DISTRIBUTION SHEET

To	From	Page 1 of 1
Distribution	Civil/Structural Engineering	Date 4/26/95
Project Title/Work Order		EDT No.
Seismic Analysis of Equipment in 2736-Z Complex		ECN No. 615960

Name	MSIN	Text With All Attach.	Text Only	Attach./ Appendix Only	EDT/ECN Only
E. P. Bonadie	T5-55	X			
T. J. Conrads	B1-17	X			
O. P. Dhiman	T4-20	X			
S. K. Farnworth	H5-57	X			
M. W. Gibson	T5-55	X			
R. A. Giller	H5-55	X			
G. A. Glover	T4-20	X			
E. G. Hess	T4-18				X
M. A. Islam	H5-57	X			
C. M. Kronvall	T5-53	X			
S. B. Merrick	T4-20	X			
C. J. Moore	H5-57	X			
S. E. Nunn	T4-18	X			
E. C. Ocoma (2)	H5-55	X			
A. L. Ramble	H4-68	X			
R. D. Redekopp	T5-50				X
L. H. Rodgers	T5-54	X			
M. S. Ruben	E6-46	X			
A. K. Sharma	H5-60				X
R. W. Szempruch (6)	T4-18	X			
M. D. Talbot	T5-52	X			
R. J. Thomas	T4-20	X			
M. P. Weis	S3-09	X			
E. V. Weiss	T3-01	X			
Central Files	L8-04	X			
OSTI (2)	L8-07	X			

DISCLAIMER

Portions of this document may be illegible in electronic image products. Images are produced from the best available original document.

ENGINEERING CHANGE NOTICE

Page 1 of 12

1. ECN 615960

Proj. ECN

2. ECN Category (mark one)	3. Originator's Name, Organization, MSIN, and Telephone No.	3a. USQ Required?	4. Date
Supplemental [] Direct Revision [x] Change ECN [] Temporary [] Standby [] Supersedure [] Cancel/Void []	EC Ocoma / Civil-Struc. Engr. H5-57 / 6-0332 57200	[] Yes [X] No	4/26/95
	5. Project Title/No./Work Order No. Seismic Analysis of Equipment in 2736-Z Complex / K6058	6. Bldg./Sys./Fac. No. 2736-Z Complex	7. Approval Designator QS KN
	8. Document Numbers Changed by this ECN (includes sheet no. and rev.) WHC-SD-CP-SA-026, Revision 0	9. Related ECN No(s). N/A	10. Related PO No. N/A

11a. Modification Work	11b. Work Package No.	11c. Modification Work Complete	11d. Restored to Original Condition (Temp. or Standby ECN only)
[] Yes (fill out Blk. 11b) [X] No (NA Blks. 11b, 11c, 11d)	N/A	N/A Cog. Engineer Signature & Date	N/A Cog. Engineer Signature & Date

12. Description of Change

Revsion 0 text is replaced with Revision 1 text.
Revision 0 Appendices are brought forward intact.
Pages A-60 thru A-158 are added to Appendix A.
Pages B-31 thru B-92 are added to Appendix B.
Pages C-57 thru C-385 are added to Appendix C.
Appendix D is brought entirely from Revision 0.
New Appendices E, F and G are added to Revision 1.

NOTE: Appendices were not completely rewritten to agree with the contents of the new text for Revision 1. This was done to satisfy budget and schedule limitations.

13a. Justification (mark one)

Criteria Change	[X]	Design Improvement	[]	Environmental	[]	Facility Deactivation	[]
As-Found	[]	Facilitate Const	[]	Const. Error/Omission	[]	Design Error/Omission	[]

13b. Justification Details

To reconcile the U. S. DOE review comments from the Revision 0. These comments were dispositioned in Reference [21].

14. Distribution (include name, MSIN, and no. of copies)

[SEE DISTRIBUTION SHEET]

RELEASE STAMP

OFFICIAL RELEASE BY WHC
DATE MAY 03 1995
Sta. 21

A-7900-013-2 (11/94) GEF095

ENGINEERING CHANGE NOTICE	Page 2 of 2	1. ECN (use no. from pg. 1) 615960

15. Design Verification Required	16. Cost Impact		17. Schedule Impact (days)
	ENGINEERING	CONSTRUCTION	
[X] Yes Independent Review	Additional [] $	Additional [] $	Improvement []
[] No	Savings [] $	Savings [] $	Delay []

18. Change Impact Review: Indicate the related documents (other than the engineering documents identified on Side 1) that will be affected by the change described in Block 12. Enter the affected document number in Block 19.

SDD/DD	[]	Seismic/Stress Analysis	[]	Tank Calibration Manual	[]
Functional Design Criteria	[]	Stress/Design Report	[]	Health Physics Procedure	[]
Operating Specification	[]	Interface Control Drawing	[]	Spares Multiple Unit Listing	[]
Criticality Specification	[]	Calibration Procedure	[]	Test Procedures/Specification	[]
Conceptual Design Report	[]	Installation Procedure	[]	Component Index	[]
Equipment Spec.	[]	Maintenance Procedure	[]	ASME Coded Item	[]
Const. Spec.	[]	Engineering Procedure	[]	Human Factor Consideration	[]
Procurement Spec.	[]	Operating Instruction	[]	Computer Software	[]
Vendor Information	[]	Operating Procedure	[]	Electric Circuit Schedule	[]
OM Manual	[]	Operational Safety Requirement	[]	ICRS Procedure	[]
FSAR/SAR	[X]	IEFD Drawing	[]	Process Control Manual/Plan	[]
Safety Equipment List	[X]	Cell Arrangement Drawing	[]	Process Flow Chart	[]
Radiation Work Permit	[]	Essential Material Specification	[]	Purchase Requisition	[]
Environmental Impact Statement	[]	Fac. Proc. Samp. Schedule	[]	Tickler File	[]
Environmental Report	[]	Inspection Plan	[]		[]
Environmental Permit	[]	Inventory Adjustment Request	[]		[]

19. Other Affected Documents: (NOTE: Documents listed below will not be revised by this ECN.) Signatures below indicate that the signing organization has been notified of other affected documents listed below.

Document Number/Revision	Document Number/Revision	Document Number Revision

20. Approvals

Signature	Date	Signature	Date
OPERATIONS AND ENGINEERING		ARCHITECT-ENGINEER	
Cog. Eng. EC Ocoma E. C. Ocoma	5/2/95	PE	
Cog. Mgr. SK Farnworth SK Farnworth	5/3/95	QA	
QA AK Sharma AK Sharma	5/3/95	Safety	
Safety EG Hess E N Hess	5-2-95	Design	
Environ.		Environ.	
Other		Other	
PFP Engr. LH Rodgers L. H. Rodgers	5-2-95		
PFP Ops. EP Bonadie EP Bonadie	5-2-95		
PFP Ops. RW Szempruch R W Szempruch	5/2/95	DEPARTMENT OF ENERGY	
PFP Engr. RJ Thomas R. J. Thomas	5/2/95	Signature or a Control Number that tracks the Approval Signature	
Struct. Engr. MA Islam M A Islam	5/2/95		
Struct. Engr. RA Giller R A Giller	5-3-95	ADDITIONAL	

RELEASE AUTHORIZATION

Document Number:	WHC-SD-CP-SA-026, Rev. 1
Document Title:	Seismic Analyses of Equipment in 2736-Z Complex
Release Date:	May 2, 1995

This document was reviewed following the procedures described in WHC-CM-3-4 and is:

APPROVED FOR PUBLIC RELEASE

WHC Information Release Administration Specialist:

V L Birkland — May 2, 1995

V.L. Birkland

TRADEMARK DISCLAIMER. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise, does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof or its contractors or subcontractors.

This report has been reproduced from the best available copy. Available in paper copy and microfiche. Printed in the United States of America. Available to the U.S. Department of Energy and its contractors from:

U.S. Department of Energy
Office of Scientific and Technical Information (OSTI)
P.O. Box 62
Oak Ridge, TN 37831
Telephone: (615) 576-8401

Available to the public from:

U.S. Department of Commerce
National Technical Information Service (NTIS)
5285 Port Royal Road
Springfield, VA 22161
Telephone: (703) 487-4650

SUPPORTING DOCUMENT

1. Total Pages 937 860 KN

2. Title	3. Number	4. Rev No.
Seismic Analyses of Equipment in 2736-Z Complex	WHC-SD-CP-SA-026	1

5. Key Words

Seismic analysis
Response Spectra
Safety Class 1
SQUG/GIP
Walkdown

6. Author

Name: E. C. Ocoma

E. C. Ocoma
Signature

Organization/Charge Code
57200/K6058

7. Abstract

This report documents the structural qualification for the existing equipment when subjected to seismic loading in the Plutonium Storage Complex. It replaces in entirety Revision 0 and reconciles the U.S. Department of Energy (DOE) comments on Revision 0. The Complex consists of 2736-Z Building (plutonium storage vault), 2736-ZA Building (vault ventilation equipment building), and 2736-ZB Building (shipping/receiving, repackaging activities). The existing equipment structurally qualified in this report are the metal storage racks for 7 inch and lard cans in room 2 of Building 2736-Z; the cubicles, can holders and pedestals in rooms 1, 3, and 4 of Building 2736-Z; the ventilation duct including exhaust fans/motors, emergency diesel generator, and HEPA filter housing in Building 2736-ZA; the repackaging glovebox in Building 2736-ZB; and the interface duct between Buildings 2736-Z and 2736-ZA.

8. RELEASE STAMP

OFFICIAL RELEASE BY WHC 21
DATE MAY 03 1995
Sta. 21

RECORD OF REVISION	(1) Document Number WHC-SD-CP-SA-026	Page 1

(2) Title

Seismic Analyses of Equipment in 2736-Z Complex, 200 W Area.

CHANGE CONTROL RECORD

(3) Revision	(4) Description of Change - Replace, Add, and Delete Pages	Authorized for Release	
		(5) Cog. Engr.	(6) Cog. Mgr. Date
	(7)		
0	Initial release per EDT 141870, 6/14/94		
1 RS	Revise Revision 0 to Revision 1 per ECN 615960.	E. C. Ocoma E.C. Ocoma	S. K. Farnworth S K Farnworth 5/2/95

SEISMIC ANALYSES OF EQUIPMENT IN 2736-Z COMPLEX

200 W AREA

April 1995

Prepared & Checked by:
M. A. Islam, Principal Engineer — Civil/Structural Engineering — 5-2-95 Date
R. A. Giller, Senior Engineer — Civil/Structural Engineering — 5-2-95 Date
C. J. Moore, Principal Engineer — TWRS Analytical Services — 5-2-95 Date
G. R. Wagenblast, Sr. Principal Engr. — Civil/Structural Engineering — 5-2-95 Date
D. E. Barlow, Principal Engineer — Equipment Stress Analysis — 5-2-95 Date
for D. L. Koreis, Principal Engineer (E. C. Ocoma per telecon) — Equipment Stress Analysis — 5-2-95 Date
for M. P. Weis, Engineer (E. C. Ocoma per telecon) — Component Stress Analysis — 5-2-95 Date
Reviewed & Authored by: E. C. Ocoma, Principal Engineer — Civil/Structural Engineering — 5-2-95 Date
Approved by: R. W. Szempruch, Staff Manager — Plutonium Finishing Plant — 5-2-95 Date
Approved by: S. K. Farnworth, Dep. Manager — Civil/Structural Engineering — 5-2-95 Date

WESTINGHOUSE HANFORD COMPANY / ICF - KAISER HANFORD
Hanford Operations and Engineering Contractor
for the
U.S. Department Of Energy
Field Office, Richland, Washington

MASTER

DISTRIBUTION OF THIS DOCUMENT IS UNLIMITED 35

CONTENTS

PAGE

1.0 INTRODUCTION....3
2.0 SUMMARY OF EVALUATIONS....5
3.0 DESIGN ANALYSIS....11
4.0 CONCLUSIONS....16
5.0 REFERENCES....17

DESIGN VERIFICATION METHOD....19
INDEPENDENT REVIEW CHECKLIST....20

APPENDIX A: REPACKAGING GLOVEBOX EVALUATION.... A-60
APPENDIX B: METAL STORAGE RACKS EVALUATION....B-1
Storage Racks for Lard Cans Reanalysis....B-31
Storage Racks for 7-inch Cans Reanalysis....B-63
APPENDIX C: CUBICLES AND PEDESTAL EVALUATION....C-145
Old Configuration Cubicle Reanalysis....C-148
New Configuration Cubicle Reanalysis....C-161
Pedestals Reanalysis....C-255
Can Holder Justification for Using SRSS Method C-382
APPENDIX D: 2736-ZA BUILDING VENTILATION EVALUATION....D-1
APPENDIX E: IN-STRUCTURE RESPONSE SPECTRA FOR BUILDING 2736-Z E-1
APPENDIX F: SEISMIC INTERACTION WALKDOWN AND EVALUATION RESULTS....F-1

DISCLAIMER

This report was prepared as an account of work sponsored by an agency of the United States Government. Neither the United States Government nor any agency thereof, nor any of their employees, makes any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States Government or any agency thereof.

SEISMIC ANALYSES OF EQUIPMENT IN 2736-Z COMPLEX, 200 W AREA

1.0 INTRODUCTION

This report documents the structural qualification for the existing equipment when subjected to seismic loading in the Plutonium Storage Complex. It replaces in entirety Revision 0 [15] and reconciles the U.S. Department of Energy (DOE) comments on Revision 0 [15]. The DOE comments have been previously dispositioned in Reference [21]. The Complex consists of 2736-Z Building (plutonium storage vault), 2736-ZA Building (vault ventilation equipment building), and 2736-ZB Building (shipping/receiving, repackaging activities). The existing equipment structurally qualified in this report are the metal storage racks for 7 inch and lard cans in room 2 of Building 2736-Z; the cubicles, can holders and pedestals in rooms 1, 3, and 4 of Building 2736-Z; the ventilation duct including exhaust fans/motors, emergency diesel generator, and HEPA filter housing in Building 2736-ZA; the repackaging glovebox in Building 2736-ZB; and the interface duct between Buildings 2736-Z and 2736-ZA.

Calculations performed as part of the Revision 0 are presented intact in this revision along with subsequent supplemental seismic analyses required for existing SC 1 and 3 equipment. The results summarized in the narrative portion of this document are developed from the combination of these analyses presented in the Appendices. The Design Basis Earthquake loads are applied in the analysis. The safety classification assigned by the PFP facilty to the various components are shown below:

SAFETY CLASSIFICATION	
	Safety Class
7-in can storage racks	1(2)
Lard can storage racks	1(2)
Pedestals and can holders	1(2)
Storage cubicles	1(2)
Repackaging glovebox	1(2)
Exhaust duct between HEPA & stack	3(1)
Exh. duct bet. -Z & -ZA bldgs.	3(3)
Exh. HEPA filter housing assy.	3(1)
Exh. fan/motor assy.	3(1,4)
Diesel generator	3(1,4)

(1) Analyzed as SC 3 with SC 1 loads based on seismic interaction (3/1) methodology and criteria from [13].
(2) Analyzed as SC 1 equipment based on DOE, 1990 [5] and DOE-RL, 1993 [7].
(3) Applied differential motion displacements between buildings from SC 1 loads.
(4) Also qualified for operability after DBE (.2g PGA) based on SQUG/GIP [18].

The anchorage evaluations for the existing equipment used anchor capacities in Ocoma 1993, WHC-SD-GN-DGS-30006, Revision 1, [13]. The Revision 0 [15] evaluations contain the following:

- Verification that the anchorage of the storage container systems (racks, pedestals, and cubicles) are adequate for the seismic loads from the DBE. Review of the test results from the testing done by Wyle Labs in Myrick, 1976 [10] for the can holder configuration to determine they are still valid for the existing installed configuration. The test was performed to establish the highest level of input acceleration for which the cans did not fall out of the can holder.

- Verification that the anchorage of the repackaging glovebox is adequate to resist overturning and sliding from DBE loads. This task considered the contributary loads from the connected exhaust and supply ducts, piping and glovebox exhaust filters.

- Verification that the anchorage and support of the exhaust duct from the fan/motor to the stack in Building 2736-ZA during DBE is adequate. Verification that the interface duct connecting 2736-Z and 2736-ZA buildings does not fall and still provides an acceptable flowpath during a DBE due to building differential motion. Verification that the SC 3 exhaust fan/motor and the emergency diesel generator are functional and operational after the DBE using the applicable Seismic Qualification Utilities Group/Generic Implementation Procedure (SQUG/GIP) methodology.

The safety class has generated various evaluation tasks as shown in the work plan (see Appendix F) that were not considered in Revision 0. Some of the tasks are:

- Generate a facility specific seismic walkdown procedure and acceptance criteria [17].

- Perform seismic interaction evaluation by walkdown based on SQUG/GIP methodology and using the procedure mentioned above.

- Perform anchorage inspection of existing safety class equipment to verify installation adequacy as required by SQUG/GIP [18].

- Perform the equipment evaluation using dynamic analysis in compliance with DOE 1990 [5] and DOE-RL 1993 [7].

- Generate 2736-Z building in-structure response spectra for the dynamic analysis of the equipment that are supported off the building wall.

2.0 SUMMARY OF EVALUATIONS

The results of this evaluation show that the anchorage and supporting structural members of the subject equipment have positive margins of safety with respect to the allowable load capacities or applicable code stress allowables, except the lard cans storage racks and the interface duct between 2736-Z and 2736-ZA buildings. Margin of safety is defined as

$$M.S. = \frac{\text{Allowable load}}{\text{Actual load}} - 1$$

which must be greater than 0.0. The controlling margins of safety for each of the equipment are shown in Table 2.1.

Metal Storage Racks in Room 2, Bldg. 2736-Z

Metal Storage Racks for 7 inch Cans - The results of the analysis indicate that the metal racks for 7 in. can in vault 2 are adequate to withstand SC 1 DBE loads. The analysis presented in pages B-2 thru B-30 applied conservative seismic acceleration values to the equipment in the absence of the 2736-Z in-structure response spectra. In Appendix F, the in-structure response spectra has been generated. From the in-structure response spectra, the corresponding seismic acceleration at the frequency range of interest is approximately 50% of the value used in pages B-2 thru B-30. Thus, the resulting loads from the analysis in pages B-63 thru B-92 are less. The evaluation of the anchor bolts was also performed in pages B-63 thru B-92 due to a revision in the anchor allowable capacities to satisfy the requirements of Safety Class 1 items. The anchor bolt loads at the base, stresses in the base angle and connections between the rack and the cross brace at the top of the rack, and the anchor loads of the cross brace to the concrete wall as determined in Revision 0 are less than the allowable capacities. Therefore, the racks as-is are qualified for the SC 1 DBE loads. The reanalysis is included in Appendix B, pages B-63 thru B-92.

