M_z \ell'}{EI_z}$$

$$I_z = \frac{2(WB) I_{ZTR}\, \ell'}{\ell^2}$$

$$I_{z\,DRIVER} = \frac{2(60)(6284)(27)}{(17.44)^2} = 66940 \text{ in}^4$$

$$I_{z\,IDLER} = \frac{2(48)(6284)(27)}{(11.44)^2} = 124500 \text{ in}^4$$

FOR FORCE IN Z DIRECTION

(REF 3 P104 TABLE III CASE 18 P191)

15.94 — $\frac{1}{2}F_z$; ℓ = 17.44 DRIVER, 11.44 IDLER

$$\Delta Z = \frac{\frac{1}{2}F_z \ell^3}{3EI_{yTR}} + \frac{\frac{1}{2}F_z(15.94)^2 \ell}{J_{TR}G}$$

$$G = \frac{E}{2(1+.3)} = \frac{E}{2.6}$$

F_z, ℓ'

$$\Delta Z = \frac{F_z \ell'^3}{3EI_y}$$

$$I_y = \frac{\ell'^3}{3\left(\frac{\ell^3}{6\,I_{yTR}} + \frac{1.3(15.94)^2\ell}{J_{TR}}\right)} = \frac{\ell'^3}{\frac{\ell^3}{2I_{yTR}} + \frac{(991)\ell}{J_{TR}}}$$

$$I_{y\,DRIVER} = \frac{(27)^3}{\frac{(17.44)^3}{2(1306)} + \frac{(991)(17.44)}{1694}} = 1609 \text{ in}^4$$

$$I_{y\,IDLER} = \frac{(27)^3}{\frac{(11.44)^3}{2(1306)} + \frac{(991)(11.44)}{1694}} = 2709 \text{ in}^4$$

BECAUSE THE MODEL RESTRAINS THE BRIDGE ON ONE SIDE ONLY AND THE LOAD IS ASSUMED TO BE DISTRIBUTED TO THE RUNWAY ON A 2/3 1/3 RATIO TO ACCOUNT FOR FRICTIONAL RESISTANCE ON THE UNRESTRAINED SIDE:

$$I_{y\,DRIVER} = \frac{1609}{2/3} = 2414 \text{ in}^4$$

$$I_{y\,IDLER} = \frac{2709}{2/3} = 4064 \text{ in}^4$$

TROLLEY

FRAME MODELED AS RIGID

MAIN HOIST ROPE
1½ DIA PYTHON 10 F 16 V - ALL STEEL - 26 STRAND - 362 WIRES
REEVED - 2 - 6 PART SYSTEMS - REDUNDANT (REF 8)

$$\text{AREA} = 12 \times \frac{(1\tfrac{1}{2})^2 \pi}{4} \times .629 = 13.34 \text{ in}^2$$

MODULUS OF ELASTICITY 14,000,000 PSI

BRIDGE SPRING

THE BRIDGE SPRING IS USED AS A RIGID LINK FOR TRANSMITTING REACTIONS IN THE GLOBAL X DIRECTION (PARALLEL WITH THE GIRDERS). THE SPRING RATE IS SELECTED TO PROVIDE A NATURAL FREQUENCY IN THE HIGH FREQUENCY (STIFF) PORTION OF THE EXCITATION SPECTRUM. II

$$K = \frac{W}{g}(2\pi f)^2$$

$$= \frac{284000}{386.4}(2\pi(33))^2 = 31600000 \text{ lb/in}$$

WHERE
- K = SPRING RATE, lb/in
- W = TOTAL WEIGHT OF CRANE, lb (WITHOUT LIFTED LOAD)
- g = ACCELERATION OF GRAVITY, in/sec^2
- f = NATURAL FREQUENCY, Hz

[illegible]

MASS ELEMENTS

DESCRIPTION	NODE	WEIGHT LB	MASS LB SEC²/IN
TROLLEY LESS BLOCK	407	124000	320.9
BLOCK ONLY	406	20000	51.76
BLOCK W/ 50 T LIFTED LOAD	406	120000	310.6
BRIDGE DRIVE ASSEMBLY	502	4000	10.35
SINGLE REDUCTION UNITS	501,503	2000	5.18
DRIVE TRUCKS	103,203	5000	12.94
	101,201	2000	5.18
IDLER TRUCKS	104,204	4500	11.65
	102,202	2000	5.18

DISTRIBUTED MASS ON BEAM ELEMENTS

DISTRIBUTED WEIGHT (LB/FT)

GIRDERS	GIRDER A	GIRDER B
GIRDER INCLUDES STIFFENERS	470	470
RAIL	60	60
WALK	60	–
SQ SHAFT & CPLGS	20	–
CTRLS & SUPPT	80	–
BRIDGE CONDUCTOR	–	40
MISC (Incl RACK ON B)	10	30
	700	600

MASS DENSITY

GIRDER A

$$\frac{700}{12 \times 110.6 \times 386.4} = .001365 \ lb\,sec^2/in^4$$

GIRDER B

$$\frac{600}{12 \times 110.6 \times 386.4} = .001170 \ lb\,sec^2/in^4$$

END CONNECTIONS

DISTRIBUTED WEIGHT
180 lb/ft

MASS DENSITY

$$\frac{180}{12 \times 35.70 \times 386.4} = .001087 \ lb\,sec^2/in^4$$

SUPPLEMENTAL CALCULATIONS

This section summarizes the analysis of those components which were not directly analyzed by the finite element program utilizing the loadings that were generated by this program.

For effects of seismic loads on trolley components see separate Structural Design Calculation Report.

FORM N-2494

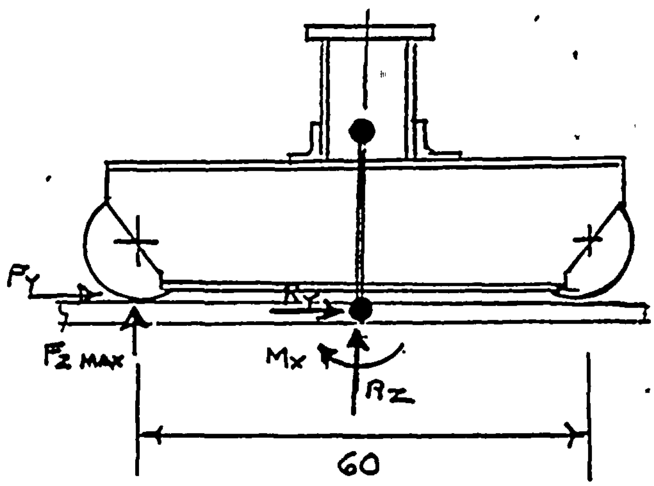
WHITING REQN. 79604 DATE 6-8-87

BY MJM PAGE 4-2 OF 2

82487

SCALE FACTOR

BECAUSE SLIP WILL OCCUR AT THE RAIL WHEEL INTERFACE IF THE REACTION IN THE Y DIRECTION EXCEEDS THE MAXIMUM WHEEL LOAD IN THE Z DIRECTION TIMES THE COEFFICIENT OF FRICTION, THE ACCELERATION IN THE Y DIRECTION WILL BE LESS THAN PREDICTED BY A MODAL ANALYSIS. THE PRIMARY Y MODE MAY BE PROPORTIONED BY A SCALE FACTOR THAT ACCOUNTS FOR SLIDING AND THAT IS DERIVED AS FOLLOWS:



WHERE

R_Z, R_Y & M_X ARE MAXIMUM REACTIONS FROM FINITE ELEMENT MODAL ANALYSIS

AND

$F_{Z\,MAX}$ IS MAX Z REACTION AT A DRIVE WHEEL

F_Y IS MAX Y REACTION BY FRICTION

SCF IS SCALE FACTOR

$$F_{Z\,MAX} = \frac{R_Z}{2} + \frac{M_X}{60}$$

$$F_Y = .25\ F_{Z\,MAX}$$ (REF 15, P 3-38)

$$SCF = \frac{F_Y}{R_Y}$$

OBSERVING THAT M_X IS DUE PRIMARILY TO Y EXCITATIONS.

$$SCF = \frac{.25}{R_Y}\left(\frac{R_Z}{2} + \frac{SCF(M_X)}{60}\right)$$

$$SCF = \frac{R_Z}{8R_Y\left(1 - \frac{M_X}{240(R_Y)}\right)}$$

TABLE 4-1
SCALE FACTORS

TROLLEY	LOAD	OBE	SSE
MID	50T UP	.1096	.0744
	50T DN	.1420	.1078
1/4	50T UP	.1024	.0636
	50T DN	.1436	.1074
END	50T UP	.2260	.1356
	50T DN	.3365	.2385
MID	No LOAD	.0801	.0554
1/4	No LOAD	.0775	.0521
RHE	No LOAD	.3696	.2156

FOR REACTIONS SEE TABLES B19 through B54

TRUCK LOADS

THE R_X AT 124 IS DIVIDED BY 2 FOR THE 2 TRUCKS ON THE HELD SIDE AND MULTIPLIED BY 2/3 TO ACCOUNT FOR FRICTIONAL RESISTANCE AT THE UNRESTRAINED WHEELS. THE MINIMUM TRUCK LOAD IS THE NEGATIVE OF THE MAXIMUM CONSIDERING COMPLETE REVERSAL.

$$F_X = \frac{2}{3}\left(\frac{Rx}{2}\right) = \frac{Rx}{3}$$

ALL OTHER TRUCK LOADS ARE SUMMARIZED DIRECTLY FROM TABLES B19 TO B54 AFTER THE APPLICATION OF THE SCALE FACTOR AS PREVIOUSLY DESCRIBED.

TABLE 4-2

TRUCK LOADS (OBE - SCALED)

	TROLLEY	LOAD	SUM (MAX)				DIFFER (MIN.)			
			F_X	F_Y	F_Z	M_X	F_X'	F_Y'	F_Z'	M_X'
DRIVER	MID	UP	11.2	26.5	141.7	1869	-11.2	-26.5	60.1	-1781
(NODE		DN	11.3	34.3	192.6	2338	-11.3	-34.3	9.3	-2250
101,201)		NO	10.9	19.4	90.9	1339	-10.9	-19.4	60.2	-1252
	1/4	UP	8.57	32.0	159.5	2200	-8.57	-32.0	54.3	-2113
		DN	11.8	44.1	242.8	3011	-11.8	-44.1	25.1	-2924
		NO	10.6	25.0	110.8	1730	-10.6	-25.0	46.5	-1647
	END	UP	9.17	39.5	165.8	2717	-9.17	-39.5	44.7	-2633
		DN	10.3	49.8	250.2	3267	-10.3	-49.8	31.9	-3184
		NO	9.16	43.9	116.4	2970	-9.16	-43.9	37.1	-2891
IDLER	MID	UP	11.2	0	130.0	458.8	-11.2	0	55.1	-278.3
(NODE		DN	11.3	0	180.9	204.2	-11.3	0	4.55	-23.7
102,202)		NO	10.9	0	80.9	171.4	-10.9	0	53.9	7.5
	1/4	UP	8.57	0	145.6	382.8	-8.57	0	50.3	-203.0
		DN	11.8	0	227.6	374.4	-11.8	0	17.7	-194.6
		NO	10.6	0	97.6	365.7	-10.6	0	42.3	-188.3
	END	UP	9.17	0	152.8	892.1	-9.17	0	40.1	-710.2
		DN	10.3	0	237.3	933.4	-10.3	0	27.3	-751.5
		NO	9.16	0	105.0	940.9	-9.16	0	32.0	-772.2

ALL FORCES IN KIPS, MOMENTS IN IN.KIP IN GLOBAL COORDINATE SYSTEM

TABLE 4-3

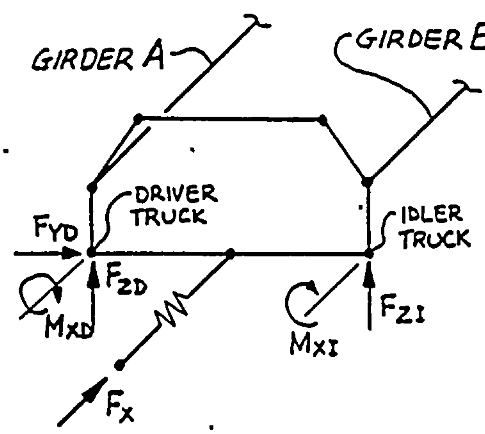
TRUCK LOADS (SSE-SCALED)

	TROLLEY	LOAD	SUM (MAX)				DIFFER (MIN.)			
			F_X	F_Y	F_Z	M_X	F_X'	F_Y'	F_Z'	M_X'
DRIVER (NODE 101,201)	MID	UP	21.3	33.8	172.7	2436	-21.3	-33.8	30.2	-2348
		DN	21.5	48.9	271.9	3313	-21.5	-48.9	-67.8	-3224
		NO	20.9	25.2	109.7	1728	-20.9	-25.2	42.2	-1641
	1/4	UP	17.2	42.2	194.2	2894	-17.2	-42.2	38.2	-2808
		DN	22.2	63.0	338.0	4313	-22.2	-63.0	-69.5	-4227
		NO	20.4	33.9	129.1	2349	-20.4	-33.9	36.7	-2265
	END	UP	18.6	62.2	189.4	4456	-18.6	-62.2	35.1	-4373
		DN	19.8	77.2	339.4	5224	-19.8	-77.2	-42.6	-5141
		NO	18.3	78.8	127.4	5384	-18.3	-78.8	29.9	-5305
IDLER (NODE 102,202)	MID	UP	21.3	0	158.3	743.6	-21.3	0	27.6	-563.1
		DN	21.5	0	257.0	268.5	-21.5	0	-69.2	-88.0
		NO	20.9	0	97.0	224.9	-20.9	0	38.8	-46.0
	1/4	UP	17.2	0	176.5	614.9	-17.2	0	35.3	-435.1
		DN	22.2	0	319.4	605.6	-22.2	0	-74.1	-425.8
		NO	20.4	0	112.6	581.4	-20.4	0	33.5	-404.1
	END	UP	18.6	0	173.2	1521	-18.6	0	31.6	-1339
		DN	19.8	0	324.8	1573	-19.8	0	-50.4	-1391
		NO	18.3	0	114.0	1626	-18.3	0	25.6	-1457

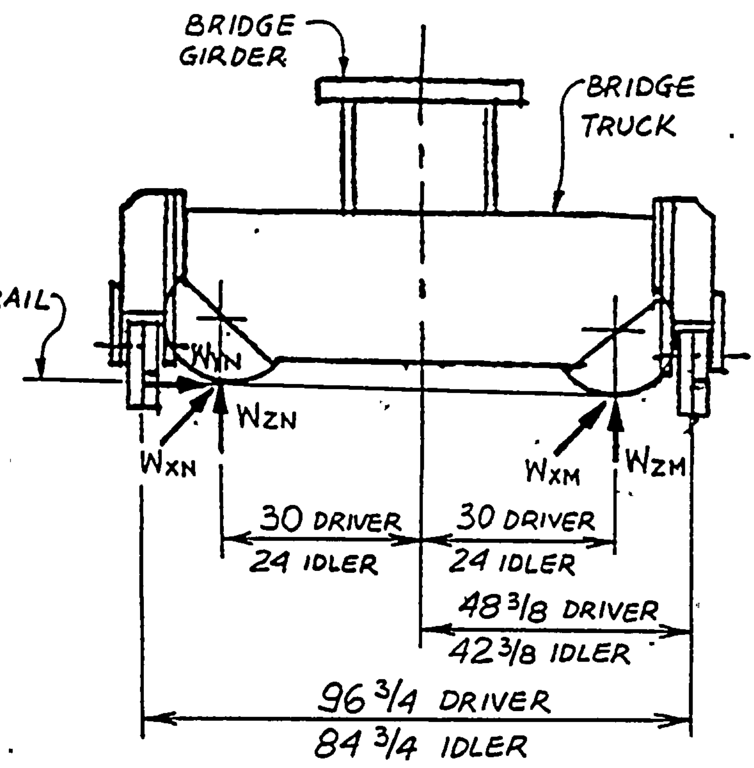
ALL FORCES IN KIPS, MOMENTS IN IN.KIP IN GLOBAL COORDINATE SYSTEM

BRIDGE WHEEL LOADS AND UPKICK

THE WHEEL LOADS ARE DETERMINED BY APPLYING THE BRIDGE TRUCK REACTIONS, SHOWN IN SCALED TABLES B19 TO B54, TO THE TRUCKS IN THE FOLLOWING MANNER:



MODEL SCHEMATIC OF END OF CRANE



BRIDGE DRIVER TRUCK IS LOCATED ON GIRDER A AND IDLER TRUCK IS LOCATED ON GIRDER B.

FLANGING WHEEL LOADS.

$W_{X\,MAX}$ → F_X (FROM SCALED TABLES B19 TO B54) IS DIVIDED BETWEEN OPPOSITE ENDS OF CRANE IN A 2/3 AND 1/3 MANNER. FOR THE FOUR WHEELS ON THE HELD SIDE F_X IS DIVIDED BY 4 AND MULTIPLIED BY 2/3 TO ACCOUNT FOR FRICTIONAL RESISTANCE AT THE UNRESTRAINED WHEELS.

$$W_{X\,MAX} = \frac{1}{4}\left(\frac{2}{3}\right) F_X = \frac{F_X}{6}$$

$W_{X\,MIN}$ → THE MINIMUM WHEEL LOAD IS THE NEGATIVE OF THE MAXIMUM CONSIDERING COMPLETE REVERSAL

$$W_{X\,MIN} = -W_{X\,MAX}$$

VERTICAL WHEEL LOADS AND UPKICK LOADS.

WHEEL LOADS.

$W_{Z\,MAX}, W_{Z\,MIN}$ → IN DETERMINING WHEEL LOADS THE MAX. TRUCK REACTIONS F_Z AND M_X WERE TAKEN FROM THE "SUM" COLUMN OF SCALED TABLES B19 TO B54.

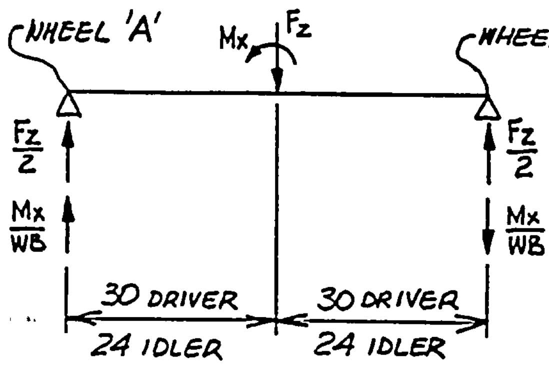
IF $\frac{F_Z}{2} \le \frac{M_X}{WB}$ THEN $W_{ZMIN} = 0$ AND UPKICK OCCURS.

$\therefore$ FROM UP-KICK CALCULATIONS FOR THIS CONDITION $W_{ZMAX} = f_A F_Z + \frac{M_X}{SP}$

$W_{ZMIN} = 0$ AND

UPKICK = $W_{ZMAX} - F_Z$

(SEE PG. 4-10)



WHEEL BASE WB = 60 IN. (DRIVER)

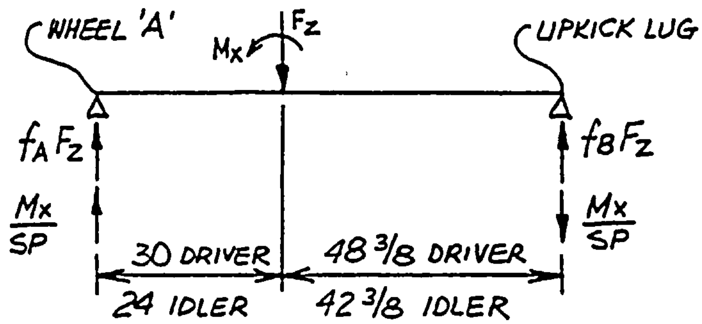
= 48 IN. (IDLER)

$$W_{ZMAX} = W_{ZA} = \frac{F_Z}{2} + \frac{M_X}{WB} \qquad W_{ZMIN} = W_{ZB} = \frac{F_Z}{2} - \frac{M_X}{WB}$$

UPKICK LOAD

P_{UL}, P_{UR} → IN DETERMINING UPKICK LOADS, THE LOAD F_Z WAS TAKEN FROM THE "DIFFERENCE" COLUMN AND MOMENT M_X WAS TAKEN FROM THE "SUM" COLUMN OF SCALED TABLES B19 TO B54. ROPE UPKICK LOAD (R_U) WAS TAKEN FROM TABLES B62 AND B64 FOR LOAD IN DOWN POSITION. FOR LOADS IN UP POSITION AND FOR THE NO-LOAD CONDITION ROPE UPKICK LOAD (R_U) DOES NOT EXIST AND THEREFORE EQUALS ZERO.

IF $\frac{1}{2}\left[F_Z - \frac{x_i}{BS}\frac{R_U}{2}\right] < \frac{M_x}{WB}$ THEN UPKICK OCCURS



SPAN SP = 78 3/8 IN. (DRIVER)

= 66 3/8 IN. (IDLER)

LOAD FACTOR = f

A DRIVER $f_A = \frac{48.375}{78.375} = 0.62$

A IDLER $f_A = \frac{42.375}{66.375} = 0.64$

B DRIVER $f_B = \frac{30}{78.375} = 0.38$

B IDLER $f_B = \frac{24}{66.375} = 0.36$

$W_Z = f_A(F_Z) + \frac{M_x}{SP}$

$P_{Ui} = -f_B\left(F_{Zi} - \frac{x_i}{BS}\frac{R_U}{2}\right) + \frac{M_{xi}}{SP}$

$i = L$ FOR BRIDGE LHE AND $i = R$ FOR BRIDGE RHE

F_{ZL} AND M_{XL} WERE TAKEN AT NODES 201 FOR DRIVER AND 202 FOR IDLER FROM SCALED TABLES B19 TO B54.

F_{ZR} AND M_{ZR} WERE TAKEN AT NODES 101 FOR DRIVER AND 102 FOR IDLER FROM SCALED TABLES B19 TO B54.

X IS A DISTANCE BETWEEN BRIDGE END AND MAIN TROLLEY HOOK AND DEPENDS ON TROLLEY POSITION AND EQUALS:

FOR MAIN TROLLEY AT MID. $X_L = 466$ IN. $X_R = 466$ IN.

QUARTER $X_L = 233$ IN. $X_R = 699$ IN.

END $X_L = 123.25$ IN. $X_R = 808.75$ IN

BRIDGE SPAN BS = 932 IN.

SINCE THE LINEAR COMPUTER ANALYSIS SHOWS THE HOIST ROPE GOING IN COMPRESSION (SLACK ROPE CONDITION) WHEN THE LOAD IS IN THE DOWN POSITION, THE UPKICK LOADS WERE DETERMINED BY SUB TRACTING THE RELATIVE PROPORTION OF THE ROPE COMPRESSIVE LOAD [R_U] (WHICH CAN NOT EXIST) FROM THE VERTICAL REACTIONS.

TANGENTIAL WHEEL LOADS (BRAKE WHEEL ON DRIVER TRUCK ONLY).

W_{YMAX} → THE MAXIMUM WHEEL LOAD IN THE Y DIRECTION IS TAKEN TO BE LIMITED BY THE COEFFICIENT OF FRICTION OF 0.25 AND THE MAXIMUM WHEEL LOAD (W_{ZMAX}).

$$W_{YMAX} = 0.25\, W_{ZMAX}$$

THE MINIMUM WHEEL LOAD IS THE NEGATIVE OF THE MAXIMUM CONSIDERING COMPLETE REVERSAL.

TABLE 4-4

CRANE WHEEL LOADS OBE SCALED

	TROLLEY	LOAD	W_{XMAX}	W_{YMAX}	MAX. W_Z		P_{UL} 201,202	P_{UR} 101,102	TABLE USED
					W_A(MAX)	W_B**			
DRIVER 101,201	MID	UP	5.60	25.5	102.0	39.7	–	–	B20
		DN	5.64	33.8	135.3	57.3	12.0	13.3	B24
	1/4	UP	4.28	29.1	116.4	43.1	–	–	B28
		DN	5.88	42.9	171.6	71.2	1.3	12.6	B32
	END	UP	4.59	32.0	128.2	37.6	0.3	–	B36
		DN	5.13	44.9	179.6	70.6	3.8	8.5	B40
	MID	NO	5.46	16.9	67.8	23.1	–	–	B44
	1/4	NO	5.31	21.1	84.2	26.6	–	–	B48
	END	NO	4.58	26.9	107.7	8.7	7.0	0.5	B52
IDLER 102,202	MID	UP	5.60	–	74.6	55.4	–	–	B20
		DN	5.64	–	94.7	86.2	–	–	B24
	1/4	UP	4.28	–	80.8	64.8	–	–	B28
		DN	5.88	–	121.6	106.0	–	–	B32
	END	UP	4.59	–	95.0	57.8	–	–	B36
		DN	5.13	–	138.1	99.2	–	–	B40
	MID	NO	5.46	–	44.0	36.9	–	–	B44
	1/4	NO	5.31	–	56.4	41.2	–	–	B48
	END	NO	4.58	–	71.7	33.3	2.7	–	B52

ALL FORCES IN KIPS IN GLOBAL COORDINATE SYSTEM.

* INDICATES UPKICK LOAD AT UPKICK LUG FOR THE STATIC PLUS DYNAMIC CONDITION.

** W_B IS LOAD ON OTHER WHEEL OF TRUCK WHEN W_A IS MAX.

TABLE 4-5

CRANE WHEEL LOADS SSE SCALED

	TROLLEY	LOAD	W_{XMAX}	W_{YMAX}	MAX. W_Z		P_{UL}	P_{UR}	TABLE
					W_A (MAX)	W_B **	201, 202	101, 102	USED
DRIVER 101, 201	MID	UP	10.6	31.7	127.0	45.7	15.8	19.2	B22
		DN	10.8	47.8	191.2	80.7	32.5	35.4	B26
	1/4	UP	8.6	36.3	145.3	48.9	2.3	8.7	B30
		DN	11.1	60.2	240.9	97.1	12.5	36.3	B34
	END	UP	9.3	42.2	169.0	20.4	17.1	16.0	B38
		DN	9.9	64.2	256.8	82.6	19.3	36.6	B42
	MID	NO	10.4	20.9	83.7	26.0	4.3	5.2	B46
	1/4	NO	10.2	25.9	103.7	25.4	0.1	5.5	B50
	END	NO	9.2	38.4	153.4	−(26.0*)	26.4	35.5	B54
IDLER 102, 202	MID	UP	10.6	−	94.6	63.7	−	0.6	B22
		DN	10.8	−	134.1	122.9	−	−	B26
	1/4	UP	8.6	−	101.1	75.4	−	−	B30
		DN	11.1	−	172.3	147.1	−	−	B34
	END	UP	9.3	−	118.3	54.9	9.4	−	B38
		DN	9.9	−	195.2	129.6	10.6	−	B42
	MID	NO	10.4	−	53.2	43.8	−	−	B46
	1/4	NO	10.2	−	68.4	44.2	−	−	B50
	END	NO	9.2	−	88.6	25.4	15.3	−	B54

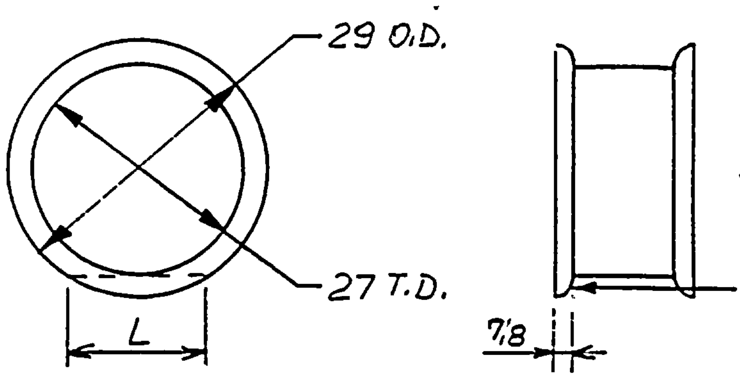
ALL FORCES IN KIPS IN GLOBAL COORDINATE SYSTEM.

* INDICATES UPKICK LOAD AT UPKICK LUG FOR THE STATIC PLUS DYNAMIC CONDITION.

** W_B IS LOAD ON OTHER WHEEL OF TRUCK WHEN W_A IS MAX.

BRIDGE WHEEL

FLANGE SHEAR STRESS



MTRL: ROLLED STEEL

$\sigma_{Y MIN} = 53$ KSI

OBE $\tau_{ALL} = 0.6 \dfrac{\sigma_{Y MIN}}{1.5} = 21.2$ KSI

SSE $\tau_{ALL} = 0.6 \dfrac{\sigma_{Y MIN}}{1.1} = 28.9$ KSI.

$F_X = 5.88$ KIP (MAX. FOR OBE FROM TABLE 4-4)

$= 11.1$ KIP (MAX. FOR SSE FROM TABLE 4-5)

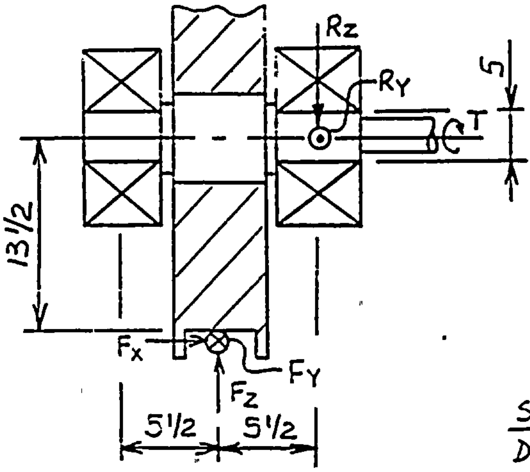
$$L = 2\left[\left(\tfrac{29}{2}\right)^2 - \left(\tfrac{27}{2}\right)^2\right]^{1/2} = 10.6 \text{ IN.}$$

ASSUME ONLY HALF EFFECTIVE IN SHEAR

OBE $\tau = \dfrac{5.88}{0.5 \times 10.6 \times 0.875} = 1.3$ KSI

SSE $\tau = \dfrac{11.1}{0.5 \times 10.6 \times 0.875} = 2.4$ KSI

BRIDGE AXLE



MTRL: AISI-1144 HT, 220-260 BHN

$\sigma_{Y MIN} = 60$ KSI

OBE $\tau_{ALL} = 0.6 \dfrac{\sigma_{Y MIN}}{1.5} = 24$ KSI

SSE $\tau_{ALL} = 0.6 \dfrac{\sigma_{Y MIN}}{1.1} = 32.7$ KSI

$\dfrac{SPAN}{DEPTH} = \dfrac{11}{5} = 2.2 < 3$ ∴ MODE OF FAILURE IS SHEAR FOR SEISMIC LOADS

FROM TABLE 4-4 FOR OBE MAX. LOADS ARE:

DRIVER $W_{X\,MAX} = 5.88$ KIP $\quad W_{Y\,MAX} = 44.9$ KIP $\quad W_{Z\,MAX} = 179.6$ KIP

IDLER $W_{X\,MAX} = 5.88$ KIP $\quad W_{Y\,MAX} = 0$ $\quad W_{Z\,MAX} = 138.1$ KIP

FROM TABLE 4-5 FOR SSE MAX. LOADS ARE:

DRIVER $W_{X\,MAX} = 11.1$ KIP $\quad W_{Y\,MAX} = 64.2$ KIP $\quad W_{Z\,MAX} = 256.8$ KIP

IDLER $W_{X\,MAX} = 11.1$ KIP $\quad W_{Y\,MAX} = 0$ $\quad W_{Z\,MAX} = 195.2$ KIP

OBE

DRIVER
$$R_{RD} = \sqrt{\left(\frac{W_{YMAX}}{2}\right)^2 + \left(\frac{W_{ZMAX}}{2} + \frac{W_{XMAX}\frac{TD}{2}}{SPAN}\right)^2} = \sqrt{\left(\frac{44.9}{2}\right)^2 + \left(\frac{179.6}{2} + \frac{5.88 \times 13.5}{11}\right)^2}$$
$$= 99.6 \text{ KIP}$$

IDLER
$$R_{RI} = \frac{138.1}{2} + \frac{5.88 \times 13.5}{11} = 76.3 \text{ KIP}$$

$$\tau_{MAX} = \frac{4}{3}\frac{R_{RMAX}}{A} = \frac{4}{3}\,\frac{99.6}{\frac{\pi \times 5^2}{4}} = 6.8 \text{ KSI}$$

SSE

DRIVER
$$R_{RD} = \sqrt{\left(\frac{64.2}{2}\right)^2 + \left(\frac{256.8}{2} + \frac{11.1 \times 13.5}{11}\right)^2} = 145.6 \text{ KIP}$$

IDLER
$$R_{RI} = \frac{195.2}{2} + \frac{11.1 \times 13.5}{11} = 111.2 \text{ KIP}$$

$$\tau_{MAX} = \frac{4}{3}\,\frac{145.6}{\frac{\pi \times 5^2}{4}} = 9.9 \text{ KSI}$$

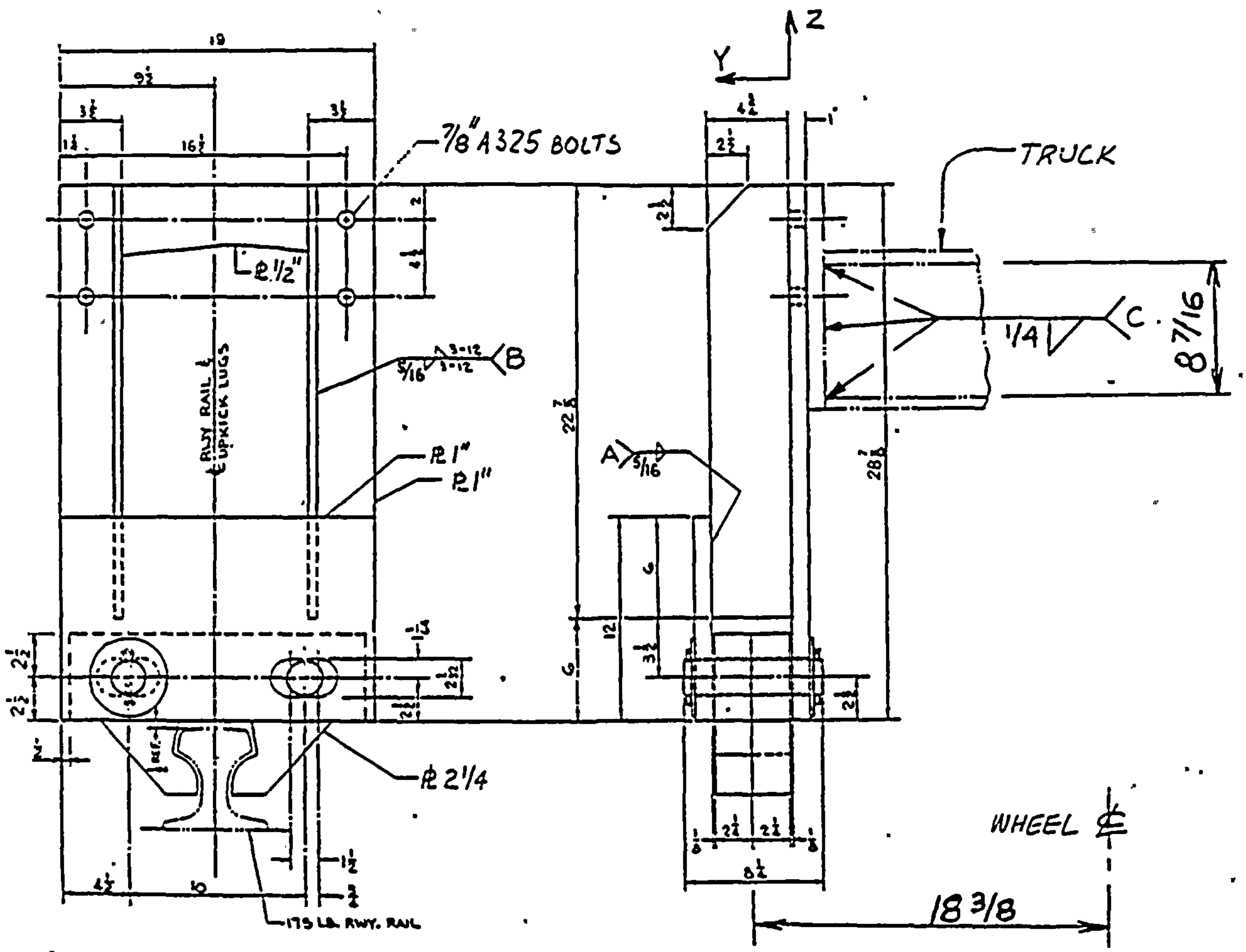
FORM N-2494

WHITING REQN. 79504 DATE 8-13-87

BY ASZ PAGE 4-16 OF 2

MJM 8-24-87

BRIDGE TRUCK SEISMIC LUGS.

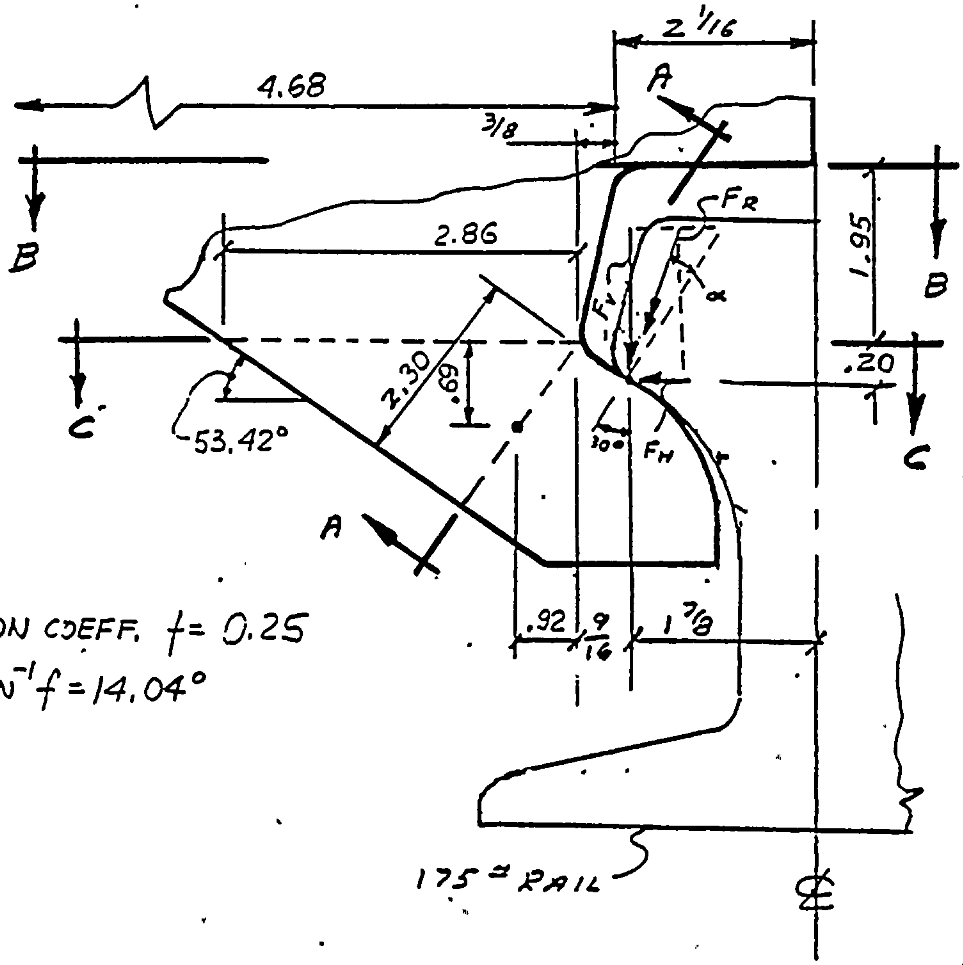


MTRL.: ASTM-A36

$\sigma_{Y\,MIN} = 36$ KSI

<u>OBE</u> $\sigma_{ALL} = \frac{\sigma_{Y\,MIN}}{1.5} = 24$ KSI $\quad \tau_{ALL} = 0.6\,\sigma_{ALL} = 14.4$ KSI

<u>SSE</u> $\sigma_{ALL} = \frac{\sigma_{Y\,MIN}}{1.1} = 32.7$ KSI $\quad \tau_{ALL} = 0.6\,\sigma_{ALL} = 19.6$ KSI



FRICTION COEFF. $f = 0.25$

$\alpha = TAN^{-1} f = 14.04°$

MAX. WHEEL UPKICK LOAD $P_{MAX} = P_{UR}$ FROM TABLE 4-4 TO 4-5

OBE ... $P_{MAX} = 13.3$ KIP

SSE $P_{MAX} = 36.6$ KIP

LOAD ON EACH OF THE CONTOURED LUGS:

$$F_V = \frac{P_{MAX}}{2} \qquad F_H = F_V \tan(30-\alpha) = 0.5\,P_{MAX} \tan(30-14.04)$$
$$= 0.143\,P_{MAX}$$

RESULTANT $F_R = \sqrt{F_V^2 + F_H^2} = \sqrt{(0.5\,P_{MAX})^2 + (0.143\,P_{MAX})^2}$
$= 0.52\,P_{MAX}$

OBE $F_V = 0.5 \times 13.3 = 6.7$ KIP $\quad F_H = 0.143 \times 13.3 = 1.9$ KIP
$F_R = 0.52 \times 13.3 = 6.9$ KIP

SSE $F_V = 0.5 \times 36.6 = 18.3$ KIP $\quad F_H = 0.143 \times 36.6 = 5.2$ KIP
$F_R = 0.52 \times 36.6 = 19.0$ KIP.

SECTION A-A (SHEAR)

$$\tau_A = \frac{F_R \cos(53.42^\circ - 30^\circ + 14.04)}{A_A}$$

OBE $\tau_A = \dfrac{6.9 \cos 37.46^\circ}{2.25 \times 2.3} = 1.1$ KSI

SSE $\tau_A = \dfrac{19 \cos 37.46^\circ}{2.25 \times 2.3} = 2.9$ KSI

SECTION B-B (TENSION)

DIRECT $\sigma_D = \frac{F_V}{A}$

BENDING $\sigma_{BH} = \frac{M_H}{S} = \frac{F_H(2.15)}{S}$

$$\sigma_{BV} = \frac{M_V}{S} = \frac{F_V\left(\frac{4.68}{2} - 0.375 + 0.563\right)}{S}$$

$$\sigma_B = \sigma_D + \sigma_{BH} + \sigma_{BV}$$

OBE $\sigma_B = \frac{6.7}{2.25 \times 4.68} + \frac{1.9 \times 2.15}{\frac{2.25 \times 4.68^2}{6}} + \frac{6.7 \times 2.53}{\frac{2.25 \times 4.68^2}{6}} = 3.2$ KSI

SSE $\sigma_B = \frac{18.3}{2.25 \times 4.68} + \frac{5.2 \times 2.15}{\frac{2.25 \times 4.68^2}{6}} + \frac{18.3 \times 2.53}{\frac{2.25 \times 4.68^2}{6}} = 8.7$ KSI

SECTION C-C (TENSION)

DIRECT $\sigma_D = \frac{F_V}{A}$

BENDING $\sigma_{BH} = \frac{F_H(0.23)}{S}$

$$\sigma_{BV} = \frac{F_V\left(\frac{2.86}{2} + 0.563\right)}{S}$$

$$\sigma_C = \sigma_D + \sigma_{BH} + \sigma_{BV}$$

OBE $\sigma_C = \frac{6.7}{2.25 \times 2.86} + \frac{1.9 \times 0.20}{\frac{2.25 \times 2.86^2}{6}} + \frac{6.7 \times 1.99}{\frac{2.25 \times 2.86^2}{6}} = 5.5$ KSI

SSE $\sigma_C = \frac{18.3}{2.25 \times 2.86} + \frac{5.2 \times 0.20}{\frac{2.25 \times 2.86^2}{6}} + \frac{18.3 \times 1.99}{\frac{2.25 \times 2.86^2}{6}} = 15.1$ KSI

[illegible]

FORM N-2494

WHITING REQN. 73604 DATE 8-?-8?
BY ASZ PAGE 4-20 OF 13
MJM 8-24-87

SECTION A-A (TENSION)

DIRECT $\sigma_D = \dfrac{F_R \sin(53.42 - 30 + 14.04)}{A}$

BENDING $\sigma_{BH} = \dfrac{-F_H (0.69 - 0.20)}{S}$

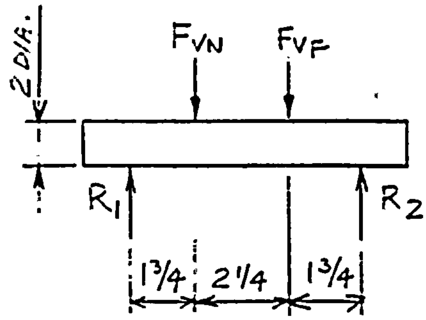
$\sigma_{BV} = \dfrac{F_V (0.92 + 0.56)}{S}$

TENSILE $\sigma_A = \sigma_D + \sigma_{BH} + \sigma_{BV}$

OBE $\sigma_A = \dfrac{6.9 \sin 37.46°}{2.25 \times 2.3} - \dfrac{1.9 \times 0.49}{\frac{2.25 \times 2.3^2}{6}} + \dfrac{6.7 \times 1.48}{\frac{2.25 \times 2.3^2}{6}} = 5.3$ KSI

SSA $\sigma_A = \dfrac{19 \sin 37.46°}{2.25 \times 2.3} - \dfrac{5.2 \times 0.49}{\frac{2.25 \times 2.3^2}{6}} + \dfrac{18.3 \times 1.48}{\frac{2.25 \times 2.3^2}{6}} = 14.6$ KSI

LUG PIN



MATRL.: 1018 COLD FINISH

$\sigma_{Y MIN} = 30$ KSI

OBE $\sigma_{ALL} = \frac{30}{1.5} = 20.0$ KSI

$\tau_{ALL} = 0.6\,\sigma_{ALL} = 12.0$ KSI

SSE $\sigma_{ALL} = \frac{30}{1.1} = 27.3$ KSI

$\tau_{ALL} = 0.6\,\sigma_{ALL} = 16.4$ KSI

OBE $P_{MAX} = 13.3$ KIP

SSE $P_{MAX} = 36.6$ KIP

VERTICAL LOAD ON NEARSIDE PIN.

$$F_{VN} = \frac{(\frac{10}{2} + 1.875)F_V - (2 + 0.23 + 2.5)F_H}{10} = \frac{6.875(0.5 P_{MAX}) - 4.73(0.143 P_{MAX})}{10}$$

OBE $F_{VN} = 3.7$ KIP

SSE $F_{VN} = 10.1$ KIP

VERTICAL LOAD ON FARSIDE PIN.

$$F_{VF} = \frac{(\frac{10}{2} - 1.875)F_V + 4.73 F_H}{10} = \frac{3.125(0.5 P_{MAX}) + 4.73(0.143 P_{MAX})}{10}$$

OBE $F_{VF} = 3.0$ KIP

SSE $F_{VF} = 8.2$ KIP

$$R_1 = \frac{F_{VN}(5.75-1.75) + F_{VF}(1.75)}{5.75} \qquad R_2 = \frac{F_{VN}(1.75) + F_{VF}(5.75-1.75)}{5.75}$$

OBE $R_1 = 3.5$ KIP $R_2 = 3.2$ KIP

SSE $R_1 = 9.5$ KIP $R_2 = 8.8$ KIP

$$\frac{ARM}{DEPTH} = \frac{1.75}{2} = 0.875 < 1.5$$

OK

∴ PROBABLE MODE OF FAILURE IS SHEAR

SHEAR STRESS $\tau = \frac{4}{3}\frac{R_{MAX}}{A} = \frac{4}{3}\frac{R_1}{\frac{\pi 2^2}{4}}$

OBE $\tau = 1.5$ KSI

SSE $\tau = 4.0$ KSI

WELDS

ALLOWABLES

MTRL : ASTM-A36 $\sigma_{Y\,MIN} = 36$ KSI

WELD MTRL : E70XX ELECTRODES FOR WELD TYPE A AND B, $\sigma_{Y\,MIN} = 57$ KSI

OBE $\tau_{W.ALL} = \frac{57 \times 0.6}{1.5} = 22.8$ KSI

$= \frac{0.6 \times 36\sqrt{2}}{1.5} = 20.4$ KSI

$\therefore \tau_{W,ALL} = 20.4$ KSI

SSE $\tau_{W.ALL} = \frac{57 \times 0.6}{1.1} = 31.1$ KSI

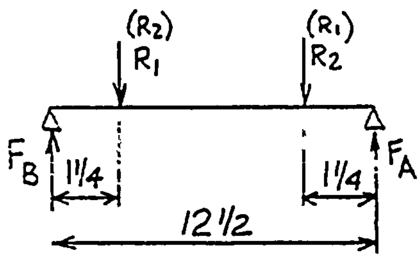
$= \frac{0.6 \times 36\sqrt{2}}{1.1} = 27.8$ KSI

$\therefore \tau_{W,ALL} = 27.8$ KSI

WELD MTRL: E60XX ELECTRODES FOR WELD TYPE C, $\sigma_{Y\,MIN} = 50$ KSI

OBE $\tau_{W.ALL} = \frac{50 \times 0.6}{1.5} = 20$ KSI

SSE $\tau_{W.ALL} = \frac{50 \times 0.6}{1.1} = 27.3$ KSI



MAX. FORCE ON WELD A, B

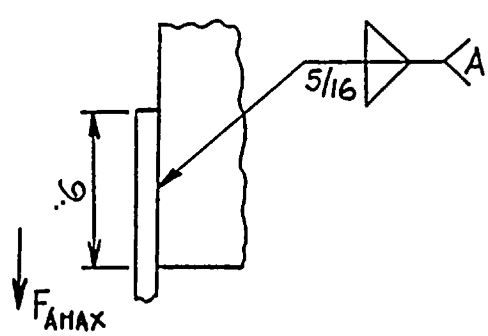
$$F_{A\,MAX} = F_{B\,MAX} = \frac{R_1(11.25) + R_2(1.25)}{12.5}$$

OBE $F_{A\,MAX} = F_{B\,MAX} = 3.5$ KIP

SSE $F_{A\,MAX} = F_{B\,MAX} = 9.4$ KIP

WELD A

$$\tau_A = \frac{F_{A\,MAX}}{A} = \frac{F_{A\,MAX}}{0.707 \times 0.3125(2 \times 6)}$$



OBE $\tau_A = 1.3$ KSI

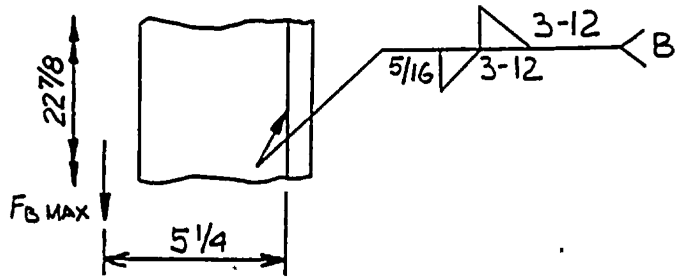
SSE $\tau_A = 3.5$ KSI

WELD B

$$\tau_B = \sqrt{\tau_Y^2 + \tau_Z^2} = \frac{F_{B\,MAX}}{0.707(0.3125)(\frac{3}{12})2} \sqrt{\left(\frac{5.25}{\frac{22.875^2}{6}}\right)^2 + \left(\frac{1}{22.875}\right)^2} = \frac{F_{B\,MAX}}{1.48}$$

OBE $\tau_B = 2.4$ KSI

SSE $\tau_B = 6.3$ KSI



WELD C

MAX. FORCE ON WELD = P_{MAX}

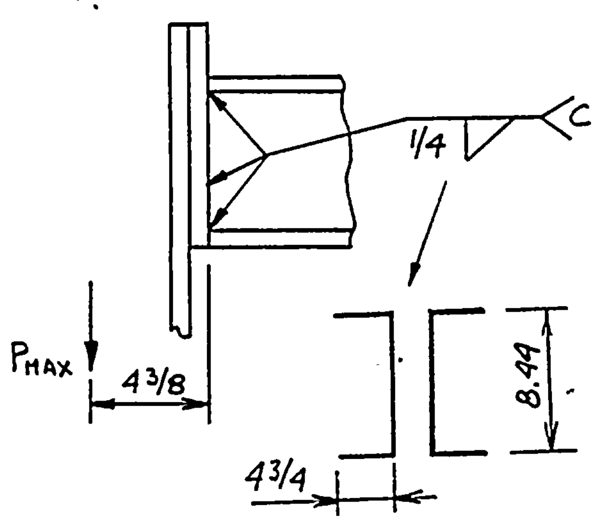
OBE 13.3 KIP SSE 36.6 KIP (REF. PG. 4-16)

$$\tau_C = \sqrt{\tau_Y^2 + \tau_Z^2} = \frac{P_{MAX}}{0.707 \times 0.25} \sqrt{\left(\frac{4.38}{2(4.75 \times 8.44) + \frac{8.44^2}{3}}\right)^2 + \left(\frac{1}{2(2 \times 4.75 + 8.44)}\right)^2}$$

$$= \frac{P_{MAX}}{3.50}$$

OBE $\tau_C = 3.8$ KSI

SSE $\tau_C = 10.5$ KSI



BOLTS

7/8" DIA. A325 4 REQ'D

$\sigma_{YMIN} = 92$ KSI

OBE $\sigma_{ALL} = \frac{92}{1.5} = 61.3$ KSI
$\tau_{ALL} = 0.6\,\sigma_{ALL} = 36.8$ KSI

SSE $\sigma_{ALL} = \frac{92}{1.1} = 83.6$ KSI
$\tau_{ALL} = 0.6\,\sigma_{ALL} = 50.2$ KSI

MAX. FORCE ON BOLTS = P_{MAX}

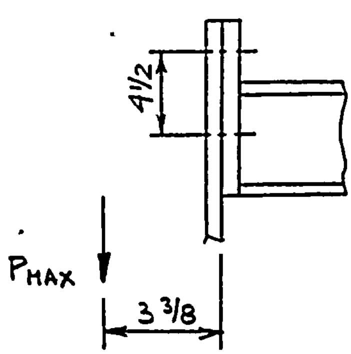
OBE 13.3 KIP SSE 36.6 KIP

SHEAR STRESS $\tau = \frac{P_{MAX}}{nA} = \frac{P_{MAX}}{4\,\pi/4\,(0.875)^2}$

OBE $\tau = 5.5$ KSI SSE $\tau = 15.2$ KSI

TENSILE STRESS $\sigma = \frac{M}{S} = \frac{P_{MAX}(3.38)}{4A(2.25)} = \frac{P_{MAX}}{2.66}$

$S = \frac{I}{r} \approx \frac{4Ar^2}{r} = 4Ar$



FOR 7/8 BOLTS (4 REQ'D)

TENSILE AREA $A_T = 0.462\ IN^2$

SHANK AREA $A_S = 0.601\ IN^2$

IN THREADS

OBE $\sigma = 10.8$ KSI SSE $\sigma = 29.7$ KSI

IN SHANK

OBE $\sigma = 8.3$ KSI SSE $\sigma = 22.8$ KSI

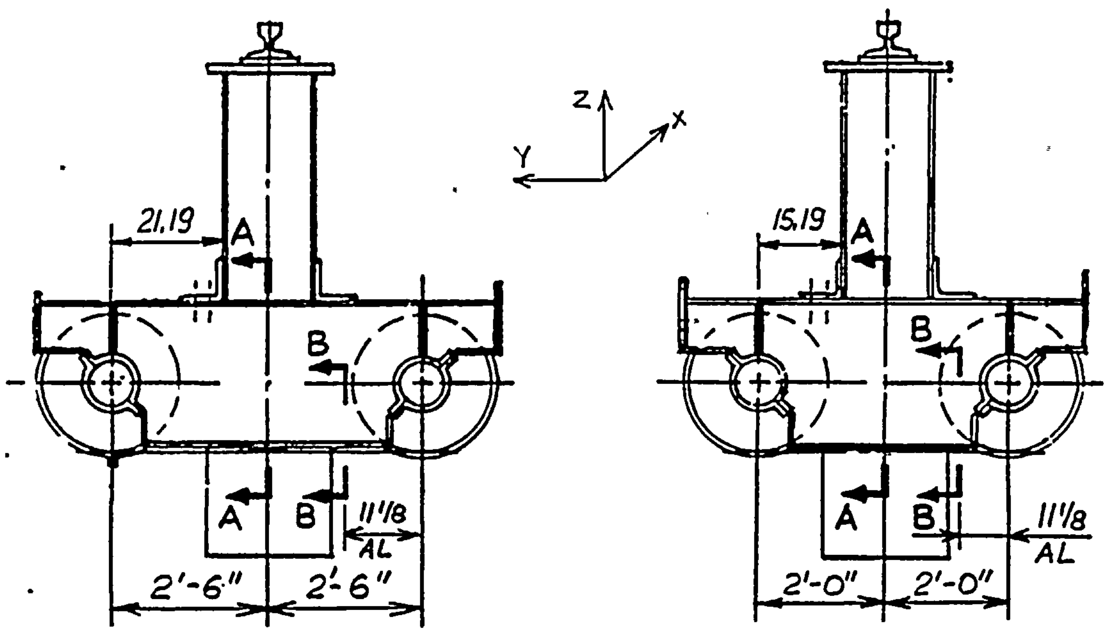
COMBINED IN SHANK

$$\tau_{COMB} = \sqrt{\left(\frac{\sigma}{2}\right)^2 + \tau^2}$$

OBE $\tau_{COMB} = \sqrt{\left(\frac{8.3}{2}\right)^2 + 5.5^2} = 6.9$ KSI

SSE $\tau_{COMB} = \sqrt{\left(\frac{22.8}{2}\right)^2 + 15.2^2} = 19.0$ KSI

BRIDGE TRUCKS



DRIVER TRUCK IDLER TRUCK

MTRL: ASTM-A36

$\sigma_{Y MIN} = 36$ KSI

OBE $\sigma_{ALL} = \frac{\sigma_{Y MIN}}{1.5} = 24$ KSI

$\tau_{ALL} = 0.6\,\sigma_{ALL} = 14.4$ KSI

SSE $\sigma_{ALL} = \frac{\sigma_{Y MIN}}{1.1} = 32.7$ KSI

$\tau_{ALL} = 0.6\,\sigma_{ALL} = 19.6$ KSI

MAX. LOADINGS PER TABLES 4-4 AND 4-5.

