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WHITING CORPORATION
PRODUCTION ENGINEERING DEPT.
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AREA CODE 312 331-4000

CUSTOMER AMERICAN ELECTRIC POWER
C.O. NO. C6766 REQN. 79508
DATE 9-9-87 BY MJM
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REV. 1 ASZ 11-4-87 [1]
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CRANE SEISMIC REPORT
CASK HANDLING CRANE
150/20 TON CAPACITY
S/N 12115

CUSTOMER: AMERICAN ELECTRIC POWER CORP.
COLUMBUS, OHIO

FOR: INDIANA & MICHIGAN ELECTRIC CO.
DONALD C COOK FACILITY
BRIDGMAN, MICHIGAN

P.O. NO: C 6766

SPECIFICATION: DCC-MH-103-QCN Rev. 1
DCCNE-101-QCN Rev. 0

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ABSTRACT

The equipment reviewed in this report is an 'Electric Overhead Crane', consisting of two separate top running trolleys and a monorail underhung hoist unit with the track mounted on the side of girder 'B'. The crane is designed and rated for a maximum capacity load of 150 tons with limitations of 150 tons on the main trolley, 20 tons on the auxiliary trolley or 1-1/4 tons on the monorail hoist unit. 1

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 60 tons and no load on the main hook and the trolley at mid-span, quarter span and both ends of span. The auxiliary trolley was unloaded and parked on the south end for the loaded cases. Additional unloaded cases were run with both trolleys at various positions. For all cases the monorail hoist unit was unloaded and located on the north end. 1

The crane was mathematicaly 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 paralled 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 60 ton load on the main hook.

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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 trolleys, the drive units and the bridge trucks were represented as rigid bodies.

The crane was analyzed with the main trolley at mid-span, quarter span and both ends of span. For these positions the analysis was done with a 60 ton load on the main hook and with no load. For all loaded cases the auxiliary trolley was unloaded and parked on the south end. Additional unloaded cases were run with both trolleys at various positions. For all cases the monorail hoist unit on girder B was unloaded, and located on the north end. In order to simulate the additional pendulum effect of the monorail hoist unit hanging under the track, a torsional spring was included in the model. 1

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 eqrthquakes. Also included in this Appendix are the mode coefficients and natural frequencies for mode shapes considered.

The normal mode approach was employed for the analysis of the components. All significant eigen-values and eigen-vectors were extracted, and these modes were combined by the method specified by the U. S. Nuclear Regulatory Commission, Regulatory Guide 1.92, Rev. 1, Section 1.2.2 (Combination of Modal Responses with Closely Spaced Modes by the 10% Method). Those modes with mode coefficient ratios less than those shown in table 1-1 were dropped because their contribution is proportionally small when compared to the largest mode coefficient of the related directional excitation. The results of the three orthogonal dynamic excitations were combined by the square root of the sum of the squares method (SRSS) and then absolutely added to the results of the static condition.

Because the y reaction exceeds the frictional resistance of those bridge wheels that are braked, slip will occur. The maximum acceleration in the y direction will be reduced from that predicted by the modal analysis. The primary y mode was therefore reduced by a scale factor such that the resulting y reaction approaches the maximum that could be sustained before slip. The results were then resummed as previously described. ①

For the specified seismic excitations it is required that the crane retain control of and hold the load and that the bridge and trolley remain in place on their respective runways.

In order to assure structural integrity, the job specification requires that the maximum stresses not exceed the minimum yield strength of the material divided by 1.5 for the OBE and 1.1 for the SSE.

The crane is constructed of ASTM A36 structural steel except for components which are specifically noted in the report. A36 material has a specified minimum yield strength of 36 ksi. The combined bending and axial stresses are limited to 24 ksi for the OBE and 32.7 ksi for the SSE.

The actual properties of the specified materials show a great deal of variation and are generally considerably higher than the minimum required by the material specification. Also the maximum stresses occur only at a point on a section and cannot of themselves be indicative of the tendency of the section to permanently deform, especially when the nominal stresses on the extreme fibers of the adjoining faces are significantly lower. It is therefore conservative to compare the combined bending and axial stresses at the corners with the specified allowables to assure structural integrity.

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.

TABLE 1-1

MODE COEFFICIENT SIGNIFICANCE

CASES	TROLLEY MAIN	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	.006

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 main trolley at mid-span, quarter span and both ends of span. For these positions the analysis was done with a 60 ton load on the main hook and with no load. For all loaded cases the auxiliary trolley was unloaded and parked on the south end. Additional unloaded cases were run with both trolleys at various positions. For all cases the monorail hoist unit on girder B was unloaded and located on the north end. Appendix A summarizes the load positions considered and the dynamic response of the crane for these cases. The cases considered provide maximum loadings on the principal components for the specified seismic events when the crane is handling loads up to 60 tons. 1

Tables 2-1 and 2-2 summarize the maximum stresses in the members used in 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 with the allowables required by the job specification with a 60 ton load. 1

Table 2-5 summarizes the buckling stability of the girder web which is also within the allowables required by the job specification. The stresses in the monorail track exceed the allowables required by the job specification but the maximum loadings do not exceed the ultimate load from a plastic analysis. Because the monorail track is not required to retain control of and hold the load or maintain the bridge and trolley in place on their respective runways, it is not necessary to meet the specification allowables as long as the track does not become detached from the crane. The results as summarized in Table 2-6 show that the maximum loads do not exceed the ultimate loads.

Table 2-7 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 predicated by the modal analysis is well below the allowable rope load.

Table 2-8 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 time 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 specificed excitations the specified linear analysis will conservatively predict the behavior of the crane durning 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 60 ton load on the main hook.

TABLE 2-1 OBE

SUMMARY OF MAXIMUM STRESS FROM COMPUTER OUTPUT AND MODIFIED RESULTS FROM SECTION 4 AS INDICATED.

COMPONENT	TROLLEY	LOAD	ELEMENT	NODE	STRESS KSI	ALLOW KSI	STRESS (OR LOAD) / ALLOW
GIRDER A	M MID	DN	34	318	21.6	24.0	.90
GIRDER B	M MID	DN	71	364	21.3	24.0	.89
END TIE RHE	M LHE	DN	17	154	14.4	24.0	.60
END TIE LHE	M LHE	DN	172	252	19.9	24.0	.83
MONORAIL TRACK	M LHE	DN	138	443	P.A.	—	.51 *1
TRACK SUPPORT	M LHE	DN	112	564	7.3	24.0	.30 *2

FOR ADDITIONAL DETAILS SEE TABLES B1 TO B32

* 1. PLASTIC ANALYSIS PERFORMED, SEE PP 4-158 TO 4-163 FOR LOAD RATIO ANALYSIS 1
* 2. SECTION REVISED FROM COMPUTER ANALYSIS, SEE PP. 4-149 AND 4-150 FOR ANALYSIS 1

P.A.= PLASTIC ANALYSIS PERFORMED 1

TABLE 2-2 SSE

SUMMARY OF MAXIMUM STRESS FROM COMPUTER OUTPUT AND MODIFIED RESULTS FROM SECTION 4 AS INDICATED. 1

COMPONENT	TROLLEY	LOAD	ELEMENT	NODE	STRESS KSI	ALLOW KSI	STRESS (OR LOAD) / ALLOW
GIRDER A	M MID	DN	34	318	30.9	32.7	.95
GIRDER B	M. MID	DN	71	364	30.4	32.7	.93
END TIE RHE	A 1/4	NO	17	154	22.7	32.7	.69
END TIE LHE	M LHE	DN	172	252	30.1	32.7	.92 *3
MONORAIL TRACK	M LHE	DN	138	443	P.A.	—	.95 *4
TRACK SUPPORT	M LHE	DN	112	564.	13.4	32.7	.41 *5

FOR ADDITIONAL DETAILS. SEE TABLES B1 TO B32

* 3 SECTION REVISED FROM COMP. ANALYSIS, SEE PP. 4-108 TO 4-111 FOR ANALYSIS 1
* 4. PLASTIC ANALYSIS PERFORMED, SEE PP 4-158 TO 4-163 FOR LOAD RATIO ANALYSIS 1
* 5 SECTION REVISED FROM COMP. ANALYSIS, SEE PP. 4-149 AND 4-150 FOR ANALYSIS 1

P.A.= PLASTIC ANALYSIS PERFORMED 1

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	4-18	1.4	21.2	0.07	
BRIDGE AXLE	SHEAR	4-20	8.0	17.2	0.47	
BRIDGE TRUCK SEISMIC						
LUGS: LUG PLATE	SHEAR	4-23	2.1	14.4	0.15	
LUG PLATE	TENSION	4-24	11.0	24.0	0.46	
LUG PIN	SHEAR	4-27	3.0	12.0	0.25	
	WELDS	4-29	6.9	20.4	0.34	
	BOLTS TENSION	4-31	16.6	61.3	0.27	
	BOLTS SHEAR	4-31	10.6	36.8	0.29	
BRIDGE TRUCK	TENSION	4-35	14.2	24.0	0.59	
	SHEAR	4-35	12.2	14.4	0.85	
	WELDS	4-35	16.1	20.4	0.79	
TRUCK TO GIRDER	BOLTS	4-55	23.6	36.8	0.64	
	WELDS	4-75	15.0	20.4	0.74	1
GIRDER TO END TIE	BOLTS	4-87	25.6	36.8	0.70	
	WELDS	4-99	15.0	20.4	0.74	
MONORAIL:						
SUPPORT TO GIRDER	WELDS	4-141	13.3	20.4	0.65	
SUPPORT	TENSION	4-150	7.3	24.0	0.30	
TRACK TO SUPPORT	BOLTS	4-157	24.1	36.8	0.65	
GIRDER	WELDS	4-170	15.6	20.4	0.76	
GIRDER END	SHEAR	4-171	10.9	14.4	0.76	
	WELDS	4-171	12.7	20.4	0.62	

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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	4-18	2.7	28.9	0.09	
BRIDGE AXLE	SHEAR	4-20	11.6	23.5	0.49	
BRIDGE TRUCK SEISMIC						
LUGS: LUG PLATE	SHEAR	4-23	6.3	19.6	0.32	
LUG PLATE	TENSION	4-24	32.5	32.7	0.99	
LUG PIN	SHEAR	4-27	8.7	16.4	0.53	
	WELDS	4-29	20.3	27.8	0.73	
	BOLTS TENSION	4-31	48.9	83.6	0.58	
	BOLTS SHEAR	4-31	31.4	50.2	0.63	
BRIDGE TRUCK	TENSION	4-41	20.8	32.7	0.64	
	SHEAR	4-41	17.7	19.6	0.90	
	WELDS	4-41	23.7	27.8	0.85	
TRUCK TO GIRDER	BOLTS	4-61	43.1	50.2	0.86	
	WELDS	4-75	22.6	27.8	0.81	1
GIRDER TO END TIE	BOLTS	4-94	48.5	50.2	0.97	
	WELDS	4-107	24.7	27.8	0.89	
END TIE	TENSION	4-111	30.1	32.7	0.92	
MONORAIL:						
SUPPORT TO GIRDER	WELDS	4-145	24.1	27.8	0.87	
SUPPORT	TENSION	4-150	13.4	32.7	0.41	
TRACK TO SUPPORT	BOLTS	4-157	44.4	50.2	0.88	
GIRDER	WELDS	4-170	27.1	27.8	0.97	
GIRDER END	SHEAR	4-171	14.9	19.6	0.76	
	WELDS	4-171	17.4	27.8	0.63	

TABLE 2-5

SUMMARY OF PLASTIC ANALYSIS FROM SUPPLEMENTARY CALCULATIONS.

COMPONENT		PAGE	ACTUAL LOAD (KIPS)	ULTIMATE LOAD (KIPS)	ACTUAL / ULTIMATE
MONORAIL TRACK	OBE	4-163	2.45	4.8	0.51
	SSE	4-163	4.58	4.8	0.95

FOR ADDITIONAL DETAILS SEE REFERENCED PAGES.

TABLE 2-6

SUMMARY OF BUCKLING STABILITY FROM SUPPLEMENTARY CALCULATIONS.

COMPONENT		PAGE	STABILITY FACTOR	ALLOW. FACTOR	STABILITY / ALLOW.
GIRDER WEB	OBE	4-169	0.592	0.667	0.89
	SSE	4-169	0.859	0.909	0.94

FOR ADDITIONAL DETAILS SEE REFERENCED PAGES.

TABLE 2-7

SUMMARY OF MAXIMUM ROPE LOAD (KIPS)

	TROLLEY	LOAD	STATIC	SUM	DIFF.	ALLOW. LOAD	SUM / ALL. LOAD	DLF
OBE	M MID	DN	140	418.4	-138.4	1545	0.27	3.0
SSE	M MID	DN	140	661.9	-381.9	2106	0.31	4.7

1

REF. PP. 4-181 AND 4-182 1

FOR ADDITIONAL DETAILS SEE TABLES B 115 TO B 118

DLF = DYNAMIC LOAD FACTOR = $\frac{SUM}{STATIC}$ 1

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TABLE 2-8

SUMMARY OF MAXIMUM WHEEL LOADS

(KIPS)

	TRUCK	Wx MAX AT MID UP	WY MAX AT LHE DN AT RHE DN	MAX Wz: WA MAX LHE DN RHE DN	MAX Wz: WB * LHE DN, RHE DN	SEISMIC LUG LOAD
OBE	DRIVER 101, 201	6.66	53.2 48.8	212.9 195.3	60.2 84.2	26.7 AT LHE DN
	IDLER 102, 202	6.66	— —	139.0 142.9	123.8 123.6	—
SSE	DRIVER 101, 201	12.7	75.9 67.7	303.5 270.7	72.9 111.6	78.9 AT AUX 1/4 MAIN LHE
	IDLER 102, 202	12.7	— —	196.3 199.7	168.5 167.7	4.8 AT LHE DN

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

FOR ADDITIONAL DETAILS SEE TABLES 4-6 THROUGH 4-9.

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. An auxiliary trolley is supplied which is designed and rated for a capacity load of 20 tons on its hook. For this analysis, the lifted load is limited to 60 tons on the main hook and the minimum loaded main hook approach is 10'-3-1/4 to the Left Hand End of the crane. The auxiliary trolley is unloaded for all cases analyzed and is in a parked position at the Right Hand End of the crane when there is a load on the main hook. The monorail hoist unit on Girder B is unloaded in a parked position at the Left Hand End for all load cases. The mathematical model of the crane with node numbering and global coordinates is illustrated on pages 3-8 through 3-16.

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 to 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 restraints at node 428 were applied so that a torsional spring could be employed to simulate the unrestrained swing of the monorail hoist unit. The other restraints of nodes 123 and 124 were selected to simplify the analysis.

The nodes which are coupled have the same displacement in the indicated directions only. Their displacemnts 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 to the runway.

MAIN 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 with the girders.

NODES - 392-402, 393-403

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

AUX. TROLLEY

NODES - 341-411, 342-412, 343-413, 344-414

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

NODES - 343-413, 344-414

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

NODES - 342-412, 343-413

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

HOIST UNIT

NODES - 423-425, 424-426

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

NODES - 423-425

UX: Simulates the drive brake which provides stability parallel with the track.

NODES - 423-425, 424-426

UY: Simulates wheel to track contact perpendicular to the track.

NODES - 423-425, 424-426

ROTX: Simulates restraint developed to rotation after clearance is taken up in unrestrained swing.

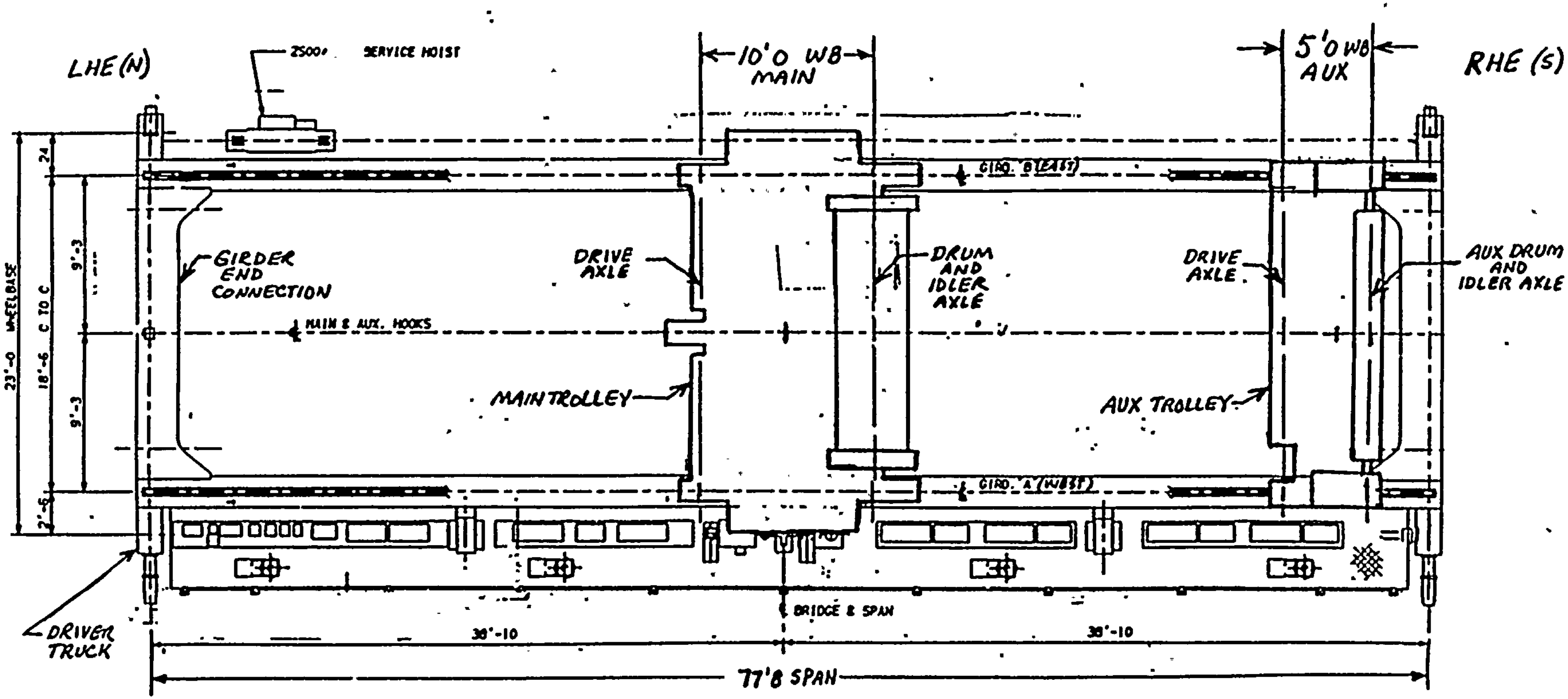
The master dynamic degrees of freedom for a reduced modal analysis tabulated in table 3-3 are selected to obtain those modal shapes which characterize the principal vibrations of the structure. Placement is such as to include coupled modal shapes due to eccentricities. Higher degrees of freedom were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

The girders, the girder end connections, the monorail track and track supports 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 trolleys, 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 trolleys, the bridge trucks, the drive and the wheels. Additionally the beam members were assigned distributed masses.

The trolleys 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 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 modal solveable with available resources while predicting the seismic response with reasonable accuracy.



CRANE PLAN VIEW

NORTH

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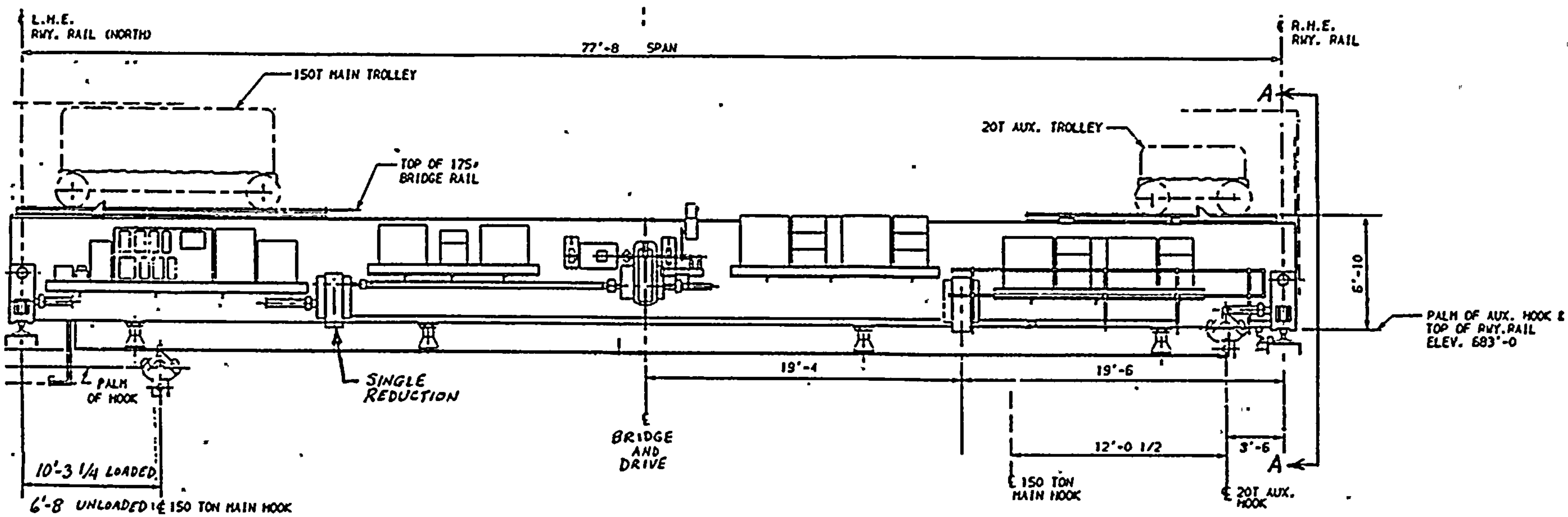

GENERAL ARRANGEMENT OF ONE MOTOR BRIDGE

FRONT ELEVATION

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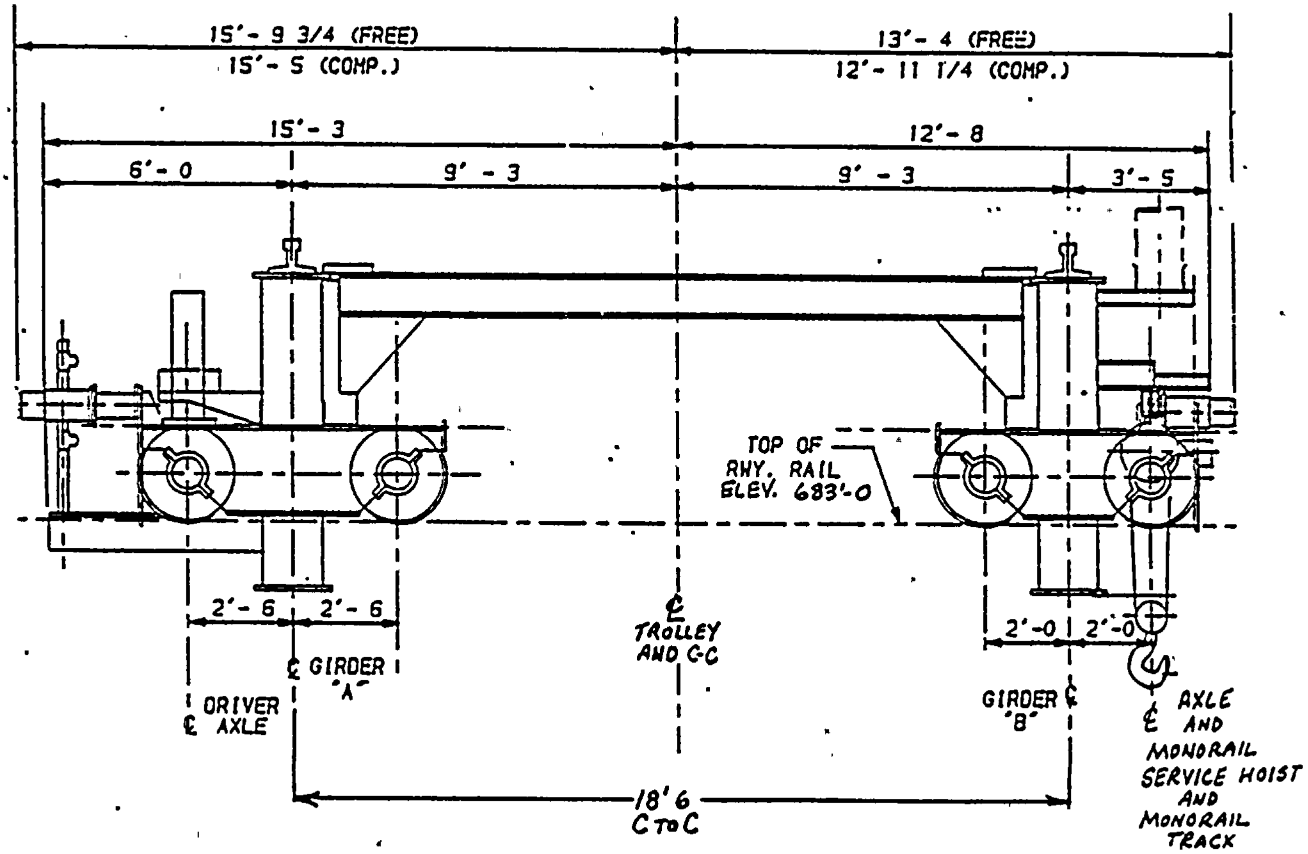

VIEW "A-A"
BRIDGE END ELEVATION

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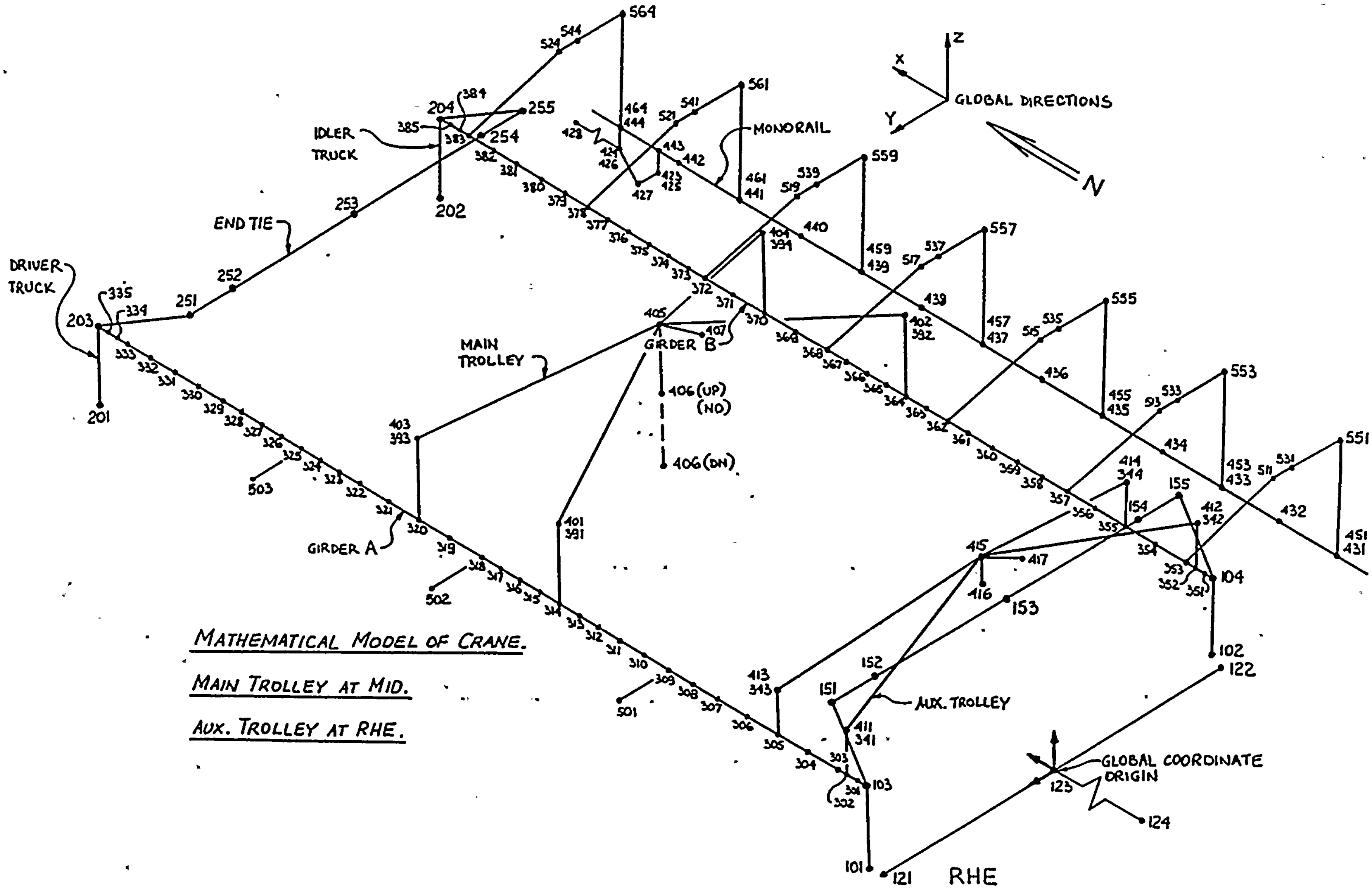
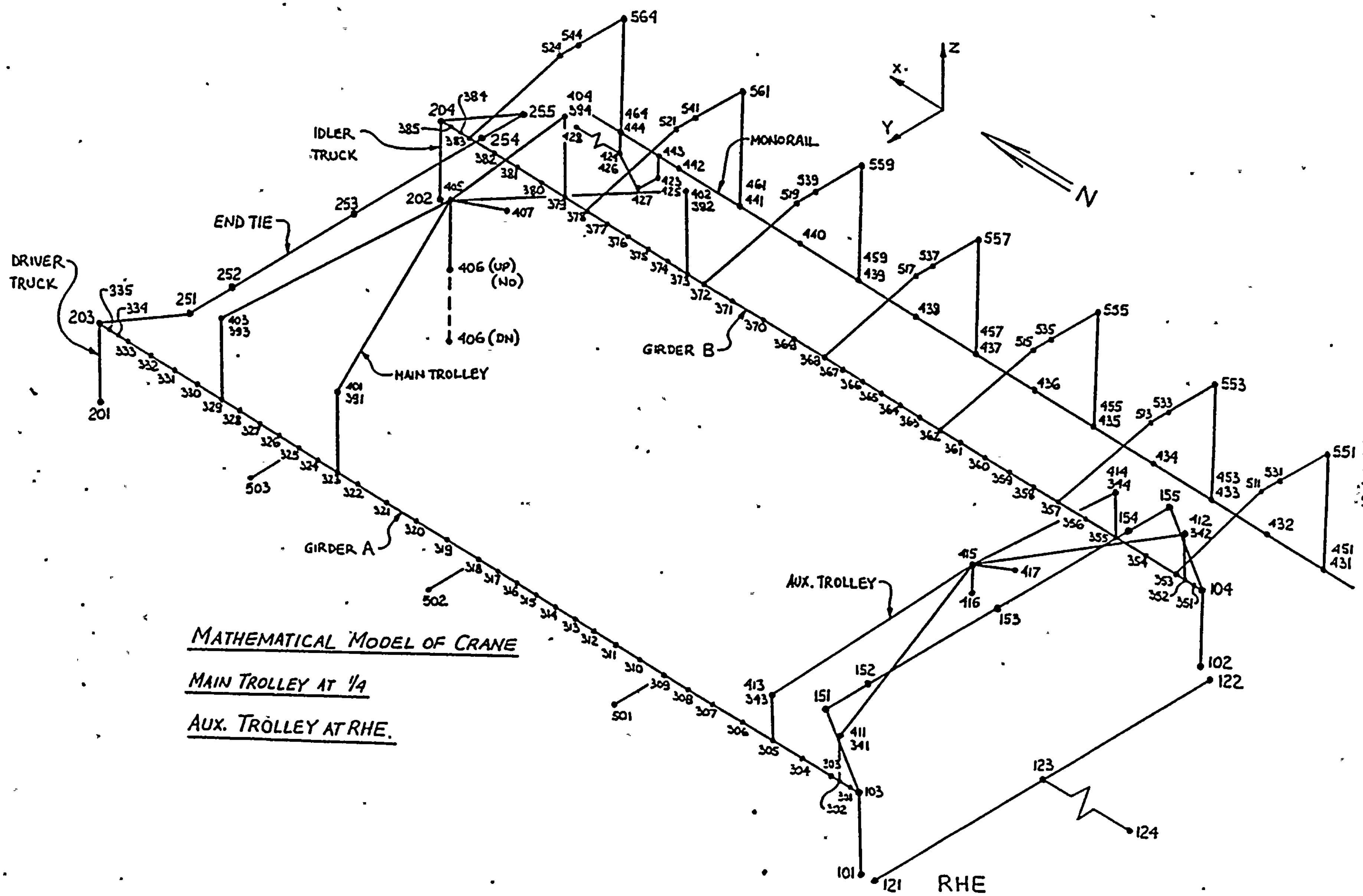


MATHEMATICAL MODEL OF CRANE.

MAIN TROLLEY AT MID.

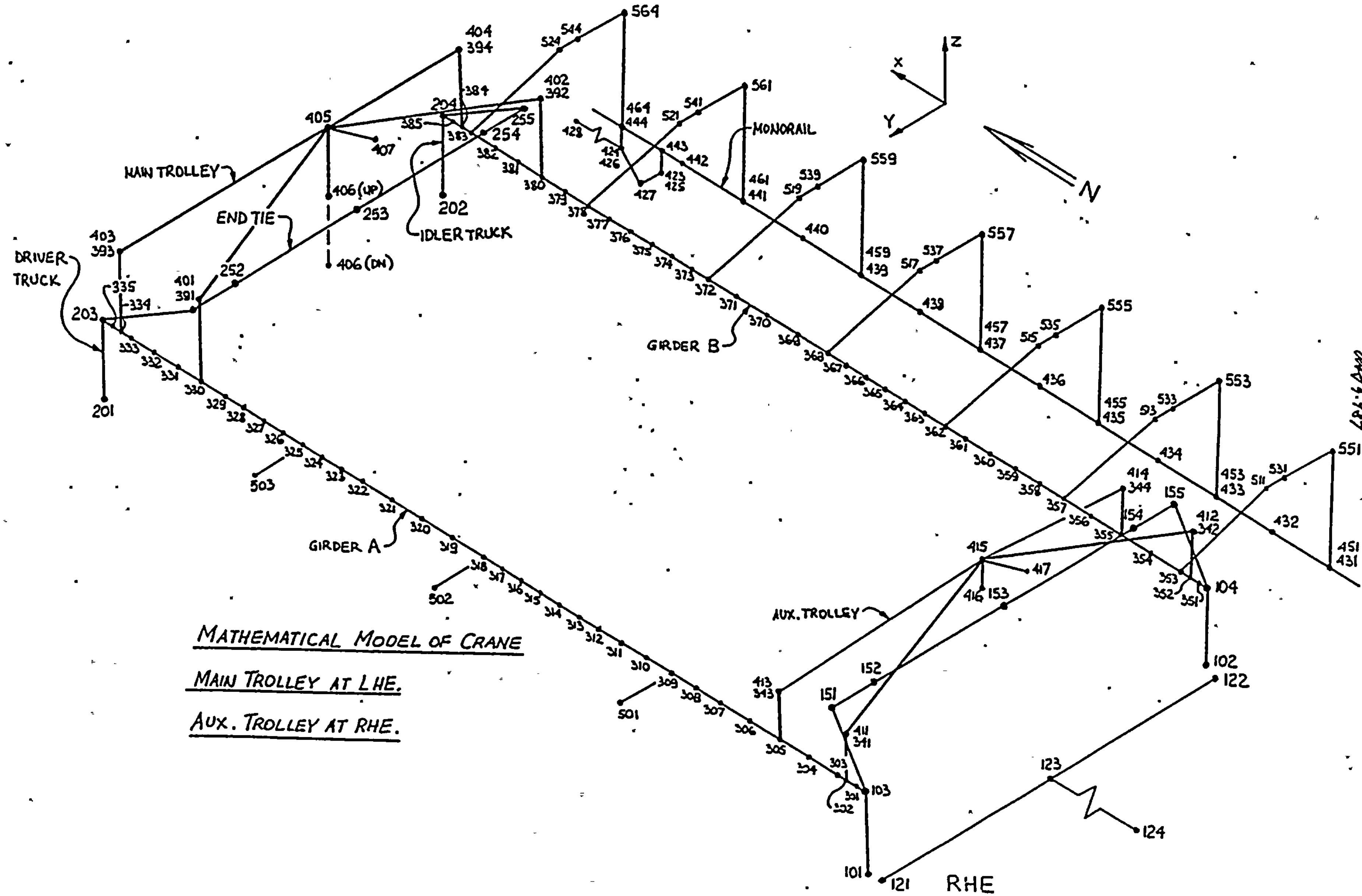
AUX. TROLLEY AT RHE.



MATHEMATICAL MODEL OF CRANE

MAIN TROLLEY AT 1/4

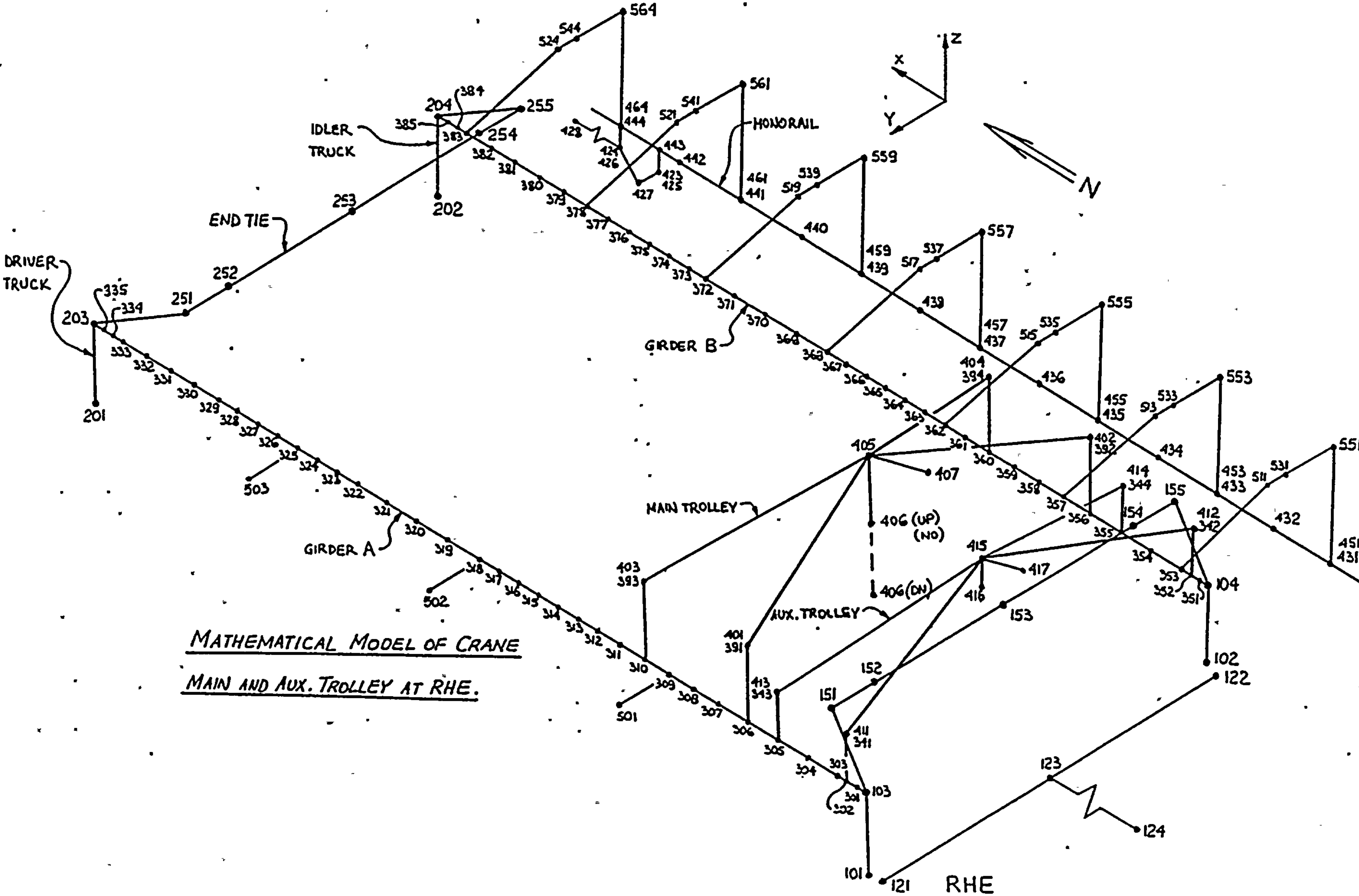
AUX. TROLLEY AT RHE.



MATHEMATICAL MODEL OF CRANE

MAIN TROLLEY AT LHE.

AUX. TROLLEY AT RHE.



MATHEMATICAL MODEL OF CRANE

MAIN AND AUX. TROLLEY AT RHE.

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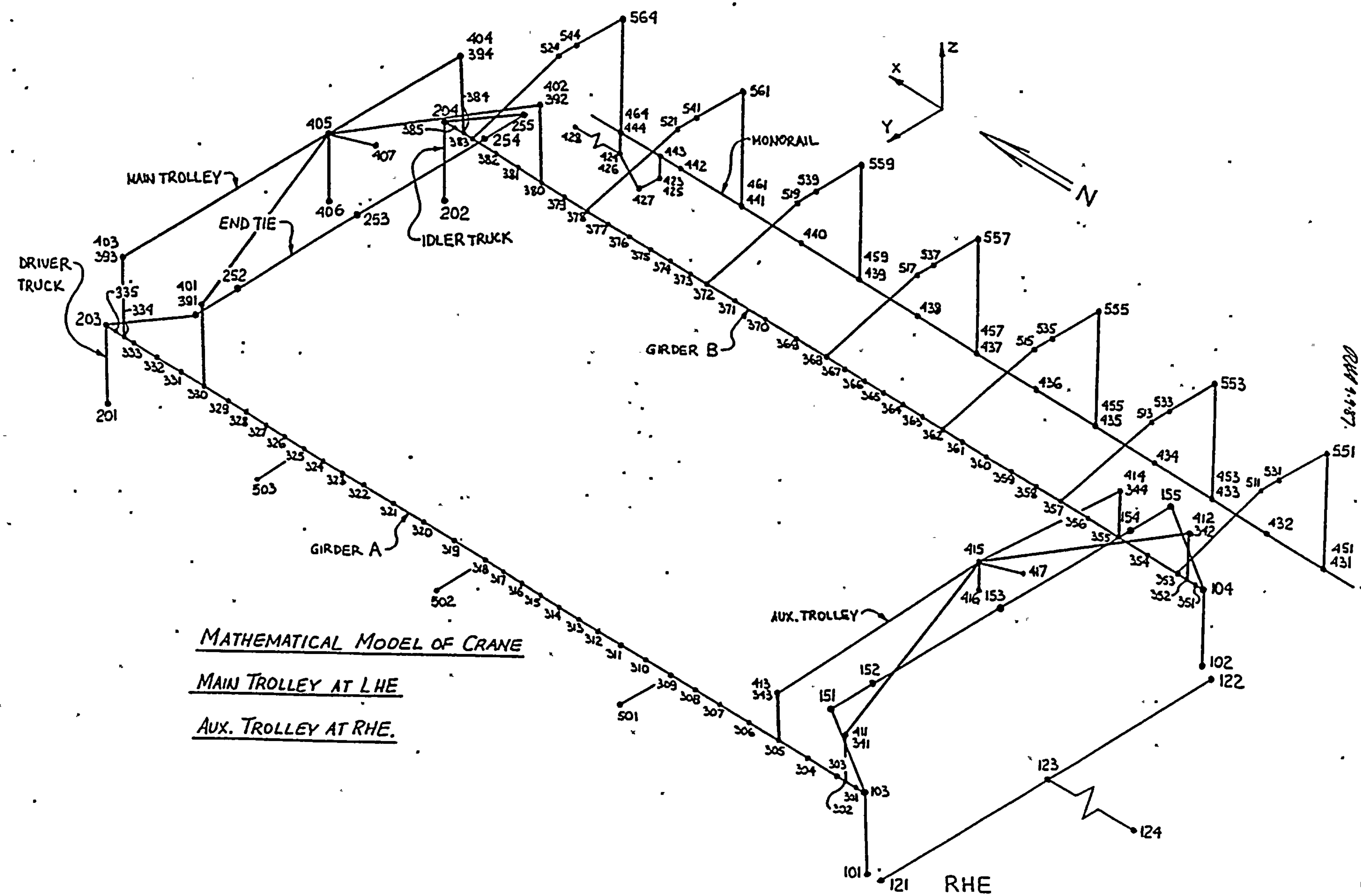

MATHEMATICAL MODEL OF CRANE

MAIN TROLLEY AT LHE

AUX. TROLLEY AT RHE.

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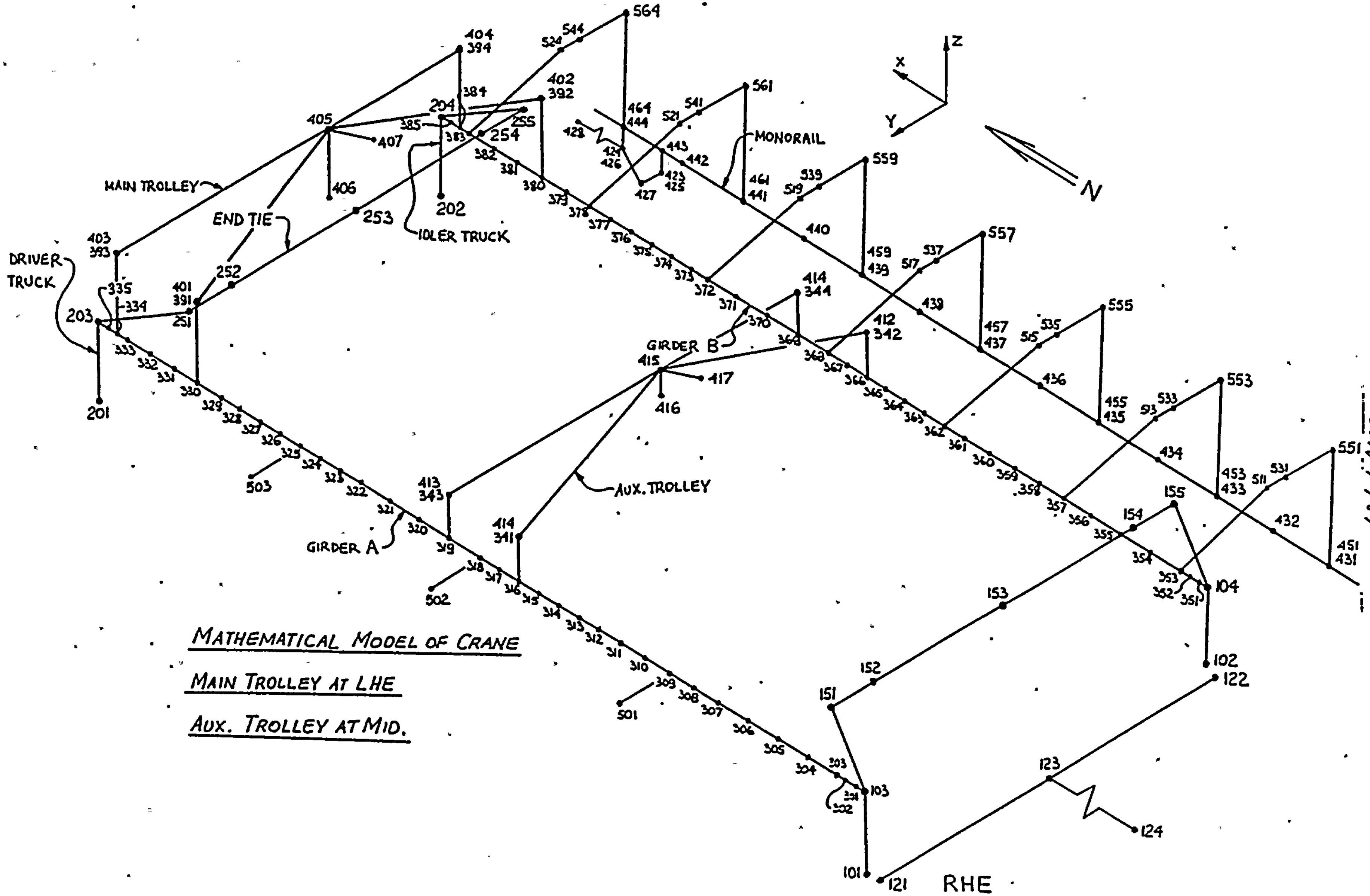


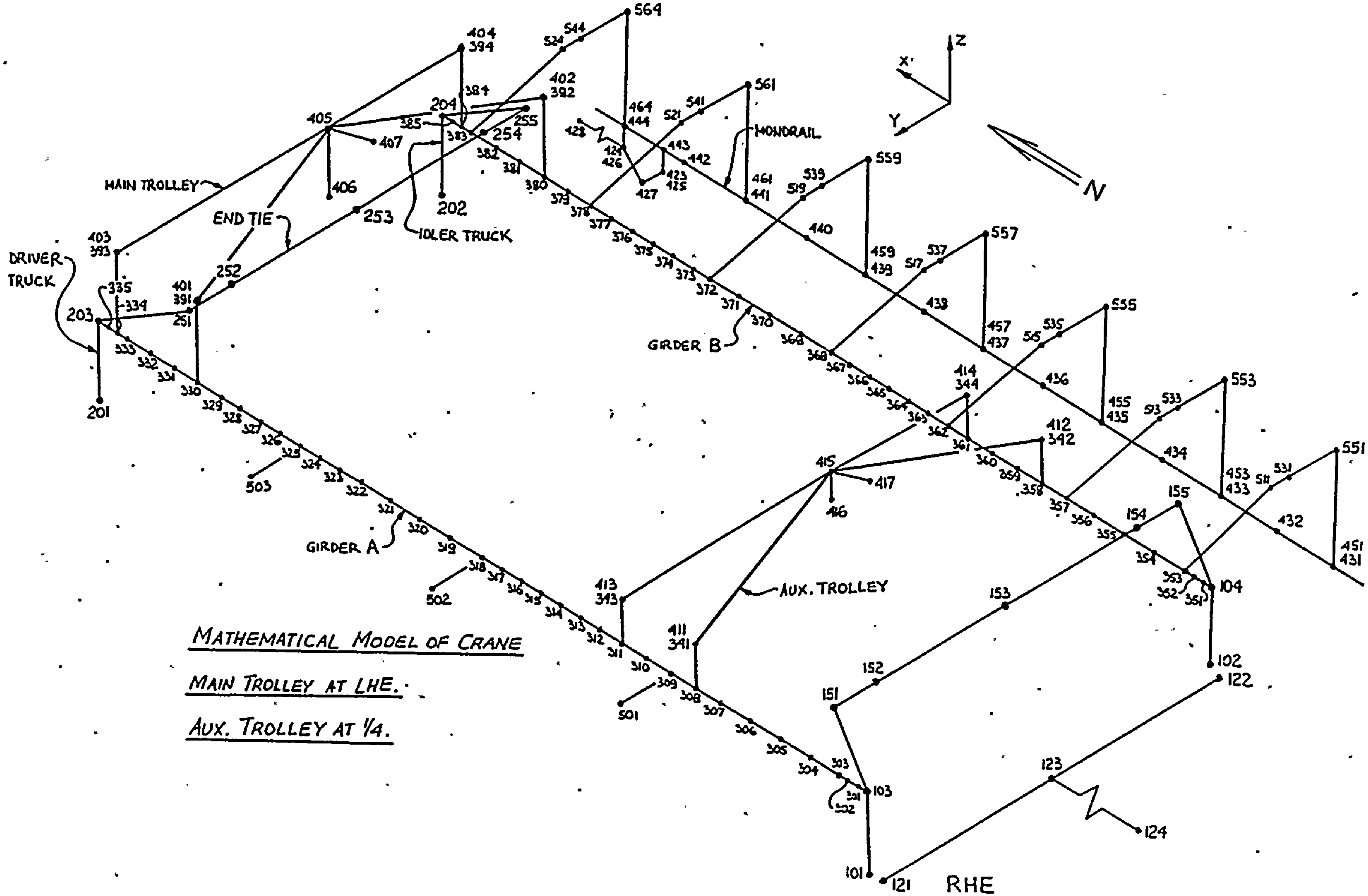
MATHEMATICAL MODEL OF CRANE

MAIN TROLLEY AT LHE

AUX. TROLLEY AT MID.

WHITING REQN. 19508 DATE 8-31-87

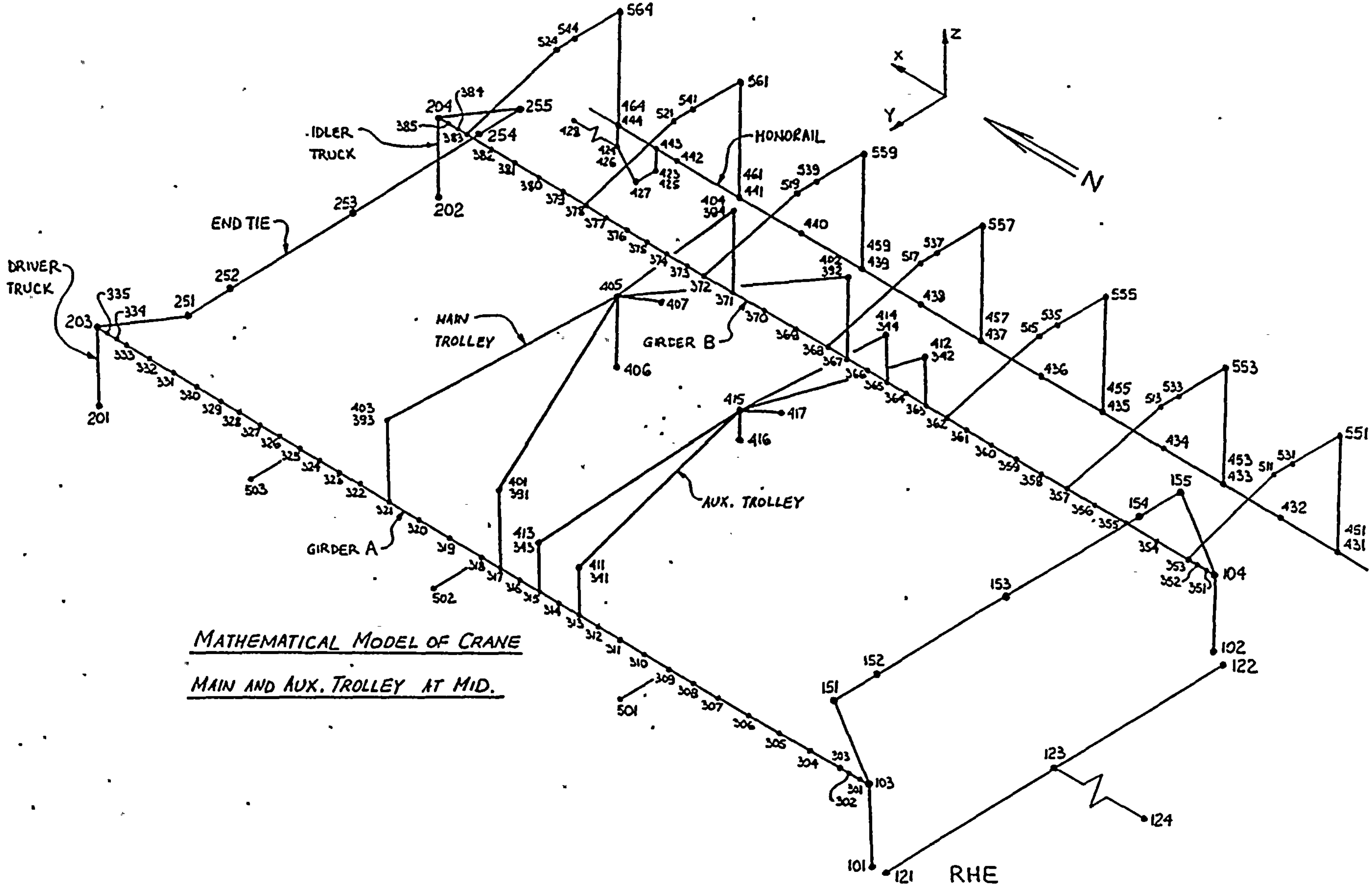
BY ASZ CHK 9-9-87 PAGE 3-13 OF 34



MATHEMATICAL MODEL OF CRANE

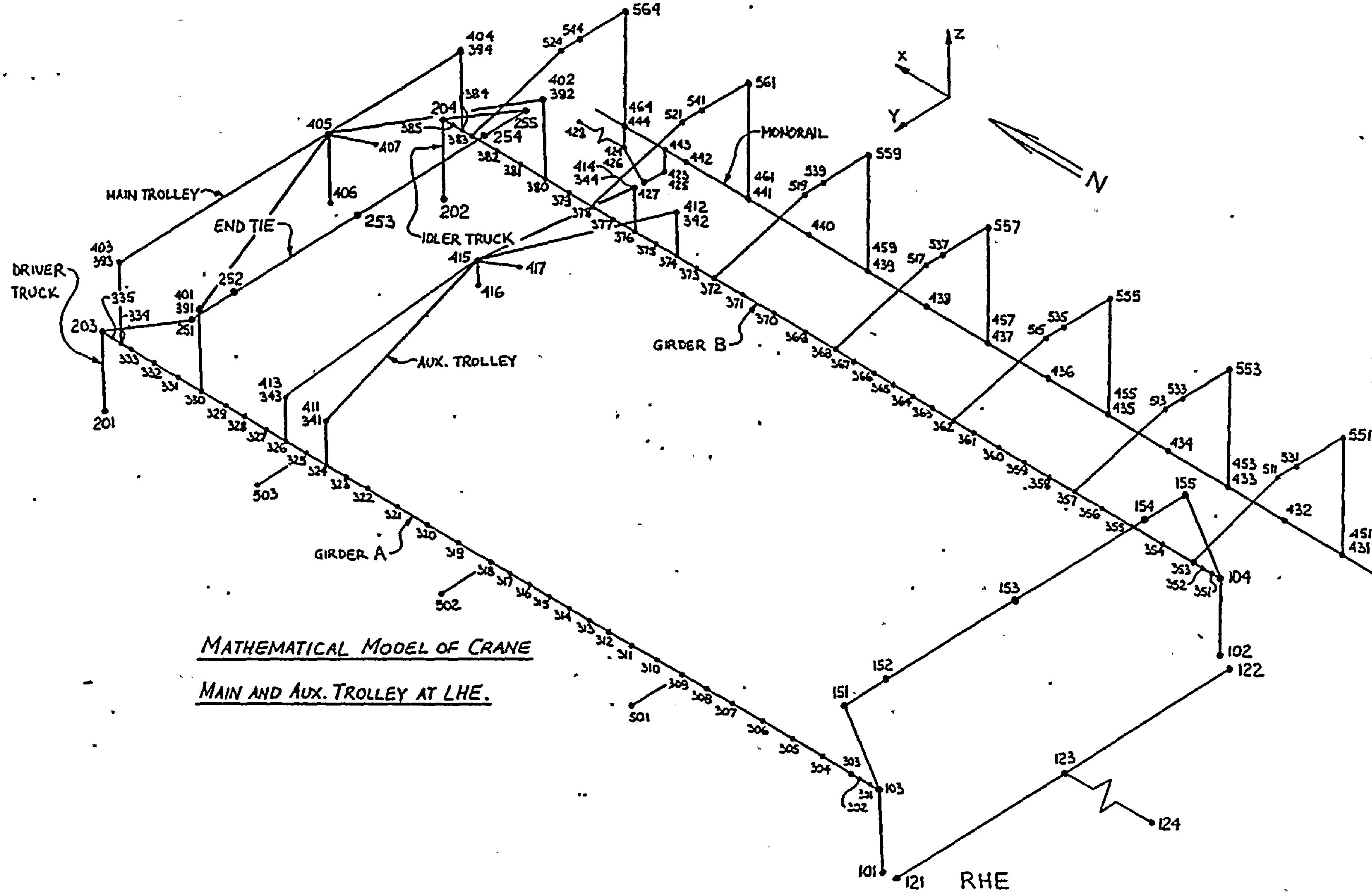
MAIN TROLLEY AT LHE.

AUX. TROLLEY AT 1/4.



MATHEMATICAL MODEL OF CRANE

MAIN AND AUX. TROLLEY AT MID.



MATHEMATICAL MODEL OF CRANE

MAIN AND AUX. TROLLEY AT LHE.

WHITING REQN. 79508 DATE 8-31-87

BY ASZ [illegible] 9-9-87 PAGE 3-16 OF 34

TABLE 3-1

BOUNDARY CONDITIONS

NODES WITH ZERO DISPLACEMENT IN THE INDICATED DIRECTIONS

LOCATION	NODE	TRANSLATION			ROTATION		
		UX	UY	UZ	ROTX	ROTY	ROTZ
BR SPRING	124	X	X	X	X	X	X
BR SPRING	123		X	X	X	X	
TRUCK RHE	101		X	X	X		
RHE	102			X	X		
TRUCK LHE	201		X	X	X		
LHE	202			X	X		
HOIST	428	X	X	X	X	X	X

TABLE 3-2

COUPLED NODES

NODES WITH EQUAL DISPLACEMENTS IN THE INDICATED DIRECTIONS

LOCATION	NODES		TRANSLATION			ROTATION		
			UX	UY	UZ	ROTX	ROTY	ROTZ
BR TRUCK	101	121	X					
	102	122	X					
MAIN TROLLEY	401	391			X			
	402	392		X	X			
	403	393	X	X	X			
	404	394	X		X			
AUX TROLLEY	411	341			X			
	412	342		X	X			
	413	343	X	X	X			
	414	344	X		X			
HOIST	423	425	X	X	X	X		
	424	426		X	X	X		

TABLE 3-3

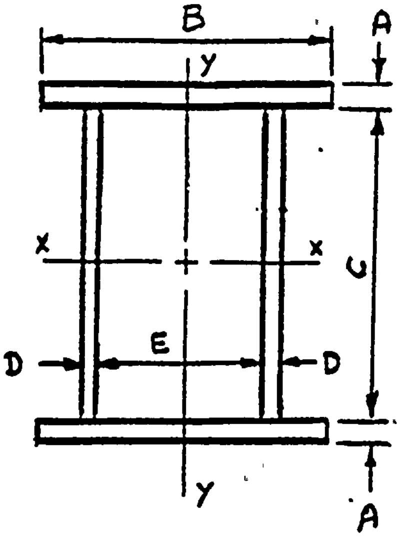
DYNAMIC DEGREES OF FREEDOM

MASTER NODES FOR REDUCED MODAL ANALYSIS
FREE IN INDICATED DIRECTION

LOCATION	NODE	TRANSLATION		
		UX	UY	UZ
GIRDER A	309		X	X
	318	X	X	X
	325		X	X
GIRDER B	359		X	X
	368	X	X	X
	375		X	X
END TIE R	153	X		X
L	253	X		X
MONORAIL TRK	432		X	X
	434		X	X
	436		X	X
	438	X	X	X
	440		X	X
	442			X
MAIN TROLLEY	407	X	X	X
	406			X
AUX TROLEY	417	X	X	X
	416			X
MONORAIL HOIST	427	X	X	X
DRIVE MACH	501	X		X
	502	X		X
	503	X		X

SYMMETRICAL BOX GIRDER PROPERTIES

PROGRAM 107 PROGRAM ID 1-A-1-09(019)
WHITING REQN 79508 DATE 5-26-87
BY MJM PAGE 3-19 OF 34
RAH 9.9.87 NEW GIRDER



....
07.
....

		READ		ENTER
1.2500	-------	1	A	1.25
22.0000	-------	2	B	22.
96.0000	-------	3	C	96.
0.3125	-------	4	D	.3125
18.0000	-------	5	E	18.

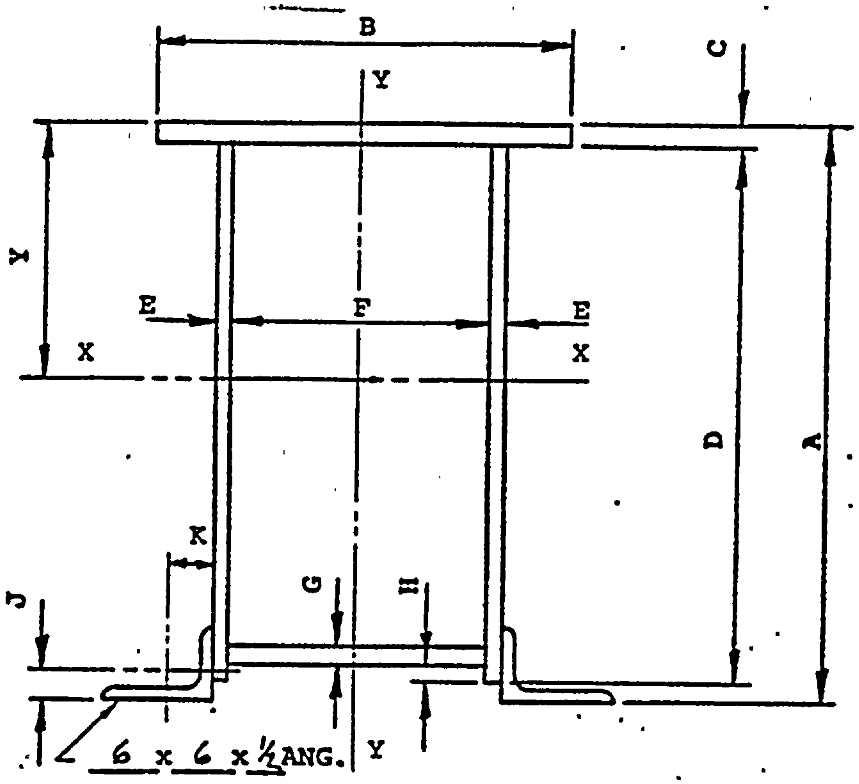
....

176,128.6458	-------	Ixx
3,576.2161	-------	Sxx
7,249.0364	-------	Iyy
659.0033	-------	Syy
115.0000	-------	AREA
19,466.4503	-------	TORSIONAL CONSTANT (K)

....

GIRDER END
SECTION PROPERTIES
SECTION "BB"

PROGRAM 117 PROGRAM ID 1-A-2-06 (046)
WHITING REQN 79508 DATE 5-26-87
BY MJM PAGE 3-20 OF 34
RAJ 9.9.87 NEW GIRDER



$A = .75(18) + 1.25(22) + 2(.3125)(72.625) + 2(5.75) = 97.89 \text{ in}^2$

$$J_z = \frac{4(18.31 \times 72.38)^2}{\frac{18.31}{1.25} + \frac{18.31}{.75} + 2\frac{72.38}{.312}} = 13970 \text{ in}^4$$

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GIVEN DATA

1.	74.375	= DIMENSION A (IN.)	74.3750
2.	22.	= DIMENSION B (IN.)	22.0000
3.	1.25	= DIMENSION C (IN.)	1.2500
4.	72.625	= DIMENSION D (IN.)	72.6250
5.	.3125	= DIMENSION E (IN.)	0.3125
6.	18.	= DIMENSION F (IN.)	18.0000
7.	.75	= DIMENSION G (IN.)	0.7500
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)	6708.8491
$\bar{Y}$ (IN.)	36.2002
I_{x-x} (IN.^{4}) (MOMENT OF INERTIA OF SECTION)	88481.3191

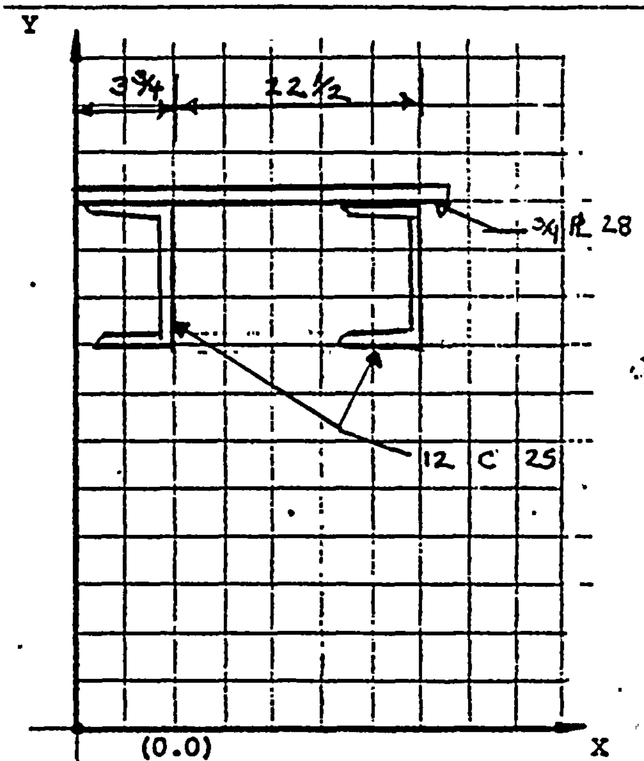
SECTIONAL PROPERTIES

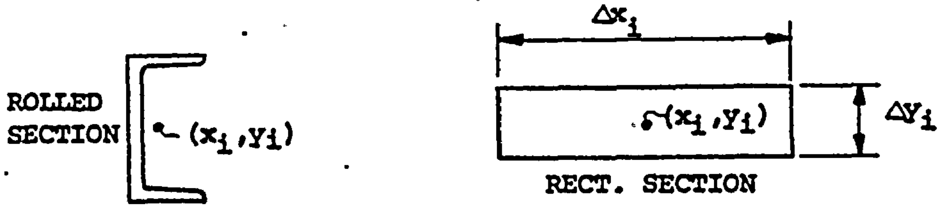
(BUILT UP OF ROLLED & RECTANGULAR SECTIONS)

PROGRAM 11_ PROGRAM ID 1-A-2-5(044)
WHITING REQN 79508 DATE 5-27-87
BY MJM PAGE 3-21 OF 34
9-4-87
GIRDER END CONNECTION THRU MID

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	34.5
2	7.35	144.	4.47	25.576	34.5
	1000.				

RECT. (1000+i)	Δx_i	Δy_i	x_i	y_i
1003	28.	.75	14.	40.875
	-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.
38.2500	$\bar{y}$	- 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.
3242.3277	Iy	- Moment of inertia about the section's neutral axis which is parallel to the 'y' axis.

SECTIONAL PROPERTIES

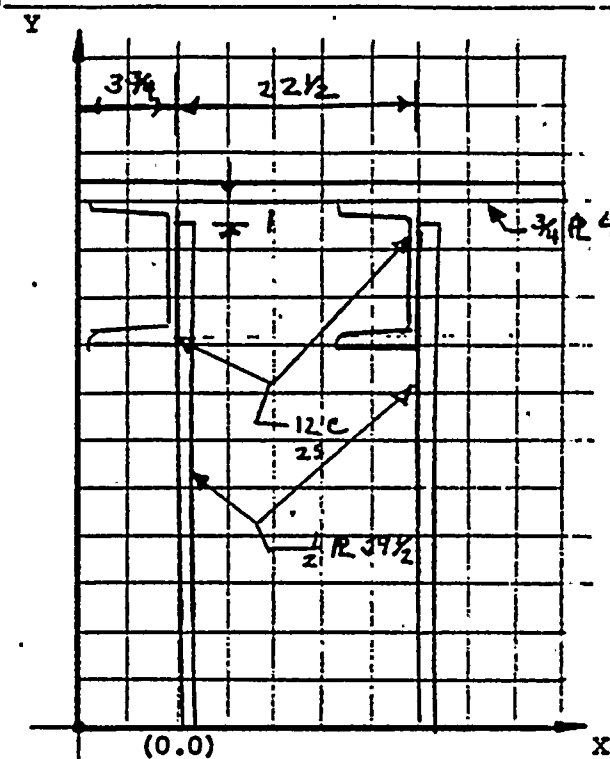
(BUILT UP OF ROLLED & RECTANGULAR SECTIONS)

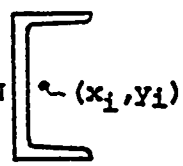
PROGRAM 116 PROGRAM ID 1-A-2-5(044)
WHITING REQN 79508 DATE 5-27-87
BY MJM PAGE 3-22 OF 34

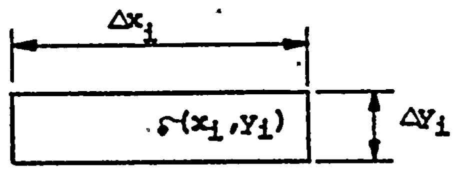
9-9-87 GIRDER END CONNECTION AT ENDS

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	34.5
2	7.35	144.	4.47	25.576	34.5
	1000.				

RECT. (1000+i)	Δx_i	Δy_i	x_i	y_i
1003	49	.75	24.5	40.875
1004	.5	39.5	4.	19.75
1005	.5	39.5	26.5	19.75
	-1.			







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

18.8382	$\bar{x}$	- Distance from the 'y' axis to the centroid of the section.
30.6699	$\bar{y}$	- Distance from the 'x' axis to the centroid of the section.
90.9500	A	- Area of the section.
14,178.6306	Ix	- Moment of inertia about the section's neutral axis which is parallel to the 'x' axis.
16,208.4309	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)

$$A = (35.7 + \sqrt{35.7(90.95)} + 90.95)/3 = 61.21 \ in^2$$

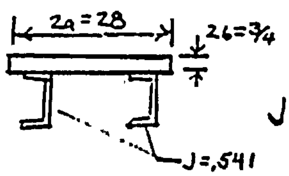
$$I_{xx} = \frac{(640.4 + \sqrt[4]{(640.4)^3(14180)} + \sqrt{(640.4)(14180)} + \sqrt[4]{(640.4)(14180)^3} + 14180)}{5}$$

$$= 5152. \ in^4$$

$$I_{yy} = \frac{(3242 + \sqrt[4]{(3242)^3(16210)} + \sqrt{(3242)(16210)} + \sqrt[4]{(3242)(16210)^3} + 16210)}{5}$$

$$= 8478. \ in^4$$

EFFECTIVE TORSIONAL PROPERTIES

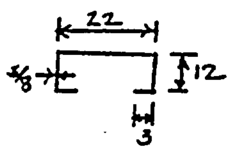


$$J = 2(.541) + 14(.375)^3\left[\frac{16}{3} - 3.36\frac{.375}{14}\left(1 - \frac{.375^4}{12(14)^4}\right)\right]$$

$$= 4.953 \ in^4$$

(REF 4, p. 290, TABLE 20, CASE 4)

FURTHER SIMPLIFY



(REF 4, p.300, TABLE 21, CASE 2)

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

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

$$= 75090 \ in^6$$

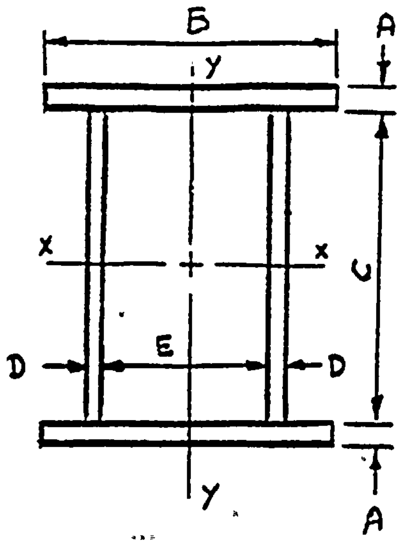
$$\beta = \left(\frac{4.953\ (11.2\times10^6)}{75090\ (29\times10^6)}\right)^{1/2} = .005047 \ in^{-1}$$

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

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

$$= 483.3 \ in^4$$

SYMMETRICAL BOX GIRDER PROPERTIES



PROGRAM 107 PROGRAM ID 1-A-1-0?(013)

WHITING REQN 79508 DATE 5-27-87

BY MJM PAGE 3-24 OF 34

9.9.87

TRUCKS

•••••••••••

107•

•••••••••••

		READ		ENTER
0•7500	--------	1	A	.75
18•0000	--------	2	B	18.
26•2500	--------	3	C	26.25
0•3750	--------	4	D	.375
8•5000	--------	5	E	8.5

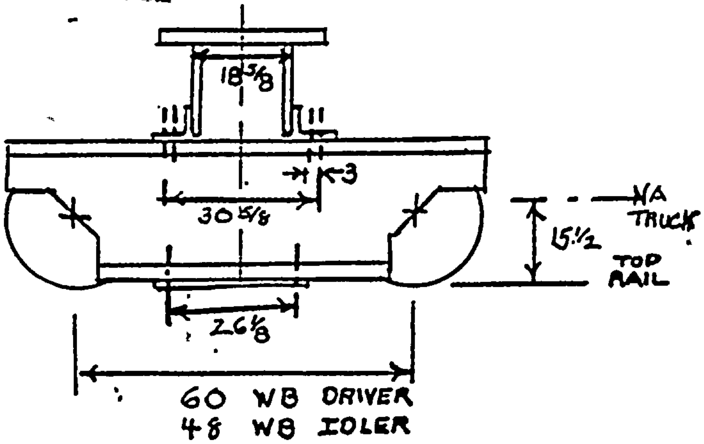
•••••••••••

6052•5087	--------	Ixx
436•2168	--------	Sxx
1116•9052	--------	Iyy
124•1005	--------	Syy
46•6875	--------	AREA
1369•8641	--------	TORSIONAL CONSTANT (K)

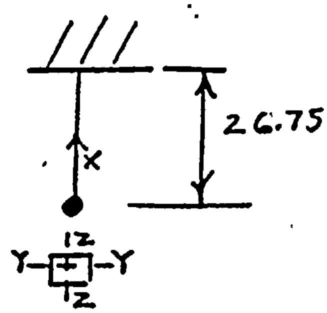
•••••••••••

WHITING REQN. T1508 DATE 6-8-87
BY MJM [initials] 9.9.87 PAGE 3-25 OF 34

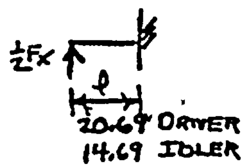
EFFECTIVE PROPERTIES OF BEAMS TO SIMULATE TRUCKS



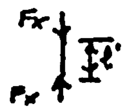
SIMULATE W/ BEAM



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



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



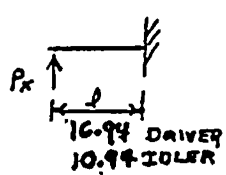
$$\Delta x = \frac{F_x \ell'}{AE}$$

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

$$A_{DRIVER} = \frac{6(6052)(26.75)}{(20.69)^3} = 109.7 \text{ in}^2$$

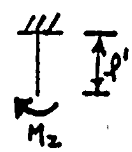
$$A_{IDLER} = \frac{6(6052)(26.75)}{(14.69)^3} = 306.4 \text{ in}^2$$

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



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

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



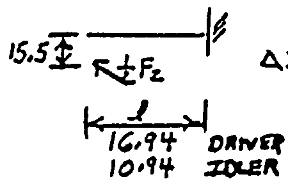
$$\theta = \frac{M_z \ell'}{EI_z}$$

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

$$I_{z\,DRIVER} = \frac{2(60)(6052)(26.75)}{(16.94)^2} = 67700 \text{ in}^4$$

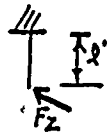
$$I_{z\,IDLER} = \frac{2(48)(6052)(26.75)}{(10.94)^2} = 129900 \text{ in}^4$$

FOR FORCE IN Z DIRECTION (REF 3, p 104, TABLE III, CASE 1 & p 171)



$$\Delta Z = \frac{\frac{1}{2}F_z \ell^3}{3EI_{yTR}} + \frac{\frac{1}{2}F_z (15.5)^2 \ell}{J_{TR}G}$$

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



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

$$I_y = \frac{\ell'^3}{3\left(\frac{\ell^3}{6 I_{yTR}} + \frac{1.3(15.5)^2 \ell}{J_{TR}}\right)} = \frac{\ell'^3}{\frac{\ell^3}{2I_{yTR}} + \frac{(937)\ell}{J_{TR}}}$$

$$I_{y\,DRIVER} = \frac{(26.75)^3}{\frac{(16.94)^3}{2(1117)} + \frac{(937)(16.94)}{1370}} = 1391 \text{ in}^4$$

$$I_{y\,IDLER} = \frac{(26.75)^3}{\frac{(10.94)^3}{2(1117)} + \frac{(937)(10.94)}{1370}} = 2372 \text{ in}^4$$

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:

$$I_{y\,DRIVER} = \frac{1391}{2/3} = 2086 \text{ in}^4$$

$$I_{y\,IDLER} = \frac{2372}{2/3} = 3558 \text{ in}^4$$

TROLLEY

FRAMES MODELED AS RIGID

MAIN HOIST ROPE
1½" DIA - PYTHON 10F16V - ALL STEEL - 26 STRAND - 362 WIRE
REEVED - 2 - 6 PART SYSTEMS - REDUNDANT (REF 8)

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

MODULUS OF ELASTICITY 14,000,000 PSI

AUX HOIST ROPE
¾ DIA - STAINLESS STEEL - 6X37, IWRC
REEVED - 2 - 4 PART SYSTEMS - REDUNDANT (REF 11)

$$AREA = 8 \times .258 = 2.06 \text{ in}^2$$

MODULUS OF ELASTICITY 13,000,000 PSI

MONORAIL HOIST UNIT

MODELED AS RIGID

BRIDGE SPRING

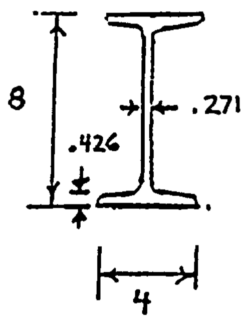
THE BRIDGE SPRING IS USED AS A RIGID LINK FOR TRANSMITTING REACTIONS IN THE GLOBAL X DIRECTION (PARALLEL WITH THE GIRDERS). THE SPRING RATE IS SELECTED TO PROVIDE A NATURAL FREQUENCY IN THE HIGH FREQUENCY (STIFF) PORTION OF THE EXCITATION SPECTRUM.

$$K = \frac{W}{g}(2\pi f)^2$$
$$= \frac{318000}{386.4}(2\pi(33))^2 = 35\,4000\,000 \text{ lb/in}$$

WHERE
K = SPRING RATE, lb/in
W = TOTAL WEIGHT OF CRANE, lb (WITHOUT LIFTED LOAD)
g = ACCELERATION OF GRAVITY, in/sec²
f = NATURAL FREQUENCY, HZ

MONORAIL TRACK & FLT SUPPT

S 8 x 18.4



$A = 5.41 \text{ in}^2$

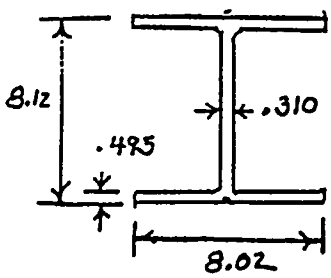
$I_{xx} = 57.6 \text{ in}^4$

$I_{yy} = 3.73 \text{ in}^4$

$J_z = .34 \text{ in}^4$

FXD SUPPT

W 8 x 35



$A = 10.3 \text{ in}^2$

$I_{xx} = 127. \text{ in}^4$

$I_{YY} = 42.6 \text{ in}^4$

$J_z = .77 \text{ in}^4$

TORSIONAL SPRING

TO SIMULATE UNRESTRAINED SWING OF HOIST

(REF 15, p 3-25)

SMALL IN RADIANS

$T = W \ell \theta$

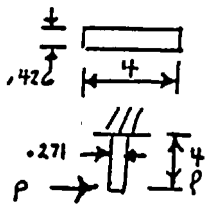
$T = K \theta$

$K = w \ell$

$= 1200 (12) = 14400$ in lb/radian

TRACK WEB SPRING RATE

(REF. 4, PP 128-145)



$$I_B = \frac{.426(4)^3}{12} = 2.272 \text{ in}^4$$

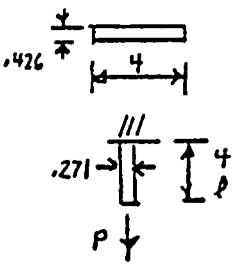
FOR A 1 in STRIP

$$I_S = \frac{(.271)^3}{12} = .001658 \text{ in}^4$$

$$\beta = \sqrt[4]{\frac{\frac{3EI_S}{\ell^3}}{4EI_B}} = \sqrt[4]{\frac{3I_S}{4\ell^3 I_B}}$$

$$I_{EQUIV} = \frac{2\ell^3 \frac{3EI_S}{\ell^3}}{3E\sqrt[4]{\frac{3I_S}{4\ell^3 I_B}}} = 2.149\sqrt[4]{I_S^3 \ell^3 I_B}$$

$$= 2.149\sqrt[4]{(.001658)^3(4)^3(2.272)} = .06132 \text{ in}^4$$



$$I_B = \frac{4(.426)^3}{12} = .02577 \text{ in}^4$$

FOR A 1 in STRIP

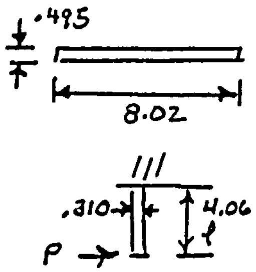
$$A_S = .271(1) = .271 \text{ in}^2$$

$$\beta = \sqrt[4]{\frac{\frac{A_S E}{\ell}}{4EI_B}} = \sqrt[4]{\frac{A_S}{4I_B \ell}}$$

$$A_{EQUIV} = \frac{2\frac{A_S E}{\ell}\ell}{E\sqrt[4]{\frac{A_S}{4I_B\ell}}} = 2.828\sqrt[4]{A_S^3 I_B \ell}$$

$$= 2.828\sqrt[4]{(.271)^3(.02577)(4)} = .6019 \text{ in}^2$$

FXD SUPPORT WEB SPRING RATE (REF 4, PP 128-145)



$$I_B = \frac{.495(8.02)^3}{12} = 21.28 \text{ in}^4$$

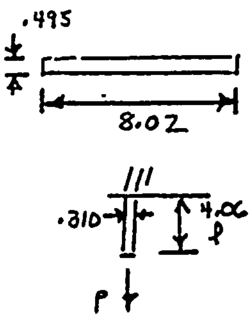
FOR A 1 in STRIP

$$I_s = \frac{(.310)^3}{12} = .002483 \text{ in}^4$$

$$\beta = \sqrt[4]{\frac{\frac{3EI_s}{l^3}}{4EI_B}} = \sqrt[4]{\frac{3I_s}{4l^3 I_B}}$$

$$I_{EQUIV} = \frac{2l^3\,\frac{3EI_s}{l^3}}{3E\sqrt[4]{\frac{3I_s}{4l^3 I_B}}} = 2.149\sqrt[4]{I_s^3 l^3 I_B}$$

$$= 2.149\sqrt[4]{(.002483)^3(4.06)^3(21.28)} = .1468 \text{ in}^4$$



$$I_B = \frac{8.02(.495)^3}{12} = .08106 \text{ in}^4$$

FOR A 1 in STRIP

$$A_s = .310(1) = .310 \text{ in}^2$$

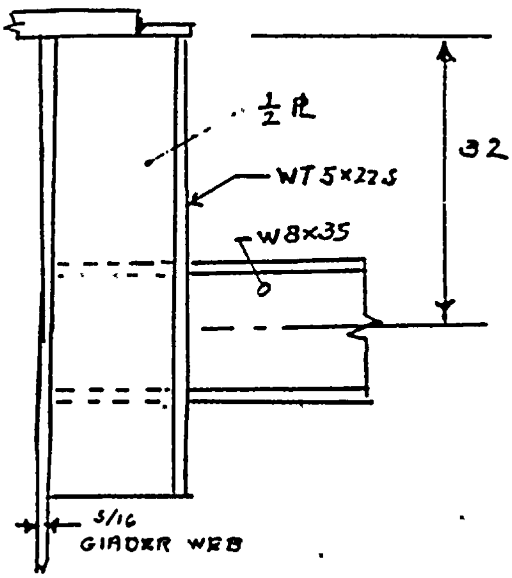
$$\beta = \sqrt[4]{\frac{\frac{A_sE}{l}}{4EI_B}} = \sqrt[4]{\frac{A_s}{4I_B l}}$$

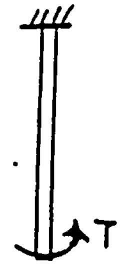
$$A_{EQUIV} = \frac{2\,\frac{AE}{l}\,l}{E\sqrt[4]{\frac{A_s}{4I_B l}}} = 2.828\sqrt[4]{A_s^3 I_B l}$$

$$= 2.828\sqrt[4]{(.310)^3(.08106)(4.06)} = .8899 \text{ in}^2$$

LATERAL INERTIA OF BEAM
TO SIMULATE FXD SUPPORT CONNECTION TO GIRDER

(REF 3, P 191 & P 106, TABLE III, CASE 9)

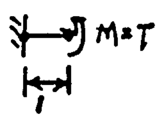




$$\theta = \frac{T\ell}{JG}$$

$$G = \frac{E}{2(1+.3)} \qquad \ell = (32-4)$$

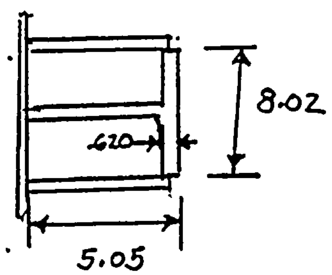
$$\theta = 72.8\,\frac{T}{JE}$$



$$\theta = \frac{M\ell}{EI} = \frac{T}{EI}$$

$$72.8\,\frac{T}{JE} = \frac{T}{EI}$$

$$I = \frac{J}{72.8}$$



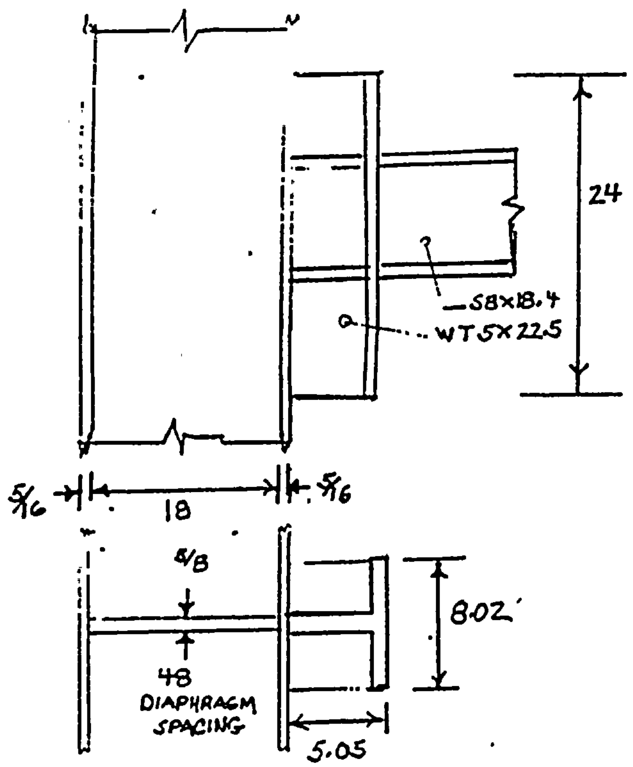
$$J = \frac{4(8.52 \times 4.90)^2}{\frac{8.52}{.620} + \frac{8.52}{.312} + 2\frac{4.90}{.5}} = 114.9 \quad in^4$$

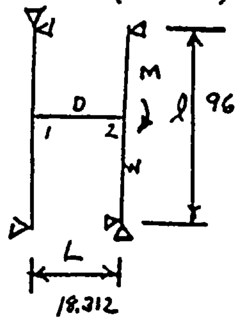
$$I_{EFFECTIVE} = \frac{114.9}{72.8} = 1.58 \quad in^4$$

RIGID FOR OTHER PROPERTIES

LATERAL INERTIA OF BEAM
TO SIMULATE FLT SUPPORT CONNECTION TO GIRDER

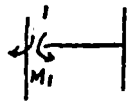
(REF 3, P 108, TABLE III, CASE 19+20+9)





$$\frac{l}{I_W} = \frac{96}{\frac{24(.3125)^3}{12}} = 1573 \text{ in}^{-3}$$

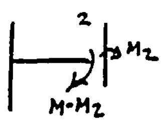
$$\frac{L}{I_D} = \frac{18.312}{\frac{24(.625)^3}{12}} = 37.5 \text{ in}^{-3}$$



$$\theta_1 = \frac{M_1 l}{12EI_W} = -\frac{M_1 L}{3EI_D} + \frac{(M-M_2)L}{6EI_D}$$

$$M_1 = (M-M_2)\frac{\frac{L}{6EI_D}}{\frac{l}{12EI_W}+\frac{L}{3EI_D}}$$

$$= .0\,4353\,(M-M_2)$$



$$\theta_2 = -\frac{M_2 l}{12EI_W} = -\frac{M_1 L}{6EI_D} - \frac{(M-M_2)L}{3EI_D}$$

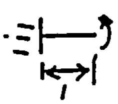
$$\frac{M_2}{E}\left(\frac{1573}{12}\right) = (M-M_2)\left(\frac{.0453}{6}+\frac{1}{3}\right)\frac{37.5}{E}$$

$$M_2 = \frac{M\left(\frac{.0453}{6}+\frac{1}{3}\right)37.5}{\frac{1573}{12}+\left(\frac{.0453}{6}+\frac{1}{3}\right)37.5}$$

$$= .0888\,M$$

$$\theta_2 = \frac{(.0888\,M)\,l}{12\,E\,I_W}$$

$$= 11.65\,\frac{M}{E}$$



$$\theta = \frac{M\,l}{EI} = \frac{M}{EI}$$

$$I_{EFFECTIVE} = \frac{1}{11.65} = .0858 \text{ in}^4$$

RIGID FOR OTHER PROPERTIES

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9.9.87

MASS ELEMENTS

DESCRIPTION	NODE	WEIGHT LB	MASS LB SEC^2/IN
MAIN TROLLEY LESS BLOCK	407	124000	320.9
BLOCK ONLY	406	20000	51.76
BLOCK W/ 60 T LIFTED LOAD	406	140000	362.3:
AUX TROLLEY LESS BLOCK	417	22300	57.71
BLOCK ONLY	416	3200	8.28
BRIDGE DRIVE ASSEMBLY	502	4000	10.35
SINGLE REDUCTION UNITS	501,503	2000	5.18
MONORAIL HOIST UNIT	421	1200	3.11
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

GIRDER:

	DISTRIBUTED WEIGHT (LB/FT) GIRDER A	GIRDER B
GIRDER	510	510
RAIL	60	60
WALK	60	—
SQ SHAFT & CPLGS	20	—
CTRLS & SUPPT	85	—
BRIDGE CONDUCTOR	—	40
MISC	15	10
	750	620

MASS DENSITY

GIRDER A

$$\frac{750}{12 \times .1150 \times 386.4} = .001406 \ \text{lb sec}^2/\text{in}^4$$

GIRDER B

$$\frac{620}{12 \times 115.0 \times 386.4} = .001163 \ \text{lb sec}^2/\text{in}^4$$

END CONNECTIONS

DISTRIBUTED WEIGHT
180 lb/ft

MASS DENSITY

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

MONORAIL TRACK

DISTRIBUTED WEIGHT INCLUDING CONDUCTORS
25 lb/ft

MASS DENSITY

$$\frac{25}{12 \times 5.41 \times 386.4} = .000997 \ \text{lb sec}^2/\text{in}^4$$

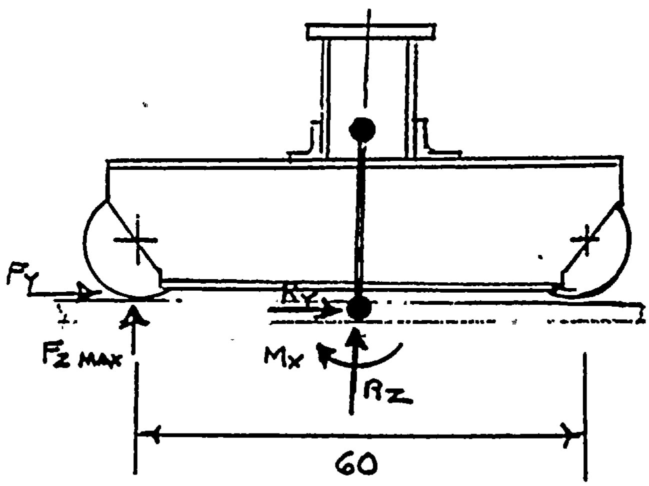
SUPPLEMENTAL CALCULATIONS

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.

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

MAIN TROLLEY	AUX TROLLEY	MAIN LOAD	OBE	SSE
MID	RHE	60T UP	.1183	.0785
	RHE	60T DN	.1508	.1121
	RHE	NO	.0852	.0572
	MID	NO	.0796	.0549
1/4	RHE	60T UP	.1242	.0841
	RHE	60T DN	.1773	.1338
	RHE	NO	.0892	.0606
RHE	RHE	60T UP	.1125	.0729
	RHE	60T DN	.1581	.1160
	RHE	NO	.0826	.0537
LHE	RHE	60T UP	.2171	.1374
	RHE	60T DN	.3187	.2344
	RHE	NO	.2545	.1502
	MID	NO	.1121	.0678
	1/4	NO	.2037	.1206
	LHE	NO	.1242	.0770

FOR REACTIONS SEE TABLES B 33 THROUGH B 96

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TRUCK LOADS

THE RX 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.

$$F_x = \frac{2}{3}\left(\frac{R_x}{2}\right) = \frac{R_x}{3}$$

ALL OTHER TRUCK LOADS ARE SUMMARIZED DIRECTLY FROM TABLES B33 TO B96 AFTER THE APPLICATION OF THE SCALE FACTOR AS PREVIOUSLY DESCRIBED.

TABLE 4-2

DRIVE TRUCK LOADS (NODES 101-201)
(OBE - SCALED)

TROLLEY	LOAD	SUM (MAX)				DIFFER (MIN)			
		FX	FY	FZ	MX	FX	FY	FZ	MX
MAIN MID	UP	13.3	29.7	164.3	1922.	-13.3	-29.7	64.5	-1847.
	DN	13.1	37.8	217.1	2436.	-13.1	-37.8	11.7	-2361.
1/4	UP	13.0	37.2	168.2	2490.	-13.0	-37.2	73.0	-2412.
	DN	13.0	50.2	259.9	3486.	-13.0	-50.2	18.9	-3409.
LHE	UP	12.6	61.6	176.4	3510.	-12.6	-61.6	63.8	-3433.
	DN	12.4	71.2	273.1	4585.	-12.4	-71.2	36.8	-4507.
RHE	UP	10.7	37.1	187.3	2458.	-10.7	-37.1	54.1	-2380.
	DN	12.8	50.6	279.5	3336.	-12.8	-50.6	30.5	-3258.
MID	NO	12.6	21.4	105.9	1393.	-12.6	-21.4	62.1	-1320.
1/4	NO	13.0	29.3	108.2	1847.	-13.0	-29.3	64.3	-1773.
LHE	NO	12.4	25.3	116.7	2204.	-12.4	25.3	55.0	-2130.
RHE	NO	11.7	28.6	128.0	1919.	-11.7	-28.6	45.5	-1844.
AUX MID	NO	12.2	25.2	123.3	1885.	-12.2	-25.2	47.9	-1802.
1/4	NO	12.3	57.5	122.1	4764.	-12.3	-575	50.9	-4685.
BOTH MID	NO	12.7	21.3	100.1	1526.	-12.7	-21.3	67.3	-1445.
LHE	NO	11.9	29.5	128.0	2238.	-11.9	-29.5	45.0	-2151.

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

TABLE 4-3

IDLER TRUCK LOADS (NODES 102-202)
(OBE - SCALED)

TROLLEY	LOAD	SUM (MAX)				DIFFER (MIN)			
		Fx	Fy	Fz	Mx	Fx	Fy	Fz	Mx
MAIN MID	UP	13.3	0	151.1	244.7	-13.3	0	61.0	-103.8
	DN	13.1	0	204.1	198.5	-13.1	0	8.1	-114.9
1/4	UP	13.0	0	157.4	410.5	-13.0	0	67.9	-266.1
	DN	13.0	0	248.6	423.4	-13.0	0	12.6	-279.0
LHE	UP	12.6	0	165.8	753.4	-12.6	0	58.1	-610.6
	DN	12.4	0	262.8	815.1	-12.4	0	29.5	-672.3
RHE	UP	10.7	0	174.5	445.4	-10.7	0	50.3	-366.7
	DN	12.8	0	266.5	485.1	-12.8	0	26.8	-407.6
MID	NO	12.6	0	94.4	173.6	-12.6	0	57.6	-92.4
1/4	NO	13.0	0	97.5	407.0	-13.0	0	58.7	-264.1
LHE	NO	12.4	0	106.7	545.3	-12.4	0	49.3	-403.7
RHE	NO	11.7	0	116.3	432.4	-11.7	0	41.8	-345.7
AUX MID	NO	12.2	0	112.3	339.1	-12.2	0	43.0	-260.0
1/4	NO	12.3	0	111.7	612.8	-12.3	0	45.5	-483.4
BOTH MID	NO	12.7	0	90.4	255.3	-12.7	0	61.3	-119.3
LHE	NO	11.9	0	116.1	332.0	-11.9	0	40.3	-253.6

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

TABLE 4-4

DRIVE TRUCK LOADS (NODES 101-201)
(SSE - SCALED)

TROLLEY	LOAD	SUM (MAX)				DIFFER (MIN)			
		Fx	Fy	Fz	Mx	Fx'	Fy'	Fz'	Mx'
MAIN MID	UP	25.3	37.1	197.4	2391.	-25.3	-37.1	33.0	-2315.
	DN	25.0	52.7	300.7	3384.	-25.0	-52.7	-69.8	-3309.
1/4	UP	25.4	53.0	207.3	3265.	-25.4	-53.0	53.6	-3187.
	DN	25.3	74.2	365.3	4979.	-25.3	-74.2	-86.5	-4901.
LHE	UP	24.8	106.6	204.7	5258.	-24.8	-106.6	52.9	-5180.
	DN	24.4	119.7	376.4	6916.	-24.4	-119.7	-66.5	-6839.
RHE	UP	21.7	48.9	221.6	3261.	-21.7	-48.9	39.8	-3183.
	DN	24.6	72.1	382.3	4772.	-24.6	-72.1	-58.1	-4695.
MID	NO	24.4	27.0	124.8	1751.	-24.4	-27.0	44.7	-1677.
1/4	NO	25.3	44.2	126.4	2498.	-25.3	-44.2	53.5	-2424.
LHE	NO	24.7	37.9	129.0	3833.	-24.7	-37.9	48.2	-3759.
RHE	NO	23.1	39.7	145.4	2685	-23.1	-39.7	36.2	-2610.
AUX MID	NO	24.4	32.3	137.2	2455.	-24.4	-32.3	39.6	-2373.
1/4	NO	24.6	100.7	137.0	8589.	-24.6	-100.7	42.4	-8510.
BOTH MID	NO	24.8	27.7	121.5	1997.	-24.8	-27.7	47.0	-1915.
LHE	NO	23.7	40.8	142.7	3048.	-23.7	-40.8	37.5	-2961.

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

TABLE 4-5

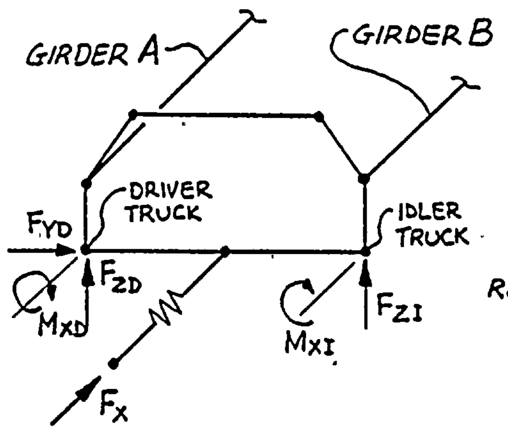
IDLER TRUCK LOADS (NODES 102-202) (SSE - SCALED)

TROLLEY	LOAD	SUM (MAX)				DIFFER (MIN)			
		Fx	FY	FZ	Mx	Fx'	FY'	FZ'	Mx'
MAIN MID	UP	25.3	0	181.4	383.5	-25.3	0	31.3	-233.7
	DN	25.0	0	284.4	309.9	-25.0	0	-71.6	-226.3
1/4	UP	25.4	0	193.7	720.2	-25.4	0	50.4	-575.8
	DN	25.3	0	351.8	749.1	-25.3	0	-90.6	-604.7
LHE	UP	24.8	0	191.5	1331.	-24.8	0	48.6	-1188.
	DN	24.4	0	364.8	1410.	-24.4	0	-72.4	-1267.
RHE	UP	21.7	0	205.6	741.5	-21.7	0	37.2	-664.0
	DN	24.6	0	367.4	817.0	-24.6	0	-65.2	-739.6
MID	NO	24.4	0	110.5	279.9	-24.4	0	42.1	-198.7
1/4	NO	25.3	0	113.1	717.0	-25.3	0	49.2	-574.1
LHE	NO	24.7	0	116.9	1017.	-24.7	0	44.0	-875.3
RHE	NO	23.1	0	131.1	725.8	-23.1	0	33.5	-640.9
AUX MID	NO	24.4	0	123.9	581.1	-24.4	0	36.0	-501.9
1/4	NO	24.6	0	124.4	1002.	-24.6	0	38.6	-873.1
BOTH MID	NO	24.8	0	109.0	415.0	-24.8	0	43.2	-279.0
LHE	NO	23.7	0	128.0	590.3	-23.7	0	34.1	-511.8

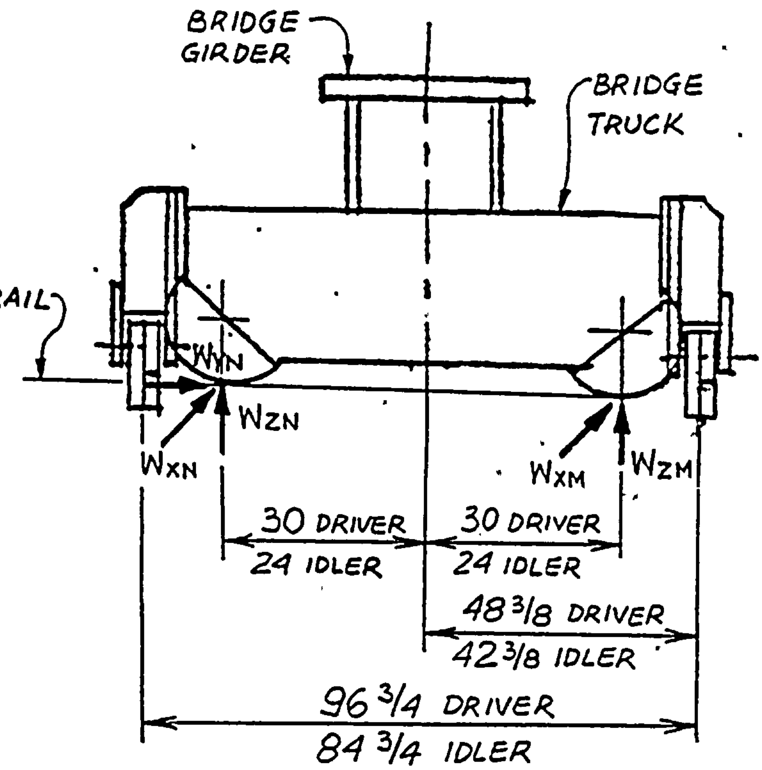
ALL FORCES IN KIPS, MOMENTS IN IN KIPS IN GLOBAL COORDINATE SYSTEM

BRIDGE WHEEL LOADS AND UPKICK

THE WHEEL LOADS ARE DETERMINED BY APPLYING THE BRIDGE TRUCK REACTIONS, SHOWN IN SCALED TABLES B33 TO B96 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 B33 TO B96) 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.