Metal Storage Racks for Lard Cans - The results of the analysis indicate that the as-built storage racks for the lard can in vault 2 are not adequate to maintain their structural integrity when subjected to SC 1 DBE loads. The safety margin in the base anchors is negative and substantially less than zero (see page B-20 and page B-46).

Additionally, the analysis provided designs and details for braces at the top of the racks in the two horizontal directions to resolve the seismic inadequacy. The results of the analysis with the seismic braces indicate that the stresses in the anchor, the brace, and the connections are less than the allowable values. The reanalysis for the lard can storage racks are included in Appendix B, pages B-31 through B- 62. Qualification of these racks requires installation and completion of the design modification.

Storage Cubicles and Pedestals in Rooms 1, 3, & 4, Bldg. 2736-Z

Cubicles, Pedestals and Can Holders - The results of the evaluations indicate that the precast concrete cubicles and the pedestal assemblies that are the welded design in vaults 3 and 4 and the bolted design in vault 1 are adequate to withstand SC 1 DBE loads. The stresses in the embedded anchors, concrete, reinforcement, and the connections between the cubicles and the pedestals are less than the allowable values. Therefore, the cubicles and the pedestals are structurally qualified for the SC 1 DBE loads. The can holder evaluation determined that the cans stay in the can holders when subjected to DBE loads. For the cubicles and pedestals, the evaluations show that they will remain standing up after the DBE. The reanalyses for the cubicles, the pedestals and the can holders are included in Appendix C, pages C-57 through C-406.

Repackaging Glovebox in Room 636, Bldg. 2736-ZB

The results of the evaluations show that the support frame and anchorage of the repackaging glovebox in 2736-ZB Building is adequate to withstand SC 1 DBE loads. The anchor loads and the stresses in the support frame members, connections between the support frame and the glovebox, and the filter housing support are less than the allowable values. The contributary loads from the exhaust ducts, piping, and the two filter housing were considered in the analysis. A seismic interaction (3/1) evaluation was conducted in the room since the glovebox is SC 1 and the exhaust ducts were found to be outliers (see Appendix F, page F-9). The glovebox anchor bolts were also inspected (page F-4) in accordance with SQUG/GIP [18] to verify installation adequacy. The additional analysis for the glovebox and the outliers are included in Appendix A, pages A-85 through A-158 that show the glovebox and associated equipment/systems are structurally adequate.

Storage Vault Exhaust System in Building 2736-ZA

The results of the evaluations indicate that the differential motions between Buildings 2736-ZA and 2736-Z due to SC 1 seismic event will cause some local shear tearing (approx. 0.15 inch gap) failure of the light gage sheet metal portion of the interface duct assembly that connects these buildings. However, the interface duct assembly will remain in place to provide an acceptable flowpath after the DBE. The results also indicate that the anchorage of the emergency diesel generator, HEPA filter assembly, exhaust stack, and the exhaust fan/motor assembly are all adequate to withstand the SC 1 seismic loading. As directed by PFP management, the analysis of the supply duct from the east wall duct penetration (connecting to light gage portion of the interface duct assembly) to the HEPA filter assembly will not be necessary if the exhaust stack from the exhaust fan to the roof penetration can withstand the SC 1 seismic loads and vice versa. Verified the operability of the SC 3 emergency diesel generator and the exhaust fan/motor assembly after a DBE by using applicable SQUP/GIP methods. The analyses for the storage vault exhaust system are included in Appendix D.

IAEA Security Bar Assembly

Security bars proposed for installation in the plutonium storage cubicles in the Plutonium Finishing Plant (PFP) 2736-Z vault, Room 3, are analyzed herein for SC 1 seismic loading. Other loads are considered negligible. The bars are attached to each pedestal assembly and envelope the cans in the holders in the assembly. The security bars are analysed herein as potential seismic interaction item to the SC 1 pedestals; only attachment to the pedestal assembly is considered important with regard to the bars themselves. Analysis of the pedestal in other section of this report shows that the addition of the security bar assembly does not compromise the structural integrity of the pedestal. The analysis of the security bar assembly is shown on pages C-334 thru C-367.

Seismic Interaction Evaluation

A seismic interaction evaluation walkdown was conducted in the rooms where the safety class 1 equipment are located. The seismic walkdown identified three (3) candidate outliers that are included in Appendix F. All candidates were found acceptable after further analytical and safety evaluations as shown on Appendix F.

Table 2.1. Summary of Results.

Component	Description/Location	Safety Margin	Reference Page	Remarks
a. 7-in. Can Rack 2736-Z Bldg. Room 2	Base expansion anchor	.15	B-6	
	Bolt connection betn. brace and rack	.67	B-7	
	Anchor betn. brace and conc. wall	.12	B-7	
b. Lard Can Rack 2736-Z Bldg. Room 2	Base expansion anchor	.24(1)	B-52	(1) With seismic brace installed
	Wall expansion anchor	.28	B-52	
	Steel brace	.18	B-53	
	Splice	1.7	B-55	
	Bolt connection betn. panel frames	.15	B-56	
	Can restraining chain	.28	B-57	
c. Storage Cubicles Floor Mounted 2736-Z Bldg.	Rooms 3 and 4			
	Concrete emb. anchor	1.78	C-70	
	Concrete wall	.87	C-69	
	Emb. base plate	1.5	C-77	
	Connect. @ panel top	.56	C-79	
	Rebar	.86	C-26	
	Weld	.85	C-23	
	Room 1			
	Concrete emb. anchor	3.06	C-87	
	Concrete wall	.007	C-86	
	Emb. base plate	.39	C-93	
	Connect. @ panel top	1.08	C-94	
	Rebar	.86	C-47	
	Weld	.09	C-43	

Table 2.1. Summary of Results.

Component	Description/Location	Safety Margin	Reference Page	Remarks
d. Storage Cubicles Wall Mounted 2736-Z Bldg.	Rooms 3 and 4			
	Building wall	1.03	C-152	
	Cubicle wall	2.23	C-154	
	Floor emb. anchor	2.3	C-157	
	Cubicle wall anchor	1.3	C-158	
	Weld connection	.1	C-160	
	Room 1			
	Building wall	.24	C-166	
	Cubicle wall	3.4	C-168	
	Floor emb. anchor	1.8	C-171	
	Cubicle wall anchor	4.0	C-172	
	Weld connection	.09	C-173	
e. Pedestals on floor mounted cubicles 2736-Z Bldg.	Bolted, Room 1			
	If HKB used	3.5	C-265	
	If unistrut used	3.18	C-266	
	Welded, Rooms 3 and 4			
	Channel welds	.20	C-282	
	Channel	>10	C-332	
	Emb. plates studs	1.8	C-333	
f. Pedestals in Wall Mounted Cubicles 2736-Z Bldg.	Bolted, Room 1			
	If HKB used	.33	C-372	
	If Unistrut stud	.57	C-372	
	Welded, Rooms 3 and 4			
	Welded pedestal	.32	C-378	
g. Can Holders	Test response spectra vs. SDC-4.1 spectra	.26	C-9	

Table 2.1. Summary of Results.

Component	Description/Location	Safety Margin	Reference Page	Remarks
h. Repackaging Glovebox 2736-Z Bldg. Room 636	Base expansion anchor	.15	A-150	
	Steel	.41	A-152	
	Bolt connection betn. support frame and glovebox	.61	A-153	
	Weld connection	.6	A.153	
	Hanger rod support	.06	A.155	
	Guide support @ wall	.2	A-156	
	Filter housing support	1.92	A.157	
i. Ventilation System in Building 2736-ZA	Exhaust Stack			
	Duct stress	1.64	D7	
	Welded stud	1.32	D9	
	Embedded plate	1.5	D11	
	HEPA Filter & Fan Base			
	Bolts between snubber and frame	.24	D23	
	Embedded plate	.2	D24	
	Diesel Engine			
	Mounting bolt	.49	D38	
	Bolt between snubber and frame	.15	D40	
	Embedded plate	.25	D41	
	Duct between Buildings 2736Z and 2736-ZA			
	Differential motion north-south direction	-.86	D54	
	East-west direction	137.	D55	
j. IAEA Security Bar Assembly 2736-Z Bldg. Room 3	Screws	7.7	C-343	3/1 analysis
	Channel Bending	1.4	C-345	
	Effect on pedestal assembly	2.95	C-349	

3.0 DESIGN ANALYSIS

Existing Equipment in 2736-Z Building

The 2736-Z Building is a one story plutonium storage vault consisting of four individual storage rooms, two on each side of a central corridor. The building houses the cubicles and pedestals, and storage metal racks for 7 inch cans and lard cans. Storage rooms 1, 3, and 4 contain floor and wall mounted storage cubicles with pedestals. The cubicles are constructed of precast concrete panels which are anchored to the embedded steel in the floor or wall. The steel pedestals are anchored inside the cubicles. Each cubicle in Rooms 3 and 4 has two pedestal assemblies which contain a maximum of 28 storage cans. The cubicles in Room 1 are enclosed by concrete panels on four sides and each cubicle contains a maximum of 45 storage cans. Each can weighs a maximum of approximately 5.5 pounds.

The concrete panels for the cubicles are reinforced and the corners and the top are covered with embedded steel channels or angles. The channels and the angles are anchored by welded studs. The panels are connected to each other at the top with steel plates or angles (see Dwg. H-2-26651).

Room 2 of 2736-Z Building has metal storage racks for 7 inch and lard cans. The storage racks for 7 in. cans consist of panels that are three feet wide and seven feet high. Each panel has seven layers with four compartments in each layer. The typical size of a compartment is 9 in. by 12 in. The panel is made of 1/16 in. thick sheet metal. The front of the panel is covered with steel wire mesh. The posts are anchored to the concrete floor with expansion anchors. The field verification revealed that the panels are connected to each other by bolts. The panel is held at the top by means of a cross brace which is anchored to the concrete wall. There are five such cross braces for nine rows of panels. This indicates that about half of all panels are not connected to the cross braces. One section of Room 2 also accommodates the metal storage racks for lard cans. The frame for the rack consists of posts and lateral bracings made of 2 1/2 x 2 1/2 x 1/4 square tube steel. Each post is anchored to the concrete floor by an expansion anchor, however, the top of the rack has no support or bracing. Each panel of the rack is 42 in. wide and 72 in. high and has four layers. The cans are seated on a pair of steel angles which are supported by lateral bracing. Similar to the racks for 7 in. cans, all racks for the lard cans are connected to each other by bolts. Each layer accommodates six cans; therefore, a typical panel supports 24 cans. Each can weighs approximately 50 lbs.

The classification of these equipment requires dynamic analysis based on DOE 1990 [5] and the anchorage inspected to verify installation adequacy as directed by the SQUG/GIP [18] methodology. Because the metal racks and some of the cubicles are attached to the building wall, in-structure response spectra for the wall was needed for the reanalyses of all these equipment. The in-structure response spectra for this building was not generated when the building was analyzed in Giller 1994 [16]. This has necessitated developing in-structure response spectra for the building. The in-structure response spectra was later used in the reanalysis of cubicles and pedestals, and storage metal racks.

Cubicles and Pedestals

The methodology in this analysis of the cubicles and pedestals is different than the Revision 0 analysis. For the floor mounted cubicles, a modal analysis was performed and the results were used to determine the seismic acceleration from the ground response spectra per Figure 3 of Hanford Plant Standard, DOE-RL 1993, [7]. Because the floor mounted cubicles are attached only to the ground floor, use of this response spectra was justified. However, for the wall mounted cubicles which are supported off the building wall and the ground floor, the analysis used the in-structure response spectra developed for the Building 2736-Z walls (see Appendix E). The results of the modal analysis indicates that significant participation of the modal mass occurs in the first mode. Also, the fundamental frequency was determined to be in the rigid range of the building in-structure response spectra. The corresponding seismic accelerations to the frequency range of interest were used to calculate the support reactions for both the floor mounted and the wall supported cubicles.

The cubicle panels in Vaults 1, 3, and 4 were independently analyzed. In addition to the stability of the panels, several other items were checked to ensure the adequacy of the panels. The stresses in the concrete walls, columns, base plate, embedded anchors have been evaluated to satisfy the requirements of ACI 1992 and AISC 1980 codes. During the field verification walkdown, the fillet welds that attaches the cubicles to the floor and the building wall were found to be 1/8" x 1 1/2" long at some locations instead of 3/16" x 3" long fillets as called out in the drawings. The reanalysis has considered the smaller welds on all the locations that specified the larger welds.

There are two existing designs for the connection of the pedestals, welded and bolted. The bolted configuration was used only in room 1. The bolted design uses four (4) bolts to fasten the pedestals to the cubicle walls. At this writing, the type of anchor bolt used is still not determined. As discussed and provided in Appendix C, two assumptions were considered based on the visual inspection (without disassembly) and the measurement of the bolt size.

The first, assumed that the anchor bolts are 3/8 inch Hilti-Kwik Bolts (HKB). The evaluation of the SC1 anchor bolts was performed using the SQUG/GIP [18] methodology. Due to high radiation doses in the cubicles, full inspection as described in [18] was not conducted, instead the Reduced Inspection Alternative (RIA), as allowed in [18] was used in conjunction with the other requirements. The RIA does not require tightness and embedment depth check if all the other criteria are satisfied. In conjunction with the RIA, the anchor bolt analysis used a reduced allowable capacity equal to 75% of the bolt nominal capacity as a penalty for not performing these two checks. The anchor bolt nominal capacities were taken from Ocoma 1993 [13], Chapter 8 for SC 1 existing anchor bolts. Another mandatory penalty that was considered is that only two-thirds (2/3) of the total number of active load carrying bolts shall be used in the analysis. The second, assumed that the bolts are unistrut stud nuts which do not require the penalties used above.

The reanalyses for the cubicles,the pedestals and can holders are included in Appendix C, pages C-57 through C-406.

Metal Storage Racks

The metal storage racks for 7 in. and lard cans are installed in vault 2 of 2736-Z building. Based on the negative margin of safety shown in [15], a structural seismic upgrade was initiated for the lard can racks. The proposed upgrade consists of horizontal braces across the top of the racks on both lateral directions and then anchor the opposite end of the braces to the concrete building walls. A field verification walkdown was conducted to document the existing load path configuration. The field walkdown revealed that some of the top horizontal braces designed to inter-connect the rows of racks were previously deleted or removed. The proposed design modifications include all the required horizontal braces. Also, the proposed modifications are documented and analyzed in this report.

The proposed seismic upgrade for the lard can racks, by using the building floor and the walls for support attachments, is similar to the existing 7-inch can rack support configuration, therefore the analysis for both racks are also similar. Separate modal analyses were performed using the ANSYS program to determine the fundamental frequency of both racks. The resulting fundamental frequency shows that both the lard can and the 7-inch can racks are rigid systems. Hence, the use of simple dynamic analysis is justified. The corresponding seismic accelerations for each of the frequency ranges of interest were determined from the 2736-Z building in-structure response spectra and then applied to the model using hand calculations to determine the anchorage adequacy. The resulting seismic accelerations are approximately 50% of the values used in the Revision 0 analysis.

The evaluation of the existing anchor bolts were performed using the SQUG/GIP [18] methodology. Due to the radiation concerns in Room 2, full inspection of the anchor bolts as described in [18] was not conducted, instead the RIA was used in conjunction with the other requirements. As discussed previously in the pedestals, the two penalties or capacity reductions were also applied in the reanalysis to verify anchorage adequacy.

The reanalyses for both racks are included in Appendix B, pages B-31 through B-92.

Building 2736-Z In-structure Response Spectra

The in-structure response spectra for the building 2736-Z was developed using seismic shock spectrum and the relative storage rack anchor point motions inside the building. SASSI finite-element evaluation was performed using a simplified quarter model of the building. The calculations including the input and the plots for developing the response spectra of the building are provided in Appendix E, pages E-1 through E-75.

Existing Repackaging Glovebox in Room 636 of 2736-ZB Building

The repackaging glovebox located in Building 2736-ZB is supported by a steel frame. Each post of the frame is anchored to the concrete floor by means of an expansion anchor. Load-in hood and Load-out hood are connected to either ends of the glovebox. Both hoods are also supported by independent frames. The support frames of both hoods are also anchored to the floor. The base of the glovebox is connected to the support frame by six stud bolts. The top panel of the glovebox supports two exhaust filters. The hoods are attached to 10 inch diameter ducts from pre-filter assemblies that are supported from the ceiling with rod hangers.

An initial simplified evaluation of the glovebox support ignored the individual supports for the hoods. Only the six anchors for the glovebox were assumed to resist the total load including the seismic loads and the loads from the hoods. This conservative assumption overloaded the glovebox support anchor bolts substantially. This suggested a more rigorous evaluation with a more realistic model which considered the anchors from the hoods as individual supports.

The repackaging glovebox is floor mounted, therefore generation of in-structure response spectra for the building was not necessary for the analysis of the glovebox. This analysis considered the support loads for the exhaust systems consisting of piping, ducting, and the filter housings which are within the seismic zone-of-influence of the SC 1 glovebox. The exhaust systems are connected at the top of the glovebox such that the interaction effects were considered. The systems were modelled in the AUTOPIPE program using appropriate seismic accelerations from [13] to determine the reaction loads at the anchor points at the glovebox top. Similarly, all ANSYS runs performed in the earlier analysis were also revised to input the new external loads. The revision to the ANSYS run also includes the elimination of the self weight in determining the stiffnesses of the glovebox top and support frame, and the hood plate to resolve a Revision 0 review comment. The AUTOPIPE models used the revised stiffnesses computed in the ANSYS runs to determine the reaction forces at the top of the glovebox and the hood. The seismic acceleration applied to the glovebox was also revised using Figure 3 of [7].

The SC 1 glovebox and the exhaust system were walked down to verify the SC 1 anchorage. The walkdown also documented the exhaust system as-built configuration to be used in the further evaluation since the system is outlier candidate by being connected to the glovebox. The repackaging glovebox is in a room where high radiation dose is not a concern, therefore, the full inspection required by SQUG/GIP [18] was conducted to verify the anchor bolts installation adequacy. The RIA option was not applied to the glvebox evaluation. The inspection is documented in Appendix F. The glovebox anchors were analyzed using chapter 8 of [13], whereas, the steel and the support components were evaluated per AISC 1980 [2] and PPC 1984 [11]. The analysis for the glovebox including ANSYS and AUTOPIPE input and output is included in Appendix A, pages A-60 through A-158.

Existing SC 3 Equipment in 2736-ZA Building

The 2736-ZA Building houses the ventilation system and equipment needed to control the temperature in the plutonium storage vaults in Building 2736-Z. The 2736-ZA Building is a relatively small reinforced concrete structure with two rooms. Room 1 houses an emergency diesel generator dedicated to providing emergency power for the exhaust ventilation equipment. Room 2 houses the HEPA filters, exhaust stack, supply duct and fans. All equipment, ducts, and the connections were inspected to support the analyses assumptions.