OBE $F_X = 5.88$ KIP $F_Y = 44.9$ KIP $F_Z = 179.6$ KIP

$F_X = 5.88$ KIP $F_Y = 0$ KIP $F_Z = 138.1$ KIP

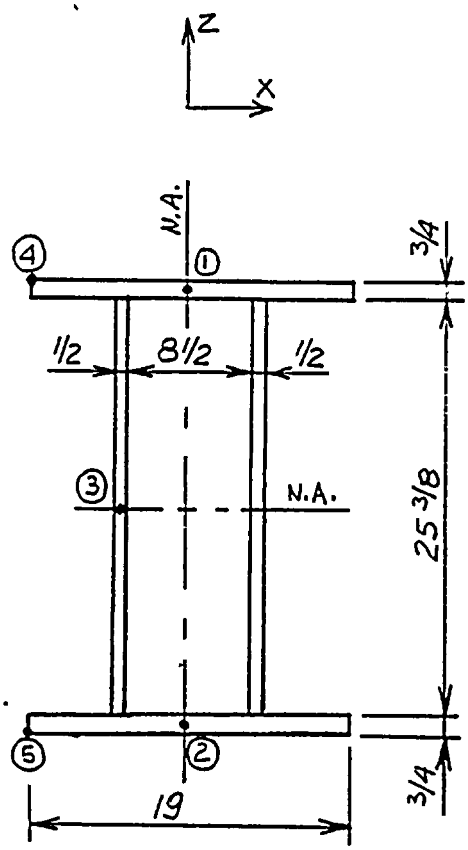
SSE $F_X = 11.1$ KIP $F_Y = 64.2$ KIP $F_Z = 256.8$ KIP

$F_X = 11.1$ KIP $F_Y = 0$ KIP $F_Z = 195.2$ KIP

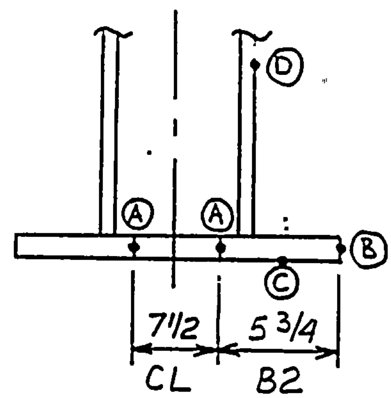
FORM N-2494

WHITING REQN. 79604 DATE 5-?-87

BY ASZ MJM 8-26-87 PAGE 4-28 OF 12



SECTION A-A



SECTION B-B

SECTION A-A WAS SIMPLIFIED FOR COMPUTER PROGRAM PURPOSE.

ACTUAL SECTION CONSISTS OF TWO W27×94 BEAMS WITH FLANGES CUT OFF FROM ONE SIDE 1/2 IN. AND WELDED TOGETHER (TOTAL FLANGE LENGTH EQUALS 19 IN.)

FORM N-2494

WHITING REQN. 79604 DATE 8-25-87
BY RGG PAGE 4-29 OF 112
MJM 8-26-87

AEP 50T BRIDGE DRIVER TRUCK OBE

TRUCK SIZE , TOP PLT = 0.75 X 19.00 IN.
BOT PLT = 0.75 X 19.00 IN.
WEB PLT = 0.50 X 25.38 IN.
DISTANCE BETWEEN WEB PLTS = 8.50 IN.

TRUCK WHEEL BASE = 42.38 IN.
COEF. OF FRICTION = 0.250

RAIL TO CENTER OF TWIST = 15.938 IN.

** FORCES IN THE GLOBAL COORDINATE SYSTEM **

FX = 5880.0 LBS.
FY = 44900.0 LBS.
FZ = 179600.0 LBS.

** SECTION PROPERTIES **

AREA IN SQ. IN.	53.9
VERTICAL MOMENT OF INERTIA	6225.8
VERTICAL SECTION MODULUS	463.3
VERTICAL CENTER OF GRAVITY	13.4
HORIZ. MOMENT OF INERTIA	1371.7
HORIZ. SECTION MODULUS	144.4

** MAXIMUM DEFLECTIONS IN INCHES **

VERTICAL BENDING DEFL. DUE TO FZ	0.00305
HORIZ. BENDING DEFL. DUE TO FX	0.00045
VERTICAL SHEAR DEFL. DUE TO FZ	0.01419
HORIZ. SHEAR DEFL. DUE TO FX	0.00066

** TRUCK STRESSES IN PSI ** AT POINT (N) SECTION A-A

BENDING STRESS TOP FLANGE DUE TO FX	862.9	(4)
BENDING STRESS BOT FLANGE DUE TO FX	862.9	(5)
BENDING STRESS TOP FLANGE DUE TO FY	1544.5	(1)(4)
BENDING STRESS BOT FLANGE DUE TO FY	1544.5	(2)(5)
BENDING STRESS TOP FLANGE DUE TO FZ	8214.1	(1)(4)
BENDING STRESS BOT FLANGE DUE TO FZ	8214.1	(2)(5)
BENDING STRESS ON WEB DUE TO FX	431.4	(3)
BENDING STRESS ON WEB DUE TO FY	0.0	(3)
TRANSVERSE SHEAR ON FLANGE DUE TO FX	356.6	(1)(2)
TRANSVERSE SHEAR ON WEB DUE TO FZ	7701.5	(3)
TORSIONAL SHEAR ON FLANGE DUE TO FX	265.7	(1)(2)
TORSIONAL SHEAR ON FLANGE DUE TO FZ	0.0	(3)
DIRECT TENSILE STRESS DUE TO FY	833.4	(ALL)
TORSIONAL SHEAR ON WEB DUE TO FX	398.6	(3)
TORSIONAL SHEAR ON WEB DUE TO FZ	0.0	(3)

** ALLOWABLE BENDING = 24000.0 ** ALLOWABLE SHEAR = 14400.0

BEND. STRESS IN TOP FLG. DUE TO FY & FZ	9758.6	(1)
BEND. STRESS IN BOT. FLG. DUE TO FY & FZ	9758.6	(2)
BENDING STRESS IN WEB DUE TO FX & FY	431.4	(3)
TOTAL TORSIONAL SHEAR STRESS IN FLANGES	265.7	(1)(2)
TOTAL TORSIONAL SHEAR STRESS IN WEB	398.6	(3)
MAX TENSILE STRESS IN TOP FLANGE (PSI)	11454.9	(4)
MAX TENSILE STRESS IN BOT FLANGE (PSI)	11454.9	(5)
MAX SHEAR STRESS-CENTER TOP FLANGE	5332.4	(1)
MAX SHEAR STRESS-CENTER BOT FLANGE	5332.4	(2)
MAX SHEAR STRESS-CENTER WEB (PSI)	8124.7	(3)

[illegible]

FORM N-2494

WHITING REQN. 7960-4 DATE 8-25-87
BY RGG PAGE 4-30 OF 112
MJM 8-26-87

AEP 50T BRIDGE DRIVER TRUCK OBE

** ANALYSIS OF TRUCK END DUE TO TORSION **

ADDED DIMENSIONS - B2 = 5.750 IN.
AL = 11.125 IN.
CL = 7.500 IN.

TORSIONAL RESISTANCE----------------	6.4	IN**4
SHEAR CENTER FROM CENTER OF TOP PLT--	10.217	IN.
WARPING CONSTANT--------------------	51145.9	IN**6
WARPING MOMENT----------------------	93712.5	IN-LBS.
ANGLE OF TWIST - 2ND DERIVATIVE------	0.3396E-06	
3RD DERIVATIVE------	0.6108E-07	

** TRUCK END STRESSES IN PSI **

TENSILE STRESS DUE TO WARPING RIGIDITY
THROUGHOUT THE THICKNESS @ PT. A-------- 712.0

TENSILE STRESS DUE TO WARPING RIGIDITY
THROUGHOUT THE THICKNESS @ PT. B-------- 2544.0

SHEAR STRESS DUE TO WARPING RIGIDITY
THROUGHOUT THE THICKNESS @ PT. C;
AT A DISTANCE (Y) 1.943 IN. FROM
THE INSIDE FACE OF THE WEB-------------- 307.9

SHEAR STRESS DUE TO WARPING RIGIDITY
THROUGHOUT THE THICKNESS @ PT. D;
AT A DISTANCE (Z) 10.717 IN. FROM
THE TOP FLANGE-------------------------- 811.2

TRANSVERSE SHEAR STRESS IN FLG DUE TO FX- 412.6
TRANSVERSE SHEAR STRESS IN WEB DUE TO FZ- 6682.8

MAX SHEAR STRESS IN WEB @ PT. D---------- 7494.0
MAX SHEAR STRESS IN BOT FLANGE----------- 1308.7

** STRESS CALC. CALLED 2 TIMES

FORM N-2494

WHITING REQN. 79604 DATE 8-25-87

AEP 50T BRIDGE IDLER TRUCK OBE

BY RGG PAGE 4-31 OF 42

MJM 8-26-87

TRUCK SIZE , TOP PLT = 0.75 X 19.00 IN.
BOT PLT = 0.75 X 19.00 IN.
WEB PLT = 0.50 X 25.38 IN.
DISTANCE BETWEEN WEB PLTS = 8.50 IN.

TRUCK WHEEL BASE = 30.38 IN.
COEF. OF FRICTION = 0.250

RAIL TO CENTER OF TWIST = 15.938 IN.

** FORCES IN THE GLOBAL COORDINATE SYSTEM **

FX = 5880.0 LBS.
FY = 0.0 LBS.
FZ = 138100.0 LBS.

** SECTION PROPERTIES **

AREA IN SQ. IN.	53.9
VERTICAL MOMENT OF INERTIA	6225.8
VERTICAL SECTION MODULUS	463.3
VERTICAL CENTER OF GRAVITY	13.4
HORIZ. MOMENT OF INERTIA	1371.7
HORIZ. SECTION MODULUS	144.4

** MAXIMUM DEFLECTIONS IN INCHES **

VERTICAL BENDING DEFL. DUE TO FZ	0.00086
HORIZ. BENDING DEFL. DUE TO FX	0.00017
VERTICAL SHEAR DEFL. DUE TO FZ	0.00782
HORIZ. SHEAR DEFL. DUE TO FX	0.00047

** TRUCK STRESSES IN PSI ** AT POINT (N) SECTION A-A

BENDING STRESS TOP FLANGE DUE TO FX	618.6	(4)
BENDING STRESS BOT FLANGE DUE TO FX	618.6	(5)
BENDING STRESS TOP FLANGE DUE TO FY	0.0	(1)(4)
BENDING STRESS BOT FLANGE DUE TO FY	0.0	(2)(5)
BENDING STRESS TOP FLANGE DUE TO FZ	4527.7	(1)(4)
BENDING STRESS BOT FLANGE DUE TO FZ	4527.7	(2)(5)
BENDING STRESS ON WEB DUE TO FX	309.3	(3)
BENDING STRESS ON WEB DUE TO FY	0.0	(3)
TRANSVERSE SHEAR ON FLANGE DUE TO FX	356.6	(1)(2)
TRANSVERSE SHEAR ON WEB DUE TO FZ	5921.9	(3)
TORSIONAL SHEAR ON FLANGE DUE TO FX	265.7	(1)(2)
TORSIONAL SHEAR ON FLANGE DUE TO FZ	0.0	(3)
DIRECT TENSILE STRESS DUE TO FY	0.0	(ALL)
TORSIONAL SHEAR ON WEB DUE TO FX	398.6	(3)
TORSIONAL SHEAR ON WEB DUE TO FZ	0.0	(3)

** ALLOWABLE BENDING = 24000.0 ** ALLOWABLE SHEAR = 14400.0

BEND. STRESS IN TOP FLG. DUE TO FY & FZ	4527.7	(1)
BEND. STRESS IN BOT. FLG. DUE TO FY & FZ	4527.7	(2)
BENDING STRESS IN WEB DUE TO FX & FY	309.3	(3)
TOTAL TORSIONAL SHEAR STRESS IN FLANGES	265.7	(1)(2)
TOTAL TORSIONAL SHEAR STRESS IN WEB	398.6	(3)
MAX TENSILE STRESS IN TOP FLANGE (PSI)	5146.2	(4)
MAX TENSILE STRESS IN BOT FLANGE (PSI)	5146.2	(5)
MAX SHEAR STRESS-CENTER TOP FLANGE	2347.8	(1)
MAX SHEAR STRESS-CENTER BOT FLANGE	2347.8	(2)
MAX SHEAR STRESS-CENTER WEB (PSI)	6322.4	(3)

AEP 50T BRIDGE IDLER TRUCK OBE

** ANALYSIS OF TRUCK END DUE TO TORSION **

ADDED DIMENSIONS - B2 = 5.750 IN.
AL = 11.125 IN.
CL = 7.500 IN.

TORSIONAL RESISTANCE------------------ 6.4 IN**4
SHEAR CENTER FROM CENTER OF TOP PLT-- 10.217 IN.
WARPING CONSTANT--------------------- 51145.9 IN**6
WARPING MOMENT----------------------- 93712.5 IN-LBS.
ANGLE OF TWIST - 2ND DERIVATIVE------ 0.3396E-06
3RD DERIVATIVE------ 0.6108E-07

** TRUCK END STRESSES IN PSI **

TENSILE STRESS DUE TO WARPING RIGIDITY
THROUGHOUT THE THICKNESS @ PT. A--------- 712.0

TENSILE STRESS DUE TO WARPING RIGIDITY
THROUGHOUT THE THICKNESS @ PT. B--------- 2544.0

SHEAR STRESS DUE TO WARPING RIGIDITY
THROUGHOUT THE THICKNESS @ PT. C;
AT A DISTANCE (Y) 1.943 IN. FROM
THE INSIDE FACE OF THE WEB--------------- 307.9

SHEAR STRESS DUE TO WARPING RIGIDITY
THROUGHOUT THE THICKNESS @ PT. D;
AT A DISTANCE (Z) 10.717 IN. FROM
THE TOP FLANGE--------------------------- 811.2

TRANSVERSE SHEAR STRESS IN FLG DUE TO FX- 412.6
TRANSVERSE SHEAR STRESS IN WEB DUE TO FZ- 5138.6

MAX SHEAR STRESS IN WEB @ PT. D---------- 5949.8
MAX SHEAR STRESS IN BOT FLANGE----------- 1308.7

** STRESS CALC. CALLED 2 TIMES

FORM N-2494

WHITING REQN. 79604 DATE 8-25-87

AEP 50T BRIDGE DRIVER TRUCK SSE

BY EGG PAGE 4-33 OF 112

MJM 8-26-87

TRUCK SIZE , TOP PLT = 0.75 X 19.00 IN.
BOT PLT = 0.75 X 19.00 IN.
WEB PLT = 0.50 X 25.38 IN.
DISTANCE BETWEEN WEB PLTS = 8.50 IN.

TRUCK WHEEL BASE = 42.38 IN.
COEF. OF FRICTION = 0.250

RAIL TO CENTER OF TWIST = 15.938 IN.

** FORCES IN THE GLOBAL COORDINATE SYSTEM **

FX = 11100.0 LBS.
FY = 64200.0 LBS.
FZ = 256800.0 LBS.

** SECTION PROPERTIES **

AREA IN SQ. IN.	53.9
VERTICAL MOMENT OF INERTIA	6225.8
VERTICAL SECTION MODULUS	463.3
VERTICAL CENTER OF GRAVITY	13.4
HORIZ. MOMENT OF INERTIA	1371.7
HORIZ. SECTION MODULUS	144.4

** MAXIMUM DEFLECTIONS IN INCHES **

VERTICAL BENDING DEFL. DUE TO FZ	0.00436
HORIZ. BENDING DEFL. DUE TO FX	0.00086
VERTICAL SHEAR DEFL. DUE TO FZ	0.02029
HORIZ. SHEAR DEFL. DUE TO FX	0.00124

** TRUCK STRESSES IN PSI ** AT POINT (N) SECTION A-A

BENDING STRESS TOP FLANGE DUE TO FX	1628.9	(4)
BENDING STRESS BOT FLANGE DUE TO FX	1628.9	(5)
BENDING STRESS TOP FLANGE DUE TO FY	2208.4	(1)(4)
BENDING STRESS BOT FLANGE DUE TO FY	2208.4	(2)(5)
BENDING STRESS TOP FLANGE DUE TO FZ	11744.9	(1)(4)
BENDING STRESS BOT FLANGE DUE TO FZ	11744.9	(2)(5)
BENDING STRESS ON WEB DUE TO FX	814.5	(3)
BENDING STRESS ON WEB DUE TO FY	0.0	(3)
TRANSVERSE SHEAR ON FLANGE DUE TO FX	673.1	(1)(2)
TRANSVERSE SHEAR ON WEB DUE TO FZ	11012.0	(3)
TORSIONAL SHEAR ON FLANGE DUE TO FX	501.6	(1)(2)
TORSIONAL SHEAR ON FLANGE DUE TO FZ	0.0	(3)
DIRECT TENSILE STRESS DUE TO FY	1191.6	(ALL)
TORSIONAL SHEAR ON WEB DUE TO FX	752.4	(3)
TORSIONAL SHEAR ON WEB DUE TO FZ	0.0	(3)

** ALLOWABLE BENDING = 32700.0 ** ALLOWABLE SHEAR = 19600.0

BEND. STRESS IN TOP FLG. DUE TO FY & FZ	13953.3	(1)
BEND. STRESS IN BOT. FLG. DUE TO FY & FZ	13953.3	(2)
BENDING STRESS IN WEB DUE TO FX & FY	814.5	(3)
TOTAL TORSIONAL SHEAR STRESS IN FLANGES	501.6	(1)(2)
TOTAL TORSIONAL SHEAR STRESS IN WEB	752.4	(3)
MAX TENSILE STRESS IN TOP FLANGE (PSI)	16773.8	(4)
MAX TENSILE STRESS IN BOT FLANGE (PSI)	16773.8	(5)
MAX SHEAR STRESS-CENTER TOP FLANGE	7663.0	(1)
MAX SHEAR STRESS-CENTER BOT FLANGE	7663.0	(2)
MAX SHEAR STRESS-CENTER WEB (PSI)	11807.0	(3)

AEP 50T BRIDGE DRIVER TRUCK SSE

** ANALYSIS OF TRUCK END DUE TO TORSION **

ADDED DIMENSIONS - B2 = 5.750 IN.
AL = 11.125 IN.
CL = 7.500 IN.

TORSIONAL RESISTANCE----------------	6.4 IN**4
SHEAR CENTER FROM CENTER OF TOP PLT--	10.217 IN.
WARPING CONSTANT--------------------	51145.9 IN**6
WARPING MOMENT----------------------	176906.3 IN-LBS.
ANGLE OF TWIST - 2ND DERIVATIVE------	0.6410E-06
3RD DERIVATIVE------	0.1153E-06

** TRUCK END STRESSES IN PSI **

TENSILE STRESS DUE TO WARPING RIGIDITY THROUGHOUT THE THICKNESS @ PT. A---------	1344.1
TENSILE STRESS DUE TO WARPING RIGIDITY THROUGHOUT THE THICKNESS @ PT. B---------	4802.5
SHEAR STRESS DUE TO WARPING RIGIDITY THROUGHOUT THE THICKNESS @ PT. C; AT A DISTANCE (Y) 1.943 IN. FROM THE INSIDE FACE OF THE WEB--------------	581.2
SHEAR STRESS DUE TO WARPING RIGIDITY THROUGHOUT THE THICKNESS @ PT. D; AT A DISTANCE (Z) 10.717 IN. FROM THE TOP FLANGE---------------------------	1531.3
TRANSVERSE SHEAR STRESS IN FLG DUE TO FX-	778.9
TRANSVERSE SHEAR STRESS IN WEB DUE TO FZ-	9555.3
MAX SHEAR STRESS IN WEB @ PT. D----------	11086.7
MAX SHEAR STRESS IN BOT FLANGE-----------	2470.6

** STRESS CALC. CALLED 2 TIMES

AEP 50T BRIDGE-IDLER TRUCK SSE

TRUCK SIZE , TOP PLT = 0.75 X 19.00 IN.
BOT PLT = 0.75 X 19.00 IN.
WEB PLT = 0.50 X 25.38 IN.
DISTANCE BETWEEN WEB PLTS = 8.50 IN.

TRUCK WHEEL BASE = 30.38 IN.
COEF. OF FRICTION = 0.250

RAIL TO CENTER OF TWIST = 15.938 IN.

** FORCES IN THE GLOBAL COORDINATE SYSTEM **

FX = 11100.0 LBS.
FY = 0.0 LBS.
FZ = 195200.0 LBS.

** SECTION PROPERTIES **

AREA IN SQ. IN.	53.9
VERTICAL MOMENT OF INERTIA	6225.8
VERTICAL SECTION MODULUS	463.3
VERTICAL CENTER OF GRAVITY	13.4
HORIZ. MOMENT OF INERTIA	1371.7
HORIZ. SECTION MODULUS	144.4

** MAXIMUM DEFLECTIONS IN INCHES **

VERTICAL BENDING DEFL. DUE TO FZ	0.00122
HORIZ. BENDING DEFL. DUE TO FX	0.00032
VERTICAL SHEAR DEFL. DUE TO FZ	0.01106
HORIZ. SHEAR DEFL. DUE TO FX	0.00089

** TRUCK STRESSES IN PSI ** AT POINT (N) SECTION A-A

BENDING STRESS TOP FLANGE DUE TO FX	1167.7	(4)
BENDING STRESS BOT FLANGE DUE TO FX	1167.7	(5)
BENDING STRESS TOP FLANGE DUE TO FY	0.0	(1)(4)
BENDING STRESS BOT FLANGE DUE TO FY	0.0	(2)(5)
BENDING STRESS TOP FLANGE DUE TO FZ	6399.7	(1)(4)
BENDING STRESS BOT FLANGE DUE TO FZ	6399.7	(2)(5)
BENDING STRESS ON WEB DUE TO FX	583.8	(3)
BENDING STRESS ON WEB DUE TO FY	0.0	(3)
TRANSVERSE SHEAR ON FLANGE DUE TO FX	673.1	(1)(2)
TRANSVERSE SHEAR ON WEB DUE TO FZ	8370.5	(3)
TORSIONAL SHEAR ON FLANGE DUE TO FX	501.6	(1)(2)
TORSIONAL SHEAR ON FLANGE DUE TO FZ	0.0	(3)
DIRECT TENSILE STRESS DUE TO FY	0.0	(ALL)
TORSIONAL SHEAR ON WEB DUE TO FX	752.4	(3)
TORSIONAL SHEAR ON WEB DUE TO FZ	0.0	(3)

** ALLOWABLE BENDING = 32700.0 ** ALLOWABLE SHEAR = 19600.0

BEND. STRESS IN TOP FLG. DUE TO FY & FZ	6399.7	(1)
BEND. STRESS IN BOT. FLG. DUE TO FY & FZ	6399.7	(2)
BENDING STRESS IN WEB DUE TO FX & FY	583.8	(3)
TOTAL TORSIONAL SHEAR STRESS IN FLANGES	501.6	(1)(2)
TOTAL TORSIONAL SHEAR STRESS IN WEB	752.4	(3)
MAX TENSILE STRESS IN TOP FLANGE (PSI)	7567.4	(4)
MAX TENSILE STRESS IN BOT FLANGE (PSI)	7567.4	(5)
MAX SHEAR STRESS-CENTER TOP FLANGE	3408.7	(1)
MAX SHEAR STRESS-CENTER BOT FLANGE	3408.7	(2)
MAX SHEAR STRESS-CENTER WEB (PSI)	9127.5	(3)

AEP 50T BRIDGE IDLER TRUCK SSE

** ANALYSIS OF TRUCK END DUE TO TORSION **

ADDED DIMENSIONS - B2 = 5.750 IN.
AL = 11.125 IN.
CL = 7.500 IN.

TORSIONAL RESISTANCE------------------ 6.4 IN**4
SHEAR CENTER FROM CENTER OF TOP PLT-- 10.217 IN.
WARPING CONSTANT--------------------- 51145.9 IN**6
WARPING MOMENT----------------------- 176906.3 IN-LBS.
ANGLE OF TWIST - 2ND DERIVATIVE------ 0.6410E-06
3RD DERIVATIVE------ 0.1153E-06

** TRUCK END STRESSES IN PSI **

TENSILE STRESS DUE TO WARPING RIGIDITY
THROUGHOUT THE THICKNESS @ PT. A--------- 1344.1

TENSILE STRESS DUE TO WARPING RIGIDITY
THROUGHOUT THE THICKNESS @ PT. B--------- 4802.5

SHEAR STRESS DUE TO WARPING RIGIDITY
THROUGHOUT THE THICKNESS @ PT. C;
AT A DISTANCE (Y) 1.943 IN. FROM
THE INSIDE FACE OF THE WEB-------------- 581.2

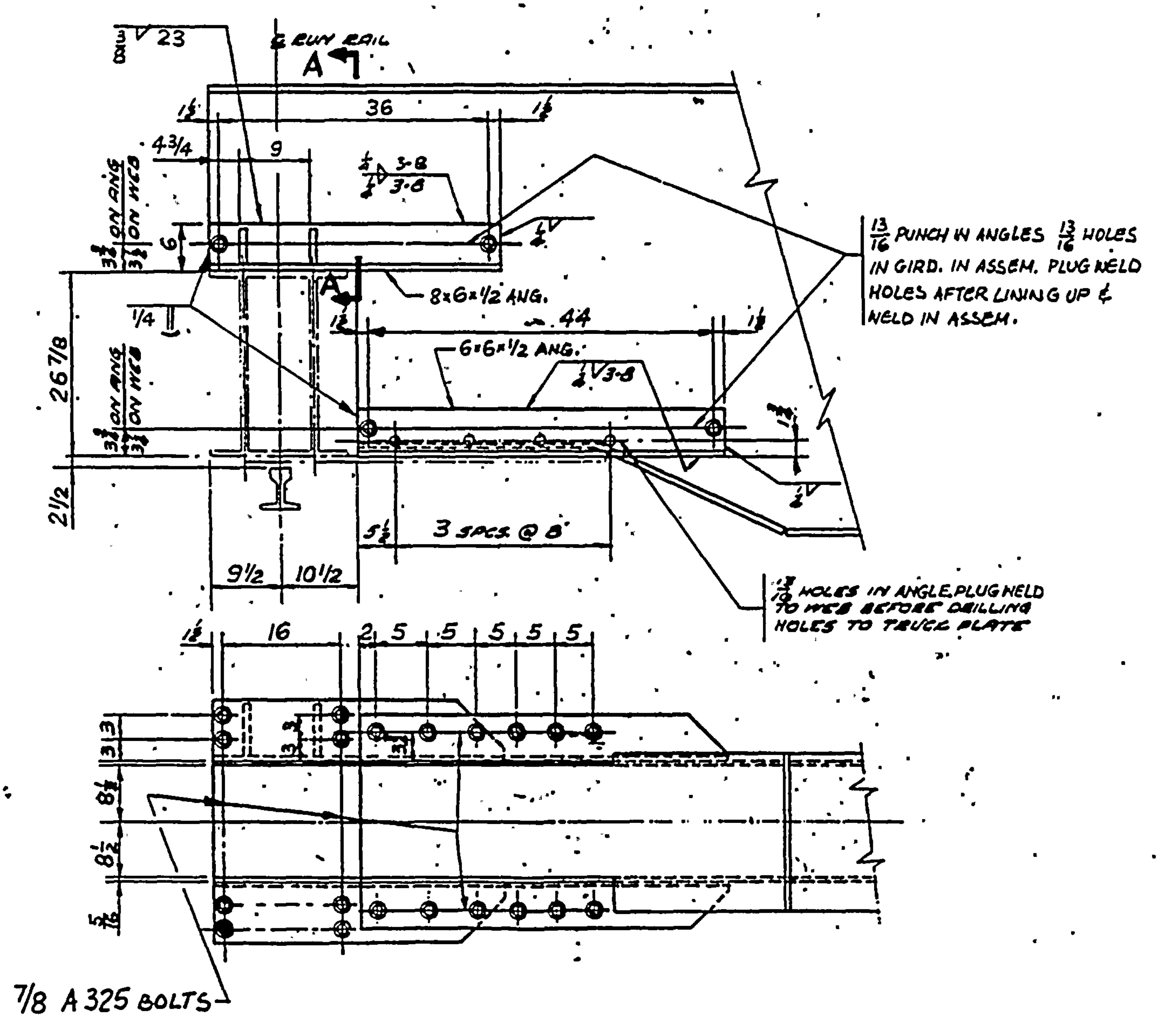
SHEAR STRESS DUE TO WARPING RIGIDITY
THROUGHOUT THE THICKNESS @ PT. D;
AT A DISTANCE (Z) 10.717 IN. FROM
THE TOP FLANGE-------------------------- 1531.3

TRANSVERSE SHEAR STRESS IN FLG DUE TO FX- 778.9
TRANSVERSE SHEAR STRESS IN WEB DUE TO FZ- 7263.3

MAX SHEAR STRESS IN WEB @ PT. D---------- 8794.6
MAX SHEAR STRESS IN BOT FLANGE----------- 2470.6

** STRESS CALC. CALLED 2 TIMES

GIRDER TO TRUCK CONNECTION.



ALLOWABLES

7/8" BOLTS

MTRL: A325

$\sigma_{Y MIN} = 92\ KSI$

OBE $\sigma_{ALL} = \frac{\sigma_{Y MIN}}{1.5} = 61.3\ KSI$

$\tau_{ALL} = 0.6\ \sigma_{ALL} = 36.8\ KSI$

SSE $\sigma_{ALL} = \frac{\sigma_{Y MIN}}{1.1} = 83.6\ KSI$

$\tau_{ALL} = 0.6\ \sigma_{ALL} = 50.2\ KSI$

WELDS (FILLET THRU THROAT)

BASE MTRL: ASTM-A36 $\sigma_{Y MIN} = 36\ KSI$

WELD MTRL: MIN. E60XX ELECTRODES $\sigma_{Y MIN} = 50\ KSI$

OBE $\tau_{W.ALL} = \frac{\sigma_{Y MIN. WELD}}{1.5}\ 0.6 = 20.0\ KSI$

$= \frac{0.6\sqrt{2}\ \sigma_{Y MIN. BASE}}{1.5} = 20.4\ KSI$

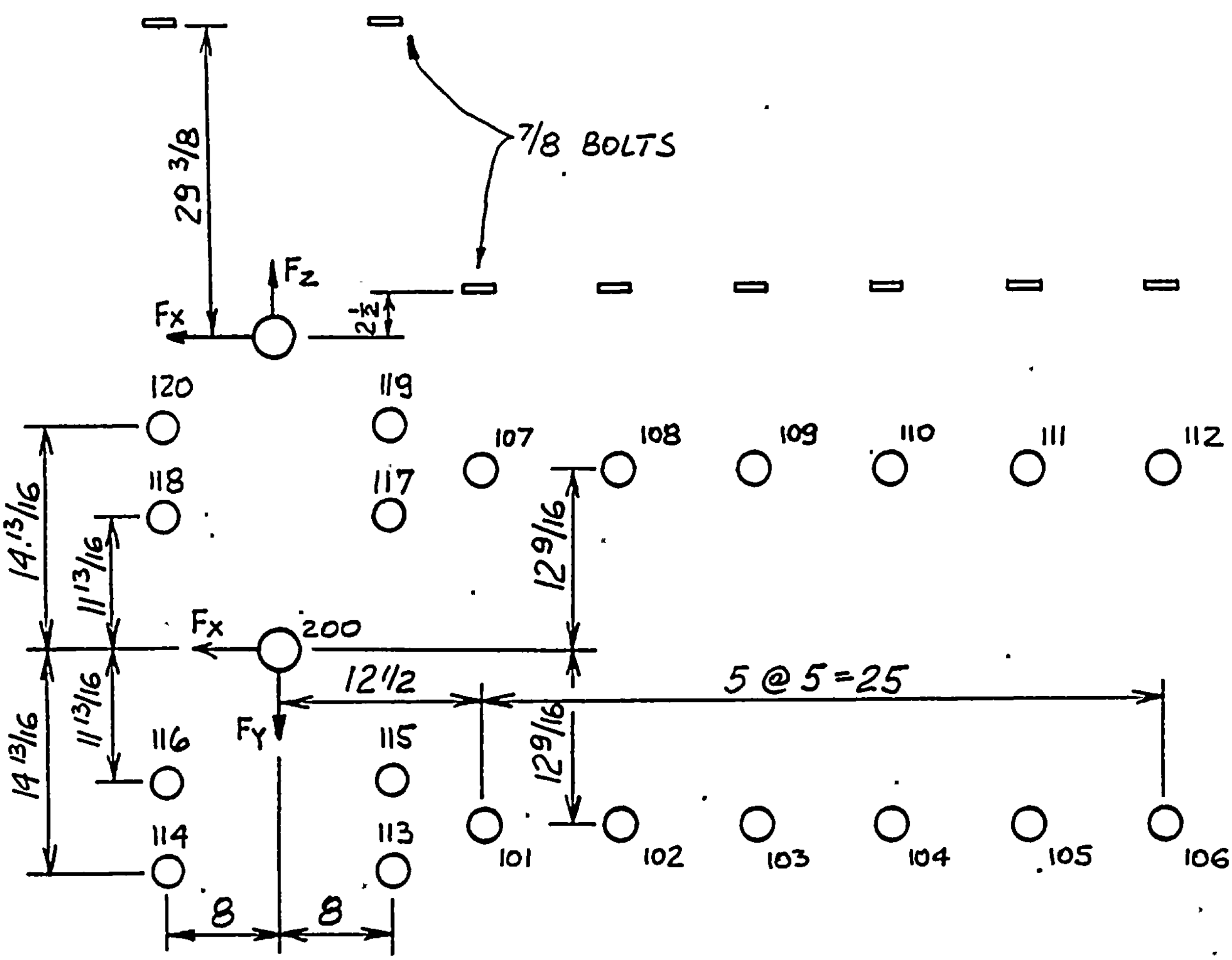
$\therefore\ \tau_{W.ALL} = 20.0\ KSI$

SSE $\tau_{W.ALL} = \frac{0.6\ \sigma_{Y MIN. WELD}}{1.1} = 27.3\ KSI$

$= \frac{0.6\sqrt{2}\ \sigma_{Y MIN. BASE}}{1.1} = 27.8\ KSI$

$\therefore\ \tau_{W.ALL} = 27.3\ KSI$

BOLTED CONNECTION



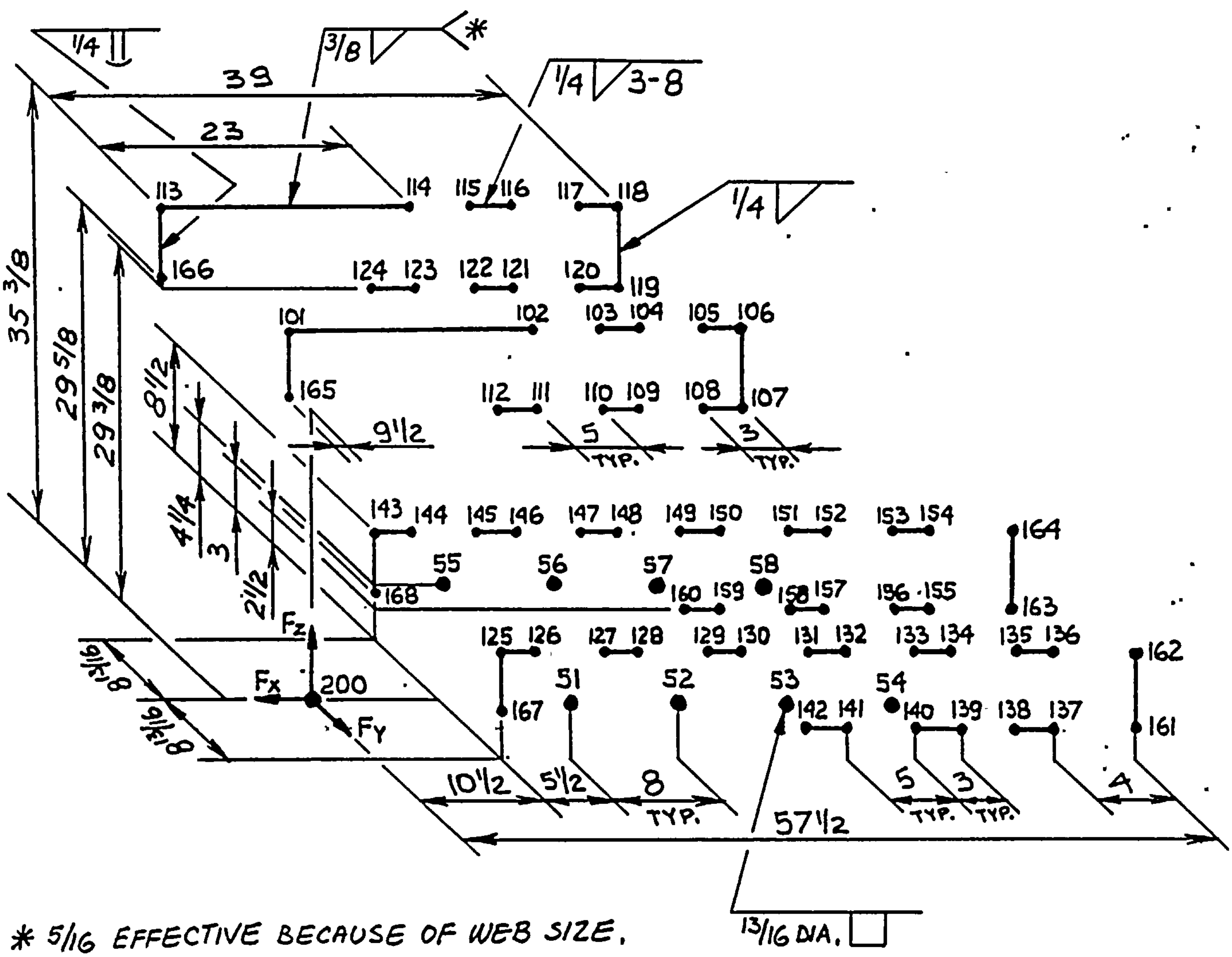
F_Z LOAD IS TRANSFERRED IN BEARING OF WEBS ON TRUCK. OTHER LOADS ARE TRANSFERRED IN SHEAR OF BOLTS. BOLTS ARE NOT IN TENSION.

MAX. LOADINGS PER TABLE 4-2 AND 4-3

OBE F_X = 11.8 KIP F_Y = 49.8 KIP F_Z = 250.2 KIP M_x = 3267 IN. KIP

SSE F_X = 22.2 KIP F_Y = 78.8 KIP F_Z = 339.4 KIP M_x = 5384 IN. KIP

WELDED CONNECTION.



* 5/16 EFFECTIVE BECAUSE OF WEB SIZE.

1/4 SQUARE WELDS WERE TREATED AS 1/4 FILLET WELDS.

PLUG WELDS WERE OMITTED, WHICH IS CONSERVATIVE.

BECAUSE WELDS ARE LOADED BY BOLTS. THEY ARE CONSIDERED INEFFECTIVE IN Z DIRECTION (BOLT TENSION).

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                                 ***** CONSYS INPUT DATA LISTING *****      08/21/87
                                 ASZ                PAGE 4-41  OF 112
         5   10   15   20   25   30   35   40   45   50   55   60   65   70
         V    V    V    V    V    V    V    V    V    V    V    V    V    V
  1. AEP * 150T CRANE  * 50T LOAD * TRUCK TO GIRDER * BOLTS * OBE  MJM 8-25-87
  2. 79604 ASZ  4.   1.   1.                            1.   1.
  3.  1.   3.   2.
  4.  2.   4.   0.
  5. -1.
  6. 0.875     36.8                           3.
  7. -1.
  8.  101.               1.   1.         12.
  9.  113.               1.   1.          8.
 10.  200.               2.
 11. -1.
 12. -6.   6.                -25.125
 13.  101.          -12.5      12.5625     2.5
 14.  102.          -17.5      12.5625     2.5
 15.  103.          -22.5      12.5625     2.5
 16.  104.          -27.5      12.5625     2.5
 17.  105.          -32.5      12.5625     2.5
 18.  106.          -37.5      12.5625     2.5
 19.  113.           -8.       14.8125    29.375
 20.  114.            8.       14.8125    29.375
 21.  115.           -8.       11.8125    29.375
 22.  116.            8.       11.8125    29.375
 23.  117.           -8.      -11.8125    29.375
 24.  118.            8.      -11.8125    29.375
 25.  119.           -8.      -14.8125    29.375
 26.  120.            8.      -14.8125    29.375
 27.  200.            0.         0.        0.
 28.  9999.
 29.  101.  1.  120.
 30. -1.
 31.  200. 11.8      49.8       0.       -3267.
 32. -1.
 33.  200. 11.8     -49.8       0.        3267.
 34. -1.
 35.  200.-11.8      49.8       0.       -3267.
 36. -1.
 37.  200.-11.8     -49.8       0.        3267.
 38. -1.
 39. FINISH
         A    A    A    A    A    A    A    A    A    A    A    A    A    A
```

AEP * 150T CRANE * 50T LOAD * TRUCK TO GIRDER * BOLTS * OBE

***** WORST CASE ANALYSIS SUMMARY *****

AEP * 150T CRANE * 50T LOAD * TRUCK TO GIRDER * BOLTS * OBE

LOAD STEP...... 1	X	DIRECTION Y	Z
TRANSLATED FORCES.........	11.80	49.80	0.00
TRANSLATED MOMENTS........	-2607.15	-156.35	747.00

NUMBER OF FORCE DEFINITION NODES... 1

MAXIMUM ABSOLUTE STRESS ON ELEMENT 14 = 28.1 KSI
COMPARISON FACTOR MATCH ON ELEMENT 14 = 1.3081508

AEP * 150T CRANE * 50T LOAD * TRUCK TO GIRDER * BOLTS * OBE

LOAD STEP...... 2	X	DIRECTION Y	Z
TRANSLATED FORCES.........	11.80	-49.80	0.00
TRANSLATED MOMENTS........	2607.15	-156.35	-747.00

NUMBER OF FORCE DEFINITION NODES... 1

MAXIMUM ABSOLUTE STRESS ON ELEMENT 20 = 28.1 KSI
COMPARISON FACTOR MATCH ON ELEMENT 20 = 1.3081508

AEP * 150T CRANE * 50T LOAD * TRUCK TO GIRDER * BOLTS * OBE

LOAD STEP...... 3	X	DIRECTION Y	Z
TRANSLATED FORCES.........	-11.80	49.80	0.00
TRANSLATED MOMENTS........	-2607.15	156.35	747.00

NUMBER OF FORCE DEFINITION NODES... 1

MAXIMUM ABSOLUTE STRESS ON ELEMENT 20 = 28.1 KSI
COMPARISON FACTOR MATCH ON ELEMENT 20 = 1.3081508

AEP * 150T CRANE * 50T LOAD * TRUCK TO GIRDER * BOLTS * OBE

LOAD STEP...... 4	X	DIRECTION Y	Z
TRANSLATED FORCES.........	-11.80	-49.80	0.00
TRANSLATED MOMENTS........	2607.15	156.35	-747.00

NUMBER OF FORCE DEFINITION NODES... 1

MAXIMUM ABSOLUTE STRESS ON ELEMENT 14 = 28.1 KSI
COMPARISON FACTOR MATCH ON ELEMENT 14 = 1.3081508

***** WORST CASE ANALYSIS COMPLETE *****

WORST CASE OCCURED DURING LOAD STEP 1

AEP * 150T CRANE * 50T LOAD * TRUCK TO GIRDER * BOLTS * OBE

***** SYSTEM PROPERTIES *****

LOAD STEP...... 1

	DIRECTION, LOCATION OR AXIS		
	X	Y	Z
CENTROIDS, X AXIS.........		0.00	13.25
Y AXIS.........	0.00		13.25
Z AXIS.........	-15.00	-0.00	
SHEAR AREAS...............	12.03	12.03	0.00
POLAR MOMENTS OF INERTIA..	2084.70	2084.70	4640.13
TRANSLATED FORCES.........	11.80	49.80	0.00
TRANSLATED MOMENTS........	-2607.15	-156.35	747.00

NUMBER OF FORCE DEFINITION NODES... 1

***** SYSTEM ELEMENT STRESSES *****

DIRECT STRESSES ARE EQUALLY DISTRIBUTED THROUGHOUT SHEAR AREA
DRX 1.0   DRY 4.1   DRZ 0.0

2-D POINT ELEMENT 1   NODE 101   AREA 0.601   DIAMETER 0.875
STRESS AT NODE 8.9   ALLOWABLE 36.8
STRESS EXPANSION FOR NODE 101
0.8   -2.0   -13.4   0.4   0.0   0.0
FORCES AT NODE 101   FX -0.   FY -5.   FZ 0.

2-D POINT ELEMENT 2   NODE 102   AREA 0.601   DIAMETER 0.875
STRESS AT NODE 9.7   ALLOWABLE 36.8
STRESS EXPANSION FOR NODE 102
0.8   -2.0   -13.4   -0.4   0.0   0.0
FORCES AT NODE 102   FX -0.   FY -6.   FZ 0.

2-D POINT ELEMENT 3   NODE 103   AREA 0.601   DIAMETER 0.875
STRESS AT NODE 10.5   ALLOWABLE 36.8
STRESS EXPANSION FOR NODE 103
0.8   -2.0   -13.4   -1.2   0.0   0.0
FORCES AT NODE 103   FX -0.   FY -6.   FZ 0.

2-D POINT ELEMENT 4   NODE 104   AREA 0.601   DIAMETER 0.875
STRESS AT NODE 11.3   ALLOWABLE 36.8
STRESS EXPANSION FOR NODE 104
0.8   -2.0   -13.4   -2.0   0.0   0.0
FORCES AT NODE 104   FX -0.   FY -7.   FZ 0.

2-D POINT ELEMENT 5   NODE 105   AREA 0.601   DIAMETER 0.875
STRESS AT NODE 12.1   ALLOWABLE 36.8
STRESS EXPANSION FOR NODE 105
0.8   -2.0   -13.4   -2.8   0.0   0.0
FORCES AT NODE 105   FX -0.   FY -7.   FZ 0.

AEP * 150T CRANE * 50T LOAD * TRUCK TO GIRDER * BOLTS * OBE

***** SYSTEM ELEMENT STRESSES *****

2-D POINT ELEMENT 6 NODE 106 AREA 0.601 DIAMETER 0.875
STRESS AT NODE 12.9 ALLOWABLE 36.8
STRESS EXPANSION FOR NODE 106
0.8 -2.0 -13.4 -3.6 0.0 0.0
FORCES AT NODE 106 FX -0. FY -8. FZ 0.

2-D POINT ELEMENT 7 NODE 107 AREA 0.601 DIAMETER 0.875
STRESS AT NODE 9.7 ALLOWABLE 36.8
STRESS EXPANSION FOR NODE 107
0.8 2.0 -13.4 0.4 0.0 0.0
FORCES AT NODE 107 FX 2. FY -5. FZ 0.

2-D POINT ELEMENT 8 NODE 108 AREA 0.601 DIAMETER 0.875
STRESS AT NODE 10.4 ALLOWABLE 36.8
STRESS EXPANSION FOR NODE 108
0.8 2.0 -13.4 -0.4 0.0 0.0
FORCES AT NODE 108 FX 2. FY -6. FZ 0.

2-D POINT ELEMENT 9 NODE 109 AREA 0.601 DIAMETER 0.875
STRESS AT NODE 11.2 ALLOWABLE 36.8
STRESS EXPANSION FOR NODE 109
0.8 2.0 -13.4 -1.2 0.0 0.0
FORCES AT NODE 109 FX 2. FY -6. FZ 0.

2-D POINT ELEMENT 10 NODE 110 AREA 0.601 DIAMETER 0.875
STRESS AT NODE 11.9 ALLOWABLE 36.8
STRESS EXPANSION FOR NODE 110
0.8 2.0 -13.4 -2.0 0.0 0.0
FORCES AT NODE 110 FX 2. FY -7. FZ 0.

2-D POINT ELEMENT 11 NODE 111 AREA 0.601 DIAMETER 0.875
STRESS AT NODE 12.7 ALLOWABLE 36.8
STRESS EXPANSION FOR NODE 111
0.8 2.0 -13.4 -2.8 0.0 0.0
FORCES AT NODE 111 FX 2. FY -7. FZ 0.

2-D POINT ELEMENT 12 NODE 112 AREA 0.601 DIAMETER 0.875
STRESS AT NODE 13.5 ALLOWABLE 36.8
STRESS EXPANSION FOR NODE 112
0.8 2.0 -13.4 -3.6 0.0 0.0
FORCES AT NODE 112 FX 2. FY -8. FZ 0.

2-D POINT ELEMENT 13 NODE 113 AREA 0.601 DIAMETER 0.875
STRESS AT NODE 25.6 ALLOWABLE 36.8
STRESS EXPANSION FOR NODE 113
-1.2 -2.4 20.2 1.1 0.0 0.0
FORCES AT NODE 113 FX -2. FY 15. FZ 0.

2-D POINT ELEMENT 14 NODE 114 AREA 0.601 DIAMETER 0.875
STRESS AT NODE 28.1 ALLOWABLE 36.8
STRESS EXPANSION FOR NODE 114
-1.2 -2.4 20.2 3.7 0.0 0.0
FORCES AT NODE 114 FX -2. FY 17. FZ 0.

AEP * 150T CRANE * 50T LOAD * TRUCK TO GIRDER * BOLTS * OBE

***** SYSTEM ELEMENT STRESSES *****

2-D POINT ELEMENT 15   NODE 115   AREA 0.601   DIAMETER 0.875
STRESS AT NODE 25.5   ALLOWABLE 36.8
STRESS EXPANSION FOR NODE 115
-1.2   -1.9   20.2   1.1   0.0   0.0
FORCES AT NODE 115   FX -1.   FY 15.   FZ 0.

2-D POINT ELEMENT 16   NODE 116   AREA 0.601   DIAMETER 0.875
STRESS AT NODE 28.1   ALLOWABLE 36.8
STRESS EXPANSION FOR NODE 116
-1.2   -1.9   20.2   3.7   0.0   0.0
FORCES AT NODE 116   FX -1.   FY 17.   FZ 0.

2-D POINT ELEMENT 17   NODE 117   AREA 0.601   DIAMETER 0.875
STRESS AT NODE 25.5   ALLOWABLE 36.8
STRESS EXPANSION FOR NODE 117
-1.2   1.9   20.2   1.1   0.0   0.0
FORCES AT NODE 117   FX 1.   FY 15.   FZ 0.

2-D POINT ELEMENT 18   NODE 118   AREA 0.601   DIAMETER 0.875
STRESS AT NODE 28.1   ALLOWABLE 36.8
STRESS EXPANSION FOR NODE 118
-1.2   1.9   20.2   3.7   0.0   0.0
FORCES AT NODE 118   FX 1.   FY 17.   FZ 0.

2-D POINT ELEMENT 19   NODE 119   AREA 0.601   DIAMETER 0.875
STRESS AT NODE 25.5   ALLOWABLE 36.8
STRESS EXPANSION FOR NODE 119
-1.2   2.4   20.2   1.1   0.0   0.0
FORCES AT NODE 119   FX 1.   FY 15.   FZ 0.

2-D POINT ELEMENT 20   NODE 120   AREA 0.601   DIAMETER 0.875
STRESS AT NODE 28.1   ALLOWABLE 36.8
STRESS EXPANSION FOR NODE 120
-1.2   2.4   20.2   3.7   0.0   0.0
FORCES AT NODE 120   FX 1.   FY 17.   FZ 0.

FORCE DEFINITION NODE   DIRECT   ELEMENT 21   NODE 200
FX 11.80 ;   FY 49.80 ;   FZ 0.00
MX -3267.00 ;   MY 0.00 ;   MZ 0.00

MAXIMUM ABSOLUTE STRESS ON ELEMENT 14 = 28.1 KSI

[illegible]

*** CONSYS ANALYSIS PROGRAM ***   REQUISITION 79604   DATE 08/21/87
VERSION 4.2   RELEASED 12/03/82   BY: ASZ   PAGE 4-46 OF 112
MJM 8-25-87

AEP * 150T CRANE * 50T LOAD * TRUCK TO GIRDER * BOLTS * OBE

***** REPORT SUMMARY, FOR A 4 LOAD STEP ANALYSIS *****

WORST CASE ANALYSIS.........NO
ELEMENT STRESSES PRINTED....YES, STRESS SUMMATION MODE WAS DIRECT

ELEMENT STATISTICS

TYPE	DESCRIPTION	NUMBER USED
1	2-DIMENSIONAL POINT ELEMENT........	20
2	FORCE DEFINITION NODE - DIRECT.....	1

TOTAL NUMBER OF ELEMENTS = 21, NODES = 21

SYSTEM PROPERTIES

LOAD STEP....... 1   DIRECTION, LOCATION OR AXIS

	X	Y	Z
CENTROIDS, X AXIS.........		0.00	13.25
Y AXIS.........	0.00		13.25
Z AXIS.........	-15.00	-0.00	
SHEAR AREAS................	12.03	12.03	0.00
POLAR MOMENTS OF INERTIA..	2084.70	2084.70	4640.13
TRANSLATED FORCES.........	11.80	49.80	0.00
TRANSLATED MOMENTS........	-2607.15	-156.35	747.00

MAXIMUM ELEMENT STRESSES

DESCRIPTION	NUMBER USED	ELEMENT	NODE	STRESS	ALLOWABLE	COMPARISON FACTOR
2-D POINT ELEMENT	20	14	114	28.1 KSI	36.8 KSI	1.3082

***** JOB COMPLETED *****

***** CONSYS INPUT DATA LISTING *****   08/21/87

ASZ   PAGE 4-47 OF 112

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        5    10   15   20   25   30   35   40   45   50   55   60   65   70
        V    V    V    V    V    V    V    V    V    V    V    V    V    V
 1. AEP * 150T CRANE * 50T LOAD * TRUCK TO GIRDER * BOLTS * SSE   MJM8-25-87
 2. 79604 ASZ  4.   1.   1.                            1.   1.
 3.  1.   3.   2.
 4.  2.   4.   0.
 5. -1.
 6.  0.875    50.2                           3.
 7. -1.
 8.  101.                1.   1.        12.
 9.  113.                1.   1.         8.
10.  200.                2.
11. -1.
12. -6.   6.                 -25.125
13.  101.           -12.5      12.5625    2.5
14.  102.           -17.5      12.5625    2.5
15.  103.           -22.5      12.5625    2.5
16.  104.           -27.5      12.5625    2.5
17.  105.           -32.5      12.5625    2.5
18.  106.           -37.5      12.5625    2.5
19.  113.            -8.       14.8125   29.375
20.  114.             8.       14.8125   29.375
21.  115.            -8.       11.8125   29.375
22.  116.             8.       11.8125   29.375
23.  117.            -8.      -11.8125   29.375
24.  118.             8.      -11.8125   29.375
25.  119.            -8.      -14.8125   29.375
26.  120.             8.      -14.8125   29.375
27.  200.             0.        0.        0.
28.  9999.
29.  101. 1.  120.
30. -1.
31.  200. 22.2      78.8       0.       -5384.
32. -1.
33.  200. 22.2     -78.8       0.        5384.
34. -1.
35.  200.-22.2      78.8       0.       -5384.
36. -1.
37.  200.-22.2     -78.8       0.        5384.
38. -1.
39. FINISH
        A    A    A    A    A    A    A    A    A    A    A    A    A    A
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*** CONSYS ANALYSIS PROGRAM ***. REQUISITION 79604 DATE 08/21/87
VERSION 4.2 RELEASED 12/03/82 BY: ASZ PAGE 4-48 OF 112
MJM 8-25-87

AEP * 150T CRANE * 50T LOAD * TRUCK TO GIRDER * BOLTS * SSE

***** WORST CASE ANALYSIS SUMMARY *****

AEP * 150T CRANE * 50T LOAD * TRUCK TO GIRDER * BOLTS * SSE

LOAD STEP...... 1	X	Y (DIRECTION)	Z
TRANSLATED FORCES.........	22.20	78.80	0.00
TRANSLATED MOMENTS........	-4339.90	-294.15	1182.00

NUMBER OF FORCE DEFINITION NODES... 1

MAXIMUM ABSOLUTE STRESS ON ELEMENT 14 = 46.2 KSI
COMPARISON FACTOR MATCH ON ELEMENT 14 = 1.0872481

AEP * 150T CRANE * 50T LOAD * TRUCK TO GIRDER * BOLTS * SSE

LOAD STEP...... 2	X	Y (DIRECTION)	Z
TRANSLATED FORCES.........	22.20	-78.80	0.00
TRANSLATED MOMENTS........	4339.90	-294.15	-1182.00

NUMBER OF FORCE DEFINITION NODES... 1

MAXIMUM ABSOLUTE STRESS ON ELEMENT 20 = 46.2 KSI
COMPARISON FACTOR MATCH ON ELEMENT 20 = 1.0872481

AEP * 150T CRANE * 50T LOAD * TRUCK TO GIRDER * BOLTS * SSE

LOAD STEP...... 3	X	Y (DIRECTION)	Z
TRANSLATED FORCES.........	-22.20	78.80	0.00
TRANSLATED MOMENTS........	-4339.90	294.15	1182.00

NUMBER OF FORCE DEFINITION NODES... 1

MAXIMUM ABSOLUTE STRESS ON ELEMENT 20 = 46.2 KSI
COMPARISON FACTOR MATCH ON ELEMENT 20 = 1.0872481

AEP * 150T CRANE * 50T LOAD * TRUCK TO GIRDER * BOLTS * SSE

LOAD STEP...... 4	X	Y (DIRECTION)	Z
TRANSLATED FORCES.........	-22.20	-78.80	0.00
TRANSLATED MOMENTS........	4339.90	294.15	-1182.00

NUMBER OF FORCE DEFINITION NODES... 1

MAXIMUM ABSOLUTE STRESS ON ELEMENT 14 = 46.2 KSI
COMPARISON FACTOR MATCH ON ELEMENT 14 = 1.0872481

***** WORST CASE ANALYSIS COMPLETE *****

WORST CASE OCCURED DURING LOAD STEP 1

*** CONSYS ANALYSIS PROGRAM *** REQUISITION 79604 DATE 08/21/87

VERSION 4.2 RELEASED 12/03/82 BY: ASZ PAGE 4-49 OF 112

MJM 8-25-87

AEP * 150T CRANE * 50T LOAD * TRUCK TO GIRDER * BOLTS * SSE

***** SYSTEM PROPERTIES *****

LOAD STEP...... 1	DIRECTION, LOCATION OR AXIS		
	X	Y	Z
CENTROIDS, X AXIS..........		0.00	13.25
Y AXIS..........	0.00		13.25
Z AXIS..........	-15.00	-0.00	
SHEAR AREAS................	12.03	12.03	0.00
POLAR MOMENTS OF INERTIA..	2084.70	2084.70	4640.13
TRANSLATED FORCES..........	22.20	78.80	0.00
TRANSLATED MOMENTS.........	-4339.90	-294.15	1182.00

NUMBER OF FORCE DEFINITION NODES... 1

***** SYSTEM ELEMENT STRESSES *****

DIRECT STRESSES ARE EQUALLY DISTRIBUTED THROUGHOUT SHEAR AREA
DRX 1.8 DRY 6.6 DRZ 0.0

2-D POINT ELEMENT 1 NODE 101 AREA 0.601 DIAMETER 0.875
STRESS AT NODE 15.2 ALLOWABLE 50.2
STRESS EXPANSION FOR NODE 101
1.5 -3.2 -22.4 0.6 0.0 0.0
FORCES AT NODE 101 FX 0. FY -9. FZ 0.

2-D POINT ELEMENT 2 NODE 102 AREA 0.601 DIAMETER 0.875
STRESS AT NODE 16.5 ALLOWABLE 50.2
STRESS EXPANSION FOR NODE 102
1.5 -3.2 -22.4 -0.6 0.0 0.0
FORCES AT NODE 102 FX 0. FY -10. FZ 0.

2-D POINT ELEMENT 3 NODE 103 AREA 0.601 DIAMETER 0.875
STRESS AT NODE 17.7 ALLOWABLE 50.2
STRESS EXPANSION FOR NODE 103
1.5 -3.2 -22.4 -1.9 0.0 0.0
FORCES AT NODE 103 FX 0. FY -11. FZ 0.

2-D POINT ELEMENT 4 NODE 104 AREA 0.601 DIAMETER 0.875
STRESS AT NODE 19.0 ALLOWABLE 50.2
STRESS EXPANSION FOR NODE 104
1.5 -3.2 -22.4 -3.2 0.0 0.0
FORCES AT NODE 104 FX 0. FY -11. FZ 0.

2-D POINT ELEMENT 5 NODE 105 AREA 0.601 DIAMETER 0.875
STRESS AT NODE 20.3 ALLOWABLE 50.2
STRESS EXPANSION FOR NODE 105
1.5 -3.2 -22.4 -4.5 0.0 0.0
FORCES AT NODE 105 FX 0. FY -12. FZ 0.

*** CONSYS ANALYSIS PROGRAM ***   REQUISITION 79604   DATE 08/21/87

VERSION 4.2   RELEASED 12/03/82   BY: ASZ   PAGE 4-50 OF 112

MJM 8-25-87

AEP * 150T CRANE * 50T LOAD * TRUCK TO GIRDER * BOLTS * SSE

***** SYSTEM ELEMENT STRESSES *****

2-D POINT ELEMENT 6 NODE 106 AREA 0.601 DIAMETER 0.875
STRESS AT NODE 21.6 ALLOWABLE 50.2
STRESS EXPANSION FOR NODE 106
1.5 -3.2 -22.4 -5.7 0.0 0.0
FORCES AT NODE 106 FX 0. FY -13. FZ 0.

2-D POINT ELEMENT 7 NODE 107 AREA 0.601 DIAMETER 0.875
STRESS AT NODE 16.5 ALLOWABLE 50.2
STRESS EXPANSION FOR NODE 107
1.5 3.2 -22.4 0.6 0.0 0.0
FORCES AT NODE 107 FX 4. FY -9. FZ 0.

2-D POINT ELEMENT 8 NODE 108 AREA 0.601 DIAMETER 0.875
STRESS AT NODE 17.7 ALLOWABLE 50.2
STRESS EXPANSION FOR NODE 108
1.5 3.2 -22.4 -0.6 0.0 0.0
FORCES AT NODE 108 FX 4. FY -10. FZ 0.

2-D POINT ELEMENT 9 NODE 109 AREA 0.601 DIAMETER 0.875
STRESS AT NODE 18.9 ALLOWABLE 50.2
STRESS EXPANSION FOR NODE 109
1.5 3.2 -22.4 -1.9 0.0 0.0
FORCES AT NODE 109 FX 4. FY -11. FZ 0.

2-D POINT ELEMENT 10 NODE 110 AREA 0.601 DIAMETER 0.875
STRESS AT NODE 20.1 ALLOWABLE 50.2
STRESS EXPANSION FOR NODE 110
1.5 3.2 -22.4 -3.2 0.0 0.0
FORCES AT NODE 110 FX 4. FY -11. FZ 0.

2-D POINT ELEMENT 11 NODE 111 AREA 0.601 DIAMETER 0.875
STRESS AT NODE 21.3 ALLOWABLE 50.2
STRESS EXPANSION FOR NODE 111
1.5 3.2 -22.4 -4.5 0.0 0.0
FORCES AT NODE 111 FX 4. FY -12. FZ 0.

2-D POINT ELEMENT 12 NODE 112 AREA 0.601 DIAMETER 0.875
STRESS AT NODE 22.5 ALLOWABLE 50.2
STRESS EXPANSION FOR NODE 112
1.5 3.2 -22.4 -5.7 0.0 0.0
FORCES AT NODE 112 FX 4. FY -13. FZ 0.

2-D POINT ELEMENT 13 NODE 113 AREA 0.601 DIAMETER 0.875
STRESS AT NODE 42.1 ALLOWABLE 50.2
STRESS EXPANSION FOR NODE 113
-2.3 -3.8 33.6 1.8 0.0 0.0
FORCES AT NODE 113 FX -3. FY 25. FZ 0.

2-D POINT ELEMENT 14 NODE 114 AREA 0.601 DIAMETER 0.875
STRESS AT NODE 46.2 ALLOWABLE 50.2
STRESS EXPANSION FOR NODE 114
-2.3 -3.8 33.6 5.9 0.0 0.0
FORCES AT NODE 114 FX -3. FY 28. FZ 0.

AEP * 150T CRANE * 50T LOAD * TRUCK TO GIRDER * BOLTS * SSE

***** SYSTEM ELEMENT STRESSES *****

2-D POINT ELEMENT 15 NODE 115 AREA 0.601 DIAMETER 0.875
STRESS AT NODE 42.0 ALLOWABLE 50.2
STRESS EXPANSION FOR NODE 115
-2.3 -3.0 33.6 1.8 0.0 0.0
FORCES AT NODE 115 FX -2. FY 25. FZ 0.

2-D POINT ELEMENT 16 NODE 116 AREA 0.601 DIAMETER 0.875
STRESS AT NODE 46.1 ALLOWABLE 50.2
STRESS EXPANSION FOR NODE 116
-2.3 -3.0 33.6 5.9 0.0 0.0
FORCES AT NODE 116 FX -2. FY 28. FZ 0.

2-D POINT ELEMENT 17 NODE 117 AREA 0.601 DIAMETER 0.875
STRESS AT NODE 42.0 ALLOWABLE 50.2
STRESS EXPANSION FOR NODE 117
-2.3 3.0 33.6 1.8 0.0 0.0
FORCES AT NODE 117 FX 2. FY 25. FZ 0.

2-D POINT ELEMENT 18 NODE 118 AREA 0.601 DIAMETER 0.875
STRESS AT NODE 46.1 ALLOWABLE 50.2
STRESS EXPANSION FOR NODE 118
-2.3 3.0 33.6 5.9 0.0 0.0
FORCES AT NODE 118 FX 2. FY 28. FZ 0.

2-D POINT ELEMENT 19 NODE 119 AREA 0.601 DIAMETER 0.875
STRESS AT NODE 42.0 ALLOWABLE 50.2
STRESS EXPANSION FOR NODE 119
-2.3 3.8 33.6 1.8 0.0 0.0
FORCES AT NODE 119 FX 2. FY 25. FZ 0.

2-D POINT ELEMENT 20 NODE 120 AREA 0.601 DIAMETER 0.875
STRESS AT NODE 46.1 ALLOWABLE 50.2
STRESS EXPANSION FOR NODE 120
-2.3 3.8 33.6 5.9 0.0 0.0
FORCES AT NODE 120 FX 2. FY 28. FZ 0.

FORCE DEFINITION NODE DIRECT ELEMENT 21 NODE 200
FX 22.20 ; FY 78.80 ; FZ 0.00
MX -5384.00 ; MY 0.00 ; MZ 0.00

MAXIMUM ABSOLUTE STRESS ON ELEMENT 14 = 46.2 KSI

*** CONSYS ANALYSIS PROGRAM ***   REQUISITION 79604   DATE 08/21/87
VERSION 4.2 RELEASED 12/03/82   BY: ASZ   PAGE 4-52 OF 112
MJM 8-25-87

AEP * 150T CRANE * 50T LOAD * TRUCK TO GIRDER * BOLTS * SSE

***** REPORT SUMMARY, FOR A 4 LOAD STEP ANALYSIS *****

WORST CASE ANALYSIS.........NO
ELEMENT STRESSES PRINTED....YES, STRESS SUMMATION MODE WAS DIRECT

ELEMENT STATISTICS

TYPE	DESCRIPTION	NUMBER USED
1	2-DIMENSIONAL POINT ELEMENT........	20
2	FORCE DEFINITION NODE - DIRECT.....	1

TOTAL NUMBER OF ELEMENTS = 21, NODES = 21

SYSTEM PROPERTIES

LOAD STEP....... 1   DIRECTION, LOCATION OR AXIS

	X	Y	Z
CENTROIDS, X AXIS.........		0.00	13.25
Y AXIS.........	0.00		13.25
Z AXIS.........	-15.00	-0.00	
SHEAR AREAS................	12.03	12.03	0.00
POLAR MOMENTS OF INERTIA..	2084.70	2084.70	4640.13
TRANSLATED FORCES.........	22.20	78.80	0.00
TRANSLATED MOMENTS........	-4339.90	-294.15	1182.00

MAXIMUM ELEMENT STRESSES

DESCRIPTION	NUMBER USED	ELEMENT	NODE	STRESS	ALLOWABLE	COMPARISON FACTOR
2-D POINT ELEMENT	20	14	114	46.2 KSI	50.2 KSI	1.0872

***** JOB COMPLETED *****

***** CONSYS INPUT DATA LISTING *****   08/27/87 .   #79604

ASZ
PAGE 4-53 OF 112
MJM 8-27-87

