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STRUCTURAL ANALYSIS OF
EQUIPMENT STATION 75-0010
VOLUME I

November 1977

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STRUCTURAL ANALYSIS OF
EQUIPMENT STATION 75-0010
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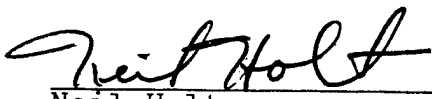
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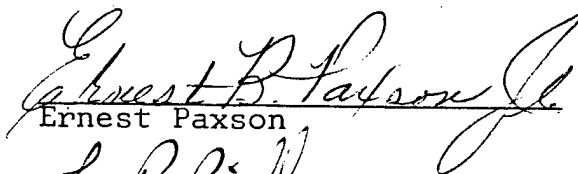
This report describes the structural analysis used to verify the structural adequacy of equipment station 75-0010 under crash loadings as specified by MIL-A-8865. This work was done by the Aerospace Structures Information and Analysis Center, which is operated for the Air Force Flight Dynamics Laboratory by Anamet Laboratories under Contract Number F33615-77-C-3046. The work was performed in support of the 6585th Test Group at Holloman Air Force Base, New Mexico.

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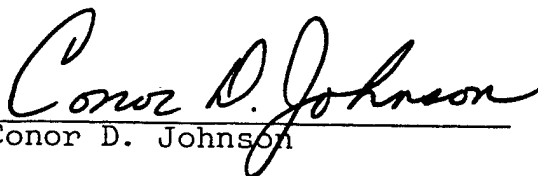

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I. INTRODUCTION

This report documents a structural analysis performed by ASIAC at the request of the Air Force to verify the structural adequacy of equipment station 75-0010 under crash loadings as specified by MIL-A-8865.

Equipment station 75-0010 is schematically shown in Fig. 1. The equipment station is composed of a rack pallet and a seat pallet. A typical rack pallet with isolators used for connecting the rack to the pallet is shown in Fig. 2. Shown in Fig. 3 is a picture of a typical rack structure. Detailed finite element models of the equipment rack and pallets have been developed in order to accurately determine deflections and stresses at equipment station 75-0010.

Section II presents a discussion of the approach taken to analyze this structure including details concerning modeling assumptions and interpretation of results. In Section III the results of the finite element modeling and detailed hand calculations are presented. Conclusions are in Section IV. The appendices include supportive material needed to verify the validity of the analysis.

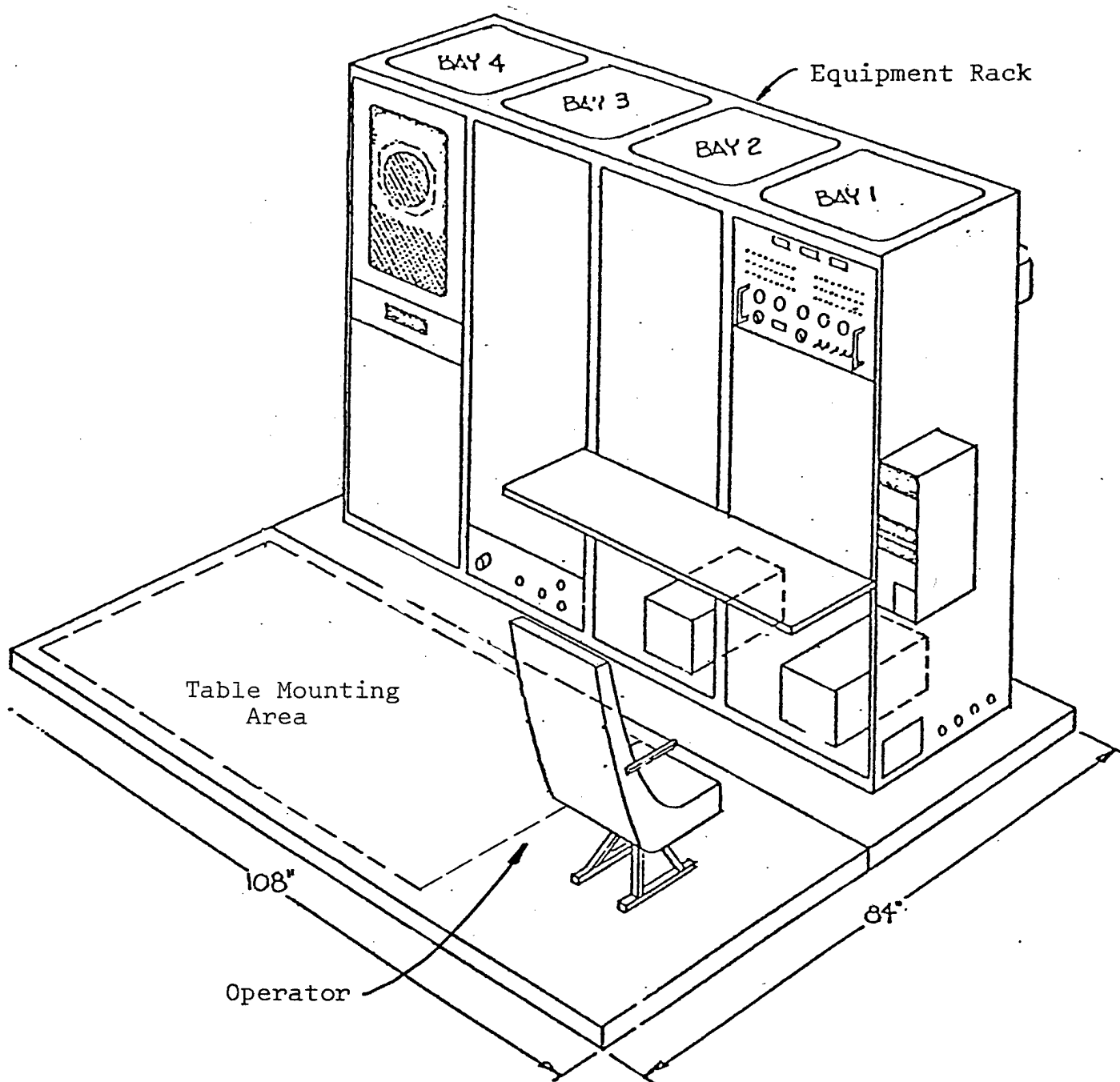


Fig. 1 Schematic of Equipment Station in Aircraft

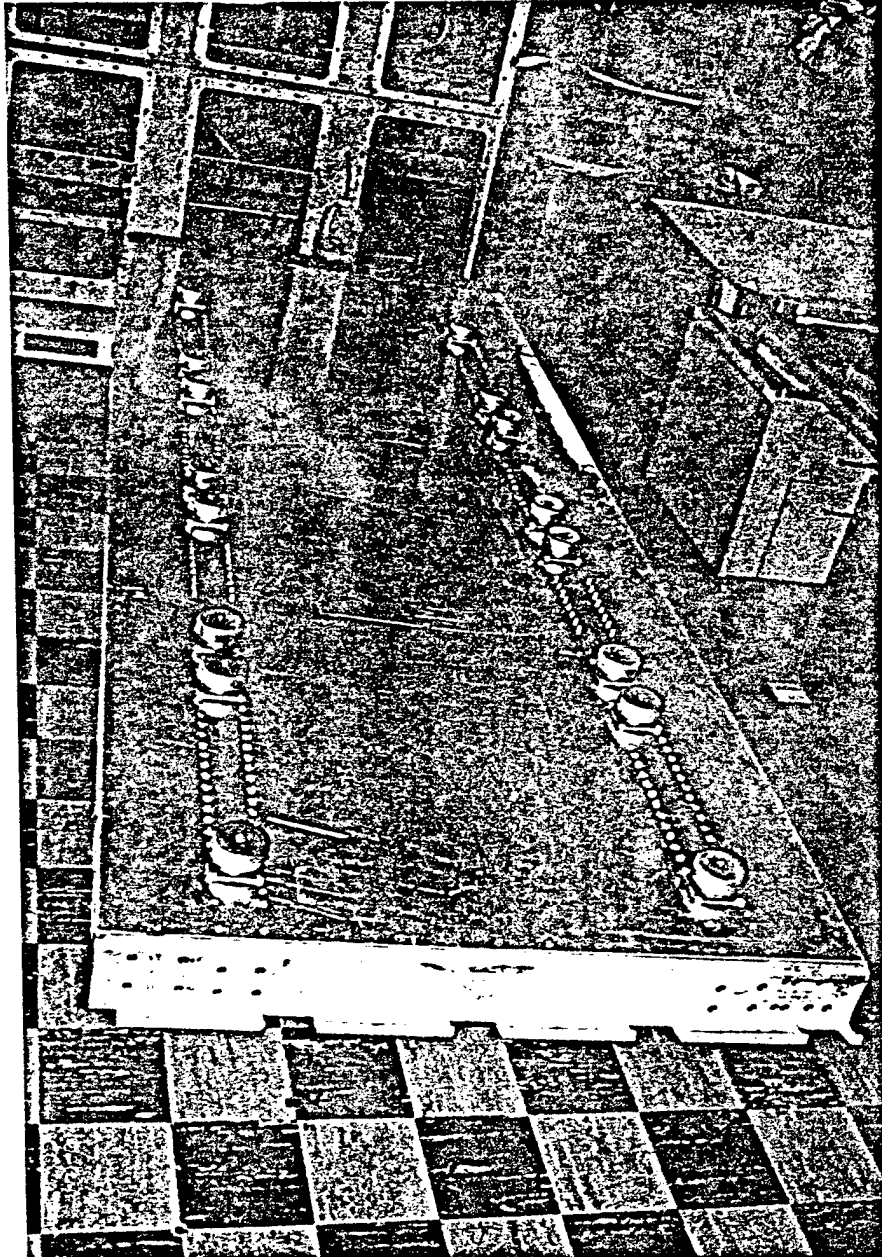


Fig. 2 Top View of Typical Pallet Showing Isolators

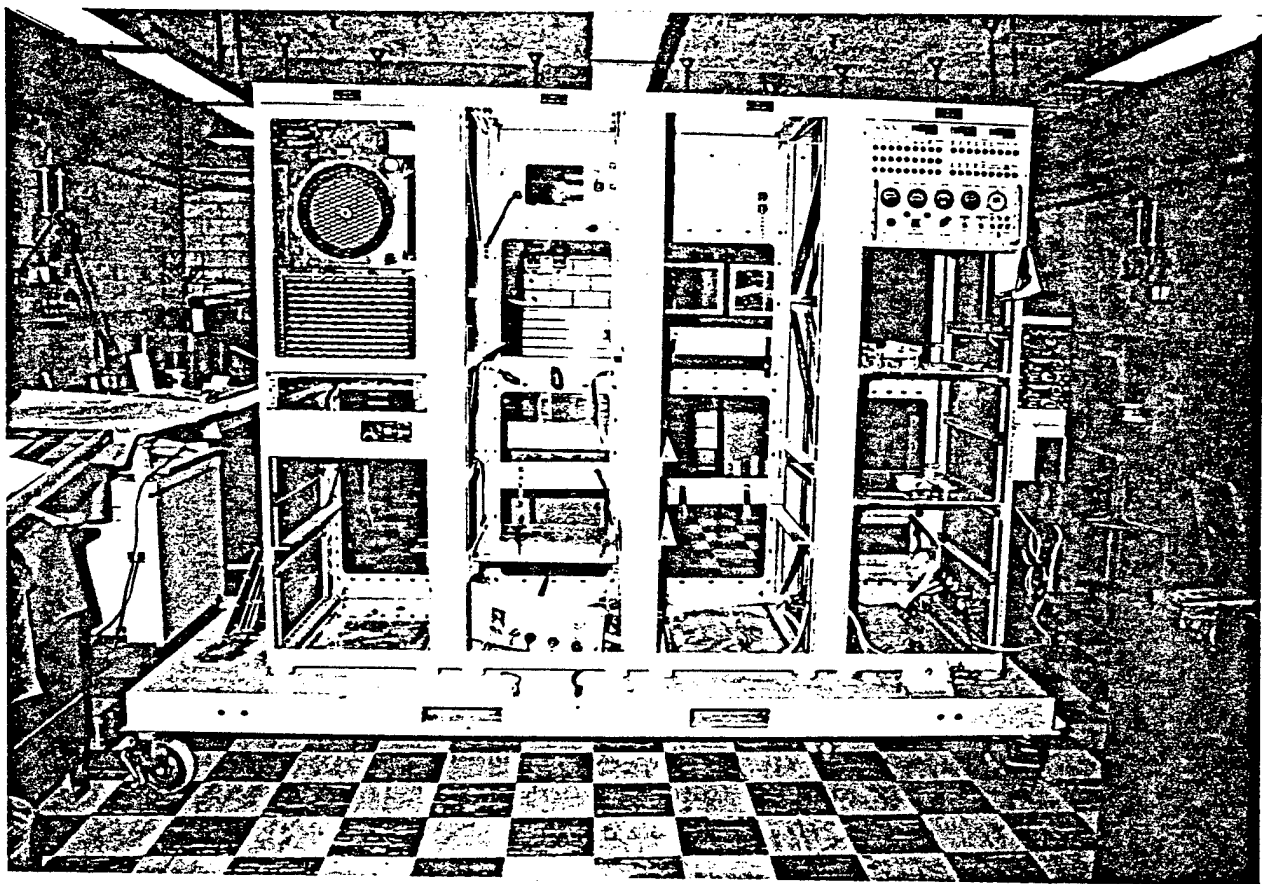


Fig. 3 Typical Equipment Rack on Pallet

II. TECHNICAL DISCUSSION

Structural analysis of this equipment station has been accomplished by using the finite element code NASTRAN in combination with detailed hand calculation stress analysis for areas that indicate either a low margin of safety or can not be adequately modeled with finite elements.

Included in the following paragraphs is detailed information concerning the items listed below:

1. Boundary conditions
2. Loads
3. Materials
4. Model discretization
5. Mass distribution of equipment
6. Presentation of results

Once placed and secured in the C141 aircraft the pallets are prevented from movement in the following manner (as described in Reference 1). The forward/aft movement is restrained by mechanisms that lock the C141 restraint rail onto the pallet edge (2 per pallet half, one on each side of pallet). Right/left and vertical up motion is prevented by the restraint rail lip that fits over the edge of the pallet. Vertical down motion is prevented by four rows of rollers that run in the forward/aft direction of the aircraft. Rollers are present along each edge and also under each fork lift tunnel. These restraints have been modeled with the use of the appropriate SPC card in NASTRAN. An SPC card in NASTRAN is used to specify a constrained degree-of-freedom at a particular node point. Under forward/aft and right/left g loadings, the pallets tend to bend and twist such that the roller supports under the tunnel may or may not be in contact with the pallet bottom. However, after an initial NASTRAN run the movement of the pallet bottom was determined and the appropriate SPC cards were used to constrain those points on the pallet which contact the rollers. For instance, nodes 86, 92, 93, and 99

are located at the edges of the pallet under the tunnel (see Figures in Appendix D). For vertical up loads these points are not SPC'd since the pallet lifts off the rollers. For vertical down loads these nodes are SPC'd since the pallet contacts the rollers. For non-vertical loads the pallet tips, and thus, two nodes must be SPC'd since the pallet contacts the rollers and the others are left free since the pallet lifts away from the rollers. For instance, for a 9 g aft load, nodes 86 and 93 are SPC'd, the others are not. In this manner, the boundary conditions for the pallet are correctly handled.

The equipment rack is loaded with 350 lb. for Bays 1 and 2 located at a center of gravity approximately half the total height of the rack. Bays 3 and 4 were loaded according to the weights and location per the technical drawings available (see Appendix A).

Several procedures have been incorporated into the modeling process to insure that the final data set used for analysis was consistent and accurate. In particular, the aspect ratio of each of the plate elements is checked to insure that element connectivity and node point location are correct. This check on the aspect ratio also insures that excessively stiff elements (due to large aspect ratio) are not utilized in the analysis. Numerous plots are also made to insure that the model has been assembled correctly and accurately represents the physical structure. Some of these plots are included in the appendices.

During the execution phase the NASTRAN program also prints out diagnostic messages to inform the user of the validity of the answers and the correctness of the data input. In particular, the quantity EPSILON as output by NASTRAN is a measure of the accuracy of the numerical solution. For all subcases and for each pallet system analyzed EPSILON was checked to insure that analytical results were accurate. Typically, EPSILON had a value in the range of 1×10^{-10} to 1×10^{-12} which indicates a good NASTRAN numerical solution.

The displacements and SPC forces printed are also checked to insure that the data input correctly represents the boundary conditions applied to the actual structure.

The loads used in the analysis are shown below and were obtained from MIL-A-8865. (Reference 2)

Forward/Aft	9 g
Right/Left	1.5 g
Vertical up	4 g
Vertical down	6 g

For the seat the following loads are used:

Forward	16 g
Aft	6 g
Right/Left	5.5 g
Vertical up	7.5 g
Vertical down	16 g

These loads were used to form 6 subcases for the NASTRAN runs. In this analysis, the stresses due to combination of orthogonal loadings is not considered or required for qualifications.

Materials used in the construction of the pallets are primarily various aluminum alloys. Properties for each particular alloy were obtained from MIL-HDBK-5. Elastic structural analysis and the appropriate elastic properties have been used.

Utilizing the drawings referenced in Appendix A, in conjunction with personal communication with knowledgeable Air Force personnel, the pallet stations were idealized as an assemblage of plates, bars, shear panels, rods, springs, etc. Sufficient elements and nodal points were incorporated into the model to insure that stress results would be very representative of the stress states in the pallet stations. Areas not adequately modeled by the finite element technique or areas that showed a low margin of safety were analyzed in detail by hand to insure adequate structural margins under the imposed

loads. The final equipment station models used are shown plotted in Appendices B, C and D.

Calculations of bar properties are presented in Appendix E along with the necessary information to determine bar offsets and stress recovery points. Areas of the pallet system that are critical in terms of their structural capability have been modeled very accurately with respect to properties and spatial position of centroids, etc. For less important areas, the increase in moment of inertia due to a bar being offset has been neglected which is a conservative assumption with respect to this structure. All margins of safety unless otherwise noted, are based on the yield properties of that material.

The stress output from NASTRAN is quite voluminous and thus is not included in this report. The output, however, will be retained at ASIAC and is available upon request. Microfiche copies of the output are included with this report. The table below lists the run identification number that corresponds to the particular run.

<u>RUN ID</u>	<u>NAME</u>
RRAlSCS	75-0010 Seat Pallet
RRAlRlT	75-0010 Rack Pallet

The detailed stress analysis hand calculations are presented in Appendix G.

III. SUMMARY OF RESULTS

The structural adequacy for this equipment station is verified by utilizing both the finite element technique and detailed stress analysis. Both of these approaches complement each other.

The finite element analysis uses NASTRAN to calculate internal moments and forces as well as displacements and member stresses. The internal forces and moments are used in the detailed stress analysis. The member stresses are examined to determine what areas of the structure may require further analysis.

The results of the NASTRAN analysis are shown in Tables 1 through 4 for Tension and Tables 6 through 9 for Compression. The allowable stresses for the various aluminum grades are presented in Table 5. Subcase numbers correspond as follows:

Subcase No. 1	9 g aft
Subcase No. 2	9 g forward
Subcase No. 3	6 g down
Subcase No. 4	4 g up
Subcase No. 5	1.5 g left
Subcase No. 6	1.5 g right

The margins of safety presented in these tables are based on yield strength of the material. As can be seen, there are no negative margins.

The detailed stress analysis (See Appendix G) is used to examine areas of the structure that have:

- (1) Low margins of safety in tension.
- (2) Low margins in compression where buckling phenomenon may be of concern.
- (3) Areas not modeled adequately by the finite element technique.
- (4) Fasteners, bolted joints, etc., which are not modeled.

TABLE 1
STRESSES AND MARGINS OF SAFETY FOR TENSION
IN SEAT PALLET*

Element No.	Load Case (Subcase No.)	Max. Stress (Psi.)	Margin of Safety
1028	1	13,826	+2.0
1036	1	18,675	+1.2
1605	1	18,482	+1.3
1607	1	18,647	+1.3
1608	1	17,874	+1.3
1615	1	15,702	+1.7
1616	1	15,740	+1.7
2044	1	20,292	+1.1
2045	1	23,837	+ .8
2050	1	17,077	+1.5
2051	1	18,878	+1.2
1029	2	14,041	+2.0
1037	2	25,278	+ .7
2042	2	19,432	+1.2
2043	2	17,414	+1.4
2048	2	19,051	+1.2
2049	2	18,005	+1.3
1615	3	18,018	+1.3

* For margins less than or equal to 2.0

TABLE 2
STRESSES AND MARGINS OF SAFETY FOR TENSION
IN RACK PALLET *

Element No.	Load Case (Subcase No.)	Max. Stress (Psi.)	Margin of Safety
3005	1	27,704	+ .5
3008	1	28,521	+ .5
3031	1	26,241	+ .6
3039	1	23,676	+ .8
3047	1	22,813	+ .5
3083	1	16,953	+1.0
3089	1	16,522	+1.0
3095	1	29,250	+ .4
3096	1	27,755	+ .5
3600	1	27,160	+ .6
3603	1	26,123	+ .6
3606	1	20,914	+1.0
4017	1	20,639	+1.0
3017	2	27,297	+ .5
3020	2	29,433	+ .4
3031	2	36,072	+ .2
3039	2	32,736	+ .3
3052	2	23,185	+ .4
3088	2	17,158	+ .9
3094	2	16,922	+1.0
3611	2	27,018	+ .6
4005	2	20,924	+1.0
4095	2	26,662	+ .6
4098	2	24,527	+ .7

* For margins less than or equal to 1.0

TABLE 3
STRESSES AND MARGINS OF SAFETY FOR TENSION
IN EQUIPMENT RACK *

Element No.	Load Case (Subcase No.)	Max. Stress (Psi.)	Margin of Safety
264	1	23,633	+ .8
444	1	17,036	+ .9
461	1	18,782	+ .8
464	1	18,670	+ .8
465	1	18,358	+ .8
466	1	16,870	+1.0
467	1	17,087	+ .9
468	1	16,104	+1.0
469	1	17,616	+ .9
470	1	17,237	+ .9
472	1	16,484	+1.0
475	1	17,104	+ .9
477	1	18,119	+ .8
478	1	20,263	+ .6
479	1	17,956	+ .8
482	1	18,766	+ .8
483	1	16,645	+1.0
485	1	24,504	+ .4
362	2	28,854	+ .5
363	2	23,495	+ .8
366	2	27,735	+ .5
367	2	22,961	+ .8
461	2	29,003	+ .1
463	2	24,654	+ .3
466	2	21,765	+ .5
469	2	17,798	+ .9
472	2	20,470	+ .6
475	2	22,679	+ .5
478	2	17,964	+ .8
480	2	22,292	+ .5
481	2	22,052	+ .5
482	2	30,844	+ .7
362	5	21,250	+1.0
366	5	21,935	+ .9
370	5	20,968	+1.0
364	6	20,793	+1.0
367	6	20,532	+1.0
368	6	21,676	+ .9

* For margins less than or equal to 1.0

TABLE 4
STRESSES AND MARGINS OF SAFETY FOR TENSION
IN SEAT PALLET TABLE*

Element No.	Load Case (Subcase No.)	Max. Stress (Psi.)	Margin of Safety
2247	2	14,687	+1.9
2250	2	21,225	+1.0
2257	2	30,064	+ .4
2263	2	15,752	+1.7
2266	2	16,619	+1.5
2267	2	27,158	+ .6
2268	2	16,437	+1.6
2229	1	28,676	+ .5
2257	1	22,406	+ .9
2267	1	18,104	+1.3
2266	1	22,791	+ .8
2262	1	16,718	+1.5

*For margins less than or equal to 2.0

TABLE 5
MATERIAL PROPERTIES OF ALUMINUM*

Property	Sheet 2024-T3	Extruded 6061-T6	Extruded 2024-T3
E ($\times 10^6$ psi)	10.50	9.90	10.8
G** ($\times 10^6$ psi)	3.95	3.72	4.06
μ	0.33	0.33	0.33
w (lb/in ³)	0.100	0.098	0.100
F _{tu} (psi)	63,000	37,000	54,000
F _{ty} (psi)	42,000	33,000	37,000
F _{cy} (psi)	39,000	35,000	34,000
F _{su} (psi)	39,000	27,000	29,000
F _{bru} (psi) $\frac{e}{D} = 1.5$	106,000	64,000	84,000
$\frac{e}{D} = 2.0$	131,000	82,000	108,000
F _{bry} (psi) $\frac{e}{D} = 1.5$	73,000	54,000	61,000
$\frac{e}{D} = 2.0$	88,000	60,000	108,000

* MIL-HDBK-5

** As determined by NASTRAN code using $G = \frac{E}{2(1+\mu)}$

TABLE 6
STRESSES AND MARGINS OF SAFETY FOR COMPRESSION
IN SEAT PALLET*

Element No.	Load Case (Subcase No.)	Max. Stress (Psi.)	Margin of Safety
1029	1	14,292	+1.7
1037	1	25,389	+ .5
2042	1	19,678	+1.0
2043	1	17,812	+1.2
2048	1	19,002	+1.1
2049	1	18,082	+1.2
1028	2	14,012	+1.8
1605	2	15,968	+1.4
1607	2	18,508	+1.1
1608	2	17,143	+1.3
1615	2	19,003	+1.1
1616	2	16,201	+1.4
2044	2	20,699	+ .9
2045	2	24,167	+ .6
2050	2	17,121	+1.3
2051	2	18,799	+1.1
1615	3	18,304	+ .7

*For margins less than or equal to 2.0

TABLE 7
STRESSES AND MARGINS OF SAFETY FOR COMPRESSION
IN RACK PALLET *

Element No.	Load Case (Subcase No.)	Max. Stress (Psi.)	Margin of Safety
3005	1	20,286	+ .9
3031	1	35,882	+ .1
3039	1	32,352	+ .2
3052	1	19,897	+ .8
3095	1	20,699	+ .9
3096	1	21,805	+ .8
3600	1	24,620	+ .6
3603	1	26,080	+ .5
3017	2	22,292	+ .8
3020	2	22,445	+ .7
3031	2	27,358	+ .4
3039	2	24,897	+ .6
3047	2	19,083	+ .8
3097	2	23,858	+ .6
3098	2	23,681	+ .7
3592	2	25,869	+ .5
3611	2	24,449	+ .6
4095	2	21,040	+ .9

* For margins less than or equal to 1.0

TABLE 8
STRESSES AND MARGINS OF SAFETY FOR COMPRESSION
IN EQUIPMENT RACK*

Element No.	Load Case (Subcase No.)	Max. Stress (Psi.)	Margin of Safety
251	1	21,769	+ .8
362	1	23,260	+ .7
363	1	21,184	+ .8
364	1	25,833	+ .5
366	1	25,173	+ .6
367	1	20,196	+ .9
443	1	17,652	+1.0
461	1	19,656	+ .8
462	1	18,984	+ .8
463	1	25,493	+ .4
466	1	24,801	+ .4
469	1	24,277	+ .4
472	1	26,124	+ .3
475	1	23,396	+ .5
478	1	17,331	+1.0
480	1	23,582	+ .4
481	1	23,285	+ .5
482	1	23,932	+ .5
260	2	20,774	+ .9
262	2	21,509	+ .8
264	2	21,683	+ .8
444	2	20,409	+ .7
461	2	23,631	+ .5
464	2	18,992	+ .8
465	2	19,302	+ .8
468	2	18,380	+ .9
474	2	20,066	+ .7
477	2	18,747	+ .9
478	2	20,793	+ .7
479	2	18,257	+ .9
482	2	22,709	+ .5
483	2	19,542	+ .8
364	5	21,027	+ .9
367	5	20,566	+ .9
368	5	21,712	+ .8
372	5	20,779	+ .9
362	6	21,006	+ .9
363	6	20,138	+ .9
366	6	21,787	+ .8
367	6	20,781	+ .9

* For margins less than or equal to 1.0

TABLE 9
STRESSES AND MARGINS OF SAFETY FOR COMPRESSION
IN SEAT PALLET TABLE*

Element No.	Load Case (Subcase No.)	Max. Stress (Psi.)	Margin of Safety
2229	1	18,441	+1.1
2247	1	14,580	+1.7
2250	1	21,354	+ .8
2257	1	30,327	+ .3
2263	1	15,558	+1.5
2266	1	16,502	+1.4
2267	1	26,895	+ .5
2268	1	16,539	+1.4
2229	2	28,484	+ .4
2250	2	13,123	+2.0
2257	2	22,280	+ .8
2262	2	16,742	+1.3
2266	2	22,862	+ .7
2267	2	18,090	+1.2
2253	6	13,089	+2.0

*For margins less than or equal to 2.0

IV. CONCLUSIONS

A structural analysis of equipment station 75-0010 has been performed. Both finite element and detailed hand calculations were employed in order to determine the stresses and margins of safety. Crash loadings as specified in MIL-A-8865 were used.

For equipment station 75-0010, the lowest margins of safety and their corresponding locations are as follows:

Seat Rail Flange	+ .20
Seat pallet table	+ .30
Internal Diagonal connection, vertical extrusion	+ .48
Clips	+ .50
Corner bolting	+ .53
Equipment rack clip, 2 bolt section	+ .57
Table bolts at vertical column connection	+ .59
Seat rail support beams	+ .60

The results show that under the specified loads and for the given pallet-attached structures, the pallets and equipment rack retain their structural load carrying capability.

REFERENCES

1. Letter from Paul A. Riemer, AMDA to 4950/AMS Concerning "6585TG Submittal of PDMM Drawings dated 1 Sept. 1977," letter dated 9 Sept. 1977.
2. MIL-A-8865
3. Baker, E. H, Kovalsky, L, and Rish, F. L., Structural Analysis of Shells, McGraw Hill Book Company, New York 1972.
4. Communication with Dan Scott, U.S.A.F., Holloman AFB, 6585th Test Group.GDLC. Tests performed by Dan Scott.
5. INERTIA User's Guide, Anamet Report No. 1077.556.

APPENDIX A

TABULATION OF TECHNICAL DRAWINGS
FOR EQUIPMENT STATION 75-0010

TABULATION OF TECHNICAL DRAWINGS

<u>Description</u>	<u>U. S. Air Force Drawing Number</u>
CIRIS Block Diagram	77XEE-1154
CIRIS Interconnect Cables	77XEE-1155
Mars Recorder, CC301 & Doppler Cables	77XEF-1156
CIRIS Interconnect Cable W14	77XEF-1157
Cains Interconnect Cables	77XEE-1158
Seat Power Distribution	77XEE-1159
Power Distribution and Control	77XEE-1160
CC301 Shelf Installation	77XMF-1166
Seat Equipment Installation (Front)	77XME-1170
Seat Equipment Installation	77XME-1170
Seat Equipment Installation (Back)	77XME-1170
CIU Installation	77XMC-1171
Cabinet Slide Detail (Left Side)	77XMF-1172
Unitron Slide Detail (Left Side)	77XMF-1173
Mars Recorder Installation	77XMF-1174
CC301 Installation	77XMF-1175
Rack Equipment Identification	77XME-1176
Rack Equipment Installation	77XME-1177
Unitron Installation (400 ~ 30 to 60 ~ 10)	77XME-1177
Equipment Installation (Bay #2)	77XME-1177
Computer and Disc Installation	77XME-1177
Air Conditioner Installation	77XME-1177
Tape Drive and I/O Extender	77XME-1177

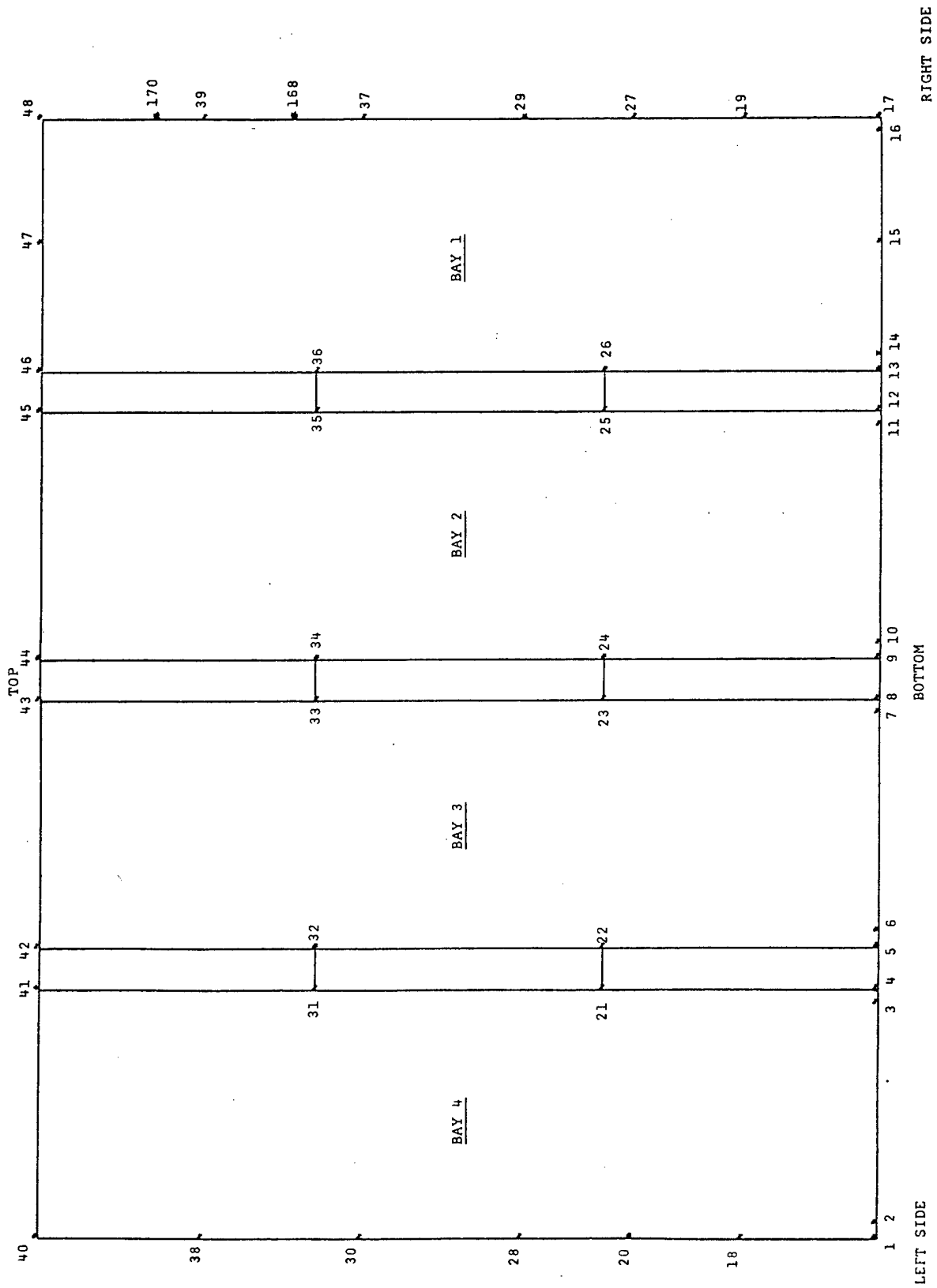
TABULATION OF TECHNICAL DRAWINGS (cont'd)

<u>Description</u>	<u>U. S. Air Force Drawing Number</u>
Power Distribution and Control Panel	77XME-1177
Hard Copier Installation	77XME-1177
CIRIS Cargo Pallets	77XME-1161
Plate & Seat to Pallet Attachment (PDMM only)	77XME-1162
Seat Pallet	77XME-1162
Seat Pallet Detail	77XME-1162
Equipment Rack Pallet	77XME-1163
CIRIS Half Pallet (Seat)	77XME-1164
Plate Installation (Item 26)	77XMF-1165

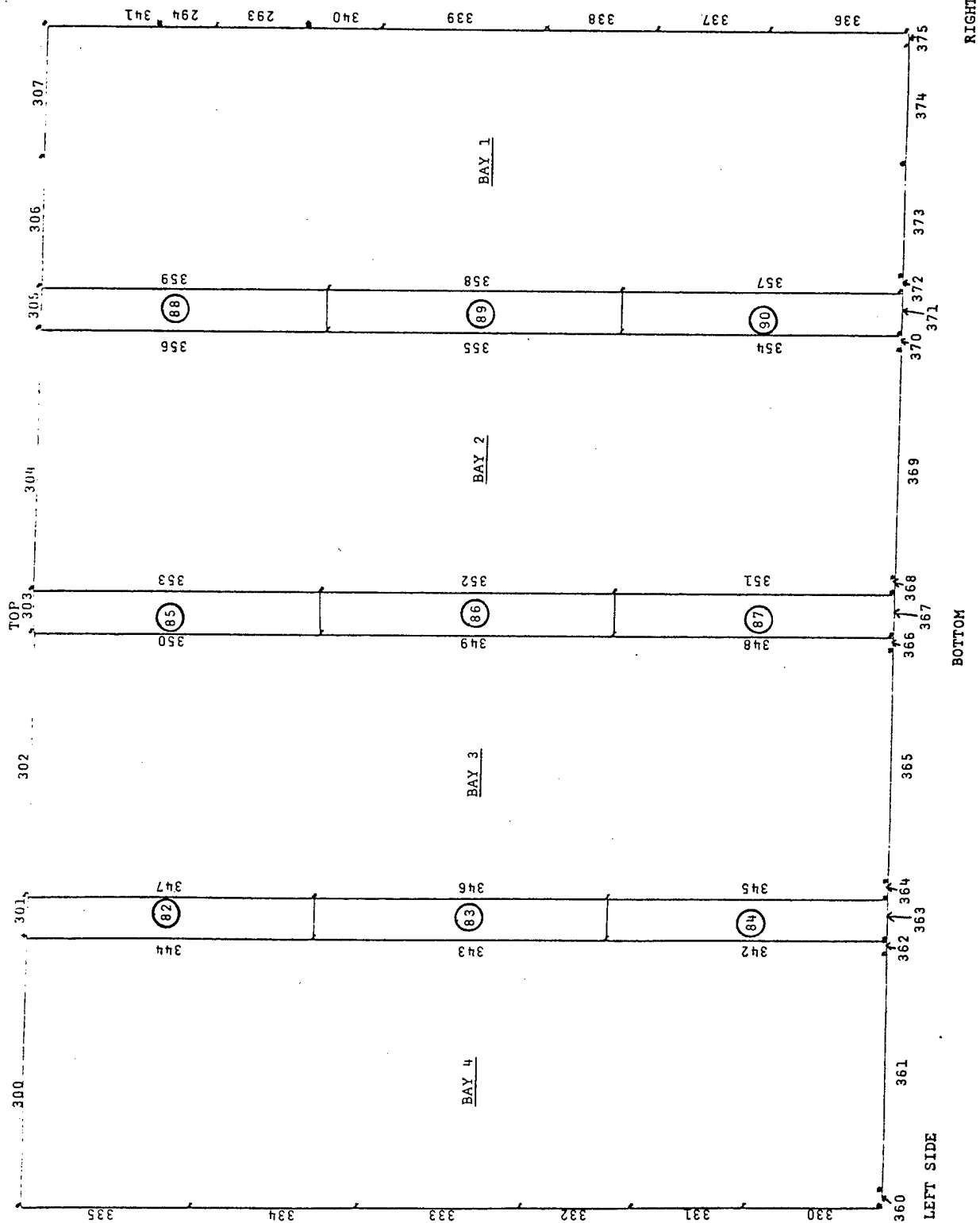
APPENDIX B

FINITE ELEMENT MODEL
OF EQUIPMENT RACK

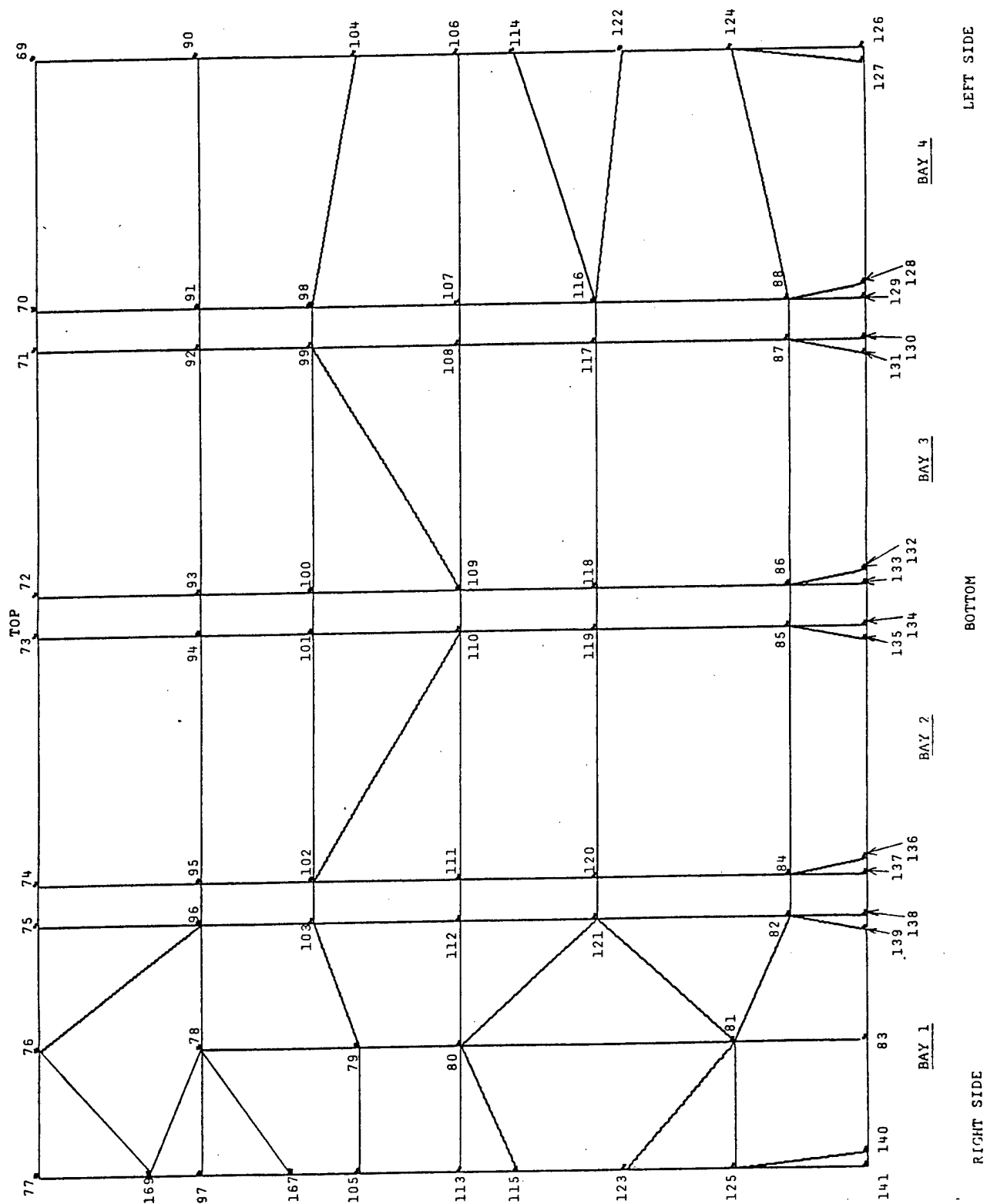
In this appendix, plots of the equipment rack model are presented. The model contains almost 1100 degrees of freedom, with 185 grid points, 300 bars, and 151 plate elements.

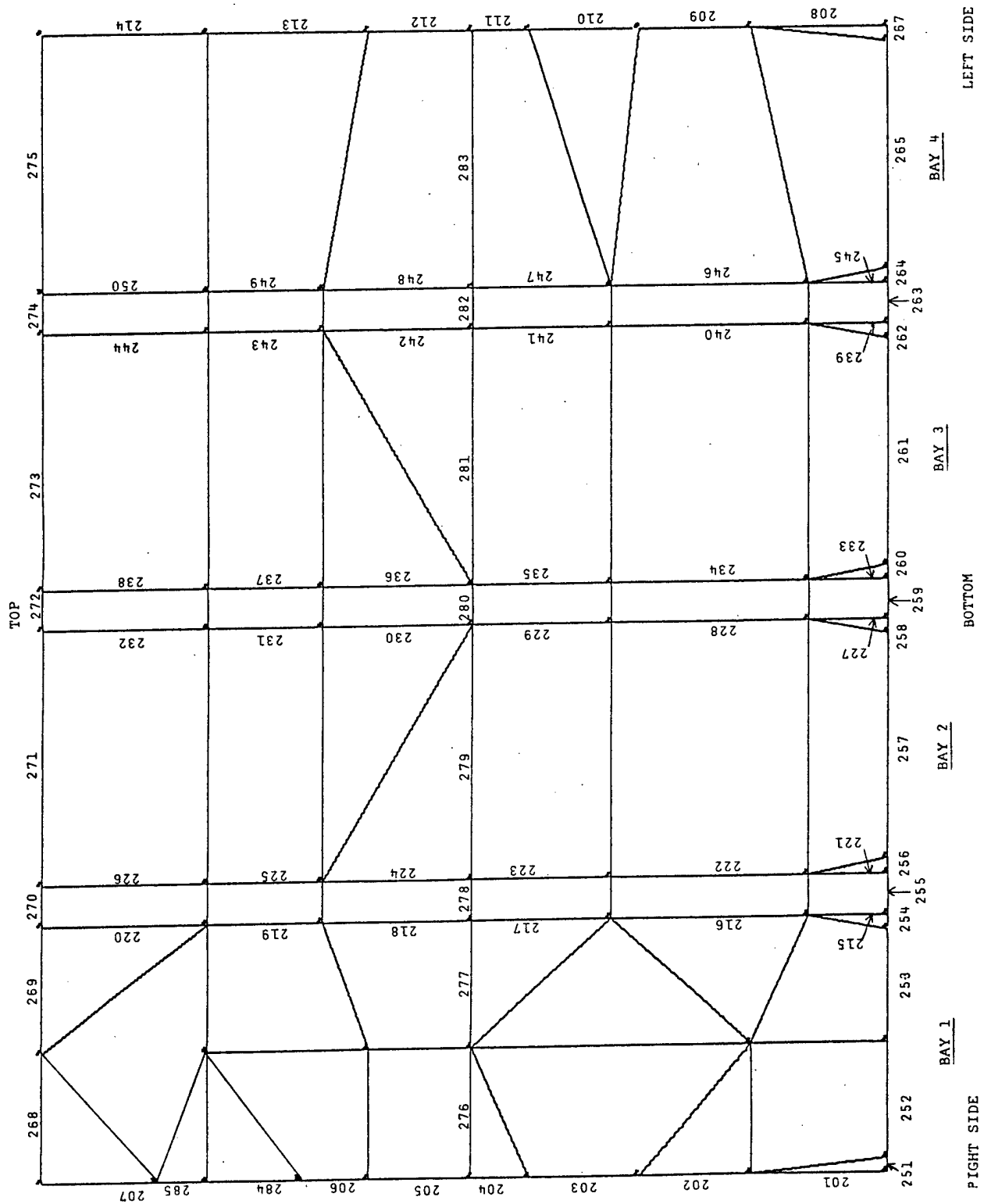


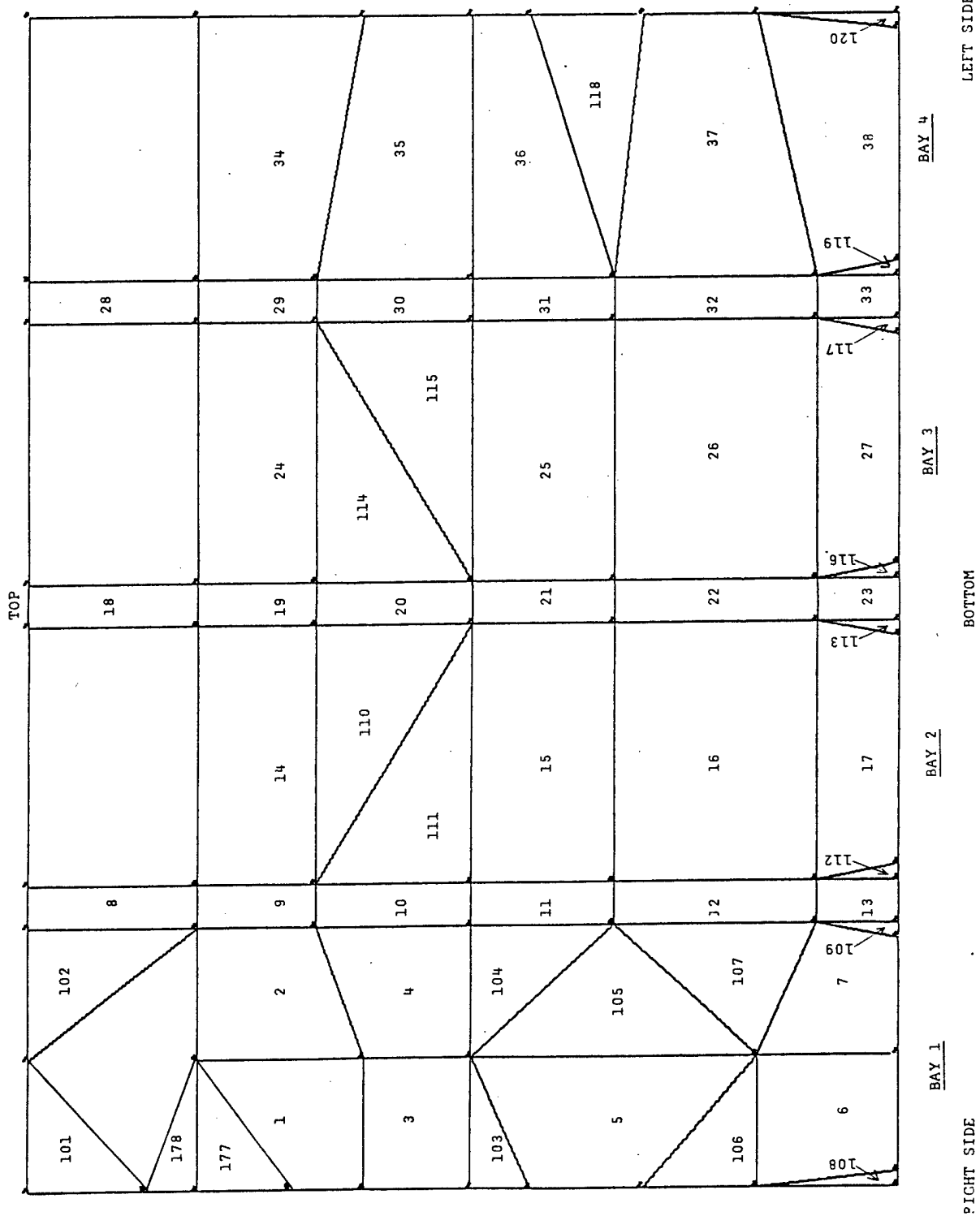
Front Structure, Equipment Rack, Grid Points



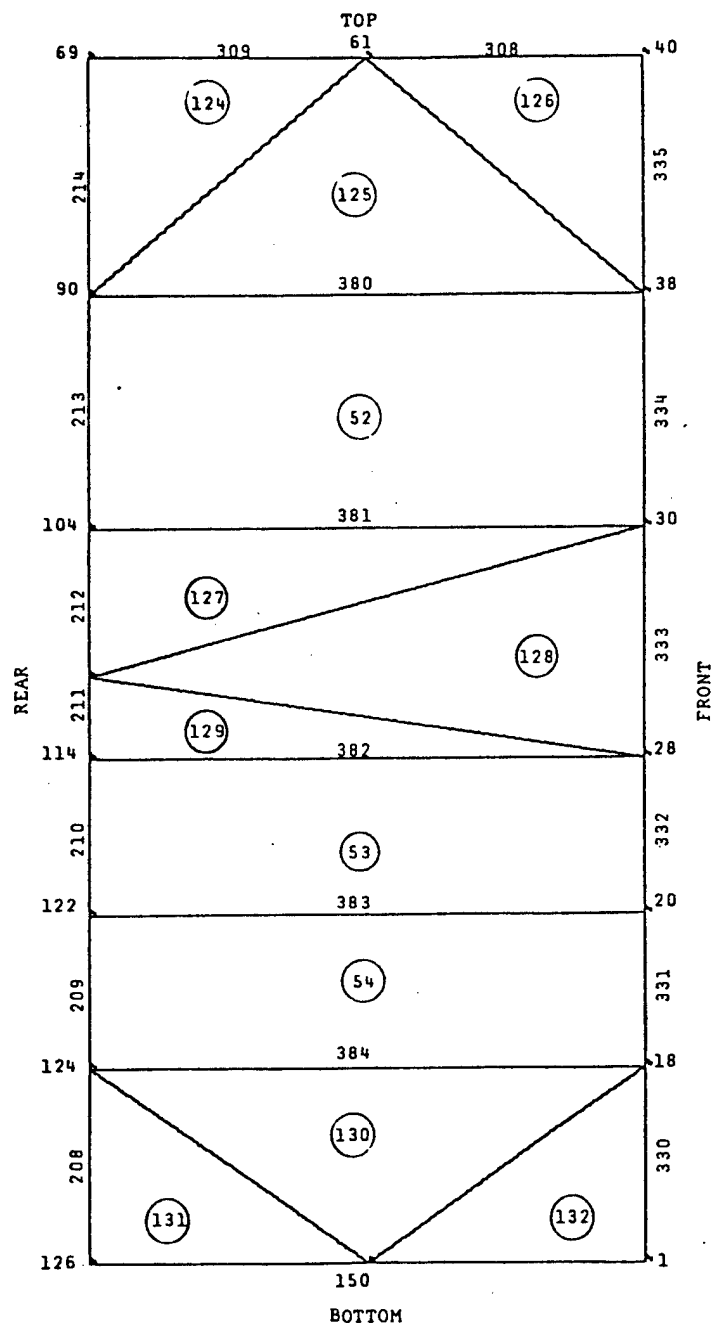
Front structure, Equipment Rack, Bar and Plate Elements