The evaluation consist of four sections. The four sections include the exhaust stack; HEPA filter and exhaust fan/motor anchorage; diesel engine anchorage; and the duct between Buildings 2736-Z and 2736-ZA. For the exhaust stack analysis, the masses, accelerations, and the support forces were taken from Certified Vendor Information, CVI 20369 [19] file which shows the dynamic analysis performed by the vendor, MASON INDUSTRIES Inc., in 1977. It was assumed in the vendor's analysis that the stack is not restrained at the roof penetration. However, the field walkdown identified a rigid support at the roof penetration which now makes the assumption conservative. This analysis verified that the exhaust stack from the exhaust fan to the roof/ceiling penetration will not fall during the DBE. As directed by PFP management, the analysis of the supply duct from the east wall duct penetration (connecting to light gage portion of the interface duct assembly) to the HEPA filter assembly will not be necessary if the exhaust stack can withstand the SC 1 seismic loads and vice versa.

Similar to the exhaust stack, the analysis for the base frame support common to the exhaust fan and HEPA filter housing assembly was also performed using the data from the MASON INDUSTRIES INC. CVI 20369, [19]. These data were further compared to the test data from another vendor, Smith-Emery Company. The analysis focussed on the anchorage of the seismic snubber and the connection between the snubber and the base frame since these were not evaluated by the vendor. The analysis for the diesel generator used the load from CVI 20370 file [20] to verify the adequacy of the anchorage. The operability of the SC 3 diesel generator and the exhaust fans were verified using the applicable SQUG/GIP [18] methods.

The last section is the evaluation of the interface duct between Buildings 2736-Z and 2736-ZA. The duct is 60 inches long and composed of two sections: 3/8 in. and 28 gage thick metal sections. For the 28 gage section, the analysis determined the allowable duct movements from the section properties of the duct and compared these with the building movements (differential motions) from the building seismic analyses in [16]. For the other section, the bending stress in the duct was compared to the allowable stress per AISC 1980 [2]. The analyses pertaining to the ventilation system are included in Appendix D.

Seismic Interaction Evaluation

In compliance with SQUG/GIP [18], a seismic interaction evaluation walkdown was conducted in the rooms where the safety class 1 equipment are located. An approved seismic walkdown procedure was used and is documented in Ocoma 1995 [17]. The procedure was based on the SQUG/GIP methodology. The results of the walkdown are included in Appendix F which identified three (3) candidate outliers that did not meet the screening criteria. Two of the three candidates were further evaluated analytically and were found acceptable. Further safety evaluation shown in Reference [22] of the remaining candidate, unrestrained shipping containers and the 55 gallon drums, with respect to the SC 1 function (prevention of nuclear criticality) of the storage racks was performed and is presented in Appendix F page F-38. The evaluation states "criticality is not credible".

Just before this reanalysis started, a new security bar assembly was being designed and fabricated for installation in vault 3 to satisfy the International Atomic Energy Agency (IAEA) security and monitoring requirements. The assembly, which is classified as SC 3, attaches to the channel detail of each pedestal assembly. The security bar assembly was designed and analyzed to the seismic interaction requirements of [13] for SC 3/1 evaluation as shown in Appendix C.

4.0 CONCLUSIONS

All equipment analyzed herein are structurally qualified as-is except the lard can rack is qualified based on the proposed structural modification.

5.0 REFERENCES

[1] ACI, 1989, *Building Code Requirements for Reinforced Concrete and Commentary*, ACI 318-89, American Concrete Institute, Detroit, Michigan.

[2] AISC, 1980, *Manual of Steel Construction, 8th Edition*, American Institute of Steel Construction, Inc., Chicago, Illinois.

[3] Blodgett, O.W., 1966, *Design of Welded Structures*, The James F. Lincoln Arc Welding Foundation, Cleveland, Ohio.

[4] Clough & Penzien, 1975, *Dynamics of Structures*, McGraw-Hill, New York, New York.

[5] DOE, 1990, *Design and Evaluation Guidelines for Department of Energy Facilities Subjected to Natural Phenomena Hazards*, UCRL-15910, U.S. Department of Energy, Livermore, California.

[6] DOE-RL, 1992, *Hanford Plant Standards*, HPS-SDC-4.2, Revision 0, U.S. Department of Energy-Richland Operation Office, Richland, Washington.

[7] DOE-RL, 1993, *Hanford Plant Standards*, HPS-SDC-4.1, Revision 12, U.S. Department of Energy-Richland Operation Office, Richland, Washington.

[8] ECN, 1994, *Seismic Upgrade of Lard Can Rack in Vault 2, Building 2736-Z*, ECN 607104, Richland, Washington.

[9] ESR, 1987, *Lard Can Storage in Room 2 of 2736-Z*, Engineering Service Request No. 9539, Rockwell Hanford Operation, Richland, Washington.

[10] Myrick, R.C., 1976, *Seismic Testing of Two Barium Chloride Containers One Lead Specimen for Atlantic Richfield Hanford Company*, WYLE Laboratory, Norco, California.

[11] PPC, 1984, *Pipe Hangers and Supports, Catalog 84*, Power Piping Company, Pittsburgh, Pennsylvania.

[12] TRW, 1975, *Embedment Properties of Headed Studs, Design Data 10*, TRW Nelson Division, Lorain, Ohio.

[13] Ocoma, E.C., 1993, *Guidelines for Assessing the Seismic Adequacy of Safety Class 3 and 4 Equipment at the Hanford Site*, WHC-SD-GN-DGS-30006, Revision 1, Richland, Washington. September 23, 1993.

[14] WHC, 1993, *Safety Assessment for Plutonium Finishing Plant Inventory Sensitivity of the Seismic Event*, WHC-SD-CP-SAD-002, Revision 0, Correspondence No. 9306429B R3, Richland, Washington.

[15] Ocoma, E.C.,1994, *Seismic Analysis of Equipment in 2736-Z, Complex, 200W Area, WHC-SD-CP-SA-026, Rev. 0*, Richland, Washington. July 14, 1994.

[16] Giller, R.A., 1994, *Structural Evaluation of the 2736-Z Building for Seismic Loads, WHC-SD-CP-SA-023, Revision 0*, Richland, Washington. April 6, 1994.

[17] Ocoma, E.C., 1995, *Walkdown Procedure Seismic Adequacy Review of Safety Class 3 and 4 Commodities in 2736-Z and -ZB Buildings at the PFP Facility*, Richland, Washington. April 6, 1995.

[18] SQUG/GIP,1992, *Seismic Qualification Utilities Group / Generic Implementation Procedure for Seismic Verification of Nuclear Plant Equipment*, Revision 2, February 1992.

[19] CVI 20369, *Certified Vendor Information File Number 20369.*

[20] CVI 20370, *Certified Vendor Information File Number 20370.*

[21] Vogt, E. C., *Correspondence No. 9406439B R1, E. C. Vogt to O. A. Farabee, "Transmittal of Response to Comments: Confirmation of Seismic Qualification for the Plutonium Storage Complex"*, dated October 7, 1994.

[22] PFP, 1995, *Internal Memo 15500-95-LTN-028, L. T. Nirider to E. C. Ocoma, "Evaluation of Potential Impact of Unconstrained 55 Gallon Drums and Shipping Containers in Room 2, 2736-Z Building"*, dated May 2, 1995

DESIGN VERIFICATION METHOD

The need for design verification has been reviewed with the method selected as indicated below:

x	Independent Review
	Alternate Calculations
	Qualification Testing
	Formal Design Review

S. K. Farnworth SK Farnworth 5/2/95
Cognizant Manager

SD #WHC-SD-CP-SA-026, Revision 1

ECN # 615960

DWG(S) # N/A

TYPICAL CHECKLIST FOR INDEPENDENT REVIEW

Document Reviewed Seismic Analyses of Equipment in 2736-Z Complex, 200 W Area

Prepared by MA Islam, RA Giller, CJ Moore, DE Barlow, DL Koreis, and MP Weis

Yes	No	N/A	
[x]	[ ]	[ ]	Problem completely defined.
[x]	[ ]	[ ]	Necessary assumptions explicitly stated and supported.
[x]	[ ]	[ ]	Computer codes and data files documented.
[x]	[ ]	[ ]	Data used in calculations explicitly stated in document.
[x]	[ ]	[ ]	Data checked for consistency with original source information as applicable.
[x]	[ ]	[ ]	Mathematical derivations checked including dimensional consistency of results.
[x]	[ ]	[ ]	Models appropriate and used within range of validity or use outside range of established validity justified.
[x]	[ ]	[ ]	Hand calculations checked for errors.
[x]	[ ]	[ ]	Code run streams correct and consistent with analysis documentation.
[x]	[ ]	[ ]	Code output consistent with input and with results reported in analysis documentation.
[x]	[ ]	[ ]	Acceptability limits on analytical results applicable and supported. Limits checked against sources.
[x]	[ ]	[ ]	Safety margins consistent with good engineering practices.
[x]	[ ]	[ ]	Conclusions consistent with analytical results and applicable limits.
[x]	[ ]	[ ]	Results and conclusions address all points required in the problem statement.

Reviewer Comments:

The analysis for the lard can and 7-inch can storage racks did not consider the other anchor bolt capacity reduction when tightness and embedment checks are not performed when qualifying existing safety class 1 anchor bolts based on SQUG/EPRI methodology. See next page for consideration.

Reviewer: EC Ocoma E.C. Ocoma Date: 5/2/95

ANALYTICAL CALCULATIONS

Subject INDEPENDENT REVIEW COMMENTS

Originator _____ Date _____

Checker E.C. Ocomo Date 4-26-95

ANCHOR BOLT CAPACITY REDUCTION BASED ON "REDUCED INSPECTION ALTERNATIVE".

THE REDUCTION NOT CONSIDERED IN THE LARD CAN AND 7-INCH CAN STORAGE RACKS IS THE USE OF ONLY TWO-THIRDS (2/3) OF THE TOTAL NUMBER OF ACTIVE LOAD CARRYING BOLTS IN THE ANALYSIS.

LARD CAN STORAGE RACKS:

SHEAR LOAD, V = 229# PER ANCHOR BASED ON .68g ACCEL. (PAGE B-50)

TENSION LOAD, T = 0 FOR FLOOR ANCHOR BOLTS (PAGE B-50)

REVISION 0 ACCEL = .68 g

REVISION 1 ACCEL = .33g

NEW $V = 229\,(1.33)\,(\tfrac{.33}{.68})$ (ONLY 2/3 OF BOLTS ACTING)

$= 148^{\#}$

INTERSECTION, $I = \frac{148}{285} = .52$ $V_{ALLOW} = 285$ (SC 1 BOLT) (B-52)

$M.S = \frac{1}{.52} - 1 = 0.92$ OK FOR BOLT REDUCTION

7-IN CAN STORAGE RACK:

$V_1 = 147^{\#}$, $V_2 = 294^{\#}$ (B-6)

REV. 0 ACCEL = .68 g (B-92)

REV. 1 ACCEL = .36g (B-92)

NEW $V = \sqrt{(147)^2 + (294)^2}\,(1.33)\,(\tfrac{.36}{.68}) = 231^{\#}$

INTERSECTION, $I = \frac{231}{285} = 0.812$

$M.S = \frac{1}{.812} - 1 = 0.23$ OK

APPENDIX A

REPACKAGING GLOVEBOX EVALUATION

ANALYTICAL CALCULATIONS

Subject Glovebox, 2736-ZB Bldg.
Originator M. A. ISLAM Date 5/23/94
Checker G. C. Oconnor Date 6/7/94

Objective

Analyze Repackaging Glovebox in Bldg. 2736-ZB, Room 636, to verify adequacy from overturning and sliding during a DBE event. The glovebox was previously classified as safety class 3 but will be analyzed using safety class 1 seismic loads.

Criteria

Seismic Accelerations per Guideline, WHC-SD-GN-DGS-30006, Rev 1, Table 2.5.
Allowable stress per AISC, 8th Ed., Fy = 36 ksi

Concrete Anchor (Star Expansion, stud type) allowable per Guideline, WHC-SD-GN-DGS-30006, Rev 1

UCRL-15910

HPS SDC-4.1, Rev 12

Reference Drawings

H-2-80174
80175 sht 1 & 2
80176 " "
80177
80178
80179
80172
80169

Subject Glovebox, 2736-ZB Bldg.
Originator M.A-ISLAM Date 5/23/94
Checker G.C. Owens Date 6/7/94

Discussion on Computer Runs used for the evaluation of the glovebox

There are five independent computer runs. Three Comp. runs determined the stiffnesses of the glove box support and tops by using ANSYS-PC. The other two using the stiffness values from ANSYS, performed AUTOPIPE to determine reactions to glovebox from load-in and load-out hoods.

ANSYS Runs

1. Glovebox support was analyzed for stiffness to determine if the support frame is rigid.

2. Glovebox top was analyzed for its stiffness to be used in AUTOPIPE Run. The top supports two Flanders filter housings which are connected to piping, duct, and a 5-Ft. Filter housing.

3. Hood top was analyzed for its stiffness to be used in AUTOPIPE Runs. The top anchors a 10" dia. exhaust pipe.

AUTOPIPE Runs

1. The Run includes the 'Load-out Hood', 2 in thru 10 in pipes and a 5-Ft filter housing. This run using stiffnesses from ANSYS Run 2, determines reactions at glovebox top and Load-out Hood top.

2. The Run includes the 'Load-In Hood' which supports a 10" pipe from a 6-Ft filter housing. Similarly, in this Run, stiffnesses from ANSYS Run 3 are used to determine the reactions at Load-Out Hood top.

All reactions from the top of the glovebox and the Load-In and Load-Out Hoods have been considered in the evaluation of the glovebox support adequacy.

ANALYTICAL CALCULATIONS

Subject Glovebox, 2736-ZB Bldg.
Originator M.A. ISLAM Date 5/23/94
Checker E.C. O'Connor Date 6/7/94

Assumptions

1. Glovebox is rigid
2. Glovebox support frame posts are pin connected. (because of one anchor)
3. Consider prying action to determine the pullout in anchor.
4. Initial analysis considers 6 anchors w/Glovebox to resist bending and pullout due to forces from Glovebox and filter Housing, however, all 12 anchors will resist compression and shear.

   Note: This assumption is conservative. Because the load in & load out hoods are rigidly connected to the glovebox by means of bolts. Therefore, if the forces from hoods are allowed to be transmitted to the glovebox, the anchors supporting the hoods should also be considered to resist forces from hoods and glovebox.
5. Final analysis considers all 6 anchors with glovebox and all anchors from each hood support. (Total 12 anchors)

Conclusion

The results of the analusis indicate that the glovebox is NOT adequate per Initial analysis (Item 4). The anchors show an overstress of 76%.

However, these anchors are adequate per Final analysis (Item 5).

Therefore, the glovebox support frame and the anchors are acceptable as-is to withstand the safety class 1 seismic loads.

ANALYTICAL CALCULATIONS

Subject Glovebox, 2736-ZB Bldg.
Originator M. A. ISLAM Date 5/10/94
Checker E. C. Ocoma Date 6/7/94

Walkdown Report

The following engineers walked down the glovebox located in 2736-ZB on March 10, 1994.

E. C. Ocoma, M. A. Islam, R. A. Giller } Engineering Analysis Function, WHC
K. R. Herzog — PFP Operation

Items walked down

Glove box anchorage, Filter housing & ducts

Findings

Each glovebox support post is anchored to concrete floor with one (1) 5/8" ϕ expansion anchor and 1/2" thick base plate. The concrete floor around the anchor had no surface degradation. No spalling of concrete or crack in the floor was observed. The anchor bolt head was not lifted off the washer or the base plate nor was the base plate lifted off the concrete floor.
The length of the embedment could not be verified, however, Dwg. H-2-80174, Rev 2, which incorporated As-built information in 1981, documented a 3 1/2" total length of the bolt. i.e. Emb. = (3 1/2" − 1/2" − 1/16" − 1/4") = 2 5/8".
(base plate, washer, grout)

For walkdown reports for Filter housing and pipes, see AUTOPIPE Input models for Load-In Hood and Load-Out Hood, Pages A-40 & A-51.

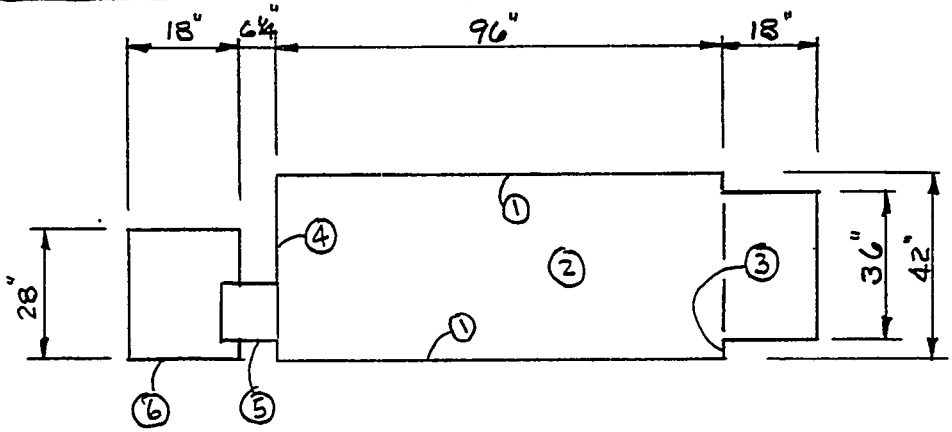
ANALYTICAL CALCULATIONS

Subject Glove Box, 2736-ZB Bldg.

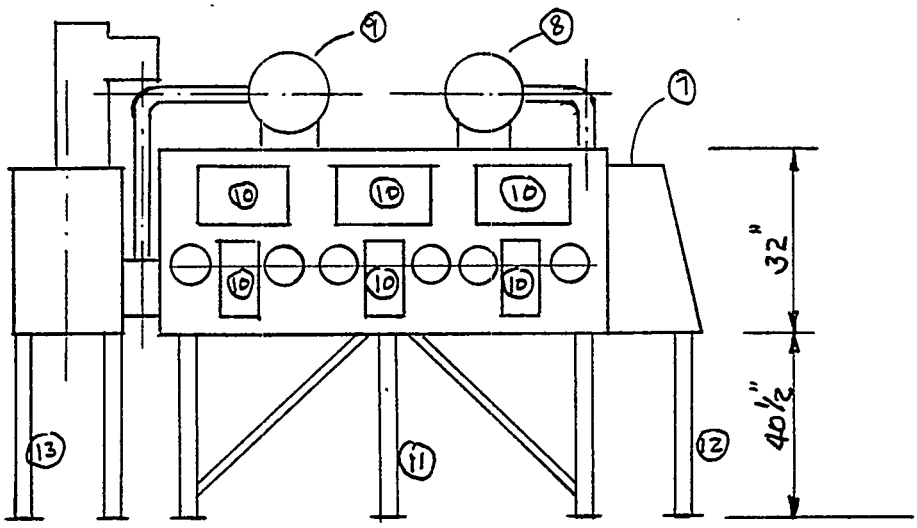
Originator M. A. ISLAM Date 2/18/94

Checker E.C-O'connor Date 6/7/94

ANALYSIS



PLAN



GLOVE BOX ELEVATION

Subject Glove Box, 2736-ZB Bldg.