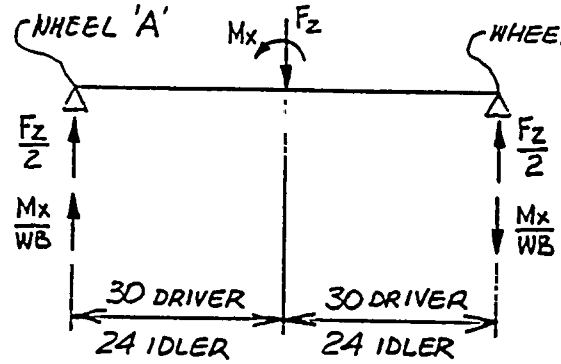
$W_{Z MAX}, W_{Z MIN}$ → IN DETERMINING WHEEL LOADS THE MAX. TRUCK REACTIONS F_Z AND M_X WERE TAKEN FROM THE "SUM" COLUMN OF SCALED TABLES B33 TO B96.

IF $\frac{F_Z}{2} \leq \frac{M_X}{WB}$ THEN $W_{Z\,MIN} = 0$ AND UPKICK OCCURS.

∴ FROM UP-KICK CALCULATIONS FOR THIS CONDITION $W_{Z\,MAX} = f_A F_Z + \frac{M_X}{SP}$

$W_{Z\,MIN} = 0$ AND

UPKICK = $W_{Z\,MAX} - F_Z$
(SEE PG. 4-12)



WHEEL BASE WB = 60 IN. (DRIVER)

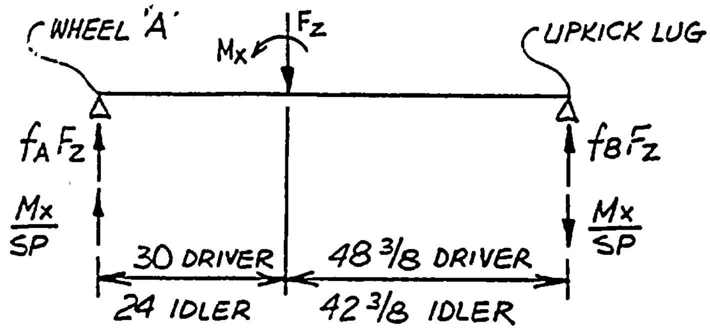
= 48 IN. (IDLER)

$$W_{Z\,MAX} = W_{ZA} = \frac{F_Z}{2} + \frac{M_X}{WB} \qquad W_{Z\,MIN} = W_{ZB} = \frac{F_Z}{2} - \frac{M_X}{WB}$$

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 B33 TO B96. ROPE UPKICK LOAD (R_U) WAS TAKEN FROM TABLES B116 AND B118 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

<u>A</u> <u>DRIVER</u> $f_A = \frac{48.375}{78.375} = 0.62$

<u>A</u> <u>IDLER</u> $f_A = \frac{42.375}{66.375} = 0.64$

<u>B</u> <u>DRIVER</u> $f_B = \frac{30}{78.375} = 0.38$

<u>B</u> <u>IDLER</u> $f_B = \frac{24}{66.375} = 0.36$

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

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

$i = L$ 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 B33 TO B96.

F_{ZR} AND M_{ZR} WERE TAKEN AT NODES 101 FOR DRIVER AND 102 FOR IDLER FROM SCALED TABLES B33 TO B96.

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

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

RHE $X_L = 186.5$ IN. $X_R = 745.5$ 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 SUBSTRACTING THE RELATIVE PROPORTION OF THE ROPE COMPRESSIVE LOAD [R_U] (WHICH CAN NOT EXIST) FROM THE VERTICAL REACTIONS.

<u>TANGENTIAL WHEEL LOADS (BRAKE WHEEL ON DRIVER TRUCK ONLY).</u>

$W_{Y MAX}$ → 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 ($W_{Z MAX}$).

$$W_{Y MAX} = 0.25\, W_{Z MAX}$$

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

FORM N-2494

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TABLE 4-6

CRANE WHEEL LOADS - DRIVER (NODE 101, 201) - OBE (SCALED)

TROLLEY	LOAD	$W_{X MAX}$	$W_{Y MAX}$	MAX. W_Z		P_{UL} (201)	P_{UR} (101)	TABLE USED
				$W_{A (MAX)}$	W_B **			
MAIN-MID.	UP	6.66	28.6	114.2	50.1	—	—	B 34
	DN	6.54	37.3	149.2	67.9	11.9	7.9	B 38
1/4	UP	6.51	31.4	125.6	42.6	—	—	B 42
	DN	6.48	47.0	188.0	71.9	19.3	—	B 46
LHE	UP	6.28	36.7	146.7	29.7	—	—	B 50
	DN	6.21	53.2	212.9	60.2	26.7	—	B 54
RHE	UP	5.35	33.6	134.6	52.7	—	—	B 58
	DN	6.38	48.8	195.3	84.2	1.9	7.9	B 62
MID.	NO	6.31	19.0	76.2	29.7	—	—	B 66
1/4	NO	6.48	21.2	84.9	23.3	—	—	B 70
LHE	NO	6.20	23.8	95.1	21.6	—	—	B 74
RHE	NO	5.87	24.0	96.0	32.0	—	—	B 94
AUX.-MID	NO	6.11	23.3	93.1	30.2	—	—	B 78
1/4	NO	6.17	34.1	136.5	-(14.4*)	24.4	—	B 82
BOTH-MID	NO	6.37	18.9	75.5	24.6	—	—	B 86
LHE	NO	5.93	25.3	101.3	26.7	—	—	B 90

ALL FORCES IN KIPS IN GLOBAL CO-ORDINATE 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.

FORM N-2494

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TABLE 4-7

CRANE WHEEL LOADS - IDLER (NODE 102,202) - OBE (SCALED)

TROLLEY	LOAD	W_{XMAX}	W_{YMAX}	MAX. W_Z		P_{UL} (202)	P_{UR} (102)	TABLE USED
				$W_{A(MAX)}$	W_B **			
MAIN-MID.	UP	6.66	—	80.7	70.4	—	—	B 34
	DN	6.54	—	106.0	98.1	—	—	B 38
1/4	UP	6.51	—	82.7	74.7	—	—	B 42
	DN	6.48	—	128.8	119.8	—	—	B 46
LHE	UP	6.28	—	90.3	75.5	—	—	B 50
	DN	6.21	—	139.0	123.8	—	—	B 54
RHE	UP	5.35	—	96.5	78.0	—	—	B 58
	DN	5.38	—	142.9	123.6	—	—	B 62
MID.	NO	6.31	—	50.7	43.7	—	—	B 66
1/4	NO	6.48	—	52.7	44.8	—	—	B 70
LHE	NO	6.20	—	59.8	46.9	—	—	B 74
RHE	NO	5.87	—	67.2	49.1	—	—	B 94
AUX.-MID	NO	6.11	—	63.2	49.1	—	—	B 78
1/4	NO	6.17	—	61.9	49.8	—	—	B 82
BOTH-MID	NO	6.37	—	48.6	41.8	—	—	B 86
LHE	NO	5.93	—	65.0	51.1	—	—	B 90

ALL FORCES IN KIPS IN GLOBAL CO-ORDINATE 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 4-8

CRANE WHEEL LOADS-DRIVER (NODE 101, 201)-SSE (SCALED)

TROLLEY	LOAD	W_{XMAX}	W_{YMAX}	MAX. W_Z: $W_{A(MAX)}$	MAX. W_Z: W_B **	P_{UL} (201)	P_{UR} (101)	TABLE USED
MAIN-MID.	UP	12.7	34.6	138.6	58.8	16.5	13.0	B 36
	DN	12.5	51.7	206.7	94.0	31.3	28.6	B 40
1/4	UP	12.7	39.5	158.0	49.3	14.5	—	B 44
	DN	12.7	66.4	265.7	99.6	45.2	11.7	B 48
LHE	UP	12.4	47.5	190.0	14.7	27.1	6.7	B 52
	DN	12.2	75.9	303.5	72.9	59.9	11.0	B 56
RHE	UP	10.9	41.3	165.2	56.4	5.7	2.6	B 60
	DN	12.3	67.7	270.7	111.6	13.7	31.3	B 64
MID.	NO	12.2	22.9	91.6	33.2	4.4	—	B 68
1/4	NO	12.7	26.2	104.8	21.6	8.1	—	B 72
LHE	NO	12.3	32.1	128.4	0.6	17.3	—	B 76
RHE	NO	11.6	29.4	117.5	27.9	4.7	2.7	B 96
AUX.-MID	NO	12.2	27.4	109.5	27.7	—	—	B 80
1/4	NO	12.3	48.6	194.5	—(57.5*)	78.9	2.7	B 84
BOTH-MID	NO	12.4	23.5	94.0	27.5	7.5	5.9	B 88
LHE	NO	11.9	30.5	122.1	20.6	5.1	—	B 92

ALL FORCES IN KIPS IN GLOBAL CO-ORDINATE 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 4-9

CRANE WHEEL LOADS - IDLER (NODE 102, 202) - SSE (SCALED)

TROLLEY	LOAD	W_{XMAX}	W_{YMAX}	MAX. W_Z		P_{UL} (202)	P_{UR} (102)	TABLE USED
				$W_{A(MAX)}$	W_B **			
MAIN-MID.	UP	12.7	—	98.7	82.7	—	—	B 36
	DN	12.5	—	147.8	136.6	—	—	B 40
1/4	UP	12.7	—	103.7	90.0	—	—	B 44
	DN	12.7	—	183.7	168.1	—	—	B 48
LHE	UP	12.4	—	109.5	82.0	—	2.5	B 52
	DN	12.2	—	196.3	168.5	—	4.8	B 56
RHE	UP	10.9	—	118.2	87.4	—	—	B 60
	DN	12.3	—	199.7	167.7	1.0	—	B 64
MID.	NO	12.2	—	60.4	50.1	—	—	B 68
1/4	NO	12.7	—	63.5	49.6	—	—	B 72
LHE	NO	12.3	—	70.8	46.1	—	—	B 76
RHE	NO	11.6	—	80.7	50.4	—	—	B 96
AUX.-MID	NO	12.2	—	74.1	49.8	—	—	B 80
1/4	NO	12.3	—	72.2	52.1	—	1.2	B 84
BOTH-MID	NO	12.4	—	60.2	48.8	—	—	B 88
LHE	NO	11.9	—	76.3	51.7	—	—	B 92

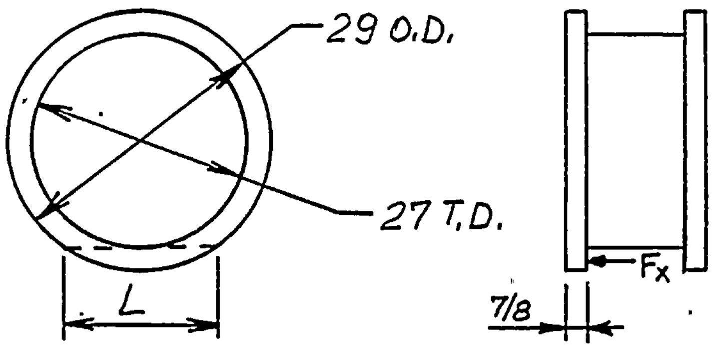
ALL FORCES IN KIPS IN GLOBAL CO-ORDINATE SYSTEM.

* 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

$\sigma_{YMIN} = 53$ KSI

OBE $\tau_{ALL} = 0.6 \frac{\sigma_{YMIN}}{1.5} = 21.2$ KSI

SSE $\tau_{ALL} = 0.6 \frac{\sigma_{YMIN}}{1.1} = 28.9$ KSI

MAX. LOAD OBE $F_X = W_{XMAX} = 6.66$ KIP (TABLE 4-6 AND 4-7)

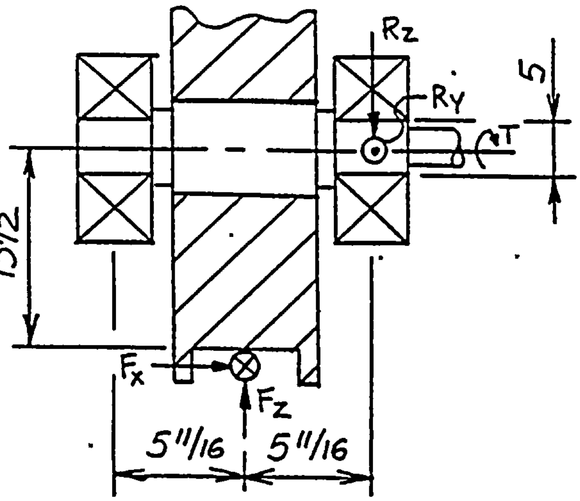
SSE $F_X = W_{XMAX} = 12.7$ KIP (TABLE 4-8 AND 4-9)

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

ASSUME ONLY HALF EFFECTIVE IN SHEAR

OBE $\tau = \frac{6.66}{0.5 \times 10.6 \times 0.875} = 1.4$ KSI SSE $\tau = \frac{12.7}{0.5 \times 10.6 \times 0.875} = 2.7$ KSI

BRIDGE AXLE



MTRL: AISI-1144 HOT ROLLED

$\sigma_{Y MIN} = 43$ KSI

OBE $\tau_{ALL} = 0.6 \frac{43}{1.5} = 17.2$ KSI

SSE $\tau_{ALL} = 0.6 \frac{43}{1.1} = 23.5$ KSI

$\frac{SPAN}{DEPTH} < 3$ $\frac{11.375}{5} = 2.3$

∴ MODE OF FAILURE IS SHEAR FOR SEISMIC LOADS

MAX. LOADS PER TABLES 4-6 AND 4-7 FOR OBE, AND 4-8 AND 4-9 FOR SSE.

OBE DRIVER $F_X = W_{XMAX} = 6.66$ KIP $F_Y = W_{YMAX} = 53.2$ KIP $F_Z = W_{ZMAX} = 212.9$ KIP

IDLER $F_X = 6.66$ KIP $F_Y = 0$ $F_Z = 142.9$ KIP

SSE DRIVER $F_X = 12.7$ KIP $F_Y = 75.9$ KIP $F_Z = 303.5$ KIP

IDLER $F_X = 12.7$ KIP $F_Y = 0$ $F_Z = 199.7$ KIP

OBE

DRIVER $R_R = \sqrt{\left(\frac{F_Y}{2}\right)^2 + \left(\frac{F_Z}{2} + \frac{F_X \frac{TD}{2}}{SPAN}\right)^2} = \sqrt{\left(\frac{53.2}{2}\right)^2 + \left(\frac{212.9}{2} + \frac{6.66 \times 13.5}{11.375}\right)^2}$

$= 117.4$ KIP

IDLER $R_R = \frac{142.9}{2} + \frac{6.66 \times 13.5}{11.375} = 79.4$ KIP

SSE

DRIVER $R_R = \sqrt{\left(\frac{75.9}{2}\right)^2 + \left(\frac{303.5}{2} + \frac{12.7 \times 13.5}{11.375}\right)^2} = 171.1$ KIP

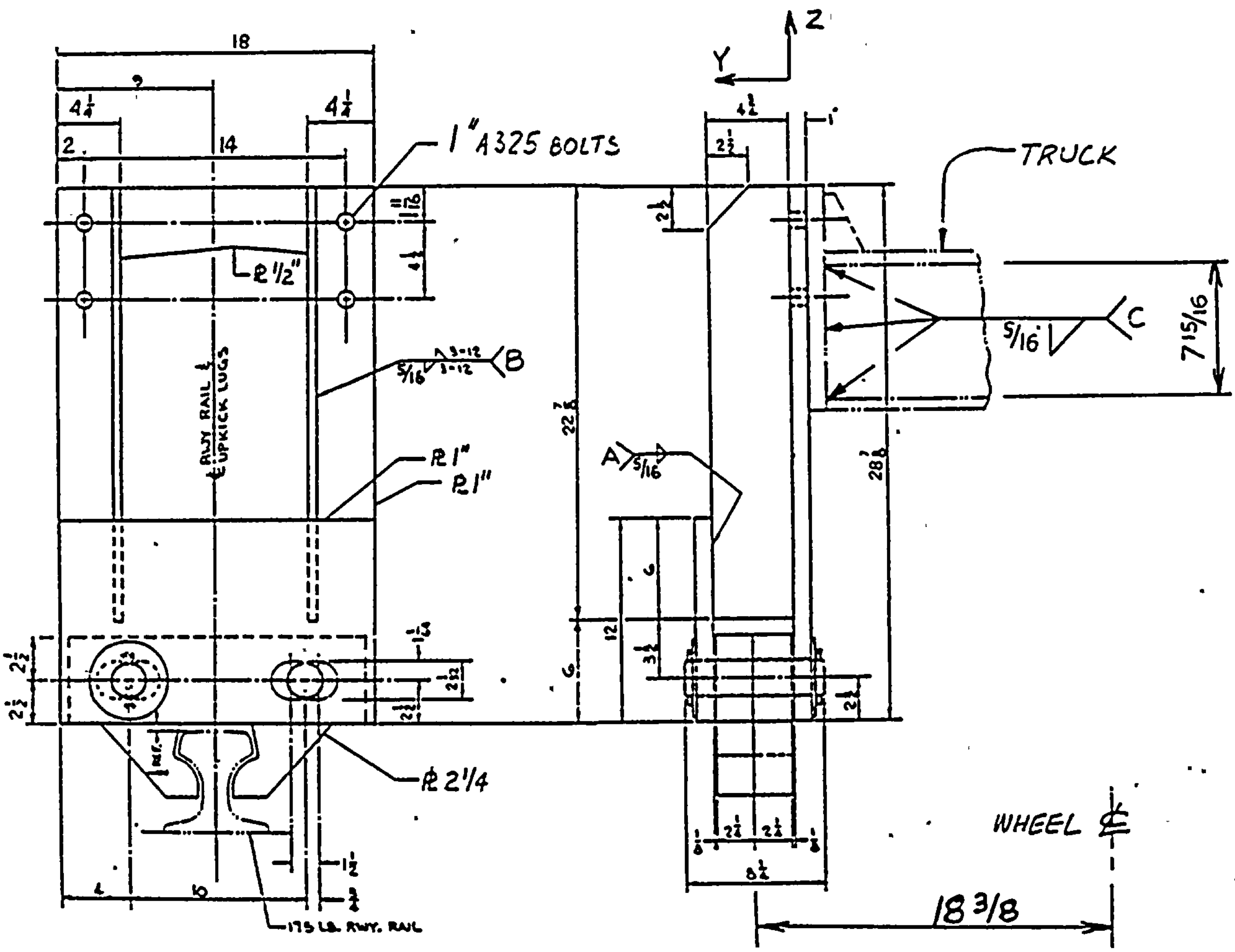
IDLER $R_R = \frac{199.7}{2} + \frac{12.7 \times 13.5}{11.375} = 114.9$ KIP

$\tau_{MAX} = \frac{4}{3} \frac{R_{R\,MAX}}{A}$

OBE $\tau = \frac{4}{3} \frac{117.4}{\frac{\pi 5^2}{4}} = 8.0$ KSI

SSE $\tau = \frac{4}{3} \frac{171.1}{\frac{\pi 5^2}{4}} = 11.6$ KSI

BRIDGE TRUCK SEISMIC LUGS.

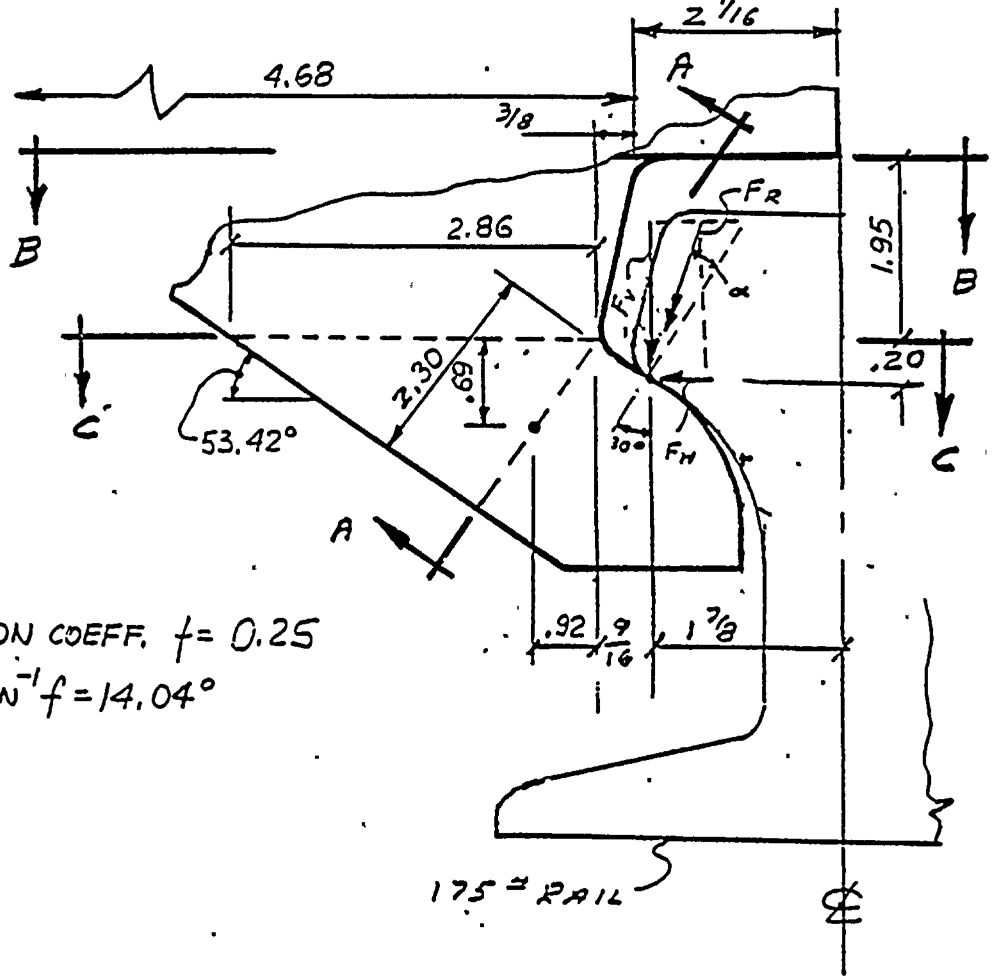


MTRL.: ASTM-A36

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

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

<u>SSE</u> $\sigma_{ALL} = \dfrac{\sigma_{Y\,MIN}}{1.1} = 32.7$ 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. $P_{MAX} = P_{UL}$ FROM TABLE 4-6 TO 4-9

OBE $P_{MAX} = 26.7$ KIP

SSE $P_{MAX} = 78.9$ 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 $F_V = 0.5 \times 26.7 = 13.4$ KIP $F_H = 0.143 \times 26.7 = 3.8$ KIP
$F_R = 0.52 \times 26.7 = 13.9$ KIP

SSE $F_V = 0.5 \times 78.9 = 39.5$ KIP $F_H = 0.143 \times 78.9 = 11.3$ KIP
$F_R = 0.52 \times 78.9 = 41.0$ KIP

SECTION A-A (SHEAR)

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

OBE $\tau_A = \frac{13.9 \cos 37.46°}{2.25 \times 2.3} = 2.1$ KSI

SSE $\tau_A = \frac{41 \cos 37.46°}{2.25 \times 2.3} = 6.3$ KSI

SECTION B-B (TENSION)

DIRECT $\sigma_D = \dfrac{F_V}{A}$ BENDING $\sigma_{BH} = \dfrac{M_H}{S} = \dfrac{F_H(2.15)}{S}$

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

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

OBE $\sigma_B = \dfrac{13.4}{2.25 \times 4.68} + \dfrac{3.8 \times 2.15}{\frac{2.25 \times 4.68^2}{6}} + \dfrac{13.4 \times 2.53}{\frac{2.25 \times 4.68^2}{6}} = 6.4 \text{ KSI}$

SSE $\sigma_B = \dfrac{39.5}{2.25 \times 4.68} + \dfrac{11.3 \times 2.15}{\frac{2.25 \times 4.68^2}{6}} + \dfrac{39.5 \times 2.53}{\frac{2.25 \times 4.68^2}{6}} = 18.9 \text{ KSI}$

SECTION C-C (TENSION)

DIRECT $\sigma_D = \dfrac{F_V}{A}$ BENDING $\sigma_{BH} = \dfrac{F_H(0.20)}{S}$

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

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

OBE $\sigma_C = \dfrac{13.4}{2.25 \times 2.86} + \dfrac{3.8 \times 0.20}{\frac{2.25 \times 2.86^2}{6}} + \dfrac{13.4 \times 1.99}{\frac{2.25 \times 2.86^2}{6}} = 11.0 \text{ KSI}$

SSE $\sigma_C = \dfrac{39.5}{2.25 \times 2.86} + \dfrac{11.3 \times 0.20}{\frac{2.25 \times 2.86^2}{6}} + \dfrac{39.5 \times 1.99}{\frac{2.25 \times 2.86^2}{6}} = 32.5 \text{ KSI}$

SECTION A-A (TENSION)

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

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

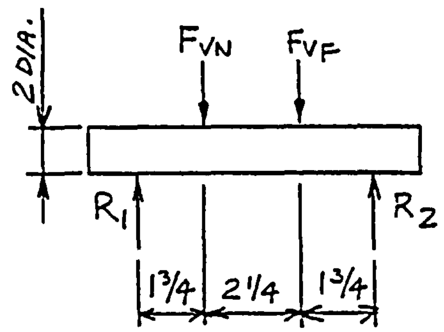
$\sigma_{BV} = \dfrac{F_V(0.92+0.56)}{S}$

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

OBE $\sigma_A = \dfrac{13.9 \sin 37.46°}{2.25 \times 2.3} - \dfrac{3.8 \times 0.49}{\frac{2.25 \times 2.3^2}{6}} + \dfrac{13.4 \times 1.48}{\frac{2.25 \times 2.3^2}{6}} = 10.7$ KSI

SSA $\sigma_A = \dfrac{41 \sin 37.46°}{2.25 \times 2.3} - \dfrac{11.3 \times 0.49}{\frac{2.25 \times 2.3^2}{6}} + \dfrac{39.5 \times 1.48}{\frac{2.25 \times 2.3^2}{6}} = 31.5$ 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 $P_{MAX} = 26.7$ KIP

SSE $P_{MAX} = 78.9$ KIP

VERTICAL LOAD ON NEARSIDE PIN.

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

OBE $F_{VN} = 7.4$ KIP

SSE $F_{VN} = 21.8$ KIP

VERTICAL LOAD ON FARSIDE PIN.

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

OBE $F_{VF} = 6.0$ KIP

SSE $F_{VF} = 17.7$ 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 $R_1 = 7.0$ KIP $R_2 = 6.4$ KIP

SSE $R_1 = 20.6$ KIP $R_2 = 18.9$ KIP

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

OK

∴ PROBABLE MODE OF FAILURE IS SHEAR

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

OBE $\tau = 3.0$ KSI

SSE $\tau = 8.7$ KSI

WELDS

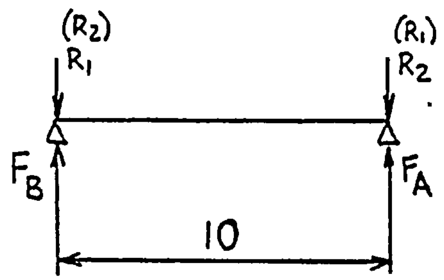
ALLOWABLES

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

WELD MTRL : E70XX ELECTRODES FOR ALL WELDS $\sigma_{Y MIN} = 57$ 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



MAX. FORCE ON WELD A, B

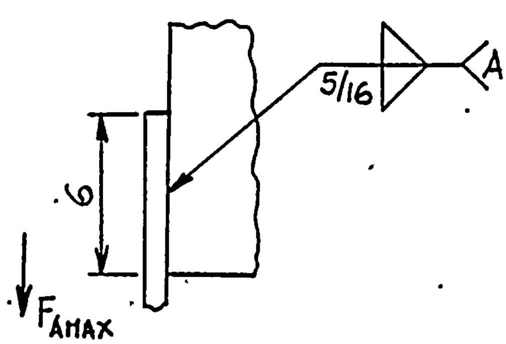
$F_{A MAX} = F_{B MAX} = R_{MAX}$

OBE $F_{A MAX} = F_{B MAX} = 7.0$ KIP

SSE $F_{A MAX} = F_{B MAX} = 20.6$ KIP

WELD A

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



OBE $\tau_A = 2.6$ KSI

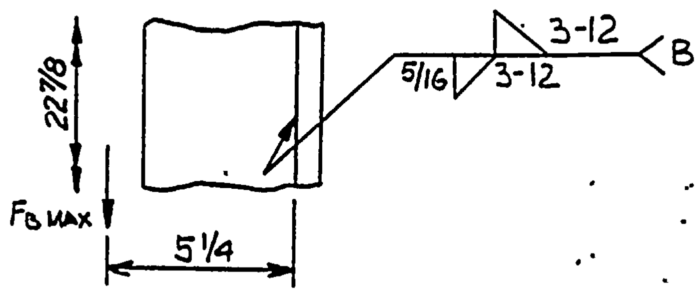
SSE $\tau_A = 7.8$ KSI

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 $\tau_B = 4.7$ KSI

SSE $\tau_B = 13.9$ KSI



WELD C

MAX. FORCE ON WELD = P_{MAX}

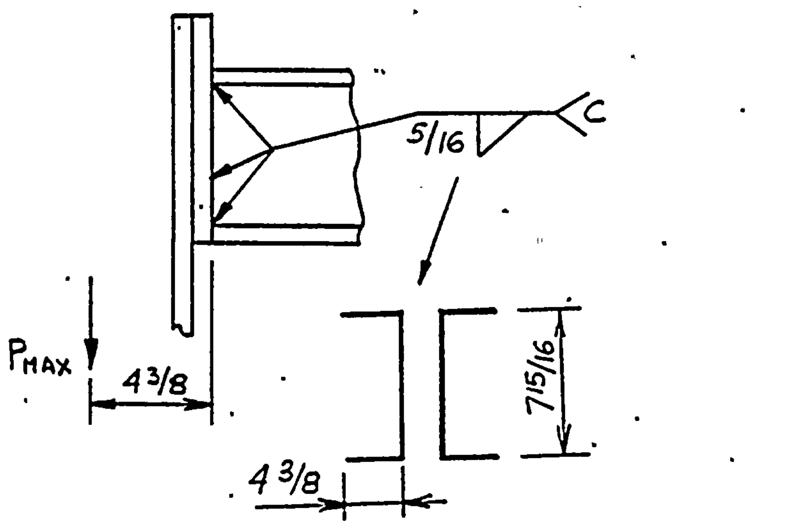
OBE 26.7 KIP SSE 78.9 KIP (REF. PG. 4-22)

$$\tau_C = \sqrt{\tau_Y^2 + \tau_Z^2} = \frac{P_{MAX}}{0.707(0.3125)}\sqrt{\left(\frac{4.38}{2(4.38 \times 7.94) + \frac{7.94^2}{3}}\right)^2 + \left(\frac{1}{2(2 \times 4.38 + 7.94)}\right)^2}$$

$$= \frac{P_{MAX}}{3.88}$$

OBE $\tau_C = 6.9$ KSI

SSE $\tau_C = 20.3$ KSI



BOLTS

1" 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}

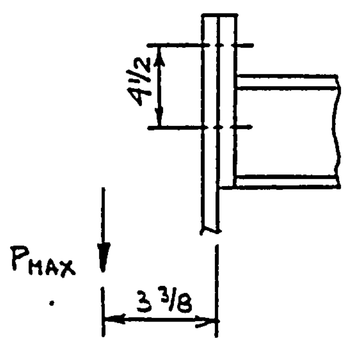
OBE 26.7 KIP SSE 78.9 KIP

SHEAR STRESS $\tau = \frac{P_{MAX}}{nA} = \frac{P_{MAX}}{4\,\frac{\pi}{4}(1)^2}$

OBE $\tau = 8.5$ KSI SSE $\tau = 25.1$ KSI

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

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



FOR 1" BOLTS (4 REQ'D)

TENSILE AREA $A_T = 0.606$ IN^2

SHANK AREA $A_S = 0.785$ IN^2

IN THREADS

OBE $\sigma = 16.6$ KSI   SSE $\sigma = 48.9$ KSI

IN SHANK

OBE $\sigma = 12.8$ KSI   SSE $\sigma = 37.8$ KSI

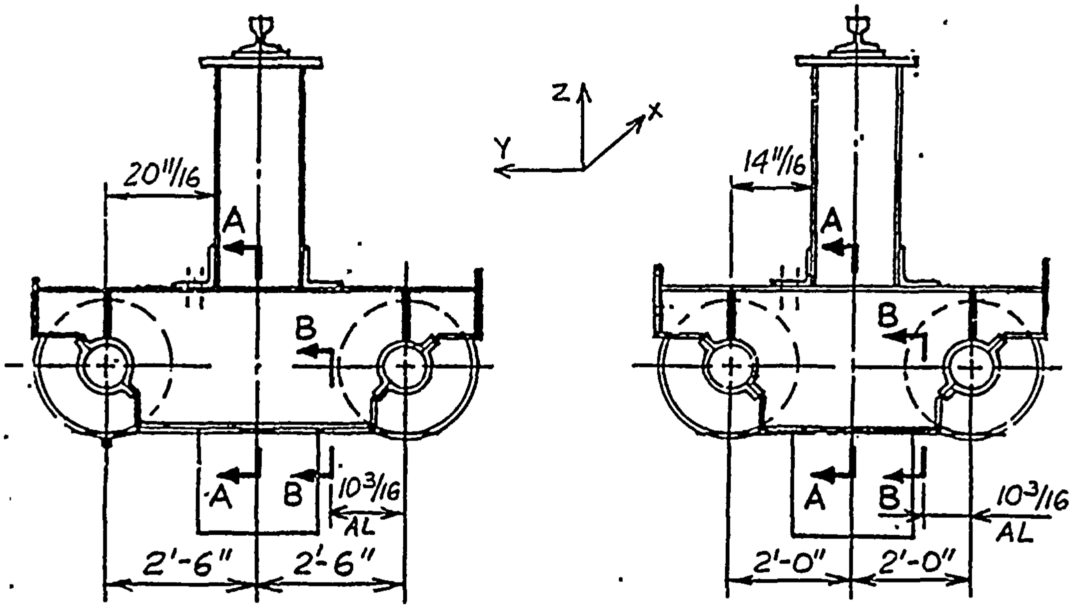
COMBINED IN SHANK

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

OBE $\tau_{COMB} = \sqrt{\left(\frac{12.8}{2}\right)^2 + 8.5^2} = 10.6$ KSI

SSE $\tau_{COMB} = \sqrt{\left(\frac{37.8}{2}\right)^2 + 25.1^2} = 31.4$ KSI

BRIDGE TRUCKS



DRIVER TRUCK — IDLER TRUCK

MTRL: ASTM-A36

$\sigma_{YMIN} = 36$ KSI

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

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

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

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

WELDS (FILLET THRU THROAT)

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

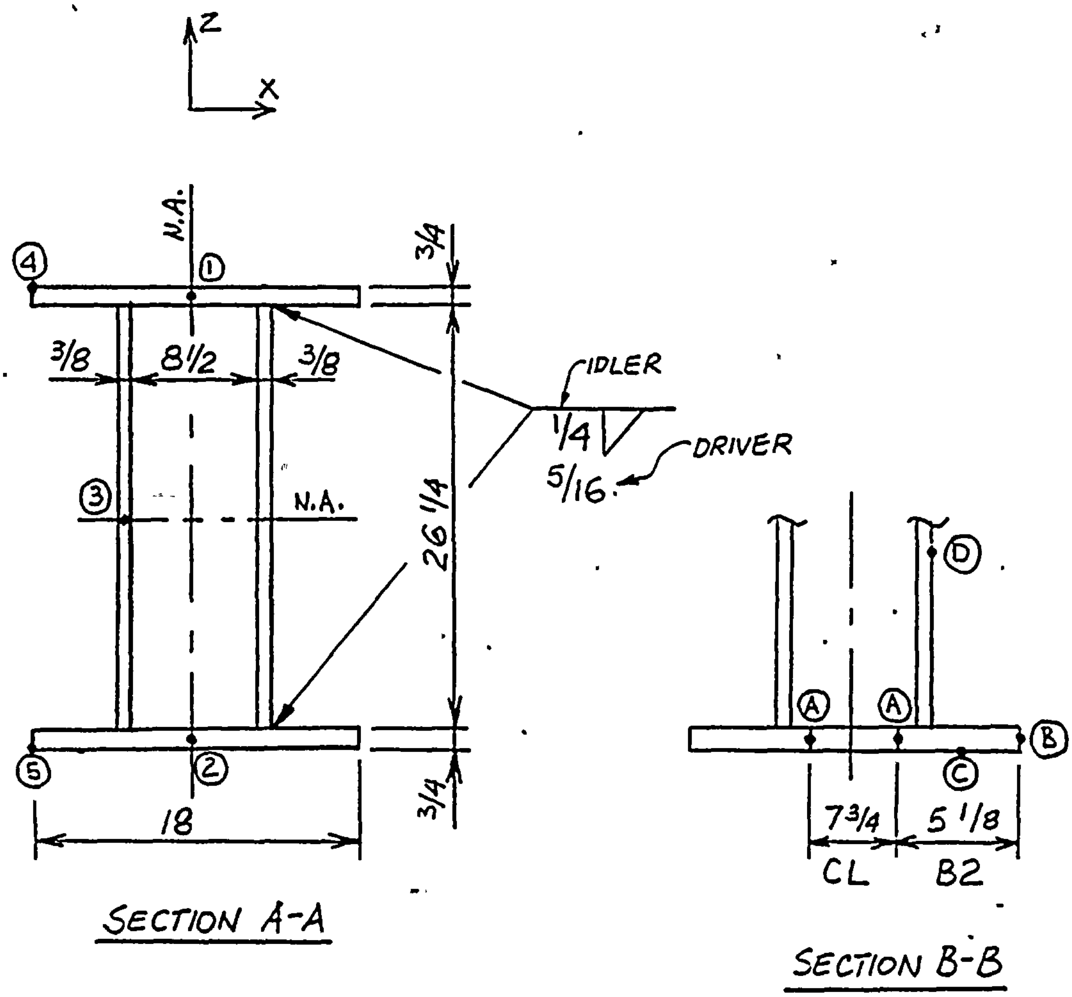
WELD MTRL: E70XX ELECTRODES $\sigma_{YMIN} = 57$ KSI

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

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

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

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



MAX. LOADINGS PER TABLE 4-6 TO 4-9

OBE	F_X = 6.66 KIP	F_Y = 53.2 KIP	F_Z = 212.9 KIP	DRIVER
	F_X = 6.66 KIP	F_Y = 0 KIP	F_Z = 142.9 KIP	IDLER
SSE	F_X = 12.7 KIP	F_Y = 75.9 KIP	F_Z = 303.5 KIP	DRIVER
	F_X = 12.7 KIP	F_Y = 0 KIP	F_Z = 199.7 KIP	IDLER

FORM N-2494

WHITING REQN. 79508 DATE 9-3-87
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MJM 9-4-87

* 79508 * AEP * 60T LOAD * BRIDGE DRIVER TRUCK * OBE

TRUCK SIZE , TOP PLT = 0.75 X 18.00 IN.
BOT PLT = 0.75 X 18.00 IN.
WEB PLT = 0.38 X 26.25 IN.
DISTANCE BETWEEN WEB PLTS = 8.50 IN.

TRUCK WHEEL BASE = 41.38 IN.
COEF. OF FRICTION = 0.250

RAIL TO CENTER OF TWIST = 15.500 IN.

** FORCES IN THE GLOBAL COORDINATE SYSTEM **

FX = 6660.0 LBS.
FY = 53200.0 LBS.
FZ = 212900.0 LBS.

** SECTION PROPERTIES **

AREA IN SQ. IN.	46.7
VERTICAL MOMENT OF INERTIA	6052.5
VERTICAL SECTION MODULUS	436.2
VERTICAL CENTER OF GRAVITY	13.9
HORIZ. MOMENT OF INERTIA	1116.9
HORIZ. SECTION MODULUS	124.1

** MAXIMUM DEFLECTIONS IN INCHES **

VERTICAL BENDING DEFL. DUE TO FZ	0.00346
HORIZ. BENDING DEFL. DUE TO FX	0.00059
VERTICAL SHEAR DEFL. DUE TO FZ	0.02083
HORIZ. SHEAR DEFL. DUE TO FX	0.00075

** WELD SIZES BASED ON ALLOWABLE LOAD OF 14420.0 #/IN. **

FILLET SIZE FOR WEB TO TOP PLATE CONN. = 0.246
FILLET SIZE FOR WEB TO BOT PLATE CONN. = 0.246 } 5/16 PROVIDED

** WELD STRESS THRU THROAT (PSI) ** (BASED ON 0.246 LEG)

SHEAR STRESS AT WEB TO TOP PLT. CONN	20396.0
SHEAR STRESS AT WEB TO BOT PLT. CONN	20396.0

** TRUCK STRESSES IN PSI ** (AT POINT NO. (n) SEC. A-A)

BENDING STRESS TOP FLANGE DUE TO FX------	1110.4	(4)
BENDING STRESS BOT FLANGE DUE TO FX------	1110.4	(5)
BENDING STRESS TOP FLANGE DUE TO FY------	1890.3	(1)(4)
BENDING STRESS BOT FLANGE DUE TO FY------	1890.3	(2)(5)
BENDING STRESS TOP FLANGE DUE TO FZ------	10098.0	(1)(4)
BENDING STRESS BOT FLANGE DUE TO FZ------	10098.0	(2)(5)
BENDING STRESS ON WEB DUE TO FX----------	570.6	(3)
BENDING STRESS ON WEB DUE TO FY----------	0.0	(3)
TRANSVERSE SHEAR ON FLANGE DUE TO FX-----	415.1	(1)(2)
TRANSVERSE SHEAR ON WEB DUE TO FZ--------	11579.5	(3)
TORSIONAL SHEAR ON FLANGE DUE TO FX------	287.2	(1)(2)
TORSIONAL SHEAR ON FLANGE DUE TO FZ------	0.0	(3)
DIRECT TENSILE STRESS DUE TO FY----------	1139.5	(ALL)
TORSIONAL SHEAR ON WEB DUE TO FX---------	574.4	(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--	11988.3	(1)
BEND. STRESS IN BOT. FLG. DUE TO FY & FZ-	11988.3	(2)
BENDING STRESS IN WEB DUE TO FX & FY-----	570.6	(3)
TOTAL TORSIONAL SHEAR STRESS IN FLANGES--	287.2	(1)(2)
TOTAL TORSIONAL SHEAR STRESS IN WEB------	574.4	(3)
MAX TENSILE STRESS IN TOP FLANGE---------	14238.1 PSI	(4)
MAX TENSILE STRESS IN BOT FLANGE---------	14238.1 PSI	(5)
MAX SHEAR STRESS-CENTER TOP FLANGE-------	6601.4	(1)
MAX SHEAR STRESS-CENTER BOT FLANGE-------	6601.4	(2)
MAX SHEAR STRESS-CENTER WEB--------------	12183.9 PSI	(3)

WELD STRESS FOR ACTUAL SIZE $20396 \frac{0.246}{0.312} = 16\,080$ PSI

FORM N-2494

WHITING REQN. 79508 DATE 9-3-87
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MJM 9-4-87

* 79508 * AEP * 60T LOAD * BRIDGE DRIVER TRUCK * OBE

** ANALYSIS OF TRUCK END DUE TO TORSION ** (SEC. B-B)

ADDED DIMENSIONS - B2 = 5.125 IN.
AL = 10.188 IN.
CL = 7.750 IN.

TORSIONAL RESISTANCE------------------	4.9 IN**4
SHEAR CENTER FROM CENTER OF TOP PLT--	11.115 IN.
WARPING CONSTANT---------------------	37301.4 IN**6
WARPING MOMENT-----------------------	103230.0 IN-LBS.
ANGLE OF TWIST - 2ND DERIVATIVE------	0.4697E-06
3RD DERIVATIVE------	0.9225E-07

** TRUCK END STRESSES IN PSI **

TENSILE STRESS DUE TO WARPING RIGIDITY THROUGHOUT THE THICKNESS @ PT. A---------	969.8
TENSILE STRESS DUE TO WARPING RIGIDITY THROUGHOUT THE THICKNESS @ PT. B---------	3396.0
SHEAR STRESS DUE TO WARPING RIGIDITY THROUGHOUT THE THICKNESS @ PT. C; AT A DISTANCE (Y) 1.824 IN. FROM THE INSIDE FACE OF THE WEB--------------	391.7
SHEAR STRESS DUE TO WARPING RIGIDITY THROUGHOUT THE THICKNESS @ PT. D; AT A DISTANCE (Z) 11.490 IN. FROM THE TOP FLANGE----------------------------	1259.0
TRANSVERSE SHEAR STRESS IN FLG DUE TO FX-	493.3
TRANSVERSE SHEAR STRESS IN WEB DUE TO FZ-	10229.4
MAX SHEAR STRESS IN WEB @ PT. D------------	11488.4
MAX SHEAR STRESS IN BOT FLANGE------------	1742.6

** STRESS CALC. CALLED 2 TIMES

* 79508 * AEP * 60T LOAD * BRIDGE IDLER TRUCK * OBE

TRUCK SIZE , TOP PLT = 0.75 X 18.00 IN.
BOT PLT = 0.75 X 18.00 IN.
WEB PLT = 0.38 X 26.25 IN.
DISTANCE BETWEEN WEB PLTS = 8.50 IN.

TRUCK WHEEL BASE = 29.38 IN.
COEF. OF FRICTION = 0.250

RAIL TO CENTER OF TWIST = 15.500 IN.

** FORCES IN THE GLOBAL COORDINATE SYSTEM **

FX = 6660.0 LBS.
FY = 0.0 LBS.
FZ = 142900.0 LBS.

** SECTION PROPERTIES **

AREA IN SQ. IN.	46.7
VERTICAL MOMENT OF INERTIA	6052.5
VERTICAL SECTION MODULUS	436.2
VERTICAL CENTER OF GRAVITY	13.9
HORIZ. MOMENT OF INERTIA	1116.9
HORIZ. SECTION MODULUS	124.1

** MAXIMUM DEFLECTIONS IN INCHES **

VERTICAL BENDING DEFL. DUE TO FZ	0.00083
HORIZ. BENDING DEFL. DUE TO FX	0.00021
VERTICAL SHEAR DEFL. DUE TO FZ	0.00993
HORIZ. SHEAR DEFL. DUE TO FX	0.00053

** WELD SIZES BASED ON ALLOWABLE LOAD OF 14420.0 #/IN. **

FILLET SIZE FOR WEB TO TOP PLATE CONN. = 0.173
FILLET SIZE FOR WEB TO BOT PLATE CONN. = 0.173 } 1/4 PROVIDED

** WELD STRESS THRU THROAT (PSI) ** (BASED ON 0.173 LEG)

SHEAR STRESS AT WEB TO TOP PLT. CONN	20396.0
SHEAR STRESS AT WEB TO BOT PLT. CONN	20396.0

** TRUCK STRESSES IN PSI ** (AT POINT NO. (n) SEC. A-A)

BENDING STRESS TOP FLANGE DUE TO FX------	788.4	(4)
BENDING STRESS BOT FLANGE DUE TO FX-------	788.4	(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-------	4812.3	(1)(4)
BENDING STRESS BOT FLANGE DUE TO FZ-------	4812.3	(2)(5)
BENDING STRESS ON WEB DUE TO FX-----------	405.1	(3)
BENDING STRESS ON WEB DUE TO FY-----------	0.0	(3)
TRANSVERSE SHEAR ON FLANGE DUE TO FX-----	415.1	(1)(2)
TRANSVERSE SHEAR ON WEB DUE TO FZ--------	7772.3	(3)
TORSIONAL SHEAR ON FLANGE DUE TO FX------	287.2	(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---------	574.4	(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--	4812.3	(1)
BEND. STRESS IN BOT. FLG. DUE TO FY & FZ-	4812.3	(2)
BENDING STRESS IN WEB DUE TO FX & FY-----	405.1	(3)
TOTAL TORSIONAL SHEAR STRESS IN FLANGES--	287.2	(1)(2)
TOTAL TORSIONAL SHEAR STRESS IN WEB------	574.4	(3)
MAX TENSILE STRESS IN TOP FLANGE---------	5600.6 PSI	(4)
MAX TENSILE STRESS IN BOT FLANGE---------	5600.6 PSI	(5)
MAX SHEAR STRESS-CENTER TOP FLANGE-------	2506.6	(1)
MAX SHEAR STRESS-CENTER BOT FLANGE-------	2506.6	(2)
MAX SHEAR STRESS-CENTER WEB--------------	8349.1 PSI	(3)

WELD STRESS FOR ACTUAL SIZE $20396 \frac{0.173}{0.250} = 14110$ PSI

* 79508 * AEP * 60T LOAD * BRIDGE IDLER TRUCK * OBE

** ANALYSIS OF TRUCK END DUE TO TORSION ** (SEC. B-B)

```
ADDED DIMENSIONS - B2 =    5.125 IN.
                   AL =   10.188 IN.
                   CL =    7.750 IN.

TORSIONAL RESISTANCE-----------------              4.9 IN**4
SHEAR CENTER FROM CENTER OF TOP PLT--          11.115 IN.
WARPING CONSTANT---------------------         37301.4 IN**6
WARPING MOMENT-----------------------        103230.0 IN-LBS.
ANGLE OF TWIST - 2ND DERIVATIVE------ 0.4697E-06
                 3RD DERIVATIVE------ 0.9225E-07
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** TRUCK END STRESSES IN PSI **

```
TENSILE STRESS DUE TO WARPING RIGIDITY
 THROUGHOUT THE THICKNESS @ PT. A---------     969.8

TENSILE STRESS DUE TO WARPING RIGIDITY
 THROUGHOUT THE THICKNESS @ PT. B---------    3396.0

SHEAR STRESS DUE TO WARPING RIGIDITY
 THROUGHOUT THE THICKNESS @ PT. C;
 AT A DISTANCE (Y)  1.824 IN. FROM
 THE INSIDE FACE OF THE WEB---------------     391.7

SHEAR STRESS DUE TO WARPING RIGIDITY
 THROUGHOUT THE THICKNESS @ PT. D;
 AT A DISTANCE (Z) 11.490 IN. FROM
 THE TOP FLANGE---------------------------    1259.0

TRANSVERSE SHEAR STRESS IN FLG DUE TO FX-     493.3
TRANSVERSE SHEAR STRESS IN WEB DUE TO FZ-    6866.1

MAX SHEAR STRESS IN WEB @ PT. D----------    8125.0
MAX SHEAR STRESS IN BOT FLANGE-----------    1742.6
```

** STRESS CALC. CALLED 2 TIMES

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* 79508 * AEP * 60T LOAD * BRIDGE DRIVER TRUCK * SSE

TRUCK SIZE , TOP PLT = 0.75 X 18.00 IN.
BOT PLT = 0.75 X 18.00 IN.
WEB PLT = 0.38 X 26.25 IN.
DISTANCE BETWEEN WEB PLTS = 8.50 IN.

TRUCK WHEEL BASE = 41.38 IN.
COEF. OF FRICTION = 0.250

RAIL TO CENTER OF TWIST = 15.500 IN.

** FORCES IN THE GLOBAL COORDINATE SYSTEM **

FX = 12700.0 LBS.
FY = 75900.0 LBS. *** MAX. FY DUE TO FRICTION = 75875.(
FZ = 303500.0 LBS.

** SECTION PROPERTIES **

AREA IN SQ. IN.----------------	46.7
VERTICAL MOMENT OF INERTIA----	6052.5
VERTICAL SECTION MODULUS------	436.2
VERTICAL CENTER OF GRAVITY----	13.9
HORIZ. MOMENT OF INERTIA------	1116.9
HORIZ. SECTION MODULUS---------	124.1

** MAXIMUM DEFLECTIONS IN INCHES **

VERTICAL BENDING DEFL. DUE TO FZ----------	0.00493
HORIZ. BENDING DEFL. DUE TO FX------------	0.00112
VERTICAL SHEAR DEFL. DUE TO FZ------------	0.02970
HORIZ. SHEAR DEFL. DUE TO FX--------------	0.00142

** WELD SIZES BASED ON ALLOWABLE LOAD OF 19660.0 #/IN. **

FILLET SIZE FOR WEB TO TOP PLATE CONN. = 0.266
FILLET SIZE FOR WEB TO BOT PLATE CONN. = 0.266
} 5/16 PROVIDED

** WELD STRESS THRU THROAT (PSI) ** (BASED ON 0.266 LEG)

SHEAR STRESS AT WEB TO TOP PLT. CONN-----	27807.6
SHEAR STRESS AT WEB TO BOT PLT. CONN-----	27807.6

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** TRUCK STRESSES IN PSI ** (AT POINT NO. (n) SECT. A-A)

BENDING STRESS TOP FLANGE DUE TO FX------	2117.3	(4)
BENDING STRESS BOT FLANGE DUE TO FX------	2117.3	(5)
BENDING STRESS TOP FLANGE DUE TO FY------	2696.1	(1)(4)
BENDING STRESS BOT FLANGE DUE TO FY------	2696.1	(2)(5)
BENDING STRESS TOP FLANGE DUE TO FZ------	14395.2	(1)(4)
BENDING STRESS BOT FLANGE DUE TO FZ------	14395.2	(2)(5)
BENDING STRESS ON WEB DUE TO FX----------	1088.1	(3)
BENDING STRESS ON WEB DUE TO FY----------	0.0	(3)
TRANSVERSE SHEAR ON FLANGE DUE TO FX-----	791.6	(1)(2)
TRANSVERSE SHEAR ON WEB DUE TO FZ--------	16507.2	(3)
TORSIONAL SHEAR ON FLANGE DUE TO FX------	547.7	(1)(2)
TORSIONAL SHEAR ON FLANGE DUE TO FZ------	0.0	(3)
DIRECT TENSILE STRESS DUE TO FY----------	1625.2	(ALL)
TORSIONAL SHEAR ON WEB DUE TO FX---------	1095.3	(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--	17091.2	(1)
BEND. STRESS IN BOT. FLG. DUE TO FY & FZ-	17091.2	(2)
BENDING STRESS IN WEB DUE TO FX & FY-----	1088.1	(3)
TOTAL TORSIONAL SHEAR STRESS IN FLANGES--	547.7	(1)(2)
TOTAL TORSIONAL SHEAR STRESS IN WEB------	1095.3	(3)
MAX TENSILE STRESS IN TOP FLANGE---------	20833.7 PSI	(4)
MAX TENSILE STRESS IN BOT FLANGE---------	20833.7 PSI	(5)
MAX SHEAR STRESS-CENTER TOP FLANGE-------	9453.5	(1)
MAX SHEAR STRESS-CENTER BOT FLANGE-------	9453.5	(2)
MAX SHEAR STRESS-CENTER WEB--------------	17654.7 PSI	(3)

WELD STRESS FOR ACTUAL SIZE $27808 \frac{0.266}{0.312} = 23710$ PSI

* 79508 * AEP * 60T LOAD * BRIDGE DRIVER TRUCK * SSE

** ANALYSIS OF TRUCK END DUE TO TORSION ** (SEC. B-B)

ADDED DIMENSIONS - B2 = 5.125 IN.
AL = 10.188 IN.
CL = 7.750 IN.

TORSIONAL RESISTANCE---------------- 4.9 IN**4
SHEAR CENTER FROM CENTER OF TOP PLT-- 11.115 IN.
WARPING CONSTANT-------------------- 37301.4 IN**6
WARPING MOMENT---------------------- 196850.0 IN-LBS.
ANGLE OF TWIST - 2ND DERIVATIVE------ 0.8956E-06
3RD DERIVATIVE------ 0.1759E-06

** TRUCK END STRESSES IN PSI **

TENSILE STRESS DUE TO WARPING RIGIDITY
THROUGHOUT THE THICKNESS @ PT. A--------- 1849.3

TENSILE STRESS DUE TO WARPING RIGIDITY
THROUGHOUT THE THICKNESS @ PT. B--------- 6475.9

SHEAR STRESS DUE TO WARPING RIGIDITY
THROUGHOUT THE THICKNESS @ PT. C;
AT A DISTANCE (Y) 1.824 IN. FROM
THE INSIDE FACE OF THE WEB-------------- 747.0

SHEAR STRESS DUE TO WARPING RIGIDITY
THROUGHOUT THE THICKNESS @ PT. D;
AT A DISTANCE (Z) 11.490 IN. FROM
THE TOP FLANGE-------------------------- 2400.7

TRANSVERSE SHEAR STRESS IN FLG DUE TO FX- 940.7
TRANSVERSE SHEAR STRESS IN WEB DUE TO FZ- 14582.6

MAX SHEAR STRESS IN WEB @ PT. D---------- 16983.3
MAX SHEAR STRESS IN BOT FLANGE----------- 3323.0

** STRESS CALC. CALLED 2 TIMES

* 79508 * AEP * 60T LOAD * BRIDGE IDLER TRUCK * SSE

TRUCK SIZE , TOP PLT = 0.75 X 18.00 IN.
BOT PLT = 0.75 X 18.00 IN.
WEB PLT = 0.38 X 26.25 IN.
DISTANCE BETWEEN WEB PLTS = 8.50 IN.

TRUCK WHEEL BASE = 29.38 IN.
COEF. OF FRICTION = 0.250

RAIL TO CENTER OF TWIST = 15.500 IN.

** FORCES IN THE GLOBAL COORDINATE SYSTEM **

FX = 12700.0 LBS.
FY = 0.0 LBS.
FZ = 199700.0 LBS.

** SECTION PROPERTIES **

AREA IN SQ. IN.	46.7
VERTICAL MOMENT OF INERTIA	6052.5
VERTICAL SECTION MODULUS	436.2
VERTICAL CENTER OF GRAVITY	13.9
HORIZ. MOMENT OF INERTIA	1116.9
HORIZ. SECTION MODULUS	124.1

** MAXIMUM DEFLECTIONS IN INCHES **

VERTICAL BENDING DEFL. DUE TO FZ	0.00116
HORIZ. BENDING DEFL. DUE TO FX	0.00040
VERTICAL SHEAR DEFL. DUE TO FZ	0.01387
HORIZ. SHEAR DEFL. DUE TO FX	0.00101

** WELD SIZES BASED ON ALLOWABLE LOAD OF 19660.0 #/IN. **

FILLET SIZE FOR WEB TO TOP PLATE CONN. = 0.186 } 1/4 PROVIDED
FILLET SIZE FOR WEB TO BOT PLATE CONN. = 0.186

** WELD STRESS THRU THROAT (PSI) ** (BASED ON 0.186 LEG)

SHEAR STRESS AT WEB TO TOP PLT. CONN	27807.6
SHEAR STRESS AT WEB TO BOT PLT. CONN	27807.6

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** TRUCK STRESSES IN PSI ** (AT POINT NO. (n) SEC. A-A)

BENDING STRESS TOP FLANGE DUE TO FX------	1503.3	(4)
BENDING STRESS BOT FLANGE DUE TO FX------	1503.3	(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------	6725.1	(1)(4)
BENDING STRESS BOT FLANGE DUE TO FZ------	6725.1	(2)(5)
BENDING STRESS ON WEB DUE TO FX----------	772.5	(3)
BENDING STRESS ON WEB DUE TO FY----------	0.0	(3)
TRANSVERSE SHEAR ON FLANGE DUE TO FX-----	791.6	(1)(2)
TRANSVERSE SHEAR ON WEB DUE TO FZ--------	10861.6	(3)
TORSIONAL SHEAR ON FLANGE DUE TO FX------	547.7	(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---------	1095.3	(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--	6725.1	(1)
BEND. STRESS IN BOT. FLG. DUE TO FY & FZ-	6725.1	(2)
BENDING STRESS IN WEB DUE TO FX & FY-----	772.5	(3)
TOTAL TORSIONAL SHEAR STRESS IN FLANGES--	547.7	(1)(2)
TOTAL TORSIONAL SHEAR STRESS IN WEB------	1095.3	(3)
MAX TENSILE STRESS IN TOP FLANGE---------	8228.4 PSI	(4)
MAX TENSILE STRESS IN BOT FLANGE---------	8228.4 PSI	(5)
MAX SHEAR STRESS-CENTER TOP FLANGE-------	3619.4	(1)
MAX SHEAR STRESS-CENTER BOT FLANGE-------	3619.4	(2)
MAX SHEAR STRESS-CENTER WEB--------------	11963.1 PSI	(3)

WELD STRESS FOR ACTUAL SIZE $27808 \frac{0.186}{0.250} = 20\,690$ PSI

FORM N-2494

WHITING REQN. 79508 DATE 9-3-87
BY ASZ PAGE 4-45 OF 182
MJM 9-4-87

* 79508 * ALP * 60T LOAD * BRIDGE IDLER TRUCK * SSE ·

** ANALYSIS OF TRUCK END DUE TO TORSION ** (SEC. B-B)

ADDED DIMENSIONS - B2 = 5.125 IN.
AL = 10.188 IN.
CL = 7.750 IN.

TORSIONAL RESISTANCE------------------	4.9 IN**4
SHEAR CENTER FROM CENTER OF TOP PLT--	11.115 IN.
WARPING CONSTANT----------------------	37301.4 IN**6
WARPING MOMENT------------------------	196850.0 IN-LBS.
ANGLE OF TWIST - 2ND DERIVATIVE------	0.8956E-06
3RD DERIVATIVE------	0.1759E-06

** TRUCK END STRESSES IN PSI **

TENSILE STRESS DUE TO WARPING RIGIDITY THROUGHOUT THE THICKNESS @ PT. A---------	1849.3
TENSILE STRESS DUE TO WARPING RIGIDITY THROUGHOUT THE THICKNESS @ PT. B---------	6475.9
SHEAR STRESS DUE TO WARPING RIGIDITY THROUGHOUT THE THICKNESS @ PT. C; AT A DISTANCE (Y) 1.824 IN. FROM THE INSIDE FACE OF THE WEB--------------	747.0
SHEAR STRESS DUE TO WARPING RIGIDITY THROUGHOUT THE THICKNESS @ PT. D; AT A DISTANCE (Z) 11.490 IN. FROM THE TOP FLANGE--------------------------	2400.7
TRANSVERSE SHEAR STRESS IN FLG DUE TO FX-	940.7
TRANSVERSE SHEAR STRESS IN WEB DUE TO FZ-	9595.2
MAX SHEAR STRESS IN WEB @ PT. D-----------	11995.9
MAX SHEAR STRESS IN BOT FLANGE------------	3323.0

** STRESS CALC. CALLED 2 TIMES

FORM N-2494

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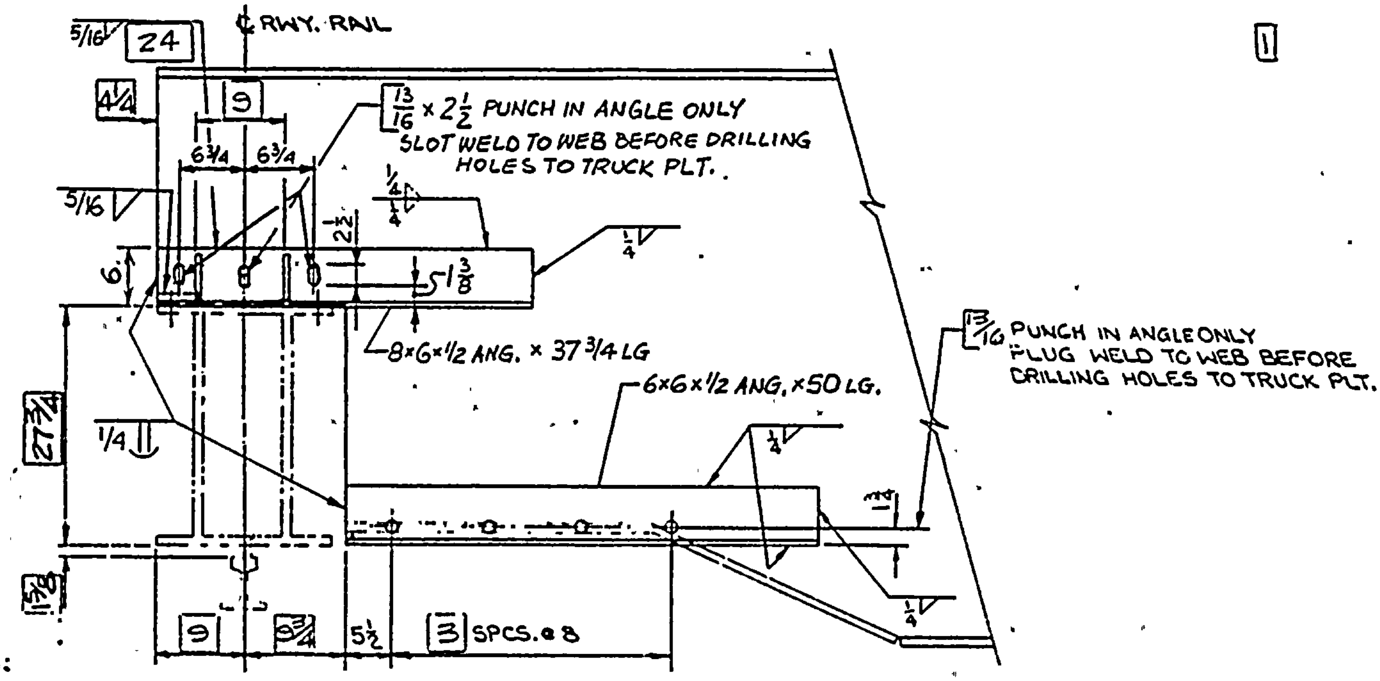
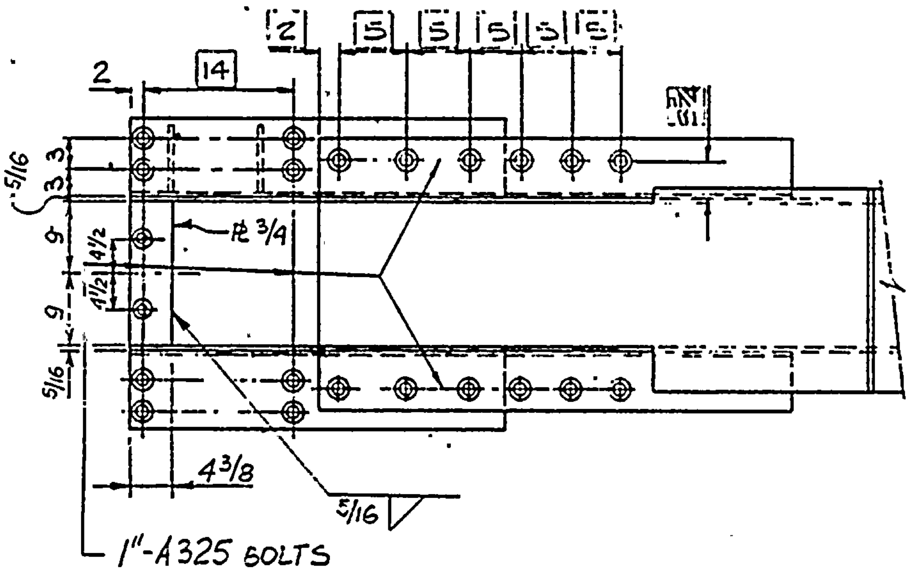
BY ASZ PAGE 4-46R1 OF 182
MJM 9-8-87
REV. 1 ASZ 11-3-87
CHK WAH 11-5-87

GIRDER TO TRUCK CONNECTION.





ALLOWABLES

1" HEX. BOLTS

MTRL: ASTM-A 325

$\sigma_{YMIN} = 92$ KSI

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

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

WELDS (FILLET THRU THROAT)

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

WELD MTRL: E70XX ELECTRODES $\sigma_{YMIN} = 57$ KSI

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

$= \frac{0.6\sqrt{2}\,36}{1.5} = 20.4$ KSI $\therefore \tau_{W.ALL} = 20.4$ KSI

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

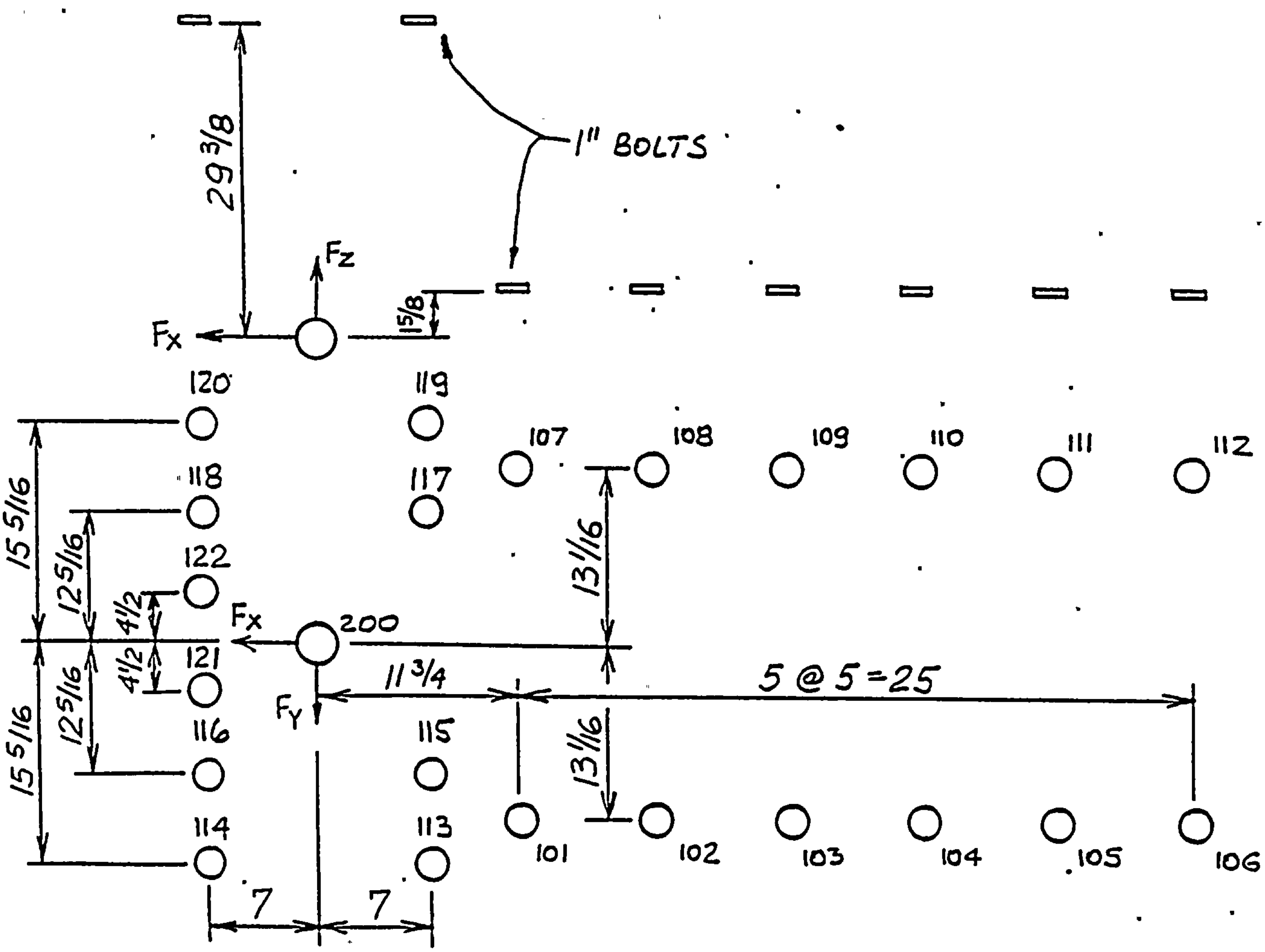
$= \frac{0.6\sqrt{2}\,36}{1.1} = 27.8$ KSI $\therefore \tau_{W.ALL} = 27.8$ KSI

MAX. LOADINGS PER TABLE 4-2 TO 4-5.

OBE $F_X = 13.3$ KIP $F_Y = 57.5$ KIP $F_Z = 279.5$ KIP $M_X = 4764$ IN. KIP

SSE $F_X = 25.4$ KIP $F_Y = 119.7$ KIP $F_Z = 382.3$ KIP $M_X = 8589$ IN. KIP

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.

FORM N-2494

WHITING REQN. 79508 DATE 7-27-87
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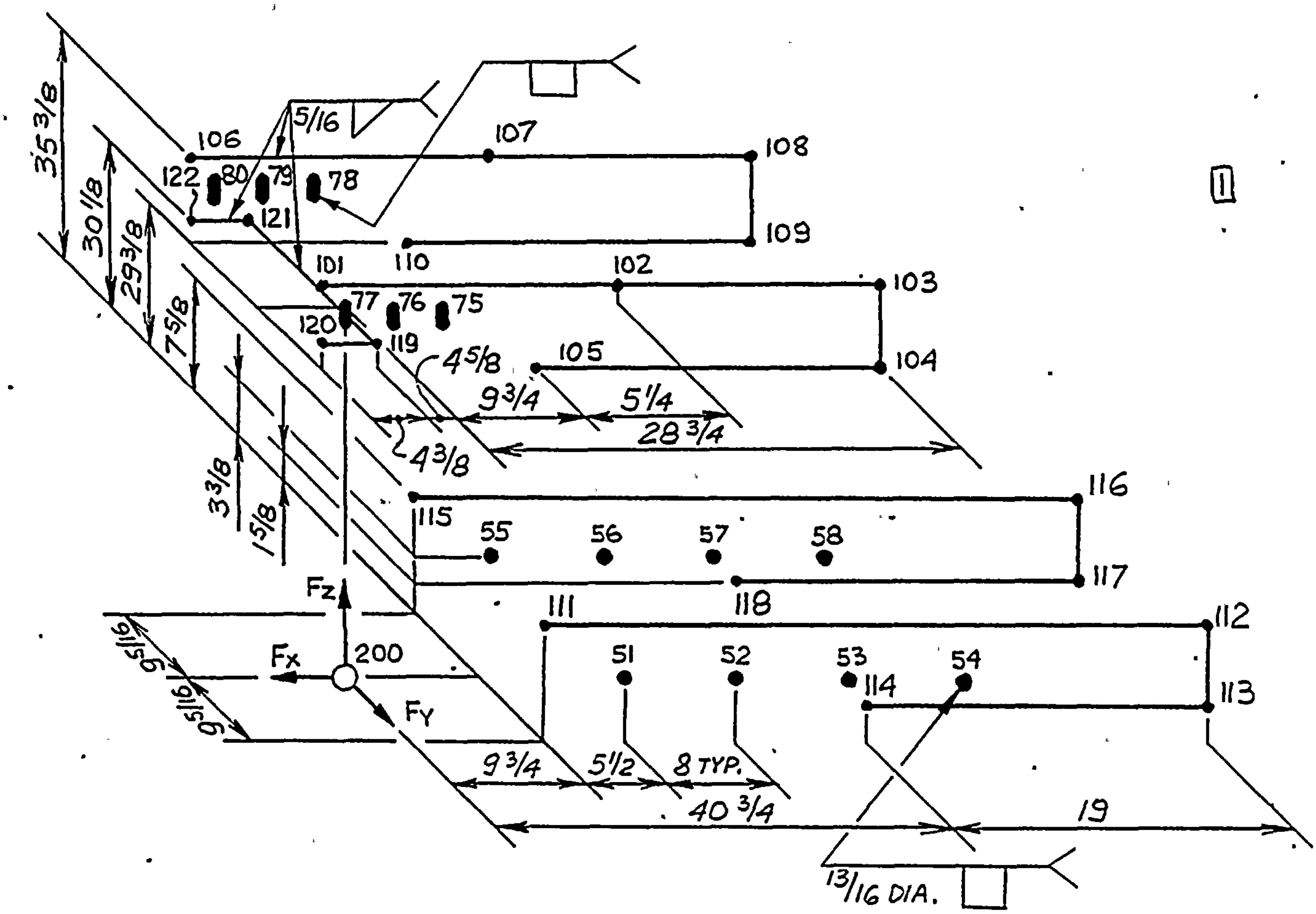
REV.1 ASZ 11-3-87
CHK WAY 11-5-87

1

WELDED CONNECTION



1/4 FILLET WELDS EXCEPT AS NOTED

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

PLUG AND SLOT WELDS WERE OMITTED WHICH IS CONSERVATIVE.

#79508 2-21-27

***** 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 * 60T LOAD * TRUCK TO GIRDER * BOLTS * OBE
    2.  79508 ASZ  4.      1.    1.                                    1.    1.
    3.   1.     3.    2.                                         MJM 9-8-87
    4.   2.     4.    0.
    5.  -1.
    6.   1.           36.8                                  3.
    7.  -1.
    8.   101.                     1.    1.          12.
    9.   113.                     1.    1.          10.
   10.   200.                     2.
   11.  -1.
   12.  -6.     6.                    -26.125
   13.   101.               -11.75     13.0625       1.625
   14.   102.               -16.75     13.0625       1.625
   15.   103.               -21.75     13.0625       1.625
   16.   104.               -26.75     13.0625       1.625
   17.   105.               -31.75     13.0625       1.625
   18.   106.               -36.75     13.0625       1.625
   19.   113.                 -7.0     15.3125      29.375
   20.   114.                  7.0     15.3125      29.375
   21.   115.                 -7.0     12.3125      29.375
   22.   116.                  7.0     12.3125      29.375
   23.   117.                 -7.0    -12.3125      29.375
   24.   118.                  7.0    -12.3125      29.375
   25.   119.                 -7.0    -15.3125      29.375
   26.   120.                  7.0    -15.3125      29.375
   27.   121.                  7.0     .4.5         29.375
   28.   122.                  7.0     -4.5         29.375
   29.   200.                  0.       0.           0.
   30.  9999.
   31.   101.   1.    122.
   32.  -1.
   33.   200.  13.3        57.5    0.          -4764.
   34.  -1.
   35.   200.  13.3       -57.5    0.           4764.
   36.  -1.
   37.   200. -13.3        57.5    0.          -4764.
   38.  -1.
   39.   200. -13.3       -57.5    0.           4764.
   40.  -1.
   41.  FINISH
              A     A     A     A     A     A     A     A     A     A     A     A     A
```

AEP * 150T CRANE * 60T LOAD * TRUCK TO GIRDER * BOLTS * OBE

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

AEP * 150T CRANE * 60T LOAD * TRUCK TO GIRDER * BOLTS * OBE

LOAD STEP...... 1	X	DIRECTION Y	Z
TRANSLATED FORCES.........	13.30	57.50	0.00
TRANSLATED MOMENTS........	-3945.28	-189.37	723.98

NUMBER OF FORCE DEFINITION NODES... 1

MAXIMUM ABSOLUTE STRESS ON ELEMENT 14 = 23.6 KSI
COMPARISON FACTOR MATCH ON ELEMENT 14 = 1.5591524

AEP * 150T CRANE * 60T LOAD * TRUCK TO GIRDER * BOLTS * OBE

LOAD STEP...... 2	X	DIRECTION Y	Z
TRANSLATED FORCES.........	13.30	-57.50	0.00
TRANSLATED MOMENTS........	3945.28	-189.37	-723.98

NUMBER OF FORCE DEFINITION NODES... 1

MAXIMUM ABSOLUTE STRESS ON ELEMENT 20 = 23.6 KSI
COMPARISON FACTOR MATCH ON ELEMENT 20 = 1.5591524

AEP * 150T CRANE * 60T LOAD * TRUCK TO GIRDER * BOLTS * OBE

LOAD STEP...... 3	X	DIRECTION Y	Z
TRANSLATED FORCES.........	-13.30	57.50	0.00
TRANSLATED MOMENTS........	-3945.28	189.37	723.98

NUMBER OF FORCE DEFINITION NODES... 1

MAXIMUM ABSOLUTE STRESS ON ELEMENT 20 = 23.6 KSI
COMPARISON FACTOR MATCH ON ELEMENT 20 = 1.5591524

AEP * 150T CRANE * 60T LOAD * TRUCK TO GIRDER * BOLTS * OBE

LOAD STEP...... 4	X	DIRECTION Y	Z
TRANSLATED FORCES.........	-13.30	-57.50	0.00
TRANSLATED MOMENTS........	3945.28	189.37	-723.98

NUMBER OF FORCE DEFINITION NODES... 1

MAXIMUM ABSOLUTE STRESS ON ELEMENT 14 = 23.6 KSI
COMPARISON FACTOR MATCH ON ELEMENT 14 = 1.5591524

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

WORST CASE OCCURED DURING LOAD STEP 1

AEP * 150T CRANE * 60T LOAD * TRUCK TO GIRDER * BOLTS * OBE

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

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

	X	Y	Z
CENTROIDS, X AXIS.........		0.00	14.24
Y AXIS.........	0.00		14.24
Z AXIS.........	-12.59	-0.00	
SHEAR AREAS...............	17.28	17.28	0.00
POLAR MOMENTS OF INERTIA..	3298.94	3298.94	6728.02
TRANSLATED FORCES.........	13.30	57.50	0.00
TRANSLATED MOMENTS........	-3945.28	-189.37	723.98

NUMBER OF FORCE DEFINITION NODES... 1

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

DIRECT STRESSES ARE EQUALLY DISTRIBUTED THROUGHOUT SHEAR AREA
DRX 0.8 DRY 3.3 DRZ 0.0

2-D POINT ELEMENT 1 NODE 101 AREA 0.785 DIAMETER 1.000
STRESS AT NODE 11.7 ALLOWABLE 36.8
STRESS EXPANSION FOR NODE 101
0.7 -1.4 -15.1 0.1 0.0 0.0
FORCES AT NODE 101 FX 0. FY -9. FZ 0.

2-D POINT ELEMENT 2 NODE 102 AREA 0.785 DIAMETER 1.000
STRESS AT NODE 12.2 ALLOWABLE 36.8
STRESS EXPANSION FOR NODE 102
0.7 -1.4 -15.1 -0.4 0.0 0.0
FORCES AT NODE 102 FX 0. FY -10. FZ 0.

2-D POINT ELEMENT 3 NODE 103 AREA 0.785 DIAMETER 1.000
STRESS AT NODE 12.7 ALLOWABLE 36.8
STRESS EXPANSION FOR NODE 103
0.7 -1.4 -15.1 -1.0 0.0 0.0
FORCES AT NODE 103 FX 0. FY -10. FZ 0.

2-D POINT ELEMENT 4 NODE 104 AREA 0.785 DIAMETER 1.000
STRESS AT NODE 13.3 ALLOWABLE 36.8
STRESS EXPANSION FOR NODE 104
0.7 -1.4 -15.1 -1.5 0.0 0.0
FORCES AT NODE 104 FX 0. FY -10. FZ 0.

2-D POINT ELEMENT 5 NODE 105 AREA 0.785 DIAMETER 1.000
STRESS AT NODE 13.8 ALLOWABLE 36.8
STRESS EXPANSION FOR NODE 105
0.7 -1.4 -15.1 -2.1 0.0 0.0
FORCES AT NODE 105 FX 0. FY -11. FZ 0.

AEP * 150T CRANE * 60T LOAD * TRUCK TO GIRDER * BOLTS * OBE

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

2-D POINT ELEMENT 6 NODE 106 AREA 0.785 DIAMETER 1.000
STRESS AT NODE 14.4 ALLOWABLE 36.8
STRESS EXPANSION FOR NODE 106
0.7 -1.4 -15.1 -2.6 0.0 0.0
FORCES AT NODE 106 FX 0. FY -11. FZ 0.

2-D POINT ELEMENT 7 NODE 107 AREA 0.785 DIAMETER 1.000
STRESS AT NODE 12.0 ALLOWABLE 36.8
STRESS EXPANSION FOR NODE 107
0.7 1.4 -15.1 0.1 0.0 0.0
FORCES AT NODE 107 FX 2. FY -9. FZ 0.

2-D POINT ELEMENT 8 NODE 108 AREA 0.785 DIAMETER 1.000
STRESS AT NODE 12.5 ALLOWABLE 36.8
STRESS EXPANSION FOR NODE 108
0.7 1.4 -15.1 -0.4 0.0 0.0
FORCES AT NODE 108 FX 2. FY -10. FZ 0.

2-D POINT ELEMENT 9 NODE 109 AREA 0.785 DIAMETER 1.000
STRESS AT NODE 13.1 ALLOWABLE 36.8
STRESS EXPANSION FOR NODE 109
0.7 1.4 -15.1 -1.0 0.0 0.0
FORCES AT NODE 109 FX 2. FY -10. FZ 0.

2-D POINT ELEMENT 10 NODE 110 AREA 0.785 DIAMETER 1.000
STRESS AT NODE 13.6 ALLOWABLE 36.8
STRESS EXPANSION FOR NODE 110
0.7 1.4 -15.1 -1.5 0.0 0.0
FORCES AT NODE 110 FX 2. FY -10. FZ 0.

2-D POINT ELEMENT 11 NODE 111 AREA 0.785 DIAMETER 1.000
STRESS AT NODE 14.1 ALLOWABLE 36.8
STRESS EXPANSION FOR NODE 111
0.7 1.4 -15.1 -2.1 0.0 0.0
FORCES AT NODE 111 FX 2. FY -11. FZ 0.

2-D POINT ELEMENT 12 NODE 112 AREA 0.785 DIAMETER 1.000
STRESS AT NODE 14.6 ALLOWABLE 36.8
STRESS EXPANSION FOR NODE 112
0.7 1.4 -15.1 -2.6 0.0 0.0
FORCES AT NODE 112 FX 2. FY -11. FZ 0.

2-D POINT ELEMENT 13 NODE 113 AREA 0.785 DIAMETER 1.000
STRESS AT NODE 22.1 ALLOWABLE 36.8
STRESS EXPANSION FOR NODE 113
-0.9 -1.6 18.1 0.6 0.0 0.0
FORCES AT NODE 113 FX -1. FY 17. FZ 0.

2-D POINT ELEMENT 14 NODE 114 AREA 0.785 DIAMETER 1.000
STRESS AT NODE 23.6 ALLOWABLE 36.8
STRESS EXPANSION FOR NODE 114
-0.9 -1.6 18.1 2.1 0.0 0.0
FORCES AT NODE 114 FX -1. FY 18. FZ 0.

```
AEP * 150T CRANE * 60T LOAD * TRUCK TO GIRDER * BOLTS * OBE

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

2-D POINT ELEMENT   15   NODE 115   AREA   0.785   DIAMETER   1.000
  STRESS AT NODE          22.1   ALLOWABLE        36.8
  STRESS EXPANSION FOR NODE 115
       -0.9        -1.3        18.1        0.6        0.0        0.0
  FORCES AT NODE 115   FX       -1.   FY       17.   FZ       0.

2-D POINT ELEMENT   16   NODE 116   AREA   0.785   DIAMETER   1.000
  STRESS AT NODE          23.6   ALLOWABLE        36.8
  STRESS EXPANSION FOR NODE 116
       -0.9        -1.3        18.1        2.1        0.0        0.0
  FORCES AT NODE 116   FX       -1.   FY       18.   FZ       0.

2-D POINT ELEMENT   17   NODE 117   AREA   0.785   DIAMETER   1.000
  STRESS AT NODE          22.1   ALLOWABLE        36.8
  STRESS EXPANSION FOR NODE 117
       -0.9         1.3        18.1        0.6        0.0        0.0
  FORCES AT NODE 117   FX        1.   FY       17.   FZ       0.

2-D POINT ELEMENT   18   NODE 118   AREA   0.785   DIAMETER   1.000
  STRESS AT NODE          23.6   ALLOWABLE        36.8
  STRESS EXPANSION FOR NODE 118
       -0.9         1.3        18.1        2.1        0.0        0.0
  FORCES AT NODE 118   FX        1.   FY       18.   FZ       0.

2-D POINT ELEMENT   19   NODE 119   AREA   0.785   DIAMETER   1.000
  STRESS AT NODE          22.1   ALLOWABLE        36.8
  STRESS EXPANSION FOR NODE 119
       -0.9         1.6        18.1        0.6        0.0        0.0
  FORCES AT NODE 119   FX        1.   FY       17.   FZ       0.

2-D POINT ELEMENT   20   NODE 120   AREA   0.785   DIAMETER   1.000
  STRESS AT NODE          23.6   ALLOWABLE        36.8
  STRESS EXPANSION FOR NODE 120
       -0.9         1.6        18.1        2.1        0.0        0.0
  FORCES AT NODE 120   FX        1.   FY       18.   FZ       0.

2-D POINT ELEMENT   21   NODE 121   AREA   0.785   DIAMETER   1.000
  STRESS AT NODE          23.5   ALLOWABLE        36.8
  STRESS EXPANSION FOR NODE 121
       -0.9        -0.5        18.1        2.1        0.0        0.0
  FORCES AT NODE 121   FX       -0.   FY       18.   FZ       0.

2-D POINT ELEMENT   22   NODE 122   AREA   0.785   DIAMETER   1.000
  STRESS AT NODE          23.5   ALLOWABLE        36.8
  STRESS EXPANSION FOR NODE 122
       -0.9         0.5        18.1        2.1        0.0        0.0
  FORCES AT NODE 122   FX        0.   FY       18.   FZ       0.

FORCE DEFINITION NODE  DIRECT   ELEMENT  23  NODE 200
   FX        13.30 ;   FY        57.50 ;   FZ        0.00
   MX     -4764.00 ;   MY         0.00 ;   MZ        0.00


MAXIMUM ABSOLUTE STRESS ON ELEMENT  14 =        23.6 KSI
```

AEP * 150T CRANE * 60T 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........	22
2	FORCE DEFINITION NODE - DIRECT.....	1

TOTAL NUMBER OF ELEMENTS = 23, NODES = 23

SYSTEM PROPERTIES

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

	X	Y	Z
CENTROIDS, X AXIS.........		0.00	14.24
Y AXIS.........	0.00		14.24
Z AXIS.........	-12.59	-0.00	
SHEAR AREAS.............	17.28	17.28	0.00
POLAR MOMENTS OF INERTIA..	3298.94	3298.94	6728.02
TRANSLATED FORCES.........	13.30	57.50	0.00
TRANSLATED MOMENTS........	-3945.28	-189.37	723.98

MAXIMUM ELEMENT STRESSES

DESCRIPTION	NUMBER USED	ELEMENT	NODE	STRESS	ALLOWABLE	COMPAR FACT
2-D POINT ELEMENT	22	14	114	23.6 KSI	36.8 KSI	1.55

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

#9508 9-2-87

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

ASZ — PAGE 4-56 OF 182

```
              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 * 60T LOAD * TRUCK TO GIRDER * BOLTS * SSE
   2.  79508 ASZ   4.    1.    1.                                     1.    1.
   3.  1.    3.    2.                                   MJM 9-8-87
   4.  2.    4.    0.
   5.  -1.
   6.  1.          50.2                                3.
   7.  -1.
   8.   101.                   1.    1.         12.
   9.   113.                   1.    1.         10.
  10.   200.                   2.
  11.  -1.
  12.  -6.   6.                          -26.125
  13.   101.              -11.75     13.0625        1.625
  14.   102.              -16.75     13.0625        1.625
  15.   103.              -21.75     13.0625        1.625
  16.   104.              -26.75     13.0625        1.625
  17.   105.              -31.75     13.0625        1.625
  18.   106.              -36.75     13.0625        1.625
  19.   113.               -7.0      15.3125       29.375
  20.   114.                7.0      15.3125       29.375
  21.   115.               -7.0      12.3125       29.375
  22.   116.                7.0      12.3125       29.375
  23.   117.               -7.0     -12.3125       29.375
  24.   118.                7.0     -12.3125       29.375
  25.   119.               -7.0     -15.3125       29.375
  26.   120.                7.0     -15.3125       29.375
  27.   121.                7.0       4.5          29.375
  28.   122.                7.0      -4.5          29.375.
  29.   200.               0.         0.            0.
  30.  9999.
  31.   101.  1.   122.
  32.  -1.
  33.   200.  25.4      119.7     0.          -8589.
  34.  -1.
  35.   200.  25.4     -119.7     0.           8589.
  36.  -1.
  37.   200. -25.4      119.7     0.          -8589.
  38.  -1.
  39.   200. -25.4     -119.7     0.           8589.
  40.  -1.
  41.  FINISH
             A     A     A     A     A     A     A     A     A     A     A     A     A
```

AEP * 150T CRANE * 60T LOAD * TRUCK TO GIRDER * BOLTS * SSE

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

AEP * 150T CRANE * 60T LOAD * TRUCK TO GIRDER * BOLTS * SSE

LOAD STEP...... 1	X	DIRECTION Y	Z
TRANSLATED FORCES.........	25.40	119.70	0.00
TRANSLATED MOMENTS........	-6884.63	-361.66	1507.14

NUMBER OF FORCE DEFINITION NODES... 1

MAXIMUM ABSOLUTE STRESS ON ELEMENT 14 = 43.1 KSI
COMPARISON FACTOR MATCH ON ELEMENT 14 = 1.1658974

AEP * 150T CRANE * 60T LOAD * TRUCK TO GIRDER * BOLTS * SSE

LOAD STEP...... 2	X	DIRECTION Y	Z
TRANSLATED FORCES.........	25.40	-119.70	0.00
TRANSLATED MOMENTS........	6884.63	-361.66	-1507.14

NUMBER OF FORCE DEFINITION NODES... 1

MAXIMUM ABSOLUTE STRESS ON ELEMENT 20 = 43.1 KSI
COMPARISON FACTOR MATCH ON ELEMENT 20 = 1.1658974

AEP * 150T CRANE * 60T LOAD * TRUCK TO GIRDER * BOLTS * SSE

LOAD STEP...... 3	X	DIRECTION Y	Z
TRANSLATED FORCES.........	-25.40	119.70	0.00
TRANSLATED MOMENTS........	-6884.63	361.66	1507.14

NUMBER OF FORCE DEFINITION NODES... 1

MAXIMUM ABSOLUTE STRESS ON ELEMENT 20 = 43.1 KSI
COMPARISON FACTOR MATCH ON ELEMENT 20 = 1.1658974

AEP * 150T CRANE * 60T LOAD * TRUCK TO GIRDER * BOLTS * SSE

LOAD STEP...... 4	X	DIRECTION Y	Z
TRANSLATED FORCES.........	-25.40	-119.70	0.00
TRANSLATED MOMENTS........	6884.63	361.66	-1507.14

NUMBER OF FORCE DEFINITION NODES... 1

MAXIMUM ABSOLUTE STRESS ON ELEMENT 14 = 43.1 KSI
COMPARISON FACTOR MATCH ON ELEMENT 14 = 1.1658974

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

WORST CASE OCCURED DURING LOAD STEP 1

AEP * 150T CRANE * 60T LOAD * TRUCK TO GIRDER * BOLTS * SSE

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

LOAD STEP...... 1

	DIRECTION, LOCATION OR AXIS		
	X	Y	Z
CENTROIDS, X AXIS.........		0.00	14.24
Y AXIS.........	0.00		14.24
Z AXIS.........	-12.59	-0.00	
SHEAR AREAS................	17.28	17.28	0.00
POLAR MOMENTS OF INERTIA..	3298.94	3298.94	6728.02
TRANSLATED FORCES..........	25.40	119.70	0.00
TRANSLATED MOMENTS.........	-6884.63	-361.66	1507.14

NUMBER OF FORCE DEFINITION NODES... 1

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

DIRECT STRESSES ARE EQUALLY DISTRIBUTED THROUGHOUT SHEAR AREA
DRX 1.5 DRY 6.9 DRZ 0.0

2-D POINT ELEMENT 1 NODE 101 AREA 0.785 DIAMETER 1.000
STRESS AT NODE 19.2 ALLOWABLE 50.2
STRESS EXPANSION FOR NODE 101
1.4 -2.9 -26.3 0.2 0.0 0.0
FORCES AT NODE 101 FX -0. FY -15. FZ 0.

2-D POINT ELEMENT 2 NODE 102 AREA 0.785 DIAMETER 1.000
STRESS AT NODE 20.3 ALLOWABLE 50.2
STRESS EXPANSION FOR NODE 102
1.4 -2.9 -26.3 -0.9 0.0 0.0
FORCES AT NODE 102 FX -0. FY -16. FZ 0.

2-D POINT ELEMENT 3 NODE 103 AREA 0.785 DIAMETER 1.000
STRESS AT NODE 21.4 ALLOWABLE 50.2
STRESS EXPANSION FOR NODE 103
1.4 -2.9 -26.3 -2.1 0.0 0.0
FORCES AT NODE 103 FX -0. FY -17. FZ 0.

2-D POINT ELEMENT 4 NODE 104 AREA 0.785 DIAMETER 1.000
STRESS AT NODE 22.6 ALLOWABLE 50.2
STRESS EXPANSION FOR NODE 104
1.4 -2.9 -26.3 -3.2 0.0 0.0
FORCES AT NODE 104 FX -0. FY -18. FZ 0.

2-D POINT ELEMENT 5 NODE 105 AREA 0.785 DIAMETER 1.000
STRESS AT NODE 23.7 ALLOWABLE 50.2
STRESS EXPANSION FOR NODE 105
1.4 -2.9 -26.3 -4.3 0.0 0.0
FORCES AT NODE 105 FX -0. FY -19. FZ 0.