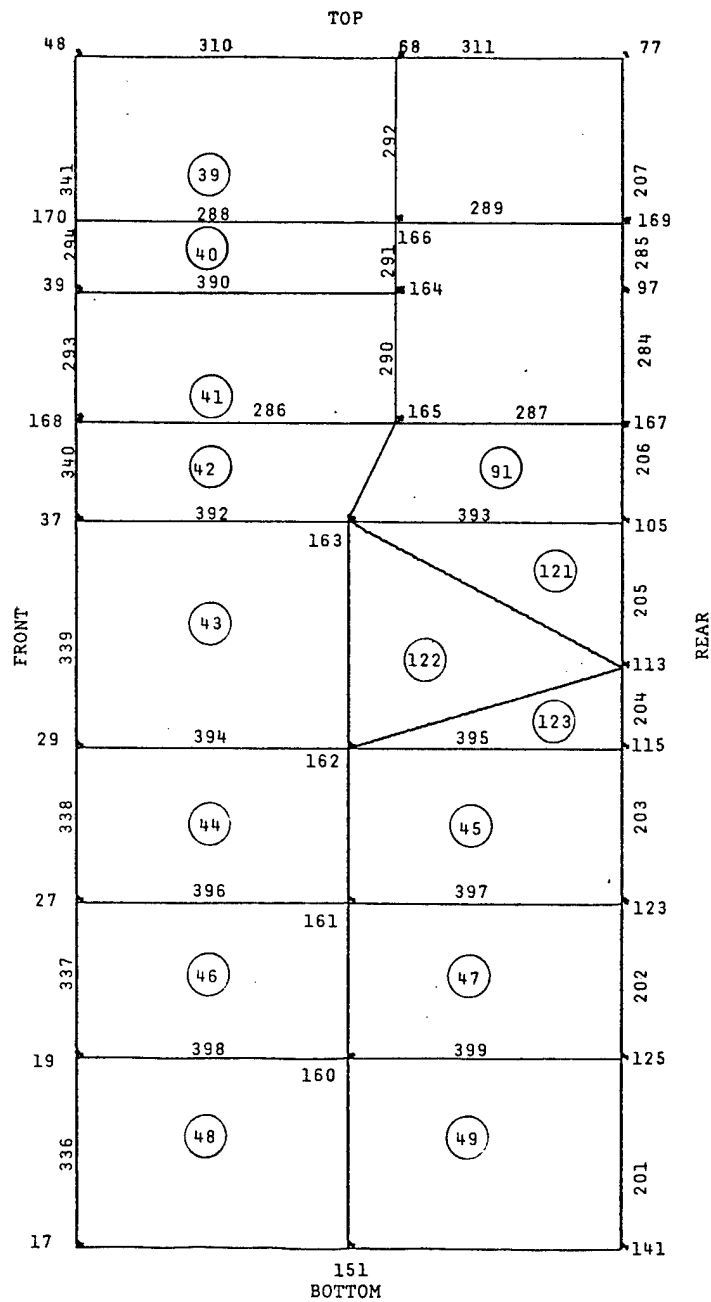




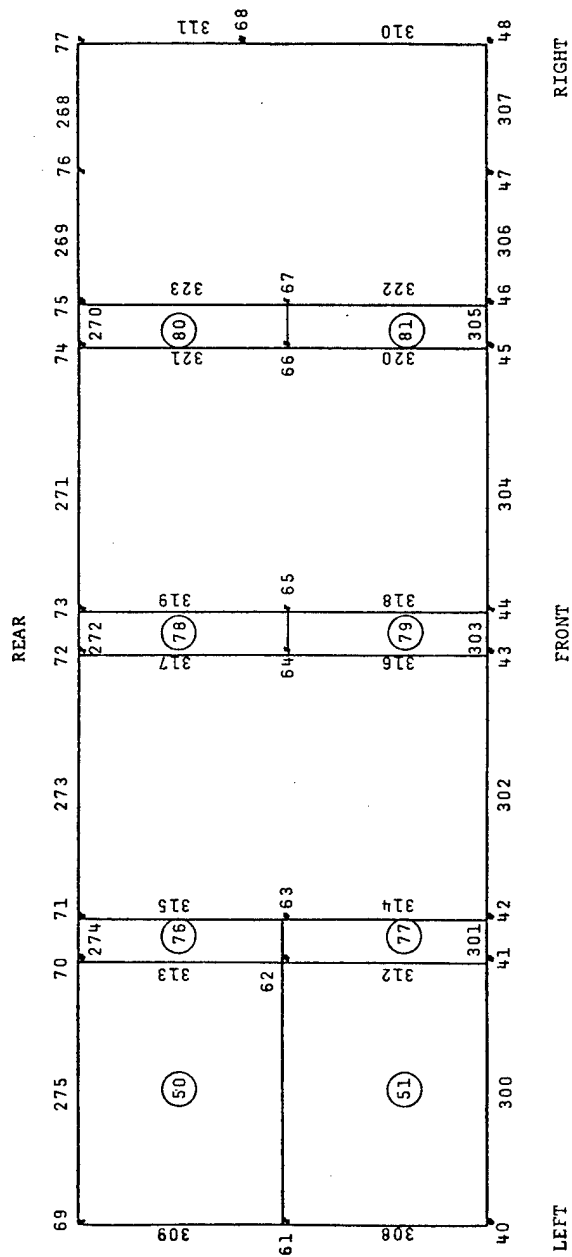
Back Structure, Rear View, Equipment Rack, Plate Elements



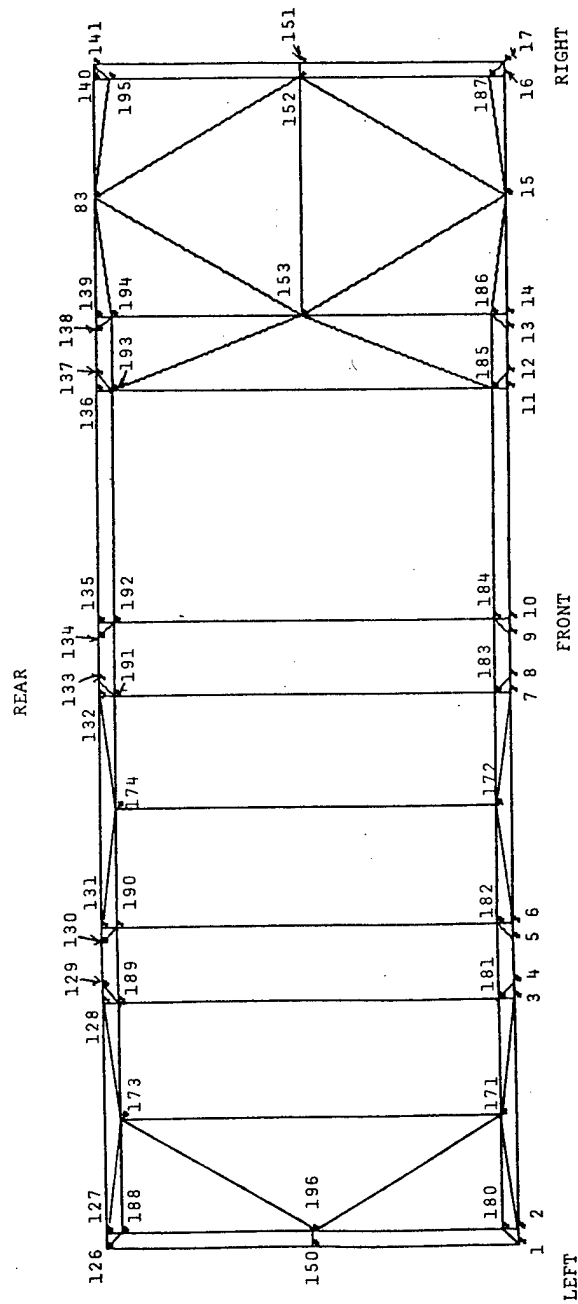
Left Side Structure, Equipment Rack,
Bar and Plate Elements and Grid Points



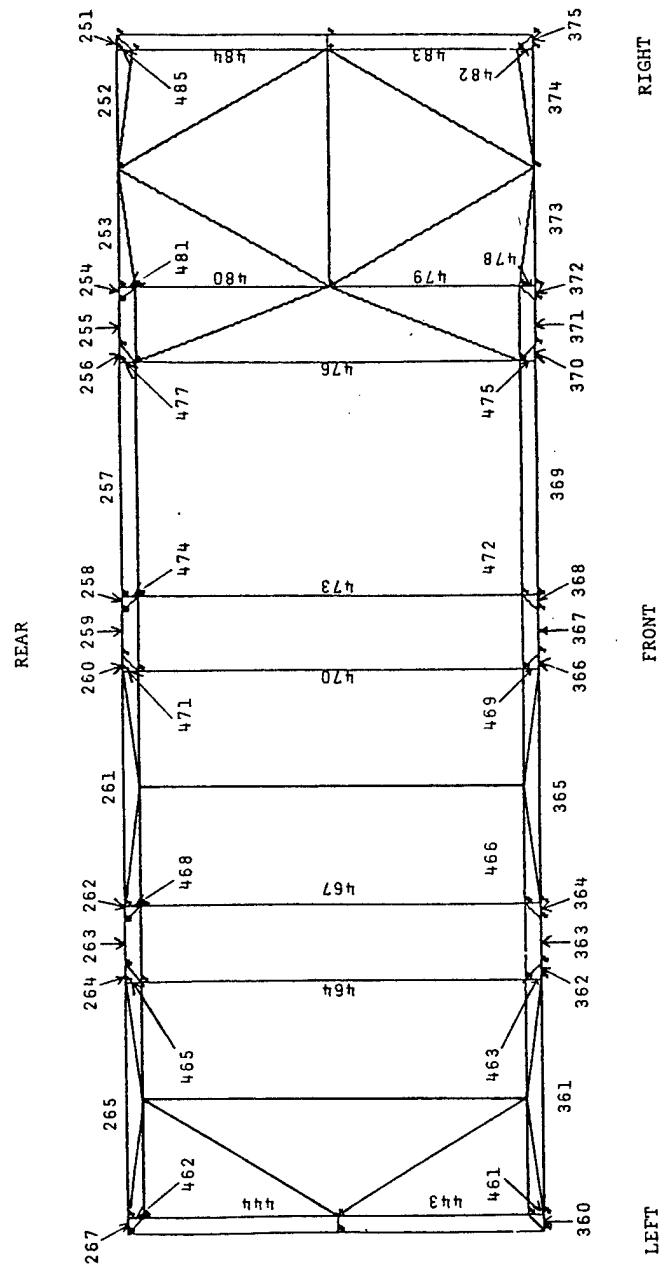
Right Side Structure, Equipment Rack,
Bar and Plate Elements and Grid Points



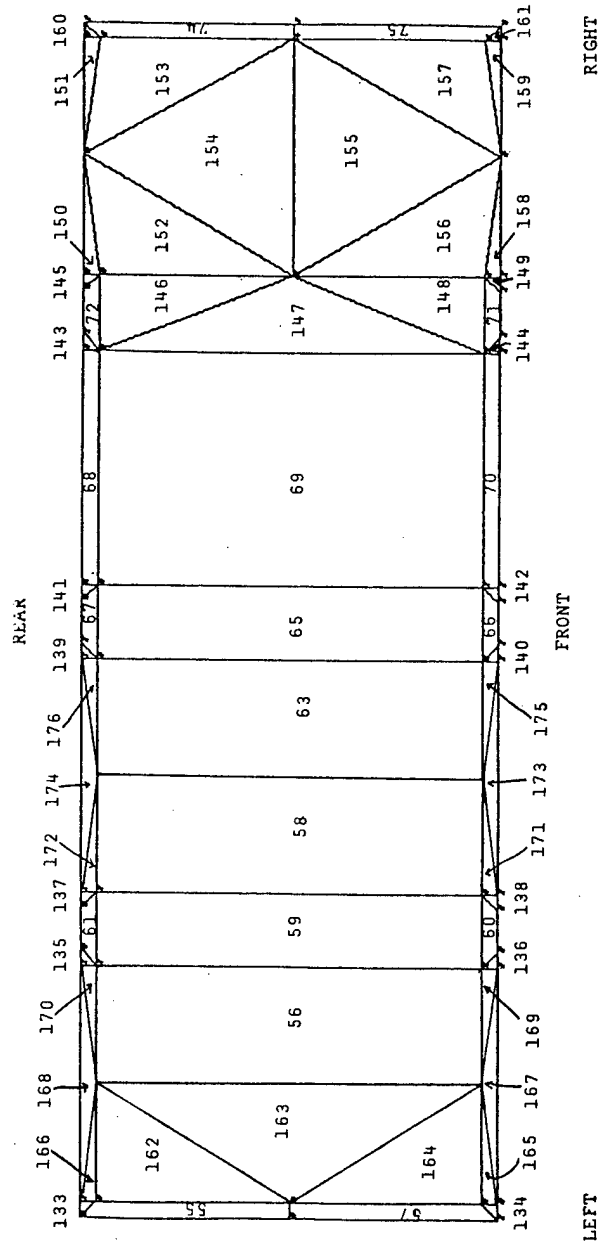
Roof Structure, Top View, Equipment Rack,
Bar and Plate Elements and Grid Points



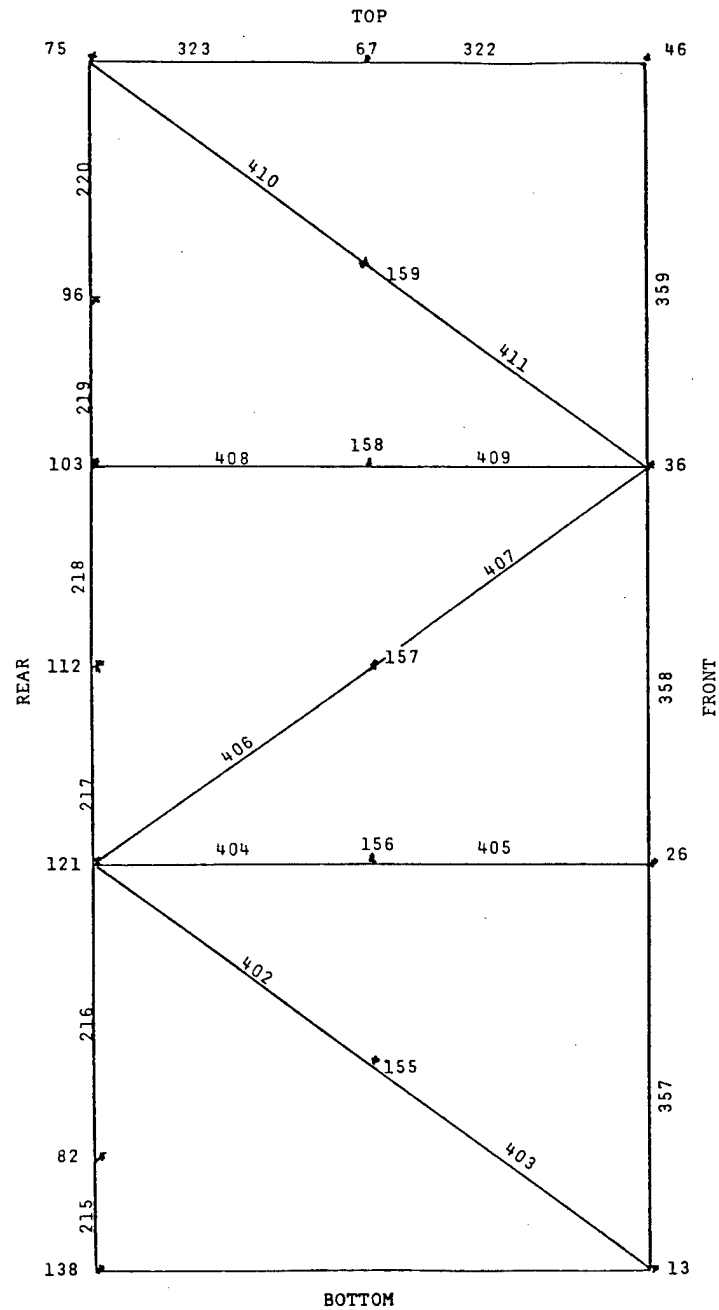
Floor Structure (Looking down from top),
Equipment Rack, Grid Points



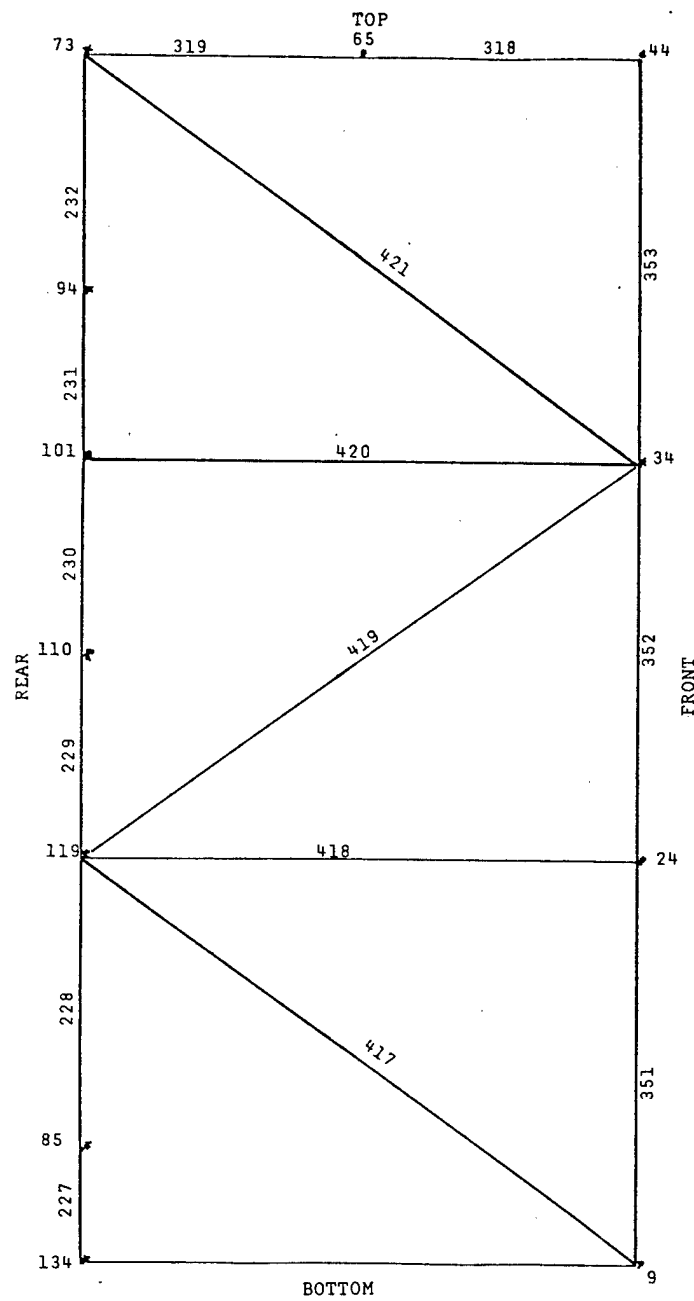
Floor Structure, (Looking down from top), Equipment Rack
Bar Elements



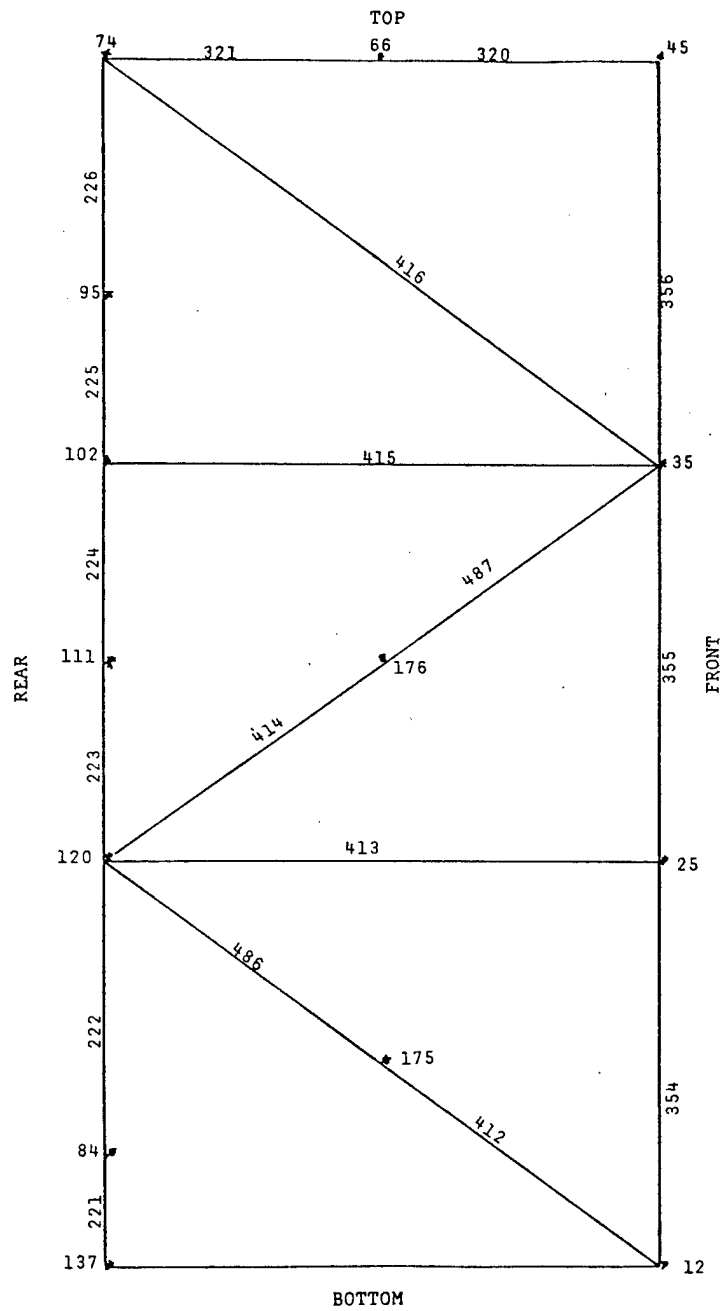
Floor Structure (Looking down from top), Equipment Rack
Plate Elements



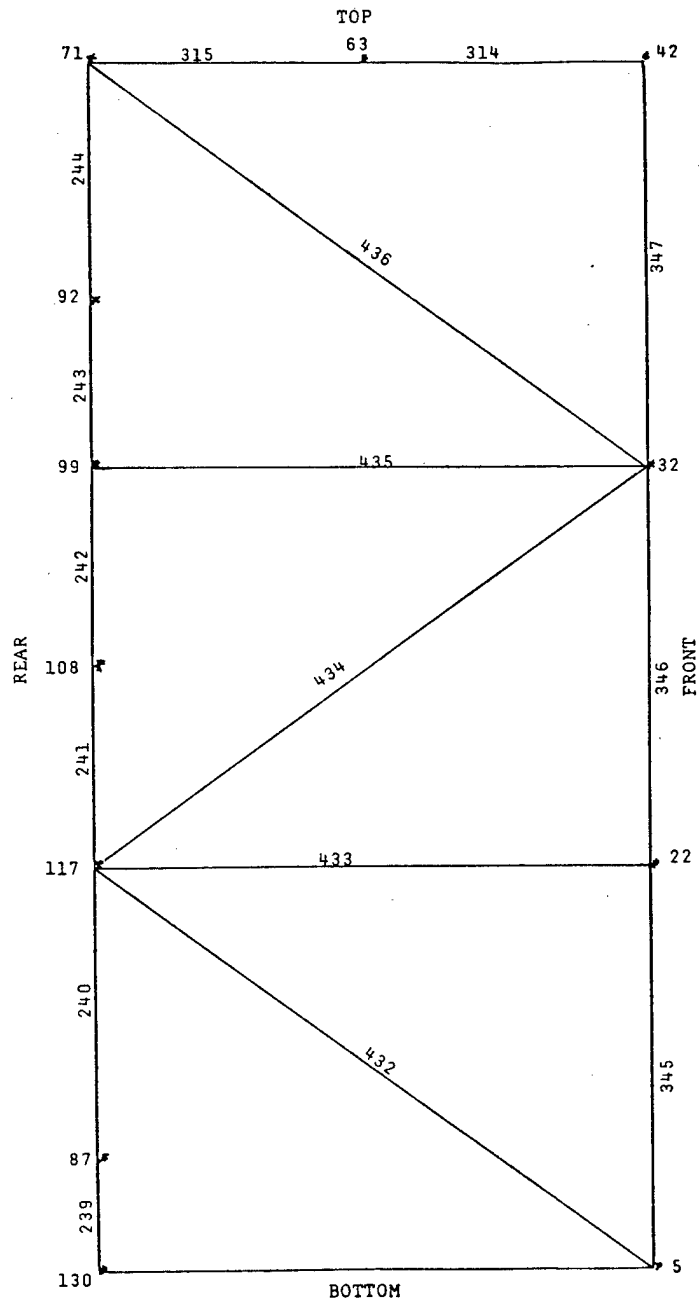
Intermediate Bracking Structure, LHS Bay 1,
Equipment Rack, Bar Elements and Grid Points



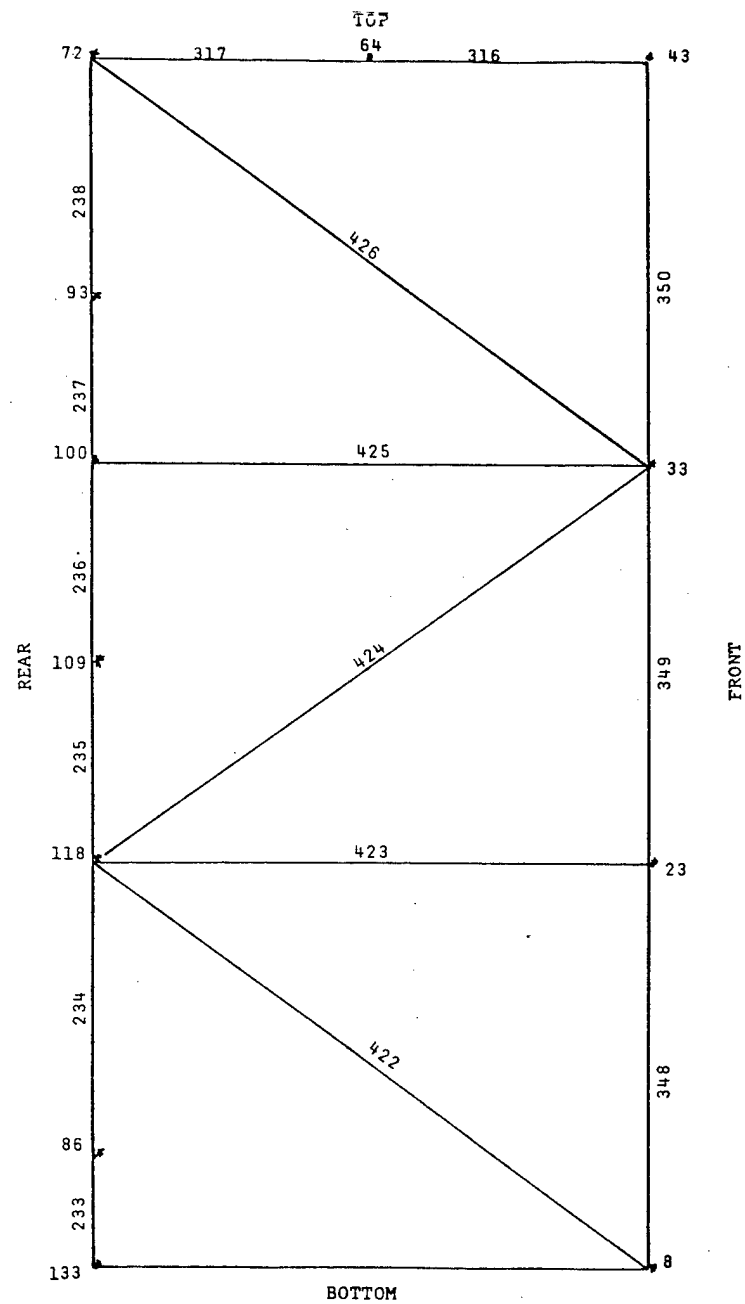
Intermediate Bracing Structure, LHS Bay 2,
Equipment Rack, Bar Elements and Grid Points



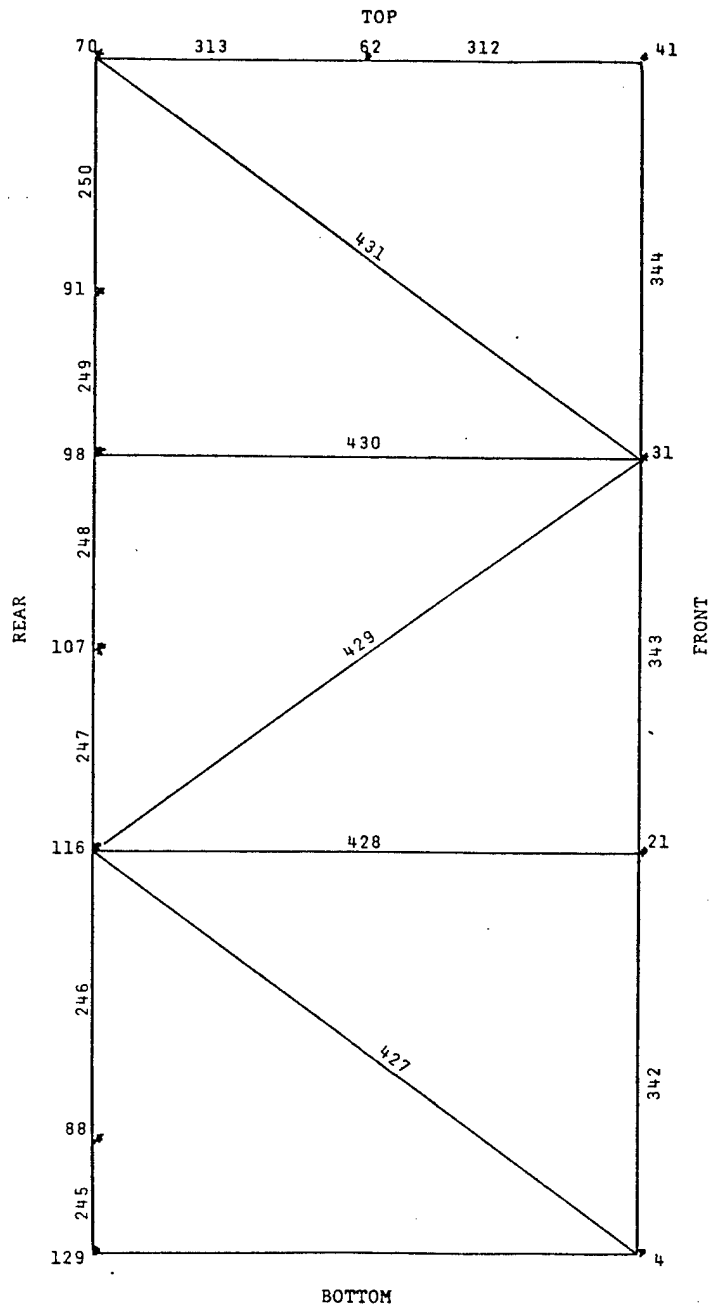
Intermediate Bracing Structure, RHS Bay 2,
Equipment Rack, Bar Elements and Grid Points



Intermediate Bracing Structure, LHS Bay 3,
Equipment Rack, Bar Elements and Grid Points



Intermediate Bracing Structure, RHS Bay 3,
Equipment Rack, Bar Elements and Grid Points



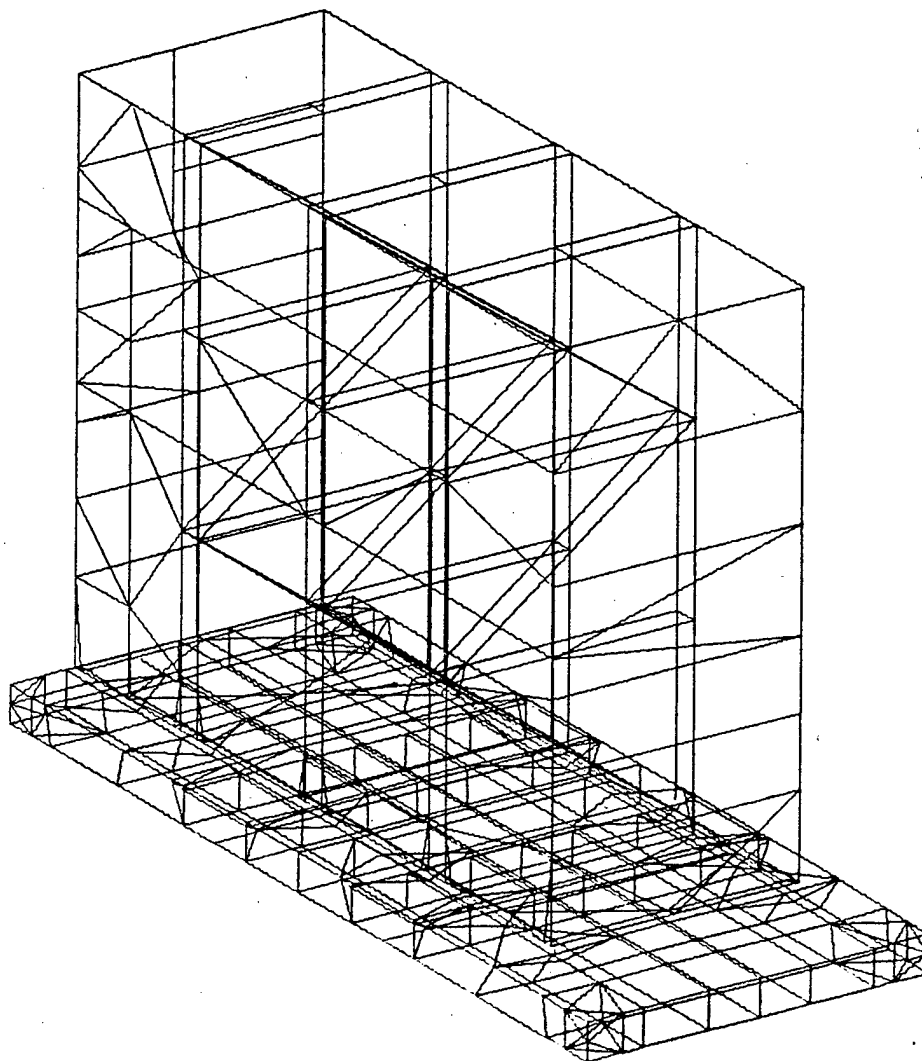
Intermediate Bracing Structure, RHS Bay 4,
Equipment Rack, Bar Elements and Grid Points

APPENDIX C

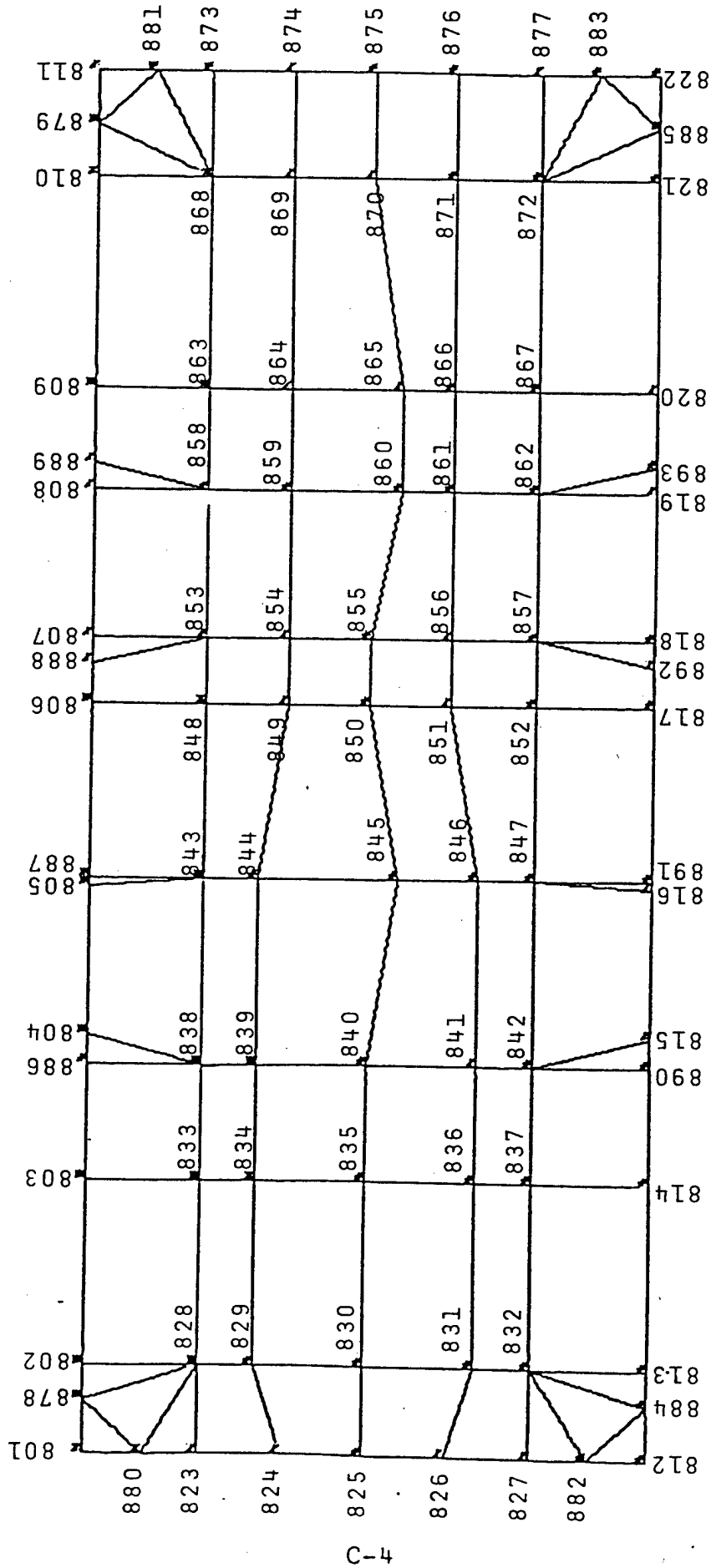
FINITE ELEMENT MODEL

RACK PALLET HALF

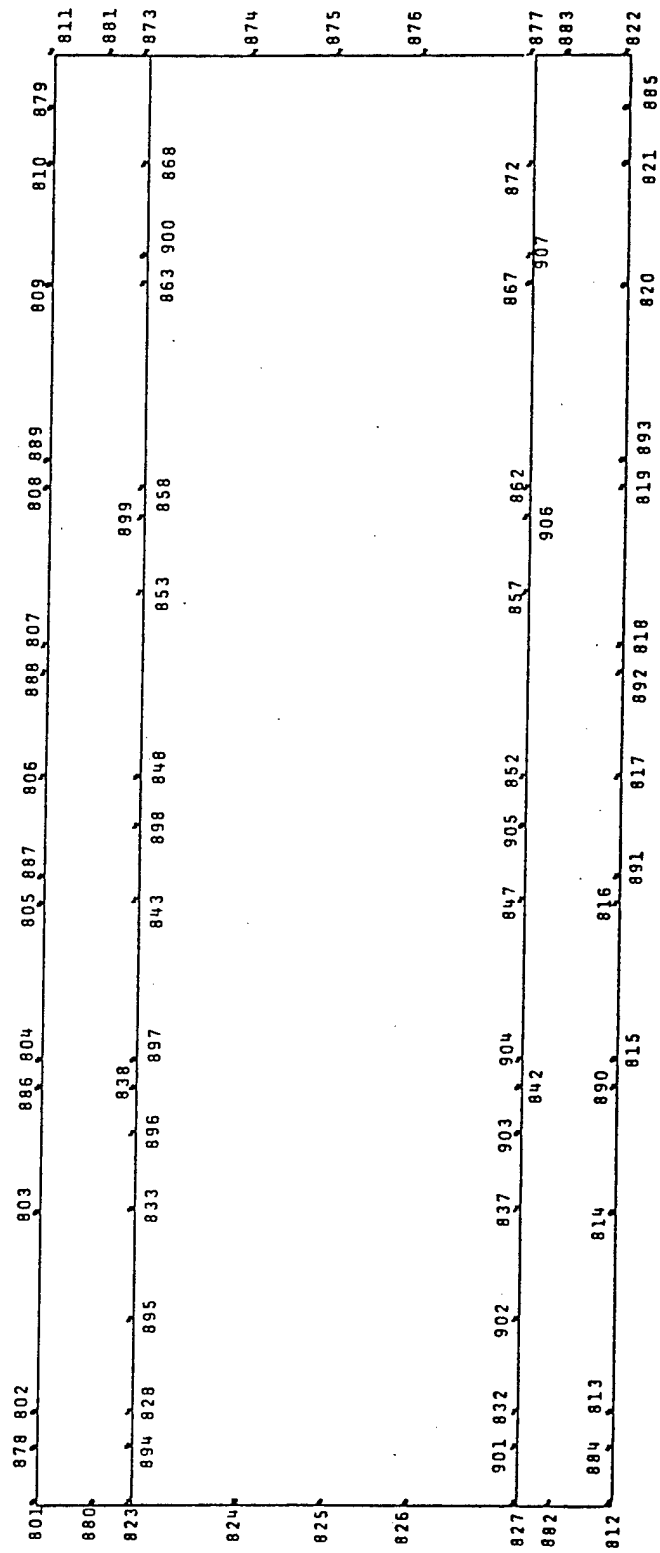
This appendix contains a plot of the equipment rack pallet, combined with the equipment rack. There are approximately 403 grid points, 546 bars, 441 plate elements, and over 2200 degrees of freedom in the model.



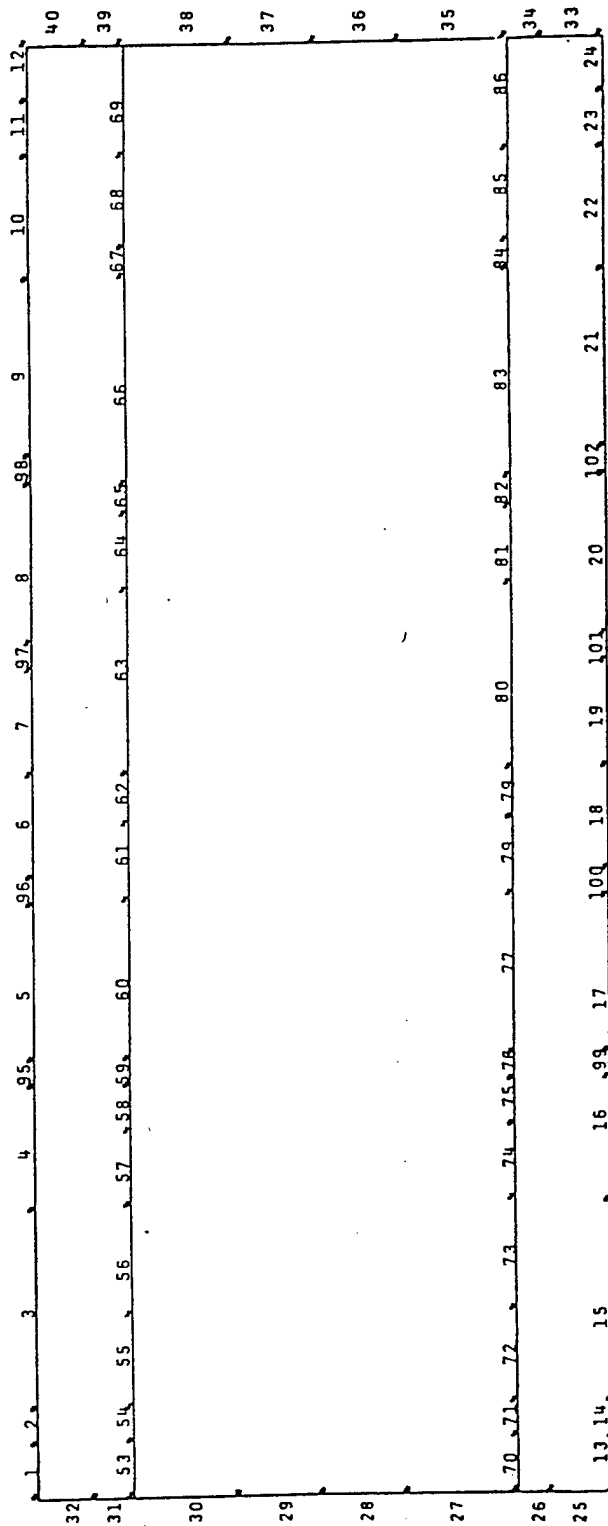
Rack Pallet Model



Top Plate, Rack Pallet, Nodes Only Shown

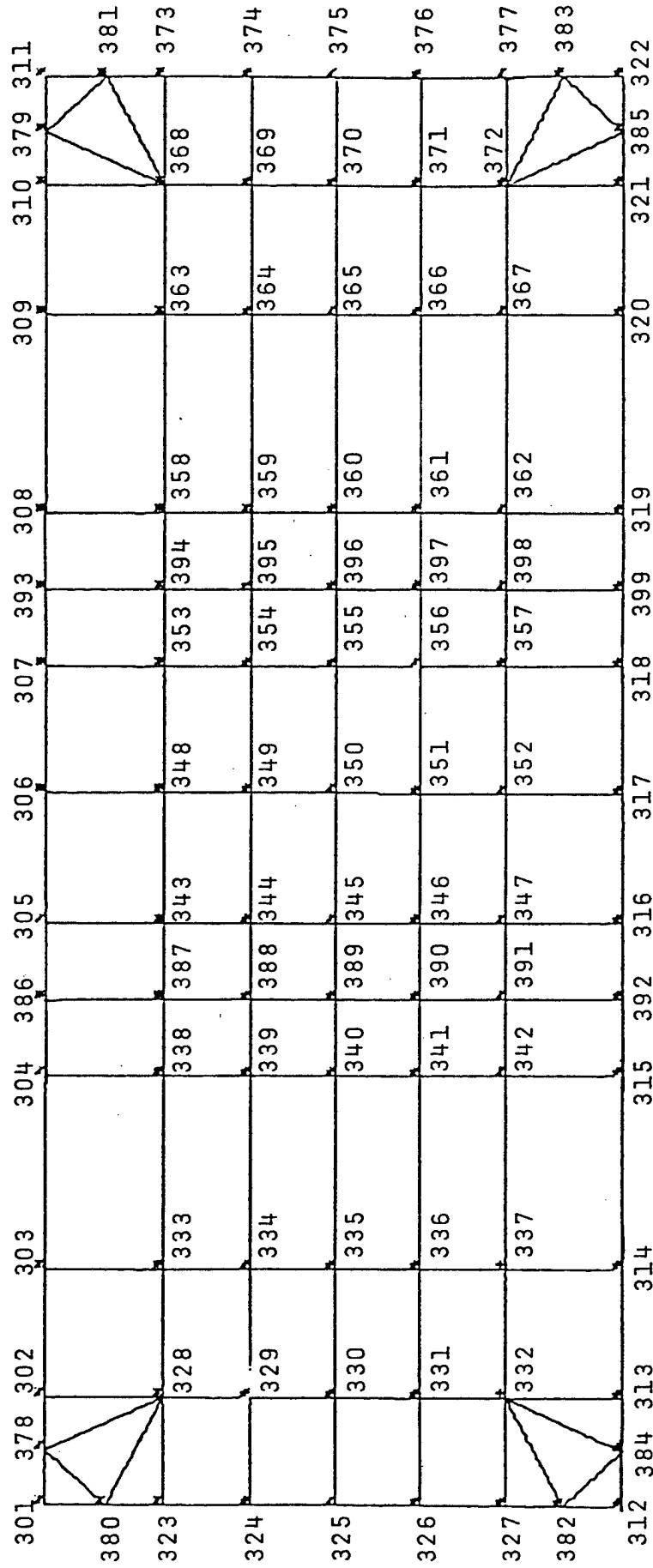


Top view, Rack Pallet, Node points pertaining to bar elements

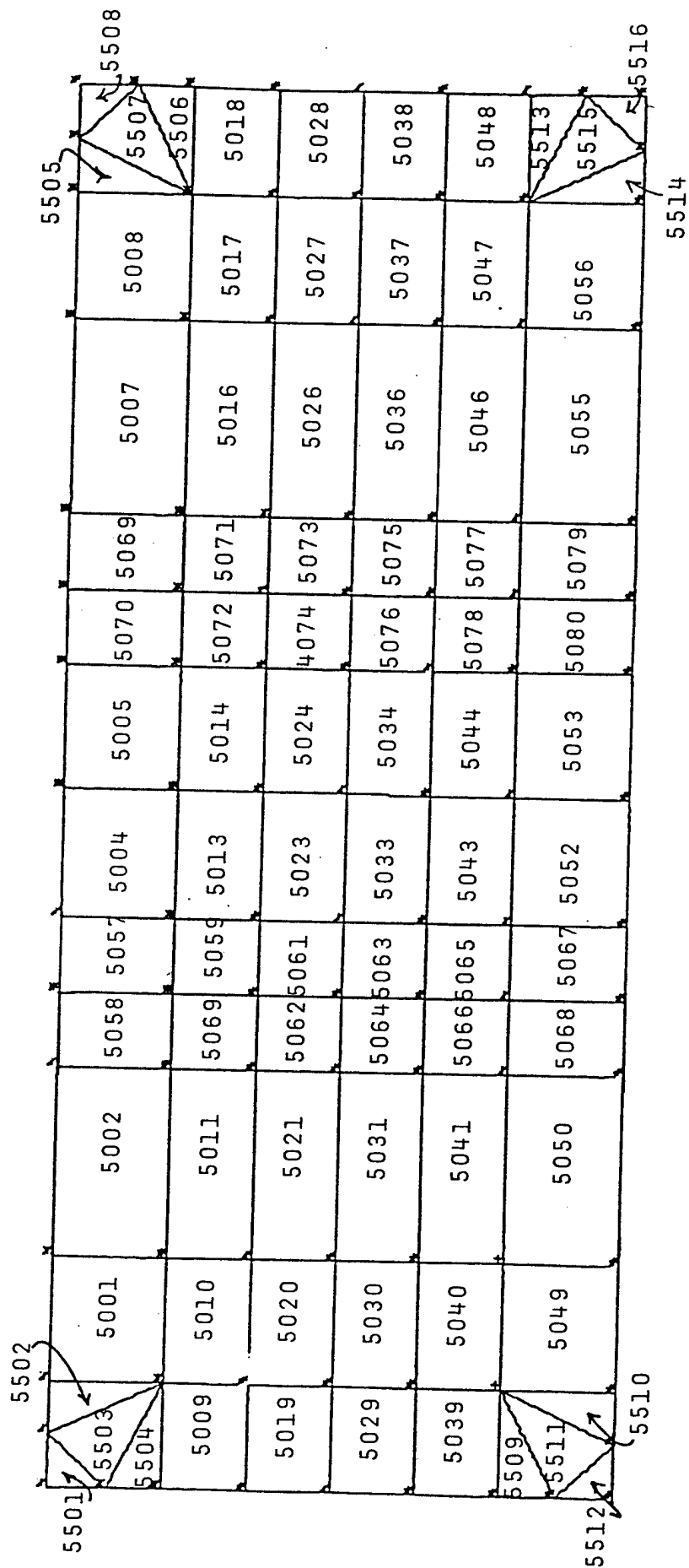


Note: Add u000 to all Bar Element ID's

Top view, Rack Pallet, Bar elements only shown



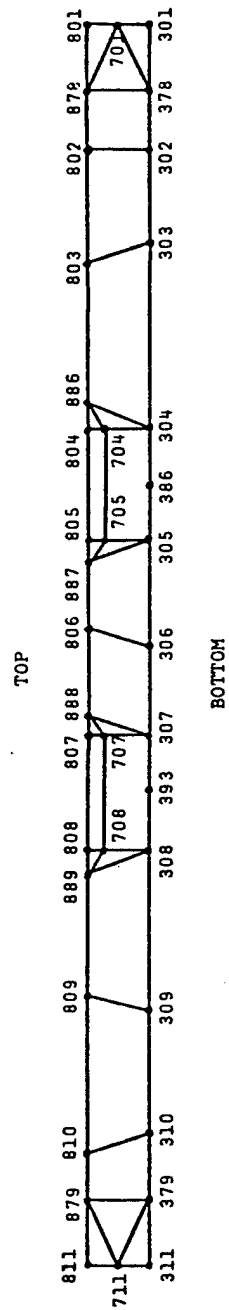
Bottom Plate, Rack Pallet. Nodes Only Shown.



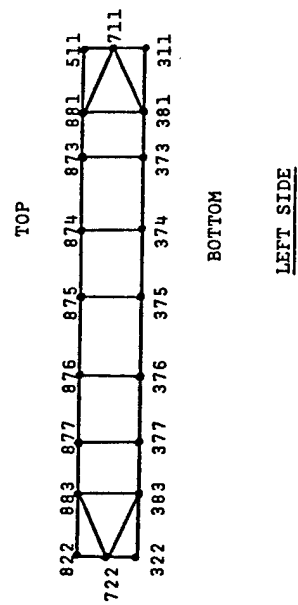
Bottom Plate, Rack Pallet. Plate Elements Only Shown.