Originator M.A. ISLAM Date 2/18/94

Checker G.C. Owens Date 6/7/94

Calculation of Weights of Glove Box
(Item nos. shown on Page A-6)

① Side Wall $96 \times 32 = 3072\ in^2$

deduct open.:

Window = $20.5 \times 12.5 \times 3$ } $= 1275\ in^2$

" = $10.5 \times 6.5 \times 3$ }

" = $\pi/4 \times 8^2 \times 6$ }

$1797.1\ in^2 \left[\left(\frac{3}{16} + .0635\right) \times .283 + \frac{1}{4} \times .411\right]$

(3/16 = SST wall; .0635 = cladding; .283; 1/4 = Lead; .411)

$= 312.3\ \#$ × 2 sides $= \underline{624.6\ \#}$

② Bottom Wall $96 \times 32 \left[\left(\frac{3}{16} + .0635\right) \times .283 + \frac{1}{4} \times .411\right]$ (.17378)

$= 533.9\ \#$

Stiffener $= 4 \times \frac{3}{8} [9 \times 33.12 + 2 \times 93] \times .283$

$= 205.5\ \#$

$\Sigma = 533.9 + 205.5 = \underline{739.4\ \#}$

Top Wall 96×32

Deduct opng.

Window = $21.625 \times 6.5 \times 4$ } $= 679.25\ in^2$

" = $9 \times 6.5 \times 2$ }

$2397.75 \times 3/16 \times .283 = \underline{127.0}$

(Ignore cover stiff.)

③ Front End $42 \times 15 + \frac{1}{2}(42+33) \times (32-15) = 1267.5\ in^2$

opng. $= \frac{\pi}{4}(5^2 + 11^2 + 15^2) = 291.2\ in^2$

$976.3 \times .17378 = \underline{169.7\ \#}$

④ Rear End $= (1267.5\ in^2 - \frac{100}{10 \times 10}) \times .17378 = \underline{203\ \#}$

Subject Glove Box, 2736-ZB Bldg.

Originator M. A. ISLAM Date 2/18/94

Checker E. C. O'connor Date 6/7/94

⑤ & ⑥ Load in Hood

$$\left.\begin{array}{l} \text{Wall} = 2(28+18)\times 28\times 3/16 \\ \text{Top \& Bot.} = 2(28\times 18)\times 3/16 \\ \text{Tube} = \frac{\pi}{4}\times 8^2\times\frac{1}{8}\times(8+19+7) \end{array}\right\} = 885.5\ in^3$$

$$\text{opng.} = \left.\begin{array}{l} \frac{\pi}{4}(6^2\times 2+8^2\times 2)\times\frac{3}{16} \\ (20.5\times 12.5+2\times 6.5\times 21.5)\times\frac{1}{8} \end{array}\right\} = 96.4\ in^3$$

$$\Sigma = (885.5-96.4)\times .283 = \underline{223.3\ \#}$$

⑦ Load out Hood

$$\left.\begin{array}{l} \text{Wall} = 2\left(\frac{18+14}{2}\right)\times 30\times 3/16 \\ \text{Top \& Bot.} = (14+18)\times 36\times 3/16 \\ \text{Front} = 36\times 30\times 3/16 \end{array}\right\} = 598.5\ in^3$$

$$\text{opng.} = \left.\begin{array}{l} 2\times 6.5\times 21.625\times 3/16 \\ 25.5\times 31.5\times 3/16 \end{array}\right\} = 203.3\ in^3$$

$$\Sigma = (598.5-203.3)\times .283 = \underline{111.8\ \#}$$

⑧ Flander Assembly (14 gauge, t = .0785")

Approximate Wt.:

$$\left.\begin{array}{l} \text{Flander } 15"\phi = \pi(15)(.0785)\times 19\times .283 \\ 2"\text{sch 40S pipe} = 1'\times 3.65\ \#/' \\ \text{Flange} = 2\times 9\ \# \\ \text{T's} = 2\ \# \\ \text{Misc. pipe} = 10\ \# \end{array}\right\}$$

$$\Sigma = 53.5\ \#$$

⑨ Flander Assembly (other end)

Same as in ⑧ except some additional pipe

Use W = 55 #

⑩ Leaded Glass in all openings ($\frac{1}{2}"\times 160\ \#/CF = 6.67\ \#/SF$ Approx.)

$$\Sigma = \left[1275 + 679.25 + 291.2 + 100 + \left(\frac{96.4+203.3}{.1875}\right)\right]\times\frac{6.67}{144} = \underline{182.7\ \#}$$

$$\Sigma\ 1 \text{ thru } 10 = 2{,}490\ \#$$

ANALYTICAL CALCULATIONS

Subject Glove Box, 2736-ZB Bldg.

Originator M. A. ISLAM Date 2/22/94

Checker E.C. O'Connor Date 4/7/94

(11) Glove Box Support Frame

$L3\times3\times3/8$ Post = $6\times29''\times7.2^{\#/'}\times\frac{1}{12}$ = $104.4^{\#}$

" Horiz. = $2(39+93)\times7.2/12$ = $158.4^{\#}$

$L2\times2\times3/8$ brace = $4\times4'\times4.7^{\#/'}$ = $75^{\#}$

(12) Load out Hood Support

$L3\times3\times3/8$ Post = $2\times41.5\times7.2/12$ = $50^{\#}$

$L2\times2\times3/8$ Horiz. = $2\times18\times4.7/12$ = $14^{\#}$

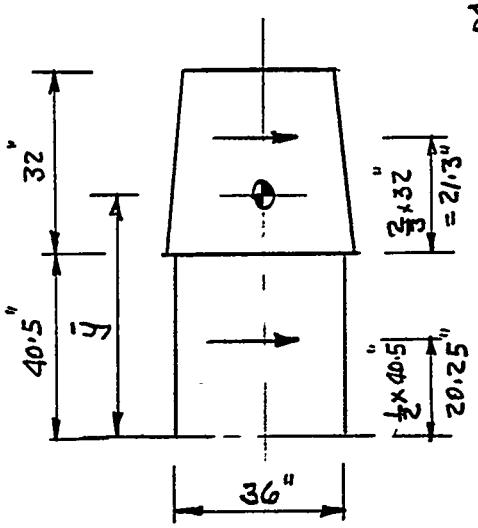
(13) Load in Hood Support

$L3\times3\times3/8$ Post = $4\times41.5\times7.2/12$ = $100^{\#}$

$L4\times3\times3/8$ Horiz. = $2(26+24)\times8.5/12$ = $71^{\#}$

Σ Support = $572.8^{\#}$

Approximate Location of C.G.



Σ Glove box Wt. = $2{,}490^{\#}$
Add 5% Misc. = $125^{\#}$ } = $2{,}615^{\#}$

Σ Support Wt. = $572.8^{\#}$

$$\bar{y} = \frac{2615\times(40.5+21.3)+572.8\times20.125}{2615+572.8}$$

$$= 54.3 \text{ in}$$

ΣW = 2615 + 572.8

= $3{,}188^{\#}$

$\simeq$ $3{,}200^{\#}$

Subject Glove Box, 2736-ZB Bldg.
Originator M.A. ISLAM Date 2/22/94
Checker E.C. Ocon Date 6/7/94

Acceleration

Refer to WHC-SD-GN-DGS-30006, Rev 1, Table 2.5.

$A_H = .68\ g$

$A_V = \frac{2}{3} \times .68 = .45g$

Overturning (Transverse direction)

Moment due to Force = $3200 \times 54.3 \times .68$

Resisting Moment = $3200 \times 18 \times (1 - .45)$

$$\frac{3200 \times 18\,(1 - .45)}{3200 \times 54.3 \times .68} = .27 < 1.$$

overturning would occur if not anchored !

Forces (due to seismic)

Lateral force, $F_{H1} = .68 \times 3200 = 2{,}176^{\#}$

" " $F_{H2} =$ " =

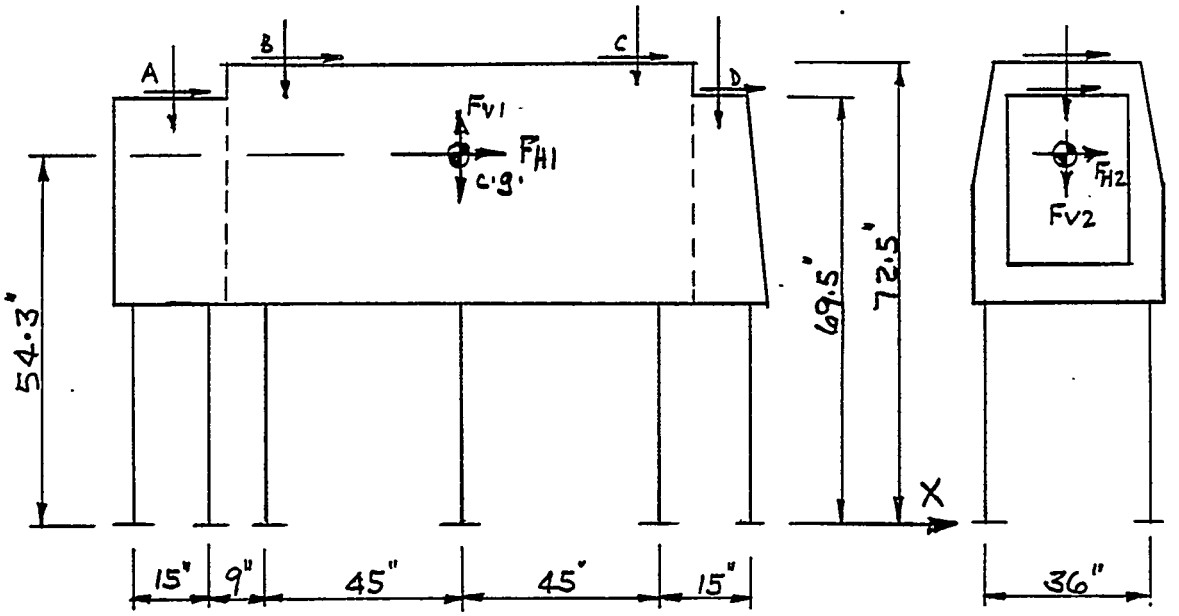
Vertical Force, $F_{V1} = .45 \times 3200 = 1{,}440^{\#}$ ↑↓

$F_{V2} = 3200^{\#}$ ↓

ANALYTICAL CALCULATIONS

Subject Glovebox, 2736-ZB Bldg.
Originator M. A. ISLAM Date 5/20/94
Checker E.C. Oconnell Date 6/7/94

Reactions at Glovebox top from Filter Housing



Longitudinal Transverse

Reactions @ A, B, C, D (Glovebox & Hood top)

A (refer AUTOPIPE Run 2; File: HOODIN, Page A-59)
support Pt. B02
$F_x = 183^{\#}$; $F_y = 0$, $F_z = 140^{\#}$; $M_x = 4 \times 12 = 48^{\#\text{-in}}$

B, C, D (refer AUTOPIPE Run 1; FILE: HOODOUT, Page A-50)
For B (Pt. B04): $F_x = 6^{\#}$; $F_y = 2^{\#}$; $F_z = 21^{\#}$; $M_x = 4 \times 12 = 48^{\#\text{-in}}$
For C (Pt. C03): $F_x = 6^{\#}$; $F_y = 5^{\#}$; $F_z = 6^{\#}$; $M_x = 4 \times 12 = 48^{\#\text{-in}}$
For D (Pt. A09): $F_x = 334^{\#}$; $F_y = 0$; F_z $208^{\#}$; $M_x = 4 \times 12 = 48^{\#\text{in}}$
$M_z = 2 \times 12 = 24^{\#\text{-in}}$;
Reactions computed above are all summed for seismic loads.

ANALYTICAL CALCULATIONS

Subject Glovebox, 2736-ZB Bldg.
Originator M.A. ISLAM Date 5/23/94
Checker E.C. Ocampo Date 6/7/94

INITIAL ANALYSIS

Transverse

Tension @ base of post

$$\frac{2176^{\text{Glovebox}} \times 54.3}{3 \times 36} + \frac{(140+208)^{A,D} \times 69.5 + (21+6)^{B,C} \times 72.5 + (48+48+48+48)^{M_x @ A,\text{thru}D}}{3 \times 36}$$

$$= 1{,}338^{\#}$$

$$\text{Shear @ base of Post} = \frac{2176^{G}}{12} + \frac{(140+208)^{A,D} + (21+6)^{B,C}}{12}$$

$$= 213^{\#}$$

Longitudinal

Tension @ base of Post

$$\frac{2176^{G} \times 54.3}{2 \times 90} + \frac{(183+334)^{A,D} \times 69.5 + (6+6)^{B,C} \times 72.5}{2 \times 90}$$

$$= 861^{\#}$$

$$\text{Shear @ base of Post} = \frac{2176^{G}}{12} + \frac{(183+334)^{A,D} + (6+6)^{B,C}}{12}$$

$$= 225^{\#}$$

Vertical

$$\text{Tension @ base} = \frac{1440^{G}}{6} + \frac{(2+5)^{B,C}}{6} = 241^{\#}$$

$$\text{Compression @ base (Gravity)} = \frac{3200}{12} = 267^{\#}$$

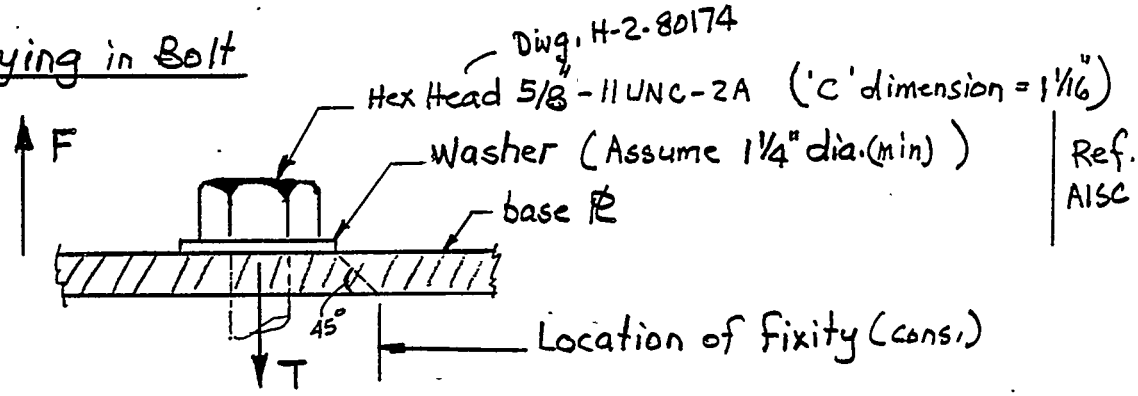
* Net Tension, $T = 1338 + 861 \times .4 + 241 \times .4 - 267 \times .85 = \underline{1{,}552}^{\#}$
* Net Shear, $V = \sqrt{213^2 + 225^2} = \underline{310}^{\#}$

* Per WHC-SD-GN-DGS-30006, Rev 1

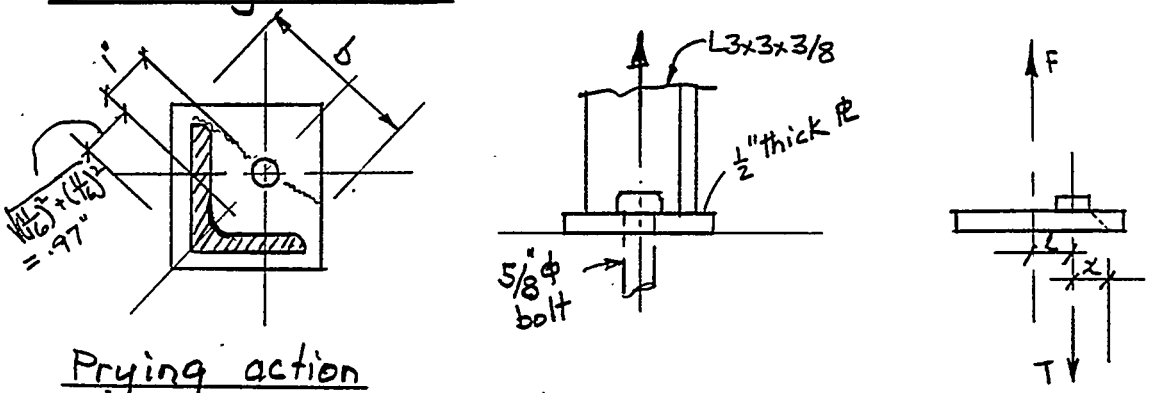
ANALYTICAL CALCULATIONS

Subject Glove Box, 2736-ZB
Originator M. A. ISLAM Date 5/23/94
Checker E.C. Ocon Date 6/7/94

Prying in Bolt



Anchorage Check



Prying action

For 5/8" ϕ bolt & 1/2" thick PL

$\therefore x = 1.25 \times \frac{1}{2} + \frac{1}{2}$ - PL thick. $= 1.125"$

$\ell = \sqrt{1.5^2 + 1.5^2} - 1.125 \simeq 1."$

Tension Force, $F = 1{,}552^{\#}$ $\therefore T = \frac{F(\ell + x)}{x} = \frac{1{,}552(1 + 1.125)}{1.125}$

$= 2{,}932^{\#}$

Shear $= 310^{\#}$

Allowable Values for STAR EXPANSION anchor

Refer to Guideline, WHC-SD-GN-DGS-30006, Rev 1
Table 4-3, Page 4-31

$T_{all.} = 2380 \times \frac{3000}{4000} = 1785^{\#}$

$V_{all.} = 2840 \times \left[\frac{3000}{10000} + .65\right] = 2698^{\#}$

} 5/8" ϕ x 2 3/4" Emb. prorated for $f'_c = 3000$ Psi

Subject Glovebox, 2736-ZB Bldg.
Originator M.A. ISLAM Date 5/23/94
Checker E.C. Ocon Date 6/7/94

$$\text{Interaction, } I = \frac{T}{T_{all.}} + \frac{V}{V_{all.}} \leq 1.$$

$$I = \frac{2,932}{1785} + \frac{310}{2698} = 1.76 > 1. \quad \text{(N.G.)}$$

Try Final Analysis with 12 anchors in Tension
Refer results from Initial analysis