AEP * 150T CRANE * 60T LOAD * TRUCK TO GIRDER * BOLTS * SSE

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

```
2-D POINT ELEMENT    6   NODE 106   AREA   0.785   DIAMETER   1.000
  STRESS AT NODE          24.8    ALLOWABLE        50.2
  STRESS EXPANSION FOR NODE 106
       1.4       -2.9      -26.3       -5.4        0.0        0.0
  FORCES AT NODE 106   FX      -0.   FY     -19.   FZ      0.

2-D POINT ELEMENT    7   NODE 107   AREA   0.785   DIAMETER   1.000
  STRESS AT NODE          20.1    ALLOWABLE        50.2
  STRESS EXPANSION FOR NODE 107
       1.4        2.9      -26.3        0.2        0.0        0.0
  FORCES AT NODE 107   FX       5.   FY     -15.   FZ      0.

2-D POINT ELEMENT    8   NODE 108   AREA   0.785   DIAMETER   1.000
  STRESS AT NODE          21.1    ALLOWABLE        50.2
  STRESS EXPANSION FOR NODE 108
       1.4        2.9      -26.3       -0.9        0.0        0.0
  FORCES AT NODE 108   FX       5.   FY     -16.   FZ      0.

2-D POINT ELEMENT    9   NODE 109   AREA   0.785   DIAMETER   1.000
  STRESS AT NODE          22.2    ALLOWABLE        50.2
  STRESS EXPANSION FOR NODE 109
       1.4        2.9      -26.3       -2.1        0.0        0.0
  FORCES AT NODE 109   FX       5.   FY     -17.   FZ      0.

2-D POINT ELEMENT   10   NODE 110   AREA   0.785   DIAMETER   1.000
  STRESS AT NODE          23.3    ALLOWABLE        50.2
  STRESS EXPANSION FOR NODE 110
       1.4        2.9      -26.3       -3.2        0.0        0.0
  FORCES AT NODE 110   FX       5.   FY     -18.   FZ      0.

2-D POINT ELEMENT   11   NODE 111   AREA   0.785   DIAMETER   1.000
  STRESS AT NODE          24.4    ALLOWABLE        50.2
  STRESS EXPANSION FOR NODE 111
       1.4        2.9      -26.3       -4.3        0.0        0.0
  FORCES AT NODE 111   FX       5.   FY     -19.   FZ      0.

2-D POINT ELEMENT   12   NODE 112   AREA   0.785   DIAMETER   1.000
  STRESS AT NODE          25.5    ALLOWABLE        50.2
  STRESS EXPANSION FOR NODE 112
       1.4        2.9      -26.3       -5.4        0.0        0.0
  FORCES AT NODE 112   FX       5.   FY     -19.   FZ      0.

2-D POINT ELEMENT   13   NODE 113   AREA   0.785   DIAMETER   1.000
  STRESS AT NODE          39.9    ALLOWABLE        50.2
  STRESS EXPANSION FOR NODE 113
      -1.7       -3.4       31.6        1.3        0.0        0.0
  FORCES AT NODE 113   FX      -3.   FY      31.   FZ      0.

2-D POINT ELEMENT   14   NODE 114   AREA   0.785   DIAMETER   1.000
  STRESS AT NODE          43.1    ALLOWABLE        50.2
  STRESS EXPANSION FOR NODE 114
      -1.7       -3.4       31.6        4.4        0.0        0.0
  FORCES AT NODE 114   FX      -3.   FY      34.   FZ      0.
```

AEP * 150T CRANE * 60T LOAD * TRUCK TO GIRDER * BOLTS * SSE

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

```
2-D POINT ELEMENT   15    NODE 115    AREA    0.785    DIAMETER    1.000
 STRESS AT NODE          39.9     ALLOWABLE       50.2
 STRESS EXPANSION FOR NODE 115
    -1.7        -2.8         31.6          1.3          0.0          0.0
 FORCES AT NODE 115    FX          -2.    FY         31.    FZ          0.

2-D POINT ELEMENT   16    NODE 116    AREA    0.785    DIAMETER    1.000
 STRESS AT NODE          43.0     ALLOWABLE       50.2
 STRESS EXPANSION FOR NODE 116
    -1.7        -2.8         31.6          4.4          0.0          0.0
 FORCES AT NODE 116    FX          -2.    FY         34.    FZ          0.

2-D POINT ELEMENT   17    NODE 117    AREA    0.785    DIAMETER    1.000
 STRESS AT NODE          39.9     ALLOWABLE       50.2
 STRESS EXPANSION FOR NODE 117
    -1.7         2.8         31.6          1.3          0.0          0.0
 FORCES AT NODE 117    FX           2.    FY         31.    FZ          0.

2-D POINT ELEMENT   18    NODE 118    AREA    0.785    DIAMETER    1.000
 STRESS AT NODE          43.0     ALLOWABLE       50.2
 STRESS EXPANSION FOR NODE 118
    -1.7         2.8         31.6          4.4          0.0          0.0
 FORCES AT NODE 118    FX           2.    FY         34.    FZ          0.

2-D POINT ELEMENT   19    NODE 119    AREA    0.785    DIAMETER    1.000
 STRESS AT NODE          39.9     ALLOWABLE       50.2
 STRESS EXPANSION FOR NODE 119
    -1.7         3.4         31.6          1.3          0.0          0.0
 FORCES AT NODE 119    FX           3.    FY         31.    FZ          0.

2-D POINT ELEMENT   20    NODE 120    AREA    0.785    DIAMETER    1.000
 STRESS AT NODE          43.0     ALLOWABLE       50.2
 STRESS EXPANSION FOR NODE 120
    -1.7         3.4         31.6          4.4          0.0          0.0
 FORCES AT NODE 120    FX           3.    FY         34.    FZ          0.

2-D POINT ELEMENT   21    NODE 121    AREA    0.785    DIAMETER    1.000
 STRESS AT NODE          42.9     ALLOWABLE       50.2
 STRESS EXPANSION FOR NODE 121
    -1.7        -1.0         31.6          4.4          0.0          0.0
 FORCES AT NODE 121    FX          -1.    FY         34.    FZ          0.

2-D POINT ELEMENT   22    NODE 122    AREA    0.785    DIAMETER    1.000
 STRESS AT NODE          42.9     ALLOWABLE       50.2
 STRESS EXPANSION FOR NODE 122
    -1.7         1.0         31.6          4.4          0.0          0.0
 FORCES AT NODE 122    FX           1.    FY         34.    FZ          0.

FORCE DEFINITION NODE  DIRECT    ELEMENT  23   NODE 200
  FX        25.40 ;   FY       119.70 ;   FZ        0.00
  MX     -8589.00 ;   MY         0.00 ;   MZ        0.00

MAXIMUM ABSOLUTE STRESS ON ELEMENT  14 =        43.1 KSI
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MJM 9-8-87

AEP * 150T CRANE * 60T 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........	22
2	FORCE DEFINITION NODE - DIRECT......	1

TOTAL NUMBER OF ELEMENTS = 23, NODES = 23

SYSTEM PROPERTIES

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

	X	Y	Z
CENTROIDS, X AXIS.........		0.00	14.24
Y AXIS.........	0.00		14.24
Z AXIS.........	-12.59	-0.00	
SHEAR AREAS.................	17.28	17.28	0.00
POLAR MOMENTS OF INERTIA..	3298.94	3298.94	6728.02
TRANSLATED FORCES.........	25.40	119.70	0.00
TRANSLATED MOMENTS........	-6884.63	-361.66	1507.14

MAXIMUM ELEMENT STRESSES

DESCRIPTION	NUMBER USED	ELEMENT	NODE	STRESS	ALLOWABLE	COMPAR: FACTC
2-D POINT ELEMENT	22	14	114	43.1 KSI	50.2 KSI	1.165

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

REQN. 79508

***** CONSYS INPUT DATA LISTING ***** 11/03/87

REV.1 ASZ ~~ WAH 11-5-87 PAGE 4-62R1 OF 182

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         5   10   15   20   25   30   35   40   45   50   55   60   65   70   75
         V    V    V    V    V    V    V    V    V    V    V    V    V    V    V
  1. AEP * 150T CRANE * 60T LOAD * TRUCK TO GIRDER * WELDS * OBE
  2. 79508 ASZ 4.    1.   1.   0.                       1.   1.
  3.  1.   1.
  4.  2.   4.
  5. -1.
  6.  0.25      20.4                 1.        3.
  7.  0.3125    20.4                 1.        3.
  8. -1.
  9.  101. 102.           1.   2.
 10.  106. 107.           1.   2.
 11.  102. 103.           1.   1.        3.         2.
 12.  107. 108.           1.   1.
 13.  111. 112.           1.   1.        3.         2.
 14.  115. 116.           1.   1.
 15.  119. 120.           1.   2.        2.   2.
 16.  119. 121.           1.   2.
 17.  200.                2.
 18. -1.
 19. -5.   5.                 -18.625
 20.  101.            9.        9.3125    35.375
 21.  102.          -15.        9.3125    35.375                                  1
 22.  103.          -28.75      9.3125    35.375
 23.  104.          -28.75      9.3125    29.375
 24.  105.           -9.75      9.3125    29.375
 25. -4.   4.                 -18.625
 26.  111.           -9.75      9.3125     7.625
 27.  112.          -59.75      9.3125     7.625
 28.  113.          -59.75      9.3125     1.625
 29.  114.          -40.75      9.3125     1.625
 30. -2.   2.                 -18.
 31.  119.            4.625     9.        30.125
 32.  120.            9.        9.        30.125
 33.  200.            0.        0.         0.
 34. 9999.
 35.  101.  1.    122.
 36. -1.
 37.  200.  13.3      57.5    0.       -4764.
 38. -1.
 39.  200.  13.3     -57.5    0.        4764.
 40. -1.
 41.  200. -13.3      57.5    0.       -4764.
 42. -1.
 43.  200. -13.3     -57.5    0.        4764.
 44. -1.
 45. FINISH
         A    A    A    A    A    A    A    A    A    A    A    A    A    A    A
```

AEP * 150T CRANE * 60T LOAD * TRUCK TO GIRDER * WELDS * OBE

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

AEP * 150T CRANE * 60T LOAD * TRUCK TO GIRDER * WELDS * OBE

LOAD STEP...... 1	X	DIRECTION Y	Z
TRANSLATED FORCES.........	13.30	57.50	0.00
TRANSLATED MOMENTS........	-3601.75	-268.83	1394.06

NUMBER OF FORCE DEFINITION NODES... 1

MAXIMUM ABSOLUTE STRESS ON ELEMENT 1 = 7.8 KSI
COMPARISON FACTOR MATCH ON ELEMENT 1 = 2.6251454

AEP * 150T CRANE * 60T LOAD * TRUCK TO GIRDER * WELDS * OBE

LOAD STEP...... 2	X	DIRECTION Y	Z
TRANSLATED FORCES.........	13.30	-57.50	0.00
TRANSLATED MOMENTS........	3601.75	-268.83	-1394.06

NUMBER OF FORCE DEFINITION NODES... 1

MAXIMUM ABSOLUTE STRESS ON ELEMENT 2 = 7.8 KSI
COMPARISON FACTOR MATCH ON ELEMENT 2 = 2.6251454

AEP * 150T CRANE * 60T LOAD * TRUCK TO GIRDER * WELDS * OBE

LOAD STEP...... 3	X	DIRECTION Y	Z
TRANSLATED FORCES.........	-13.30	57.50	0.00
TRANSLATED MOMENTS........	-3601.75	268.83	1394.06

NUMBER OF FORCE DEFINITION NODES... 1

MAXIMUM ABSOLUTE STRESS ON ELEMENT 2 = 7.8 KSI
COMPARISON FACTOR MATCH ON ELEMENT 2 = 2.6251454

AEP * 150T CRANE * 60T LOAD * TRUCK TO GIRDER * WELDS * OBE

LOAD STEP...... 4	X	DIRECTION Y	Z
TRANSLATED FORCES.........	-13.30	-57.50	0.00
TRANSLATED MOMENTS........	3601.75	268.83	-1394.06

NUMBER OF FORCE DEFINITION NODES... 1

MAXIMUM ABSOLUTE STRESS ON ELEMENT 1 = 7.8 KSI
COMPARISON FACTOR MATCH ON ELEMENT 1 = 2.6251454

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

WORST CASE OCCURED DURING LOAD STEP 1

AEP * 150T CRANE * 60T LOAD * TRUCK TO GIRDER * WELDS * OBE

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

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

	X	Y	Z
CENTROIDS, X AXIS.........		0.00	20.21
Y AXIS.........	0.00		20.21
Z AXIS.........	-24.24	-0.00	
SHEAR AREAS...............	56.73	56.73	0.00
POLAR MOMENTS OF INERTIA..	10664.59	10664.59	28720.45
TRANSLATED FORCES.........	13.30	57.50	0.00
TRANSLATED MOMENTS........	-3601.75	-268.83	1394.06

NUMBER OF FORCE DEFINITION NODES... 1

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

DIRECT STRESSES ARE EQUALLY DISTRIBUTED THROUGHOUT SHEAR AREA
DRX 0.2 DRY 1.0 DRZ 0.0

3-D LINE ELEMENT 1 SIZE 0.313 LENGTH 24.000 AREA 5.303
STRESS AT NODES 101, 102 7.8, 6.6 ALLOWABLE 20.4

STRESS EXPANSION FOR NODE 101					
-0.4	-0.5	5.1	1.6	0.0	0.0
STRESS EXPANSION FOR NODE 102					
-0.4	-0.5	5.1	0.4	0.0	0.0

3-D LINE ELEMENT 2 SIZE 0.313 LENGTH 24.000 AREA 5.303
STRESS AT NODES 106, 107 7.8, 6.6 ALLOWABLE 20.4

STRESS EXPANSION FOR NODE 106					
-0.4	0.5	5.1	1.6	0.0	0.0
STRESS EXPANSION FOR NODE 107					
-0.4	0.5	5.1	0.4	0.0	0.0

3-D LINE ELEMENT 3 SIZE 0.250 LENGTH 13.750 AREA 2.431
STRESS AT NODES 102, 103 6.6, 5.9 ALLOWABLE 20.4

STRESS EXPANSION FOR NODE 102					
-0.4	-0.5	5.1	0.4	0.0	0.0
STRESS EXPANSION FOR NODE 103					
-0.4	-0.5	5.1	-0.2	0.0	0.0

3-D LINE ELEMENT 4 SIZE 0.250 LENGTH 6.000 AREA 1.061
STRESS AT NODES 103, 104 5.9, 3.9 ALLOWABLE 20.4

STRESS EXPANSION FOR NODE 103					
-0.4	-0.5	5.1	-0.2	0.0	0.0
STRESS EXPANSION FOR NODE 104					
-0.2	-0.5	3.1	-0.2	0.0	0.0

AEP * 150T CRANE * 60T LOAD * TRUCK TO GIRDER * WELDS * OBE

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

3-D LINE ELEMENT 5 SIZE 0.250 LENGTH 19.000 AREA 3.359
STRESS AT NODES 104,105 3.9, 4.8 ALLOWABLE 20.4
STRESS EXPANSION FOR NODE 104
-0.2 -0.5 3.1 -0.2 0.0 0.0
STRESS EXPANSION FOR NODE 105
-0.2 -0.5 3.1 0.7 0.0 0.0

3-D LINE ELEMENT 6 SIZE 0.250 LENGTH 13.750 AREA 2.431
STRESS AT NODES 107,108 6.6, 5.9 ALLOWABLE 20.4
STRESS EXPANSION FOR NODE 107
-0.4 0.5 5.1 0.4 0.0 0.0
STRESS EXPANSION FOR NODE 108
-0.4 0.5 5.1 -0.2 0.0 0.0

3-D LINE ELEMENT 7 SIZE 0.250 LENGTH 6.000 AREA 1.061
STRESS AT NODES 108,109 5.9, 3.9 ALLOWABLE 20.4
STRESS EXPANSION FOR NODE 108
-0.4 0.5 5.1 -0.2 0.0 0.0
STRESS EXPANSION FOR NODE 109
-0.2 0.5 3.1 -0.2 0.0 0.0

3-D LINE ELEMENT 8 SIZE 0.250 LENGTH 19.000 AREA 3.359
STRESS AT NODES 109,110 3.9, 4.8 ALLOWABLE 20.4
STRESS EXPANSION FOR NODE 109
-0.2 0.5 3.1 -0.2 0.0 0.0
STRESS EXPANSION FOR NODE 110
-0.2 0.5 3.1 0.7 0.0 0.0

3-D LINE ELEMENT 9 SIZE 0.250 LENGTH 50.000 AREA 8.839
STRESS AT NODES 111,112 2.5, 5.0 ALLOWABLE 20.4
STRESS EXPANSION FOR NODE 111
0.3 -0.5 -4.3 0.7 0.0 0.0
STRESS EXPANSION FOR NODE 112
0.3 -0.5 -4.3 -1.7 0.0 0.0

3-D LINE ELEMENT 10 SIZE 0.250 LENGTH 6.000 AREA 1.061
STRESS AT NODES 112,113 5.0, 7.0 ALLOWABLE 20.4
STRESS EXPANSION FOR NODE 112
0.3 -0.5 -4.3 -1.7 0.0 0.0
STRESS EXPANSION FOR NODE 113
0.5 -0.5 -6.3 -1.7 0.0 0.0

3-D LINE ELEMENT 11 SIZE 0.250 LENGTH 19.000 AREA 3.359
STRESS AT NODES 113,114 7.0, 6.1 ALLOWABLE 20.4
STRESS EXPANSION FOR NODE 113
0.5 -0.5 -6.3 -1.7 0.0 0.0
STRESS EXPANSION FOR NODE 114
0.5 -0.5 -6.3 -0.8 0.0 0.0

3-D LINE ELEMENT 12 SIZE 0.250 LENGTH 50.000 AREA 8.839
STRESS AT NODES 115,116 2.7, 5.1 ALLOWABLE 20.4
STRESS EXPANSION FOR NODE 115
0.3 0.5 -4.3 0.7 0.0 0.0
STRESS EXPANSION FOR NODE 116
0.3 0.5 -4.3 -1.7 0.0 0.0

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*** CONSYS ANALYSIS PROGRAM ***     REQUISITION 79508  DATE 11/03/87
VERSION 4.2  RELEASED 12/03/82  Rev/By: ASZ          PAGE 4-66 R1 OF 182
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AEP * 150T CRANE * 60T LOAD * TRUCK TO GIRDER * WELDS * OBE

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

3-D LINE ELEMENT  13    SIZE   0.250   LENGTH   6.000   AREA   1.061
 STRESS AT NODES 116,117       5.1,       7.1   ALLOWABLE      20.4
 STRESS EXPANSION FOR NODE 116
      0.3         0.5        -4.3       -1.7         0.0         0.0
 STRESS EXPANSION FOR NODE 117
      0.5         0.5        -6.3       -1.7         0.0         0.0

3-D LINE ELEMENT  14    SIZE   0.250   LENGTH  19.000   AREA   3.359
 STRESS AT NODES 117,118       7.1,       6.2   ALLOWABLE      20.4
 STRESS EXPANSION FOR NODE 117
      0.5         0.5        -6.3       -1.7         0.0         0.0
 STRESS EXPANSION FOR NODE 118
      0.5         0.5        -6.3       -0.8         0.0         0.0

3-D LINE ELEMENT  15    SIZE   0.313   LENGTH   4.375   AREA   0.967
 STRESS AT NODES 119,120       5.8,       6.0   ALLOWABLE      20.4
 STRESS EXPANSION FOR NODE 119
     -0.2        -0.4         3.3        1.4         0.0         0.0
 STRESS EXPANSION FOR NODE 120
     -0.2        -0.4         3.3        1.6         0.0         0.0

3-D LINE ELEMENT  16    SIZE   0.313   LENGTH   4.375   AREA   0.967
 STRESS AT NODES 121,122       5.8,       6.0   ALLOWABLE      20.4
 STRESS EXPANSION FOR NODE 121
     -0.2         0.4         3.3        1.4         0.0         0.0
 STRESS EXPANSION FOR NODE 122
     -0.2         0.4         3.3        1.6         0.0         0.0

3-D LINE ELEMENT  17    SIZE   0.313   LENGTH  18.000   AREA   3.977
 STRESS AT NODES 119,121       5.8,       5.8   ALLOWABLE      20.4
 STRESS EXPANSION FOR NODE 119
     -0.2        -0.4         3.3        1.4         0.0         0.0
 STRESS EXPANSION FOR NODE 121
     -0.2         0.4         3.3        1.4         0.0         0.0

FORCE DEFINITION NODE  DIRECT   ELEMENT  18  NODE 200
  FX        13.30 ;  FY        57.50 ;  FZ        0.00
  MX     -4764.00 ;  MY         0.00 ;  MZ        0.00

MAXIMUM ABSOLUTE STRESS ON ELEMENT    1 =       7.8 KSI
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CHK WAN 11-5-87

AEP * 150T CRANE * 60T 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.........	17
2	FORCE DEFINITION NODE - DIRECT.....	1

TOTAL NUMBER OF ELEMENTS = 18, NODES = 23

SYSTEM PROPERTIES

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

	X	Y	Z
CENTROIDS, X AXIS.........		0.00	20.21
Y AXIS.........	0.00		20.21
Z AXIS.........	-24.24	-0.00	
SHEAR AREAS...............	56.73	56.73	0.00
POLAR MOMENTS OF INERTIA..	10664.59	10664.59	28720.45
TRANSLATED FORCES.........	13.30	57.50	0.00
TRANSLATED MOMENTS........	-3601.75	-268.83	1394.06

MAXIMUM ELEMENT STRESSES

DESCRIPTION	NUMBER USED	ELEMENT	NODE	STRESS	ALLOWABLE	COMPARISON FACTOR
3-D LINE ELEMENT	12	13	117	7.1 KSI	20.4 KSI	2.8804
3-D LINE ELEMENT	5	1	101	7.8 KSI	20.4 KSI	2.6251

1

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

REQN. 79508

***** CONSYS INPUT DATA LISTING *****   11/03/87

REV. 1ASZ   CHK WAH 11-5-87   PAGE 4-68R1   OF 182

```
        5   10   15   20   25   30   35   40   45   50   55   60   65   70   75
        V    V    V    V    V    V    V    V    V    V    V    V    V    V    V
 1. AEP * 150T CRANE * 60T LOAD * TRUCK TO GIRDER * WELDS * SSE
 2. 79508 ASZ  4.   1.   1.   0.                       1.   1.
 3.  1.   1.
 4.  2.   4.
 5. -1.
 6.  0.25      27.8                1.        3.
 7.  0.3125    27.8                1.        3.
 8. -1.
 9.  101. 102.           1.   2.
10.  106. 107.           1.   2.
11.  102. 103.           1.   1.        3.        2.
12.  107. 108.           1.   1.
13.  111. 112.           1.   1.        3.        2.
14.  115. 116.           1.   1.
15.  119. 120.           1.   2.        2.   2.
16.  119. 121.           1.   2.
17.  200.                2.
18. -1.
19. -5.   5.                  -18.625
20.  101.             9.         9.3125   35.375
21.  102.           -15.         9.3125   35.375
22.  103.           -28.75       9.3125   35.375
23.  104.           -28.75       9.3125   29.375
24.  105.            -9.75       9.3125   29.375
25. -4.   4.                  -18.625
26.  111.            -9.75       9.3125    7.625
27.  112.           -59.75       9.3125    7.625
28.  113.           -59.75       9.3125    1.625
29.  114.           -40.75       9.3125    1.625
30. -2.   2.                  -18.
31.  119.             4.625      9.       30.125
32.  120.             9.         9.       30.125
33.  200.             0.         0.        0.
34.  9999.
35.  101. 1.   122.
36. -1.
37.  200. 25.4      119.7     0.       -8589.
38. -1.
39.  200. 25.4     -119.7     0.        8589.
40. -1.
41.  200.-25.4      119.7     0.       -8589.
42. -1.
43.  200.-25.4     -119.7     0.        8589.
44. -1.
45. FINISH
        A    A    A    A    A    A    A    A    A    A    A    A    A    A    A
```

AEP * 150T CRANE * 60T LOAD * TRUCK TO GIRDER * WELDS * SSE

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

AEP * 150T CRANE * 60T LOAD * TRUCK TO GIRDER * WELDS * SSE

		DIRECTION	
LOAD STEP...... 1	X	Y	Z
TRANSLATED FORCES.........	25.40	119.70	0.00
TRANSLATED MOMENTS........	-6169.50	-513.41	2902.08

NUMBER OF FORCE DEFINITION NODES... 1

MAXIMUM ABSOLUTE STRESS ON ELEMENT 1 = 14.3 KSI
COMPARISON FACTOR MATCH ON ELEMENT 1 = 1.9450412

AEP * 150T CRANE * 60T LOAD * TRUCK TO GIRDER * WELDS * SSE

		DIRECTION	
LOAD STEP...... 2	X	Y	Z
TRANSLATED FORCES.........	25.40	-119.70	0.00
TRANSLATED MOMENTS........	6169.50	-513.41	-2902.08

NUMBER OF FORCE DEFINITION NODES... 1

MAXIMUM ABSOLUTE STRESS ON ELEMENT 2 = 14.3 KSI
COMPARISON FACTOR MATCH ON ELEMENT 2 = 1.9450409

AEP * 150T CRANE * 60T LOAD * TRUCK TO GIRDER * WELDS * SSE

		DIRECTION	
LOAD STEP...... 3	X	Y	Z
TRANSLATED FORCES.........	-25.40	119.70	0.00
TRANSLATED MOMENTS........	-6169.50	513.41	2902.08

NUMBER OF FORCE DEFINITION NODES... 1

MAXIMUM ABSOLUTE STRESS ON ELEMENT 2 = 14.3 KSI
COMPARISON FACTOR MATCH ON ELEMENT 2 = 1.9450412

AEP * 150T CRANE * 60T LOAD * TRUCK TO GIRDER * WELDS * SSE

		DIRECTION	
LOAD STEP...... 4	X	Y	Z
TRANSLATED FORCES.........	-25.40	-119.70	0.00
TRANSLATED MOMENTS........	6169.50	513.41	-2902.08

NUMBER OF FORCE DEFINITION NODES... 1

MAXIMUM ABSOLUTE STRESS ON ELEMENT 1 = 14.3 KSI
COMPARISON FACTOR MATCH ON ELEMENT 1 = 1.9450412

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

WORST CASE OCCURED DURING LOAD STEP 2

CHK ?WAH 11-5-87

AEP * 150T CRANE * 60T LOAD * TRUCK TO GIRDER * WELDS * SSE

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

LOAD STEP...... 2   DIRECTION, LOCATION OR AXIS

	X	Y	Z
CENTROIDS, X AXIS.........		0.00	20.21
Y AXIS.........	0.00		20.21
Z AXIS.........	-24.24	-0.00	
SHEAR AREAS...............	56.73	56.73	0.00
POLAR MOMENTS OF INERTIA..	10664.59	10664.59	28720.45
TRANSLATED FORCES.........	25.40	-119.70	0.00
TRANSLATED MOMENTS........	6169.50	-513.41	-2902.08

NUMBER OF FORCE DEFINITION NODES... 1

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

DIRECT STRESSES ARE EQUALLY DISTRIBUTED THROUGHOUT SHEAR AREA
DRX 0.4 DRY -2.1 DRZ 0.0

3-D LINE ELEMENT 1 SIZE 0.313 LENGTH 24.000 AREA 5.303
STRESS AT NODES 101, 102 14.3, 11.8 ALLOWABLE 27.8

STRESS EXPANSION FOR NODE 101					
-0.7	0.9	-8.8	-3.4	0.0	0.0
STRESS EXPANSION FOR NODE 102					
-0.7	0.9	-8.8	-0.9	0.0	0.0

3-D LINE ELEMENT 2 SIZE 0.313 LENGTH 24.000 AREA 5.303
STRESS AT NODES 106, 107 14.3, 11.9 ALLOWABLE 27.8

STRESS EXPANSION FOR NODE 106					
-0.7	-0.9	-8.8	-3.4	0.0	0.0
STRESS EXPANSION FOR NODE 107					
-0.7	-0.9	-8.8	-0.9	0.0	0.0

3-D LINE ELEMENT 3 SIZE 0.250 LENGTH 13.750 AREA 2.431
STRESS AT NODES 102, 103 11.8, 10.4 ALLOWABLE 27.8

STRESS EXPANSION FOR NODE 102					
-0.7	0.9	-8.8	-0.9	0.0	0.0
STRESS EXPANSION FOR NODE 103					
-0.7	0.9	-8.8	0.5	0.0	0.0

3-D LINE ELEMENT 4 SIZE 0.250 LENGTH 6.000 AREA 1.061
STRESS AT NODES 103, 104 10.4, 7.0 ALLOWABLE 27.8

STRESS EXPANSION FOR NODE 103					
-0.7	0.9	-8.8	0.5	0.0	0.0
STRESS EXPANSION FOR NODE 104					
-0.4	0.9	-5.3	0.5	0.0	0.0

AEP * 150T CRANE * 60T LOAD * TRUCK TO GIRDER * WELDS * SSE

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

3-D LINE ELEMENT 5 SIZE 0.250 LENGTH 19.000 AREA 3.359
STRESS AT NODES 104,105 7.0, 8.9 ALLOWABLE 27.8
STRESS EXPANSION FOR NODE 104
-0.4 0.9 -5.3 0.5 0.0 0.0
STRESS EXPANSION FOR NODE 105
-0.4 0.9 -5.3 -1.5 0.0 0.0

3-D LINE ELEMENT 6 SIZE 0.250 LENGTH 13.750 AREA 2.431
STRESS AT NODES 107,108 11.9, 10.5 ALLOWABLE 27.8
STRESS EXPANSION FOR NODE 107
-0.7 -0.9 -8.8 -0.9 0.0 0.0
STRESS EXPANSION FOR NODE 108
-0.7 -0.9 -8.8 0.5 0.0 0.0

3-D LINE ELEMENT 7 SIZE 0.250 LENGTH 6.000 AREA 1.061
STRESS AT NODES 108,109 10.5, 7.0 ALLOWABLE 27.8
STRESS EXPANSION FOR NODE 108
-0.7 -0.9 -8.8 0.5 0.0 0.0
STRESS EXPANSION FOR NODE 109
-0.4 -0.9 -5.3 0.5 0.0 0.0

3-D LINE ELEMENT 8 SIZE 0.250 LENGTH 19.000 AREA 3.359
STRESS AT NODES 109,110 7.0, 8.9 ALLOWABLE 27.8
STRESS EXPANSION FOR NODE 109
-0.4 -0.9 -5.3 0.5 0.0 0.0
STRESS EXPANSION FOR NODE 110
-0.4 -0.9 -5.3 -1.5 0.0 0.0

3-D LINE ELEMENT 9 SIZE 0.250 LENGTH 50.000 AREA 8.839
STRESS AT NODES 111,112 4.2, 9.0 ALLOWABLE 27.8
STRESS EXPANSION FOR NODE 111
0.6 0.9 7.3 -1.5 0.0 0.0
STRESS EXPANSION FOR NODE 112
0.6 0.9 7.3 3.6 0.0 0.0

3-D LINE ELEMENT 10 SIZE 0.250 LENGTH 6.000 AREA 1.061
STRESS AT NODES 112,113 9.0, 12.4 ALLOWABLE 27.8
STRESS EXPANSION FOR NODE 112
0.6 0.9 7.3 3.6 0.0 0.0
STRESS EXPANSION FOR NODE 113
0.9 0.9 10.8 3.6 0.0 0.0

3-D LINE ELEMENT 11 SIZE 0.250 LENGTH 19.000 AREA 3.359
STRESS AT NODES 113,114 12.4, 10.6 ALLOWABLE 27.8
STRESS EXPANSION FOR NODE 113
0.9 0.9 10.8 3.6 0.0 0.0
STRESS EXPANSION FOR NODE 114
0.9 0.9 10.8 1.7 0.0 0.0

3-D LINE ELEMENT 12 SIZE 0.250 LENGTH 50.000 AREA 8.839
STRESS AT NODES 115,116 3.7, 8.8 ALLOWABLE 27.8
STRESS EXPANSION FOR NODE 115
0.6 -0.9 7.3 -1.5 0.0 0.0
STRESS EXPANSION FOR NODE 116
0.6 -0.9 7.3 3.6 0.0 0.0

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AEP * 150T CRANE * 60T LOAD * TRUCK TO GIRDER * WELDS * SSE

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

3-D LINE ELEMENT   13   SIZE   0.250   LENGTH   6.000   AREA   1.061
 STRESS AT NODES 116,117         8.8,       12.2   ALLOWABLE      27.8
 STRESS EXPANSION FOR NODE 116
      0.6        -0.9        7.3        3.6        0.0        0.0
 STRESS EXPANSION FOR NODE 117
      0.9        -0.9       10.8        3.6        0.0        0.0

3-D LINE ELEMENT   14   SIZE   0.250   LENGTH  19.000   AREA   3.359
 STRESS AT NODES 117,118        12.2,       10.3   ALLOWABLE      27.8
 STRESS EXPANSION FOR NODE 117
      0.9        -0.9       10.8        3.6        0.0        0.0
 STRESS EXPANSION FOR NODE 118
      0.9        -0.9       10.8        1.7        0.0        0.0

3-D LINE ELEMENT   15   SIZE   0.313   LENGTH   4.375   AREA   0.967
 STRESS AT NODES 119,120        10.8,       11.2   ALLOWABLE      27.8
 STRESS EXPANSION FOR NODE 119
     -0.5         0.9       -5.7       -2.9        0.0        0.0
 STRESS EXPANSION FOR NODE 120
     -0.5         0.9       -5.7       -3.4        0.0        0.0

3-D LINE ELEMENT   16   SIZE   0.313   LENGTH   4.375   AREA   0.967
 STRESS AT NODES 121,122        10.8,       11.2   ALLOWABLE      27.8
 STRESS EXPANSION FOR NODE 121
     -0.5        -0.9       -5.7       -2.9        0.0        0.0
 STRESS EXPANSION FOR NODE 122
     -0.5        -0.9       -5.7       -3.4        0.0        0.0

3-D LINE ELEMENT   17   SIZE   0.313   LENGTH  18.000   AREA   3.977
 STRESS AT NODES 119,121        10.8,       10.8   ALLOWABLE      27.8
 STRESS EXPANSION FOR NODE 119
     -0.5         0.9       -5.7       -2.9        0.0        0.0
 STRESS EXPANSION FOR NODE 121
     -0.5        -0.9       -5.7       -2.9        0.0        0.0

FORCE DEFINITION NODE  DIRECT   ELEMENT  18   NODE 200
  FX         25.40 ;  FY      -119.70 ;  FZ         0.00
  MX       8589.00 ;  MY         0.00 ;  MZ         0.00

MAXIMUM ABSOLUTE STRESS ON ELEMENT   2 =        14.3 KSI
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*** CONSYS ANALYSIS PROGRAM *** REQUISITION 79508 DATE 11/03/87
VERSION 4.2 RELEASED 12/03/82 Rev.1 BY: ASZ PAGE 4-73 R1 OF 182

CHK [illegible] 11-5-87

AEP * 150T CRANE * 60T 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.........	17
2	FORCE DEFINITION NODE - DIRECT.....	1

TOTAL NUMBER OF ELEMENTS = 18, NODES = 23

SYSTEM PROPERTIES

LOAD STEP...... 2 DIRECTION, LOCATION OR AXIS

	X	Y	Z
CENTROIDS, X AXIS.........	.	0.00	20.21
Y AXIS.........	0.00	.	20.21
Z AXIS.........	-24.24	-0.00	
SHEAR AREAS...............	56.73	56.73	0.00
POLAR MOMENTS OF INERTIA..	10664.59	10664.59	28720.45
TRANSLATED FORCES.........	25.40	-119.70	0.00
TRANSLATED MOMENTS........	6169.50	-513.41	-2902.08

MAXIMUM ELEMENT STRESSES

DESCRIPTION	NUMBER USED	ELEMENT	NODE	STRESS	ALLOWABLE	COMPARISON FACTOR
3-D LINE ELEMENT	12	10	113	12.4 ksi	27.8 ksi	2.2343
3-D LINE ELEMENT	5	2	106	14.3 ksi	27.8 ksi	1.9450

[1]

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

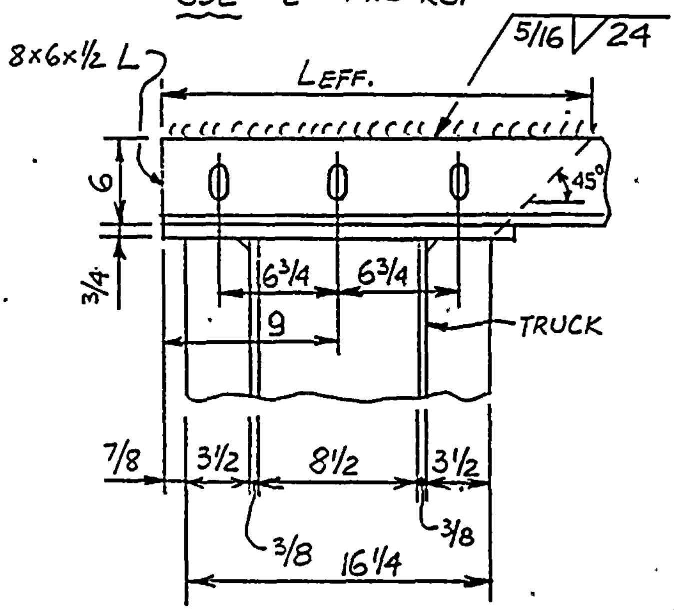
TOP ANGLE TO WEB CONNECTION.

F_Z LOAD IS TRANSFERRED FROM TRUCK TO WELDS CONNECTING 8×6×1/2 ANGLE WITH GIRDER WEB (TOP 5/16 FILLET AND SLOT WELDS) AND STIFFENING PL 3/4×4 3/8×18 WITH GIRDER WEB (5/16 FILLET WELD) (REF. PG. 4-46).

FROM PAGE 4-67 AND 4-73 MAXIMUM STRESS ON WELD

FOR OBE $\tau = 7.8$ KSI

SSE $\tau = 14.3$ KSI 1



$L_{EFF} = 0.875 + 16.25 + 0.75 + 6$ 1

$= 23.875$ IN.

AREA OF SLOT WELD

$$A_S = \frac{\pi (0.81)^2}{4} + 0.81(2.5 - 0.81)$$ 1

$= 1.89$ IN^2

TOTAL SHEAR AREA OF WELD

$$A_W = \frac{2(5/16)23.875}{\sqrt{2}} + 6 \times 1.89$$ 1

$= 21.9$ IN^2

TOTAL WELD SHEAR STRESS $\tau_R = \sqrt{\tau^2 + \tau_Z^2}$

WELD SHEAR STRESS IN Z DIRECTION $\tau_Z = \frac{F_Z}{A_W} = \frac{F_Z}{21.9}$ [1]

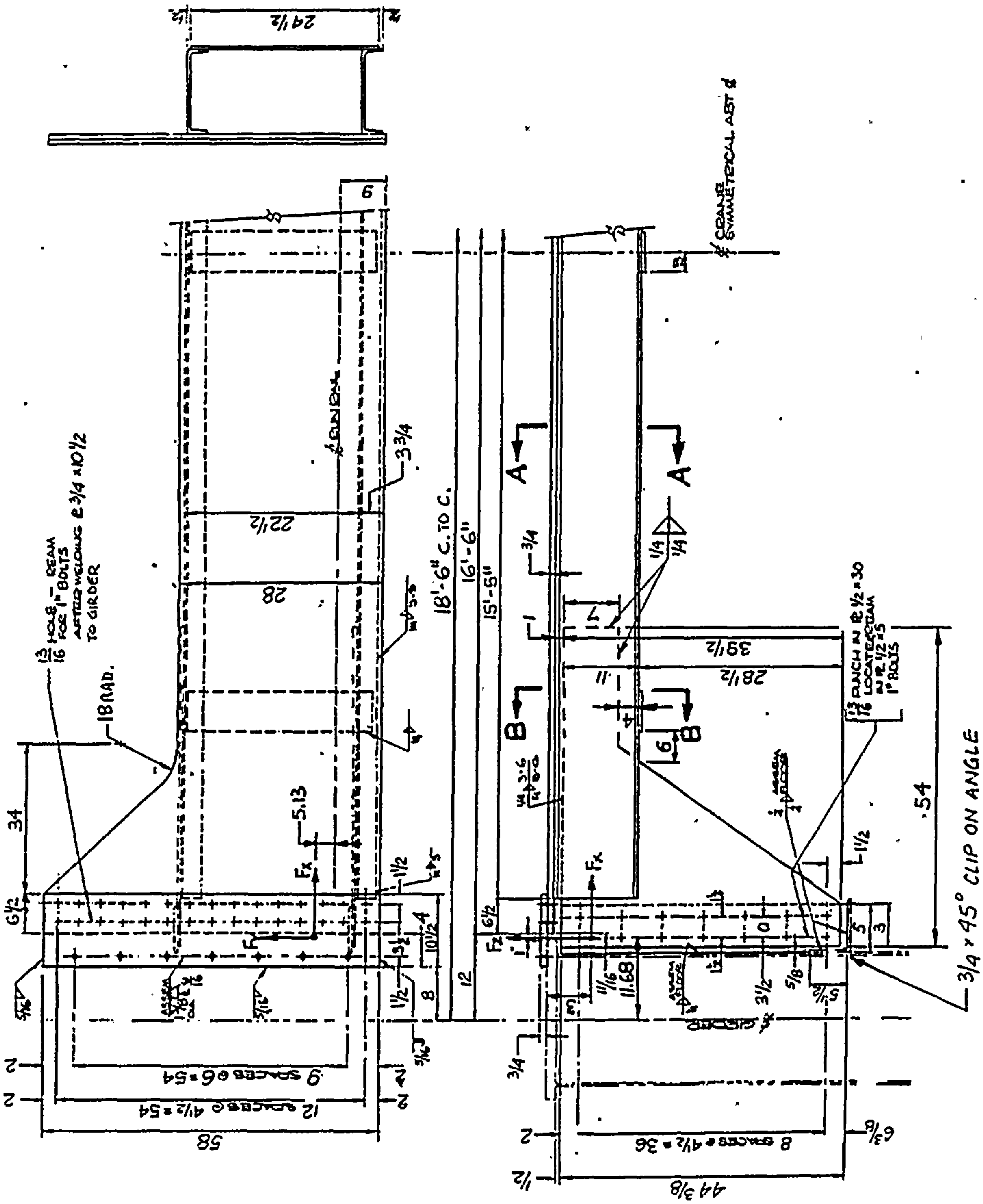
OBE $F_Z = 279.5$ KIP SSE $F_Z = 382.3$ KIP (REF. PG. 4-48)

OBE $\tau_Z = 12.8$ KSI SSE $\tau_Z = 17.5$ KSI

OBE $\tau_R = \sqrt{7.8^2 + 12.8^2} = 15.0$ KSI $\tau_{ALL} = 20.4$ KSI [1]

SSE $\tau_R = \sqrt{14.3^2 + 17.5^2} = 22.6$ KSI $\tau_{ALL} = 27.8$ KSI [1]

GIRDER TO END TIE CONNECTION.



ALLOWABLES

1" HEX. BOLTS

MTRL: ASTM-A 325

$\sigma_{YMIN} = 92$ KSI

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

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

WELDS (FILLET THRU THROAT)

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

WELD MTRL: E70XX ELECTRODES $\sigma_{YMIN} = 57$ KSI

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

$= \frac{0.6\sqrt{2}\,36}{1.5} = 20.4$ KSI $\therefore \tau_{W,ALL} = 20.4$ KSI

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

$= \frac{0.6\sqrt{2}\,36}{1.1} = 27.8$ KSI $\therefore \tau_{W,ALL} = 27.8$ KSI

MAX. LOADINGS FOR OBE PER TABLE B105.

F_X = 71.4 KIP F_Y = 42.8 KIP F_Z = 2.3 KIP M_X = 6.4 IN.KIP

M_Y = 106.9 IN.KIP M_Z = 5537 IN. KIP

ACTUAL LOADINGS FOR SSE PER TABLE B106.

TABLE 4-10

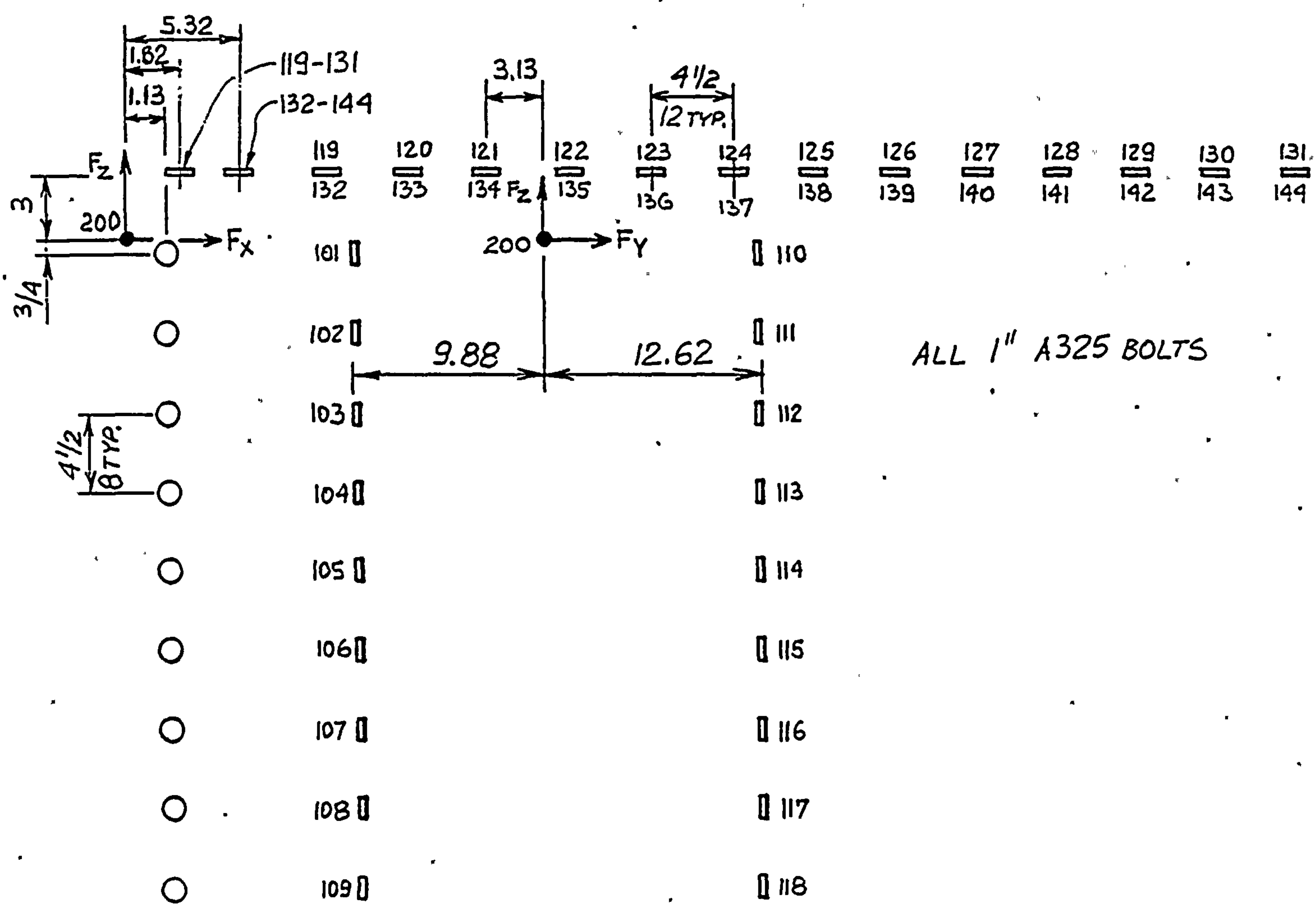
TROLLEY	LOAD	NODE	F_X KIP	F_Y KIP	F_Z KIP	M_X IN.KIP	M_Y IN.KIP	M_Z IN.KIP
M-LHE	D	251	43.2	79.5	2.3	8.9	125.6	10 511
AUX-Q	NO	251	32.7	43.6	2.5	3.2	144.7	6215
AUX-Q	NO	151,155	13.0	61.7	2.0	9.8	83.5	6831
AUX-Q	NO	255	32.7	44.5	2.5	3.2	122.5	2541
M-LHE	D	255	43.2	81.5	2.5	8.9	118.5	5495
M-LHE	D	151,155	133.8	53.0	2.1	9.5	93.5	5754

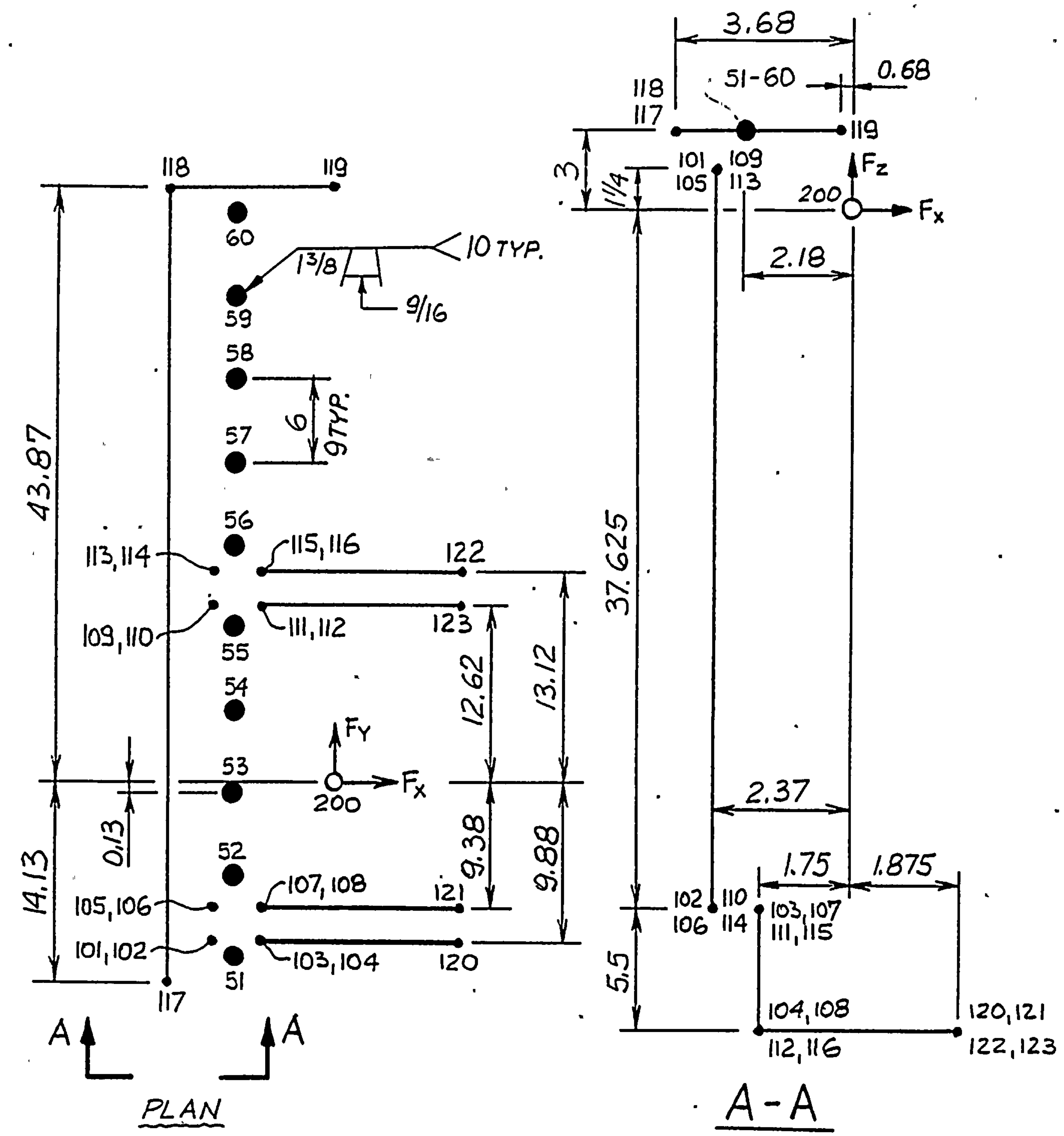
MAX. LOADINGS FOR SSE PER TABLE B106.

F_X = 133.8 KIP F_Y = 81.5 KIP F_Z = 2.5 KIP M_X = 9.8 IN.KIP

M_Y = 144.7 IN.KIP M_Z = 10 511 IN. KIP

BOLTED CONNECTION





5/16 FILLET WELDS EXCEPT AS NOTED

#79508

8-21-87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        5    10   15   20   25   30   35   40   45   50   55   60   65   7
        V    V    V    V    V    V    V    V    V    V    V    V    V
 1. AEP * 150T CRANE * 60T LOAD * GIRDER TO END TIE * BOLTS * OBE
 2. 79508 ASZ  1.   0.   0.   1.   0.   0.   0.   0.   1.   0.
 3. 1.    3.   2.                                      MJM 9-4-87
 4. 2.    3.   2.
 5. 3.    5.   0.
 6. -1.
 7. 1.0        36.8                          3.
 8. 1.0        36.8                          2.
 9. -1.
10. 101.                 1.   2.        18.
11. 119.                 2.   1.        26.
12. 200.                 3.
13. -1.
14. -9.    9.                 22.5
15.  101.           1.13     -9.88      -0.75
16.  102.           1.13     -9.88      -5.25
17.  103.           1.13     -9.88      -9.75
18.  104.           1.13     -9.88     -14.25
19.  105.           1.13     -9.88     -18.75
20.  106.           1.13     -9.88     -23.25
21.  107.           1.13     -9.88     -27.75
22.  108.           1.13     -9.88     -32.25
23.  109.           1.13     -9.88     -36.75
24. -1.   1.   13.             4.5
25.  119.           1.82     -12.13      3.
26. -1.   1.   13.             4.5
27.  132.           5.32     -12.13      3.
28.  200.           0.         0.         0.
29. 9999.
30. 101.  1.   144.
31. -1.
32. 200.  71.4      42.8      2.3       6.4        106.9     5537.
33. -1.
34. FINISH
        A    A    A    A    A    A    A    A    A    A    A    A    A
```

AEP * 150T CRANE * 60T 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.........	1.13		-5.90
Z AXIS.........	3.57	9.35	
SHEAR AREAS...............	34.56	20.42	14.14
POLAR MOMENTS OF INERTIA..	1789.23	5860.36	9163.40
TRANSLATED FORCES.........	71.40	42.80	2.30
TRANSLATED MOMENTS........	137.95	530.60	6357.19

NUMBER OF FORCE DEFINITION NODES... 1

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

DIRECT STRESSES ARE EQUALLY DISTRIBUTED THROUGHOUT SHEAR AREA
DRX 2.1   DRY 2.1   DRZ 0.2

2-D POINT ELEMENT 1   NODE 101   AREA 0.785   DIAMETER 1.000
STRESS AT NODE 15.9   ALLOWABLE 36.8
STRESS EXPANSION FOR NODE 101

0.5	13.3	0.0	0.0	-0.9	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 15.5   ALLOWABLE 36.8
STRESS EXPANSION FOR NODE 102

0.1	13.3	0.0	0.0	-0.9	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 15.8   ALLOWABLE 36.8
STRESS EXPANSION FOR NODE 103

-0.3	13.3	0.0	0.0	-0.9	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 16.2   ALLOWABLE 36.8
STRESS EXPANSION FOR NODE 104

-0.8	13.3	0.0	0.0	-0.9	0.0

FORCES AT NODE 104   FX 13.   FY 0.   FZ 1.

2-D POINT ELEMENT 5   NODE 105   AREA 0.785   DIAMETER 1.000
STRESS AT NODE 16.6   ALLOWABLE 36.8
STRESS EXPANSION FOR NODE 105

-1.2	13.3	0.0	0.0	-0.9	0.0

FORCES AT NODE 105   FX 13.   FY 0.   FZ 1.

AEP * 150T CRANE * 60T 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 17.0 ALLOWABLE 36.8
STRESS EXPANSION FOR NODE 106
-1.6 13.3 0.0 0.0 -0.9 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 17.4 ALLOWABLE 36.8
STRESS EXPANSION FOR NODE 107
-2.0 13.3 0.0 0.0 -0.9 0.0
FORCES AT NODE 107 FX 14. FY 0. FZ 1.

2-D POINT ELEMENT 8 NODE 108 AREA 0.785 DIAMETER 1.000
STRESS AT NODE 17.8 ALLOWABLE 36.8
STRESS EXPANSION FOR NODE 108
-2.4 13.3 0.0 0.0 -0.9 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 18.2 ALLOWABLE 36.8
STRESS EXPANSION FOR NODE 109
-2.8 13.3 0.0 0.0 -0.9 0.0
FORCES AT NODE 109 FX 14. FY 0. FZ 1.

2-D POINT ELEMENT 10 NODE 110 AREA 0.785 DIAMETER 1.000
STRESS AT NODE 4.9 ALLOWABLE 36.8
STRESS EXPANSION FOR NODE 110
0.5 -2.3 0.0 0.0 0.9 0.0
FORCES AT NODE 110 FX 4. FY 0. FZ 1.

2-D POINT ELEMENT 11 NODE 111 AREA 0.785 DIAMETER 1.000
STRESS AT NODE 4.5 ALLOWABLE 36.8
STRESS EXPANSION FOR NODE 111
0.1 -2.3 0.0 0.0 0.9 0.0
FORCES AT NODE 111 FX 3. FY 0. FZ 1.

2-D POINT ELEMENT 12 NODE 112 AREA 0.785 DIAMETER 1.000
STRESS AT NODE 4.8 ALLOWABLE 36.8
STRESS EXPANSION FOR NODE 112
-0.3 -2.3 0.0 0.0 0.9 0.0
FORCES AT NODE 112 FX 4. FY 0. FZ 1.

2-D POINT ELEMENT 13 NODE 113 AREA 0.785 DIAMETER 1.000
STRESS AT NODE 5.2 ALLOWABLE 36.8
STRESS EXPANSION FOR NODE 113
-0.8 -2.3 0.0 0.0 0.9 0.0
FORCES AT NODE 113 FX 4. FY 0. FZ 1.

2-D POINT ELEMENT 14 NODE 114 AREA 0.785 DIAMETER 1.000
STRESS AT NODE 5.6 ALLOWABLE 36.8
STRESS EXPANSION FOR NODE 114
-1.2 -2.3 0.0 0.0 0.9 0.0
FORCES AT NODE 114 FX 4. FY 0. FZ 1.

AEP * 150T CRANE * 60T 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 6.0 ALLOWABLE 36.8
STRESS EXPANSION FOR NODE 115
-1.6 -2.3 0.0 0.0 0.9 0.0
FORCES AT NODE 115 FX 5. FY 0. FZ 1.

2-D POINT ELEMENT 16 NODE 116 AREA 0.785 DIAMETER 1.000
STRESS AT NODE 6.4 ALLOWABLE 36.8
STRESS EXPANSION FOR NODE 116
-2.0 -2.3 0.0 0.0 0.9 0.0
FORCES AT NODE 116 FX 5. FY 0. FZ 1.

2-D POINT ELEMENT 17 NODE 117 AREA 0.785 DIAMETER 1.000
STRESS AT NODE 6.8 ALLOWABLE 36.8
STRESS EXPANSION FOR NODE 117
-2.4 -2.3 0.0 0.0 0.9 0.0
FORCES AT NODE 117 FX 5. FY 0. FZ 1.

2-D POINT ELEMENT 18 NODE 118 AREA 0.785 DIAMETER 1.000
STRESS AT NODE 7.2 ALLOWABLE 36.8
STRESS EXPANSION FOR NODE 118
-2.8 -2.3 0.0 0.0 0.9 0.0
FORCES AT NODE 118 FX 6. FY 0. FZ 1.

2-D POINT ELEMENT 19 NODE 119 AREA 0.785 DIAMETER 1.000
STRESS AT NODE 18.1 ALLOWABLE 36.8
STRESS EXPANSION FOR NODE 119
0.8 14.9 0.0 -1.2 0.0 0.0
FORCES AT NODE 119 FX 14. FY 3. FZ 0.

2-D POINT ELEMENT 20 NODE 120 AREA 0.785 DIAMETER 1.000
STRESS AT NODE 15.0 ALLOWABLE 36.8
STRESS EXPANSION FOR NODE 120
0.8 11.8 0.0 -1.2 0.0 0.0
FORCES AT NODE 120 FX 12. FY 3. FZ 0.

2-D POINT ELEMENT 21 NODE 121 AREA 0.785 DIAMETER 1.000
STRESS AT NODE 12.0 ALLOWABLE 36.8
STRESS EXPANSION FOR NODE 121
0.8 8.7 0.0 -1.2 0.0 0.0
FORCES AT NODE 121 FX 9. FY 3. FZ 0.

2-D POINT ELEMENT 22 NODE 122 AREA 0.785 DIAMETER 1.000
STRESS AT NODE 9.0 ALLOWABLE 36.8
STRESS EXPANSION FOR NODE 122
0.8 5.5 0.0 -1.2 0.0 0.0
FORCES AT NODE 122 FX 7. FY 3. FZ 0.

2-D POINT ELEMENT 23 NODE 123 AREA 0.785 DIAMETER 1.000
STRESS AT NODE 6.2 ALLOWABLE 36.8
STRESS EXPANSION FOR NODE 123
0.8 2.4 0.0 -1.2 0.0 0.0
FORCES AT NODE 123 FX 4. FY 3. FZ 0.

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 AEP * 150T CRANE * 60T 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            4.9    ALLOWABLE         36.8
   STRESS EXPANSION FOR NODE 124
              0.8         -0.7          0.0        -1.2         0.0         0.0
   FORCES AT NODE 124    FX          3.    FY            3.    FZ           0.

 2-D POINT ELEMENT   25    NODE 125    AREA    0.785   DIAMETER   1.000
   STRESS AT NODE            7.5    ALLOWABLE         36.8
   STRESS EXPANSION FOR NODE 125
              0.8         -3.8          0.0        -1.2         0.0         0.0
   FORCES AT NODE 125    FX          5.    FY            3.    FZ           0.

 2-D POINT ELEMENT   26    NODE 126    AREA    0.785   DIAMETER   1.000
   STRESS AT NODE           10.4    ALLOWABLE         36.8
   STRESS EXPANSION FOR NODE 126
              0.8         -7.0          0.0        -1.2         0.0         0.0
   FORCES AT NODE 126    FX          8.    FY            3.    FZ           0.

 2-D POINT ELEMENT   27    NODE 127    AREA    0.785   DIAMETER   1.000
   STRESS AT NODE           13.4    ALLOWABLE         36.8
   STRESS EXPANSION FOR NODE 127
              0.8        -10.1          0.0        -1.2         0.0         0.0
   FORCES AT NODE 127    FX         10.    FY            3.    FZ           0.

 2-D POINT ELEMENT   28    NODE 128    AREA    0.785   DIAMETER   1.000
   STRESS AT NODE           16.4    ALLOWABLE         36.8
   STRESS EXPANSION FOR NODE 128
              0.8        -13.2          0.0        -1.2         0.0         0.0
   FORCES AT NODE 128    FX         13.    FY            3.    FZ           0.

 2-D POINT ELEMENT   29    NODE 129    AREA    0.785   DIAMETER   1.000
   STRESS AT NODE           19.5    ALLOWABLE         36.8
   STRESS EXPANSION FOR NODE 129
              0.8        -16.3          0.0        -1.2         0.0         0.0
   FORCES AT NODE 129    FX         15.    FY            3.    FZ           0.

 2-D POINT ELEMENT   30    NODE 130    AREA    0.785   DIAMETER   1.000
   STRESS AT NODE           22.6    ALLOWABLE         36.8
   STRESS EXPANSION FOR NODE 130
              0.8        -19.4          0.0        -1.2         0.0         0.0
   FORCES AT NODE 130    FX         18.    FY            3.    FZ           0.

 2-D POINT ELEMENT   31    NODE 131    AREA    0.785   DIAMETER   1.000
   STRESS AT NODE           25.6    ALLOWABLE         36.8
   STRESS EXPANSION FOR NODE 131
              0.8        -22.6          0.0        -1.2         0.0         0.0
   FORCES AT NODE 131    FX         20.    FY            3.    FZ           0.

 2-D POINT ELEMENT   32    NODE 132    AREA    0.785   DIAMETER   1.000
   STRESS AT NODE           18.1    ALLOWABLE         36.8
   STRESS EXPANSION FOR NODE 132
              0.8         14.9          0.0         1.2         0.0         0.0
   FORCES AT NODE 132    FX         14.    FY            3.    FZ           0.
```

AEP * 150T CRANE * 60T LOAD * GIRDER TO END TIE * BOLTS * OBE

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

2-D POINT ELEMENT 33 NODE 133 AREA 0.785 DIAMETER 1.000
STRESS AT NODE 15.0 ALLOWABLE 36.8
STRESS EXPANSION FOR NODE 133
0.8 11.8 0.0 1.2 0.0 0.0
FORCES AT NODE 133 FX 12. FY 3. FZ 0.

2-D POINT ELEMENT 34 NODE 134 AREA 0.785 DIAMETER 1.000
STRESS AT NODE 12.0 ALLOWABLE 36.8
STRESS EXPANSION FOR NODE 134
0.8 8.7 0.0 1.2 0.0 0.0
FORCES AT NODE 134 FX 9. FY 3. FZ 0.

2-D POINT ELEMENT 35 NODE 135 AREA 0.785 DIAMETER 1.000
STRESS AT NODE 9.0 ALLOWABLE 36.8
STRESS EXPANSION FOR NODE 135
0.8 5.5 0.0 1.2 0.0 0.0
FORCES AT NODE 135 FX 7. FY 3. FZ 0.

2-D POINT ELEMENT 36 NODE 136 AREA 0.785 DIAMETER 1.000
STRESS AT NODE 6.2 ALLOWABLE 36.8
STRESS EXPANSION FOR NODE 136
0.8 2.4 0.0 1.2 0.0 0.0
FORCES AT NODE 136 FX 4. FY 3. FZ 0.

2-D POINT ELEMENT 37 NODE 137 AREA 0.785 DIAMETER 1.000
STRESS AT NODE 4.9 ALLOWABLE 36.8
STRESS EXPANSION FOR NODE 137
0.8 -0.7 0.0 1.2 0.0 0.0
FORCES AT NODE 137 FX 3. FY 3. FZ 0.

2-D POINT ELEMENT 38 NODE 138 AREA 0.785 DIAMETER 1.000
STRESS AT NODE 7.5 ALLOWABLE 36.8
STRESS EXPANSION FOR NODE 138
0.8 -3.8 0.0 1.2 0.0 0.0
FORCES AT NODE 138 FX 5. FY 3. FZ 0.

2-D POINT ELEMENT 39 NODE 139 AREA 0.785 DIAMETER 1.000
STRESS AT NODE 10.4 ALLOWABLE 36.8
STRESS EXPANSION FOR NODE 139
0.8 -7.0 0.0 1.2 0.0 0.0
FORCES AT NODE 139 FX 8. FY 3. FZ 0.

2-D POINT ELEMENT 40 NODE 140 AREA 0.785 DIAMETER 1.000
STRESS AT NODE 13.4 ALLOWABLE 36.8
STRESS EXPANSION FOR NODE 140
0.8 -10.1 0.0 1.2 0.0 0.0
FORCES AT NODE 140 FX 10. FY 3. FZ 0.

2-D POINT ELEMENT 41 NODE 141 AREA 0.785 DIAMETER 1.000
STRESS AT NODE 16.4 ALLOWABLE 36.8
STRESS EXPANSION FOR NODE 141
0.8 -13.2 0.0 1.2 0.0 0.0
FORCES AT NODE 141 FX 13. FY 3. FZ 0.

AEP * 150T CRANE * 60T LOAD * GIRDER TO END TIE * BOLTS * OBE

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

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2-D POINT ELEMENT  42   NODE 142   AREA   0.785  DIAMETER  1.000
 STRESS AT NODE        19.5   ALLOWABLE      36.8
 STRESS EXPANSION FOR NODE 142
      0.8      -16.3         0.0          1.2          0.0         0.0
 FORCES AT NODE 142   FX         15.   FY          3.   FZ         0.

2-D POINT ELEMENT  43   NODE 143   AREA   0.785  DIAMETER  1.000
 STRESS AT NODE        22.6   ALLOWABLE      36.8
 STRESS EXPANSION FOR NODE 143
      0.8      -19.4         0.0          1.2          0.0         0.0
 FORCES AT NODE 143   FX         18.   FY          3.   FZ         0.

2-D POINT ELEMENT  44   NODE 144   AREA   0.785  DIAMETER  1.000
 STRESS AT NODE        25.6   ALLOWABLE      36.8
 STRESS EXPANSION FOR NODE 144
      0.8      -22.6         0.0          1.2          0.0         0.0
 FORCES AT NODE 144   FX         20.   FY          3.   FZ         0.

FORCE DEFINITION NODE ABSOLUTE  ELEMENT  45  NODE 200
  FX          71.40 ;  FY         42.80 ;  FZ          2.30
  MX           6.40 ;  MY        106.90 ;  MZ       5537.00


MAXIMUM ABSOLUTE STRESS ON ELEMENT  31 =        25.6 KSI


***** JOB COMPLETED *****
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#72002
8-21-87

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

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```
                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 * 60T LOAD * GIRDER TO END TIE * BOLTS * SSE
      2.  79508 ASZ   1.    0.    0.    1.    0.    0.    0.    0.    1.    0.
      3.  1.    3.    2.                                         MJM  9-4-87
      4.  2.    3.    2.
      5.  3.    5.    0.
      6.  -1.
      7.  1.0         50.2                          3.
      8.  1.0         50.2                          2.
      9.  -1.
     10.  101.                    1.    2.          18.
     11.  119.                    2.    1.          26.
     12.  200.                    3.
     13.  -1.
     14.  -9.     9.                  22.5
     15.    101.            1.13     -9.88       -0.75
     16.    102.            1.13     -9.88       -5.25
     17.    103.            1.13     -9.88       -9.75
     18.    104.            1.13     -9.88      -14.25
     19.    105.            1.13     -9.88      -18.75
     20.    106.            1.13     -9.88      -23.25
     21.    107.            1.13     -9.88      -27.75
     22.    108.            1.13     -9.88      -32.25
     23.    109.            1.13     -9.88      -36.75
     24.  -1.   1.    13.             4.5
     25.  119.              1.82    -12.13        3.
     26.  -1.   1.    13.             4.5
     27.  132.              5.32    -12.13        3.
     28.  200.              0.        0.          0.
     29.  9999.
     30.  101.  1.    144.
     31.  -1.
     32.  200.  133.8       81.5      2.5         9.8         144.7       10511.
     33.  -1.
     34.  FINISH
                A     A     A     A     A     A     A     A     A     A     A     A     A
```

AEP * 150T CRANE * 60T 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.........	1.13		-5.90
Z AXIS.........	3.57	9.35	
SHEAR AREAS................	34.56	20.42	14.14
POLAR MOMENTS OF INERTIA..	1789.23	5860.36	9163.40
TRANSLATED FORCES.........	133.80	81.50	2.50
TRANSLATED MOMENTS........	257.73	936.65	12052.62

NUMBER OF FORCE DEFINITION NODES... 1

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

DIRECT STRESSES ARE EQUALLY DISTRIBUTED THROUGHOUT SHEAR AREA
DRX 3.9 DRY 4.0 DRZ 0.2

2-D POINT ELEMENT 1 NODE 101 AREA 0.785 DIAMETER 1.000
STRESS AT NODE 30.0 ALLOWABLE 50.2
STRESS EXPANSION FOR NODE 101
0.8 25.3 0.0 0.0 -1.6 0.0
FORCES AT NODE 101 FX 24. FY 0. FZ 1.

2-D POINT ELEMENT 2 NODE 102 AREA 0.785 DIAMETER 1.000
STRESS AT NODE 29.3 ALLOWABLE 50.2
STRESS EXPANSION FOR NODE 102
0.1 25.3 0.0 0.0 -1.6 0.0
FORCES AT NODE 102 FX 23. FY 0. FZ 1.

2-D POINT ELEMENT 3 NODE 103 AREA 0.785 DIAMETER 1.000
STRESS AT NODE 29.8 ALLOWABLE 50.2
STRESS EXPANSION FOR NODE 103
-0.6 25.3 0.0 0.0 -1.6 0.0
FORCES AT NODE 103 FX 23. FY 0. FZ 1.

2-D POINT ELEMENT 4 NODE 104 AREA 0.785 DIAMETER 1.000
STRESS AT NODE 30.5 ALLOWABLE 50.2
STRESS EXPANSION FOR NODE 104
-1.3 25.3 0.0 0.0 -1.6 0.0
FORCES AT NODE 104 FX 24. FY 0. FZ 1.

2-D POINT ELEMENT 5 NODE 105 AREA 0.785 DIAMETER 1.000
STRESS AT NODE 31.3 ALLOWABLE 50.2
STRESS EXPANSION FOR NODE 105
-2.1 25.3 0.0 0.0 -1.6 0.0
FORCES AT NODE 105 FX 25. FY 0. FZ 1.

AEP * 150T CRANE * 60T 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 32.0 ALLOWABLE 50.2
STRESS EXPANSION FOR NODE 106
-2.8 25.3 0.0 0.0 -1.6 0.0
FORCES AT NODE 106 FX 25. FY 0. FZ 1.

2-D POINT ELEMENT 7 NODE 107 AREA 0.785 DIAMETER 1.000
STRESS AT NODE 32.7 ALLOWABLE 50.2
STRESS EXPANSION FOR NODE 107
-3.5 25.3 0.0 0.0 -1.6 0.0
FORCES AT NODE 107 FX 26. FY 0. FZ 1.

2-D POINT ELEMENT 8 NODE 108 AREA 0.785 DIAMETER 1.000
STRESS AT NODE 33.4 ALLOWABLE 50.2
STRESS EXPANSION FOR NODE 108
-4.2 25.3 0.0 0.0 -1.6 0.0
FORCES AT NODE 108 FX 26. FY 0. FZ 1.

2-D POINT ELEMENT 9 NODE 109 AREA 0.785 DIAMETER 1.000
STRESS AT NODE 34.1 ALLOWABLE 50.2
STRESS EXPANSION FOR NODE 109
-4.9 25.3 0.0 0.0 -1.6 0.0
FORCES AT NODE 109 FX 27. FY 0. FZ 1.

2-D POINT ELEMENT 10 NODE 110 AREA 0.785 DIAMETER 1.000
STRESS AT NODE 9.2 ALLOWABLE 50.2
STRESS EXPANSION FOR NODE 110
0.8 -4.3 0.0 0.0 1.6 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 8.5 ALLOWABLE 50.2
STRESS EXPANSION FOR NODE 111
0.1 -4.3 0.0 0.0 1.6 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 9.0 ALLOWABLE 50.2
STRESS EXPANSION FOR NODE 112
-0.6 -4.3 0.0 0.0 1.6 0.0
FORCES AT NODE 112 FX 7. FY 0. FZ 1.

2-D POINT ELEMENT 13 NODE 113 AREA 0.785 DIAMETER 1.000
STRESS AT NODE 9.7 ALLOWABLE 50.2
STRESS EXPANSION FOR NODE 113
-1.3 -4.3 0.0 0.0 1.6 0.0
FORCES AT NODE 113 FX 7. FY 0. FZ 1.

2-D POINT ELEMENT 14 NODE 114 AREA 0.785 DIAMETER 1.000
STRESS AT NODE 10.4 ALLOWABLE 50.2
STRESS EXPANSION FOR NODE 114
-2.1 -4.3 0.0 0.0 1.6 0.0
FORCES AT NODE 114 FX 8. FY 0. FZ 1.

AEP * 150T CRANE * 60T 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          11.1    ALLOWABLE     50.2
  STRESS EXPANSION FOR NODE 115
       -2.8        -4.3        0.0        0.0        1.6        0.0
  FORCES AT NODE 115   FX        9.   FY         0.   FZ         1.

2-D POINT ELEMENT  16   NODE 116   AREA   0.785   DIAMETER   1.000
  STRESS AT NODE          11.8    ALLOWABLE     50.2
  STRESS EXPANSION FOR NODE 116
       -3.5        -4.3        0.0        0.0        1.6        0.0
  FORCES AT NODE 116   FX        9.   FY         0.   FZ         1.

2-D POINT ELEMENT  17   NODE 117   AREA   0.785   DIAMETER   1.000
  STRESS AT NODE          12.5    ALLOWABLE     50.2
  STRESS EXPANSION FOR NODE 117
       -4.2        -4.3        0.0        0.0        1.6        0.0
  FORCES AT NODE 117   FX       10.   FY         0.   FZ         1.

2-D POINT ELEMENT  18   NODE 118   AREA   0.785   DIAMETER   1.000
  STRESS AT NODE          13.2    ALLOWABLE     50.2
  STRESS EXPANSION FOR NODE 118
       -4.9        -4.3        0.0        0.0        1.6        0.0
  FORCES AT NODE 118   FX       10.   FY         0.   FZ         1.

2-D POINT ELEMENT  19   NODE 119   AREA   0.785   DIAMETER   1.000
  STRESS AT NODE          34.1    ALLOWABLE     50.2
  STRESS EXPANSION FOR NODE 119
        1.4        28.2        0.0       -2.3        0.0        0.0
  FORCES AT NODE 119   FX       26.   FY         5.   FZ         0.

2-D POINT ELEMENT  20   NODE 120   AREA   0.785   DIAMETER   1.000
  STRESS AT NODE          28.3    ALLOWABLE     50.2
  STRESS EXPANSION FOR NODE 120
        1.4        22.3        0.0       -2.3        0.0        0.0
  FORCES AT NODE 120   FX       22.   FY         5.   FZ         0.

2-D POINT ELEMENT  21   NODE 121   AREA   0.785   DIAMETER   1.000
  STRESS AT NODE          22.6    ALLOWABLE     50.2
  STRESS EXPANSION FOR NODE 121
        1.4        16.4        0.0       -2.3        0.0        0.0
  FORCES AT NODE 121   FX       17.   FY         5.   FZ         0.

2-D POINT ELEMENT  22   NODE 122   AREA   0.785   DIAMETER   1.000
  STRESS AT NODE          17.0    ALLOWABLE     50.2
  STRESS EXPANSION FOR NODE 122
        1.4        10.5        0.0       -2.3        0.0        0.0
  FORCES AT NODE 122   FX       12.   FY         5.   FZ         0.

2-D POINT ELEMENT  23   NODE 123   AREA   0.785   DIAMETER   1.000
  STRESS AT NODE          11.7    ALLOWABLE     50.2
  STRESS EXPANSION FOR NODE 123
        1.4         4.6        0.0       -2.3        0.0        0.0
  FORCES AT NODE 123   FX        8.   FY         5.   FZ         0.
```

AEP * 150T CRANE * 60T 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          9.1   ALLOWABLE        50.2
  STRESS EXPANSION FOR NODE 124
       1.4        -1.3         0.0        -2.3         0.0         0.0
  FORCES AT NODE 124   FX       5.   FY        5.   FZ        0.

2-D POINT ELEMENT   25   NODE 125   AREA   0.785   DIAMETER   1.000
  STRESS AT NODE         14.0   ALLOWABLE        50.2
  STRESS EXPANSION FOR NODE 125
       1.4        -7.3         0.0        -2.3         0.0         0.0
  FORCES AT NODE 125   FX      10.   FY        5.   FZ        0.

2-D POINT ELEMENT   26   NODE 126   AREA   0.785   DIAMETER   1.000
  STRESS AT NODE         19.5   ALLOWABLE        50.2
  STRESS EXPANSION FOR NODE 126
       1.4       -13.2         0.0        -2.3         0.0         0.0
  FORCES AT NODE 126   FX      15.   FY        5.   FZ        0.

2-D POINT ELEMENT   27   NODE 127   AREA   0.785   DIAMETER   1.000
  STRESS AT NODE         25.2   ALLOWABLE        50.2
  STRESS EXPANSION FOR NODE 127
       1.4       -19.1         0.0        -2.3         0.0         0.0
  FORCES AT NODE 127   FX      19.   FY        5.   FZ        0.

2-D POINT ELEMENT   28   NODE 128   AREA   0.785   DIAMETER   1.000
  STRESS AT NODE         31.0   ALLOWABLE        50.2
  STRESS EXPANSION FOR NODE 128
       1.4       -25.0         0.0        -2.3         0.0         0.0
  FORCES AT NODE 128   FX      24.   FY        5.   FZ        0.

2-D POINT ELEMENT   29   NODE 129   AREA   0.785   DIAMETER   1.000
  STRESS AT NODE         36.8   ALLOWABLE        50.2
  STRESS EXPANSION FOR NODE 129
       1.4       -30.9         0.0        -2.3         0.0         0.0
  FORCES AT NODE 129   FX      28.   FY        5.   FZ        0.

2-D POINT ELEMENT   30   NODE 130   AREA   0.785   DIAMETER   1.000
  STRESS AT NODE         42.6   ALLOWABLE        50.2
  STRESS EXPANSION FOR NODE 130
       1.4       -36.9         0.0        -2.3         0.0         0.0
  FORCES AT NODE 130   FX      33.   FY        5.   FZ        0.

2-D POINT ELEMENT   31   NODE 131   AREA   0.785   DIAMETER   1.000
  STRESS AT NODE         48.5   ALLOWABLE        50.2
  STRESS EXPANSION FOR NODE 131
       1.4       -42.8         0.0        -2.3         0.0         0.0
  FORCES AT NODE 131   FX      38.   FY        5.   FZ        0.

2-D POINT ELEMENT   32   NODE 132   AREA   0.785   DIAMETER   1.000
  STRESS AT NODE         34.1   ALLOWABLE        50.2
  STRESS EXPANSION FOR NODE 132
       1.4        28.2         0.0         2.3         0.0         0.0
  FORCES AT NODE 132   FX      26.   FY        5.   FZ        0.
```

AEP * 150T CRANE * 60T LOAD * GIRDER TO END TIE * BOLTS * SSE

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

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2-D POINT ELEMENT   33    NODE 133    AREA    0.785   DIAMETER    1.000
 STRESS AT NODE            28.3     ALLOWABLE        50.2
 STRESS EXPANSION FOR NODE 133
        1.4         22.3           0.0           2.3           0.0           0.0
 FORCES AT NODE 133    FX           22.    FY           5.   FZ          0.

2-D POINT ELEMENT   34    NODE 134    AREA    0.785   DIAMETER    1.000
 STRESS AT NODE            22.6     ALLOWABLE        50.2
 STRESS EXPANSION FOR NODE 134
        1.4         16.4           0.0           2.3           0.0           0.0
 FORCES AT NODE 134    FX           17.    FY           5.   FZ          0.

2-D POINT ELEMENT   35    NODE 135    AREA    0.785   DIAMETER    1.000
 STRESS AT NODE            17.0     ALLOWABLE        50.2
 STRESS EXPANSION FOR NODE 135
        1.4         10.5           0.0           2.3           0.0           0.0
 FORCES AT NODE 135    FX           12.    FY           5.   FZ          0.

2-D POINT ELEMENT   36    NODE 136    AREA    0.785   DIAMETER    1.000
 STRESS AT NODE            11.7     ALLOWABLE        50.2
 STRESS EXPANSION FOR NODE 136
        1.4          4.6           0.0           2.3           0.0           0.0
 FORCES AT NODE 136    FX            8.    FY           5.   FZ          0.

2-D POINT ELEMENT   37    NODE 137    AREA    0.785   DIAMETER    1.000
 STRESS AT NODE             9.1     ALLOWABLE        50.2
 STRESS EXPANSION FOR NODE 137
        1.4         -1.3           0.0           2.3           0.0           0.0
 FORCES AT NODE 137    FX            5.    FY           5.   FZ          0.

2-D POINT ELEMENT   38    NODE 138    AREA    0.785   DIAMETER    1.000
 STRESS AT NODE            14.0     ALLOWABLE        50.2
 STRESS EXPANSION FOR NODE 138
        1.4         -7.3           0.0           2.3           0.0           0.0
 FORCES AT NODE 138    FX           10.    FY           5.   FZ          0.

2-D POINT ELEMENT   39    NODE 139    AREA    0.785   DIAMETER    1.000
 STRESS AT NODE            19.5     ALLOWABLE        50.2
 STRESS EXPANSION FOR NODE 139
        1.4        -13.2           0.0           2.3           0.0           0.0
 FORCES AT NODE 139    FX           15.    FY           5.   FZ          0.

2-D POINT ELEMENT   40    NODE 140    AREA    0.785   DIAMETER    1.000
 STRESS AT NODE            25.2     ALLOWABLE        50.2
 STRESS EXPANSION FOR NODE 140
        1.4        -19.1           0.0           2.3           0.0           0.0
 FORCES AT NODE 140    FX           19.    FY           5.   FZ          0.

2-D POINT ELEMENT   41    NODE 141    AREA    0.785   DIAMETER    1.000
 STRESS AT NODE            31.0     ALLOWABLE        50.2
 STRESS EXPANSION FOR NODE 141
        1.4        -25.0           0.0           2.3           0.0           0.0
 FORCES AT NODE 141    FX           24.    FY           5.   FZ          0.
```

AEP * 150T CRANE * 60T LOAD * GIRDER TO END TIE * BOLTS * SSE

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

2-D POINT ELEMENT 42 NODE 142 AREA 0.785 DIAMETER 1.000
STRESS AT NODE 36.8 ALLOWABLE 50.2
STRESS EXPANSION FOR NODE 142
1.4 -30.9 0.0 2.3 0.0 0.0
FORCES AT NODE 142 FX 28. FY 5. FZ 0.

2-D POINT ELEMENT 43 NODE 143 AREA 0.785 DIAMETER 1.000
STRESS AT NODE 42.6 ALLOWABLE 50.2
STRESS EXPANSION FOR NODE 143
1.4 -36.9 0.0 2.3 0.0 0.0
FORCES AT NODE 143 FX 33. FY 5. FZ 0.

2-D POINT ELEMENT 44 NODE 144 AREA 0.785 DIAMETER 1.000
STRESS AT NODE 48.5 ALLOWABLE 50.2
STRESS EXPANSION FOR NODE 144
1.4 -42.8 0.0 2.3 0.0 0.0
FORCES AT NODE 144 FX 38. FY 5. FZ 0.