```
           5    10   15   20   25   30   35   40   45   50   55   60   65   70   75   80
           V    V    V    V    V    V    V    V    V    V    V    V    V    V    V    V
 1. AEP * 150T CRANE * 50T LOAD * TRUCK TO GIRDER * WELDS * OBE
 2. 79604  ASZ 4.   1.   1.   0.                            1.   1.
 3.  1.   1.
 4.  2.   1.
 5.  3.   4.
 6. -1.
 7.  0.25      20.0                     1.        3.
 8.  0.3125    20.0                     1.        3.
 9. -1.
10.  101. 102.            2.   2.       2.        12.
11.  103. 104.            1.   1.       5.        2.
12.  115. 116.            1.   1.       23.       2.
13.  106. 107.            1.   1.       2.        12.
14.  101. 165.            1.   1.
15.  113. 166.            1.   1.
16.  125. 167.            1.   1.
17.  143. 168.            1.   1.
18.  161. 162.            1.   1.       2.        2.
19.  200.                 3.
20. -1.
21. -12.  12.                 -17.625
22.  101.            9.5        8.8125  35.375
23.  102.          -13.5        8.8125  35.375
24.  103.          -18.5        8.8125  35.375
25.  104.          -21.5        8.8125  35.375
26.  105.          -26.5        8.8125  35.375
27.  106.          -29.5        8.8125  35.375
28.  107.          -29.5        8.8125  29.375
29.  108.          -26.5        8.8125  29.375
30.  109.          -21.5        8.8125  29.375
31.  110.          -18.5        8.8125  29.375
32.  111.          -13.5        8.8125  29.375
33.  112.          -10.5        8.8125  29.375
34. -18.  18.                 -17.625
35.  125.          -10.5        8.8125   8.5
36.  126.          -13.5        8.8125   8.5
37.  127.          -18.5        8.8125   8.5
38.  128.          -21.5        8.8125   8.5
39.  129.          -26.5        8.8125   8.5
40.  130.          -29.5        8.8125   8.5
41.  131.          -34.5        8.8125   8.5
42.  132.          -37.5        8.8125   8.5
43.  133.          -42.5        8.8125   8.5
44.  134.          -45.5        8.8125   8.5
45.  135.          -50.5        8.8125   8.5
46.  136.          -53.5        8.8125   8.5
47.  137.          -53.5        8.8125   2.5
48.  138.          -50.5        8.8125   2.5
49.  139.          -45.5        8.8125   2.5
50.  140.          -42.5        8.8125   2.5
51.  141.          -37.5        8.8125   2.5
52.  142.          -34.5        8.8125   2.5
53. -2.   2.                    -17.625
54.  161.          -57.5        8.8125   2.5
55.  162.          -57.5        8.8125   8.5
56.  165.            9.5        8.8125  29.625
57.  166.            9.5       -8.8125  29.625
58.  167.          -10.5        8.8125   3.0
59.  168.          -10.5       -8.8125   3.0
60.  200.            0.        0.        0.
61.  9999.
62.  101.   1.   168.
63. -1.
64.  200.  11.8      49.8      0.       -3267.
65. -1.
66.  200.  11.8     -49.8      0.        3267.
67. -1.
68.  200. -11.8      49.8      0.       -3267.
69. -1.
70.  200. -11.8     -49.8      0.        3267.
71. -1.
72. FINISH
           A    A    A    A    A    A    A    A    A    A    A    A    A    A    A    A
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AEP * 150T CRANE * 50T LOAD * TRUCK TO GIRDER * WELDS * OBE

***** WORST CASE ANALYSIS SUMMARY *****

AEP * 150T CRANE * 50T LOAD * TRUCK TO GIRDER *.WELDS * OBE

LOAD STEP...... 1	DIRECTION X	Y	Z
TRANSLATED FORCES.........	11.80	49.80	0.00
TRANSLATED MOMENTS........	-2146.55	-265.49	995.28

NUMBER OF FORCE DEFINITION NODES... 1

MAXIMUM ABSOLUTE STRESS ON ELEMENT 38 = 7.9 KSI
COMPARISON FACTOR MATCH ON ELEMENT 38 = 2.5354438

AEP * 150T CRANE * 50T LOAD * TRUCK TO GIRDER * WELDS * OBE

LOAD STEP...... 2	DIRECTION X	Y	Z
TRANSLATED FORCES.........	11.80	-49.80	0.00
TRANSLATED MOMENTS........	2146.55	-265.49	-995.28

NUMBER OF FORCE DEFINITION NODES... 1

MAXIMUM ABSOLUTE STRESS ON ELEMENT 37 = 7.9 KSI
COMPARISON FACTOR MATCH ON ELEMENT 37 = 2.5354452

AEP * 150T CRANE * 50T LOAD * TRUCK TO GIRDER * WELDS * OBE

LOAD STEP...... 3	DIRECTION X	Y	Z
TRANSLATED FORCES.........	-11.80	49.80	0.00
TRANSLATED MOMENTS........	-2146.55	265.49	995.28

NUMBER OF FORCE DEFINITION NODES... 1

MAXIMUM ABSOLUTE STRESS ON ELEMENT 37 = 7.9 KSI
COMPARISON FACTOR MATCH ON ELEMENT 37 = 2.5354433

AEP * 150T CRANE * 50T LOAD * TRUCK TO GIRDER * WELDS * OBE

LOAD STEP...... 4	DIRECTION X	Y	Z
TRANSLATED FORCES.........	-11.80	-49.80	0.00
TRANSLATED MOMENTS........	2146.55	265.49	-995.28

NUMBER OF FORCE DEFINITION NODES... 1

MAXIMUM ABSOLUTE STRESS ON ELEMENT 38 = 7.9 KSI
COMPARISON FACTOR MATCH ON ELEMENT 38 = 2.5354452

***** WORST CASE ANALYSIS COMPLETE *****

WORST CASE OCCURED DURING LOAD STEP 3

*** CONSYS ANALYSIS PROGRAM *** REQUISITION 79604 DATE 08/27/87
VERSION 4.2 RELEASED 12/03/82 BY: ASZ PAGE 4-55 OF 112
MJM 8-27-87

AEP * 150T CRANE * 50T LOAD * TRUCK TO GIRDER * WELDS * OBE

***** SYSTEM PROPERTIES *****

LOAD STEP...... 3

	DIRECTION, LOCATION OR AXIS		
	X	Y	Z
CENTROIDS, X AXIS.........		0.00	22.50
Y AXIS.........	0.00		22.50
Z AXIS.........	-19.99	-0.00	
SHEAR AREAS................	33.23	33.23	0.00
POLAR MOMENTS OF INERTIA..	6299.12	6299.12	15729.29
TRANSLATED FORCES.........	-11.80	49.80	0.00
TRANSLATED MOMENTS........	-2146.55	265.49	995.28

NUMBER OF FORCE DEFINITION NODES... 1

***** SYSTEM ELEMENT STRESSES *****

DIRECT STRESSES ARE EQUALLY DISTRIBUTED THROUGHOUT SHEAR AREA
DRX -0.4 DRY 1.5 DRZ 0.0

3-D LINE ELEMENT 1 SIZE 0.313 LENGTH 23.000 AREA 5.082
STRESS AT NODES 101, 102 7.8, 6.3 ALLOWABLE 20.0
STRESS EXPANSION FOR NODE 101
0.5 -0.6 4.4 1.9 0.0 0.0
STRESS EXPANSION FOR NODE 102
0.5 -0.6 4.4 0.4 0.0 0.0

3-D LINE ELEMENT 2 SIZE 0.313 LENGTH 23.000 AREA 5.082
STRESS AT NODES 113, 114 7.8, 6.3 ALLOWABLE 20.0
STRESS EXPANSION FOR NODE 113
0.5 0.6 4.4 1.9 0.0 0.0
STRESS EXPANSION FOR NODE 114
0.5 0.6 4.4 0.4 0.0 0.0

3-D LINE ELEMENT 3 SIZE 0.250 LENGTH 3.000 AREA 0.530
STRESS AT NODES 103, 104 6.0, 5.8 ALLOWABLE 20.0
STRESS EXPANSION FOR NODE 103
0.5 -0.6 4.4 0.1 0.0 0.0
STRESS EXPANSION FOR NODE 104
0.5 -0.6 4.4 -0.1 0.0 0.0

3-D LINE ELEMENT 4 SIZE 0.250 LENGTH 3.000 AREA 0.530
STRESS AT NODES 105, 106 5.5, 5.3 ALLOWABLE 20.0
STRESS EXPANSION FOR NODE 105
0.5 -0.6 4.4 -0.4 0.0 0.0
STRESS EXPANSION FOR NODE 106
0.5 -0.6 4.4 -0.6 0.0 0.0

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*** CONSYS ANALYSIS PROGRAM ***      REQUISITION 79604   DATE 08/27/87
VERSION 4.2  RELEASED 12/03/82       BY: ASZ        PAGE 4-56 OF 112
                                         MJM  8-27-87
AEP * 150T CRANE * 50T LOAD * TRUCK TO GIRDER * WELDS * OBE

          ***** SYSTEM ELEMENT STRESSES *****

3-D LINE ELEMENT    5    SIZE   0.250   LENGTH   3.000   AREA   0.530
 STRESS AT NODES 107,108        3.3,       3.5   ALLOWABLE     20.0
 STRESS EXPANSION FOR NODE 107
       0.3        -0.6       2.3       -0.6        0.0        0.0
 STRESS EXPANSION FOR NODE 108
       0.3        -0.6       2.3       -0.4        0.0        0.0

3-D LINE ELEMENT    6    SIZE   0.250   LENGTH   3.000   AREA   0.530
 STRESS AT NODES 109,110        3.8,       4.0   ALLOWABLE     20.0
 STRESS EXPANSION FOR NODE 109
       0.3        -0.6       2.3       -0.1        0.0        0.0
 STRESS EXPANSION FOR NODE 110
       0.3        -0.6       2.3        0.1        0.0        0.0

3-D LINE ELEMENT    7    SIZE   0.250   LENGTH   3.000   AREA   0.530
 STRESS AT NODES 111,112        4.3,       4.5   ALLOWABLE     20.0
 STRESS EXPANSION FOR NODE 111
       0.3        -0.6       2.3        0.4        0.0        0.0
 STRESS EXPANSION FOR NODE 112
       0.3        -0.6       2.3        0.6        0.0        0.0

3-D LINE ELEMENT    8    SIZE   0.250   LENGTH   3.000   AREA   0.530
 STRESS AT NODES 115,116        6.0,       5.8   ALLOWABLE     20.0
 STRESS EXPANSION FOR NODE 115
       0.5         0.6       4.4        0.1        0.0        0.0
 STRESS EXPANSION FOR NODE 116
       0.5         0.6       4.4       -0.1        0.0        0.0

3-D LINE ELEMENT    9    SIZE   0.250   LENGTH   3.000   AREA   0.530
 STRESS AT NODES 117,118        5.5,       5.3   ALLOWABLE     20.0
 STRESS EXPANSION FOR NODE 117
       0.5         0.6       4.4       -0.4        0.0        0.0
 STRESS EXPANSION FOR NODE 118
       0.5         0.6       4.4       -0.6        0.0        0.0

3-D LINE ELEMENT   10    SIZE   0.250   LENGTH   3.000   AREA   0.530
 STRESS AT NODES 119,120        3.3,       3.5   ALLOWABLE     20.0
 STRESS EXPANSION FOR NODE 119
       0.3         0.6       2.3       -0.6        0.0        0.0
 STRESS EXPANSION FOR NODE 120
       0.3         0.6       2.3       -0.4        0.0        0.0

3-D LINE ELEMENT   11    SIZE   0.250   LENGTH   3.000   AREA   0.530
 STRESS AT NODES 121,122        3.8,       4.0   ALLOWABLE     20.0
 STRESS EXPANSION FOR NODE 121
       0.3         0.6       2.3       -0.1        0.0        0.0
 STRESS EXPANSION FOR NODE 122
       0.3         0.6       2.3        0.1        0.0        0.0

3-D LINE ELEMENT   12    SIZE   0.250   LENGTH   3.000   AREA   0.530
 STRESS AT NODES 123,124        4.3,       4.5   ALLOWABLE     20.0
 STRESS EXPANSION FOR NODE 123
       0.3         0.6       2.3        0.4        0.0        0.0
 STRESS EXPANSION FOR NODE 124
       0.3         0.6       2.3        0.6        0.0        0.0
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AEP * 150T CRANE * 50T LOAD * TRUCK TO GIRDER * WELDS * OBE

***** SYSTEM ELEMENT STRESSES *****

3-D LINE ELEMENT 13 SIZE 0.250 LENGTH 3.000 AREA 0.530
STRESS AT NODES 125,126 3.1, 3.2 ALLOWABLE 20.0
STRESS EXPANSION FOR NODE 125
-0.6 -0.6 -4.8 0.6 0.0 0.0
STRESS EXPANSION FOR NODE 126
-0.6 -0.6 -4.8 0.4 0.0 0.0

3-D LINE ELEMENT 14 SIZE 0.250 LENGTH 3.000 AREA 0.530
STRESS AT NODES 127,128 3.5, 3.7 ALLOWABLE 20.0
STRESS EXPANSION FOR NODE 127
-0.6 -0.6 -4.8 0.1 0.0 0.0
STRESS EXPANSION FOR NODE 128
-0.6 -0.6 -4.8 -0.1 0.0 0.0

3-D LINE ELEMENT 15 SIZE 0.250 LENGTH 3.000 AREA 0.530
STRESS AT NODES 129,130 4.0, 4.2 ALLOWABLE 20.0
STRESS EXPANSION FOR NODE 129
-0.6 -0.6 -4.8 -0.4 0.0 0.0
STRESS EXPANSION FOR NODE 130
-0.6 -0.6 -4.8 -0.6 0.0 0.0

3-D LINE ELEMENT 16 SIZE 0.250 LENGTH 3.000 AREA 0.530
STRESS AT NODES 131,132 4.5, 4.6 ALLOWABLE 20.0
STRESS EXPANSION FOR NODE 131
-0.6 -0.6 -4.8 -0.9 0.0 0.0
STRESS EXPANSION FOR NODE 132
-0.6 -0.6 -4.8 -1.1 0.0 0.0

3-D LINE ELEMENT 17 SIZE 0.250 LENGTH 3.000 AREA 0.530
STRESS AT NODES 133,134 4.9, 5.1 ALLOWABLE 20.0
STRESS EXPANSION FOR NODE 133
-0.6 -0.6 -4.8 -1.4 0.0 0.0
STRESS EXPANSION FOR NODE 134
-0.6 -0.6 -4.8 -1.6 0.0 0.0

3-D LINE ELEMENT 18 SIZE 0.250 LENGTH 3.000 AREA 0.530
STRESS AT NODES 135,136 5.4, 5.6 ALLOWABLE 20.0
STRESS EXPANSION FOR NODE 135
-0.6 -0.6 -4.8 -1.9 0.0 0.0
STRESS EXPANSION FOR NODE 136
-0.6 -0.6 -4.8 -2.1 0.0 0.0

3-D LINE ELEMENT 19 SIZE 0.250 LENGTH 3.000 AREA 0.530
STRESS AT NODES 137,138 7.6, 7.5 ALLOWABLE 20.0
STRESS EXPANSION FOR NODE 137
-0.8 -0.6 -6.8 -2.1 0.0 0.0
STRESS EXPANSION FOR NODE 138
-0.8 -0.6 -6.8 -1.9 0.0 0.0

3-D LINE ELEMENT 20 SIZE 0.250 LENGTH 3.000 AREA 0.530
STRESS AT NODES 139,140 7.1, 7.0 ALLOWABLE 20.0
STRESS EXPANSION FOR NODE 139
-0.8 -0.6 -6.8 -1.6 0.0 0.0
STRESS EXPANSION FOR NODE 140
-0.8 -0.6 -6.8 -1.4 0.0 0.0

AEP * 150T CRANE * 50T LOAD * TRUCK TO GIRDER * WELDS * OBE

***** SYSTEM ELEMENT STRESSES *****

3-D LINE ELEMENT 21 SIZE 0.250 LENGTH 3.000 AREA 0.530
STRESS AT NODES 141, 142 6.7, 6.5 ALLOWABLE 20.0
STRESS EXPANSION FOR NODE 141
-0.8 -0.6 -6.8 -1.1 0.0 0.0
STRESS EXPANSION FOR NODE 142
-0.8 -0.6 -6.8 -0.9 0.0 0.0

3-D LINE ELEMENT 22 SIZE 0.250 LENGTH 3.000 AREA 0.530
STRESS AT NODES 143, 144 2.7, 2.9 ALLOWABLE 20.0
STRESS EXPANSION FOR NODE 143
-0.6 0.6 -4.8 0.6 0.0 0.0
STRESS EXPANSION FOR NODE 144
-0.6 0.6 -4.8 0.4 0.0 0.0

3-D LINE ELEMENT 23 SIZE 0.250 LENGTH 3.000 AREA 0.530
STRESS AT NODES 145, 146 3.2, 3.4 ALLOWABLE 20.0
STRESS EXPANSION FOR NODE 145
-0.6 0.6 -4.8 0.1 0.0 0.0
STRESS EXPANSION FOR NODE 146
-0.6 0.6 -4.8 -0.1 0.0 0.0

3-D LINE ELEMENT 24 SIZE 0.250 LENGTH 3.000 AREA 0.530
STRESS AT NODES 147, 148 3.7, 3.9 ALLOWABLE 20.0
STRESS EXPANSION FOR NODE 147
-0.6 0.6 -4.8 -0.4 0.0 0.0
STRESS EXPANSION FOR NODE 148
-0.6 0.6 -4.8 -0.6 0.0 0.0

3-D LINE ELEMENT 25 SIZE 0.250 LENGTH 3.000 AREA 0.530
STRESS AT NODES 149, 150 4.2, 4.4 ALLOWABLE 20.0
STRESS EXPANSION FOR NODE 149
-0.6 0.6 -4.8 -0.9 0.0 0.0
STRESS EXPANSION FOR NODE 150
-0.6 0.6 -4.8 -1.1 0.0 0.0

3-D LINE ELEMENT 26 SIZE 0.250 LENGTH 3.000 AREA 0.530
STRESS AT NODES 151, 152 4.7, 4.9 ALLOWABLE 20.0
STRESS EXPANSION FOR NODE 151
-0.6 0.6 -4.8 -1.4 0.0 0.0
STRESS EXPANSION FOR NODE 152
-0.6 0.6 -4.8 -1.6 0.0 0.0

3-D LINE ELEMENT 27 SIZE 0.250 LENGTH 3.000 AREA 0.530
STRESS AT NODES 153, 154 5.2, 5.4 ALLOWABLE 20.0
STRESS EXPANSION FOR NODE 153
-0.6 0.6 -4.8 -1.9 0.0 0.0
STRESS EXPANSION FOR NODE 154
-0.6 0.6 -4.8 -2.1 0.0 0.0

3-D LINE ELEMENT 28 SIZE 0.250 LENGTH 3.000 AREA 0.530
STRESS AT NODES 155, 156 7.5, 7.3 ALLOWABLE 20.0
STRESS EXPANSION FOR NODE 155
-0.8 0.6 -6.8 -2.1 0.0 0.0
STRESS EXPANSION FOR NODE 156
-0.8 0.6 -6.8 -1.9 0.0 0.0

[illegible]

AEP * 150T CRANE * 50T LOAD * TRUCK TO GIRDER * WELDS * OBE

***** SYSTEM ELEMENT STRESSES *****

3-D LINE ELEMENT 29   SIZE 0.250   LENGTH 3.000   AREA 0.530
STRESS AT NODES 157,158   7.0,   6.8   ALLOWABLE   20.0
STRESS EXPANSION FOR NODE 157
-0.8   0.6   -6.8   -1.6   0.0   0.0
STRESS EXPANSION FOR NODE 158
-0.8   0.6   -6.8   -1.4   0.0   0.0

3-D LINE ELEMENT 30   SIZE 0.250   LENGTH 3.000   AREA 0.530
STRESS AT NODES 159,160   6.5,   6.3   ALLOWABLE   20.0
STRESS EXPANSION FOR NODE 159
-0.8   0.6   -6.8   -1.1   0.0   0.0
STRESS EXPANSION FOR NODE 160
-0.8   0.6   -6.8   -0.9   0.0   0.0

3-D LINE ELEMENT 31   SIZE 0.250   LENGTH 6.000   AREA 1.061
STRESS AT NODES 106,107   5.3,   3.3   ALLOWABLE   20.0
STRESS EXPANSION FOR NODE 106
0.5   -0.6   4.4   -0.6   0.0   0.0
STRESS EXPANSION FOR NODE 107
0.3   -0.6   2.3   -0.6   0.0   0.0

3-D LINE ELEMENT 32   SIZE 0.250   LENGTH 6.000   AREA 1.061
STRESS AT NODES 118,119   5.3,   3.3   ALLOWABLE   20.0
STRESS EXPANSION FOR NODE 118
0.5   0.6   4.4   -0.6   0.0   0.0
STRESS EXPANSION FOR NODE 119
0.3   0.6   2.3   -0.6   0.0   0.0

3-D LINE ELEMENT 33   SIZE 0.250   LENGTH 5.750   AREA 1.016
STRESS AT NODES 101,165   7.8,   5.8   ALLOWABLE   20.0
STRESS EXPANSION FOR NODE 101
0.5   -0.6   4.4   1.9   0.0   0.0
STRESS EXPANSION FOR NODE 165
0.3   -0.6   2.4   1.9   0.0   0.0

3-D LINE ELEMENT 34   SIZE 0.250   LENGTH 5.750   AREA 1.016
STRESS AT NODES 113,166   7.8,   5.8   ALLOWABLE   20.0
STRESS EXPANSION FOR NODE 113
0.5   0.6   4.4   1.9   0.0   0.0
STRESS EXPANSION FOR NODE 166
0.3   0.6   2.4   1.9   0.0   0.0

3-D LINE ELEMENT 35   SIZE 0.250   LENGTH 5.500   AREA 0.972
STRESS AT NODES 125,167   3.1,   4.9   ALLOWABLE   20.0
STRESS EXPANSION FOR NODE 125
-0.6   -0.6   -4.8   0.6   0.0   0.0
STRESS EXPANSION FOR NODE 167
-0.8   -0.6   -6.6   0.6   0.0   0.0

3-D LINE ELEMENT 36   SIZE 0.250   LENGTH 5.500   AREA 0.972
STRESS AT NODES 143,168   2.7,   4.6   ALLOWABLE   20.0
STRESS EXPANSION FOR NODE 143
-0.6   0.6   -4.8   0.6   0.0   0.0
STRESS EXPANSION FOR NODE 168
-0.8   0.6   -6.6   0.6   0.0   0.0

EP * 150T CRANE * 50T LOAD * TRUCK TO GIRDER * WELDS * OBE

***** SYSTEM ELEMENT STRESSES *****

3-D LINE ELEMENT 37 SIZE 0.250 LENGTH 6.000 AREA 1.061

STRESS AT NODES 161, 162 7.9, 5.8 ALLOWABLE 20.0

STRESS EXPANSION FOR NODE 161

-0.8	-0.6	-6.8	-2.4	0.0	0.0

STRESS EXPANSION FOR NODE 162

-0.6	-0.6	-4.8	-2.4	0.0	0.0

3-D LINE ELEMENT 38 SIZE 0.250 LENGTH 6.000 AREA 1.061

STRESS AT NODES 163, 164 7.7, 5.7 ALLOWABLE 20.0

STRESS EXPANSION FOR NODE 163

-0.8	0.6	-6.8	-2.4	0.0	0.0

STRESS EXPANSION FOR NODE 164

-0.6	0.6	-4.8	-2.4	0.0	0.0

FORCE DEFINITION NODE DIRECT ELEMENT 39 NODE 200

FX -11.80 ; FY 49.80 ; FZ 0.00

MX -3267.00 ; MY 0.00 ; MZ 0.00

MAXIMUM ABSOLUTE STRESS ON ELEMENT 37 = 7.9 KSI

*** CONSYS ANALYSIS PROGRAM *** REQUISITION 79604 DATE 08/27/87
VERSION 4.2 RELEASED 12/03/82 BY: ASZ PAGE 4-61 OF 112
MJM 8-27-87

AEP * 150T CRANE * 50T LOAD * TRUCK TO GIRDER * WELDS * OBE

***** REPORT SUMMARY, FOR A 4 LOAD STEP ANALYSIS *****

WORST CASE ANALYSIS.........NO
ELEMENT STRESSES PRINTED....YES, STRESS SUMMATION MODE WAS DIRECT

ELEMENT STATISTICS

TYPE	DESCRIPTION	NUMBER USED
1	3-DIMENSIONAL LINE ELEMENT.........	36
2	3-DIMENSIONAL LINE ELEMENT.........	2
3	FORCE DEFINITION NODE - DIRECT.....	1

TOTAL NUMBER OF ELEMENTS = 39, NODES = 69

SYSTEM PROPERTIES

LOAD STEP...... 3 — DIRECTION, LOCATION OR AXIS

	X	Y	Z
CENTROIDS, X AXIS..........		0.00	22.50
Y AXIS..........	0.00		22.50
Z AXIS..........	-19.99	-0.00	
SHEAR AREAS................	33.23	33.23	0.00
POLAR MOMENTS OF INERTIA..	6299.12	6299.12	15729.29
TRANSLATED FORCES..........	-11.80	49.80	0.00
TRANSLATED MOMENTS.........	-2146.55	265.49	995.28

MAXIMUM ELEMENT STRESSES

DESCRIPTION	NUMBER USED	ELEMENT	NODE	STRESS	ALLOWABLE	COMPAR FACT
3-D LINE ELEMENT	36	37	161	7.9 KSI	20.0 KSI	2.53
3-D LINE ELEMENT	2	2	113	7.8 KSI	20.0 KSI	2.56
3-D LINE ELEMENT	36	37	161	7.9 KSI	20.0 KSI	2.53
3-D LINE ELEMENT	2	2	113	7.8 KSI	20.0 KSI	2.56

***** JOB COMPLETED *****

ASZ

PAGE 4-62 OF 112

MJM 8-27-87

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           5    10   15   20   25   30   35   40   45   50   55   60   65   70   75   80
           V    V    V    V    V    V    V    V    V    V    V    V    V    V    V    V
  1.  AEP * 150T CRANE * 50T LOAD * TRUCK TO GIRDER * WELDS * SSE
  2.  79604   ASZ 4.    1.    1.    0.                          1.    1.
  3.  1.     1.
  4.  2.     1.
  5.  3.     4.
  6.  -1.
  7.  0.25        27.3                     1.          3.
  8.  0.3125      27.3                     1.          3.
  9.  -1.
 10.  101.  102.            2.     2.      2.     12.
 11.  103.  104.            1.     1.      5.     2.
 12.  115.  116.            1.     1.      23.    2.
 13.  106.  107.            1.     1.      2.     12.
 14.  101.  165.            1.     1.
 15.  113.  166.            1.     1.
 16.  125.  167.            1.     1.
 17.  143.  168.            1.     1.
 18.  161.  162.            1.     1.      2.     2.
 19.  200.                  3.
 20.  -1.
 21.  -12.   12.                  -17.625
 22.  101.            9.5          8.8125  35.375
 23.  102.          -13.5          8.8125  35.375
 24.  103.          -18.5          8.8125  35.375
 25.  104.          -21.5          8.8125  35.375
 26.  105.          -26.5          8.8125  35.375
 27.  106.          -29.5          8.8125  35.375
 28.  107.          -29.5          8.8125  29.375
 29.  108.          -26.5          8.8125  29.375
 30.  109.          -21.5          8.8125  29.375
 31.  110.          -18.5          8.8125  29.375
 32.  111.          -13.5          8.8125  29.375
 33.  112.          -10.5          8.8125  29.375
 34.  -18.   18.                  -17.625
 35.  125.          -10.5          8.8125   8.5
 36.  126.          -13.5          8.8125   8.5
 37.  127.          -18.5          8.8125   8.5
 38.  128.          -21.5          8.8125   8.5
 39.  129.          -26.5          8.8125   8.5
 40.  130.          -29.5          8.8125   8.5
 41.. 131.          -34.5          8.8125   8.5
 42.  132.          -37.5          8.8125   8.5
 43.  133.          -42.5          8.8125   8.5
 44.  134.          -45.5          8.8125   8.5
 45.  135.          -50.5          8.8125   8.5
 46.  136.          -53.5          8.8125   8.5
 47.  137.          -53.5          8.8125   2.5
 48.  138.          -50.5          8.8125   2.5
 49.  139.          -45.5          8.8125   2.5
 50.  140.          -42.5          8.8125   2.5
 51.  141.          -37.5          8.8125   2.5
 52.  142.          -34.5          8.8125   2.5
 53.  -2.    2.                   -17.625
 54.  161.          -57.5          8.8125   2.5
 55.  162.          -57.5          8.8125   8.5
 56.  165.            9.5          8.8125  29.625
 57.  166.            9.5         -8.8125  29.625
 58.  167.          -10.5          8.8125   3.0
 59.  168.          -10.5         -8.8125   3.0
 60.  200.            0.           0.       0.
 61.  9999.
 62.  101.   1.    168.
 63.  -1.
 64.  200.  22.2       78.8        0.       -5384.
 65.  -1.
 66.  200.  22.2      -78.8        0.        5384.
 67.  -1.
 68.  200. -22.2       78.8        0.       -5384.
 69.  -1.
 70.  200. -22.2      -78.8        0.        5384.
 71.  -1.
 72.  FINISH
           A    A    A    A    A    A    A    A    A    A    A    A    A    A    A    A
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AEP * 150T CRANE * 50T LOAD * TRUCK TO GIRDER * WELDS * SSE

***** WORST CASE ANALYSIS SUMMARY *****

AEP * 150T CRANE * 50T LOAD * TRUCK TO GIRDER * WELDS * SSE

		DIRECTION	
LOAD STEP...... 1	X	Y	Z
TRANSLATED FORCES.........	22.20	78.80	0.00
TRANSLATED MOMENTS........	-3611.08	-499.48	1574.85

NUMBER OF FORCE DEFINITION NODES... 1

MAXIMUM ABSOLUTE STRESS ON ELEMENT 38 = 13.2 KSI
COMPARISON FACTOR MATCH ON ELEMENT 38 = 2.0639749

AEP * 150T CRANE * 50T LOAD * TRUCK TO GIRDER * WELDS * SSE

		DIRECTION	
LOAD STEP...... 2	X	Y	Z
TRANSLATED FORCES.........	22.20	-78.80	0.00
TRANSLATED MOMENTS........	3611.08	-499.48	-1574.85

NUMBER OF FORCE DEFINITION NODES... 1

MAXIMUM ABSOLUTE STRESS ON ELEMENT 37 = 13.2 KSI
COMPARISON FACTOR MATCH ON ELEMENT 37 = 2.0639758

AEP * 150T CRANE * 50T LOAD * TRUCK TO GIRDER * WELDS * SSE

		DIRECTION	
LOAD STEP...... 3	X	Y	Z
TRANSLATED FORCES.........	-22.20	78.80	0.00
TRANSLATED MOMENTS........	-3611.08	499.48	1574.85

NUMBER OF FORCE DEFINITION NODES... 1

MAXIMUM ABSOLUTE STRESS ON ELEMENT 37 = 13.2 KSI
COMPARISON FACTOR MATCH ON ELEMENT 37 = 2.0639749

AEP * 150T CRANE * 50T LOAD * TRUCK TO GIRDER * WELDS * SSE

		DIRECTION	
LOAD STEP...... 4	X	Y	Z
TRANSLATED FORCES.........	-22.20	-78.80	0.00
TRANSLATED MOMENTS........	3611.08	499.48	-1574.85

NUMBER OF FORCE DEFINITION NODES... 1

MAXIMUM ABSOLUTE STRESS ON ELEMENT 38 = 13.2 KSI
COMPARISON FACTOR MATCH ON ELEMENT 38 = 2.0639758

***** WORST CASE ANALYSIS COMPLETE *****

WORST CASE OCCURED DURING LOAD STEP 1

AEP * 150T CRANE * 50T LOAD * TRUCK TO GIRDER * WELDS * SSE

***** SYSTEM PROPERTIES *****

LOAD STEP..... 1

	DIRECTION, LOCATION OR AXIS		
	X	Y	Z
CENTROIDS, X AXIS.........		0.00	22.50
Y AXIS.........	0.00		22.50
Z AXIS.........	-19.99	-0.00	
SHEAR AREAS................	33.23	33.23	0.00
POLAR MOMENTS OF INERTIA..	6299.12	6299.12	15729.29
TRANSLATED FORCES.........	22.20	78.80	0.00
TRANSLATED MOMENTS........	-3611.08	-499.48	1574.85

NUMBER OF FORCE DEFINITION NODES... 1

***** SYSTEM ELEMENT STRESSES *****

DIRECT STRESSES ARE EQUALLY DISTRIBUTED THROUGHOUT SHEAR AREA
DRX 0.7   DRY 2.4   DRZ 0.0

3-D LINE ELEMENT 1   SIZE 0.313   LENGTH 23.000   AREA 5.082
STRESS AT NODES 101, 102   12.8,   10.5   ALLOWABLE 27.3
STRESS EXPANSION FOR NODE 101
-1.0   -0.9   7.4   3.0   0.0   0.0
STRESS EXPANSION FOR NODE 102
-1.0   -0.9   7.4   0.6   0.0   0.0

3-D LINE ELEMENT 2   SIZE 0.313   LENGTH 23.000   AREA 5.082
STRESS AT NODES 113, 114   12.7,   10.4   ALLOWABLE 27.3
STRESS EXPANSION FOR NODE 113
-1.0   0.9   7.4   3.0   0.0   0.0
STRESS EXPANSION FOR NODE 114
-1.0   0.9   7.4   0.6   0.0   0.0

3-D LINE ELEMENT 3   SIZE 0.250   LENGTH 3.000   AREA 0.530
STRESS AT NODES 103, 104   10.0,   9.7   ALLOWABLE 27.3
STRESS EXPANSION FOR NODE 103
-1.0   -0.9   7.4   0.1   0.0   0.0
STRESS EXPANSION FOR NODE 104
-1.0   -0.9   7.4   -0.2   0.0   0.0

3-D LINE ELEMENT 4   SIZE 0.250   LENGTH 3.000   AREA 0.530
STRESS AT NODES 105, 106   9.2,   8.9   ALLOWABLE 27.3
STRESS EXPANSION FOR NODE 105
-1.0   -0.9   7.4   -0.7   0.0   0.0
STRESS EXPANSION FOR NODE 106
-1.0   -0.9   7.4   -1.0   0.0   0.0

AEP * 150T CRANE * 50T LOAD * TRUCK TO GIRDER * WELDS * SSE

***** SYSTEM ELEMENT STRESSES *****

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3-D LINE ELEMENT    5    SIZE   0.250   LENGTH   3.000   AREA   0.530
 STRESS AT NODES 107,108        5.4,       5.7   ALLOWABLE      27.3
 STRESS EXPANSION FOR NODE 107
      -0.5        -0.9        3.9       -1.0        0.0        0.0
 STRESS EXPANSION FOR NODE 108
      -0.5        -0.9        3.9       -0.7        0.0        0.0

3-D LINE ELEMENT    6    SIZE   0.250   LENGTH   3.000   AREA   0.530
 STRESS AT NODES 109,110        6.2,       6.5   ALLOWABLE      27.3
 STRESS EXPANSION FOR NODE 109
      -0.5        -0.9        3.9       -0.2        0.0        0.0
 STRESS EXPANSION FOR NODE 110
      -0.5        -0.9        3.9        0.1        0.0        0.0

3-D LINE ELEMENT    7    SIZE   0.250   LENGTH   3.000   AREA   0.530
 STRESS AT NODES 111,112        7.0,       7.3   ALLOWABLE      27.3
 STRESS EXPANSION FOR NODE 111
      -0.5        -0.9        3.9        0.6        0.0        0.0
 STRESS EXPANSION FOR NODE 112
      -0.5        -0.9        3.9        0.9        0.0        0.0

3-D LINE ELEMENT    8    SIZE   0.250   LENGTH   3.000   AREA   0.530
 STRESS AT NODES 115,116        9.9,       9.6   ALLOWABLE      27.3
 STRESS EXPANSION FOR NODE 115
      -1.0         0.9        7.4        0.1        0.0        0.0
 STRESS EXPANSION FOR NODE 116
      -1.0         0.9        7.4       -0.2        0.0        0.0

3-D LINE ELEMENT    9    SIZE   0.250   LENGTH   3.000   AREA   0.530
 STRESS AT NODES 117,118        9.1,       8.8   ALLOWABLE      27.3
 STRESS EXPANSION FOR NODE 117
      -1.0         0.9        7.4       -0.7        0.0        0.0
 STRESS EXPANSION FOR NODE 118
      -1.0         0.9        7.4       -1.0        0.0        0.0

3-D LINE ELEMENT   10    SIZE   0.250   LENGTH   3.000   AREA   0.530
 STRESS AT NODES 119,120        5.5,       5.7   ALLOWABLE      27.3
 STRESS EXPANSION FOR NODE 119
      -0.5         0.9        3.9       -1.0        0.0        0.0
 STRESS EXPANSION FOR NODE 120
      -0.5         0.9        3.9       -0.7        0.0        0.0

3-D LINE ELEMENT   11    SIZE   0.250   LENGTH   3.000   AREA   0.530
 STRESS AT NODES 121,122        6.2,       6.5   ALLOWABLE      27.3
 STRESS EXPANSION FOR NODE 121
      -0.5         0.9        3.9       -0.2        0.0        0.0
 STRESS EXPANSION FOR NODE 122
      -0.5         0.9        3.9        0.1        0.0        0.0

3-D LINE ELEMENT   12    SIZE   0.250   LENGTH   3.000   AREA   0.530
 STRESS AT NODES 123,124        7.0,       7.3   ALLOWABLE      27.3
 STRESS EXPANSION FOR NODE 123
      -0.5         0.9        3.9        0.6        0.0        0.0
 STRESS EXPANSION FOR NODE 124
      -0.5         0.9        3.9        0.9        0.0        0.0
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AEP * 150T CRANE * 50T LOAD * TRUCK TO GIRDER * WELDS * SSE

***** SYSTEM ELEMENT STRESSES *****

3-D LINE ELEMENT 13 SIZE 0.250 LENGTH 3.000 AREA 0.530
STRESS AT NODES 125,126 4.8, 5.1 ALLOWABLE 27.3
STRESS EXPANSION FOR NODE 125
1.1 -0.9 -8.0 0.9 0.0 0.0
STRESS EXPANSION FOR NODE 126
1.1 -0.9 -8.0 0.6 0.0 0.0

3-D LINE ELEMENT 14 SIZE 0.250 LENGTH 3.000 AREA 0.530
STRESS AT NODES 127,128 5.6, 5.9 ALLOWABLE 27.3
STRESS EXPANSION FOR NODE 127
1.1 -0.9 -8.0 0.1 0.0 0.0
STRESS EXPANSION FOR NODE 128
1.1 -0.9 -8.0 -0.2 0.0 0.0

3-D LINE ELEMENT 15 SIZE 0.250 LENGTH 3.000 AREA 0.530
STRESS AT NODES 129,130 6.4, 6.7 ALLOWABLE 27.3
STRESS EXPANSION FOR NODE 129
1.1 -0.9 -8.0 -0.7 0.0 0.0
STRESS EXPANSION FOR NODE 130
1.1 -0.9 -8.0 -1.0 0.0 0.0

3-D LINE ELEMENT 16 SIZE 0.250 LENGTH 3.000 AREA 0.530
STRESS AT NODES 131,132 7.2, 7.5 ALLOWABLE 27.3
STRESS EXPANSION FOR NODE 131
1.1 -0.9 -8.0 -1.5 0.0 0.0
STRESS EXPANSION FOR NODE 132
1.1 -0.9 -8.0 -1.8 0.0 0.0

3-D LINE ELEMENT 17 SIZE 0.250 LENGTH 3.000 AREA 0.530
STRESS AT NODES 133,134 8.0, 8.3 ALLOWABLE 27.3
STRESS EXPANSION FOR NODE 133
1.1 -0.9 -8.0 -2.3 0.0 0.0
STRESS EXPANSION FOR NODE 134
1.1 -0.9 -8.0 -2.6 0.0 0.0

3-D LINE ELEMENT 18 SIZE 0.250 LENGTH 3.000 AREA 0.530
STRESS AT NODES 135,136 8.8, 9.1 ALLOWABLE 27.3
STRESS EXPANSION FOR NODE 135
1.1 -0.9 -8.0 -3.1 0.0 0.0
STRESS EXPANSION FOR NODE 136
1.1 -0.9 -8.0 -3.4 0.0 0.0

3-D LINE ELEMENT 19 SIZE 0.250 LENGTH 3.000 AREA 0.530
STRESS AT NODES 137,138 12.5, 12.2 ALLOWABLE 27.3
STRESS EXPANSION FOR NODE 137
1.6 -0.9 -11.5 -3.4 0.0 0.0
STRESS EXPANSION FOR NODE 138
1.6 -0.9 -11.5 -3.1 0.0 0.0

3-D LINE ELEMENT 20 SIZE 0.250 LENGTH 3.000 AREA 0.530
STRESS AT NODES 139,140 11.7, 11.4 ALLOWABLE 27.3
STRESS EXPANSION FOR NODE 139
1.6 -0.9 -11.5 -2.6 0.0 0.0
STRESS EXPANSION FOR NODE 140
1.6 -0.9 -11.5 -2.3 0.0 0.0

AEP * 150T CRANE * 50T LOAD * TRUCK TO GIRDER * WELDS * SSE

***** SYSTEM ELEMENT STRESSES *****

3-D LINE ELEMENT	21	SIZE	0.250	LENGTH	3.000	AREA	0.530	
STRESS AT NODES	141,142		10.9,	10.6	ALLOWABLE		27.3	
STRESS EXPANSION FOR NODE 141								
	1.6	-0.9	-11.5	-1.8	0.0	0.0		
STRESS EXPANSION FOR NODE 142								
	1.6	-0.9	-11.5	-1.5	0.0	0.0		
3-D LINE ELEMENT	22	SIZE	0.250	LENGTH	3.000	AREA	0.530	
STRESS AT NODES	143,144		5.4,	5.7	ALLOWABLE		27.3	
STRESS EXPANSION FOR NODE 143								
	1.1	0.9	-8.0	0.9	0.0	0.0		
STRESS EXPANSION FOR NODE 144								
	1.1	0.9	-8.0	0.6	0.0	0.0		
3-D LINE ELEMENT	23	SIZE	0.250	LENGTH	3.000	AREA	0.530	
STRESS AT NODES	145,146		6.1,	6.4	ALLOWABLE		27.3	
STRESS EXPANSION FOR NODE 145								
	1.1	0.9	-8.0	0.1	0.0	0.0		
STRESS EXPANSION FOR NODE 146								
	1.1	0.9	-8.0	-0.2	0.0	0.0		
3-D LINE ELEMENT	24	SIZE	0.250	LENGTH	3.000	AREA	0.530	
STRESS AT NODES	147,148		6.8,	7.1	ALLOWABLE		27.3	
STRESS EXPANSION FOR NODE 147								
	1.1	0.9	-8.0	-0.7	0.0	0.0		
STRESS EXPANSION FOR NODE 148								
	1.1	0.9	-8.0	-1.0	0.0	0.0		
3-D LINE ELEMENT	25	SIZE	0.250	LENGTH	3.000	AREA	0.530	
STRESS AT NODES	149,150		7.6,	7.9	ALLOWABLE		27.3	
STRESS EXPANSION FOR NODE 149								
	1.1	0.9	-8.0	-1.5	0.0	0.0		
STRESS EXPANSION FOR NODE 150								
	1.1	0.9	-8.0	-1.8	0.0	0.0		
3-D LINE ELEMENT	26	SIZE	0.250	LENGTH	3.000	AREA	0.530	
STRESS AT NODES	151,152		8.3,	8.6	ALLOWABLE		27.3	
STRESS EXPANSION FOR NODE 151								
	1.1	0.9	-8.0	-2.3	0.0	0.0		
STRESS EXPANSION FOR NODE 152								
	1.1	0.9	-8.0	-2.6	0.0	0.0		
3-D LINE ELEMENT	27	SIZE	0.250	LENGTH	3.000	AREA	0.530	
STRESS AT NODES	153,154		9.1,	9.4	ALLOWABLE		27.3	
STRESS EXPANSION FOR NODE 153								
	1.1	0.9	-8.0	-3.1	0.0	0.0		
STRESS EXPANSION FOR NODE 154								
	1.1	0.9	-8.0	-3.4	0.0	0.0		
3-D LINE ELEMENT	28	SIZE	0.250	LENGTH	3.000	AREA	0.530	
STRESS AT NODES	155,156		12.8,	12.5	ALLOWABLE		27.3	
STRESS EXPANSION FOR NODE 155								
	1.6	0.9	-11.5	-3.4	0.0	0.0		
STRESS EXPANSION FOR NODE 156								
	1.6	0.9	-11.5	-3.1	0.0	0.0		

AEP * 150T CRANE * 50T LOAD * TRUCK TO GIRDER * WELDS * SSE

***** SYSTEM ELEMENT STRESSES *****

3-D LINE ELEMENT 29 SIZE 0.250 LENGTH 3.000 AREA 0.530
STRESS AT NODES 157,158 12.1, 11.8 ALLOWABLE 27.3
STRESS EXPANSION FOR NODE 157
1.6 0.9 -11.5 -2.6 0.0 0.0
STRESS EXPANSION FOR NODE 158
1.6 0.9 -11.5 -2.3 0.0 0.0