Transverse Tension $= 1338 \times \frac{6}{12} = 669^{\#}$

Longitudinal Tension $= 861 \times \frac{90}{(90+15\times2+9)} = 601^{\#}$

Vertical Tension $= 241 \times \frac{6}{12} = 121^{\#}$

$$\text{Net } T = 669 + 601\times.4 + 121\times.4 - 267\times.85 = 731^{\#}$$

No change in shear, $V = 310^{\#}$

$$\therefore T \text{ (w/Prying)} = \frac{669(1. + 1.125)}{1.125} = 1,264^{\#}$$

$$\therefore \text{Interaction, } I = \frac{1,264}{1785} + \frac{310}{2698} = .82 < 1. \quad \text{OK.}$$

$$\text{Safety Margin} = \frac{1}{.82} - 1 = .22$$

Subject Glove Box, 2736-ZB
Originator M. A. ISLAM Date 5/23/94
Checker E.C. Ocon Date 6/7/94

Stress in Base Pl

Base Pl Bending

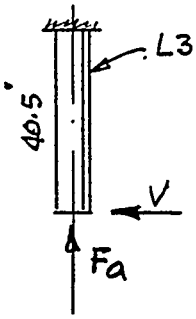
$b = \sqrt{1.5^2 + 1.5^2} = 2.12"$

Section modulus, $S = \frac{bt^2}{6} = \frac{2.12 \times .5^2}{6} = .0883\ in^3$

$M = T(1.0) = 1,264 \times 1.0 = 1,264\ \#in$

$\therefore \sigma_b = \frac{M}{S} = \frac{1264}{.0883} = 14,315\ Psi < 27000\ Psi$ OK

Check Support Post



$V = 310\ \#$

$F_a = 669 + 601 \times .4 + 121 \times .4 + 267 = 1,225\ \#$

M @ top $= 310 \times 40.5 = 12,555\ \#\text{-in}$

$\sigma_a = \frac{1225}{2.11} = 581\ Psi$; $\frac{KL}{r} = \frac{2 \times 40.5}{.587} = 138 < 200$ OK

$\sigma_{a\ (allow.)} = 7840\ Psi$ @ $\frac{KL}{r} = 138$

$\therefore$ Interaction, $I = \frac{581}{7840} + \frac{12,555}{.833} / 27000$

$I = .63 < 1.0$ OK

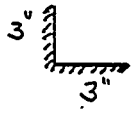
$S.M. = \frac{1}{.63} - 1 = .59$

Subject Glove Box, 2736-ZB

Originator M. A. ISLAM Date 5/23/94

Checker E. C. Ocon Date 6/7/94

Weld betn. L3x3 & base Pl



$A_w = 2 \times 3 = 6$ in

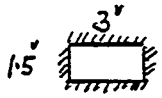
Tension $= 1{,}264^{\#}$; $V = 310^{\#}$

$$f_w = \sqrt{\left(\frac{1264}{6}\right)^2 + \left(\frac{310}{6}\right)^2} = 217\ ^{\#}/_{in}$$ very low

F_w (for 1/8" Fillet Weld) $= .4 \times 36000 \times .125 = 1800\ ^{\#}/_{in}$

$>> 217\ ^{\#}/_{in}$ OK

Weld betn. L3x3 & L3x3



$A_w = 2(1.5+3) = 9$ in

$S_w = \frac{1.5^2}{3} + 3 \times 1.5 = 5.25\ in^2$

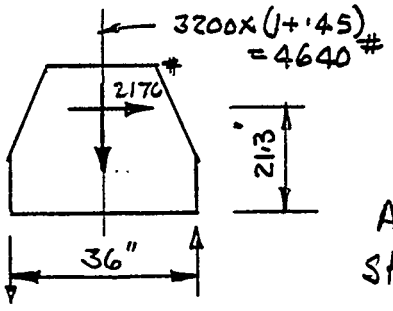
$F_a = 1{,}225^{\#}$; $V = 310^{\#}$; $M = 12{,}555^{\#\text{-in}}$

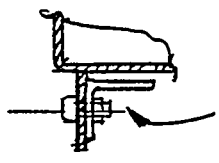
$$f_w = \left[\left(\frac{1225}{9} + \frac{12555}{5.25}\right)^2 + \left(\frac{310}{9}\right)^2\right]^{\frac{1}{2}} = 2528\ ^{\#}/_{in}$$

F_w (for 1/4" Fillet) $= .4 \times 36000 \times .25 = 3600\ ^{\#}/_{in} > 2528\ ^{\#}/_{in}$ OK

$S.M. = \frac{3600}{2528} - 1 = .42$

Connection betn. Glove box & Support Frame





Axial Force in bolt $= \frac{2176}{6} = 363^{\#}$

Shear $= \frac{4640}{2 \times 6} + \frac{2176 \times 21.3}{36 \times 6} = 601^{\#}$

Bolt Allowables : $T = 20\ Ksi \times .11 = 2200^{\#}$

$V = 10\ Ksi \times .11 = 1100^{\#}$

Interaction, $I = \frac{363}{2200} + \frac{601}{1100} = .71 < 1.$ OK

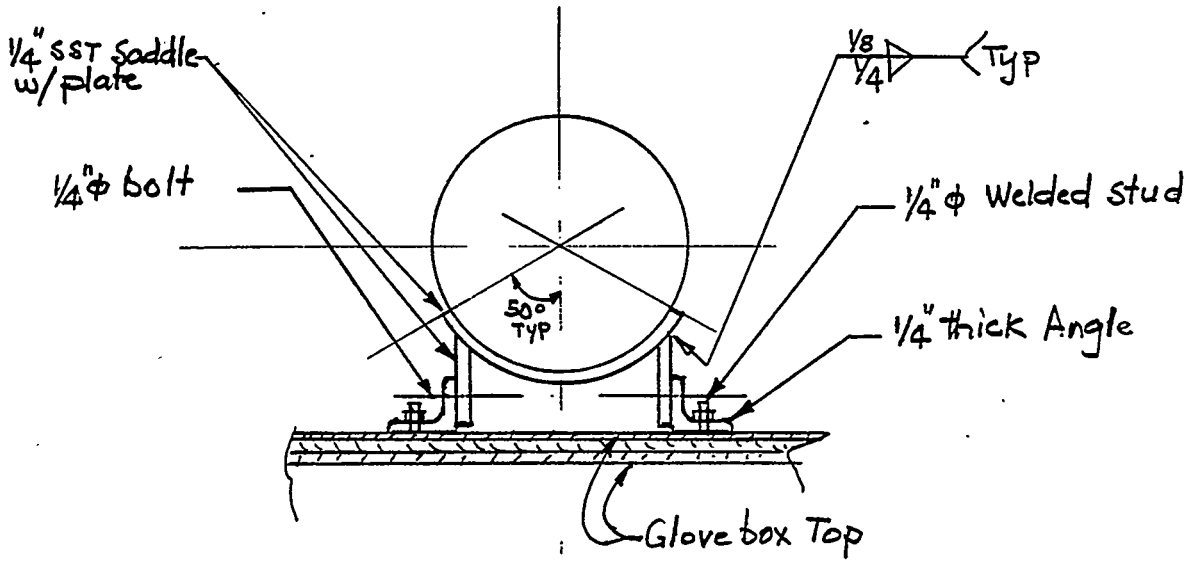
$S.M. = \frac{1}{.71} - 1 = .41$

Subject Glove box, 2736-ZB

Originator M. A. ISLAM Date 5/23/94

Checker E.C. Olson Date 6/7/94

Filter Housing Support



Approximate wt. of Filter Housing Assembly ≃ 60#

Accln. A_H = .68 g

A_V = .45 g ∴ No uplift for Filter Housing

Total Downward load, W = 1.45 x 60 = 87#. This load is small. Therefore, 1/4" ℄ and angle, bolt, stud are adequate.

Max. lateral load, F_H = 60 x .68 = 41# very small. Saddle built at 50° from the center will be adequate to restrain 41# load.

Safety Margin Listing

Anchor bolt = .22

steel stress = .59

Weld = .42

Conn. bolt = .41

COMPUTER INPUT AND OUTPUT

Subject Glovebox, 2736-ZB Bldg.

Originator M. A. ISLAM Date 3/22/94

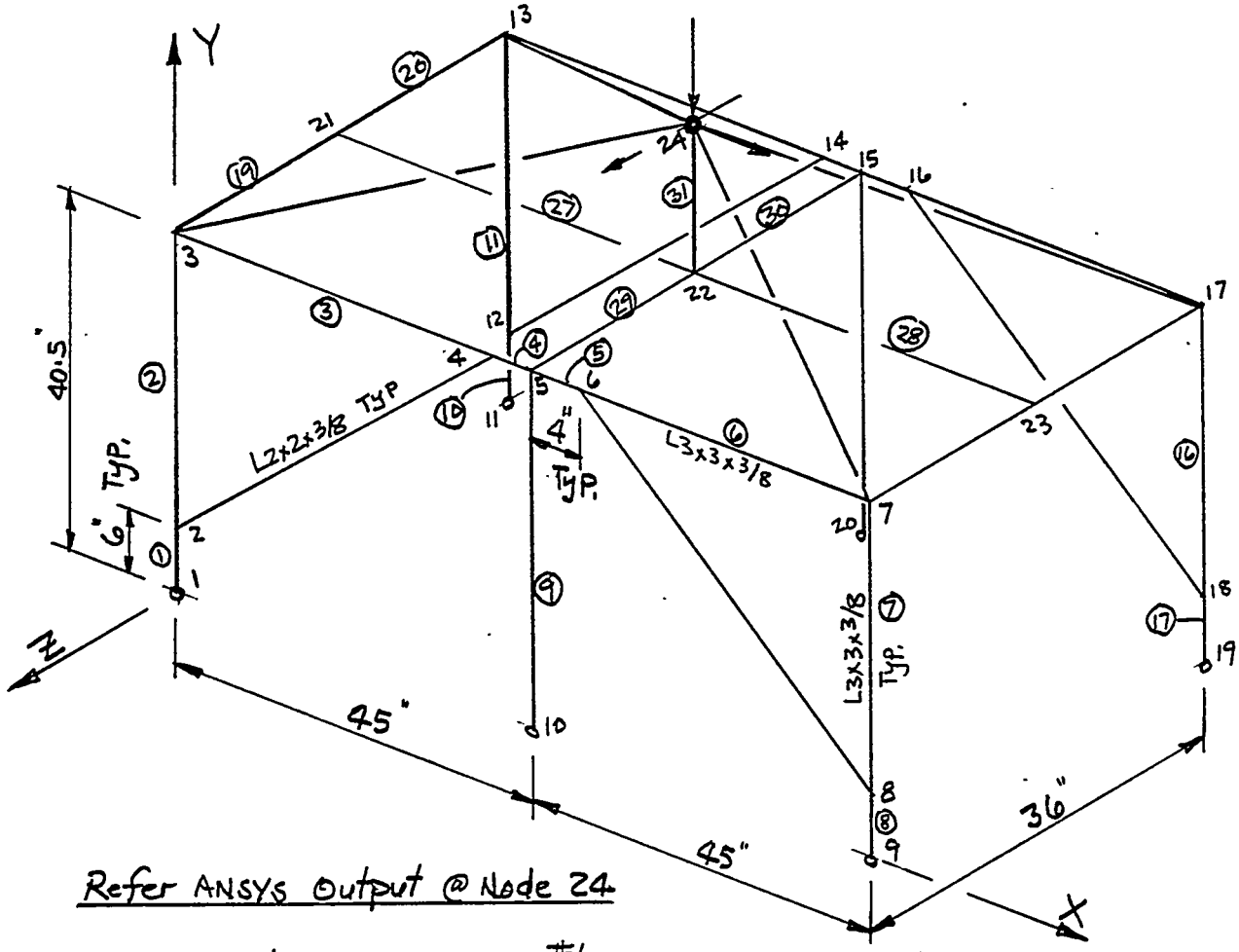
Checker E.C. Ormsby Date 6/7/94

ANSYS RUN 1

stiffness of Glovebox Support

ANSYS MODEL

$\sum W = 3200$ #



Refer ANSYS Output @ Node 24

$K_x = \frac{1}{.8648E\text{-}5} = 1.12E5$ #/in ;

$K_y = \frac{1}{.2724E\text{-}4} = 3.67E4$;

$K_z = \frac{1}{.6677E\text{-}4} = 1.5E4$;

$f_x = 3.13\sqrt{\frac{K_x}{W}} = 3.13\sqrt{\frac{1.12E5}{3200}} = 18.5$ Hz

$f_y = 3.13\sqrt{\frac{3.67E4}{3200}} = 10.6$ Hz

$f_z = 3.13\sqrt{\frac{1.5E4}{3200}} = 7$ Hz

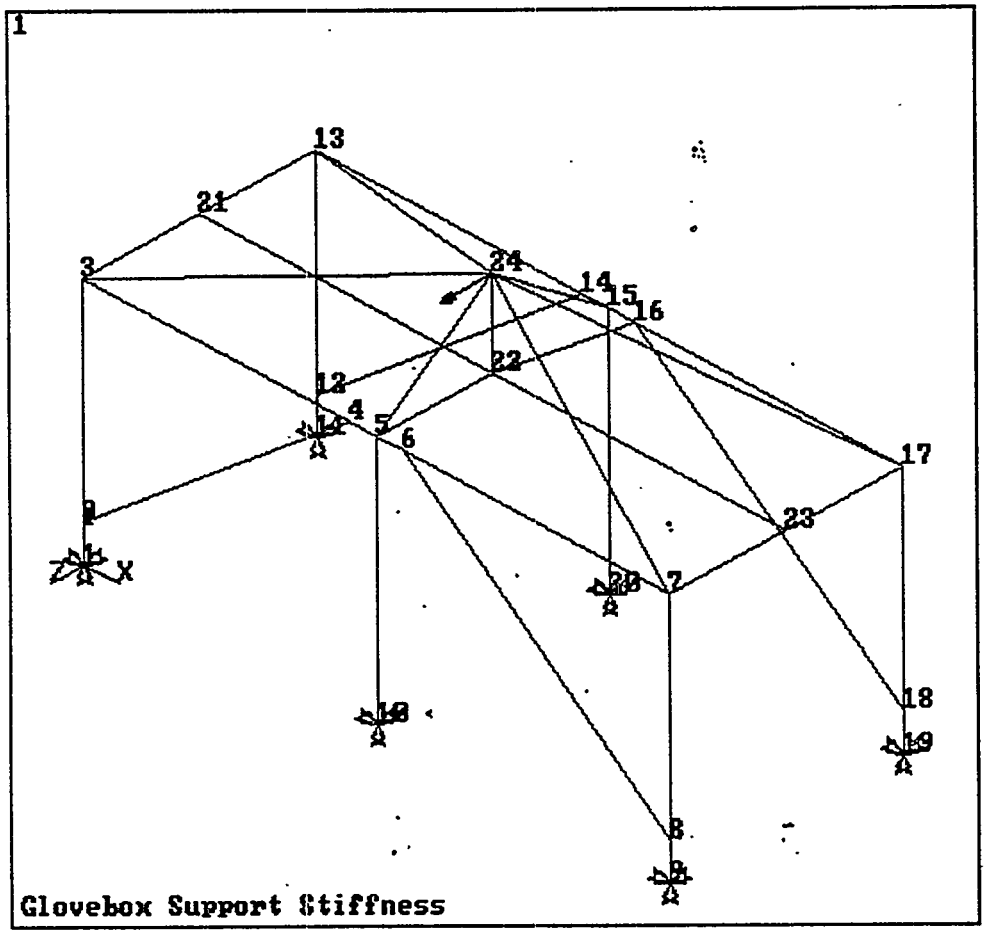
Per SDC-4.1, Rev 11, Fig. 3, all frequencies above fall beyond rigid region. Therefore for equivalent static analysis, consider the glovebox support frame flexible.

ANSYS RUN FOR GLOVEBOX SUPPORT FRAME STIFFNESS

```
/title,Glovebox Support Stiffness
/show,ega256
/view,1,1,1,1
/com                    Filename: support
/com
/com
/com
/com                    Input by: MAI 5/23/94 Chk by: C.O 6/7/94
/com
/com
et,1,4                  * beam element
/com
kan,0
mp,ex,1,29e6
mp,dens,1,.000734       * steel
mp,ex,2,29e6
mp,dens,2,.00000001     * weightless
/com
n,1
n,2,,6
n,3,,40.5
n,4,41,40.5
n,5,45,40.5
n,6,49,40.5
n,7,90,40.5
n,8,90,6
n,9,90
n,10,45
ngen,2,10,1,10,1,,,-36
n,21,,40.5,-18
n,22,45,40.5,-18
n,23,90,40.5,-18
n,24,45,54.3,-18
r,1,2.11,1.76,1.76,4.224,4.224,,,.105   *L3x3x3/8
r,2,1.36,.479,.479,2.728,2.728,,,.07    *L2x2x3/8
r,3,100,10000,1000,25,25,,,100          *Rigid link
mat,1
type,1
real,1
e,1,2
egen,8,1,-1
e,5,10
egen,2,10,1,9
e,3,21
e,21,13
e,7,23
e,23,17
real,2
e,2,4
e,6,8
egen,2,10,23,24
mat,2
real,3
e,21,22

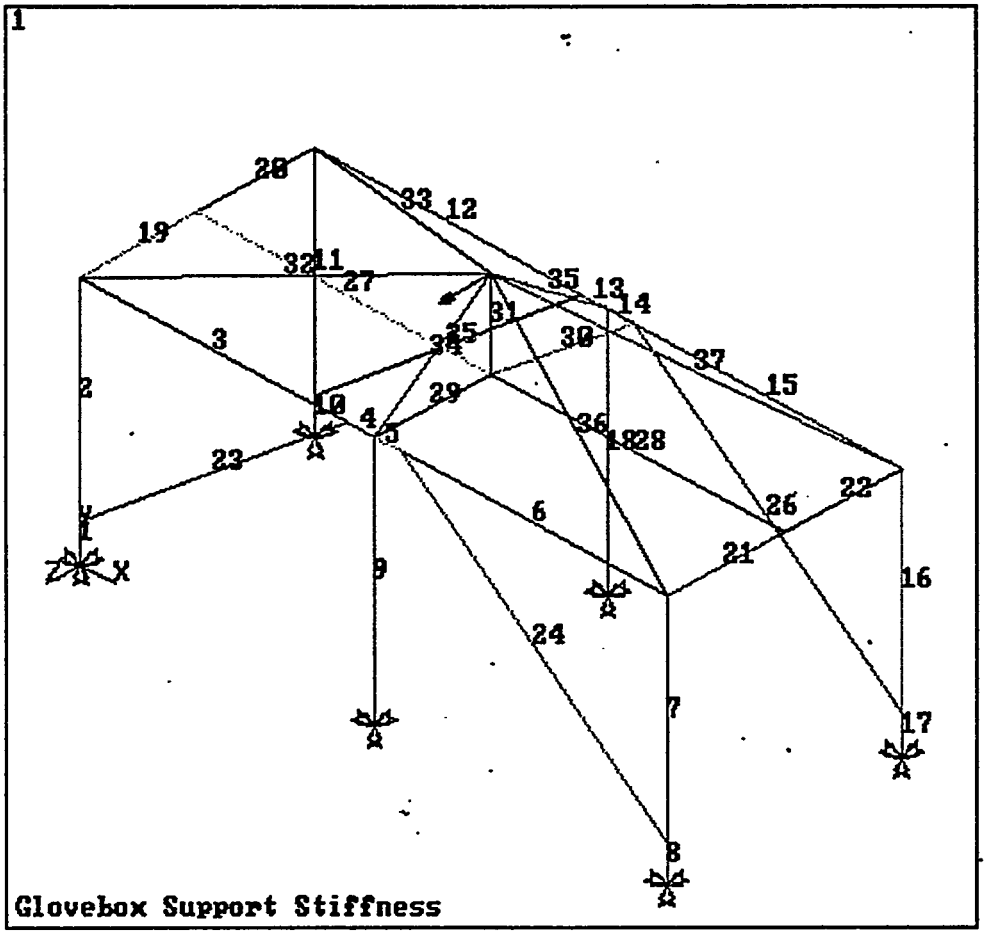
e,22,23
e,5,22
e,22,16
e,22,24
e,3,24
e,13,24
e,5,24
e,15,24
e,7,24
e,17,24
/com
/com
d,1,ux,,,11,10,uy,uz
d,9,ux,,,19,10,uy,uz
d,10,ux,,,20,10,uy,uz
iter,1,1,1
/com
acel,,386.4             * dead loads
f,24,fx,1               * Unit load along X
lwrite
```

```
fdele,24,fx
f,24,fy,1          * Unit load along Y
lwrite
fdele,24,fy
f,24,fz,1          * Unit load along Z
nlist,all
elist,all
lwrite
afwrite
```