3032	3046	3052	3058	3064	3070	3076	3082	3088	3094	3040
3031	3045	3051	3057	3063	3069	3075	3081	3087	3093	3039
3030	3044	3050	3056	3062	3068	3074	3080	3086	3092	3038
3029	3043	3049	3055	3061	3067	3073	3079	3085	3091	3037
3028	3042	3048	3054	3060	3066	3072	3078	3084	3090	3036
3027	3041	3047	3053	3059	3065	3071	3077	3083	3089	3035
3026										3034
3025										3033
3013	3015	3016	3017	3018	3019	3020	3021	3022	3023	3024
3014										
3002										
3001										
3003										
3004										
3005										
3006										
3007										
3008										
3009										
3010										
3011										
3012										

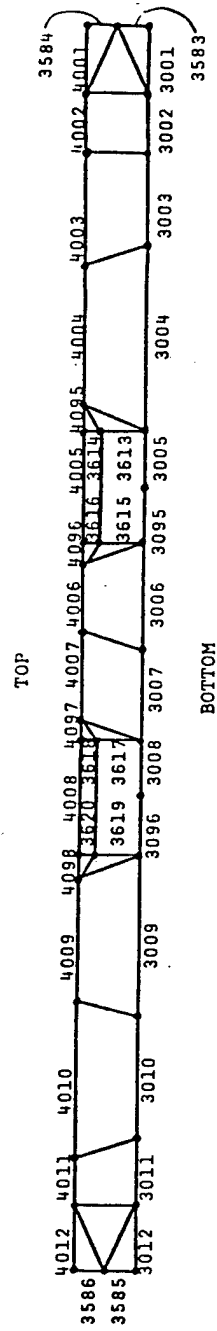
Bottom Surface, Rack Pallet. Bar Elements Only Shown.



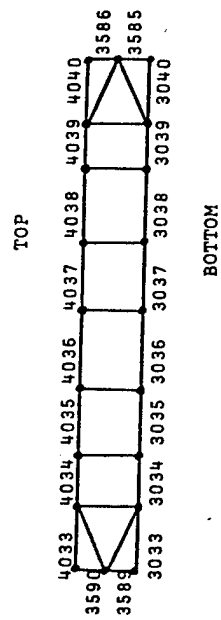
FRONT



Front and Left Side View of Rack Pallet Structure. Node Points Only Shown.

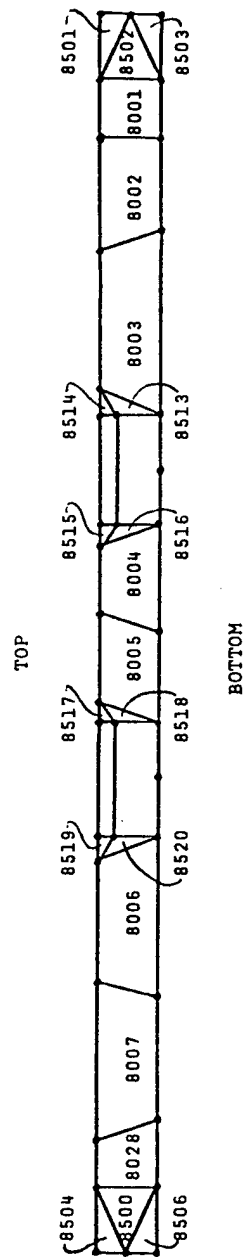


FRONT

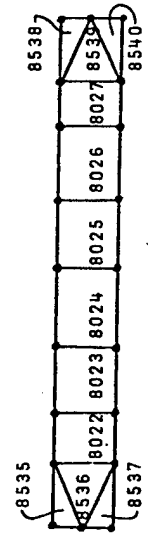


LEFT SIDE

Front and Left Side View of Rack Pallet Structure. Bar Elements Only Shown.

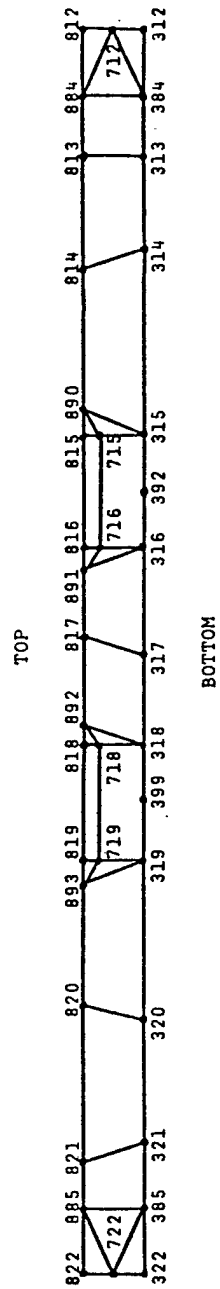


FRONT

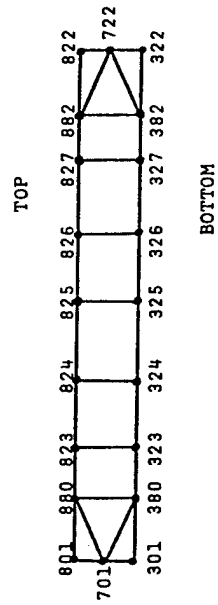


LEFT SIDE

Front and Left Side View of Rack Pallet Structure. Plate Elements Only Shown.

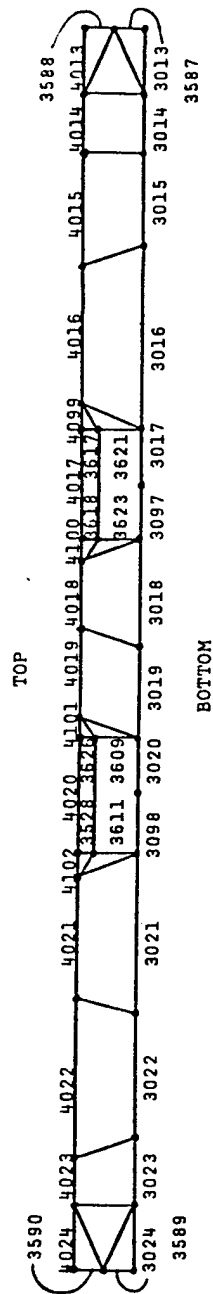


BACK

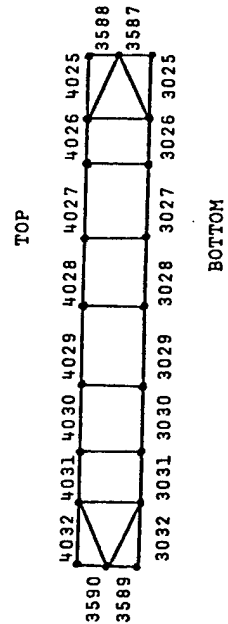


RIGHT SIDE

Back and Right Side View of Rack Pallet Structure. Node Points Only Shown.

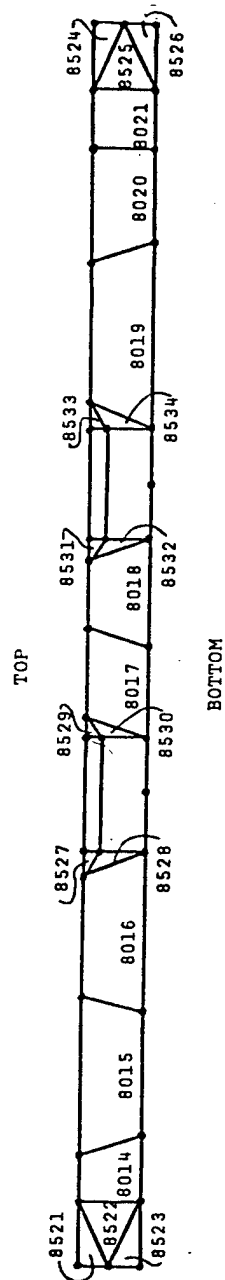


BACK



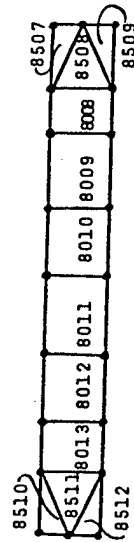
RIGHT SIDE

Back and Right Side View of Rack Pallet Structure. Bar Elements Only Shown.



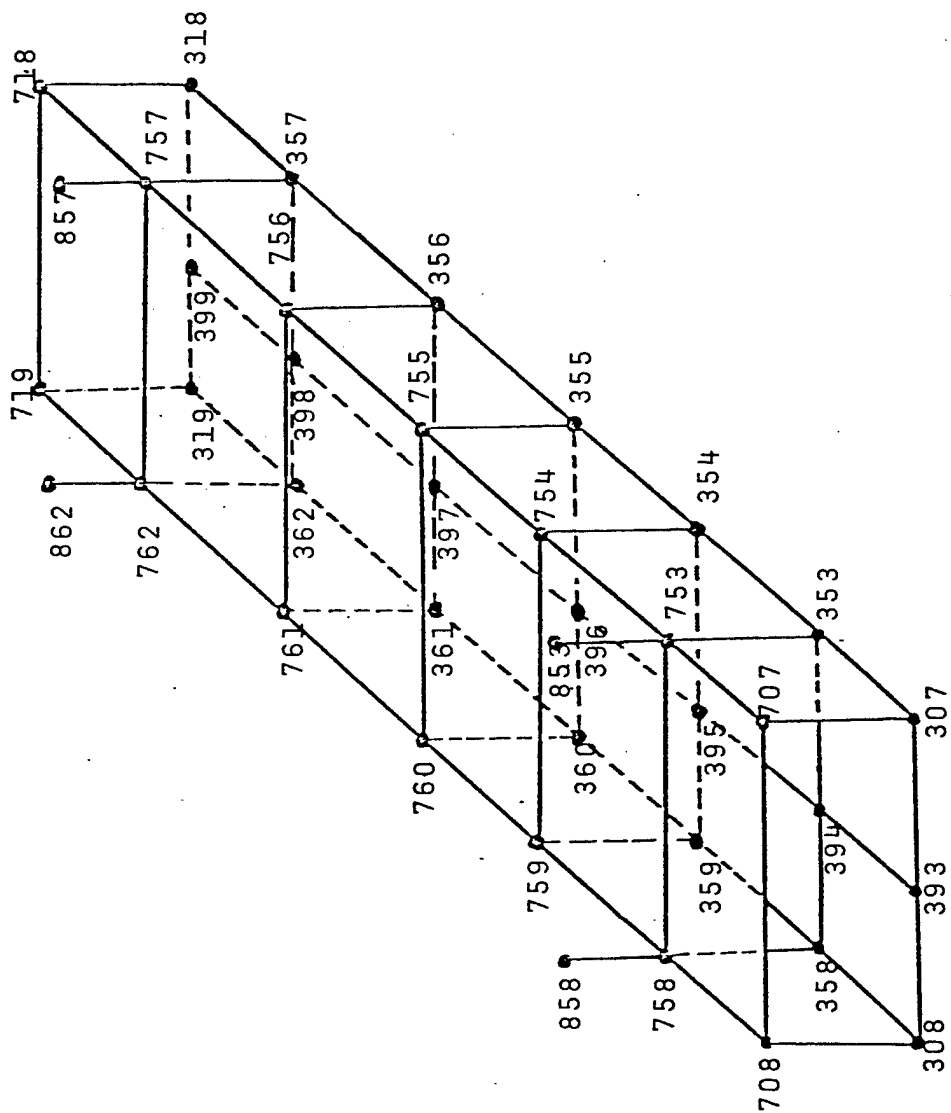
BACK

TOP

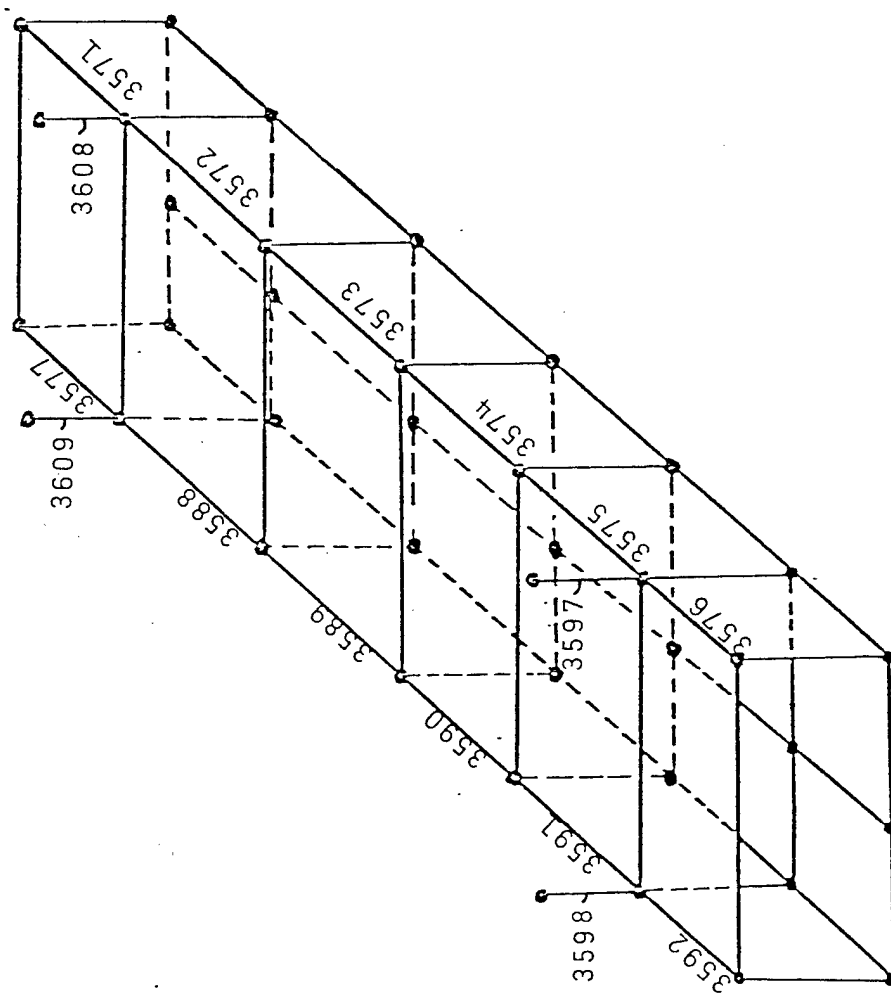


RIGHT SIDE

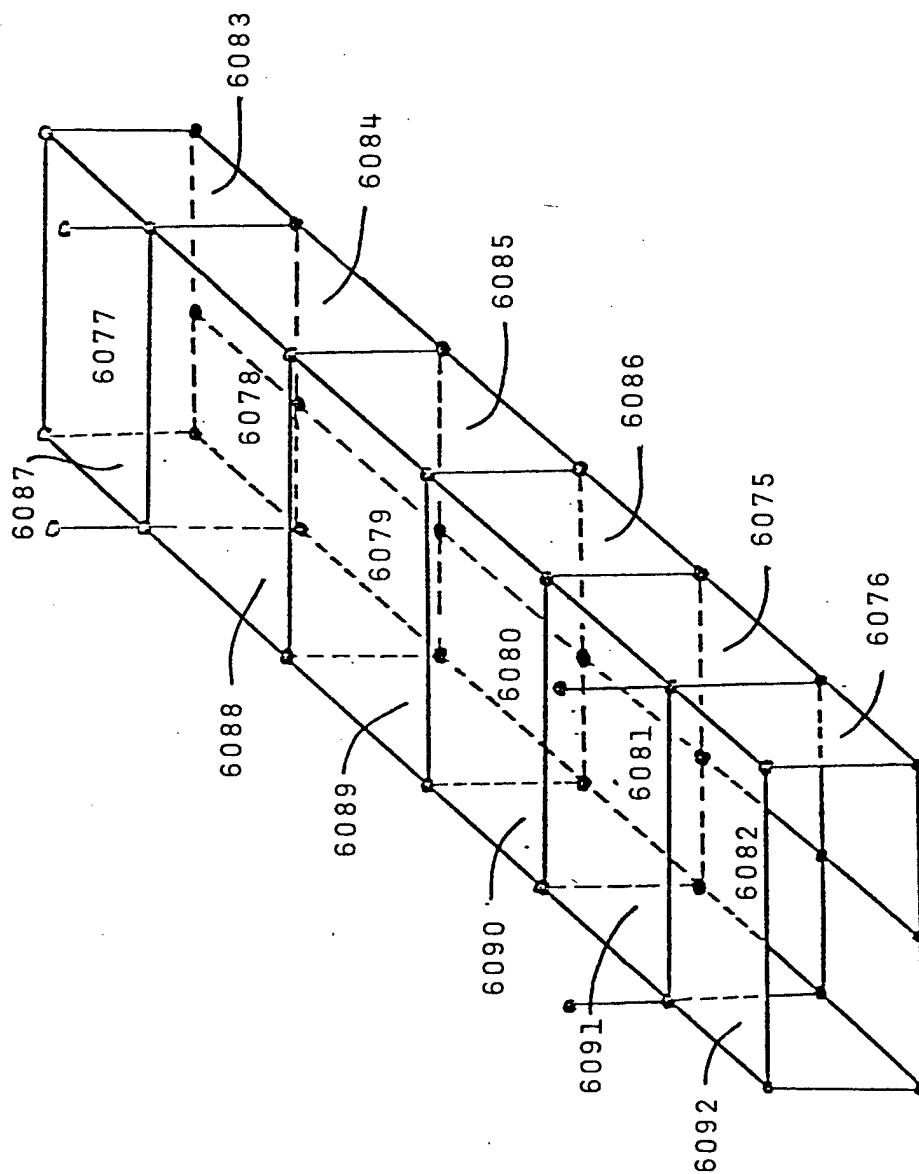
Back and Right Side View of Rack Pallet Structure. Plate Elements Only Shown.



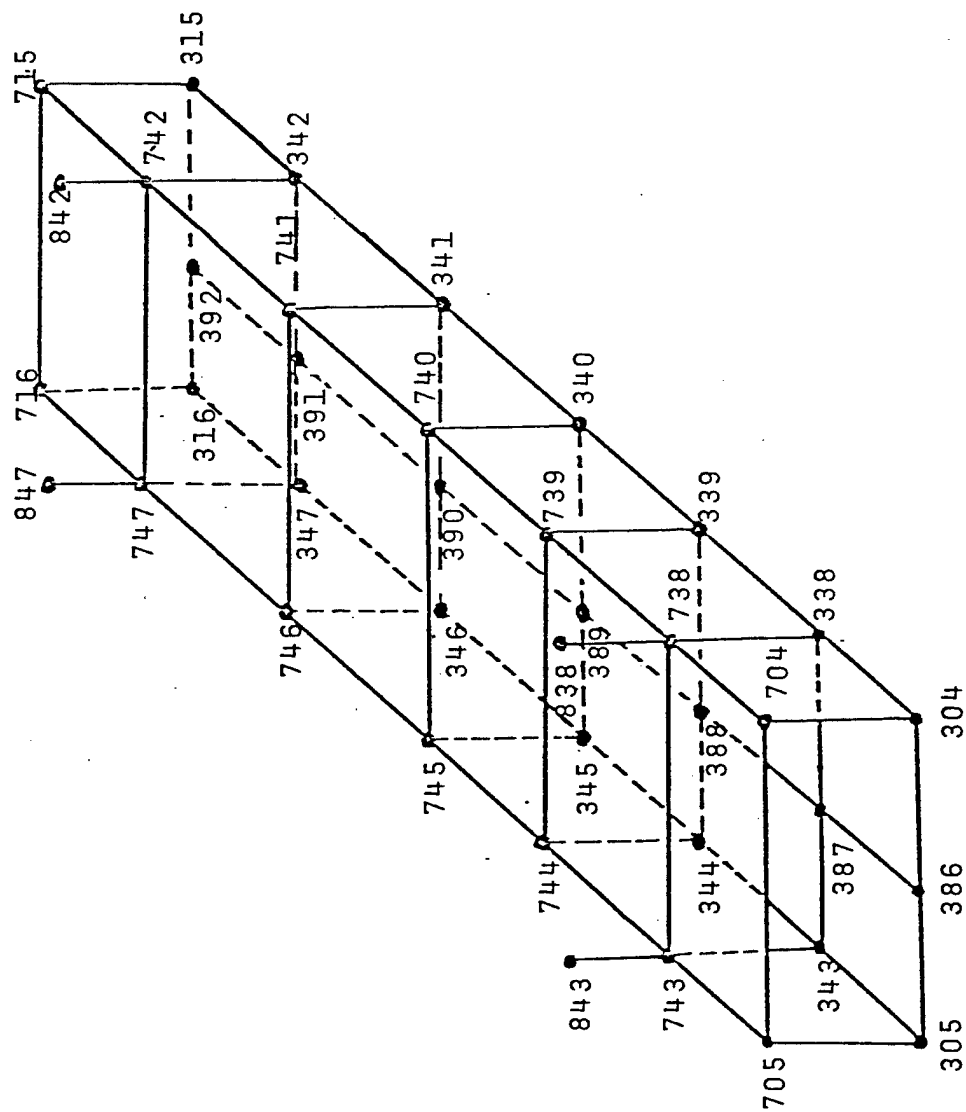
Left Tunnel, Rack Pallet. Node Points Only Shown.



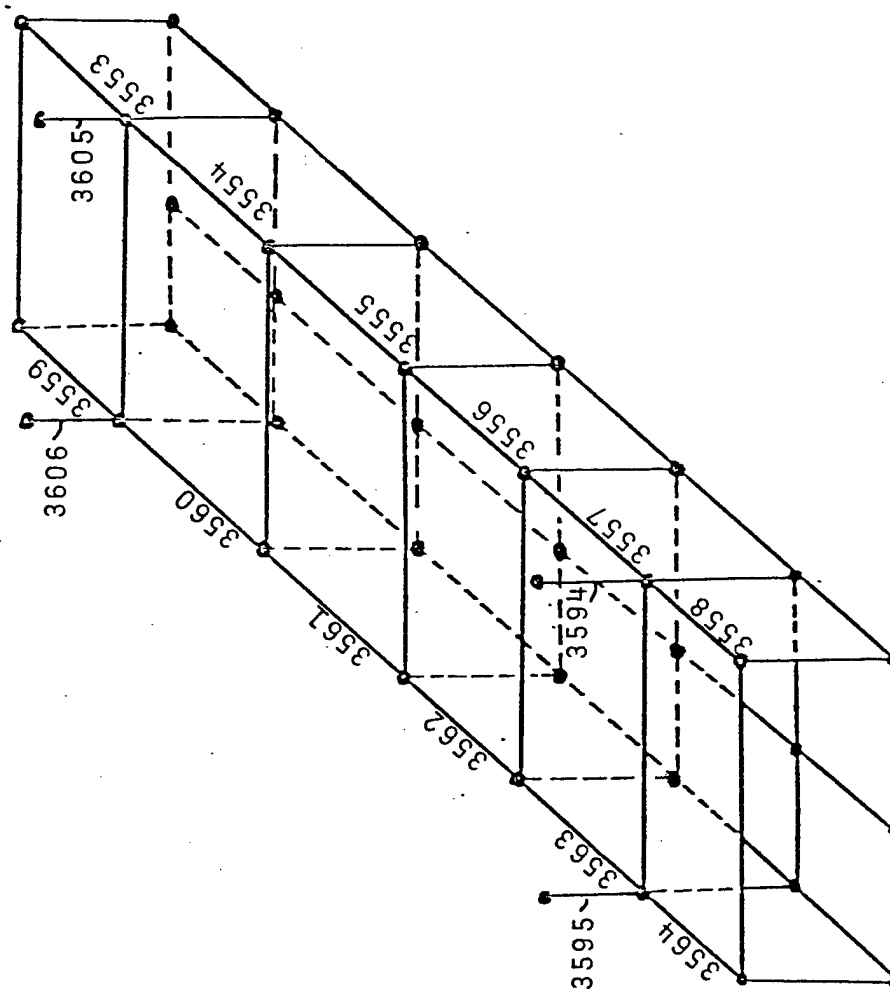
Left Tunnel, Rack Pallet. Bar Elements Only Shown.



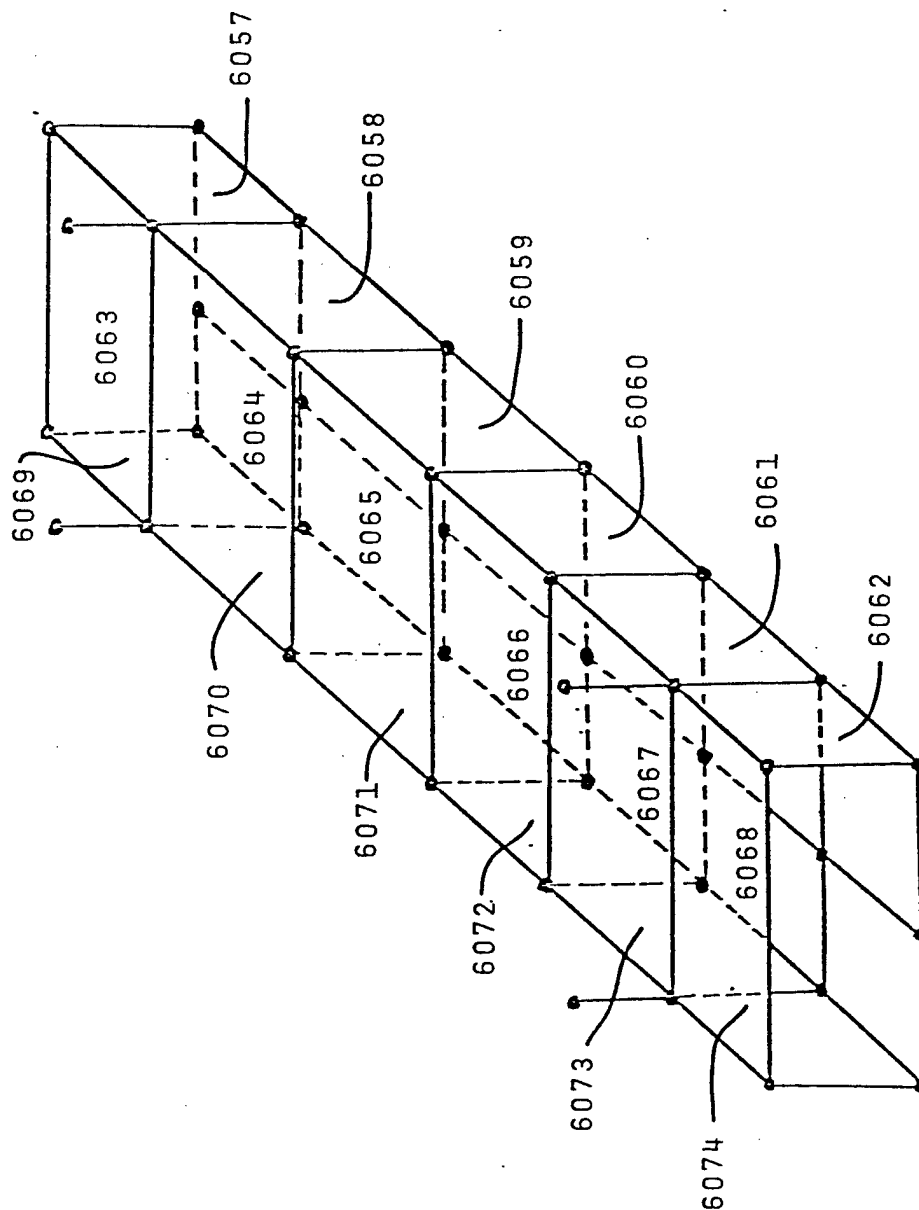
Left Tunnel, Rack Pallet. Plate Elements Only Shown.



Right Tunnel, Rack Pallet. Node Points Only Shown.



Right Tunnel, Rack Pallet. Bar Elements Only Shown.



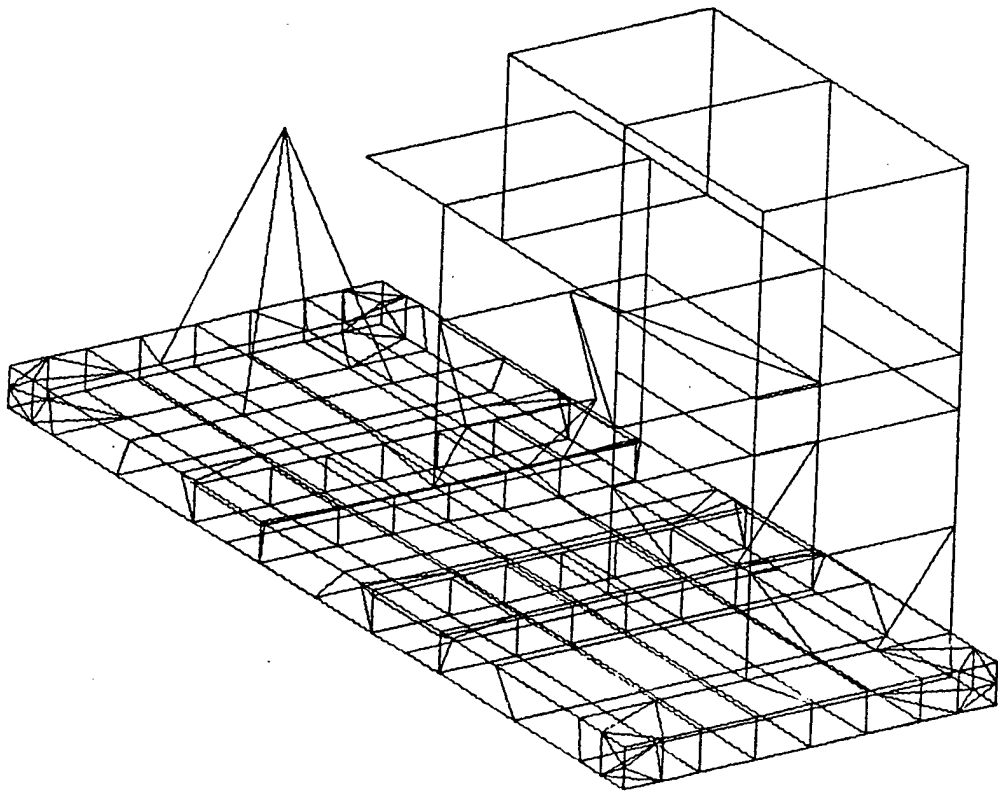
Right Tunnel, Rack Pallet. Plate Elements Only Shown.

APPENDIX D

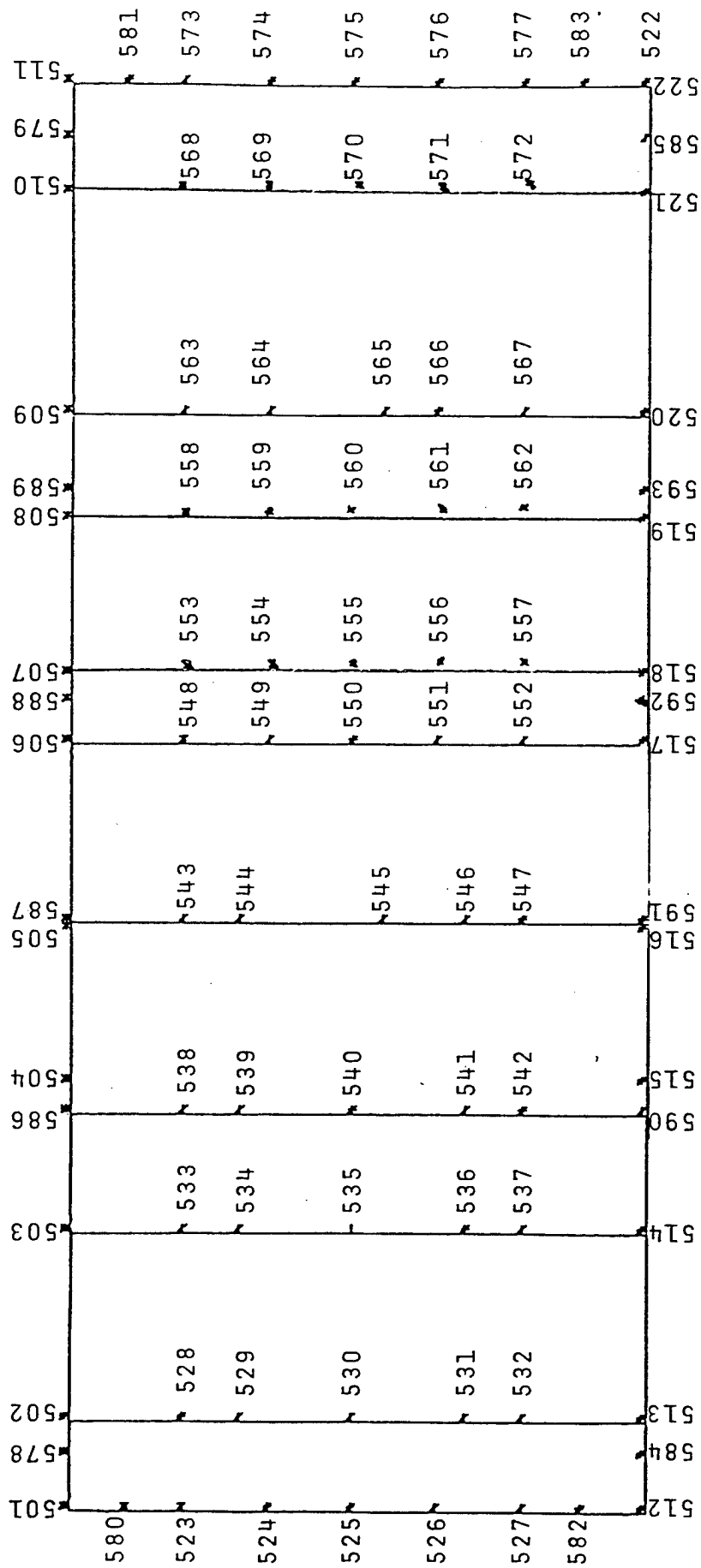
FINITE ELEMENT MODEL

SEAT PALLET HALF

In this appendix, the plots associated with the seat pallet model are included. The model contains 236 grid points, 245 bars, and 267 plate elements.



Seat Pallet Model

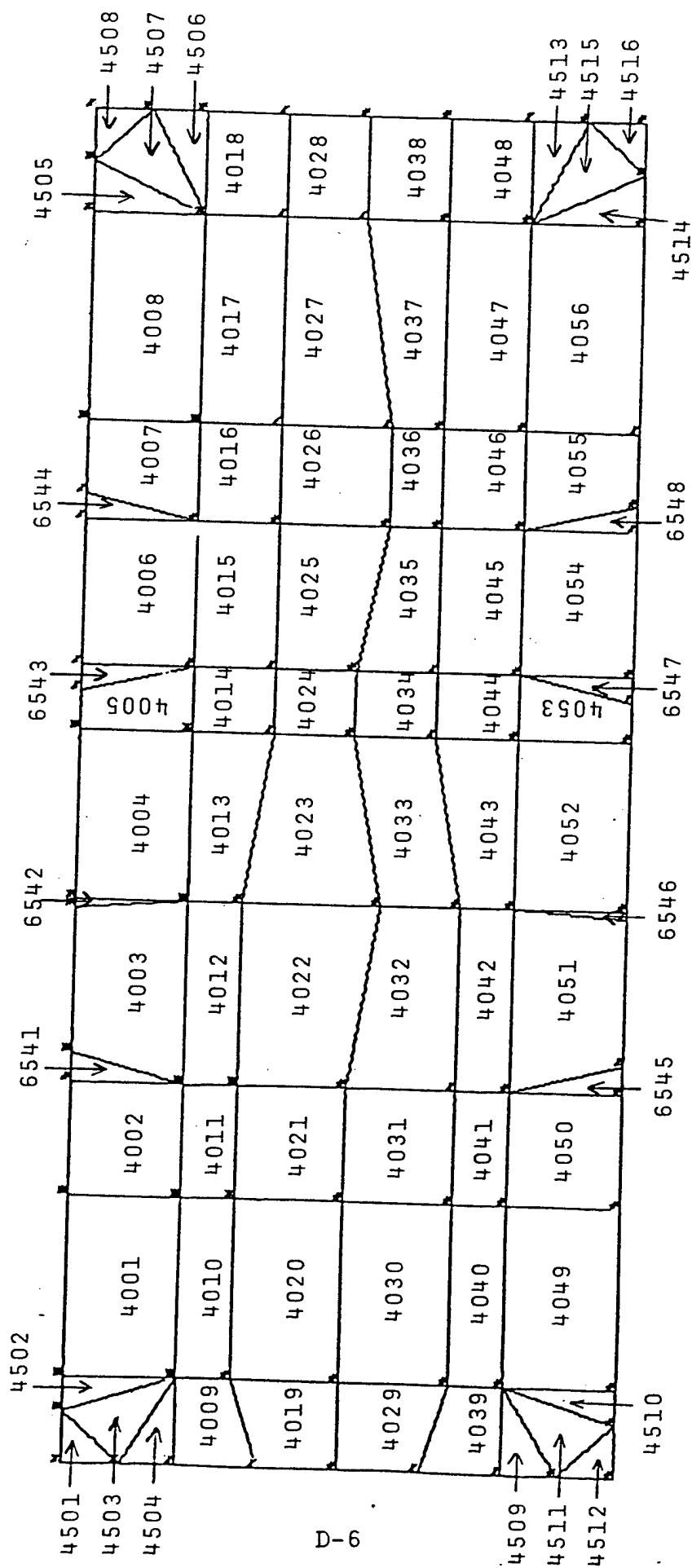


Top Plate, Seat Pallet, Nodes Only Shown

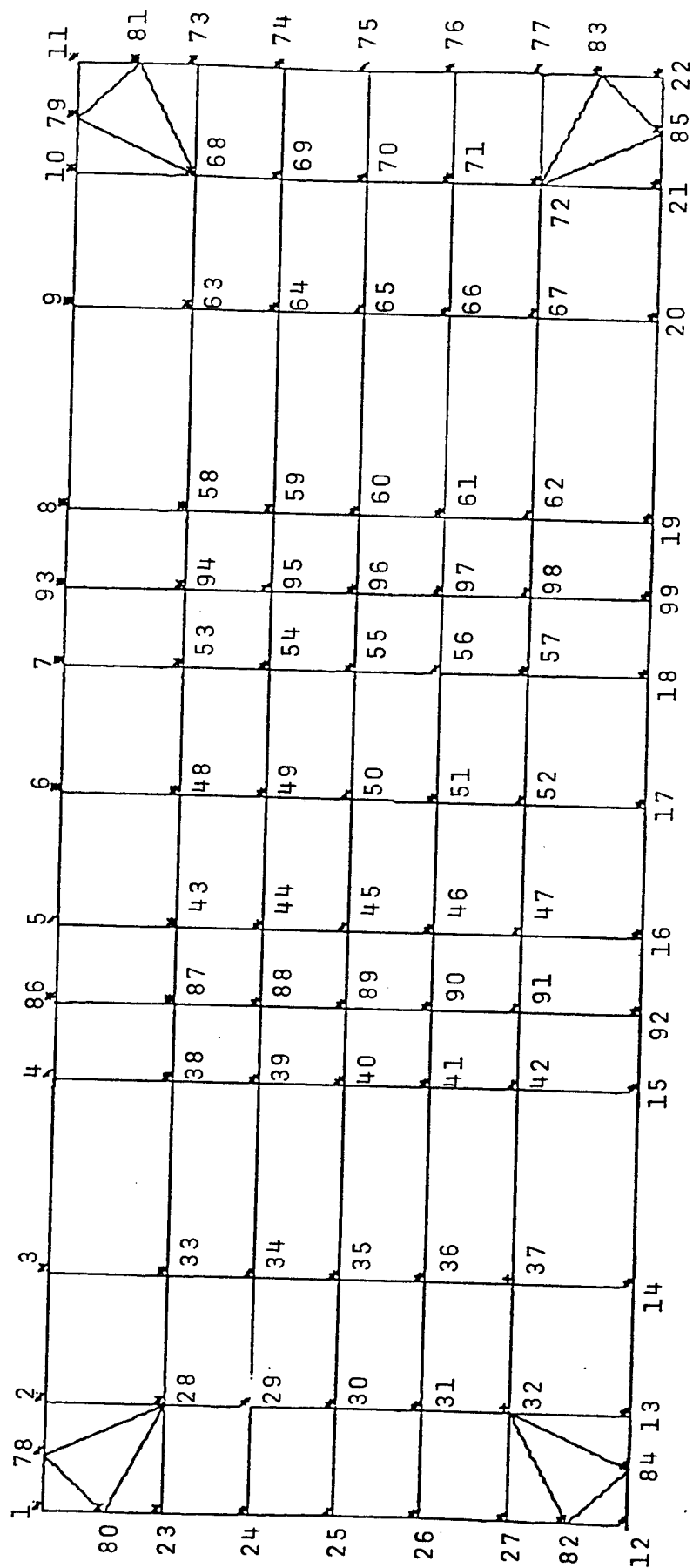
1032	1046	1052	1058	1064	1076	1088	1040
1031	1045	1051	1057	1063	1075	1087	1039
1030	1044	1050	1056	1062	1074	1086	1038
1029	1043	1049	1055	1061	1073	1085	1037
1028	1042	1048	1054	1060	1072	1084	1036
1027	1041	1047	1053	1059	1071	1083	1035
1026							1034
1025							1033
1013							
1014							
1015							
1016							
1017							
1100							
1018							
1019							
1101							
1020							
1102							
1021							
1022							
1023							
1024							

Note: Add 1000 to bar element I.D. numbers

Top Plate, Seat Pallet, Bar Elements Only Shown



Top Plate, Seat Pallet, Plate Elements Only Shown



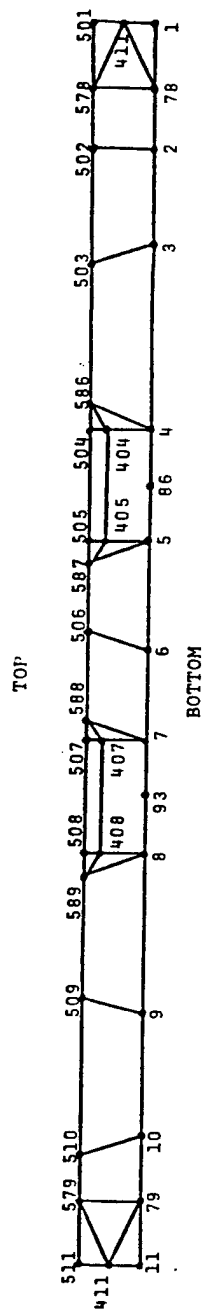
Bottom Plate, Seat Pallet, Nodes Only Shown.

1032	1001	1002	1003	1004	1005	1006	1007	1008	1009	1010	1011	1012
		1046	1052	1058	1064	1070	1076	1082	1088	1094		1040
1031												1039
		1045	1051	1057	1063	1069	1075	1081	1087	1093		1038
1030												
		1044	1050	1056	1062	1068	1074	1080	1086	1092		1037
1029												
		1043	1049	1055	1061	1067	1073	1079	1085	1091		1036
1028												
		1042	1048	1054	1060	1066	1072	1078	1084	1090		1035
1027												
		1041	1047	1053	1059	1065	1071	1077	1083	1089		1034
1026												1033
1025	1013	1014	1015	1016	1017	1018	1019	1020	1021	1022	1023	1024

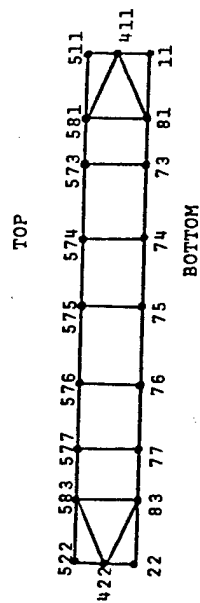
Bottom Surface, Seat Pallet. Bar Elements Only Shown.

3501	3502	3001	3002	3058	3057	3004	3005	3070	3069	3007	3008	3505	3508
3503	3504	3009	3010	3069	3059	3013	3014	3072	3071	3016	3017	3506	3507
3019	3020	3021	3062	3061	3023	3024	3074	3073	3026	3027	3028	3018	3018
3029	3030	3031	3064	3063	3033	3034	3076	3075	3036	3037	3038	3038	3038
3039	3040	3041	3066	3065	3043	3044	3078	3077	3046	3047	3048	3513	3515
3509	3511	3049	3050	3068	3067	3052	3053	3080	3079	3055	3056	3514	3516
3512	3510												

Bottom Plate, Seat Pallet. Plate Elements Only Shown.

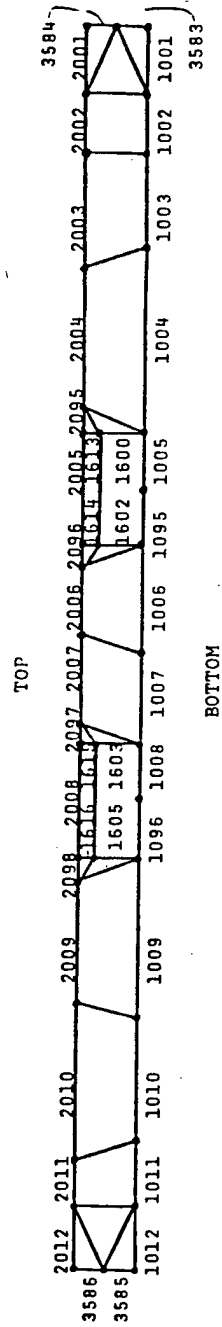


FRONT

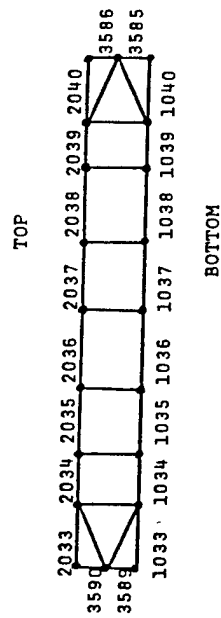


LEFT SIDE

Front and Left Side View of Seat Pallet Structure. Node Points Only Shown.

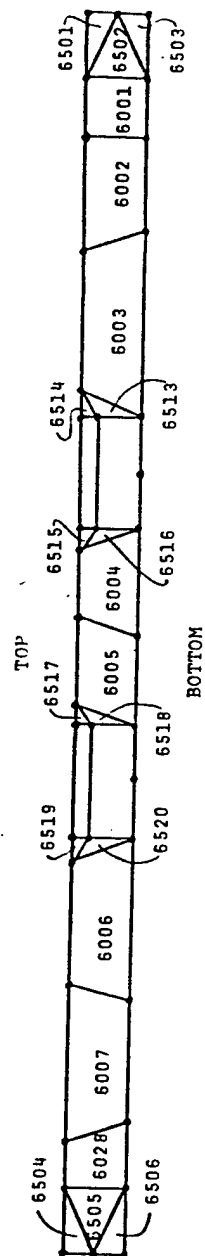


FRONT



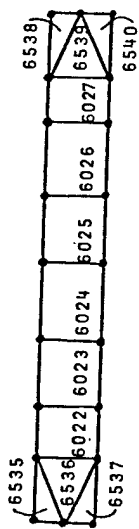
LEFT SIDE

Front and Left Side View of Seat Pallet Structure. Bar Elements Only Shown.



FRONT

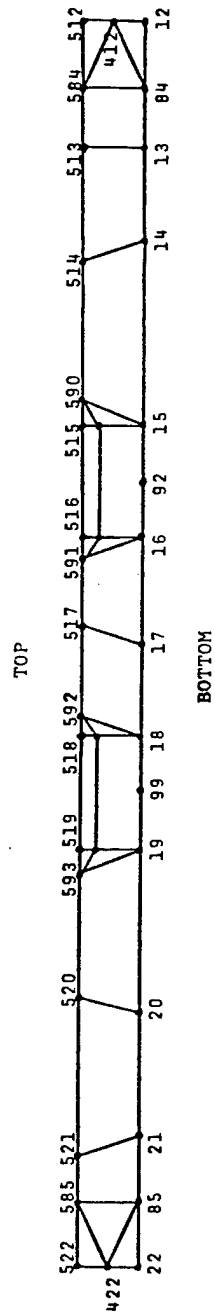
TOP



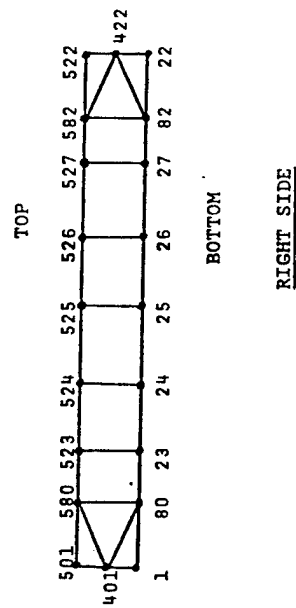
BOTTOM

LEFT SIDE

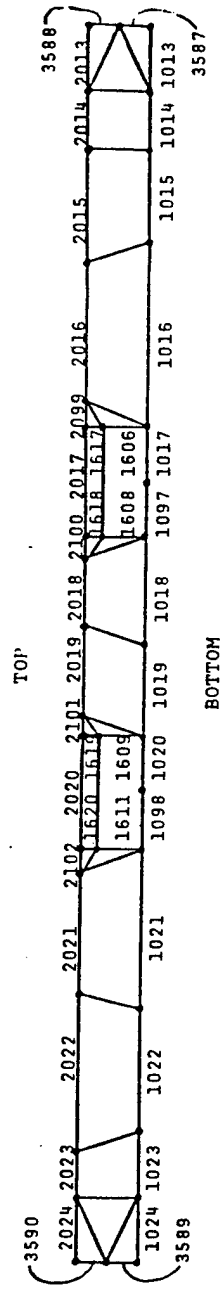
Front and Left Side View of Seat Pallet Structure. Plate Elements Only Shown.



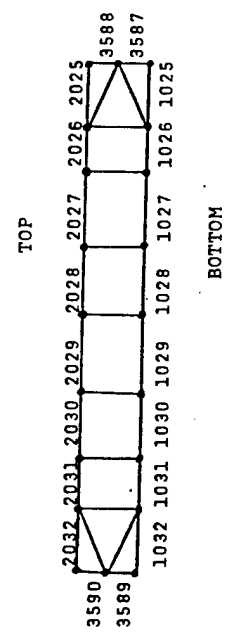
BACK



Back and Right Side View of Seat Pallet Structure. Node Points Only Shown.