FORCE DEFINITION NODE ABSOLUTE ELEMENT 45 NODE 200
FX 133.80 ; FY 81.50 ; FZ 2.50
MX 9.80 ; MY 144.70 ; MZ 10511.00

MAXIMUM ABSOLUTE STRESS ON ELEMENT 31 = 48.5 KSI

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

#79508 8-25-87

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

ASZ


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            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 * 60T LOAD * GIRDER TO END'TIE * WELDS * OBE
    2.  79508 ASZ 1.   0.   0.   1.                       1.   MJM 9-4-87
    3.  1.   1.
    4.  2.   3.
    5.  3.   5.
    6.  -1.
    7.  0.3125    20.4                1.
    8.  1.375     20.4                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.        10.
   17.  200.                3.
   18.  -1.
   19.   101.          -2.37       -9.88      1.25
   20.   102.          -2.37       -9.88   -37.625
   21.   103.          -1.75       -9.88   -37.625
   22.   104.          -1.75       -9.88   -43.125
   23.   105.          -2.37       -9.38      1.25
   24.   106.          -2.37       -9.38   -37.625
   25.   107.          -1.75       -9.38   -37.625
   26.   108.          -1.75       -9.38   -43.125
   27.   109.          -2.37       12.62      1.25
   28.   110.          -2.37       12.62   -37.625
   29.   111.          -1.75       12.62   -37.625
   30.   112.          -1.75       12.62   -43.125
   31.   113.          -2.37       13.12      1.25
   32.   114.          -2.37       13.12   -37.625
   33.   115.          -1.75       13.12   -37.625
   34.   116.          -1.75       13.12   -43.125
   35.   117.          -3.68      -14.13      3.
   36.   118.          -3.68       43.87      3.
   37.   119.          -0.68       43.87      3.
   38.   120.            1.875      -9.88   -43.125
   39.   121.            1.875      -9.38   -43.125
   40.   122.            1.875      13.12   -43.125
   41.   123.            1.875      12.62   -43.125
   42.  -1.  1.   10.               6.0
   43.   51.           -2.18      -12.13      3.
   44.  200.             0.          0.        0.
   45.  9999.
   46.  51.  1.   60.
   47.  101. 1.  123.
   49.  200.   71.4    42.8       2.3       6.4        106.9     5537.
   50.  -1.
   51.   FINISH
            A    A    A    A    A    A    A    A    A    A    A    A    A
```

AEP * 150T CRANE * 60T LOAD * GIRDER TO END TIE * WELDS * OBE

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

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

	X	Y	Z
CENTROIDS, X AXIS.........		5.16	-12.36
Y AXIS.........	-2.47		-12.36
Z AXIS.........	-2.41	7.20	
SHEAR AREAS...............	70.75	70.75	55.91
POLAR MOMENTS OF INERTIA..	30736.40	19084.18	17262.38
TRANSLATED FORCES.........	71.40	42.80	2.30
TRANSLATED MOMENTS........	547.20	994.98	6154.11

NUMBER OF FORCE DEFINITION NODES... 1

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

DIRECT STRESSES ARE EQUALLY DISTRIBUTED THROUGHOUT SHEAR AREA
DRX 1.0 DRY 0.6 DRZ 0.0

3-D LINE ELEMENT 1 SIZE 0.313 LENGTH 38.875 AREA 8.590
STRESS AT NODES 101,102 7.9, 8.5 ALLOWABLE 20.4
STRESS EXPANSION FOR NODE 101
0.7 6.1 -0.2 0.0 -0.3 -0.0
STRESS EXPANSION FOR NODE 102
-1.3 6.1 0.4 0.0 -0.3 -0.0

3-D LINE ELEMENT 2 SIZE 0.313 LENGTH 5.500 AREA 1.215
STRESS AT NODES 103,104 8.5, 8.8 ALLOWABLE 20.4
STRESS EXPANSION FOR NODE 103
-1.3 6.1 0.4 0.2 -0.3 -0.0
STRESS EXPANSION FOR NODE 104
-1.6 6.1 0.5 0.2 -0.3 -0.0

3-D LINE ELEMENT 3 SIZE 0.313 LENGTH 38.875 AREA 8.590
STRESS AT NODES 105,106 7.7, 8.3 ALLOWABLE 20.4
STRESS EXPANSION FOR NODE 105
0.7 5.9 -0.2 0.0 -0.3 -0.0
STRESS EXPANSION FOR NODE 106
-1.3 5.9 0.4 0.0 -0.3 -0.0

3-D LINE ELEMENT 4 SIZE 0.313 LENGTH 5.500 AREA 1.215
STRESS AT NODES 107,108 8.3, 8.6 ALLOWABLE 20.4
STRESS EXPANSION FOR NODE 107
-1.3 5.9 0.4 0.2 -0.3 -0.0
STRESS EXPANSION FOR NODE 108
-1.6 5.9 0.5 0.2 -0.3 -0.0

AEP * 150T CRANE * 60T LOAD * GIRDER TO END TIE * WELDS * OBE

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

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3-D LINE ELEMENT     5    SIZE    0.313   LENGTH   38.875   AREA    8.590
 STRESS AT NODES 109,110          3.8,        4.4   ALLOWABLE       20.4
 STRESS EXPANSION FOR NODE 109
       0.7          -1.9        -0.2          0.0          0.1          -0.0
 STRESS EXPANSION FOR NODE 110
      -1.3          -1.9         0.4          0.0          0.1          -0.0

3-D LINE ELEMENT     6    SIZE    0.313   LENGTH    5.500   AREA    1.215
 STRESS AT NODES 111,112          4.5,        4.8   ALLOWABLE       20.4
 STRESS EXPANSION FOR NODE 111
      -1.3          -1.9         0.4          0.2          0.1          -0.0
 STRESS EXPANSION FOR NODE 112
      -1.6          -1.9         0.5          0.2          0.1          -0.0

3-D LINE ELEMENT     7    SIZE    0.313   LENGTH   38.875   AREA    8.590
 STRESS AT NODES 113,114          3.9,        4.6   ALLOWABLE       20.4
 STRESS EXPANSION FOR NODE 113
       0.7          -2.1        -0.2          0.0          0.1          -0.0
 STRESS EXPANSION FOR NODE 114
      -1.3          -2.1         0.4          0.0          0.1          -0.0

3-D LINE ELEMENT     8    SIZE    0.313   LENGTH    5.500   AREA    1.215
 STRESS AT NODES 115,116          4.6,        4.9   ALLOWABLE       20.4
 STRESS EXPANSION FOR NODE 115
      -1.3          -2.1         0.4          0.2          0.1          -0.0
 STRESS EXPANSION FOR NODE 116
      -1.6          -2.1         0.5          0.2          0.1          -0.0

3-D LINE ELEMENT     9    SIZE    0.313   LENGTH   58.000   AREA   12.816
 STRESS AT NODES 117,118          9.5,       15.0   ALLOWABLE       20.4
 STRESS EXPANSION FOR NODE 117
       0.8           7.6        -0.3         -0.5         -0.3           0.1
 STRESS EXPANSION FOR NODE 118
       0.8         -13.1        -0.3         -0.5          0.7           0.1

3-D LINE ELEMENT    10    SIZE    0.313   LENGTH    3.000   AREA    0.663
 STRESS AT NODES 118,119         15.0,       15.0   ALLOWABLE       20.4
 STRESS EXPANSION FOR NODE 118
       0.8         -13.1        -0.3         -0.5          0.7           0.1
 STRESS EXPANSION FOR NODE 119
       0.8         -13.1        -0.3          0.6          0.7          -0.1

3-D LINE ELEMENT    11    SIZE    0.313   LENGTH    3.625   AREA    0.801
 STRESS AT NODES 104,120          8.8,        9.1   ALLOWABLE       20.4
 STRESS EXPANSION FOR NODE 104
      -1.6           6.1         0.5          0.2         -0.3          -0.0
 STRESS EXPANSION FOR NODE 120
      -1.6           6.1         0.5          1.5         -0.3          -0.2

3-D LINE ELEMENT    12    SIZE    0.313   LENGTH    3.625   AREA    0.801
 STRESS AT NODES 108,121          8.6,        9.0   ALLOWABLE       20.4
 STRESS EXPANSION FOR NODE 108
      -1.6           5.9         0.5          0.2         -0.3          -0.0
 STRESS EXPANSION FOR NODE 121
      -1.6           5.9         0.5          1.5         -0.3          -0.2
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AEP * 150T CRANE * 60T LOAD * GIRDER TO END TIE * WELDS * OBE

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

3-D LINE ELEMENT 13 SIZE 0.313 LENGTH 3.625 AREA 0.801
STRESS AT NODES 116, 122 4.9, 5.4 ALLOWABLE 20.4
STRESS EXPANSION FOR NODE 116
-1.6 -2.1 0.5 0.2 0.1 -0.0
STRESS EXPANSION FOR NODE 122
-1.6 -2.1 0.5 1.5 0.1 -0.2

3-D LINE ELEMENT 14 SIZE 0.313 LENGTH 3.625 AREA 0.801
STRESS AT NODES 112, 123 4.8, 5.3 ALLOWABLE 20.4
STRESS EXPANSION FOR NODE 112
-1.6 -1.9 0.5 0.2 0.1 -0.0
STRESS EXPANSION FOR NODE 123
-1.6 -1.9 0.5 1.5 0.1 -0.2

2-D POINT ELEMENT 15 NODE 51 AREA 1.485 DIAMETER 1.375
STRESS AT NODE 8.8 ALLOWABLE 20.4
STRESS EXPANSION FOR NODE 51
0.8 6.9 -0.3 0.1 0.0 0.0

2-D POINT ELEMENT 16 NODE 52 AREA 1.485 DIAMETER 1.375
STRESS AT NODE 6.6 ALLOWABLE 20.4
STRESS EXPANSION FOR NODE 52
0.8 4.8 -0.3 0.1 0.0 0.0

2-D POINT ELEMENT 17 NODE 53 AREA 1.485 DIAMETER 1.375
STRESS AT NODE 4.5 ALLOWABLE 20.4
STRESS EXPANSION FOR NODE 53
0.8 2.6 -0.3 0.1 0.0 0.0

2-D POINT ELEMENT 18 NODE 54 AREA 1.485 DIAMETER 1.375
STRESS AT NODE 2.5 ALLOWABLE 20.4
STRESS EXPANSION FOR NODE 54
0.8 0.5 -0.3 0.1 0.0 0.0

2-D POINT ELEMENT 19 NODE 55 AREA 1.485 DIAMETER 1.375
STRESS AT NODE 3.6 ALLOWABLE 20.4
STRESS EXPANSION FOR NODE 55
0.8 -1.7 -0.3 0.1 0.0 0.0

2-D POINT ELEMENT 20 NODE 56 AREA 1.485 DIAMETER 1.375
STRESS AT NODE 5.7 ALLOWABLE 20.4
STRESS EXPANSION FOR NODE 56
0.8 -3.8 -0.3 0.1 0.0 0.0

2-D POINT ELEMENT 21 NODE 57 AREA 1.485 DIAMETER 1.375
STRESS AT NODE 7.8 ALLOWABLE 20.4
STRESS EXPANSION FOR NODE 57
0.8 -5.9 -0.3 0.1 0.0 0.0

2-D POINT ELEMENT 22 NODE 58 AREA 1.485 DIAMETER 1.375
STRESS AT NODE 9.9 ALLOWABLE 20.4
STRESS EXPANSION FOR NODE 58
0.8 -8.1 -0.3 0.1 0.0 0.0

AEP * 150T CRANE * 60T LOAD * GIRDER TO END TIE * WELDS * OBE

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

2-D POINT ELEMENT 23   NODE 59   AREA 1.485   DIAMETER 1.375
STRESS AT NODE 12.1   ALLOWABLE 20.4
STRESS EXPANSION FOR NODE 59

0.8	-10.2	-0.3	0.1	0.0	0.0

2-D POINT ELEMENT 24   NODE 60   AREA 1.485   DIAMETER 1.375
STRESS AT NODE 14.2   ALLOWABLE 20.4
STRESS EXPANSION FOR NODE 60

0.8	-12.4	-0.3	0.1	0.0	0.0

FORCE DEFINITION NODE ABSOLUTE   ELEMENT 25   NODE 200
FX 71.40 ;   FY 42.80 ;   FZ 2.30
MX 6.40 ;   MY 106.90 ;   MZ 5537.00

MAXIMUM ABSOLUTE STRESS ON ELEMENT 10 = 15.0 KSI

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

#72502

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                                  ***** CONSYS INPUT DATA LISTING *****      08/25/87
                                           ASZ                PAGE 4-100 OF    182
             5    10    15    20    25    30    35    40    45    50    55    60    65    70    75
             V     V     V     V     V     V     V     V     V     V     V     V     V     V     V
       1.  AEP * 150T CRANE * 60T LOAD * GIRDER TO END TIE * WELDS * SSE
       2.  79508 ASZ   6.    1.    0.    0.                            1.    1.   MJM 9-4-87
       3.  1.    1.
       4.  2.    3.
       5.  3.    5.
       6.  -1.
       7.  0.3125      27.8              1.
       8.  1.375       27.8              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.        10.
      17.  200.                    3.
      18.  -1.
      19.    101.            -2.37       -9.88       1.25
      20.    102.            -2.37       -9.88     -37.625
      21.    103.            -1.75       -9.88     -37.625
      22.    104.            -1.75       -9.88     -43.125
      23.    105.            -2.37       -9.38       1.25
      24.    106.            -2.37       -9.38     -37.625
      25.    107.            -1.75       -9.38     -37.625
      26.    108.            -1.75       -9.38     -43.125
      27.    109.            -2.37       12.62       1.25
      28.    110.            -2.37       12.62     -37.625
      29.    111.            -1.75       12.62     -37.625
      30.    112.            -1.75       12.62     -43.125
      31.    113.            -2.37       13.12       1.25
      32.    114.            -2.37       13.12     -37.625
      33.    115.            -1.75       13.12     -37.625
      34.    116.            -1.75       13.12     -43.125
      35.    117.            -3.68      -14.13       3.
      36.    118.            -3.68       43.87       3.
      37.    119.            -0.68       43.87       3.
      38.    120.              1.875       -9.88     -43.125
      39.    121.              1.875       -9.38     -43.125
      40.    122.              1.875       13.12     -43.125
      41.    123.              1.875       12.62     -43.125
      42.  -1.     1.     10.               6.0
      43.    51.             -2.18      -12.13       3.
      44.  200.                0.           0.        0.
      45.  9999.
      46.    51.   1.     60.
      47.  101.    1.    123.
      48.  -1.
      49.  200.     43.2     79.5      2.3       8.9        125.6    10511.
      50.  -1.
      51.  200.     32.7     43.6      2.5       3.2        144.7     6215.
      52.  -1.
      53.  200.     13.0     61.7      2.0       9.8         83.5     6831.
      54.  -1.
      55.  200.     32.7     44.5      2.5       3.2        122.5     2541.
      56.  -1.
      57.  200.     43.2     81.5      2.5       8.9        118.5     5495.
      58.  -1.
      59.  200.    133.8     53.0      2.1       9.5         93.5     5754.
      60.  -1.
      61.  FINISH
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MJM 9-4-87

AEP * 150T CRANE * 60T LOAD * GIRDER TO END TIE * WELDS * SSE

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

AEP * 150T CRANE * 60T LOAD * GIRDER TO END TIE * WELDS * SSE

		DIRECTION	
LOAD STEP...... 1	X	Y	Z
TRANSLATED FORCES.........	43.20	79.50	2.30
TRANSLATED MOMENTS........	1003.26	665.17	11013.72

NUMBER OF FORCE DEFINITION NODES... 1

MAXIMUM ABSOLUTE STRESS ON ELEMENT 10 = 24.7 KSI
COMPARISON FACTOR MATCH ON ELEMENT 10 = 1.1239865

AEP * 150T CRANE * 60T LOAD * GIRDER TO END TIE * WELDS * SSE

		DIRECTION	
LOAD STEP...... 2	X	Y	Z
TRANSLATED FORCES.........	32.70	43.60	2.50
TRANSLATED MOMENTS........	554.92	555.01	6555.53

NUMBER OF FORCE DEFINITION NODES... 1

MAXIMUM ABSOLUTE STRESS ON ELEMENT 10 = 14.9 KSI
COMPARISON FACTOR MATCH ON ELEMENT 10 = 1.8610315

AEP * 150T CRANE * 60T LOAD * GIRDER TO END TIE * WELDS * SSE

		DIRECTION	
LOAD STEP...... 3	X	Y	Z
TRANSLATED FORCES.........	13.00	61.70	2.00
TRANSLATED MOMENTS........	782.63	249.11	7073.43

NUMBER OF FORCE DEFINITION NODES... 1

MAXIMUM ABSOLUTE STRESS ON ELEMENT 10 = 15.6 KSI
COMPARISON FACTOR MATCH ON ELEMENT 10 = 1.7852123

AEP * 150T CRANE * 60T LOAD * GIRDER TO END TIE * WELDS * SSE

		DIRECTION	
LOAD STEP...... 4	X	Y	Z
TRANSLATED FORCES.........	32.70	44.50	2.50
TRANSLATED MOMENTS:.......	566.04	532.81	2883.70

NUMBER OF FORCE DEFINITION NODES... 1

MAXIMUM ABSOLUTE STRESS ON ELEMENT 10 = 7.2 KSI
COMPARISON FACTOR MATCH ON ELEMENT 10 = 3.8799543

AEP * 150T CRANE * 60T LOAD * GIRDER TO END TIE * WELDS * SSE

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

AEP * 150T CRANE * 60T LOAD * GIRDER TO END TIE * WELDS * SSE

	DIRECTION		
LOAD STEP...... 5	X	Y	Z
TRANSLATED FORCES.........	43.20	81.50	2.50
TRANSLATED MOMENTS........	1029.00	658.57	6002.54

NUMBER OF FORCE DEFINITION NODES... 1

MAXIMUM ABSOLUTE STRESS ON ELEMENT 10 = 14.1 KSI
COMPARISON FACTOR MATCH ON ELEMENT 10 = 1.9651527

AEP * 150T CRANE * 60T LOAD * GIRDER TO END TIE * WELDS * SSE

	DIRECTION		
LOAD STEP...... 6	X	Y	Z
TRANSLATED FORCES.........	133.80	53.00	2.10
TRANSLATED MOMENTS........	675.33	1752.25	6844.79

NUMBER OF FORCE DEFINITION NODES... 1

MAXIMUM ABSOLUTE STRESS ON ELEMENT 10 = 18.0
COMPARISON FACTOR MATCH ON ELEMENT 10 = 1.5477498

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

WORST CASE OCCURED DURING LOAD STEP 1

MJM 9-4-87

AEP * 150T CRANE * 60T LOAD * GIRDER TO END TIE * WELDS * SSE

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

LOAD STEP...... 1

	DIRECTION, LOCATION OR AXIS		
	X	Y	Z
CENTROIDS, X AXIS.........		5.16	-12.36
Y AXIS.........	-2.47		-12.36
Z AXIS.........	-2.41	7.20	
SHEAR AREAS................	70.75	70.75	55.91
POLAR MOMENTS OF INERTIA..	30736.40	19084.18	17262.38
TRANSLATED FORCES..........	43.20	79.50	2.30
TRANSLATED MOMENTS.........	1003.26	665.17	11013.72

NUMBER OF FORCE DEFINITION NODES... 1

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

DIRECT STRESSES ARE EQUALLY DISTRIBUTED THROUGHOUT SHEAR AREA
DRX 0.6 DRY 1.1 DRZ 0.0

3-D LINE ELEMENT 1 SIZE 0.313 LENGTH 38.875 AREA 8.590
STRESS AT NODES 101,102 12.1, 12.6 ALLOWABLE 27.8
STRESS EXPANSION FOR NODE 101

0.5	10.9	-0.4	0.0	-0.5	-0.0

STRESS EXPANSION FOR NODE 102

-0.9	10.9	0.8	0.0	-0.5	-0.0

3-D LINE ELEMENT 2 SIZE 0.313 LENGTH 5.500 AREA 1.215
STRESS AT NODES 103,104 12.6, 12.8 ALLOWABLE 27.8
STRESS EXPANSION FOR NODE 103

-0.9	10.9	0.8	0.4	-0.5	-0.0

STRESS EXPANSION FOR NODE 104

-1.1	10.9	1.0	0.4	-0.5	-0.0

3-D LINE ELEMENT 3 SIZE 0.313 LENGTH 38.875 AREA 8.590
STRESS AT NODES 105,106 11.8, 12.2 ALLOWABLE 27.8
STRESS EXPANSION FOR NODE 105

0.5	10.6	-0.4	0.0	-0.5	-0.0

STRESS EXPANSION FOR NODE 106

-0.9	10.6	0.8	0.0	-0.5	-0.0

3-D LINE ELEMENT 4 SIZE 0.313 LENGTH 5.500 AREA 1.215
STRESS AT NODES 107,108 12.3, 12.5 ALLOWABLE 27.8
STRESS EXPANSION FOR NODE 107

-0.9	10.6	0.8	0.4	-0.5	-0.0

STRESS EXPANSION FOR NODE 108

-1.1	10.6	1.0	0.4	-0.5	-0.0

AEP * 150T CRANE * 60T LOAD * GIRDER TO END TIE * WELDS * SSE

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

3-D LINE ELEMENT 5 SIZE 0.313 LENGTH 38.875 AREA 8.590
STRESS AT NODES 109,110　4.8,　5.3　ALLOWABLE　27.8
STRESS EXPANSION FOR NODE 109
0.5　-3.5　-0.4　0.0　0.2　-0.0
STRESS EXPANSION FOR NODE 110
-0.9　-3.5　0.8　0.0　0.2　-0.0

3-D LINE ELEMENT 6 SIZE 0.313 LENGTH 5.500 AREA 1.215
STRESS AT NODES 111,112　5.5,　5.7　ALLOWABLE　27.8
STRESS EXPANSION FOR NODE 111
-0.9　-3.5　0.8　0.4　0.2　-0.0
STRESS EXPANSION FOR NODE 112
-1.1　-3.5　1.0　0.4　0.2　-0.0

3-D LINE ELEMENT 7 SIZE 0.313 LENGTH 38.875 AREA 8.590
STRESS AT NODES 113,114　5.1,　5.6　ALLOWABLE　27.8
STRESS EXPANSION FOR NODE 113
0.5　-3.8　-0.4　0.0　0.3　-0.0
STRESS EXPANSION FOR NODE 114
-0.9　-3.8　0.8　0.0　0.3　-0.0

3-D LINE ELEMENT 8 SIZE 0.313 LENGTH 5.500 AREA 1.215
STRESS AT NODES 115,116　5.8,　6.0　ALLOWABLE　27.8
STRESS EXPANSION FOR NODE 115
-0.9　-3.8　0.8　0.4　0.3　-0.0
STRESS EXPANSION FOR NODE 116
-1.1　-3.8　1.0　0.4　0.3　-0.0

3-D LINE ELEMENT 9 SIZE 0.313 LENGTH 58.000 AREA 12.816
STRESS AT NODES 117,118　15.0,　24.7　ALLOWABLE　27.8
STRESS EXPANSION FOR NODE 117
0.5　13.6　-0.5　-0.8　-0.6　0.0
STRESS EXPANSION FOR NODE 118
0.5　-23.4　-0.5　-0.8　1.3　0.0

3-D LINE ELEMENT 10 SIZE 0.313 LENGTH 3.000 AREA 0.663
STRESS AT NODES 118,119　24.7,　24.7　ALLOWABLE　27.8
STRESS EXPANSION FOR NODE 118
0.5　-23.4　-0.5　-0.8　1.3　0.0
STRESS EXPANSION FOR NODE 119
0.5　-23.4　-0.5　1.1　1.3　-0.1

3-D LINE ELEMENT 11 SIZE 0.313 LENGTH 3.625 AREA 0.801
STRESS AT NODES 104,120　12.8,　13.5　ALLOWABLE　27.8
STRESS EXPANSION FOR NODE 104
-1.1　10.9　1.0　0.4　-0.5　-0.0
STRESS EXPANSION FOR NODE 120
-1.1　10.9　1.0　2.7　-0.5　-0.2

3-D LINE ELEMENT 12 SIZE 0.313 LENGTH 3.625 AREA 0.801
STRESS AT NODES 108,121　12.5,　13.2　ALLOWABLE　27.8
STRESS EXPANSION FOR NODE 108
-1.1　10.6　1.0　0.4　-0.5　-0.0
STRESS EXPANSION FOR NODE 121
-1.1　10.6　1.0　2.7　-0.5　-0.2

AEP * 150T CRANE * 60T LOAD * GIRDER TO END TIE * WELDS * SSE

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

3-D LINE ELEMENT 13 SIZE 0.313 LENGTH 3.625 AREA 0.801
STRESS AT NODES 116,122 6.0, 7.3 ALLOWABLE 27.8
STRESS EXPANSION FOR NODE 116

-1.1	-3.8	1.0	0.4	0.3	-0.0

STRESS EXPANSION FOR NODE 122

-1.1	-3.8	1.0	2.7	0.3	-0.2

3-D LINE ELEMENT 14 SIZE 0.313 LENGTH 3.625 AREA 0.801
STRESS AT NODES 112,123 5.7, 7.1 ALLOWABLE 27.8
STRESS EXPANSION FOR NODE 112

-1.1	-3.5	1.0	0.4	0.2	-0.0

STRESS EXPANSION FOR NODE 123

-1.1	-3.5	1.0	2.7	0.2	-0.2

2-D POINT ELEMENT 15 NODE 51 AREA 1.485 DIAMETER 1.375
STRESS AT NODE 13.6 ALLOWABLE 27.8
STRESS EXPANSION FOR NODE 51

0.5	12.3	-0.5	0.1	0.0	0.0

2-D POINT ELEMENT 16 NODE 52 AREA 1.485 DIAMETER 1.375
STRESS AT NODE 9.8 ALLOWABLE 27.8
STRESS EXPANSION FOR NODE 52

0.5	8.5	-0.5	0.1	0.0	0.0

2-D POINT ELEMENT 17 NODE 53 AREA 1.485 DIAMETER 1.375
STRESS AT NODE 6.1 ALLOWABLE 27.8
STRESS EXPANSION FOR NODE 53

0.5	4.7	-0.5	0.1	0.0	0.0

2-D POINT ELEMENT 18 NODE 54 AREA 1.485 DIAMETER 1.375
STRESS AT NODE 2.7 ALLOWABLE 27.8
STRESS EXPANSION FOR NODE 54

0.5	0.8	-0.5	0.1	0.0	0.0

2-D POINT ELEMENT 19 NODE 55 AREA 1.485 DIAMETER 1.375
STRESS AT NODE 4.5 ALLOWABLE 27.8
STRESS EXPANSION FOR NODE 55

0.5	-3.0	-0.5	0.1	0.0	0.0

2-D POINT ELEMENT 20 NODE 56 AREA 1.485 DIAMETER 1.375
STRESS AT NODE 8.2 ALLOWABLE 27.8
STRESS EXPANSION FOR NODE 56

0.5	-6.8	-0.5	0.1	0.0	0.0

2-D POINT ELEMENT 21 NODE 57 AREA 1.485 DIAMETER 1.375
STRESS AT NODE 11.9 ALLOWABLE 27.8
STRESS EXPANSION FOR NODE 57

0.5	-10.6	-0.5	0.1	0.0	0.0

2-D POINT ELEMENT 22 NODE 58 AREA 1.485 DIAMETER 1.375
STRESS AT NODE 15.7 ALLOWABLE 27.8
STRESS EXPANSION FOR NODE 58

0.5	-14.5	-0.5	0.1	0.0	0.0

AEP * 150T CRANE * 60T LOAD * GIRDER TO END TIE * WELDS * SSE

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

2-D POINT ELEMENT 23 NODE 59 AREA 1.485 DIAMETER 1.375
STRESS AT NODE 19.5 ALLOWABLE 27.8
STRESS EXPANSION FOR NODE 59
0.5 -18.3 -0.5 0.1 0.0 0.0

2-D POINT ELEMENT 24 NODE 60 AREA 1.485 DIAMETER 1.375
STRESS AT NODE 23.3 ALLOWABLE 27.8
STRESS EXPANSION FOR NODE 60
0.5 -22.1 -0.5 0.1 0.0 0.0

FORCE DEFINITION NODE ABSOLUTE ELEMENT 25 NODE 200
FX 43.20 ; FY 79.50 ; FZ 2.30
MX 8.90 ; MY 125.60 ; MZ 10511.00

MAXIMUM ABSOLUTE STRESS ON ELEMENT 10 = 24.7 KSI

MJM 9-4-87

AEP * 150T CRANE * 60T LOAD * GIRDER TO END TIE * WELDS * SSE

***** REPORT SUMMARY, FOR A 6 LOAD STEP ANALYSIS *****

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

ELEMENT STATISTICS

TYPE	DESCRIPTION	NUMBER USED
1	3-DIMENSIONAL LINE ELEMENT.........	14
2	2-DIMENSIONAL POINT ELEMENT........	10
3	FORCE DEFINITION NODE - ABSOLUTE...	1

TOTAL NUMBER OF ELEMENTS = 25, NODES = 34

SYSTEM PROPERTIES

LOAD STEP...... 1

	DIRECTION, LOCATION OR AXIS X	Y	Z
CENTROIDS, X AXIS.........		5.16	-12.36
Y AXIS.........	-2.47		-12.36
Z AXIS.........	-2.41	7.20	
SHEAR AREAS...............	70.75	70.75	55.91
POLAR MOMENTS OF INERTIA..	30736.40	19084.18	17262.38
TRANSLATED FORCES.........	43.20	79.50	2.30
TRANSLATED MOMENTS........	1003.26	665.17	11013.72

MAXIMUM ELEMENT STRESSES

DESCRIPTION	NUMBER USED	ELEMENT	NODE	STRESS	ALLOWABLE	COMPAR FACT
3-D LINE ELEMENT	14	10	119	24.7 KSI	27.8 KSI	1.12
2-D POINT ELEMENT	10	24	60	23.3 KSI	27.8 KSI	1.19

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

END TIE
SECTION A-A

MAXIMUM STRESSES TABLES B16 AND B17 (SSE, TROLLEY AT LHE, 60T LOAD - UP AND DOWN) SHOW THAT END CONNECTION IS OVERSTRESSED AT ELEMENT 172 (252,253), NODE 252. [1]

TO REINFORCE END CONNECTION ℙ 1/2 × 39 1/2 × 30 WAS CHANGED TO ℙ 1/2 × 39 1/2 × 54 (REF. PG. 4-76). THIS HAS AN INSIGNIFICANT EFFECT ON DYNAMIC RESPONSE OF CRANE.

NEW DESIGN WAS BASED ON MAX. LOADINGS WHICH OCCURED FOR SSE, TROLLEY AT LHE, 60T LOAD-DOWN (REF. SRSS COMPUTER OUTPUT - SUM OF ELEMENT FORCES IN ELEMENT CO-ORDINATE SYSTEM)

FOR ELEM. 172, NODE 252

$F_X = 43.2$ KIP $M_Y = 67.8$ IN. KIP $M_Z = 8131$ IN. KIP

FOR. ELEM. 172, NODE 253

$F_X = 43.2$ KIP $M_Y = 25.7$ IN. KIP $M_Z = 2642$ IN. KIP

MATRL.: ASTM-A36 $\sigma_{YMIN} = 36$ KSI

SSE $\sigma_{ALL} = \frac{36}{1.1} = 32.7$ KSI

SECTIONAL PROPERTIES

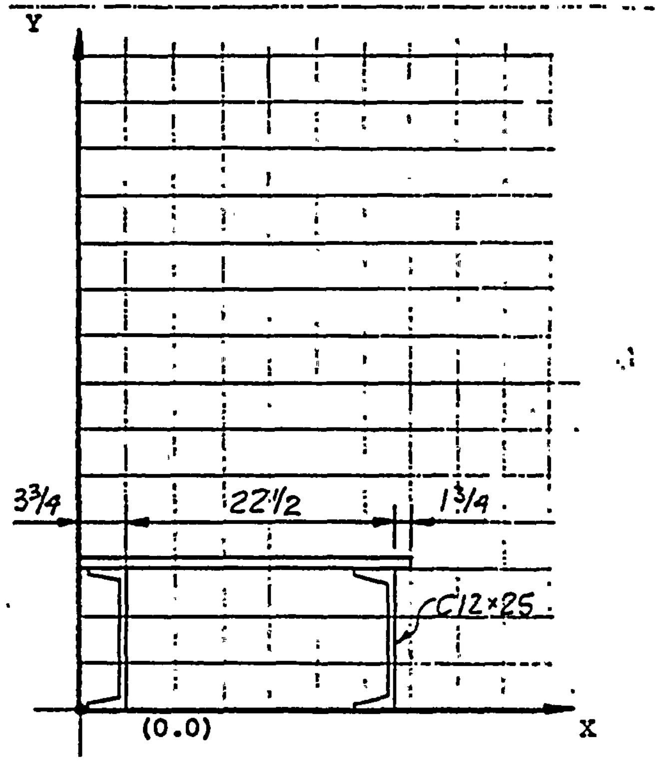
(BUILT UP OF ROLLED & RECTANGULAR SECTIONS)

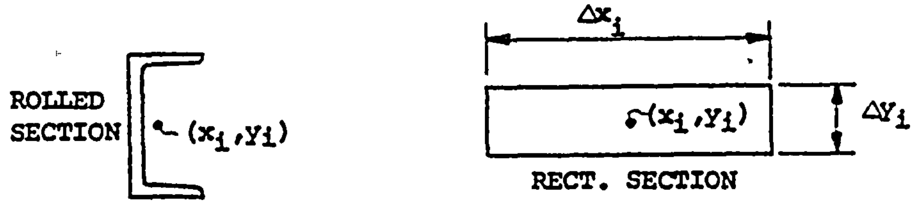
PROGRAM 1 PROGRAM ID 1-A-2-5(044)
WHITING REQN 73502 DATE 3-1-87
BY ASZ PAGE 4-102 OF 182
MJM 9-3-87

GIRDER END TIE CONNECTION AT SECTION A-A (REF. PG. 4-75)

ELEMENT NO. (i) ROLLED (i)	ELEMENT PROPERTIES/ DIMENSIONS A_i	Ix_i	Iy_i	ELEMENT CENTROID x_i	y_i
1.	7.35	144	4.47	3.076	6
	7.35	144	4.47	25.576	6

RECT. (1000+i)	Δx_i	Δy_i	x_i	y_i
1003	28	0.75	14	12.375





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'.

$$S_{XMIN} = \frac{640}{9.75} = 65.6 \ IN^3$$

$$S_{YMIN} = \frac{3242}{14.13} = 229 \ IN^3$$

COMPUTED DATA

14.1342	$\bar{x}$	- Distance from the 'y' axis to the centroid of the section.
9.7500	$\bar{y}$	- 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.
3242.3277	Iy	- Moment of inertia about the section's neutral axis which is parallel to the 'y' axis.

SECTIONAL PROPERTIES

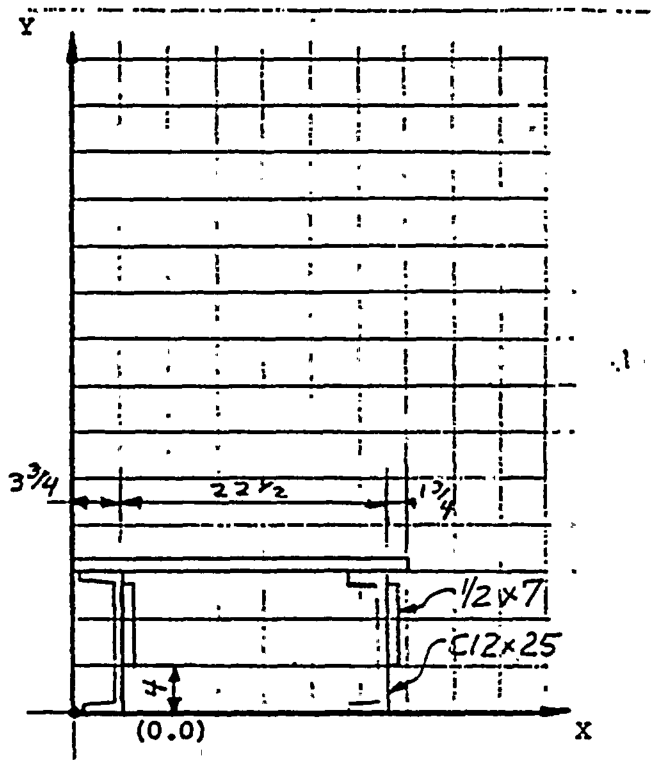
(BUILT UP OF ROLLED & RECTANGULAR SECTIONS)

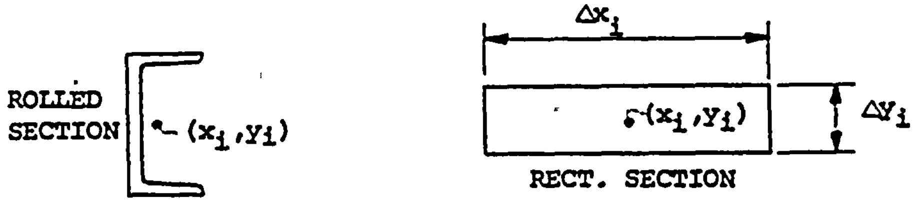
PROGRAM 11_ PROGRAM ID 1-A-2-5(044)
WHITING REQN 79508 DATE [illegible]
BY [illegible] PAGE 4-110 OF 182
MJM 9-3-87

GIRDER END TIE CONNECTION AT SECTION B-B (REF. PG. 4-76)

ELEMENT NO. (i) ROLLED (i)	ELEMENT PROPERTIES/ DIMENSIONS A_i	Ix_i	Iy_i	ELEMENT CENTROID x_i	Y_i
1	7.35	144	4.47	3.076	6
2	7.35	144	4.47	[illegible]	6

RECT. (1000+i)	Δx_i	Δy_i	x_i	Y_i
1003	28	.75	14	12.375
1004	.5	7	4	7.5
1005	.5	7	26.5	7.5





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'.

$S_{x\,min} = \frac{699}{9.38} = 74.5\ in^3$

$S_{y\,min} = \frac{4136}{14.32} = 289\ in^3$

COMPUTED DATA

14•3171 ______ $\bar{x}$ - Distance from the 'y' axis to the centroid of the section.

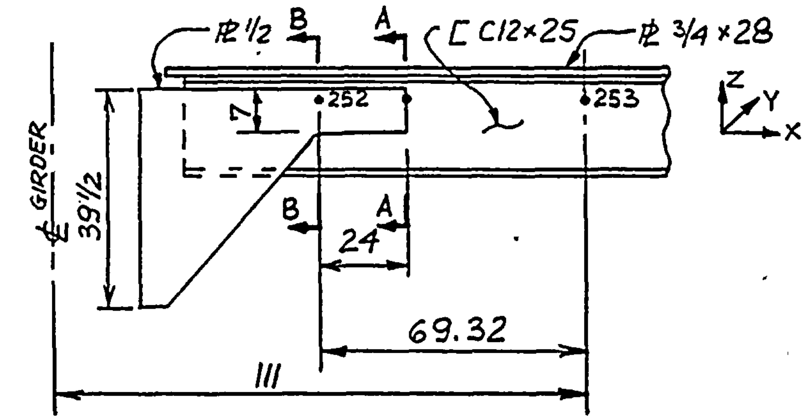
9•3811 ______ $\bar{y}$ - Distance from the 'x' axis to the centroid of the section.

42•7000 ______ A - Area of the section.

698•6176 ______ Ix - Moment of inertia about the section's neutral axis which is parallel to the 'x' axis.

4135•6969 ______ Iy - Moment of inertia about the section's neutral axis which is parallel to the 'y' axis.

GIRDER END TIE CONNECTION. 1



1

LOAD	@ 252 SECT. B-B	@ 253	INTERPOLATED TO SECT. A-A
F_X (KIPS)	43.2	43.2	43.2
M_Y (IN.KIP)	67.8	25.7	53.2
M_Z (IN.KIP)	8131	2642	6231

1

STRESS AT SECTION A-A. 1

$$\sigma_{AA} = \frac{F_X}{A} + \frac{M_Y}{S_Y} + \frac{M_Z}{S_Z} = \frac{43.2}{35.7} + \frac{53.2}{65.6} + \frac{6231}{229} = \underline{29.2 \text{ KSI}}$$

STRESS AT SECTION B-B (NODE 252) 1

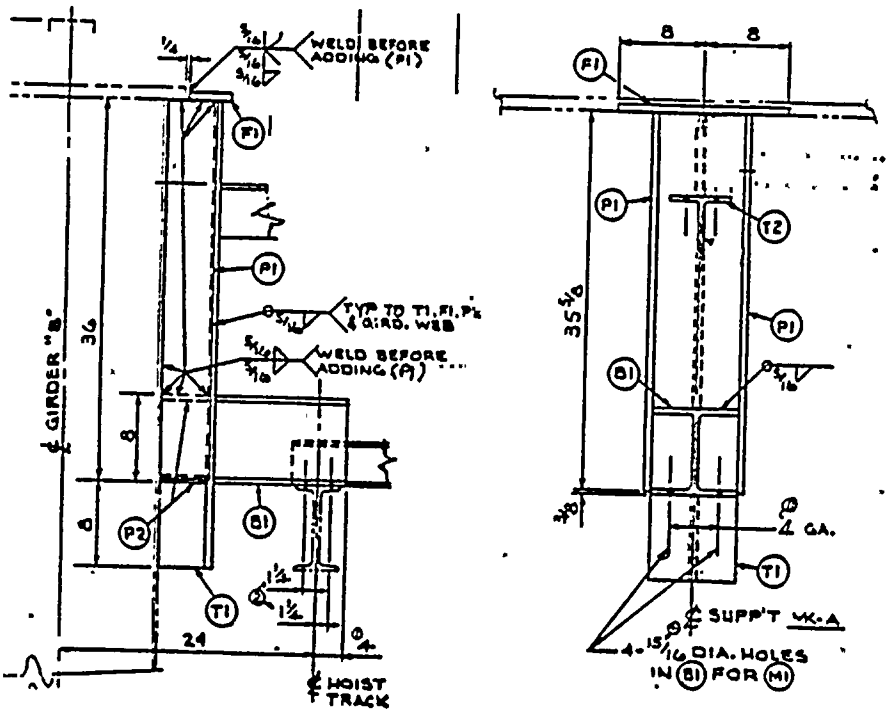
$$\sigma_{BB} = \frac{43.2}{42.7} + \frac{67.8}{74.5} + \frac{8131}{289} = \underline{\underline{30.1 \text{ KSI}}}$$

FORM N-2494

WHITING REQN. 79508 DATE 8-29-87
BY MJM PAGE 4-112 OF 182
ASZ 9-9-87

MONORAIL SUPPORT TO GIRDER

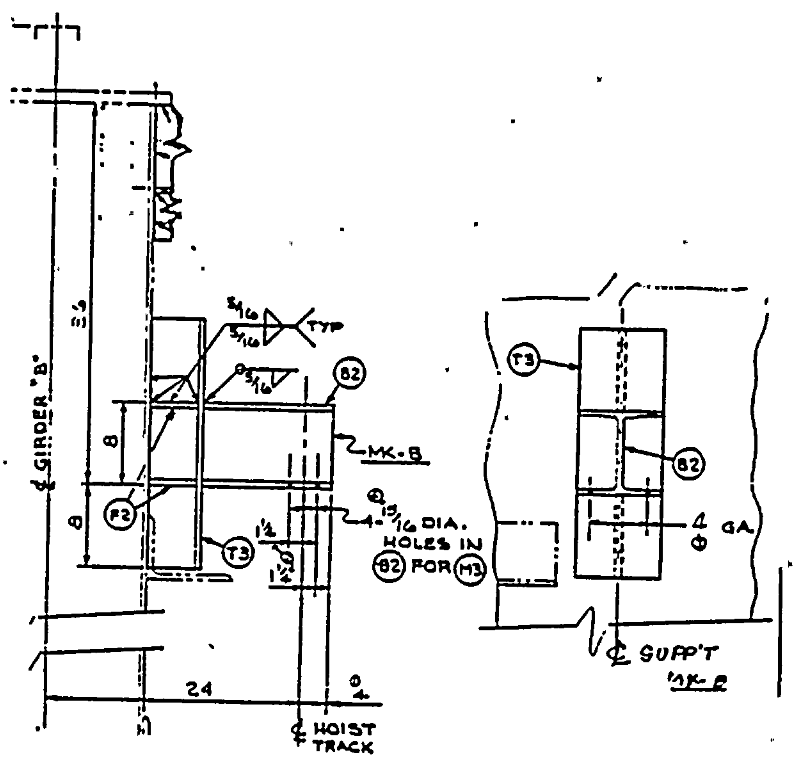
FIXED SUPPORT MK-A



1 REQD

P1	½ PL 4 9/16 x 35 5/8	
P2	½ PL 3 9/16 x 4 3/8	
B1	W8x35	13 5/8
T1	WT 5x22.5	44
F1	3/4x4 BAR	16
M1	7/8 x 2½ A325 BOLT	

FLOAT SUPPORT MK-B



6 REQD

B2	W8x35	13 5/8
T3	WT 5x22.5	24
F2	½x3 BAR	4 3/8
M3	7/8 x 2½ A325 BOLT	

WELDED CONNECTIONS

ALLOWABLE STRESS THROUGH THROAT
WELD MATERIAL E70XX MIN YIELD 57 KSI
BASE MATERIAL
℄ & SHAPES A36 MIN YIELD 36 KSI
BARS M1020 MIN YIELD 30 KSI

OBE $\frac{57}{1.5} .6 = 22.8$ KSI $\frac{36}{1.5} .6\sqrt{2} = 20.4$ KSI

$\frac{30}{1.5} .6\sqrt{2} = 17.0$ KSI

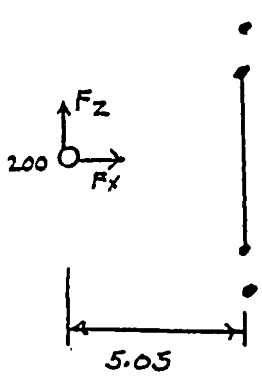
SSE $\frac{57}{1.1} .6 = 31.1$ KSI $\frac{36}{1.1} .6\sqrt{2} = 27.8$ KSI

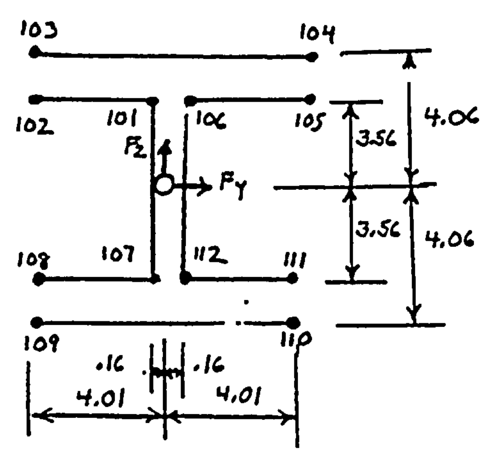
$\frac{30}{1.1} .6\sqrt{2} = 23.1$ KSI

A) WELD BETWEEN SUPPORT BEAM AND TEE
SAME FOR FIXED AND FLOAT

MAX LOADINGS PER TABLES B101 THROUGH 104

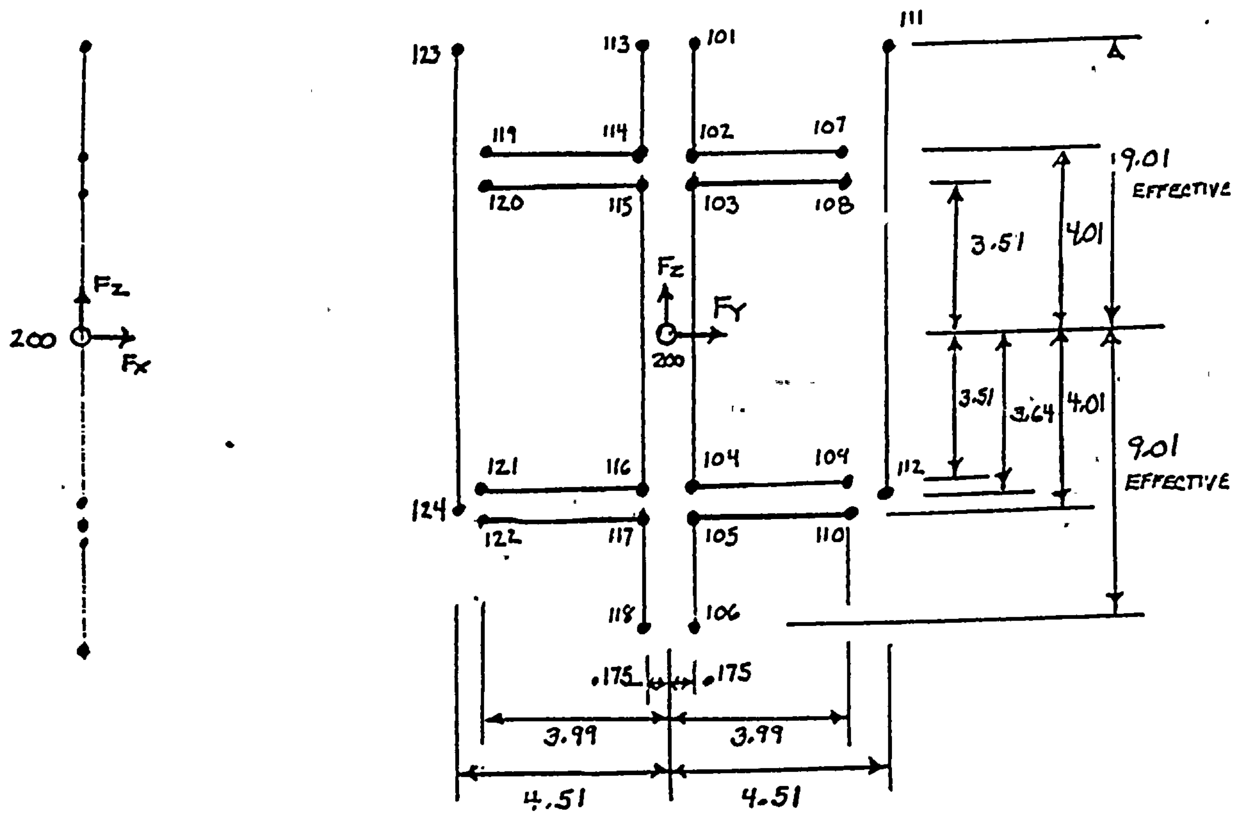
OBE	F_X =	4.2	KIP	F_Y =	4.1	KIP	F_Z =	1.4	KIP
	M_X =	3.0	IN KIP	M_Y =	113.8	IN KIP	M_Z =	47.9	IN KIP
SSE	F_X =	7.8	KIP	F_Y =	7.6	KIP	F_Z =	1.6	KIP
	M_X =	5.6	IN KIP	M_Y =	198.2	IN KIP	M_Z =	89.5	IN KIP





5/16 FILLET WELDS
USE .219 FOR ELEMENTS 101-107 & 106-112 TO MATCH WEB OF BEAM

B) WELD OF FIXED SUPPORT TO GIRDER WEB



ALL 5/16 WELD

BECAUSE OF RELATIVE STIFFNESS ASSUME
ELEMENTS 111-112 & 123-124 TRANSFER FORCES IN Z ONLY
ELEMENTS 102-107, 103-108, 104-109, 105-110, 114-119, 115-120, 116-121, & 117-122 TRANSFER FORCES IN Y ONLY
USE .247 FOR ELEMENT 101-102, 103-104, 105-106, 113-114, 115-116, & 117-118 TO MATCH WEB OF TEE

THE MOMENT ABOUT Z IS ASSUMED TO BE TRANSFERRED TO BOX SECTION WHICH HAS MUCH GREATER RIGIDITY

FORM N-2494

WHITING REQN. 79503 DATE 8-28-87
BY MJM PAGE 4-115 OF 132
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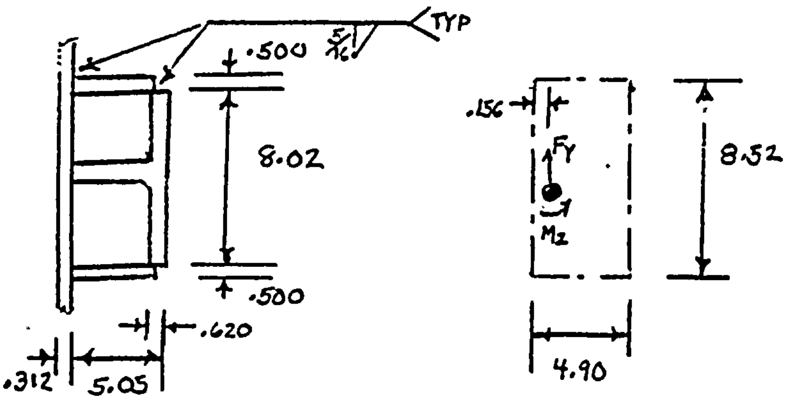
BECAUSE OF GREATER RIGIDITY THE Mz IS ASSUMED TRANSFERRED 100% IN TORSION THROUGH BOX SECTION



OBE FROM TABLE B101

$$M_z = 4.1\left(\frac{4.9}{2} - .156\right) + 47.9 = 57.3 \text{ IN KIP}$$

$$\tau = \frac{57.3}{2(5/16 \times .707)(4.90 \times 8.52)} = 3.1 \text{ KSI}$$

SSE FROM TABLE B102

$$M_z = 7.6\left(\frac{4.9}{2} - .156\right) + 89.5 = 106.9 \text{ IN KIP}$$

$$\tau = \frac{106.9}{2(5/16 \times .707)(4.90 \times 8.52)} = 5.8 \text{ KSI}$$

FORM N-2494

WHITING REQN. 79508 DATE 3-23-87
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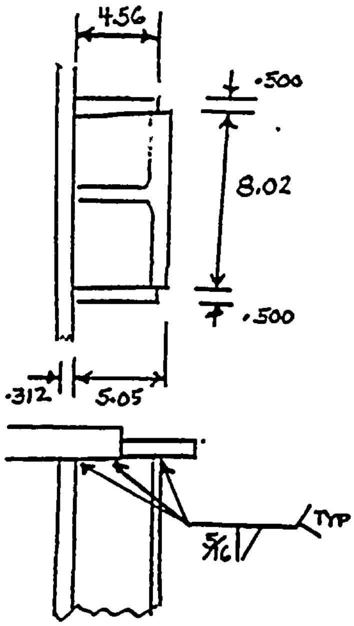
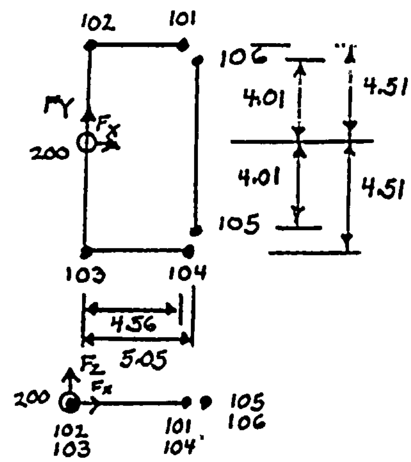
ASZ 9-9-87

c) WELD OF BOX SECTION TO COVER PLATE





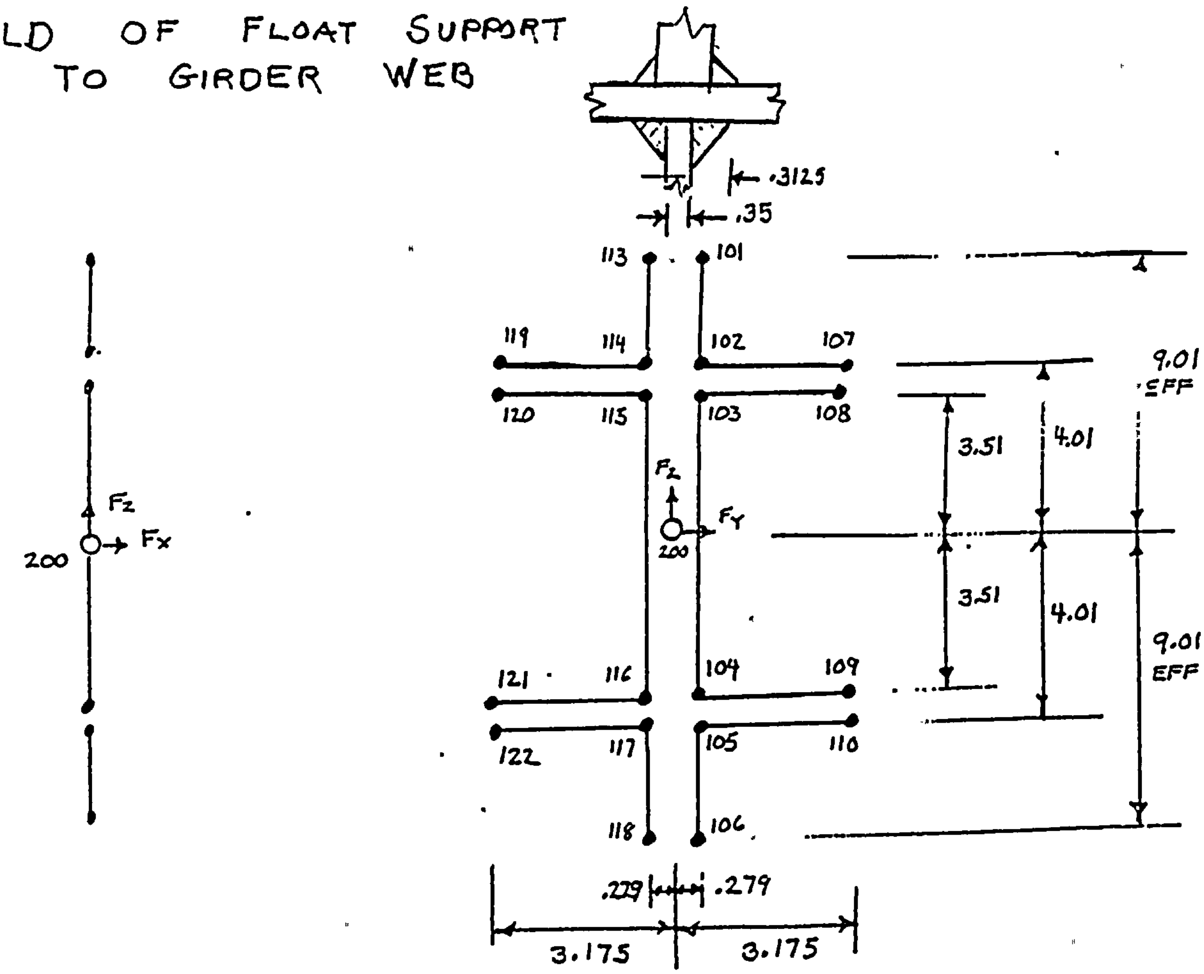
OBE FROM TABLE 8101

F_Y = 4.1 KIP M_Z = 47.9 KIP

SSE FROM TABLE 8102

F_Y = 7.6 KIP M_Z = 89.5 KIP

B') WELD OF FLOAT SUPPORT TO GIRDER WEB



ALL 5/16 WELD
USE .247 FOR ELEMENTS 101-102, 103-104, 105-106, 113-114, 115-116 & 117-118 TO MATCH WEB OF TEE BUT LOCATE AT CG OF WELDS
BECAUSE OF RELATIVE STIFFNESS ASSUME ELEMENTS 102-107, 103-108, 104-109, 105-110, 114-119, 115-120, 116-121 & 117-122 TRANSFER FORCES IN Y ONLY WHICH IS CONSERVATIVE
MAX LOADINGS PER TABLES B103 & B104

OBE	Fx =	4.2	KIP	Fy =	2.8	KIP	Fz =	1.4	KIP
	Mx =	2.2	IN KIP	My =	113.8	IN KIP	Mz	10.6	IN KIP
SSE	Fx =	7.8	KIP	Fy =	4.8	KIP	Fz =	1.6	KIP
	Mx =	3.8	IN KIP	My =	198.2	IN KIP	Mz =	19.9	IN KIP

#79508   9-9-87

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                                   ***** CONSYS INPUT DATA LISTING *****
                                    A-Z                      PAGE 4-118   OF 182
         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 * 60T LOAD *  SUPPORT TO GIRDER * WELDS * A * OBE
  2. 79508 ASZ  1.   0.   0.   1.                       1.
  3. 1.    1.                                              MJM 9-10-87
  4. 2.    5.
  5. -1.
  6. 0.3125     20.4                1.
  7. 0.219      20.4                1.
  8. -1.
  9. 101. 102.            1.   1.         6.   2.
 10. 101. 107.            1.   2.         2.   5.
 11. 200.                 2.
 12. -1.
 13. -6.    4.                           -7.12
 14.  101.          5.05        -0.16     3.56
 15.  102.          5.05        -4.01     3.56
 16.  105.          5.05         0.16     3.56
 17.  106.          5.05         4.01     3.56
 18. -6.    2.                           -8.12
 19.  103.          5.05        -4.01     4.06
 20.  104.          5.05         4.01     4.06
 21.  200.          0.           0.        0.
 22.  9999.
 23.  101.  1.  112.
 24. -1.
 25.  200. 4.2      4.1       1.4       3.0       113.8     47.9
 26. -1.
 27. FINISH
         A    A    A    A    A    A    A    A    A    A    A    A    A
```

MJM 9-10-87

AEP * 150T CRANE * 60T LOAD * SUPPORT TO GIRDER * WELDS * A * OBE

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

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

	X	Y	Z
CENTROIDS, X AXIS.........		0.46	-0.00
Y AXIS.........	5.05		-0.00
Z AXIS.........	5.05	0.46	
SHEAR AREAS................	9.15	9.15	9.15
POLAR MOMENTS OF INERTIA..	164.65	110.87	53.78
TRANSLATED FORCES.........	4.20	4.10	1.40
TRANSLATED MOMENTS........	3.65	120.87	70.55

NUMBER OF FORCE DEFINITION NODES... 1

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

DIRECT STRESSES ARE EQUALLY DISTRIBUTED THROUGHOUT SHEAR AREA
DRX 0.5 DRY 0.4 DRZ 0.2

3-D LINE ELEMENT 1 SIZE 0.313 LENGTH 3.850 AREA 0.851
STRESS AT NODES 101, 102 5.2, 10.2 ALLOWABLE 20.4
STRESS EXPANSION FOR NODE 101

3.9	0.8	-0.1	0.0	-0.0	-0.0

STRESS EXPANSION FOR NODE 102

3.9	5.9	-0.1	0.0	-0.1	-0.0

3-D LINE ELEMENT 2 SIZE 0.313 LENGTH 8.020 AREA 1.772
STRESS AT NODES 103, 104 10.8, 9.6 ALLOWABLE 20.4
STRESS EXPANSION FOR NODE 103

4.4	5.9	-0.1	0.0	-0.1	-0.0

STRESS EXPANSION FOR NODE 104

4.4	-4.7	-0.1	0.0	0.1	-0.0

3-D LINE ELEMENT 3 SIZE 0.313 LENGTH 3.850 AREA 0.851
STRESS AT NODES 105, 106 4.8, 9.0 ALLOWABLE 20.4
STRESS EXPANSION FOR NODE 105

3.9	0.4	-0.1	0.0	-0.0	-0.0

STRESS EXPANSION FOR NODE 106

3.9	-4.7	-0.1	0.0	0.1	-0.0

3-D LINE ELEMENT 4 SIZE 0.313 LENGTH 3.850 AREA 0.851
STRESS AT NODES 107, 108 5.2, 10.2 ALLOWABLE 20.4
STRESS EXPANSION FOR NODE 107

-3.9	0.8	0.1	0.0	-0.0	-0.0

STRESS EXPANSION FOR NODE 108

-3.9	5.9	0.1	0.0	-0.1	-0.0

AEP * 150T CRANE * 60T LOAD * SUPPORT TO GIRDER * WELDS * A * OBE

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

3-D LINE ELEMENT 5 SIZE 0.313 LENGTH 8.020 AREA 1.772
STRESS AT NODES 109,110 10.8, 9.6 ALLOWABLE 20.4
STRESS EXPANSION FOR NODE 109
-4.4 5.9 0.1 0.0 -0.1 -0.0
STRESS EXPANSION FOR NODE 110
-4.4 -4.7 0.1 0.0 0.1 -0.0

3-D LINE ELEMENT 6 SIZE 0.313 LENGTH 3.850 AREA 0.851
STRESS AT NODES 111,112 4.8, 9.0 ALLOWABLE 20.4
STRESS EXPANSION FOR NODE 111
-3.9 0.4 0.1 0.0 -0.0 -0.0
STRESS EXPANSION FOR NODE 112
-3.9 -4.7 0.1 0.0 0.1 -0.0

3-D LINE ELEMENT 7 SIZE 0.219 LENGTH 7.120 AREA 1.103
STRESS AT NODES 101,107 5.2, 5.2 ALLOWABLE 20.4
STRESS EXPANSION FOR NODE 101
3.9 0.8 -0.1 0.0 -0.0 -0.0
STRESS EXPANSION FOR NODE 107
-3.9 0.8 0.1 0.0 -0.0 -0.0

3-D LINE ELEMENT 8 SIZE 0.219 LENGTH 7.120 AREA 1.103
STRESS AT NODES 106,112 9.0, 9.0 ALLOWABLE 20.4
STRESS EXPANSION FOR NODE 106
3.9 -4.7 -0.1 0.0 0.1 -0.0
STRESS EXPANSION FOR NODE 112
-3.9 -4.7 0.1 0.0 0.1 -0.0

FORCE DEFINITION NODE ABSOLUTE ELEMENT 9 NODE 200
FX 4.20 ; FY 4.10 ; FZ 1.40
MX 3.00 ; MY 113.80 ; MZ 47.90

MAXIMUM ABSOLUTE STRESS ON ELEMENT 5 = 10.8 KSI

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

#79502   2-9-87

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

ASZ   PAGE 4-121 OF 182

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         5    10   15   20   25   30   35   40   45   50   55   60   65   7
         V    V    V    V    V    V    V    V    V    V    V    V    V
  1. AEP * 150T CRANE * 60T LOAD *  SUPPORT TO GIRDER * WELDS * A * SSE
  2. 79508 ASZ 1.    0.   0.   1.                       1.
  3.  1.   1.                                           MJM 9-10-87
  4.  2.   5.
  5. -1.
  6.  0.3125    27.8                1.
  7.  0.219     27.8                1.
  8. -1.
  9. 101. 102.            1.   1.        6.   2.
 10. 101. 107.            1.   2.        2.   5.
 11. 200.                 2.
 12. -1.
 13. -6.   4.                            -7.12
 14.  101.           5.05       -0.16     3.56
 15.  102.           5.05       -4.01     3.56
 16.  105.           5.05        0.16     3.56
 17.  106.           5.05        4.01     3.56
 18. -6.   2.                            -8.12
 19.  103.           5.05       -4.01     4.06
 20.  104.           5.05        4.01     4.06
 21.  200.           0.          0.       0.
 22.  9999.
 23.  101.  1.  112.
 24. -1.
 25.  200. 7.8       7.6       1.6       5.6       198.2     89.5
 26. -1.
 27. FINISH
         A    A    A    A    A    A    A    A    A    A    A    A    A
```

AEP * 150T CRANE * 60T LOAD * SUPPORT TO GIRDER * WELDS * A * SSE

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

LOAD STEP...... 1	DIRECTION, LOCATION OR AXIS		
	X	Y	Z
CENTROIDS, X AXIS.........		0.46	-0.00
Y AXIS.........	5.05		-0.00
Z AXIS.........	5.05	0.46	
SHEAR AREAS...............	9.15	9.15	9.15
POLAR MOMENTS OF INERTIA..	164.65	110.87	53.78
TRANSLATED FORCES.........	7.80	7.60	1.60
TRANSLATED MOMENTS........	6.34	206.28	131.50

NUMBER OF FORCE DEFINITION NODES... 1

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

DIRECT STRESSES ARE EQUALLY DISTRIBUTED THROUGHOUT SHEAR AREA
DRX 0.9 DRY 0.8 DRZ 0.2

3-D LINE ELEMENT 1 SIZE 0.313 LENGTH 3.850 AREA 0.851
STRESS AT NODES 101,102 9.1, 18.4 ALLOWABLE 27.8
STRESS EXPANSION FOR NODE 101

6.6	1.5	-0.1	0.0	-0.0	-0.0

STRESS EXPANSION FOR NODE 102

6.6	10.9	-0.1	0.0	-0.2	-0.0

3-D LINE ELEMENT 2 SIZE 0.313 LENGTH 8.020 AREA 1.772
STRESS AT NODES 103,104 19.4, 17.1 ALLOWABLE 27.8
STRESS EXPANSION FOR NODE 103

7.6	10.9	-0.2	0.0	-0.2	-0.0

STRESS EXPANSION FOR NODE 104

7.6	-8.7	-0.2	0.0	0.1	-0.0

3-D LINE ELEMENT 3 SIZE 0.313 LENGTH 3.850 AREA 0.851
STRESS AT NODES 105,106 8.3, 16.2 ALLOWABLE 27.8
STRESS EXPANSION FOR NODE 105

6.6	0.7	-0.1	0.0	-0.0	-0.0

STRESS EXPANSION FOR NODE 106

6.6	-8.7	-0.1	0.0	0.1	-0.0

3-D LINE ELEMENT 4 SIZE 0.313 LENGTH 3.850 AREA 0.851
STRESS AT NODES 107,108 9.1, 18.4 ALLOWABLE 27.8
STRESS EXPANSION FOR NODE 107

-6.6	1.5	0.1	0.0	-0.0	-0.0

STRESS EXPANSION FOR NODE 108

-6.6	10.9	0.1	0:0	-0.2	-0.0

AEP * 150T CRANE * 60T LOAD * SUPPORT TO GIRDER * WELDS * A * SSE

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

3-D LINE ELEMENT 5 SIZE 0.313 LENGTH 8.020 AREA 1.772
STRESS AT NODES 109,110 19.4, 17.1 ALLOWABLE 27.8
STRESS EXPANSION FOR NODE 109

-7.6	10.9	0.2	0.0	-0.2	-0.0

STRESS EXPANSION FOR NODE 110

-7.6	-8.7	0.2	0.0	0.1	-0.0

3-D LINE ELEMENT 6 SIZE 0.313 LENGTH 3.850 AREA 0.851
STRESS AT NODES 111,112 8.3, 16.2 ALLOWABLE 27.8
STRESS EXPANSION FOR NODE 111

-6.6	0.7	0.1	0.0	-0.0	-0.0

STRESS EXPANSION FOR NODE 112

-6.6	-8.7	0.1	0.0	0.1	-0.0

3-D LINE ELEMENT 7 SIZE 0.219 LENGTH 7.120 AREA 1.103
STRESS AT NODES 101,107 9.1, 9.1 ALLOWABLE 27.8
STRESS EXPANSION FOR NODE 101

6.6	1.5	-0.1	0.0	-0.0	-0.0

STRESS EXPANSION FOR NODE 107

-6.6	1.5	0.1	0.0	-0.0	-0.0

3-D LINE ELEMENT 8 SIZE 0.219 LENGTH 7.120 AREA 1.103
STRESS AT NODES 106,112 16.2, 16.2 ALLOWABLE 27.8
STRESS EXPANSION FOR NODE 106

6.6	-8.7	-0.1	0.0	0.1	-0.0

STRESS EXPANSION FOR NODE 112

-6.6	-8.7	0.1	0.0	0.1	-0.0

FORCE DEFINITION NODE ABSOLUTE ELEMENT 9 NODE 200

FX	7.80 ;	FY	7.60 ;	FZ	1.60
MX	5.60 ;	MY	198.20 ;	MZ	89.50

MAXIMUM ABSOLUTE STRESS ON ELEMENT 5 = 19.4 KSI

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

79508


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                5    10   15   20   25   30   35   40   45   50   55   60   65   70   7
                V    V    V    V    V    V    V    V    V    V    V    V    V    V
      1.  AEP * 150T CRANE * 60T LOAD * FIXED SUPPORT TO GIRDER * WELDS * B * OBE
      2.  79508 ASZ  1.    0.    0.   1.                             1.     MJM 9-10-87
      3.  1.    1.
      4.  2.    5.
      5.  -1.
      6.  0.3125    20.4                 1.         11.
      7.  0.3125    20.4                 1.         12.
      8.  0.247     20.4                 1.
      9.  -1.
     10.  101.  102.               1.   3.        3.   2.   2.
     11.  113.  114.               1.   3.
     12.  102.  107.               1.   1.        4.        2.
     13.  114.  119.               1.   1.
     14.  111.  112.               1.   2.        2.   12.
     15.  200.                     2.
     16.  -1.
     17.  -12.  6.                     -0.35
     18.   101.          0.             0.175    9.01
     19.   102.          0.             0.175    4.01
     20.   103.          0.             0.175    3.51
     21.   104.          0.             0.175   -3.51
     22.   105.          0.             0.175   -4.01
     23.   106.          0.             0.175   -9.01
     24.  -12.  4.                      -7.98
     25.   107.          0.             3.99     4.01
     26.   108.          0.             3.99     3.51
     27.   109.          0.             3.99    -3.51
     28.   110.          0.             3.99    -4.01
     29.  -12.  2.                      -9.02
     30.   111.          0.             4.51     9.01
     31.   112.          0.             4.51    -3.64
     32.   200.          0.             0.       0.
     33.   9999.
     34.   101.   1.   124.
     35.  -1.
     36.   200.  4.2         4.1       1.4       3.0        113.8
     37.  -1.
     38.  FINISH
              A    A    A    A    A    A    A    A    A    A    A    A    A    A
```

AEP * 150T CRANE * 60T LOAD * FIXED SUPPORT TO GIRDER * WELDS * B * OBE

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

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

	X	Y	Z
CENTROIDS, X AXIS.........		-0.00	-0.00
Y AXIS.........	0.00		-0.00
Z AXIS.........	0.00	-0.00	
SHEAR AREAS................	5.95	12.69	11.54
POLAR MOMENTS OF INERTIA..	375.05	165.39	0.18
TRANSLATED FORCES.........	4.20	4.10	1.40
TRANSLATED MOMENTS........	3.00	113.80	0.00

NUMBER OF FORCE DEFINITION NODES... 1

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

DIRECT STRESSES ARE EQUALLY DISTRIBUTED THROUGHOUT SHEAR AREA
DRX 0.7 DRY 0.3 DRZ 0.1

3-D LINE ELEMENT 1 SIZE 0.247 LENGTH 5.000 AREA 0.873
STRESS AT NODES 101,102 6.9, 3.5 ALLOWABLE 20.4
STRESS EXPANSION FOR NODE 101

6.2	-0.0	-0.1	0.0	0.0	0.0

STRESS EXPANSION FOR NODE 102

2.8	-0.0	-0.0	0.0	0.0	0.0

3-D LINE ELEMENT 2 SIZE 0.247 LENGTH 7.020 AREA 1.226
STRESS AT NODES 103,104 3.1, 3.1 ALLOWABLE 20.4
STRESS EXPANSION FOR NODE 103

2.4	-0.0	-0.0	0.0	0.0	0.0

STRESS EXPANSION FOR NODE 104

-2.4	-0.0	0.0	0.0	0.0	0.0

3-D LINE ELEMENT 3 SIZE 0.247 LENGTH 5.000 AREA 0.873
STRESS AT NODES 105,106 3.5, 6.9 ALLOWABLE 20.4
STRESS EXPANSION FOR NODE 105

-2.8	-0.0	0.0	0.0	0.0	0.0

STRESS EXPANSION FOR NODE 106

-6.2	-0.0	0.1	0.0	0.0	0.0

3-D LINE ELEMENT 4 SIZE 0.247 LENGTH 5.000 AREA 0.873
STRESS AT NODES 113,114 6.9, 3.5 ALLOWABLE 20.4
STRESS EXPANSION FOR NODE 113

6.2	0.0	-0.1	0.0	-0.0	0.0

STRESS EXPANSION FOR NODE 114

2.8	0.0	-0.0	0.0	-0.0	0.0

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AEP * 150T CRANE * 60T LOAD * FIXED SUPPORT TO GIRDER * WELDS * B * OBE

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

3-D LINE ELEMENT     5     SIZE    0.247    LENGTH    7.020    AREA    1.226
  STRESS AT NODES 115,116          3.1,          3.1   ALLOWABLE        20.4
  STRESS EXPANSION FOR NODE 115
        2.4          0.0         -0.0          0.0         -0.0          0.0
  STRESS EXPANSION FOR NODE 116
       -2.4          0.0          0.0          0.0         -0.0          0.0

3-D LINE ELEMENT     6     SIZE    0.247    LENGTH    5.000    AREA    0.873
  STRESS AT NODES 117,118          3.5,          6.9   ALLOWABLE        20.4
  STRESS EXPANSION FOR NODE 117
       -2.8          0.0          0.0          0.0         -0.0          0.0
  STRESS EXPANSION FOR NODE 118
       -6.2          0.0          0.1          0.0         -0.0          0.0

3-D LINE ELEMENT     7     SIZE    0.313    LENGTH    3.815    AREA    0.843
  STRESS AT NODES 102,107          0.4,          0.4   ALLOWABLE        20.4
  STRESS EXPANSION FOR NODE 102
        0.0          0.0         -0.0          0.0          0.0          0.0
  STRESS EXPANSION FOR NODE 107
        0.0          0.0         -0.0          0.0          0.0          0.0

3-D LINE ELEMENT     8     SIZE    0.313    LENGTH    3.815    AREA    0.843
  STRESS AT NODES 103,108          0.4,          0.4   ALLOWABLE        20.4
  STRESS EXPANSION FOR NODE 103
        0.0          0.0         -0.0          0.0          0.0          0.0
  STRESS EXPANSION FOR NODE 108
        0.0          0.0         -0.0          0.0          0.0          0.0

3-D LINE ELEMENT     9     SIZE    0.313    LENGTH    3.815    AREA    0.843
  STRESS AT NODES 104,109          0.4,          0.4   ALLOWABLE        20.4
  STRESS EXPANSION FOR NODE 104
        0.0          0.0          0.0          0.0          0.0          0.0
  STRESS EXPANSION FOR NODE 109
        0.0          0.0          0.0          0.0          0.0          0.0

3-D LINE ELEMENT    10     SIZE    0.313    LENGTH    3.815    AREA    0.843
  STRESS AT NODES 105,110          0.4,          0.4   ALLOWABLE        20.4
  STRESS EXPANSION FOR NODE 105
        0.0          0.0          0.0          0.0          0.0          0.0
  STRESS EXPANSION FOR NODE 110
        0.0          0.0          0.0          0.0          0.0          0.0

3-D LINE ELEMENT    11     SIZE    0.313    LENGTH    3.815    AREA    0.843
  STRESS AT NODES 114,119          0.4,          0.4   ALLOWABLE        20.4
  STRESS EXPANSION FOR NODE 114
        0.0          0.0         -0.0          0.0          0.0          0.0
  STRESS EXPANSION FOR NODE 119
        0.0          0.0         -0.0          0.0          0.0          0.0

3-D LINE ELEMENT    12     SIZE    0.313    LENGTH    3.815    AREA    0.843
  STRESS AT NODES 115,120          0.4,          0.4   ALLOWABLE        20.4
  STRESS EXPANSION FOR NODE 115
        0.0          0.0         -0.0          0.0          0.0          0.0
  STRESS EXPANSION FOR NODE 120
        0.0          0.0         -0.0          0.0          0.0          0.0
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MJM 9-10-87

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AEP * 150T CRANE * 60T LOAD * FIXED SUPPORT TO GIRDER * WELDS * B * OBE

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

3-D LINE ELEMENT   13    SIZE    0.313   LENGTH    3.815   AREA    0.843
 STRESS AT NODES 116,121          0.4,        0.4   ALLOWABLE      20.4
 STRESS EXPANSION FOR NODE 116
       0.0          0.0         0.0         0.0          0.0          0.0
 STRESS EXPANSION FOR NODE 121
       0.0          0.0         0.0         0.0          0.0          0.0

3-D LINE ELEMENT   14    SIZE    0.313   LENGTH    3.815   AREA    0.843
 STRESS AT NODES 117,122          0.4,        0.4   ALLOWABLE      20.4
 STRESS EXPANSION FOR NODE 117
       0.0          0.0         0.0         0.0          0.0          0.0
 STRESS EXPANSION FOR NODE 122
       0.0          0.0         0.0         0.0          0.0          0.0

3-D LINE ELEMENT   15    SIZE    0.313   LENGTH   12.650   AREA    2.795
 STRESS AT NODES 111,112          0.2,        0.2   ALLOWABLE      20.4
 STRESS EXPANSION FOR NODE 111
       0.0          0.0         0.0         0.0          0.0          0.0
 STRESS EXPANSION FOR NODE 112
       0.0          0.0         0.0         0.0          0.0          0.0

3-D LINE ELEMENT   16    SIZE    0.313   LENGTH   12.650   AREA    2.795
 STRESS AT NODES 123,124          0.2,        0.2   ALLOWABLE      20.4
 STRESS EXPANSION FOR NODE 123
       0.0          0.0         0.0         0.0         -0.0          0.0
 STRESS EXPANSION FOR NODE 124
       0.0          0.0         0.0         0.0         -0.0          0.0

FORCE DEFINITION NODE ABSOLUTE   ELEMENT   17   NODE 200
  FX           4.20 ;  FY          4.10 ;  FZ          1.40
  MX           3.00 ;  MY        113.80 ;  MZ          0.00

MAXIMUM ABSOLUTE STRESS ON ELEMENT     1 =          6.9  KSI

***** JOB COMPLETED *****
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#73302

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                                   ***** CONSYS INPUT DATA LISTING *****        09/09/87
                                   ASZ                 PAGE 4-128    OF 182
         5    10   15   20   25   30   35   40   45   50   55   60   65   70   7
         V    V    V    V    V    V    V    V    V    V    V    V    V    V
  1. AEP * 150T CRANE * 60T LOAD * FIXED SUPPORT TO GIRDER * WELDS * B * SSE
  2. 79508 ASZ  1.   0.   0.   1.                       1.
  3.  1.    1.                                            MJM 9-10-87
  4.  2.   5.
  5. -1.
  6.  0.3125    27.8                1.        11.
  7.  0.3125    27.8                1.        12.
  8.  0.247     27.8                1.
  9. -1.
 10. 101. 102.           1.   3.        3.   2.   2.
 11. 113. 114.           1.   3.
 12. 102. 107.           1.   1.        4.        2.
 13. 114. 119.           1.   1.
 14. 111. 112.           1.   2.        2.   12.
 15. 200.                2.
 16. -1.
 17. -12.  6.               -0.35
 18.  101.          0.       0.175     9.01
 19.  102.          0.       0.175     4.01
 20.  103.          0.       0.175     3.51
 21.  104.          0.       0.175    -3.51
 22.  105.          0.       0.175    -4.01
 23.  106.          0.       0.175    -9.01
 24. -12.  4.               -7.98
 25.  107.          0.       3.99      4.01
 26.  108.          0.       3.99      3.51
 27.  109.          0.       3.99     -3.51
 28.  110.          0.       3.99     -4.01
 29. -12.  2.               -9.02
 30.  111.          0.       4.51      9.01
 31.  112.          0.       4.51     -3.64
 32.  200.          0.        0.       0.
 33. 9999.
 34. 101.   1.  124.
 35. -1.
 36.  200. 7.8      7.6      1.6      5.6       198.2
 37. -1.
 38. FINISH
         A    A    A    A    A    A    A    A    A    A    A    A    A    A
```

AEP * 150T CRANE * 60T LOAD * FIXED SUPPORT TO GIRDER * WELDS * B * SSE

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

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

	X	Y	Z
CENTROIDS, X AXIS.........		-0.00	-0.00
Y AXIS.........	0.00		-0.00
Z AXIS.........	0.00	-0.00	
SHEAR AREAS..............	5.95	12.69	11.54
POLAR MOMENTS OF INERTIA..	375.05	165.39	0.18
TRANSLATED FORCES.........	7.80	7.60	1.60
TRANSLATED MOMENTS........	5.60	198.20	0.00

NUMBER OF FORCE DEFINITION NODES... 1

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

DIRECT STRESSES ARE EQUALLY DISTRIBUTED THROUGHOUT SHEAR AREA
DRX 1.3 DRY 0.6 DRZ 0.1

3-D LINE ELEMENT 1 SIZE 0.247 LENGTH 5.000 AREA 0.873
STRESS AT NODES 101, 102 12.1, 6.2 ALLOWABLE 27.8
STRESS EXPANSION FOR NODE 101

10.8	-0.0	-0.1	0.0	0.0	0.0

STRESS EXPANSION FOR NODE 102

4.8	-0.0	-0.1	0.0	0.0	0.0

3-D LINE ELEMENT 2 SIZE 0.247 LENGTH 7.020 AREA 1.226
STRESS AT NODES 103, 104 5.6, 5.6 ALLOWABLE 27.8
STRESS EXPANSION FOR NODE 103

4.2	-0.0	-0.1	0.0	0.0	0.0

STRESS EXPANSION FOR NODE 104

-4.2	-0.0	0.1	0.0	0.0	0.0

3-D LINE ELEMENT 3 SIZE 0.247 LENGTH 5.000 AREA 0.873
STRESS AT NODES 105, 106 6.2, 12.1 ALLOWABLE 27.8
STRESS EXPANSION FOR NODE 105

-4.8	-0.0	0.1	0.0	0.0	0.0

STRESS EXPANSION FOR NODE 106

-10.8	-0.0	0.1	0.0	0.0	0.0

3-D LINE ELEMENT 4 SIZE 0.247 LENGTH 5.000 AREA 0.873
STRESS AT NODES 113, 114 12.1, 6.2 ALLOWABLE 27.8
STRESS EXPANSION FOR NODE 113

10.8	0.0	-0.1	0.0	-0.0	0.0

STRESS EXPANSION FOR NODE 114

4.8	0.0	-0.1	0.0	-0.0	0.0

MJM 9-10-87

AEP * 150T CRANE * 60T LOAD * FIXED SUPPORT TO GIRDER * WELDS * B * SSE

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

```
3-D LINE ELEMENT   5   SIZE   0.247   LENGTH   7.020   AREA   1.226
 STRESS AT NODES 115,116        5.6,      5.6   ALLOWABLE      27.8
 STRESS EXPANSION FOR NODE 115
      4.2         0.0        -0.1        0.0        -0.0        0.0
 STRESS EXPANSION FOR NODE 116
     -4.2         0.0         0.1        0.0        -0.0        0.0

3-D LINE ELEMENT   6   SIZE   0.247   LENGTH   5.000   AREA   0.873
 STRESS AT NODES 117,118        6.2,     12.1   ALLOWABLE      27.8
 STRESS EXPANSION FOR NODE 117
     -4.8         0.0         0.1        0.0        -0.0        0.0
 STRESS EXPANSION FOR NODE 118
    -10.8         0.0         0.1        0.0        -0.0        0.0

3-D LINE ELEMENT   7   SIZE   0.313   LENGTH   3.815   AREA   0.843
 STRESS AT NODES 102,107        0.7,      0.7   ALLOWABLE      27.8
 STRESS EXPANSION FOR NODE 102
      0.0         0.0        -0.1        0.0         0.0        0.0
 STRESS EXPANSION FOR NODE 107
      0.0         0.0        -0.1        0.0         0.0        0.0

3-D LINE ELEMENT   8   SIZE   0.313   LENGTH   3.815   AREA   0.843
 STRESS AT NODES 103,108        0.7,      0.7   ALLOWABLE      27.8
 STRESS EXPANSION FOR NODE 103
      0.0         0.0        -0.1        0.0         0.0        0.0
 STRESS EXPANSION FOR NODE 108
      0.0         0.0        -0.1        0.0         0.0        0.0

3-D LINE ELEMENT   9   SIZE   0.313   LENGTH   3.815   AREA   0.843
 STRESS AT NODES 104,109        0.7,      0.7   ALLOWABLE      27.8
 STRESS EXPANSION FOR NODE 104
      0.0         0.0         0.1        0.0         0.0        0.0
 STRESS EXPANSION FOR NODE 109
      0.0         0.0         0.1        0.0         0.0        0.0

3-D LINE ELEMENT  10   SIZE   0.313   LENGTH   3.815   AREA   0.843
 STRESS AT NODES 105,110        0.7,      0.7   ALLOWABLE      27.8
 STRESS EXPANSION FOR NODE 105
      0.0         0.0         0.1        0.0         0.0        0.0
 STRESS EXPANSION FOR NODE 110
      0.0         0.0         0.1        0.0         0.0        0.0

3-D LINE ELEMENT  11   SIZE   0.313   LENGTH   3.815   AREA   0.843
 STRESS AT NODES 114,119        0.7,      0.7   ALLOWABLE      27.8
 STRESS EXPANSION FOR NODE 114
      0.0         0.0        -0.1        0.0         0.0        0.0
 STRESS EXPANSION FOR NODE 119
      0.0         0.0        -0.1        0.0         0.0        0.0

3-D LINE ELEMENT  12   SIZE   0.313   LENGTH   3.815   AREA   0.843
 STRESS AT NODES 115,120        0.7,      0.7   ALLOWABLE      27.8
 STRESS EXPANSION FOR NODE 115
      0.0         0.0        -0.1        0.0         0.0        0.0
 STRESS EXPANSION FOR NODE 120
      0.0         0.0        -0.1        0.0         0.0        0.0
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AEP * 150T CRANE * 60T LOAD * FIXED SUPPORT TO GIRDER * WELDS * B * SSE

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

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3-D LINE ELEMENT  13   SIZE   0.313   LENGTH   3.815   AREA   0.843
  STRESS AT NODES 116,121     0.7,      0.7   ALLOWABLE       27.8
  STRESS EXPANSION FOR NODE 116
        0.0        0.0        0.1        0.0        0.0        0.0
  STRESS EXPANSION FOR NODE 121
        0.0        0.0        0.1        0.0        0.0        0.0

3-D LINE ELEMENT  14   SIZE   0.313   LENGTH   3.815   AREA   0.843
  STRESS AT NODES 117,122     0.7,      0.7   ALLOWABLE       27.8
  STRESS EXPANSION FOR NODE 117
        0.0        0.0        0.1        0.0        0.0        0.0
  STRESS EXPANSION FOR NODE 122
        0.0        0.0        0.1        0.0        0.0        0.0

3-D LINE ELEMENT  15   SIZE   0.313   LENGTH  12.650   AREA   2.795
  STRESS AT NODES 111,112     0.2,      0.2   ALLOWABLE       27.8
  STRESS EXPANSION FOR NODE 111
        0.0        0.0        0.0        0.0        0.1        0.0
  STRESS EXPANSION FOR NODE 112
        0.0        0.0        0.0        0.0        0.1        0.0

3-D LINE ELEMENT  16   SIZE   0.313   LENGTH  12.650   AREA   2.795
  STRESS AT NODES 123,124     0.2,      0.2   ALLOWABLE       27.8
  STRESS EXPANSION FOR NODE 123
        0.0        0.0        0.0        0.0       -0.1        0.0
  STRESS EXPANSION FOR NODE 124
        0.0        0.0        0.0        0.0       -0.1        0.0

FORCE DEFINITION NODE ABSOLUTE   ELEMENT   17   NODE 200
  FX          7.80 ;   FY          7.60 ;   FZ          1.60
  MX          5.60 ;   MY        198.20 ;   MZ          0.00

MAXIMUM ABSOLUTE STRESS ON ELEMENT    1 =        12.1 KSI

***** JOB COMPLETED *****
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#79508 9-9-87

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

ASZ — PAGE 4-132 CF 182

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              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 * 60T LOAD *  SUPPORT TO GIRDER * WELDS * C * OBE
  2.  79508 ASZ  1.   0.    0.    1.                        1.
  3.  1.    1.                                              MJM 9-10-87
  4.  2.    5.
  5.  -1.
  6.  0.3125    20.4                  1.
  7.  0.3125    17.0                  1.
  8.  -1.
  9.  101.  102.          1.    1.         3.
 10.  105.  106.          1.    2.
 11.  200.                2.
 12.  -1.
 13.  101.           4.56       4.51   0.
 14.  102.           0.         4.51   0.
 15.  103.           0.        -4.51   0.
 16.  104.           4.56      -4.51   0.
 17.  105.           5.05      -4.01   0.
 18.  106.           5.05       4.01   0.
 19.   200.          0.         0.     0.
 20.  9999.
 21.   101.  1.   106.
 22.  -1.
 23.  200.           4.1                                         47.9
 24.  -1.
 25.  FINISH
              A     A     A     A     A     A     A     A     A     A     A     A     A
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AEP * 150T CRANE * 60T LOAD * SUPPORT TO GIRDER * WELDS * C * OBE

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

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

	X	Y	Z
CENTROIDS, X AXIS.........		-0.00	0.00
Y AXIS.........	2.34		0.00
Z AXIS.........	2.34	-0.00	
SHEAR AREAS...............	5.78	5.78	5.78
POLAR MOMENTS OF INERTIA..	64.00	27.43	91.43
TRANSLATED FORCES.........	0.00	4.10	0.00
TRANSLATED MOMENTS........	0.00	0.00	57.51

NUMBER OF FORCE DEFINITION NODES... 1

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

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

3-D LINE ELEMENT 1 SIZE 0.313 LENGTH 4.560 AREA 1.008
STRESS AT NODES 101, 102 3.5, 3.6 ALLOWABLE 20.4
STRESS EXPANSION FOR NODE 101
0.0 -2.8 0.0 1.4 0.0 0.0
STRESS EXPANSION FOR NODE 102
0.0 -2.8 0.0 -1.5 0.0 0.0

3-D LINE ELEMENT 2 SIZE 0.313 LENGTH 9.020 AREA 1.993
STRESS AT NODES 102, 103 3.6, 3.6 ALLOWABLE 20.4
STRESS EXPANSION FOR NODE 102
0.0 -2.8 0.0 -1.5 0.0 0.0
STRESS EXPANSION FOR NODE 103
0.0 2.8 0.0 -1.5 0.0 0.0

3-D LINE ELEMENT 3 SIZE 0.313 LENGTH 4.560 AREA 1.008
STRESS AT NODES 103, 104 3.6, 3.5 ALLOWABLE 20.4
STRESS EXPANSION FOR NODE 103
0.0 2.8 0.0 -1.5 0.0 0.0
STRESS EXPANSION FOR NODE 104
0.0 2.8 0.0 1.4 0.0 0.0

3-D LINE ELEMENT 4 SIZE 0.313 LENGTH 8.020 AREA 1.772
STRESS AT NODES 105, 106 3.5, 3.5 ALLOWABLE 17.0
STRESS EXPANSION FOR NODE 105
0.0 2.5 0.0 1.7 0.0 0.0
STRESS EXPANSION FOR NODE 106
0.0 -2.5 0.0 1.7 0.0 0.0

AEP * 150T CRANE * 60T LOAD * SUPPORT TO GIRDER * WELDS * C * OBE

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

FORCE DEFINITION NODE ABSOLUTE　ELEMENT　5　NODE 200

FX	0.00 ;	FY	4.10 ;	FZ	0.00
MX	0.00 ;	MY	0.00 ;	MZ	47.90

MAXIMUM ABSOLUTE STRESS ON ELEMENT　1 =　　3.6 KSI

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

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                    ***** CONSYS INPUT DATA LISTING *****
                    ASZ                 PAGE 4-135   OF 182
          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 * 60T LOAD *  SUPPORT TO GIRDER * WELDS * C * SSE
  2.  79508 ASZ  1.   0.   0.   1.                          1.
  3.   1.   1.                                        MJM 9-10-87
  4.   2.   5.
  5.  -1.
  6.   0.3125    27.8              1.
  7.   0.3125    23.1              1.
  8.  -1.
  9.  101. 102.           1.   1.        3.
 10.  105. 106.           1.   2.
 11.  200.                2.
 12.  -1.
 13.  101.           4.56      4.51      0.
 14.  102.           0.        4.51      0.
 15.  103.           0.       -4.51      0.
 16.  104.           4.56     -4.51      0.
 17.  105.           5.05     -4.01      0.
 18.  106.           5.05      4.01      0.
 19.   200.          0.        0.        0.
 20.  9999.
 21.   101.    1.   106.
 22.  -1.
 23.  200.           7.6                                       89.5
 24.  -1.
 25.  FINISH
          A    A    A    A    A    A    A    A    A    A    A    A    A
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MJM 9-10-87

AEP * 150T CRANE * 60T LOAD * SUPPORT TO GIRDER * WELDS * C * SSE

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

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

	X	Y	Z
CENTROIDS, X AXIS.........		-0.00	0.00
Y AXIS.........	2.34		0.00
Z AXIS.........	2.34	-0.00	
SHEAR AREAS...............	5.78	5.78	5.78
POLAR MOMENTS OF INERTIA..	64.00	27.43	91.43
TRANSLATED FORCES.........	0.00	7.60	0.00
TRANSLATED MOMENTS........	0.00	0.00	107.31

NUMBER OF FORCE DEFINITION NODES... 1

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

DIRECT STRESSES ARE EQUALLY DISTRIBUTED THROUGHOUT SHEAR AREA
DRX 0.0 DRY 1.3 DRZ 0.0

3-D LINE ELEMENT 1 SIZE 0.313 LENGTH 4.560 AREA 1.008
STRESS AT NODES 101, 102 6.6, 6.7 ALLOWABLE 27.8

STRESS EXPANSION FOR NODE 101					
0.0	-5.3	0.0	2.6	0.0	0.0
STRESS EXPANSION FOR NODE 102					
0.0	-5.3	0.0	-2.7	0.0	0.0

3-D LINE ELEMENT 2 SIZE 0.313 LENGTH 9.020 AREA 1.993
STRESS AT NODES 102, 103 6.7, 6.7 ALLOWABLE 27.8

STRESS EXPANSION FOR NODE 102					
0.0	-5.3	0.0	-2.7	0:0	0.0
STRESS EXPANSION FOR NODE 103					
0.0	5.3	0.0	-2.7	0.0	0.0

3-D LINE ELEMENT 3 SIZE 0.313 LENGTH 4.560 AREA 1.008
STRESS AT NODES 103, 104 6.7, 6.6 ALLOWABLE 27.8

STRESS EXPANSION FOR NODE 103					
0.0	5.3	0.0	-2.7	0.0	0.0
STRESS EXPANSION FOR NODE 104					
0.0	5.3	0.0	2.6	0.0	0.0

3-D LINE ELEMENT 4 SIZE 0.313 LENGTH 8.020 AREA 1.772
STRESS AT NODES 105, 106 6.5, 6.5 ALLOWABLE 23.1

STRESS EXPANSION FOR NODE 105					
0.0	4.7	0.0	3.2	0.0	0.0
STRESS EXPANSION FOR NODE 106					
0.0	-4.7	0.0	3.2	0.0	0.0

MJM 9-10-87

AEP * 150T CRANE * 60T LOAD * SUPPORT TO GIRDER * WELDS * C * SSE

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

FORCE DEFINITION NODE ABSOLUTE   ELEMENT 5   NODE 200

FX	0.00 ;	FY	7.60 ;	FZ	0.00
MX	0.00 ;	MY	0.00 ;	MZ	89.50

MAXIMUM ABSOLUTE STRESS ON ELEMENT 1 = 6.7 KSI

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

#79508


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             5    10    15    20    25    30    35    40    45    50    55    60    65    70    75
             V     V     V     V     V     V     V     V     V     V     V     V     V     V     V
    1.  AEP * 150T CRANE * 60T LOAD * FLT SUPPORT TO GIRDER * WELDS * B' * OBE
    2.  79508 ASZ  1.    0.    0.    1.                                 1.
    3.   1.    1.                                                     MJM 9-10-87
    4.   2.    5.
    5.  -1.
    6.   0.3125     17.0                  1.         11.
    7.   0.247      20.4                  1.
    8.  -1.
    9.  101.  102.              1.    2.          3.    2.    2.
   10.  113.  114.              1.    2.
   11.  102.  107.              1.    1.          4.          2.
   12.  114.  119.              1.    1.
   13.  200.                    2.
   14.  -1.
   15.  -12.   6.                    -0.558
   16.   101.             0.          0.279       9.01
   17.   102.             0.          0.279       4.01
   18.   103.             0.          0.279       3.51
   19.   104.             0.          0.279      -3.51
   20.   105.             0.          0.279      -4.01
   21.   106.             0.          0.279      -9.01
   22.  -12.   4.                    -6.35
   23.   107.             0.          3.175       4.01
   24.   108.             0.          3.175       3.51
   25.   109.             0.          3.175      -3.51
   26.   110.             0.          3.175      -4.01
   27.   200.             0.           0.         0.
   28.  9999.
   29.   101.   1.   122.
   30.  -1.
   31.   200.  4.2        2.8        1.4        2.2        113.8      10.6
   32.  -1.
   33.  FINISH
             A     A     A     A     A     A     A     A     A     A     A     A     A     A
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MJM 9-10-87

AEP * 150T CRANE * 60T LOAD * FLT SUPPORT TO GIRDER * WELDS * B' * OBE

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

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

	X	Y	Z
CENTROIDS, X AXIS.........		-0.00	-0.00
Y AXIS.........	0.00		-0.00
Z AXIS.........	0.00	-0.00	
SHEAR AREAS...............	5.95	11.06	5.95
POLAR MOMENTS OF INERTIA..	238.55	165.39	0.46
TRANSLATED FORCES.........	4.20	2.80	1.40
TRANSLATED MOMENTS........	2.20	113.80	10.60

NUMBER OF FORCE DEFINITION NODES... 1

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

DIRECT STRESSES ARE EQUALLY DISTRIBUTED THROUGHOUT SHEAR AREA
DRX 0.7 DRY 0.3 DRZ 0.2

3-D LINE ELEMENT 1 SIZE 0.247 LENGTH 5.000 AREA 0.873
STRESS AT NODES 101, 102 13.3, 9.9 ALLOWABLE 20.4
STRESS EXPANSION FOR NODE 101
6.2 -6.4 -0.1 0.0 0.0 0.0
STRESS EXPANSION FOR NODE 102
2.8 -6.4 -0.0 0.0 0.0 0.0

3-D LINE ELEMENT 2 SIZE 0.247 LENGTH 7.020 AREA 1.226
STRESS AT NODES 103, 104 9.5, 9.5 ALLOWABLE 20.4
STRESS EXPANSION FOR NODE 103
2.4 -6.4 -0.0 0.0 0.0 0.0
STRESS EXPANSION FOR NODE 104
-2.4 -6.4 0.0 0.0 0.0 0.0

3-D LINE ELEMENT 3 SIZE 0.247 LENGTH 5.000 AREA 0.873
STRESS AT NODES 105, 106 9.9, 13.3 ALLOWABLE 20.4
STRESS EXPANSION FOR NODE 105
-2.8 -6.4 0.0 0.0 0.0 0.0
STRESS EXPANSION FOR NODE 106
-6.2 -6.4 0.1 0.0 0.0 0.0

3-D LINE ELEMENT 4 SIZE 0.247 LENGTH 5.000 AREA 0.873
STRESS AT NODES 113, 114 13.3, 9.9 ALLOWABLE 20.4
STRESS EXPANSION FOR NODE 113
6.2 6.4 -0.1 0.0 -0.0 0.0
STRESS EXPANSION FOR NODE 114
2.8 6.4 -0.0 0.0 -0.0 0.0

*** CONSYS ANALYSIS PROGRAM *** REQUISITION 79508 DATE 09/10/87
VERSION 4.2 RELEASED 12/03/82 BY: ASZ PAGE 4-140 OF 182
MJM 9-10-87

AEP * 150T CRANE * 60T LOAD * FLT SUPPORT TO GIRDER * WELDS * B' * OBE

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

3-D LINE ELEMENT 5 SIZE 0.247 LENGTH 7.020 AREA 1.226
STRESS AT NODES 115,116 9.5, 9.5 ALLOWABLE 20.4
STRESS EXPANSION FOR NODE 115
2.4 6.4 -0.0 0.0 -0.0 0.0
STRESS EXPANSION FOR NODE 116
-2.4 6.4 0.0 0.0 -0.0 0.0

3-D LINE ELEMENT 6 SIZE 0.247 LENGTH 5.000 AREA 0.873
STRESS AT NODES 117,118 9.9, 13.3 ALLOWABLE 20.4
STRESS EXPANSION FOR NODE 117
-2.8 6.4 0.0 0.0 -0.0 0.0
STRESS EXPANSION FOR NODE 118
-6.2 6.4 0.1 0.0 -0.0 0.0

3-D LINE ELEMENT 7 SIZE 0.313 LENGTH 2.896 AREA 0.640
STRESS AT NODES 102,107 0.3, 0.3 ALLOWABLE 17.0
STRESS EXPANSION FOR NODE 102
0.0 0.0 -0.0 0.0 0.0 0.0
STRESS EXPANSION FOR NODE 107
0.0 0.0 -0.0 0.0 0.0 0.0

3-D LINE ELEMENT 8 SIZE 0.313 LENGTH 2.896 AREA 0.640
STRESS AT NODES 103,108 0.3, 0.3 ALLOWABLE 17.0
STRESS EXPANSION FOR NODE 103
0.0 0.0 -0.0 0.0 0.0 0.0
STRESS EXPANSION FOR NODE 108
0.0 0.0 -0.0 0.0 0.0 0.0

3-D LINE ELEMENT 9 SIZE 0.313 LENGTH 2.896 AREA 0.640
STRESS AT NODES 104,109 0.3, 0.3 ALLOWABLE 17.0
STRESS EXPANSION FOR NODE 104
0.0 0.0 0.0 0.0 0.0 0.0
STRESS EXPANSION FOR NODE 109
0.0 0.0 0.0 0.0 0.0 0.0

3-D LINE ELEMENT 10 SIZE 0.313 LENGTH 2.896 AREA 0.640
STRESS AT NODES 105,110 0.3, 0.3 ALLOWABLE 17.0
STRESS EXPANSION FOR NODE 105
0.0 0.0 0.0 0.0 0.0 0.0
STRESS EXPANSION FOR NODE 110
0.0 0,0 0.0 0.0 0.0 0.0

3-D LINE ELEMENT 11 SIZE 0.313 LENGTH 2.896 AREA 0.640
STRESS AT NODES 114,119 0.3, 0.3 ALLOWABLE 17.0
STRESS EXPANSION FOR NODE 114
0.0 0.0 -0.0 0.0 0.0 0.0
STRESS EXPANSION FOR NODE 119
0.0 0.0 -0.0 0.0 0.0 0.0

3-D LINE ELEMENT 12 SIZE 0.313 LENGTH 2.896 AREA 0.640
STRESS AT NODES 115,120 0.3, 0.3 ALLOWABLE 17.0
STRESS EXPANSION FOR NODE 115
0.0 0.0 -0.0 0.0 0.0 0.0
STRESS EXPANSION FOR NODE 120
0.0 0.0 -0.0 0.0 0.0 0.0

AEP * 150T CRANE * 60T LOAD * FLT SUPPORT TO GIRDER * WELDS * B' * OBE

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

3-D LINE ELEMENT 13   SIZE 0.313   LENGTH 2.896   AREA 0.640
STRESS AT NODES 116,121   0.3,   0.3   ALLOWABLE 17.0
STRESS EXPANSION FOR NODE 116

0.0	0.0	0.0	0.0	0.0	0.0

STRESS EXPANSION FOR NODE 121

0.0	0.0	0.0	0.0	0.0	0.0

3-D LINE ELEMENT 14   SIZE 0.313   LENGTH 2.896   AREA 0.640
STRESS AT NODES 117,122   0.3,   0.3   ALLOWABLE 17.0
STRESS EXPANSION FOR NODE 117

0.0	0.0	0.0	0.0	0.0	0.0

STRESS EXPANSION FOR NODE 122

0.0	0.0	0.0	0.0	0.0	0.0

FORCE DEFINITION NODE ABSOLUTE   ELEMENT 15   NODE 200
FX   4.20 ;   FY   2.80 ;   FZ   1.40
MX   2.20 ;   MY   113.80 ;   MZ   10.60

MAXIMUM ABSOLUTE STRESS ON ELEMENT 1 =   13.3 KSI

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

#73508

***** CONSYS INPUT DATA LISTING ***** 09/10/87

ASZ PAGE 4-142 OF 182

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                  5    10    15    20    25    30    35    40    45    50    55    60    65    70    75
                  V    V     V     V     V     V     V     V     V     V     V     V     V     V     V
         1.  AEP * 150T CRANE * 60T LOAD * FLT SUPPORT TO GIRDER * WELDS * B' * SSE
         2.  79508 ASZ  1.    0.    0.    1.                               1.'
         3.   1.    1.                                                   MJM 9-10-87
         4.   2.    5.
         5.  -1.
         6.   0.3125      23.1              1.         11.
         7.   0.247       27.8              1.
         8.  -1.
         9.  101.  102.             1.    2.        3.    2.    2.
        10.  113.  114.             1.    2.
        11.  102.  107.             1.    1.        4.          2.
        12.  114.  119.             1.    1.
        13.  200.                   2.
        14.  -1.
        15.  -12.   6.                   -0.558
        16.   101.           0.           0.279    9.01
        17.   102.           0.           0.279    4.01
        18.   103.           0.           0.279    3.51
        19.   104.           0.           0.279   -3.51
        20.   105.           0.           0.279   -4.01
        21.   106.           0.           0.279   -9.01
        22.  -12.   4.                   -6.35
        23.   107.           0.           3.175    4.01
        24.   108.           0.           3.175    3.51
        25.   109.           0.           3.175   -3.51
        26.   110.           0.           3.175   -4.01
        27.   200.           0.           0.       0.
        28.  9999.
        29.   101.   1.   122.
        30.  -1.
        31.   200.  7.8      4.8      1.6      3.8       198.2     19.9
        32.  -1.
        33.  FINISH
                  A    A     A     A     A     A     A     A     A     A     A     A     A     A
```

/87
2

*** CONSYS ANALYSIS PROGRAM *** REQUISITION 79508 DATE 09/10/87
VERSION 4.2 RELEASED 12/03/82 BY: ASZ PAGE 4-143 OF 182 SE
MJM 9-10-87

EP * 150T CRANE * 60T LOAD * FLT SUPPORT TO GIRDER * WELDS * B' * SSE

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

OAD STEP..... 1	DIRECTION, LOCATION OR AXIS		
	X	Y	Z
ENTROIDS, X AXIS.........		-0.00	-0.00
Y AXIS.........	0.00		-0.00
Z AXIS.........	0.00	-0.00	
HEAR AREAS................	5.95	11.06	5.95
OLAR MOMENTS OF INERTIA..	238.55	165.39	0.46
RANSLATED FORCES.........	7.80	4.80	1.60
RANSLATED MOMENTS........	3.80	198.20	19.90

UMBER OF FORCE DEFINITION NODES... 1

***** SYSTEM ELEMENT STESSES *****

IRECT STRESSES ARE EQUALLY DISTRIBUTED THROUGHOUT SHEAR AREA
DRX 1.3 DRY 0.4 DRZ 0.3

-D LINE ELEMENT 1 SIZE 0.247 LENGTH 5.000 AREA 0.873
STRESS AT NODES 101,102 24.1, 18.1 ALLOWABLE 27.8
STRESS EXPANSION FOR NODE 101

10.8	-12.0	-0.1	0.0	0.0	0.0

STRESS EXPANSION FOR NODE 102

4.8	-12.0	-0.1	0.0	0.0	0.0

-D LINE ELEMENT 2 SIZE 0.247 LENGTH 7.020 AREA 1.226
STRESS AT NODES 103,104 17.5, 17.5 ALLOWABLE 27.8
STRESS EXPANSION FOR NODE 103

4.2	-12.0	-0.1	0.0	0.0	0.0

STRESS EXPANSION FOR NODE 104

-4.2	-12.0	0.1	0.0	0.0	0.0

-D LINE ELEMENT 3 SIZE 0.247 LENGTH 5.000 AREA 0.873
STRESS AT NODES 105,106 18.1, 24.1 ALLOWABLE 27.8
STRESS EXPANSION FOR NODE 105

-4.8	-12.0	0.1	0.0	0.0	0.0

STRESS EXPANSION FOR NODE 106

-10.8	-12.0	0.1	0.0	0.0	0.0

-D LINE ELEMENT 4 SIZE 0.247 LENGTH 5.000 AREA 0.873
STRESS AT NODES 113,114 24.1, 18.1 ALLOWABLE 27.8
STRESS EXPANSION FOR NODE 113

10.8	12.0	-0.1	0.0	-0.0	0.0

STRESS EXPANSION FOR NODE 114

4.8	12.0	-0.1	0.0	-0.0	0.0

.0
.0
0.0
0.0
0.0
0.0
0.0
0.0
0.0
0.0
0.0
0.0
0.0
0.0
0.0
0.0
0.0
0.0

AEP * 150T CRANE * 60T LOAD * FLT SUPPORT TO GIRDER * WELDS * B' * SSE

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

3-D LINE ELEMENT 13 SIZE 0.313 LENGTH 2.896 AREA 0.640
STRESS AT NODES 116,121 0.5, 0.5 ALLOWABLE 23.1
STRESS EXPANSION FOR NODE 116
0.0 0.0 0.1 0.0 0.0 0.0
STRESS EXPANSION FOR NODE 121
0.0 0.0 0.1 0.0 0.0 0.0

3-D LINE ELEMENT 14 SIZE 0.313 LENGTH 2.896 AREA 0.640
STRESS AT NODES 117,122 0.5, 0.5 ALLOWABLE 23.1
STRESS EXPANSION FOR NODE 117
0.0 0.0 0.1 0.0 0.0 0.0
STRESS EXPANSION FOR NODE 122
0.0 0.0 0.1 0.0 0.0 0.0

FORCE DEFINITION NODE ABSOLUTE ELEMENT 15 NODE 200
FX 7.80 ; FY 4.80 ; FZ 1.60
MX 3.80 ; MY 198.20 ; MZ 19.90

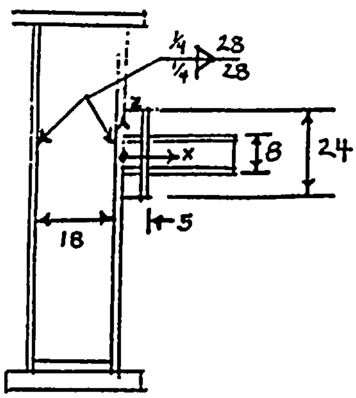
MAXIMUM ABSOLUTE STRESS ON ELEMENT 1 = 24.1 KSI

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

FORM N-2494

WHITING REQN. 79508 DATE 8-6-87
BY MJM PAGE 4-46 OF 192
AS2 9-9-87

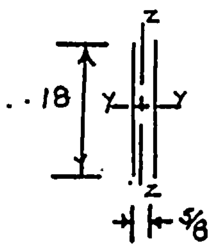
WELD OF DIAPHPAGM TO WEB AT MONORAIL SUPPORT - FLT



ASSUME 18 in OF WELD IS EFFECTIVE IN TRANSFERRING LOADINGS DUE TO F_x, M_y and M_z; OTHER LOADINGS ARE TRANSFERRED TO WEB IN SHEAR

MAX LOADS FROM TABLES B103 & B104

	OBE		SSE	
F_x	4.2	KIP	7.8	KIP
M_y	113.8	IN KIP	198.2	IN KIP
M_z	10.6	IN KIP	19.9	IN KIP

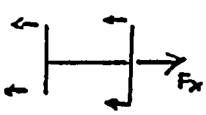


$A = 2\left(\frac{1}{4} \times .707\right) 18 = 6.36 \ in^2$

$I_{yy} = \frac{\left(\frac{1}{4}\times .707\right) 18^3}{6} = 171.8 \ in^4$

$I_{zz} = \frac{\left(\frac{1}{4}\times .707\right)(18)\left(\frac{5}{8}\right)^2}{2} = .6214 \ in^4$

F_x ½ TRANSFERRED TO FAR WEB



OBE

$\tau_x = \frac{4.2/2}{6.36} = .33$ KSI

SSE

$\tau_x = \frac{7.8/2}{6.36} = .61$ KSI

M_Y

TAKEN AS SIMPLY SUPPORTED BEAM

OBE

$$R = \frac{113.8}{18} = 6.32 \text{ KIP}$$

$$\tau_z = \frac{6.32}{6.36} = .99 \text{ KSI}$$

$$\tau_x = \frac{113.8(9)}{171.8} = 5.96 \text{ KSI}$$

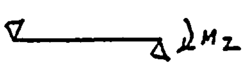
SSE

$$R = \frac{198.2}{18} = 11.0 \text{ KIP}$$

$$\tau_z = \frac{11.0}{6.36} = 1.73 \text{ KSI}$$

$$\tau_x = \frac{198.2(9)}{171.8} = 10.38 \text{ KSI}$$

M_Z



TAKEN AS SIMPLY SUPPORTED BEAM CARRING WHOLE M_Z - CONSERVATIVE BECAUSE WEB SPRING RATE WILL REDUCE SLIGHTLY

OBE

$$R = \frac{10.6}{18} = .59 \text{ KIP}$$

$$\tau_y = \frac{.59}{6.36} = .09 \text{ KSI}$$

$$\tau_x = \frac{10.6(5/16)}{.6214} = 5.33 \text{ KSI}$$

SSE

$$R = \frac{19.9}{18} = 1.10 \text{ KIP}$$

$$\tau_y = \frac{1.10}{6.36} = .17 \text{ KSI}$$

$$\tau_x = \frac{19.9(5/16)}{.6214} = 10.00 \text{ KSI}$$

COMBINED STRESS

OBE

$$\tau = [(.33+5.96+5.33)^2+(.09)^2+(.99)^2]^{1/2}$$
$$= 11.7 \text{ KSI}$$

ALLOWABLE 20.4 KSI

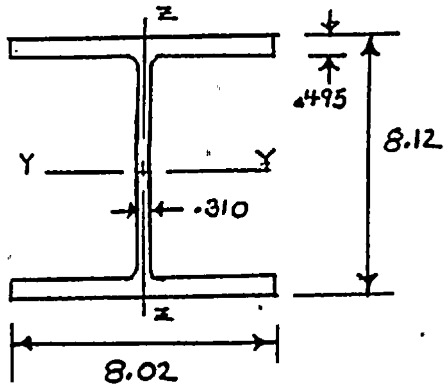
SSE

$$\tau = [(.61+10.38+10.03)^2+(.17)^2+(1.73)^2]^{1/2}$$
$$= 21.1 \text{ KSI}$$

ALLOWABLE 27.8 KSI

MONORAIL SUPPORTS

AFTER THE COMPLETION OF ALL COMPUTER RUNS, IT WAS DECIDED TO CHANGE THE SUPPORT BEAMS FROM A S8×18.4 TO A W8×35. THIS WILL HAVE AN INSIGNIFICANT EFFECT ON THE DYNAMIC RESPONSE OF THE CRANE. THE LOADINGS FROM THE COMPUTER MODEL WILL BE USED TO EVALUATE THIS NEW SECTION.



$A = 10.3\ in^2$

$I_{YY} = 127\ in^4$

$S_{YY} = 31.2\ in^3$

$I_{ZZ} = 42.6\ in^4$

$S_{ZZ} = 10.6\ in^3$

AN OVERSTRESS CONDITION FOR THIS MEMBER WAS INDICATED IN TABLES B13, B14, B15, B25, B26, B30 FOR THE OBE AND TABLES B16, B17, B18, B27, B28, B32 FOR THE SSE. THE MAXIMUM STRESS OCCURS FOR THE MAIN TROLLEY AT THE LHE WITH THE LOAD DOWN. (TABLES B14 AND B17). THE LOADING WHICH PRODUCE THIS STRESS ARE TAKEN FROM THE COMPUTER OUTPUTS:

OBE (PFANMEDO)

$F_x = 4.16$ KIP $F_y = 2.76$ KIP $F_z = 1.26$ KIP

$M_x = 2.16$ IN KIP $M_y = 98.46$ IN KIP $M_z = 39.41$ IN KIP

SSE (PFANMEDS)

$F_x = 7.78$ KIP $F_y = 4.84$ KIP $F_z = 1.39$ KIP

$M_x = 3.76$ IN KIP $M_y = 183.96$ IN KIP $M_z = 72.06$ IN KIP

{ELEMENT 112 (544, 564), NODE 564}

[1]

SUPPORTS - CONTD

MAX STRESS AT CORNER

OBE

$$\sigma = \frac{4.16}{10.3} + \frac{98.46}{31.2} + \frac{39.41}{10.6} = 7.3 \text{ KSI}$$

ALLOWABLE

$$\frac{36}{1.5} = 24.0 \text{ KSI}$$

SSE

$$\sigma = \frac{7.78}{10.3} + \frac{183.96}{31.2} + \frac{72.06}{10.6} = 13.4 \text{ KSI}$$

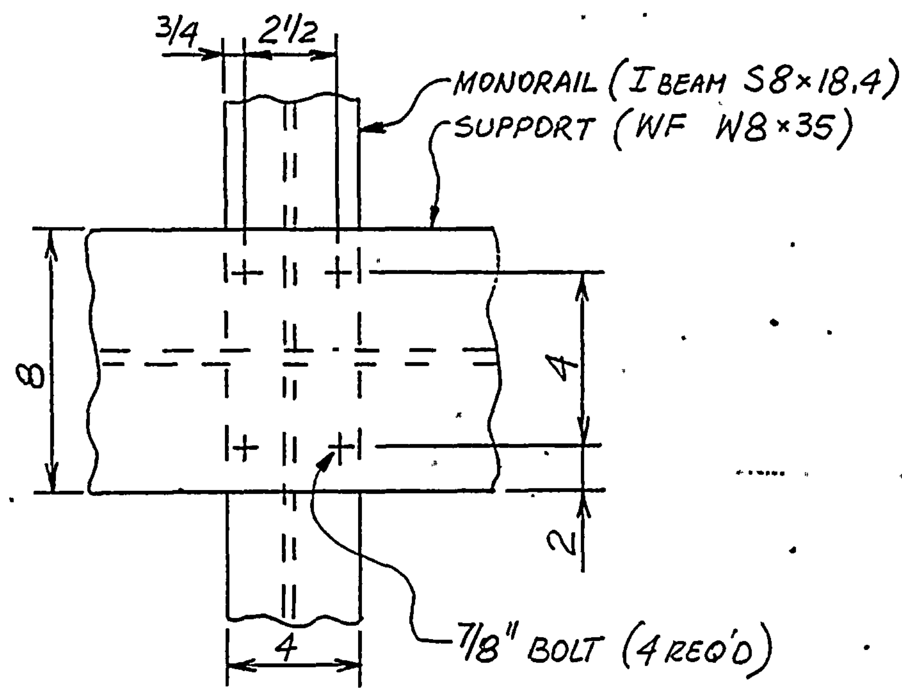
ALLOWABLE

$$\frac{36}{1.1} = 32.7 \text{ KSI}$$

THIS CHANGE ELIMINATES THE APPARENT OVERSTRESS CONDITION AND BRINGS THE STRESS CALCULATED BY ORDINARY ELASTIC METHODS BELOW THE REQUIRED ALLOWABLES.

MONORAIL TRACK TO SUPPORT CONNECTION.

FLOATING AND FIXED CONNECTIONS HAVE THE SAME DESIGN.



BOLTS MATL.: ASTM-A325 $\sigma_{YMIN} = 92\ KSI$

FOR 7/8" BOLT TENSILE AREA $A_T = 0.462\ IN^2$, NOM. AREA $A = 0.601\ IN^2$

THE FOLLOWING TENSILE ALLOWABLES ARE ADJUSTED IN ORDER TO ACCOUNT [1]
FOR THE LOWER TENSILE AREA THRU THE THREADED PORTION THAN
THE NOMINAL SHANK AREA.

OBE $\sigma_{ALL} = \frac{A_T}{A} \frac{\sigma_{YMIN}}{1.5} = 47.1\ KSI$ $\tau_{ALL} = 0.6 \frac{\sigma_{YMIN}}{1.5} = 36.8\ KSI$

SSE $\sigma_{ALL} = \frac{A_T}{A} \frac{\sigma_{YMIN}}{1.1} = 64.3\ KSI$ $\tau_{ALL} = 0.6 \frac{\sigma_{YMIN}}{1.1} = 50.2\ KSI$

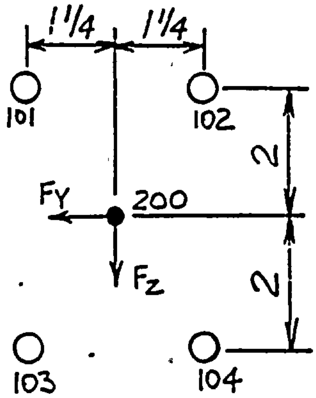
MAX. LOADINGS PER TABLE B97 TO B100.

<u>OBE</u> $F_X = 1.3$ KIP $F_Y = 4.2$ KIP $F_Z = 4.1$ KIP $M_X = 39.4$ IN. KIP

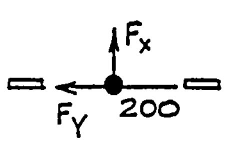
$M_Y = 13.2$ IN. KIP $M_Z = 81.8$ IN. KIP

<u>SSE</u> $F_X = 1.5$ KIP $F_Y = 7.8$ KIP $F_Z = 7.6$ KIP $M_X = 72.1$ IN. KIP

$M_Y = 24.8$ IN. KIP $M_Z = 152.9$ IN. KIP



BOLTS ARE IN TENSION AND SHEAR.



#79508 9-8-87

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

ASZ PAGE 4-153 OF 182

```
             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 * 60T LOAD * MONORAIL TO  SUPPORT * BOLTS * OBE
  2.  79508 ASZ  1.    0.    0.    1.                                1.  MJM 9-8-87
  3.  1.    3.   2.
  4.  2.    5.
  5.  -1.
  6.  0.875      36.8        47.1              4.
  7.  -1.
  8.   101.                  1.    1.        4.
  9.   200.                  2.
 10.  -1.
 11.   101.           0.          1.25     -2.
 12.   102.           0.         -1.25     -2.
 13.   103.           0.          1.25      2.
 14.   104.           0.         -1.25      2.
 15.   200.           0.          0.        0.
 16.  9999.
 17.   101.  1.   104.
 18.  -1.
 19.   200.  1.3          4.2        4.1        39.4       13.2       81.8
 20.  -1.
 21.  FINISH
             A    A     A     A     A     A     A     A     A     A     A     A     A
```

*** CONSYS ANALYSIS PROGRAM *** REQUISITION 79508 DATE 09/08/87
VERSION 4.2 RELEASED 12/03/82 BY: ASZ PAGE 4-154R OF 182
MJM 9-8-87 REV. ASZ 11-4-87
CHK WAH 11-5-87

AEP * 150T CRANE * 60T LOAD * MONORAIL TO SUPPORT * BOLTS * OBE

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

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

	X	Y	Z
CENTROIDS, X AXIS.........		-0.00	0.00
Y AXIS.........	0.00		0.00
Z AXIS.........	0.00	-0.00	
SHEAR AREAS................	2.41	2.41	2.41
POLAR MOMENTS OF INERTIA..	13.38	9.62	3.76
TRANSLATED FORCES.........	1.30	4.20	4.10
TRANSLATED MOMENTS........	39.40	13.20	81.80

NUMBER OF FORCE DEFINITION NODES... 1

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

DIRECT STRESSES ARE EQUALLY DISTRIBUTED THROUGHOUT SHEAR AREA
DRX 0.5 DRY τ_{YD} = 1.7 KSI DRZ τ_{ZD} = 1.7 KSI ☑

2-D POINT ELEMENT 1 AREA 0.601 DIAMETER 0.875 ALLOWABLES
STRESSES AT NODE 101 17.9, σ = 30.5 KSI 36.8, 47.1 ☑
STRESS EXPANSION FOR NODE 101
-2.7 -27.2 τ_{YB} = 5.9 KSI 0.0 τ_{ZB} = 3.7 KSI 0.0 ☑
FORCES AT NODE 101 FX 18. FY 5. FZ 3.

2-D POINT ELEMENT 2 AREA 0.601 DIAMETER 0.875 ALLOWABLES
STRESSES AT NODE 102 17.9, 30.5 36.8, 47.1
STRESS EXPANSION FOR NODE 102
-2.7 27.2 5.9 0.0 -3.7 0.0
FORCES AT NODE 102 FX 18. FY 5. FZ 3.

2-D POINT ELEMENT 3 AREA 0.601 DIAMETER 0.875 ALLOWABLES
STRESSES AT NODE 103 17.9, 30.5 36.8, 47.1
STRESS EXPANSION FOR NODE 103
2.7 -27.2 -5.9 0.0 3.7 0.0
FORCES AT NODE 103 FX 18. FY 5. FZ 3.

2-D POINT ELEMENT 4 AREA 0.601 DIAMETER 0.875 ALLOWABLES
STRESSES AT NODE 104 17.9, 30.5 36.8, 47.1
STRESS EXPANSION FOR NODE 104
2.7 27.2 -5.9 0.0 -3.7 0.0
FORCES AT NODE 104 FX 18. FY 5. FZ 3.

FORCE DEFINITION NODE ABSOLUTE ELEMENT 5 NODE 200
FX 1.30 ; FY 4.20 ; FZ 4.10
MX 39.40 ; MY 13.20 ; MZ 81.80

MAXIMUM TENSILE STRESS ON ELEMENT 1 = 30.5 KSI (OBE) σ_{ALL} = 47.1 KSI ☑

#79508 9-8-87