ANSYS-PC 4.4A1
MAR 22 1993
14:54:21
PREP7 ELEMENTS
TYPE NUM
TDIS
FORC

XV =1
YV =1
ZV =1
DIST=52.676
XF =45
YF =27.15
ZF =-18


1
ANSYS-PC 4.4A1
MAR 22 1993
14:56:23
PREP7 ELEMENTS
ELEM NUM
TDIS
FORC
XV =1
YV =1
ZV =1
DIST=52.676
XF =45
YF =27.15
ZF =-18
Glovebox Support Stiffness

```
POST DATA FILE12  NAME=DWT12.DAT

MAXIMUM NUMBER OF STORED LOAD SETS SET TO   1
 ALL PREVIOUSLY STORED SETS ERASED

MAXIMUM NUMBER OF STORED LOAD SETS SET TO   3
 ALL PREVIOUSLY STORED SETS ERASED

CURRENT LOAD CASE=   1

USE LOAD STEP     1  ITERATION     1  SECTION   1  FOR LOAD CASE     1


GEOMETRY STORED FOR     24  NODES     37  ELEMENTS
 TITLE= Glovebox Support Stiffness

DISPLACEMENT STORED FOR   24 NODES

ITERATION SUMMARY INFORMATION STORED

NODAL FORCES STORED FOR   37 ELEMENTS

REACTIONS STORED FOR   18 REACTIONS

FOR LOAD STEP=     1  ITERATION=     1  SECTION=   1
 TIME=  0.000000E+00   LOAD CASE=  1
 TITLE= Glovebox Support Stiffness

NSEL  FOR LABEL= NODE  FROM    24 TO    24 BY    1

     1  NODES (OF     24  DEFINED) SELECTED BY  NSEL  COMMAND.

PRINT NODAL DISPLACEMENTS

        ***** POST1 NODAL DISPLACEMENT LISTING *****

 LOAD STEP     1  ITERATION=     1  SECTION=  1
 TIME=   0.00000E+00     LOAD CASE=  1

 THE FOLLOWING X,Y,Z DISPLACEMENTS ARE IN GLOBAL COORDINATES

   NODE      UX              UY              UZ              ROTX            ROTY            ROTZ
    24   0.86478121E-05 -0.27361052E-04 -0.87301244E-06 -0.15589076E-07 -0.28188283E-06 -0.32479080E-08

MAXIMUMS
NODE        24              24              24              24              24              24
VALUE    0.86478121E-05 -0.27361052E-04 -0.87301244E-06 -0.15589076E-07 -0.28188283E-06 -0.32479080E-08

CURRENT LOAD CASE=   2

USE LOAD STEP     2  ITERATION     1  SECTION   1  FOR LOAD CASE     2

DISPLACEMENT STORED FOR   24 NODES

ITERATION SUMMARY INFORMATION STORED

NODAL FORCES STORED FOR   37 ELEMENTS

REACTIONS STORED FOR   18 REACTIONS

FOR LOAD STEP=     2  ITERATION=     1  SECTION=   1
 TIME=  0.000000E+00   LOAD CASE=  2
 TITLE= Glovebox Support Stiffness

NSEL  FOR LABEL= NODE  FROM    24 TO    24 BY    1

     1  NODES (OF     24  DEFINED) SELECTED BY  NSEL  COMMAND.

PRINT NODAL DISPLACEMENTS

        ***** POST1 NODAL DISPLACEMENT LISTING *****

 LOAD STEP     2  ITERATION=     1  SECTION=  1
```

```
 TIME=   0.00000E+00     LOAD CASE=  2

 THE FOLLOWING X,Y,Z DISPLACEMENTS ARE IN GLOBAL COORDINATES

   NODE      UX              UY              UZ              ROTX            ROTY            ROTZ
    24   0.60031607E-05 -0.27242487E-04 -0.87728280E-06 -0.15658166E-07 -0.28331914E-06 -0.18630300E-08

MAXIMUMS
NODE         24              24              24              24              24              24
VALUE    0.60031607E-05 -0.27242487E-04 -0.87728280E-06 -0.15658166E-07 -0.28331914E-06 -0.18630300E-08

CURRENT LOAD CASE=   3

USE LOAD STEP     3  ITERATION     1  SECTION   1  FOR LOAD CASE     3

DISPLACEMENT STORED FOR   24 NODES

ITERATION SUMMARY INFORMATION STORED

NODAL FORCES STORED FOR   37 ELEMENTS

REACTIONS STORED FOR   18 REACTIONS

FOR LOAD STEP=     3  ITERATION=     1  SECTION=   1
 TIME=  0.000000E+00   LOAD CASE=  3
 TITLE= Glovebox Support Stiffness

NSEL  FOR LABEL= NODE  FROM    24 TO    24 BY    1

     1  NODES (OF     24  DEFINED) SELECTED BY  NSEL  COMMAND.

PRINT NODAL DISPLACEMENTS

        ***** POST1 NODAL DISPLACEMENT LISTING *****

 LOAD STEP     3  ITERATION=     1  SECTION=  1
 TIME=   0.00000E+00     LOAD CASE=  3

 THE FOLLOWING X,Y,Z DISPLACEMENTS ARE IN GLOBAL COORDINATES

   NODE      UX              UY              UZ              ROTX            ROTY            ROTZ
    24   0.60031901E-05 -0.27365293E-04  0.66765344E-04  0.34323141E-08 -0.28308610E-06 -0.18625766E-08

MAXIMUMS
NODE         24.             24              24              24              24              24
VALUE    0.60031901E-05 -0.27365293E-04  0.66765344E-04  0.34323141E-08 -0.28308610E-06 -0.18625766E-08

ALL CURRENT POST1 DATA WRITTEN TO FILE07   NAME= FILE07.DAT
 FOR POSSIBLE RESUME FROM THIS POINT


***** ROUTINE COMPLETED *****  CP =       62.230

SYSTEM= 32053-PC/LT-4.4A   REVISION= 4.4     A 1
FOR SUPPORT CALL                  PHONE                TWX
CURRENT JOBNAME=FILE

/EOF ENCOUNTERED ON FILE 5

DATA INPUT WRITTEN ON FILE18

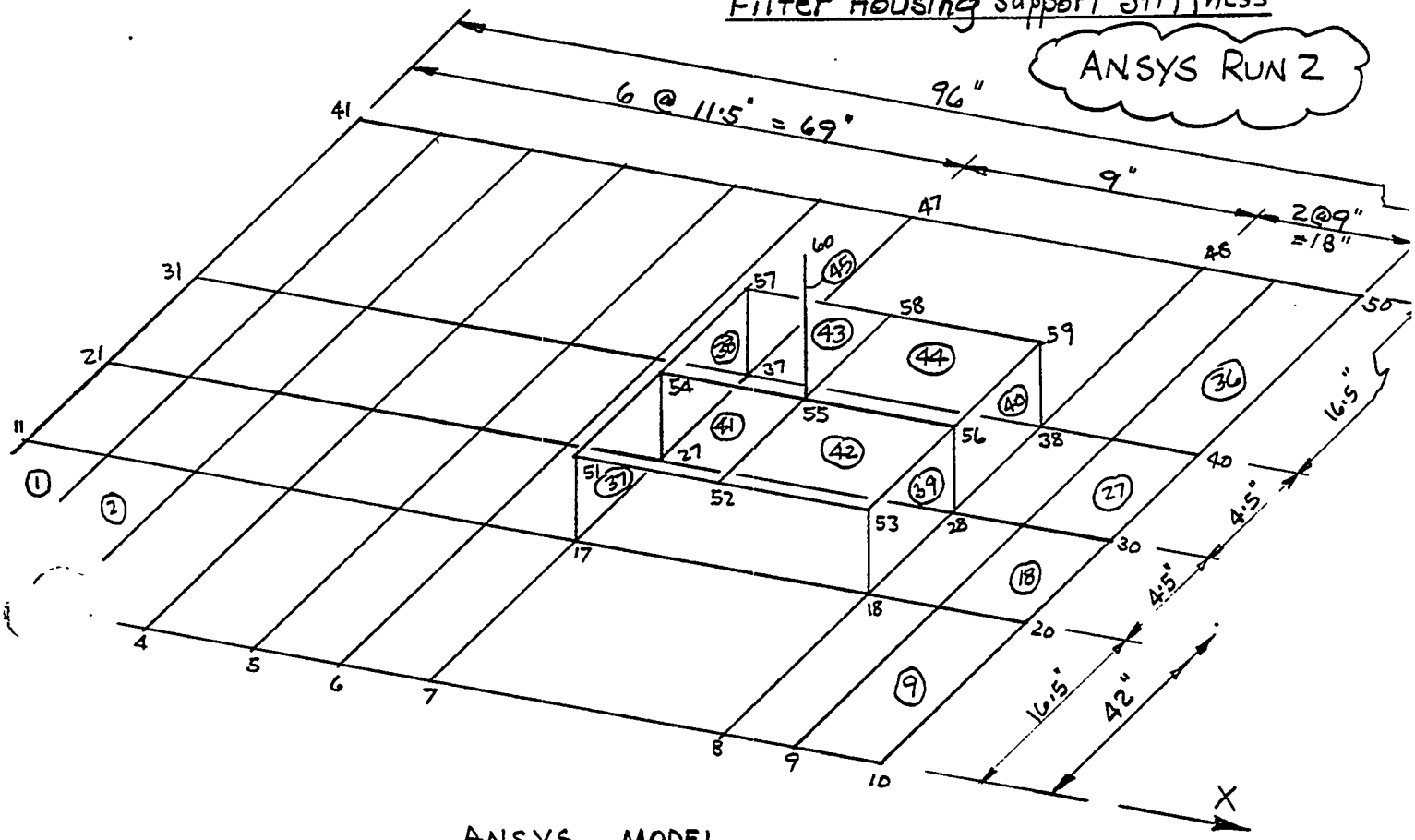

***** RUN COMPLETED *****  CP=       71.5600   TIME=   15.0470
```

Subject Glove Box, 2736-ZB Bldg.

Originator M. A. ISLAM Date 3/3/94

Checker E. C. Oconnell Date 6/7/94

Filter Housing Support Stiffness



ANSYS MODEL

Section Properties

Element 1 thru 36, $t = 3/16"$ SST

mass density = .283/386.4 = .000734

Element 37 thru 44, $t = 1/4"$ SST

mass density = .283/386.4 = .000734

Element 45 – Rigid Link

Assumption : Element 1 thru 36 (Glovebox top) is supported all around (because of Glovebox wall, Support frame).

Subject Glovebox, 2736-ZB Bldg.
Originator M.A. ISLAM Date 3/4/94
Checker E.C. Ocoma Date 6/7/94

stiffnesses (Filter Housing Support)