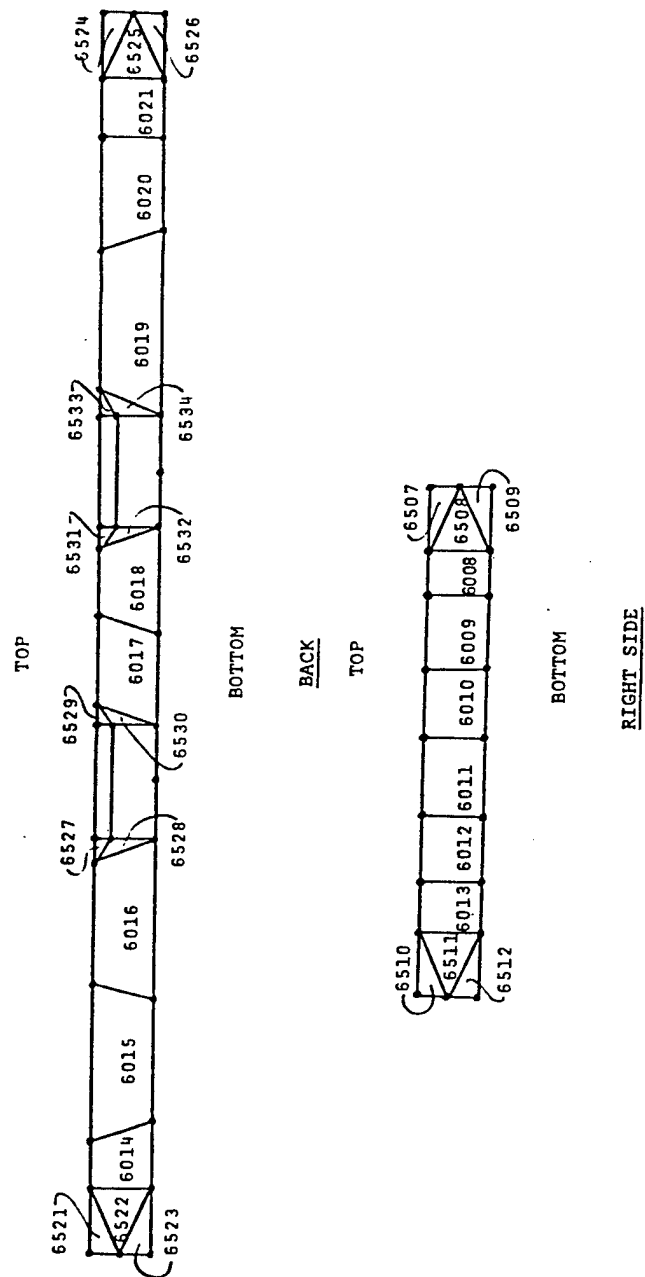


BACK

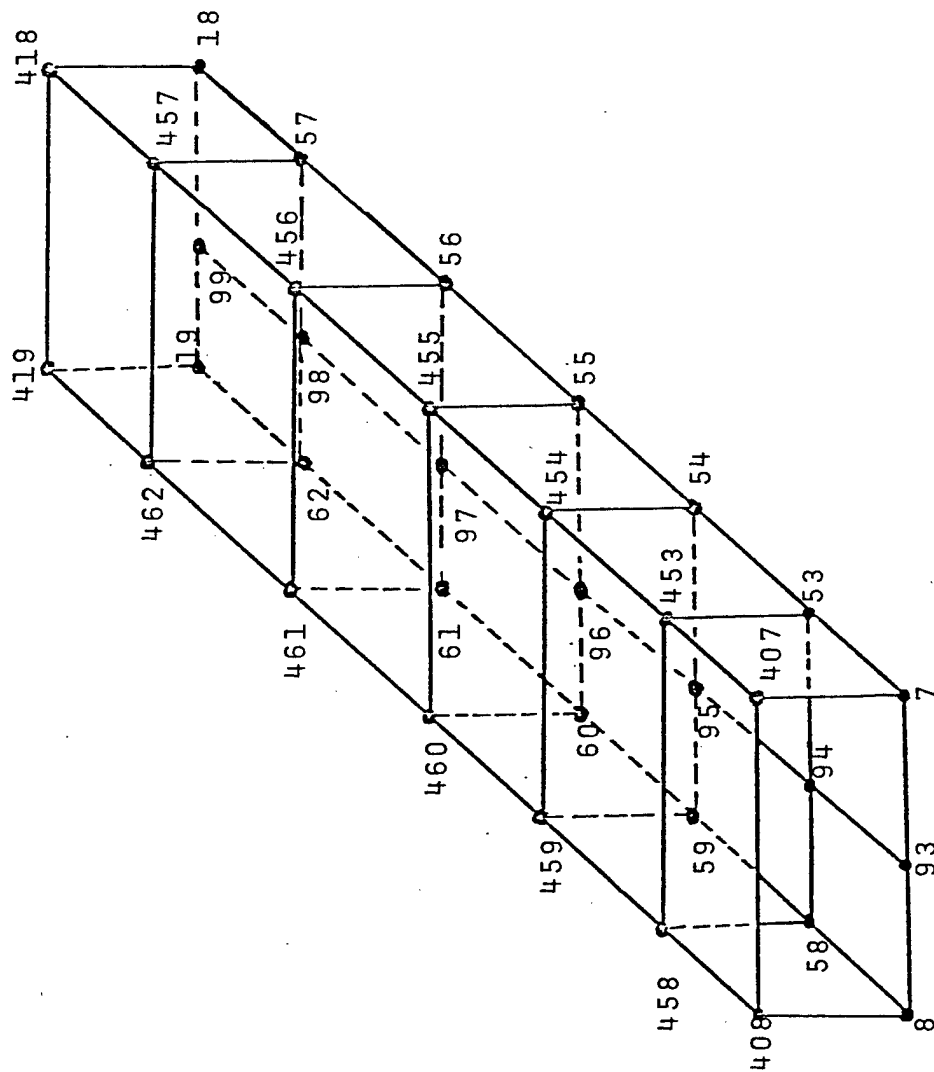


RIGHT SIDE

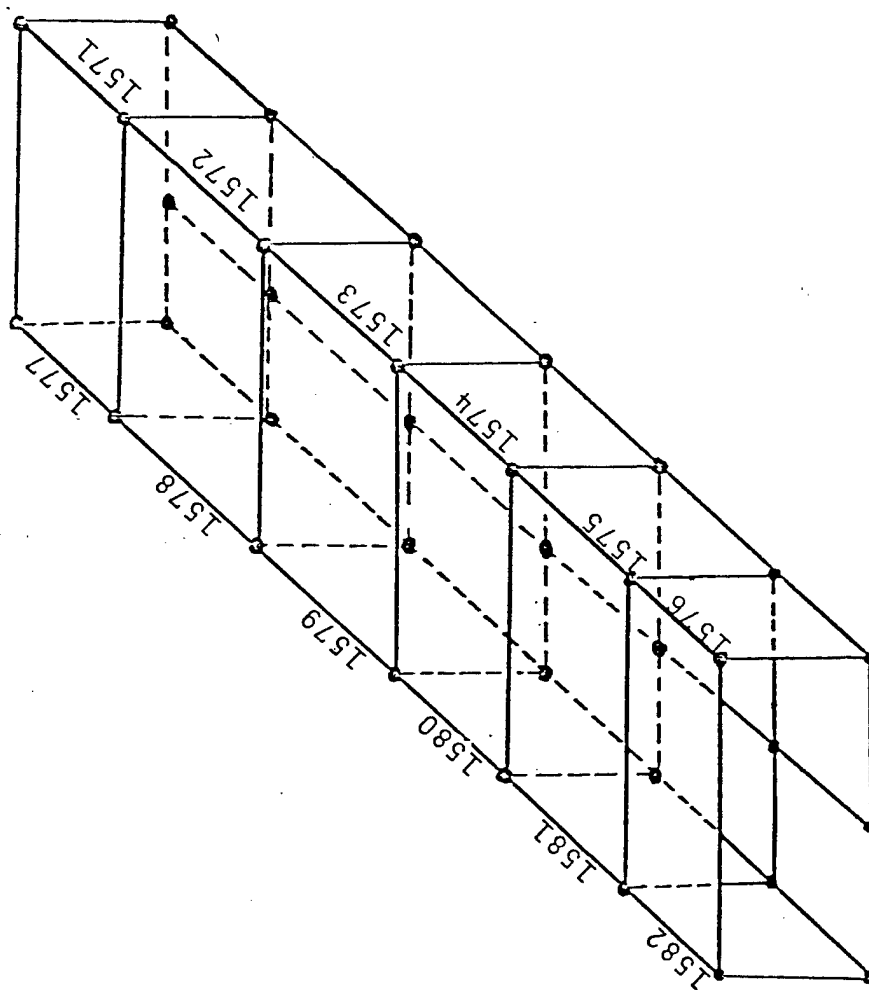
Back and Right Side View of Seat Pallet Structure. Bar Elements Only Shown.



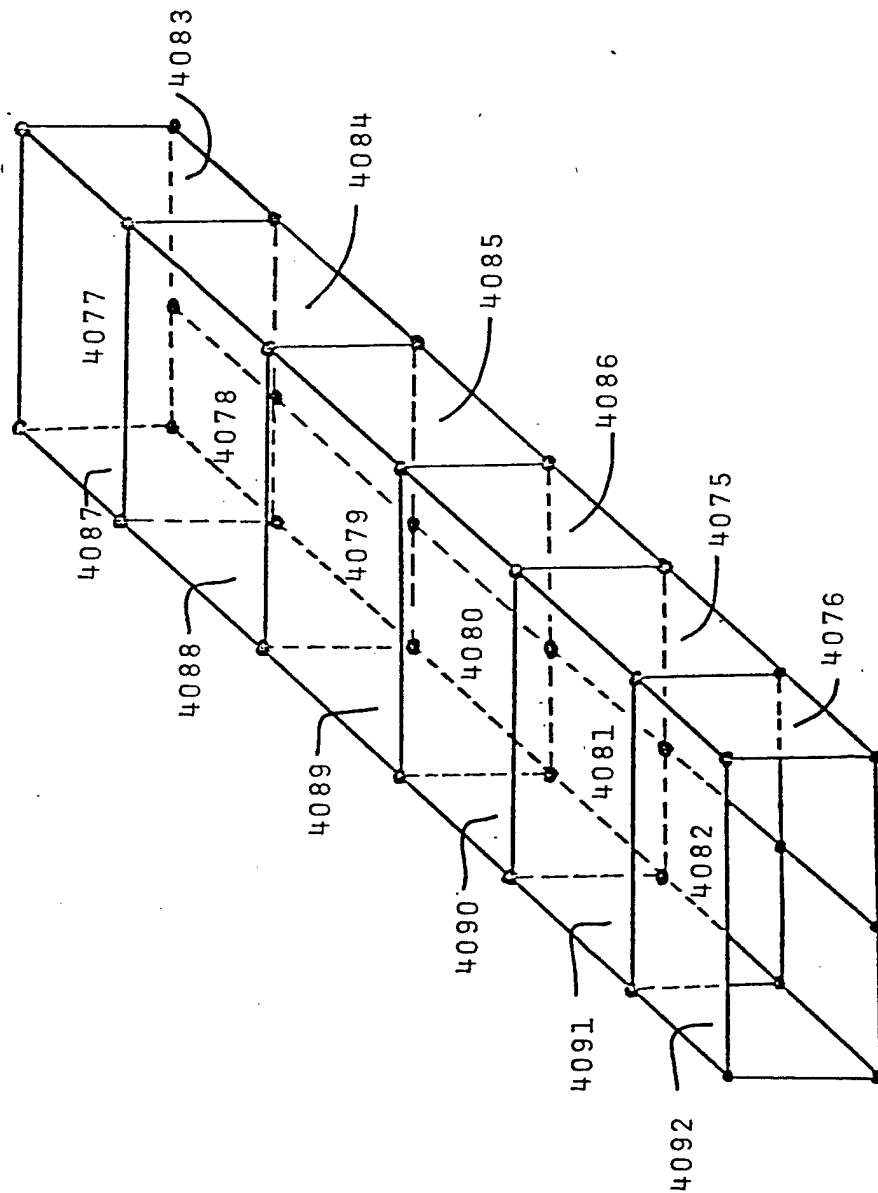
Back and Right Side View of Seat Pallet Structure. Plate Elements Only Shown.



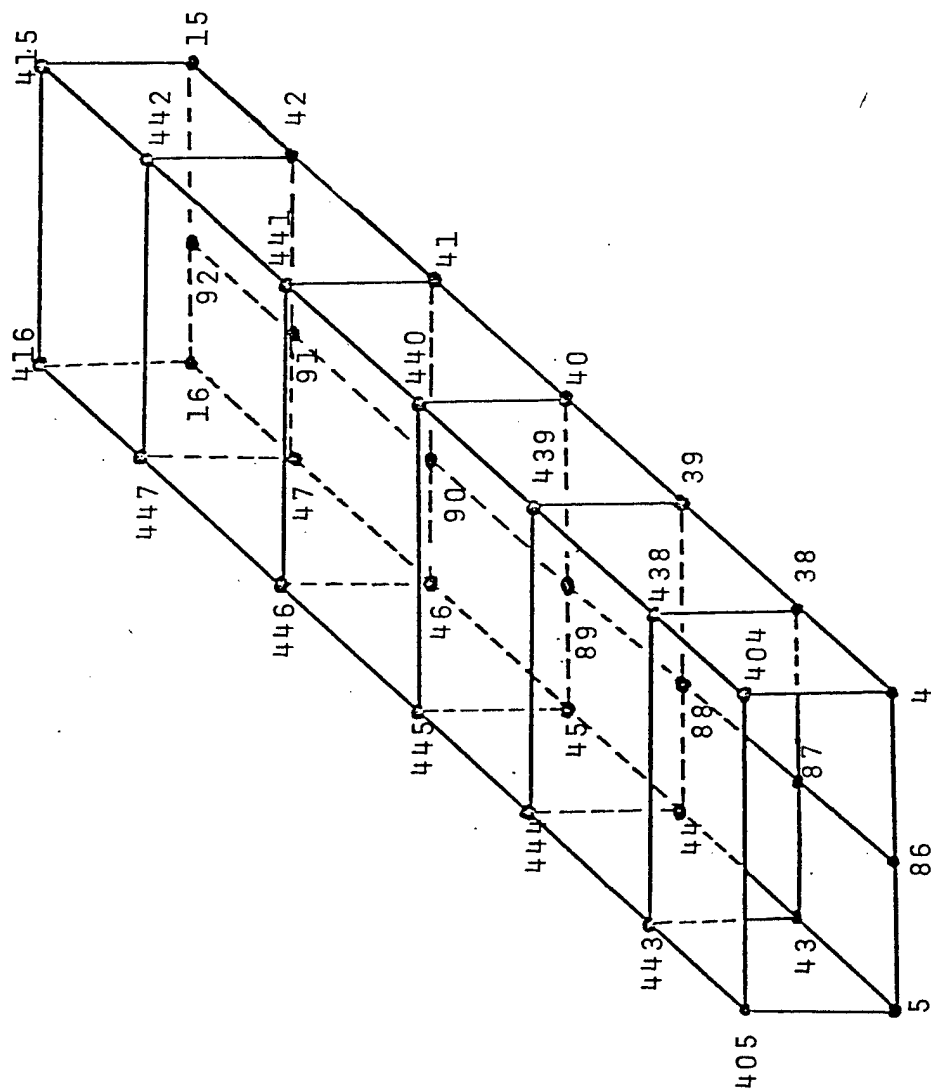
Left Tunnel, Seat Pallet. Node Points Only Shown.



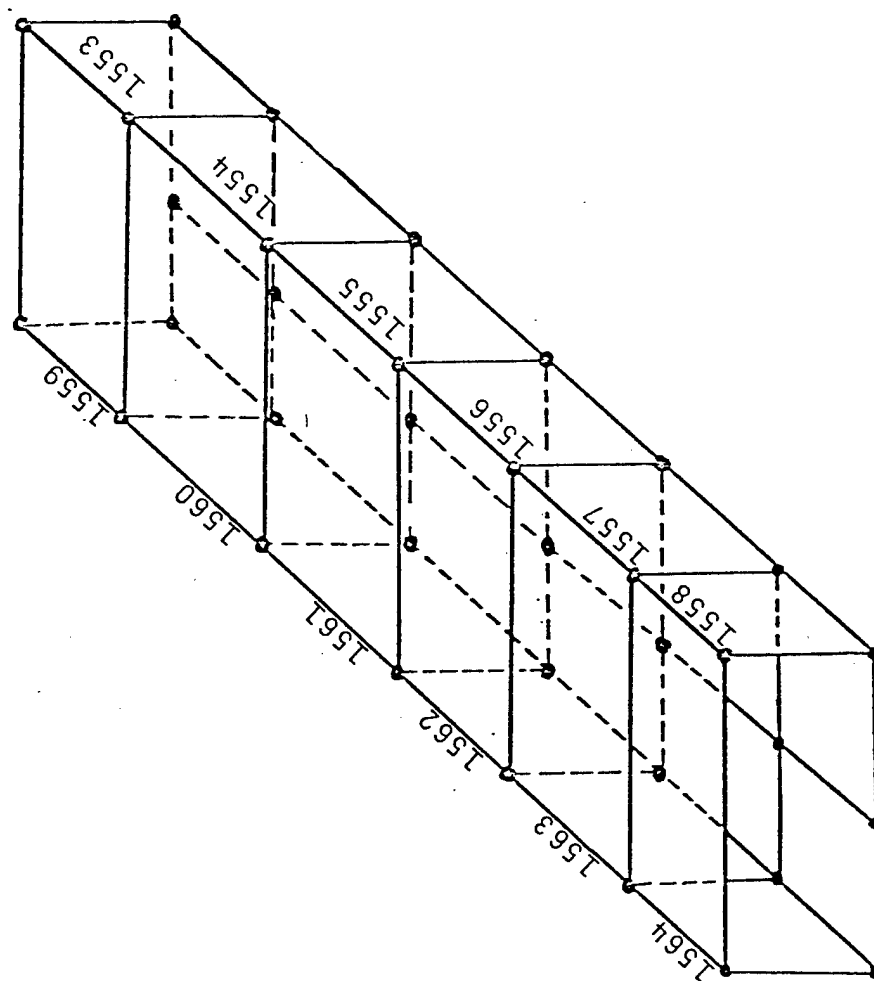
Left Tunnel, Seat Pallet. Bar Elements Only Shown.

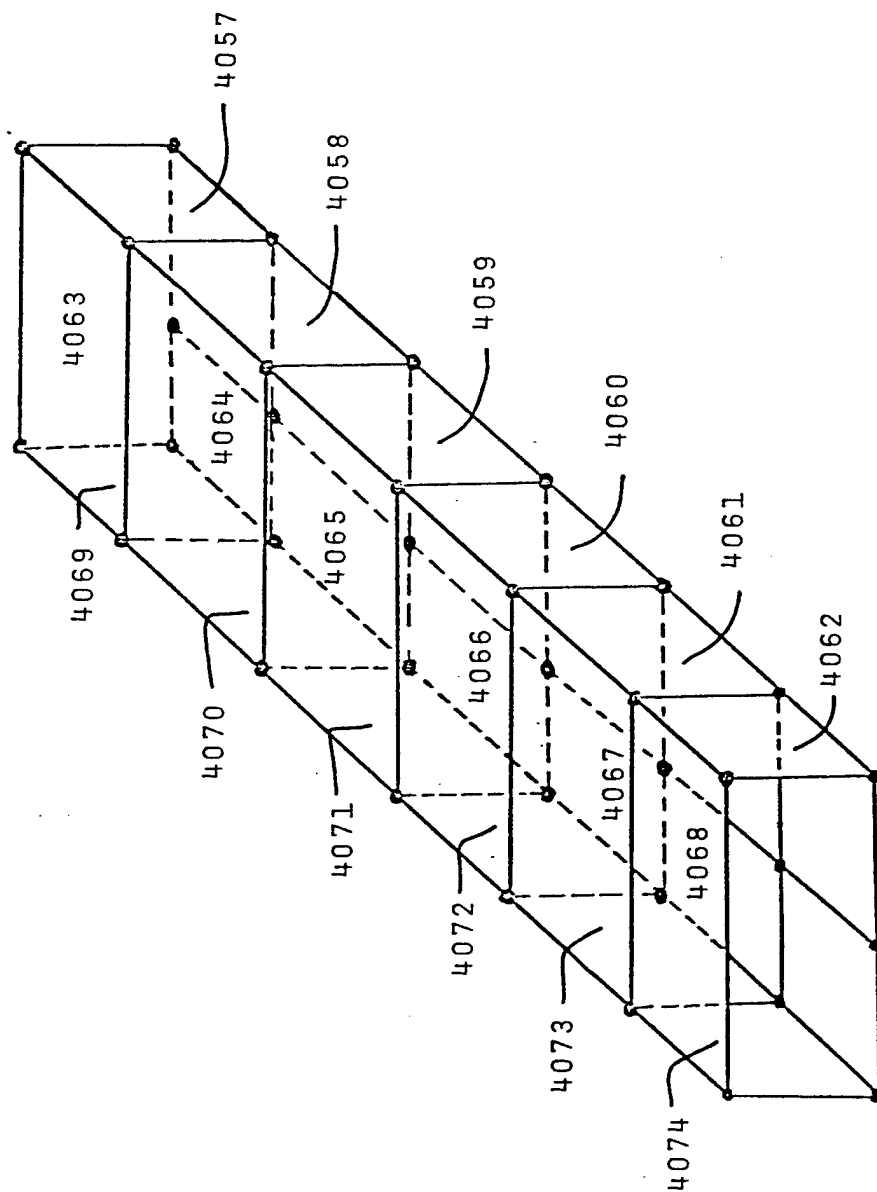


Left Tunnel, Seat Pallet. Plate Elements Only Shown.

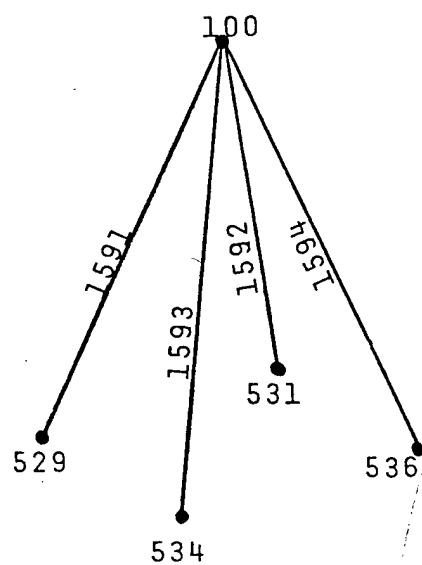


Right Tunnel, Seat Pallet. Node Points Only Shown.





Right Tunnel, Seat Pallet. Plate Elements Only Shown.



Airman and Mass, Seat Pallet,
Nodes and Bar Elements Shown.

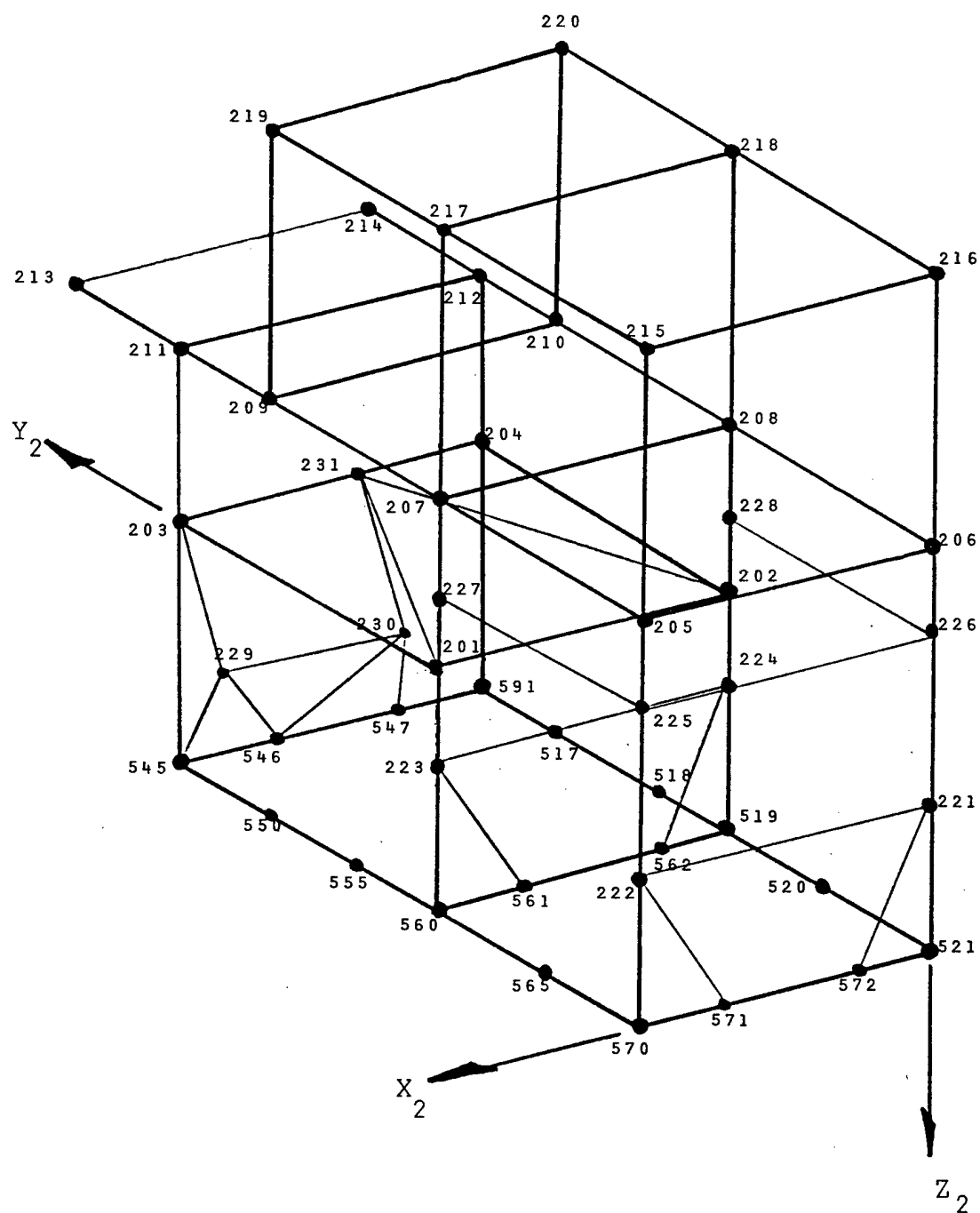


Table Model, Nodal points only given.

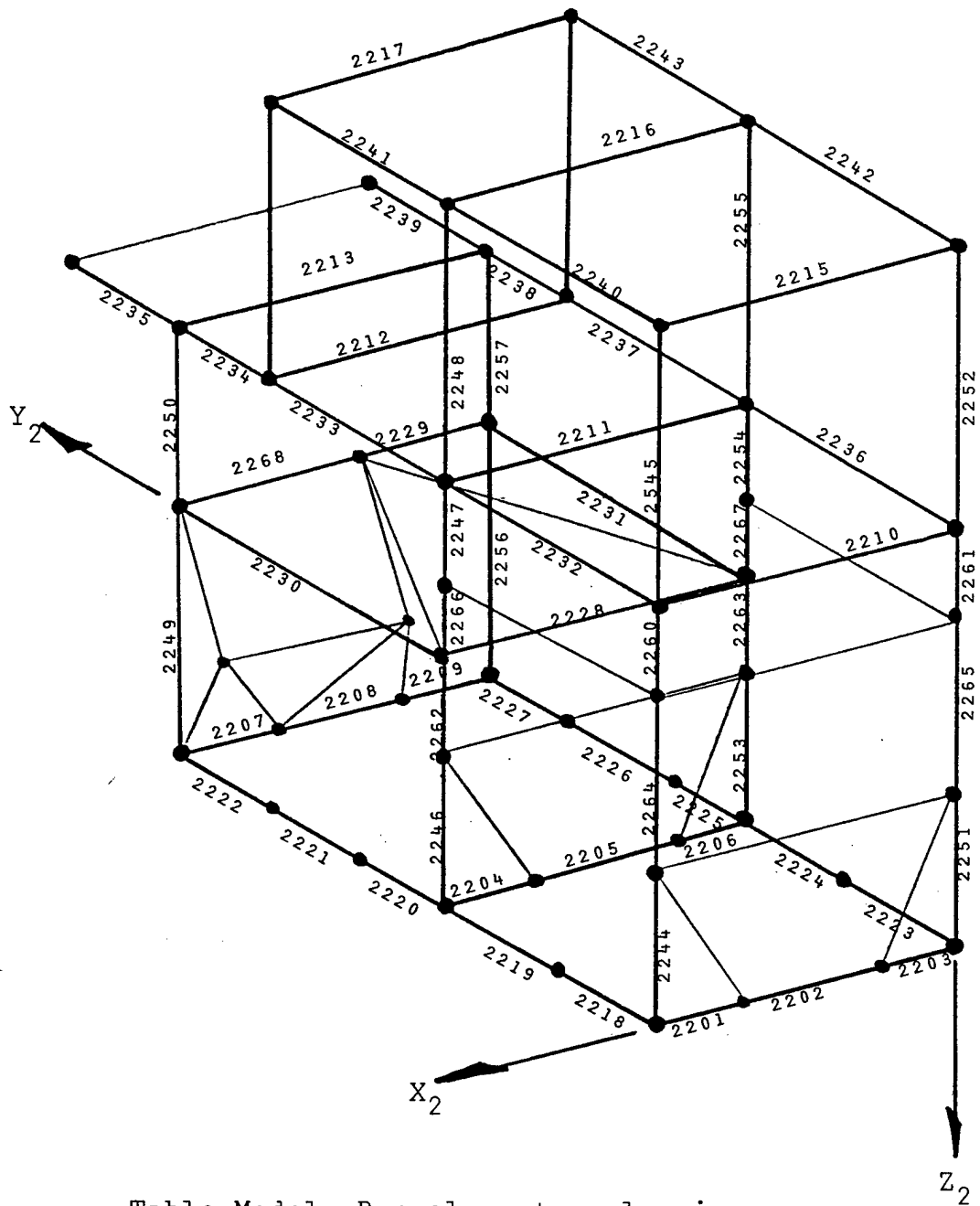


Table Model, Bar elements only given.

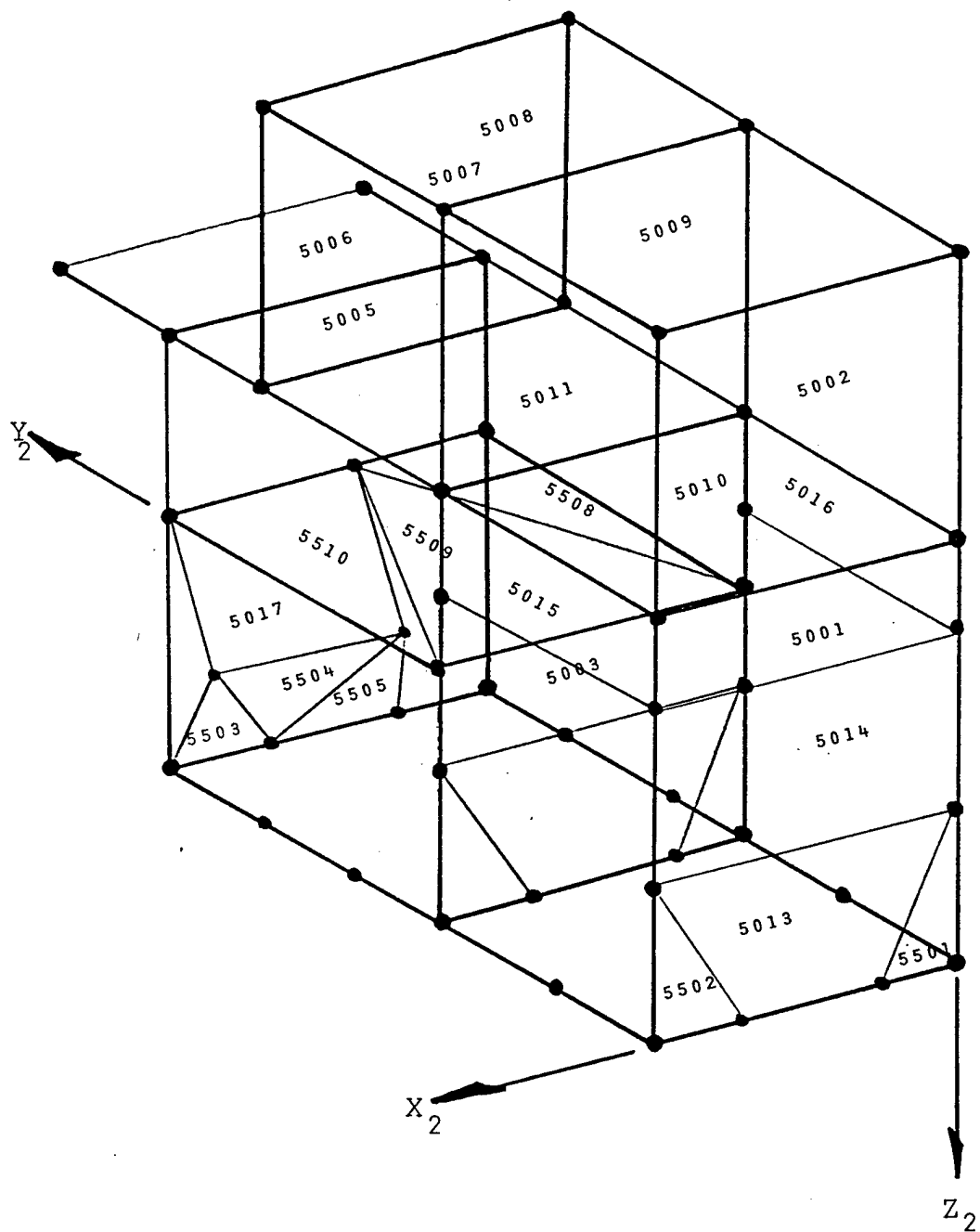


Table Model, Plate elements only.

APPENDIX E

PBAR PROPERTY CALCULATIONS

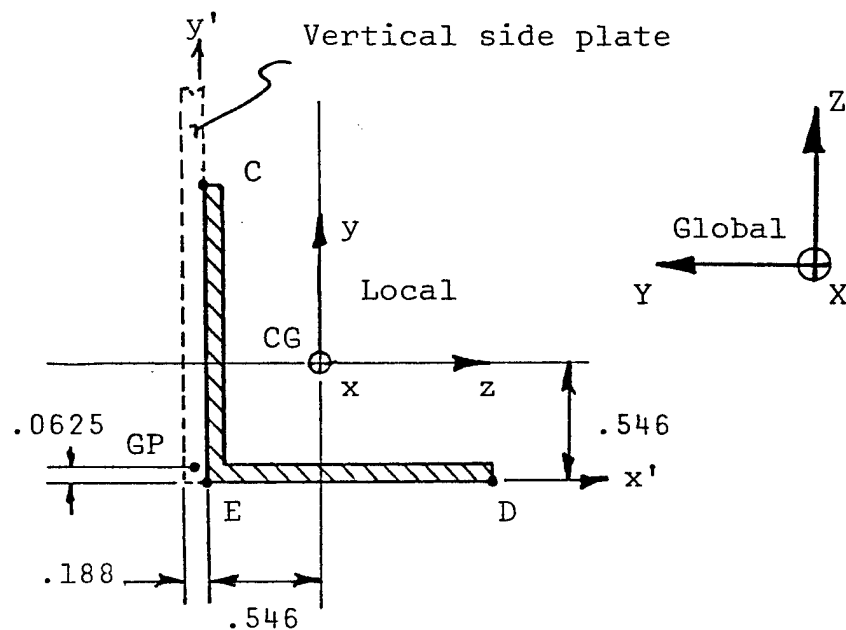
Included in this appendix are the detailed calculations for determining the cross-section properties used for the PBAR cards of NASTRAN. As an aid to the preparation of this data, the Anamet's computer program INERTIA has been used (reference 5).

STRUCTURE: Rack Pallet 75-0010

PROPERTY NUMBER: 1

ELEMENT NUMBERS: 3001-3004
3006-3007
3009-3016
3018-3019
3021-3024

DESCRIPTION: 2 x 2 x $\frac{1}{8}$ x 103.75 Angle
(Part No. -39, Al 2024-T3)



PROPERTY NUMBER: 1 (continued)

CALCULATIONS:

See INERTIA program output on following page.

STRESS RECOVERY POINTS

<u>Point</u>	<u>y</u>	<u>z</u>
C	+1.454	-.546
D	-.546	+1.454
E	-.546	-.546

OFFSET

<u>CBAR Element No.</u>	<u>Z1A</u>	<u>Z2A</u>	<u>Z3A</u>	<u>Z1B</u>	<u>Z2B</u>	<u>Z3B</u>
3001-3004	0.	-.640	+.4835	0.	-.640	+.4835
3006-3007						
3009-3012						
3013-3016	0.	+.640	+.4835	0.	+.640	+.4835
3018-3019						
3021-3024						

[illegible][illegible][illegible][illegible][illegible][illegible]

[illegible]

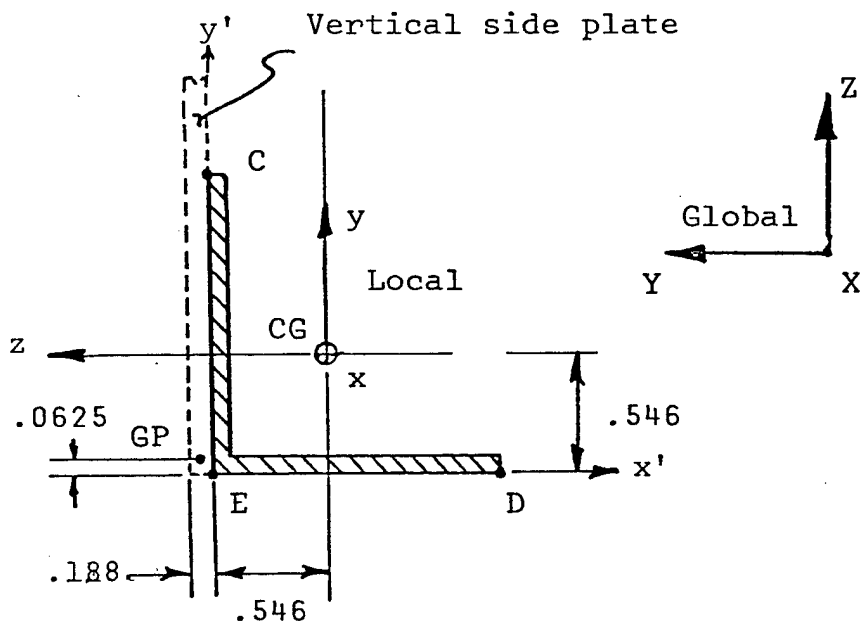
STRUCTURE: Rack Pallet 75-0010

PROPERTY NUMBER: 2 and 3

ELEMENT NUMBERS: 4001-4004 }
4013-4016 } PID No. 2
4095-4102 }

4005-4012 }
4017-4024 } PID No. 3

DESCRIPTION: 2 x 2 x $\frac{1}{8}$ x 103.75 Angle
(Part No. -39, A1 2024-T3)



PROPERTY NUMBER: 2 and 3 (continued)

CALCULATIONS:

See INERTIA program output for PBAR No. 1.

STRESS RECOVERY POINTS

<u>Point</u>	<u>y</u>	<u>z</u>
C	1.454	.546
D	-.546	-1.454
E	-.546	+ .546

OFFSET

<u>CBAR Element No.</u>	<u>Z1A</u>	<u>Z2A</u>	<u>Z3A</u>	<u>Z1B</u>	<u>Z2B</u>	<u>Z3B</u>
-------------------------	------------	------------	------------	------------	------------	------------

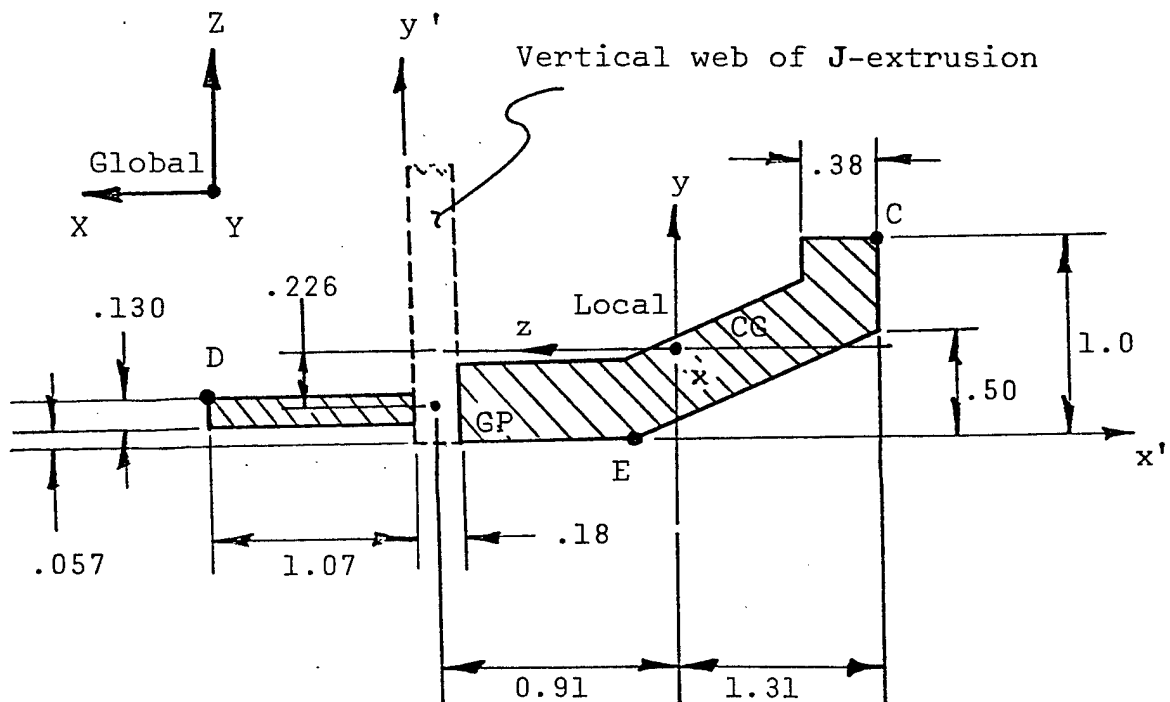
NONE

STRUCTURE: Rack Pallet 75-0010

PROPERTY NUMBER: 4

ELEMENT NUMBERS: 3025-3040

DESCRIPTION: Bottom Flange of Al 2024-T3 J-extrusion



PROPERTY NUMBER: 4 (continued)

CALCULATIONS:

See INERTIA program output on following page.

STRESS RECOVERY POINTS

<u>Point</u>	<u>y</u>	<u>z</u>
C	+0.652	-1.310
D	-0.161	+2.070
E	-0.348	-0.055

OFFSET

<u>CBAR Element No.</u>	<u>Z1A</u>	<u>Z2A</u>	<u>Z3A</u>	<u>Z1B</u>	<u>Z2B</u>	<u>Z3B</u>
3025-3032	-0.91	0.	+0.226	-0.91	0.	+0.226
3033-3040	+0.91	0.	+0.226	+0.91	0.	+0.226

INERTIA

HAR PROPERTY NUMBER
DESCRIPTION-PID NO 4 BOTTOM FLANGE OF J-EXTRUSION (RACK PALLET 75-0010)

INPUT	TYPE	DUM	B	H	BI	HI	X	Y	ALF
RECT	0.00	1.07000		.13000	0.00000	0.00000	-.53500	.05700	0.00000
RECT	0.00	.87500		.38000	0.00000	0.00000	.61800	0.00000	0.00000
RECT	0.00	.87500		.38000	0.00000	0.00000	1.40300	0.00000	0.00000
RIRI	-1.00	.38000		.87500	0.00000	0.00000	1.84000	0.00000	90.00000
RIRI	0.00	.33300		.87500	0.00000	0.00000	1.84000	.38000	90.00000
RECT	0.00	1.00000		.38000	0.00000	0.00000	2.22000	.50000	90.00000
RIRI	-1.00	.12000		.38000	0.00000	0.00000	2.22000	.38000	90.00000
RECT	-1.00	.38000		.38000	0.00000	0.00000	2.03000	0.00000	0.00000

OUTPUT	NO.	AREA	XC	YC	IX	IY	IXY	K
1	13910	-.53500		.12200	.00020	.01327	0.00000	.00078
2	.33250	.61800		.19000	.00400	.02121	0.00000	.01600
3	.33250	1.40300		.19000	.00400	.02121	0.00000	.01600
4	-.16625	1.54833		.12667	-.00133	-.00707	.01382	-.00841
5	.14569	1.54833		.49100	.00090	.00620	-.01061	.00709
6	.38000	2.03000		.50000	.03167	.00457	-.00000	.01829
7	-.02280	2.09333		.42000	-.00002	-.00018	.00026	-.00020
8	-.14440	2.03000		.19000	-.00174	-.00174	0.00000	-.00695

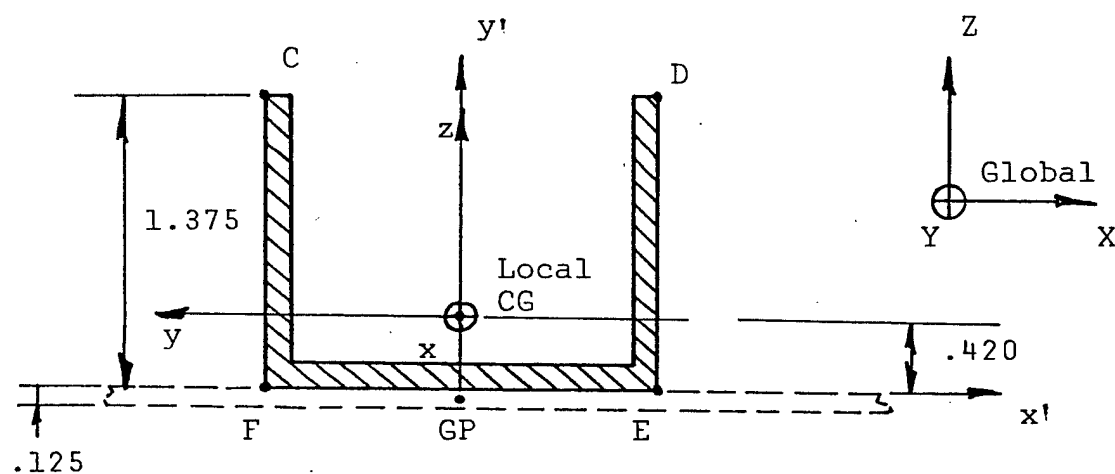
[illegible]

STRUCTURE: Rack Pallet 75-0010

PROPERTY NUMBER: 5

ELEMENT NUMBERS: 3041-3052
3065-3070
3083-3094

DESCRIPTION: $3 \times 1\frac{3}{8} \times \frac{1}{4}$ Channel (Al 6061-T6)



PROPERTY NUMBER: 5 (continued)

CALCULATIONS:

See INERTIA program output on following page.

STRESS RECOVERY POINTS

<u>Point</u>	<u>y</u>	<u>z</u>
C	+1.500	+.955
D	-1.500	+.955
E	-1.500	-.420
F	+1.500	-.420

SHEAR FACTORS

$$K_1 = \frac{3(\frac{1}{4})}{1.31} = .573$$

$$K_2 = \frac{2 (1.375)(\frac{1}{4})}{1.31} = .525$$

OFFSET

<u>CBAR Element No.</u>	<u>Z1A</u>	<u>Z2A</u>	<u>Z3A</u>	<u>Z1B</u>	<u>Z2B</u>	<u>Z3B</u>
3041-3052	0.	0.	+.4865	0.	0.	+.4865
3065-3070						
3083-3094						

INERTIA

BAR PROPERTY NUMBER
 DESCRIPTION- PID NO 5 3X1.375X.25 BOTTOM CHANNEL (RACK PALLET 75-0010)

INPUT

TYPE	DUM	B	H	B1	H1	X	Y	ALF
RECT	0.00	2.5000	.2500	0.0000	0.0000	0.0000	0.0000	0.00000
RECT	0.00	.2500	1.3750	0.0000	0.0000	-1.3750	0.0000	0.00000
RECT	0.00	.2500	1.3750	0.0000	0.0000	1.3750	0.0000	0.00000

OUTPUT

NO.	AREA	XC	YC	IX	IY	IXY	K
1	.62500	0.00000	.12500	.00326	.32552	0.00000	.01302
2	.34375	-1.37500	.68750	.05416	.00179	0.00000	.00716
3	.34375	1.37500	.68750	.05416	.00179	0.00000	.00716

[illegible]

STRUCTURE: Seat Pallet 75-0010

PROPERTY NUMBER: 5

ELEMENT NUMBERS:

 1041-1052

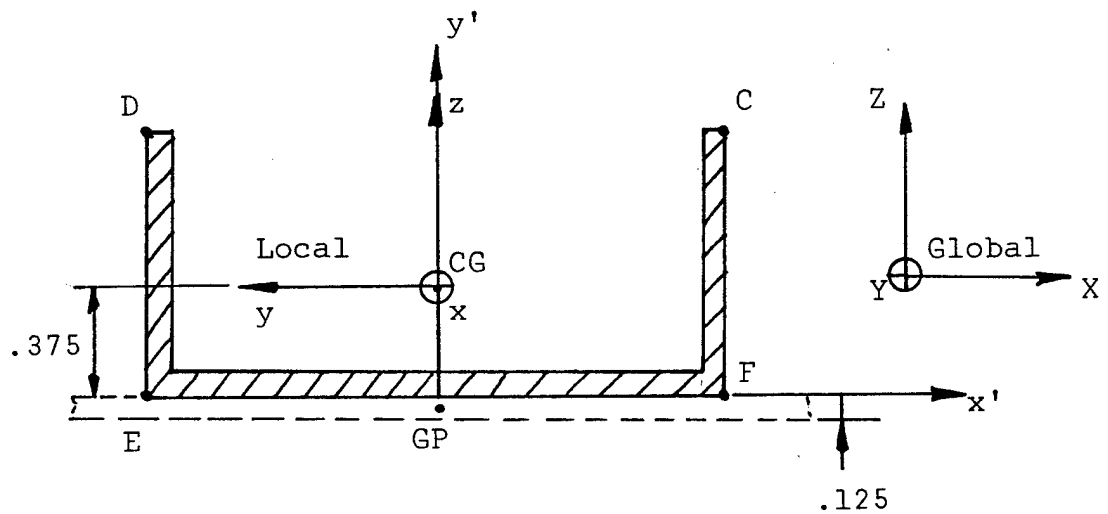
 1065-1070

 1083-1094

 2053-2064 (top channel)

DESCRIPTION: Bottom Channel

 (3 x $1\frac{3}{8}$ x $\frac{1}{8}$ channel, AL 2024-T3)



PROPERTY NUMBER: 5 (continued)

CALCULATIONS:

See INERTIA program output on following page.

STRESS RECOVERY POINTS

<u>Point</u>	<u>y</u>	<u>z</u>
C	-1.500	+1.000
D	+1.500	+1.000
E	+1.500	-1.000
F	-1.500	-1.000

OFFSET

<u>CBAR Element No.</u>	<u>Z1A</u>	<u>Z2A</u>	<u>Z3A</u>	<u>Z1B</u>	<u>Z2B</u>	<u>Z3B</u>
1041-1052	0.	0.	+.4375	0.	0.	+.4375
1065-1070						
1083-1094						
2053-2064	0.	0.	-.415	0.	0.	-.415

SHEAR FACTORS

$$K_1 = \frac{3(\frac{1}{8})}{.688} = .545$$

$$K_2 = \frac{2(1\frac{3}{8})(\frac{1}{8})}{.688} = .500$$

INERTIA

BAR PROPERTY NUMBER
DESCRIPTION- PID 5 BOTTOM CHANNELS (SEAT PALLET 75-0010)

INPUT		DUM	B	H	B1	H1	X	Y	ALF
TYPE	RECT	0.00	2.75000	.12500	0.00000	0.00000	0.00000	0.00000	0.00000
	RECT	0.00	.12500	1.37500	0.00000	0.00000	-1.43750	0.00000	0.00000
	RECT	0.00	.12500	1.37500	0.00000	0.00000	1.43750	0.00000	0.00000

OUTPUT		AREA	XC	YC	IX	IY	IXY	K
NO.	1	.34375	0.00000	.06250	.00045	.21663	0.00000	.00179
	2	.17188	-1.43750	.68750	.02708	.00022	0.00000	.00090
	3	.17188	1.43750	.68750	.02708	.00022	0.00000	.00090

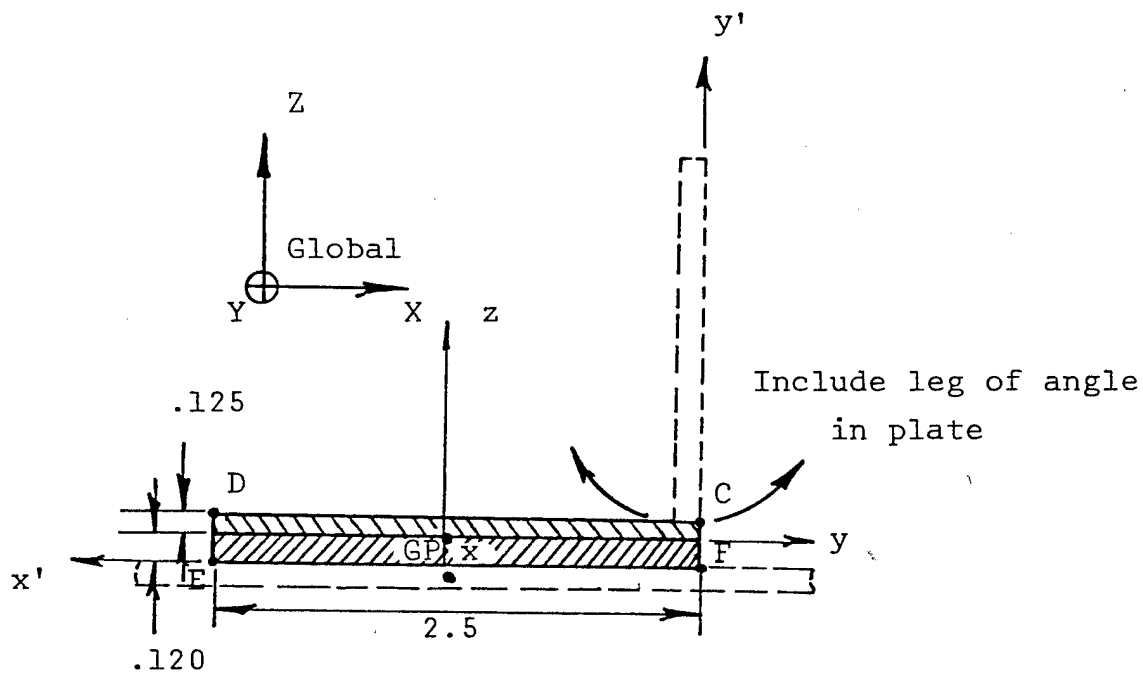
[illegible]

STRUCTURE: Rack Pallet 75-0010

PROPERTY NUMBER: 6

ELEMENT NUMBERS: 3053-3064
3071-3082

DESCRIPTION: Angle at fork lift tunnel
(2.5 x 2.5 x $\frac{1}{8}$ angle A1 2024-T3)



PROPERTY NUMBER: 6 (continued)

CALCULATIONS:

See INERTIA program output on following page.