```
                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 * 60T LOAD * MONORAIL TO SUPPORT * BOLTS * SSE
      2.  79508 ASZ  1.    0.    0.    1.                                1.    MJM 9-8-87
      3.  1.    3.   2.
      4.  2.    5.
      5.  -1.
      6.  0.875      50.2        64.3                    4.
      7.  -1.
      8.    101.                 1.    1.          4.
      9.    200.                 2.
     10.  -1.
     11.    101.           0.          1.25        -2.
     12.    102.           0.         -1.25        -2.
     13.    103.           0.          1.25         2.
     14.    104.           0.         -1.25         2.
     15.    200.           0.          0.           0.
     16.  9999.
     17.    101.  1.   104.
     18.  -1.
     19.    200.  1.5          7.8         7.6         72.1        24.8        152.9
     20.  -1.
     21.  FINISH
                A     A     A     A     A     A     A     A     A     A     A     A     A
```

*** CONSYS ANALYSIS PROGRAM *** REQUISITION 79503 DATE 09/08/87
VERSION 4.2 RELEASED 12/03/82 BY: ASZ PAGE 9-156R1 OF 182
MJM 9-8-87 Rev. 1 ASZ 11-4-87

AEP * 150T CRANE * 60T LOAD * MONORAIL TO SUPPORT * BOLTS * SSE

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

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

	X	Y	Z
CENTROIDS, X AXIS.........		-0.00	0.00
Y AXIS.........	0.00		0.00
Z AXIS.........	0.00	-0.00	
SHEAR AREAS..............	2.41	2.41	2.41
POLAR MOMENTS OF INERTIA..	13.38	9.62	3.76
TRANSLATED FORCES.........	1.50	7.80	7.60
TRANSLATED MOMENTS........	72.10	24.80	152.90

NUMBER OF FORCE DEFINITION NODES... 1

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

DIRECT STRESSES ARE EQUALLY DISTRIBUTED THROUGHOUT SHEAR AREA
DRX 0.6 DRY τ_{YD} = 3.2 KSI DRZ τ_{ZD} = 3.2 KSI [I]

2-D POINT ELEMENT 1 AREA 0.601 DIAMETER 0.875 ALLOWABLES
STRESSES AT NODE 101 33.1, σ = 56.6 KSI 50.2, 64.3 [I]
STRESS EXPANSION FOR NODE 101
-5.2 -50.9 τ_{YB} = 10.8 KSI 0.0 τ_{ZB} = 6.7 KSI 0.0 [I]
FORCES AT NODE 101 FX 34. FY 8. FZ 6.

2-D POINT ELEMENT 2 AREA 0.601 DIAMETER 0.875 ALLOWABLES
STRESSES AT NODE 102 33.1, 56.6 50.2, 64.3
STRESS EXPANSION FOR NODE 102
-5.2 50.9 10.8 0.0 -6.7 0.0
FORCES AT NODE 102 FX 34. FY 8. FZ 6.

2-D POINT ELEMENT 3 AREA 0.601 DIAMETER 0.875 ALLOWABLES
STRESSES AT NODE 103 33.1, 56.6 50.2, 64.3
STRESS EXPANSION FOR NODE 103
5.2 -50.9 -10.8 0.0 6.7 0.0
FORCES AT NODE 103 FX 34. FY 8. FZ 6.

2-D POINT ELEMENT 4 AREA 0.601 DIAMETER 0.875 ALLOWABLES
STRESSES AT NODE 104 33.1, 56.6 50.2, 64.3
STRESS EXPANSION FOR NODE 104
5.2 50.9 -10.8 0.0 -6.7 0.0
FORCES AT NODE 104 FX 34. FY 8. FZ 6.

FORCE DEFINITION NODE ABSOLUTE ELEMENT 5 NODE 200
FX 1.50 ; FY 7.80 ; FZ 7.60
MX 72.10 ; MY 24.80 ; MZ 152.90

(SSE)
MAXIMUM TENSILE STRESS ON ELEMENT 1 = 56.6 KSI σ_{ALL} = 64.3 KSI [I]

DUE TO THE DISTANCE BETWEEN THE EDGE OF THE BOLT AND THE EDGE OF THE TRACK BEAM BEING RELATIVELY SMALL, THE RESISTANT LOAD ON THE BOLTS IN THESE DIRECTIONS SHOULD NOT BE TAKEN INTO ACCOUNT. THEREFORE THE RESULTS FROM THE COMPUTER ANALYSIS MUST BE ADJUSTED. 1

IT IS CONSERVATIVE TO ASSUME THAT ONLY TWO BOLTS RESIST ALL THE SHEAR LOADS RATHER THAN ALL FOUR BOLTS. THIS REQUIRES THE CALCULATED SHEAR STRESS FROM THE COMPUTER ANALYSIS TO BE DOUBLED.

$$\therefore \quad \tau_{MAX} = \left[\left(\frac{\sigma}{2}\right)^2 + (2\tau_1)^2\right]^{1/2}$$

WHERE $\sigma \rightarrow$ CALCULATED TENSILE STRESS

$\tau_1 \rightarrow$ COMBINED SHEAR STRESS ASSUMING ALL 4 BOLTS ARE EFFECTIVE

$$= \left[(\tau_{YD} + \tau_{YB})^2 + (\tau_{ZD} + \tau_{ZB})^2\right]^{1/2}$$

WHERE τ_{YD} AND τ_{ZD} ARE SHEAR STRESSES IN THE Y AND Z DIRECTIONS AS A RESULT OF THE DIRECT LOADS F_Y AND F_Z

τ_{YB} AND τ_{ZB} ARE SHEAR STRESSES IN THE Y AND Z DIRECTIONS AS A RESULT OF THE MOMENT LOAD M_X

OBE $\sigma = 30.5$ KSI $\sigma_{ALL} = 47.1$ KSI

$$\tau_1 = \left[(1.7+5.9)^2 + (1.7+3.7)^2\right]^{1/2} = 9.3 \text{ KSI}$$

$$\tau_{MAX} = \left[\left(\frac{30.5}{2}\right)^2 + (2 \times 9.3)^2\right]^{1/2} = 24.1 \text{ KSI} \qquad \tau_{ALL} = 36.8 \text{ KSI}$$

SSE $\sigma = 56.6$ KSI $\sigma_{ALL} = 64.3$ KSI

$$\tau_1 = \left[(3.2+10.8)^2 + (3.2+6.7)^2\right]^{1/2} = 17.1 \text{ KSI}$$

$$\tau_{MAX} = \left[\left(\frac{56.6}{2}\right)^2 + (2 \times 17.1)^2\right]^{1/2} = 44.4 \text{ KSI} \qquad \tau_{ALL} = 50.2 \text{ KSI}$$

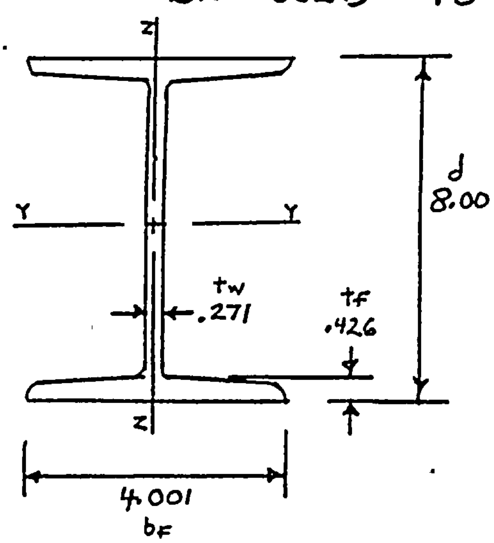
MONORAIL TRACK

AN OVERSTRESS CONDITION FOR THIS MEMBER WAS INDICATED IN TABLES B13, B14, B25, AND B30 FOR THE OBE AND TABLES B16, B17, B18 B27, B28, AND B32 FOR THE SSE. THE MAXIMUM STRESS OCCURS FOR THE MAIN TROLLEY AT THE LHE WITH THE LOAD DOWN. (TABLES B14 AND B17). THE LOADINGS WHICH PRODUCE THIS STRESS ARE TAKEN FROM THE COMPUTER SUMMATION OUTPUTS:

OBE PFANMEDO	F_x = 3.08 KIP	F_Y = .80 KIP	F_Z = .32 KIP
	M_x = 9.18 IN KIP	M_Y = 35.28 IN KIP	M_Z = 44.11 IN KIP
SSE PFANMEDS	F_x = 5.25 KIP	F_Y = 1.45 KIP	F_Z = .43 KIP
	M_x = 17.16 IN KIP	M_Y = 46.42 IN KIP	M_Z = 81.38 IN KIP

{ELEMENT 138 (442,443), NODE 443} 1

THE MONORAIL TRACK IS A S 8×18.4. CHANGES IN THIS SECTION WILL HAVE A SIGNIFICANT EFFECT ON THE DYNAMIC RESPONSE OF THE CRANE. A PLASTIC ANALYSIS WILL BE USED TO FURTHER EVALUATE THIS SECTION.



(REF 6 p1-32)

A = 5.41 IN^2 A 36
I_{yy} = 57.6 IN^4 $\sigma_{y\,min}$ = 36 KSI
S_{yy} = 14.4 IN^3
Z_{yy} = 16.5 IN^3 r_y = 3.26 in
I_{zz} = 3.73 IN^4
S_{zz} = 1.86 IN^3 r_z = .831 in
Z_{zz} = 3.16 IN^3
J = .34 IN^4

$\frac{b_f}{2t_f}$ = 4.7

$\frac{d}{t_w}$ = 29.5

TRACK CONT'D

SECTION PROPORTIONS

AXIAL LOAD FOR YIELD

$P_Y = 36 \times 5.41 = 194.8$ KIP

MAX AXIAL LOAD OCCURS FOR SSE

$P = 5.25$ KIP

$\frac{P}{P_Y} = \frac{5.25}{194.8} = .027 < .27$ (REF 6 p 5-66 sec 2.7)

MAX $\frac{d}{t_W} = \frac{412}{\sqrt{36}}(1 - 1.4(.027)) = 66.1$

MAX $\frac{b_f}{2t_f} = 8.5$

SHEAR

MAX SHEAR IN WEB OCCURS FOR SSE

$V_{MAX} = .43$ KIP

HOWEVER IF WHEEL OF HOIST SLIGHTLY OFFSET THIS COULD INCREASE, IT IS CONSERVATIVE TO USE MAX Fx FROM TABLE B 100

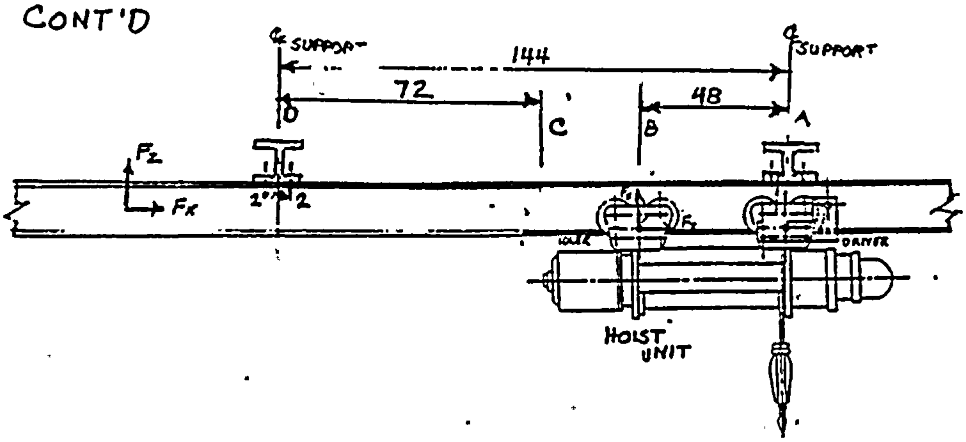
$V_{MAX} = 1.5$ KIP.

(REF 6 p 5-65 sec 2.5)

$V_U \leq .55(36)(.271)(8.00) = 42.9$ KIP

∴ PLASTIC ANALYSIS IS APPLICABLE

TRACK CONT'D



FOR SSE LHE ON
MAX COMBINED STRESS, FROM COMPUTER SUMMATION PFANMEDS

POINT	EL.	NODE	STRESS
A	139	444	41.9 KSI
B	138	443	47.7 KSI
C	137	442	27.7 KSI
D	137	441	37.5 KSI

MOMENT ABOUT TRACK ZZ AXIS IS OBSERVED TO BE LARGEST COMPONENT

THIS IS WEAK AXIS OF MEMBER THEREFORE REQUIREMENTS FOR LATERAL SUPPORT SPACING DO NOT APPLY (REF 6 P 5-67 SEC 2.9)

THE ELEMENT LOADS FROM THE COMPUTER SUMMATION PFANMEDS ARE:

PT	EL	NODE			
A	139	444	F_x = 4.84 KIP	M_Y = 34.96 IN KIP	M_Z = 72.06 IN KIP
B	138	443	F_x = 5.25 KIP	M_Y = 46.42 IN KIP	M_Z = 81.38 IN KIP
C	137	442	F_x = 5.25 KIP	M_Y = 36.29 IN KIP	M_Z = 45.45 IN KIP
D	137	441	F_x = 5.25 KIP	M_Y = 19.19 IN KIP	M_Z = 66.66 IN KIP

IT IS ALSO OBSERVED THAT THE MAJOR CONTRIBUTION TO MZ IS FROM A MODE WITH A FREQUENCY OF 2.84 HZ IN THE Y EXCITATION. THIS MODE HAS ACCELERATIONS AT THE PEAK OF THE CURVE.

TRACK CONT'D

THE INTERACTION FORMULAS (REF 6 p5-64 sec 2.4) SHALL BE USED TO EVALUATE THE PLASTIC MOMENT WHICH MAY BE ASSUMED TO EXIST AT A HINGE

$$\frac{l}{r_y} = \frac{140}{3.26} = 42.9, \quad \frac{l}{r_z} = \frac{140}{.831} = 168.5, \quad C_c = \sqrt{\frac{2\pi^2 E}{F_y}} = 126.1$$

Although $\frac{l}{r_z} > C_c$, THE APPLIED AXIAL LOAD IS SMALL. THEREFORE, F_A SHALL BE DETERMINED FROM 1.5-2 OF REF 6:

$$F_a = \frac{12\pi^2(29000)}{23(168.5)^2} = 5.26 \text{ KSI}$$

$$P_{cr} = \frac{23}{12}(5.41)(5.26) = 54.5 \text{ KIP}$$

$$P_Y = 5.41(36) = 194.8 \text{ KIP}$$

$$P_{ey} = \frac{23}{12}(5.41)\frac{12\pi^2(29000)}{23(42.9)^2} = 841.4 \text{ KIP}$$

$$P_{ez} = \frac{23}{12}(5.41)\frac{12\pi^2(29000)}{23(168.5)^2} = 54.5 \text{ KIP}$$

$$M_{PY} = 16.5(36) = 594 \text{ IN KIP}$$

$$M_{mY} = \left[1.07 - \frac{168.5\sqrt{36}}{3160}\right]594 = 445.5 \text{ IN KIP}$$

$$M_{Pz} = 3.16(36) = 113.8 \text{ IN KIP}$$

$$M_{mz} = \left[1.07 - \frac{168.5\sqrt{36}}{3160}\right]113.8 = 85.4 \text{ IN KIP}$$

$$\frac{5.25}{54.5} + \frac{.85(46.42)}{(1-\frac{5.25}{841.4})445.5} + \frac{.85 M_z}{(1-\frac{5.25}{54.5})85.4} \le 1$$

$$M_z \le 90.8(1 - .096 - .089) = 74.0 \text{ IN KIP}$$

$$\frac{5.25}{194.8} + \frac{46.42}{1.18(594)} + \frac{M_z}{1.18(113.8)} \le 1$$

$$M_z \le 134.3(1 - .027 - .066) = 121.8 \text{ IN KIP}$$

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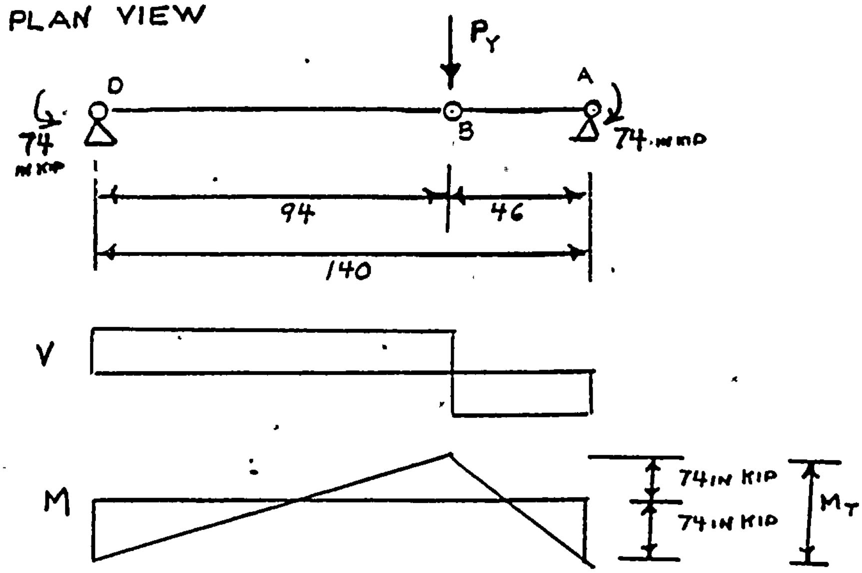
TRACK CONT'D

THE PLASTIC MOMENT WHICH CAN BE CONSERVATIVELY ASSUMED TO EXIST AT A HINGE IS 74.0 IN KIP.

FOR A 3 HINGE MECHANISM IN TRACK:

PLAN VIEW



$$M_T = 2(74) = \frac{P_Y(94)(46)}{140}$$

$$P_Y = \frac{148(140)}{94(46)} = 4.8 \text{ KIP}$$

IT WOULD REQUIRE A LOAD OF 4.8 KIP TO FORM THIS MECHANISM

THIS IS THE ULTIMATE LOAD THAT THE SECTION WOULD SUSTAIN BEFORE PLASTIC FAILURE.

TRACK CONT'D

THE MAXIMUM LATERAL WHEEL LOADS (ELEMENT 140 NODE 443) FROM THE COMPUTER SUMMATIONS (PFANMEDO & PFANMEDS) ARE:

OBE F_Y = 2.45 KIP

SSE F_Y = 4.58 KIP

COMPARING THESE WITH THE ULTIMATE LOAD

OBE $\frac{2.45}{4.8} = .51$

SSE $\frac{4.58}{4.8} = .95$

ALTHOUGH THE STRESSES ARE HIGHER THAN THE ALLOWABLES, THE PEAK WHEEL LOADS FROM THE LINEAR ELASTIC MODAL ANALYSIS ARE LESS THAN THE ULTIMATE LOAD THAT WOULD BE REQUIRED TO FORM A PLASTIC MECHANISM USING A CONSERVATIVE ANALYSIS. IT IS NOT POSSIBLE TO INCLUDE NON LINEAR (PLASTIC) EFFECTS IN A MODAL ANALYSIS BUT THE WHEEL LOADS WOULD BE REDUCED SOMEWHAT BY PLASTIC DEFORMATION OF THE BEAM.

THE STRESS FOR THE OBE IS WITHIN THE ELASTIC RANGE AND THE PEAK WHEEL LOAD IS WELL BELOW THE ULTIMATE LOAD.

THE STRESS FOR THE SSE IS WITHIN THE PLASTIC RANGE BUT THE PEAK WHEEL LOAD IS BELOW THE ULTIMATE LOAD.

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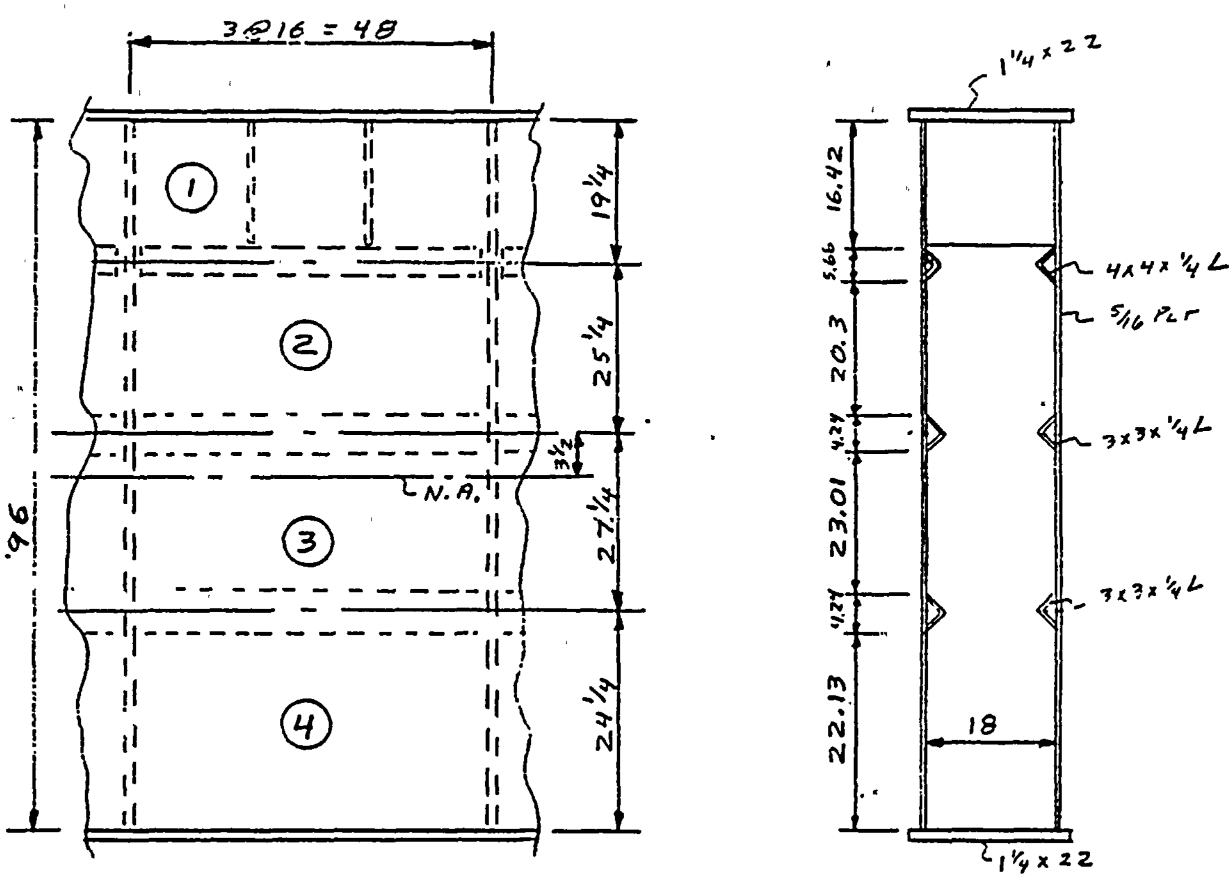
BUCKLING STABILITY OF GIRDER WEB
(REF.: #16 - USS STEEL DESIGN MANUAL -1981, PP. 73-102)



SECTIONAL PROPERTIES (FROM PAGE 3-19)

$A = 115\ in^2$

A_0 (ENCLOSED AREA) $= (18 + 5/16)(96 + 1 1/4) = .1780\ in^2$

$I_y = 176100\ in^4$

$I_z = 7250\ in^4$

$C_{y_{web}} = \frac{18}{2} + \frac{5}{16} = 9\ 5/16\ in$

LONGITUDINAL STIFFENER CHECK TO DETERMINE THE STIFFENING EFFECT THAT THE ANGLES WOULD HAVE ON STIFFENING THE WEB PANELS. IF THE FOLLOWING IS TRUE EACH PANEL MAY BE INDIVIDUALLY CHECKED FOR ITS MAXIMUM BUCKLING STRENGTH.

$$\frac{\gamma_1}{\gamma_2} \leq 1.0$$

WHERE:

$$\gamma_1 = \phi + \left[\left(\frac{a}{b_w}\right)^2\left(\frac{A_s}{b_w t}\right)\right] \times k_{cw}$$

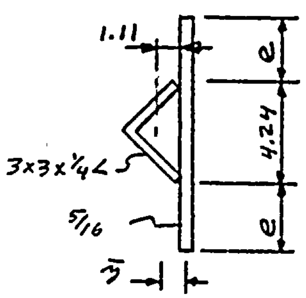
$$\gamma_2 = \frac{12(1-\nu^2)\, I_s}{b_w t^3}$$

$a = 48$ in $\quad b_w = 96$ in $\quad t = 5/16$ in $\quad \nu = .3$

FROM FIG 4.13 OF U.S.S. STEEL DESIGN MANUAL (REF. #16)

FOR $\frac{a}{b} = \frac{48}{96} = .5$ & $k_{cw_{max}} = 64$, $\phi = 5$

A_s & I_s ARE THE AREA AND MOMENT OF INERTIA OF THE STIFFENED SECTION. FOR CONSERVATISM ASSUMED ALL STIFFENERS HAVE THE PROPERTIES OF THE SMALLEST ONE.



$$e = \frac{3000\, t}{\sqrt{\sigma_y}} = \frac{3000 \times 5/16}{\sqrt{36000}} = 4.94 \text{ in}$$

ANGLE $A_A = 1.44$ in, $\bar{x} = .842$ in, $r = .592$ in

$\therefore y_A = 1.11$ in $\quad I_A = .592^2 \times 1.44 = 0.50 \text{ in}^4$

$\therefore A_s = 1.44 + 5/16\,(2 \times 4.94 + 4.24) = \underline{5.85 \text{ in}^2}$

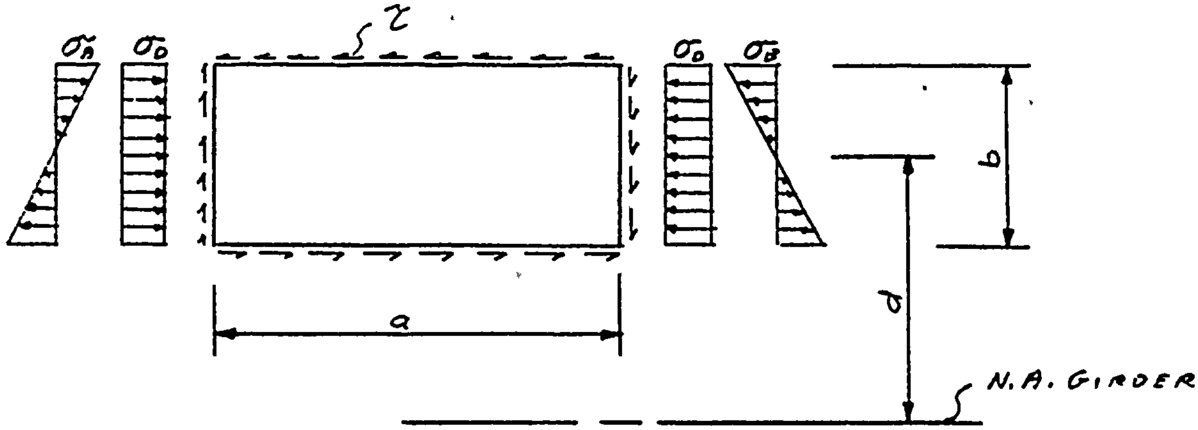
$\bar{y} = (1.11 + 5/32) \times 1.44 / 5.85 = \underline{0.31 \text{ in}}$

$I_s = \underline{2.28 \text{ in}^4}$

$$\therefore \frac{\gamma_1}{\gamma_2} = \frac{\left\{5 + \left[\left(\frac{48}{96}\right)^2\left(\frac{5.85}{96 \times 5/16}\right)\right]64\right\}}{\left[\frac{12(1-.3^2)(2.28)}{96 \times (5/16)^3}\right]} = \underline{\underline{.955}} < 1.0$$

$\therefore$ OK

WEB PANEL STABILITY CHECK



FOR BUCKLING STABILITY THE FOLLOWING CRITERIA MUST BE MET

$$\frac{\sigma_D}{\sigma_{DCR}} + \left[\frac{\sigma_B}{\sigma_{BCR}}\right]^2 + \left[\frac{\tau}{\tau_{CR}}\right]^2 = R \leq \frac{1}{D.F.} = \frac{\sigma_{ALL}}{\sigma_{YMIN}}$$

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, $\nu = .3$

$$\text{SET } \Psi = \frac{\pi^2 E t^2}{12(1-\nu^2)b^2} = \frac{\pi^2(29000)(5/16)^2}{12(1-.3^2)b^2} = \frac{2560}{b^2}$$

$\therefore$ CRITICAL STRESS $= k\Psi$ KSI

IF THE ELASTIC CRITICAL STRESS EXCEEDS THE MINIMUM YIELD STRESS, THEN THE CRITICAL STRESS IS SET TO EQUAL THE YIELD STRESS

$$\sigma_{CR\,MAX} = \sigma_{YMIN} = 36.0 \text{ KSI}$$

$$\tau_{CR\,MAX} = \tau_{YMIN} = \frac{\sigma_{YMIN}}{\sqrt{3}} = \frac{36}{\sqrt{3}} = 20.8 \text{ KSI}$$

DIRECT STRESS

$$\sigma_D = \frac{F_x}{A} + \frac{M_Y d}{I_Y} + \frac{M_Z c_W}{I_Z} = \frac{F_x}{115} + \frac{M_Y d}{176100} + \frac{M_Z (9\,^5/_{16})}{7250}$$

$$= \frac{F_x}{115} + \frac{M_Y d}{176100} + \frac{M_Z}{779}$$

BENDING STRESS

$$\sigma_B = \frac{M_Y (b/2)}{176100} = \frac{M_Y b}{352200}$$

SHEAR STRESS

$$\tau = \frac{F_Z}{2 A_{WEB}} + \frac{M_X}{2 A_0 t} = \frac{F_Z}{2 \times 96 \times 5/16} + \frac{M_X}{2 \times 1780 \times 5/16}$$

$$= \frac{F_Z}{60} + \frac{M_X}{1110}$$

FOR PANELS 1 & 2, WHICH ARE ABOVE THE GIRDER'S NEUTRAL AXIS, THE 'M_Y' MOMENT IS TAKEN AS THE SUM OF STATIC PLUS DYNAMIC. FOR PANELS 3 & 4, WHICH ARE BELOW THE NEUTRAL AXIS, 'M_Y' IS TAKEN AS THE DIFFERENCE (STATIC − DYNAMIC)

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)

$$\therefore \; R_{ALL_{OBE}} = \frac{1}{1.5} = 0.667$$

$$R_{ALL_{SSE}} = \frac{1}{1.1} = 0.909$$

TABLE 4-11 (KIPS & INCH-KIP)

FOR GIRDER STABILITY IT HAS BEEN DETERMINED THAT THE DOMINATE LOAD CONDITION WOULD BE WITH THE LOAD IN THE DOWN POSITION (THIS PRODUCES THE MAX GIRDER STRESS). THEREFORE THE FOLLOWING TABLE, TO BE USED WHEN CHECKING GIRDER WEB STABILITY, ARE LOADING VALUES FOR THE FOUR TROLLEY POSITIONS WITH THE LOAD DOWN. THE LOADINGS WERE TAKEN FROM THE ELEMENT AND NODE POINT WHERE THE MAXIMUM GIRDER STRESS OCCURS WITHIN THE ELEMENT RANGE OF WHICH THE NOMINAL GIRDER SECTION IS USED.

GIRDER 'A' ELEMENT RANGE = 21 → 48
GIRDER 'B' ELEMENT RANGE = 61 → 88

(SEE TABLES B119 AND B120)

SEISMIC & TROLLEY POSITION	GIRD.	ELEM.	NODE	FX	FY	FZ	MX	MY SUM (Σ)	MY DIFF. (Δ)	MZ
OBE										
MID	A	34	318	42.0	15.5	15.1	789.	72,340.	-2435.	3266.
QTR.	B	80	373	34.9	16.1	111.	833.	54,670.	1948.	3134.
LHE	A	35	318	46.9	18.3	32.8	427.	26,480.	7038.	5249.
RHE	A	27	310	22.7	2.1	33.9	205.	43,120.	1710.	2173.
SSE										
MID.	A	34	318	62.7	21.6	17.8	1080.	105,100.	-35,200.	4549.
QTR.	B	80	373	58.3	24.8	152.	1218	77,800.	-21,180.	4497.
LHE	A	35	318	88.2	32.2	47.4	715.	35,120.	-1595.	10,010.
RHE	A	27	310	34.4	4.5	56.5	289.	61,320.	-16,480.	3090.

TABLE 4-12

PANEL #	1 ε	2 ε	3 Δ	4 Δ
a	16	48	48	48
b	16.42	20.3	23.01	22.13
d	39.79	15.77	-10.12	-36.93
ψ	9.49	6.21	4.84	5.23
k_o	4.0	4.0	4.0	4.0
k_B	23.9	23.9	23.9	23.9
k_s	9.6	6.1.	6.3	6.2
σ_{DCR}	36.0	24.8	19.4	20.9
σ_{BCR}	36.0	36.0	36.0	36.0
τ_{CR}	20.8	20.8	20.8	20.8
OBE				
R_{MID}	.592	.461	.244	.245
R_{QTR}	.484	.395	.233	.203
R_{LHE}	.368	.388	.350	.273
R_{RHE}	.358	.282	.150	.127
SSE				
R_{MID}	.859	.669	.441	.666
R_{QTR}	.703	.580	.418	.545
R_{LHE}	.605	.684	.711	.672
R_{RHE}	.513	.406	.272	.374

MAX. R_{OBE} = .592 < .667 ∴ OK

MAX. R_{SSE} = .859 < .909 ∴ OK

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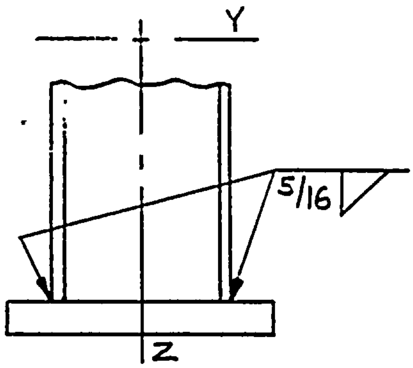
GIRDER WELDS.



ALLOWABLES

BASE MTRL.: ASTM-A36

WELD MTRL.: E70XX ELECTRODES

OBE $\tau_{W,ALL} = 20.4$ KSI (REF. PG. 4-28)

SSE $\tau_{W,ALL} = 27.8$ KSI (" " ")

FOR SECTION PROPERTIES SEE PG. 3-19

MAX. LOADINGS PER TABLE B121 AND B122.

OBE $F_Y = 71.4$ KIP $F_Z = 270.7$ KIP $M_X = 3809$ IN. KIP

SSE $F_Y = 133.8$ KIP $F_Z = 373.6$ KIP $M_X = 7243$ IN. KIP

$$\tau = \frac{1}{2 w t_f}\left[\frac{F_Z A_c d_c}{I_{YY}} + \frac{F_Y A_w d_w}{I_{ZZ}} + \frac{M_X}{A_e}\right] \leq \tau_{W,ALL}$$

$$\tau = \frac{1}{2 \times 0.3125 \times 0.707}\left[\frac{F_Z (22 \times 1.25) 48.625}{176129} + \frac{F_Y (0.3125 \times 96) 9.156}{7249} + \frac{M_X}{18.3125 \times 97.25}\right]$$

OBE $\tau = 15.6$ KSI.

SSE $\tau = 27.1$ KSI

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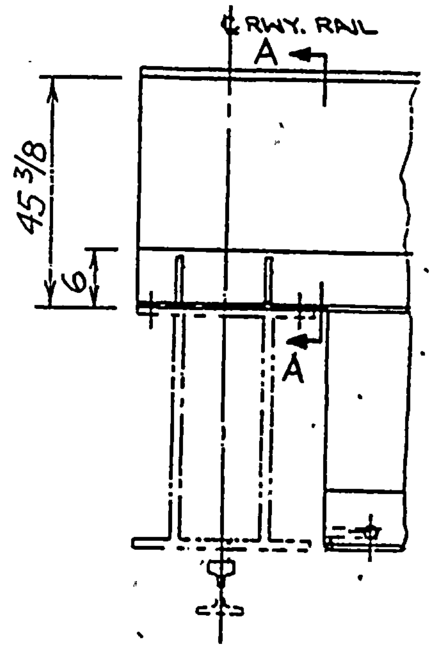
GIRDER END



ALLOWABLES

MTRL.: ASTM-A 36 $\sigma_{YMIN} = 36$ KSI

OBE $\tau_{ALL} = 0.6\,\frac{36}{1.5} = 14.4$ KSI

SSE $\tau_{ALL} = 0.6\,\frac{36}{1.1} = 19.6$ KSI

WELD MTRL.: E70XX ELECTRODES

OBE $\tau_{W,ALL} = 20.4$ KSI (REF. PG 4-170)

SSE $\tau_{W,ALL} = 27.8$ KSI (" " ")

MAX. LOAD OBE $F_Z = 279.5$ KIP (REF. PG. 4-48)

SSE $F_Z = 382.3$ KIP (" " ")

WEB SHEAR STRESS

$$\tau = \frac{F_Z Q}{I_{xx} t} = \frac{F_Z\left[22\times1.25\left(20.4-\frac{1.25}{2}\right)+2\times0.3125\left(20.4-1.25\right)^2 0.5\right]}{27051\times0.3125\times2}$$

OBE $\tau = 10.9$ KSI

SSE $\tau = 14.9$ KSI

UPPER WELDS SHEAR STRESS

$$\tau = \frac{F_Z\,(22\times1.25)(20.4-0.5\times1.25)}{2\times0.3125\times0.707\times27051}$$

OBE $\tau = 12.7$ KSI

SSE $\tau = 17.4$ KSI

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LOWER WELDS SHEAR STRESS $\tau_B = \frac{F_z (2 \times 6.75)(46.625 - 20.4 - 1.47)}{2(0.25) 0.707 \times 27051}$

OBE $\tau = 9.8$ KSI

SSE $\tau = 13.4$ KSI

$$\tau_C = \frac{F_z (0.5 \times 18)(45.125 + 1.25 - 20.4 - 0.625 - 0.5 \times 0.25)}{2 \times 0.25 \times 0.707 \times 27051}$$

OBE $\tau = 6.6$ KSI

SSE $\tau = 9.1$ KSI

GIRDER END SECTION PROPERTIES

SECTION "AA"

PROGRAM 117 PROGRAM ID 1-A-2-06 (046)

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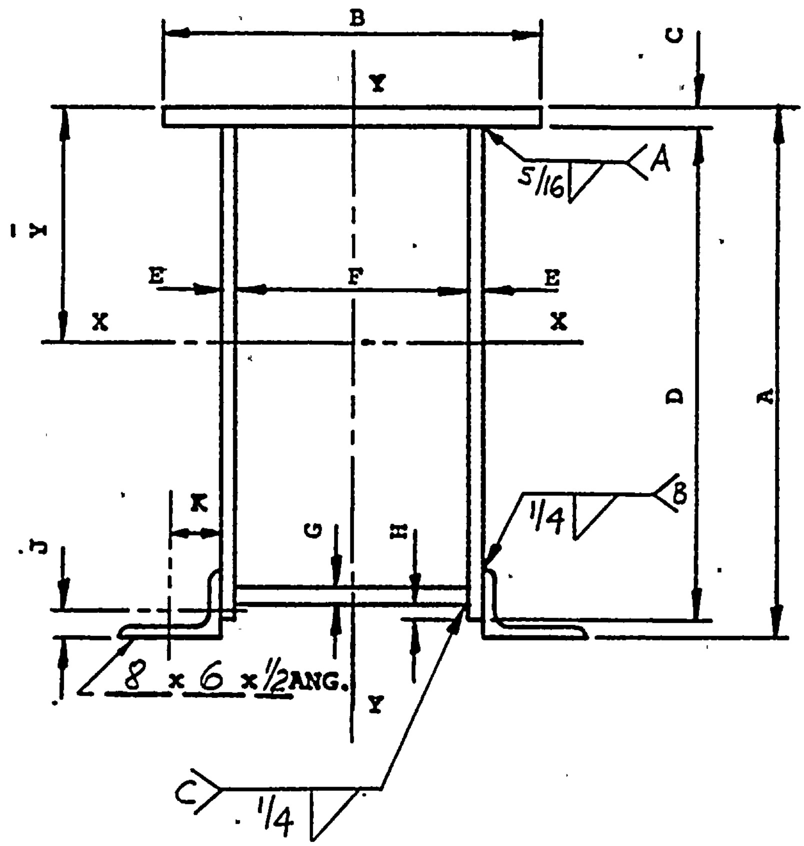


GIVEN DATA

1.	46.625	=	DIMENSION A (IN.)	46.6250
2.	22	=	DIMENSION B (IN.)	22.0000
3.	1.25	=	DIMENSION C (IN.)	1.2500
4.	45.125	=	DIMENSION D (IN.)	45.1250
5.	0.3125	=	DIMENSION E (IN.)	0.3125
6.	18	=	DIMENSION F (IN.)	18.0000
7.	0.25	=	DIMENSION G (IN.)	0.2500
8.	0.625	=	DIMENSION H (IN.)	0.6250
9.	1.47	=	DIMENSION J (IN.) ($\bar{X}$ OF ANGLE)	1.4700
10.	2.47	=	DIMENSION K (IN.) ($\bar{Y}$ 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

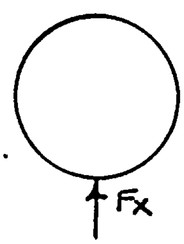
COMPUTED DATA

I_{y-y} (IN.^{4}) (MOMENT OF INERTIA OF SECTION)	5,558.1277
$\bar{Y}$ (IN.)	20.4018
I_{x-x} (IN.^{4}) (MOMENT OF INERTIA OF SECTION)	27,051.3685

TROLLEY WHEEL LOADS

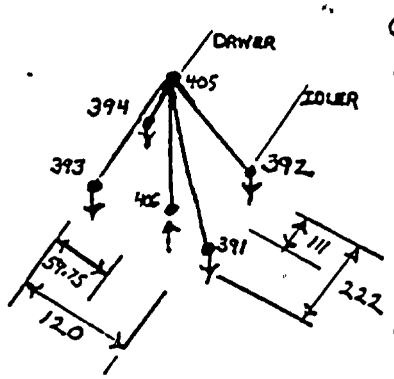
THE TROLLEY REACTIONS ARE SUMMARIZED IN TABLES B 107 THROUGH B 110 WITH THE FORCES IN THE ELEMENT COORDINATE SYSTEM

ELEMENT FX (GLOBAL FZ) — VERTICAL WHEEL LOAD



THE MAXIMUM FX IS TAKEN FROM TABLE B 107 FOR THE OBE & TABLE B.109 FOR THE SSE DIRECTLY.

THE MINIMUM FX IS TAKEN FROM TABLE B 108 FOR THE OBE & TABLE B 110 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

$$F_{X\,MIN} = F_{X\,TABLE} - F_{ROPE\,UP}\left(\frac{111}{222}\right)\left(\frac{59.75}{120}\right)$$
$$= F_{X\,TABLE} - .249\ F_{ROPE\,UP}$$

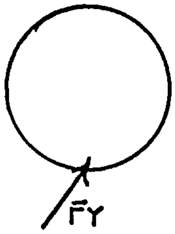
LOADS AT NODES 393, 394

$$F_{X\,MIN} = F_{X\,TABLE} - F_{ROPE\,UP}\left(\frac{111}{222}\right)\left(\frac{60.25}{120}\right)$$
$$= F_{X\,TABLE} - .251\ F_{ROPE\,UP}$$

$F_{ROPE\,UP}$ IS TAKEN FROM TABLE B 116 FOR THE OBE & TABLE B 118 FOR THE SSE

ELEMENT FY
(GLOBAL FY)

LOAD: PERPENDICULAR GIRDER

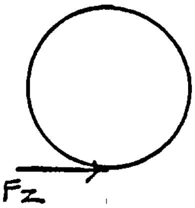


THE MAXIMUM FY IS TAKEN FROM TABLE B 107 FOR THE OBE & TABLE B 109 FOR THE SSE DIRECTLY

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 107 FOR THE OBE & TABLE B 109 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

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AS2 9-11-87

SUMMARY OF TROLLEY WHEEL LOADS

TABLE 4-13 OBE

TROLLEY	AXLE	Fx MAX KIP	Fx MIN KIP	FY MAX KIP	Fz MAX KIP
MID	DRIVER	132.6	7.3	25.7	12.6
	IDLER	172.9	23.5	25.7	—
1/4	DRIVER	134.5	5.1	33.4	16.1
	IDLER	173.3	24.0	33.4	—
LHE	DRIVER	127.1	5.2	43.2*	19.6*
	IDLER	161.2	28.8	43.2*	—
RHE	DRIVER	133.7	3.1	31.2	11.2
	IDLER	161.2	28.5 **	31.2	—

* MAIN AT LHE, AUX AT 1/4 PRODUCES FY = 45.2 KIP, FZ = 19.7 KIP
** MIN Fx FOR MAIN AT LHE, AUX AT 1/4 IS 1.4 KIP

TABLE 4-14 SSE

TROLLEY	AXLE	Fx MAX KIP	Fx MIN KIP	FY MAX KIP	Fz MAX KIP
MID	DRIVER	201.9	.4	35.9	22.6
	IDLER	252.7	5.7	35.9	—
1/4	DRIVER	199.2	-1.8	49.1	28.7
	IDLER	247.0	13.2	49.1	—
LHE	DRIVER	185.7	-2.0	61.6*	32.9*
	IDLER	224.7	21.8	61.6*	—
RHE	DRIVER	197.2	-4.6	45.1	21.8
	IDLER	224.5	17.4 **	45.1	—

* MAIN AT LHE, AUX AT 1/4 PRODUCES FY = 81.3 KIP, FZ = 36.6 KIP
** MIN Fx FOR MAIN AT LHE, AUX AT 1/4 IS -6.6 KIP

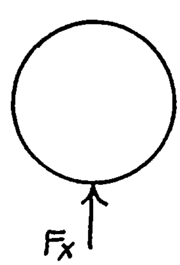
AUX TROLLEY WHEEL LOADS

THE TROLLEY REACTIONS ARE SUMMARIZED IN TABLES B 111 THROUGH B 114 WITH THE FORCES IN THE ELEMENT COORDINATE SYSTEM

IT SHOULD BE NOTED THAT FOR ALL CASES THERE IS NO LOAD ON THE AUX HOOK.

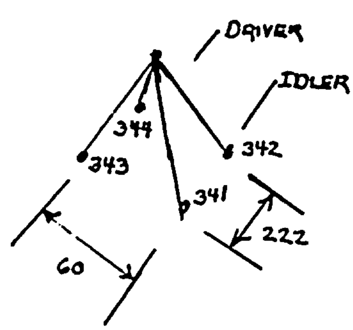
ELEMENT F_x (GLOBAL F_z)

VERTICAL WHEEL LOAD



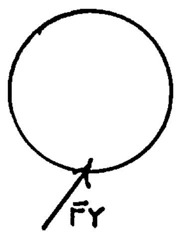
THE MAXIMUM F_x IS TAKEN FROM TABLE B·111 FOR THE OBE & TABLE B 113 FOR THE SSE

THE MINIMUM F_x IS TAKEN FROM TABLE B 112 FOR THE OBE & TABLE B 114 FOR THE SSE



ELEMENT FY
(GLOBAL FY)

LOADS PERPENDICULAR GIRDER



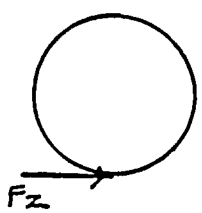
THE MAXIMUM FY IS TAKEN FROM
TABLE B 111 FOR THE OBE &
TABLE B 113 FOR THE SSE

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 111 FOR THE OBE &
TABLE B 113 FOR THE SSE



THE MINIMUM FZ IS THE NEGATIVE OF THE MAXIMUM CONSIDERING COMPLETE REVERSAL

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SUMMARY OF AUX TROLLEY WHEEL LOADS

TABLE 4-15 OBE

MAIN	AUX	AXLE	Fx MAX KIP	Fx MIN KIP	FY MAX KIP	FZ MAX KIP
MID	RHE	DRIVER	18.2	-1.3	26.6	7.6
		IDLER	22.4	-4.8	26.6	—
	MID	DRIVER	9.2	-.2	6.8	1.8
		IDLER	15.2	4.1	6.8	—
1/4	RHE	DRIVER	15.5	-5.9	34.1	9.3
		IDLER	20.1	-2.5	34.1	—
LHE	RHE	DRIVER	16.9	-8.6	66.4	18.1
		IDLER	22.0	-4.2	66.4	-
	1/4	DRIVER	10.2	-1.7	17.2	3.3
		IDLER	15.3	2.9	17.2	—
	MID	DRIVER	7.0	1.0	7.3	1.4
		IDLER	13.0	5.3	7.3	—
	LHE	DRIVER	10.4	-1.7	14.8	4.2
		IDLER	15.8	2.4	14.8	—
RHE	RHE	DRIVER	12.8	-4.0	15.9	4.6
		IDLER	17.0	.3	15.9	—

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(initials) 9.11.87

SUMMARY OF AUX TROLLEY WHEEL LOADS

TABLE 4-16 SSE

MAIN	AUX	AXLE	Fx MAX KIP	Fx MIN KIP	FY MAX KIP	FZ MAX KIP
MID	RHE	DRIVER	23.1	-4.6	36.8	11.1
		IDLER	26.2	-9.0	36.8	—
	MID	DRIVER	12.0	-1.3	11.9	3.5
		IDLER	19.2	2.4	11.9	—
1/4	RHE	DRIVER	19.7	-9.4	58.1	15.8
		IDLER	23.6	-6.2	58.1	—
LHE	RHE	DRIVER	22.9	-14.5	126.0	34.3
		IDLER	27.7	-9.9	126.0	—
	1/4	DRIVER	13.1	-3.5	28.1	5.8
		IDLER	18.4	.5	28.1	—
	MID	DRIVER	8.7	-.1	10.5	2.6
		IDLER	15.4	3.6	10.5	—
	LHE	DRIVER	13.2	-3.2	25.6	7.5
		IDLER	19.0	.3	25.6	—
RHE	RHE	DRIVER	17.2	-7.4	22.6	7.3
		IDLER	20.5	-3.7	22.6	—

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REV.1 ASZ 11-4-87

CHK 7/AH 11-5-87

ROPE.

HOIST ROPE: TWO - 6 PART SYSTEMS OF 1½ DIA PYTHON 10F16V,

XIPS RIGHT HAND REGULAR LAY ALL STEEL ROPE,

MIN. BREAKING STRENGTH $P_{BR} = 160.9\,T$

ALLOWABLE ROPE LOAD $P_{ALL} = \dfrac{P_{BR} f_P n m}{f}$

PROP. LMT. FACTOR $f_P = 0.6$

NO. OF ROPE PARTS $n = 6$

NO. OF ROPE SYSTEMS $m = 2$

OBE FACTOR $f = 1.5$

SSE FACTOR $f = 1.1$

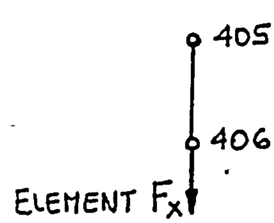
OBE $P_{ALL} = \dfrac{160.9 \times 0.6 \times 6 \times 2}{1.5} = 772.3\,T = 1545$ KIPS [I]

SSE $P_{ALL} = \dfrac{160.9 \times 0.6 \times 6 \times 2}{1.1} = 1053\,T = 2106$ KIPS [I]

MAX. ROPE LOAD PER TABLES B115 AND B117

OBE $F_X = 418.4$ KIP $= 209.2\,T$

SSE $F_X = 661.9$ KIP $= 331.0\,T$



RATIO $R = \frac{F_x}{P_{ALL}} \leq 1.0$

OBE $R = \frac{209.2}{772.3} = 0.27$ SSE $R = \frac{331}{1053} = 0.31$

ROPE DYNAMIC LOAD FACTOR. 1

DYNAMIC LOAD FACTOR $= DLF = \frac{F_x}{P_S}$

WHERE P_S = STATIC LIFTED LOAD PLUS BLOCK WEIGHT = 140 KIPS = 70T 1

OBE $DLF = \frac{209.2}{70} = 3.0$

SSE $DLF = \frac{331}{70} = 4.7$

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. C6766 REQN. 79508
DATE 9-9-87 BY MJM
PAGE i R1 OF iii

REV. 1 ASZ 11-4-87 [1]
CHK WAH 11-5-87

CRANE SEISMIC REPORT
CASK HANDLING CRANE
150/20 TON CAPACITY
S/N 12115

CUSTOMER: AMERICAN ELECTRIC POWER CORP.
COLUMBUS, OHIO

FOR: INDIANA & MICHIGAN ELECTRIC CO.
DONALD C COOK FACILITY
BRIDGMAN, MICHIGAN

P.O. NO: C 6766

SPECIFICATION: DCC-MH-103-QCN Rev. 1
: DCCNE-101-QCN Rev. 0

Charles R. Norman
REGISTERED PROFESSIONAL ENGINEER
OF ILLINOIS 62-33561

BY M McMahon
M. McMahon
Staff Engineer

BY Adrian S. Zacharjasz
A. S. Zacharjasz
Engineering Analyst

BY R.G. Guminski
R. G. Guminski
Engineering Analyst

ABSTRACT

The equipment reviewed in this report is an 'Electric Overhead Crane', consisting of two separate top running trolleys and a monorail underhung hoist unit with the track mounted on the side of girder 'B'. The crane is designed and rated for a maximum capacity load of 150 tons with limitations of 150 tons on the main trolley, 20 tons on the auxiliary trolley or 1-1/4 tons on the monorail hoist unit. 1

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 60 tons and no load on the main hook and the trolley at mid-span, quarter span and both ends of span. The auxiliary trolley was unloaded and parked on the south end for the loaded cases. Additional unloaded cases were run with both trolleys at various positions. For all cases the monorail hoist unit was unloaded and located on the north end. 1

The crane was mathematicaly 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 paralled 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 60 ton load on the main hook.

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APPENDIX A

This appendix summarizes the amplified response spectra and the modal response of the crane.

MC is the Mode coefficient (Ref 1, p 2.12.1-2.12.4)

$$MC = \frac{\gamma_i \cdot Sai}{(2\pi F_i)^2} = \frac{\{d\}_i}{\{\Psi\}_i}$$

Where Sai = 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

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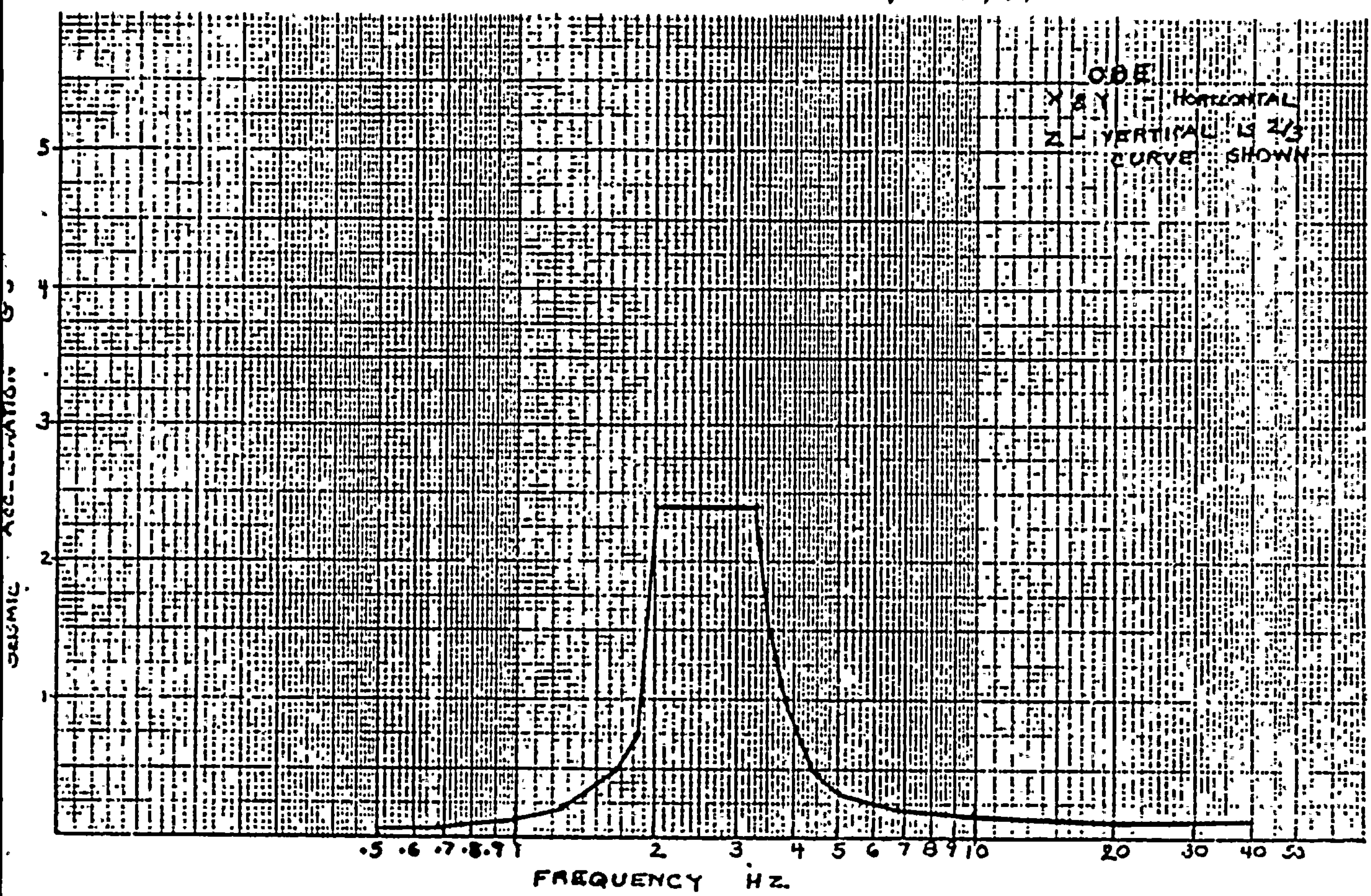

TABLE A1
OBE

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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RJJ 9-9-87

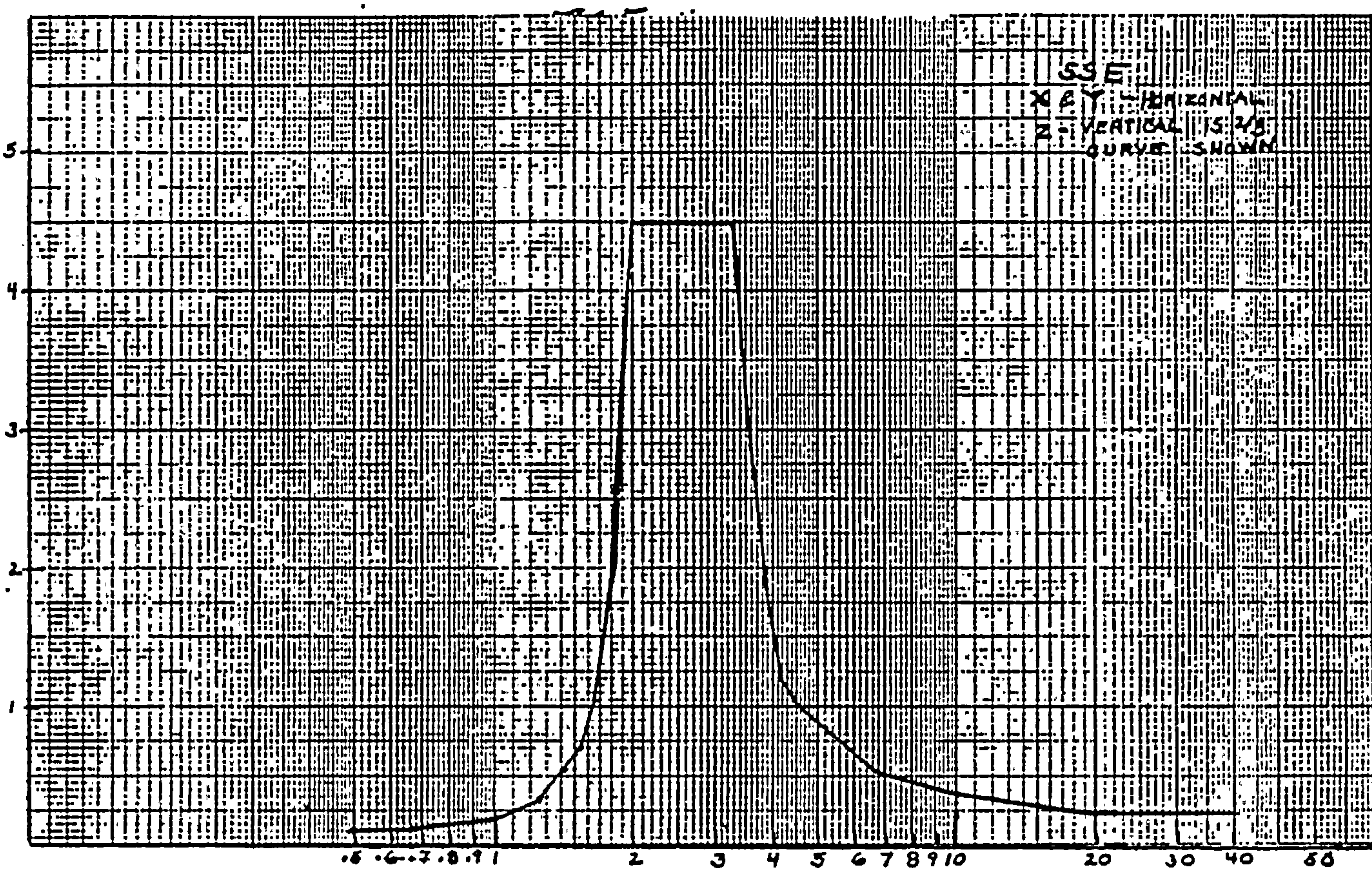

TABLE A2

SSE

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	.0001	.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

TABLE A3

SUMMARY OF NATURAL FREQUENCIES AND MODE COEFFICIENTS - PANMMUD

MODE	FREQUENCY HZ	MODE COEFFICIENT FOR SPECIFIED DIRECTION X	Y	Z
1	2.16	0.1285 *	113.9000 * MAX	0.0461 *
2	2.84	0.1094 *	3.8890 *	0.0094 *
3	4.16	0.9564 * MAX	0.1379 *	7.6260 * MAX
4	4.27	0.4532 *	0.8512 *	0.7762 *
5	8.70	0.0272 *	0.0697 *	0.0011
6	9.33	0.0127 *	0.0363	0.0024
7	11.28	0.0202 *	0.0036	0.0007
8	12.77	0.0141 *	0.0081	0.0027
9	13.57	0.0327 *	0.0108	0.0012
10	14.36	0.1396 *	0.0010	0.0023
11	15.36	0.0953 *	0.0005	0.0149 *
12	18.69	0.0006	0.0013	0.0000
13	18.91	0.0007	0.0005	0.0004
14	20.31	0.0011	0.0141	0.0008
15	20.46	0.0007	0.0062	0.0001
16	21.00	0.0003	0.0033	0.0003
17	22.59	0.0003	0.0023	0.0000
18	22.81	0.0003	0.0015	0.0001
19	24.10	0.0007	0.0071	0.0005
20	24.53	0.0014	0.0047	0.0008
21	29.02	0.0044	0.0014	0.0009
22	29.80	0.0018	0.0023	0.0006
23	31.92	0.0001	0.0019	0.0022
24	32.09	0.0007	0.0055	0.0011
25	32.65	0.0017	0.0023	0.0006
26	38.19	0.0002	0.0016	0.0000
27	44.32	0.0000	0.0000	0.0002
28	48.72	0.0003	0.0006	0.0002
29	50.87	0.0001	0.0000	0.0001
30	52.27	0.0003	0.0002	0.0001
31	57.17	0.0001	0.0000	0.0002
32	60.13	0.0000	0.0000	0.0001
33	63.49	0.0004	0.0000	0.0005
34	65.13	0.0001	0.0001	0.0001
35	68.42	0.0003	0.0000	0.0005
36	70.53	0.0003	0.0000	0.0007
37	77.78	0.0001	0.0000	0.0003
38	79.62	0.0001	0.0000	0.0000
39	86.09	0.0000	0.0001	0.0000
40	89.15	0.0001	0.0000	0.0003
41	90.64	0.0000	0.0000	0.0000
42	93.07	0.0000	0.0000	0.0003
43	100.70	0.0000	0.0000	0.0001
44	101.80	0.0000	0.0000	0.0002
45	102.90	0.0000	0.0000	0.0001
46	131.80	0.0000	0.0000	0.0000
47	140.30	0.0000	0.0000	0.0000
48	172.40	0.0000	0.0000	0.0000
SIGNIFICANCE FACTOR		0.50%	0.05%	0.05%

* INDICATES EXPANDED MODE

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[handwritten initials] 9.9.87

TABLE A4

SUMMARY OF NATURAL FREQUENCIES AND MODE COEFFICIENTS - PANMMUS

MODE	FREQUENCY HZ	MODE COEFFICIENT FOR SPECIFIED DIRECTION X	Y	Z
1	2.16	0.2409 *	213.6000 * MAX	0.0864 *
2	2.84	0.2052 *	7.2920 *	0.0176 *
3	4.16	1.6900 * MAX	0.2437 *	13.5800 * MAX
4	4.27	0.8692 *	1.6330 *	1.5010 *
5	8.70	0.0606 *	0.1554 *	0.0025
6	9.33	0.0277 *	0.0789	0.0053
7	11.28	0.0415 *	0.0074	0.0015
8	12.77	0.0280 *	0.0162	0.0054
9	13.57	0.0640 *	0.0211	0.0023
10	14.36	0.2692 *	0.0019	0.0044
11	15.36	0.1806 *	0.0009	0.0275 *
12	18.69	0.0011	0.0024	0.0000
13	18.91	0.0012	0.0009	0.0007
14	20.31	0.0019	0.0249	0.0013
15	20.46	0.0012	0.0109	0.0002
16	21.00	0.0005	0.0059	0.0005
17	22.59	0.0005	0.0041	0.0000
18	22.81	0.0005	0.0026	0.0001
19	24.10	0.0012	0.0130	0.0009
20	24.53	0.0026	0.0087	0.0014
21	29.02	0.0082	0.0027	0.0016
22	29.80	0.0033	0.0043	0.0010
23	31.92	0.0001	0.0036	0.0041
24	32.09	0.0014	0.0104	0.0020
25	32.65	0.0033	0.0045	0.0011
26	38.19	0.0004	0.0031	0.0001
27	44.32	0.0000	0.0000	0.0003
28	48.72	0.0005	0.0011	0.0004
29	50.87	0.0001	0.0000	0.0001
30	52.27	0.0005	0.0004	0.0001
31	57.17	0.0003	0.0000	0.0004
32	60.13	0.0000	0.0001	0.0002
33	63.49	0.0007	0.0000	0.0009
34	65.13	0.0002	0.0002	0.0003
35	68.42	0.0005	0.0000	0.0010
36	70.53	0.0005	0.0000	0.0014
37	77.78	0.0002	0.0000	0.0006
38	79.62	0.0002	0.0001	0.0001
39	86.09	0.0001	0.0001	0.0001
40	89.15	0.0001	0.0000	0.0005
41	90.64	0.0001	0.0000	0.0000
42	93.07	0.0001	0.0000	0.0005
43	100.70	0.0000	0.0000	0.0001
44	101.80	0.0000	0.0000	0.0003
45	102.90	0.0001	0.0000	0.0002
46	131.80	0.0000	0.0000	0.0000
47	140.30	0.0000	0.0000	0.0000
48	172.40	0.0000	0.0000	0.0000
SIGNIFICANCE FACTOR		0.50%	0.05%	0.05%

* INDICATES EXPANDED MODE

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TABLE A5

SUMMARY OF NATURAL FREQUENCIES AND MODE COEFFICIENTS - PANMMDO

MODE	FREQUENCY HZ	MODE COEFFICIENT FOR SPECIFIED DIRECTION X	Y	Z
1	2.16	0.1289 *	113.9000 * MAX	0.0607 *
2	2.77	2.4630 * MAX	0.0179	49.8000 * MAX
3	2.84	0.1128 *	3.8890 *	0.0743 *
4	4.26	0.5573 *	0.8616 *	0.0364 *
5	6.44	0.1876 *	0.0063	0.6600 *
6	8.72	0.0359 *	0.0695 *	0.0126
7	9.33	0.0131 *	0.0363	0.0019
8	11.31	0.0127 *	0.0043	0.0040
9	12.79	0.0230 *	0.0075	0.0001
10	13.60	0.0165 *	0.0108	0.0013
11	14.81	0.1663 *	0.0004	0.0105
12	18.69	0.0006	0.0013	0.0000
13	18.91	0.0007	0.0005	0.0004
14	20.30	0.0010	0.0141	0.0007
15	20.46	0.0007	0.0061	0.0002
16	21.00	0.0003	0.0033	0.0003
17	22.59	0.0003	0.0023	0.0000
18	22.81	0.0003	0.0015	0.0001
19	24.10	0.0007	0.0071	0.0005
20	24.53	0.0014	0.0047	0.0008
21	28.93	0.0044	0.0013	0.0008
22	29.80	0.0017	0.0023	0.0005
23	31.92	0.0001	0.0019	0.0022
24	32.09	0.0007	0.0055	0.0011
25	32.63	0.0017	0.0023	0.0006
26	38.19	0.0002	0.0016	0.0000
27	44.32	0.0000	0.0000	0.0002
28	48.71	0.0003	0.0006	0.0002
29	50.87	0.0001	0.0000	0.0001
30	52.26	0.0003	0.0002	0.0001
31	57.17	0.0001	0.0000	0.0002
32	60.13	0.0000	0.0000	0.0001
33	63.49	0.0004	0.0000	0.0005
34	65.13	0.0001	0.0001	0.0001
35	68.41	0.0003	0.0000	0.0005
36	70.51	0.0003	0.0000	0.0007
37	77.78	0.0001	0.0000	0.0003
38	79.62	0.0001	0.0000	0.0000
39	86.09	0.0000	0.0001	0.0000
40	89.14	0.0001	0.0000	0.0003
41	90.64	0.0000	0.0000	0.0000
42	93.07	0.0000	0.0000	0.0003
43	100.70	0.0000	0.0000	0.0001
44	101.80	0.0000	0.0000	0.0002
45	102.80	0.0000	0.0000	0.0001
46	131.80	0.0000	0.0000	0.0000
47	140.30	0.0000	0.0000	0.0000
48	172.40	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 - PANMMDS

MODE	FREQUENCY HZ	MODE COEFFICIENT FOR SPECIFIED DIRECTION X	Y	Z
1	2.16	0.2417 *	213.6000 * MAX	0.1137 *
2	2.77	4.6180 * MAX	0.0336	93.3700 * MAX
3	2.84	0.2115 *	7.2920 *	0.1393 *
4	4.26	1.0670 *	1.6500 *	0.0703 *
5	6.44	0.4603 *	0.0155	1.5820 *
6	8.72	0.0800 *	0.1548 *	0.0283
7	9.33	0.0285 *	0.0787	0.0043
8	11.31	0.0262 *	0.0088	0.0084
9	12.79	0.0457 *	0.0150	0.0001
10	13.60	0.0323 *	0.0212	0.0025
11	14.81	0.3182 *	0.0007	0.0196
12	18.69	0.0011	0.0024	0.0000
13	18.91	0.0013	0.0009	0.0007
14	20.30	0.0018	0.0250	0.0011
15	20.46	0.0012	0.0109	0.0003
16	21.00	0.0005	0.0059	0.0005
17	22.59	0.0005	0.0041	0.0000
18	22.81	0.0005	0.0026	0.0001
19	24.10	0.0012	0.0130	0.0009
20	24.53	0.0025	0.0087	0.0015
21	28.93	0.0083	0.0025	0.0015
22	29.80	0.0032	0.0043	0.0010
23	31.92	0.0001	0.0036	0.0041
24	32.09	0.0014	0.0105	0.0020
25	32.63	0.0033	0.0044	0.0011
26	38.19	0.0004	0.0031	0.0001
27	44.32	0.0000	0.0000	0.0003
28	48.71	0.0005	0.0011	0.0004
29	50.87	0.0001	0.0000	0.0001
30	52.26	0.0005	0.0004	0.0001
31	57.17	0.0003	0.0000	0.0004
32	60.13	0.0000	0.0001	0.0002
33	63.49	0.0007	0.0000	0.0009
34	65.13	0.0002	0.0002	0.0003
35	68.41	0.0005	0.0000	0.0010
36	70.51	0.0005	0.0000	0.0014
37	77.78	0.0002	0.0000	0.0006
38	79.62	0.0002	0.0001	0.0001
39	86.09	0.0001	0.0001	0.0001
40	89.14	0.0001	0.0000	0.0005
41	90.64	0.0001	0.0000	0.0000
42	93.07	0.0001	0.0000	0.0005
43	100.70	0.0000	0.0000	0.0001
44	101.80	0.0000	0.0000	0.0003
45	102.80	0.0001	0.0000	0.0002
46	131.80	0.0000	0.0000	0.0000
47	140.30	0.0000	0.0000	0.0000
48	172.40	0.0000	0.0000	0.0000
SIGNIFICANCE FACTOR		0.50%	0.05%	0.05%

* INDICATES EXPANDED MODE

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TABLE A 7

SUMMARY OF NATURAL FREQUENCIES AND MODE COEFFICIENTS - PANMQUD

MODE	FREQUENCY HZ	MODE COEFFICIENT FOR SPECIFIED DIRECTION X	Y	Z
1	2.58	1.7840 * MAX	73.5300 * MAX	0.0284 *
2	2.85	0.0822 *	1.0540 *	0.0113 *
3	3.89	0.7031 *	5.7200 *	0.1852 *
4	4.99	0.0669 *	0.0123	2.7290 * MAX
5	6.80	0.0550 *	0.1862 *	0.0024
6	8.84	0.0477 *	0.0308	0.0020
7	13.26	0.0558 *	0.0147	0.0080 *
8	13.57	0.1603 *	0.0094	0.0044 *
9	13.71	0.1153 *	0.0164	0.0102 *
10	14.88	0.0155 *	0.0005	0.0040 *
11	15.99	0.0066	0.0098	0.0017
12	17.13	0.0028	0.0083	0.0002
13	18.69	0.0004	0.0010	0.0001
14	18.91	0.0002	0.0004	0.0002
15	20.46	0.0005	0.0050	0.0001
16	21.00	0.0001	0.0023	0.0003
17	22.73	0.0003	0.0003	0.0000
18	22.78	0.0000	0.0014	0.0002
19	24.34	0.0001	0.0042	0.0002
20	24.60	0.0005	0.0084	0.0001
21	25.94	0.0007	0.0058	0.0004
22	27.97	0.0016	0.0017	0.0005
23	31.93	0.0007	0.0004	0.0021
24	32.15	0.0000	0.0011	0.0016
25	33.18	0.0003	0.0060	0.0003
26	37.25	0.0008	0.0000	0.0006
27	41.52	0.0002	0.0001	0.0002
28	44.31	0.0005	0.0001	0.0004
29	45.41	0.0028	0.0002	0.0015
30	50.46	0.0005	0.0005	0.0004
31	51.12	0.0000	0.0001	0.0000
32	58.38	0.0001	0.0000	0.0002
33	60.92	0.0001	0.0000	0.0001
34	62.97	0.0002	0.0001	0.0000
35	63.20	0.0001	0.0000	0.0001
36	70.49	0.0001	0.0000	0.0003
37	73.16	0.0000	0.0001	0.0004
38	77.88	0.0001	0.0000	0.0000
39	81.34	0.0001	0.0000	0.0006
40	87.46	0.0000	0.0001	0.0002
41	90.45	0.0000	0.0000	0.0001
42	95.61	0.0000	0.0000	0.0002
43	100.80	0.0000	0.0000	0.0001
44	101.90	0.0000	0.0000	0.0001
45	105.40	0.0000	0.0000	0.0001
46	123.20	0.0000	0.0000	0.0000
47	131.20	0.0000	0.0000	0.0000
48	142.10	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 - PANMQUS

MODE	FREQUENCY HZ	MODE COEFFICIENT FOR SPECIFIED DIRECTION X	Y	Z
1	2.58	3.3460 * MAX	137.9000 * MAX	0.0532 *
2	2.85	0.1542 *	1.9750 *	0.0213 *
3	3.89	1.3230 *	10.7600 *	0.3552 *
4	4.99	0.1630 *	0.0299	6.5180 * MAX
5	6.80	0.1340 *	0.4539 *	0.0057
6	8.84	0.1057 *	0.0683	0.0044
7	13.26	0.1098 *	0.0289	0.0157 *
8	13.57	0.3137 *	0.0183	0.0085 *
9	13.71	0.2252 *	0.0320	0.0196 *
10	14.88	0.0297 *	0.0009	0.0074 *
11	15.99	0.0124	0.0183	0.0031
12	17.13	0.0052	0.0152	0.0003
13	18.69	0.0007	0.0018	0.0001
14	18.91	0.0004	0.0008	0.0004
15	20.46	0.0008	0.0089	0.0002
16	21.00	0.0002	0.0042	0.0004
17	22.73	0.0005	0.0005	0.0000
18	22.78	0.0000	0.0025	0.0003
19	24.34	0.0002	0.0077	0.0003
20	24.60	0.0008	0.0154	0.0002
21	25.94	0.0014	0.0106	0.0007
22	27.97	0.0030	0.0033	0.0009
23	31.93	0.0014	0.0008	0.0039
24	32.15	0.0000	0.0020	0.0031
25	33.18	0.0006	0.0115	0.0006
26	37.25	0.0016	0.0000	0.0011
27	41.52	0.0004	0.0001	0.0003
28	44.31	0.0009	0.0001	0.0007
29	45.41	0.0053	0.0004	0.0029
30	50.46	0.0009	0.0010	0.0007
31	51.12	0.0000	0.0002	0.0001
32	58.38	0.0001	0.0001	0.0004
33	60.92	0.0002	0.0000	0.0002
34	62.97	0.0004	0.0001	0.0000
35	63.20	0.0003	0.0000	0.0001
36	70.49	0.0003	0.0000	0.0005
37	73.16	0.0000	0.0002	0.0008
38	77.88	0.0001	0.0000	0.0000
39	81.34	0.0002	0.0000	0.0012
40	87.46	0.0000	0.0001	0.0003
41	90.45	0.0000	0.0000	0.0001
42	95.61	0.0000	0.0000	0.0004
43	100.80	0.0000	0.0000	0.0002
44	101.90	0.0000	0.0000	0.0002
45	105.40	0.0001	0.0000	0.0002
46	123.20	0.0000	0.0000	0.0000
47	131.20	0.0000	0.0000	0.0000
48	142.10	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 - PANMODO

MODE	FREQUENCY HZ	MODE COEFFICIENT FOR SPECIFIED DIRECTION X	Y	Z
1	2.58	1.7840 * MAX	73.5300 * MAX	0.0202
2	2.85	0.0817 *	1.0530 *	0.0609 *
3	2.93	0.3062 *	0.0799 *	41.9500 * MAX
4	3.89	0.7043 *	5.7190 *	0.0907 *
5	6.80	0.0584 *	0.1854 *	0.0743 *
6	6.89	0.0259 *	0.0174	0.5793 *
7	8.84	0.0471 *	0.0308	0.0075
8	13.43	0.1199 *	0.0203	0.0052
9	13.67	0.1661 *	0.0123	0.0104
10	14.78	0.0187 *	0.0014	0.0035
11	15.91	0.0066	0.0102	0.0014
12	17.13	0.0028	0.0083	0.0002
13	18.69	0.0004	0.0010	0.0001
14	18.91	0.0002	0.0004	0.0002
15	20.46	0.0005	0.0050	0.0001
16	21.00	0.0001	0.0023	0.0003
17	22.73	0.0003	0.0003	0.0000
18	22.78	0.0000	0.0014	0.0002
19	24.33	0.0001	0.0043	0.0002
20	24.60	0.0005	0.0084	0.0001
21	25.84	0.0010	0.0054	0.0006
22	27.35	0.0016	0.0025	0.0007
23	31.93	0.0007	0.0004	0.0021
24	32.13	0.0000	0.0010	0.0016
25	33.18	0.0003	0.0060	0.0003
26	37.24	0.0009	0.0000	0.0006
27	41.51	0.0002	0.0001	0.0002
28	44.31	0.0005	0.0001	0.0004
29	45.41	0.0028	0.0002	0.0015
30	50.46	0.0005	0.0005	0.0004
31	51.12	0.0000	0.0001	0.0000
32	58.33	0.0001	0.0000	0.0002
33	60.92	0.0001	0.0000	0.0001
34	62.96	0.0002	0.0001	0.0000
35	63.19	0.0001	0.0000	0.0001
36	70.46	0.0001	0.0000	0.0003
37	73.16	0.0000	0.0001	0.0004
38	77.88	0.0001	0.0000	0.0000
39	81.34	0.0001	0.0000	0.0006
40	87.46	0.0000	0.0001	0.0002
41	90.45	0.0000	0.0000	0.0001
42	95.61	0.0000	0.0000	0.0002
43	100.80	0.0000	0.0000	0.0001
44	101.90	0.0000	0.0000	0.0001
45	105.40	0.0000	0.0000	0.0001
46	123.10	0.0000	0.0000	0.0000
47	131.20	0.0000	0.0000	0.0000
48	142.10	0.0000	0.0000	0.0000
SIGNIFICANCE FACTOR		0.50%	0.10%	0.10%

* INDICATES EXPANDED MODE

TABLE A10

SUMMARY OF NATURAL FREQUENCIES AND MODE COEFFICIENTS - PANMODS

MODE	FREQUENCY HZ	MODE COEFFICIENT FOR SPECIFIED DIRECTION X	Y	Z
1	2.58	3.3460 * MAX	137.9000 * MAX	0.0378
2	2.85	0.1532 *	1.9750 *	0.1142 *
3	2.93	0.5742 *	0.1499 *	78.6500 * MAX
4	3.89	1.3250 *	10.7600 *	0.1740 *
5	6.80	0.1425 *	0.4521 *	0.1774 *
6	6.89	0.0627 *	0.0422	1.3790 *
7	8.84	0.1043 *	0.0682	0.0169
8	13.43	0.2354 *	0.0398	0.0101
9	13.67	0.3245 *	0.0240	0.0201
10	14.78	0.0358 *	0.0028	0.0066
11	15.91	0.0124	0.0191	0.0025
12	17.13	0.0052	0.0153	0.0003
13	18.69	0.0007	0.0018	0.0001
14	18.91	0.0004	0.0008	0.0004
15	20.46	0.0008	0.0089	0.0002
16	21.00	0.0002	0.0042	0.0004
17	22.73	0.0005	0.0005	0.0001
18	22.78	0.0000	0.0025	0.0003
19	24.33	0.0002	0.0078	0.0003
20	24.60	0.0009	0.0153	0.0002
21	25.84	0.0019	0.0100	0.0010
22	27.35	0.0030	0.0047	0.0013
23	31.93	0.0014	0.0007	0.0039
24	32.13	0.0001	0.0020	0.0030
25	33.18	0.0007	0.0116	0.0006
26	37.24	0.0016	0.0000	0.0011
27	41.51	0.0004	0.0001	0.0003
28	44.31	0.0009	0.0001	0.0007
29	45.41	0.0053	0.0004	0.0029
30	50.46	0.0009	0.0010	0.0007
31	51.12	0.0000	0.0002	0.0001
32	58.33	0.0001	0.0001	0.0004
33	60.92	0.0002	0.0000	0.0002
34	62.96	0.0004	0.0001	0.0000
35	63.19	0.0003	0.0000	0.0001
36	70.46	0.0003	0.0000	0.0005
37	73.16	0.0000	0.0002	0.0008
38	77.88	0.0001	0.0000	0.0000
39	81.34	0.0002	0.0000	0.0012
40	87.46	0.0000	0.0001	0.0003
41	90.45	0.0000	0.0000	0.0001
42	95.61	0.0000	0.0000	0.0004
43	100.80	0.0000	0.0000	0.0002
44	101.90	0.0000	0.0000	0.0002
45	105.40	0.0001	0.0000	0.0002
46	123.10	0.0000	0.0000	0.0000
47	131.20	0.0000	0.0000	0.0000
48	142.10	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 - PANMEUO

MODE	FREQUENCY HZ	MODE COEFFICIENT FOR SPECIFIED DIRECTION X	Y	Z
1	2.84	0.2731 *	8.6520 *	0.0176 *
2	3.26	2.4610 * MAX	32.0100 * MAX	0.1052 *
3	3.77	0.3090 *	10.9700 *	0.1592 *
4	5.71	0.0583 *	0.4341 *	0.0063 *
5	6.40	0.1355 *	0.0055	1.1130 * MAX
6	10.65	0.0544 *	0.1132 *	0.0069 *
7	12.07	0.0009	0.0663 *	0.0020
8	12.38	0.0027	0.0132	0.0101 *
9	13.13	0.2167 *	0.0063	0.0268 *
10	15.09	0.0076	0.0104	0.0021
11	15.97	0.0150 *	0.0164	0.0040 *
12	18.08	0.0039	0.0033	0.0018
13	18.69	0.0003	0.0012	0.0001
14	18.91	0.0002	0.0002	0.0002
15	20.55	0.0005	0.0029	0.0001
16	21.02	0.0002	0.0016	0.0003
17	22.73	0.0003	0.0030	0.0001
18	22.74	0.0005	0.0028	0.0001
19	22.94	0.0004	0.0042	0.0006
20	24.36	0.0013	0.0027	0.0002
21	25.14	0.0012	0.0056	0.0001
22	27.91	0.0065	0.0001	0.0031 *
23	31.20	0.0006	0.0076	0.0001
24	32.04	0.0005	0.0008	0.0006
25	32.09	0.0002	0.0001	0.0029 *
26	35.35	0.0003	0.0022	0.0010
27	41.82	0.0033	0.0003	0.0018
28	44.34	0.0000	0.0000	0.0002
29	46.26	0.0003	0.0001	0.0004
30	48.67	0.0001	0.0002	0.0001
31	51.17	0.0002	0.0001	0.0002
32	51.35	0.0004	0.0003	0.0003
33	57.42	0.0000	0.0001	0.0002
34	60.65	0.0003	0.0000	0.0007
35	61.96	0.0003	0.0001	0.0008
36	67.31	0.0003	0.0001	0.0003
37	69.68	0.0001	0.0001	0.0007
38	72.28	0.0001	0.0000	0.0003
39	77.47	0.0000	0.0000	0.0004
40	86.17	0.0000	0.0001	0.0001
41	90.46	0.0000	0.0000	0.0001
42	92.79	0.0000	0.0000	0.0001
43	96.39	0.0000	0.0000	0.0003
44	100.90	0.0000	0.0000	0.0001
45	102.00	0.0000	0.0000	0.0001
46	127.00	0.0000	0.0000	0.0000
47	129.30	0.0000	0.0000	0.0000
48	142.30	0.0000	0.0000	0.0000
SIGNIFICANCE FACTOR		0.50%	0.20%	0.20%

* INDICATES EXPANDED MODE

TABLE A12

SUMMARY OF NATURAL FREQUENCIES AND MODE COEFFICIENTS - PANNEUS

MODE	FREQUENCY HZ	MODE COEFFICIENT FOR SPECIFIED DIRECTION X	Y	Z
1	2.84	0.5122 *	16.2200 *	0.0330 *
2	3.26	4.6150 * MAX	60.0200 * MAX	0.1973 *
3	3.77	0.5900 *	20.9500 *	0.3072 *
4	5.71	0.1427 *	1.0620 *	0.0152 *
5	6.40	0.3324 *	0.0134	2.6690 * MAX
6	10.65	0.1133 *	0.2359 *	0.0147 *
7	12.07	0.0018	0.1338 *	0.0040
8	12.38	0.0055	0.0264	0.0204 *
9	13.13	0.4277 *	0.0125	0.0527 *
10	15.07	0.0145	0.0198	0.0038
11	15.97	0.0281 *	0.0308	0.0073 *
12	18.03	0.0071	0.0059	0.0032
13	18.69	0.0005	0.0022	0.0002
14	18.91	0.0003	0.0003	0.0004
15	20.55	0.0009	0.0052	0.0001
16	21.02	0.0004	0.0028	0.0004
17	22.73	0.0005	0.0054	0.0002
18	22.74	0.0008	0.0051	0.0002
19	22.94	0.0007	0.0076	0.0011
20	24.36	0.0024	0.0049	0.0004
21	25.14	0.0023	0.0102	0.0002
22	27.91	0.0121	0.0002	0.0057 *
23	31.20	0.0011	0.0145	0.0003
24	32.04	0.0009	0.0015	0.0011
25	32.09	0.0004	0.0003	0.0055 *
26	35.35	0.0006	0.0042	0.0018
27	41.82	0.0064	0.0005	0.0034
28	44.34	0.0000	0.0000	0.0003
29	46.26	0.0006	0.0002	0.0008
30	48.69	0.0001	0.0004	0.0002
31	51.17	0.0004	0.0002	0.0004
32	51.35	0.0007	0.0007	0.0006
33	57.42	0.0000	0.0003	0.0003
34	60.65	0.0005	0.0000	0.0012
35	61.96	0.0007	0.0001	0.0016
36	67.31	0.0005	0.0002	0.0005
37	69.68	0.0002	0.0001	0.0013
38	72.28	0.0002	0.0000	0.0006
39	77.47	0.0001	0.0000	0.0007
40	86.17	0.0000	0.0001	0.0003
41	90.46	0.0000	0.0000	0.0001
42	92.79	0.0000	0.0001	0.0002
43	96.39	0.0000	0.0000	0.0006
44	100.90	0.0000	0.0000	0.0002
45	102.00	0.0000	0.0000	0.0001
46	127.00	0.0000	0.0000	0.0000
47	129.30	0.0000	0.0000	0.0001
48	132.30	0.0000	0.0000	0.0000
SIGNIFICANCE FACTOR		0.50%	0.20%	0.20%

* INDICATES EXPANDED MODE

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TABLE A 13

SUMMARY OF NATURAL FREQUENCIES AND MODE COEFFICIENTS - PANMEDO

MODE	FREQUENCY HZ	MODE COEFFICIENT FOR SPECIFIED DIRECTION X	Y	Z
1	2.84	0.2734 *	8.6520 *	0.0002
2	3.07	0.7044 *	0.0106	35.1100 * MAX
3	3.26	2.4630 * MAX	32.0100 * MAX	0.0520
4	3.77	0.3097 *	10.9700 *	0.1385 *
5	5.71	0.0591 *	0.4341 *	0.0033
6	7.73	0.1035 *	0.0059	0.4396 *
7	10.66	0.0521 *	0.1132 *	0.0081
8	12.07	0.0015	0.0675 *	0.0011
9	13.12	0.2159 *	0.0055	0.0251
10	15.09	0.0082	0.0102	0.0025
11	15.91	0.0171 *	0.0167	0.0060
12	18.05	0.0045	0.0034	0.0027
13	18.69	0.0003	0.0012	0.0001
14	18.91	0.0002	0.0002	0.0002
15	20.55	0.0005	0.0029	0.0000
16	21.02	0.0003	0.0016	0.0002
17	22.73	0.0004	0.0033	0.0002
18	22.74	0.0005	0.0025	0.0001
19	22.93	0.0006	0.0042	0.0008
20	24.35	0.0016	0.0027	0.0005
21	25.14	0.0015	0.0056	0.0001
22	27.20	0.0070	0.0001	0.0043
23	31.20	0.0005	0.0076	0.0002
24	32.04	0.0005	0.0008	0.0007
25	32.07	0.0001	0.0000	0.0029
26	35.34	0.0004	0.0022	0.0010
27	41.82	0.0033	0.0003	0.0018
28	44.34	0.0000	0.0000	0.0002
29	46.25	0.0003	0.0001	0.0004
30	48.69	0.0001	0.0002	0.0001
31	51.17	0.0002	0.0001	0.0002
32	51.35	0.0004	0.0003	0.0003
33	57.42	0.0000	0.0001	0.0002
34	60.61	0.0003	0.0000	0.0007
35	61.82	0.0003	0.0001	0.0008
36	67.30	0.0003	0.0001	0.0003
37	69.68	0.0001	0.0001	0.0007
38	72.27	0.0001	0.0000	0.0003
39	77.47	0.0000	0.0000	0.0004
40	86.16	0.0000	0.0001	0.0001
41	90.46	0.0000	0.0000	0.0001
42	92.77	0.0000	0.0000	0.0001
43	96.38	0.0000	0.0000	0.0003
44	100.90	0.0000	0.0000	0.0001
45	102.00	0.0000	0.0000	0.0001
46	127.00	0.0000	0.0000	0.0000
47	129.80	0.0000	0.0000	0.0000
48	142.30	0.0000	0.0000	0.0000
SIGNIFICANCE FACTOR		0.50%	0.20%	0.20%

* INDICATES EXPANDED MODE

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TABLE A14

SUMMARY OF NATURAL FREQUENCIES AND MODE COEFFICIENTS - PANNEDS

MODE	FREQUENCY HZ	MODE COEFFICIENT FOR SPECIFIED DIRECTION X	Y	Z
1	2.84	0.5127 *	16.2200 *	0.0003
2	3.07	1.3210 *	0.0200	65.8200 * MAX
3	3.26	4.6180 * MAX	60.0200 * MAX	0.0975
4	3.77	0.5912 *	20.9500 *	0.2672 *
5	5.71	0.1443 *	1.0620 *	0.0080
6	7.73	0.2308 *	0.0137	1.0190 *
7	10.66	0.1035 *	0.2358 *	0.0172
8	12.07	0.0030	0.1362 *	0.0022
9	13.12	0.4262 *	0.0109	0.0492
10	15.09	0.0156	0.0195	0.0046
11	15.91	0.0321 *	0.0315	0.0110
12	18.05	0.0082	0.0063	0.0048
13	18.69	0.0005	0.0022	0.0002
14	18.91	0.0003	0.0003	0.0004
15	20.55	0.0009	0.0052	0.0000
16	21.02	0.0005	0.0028	0.0004
17	22.73	0.0007	0.0059	0.0003
18	22.74	0.0009	0.0045	0.0002
19	22.93	0.0010	0.0075	0.0014
20	24.35	0.0030	0.0048	0.0009
21	25.14	0.0027	0.0102	0.0002
22	27.20	0.0130	0.0003	0.0077
23	31.20	0.0009	0.0145	0.0003
24	32.04	0.0009	0.0015	0.0013
25	32.07	0.0003	0.0000	0.0055
26	35.34	0.0007	0.0042	0.0018
27	41.82	0.0064	0.0005	0.0034
28	44.34	0.0000	0.0000	0.0003
29	46.25	0.0006	0.0002	0.0008
30	48.69	0.0001	0.0004	0.0002
31	51.17	0.0004	0.0002	0.0004
32	51.35	0.0007	0.0007	0.0006
33	57.42	0.0000	0.0003	0.0003
34	60.61	0.0006	0.0000	0.0013
35	61.82	0.0006	0.0001	0.0015
36	67.30	0.0005	0.0002	0.0005
37	69.68	0.0002	0.0001	0.0013
38	72.27	0.0002	0.0000	0.0005
39	77.47	0.0001	0.0000	0.0007
40	86.16	0.0000	0.0001	0.0003
41	90.46	0.0000	0.0000	0.0001
42	93.77	0.0000	0.0001	0.0002
43	96.38	0.0000	0.0000	0.0006
44	100.90	0.0000	0.0000	0.0002
45	102.00	0.0000	0.0000	0.0001
46	127.00	0.0000	0.0000	0.0000
47	127.30	0.0000	0.0000	0.0001
48	142.30	0.0000	0.0000	0.0000
SIGNIFICANCE FACTOR		0.50%	0.20%	0.20%

* INDICATES EXPANDED MODE

TABLE A15

SUMMARY OF NATURAL FREQUENCIES AND MODE COEFFICIENTS - PANNRUO

MODE	FREQUENCY HZ	MODE COEFFICIENT FOR SPECIFIED DIRECTION X	Y	Z
1	2.84	0.1315 *	4.6130 *	0.0185 *
2	3.12	1.8400 * MAX	52.7200 * MAX	0.2088 *
3	4.21	0.3854 *	2.3700 *	0.0467 *
4	5.37	0.0579 *	0.2855 *	0.0566 *
5	5.62	0.6773 *	0.0143	1.7100 * MAX
6	7.85	0.0325 *	0.1323 *	0.0143 *
7	12.40	0.0063	0.0091	0.0014
8	12.94	0.1195 *	0.0020	0.0149 *
9	14.23	0.0221 *	0.0161	0.0023
10	16.45	0.0495 *	0.0061	0.0098 *
11	18.07	0.0743 *	0.0042	0.0217 *
12	18.53	0.0137 *	0.0119	0.0041 *
13	18.70	0.0067	0.0020	0.0020
14	18.92	0.0013	0.0007	0.0007
15	20.57	0.0010	0.0025	0.0004
16	21.04	0.0002	0.0014	0.0004
17	22.68	0.0004	0.0005	0.0002
18	22.90	0.0007	0.0004	0.0003
19	24.25	0.0029	0.0010	0.0029
20	24.85	0.0001	0.0014	0.0027
21	26.05	0.0001	0.0028	0.0037 *
22	26.66	0.0002	0.0035	0.0035 *
23	31.94	0.0004	0.0025	0.0013
24	32.07	0.0004	0.0009	0.0010
25	32.57	0.0001	0.0070	0.0002
26	39.72	0.0015	0.0008	0.0011
27	43.10	0.0003	0.0000	0.0001
28	44.20	0.0007	0.0006	0.0003
29	44.34	0.0002	0.0002	0.0000
30	44.91	0.0003	0.0000	0.0001
31	49.03	0.0002	0.0002	0.0001
32	51.56	0.0001	0.0000	0.0000
33	54.77	0.0007	0.0000	0.0010
34	60.66	0.0000	0.0000	0.0003
35	64.67	0.0001	0.0001	0.0007
36	70.30	0.0000	0.0000	0.0001
37	73.21	0.0001	0.0000	0.0002
38	78.71	0.0000	0.0000	0.0002
39	86.14	0.0000	0.0001	0.0000
40	90.12	0.0000	0.0000	0.0000
41	91.46	0.0000	0.0000	0.0003
42	92.63	0.0000	0.0000	0.0003
43	100.70	0.0000	0.0000	0.0001
44	102.00	0.0000	0.0000	0.0001
45	116.00	0.0000	0.0000	0.0000
46	127.40	0.0000	0.0000	0.0000
47	139.50	0.0000	0.0000	0.0000
48	140.60	0.0000	0.0000	0.0000
SIGNIFICANCE FACTOR		0.50%	0.20%	0.20%

* INDICATES EXPANDED MODE

TABLE A16

SUMMARY OF NATURAL FREQUENCIES AND MODE COEFFICIENTS - PANMRUS

MODE	FREQUENCY HZ	MODE COEFFICIENT FOR SPECIFIED DIRECTION X	Y	Z
1	2.84	0.2465 *	8.6510 *	0.0347 *
2	3.12	3.4500 * MAX	98.8600 * MAX	0.3915 *
3	4.21	0.7059 *	4.3770 *	0.0863 *
4	5.39	0.1414 *	0.6979 *	0.1355 *
5	5.62	1.6570 *	0.0362	4.0920 * MAX
6	7.35	0.0752 *	0.3060 *	0.0331 *
7	12.40	0.0126	0.0182	0.0028
8	12.94	0.2368 *	0.0040	0.0295 *
9	14.23	0.0428 *	0.0311	0.0054
10	16.45	0.0922 *	0.0114	0.0176 *
11	18.07	0.1350 *	0.0077	0.0376 *
12	18.53	0.0248 *	0.0215	0.0071
13	18.70	0.0120	0.0036	0.0034
14	18.92	0.0024	0.0013	0.0012
15	20.57	0.0018	0.0044	0.0006
16	21.04	0.0003	0.0025	0.0006
17	22.63	0.0008	0.0009	0.0003
18	22.90	0.0012	0.0007	0.0005
19	24.25	0.0053	0.0018	0.0050
20	24.85	0.0003	0.0027	0.0047
21	26.05	0.0003	0.0052	0.0066
22	26.66	0.0004	0.0066	0.0063
23	31.94	0.0007	0.0048	0.0024
24	32.07	0.0007	0.0017	0.0018
25	32.57	0.0002	0.0133	0.0004
26	37.72	0.0029	0.0015	0.0020
27	43.10	0.0006	0.0001	0.0001
28	44.20	0.0013	0.0011	0.0006
29	44.34	0.0004	0.0004	0.0001
30	44.91	0.0005	0.0001	0.0001
31	49.03	0.0003	0.0004	0.0001
32	51.56	0.0003	0.0001	0.0001
33	54.77	0.0013	0.0000	0.0018
34	60.66	0.0001	0.0000	0.0006
35	64.67	0.0001	0.0001	0.0013
36	70.30	0.0000	0.0000	0.0002
37	73.21	0.0001	0.0001	0.0004
38	78.71	0.0000	0.0000	0.0004
39	86.14	0.0000	0.0001	0.0000
40	90.12	0.0000	0.0000	0.0000
41	91.46	0.0000	0.0000	0.0006
42	92.63	0.0000	0.0000	0.0006
43	100.70	0.0000	0.0000	0.0002
44	102.00	0.0000	0.0000	0.0001
45	116.00	0.0000	0.0000	0.0000
46	127.40	0.0000	0.0000	0.0000
47	137.50	0.0000	0.0000	0.0000
48	140.60	0.0000	0.0000	0.0000
SIGNIFICANCE FACTOR		0.50%	0.20%	0.20%

* INDICATES EXPANDED MODE

TABLE A-17

SUMMARY OF NATURAL FREQUENCIES AND MODE COEFFICIENTS - PANMRDO

MODE	FREQUENCY HZ	MODE COEFFICIENT FOR SPECIFIED DIRECTION X	Y	Z
1	2.84	0.1308 *	4.6130 *	0.0104
2	2.99	3.5790 * MAX	0.4420 *	38.2000 * MAX
3	3.12	1.8050 *	52.7200 * MAX	0.1345 *
4	4.21	0.3802 *	2.3900 *	0.0206 *
5	5.39	0.0705 *	0.2857 *	0.0211 *
6	7.48	0.4004 *	0.0359 *	0.4190 *
7	7.87	0.0527 *	0.1276 *	0.0892 *
8	12.44	0.0310 *	0.0092	0.0016
9	14.22	0.0147	0.0161	0.0012
10	16.45	0.0505 *	0.0061	0.0101
11	17.51	0.0922 *	0.0036	0.0278 *
12	18.52	0.0094	0.0122	0.0029
13	18.70	0.0044	0.0020	0.0013
14	18.92	0.0013	0.0007	0.0007
15	20.57	0.0010	0.0025	0.0004
16	21.04	0.0003	0.0014	0.0004
17	22.68	0.0004	0.0005	0.0002
18	22.90	0.0006	0.0004	0.0003
19	24.24	0.0027	0.0012	0.0035
20	24.52	0.0012	0.0015	0.0039
21	25.68	0.0008	0.0011	0.0037
22	26.52	0.0004	0.0044	0.0020
23	31.94	0.0004	0.0025	0.0013
24	32.07	0.0004	0.0009	0.0010
25	32.57	0.0001	0.0070	0.0002
26	39.69	0.0015	0.0008	0.0011
27	43.08	0.0003	0.0001	0.0001
28	44.19	0.0007	0.0006	0.0003
29	44.34	0.0002	0.0002	0.0000
30	44.90	0.0003	0.0000	0.0001
31	49.03	0.0002	0.0002	0.0001
32	51.56	0.0001	0.0000	0.0000
33	54.74	0.0007	0.0000	0.0010
34	60.66	0.0000	0.0000	0.0003
35	64.66	0.0001	0.0001	0.0007
36	70.30	0.0000	0.0000	0.0001
37	73.20	0.0001	0.0000	0.0002
38	78.71	0.0000	0.0000	0.0002
39	86.14	0.0000	0.0001	0.0000
40	90.12	0.0000	0.0000	0.0000
41	91.45	0.0000	0.0000	0.0003
42	92.63	0.0000	0.0000	0.0003
43	100.70	0.0000	0.0000	0.0001
44	102.00	0.0000	0.0000	0.0001
45	116.00	0.0000	0.0000	0.0000
46	129.40	0.0000	0.0000	0.0000
47	139.50	0.0000	0.0000	0.0000
48	140.60	0.0000	0.0000	0.0000
SIGNIFICANCE FACTOR		0.50%	0.05%	0.05%

* INDICATES EXPANDED MODE

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TABLE A18

SUMMARY OF NATURAL FREQUENCIES AND MODE COEFFICIENTS - PANMRDS

MODE	FREQUENCY HZ	MODE COEFFICIENT FOR SPECIFIED DIRECTION X	Y	Z
1	2.84	0.2452 *	8.6510 *	0.0195
2	2.99	6.7110 * MAX	0.8289 *	71.6100 * MAX
3	3.12	3.3850 *	98.8600 * MAX	0.2522 *
4	4.21	0.6963 *	4.3770 *	0.0381 *
5	5.39	0.1723 *	0.6984 *	0.0504 *
6	7.48	0.9426 *	0.0846 *	0.9782 *
7	7.87	0.1218 *	0.2949 *	0.2057 *
8	12.44	0.0621 *	0.0183	0.0032
9	14.22	0.0284	0.0310	0.0023
10	16.45	0.0941 *	0.0114	0.0181
11	17.51	0.1689 *	0.0065	0.0487 *
12	18.52	0.0169	0.0220	0.0050
13	18.70	0.0079	0.0036	0.0023
14	18.92	0.0023	0.0013	0.0012
15	20.57	0.0018	0.0044	0.0006
16	21.04	0.0005	0.0025	0.0006
17	22.68	0.0007	0.0008	0.0003
18	22.90	0.0011	0.0007	0.0006
19	24.24	0.0048	0.0022	0.0061
20	24.52	0.0022	0.0027	0.0068
21	25.68	0.0014	0.0020	0.0066
22	26.52	0.0007	0.0081	0.0035
23	31.94	0.0008	0.0048	0.0025
24	32.07	0.0008	0.0017	0.0019
25	32.57	0.0002	0.0133	0.0004
26	39.69	0.0029	0.0015	0.0021
27	43.08	0.0006	0.0001	0.0001
28	44.19	0.0013	0.0011	0.0005
29	44.34	0.0003	0.0004	0.0001
30	44.90	0.0005	0.0001	0.0002
31	49.03	0.0003	0.0004	0.0001
32	51.56	0.0003	0.0001	0.0001
33	54.74	0.0013	0.0000	0.0018
34	60.66	0.0001	0.0000	0.0006
35	64.66	0.0001	0.0001	0.0013
36	70.30	0.0000	0.0000	0.0002
37	73.20	0.0001	0.0001	0.0004
38	78.71	0.0000	0.0000	0.0004
39	86.14	0.0000	0.0001	0.0000
40	90.12	0.0000	0.0000	0.0000
41	91.45	0.0000	0.0000	0.0006
42	92.63	0.0000	0.0000	0.0006
43	100.70	0.0000	0.0000	0.0002
44	102.00	0.0000	0.0000	0.0001
45	116.00	0.0000	0.0000	0.0000
46	129.40	0.0000	0.0000	0.0000
47	139.50	0.0000	0.0000	0.0000
48	140.60	0.0000	0.0000	0.0000
SIGNIFICANCE FACTOR		0.50%	0.05%	0.05%

* INDICATES EXPANDED MODE

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TABLE A19

SUMMARY OF NATURAL FREQUENCIES AND MODE COEFFICIENTS - PANNING

MODE	FREQUENCY HZ	MODE COEFFICIENT FOR SPECIFIED DIRECTION X	Y	Z
1	2.16	0.1281 *	113.9000 * MAX	0.0340 *
2	2.84	0.1097 *	3.8890 *	0.0138 *
3	4.26	0.5654 * MAX	0.8618 *	0.1030 *
4	5.38	0.3270 *	0.0026	1.7090 * MAX
5	8.71	0.0326 *	0.0697 *	0.0073 *
6	9.33	0.0130 *	0.0363	0.0021 *
7	11.30	0.0142 *	0.0042	0.0031 *
8	12.79	0.0220 *	0.0076	0.0004
9	13.59	0.0176 *	0.0108	0.0011
10	14.80	0.1670 *	0.0004	0.0101 *
11	18.69	0.0006	0.0013	0.0000
12	18.91	0.0007	0.0005	0.0004
13	20.30	0.0010	0.0141	0.0006
14	20.46	0.0007	0.0061	0.0002
15	21.00	0.0003	0.0033	0.0003
16	22.59	0.0003	0.0023	0.0000
17	22.81	0.0003	0.0015	0.0001
18	24.10	0.0007	0.0071	0.0006
19	24.52	0.0014	0.0048	0.0009
20	28.40	0.0042 *	0.0008	0.0004
21	29.79	0.0013	0.0025	0.0004
22	30.88	0.0016	0.0013	0.0010
23	31.92	0.0000	0.0022	0.0021 *
24	32.10	0.0007	0.0052	0.0011
25	32.77	0.0019	0.0024	0.0007
26	38.20	0.0002	0.0016	0.0001
27	44.32	0.0000	0.0000	0.0002
28	48.72	0.0003	0.0006	0.0002
29	50.87	0.0001	0.0000	0.0000
30	52.28	0.0003	0.0002	0.0000
31	57.17	0.0001	0.0000	0.0002
32	60.13	0.0000	0.0000	0.0001
33	63.49	0.0004	0.0000	0.0005
34	65.13	0.0001	0.0001	0.0001
35	68.42	0.0003	0.0000	0.0005
36	70.54	0.0003	0.0000	0.0007
37	77.78	0.0001	0.0000	0.0003
38	79.62	0.0001	0.0000	0.0000
39	86.09	0.0000	0.0001	0.0000
40	89.15	0.0001	0.0000	0.0003
41	90.65	0.0000	0.0000	0.0000
42	93.07	0.0000	0.0000	0.0003
43	100.70	0.0000	0.0000	0.0001
44	101.80	0.0000	0.0000	0.0002
45	102.90	0.0000	0.0000	0.0001
46	131.80	0.0000	0.0000	0.0000
47	140.30	0.0000	0.0000	0.0000
48	172.40	0.0000	0.0000	0.0000
SIGNIFICANCE FACTOR		0.50%	0.05%	0.10%

* INDICATES EXPANDED MODE

TABLE A26

SUMMARY OF NATURAL FREQUENCIES AND MODE COEFFICIENTS - PANMMNS

MODE	FREQUENCY HZ	MODE COEFFICIENT FOR SPECIFIED DIRECTION X	Y	Z
1	2.16	0.2402 *	213.6000 * MAX	0.0638 *
2	2.84	0.2056 *	7.2920 *	0.0259 *
3	4.26	1.0830 * MAX	1.6500 *	0.1989 *
4	5.38	0.7994 *	0.0063	4.0890 * MAX
5	8.71	0.0725 *	0.1552 *	0.0164 *
6	9.33	0.0283 *	0.0788	0.0046 *
7	11.30	0.0292 *	0.0085	0.0065 *
8	12.79	0.0437 *	0.0151	0.0007
9	13.59	0.0345 *	0.0212	0.0022
10	14.80	0.3197 *	0.0007	0.0189 *
11	18.69	0.0011	0.0024	0.0000
12	18.91	0.0013	0.0008	0.0007
13	20.30	0.0017	0.0250	0.0010
14	20.46	0.0012	0.0109	0.0003
15	21.00	0.0005	0.0058	0.0005
16	22.59	0.0005	0.0041	0.0000
17	22.81	0.0005	0.0026	0.0001
18	24.10	0.0012	0.0130	0.0010
19	24.52	0.0025	0.0087	0.0015
20	28.40	0.0078 *	0.0016	0.0007
21	29.79	0.0024	0.0046	0.0007
22	30.88	0.0031	0.0024	0.0019
23	31.92	0.0001	0.0041	0.0040
24	32.10	0.0014	0.0100	0.0020
25	32.77	0.0036	0.0046	0.0012
26	38.20	0.0004	0.0031	0.0001
27	44.32	0.0000	0.0000	0.0003
28	48.72	0.0005	0.0011	0.0004
29	50.87	0.0001	0.0000	0.0001
30	52.28	0.0005	0.0004	0.0001
31	57.17	0.0003	0.0000	0.0004
32	60.13	0.0000	0.0001	0.0002
33	63.49	0.0007	0.0000	0.0009
34	65.13	0.0002	0.0002	0.0003
35	68.42	0.0005	0.0000	0.0010
36	70.54	0.0005	0.0000	0.0014
37	77.78	0.0002	0.0000	0.0006
38	79.62	0.0002	0.0001	0.0001
39	86.09	0.0001	0.0001	0.0001
40	89.15	0.0001	0.0000	0.0005
41	90.65	0.0001	0.0000	0.0000
42	93.07	0.0001	0.0000	0.0005
43	100.70	0.0000	0.0000	0.0001
44	101.80	0.0000	0.0000	0.0003
45	102.90	0.0001	0.0000	0.0002
46	131.80	0.0000	0.0000	0.0000
47	140.30	0.0000	0.0000	0.0000
48	172.40	0.0000	0.0000	0.0000
SIGNIFICANCE FACTOR		0.50%	0.05%	0.10%

* INDICATES EXPANDED MODE

TABLE A21

SUMMARY OF NATURAL FREQUENCIES AND MODE COEFFICIENTS - PANMGND

MODE	FREQUENCY HZ	MODE COEFFICIENT FOR SPECIFIED DIRECTION X	Y	Z
1	2.58	1.7850 * MAX	73.5300 * MAX	0.0312 *
2	2.85	0.0822 *	1.0540 *	0.0163 *
3	3.89	0.7037 *	5.7200 *	0.1343 *
4	6.18	0.0438 *	0.0079	1.0490 * MAX
5	6.80	0.0545 *	0.1861 *	0.0061 *
6	8.84	0.0473 *	0.0308	0.0056 *
7	13.42	0.1192 *	0.0203	0.0052 *
8	13.67	0.1666 *	0.0122	0.0104 *
9	14.77	0.0189 *	0.0016	0.0034 *
10	15.90	0.0066	0.0102	0.0013
11	17.13	0.0028	0.0083	0.0002
12	18.69	0.0004	0.0010	0.0001
13	18.91	0.0003	0.0004	0.0002
14	20.46	0.0005	0.0050	0.0001
15	21.00	0.0001	0.0023	0.0003
16	22.73	0.0003	0.0003	0.0000
17	22.78	0.0000	0.0014	0.0002
18	24.33	0.0000	0.0044	0.0003
19	24.60	0.0005	0.0084	0.0001
20	25.19	0.0017	0.0024	0.0013
21	26.35	0.0006	0.0054	0.0004
22	31.51	0.0008	0.0001	0.0014
23	31.94	0.0006	0.0005	0.0017
24	32.41	0.0003	0.0014	0.0014
25	33.19	0.0003	0.0060	0.0004
26	37.26	0.0008	0.0000	0.0006
27	41.52	0.0002	0.0001	0.0002
28	44.31	0.0005	0.0001	0.0004
29	45.41	0.0028	0.0002	0.0015
30	50.46	0.0005	0.0005	0.0004
31	51.12	0.0000	0.0001	0.0000
32	58.40	0.0001	0.0000	0.0002
33	60.92	0.0001	0.0000	0.0001
34	62.98	0.0002	0.0001	0.0000
35	63.21	0.0001	0.0000	0.0001
36	70.50	0.0001	0.0000	0.0003
37	73.16	0.0000	0.0001	0.0004
38	77.88	0.0001	0.0000	0.0000
39	81.34	0.0001	0.0000	0.0006
40	87.46	0.0000	0.0001	0.0002
41	90.45	0.0000	0.0000	0.0001
42	95.61	0.0000	0.0000	0.0002
43	100.80	0.0000	0.0000	0.0001
44	101.90	0.0000	0.0000	0.0001
45	105.40	0.0000	0.0000	0.0001
46	123.20	0.0000	0.0000	0.0000
47	131.20	0.0000	0.0000	0.0000
48	142.10	0.0000	0.0000	0.0000
SIGNIFICANCE FACTOR		0.50%	0.10%	0.20%

* INDICATES EXPANDED MODE

TABLE A22

SUMMARY OF NATURAL FREQUENCIES AND MODE COEFFICIENTS - PANMONS

MODE	FREQUENCY HZ	MODE COEFFICIENT FOR SPECIFIED DIRECTION X	Y	Z
1	2.58	3.3460 * MAX	137.9000 * MAX	0.0584 *
2	2.85	0.1542 *	1.9760 *	0.0306 *
3	3.89	1.3240 *	10.7600 *	0.2576 *
4	6.18	0.1074 *	0.0194	2.5130 * MAX
5	6.80	0.1329 *	0.4537 *	0.0146 *
6	8.84	0.1048 *	0.0682	0.0127 *
7	13.42	0.2340 *	0.0399	0.0101 *
8	13.67	0.3255 *	0.0238	0.0201 *
9	14.77	0.0362 *	0.0031	0.0064 *
10	15.90	0.0124	0.0191	0.0024
11	17.13	0.0052	0.0153	0.0003
12	18.69	0.0007	0.0018	0.0001
13	18.91	0.0005	0.0008	0.0004
14	20.46	0.0008	0.0089	0.0002
15	21.00	0.0002	0.0042	0.0004
16	22.73	0.0005	0.0005	0.0001
17	22.78	0.0000	0.0025	0.0003
18	24.33	0.0001	0.0080	0.0005
19	24.60	0.0009	0.0154	0.0002
20	25.19	0.0032	0.0045	0.0022
21	26.35	0.0011	0.0099	0.0008
22	31.51	0.0015	0.0002	0.0026
23	31.94	0.0012	0.0010	0.0032
24	32.41	0.0005	0.0027	0.0027
25	33.19	0.0006	0.0114	0.0007
26	37.26	0.0016	0.0000	0.0011
27	41.52	0.0004	0.0001	0.0003
28	44.31	0.0009	0.0001	0.0007
29	45.41	0.0053	0.0004	0.0029
30	50.46	0.0009	0.0010	0.0007
31	51.12	0.0000	0.0002	0.0001
32	58.40	0.0001	0.0001	0.0004
33	60.92	0.0002	0.0000	0.0002
34	62.98	0.0004	0.0001	0.0001
35	63.21	0.0003	0.0000	0.0001
36	70.50	0.0003	0.0000	0.0005
37	73.16	0.0000	0.0002	0.0008
38	77.88	0.0001	0.0000	0.0000
39	81.34	0.0002	0.0000	0.0012
40	87.46	0.0000	0.0001	0.0003
41	90.45	0.0000	0.0000	0.0001
42	95.61	0.0000	0.0000	0.0004
43	100.80	0.0000	0.0000	0.0002
44	101.90	0.0000	0.0000	0.0002
45	105.40	0.0001	0.0000	0.0002
46	123.20	0.0000	0.0000	0.0000
47	131.20	0.0000	0.0000	0.0000
48	142.10	0.0000	0.0000	0.0000
SIGNIFICANCE FACTOR		0.50%	0.10%	0.20%

* INDICATES EXPANDED MODE

TABLE A23

SUMMARY OF NATURAL FREQUENCIES AND MODE COEFFICIENTS - PANMLNO

MODE	FREQUENCY HZ	MODE COEFFICIENT FOR SPECIFIED DIRECTION X	Y	Z
1	2.84	0.1977 *	6.7410 *	0.0250 *
2	3.51	1.6400 * MAX	5.3820 *	0.2115 *
3	3.90	0.3388 *	10.8600 * MAX	0.0765 *
4	5.35	0.0689 *	0.5447 *	0.0042 *
5	7.99	0.1276 *	0.0030	0.4316 * MAX
6	11.21	0.0240 *	0.0258 *	0.0046 *
7	12.79	0.2280 *	0.0107	0.0317 *
8	14.51	0.0053	0.0453 *	0.0032 *
9	15.17	0.0083 *	0.0248 *	0.0058 *
10	16.88	0.0137 *	0.0450 *	0.0059 *
11	18.20	0.0014	0.0295 *	0.0024
12	18.70	0.0002	0.0003	0.0000
13	18.91	0.0001	0.0004	0.0002
14	20.57	0.0004	0.0024	0.0000
15	21.03	0.0002	0.0018	0.0002
16	22.35	0.0007	0.0042	0.0003
17	22.73	0.0000	0.0007	0.0001
18	22.83	0.0003	0.0018	0.0003
19	24.36	0.0035	0.0012	0.0023
20	25.87	0.0041	0.0048	0.0039 *
21	26.26	0.0057	0.0032	0.0076 *
22	30.52	0.0007	0.0073	0.0003
23	31.32	0.0036	0.0022	0.0014
24	32.03	0.0008	0.0008	0.0003
25	32.45	0.0021	0.0015	0.0027 *
26	35.28	0.0003	0.0024	0.0012
27	40.08	0.0036	0.0003	0.0021
28	44.33	0.0000	0.0000	0.0002
29	45.20	0.0000	0.0001	0.0003
30	48.63	0.0003	0.0003	0.0006
31	50.65	0.0003	0.0001	0.0005
32	51.28	0.0000	0.0000	0.0000
33	52.52	0.0002	0.0005	0.0000
34	59.98	0.0005	0.0000	0.0016
35	61.08	0.0001	0.0000	0.0005
36	65.25	0.0003	0.0001	0.0003
37	68.43	0.0000	0.0001	0.0005
38	71.03	0.0001	0.0000	0.0004
39	77.23	0.0000	0.0000	0.0003
40	87.39	0.0000	0.0001	0.0000
41	90.69	0.0000	0.0000	0.0000
42	92.92	0.0000	0.0000	0.0003
43	96.77	0.0000	0.0000	0.0002
44	101.30	0.0000	0.0000	0.0001
45	102.00	0.0000	0.0000	0.0001
46	122.10	0.0000	0.0000	0.0001
47	126.30	0.0000	0.0000	0.0000
48	140.90	0.0000	0.0000	0.0000
SIGNIFICANCE FACTOR		0.50%	0.20%	0.60%

* INDICATES EXPANDED MODE

TABLE A24

SUMMARY OF NATURAL FREQUENCIES AND MODE COEFFICIENTS - PANMLNS

MODE	FREQUENCY HZ	MODE COEFFICIENT FOR SPECIFIED DIRECTION X	Y	Z
1	2.84	0.3708 *	12.6400 *	0.0469 *
2	3.51	3.1470 * MAX	10.3300 *	0.4004 *
3	3.90	0.6368 *	20.4100 * MAX	0.1465 *
4	5.35	0.1683 *	1.3310 *	0.0100 *
5	7.99	0.2933 *	0.0068	0.9924 * MAX
6	11.21	0.0493 *	0.0530 *	0.0097 *
7	12.79	0.4531 *	0.0213	0.0628 *
8	14.51	0.0101	0.0872 *	0.0060 *
9	15.17	0.0157	0.0471 *	0.0107 *
10	16.88	0.0253 *	0.0833 *	0.0105 *
11	18.20	0.0025	0.0535 *	0.0041
12	18.70	0.0004	0.0005	0.0001
13	18.91	0.0003	0.0007	0.0004
14	20.57	0.0007	0.0043	0.0000
15	21.03	0.0003	0.0032	0.0004
16	22.35	0.0012	0.0075	0.0006
17	22.73	0.0001	0.0012	0.0002
18	22.83	0.0006	0.0032	0.0004
19	24.36	0.0065	0.0021	0.0040
20	25.87	0.0076	0.0089	0.0068 *
21	26.26	0.0105	0.0059	0.0135 *
22	30.52	0.0013	0.0137	0.0005
23	31.32	0.0067	0.0043	0.0026
24	32.03	0.0015	0.0014	0.0006
25	32.45	0.0040	0.0028	0.0050
26	35.28	0.0005	0.0045	0.0022
27	40.08	0.0068	0.0006	0.0040
28	44.33	0.0000	0.0001	0.0003
29	45.20	0.0000	0.0002	0.0005
30	48.63	0.0006	0.0006	0.0011
31	50.65	0.0006	0.0001	0.0009
32	51.28	0.0000	0.0001	0.0001
33	52.52	0.0004	0.0009	0.0001
34	59.98	0.0010	0.0000	0.0027
35	61.08	0.0003	0.0000	0.0010
36	65.25	0.0005	0.0003	0.0005
37	68.43	0.0000	0.0002	0.0009
38	71.03	0.0002	0.0000	0.0008
39	77.23	0.0001	0.0000	0.0006
40	87.39	0.0000	0.0002	0.0000
41	90.69	0.0000	0.0000	0.0001
42	92.92	0.0000	0.0001	0.0006
43	96.77	0.0000	0.0001	0.0004
44	101.30	0.0000	0.0000	0.0002
45	102.00	0.0000	0.0000	0.0001
46	122.10	0.0001	0.0000	0.0001
47	126.30	0.0000	0.0000	0.0000
48	140.90	0.0000	0.0000	0.0000
SIGNIFICANCE FACTOR		0.50%	0.20%	0.60%

* INDICATES EXPANDED MODE

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TABLE A25

SUMMARY OF NATURAL FREQUENCIES AND MODE COEFFICIENTS - PANAMNO

MODE	FREQUENCY HZ	MODE COEFFICIENT FOR SPECIFIED DIRECTION X	Y	Z
1	2.84	0.1887 *	7.9690 *	0.0147 *
2	3.40	1.2250 * MAX	35.9100 * MAX	0.0613 *
3	3.89	0.8054 *	0.4671 *	0.0974 *
4	7.20	0.1655 *	0.0050	0.6057 * MAX
5	8.73	0.0059	0.0567	0.0200 *
6	10.35	0.0286 *	0.0194	0.0020
7	12.35	0.0635 *	0.0042	0.0016
8	12.78	0.2190 *	0.0124	0.0295 *
9	14.81	0.0046	0.0174	0.0030 *
10	15.98	0.0139 *	0.0325	0.0049 *
11	16.93	0.0002	0.0492	0.0022
12	18.69	0.0002	0.0011	0.0000
13	18.91	0.0000	0.0002	0.0003
14	20.62	0.0001	0.0076	0.0004
15	20.80	0.0003	0.0110	0.0005
16	21.17	0.0001	0.0050	0.0001
17	22.70	0.0002	0.0002	0.0003
18	22.79	0.0016	0.0004	0.0006
19	23.67	0.0115 *	0.0011	0.0081 *
20	25.02	0.0069 *	0.0019	0.0066 *
21	30.09	0.0035	0.0002	0.0019
22	30.40	0.0019	0.0001	0.0006
23	31.62	0.0005	0.0004	0.0002
24	32.16	0.0002	0.0004	0.0015
25	32.94	0.0011	0.0001	0.0001
26	37.78	0.0010	0.0012	0.0003
27	42.58	0.0009	0.0000	0.0011
28	44.33	0.0001	0.0000	0.0003
29	45.84	0.0013	0.0002	0.0020
30	48.92	0.0003	0.0001	0.0012
31	51.24	0.0001	0.0000	0.0004
32	54.37	0.0001	0.0000	0.0013
33	59.33	0.0003	0.0000	0.0002
34	60.92	0.0001	0.0000	0.0001
35	67.82	0.0002	0.0001	0.0002
36	72.01	0.0001	0.0000	0.0002
37	75.66	0.0003	0.0000	0.0002
38	81.67	0.0001	0.0000	0.0000
39	86.87	0.0000	0.0000	0.0001
40	88.17	0.0000	0.0001	0.0000
41	90.69	0.0000	0.0000	0.0000
42	97.79	0.0000	0.0000	0.0000
43	100.70	0.0000	0.0000	0.0001
44	101.20	0.0000	0.0000	0.0001
45	104.60	0.0000	0.0000	0.0001
46	130.20	0.0000	0.0000	0.0000
47	141.40	0.0000	0.0000	0.0000
48	146.60	0.0000	0.0000	0.0000
SIGNIFICANCE FACTOR		0.50%	0.20%	0.40%

* INDICATES EXPANDED MODE

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TABLE A26

SUMMARY OF NATURAL FREQUENCIES AND MODE COEFFICIENTS - PANAMNS

MODE	FREQUENCY HZ	MODE COEFFICIENT FOR SPECIFIED DIRECTION X	Y	Z
1	2.84	0.3538 *	14.9400 *	0.0276 *
2	3.40	2.3190 * MAX	67.9900 * MAX	0.1153 *
3	3.89	1.5170 *	0.8800 *	0.1871 *
4	7.20	0.3951 *	0.0119	1.4270 * MAX
5	8.73	0.0132 *	0.1262	0.0451 *
6	10.35	0.0599 *	0.0407	0.0044
7	12.35	0.1274 *	0.0084	0.0032
8	12.78	0.4353 *	0.0246	0.0586 *
9	14.81	0.0088	0.0333	0.0057
10	15.98	0.0262 *	0.0609	0.0089 *
11	16.93	0.0004	0.0910	0.0038
12	18.69	0.0003	0.0019	0.0000
13	18.91	0.0000	0.0004	0.0005
14	20.62	0.0002	0.0135	0.0007
15	20.80	0.0006	0.0197	0.0009
16	21.17	0.0002	0.0089	0.0002
17	22.70	0.0004	0.0003	0.0006
18	22.79	0.0028	0.0007	0.0010
19	23.67	0.0209 *	0.0020	0.0141 *
20	25.02	0.0127 *	0.0034	0.0116 *
21	30.09	0.0067	0.0004	0.0035
22	30.40	0.0037	0.0001	0.0011
23	31.62	0.0009	0.0007	0.0004
24	32.16	0.0005	0.0008	0.0028
25	32.94	0.0021	0.0002	0.0003
26	37.78	0.0019	0.0023	0.0006
27	42.58	0.0017	0.0000	0.0022
28	44.33	0.0002	0.0000	0.0006
29	45.84	0.0025	0.0003	0.0037
30	48.92	0.0006	0.0002	0.0023
31	51.24	0.0002	0.0001	0.0008
32	54.37	0.0002	0.0001	0.0025
33	59.33	0.0005	0.0000	0.0003
34	60.92	0.0001	0.0000	0.0001
35	67.82	0.0005	0.0001	0.0004
36	72.01	0.0002	0.0000	0.0003
37	75.66	0.0005	0.0001	0.0005
38	81.67	0.0001	0.0001	0.0000
39	86.87	0.0000	0.0001	0.0002
40	88.17	0.0000	0.0002	0.0001
41	90.69	0.0000	0.0000	0.0001
42	97.79	0.0000	0.0001	0.0000
43	100.70	0.0000	0.0000	0.0002
44	101.20	0.0000	0.0000	0.0002
45	104.60	0.0000	0.0000	0.0001
46	130.20	0.0000	0.0000	0.0000
47	141.40	0.0000	0.0000	0.0000
48	146.60	0.0000	0.0000	0.0000
SIGNIFICANCE FACTOR		0.50%	0.20%	0.40%

* INDICATES EXPANDED MODE

WHITING REQN 79502 DATE 7-16-87
BY MJM PAGE A-29 OF 38
[handwritten initials] 9.9.87

TABLE A 27

SUMMARY OF NATURAL FREQUENCIES AND MODE COEFFICIENTS - PANAQNO

MODE	FREQUENCY HZ	MODE COEFFICIENT FOR SPECIFIED DIRECTION X	Y	Z
1	2.84	0.1944 *	6.9310 *	0.0195 *
2	3.61	1.5100 * MAX	9.8580 *	0.1005 *
3	3.91	0.0150 *	10.8900 * MAX	0.0923 *
4	6.50	0.0033	0.0580 *	0.0318 *
5	7.62	0.1268 *	0.0028	0.5187 * MAX
6	10.55	0.0259 *	0.0730 *	0.0029 *
7	12.66	0.2233 *	0.0108	0.0267 *
8	12.72	0.0586 *	0.0150	0.0136 *
9	16.31	0.0130 *	0.0280 *	0.0063 *
10	17.41	0.0016	0.0415 *	0.0015
11	18.65	0.0006	0.0043	0.0004
12	18.81	0.0007	0.0029	0.0008
13	18.96	0.0005	0.0005	0.0003
14	20.07	0.0008	0.0156	0.0003
15	20.73	0.0003	0.0056	0.0003
16	21.06	0.0002	0.0018	0.0005
17	22.66	0.0007	0.0010	0.0003