Refer ANSYS output for displacement @ Node 60

$K_x = \frac{1}{.02243} = 45\ ^{\#}/_{in}$

$K_y = \frac{1}{.074} = .14\ ^{\#}/_{in}$

$K_z = \frac{1}{.0008429} = 1{,}186\ ^{\#}/_{in}$

$ROTX = \frac{1}{.9445E-5} = 1.1E5\ ^{\#\text{-in}}/_{\text{radian}}$

$ROTY = \frac{1}{.0003852} = 2{,}596\ ^{\#\text{-in}}/_{\text{rad.}}$

$ROTZ = \frac{1}{.002116} = 473\ ^{\#\text{-in}}/_{\text{rad}}$

ANSYS RUN FOR GLOVE BOX TOP STIFFNESS & FILTER HOUSING SUPPORT


```
/title,Filter Housing Support Stiffness
/show,ega256
/view,1,1,1,1
/com                    Filename: Glovebox
/com
/com
/com
/com                    Input by: MAI 3/23/94   Chk by: E.C.O. 6/7/94
/com
/com
et,1,63                 * plate
et,2,4                  * beam element
/com
kan,0
mp,ex,1,29e6
mp,dens,1,.000734       * glovebox top & filter housing support
mp,ex,2,29e6
mp,dens,2,.000000001    * weightless
/com
n,1
n,2,11.5
n,3,23
n,4,34.5
n,5,46
n,6,57.5
n,7,69
n,8,78
n,9,87
n,10,96
ngen,2,10,1,10,1,,,-16.5
ngen,3,10,11,20,1,,,-4.5
ngen,2,10,31,40,1,,,-16.5
n,51,69,3,-16.5
n,52,73.5,3,-16.5
n,53,78,3,-16.5
ngen,3,3,51,53,1,,,-4.5
n,60,73.5,11,-21
r,1,.1875                       *Glovebox top
r,2,.25                         *Filter Housing
r,3,100,10000,1000,25,25,,,100  *Rigid link
mat,1
type,1
real,1
e,1,2,12,11
egen,9,1,-1
egen,4,10,1,9
real,2
e,17,27,54,51
e,27,37,57,54
e,18,28,56,53
e,28,38,59,56
e,51,52,55,54
e,52,53,56,55
egen,2,3,41,42
mat,2
type,2
real,3
e,55,60
/com
/com
d,1,ux,,,10,1,uy,uz
d,41,ux,,,50,1,uy,uz
d,11,ux,,,31,10,uy,uz
d,20,ux,,,40,10,uy,uz
iter,1,1,1
/com
acel,,386.4             * dead loads
f,60,fx,1               * Unit load along X
lwrite
fdele,60,fx
f,60,fy,1               * Unit load along Y
lwrite
fdele,60,fy
f,60,fz,1               * Unit load along Z
lwrite
```

```
fdele,60,fz
f,60,mx,1                    * Unit moment about X
lwrite
fdele,60,mx
f,60,my,1                    * Unit momemt about Y
lwrite
fdele,60,my
f,60,mz,1                    * Unit moment about Z
nlist,all
elist,all
lwrite
afwrite
```

```
POST DATA FILE12  NAME=DWT12.DAT

MAXIMUM NUMBER OF STORED LOAD SETS SET TO   1
 ALL PREVIOUSLY STORED SETS ERASED

MAXIMUM NUMBER OF STORED LOAD SETS SET TO   6
 ALL PREVIOUSLY STORED SETS ERASED

CURRENT LOAD CASE=   1

USE LOAD STEP     1  ITERATION     1  SECTION - 1  FOR LOAD CASE     1


***  NOTE  ***
ALL STRESSES ARE IN GLOBAL COORDINATES UNLESS
     THE COMMAND -- GLOBAL,0 --  IS ENTERED

GEOMETRY STORED FOR     60  NODES     45  ELEMENTS
 TITLE= Filter Housing Support Stiffness

DISPLACEMENT STORED FOR   60 NODES

***WARNING ***                            CP=    53.110   TIME=  10.07416
MODEL CONTAINS DIFFERENT MATERIAL TYPES, NODAL STRESS AVERAGING MAY
 BE INVALID AMONG DISSIMILAR MATERIALS

STRESSES STORED FOR    4  SELECTED ITEMS

NODAL STRESSES AND TEMPS. STORED FOR   44 ELEMENTS

ITERATION SUMMARY INFORMATION STORED

NODAL FORCES STORED FOR   45 ELEMENTS

REACTIONS STORED FOR   78 REACTIONS

FOR LOAD STEP=     1  ITERATION=     1  SECTION=   1
 TIME=  0.000000E+00   LOAD CASE=  1
 TITLE= Filter Housing Support Stiffness

NSEL  FOR LABEL= NODE  FROM    60 TO    60 BY    1

     1  NODES (OF     60  DEFINED) SELECTED BY  NSEL  COMMAND.

PRINT NODAL DISPLACEMENTS

        ***** POST1 NODAL DISPLACEMENT LISTING *****

 LOAD STEP     1  ITERATION=     1  SECTION=  1
 TIME=   0.00000E+00     LOAD CASE=  1

 THE FOLLOWING X,Y,Z DISPLACEMENTS ARE IN GLOBAL COORDINATES

   NODE      UX              UY              UZ             ROTX           ROTY           ROTZ
    60  -0.22426534E-01 -0.74820843E-01  0.11777198E-13  0.10698851E-14  0.50138453E-16  0.20249575E-02

MAXIMUMS
NODE         60              60              60             60             60             60
VALUE    -0.22426534E-01 -0.74820843E-01  0.11777198E-13  0.10698851E-14  0.50138453E-16  0.20249575E-02

CURRENT LOAD CASE=   2

USE LOAD STEP     2  ITERATION     1  SECTION   1  FOR LOAD CASE     2

DISPLACEMENT STORED FOR   60 NODES

STRESSES STORED FOR    4  SELECTED ITEMS

NODAL STRESSES AND TEMPS. STORED FOR   44 ELEMENTS

ITERATION SUMMARY INFORMATION STORED

NODAL FORCES STORED FOR   45 ELEMENTS
```

```
REACTIONS STORED FOR   78 REACTIONS

FOR LOAD STEP=     2  ITERATION=     1  SECTION=   1
 TIME=  0.000000E+00   LOAD CASE=  2
 TITLE= Filter Housing Support Stiffness

NSEL  FOR LABEL= NODE  FROM    60 TO    60 BY    1

     1  NODES (OF     60  DEFINED) SELECTED BY  NSEL  COMMAND.

PRINT NODAL DISPLACEMENTS

        ***** POST1 NODAL DISPLACEMENT LISTING *****

 LOAD STEP     2  ITERATION=     1  SECTION=  1
 TIME=   0.00000E+00     LOAD CASE=  2

 THE FOLLOWING X,Y,Z DISPLACEMENTS ARE IN GLOBAL COORDINATES

   NODE      UX              UY              UZ              ROTX            ROTY            ROTZ
    60  -0.23079340E-01 -0.73989444E-01  0.11640737E-13  0.10574847E-14  0.49793010E-16  0.20946685E-02

MAXIMUMS
NODE         60              60              60              60              60              60
VALUE   -0.23079340E-01 -0.73989444E-01  0.11640737E-13  0.10574847E-14  0.49793010E-16  0.20946685E-02

CURRENT LOAD CASE=   3

USE LOAD STEP     3  ITERATION     1  SECTION   1  FOR LOAD CASE     3

DISPLACEMENT STORED FOR   60 NODES

STRESSES STORED FOR    4  SELECTED ITEMS

NODAL STRESSES AND TEMPS. STORED FOR   44 ELEMENTS

ITERATION SUMMARY INFORMATION STORED

NODAL FORCES STORED FOR   45 ELEMENTS

REACTIONS STORED FOR   78 REACTIONS

FOR LOAD STEP=     3  ITERATION=     1  SECTION=   1
 TIME=  0.000000E+00   LOAD CASE=  3
 TITLE= Filter Housing Support Stiffness

NSEL  FOR LABEL= NODE  FROM    60 TO    60 BY    1

     1  NODES (OF     60  DEFINED) SELECTED BY  NSEL  COMMAND.

PRINT NODAL DISPLACEMENTS

        ***** POST1 NODAL DISPLACEMENT LISTING *****

 LOAD STEP     3  ITERATION=     1  SECTION=  1
 TIME=   0.00000E+00     LOAD CASE=  3

 THE FOLLOWING X,Y,Z DISPLACEMENTS ARE IN GLOBAL COORDINATES

   NODE      UX              UY              UZ              ROTX            ROTY            ROTZ
    60  -0.23213354E-01 -0.74954857E-01  0.84286135E-03  0.88080023E-04 -0.42201447E-08  0.21068184E-02

MAXIMUMS
NODE         60              60              60              60              60              60
VALUE   -0.23213354E-01 -0.74954857E-01  0.84286135E-03  0.88080023E-04 -0.42201447E-08  0.21068184E-02

CURRENT LOAD CASE=   4

USE LOAD STEP     4  ITERATION     1  SECTION   1  FOR LOAD CASE     4

DISPLACEMENT STORED FOR   60 NODES

STRESSES STORED FOR    4  SELECTED ITEMS

NODAL STRESSES AND TEMPS. STORED FOR   44 ELEMENTS
```

```
ITERATION SUMMARY INFORMATION STORED

NODAL FORCES STORED FOR   45 ELEMENTS

REACTIONS STORED FOR   78 REACTIONS

FOR LOAD STEP=     4  ITERATION=     1  SECTION=   1
 TIME=  0.000000E+00   LOAD CASE=  4
 TITLE= Filter Housing Support Stiffness

NSEL  FOR LABEL= NODE  FROM    60 TO    60 BY    1

     1  NODES (OF     60  DEFINED) SELECTED BY  NSEL  COMMAND.

PRINT NODAL DISPLACEMENTS

        ***** POST1 NODAL DISPLACEMENT LISTING *****

 LOAD STEP     4  ITERATION=     1  SECTION=  1
 TIME=   0.00000E+00     LOAD CASE=  4

 THE FOLLOWING X,Y,Z DISPLACEMENTS ARE IN GLOBAL COORDINATES

   NODE      UX              UY              UZ              ROTX            ROTY            ROTZ
    60  -0.23213354E-01 -0.74954857E-01  0.88080023E-04  0.94449174E-05 -0.33598137E-09  0.21068184E-02

MAXIMUMS
NODE         60              60              60              60              60              60
VALUE   -0.23213354E-01 -0.74954857E-01  0.88080023E-04  0.94449174E-05 -0.33598137E-09  0.21068184E-02

CURRENT LOAD CASE=   5

USE LOAD STEP     5  ITERATION     1  SECTION   1  FOR LOAD CASE     5

DISPLACEMENT STORED FOR   60 NODES

STRESSES STORED FOR    4  SELECTED ITEMS

NODAL STRESSES AND TEMPS. STORED FOR   44 ELEMENTS

ITERATION SUMMARY INFORMATION STORED

NODAL FORCES STORED FOR   45 ELEMENTS

REACTIONS STORED FOR   78 REACTIONS

FOR LOAD STEP=     5  ITERATION=     1  SECTION=   1
 TIME=  0.000000E+00   LOAD CASE=  5
 TITLE= Filter Housing Support Stiffness

NSEL  FOR LABEL= NODE  FROM    60 TO    60 BY    1

     1  NODES (OF     60  DEFINED) SELECTED BY  NSEL  COMMAND.

PRINT NODAL DISPLACEMENTS

        ***** POST1 NODAL DISPLACEMENT LISTING *****

 LOAD STEP     5  ITERATION=     1  SECTION=  1
 TIME=   0.00000E+00     LOAD CASE=  5

 THE FOLLOWING X,Y,Z DISPLACEMENTS ARE IN GLOBAL COORDINATES

   NODE      UX              UY              UZ              ROTX            ROTY            ROTZ
    60  -0.23213354E-01 -0.74954857E-01 -0.42201329E-08 -0.33598035E-09  0.38523925E-03  0.21068184E-02

MAXIMUMS
NODE         60              60              60              60              60              60
VALUE   -0.23213354E-01 -0.74954857E-01 -0.42201329E-08 -0.33598035E-09  0.38523925E-03  0.21068184E-02

CURRENT LOAD CASE=   6

USE LOAD STEP     6  ITERATION     1  SECTION   1  FOR LOAD CASE     6

DISPLACEMENT STORED FOR   60 NODES
```

```
STRESSES STORED FOR    4  SELECTED ITEMS

NODAL STRESSES AND TEMPS. STORED FOR   44 ELEMENTS

ITERATION SUMMARY INFORMATION STORED

NODAL FORCES STORED FOR   45 ELEMENTS

REACTIONS STORED FOR   78 REACTIONS

FOR LOAD STEP=     6  ITERATION=     1  SECTION=   1
 TIME=  0.000000E+00   LOAD CASE=  6
 TITLE= Filter Housing Support Stiffness

NSEL  FOR LABEL= NODE  FROM    60 TO    60 BY    1

     1  NODES (OF     60  DEFINED) SELECTED BY  NSEL  COMMAND.

PRINT NODAL DISPLACEMENTS

        ***** POST1 NODAL DISPLACEMENT LISTING *****

 LOAD STEP     6  ITERATION=     1  SECTION=  1
 TIME=   0.00000E+00     LOAD CASE=  6

 THE FOLLOWING X,Y,Z DISPLACEMENTS ARE IN GLOBAL COORDINATES

   NODE      UX              UY              UZ              ROTX            ROTY            ROTZ
    60  -0.23295214E-01 -0.74967007E-01  0.11794663E-13  0.10714674E-14  0.50412351E-16  0.21156784E-02

MAXIMUMS
NODE         60              60              60              60              60              60
VALUE   -0.23295214E-01 -0.74967007E-01  0.11794663E-13  0.10714674E-14  0.50412351E-16  0.21156784E-02

ALL CURRENT POST1 DATA WRITTEN TO FILE07   NAME= FILE07.DAT
 FOR POSSIBLE RESUME FROM THIS POINT


***** ROUTINE COMPLETED *****  CP =       58.930

***  NOTE  ***
A TOTAL OF      1. WARNINGS AND ERRORS WRITTEN TO FILE19

SYSTEM= 32053-PC/LT-4.4A   REVISION= 4.4     A 1
FOR SUPPORT CALL                   PHONE                TWX
CURRENT JOBNAME=FILE

/EOF ENCOUNTERED ON FILE 5

DATA INPUT WRITTEN ON FILE18

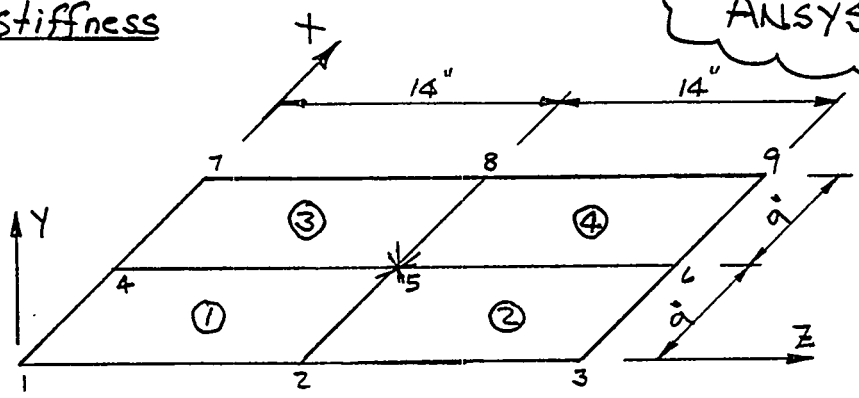

***** RUN COMPLETED *****  CP=       72.5000   TIME=   10.0795
```

ANALYTICAL CALCULATIONS

Subject Glovebox, 2736-EB Bldg.
Originator M. A. ISLAM Date 3/15/94
Checker E. C. O'Connor Date 6/7/94

Hood stiffness

ANSYS RUN 3



ANSYS MODEL

Element ① thru ④, $t = 3/16"$ SST
mass density = .000734

stiffnesses (Refer ANSYS output for displacements @ Node 5)

$K_x = \frac{1}{.2128E-6} = 4.7E6\ ^{\#}/_{in}$; $ROTX = \frac{1}{.1405E-4} = 7.1E4\ ^{\#\text{-in}}/_{radian}$

$K_y = \frac{1}{.02355} = 42$; $ROTY = \frac{1}{1.8245} = .55\ ^{\#\text{-in}}/_{rad.}$

$K_z = \frac{1}{.1419E-6} = 7.0E6$; $ROTZ = \frac{1}{.1699E-4} = 5.9E4\ ^{\#\text{-in}}/_{radian}$

ANSYS RUN FOR HOOD TOP STIFFNESS


```
/title,Hood Top Stiffness
/show,ega256
/view,1,1,1,1
/com                    Filename: Hood
/com
/com
/com                    Input by: MAI 3/23/94  Chk by: ECO 6/7/94
/com
/com
et,1,63                 * plate
/com
kan,0
mp,ex,1,29e6
mp,dens,1,.000734       * Hood top
/com
n,1
n,2,,,14
n,3,,,28
ngen,3,3,1,3,1,9
r,1,.1875                       *Hood top
mat,1
type,1
real,1
e,1,2,5,4
e,2,3,6,5
egen,2,3,1,2
/com
/com
d,1,ux,,,3,2,uy,uz
d,7,ux,,,9,2,uy,uz
iter,1,1,1
/com
acel,,386.4              * dead loads
f,5,fx,1                * Unit load along X
lwrite
fdele,5,fx
f,5,fy,1                * Unit load along Y
lwrite
fdele,5,fy
f,5,fz,1                * Unit load along Z
lwrite
fdele,5,fz
f,5,mx,1                * Unit moment about X
lwrite
fdele,5,mx
f,5,my,1                * Unit momemt about Y
lwrite
fdele,5,my
f,5,mz,1                * Unit moment about Z
nlist,all
elist,all
lwrite
afwrite
```

```
POST DATA FILE12  NAME=DWT12.DAT

MAXIMUM NUMBER OF STORED LOAD SETS SET TO   1
 ALL PREVIOUSLY STORED SETS ERASED

MAXIMUM NUMBER OF STORED LOAD SETS SET TO   6
 ALL PREVIOUSLY STORED SETS ERASED

CURRENT LOAD CASE=   1

USE LOAD STEP     1  ITERATION     1  SECTION   1  FOR LOAD CASE     1


***  NOTE  ***
ALL STRESSES ARE IN GLOBAL COORDINATES UNLESS
     THE COMMAND -- GLOBAL,0 --  IS ENTERED

GEOMETRY STORED FOR      9  NODES      4  ELEMENTS
 TITLE= Hood Top Stiffness

DISPLACEMENT STORED FOR    9 NODES

STRESSES STORED FOR    4  SELECTED ITEMS

NODAL STRESSES AND TEMPS. STORED FOR    4 ELEMENTS

ITERATION SUMMARY INFORMATION STORED

NODAL FORCES STORED FOR    4 ELEMENTS

REACTIONS STORED FOR   12 REACTIONS

FOR LOAD STEP=     1  ITERATION=     1  SECTION=   1
 TIME=  0.000000E+00   LOAD CASE=  1
 TITLE= Hood Top Stiffness

NSEL  FOR LABEL= NODE  FROM     5 TO     5 BY    1

     1  NODES (OF      9  DEFINED) SELECTED BY  NSEL  COMMAND.

PRINT NODAL DISPLACEMENTS

        ***** POST1 NODAL DISPLACEMENT LISTING *****

 LOAD STEP     1  ITERATION=     1  SECTION=  1
 TIME=   0.00000E+00     LOAD CASE=  1

 THE FOLLOWING X,Y,Z DISPLACEMENTS ARE IN GLOBAL COORDINATES

   NODE      UX              UY              UZ              ROTX            ROTY            ROTZ
     5   0.21284802E-06 -0.25058362E-01 -0.99261674E-23 -0.54210109E-19  0.00000000E+00 -0.65052130E-18

MAXIMUMS
NODE         5               5               5               5               0               5
VALUE    0.21284802E-06 -0.25058362E-01 -0.99261674E-23 -0.54210109E-19  0.00000000E+00 -0.65052130E-18

CURRENT LOAD CASE=   2

USE LOAD STEP     2  ITERATION     1  SECTION   1  FOR LOAD CASE     2

DISPLACEMENT STORED FOR    9 NODES

STRESSES STORED FOR    4  SELECTED ITEMS

NODAL STRESSES AND TEMPS. STORED FOR    4 ELEMENTS

ITERATION SUMMARY INFORMATION STORED

NODAL FORCES STORED FOR    4 ELEMENTS

REACTIONS STORED FOR   12 REACTIONS

FOR LOAD STEP=     2  ITERATION=     1  SECTION=   1
```

```
 TIME=  0.000000E+00   LOAD CASE=  2
 TITLE= Hood Top Stiffness

NSEL  FOR LABEL= NODE  FROM     5 TO     5 BY    1

     1  NODES (OF      9  DEFINED) SELECTED BY  NSEL  COMMAND.

PRINT NODAL DISPLACEMENTS

        ***** POST1 NODAL DISPLACEMENT LISTING *****

 LOAD STEP     2  ITERATION=     1  SECTION=  1
 TIME=   0.00000E+00     LOAD CASE=  2

 THE FOLLOWING X,Y,Z DISPLACEMENTS ARE IN GLOBAL COORDINATES

   NODE      UX              UY              UZ              ROTX            ROTY            ROTZ
     5   0.00000000E+00 -0.23548373E-01  0.00000000E+00 -0.54210109E-19  0.00000000E+00 -0.75894152E-18

MAXIMUMS
NODE         0               5               0               5               0               5
VALUE    0.00000000E+00 -0.23548373E-01  0.00000000E+00 -0.54210109E-19  0.00000000E+00 -0.75894152E-18

CURRENT LOAD CASE=   3

USE LOAD STEP     3  ITERATION     1  SECTION   1  FOR LOAD CASE     3

DISPLACEMENT STORED FOR    9 NODES

STRESSES STORED FOR    4  SELECTED ITEMS

NODAL STRESSES AND TEMPS. STORED FOR    4 ELEMENTS

ITERATION SUMMARY INFORMATION STORED

NODAL FORCES STORED FOR    4 ELEMENTS

REACTIONS STORED FOR   12 REACTIONS

FOR LOAD STEP=     3  ITERATION=     1  SECTION=   1
 TIME=  0.000000E+00   LOAD CASE=  3
 TITLE= Hood Top Stiffness

NSEL  FOR LABEL= NODE  FROM     5 TO     5 BY    1

     1  NODES (OF      9  DEFINED) SELECTED BY  NSEL  COMMAND.

PRINT NODAL DISPLACEMENTS

        ***** POST1 NODAL DISPLACEMENT LISTING *****

 LOAD STEP     3  ITERATION=     1  SECTION=  1
 TIME=   0.00000E+00     LOAD CASE=  3

 THE FOLLOWING X,Y,Z DISPLACEMENTS ARE IN GLOBAL COORDINATES

   NODE      UX              UY              UZ              ROTX            ROTY            ROTZ
     5  -0.93389891E-23 -0.25058362E-01  0.14193030E-06 -0.54210109E-19  0.00000000E+00 -0.75894152E-18

MAXIMUMS
NODE         5               5               5               5               0               5
VALUE   -0.93389891E-23 -0.25058362E-01  0.14193030E-06 -0.54210109E-19  0.00000000E+00 -0.75894152E-18

CURRENT LOAD CASE=   4

USE LOAD STEP     4  ITERATION     1  SECTION   1  FOR LOAD CASE     4

DISPLACEMENT STORED FOR    9 NODES

STRESSES STORED FOR    4  SELECTED ITEMS

NODAL STRESSES AND TEMPS. STORED FOR    4 ELEMENTS

ITERATION SUMMARY INFORMATION STORED

NODAL FORCES STORED FOR    4 ELEMENTS
```

```
REACTIONS STORED FOR   12 REACTIONS

FOR LOAD STEP=     4  ITERATION=     1  SECTION=   1
 TIME=  0.000000E+00   LOAD CASE=  4
 TITLE= Hood Top Stiffness

NSEL  FOR LABEL= NODE  FROM     5 TO     5 BY    1

     1  NODES (OF      9  DEFINED) SELECTED BY  NSEL  COMMAND.

PRINT NODAL DISPLACEMENTS

        ***** POST1 NODAL DISPLACEMENT LISTING *****

 LOAD STEP     4  ITERATION=     1  SECTION=  1
 TIME=   0.00000E+00     LOAD CASE=  4

 THE FOLLOWING X,Y,Z DISPLACEMENTS ARE IN GLOBAL COORDINATES

   NODE      UX              UY              UZ              ROTX            ROTY            ROTZ
     5   0.00000000E+00 -0.25058362E-01  0.00000000E+00  0.14049548E-04  0.00000000E+00 -0.10842022E-17

MAXIMUMS
NODE         0               5               0               5               0               5
VALUE    0.00000000E+00 -0.25058362E-01  0.00000000E+00  0.14049548E-04  0.00000000E+00 -0.10842022E-17

CURRENT LOAD CASE=   5

USE LOAD STEP     5  ITERATION     1  SECTION   1  FOR LOAD CASE     5

DISPLACEMENT STORED FOR    9 NODES

STRESSES STORED FOR    4  SELECTED ITEMS

NODAL STRESSES AND TEMPS. STORED FOR    4 ELEMENTS

ITERATION SUMMARY INFORMATION STORED

NODAL FORCES STORED FOR    4 ELEMENTS

REACTIONS STORED FOR   12 REACTIONS

FOR LOAD STEP=     5  ITERATION=     1  SECTION=   1
 TIME=  0.000000E+00   LOAD CASE=  5
 TITLE= Hood Top Stiffness

NSEL  FOR LABEL= NODE  FROM     5 TO     5 BY    1

     1  NODES (OF      9  DEFINED) SELECTED BY  NSEL  COMMAND.

PRINT NODAL DISPLACEMENTS

        ***** POST1 NODAL DISPLACEMENT LISTING *****

 LOAD STEP     5  ITERATION=     1  SECTION=  1
 TIME=   0.00000E+00     LOAD CASE=  5

 THE FOLLOWING X,Y,Z DISPLACEMENTS ARE IN GLOBAL COORDINATES

   NODE      UX              UY              UZ              ROTX            ROTY            ROTZ
     5   0.00000000E+00 -0.25058362E-01  0.00000000E+00 -0.54210109E-19  1.8245256      -0.75894152E-18

MAXIMUMS
NODE         0               5               0               5               5               5
VALUE    0.00000000E+00 -0.25058362E-01  0.00000000E+00 -0.54210109E-19  1.8245256      -0.75894152E-18

CURRENT LOAD CASE=   6

USE LOAD STEP     6  ITERATION     1  SECTION   1  FOR LOAD CASE     6

DISPLACEMENT STORED FOR    9 NODES

STRESSES STORED FOR    4  SELECTED ITEMS

NODAL STRESSES AND TEMPS. STORED FOR    4 ELEMENTS
```

```
ITERATION SUMMARY INFORMATION STORED

NODAL FORCES STORED FOR    4 ELEMENTS

REACTIONS STORED FOR   12 REACTIONS

FOR LOAD STEP=     6  ITERATION=     1  SECTION=   1
 TIME=  0.000000E+00   LOAD CASE=  6
 TITLE= Hood Top Stiffness

NSEL  FOR LABEL= NODE  FROM     5 TO     5 BY    1

     1  NODES (OF      9  DEFINED) SELECTED BY  NSEL  COMMAND.

PRINT NODAL DISPLACEMENTS

        ***** POST1 NODAL DISPLACEMENT LISTING *****

 LOAD STEP     6  ITERATION=     1  SECTION=  1
 TIME=   0.00000E+00     LOAD CASE=  6

 THE FOLLOWING X,Y,Z DISPLACEMENTS ARE IN GLOBAL COORDINATES

   NODE      UX             UY             UZ             ROTX           ROTY           ROTZ
     5   0.00000000E+00 -0.25058362E-01  0.00000000E+00 -0.81315163E-19  0.00000000E+00  0.16986440E-04

MAXIMUMS
NODE         0              5              0              5              0              5
VALUE    0.00000000E+00 -0.25058362E-01  0.00000000E+00 -0.81315163E-19  0.00000000E+00  0.16986440E-04

ALL CURRENT POST1 DATA WRITTEN TO FILE07   NAME= FILE07.DAT
 FOR POSSIBLE RESUME FROM THIS POINT


***** ROUTINE COMPLETED *****  CP =       50.910

SYSTEM= 32053-PC/LT-4.4A   REVISION= 4.4      A 1
FOR SUPPORT CALL                  PHONE                    TWX
CURRENT JOBNAME=FILE

/EOF ENCOUNTERED ON FILE 5

DATA INPUT WRITTEN ON FILE18

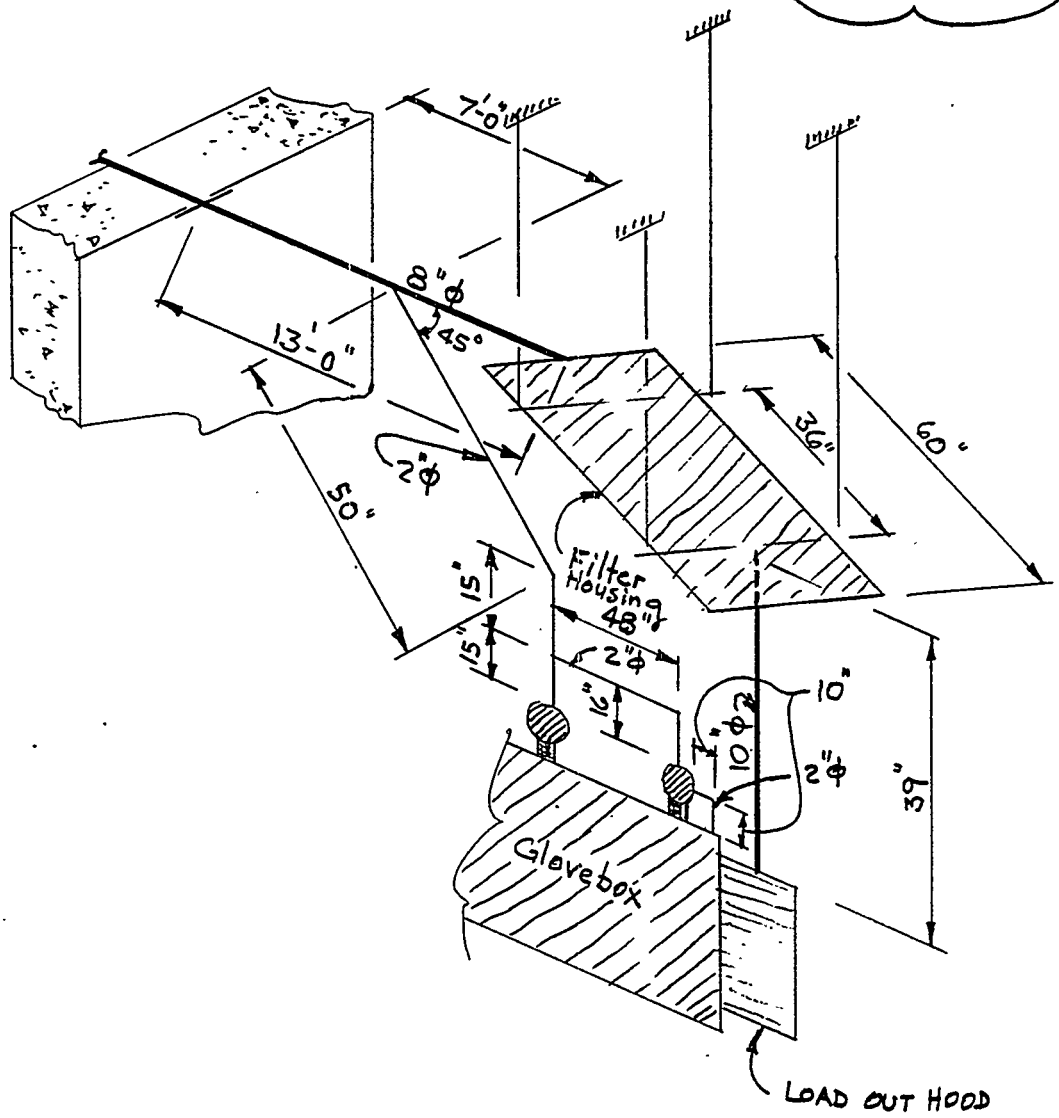

***** RUN COMPLETED *****  CP=      66.1800   TIME=   16.2125
```