STRESS RECOVERY POINTS

<u>Point</u>	<u>y</u>	<u>z</u>
C	+1.25	.122
D	-1.25	.122
E	-1.25	-.123
F	+1.25	-.123

OFFSET

<u>CBAR Element No.</u>	<u>Z1A</u>	<u>Z2A</u>	<u>Z3A</u>	<u>Z1B</u>	<u>Z2B</u>	<u>Z3B</u>
None						

INERTIA

BAR-PROPERTY NUMBER
 DESCRIPTION- PID NO 6 BOTTOM HOR. MEMBER ON TUNNEL (RACK PALLET 75-0010)

INPUT											
TYPE	DUM	B	H	B1	H1	X	Y	ALF			
RECT	0.00	2.50000	.12000	0.00000	0.00000	1.25000	0.00000	0.00000	0.00000	0.00000	
RECT	0.00	2.50000	.12500	0.00000	0.00000	1.25000	.12000	0.00000	0.00000	0.00000	

OUTPUT											
NO.	AREA	XC	YC	IX	IY	IXY	K				
1	.30000	1.25000	.06000	.00036	.15625	0.00000	.00144				
2	.31250	1.25000	.18250	.00041	.16276	0.00000	.00163				

[illegible]

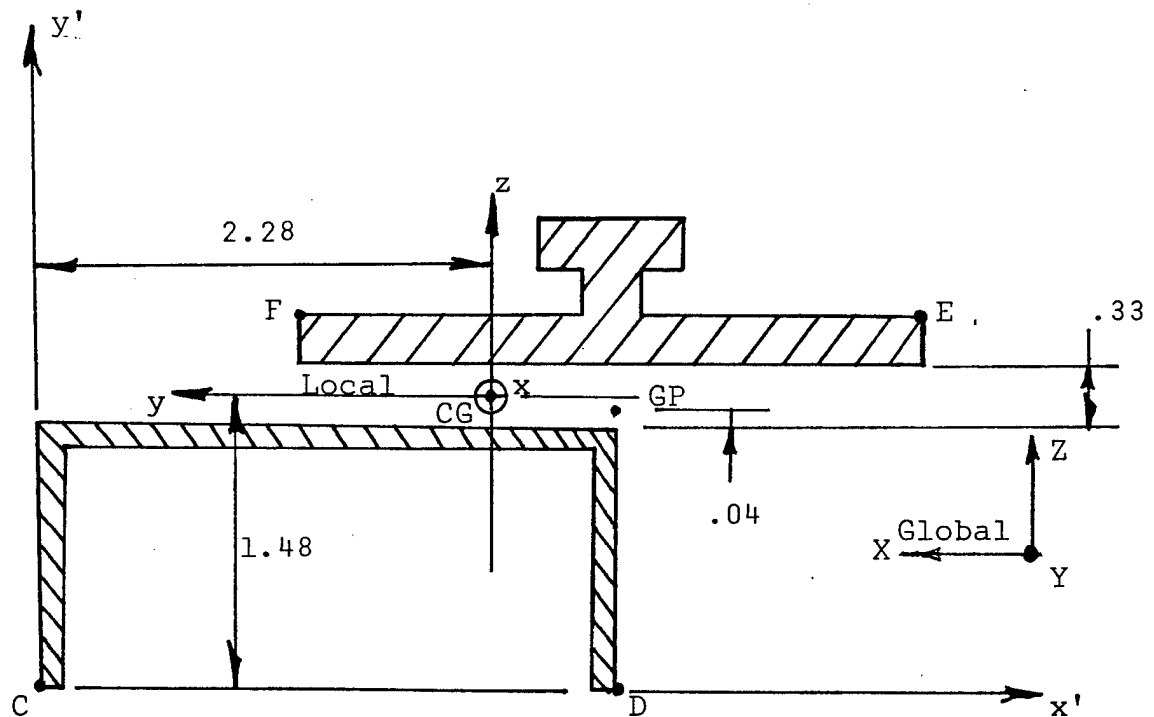
STRUCTURE: Seat Pallet 75-0010

PROPERTY NUMBER: 7

ELEMENT NUMBERS: 2042-2045
 2048-2051

DESCRIPTION: Seat Rail Support Beams

(3 x $1\frac{3}{8}$ x $\frac{3}{16}$ channel with seat rail, AL 2024-T3)



PROPERTY NUMBER: 7 (continued)

CALCULATIONS:

See INERTIA program output on following page.

STRESS RECOVERY POINTS

<u>Point</u>	<u>y</u>	<u>z</u>
C	+2.280	-1.480
D	-0.720	-1.480
E	-2.345	+0.475
F	+0.905	+0.475

OFFSET

<u>CBAR Element No.</u>	<u>Z1A</u>	<u>Z2A</u>	<u>Z3A</u>	<u>Z1B</u>	<u>Z2B</u>	<u>Z3B</u>
2042-2045	+0.720	0.	+0.065	+0.720	0.	+0.065
2048-2051	-0.720	0.	+0.065	-0.720	0.	+0.065

SHEAR FACTORS

$$K_1 = \frac{.8125 + .07 + .21 + \frac{1}{8}(3)}{1.78} = .824$$

$$K_2 = \frac{\frac{1}{8}(2)(1.375) + .8125 + .07 + .21}{1.78} = .807$$

INERTIA

BAR PROPERTY NUMBER
DESCRIPTION- PID NO 7 SEAT RAILS (SEAT PALLET 75-0010)

INPUT

TYPE	DUM	B	H	BI	HI	X	Y	ALF
RECT	0.00	.18750	1.37500	0.00000	0.00000	.09375	0.00000	0.00000
RECT	0.00	2.62500	.18750	0.00000	0.00000	1.50000	1.18750	0.00000
RECT	0.00	.18750	1.37500	0.00000	0.00000	2.90625	0.00000	0.00000
RECT	0.00	3.25000	.25000	0.00000	0.00000	3.00000	1.70500	0.00000
RECT	0.00	.35000	.20000	0.00000	0.00000	3.00000	1.95500	0.00000
RECT	0.00	.70000	.30000	0.00000	0.00000	3.00000	2.15500	0.00000

OUTPUT

NO.	AREA	XC	YC	IX	IY	IXY	K
1	.25781	.09375	.68750	.04062	.00076	0.00000	.00302
2	.49219	1.50000	1.28125	.00144	.28262	0.00000	.00577
3	.25781	2.90625	.68750	.04062	.00076	0.00000	.00302
4	.81250	3.00000	1.83000	.00423	.71517	0.00000	.01693
5	.07000	3.00000	2.05500	.00023	.00071	0.00000	.00093
6	.21000	3.00000	2.30500	.00158	.00858	0.00000	.00630

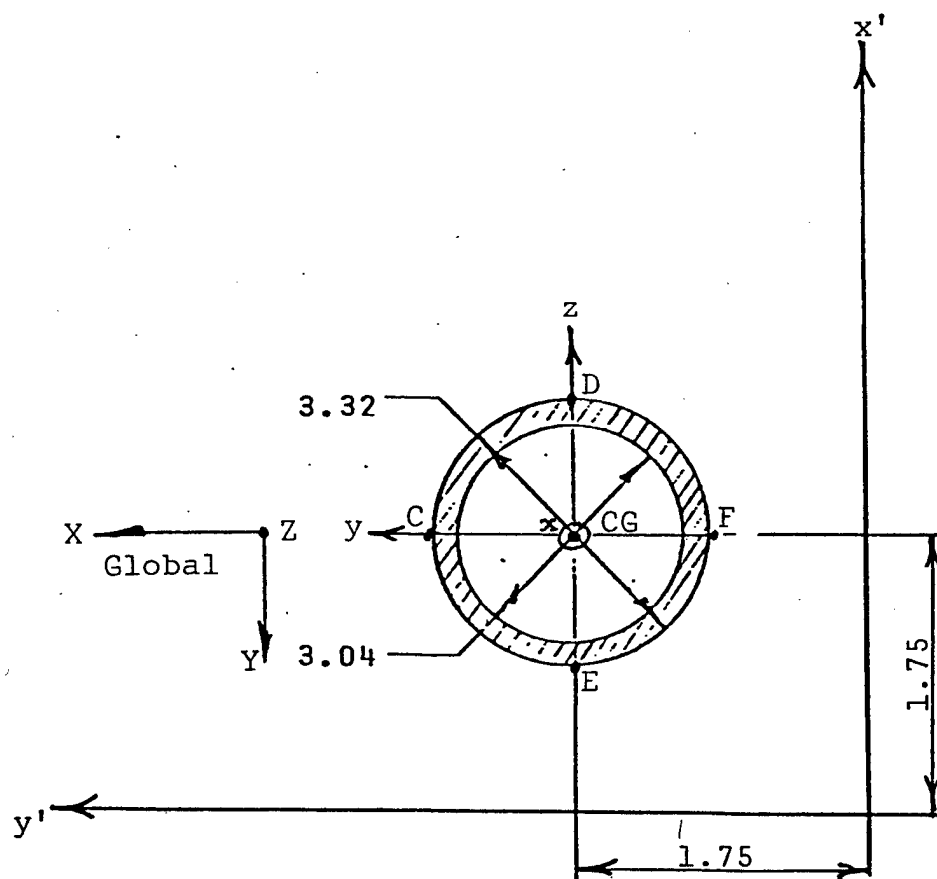
[illegible]

STRUCTURE: Rack Pallet 75-0010

PROPERTY NUMBER: 8

ELEMENT NUMBERS: 3583-3590

DESCRIPTION: Corner Post



PROPERTY NUMBER: 8 (continued)

CALCULATIONS:

See INERTIA program output on following page.

STRESS RECOVERY POINTS

<u>Point</u>	<u>y</u>	<u>z</u>
C	+1.66	0.0
D	0.0	+1.66
E	0.0	-1.66
F	-1.66	0.0

OFFSET

<u>CBAR Element No.</u>	<u>Z1A</u>	<u>Z2A</u>	<u>Z3A</u>	<u>Z1B</u>	<u>Z2B</u>	<u>Z3B</u>
None						

INERTIA

BAR PROPERTY NUMBER
DESCRIPTION- PHAR NO. 8

INPUT	TYPE	DUM	B	H	B1	H1	X	Y	ALF
CIRC	0.00	1.66000	0.00000	0.00000	0.00000	0.00000	1.75000	1.75000	0.00000
CIRC	-1.00	1.52000	0.00000	0.00000	0.00000	0.00000	1.75000	1.75000	0.00000

OUTPUT	NO.	AREA	XC	YC	IX	IY	IXY	K
1	8.65697	1.75000	1.75000	5.96378	5.96378	0.00000	11.92757	
2	-7.25833	1.75000	1.75000	-4.19241	-4.19241	0.00000	-8.38482	

```

*****
TOTAL AREA= .140E+01
X CENTROID DISTANCE= .175E+01
Y CENTROID DISTANCE= .175E+01
IX (ABOUT CENTROID)= .177E+01
IY (ABOUT CENTROID)= .177E+01
IXY (ABOUT CENTROID)= -.284E-13
IMAX= .177E+01
IMIN= .177E+01
ALPHA= .900E+02
TORSIONAL CONSTANT, K= .354E+01
IX (ABOUT INPUT AXIS)= .605E+01
IY (ABOUT INPUT AXIS)= .605E+01
IXY (ABOUT INPUT AXIS)= .428E+01
*****
TORSIONAL CONSTANT BASED ON SUM
NOT NECESSARILY ACCURATE
*****

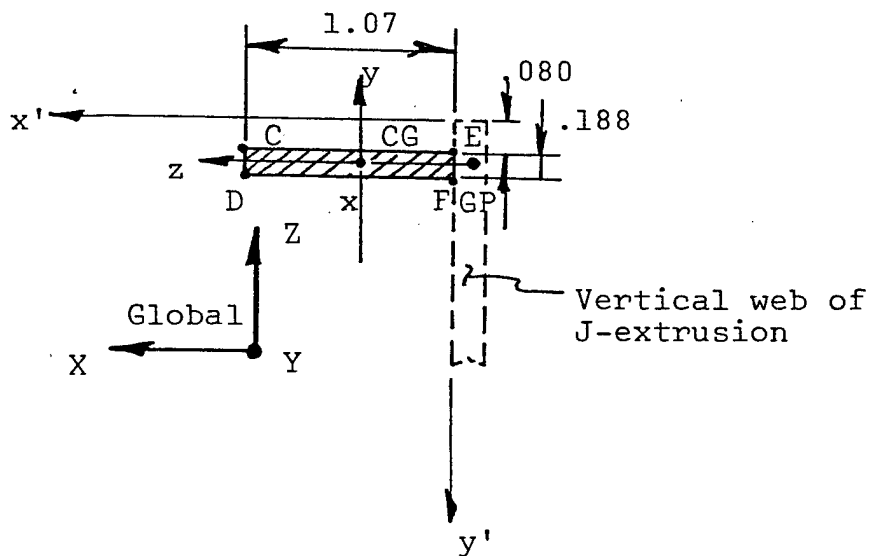
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STRUCTURE: Rack Pallet 75-0010

PROPERTY NUMBER: 9

ELEMENT NUMBERS: 4025-4040

DESCRIPTION: Upper Flange of J-extrusion
(Al 2024-T3)



PROPERTY NUMBER: 9 (continued)

CALCULATIONS:

See INERTIA program output on following page.

STRESS RECOVERY POINTS

<u>Point</u>	<u>y</u>	<u>z</u>
C	+0.094	+0.535
D	-0.094	+0.535
E	+0.094	-0.535
F	-0.094	-0.535

OFFSET

<u>CBAR Element No.</u>	<u>Z1A</u>	<u>Z2A</u>	<u>Z3A</u>	<u>Z1B</u>	<u>Z2B</u>	<u>Z3B</u>
None						

INERTIA

BAR PROPERTY NUMBER

DESCRIPTION- PID NO 9 TOP FLANGE OF J-EXTRUSION (RACK PALLET 75-0010)

INPUT

TYPE DUM B H B1 H1 X Y ALF
RECT 0.00 1.07000 .18800 0.00000 0.00000 .53500 .08000 0.00000

OUTPUT

NO. AREA XC YC IX IY IXY K
1 .20116 .53500 .17400 .00059 .01919 0.00000 .00237

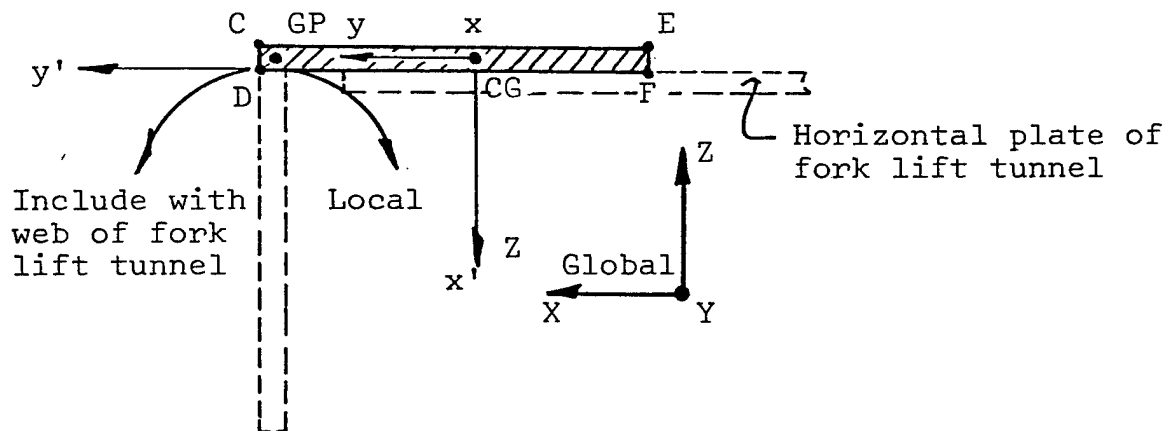
[illegible]

STRUCTURE: Rack Pallet 75-0010

PROPERTY NUMBER: 10

ELEMENT NUMBERS: 3553-3582

DESCRIPTION: Fork lift tunnel beam
($\frac{1}{8}$ x 2 leg of angle, A1 2024-T3)



PROPERTY NUMBER: 10 (continued)

CALCULATIONS:

See INERTIA program output on following page.

STRESS RECOVERY POINTS

<u>Point</u>	<u>y</u>	<u>z</u>
C	+1.00	-.0625
D	+1.00	+.0625
E	-1.00	-.0625
F	-1.00	+.0625

OFFSET

<u>CBAR Element No.</u>	<u>Z1A</u>	<u>Z2A</u>	<u>Z3A</u>	<u>Z1B</u>	<u>Z2B</u>	<u>Z3B</u>
None						

INERTIA									
BAR PROPERTY NUMBER									
DESCRIPTION- PID NO 10 TOP HOR. MEMBER OF TUNNEL (RACK PALLET 75-0010)									
INPUT	TYPE	DUM	B	H	B1	H1	X	Y	ALF
RECT	0.00	2.00000		.12500	0.00000	0.00000	0.00000	0.00000	90.00000
OUTPUT									
NO.	AREA	XC	YC	IX	IY	IXY	K		
1	.25000	-.06250	.00000	.08333	.00033	-.00000	.00130		

DESCRIPTION-	PID NO	TOP HOR.	MEMBER OF TUNNEL	(RACK PALLET	75-0010)

TYPE	DUM	B	H	B1	H1	X	Y	ALF
RECT	0.00	2.00000	.12500	0.00000	0.00000	0.00000	0.00000	90.00000

NO.	AREA	XC	YC	IX	IY	IXY	K
1	.25000	-.06250	.00000	.08333	.00033	-.00000	.00130

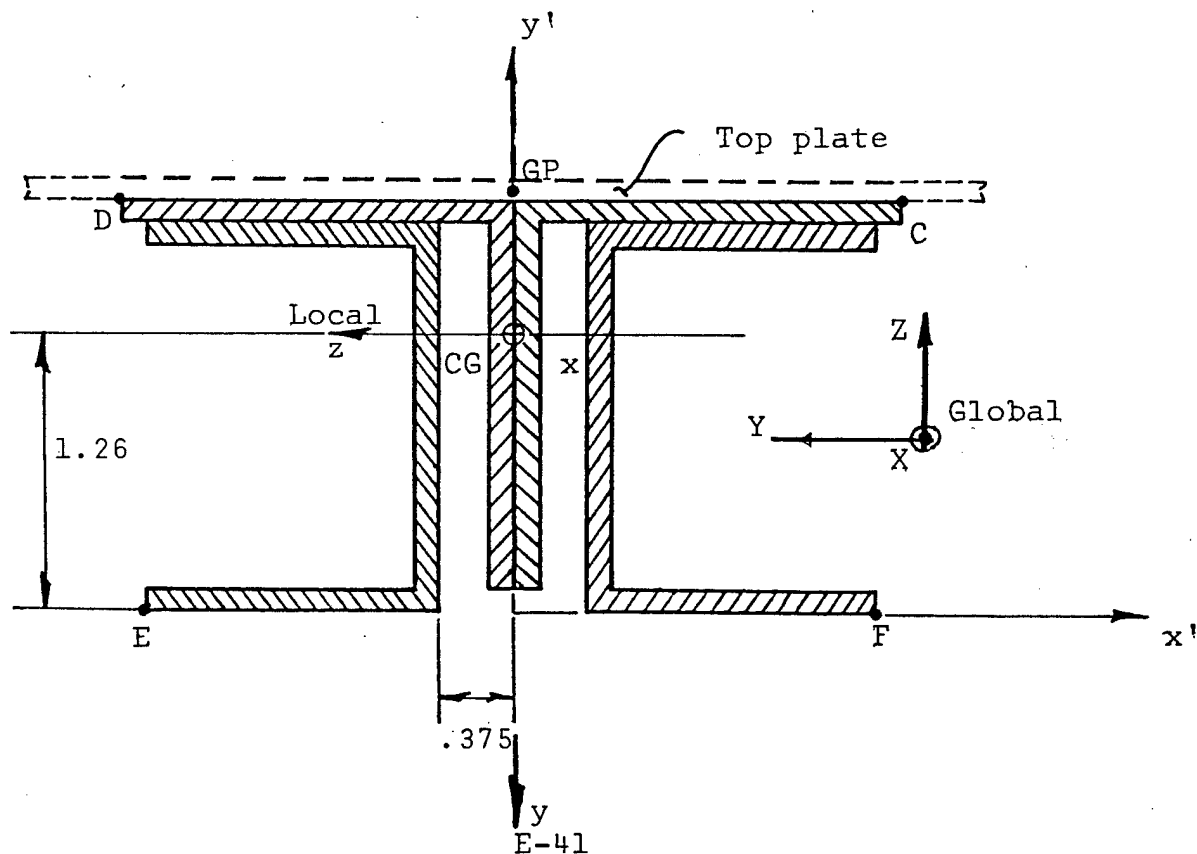
[illegible]

STRUCTURE: Rack Pallet 75-0010

PROPERTY NUMBER: 11

ELEMENT NUMBERS: 4053-4058
4061-4063
4066-4075
4078-4080

DESCRIPTION: Rack support beams
(Two $2 \times 2 \times \frac{1}{8}$ angles with two
 $2 \times 1\frac{1}{2} \times \frac{1}{8}$ channels Al 2024-T3)



PROPERTY NUMBER: 11 (continued)

CALCULATIONS:

See INERTIA program output on following page.

STRESS RECOVERY POINTS

<u>Point</u>	<u>y</u>	<u>z</u>
C	- .865	-2.00
D	- .865	+2.00
E	+1.260	+1.875
F	+1.260	-1.875

OFFSET

<u>CBAR Element No.</u>	<u>Z1A</u>	<u>Z2A</u>	<u>Z3A</u>	<u>Z1B</u>	<u>Z2B</u>	<u>Z3B</u>
4053-4058	}	0.	0.	-0.905	0.	0.
4061-4063						
4066-4075						
4078-4080						
4083-4086						
						-0.905

SHEAR FACTORS

$$K_1 = \frac{2(2)(\frac{1}{8}) + 2(2)(\frac{1}{8})}{2.16} = .463$$

$$K_2 = \frac{4(\frac{1}{8}) + 4(1.5)(\frac{1}{8})}{2.16} = .579$$

BAR-PROPERTY NUMBER
DESCRIPTION- PID NO 11 RACK SUPPORT BEAM
(RACK PALLET 75-0010)

OUTPUT NO.	AREA	XC	YC	IX	IY	IXY	K
1	.17188	-1.18750	.06250	.00022	.02708	0.00000	.00090
2	.17188	1.18750	.06250	.00022	.02708	0.00000	.00090
3	.25000	-.43750	1.00000	.08333	.00033	0.00000	.00130
4	.25000	.43750	1.00000	.08333	.00033	0.00000	.00130
5	.17188	-1.18750	1.93750	.00022	.02708	0.00000	.00090
6	.17188	1.18750	1.93750	.00022	.02708	0.00000	.00090
7	.25000	-.06250	1.12500	.08333	.00033	0.00000	.00130
8	.25000	.06250	1.12500	.08333	.00033	0.00000	.00130
9	.23438	-1.06250	2.06250	.00031	.06866	0.00000	.00122
10	.23438	1.06250	2.06250	.00031	.06866	0.00000	.00122

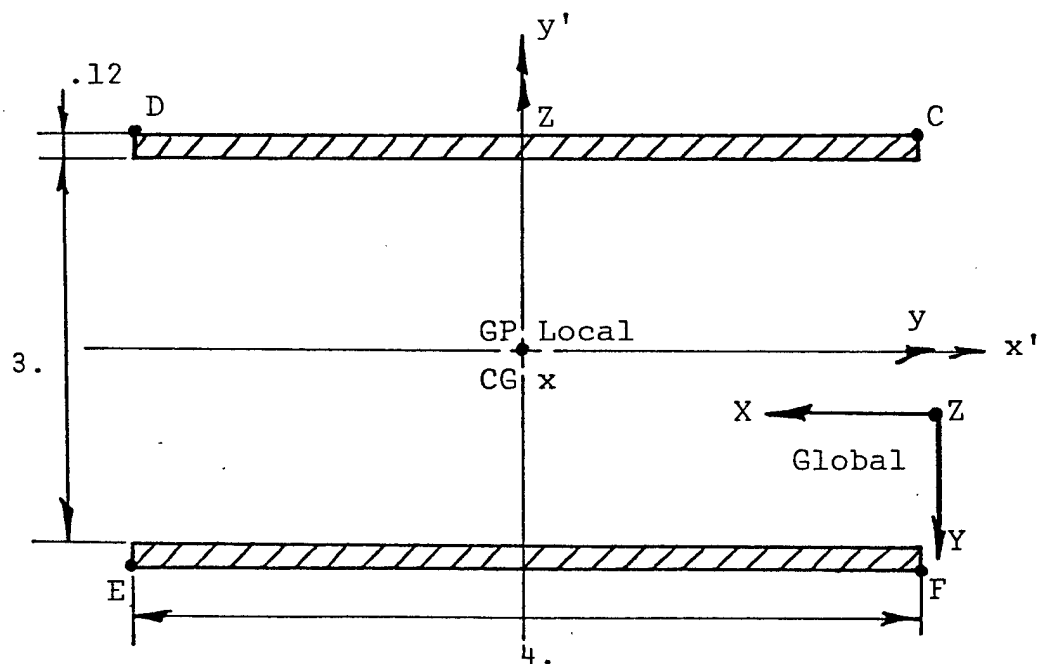
[illegible]

STRUCTURE: Rack Pallet 75-0010

PROPERTY NUMBER: 12

ELEMENT NUMBERS: 3592
3593
3596
3599
3603
3604
3607
3610

DESCRIPTION: Clip between rack beam support and
bottom channels (A1 2024-T3)



PROPERTY NUMBER: 12 (continued)

CALCULATIONS:

See INERTIA program output on following page.

STRESS RECOVERY POINTS

<u>Point</u>	<u>y</u>	<u>z</u>
C	+2.00	+1.62
D	-2.00	+1.62
E	-2.00	-1.62
F	+2.00	-1.62

OFFSET

<u>CBAR Element No.</u>	<u>Z1A</u>	<u>Z2A</u>	<u>Z3A</u>	<u>Z1B</u>	<u>Z2B</u>	<u>Z3B</u>
None						

BAR PROPERTY NUMBER
DESCRIPTION- PID NO 12 CLIP, PN 81
(RACK PALLET 75-0010)

INPUT

TYPE	DUM	B	H	BI	H1	X	Y	ALF
PREC1	0.00	4.00000	.12000	0.00000	0.00000	0.00000	1.50000	0.00000
PREC1	0.00	4.00000	.12000	0.00000	0.00000	0.00000	-1.62000	0.00000

OUTPUT

O.	AREA	XC	YC	IX	IY	IXY	K
1	.48000	0.00000	1.56000	.00058	.64000	0.00000	.00230
2	.48000	0.00000	-1.56000	.00058	.64000	0.00000	.00230

[illegible]

STRUCTURE: Seat Pallet 75-0010

PROPERTY NUMBER: 12

ELEMENT NUMBERS:

DESCRIPTION: Simulation of seat structure connecting
 mass of airman and seat to seat rails.

PROPERTY NUMBER: 12 (continued)

CALCULATIONS:

$$A = .79$$

$$I_1 = I_2 = .05$$

$$J = .10$$

STRESS RECOVERY POINTS

<u>Point</u>	<u>y</u>	<u>z</u>
None		

OFFSET

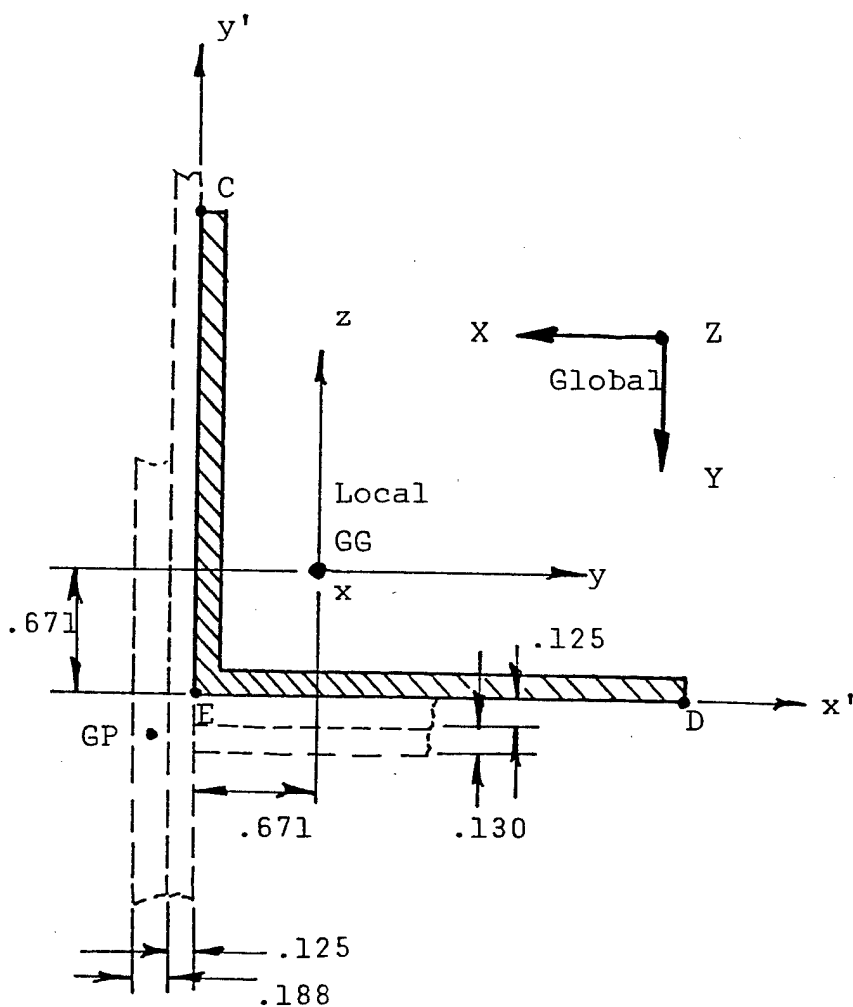
<u>CBAR Element No.</u>	<u>Z1A</u>	<u>Z2A</u>	<u>Z3A</u>	<u>Z1B</u>	<u>Z2B</u>	<u>Z3B</u>
None						

STRUCTURE: Rack Pallet 75-0010

PROPERTY NUMBER: 13

ELEMENT NUMBERS: 3613-3628

DESCRIPTION: Vertical tunnel members
($2\frac{1}{2} \times 2\frac{1}{2} \times \frac{1}{8}$ angle, 2024-T3)



PROPERTY NUMBER: 13 (continued)

CALCULATIONS:

See INERTIA program output on following page.

STRESS RECOVERY POINTS

<u>Point</u>	<u>y</u>	<u>z</u>
C	-.671	1.829
D	1.829	-.671
E	-.671	-.671

OFFSET

<u>CBAR Element No.</u>	<u>Z1A</u>	<u>Z2A</u>	<u>Z3A</u>	<u>Z1B</u>	<u>Z2B</u>	<u>Z3B</u>
3613-3614 } 3617-3618 }	-.890	-.861	0.	-.890	-.861	0.
3615-3616 } 3619-3620 }	+.890	-.861	0.	+.890	-.861	0.
3621-3622 } 3625-3626 }	-.890	+.861	0.	-.890	+.861	0.
3623-3624 } 3627-3628 }	+.890	+.861	0.	+.890	+.861	0.

SHEAR FACTORS

$$K_1 = K_2 = \frac{(2.5)(\frac{1}{8})}{.609} = .513$$

INERTIA

BAR PROPERTY NUMBER

DESCRIPTION- PID NO 13 VERTICAL MEMBERS OF TUNNEL (RACK PALLET 75-0010)

*****	TOTAL AREA=	.609E+00
*****	X CENTROID DISTANCE=	.671E+00
*****	Y CENTROID DISTANCE=	.671E+00
*****	IX (ABOUT CENTROID)=	.378E+00
*****	IY (ABOUT CENTROID)=	.378E+00
*****	IXY (ABOUT CENTROID)=	.226E+00
*****	IMAX=	.378E+00
*****	IMIN=	.378E+00
*****	ALPHA=	.900E+02
*****	TORSIONAL CONSTANT, K=	.317E-02
*****	IX (ABOUT INPUT AXIS)=	.653E+00
*****	IY (ABOUT INPUT AXIS)=	.653E+00
*****	IXY (ABOUT INPUT AXIS)=	.488E-01

TORSIONAL CONSTANT BASED ON SUM
NOT NECESSARILY ACCURATE

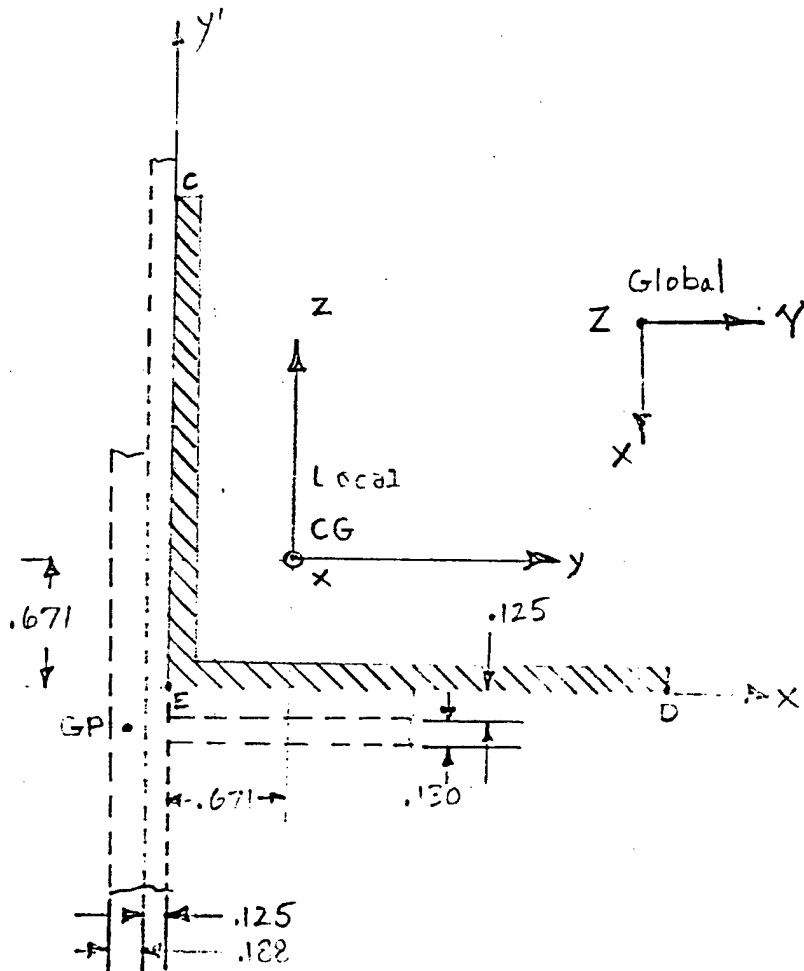
E-54

STRUCTURE: Seat Pallet 75-0010

PROPERTY NUMBER: 13

ELEMENT NUMBERS: 1603
 1604
 1607
 1608
 1609
 1610
 1613
 1614

DESCRIPTION: Vertical tunnel members
 ($2\frac{1}{2} \times 2\frac{1}{2} \times \frac{1}{8}$ angle, 2024-T-3)



PROPERTY NUMBER: 13

CALCULATIONS:

See INERTIA program output on following page.

STRESS RECOVERY POINTS

<u>Point</u>	<u>y</u>	<u>z</u>
C	-.671	+1.829
D	+1.829	-.671
E	-.671	-.671

OFFSET

<u>CBAR Element No.</u>	<u>Z1A</u>	<u>Z2A</u>	<u>Z3A</u>	<u>Z1B</u>	<u>Z2B</u>	<u>Z3B</u>
1603	-.861	+.890	0.0	-.861	+.890	0.0
1604						
1607						
1608						
1609	-.861	-.890	0.0	-.861	-.890	0.0
1610						
1613						
1614						

SHEAR FACTORS

$$K_1 = K_2 = \frac{(2.5)(\frac{1}{8})}{.609} = .513$$

TOTAL AREA=	.609E+00
X CENTROID DISTANCE=	.671E+00
Y CENTROID DISTANCE=	.671E+00
IX (ABOUT CENTROID)=	.378E+00
IY (ABOUT CENTROID)=	.378E+00
IXY (ABOUT CENTROID)=	-.226E+00
IMAX=	.378E+00
IMIN=	.378E+00
ALPHA=	.900E+02
TORSIONAL CONSTANT, K=	.317E-02
IX (ABOUT INPUT AXIS)=	.653E+00
IY (ABOUT INPUT AXIS)=	.653E+00
IXY (ABOUT INPUT AXIS)=	.488E-01

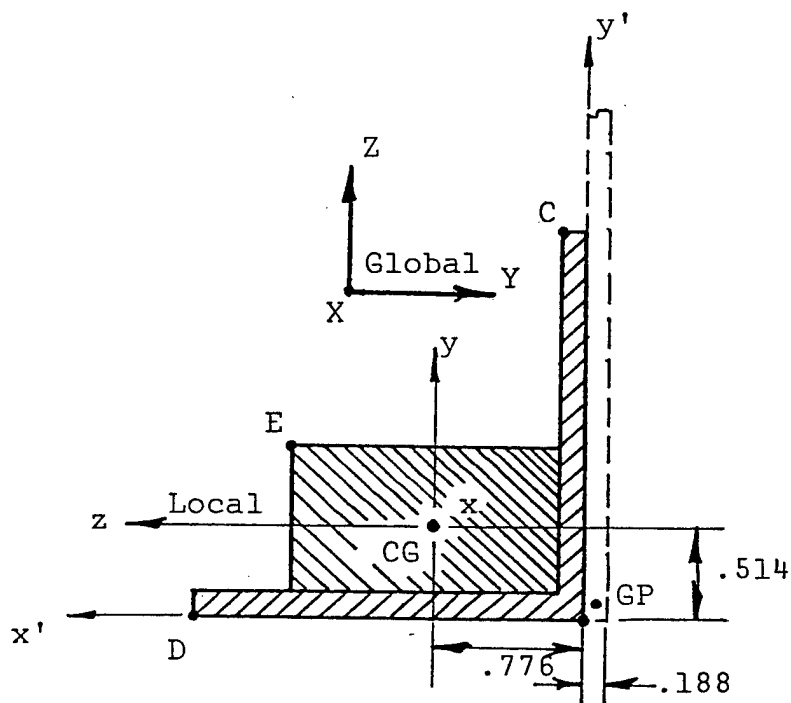
**TORSIONAL CONSTANT BASED ON SUM
NOT NECESSARILY ACCURATE**

STRUCTURE: Rack Pallet 75-0010

PROPERTY NUMBER: 15

ELEMENT NUMBERS: 3005
3008
3017
3020
3095-3098

DESCRIPTION: Horizontal tunnel member on bottom on pallet
(2 x 2 x $\frac{1}{8}$ angle $\frac{3}{4}$ x $1\frac{1}{2}$ bar Al 2024-T3)



PROPERTY NUMBER: 15 (continued)

CALCULATIONS:

See INERTIA program output on following page.

STRESS RECOVERY POINTS

<u>Point</u>	<u>y</u>	<u>z</u>
C	1.486	-.776
D	-.514	1.224
E	.361	.849
F	-.514	-.776

OFFSET

<u>CBAR Element No.</u>	<u>Z1A</u>	<u>Z2A</u>	<u>Z3A</u>	<u>Z1B</u>	<u>Z2B</u>	<u>Z3B</u>
3005	0.	-.870	+.4515	0.	-.870	+.4515
3008						
3095						
3096						
3017	0.	+.870	+.4515	0.	+.870	+.4515
3020						
3097						
3098						

SHEAR FACTORS

$$K_1 = K_2 = \frac{(\frac{3}{4})(1.5) + 2(\frac{1}{8})}{1.61} = .854$$

INERTIA

BAR PROPERTY NUMBER
DESCRIPTION- PID NO 15 HORIZONTAL MEMBER OF TUNNEL (RACK PALLET 75-0010)

INPUT	TYPE	DUM	B	H	B1	H1	X	Y	ALF
RECT	0.00	1.87500	.12500	0.00000	0.00000	1.06250	0.00000	0.00000	0.00000
RECT	0.00	.12500	2.00000	0.00000	0.00000	.06250	0.00000	0.00000	0.00000
RECT	0.00	1.50000	.75000	0.00000	0.00000	.87500	.12500	0.00000	0.00000

OUTPUT	NO.	AREA	XC	YC	IX	IY	IXY	K
1	.23438	1.06250	.06250	.06866	.00031	.06866	0.00000	.00122
2	.25000	.06250	1.00000	.08333	.00033	.00033	0.00000	.00130
3	1.12500	.87500	.50000	.05273	.21094	.21094	0.00000	.21094

E-62

STRUCTURE: Seat Pallet 75-0010

PROPERTY NUMBER: 15

ELEMENT NUMBERS:

1601

1602

1605

1606

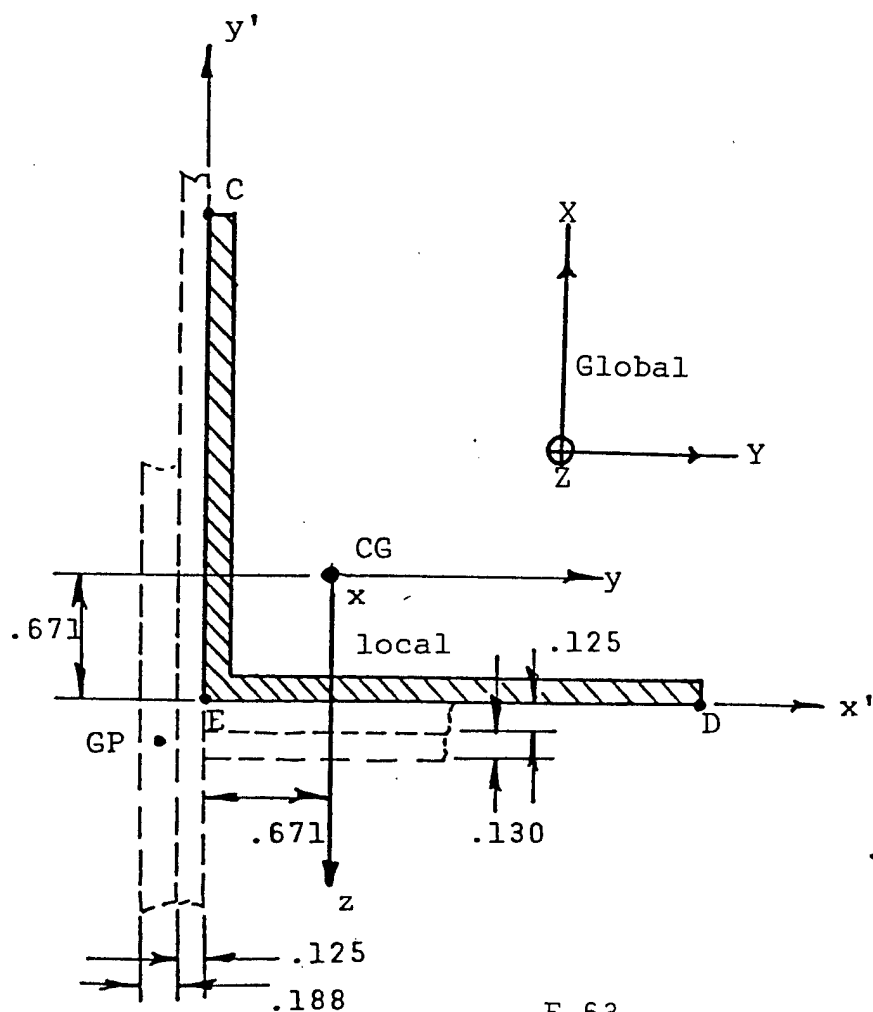
1611

1612

1615

1616

DESCRIPTION: Vertical tunnel members
($2\frac{1}{2} \times 2\frac{1}{2} \times \frac{1}{8}$ angle, 2024-T3)



PROPERTY NUMBER: 15 (continued)

CALCULATIONS:

See INERTIA program output on following page.

STRESS RECOVERY POINTS

<u>Point</u>	<u>y</u>	<u>z</u>
C	-.671	-1.829
D	1.829	+.671
E	-.671	+.671

OFFSET

<u>CBAR Element No.</u>	<u>Z1A</u>	<u>Z2A</u>	<u>Z3A</u>	<u>Z1B</u>	<u>Z2B</u>	<u>Z3B</u>
1601	-.861	+.890	0.0	-.861	+.890	0.0
1602						
1605						
1606						
1611	+.861	-.890	0.0	+.861	-.890	0.0
1612						
1615						
1616						

SHEAR FACTORS

$$K_1 = K_2 = \frac{(2.5)(\frac{1}{8})}{.609} = .513$$

BAR PROPERTY NUMBER
DESCRIPTION- PID NO 15 VERTICAL MEMBERS OF TUNNEL (SEAT PALLET 75-0010)

E-65.

[illegible]

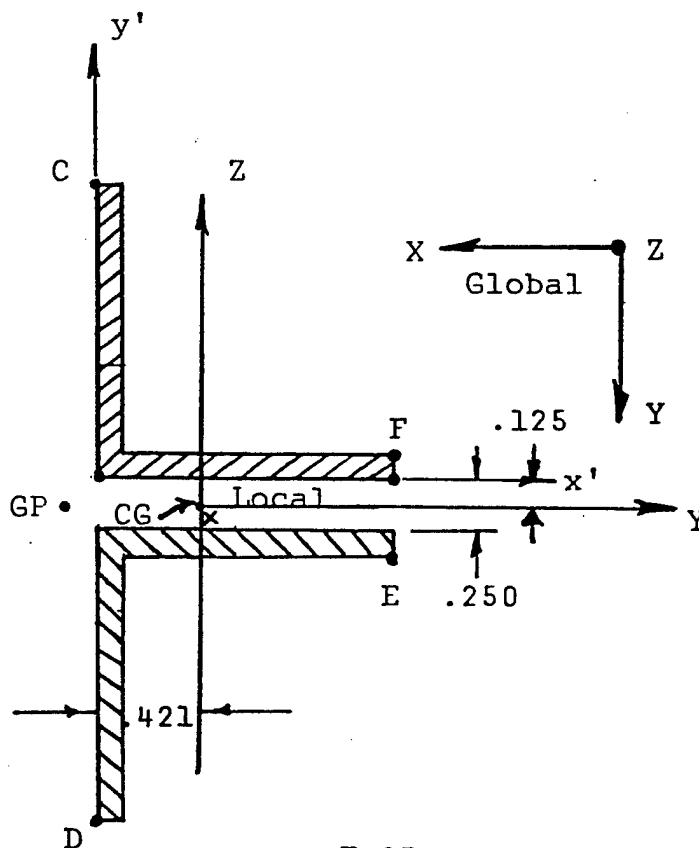
STRUCTURE: Rack Pallet 75-0010

PROPERTY NUMBER: 16

ELEMENT NUMBERS: 3594
3595
3597
3598
3605
3606
3608
3609

DESCRIPTION: Clip between lower and upper plate at
fork lift tunnel

(1.5 x 1.5 x $\frac{1}{8}$ angle A1 2024-T3)



PROPERTY NUMBER: 16 (continued)

CALCULATIONS:

See INERTIA program output on following page. Data shown here is for 2 clip system.

STRESS RECOVERY POINTS

<u>Point</u>	<u>y</u>	<u>z</u>
C	-.421	+1.625
D	-.421	-1.625
E	+1.079	-.25
F	+1.079	+.25

OFFSET

<u>CBAR Element No.</u>	<u>Z1A</u>	<u>Z2A</u>	<u>Z3A</u>	<u>Z1B</u>	<u>Z2B</u>	<u>Z3B</u>
3594	0.	0.	0.	+2.000	0.	0.
3595	0.	0.	0.	-.410	0.	0.
3597	0.	0.	0.	-3.810	0.	0.
3598	0.	0.	0.	0.	0.	0.
3605	0.	0.	0.	+2.000	0.	0.
3606	0.	0.	0.	-.410	0.	0.
3608	0.	0.	0.	-3.820	0.	0.
3609	0.	0.	0.	0.	0.	0.

SHEAR FACTORS

$$K_1 = K_2 = \frac{(1.5)(\frac{1}{8})}{.359} = .521$$

INERTIA

HAR PROPERTY NUMBER
 DESCRIPTION- PID NO 16 CLIP, PN 13 (RACK PALLET 75-0010)

INPUT

TYPE	DUM	B	H	B1	H1	X	Y	ALF
RECT	0.00	.12500	1.50000	0.00000	0.00000	.06250	0.00000	0.00000
RECT	0.00	1.37500	.12500	0.00000	0.00000	.81250	0.00000	0.00000
RECT	0.00	1.37500	.12500	0.00000	0.00000	.81250	-.25000	0.00000
RECT	0.00	.12500	1.50000	0.00000	0.00000	.06250	-.25000	180.00000

OUTPUT

NO.	AREA	XC	YC	IX	IY	IXY	K
1	.18750	.06250	.75000	.03516	.00024	0.00000	.00098
2	.17188	.81250	.06250	.00022	.02708	0.00000	.00090
3	.17188	.81250	-.18750	.00022	.02708	0.00000	.00090
4	.18750	.06249	-1.00000	.03516	.00024	-.00000	.00098

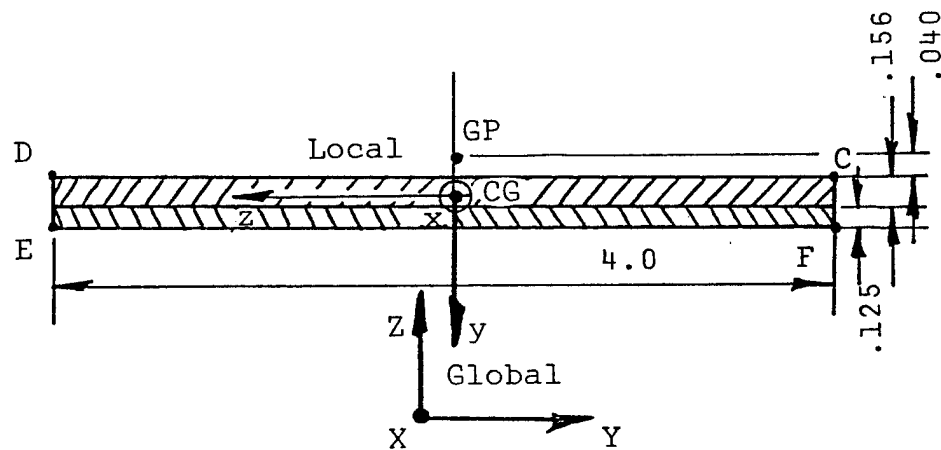
[illegible]

STRUCTURE: Rack Pallet 75- 0010

PROPERTY NUMBER: 17

ELEMENT NUMBERS: 4059
4060
4064
4065
4076
4077
4081
4082

DESCRIPTION: Rack support beam above tunnel
(.156 x 4 bar Al 2024-T3)



PROPERTY NUMBER: 17 (continued)

CALCULATIONS:

$$\begin{aligned} I_y \text{ (about GP)} &= \frac{bh^3}{12} + Ad^2 \\ &= \frac{(4)(.281)^3}{12} + (4)(.281)\left(\frac{.281}{2} + .04\right)^2 = .044 \end{aligned}$$

$$I_x \text{ (about GP)} = \frac{bh^3}{12} = \frac{(.281)(4.)^3}{12} = 1.4987$$

$$I_{xy} = 0$$

$$K = \frac{1}{3}ct^3 = \frac{1}{3}(4)(.281)^3 = .0296$$

$$A = (4)(.281) = 1.124$$

STRESS RECOVERY POINTS

<u>Point</u>	<u>y</u>	<u>z</u>
C	-.1405	-2.000
D	-.1405	+2.000
E	+.1405	+2.000
F	+.1405	-2.000

OFFSET

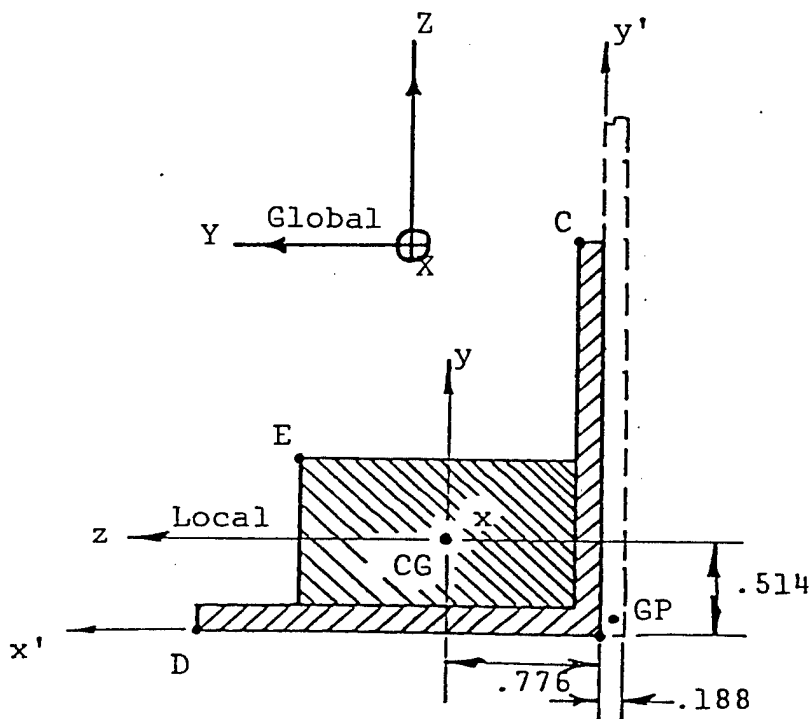
<u>CBAR Element No.</u>	<u>Z1A</u>	<u>Z2A</u>	<u>Z3A</u>	<u>Z1B</u>	<u>Z2B</u>	<u>Z3B</u>
None						

STRUCTURE: Seat Pallet 75-0010

PROPERTY NUMBER: 17

ELEMENT NUMBERS: 1005
 1008
 1017
 1020
 1095-1098

DESCRIPTION: Horizontal tunnel member on bottom of pallet
 (2 x 2 x $\frac{1}{8}$ angle with $\frac{3}{4}$ x $1\frac{1}{2}$ bar, Al 2024-T3)



PROPERTY NUMBER: 17 (continued)

CALCULATIONS:

See INERTIA program output on following page.

STRESS RECOVERY POINTS

<u>Point</u>	<u>y</u>	<u>z</u>
C	1.486	-.776
D	-.514	1.224
E	.361	.849
F	-.514	-.776

OFFSET

<u>CBAR Element No.</u>	<u>Z1A</u>	<u>Z2A</u>	<u>Z3A</u>	<u>Z1B</u>	<u>Z2B</u>	<u>Z3B</u>
1005	0.	+.870	+.4515	0.	+.870	+.4515
1008						
1095						
1096						
1017	0.	-.870	+.4515	0.	-.870	+.4515
1020						
1097						
1098						

INERTIA

BAR PROPERTY NUMBER
DESCRIPTION= PID NO 17 HORIZONTAL MEMBER OF TUNNEL (SEAT PALLET 75-0010)

INPUT

TYPE	DUM	B	H	BI	HI	X	Y	ALF
RECT	0.00	1.87500	.12500	0.00000	0.00000	1.06250	0.00000	0.00000
RECT	0.00	.12500	2.00000	0.00000	0.00000	.06250	0.00000	0.00000
RECT	0.00	1.50000	.75000	0.00000	0.00000	.87500	.12500	0.00000

OUTPUT

NO.	AREA	XC	YC	IX	IY	IXY	K
1	.23438	1.06250	.06250	.00031	.06866	0.00000	.00122
2	.25000	.06250	1.00000	.08333	.00033	0.00000	.00130
3	1.12500	.87500	.50000	.05273	.21094	0.00000	.21094