18	22.99	0.0027	0.0026	0.0008
19	23.55	0.0121 *	0.0003	0.0070 *
20	24.63	0.0075	0.0003	0.0050 *
21	25.23	0.0026	0.0015	0.0026 *
22	26.91	0.0006	0.0030	0.0023 *
23	30.03	0.0038	0.0003	0.0025 *
24	32.10	0.0002	0.0005	0.0014
25	33.55	0.0021	0.0001	0.0010
26	40.65	0.0017	0.0005	0.0015
27	43.83	0.0021	0.0002	0.0025 *
28	44.37	0.0005	0.0000	0.0004
29	45.82	0.0002	0.0003	0.0003
30	47.38	0.0003	0.0001	0.0011
31	50.95	0.0001	0.0000	0.0008
32	51.58	0.0002	0.0001	0.0009
33	57.70	0.0001	0.0000	0.0001
34	60.93	0.0000	0.0000	0.0000
35	66.02	0.0001	0.0001	0.0003
36	71.69	0.0001	0.0000	0.0005
37	75.19	0.0001	0.0000	0.0001
38	77.03	0.0001	0.0000	0.0002
39	82.11	0.0000	0.0001	0.0000
40	89.58	0.0000	0.0001	0.0001
41	90.93	0.0000	0.0000	0.0000
42	96.35	0.0000	0.0001	0.0000
43	100.80	0.0000	0.0000	0.0001
44	101.30	0.0000	0.0000	0.0001
45	114.60	0.0000	0.0000	0.0000
46	130.40	0.0000	0.0000	0.0000
47	140.80	0.0000	0.0000	0.0000
48	141.00	0.0000	0.0000	0.0000
SIGNIFICANCE FACTOR		0.50%	0.20%	0.40%

* INDICATES EXPANDED MODE

TABLE A28

SUMMARY OF NATURAL FREQUENCIES AND MODE COEFFICIENTS - PANAQNS

MODE	FREQUENCY HZ	MODE COEFFICIENT FOR SPECIFIED DIRECTION X	Y	Z
1	2.84	0.3645 *	13.0000 *	0.0366 *
2	3.61	2.9120 * MAX	19.0100 *	0.1915 *
3	3.91	0.0282 *	20.4000 * MAX	0.1760 *
4	6.50	0.0081	0.1424 *	0.0762 *
5	7.62	0.2965 *	0.0065	1.2060 * MAX
6	10.55	0.0541 *	0.1524 *	0.0062 *
7	12.66	0.4448 *	0.0216	0.0531 *
8	12.72	0.1166 *	0.0298	0.0271 *
9	16.31	0.0242 *	0.0523 *	0.0114 *
10	17.41	0.0030	0.0761 *	0.0026
11	18.65	0.0012	0.0078	0.0007
12	18.81	0.0012	0.0052	0.0013
13	18.96	0.0008	0.0010	0.0005
14	20.07	0.0015	0.0276	0.0006
15	20.73	0.0005	0.0100	0.0005
16	21.06	0.0003	0.0033	0.0008
17	22.66	0.0013	0.0018	0.0006
18	22.99	0.0049	0.0046	0.0015
19	23.55	0.0221 *	0.0005	0.0121 *
20	24.63	0.0137	0.0005	0.0088 *
21	25.23	0.0049	0.0027	0.0046
22	26.91	0.0012	0.0055	0.0041
23	30.03	0.0072	0.0005	0.0046
24	32.10	0.0005	0.0009	0.0026
25	33.55	0.0040	0.0003	0.0018
26	40.65	0.0033	0.0010	0.0028
27	43.83	0.0040	0.0004	0.0046
28	44.37	0.0009	0.0001	0.0007
29	45.82	0.0005	0.0006	0.0006
30	47.38	0.0005	0.0002	0.0021
31	50.95	0.0002	0.0001	0.0016
32	51.58	0.0004	0.0002	0.0017
33	57.70	0.0002	0.0000	0.0002
34	60.93	0.0000	0.0000	0.0001
35	66.02	0.0002	0.0001	0.0006
36	71.69	0.0002	0.0001	0.0009
37	75.19	0.0001	0.0001	0.0002
38	77.03	0.0001	0.0000	0.0003
39	82.11	0.0001	0.0001	0.0000
40	89.58	0.0001	0.0001	0.0001
41	90.93	0.0000	0.0001	0.0000
42	96.35	0.0000	0.0001	0.0000
43	100.80	0.0000	0.0000	0.0002
44	101.30	0.0000	0.0000	0.0002
45	114.60	0.0000	0.0000	0.0000
46	130.40	0.0000	0.0000	0.0000
47	140.80	0.0000	0.0000	0.0000
48	141.00	0.0000	0.0000	0.0000
SIGNIFICANCE FACTOR		0.50%	0.20%	0.40%

* INDICATES EXPANDED MODE

TABLE A29

SUMMARY OF NATURAL FREQUENCIES AND MODE COEFFICIENTS - PANBNNO

MODE	FREQUENCY HZ	MODE COEFFICIENT FOR SPECIFIED DIRECTION X	Y	Z
1	2.03	0.3419 *	135.2000 * MAX	0.0097 *
2	2.84	0.0914 *	3.8970 *	0.0104 *
3	4.55	0.3911 * MAX	0.5599 *	0.1445 *
4	5.14	0.1943 *	0.0047	2.1000 * MAX
5	8.68	0.0314 *	0.0616	0.0092 *
6	9.63	0.0124 *	0.0261	0.0035 *
7	11.03	0.0255 *	0.0087	0.0024 *
8	11.92	0.0046 *	0.0248	0.0007
9	13.98	0.1261 *	0.0041	0.0039 *
10	14.08	0.1425 *	0.0041	0.0036 *
11	18.45	0.0020 *	0.0043	0.0008
12	18.69	0.0004	0.0007	0.0000
13	18.95	0.0012	0.0014	0.0007
14	20.51	0.0000	0.0063	0.0001
15	20.70	0.0004	0.0043	0.0000
16	21.28	0.0002	0.0013	0.0003
17	22.59	0.0002	0.0008	0.0000
18	23.00	0.0001	0.0008	0.0001
19	24.32	0.0005	0.0006	0.0008
20	27.11	0.0007	0.0029	0.0001
21	27.82	0.0031 *	0.0003	0.0002
22	31.39	0.0014	0.0000	0.0013
23	32.18	0.0000	0.0000	0.0004
24	33.47	0.0017	0.0000	0.0000
25	35.92	0.0011	0.0000	0.0001
26	42.20	0.0015	0.0000	0.0009
27	43.75	0.0011	0.0000	0.0006
28	44.35	0.0002	0.0000	0.0000
29	49.49	0.0001	0.0000	0.0000
30	51.26	0.0002	0.0000	0.0000
31	52.90	0.0004	0.0001	0.0001
32	58.25	0.0002	0.0001	0.0000
33	60.10	0.0000	0.0000	0.0002
34	70.01	0.0000	0.0000	0.0001
35	70.87	0.0000	0.0000	0.0002
36	71.82	0.0002	0.0000	0.0002
37	78.84	0.0000	0.0000	0.0000
38	83.84	0.0000	0.0000	0.0000
39	88.30	0.0001	0.0000	0.0000
40	89.19	0.0000	0.0001	0.0001
41	90.93	0.0001	0.0000	0.0001
42	92.63	0.0000	0.0000	0.0001
43	98.19	0.0000	0.0000	0.0001
44	100.70	0.0000	0.0000	0.0001
45	101.00	0.0000	0.0000	0.0001
46	128.10	0.0000	0.0000	0.0000
47	140.90	0.0000	0.0000	0.0000
48	155.20	0.0000	0.0000	0.0000
SIGNIFICANCE FACTOR		0.50%	0.05%	0.10%

* INDICATES EXPANDED MODE

TABLE A30

SUMMARY OF NATURAL FREQUENCIES AND MODE COEFFICIENTS - PANBMNS

MODE	FREQUENCY HZ	MODE COEFFICIENT FOR SPECIFIED DIRECTION X	Y	Z
1	2.03	0.6411 *	253.5000 * MAX	0.0181 *
2	2.84	0.1714 *	7.3080 *	0.0194 *
3	4.55	0.8882 * MAX	1.2710 *	0.3297 *
4	5.14	0.4745 *	0.0116	5.0220 * MAX
5	8.68	0.0701 *	0.1372 *	0.0207 *
6	9.63	0.0266 *	0.0560	0.0076 *
7	11.03	0.0526 *	0.0179	0.0049
8	11.92	0.0092 *	0.0501	0.0014
9	13.98	0.2450 *	0.0079	0.0074 *
10	14.08	0.2763 *	0.0079	0.0068 *
11	18.45	0.0036	0.0078	0.0014
12	18.69	0.0007	0.0012	0.0000
13	18.95	0.0022	0.0026	0.0011
14	20.51	0.0001	0.0112	0.0002
15	20.70	0.0007	0.0077	0.0001
16	21.28	0.0003	0.0022	0.0005
17	22.59	0.0004	0.0014	0.0000
18	23.00	0.0001	0.0015	0.0002
19	24.32	0.0010	0.0011	0.0013
20	27.11	0.0013	0.0055	0.0002
21	27.82	0.0057 *	0.0006	0.0004
22	31.39	0.0027	0.0001	0.0024
23	32.18	0.0001	0.0001	0.0008
24	33.47	0.0032	0.0000	0.0000
25	35.92	0.0020	0.0001	0.0003
26	42.20	0.0029	0.0000	0.0017
27	43.75	0.0021	0.0000	0.0012
28	44.35	0.0004	0.0000	0.0000
29	49.49	0.0002	0.0000	0.0000
30	51.26	0.0003	0.0001	0.0001
31	52.90	0.0007	0.0003	0.0001
32	58.25	0.0004	0.0002	0.0001
33	60.10	0.0000	0.0000	0.0003
34	70.01	0.0000	0.0000	0.0001
35	70.87	0.0000	0.0000	0.0004
36	71.82	0.0003	0.0000	0.0004
37	78.84	0.0000	0.0000	0.0000
38	83.84	0.0000	0.0000	0.0000
39	88.30	0.0002	0.0000	0.0000
40	89.19	0.0001	0.0001	0.0001
41	90.93	0.0001	0.0000	0.0001
42	92.63	0.0000	0.0000	0.0002
43	98.19	0.0000	0.0000	0.0002
44	100.70	0.0000	0.0000	0.0001
45	101.00	0.0000	0.0000	0.0002
46	128.10	0.0000	0.0000	0.0000
47	140.90	0.0000	0.0000	0.0000
48	155.20	0.0000	0.0000	0.0000
SIGNIFICANCE FACTOR		0.50%	0.05%	0.10%

* INDICATES EXPANDED MODE

WHITING REQN 79508 DATE 7-24-87
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TABLE A31

SUMMARY OF NATURAL FREQUENCIES AND MODE COEFFICIENTS - PANBLNO

MODE	FREQUENCY HZ	MODE COEFFICIENT FOR SPECIFIED DIRECTION X	Y	Z
1	2.84	0.2090 *	8.3420 *	0.0122 *
2	3.40	1.9090 * MAX	33.3100 * MAX	0.0246 *
3	4.15	0.2758 *	3.0290 *	0.0902 *
4	5.64	0.0667 *	0.2614 *	0.0091 *
5	7.52	0.2120 *	0.0028	0.5364 * MAX
6	11.62	0.0553 *	0.0227	0.0046 *
7	12.84	0.2172 *	0.0129	0.0387 *
8	13.03	0.0264 *	0.0244	0.0104 *
9	15.09	0.0001	0.0336	0.0018
10	16.12	0.0195 *	0.0277	0.0092 *
11	17.72	0.0005	0.0182	0.0009
12	18.69	0.0002	0.0017	0.0001
13	18.91	0.0002	0.0009	0.0002
14	19.75	0.0000	0.0288	0.0000
15	20.62	0.0003	0.0054	0.0000
16	21.15	0.0002	0.0050	0.0002
17	22.74	0.0001	0.0003	0.0000
18	22.77	0.0003	0.0004	0.0003
19	24.27	0.0045	0.0029	0.0028 *
20	25.34	0.0038	0.0011	0.0041 *
21	25.87	0.0040	0.0006	0.0049 *
22	26.35	0.0051	0.0022	0.0048 *
23	30.38	0.0037	0.0002	0.0009
24	32.01	0.0008	0.0004	0.0014
25	32.70	0.0022	0.0002	0.0009
26	38.83	0.0006	0.0003	0.0009
27	41.84	0.0013	0.0001	0.0010
28	44.34	0.0000	0.0000	0.0002
29	45.26	0.0002	0.0001	0.0004
30	47.97	0.0003	0.0001	0.0005
31	51.22	0.0000	0.0000	0.0000
32	56.81	0.0010	0.0001	0.0011
33	58.46	0.0002	0.0000	0.0013
34	60.78	0.0000	0.0000	0.0001
35	62.73	0.0001	0.0001	0.0003
36	68.24	0.0002	0.0000	0.0001
37	75.28	0.0000	0.0000	0.0001
38	76.62	0.0001	0.0000	0.0000
39	79.75	0.0001	0.0001	0.0000
40	88.53	0.0001	0.0000	0.0001
41	90.66	0.0000	0.0000	0.0001
42	93.55	0.0000	0.0001	0.0001
43	99.16	0.0000	0.0000	0.0001
44	100.70	0.0000	0.0000	0.0001
45	101.30	0.0000	0.0000	0.0001
46	129.70	0.0000	0.0000	0.0000
47	142.20	0.0000	0.0000	0.0000
48	153.80	0.0000	0.0000	0.0000
SIGNIFICANCE FACTOR		0.50%	0.20%	0.40%

* INDICATES EXPANDED MODE

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TABLE A32

SUMMARY OF NATURAL FREQUENCIES AND MODE COEFFICIENTS - PANBLNS

MODE	FREQUENCY HZ	MODE COEFFICIENT FOR SPECIFIED DIRECTION X	Y	Z
1	2.84	0.3918 *	15.6400 *	0.0228 *
2	3.40	3.6150 * MAX	63.0700 * MAX	0.0464 *
3	4.15	0.4884 *	5.3620 *	0.1610 *
4	5.64	0.1631 *	0.6395 *	0.0218 *
5	7.52	0.4982 *	0.0066	1.2510 * MAX
6	11.62	0.1126 *	0.0463	0.0095 *
7	12.84	0.4311 *	0.0255	0.0766 *
8	13.03	0.0522 *	0.0483	0.0205 *
9	15.09	0.0002	0.0639	0.0033
10	16.12	0.0366 *	0.0519	0.0167 *
11	17.72	0.0009	0.0332	0.0016
12	18.69	0.0004	0.0031	0.0002
13	18.91	0.0003	0.0016	0.0003
14	19.75	0.0001	0.0511	0.0000
15	20.62	0.0006	0.0097	0.0001
16	21.15	0.0003	0.0088	0.0003
17	22.74	0.0001	0.0005	0.0001
18	22.77	0.0006	0.0007	0.0005
19	24.27	0.0082	0.0053	0.0049
20	25.34	0.0069	0.0020	0.0073 *
21	25.87	0.0074	0.0011	0.0087 *
22	26.35	0.0094	0.0042	0.0086 *
23	30.38	0.0070	0.0004	0.0017
24	32.01	0.0015	0.0007	0.0025
25	32.70	0.0042	0.0004	0.0017
26	38.83	0.0012	0.0006	0.0018
27	41.84	0.0025	0.0002	0.0019
28	44.34	0.0001	0.0000	0.0003
29	45.26	0.0004	0.0002	0.0008
30	47.97	0.0005	0.0003	0.0009
31	51.22	0.0000	0.0001	0.0001
32	56.81	0.0018	0.0001	0.0021
33	58.46	0.0004	0.0001	0.0025
34	60.78	0.0000	0.0000	0.0001
35	62.73	0.0002	0.0001	0.0006
36	68.24	0.0003	0.0001	0.0003
37	75.28	0.0000	0.0000	0.0002
38	76.62	0.0002	0.0001	0.0001
39	79.75	0.0002	0.0001	0.0000
40	88.53	0.0002	0.0001	0.0002
41	90.66	0.0000	0.0000	0.0001
42	93.55	0.0000	0.0002	0.0001
43	99.18	0.0000	0.0000	0.0001
44	100.70	0.0000	0.0000	0.0002
45	101.30	0.0000	0.0000	0.0002
46	129.70	0.0000	0.0000	0.0000
47	142.20	0.0000	0.0000	0.0000
48	153.80	0.0000	0.0000	0.0000
SIGNIFICANCE FACTOR		0.50%	0.20%	0.40%

* INDICATES EXPANDED MODE

TABLE A34

SUMMARY OF NATURAL FREQUENCIES AND MODE COEFFICIENTS - PANMRNS

MODE	FREQUENCY HZ	MODE COEFFICIENT FOR SPECIFIED DIRECTION X	Y	Z
1	2.84	0.2467 *	8.6510 *	0.0365 *
2	3.12	3.4450 * MAX	98.8600 * MAX	0.3373 *
3	4.21	0.7004 *	4.3770 *	0.0587 *
4	5.39	0.1697 *	0.6984 *	0.0575 *
5	6.92	1.1450 *	0.0411	1.5670 * MAX
6	7.86	0.0079	0.3041 *	0.0931 *
7	12.44	0.0593 *	0.0183	0.0029
8	14.22	0.0268 *	0.0310	0.0019
9	16.45	0.0951 *	0.0114	0.0184 *
10	17.29	0.1772 *	0.0064	0.0514 *
11	18.52	0.0155	0.0221	0.0046
12	18.70	0.0069	0.0036	0.0021
13	18.92	0.0023	0.0013	0.0012
14	20.57	0.0019	0.0044	0.0006
15	21.04	0.0007	0.0025	0.0007
16	22.68	0.0006	0.0008	0.0004
17	22.90	0.0008	0.0006	0.0008
18	23.71	0.0051	0.0029	0.0091 *
19	24.26	0.0057	0.0013	0.0036
20	25.36	0.0020	0.0003	0.0032
21	26.44	0.0007	0.0085	0.0015
22	31.24	0.0005	0.0005	0.0041
23	31.94	0.0009	0.0049	0.0021
24	32.28	0.0005	0.0026	0.0007
25	32.58	0.0002	0.0131	0.0005
26	39.77	0.0028	0.0015	0.0020
27	43.11	0.0006	0.0001	0.0001
28	44.20	0.0013	0.0011	0.0006
29	44.34	0.0004	0.0004	0.0000
30	44.91	0.0005	0.0001	0.0001
31	49.03	0.0003	0.0004	0.0001
32	51.56	0.0003	0.0001	0.0001
33	54.78	0.0013	0.0000	0.0018
34	60.66	0.0001	0.0000	0.0006
35	64.67	0.0001	0.0001	0.0013
36	70.30	0.0000	0.0000	0.0002
37	73.21	0.0001	0.0001	0.0004
38	78.71	0.0000	0.0000	0.0004
39	86.14	0.0000	0.0001	0.0000
40	90.12	0.0000	0.0000	0.0000
41	91.46	0.0000	0.0000	0.0006
42	92.63	0.0000	0.0000	0.0006
43	100.70	0.0000	0.0000	0.0002
44	102.00	0.0000	0.0000	0.0001
45	116.00	0.0000	0.0000	0.0000
46	129.40	0.0000	0.0000	0.0000
47	139.50	0.0000	0.0000	0.0000
48	140.60	0.0000	0.0000	0.0000
SIGNIFICANCE FACTOR		0.50%	0.20%	0.40%

* INDICATES EXPANDED MODE

FORM N-2494

WHITING REQN. 79508 DATE 7-16-87

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RH 9.9.87

TABLE A-35
SUMMARY OF COMPUTER RUNS
OBE

MAIN TROLLEY	AUX TROLLEY	MAIN LOAD	STATIC	DYNAMIC	SUM	SCALED SUM
MID	RHE	60T UP	PANMMU	PANMMUO	PSANMMUO	PFANMMUO
	RHE	60T DN	PANMMU	PANMMDO	PSANMMDO	PFANMMDO
	RHE	NO	PANMMN	PANMMNO	PSANMMNO	PFANMMNO
	MID	NO	PANBMN	PANBMNO	PSANBMNO	PFANBMNO
1/4	RHE	60T UP	PANMQU	PANMQUO	PSANMQUO	PFANMQUO
	RHE	60T DN	PANMQU	PANMQDO.	PSANMQDO	PFANMQDO
	RHE	NO	PANMQN	PANMQNO	PSANMQNO	PFANMQNO
RHE	RHE	60T UP	PANMRU	PANMRUO	PSANMRUO	PFANMRUO
	RHE	60T DN	PANMRU	PANMRDO	PSANMRDO	PFANMRDO
	RHE	NO	PANMRN	PANMRNO	PSANMRNO	PFANMRNO
LHE	RHE	60T UP	PANMEU	PANMEUO	PSANMEUO	PFANMEUO
	RHE	60T DN	PANMEU	PANMEDO	PSANMEDO	PFANMEDO
	RHE	NO	PANMLN	PANMLNO	PSANMLNO	PFANMLNO
	MID	NO	PANAMN	PANAMNO	PSANAMNO	PFANAMNO
	1/4	NO	PANAQN	PANAQNO	PSANAQNO	PFANAQNO
	LHE	NO	PANBLN	PANBLNO	PSANBLNO	PFANBLNO

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TABLE A-36
SUMMARY OF COMPUTER RUNS
SSE

MAIN TROLLEY	AUX TROLLEY	MAIN LOAD	STATIC	DYNAMIC	SUM	SCALED SUM
MID	RHE	60T UP	PANMMU	PANMMUS	PSANMMUS	PFANMMUS
	RHE	60T DN	PANMMU	PANMMDS	PSANMMDS	PFANMMDS
	RHE	NO	PANMMN	PANMMNS	PSANMMNS	PFANMMNS
	MID	NO	PAN8MN	PAN8MNS	PSAN8MNS	PFAN8MNS
1/4	RHE	60T UP	PANMQU	PANMQUS	PSANMQUS	PFANMQUS
	RHE	60T DN	PANMQU	PANMQDS	PSANMQDS	PFANMQDS
	RHE	NO	PANMQN	PANMQNS	PSANMQNS	PFANMQNS
RHE	RHE	60T UP	PANMRU	PANMRUS	PSANMRUS	PFANMRUS
	RHE	60T DN	PANMRU	PANMRDS	PSANMRDS	PFANMRDS
	RHE	NO	PANMRN	PANMRNS	PSANMRNS	PFANMRNS
LHE	RHE	60T UP	PANMEU	PANMEUS	PSANMEUS	PFANMEUS
	RHE	60T DN	PANMEU	PANMEDS	PSANMEDS	PFANMEDS
	RHE	NO	PANMLN	PANMLNS	PSANMLNS	PFANMLNS
	MID	NO	PANAMN	PANAMNS	PSANAMNS	PFANAMNS
	1/4	NO	PANAQN	PANAQNS	PSANAQNS	PFANAQNS
	LHE	NO	PANBLN	PANBLNS	PSANBLNS	PFANBLNS

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TABLE 81

MAXIMUM STRESSES FROM PFANMMUO
OBE MID 60 U

COMPONENT	ELEM	NODE	X	Y	Z	SRSS	STATIC	SUM
GIRDER A	34	318	788.	4159.	4919.	6490.	9813.	16303.
GIRDER B	71	364	658.	4593.	4273.	6307.	9449.	15757.
END CONNECT-RHE	17	154	796.	10208.	2137.	10459.	448.	10908.
END CONNECT-LHE	172	252	877.	8585.	2534.	8993.	281.	9274.
MONORAIL TRACK	138	443	602.	10921.	1110.	10994.	1934.	12928.
TRACK SUPPORT	112	564	646.	12712.	1474.	12814.	1033.	13847.

TABLE 82

MAXIMUM STRESSES FROM PFANMMDO
OBE MID 60 D

COMPONENT	ELEM	NODE	X	Y	Z	SRSS	STATIC	SUM
GIRDER A	34	318	626.	5286.	10496.	11768.	9813.	21581.
GIRDER B	71	364	615.	5850.	10291.	11854.	9449.	21303.
END CONNECT-RHE	17	154	736.	12983.	169.	13005.	448.	13454.
END CONNECT-LHE	172	252	853.	10895.	161.	10929.	281.	11210.
MONORAIL TRACK	138	443	602.	10937.	1320.	11033.	1934.	12967.
TRACK SUPPORT	112	564	619.	12977.	1521.	13081.	1033.	14114.

TABLE 83

MAXIMUM STRESSES FROM PFANMMNO
OBE MID NL

COMPONENT	ELEM	NODE	X	Y	Z	SRSS	STATIC	SUM
GIRDER A	37	320	292.	3479.	1277.	3717.	6114.	9831.
GIRDER B	71	364	394.	3305.	1249.	3556.	6047.	9602.
END CONNECT-RHE	17	154	748.	7390.	151.	7429.	446.	7875.
END CONNECT-LHE	172	252	865.	6243.	165.	6309.	291.	6600.
MONORAIL TRACK	138	443	572.	10908.	190.	10924.	1681.	12605.
TRACK SUPPORT	112	564	580.	12504.	177.	12519.	583.	13102.

STRESS IN PSI

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TABLE B4

MAXIMUM STRESSES FROM PFANMMUS
SSE MID 60 U

COMPONENT	ELEM	NODE	X	Y	Z	SRSS	STATIC	SUM
GIRDER A	34	318	1430.	5202.	8796.	10319.	9813.	20132.
GIRDER B	71	364	1192.	5721.	7622.	9604.	9449.	19053.
END CONNECT-RHE	17	154	1512.	12799.	3954.	13481.	448.	13929.
END CONNECT-LHE	172	252	1658.	10846.	4687.	11931.	281.	12212.
MONORAIL TRACK	138	443	1142.	20450.	2026.	20582.	1934.	22516.
TRACK SUPPORT	112	564	1224.	23384.	2688.	23570.	1033.	24603.

TABLE B5

MAXIMUM STRESSES FROM PFANMMDS
SSE MID 60 D

COMPONENT	ELEM	NODE	X	Y	Z	SRSS	STATIC	SUM
GIRDER A	34	318	1207.	7376.	19696.	21066.	9813.	30879.
GIRDER B	71	364	1181.	8156.	19309.	20994.	9449.	30443.
END CONNECT-RHE	17	154	1411.	18154.	321.	18211.	448.	18660.
END CONNECT-LHE	172	252	1636.	15281.	304.	15372.	281.	15653.
MONORAIL TRACK	138	443	1145.	20473.	2478.	20654.	1934.	22588.
TRACK SUPPORT	112	564	1177.	23756.	2853.	23956.	1033.	24989.

TABLE B6

MAXIMUM STRESSES FROM PFANMMNS
SSE MID NL

COMPONENT	ELEM	NODE	X	Y	Z	SRSS	STATIC	SUM
GIRDER A	37	320	673.	4382.	3054.	5384.	6114.	11498.
GIRDER B	71	364	839.	4163.	2989.	5193.	6047.	11240.
END CONNECT-RHE	17	154	1434.	9435.	309.	9548.	446.	9994.
END CONNECT-LHE	172	252	1657.	8084.	330.	8259.	291.	8550.
MONORAIL TRACK	138	443	1039.	20440.	427.	20473.	1681.	22154.
TRACK SUPPORT	112	564	1106.	23214.	378.	23244.	583.	23827.

STRESS IN PSI

TABLE 87

MAXIMUM STRESSES FROM PFANMQUO
OBE 1/4 60 U

COMPONENT	ELEM	NODE	X	Y	Z	SRSS	STATIC	SUM
GIRDER A	40	323	782.	3020.	1865.	3634.	7990.	11624.
GIRDER B	80	373	740.	3590.	1859.	4110.	7924.	12034.
END CONNECT-RHE	17	154	1808.	9473.	123.	9645.	407.	10051.
END CONNECT-LHE	172	252	1556.	10921.	332.	11036.	277.	11313.
MONORAIL TRACK	139	444	1378.	7353.	350.	7489.	1111.	8601.
TRACK SUPPORT	112	564	1379.	7605.	316.	7735.	999.	8734.

TABLE 88

MAXIMUM STRESSES FROM PFANMQDO
OBE 1/4 60 D

COMPONENT	ELEM	NODE	X	Y	Z	SRSS	STATIC	SUM
GIRDER A	40	323	817.	4222.	7443.	8596.	7990.	16585.
GIRDER B	80	373	738.	5061.	7417.	9009.	7924.	16934.
END CONNECT-RHE	17	154	1807.	13098.	278.	13225.	407.	13632.
END CONNECT-LHE	172	252	1583.	11912.	275.	12020.	277.	12297.
MONORAIL TRACK	139	444	1363.	10109.	1641.	10331.	1111.	11443.
TRACK SUPPORT	112	564	1367.	10281.	1591.	10492.	999.	11491.

TABLE 89

MAXIMUM STRESSES FROM PFANMQNO
OBE 1/4 NL

COMPONENT	ELEM	NODE	X	Y	Z	SRSS	STATIC	SUM
GIRDER A	35	318	667.	4066.	852.	4208.	4772.	8979.
GIRDER B	80	373	736.	2643.	914.	2892.	5243.	8135.
END CONNECT-RHE	17	154	1807.	7180.	92.	7405.	408.	7813.
END CONNECT-LHE	172	252	1582.	10427.	242.	10549.	296.	10845.
MONORAIL TRACK	139	444	1362.	5623.	138.	5738.	659.	6447.
TRACK SUPPORT	112	564	1365.	5959.	174.	6116.	597.	6713.

STRESS IN PSI

TABLE 810

MAXIMUM STRESSES FROM PFANMQUS
SSE 1/4 60 U

COMPONENT	ELEM	NODE	X	Y	Z	SRSS	STATIC	SUM
GIRDER A	49	332	1767.	13387.	1368.	13572.	2293.	15865.
GIRDER B	80	373	1399.	4705.	4440.	6619.	7924.	14543.
END CONNECT-RHE	17	154	3401.	12881.	246.	13324.	407.	13731.
END CONNECT-LHE	172	252	2936.	19506.	647.	19736.	277.	20013.
MONORAIL TRACK	139	444	2589.	10094.	832.	10454.	1111.	11565.
TRACK SUPPORT	112	564	2588.	10753.	750.	11085.	999.	12085.

TABLE 811

MAXIMUM STRESSES FROM PFANMQDS
SSE 1/4 60 D

COMPONENT	ELEM	NODE	X	Y	Z	SRSS	STATIC	SUM
GIRDER A	40	323	1566.	6061.	13974.	15312.	7990.	23302.
GIRDER B	80	373	1397.	7243.	13936.	15768.	7924.	23692.
END CONNECT-RHE	17	154	3399.	18987.	656.	19300.	407.	19707.
END CONNECT-LHE	172	252	2989.	20839.	568.	21060.	277.	21337.
MONORAIL TRACK	139	444	2558.	14708.	3086.	15245.	1111.	16356.
TRACK SUPPORT	112	564	2565.	15148.	2990.	15652.	999.	16651.

TABLE 812

MAXIMUM STRESSES FROM PFANMQNS
SSE 1/4 NL

COMPONENT	ELEM	NODE	X	Y	Z	SRSS	STATIC	SUM
GIRDER A	51	335	2167.	14816.	417.	14979.	365.	15344.
GIRDER B	89	382	1433.	9655.	611.	9780.	1387.	11167.
END CONNECT-RHE	17	154	3398.	10237.	181.	10788.	408.	11196.
END CONNECT-LHE	172	252	2987.	19058.	473.	19306.	296.	19602.
MONORAIL TRACK	139	444	2555.	8120.	444.	8524.	659.	9183.
TRACK SUPPORT	112	564	2561.	8738.	406.	9306.	597.	9904.

STRESS IN PSI

TABLE 813

MAXIMUM STRESSES FROM PFANMEUD
OBE LHE 60 U

COMPONENT	ELEM	NODE	X	Y	Z	SRSS	STATIC	SUM
GIRDER A	49	332	1427.	12396.	411.	12485.	2566.	15051.
GIRDER B	89	382	490.	7494.	361.	7519.	2432.	9951.
END CONNECT-RHE	16	152	1563.	10410.	156.	10528.	431.	10959.
END CONNECT-LHE	172	252	1138.	19336.	286.	19371.	271.	19642.
MONORAIL TRACK	138	443	1570.	24340.	234.	24391.	1833.	26224.
TRACK SUPPORT	112	564	1509.	27697.	221.	27739.	704.	28444.

TABLE 814

MAXIMUM STRESSES FROM PFANMEDO
OBE LHE 60 D

COMPONENT	ELEM	NODE	X	Y	Z	SRSS	STATIC	SUM
GIRDER A	49	332	1469.	13085.	2125.	13337.	2566.	15903.
GIRDER B	84	377	1137.	4319.	3976.	5993.	5379.	11371.
END CONNECT-RHE	17	154	3154.	13622.	69.	13982.	394.	14376.
END CONNECT-LHE	172	252	1137.	19549.	258.	19584.	271.	19855.
MONORAIL TRACK	138	443	1585.	24685.	517.	24741.	1833.	26574.
TRACK SUPPORT	112	564	1530.	27948.	746.	28000.	704.	28704.

TABLE 815

MAXIMUM STRESSES FROM PFANMLNO
OBE LHE NL

COMPONENT	ELEM	NODE	X	Y	Z	SRSS	STATIC	SUM
GIRDER A	51	334	1952.	6550.	269.	6840.	857.	7697.
GIRDER B	59	352	1501.	5136.	203.	5355.	347.	5702.
END CONNECT-RHE	17	154	1392.	6934.	260.	7192.	393.	7585.
END CONNECT-LHE	172	252	2355.	8236.	315.	8572.	293.	8865.
MONORAIL TRACK	138	443	708.	18969.	260.	18993.	1600.	20592.
TRACK SUPPORT	112	564	998.	21505.	220.	21529.	355.	21884.

STRESS IN PSI

TABLE 816

MAXIMUM STRESSES FROM PFANMEUS
SSE LHE 60 U

COMPONENT	ELEM	NODE	X	Y	Z	SRSS	STATIC	SUM
GIRDER A	51	335	1673.	26704.	469.	26761.	619.	27379.
GIRDER B	91	385	641.	16742.	347.	16758.	600.	17358.
END CONNECT-RHE	16	152	2935.	18791.	303.	19021.	431.	19452.
END CONNECT-LHE	172	252	2162.	36702.	555.	36770.	271.	37041.
MONORAIL TRACK	138	443	2947.	45301.	538.	45400.	1833.	47232.
TRACK SUPPORT	112	564	2830.	51691.	508.	51771.	704.	52475.

TABLE 817

MAXIMUM STRESSES FROM PFANMEDS
SSE LHE 60 D

COMPONENT	ELEM	NODE	X	Y	Z	SRSS	STATIC	SUM
GIRDER A	51	335	1687.	26939.	1073.	27013.	619.	27632.
GIRDER B	91	385	646.	16760.	1007.	16802.	600.	17402.
END CONNECT-RHE	17	154	5918.	19523.	133.	20401.	394.	20795.
END CONNECT-LHE	172	252	2157.	36964.	498.	37031.	271.	37302.
MONORAIL TRACK	138	443	2975.	45734.	985.	45841.	1833.	47674.
TRACK SUPPORT	112	564	2870.	52005.	1406.	52103.	704.	52807.

TABLE 818

MAXIMUM STRESSES FROM PFANMLNS
SSE LHE NL

COMPONENT	ELEM	NODE	X	Y	Z	SRSS	STATIC	SUM
GIRDER A	51	334	3745.	12344.	520.	12911.	857.	13768.
GIRDER B	59	352	2890.	9373.	388.	9816.	347.	10163.
END CONNECT-RHE	17	154	3632.	12405.	493.	12935.	393.	13328.
END CONNECT-LHE	172	252	4517.	15058.	597.	15732.	293.	16026.
MONORAIL TRACK	138	443	1731.	35563.	500.	35609.	1600.	37209.
TRACK SUPPORT	112	564	1398.	40306.	406.	40353.	355.	40708.

STRESS IN PSI

TABLE B19

MAXIMUM STRESSES FROM PFANMRUO
OBE RHE 60 U

COMPONENT	ELEM	NODE	X	Y	Z	SRSS	STATIC	SUM
GIRDER A	27	310	967.	2493.	1357.	2999.	6304.	9303.
GIRDER B	67	360	869.	2235.	1279.	2717.	6357.	9075.
END CONNECT-RHE	17	154	1615.	6577.	248.	6777.	438.	7215.
END CONNECT-LHE	172	252	2257.	7662.	239.	7993.	304.	8297.
MONORAIL TRACK	138	443	692.	13558.	211.	13578.	1637.	15215.
TRACK SUPPORT	112	564	673.	14900.	185.	14916.	519.	15435.

TABLE B20

MAXIMUM STRESSES FROM PFANMRDO
OBE RHE 60 D

COMPONENT	ELEM	NODE	X	Y	Z	SRSS	STATIC	SUM
GIRDER A	27	310	1365.	3541.	5743.	7051.	6304.	13355.
GIRDER B	67	360	1289.	3173.	5953.	6868.	6357.	13225.
END CONNECT-RHE	17	154	1660.	8044.	660.	8240.	438.	8678.
END CONNECT-LHE	172	252	2261.	10493.	652.	10754.	304.	11057.
MONORAIL TRACK	138	443	737.	13810.	458.	13837.	1637.	15474.
TRACK SUPPORT	112	564	680.	14954.	636.	14983.	519.	15502.

TABLE B21

MAXIMUM STRESSES FROM PFANMRNO
OBE RHE NL

COMPONENT	ELEM	NODE	X	Y	Z	SRSS	STATIC	SUM
GIRDER A	26	310	913.	1874.	579.	2163.	4005.	6169.
GIRDER B	66	360	831.	1666.	601.	1956.	4058.	6014.
END CONNECT-RHE	17	154	1608.	5744.	252.	5970.	430.	6401.
END CONNECT-LHE	172	252	2249.	5846.	245.	6268.	310.	6579.
MONORAIL TRACK	138	443	714.	13397.	172.	13417.	1520.	14937.
TRACK SUPPORT	112	564	643.	14868.	125.	14882.	304.	15186.

STRESS IN PSI

TABLE B22

MAXIMUM STRESSES FROM PFANMRUS
SSE RHE 60 U

COMPONENT	ELEM	NODE	X	Y	Z	SRSS	STATIC	SUM
GIRDER A	27	310	2028.	3158.	3245.	4961.	6304.	11265.
GIRDER B	67	360	1816.	2757.	3057.	4500.	6357.	10857.
END CONNECT-RHE	17	154	3022.	10192.	523.	10644.	438.	11082.
END CONNECT-LHE	172	252	4237.	9873.	569.	10759.	304.	11063.
MONORAIL TRACK	138	443	1295.	25017.	459.	25055.	1637.	26692.
TRACK SUPPORT	112	564	1261.	27847.	386.	27878.	519.	28397.

TABLE B23

MAXIMUM STRESSES FROM PFANMRDS
SSE RHE 60 D

COMPONENT	ELEM	NODE	X	Y	Z	SRSS	STATIC	SUM
GIRDER A	27	310	2626.	4986.	11159.	12501.	6304.	18805.
GIRDER B	67	360	2489.	4432.	11178.	12280.	6357.	18637.
END CONNECT-RHE	17	154	3163.	12424.	1469.	12905.	438.	13343.
END CONNECT-LHE	172	252	4256.	14772.	1305.	15429.	304.	15732.
MONORAIL TRACK	138	443	1377.	25463.	869.	25515.	1637.	27152.
TRACK SUPPORT	112	564	1266.	27945.	1197.	27999.	519.	28518.

TABLE B24

MAXIMUM STRESSES FROM PFANMRNS
SSE RHE NL

COMPONENT	ELEM	NODE	X	Y	Z	SRSS	STATIC	SUM
GIRDER A	26	310	1821.	2452.	1363.	3344.	4005.	7349.
GIRDER B	60	354	1366.	5856.	799.	6066.	1619.	7685.
END CONNECT-RHE	17	154	3008.	9406.	552.	9890.	430.	10321.
END CONNECT-LHE	172	252	4218.	7796.	481.	8877.	310.	9187.
MONORAIL TRACK	138	443	1336.	24822.	352.	24861.	1520.	26381.
TRACK SUPPORT	112	564	1178.	27809.	246.	27835.	304.	28139.

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TABLE B25

MAXIMUM STRESSES FROM PFANAMNO
OBE A M NL

COMPONENT	ELEM	NODE	X	Y	Z	SRSS	STATIC	SUM
GIRDER A	35	317	576.	1506.	631.	1732.	4036.	5767.
GIRDER B	74	368	725.	2006.	565.	2206.	3658.	5865.
END CONNECT-RHE	17	154	1794.	5889.	111.	6157.	425.	6582.
END CONNECT-LHE	172	252	1301.	1899.	148.	2307.	344.	2651.
MONORAIL TRACK	138	443	1083.	22293.	634.	22328.	1652.	23980.
TRACK SUPPORT	112	564	867.	25279.	160.	25294.	448.	25742.

TABLE B26

MAXIMUM STRESSES FROM PFANAGNO
OBE A G NL

COMPONENT	ELEM	NODE	X	Y	Z	SRSS	STATIC	SUM
GIRDER A	51	334	1377.	10503.	201.	10595.	901.	11496.
GIRDER B	58	351	1327.	10870.	212.	10952.	215.	11167.
END CONNECT-RHE	17	154	1476.	12940.	245.	13026.	437.	13463.
END CONNECT-LHE	172	252	1609.	13175.	245.	13276.	315.	13591.
MONORAIL TRACK	138	443	1035.	20008.	567.	20042.	1625.	21667.
TRACK SUPPORT	112	564	1097.	22301.	184.	22328.	401.	23229.

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TABLE B27

MAXIMUM STRESSES FROM PFANAMNS
SSE A M NL

COMPONENT	ELEM	NODE	X	Y	Z	SRSS	STATIC	SUM
GIRDER A	34	318	1216.	1751.	1473.	2591.	4007.	6598.
GIRDER B	58	351	3013.	5789.	232.	6530.	203.	6733.
END CONNECT-RHE	17	154	3398.	6799.	217.	7603.	425.	8028.
END CONNECT-LHE	172	252	2457.	2424.	283.	3464.	344.	3808.
MONORAIL TRACK	138	443	2017.	41741.	1136.	41805.	1652.	43457.
TRACK SUPPORT	112	564	1635.	47338.	355.	47368.	448.	47816.

TABLE B28

MAXIMUM STRESSES FROM PFANAQNS
SSE A Q NL

COMPONENT	ELEM	NODE	X	Y	Z	SRSS	STATIC	SUM
GIRDER A	51	334	2659.	18851.	410.	19042.	901.	19943.
GIRDER B	58	351	2568.	18683.	408.	18863.	215.	19078.
END CONNECT-RHE	17	154	2846.	22119.	467.	22306.	437.	22743.
END CONNECT-LHE	172	252	3105.	22990.	478.	23203.	315.	23519.
MONORAIL TRACK	138	443	1964.	37540.	375.	37601.	1625.	39226.
TRACK SUPPORT	112	564	2097.	42773.	347.	42825.	401.	43226.

STRESS IN PSI

TABLE 829

MAXIMUM STRESSES FROM PFANBMNO
OBE B M NL

COMPONENT	ELEM	NODE	X	Y	Z	SRSS	STATIC	SUM
GIRDER A	35	313	498.	2613.	1620.	3115.	7199.	10313.
GIRDER B	74	367	504.	3448.	1535.	3808.	6749.	10557.
END CONNECT-RHE	17	154	605.	7447.	155.	7473.	477.	7950.
END CONNECT-LHE	172	252	775.	6166.	308.	6223.	277.	6500.
MONORAIL TRACK	138	443	478.	10949.	190.	10961.	1733.	12694.
TRACK SUPPORT	112	564	679.	12627.	170.	12646.	669.	13316.

TABLE 830

MAXIMUM STRESSES FROM PFANBLNO
OBE B L NL

COMPONENT	ELEM	NODE	X	Y	Z	SRSS	STATIC	SUM
GIRDER A	34	313	630.	2451.	564.	2593.	3607.	6199.
GIRDER B	87	380	736.	2615.	469.	2757.	3277.	6034.
END CONNECT-RHE	16	152	2324.	6163.	125.	6588.	322.	6909.
END CONNECT-LHE	172	252	454.	3491.	119.	3523.	395.	3917.
MONORAIL TRACK	138	443	1132.	23349.	400.	23379.	1662.	25041.
TRACK SUPPORT	112	564	1225.	26511.	178.	26540.	458.	26998.

STRESS IN PSI

TABLE 831

MAXIMUM STRESSES FROM PFANBMNS
SSE B M NL

COMPONENT	ELEM	NODE	X	Y	Z	SRSS	STATIC	SUM
GIRDER A	35	310	1002.	3398.	3873.	5249.	7199.	12447.
GIRDER B	74	367	1008.	4472.	3671.	5873.	6749.	12622.
END CONNECT-RHE	17	154	1232.	9672.	359.	9757.	477.	10234.
END CONNECT-LHE	172	252	1701.	8182.	715.	8387.	277.	8665.
MONORAIL TRACK	138	443	943.	20505.	448.	20531.	1733.	22264.
TRACK SUPPORT	112	564	1344.	23352.	398.	23394.	669.	24063.

TABLE 832

MAXIMUM STRESSES FROM PFANBLNS
SSE B L NL

COMPONENT	ELEM	NODE	X	Y	Z	SRSS	STATIC	SUM
GIRDER A	34	310	1238.	4146.	1306.	4519.	3607.	8126.
GIRDER B	87	330	1425.	4311.	1085.	4668.	3277.	7946.
END CONNECT-RHE	16	152	4399.	8739.	231.	9786.	322.	10108.
END CONNECT-LHE	172	252	855.	6169.	216.	6232.	395.	6627.
MONORAIL TRACK	138	443	2144.	43681.	533.	43737.	1662.	45398.
TRACK SUPPORT	112	564	2314.	49606.	375.	49661.	458.	50120.

STRESS IN PSI

SRSS-4.3 WHITING CORPORATION ANSYS SRSS PROGRAM 79508 87/07/06.
TABLE # E33 BY MJM PAGE 876 OF 121

79508/MJM/AEP, DCC, NEW MAIN TROLLEY MID, 60T LD UP / OBE 'X'

REACTION SUMMARY

LOAD STEP / NODE LABEL		1	2	3	SRSS	STATIC	SUM	DIFFER
101	FY	1690.	250271.	1219.	250280.	0.	250280.	-250280.
101	FZ	6040.	30606.	41935.	52267.	121799.	174066.	69533.
101	MX	86863.	15891551.	91762.	15892053.	37782.	15929835.	-15854272.
102	FZ	5637.	30662.	38236.	49335.	112265.	161600.	62930.
102	MX	93846.	542935.	111205.	562096.	74887.	636983.	-487209.
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	37451.	1247.	13884.	39961.	0.	39961.	-39961.
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	1368.	229094.	2130.	229108.	0.	229108.	-229108.
201	FZ	5456.	29771.	39818.	50016.	104874.	154890.	54858.
201	MX	75179.	15037836.	78789.	15038231.	38576.	15076806.	-14999655.
202	FZ	5076.	30008.	37687.	48441.	99162.	147604.	50721.
202	MX	23953.	673163.	27591.	674154.	41800.	715954.	-632354.
428	FX	0.	0.	0.	0.	0.	0.	0.
428	FY	0.	0.	0.	0.	0.	0.	0.
428	FZ	0.	0.	0.	0.	0.	0.	0.
428	MX	53.	1924.	39.	1925.	-2.	1927.	-1922.
428	MY	0.	0.	0.	0.	0.	0.	0.
428	MZ	0.	0.	0.	0.	0.	0.	0.

(lb, in-lb)

SRSS-4.3 WHITING CORPORATION ANSYS SRSS PROGRAM 79508 87/07/06.
TABLE # B34 LS 2 MODE 1 SCALE FACTOR = .1183 BY MJM PAGE 8-17 OF 121

79508/MJM/AEP, DCC, NEW MAIN TROLLEY MID, 60T LD UP / OBE

REACTION SUMMARY

LOAD STEP NODE	LABEL	1	2	3	SRSS	STATIC	SUM	DIFFER
101	FY	1690.	29616.	1219.	29689.	0.	29689.	-29689.
101	FZ	6040.	3772.	41935.	42535.	121799.	164334.	79264.
101	MX	86863.	1880461.	91762.	1884692.	37782.	1922474.	-1846910.
102	FZ	5637.	3987.	38236.	38854.	112265.	151119.	73411.
102	MX	93846.	87626.	111205.	169858.	74887.	244745.	-94971.
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	37451.	1126.	13884.	39957.	0.	39957.	-39957.
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	1368.	27181.	2130.	27299.	0.	27299.	-27299.
201	FZ	5456.	3854.	39818.	40374.	104874.	145248.	64500.
201	MX	75179.	1784605.	78789.	1787916.	38576.	1826492.	-1749340.
202	FZ	5076.	3686.	37687.	38205.	99162.	137367.	60957.
202	MX	23953.	140962.	27591.	145619.	41800.	187419.	-103819.
428	FX	0.	0.	0.	0.	0.	0.	0.
428	FY	0.	0.	0.	0.	0.	0.	0.
428	FZ	0.	0.	0.	0.	0.	0.	0.
428	MX	53.	1836.	39.	1838.	-2.	1840.	-1836.
428	MY	0.	0.	0.	0.	0.	0.	0.
428	MZ	0.	0.	0.	0.	0.	0.	0.

(lb - in lb)

SRSS-4.3 WHITING CORPORATION ANSYS SRSS PROGRAM 79508 87/07/06.
TABLE # B35 BY M.M. PAGE 8-18 OF 121

79508/MJM/AEP, DCC, NEW MAIN TROLLEY MID, 60T LD UP / SSE

REACTION SUMMARY

LOAD STEP NODE	LABEL	1	2	3	SRSS	STATIC	SUM	DIFFER
101	FY	3284.	469292.	2260.	469309.	0.	469309.	-469309.
101	FZ	10891.	57392.	74683.	94816.	121799.	216615.	26984.
101	MX	170130.	29798837.	166003.	29799785.	37782.	29837566.	-29762003.
102	FZ	10154.	57497.	68199.	89778.	112265.	202043.	22487.
102	MX	182151.	1018356.	206122.	1054853.	74887.	1129739.	-979966.
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	71774.	2366.	24860.	75994.	0.	75994.	-75994.
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	2648.	429582.	3932.	429608.	0.	429608.	-429608.
201	FZ	9744.	55824.	71003.	90844.	104874.	195718.	14030.
201	MX	147644.	28197996.	142586.	28198743.	38576.	28237319.	-28160168.
202	FZ	9069.	56269.	67128.	88060.	99162.	187222.	11102.
202	MX	49910.	1262486.	51195.	1264509.	41800.	1306309.	-1222709.
428	FX	0.	0.	0.	0.	0.	0.	0.
428	FY	0.	0.	0.	0.	0.	0.	0.
428	FZ	0.	0.	0.	0.	0.	0.	0.
428	MX	100.	3607.	71.	3609.	-2.	3612.	-3607.
428	MY	0.	0.	0.	0.	0.	0.	0.
428	MZ	0.	0.	0.	0.	0.	0.	0.

(lb, in-lb)

SRSS-4.3 WHITING CORPORATION ANSYS SRSS PROGRAM 79508 87/07/06.
TABLE # B36 LS 2 MODE 1 SCALE FACTOR = .0785 BY MJM PAGE B-19 OF 121

79508/MJM/AEP, DCC, NEW MAIN TROLLEY MID, 60T LD UP / SSE

REACTION SUMMARY

LOAD STEP NODE LABEL	1	2	3	SRSS	STATIC	SUM	DIFFER
101 FY	3284.	36868.	2260.	37083.	0.	37083.	-37083.
101 FZ	10891.	4931.	74683.	75633.	121799.	197432.	46166.
101 MX	170130.	2341089.	166003.	2353111.	37782.	2390893.	-2315329.
102 FZ	10154.	5490.	68199.	69169.	112265.	181434.	43096.
102 MX	182151.	139813.	206122.	308565.	74887.	383452.	-233678.
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	71774.	2140.	24860.	75987.	0.	75987.	-75987.
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	2648.	33952.	3932.	34282.	0.	34282.	-34282.
201 FZ	9744.	5274.	71003.	71862.	104874.	176736.	33012.
201 MX	147644.	2229893.	142586.	2239305.	38576.	2277881.	-2200729.
202 FZ	9069.	4790.	67128.	67907.	99162.	167069.	31255.
202 MX	49910.	241466.	51195.	251828.	41800.	293628.	-210028.
428 FX	0.	0.	0.	0.	0.	0.	0.
428 FY	0.	0.	0.	0.	0.	0.	0.
428 FZ	0.	0.	0.	0.	0.	0.	0.
428 MX	100.	3443.	71.	3445.	-2.	3447.	-3443.
428 MY	0.	0.	0.	0.	0.	0.	0.
428 MZ	0.	0.	0.	0.	0.	0.	0.

(lb, in-lb)

SRSS-4.3 WHITING CORPORATION ANSYS SRSS PROGRAM 79508 87/07/06.
TABLE # 037 BY MJM PAGE 0-20 OF 121

79508/MJM/AEP, DCC, NEW MAIN TROLLEY MID, 60T LD DN / OBE

REACTION SUMMARY

LOAD STEP NODE LABEL	1	2	3	SRSS	STATIC	SUM	DIFFER
101 FY	1188.	250271.	162.	250274.	0.	250274.	-250274.
101 FZ	5672.	30570.	95051.	100007.	121799.	221807.	21792.
101 MX	67236.	15891541.	63385.	15891810.	37782.	15929592.	-15854028.
102 FZ	5498.	30646.	91517.	96668.	112265.	208933.	15596.
102 MX	55219.	542934.	4444.	545753.	74887.	620640.	-470867.
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	37097.	1242.	12736.	39242.	0.	39242.	-39242.
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	1157.	229094.	256.	229097.	0.	229097.	-229097.
201 FZ	4935.	29709.	92888.	97648.	104874.	202522.	7226.
201 MX	53084.	15037828.	54529.	15038021.	38576.	15076596.	-14999445.
202 FZ	4739.	30018.	90813.	95763.	99162.	194925.	3400.
202 MX	28429.	673167.	5826.	673792.	41800.	715592.	-631992.
428 FX	0.	0.	0.	0.	0.	0.	0.
428 FY	0.	0.	0.	0.	0.	0.	0.
428 FZ	0.	0.	0.	0.	0.	0.	0.
428 MX	56.	1924.	62.	1925.	-2.	1928.	-1923.
428 MY	0.	0.	0.	0.	0.	0.	0.
428 MZ	0.	0.	0.	0.	0.	0.	0.

(lb, in lb)

SRSS-4.3 WHITING CORPORATION ANSYS SRSS PROGRAM 79508 87/07/06.
TABLE # 838 LS 2 MODE 1 SCALE FACTOR = 1508 BY MJM PAGE 8-21 OF 121

79508/MJM/AEP, DCC, NEW MAIN TROLLEY MID, 60T LD DN / OBE

REACTION SUMMARY

LOAD STEP NODE	LABEL	1	2	3	SRSS	STATIC	SUM	DIFFER
101	FY	1188.	37748.	162.	37767.	0.	37767.	-37767.
101	FZ	5672.	4646.	95051.	95333.	121799.	217132.	26466.
101	MX	67236.	2396816.	63385.	2398585.	37782.	2436367.	-2360803.
102	FZ	5498.	4659.	91517.	91800.	112265.	204065.	20465.
102	MX	55219.	101118.	4444.	115298.	74887.	190185.	-40411.
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	37097.	1121.	12736.	39238.	0.	39238.	-39238.
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	1157.	34609.	256.	34629.	0.	34629.	-34629.
201	FZ	4935.	4495.	92888.	93127.	104874.	198001.	11747.
201	MX	53084.	2272079.	54529.	2273341.	38576.	2311917.	-2234765.
202	FZ	4739.	4551.	90813.	91050.	99162.	190212.	8112.
202	MX	28429.	154006.	5826.	156715.	41800.	198515.	-114915.
428	FX	0.	0.	0.	0.	0.	0.	0.
428	FY	0.	0.	0.	0.	0.	0.	0.
428	FZ	0.	0.	0.	0.	0.	0.	0.
428	MX	56.	1837.	62.	1839.	-2.	1841.	-1837.
428	MY	0.	0.	0.	0.	0.	0.	0.
428	MZ	0.	0.	0.	0.	0.	0.	0.

(lb, in-lb)

SRSS-4.3 WHITING CORPORATION ANSYS SRSS PROGRAM 79508 87/07/06.
TABLE # 839 BY MJM PAGE B-22 OF 121

79508/MJM/AEP, DCC, NEW MAIN TROLLEY MID, 60T LD DN / SSE *

REACTION SUMMARY

LOAD STEP NODE	LABEL	1	2	3	SRSS	STATIC	SUM	DIFFER
101	FY	2311.	469292.	308.	469298.	0.	469298.	-469298.
101	FZ	10991.	57325.	178400.	187706.	121799.	309505.	-65907.
101	MX	134093.	29798818.	123580.	29799376.	37782.	29837158.	-29761595.
102	FZ	10556.	57468.	171695.	181364.	112265.	293629.	-69100.
102	MX	107570.	1018354.	9922.	1024067.	74887.	1098954.	-949181.
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	71007.	2396.	24505.	75155.	0.	75155.	-75155.
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	2252.	429582.	498.	429588.	0.	429588.	-429588.
201	FZ	9539.	55709.	174308.	183242.	104874.	288116.	-78368.
201	MX	106996.	28197981.	106212.	28198384.	38576.	28236959.	-28159808.
202	FZ	9092.	56289.	170368.	179656.	99162.	278818.	-80494.
202	MX	59350.	1262494.	12273.	1263948.	41800.	1305748.	-1222148.
428	FX	0.	0.	0.	0.	0.	0.	0.
428	FY	0.	0.	0.	0.	0.	0.	0.
428	FZ	0.	0.	0.	0.	0.	0.	0.
428	MX	106.	3607.	116.	3610.	-2.	3613.	-3608.
428	MY	0.	0.	0.	0.	0.	0.	0.
428	MZ	0.	0.	0.	0.	0.	0.	0.

(lb; in lb)

79508/MJM/AEP, DCC, NEW MAIN TROLLEY MID, 60T LD DN / SSE

REACTION SUMMARY

NODE	LABEL	1	2	3	SRSS	STATIC	SUM	DIFFER
101	FY	2311.	52628.	308.	52679.	0.	52679.	-52679.
101	FZ	10991.	6536.	178400.	178857.	121799.	300656.	-57058.
101	MX	134093.	3341733.	123580.	3346684.	37782.	3384466.	-3308902.
102	FZ	10556.	6564.	171695.	172144.	112265.	284409.	-59879.
102	MX	107570.	161562.	9922.	194350.	74887.	269237.	-119463.
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	71007.	2172.	24505.	75148.	0.	75148.	-75148.
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	2252.	48317.	498.	48371.	0.	48371.	-48371.
201	FZ	9539.	6293.	174308.	174681.	104874.	279555.	-69807.
201	MX	106996.	3172370.	106212.	3175929.	38576.	3214505.	-3137353.
202	FZ	9092.	6389.	170368.	170729.	99162.	269891.	-71567.
202	MX	59350.	261189.	12273.	268127.	41800.	309927.	-226327.
428	FX	0.	0.	0.	0.	0.	0.	0.
428	FY	0.	0.	0.	0.	0.	0.	0.
428	FZ	0.	0.	0.	0.	0.	0.	0.
428	MX	106.	3444.	116.	3448.	-2.	3450.	-3446.
428	MY	0.	0.	0.	0.	0.	0.	0.
428	MZ	0.	0.	0.	0.	0.	0.	0.

(lb, in-lb)

79508/MJM/AEP, DCC, NEW MAIN TROLLEY 1/4, 60T LD UP / OBE 'X'

REACTION SUMMARY

LOAD STEP NODE LABEL	1	2	3	SRSS	STATIC	SUM	DIFFER
101 FY	5386.	137141.	638.	137248.	0.	137248.	-137248.
101 FZ	3265.	15643.	13814.	21123.	87297.	108420.	66174.
101 MX	307191.	8118468.	39458.	8124373.	35053.	8159426.	-8089320.
102 FZ	1595.	15426.	12598.	19980.	80770.	100750.	60789.
102 MX	66627.	582043.	11482.	585956.	72192.	658148.	-513764.
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	38732.	10528.	2564.	40219.	0.	40219.	-40219.
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	6819.	266780.	536.	266867.	0.	266867.	-266867.
201 FZ	3536.	36657.	28147.	46352.	139398.	185750.	93046.
201 MX	547256.	19147476.	39855.	19155337.	38904.	19194241.	-19116433.
202 FZ	3669.	37082.	26097.	45493.	130636.	176129.	85143.
202 MX	87915.	524079.	10986.	531515.	42131.	573647.	-489384.
428 FX	0.	0.	0.	0.	0.	0.	0.
428 FY	0.	0.	0.	0.	0.	0.	0.
428 FZ	0.	0.	0.	0.	0.	0.	0.
428 MX	78.	2819.	6.	2820.	-2.	2822.	-2817.
428 MY	0.	0.	0.	0.	0.	0.	0.
428 MZ	0.	0.	0.	0.	0.	0.	0.

(lb; in-lb)

SRSS-4.3 WHITING CORPORATION ANSYS SRSS PROGRAM 79508 87/07/11.
TABLE # 842 LS 2 MODE 1 SCALE_FACTOR = .1242 BY MJM PAGE 8-25 OF 121

79508/MJM/AEP, DCC, NEW MAIN TROLLEY 1/4, 60T LD UP / OBE 'X'

REACTION SUMMARY

LOAD STEP NODE	LABEL	1	2	3	SRSS	STATIC	SUM	DIFFER
101	FY	5386.	23345.	638.	23967.	0.	23967.	-23967.
101	FZ	3265.	1980.	13814.	14332.	87297.	101629.	72965.
101	MX	307191.	1063540.	39458.	1107712.	35053.	1142765.	-1072659.
102	FZ	1595.	1924.	12598.	12843.	80770.	93613.	67927.
102	MX	66627.	331476.	11482.	338300.	72192.	410492.	-266108.
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	38732.	4108.	2564.	39033.	0.	39033.	-39033.
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	6819.	36616.	536.	37250.	0.	37250.	-37250.
201	FZ	3536.	4722.	28147.	28759.	139398.	168157.	110639.
201	MX	547256.	2388693.	39855.	2450894.	38904.	2489798.	-2411990.
202	FZ	3669.	4614.	26097.	26754.	130636.	157390.	103882.
202	MX	87915.	124034.	10986.	152427.	42131.	194558.	-110296.
428	FX	0.	0.	0.	0.	0.	0.	0.
428	FY	0.	0.	0.	0.	0.	0.	0.
428	FZ	0.	0.	0.	0.	0.	0.	0.
428	MX	78.	609.	6.	614.	-2.	616.	-612.
428	MY	0.	0.	0.	0.	0.	0.	0.
428	MZ	0.	0.	0.	0.	0.	0.	0.

(16, in-16)

SRSS-4.3 WHITING CORPORATION ANSYS SRSS PROGRAM 79508 87/07/11.
TABLE # 843 BY MJM PAGE 8-26 OF 121

79508/MJM/AEP, DCC, NEW MAIN TROLLEY 1/4, 60T LD UP / SSE 'X'

REACTION SUMMARY

LOAD STEP NODE	LABEL	1	2	3	SRSS	STATIC	SUM	DIFFER
101	FY	10329.	257172.	1244.	257383.	0.	257383.	-257383.
101	FZ	6403.	29333.	32988.	44605.	87297.	131902.	42692.
101	MX	592024.	15224246.	87895.	15236007.	35053.	15271059.	-15200954.
102	FZ	3136.	28927.	30086.	41854.	80770.	122623.	38916.
102	MX	135975.	1101158.	22890.	1109758.	72192.	1181950.	-1037566.
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	75752.	19761.	5300.	78466.	0.	78466.	-78466.
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	12820.	500255.	1036.	500420.	0.	500420.	-500420.
201	FZ	6966.	68737.	67221.	96395.	139398.	235793.	43003.
201	MX	1040852.	35904380.	88219.	35919572.	38904.	35958476.	-35880668.
202	FZ	7221.	69535.	62324.	93656.	130636.	224292.	36980.
202	MX	173155.	986328.	21165.	1001636.	42131.	1043767.	-959504.
428	FX	0.	0.	0.	0.	0.	0.	0.
428	FY	0.	0.	0.	0.	0.	0.	0.
428	FZ	0.	0.	0.	0.	0.	0.	0.
428	MX	147.	5285.	12.	5287.	-2.	5290.	-5285.
428	MY	0.	0.	0.	0.	0.	0.	0.
428	MZ	0.	0.	0.	0.	0.	0.	0.

(lb, in-lb)

SRSS-4.3 WHITING CORPORATION ANSYS SRSS PROGRAM 79508 87/07/11.
TABLE # 844 LS 2 MODE 1 SCALE FACTOR = .0841 BY MJM PAGE B-27 OF 121

79508/MJM/AEP, DCC, NEW MAIN TROLLEY 1/4, 60T LD UP / SSE "X"

REACTION SUMMARY

LOAD STEP NODE	LABEL	1	2	3	SRSS	STATIC	SUM	DIFFER
101	FY	10329.	37140.	1244.	38569.	0.	38569.	-38569.
101	FZ	6403.	2571.	32988.	33702.	87297.	120999.	53595.
101	MX	592024.	1440857.	87895.	1560212.	35053.	1595265.	-1525159.
102	FZ	3136.	2457.	30086.	30349.	80770.	111119.	50421
102	MX	135975.	633159.	22870.	647996.	72192.	720188.	-575804.
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	75752.	7573.	5300.	76314.	0.	76314.	-76314.
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	12820.	51367.	1036.	52952.	0.	52952.	-52952.
201	FZ	6966.	6248.	67221.	67869.	139398.	207267.	71529.
201	MX	1040852.	3052309.	88219.	3226085.	38904.	3264989.	-3187181.
202	FZ	7221.	5872.	62324.	63015.	130636.	193651.	67621.
202	MX	173155.	231226.	21165.	289647.	42131.	331778.	-247516.
428	FX	0.	0.	0.	0.	0.	0.	0.
428	FY	0.	0.	0.	0.	0.	0.	0.
428	FZ	0.	0.	0.	0.	0.	0.	0.
428	MX	147.	1037.	12.	1048.	-2.	1050.	-1046.
428	MY	0.	0.	0.	0.	0.	0.	0.
428	MZ	0.	0.	0.	0.	0.	0.	0.

(lb, in-lb)

SRSS-4.3 WHITING CORPORATION ANSYS SRSS PROGRAM 79508 87/07/11.
TABLE # 845 BY MJM PAGE B-28 OF 121

79508/MJM/AEP, DCC, NEW MAIN TROLLEY 1/4, 60T LD DN / OBE 'X'

REACTION SUMMARY

LOAD STEP NODE LABEL		1	2	3	SRSS	STATIC	SUM	DIFFER
101	FY	5717.	137141.	626.	137261.	0.	137261.	-137261.
101	FZ	1010.	15651.	45987.	48588.	87297.	135885.	38709.
101	MX	333398.	8118470.	72521.	8125637.	35053.	8160689.	-8090584.
102	FZ	1478.	15418.	44474.	47094.	80770.	127864.	33676.
102	MX	67795.	581875.	72904.	590330.	72192.	662522.	-518137.
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	38592.	10531.	1788.	40043.	0.	40043.	-40043.
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	6785.	266779.	561.	266866.	0.	266866.	-266866.
201	FZ	3602.	36675.	120228.	125749.	139398.	265146.	13649.
201	MX	555002.	19147480.	52972.	19155595.	38904.	19194499.	-19116691.
202	FZ	2619.	37063.	117774.	123496.	130636.	254131.	7140.
202	MX	96742.	524018.	42102.	534533.	42131.	576665.	-492402.
428	FX	0.	0.	0.	0.	0.	0.	0.
428	FY	0.	0.	0.	0.	0.	0.	0.
428	FZ	0.	0.	0.	0.	0.	0.	0.
428	MX	78.	2819.	66.	2821.	-2.	2823.	-2818.
428	MY	0.	0.	0.	0.	0.	0.	0.
428	MZ	0.	0.	0.	0.	0.	0.	0.

(lb, in-lb)

SRSS-4.3 WHITING CORPORATION ANSYS SRSS PROGRAM 79508 87/07/11.
TABLE # B46 LS 2 MODE 1 SCALE FACTOR = .1773 BY MJM PAGE B-29 OF 121

79508/MJM/AEP, DCC, NEW MAIN TROLLEY 1/4, 60T LD DN / OBE 'X'

REACTION SUMMARY

LOAD STEP NODE LABEL		1	2	3	SRSS	STATIC	SUM	DIFFER
101	FY	5717.	29016.	626.	29581.	0.	29581.	-29581.
101	FZ	1010.	2793.	45987.	46083.	87297.	133380.	41214.
101	MX	333398.	1477974.	72521.	1516841.	35053.	1551894.	-1481788.
102	FZ	1478.	2743.	44474.	44583.	80770.	125353.	36187.
102	MX	67795.	336753.	72904.	351159.	72192.	423351.	-278967.
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	38592.	4300.	1788.	38872.	0.	38872.	-38872.
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	6785.	49762.	561.	50225.	0.	50225.	-50225.
201	FZ	3602.	6587.	120228.	120462.	139398.	259860.	18936.
201	MX	555002.	3402136.	52972.	3447496.	38904.	3486400.	-3408592.
202	FZ	2619.	6600.	117774.	117987.	130636.	248623.	12649.
202	MX	96742.	139766.	42102.	175116.	42131.	217247.	-132985.
428	FX	0.	0.	0.	0.	0.	0.	0.
428	FY	0.	0.	0.	0.	0.	0.	0.
428	FZ	0.	0.	0.	0.	0.	0.	0.
428	MX	78.	703.	66.	710.	-2.	712.	-708.
428	MY	0.	0.	0.	0.	0.	0.	0.
428	MZ	0.	0.	0.	0.	0.	0.	0.

(16, 17-16)

79508/MJM/AEP, DCC, NEW MAIN TROLLEY 1/4, 60T LD DN / SSE

REACTION SUMMARY

NODE	LABEL	LOAD STEP 1	2	3	SRSS	STATIC	SUM	DIFFER
101	FY	10994.	257172.	1427.	257411.	0.	257411.	-257411.
101	FZ	1980.	29348.	86502.	91366.	87297.	178663.	-4069.
101	MX	644654.	15224241.	167397.	15238803.	35053.	15273856.	-15203750.
102	FZ	2895.	28913.	83588.	88494.	80770.	169264.	-7725.
102	MX	139443.	1100621.	173630.	1122924.	72192.	1195116.	-1050732.
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	75480.	19769.	3554.	78106.	0.	78106.	-78106.
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	12749.	500255.	1228.	500419.	0.	500419.	-500419.
201	FZ	7031.	68773.	225627.	235980.	139398.	375378.	-96582.
201	MX	1056769.	35904386.	119015.	35920132.	38904.	35959035.	-35881228.
202	FZ	5077.	69498.	220950.	231678.	130636.	362314.	-101043.
202	MX	190693.	986132.	100281.	1009394.	42131.	1051525.	-967262.
428	FX	0.	0.	0.	0.	0.	0.	0.
428	FY	0.	0.	0.	0.	0.	0.	0.
428	FZ	0.	0.	0.	0.	0.	0.	0.
428	MX	147.	5285.	125.	5289.	-2.	5291.	-5286.
428	MY	0.	0.	0.	0.	0.	0.	0.
428	MZ	0.	0.	0.	0.	0.	0.	0.

(lb, in-lb)

SRSS-4.3 WHITING CORPORATION ANSYS SRSS PROGRAM 79508 87/07/11.
TABLE # 848 LS 2 MODE 1 SCALE_FACTOR = .1338 BY MJM PAGE 8-3) OF 121

79508/MJM/AEP, DCC, NEW MAIN TROLLEY 1/4, 60T LD DN / SSE

REACTION SUMMARY

LOAD STEP NODE	LABEL	1	2	3	SRSS	STATIC	SUM	DIFFER
101	FY	10994.	45669.	1427.	46995.	0.	46995.	-46995.
101	FZ	1980.	3978.	86502.	86616.	87297.	173913.	681.
101	MX	644654.	2140310.	167397.	2241533.	35053.	2276586.	-2206480.
102	FZ	2895.	3906.	83588.	83729.	80770.	164499.	-2959.
102	MX	139443.	639186.	173630.	676866.	72192.	749058.	-604674.
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	75480.	7829.	3554.	75968.	0.	75968.	-75968.
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	12749.	73069.	1228.	74183.	0.	74183.	-74183.
201	FZ	7031.	9425.	225627.	225932.	139398.	365330.	-86534.
201	MX	1056769.	4824430.	119015.	4940223.	38904.	4979127.	-4901319.
202	FZ	5077.	9376.	220950.	221206.	130636.	351842.	-90570.
202	MX	190693.	251201.	100281.	330940.	42131.	373071.	-288809.
428	FX	0.	0.	0.	0.	0.	0.	0.
428	FY	0.	0.	0.	0.	0.	0.	0.
428	FZ	0.	0.	0.	0.	0.	0.	0.
428	MX	147.	1170.	125.	1186.	-2.	1188.	-1184.
428	MY	0.	0.	0.	0.	0.	0.	0.
428	MZ	0.	0.	0.	0.	0.	0.	0.

(16, in-16)

SRSS-4.3 WHITING CORPORATION ANSYS SRSS PROGRAM 79508 87/07/08.
TABLE # E49 BY MJM PAGE B-32 OF 121

79508/MJM/AEP, DCC, NEW MAIN TROLLEY END, 60T LD UP / OBE

REACTION SUMMARY

LOAD STEP / NODE LABEL	1	2	3	SRSS	STATIC	SUM	DIFFER
101 FY	3483.	57543.	591.	57651.	0.	57651.	-57651.
101 FZ	1086.	5970.	7657.	9770.	71769.	81539.	61999.
101 MX	244203.	3137938.	36683.	3147640.	34083.	3181723.	-3113557.
102 FZ	1097.	5761.	6570.	8322.	65211.	74033.	56390.
102 MX	102254.	1412014.	10044.	1415748.	71391.	1487138.	-1344357.
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	36879.	15354.	6337.	40447.	0.	40447.	-40447.
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	12054.	160905.	942.	161359.	0.	161359.	-161359.
201 FZ	5318.	25278.	20064.	32709.	154938.	187647.	122230.
201 MX	989301.	12722228.	64196.	12760796.	38610.	12799406.	-12722186.
202 FZ	4153.	24747.	18294.	31054.	146182.	177235.	115128.
202 MX	34575.	392885.	6205.	394452.	41417.	435869.	-353035.
428 FX	0.	0.	0.	0.	0.	0.	0.
428 FY	0.	0.	0.	0.	0.	0.	0.
428 FZ	0.	0.	0.	0.	0.	0.	0.
428 MX	179.	4375.	10.	4378.	-2.	4380.	-4376.
428 MY	0.	0.	0.	0.	0.	0.	0.
428 MZ	0.	0.	0.	0.	0.	0.	0.

(lb, in-lb)

SRSS-4.3 WHITING CORPORATION ANSYS SRSS PROGRAM 79508 87/07/08.
TABLE # B50 LS 2 MODE 2 SCALE FACTOR = .2171 BY MJM PAGE B-33 OF 121

79508/MJM/AEP, DCC, NEW MAIN TROLLEY END, 60T LD UP / OBE 4X

REACTION SUMMARY

LOAD STEP NODE LABEL	1	2	3	SRSS	STATIC	SUM	DIFFER
101 FY	3483.	39827.	591.	39983.	0.	39983.	-39983.
101 FZ	1086.	2096.	7657.	8013.	71769.	79782.	63756.
101 MX	244203.	1159630.	36683.	1185624.	34083.	1219707.	-1151541.
102 FZ	1097.	2467.	6590.	7121.	65211.	72332.	58090.
102 MX	102254.	674253.	10044.	682033.	71391.	753424.	-610642.
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	36879.	4557.	6337.	37696.	0.	37696.	-37696.
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	12054.	60399.	942.	61597.	0.	61597.	-61597.
201 FZ	5318.	5583.	20064.	21495.	154938.	176433.	133443.
201 MX	989301.	3327053.	64176.	3471599.	38610.	3510209.	-3432989.
202 FZ	4153.	5638.	18294.	19588.	146182.	165770.	126594.
202 MX	34575.	313319.	6205.	315282.	41417.	356699.	-273865.
428 FX	0.	0.	0.	0.	0.	0.	0.
428 FY	0.	0.	0.	0.	0.	0.	0.
428 FZ	0.	0.	0.	0.	0.	0.	0.
428 MX	179.	4081.	10.	4085.	-2.	4087.	-4083.
428 MY	0.	0.	0.	0.	0.	0.	0.
428 MZ	0.	0.	0.	0.	0.	0.	0.

(lb, in-lb)

SRSS-4.3 WHITING CORPORATION ANSYS SRSS PROGRAM 79508 07/07/08.
TABLE # 651 BY MJM PAGE 8-34 OF 121

79508/MJM/AEP, DCC, NEW MAIN TROLLEY END, 60T LD UP / SSE

REACTION SUMMARY

LOAD STEP NODE LABEL	1	2	3	SRSS	STATIC	SUM	DIFFER
101 FY	6565.	108843.	1149.	109047.	0.	109047.	-109047.
101 FZ	2521.	11212.	18349.	21650.	71769.	93419.	50119.
101 MX	462285.	5901885.	83201.	5920547.	34083.	5954630.	-5886464.
102 FZ	2444.	10832.	15791.	19304.	65211.	84516.	45907.
102 MX	195142.	2668426.	19661.	2675624.	71391.	.2747015.	-2604233.
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	72788.	28865.	13805.	79510.	0.	79510.	-79510.
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	22696.	302276.	1823.	303132.	0.	303132.	-303132.
201 FZ	11020.	47409.	48084.	68418.	154938.	223357.	86520.
201 MX	1863051.	23867407.	131969.	23940373.	33610.	23978983.	-23901763.
202 FZ	8745.	46423.	43843.	64450.	146182.	210632.	81732.
202 MX	71319.	761407.	13782.	764864.	41417.	806281.	-723447.
428 FX	0.	0.	0.	0.	0.	0.	0.
428 FY	0.	0.	0.	0.	0.	0.	0.
428 FZ	0.	0.	0.	0.	0.	0.	0.
428 MX	335.	8203.	19.	8210.	-2.	8212.	-8208.
428 MY	0.	0.	0.	0.	0.	0.	0.
428 MZ	0.	0.	0.	0.	0.	0.	0.

(lb, in-lb)

SRSS-4.3 WHITING CORPORATION ANSYS SRSS PROGRAM 79508 87/07/08.
TABLE # B52 LS 2 MODE 2 SCALE FACTOR = .1374 BY MJM PAGE B-35 OF 121

79508/MJM/AEP, DCC, NEW MAIN TROLLEY END, 60T LD UP / SSE "X"

REACTION SUMMARY

LOAD STEP NODE	LABEL	1	2	3	SRSS	STATIC	SUM	DIFFER
101	FY	6565.	74845.	1149.	75141.	0.	75141.	-75141.
101	FZ	2521.	3546.	18349.	18858.	71769.	90627.	52911.
101	MX	462285.	2012971.	83201.	2067038.	34083.	2101121.	-2032955.
102	FZ	2444.	4379.	15791.	16568.	65211.	81779.	48643.
102	MX	195142.	1244230.	19661.	1259586.	71391.	1330977.	-1188195.
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	72788.	7405.	13805.	74454.	0.	74454.	-74454.
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	22696.	104137.	1823.	106597.	0.	106597.	-106597.
201	FZ	11020.	6857.	48084.	49805.	154938.	204743.	105133.
201	MX	1863051.	4873432.	131969.	5219054.	38610.	5257664.	-5180444.
202	FZ	8745.	7277.	43843.	45295.	146182.	191477.	100887.
202	MX	71319.	613445.	13782.	617727.	41417.	659144.	-576310.
428	FX	0.	0.	0.	0.	0.	0.	0.
428	FY	0.	0.	0.	0.	0.	0.	0.
428	FZ	0.	0.	0.	0.	0.	0.	0.
428	MX	335.	7636.	19.	7644.	-2.	7646.	-7642.
428	MY	0.	0.	0.	0.	0.	0.	0.
428	MZ	0.	0.	0.	0.	0.	0.	0.

(16; in 16)

79508/MJM/AEP, DCC, NEW MAIN TROLLEY END, 60T LD DN / ONE

REACTION SUMMARY

LOAD STEP NODE	LABEL	1	2	3	SRSS	STATIC	SUM	DIFFER
101	FY	3486.	57543.	489.	57651.	0.	57651.	-57651.
101	FZ	1548.	5936.	22311.	23139.	71769.	94908.	48630.
101	MX	245750.	3137916.	32640.	3147693.	34083.	3181776.	-3113611.
102	FZ	1289.	5790.	21342.	22151.	65211.	87363.	43060.
102	MX	102319.	1412027.	7764.	1415751.	71391.	1487142.	-1344360.
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	36474.	15353.	4939.	39881.	0.	39881.	-39881.
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	12041.	160906.	648.	161358.	0.	161358.	-161358.
201	FZ	6029.	25072.	117698.	120489.	154938.	275428.	34449.
201	MX	988558.	12722291.	51140.	12760743.	38610.	12799353.	-12722132.
202	FZ	5027.	24942.	116267.	119019.	146182.	265200.	27163.
202	MX	34413.	392903.	3170.	394420.	41417.	435837.	-353003.
428	FX	0.	0.	0.	0.	0.	0.	0.
428	FY	0.	0.	0.	0.	0.	0.	0.
428	FZ	0.	0.	0.	0.	0.	0.	0.
428	MX	179.	4375.	9.	4378.	-2.	4380.	-4376.
428	MY	0.	0.	0.	0.	0.	0.	0.
428	MZ	0.	0.	0.	0.	0.	0.	0.

(lb, in-lb)

79508/MJM/AEP, DCC, NEW MAIN TROLLEY END, 60T LD DN / OBE 'X'

REACTION SUMMARY

LOAD STEP NODE	LABEL	1	2	3	SRSS	STATIC	SUM	DIFFER
101	FY	3486.	41046.	489.	41197.	0.	41197.	-41197.
101	FZ	1548.	2486.	22311.	22502.	71769.	94271.	49267.
101	MX	245750.	1352942.	32640.	1375460.	34083.	1409543.	-1341377.
102	FZ	1289.	2756.	21342.	21558.	65211.	86769.	43653.
102	MX	102319.	736595.	7764.	743705.	71391.	815096.	-672314.
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	36474.	5729.	4939.	37250.	0.	37250.	-37250.
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	12041.	70136.	648.	71165.	0.	71165.	-71165.
201	FZ	6029.	8052.	117698.	118126.	154938.	273064.	36812.
201	MX	988558.	4436849.	51140.	4545912.	38610.	4584522.	-4507302.
202	FZ	5027.	8096.	116267.	116656.	146182.	262838.	29526.
202	MX	34413.	318419.	3170.	320288.	41417.	361705.	-278871.
428	FX	0.	0.	0.	0.	0.	0.	0.
428	FY	0.	0.	0.	0.	0.	0.	0.
428	FZ	0.	0.	0.	0.	0.	0.	0.
428	MX	179.	4098.	9.	4102.	-2.	4104.	-4100.
428	MY	0.	0.	0.	0.	0.	0.	0.
428	MZ	0.	0.	0.	0.	0.	0.	0.

(lb, in-lb)

SRSS-4.3 WHITING CORPORATION ANSYS SRSS PROGRAM 79508 07/07/08.
TABLE # B55 ~~BY~~ MJM ~~PAGE B-38 OF~~ 121
[illegible]

79508/MJM/AEP, DCC, NEW MAIN TROLLEY END, 60T LD DN / SSE ^X/

REACTION SUMMARY

LOAD STEP NODE LABEL	1	2	3	SRSS	STATIC	SUM	DIFFER
101 FY	6570.	108845.	945.	109047.	0.	109047.	-109047.
101 FZ	3279.	11148.	42282.	43849.	71769.	115618.	27920.
101 MX	465388.	5901844.	69251.	5920570.	34083.	5954653.	-5886487.
102 FZ	2707.	10884.	40322.	41853.	65211.	107064.	23359.
102 MX	195324.	2668453.	15219.	2675635.	71391.	2747026.	-2604245.
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	72004.	28859.	10275.	78250.	0.	78250.	-78250.
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	22664.	302278.	1264.	303130.	0.	303130.	-303130.
201 FZ	11784.	47021.	220866.	226123.	154938.	381061.	-71185.
201 MX	1861003.	23867546.	105903.	23940223.	30610.	23970834.	-23901613.
202 FZ	9709.	46786.	218109.	223282.	146182.	369463.	-77100.
202 MX	71029.	761449.	6339.	764781.	41417.	806198.	-723364.
428 FX	0.	0.	0.	0.	0.	0.	0.
428 FY	0.	0.	0.	0.	0.	0.	0.
428 FZ	0.	0.	0.	0.	0.	0.	0.
428 MX	335.	8203.	16.	8210.	-2.	8212.	-8208.
428 MY	0.	0.	0.	0.	0.	0.	0.
428 MZ	0.	0.	0.	0.	0.	0.	0.

(16, in-16)

SRSS-4.3.1 WHITING CORPORATION ANSYS SRSS PROGRAM 79508 87/07/27.
TABLE # B56 LS 2 MODE 2 SCALE FACTOR = .2344 BY MJM PAGE B39 OF 121

79508/MJM/AEP, DCC, NEW MAIN TROLLEY END, 60T LD DN / SSE

REACTION SUMMARY

LOAD STEP NODE LABEL	1	2	3	SRSS	STATIC	SUM	DIFFER
101 FY	6570.	76365.	945.	76652.	0.	76652.	-76652.
101 FZ	3279.	4099.	42282.	42606.	71769.	114375.	29163.
101 MX	465388.	2276728.	69251.	2324829.	34083.	2358912.	-2290746.
102 FZ	2707.	4752.	40322.	40691.	65211.	105902.	24520.
102 MX	195324.	1324024.	15219.	1338431.	71391.	1409822.	-1267040.
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	72004.	9076.	10275.	73297.	0.	73297.	-73297.
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	22664.	117497.	1264.	119669.	0.	119669.	-119669.
201 FZ	11784.	11219.	220866.	221464.	154938.	376402.	-66526.
201 MX	1861003.	6620042.	105908.	6877420.	38610.	6916030.	-6838810.
202 FZ	9709.	11422.	218109.	218623.	146182.	364805.	-72441.
202 MX	71029.	619551.	6339.	623639.	41417.	665056.	-582222.
428 FX	0.	0.	0.	0.	0.	0.	0.
428 FY	0.	0.	0.	0.	0.	0.	0.
428 FZ	0.	0.	0.	0.	0.	0.	0.
428 MX	335.	7658.	16.	7665.	-2.	7667.	-7663.
428 MY	0.	0.	0.	0.	0.	0.	0.
428 MZ	0.	0.	0.	0.	0.	0.	0.

(lb, in-lb)

79508/MJM/AEP, DCC, NEW MAIN TROLLEY RHE, 60T LD UP / ONE

REACTION SUMMARY

LOAD STEP NODE LABEL	1	2	3	SRSS	STATIC	SUM	DIFFER
101 FY	10876.	307764.	1378.	307960.	-0.	307960.	-307960.
101 FZ	10222.	31492.	22722.	40156.	162102.	202258.	121946.
101 MX	706248.	19917739.	102825.	19930521.	38871.	19967392.	-19891650.
102 FZ	10553.	33180.	20457.	40383.	151130.	191513.	110747.
102 MX	82048.	978389.	18142.	981990.	73514.	1055504.	-908477.
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	26634.	15587.	17681.	35566.	0.	35566.	-35566.
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	4911.	136423.	652.	136513.	0.	136513.	-136513.
201 FZ	4318.	15124.	9434.	18340.	64598.	82939.	46258.
201 MX	259281.	7001031.	36690.	7005927.	35968.	7041875.	-6969959.
202 FZ	4475.	16067.	8670.	18797.	60270.	79067.	41472.
202 MX	68825.	1270802.	19602.	1292784.	38732.	1331516.	-1254051.
428 FX	0.	0.	0.	0.	0.	0.	0.
428 FY	0.	0.	0.	0.	0.	0.	0.
428 FZ	0.	0.	0.	0.	0.	0.	0.
428 MX	83.	2749.	11.	2751.	-2.	2752.	-2749.
428 MY	0.	0.	0.	0.	0.	0.	0.
428 MZ	0.	0.	0.	0.	0.	0.	0.

(16, in 16)

SRSS-4.3 WHITING CORPORATION ANSYS SRSS PROGRAM 79503 87/07/08.
TABLE # B58 LS 2 MODE 2 SCALE FACTOR = .1125 BY MJM PAGE B-41 OF 121

79508/MJM/AEP, DCC, NEW MAIN TROLLEY RHE, 60T LD UP / OBE

REACTION SUMMARY

LOAD STEP NODE LABEL	1	2	3	SRSS	STATIC	SUM	DIFFER
101 FY	10876.	35417.	1378.	37074.	0.	37074.	-37074.
101 FZ	10222.	3683.	22722.	25186.	162102.	187288.	136916.
101 MX	706248.	2311680.	102825.	2419331.	38871.	2458202.	-2380460.
102 FZ	10553.	3893.	20457.	23345.	151130.	174475.	127785.
102 MX	82048.	362264.	18142.	371880.	73514.	445394.	-298366.
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	25634.	2591.	17681.	32073.	0.	32073.	-32073.
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	4911.	18124.	652.	18789.	0.	18789.	-18789.
201 FZ	4318.	1711.	9434.	10515.	64598.	75113.	54083.
201 MX	259281.	1052114.	36690.	1084205.	35968.	1120173.	-1048237.
202 FZ	4475.	1816.	8670.	9924.	60270.	70194.	50346.
202 MX	68825.	399089.	19602.	405451.	38732.	444183.	-366719.
428 FX	0.	0.	0.	0.	0.	0.	0.
428 FY	0.	0.	0.	0.	0.	0.	0.
428 FZ	0.	0.	0.	0.	0.	0.	0.
428 MX	83.	2242.	11.	2243.	-2.	2245.	-2241.
428 MY	0.	0.	0.	0.	0.	0.	0.
428 MZ	0.	0.	0.	0.	0.	0.	0.

(lb, in-lb)

SRSS-4.3 WHITING CORPORATION ANSYS SRSS PROGRAM 79508 87/07/08.
TABLE # B59 BY MJM PAGE B-42 OF 121

79508/MJM/AEP, DCC, NEW MAIN TROLLEY RHE, 607 LD UP / SSE

REACTION SUMMARY

LOAD STEP NODE LABEL	1	2	3	SRSS	STATIC	SUM	DIFFER
101 FY	20400.	577102.	2611.	577469.	-0.	577469.	-577469.
101 FZ	23826.	59062.	54345.	83722.	162102.	245824.	78380.
101 MX	1326411.	37348937.	211618.	37373082.	38871.	37411953.	-37334211.
102 FZ	23448.	62228.	48870.	82526.	151130.	233656.	68604.
102 MX	155050.	1830148.	31738.	1836982.	73514.	1910496.	-1763468.
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	50513.	29224.	40910.	71268.	0.	71268.	-71268.
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	9209.	255812.	1201.	255981.	0.	255981.	-255981.
201 FZ	10041.	28360.	22570.	37610.	64598.	102208.	26988.
201 MX	486123.	13126727.	71130.	13135918.	35968.	13171886.	-13099949.
202 FZ	9928.	30127.	20712.	37884.	60270.	98154.	22386.
202 MX	129527.	2418622.	41329.	2422441.	38732.	2461173.	-2383708.
428 FX	0.	0.	0.	0.	0.	0.	0.
428 FY	0.	0.	0.	0.	0.	0.	0.
428 FZ	0.	0.	0.	0.	0.	0.	0.
428 MX	155.	5155.	21.	5158.	-2.	5160.	-5156.
428 MY	0.	0.	0.	0.	0.	0.	0.
428 MZ	0.	0.	0.	0.	0.	0.	0.

(lb, in lb)

SRSS-4.3 WHITING CORPORATION ANSYS SRSS PROGRAM 79508 87/07/08.
TABLE # 860 LS 2 MODE 2 SCALE FACTOR = .0729 BY MJM PAGE 8-43 OF 121

79508/MJM/AEP, DCC, NEW MAIN TROLLEY RHE, 60T LD UP / SSE 'X'

REACTION SUMMARY

LOAD STEP NODE LABEL	1	2	3	SRSS	STATIC	SUM	DIFFER
101 FY	20400.	44312.	2611.	48852.	0.	48852.	-48852
101 FZ	23826.	4771.	54345.	59530.	162102.	221632.	102572
101 MX	1326411.	2928703.	211618.	3222010.	38871.	3260881.	-3183139
102 FZ	23448.	5088.	48870.	54442.	151130.	205572.	96688
102 MX	155050.	647899.	31938.	666955.	73514.	740469.	-593441
123 FY	0.	0.	0.	0.	0.	0.	C
123 FZ	0.	0.	0.	0.	0.	0.	C
123 MX	0.	0.	0.	0.	0.	0.	C
123 MY	0.	0.	0.	0.	0.	0.	C
124 FX	50513.	4115.	40910.	65131.	0.	65131.	-65131
124 FY	0.	0.	0.	0.	0.	0.	C
124 FZ	0.	0.	0.	0.	0.	0.	C
124 MX	0.	0.	0.	0.	0.	0.	C
124 MY	0.	0.	0.	0.	0.	0.	C
124 MZ	0.	0.	0.	0.	0.	0.	C
201 FY	9209.	24531.	1201.	26230.	0.	26230.	-26230
201 FZ	10041.	2097.	22570.	24792.	64598.	89390.	39806
201 MX	486123.	1522716.	71130.	1600006.	35968.	1635974.	-1564038
202 FZ	9928.	2214.	20712.	23075.	60270.	83345.	37195
202 MX	129527.	689485.	41329.	702760.	38732.	741492.	-664028
428 FX	0.	0.	0.	0.	0.	0.	C
428 FY	0.	0.	0.	0.	0.	0.	C
428 FZ	0.	0.	0.	0.	0.	0.	C
428 MX	155.	4160.	21.	4163.	-2.	4165.	-4161
428 MY	0.	0.	0.	0.	0.	0.	C
428 MZ	0.	0.	0.	0.	0.	0.	C

(lb, in-lb)

SRSS-4.3 WHITING CORPORATION ANSYS SRSS PROGRAM 79508 87/07/07.
TABLE # B61 BY MJM PAGE B-44 OF 121

79508/MJM/AEP, DCC, NEW MAIN TROLLEY RHE, 60T LD DN / OBE

--- REACTION SUMMARY---

LOAD STEP NODE LABEL	1	2	3	SRSS	STATIC	SUM	DIFFER
~~101 FY~~	~~11042.~~	~~307767.~~	~~3881.~~	~~307989.~~	~~-0.~~	~~307989.~~	~~-307989.~~
101 FZ	14444.	34526.	116284.	122158.	162102.	284260.	39944.
101 MX	730647.	19918026.	305836.	19933769.	38871.	19972640.	-19894898.
~~102 FZ~~	~~14737.~~	~~32861.~~	~~114237.~~	~~119780.~~	~~151130.~~	~~270910.~~	~~31350.~~
102 MX	75347.	978398.	46972.	982419.	73514.	1055933.	-908905.
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~~	~~30717.~~	~~15567.~~	~~22569.~~	~~41173.~~	~~0.~~	~~41173.~~	~~-41173.~~
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~~	~~4938.~~	~~136424.~~	~~1740.~~	~~136524.~~	~~0.~~	~~136524.~~	~~-136524.~~
201 FZ	5394.	16010.	33566.	37578.	64598.	102176.	27020.
201 MX	252567.	7001174.	36329.	7005822.	35968.	7041791.	-6969854.
~~202 FZ~~	~~5371.~~	~~15973.~~	~~32888.~~	~~36954.~~	~~60270.~~	~~97224.~~	~~23316.~~
202 MX	80162.	1290811.	61621.	1294765.	38732.	1333498.	-1256033.
428 FX	0.	0.	0.	0.	0.	0.	0.
~~428 FY~~	~~0.~~	~~0.~~	~~0.~~	~~0.~~	~~0.~~	~~0.~~	~~0.~~
428 FZ	0.	0.	0.	0.	0.	0.	0.
428 MX	82.	2749.	3.	2751.	-2.	2752.	-2749.
~~428 MY~~	~~0.~~	~~0.~~	~~0.~~	~~0.~~	~~0.~~	~~0.~~	~~0.~~
428 MZ	0.	0.	0.	0.	0.	0.	0.

(11, 17-16)

SRSS-4.3 WHITING CORPORATION ANSYS SRSS PROGRAM 79503 87/07/07.
TABLE # B62 LS 2 MODE 3 SCALE FACTOR = .1581 BY MJM PAGE B-45 OF 121

79508/MJM/AEP, DCC, NEW MAIN TROLLEY RHE, 60T LD DN / OBE

REACTION SUMMARY

LOAD STEP NODE LABEL		1	2	3	SRSS	STATIC	SUM	DIFFER
101	FY	11042.	49251.	3881.	50622.	0.	50622.	-50622.
101	FZ	14444.	6696.	116284.	117368.	162102.	279470.	44734.
101	MX	730647.	3200663.	305836.	3297198.	38871.	3336069.	-3258327.
102	FZ	14737.	6508.	114237.	115367.	151130.	266497.	35763.
102	MX	75347.	377711.	46972.	388004.	73514.	461518.	-314490.
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	30717.	3525.	22569.	38279.	0.	38279.	-38279.
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	4938.	24078.	1740.	24641.	0.	24641.	-24641.
201	FZ	5394.	2921.	33566.	34122.	64598.	98720.	30476.
201	MX	252567.	1338810.	36329.	1362902.	35968.	1398870.	-1326934.
202	FZ	5371.	2895.	32888.	33449.	60270.	93719.	26821.
202	MX	80162.	434739.	61621.	446339.	38732.	485071.	-407607.
428	FX	0.	0.	0.	0.	0.	0.	0.
428	FY	0.	0.	0.	0.	0.	0.	0.
428	FZ	0.	0.	0.	0.	0.	0.	0.
428	MX	82.	2268.	3.	2269.	-2.	2271.	-2267.
428	MY	0.	0.	0.	0.	0.	0.	0.
428	MZ	0.	0.	0.	0.	0.	0.	0.

(lb, in-lb)

79508/MJM/AEP, DCC, NEW MAIN TROLLEY RHE, 60T LD DN / SSE

REACTION SUMMARY

LOAD STEP NODE LABEL	1	2	3	SRSS	STATIC	SUM	DIFFER
~~101 FY~~	~~20976.~~	~~577107.~~	~~8446.~~	~~577550.~~	~~0.~~	~~577550.~~	~~-577550.~~
101 FZ	28246.	64752.	218174.	229326.	162102.	391429.	-67224.
101 MX	1404470.	37349481.	691846.	37382281.	38871.	37421152.	-37343410.
~~102 FZ~~	~~28002.~~	~~61648.~~	~~214250.~~	~~224695.~~	~~151180.~~	~~375825.~~	~~-73565.~~
102 MX	148869.	1830173.	108823.	1839439.	73514.	1912953.	-1765925.
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~~	~~58408.~~	~~29250.~~	~~44630.~~	~~79113.~~	~~0.~~	~~79113.~~	~~-79113.~~
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~~	~~9366.~~	~~255813.~~	~~3725.~~	~~256011.~~	~~0.~~	~~256011.~~	~~-256011.~~
201 FZ	11320.	30033.	63155.	70843.	64598.	135441.	-6245.
201 MX	473457.	13126995.	74244.	13135740.	35968.	13171709.	-13099772.
~~202 FZ~~	~~10946.~~	~~29960.~~	~~61826.~~	~~69569.~~	~~60270.~~	~~129839.~~	~~-9299.~~
202 MX	163261.	2418646.	142444.	2428332.	38732.	2467064.	-2389599.
428 FX	0.	0.	0.	0.	0.	0.	0.
~~428 FY~~	~~0.~~	~~0.~~	~~0.~~	~~0.~~	~~0.~~	~~0.~~	~~0.~~
428 FZ	0.	0.	0.	0.	0.	0.	0.
428 MX	154.	5155.	6.	5158.	-2.	5160.	-5156.
~~428 MY~~	~~0.~~	~~0.~~	~~0.~~	~~0.~~	~~0.~~	~~0.~~	~~0.~~
428 MZ	0.	0.	0.	0.	0.	0.	0.

(lb, in-lb)

SRSS-4.3 WHITING CORPORATION ANSYS SRSS PROGRAM 79508 87/07/07.
TABLE # B64 LS 2 NODE 3 SCALE FACTOR = .1160 BY MJM PAGE B-47 OF 121

79508/MJM/AEP, DCC, NEW MAIN TROLLEY RHE, 60T LD DN / SSE

REACTION SUMMARY

LOAD STEP NODE LABEL	1	2	3	SRSS	STATIC	SUM	DIFFER
101 FY	20976.	68439.	8446.	72078.	0.	72078.	-72078.
101 FZ	28246.	10038.	218174.	220223.	162102.	382325.	-58121.
101 MX	1404470.	4467031.	691846.	4733427.	38871.	4772298.	-4694556.
102 FZ	28002.	9980.	214250.	216302.	151130.	367432.	-65172.
102 MX	148869.	669163.	108823.	694104.	73514.	767618.	-620590.
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	58408.	6056.	44630.	73756.	0.	73756.	-73756.
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	9366.	34852.	3725.	36280.	0.	36280.	-36280.
201 FZ	11320.	4365.	63155.	64309.	64598.	128907.	289.
201 MX	473457.	2005904.	74244.	2062354.	35968.	2098322.	-2026386.
202 FZ	10946.	4286.	61826.	62933.	60270.	123203.	-2663.
202 MX	163261.	747532.	142444.	778295.	38732.	817027.	-739563.
428 FX	0.	0.	0.	0.	0.	0.	0.
428 FY	0.	0.	0.	0.	0.	0.	0.
428 FZ	0.	0.	0.	0.	0.	0.	0.
428 MX	154.	4206.	6.	4209.	-2.	4211.	-4207.
428 MY	0.	0.	0.	0.	0.	0.	0.
428 MZ	0.	0.	0.	0.	0.	0.	0.

(lb, in-lb)

79508/MJM/AEP, DCC, NEW MAIN TROLLEY MID, NO LD / OBE

REACTION SUMMARY

LOAD STEP NODE LABEL		1	2	3	SRSS	STATIC	SUM	DIFFER
101	FY	1218.	250271.	212.	250274.	0.	250274.	-250274.
101	FZ	3751.	30614.	13278.	33580.	91810.	125389.	58230.
101	MX	67951.	15891558.	33717.	15891739.	36622.	15928361.	-15855117.
102	FZ	3561.	30603.	11283.	32811.	82258.	115069.	49447.
102	MX	57201.	542936.	9644.	546026.	73584.	619610.	-472442.
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	37285.	1247.	6592.	37883.	0.	37883.	-37883.
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	1171.	229094.	163.	229097.	0.	229097.	-229097.
201	FZ	2617.	29751.	12282.	32292.	74889.	107181.	42597.
201	MX	53360.	15037842.	27015.	15037961.	37470.	15075431.	-15000491.
202	FZ	2336.	29977.	10970.	32006.	69151.	101157.	37145.
202	MX	27429.	673166.	5422.	673746.	40599.	714346.	-633147.
428	FX	0.	0.	0.	0.	0.	0.	0.
428	FY	0.	0.	0.	0.	0.	0.	0.
428	FZ	0.	0.	0.	0.	0.	0.	0.
428	MX	54.	1924.	7.	1924.	-2.	1926.	-1922.
428	MY	0.	0.	0.	0.	0.	0.	0.
428	MZ	0.	0.	0.	0.	0.	0.	0.

(lb, in-lb)

79508/MJM/AEP, DCC, NEW MAIN TROLLEY MID, NO LD / OBE

REACTION SUMMARY

LOAD STEP NODE	LABEL	1	2	3	SRSS	STATIC	SUM	DIFFER
101	FY	1218.	21336.	212.	21372.	0.	21372.	-21372.
101	FZ	3751.	2684.	13278.	14056.	91810.	105866.	77754.
101	MX	67951.	1354653.	33717.	1356768.	36622.	1393390.	-1320146.
102	FZ	3561.	2667.	11283.	12128.	82258.	94386.	70130.
102	MX	57201.	75613.	9644.	95301.	73584.	168885.	-21717.
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	37285.	1125.	6592.	37880.	0.	37880.	-37880.
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	1171.	19630.	163.	19666.	0.	19666.	-19666.
201	FZ	2617.	2560.	12282.	12816.	74889.	87705.	62073.
201	MX	53360.	1289085.	27015.	1290463.	37470.	1327933.	-1252993.
202	FZ	2336.	2602.	10970.	11514.	69151.	80665.	57637.
202	MX	27429.	130055.	5422.	133026.	40599.	173625.	-92427.
428	FX	0.	0.	0.	0.	0.	0.	0.
428	FY	0.	0.	0.	0.	0.	0.	0.
428	FZ	0.	0.	0.	0.	0.	0.	0.
428	MX	54.	1836.	7.	1837.	-2.	1839.	-1835.
428	MY	0.	0.	0.	0.	0.	0.	0.
428	MZ	0.	0.	0.	0.	0.	0.	0.

(16, 17-16)

79508/MJM/AEP, DCC, NEW MAIN TROLLEY MID, NO LD / SSE "X"