3-D LINE ELEMENT 30 SIZE 0.250 LENGTH 3.000 AREA 0.530
STRESS AT NODES 159,160 11.3, 11.0 ALLOWABLE 27.3
STRESS EXPANSION FOR NODE 159
1.6 0.9 -11.5 -1.8 0.0 0.0
STRESS EXPANSION FOR NODE 160
1.6 0.9 -11.5 -1.5 0.0 0.0

3-D LINE ELEMENT 31 SIZE 0.250 LENGTH 6.000 AREA 1.061
STRESS AT NODES 106,107 8.9, 5.4 ALLOWABLE 27.3
STRESS EXPANSION FOR NODE 106
-1.0 -0.9 7.4 -1.0 0.0 0.0
STRESS EXPANSION FOR NODE 107
-0.5 -0.9 3.9 -1.0 0.0 0.0

3-D LINE ELEMENT 32 SIZE 0.250 LENGTH 6.000 AREA 1.061
STRESS AT NODES 118,119 8.8, 5.5 ALLOWABLE 27.3
STRESS EXPANSION FOR NODE 118
-1.0 0.9 7.4 -1.0 0.0 0.0
STRESS EXPANSION FOR NODE 119
-0.5 0.9 3.9 -1.0 0.0 0.0

3-D LINE ELEMENT 33 SIZE 0.250 LENGTH 5.750 AREA 1.016
STRESS AT NODES 101,165 12.8, 9.4 ALLOWABLE 27.3
STRESS EXPANSION FOR NODE 101
-1.0 -0.9 7.4 3.0 0.0 0.0
STRESS EXPANSION FOR NODE 165
-0.6 -0.9 4.1 3.0 0.0 0.0

3-D LINE ELEMENT 34 SIZE 0.250 LENGTH 5.750 AREA 1.016
STRESS AT NODES 113,166 12.7, 9.5 ALLOWABLE 27.3
STRESS EXPANSION FOR NODE 113
-1.0 0.9 7.4 3.0 0.0 0.0
STRESS EXPANSION FOR NODE 166
-0.6 0.9 4.1 3.0 0.0 0.0

3-D LINE ELEMENT 35 SIZE 0.250 LENGTH 5.500 AREA 0.972
STRESS AT NODES 125,167 4.8, 8.0 ALLOWABLE 27.3
STRESS EXPANSION FOR NODE 125
1.1 -0.9 -8.0 0.9 0.0 0.0
STRESS EXPANSION FOR NODE 167
1.5 -0.9 -11.2 0.9 0.0 0.0

3-D LINE ELEMENT 36 SIZE 0.250 LENGTH 5.500 AREA 0.972
STRESS AT NODES 143,168 5.4, 8.4 ALLOWABLE 27.3
STRESS EXPANSION FOR NODE 143
1.1 0.9 -8.0 0.9 0.0 0.0
STRESS EXPANSION FOR NODE 168
1.5 0.9 -11.2 0.9 0.0 0.0

AEP * 150T CRANE * 50T LOAD * TRUCK TO GIRDER * WELDS * SSE

***** SYSTEM ELEMENT STRESSES *****

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3-D LINE ELEMENT   37    SIZE    0.250    LENGTH    6.000    AREA    1.061
  STRESS AT NODES 161,162          12.9,         9.5    ALLOWABLE      27.3
  STRESS EXPANSION FOR NODE 161
        1.6          -0.9         -11.5         -3.8          0.0          0.0
  STRESS EXPANSION FOR NODE 162
        1.1          -0.9          -8.0         -3.8          0.0          0.0

3-D LINE ELEMENT   38    SIZE    0.250    LENGTH    6.000    AREA    1.061
  STRESS AT NODES 163,164          13.2,         9.8    ALLOWABLE      27.3
  STRESS EXPANSION FOR NODE 163
        1.6           0.9         -11.5         -3.8          0.0          0.0
  STRESS EXPANSION FOR NODE 164
        1.1           0.9          -8.0         -3.8          0.0          0.0

FORCE DEFINITION NODE  DIRECT   ELEMENT  39   NODE 200
  FX          22.20 ;  FY         78.80 ;  FZ          0.00
  MX       -5384.00 ;  MY          0.00 ;  MZ          0.00

MAXIMUM ABSOLUTE STRESS ON ELEMENT  38 =      13.2 KSI
```

AEP * 150T CRANE * 50T LOAD * TRUCK TO GIRDER * WELDS * SSE

***** REPORT SUMMARY, FOR A 4 LOAD STEP ANALYSIS *****

WORST CASE ANALYSIS.......... NO
ELEMENT STRESSES PRINTED.... YES, STRESS SUMMATION MODE WAS DIRECT

ELEMENT STATISTICS

TYPE	DESCRIPTION	NUMBER USED
1	3-DIMENSIONAL LINE ELEMENT.........	36
2	3-DIMENSIONAL LINE ELEMENT.........	2
3	FORCE DEFINITION NODE - DIRECT.....	1

TOTAL NUMBER OF ELEMENTS = 39, NODES = 69

SYSTEM PROPERTIES

LOAD STEP...... 1 DIRECTION, LOCATION OR AXIS

	X	Y	Z
CENTROIDS, X AXIS..........		0.00	22.50
Y AXIS..........	0.00		22.50
Z AXIS..........	-19.99	-0.00	
SHEAR AREAS................	33.23	33.23	0.00
POLAR MOMENTS OF INERTIA..	6299.12	6299.12	15729.29
TRANSLATED FORCES..........	22.20	78.80	0.00
TRANSLATED MOMENTS.........	-3611.08	-499.48	1574.85

MAXIMUM ELEMENT STRESSES.

DESCRIPTION	NUMBER USED	ELEMENT	NODE	STRESS	ALLOWABLE	COMPAR. FACT(
3-D LINE ELEMENT	36	38	163	13.2 KSI	27.3 KSI	2.06
3-D LINE ELEMENT	2	1	101	12.8 KSI	27.3 KSI	2.13
3-D LINE ELEMENT	36	38	163	13.2 KSI	27.3 KSI	2.06
3-D LINE ELEMENT	2	1	101	12.8 KSI	27.3 KSI	2.13

***** JOB COMPLETED *****

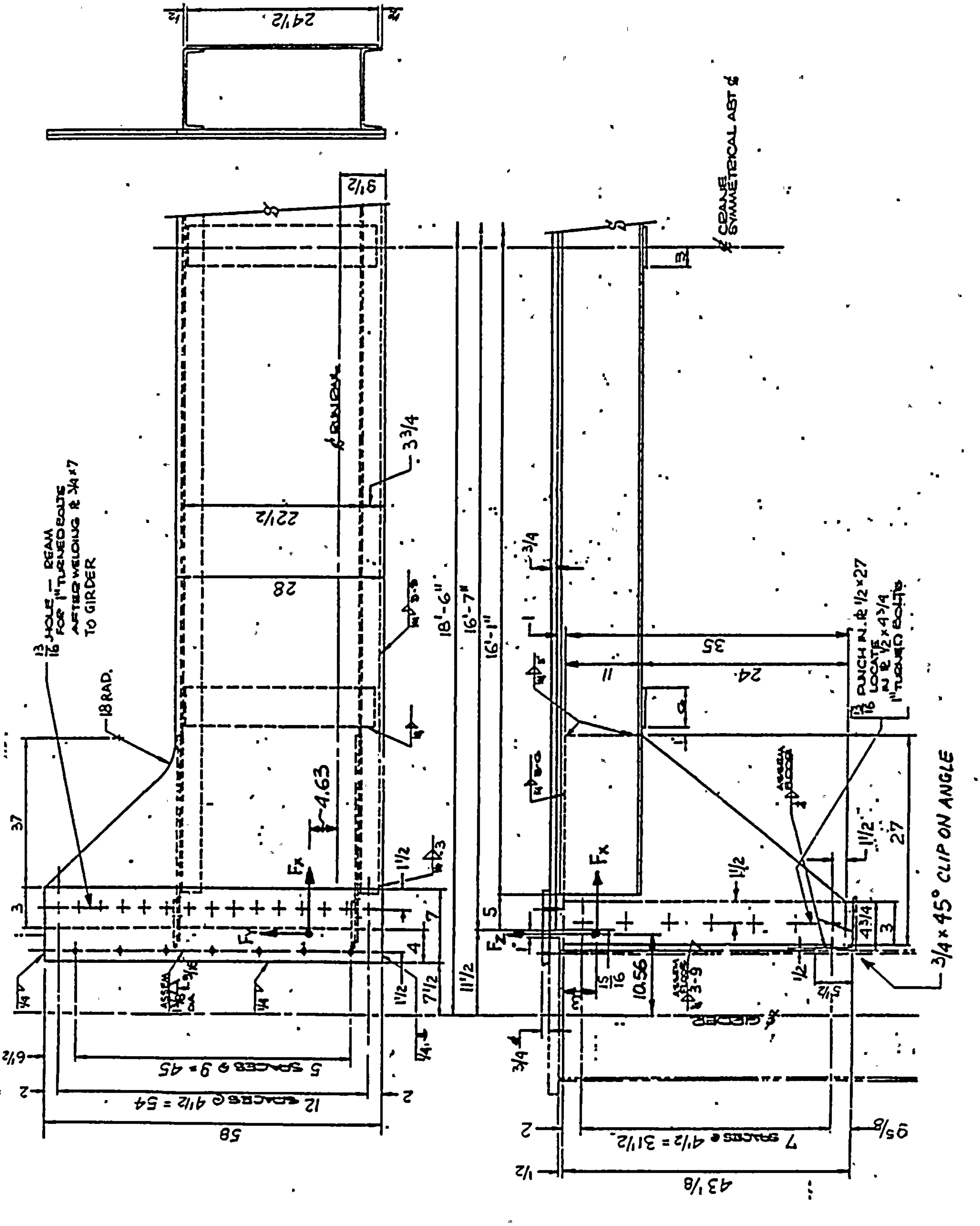
FORM N-2494

WHITING REQN. 79604 DATE 6-26-87

BY ASZ PAGE 4-71 OF 112

MJM 8-26-87

GIRDER TO END TIE CONNECTION.



ALLOWABLES

1" BOLTS

MTRL: ASTM-A325

OBE $\sigma_{ALL} = 61.3$ KSI $\tau_{ALL} = 36.8$ KSI
SSE $\sigma_{ALL} = 83.6$ KSI $\tau_{ALL} = 50.2$ KSI
(REF PG. 4-38)

WELDS (FILLET THRU THROAT)

BASE MTRL: ASTM-A36

WELD MTRL: MIN. E60XX ELECTRODES

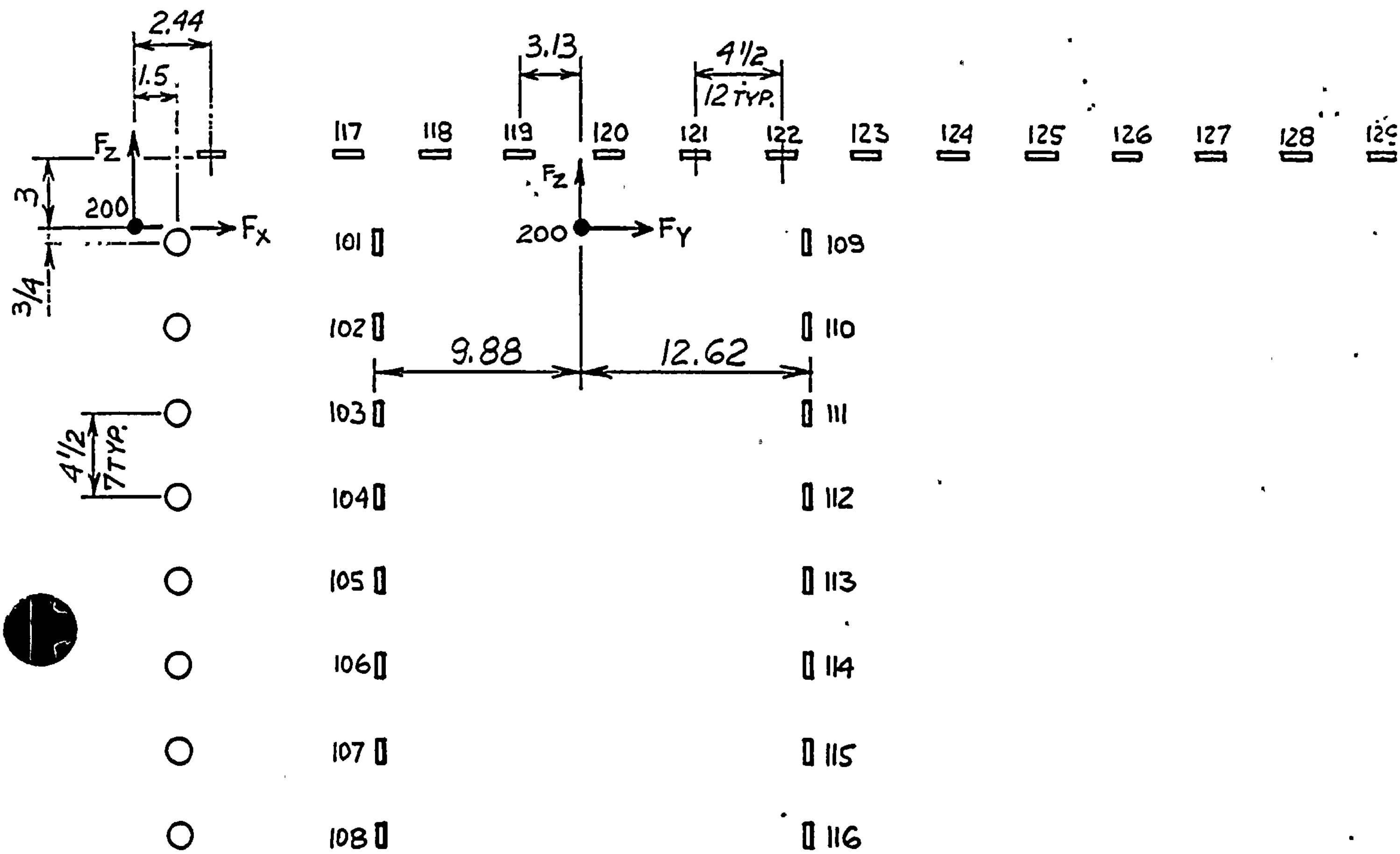
OBE $\tau_{W.ALL} = 20.0$ KSI
SSE $\tau_{W.ALL} = 27.3$ KSI
(REF. PG. 4-38)

MAX. LOADS PER TABLE B55 AND B56.

OBE $F_X = 38.5$ KIP $F_Y = 34$ KIP $F_Z = 2.1$ KIP $M_X = 8$ IN.KIP. $M_Y = 87.1$ IN.KIP.
$M_Z = 3731$ IN.KIP

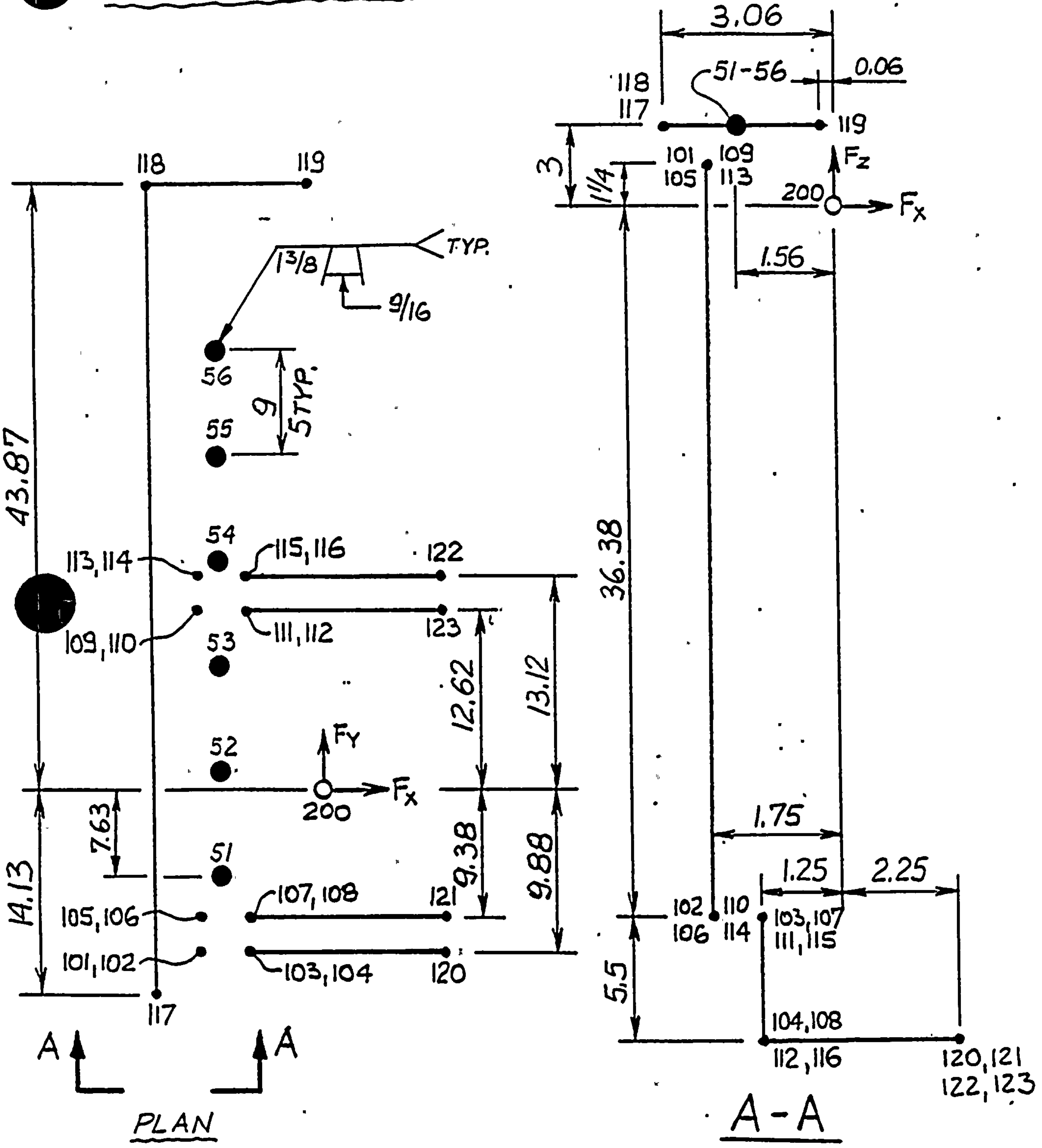
SSE $F_X = 57.7$ KIP $F_Y = 49.5$ KIP $F_Z = 2.2$ KIP $M_X = 10.5$ IN.KIP
$M_Y = 103.3$ IN.KIP $M_Z = 6359$ IN.KIP.

BOLTED CONNECTION



ALL 1" A325 BOLTS

WELDED CONNECTION.



1/4 FILLET WELDS EXCEPT AS NOTED

#79604 8-27-87

***** CONSYS INPUT DATA LISTING *****

ASZ PAGE 4-75 OF 112

```
        5   10   15   20   25   30   35   40   45   50   55   60   65
        V    V    V    V    V    V    V    V    V    V    V    V    V
 1. AEP * 150T CRANE * 50T LOAD * GIRDER TO END TIE * BOLTS * OBE
 2. 79604 ASZ 1.    0.   0.   1.   0.   0.   0.   0.   1.  0.
 3. 1.    3.  2.                                   MJM 8-27-87
 4. 2.    3.  2.
 5. 3.    5.  0.
 6. -1.
 7. 1.         36.8                          3.
 8. 1.         36.8                          2.
 9. -1.
10. 101.                 1.   2.        16.
11. 117.                 2.   1.        13.
12. 200.                 3.
13. -1.
14. -8.    8.                  22.5
15. 101.             1.5       -9.88     -0.75
16. 102.             1.5       -9.88     -5.25
17. 103.             1.5       -9.88     -9.75
18. 104.             1.5       -9.88    -14.25
19. 105.             1.5       -9.88    -18.75
20. 106.             1.5       -9.88    -23.25
21. 107.             1.5       -9.88    -27.75
22. 108.             1.5       -9.88    -32.25
23. -1.    1.  13.              4.5
24. 117.            2.44      -12.13      3.
25. 200.            0.          0.        0.
26. 9999.
27. 101.  1.   129.
28. -1.
29. 200.  38.5      34.       2.1       8.         87.1     3731.
30. -1.
31. FINISH
        A    A    A    A    A    A    A    A    A    A    A    A    A
```

AEP * 150T CRANE * 50T LOAD * GIRDER TO END TIE * BOLTS * OBE

***** SYSTEM PROPERTIES *****

LOAD STEP...... 1 DIRECTION, LOCATION OR AXIS

	X	Y	Z
CENTROIDS, X AXIS.........		1.37	3.00
Y AXIS.........	1.50		-7.76
Z AXIS.........	2.44	7.42	
SHEAR AREAS................	22.78	10.21	12.57
POLAR MOMENTS OF INERTIA..	1590.43	3477.98	5511.66
TRANSLATED FORCES.........	38.50	34.00	2.10
TRANSLATED MOMENTS........	112.88	388.96	4099.70

NUMBER OF FORCE DEFINITION NODES... 1

***** SYSTEM ELEMENT STRESSES *****

DIRECT STRESSES ARE EQUALLY DISTRIBUTED THROUGHOUT SHEAR AREA
DRX 1.7 DRY 3.3 DRZ 0.2

2-D POINT ELEMENT 1 NODE 101 AREA 0.785 DIAMETER 1.000
STRESS AT NODE 15.4 ALLOWABLE 36.8
STRESS EXPANSION FOR NODE 101
0.8 12.9 0.0 0.0 -0.8 0.0
FORCES AT NODE 101 FX 12. FY 0. FZ 1.

2-D POINT ELEMENT 2 NODE 102 AREA 0.785 DIAMETER 1.000
STRESS AT NODE 14.9 ALLOWABLE 36.8
STRESS EXPANSION FOR NODE 102
0.3 12.9 0.0 0.0 -0.8 0.0
FORCES AT NODE 102 FX 12. FY 0. FZ 1.

2-D POINT ELEMENT 3 NODE 103 AREA 0.785 DIAMETER 1.000
STRESS AT NODE 14.8 ALLOWABLE 36.8
STRESS EXPANSION FOR NODE 103
-0.2 12.9 0.0 0.0 -0.8 0.0
FORCES AT NODE 103 FX 12. FY 0. FZ 1.

2-D POINT ELEMENT 4 NODE 104 AREA 0.785 DIAMETER 1.000
STRESS AT NODE 15.3 ALLOWABLE 36.8
STRESS EXPANSION FOR NODE 104
-0.7 12.9 0.0 0.0 -0.8 0.0
FORCES AT NODE 104 FX 12. FY 0. FZ 1.

2-D POINT ELEMENT 5 NODE 105 AREA 0.785 DIAMETER 1.000
STRESS AT NODE 15.8 ALLOWABLE 36.8
STRESS EXPANSION FOR NODE 105
-1.2 12.9 0.0 0.0 -0.8 0.0
FORCES AT NODE 105 FX 12. FY 0. FZ 1.

AEP * 150T CRANE * 50T LOAD * GIRDER TO END TIE * BOLTS * OBE

***** SYSTEM ELEMENT STRESSES *****

```
2-D POINT ELEMENT   6   NODE 106   AREA   0.785   DIAMETER   1.000
  STRESS AT NODE        16.3   ALLOWABLE      36.8
  STRESS EXPANSION FOR NODE 106
       -1.7       12.9        0.0        0.0        -0.8        0.0
  FORCES AT NODE 106   FX        13.   FY          0.   FZ          1.

2-D POINT ELEMENT   7   NODE 107   AREA   0.785   DIAMETER   1.000
  STRESS AT NODE        16.8   ALLOWABLE      36.8
  STRESS EXPANSION FOR NODE 107
       -2.2       12.9        0.0        0.0        -0.8        0.0
  FORCES AT NODE 107   FX        13.   FY          0.   FZ          1.

2-D POINT ELEMENT   8   NODE 108   AREA   0.785   DIAMETER   1.000
  STRESS AT NODE        17.3   ALLOWABLE      36.8
  STRESS EXPANSION FOR NODE 108
       -2.7       12.9        0.0        0.0        -0.8        0.0
  FORCES AT NODE 108   FX        14.   FY          0.   FZ          1.

2-D POINT ELEMENT   9   NODE 109   AREA   0.785   DIAMETER   1.000
  STRESS AT NODE         6.4   ALLOWABLE      36.8
  STRESS EXPANSION FOR NODE 109
        0.8       -3.9        0.0        0.0         0.8        0.0
  FORCES AT NODE 109   FX         5.   FY          0.   FZ          1.

2-D POINT ELEMENT  10   NODE 110   AREA   0.785   DIAMETER   1.000
  STRESS AT NODE         5.9   ALLOWABLE      36.8
  STRESS EXPANSION FOR NODE 110
        0.3       -3.9        0.0        0.0         0.8        0.0
  FORCES AT NODE 110   FX         5.   FY          0.   FZ          1.

2-D POINT ELEMENT  11   NODE 111   AREA   0.785   DIAMETER   1.000
  STRESS AT NODE         5.9   ALLOWABLE      36.8
  STRESS EXPANSION FOR NODE 111
       -0.2       -3.9        0.0        0.0         0.8        0.0
  FORCES AT NODE 111   FX         5.   FY          0.   FZ          1.

2-D POINT ELEMENT  12   NODE 112   AREA   0.785   DIAMETER   1.000
  STRESS AT NODE         6.4   ALLOWABLE      36.8
  STRESS EXPANSION FOR NODE 112
       -0.7       -3.9        0.0        0.0         0.8        0.0
  FORCES AT NODE 112   FX         5.   FY          0.   FZ          1.

2-D POINT ELEMENT  13   NODE 113   AREA   0.785   DIAMETER   1.000
  STRESS AT NODE         6.9   ALLOWABLE      36.8
  STRESS EXPANSION FOR NODE 113
       -1.2       -3.9        0.0        0.0         0.8        0.0
  FORCES AT NODE 113   FX         5.   FY          0.   FZ          1.

2-D POINT ELEMENT  14   NODE 114   AREA   0.785   DIAMETER   1.000
  STRESS AT NODE         7.4   ALLOWABLE      36.8
  STRESS EXPANSION FOR NODE 114
       -1.7       -3.9        0.0        0.0         0.8        0.0
  FORCES AT NODE 114   FX         6.   FY          0.   FZ          1.
```

AEP * 150T CRANE * 50T LOAD * GIRDER TO END TIE * BOLTS * OBE

***** SYSTEM ELEMENT STRESSES *****

2-D POINT ELEMENT 15 NODE 115 AREA 0.785 DIAMETER 1.000
STRESS AT NODE 7.9 ALLOWABLE 36.8
STRESS EXPANSION FOR NODE 115
-2.2 -3.9 0.0 0.0 0.8 0.0
FORCES AT NODE 115 FX 6. FY 0. FZ 1.

2-D POINT ELEMENT 16 NODE 116 AREA 0.785 DIAMETER 1.000
STRESS AT NODE 8.4 ALLOWABLE 36.8
STRESS EXPANSION FOR NODE 116
-2.7 -3.9 0.0 0.0 0.8 0.0
FORCES AT NODE 116 FX 7. FY 0. FZ 1.

2-D POINT ELEMENT 17 NODE 117 AREA 0.785 DIAMETER 1.000
STRESS AT NODE 17.8 ALLOWABLE 36.8
STRESS EXPANSION FOR NODE 117
1.2 14.5 0.0 -0.0 0.0 0.0
FORCES AT NODE 117 FX 14. FY 3. FZ 0.

2-D POINT ELEMENT 18 NODE 118 AREA 0.785 DIAMETER 1.000
STRESS AT NODE 14.5 ALLOWABLE 36.8
STRESS EXPANSION FOR NODE 118
1.2 11.2 0.0 -0.0 0.0 0.0
FORCES AT NODE 118 FX 11. FY 3. FZ 0.

2-D POINT ELEMENT 19 NODE 119 AREA 0.785 DIAMETER 1.000
STRESS AT NODE 11.2 ALLOWABLE 36.8
STRESS EXPANSION FOR NODE 119
1.2 7.8 0.0 -0.0 0.0 0.0
FORCES AT NODE 119 FX 8. FY 3. FZ 0.

2-D POINT ELEMENT 20 NODE 120 AREA 0.785 DIAMETER 1.000
STRESS AT NODE 8.1 ALLOWABLE 36.8
STRESS EXPANSION FOR NODE 120
1.2 4.5 0.0 -0.0 0.0 0.0
FORCES AT NODE 120 FX 6. FY 3. FZ 0.

2-D POINT ELEMENT 21 NODE 121 AREA 0.785 DIAMETER 1.000
STRESS AT NODE 5.2 ALLOWABLE 36.8
STRESS EXPANSION FOR NODE 121
1.2 1.2 0.0 -0.0 0.0 0.0
FORCES AT NODE 121 FX 3. FY 3. FZ 0.

2-D POINT ELEMENT 22 NODE 122 AREA 0.785 DIAMETER 1.000
STRESS AT NODE 6.1 ALLOWABLE 36.8
STRESS EXPANSION FOR NODE 122
1.2 -2.2 0.0 -0.0 0.0 0.0
FORCES AT NODE 122 FX 4. FY 3. FZ 0.

2-D POINT ELEMENT 23 NODE 123 AREA 0.785 DIAMETER 1.000
STRESS AT NODE 9.1 ALLOWABLE 36.8
STRESS EXPANSION FOR NODE 123
1.2 -5.5 0.0 -0.0 0.0 0.0
FORCES AT NODE 123 FX 7. FY 3. FZ 0.

*** CONSYS ANALYSIS PROGRAM *** REQUISITION 79604 DATE 08/27/87
VERSION 4.2 RELEASED 12/03/82 BY: ASZ PAGE 4-79 OF 112
MJM 8-27-87

AEP * 150T CRANE * 50T LOAD * GIRDER TO END TIE * BOLTS * OBE

***** SYSTEM ELEMENT STRESSES *****

```
2-D POINT ELEMENT   24    NODE 124    AREA    0.785    DIAMETER    1.000
  STRESS AT NODE            12.2    ALLOWABLE        36.8
  STRESS EXPANSION FOR NODE 124
        1.2          -8.9          0.0          -0.0          0.0          0.0
  FORCES AT NODE 124    FX          9.   FY           3.   FZ           0.

2-D POINT ELEMENT   25    NODE 125    AREA    0.785    DIAMETER    1.000
  STRESS AT NODE            15.5    ALLOWABLE        36.8
  STRESS EXPANSION FOR NODE 125
        1.2         -12.2          0.0          -0.0          0.0          0.0
  FORCES AT NODE 125    FX         12.   FY           3.   FZ           0.

2-D POINT ELEMENT   26    NODE 126    AREA    0.785    DIAMETER    1.000
  STRESS AT NODE            18.8    ALLOWABLE        36.8
  STRESS EXPANSION FOR NODE 126
        1.2         -15.6          0.0          -0.0          0.0          0.0
  FORCES AT NODE 126    FX         15.   FY           3.   FZ           0.

2-D POINT ELEMENT   27    NODE 127    AREA    0.785    DIAMETER    1.000
  STRESS AT NODE            22.1    ALLOWABLE        36.8
  STRESS EXPANSION FOR NODE 127
        1.2         -18.9          0.0          -0.0          0.0          0.0
  FORCES AT NODE 127    FX         17.   FY           3.   FZ           0.

2-D POINT ELEMENT   28    NODE 128    AREA    0.785    DIAMETER    1.000
  STRESS AT NODE            25.4    ALLOWABLE        36.8
  STRESS EXPANSION FOR NODE 128
        1.2         -22.3          0.0          -0.0          0.0          0.0
  FORCES AT NODE 128    FX         20.   FY           3.   FZ           0.

2-D POINT ELEMENT   29    NODE 129    AREA    0.785    DIAMETER    1.000
  STRESS AT NODE            28.7    ALLOWABLE        36.8
  STRESS EXPANSION FOR NODE 129
        1.2         -25.6          0.0          -0.0          0.0          0.0
  FORCES AT NODE 129    FX         22.   FY           3.   FZ           0.

FORCE DEFINITION NODE ABSOLUTE   ELEMENT  30   NODE 200
   FX          38.50 ;   FY         34.00 ;   FZ          2.10
   MX           8.00 ;   MY         87.10 ;   MZ       3731.00


MAXIMUM ABSOLUTE STRESS ON ELEMENT  29 =        28.7 KSI


***** JOB COMPLETED *****
```

#79604 8-27-87

***** CONSYS INPUT DATA LISTING *****

ASZ


```
         5   10   15   20   25   30   35   40   45   50   55   60   65
         V    V    V    V    V    V    V    V    V    V    V    V    V
  1. AEP * 150T CRANE * 50T LOAD * GIRDER TO END TIE * BOLTS * SSE
  2. 79604 ASZ  1.   0.   0.   1.   0.   0.   0.   0.   1.   0.
  3. 1.    3.   2.                                   MJM 8-27-87
  4. 2.    3.   2.
  5. 3.    5.   0.
  6. -1.
  7. 1.         50.2                          3.
  8. 1.         50.2                          2.
  9. -1.
 10. 101.                 1.   2.        16.
 11. 117.                 2.   1.        13.
 12. 200.                 3.
 13. -1.
 14. -8.    8.                  22.5
 15. 101.             1.5       -9.88     -0.75
 16. 102.             1.5       -9.88     -5.25
 17. 103.             1.5       -9.88     -9.75
 18. 104.             1.5       -9.88    -14.25
 19. 105.             1.5       -9.88    -18.75
 20. 106.             1.5       -9.88    -23.25
 21. 107.             1.5       -9.88    -27.75
 22. 108.             1.5       -9.88    -32.25
 23. -1.    1.  13.              4.5
 24. 117.            2.44      -12.13      3.
 25. 200.            0.          0.        0.
 26. 9999.
 27. 101.  1.   129.
 28. -1.
 29. 200.  57.7      49.5      2.2       10.5      103.3     6359.
 30. -1.
 31. FINISH
         A    A    A    A    A    A    A    A    A    A    A    A    A
```

*** CONSYS ANALYSIS PROGRAM *** REQUISITION 79604 DATE 08/27/87
VERSION 4.2 RELEASED 12/03/82 BY: ASZ PAGE 4-81 OF 112
MJM 8-27-87

AEP * 150T CRANE * 50T LOAD * GIRDER TO END TIE * BOLTS * SSE

***** SYSTEM PROPERTIES *****

LOAD STEP...... 1 DIRECTION, LOCATION OR AXIS

	X	Y	Z
CENTROIDS, X AXIS.........		1.37	3.00
Y AXIS.........	1.50		-7.76
Z AXIS.........	2.44	7.42	
SHEAR AREAS................	22.78	10.21	12.57
POLAR MOMENTS OF INERTIA..	1590.43	3477.98	5511.66
TRANSLATED FORCES.........	57.70	49.50	2.20
TRANSLATED MOMENTS........	162.01	554.27	6908.01

NUMBER OF FORCE DEFINITION NODES... 1

***** SYSTEM ELEMENT STRESSES *****

DIRECT STRESSES ARE EQUALLY DISTRIBUTED THROUGHOUT SHEAR AREA
DRX 2.5 DRY 4.8 DRZ 0.2

2-D POINT ELEMENT 1 NODE 101 AREA 0.785 DIAMETER 1.000
STRESS AT NODE 25.4 ALLOWABLE 50.2
STRESS EXPANSION FOR NODE 101
1.1 21.7 0.0 0.0 -1.1 0.0
FORCES AT NODE 101 FX 20. FY 0. FZ 1.

2-D POINT ELEMENT 2 NODE 102 AREA 0.785 DIAMETER 1.000
STRESS AT NODE 24.7 ALLOWABLE 50.2
STRESS EXPANSION FOR NODE 102
0.4 21.7 0.0 0.0 -1.1 0.0
FORCES AT NODE 102 FX 19. FY 0. FZ 1.

2-D POINT ELEMENT 3 NODE 103 AREA 0.785 DIAMETER 1.000
STRESS AT NODE 24.6 ALLOWABLE 50.2
STRESS EXPANSION FOR NODE 103
-0.3 21.7 0.0 0.0 -1.1 0.0
FORCES AT NODE 103 FX 19. FY 0. FZ 1.

2-D POINT ELEMENT 4 NODE 104 AREA 0.785 DIAMETER 1.000
STRESS AT NODE 25.3 ALLOWABLE 50.2
STRESS EXPANSION FOR NODE 104
-1.0 21.7 0.0 0.0 -1.1 0.0
FORCES AT NODE 104 FX 20. FY 0. FZ 1.

2-D POINT ELEMENT 5 NODE 105 AREA 0.785 DIAMETER 1.000
STRESS AT NODE 26.0 ALLOWABLE 50.2
STRESS EXPANSION FOR NODE 105
-1.8 21.7 0.0 0.0 -1.1 0.0
FORCES AT NODE 105 FX 20. FY 0. FZ 1.

*** CONSYS ANALYSIS PROGRAM *** REQUISITION 79604 DATE 08/27/87
VERSION 4.2 RELEASED 12/03/82 BY: ASZ
MJM 8-27-87

AEP * 150T CRANE * 50T LOAD * GIRDER TO END TIE * BOLTS * SSE

***** SYSTEM ELEMENT STRESSES *****

2-D POINT ELEMENT 6 NODE 106 AREA 0.785 DIAMETER 1.000
STRESS AT NODE 26.7 ALLOWABLE 50.2
STRESS EXPANSION FOR NODE 106
-2.5 21.7 0.0 0.0 -1.1 0.0
FORCES AT NODE 106 FX 21. FY 0. FZ 1.

2-D POINT ELEMENT 7 NODE 107 AREA 0.785 DIAMETER 1.000
STRESS AT NODE 27.4 ALLOWABLE 50.2
STRESS EXPANSION FOR NODE 107
-3.2 21.7 0.0 0.0 -1.1 0.0
FORCES AT NODE 107 FX 22. FY 0. FZ 1.

2-D POINT ELEMENT 8 NODE 108 AREA 0.785 DIAMETER 1.000
STRESS AT NODE 28.2 ALLOWABLE 50.2
STRESS EXPANSION FOR NODE 108
-3.9 21.7 0.0 0.0 -1.1 0.0
FORCES AT NODE 108 FX 22. FY 0. FZ 1.

2-D POINT ELEMENT 9 NODE 109 AREA 0.785 DIAMETER 1.000
STRESS AT NODE 10.3 ALLOWABLE 50.2
STRESS EXPANSION FOR NODE 109
1.1 -6.5 0.0 0.0 1.1 0.0
FORCES AT NODE 109 FX 8. FY 0. FZ 1.

2-D POINT ELEMENT 10 NODE 110 AREA 0.785 DIAMETER 1.000
STRESS AT NODE 9.5 ALLOWABLE 50.2
STRESS EXPANSION FOR NODE 110
0.4 -6.5 0.0 0.0 1.1 0.0
FORCES AT NODE 110 FX 7. FY 0. FZ 1.

2-D POINT ELEMENT 11 NODE 111 AREA 0.785 DIAMETER 1.000
STRESS AT NODE 9.5 ALLOWABLE 50.2
STRESS EXPANSION FOR NODE 111
-0.3 -6.5 0.0 0.0 1.1 0.0
FORCES AT NODE 111 FX 7. FY 0. FZ 1.

2-D POINT ELEMENT 12 NODE 112 AREA 0.785 DIAMETER 1.000
STRESS AT NODE 10.2 ALLOWABLE 50.2
STRESS EXPANSION FOR NODE 112
-1.0 -6.5 0.0 0.0 1.1 0.0
FORCES AT NODE 112 FX 8. FY 0. FZ 1.

2-D POINT ELEMENT 13 NODE 113 AREA 0.785 DIAMETER 1.000
STRESS AT NODE 10.9 ALLOWABLE 50.2
STRESS EXPANSION FOR NODE 113
-1.8 -6.5 0.0 0.0 1.1 0.0
FORCES AT NODE 113 FX 8. FY 0. FZ 1.

2-D POINT ELEMENT 14 NODE 114 AREA 0.785 DIAMETER 1.000
STRESS AT NODE 11.6 ALLOWABLE 50.2
STRESS EXPANSION FOR NODE 114
-2.5 -6.5 0.0 0.0 1.1 0.0
FORCES AT NODE 114 FX 9. FY 0. FZ 1.

AEP * 150T CRANE * 50T LOAD * GIRDER TO END TIE * BOLTS * SSE

***** SYSTEM ELEMENT STRESSES *****

```
2-D POINT ELEMENT  15   NODE 115   AREA  0.785   DIAMETER  1.000
 STRESS AT NODE         12.3    ALLOWABLE       50.2
 STRESS EXPANSION FOR NODE 115
      -3.2        -6.5         0.0         0.0          1.1          0.0
 FORCES AT NODE 115   FX         10.   FY          0.   FZ          1.

2-D POINT ELEMENT  16   NODE 116   AREA  0.785   DIAMETER  1.000
 STRESS AT NODE         13.0    ALLOWABLE       50.2
 STRESS EXPANSION FOR NODE 116
      -3.9        -6.5         0.0         0.0          1.1          0.0
 FORCES AT NODE 116   FX         10.   FY          0.   FZ          1.

2-D POINT ELEMENT  17   NODE 117   AREA  0.785   DIAMETER  1.000
 STRESS AT NODE         29.2    ALLOWABLE       50.2
 STRESS EXPANSION FOR NODE 117
       1.7        24.5         0.0        -0.0          0.0          0.0
 FORCES AT NODE 117   FX         23.   FY          4.   FZ          0.

2-D POINT ELEMENT  18   NODE 118   AREA  0.785   DIAMETER  1.000
 STRESS AT NODE         23.6    ALLOWABLE       50.2
 STRESS EXPANSION FOR NODE 118
       1.7        18.9         0.0        -0.0          0.0          0.0
 FORCES AT NODE 118   FX         18.   FY          4.   FZ          0.

2-D POINT ELEMENT  19   NODE 119   AREA  0.785   DIAMETER  1.000
 STRESS AT NODE         18.1    ALLOWABLE       50.2
 STRESS EXPANSION FOR NODE 119
       1.7        13.2         0.0        -0.0          0.0          0.0
 FORCES AT NODE 119   FX         14.   FY          4.   FZ          0.

2-D POINT ELEMENT  20   NODE 120   AREA  0.785   DIAMETER  1.000
 STRESS AT NODE         12.8    ALLOWABLE       50.2
 STRESS EXPANSION FOR NODE 120
       1.7         7.6         0.0        -0.0          0.0          0.0
 FORCES AT NODE 120   FX          9.   FY          4.   FZ          0.

2-D POINT ELEMENT  21   NODE 121   AREA  0.785   DIAMETER  1.000
 STRESS AT NODE          7.9    ALLOWABLE       50.2
 STRESS EXPANSION FOR NODE 121
       1.7         1.9         0.0        -0.0          0.0          0.0
 FORCES AT NODE 121   FX          5.   FY          4.   FZ          0.

2-D POINT ELEMENT  22   NODE 122   AREA  0.785   DIAMETER  1.000
 STRESS AT NODE          9.3    ALLOWABLE       50.2
 STRESS EXPANSION FOR NODE 122
       1.7        -3.7         0.0        -0.0          0.0          0.0
 FORCES AT NODE 122   FX          6.   FY          4.   FZ          0.

2-D POINT ELEMENT  23   NODE 123   AREA  0.785   DIAMETER  1.000
 STRESS AT NODE         14.4    ALLOWABLE       50.2
 STRESS EXPANSION FOR NODE 123
       1.7        -9.3         0.0        -0.0          0.0          0.0
 FORCES AT NODE 123   FX         11.   FY          4.   FZ          0.
```

AEP * 150T CRANE * 50T LOAD * GIRDER TO END TIE * BOLTS * SSE

***** SYSTEM ELEMENT STRESSES *****

2-D POINT ELEMENT 24   NODE 124   AREA 0.785   DIAMETER 1.000
STRESS AT NODE 19.8   ALLOWABLE 50.2
STRESS EXPANSION FOR NODE 124
1.7   -15.0   0.0   -0.0   0.0   0.0
FORCES AT NODE 124   FX 15.   FY 4.   FZ 0.

2-D POINT ELEMENT 25   NODE 125   AREA 0.785   DIAMETER 1.000
STRESS AT NODE 25.3   ALLOWABLE 50.2
STRESS EXPANSION FOR NODE 125
1.7   -20.6   0.0   -0.0   0.0   0.0
FORCES AT NODE 125   FX 20.   FY 4.   FZ 0.

2-D POINT ELEMENT 26   NODE 126   AREA 0.785   DIAMETER 1.000
STRESS AT NODE 30.9   ALLOWABLE 50.2
STRESS EXPANSION FOR NODE 126
1.7   -26.3   0.0   -0.0   0.0   0.0
FORCES AT NODE 126   FX 24.   FY 4.   FZ 0.

2-D POINT ELEMENT 27   NODE 127   AREA 0.785   DIAMETER 1.000
STRESS AT NODE 36.5   ALLOWABLE 50.2
STRESS EXPANSION FOR NODE 127
1.7   -31.9   0.0   -0.0   0.0   0.0
FORCES AT NODE 127   FX 28.   FY 4.   FZ 0.

2-D POINT ELEMENT 28   NODE 128   AREA 0.785   DIAMETER 1.000
STRESS AT NODE 42.1   ALLOWABLE 50.2
STRESS EXPANSION FOR NODE 128
1.7   -37.5   0.0   -0.0   0.0   0.0
FORCES AT NODE 128   FX 33.   FY 4.   FZ 0.

2-D POINT ELEMENT 29   NODE 129   AREA 0.785   DIAMETER 1.000
STRESS AT NODE 47.7   ALLOWABLE 50.2
STRESS EXPANSION FOR NODE 129
1.7   -43.2   0.0   -0.0   0.0   0.0
FORCES AT NODE 129   FX 37.   FY 4.   FZ 0.

FORCE DEFINITION NODE ABSOLUTE   ELEMENT 30   NODE 200
FX 57.70 ;   FY 49.50 ;   FZ 2.20
MX 10.50 ;   MY 103.30 ;   MZ 6359.00

MAXIMUM ABSOLUTE STRESS ON ELEMENT 29 = 47.7 KSI

***** JOB COMPLETED *****

#79604 8-21-87

***** CONSYS INPUT DATA LISTING *****

ASZ PAGE 4-85 OF 112

```
         5    10   15   20   25   30   35   40   45   50   55   60   65
         V    V    V    V    V    V    V    V    V    V    V    V    V
  1. AEP * 150T CRANE * 50T LOAD * GIRDER TO END TIE * WELDS * OBE
  2. 79604 ASZ  1.   0.   0.   1.                       1.
  3.  1.   1.                                      MJM 8-26-87
  4.  2.   3.
  5.  3.   5.
  6. -1.
  7.  0.25      20.0                1.
  8.  1.375     20.0                0.56      3.
  9. -1.
 10. 101. 102.            1.   1.        8.   2.
 11. 117. 118.            1.   1.        2.
 12. 104. 120.            1.   1.
 13. 108. 121.            1.   1.
 14. 116. 122.            1.   1.
 15. 112. 123.            1.   1.
 16.   51.                2.   2.         6.
 17. 200.                 3.
 18. -1.
 19. 101.            -1.75       -9.88      1.25
 20. 102.            -1.75       -9.88    -36.38
 21. 103.            -1.25       -9.88    -36.38
 22. 104.            -1.25       -9.88    -41.88
 23. 105.            -1.75       -9.38      1.25
 24. 106.            -1.75       -9.38    -36.38
 25. 107.            -1.25       -9.38    -36.38
 26. 108.            -1.25       -9.38    -41.88
 27. 109.            -1.75       12.62      1.25
 28. 110.            -1.75       12.62    -36.38
 29. 111.            -1.25       12.62    -36.38
 30. 112.            -1.25       12.62    -41.88
 31. 113.            -1.75       13.12      1.25
 32. 114.            -1.75       13.12    -36.38
 33. 115.            -1.25       13.12    -36.38
 34. 116.            -1.25       13.12    -41.88
 35. 117.            -3.06      -14.13      3.
 36. 118.            -3.06       43.87      3.
 37. 119.            -0.06       43.87      3.
 38.   51.           -1.56       -7.63      3.
 39.   52.           -1.56        1.37      3.
 40.   53.           -1.56       10.37      3.
 41.   54.           -1.56       19.37      3.
 42.   55.           -1.56       28.37      3.
 43.   56.           -1.56       37.37      3.
 44. 120.             2.25       -9.88    -41.88
 45. 121.             2.25       -9.38    -41.88
 46. 122.             2.25       13.12    -41.88
 47. 123.             2.25       12.62    -41.88
 48. 200.             0.          0.        0.
 49. 9999.
 50. 101.  1.  123.
 51.   51.  1.   56.
 52. -1.
 53. 200.  38.5      34.0      2.1       8.0       87.1      3731.
 54. -1.
 55. FINISH
         A    A    A    A    A    A    A    A    A    A    A    A    A
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*** CONSYS ANALYSIS PROGRAM *** REQUISITION 79604 DATE 08/21/87
VERSION 4.2 RELEASED 12/03/82 BY: ASZ PAGE 4-86 OF '2
MJM 8-26-87

AEP * 150T CRANE * 50T LOAD * GIRDER TO END TIE * WELDS * OBE

***** SYSTEM PROPERTIES *****

LOAD STEP...... 1	DIRECTION, LOCATION OR AXIS		
	X	Y	Z
CENTROIDS, X AXIS.........		5.24	-12.61
Y AXIS.........	-1.88		-12.61
Z AXIS.........	-1.83	6.87	
SHEAR AREAS...............	52.67	52.67	43.76
POLAR MOMENTS OF INERTIA..	22680.72	13490.29	12049.47
TRANSLATED FORCES.........	38.50	34.00	2.10
TRANSLATED MOMENTS........	447.75	576.55	4057.52

NUMBER OF FORCE DEFINITION NODES... 1

***** SYSTEM ELEMENT STRESSES *****

DIRECT STRESSES ARE EQUALLY DISTRIBUTED THROUGHOUT SHEAR AREA
DRX 0.7 DRY 0.6 DRZ 0.0

3-D LINE ELEMENT 1 SIZE 0.250 LENGTH 37.630 AREA 6.652
STRESS AT NODES 101, 102 7.0, 7.5 ALLOWABLE 20.0
STRESS EXPANSION FOR NODE 101

0.6	5.6	-0.3	0.0	-0.3	-0.0

STRESS EXPANSION FOR NODE 102

-1.0	5.6	0.5	0.0	-0.3	-0.0

3-D LINE ELEMENT 2 SIZE 0.250 LENGTH 5.500 AREA 0.972
STRESS AT NODES 103, 104 7.5, 7.8 ALLOWABLE 20.0
STRESS EXPANSION FOR NODE 103

-1.0	5.6	0.5	0.2	-0.3	-0.0

STRESS EXPANSION FOR NODE 104

-1.3	5.6	0.6	0.2	-0.3	-0.0

3-D LINE ELEMENT 3 SIZE 0.250 LENGTH 37.630 AREA 6.652
STRESS AT NODES 105, 106 6.9, 7.3 ALLOWABLE 20.0
STRESS EXPANSION FOR NODE 105

0.6	5.5	-0.3	0.0	-0.3	-0.0

STRESS EXPANSION FOR NODE 106

-1.0	5.5	0.5	0.0	-0.3	-0.0

3-D LINE ELEMENT 4 SIZE 0.250 LENGTH 5.500 AREA 0.972
STRESS AT NODES 107, 108 7.3, 7.6 ALLOWABLE 20.0
STRESS EXPANSION FOR NODE 107

-1.0	5.5	0.5	0.2	-0.3	-0.0

STRESS EXPANSION FOR NODE 108

-1.3	5.5	0.6	0.2	-0.3	-0.0

*** CONSYS ANALYSIS PROGRAM *** REQUISITION 79604 DATE 08/21/87
VERSION 4.2 RELEASED 12/03/82 BY: ASZ PAGE 4-87 OF 12
MJM 8-26-87

AEP * 150T CRANE * 50T LOAD * GIRDER TO END TIE * WELDS * OBE

***** SYSTEM ELEMENT STRESSES *****

3-D LINE ELEMENT 5 SIZE 0.250 LENGTH 37.630 AREA 6.652
STRESS AT NODES 109,110 3.4, 3.9 ALLOWABLE 20.0
STRESS EXPANSION FOR NODE 109
0.6 -1.9 -0.3 0.0 0.1 -0.0
STRESS EXPANSION FOR NODE 110
-1.0 -1.9 0.5 0.0 0.1 -0.0

3-D LINE ELEMENT 6 SIZE 0.250 LENGTH 5.500 AREA 0.972
STRESS AT NODES 111,112 3.9, 4.2 ALLOWABLE 20.0
STRESS EXPANSION FOR NODE 111
-1.0 -1.9 0.5 0.2 0.1 -0.0
STRESS EXPANSION FOR NODE 112
-1.3 -1.9 0.6 0.2 0.1 -0.0

3-D LINE ELEMENT 7 SIZE 0.250 LENGTH 37.630 AREA 6.652
STRESS AT NODES 113,114 3.6, 4.0 ALLOWABLE 20.0
STRESS EXPANSION FOR NODE 113
0.6 -2.1 -0.3 0.0 0.2 -0.0
STRESS EXPANSION FOR NODE 114
-1.0 -2.1 0.5 0.0 0.2 -0.0

3-D LINE ELEMENT 8 SIZE 0.250 LENGTH 5.500 AREA 0.972
STRESS AT NODES 115,116 4.1, 4.3 ALLOWABLE 20.0
STRESS EXPANSION FOR NODE 115
-1.0 -2.1 0.5 0.2 0.2 -0.0
STRESS EXPANSION FOR NODE 116
-1.3 -2.1 0.6 0.2 0.2 -0.0

3-D LINE ELEMENT 9 SIZE 0.250 LENGTH 58.000 AREA 10.253
STRESS AT NODES 117,118 8.6, 14.0 ALLOWABLE 20.0
STRESS EXPANSION FOR NODE 117
0.7 7.1 -0.3 -0.4 -0.4 0.1
STRESS EXPANSION FOR NODE 118
0.7 -12.5 -0.3 -0.4 0.8 0.1

3-D LINE ELEMENT 10 SIZE 0.250 LENGTH 3.000 AREA 0.530
STRESS AT NODES 118,119 14.0, 14.0 ALLOWABLE 20.0
STRESS EXPANSION FOR NODE 118
0.7 -12.5 -0.3 -0.4 0.8 0.1
STRESS EXPANSION FOR NODE 119
0.7 -12.5 -0.3 0.6 0.8 -0.1

3-D LINE ELEMENT 11 SIZE 0.250 LENGTH 3.500 AREA 0.619
STRESS AT NODES 104,120 7.8, 8.1 ALLOWABLE 20.0
STRESS EXPANSION FOR NODE 104
-1.3 5.6 0.6 0.2 -0.3 -0.0
STRESS EXPANSION FOR NODE 120
-1.3 5.6 0.6 1.4 -0.3 -0.2

3-D LINE ELEMENT 12 SIZE 0.250 LENGTH 3.500 AREA 0.619
STRESS AT NODES 108,121 7.6, 7.9 ALLOWABLE 20.0
STRESS EXPANSION FOR NODE 108
-1.3 5.5 0.6 0.2 -0.3 -0.0
STRESS EXPANSION FOR NODE 121
-1.3 5.5 0.6 1.4 -0.3 -0.2

AEP * 150T CRANE * 50T LOAD * GIRDER TO END TIE * WELDS * OBE

***** SYSTEM ELEMENT STRESSES *****

3-D LINE ELEMENT 13 SIZE 0.250 LENGTH 3.500 AREA 0.619
STRESS AT NODES 116, 122 4.3, 4.9 ALLOWABLE 20.0
STRESS EXPANSION FOR NODE 116

-1.3	-2.1	0.6	0.2	0.2	-0.0

STRESS EXPANSION FOR NODE 122

-1.3	-2.1	0.6	1.4	0.2	-0.2

3-D LINE ELEMENT 14 SIZE 0.250 LENGTH 3.500 AREA 0.619
STRESS AT NODES 112, 123 4.2, 4.7 ALLOWABLE 20.0
STRESS EXPANSION FOR NODE 112