```

*****
***** TOTAL AREA= .161E+01 *****
***** X CENTROID DISTANCE= .776E+00 *****
***** Y CENTROID DISTANCE= .514E+00 *****
***** IX (ABOUT CENTROID)= .243E+00 *****
***** IY (ABOUT CENTROID)= .437E+00 *****
***** IXY (ABOUT CENTROID)= -.119E+00 *****
***** IMAX= .494E+00 *****
***** IMIN= .187E+00 *****
***** ALPHA= .155E+03 *****
***** TORSIONAL CONSTANT, K= .213E+00 *****
***** IX (ABOUT INPUT AXIS)= .669E+00 *****
***** IY (ABOUT INPUT AXIS)= .141E+01 *****
***** IXY (ABOUT INPUT AXIS)= .523E+00 *****
*****
***** Y= 0. *****
***** X= 0. *****
*****

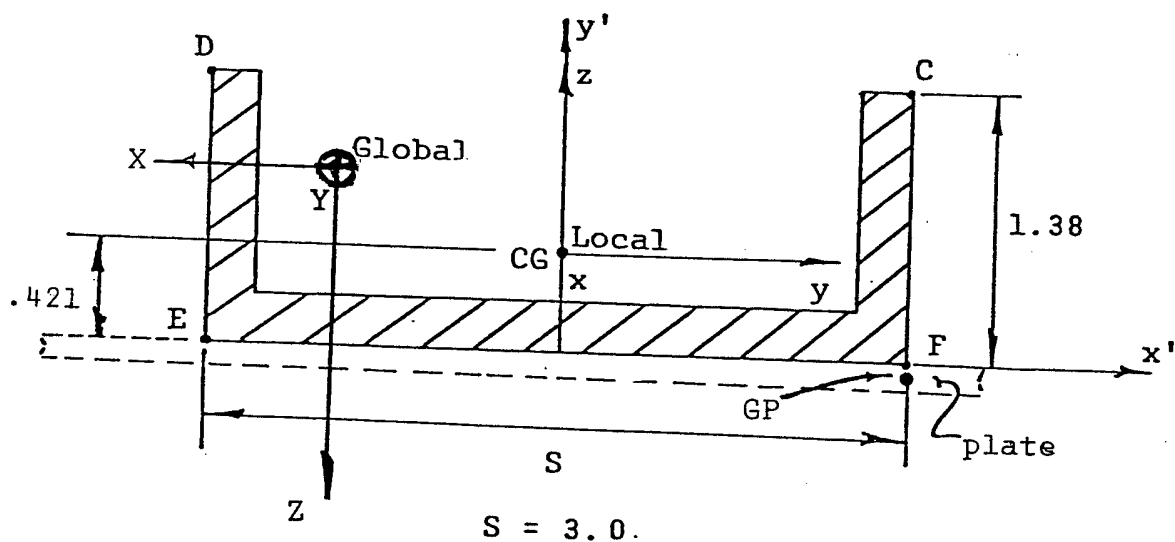
```

*****	TORSIONAL CONSTANT BASED ON SUM	*****
*****	NOT NECESSARILY ACCURATE	*****
*****		*****

[illegible][illegible][illegible][illegible][illegible][illegible]

STRUCTURE: Seat Pallet 75-0010
PROPERTY NUMBER: 18
ELEMENT NUMBERS: 2041
 2046
 2047
 2052

DESCRIPTION: Seat Channel
 (3.0 x 1.38 x $\frac{1}{4}$ channel, Al 2024-T3)



PROPERTY NUMBER: 18 (continued)

CALCULATIONS:

See INERTIA program output on following page.

STRESS RECOVERY POINTS

<u>Point</u>	<u>y</u>	<u>z</u>
C	+1.500	+0.959
D	-1.500	+0.959
E	-1.500	-0.421
F	+1.500	-0.421

OFFSET

<u>CBAR Element No.</u>	<u>Z1A</u>	<u>Z2A</u>	<u>Z3A</u>	<u>Z1B</u>	<u>Z2B</u>	<u>Z3B</u>
2041 } 2046 }	+1.500	0.	-0.461	+1.500	0.	-0.461
2047 } 2052 }	-1.500	0.	-0.461	-1.500	0.	-0.461

SHEAR FACTORS

$$K_1 = \frac{(\frac{1}{4})(3)}{1.32} = .57$$

$$K_2 = \frac{2(1.38)(\frac{1}{4})}{1.32} = .52$$

INERTIA

BAR PROPERTY NUMBER 18 SEAT CHANNELS (SEAT PALLET 75-0010)

INPUT

TYPE	DUM	B	H	B1	H1	X	Y	ALF
RECT	0.00	2.50000	.25000	0.00000	0.00000	0.00000	0.00000	0.00000
RECT	0.00	.25000	1.38000	0.00000	0.00000	-1.37500	0.00000	0.00000
RECT	0.00	.25000	1.38000	0.00000	0.00000	1.37500	0.00000	0.00000

OUTPUT

NO.	AREA	XC	YC	IX	IY	IXY	K
1	.62500	0.00000	.12500	.00326	.32552	0.00000	.01302
2	.34500	-1.37500	.69000	.05475	.00180	0.00000	.00719
3	.34500	1.37500	.69000	.05475	.00180	0.00000	.00719

[illegible]

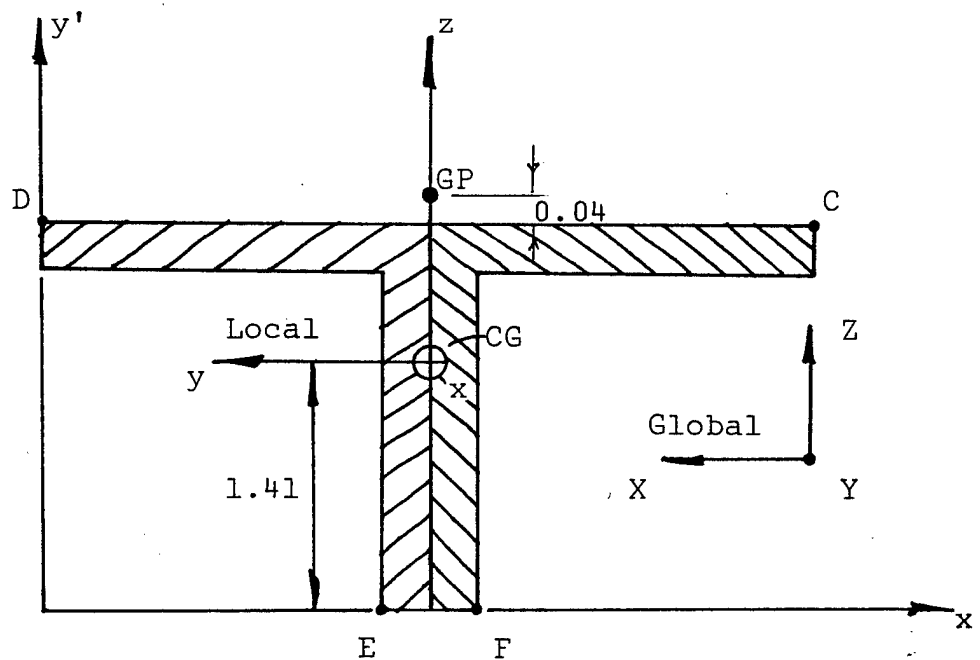
TORSIONAL CONSTANT BASED ON SUM
NOT NECESSARILY ACCURATE

STRUCTURE: Seat Pallet 75-0010

PROPERTY NUMBER: 26

ELEMENT NUMBERS: 2071-2094

DESCRIPTION: Top plate support angles
(2 x 2 x $\frac{1}{4}$ angles, A1 2024-T3)



PROPERTY NUMBER: 26 (continued)

CALCULATIONS:

See INERTIA program output on following page.

STRESS RECOVERY POINTS

<u>Point</u>	<u>y</u>	<u>z</u>
C	-2.000	+ .590
D	+2.000	+ .590
E	+2.000	-1.410
F	-2.000	-1.410

OFFSET

<u>CBAR Element No.</u>	<u>Z1A</u>	<u>Z2A</u>	<u>Z3A</u>	<u>Z1B</u>	<u>Z2B</u>	<u>Z3B</u>
2071-2094	0.	0.	-.630	0.	0.	-.630

SHEAR FACTORS

$$K_1 = \frac{(\frac{1}{4})(4)}{1.88} = .532$$

$$K_2 = \frac{2(\frac{1}{4})(1.75)}{1.88} = .465$$

INERTIA

BAR PROPERTY NUMBER
DESCRIPTION- PID NO 26 TOP PLATE SUPPORT ANGLES (SEAT PALLET 75-0010)

INPUT

TYPE	DUM	B	H	B1	H1	X	Y	ALF
RECT	0.00	.25000	2.00000	0.00000	0.00000	1.87500	0.00000	0.00000
RECT	0.00	.25000	2.00000	0.00000	0.00000	2.12500	0.00000	0.00000
RECT	0.00	1.75000	.25000	0.00000	0.00000	.87500	1.75000	0.00000
RECT	0.00	1.75000	.25000	0.00000	0.00000	3.12500	1.75000	0.00000

OUTPUT

NO.	AREA	XC	YC	IX	IY	IXY	K
1	.50000	1.87500	1.00000	.16667	.00260	0.00000	.01042
2	.50000	2.12500	1.00000	.16667	.00260	0.00000	.01042
3	.43750	.87500	1.87500	.00228	.11165	0.00000	.00911
4	.43750	3.12500	1.87500	.00228	.11165	0.00000	.00911

[illegible]

STRUCTURE: Seat Pallet 75-0010

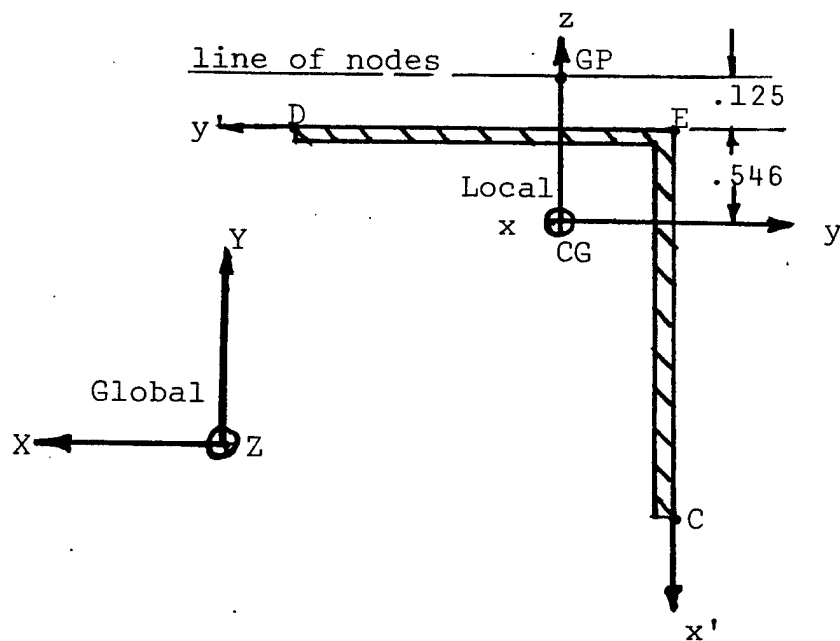
PROPERTY NUMBER: 32

ELEMENT NUMBERS: 2253-2255

2263

2267

DESCRIPTION: Vertical Members, AL 2024-T3
2x2x $\frac{1}{8}$ angle



PROPERTY NUMBER: 32

CALCULATIONS:

See INERTIA program output on following page.

STRESS RECOVERY POINTS

<u>Point</u>	<u>y</u>	<u>z</u>
C	+0.546	-1.454
D	-1.454	+0.546
E	+0.546	+0.546

OFFSET

<u>CBAR Element No.</u>	<u>Z1A</u>	<u>Z2A</u>	<u>Z3A</u>	<u>Z1B</u>	<u>Z2B</u>	<u>Z3B</u>
2253-2255	0.0	-.671	0.0	0.0	-.671	0.0
2263						
2267						

[illegible]

INERTIA

BAR PROPERTY NUMBER
DESCRIPTION- PID NO 32 VERTICAL MEMBERS (SEAT PALLET 75-0010)

INPUT

TYPE	DUM	B	H	B1	H1	X	Y	ALF
RECT	0.00	1.87500	.12500	0.00000	0.00000	.12500	1.06300	90.00000
RECT	0.00	2.00000	.12500	0.00000	0.00000	1.00000	0.00000	0.00000

OUTPUT

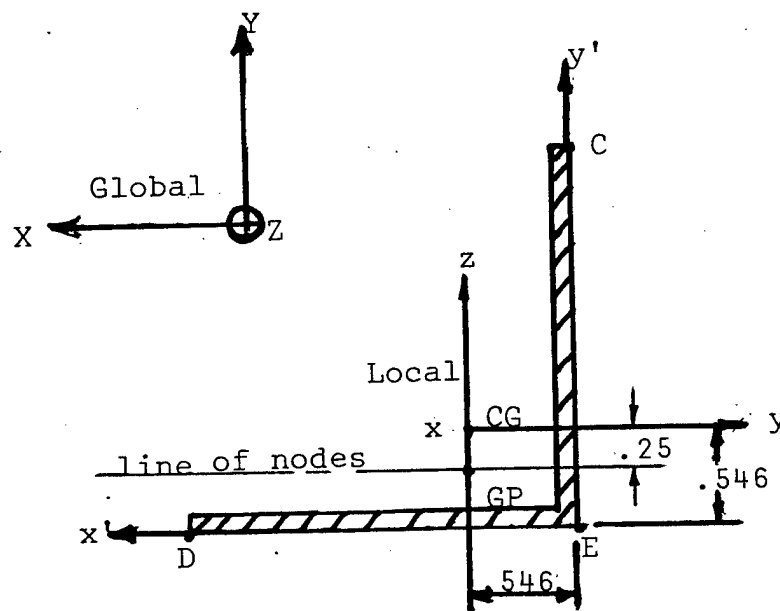
NO.	AREA	XC	YC	IX	IY	IXY	K
1	.23438	.06250	1.06300	.06866	.00031	.00000	.00122
2	.25000	1.00000	.06250	.00033	.08333	0.00000	.00130

STRUCTURE: Seat Pallet 75-0010

PROPERTY NUMBER: 33

ELEMENT NUMBERS: 2246-2248
 2262
 2266

DESCRIPTION: Vertical members ($2 \times 2 \times \frac{1}{8}$ angle)
AL 2024-T3



PROPERTY NUMBER: 33

CALCULATIONS:

See INERTIA program output on following page.

STRESS RECOVERY POINTS

<u>Point</u>	<u>y</u>	<u>z</u>
C	+.546	+1.454
D	-1.454	- .546
E	+ .546	- .546

OFFSET

<u>CBAR Element No.</u>	<u>Z1A</u>	<u>Z2A</u>	<u>Z3A</u>	<u>Z1B</u>	<u>Z2B</u>	<u>Z3B</u>
2246-2248 } 2262 2266 }	0.0	+.25	0.0	0.0	+.25	0.0

INERTIA

BAR PROPERTY NUMBER
 DESCRIPTION= PID NO. 33 VERTICAL MEMBERS (SEAT PALLET 75-0010)

INPUT		B		H		B1		H1		X		Y		ALF	
TYPE	DUM														
RECT	0.00	1.87500		.12500	0.00000	0.00000	0.00000	0.00000	0.00000	.12500	1.06300	0.00000	90.00000		
RECT	0.00	2.00000		.12500	0.00000	0.00000	0.00000	0.00000	0.00000	1.00000	0.00000	0.00000	0.00000		

OUTPUT

NO.	AREA	XC	YC	IX	IY	IXY	K
1	.23438	.06250	1.06300	.06866	.00031	-.00000	.00122
2	.25000	1.00000	.06250	.00033	.08333	0.00000	.00130

```

*****
TOTAL AREA= .484E+00
X CENTROID DISTANCE= .546E+00
Y CENTROID DISTANCE= .547E+00
IX (ABOUT CENTROID)= .190E+00
IY (ABOUT CENTROID)= .190E+00
IXY (ABOUT CENTROID)= -.113E+00
IMAX= .303E+00
IMIN= .766E-01
ALPHA= .450E+02
TORSIONAL CONSTANT, K= .252E-02
IX (ABOUT INPUT AXIS)= .335E+00
IY (ABOUT INPUT AXIS)= .335E+00
IXY (ABOUT INPUT AXIS)= .312E-01
Y = 0.
X = 0.

TORSIONAL CONSTANT BASED ON SUM
NOT NECESSARILY ACCURATE
*****

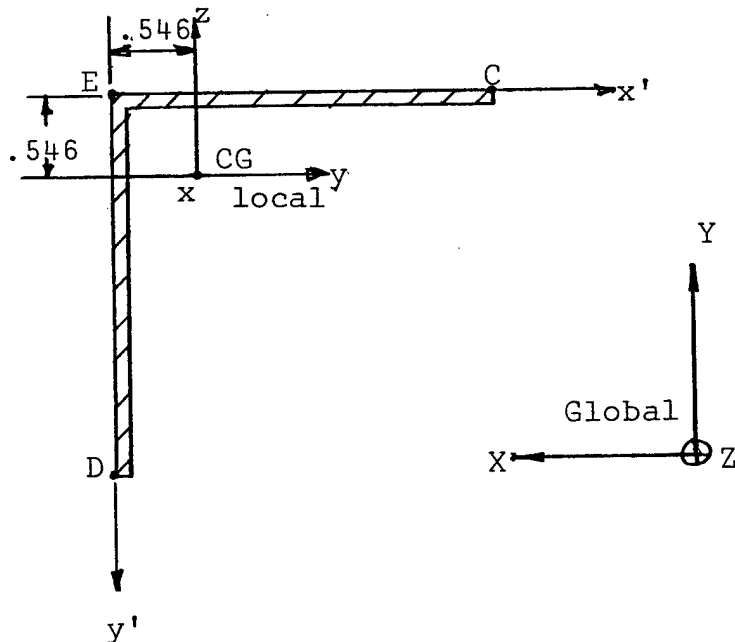
```

STRUCTURE: Seat Pallet 75-0010

PROPERTY NUMBER: 35

ELEMENT NUMBERS: 2251-2252
 2261
 2265

DESCRIPTION: Vertical members (2 x 2 x $\frac{1}{8}$ angle)
 AL 2024-T3



PROPERTY NUMBER: 35

CALCULATIONS:

See INERTIA program output on following page.

STRESS RECOVERY POINTS

<u>Point</u>	<u>y</u>	<u>z</u>
C	+1.454	+0.546
D	-0.546	-1.454
E	-0.546	-0.546

OFFSET

<u>CBAR Element No.</u>	<u>Z1A</u>	<u>Z2A</u>	<u>Z3A</u>	<u>Z1B</u>	<u>Z2B</u>	<u>Z3B</u>
2251-2252	-1.155	-.671	0.0	-1.155	-.671	0.0
2261						
2265						

INERTIA

BAR PROPERTY NUMBER
DESCRIPTION= PID NO. 35 VERTICAL MEMBERS (SEAT PALLET 75-0010)

INPUT	TYPE	DUM	B	H	H1	X	Y	ALF
RECT	0.00	1.87500	.12500	0.00000	0.00000	.12500	1.06300	90.00000
RECT	0.00	2.00000	.12500	0.00000	0.00000	1.00000	0.00000	0.00000

OUTPUT	NO.	AREA	XC	YC	IX	IY	IXY	K
1	.23438	.06250	1.06300	.06866	.00031	.00000	.00122	
2	.25000	1.00000	.06250	.00033	.08333	0.00000	.00130	

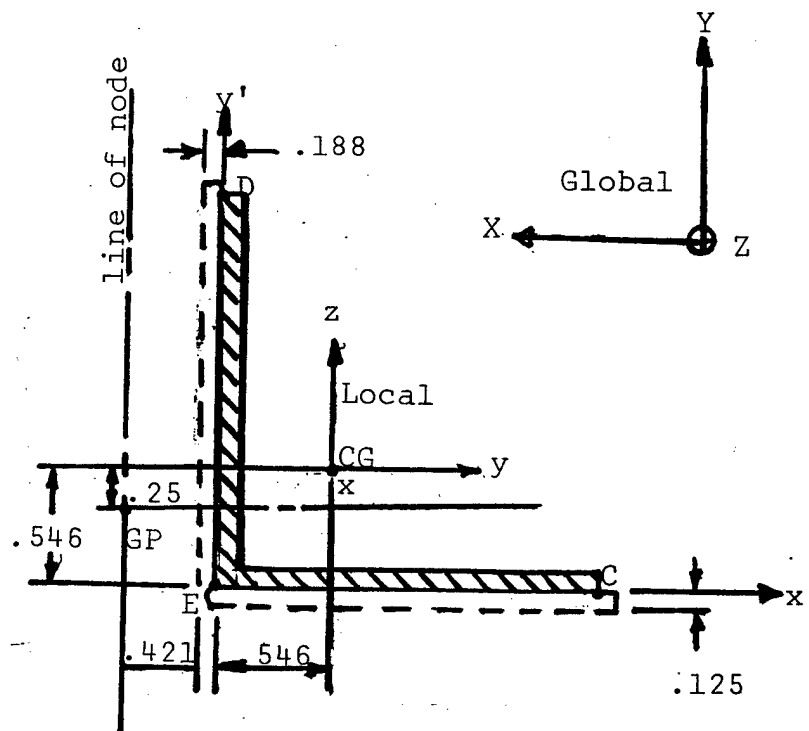
[illegible]

STRUCTURE: Seat Pallet
 75-0010

PROPERTY NUMBER: 36

ELEMENT NUMBERS: 2244-2245
 2260
 2264

DESCRIPTION: Vertical members ($2 \times 2 \times \frac{1}{8}$ angle)
 AL 2024-T3



PROPERTY NUMBER: 36

CALCULATIONS:

See INERTIA program output on following page.

STRESS RECOVERY POINTS

<u>Point</u>	<u>y</u>	<u>z</u>
C	+1.454	-.546
D	-.546	+1.454
E	-.546	-.546

OFFSET

<u>CBAR Element No.</u>	<u>Z1A</u>	<u>Z2A</u>	<u>Z3A</u>	<u>Z1B</u>	<u>Z2B</u>	<u>Z3B</u>
2244-2245						
2260	-1.155	.250	0.0	-1.155	.250	0.0
2264						

BAR PROPERTY NUMBER	PID 36 VERTICAL MEMBERS	(SEAT PALLET 75-0010)
DESCRIPTION-		

INPUT	DUM	B	H	B1	H1	X	Y	ALF
RECT	0.00	1.87500	.12500	0.00000	0.00000	.12500	1.06300	90.00000
RECT	0.00	2.00000	.12500	0.00000	0.00000	1.00000	0.00000	0.00000

OUTPUT NO.	AREA	XC	YC	IX	IY	IXY	K
1	.23438	.06250	1.06300	.06866	.00031	.00000	.00122
2	.25000	1.00000	.06250	.00033	.08333	0.00000	.00130

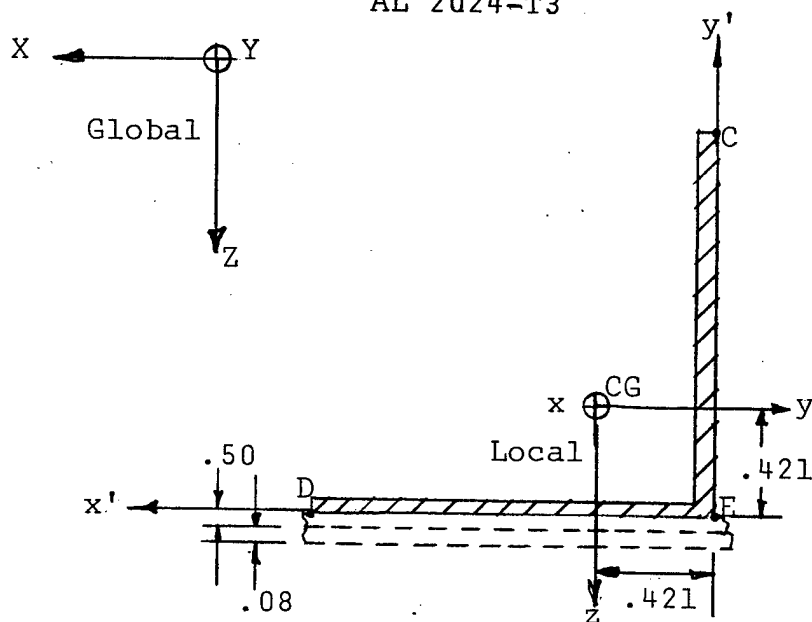
```
*****  
TOTAL AREA= .484E+00  
X CENTROID DISTANCE= .546E+00  
Y CENTROID DISTANCE= .547E+00  
IX (ABOUT CENTROID)= .190E+00  
IY (ABOUT CENTROID)= .190E+00  
IXY (ABOUT CENTROID)= -.113E+00  
IMAX= .303E+00  
IMIN= .766E-01  
ALPHA= .450E+02  
TORSIONAL CONSTANT, K= .252E-02  
IX (ABOUT INPUT AXIS)= .335E+00  
IY (ABOUT INPUT AXIS)= .335E+00  
IXY (ABOUT INPUT AXIS)= .312E-01  
  
Y= 0.  
X= 0.  
  
TORSIONAL CONSTANT BASED ON SUM  
NOT NECESSARILY ACCURATE
```

STRUCTURE: Seat Pallet 75-0010

PROPERTY NUMBER: 42

ELEMENT NUMBERS: 2201-2206

DESCRIPTION: BOTTOM HORIZONTAL MEMBERS ($1\frac{1}{2} \times 1\frac{1}{2} \times \frac{1}{8}$ angle)
AL 2024-T3



PROPERTY NUMBER: 42

CALCULATIONS:

See INERTIA program output on following page.

STRESS RECOVERY POINTS

<u>Point</u>	<u>y</u>	<u>z</u>
C	+ .421	-1.079
D	-1.079	+ .421
E	+ .421	+ .421

OFFSET

<u>CBAR Element No.</u>	<u>Z1A</u>	<u>Z2A</u>	<u>Z3A</u>	<u>Z1B</u>	<u>Z2B</u>	<u>Z3B</u>
2201-2206	0.0	0.0	-.961	0.0	0.0	-.961

INERTIA

BAR PROPERTY NUMBER
DESCRIPTION- PID NO. 42 BOTTOM HORIZONTAL MEMBERS (SEAT PALLET 75-0010)

INPUT	TYPE	DUM	B	H	B1	H1	X	Y	ALF
RECT	0.00	1.37500	.12500	0.00000	0.00000	0.00000	.81250	0.00000	0.00000
RECT	0.00	.12500	1.50000	0.00000	0.00000	0.00000	.06250	0.00000	0.00000

OUTPUT	NO.	AREA	XC	YC	IX	IY	IXY	K
1	.17188	.81250	.06250	.0022	.02708	0.00000	.00090	
2	.18750	.06250	.75000	.03516	.00024	0.00000	.00098	

TOTAL AREA=	.359E+00
X CENTROID DISTANCE=	.421E+00
Y CENTROID DISTANCE=	.421E+00
IX (ABOUT CENTROID)=	.778E-01
IY (ABOUT CENTROID)=	.778E-01
IXY (ABOUT CENTROID)=	-.462E-01
IMAX=	.778E-01
IMIN=	.362E-01
ALPHA=	.900E+02
TORSIONAL CONSTANT, K=	.187E-02
IX (ABOUT INPUT AXIS)=	.142E+00
IY (ABOUT INPUT AXIS)=	.142E+00
IXY (ABOUT INPUT AXIS)=	.175E-01
TORSIONAL CONSTANT BASED ON SUM NOT NECESSARILY ACCURATE	

STRUCTURE: Seat Pallet 75-0010

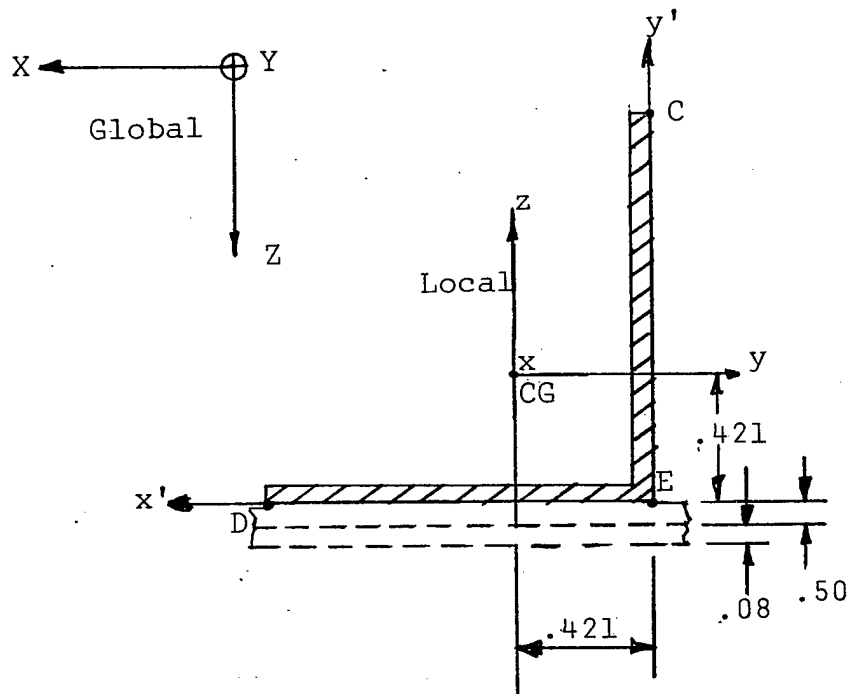
PROPERTY NUMBER: 43

ELEMENT NUMBERS: 2207-2209

2211

2216

DESCRIPTION: Horizontal members ($1\frac{1}{2} \times 1\frac{1}{2} \times \frac{1}{8}$ angle)
AL 2024-T3



PROPERTY NUMBER: 43

CALCULATIONS:

See INERTIA program output on following page.

STRESS RECOVERY POINTS

<u>Point</u>	<u>y</u>	<u>z</u>
C	+ .421	+1.079
D	-1.079	- .421
E	+ .421	- .421

OFFSET

<u>CBAR Element No.</u>	<u>Z1A</u>	<u>Z2A</u>	<u>Z3A</u>	<u>Z1B</u>	<u>Z2B</u>	<u>Z3B</u>
2207-2209	0.0	0.0	-.961	0.0	0.0	-.961
2211	0.0	0.0	0.0	0.0	0.0	0.0
2216	0.0	0.0	+.484	0.0	0.0	+.484

INERTIA

BAR PROPERTY NUMBER
 DESCRIPTION= P.I.D. NO. 43 HORIZONTAL MEMBERS (SEAT PALLET 75-0010)

INPUT		OUTPUT													
TYPE	DUM	H	B1	H1	X	Y	ALF	NO.	AREA	XC	YC	IX	IY	IXY	K
RECT	0.00	1.37500	.12500	0.00000	0.00000	.81250	0.00000	0.00000	0.00000	.81250	.06250	.00022	.02708	0.00000	.00090
RECT	0.00	.12500	1.50000	0.00000	0.00000	.06250	0.00000	0.00000	.06250	.75000	.03516	.00024	0.00000	.00098	

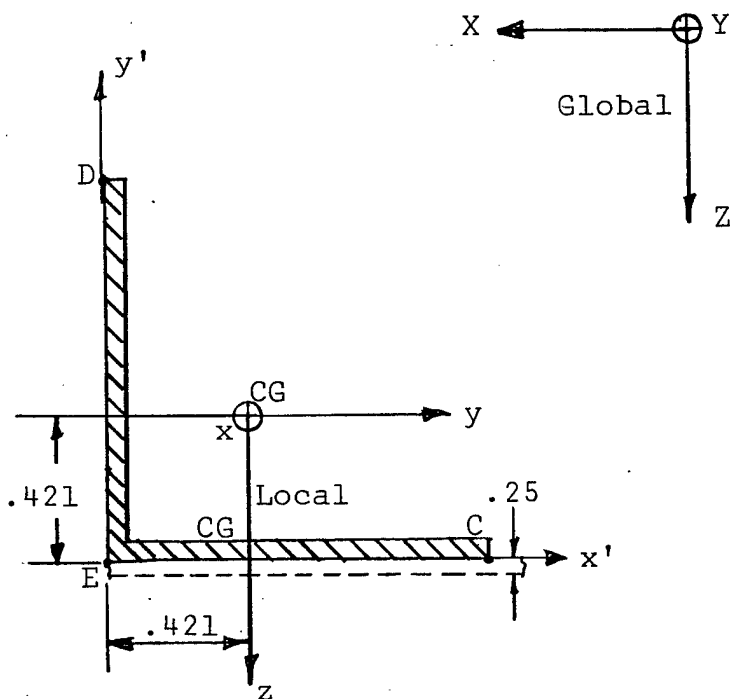
[illegible]

STRUCTURE: Seat Pallet 75-0010

PROPERTY NUMBER: 45

ELEMENT NUMBERS: 2213
2217
2223-2227
2229-2230
2232-2235
2240-2241
2249-2250
2258
2268

DESCRIPTION: Horizontal members ($1\frac{1}{2} \times 1\frac{1}{2} \times \frac{1}{8}$ angle)
AL 2024-T3



PROPERTY NUMBER: 45

CALCULATIONS:

See INERTIA program output on following page.

STRESS RECOVERY POINTS

<u>Point</u>	<u>y</u>	<u>z</u>
C	+1.079	+ .421
D	- .421	-1.079
E	- .421	+ .421

<u>CBAR Element No.</u>	<u>OFFSET</u>					
	<u>Z1A</u>	<u>Z2A</u>	<u>Z3A</u>	<u>Z1B</u>	<u>Z2B</u>	<u>Z3B</u>
2213	0.0	0.0	0.0	0.0	0.0	0.0
2217	0.0	0.0	+.484	0.0	0.0	+.484
2223-2227	0.0	-.421	-.961	0.0	-.421	-.961
2229-2230	0.0	0.0	0.0	0.0	0.0	0.0
2232-2235	0.0	0.0	0.0	0.0	0.0	0.0
2240-2241	0.0	0.0	-.484	0.0	0.0	-.484
2249-2250	0.0	0.0	0.0	0.0	0.0	0.0
2258	0.0	-.125	0.0	0.0	-.125	0.0
2268	0.0	0.0	0.0	0.0	0.0	0.0

INERTIA

BAR PROPERTY NUMBER
DESCRIPTION- PID NO 45 HORIZONTAL MEMBERS (SEAT PALLET 75-0010)

INPUT								
TYPE	DUM	B	H	B1	H1	X	Y	ALF
RECT	0.00	1.37500	.12500	0.00000	0.00000	.81250	0.00000	0.00000
RECT	0.00	.12500	1.50000	0.00000	0.00000	.06250	0.00000	0.00000
OUTPUT								
NO.	AREA	XC	YC	IX	IY	IXY	K	
1	.17188	.81250	.06250	.00022	.02708	0.00000	.00090	
2	.18750	.06250	.75000	.03516	.00024	0.00000	.00098	

```

*****  

TOTAL AREA= .359E+00  

X CENTROID DISTANCE= .421E+00  

Y CENTROID DISTANCE= .421E+00  

IX (ABOUT CENTROID)= .778E-01  

IY (ABOUT CENTROID)= .778E-01  

IXY (ABOUT CENTROID)= -.462E-01  

IMAX= .778E-01  

IMIN= .362E-01  

ALPHA= .900E+02  

TORSIONAL CONSTANT, K= .187E-02  

IX (ABOUT INPUT AXIS)= Y= 0.  

IY (ABOUT INPUT AXIS)= X= 0.  

IXY (ABOUT INPUT AXIS)= .175E-01  

TORSIONAL CONSTANT BASED ON SUM  

NOT NECESSARILY ACCURATE  

*****

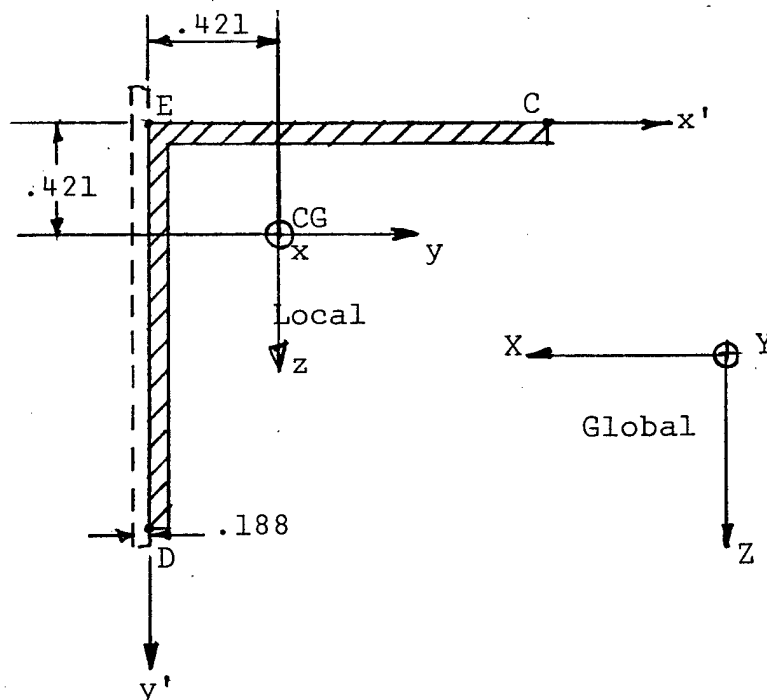
```

STRUCTURE: Seat Pallet 75-0010

PROPERTY NUMBER: 46

ELEMENT NUMBERS: 2210
 2212
 2215
 2218-2222
 2228
 2231
 2236-2239
 2242-2243
 2256-2257
 2259

DESCRIPTION: Horizontal members ($1\frac{1}{2} \times 1\frac{1}{2} \times \frac{1}{8}$ angle)
 AL 2024-T3



PROPERTY NUMBER: 46

CALCULATIONS:

See INERTIA program output on following page.

STRESS RECOVERY POINTS

<u>Point</u>	<u>y</u>	<u>z</u>
C	+1.079	- .421
D	- .421	+1.079
E	- .421	- .421

OFFSET

<u>CBAR Element No.</u>	<u>Z1A</u>	<u>Z2A</u>	<u>Z3A</u>	<u>Z1B</u>	<u>Z2B</u>	<u>Z3B</u>
2210	-1.030	0.0	0.0	-1.030	0.0	0.0
2212	0.0	0.0	-1.092	0.0	0.0	-1.092
2215	-1.030	0.0	+.484	-1.030	0.0	+.484
2218-2222	0.0	0.0	-.961	0.0	0.0	-.961
2228	-.967	0.0	0.0	-.967	0.0	0.0
2231	0.0	-.421	0.0	0.0	-.421	0.0
2236-2239	-.421	0.0	0.0	-.421	0.0	0.0
2242-2243	-.421	0.0	-.484	-.421	0.0	-.484
2256-2257	0.0	-.546	0.0	0.0	-.546	0.0
2259	0.0	-.546	0.0	0.0	-.546	0.0

INERTIA

BAR PROPERTY NUMBER
DESCRIPTION= P.I.D. NO 46 HORIZONTAL MEMBERS (SEAT PALLET 75-0010)

INPUT		H		B1		H1		X		Y		ALF	
TYPE	DUM	R											
RECT	0.00	1.37500	.12500	0.00000	0.00000	.81250	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
RECT	0.00	.12500	1.50000	0.00000	0.00000	.06250	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000

OUTPUT		AREA		XC		YC		IX		IY		IXY		K	
NO.															
1	.17188	.81250	.06250	.00022	.02708	0.00000	.00090								
2	.18750	.06250	.75000	.03516	.00024	0.00000	.00098								

```
*****  
TOTAL AREA= .359E+00  
X CENTROID DISTANCE= .421E+00  
Y CENTROID DISTANCE= .421E+00  
IX (ABOUT CENTROID)= .778E-01  
IY (ABOUT CENTROID)= .778E-01  
IXY (ABOUT CENTROID)= -.462E-01  
IMAX= .778E-01  
IMIN= .362E-01  
ALPHA= .900E+02  
TORSIONAL CONSTANT, K= .187E-02  
IX (ABOUT INPUT AXIS)= .142E+00 Y= 0.  
IY (ABOUT INPUT AXIS)= .142E+00 X= 0.  
IXY (ABOUT INPUT AXIS)= .175E-01  
  