REACTION SUMMARY

LOAD STEP / NODE	LABEL	1	2	3	SRSS	STATIC	SUM	DIFFER
101	FY	2367.	469292.	234.	469299.	0.	469299.	-469299.
101	FZ	8165.	57408.	31765.	66116.	91810.	157925.	25694.
101	MX	134895.	29798849.	75131.	29799249.	36622.	29835871.	-29762627.
102	FZ	7581.	57388.	26992.	63870.	82258.	146128.	18388.
102	MX	111395.	1018355.	20387.	1024633.	73584.	1098217.	-951048.
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	71391.	2401.	15416.	73076.	0.	73076.	-73076.
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	2276.	429582.	328.	429588.	0.	429588.	-429588.
201	FZ	6159.	55788.	29382.	63352.	74889.	138241.	11537.
201	MX	107009.	28198007.	63956.	28198282.	37470.	28235752.	-28160812.
202	FZ	5501.	56212.	26243.	62280.	69151.	131431.	6871.
202	MX	57110.	1262493.	12014.	1263841.	40599.	1304440.	-1223241.
428	FX	0.	0.	0.	0.	0.	0.	0.
428	FY	0.	0.	0.	0.	0.	0.	0.
428	FZ	0.	0.	0.	0.	0.	0.	0.
428	MX	101.	3607.	14.	3609.	-2.	3610.	-3607.
428	MY	0.	0.	0.	0.	0.	0.	0.
428	MZ	0.	0.	0.	0.	0.	0.	0.

(lb, in-lb)

SRSS-4.3 WHITING CORPORATION ANSYS SRSS PROGRAM 79508 87/07/13.
TABLE # B68 LS 2 MODE 1 SCALE FACTOR = .0572 BY MJM PAGE B-51 OF 121

79508/MJM/AEP, DCC, NEW MAIN TROLLEY MID, NO LD / SSE

REACTION SUMMARY

LOAD STEP / NODE LABEL	1	2	3	SRSS	STATIC	SUM	DIFFER
101 FY	2367.	26884.	234.	26989.	0.	26989.	-26989.
101 FZ	8165.	3534.	31765.	32987.	91810.	124797.	58823.
101 MX	134895.	1707088.	75131.	1714049.	36622.	1750671.	-1677427.
102 FZ	7581.	3492.	26992.	28253.	82258.	110511.	54005.
102 MX	111395.	128785.	20387.	171493.	73584.	245077.	-97909.
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	71391.	2178.	15416.	73069.	0.	73069.	-73069.
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	2276.	24888.	328.	24994.	0.	24994.	-24994.
201 FZ	6159.	3281.	29382.	30199.	74889.	105088.	44690.
201 MX	107009.	1635357.	63956.	1640095.	37470.	1677565.	-1602625.
202 FZ	5501.	3378.	26243.	27025.	69151.	96176.	42126.
202 MX	57110.	232074.	12014.	239298.	40599.	279897.	-198699.
428 FX	0.	0.	0.	0.	0.	0.	0.
428 FY	0.	0.	0.	0.	0.	0.	0.
428 FZ	0.	0.	0.	0.	0.	0.	0.
428 MX	101.	3443.	14.	3444.	-2.	3446.	-3442.
428 MY	0.	0.	0.	0.	0.	0.	0.
428 MZ	0.	0.	0.	0.	0.	0.	0.

(lb, in lb)

SRSS-4.3 WHITING CORPORATION ANSYS SRSS PROGRAM 79508 87/07/13.
TABLE # 869 BY MJM PAGE B-52 OF 121

79508/MJM/AEP, DCC, NEW MAIN TROLLEY 1/4, NO LD / OBE "X"

REACTION SUMMARY

LOAD STEP NODE	LABEL	1	2	3	SRSS	STATIC	SUM	DIFFER
101	FY	5705.	137141.	469.	137260.	-0.	137260.	-137260.
101	FZ	1018.	15639.	7780.	17497.	72301.	89797.	54804.
101	MX	332723.	8118468.	38211.	8125373.	34545.	8159919.	-8090828.
102	FZ	1451.	15429.	6762.	16908.	65768.	82676.	48860.
102	MX	66320.	582047.	8643.	585877.	71446.	657323.	-514431.
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	38594.	10529.	2487.	40082.	0.	40082.	-40082.
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	6784.	266780.	416.	266866.	0.	266866.	-266866.
201	FZ	3516.	36644.	12889.	39003.	94419.	133423.	55416.
201	MX	554359.	19147476.	41527.	19155544.	37173.	19192717.	-19118370.
202	FZ	2553.	37092.	11131.	38810.	85619.	124430.	46809.
202	MX	96242.	524078.	10010.	532936.	40365.	573301.	-492571.
428	FX	0.	0.	0.	0.	0.	0.	0.
428	FY	0.	0.	0.	0.	0.	0.	0.
428	FZ	0.	0.	0.	0.	0.	0.	0.
428	MX	78.	2819.	8.	2820.	-2.	2822.	-2818.
428	MY	0.	0.	0.	0.	0.	0.	0.
428	MZ	0.	0.	0.	0.	0.	0.	0.

(lb, in-lb)

SRSS-4.3 WHITING CORPORATION ANSYS SRSS PROGRAM 79508 87/07/13.
TABLE # 870 LS 2 MODE 1 SCALE FACTOR = .0892 BY MJM PAGE 8-53 OF 121

79508/MJM/AEP, DCC, NEW MAIN TROLLEY 1/4, NO LD / OBE

REACTION SUMMARY

LOAD STEP NODE LABEL	1	2	3	SRSS	STATIC	SUM	DIFFER
101 FY	5705.	20161.	469.	20958.	0.	20958.	-20958.
101 FZ	1018.	1432.	7780.	7976.	72301.	80277.	64325.
101 MX	332723.	799838.	38211.	867120.	34545.	901665.	-832575.
102 FZ	1451.	1381.	6762.	7052.	65768.	72820.	58716.
102 MX	66320.	328855.	8643.	335585.	71446.	407031.	-264139.
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	38594.	4024.	2487.	38883.	0.	38883.	-38883.
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	6784.	28478.	416.	29278.	0.	29278.	-29278.
201 FZ	3516.	3451.	12889.	13798.	94419.	108217.	80621.
201 MX	554359.	1722773.	41527.	1810236.	37173.	1847409.	-1773063.
202 FZ	2553.	3336.	11131.	11897.	85619.	97516.	73722.
202 MX	96242.	115829.	10010.	150927.	40365.	191292.	-110562.
428 FX	0.	0.	0.	0.	0.	0.	0.
428 FY	0.	0.	0.	0.	0.	0.	0.
428 FZ	0.	0.	0.	0.	0.	0.	0.
428 MX	78.	559.	8.	565.	-2.	567.	-563.
428 MY	0.	0.	0.	0.	0.	0.	0.
428 MZ	0.	0.	0.	0.	0.	0.	0.

(lb, in-lb)

SRSS-4.3 WHITING CORPORATION ANSYS SRSS PROGRAM 79508 87/07/13.
TABLE # 871 BY MJM PAGE 8-54 OF 121

79508/MJM/AEP, DCC, NEW MAIN TROLLEY 1/4, NO LD / SSE 1X

REACTION SUMMARY

LOAD STEP NODE	LABEL	1	2	3	SRSS	STATIC	SUM	DIFFER
101	FY	10970.	257173.	918.	257408.	-0.	257408.	-257408.
101	FZ	2032.	29324.	18642.	34808.	72301.	107108.	37493.
101	MX	643106.	15224245.	87965.	15238076.	34545.	15272621.	-15203531.
102	FZ	2859.	28931.	16201.	33282.	65768.	99050.	32487.
102	MX	135327.	1101161.	17392.	1109582.	71446.	1181028.	-1038136.
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	75484.	19763.	5059.	78192.	0.	78192.	-78192.
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	12748.	500255.	821.	500418.	0.	500418.	-500418.
201	FZ	6903.	68712.	30882.	75649.	94419.	170068.	18771.
201	MX	1055442.	35904378.	95351.	35920014.	37173.	35957187.	-35882840.
202	FZ	5003.	69553.	26670.	74658.	85619.	160278.	10961.
202	MX	189408.	986324.	20555.	1004556.	40365.	1044921.	-964191.
428	FX	0.	0.	0.	0.	0.	0.	0.
428	FY	0.	0.	0.	0.	0.	0.	0.
428	FZ	0.	0.	0.	0.	0.	0.	0.
428	MX	147.	5285.	15.	5287.	-2.	5289.	-5286.
428	MY	0.	0.	0.	0.	0.	0.	0.
428	MZ	0.	0.	0.	0.	0.	0.	0.

(lb, in-lb)

SRSS-4.3 WHITING CORPORATION ANSYS SRSS PROGRAM 79508 87/07/13.
TABLE # 872 LS 2 MODE 1 SCALE FACTOR = .0606 BY MJM PAGE 8-55 OF 121

79508/MJM/AEP, DCC, NEW MAIN TROLLEY 1/4, NO LD / SSE

REACTION SUMMARY

LOAD STEP NODE LABEL		1	2	3	SRSS	STATIC	SUM	DIFFER
101	FY	10970.	34024.	918.	35760.	0.	35760.	-35760.
101	FZ	2032.	1880.	18642.	18846.	72301.	91147.	53455.
101	MX	643106.	1135544.	87965.	1307962.	34545.	1342507.	-1273417.
102	FZ	2859.	1767.	16201.	16546.	65768.	82314.	49222.
102	MX	135327.	630965.	17392.	645546.	71446.	716992.	-574100.
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	75484.	7503.	5059.	76024.	0.	76024.	-76024.
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	12748.	42315.	821.	44201.	0.	44201.	-44201.
201	FZ	6903.	4658.	30882.	31985.	94419.	126404.	62434.
201	MX	1055442.	2221201.	95351.	2461037.	37173.	2498210.	-2423864.
202	FZ	5003.	4292.	26670.	27473.	85619.	113092.	58147.
202	MX	189408.	224294.	20555.	294287.	40365.	334652.	-253922.
428	FX	0.	0.	0.	0.	0.	0.	0.
428	FY	0.	0.	0.	0.	0.	0.	0.
428	FZ	0.	0.	0.	0.	0.	0.	0.
428	MX	147.	992.	15.	1003.	-2.	1005.	-1001.
428	MY	0.	0.	0.	0.	0.	0.	0.
428	MZ	0.	0.	0.	0.	0.	0.	0.

(lb, in-lb)

SRSS-4.3 WHITING CORPORATION ANSYS SRSS PROGRAM 79508 87/07/15.
TABLE # B73 BY MJM PAGE B-56 OF 121

79508/MJM/AEP, DCC, NEW MAIN TROLLEY LHE, NO LD / OBE

REACTION SUMMARY

NODE	LOAD STEP LABEL	1	2	3	SRSS	STATIC	SUM	DIFFER
101	FY	1600.	41009.	582.	41045.	-0.	41045.	-41045.
101	FZ	1776.	3188.	4882.	6095.	60586.	66681.	54491.
101	MX	86313.	1256695.	47578.	1260554.	33468.	1294022.	-1227086.
102	FZ	1187.	3417.	3856.	5287.	53844.	59131.	48557.
102	MX	129316.	499252.	18530.	506393.	70761.	577155.	-435632.
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	36357.	5131.	6901.	37360.	0.	37360.	-37360.
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	5142.	76842.	1024.	77021.	-0.	77021.	-77021.
201	FZ	4637.	6304.	8263.	11381.	106149.	117530.	94768.
201	MX	550616.	4560418.	97344.	4594569.	37051.	4631621.	-4557518.
202	FZ	3771.	7190.	6676.	10511.	97529.	108040.	87017.
202	MX	30805.	317331.	17497.	319302.	38874.	358176.	-280428.
428	FX	0.	0.	0.	0.	0.	0.	0.
428	FY	0.	0.	0.	0.	0.	0.	0.
428	FZ	0.	0.	0.	0.	0.	0.	0.
428	MX	108.	3187.	14.	3189.	-2.	3191.	-3187.
428	MY	0.	0.	0.	0.	0.	0.	0.
428	MZ	0.	0.	0.	0.	0.	0.	0.

(lb, in-lb)

SRSS-4.3 WHITING CORPORATION ANSYS SRSS PROGRAM 79508 87/07/15.
TABLE # 874 LS 2 MODE 3 SCALE FACTOR = .2545 BY MJM , PAGE B-57 OF 121

79508/MJM/AEP, DCC, NEW MAIN TROLLEY LHE, NO LD / OBE "X"

REACTION SUMMARY

LOAD STEP NODE LABEL		1	2	3	SRSS	STATIC	SUM	DIFFER
101	FY	1600.	11212.	582.	11340.	0.	11340.	-11340.
101	FZ	1776.	2020.	4882.	5574.	60586.	66160.	55012.
101	MX	86313.	454935.	47578.	465485.	33468.	498953.	-432017.
102	FZ	1187.	1991.	3856.	4499.	53844.	58343.	49345.
102	MX	129316.	456157.	18530.	474492.	70761.	545253.	-403731.
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	36357.	3751.	6901.	37196.	0.	37196.	-37196.
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	5142.	24717.	1024.	25267.	0.	25267.	-25267.
201	FZ	4637.	4575.	8263.	10522.	106149.	116671.	95627.
201	MX	550616.	2093517.	97344.	2166891.	37051.	2203942.	-2129840.
202	FZ	3771.	4958.	6676.	9131.	97529.	106660.	88398.
202	MX	30805.	269416.	17497.	271734.	38874.	310608.	-232860.
428	FX	0.	0.	0.	0.	0.	0.	0.
428	FY	0.	0.	0.	0.	0.	0.	0.
428	FZ	0.	0.	0.	0.	0.	0.	0.
428	MX	108.	3182.	14.	3184.	-2.	3186.	-3182.
428	MY	0.	0.	0.	0.	0.	0.	0.
428	MZ	0.	0.	0.	0.	0.	0.	0.

(lb, in-lb)

SRSS-4.3 WHITING CORPORATION ANSYS SRSS PROGRAM 79508 87/07/15.
TABLE # B75 BY MJM PAGE B-58 OF 121

79508/MJM/AEP, DCC, NEW MAIN TROLLEY LHE, NO LD / SSE

REACTION SUMMARY

LOAD STEP NODE LABEL	1	2	3	SRSS	STATIC	SUM	DIFFER
101 FY	3081.	77193.	1041.	77261.	-0.	77261.	-77261.
101 FZ	3893.	5942.	11210.	13272.	60586.	73858.	47314.
101 MX	170168.	2387508.	92863.	2395366.	33468.	2428834.	-2361898.
102 FZ	2687.	6380.	8847.	11234.	53844.	65077.	42610.
102 MX	250293.	972974.	34712.	1005251.	70761.	1076012.	-934489.
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	72260.	9730.	14668.	74373.	0.	74373.	-74373.
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	9826.	144480.	1912.	144826.	-0.	144826.	-144826.
201 FZ	9602.	11950.	18887.	24325.	106149.	130474.	81824.
201 MX	1053435.	8594126.	185675.	8660439.	37051.	8697490.	-8623388.
202 FZ	7792.	13547.	15256.	21840.	97529.	119368.	75689.
202 MX	64092.	635616.	31700.	639626.	38874.	678499.	-600752.
428 FX	0.	0.	0.	0.	0.	0.	0.
428 FY	0.	0.	0.	0.	0.	0.	0.
428 FZ	0.	0.	0.	0.	0.	0.	0.
428 MX	203.	5977.	26.	5980.	-2.	5982.	-5979.
428 MY	0.	0.	0.	0.	0.	0.	0.
428 MZ	0.	0.	0.	0.	0.	0.	0.

(lb, in-lb)

SRSS-4.3 WHITING CORPORATION ANSYS SRSS PROGRAM 79508 87/07/15.
TABLE # 876 LS 2 MODE 3 SCALE FACTOR = .1502 BY MJM PAGE B-59 OF 121

79508/MJM/AEP, DCC, NEW MAIN TROLLEY LHE, NO LD / SSE

REACTION SUMMARY

NODE	LABEL	LOAD STEP 1	2	3	SRSS	STATIC	SUM	DIFFER
101	FY	3081.	14658.	1041.	15015.	0.	15015.	-15015.
101	FZ	3893.	3587.	11210.	12397.	60586.	72983.	48189.
101	MX	170168.	796628.	92863.	819872.	33468.	853340.	-786404.
102	FZ	2687.	3497.	8847.	9885.	53844.	63729.	43959.
102	MX	250293.	911692.	34712.	946059.	70761.	1016820.	-875298.
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	72260.	7030.	14668.	74068.	0.	74068.	-74068.
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	9826.	36518.	1912.	37865.	0.	37865.	-37865.
201	FZ	9602.	8563.	18887.	22853.	106149.	129002.	83296.
201	MX	1053435.	3642586.	185695.	3796371.	37051.	3833422.	-3759320.
202	FZ	7792.	9133.	15256.	19413.	97529.	116942.	78116.
202	MX	64092.	547935.	31700.	552579.	38874.	591453.	-513705.
428	FX	0.	0.	0.	0.	0.	0.	0.
428	FY	0.	0.	0.	0.	0.	0.	0.
428	FZ	0.	0.	0.	0.	0.	0.	0.
428	MX	203.	5968.	26.	5971.	-2.	5973.	-5969.
428	MY	0.	0.	0.	0.	0.	0.	0.
428	MZ	0.	0.	0.	0.	0.	0.	0.

(lb, in-lb)

SRSS-4.3 WHITING CORPORATION ANSYS SRSS PROGRAM 79508 87/07/17.
TABLE # B377 BY RGG PAGE 8-60 OF 121
MJM 8-4-87

79508/MJM/AEP, DCC, NEW AUX TROLLEY MID, NO LD / OBE

REACTION SUMMARY

LOAD STEP NODE LABEL	1	2	3	SRSS	STATIC	SUM	DIFFER
101 FY	4654.	128033.	316.	128118.	0.	128118.	-128118.
101 FZ	1885.	13653.	5916.	14998.	54267.	69265.	39269.
101 MX	264922.	7090910.	47245.	7096015.	37126.	7133141.	-7058889.
102 FZ	1627.	13870.	5045.	14848.	48563.	63411.	33715.
102 MX	131239.	2107954.	18988.	2112121.	63560.	2175681.	-2048561.
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	35929.	11463.	7051.	38367.	-0.	38367.	-38367.
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	7536.	207988.	676.	208126.	0.	208126.	-208126.
201. FZ	4766.	14648.	9629.	18166.	112462.	130627.	94296.
201 MX	615374.	14945003.	65816.	14957811.	41382.	14999194.	-14916429.
202 FZ	5022.	15289.	7822.	17893.	102816.	120709.	84923.
202 MX	135065.	1072808.	17619.	1081421.	39555.	1120976.	-1041866.
428 FX	0.	0.	0.	0.	0.	0.	0.
428 FY	0.	0.	0.	0.	0.	0.	0.
428 FZ	0.	0.	0.	0.	0.	0.	0.
428 MX	98.	3920.	8.	3922.	-2.	3923.	-3920.
428 MY	0.	0.	0.	0.	0.	0.	0.
428 MZ	0.	0.	0.	0.	0.	0.	0.

(16, 17-16)

SRSS-4.3 WHITING CORPORATION ANSYS SRSS PROGRAM 79508 87/07/17.
TABLE # 878 LS 2 MODE 2 SCALE FACTOR = .1121 BY MJM PAGE 8-61 OF 121

79508/MJM/AEP, DCC, NEW AUX TROLLEY MID, NO LD / OBE

REACTION SUMMARY

LOAD STEP NODE LABEL	1	2	3	SRSS	STATIC	SUM	DIFFER
101 FY	4654.	14418.	316.	15154.	0.	15154.	-15154.
101 FZ	1885.	1536.	5916.	6396.	54267.	60663.	47871.
101 MX	264922.	798053.	47245.	842198.	37126.	879324.	-805072.
102 FZ	1627.	1560.	5045.	5526.	48563.	54089.	43037.
102 MX	131239.	238544.	18988.	272923.	63560.	336483.	-209363.
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	35929.	1344.	7051.	36639.	0.	36639.	-36639.
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	7536.	24064.	676.	25226.	0.	25226.	-25226.
201 FZ	4766.	1700.	9629.	10878.	112462.	123340.	101584.
201 MX	615374.	1736736.	65816.	1843703.	41382.	1885085.	-1802321.
202 FZ	5022.	1756.	7822.	9460.	102816.	112276.	93356.
202 MX	135065.	266743.	17619.	299506.	39555.	339061.	-259951.
428 FX	0.	0.	0.	0.	0.	0.	0.
428 FY	0.	0.	0.	0.	0.	0.	0.
428 FZ	0.	0.	0.	0.	0.	0.	0.
428 MX	98.	3757.	8.	3758.	-2.	3760.	-3756.
428 MY	0.	0.	0.	0.	0.	0.	0.
428 MZ	0.	0.	0.	0.	0.	0.	0.

(lb, in-lb)

SRSS-4.3 WHITING CORPORATION ANSYS SRSS PROGRAM 79508 87/07/17.
TABLE # B79 BY RGG PAGE B-62 OF 121

MJM 8-4-87

79508/MJM/AEP, DCC, NEW AUX TROLLEY MID, NO LD / SSE

REACTION SUMMARY

LOAD STEP NODE LABEL	1	2	3	SRSS	STATIC	SUM	DIFFER
101 FY	8809.	242389.	578.	242550.	0.	242550.	-242550.
101 FZ	4285.	25847.	13920.	29668.	54267.	83935.	24599.
101 MX	505106.	13424336.	108159.	13434271.	37126.	13471397.	-13397145.
102 FZ	3675.	26258.	11867.	29048.	48563.	77611.	19515.
102 MX	258081.	3990721.	41751.	3999276.	63560.	4062835.	-3935716.
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	71455.	21702.	15399.	76249.	-0.	76249.	-76249.
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	14314.	393756.	1280.	394018.	0.	394018.	-394018.
201 FZ	9985.	27731.	22570.	37123.	112462.	149585.	75338.
201 MX	1177982.	28293286.	129718.	28318095.	41382.	28359477.	-28276712.
202 FZ	10291.	28944.	18319.	35767.	102816.	138583.	67049.
202 MX	268060.	2030059.	38469.	2048041.	39555.	2087596.	-2008487.
428 FX	0.	0.	0.	0.	0.	0.	0.
428 FY	0.	0.	0.	0.	0.	0.	0.
428 FZ	0.	0.	0.	0.	0.	0.	0.
428 MX	185.	7357.	14.	7359.	-2.	7361.	-7357.
428 MY	0.	0.	0.	0.	0.	0.	0.
428 MZ	0.	0.	0.	0.	0.	0.	0.

(lb, in-lb)

SRSS-4.3 WHITING CORPORATION ANSYS SRSS PROGRAM 79503 87/07/17.
TABLE # 880 LS 2 MODE 2 SCALE FACTOR = .0678 BY MJM PAGE 8-63 OF 121

79508/MJM/AEP, DCC, NEW AUX TROLLEY MID, NO LD / SSE

REACTION SUMMARY

NODE	LABEL	1	2	3	SRSS	STATIC	SUM	DIFFER
101	FY	8809.	16636.	578.	18833.	0.	18833.	-18833.
101	FZ	4285.	1769.	13920.	14672.	54267.	68939.	39595.
101	MX	505106.	919952.	108159.	1055050.	37126.	1092176.	-1017924.
102	FZ	3675.	1798.	11867.	12552.	48563.	61115.	36011.
102	MX	258081.	277464.	41751.	381226.	63560.	444786.	-317666.
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	71455.	1650.	15399.	73114.	0.	73114.	-73114.
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	14314.	28957.	1280.	32327.	0.	32327.	-32327.
201	FZ	9985.	2056.	22570.	24765.	112462.	137227.	87697.
201	MX	1177982.	2103032.	129718.	2413951.	41382.	2455333.	-2372569.
202	FZ	10291.	2091.	18319.	21115.	102816.	123931.	81701.
202	MX	268060.	468926.	38469.	541504.	39555.	581059.	-501949.
428	FX	0.	0.	0.	0.	0.	0.	0.
428	FY	0.	0.	0.	0.	0.	0.	0.
428	FZ	0.	0.	0.	0.	0.	0.	0.
428	MX	185.	7043.	14.	7046.	-2.	7048.	-7044.
428	MY	0.	0.	0.	0.	0.	0.	0.
428	MZ	0.	0.	0.	0.	0.	0.	0.

(lb, in-lb)

SRSS-4.3 WHITING CORPORATION ANSYS SRSS PROGRAM 79508 87/07/16.
TABLE # C81 BY MJM PAGE B-64 OF 121

79508/MJM/AEP, DCC, NEW AUX TROLLEY 1/4, NO LD / OBE

REACTION SUMMARY

NODE	LABEL	LOAD STEP 1	2	3	SRSS	STATIC	SUM	DIFFER
101	FY	1045.	63126.	593.	63137.	0.	63137.	-63137.
101	FZ	2087.	5627.	6052.	8524.	57825.	66349.	49301.
101	MX	150871.	3363868.	47746.	3367588.	37411.	3404999.	-3330177.
102	FZ	1443.	5936.	4989.	7887.	51379.	59266.	43492.
102	MX	64009.	1123385.	20890.	1125401.	64701.	1190102.	-1060700.
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	35691.	7526.	6517.	37053.	0.	37053.	-37053.
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	7177.	105771.	1120.	106020.	0.	106020.	-106020.
201	FZ	4236.	8882.	9006.	13340.	108905.	122244.	95565.
201	MX	636427.	7374080.	86758.	7402001.	39423.	7441424.	-7362578.
202	FZ	3647.	9100.	7244.	12189.	99999.	112188.	87809.
202	MX	23427.	605967.	21812.	606812.	39871.	646683.	-566941.
428	FX	0.	0.	0.	0.	0.	0.	0.
428	FY	0.	0.	0.	0.	0.	0.	0.
428	FZ	0.	0.	0.	0.	0.	0.	0.
428	MX	106.	3294.	10.	3296.	-2.	3298.	-3294.
428	MY	0.	0.	0.	0.	0.	0.	0.
428	MZ	0.	0.	0.	0.	0.	0.	0.

(lb, in-lb)

SRSS-4.3 WHITING CORPORATION ANSYS SRSS PROGRAM 79508 87/07/16.
TABLE # 882 LS 2 MODE 3 SCALE FACTOR = .2037 BY MJM PAGE 8-65 OF 121

79508/MJM/AEP, DCC, NEW AUX TROLLEY 1/4, NO LD / OBE ^X^

REACTION SUMMARY

LOAD STEP NODE	LABEL	1	2	3	SRSS	STATIC	SUM	DIFFER
101	FY	1045.	15756.	593.	15801.	0.	15801.	-15801.
101	FZ	2087.	2660.	6052.	6933.	57825.	64758.	50892.
101	MX	150871.	984445.	47746.	997077.	37411.	1034488.	-959666.
102	FZ	1443.	2661.	4989.	5836.	51379.	57215.	45543.
102	MX	64009.	543902.	20890.	548052.	64701.	612753.	-483351.
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	35691.	7393.	6517.	37027.	0.	37027.	-37027.
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	7177.	57033.	1120.	57494.	0.	57494.	-57494.
201	FZ	4236.	8696.	9006.	13216.	108905.	122121.	95689.
201	MX	636427.	4681015.	86758.	4724849.	39423.	4764272.	-4685426.
202	FZ	3647.	8433.	7244.	11700.	99999.	111699.	88299.
202	MX	23427.	249605.	21812.	251648.	39871.	291519.	-211777.
428	FX	0.	0.	0.	0.	0.	0.	0.
428	FY	0.	0.	0.	0.	0.	0.	0.
428	FZ	0.	0.	0.	0.	0.	0.	0.
428	MX	106.	3287.	10.	3289.	-2.	3291.	-3287.
428	MY	0.	0.	0.	0.	0.	0.	0.
428	MZ	0.	0.	0.	0.	0.	0.	0.

(lb, in-lb)

FORM N-2494

WHITING REQN. 79508 DATE 9-9-87

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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 B33 to B96 which show factored and unfactored reactions.

Page	Table	Title
B-24	B41	Reactions, 1/4, 60T UP, OBE
B-25	B42	Reactions, 1/4, 60T UP, OBE, SCALED
B-26	B43	Reactions, 1/4, 60T UP, SSE
B-27	B44	Reactions, 1/4, 60T UP, SSE, SCALED
B-28	B45	Reactions, 1/4, 60T DN, OBE
B-29	B46	Reactions, 1/4, 60T DN, OBE, SCALED
B-30	B47	Reactions, 1/4, 60T DN, SSE
B-31	B48	Reactions, 1/4, 60T DN, SSE, SCALED
B-32	B49	Reactions, LHE, 60T UP, OBE
B-33	B50	Reactions, LHE, 60T UP, OBE, SCALED
B-34	B51	Reactions, LHE, 60T UP, SSE
B-35	B52	Reactions, LHE, 60T UP, SSE, SCALED
B-36	B53	Reactions, LHE, 60T DN, OBE
B-37	B54	Reactions, LHE, 60T DN, OBE, SCALED
B-38	B55	Reactions, LHE, 60T DN, SSE
B-39	B56	Reactions, LHE, 60T DN, SSE, SCALED
B-40	B57	Reactions, RHE, 60T UP, OBE
B-41	B58	Reactions, RHE, 60T UP, OBE, SCALED
B-42	B59	Reactions, RHE, 60T UP, SSE
B-43	B60	Reactions, RHE, 60T UP, SSE, SCALED
B-44	B61	Reactions, RHE, 60T DN, OBE
B-45	B62	Reactions, RHE, 60T DN, OBE, SCALED
B-46	B63	Reactions, RHE, 60T DN, SSE
B-47	B64	Reactions, RHE, 60T DN, SSE, SCALED
B-48	B65	Reactions, Main Mid, No Load, OBE
B-49	B66	Reactions, Main Mid, No Load, OBE, SCALED
B-50	B67	Reactions, Main Mid, No Load, SSE
B-51	B68	Reactions, Main Mid, No Load, SSE, SCALED
B-52	B69	Reactions, Main 1/4, No Load, OBE
B-53	B70	Reactions, Main 1/4, No Load, OBE, SCALED
B-54	B71	Reactions, Main 1/4, No Load, SSE
B-55	B72	Reactions, Main 1/4, No Load, SSE, SCALED
B-56	B73	Reactions, Main LHE, No Load, OBE
B-57	B74	Reactions, Main LHE, No Load, OBE, SCALED
B-58	B75	Reactions, Main LHE, No Load, SSE
B-59	B76	Reactions, Main LHE, No Load, SSE, SCALED
B-60	B77	Reactions, Aux Mid, No Load, OBE
B-61	B78	Reactions, Aux Mid, No Load, OBE, SCALED
B-62	B79	Reactions, Aux Mid, No Load, SSE
B-63	B80	Reactions, Aux Mid, No Load SSE, SCALED
B-64	B81	Reactions, Aux 1/4, No Load, OBE
B-65	B82	Reactions, Aux 1/4, No Load, OBE, SCALED
B-66	B83	Reactions, Aux 1/4, No Load, SSE
B-67	B84	Reactions, Aux 1/4, No Load, SSE, SCALED
B-68	B85	Reactions, Both Mid, No Load, OBE
B-69	B86	Reactions, Both Mid, No Load, OBE, SCALED

SRSS-4.3 WHITING CORPORATION ANSYS SRSS PROGRAM 79508 87/07/15.
TABLE # 886 LS 2 MODE 1 SCALE FACTOR = .0796 BY MJM PAGE 869 OF 121

79508/MJM/AEP, DCC, NEW BOTH TROLLEYS MID, NO LD / OBE

REACTION SUMMARY

LOAD STEP NODE LABEL	1	2	3	SRSS	STATIC	SUM	DIFFER
101 FY	1011.	20752.	119.	20777.	0.	20777.	-20777.
101 FZ	2625.	2679.	14514.	14991.	82285.	97276.	67294.
101 MX	82928.	1397582.	31161.	1400378.	40752.	1441130.	-1359626.
102 FZ	2477.	2639.	12940.	13437.	74724.	88161.	61287.
102 MX	167385.	83471.	9572.	187287.	67977.	255264.	-119310.
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	38043.	860.	3670.	38229.	0.	38229.	-38229.
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	1176.	21239.	241.	21273.	0.	21273.	-21273.
201 FZ	2033.	2580.	15323.	15671.	84393.	100064.	68722.
201 MX	206061.	1470844.	31475.	1485536.	40856.	1526392.	-1444680.
202 FZ	1898.	2610.	13303.	13689.	76705.	90394.	63016.
202 MX	29350.	118341.	7121.	122133.	43161.	165294.	-78972.
428 FX	0.	0.	0.	0.	0.	0.	0.
428 FY	0.	0.	0.	0.	0.	0.	0.
428 FZ	0.	0.	0.	0.	0.	0.	0.
428 MX	44.	1841.	7.	1841.	-2.	1843.	-1839.
428 MY	0.	0.	0.	0.	0.	0.	0.
428 MZ	0.	0.	0.	0.	0.	0.	0.

(lb, in-lb)

SRSS-4.3 WHITING CORPORATION ANSYS SRSS PROGRAM 79508 87/07/15.
TABLE #: B87 BY MJM PAGE B-70 OF 121

79508/MJM/AEP, DCC, NEW BOTH TROLLEYS MID, NO LD / SSE

REACTION SUMMARY

LOAD STEP NODE LABEL	1	2	3	SRSS	STATIC	SUM	DIFFER
101 FY	1990.	488788.	254.	488792.	-0.	488792.	-488792.
101 FZ	5484.	62360.	34703.	71576.	82285.	153862.	10709.
101 MX	162009.	32919997.	74050.	32920479.	40752.	32961231.	-32879727.
102 FZ	5133.	62009.	30940.	69490.	74724.	144214.	5235.
102 MX	325549.	1890463.	21239.	1918407.	67977.	1986383.	-1850430.
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	73812.	3204.	8646.	74386.	-0.	74386.	-74386.
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	2389.	498108.	546.	498114.	-0.	498114.	-498114.
201 FZ	4479.	60777.	36639.	71108.	84393.	155501.	13285.
201 MX	400004.	34501688.	74567.	34504087.	40856.	34544943.	-34463231.
202 FZ	4129.	61235.	31809.	69127.	76705.	145832.	7578.
202 MX	59009.	640186.	16567.	643113.	43161.	686274.	-599953.
428 FX	0.	0.	0.	0.	0.	0.	0.
428 FY	0.	0.	0.	0.	0.	0.	0.
428 FZ	0.	0.	0.	0.	0.	0.	0.
428 MX	84.	3621.	14.	3622.	-2.	3624.	-3620.
428 MY	0.	0.	0.	0.	0.	0.	0.
428 MZ	0.	0.	0.	0.	0.	0.	0.

(lb, in-lb)

79508/MJM/AEP, DCC, NEW BOTH TROLLEYS MID, NO LD / SSE

REACTION SUMMARY

LOAD STEP NODE	LABEL	1	2	3	SRSS	STATIC	SUM	DIFFER
101	FY	1990.	26863.	254.	26937.	0.	26937.	-26937.
101	FZ	5484.	3639.	34703.	35321.	82285.	117606.	46964.
101	MX	162009.	1808289.	74050.	1817031.	40752.	1857783.	-1776279.
102	FZ	5133.	3544.	30940.	31562.	74724.	106286.	43162.
102	MX	325549.	118145.	21239.	346973.	67977.	414950.	-278996.
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	73812.	2014.	8646.	74344.	0.	74344.	-74344.
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	2389.	27626.	546.	27735.	0.	27735.	-27735.
201	FZ	4479.	3526.	36639.	37080.	84393.	121473.	47313.
201	MX	400004.	1913141.	74567.	1955922.	40856.	1996778.	-1915066.
202	FZ	4129.	3641.	31809.	32282.	76705.	108987.	44423.
202	MX	59009.	220864.	16567.	229209.	43161.	272370.	-186048.
428	FX	0.	0.	0.	0.	0.	0.	0.
428	FY	0.	0.	0.	0.	0.	0.	0.
428	FZ	0.	0.	0.	0.	0.	0.	0.
428	MX	84.	3451.	14.	3452.	-2.	3454.	-3450.
428	MY	0.	0.	0.	0.	0.	0.	0.
428	MZ	0.	0.	0.	0.	0.	0.	0.

(16, 17-16)

SRSS-4.3 WHITING CORPORATION ANSYS SRSS PROGRAM 79508 87/07/16.
TABLE # 889 BY MJM PAGE B-72 OF 121

79508/MJM/AEP, DCC, NEW BOTH TROLLEYS LHE, NO LD / OBE

REACTION SUMMARY

LOAD STEP NODE	LABEL	1	2	3	SRSS	STATIC	SUM	DIFFER
101	FY	5018.	83485.	458.	83637.	-0.	83637.	-83637.
101	FZ	2442.	10336.	5217.	11833.	50934.	62766.	39101.
101	MX	267275.	4525551.	36627.	4533584.	35843.	4569428.	-4497741.
102	FZ	1876.	10467.	4383.	11502.	45289.	56791.	33787.
102	MX	95364.	1453874.	14060.	1457066.	62702.	1519768.	-1394364.
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	34206.	16637.	9564.	39221.	-0.	39221.	-39221.
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	12022.	206522.	786.	206873.	-0.	206873.	-206873.
201	FZ	6268.	22152.	9826.	25031.	115797.	140828.	90766.
201	MX	911177.	15565642.	72090.	15592455.	43459.	15635913.	-15548996.
202	FZ	5043.	22300.	8014.	24227.	106088.	130315.	81862.
202	MX	34623.	402727.	16501.	404549.	39220.	443768.	-365329.
428	FX	0.	0.	0.	0.	0.	0.	0.
428	FY	0.	0.	0.	0.	0.	0.	0.
428	FZ	0.	0.	0.	0.	0.	0.	0.
428	MX	124.	4145.	6.	4147.	-2.	4149.	-4145.
428	MY	0.	0.	0.	0.	0.	0.	0.
428	MZ	0.	0.	0.	0.	0.	0.	0.

(lb, in-lb)

SRSS-4.3 WHITING CORPORATION ANSYS SRSS PROGRAM 79508 87/07/16.
TABLE # 890 LS 2 MODE 2 SCALE FACTOR = .1242 BY MJM PAGE 8-73 OF 121

79508/MJM/AEP, DCC, NEW BOTH TROLLEYS LHE, NO LD / OBE 1X

REACTION SUMMARY

LOAD STEP NODE LABEL	1	2	3	SRSS	STATIC	SUM	DIFFER
101 FY	5018.	14887.	458.	15717.	0.	15717.	-15717.
101 FZ	2442.	1310.	5217.	5907.	50934.	56841.	45027.
101 MX	267275.	617917.	36627.	674237.	35843.	710080.	-638394.
102 FZ	1876.	1370.	4383.	4961.	45289.	50250.	40328.
102 MX	95364.	210644.	14060.	231652.	62702.	294354.	-168950.
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	34206.	2538.	9564.	35608.	0.	35608.	-35608.
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	12022.	26976.	786.	29544.	0.	29544.	-29544.
201 FZ	6268.	3545.	9826.	12182.	115797.	127979.	103615.
201 MX	911177.	1995414.	72090.	2194783.	43459.	2238242.	-2151324.
202 FZ	5043.	3259.	8014.	10014.	106088.	116102.	96074.
202 MX	34623.	290275.	16501.	292796.	39220.	332016.	-253576.
428 FX	0.	0.	0.	0.	0.	0.	0.
428 FY	0.	0.	0.	0.	0.	0.	0.
428 FZ	0.	0.	0.	0.	0.	0.	0.
428 MX	124.	3932.	6.	3934.	-2.	3936.	-3932.
428 MY	0.	0.	0.	0.	0.	0.	0.
428 MZ	0.	0.	0.	0.	0.	0.	0.

(lb, in-lb)

SRSS-4.3 WHITING CORPORATION ANSYS SRSS PROGRAM 79508 87/07/16.
TABLE # 891 BY MJM PAGE 8-74 OF 121

79508/MJM/AEP, DCC, NEW BOTH TROLLEYS LHE, NO LD / SSE

REACTION SUMMARY

LOAD STEP NODE	LABEL	1	2	3	SRSS	STATIC	SUM	DIFFER
101	FY	9522.	157894.	843.	158183.	-0.	158183.	-158183.
101	FZ	5473.	19568.	12144.	23671.	50934.	74605.	27262.
101	MX	508982.	8567433.	75830.	8582873.	35843.	8618717.	-8547030.
102	FZ	4286.	19814.	10195.	22692.	45289.	67981.	22597.
102	MX	185169.	2754744.	25779.	2761080.	62702.	2823783.	-2698378.
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	67992.	31484.	20873.	77781.	-0.	77781.	-77781.
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	22783.	390965.	1400.	391631.	-0.	391631.	-391631.
201	FZ	13322.	41912.	22795.	49534.	115797.	165331.	66262.
201	MX	1728139.	29468462.	138389.	29519417.	43459.	29562876.	-29475959.
202	FZ	10710.	42203.	18573.	47337.	106088.	153425.	58752.
202	MX	71661.	761368.	29350.	765296.	39220.	804515.	-726076.
428	FX	0.	0.	0.	0.	0.	0.	0.
428	FY	0.	0.	0.	0.	0.	0.	0.
428	FZ	0.	0.	0.	0.	0.	0.	0.
428	MX	234.	7780.	11.	7783.	-2.	7785.	-7782.
428	MY	0.	0.	0.	0.	0.	0.	0.
428	MZ	0.	0.	0.	0.	0.	0.	0.

(lb, in-lb)

79508/MJM/AEP, DCC, NEW BOTH TROLLEYS LHE, NO LD / SSE

REACTION SUMMARY

LOAD STEP NODE	LABEL	1	2	3	SRSS	STATIC	SUM	DIFFER
101	FY	9522.	22601.	843.	24539.	0.	24539.	-24539.
101	FZ	5473.	1578.	12144.	13413.	50934.	64347.	37521.
101	MX	508982.	817802.	75830.	966230.	35843.	1002073.	-930387.
102	FZ	4286.	1710.	10195.	11191.	45289.	56480.	34098.
102	MX	185169.	316374.	25779.	367483.	62702.	430185.	-304781.
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	67992.	3597.	20873.	71215.	0.	71215.	-71215.
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	22783.	33820.	1400.	40802.	0.	40802.	-40802.
201	FZ	13322.	5131.	22795.	26896.	115797.	142693.	88901.
201	MX	1728139.	2453474.	138889.	3004195.	43459.	3047654.	-2960736.
202	FZ	10710.	4472.	18573.	21901.	106088.	127989.	84187.
202	MX	71661.	545598.	29350.	551064.	39220.	590284.	-511844.
428	FX	0.	0.	0.	0.	0.	0.	0.
428	FY	0.	0.	0.	0.	0.	0.	0.
428	FZ	0.	0.	0.	0.	0.	0.	0.
428	MX	234.	7370.	11.	7373.	-2.	7375.	-7371.
428	MY	0.	0.	0.	0.	0.	0.	0.
428	MZ	0.	0.	0.	0.	0.	0.	0.

(lb, in-lb)

SRSS-4.3 WHITING CORPORATION ANSYS SRSS PROGRAM 79508 87/07/14.
TABLE # 893 BY MJM PAGE B-76 OF 121

79508/MJM/AEP, DCC, NEW MAIN TROLLEY RHE, NO LD / OBE

REACTION SUMMARY

LOAD STEP / NODE LABEL	1	2	3	SRSS	STATIC	SUM	DIFFER
101 FY	10830.	307765.	1523.	307960.	-0.	307960.	-307960.
101 FZ	9272.	31631.	9931.	34426.	114128.	148554.	79703.
101 MX	704834.	19917819.	126307.	19930687.	37463.	19968149.	-19893224.
102 FZ	10128.	33044.	7966.	35467.	103123.	138590.	67656.
102 MX	68764.	978385.	17770.	980959.	71018.	1051977.	-909941.
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	31351.	15558.	15878.	38433.	0.	38433.	-38433.
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	4853.	136423.	672.	136511.	-0.	136511.	-136511.
201 FZ	4350.	15165.	5418.	16681.	52597.	69278.	35915.
201 MX	256449.	7001079.	28818.	7005834.	35509.	7041343.	-6970325.
202 FZ	4188.	16027.	4784.	17242.	48260.	65502.	31017.
202 MX	66272.	1290792.	21848.	1292677.	38335.	1331013.	-1254342.
428 FX	0.	0.	0.	0.	0.	0.	0.
428 FY	0.	0.	0.	0.	0.	0.	0.
428 FZ	0.	0.	0.	0.	0.	0.	0.
428 MX	83.	2749.	11.	2751.	-2.	2752.	-2749.
428 MY	0.	0.	0.	0.	0.	0.	0.
428 MZ	0.	0.	0.	0.	0.	0.	0.

(lb, in-lb)

SRSS-4.3 WHITING CORPORATION ANSYS SRSS PROGRAM 79508 87/07/14.
TABLE # 894 LS 2 MODE 2 SCALE FACTOR = .0826 BY MJM PAGE 8-77 OF 121

79508/MJM/AEP, DCC, NEW MAIN TROLLEY RHE, NO LD / OBE

REACTION SUMMARY

LOAD STEP NODE LABEL		1	2	3	SRSS	STATIC	SUM	DIFFER
101	FY	10830.	26472.	1523.	28642.	0.	28642.	-28642.
101	FZ	9272.	2745.	9931.	13861.	114128.	127989.	100267.
101	MX	704834.	1739898.	126307.	1881481.	37463.	1918944.	-1844018.
102	FZ	10128.	2957.	7966.	13220.	103123.	116343.	89903.
102	MX	68764.	354323.	17770.	361370.	71018.	432388.	-290352.
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	31351.	2262.	15878.	35215.	0.	35215.	-35215.
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	4853.	14299.	672.	15115.	0.	15115.	-15115.
201	FZ	4350.	1266.	5418.	7063.	52597.	59660.	45534.
201	MX	256449.	872989.	28818.	910329.	35509.	945838.	-874820.
202	FZ	4188.	1336.	4784.	6497.	48260.	54757.	41763.
202	MX	66272.	377599.	21848.	383991.	38335.	422326.	-345656.
428	FX	0.	0.	0.	0.	0.	0.	0.
428	FY	0.	0.	0.	0.	0.	0.	0.
428	FZ	0.	0.	0.	0.	0.	0.	0.
428	MX	83.	2225.	11.	2226.	-2.	2228.	-2224.
428	MY	0.	0.	0.	0.	0.	0.	0.
428	MZ	0.	0.	0.	0.	0.	0.	0.

(lb, in lb)

79508/MJM/AEP, DCC, NEW MAIN TROLLEY RHE, NO LD / SSE

REACTION SUMMARY

LOAD STEP NODE LABEL		1	2	3	SRSS	STATIC	SUM	DIFFER
101	FY	20321.	577104.	3206.	577470.	-0.	577470.	-577470.
101	FZ	20375.	59318.	23473.	66969.	114128.	181097.	47160.
101	MX	1324640.	37349068.	279761.	37373598.	37463.	37411061.	-37336135.
102	FZ	20528.	61976.	18507.	67859.	103123.	170982.	35263.
102	MX	128371.	1830133.	40152.	1835069.	71018.	1906087.	-1764051.
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	59721.	29166.	35175.	75197.	0.	75197.	-75197.
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	9106.	255812.	1378.	255978.	-0.	255978.	-255978.
201	FZ	10074.	28438.	12861.	32797.	52597.	85393.	19800.
201	MX	480582.	13126818.	56622.	13135735.	35509.	13171244.	-13100225.
202	FZ	9394.	30053.	11323.	33461.	48260.	81721.	14799.
202	MX	124276.	2418594.	50290.	2422307.	38335.	2460643.	-2383972.
428	FX	0.	0.	0.	0.	0.	0.	0.
428	FY	0.	0.	0.	0.	0.	0.	0.
428	FZ	0.	0.	0.	0.	0.	0.	0.
428	MX	155.	5155.	21.	5158.	-2.	5159.	-5156.
428	MY	0.	0.	0.	0.	0.	0.	0.
428	MZ	0.	0.	0.	0.	0.	0.	0.

(lb, in-lb)

SRSS-4.3 WHITING CORPORATION ANSYS SRSS PROGRAM 79508 87/07/14.
TABLE # B96 LS 2 MODE 2 SCALE FACTOR = .0537 BY MJM PAGE B-79 OF 121

79508/MJM/AEP, DCC, NEW MAIN TROLLEY RHE, NO LD / SSE

REACTION SUMMARY

LOAD STEP NODE	LABEL	1	2	3	SRSS	STATIC	SUM	DIFFER
101	FY	20321.	33925.	3206.	39675.	0.	39675.	-39675.
101	FZ	20375.	3607..	23473.	31291.	114128.	145419.	82837.
101	MX	1324640.	2275217.	279761.	2647545.	37463.	2685008.	-2610082.
102	FZ	20528.	4133.	18507.	27946.	103123.	131069.	75177.
102	MX	128371.	640784.	40152.	654746.	71018.	725764.	-583728.
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	59721.	3754.	35175.	69411.	0.	69411.	-69411.
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	9106.	20115.	1378.	22123.	0.	22123.	-22123.
201	FZ	10074.	1575.	12861.	16413.	52597.	69010.	36184.
201	MX	480582.	1324406.	56622.	1410035.	35509.	1445544.	-1374526.
202	FZ	9394.	1649.	11323.	14805.	48260.	63065.	33455.
202	MX	124276.	665857.	50290.	679217.	38335.	717552.	-640882.
428	FX	0.	0.	0.	0.	0.	0.	0.
428	FY	0.	0.	0.	0.	0.	0.	0.
428	FZ	0.	0.	0.	0.	0.	0.	0.
428	MX	155.	4139.	21.	4142.	-2.	4144.	-4140.
428	MY	0.	0.	0.	0.	0.	0.	0.
428	MZ	0.	0.	0.	0.	0.	0.	0.

(lb, in-lb)

EFS-1.3 FOR SRSS-4.3

WHITING REGN 79508 DATE 8-4-87
BY MJM PAGE 8-80 OF 121

TABLE 897

OBE MONORAIL TO SUPPORT CONNECTN FXD
SUM OF ELEMENT FORCES IN ELEMENT CO-ORDINATE SYSTEM (lb, in-lb)

	ELEM	NODE	FX	FY	FZ	MX	MY	MZ
MID 60 U	123	J 457	402.	57.	936.	2455.	3060.	213.
MID 60 D	123	J 457	409.	71.	818.	1869.	2679.	262.
1/4 60 U	123	J 457	397.	22.	1959.	5518.	6389.	91.
1/4 60 D	123	J 457	423.	28.	2463.	6839.	8037.	112.
LHE 60 U	123	J 457	392.	42.	2026.	5856.	6602.	172.
LHE 60 D	123	J 457	396.	49.	2790.	8002.	9095.	199.
RHE 60 U	123	J 457	406.	61.	1770.	5215.	5777.	245.
RHE 60 D	123	J 457	411.	62.	2227.	6478.	7269.	253.
MID NO	123	J 457	376.	40.	642.	1691.	2101.	151.
1/4 NO	123	J 457	392.	19.	1632.	4680.	5317.	76.
LHE NO	123	J 457	406.	40.	1507.	4444.	4908.	161.
RHE NO	123	J 457	388.	55.	1456.	4286.	4750.	223.
B M NO	123	J 457	390.	50.	507.	1812.	1658.	187.
B L NO	123	J 457	380.	30.	1415.	4142.	4607.	127.
A M NO	123	J 457	399.	27.	796.	2385.	2589.	115.
A G NO	123	J 457	399.	59.	4057.	11756.	13243.	237.
MAXIMUM VALUES			423.	71.	4057.	11756.	13243.	262.

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TABLE 298

SSE MONORAIL TO SUPPORT CONNECTN FXD

SUM OF ELEMENT FORCES IN ELEMENT CO-ORDINATE SYSTEM (lb, in-lb)

	ELEM	NODE	FX	FY	FZ	MX	MY	MZ
MID	60 U 123	J 457	459.	71.	1589.	4430.	5186.	265.
MID	60 D 123	J 457	472.	97.	1304.	3275.	4264.	360.
1/4	60 U 123	J 457	474.	41.	3020.	8673.	9846.	163.
1/4	60 D 123	J 457	508.	51.	3794.	10675.	12376.	206.
LHE	60 U 123	J 457	470.	73.	2754.	8082.	8971.	304.
LHE	60 D 123	J 457	470.	83.	4013.	11580.	13080.	339.
RHE	60 U 123	J 457	481.	102.	2527.	7566.	8241.	412.
RHE	60 D 123	J 457	493.	106.	3283.	9640.	10708.	432.
MID	NO 123	J 457	423.	52.	1086.	3082.	3547.	196.
1/4	NO 123	J 457	464.	36.	2695.	7858.	8780.	146.
LHE	NO 123	J 457	488.	78.	2807.	8272.	9146.	314.
RHE	NO 123	J 457	455.	96.	2196.	6537.	7162.	388.
B M	NO 123	J 457	448.	65.	1080.	3745.	3528.	245.
B L	NO 123	J 457	441.	51.	2001.	5972.	6515.	217.
A M	NO 123	J 457	471.	44.	1296.	3854.	4215.	190.
A G	NO 123	J 457	466.	94.	7589.	21976.	24766.	377.
MAXIMUM VALUES			508.	106.	7589.	21976.	24766.	432.

EFS-1.3 FOR SRSS-4.3

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TABLE 899

OBE MONORAIL TO SUPPORT CONNECTN FLT
SUM OF ELEMENT FORCES IN ELEMENT CO-ORDINATE SYSTEM (lb, in-lb)

			ELEM		NODE	FX	FY	FZ	MX	MY	MZ
MID	60	U	120	J	451	206.	132.	956.	9585.	3108.	507.
MID	60	U	121	J	453	384.	49.	1667.	18029.	5441.	195.
MID	60	U	122	J	455	377.	47.	1176.	12611.	3834.	179.
MID	60	U	124	J	459	331.	44.	1109.	11995.	3614.	214.
MID	60	U	125	J	461	776.	391.	1696.	20905.	5551.	5406.
MID	60	U	126	J	464	1219.	1893.	1413.	19677.	4510.	36749.
MID	60	D	120	J	451	223.	162.	1172.	11762.	3812.	621.
MID	60	D	121	J	453	388.	53.	2055.	22226.	6709.	209.
MID	60	D	122	J	455	391.	49.	1426.	15284.	4651.	180.
MID	60	D	124	J	459	309.	45.	1376.	14870.	4485.	219.
MID	60	D	125	J	461	780.	394.	1936.	23099.	6335.	5416.
MID	60	D	126	J	464	1226.	1897.	1471.	20259.	4702.	36784.
1/4	60	U	120	J	451	160.	71.	563.	4999.	1816.	275.
1/4	60	U	121	J	453	384.	68.	841.	9056.	2743.	260.
1/4	60	U	122	J	455	364.	36.	914.	9887.	2986.	146.
1/4	60	U	124	J	459	329.	53.	648.	7201.	2100.	171.
1/4	60	U	125	J	461	686.	139.	1354.	14267.	4451.	1825.
1/4	60	U	126	J	464	1222.	715.	1358.	14325.	4349.	12518.
1/4	60	D	120	J	451	164.	77.	590.	5416.	1903.	297.
1/4	60	D	121	J	453	398.	91.	1078.	11546.	3515.	349.
1/4	60	D	122	J	455	382.	45.	1229.	13279.	4012.	182.
1/4	60	D	124	J	459	369.	63.	797.	8879.	2582.	189.
1/4	60	D	125	J	461	692.	153.	1788.	18596.	5872.	2082.
1/4	60	D	126	J	464	1265.	864.	1807.	19043.	5812.	14594.
LHE	60	U	120	J	451	156.	61.	504.	4282.	1622.	236.
LHE	60	U	121	J	453	388.	75.	715.	7684.	2333.	290.
LHE	60	U	122	J	455	374.	48.	866.	9393.	2827.	194.
LHE	60	U	124	J	459	384.	73.	455.	5086.	1470.	383.
LHE	60	U	125	J	461	813.	858.	2335.	33185.	7603.	11982.
LHE	60	U	126	J	464	1254.	4156.	2621.	38941.	8419.	81499.
LHE	60	D	120	J	451	157.	63.	565.	4453.	1815.	241.
LHE	60	D	121	J	453	404.	103.	831.	8831.	2709.	393.
LHE	60	D	122	J	455	400.	59.	1167.	12648.	3808.	238.
LHE	60	D	124	J	459	412.	76.	470.	5262.	1518.	385.
LHE	60	D	125	J	461	812.	865.	2633.	36089.	8580.	12042.
LHE	60	D	126	J	464	1257.	4164.	2759.	39413.	8874.	81810.
RHE	60	U	120	J	451	231.	129.	1007.	9201.	3275.	491.
RHE	60	U	121	J	453	369.	72.	1136.	12566.	3703.	267.
RHE	60	U	122	J	455	365.	58.	610.	6691.	1986.	233.
RHE	60	U	124	J	459	366.	79.	692.	7761.	2243.	361.
RHE	60	U	125	J	461	775.	514.	1535.	20594.	5015.	6741.
RHE	60	U	126	J	464	1234.	2282.	1517.	21106.	4835.	44757.
RHE	60	D	120	J	451	267.	165.	1309.	11906.	4260.	628.
RHE	60	D	121	J	453	387.	76.	1392.	15410.	4541.	275.
RHE	60	D	122	J	455	373.	57.	623.	6845.	2029.	227.
RHE	60	D	124	J	459	387.	84.	872.	9744.	2837.	387.
RHE	60	D	125	J	461	786.	537.	1617.	21400.	5284.	6888.
RHE	60	D	126	J	464	1238.	2306.	1566.	21150.	4993.	45272.
MID	NO		120	J	451	179.	93.	671.	6728.	2176.	356.

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TABLE 899 Continued

OBE MONORAIL TO SUPPORT CONNECTN FLT
SUM OF ELEMENT FORCES IN ELEMENT CO-ORDINATE SYSTEM (lb, in-lb)

		ELEM	NODE	FX	FY	FZ	MX	MY	MZ
MID	NO	121	J 453	364.	33.	1177.	12731.	3844.	128.
MID	NO	122	J 455	343.	29.	818.	8774.	2669.	109.
MID	NO	124	J 459	290.	38.	783.	8484.	2551.	193.
MID	NO	125	J 461	757.	385.	1334.	17442.	4367.	5385.
MID	NO	126	J 464	1190.	1880.	1217.	18175.	3870.	36687.
1/4	NO	120	J 451	157.	63.	507.	4407.	1632.	242.
1/4	NO	121	J 453	378.	53.	637.	6900.	2079.	205.
1/4	NO	122	J 455	356.	32.	672.	7271.	2195.	127.
1/4	NO	124	J 459	310.	44.	532.	5898.	1724.	150.
1/4	NO	125	J 461	690.	128.	998.	10701.	3289.	1676.
1/4	NO	126	J 464	1194.	626.	1006.	10768.	3201.	11425.
LHE	NO	120	J 451	144.	37.	314.	2481.	1004.	147.
LHE	NO	121	J 453	382.	64.	451.	4816.	1469.	249.
LHE	NO	122	J 455	367.	46.	625.	6797.	2039.	186.
LHE	NO	124	J 459	366.	66.	226.	2553.	730.	324.
LHE	NO	125	J 461	794.	666.	1711.	24932.	5576.	9329.
LHE	NO	126	J 464	1222.	3236.	1981.	29852.	6341.	63510.
RHE	NO	120	J 451	200.	97.	750.	6911.	2435.	369.
RHE	NO	121	J 453	372.	63.	909.	9999.	2963.	235.
RHE	NO	122	J 455	346.	52.	578.	6330.	1884.	209.
RHE	NO	124	J 459	347.	73.	552.	6230.	1786.	331.
RHE	NO	125	J 461	772.	497.	1432.	19511.	4680.	6642.
RHE	NO	126	J 464	1217.	2261.	1445.	20704.	4602.	44400.
B M	NO	120	J 451	172.	88.	582.	6129.	1888.	340.
B M	NO	121	J 453	397.	70.	1164.	12523.	3800.	273.
B M	NO	122	J 455	357.	68.	905.	9715.	2954.	263.
B M	NO	124	J 459	280.	63.	828.	8972.	2698.	270.
B M	NO	125	J 461	753.	390.	1443.	18469.	4723.	5402.
B M	NO	126	J 464	1173.	1886.	1276.	18619.	4063.	36772.
B L	NO	120	J 451	144.	40.	340.	2766.	1087.	156.
B L	NO	121	J 453	376.	52.	442.	4735.	1442.	199.
B L	NO	122	J 455	349.	33.	575.	6241.	1879.	132.
B L	NO	124	J 459	362.	65.	350.	3939.	1135.	359.
B L	NO	125	J 461	831.	822.	2022.	29878.	6582.	11525.
B L	NO	126	J 464	1233.	4001.	2389.	36762.	7661.	78483.
A M	NO	120	J 451	148.	43.	269.	2935.	862.	169.
A M	NO	121	J 453	390.	50.	668.	7155.	2179.	197.
A M	NO	122	J 455	360.	31.	649.	7018.	2119.	124.
A M	NO	124	J 459	362.	71.	434.	4753.	1409.	365.
A M	NO	125	J 461	890.	784.	1931.	28567.	6287.	11008.
A M	NO	126	J 464	1340.	3823.	2250.	35013.	7206.	74988.
A G	NO	120	J 451	219.	143.	1202.	10016.	3892.	540.
A G	NO	121	J 453	441.	119.	668.	7541.	2189.	449.
A G	NO	122	J 455	443.	66.	1202.	13024.	3926.	267.
A G	NO	124	J 459	435.	81.	626.	6781.	2047.	355.
A G	NO	125	J 461	837.	700.	2234.	30249.	7283.	9656.
A G	NO	126	J 464	1278.	3331.	2403.	32239.	7723.	65548.
MAXIMUM VALUES				1340.	4164.	2759.	39413.	8874.	81810.

TABLE 8100

SSE MONORAIL TO SUPPORT CONNECTN FLT
SUM OF ELEMENT FORCES IN ELEMENT CO-ORDINATE SYSTEM (lb, in-lb)

			ELEM		NODE	FX	FY	FZ	MX	MY	MZ
MID	60	U	120	J	451	229.	160.	1154.	11567.	3753.	615.
MID	60	U	121	J	453	423.	71.	2014.	21789.	6575.	278.
MID	60	U	122	J	455	435.	68.	1469.	15774.	4793.	261.
MID	60	U	124	J	459	428.	71.	1348.	14579.	4395.	359.
MID	60	U	125	J	461	898.	725.	2435.	32136.	7944.	10108.
MID	60	U	126	J	464	1309.	3521.	2349.	34206.	7533.	68787.
MID	60	D	120	J	451	262.	218.	1582.	15862.	5149.	837.
MID	60	D	121	J	453	434.	74.	2777.	30033.	9064.	290.
MID	60	D	122	J	455	463.	67.	1941.	20804.	6331.	249.
MID	60	D	124	J	459	393.	73.	1871.	20216.	6102.	367.
MID	60	D	125	J	461	911.	729.	2845.	35696.	9289.	10123.
MID	60	D	126	J	464	1329.	3526.	2433.	35053.	7812.	68842.
1/4	60	U	120	J	451	188.	114.	911.	7896.	2943.	440.
1/4	60	U	121	J	453	428.	95.	1102.	11967.	3596.	362.
1/4	60	U	122	J	455	438.	61.	1173.	12682.	3830.	240.
1/4	60	U	124	J	459	400.	80.	948.	10482.	3077.	278.
1/4	60	U	125	J	461	767.	240.	1715.	18538.	5629.	3119.
1/4	60	U	126	J	464	1326.	1151.	1809.	19305.	5812.	21160.
1/4	60	D	120	J	451	193.	122.	959.	8576.	3101.	475.
1/4	60	D	121	J	453	446.	133.	1502.	16150.	4898.	513.
1/4	60	D	122	J	455	460.	77.	1712.	18509.	5592.	306.
1/4	60	D	124	J	459	460.	96.	1179.	13097.	3826.	309.
1/4	60	D	125	J	461	763.	259.	2465.	25888.	8085.	3483.
1/4	60	D	126	J	464	1388.	1374.	2571.	27247.	8293.	24155.
LHE	60	U	120	J	451	184.	106.	809.	7291.	2614.	412.
LHE	60	U	121	J	453	424.	104.	1120.	12157.	3654.	403.
LHE	60	U	122	J	455	438.	82.	1144.	12427.	3735.	327.
LHE	60	U	124	J	459	502.	127.	813.	9055.	2634.	693.
LHE	60	U	125	J	461	1010.	1597.	3872.	57231.	12580.	22391.
LHE	60	U	126	J	464	1392.	7770.	4659.	71456.	15004.	152460.
LHE	60	D	120	J	451	185.	108.	892.	7527.	2878.	421.
LHE	60	D	121	J	453	446.	148.	1283.	13750.	4181.	570.
LHE	60	D	122	J	455	472.	96.	1643.	17819.	5363.	387.
LHE	60	D	124	J	459	539.	132.	832.	9277.	2695.	696.
LHE	60	D	125	J	461	1005.	1606.	4283.	61098.	13925.	22465.
LHE	60	D	126	J	464	1390.	7780.	4839.	72061.	15601.	152850.
RHE	60	U	120	J	451	259.	165.	1253.	11590.	4078.	631.
RHE	60	U	121	J	453	406.	116.	1559.	17220.	5082.	436.
RHE	60	U	122	J	455	430.	99.	1033.	11309.	3364.	396.
RHE	60	U	124	J	459	464.	134.	940.	10615.	3048.	604.
RHE	60	U	125	J	461	901.	924.	2569.	35430.	8367.	12398.
RHE	60	U	126	J	464	1353.	4227.	2687.	38710.	8617.	83037.
RHE	60	D	120	J	451	325.	227.	1777.	16241.	5786.	863.
RHE	60	D	121	J	453	435.	122.	1976.	21828.	6443.	446.
RHE	60	D	122	J	455	443.	96.	1056.	11577.	3439.	385.
RHE	60	D	124	J	459	501.	142.	1236.	13871.	4014.	651.
RHE	60	D	125	J	461	919.	966.	2715.	36865.	8844.	12658.
RHE	60	D	126	J	464	1358.	4270.	2775.	38793.	8899.	83952.
MID	NO		120	J	451	195.	114.	827.	8252.	2682.	438.

Continued

TABLE 8100 Continued

SSE MONORAIL TO SUPPORT CONNECTN FLT
SUM OF ELEMENT FORCES IN ELEMENT CO-ORDINATE SYSTEM (lb, in-lb)

		ELEM	NODE	FX	FY	FZ	MX	MY	MZ
MID	NO	121	J 453	397.	45.	1443.	15612.	4710.	175.
MID	NO	122	J 455	390.	39.	1021.	10950.	3330.	147.
MID	NO	124	J 459	360.	64.	967.	10469.	3150.	333.
MID	NO	125	J 461	873.	719.	2036.	28449.	6639.	10086.
MID	NO	126	J 464	1251.	3508.	2121.	32619.	6792.	68724.
1/4	NO	120	J 451	184.	105.	852.	7284.	2749.	405.
1/4	NO	121	J 453	420.	80.	881.	9647.	2876.	307.
1/4	NO	122	J 455	426.	57.	893.	9666.	2918.	226.
1/4	NO	124	J 459	378.	70.	830.	9157.	2696.	255.
1/4	NO	125	J 461	761.	230.	1306.	14550.	4292.	2982.
1/4	NO	126	J 464	1283.	1066.	1417.	15377.	4536.	20147.
LHE	NO	120	J 451	164.	71.	567.	4611.	1819.	281.
LHE	NO	121	J 453	426.	119.	794.	8509.	2584.	462.
LHE	NO	122	J 455	447.	91.	1100.	11958.	3587.	362.
LHE	NO	124	J 459	493.	121.	452.	5054.	1467.	595.
LHE	NO	125	J 461	956.	1248.	3069.	45321.	9976.	17489.
LHE	NO	126	J 464	1297.	6058.	3652.	55365.	11743.	119060.
RHE	NO	120	J 451	225.	129.	974.	9112.	3165.	494.
RHE	NO	121	J 453	410.	105.	1324.	14514.	4316.	397.
RHE	NO	122	J 455	401.	90.	1001.	10949.	3263.	362.
RHE	NO	124	J 459	440.	125.	800.	9058.	2591.	566.
RHE	NO	125	J 461	896.	903.	2455.	34235.	7996.	12280.
RHE	NO	126	J 464	1325.	4203.	2608.	38302.	8363.	82611.
B M	NO	120	J 451	188.	117.	749.	7854.	2430.	459.
B M	NO	121	J 453	458.	120.	1456.	15673.	4754.	472.
B M	NO	122	J 455	433.	122.	1149.	12341.	3753.	469.
B M	NO	124	J 459	344.	111.	1048.	11382.	3416.	480.
B M	NO	125	J 461	868.	728.	2165.	29621.	7061.	10117.
B M	NO	126	J 464	1246.	3518.	2183.	33101.	6994.	68879.
B L	NO	120	J 451	159.	65.	508.	4392.	1630.	255.
B L	NO	121	J 453	403.	73.	673.	7293.	2195.	284.
B L	NO	122	J 455	400.	55.	771.	8368.	2519.	219.
B L	NO	124	J 459	463.	115.	581.	6537.	1892.	647.
B L	NO	125	J 461	1016.	1537.	3514.	53339.	11412.	21588.
B L	NO	126	J 464	1321.	7490.	4347.	67991.	13990.	147060.
A M	NO	120	J 451	165.	60.	398.	4079.	1279.	237.
A M	NO	121	J 453	441.	66.	835.	8973.	2724.	258.
A M	NO	122	J 455	437.	45.	805.	8705.	2628.	180.
A M	NO	124	J 459	479.	122.	566.	6220.	1838.	651.
A M	NO	125	J 461	1130.	1468.	3338.	50868.	10843.	20629.
A M	NO	126	J 464	1538.	7158.	4115.	64815.	13233.	140530.
A Q	NO	120	J 451	282.	233.	2022.	16348.	6553.	877.
A Q	NO	121	J 453	533.	215.	846.	9767.	2775.	804.
A Q	NO	122	J 455	581.	111.	2105.	22770.	6883.	444.
A Q	NO	124	J 459	625.	137.	950.	10263.	3117.	617.
A Q	NO	125	J 461	1018.	1309.	3978.	54633.	12942.	18105.
A Q	NO	126	J 464	1404.	6236.	4464.	59849.	14410.	122890.
MAXIMUM VALUES				1538.	7780.	4839.	72061.	15601.	152850.

EFS-1.3 FOR SRSS-4.3

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TABLE 8101

OBE SUPPORT TO GIRDER CONNECTION FXD

SUM OF ELEMENT FORCES IN ELEMENT CO-ORDINATE SYSTEM (lb, in-lb)

			ELEM		NODE	FX	FY	FZ	MX	MY	MZ
MID	60	U	109	I	537	57.	936.	460.	684.	6026.	11372.
MID	60	D	109	I	537	71.	818.	467.	593.	5945.	10253.
1/4	60	U	109	I	537	22.	1959.	455.	1449.	6211.	23289.
1/4	60	D	109	I	537	28.	2463.	481.	1816.	6536.	29363.
LHE	60	U	109	I	537	42.	2026.	450.	1503.	6262.	23917.
LHE	60	D	109	I	537	49.	2790.	455.	2066.	6336.	32990.
RHE	60	U	109	I	537	61.	1770.	464.	1305.	6514.	20810.
RHE	60	D	109	I	537	62.	2227.	470.	1641.	6577.	26245.
MID	NO		109	I	537	40.	642.	435.	468.	5723.	7808.
1/4	NO		109	I	537	19.	1632.	450.	1209.	6172.	19315.
LHE	NO		109	I	537	40.	1507.	464.	1120.	6518.	17723.
RHE	NO		109	I	537	55.	1456.	446.	1073.	6295.	17100.
B M	NO		109	I	537	50.	507.	449.	369.	5921.	5986.
B L	NO		109	I	537	30.	1415.	438.	1051.	6098.	16646.
A M	NO		109	I	537	27.	796.	458.	596.	6409.	9386.
A Q	NO		109	I	537	59.	4057.	457.	2990.	6488.	47884.
MAXIMUM VALUES						71.	4057.	481.	2990.	6577.	47884.

EFS-1.3 FOR SRSS-4.3

WHITING REGN 79508 DATE 8-4-87
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TABLE 8102

SSE SUPPORT TO GIRDER CONNECTION FXD

SUM OF ELEMENT FORCES IN ELEMENT CO-ORDINATE SYSTEM (lb, in-lb)

			ELEM	NODE	FX	FY	FZ	MX	MY	MZ
MID	60	U	109	I 537	71.	1589.	517.	1169.	6874.	18988.
MID	60	D	109	I 537	97.	1304.	530.	952.	6730.	16049.
1/4	60	U	109	I 537	41.	3020.	533.	2236.	7394.	35748.
1/4	60	D	109	I 537	51.	3794.	566.	2799.	7799.	45100.
LHE	60	U	109	I 537	73.	2754.	528.	2045.	7523.	32391.
LHE	60	D	109	I 537	83.	4013.	529.	2972.	7545.	47381.
RHE	60	U	109	I 537	102.	2527.	539.	1866.	7700.	29595.
RHE	60	D	109	I 537	106.	3283.	551.	2423.	7865.	38582.
MID	NO		109	I 537	52.	1086.	482.	797.	6423.	12950.
1/4	NO		109	I 537	36.	2695.	522.	1999.	7284.	31782.
LHE	NO		109	I 537	78.	2807.	546.	2084.	7917.	33025.
RHE	NO		109	I 537	96.	2196.	513.	1621.	7398.	25724.
B M	NO		109	I 537	65.	1080.	506.	791.	6812.	12730.
B L	NO		109	I 537	51.	2001.	499.	1488.	7078.	23440.
A M	NO		109	I 537	44.	1296.	530.	968.	7588.	15324.
A G	NO		109	I 537	94.	7589.	524.	5595.	7575.	89548.
MAXIMUM VALUES					106.	7589.	566.	5595.	7917.	89548.

TABLE B103

OBE SUPPORT TO GIRDER CONNECTION FLT
SUM OF ELEMENT FORCES IN ELEMENT CO-ORDINATE SYSTEM (lb, in-lb)

			ELEM		NODE	FX	FY	FZ	MX	MY	MZ
MID	60	U	106	I	531	132.	956.	236.	718.	2837.	4482.
MID	60	U	107	I	533	49.	1667.	414.	1226.	5816.	6455.
MID	60	U	108	I	535	47.	1176.	408.	868.	5537.	4656.
MID	60	U	110	I	539	44.	1109.	362.	822.	4985.	4302.
MID	60	U	111	I	541	391.	1696.	807.	1234.	17947.	5717.
MID	60	U	112	I	544	1893.	1413.	1250.	1142.	60058.	4382.
MID	60	D	106	I	531	162.	1172.	254.	877.	3101.	5492.
MID	60	D	107	I	533	53.	2055.	418.	1512.	5765.	7961.
MID	60	D	108	I	535	49.	1426.	421.	1053.	5633.	5661.
MID	60	D	110	I	539	45.	1376.	340.	1017.	4578.	5341.
MID	60	D	111	I	541	394.	1936.	810.	1409.	17968.	6879.
MID	60	D	112	I	544	1897.	1471.	1256.	1182.	60093.	4403.
1/4	60	U	106	I	531	71.	563.	191.	438.	2452.	3610.
1/4	60	U	107	I	533	68.	841.	414.	620.	5603.	3303.
1/4	60	U	108	I	535	36.	914.	394.	672.	5433.	3546.
1/4	60	U	110	I	539	53.	648.	360.	492.	4878.	2321.
1/4	60	U	111	I	541	139.	1354.	717.	964.	12148.	5872.
1/4	60	U	112	I	544	715.	1358.	1253.	1083.	31274.	6267.
1/4	60	D	106	I	531	77.	590.	195.	457.	2606.	3867.
1/4	60	D	107	I	533	91.	1078.	428.	795.	5711.	4291.
1/4	60	D	108	I	535	45.	1229.	413.	902.	5634.	4766.
1/4	60	D	110	I	539	63.	797.	400.	605.	5403.	2827.
1/4	60	D	111	I	541	153.	1788.	722.	1281.	12569.	7859.
1/4	60	D	112	I	544	864.	1807.	1296.	1418.	33806.	7993.
LHE	60	U	106	I	531	61.	504.	186.	395.	2350.	3464.
LHE	60	U	107	I	533	75.	715.	419.	528.	5619.	2840.
LHE	60	U	108	I	535	48.	866.	404.	637.	5546.	3325.
LHE	60	U	110	I	539	73.	455.	415.	351.	5789.	1702.
LHE	60	U	111	I	541	858.	2335.	844.	1735.	27378.	5176.
LHE	60	U	112	I	544	4156.	2621.	1284.	2065.	113440.	7594.
LHE	60	D	106	I	531	63.	565.	188.	444.	2403.	4294.
LHE	60	D	107	I	533	103.	831.	435.	615.	5653.	3393.
LHE	60	D	108	I	535	59.	1167.	430.	857.	5797.	4485.
LHE	60	D	110	I	539	76.	470.	443.	363.	6248.	1747.
LHE	60	D	111	I	541	865.	2633.	842.	1954.	27442.	6357.
LHE	60	D	112	I	544	4164.	2759.	1287.	2163.	113820.	10097.
RHE	60	U	106	I	531	129.	1007.	262.	754.	3081.	5661.
RHE	60	U	107	I	533	72.	1136.	400.	839.	5397.	4135.
RHE	60	U	108	I	535	58.	610.	395.	454.	5601.	2280.
RHE	60	U	110	I	539	79.	692.	397.	523.	5535.	2811.
RHE	60	U	111	I	541	514.	1535.	806.	1125.	19858.	3956.
RHE	60	U	112	I	544	2282.	1517.	1265.	1234.	69023.	4617.
RHE	60	D	106	I	531	165.	1309.	298.	976.	3517.	7370.
RHE	60	D	107	I	533	76.	1392.	418.	1027.	5596.	5045.
RHE	60	D	108	I	535	57.	623.	403.	466.	5660.	2318.
RHE	60	D	110	I	539	84.	872.	417.	656.	5762.	3521.
RHE	60	D	111	I	541	537.	1617.	817.	1186.	20055.	4324.
RHE	60	D	112	I	544	2306.	1566.	1268.	1273.	69477.	5208.
MID	NO		106	I	531	93.	671.	210.	508.	2502.	3152.

Continued

TABLE 8103 Continued

OBE SUPPORT TO GIRDER CONNECTION FLT

SUM OF ELEMENT FORCES IN ELEMENT CO-ORDINATE SYSTEM (lb, in-lb)

		ELEM		NODE	FX	FY	FZ	MX	MY	MZ
MID	NO	107	I	533	33.	1177.	394.	865.	5515.	4560.
MID	NO	108	I	535	29.	818.	373.	604.	5094.	3245.
MID	NO	110	I	539	38.	783.	321.	583.	4373.	3035.
MID	NO	111	I	541	385.	1334.	787.	969.	17898.	4050.
MID	NO	112	I	544	1880.	1217.	1221.	998.	59893.	2690.
1/4	NO	106	I	531	63.	507.	188.	396.	2350.	3227.
1/4	NO	107	I	533	53.	637.	409.	468.	5579.	2469.
1/4	NO	108	I	535	32.	672.	387.	494.	5370.	2606.
1/4	NO	110	I	539	44.	532.	341.	404.	4728.	1920.
1/4	NO	111	I	541	128.	998.	721.	703.	12103.	4293.
1/4	NO	112	I	544	626.	1006.	1225.	822.	29839.	4824.
LHE	NO	106	I	531	37.	314.	174.	254.	2300.	2375.
LHE	NO	107	I	533	64.	451.	413.	335.	5710.	1825.
LHE	NO	108	I	535	46.	625.	398.	461.	5524.	2390.
LHE	NO	110	I	539	66.	226.	396.	176.	5667.	908.
LHE	NO	111	I	541	666.	1711.	825.	1268.	23640.	3237.
LHE	NO	112	I	544	3236.	1981.	1252.	1584.	91860.	5538.
RHE	NO	106	I	531	97.	750.	231.	566.	2701.	4192.
RHE	NO	107	I	533	63.	909.	403.	671.	5491.	3357.
RHE	NO	108	I	535	52.	578.	376.	430.	5293.	2166.
RHE	NO	110	I	539	73.	552.	377.	421.	5329.	2250.
RHE	NO	111	I	541	497.	1432.	803.	1049.	19743.	3563.
RHE	NO	112	I	544	2261.	1445.	1247.	1179.	68670.	4046.
B M	NO	106	I	531	88.	582.	202.	440.	2564.	2507.
B M	NO	107	I	533	70.	1164.	428.	854.	6417.	4571.
B M	NO	108	I	535	68.	905.	388.	666.	5704.	3577.
B M	NO	110	I	539	63.	828.	311.	615.	4220.	3217.
B M	NO	111	I	541	390.	1443.	783.	1048.	17894.	4555.
B M	NO	112	I	544	1886.	1276.	1204.	1040.	60016.	3182.
B L	NO	106	I	531	40.	340.	174.	274.	2264.	2426.
B L	NO	107	I	533	52.	442.	406.	326.	5556.	1771.
B L	NO	108	I	535	33.	575.	380.	423.	5285.	2215.
B L	NO	110	I	539	65.	350.	392.	265.	5420.	1324.
B L	NO	111	I	541	822.	2022.	861.	1504.	26966.	3752.
B L	NO	112	I	544	4001.	2389.	1263.	1896.	109700.	5231.
A M	NO	106	I	531	43.	269.	179.	213.	2376.	1407.
A M	NO	107	I	533	50.	668.	421.	492.	5979.	2658.
A M	NO	108	I	535	31.	649.	390.	479.	5555.	2523.
A M	NO	110	I	539	71.	434.	393.	328.	5422.	1710.
A M	NO	111	I	541	784.	1931.	921.	1435.	26431.	3511.
A M	NO	112	I	544	3823.	2250.	1370.	1793.	105580.	4083.
A G	NO	106	I	531	143.	1202.	249.	916.	2559.	7640.
A G	NO	107	I	533	119.	668.	471.	485.	6160.	2281.
A G	NO	108	I	535	66.	1202.	474.	881.	6539.	4633.
A G	NO	110	I	539	81.	626.	466.	455.	6672.	2452.
A G	NO	111	I	541	700.	2234.	867.	1652.	24201.	5332.
A G	NO	112	I	544	3331.	2403.	1309.	1887.	94266.	10557.
MAXIMUM VALUES					4164.	2759.	1370.	2163.	113820.	10557.

TABLE B104

SSE SUPPORT TO GIRDER CONNECTION FLT

SUM OF ELEMENT FORCES IN ELEMENT CO-ORDINATE SYSTEM (lb, in-lb)

			ELEM		NODE	FX	FY	FZ	MX	MY	MZ
MID	60	U	106	I	531	160.	1154.	260.	865.	3106.	5441.
MID	60	U	107	I	533	71.	2014.	454.	1482.	6432.	7806.
MID	60	U	108	I	535	68.	1469.	466.	1085.	6383.	5809.
MID	60	U	110	I	539	71.	1348.	458.	997.	6395.	5248.
MID	60	U	111	I	541	725.	2435.	929.	1795.	25326.	7109.
MID	60	U	112	I	544	3521.	2349.	1340.	1862.	98135.	6682.
MID	60	D	106	I	531	218.	1582.	293.	1179.	3641.	7459.
MID	60	D	107	I	533	74.	2777.	464.	2044.	6382.	10759.
MID	60	D	108	I	535	67.	1941.	493.	1433.	6596.	7708.
MID	60	D	110	I	539	73.	1871.	424.	1381.	5719.	7281.
MID	60	D	111	I	541	729.	2845.	941.	2092.	25377.	9334.
MID	60	D	112	I	544	3526.	2433.	1360.	1921.	98198.	6630.
1/4	60	U	106	I	531	114.	911.	218.	702.	2661.	5797.
1/4	60	U	107	I	533	95.	1102.	459.	812.	6238.	4246.
1/4	60	U	108	I	535	61.	1173.	468.	861.	6562.	4547.
1/4	60	U	110	I	539	80.	948.	431.	713.	5971.	3443.
1/4	60	U	111	I	541	240.	1715.	798.	1231.	14464.	7307.
1/4	60	U	112	I	544	1151.	1809.	1356.	1424.	41582.	8854.
1/4	60	D	106	I	531	122.	959.	224.	737.	2901.	6199.
1/4	60	D	107	I	533	133.	1502.	477.	1109.	6339.	5935.
1/4	60	D	108	I	535	77.	1712.	491.	1257.	6777.	6643.
1/4	60	D	110	I	539	96.	1179.	491.	890.	6761.	4223.
1/4	60	D	111	I	541	259.	2465.	794.	1778.	14988.	10777.
1/4	60	D	112	I	544	1374.	2571.	1419.	1990.	45331.	11664.
LHE	60	U	106	I	531	106.	809.	215.	622.	2515.	4997.
LHE	60	U	107	I	533	104.	1120.	455.	828.	6278.	4320.
LHE	60	U	108	I	535	82.	1144.	469.	841.	6657.	4378.
LHE	60	U	110	I	539	127.	813.	532.	618.	7449.	3071.
LHE	60	U	111	I	541	1597.	3872.	1041.	2907.	43502.	7579.
LHE	60	U	112	I	544	7770.	4659.	1422.	3630.	197760.	10378.
LHE	60	D	106	I	531	108.	892.	216.	690.	2593.	6258.
LHE	60	D	107	I	533	148.	1283.	476.	950.	6280.	5120.
LHE	60	D	108	I	535	96.	1643.	502.	1207.	6928.	6307.
LHE	60	D	110	I	539	132.	832.	569.	635.	8072.	3128.
LHE	60	D	111	I	541	1606.	4283.	1036.	3207.	43575.	9367.
LHE	60	D	112	I	544	7780.	4839.	1420.	3757.	198230.	14459.
RHE	60	U	106	I	531	165.	1253.	290.	936.	3385.	6997.
RHE	60	U	107	I	533	116.	1559.	437.	1155.	5906.	5733.
RHE	60	U	108	I	535	99.	1033.	461.	767.	6616.	3874.
RHE	60	U	110	I	539	134.	940.	495.	713.	7082.	3872.
RHE	60	U	111	I	541	924.	2569.	932.	1908.	28647.	6149.
RHE	60	U	112	I	544	4227.	2687.	1384.	2131.	114430.	7404.
RHE	60	D	106	I	531	227.	1777.	355.	1321.	4185.	9968.
RHE	60	D	107	I	533	122.	1976.	466.	1461.	6203.	7206.
RHE	60	D	108	I	535	96.	1056.	474.	786.	6678.	3942.
RHE	60	D	110	I	539	142.	1236.	532.	930.	7498.	5056.
RHE	60	D	111	I	541	966.	2715.	949.	2015.	28987.	6766.
RHE	60	D	112	I	544	4270.	2775.	1389.	2200.	115230.	8416.
MID	NO		106	I	531	114.	827.	226.	624.	2686.	3955.

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TABLE B104 Continued

SSE SUPPORT TO GIRDER CONNECTION FLT
SUM OF ELEMENT FORCES IN ELEMENT CO-ORDINATE SYSTEM (lb, in-lb)

		ELEM		NODE	FX	FY	FZ	MX	MY	MZ
MID	NO	107	I	533	45.	1443.	428.	1060.	5998.	5579.
MID	NO	108	I	535	39.	1021.	420.	754.	5788.	4044.
MID	NO	110	I	539	64.	967.	390.	717.	5360.	3768.
MID	NO	111	I	541	719.	2036.	903.	1504.	25259.	5078.
MID	NO	112	I	544	3508.	2121.	1282.	1694.	97963.	4173.
1/4	NO	106	I	531	105.	852.	215.	658.	2514.	5405.
1/4	NO	107	I	533	80.	881.	451.	648.	6163.	3320.
1/4	NO	108	I	535	57.	893.	456.	656.	6435.	3462.
1/4	NO	110	I	539	70.	830.	409.	624.	5855.	3040.
1/4	NO	111	I	541	230.	1306.	792.	932.	14350.	5436.
1/4	NO	112	I	544	1066.	1417.	1314.	1134.	40205.	7345.
LHE	NO	106	I	531	71.	567.	194.	448.	2453.	4173.
LHE	NO	107	I	533	119.	794.	457.	592.	6377.	3183.
LHE	NO	108	I	535	91.	1100.	477.	811.	6754.	4205.
LHE	NO	110	I	539	121.	452.	524.	342.	7667.	1796.
LHE	NO	111	I	541	1248.	3069.	987.	2300.	36294.	5442.
LHE	NO	112	I	544	6058.	3652.	1327.	2864.	157850.	10086.
RHE	NO	106	I	531	129.	974.	255.	731.	2891.	5398.
RHE	NO	107	I	533	105.	1324.	440.	981.	5978.	4951.
RHE	NO	108	I	535	90.	1001.	432.	742.	6124.	3759.
RHE	NO	110	I	539	125.	800.	470.	609.	6828.	3281.
RHE	NO	111	I	541	903.	2455.	926.	1824.	28496.	5731.
RHE	NO	112	I	544	4203.	2608.	1356.	2071.	114010.	6788.
B M	NO	106	I	531	117.	749.	219.	565.	2827.	3388.
B M	NO	107	I	533	120.	1456.	489.	1069.	7666.	5714.
B M	NO	108	I	535	122.	1149.	463.	845.	7081.	4541.
B M	NO	110	I	539	111.	1048.	375.	777.	5130.	4080.
B M	NO	111	I	541	728.	2165.	899.	1597.	25270.	5774.
B M	NO	112	I	544	3518.	2183.	1276.	1737.	98175.	4707.
B L	NO	106	I	531	65.	508.	190.	402.	2386.	3354.
B L	NO	107	I	533	73.	673.	434.	498.	6031.	2617.
B L	NO	108	I	535	55.	771.	431.	567.	6115.	2968.
B L	NO	110	I	539	115.	581.	494.	434.	6828.	2246.
B L	NO	111	I	541	1537.	3514.	1047.	2643.	42531.	5607.
B L	NO	112	I	544	7490.	4347.	1352.	3400.	191180.	7918.
A M	NO	106	I	531	60.	398.	196.	311.	2596.	2140.
A M	NO	107	I	533	66.	835.	472.	616.	6827.	3297.
A M	NO	108	I	535	45.	805.	467.	594.	6772.	3132.
A M	NO	110	I	539	122.	566.	510.	426.	7047.	2309.
A M	NO	111	I	541	1468.	3338.	1160.	2509.	41504.	5005.
A M	NO	112	I	544	7158.	4115.	1569.	3226.	183500.	6466.
A G	NO	106	I	531	233.	2022.	313.	1536.	2818.	13363.
A G	NO	107	I	533	215.	846.	564.	611.	6977.	2675.
A G	NO	108	I	535	111.	2105.	612.	1539.	8330.	8162.
A G	NO	110	I	539	137.	950.	656.	683.	9579.	3786.
A G	NO	111	I	541	1309.	3978.	1048.	2968.	37291.	9001.
A G	NO	112	I	544	6236.	4464.	1434.	3448.	162360.	19946.
MAXIMUM VALUES					7780.	4839.	1569.	3757.	198230.	19946.

TABLE 8105

OBE 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	60	U	14	I	151	36258.	24707.	1926.	4784.	79560.	2031100.
MID	60	U	15	I	155	36258.	24673.	2063.	4784.	85784.	2881400.
MID	60	U	170	I	251	12103.	24733.	1912.	5646.	77482.	2682600.
MID	60	U	171	I	255	12103.	24878.	2049.	5646.	85128.	2255800.
MID	60	D	14	I	151	46002.	30847.	1976.	5333.	85616.	2552600.
MID	60	D	15	I	155	46002.	30803.	2116.	5333.	90081.	3574300.
MID	60	D	170	I	251	15312.	30432.	1956.	5706.	82791.	3260500.
MID	60	D	171	I	255	15312.	30631.	2098.	5706.	89172.	2809700.
1/4	60	U	14	I	151	35500.	21984.	1885.	4016.	74303.	1808400.
1/4	60	U	15	I	155	35500.	21837.	1973.	4016.	78100.	2632500.
1/4	60	U	170	I	251	14474.	26863.	1944.	5642.	81976.	3231000.
1/4	60	U	171	I	255	14474.	27258.	2099.	5642.	88856.	2160700.
1/4	60	D	14	I	151	43203.	30943.	1926.	4854.	79295.	2526500.
1/4	60	D	15	I	155	43203.	30761.	2017.	4854.	81566.	3665500.
1/4	60	D	170	I	251	19619.	29544.	2026.	5687.	91763.	3488300.
1/4	60	D	171	I	255	19619.	29969.	2189.	5687.	96077.	2446300.
LHE	60	U	14	I	151	70290.	26786.	1914.	5475.	77744.	2713700.
LHE	60	U	15	I	155	70290.	26882.	1986.	5475.	78874.	2878500.
LHE	60	U	170	I	251	22387.	41617.	2032.	5082.	92127.	5501500.
LHE	60	U	171	I	255	22387.	42691.	2170.	5082.	94478.	2880400.
LHE	60	D	14	I	151	71419.	34873.	1930.	6037.	79783.	3171600.
LHE	60	D	15	I	155	71419.	34724.	2005.	6037.	80283.	3985900.
LHE	60	D	170	I	251	24665.	41757.	2116.	5089.	102280.	5536600.
LHE	60	D	171	I	255	24665.	42836.	2260.	5089.	101700.	2881100.
RHE	60	U	14	I	151	34200.	15335.	1949.	2856.	82688.	1253400.
RHE	60	U	15	I	155	34200.	15312.	2088.	2856.	87660.	1800400.
RHE	60	U	170	I	251	10718.	20782.	1872.	4384.	72557.	2344700.
RHE	60	U	171	I	255	10718.	20839.	1948.	4384.	75997.	1953100.
RHE	60	D	14	I	151	46503.	18516.	2029.	3110.	92233.	1556600.
RHE	60	D	15	I	155	46503.	18583.	2171.	3110.	94384.	2138800.
RHE	60	D	170	I	251	12858.	28583.	1906.	5334.	76324.	3192500.
RHE	60	D	171	I	255	12858.	28664.	1978.	5334.	78677.	2634500.
MID	NO		14	I	151	26309.	17655.	1885.	4018.	74531.	1464800.
MID	NO		15	I	155	26309.	17609.	1999.	4018.	80463.	2047500.
MID	NO		170	I	251	8844.	17515.	1874.	4428.	72965.	1882500.
MID	NO		171	I	255	8844.	17615.	1988.	4428.	79904.	1611900.
1/4	NO		14	I	151	31416.	16167.	1865.	3401.	71757.	1346500.
1/4	NO		15	I	155	31416.	16033.	1941.	3401.	75491.	1971800.
1/4	NO		170	I	251	11296.	25520.	1910.	5523.	77417.	3104300.
1/4	NO		171	I	255	11296.	25904.	2027.	5523.	82805.	2015900.
LHE	NO		14	I	151	22039.	15215.	1822.	3063.	66752.	1116500.
LHE	NO		15	I	155	22039.	14880.	1892.	3063.	71345.	1967800.
LHE	NO		170	I	251	7372.	16707.	1950.	1740.	81463.	2396800.
LHE	NO		171	I	255	7372.	17158.	2023.	1740.	82316.	971700.
RHE	NO		14	I	151	26507.	13564.	1920.	2825.	78829.	1080000.
RHE	NO		15	I	155	26507.	13469.	2024.	2825.	82259.	1619400.
RHE	NO		170	I	251	9420.	15866.	1856.	3984.	70745.	1811600.
RHE	NO		171	I	255	9420.	15904.	1927.	3984.	74133.	1532000.
B M	NO		14	I	151	12159.	21587.	1885.	5611.	74235.	2034800.

Continued

(1/20/91.287)

TABLE E105 Continued

OBE 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
B	M	NO	15	I 155	12159.	21586.	2015.	5611.	82239.	2275900.
B	M	NO	170	I 251	9640.	17114.	1882.	5351.	74054.	1838400.
B	M	NO	171	I 255	9640.	17222.	2025.	5351.	83126.	1580700.
B	L	NO	14	I 151	6613.	18907.	1852.	4218.	69632.	2003900.
B	L	NO	15	I 155	6613.	18928.	1911.	4218.	73255.	1847700.
B	L	NO	170	I 251	10432.	7396.	1951.	2123.	81709.	1004400.
B	L	NO	171	I 255	10432.	7630.	2035.	2123.	83454.	491500.
A	M	NO	14	I 151	8598.	18171.	1859.	4064.	70764.	1727100.
A	M	NO	15	I 155	8598.	18107.	1926.	4064.	74377.	1900100.
A	M	NO	170	I 251	5405.	4765.	1924.	1730.	78420.	621360.
A	M	NO	171	I 255	5405.	4906.	2007.	1730.	81300.	340700.
A	Q	NO	14	I 151	10260.	36017.	1905.	6430.	75268.	3130300.
A	Q	NO	15	I 155	10260.	35279.	1939.	6430.	75774.	3978900.
A	Q	NO	170	I 251	17148.	25277.	2168.	2330.	106890.	3582200.
A	Q	NO	171	I 255	17148.	25819.	2224.	2330.	98634.	1493000.
MAXIMUM VALUES					71419.	42836.	2260.	6430.	106890.	5536600.

TABLE B106

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	60	U	14	I	151	44999.	31591.	1972.	5782.	84985.	2560400.
MID	60	U	15	I	155	44999.	31524.	2111.	5782.	89751.	3725000.
MID	60	U	170	I	251	15340.	32286.	1958.	7367.	82665.	3557500.
MID	60	U	171	I	255	15340.	32437.	2096.	7367.	89145.	2891700.
MID	60	D	14	I	151	63869.	43104.	2070.	6832.	96795.	3553100.
MID	60	D	15	I	155	63869.	43024.	2216.	6832.	98255.	5006800.
MID	60	D	170	I	251	21478.	42675.	2044.	7357.	92933.	4584800.
MID	60	D	171	I	255	21478.	42940.	2192.	7357.	97106.	3926600.
1/4	60	U	14	I	151	57311.	28632.	1934.	5310.	80137.	2372600.
1/4	60	U	15	I	155	57311.	28384.	2024.	5310.	82267.	3528700.
1/4	60	U	170	I	251	20305.	47646.	2015.	8985.	90287.	5810300.
1/4	60	U	171	I	255	20305.	48363.	2178.	8985.	95318.	3742300.
1/4	60	D	14	I	151	68765.	44118.	2002.	6600.	88367.	3606600.
1/4	60	D	15	I	155	68765.	43823.	2097.	6600.	88002.	5285600.
1/4	60	D	170	I	251	28790.	51277.	2155.	9001.	107080.	6154300.
1/4	60	D	171	I	255	28790.	52033.	2331.	9001.	107700.	4138200.
LHE	60	U	14	I	151	132370.	40401.	2023.	8734.	90741.	4617000.
LHE	60	U	15	I	155	132370.	41000.	2094.	8734.	87363.	3930300.
LHE	60	U	170	I	251	40197.	79297.	2184.	8875.	110010.	10468000.
LHE	60	U	171	I	255	40197.	81344.	2327.	8875.	107280.	5494400.
LHE	60	D	14	I	151	133760.	52835.	2044.	9486.	93460.	5250300.
LHE	60	D	15	I	155	133760.	52953.	2119.	9486.	89260.	5757400.
LHE	60	D	170	I	251	43189.	79467.	2314.	8884.	125620.	10511000.
LHE	60	D	171	I	255	43189.	81520.	2466.	8884.	118460.	5495200.
RHE	60	U	14	I	151	44924.	24104.	2016.	4074.	90899.	1886800.
RHE	60	U	15	I	155	44924.	23912.	2160.	4074.	93221.	2896600.
RHE	60	U	170	I	251	16798.	26843.	1907.	5711.	77232.	3087200.
RHE	60	U	171	I	255	16798.	26915.	1994.	5711.	79263.	2616400.
RHE	60	D	14	I	151	66079.	28975.	2157.	4473.	107630.	2361100.
RHE	60	D	15	I	155	66079.	28938.	2305.	4473.	105170.	3409700.
RHE	60	D	170	I	251	20362.	40283.	1965.	7321.	83671.	4534400.
RHE	60	D	171	I	255	20362.	40399.	2045.	7321.	83817.	3774100.
MID	NO		14	I	151	32991.	22602.	1920.	4873.	78624.	1856500.
MID	NO		15	I	155	32991.	22493.	2036.	4873.	83424.	2635500.
MID	NO		170	I	251	11492.	22688.	1906.	5477.	76721.	2463800.
MID	NO		171	I	255	11492.	22786.	2023.	5477.	82806.	2062600.
1/4	NO		14	I	151	53554.	21585.	1911.	4541.	77224.	1821400.
1/4	NO		15	I	155	53554.	21332.	1990.	4541.	79391.	2754500.
1/4	NO		170	I	251	16774.	46445.	1972.	8784.	84558.	5699100.
1/4	NO		171	I	255	16774.	47154.	2093.	8784.	88260.	3610800.
LHE	NO		14	I	151	29895.	25561.	1839.	3960.	69195.	1571000.
LHE	NO		15	I	155	29895.	24796.	1919.	3960.	73232.	3534900.
LHE	NO		170	I	251	10949.	30724.	2085.	2507.	97346.	4418000.
LHE	NO		171	I	255	10949.	31496.	2150.	2507.	92475.	1769100.
RHE	NO		14	I	151	36585.	22454.	1983.	4114.	86632.	1720300.
RHE	NO		15	I	155	36585.	22182.	2091.	4114.	87436.	2730500.
RHE	NO		170	I	251	15379.	21353.	1889.	5457.	75216.	2498900.
RHE	NO		171	I	255	15379.	21403.	1972.	5457.	77387.	2158400.
B M	NO		14	I	151	15829.	28117.	1928.	6959.	79094.	2648700.

Continued

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TABLE B106 Continued

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
B	M	NO	15	I	155	15829.	28097.	2060.	6959.	85990.	2961600.
B	M	NO	170	I	251	12975.	22707.	1925.	6815.	79141.	2471300.
B	M	NO	171	I	255	12975.	22828.	2077.	6815.	87375.	2072700.
B	L	NO	14	I	151	9514.	26124.	1878.	5437.	72738.	2913600.
B	L	NO	15	I	155	9514.	26303.	1943.	5437.	75748.	2488100.
B	L	NO	170	I	251	16649.	12999.	2016.	3176.	89493.	1761400.
B	L	NO	171	I	255	16649.	13410.	2100.	3176.	88597.	866190.
A	M	NO	14	I	151	10636.	22415.	1879.	4751.	73185.	2127400.
A	M	NO	15	I	155	10636.	22334.	1948.	4751.	76235.	2342200.
A	M	NO	170	I	251	9354.	7087.	1973.	2089.	84107.	935490.
A	M	NO	171	I	255	9354.	7242.	2052.	2089.	84988.	489620.
A	Q	NO	14	I	151	13040.	61695.	1985.	9802.	83476.	5307500.
A	Q	NO	15	I	155	13040.	60238.	1981.	9802.	79552.	6831400.
A	Q	NO	170	I	251	32667.	43646.	2493.	3206.	144730.	6215200.
A	Q	NO	171	I	255	32667.	44507.	2521.	3206.	122520.	2541100.
MAXIMUM VALUES						133760.	81520.	2521.	9802.	144730.	10511000.

TABLE 8107

OBE MAIN TROLLEY REACTIONS

SUM OF ELEMENT FORCES IN ELEMENT CO-ORDINATE SYSTEM (lb, in-lb)

			ELEM		NODE	FX	FY	FZ	MX	MY	MZ