-1.3	-1.9	0.6	0.2	0.1	-0.0

STRESS EXPANSION FOR NODE 123

-1.3	-1.9	0.6	1.4	0.1	-0.2

2-D POINT ELEMENT 15 NODE 51 AREA 1.485 DIAMETER 1.375
STRESS AT NODE 6.4 ALLOWABLE 20.0
STRESS EXPANSION FOR NODE 51

0.7	4.9	-0.3	0.1	0.0	0.0

2-D POINT ELEMENT 16 NODE 52 AREA 1.485 DIAMETER 1.375
STRESS AT NODE 3.4 ALLOWABLE 20.0
STRESS EXPANSION FOR NODE 52

0.7	1.9	-0.3	0.1	0.0	0.0

2-D POINT ELEMENT 17 NODE 53 AREA 1.485 DIAMETER 1.375
STRESS AT NODE 2.8 ALLOWABLE 20.0
STRESS EXPANSION FOR NODE 53

0.7	-1.2	-0.3	0.1	0.0	0.0

2-D POINT ELEMENT 18 NODE 54 AREA 1.485 DIAMETER 1.375
STRESS AT NODE 5.7 ALLOWABLE 20.0
STRESS EXPANSION FOR NODE 54

0.7	-4.2	-0.3	0.1	0.0	0.0

2-D POINT ELEMENT 19 NODE 55 AREA 1.485 DIAMETER 1.375
STRESS AT NODE 8.7 ALLOWABLE 20.0
STRESS EXPANSION FOR NODE 55

0.7	-7.2	-0.3	0.1	0.0	0.0

2-D POINT ELEMENT 20 NODE 56 AREA 1.485 DIAMETER 1.375
STRESS AT NODE 11.7 ALLOWABLE 20.0
STRESS EXPANSION FOR NODE 56

0.7	-10.3	-0.3	0.1	0.0	0.0

FORCE DEFINITION NODE ABSOLUTE ELEMENT 21 NODE 200
FX 38.50 ; FY 34.00 ; FZ 2.10
MX 8.00 ; MY 87.10 ; MZ 3731.00

MAXIMUM ABSOLUTE STRESS ON ELEMENT 10 = 14.0 KSI

```
             5    10    15    20    25    30    35    40    45    50    55    60    65
             V     V     V     V     V     V     V     V     V     V     V     V     V
     1.  AEP * 150T CRANE * 50T LOAD * GIRDER TO END TIE * WELDS * SSE
     2.  79604 ASZ  1.    0.    0.    1.                             1.
     3.  1.    1.                                              MJM  8-26-87
     4.  2.    3.
     5.  3.    5.
     6.  -1.
     7.  0.25        27.3                    1.
     8.  1.375       27.3                    0.56        3.
     9.  -1.
    10.  101.  102.              1.    1.          8.    2.
    11.  117.  118.              1.    1.          2.
    12.  104.  120.              1.    1.
    13.  108.  121.              1.    1.
    14.  116.  122.              1.    1.
    15.  112.  123.              1.    1.
    16.   51.                    2.    2.          6.
    17.  200.                    3.
    18.  -1.
    19.  101.              -1.75       -9.88       1.25
    20.  102.              -1.75       -9.88     -36.38
    21.  103.              -1.25       -9.88     -36.38
    22.  104.              -1.25       -9.88     -41.88
    23.  105.              -1.75       -9.38       1.25
    24.  106.              -1.75       -9.38     -36.38
    25.  107.              -1.25       -9.38     -36.38
    26.  108.              -1.25       -9.38     -41.88
    27.  109.              -1.75       12.62       1.25
    28.  110.              -1.75       12.62     -36.38
    29.  111.              -1.25       12.62     -36.38
    30.  112.              -1.25       12.62     -41.88
    31.  113.              -1.75       13.12       1.25
    32.  114.              -1.75       13.12     -36.38
    33.  115.              -1.25       13.12     -36.38
    34.  116.              -1.25       13.12     -41.88
    35.  117.              -3.06      -14.13       3.
    36.  118.              -3.06       43.87       3.
    37.  119.              -0.06       43.87       3.
    38.   51.              -1.56       -7.63       3.
    39.   52.              -1.56        1.37       3.
    40.   53.              -1.56       10.37       3.
    41.   54.              -1.56       19.37       3.
    42.   55.              -1.56       28.37       3.
    43.   56.              -1.56       37.37       3.
    44.  120.               2.25       -9.88     -41.88
    45.  121.               2.25       -9.38     -41.88
    46.  122.               2.25       13.12     -41.88
    47.  123.               2.25       12.62     -41.88
    48.  200.               0.          0.          0.
    49.  9999.
    50.  101.   1.   123.
    51.   51.   1.    56.
    52.  -1.
    53.  200.  57.7        49.5        2.2         10.5        103.3       6359.
    54.  -1.
    55.  FINISH
             A     A     A     A     A     A     A     A     A     A     A     A     A
```

AEP * 150T CRANE * 50T LOAD * GIRDER TO END TIE * WELDS * SSE

***** SYSTEM PROPERTIES *****

LOAD STEP ..... 1 DIRECTION, LOCATION OR AXIS

	X	Y	Z
CENTROIDS, X AXIS.........		5.24	-12.61
Y AXIS.........	-1.88		-12.61
Z AXIS.........	-1.83	6.87	
SHEAR AREAS...............	52.67	52.67	43.76
POLAR MOMENTS OF INERTIA..	22680.72	13490.29	12049.47
TRANSLATED FORCES.........	57.70	49.50	2.20
TRANSLATED MOMENTS........	646.24	835.06	6845.70

NUMBER OF FORCE DEFINITION NODES... 1

***** SYSTEM ELEMENT STRESSES *****

DIRECT STRESSES ARE EQUALLY DISTRIBUTED THROUGHOUT SHEAR AREA
DRX 1.1 DRY 0.9 DRZ 0.1

3-D LINE ELEMENT 1 SIZE 0.250 LENGTH 37.630 AREA 6.652
STRESS AT NODES 101, 102 11.6, 12.2 ALLOWABLE 27.3
STRESS EXPANSION FOR NODE 101
0.9 9.5 -0.4 0.0 -0.4 -0.0
STRESS EXPANSION FOR NODE 102
-1.5 9.5 0.7 0.0 -0.4 -0.0

3-D LINE ELEMENT 2 SIZE 0.250 LENGTH 5.500 AREA 0.972
STRESS AT NODES 103, 104 12.2, 12.6 ALLOWABLE 27.3
STRESS EXPANSION FOR NODE 103
-1.5 9.5 0.7 0.3 -0.4 -0.0
STRESS EXPANSION FOR NODE 104
-1.8 9.5 0.8 0.3 -0.4 -0.0

3-D LINE ELEMENT 3 SIZE 0.250 LENGTH 37.630 AREA 6.652
STRESS AT NODES 105, 106 11.3, 11.9 ALLOWABLE 27.3
STRESS EXPANSION FOR NODE 105
0.9 9.2 -0.4 0.0 -0.4 -0.0
STRESS EXPANSION FOR NODE 106
-1.5 9.2 0.7 0.0 -0.4 -0.0

3-D LINE ELEMENT 4 SIZE 0.250 LENGTH 5.500 AREA 0.972
STRESS AT NODES 107, 108 12.0, 12.3 ALLOWABLE 27.3
STRESS EXPANSION FOR NODE 107
-1.5 9.2 0.7 0.3 -0.4 -0.0
STRESS EXPANSION FOR NODE 108
-1.8 9.2 0.8 0.3 -0.4 -0.0

AEP * 150T CRANE * 50T LOAD * GIRDER TO END TIE * WELDS * SSE

***** SYSTEM ELEMENT STRESSES *****

3-D LINE ELEMENT 5 SIZE 0.250 LENGTH 37.630 AREA 6.652
STRESS AT NODES 109, 110 5.4, 6.1 ALLOWABLE 27.3
STRESS EXPANSION FOR NODE 109

0.9	-3.3	-0.4	0.0	0.2	-0.0

STRESS EXPANSION FOR NODE 110

-1.5	-3.3	0.7	0.0	0.2	-0.0

3-D LINE ELEMENT 6 SIZE 0.250 LENGTH 5.500 AREA 0.972
STRESS AT NODES 111, 112 6.2, 6.5 ALLOWABLE 27.3
STRESS EXPANSION FOR NODE 111

-1.5	-3.3	0.7	0.3	0.2	-0.0

STRESS EXPANSION FOR NODE 112

-1.8	-3.3	0.8	0.3	0.2	-0.0

3-D LINE ELEMENT 7 SIZE 0.250 LENGTH 37.630 AREA 6.652
STRESS AT NODES 113, 114 5.7, 6.3 ALLOWABLE 27.3
STRESS EXPANSION FOR NODE 113

0.9	-3.6	-0.4	0.0	0.2	-0.0

STRESS EXPANSION FOR NODE 114

-1.5	-3.6	0.7	0.0	0.2	-0.0

3-D LINE ELEMENT 8 SIZE 0.250 LENGTH 5.500 AREA 0.972
STRESS AT NODES 115, 116 6.4, 6.8 ALLOWABLE 27.3
STRESS EXPANSION FOR NODE 115

-1.5	-3.6	0.7	0.3	0.2	-0.0

STRESS EXPANSION FOR NODE 116

-1.8	-3.6	0.8	0.3	0.2	-0.0

3-D LINE ELEMENT 9 SIZE 0.250 LENGTH 58.000 AREA 10.253
STRESS AT NODES 117, 118 14.2, 23.2 ALLOWABLE 27.3
STRESS EXPANSION FOR NODE 117

1.0	11.9	-0.4	-0.7	-0.6	0.1

STRESS EXPANSION FOR NODE 118

1.0	-21.0	-0.4	-0.7	1.1	0.1

3-D LINE ELEMENT 10 SIZE 0.250 LENGTH 3.000 AREA 0.530
STRESS AT NODES 118, 119 23.2, 23.2 ALLOWABLE 27.3
STRESS EXPANSION FOR NODE 118

1.0	-21.0	-0.4	-0.7	1.1	0.1

STRESS EXPANSION FOR NODE 119

1.0	-21.0	-0.4	1.0	1.1	-0.1

3-D LINE ELEMENT 11 SIZE 0.250 LENGTH 3.500 AREA 0.619
STRESS AT NODES 104, 120 12.6, 13.1 ALLOWABLE 27.3
STRESS EXPANSION FOR NODE 104

-1.8	9.5	0.8	0.3	-0.4	-0.0

STRESS EXPANSION FOR NODE 120

-1.8	9.5	0.8	2.3	-0.4	-0.3

3-D LINE ELEMENT 12 SIZE 0.250 LENGTH 3.500 AREA 0.619
STRESS AT NODES 108, 121 12.3, 12.8 ALLOWABLE 27.3
STRESS EXPANSION FOR NODE 108

-1.8	9.2	0.8	0.3	-0.4	-0.0

STRESS EXPANSION FOR NODE 121

-1.8	9.2	0.8	2.3	-0.4	-0.3

AEP * 150T CRANE * 50T LOAD * GIRDER TO END TIE * WELDS * SSE

***** SYSTEM ELEMENT STRESSES *****

3-D LINE ELEMENT 13 SIZE 0.250 LENGTH 3.500 AREA 0.619
STRESS AT NODES 116,122 6.8, 7.7 ALLOWABLE 27.3
STRESS EXPANSION FOR NODE 116
-1.8 -3.6 0.8 0.3 0.2 -0.0
STRESS EXPANSION FOR NODE 122
-1.8 -3.6 0.8 2.3 0.2 -0.3

3-D LINE ELEMENT 14 SIZE 0.250 LENGTH 3.500 AREA 0.619
STRESS AT NODES 112,123 6.5, 7.4 ALLOWABLE 27.3
STRESS EXPANSION FOR NODE 112
-1.8 -3.3 0.8 0.3 0.2 -0.0
STRESS EXPANSION FOR NODE 123
-1.8 -3.3 0.8 2.3 0.2 -0.3

2-D POINT ELEMENT 15 NODE 51 AREA 1.485 DIAMETER 1.375
STRESS AT NODE 10.4 ALLOWABLE 27.3
STRESS EXPANSION FOR NODE 51
1.0 8.2 -0.4 0.2 0.0 0.0

2-D POINT ELEMENT 16 NODE 52 AREA 1.485 DIAMETER 1.375
STRESS AT NODE 5.4 ALLOWABLE 27.3
STRESS EXPANSION FOR NODE 52
1.0 3.1 -0.4 0.2 0.0 0.0

2-D POINT ELEMENT 17 NODE 53 AREA 1.485 DIAMETER 1.375
STRESS AT NODE 4.3 ALLOWABLE 27.3
STRESS EXPANSION FOR NODE 53
1.0 -2.0 -0.4 0.2 0.0 0.0

2-D POINT ELEMENT 18 NODE 54 AREA 1.485 DIAMETER 1.375
STRESS AT NODE 9.3 ALLOWABLE 27.3
STRESS EXPANSION FOR NODE 54
1.0 -7.1 -0.4 0.2 0.0 0.0

2-D POINT ELEMENT 19 NODE 55 AREA 1.485 DIAMETER 1.375
STRESS AT NODE 14.4 ALLOWABLE 27.3
STRESS EXPANSION FOR NODE 55
1.0 -12.2 -0.4 0.2 0.0 0.0

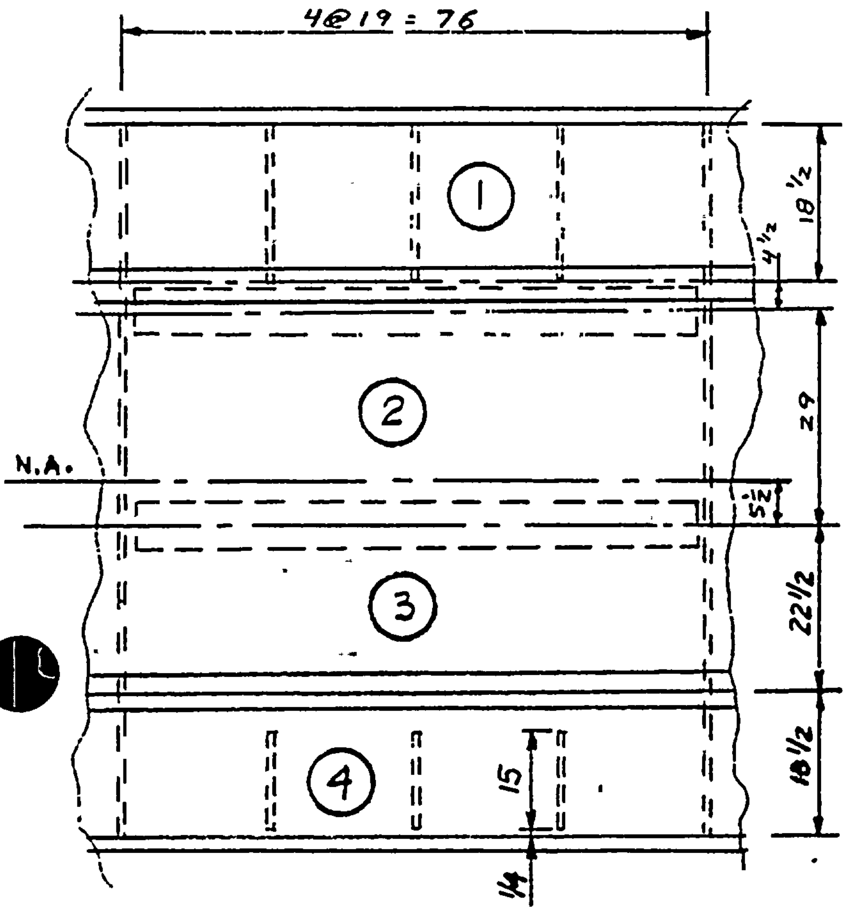
2-D POINT ELEMENT 20 NODE 56 AREA 1.485 DIAMETER 1.375
STRESS AT NODE 19.5 ALLOWABLE 27.3
STRESS EXPANSION FOR NODE 56
1.0 -17.3 -0.4 0.2 0.0 0.0

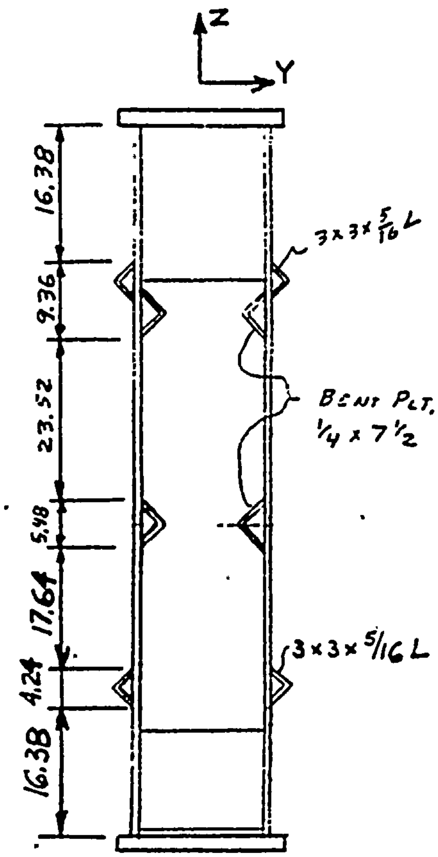
FORCE DEFINITION NODE ABSOLUTE ELEMENT 21 NODE 200
FX 57.70 ; FY 49.50 ; FZ 2.20
MX 10.50 ; MY 103.30 ; MZ 6359.00

MAXIMUM ABSOLUTE STRESS ON ELEMENT 10 = 23.2 KSI

BUCKLING STABILITY OF GIRDER WEB

(REF 16 - USS STEEL DESIGN MANUAL - 1981, PP. 73-95)





FOR CALCULATIONS ASSUME ALL EDGES ARE SIMPLY SUPPORTED.

GIRDER SECTION PROPERTIES PER PG. 3-13.

MATERIAL: ASTM-A36

$\sigma_{Y\,MIN} = 36$ KSI

$E = 29000$ KSI

LONGITUDINAL STIFFENERS CHECK TO DETERMINE THE EFFECTIVENESS OF EACH STIFFENER HAS WHEN DETERMINING THE CRITICAL STRESS OF EACH PANEL.

$$\gamma_1 = \phi + \left(\frac{a}{b_W}\right)^2 \frac{A_s}{b_W t} k_c$$

$$\gamma_2 = \frac{12(1-\nu^2) I_s}{b_W t^3}$$

ϕ AND k_C ARE DEPENDANT ON EACH OTHER AND THE VALUES MUST BE DETERMINED SO THAT THE FOLLOWING IS TRUE. (FIG. 4.13)

$(k_{C\,MAX} = 64$ AND $\phi_{MAX} = 11.0)$

THE EFFECTIVENESS OF THE STIFFENER IS DETERMINED BY THE FOLLOWING RATIO. $\beta_{EFF.} = \dfrac{k_C}{k_{C\,MAX}} = \dfrac{k_C}{64}$

$\nu = 0.3$ $a = 76$ IN. $b_W = 93$ IN. $t = 5/16$ IN. $\dfrac{a}{b_W} = 0.82$

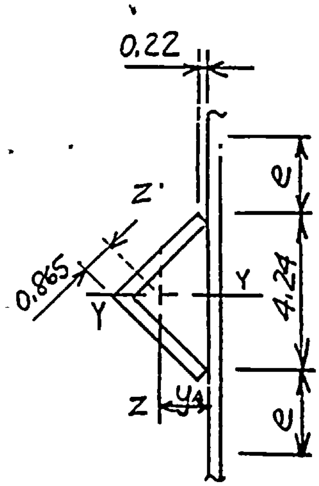
EFFECTIVE PLATE WIDTH $e = \frac{1}{2}\dfrac{6000t}{\sqrt{\sigma_y}} = \frac{1}{2}\dfrac{6000 \times 0.3125}{\sqrt{36000}} = 4.94$ IN.

<u>BOTTOM STIFFENER 3×3×5/16 ANGLE</u>

<u>WEB</u>

$\bar{y}_W = \frac{1}{2} \times \frac{5}{16} = 0.156$ IN. $A_W = (2 \times 4.94 + 4.24)0.3125 = 4.4$ IN^2

$$I_{ZW} = \frac{0.3125^3(2 \times 4.94 + 4.24)}{12} = 0.04 \text{ IN}^4$$



ANGLE

$$\bar{y}_A = 3\cos 45° - \frac{0.865}{\cos 45°} + 0.22 = 1.12 \text{ IN.}$$

$$A_A = 1.78 \text{ IN}^2 \qquad r_A = 0.589 \text{ IN.}$$

$$I_{ZA} = r_A^2 A_A = 0.589^2 \times 1.78 = 0.62 \text{ IN}^4$$

TOTAL FOR SECTION

$$\bar{y}_s = \frac{1.78\,(1.12+0.156)}{6.18} = 0.37 \text{ IN}$$

$$A_S = 4.4 + 1.78 = 6.18 \text{ IN}^2$$

$$I_S = 0.04 + 4.4 \times 0.37^2 + 0.62 + 1.78(1.28-0.37)^2 = 2.73 \text{ IN}^4$$

$$\frac{a}{b_W} = 0.82$$

FROM FIG. 4.13 → $\phi = 5.5$ $k_C = 34.7$

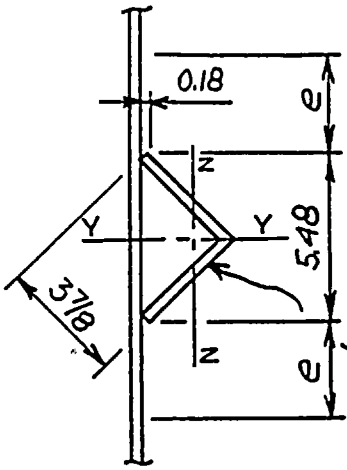
$$\frac{\gamma_1}{\gamma_2} = \frac{5.5 + 0.82^2 \frac{6.18}{93 \times 0.3125} 34.7}{\frac{10.9 \times 2.73}{93 \times 0.3125^3}} = 0.998 \leq 1.0$$

OK

∴ STIFFENER EFFECTIVENESS $\beta_{\substack{EFF \\ BOTTOM}} = \frac{34.7}{64} = 0.54 = 54\%$

[illegible]

CENTER STIFFENER 1/4 × 7 1/2 BENT PL



WEB

$\bar{y}_W = \frac{1}{2}\,0.3125 = 0.156$ IN.

$A_W = (2 \times 4.94 + 5.48)0.3125 = 4.8$ IN^2

$I_W = \dfrac{0.3125^3(2 \times 4.94 + 5.48)}{12} = 0.04$ IN^4

BENT PL 1/4 × 7 1/2 $a = 3\tfrac{7}{8}$ IN. $t = \tfrac{1}{4}$ IN. $b = a - t = 3\tfrac{5}{8}$ IN

$\bar{y}_B = 3.875\cos 45° - \dfrac{3.875^2 + 3.875 \times 0.25 - 0.25^2}{2(2 \times 3.875 - 0.25)\cos 45°}$ ($y = 1.5$)

$+0.18 = 1.42$ IN.

$I_{ZB} = \frac{A_B}{12}\left[7(a^2+b^2) - 12y^2\right] - 2ab^2(a-b) = 1.12$ IN^4

$A_B = 0.25 \times 7.5 = 1.875$ IN^2

TOTAL FOR SECTION

$\bar{y}_S = \dfrac{1.875(1.42 + 0.156)}{6.675} = 0.44$ IN

$A_S = 4.8 + 1.875 = 6.675$ IN^2

$I_S = 0.04 + 4.8 \times 0.44^2 + 1.12 + 1.875(1.58 - 0.44)^2 = 4.5$ IN^4

[illegible]

$$\frac{a}{b_W} = 0.82$$

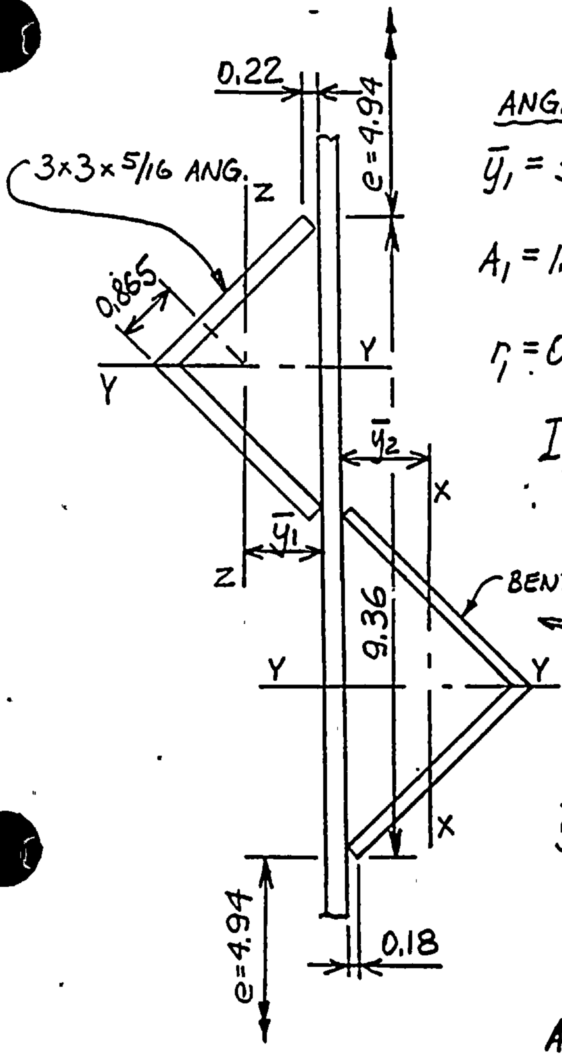
FROM FIG 4.13 → $\phi = 9.0$ $k_c = 53$

$$\frac{\gamma_1}{\gamma_2} = \frac{9.0 + 0.82^2 \frac{6.675}{93 \times 0.3125} 53}{\frac{10.9 \times 4.5}{93 \times 0.3125^3}} = 0.99 \leq 1.0$$

OK

∴ STIFFENER EFFECTIVENESS $\beta_{EFF. CENTER} = \frac{53}{64} = 0.83 = 83\%$

TOP STIFFENER - ANGLE AND BENT PL



ANGLE

$$\bar{y}_1 = 3\cos 45° - \frac{0.865}{\cos 45°} + 0.22 = 1.12 \text{ IN.}$$

$A_1 = 1.78 \text{ IN}^2$

$r_1 = 0.589 \text{ IN.}$

$$I_{z_1} = r_1^2 A_1 = 0.589^2 \times 1.78 = 0.62 \text{ IN}^4$$

(MACHINERY'S HANDBOOK, 22/ED, PG. 266)

BENT PL

$$\bar{y}_2 = 3.875\cos 45° - \underbrace{\frac{3.875^2 + 3.875 \times 0.25 - 0.25^2}{2(2\times 3.875 - 0.25)\cos 45°}}_{y} + 0.18$$

$= 1.42 \text{ IN.}$

$A_2 = 0.25 \times 7.5 = 1.875 \text{ IN}^2$

$$I_{z_2} = \frac{A_2}{12}\left[7(a^2+b^2) - 12y^2\right] - 2ab^2(a-b)$$

$a = 3\frac{7}{8}$ IN. $t = 0.25$ IN $b = a - t = 3\frac{5}{8}$ IN. $y = 1.50$ IN.

$I_{z_2} = 1.12 \text{ IN}^4$

WEB

$\bar{y}_w = \frac{1}{2}\, 0.3125 = 0.156$ IN

$A_w = (2\times 4.94 + 9.36)\,0.3125 = 6.01 \text{ IN}^2$

$$I_w = \frac{0.3125^3 \times 19.24}{12} = 0.05 \text{ IN}^4$$

TOTAL FOR SECTION

$$\bar{y} = \frac{1.78(1.12+0.156) - 1.88(1.41+0.156)}{9.67} = -0.07 \text{ IN.}$$

$$A_S = 6.01 + 1.78 + 1.88 = 9.67 \text{ IN}^2$$

$$I_x = I_S = 0.05 + 6.01(0.07)^2 + 0.62 + 1.78(1.28-0.07)^2 + 1.12$$
$$+ 1.875(1.57-0.07)^2 = 8.64 \text{ IN}^4$$

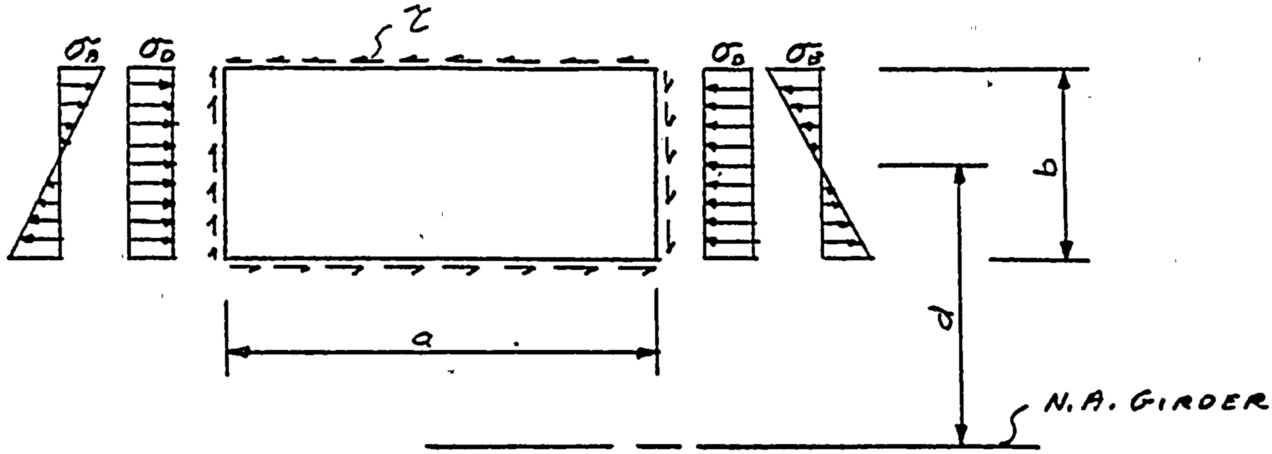
$$\frac{a}{b_W} = 0.82$$

FROM FIG. 4.13 → $\phi = 11.0 \quad k_c = 64$

$$\frac{\gamma_1}{\gamma_2} = \frac{11.0 + 0.82^2 \frac{9.67}{93 \times 0.3125} 64}{\frac{10.9 \times 8.64}{93 \times 0.3125^3}} = 0.76$$

∴ STIFFENER EFFECTIVENESS $\beta_{\substack{EFF. \\ TOP}} = \frac{64}{64} = 1.0 = 100\%$

WEB PANEL STABILITY CHECK



FOR BUCKLING STABILITY THE FOLLOWING CRITERIA MUST BE MET

$$\frac{\sigma_D}{\sigma_{DCR}} + \left[\frac{\sigma_B}{\sigma_{BCR}}\right]^2 + \left[\frac{\tau}{\tau_{CR}}\right]^2 = R \leq \frac{1}{D.F.} = \frac{\sigma_{ALL}}{\sigma_{Y MIN}}$$

D.F. = DESIGN FACTOR

$$\text{THE CRITICAL STRESS} = k\,\frac{\pi^2 E t^2}{12(1-\nu^2)b^2}$$

$t = 5/16$ in, $E = 29000$ KSI, $\nu = .3$

$$\text{SET } \Psi = \frac{\pi^2 E t^2}{12(1-\nu^2)b^2} = \frac{\pi^2 (29000)(5/16)^2}{12(1-.3^2)b^2} = \frac{2560}{b^2}$$

∴ CRITICAL STRESS $= \beta_{EFF} k \Psi$ KSI, WHERE β_{EFF} IS THE EFFECTIVENESS RATIO OF THE WEB STIFFENER

IF THE ELASTIC CRITICAL STRESS EXCEEDS THE MINIMUM YIELD STRESS, THEN THE CRITICAL STRESS IS SET TO EQUAL THE YIELD STRESS

$$\sigma_{CR\,max} = \sigma_{Y MIN} = 36.0 \text{ KSI}$$

$$\tau_{CR\,max} = \tau_{Y MIN} = \frac{\sigma_{Y MIN}}{\sqrt{3}} = \frac{36}{\sqrt{3}} = 20.8 \text{ KSI}$$

DIRECT STRESS

$$\sigma_D = \frac{F_X}{A} + \frac{M_Y d}{I_Y} + \frac{M_Z c_W}{I_Z} = \frac{F_X}{110} + \frac{M_Y d}{158490} + \frac{M_Z \frac{17.3125}{2}}{6285}$$

$$= \frac{F_X}{110} + \frac{M_Y d}{158490} + \frac{M_Z}{726}$$

BENDING STRESS

$$\sigma_B = \frac{M_Y (b/2)}{158490} = \frac{M_Y b}{316980}$$

SHEAR STRESS

$$\tau = \frac{F_Z}{2 A_{WEB}} + \frac{M_X}{2 A_{\square} t} = \frac{F_Z}{2 \times 93 \times 0.3125} + \frac{M_X}{2 \times 17.3125 \times 94.25 \times 0.3125}$$

$$= \frac{F_Z}{58} + \frac{M_X}{1020}$$

THE ALLOWABLE STABILITY RATIO IS 1.0 DIVIDED BY THE DESIGN FACTOR (OR THE ALLOWABLE STRESS DIVIDED BY THE MINIMUM YIELD STRENGTH OF THE WEB)

$\therefore$ OBE $R_{ALL} = \frac{1}{1.5} = 0.667$

SSE $R_{ALL} = \frac{1}{1.1} = 0.909$

ROPE

MAIN HOIST ROPE : 1½ DIA. PYTHON 10 F16 V, XIPS RIGHT HAND REGULAR LAY ALL STEEL ROPE, TWO-6 PART SYSTEMS

MIN. BREAKING STRENGTH $P_{BR} = 160.9\ T$

ALLOWABLE ROPE LOAD $P_{ALL} = \dfrac{P_{BR}\, f_P\, n m}{f}$

PROP. LMT. FACTOR $f_P = 0.6$ OBE FACTOR $f = 1.5$

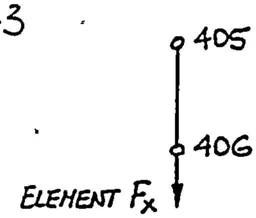
NO. OF ROPE PARTS $n = 6$ SSE FACTOR $f = 1.1$

NO. OF ROPE SYSTEMS $m = 2$

OBE $P_{ALL} = \dfrac{160.9 \times 0.6 \times 6 \times 2}{1.5} = 772.3\ T$

SSE $P_{ALL} = \dfrac{160.9 \times 0.6 \times 6 \times 2}{1.1} = 1053\ T$

MAX. ROPE LOAD PER TABLES B61 AND B63 [1]



OBE $F_X = 367.3$ KIP $= 183.6\ T$

SSE $F_X = 583.7$ KIP $= 291.8\ T$

RATIO $R = \dfrac{F_X}{P_{ALL}} \leq 1.0$

OBE $R = \dfrac{183.6}{772.3} = 0.24$ SSE $R = \dfrac{291.8}{1053} = 0.28$

DYNAMIC LOAD FACTOR $DLF = \frac{F_x}{P_S}$ $DLF' = \frac{F_x}{P_S'}$

STATIC LOAD $P_S = W + P_L$

TROLLEY BLOCK WEIGHT $W = 20000$ LBS $= 10T$

SEISMIC LIVE LOAD $P_L = 50T$

$P_S = 10 + 50 = 60T$

STATIC LOAD $P_S' = W + P_L'$

RATED LIVE LOAD $P_L' = 150T$

$P_S' = 10 + 150 = 160T$

OBE $DLF = \frac{183.6}{60} = 3.1$ $DLF' = \frac{183.6}{160} = 1.1$

SSE $DLF = \frac{291.8}{60} = 4.9$ $DLF' = \frac{291.8}{160} = 1.8$

FOR PANELS 1 AND 2, WHICH ARE ABOVE THE GIRDER'S NEUTRAL AXIS, THE M_Y MOMENT IS TAKEN AS THE SUM OF STATIC AND DYNAMIC. FOR PANELS 3 AND 4, WHICH ARE BELOW THE NEUTRAL AXIS, THE M_Y IS TAKEN AS THE DIFFERENCE OF STATIC AND DYNAMIC.

FOR GIRDER STABILITY, IT HAS BEEN DETERMINED THAT THE DOMINANT LOAD CONDITION WOULD BE WITH THE LOAD IN THE DOWN POSITION (THIS PRODUCES THE MAXIMUM GIRDER STRESS). THE LOADINGS WERE TAKEN FROM TABLES B65 AND B66. IT IS FOUND THAT THE STABILITY RATIO IS MAXIMUM FOR THE TROLLEY AT MID.

TABLE 4-6

	PANEL 1	PANEL 2	PANEL 3	PANEL 4
a	19	76	76	19
b	16.38	23.52	17.64	16.38
d	38.31	·9.0	-17.06	-38.31
ψ	9.54	4.63	8.23	9.54
k_D	4.0	4.0	4.0	4.0
k_B	23.9	23.9	23.9	23.9
k_S	8.3	5.8	5.6	8.3
$\beta_{EFF.}$	1.0	0.83	0.54	0.54
σ_{DCR}	36.0	15.4	17.8	20.6
σ_{BCR}	36.0	36.0	36.0	36.0
τ_{CR}	20.8	20.8	20.8	20.8
OBE				
R_{MID-A}	0.590	0.556	0.264	0.246
R_{MID-B}	0.594	0.597	0.315	0.297
SSE				
R_{MID-A}	0.864	0.816	0.564	0.712
R_{MID-B}	0.870	0.876	0.627	0.764

OBE $R_{MAX} = 0.597 < 0.667$ ∴ OK

SSE $R_{MAX} = 0.876 < 0.909$ ∴ OK

GIRDER END

(REF. DWG. ON PG. 4-37, SECTION A-A)

MTRL: ASTM-A36

$\sigma_{Y MIN} = 36$ KSI

ALLOWABLES

OBE $\tau_{ALL} = \frac{\sigma_{YMIN}}{1.5} 0.6 = 14.4$ KSI $\quad \tau_{W.ALL} = 20.0$ KSI

(REF. PG. 4-38)

SSE $\tau_{ALL} = \frac{\sigma_{YMIN}}{1.1} 0.6 = 19.6$ KSI $\quad \tau_{W.ALL} = 27.3$ KSI

MAX. LOADS (REF. PG. 4-40). OBE $F_Z = 250.2$ KIP

SSE $F_Z = 339.4$ KIP

OTHER LOADS ARE TRANSFERRED THROUGH BOLTED CONNECTION

WEB SHEAR STRESS $\tau = \frac{F_Z Q}{I_{xx} t}$

OBE $\tau = \frac{250.2[21 \times 1.25(18.53 - 0.625) + 2 \times 0.3125(18.53 - 1.25)^2 0.5]}{22150 \times 0.3125 \times 2} = 10.2$ KSI

SSE $\tau = \frac{339.4 \times 563.3}{22150 \times 0.3125 \times 2} = 13.8$ KSI

UPPER WELDS SHEAR STRESS

OBE $\tau_W = \frac{250.2\,(21 \times 1.25)(18.53 - 0.625)}{2 \times 0.3125 \times 0.707 \times 22150} = 12.0$ KSI

SSE $\tau_W = \frac{339.4 \times 21 \times 1.25(18.53 - 0.625)}{2 \times 0.3125 \times 0.707 \times 22150} = 16.3$ KSI

LOWER WELDS
SHEAR STRESS

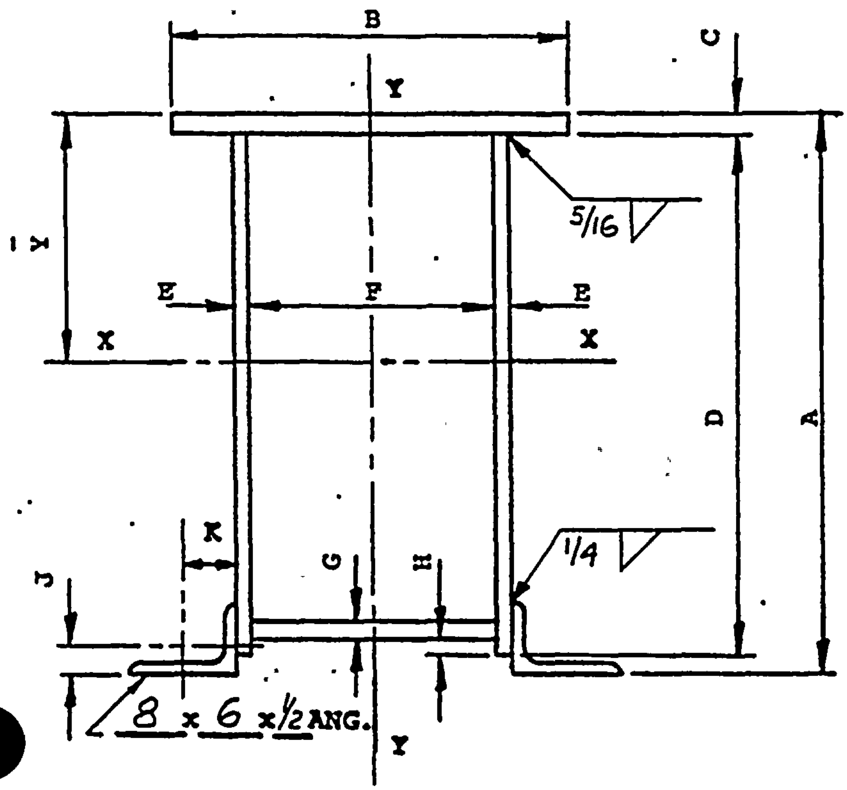
OBE $$\tau_W = \frac{250.2\,(2\times 6.75)(45.375-18.53-1.47)}{2(0.25)\,0.707\times 22150}$$

$$= 10.9\ \text{KSI}$$

SSE $$\tau_W = \frac{339.4\times 2\times 6.75\,(45.375-18.53-1.47)}{2(0.25)\,0.707\times 22150} = 14.8\ \text{KSI}$$

GIRDER END
SECTION PROPERTIES
SECTION "AA"

PROGRAM 117 PROGRAM ID 1-A-2-06 (046)
WHITING REQN 79604 DATE 6-25-87
BY ASZ PAGE 4-107 OF 112
MJM 8-26-87



GIVEN DATA

1.	45.375	=	DIMENSION A (IN.)	45.3750
2.	21	=	DIMENSION B (IN.)	21.0000
3.	1.25	=	DIMENSION C (IN.)	1.2500
4.	43.875	=	DIMENSION D (IN.)	43.8750
5.	0.3125	=	DIMENSION E (IN.)	0.3125
6.	17	=	DIMENSION F (IN.)	17.0000
7.	0	=	DIMENSION G (IN.)	0.0000
8.	0	=	DIMENSION H (IN.)	0.0000
9.	1.47	=	DIMENSION J (IN.)($\bar{Y}$ OF ANGLE)	1.4700
10.	2.47	=	DIMENSION K (IN.)($\bar{X}$ OF ANGLE)	2.4700
11.	6.75	=	AREA OF ANGLE (IN.^{2})	6.7500
12.	44.3	=	MOMENT OF INERTIA OF ANGLE(IN^4)(ABT. VERT)	44.3000
13.	21.7	=	MOMENT OF INERTIA OF ANGLE(IN^4)(ABT. HORZ)	21.7000

COMPUTED DATA

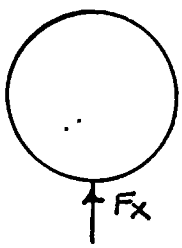
I_{y-y}(IN.^{4}) (MOMENT OF INERTIA OF SECTION)	4826.7298
$\bar{Y}$ (IN.)	18.5340
I_{x-x}(IN.^{4}) (MOMENT OF INERTIA OF SECTION)	22148.6073

TROLLEY WHEEL LOADS

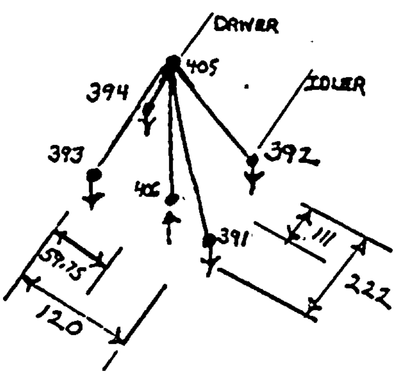
THE TROLLEY REACTIONS ARE SUMMARIZED IN TABLES B 57 THROUGH B 60 WITH THE FORCES IN THE ELEMENT COORDINATE SYSTEM

ELEMENT FX (GLOBAL FZ) — VERTICAL WHEEL LOAD

THE MAXIMUM FX IS TAKEN FROM TABLE B 57 FOR THE OBE & TABLE B 59 FOR THE SSE DIRECTLY.



THE MINIMUM FX IS TAKEN FROM TABLE B 58 FOR THE OBE & TABLE B 60 FOR THE SSE EXCEPT FOR THE ROPE DOWN CASES WHERE THE ROPE IS OBSERVED TO BE IN COMPRESSION WHICH CAN NOT BE. FOR THESE CASES THE PROPORTIONATE AMOUNT OF ROPE UPKICK IS DEDUCTED



LOADS AT NODES 391, 392

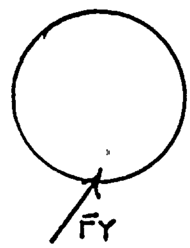
$$F_{X\,MIN} = F_{X\,TABLE} - F_{ROPE\,UP}\left(\frac{111}{222}\right)\left(\frac{59.75}{120}\right)$$
$$= F_{X\,TABLE} - .249\ F_{ROPE\,UP}$$

LOADS AT NODES 393, 394

$$F_{X\,MIN} = F_{X\,TABLE} - F_{ROPE\,UP}\left(\frac{111}{222}\right)\left(\frac{60.25}{120}\right)$$
$$= F_{X\,TABLE} - .251\ F_{ROPE\,UP}$$

$F_{ROPE\,UP}$ IS TAKEN FROM TABLE B 62 FOR THE OBE & TABLE B 64 FOR THE SSE

ELEMENT FY
(GLOBAL FY)

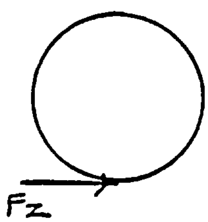


LOAD: PERPENDICULAR GIRDER

THE MAXIMUM FY IS TAKEN FROM TABLE B 57 FOR THE OBE & TABLE B 59 FOR THE SSE DIRECTLY

THE MINIMUM FY IS THE NEGATIVE OF THE MAXIMUM CONSIDERING COMPLETE REVERSAL

ELEMENT FZ
(GLOBAL FX)



LOADS PARALLEL GIRDER

THE MAXIMUM FZ IS TAKEN FROM TABLE B 57 FOR THE OBE & TABLE B 59 FOR THE SSE

OR IS THE MAXIMUM FX (VERTICAL) TIMES THE COEFFICIENT OF FRICTION (.25) IF THIS IS LESS

THE MINIMUM FZ IS THE NEGATIVE OF THE MAXIMUM CONSIDERING COMPLETE REVERSAL

SUMMARY OF TROLLEY WHEEL LOADS

TABLE 4-7 OBE

TROLLEY	AXLE	Fx MAX KIP	Fx MIN KIP	FY MAX KIP	Fz MAX KIP
MID	DRIVER	119.1	6.4	25.7	11.9
	IDLER	161.7	20.3	25.7	—
1/4	DRIVER	131.0	.1	29.8	11.9
	IDLER	161.8	25.3	29.8	—
END	DRIVER	120.1	-4.6	39.4	14.1
	IDLER	145.9	25.4	39.4	—

TABLE 4-8 SSE

TROLLEY	AXLE	Fx MAX KIP	Fx MIN KIP	FY MAX KIP	Fz MAX KIP
MID	DRIVER	182.4	-2.6	36.5	21.9
	IDLER	237.4	-1.4	36.5	—
1/4	DRIVER	193.0	-2.5	43.0	22.5
	IDLER	226.5	16.8	43.0	—
END	DRIVER	173.6	-16.8	56.8	25.6
	IDLER	197.5	13.9	56.8	—

FORM N-2494

WHITING REQN. 79604 DATE 8-21-87

BY MJM PAGE A1 R1 OF 22

8-24-87

Rev. MJM 9-14-87 9-15-87

APPENDIX A

This appendix summarizes the amplified response spectra and the modal response of the crane.

Page	Table	Title
A-2	A1	Response Spectrum OBE
A-3	A2	Response Spectrum SSE
A-4	A3	Freq & MC, Mid, 50T, UP, OBE
A-5	A4	Freq & MC, Mid, 50T, UP, SSE
A-6	A5	Freq &MC, Mid, 50T, DN, OBE
A-7	A6	Freq & MC, Mid, 50T, DN, SSE
A-8	A7	Freq & MC, 1/4, 50T, UP, OBE
A-9	A8	Freq & MC, 1/4, 50T, UP, SSE
A-10	A9	Freq & MC, 1/4, 50T, DN, OBE
A-11	A10	Freq & MC, 1/4, 50T, DN, SSE
A-12	A11	Freq & MC, End, 50T, UP, OBE
A-13	A12	Freq & MC, End, 50T, UP, SSE
A-14	A-13	Freq & MC, End, 50T, DN, OBE
A-15	A14	Freq & MC, End, 50T, DN, SSE
A-16	A15	Freq & MC, Mid, No Load, OBE
A-17	A16	Freq & MC, Mid, No Load, SSE
A-18	A17	Freq & MC, 1/4, No Load, OBE
A-19	A18	Freq & MC, 1/4, No Load, SSE
A-20	A19	Freq & MC, End, No Load, OBE
A-21	A20	Freq & MC, End, No Load, SSE
A-22	A21	Summary of Computer Runs

MC is the Mode coefficient (Ref 1, p 2.12.1-2.12.4) II

$$MC = \frac{\gamma_i \; Sa_i}{(2\pi F_i)^2} = \frac{\{d\}_i}{\{\psi\}_i}$$

Where Sa_i = modal spectrum acceleration for ith mode

F_i = frequency of ith mode (eigen value)

$\{d\}_i$ = maximum modal displacement vector for ith mode

$\{\psi\}_i$ = normalized modal displacement vector for ith mode (eigen vector)

γ_i = participation factor for ith mode

$= \{\psi\}_i^T [M] \{D\}$

where $[\psi]$ is the square matrix containing all mode shape vectors such that the ith column is the mode shape vector for the ith mode = $\{\psi\}_i$

$[M]$ = reduced mass matrix

$\{D\}$ = unit vector describing excitation

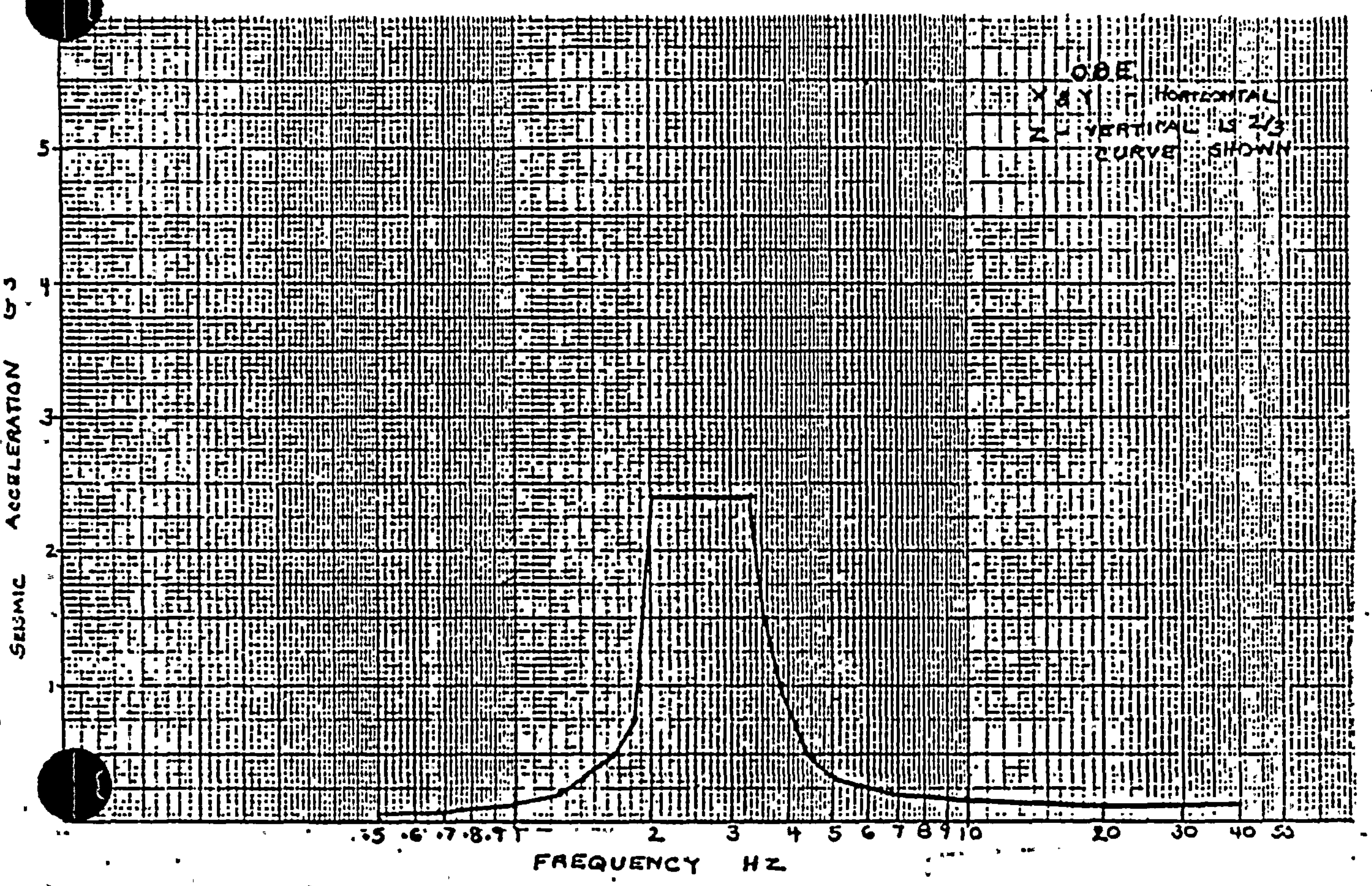


TABLE A-1
OBE

POINT	FREQ HZ	X OR Y G's	X OR Y in/sec²	Z G's	Z in/sec²	POINT	FREQ HZ	X OR Y G's	X OR Y in/sec²	Z G's	Z in/sec²
1	0.001	.001	.4	.001	.4	11	3.57	1.5	579.6	1.0	386.4
2	.50	.07	27.0	.05	19.3	12	3.85	1.0	386.4	.67	258.9
3	.67	.09	34.8	.06	23.2	13	4.17	.68	262.8	.45	173.9
4	1.0	.15	58.0	.10	38.6	14	4.45	.47	181.6	.31	119.8
5	1.25	.23	88.9	.15	58.0	15	5.0	.34	131.4	.23	88.9
6	1.42	.32	123.6	.21	81.1	16	6.67	.22	85.0	.15	58.0
7	1.67	.50	193.2	.33	127.5	17	10.	.17	65.7	.11	42.5
8	1.81	.75	289.8	.50	193.2	18	20.	.13	50.2	.09	34.8
9	2.0	2.4	927.4	1.6	618.2	19	33.	.12	46.4	.08	30.9
10	3.33	2.4	927.4	1.6	618.2	20	50.	.12	46.4	.08	30.9

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WHITING REQN. 79604 DATE 6-8-87

BY MJM PAGE A-3 OF 22

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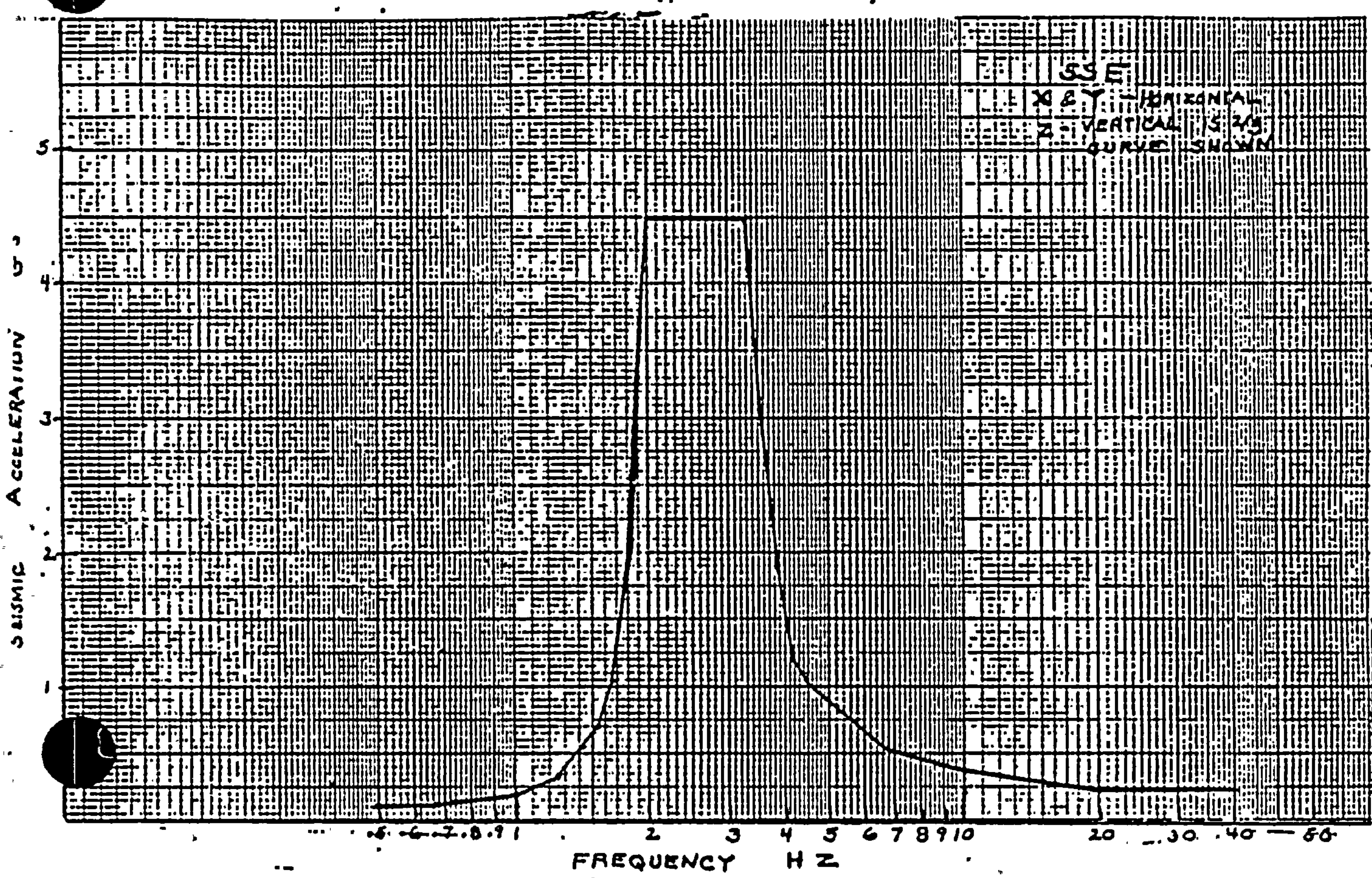