TORSIONAL CONSTANT BASED ON SUM  
NOT NECESSARILY ACCURATE  
  
*****
```

(Equipment Rack 75-0010)

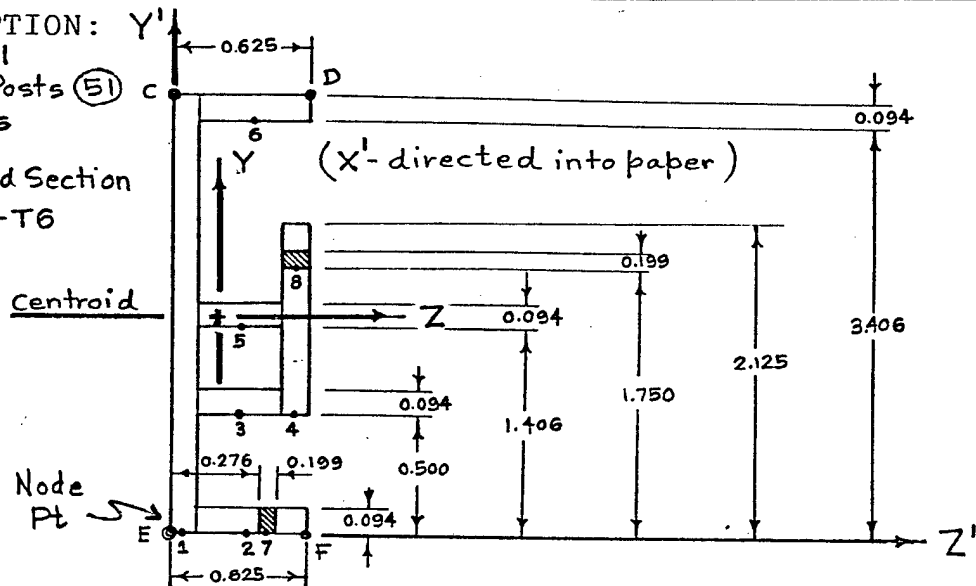
ELEMENT NUMBERS: CBAR 201 thru 214
CBAR 330 thru 341
CBAR 284, 285
CBAR 293, 294

DESCRIPTION:

Vertical

Corner Posts (E)
on Dwgs

Extruded Section
AL6061-T6



C, D, E, F are NASTRAN stress output points (E also a Node Point)

CALCULATIONS:

The following information will be input to the INERTIA program from which section properties will be calculated for the above pictured cross-section.

Rectangle No.	Loc Pt Z_i	Coordinates Y_i	Basic Dimensions B_i	H_i
1	0.047	0.0	0.094	3.500
2	0.360	0.0	0.531	0.094
3	0.313	0.500	0.437	0.094
4	0.578	0.500	0.094	1.625
5	0.313	1.406	0.437	0.094
6	0.360	3.406	0.531	0.094
* 7	0.376	0.0	0.199	0.094
* 8	0.578	1.750	0.094	0.199

* Negative Areas

**** "Z" corresponds to "X" in the INERTIA Program**

INERTIA

WRITTEN BY ANAMET LABORATORIES
SAN CARLOS, CA.

BAR PROPERTY NUMBER
DESCRIPTION- PID 101 RACK 75-0010

INPUT

TYPE	DUM	B	H	B1	H1	X	Y	ALF
RECT	0.00	.9400E-01	.3500E+010.	0.	0.	.4700E-010.	0.	0.
RECT	0.00	.5310E+00	.9400E-010.	0.	0.	.3600E+000.	0.	0.
RECT	0.00	.4370E+00	.9400E-010.	0.	0.	.3130E+00	.5000E+000.	0.
RECT	0.00	.9400E-01	.1625E+010.	0.	0.	.5780E+00	.5000E+000.	0.
RECT	0.00	.4370E+00	.9400E-010.	0.	0.	.3130E+00	.1406E+010.	0.
RECT	0.00	.5310E+00	.9400E-010.	0.	0.	.3600E+00	.3406E+010.	0.
RECT	1.00	.1990E+00	.9400E-010.	0.	0.	.3760E+000.	0.	0.
RECT	1.00	.9400E-01	.1990E+000.	0.	0.	.5780E+00	.1750E+010.	0.

OUTPUT

NO.	AREA	XC	YC	IX	IY	IXY	K
1	.329E+00	.470E-01	.175E+01	.336E+00	.242E-03	0.	.969E-03
2	.499E-01	.360E+00	.470E-01	.368E-04	.117E-02	0.	.147E-03
3	.411E-01	.313E+00	.547E+00	.302E-04	.654E-03	0.	.121E-03
4	.153E+00	.578E+00	.131E+01	.336E-01	.112E-03	0.	.450E-03
5	.411E-01	.313E+00	.145E+01	.302E-04	.654E-03	0.	.121E-03
6	.499E-01	.360E+00	.345E+01	.368E-04	.117E-02	0.	.147E-03
7	.187E-01	.376E+00	.470E-01	.138E-04	.617E-04	0.	.551E-04
8	.187E-01	.578E+00	.185E+01	.617E-04	.138E-04	0.	.551E-04

[illegible]

In order to specify how the beam elements are oriented w.r.t. the Basic Coordinate System, the cross-sections for each CBAR element are shown below with the Basic Coordinate directions indicated.

CBAR 201 thru 207, 284, 285

DESCRIPTION: Y'
Vertical
Corner Posts (E1) c D
on Dwgs
Extruded Section
AL6061-T6

0.625

0.094

6

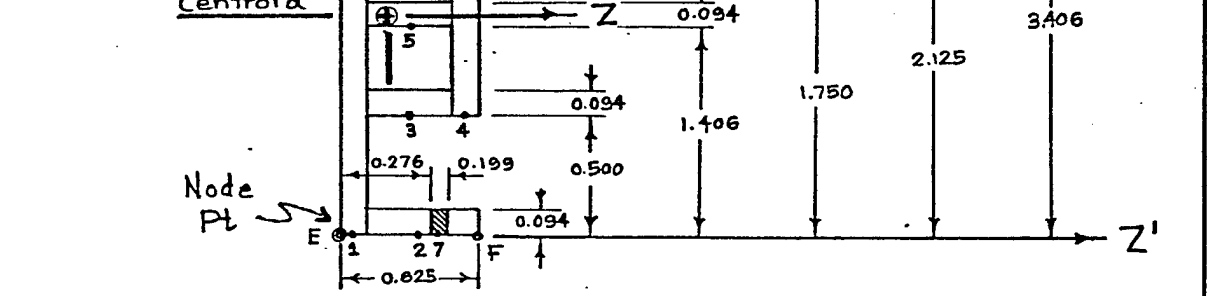
Y'

(X' -directed into paper)

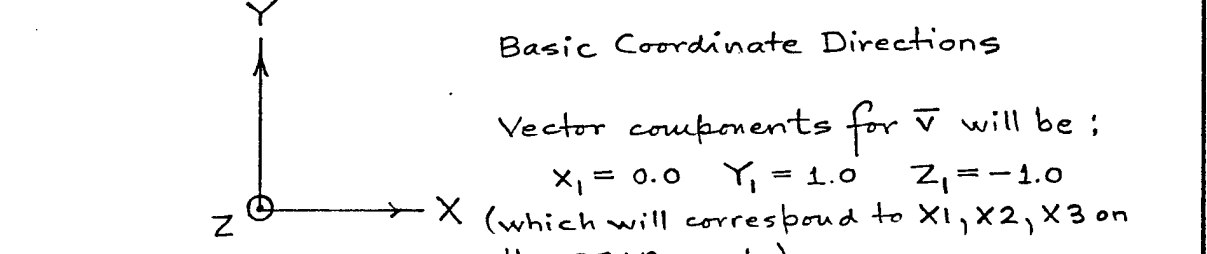
Contract

8

0.199



C, D, E, F are NASTRAN stress output points (E also a Node Point)



offsets will be: (the CBAR card.)

$$X_a = 0.236 \quad X_b = 0.236$$

$$Y_a = 1.59 \quad Y_b = 1.59$$

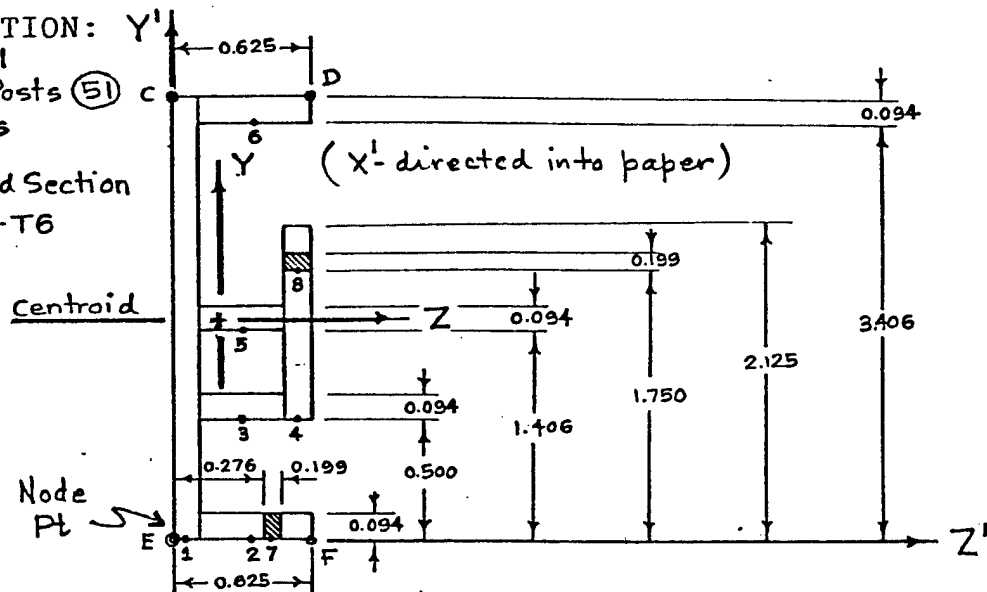
$$Z_a = 0.0 \quad Z_b = 0.0$$

E-120

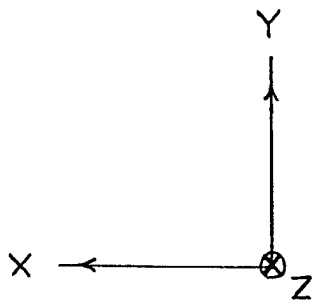
CBAR 208 thru 214

DESCRIPTION: Y'
Vertical
Corner Posts (51) c
on Dwgs

Extruded Section
AL6061-T6



C, D, E, F are NASTRAN stress output prints (E also a Node Point)



Basic Coordinate Directions

Vector components for $\vec{v}$ will be:

$$X_1 = 0.0 \quad Y_1 = 1.0 \quad Z_1 = 1.0$$

(which correspond to x_1, x_2, x_3 on the CBAR card)

offsets will be:

$$X_a = -0.236$$

$$X_b = -0.236$$

$$Y_4 = 1.59$$

$$Y_b = 1.59$$

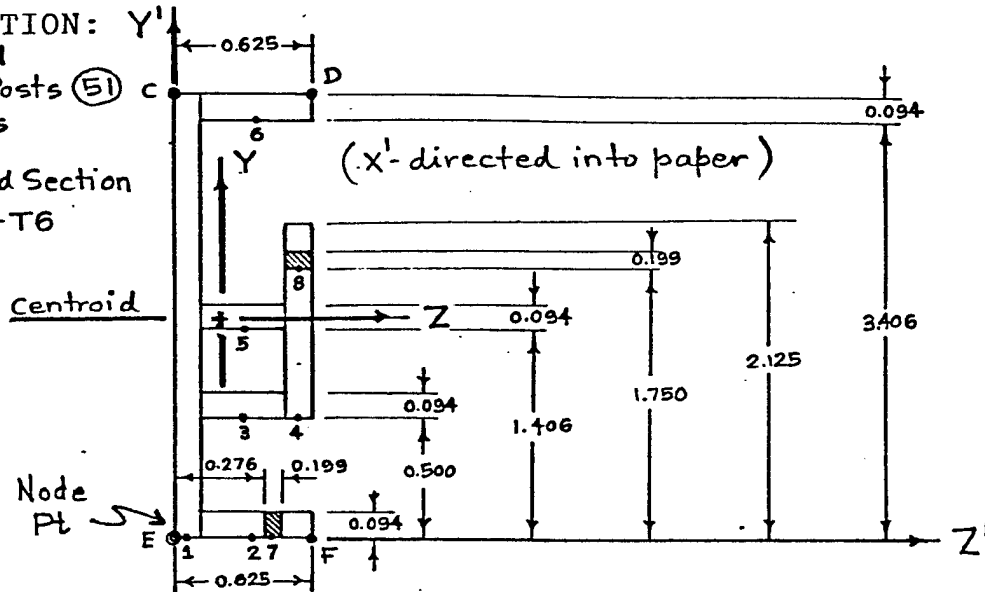
$$Z_a = 0.0$$

$$Z_b = 0.0$$

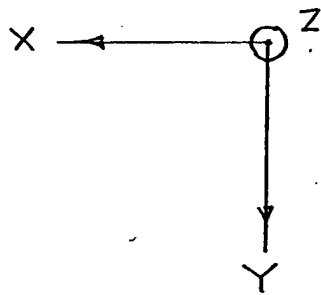
CBAR 330 thru 335

DESCRIPTION: Y'
Vertical
Corner Posts (E) c
on Dwgs

Extruded Section
AL6061-T6



C, D, E, F are NASTRAN stress output points (E also a Node Point)



Basic Coordinate Directions

Vector Components for $\bar{v}$ will be

$$X_1 = 0.0 \quad Y_1 = -1.0 \quad Z_1 = -1.0$$

(which correspond to X_1, X_2, X_3 on
CBAR card.)

offsets will be:

$$X_a = -0.236$$

$$X_b = -0.236$$

$$Y_a = -1.59$$

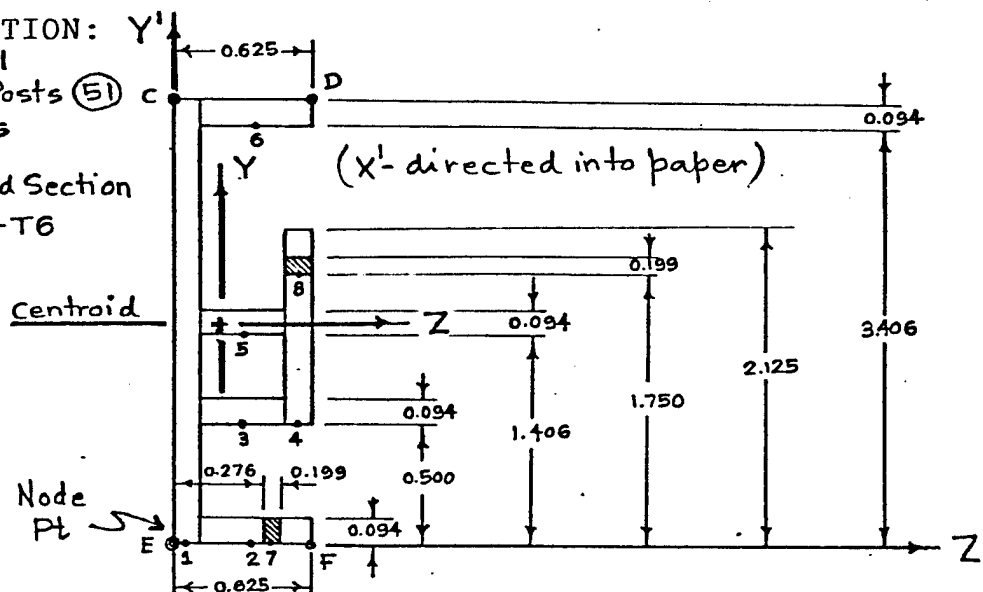
$$Y_b = -1.59$$

$$Z_a = 0.0$$

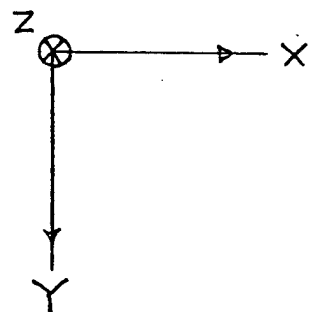
$$Z_b = 0.0$$

CBAR 336 thru 341, 293, 294

DESCRIPTION: Y'
Vertical
Corner Posts (51)
on Dwgs
Extruded Section
AL6061-T6



C, D, E, F are NASTRAN stress output points (E also a Node Point)



Basic Coordinate Directions

Vector components for $\bar{V}$

$$X_1 = 0.0 \quad Y_1 = -1.0 \quad Z_1 = 1.0$$

(which correspond to X1, X2, X3 on
CBAR card.)

Offsets will be

$$X_a = 0.236$$

$$X_b = 0.236$$

$$Y_a = -1.59$$

$$Y_b = -1.59$$

$$Z_a = 0.0$$

$$Z_b = 0.0$$

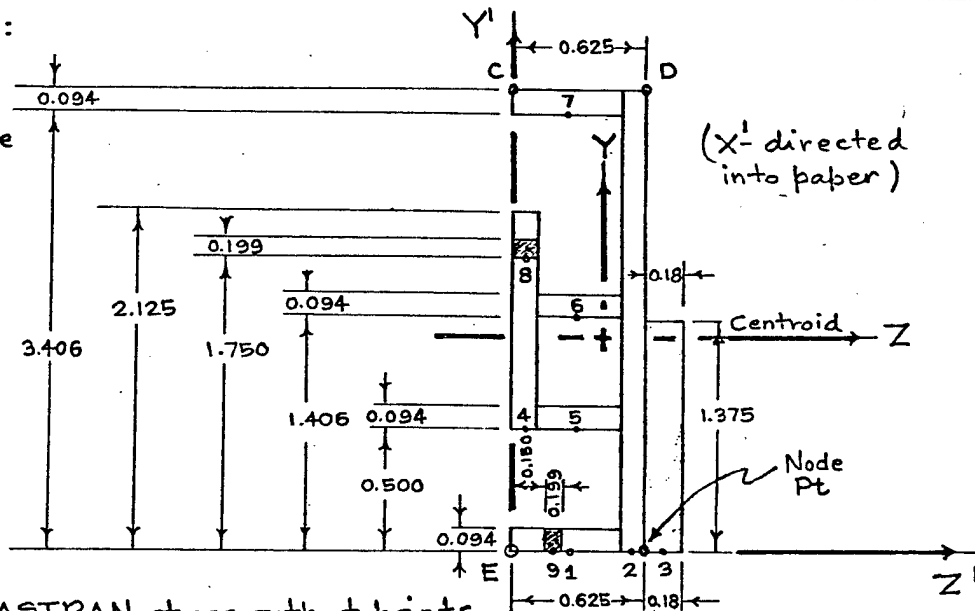
PROPERTY NUMBER: PID 102

ELEMENT NUMBERS:

CBAR 342 thru 359

DESCRIPTION:

Vertical
Posts (5)
w/ one flange
(53) Channel
on Dwgs



C, D, E are NASTRAN stress output points

CALCULATIONS:

The following information will be input to the INERTIA program from which section properties will be calculated.

Rectangle No.	Loc Pt ** Z _i	Coordinates Y _i	Basic Dimensions B _i	H _i
1	0.266	0.0	0.531	0.094
2	0.578	0.0	0.094	3.500
3	0.715	0.0	0.18	1.375
4	0.047	0.500	0.094	1.625
5	0.313	0.500	0.437	0.094
6	0.313	1.406	0.437	0.094
7	0.266	3.406	0.531	0.094
* 8	0.047	1.750	0.094	0.199
* 9	0.250	0.0	0.199	0.094

** "Z" corresponds to "X" in the INERTIA Program

* Negative Areas

[illegible]

INPUT	DUM	B	H	B1	H1	X	Y	ALF
RECT 0.00		.53100	.09400	0.00000	0.00000	.26600	0.00000	0.00000
RECT 0.00		.09400	3.50000	0.00000	0.00000	.57800	0.00000	0.00000
RECT 0.00		.18000	1.37500	0.00000	0.00000	.71500	0.00000	0.00000
RECT 0.00		.09400	1.62500	0.00000	0.00000	.04700	.50000	0.00000
RECT 0.00		.43700	.09400	0.00000	0.00000	.31300	.50000	0.00000
RECT 0.00		.43700	.09400	0.00000	0.00000	.31300	1.40600	0.00000
RECT 0.00		.53100	.09400	0.00000	0.00000	.26600	3.40600	0.00000
RECT-1.00		.09400	.19900	0.00000	0.00000	.04700	1.75000	0.00000
RECT-1.00		.19900	.09400	0.00000	0.00000	.25000	0.00000	0.00000

NO.	AREA	XC	YC	IX	IY	IXY	K
1	.04991	.26600	.04700	.00004	.00117	0.00000	.00015
2	.32900	.57800	1.75000	.33585	.00024	0.00000	.00097
3	.24750	.71500	.68750	.03899	.00067	0.00000	.00267
4	.15275	.04700	1.31250	.03361	.00011	0.00000	.00045
5	.04108	.31300	.54700	.00003	.00065	0.00000	.00012
6	.04108	.31300	1.45300	.00003	.00065	0.00000	.00012
7	.04991	.26600	3.45300	.00004	.00117	0.00000	.00015
8	-.01871	.04700	1.84950	-.00006	-.00001	0.00000	-.00006
9	-.01871	.25000	.04700	-.00001	-.00006	0.00000	-.00006

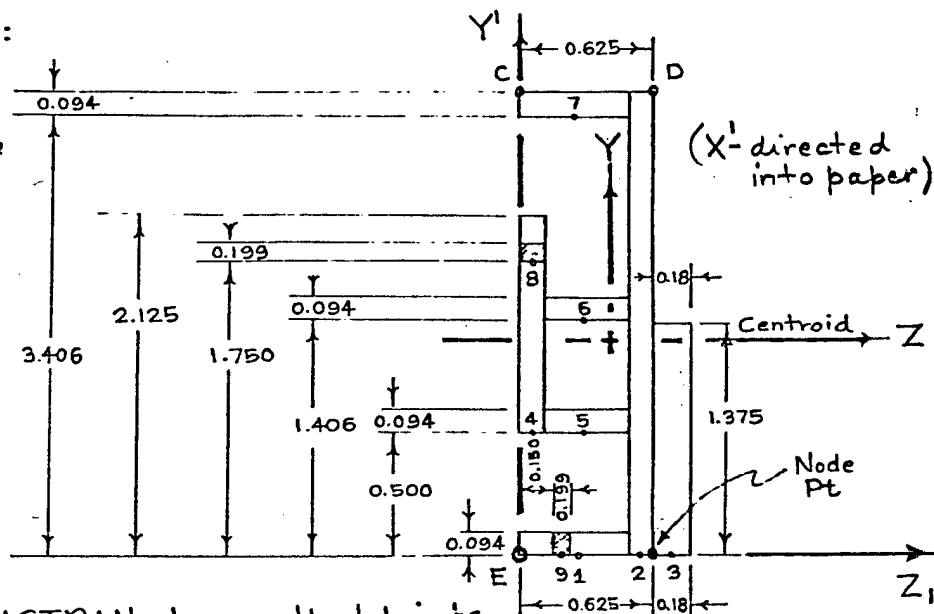
[illegible]

CBAR 348 thru 350

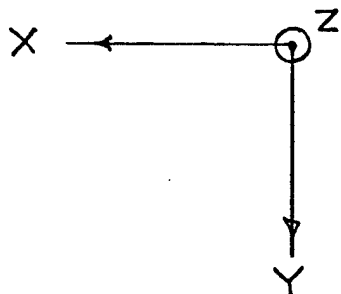
CBAR 354 thru 356

DESCRIPTION:

Vertical
Posts (51)
w/ one flange
(53) Channel
on Dwg



C, D, E are NASTRAN stress output prints



Basic Coordinate Directions

Vector Components for ∇

$$X_1 = 0.0 \quad Y_1 = -1.0 \quad Z_1 = -1.0$$

Offsets will be:

$$X_a = 0.143$$

$$X_b = 0.143$$

$$Y_a = -1.34$$

$$Y_b = -1.34$$

$$Z_a = 0.0$$

$$Z_b = 0.0$$

PROPERTY NUMBER: PID102 (continued)

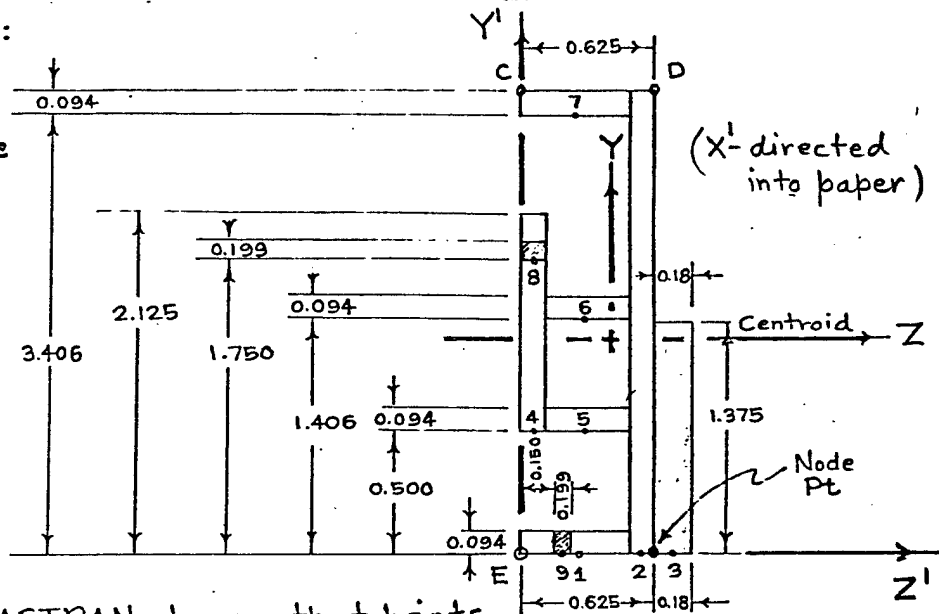
CBAR 345 thru 347

CBAR 351 thru 353

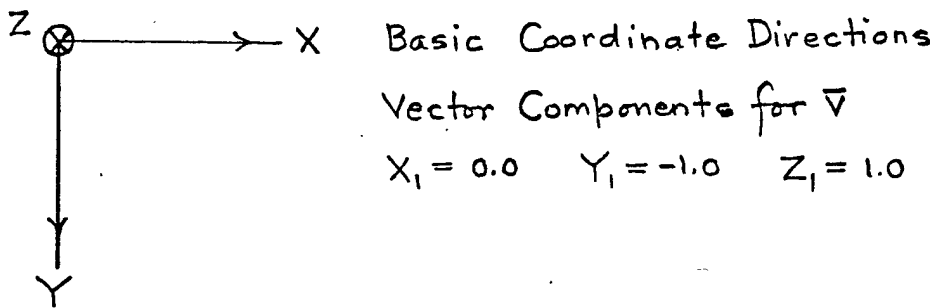
CBAR 357 thru 359

DESCRIPTION:

Vertical
Posts (51)
w/ one flange
(53) Channel
on Dwg's



C, D, E are NASTRAN stress output points



Offsets will be:

$$X_a = -0.143 \quad X_b = -0.143$$

$$Y_a = -1.34 \quad Y_b = -1.34$$

$$Z_a = 0.0 \quad Z_b = 0.0$$

PROPERTY NUMBER: PID 103

ELEMENT NUMBERS: CBAR 268 thru 275
CBAR 300 thru 307

CBAR 251, 254 thru 256, 258 thru 260, 262 thru 264, 267
CBAR 360, 362 thru 364, 366 thru 368, 370 thru 372, 375

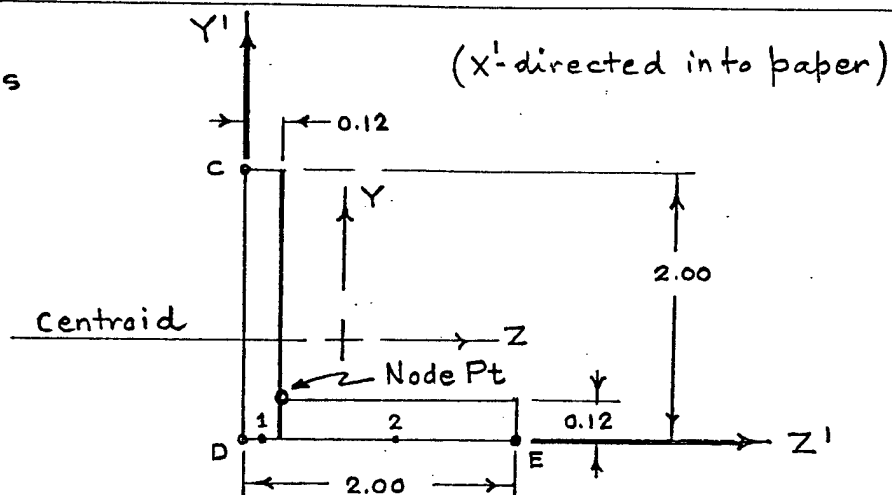
DESCRIPTION:

Corner Angles

② on Dwgs

0.12 X 2 X 2

AL 2024-T3



C, D, E are NASTRAN stress outputs

CALCULATIONS:

The following information will be input to the INERTIA program from which section properties for the above pictured member will be calculated.

Rectangle No.	Loc Pt Coordinates		Basic Dimensions	
	* Z'_i	Y'_i	B_i	H_i
1	0.06	0.0	0.12	2.00
2	1.06	0.0	1.88	0.12

* "Z" corresponds to "X" in the INERTIA Program

WRITTEN BY ANAMET LABORATORIES
SAN CARLOS, CA.

BBAR PROPERTY NUMBER PID 103RACK 75-0010

INPUT

TYPE	DUM	B	H	B1	H1	X	Y	ALF
RECT	0.00	.1200E+00	.2000E+010.		0.	.6000E-010.		0.
RECT	0.00	.1880E+01	.1200E+000.		0.	.1060E+010.		0.

OUTPUT

NO.	AREA	XC	YC	IX	IY	IXY	K
1	.240E+00	.600E-01	.100E+01	.800E-01	.288E-03	0.	.115E-02
2	.226E+00	.106E+01	.600E-01	.271E-03	.664E-01	0.	.108E-02

```

*****  

TOTAL AREA= .466E+00  

X CENTROID DISTANCE= .545E+00  

Y CENTROID DISTANCE= .545E+00  

IX (ABOUT CENTROID)= .183E+00  

IY (ABOUT CENTROID)= .183E+00  

IXY (ABOUT CENTROID)= -.109E+00  

IMAX= .183E+00  

IMIN= .183E+00  

ALPHA= .900E+02  

TORSIONAL CONSTANT, K= .223E-02  

IX (ABOUT INPUT AXIS)= .321E+00 Y= 0.  

IY (ABOUT INPUT AXIS)= .321E+00 X= 0.  

IXY (ABOUT INPUT AXIS)= .287E-01  

TORSIONAL CONSTANT BASED ON SUM  

NOT NECESSARILY ACCURATE  

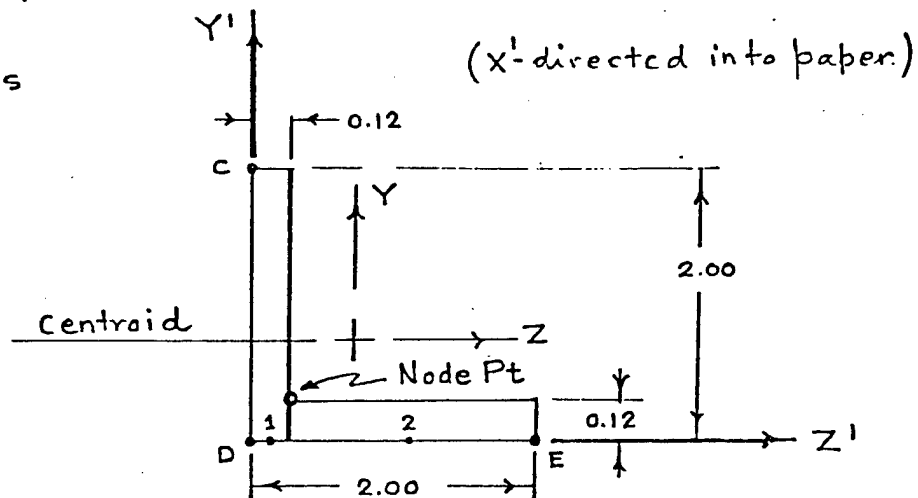
*****

```

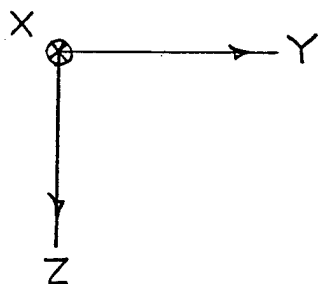
Orientation of Beam Element w.r.t. Basic Coordinate System is shown below for:
CBAR 268 thru. 275

DESCRIPTION:

Corner Angles
(21) on Dwg
0.12 X 2 X 2
AL 2024-T3



C, D, E are NASTRAN stress outputs



Basic Coordinate Directions
Vector Components for $\bar{V}$
 $X_1 = 1.0$ $Y_1 = 0.0$ $Z_1 = -1.0$

offsets will be:

$$\begin{aligned} X_a &= 0.0 & X_b &= 0.0 \\ Y_a &= 0.425 & Y_b &= 0.425 \\ Z_a &= -0.425 & Z_b &= -0.425 \end{aligned}$$

Orientation of Beam Element w.r.t. Basic Coordinate System is shown below for:

CBAR 300 thru 307

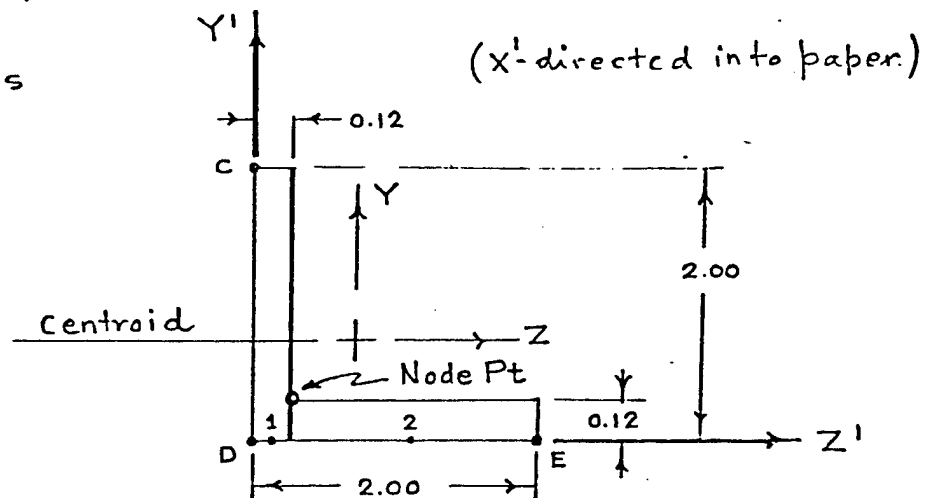
DESCRIPTION:

Corner Angles

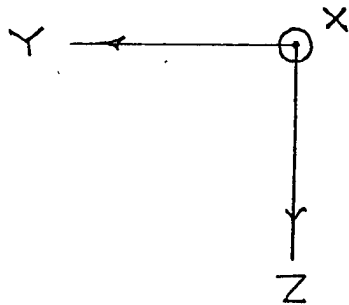
②1 on Dwgs

$$0.12 \times 2 \times 2$$

AL 2024-T3



C, D, E are NASTRAN stress outputs



Basic Coordinate Directions

Vector components for $\bar{v}$

$$X_1 = -1.0 \quad Y_1 = 0.0 \quad Z_1 = -1.0$$

Offsets will be:

$$X_a = 0.0$$

$$X_b = 0.0$$

$$Y_a = -0.425$$

$$Y_b = -0.425$$

$$Z_a = -0.425$$

$$Z_6 = -0.425$$

Orientation of beam element w.r.t. Basic Coordinate System is shown below for

CBA2 251, 254 thru 256, 258 thru 260, 262 thru 264, 267

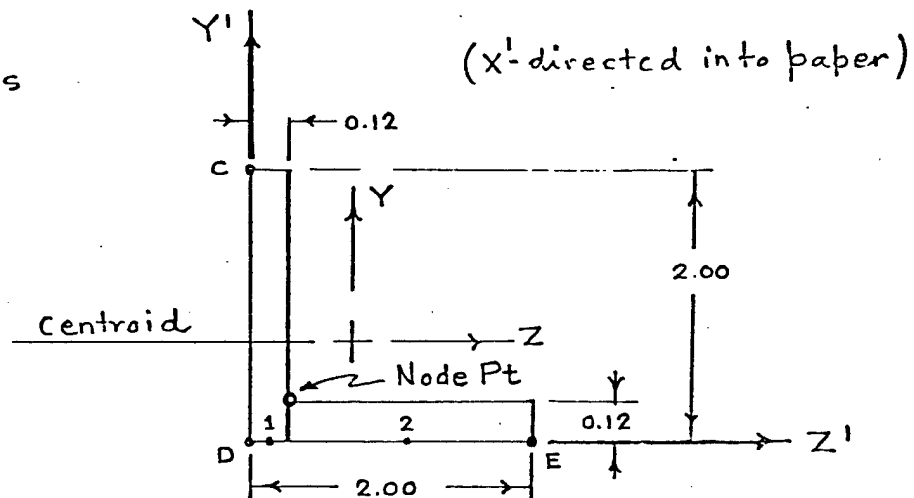
DESCRIPTION:

Corner Angles

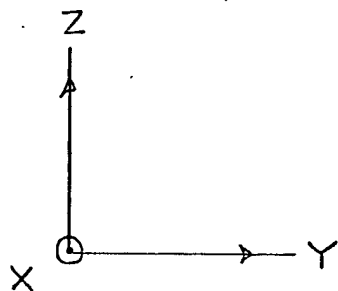
②1 on Dwg's

$$0.12 \times 2 \times 2$$

AL 2024-T3



C, D, E are NASTRAN stress outputs



Basic Coordinate Directions

Vector Components for $\vec{v}$

$$X_1 = -1.0 \quad Y_1 = 0.0 \quad Z_1 = 1.0$$

offsets will be

$$X_a = 0.0$$

$$X_b = 0.0$$

$$Y_a = 0.425$$

$$Y_b = 0.425$$

$$Z_a = 0.425$$

$$\dot{Z}_b = 0.425$$

PROPERTY NUMBER: PID 103 (continued)

Orientation of Beam Element w.r.t. Basic Coordinate System is shown below for:

CBAR 360, 362 thru 364, 366 thru 368, 170 thru 172, 175

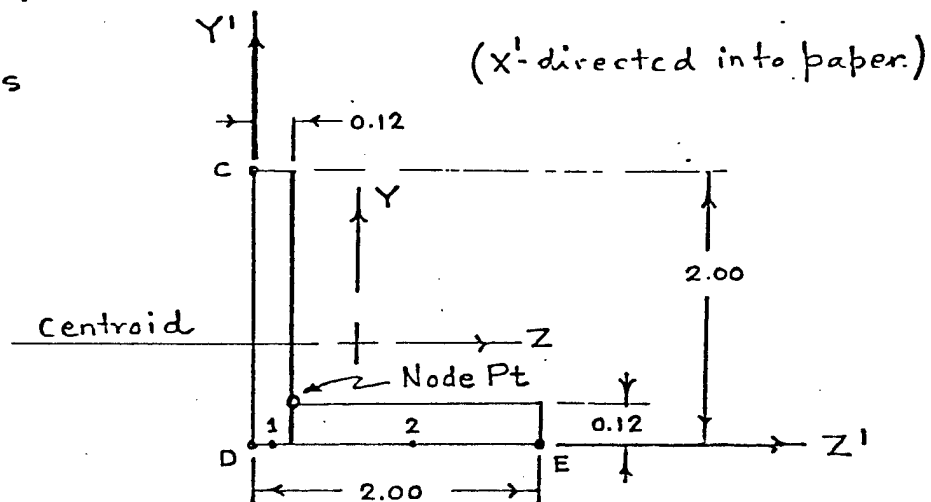
DESCRIPTION:

Corner Angles

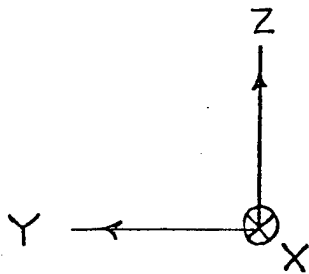
(21) on Dwg

0.12 X 2 X 2

AL 2024-T3



C, D, E are NASTRAN stress outputs



Basic Coordinate Directions
Vector Components for $\bar{V}$

$$X_1 = 1.0 \quad Y_1 = 0.0 \quad Z_1 = 1.0$$

Offsets will be:

$$X_a = 0.0$$

$$X_b = 0.0$$

$$Y_a = -0.425$$

$$Y_b = -0.425$$

$$Z_a = 0.425$$

$$Z_b = 0.425$$

PROPERTY NUMBER: PID 104

ELEMENT NUMBERS: CBAR 276 thru 283

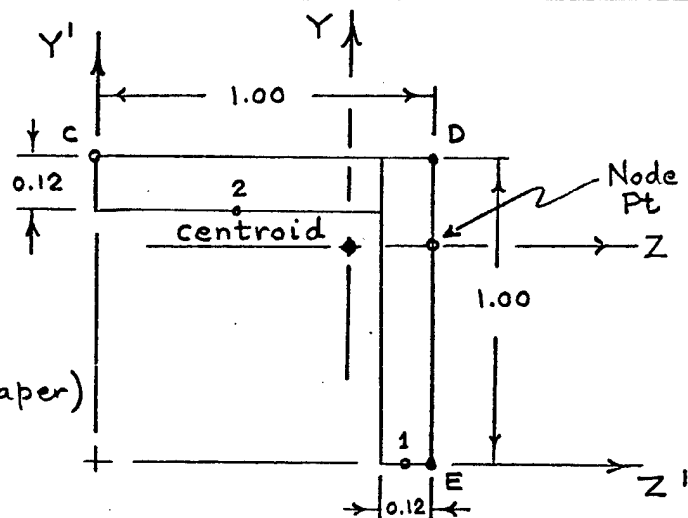
DESCRIPTION:

Back Plate Support
Angle (33) on Dwg

0.12 x 1 x 1

AL 2024-T3

(X' - directed into paper)



C, D, E are NASTRAN stress output points

CALCULATIONS:

The following information will be input to the INERTIA program from which section properties for the above pictured member will be calculated.

Rectangle No.	Loc Pt * Z'_i	Coordinates Y'_i	Basic Dimensions	
			B_i	H_i
1	0.94	0.0	0.12	1.00
2	0.44	0.88	0.88	0.12

* "Z" corresponds to "X" in the INERTIA Program.

WRITTEN BY ANAMET LABORATORIES
SAN CARLOS, CA.

BARBARA PROPERTY NUMBER	PID 104 RACK 75-0010
DESCRIPTION-	

INPUT

TYPE	DUM	B	H	B1	H1	X	Y	ALF
RECT	0.00	.1200E+00	.1000E+010.		0.	.9400E+000.		0.
RECT	0.00	.8800E+00	.1200E+000.		0.	.4400E+00	.8800E+000.	

OUTPUT

NO.	AREA	XC	YC	IX	IY	IXY	K
1	.120E+00	.940E+00	.500E+00	.100E-01	.144E-03	0.	.576E-03
2	.106E+00	.440E+00	.940E+00	.127E-03	.681E-02	0.	.507E-03

[illegible]

Orientation of Beam Element w.r.t. Basic Coordinate System is shown below for:

CBAR 276 thru 283

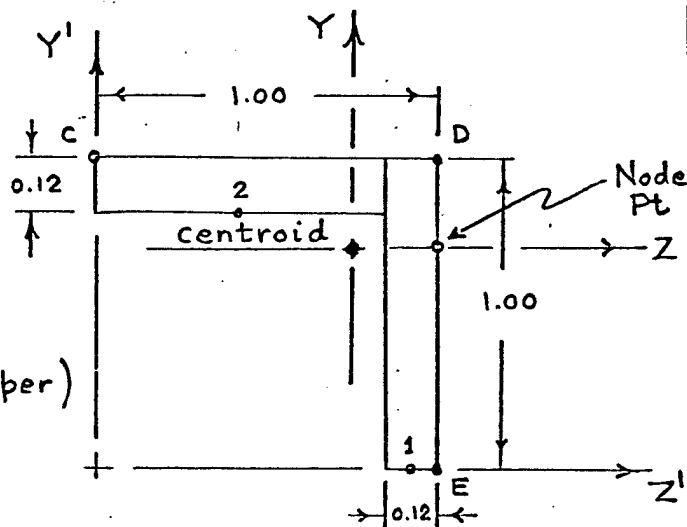
DESCRIPTION:

Back Plate Support
Angle (33) on Dwgs

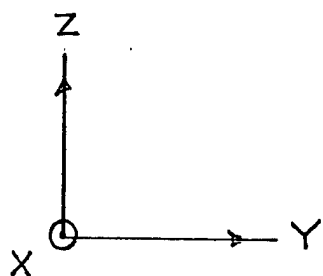
 $0.12 \times 1 \times 1$

AL 2024-T3

(X^1 -directed into paper)



C, D, E are NASTRAN stress output points



Basic Coordinate Directions

Vector Components of $\vec{v}$

$$X_1 = -1.0 \quad Y_1 = 0.0 \quad Z_1 = 1.0$$

offsets will be:

$$X_a = 0.0$$

$$X_b = 0.0$$

$$Y_a = -0.294$$

$$Y_b = -0.294$$

$$Z_a = 0.0$$

$$Z_b = 0.0$$

PROPERTY NUMBER: PID 105

ELEMENT NUMBERS: CBAR 312, 313

DESCRIPTION:

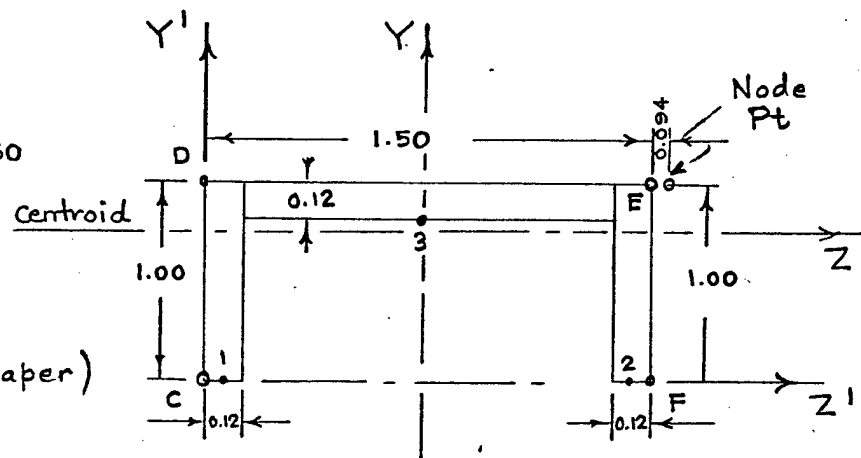
Roof Channels

(4) on Dwg's

0.12 x 1.00 x 1.00 x 1.50

AL 2024-T3

(X' - directed into paper)



C, D, E, F are NASTRAN Stress Output Points

CALCULATIONS:

The following information will be input to the INERTIA program which will calculate section properties for the above pictured member.

Rectangle No.	Loc Pt Coordinates		Basic Dimensions	
	* Z'_i	Y'_i	B_i	H_i
1	0.06	0.0	0.12	1.00
2	1.44	0.0	0.12	1.00
3	0.75	0.88	1.26	0.12

* "Z" corresponds to "X" in INERTIA Program

INERTIA

BAR PROPERTY NUMBER
DESCRIPTION- PID-105 RACK 75-0010

INPUT				OUTPUT			
TYPE	DUM	B	H	XC	AREA	Y	ALF
RECT	0.00	.12000	1.00000	.06000	.12000	0.00000	0.00000
RECT	0.00	.12000	1.00000	1.44000	.12000	0.00000	0.00000
RECT	0.00	1.26000	.12000	.75000	.15120	.88000	0.00000

E-142

PROPERTY NUMBER: PID 105 (continued)

Orientation of Beam Elements w.r.t. Basic
Coordinate System is shown below for:
CBAR 312, 313

DESCRIPTION:

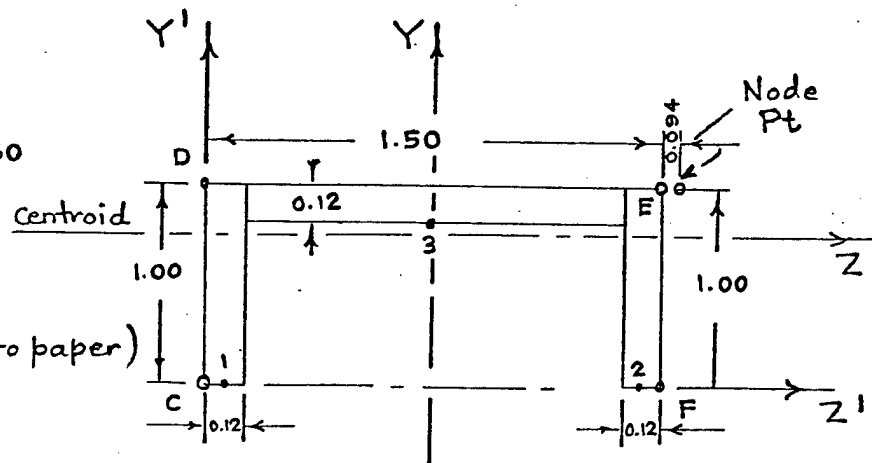
Roof Channels

(41) on Dwg's

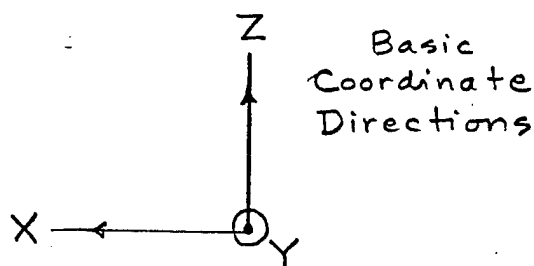
0.12 x 1.00 x 1.00 x 1.50

AL 2024-T3

(X' - directed into paper)



C, D, E, F are NASTRAN Stress Output Points



∇ Components

$$X_1 = 0.0 \quad Y_1 = -1.0 \quad Z_1 = 1.0$$

Offsets will be:

$$X_a = 0.844 \quad X_b = 0.844$$

$$Y_a = 0.0 \quad Y_b = 0.0$$

$$Z_a = -0.330 \quad Z_b = -0.330$$

PROPERTY NUMBER: PID 106

ELEMENT NUMBERS:

CBAR 314 thru 323

DESCRIPTION:

Roof Channels

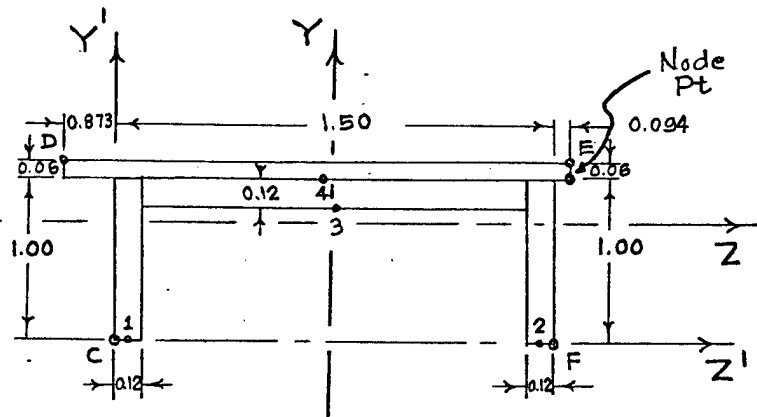
(41) on Dwgs

0.12 X 1.00 X 1.00 X 1.50

AL 2024-T3

plus part of
roof plate (27)

Centroid



(X' - directed into paper)

C, D, E, F are NASTRAN Stress Output Points

CALCULATIONS:

The following information will be input to the INERTIA program which will calculate section properties for the above pictured member.

Rectangle No.	Loc Pt * Z_i	Coordinates Y_i	Basic Dimensions	
			B_i	H_i
1	0.06	0.0	0.12	1.00
2	1.44	0.0	0.12	1.00
3	0.75	0.88	1.26	0.12
4	0.361	1.00	2.467	0.06

* "Z" corresponds to "X" in the INERTIA Program

INERTIA

BAR PROPERTY NUMBER
DESCRIPTION- PID-106 RACK-75-0010

INPUT									
TYPE	DUM	B	H	B1	H1	X	Y	ALF	
RECT	0.00	.12000	1.00000	0.00000	0.00000	.06000	0.00000	0.00000	
RECT	0.00	.12000	1.00000	0.00000	0.00000	1.44000	0.00000	0.00000	
RECT	0.00	1.26000	.12000	0.00000	0.00000	.75000	.88000	0.00000	
RECT	0.00	2.46700	.06000	0.00000	0.00000	.36100	1.00000	0.00000	

OUTPUT									
NO.	AREA	XC	YC	IX	IY	IXY	K		
1	.12000	.06000	.50000	.01000	.00014	0.00000	.00058		
2	.12000	1.44000	.50000	.01000	.00014	0.00000	.00058		
3	.15120	.75000	.94000	.00018	.02000	0.00000	.00073		
4	.14802	.36100	1.03000	.00004	.07507	0.00000	.00018		

[illegible]

PROPERTY NUMBER: PID 106 (continued)

Orientation of Beam Element w.r.t. Basic Coordinate System is shown below for:

CBAR 316, 317, 320, 321

CBAR 314, 315, 318, 319, 322, 323

DESCRIPTION:

Roof Channels

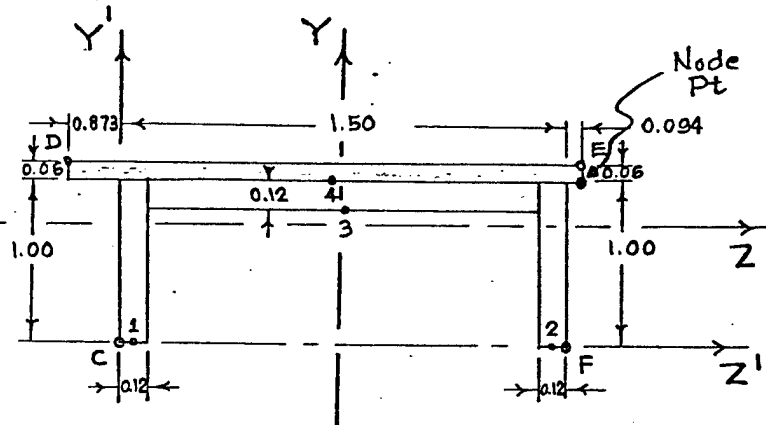
(41) on DwgS

0.12 X 1.00 X 1.00 X 1.50

AL 2024-T3

plus part of roof plate (27)

Centroid

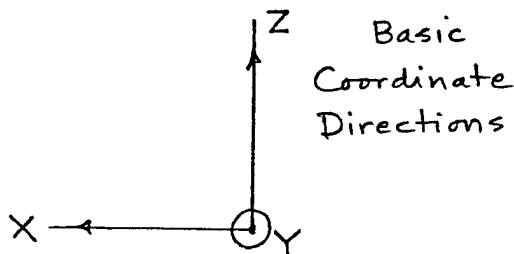


(X' - directed into paper)

C, D, E, F are NASTRAN Stress Output Points

CBAR

316, 317, 320, 321



Basic
Coordinate
Directions

∇ Components

$$X_i = 0.0 \quad Y_i = -1.0 \quad Z_i = 1.0$$

Offsets will be:

$$X_a = 0.951 \quad X_b = 0.951$$

$$Y_a = 0.0 \quad Y_b = 0.0$$

$$Z_a = -0.231 \quad Z_b = -0.231$$

CBAR 314, 315, 318, 319, 322, 323



Basic Coordinate
Directions

∇ Components

$$X_i = 0.0 \quad Y_i = 1.0 \quad Z_i = 1.0$$

Offsets will be:

$$X_a = -0.951 \quad X_b = -0.951$$

$$Y_a = 0.0 \quad Y_b = 0.0$$

$$Z_a = -0.231 \quad Z_b = -0.231$$

PROPERTY NUMBER: PID107

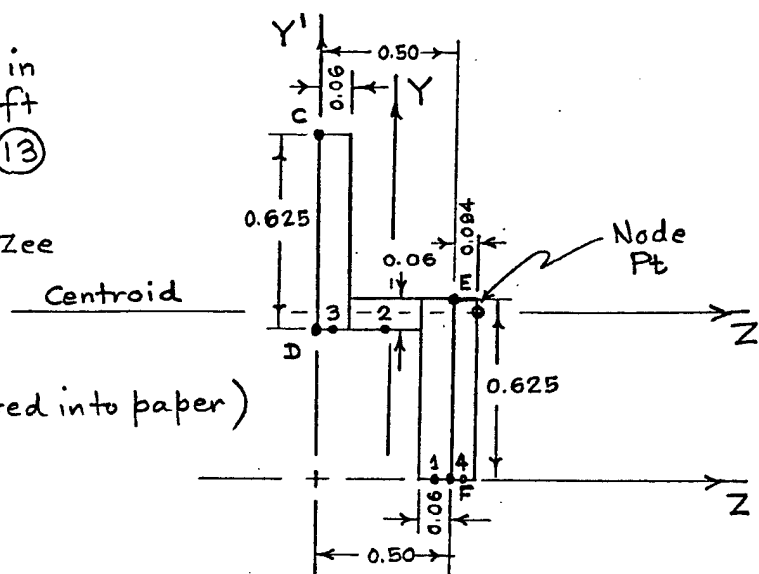
ELEMENT NUMBERS: CBAR 380 thru 384
CBAR 390, 392 thru 399

DESCRIPTION:

Zee Sections in
Right and Left
Side Panels (13)
on Dwgs

0.06X0.50X1.0 Zee
AL 2024-T3

(X^1 - directed into paper)



C, D, E, F are NASTRAN stress output points

CALCULATIONS:

The following information will be input to the INERTIA program which will calculate section properties for the above pictured member.

Rectangle No.	Loc Pt Coordinates		Basic Dimensions	
	* Z_i^1	Y_i^1	B_i	H_i
1	0.47	0.0	0.06	0.625
2	0.25	0.565	0.38	0.06
3	0.03	0.565	0.06	0.625
4	0.547	0.0	0.094	0.625

* "Z" corresponds to "X" in the INERTIA Program

INERTIA

BAR PROPERTY NUMBER
DESCRIPTION-- PID 107 RACK 75-0010

INPUT		B	H	B1	H1	X	Y	ALF
TYPE	DUM							
RECT	0.00	.06000	.62500	0.00000	0.00000	.47000	0.00000	0.00000
RECT	0.00	.38000	.06000	0.00000	0.00000	.25000	.56500	0.00000
RECT	0.00	.06000	.62500	0.00000	0.00000	.03000	.56500	0.00000
RECT	0.00	.09400	.62500	0.00000	0.00000	.54700	0.00000	0.00000

OUTPUT

NO.	AREA	XC	YC	IX	IY	IXY	K
1	.03750	.47000	.31250	.00122	.00001	0.00000	.00005
2	.02280	.25000	.59500	.00001	.00027	0.00000	.00003
3	.03750	.03000	.87750	.00122	.00001	0.00000	.00005
4	.05875	.54700	.31250	.00191	.00004	0.00000	.00017

Orientation of Beam Elements w.r.t. Basic Coordinate System is shown below for :

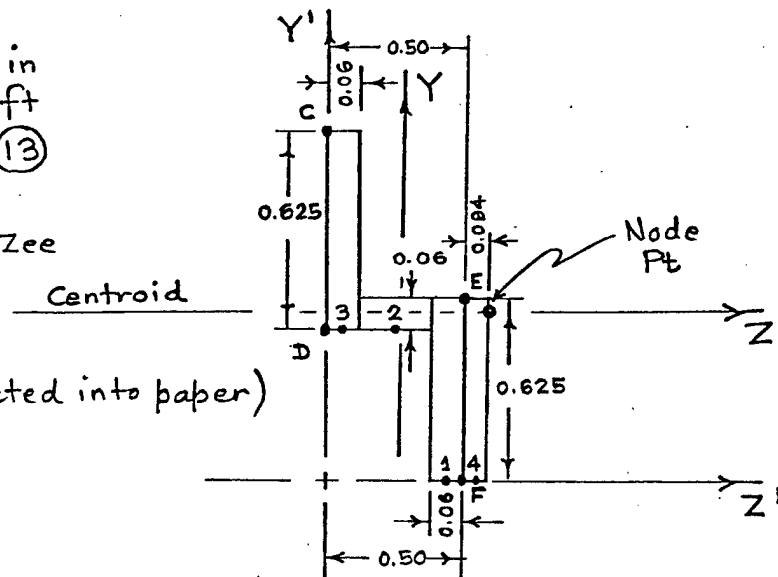
CBAR 380 thru 384 and
CBAR 390, 392 thru 399

DESCRIPTION:

Zee Sections in
Right and Left
Side Panels (13)
on Dwg's

0.06X0.50X1.0 Zee
AL 2024-T3

(X^1 - directed into paper)



C, D, E, F are NASTRAN stress output points

CBAR 380 thru 384

Basic Coordinate
Directions

∇ Components

$$X_1 = 0.0 \quad Y_1 = 1.0 \quad Z_1 = 1.0$$

Offsets will be :

$$X_a = -0.233 \quad X_b = -0.233$$

$$Y_a = 0.0 \quad Y_b = 0.0$$

$$Z_a = 0.0 \quad Z_b = 0.0$$

CBAR 390, 392 thru 399

Basic Coordinate
Directions

∇ Components

$$X_1 = 0.0 \quad Y_1 = -1.0 \quad Z_1 = 1.0$$

Offsets will be :

$$X_a = 0.233 \quad X_b = 0.233$$

$$Y_a = 0.0 \quad Y_b = 0.0$$

$$Z_a = 0.0 \quad Z_b = 0.0$$

PROPERTY NUMBER: PID 108

ELEMENT NUMBERS:

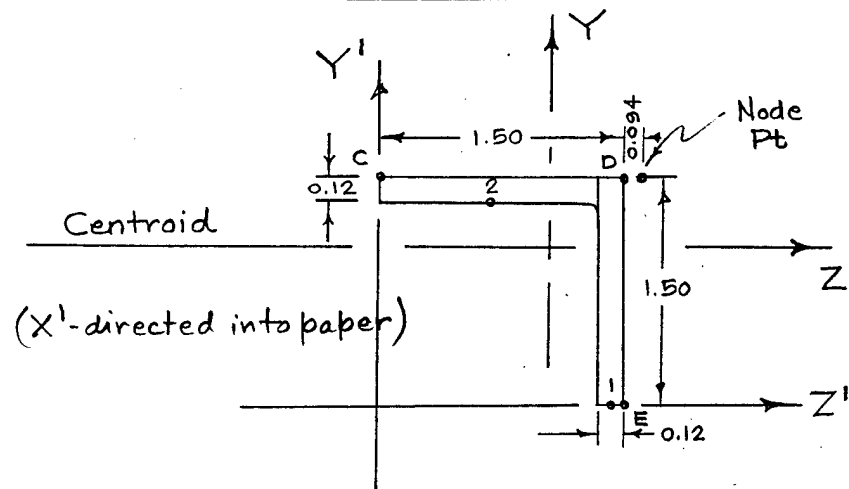
CBAR 308,309

DESCRIPTION:

Left Top Corner

4 (55) on Dwg
0.12 x 1.5 x 1.5

AL 2024-T3



C, D, E are NASTRAN Stress Output points

CALCULATIONS:

The following information will be input to the INERTIA program which will calculate section properties for the above member.

Rectangle No.	Basic Dimensions B_i	H_i	Loc Pt Coordinates * Z'_i	Y'_i
1	0.12	1.50	1.44	0.0
2	1.38	0.12	0.69	1.38

* "Z" corresponds to "X" in the INERTIA program

INERTIA

BAR PROPERTY NUMBER

DESCRIPTION- PID 108 RACK 75-0010

INPUT

TYPE	DUM	B	H	B1	H1	X	Y	ALF
RECT	0.00	.12000	1.50000	0.00000	0.00000	1.44000	0.00000	0.00000
RECT	0.00	1.38000	.12000	0.00000	0.00000	.69000	1.38000	0.00000

OUTPUT

NO.	AREA	XC	YC	IX	IY	IXY	K
1	.18000	1.44000	.75000	.03375	.00022	0.00000	.00086
2	.16560	.69000	1.44000	.00020	.02628	0.00000	.00079

[illegible]

Orientation of Beam Elements w.r.t. Basic Coordinate System is shown below for

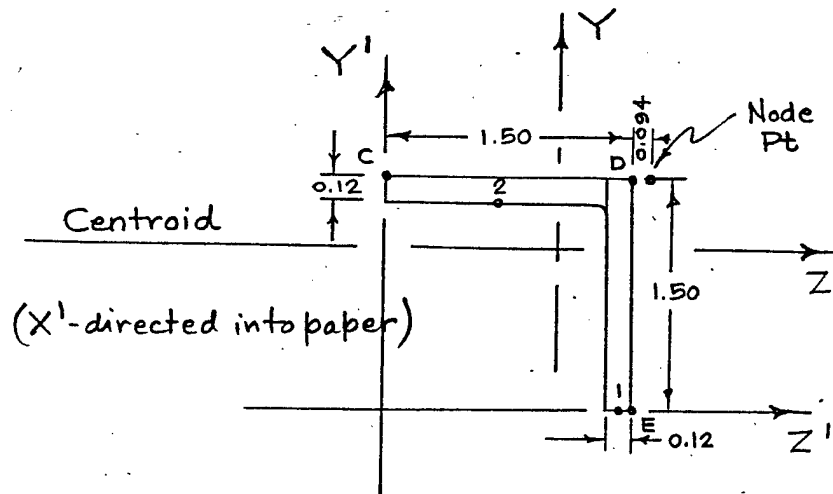
CBAR 308,309

DESCRIPTION:

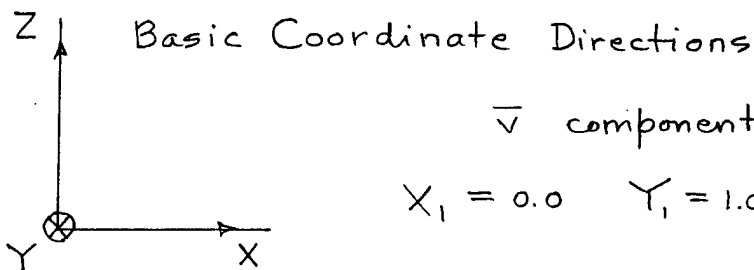
Left Top Corner

4 (55) on Dwg
0.12x1.5x1.5 4

AL 2024-T3



C, D, E are NASTRAN Stress Output points



$\bar{v}$ components

$$X_1 = 0.0 \quad Y_1 = 1.0 \quad Z_1 = 1.0$$

Offsets will be:

$$X_a = -0.514$$

$$X_b = -0.514$$

$$Y_a = 0.0$$

$$Y_b = 0.0$$

$$Z_a = -0.420$$

$$Z_b = -0.420$$

PROPERTY NUMBER: PID 109

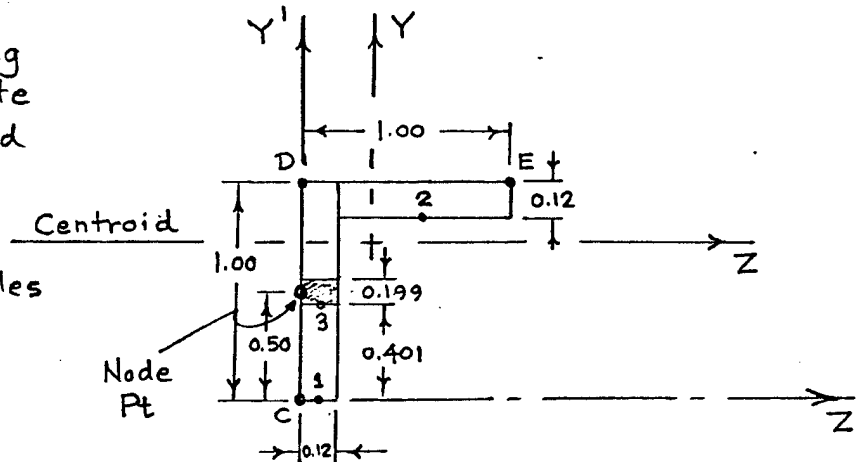
ELEMENT NUMBERS: CBAR 404, 405, 408 thru 411, 413, 415, 416
418, 420, 421, 423, 425, 426
428, 430, 431, 433, 435, 436

DESCRIPTION:

Diagonal Bracing
for Intermediate
Bays designated

⑦ ⑨

0.12x1.0x1.0 angles
AL 2024-T3



C, D, E are NASTRAN stress output points

CALCULATIONS:

The following information will be input to the INERTIA program which will calculate section properties for the above pictured member.

Rectangle No.	Loc Pt. Coordinates		Basic Dimensions	
	Z_i	Y_i	B_i	H_i
1	0.06	0.0	0.12	1.00
2	0.56	0.88	0.88	0.12
* 3	0.06	0.401	0.12	0.199

* Negative Area

INERTIA

WRITTEN BY ANAMET LABORATORIES
SAN CARLOS, CA.

BAR PROPERTY NUMBER
DESCRIPTION- PID109 RACK 75-0010

INPUT

TYPE	DUM	B	H	B1	H1	X	Y	ALF
RECT	0.00	.1200E+00	.1000E+010.	0.	0.	.6000E-010.	0.	
RECT	0.00	.8800E+00	.1200E+000.	0.	0.	.5600E+00	.8800E+000.	
RECT	-1.00	.1200E+00	.1990E+000.	0.	0.	.6000E-01	.4010E+000.	

OUTPUT

NO.	AREA	XC	YC	IX	IY	IXY	K
1	.120E+00	.600E-01	.500E+00	.100E-01	.144E-03	0.	.576E-03
2	.106E+00	.560E+00	.940E+00	.127E-03	.681E-02	0.	.507E-03
3	-.239E-01	.600E-01	.501E+00	-.788E-04	-.287E-04	0.	-.115E-03

TOTAL AREA=	.202E+00
X CENTROID DISTANCE=	.322E+00
Y CENTROID DISTANCE=	.730E+00
IX (ABOUT CENTROID)=	.198E-01
IY (ABOUT CENTROID)=	.195E-01
IXY (ABOUT CENTROID)=	.111E-01
IMAX=	.307E-01
IMIN=	.858E-02
ALPHA=	-.446E+02
TORSIONAL CONSTANT, K=	.968E-03
IX (ABOUT INPUT AXIS)=	.127E+00
IY (ABOUT INPUT AXIS)=	.404E-01
IXY (ABOUT INPUT AXIS)=	.585E-01
TORSIONAL CONSTANT BASED ON SUM NOT NECESSARILY ACCURATE	

PROPERTY NUMBER: PID 110

ELEMENT NUMBERS:

CBAR 310,311

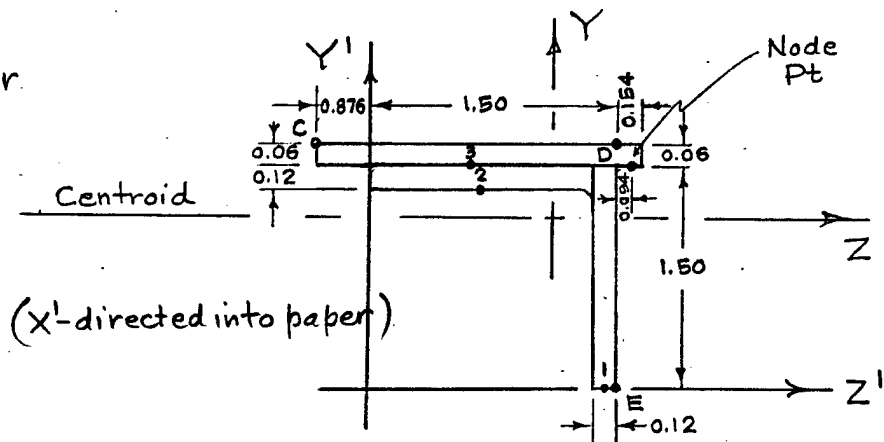
DESCRIPTION:

Right Top Corner

4 (55) on Dwg

0.12 X 1.5 X 1.5 4

AL 2024-T3



C, D, E are NASTRAN Stress Output Points

CALCULATIONS:

The following information will be input to the INERTIA program which will calculate section properties for the above member.

Rectangle No.	Basic Dimensions		Loc Pt Coordinates	
	B_i	H_i	* Z'_i	Y'_i
1	0.12	1.50	1.44	0.0
2	1.38	0.12	0.69	1.38
3	2.53	0.06	0.389	1.50

*"Z" corresponds to "X" in the INERTIA program

BAR PROPERTY NUMBER
DESCRIPTION- PID-110-RACK-75-0010

E-160

[illegible]

Orientation of Beam Elements w.r.t. Basic Coordinate System is shown below for
CBAR 310, 311

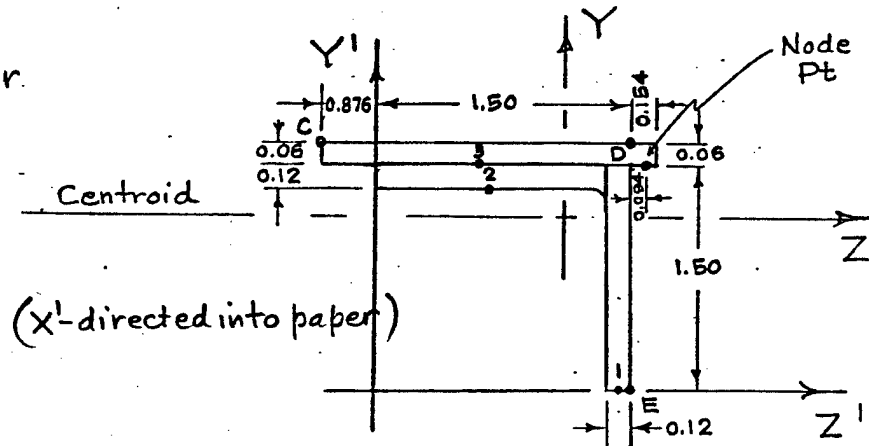
DESCRIPTION:

Right Top Corner

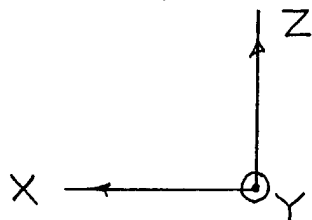
4 (55) on Dwg

0.12 X 1.5 X 1.5 4

AL 2024-T3



C, D, E are NASTRAN Stress Output Points



Basic Coordinate Directions
∇ components

$$X_1 = 0.0 \quad Y_1 = -1.0 \quad Z_1 = 1.0$$

Offsets will be:

$$X_a = 0.724$$

$$X_b = 0.724$$

$$Y_a = 0.0$$

$$Y_b = 0.0$$

$$Z_a = -0.280$$

$$Z_b = -0.280$$

PROPERTY NUMBER: PID111 (continued)

Orientation of Beam Element w.r.t. Basic Coordinate System is shown below for:

(a) CBAR 443, 444, 461, 462, 466 thru 468, 472 thru 474, and 478 thru 481

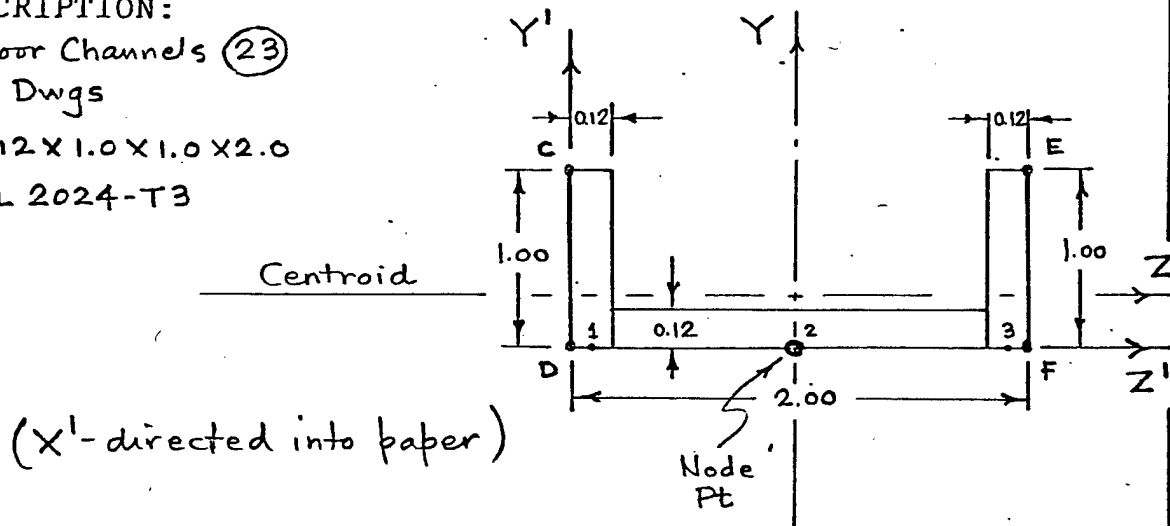
(b) CBAR 463 thru 465, 469 thru 471, 475 thru 477, and 482 thru 485

DESCRIPTION:

Floor Channels (23)
on Dwg's

0.12 X 1.0 X 1.0 X 2.0

AL 2024-T3



C, D, E, F are NASTRAN Stress Output Points

(a) Z Basic Coordinate Directions

Y ⊗ X

$\bar{V}$ Components

$X_1 = 0.0$ $Y_1 = 1.0$ $Z_1 = 1.0$

Offsets will be:

$X_a = 0.0$ $X_b = 0.0$

$Y_a = 0.0$ $Y_b = 0.0$

$Z_a = 0.294$ $Z_b = 0.294$

(b) Z Basic Coordinate Directions

X ← Y ⊙

$\bar{V}$ Components

$X_1 = 0.0$ $Y_1 = -1.0$ $Z_1 = 1.0$

Offsets will be:

$X_a = 0.0$ $X_b = 0.0$

$Y_a = 0.0$ $Y_b = 0.0$

$Z_a = 0.294$ $Z_b = 0.294$

INERTIA

WRITTEN BY ANAMET LABORATORIES
SAN CARLOS, CA.

BAR PROPERTY NUMBER
DESCRIPTION- PID III RACK 75-0010

INPUT

TYPE	DUM	B	H	BI	H1	X	Y	ALF
RECT	0.00	.1200E+00	.1000E+010.	0.		.6000E-010.	0.	
RECT	0.00	.1760E+01	.1200E+000.	0.		.1000E+010.	0.	
RECT	0.00	.1200E+00	.1000E+010.	0.		.1940E+010.	0.	

OUTPUT

NO.	AREA	XC	YC	IX	IY	IXY	K
1	.120E+00	.600E-01	.500E+00	.100E-01	.144E-03	0.	.576E-03
2	.211E+00	.100E+01	.600E-01	.253E-03	.545E-01	0.	.101E-02
3	.120E+00	.194E+01	.500E+00	.100E-01	.144E-03	0.	.576E-03