MID	60	U	146	J	391	121530.	0.	0.	0.	0.	0.
MID	60	U	147	J	393	75909.	20345.	12157.	0.	0.	0.
MID	60	U	148	J	392	116010.	19874.	0.	0.	0.	0.
MID	60	U	149	J	394	81454.	0.	12007.	0.	0.	0.
MID	60	D	146	J	391	172930.	0.	0.	0.	0.	0.
MID	60	D	147	J	393	128110.	25738.	12607.	0.	0.	0.
MID	60	D	148	J	392	168420.	25225.	0.	0.	0.	0.
MID	60	D	149	J	394	132550.	0.	12634.	0.	0.	0.
1/4	60	U	146	J	391	91235.	0.	0.	0.	0.	0.
1/4	60	U	147	J	393	77078.	24551.	14422.	0.	0.	0.
1/4	60	U	148	J	392	112610.	15690.	0.	0.	0.	0.
1/4	60	U	149	J	394	57248.	0.	14209.	0.	0.	0.
1/4	60	D	146	J	391	150280.	0.	0.	0.	0.	0.
1/4	60	D	147	J	393	134480.	33446.	16064.	0.	0.	0.
1/4	60	D	148	J	392	173260.	21659.	0.	0.	0.	0.
1/4	60	D	149	J	394	111340.	0.	15977.	0.	0.	0.
LHE	60	U	146	J	391	93542.	0.	0.	0.	0.	0.
LHE	60	U	147	J	393	79244.	30666.	16661.	0.	0.	0.
LHE	60	U	148	J	392	112320.	20005.	0.	0.	0.	0.
LHE	60	U	149	J	394	59829.	0.	16232.	0.	0.	0.
LHE	60	D	146	J	391	141310.	0.	0.	0.	0.	0.
LHE	60	D	147	J	393	127130.	43219.	19597.	0.	0.	0.
LHE	60	D	148	J	392	161160.	22327.	0.	0.	0.	0.
LHE	60	D	149	J	394	106990.	0.	19341.	0.	0.	0.
RHE	60	U	146	J	391	104740.	0.	0.	0.	0.	0.
RHE	60	U	147	J	393	55942.	10924.	9344.	0.	0.	0.
RHE	60	U	148	J	392	85532.	22939.	0.	0.	0.	0.
RHE	60	U	149	J	394	78248.	0.	9578.	0.	0.	0.
RHE	60	D	146	J	391	161210.	0.	0.	0.	0.	0.
RHE	60	D	147	J	393	110660.	13806.	11210.	0.	0.	0.
RHE	60	D	148	J	392	139480.	31193.	0.	0.	0.	0.
RHE	60	D	149	J	394	133660.	0.	11093.	0.	0.	0.
MID	NO		146	J	391	64638.	0.	0.	0.	0.	0.
MID	NO		147	J	393	26375.	14646.	11322.	0.	0.	0.
MID	NO		148	J	392	60999.	14315.	0.	0.	0.	0.
MID	NO		149	J	394	29814.	0.	11335.	0.	0.	0.
1/4	NO		146	J	391	53409.	0.	0.	0.	0.	0.
1/4	NO		147	J	393	40873.	19038.	13468.	0.	0.	0.
1/4	NO		148	J	392	72666.	12004.	0.	0.	0.	0.
1/4	NO		149	J	394	20615.	0.	13235.	0.	0.	0.
LHE	NO		146	J	391	52261.	0.	0.	0.	0.	0.
LHE	NO		147	J	393	39156.	25983.	15233.	0.	0.	0.
LHE	NO		148	J	392	68148.	7564.	0.	0.	0.	0.
LHE	NO		149	J	394	22366.	0.	15771.	0.	0.	0.
RHE	NO		146	J	391	68419.	0.	0.	0.	0.	0.
RHE	NO		147	J	393	22285.	9393.	10120.	0.	0.	0.
RHE	NO		148	J	392	54164.	17889.	0.	0.	0.	0.
RHE	NO		149	J	394	42822.	0.	9967.	0.	0.	0.
B M	NO		146	J	391	58308.	0.	0.	0.	0.	0.

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TABLE 8107 Continued

OBE MAIN TROLLEY REACTIONS
SUM OF ELEMENT FORCES IN ELEMENT CO-ORDINATE SYSTEM (lb, in-lb)

			ELEM	NODE	FX	FY	FZ	MX	MY	MZ
B	M	NO	147	J 393	32839.	15311.	11883.	0.	0.	0.
B	M	NO	148	J 392	68228.	12521.	0.	0.	0.	0.
B	M	NO	149	J 394	23118.	0.	11769.	0.	0.	0.
B	L	NO	146	J 391	51883.	0.	0.	0.	0.	0.
B	L	NO	147	J 393	39091.	22695.	15323.	0.	0.	0.
B	L	NO	148	J 392	68935.	21288.	0.	0.	0.	0.
B	L	NO	149	J 394	20777.	0.	15964.	0.	0.	0.
A	M	NO	146	J 391	50448.	0.	0.	0.	0.	0.
A	M	NO	147	J 393	37927.	18536.	13577.	0.	0.	0.
A	M	NO	148	J 392	69864.	5680.	0.	0.	0.	0.
A	M	NO	149	J 394	19189.	0.	14782.	0.	0.	0.
A	Q	NO	146	J 391	53612.	0.	0.	0.	0.	0.
A	Q	NO	147	J 393	43237.	45224.	19303.	0.	0.	0.
A	Q	NO	148	J 392	70180.	23023.	0.	0.	0.	0.
A	Q	NO	149	J 394	25224.	0.	19739.	0.	0.	0.
MAXIMUM VALUES					173260.	45224.	19739.	0.	0.	0.

EFS-1.3 FOR SRSS-4.3

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TABLE 8108

OBE MAIN TROLLEY REACTIONS

DIFFERENCE OF ELEMENT FORCES IN ELEMENT CO-ORDINATE SYSTEM (lb, in-lb)

			ELEM	NODE	FX	FY	FZ	MX	MY	MZ
MID	60	U	146	J 391	41790.	0.	0.	0.	0.	0.
MID	60	U	147	J 393	24760.	-20142.	-12048.	0.	0.	0.
MID	60	U	148	J 392	41426.	-19672.	0.	0.	0.	0.
MID	60	U	149	J 394	25101.	0.	-11898.	0.	0.	0.
MID	60	D	146	J 391	-9606.	0.	0.	0.	0.	0.
MID	60	D	147	J 393	-27440.	-25536.	-12498.	0.	0.	0.
MID	60	D	148	J 392	-10992.	-25023.	0.	0.	0.	0.
MID	60	D	149	J 394	-25993.	0.	-12525.	0.	0.	0.
1/4	60	U	146	J 391	51561.	0.	0.	0.	0.	0.
1/4	60	U	147	J 393	44115.	-24384.	-14332.	0.	0.	0.
1/4	60	U	148	J 392	65351.	-15523.	0.	0.	0.	0.
1/4	60	U	149	J 394	28782.	0.	-14119.	0.	0.	0.
1/4	60	D	146	J 391	-7489.	0.	0.	0.	0.	0.
1/4	60	D	147	J 393	-13292.	-33279.	-15974.	0.	0.	0.
1/4	60	D	148	J 392	4697.	-21492.	0.	0.	0.	0.
1/4	60	D	149	J 394	-25309.	0.	-15887.	0.	0.	0.
LHE	60	U	146	J 391	49782.	0.	0.	0.	0.	0.
LHE	60	U	147	J 393	41421.	-30625.	-16638.	0.	0.	0.
LHE	60	U	148	J 392	65104.	-19963.	0.	0.	0.	0.
LHE	60	U	149	J 394	26730.	0.	-16209.	0.	0.	0.
LHE	60	D	146	J 391	2011.	0.	0.	0.	0.	0.
LHE	60	D	147	J 393	-6467.	-43177.	-19574.	0.	0.	0.
LHE	60	D	148	J 392	16271.	-22285.	0.	0.	0.	0.
LHE	60	D	149	J 394	-20427.	0.	-19319.	0.	0.	0.
RHE	60	U	146	J 391	73626.	0.	0.	0.	0.	0.
RHE	60	U	147	J 393	29681.	-10668.	-9205.	0.	0.	0.
RHE	60	U	148	J 392	56856.	-22682.	0.	0.	0.	0.
RHE	60	U	149	J 394	43353.	0.	-9440.	0.	0.	0.
RHE	60	D	146	J 391	17153.	0.	0.	0.	0.	0.
RHE	60	D	147	J 393	-25033.	-13550.	-11072.	0.	0.	0.
RHE	60	D	148	J 392	2908.	-30937.	0.	0.	0.	0.
RHE	60	D	149	J 394	-12057.	0.	-10954.	0.	0.	0.
MID	NO		146	J 391	38928.	0.	0.	0.	0.	0.
MID	NO		147	J 393	14055.	-14462.	-11223.	0.	0.	0.
MID	NO		148	J 392	36696.	-14131.	0.	0.	0.	0.
MID	NO		149	J 394	16487.	0.	-11236.	0.	0.	0.
1/4	NO		146	J 391	29626.	0.	0.	0.	0.	0.
1/4	NO		147	J 393	20089.	-18860.	-13372.	0.	0.	0.
1/4	NO		148	J 392	45560.	-11826.	0.	0.	0.	0.
1/4	NO		149	J 394	5156.	0.	-13138.	0.	0.	0.
LHE	NO		146	J 391	32574.	0.	0.	0.	0.	0.
LHE	NO		147	J 393	20005.	-25875.	-15174.	0.	0.	0.
LHE	NO		148	J 392	48278.	-7456.	0.	0.	0.	0.
LHE	NO		149	J 394	5205.	0.	-15713.	0.	0.	0.
RHE	NO		146	J 391	50209.	0.	0.	0.	0.	0.
RHE	NO		147	J 393	3083.	-9067.	-9944.	0.	0.	0.
RHE	NO		148	J 392	28469.	-17563.	0.	0.	0.	0.
RHE	NO		149	J 394	18541.	0.	-9791.	0.	0.	0.
B M	NO		146	J 391	34478.	0.	0.	0.	0.	0.

Continued

TABLE 8108 Continued

OBE MAIN TROLLEY REACTIONS

DIFFERENCE OF ELEMENT FORCES IN ELEMENT CO-ORDINATE SYSTEM (lb, in-lb)

			ELEM	NODE	FX	FY	FZ	MX	MY	MZ
B	M	NO	147	J 393	18372.	-15092.	-11765.	0.	0.	0.
B	M	NO	148	J 392	40247.	-12302.	0.	0.	0.	0.
B	M	NO	149	J 394	12402.	0.	-11651.	0.	0.	0.
B	L	NO	146	J 391	32130.	0.	0.	0.	0.	0.
B	L	NO	147	J 393	20892.	-21439.	-14644.	0.	0.	0.
B	L	NO	148	J 392	48312.	-20031.	0.	0.	0.	0.
B	L	NO	149	J 394	5971.	0.	-15285.	0.	0.	0.
A	M	NO	146	J 391	31997.	0.	0.	0.	0.	0.
A	M	NO	147	J 393	23624.	-17911.	-13239.	0.	0.	0.
A	M	NO	148	J 392	48951.	-5056.	0.	0.	0.	0.
A	M	NO	149	J 394	5991.	0.	-14444.	0.	0.	0.
A	Q	NO	146	J 391	30258.	0.	0.	0.	0.	0.
A	Q	NO	147	J 393	16888.	-44897.	-19126.	0.	0.	0.
A	Q	NO	148	J 392	47210.	-22696.	0.	0.	0.	0.
A	Q	NO	149	J 394	1382.	0.	-19562.	0.	0.	0.
MINIMUM VALUES					-27440.	-44897.	-19574.	0.	0.	0.

TABLE B109

SSE MAIN TROLLEY REACTIONS

SUM OF ELEMENT FORCES IN ELEMENT CO-ORDINATE SYSTEM (lb, in-lb)

		ELEM		NODE	FX	FY	FZ	MX	MY	MZ
MID	60 U	146	J	391	152480.	0.	0.	0.	0.	0.
MID	60 U	147	J	393	96050.	25598.	21957.	0.	0.	0.
MID	60 U	148	J	392	145100.	24851.	0.	0.	0.	0.
MID	60 U	149	J	394	103490.	0.	21683.	0.	0.	0.
MID	60 D	146	J	391	252730.	0.	0.	0.	0.	0.
MID	60 D	147	J	393	196120.	35935.	22564.	0.	0.	0.
MID	60 D	148	J	392	246820.	35157.	0.	0.	0.	0.
MID	60 D	149	J	394	201880.	0.	22577.	0.	0.	0.
1/4	60 U	146	J	391	115840.	0.	0.	0.	0.	0.
1/4	60 U	147	J	393	97569.	34361.	26624.	0.	0.	0.
1/4	60 U	148	J	392	142980.	21575.	0.	0.	0.	0.
1/4	60 U	149	J	394	73363.	0.	26018.	0.	0.	0.
1/4	60 D	146	J	391	219080.	0.	0.	0.	0.	0.
1/4.	60 D	147	J	393	199190.	49092.	28739.	0.	0.	0.
1/4	60 D	148	J	392	246950.	31651.	0.	0.	0.	0.
1/4	60 D	149	J	394	171130.	0.	28259.	0.	0.	0.
LHE	60 U	146	J	391	115630.	0.	0.	0.	0.	0.
LHE	60 U	147	J	393	98214.	40499.	29377.	0.	0.	0.
LHE	60 U	148	J	392	137730.	36116.	0.	0.	0.	0.
LHE	60 U	149	J	394	75386.	0.	28415.	0.	0.	0.
LHE	60 D	146	J	391	202280.	0.	0.	0.	0.	0.
LHE	60 D	147	J	393	185690.	61647.	32935.	0.	0.	0.
LHE	60 D	148	J	392	224720.	39156.	0.	0.	0.	0.
LHE	60 D	149	J	394	162800.	0.	32289.	0.	0.	0.
RHE	60 U	146	J	391	125440.	0.	0.	0.	0.	0.
RHE	60 U	147	J	393	70362.	16988.	19406.	0.	0.	0.
RHE	60 U	148	J	392	101800.	30764.	0.	0.	0.	0.
RHE	60 U	149	J	394	98714.	0.	20127.	0.	0.	0.
RHE	60 D	146	J	391	224450.	0.	0.	0.	0.	0.
RHE	60 D	147	J	393	169590.	21701.	21811.	0.	0.	0.
RHE	60 D	148	J	392	199170.	45079.	0.	0.	0.	0.
RHE	60 D	149	J	394	197170.	0.	21648.	0.	0.	0.
MID	NO	146	J	391	80895.	0.	0.	0.	0.	0.
MID	NO	147	J	393	33813.	18627.	21046.	0.	0.	0.
MID	NO	148	J	392	76203.	18079.	0.	0.	0.	0.
MID	NO	149	J	394	38099.	0.	21051.	0.	0.	0.
1/4	NO	146	J	391	65820.	0.	0.	0.	0.	0.
1/4	NO	147	J	393	51446.	28220.	25453.	0.	0.	0.
1/4	NO	148	J	392	88714.	17438.	0.	0.	0.	0.
1/4	NO	149	J	394	27586.	0.	24915.	0.	0.	0.
LHE	NO	146	J	391	60069.	0.	0.	0.	0.	0.
LHE	NO	147	J	393	47620.	48726.	29992.	0.	0.	0.
LHE	NO	148	J	392	77249.	14510.	0.	0.	0.	0.
LHE	NO	149	J	394	29587.	0.	31126.	0.	0.	0.
RHE	NO	146	J	391	79193.	0.	0.	0.	0.	0.
RHE	NO	147	J	393	29966.	15556.	20271.	0.	0.	0.
RHE	NO	148	J	392	65221.	25262.	0.	0.	0.	0.
RHE	NO	149	J	394	54644.	0.	19998.	0.	0.	0.
B M	NO	146	J	391	73358.	0.	0.	0.	0.	0.

Continued

TABLE B109 Continued

SSE MAIN TROLLEY REACTIONS
SUM OF ELEMENT FORCES IN ELEMENT CO-ORDINATE SYSTEM (lb, in-lb)

			ELEM	NODE	FX	FY	FZ	MX	MY	MZ
B	M	NO	147	J 393	42154.	21224.	22325.	0.	0.	0.
B	M	NO	148	J 392	86379.	16836.	0.	0.	0.	0.
B	M	NO	149	J 394	29578.	0.	22088.	0.	0.	0.
B	L	NO	146	J 391	60014.	0.	0.	0.	0.	0.
B	L	NO	147	J 393	47045.	33449.	27932.	0.	0.	0.
B	L	NO	148	J 392	78975.	37167.	0.	0.	0.	0.
B	L	NO	149	J 394	26746.	0.	29237.	0.	0.	0.
A	M	NO	146	J 391	56774.	0.	0.	0.	0.	0.
A	M	NO	147	J 393	43771.	23272.	24487.	0.	0.	0.
A	M	NO	148	J 392	79313.	9252.	0.	0.	0.	0.
A	M	NO	149	J 394	24205.	0.	27042.	0.	0.	0.
A	Q	NO	146	J 391	62303.	0.	0.	0.	0.	0.
A	Q	NO	147	J 393	52805.	81289.	35696.	0.	0.	0.
A	Q	NO	148	J 392	79863.	41380.	0.	0.	0.	0.
A	Q	NO	149	J 394	33169.	0.	36605.	0.	0.	0.
MAXIMUM VALUES					252730.	81289.	36605.	0.	0.	0.

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TABLE B110

SSE MAIN TROLLEY REACTIONS
DIFFERENCE OF ELEMENT FORCES IN ELEMENT CO-ORDINATE SYSTEM (lb, in-lb)

			ELEM		NODE	FX	FY	FZ	MX	MY	MZ
MID	60	U	146	J	391	10836.	0.	0.	0.	0.	0.
MID	60	U	147	J	393	4619.	-25395.	-21848.	0.	0.	0.
MID	60	U	148	J	392	12334.	-24649.	0.	0.	0.	0.
MID	60	U	149	J	394	3068.	0.	-21574.	0.	0.	0.
MID	60	D	146	J	391	-89405.	0.	0.	0.	0.	0.
MID	60	D	147	J	393	-95454.	-35733.	-22454.	0.	0.	0.
MID	60	D	148	J	392	-89392.	-34954.	0.	0.	0.	0.
MID	60	D	149	J	394	-95322.	0.	-22468.	0.	0.	0.
1/4	60	U	146	J	391	26955.	0.	0.	0.	0.	0.
1/4	60	U	147	J	393	23624.	-34194.	-26534.	0.	0.	0.
1/4	60	U	148	J	392	34974.	-21408.	0.	0.	0.	0.
1/4	60	U	149	J	394	12668.	0.	-25927.	0.	0.	0.
1/4	60	D	146	J	391	-76287.	0.	0.	0.	0.	0.
1/4	60	D	147	J	393	-77997.	-48924.	-28648.	0.	0.	0.
1/4	60	D	148	J	392	-68989.	-31483.	0.	0.	0.	0.
1/4	60	D	149	J	394	-85099.	0.	-28168.	0.	0.	0.
LHE	60	U	146	J	391	27693.	0.	0.	0.	0.	0.
LHE	60	U	147	J	393	22450.	-40458.	-29355.	0.	0.	0.
LHE	60	U	148	J	392	39701.	-36075.	0.	0.	0.	0.
LHE	60	U	149	J	394	11173.	0.	-28393.	0.	0.	0.
LHE	60	D	146	J	391	-58955.	0.	0.	0.	0.	0.
LHE	60	D	147	J	393	-65026.	-61605.	-32913.	0.	0.	0.
LHE	60	D	148	J	392	-47288.	-39114.	0.	0.	0.	0.
LHE	60	D	149	J	394	-76239.	0.	-32267.	0.	0.	0.
RHE	60	U	146	J	391	52930.	0.	0.	0.	0.	0.
RHE	60	U	147	J	393	15261.	-16732.	-19268.	0.	0.	0.
RHE	60	U	148	J	392	40587.	-30507.	0.	0.	0.	0.
RHE	60	U	149	J	394	22887.	0.	-19989.	0.	0.	0.
RHE	60	D	146	J	391	-46088.	0.	0.	0.	0.	0.
RHE	60	D	147	J	393	-83964.	-21444.	-21672.	0.	0.	0.
RHE	60	D	148	J	392	-56785.	-44823.	0.	0.	0.	0.
RHE	60	D	149	J	394	-75572.	0.	-21509.	0.	0.	0.
MID	NO		146	J	391	22671.	0.	0.	0.	0.	0.
MID	NO		147	J	393	6617.	-18443.	-20947.	0.	0.	0.
MID	NO		148	J	392	21491.	-17895.	0.	0.	0.	0.
MID	NO		149	J	394	8202.	0.	-20952.	0.	0.	0.
1/4	NO		146	J	391	17215.	0.	0.	0.	0.	0.
1/4	NO		147	J	393	9515.	-28042.	-25357.	0.	0.	0.
1/4	NO		148	J	392	29512.	-17260.	0.	0.	0.	0.
1/4	NO		149	J	394	-1816.	0.	-24819.	0.	0.	0.
LHE	NO		146	J	391	24766.	0.	0.	0.	0.	0.
LHE	NO		147	J	393	11540.	-48619.	-29934.	0.	0.	0.
LHE	NO		148	J	392	39176.	-14402.	0.	0.	0.	0.
LHE	NO		149	J	394	-2016.	0.	-31068.	0.	0.	0.
RHE	NO		146	J	391	39435.	0.	0.	0.	0.	0.
RHE	NO		147	J	393	-4598.	-15230.	-20095.	0.	0.	0.
RHE	NO		148	J	392	17411.	-24936.	0.	0.	0.	0.
RHE	NO		149	J	394	6719.	0.	-19821.	0.	0.	0.
B M	NO		146	J	391	19428.	0.	0.	0.	0.	0.

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TABLE 8110 Continued

SSE MAIN TROLLEY REACTIONS

DIFFERENCE OF ELEMENT FORCES IN ELEMENT CO-ORDINATE SYSTEM (lb, in-lb)

			ELEM	NODE	FX	FY	FZ	MX	MY	MZ
B	M	NO	147	J 393	9056.	-21005.	-22207.	0.	0.	0.
B	M	NO	148	J 392	22096.	-16617.	0.	0.	0.	0.
B	M	NO	149	J 394	5943.	0.	-21970.	0.	0.	0.
B	L	NO	146	J 391	24000.	0.	0.	0.	0.	0.
B	L	NO	147	J 393	12937.	-32193.	-27253.	0.	0.	0.
B	L	NO	148	J 392	38273.	-35910.	0.	0.	0.	0.
B	L	NO	149	J 394	2.	0.	-28558.	0.	0.	0.
A	M	NO	146	J 391	25671.	0.	0.	0.	0.	0.
A	M	NO	147	J 393	17780.	-22647.	-24149.	0.	0.	0.
A	M	NO	148	J 392	39503.	-8628.	0.	0.	0.	0.
A	M	NO	149	J 394	975.	0.	-26705.	0.	0.	0.
A	Q	NO	146	J 391	21567.	0.	0.	0.	0.	0.
A	Q	NO	147	J 393	7321.	-80962.	-35519.	0.	0.	0.
A	Q	NO	148	J 392	37527.	-41053.	0.	0.	0.	0.
A	Q	NO	149	J 394	-6563.	0.	-36428.	0.	0.	0.
MINIMUM VALUES					-95454.	-80962.	-36428.	0.	0.	0.

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TABLE 8111

OBE AUX TROLLEY REACTIONS
SUM OF ELEMENT FORCES IN ELEMENT CO-ORDINATE SYSTEM (lb, in-lb)

			ELEM		NODE	FX	FY	FZ	MX	MY	MZ
MID	60	U	158	J	341	21939.	0.	0.	0.	0.	0.
MID	60	U	159	J	343	8948.	20666.	6107.	0.	0.	0.
MID	60	U	160	J	342	6462.	21075.	0.	0.	0.	0.
MID	60	U	161	J	344	17619.	0.	6212.	0.	0.	0.
MID	60	D	158	J	341	22350.	0.	0.	0.	0.	0.
MID	60	D	159	J	343	9204.	26148.	7423.	0.	0.	0.
MID	60	D	160	J	342	7046.	26557.	0.	0.	0.	0.
MID	60	D	161	J	344	18199.	0.	7643.	0.	0.	0.
1/4	60	U	158	J	341	18817.	0.	0.	0.	0.	0.
1/4	60	U	159	J	343	6065.	28120.	7681.	0.	0.	0.
1/4	60	U	160	J	342	9619.	30410.	0.	0.	0.	0.
1/4	60	U	161	J	344	14006.	0.	8168.	0.	0.	0.
1/4	60	D	158	J	341	20127.	0.	0.	0.	0.	0.
1/4	60	D	159	J	343	7340.	32321.	8876.	0.	0.	0.
1/4	60	D	160	J	342	11131.	34051.	0.	0.	0.	0.
1/4	60	D	161	J	344	15493.	0.	9265.	0.	0.	0.
LHE	60	U	158	J	341	20522.	0.	0.	0.	0.	0.
LHE	60	U	159	J	343	7889.	64057.	17129.	0.	0.	0.
LHE	60	U	160	J	342	12166.	66325.	0.	0.	0.	0.
LHE	60	U	161	J	344	15529.	0.	18034.	0.	0.	0.
LHE	60	D	158	J	341	21971.	0.	0.	0.	0.	0.
LHE	60	D	159	J	343	9197.	64291.	17195.	0.	0.	0.
LHE	60	D	160	J	342	13689.	66408.	0.	0.	0.	0.
LHE	60	D	161	J	344	16933.	0.	18090.	0.	0.	0.
RHE	60	U	158	J	341	16568.	0.	0.	0.	0.	0.
RHE	60	U	159	J	343	3809.	10400.	3315.	0.	0.	0.
RHE	60	U	160	J	342	9124.	11893.	0.	0.	0.	0.
RHE	60	U	161	J	344	12125.	0.	3498.	0.	0.	0.
RHE	60	D	158	J	341	16970.	0.	0.	0.	0.	0.
RHE	60	D	159	J	343	4180.	13767.	4320.	0.	0.	0.
RHE	60	D	160	J	342	9608.	15942.	0.	0.	0.	0.
RHE	60	D	161	J	344	12753.	0.	4625.	0.	0.	0.
MID	NO		158	J	341	20070.	0.	0.	0.	0.	0.
MID	NO		159	J	343	7174.	15080.	4413.	0.	0.	0.
MID	NO		160	J	342	4706.	15350.	0.	0.	0.	0.
MID	NO		161	J	344	15476.	0.	4502.	0.	0.	0.
1/4	NO		158	J	341	17426.	0.	0.	0.	0.	0.
1/4	NO		159	J	343	4813.	26104.	7204.	0.	0.	0.
1/4	NO		160	J	342	8496.	28759.	0.	0.	0.	0.
1/4	NO		161	J	344	12876.	0.	7614.	0.	0.	0.
LHE	NO		158	J	341	17798.	0.	0.	0.	0.	0.
LHE	NO		159	J	343	4904.	22641.	6314.	0.	0.	0.
LHE	NO		160	J	342	9376.	23909.	0.	0.	0.	0.
LHE	NO		161	J	344	12967.	0.	6666.	0.	0.	0.
RHE	NO		158	J	341	16760.	0.	0.	0.	0.	0.
RHE	NO		159	J	343	4007.	8254.	2722.	0.	0.	0.
RHE	NO		160	J	342	9419.	9265.	0.	0.	0.	0.
RHE	NO		161	J	344	12336.	0.	2909.	0.	0.	0.
B M	NO		158	J	341	15186.	0.	0.	0.	0.	0.

Continued

TABLE B111 Continued

OBE AUX TROLLEY REACTIONS

SUM OF ELEMENT FORCES IN ELEMENT CO-ORDINATE SYSTEM (lb, in-lb)

			ELEM	NODE	FX	FY	FZ	MX	MY	MZ
B	M	NO	159	J 343	1477.	5083.	1698.	0.	0.	0.
B	M	NO	160	J 342	7257.	6751.	0.	0.	0.	0.
B	M	NO	161	J 344	9176.	0.	1800.	0.	0.	0.
B	L	NO	158	J 341	8718.	0.	0.	0.	0.	0.
B	L	NO	159	J 343	10404.	13624.	4160.	0.	0.	0.
B	L	NO	160	J 342	15810.	14831.	0.	0.	0.	0.
B	L	NO	161	J 344	2752.	0.	4057.	0.	0.	0.
A	M	NO	158	J 341	9961.	0.	0.	0.	0.	0.
A	M	NO	159	J 343	6955.	2362.	1309.	0.	0.	0.
A	M	NO	160	J 342	12952.	7287.	0.	0.	0.	0.
A	M	NO	161	J 344	4097.	0.	1372.	0.	0.	0.
A	Q	NO	158	J 341	15258.	0.	0.	0.	0.	0.
A	Q	NO	159	J 343	3357.	6904.	2884.	0.	0.	0.
A	Q	NO	160	J 342	8785.	17230.	0.	0.	0.	0.
A	Q	NO	161	J 344	10194.	0.	3326.	0.	0.	0.
MAXIMUM VALUES					22350.	66408.	18090.	0.	0.	0.

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TABLE B112

OBE AUX TROLLEY REACTIONS
DIFFERENCE OF ELEMENT FORCES IN ELEMENT CO-ORDINATE SYSTEM (lb, in-lb)

	ELEM	NODE	FX	FY	FZ	MX	MY	MZ
MID	60 U 158	J 341	11427.	0.	0.	0.	0.	0.
MID	60 U 159	J 343	-1081.	-19313.	-5741.	0.	0.	0.
MID	60 U 160	J 342	-4239.	-19721.	0.	0.	0.	0.
MID	60 U 161	J 344	5657.	0.	-5846.	0.	0.	0.
MID	60 D 158	J 341	11016.	0.	0.	0.	0.	0.
MID	60 D 159	J 343	-1337.	-24794.	-7057.	0.	0.	0.
MID	60 D 160	J 342	-4823.	-25203.	0.	0.	0.	0.
MID	60 D 161	J 344	5077.	0.	-7277.	0.	0.	0.
1/4	60 U 158	J 341	8139.	0.	0.	0.	0.	0.
1/4	60 U 159	J 343	-4608.	-26726.	-7304.	0.	0.	0.
1/4	60 U 160	J 342	-987.	-29016.	0.	0.	0.	0.
1/4	60 U 161	J 344	2861.	0.	-7791.	0.	0.	0.
1/4	60 D 158	J 341	6829.	0.	0.	0.	0.	0.
1/4	60 D 159	J 343	-5883.	-30928.	-8500.	0.	0.	0.
1/4	60 D 160	J 342	-2499.	-32657.	0.	0.	0.	0.
1/4	60 D 161	J 344	1374.	0.	-8888.	0.	0.	0.
LHE	60 U 158	J 341	5613.	0.	0.	0.	0.	0.
LHE	60 U 159	J 343	-7252.	-62566.	-16726.	0.	0.	0.
LHE	60 U 160	J 342	-2714.	-64834.	0.	0.	0.	0.
LHE	60 U 161	J 344	516.	0.	-17631.	0.	0.	0.
LHE	60 D 158	J 341	4164.	0.	0.	0.	0.	0.
LHE	60 D 159	J 343	-8560.	-62800.	-16792.	0.	0.	0.
LHE	60 D 160	J 342	-4236.	-64917.	0.	0.	0.	0.
LHE	60 D 161	J 344	-887.	0.	-17687.	0.	0.	0.
RHE	60 U 158	J 341	9081.	0.	0.	0.	0.	0.
RHE	60 U 159	J 343	-3658.	-9424.	-3051.	0.	0.	0.
RHE	60 U 160	J 342	815.	-10917.	0.	0.	0.	0.
RHE	60 U 161	J 344	3435.	0.	-3234.	0.	0.	0.
RHE	60 D 158	J 341	8680.	0.	0.	0.	0.	0.
RHE	60 D 159	J 343	-4029.	-12791.	-4057.	0.	0.	0.
RHE	60 D 160	J 342	330.	-14966.	0.	0.	0.	0.
RHE	60 D 161	J 344	2807.	0.	-4362.	0.	0.	0.
MID	NO 158	J 341	13239.	0.	0.	0.	0.	0.
MID	NO 159	J 343	637.	-13733.	-4049.	0.	0.	0.
MID	NO 160	J 342	-2427.	-14004.	0.	0.	0.	0.
MID	NO 161	J 344	7743.	0.	-4138.	0.	0.	0.
1/4	NO 158	J 341	9468.	0.	0.	0.	0.	0.
1/4	NO 159	J 343	-3417.	-24751.	-6839.	0.	0.	0.
1/4	NO 160	J 342	198.	-27406.	0.	0.	0.	0.
1/4	NO 161	J 344	3928.	0.	-7249.	0.	0.	0.
LHE	NO 158	J 341	8584.	0.	0.	0.	0.	0.
LHE	NO 159	J 343	-4021.	-21111.	-5901.	0.	0.	0.
LHE	NO 160	J 342	-169.	-22379.	0.	0.	0.	0.
LHE	NO 161	J 344	3325.	0.	-6253.	0.	0.	0.
RHE	NO 158	J 341	8871.	0.	0.	0.	0.	0.
RHE	NO 159	J 343	-3875.	-7461.	-2508.	0.	0.	0.
RHE	NO 160	J 342	538.	-8472.	0.	0.	0.	0.
RHE	NO 161	J 344	3205.	0.	-2695.	0.	0.	0.
B M	NO 158	J 341	9064.	0.	0.	0.	0.	0.

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TABLE B112 Continued

OBE AUX TROLLEY REACTIONS
DIFFERENCE OF ELEMENT FORCES IN ELEMENT CO-ORDINATE SYSTEM (lb, in-lb)

			ELEM	NODE	FX	FY	FZ	MX	MY	MZ
B	M	NO	159	J 343	-228.	-4507.	-1543.	0.	0.	0.
B	M	NO	160	J 342	4082.	-6175.	0.	0.	0.	0.
B	M	NO	161	J 344	4984.	0.	-1644.	0.	0.	0.
B	L	NO	158	J 341	2401.	0.	0.	0.	0.	0.
B	L	NO	159	J 343	3976.	-12776.	-3931.	0.	0.	0.
B	L	NO	160	J 342	8659.	-13983.	0.	0.	0.	0.
B	L	NO	161	J 344	-1723.	0.	-3828.	0.	0.	0.
A	M	NO	158	J 341	5252.	0.	0.	0.	0.	0.
A	M	NO	159	J 343	3331.	-1926.	-1191.	0.	0.	0.
A	M	NO	160	J 342	7423.	-6851.	0.	0.	0.	0.
A	M	NO	161	J 344	1026.	0.	-1254.	0.	0.	0.
A	Q	NO	158	J 341	8626.	0.	0.	0.	0.	0.
A	Q	NO	159	J 343	-1742.	-6418.	-2752.	0.	0.	0.
A	Q	NO	160	J 342	2920.	-16744.	0.	0.	0.	0.
A	Q	NO	161	J 344	3600.	0.	-3195.	0.	0.	0.
MINIMUM VALUES					-8560.	-64917.	-17687.	0.	0.	0.

TABLE 8113

SSE AUX TROLLEY REACTIONS

SUM OF ELEMENT FORCES IN ELEMENT CO-ORDINATE SYSTEM (lb, in-lb)

		ELEM	NODE	FX	FY	FZ	MX	MY	MZ
MID	60 U	158	J 341	25263.	0.	0.	0.	0.	0.
MID	60 U	159	J 343	12049.	25594.	8317.	0.	0.	0.
MID	60 U	160	J 342	9852.	26275.	0.	0.	0.	0.
MID	60 U	161	J 344	21569.	0.	8407.	0.	0.	0.
MID	60 D	158	J 341	26164.	0.	0.	0.	0.	0.
MID	60 D	159	J 343	12448.	36209.	10778.	0.	0.	0.
MID	60 D	160	J 342	11216.	36814.	0.	0.	0.	0.
MID	60 D	161	J 344	23089.	0.	11126.	0.	0.	0.
1/4	60 U	158	J 341	21864.	0.	0.	0.	0.	0.
1/4	60 U	159	J 343	9062.	47923.	13235.	0.	0.	0.
1/4	60 U	160	J 342	12655.	52968.	0.	0.	0.	0.
1/4	60 U	161	J 344	17615.	0.	14250.	0.	0.	0.
1/4	60 D	158	J 341	23615.	0.	0.	0.	0.	0.
1/4	60 D	159	J 343	10815.	53955.	14960.	0.	0.	0.
1/4	60 D	160	J 342	14852.	58105.	0.	0.	0.	0.
1/4	60 D	161	J 344	19691.	0.	15779.	0.	0.	0.
LHE	60 U	158	J 341	25674.	0.	0.	0.	0.	0.
LHE	60 U	159	J 343	13286.	121440.	32503.	0.	0.	0.
LHE	60 U	160	J 342	17256.	125910.	0.	0.	0.	0.
LHE	60 U	161	J 344	20955.	0.	34254.	0.	0.	0.
LHE	60 D	158	J 341	27697.	0.	0.	0.	0.	0.
LHE	60 D	159	J 343	15092.	121720.	32579.	0.	0.	0.
LHE	60 D	160	J 342	19395.	126010.	0.	0.	0.	0.
LHE	60 D	161	J 344	22880.	0.	34319.	0.	0.	0.
RHE	60 U	158	J 341	19772.	0.	0.	0.	0.	0.
RHE	60 U	159	J 343	6838.	14134.	5406.	0.	0.	0.
RHE	60 U	160	J 342	12749.	15817.	0.	0.	0.	0.
RHE	60 U	161	J 344	16089.	0.	5613.	0.	0.	0.
RHE	60 D	158	J 341	20542.	0.	0.	0.	0.	0.
RHE	60 D	159	J 343	7550.	19761.	6822.	0.	0.	0.
RHE	60 D	160	J 342	13661.	22647.	0.	0.	0.	0.
RHE	60 D	161	J 344	17167.	0.	7309.	0.	0.	0.
MID	NO	158	J 341	22941.	0.	0.	0.	0.	0.
MID	NO	159	J 343	9621.	18864.	6235.	0.	0.	0.
MID	NO	160	J 342	7871.	19294.	0.	0.	0.	0.
MID	NO	161	J 344	19177.	0.	6366.	0.	0.	0.
1/4	NO	158	J 341	19804.	0.	0.	0.	0.	0.
1/4	NO	159	J 343	7312.	46233.	12884.	0.	0.	0.
1/4	NO	160	J 342	11147.	51663.	0.	0.	0.	0.
1/4	NO	161	J 344	16081.	0.	13685.	0.	0.	0.
LHE	NO	158	J 341	21060.	0.	0.	0.	0.	0.
LHE	NO	159	J 343	7957.	34698.	10012.	0.	0.	0.
LHE	NO	160	J 342	12878.	38006.	0.	0.	0.	0.
LHE	NO	161	J 344	16667.	0.	10684.	0.	0.	0.
RHE	NO	158	J 341	20176.	0.	0.	0.	0.	0.
RHE	NO	159	J 343	7307.	11913.	4590.	0.	0.	0.
RHE	NO	160	J 342	13310.	13013.	0.	0.	0.	0.
RHE	NO	161	J 344	16472.	0.	4940.	0.	0.	0.
B M	NO	158	J 341	19201.	0.	0.	0.	0.	0.

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TABLE B113 Continued

SSE AUX TROLLEY REACTIONS
SUM OF ELEMENT FORCES IN ELEMENT CO-ORDINATE SYSTEM (lb, in-lb)

			ELEM	NODE	FX	FY	FZ	MX	MY	MZ
B	M	NO	159	J 343	2575.	9886.	3321.	0.	0.	0.
B	M	NO	160	J 342	8985.	11870.	0.	0.	0.	0.
B	M	NO	161	J 344	12040.	0.	3552.	0.	0.	0.
B	L	NO	158	J 341	10861.	0.	0.	0.	0.	0.
B	L	NO	159	J 343	13180.	23752.	7476.	0.	0.	0.
B	L	NO	160	J 342	19009.	25614.	0.	0.	0.	0.
B	L	NO	161	J 344	4234.	0.	7331.	0.	0.	0.
A	M	NO	158	J 341	11660.	0.	0.	0.	0.	0.
A	M	NO	159	J 343	8658.	3871.	2514.	0.	0.	0.
A	M	NO	160	J 342	15442.	10491.	0.	0.	0.	0.
A	M	NO	161	J 344	5214.	0.	2618.	0.	0.	0.
A	Q	NO	158	J 341	18404.	0.	0.	0.	0.	0.
A	Q	NO	159	J 343	5069.	11721.	5061.	0.	0.	0.
A	Q	NO	160	J 342	11167.	28131.	0.	0.	0.	0.
A	Q	NO	161	J 344	13121.	0.	5770.	0.	0.	0.
MAXIMUM VALUES					27697.	126010.	34319.	0.	0.	0.

TABLE 8.14

SSE AUX TROLLEY REACTIONS

DIFFERENCE OF ELEMENT FORCES IN ELEMENT CO-ORDINATE SYSTEM (lb, in-lb)

			ELEM		NODE	FX	FY	FZ	MX	MY	MZ
MID	60	U	158	J	341	8103.	0.	0.	0.	0.	0.
MID	60	U	159	J	343	-4182.	-24240.	-7951.	0.	0.	0.
MID	60	U	160	J	342	-7629.	-24921.	0.	0.	0.	0.
MID	60	U	161	J	344	1707.	0.	-8041.	0.	0.	0.
MID	60	D	158	J	341	7202.	0.	0.	0.	0.	0.
MID	60	D	159	J	343	-4581.	-34855.	-10412.	0.	0.	0.
MID	60	D	160	J	342	-8993.	-35460.	0.	0.	0.	0.
MID	60	D	161	J	344	187.	0.	-10760.	0.	0.	0.
1/4	60	U	158	J	341	5092.	0.	0.	0.	0.	0.
1/4	60	U	159	J	343	-7605.	-46529.	-12859.	0.	0.	0.
1/4	60	U	160	J	342	-4023.	-51574.	0.	0.	0.	0.
1/4	60	U	161	J	344	-749.	0.	-13873.	0.	0.	0.
1/4	60	D	158	J	341	3341.	0.	0.	0.	0.	0.
1/4	60	D	159	J	343	-9358.	-52561.	-14583.	0.	0.	0.
1/4	60	D	160	J	342	-6219.	-56712.	0.	0.	0.	0.
1/4	60	D	161	J	344	-2825.	0.	-15402.	0.	0.	0.
LHE	60	U	158	J	341	462.	0.	0.	0.	0.	0.
LHE	60	U	159	J	343	-12650.	-119950.	-32100.	0.	0.	0.
LHE	60	U	160	J	342	-7803.	-124420.	0.	0.	0.	0.
LHE	60	U	161	J	344	-4909.	0.	-33851.	0.	0.	0.
LHE	60	D	158	J	341	-1561.	0.	0.	0.	0.	0.
LHE	60	D	159	J	343	-14455.	-120230.	-32176.	0.	0.	0.
LHE	60	D	160	J	342	-9943.	-124520.	0.	0.	0.	0.
LHE	60	D	161	J	344	-6834.	0.	-33916.	0.	0.	0.
RHE	60	U	158	J	341	5877.	0.	0.	0.	0.	0.
RHE	60	U	159	J	343	-6687.	-13158.	-5142.	0.	0.	0.
RHE	60	U	160	J	342	-2810.	-14841.	0.	0.	0.	0.
RHE	60	U	161	J	344	-529.	0.	-5349.	0.	0.	0.
RHE	60	D	158	J	341	5107.	0.	0.	0.	0.	0.
RHE	60	D	159	J	343	-7399.	-18785.	-6558.	0.	0.	0.
RHE	60	D	160	J	342	-3722.	-21671.	0.	0.	0.	0.
RHE	60	D	161	J	344	-1607.	0.	-7045.	0.	0.	0.
MID	NO		158	J	341	10368.	0.	0.	0.	0.	0.
MID	NO		159	J	343	-1810.	-17518.	-5871.	0.	0.	0.
MID	NO		160	J	342	-5593.	-17947.	0.	0.	0.	0.
MID	NO		161	J	344	4042.	0.	-6002.	0.	0.	0.
1/4	NO		158	J	341	7090.	0.	0.	0.	0.	0.
1/4	NO		159	J	343	-5917.	-44881.	-12518.	0.	0.	0.
1/4	NO		160	J	342	-2453.	-50310.	0.	0.	0.	0.
1/4	NO		161	J	344	723.	0.	-13319.	0.	0.	0.
LHE	NO		158	J	341	5322.	0.	0.	0.	0.	0.
LHE	NO		159	J	343	-7074.	-33167.	-9599.	0.	0.	0.
LHE	NO		160	J	342	-3671.	-36476.	0.	0.	0.	0.
LHE	NO		161	J	344	-375.	0.	-10271.	0.	0.	0.
RHE	NO		158	J	341	5455.	0.	0.	0.	0.	0.
RHE	NO		159	J	343	-7174.	-11120.	-4375.	0.	0.	0.
RHE	NO		160	J	342	-3353.	-12220.	0.	0.	0.	0.
RHE	NO		161	J	344	-930.	0.	-4726.	0.	0.	0.
B M	NO		158	J	341	5049.	0.	0.	0.	0.	0.

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TABLE 8114 Continued

SSE AUX TROLLEY REACTIONS

DIFFERENCE OF ELEMENT FORCES IN ELEMENT CO-ORDINATE SYSTEM (lb, in-lb)

			ELEM	NODE	FX	FY	FZ	MX	MY	MZ
B	M	NO	159	J 343	-1326.	-9310.	-3165.	0.	0.	0.
B	M	NO	160	J 342	2354.	-11293.	0.	0.	0.	0.
B	M	NO	161	J 344	2120.	0.	-3396.	0.	0.	0.
B	L	NO	158	J 341	258.	0.	0.	0.	0.	0.
B	L	NO	159	J 343	1200.	-22904.	-7247.	0.	0.	0.
B	L	NO	160	J 342	5460.	-24766.	0.	0.	0.	0.
B	L	NO	161	J 344	-3205.	0.	-7102.	0.	0.	0.
A	M	NO	158	J 341	3553.	0.	0.	0.	0.	0.
A	M	NO	159	J 343	1628.	-3434.	-2396.	0.	0.	0.
A	M	NO	160	J 342	4934.	-10055.	0.	0.	0.	0.
A	M	NO	161	J 344	-90.	0.	-2500.	0.	0.	0.
A	Q	NO	158	J 341	5480.	0.	0.	0.	0.	0.
A	Q	NO	159	J 343	-3454.	-11235.	-4930.	0.	0.	0.
A	Q	NO	160	J 342	538.	-27645.	0.	0.	0.	0.
A	Q	NO	161	J 344	673.	0.	-5638.	0.	0.	0.
MINIMUM VALUES					-14455.	-124520.	-33916.	0.	0.	0.

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TABLE B115

OBE ROPE LOADS
SUM OF ELEMENT FORCES IN ELEMENT CO-ORDINATE SYSTEM (lb, in-lb)

	ELEM	NODE	FX	FY	FZ	MX	MY	MZ
MID 60 U	156	J 406	213650.	0.	0.	0.	0.	0.
MID 60 D	156	J 406	418350.	0.	0.	0.	0.	0.
1/4 60 U	156	J 406	178700.	0.	0.	0.	0.	0.
1/4 60 D	156	J 406	406260.	0.	0.	0.	0.	0.
LHE 60 U	156	J 406	161450.	0.	0.	0.	0.	0.
LHE 60 D	156	J 406	387690.	0.	0.	0.	0.	0.
RHE 60 U	156	J 406	171720.	0.	0.	0.	0.	0.
RHE 60 D	156	J 406	396160.	0.	0.	0.	0.	0.
MID NO	156	J 406	24555.	0.	0.	0.	0.	0.
1/4 NO	156	J 406	23100.	0.	0.	0.	0.	0.
LHE NO	156	J 406	21673.	0.	0.	0.	0.	0.
RHE NO	156	J 406	23222.	0.	0.	0.	0.	0.
B M NO	156	J 406	24721.	0.	0.	0.	0.	0.
B L NO	156	J 406	21610.	0.	0.	0.	0.	0.
A M NO	156	J 406	21854.	0.	0.	0.	0.	0.
A G NO	156	J 406	21655.	0.	0.	0.	0.	0.
MAXIMUM VALUES			418350.	0.	0.	0.	0.	0.

TABLE B116

OBE ROPE LOADS
DIFFERENCE OF ELEMENT FORCES IN ELEMENT CO-ORDINATE SYSTEM (lb, in-lb)

	ELEM	NODE	FX	FY	FZ	MX	MY	MZ
MID 60 U	156 J	406	66332.	0.	0.	0.	0.	0.
MID 60 D	156 J	406	-138360.	0.	0.	0.	0.	0.
1/4 60 U	156 J	406	101280.	0.	0.	0.	0.	0.
1/4 60 D	156 J	406	-126280.	0.	0.	0.	0.	0.
LHE 60 U	156 J	406	118530.	0.	0.	0.	0.	0.
LHE 60 D	156 J	406	-107710.	0.	0.	0.	0.	0.
RHE 60 U	156 J	406	108260.	0.	0.	0.	0.	0.
RHE 60 D	156 J	406	-116180.	0.	0.	0.	0.	0.
MID NO	156 J	406	15445.	0.	0.	0.	0.	0.
1/4 NO	156 J	406	16900.	0.	0.	0.	0.	0.
LHE NO	156 J	406	18327.	0.	0.	0.	0.	0.
RHE NO	156 J	406	16779.	0.	0.	0.	0.	0.
B M NO	156 J	406	15279.	0.	0.	0.	0.	0.
B L NO	156 J	406	18390.	0.	0.	0.	0.	0.
A M NO	156 J	406	18146.	0.	0.	0.	0.	0.
A Q NO	156 J	406	18345.	0.	0.	0.	0.	0.
MINIMUM VALUES			-138360.	0.	0.	0.	0.	0.

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TABLE B117

SSE ROPE LOADS
SUM OF ELEMENT FORCES IN ELEMENT CO-ORDINATE SYSTEM (lb, in-lb)

	ELEM	NODE	FX	FY	FZ	MX	MY	MZ
MID	60 U	156 J 406	271940.	0.	0.	0.	0.	0.
MID	60 D	156 J 406	661920.	0.	0.	0.	0.	0.
1/4	60 U	156 J 406	229250.	0.	0.	0.	0.	0.
1/4	60 D	156 J 406	639230.	0.	0.	0.	0.	0.
LHE	60 U	156 J 406	191310.	0.	0.	0.	0.	0.
LHE	60 D	156 J 406	604390.	0.	0.	0.	0.	0.
RHE	60 U	156 J 406	214660.	0.	0.	0.	0.	0.
RHE	60 D	156 J 406	620280.	0.	0.	0.	0.	0.
MID	NO	156 J 406	30865.	0.	0.	0.	0.	0.
1/4	NO	156 J 406	27426.	0.	0.	0.	0.	0.
LHE	NO	156 J 406	23397.	0.	0.	0.	0.	0.
RHE	NO	156 J 406	27324.	0.	0.	0.	0.	0.
B M	NO	156 J 406	31271.	0.	0.	0.	0.	0.
B L	NO	156 J 406	23365.	0.	0.	0.	0.	0.
A M	NO	156 J 406	23773.	0.	0.	0.	0.	0.
A Q	NO	156 J 406	23234.	0.	0.	0.	0.	0.
MAXIMUM VALUES			661920.	0.	0.	0.	0.	0.

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TABLE 8118

SSE ROPE LOADS

DIFFERENCE OF ELEMENT FORCES IN ELEMENT CO-ORDINATE SYSTEM (lb, in-lb)

		ELEM	NODE	FX	FY	FZ	MX	MY	MZ
MID	60 U	156 J	406	8043.	0.	0.	0.	0.	0.
MID	60 D	156 J	406	-381930.	0.	0.	0.	0.	0.
1/4	60 U	156 J	406	50740.	0.	0.	0.	0.	0.
1/4	60 D	156 J	406	-359250.	0.	0.	0.	0.	0.
LHE	60 U	156 J	406	88676.	0.	0.	0.	0.	0.
LHE	60 D	156 J	406	-324400.	0.	0.	0.	0.	0.
RHE	60 U	156 J	406	65321.	0.	0.	0.	0.	0.
RHE	60 D	156 J	406	-340290.	0.	0.	0.	0.	0.
MID	NO	156 J	406	9135.	0.	0.	0.	0.	0.
1/4	NO	156 J	406	12574.	0.	0.	0.	0.	0.
LHE	NO	156 J	406	16603.	0.	0.	0.	0.	0.
RHE	NO	156 J	406	12676.	0.	0.	0.	0.	0.
B M	NO	156 J	406	8729.	0.	0.	0.	0.	0.
B L	NO	156 J	406	16635.	0.	0.	0.	0.	0.
A M	NO	156 J	406	16227.	0.	0.	0.	0.	0.
A Q	NO	156 J	406	16766.	0.	0.	0.	0.	0.
MINIMUM VALUES				-381930.	0.	0.	0.	0.	0.

TABLE B119

ELEMENT LOADS FOR GIRDER A AT THE POINTS OF THE MAXIMUM STRESS WITHIN THE ELEMENT RANGE FROM 21 TO 48 (NOMINAL GIRDER SECTION).

ALL LOADS ARE IN ELEMENT COORDINATE SYSTEM.

MAIN TROLLEY	LOAD	ELEM.	NODE	Fx (KIP)	FY (KIP)	FZ (KIP)	Mx (IN.KIP)	MY (IN.KIP) SUM (Σ)	MY (IN.KIP) DIFF. (Δ)	MZ (IN.KIP)
OBE MID.	UP	34	318	35.1	12.3	15.6	638.1	50906	18998	2586
	DN	34	318	42.0	15.5	15.1	789.4	72338	-2435	3266
1/4	UP	40	323	31.7	13.0	64.4	367.0	35112	21879	1832
	DN	40	323	38.1	14.0	94.2	490.5	54932	2059	2562
LHE	UP	35	318	46.0	16.7	19.9	398.1	19668	13854	5246
	DN	35	318	46.9	12.3	32.8	427.0	26484	7038	5249
RHE	UP	27	310	17.8	2.1	12.3	182.8	27164	17663	1604
	DN	27	310	22.7	2.1	33.9	205.5	43123	1710	2173
SSE MID	UP	34	318	50.6	15.5	18.7	791.4	63380	6524	3247
	DN	34	318	62.7	21.6	17.8	1080	105110	-35204	4549
1/4	UP	40	323	53.1	23.4	21.2	468.8	44265	12726	2452
	DN	40	323	62.3	24.7	132.2	679.0	78125	-21134	3628
LHE	UP	35	318	87.2	30.2	23.4	677.7	23674	9847	10002
	DN	35	318	22.2	32.2	47.4	715.2	35117	-1595	10006
RHE	UP	27	310	26.7	4.5	17.0	259.6	33797	11036	2129
	DN	27	310	34.4	4.5	56.5	288.8	61316	-16483	3090

TABLE B120

ELEMENT LOADS FOR GIRDER B AT THE POINTS OF MAXIMUM STRESS WITHIN THE ELEMENT RANGE FROM 61 TO 88 (NOMINAL GIRDER SECTION).

ALL LOADS ARE IN ELEMENT COORDINATE SYSTEM.

MAIN TROLLEY	LOAD	ELEM.	NODE	F_X (KIP)	F_Y (KIP)	F_Z (KIP)	M_X (IN. KIP)	M_Y (IN. KIP) SUM (Σ)	M_Y (IN. KIP) DIFF. (Δ)	M_Z (IN. KIP)
OBE										
MID.	UP	71	364	32.6	7.4	12.3	496.1	49002	18449	2836
	DN	71	364	38.9	8.7	12.6	628.2	70443	-2942	3615
1/4	UP	80	373	30.3	12.6	80.2	605.2	34876	21745	2233
	DN	80	373	34.9	16.1	110.7	832.6	54673	1948	3134
LHE	UP	84	377	42.1	22.0	105.6	924.7	22296	16071	1224
	DN	84	377	42.3	24.4	141.4	1025	33345	5022	2795
RHE	UP	67	360	16.4	6.2	20.5	192.7	27511	17877	1409
	DN	67	360	21.0	6.9	42.2	257.5	43489	1899	1925
SSE										
MID	UP	71	364	42.0	10.4	15.0	618.6	60943	6558	3522
	DN	71	364	52.2	12.3	15.7	273.0	102590	-35088	5038
1/4	UP	80	373	51.9	19.3	101.5	835.6	43967	12654	2949
	DN	80	373	58.3	24.8	152.4	1218	77799	-21178	4497
LHE	UP	84	377	80.2	39.2	129.8	1671	26592	11774	2637
	DN	84	377	20.3	42.5	192.1	1801	45795	-7429	3997
RHE	UP	67	360	24.4	10.6	27.1	252.4	34234	11153	1832
	DN	67	360	31.9	11.6	66.3	364.2	61765	-16377	2713

TABLE B 121

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	60	U	18	I	301	32632.	6726.	155590.	640070.	2435200.	2195100.
MID	60	U	51	J	335	24733.	15554.	136510.	661830.	2196100.	2763500.
MID	60	U	58	I	351	31216.	36258.	142690.	1745800.	2417200.	3011500.
MID	60	U	91	J	385	24878.	12103.	128940.	535810.	2034000.	2492400.
MID	60	D	18	I	301	36498.	8269.	208410.	768430.	2940100.	2751500.
MID	60	D	51	J	335	30432.	19566.	189280.	792380.	2579400.	3347900.
MID	60	D	58	I	351	36526.	46002.	195630.	2213900.	2819300.	3726700.
MID	60	D	91	J	385	30631.	15312.	181770.	667320.	2524900.	3097600.
1/4	60	U	18	I	301	29879.	11671.	92851.	1440000.	1888200.	1992900.
1/4	60	U	51	J	335	26863.	22983.	159390.	1193600.	2534700.	3321000.
1/4	60	U	58	I	351	28725.	35500.	85232.	1841600.	1839000.	2807200.
1/4	60	U	91	J	385	27258.	14474.	148950.	646500.	2471400.	2423700.
1/4	60	D	18	I	301	37302.	13789.	124610.	1547100.	2308600.	2796000.
1/4	60	D	51	J	335	29544.	30816.	251140.	1547800.	3063000.	3527900.
1/4	60	D	58	I	351	35535.	43203.	116970.	2138300.	2264800.	3889900.
1/4	60	D	91	J	385	29969.	19619.	240170.	873250.	2969800.	2718500.
LHE	60	U	18	I	301	33308.	30670.	70969.	3336100.	1922700.	2935700.
LHE	60	U	51	J	335	41617.	39855.	167630.	1723600.	3370900.	5634600.
LHE	60	U	58	I	351	32250.	70290.	63931.	3798000.	1882500.	3037000.
LHE	60	U	91	J	385	42691.	22387.	157300.	970190.	3329100.	3291200.
LHE	60	D	18	I	301	40968.	30788.	85483.	3339100.	2252000.	3476900.
LHE	60	D	51	J	335	41757.	47210.	264330.	2337600.	3690600.	5716400.
LHE	60	D	58	I	351	37918.	71419.	78390.	3809200.	2251700.	4238900.
LHE	60	D	91	J	385	42836.	24665.	254390.	1071600.	3633400.	3294900.
RHE	60	U	18	I	301	22260.	4079.	178520.	254100.	2396200.	1249100.
RHE	60	U	51	J	335	20782.	9732.	66326.	256660.	1496300.	2472100.
RHE	60	U	58	I	351	22150.	34200.	166050.	1683000.	2277000.	1857400.
RHE	60	U	91	J	385	20839.	10718.	61827.	246390.	1465600.	2144400.
RHE	60	D	18	I	301	26466.	5352.	270740.	293130.	3223900.	1511600.
RHE	60	D	51	J	335	28583.	13206.	89947.	289330.	1913200.	3364500.
RHE	60	D	58	I	351	27384.	46503.	258040.	2309000.	3050000.	2176200.
RHE	60	D	91	J	385	28664.	12858.	85335.	312630.	1851500.	2908500.
MID	NO		18	I	301	25842.	4984.	97092.	479300.	1774900.	1579300.
MID	NO		51	J	335	17515.	11143.	78931.	502630.	1436200.	1935500.
MID	NO		58	I	351	25901.	26309.	85979.	1259800.	1661600.	2132300.
MID	NO		91	J	385	17615.	8844.	72257.	399200.	1401700.	1778400.
1/4	NO		18	I	301	25624.	10591.	71488.	1390500.	1516200.	1473500.
1/4	NO		51	J	335	25520.	18215.	99431.	991430.	2018200.	3220200.
1/4	NO		58	I	351	24784.	31416.	64450.	1693700.	1461600.	2117800.
1/4	NO		91	J	385	25904.	11296.	89094.	506560.	1958400.	2275400.
LHE	NO		18	I	301	24996.	12074.	57379.	1220200.	1341300.	1253300.
LHE	NO		51	J	335	16707.	19993.	107840.	1575800.	1769200.	2665500.
LHE	NO		58	I	351	22784.	22039.	49992.	1319100.	1317700.	2146600.
LHE	NO		91	J	385	17158.	7372.	98233.	415790.	1704500.	1165300.
RHE	NO		18	I	301	22383.	3227.	119190.	231000.	1811600.	1102500.
RHE	NO		51	J	335	15866.	7521.	50874.	237600.	1153700.	1910800.
RHE	NO		58	I	351	21961.	26507.	107960.	1289500.	1704500.	1682300.
RHE	NO		91	J	385	15904.	9420.	46402.	204930.	1122200.	1670500.
B M	NO		18	I	301	28682.	9137.	88513.	426500.	1828500.	2137900.

Continued

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OBE GIRDER END LOADS

SUM OF ELEMENT FORCES IN ELEMENT CO-ORDINATE SYSTEM (lb, in-lb)

			ELEM	NODE		FX	FY	FZ	MX	MY	MZ
B	M	NO	51	J	335	17114.	12091.	91306.	620840.	1514100.	1873500.
B	M	NO	58	I	351	28804.	12159.	79742.	517230.	1760400.	2471900.
B	M	NO	91	J	385	17222.	9640.	81970.	466720.	1463000.	1738400.
B	L	NO	18	I	301	26348.	10209.	48044.	285520.	1386400.	2101500.
B	L	NO	51	J	335	7396.	24513.	119170.	1232500.	1431500.	1045900.
B	L	NO	58	I	351	25514.	6613.	41879.	121390.	1364700.	2033700.
B	L	NO	91	J	385	7630.	10432.	107680.	576410.	1324500.	602860.
A	M	NO	18	I	301	26206.	6754.	51866.	237800.	1395500.	1831300.
A	M	NO	51	J	335	4765.	22305.	114550.	1176800.	1254100.	528370.
A	M	NO	58	I	351	25182.	8598.	45711.	203450.	1373500.	2072100.
A	M	NO	91	J	385	4906.	5405.	103870.	254350.	1158100.	391230.
A	Q	NO	18	I	301	43580.	5949.	55941.	432190.	2105100.	3443200.
A	Q	NO	51	J	335	25277.	40831.	113170.	2587700.	2237100.	4115500.
A	Q	NO	58	I	351	36381.	10260.	48829.	554860.	2201100.	4343300.
A	Q	NO	91	J	385	25819.	17148.	103080.	920770.	2168300.	1867600.
MAXIMUM VALUES						43580.	71419.	270740.	3809200.	3690600.	5716400.

TABLE B122

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	60	U	18	I	301	51216.	8353.	188700.	817930.	3067400.	2779700.
MID	60	U	51	J	335	32286.	19690.	168010.	828590.	2740200.	3680000.
MID	60	U	58	I	351	48209.	44999.	172990.	2181500.	3144600.	3904100.
MID	60	U	91	J	385	32437.	15340.	158620.	659710.	2407900.	3205200.
MID	60	D	18	I	301	57056.	11280.	291960.	1052100.	4085800.	3833600.
MID	60	D	51	J	335	42675.	27311.	270870.	1070700.	3508200.	4711400.
MID	60	D	58	I	351	57082.	63869.	275930.	3083400.	3941700.	5221500.
MID	60	D	91	J	385	42940.	21478.	261410.	912630.	3427600.	4331100.
1/4	60	U	18	I	301	48188.	19115.	112230.	2533700.	2429400.	2595800.
1/4	60	U	51	J	335	47646.	32924.	198530.	1708000.	3566300.	6036200.
1/4	60	U	58	I	351	46822.	57311.	102730.	3136800.	2377800.	3793200.
1/4	60	U	91	J	385	48363.	20305.	185200.	877070.	3508600.	4229600.
1/4	60	D	18	I	301	59184.	22261.	165160.	2680500.	3131100.	3982300.
1/4	60	D	51	J	335	51277.	45677.	356650.	2277900.	4507700.	6309600.
1/4	60	D	58	I	351	56780.	68765.	156090.	3563100.	3087900.	5624900.
1/4	60	D	91	J	385	52033.	28790.	343340.	1258400.	4390800.	4635300.
LHE	60	U	18	I	301	54725.	57866.	81804.	6295400.	2712800.	4935900.
LHE	60	U	51	J	335	79297.	67491.	195960.	2335300.	5132800.	10674000.
LHE	60	U	58	I	351	55472.	132370.	73354.	7229600.	2640600.	4074400.
LHE	60	U	91	J	385	81344.	40197.	183010.	1717800.	5121300.	6275900.
LHE	60	D	18	I	301	65534.	58011.	105580.	6299000.	3198300.	5693400.
LHE	60	D	51	J	335	79467.	77754.	367700.	3341100.	5707700.	10774000.
LHE	60	D	58	I	351	63076.	133760.	97501.	7243300.	3195500.	6079100.
LHE	60	D	91	J	385	81520.	43189.	356310.	1850100.	5668500.	6280300.
RHE	60	U	18	I	301	41187.	5236.	212870.	367750.	3177500.	1940800.
RHE	60	U	51	J	335	26843.	12982.	80611.	358380.	1790600.	3256000.
RHE	60	U	58	I	351	39818.	44924.	197150.	2200400.	3072000.	3025800.
RHE	60	U	91	J	385	26915.	16798.	74971.	319420.	1756300.	2844900.
RHE	60	D	18	I	301	47366.	7394.	373630.	436260.	4626200.	2342600.
RHE	60	D	51	J	335	40283.	18854.	120140.	419270.	2546500.	4780900.
RHE	60	D	58	I	351	47557.	66079.	358910.	3293800.	4418000.	3504200.
RHE	60	D	91	J	385	40399.	20362.	114800.	435530.	2432800.	4147500.
MID	NO		18	I	301	42801.	6145.	116040.	609750.	2301700.	2007700.
MID	NO		51	J	335	22688.	14163.	96331.	623720.	1696400.	2540700.
MID	NO		58	I	351	42952.	32991.	102100.	1589800.	2159200.	2750900.
MID	NO		91	J	385	22786.	11492.	87759.	493070.	1661800.	2260000.
1/4	NO		18	I	301	44057.	18153.	82364.	2491900.	2031500.	1969200.
1/4	NO		51	J	335	46445.	27750.	117630.	1505700.	3006200.	5948400.
1/4	NO		58	I	351	42984.	53554.	73941.	3007700.	1976400.	2993300.
1/4	NO		91	J	385	47154.	16774.	104660.	721100.	2955100.	4095800.
LHE	NO		18	I	301	46605.	18993.	64206.	1871900.	1998700.	1801200.
LHE	NO		51	J	335	30724.	32468.	120130.	2885100.	2464900.	4986500.
LHE	NO		58	I	351	42728.	29895.	55378.	2100400.	2010200.	3885200.
LHE	NO		91	J	385	31496.	10949.	108470.	744640.	2408000.	2138300.
RHE	NO		18	I	301	41911.	4304.	136620.	341730.	2464500.	1803400.
RHE	NO		51	J	335	21353.	10534.	60231.	338580.	1416000.	2635300.
RHE	NO		58	I	351	40368.	36585.	122690.	1766100.	2377700.	2865600.
RHE	NO		91	J	385	21403.	15379.	54706.	272820.	1376300.	2326800.
B M	NO		18	I	301	46199.	12117.	108860.	540710.	2383300.	2784900.

Continued

EFS-1.3 FOR SRSS-4.3

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TABLE 8122 Continued

SSE GIRDER END LOADS

SUM OF ELEMENT FORCES IN ELEMENT CO-ORDINATE SYSTEM (lb, in-lb)

			ELEM		NODE	FX	FY	FZ	MX	MY	MZ
B	M	NO	51	J	335	22707.	15921.	112730.	800080.	1802000.	2524900.
B	M	NO	58	I	351	46556.	15829.	97854.	686250.	2291100.	3217200.
B	M	NO	91	J	385	22828.	12975.	100550.	596640.	1759200.	2282700.
B	L	NO	18	I	301	44112.	16980.	55556.	420560.	1937100.	3021000.
B	L	NO	51	J	335	12999.	35283.	133890.	1621700.	1738200.	1808200.
B	L	NO	58	I	351	44106.	9514.	48105.	170460.	1891500.	2741200.
B	L	NO	91	J	385	13410.	16649.	119560.	918310.	1625500.	1064900.
A	M	NO	18	I	301	43154.	8439.	60150.	352400.	1848900.	2256300.
A	M	NO	51	J	335	7087.	27664.	128450.	1490100.	1420800.	887050.
A	M	NO	58	I	351	42177.	10636.	52737.	296190.	1822900.	2554700.
A	M	NO	91	J	385	7242.	9354.	115520.	436470.	1313800.	572150.
A	Q	NO	18	I	301	77621.	8099.	64428.	680920.	3286500.	5886700.
A	Q	NO	51	J	335	43646.	68783.	127850.	4591200.	3167800.	7282100.
A	Q	NO	58	I	351	64164.	13040.	55786.	872160.	3519500.	7474700.
A	Q	NO	91	J	385	44507.	32667.	115560.	1652500.	3106700.	3203600.
MAXIMUM VALUES						81520.	133760.	373630.	7243300.	5707700.	10774000.

79508/MJM/AEP, DCC, NEW AUX TROLLEY 1/4, NO LD / SSE

REACTION SUMMARY

NODE	LABEL	1	2	3	SRSS	STATIC	SUM	DIFFER
101	FY	2072.	118393.	1116.	118416.	0.	118416.	-118416.
101	FZ	4511.	10610.	14043.	18169.	57825.	75994.	39656.
101	MX	299473.	6319435.	98247.	6327290.	37411.	6364701.	-6289879.
102	FZ	3198.	11183.	11562.	16400.	51379.	67780.	34979.
102	MX	124001.	2125740.	42116.	2129770.	64701.	2194471.	-2065070.
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	71104.	14504.	13859.	73879.	0.	73879.	-73879.
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	13872.	200490.	2107.	200980.	0.	200980.	-200980.
201	FZ	8780.	17082.	20777.	28294.	108905.	137199.	80610.
201	MX	1229953.	14027115.	166349.	14081918.	39423.	14121341.	-14042495.
202	FZ	7490.	17439.	16708.	25285.	99999.	125284.	74713.
202	MX	47989.	1136971.	40329.	1138698.	39871.	1178568.	-1098827.
428	FX	0.	0.	0.	0.	0.	0.	0.
428	FY	0.	0.	0.	0.	0.	0.	0.
428	FZ	0.	0.	0.	0.	0.	0.	0.
428	MX	200.	6180.	19.	6183.	-2.	6185.	-6181.
428	MY	0.	0.	0.	0.	0.	0.	0.
428	MZ	0.	0.	0.	0.	0.	0.	0.

(16- in lb)

SRSS-4.3 WHITING CORPORATION ANSYS SRSS PROGRAM 79509 37/07/15.
TABLE # B85 BY MJM PAGE B-68 OF 121

79508/MJM/AEP, DCC, NEW BOTH TROLLEYS MID, NO LD / OBE

REACTION SUMMARY

LOAD STEP NODE LABEL	1	2	3	SRSS	STATIC	SUM	DIFFER
101 FY	1011.	260667.	119.	260669.	-0.	260669.	-260669.
101 FZ	2625.	33252.	14514.	36377.	82285.	118662.	45909.
101 MX	82928.	17556051.	31161.	17556274.	40752.	17597026.	-17515522.
102 FZ	2477.	33066.	12940.	35594.	74724.	110318.	39130.
102 MX	167385.	1007988.	9572.	1021836.	67977.	1089813.	-953860.
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	38043.	1581.	3670.	38253.	-0.	38253.	-38253.
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	1176.	265638.	241.	265640.	-0.	265640.	-265640.
201 FZ	2033.	32406.	15323.	35904.	84393.	120297.	48489.
201 MX	206061.	18399518.	31475.	18400699.	40856.	18441555	-18359843.
202 FZ	1898.	32648.	13303.	35306.	76705.	112011.	41399.
202 MX	29350.	341099.	7121.	342433.	43161.	385594.	-299273.
428 FX	0.	0.	0.	0.	0.	0.	0..
428 FY	0.	0.	0.	0.	0.	0.	0.
428 FZ	0.	0.	0.	0.	0.	0.	0.
428 MX	44.	1931.	7.	1931.	-2.	1933.	-1929.
428 MY	0.	0.	0.	0.	0.	0.	0.
428 MZ	0.	0.	0.	0.	0.	0.	0.

(lb, in-lb)

SRSS-4.3 WHITING CORPORATION ANSYS SRSS PROGRAM 79508 87/07/16.
TABLE # 084 LS 2 MODE 3 SCALE FACTOR = .1206 BY MJM PAGE B-67 OF 121

79508/MJM/AEP, DCC, NEW AUX TROLLEY 1/4, NO LD / SSE

REACTION SUMMARY

LOAD STEP NODE LABEL		1	2	3	SRSS	STATIC	SUM	DIFFER
101	FY	2072.	20519.	1116.	20654.	0.	20654.	-20654.
101	FZ	4511.	4515.	14043.	15425.	57825.	73250.	42400.
101	MX	299473.	1404494.	98247.	1439418.	37411.	1476829.	-1402007.
102	FZ	3198.	4466.	11562.	12800.	51379.	64179.	38579.
102	MX	124001.	928574.	42116.	937758.	64701.	1002459.	-873057.
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	71104.	14231.	13859.	73826.	0.	73826.	-73826.
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	13872.	99738.	2107.	100720.	0.	100720.	-100720.
201	FZ	8780.	16696.	20777.	28063.	108905.	136968.	80842.
201	MX	1229953.	8459014.	166349.	8549522.	39423.	8588944.	-8510100.
202	FZ	7490.	16056.	16708.	24353.	99999.	124352.	75646.
202	MX	47989.	435242.	40329.	439730.	39871.	479601.	-399859.
428	FX	0.	0.	0.	0.	0.	0.	0.
428	FY	0.	0.	0.	0.	0.	0.	0.
428	FZ	0.	0.	0.	0.	0.	0.	0.
428	MX	200.	6164.	19.	6167.	-2.	6169.	-6165.
428	MY	0.	0.	0.	0.	0.	0.	0.
428	MZ	0.	0.	0.	0.	0.	0.	0.

(lb, in-lb)

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WHITING REQN. 79508 DATE 8-21-87

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[handwritten initials] 8-24-87

APPENDIX 'C'

NOMENCLATURE & REFERENCES

NOMENCLATURE

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. 79508 DATE 8-21-87

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8-25-87

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ATTACHMENT 1

REQUEST TO DISPOSE OF

REMOVED STEAM GENERATOR ENCLOSURE CONCRETE

ON THE DONALD C. COOK NUCLEAR PLANT SITE

[illegible]

1.0 Introduction

Indiana Michigan Power Company (I&M) submits this application pursuant to 10 CFR 20.302, for the disposal of licensed radioactive material on the Donald C. Cook Nuclear Plant site. The proposed method of disposal is not currently authorized by the Cook Nuclear Plant operating licenses.

The subject material consists of small quantities of Cobalt-60 (Co-60), Cesium-134 (Cs-134), and Cesium-137 (Cs-137) distributed in the outer surfaces of reinforced concrete to be removed from the Cook Nuclear Plant Unit #2 steam generator doghouse enclosures.

The potential radiological and environmental impacts of the proposed disposal have been analyzed and evaluated and are presented in this application. The cost benefit of the concrete disposal versus the most feasible alternative is also discussed. I&M concludes, based on the information presented here, that the proposed method of disposal presents no significant impact or hazard to the public health and safety or to the environment.

2.0 Waste Stream Description

In late 1983, it became apparent that the Cook Nuclear Plant Unit #2 was experiencing degradation of steam generator tubing caused by inter-granular corrosion (IGC). Analysis of available remedial measures and repair techniques demonstrate replacement of the four steam generator lower assemblies to be the most viable option to insure full power operation of the unit for the remaining plant life. In the second quarter of 1988, Unit #2 will shut down and the planned steam generator repair will take place as described in the D. C. Cook Plant Unit No. 2 Steam Generator Repair Report (Ref. X.). The outage will begin when the current cycle's fuel supply is exhausted.

2.1 Structural Concrete Removal

To provide access for complete replacement of the four steam generator lower assemblies, a large opening will be cut in each of the reinforced concrete doghouses surrounding the steam generators. When the installation of the steam generator components is complete, the doghouse enclosures will be restored to the original condition using new materials.

[illegible]

2.2 Physical and Chemical Characteristics

The concrete will be removed in twenty-four to thirty large slabs ranging in weight from twenty-five to seventy tons each. It is planned to dispose of the material in this form, as large structural segments. The roof sections are three feet thick, and the wall portions are two feet thick. The estimated total weight of the slabs is 920 tons. This total includes an estimated 65 tons of reinforcing steel and steel structural supports.

The material is part of a Seismic Class I structure and is made up of a Class I structural concrete mix. Specifications for the original material require a strength of 3500 psi @ 28 days, 3-5% air content, and a strict quality control program during mixing and forming. Chemically, the material is inert, and will pose no hazard to the public or the environment. The mix specification shows the material to contain cement, fly ash, sand, and stone.

2.3 Radiological Properties

The outer surfaces of the doghouse structures are in the upper containment volume. The surfaces were painted with nuclear Grade I paint prior to operation of the unit. However, the airborne contamination inside containment, arising due to normal operations, has brought small amounts of radioactive contamination into contact with the surfaces. Over the ten years of plant operation, the small amounts of contamination have diffused through the paint and into the outer layer of concrete. Inside the doghouse structure, airborne contamination again has contributed to the deposition of radioactivity on the walls. With the exception of the roof, the interior of the doghouse is protected by steel liner plate. This plate will be removed prior to disposal of the concrete. The liner material is not included in this application for alternate disposal.

Radiological analysis was performed on samples of paint and underlying concrete from the outside wall of the doghouse structures. The sampling procedure and analysis are discussed further in the next section. Three nuclides were found in the concrete; Cobalt-60, Cesium-134, and Cesium-137. The average of the measured sample concentrations of each nuclide are given in Table 1 below. The concentrations represent the

[illegible]

activity expected in the surface of the concrete when it is disposed of after decontamination. The maximum measured sample concentration was utilized in portions of the radiological impact assessment to insure conservatism in the calculations, and these values are summarized in Table 1 also.

To calculate the total activity present in the concrete, an estimate was made, based on the sample data, of the amount of diffusion of the radionuclides into the concrete. The activity is estimated to decrease to 1/100,000th of the outer value within the first one inch from the surface. Total activity was calculated by integrating the concentration to this depth over the entire surface area of the concrete blocks.

Several conservative assumptions were made in calculating the total activity content of the concrete. First, the surface area was calculated based on total volume of concrete and a uniform thickness of two feet. This effectively creates approximately twenty-five percent more potentially contaminated surface area than actually exists. Second, all surfaces were assumed to be equally contaminated. Due to the presence of the protective steel liner plate, any contamination on the inner concrete surface is expected to be small relative to that measured on the outer surface. Table 1 indicates the total calculated activity of each radionuclide based on both the average of the sample concentrations and on the maximum concentrations measured in the surface.

Table 1
Radioactivity Content of the Doghouse Concrete

Nuclide	Half-life (years)	Ave. Conc. (pCi/gm)	Max. Conc. (pCi/gm)	Ave based Activity (uCi)	Max based Activity (uCi)
Co-60	5.3	1.33	2.70	7.8	16.0
Cs-134	2.1	0.33	0.70	1.9	4.1
Cs-137	30.0	2.60	7.70	15.4	45.6
Total		4.26	11.10	25.1	65.7

[illegible]

2.4 Sampling Program

In November of 1987, samples of the paint and outer layers of concrete were taken from the roofs and walls of the steam generator doghouse enclosures to determine the expected amount of radioactive contamination. Specialized 'scabbling' equipment was used to remove and collect samples of; the paint, first 1/16" layer, and second 1/16" layer of underlying concrete. The equipment is specially designed to accurately remove as little as 1/32". The scabbling equipment is also equipped with vacuum flow design features to collect the removed material, and provide protection from airborne radioactive particles. Material scarified from the doghouse surfaces was collected for radiological analysis. Precautions were taken to insure that cross contamination of the samples did not occur.

Samples were collected from a total of thirty-six locations on the two twin doghouse structures. Each sample area measured approximately 6" X 6". Ten samples were taken from each of the roofs of the two structures, and eight samples from the lower portion of the walls of each structure. Three passes were made at each location, first removing the paint (first pass), then 1/16" depth of the underlying concrete (second pass), and finally another 1/16" of concrete (third pass). Only a small amount of material was collected on each pass, therefore samples were combined for analysis. In each of the four areas, similar passes were combined. For example, on the roof, all 'first passes' were combined to form a representative sample of the paint from that area. The combining of all 'second passes' formed a representative sample of the first layer of concrete in that area, and so on. A total of twelve samples were collected and analyzed.

The samples were analyzed by Controls for Environmental Pollution, Inc. (CEP). CEP is under contract with I&M to perform routine and special sample analysis for the Cook Nuclear Plant. At the time of the contract award, CEP's procedures and methods were evaluated and approved as technically acceptable. An overview of the sample analysis method used is attached as Appendix A.

[illegible]

3.0 Concrete Preparation and Disposal

The concrete sections will be cut from the enclosures using a diamond wire saw cutting operation, which will result in relatively smooth cut surfaces. Equipment to control and minimize dust and debris are an integral part of the cutting operation. After removal of the large block sections, approximately one foot of concrete will be chipped back from the cutlines to expose the reinforcing bars. This concrete chipback material is not included in this application for alternate disposal.

3.1 Removal Operations and Controls

The blocks will be removed from containment to the auxiliary building. All surface areas of the blocks will then be wiped down to remove dust and materials which could be contaminated. After wipe down, the blocks will be surveyed for both loose and fixed contamination. Release surveys will be conducted in accordance with procedures for controlling the removal of any material from a radiologically controlled area.

The concrete blocks will be wrapped with protective material to further insure that no contaminated material is spread during initial handling. Wrapping shall include taping of all openings and seams. The concrete will be moved to a temporary storage area within the site protected area. Radiation protection controls during storage will be established based on the results of the contamination surveys.

3.2 Concrete Decontamination

Later in the Steam Generator Repair schedule, when space and manpower resources permit, the concrete blocks will be further processed prior to disposal. Items embedded in the concrete such as equipment supports, anchor bolts, and conduit and piping restraints shall be cut off flush with the concrete surface. The painted surface of the concrete will be removed to a minimum depth of 1/16" into the underlying concrete by a mechanical scarifying process. The paint and concrete residue resulting from this removal process is not included in this application for alternate disposal.

The decontaminated blocks will again be surveyed prior to release for disposal. Any areas on the blocks which do not meet radiation protection release criteria, or exceed the

[illegible]

assumptions made in the radiation dose evaluation of this application, will be further decontaminated prior to release for disposal.

3.3 Record Keeping

Records of contamination and radiation surveys made of the concrete material at any point in the outlined process shall be documented and maintained as required by procedures governing radiation and contamination surveys, and the removal of any material from a radiologically controlled area.

The quantity of radioactive material present in the concrete shall be reported, as it was derived in these evaluations, in the appropriate Donald C. Cook Nuclear Plant Semi-Annual Effluent Report for solid effluents as required by plant Technical Specifications.

3.4 Concrete Disposal

The proposed disposal method for the concrete blocks is to remove them to an area outside the protected area fence, but within the Donald C. Cook Nuclear Plant site boundary. The Cook Nuclear Plant is located in Lake Township, Berrien County, Michigan approximately eleven miles South-Southwest of the center of Benton Harbor, Michigan. The plant site consists of approximately 650 acres situated along the eastern shore of Lake Michigan. A more detailed description of the plant site area can be found in the "Final Environmental Statement Related to Operation of Donald C. Cook Nuclear Plant Units 1 and 2" (FES), issued by the United States Atomic Energy Commission in August 1973.

The chosen site is located as shown on the attached plot plan of the Cook Nuclear Plant site. This area is presently the site of concrete spoils and other construction remnants left from the construction of the plant. The site is more than 200 yards away from any area occupied by plant personnel on any regular basis, and is 150 yards away from Thornton Road. The site is also surrounded by earthen mounds on all sides, with the exception of the access point.

Once the concrete is in place, it will not be visible except at the access point. It has not yet been determined whether or not the slabs will be stacked or individually laid down

[illegible]

but, the maximum actual area occupied by the blocks will be less than twenty by twenty-five yards.

Due to the nature of the waste concrete, and the conclusions of the radiological and environmental assessments, I&M proposes no action beyond placement of the concrete blocks in the identified area.

This request for alternate disposal of the Unit #2 doghouse concrete is proposed for a one time occurrence due to an unusual maintenance activity. The only possible recurrence of this specific waste stream would be in the event that similar maintenance becomes necessary for Unit #1. In this event, a similar evaluation would be performed and submitted for approval.

The proposed disposal activity is expected to occur between July 1, and December 31, 1988.

4.0 Radiological Impact of Waste Disposal

An evaluation of the potential radioactive dose to a plant site worker and to a member of the general public has been performed to determine the radiological impact of placing the concrete in the proposed location on the Cook Nuclear Plant site. The details of this evaluation are included in Appendix B. The calculations were performed using applicable methodologies in Regulatory Guide 1.109, NUREG/CR-3332, and Introduction to Health Physics, Cember.

4.1 Potential and Principle Exposure Pathways

All potential exposure pathways recommended by Regulatory Guide 1.109 (Ref. I.) were evaluated with the exception of potential dose from incineration of the waste. There is no feasible scenario by which the concrete would be burned.

Highly conservative assumptions were made relative to the mechanisms and severity by which the radioactive inventory in the concrete might contribute to the exposure of any member of the public or a plant worker.

Assumptions made in each of the dose calculations, the calculational methodology followed, and the final dose results are all presented in Appendix B.

[illegible]

4.2 Exposure due to Ingestion Pathways

Calculations related to ingestion of radionuclides which escape to Lake Michigan, to the groundwater, or make their way to foodstuffs are all based on extremely conservative assumptions. No credit is taken for dilution by snow or rainwater. Liquid releases are assumed to occur at the original concentrations at time of disposal, exposure through foodstuffs is assumed after forty years of site control. The doses derived for each of these pathways are not additive, since each scenario assumed the entire inventory was available by the specific mode of exposure.

Doses due to ingestion of water from Lake Michigan, fish from Lake Michigan, or well water polluted by the concrete are on the order of one millionth to less than one trillionth of a millirem per year. In comparison to natural background radiation sources and the NRC proposed value of one millirem per year as Below Regulatory Concern (Ref. XI.), the doses from these pathways are indiscernible and essentially equal to zero.

For the calculation of dose from foodstuffs grown on the disposal site after loss of I&M control, pathways to grain, milk and meat were calculated. It was assumed the entire inventory of activity resided in the top fifteen centimeters of soil in the area equal to the concrete disposal area. It was then assumed that the entire yearly intake of food to a person was derived from that area. The maximum critical organ dose to a child under these assumptions is one tenth of a millirem. Total body and other organ doses were on the order of one hundredths or one thousandths of a millirem per year. The calculation also took no credit for rain and snow dilution.

4.3 Exposure due to Resuspension Pathway

For calculation of potential doses from inhalation of radionuclides released from the concrete, it was assumed that the radioactivity in the concrete was concentrated at the surface as dust with the potential to become airborne. The resuspension characteristics were assumed to be similar to those of very dry soil. The qualities of concrete make this scenario highly unlikely, and the calculated doses of less than one trillionth of a millirem per year indicate that the radiological impact from this pathway is realistically zero.

[illegible]

4.4 External Exposure due to 'Shine'

Shine exposure to persons in the vicinity of the concrete blocks is the most likely and most realistic pathway of radiation exposure due to this proposed disposal method. The calculation performed assumes direct exposure to the entire inventory of activity in the most conservative geometry. After loss of I&M control of the site, this exposure is assumed to be continuous. The calculation assumes that the radiation concentration is equal to the maximum sample analyzed. The radioactive inventory is assumed to be located in the extreme surface of the concrete, thus eliminating the majority of the self-shielding of the material.

4.5 Dose to the Maximally Exposed Individual

The dose to the maximally exposed plant worker is due to shine or external exposure from the concrete blocks. The assumption is that the worker stands within one meter of the block for inspection or survey purposes for 250 hours per year.

Maximum Potential Whole Body dose to a Cook Nuclear Plant Worker due to 'shine'.

0.102 mrem/year

For the case of an inadvertent intruder onto the disposal site, it was conservatively assumed that the intruder would remain in the vicinity (within one meter) of the concrete continuously for two weeks before being identified by security.

Maximum Potential Whole Body Dose to an Inadvertent Intruder on the disposal site due to 'shine'.

0.138 mrem

After loss of I&M control of the disposal site, the dose due to shine from the disposed concrete was conservatively assumed to be continuous, or twenty-four hours per day at one meter. Ingestion of foodstuffs grown on the site may also contribute to the dose impact after the site is abandoned but is not considered to be additive to the external dose. It is not likely that food would be grown in the area unless the concrete blocks had been removed.

[illegible]

Maximum Potential Whole Body Dose to an Individual after the site is released from Institutional control.

Due to 'shine'	0.711 mrem/year
Due to ingestion of foodstuffs	0.024 mrem/year

All of the evaluated maximum doses are less than the proposed NRC value of one millirem per year for material Below Regulatory Concern.

5.0 Environmental Impacts Assessment

Steam Generator Repair at Cook Nuclear Plant Unit #2 was thoroughly evaluated economically, radiologically and environmentally, as is documented in the Repair Report (Ref. X.). Removal of the concrete as described is necessary to provide access for removal and reinstallation of the steam generator lower assemblies. The concrete cannot be placed back into the unit and therefore must be disposed of.

5.1 Burial of Concrete at a Licensed Facility

The only alternative presently available for the disposal of licensed radioactive material is burial in an offsite licensed burial facility. At current rates, this option would cost a minimum of $1.8 million. This total includes the cost of cutting the blocks for shipment, burial charges, transportation, and packaging. In addition to these costs, there would be added work to the project scope which could impact the outage length. The estimated cost of the proposed method of decontamination and disposal is $200,000, including packaging, transportation, and burial of the removed painted surface material.

Aside from the dollar cost to I&M and its ratepayers, the burial of this concrete at an offsite licensed facility will require approximately 17,500 cubic feet of allocated burial space. The proposed decontamination and on-site disposal will require only an estimated 1,600 cubic feet of allocated space. I&M has already requested and been granted additional burial space to accommodate the repair outage wastes, however, the project goal will be to minimize the utilization of the allocation.

5.2 Non-Radiological Impacts

Impact of the proposed disposal method has been reviewed and shows no significant effect on the environment. The environmental characteristics examined include geographical, demographical, land use, hydrological, geological, ecological, historical, archeological, architectural, scenic, and cultural.

The conclusions on environmental impact are based on the physical and chemical stability of the high grade concrete, the present similar use of the proposed site, and the fact that no soil will be disturbed.

Noise levels generated by the construction equipment used to transport the concrete could be considered a nuisance by individuals living adjacent to the plant. However, this is only a temporary impact that will last only a few days.

5.4 Evaluation of Costs and Benefits

From a cost standpoint, the proposed disposal of the concrete shows a benefit of approximately $1.6 million over disposal in an offsite licensed facility. A savings of nearly 16,000 cubic feet of burial space allocation benefits Indiana Michigan Power Co. and all other generators of low-level radioactive waste under the provisions of the Low-Level Radioactive Waste Policy Act, as amended.

6.0 Summary and Conclusions

I&M concludes, based on the analysis and evaluations presented in this application, that disposal of the removed steam generator doghouse concrete in the manner proposed will have negligible impact on public health and safety or the environment.

To summarize, this conclusion is based on the following:

1) The maximum potential exposure to any individual, via prolonged exposures which are unlikely to occur, is 0.711 mrem per year. This is very much less than the allowed doses from regulated sources of radioactive discharges and commensurate with the NRC proposed definition of Below Regulatory Concern.

2) The material is of a physical form which is of little or no value for recycle, and would be very difficult to handle or remove from the site.

3) The estimated additional cost of $1.6 million for licensed disposal of the concrete would be borne by I&M ratepayers with no significant benefit to public health and safety or the environment.

4) Disposal of the concrete as proposed in this petition meets the intent of 10 CFR 20.302 and the Low-Level Radioactive Waste Policy Act, as amended to efficiently utilize space in existing disposal sites for licensed radioactive material.