TABLE A2

SSE

POINT	FREQ HZ	X OR Y		Z		POINT	FREQ HZ	X OR Y		Z	
		G's	in/sec²	G's	in/sec²			G's	in/sec²	G's	in/sec²
1	0.001	.001	.4	.001	.4	11	3.57	2.9	1121.	1.9	734.2
2	.50	.11	42.5	.07	27.0	12	3.85	1.9	734.2	1.3	502.3
3	.67	.12	46.4	.08	30.9	13	4.17	1.2	463.7	.80	309.1
4	1.0	.21	81.1	.14	54.1	14	4.45	1.05	405.7	.70	270.5
5	1.25	.34	131.4	.23	88.9	15	5.0	.83	320.7	.55	212.5
6	1.42	.54	208.7	.36	139.1	16	6.67	.54	208.7	.36	139.1
7	1.67	1.05	405.7	.70	270.5	17	10.	.36	139.1	.24	92.7
8	1.81	2.0	772.8	1.3	502.3	18	20.	.23	88.9	.15	58.0
9	2.0	4.5	1739.	3.0	1159.	19	33.	.23	88.9	.15	58.0
10	3.33	4.5	1739.	3.0	1159.	20	50.	.23	88.9	.15	58.0

WHITING REQN 79604 DATE 6-15-87
BY MJM PAGE A-4 OF 22
8-25-87

TABLE A3

SUMMARY OF NATURAL FREQUENCIES AND MODE COEFFICIENTS - PAOMMUD

MODE	FREQUENCY HZ	MODE COEFFICIENT FOR SPECIFIED DIRECTION X	Y	Z
1	2.02	0.0512 *	128.5000 * MAX	0.0921 *
2	4.13	0.9912 * MAX	0.5329 *	4.3220 *
3	4.16	0.1254 *	0.3077 *	6.1500 * MAX
4	7.97	0.0356 *	0.0873 *	0.0010
5	9.05	0.0202 *	0.0218	0.0022
6	9.61	0.0235 *	0.0004	0.0015
7	11.58	0.0138 *	0.0239	0.0015
8	13.30	0.0229 *	0.0069	0.0003
9	14.91	0.1403 *	0.0002	0.0007
10	15.76	0.0560 *	0.0011	0.0111 *
11	18.05	0.0034	0.0097	0.0015
12	23.32	0.0006	0.0057	0.0003
13	28.73	0.0002	0.0006	0.0000
14	31.28	0.0040	0.0002	0.0008
15	35.25	0.0007	0.0002	0.0001
16	43.69	0.0001	0.0000	0.0001
17	54.53	0.0003	0.0001	0.0000
18	56.18	0.0003	0.0000	0.0001
19	61.02	0.0003	0.0000	0.0002
20	68.95	0.0003	0.0000	0.0004
21	75.35	0.0001	0.0000	0.0001
22	83.28	0.0001	0.0001	0.0001
23	85.98	0.0001	0.0000	0.0001
24	90.24	0.0001	0.0000	0.0001
25	91.85	0.0000	0.0000	0.0001
26	91.91	0.0000	0.0000	0.0002
27	123.90	0.0000	0.0000	0.0000
28	174.80	0.0000	0.0000	0.0000
SIGNIFICANCE FACTOR		0.50%	0.05%	0.05%

* INDICATES EXPANDED MODE

TABLE A4

SUMMARY OF NATURAL FREQUENCIES AND MODE COEFFICIENTS - PAOMMUS

MODE	FREQUENCY HZ	MODE COEFFICIENT FOR SPECIFIED DIRECTION X	Y	Z
1	2.02	0.0960 *	241.0000 * MAX	0.1727 *
2	4.13	1.7650 * MAX	0.9486 *	7.7640 *
3	4.16	0.2216 *	0.5438 *	10.9500 * MAX
4	7.97	0.0819 *	0.2007 *	0.0022
5	9.05	0.0445 *	0.0479	0.0049
6	9.61	0.0504 *	0.0009	0.0032
7	11.58	0.0281 *	0.0487	0.0032
8	13.30	0.0450 *	0.0135	0.0007
9	14.91	0.2681 *	0.0004	0.0014
10	15.76	0.1054 *	0.0021	0.0204 *
11	18.05	0.0062	0.0176	0.0027
12	23.32	0.0012	0.0104	0.0005
13	28.73	0.0004	0.0011	0.0000
14	31.28	0.0076	0.0003	0.0016
15	35.25	0.0013	0.0003	0.0003
16	43.39	0.0002	0.0001	0.0003
17	54.53	0.0005	0.0003	0.0001
18	56.18	0.0005	0.0001	0.0002
19	61.02	0.0003	0.0000	0.0004
20	68.95	0.0005	0.0001	0.0008
21	75.35	0.0002	0.0000	0.0002
22	83.28	0.0002	0.0001	0.0001
23	85.98	0.0002	0.0001	0.0002
24	90.24	0.0001	0.0000	0.0001
25	91.85	0.0000	0.0000	0.0001
26	91.91	0.0000	0.0000	0.0003
27	123.90	0.0000	0.0000	0.0000
28	174.80	0.0000	0.0000	0.0000
SIGNIFICANCE FACTOR		0.50%	0.05%	0.05%

* INDICATES EXPANDED MODE

WHITING REQN 79604 DATE 6-15-87
BY MJM PAGE A-6 OF 22
RJJ 8-25-87

TABLE A5

SUMMARY OF NATURAL FREQUENCIES AND MODE COEFFICIENTS - PAOMMDO

MODE	FREQUENCY HZ	MODE COEFFICIENT FOR SPECIFIED DIRECTION X	Y	Z
1	2.02	0.0510 *	128.5000 * MAX	0.1024 *
2	2.93	1.8050 * MAX	0.0815 *	43.3700 * MAX
3	4.14	0.7464 *	0.6138 *	0.0209
4	6.34	0.1275 *	0.0140	0.6413 *
5	7.99	0.0450 *	0.0865 *	0.0264 *
6	9.05	0.0201 *	0.0219	0.0024
7	9.54	0.0176 *	0.0008	0.0102
8	11.59	0.0160 *	0.0237	0.0003
9	13.31	0.0205 *	0.0068	0.0012
10	15.09	0.1496 *	0.0006	0.0070
11	18.04	0.0030	0.0097	0.0012
12	23.32	0.0006	0.0057	0.0003
13	28.72	0.0002	0.0006	0.0000
14	31.23	0.0040	0.0002	0.0008
15	35.24	0.0006	0.0002	0.0001
16	43.69	0.0001	0.0000	0.0001
17	54.52	0.0003	0.0001	0.0000
18	56.18	0.0003	0.0000	0.0001
19	61.02	0.0003	0.0000	0.0002
20	68.89	0.0003	0.0000	0.0004
21	75.33	0.0001	0.0000	0.0001
22	83.28	0.0001	0.0001	0.0001
23	85.97	0.0001	0.0000	0.0001
24	90.22	0.0001	0.0000	0.0001
25	91.85	0.0000	0.0000	0.0001
26	91.91	0.0000	0.0000	0.0002
27	123.90	0.0000	0.0000	0.0000
28	174.80	0.0000	0.0000	0.0000
SIGNIFICANCE FACTOR		0.50%	0.05%	0.05%

* INDICATES EXPANDED MODE

TABLE A6

SUMMARY OF NATURAL FREQUENCIES AND MODE COEFFICIENTS - PAOMMDS

MODE	FREQUENCY HZ	MODE COEFFICIENT FOR SPECIFIED DIRECTION X	Y	Z
1	2.02	0.0957 *	241.0000 * MAX	0.1921 *
2	2.93	3.3850 * MAX	0.1528 *	81.3000 * MAX
3	4.14	1.3260 *	1.0900 *	0.0375
4	6.34	0.3128 *	0.0344	1.5370 *
5	7.99	0.1034 *	0.1987 *	0.0607 *
6	9.05	0.0441 *	0.0480	0.0054
7	9.54	0.0378 *	0.0017	0.0225
8	11.59	0.0325 *	0.0482	0.0007
9	13.31	0.0403 *	0.0135	0.0024
10	15.09	0.2849 *	0.0011	0.0129
11	18.04	0.0054	0.0177	0.0020
12	23.32	0.0012	0.0104	0.0006
13	28.72	0.0005	0.0011	0.0000
14	31.23	0.0077	0.0003	0.0015
15	35.24	0.0012	0.0003	0.0002
16	43.59	0.0002	0.0001	0.0003
17	54.52	0.0005	0.0003	0.0001
18	56.18	0.0005	0.0001	0.0002
19	61.02	0.0006	0.0000	0.0004
20	68.89	0.0005	0.0001	0.0008
21	75.33	0.0002	0.0000	0.0002
22	83.28	0.0002	0.0001	0.0001
23	85.97	0.0002	0.0001	0.0002
24	90.22	0.0001	0.0000	0.0001
25	91.85	0.0000	0.0000	0.0001
26	91.91	0.0000	0.0000	0.0003
27	123.90	0.0000	0.0000	0.0000
28	174.80	0.0000	0.0000	0.0000
SIGNIFICANCE FACTOR		0.50%	0.05%	0.05%

* INDICATES EXPANDED MODE

TABLE A7

SUMMARY OF NATURAL FREQUENCIES AND MODE COEFFICIENTS - PAOMQUO

MODE	FREQUENCY HZ	MODE COEFFICIENT FOR SPECIFIED DIRECTION X	Y	Z
1	2.64	1.8160 * MAX	73.3000 * MAX	0.0730 *
2	4.16	0.5832 *	2.1760 *	0.0936 *
3	5.17	0.6651 *	0.0141	2.2470 * MAX
4	5.60	0.0695 *	0.2526 *	0.0327 *
5	7.44	0.0427 *	0.0315	0.0168 *
6	12.09	0.0184 *	0.0091	0.0013
7	14.04	0.0830 *	0.0039	0.0063 *
8	14.42	0.0446 *	0.0101	0.0038 *
9	16.64	0.0376 *	0.0031	0.0056 *
10	18.31	0.0654 *	0.0052	0.0157 *
11	18.63	0.0330 *	0.0084	0.0086 *
12	23.97	0.0004	0.0008	0.0012
13	24.79	0.0013	0.0036	0.0006
14	26.44	0.0028	0.0006	0.0023 *
15	37.79	0.0003	0.0001	0.0001
16	39.04	0.0002	0.0000	0.0004
17	45.33	0.0002	0.0001	0.0007
18	48.91	0.0001	0.0001	0.0007
19	53.25	0.0005	0.0001	0.0003
20	67.15	0.0002	0.0000	0.0000
21	68.43	0.0001	0.0000	0.0001
22	85.76	0.0000	0.0001	0.0001
23	87.93	0.0000	0.0000	0.0001
24	91.79	0.0000	0.0000	0.0000
25	91.94	0.0000	0.0000	0.0002
26	100.40	0.0000	0.0000	0.0001
27	121.00	0.0000	0.0000	0.0000
28	179.90	0.0000	0.0000	0.0000
SIGNIFICANCE FACTOR		0.50%	0.10%	0.10%

* INDICATES EXPANDED MODE

TABLE A8

SUMMARY OF NATURAL FREQUENCIES AND MODE COEFFICIENTS - PAOMQUS

MODE	FREQUENCY HZ	MODE COEFFICIENT FOR SPECIFIED DIRECTION X	Y	Z
1	2.64	3.4040 * MAX	137.4000 * MAX	0.1368 *
2	4.16	1.0310 *	3.8460 *	0.1667 *
3	5.17	1.6240 *	0.0345	5.3740 * MAX
4	5.60	0.1701 *	0.6180 *	0.0783 *
5	7.44	0.1006 *	0.0743	0.0393 *
6	12.09	0.0371 *	0.0183	0.0027
7	14.04	0.1611 *	0.0076	0.0120 *
8	14.42	0.0859 *	0.0194	0.0071 *
9	16.64	0.0698 *	0.0058	0.0101 *
10	18.31	0.1184 *	0.0095	0.0271 *
11	18.63	0.0594 *	0.0152	0.0147 *
12	23.97	0.0008	0.0015	0.0022
13	24.79	0.0025	0.0066	0.0010
14	26.44	0.0051	0.0011	0.0041
15	37.79	0.0006	0.0002	0.0001
16	39.04	0.0003	0.0001	0.0008
17	45.33	0.0003	0.0003	0.0014
18	48.91	0.0002	0.0002	0.0012
19	53.25	0.0010	0.0003	0.0005
20	67.15	0.0004	0.0000	0.0001
21	68.43	0.0001	0.0000	0.0003
22	85.76	0.0001	0.0001	0.0002
23	87.93	0.0000	0.0000	0.0003
24	91.79	0.0000	0.0000	0.0001
25	91.94	0.0000	0.0000	0.0003
26	100.40	0.0000	0.0000	0.0001
27	121.00	0.0000	0.0000	0.0000
28	179.90	0.0000	0.0000	0.0000
SIGNIFICANCE FACTOR		0.50%	0.10%	0.10%

* INDICATES EXPANDED MODE

TABLE A9

SUMMARY OF NATURAL FREQUENCIES AND MODE COEFFICIENTS - PAOMQDO

MODE	FREQUENCY HZ	MODE COEFFICIENT FOR SPECIFIED DIRECTION X	Y	Z
1	2.64	1.8170 *	73.3000 * MAX	0.0943 *
2	3.14	3.4510 * MAX	0.0868 *	34.4800 * MAX
3	4.16	0.5675 *	2.1760 *	0.0089
4	5.60	0.0488 *	0.2528 *	0.0248
5	7.13	0.3278 *	0.0104	0.4583 *
6	7.47	0.0475 *	0.0298	0.1285 *
7	12.11	0.0300 *	0.0091	0.0001
8	14.37	0.0108	0.0107	0.0004
9	16.62	0.0257 *	0.0033	0.0032
10	17.54	0.0968 *	0.0021	0.0221
11	18.59	0.0120	0.0097	0.0034
12	23.88	0.0018	0.0006	0.0013
13	24.73	0.0022	0.0036	0.0006
14	26.04	0.0035	0.0009	0.0020
15	37.78	0.0003	0.0001	0.0001
16	39.03	0.0002	0.0000	0.0004
17	45.33	0.0002	0.0001	0.0008
18	48.89	0.0001	0.0001	0.0007
19	53.24	0.0005	0.0001	0.0003
20	67.15	0.0002	0.0000	0.0000
21	68.43	0.0001	0.0000	0.0001
22	85.76	0.0000	0.0001	0.0001
23	87.92	0.0000	0.0000	0.0001
24	91.79	0.0000	0.0000	0.0000
25	91.94	0.0000	0.0000	0.0002
26	100.40	0.0000	0.0000	0.0001
27	121.00	0.0000	0.0000	0.0000
28	179.90	0.0000	0.0000	0.0000
SIGNIFICANCE FACTOR		0.50%	0.10%	0.10%

* INDICATES EXPANDED MODE

[illegible]

TABLE A10

SUMMARY OF NATURAL FREQUENCIES AND MODE COEFFICIENTS - PAOMODS

MODE	FREQUENCY HZ	MODE COEFFICIENT FOR SPECIFIED DIRECTION X	Y	Z
1	2.64	3.4070 *	137.4000 * MAX	0.1768 *
2	3.14	6.4710 * MAX	0.1628 *	64.6500 * MAX
3	4.16	1.0030 *	3.8460 *	0.0158
4	5.60	0.1195 *	0.6185 *	0.0594
5	7.13	0.7857 *	0.0249	1.0820 *
6	7.47	0.1118 *	0.0703	0.3002 *
7	12.11	0.0604 *	0.0183	0.0003
8	14.37	0.0209	0.0207	0.0007
9	16.62	0.0477 *	0.0061	0.0057
10	17.54	0.1774 *	0.0039	0.0387
11	18.59	0.0217	0.0174	0.0059
12	23.88	0.0033	0.0010	0.0022
13	24.73	0.0040	0.0065	0.0010
14	26.04	0.0064	0.0017	0.0035
15	37.78	0.0005	0.0002	0.0002
16	39.03	0.0003	0.0001	0.0008
17	45.33	0.0003	0.0003	0.0014
18	48.89	0.0002	0.0002	0.0012
19	53.24	0.0010	0.0003	0.0005
20	67.15	0.0004	0.0000	0.0001
21	68.43	0.0001	0.0000	0.0003
22	85.76	0.0001	0.0001	0.0002
23	87.92	0.0000	0.0000	0.0003
24	91.79	0.0000	0.0000	0.0001
25	91.94	0.0000	0.0000	0.0003
26	100.40	0.0000	0.0000	0.0001
27	121.00	0.0000	0.0000	0.0000
28	179.90	0.0000	0.0000	0.0000
SIGNIFICANCE FACTOR		0.50%	0.10%	0.10%

* INDICATES EXPANDED MODE

TABLE A11

SUMMARY OF NATURAL FREQUENCIES AND MODE COEFFICIENTS - PAONEUO

MODE	FREQUENCY HZ	MODE COEFFICIENT FOR SPECIFIED DIRECTION X	Y	Z
1	3.49	1.7270 * MAX	22.4000 * MAX	0.2134 *
2	4.01	0.1411 *	5.5910 *	0.0283 *
3	4.75	0.1598 *	0.6807 *	0.0130 *
4	6.59	0.4757 *	0.0219	0.8717 * MAX
5	8.67	0.0222 *	0.2553 *	0.0176 *
6	11.56	0.0171 *	0.0277	0.0013
7	12.94	0.0715 *	0.0024	0.0310 *
8	13.40	0.0358 *	0.0200	0.0084 *
9	16.42	0.0265 *	0.0144	0.0051 *
10	18.18	0.0532 *	0.0048	0.0116 *
11	19.63	0.0502 *	0.0008	0.0133 *
12	23.63	0.0031	0.0005	0.0018 *
13	25.14	0.0010	0.0024	0.0005
14	31.32	0.0054	0.0000	0.0058 *
15	36.92	0.0003	0.0002	0.0016
16	42.67	0.0001	0.0001	0.0017
17	44.51	0.0001	0.0001	0.0026 *
18	49.81	0.0000	0.0000	0.0002
19	55.56	0.0004	0.0002	0.0004
20	66.86	0.0000	0.0001	0.0005
21	69.51	0.0001	0.0000	0.0000
22	78.16	0.0000	0.0000	0.0003
23	90.05	0.0000	0.0000	0.0000
24	91.70	0.0000	0.0000	0.0000
25	91.80	0.0000	0.0000	0.0002
26	92.80	0.0000	0.0000	0.0000
27	120.30	0.0000	0.0000	0.0000
28	128.20	0.0000	0.0000	0.0000
SIGNIFICANCE FACTOR		0.50%	0.20%	0.20%

* INDICATES EXPANDED MODE.

[illegible]

TABLE A12

SUMMARY OF NATURAL FREQUENCIES AND MODE COEFFICIENTS - PAOMEUS

MODE	FREQUENCY HZ	MODE COEFFICIENT FOR SPECIFIED DIRECTION X	Y	Z
1	3.49	3.3090 * MAX	42.9300 * MAX	0.4038 *
2	4.01	0.2580 *	10.2300 *	0.0524 *
3	4.75	0.3754 *	1.5990 *	0.0303 *
4	6.59	1.1680 *	0.0538	2.0900 * MAX
5	8.67	0.0496 *	0.5695 *	0.0396 *
6	11.56	0.0348 *	0.0565	0.0026
7	12.94	0.1417 *	0.0048	0.0612 *
8	13.40	0.0704 *	0.0392	0.0164 *
9	16.42	0.0494 *	0.0268	0.0092 *
10	18.18	0.0965 *	0.0087	0.0201 *
11	19.63	0.0893 *	0.0014	0.0223 *
12	23.63	0.0056	0.0010	0.0031
13	25.14	0.0018	0.0045	0.0008
14	31.32	0.0103	0.0001	0.0108 *
15	36.92	0.0006	0.0003	0.0029
16	42.67	0.0002	0.0002	0.0032
17	44.51	0.0002	0.0002	0.0049 *
18	49.81	0.0000	0.0001	0.0004
19	55.56	0.0009	0.0004	0.0008
20	66.86	0.0001	0.0001	0.0010
21	69.51	0.0002	0.0000	0.0001
22	78.16	0.0000	0.0001	0.0006
23	90.05	0.0000	0.0000	0.0001
24	91.70	0.0000	0.0000	0.0000
25	91.80	0.0000	0.0000	0.0004
26	92.80	0.0001	0.0000	0.0001
27	120.30	0.0000	0.0000	0.0001
28	128.20	0.0001	0.0000	0.0001
SIGNIFICANCE FACTOR		0.50%	0.20%	0.20%

* INDICATES EXPANDED MODE

WHITING REQN 79604 DATE 6-16-87
BY MJM PAGE A-14 OF 22
RJJ 8.25.87

TABLE A13

SUMMARY OF NATURAL FREQUENCIES AND MODE COEFFICIENTS - PAOMEDO

MODE	FREQUENCY HZ	MODE COEFFICIENT FOR SPECIFIED DIRECTION X	Y	Z
1	3.31	2.5940 * MAX	0.2644 *	28.0500 * MAX
2	3.49	1.7060 *	22.4000 * MAX	0.0088
3	4.01	0.1397 *	5.5910 *	0.0183
4	4.75	0.1593 *	0.6806 *	0.0155
5	7.82	0.3775 *	0.0425	0.3388 *
6	8.69	0.0100	0.2526 *	0.0332
7	11.56	0.0250 *	0.0274	0.0006
8	13.38	0.0204 *	0.0199	0.0011
9	16.33	0.0218 *	0.0146	0.0025
10	18.18	0.0539 *	0.0048	0.0120
11	19.54	0.0531 *	0.0009	0.0155
12	23.62	0.0033	0.0006	0.0022
13	25.14	0.0012	0.0024	0.0008
14	30.09	0.0063	0.0001	0.0074
15	36.88	0.0002	0.0002	0.0015
16	42.66	0.0001	0.0001	0.0017
17	44.44	0.0001	0.0001	0.0026
18	49.80	0.0000	0.0000	0.0002
19	55.56	0.0005	0.0002	0.0004
20	66.83	0.0000	0.0001	0.0005
21	69.51	0.0001	0.0000	0.0000
22	78.14	0.0000	0.0000	0.0003
23	90.05	0.0000	0.0000	0.0000
24	91.70	0.0000	0.0000	0.0000
25	91.80	0.0000	0.0000	0.0002
26	92.80	0.0000	0.0000	0.0000
27	120.30	0.0000	0.0000	0.0000
28	128.20	0.0000	0.0000	0.0000
SIGNIFICANCE FACTOR		0.50%	0.20%	0.20%

* INDICATES EXPANDED MODE

WHITING REQN 79604 DATE 6-16-87
BY MJM PAGE A-15 OF 22
RKH 8.25.87

TABLE A14

SUMMARY OF NATURAL FREQUENCIES AND MODE COEFFICIENTS - PAOMEDS

MODE	FREQUENCY HZ	MODE COEFFICIENT FOR SPECIFIED DIRECTION X	Y	Z
1	3.31	4.8640 * MAX	0.4958 *	52.6000 * MAX
2	3.49	3.2680 *	42.9200 * MAX	0.0166
3	4.01	0.2555 *	10.2300 *	0.0340
4	4.75	0.3741 *	1.5990 *	0.0361
5	7.82	0.8746 *	0.0984 *	0.7828 *
6	8.69	0.0222	0.5631 *	0.0749
7	11.56	0.0510 *	0.0558	0.0012
8	13.38	0.0400 *	0.0391	0.0022
9	16.38	0.0407 *	0.0272	0.0044
10	18.18	0.0979 *	0.0086	0.0207
11	19.54	0.0946 *	0.0017	0.0260
12	23.62	0.0060	0.0010	0.0038
13	25.14	0.0021	0.0045	0.0014
14	30.09	0.0120	0.0001	0.0135
15	36.88	0.0005	0.0003	0.0028
16	42.66	0.0001	0.0002	0.0033
17	44.44	0.0001	0.0002	0.0049
18	49.80	0.0000	0.0001	0.0004
19	55.56	0.0009	0.0004	0.0008
20	66.83	0.0001	0.0001	0.0010
21	69.51	0.0002	0.0000	0.0001
22	78.14	0.0000	0.0001	0.0006
23	90.05	0.0000	0.0000	0.0001
24	91.70	0.0000	0.0000	0.0000
25	91.80	0.0000	0.0000	0.0004
26	92.80	0.0001	0.0000	0.0001
27	120.30	0.0000	0.0000	0.0001
28	128.20	0.0001	0.0000	0.0001
SIGNIFICANCE FACTOR		0.50%	0.20%	0.20%

* INDICATES EXPANDED MODE

TABLE A 15

SUMMARY OF NATURAL FREQUENCIES AND MODE COEFFICIENTS - PAOMMNO

MODE	FREQUENCY HZ	MODE COEFFICIENT FOR SPECIFIED DIRECTION X	Y	Z
1	2.02	0.0515 *	128.5000 * MAX	0.0772 *
2	4.14	0.7560 * MAX	0.6143 *	0.1332 *
3	5.19	0.2460 *	0.0105	1.9000 * MAX
4	7.98	0.0403 *	0.0870 *	0.0135 *
5	9.05	0.0201 *	0.0219	0.0023 *
6	9.63	0.0197 *	0.0004	0.0072 *
7	11.59	0.0155 *	0.0237	0.0001
8	13.31	0.0208 *	0.0068	0.0011
9	15.09	0.1499 *	0.0006	0.0067 *
10	18.04	0.0029	0.0098	0.0011
11	23.32	0.0006	0.0057	0.0003
12	28.66	0.0005	0.0006	0.0001
13	29.99	0.0023	0.0002	0.0000
14	31.77	0.0033	0.0001	0.0009
15	35.30	0.0007	0.0001	0.0002
16	43.69	0.0001	0.0000	0.0001
17	54.53	0.0003	0.0001	0.0000
18	56.18	0.0003	0.0000	0.0001
19	61.02	0.0003	0.0000	0.0002
20	68.96	0.0003	0.0000	0.0004
21	75.35	0.0001	0.0000	0.0001
22	83.28	0.0001	0.0001	0.0001
23	85.99	0.0001	0.0000	0.0001
24	90.24	0.0001	0.0000	0.0001
25	91.85	0.0000	0.0000	0.0001
26	91.91	0.0000	0.0000	0.0002
27	123.90	0.0000	0.0000	0.0000
28	174.80	0.0000	0.0000	0.0000
SIGNIFICANCE FACTOR		0.50%	0.05%	0.10%

* INDICATES EXPANDED MODE

WHITING REQN 79604 DATE 6-17-87
BY MJM PAGE A-17 OF 22
[initials] 8-25-87

TABLE A16

SUMMARY OF NATURAL FREQUENCIES AND MODE COEFFICIENTS - PAOMMNS

MODE	FREQUENCY HZ	MODE COEFFICIENT FOR SPECIFIED DIRECTION X	Y	Z
1	2.02	0.0966 *	241.0000 * MAX	0.1447 *
2	4.14	1.3430 * MAX	1.0910 *	0.2387 *
3	5.19	0.6009 *	0.0256	4.5430 * MAX
4	7.98	0.0926 *	0.2001 *	0.0311 *
5	9.05	0.0442 *	0.0480	0.0052 *
6	9.63	0.0422 *	0.0008	0.0159 *
7	11.59	0.0316 *	0.0483	0.0002
8	13.31	0.0409 *	0.0135	0.0022
9	15.09	0.2855 *	0.0011	0.0125 *
10	18.04	0.0052	0.0177	0.0019
11	23.32	0.0012	0.0104	0.0006
12	28.66	0.0010	0.0011	0.0002
13	29.99	0.0044	0.0003	0.0001
14	31.77	0.0062	0.0002	0.0017
15	35.30	0.0014	0.0003	0.0003
16	43.69	0.0002	0.0001	0.0003
17	54.53	0.0005	0.0003	0.0001
18	56.18	0.0005	0.0001	0.0002
19	61.02	0.0006	0.0000	0.0004
20	68.96	0.0005	0.0001	0.0008
21	75.35	0.0002	0.0000	0.0002
22	83.28	0.0002	0.0001	0.0001
23	85.99	0.0002	0.0001	0.0002
24	90.24	0.0001	0.0000	0.0001
25	91.85	0.0000	0.0000	0.0001
26	91.91	0.0000	0.0000	0.0003
27	123.90	0.0000	0.0000	0.0000
28	174.80	0.0000	0.0000	0.0000
SIGNIFICANCE FACTOR		0.50%	0.05%	0.10%

* INDICATES EXPANDED MODE

TABLE A17

SUMMARY OF NATURAL FREQUENCIES AND MODE COEFFICIENTS - PAOMQNO

MODE	FREQUENCY HZ	MODE COEFFICIENT FOR SPECIFIED DIRECTION X	Y	Z
1	2.64	1.8150 * MAX	73.3000 * MAX	0.0630 *
2	4.16	0.5746 *	2.1760 *	0.0471 *
3	5.60	0.0414 *	0.2528 *	0.0453 *
4	6.33	0.4446 *	0.0052	0.9009 * MAX
5	7.44	0.0220 *	0.0314	0.0432 *
6	12.11	0.0284 *	0.0091	0.0003
7	14.36	0.0098 *	0.0107	0.0003
8	16.61	0.0206 *	0.0034	0.0022 *
9	17.34	0.1015 *	0.0018	0.0226 *
10	18.58	0.0100 *	0.0097	0.0030 *
11	23.73	0.0040	0.0002	0.0011
12	24.60	0.0035	0.0033	0.0004
13	25.53	0.0038	0.0017	0.0011
14	31.39	0.0002	0.0000	0.0011
15	37.79	0.0003	0.0001	0.0001
16	39.05	0.0001	0.0000	0.0004
17	45.34	0.0002	0.0001	0.0007
18	48.92	0.0001	0.0001	0.0006
19	53.26	0.0005	0.0001	0.0003
20	67.15	0.0002	0.0000	0.0000
21	68.43	0.0001	0.0000	0.0001
22	85.76	0.0000	0.0001	0.0001
23	87.93	0.0000	0.0000	0.0001
24	91.79	0.0000	0.0000	0.0000
25	91.94	0.0000	0.0000	0.0002
26	100.40	0.0000	0.0000	0.0001
27	121.00	0.0000	0.0000	0.0000
28	179.90	0.0000	0.0000	0.0000
SIGNIFICANCE FACTOR		0.50%	0.10%	0.20%

* INDICATES EXPANDED MODE

TABLE A 18

SUMMARY OF NATURAL FREQUENCIES AND MODE COEFFICIENTS - PAOMQNS

MODE	FREQUENCY HZ	MODE COEFFICIENT FOR SPECIFIED DIRECTION X	Y	Z
1	2.64	3.4030 * MAX	137.4000 * MAX	0.1181 *
2	4.16	1.0160 *	3.8460 *	0.0839 *
3	5.60	0.1014 *	0.6185 *	0.1085 *
4	6.33	1.0910 *	0.0127	2.1590 * MAX
5	7.44	0.0520 *	0.0740	0.1010 *
6	12.11	0..0572 *	0.0183	0.0006
7	14.36	0.0189 *	0.0207	0.0005
8	16.61	0.0382 *	0.0063	0.0039
9	17.34	0.1864 *	0.0033	0.0398 *
10	18.58	0.0181 *	0.0175	0.0051 *
11	23.73	0.0072	0.0003	0.0020
12	24.60	0.0063	0.0061	0.0007
13	25.53	0.0070	0.0031	0.0020
14	31.39	0.0004	0.0000	0.0021
15	37.79	0.0006	0.0002	0.0001
16	39.05	0.0003	0.0001	0.0008
17	45.34	0.0003	0.0003	0.0014
18	48.92	0.0002	0.0002	0.0012
19	53.26	0.0010	0.0003	0.0005
20	67.15	0.0004	0.0000	0.0001
21	68.43	0.0001	0.0000	0.0003
22	85.76	0.0001	0.0001	0.0002
23	87.93	0.0000	0.0000	0.0003
24	91.79	0.0000	0.0000	0.0001
25	91.94	0.0000	0.0000	0.0003
26	100.40	0.0000	0.0000	0.0001
27	121.00	0.0000	0.0000	0.0000
28	179.90	0.0000	0.0000	0.0000
SIGNIFICANCE FACTOR		0.50%	0.10%	0.20%

* INDICATES EXPANDED MODE

WHITING REQN 79604 DATE 6-17-87
BY MJM PAGE A-20 OF 22
8.25.87

TABLE A19

SUMMARY OF NATURAL FREQUENCIES AND MODE COEFFICIENTS - PAOMRNO

MODE	FREQUENCY HZ	MODE COEFFICIENT FOR SPECIFIED DIRECTION X	Y	Z
1	3.61	1.2600 * MAX	9.8790 * MAX	0.1846 *
2	4.06	0.2330 *	6.7300 *	0.0235 *
3	4.65	0.2234 *	0.5985 *	0.0079 *
4	7.74	0.4103 *	0.0177	0.3795 * MAX
5	10.73	0.0098 *	0.1372 *	0.0049 *
6	11.45	0.0223 *	0.1251 *	0.0035 *
7	13.20	0.0208 *	0.0255 *	0.0015
8	15.91	0.0269 *	0.0182	0.0026 *
9	17.76	0.0426 *	0.0072	0.0089 *
10	19.31	0.0602 *	0.0003	0.0171 *
11	22.81	0.0040	0.0003	0.0025 *
12	24.67	0.0012	0.0020	0.0008
13	27.08	0.0062	0.0000	0.0088 *
14	34.26	0.0029	0.0002	0.0008
15	36.49	0.0022	0.0003	0.0015 *
16	42.78	0.0005	0.0001	0.0014
17	47.13	0.0008	0.0001	0.0036 *
18	52.26	0.0002	0.0001	0.0005
19	54.74	0.0002	0.0002	0.0011
20	63.78	0.0002	0.0001	0.0008
21	69.25	0.0001	0.0000	0.0004
22	73.82	0.0000	0.0000	0.0004
23	86.27	0.0000	0.0000	0.0001
24	91.78	0.0000	0.0000	0.0001
25	92.03	0.0000	0.0000	0.0001
26	96.97	0.0000	0.0000	0.0001
27	116.40	0.0000	0.0000	0.0001
28	124.10	0.0000	0.0000	0.0000
SIGNIFICANCE FACTOR		0.50%	0.20%	0.40%

* INDICATES EXPANDED MODE

TABLE A 20

SUMMARY OF NATURAL FREQUENCIES AND MODE COEFFICIENTS - PAOMRNS

MODE	FREQUENCY HZ	MODE COEFFICIENT FOR SPECIFIED DIRECTION X	Y	Z
1	3.61	2.4290 * MAX	19.0500 * MAX	0.3518 *
2	4.06	0.4212 *	12.1600 *	0.0429 *
3	4.65	0.5161 *	1.3830 *	0.0183 *
4	7.74	0.9540 *	0.0411 *	0.8788 * MAX
5	10.73	0.0203 *	0.2852 *	0.0104 *
6	11.45	0.0455 *	0.2558 *	0.0073 *
7	13.20	0.0410 *	0.0503 *	0.0029
8	15.91	0.0506 *	0.0341	0.0048 *
9	17.76	0.0779 *	0.0132	0.0156 *
10	19.31	0.1076 *	0.0005	0.0290 *
11	22.81	0.0073	0.0005	0.0042 *
12	24.67	0.0022	0.0037	0.0014
13	27.08	0.0115	0.0001	0.0157 *
14	34.26	0.0057	0.0004	0.0014
15	36.49	0.0042	0.0006	0.0029
16	42.78	0.0010	0.0003	0.0027
17	47.13	0.0015	0.0002	0.0067 *
18	52.26	0.0003	0.0001	0.0009
19	54.74	0.0004	0.0004	0.0021
20	63.78	0.0003	0.0001	0.0016
21	69.25	0.0002	0.0001	0.0008
22	73.82	0.0001	0.0000	0.0008
23	86.27	0.0001	0.0001	0.0002
24	91.78	0.0000	0.0000	0.0003
25	92.03	0.0000	0.0000	0.0002
26	96.97	0.0001	0.0000	0.0002
27	116.40	0.0001	0.0000	0.0002
28	124.10	0.0000	0.0000	0.0001
SIGNIFICANCE FACTOR		0.50%	0.20%	0.40%

* INDICATES EXPANDED MODE

FORM N-2494

WHITING REQN. 79604 DATE 6-17-87
BY MJM PAGE A-22 OF 22
[signature] 7-25-87

TABLE A21

SUMMARY OF COMPUTER RUNS

OBE

TROLLEY	LOAD	STATIC	DYNAMIC	SUM	
				STRAIGHT	FACTORED
MID	50T UP	AOMMU	AOMMUO	PSAOMMUO	PFAOMMUO
	50T DN	AOMMU	AOMMDO	PSAOMMDO	PFAOMMDO
	NO LOAD	AOMMN	AOMMNO	PSAOMMNO	PFAOMMNO
1/4	50T UP	AOMQU	AOMQUO	PSAOMQUO	PFAOMQUO
	50T DN	AOMQU	AOMQDO	PSAOMQDO	PFAOMQDO
	NO LOAD	AOMQN	AOMQNO	PSAOMQNO	PFAOMQNO
END	50T UP	AOMEU	AOMEUO	PSAOMEUO	PFAOMEUO
	50T DN	AOMEU	AOMEDO	PSAOMEDO	PFAOMEDO
	NO LOAD	AOMRN	AOMRNO	PSAOMRNO	PFAOMRNS

SSE

TROLLEY	LOAD	STATIC	DYNAMIC	SUM	
				STRAIGHT	FACTORED
MID	50T UP	AOMMU	AOMMUS	PSAOMMUS	PFAOMMUS
	50T DN	AOMMU	AOMMDS	PSAOMMDS	PFAOMMDS
	NO LOAD	AOMMN	AOMMNS	PSAOMMNS	PFAOMMNS
1/4	50T UP	AOMQU	AOMQUS	PSAOMQUS	PFAOMQUS
	50T DN	AOMQU	AOMQDS	PSAOMQDS	PFAOMQDS
	NO LOAD	AOMQN	AOMQNS	PSAOMQNS	PFAOMQNS
END	50T UP	AOMEU	AOMEUS	PSAOMEUS	PFAOMEUS
	50T DN	AOMEU	AOMEDS	PSAOMEDS	PFAOMEDS
	NO LOAD	AOMRN	AOMRNS	PSAOMRNS	PFAOMRNS

APPENDIX B

This appendix summarizes the maximum stresses and maximum loadings from the computer output. All values are after application of scale factor for slip as explained in section 4 except for tables B19 to B54 which show factored and unfactored reactions.

B-31	B41	Reactions, END, 50T DN, SSE
B-32	B42	Reactions, END, 50T DN, SSE, SCALED
B-33	B43	Reactions, MID, No Load, OBE
B-34	B44	Reactions, MID, No Load, OBE, SCALED
B-35	B45	Reactions, MID, No Load, SSE
B-36	B46	Reactions, MID, No Load, SSE, SCALED
B-37	B47	Reactions, 1/4, No Load, OBE
B-38	B48	Reactions, 1/4, No Load, OBE, SCALED
B-39	B49	Reactions, 1/4, No Load, SSE
B-40	B50	Reactions, 1/4, No Load, SSE, SCALED
B-41	B51	Reactions, END, No Load, OBE
B-42	B52	Reactions, END, No Load, OBE, SCALED
B-43	B53	Reactions, END, No Load, SSE
B-44	B54	Reactions, END, No Load, SSE, SCALED
B-45	B55	Girder to End Tie Connection, OBE
B-46	B56	Girder to End Tie Connection, SSE
B-47	B57	Trolley Reactions, OBE, Sum
B-48	B58	Trolley Reactions, OBE, Diff
B-49	B59	Trolley Reactions, SSE, Sum
B-50	B60	Trolley Reactions, SSE, Diff
B-51	B61	Rope Loads, OBE, Sum
B-52	B62	Rope Loads, OBE, Diff
B-53	B63	Rope Loads, SSE, Sum
B-54	B64	Rope Loads, SSE, Diff
B-55	B65	Element Load, Girder A at MAX STRESS
B-56	B66	Element Load, Girder B at MAX STRESS
B-57	B67	Element Load, Girder End, OBE
B-58	B68	Element Load, Girder End, SSE

[illegible]

TABLE 81

MAXIMUM STRESSES FROM PEAOMMUO
OBE MID 50 U

COMPONENT	ELEM	NODE	X	Y	Z	SRSS	STATIC	SUM
GIRDER A	28	311	793.	3120.	7080.	7778.	9977.	17755.
GIRDER B	52	361	463.	4813.	4471.	6586.	9304.	15890.
END CONNECT-RHE	17	154	1115.	9524.	8691.	12942.	505.	13447.
END CONNECT-LHE	74	252	1282.	8105.	9979.	12920.	306.	13225.

TABLE 82

MAXIMUM STRESSES FROM PEAOMMDO
OBE MID 50 D

COMPONENT	ELEM	NODE	X	Y	Z	SRSS	STATIC	SUM
GIRDER A	28	312	567.	5190.	10826.	12019.	9827.	21846.
GIRDER B	52	361	530.	6222.	10468.	12189.	9304.	21493.
END CONNECT-RHE	17	154	932.	12324.	195.	12361.	505.	12866.
END CONNECT-LHE	74	252	1070.	10476.	269.	10534.	306.	10840.

TABLE 83

MAXIMUM STRESSES FROM PEAOMMNO
OBE MID NL

COMPONENT	ELEM	NODE	X	Y	Z	SRSS	STATIC	SUM
GIRDER A	30	313	249.	3325.	1442.	3633.	6483.	10116.
GIRDER B	52	361	336.	3510.	1351.	3776.	6248.	10025.
END CONNECT-RHE	17	154	944.	6980.	194.	7046.	497.	7543.
END CONNECT-LHE	74	252	1084.	5953.	208.	6055.	315.	6370.

STRESS IN PSI

TABLE 84

MAXIMUM STRESSES FROM PFAOMMUS
SSE MID 50 U

COMPONENT	ELEM	NODE	X	Y	Z	SRSS	STATIC	SUM
GIRDER A	28	311	1425.	4036.	12653.	13357.	9977.	23335.
GIRDER B	54	363	1049.	4178.	10421.	11276.	8853.	20129.
END CONNECT-RHE	17	154	1988.	12160.	15545.	19836.	505.	20341.
END CONNECT-LHE	74	252	2285.	10374.	17850.	20771.	306.	21077.

TABLE 85

MAXIMUM STRESSES FROM PFAOMMDS
SSE MID 50 D

COMPONENT	ELEM	NODE	X	Y	Z	SRSS	STATIC	SUM
GIRDER A	28	312	1074.	7391.	20314.	21643.	9827.	31470.
GIRDER B	52	361	1009.	8858.	19636.	21565.	9304.	30869.
END CONNECT-RHE	17	154	1660.	17562.	369.	17644.	505.	18149.
END CONNECT-LHE	74	252	1904.	14942.	506.	15071.	306.	15377.

TABLE 86

MAXIMUM STRESSES FROM PFAOMMNS
SSE MID NL

COMPONENT	ELEM	NODE	X	Y	Z	SRSS	STATIC	SUM
GIRDER A	28	312	781.	3811.	3625.	5318.	6769.	12087.
GIRDER B	52	361	695.	4555.	3230.	5627.	6248.	11876.
END CONNECT-RHE	17	154	1681.	9099.	377.	9261.	497.	9758.
END CONNECT-LHE	74	252	1929.	7794.	389.	8039.	315.	8354.

STRESS IN PSI

[illegible]

ESS-1.2 FOR SRSS-4.3

WHITING REQN 79604 DATE 6-18-87
BY MJM PAGE B-5 OF 58
8-25-87

TABLE B7

MAXIMUM STRESSES FROM PFAOMQUD
OBE 1/4 50 U

COMPONENT	ELEM	NODE	X	Y	Z	SRSS	STATIC	SUM
GIRDER A	27	310	901.	2878.	1665.	3445.	7184.	10630.
GIRDER B	51	360	806.	2481.	1633.	3078.	7267.	10344.
END CONNECT-RHE	17	154	1797.	7141.	201.	7367.	489.	7856.
END CONNECT-LHE	74	252	1769.	7128.	184.	7347.	351.	7698.

TABLE B8

MAXIMUM STRESSES FROM PFAOMQDD
OBE 1/4 50 D

COMPONENT	ELEM	NODE	X	Y	Z	SRSS	STATIC	SUM
GIRDER A	27	310	1053.	4014.	7040.	8172.	7184.	15356.
GIRDER B	51	360	989.	3478.	7073.	7943.	7267.	15210.
END CONNECT-RHE	17	154	1798.	9233.	632.	9427.	489.	9917.
END CONNECT-LHE	74	252	1760.	9800.	525.	9971.	351.	10322.

TABLE B9

MAXIMUM STRESSES FROM PFAOMQND
OBE 1/4 NL

COMPONENT	ELEM	NODE	X	Y	Z	SRSS	STATIC	SUM
GIRDER A	26	310	848.	2199.	778.	2482.	4778.	7260.
GIRDER B	51	360	734.	1878.	818.	2176.	4860.	7036.
END CONNECT-RHE	17	154	1779.	5989.	194.	6250.	478.	6728.
END CONNECT-LHE	74	252	1739.	5552.	144.	5820.	357.	6176.

STRESS IN PSI

[illegible]

ESS-1.2 FOR SRSS-4.3

WHITING REQN 79604 DATE 6-18-9?
BY MJM PAGE B-6 OF 58
8.25.87

TABLE 810

MAXIMUM STRESSES FROM PFAOMQUS
SSE 1/4 50 U

COMPONENT	ELEM	NODE	X	Y	Z	SRSS	STATIC	SUM
GIRDER A	27	310	1875.	3678.	3982.	5742.	7184.	12927
GIRDER B	51	360	1695.	3120.	3905.	5278.	7267.	12544
END CONNECT-RHE	17	154	3310.	10232.	386.	10761.	489.	11250
END CONNECT-LHE	74	252	3308.	9315.	393.	9892.	351.	10244

TABLE 811

MAXIMUM STRESSES FROM PFAOMQDS
SSE 1/4 50 D

COMPONENT	ELEM	NODE	X	Y	Z	SRSS	STATIC	SUM
GIRDER A	27	310	2035.	5665.	13219.	14525.	7184.	21709.
GIRDER B	51	360	1914.	4878.	13277.	14274.	7267.	21541.
END CONNECT-RHE	17	154	3342.	13631.	1433.	14108.	489.	14597.
END CONNECT-LHE	74	252	3311.	13926.	1222.	14366.	351.	14717.

TABLE 812

MAXIMUM STRESSES FROM PFAOMQNS
SSE 1/4 NL

COMPONENT	ELEM	NODE	X	Y	Z	SRSS	STATIC	SUM
GIRDER A	27	310	1649.	2857.	1931.	3822.	4777.	8600.
GIRDER B	51	360	1515.	2371.	1959.	3429.	4860.	8289.
END CONNECT-RHE	17	154	3275.	9002.	434.	9589.	478.	10067.
END CONNECT-LHE	74	252	3248.	7451.	321.	8134.	357.	8491.

STRESS IN PSI

ESS-1.2 FOR SRSS-4.3

WHITING REQN 79604 DATE 6-18-87
BY MJM PAGE B-7 OF 58

TABLE B13

MAXIMUM STRESSES FROM PFAOMEUO
OBE END 50 U

COMPONENT	ELEM	NODE	X	Y	Z	SRSS	STATIC	SUM
GIRDER A	29	312	962.	2559.	691.	2820.	4142.	6962.
GIRDER B	43	353	799.	6909.	388.	6966.	2283.	9249.
END CONNECT-RHE	17	154	493.	10150.	156.	10163.	470.	10633.
END CONNECT-LHE	75	254	1297.	9558.	185.	9647.	445.	10092.

TABLE B14

MAXIMUM STRESSES FROM PFAOMEDO
OBE END 50 D

COMPONENT	ELEM	NODE	X	Y	Z	SRSS	STATIC	SUM
GIRDER A	35	319	2181.	9504.	372.	9758.	178.	9936.
GIRDER B	43	353	940.	7280.	2032.	7616.	2283.	9899.
END CONNECT-RHE	17	154	498.	10203.	220.	10218.	470.	10687.
END CONNECT-LHE	74	252	2777.	12173.	384.	12491.	358.	12849.

TABLE B15

MAXIMUM STRESSES FROM PFAOMRNO
OBE RHE NL

COMPONENT	ELEM	NODE	X	Y	Z	SRSS	STATIC	SUM
GIRDER A	35	319	1516.	6905.	224.	7073.	142.	7215.
GIRDER B	59	369	583.	9791.	80.	9809.	155.	9963.
END CONNECT-RHE	17	154	1292.	10770.	192.	10849.	440.	11289.
END CONNECT-LHE	75	254	485.	12815.	56.	12824.	443.	13268.

STRESS IN PSI

TABLE B16

MAXIMUM STRESSES FROM PFAOMEUS
SSE END 50 U

COMPONENT	ELEM	NODE	X	Y	Z	SRSS	STATIC	SUM
GIRDER A	19	303	780.	6278.	998.	6405.	2508.	8913.
GIRDER B	42	351	815.	14159.	646.	14197.	529.	14727.
END CONNECT-RHE	17	154	975.	18612.	347.	18641.	470.	19111.
END CONNECT-LHE	75	254	2486.	16707.	357.	16895.	445.	17340.

TABLE B17

MAXIMUM STRESSES FROM PFAOMEDS
SSE END 50 D

COMPONENT	ELEM	NODE	X	Y	Z	SRSS	STATIC	SUM
GIRDER A	35	319	4179.	12973.	699.	13647.	178.	13825.
GIRDER B	43	353	1808.	12783.	3815.	13462.	2283.	15745.
END CONNECT-RHE	17	154	1003.	18675.	472.	18708.	470.	19178.
END CONNECT-LHE	75	254	2454.	17781.	366.	17953.	445.	18398.

TABLE B18

MAXIMUM STRESSES FROM PFAOMRNS
SSE RHE NL

COMPONENT	ELEM	NODE	X	Y	Z	SRSS	STATIC	SUM
GIRDER A	35	319	2922.	10877.	428.	11271.	142.	11413
GIRDER B	59	369	1102.	17599.	153.	17634.	155.	17789
END CONNECT-RHE	17	154	2505.	18890.	373.	19059.	440.	19499
END CONNECT-LHE	75	254	894.	23167.	104.	23185.	443.	23628

STRESS IN PSI

SRSS-4.3 WHITING CORPORATION ANSYS SRSS PROGRAM 79604 87/06/12.
TABLE # B19 BY MJM 8-25-87 PAGE B-9 OF 58

79604/MJM/AEP, DCC, OLD MAIN TROLLEY MID, 50T LD UP / OBE 4W

REACTION SUMMARY

LOAD STEP NODE LABEL	1	2	3	SRSS	STATIC	SUM	DIFFER
101 FY	707.	241646.	254.	241647.	0.	241647.	-241647.
101 FZ	4289.	31966.	39130.	50709.	102034.	152743.	51325.
101 MX	72713.	16139508.	441464.	16145709.	44267.	16189976.	-16101441.
102 FZ	3364.	31526.	35735.	47772.	93881.	141653.	46108.
102 MX	57126.	682900.	354863.	771715.	90260.	861974.	-681455.
123 FY	0.	0.	0.	0.	0.	0.	0.
123 FZ	0.	0.	0.	0.	0.	0.	0.
123 MX	0.	0.	0.	0.	0.	0.	0.
123 MY	0.	0.	0.	0.	0.	0.	0.
124 FX	32513.	991.	8493.	33618.	0.	33618.	-33618.
124 FY	0.	0.	0.	0.	0.	0.	0.
124 FZ	0.	0.	0.	0.	0.	0.	0.
124 MX	0.	0.	0.	0.	0.	0.	0.
124 MY	0.	0.	0.	0.	0.	0.	0.
124 MZ	0.	0.	0.	0.	0.	0.	0.
201 FY	1088.	221007.	6955.	221119.	-0.	221119.	-221119.
201 FZ	3288.	27791.	37826.	47053.	98309.	145362.	51256.
201 MX	43592.	14919499.	129377.	14920124.	43387.	14963511.	-14876737
202 FZ	3456.	27683.	34678.	44507.	90155.	134663.	45648.
202 MX	23884.	217245.	128539.	253551.	89376.	342927.	-164176.

(lb, in lb)

SRSS-4.3 WHITING CORPORATION ANSYS SRSS PROGRAM 79604 87/06/12.
TABLE # 820 LS 2 MODE 1 SCALE FACTOR = .1096 BY MJM PAGE 8-10 OF 58

79604/MJM/AEP, DCC, OLD MAIN TROLLEY MID, 50T LD UP / OBE

REACTION SUMMARY

NODE	LABEL	1	2	3	SRSS	STATIC	SUM	DIFFER
101	FY	707.	26488.	254.	26498.	0.	26498.	-26498.
101	FZ	4289.	4613.	39130.	39634.	102034.	141668.	62400.
101	MX	72713.	1769535.	441464.	1825221.	44267.	1869489.	-1780954.
102	FZ	3364.	4272.	35735.	36146.	93881.	130027.	57734.
102	MX	57126.	81473.	354863.	368550.	90260.	458809.	-278290.
123	FY	0.	0.	0.	0.	0.	0.	0.
123	FZ	0.	0.	0.	0.	0.	0.	0.
123	MX	0.	0.	0.	0.	0.	0.	0.
123	MY	0.	0.	0.	0.	0.	0.	0
124	FX	32513.	973.	8493.	33618.	0.	33618.	-33618
124	FY	0.	0.	0.	0.	0.	0.	0
124	FZ	0.	0.	0.	0.	0.	0.	0
124	MX	0.	0.	0.	0.	0.	0.	0
124	MY	0.	0.	0.	0.	0.	0.	0
124	MZ	0.	0.	0.	0.	0.	0.	0
201	FY	1088.	24231.	6955.	25233.	-0.	25233.	-25233
201	FZ	3288.	4090.	37826.	38189.	98309.	136497.	60120
201	MX	43592.	1635420.	129377.	1641109.	43387.	1684495.	-1597722
202	FZ	3456.	4022.	34678.	35082.	90155.	125237.	55074
202	MX	23884.	32968.	128539.	134832.	89376.	224208.	-45457

(16, 1x16)

79604/MJM/AEP, DCC, OLD MAIN TROLLEY MID, 50T LD UP / SSE

REACTION SUMMARY

NODE	LOAD STEP LABEL	1	2	3	SRSS	STATIC	SUM	DIFFER
101	FY	1391.	453119.	465.	453121.	0.	453121.	-453121.
101	FZ	7768.	59916.	69900.	92392.	102034.	194425.	9642.
101	MX	133853.	30263763.	790092.	30274371.	44267.	30318638.	-30230103.
102	FZ	6135.	59099.	63785.	87172.	93881.	181052.	6709.
102	MX	107256.	1280471.	634667.	1433148.	90260.	1523407.	-1342888.
123	FY	0.	0.	0.	0.	0.	0.	0.
123	FZ	0.	0.	0.	0.	0.	0.	0.
123	MX	0.	0.	0.	0.	0.	0.	0.
123	MY	0.	0.	0.	0.	0.	0.	0.
124	FX	61943.	1805.	15239.	63815.	0.	63815.	-63815.
124	FY	0.	0.	0.	0.	0.	0.	0.
124	FZ	0.	0.	0.	0.	0.	0.	0.
124	MX	0.	0.	0.	0.	0.	0.	0.
124	MY	0.	0.	0.	0.	0.	0.	0.
124	MZ	0.	0.	0.	0.	0.	0.	0.
201	FY	2003.	414417.	12443.	414608.	-0.	414608.	-414608.
201	FZ	5911.	52090.	67532.	85492.	98309.	183801.	12816.
201	MX	85953.	27976091.	231842.	27977184.	43387.	28020571.	-27933797.
202	FZ	6225.	51890.	61939.	81042.	90155.	171198.	9113.
202	MX	48493.	408205.	229821.	470957.	89376.	560333.	-381582.