```
*****  
TOTAL AREA= .451E+00  
X CENTROID DISTANCE= .100E+01  
Y CENTROID DISTANCE= .294E+00  
IX (ABOUT CENTROID)= .420E-01  
IY (ABOUT CENTROID)= .267E+00  
IXY (ABOUT CENTROID)= .888E-15  
IMAX= .420E-01  
IMIN= .267E+00  
ALPHA= -.180E+03  
TORSIONAL CONSTANT, K= .217E-02  
IX (ABOUT INPUT AXIS)= .810E-01 Y= 0.  
IY (ABOUT INPUT AXIS)= .718E+00 X= 0.  
IXY (ABOUT INPUT AXIS)= .133E+00  
  
TORSIONAL CONSTANT BASED ON SUM  
NOT NECESSARILY ACCURATE  
  
*****
```

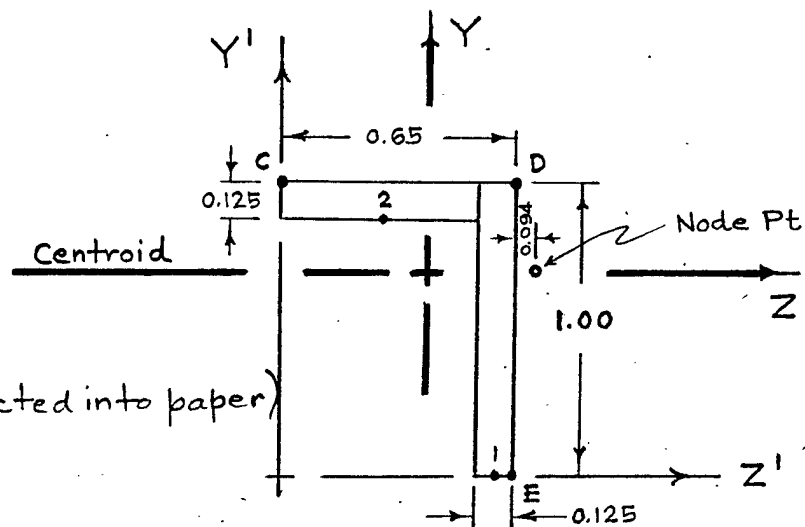
PROPERTY NUMBER: PID 112

ELEMENT NUMBERS: CBAR 286 thru 289

DESCRIPTION:

(77) Angles in
Right Side
Panel

0.125 x 0.65 x 1.0 x
AL 2024-T3



C, D, E are NASTRAN Stress Output Pts

CALCULATIONS:

The following information was input to the INERTIA program which calculated section properties for the above member.

Rectangle No	Basic Dimensions B_i	H_i	Loc Pt * Z_i	Coordinates Y_i
1	0.125	1.00	0.588	0.0
2	0.525	0.125	0.263	0.875

* "Z" corresponds to "X" in INERTIA program

INERTIA											
BAR PROPERTY NUMBER											
DESCRIPTION- PID 112 RACK 75-0010											
INPUT											
TYPE	DUM	B	H	B1	H1	X	Y	ALF			
RECT 0.00		.12500	1.00000	0.00000	0.00000	.58800	0.00000	0.00000			
RECT 0.00		.52500	.12500	0.00000	0.00000	.26300	.87500	0.00000			
OUTPUT											
NO.	AREA	XC	YC	IX	IY	IXY	K				
1	.12500	.58800	.50000	.01042	.00016	0.00000	.00065				
2	.06563	.26300	.93750	.00009	.00151	0.00000	.00034				

[illegible]

INERTIA											
BAR PROPERTY NUMBER											
DESCRIPTION- PID 112 RACK 75-0010											
INPUT											
TYPE	DUM	B	H	B1	H1	X	Y	ALF			
RECT 0.00		.12500	1.00000	0.00000	0.00000	.58800	0.00000	0.00000			
RECT 0.00		.52500	.12500	0.00000	0.00000	.26300	.87500	0.00000			
OUTPUT											
NO.	AREA	XC	YC	IX	IY	IXY	K				
1	.12500	.58800	.50000	.01042	.00016	0.00000	.00065				
2	.06563	.26300	.93750	.00009	.00151	0.00000	.00034				

INERTIA											
BAR PROPERTY NUMBER											
DESCRIPTION- PID 112 RACK 75-0010											
INPUT											
TYPE	DUM	B	H	B1	H1	X	Y	ALF			
RECT 0.00		.12500	1.00000	0.00000	0.00000	.58800	0.00000	0.00000			
RECT 0.00		.52500	.12500	0.00000	0.00000	.26300	.87500	0.00000			
OUTPUT											
NO.	AREA	XC	YC	IX	IY	IXY	K				
1	.12500	.58800	.50000	.01042	.00016	0.00000	.00065				
2	.06563	.26300	.93750	.00009	.00151	0.00000	.00034				

INERTIA											
BAR PROPERTY NUMBER											
DESCRIPTION- PID 112 RACK 75-0010											
INPUT											
TYPE	DUM	B	H	B1	H1	X	Y	ALF			
RECT 0.00		.12500	1.00000	0.00000	0.00000	.58800	0.00000	0.00000			
RECT 0.00		.52500	.12500	0.00000	0.00000	.26300	.87500	0.00000			
OUTPUT											
NO.	AREA	XC	YC	IX	IY	IXY	K				
1	.12500	.58800	.50000	.01042	.00016	0.00000	.00065				
2	.06563	.26300	.93750	.00009	.00151	0.00000	.00034				

INERTIA											
BAR PROPERTY NUMBER											
DESCRIPTION- PID 112 RACK 75-0010											
INPUT											
TYPE	DUM	B	H	B1	H1	X	Y	ALF			
RECT 0.00		.12500	1.00000	0.00000	0.00000	.58800	0.00000	0.00000			
RECT 0.00		.52500	.12500	0.00000	0.00000	.26300	.87500	0.00000			
OUTPUT											
NO.	AREA	XC	YC	IX	IY	IXY	K				
1	.12500	.58800	.50000	.01042	.00016	0.00000	.00065				
2	.06563	.26300	.93750	.00009	.00151	0.00000	.00034				

TOTAL AREA=	.191E+00
X CENTROID DISTANCE=	.476E+00
Y CENTROID DISTANCE=	.651E+00
IX (ABOUT CENTROID)=	.187E-01
IY (ABOUT CENTROID)=	.622E-02
IXY (ABOUT CENTROID)=	-.612E-02
IMAX=	.212E-01
IMIN=	.372E-02
ALPHA=	.222E+02
TORSIONAL CONSTANT, K=	.993E-03
IX (ABOUT INPUT AXIS)=	.994E-01
IY (ABOUT INPUT AXIS)=	.494E-01
IXY (ABOUT INPUT AXIS)=	.529E-01
TORSIONAL CONSTANT BASED ON SUM NOT NECESSARILY ACCURATE	

Orientation of Beam Elements w.r.t. Basic Coordinate System is shown below for:

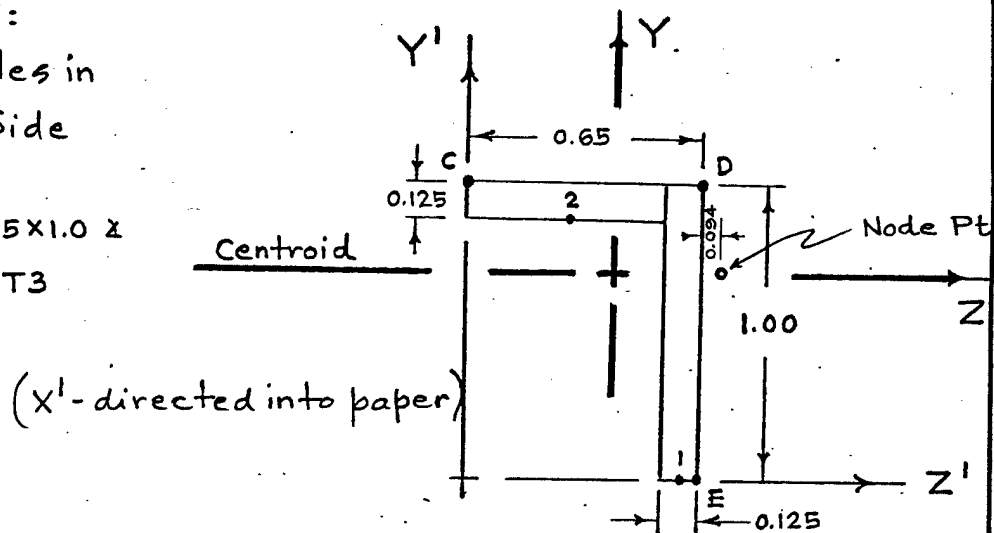
CBAR 286 thru 289

DESCRIPTION:

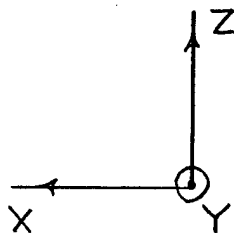
(77) Angles in
Right Side
Panel

0.125 x 0.65 x 1.0 x

AL 2024-T3



C, D, E are NASTRAN Stress Output Pts



Basic Coordinate Directions

∇ components

$$X_1 = 0.0 \quad Y_1 = -1.0 \quad Z_1 = 1.0$$

Offsets will be:

$$X_a = 0.268$$

$$X_b = 0.268$$

$$Y_a = 0.0$$

$$Y_b = 0.0$$

$$Z_a = 0.0$$

$$Z_b = 0.0$$

PROPERTY NUMBER: PID 113

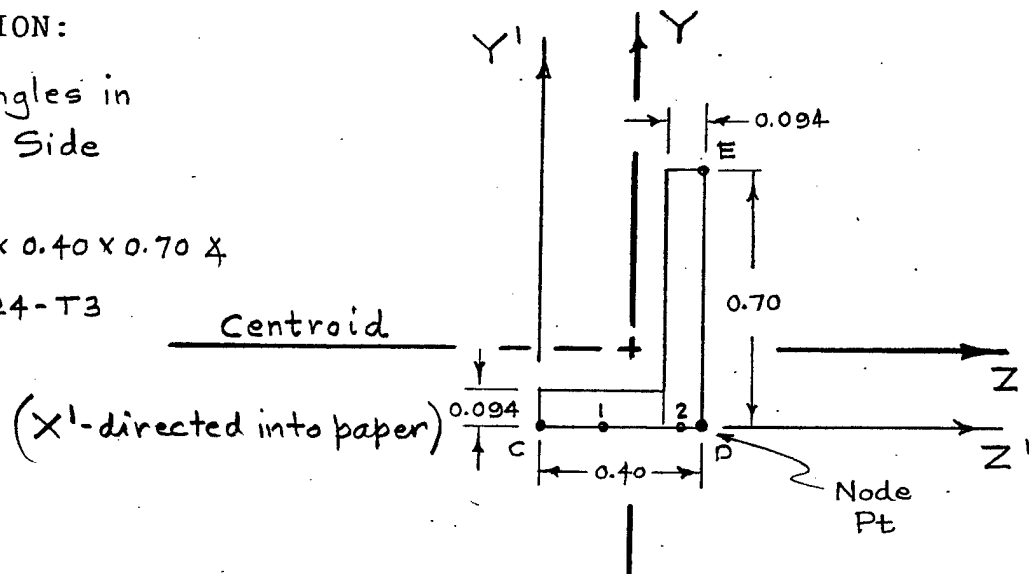
ELEMENT NUMBERS: CBAR 290 thru 292

DESCRIPTION:

(76) Angles in
Right Side
Panel

0.094 x 0.40 x 0.70 x

AL 2024-T3



C, D, E are NASTRAN Stress Output Points

CALCULATIONS:

The following information was input to the INERTIA program which calculated section properties for the above member.

Rectangle No.	Basic Dimensions		Loc Pt Coordinates	
	B_i	H_i	* Z'_i	Y'_i
1	0.306	0.094	0.153	0.0
2	0.094	0.70	0.353	0.0

* "Z" corresponds to "X" in the INERTIA program

[illegible][illegible][illegible][illegible][illegible][illegible]

```

*****  

TOTAL AREA= .946E+01  

X CENTROID DISTANCE= .292E+00  

Y CENTROID DISTANCE= .258E+00  

IX (ABOUT CENTROID)= .455E-02  

IY (ABOUT CENTROID)= .107E-02  

IXY (ABOUT CENTROID)= .121E-02  

IMAX= .493E-02  

IMIN= .692E-03  

ALPHA= -.175E+02  

TORSIONAL CONSTANT, K= .279E-03  

IX (ABOUT INPUT AXIS)= .108E-01  

IY (ABOUT INPUT AXIS)= .915E-02  

IXY (ABOUT INPUT AXIS)= .834E-02  

Y= 0.  

X= 0.  

TORSIONAL CONSTANT BASED ON SUM  

NOT NECESSARILY ACCURATE  

*****

```

Orientation of Beam Elements w.r.t. Basic Coordinate System is shown below for:

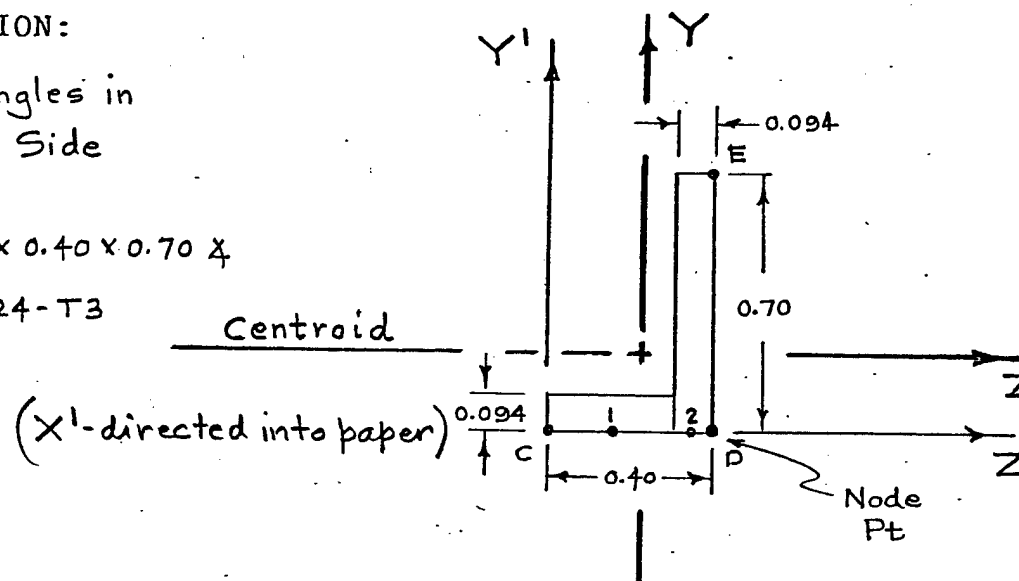
CBAR 290 thru 292

DESCRIPTION:

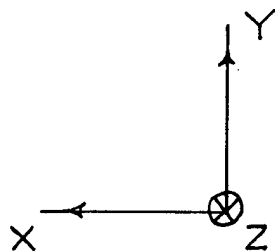
(76) Angles in
Right Side
Panel

0.094 x 0.40 x 0.70 x

AL 2024-T3



C, D, E are NASTRAN Stress Output Points



Basic Coordinate System

∇ components

$$X_1 = 0.0 \quad Y_1 = 1.0 \quad Z_1 = 1.0$$

Offsets will be:

$$X_a = 0.108$$

$$X_b = 0.108$$

$$Y_a = 0.258$$

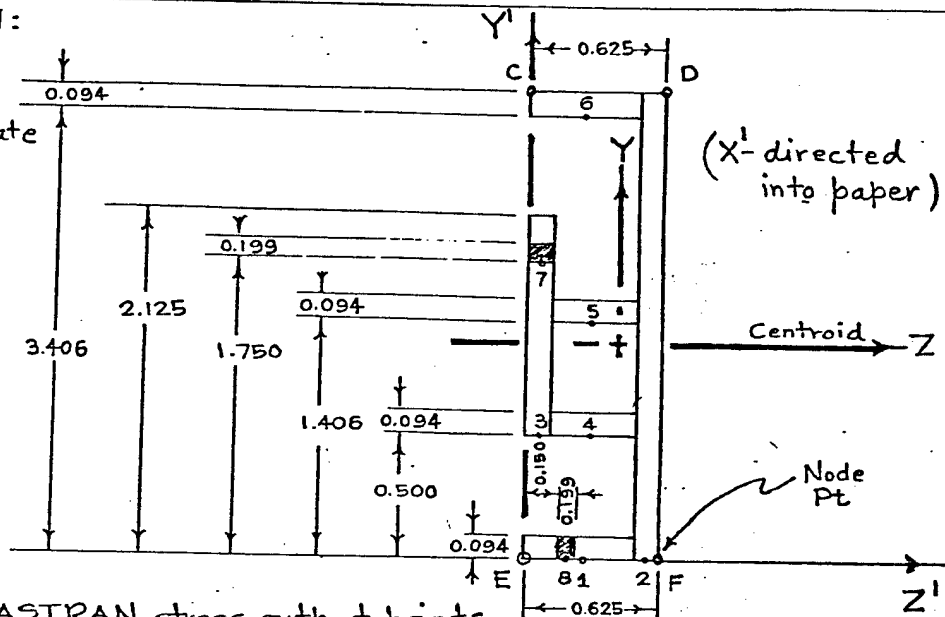
$$Y_b = 0.258$$

$$Z_a = 0.0$$

$$Z_b = 0.0$$

CBAR 215 thru 250

Vertical
Posts (5) =
@ intermediate
bays (back)
AL6061-T6



C, D, E, F are NASTRAN stress output points

The following information will be input to the INERTIA program from which section properties will be calculated

Rectangle No.	Basic Dimensions B_i	H_i	Loc Pt ** Z_i	Coordinates Y_i
1	0.531	0.094	0.266	0.0
2	0.094	3.500	0.578	0.0
3	0.094	1.625	0.047	0.500
4	0.437	0.094	0.313	0.500
5	0.437	0.094	0.313	1.406
6	0.531	0.094	0.266	3.406
* 7	0.094	0.199	0.047	1.750
* 8	0.199	0.094	0.250	0.0

** "Z" corresponds to "X" in the INERTIA Program

[illegible]

*****	BAR PROPERTY NUMBER	*****
*****	DESCRIPTION	PID 114 RACK 75-0010
*****		*****

INPUT *****

TYPE	DUM	B	H	BI	HI	X	Y	ALF	***
RECT	0.00	.53100	.09400	0.00000	0.00000	.26600	0.00000	0.00000	***
RECT	0.00	.09400	3.50000	0.00000	0.00000	.57800	0.00000	0.00000	***
RECT	0.00	.09400	1.62500	0.00000	0.00000	.04700	.50000	0.00000	***
RECT	0.00	.43700	.09400	0.00000	0.00000	.31300	.50000	0.00000	***
RECT	0.00	.43700	.09400	0.00000	0.00000	.31300	1.40600	0.00000	***
RECT	0.00	.53100	.09400	0.00000	0.00000	.26600	3.40600	0.00000	***
RECT-1.00		.09400	.19900	0.00000	0.00000	.04700	1.75000	0.00000	***
RECT-1.00		.19900	.09400	0.00000	0.00000	.25000	0.00000	0.00000	***

***** OUTPUT *****

NO.	AREA	XC	YC	IX	IY	IXY	K
1	.04991	.26600	.04700	.00004	.00117	0.00000	.00015
2	.32900	.57800	1.75000	.33585	.00024	0.00000	.00097
3	.15275	.04700	1.31250	.03361	.00011	0.00000	.00045
4	.04108	.31300	.54700	.00003	.00065	0.00000	.00012
5	.04108	.31300	1.45300	.00003	.00065	0.00000	.00012
6	.04991	.26600	3.45300	.00004	.00117	0.00000	.00015
7	-.01871	.04700	1.84950	-.00006	-.00001	0.00000	-.00006
8	-.01871	.25000	.04700	-.00001	-.00006	0.00000	-.00006

[illegible]

PROPERTY NUMBER: PID 114 (continued)

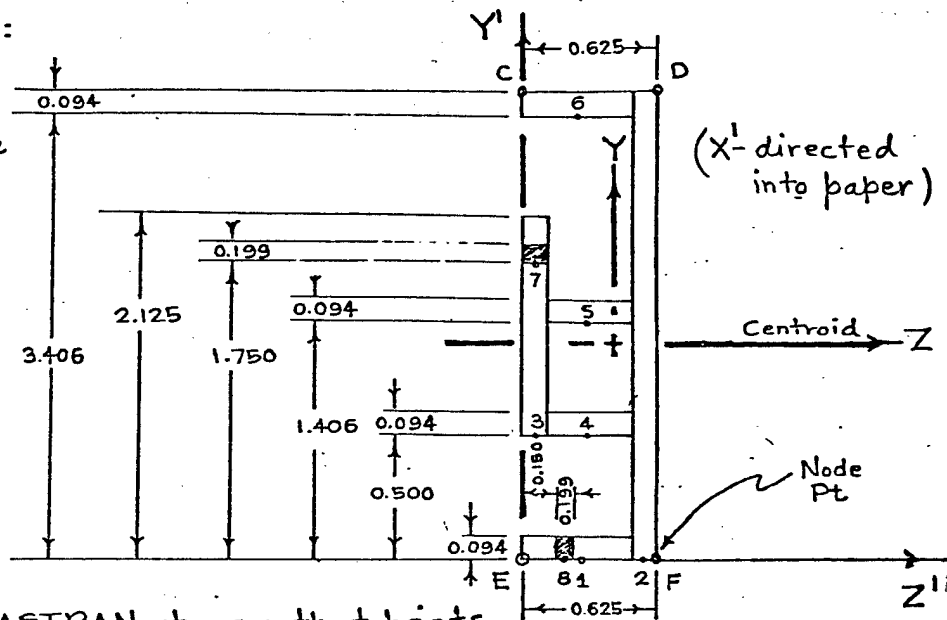
CBAR 215 thru 220

CBAR 227 thru 232

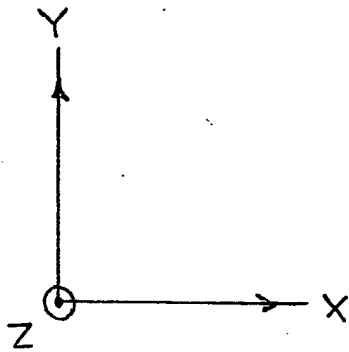
CBAR 239 thru 244

DESCRIPTION:

Vertical
Posts (5)
@ intermediate
bays (back)



C, D, E, F are NASTRAN stress output points



Basic Coordinate Directions
Vector components for $\bar{V}$

$$X_1 = 0.0 \quad Y_1 = 1.0 \quad Z_1 = -1.0$$

Offsets will be:

$$X_a = -0.235 \quad X_b = -0.235$$

$$Y_a = 1.59 \quad Y_b = 1.59$$

$$Z_a = 0.0 \quad Z_b = 0.0$$

PROPERTY NUMBER: PID114 (continued)

CBAR 221 thru 226

CBAR 233 thru 238

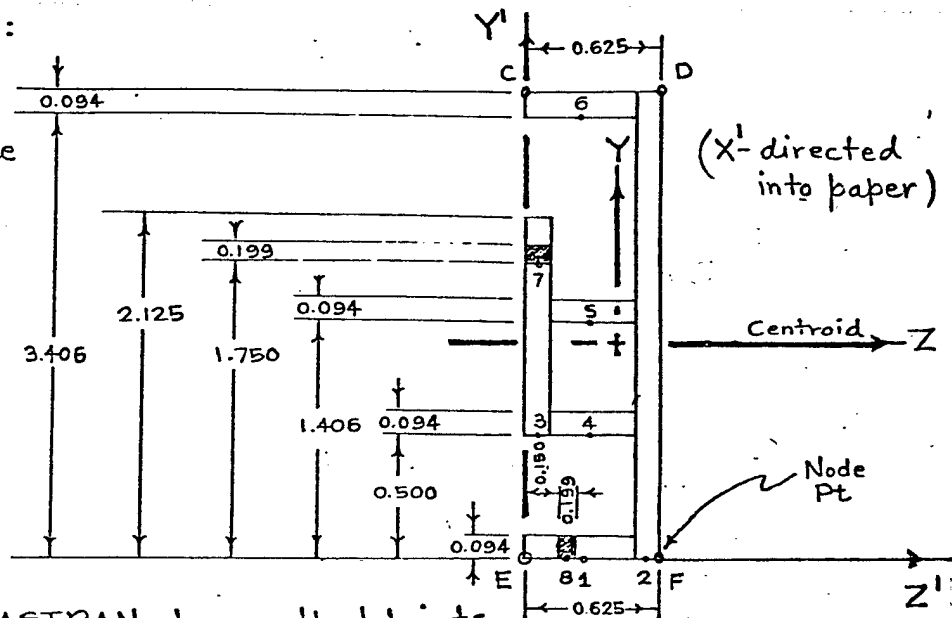
CBAR 245 thru 250

DESCRIPTION:

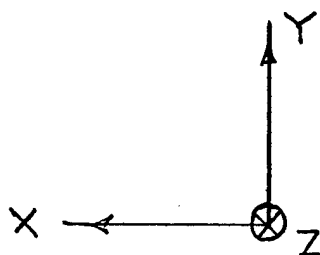
Vertical

Posts (51)

@ intermediate
bays (back)



C, D, E, F are NASTRAN stress output points



Basic Coordinate Directions

Vector Components for $\bar{V}$

$$X_1 = 0.0 \quad Y_1 = 1.0 \quad Z_1 = 1.0$$

Offsets will be:

$$X_a = 0.235$$

$$X_b = 0.235$$

$$Y_a = 1.59$$

$$Y_b = 1.59$$

$$Z_a = 0.0$$

$$Z_b = 0.0$$

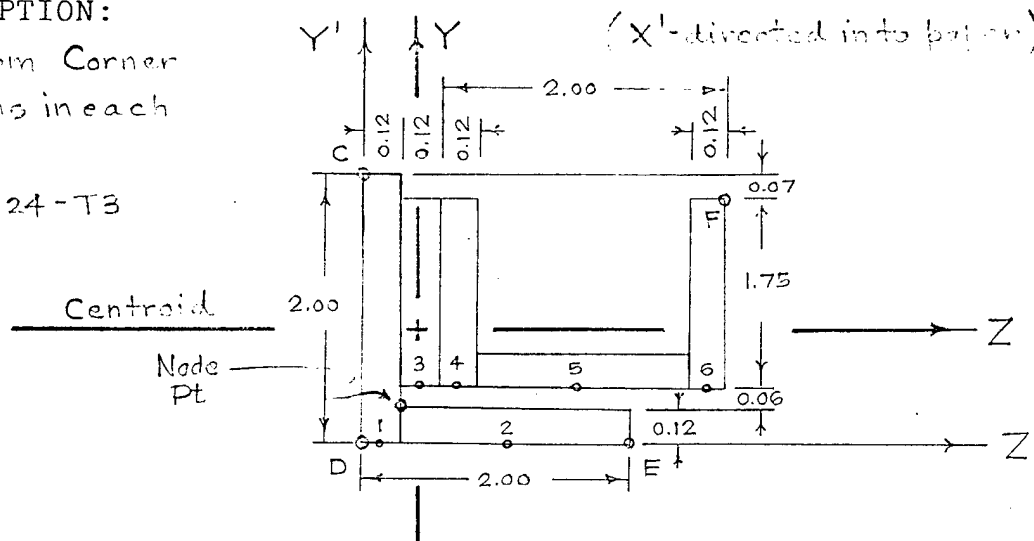
PROPERTY NUMBER: PID 115

ELEMENT NUMBERS: CBAR 252, 253, 257, 261, 265
CBAR 361, 365, 369, 373, 374

DESCRIPTION:

Bottom Corner
Beams in each
bay

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C, D, E, F are NASTRAN Stress Output points

CALCULATIONS:

The following information will be input to the INERTIA program from which section properties for the above member will be calculated

Rectangle No.	Basic Dimensions B_i	H_i	Loc Pt Coordinates * Z_i'	Y_i'
1	0.12	2.00	0.06	0.0
2	1.83	0.12	1.06	0.0
3	0.12	1.75	0.16	0.19
4	0.12	1.75	0.30	0.19
5	1.76	0.12	1.24	0.18
6	0.12	1.75	2.16	0.19

*"Z" coordinates to be "X" in the INERTIA Program

INERTIA

BAR PROPERTY NUMBER
DESCRIPTION- PID-115 RACK 75-0010

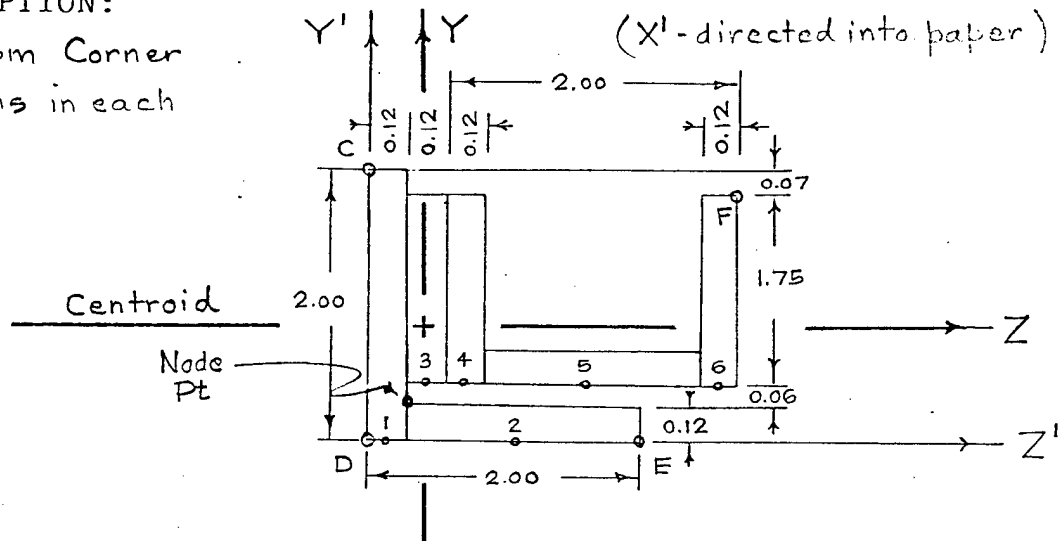
INPUT	TYPE	DUM	B	H	B1	H1	X	Y	ALF
RECT	0.00	.12000	2.00000	0.00000	0.00000	0.00000	.06000	0.00000	0.00000
RECT	0.00	1.88000	.12000	0.00000	0.00000	0.00000	1.06000	0.00000	0.00000
RECT	0.00	.12000	1.75000	0.00000	0.00000	0.00000	.18000	.18000	0.00000
RECT	0.00	.12000	1.75000	0.00000	0.00000	0.00000	.30000	.18000	0.00000
RECT	0.00	1.76000	.12000	0.00000	0.00000	0.00000	1.24000	.18000	0.00000
RECT	0.00	.12000	1.75000	0.00000	0.00000	0.00000	2.18000	.18000	0.00000

OUTPUT								
NO.	AREA	XC	YC	IX	IY	IXY	K	
1	.24000	.06000	1.00000	.08000	.00029	0.00000	.00115	
2	.22560	1.06000	.06000	.00027	.06645	0.00000	.00108	
3	.21000	.18000	1.05500	.05359	.00025	0.00000	.00101	
4	.21000	.30000	1.05500	.05359	.00025	0.00000	.00101	
5	.21120	1.24000	.24000	.00025	.05452	0.00000	.00101	
6	.21000	2.18000	1.05500	.05359	.00025	0.00000	.00101	

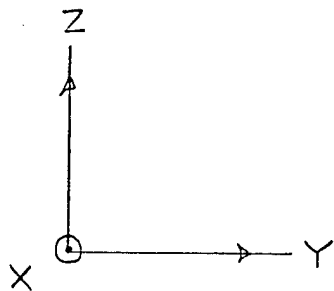
Orientation of beam element w.r.t. Basic Coordinate System is shown below for
CBAR 252, 253, 257, 261, 265

DESCRIPTION:

Bottom Corner
Beams in each
bay



C, D, E, F are NASTRAN Stress Output points



Basic Coordinate Directions

Vector Components for ∇

$$X_1 = -1.0 \quad Y_1 = 0.0 \quad Z_1 = 1.0$$

Offsets will be

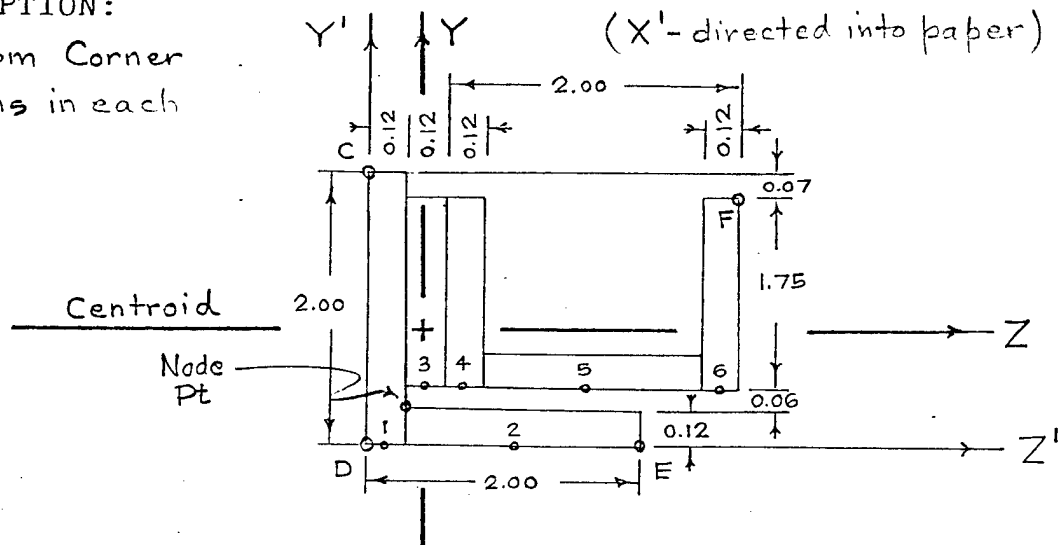
$$\begin{array}{ll} X_a = 0.0 & X_b = 0.0 \\ Y_a = 0.702 & Y_b = 0.702 \\ Z_a = 0.621 & Z_b = 0.621 \end{array}$$

Orientation of Beam Element w.r.t. Basic Coordinate System is shown below for:

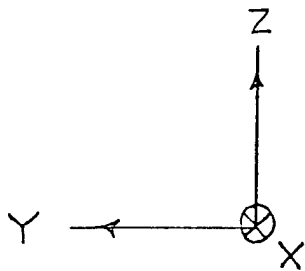
CBAR 361, 365, 369, 373, 374

DESCRIPTION:

Bottom Corner
Beams in each
bay



C, D, E, F. are NASTRAN Stress Output points



Basic Coordinate Directions
Vector Components for $\bar{V}$

$$X_1 = 1.0 \quad Y_1 = 0.0 \quad Z_1 = 1.0$$

Offsets will be:

$$X_a = 0.0$$

$$X_b = 0.0$$

$$Y_a = -0.702$$

$$Y_b = -0.702$$

$$Z_a = 0.621$$

$$Z_b = 0.621$$

PROPERTY NUMBER: PID 116

ELEMENT NUMBERS: CBAR 402, 403, 406, 407, 412, 414, 417, 419
422, 424, 427, 429, 432, 434, 486, 487

DESCRIPTION:

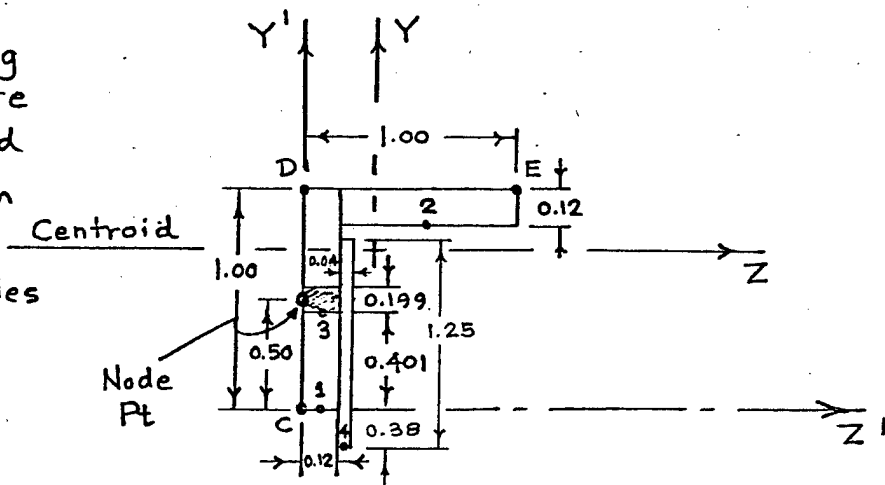
Diagonal Bracing
for Intermediate
Bays designated

⑦ and ⑪ on

Dwgs

0.12x1.0x1.0 angles

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C, D, E are NASTRAN stress output prints

CALCULATIONS:

The following information will be input to the INERTIA program which will calculate section properties for the above pictured member.

Rectangle No.	Loc Pt. Coordinates **Z _i	Y _i	Basic Dimensions B _i H _i	
1	0.06	0.0	0.12	1.00
2	0.56	0.88	0.88	0.12
* 3	0.06	0.401	0.12	0.199
4	0.14	-0.38	0.04	1.25

* Negative Area

** "Z" corresponds to "X" in the INERTIA program

INERTIA

BAR PROPERTY NUMBER
DESCRIPTION= PID 116 RAEK 75-0010

INPUT		B	H	B1	H1	X	Y	ALF
TYPE	DUM							
RECT	0.00	.12000	1.00000	0.00000	0.00000	.06000	0.00000	0.00000
RECT	0.00	.88000	.12000	0.00000	0.00000	.56000	.88000	0.00000
RECT	1.00	.12000	.19900	0.00000	0.00000	.06000	.40100	0.00000
RECT	0.00	.04000	1.25000	0.00000	0.00000	.14000	.38000	0.00000

OUTPUT		XC	YC	IX	IY	IXY	K
NO.	AREA						
1	.12000	.06000	.50000	.01000	.00014	0.00000	.00058
2	.10560	.56000	.94000	.00013	.00681	0.00000	.00051
3	-.02388	.06000	.50050	-.00008	-.00003	0.00000	-.00011
4	.05000	.14000	.24500	.00651	.00001	0.00000	.00003

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APPENDIX F

ELASTIC PROPERTIES AND ALLOWABLES
FOR ISOLATORS

Presented in this appendix are the results of experimental tests in which the isolators were subjected to tensile loading in order to determine the spring constant and allowable load. The results are shown in the following figures. This information has been obtained from tests by Air Force personnel and is documented in Reference 4.

An examination of these curves reveals an allowable load of approximately 5,000 lb. in tension.

Barry Mount C-2150-T6

Tensile load Tests

20, 21 Jan '77

D. H. Smith

Note: Mounts 1, 2, & 3 were previously subjected to 4000# compression loads. 3, 4, and 5 were subjected to 4000# tensile loads (and unloaded) 20 Jan. On 21 Jan, 1, 2, 3, & 6 were loaded to failure.

5000

4000

3000

2000

1000

0

Load (psi.)

0

10

20

30

40

50

60

70

80

90

Deflection, inches