(16; m.16)

SRSS-4.3 WHITING CORPORATION ANSYS SRSS PROGRAM 79604 87/06/12.
TABLE # 822 LS 2 MODE 1 SCALE FACTOR = .0744 BY MJM PAGE 8-12 OF 58

79604/MJM/AEP, DCC, OLD MAIN TROLLEY MID, 50T LD UP / SSE

REACTION SUMMARY

LOAD STEP NODE LABEL	1	2	3	SRSS	STATIC	SUM	DIFFER
101 FY	1391.	33726.	465.	33757.	0.	33757.	-33757.
101 FZ	7768.	6989.	69900.	70676.	102034.	172710.	31358.
101 MX	133853.	2253546.	790092.	2391784.	44267.	2436051.	-2347517.
102 FZ	6135.	6303.	63785.	64388.	93881.	158269.	29492.
102 MX	107256.	112211.	634667.	653374.	90260.	743634.	-563115.
123 FY	0.	0.	0.	0.	0.	0.	0.
123 FZ	0.	0.	0.	0.	0.	0.	0.
123 MX	0.	0.	0.	0.	0.	0.	0.
123 MY	0.	0.	0.	0.	0.	0.	0.
124 FX	61943.	1772.	15239.	63814.	0.	63814.	-63814.
124 FY	0.	0.	0.	0.	0.	0.	0.
124 FZ	0.	0.	0.	0.	0.	0.	0
124 MX	0.	0.	0.	0.	0.	0.	0
124 MY	0.	0.	0.	0.	0.	0.	0
124 MZ	0.	0.	0.	0.	0.	0.	0
201 FY	2003.	30856.	12443.	33330.	-0.	33330.	-33330
201 FZ	5911.	6255.	67532.	68078.	98309.	166387.	30230
201 MX	85953.	2082353.	231842.	2096982.	43387.	2140368.	-2053595
202 FZ	6225.	6128.	61939.	62552.	90155.	152708.	27603
202 MX	48493.	58697.	229821.	242104.	89376.	331480.	-152729

(lb, in lb)

SRSS-4.3 WHITING CORPORATION ANSYS SRSS PROGRAM 79604 87/06/12.
TABLE # 023 BY MJM PAGE B-13 OF 58

79604/MJM/AEP, DCC, OLD MAIN TROLLEY MID, 50T LD DN / OBE

REACTION SUMMARY

LOAD STEP NODE LABEL	1	2	3	SRSS	STATIC	SUM	DIFFER
101 FY	651.	241646.	260.	241647.	0.	241647.	-241647.
101 FZ	4477.	31841.	90341.	95892.	102034.	197926.	6142.
101 MX	61144.	16139510.	70410.	16139780.	44267.	16184047.	-16095513.
102 FZ	4271.	31417.	86769.	92380.	93881.	186261.	1500.
102 MX	49754.	682897.	8679.	684762.	90260.	775022.	-594503.
123 FY	0.	0.	0.	0.	0.	0.	0.
123 FZ	0.	0.	0.	0.	0.	0.	0.
123 MX	0.	0.	0.	0.	0.	0.	0.
123 MY	0.	0.	0.	0.	0.	0.	0.
124 FX	32357.	857.	9995.	33876.	0.	33876.	-33876.
124 FY	0.	0.	0.	0.	0.	0.	0.
124 FZ	0.	0.	0.	0.	0.	0.	0.
124 MX	0.	0.	0.	0.	0.	0.	0.
124 MY	0.	0.	0.	0.	0.	0.	0.
124 MZ	0.	0.	0.	0.	0.	0.	0.
201 FY	915.	221006.	454.	221009.	-0.	221009.	-221009.
201 FZ	3969.	27673.	88798.	93094.	98309.	191403.	5214.
201 MX	37625.	14919501.	54746.	14919649.	43387.	14963036.	-14876262.
202 FZ	3770.	27549.	85432.	89843.	90155.	179998.	313.
202 MX	24275.	217237.	15161.	219114.	89376.	308489.	-129738.

(lb, in. lb.)

SRSS-4.3 WHITING CORPORATION ANSYS SRSS PROGRAM 79604 87/06/12.
TABLE # B24 LS 2 MODE 1 SCALE FACTOR = .1420 BY MJM

79604/MJM/AEP, DCC, OLD MAIN TROLLEY MID, 50T LD DN / ORE

REACTION SUMMARY

LOAD STEP NODE	LABEL	1	2	3	SRSS	STATIC	SUM	DIFFER
101	FY	651.	34316.	260.	34323.	0.	34323.	-34323
101	FZ	4477.	4548.	90341.	90566.	102034.	192600.	11468
101	MX	61144.	2292296.	70410.	2294192.	44267.	2338459.	-2249924
102	FZ	4271.	4500.	86769.	86991.	93881.	180871.	6890
102	MX	49754.	102114.	8679.	113921.	90260.	204180.	-23661
123	FY	0.	0.	0.	0.	0.	0.	0
123	FZ	0.	0.	0.	0.	0.	0.	0
123	MX	0.	0.	0.	0.	0.	0.	0
123	MY	0.	0.	0.	0.	0.	0.	0
124	FX	32357.	838.	9975.	33876.	0.	33876.	-33876
124	FY	0.	0.	0.	0.	0.	0.	0
124	FZ	0.	0.	0.	0.	0.	0.	0
124	MX	0.	0.	0.	0.	0.	0.	0
124	MY	0.	0.	0.	0.	0.	0.	0
124	MZ	0.	0.	0.	0.	0.	0.	0
201	FY	915.	31390.	454.	31406.	-0.	31406.	-31402
201	FZ	3969.	3956.	88798.	88974.	98309.	187283.	9334
201	MX	37625.	2118750.	54746.	2119791.	43387.	2163178.	-2076404
202	FZ	3770.	3958.	85432.	85606.	90155.	175762.	4549
202	MX	24275.	38263.	15161.	47783.	89376.	137158.	41593

(lb, in lb)

79604/MJM/AEP, DCC, OLD MAIN TROLLEY MID, 50T LD DN / SSE

REACTION SUMMARY

LOAD STEP / NODE LABEL	1	2	3	SRSS	STATIC	SUM	DIFFER
101 FY	1294.	453119.	540.	453121.	0.	453121.	-453121.
101 FZ	8573.	59707.	169533.	179944.	102034.	281978.	-77911.
101 MX	114217.	30263766.	136583.	30264290.	44267.	30308557.	-30220023.
102 FZ	8128.	58914.	162765.	173290.	93881.	267171.	-79409.
102 MX	93966.	1280460.	20144.	1284062.	90260.	1374321.	-1193802.
123 FY	0.	0.	0.	0.	0.	0.	0.
123 FZ	0.	0.	0.	0.	0.	0.	0.
123 MX	0.	0.	0.	0.	0.	0.	0.
123 MY	0.	0.	0.	0.	0.	0.	0.
124 FX	61613.	1600.	19038.	64507.	0.	64507.	-64507.
124 FY	0.	0.	0.	0.	0.	0.	0.
124 FZ	0.	0.	0.	0.	0.	0.	0.
124 MX	0.	0.	0.	0.	0.	0.	0.
124 MY	0.	0.	0.	0.	0.	0.	0.
124 MZ	0.	0.	0.	0.	0.	0.	0.
201 FY	1693.	414417.	881.	414421.	-0.	414421.	-414421.
201 FZ	7603.	51894.	166625.	174684.	98309.	272993.	-76376.
201 MX	76265.	27976094.	107437.	27976404.	43387.	28019791.	-27933017.
202 FZ	7167.	51662.	160244.	168519.	90155.	258674.	-78363.
202 MX	50317.	408174.	32774.	412568.	89376.	501943.	-323192.

(lb, in lb)

SRSS-4.3 WHITING CORPORATION ANSYS SRSS PROGRAM 79604 87/06/12.
TABLE # 826 LS 2 MODE 1 SCALE FACTOR = .1078 BY MJM PAGE B-16 OF 58

79604/MJM/AEP, DCC, OLD MAIN TROLLEY MID, 50T LD DN / SSE

REACTION SUMMARY

LOAD STEP NODE LABEL	1	2	3	SRSS	STATIC	SUM	DIFFER
101 FY	1294.	48856.	540.	48876.	0.	48876.	-48876.
101 FZ	8573.	6518.	169533.	169875.	102034.	271909.	-67841.
101 MX	114217.	3263723.	136583.	3268576.	44267.	3312844.	-3224309.
102 FZ	8128.	6480.	162765.	163097.	93881.	256977.	-69216.
102 MX	93966.	150078.	20144.	178210.	90260.	268470.	-87951.
123 FY	0.	0.	0.	0.	0.	0.	0.
123 FZ	0.	0.	0.	0.	0.	0.	0
123 MX	0.	0.	0.	0.	0.	0.	0
123 MY	0.	0.	0.	0.	0.	0.	0
124 FX	61613.	1563.	19038.	64506.	0.	64506.	-64506
124 FY	0.	0.	0.	0.	0.	0.	0
124 FZ	0.	0.	0.	0.	0.	0.	0
124 MX	0.	0.	0.	0.	0.	0.	0
124 MY	0.	0.	0.	0.	0.	0.	0
124 MZ	0.	0.	0.	0.	0.	0.	0
201 FY	1693.	44690.	881.	44731.	-0.	44731.	-44731
201 FZ	7603.	5686.	166625.	166895.	98309.	265204.	-68587
201 MX	76265.	3016442.	107437.	3019318.	43387.	3062705.	-2975931
202 FZ	7167.	5730.	160244.	160507.	90155.	250662.	-70351
202 MX	50317.	66482.	32774.	89587.	89376.	178962.	-211

(lb, in lb)

79604/MJM/AEP, DCC, OLD MAIN TROLLEY 1/4, 50T LD UP / OBE

REACTION SUMMARY

LOAD STEP / NODE	LABEL	1	2	3	SRSS	STATIC	SUM	DIFFER
101	FY	7639.	299492.	501.	299590.	0.	299590.	-299590.
101	FZ	7662.	34427.	23834.	42567.	134245.	176812.	91678.
101	MX	511641.	20048028.	63943.	20054657.	43197.	20097854.	-20011461.
102	FZ	7936.	34825.	21176.	41523.	122672.	164196.	81149.
102	MX	120741.	290318.	19220.	315012.	89899.	404911.	-225113.
123	FY	0.	0.	0.	0.	0.	0.	0.
123	FZ	0.	0.	0.	0.	0.	0.	0.
123	MX	0.	0.	0.	0.	0.	0.	0.
123	MY	0.	0.	0.	0.	0.	0.	0.
124	FX	21338.	11126.	14092.	27887.	0.	27887.	-27887
124	FY	0.	0.	0.	0.	0.	0.	0
124	FZ	0.	0.	0.	0.	0.	0.	0
124	MX	0.	0.	0.	0.	0.	0.	0
124	MY	0.	0.	0.	0.	0.	0.	0
124	MZ	0.	0.	0.	0.	0.	0.	0
201	FY	3995.	140492.	614.	140550.	-0.	140550.	-140550
201	FZ	3594.	17565.	11086.	21080.	66138.	87218.	45058
201	MX	243707.	8123637.	30707.	8127350.	39328.	8166678.	-8088022
202	FZ	3382.	17823.	10321.	20871.	61323.	82195.	40452
202	MX	66268.	725081.	17377.	728311.	85826.	814137.	-642484

(lb, in lb)

SRSS-4.3 WHITING CORPORATION ANSYS SRSS PROGRAM 79604 07/06/15

TABLE # 828 LS 2 MODE 1 SCALE FACTOR = 1024 BY MJM PAGE B-18 OF 58

79604/MJM/AEP, DCC, OLD MAIN TROLLEY 1/4, 50T LD UP / ORE

REACTION SUMMARY

LOAD STEP NODE	LABEL	1	2	3	SRSS	STATIC	SUM	DIFFER
101	FY	7639.	31117.	501.	32045.	0.	32045.	-32045.
101	FZ	7662.	3551.	23834.	25286.	134245.	159531.	108960
101	MX	511641.	2093877.	63943.	2156429.	43197.	2199625.	-2113232
102	FZ	7936.	3572.	21176.	22895.	122672.	145567.	99777
102	MX	120741.	266132.	19220.	292872.	89899.	382771.	-202973
123	FY	0.	0.	0.	0.	0.	0.	0
123	FZ	0.	0.	0.	0.	0.	0.	0
123	MX	0.	0.	0.	0.	0.	0.	0
123	MY	0.	0.	0.	0.	0.	0.	0
124	FX	21338.	2511.	14092.	25695.	0.	25695.	-25695
124	FY	0.	0.	0.	0.	0.	0.	0
124	FZ	0.	0.	0.	0.	0.	0.	0
124	MX	0.	0.	0.	0.	0.	0.	0
124	MY	0.	0.	0.	0.	0.	0.	0
124	MZ	0.	0.	0.	0.	0.	0.	0
201	FY	3995.	14717.	614.	15262.	-0.	15262.	-15262
201	FZ	3594.	1800.	11086.	11793.	66138.	77931.	54345
201	MX	243707.	891330.	30707.	924557.	39328.	963834.	-885229
202	FZ	3382.	1846.	10321.	11017.	61323.	72340.	50307
202	MX	66268.	222331.	17377.	232646.	85826.	318473.	-146820

(lb, in lb)

SRSS-4.3 WHITING CORPORATION ANSYS SRSS PROGRAM 79604 07/06/15.
TABLE # 029 BY MJM PAGE 8-19 OF 58

79604/MJM/AEP, DCC, OLD MAIN TROLLEY 1/4, 50T LD UP / SSE

REACTION SUMMARY

LOAD STEP NODE	LABEL	1	2	3	SRSS	STATIC	SUM	DIFFER
101	FY	14304.	561578.	963.	561761.	0.	561761.	-561761.
101	FZ	18110.	64554.	56785.	87991.	134245.	222237.	46254.
101	MX	959565.	37591906.	146938.	37604438.	43197.	37647635.	-37561241.
102	FZ	17785.	55302.	50510.	84511.	122672.	207183.	38161.
102	MX	226936.	519789.	39625.	568552.	89899.	658451.	-478652.
123	FY	0.	0.	0.	0.	0.	0.	0.
123	FZ	0.	0.	0.	0.	0.	0.	0.
123	MX	0.	0.	0.	0.	0.	0.	0.
123	MY	0.	0.	0.	0.	0.	0.	0
124	FX	39750.	20819.	32036.	55603.	0.	55603.	-55603
124	FY	0.	0.	0.	0.	0.	0.	0
124	FZ	0.	0.	0.	0.	0.	0.	0
124	MX	0.	0.	0.	0.	0.	0.	0
124	MY	0.	0.	0.	0.	0.	0.	0
124	MZ	0.	0.	0.	0.	0.	0.	0
201	FY	7502.	263436.	1341.	263546.	-0.	263546.	-263546
201	FZ	8494.	32936.	26508.	43123.	66138.	109261.	23015
201	MX	457280.	15231703.	67513.	15238716.	39328.	15278043.	-15199388
202	FZ	7942.	33420.	24675.	42295.	61323.	103618.	19029
202	MX	122815.	1354101.	38767.	1360212.	85826.	1446038.	-1274386

SRSS-4.3 WHITING CORPORATION ANSYS SRSS PROGRAM 79604 87/06/15.
TABLE # 830 LS 2 MODE 1 SCALE FACTOR = .0686 BY MJM PAGE 8-20 OF 58

79604/MJM/AEP, DCC, OLD MAIN TROLLEY 1/4, 50T LD UP / SSE

REACTION SUMMARY

LOAD STEP / NODE	LABEL	1	2	3	SRSS	STATIC	SUM	DIFFER
101	FY	14304.	39642.	963.	42155.	0.	42155.	-42155.
101	FZ	18110.	4494.	56985.	59962.	134245.	194208.	74283.
101	MX	959565.	2680947.	146938.	2851286.	43197.	2894482.	-2808089.
102	FZ	17785.	4508.	50610.	53833.	122672.	176505.	68839.
102	MX	226936.	471786.	39625.	525026.	89899.	614925.	-435127.
123	FY	0.	0.	0.	0.	0.	0.	0.
123	FZ	0.	0.	0.	0.	0.	0.	0.
123	MX	0.	0.	0.	0.	0.	0.	0.
123	MY	0.	0.	0.	0.	0.	0.	0.
124	FX	39750.	4236.	32836.	51732.	0.	51732.	-51732.
124	FY	0.	0.	0.	0.	0.	0.	0.
124	FZ	0.	0.	0.	0.	0.	0.	0.
124	MX	0.	0.	0.	0.	0.	0.	0.
124	MY	0.	0.	0.	0.	0.	0.	0.
124	MZ	0.	0.	0.	0.	0.	0.	0.
201	FY	7502.	18918.	1341.	20396.	-0.	20396.	-20396.
201	FZ	8494.	2264.	26508.	27928.	66138.	94066.	38210.
201	MX	457280.	1170591.	67513.	1277173.	39328.	1316501.	-1237845.
202	FZ	7942.	2346.	24675.	26027.	61323.	87351.	35296.
202	MX	122815.	386047.	38767.	406963.	85826.	492789.	-321137.

(lb, in lb)

79604/MJM/AEP, DCC, OLD MAIN TROLLEY 1/4, 50T LD DN / ONE

REACTION SUMMARY

LOAD STEP NODE LABEL	1	2	3	SRSS	STATIC	SUM	DIFFER
101 FY	7679.	299491.	2516.	299600.	0.	299600.	-299600
101 FZ	12496.	34355.	107729.	113763.	134245.	248008.	20483
101 MX	528054.	20047981.	268216.	20056728.	43197.	20099725.	-20013531
102 FZ	12593.	34896.	104054.	110470.	122672.	233142.	12202
102 MX	79323.	290333.	60598.	307014.	87899.	376913.	-217114
123 FY	0.	0.	0.	0.	0.	0.	0
123 FZ	0.	0.	0.	0.	0.	0.	0
123 MX	0.	0.	0.	0.	0.	0.	0
123 MY	0.	0.	0.	0.	0.	0.	0
124 FX	28272.	11122.	20950.	36903.	0.	36903.	-36903
124 FY	0.	0.	0.	0.	0.	0.	0
124 FZ	0.	0.	0.	0.	0.	0.	0
124 MX	0.	0.	0.	0.	0.	0.	0
124 MY	0.	0.	0.	0.	0.	0.	0
124 MZ	0.	0.	0.	0.	0.	0.	0
201 FY	3761.	140492.	1974.	140556.	-0.	140556.	-140556
201 FZ	4863.	17540.	40712.	44596.	66138.	110734.	21542
201 MX	221374.	8123610.	62897.	8126869.	39328.	8166197.	-8087542
202 FZ	4644.	17848.	39618.	43700.	61323.	105024.	17623
202 MX	75331.	725089.	88543.	734349.	85826.	820175.	-648522

(lb, in lb)

SRSS-4.3 WHITING CORPORATION ANSYS SRSS PROGRAM 79604 87/06/15.
TABLE # 832 LS 2 MODE 1 SCALE FACTOR = .1436 BY MJM PAGE A-22 OF 58

79604/MJM/AEP, DCC, OLD MAIN TROLLEY 1/4, 50T LD DN / ORE

REACTION SUMMARY

LOAD STEP NODE	LABEL	1	2	3	SRSS	STATIC	SUM	DIFFER
101	FY	7679.	43325.	2516.	44072.	0.	44072.	-44072.
101	FZ	12496.	4949.	107729.	108564.	134245.	242810.	25681.
101	MX	528054.	2907915.	268216.	2967617.	43197.	3010813.	-2924420.
102	FZ	12593.	5025.	104054.	104934.	122672.	227606.	17738.
102	MX	79323.	266407.	60598.	284494.	87899.	374394.	-194595
123	FY	0.	0.	0.	0.	0.	0.	0
123	FZ	0.	0.	0.	0.	0.	0.	0
123	MX	0.	0.	0.	0.	0.	0.	0
123	MY	0.	0.	0.	0.	0.	0.	0
124	FX	28272.	2687.	20950.	35290.	0.	35290.	-35290
124	FY	0.	0.	0.	0.	0.	0.	0
124	FZ	0.	0.	0.	0.	0.	0.	0
124	MX	0.	0.	0.	0.	0.	0.	0
124	MY	0.	0.	0.	0.	0.	0.	0
124	MZ	0.	0.	0.	0.	0.	0.	0
201	FY	3761.	20409.	1974.	20847.	-0.	20847.	-20847
201	FZ	4863.	2526.	40712.	41079.	66138.	107217.	25059
201	MX	221374.	1209219.	62897.	1230923.	39328.	1270251.	-1191596
202	FZ	4644.	2573.	39618.	39973.	61323.	101296.	21351
202	MX	75331.	233062.	88543.	260447.	85826.	346273.	-174620

(lb, in lb)

SRSS-4.3 WHITING CORPORATION ANSYS SRSS PROGRAM 79604 87/06/15.
TABLE # 833 BY MJM ~~[illegible]~~ 8-26-87 PAGE B-23 OF 58

79604/MJM/AEP, DCC, OLD MAIN TROLLEY 1/4, 50T LD DN / SSE [illegible]

REACTION SUMMARY

LOAD STEP NODE	LABEL	1	2	3	SRSS	STATIC	SUM	DIFFER
101	FY	14505.	561577.	5841.	561795.	0.	561795.	-561795
101	FZ	24181.	64420.	202145.	213535.	134245.	347781.	-77290
101	MX	1009399.	37591820.	618523.	37610456.	43197.	37653653.	-37567260
102	FZ	23821.	65435.	195174.	207224.	122672.	329896.	-84552
102	MX	150887.	519799.	142351.	559662.	89899.	649561.	-469763
123	FY	0.	0.	0.	0.	0.	0.	0
123	FZ	- 0.	0.	0.	0.	0.	0.	0
123	MX	0.	0.	0.	0.	0.	0.	0
123	MY	0.	0.	0.	0.	0.	0.	0
124	FX	52505.	20812.	40831.	69693.	0.	69693.	-69693
124	FY	0.	0.	0.	0.	0.	0.	0
124	FZ	0.	0.	0.	0.	0.	0.	0
124	MX	0.	0.	0.	0.	0.	0.	0
124	MY	0.	0.	0.	0.	0.	0.	0
124	MZ	0.	0.	0.	0.	0.	0.	0
201	FY	7208.	263436.	4629.	263575.	-0.	263575.	-263575
201	FZ	9857.	32889.	76509.	83860.	66138.	149998.	-17722
201	MX	413484.	15231654.	131519.	15237833.	39328.	15277160.	-15198505
202	FZ	9308.	33466.	74420.	82128.	61323.	143451.	-20804
202	MX	154894.	1354108.	207965.	1378713.	85826.	1464539.	-1292886

(lb, in lb)

SRSS-4.3 WHITING CORPORATION ANSYS SRSS PROGRAM 79604 87/06/15.
TABLE # 834 LS 2 MODE 1 SCALE FACTOR = .1074 BY MJM PAGE 8-24 OF 58

79604/MJM/AEP, DCC, OLD MAIN TROLLEY 1/4, 50T LD DN / SSE

REACTION SUMMARY

LOAD STEP NODE	LABEL	1	2	3	SRSS	STATIC	SUM	DIFFER
101	FY	14505.	61028.	5841.	63000.	0.	63000.	-63000.
101	FZ	24181.	6962.	202145.	203705.	134245.	337951.	-69460
101	MX	1009399.	4102855.	618523.	4270231.	43197.	4313428	-4227035
102	FZ	23821.	7063.	195174.	196749.	122672.	319421.	-74077
102	MX	150887.	472144.	142351.	515704.	89899.	605604.	-425805
123	FY	0.	0.	0.	0.	0.	0.	0
123	FZ	0.	0.	0.	0.	0.	0.	0
123	MX	0.	0.	0.	0.	0.	0.	0
123	MY	0.	0.	0.	0.	0.	0.	0
124	FX	52505.	4450.	40831.	66662.	0.	66662.	-66662
124	FY	0.	0.	0.	0.	0.	0.	0
124	FZ	0.	0.	0.	0.	0.	0.	0
124	MX	0.	0.	0.	0.	0.	0.	0
124	MY	0.	0.	0.	0.	0.	0.	0
124	MZ	0.	0.	0.	0.	0.	0.	0
201	FY	7208.	28838.	4629.	30083.	-0.	30083.	-30083
201	FZ	9857.	3552.	76509.	77223.	66138.	143361.	-11085
201	MX	413484.	1731876.	131519.	1785402.	39328.	1824730.	-1746075
202	FZ	9308.	3617.	74420.	75087.	61323.	136410.	-13763
202	MX	154894.	400749.	207965.	477328.	85826.	563154.	-391501

(16, in 16)

SRSS-4.3 WHITING CORPORATION ANSYS SRSS PROGRAM 79604 07/06/16.
TABLE # 635 BY MJM PAGE 8-25 OF 58

79604/MJM/AEP, DCC, OLD MAIN TROLLEY END, 5OT LD UP / ORE

REACTION SUMMARY

NODE	LOAD STEP LABEL	1	2	3	SRSS	STATIC	SUM	DIFFER
101	FY	9458.	124413.	1517.	124781.	0.	124781.	-124781
101	FZ	8958.	10369.	14579.	20008	148423.	168430.	128415
101	MX	566820.	7521156.	114640.	7543356.	41630.	7584986.	-750172[illegible]
102	FZ	8617.	12098.	12447.	19379.	137229.	156608.	117850
102	MX	92425.	1299616.	17988.	1303023.	70937.	1373762.	-1212084
123	FY	0.	0.	0.	0.	0.	0.	0
123	FZ	0.	0.	0.	0.	0.	0.	0
123	MX	0.	0.	0.	0.	0.	0.	0
123	MY	0.	0.	0.	0.	0.	0.	0
124	FX	22763.	13537.	15102.	30488.	0.	30488.	-304[illegible]
124	FY	0.	0.	0.	0.	0.	0.	0
124	FZ	0.	0.	0.	0.	0.	0.	0
124	MX	0.	0.	0.	0.	0.	0.	0
124	MY	0.	0.	0.	0.	0.	0.	0
124	MZ	0.	0.	0.	0.	0.	0.	0
201	FY	4321.	55248.	619.	55421.	-0.	55421.	-55421
201	FZ	3946.	5791.	5903.	9163.	51973.	61136.	4281[illegible]
201	MX	171249.	2166056.	40011.	2173184.	37940.	2211123.	-213524[illegible]
202	FZ	3800.	6597.	5193.	9216.	46754.	55970.	3753[illegible]
202	MX	32874.	706258.	12112.	707127.	85033.	792160.	-62209[illegible]

SRSS-4.3 WHITING CORPORATION ANSYS SRSS PROGRAM 79604 07/06/16.
TABLE # B36 LS 2 MODE 1 SCALE FACTOR = .2260 BY MJM PAGE B-26 OF 58

79604/MJM/AEP, DCC, OLD MAIN TROLLEY END, 50T LD UP / OBE

REACTION SUMMARY

LOAD STEP NODE LABEL		1	2	3	SRSS	STATIC	SUM	DIFFER
101	FY	9458.	38364.	1517.	39542.	0.	39542.	-39542.
101	FZ	8958.	3118.	14579.	17393.	148423.	165815.	131030.
101	MX	566820.	2611714.	114640.	2674972.	41630.	2716603.	-2633342.
102	FZ	8617.	3757.	12447.	15598.	137229.	152827.	121631.
102	MX	92425.	795582.	17988.	801135.	90939.	892074.	-710196.
123	FY	0.	0.	0.	0.	0.	0.	0.
123	FZ	0.	0.	0.	0.	0.	0.	0.
123	MX	0.	0.	0.	0.	0.	0.	0.
123	MY	0.	0.	0.	0.	0.	0.	0.
124	FX	22763.	3330.	15102.	27519.	0.	27519.	-27519.
124	FY	0.	0.	0.	0.	0.	0.	0.
124	FZ	0.	0.	0.	0.	0.	0.	0.
124	MX	0.	0.	0.	0.	0.	0.	0.
124	MY	0.	0.	0.	0.	0.	0.	0.
124	MZ	0.	0.	0.	0.	0.	0.	0.
201	FY	4321.	19067.	619.	19560.	-0.	19560.	-19560.
201	FZ	3946.	1695.	5903.	7300.	51973.	59273.	44673.
201	MX	171249.	1305205.	40011.	1317000.	37940.	1354939.	-1279060.
202	FZ	3800.	1758.	5193.	6671.	46754.	53425.	40083.
202	MX	32874.	704022.	12112.	704893.	85033.	789926.	-619859.

(lb, in lb)

[illegible]

79604/MJM/AEP, DCC, OLD MAIN TROLLEY END, 50T LD UP / SSE

REACTION SUMMARY

LOAD STEP NODE LABEL	1	2	3	SRSS	STATIC	SUM	DIFFER
101 FY	18148.	238174.	3154.	238885.	0.	238885.	-238885.
101 FZ	20903.	19969.	34857.	45285.	148423.	193707.	103138.
101 MX	1090343.	14392910.	251470.	14436342.	41630.	14477972.	-14394712.
102 FZ	19214.	23349.	29689.	42377.	137229.	179606.	94852.
102 MX	177749.	2453840.	36569.	2460542.	90939.	2551481.	-2369602.
123 FY	0.	0.	0.	0.	0.	0.	0.
123 FZ	0.	0.	0.	0.	0.	0.	0.
123 MX	0.	0.	0.	0.	0.	0.	0.
123 MY	0.	0.	0.	0.	0.	0.	0
124 FX	43037.	25955.	35050.	61273.	0.	61273.	-61273
124 FY	0.	0.	0.	0.	0.	0.	0
124 FZ	0.	0.	0.	0.	0.	0.	0
124 MX	0.	0.	0.	0.	0.	0.	0
124 MY	0.	0.	0.	0.	0.	0.	0
124 MZ	0.	0.	0.	0.	0.	0.	0
201 FY	8308.	105576.	1184.	105909.	-0.	105909.	-105909
201 FZ	8926.	11079.	14115.	20041.	51973.	72014.	31932
201 MX	330448.	4089399.	82349.	4103555.	37940.	4141475.	-4065615
202 FZ	8294.	12629.	12376.	19543.	46754.	66297.	27211
202 MX	63933.	1295153.	26002.	1296991.	85033.	1382024.	-1211957

(lb, in lb)

SRSS-4.3 WHITING CORPORATION ANSYS SRSS PROGRAM 79604 87/06/16.
TABLE # 838 LS 2 MODE 1 SCALE FACTOR = .1356 BY MJM PAGE 8-28 OF 58

79604/MJM/AEP, DCC, OLD MAIN TROLLEY END, 50T LD UP / SSE

REACTION SUMMARY

LOAD STEP NODE LABEL		1	2	3	SRSS	STATIC	SUM	DIFFER
101	FY	18148.	59451.	3154.	62240.	0.	62240.	-62240.
101	FZ	20903.	5228.	34857.	40779.	148423.	189402.	107444.
101	MX	1090343.	4270530.	251490.	4414694.	41630.	4456324.	-4373064.
102	FZ	19214.	6551.	29689.	35966.	137229.	173195.	101263.
102	MX	177749.	1418050.	36569.	1429615.	90939.	1520554.	-1338675.
123	FY	0.	0.	0.	0.	0.	0.	0.
123	FZ	0.	0.	0.	0.	0.	0.	0.
123	MX	0.	0.	0.	0.	0.	0.	0.
123	MY	0.	0.	0.	0.	0.	0.	0.
124	FX	43037.	4454.	35050.	55682.	0.	55682.	-55682
124	FY	0.	0.	0.	0.	0.	0.	0
124	FZ	0.	0.	0.	0.	0.	0.	0
124	MX	0.	0.	0.	0.	0.	0.	0
124	MY	0.	0.	0.	0.	0.	0.	0
124	MZ	0.	0.	0.	0.	0.	0.	0
201	FY	8308.	30580.	1184.	31711.	-0.	31711.	-31711
201	FZ	8926.	2509.	14115.	16888.	51973.	68861.	35035
201	MX	330448.	2318412.	82349.	2343291.	37940.	2381231.	-2305351
202	FZ	8294.	2438.	12396.	15112.	46754.	61866.	31642
202	MX	63933.	1290520.	26002.	1292365.	85033.	1377398.	-1207331

(lb, in lb)

79604/MJM/AEP, DCC, OLD MAIN TROLLEY END, 50T LD DN / OBE

REACTION SUMMARY

LOAD STEP NODE LABEL	1	2	3	SRSS	STATIC	SUM	DIFFER
101 FY	9483.	124404.	1554.	124775.	0.	124775.	-124775.
101 FZ	11859.	12265.	100964.	102395.	148423.	250818.	46027.
101 MX	570619.	7520127.	115524.	7542630.	41630.	7584260.	-7501000.
102 FZ	11725.	12047.	99231.	100645.	137229.	237874.	36584.
102 MX	86981.	1299553.	12447.	1302520.	90939.	1393459.	-1211581.
123 FY	0.	0.	0.	0.	0.	0.	0.
123 FZ	0.	0.	0.	0.	0.	0.	0.
123 MX	0.	0.	0.	0.	0.	0.	0.
123 MY	0.	0.	0.	0.	0.	0.	0.
124 FX	24785.	13494.	17575.	33245.	0.	33245.	-33245.
124 FY	0.	0.	0.	0.	0.	0.	0.
124 FZ	0.	0.	0.	0.	0.	0.	0.
124 MX	0.	0.	0.	0.	0.	0.	0.
124 MY	0.	0.	0.	0.	0.	0.	0
124 MZ	0.	0.	0.	0.	0.	0.	0
201 FY	4222.	55248.	568.	55412.	-0.	55412.	-55412
201 FZ	4730.	6172.	19398.	20899.	51973.	72872.	31074
201 MX	146836.	2166144.	14328.	2171163.	37940.	2209102.	-2133223
202 FZ	4431.	6589.	18786.	20395.	46754.	67149.	26359
202 MX	24446.	706144.	10741.	706649.	85033.	791682.	-621616

(lb, in lb)

SRSS-4.3 WHITING CORPORATION ANSYS SRSS PROGRAM 79604 07/06/16.
TABLE # 840 LS 2 MODE 2 SCALE FACTOR = .3365 BY MJM PAGE 8-30 OF 58

79604/MJM/AEP, DCC, OLD MAIN TROLLEY END, 50T LD DN / OBE

REACTION SUMMARY

LOAD STEP NODE	LABEL	1	2	3	SRSS	STATIC	SUM	DIFFER
101	FY	9485.	48861.	1554.	49797.	0.	49797.	-49797.
101	FZ	11859.	5083.	100964.	101785.	148423.	250208.	46637.
101	MX	570619.	3172331.	115524.	3225311.	41630.	3266941.	-3183681.
102	FZ	11725.	5294.	99231.	100062.	137229.	237291.	37168.
102	MX	86981.	837853.	12447.	842448.	90939.	933387.	-751509.
123	FY	0.	0.	0.	0.	0.	0.	0.
123	FZ	0.	0.	0.	0.	0.	0.	0.
123	MX	0.	0.	0.	0.	0.	0.	0.
123	MY	0.	0.	0.	0.	0.	0.	0.
124	FX	24785.	4765.	17575.	30755.	0.	30755.	-30755.
124	FY	0.	0.	0.	0.	0.	0.	0.
124	FZ	0.	0.	0.	0.	0.	0.	0.
124	MX	0.	0.	0.	0.	0.	0.	0.
124	MY	0.	0.	0.	0.	0.	0.	0.
124	MZ	0.	0.	0.	0.	0.	0.	0.
201	FY	4222.	23233.	568.	23620.	-0.	23620.	-23620.
201	FZ	4730.	2451.	19398.	20117.	51973.	72090.	31856.
201	MX	146836.	1378161.	14328.	1386036.	37940.	1423975.	-1348096.
202	FZ	4431.	2517.	18786.	19465.	46754.	66219.	27289.
202	MX	24446.	704054.	10741.	704560.	85033.	789594.	-619527.

(lb) in lb)

SRSS-4.3 WHITING CORPORATION ANSYS SRSS PROGRAM 79604 07/06/16.
TABLE # 841 BY MJM PAGE B-31 OF 58

79604/MJM/AEP, DCC, OLD MAIN TROLLEY END, 50T LD DN / SSE

REACTION SUMMARY

LOAD STEP NODE LABEL		1	2	3	SRSS	STATIC	SUM	DIFFER
101	FY	18254.	238150.	3357.	238872.	0.	238872.	-238872.
101	FZ	23256.	23568.	189387.	192259.	148423.	340682.	-43837.
101	MX	1105214.	14390159.	263896.	14434951.	41630.	14476581.	-14393321.
102	FZ	22179.	23226.	186073.	188824.	137229.	326053.	-51595.
102	MX	167216.	2453678.	27237.	2459520.	90939.	2550459.	-2368581.
123	FY	0.	0.	0.	0.	0.	0.	0.
123	FZ	0.	0.	0.	0.	0.	0.	0.
123	MX	0.	0.	0.	0.	0.	0.	0.
123	MY	0.	0.	0.	0.	0.	0.	0.
124	FX	47263.	26010.	35459.	64557.	0.	64557.	-64557.
124	FY	0.	0.	0.	0.	0.	0.	0.
124	FZ	0.	0.	0.	0.	0.	0.	0.
124	MX	0.	0.	0.	0.	0.	0.	0.
124	MY	0.	0.	0.	0.	0.	0.	0.
124	MZ	0.	0.	0.	0.	0.	0.	0.
201	FY	8108.	105575.	1033.	105892.	-0.	105892.	-105892.
201	FZ	10032.	11847.	36619.	39774.	51973.	91747.	12199.
201	MX	281493.	4089592.	32768.	4099399.	37940.	4137339.	-4061459.
202	FZ	9131.	12633.	35401.	38681.	46754.	85435.	8074.
202	MX	48478.	1294846.	24556.	1295986.	85033.	1381019.	-1210953.

(lb, in lb)

SRSS-4.3 WHITING CORPORATION ANSYS SRSS PROGRAM 79604 87/06/16.
TABLE # 842 LS 2 MODE 2 SCALE FACTOR = .2385 BY MJM PAGE 8-32 OF 58

79604/MJM/AEP, DCC, OLD MAIN TROLLEY END, 50T LD DN / SSE

REACTION SUMMARY

LOAD STEP / NODE LABEL		1	2	3	SRSS	STATIC	SUM	DIFFER
101	FY	18254.	74899.	3357.	77164.	0.	77164.	-77164
101	FZ	23256.	8111.	189387.	190982.	148423.	339404.	-42559
101	MX	1105214.	5056053.	263896.	5182163.	41630.	5223793.	-5140533
102	FZ	22179.	8908.	186073.	187602.	137229.	324831.	-50373
102	MX	167216.	1472227.	27237.	1481943.	90939.	1572882.	-1391004
123	FY	0.	0.	0.	0.	0.	0.	0
123	FZ	0.	0.	0.	0.	0.	0.	0
123	MX	0.	0.	0.	0.	0.	0.	0
123	MY	0.	0.	0.	0.	0.	0.	0
124	FX	47263.	7327.	35459.	59538.	0.	59538.	-59538
124	FY	0.	0.	0.	0.	0.	0.	0
124	FZ	0.	0.	0.	0.	0.	0.	0
124	MX	0.	0.	0.	0.	0.	0.	0
124	MY	0.	0.	0.	0.	0.	0.	0
124	MZ	0.	0.	0.	0.	0.	0.	0
201	FY	8108.	36548.	1083.	37452.	-0.	37452.	-37452
201	FZ	10032.	3841.	36619.	38162.	51973.	90135.	13811
201	MX	281493.	2412508.	32768.	2429096.	37940.	2467036.	-2391157
202	FZ	9131.	3807.	35401.	36757.	46754.	83511.	9997
202	MX	48478.	1290395.	24556.	1291539.	85033.	1376572.	-1206505

(16, in 16)

[illegible]

SRSS-4.3 WHITING CORPORATION ANSYS SRSS PROGRAM 79604 87/06/17.
TABLE # B 43 BY MJM [illegible] PAGE B-33 OF 58

79604/MJM/AEP, DCC, OLD MAIN TROLLEY_MID, NO LD / OBE

REACTION SUMMARY

LOAD STEP NODE LABEL		1	2	3	SRSS	STATIC	SUM	DIFFER
101	FY	651.	241646.	174.	241647.	0.	241647.	-241647.
101	FZ	2818.	31807.	13366.	34616.	77038.	111654.	42421.
101	MX	61465.	16139502.	32461.	16139652.	43418.	16183070.	-16096234.
102	FZ	2597.	31449.	11463.	33574.	68869.	102443.	35295.
102	MX	50387.	682901.	12219.	684867.	89442.	774308.	-595425.
123	FY	0.	0.	0.	0.	0.	0.	0
123	FZ	0.	0.	0.	0.	0.	0.	0.
123	MX	0.	0.	0.	0.	0.	0.	0
123	MY	0.	0.	0.	0.	0.	0.	0
124	FX	32423.	854.	4497.	32744.	0.	32744.	-32744
124	FY	0.	0.	0.	0.	0.	0.	0
124	FZ	0.	0.	0.	0.	0.	0.	0
124	MX	0.	0.	0.	0.	0.	0.	0
124	MY	0.	0.	0.	0.	0.	0.	0
124	MZ	0.	0.	0.	0.	0.	0.	0
201	FY	924.	221007.	229.	221009.	-0.	221009.	-221009
201	FZ	2006.	27639.	12811.	30529.	73312.	103842.	42783
201	MX	37572.	14919495.	28612.	14919569.	42515.	14962085.	-14877054
202	FZ	1778.	27582.	10829.	29684.	65144.	94828.	35459
202	MX	23751.	217251.	11012.	218822.	88536.	307358.	-130287

(lb, in lb)

SRSS-4.3 WHITING CORPORATION ANSYS SRSS PROGRAM 79604 87/06/17.
TABLE # B44 LS 2 MODE 1 SCALE FACTOR = .0801 BY MJM 8/26/87 PAGE B-34 OF 58

79604/MJM/AEP, DCC, OLD MAIN TROLLEY MID, NO LD / OBE "X"

REACTION SUMMARY

LOAD STEP / NODE	LABEL	1	2	3	SRSS	STATIC	SUM	DIFFER
101	FY	651.	19360.	174.	19372.	0.	19372.	-19372.
101	FZ	2818.	2603.	13366.	13906.	77038.	90943.	63132.
101	MX	61465.	1293655.	32461.	1295521.	43418.	1338939.	-1252104.
102	FZ	2597.	2575.	11463.	12032.	68869.	80902.	56837.
102	MX	50387.	63514.	12219.	81989.	89442.	171431.	7453.
123	FY	0.	0.	0.	0.	0.	0.	0.
123	FZ	0.	0.	0.	0.	0.	0.	0.
123	MX	0.	0.	0.	0.	0.	0.	0.
123	MY	0.	0.	0.	0.	0.	0.	0.
124	FX	32423.	834.	4497.	32744.	0.	32744.	-32744.
124	FY	0.	0.	0.	0.	0.	0.	0.
124	FZ	0.	0.	0.	0.	0.	0.	0.
124	MX	0.	0.	0.	0.	0.	0.	0.
124	MY	0.	0.	0.	0.	0.	0.	0.
124	MZ	0.	0.	0.	0.	0.	0.	0.
201	FY	924.	17715.	229.	17740.	-0.	17740.	-17740.
201	FZ	2006.	2262.	12811.	13163.	73312.	86475.	60150.
201	MX	37572.	1195383.	28612.	1196315.	42515.	1238830.	-1153800.
202	FZ	1778.	2283.	10829.	11209.	65144.	76352.	53935.
202	MX	23751.	28769.	11012.	38898.	88536.	127433.	49638.

(lb, in lb)

SRSS-4.3 WHITING CORPORATION ANSYS SRSS PROGRAM 79604 87/06/17.
TABLE # B45 BY MJM PAGE B-35 OF 58

79604/MJM/AEP, DCC, OLD MAIN TROLLEY MID, NO LD / SSE

REACTION SUMMARY

NODE	LABEL	LOAD STEP 1	2	3	SRSS	STATIC	SUM	DIFFER
101	FY	1287.	453119.	352.	453121.	0.	453121.	-453121.
101	FZ	5987.	59644.	31962.	67933.	77038.	144970.	9105.
101	MX	114435.	30263751.	74935.	30264060.	43418.	30307478.	-30220643.
102	FZ	5451.	58975.	27412.	65262.	68869.	134132.	3607.
102	MX	95150.	1280471.	27069.	1284287.	89442.	1373728.	-1194845.
123	FY	0.	0.	0.	0.	0.	0.	0.
123	FZ	0.	0.	0.	0.	0.	0.	0
123	MX	0.	0.	0.	0.	0.	0.	0
123	MY	0.	0.	0.	0.	0.	0.	0
124	FX	61748.	1580.	10525.	62658.	0.	62658.	-62658
124	FY	0.	0.	0.	0.	0.	0.	0
124	FZ	0.	0.	0.	0.	0.	0.	0
124	MX	0.	0.	0.	0.	0.	0.	0
124	MY	0.	0.	0.	0.	0.	0.	0
124	MZ	0.	0.	0.	0.	0.	0.	0
201	FY	1709.	414417.	462.	414421.	-0.	414421.	-414421
201	FZ	4598.	51830.	30635.	60382.	73312.	133695.	12930
201	MX	75797.	27976082.	66882.	27976265.	42515.	28018780.	-27933750
202	FZ	4024.	51724.	25894.	57984.	65144.	123127.	7160
202	MX	48954.	408215.	25947.	411958.	88536.	500494.	-323423

(lb, in lb)

[illegible]

SRSS-4.3 WHITING CORPORATION ANSYS SRSS PROGRAM 79604 87/06/17.
TABLE # 846 LS 2 MODE 1 SCALE FACTOR = .0554 BY MJM PAGE 8-36 OF 58
RM182687

79604/MJM/AEP, DCC, OLD MAIN TROLLEY MID, NO LD / SSE

REACTION SUMMARY

LOAD STEP NODE	LABEL	1	2	3	SRSS	STATIC	SUM	DIFFER
101	FY	1287.	25121.	352.	25157.	0.	25157.	-25157.
101	FZ	5987.	3491.	31962.	32705.	77038.	109742.	44333.
101	MX	114435.	1679176.	74935.	1684738.	43418.	1728156.	-1641320.
102	FZ	5451.	3472.	27412.	28164.	68869.	97033.	40705.
102	MX	95150.	92480.	27069.	135421.	89442.	224862.	-45979.
123	FY	0.	0.	0.	0.	0.	0.	0.
123	FZ	0.	0.	0.	0.	0.	0.	0.
123	MX	0.	0.	0.	0.	0.	0.	0.
123	MY	0.	0.	0.	0.	0.	0.	0.
124	FX	61748.	1542.	10525.	62657.	0.	62657.	-62657.
124	FY	0.	0.	0.	0.	0.	0.	0.
124	FZ	0.	0.	0.	0.	0.	0.	0.
124	MX	0.	0.	0.	0.	0.	0.	0.
124	MY	0.	0.	0.	0.	0.	0.	0.
124	MZ	0.	0.	0.	0.	0.	0.	0.
201	FY	1709.	22990.	462.	23058.	-0.	23058.	-23058.
201	FZ	4598.	3061.	30635.	31129.	73312.	104441.	42184.
201	MX	75797.	1551117.	66882.	1554407.	42515.	1596923.	-1511892
202	FZ	4024.	3143.	25894.	26393.	65144.	91537.	38751
202	MX	48954.	55198.	25947.	78208.	88536.	166744.	10327

(lb, in lb)

SRSS-4.3 WHITING CORPORATION ANSYS SRSS PROGRAM 79604 87/06/17.
TABLE #B47 BY MJM PAGE B-37 OF 58

79604/MJM/AEP, DCC, OLD MAIN TROLLEY 1/4, NO LD / OBE

REACTION SUMMARY

LOAD STEP NODE	LABEL	1	2	3	SRSS	STATIC	SUM	DIFFER
101	FY	7570.	299492.	700.	299588.	0.	299588.	-299588.
101	FZ	7539.	34459.	11498.	37101.	96753.	133854.	59653.
101	MX	509939.	20048044.	78267.	20054681.	41923.	20096603.	-20012758.
102	FZ	7942.	34792.	9142.	36840.	85152.	121992.	48312.
102	MX	74318.	290332.	21240.	300445.	88685.	389130.	-211760.
123	FY	0.	0.	0.	0.	0.	0.	0.
123	FZ	0.	0.	0.	0.	0.	0.	0.
123	MX	0.	0.	0.	0.	0.	0.	0.
123	MY	0.	0.	0.	0.	0.	0.	0
124	FX	29151.	11113.	12583.	33639.	0.	33639.	-33639
124	FY	0.	0.	0.	0.	0.	0.	0
124	FZ	0.	0.	0.	0.	0.	0.	0
124	MX	0.	0.	0.	0.	0.	0.	0
124	MY	0.	0.	0.	0.	0.	0.	0
124	MZ	0.	0.	0.	0.	0.	0.	0
201	FY	3624.	140492.	526.	140540.	-0.	140540.	-140540
201	FZ	3225.	17577.	6260.	18935.	53637.	72573.	34702
201	MX	220891.	8123646.	15609.	8126663.	38847.	8165511.	-8087816
202	FZ	2894.	17811.	5653.	18909.	48820.	67729.	29911
202	MX	59766.	725083.	28522.	728101.	85403.	813504.	-642699

(lb, in lb)

79604/MJM/AEP, DCC, OLD MAIN TROLLEY 1/4, NO LD / OBE

REACTION SUMMARY

LOAD STEP NODE	LABEL	1	2	3	SRSS	STATIC	SUM	DIFFER
101	FY	7570.	23803.	700.	24988.	0.	24988.	-24988.
101	FZ	7539.	2698.	11498.	14011.	96753.	110765.	82742.
101	MX	509939.	1607676.	78267.	1688427.	41923.	1730349.	-1646504.
102	FZ	7942.	2703.	9142.	12408.	85152.	97560.	72744.
102	MX	74318.	266032.	21240.	277033.	88685.	365718.	-188348.
123	FY	0.	0.	0.	0.	0.	0.	0.
123	FZ	0.	0.	0.	0.	0.	0.	0.
123	MX	0.	0.	0.	0.	0.	0.	0.
123	MY	0.	0.	0.	0.	0.	0.	0.
124	FX	29151.	2364.	12583.	31838.	0.	31838.	-31838.
124	FY	0.	0.	0.	0.	0.	0.	0.
124	FZ	0.	0.	0.	0.	0.	0.	0.
124	MX	0.	0.	0.	0.	0.	0.	0.
124	MY	0.	0.	0.	0.	0.	0.	0
124	MZ	0.	0.	0.	0.	0.	0.	0
201	FY	3624.	11323.	526.	11901.	-0.	11901.	-11901
201	FZ	3225.	1371.	6260.	7174.	53637.	60811.	46464
201	MX	220891.	706609.	15609.	740495.	38847.	779342.	-701647
202	FZ	2894.	1400.	5653.	6503.	48820.	55323.	42317
202	MX	59766.	217437.	28522.	227297.	85403.	312700.	-141895

(lb, in lb)

[illegible]

SRSS-4.3 WHITING CORPORATION ANSYS SRSS PROGRAM 79604 87/06/17.
TABLE # B49 BY MJM PAGE B-39 OF 58

79604/MJM/AEP, DCC, OLD MAIN TROLLEY 1/4, NO LD / SSE

REACTION SUMMARY

LOAD STEP NODE	LABEL	1	2	3	SRSS	STATIC	SUM	DIFFER
101	FY	14177.	561578.	1597.	561759.	0.	561759.	-561759.
101	FZ	16636.	64616.	27501.	72169.	96753.	168922.	24585.
101	MX	955632.	37591937.	183870.	37604531.	41923.	37646454.	-37562609.
102	FZ	16309.	65241.	21783.	70688.	85152.	155840.	14464.
102	MX	133585.	519798.	49478.	538965.	88685.	627650.	-450280.
123	FY	0.	0.	0.	0.	0.	0.	0.
123	FZ	0.	0.	0.	0.	0.	0.	0.
123	MX	0.	0.	0.	0.	0.	0.	0.
123	MY	0.	0.	0.	0.	0.	0.	0.
124	FX	54272.	20795.	28306.	64646.	0.	64646.	-64646.
124	FY	0.	0.	0.	0.	0.	0.	0.
124	FZ	0.	0.	0.	0.	0.	0.	0.
124	MX	0.	0.	0.	0.	0.	0.	0.
124	MY	0.	0.	0.	0.	0.	0.	0.
124	MZ	0.	0.	0.	0.	0.	0.	0.
201	FY	6788.	263436.	1214.	263526.	-0.	263526.	-263526.
201	FZ	7768.	32960.	15001.	37037.	53637.	90674.	16600
201	MX	411454.	15231720.	33352.	15237313.	38847.	15276160.	-15198466
202	FZ	6990.	33397.	13547.	36711.	48820.	85531.	12109
202	MX	108988.	1354097.	67500.	1360152.	85403.	1445554.	-1274749

(lb, in lb)

SRSS-4.3 WHITING CORPORATION ANSYS SRSS PROGRAM 79604 87/06/17.
TABLE # 850 LS 2 MODE 1 SCALE FACTOR = .0521 BY MJM PAGE 8-40 OF 58

79604/MJM/AEP, DCC, OLD MAIN TROLLEY 1/4, NO LD / SSE

REACTION SUMMARY

LOAD STEP / NODE	LABEL	1	2	3	SRSS	STATIC	SUM	DIFFER
101	FY	14177.	30718.	1597.	33869.	0.	33869.	-33869.
101	FZ	16636.	3451.	27501.	32326.	96753.	129080.	64427.
101	MX	955632.	2091436.	183870.	2306760.	41923.	2348683.	-2264838.
102	FZ	16309.	3418.	21783.	27426.	85152.	112578.	57726.
102	MX	133585.	471695.	49478.	492736.	88685.	581421.	-404051.
123	FY	0.	0.	0.	0.	0.	0.	0.
123	FZ	0.	0.	0.	0.	0.	0.	0.
123	MX	0.	0.	0.	0.	0.	0.	0.
123	MY	0.	0.	0.	0.	0.	0.	0.
124	FX	54272.	4053.	28306.	61344.	0.	61344.	-61344.
124	FY	0.	0.	0.	0.	0.	0.	0.
124	FZ	0.	0.	0.	0.	0.	0.	0.
124	MX	0.	0.	0.	0.	0.	0.	0.
124	MY	0.	0.	0.	0.	0.	0.	0.
124	MZ	0.	0.	0.	0.	0.	0.	0.
201	FY	6788.	14825.	1214.	16350.	-0.	16350.	-16350.
201	FZ	7768.	1746.	15001.	16983.	53637.	70621.	36654.
201	MX	411454.	977787.	33352.	1061355.	38847.	1100202.	-1022508
202	FZ	6990.	1788.	13547.	15348.	48820.	64168.	33472.
202	MX	108988.	381647.	67500.	402602.	85403.	488005.	-317200

(lb, in lb)

[illegible]

79604/MJM/AEP, DCC, OLD MAIN TROLLEY RH END, NO LD / OBE

REACTION SUMMARY

LOAD STEP NODE	LABEL	1	2	3	SRSS	STATIC	SUM	DIFFER
101	FY	4723.	52689.	918.	52908.	0.	52908.	-52908.
101	FZ	6374.	3301.	5745.	9194.	107363.	116557.	98169.
101	MX	242849.	3188424.	69730.	3198419.	39266.	3237685.	-3159153.
102	FZ	6698.	4182.	4369.	9025.	96327.	105352.	87302.
102	MX	127156.	1210645.	19009.	1217453.	91092.	1308545.	-1126361.
123	FY	0.	0.	0.	0.	0.	0.	0.
123	FZ	0.	0.	0.	0.	0.	0.	0.
123	MX	0.	0.	0.	0.	0.	0.	0.
123	MY	0.	0.	0.	0.	0.	0.	0.
124	FX	24162.	6711.	12596.	28063.	0.	28063.	-28063
124	FY	0.	0.	0.	0.	0.	0.	0
124	FZ	0.	0.	0.	0.	0.	0.	0
124	MX	0.	0.	0.	0.	0.	0.	0
124	MY	0.	0.	0.	0.	0.	0.	0
124	MZ	0.	0.	0.	0.	0.	0.	0
201	FY	2386.	29456.	330.	29554.	-0.	29554.	-29554
201	FZ	4180.	2463.	3629.	6059.	43041.	49100.	36982
201	MX	75526.	1616605.	20677.	1618500.	37117.	1655617.	-1581383
202	FZ	4195.	2848.	3067.	5926.	37631.	43557.	31706
202	MX	50351.	901107.	7424.	902543.	84353.	986896.	-818190

(lb, in lb)

SRSS-4.3 WHITING CORPORATION ANSYS SRSS PROGRAM 79604 87/06/17.
TABLE # 852 LS 2 MODE 1 SCALE FACTOR = .3696 BY MJM PAGE 8-42 OF 58

79604/MJM/AEP, DCC, OLD MAIN TROLLEY RH END, NO LD / OBE

REACTION SUMMARY

LOAD STEP NODE	LABEL	1	2	3	SRSS	STATIC	SUM	DIFFER
101	FY	4723.	43606.	918.	43871.	0.	43871.	-4387:
101	FZ	6374.	2755.	5745.	9013.	107363.	116376.	9835:
101	MX	242849.	2919399.	69730.	2930312.	39266.	2969578.	-289104!
102	FZ	6698.	3285.	4369.	8646.	96327.	104973.	8768:
102	MX	127156.	822455.	19009.	832444.	91092.	923536.	-74135:
123	FY	0.	0.	0.	0.	0.	0.	(
123	FZ	0.	0.	0.	0.	0.	0.	(
123	MX	0.	0.	0.	0.	0.	0.	(
123	MY	0.	0.	0.	0.	0.	0.	(
124	FX	24162.	3637.	12596.	27490.	0.	27490.	-2749(
124	FY	0.	0.	0.	0.	0.	0.	(
124	FZ	0.	0.	0.	0.	0.	0.	(
124	MX	0.	0.	0.	0.	0.	0.	(
124	MY	0.	0.	0.	0.	0.	0.	(
124	MZ	0.	0.	0.	0.	0.	0.	(
201	FY	2386.	25550.	330.	25664.	-0.	25664.	-2566
201	FZ	4180.	2078.	3629.	5913.	43041.	48954.	3712
201	MX	75526.	1615928.	20677.	1617824.	37117.	1654941.	-158070
202	FZ	4195.	2214.	3067.	5649.	37631.	43280.	3198:
202	MX	50351.	855039.	7424.	856552.	84353.	940905.	-77219

(lb, in lb)

[illegible]

SRSS-4.3 WHITING CORPORATION ANSYS SRSS PROGRAM 79604 87/06/17.
TABLE # B53 BY MJM PAGE B-43 OF 58

79604/MJM/AEP, DCC, OLD MAIN TROLLEY RH END, NO LD / SSE

REACTION SUMMARY

LOAD STEP NODE	LABEL	1	2	3	SRSS	STATIC	SUM	DIFFER
101	FY	9158.	98535.	1900.	98978.	0.	98978.	-98978.
101	FZ	14291.	6626.	12952.	20393.	107363.	127756.	86970.
101	MX	480112.	5921221.	154045.	5942651.	39266.	5981917.	-5903384.
102	FZ	13393.	8315.	9500.	18405.	96327.	114733.	77922.
102	MX	245043.	2283548.	36669.	2296950.	91092.	2388042.	-2205858.
123	FY	0.	0.	0.	0.	0.	0.	0.
123	FZ	0.	0.	0.	0.	0.	0.	0.
123	MX	0.	0.	0.	0.	0.	0.	0.
123	MY	0.	0.	0.	0.	0.	0.	0.
124	FX	47007.	12988.	27806.	56139.	0.	56139.	-56139.
124	FY	0.	0.	0.	0.	0.	0.	0
124	FZ	0.	0.	0.	0.	0.	0.	0
124	MX	0.	0.	0.	0.	0.	0.	0
124	MY	0.	0.	0.	0.	0.	0.	0
124	MZ	0.	0.	0.	0.	0.	0.	0
201	FY	4626.	54352.	622.	54552.	-0.	54552.	-54552
201	FZ	9479.	4573.	8386.	13457.	43041.	56499.	29584
201	MX	143124.	2922623.	45843.	2926485.	37117.	2963601.	-2889368
202	FZ	8909.	5322.	7004.	12520.	37631.	50151.	25111
202	MX	95390.	1642764.	14628.	1645597.	84353.	1729950.	-1561244

(lb, in lb)

SRSS-4.3 WHITING CORPORATION ANSYS SRSS PROGRAM 79604 87/06/17.
TABLE # 054 LS 2 MODE 1 SCALE FACTOR = .2156 BY MJM PAGE B-44 OF 58

79604/MJM/AEP, DCC, OLD MAIN TROLLEY RH END, NO LD / SSE

REACTION SUMMARY

NODE	LOAD STEP LABEL	1	2	3	SRSS	STATIC	SUM	DIFFER
101	FY	9158.	78204.	1900.	78761.	0.	78761.	-78761
101	FZ	14291.	5508.	12952.	20058.	107363.	127421.	87305
101	MX	480112.	5320727.	154045.	5344565.	39266.	5383831.	-5305299
102	FZ	13393.	6450.	9500.	17641.	96327.	113969.	78686
102	MX	245043.	1404326.	36669.	1426017.	91092.	1517109.	-1334925
123	FY	0.	0.	0.	0.	0.	0.	0
123	FZ	0.	0.	0.	0.	0.	0.	0
123	MX	0.	0.	0.	0.	0.	0.	0
123	MY	0.	0.	0.	0.	0.	0.	0
124	FX	47007.	6167.	27806.	54962.	0.	54962.	-54962
124	FY	0.	0.	0.	0.	0.	0.	0
124	FZ	0.	0.	0.	0.	0.	0.	0
124	MX	0.	0.	0.	0.	0.	0.	0
124	MY	0.	0.	0.	0.	0.	0.	0
124	MZ	0.	0.	0.	0.	0.	0.	0
201	FY	4626.	45514.	622.	45753.	-0.	45753.	-45753
201	FZ	9479.	3705.	8386.	13188.	43041.	56229.	29854
201	MX	143124.	2921086.	45843.	2924949.	37117.	2962066.	-2887832
202	FZ	8909.	3892.	7004.	11982.	37631.	49614.	25649
202	MX	95390.	1538277.	14628.	1541302.	84353.	1625655.	-1456949

(lb, in lb)

[illegible]

TABLE 8-55

DBE GIRDER TO END TIE CONNECTION

SUM OF ELEMENT FORCES IN ELEMENT CO-ORDINATE SYSTEM (lb, in-lb)

			ELEM		NODE	FX	FY	FZ	MX	MY	MZ
MID	50	U	14	I	151	16043.	31397.	1883.	7186.	75429.	2660800.
MID	50	U	15	I	155	16043.	30706.	2006.	7186.	81974.	3678000.
MID	50	U	72	I	251	10918.	31453.	1869.	7343.	73412.	3730600.*
MID	50	U	73	I	255	10918.	31489.	1994.	7343.	81149.	2632800.
MID	50	D	14	I	151	19532.	33957.	1919.	7962.*	79934.	3225800.
MID	50	D	15	I	155	19532.	34000.*	2052.	7962.*	85839.	3607200.
MID	50	D	72	I	251	14076.	28447.	1907.	7567.	78280.	3040000.
MID	50	D	73	I	255	14076.	28622.	2038.	7567.	84808.	2693500.
1/4	50	U	14	I	151	20947.	17914.	1894.	3909.	77327.	1598200.
1/4	50	U	15	I	155	20947.	17933.	2013.	3909.	81926.	2035300.
1/4	50	U	72	I	251	7833.	19224.	1843.	3928.	69930.	2121200.
1/4	50	U	73	I	255	7833.	19288.	1901.	3928.	72781.	1809200.
1/4	50	D	14	I	151	28780.	23114.	1952.	4199.	84590.	2101100.
1/4	50	D	15	I	155	28780.	23250.	2078.*	4199.	87149.*	2587800.
1/4	50	D	72	I	251	10000.	26584.	1872.	4803.	73360.	2901000.
1/4	50	D	73	I	255	10000.	26659.	1929.	4803.	75181.	2492100.
END	50	U	14	I	151	29151.	21424.	1920.	2528.	81186.	1537100.
END	50	U	15	I	155	29151.	21182.	2030.	2528.	82415.	2778000.
END	50	U	72	I	251	15569.	22476.	1853.	4828.	72249.	2459100.
END	50	U	73	I	255	15569.	22368.	1914.	4828.	72715.	2631300.
END	50	D	14	I	151	38544.*	21467.	1964.	2528.	86420.	1576900.
END	50	D	15	I	155	38544.*	21272.	2078.*	2528.	86446.	2777500.
END	50	D	72	I	251	15788.	29950.	1870.	5747.	73735.	3545000.
END	50	D	73	I	255	15788.	29990.	1922.	5747.	73771.	2999700.
MID	NO		14	I	151	11066.	19294.	1844.	6215.	70725.	1825300.
MID	NO		15	I	155	11066.	19300.	1956.	6215.	77762.	2061100.
MID	NO		72	I	251	7974.	16318.	1837.	5996.	69804.	1748800.
MID	NO		73	I	255	7974.	16409.	1947.	5996.	77115.	1540900.
1/4	NO		14	I	151	16398.	15056.	1872.	3635.	74327.	1315300.
1/4	NO		15	I	155	16398.	14997.	1965.	3635.	77853.	1737100.
1/4	NO		72	I	251	6594.	14876.	1829.	3401.	68306.	1664800.
1/4	NO		73	I	255	6594.	14925.	1881.	3401.	70985.	1407900.
RHE	NO		14	I	151	32938.	21203.	1940.	1919.	83936.	1443000.
RHE	NO		15	I	155	32938.	21125.	2026.	1919.	81224.	2826200.
RHE	NO		72	I	251	19222.	28387.	1875.	5672.	75245.	2472600.
RHE	NO		73	I	255	19222.	28053.	1930.	5672.	73722.	3531400.

* DENOTES A MAXIMUM

EFS-1.2 FOR SRSS-4.3

WHITING REQN 79604 DATE 6-19-87
BY MJM PAGE B-46 OF 53
AAJ 82687

TABLE B56

SSE GIRDER TO END TIE CONNECTION

SUM OF ELEMENT FORCES IN ELEMENT CO-ORDINATE SYSTEM (lb, in-lb)

			ELEM		NODE	FX	FY	FZ	MX	MY	MZ
MID	50	U	14	I	151	21542.	45516.	1935.	8881.	81438.	3588800.
MID	50	U	15	I	155	21542.	43946.	2051.	8881.	85805.	5572400.
MID	50	U	72	I	251	13950.	49060.	1912.	9520.	77996.	5996700.
MID	50	U	73	I	255	13950.	49034.	2037.	9520.	84829.	3913200.
MID	50	D	14	I	151	27797.	48384.	2002.	10480.*	89851.	4594700.
MID	50	D	15	I	155	27797.	48437.	2143.	10480.*	93466.	5140600.
MID	50	D	72	I	251	20028.	40584.	1985.	10025.	87497.	4347600.
MID	50	D	73	I	255	20028.	40827.	2123.	10025.	92097.	3832800.
1/4	50	U	14	I	151	27566.	25853.	1944.	5358.	83623.	2236000.
1/4	50	U	15	I	155	27566.	25721.	2068.	5358.	86226.	2984700.
1/4	50	U	72	I	251	11503.	25017.	1867.	4904.	72983.	2818800.
1/4	50	U	73	I	255	11503.	25114.	1932.	4904.	75105.	2369200.
1/4	50	D	14	I	151	41197.	34329.	2048.	5769.	96331.	3069900.
1/4	50	D	15	I	155	41197.	34435.	2182.	5769.	95418.	3877400.
1/4	50	D	72	I	251	15089.	37878.	1918.	6421.	78868.	4160300.
1/4	50	D	73	I	255	15089.	37989.	1978.	6421.	79191.	3562500.
END	50	U	14	I	151	43470.	39246.	2027.	4068.	95340.	2767800.
END	50	U	15	I	155	43470.	38748.	2150.	4068.	90998.	5099100.
END	50	U	72	I	251	28267.	32414.	1903.	6617.	80005.	3109400.
END	50	U	73	I	255	28267.	31987.	1987.	6617.	77414.	4441400.
END	50	D	14	I	151	57701*	39292.	2091.	4066.	102910.	2817000.
END	50	D	15	I	155	57701.*	38856.	2220.*	4066.	97105.	5098100.
END	50	D	72	I	251	28531.	44051.	1929.	8000.	82034.	4948800.
END	50	D	73	I	255	28531.	43930.	1998.	8000.	78896.	4942600.
MID	NO		14	I	151	14376.	25195.	1877.	7889.	74649.	2375300.
MID	NO		15	I	155	14376.	25173.	1992.	7889.	80787.	2700000.
MID	NO		72	I	251	10353.	21482.	1867.	7677.	73408.	2320700.
MID	NO		73	I	255	10353.	21585.	1982.	7677.	80014.	2011400.
1/4	NO		14	I	151	22264.	22804.	1917.	4909.	79905.	1925400.
1/4	NO		15	I	155	22264.	22579.	2011.	4909.	81470.	2673300.
1/4	NO		72	I	251	10117.	19833.	1850.	4244.	70999.	2286800.
1/4	NO		73	I	255	10117.	19910.	1908.	4244.	72975.	1894500.
RHE	NO		14	I	151	57245.	37612.	2086.	3089.	103290.*	2578400.
RHE	NO		15	I	155	57245.	37546.	2192.	3089.	93236.	4987600.
RHE	NO		72	I	251	34657.	49500.*	1957.	8738.	86433.	3848500.
RHE	NO		73	I	255	34657.	48769.	2023.	8738.	80161.	6358900.*

* DENOTES A MAXIMUM

TABLE B57

OBE TROLLEY REACTIONS
SUM OF ELEMENT FORCES IN ELEMENT CO-ORDINATE SYSTEM (lb, in-lb)

			ELEM	NODE	FX	FY	FZ	MX	MY	MZ
MID	50	U	60 J	391	111710.	0.	0.	0.	0.	0.
MID	50	U	61 J	393	70629.	18774.	11484.	0.	0.	0.
MID	50	U	62 J	392	111120.	20165.	0.	0.	0.	0.
MID	50	U	63 J	394	71057.	0.	11946.	0.	0.	0.
MID	50	D	60 J	391	161740.	0.	0.	0.	0.	0.
MID	50	D	61 J	393	118900.	21813.	11721.	0.	0.	0.
MID	50	D	62 J	392	161490.	25653.	0.	0.	0.	0.
MID	50	D	63 J	394	119130.	0.	11757.	0.	0.	0.
1/4	50	U	60 J	391	107120.	-0.	0.	0.	0.	0.
1/4	50	U	61 J	393	45590.	10718.	8623.	0.	0.	0.
1/4	50	U	62 J	392	75758.	21635.	0.	0.	0.	0.
1/4	50	U	63 J	394	78111.	0.	8479.	0.	0.	0.
1/4	50	D	60 J	391	161840.*	0.	0.	0.	0.	0.
1/4	50	D	61 J	393	95357.	14473.	11872.	0.	0.	0.
1/4	50	D	62 J	392	126770.	29841.	0.	0.	0.	0.
1/4	50	D	63 J	394	130980.	0.	11815.	0.	0.	0.
END	50	U	60 J	391	102230.	0.	0.	0.	0.	0.
END	50	U	61 J	393	50635.	15205.	11430.	0.	0.	0.
END	50	U	62 J	392	77394.	28127.	0.	0.	0.	0.
END	50	U	63 J	394	76243.	0.	12029.	0.	0.	0.
END	50	D	60 J	391	145890.	0.	0.	0.	0.	0.
END	50	D	61 J	393	92174.	15370.	13332.	0.	0.	0.
END	50	D	62 J	392	118460.	39380.*	0.	0.	0.	0.
END	50	D	63 J	394	120080.	0.	14116.*	0.	0.	0.
MID	NO		60 J	391	63063.	0.	0.	0.	0.	0.
MID	NO		61 J	393	28189.	12423.	10811.	0.	0.	0.
MID	NO		62 J	392	63068.	14541.	0.	0.	0.	0.
MID	NO		63 J	394	28015.	0.	10835.	0.	0.	0.
1/4	NO		60 J	391	74837.	0.	0.	0.	0.	0.
1/4	NO		61 J	393	14259.	8622.	9968.	0.	0.	0.
1/4	NO		62 J	392	47858.	16797.	0.	0.	0.	0.
1/4	NO		63 J	394	46043.	0.	10021.	0.	0.	0.
RHE	NO		60 J	391	74139.	0.	0.	0.	0.	0.
RHE	NO		61 J	393	26048.	15405.	11571.	0.	0.	0.
RHE	NO		62 J	392	53301.	25359.	0.	0.	0.	0.
RHE	NO		63 J	394	49360.	0.	12015.	0.	0.	0.

* DENOTES A MAXIMUM

TABLE B58

ORE TROLLEY REACTIONS

DIFFERENCE OF ELEMENT FORCES IN ELEMENT CO-ORDINATE SYSTEM (lb, in-lb)

		ELEM	NODE	FX	FY	FZ	MX	MY	MZ
MID	50 U	60	J 391	38715.	0.	0.	0.	0.	0.
MID	50 U	61	J 393	22955.	-18555.	-11366.	0.	0.	0.
MID	50 U	62	J 392	39311.	-19946.	0.	0.	0.	0.
MID	50 U	63	J 394	22523.	0.	-11828.	0.	0.	0.
MID	50 D	60	J 391	-11312.	0.	0.	0.	0.	0.
MID	50 D	61	J 393	-25317.	-21594.	-11603.	0.	0.	0.
MID	50 D	62	J 392	-11054.	-25434.	0.	0.	0.	0.
MID	50 D	63	J 394	-25553.	0.	-11639.	0.	0.	0.
1/4	50 U	60	J 391	69725.	0.	0.	0.	0.	0.
1/4	50 U	61	J 393	21572.	-10379.	-8440.	0.	0.	0.
1/4	50 U	62	J 392	48253.	-21296.	0.	0.	0.	0.
1/4	50 U	63	J 394	41890.	0.	-8296.	0.	0.	0.
1/4	50 D	60	J 391	15005.	0.	0.	0.	0.	0.
1/4	50 D	61	J 393	-28194.*	-14134.	-11689.	0.	0.	0.
1/4	50 D	62	J 392	-2755.	-29502.	0.	0.	0.	0.
1/4	50 D	63	J 394	-10983.	0.	-11632.	0.	0.	0.
END	50 U	60	J 391	71553.	0.	0.	0.	0.	0.
END	50 U	61	J 393	19589.	-14554.	-11078.	0.	0.	0.
END	50 U	62	J 392	49678.	-27476.	0.	0.	0.	0.
END	50 U	63	J 394	40697.	0.	-11677.	0.	0.	0.
END	50 D	60	J 391	27896.	0.	0.	0.	0.	0.
END	50 D	61	J 393	-21950.	-14718.	-12980.	0.	0.	0.
END	50 D	62	J 392	8611.	-38729.*	0.	0.	0.	0.
END	50 D	63	J 394	-3145.	0.	-13764.*	0.	0.	0.
MID	NO	60	J 391	37564.	0.	0.	0.	0.	0.
MID	NO	61	J 393	15180.	-12197.	-10689.	0.	0.	0.
MID	NO	62	J 392	37566.	-14316.	0.	0.	0.	0.
MID	NO	63	J 394	15347.	0.	-10713.	0.	0.	0.
1/4	NO	60	J 391	52251.	0.	0.	0.	0.	0.
1/4	NO	61	J 393	2648.	-8271.	-9779.	0.	0.	0.
1/4	NO	62	J 392	26313.	-16447.	0.	0.	0.	0.
1/4	NO	63	J 394	23781.	0.	-9831.	0.	0.	0.
RHE	NO	60	J 391	48388.	0.	0.	0.	0.	0.
RHE	NO	61	J 393	-4579.	-14494.	-11078.	0.	0.	0.
RHE	NO	62	J 392	25433.	-24448.	0.	0.	0.	0.
RHE	NO	63	J 394	15902.	0.	-11523.	0.	0.	0.

* DENOTES A MINIMUM

EFS-1.2 FOR SRSS-4.3

WHITING REQN 79604 DATE 6-19-87
BY MJM PAGE B-49 OF 53
(8268)

TABLE B59

SSE TROLLEY REACTIONS
SUM OF ELEMENT FORCES IN ELEMENT CO-ORDINATE SYSTEM (lb, in-lb)

			ELEM	NODE	FX	FY	FZ	MX	MY	MZ
MID	50	U	60	J 391	140210.	0.	0.	0.	0.	0.
MID	50	U	61	J 393	89304.	26111.	21084.	0.	0.	0.
MID	50	U	62	J 392	139030.	26083.	0.	0.	0.	0.
MID	50	U	63	J 394	90170.	0.	21872.	0.	0.	0.
MID	50	D	60	J 391	237360.*	0.	0.	0.	0.	0.
MID	50	D	61	J 393	181970.	31098.	21425.	0.	0.	0.
MID	50	D	62	J 392	236870.	36496.	0.	0.	0.	0.
MID	50	D	63	J 394	182410.	0.	21462.	0.	0.	0.
1/4	50	U	60	J 391	132300.	0.	0.	0.	0.	0.
1/4	50	U	61	J 393	58727.	14893.	17960.	0.	0.	0.
1/4	50	U	62	J 392	92011.	28496.	0.	0.	0.	0.
1/4	50	U	63	J 394	100700.	0.	17631.	0.	0.	0.
1/4	50	D	60	J 391	226460.	0.	0.	0.	0.	0.
1/4	50	D	61	J 393	149140.	21413.	22496.	0.	0.	0.
1/4	50	D	62	J 392	183410.	43023.	0.	0.	0.	0.
1/4	50	D	63	J 394	193040.	0.	22450.	0.	0.	0.
END	50	U	60	J 391	118270.	0.	0.	0.	0.	0.
END	50	U	61	J 393	63596.	28279.	22276.	0.	0.	0.
END	50	U	62	J 392	89566.	38764.	0.	0.	0.	0.
END	50	U	63	J 394	93943.	0.	23158.	0.	0.	0.
END	50	D	60	J 391	197500.	0.	0.	0.	0.	0.
END	50	D	61	J 393	141350.	28468.	24612.	0.	0.	0.
END	50	D	62	J 392	166370.	56766.*	0.	0.	0.	0.
END	50	D	63	J 394	173580.	0.	25603.*	0.	0.	0.
MID	NO		60	J 391	79278.	0.	0.	0.	0.	0.
MID	NO		61	J 393	36341.	16267.	20246.	0.	0.	0.
MID	NO		62	J 392	79320.	18882.	0.	0.	0.	0.
MID	NO		63	J 394	35943.	0.	20280.	0.	0.	0.
1/4	NO		60	J 391	89014.	0.	0.	0.	0.	0.
1/4	NO		61	J 393	18388.	12519.	19507.	0.	0.	0.
1/4	NO		62	J 392	57327.	22714.	0.	0.	0.	0.
1/4	NO		63	J 394	58353.	0.	19705.	0.	0.	0.
RHE	NO		60	J 391	85243.	0.	0.	0.	0.	0.
RHE	NO		61	J 393	38282.	25167.	21264.	0.	0.	0.
RHE	NO		62	J 392	64824.	39439.	0.	0.	0.	0.
RHE	NO		63	J 394	63874.	0.	21903.	0.	0.	0.

* DENOTES A MAXIMUM

EFS-1.2 FOR SRSS-4.3

WHITING REQN 79604 DATE 6-19-87
BY MJM PAGE B-50 OF 58
CPA 82687

TABLE B60

SSE TROLLEY REACTIONS
DIFFERENCE OF ELEMENT FORCES IN ELEMENT CO-ORDINATE SYSTEM (lb, in-lb)

		ELEM	NODE	FX	FY	FZ	MX	MY	MZ
MID	50 U	60	J 391	10219.	0.	0.	0.	0.	0.
MID	50 U	61	J 393	4280.	-25891.	-20966.	0.	0.	0.
MID	50 U	62	J 392	11405.	-25864.	0.	0.	0.	0.
MID	50 U	63	J 394	3410.	0.	-21754.	0.	0.	0.
MID	50 D	60	J 391	-86927.	0.	0.	0.	0.	0.
MID	50 D	61	J 393	-88385.	-30879.	-21307.	0.	0.	0.
MID	50 D	62	J 392	-86440.	-36277.	0.	0.	0.	0.
MID	50 D	63	J 394	-88825.*	0.	-21344.	0.	0.	0.
1/4	50 U	60	J 391	44554.	0.	0.	0.	0.	0.
1/4	50 U	61	J 393	8436.	-14554.	-17777.	0.	0.	0.
1/4	50 U	62	J 392	32000.	-28157.	0.	0.	0.	0.
1/4	50 U	63	J 394	19297.	0.	-17448.	0.	0.	0.
1/4	50 D	60	J 391	-49614.	0.	0.	0.	0.	0.
1/4	50 D	61	J 393	-81978.	-21075.	-22313.	0.	0.	0.
1/4	50 D	62	J 392	-59399.	-42684.	0.	0.	0.	0.
1/4	50 D	63	J 394	-73044.	0.	-22267.	0.	0.	0.
END	50 U	60	J 391	55515.	0.	0.	0.	0.	0.
END	50 U	61	J 393	6629.	-27627.	-21924.	0.	0.	0.
END	50 U	62	J 392	37506.	-38113.	0.	0.	0.	0.
END	50 U	63	J 394	22997.	0.	-22806.	0.	0.	0.
END	50 D	60	J 391	-23710.	0.	0.	0.	0.	0.
END	50 D	61	J 393	-71125.	-27817.	-24260.	0.	0.	0.
END	50 D	62	J 392	-39294.	-56115.*	0.	0.	0.	0.
END	50 D	63	J 394	-56641.	0.	-25251.*	0.	0.	0.
MID	NO	60	J 391	21349.	0.	0.	0.	0.	0.
MID	NO	61	J 393	7027.	-16041.	-20124.	0.	0.	0.
MID	NO	62	J 392	21313.	-18656.	0.	0.	0.	0.
MID	NO	63	J 394	7419.	0.	-20158.	0.	0.	0.
1/4	NO	60	J 391	38074.	0.	0.	0.	0.	0.
1/4	NO	61	J 393	-1481.	-12169.	-19317.	0.	0.	0.
1/4	NO	62	J 392	16845.	-22363.	0.	0.	0.	0.
1/4	NO	63	J 394	11471.	0.	-19515.	0.	0.	0.
RHE	NO	60	J 391	37284.	0.	0.	0.	0.	0.
RHE	NO	61	J 393	-16813.	-24256.	-20772.	0.	0.	0.
RHE	NO	62	J 392	13910.	-38528.	0.	0.	0.	0.
RHE	NO	63	J 394	1388.	0.	-21411.	0.	0.	0.

* DENOTES A MINIMUM

TABLE B61

OBE ROPE LOADS

SUM OF ELEMENT FORCES IN ELEMENT CO-ORDINATE SYSTEM (lb, in-lb)

		ELEM	NODE	FX	FY	FZ	MX	MY	MZ
MID	50 U	70	J 406	182840.	0.	0.	0.	0.	0.
MID	50 D	70	J 406	367280.*	0.	0.	0.	0.	0.
1/4	50 U	70	J 406	150740.	0.	0.	0.	0.	0.
1/4	50 D	70	J 406	352890.	0.	0.	0.	0.	0.
END	50 U	70	J 406	139200.	0.	0.	0.	0.	0.
END	50 D	70	J 406	333350.	0.	0.	0.	0.	0.
MID	NO	70	J 406	24694.	0.	0.	0.	0.	0.
1/4	NO	70	J 406	23664.	0.	0.	0.	0.	0.
RHE	NO	70	J 406	22256.	0.	0.	0.	0.	0.

* DENOTES A MAXIMUM

TABLE B62

OBE ROPE LOADS

DIFFERENCE OF ELEMENT FORCES IN ELEMENT CO-ORDINATE SYSTEM (lb, in-lb)

		ELEM	NODE	FX	FY	FZ	MX	MY	MZ
MID	50 U	70 J	406	57192.	0.	0.	0.	0.	0.
MID	50 D	70 J	406	-127250.*	0.	0.	0.	0.	0.
1/4	50 U	70 J	406	89294.	0.	0.	0.	0.	0.
1/4	50 D	70 J	406	-112860.	0.	0.	0.	0.	0.
END	50 U	70 J	406	100840.	0.	0.	0.	0.	0.
END	50 D	70 J	406	-93319.	0.	0.	0.	0.	0.
MID	NO	70 J	406	15307.	0.	0.	0.	0.	0.
1/4	NO	70 J	406	16336.	0.	0.	0.	0.	0.
RHE	NO	70 J	406	17744.	0.	0.	0.	0.	0.

* DENOTES A MINIMUM

TABLE B63

SSE ROPE LOADS

SUM OF ELEMENT FORCES IN ELEMENT CO-ORDINATE SYSTEM (lb, in-lb)

		ELEM	NODE	FX	FY	FZ	MX	MY	MZ
MID	50 U	70 J	406	232540.	0.	0.	0.	0.	0.
MID	50 D	70 J	406	583660.*	0.	0.	0.	0.	0.
1/4	50 U	70 J	406	192150.	0.	0.	0.	0.	0.
1/4	50 D	70 J	406	556660.	0.	0.	0.	0.	0.
END	50 U	70 J	406	164930.	0.	0.	0.	0.	0.
END	50 D	70 J	406	519990.	0.	0.	0.	0.	0.
MID	NO	70 J	406	31220.	0.	0.	0.	0.	0.
1/4	NO	70 J	406	28491.	0.	0.	0.	0.	0.
RHE	NO	70 J	406	24622.	0.	0.	0.	0.	0.

* DENOTES A MAXIMUM

EFS-1.2 FOR SRSS-4.3

WHITING REQN 79604 DATE 6-19-87
BY MJM PAGE B-54 OF 58

TABLE B64

SSE ROPE LOADS
DIFFERENCE OF ELEMENT FORCES IN ELEMENT CO-ORDINATE SYSTEM (lb, in-lb)

		ELEM	NODE	FX	FY	FZ	MX	MY	MZ
MID	50 U	70 J	406	7496.	0.	0.	0.	0.	0.
MID	50 D	70 J	406	-343630. *	0.	0.	0.	0.	0.
1/4	50 U	70 J	406	47885.	0.	0.	0.	0.	0.
1/4	50 D	70 J	406	-316630.	0.	0.	0.	0.	0.
END	50 U	70 J	406	75100.	0.	0.	0.	0.	0.
END	50 D	70 J	406	-279950.	0.	0.	0.	0.	0.
MID	NO	70 J	406	8781.	0.	0.	0.	0.	0.
1/4	NO	70 J	406	11509.	0.	0.	0.	0.	0.
RHE	NO	70 J	406	15378.	0.	0.	0.	0.	0.

* DENOTES A MINIMUM

FORM N-2494

WHITING REQN. 79604 DATE 8-12-87

BY MJM PAGE 8-55 OF 55

CWA 22627

TABLE B65

ELEMENT LOADS FOR GIRDER A AT THE POINTS OF THE MAXIMUM STRESS WITHIN THE ELEMENT RANGE FROM 22 TO 32 (NOMINAL GIRDER SECTION)

ALL LOADS ARE IN ELEMENT COORDINATE SYSTEM

TROLLEY	LOAD	ELEM	NODE	FX (KIP)	FY (KIP)	FZ (KIP)	MX (IN KIP)	MY (IN KIP)		MZ (IN KIP)
								SUM	DIFF	
OBE										
MID	UP	28	311	33.8	11.7	11.7	506.7	48199	17811	2230
	DN	28	312	38.4	12.5	13.8	573.4	68131	-2758	2919
1/4	UP	27	310	17.5	2.9	20.0	247.5	29215	18231	1655
	DN	27	310	23.0	3.3	45.3	309.1	47099	347	2268
END	UP	29	312	22.6	7.4	19.4	238.6	16280	11072	1485
	DN	26	309	20.3	3.7	16.9	227.7	26321	2881	1734
SSE										
MID	UP	28	311	51.1	17.1	15.5	690.8	60141	5869	3382
	DN	28	312	58.2	17.8	16.5	797.1	99367	-34393	4148
1/4	UP	27	310	25.3	5.3	26.1	322.2	36862	10584	2177
	DN	27	310	34.4	5.7	71.8	423.6	67607	-20162	3228
END	UP	26	309	32.9	7.2	9.4	369.7	20925	8277	1750
	DN	26	309	35.2	7.5	29.0	369.5	36659	-7456	2512

FORM N-2494

WHITING REQN. 79604 DATE 8-12-87

BY MJM PAGE B-56 OF 58

MJ 8/26/87

TABLE B 66

ELEMENT LOADS FOR GIRDER B AT THE POINTS OF THE MAXIMUM STRESS WITHIN THE ELEMENT RANGE FROM 46 TO 56 (NOMINAL GIRDER SECTION)

ALL LOADS ARE IN ELEMENT COORDINATE SYSTEM

TROLLEY	LOAD	ELEM	NODE	Fx (KIP)	Fy (KIP)	Fz (KIP)	Mx (IN KIP)	My (IN KIP) SUM	My (IN KIP) DIFF	Mz (IN KIP)
OBE										
MID	UP	52	361	33.6	12.7	15.7	484.0	44941	16764	2707
	DN	52	361	38.0	8.4	14.0	615.7	65456	-3750	3504
1/4	UP	51	360	17.4	5.5	28.3	227.1	29663	18494	1397
	DN	51	360	23.1	6.4	54.4	313.2	47578	580	1926
END	UP	52	362	18.2	9.5	20.0	112.9	15185	10384	2569
	DN	48	358	26.0	16.7	105.0	158.2	27407	3068	1649
SSE										
MID	UP	54	363	49.0	16.4	118.6	626.2	53600	5151	2827
	DN	52	361	58.2	12.1	17.9	876.0	95760	-34054	4986
1/4	UP	51	360	25.0	9.0	36.7	299.1	37437	10721	1816
	DN	51	360	34.3	10.4	83.0	451.5	68199	-20042	2729
END	UP	52	362	31.7	16.4	23.5	155.6	18500	7070	4700
	DN	52	362	34.6	17.7	44.2	227.9	28763	-3193	4700

EES-1.2 FOR SRSS-4.3 WHITING REQN 79604 DATE 3-17-97

BY MJM PAGE B-57 OF 53

0048 81687

TABLE B 67

OBE GIRDER END LOADS

SUM OF ELEMENT FORCES IN ELEMENT CO-ORDINATE SYSTEM (lb, in-lb)

		ELEM	NODE	FX	FY	FZ	MX	MY	MZ
MID	50 U	18 I	301	36713.	12851.	132940.	573400.	2340600.	2830000.
MID	50 U	35 J	319	31453.	15646.	127770.	703400.	2126700.	3895700.
MID	50 U	42 I	351	33575.	16043.	121620.	625020.	2195600.	3924900.*
MID	50 U	59 J	369	31489.	10918.	116840.	484050.	2250300.	2924400.
MID	50 D	18 I	301	37818.	14942.	183890.	642950.	2711700.	3351700.
MID	50 D	35 J	319	28447.	17463.	178580.	789470.	2350400.	3111300.
MID	50 D	42 I	351	37979.*	19532.	172450.	795200.	2643200.	3871100.
MID	50 D	59 J	369	28622.	14076.	167350.	615700.	2263100.	2927400.
1/4	50 U	18 I	301	22049.	11406.	150770.	510490.	2121600.	1592900.
1/4	50 U	35 J	319	19224.	8596.	69154.	318540.	1394200.	2215500.
1/4	50 U	42 I	351	21956.	20947.	137180.	962820.	2003200.	2130900.
1/4	50 U	59 J	369	19288.	7833.	63996.	227100.	1362300.	1975500.
1/4	50 D	18 I	301	28998.	15587.	234080.	652640.	2863600.	2072700.
1/4	50 D	35 J	319	26584.	11721.	98454.	387440.	1774800.	3030600.
1/4	50 D	42 I	351	29214.	28780.	219210.	1328100.	2759700.	2700000.
1/4	50 D	59 J	369	26659.	10000.	92947.	313200.	1735700.	2725700.
END	50 U	18 I	301	25795.	13018.	157040.	790000.	2375900.	1559200.
END	50 U	35 J	319	22476.	10426.	50488.	321480.	1401200.	2552600.
END	50 U	42 I	351	24872.	29151.	144450.	1434000.	2271500.	2927800.
END	50 U	59 J	369	22368.	15569.	45087.	112940.	1357900.	2774100.
END	50 D	18 I	301	26644.	14022.	241480.*	799980.	2877700.*	1571700.
END	50 D	35 J	319	29950.	14863.	63314.	321060.	1750800.	3678700.
END	50 D	42 I	351	25985.	38544.*	228900.	2007700.*	2760600.	2929200.
END	50 D	59 J	369	29990.	15788.	57879.	158150.	1700900.	3221900.
MID	NO	18 I	301	25105.	8493.	82193.	416430.	1609500.	1897300.
MID	NO	35 J	319	16318.	9921.	77726.	499360.	1323500.	1792800.
MID	NO	42 I	351	25368.	11066.	72515.	450750.	1537700.	2211000.
MID	NO	59 J	369	16409.	7974.	67969.	349010.	1272400.	1675800.
1/4	NO	18 I	301	22060.	8899.	101990.	431420.	1627700.	1326000.
1/4	NO	35 J	319	14876.	6669.	52031.	277320.	1082300.	1738800.
1/4	NO	42 I	351	21534.	16398.	89193.	747530.	1534200.	1824400.
1/4	NO	59 J	369	14925.	6594.	46985.	176310.	1048700.	1533900.
RHE	NO	18 I	301	24589.	14574.	107570.	810510.	1986900.	1419400.
RHE	NO	35 J	319	28387.	10172.	40150.	295220.	1575600.	2596800.
RHE	NO	42 I	351	25813.	32938.	96593.	1349200.	1821400.	2950100.
RHE	NO	59 J	369	28053.	19222.	34926.	45552.	1520400.	3725200.

* DENOTES A MAXIMUM

EFS-1.2 FOR SRSS-4.3

WHITING REQN 79604 DATE 8-17-87
BY MJM PAGE 8-58 OF 53
CVC 72687

TABLE 8 68

SSE GIRDER END LOADS

SUM OF ELEMENT FORCES IN ELEMENT CO-ORDINATE SYSTEM (lb, in-lb)

			ELEM	NODE	FX	FY	FZ	MX	MY	MZ
MID	50	U	18	I 301	57798.	17855.	164000.	762110.	3078800.	3883900.
MID	50	U	35	J 319	49060.	22282.	157680.	946480.	2805700.	6291300.
MID	50	U	42	I 351	51328.	21542.	149840.	808370.	2836700.	5933300.
MID	50	U	59	J 369	49034.	13950.	144280.	626190.	3107000.	4388700.
MID	50	D	18	I 301	57835.	21290.	263230.	875340.	3807500.	4775100.
MID	50	D	35	J 319	40584.	24870.	256530.	1083900.	3237100.	4450400.
MID	50	D	42	I 351	58175.*	27797.	248510.	1131300.	3724800.	5516700.
MID	50	D	59	J 369	40827.	20028.	242200.	875960.	3102700.	4166900.
1/4	50	U	18	I 301	36850.	14991.	185460.	685390.	2793500.	2260500.
1/4	50	U	35	J 319	25017.	11540.	85295.	420390.	1673800.	2942500.
1/4	50	U	42	I 351	35935.	27566.	168110.	1268100.	2652100.	3138100.
1/4	50	U	59	J 369	25114.	11503.	78998.	299140.	1635100.	2579000.
1/4	50	D	18	I 301	48302.	22169.	329250.	935280.	4110500.	3048400.
1/4	50	D	35	J 319	37878.	16861.	134610.	541780.	2367400.	4345200.
1/4	50	D	42	I 351	47440.	41197.	310980.	1914700.	4021500.	4054600.
1/4	50	D	59	J 369	37989.	15089.	128040.	451530.	2309300.	3891300.
END	50	U	18	I 301	48868.	22824.	180610.	1392200.	3321500.	2832600.
END	50	U	35	J 319	32414.	13751.	60077.	507080.	1842800.	3228500.
END	50	U	42	I 351	46736.	43470.	164810.	1976400.	3224000.	5372000.
END	50	U	59	J 369	31987.	28267.	53522.	155580.	1784800.	4616300.
END	50	D	18	I 301	49965.	24123.	330690.*	1403800.	4213600.*	2847500.
END	50	D	35	J 319	44051.	21069.	81362.	504230.	2402000.	5135900.
END	50	D	42	I 351	48101.	57701.*	316400.	2894200.*	4097300.	5373400.
END	50	D	59	J 369	43930.	28531.	75158.	227920.	2326500.	5234300.
MID	NO		18	I 301	39697.	11090.	101010.	520220.	2093500.	2471100.
MID	NO		35	J 319	21482.	12930.	95709.	628360.	1578600.	2382100.
MID	NO		42	I 351	40332.	14376.	88631.	585300.	1993900.	2895800.
MID	NO		59	J 369	21585.	10353.	83137.	453190.	1525100.	2189900.
1/4	NO		18	I 301	38721.	12007.	120310.	590990.	2186700.	1971500.
1/4	NO		35	J 319	19833.	9209.	61845.	366440.	1315200.	2387100.
1/4	NO		42	I 351	37142.	22264.	104210.	1010800.	2109000.	2819200.
1/4	NO		59	J 369	19910.	10117.	55824.	238410.	1271200.	2055000.
RHE	NO		18	I 301	45144.	25976.	118580.	1278000.	2852300.	2519000.
RHE	NO		35	J 319	49500.	15167.	47411.	430290.	2504700.	4078000.
RHE	NO		42	I 351	47713.	57245.	105550.	2098400.	2633100.	5172300.
RHE	NO		59	J 369	48769.	34657.	41236.	70761.	2431000.	6697100.*

* DENOTES A MAXIMUM

APPENDIX 'C'

NOMENCLATURE & REFERENCES

NOMENCLAUTRE

A	=	Area
a	=	Length of section that is buckling
b	=	Length of section that is buckling
c	=	Distance to extreme fibers
d	=	Distance to N.A.
E	=	Modulus of elasticity
Fx	=	Force applied in the "x" direction
Fy	=	Force applied in the "y" direction
Fz	=	Force applied in the "z" direction
Ix	=	Moment of Inertia about "x-x" axis
Iy	=	Moment of Inertia about "y-y" axis
Iz	=	Moment of Inertia about "z-z" axis
Jx	=	Polar Moment of Inertia about "x-x" axis
Jy	=	Polar Moment of Inertia about "y-y" axis
Jz	=	Polar Moment of Inertia about "z-z" axis
L	=	Length
Mx	=	Moment about "x" axis
My	=	Moment about "y" axis
Mz	=	Moment about "z" axis
P	=	Load
ROTX	=	Rotation about the Global "x" axis used in modal analysis
ROTY	=	Rotation about the Global "y" axis used in modal analysis
ROTZ	=	Rotation about the Global "z" axis used in modal analysis
UX	=	Displacement in Global "x" direction used in modal analysis
UY	=	Displacement in Global "y" direction used in modal analysis
UZ	=	Displacement in Global "z" direction used in modal analysis
$\bar{x}$	=	Centroid location in "x" direction
$\bar{y}$	=	Centroid location in "y" direction
$\bar{z}$	=	Centroid location in "z" direction
σ	=	Tensile or Compressive Stress
τ	=	Shear Stress

FORM N-2494

WHITING REQN. 79604 DATE 8-21-87

BY MJM PAGE C-2 OF 3

8-25-87

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FORM N-2494

WHITING REQN. 79604 DATE 8-21-87

BY MJM PAGE C-3-R1 OF 3

RMM 8-27-87

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APPENDIX D
EVALUATION OF 55 TON LOAD

After the completion of all computer runs with a 50 ton load, it was requested that the crane be evaluated with a 55 ton load during a seismic event. The initial runs indicated that the SSE produces stresses that are closer to the allowables than the OBE. The trolley at midspan with the load down produces the maximum girder stresses and the trolley at end with the load down produces the maximum wheel loads. Therefore these two cases were run with a 55 ton load but with all other items as in the body of the report for the 50 ton load.

The mode coefficients for these runs are shown in tables D1 and D2 and the unfactored and factored reactions are shown in tables D3 through D6. The wheel loads were derived as described in the body of the report and tabulated in table D7. The maximum stresses from the computer runs are summarized in tables D8 and D9. The rope loads are summarized in table D10.

The results for trolley at mid are summarized and compared with the results for 50T and with the allowables in table D11. The results for trolley at end are summarized and compared with the results for 50T and with the allowables in table D12. For those components which were alanyzed manually with loadings from the computer program the highest stresses were proportioned from the analysis for 50T by applying a multiplier for the appropriate component from tables D11 and 12. The results are shown in table D13. The girder web stability was similarly proportioned as shown in table D14.

It was found that the stresses in the crane did not exceed the allowable stresses when loaded with a 55 ton load during the specified seismic event.

WHITING REQN 79604 DATE 8-26-87
BY MJM PAGE D-2 OF 13
RAJ 22727

TABLE D1

SUMMARY OF NATURAL FREQUENCIES AND MODE COEFFICIENTS - PAOMNDS.55

MODE	FREQUENCY HZ	MODE COEFFICIENT FOR SPECIFIED DIRECTION X	Y	Z
1	2.02	0.0955 *	241.0000 * MAX	0.2006 *
2	2.83	3.4330 * MAX	0.1574 *	88.8900 * MAX
3	4.14	1.3270 *	1.0900 *	0.0461 *
4	6.32	0.3182 *	0.0343	1.5750 *
5	7.99	0.1032 *	0.1987 *	0.0602 *
6	9.05	0.0441 *	0.0480	0.0054
7	9.64	0.0378 *	0.0017	0.0225
8	11.59	0.0325 *	0.0482	0.0007
9	13.31	0.0403 *	0.0135	0.0024
10	15.09	0.2849 *	0.0011	0.0129
11	18.04	0.0054	0.0177	0.0020
12	23.32	0.0012	0.0104	0.0006
13	28.72	0.0005	0.0011	0.0000
14	31.23	0.0077	0.0003	0.0015
15	35.24	0.0012	0.0003	0.0002
16	43.69	0.0002	0.0001	0.0003
17	54.52	0.0005	0.0003	0.0001
18	56.18	0.0005	0.0001	0.0002
19	61.02	0.0006	0.0000	0.0004
20	68.89	0.0005	0.0001	0.0008
21	75.33	0.0002	0.0000	0.0002
22	83.28	0.0002	0.0001	0.0001
23	85.97	0.0002	0.0001	0.0002
24	90.22	0.0001	0.0000	0.0001
25	91.85	0.0000	0.0000	0.0001
26	91.91	0.0000	0.0000	0.0003
27	123.90	0.0000	0.0000	0.0000
28	174.80	0.0000	0.0000	0.0000
SIGNIFICANCE FACTOR		0.50%	0.05%	0.05%

* INDICATES EXPANDED MODE

SRSS-4.3 WHITING CORPORATION ANSYS SRSS PROGRAM 79604 87/07/14.
TABLE # D4 LS 2 MODE 1 SCALE FACTOR = .1107 BY MJM PAGE D-5 OF 13

79604/MJM/AEP, DCC, OLD MAIN TROLLEY MID, 55T LD DN / SSE 'X'

REACTION SUMMARY

LOAD STEP NODE	LABEL	1	2	3	SRSS	STATIC	SUM	DIFFER
101	FY	1294.	50169.	551.	50189.	0.	50189.	-50189.
101	FZ	8341.	6691.	174882.	175208.	104525.	279734.	-70683.
101	MX	114225.	3351455.	130566.	3355941.	44352.	3400293.	-3311589.
102	FZ	7915.	6645.	168438.	168755.	96374.	265128.	-72381.
102	MX	93993.	153495.	20605.	181163.	90341.	271504.	-90822.
123	FY	0.	0.	0.	0.	0.	0.	0.
123	FZ	0.	0.	0.	0.	0.	0.	0.
123	MX	0.	0.	0.	0.	0.	0.	0.
123	MY	0.	0.	0.	0.	0.	0.	0.
124	FX	61612.	1563.	18358.	64308.	0.	64308.	-64308.
124	FY	0.	0.	0.	0.	0.	0.	0.
124	FZ	0.	0.	0.	0.	0.	0.	0.
124	MX	0.	0.	0.	0.	0.	0.	0.
124	MY	0.	0.	0.	0.	0.	0.	0.
124	MZ	0.	0.	0.	0.	0.	0.	0.
201	FY	1694.	45891.	862.	45931.	-0.	45931.	-45931.
201	FZ	7356.	5835.	172091.	172347.	100800.	273147.	-71547.
201	MX	76239.	3097556.	103406.	3100220.	43474.	3143693.	-3056746.
202	FZ	6936.	5874.	165998.	166246.	92648.	258895.	-73598.
202	MX	50304.	67267.	32586.	90095.	89459.	179555.	-636.

79604/MJM/AEP, DCC, OLD MAIN TROLLEY MID, 55T LD DN / SSE 'X'

REACTION SUMMARY

LOAD STEP NODE LABEL		1	2	3	SRSS	STATIC	SUM	DIFFER
101	FY	1294.	453119.	551.	453121.	0.	453121.	-453121.
101	FZ	8341.	59719.	174882.	184985.	104525.	289511.	-80460.
101	MX	114225.	30263769.	130566.	30264266.	44352.	30308618.	-30219914.
102	FZ	7915.	58902.	168438.	178615.	96374.	274989.	-82242.
102	MX	93993.	1280460.	20605.	1284071.	90341.	1374412.	-1193730.
123	FY	0.	0.	0.	0.	0.	0.	0.
123	FZ	0.	0.	0.	0.	0.	0.	0.
123	MX	0.	0.	0.	0.	0.	0.	0.
123	MY	0.	0.	0.	0.	0.	0.	0.
124	FX	61612.	1600.	18358.	64309.	0.	64309.	-64309.
124	FY	0.	0.	0.	0.	0.	0.	0.
124	FZ	0.	0.	0.	0.	0.	0.	0.
124	MX	0.	0.	0.	0.	0.	0.	0.
124	MY	0.	0.	0.	0.	0.	0.	0.
124	MZ	0.	0.	0.	0.	0.	0.	0.
201	FY	1694.	414417.	862.	414421.	-0.	414421.	-414421.
201	FZ	7356.	51905.	172091.	179899.	100800.	280699.	-79098.
201	MX	76239.	27976096.	103406.	27976391.	43474.	28019864.	-27932917.
202	FZ	6936.	51651.	165998.	173986.	92648.	266634.	-81337.
202	MX	50304.	408174.	32586.	412551.	89459.	502011.	-323092.

SRSS-4.3 WHITING CORPORATION ANSYS SRSS PROGRAM 79604 07/07/17.
TABLE # 06 LS 2 MODE 2 SCALE FACTOR = .2500 BY MJM PAGE D-7 OF 13

9604/MJM/AEP, DCC, OLD MAIN TROLLEY END, 55T LD DN / SSE 'X'

REACTION SUMMARY

LOAD STEP NODE LABEL		1	2	3	SRSS	STATIC	SUM	DIFFER
101	FY	18235.	76898.	3286.	79099.	0.	79099.	-79099.
101	FZ	22850.	7448.	201904.	203330.	152746.	356076.	-50583.
101	MX	1104536.	5161683.	262544.	5285064.	41780.	5326844.	-5243283.
102	FZ	21852.	8569.	198536.	199919.	141556.	341475.	-58363.
102	MX	167002.	1479978.	26226.	1489602.	91070.	1580672.	-1398532.
123	FY	0.	0.	0.	0.	0.	0.	0.
123	FZ	0.	0.	0.	0.	0.	0.	0.
123	MX	0.	0.	0.	0.	0.	0.	0.
123	MY	0.	0.	0.	0.	0.	0.	0.
124	FX	47259.	7482.	34951.	59253.	0.	59253.	-59253.
124	FY	0.	0.	0.	0.	0.	0.	0.
124	FZ	0.	0.	0.	0.	0.	0.	0.
124	MX	0.	0.	0.	0.	0.	0.	0.
124	MY	0.	0.	0.	0.	0.	0.	0.
124	MZ	0.	0.	0.	0.	0.	0.	0.
201	FY	8098.	37335.	1018.	38217.	-0.	38217.	-38217.
201	FZ	9986.	3785.	38378.	39836.	52632.	92469.	12796.
201	MX	283481.	2425952.	44822.	2442870.	37973.	2480843.	-2404897.
202	FZ	9086.	3811.	37109.	38395.	47413.	85808.	9018.
202	MX	48462.	1290425.	24622.	1291569.	85057.	1376626.	-1206512.

TABLE D-7

CRANE WHEEL LOADS 55 T LOAD

SSE SCALED

	TROLLEY	LOAD	Wx MAX	Wy MAX	MAX Wz WA (MAX)	MAX Wz WB**	PUL 201,202	PUR 101,102	TABLE USED
DRIVER 101,201	MID	ON	10.7	49.1	196.5	83.2	32.8	35.7	D4
	END	ON	9.9	66.7	266.8	89.3	19.4	37.7	D6
IDLER 102,202	MID	ON	10.7	—	138.2	126.9	—	—	D4
	END	ON	9.9	—	203.7	137.8	10.4	—	D6

ALL FORCES IN KIPS IN GLOBAL COORDINATE SYSTEM
* INDICATES UPKICK LOAD AT UPKICK LUG FOR STATIC PLUS DYNAMIC
** WB IS LOAD ON OTHER WHEEL OF TRUCK WHEN WA IS MAX

TABLE D8

MAXIMUM STRESSES FROM PFAOMMDS.55
SSE MID 55 D

COMPONENT	ELEM	NODE	X	Y	Z	SRSS	STATIC	SUM
GIRDER A	28	312	1049.	7590.	20983.	22338.	10132.	32470.
GIRDER B	52	361	985.	9096.	20341.	22304.	9609.	31913.
END CONNECT-RHE	17	154	1661.	18032.	345.	18111.	506.	18617.
END CONNECT-LHE	74	252	1905.	15340.	480.	15465.	305.	15770.

TABLE D9

MAXIMUM STRESSES FROM PFAOMEDS.55
SSE END 55 D

COMPONENT	ELEM	NODE	X	Y	Z	SRSS	STATIC	SUM
GIRDER A	35	319	4172.	13583.	665.	14225.	181.	14406.
GIRDER B	43	353	1796.	12846.	4008.	13576.	2359.	15935.
END CONNECT-RHE	17	154	1001.	18685.	465.	18718.	471.	19188.
END CONNECT-LHE	74	252	5316.	17455.	668.	18258.	358.	18616.

STRESS IN PSI

ALLOWABLE STRESS = $\frac{36000}{1.1}$ = 32700 PSI

TABLE D-10

ROPE LOADS
55 T LOAD

SSE SCALED

TROLLEY	LOAD	STATIC + DYNAMIC KIP	STATIC − DYNAMIC KIP
MID	DN	623.2	-363.2
END	DN	559.2	-299.2

MAX
623.2 KIP = 311.6 T

ALLOWABLE 1053 T

$$R = \frac{311.6}{1053} = .30$$

$$DLF = \frac{311.6}{65} = 4.79$$

$$DLF' = \frac{311.6}{160} = 1.95$$

TABLE D-11

COMPARISON BETWEEN 50 AND 55 T - SSE
TROLLEY AT MID LOAD DOWN

COMPONENT	ITEM	50 T		55 T		RATIO 55T/50T	ALLOW	RATIO STRESS/ALLOW
		LD OR STR	REF TABLE	LD OR STR	REF TABLE			
WHEEL OR	$W_{X MAX}$	10.8	4-5	10.7	D7	.99	—	—
	$W_{Y MAX}$	47.8	4-5	49.1	D7	1.03	—	—
	$W_{Z MAX}$	191.2	4-5	196.5	D7	1.03	—	—
	$P_{U MAX}$	35.4	4-5	35.7	D7	1.01	—	—
IO	$W_{X MAX}$	10.8	4-5	10.7	D7	.99	—	—
	$W_{Y MAX}$	—	4-5	—	D7	—	—	—
	$W_{Z MAX}$	134.1	4-5	138.2	D7	1.03	—	—
	$P_{U MAX}$	—	4-5	—	D7	—	—	—
GIRDER A	σ	31.5	B5	32.5	D8	1.03	32.7	.99
B	σ	30.9	B5	31.9	D8	1.03	32.7	.98
END CON R	σ	18.1	B5	18.6	D8	1.03	32.7	.57
L	σ	15.4	B5	15.8	D8	1.03	32.7	.48
ROPE SUM	P_{MAX}	583.7	B63	623.2	D10	1.07	1053x2	.30
DIFF	$P_{U MIN}$	-343.6	B64	-363.2	D10	1.06	—	—

LOADS IN KIPS
STRESS IN KSI

TABLE D-12

COMPARISON BETWEEN 50 AND 55 T - SSE
TROLLEY AT END LOAD DOWN

COMPONENT	ITEM	50 T		55 T		RATIO 55T/50T	ALLOW	RATIO STRESS/ALLOW
		LD OR STR	REF TABLE	LD OR STR	REF TABLE			
WHEEL OR	Wx MAX	9.9	4-5	9.9	D7	1.00	–	–
	Wy MAX	64.2	4-5	66.7	D7	1.04	–	–
	Wz MAX	256.8	4-5	266.8	D7	1.04	–	–
	Pu MAX	36.6	4-5	37.7	D7	1.03	–	–
ID	Wx MAX	9.9	4-5	9.9	D7	1.00	–	–
	Wy MXX	–	4-5	–	D7	–	–	–
	Wz MAX	195.2	4-5	203.7	D7	1.04	–	–
	Pu MAX	10.6	4-5	10.4	D7	.98	–	–
GIRDER A	σ	13.8	817	14.4	D9	1.04	32.7	.44
B	σ	15.7	817	15.9	D9	1.01	32.7	.49
END CON R	σ	19.2	817	19.2	D9	1.00	32.7	.59
L	σ	18.4	817	18.6	D9	1.01	32.7	.57
ROPE SUM	P_{MAX}	520.0	863	559.2	D10	1.08	1053×2	.27
DIFF	P_U	-280.0	864	-299.2	D10	1.07	–	–

LOADS IN KIPS
STRESS IN KSI

TABLE D13

RATIOED STRESSES SSE
FOR COMPONENTS ANALYZED MANUALLY
FROM COMPUTER LOADINGS

COMPONENT	DETAIL	REF PAGE	STRESS 50 T	MULT	STRESS 55 T	ALLOW	STRESS / ALLOW
BR AXLE	SHEAR	4-15	9.9	1.04	10.3	32.7	.31
SEISMIC LUG	PL TENS	4-19	15.1	1.03	15.6	32.7	.48
BR TRUCK	TENS	4-33	16.8	1.04	17.5	32.7	.54
TRK TO GIRD	BOLT	4-52	46.2	1.04	48.0	50.2	.96
"	WELD	4-70	13.2	1.04	13.7	27.3	.50
GIRD TO ET	BOLT	4-84	47.7	1.03	49.1	50.2	.98
"	WELD	4-92	23.2	1.03	23.9	27.3	.88
GIRDER END	SHEAR	4-105	13.8	1.04	14.4	19.6	.73

STRESS IN KSI

TABLE D.14

RATIOED GIRDER BUCKLING STABILITY SSE

COMPONENT	DETAIL	REF PAGE	STABILITY RATIO 50 T	MULT	STABILITY RATIO 55 T	ALLOW	RATIO / ALLOW
GIRDER WEB	PANEL 2	4-103	.876	1.03	.902	.909	.99