Subject Glovebox, 2736-ZB Bldg.

Originator M.A-ISLAM Date 3/10/94

Checker C.C. Derma Date 6/7/94

AUTOPIPE RUN 1



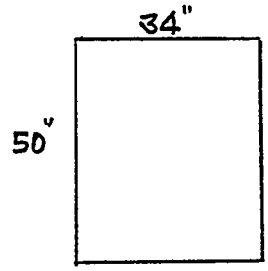
INPUT FOR AUTOPIPE MODEL

LOAD OUT HOOD (FILE: HOODOUT)

Subject Glovebox, 2736-ZB Bldg.
Originator M. A. ISLAM Date 3/4/94
Checker E. C. Owen Date 6/7/94

Filter Housing @ Load Out Hood

16 ga. sheet metal closure, $t = .0635"$ | Refer H-2-80172 sht 1 of 2
Housing dimensions, $60" \times 34" \times 50"$



Wt. of Housing per LFT

$$= \frac{2(34+50) \times .0635 \times 490}{144}$$

$$= 36.3\ \#/Ft$$

Equivalent Pipe size, 14" sch 10, $w = 36.7\ \#/$,
(Use same pipe size for Filter Housing @ Load In Hood side)

10"ϕ Pipe (Hood)

Refer Dwg. H-2-80176, sht 1 of 2
pipe wall thickness, $t = .125"$
wt. per LFT $= \pi (10 - .125) \times .125 \times \frac{490}{144} = 13.2\ \#$
Equivalent Pipe section, 8 Sch 10S, $w = 13.4\ \#/$,

8"ϕ Pipe (Hood)

Use $t = .125"$
wt. per LFT $= \pi (8 - .125) \times .125 \times \frac{490}{144} = 10.5\ \#$
Equivalent pipe section, 4 Sch 40, $w = 10.79\ \#/$,

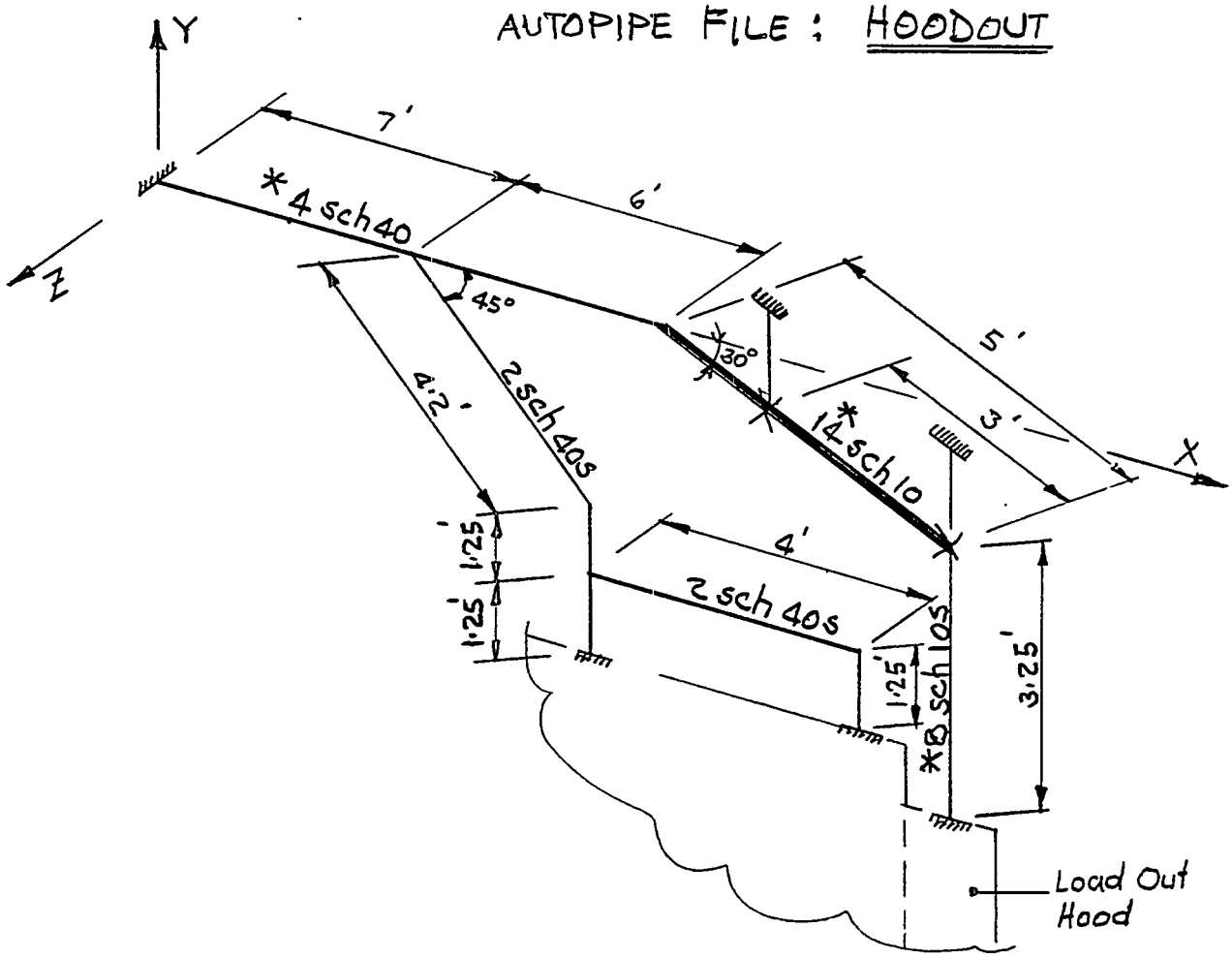
2"ϕ sch 40S (Glovebox)

Refer Dwg. H-2-80175, sht 1 of 2
OK as identified.

ANALYTICAL CALCULATIONS

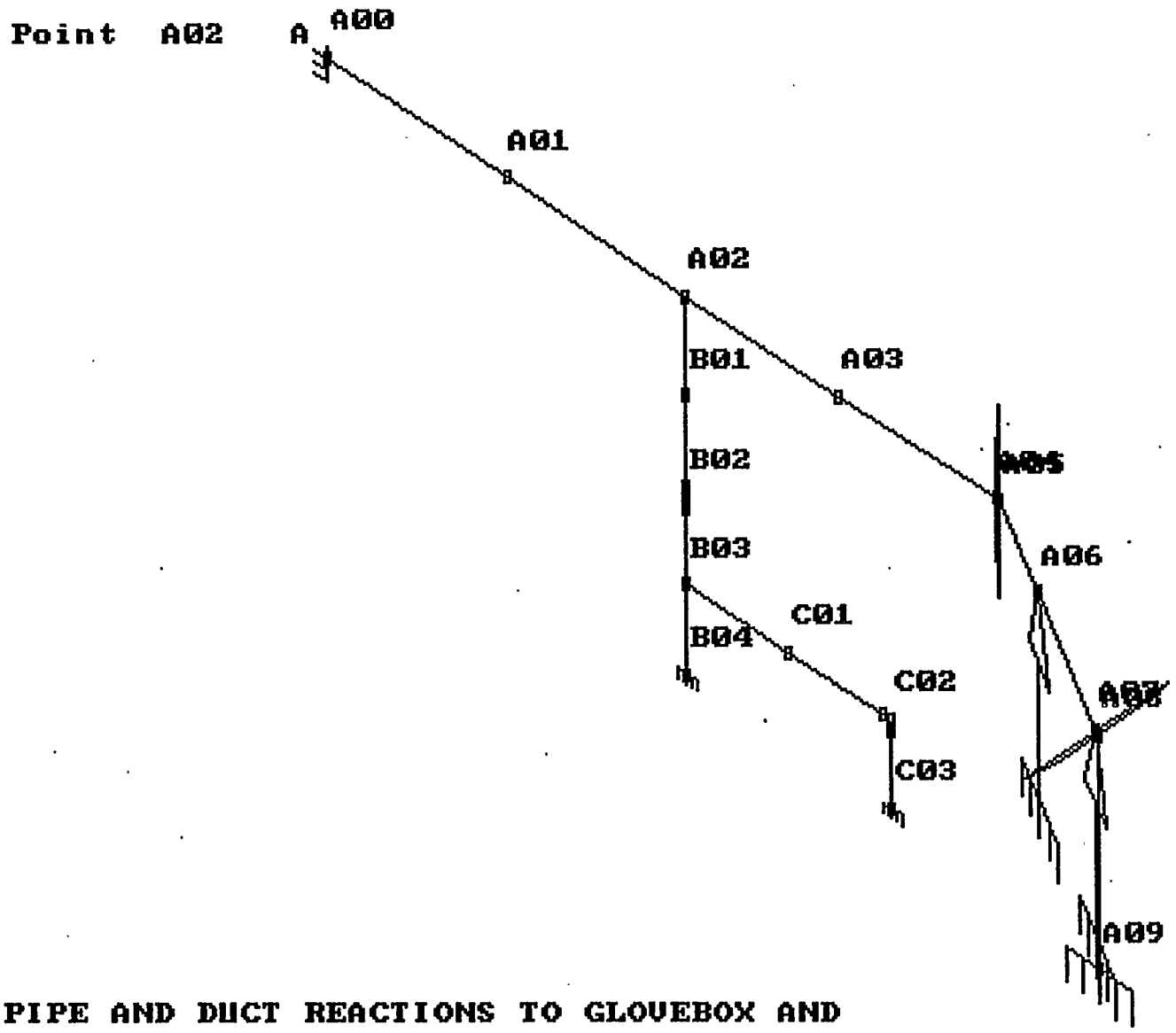
Subject Glovebox, 2736-ZB Bldg.
Originator M.A. ISLAM Date 3/15/94
Checker E.C. Ocampo Date 6/7/94

AUTOPIPE FILE : HOODOUT



PIPING ISOMETRIC

* Equivalent piping based on mass. Because the objective of the analysis is to determine reactions only, the mass based piping consideration is acceptable.



PIPE AND DUCT REACTIONS TO GLOVEBOX AND
LOAD OUT HOOD, 2736-ZB, 200 W AREA

P O I N T D A T A L I S T I N G

POINT NAME	TYPE	-----OFFSETS (ft)----- X	Y	Z	PIPE ID	DESCRIPTION
*** SEGMENT A						
A00	Run	0	0	0	4SCH40	
A01	Run	3.50	0	0		
A02	Tee	3.50	0	0		
A03	Run	3.00	0	0		
A04	Redu	3.00	0	0		
A05	Run	0.10	0	0	14SCH10	
A06	Run	1.73	0	1.00		
A07	Redu	2.60	0	1.50		
A08	Run	0.09	0	0.05	8SCH10S	
A09	Run	0	-3.25	0		
*** SEGMENT B						
A02	Tee	7.00	0	0	2SCH40S	
B01	Run	1.49	0	1.49		
B02	Bend	1.48	0	1.48		Short Elbow, Radius = 2.00 inch Bend angle change = 90.00 deg Mid point at 50.00 percent SIF - In = 2.27, Out = 1.89
B03	Tee	0	-1.25	0		
B04	Run	0	-1.25	0		
*** SEGMENT C						
B03	Tee	9.97	-1.25	2.97	2SCH40S	
C01	Run	2.00	0	0		
C02	Bend	2.00	0	0		Short Elbow, Radius = 2.00 inch Bend angle change = 90.00 deg Mid point at 50.00 percent SIF - In = 2.27, Out = 1.89
C03	Run	0	-1.25	0		

Total weight of empty pipes : 410 lb

COMPONENT DATA LISTING

POINT NAME	COORDINATE(ft) X	Y	Z	DATA TYPE	DESCRIPTION
*** SEGMENT A					
A00	0.00	0.00	0.00	ANCHOR	Rigid Thermal movements : None
A01	3.50	0.00	0.00		
A02	7.00	0.00	0.00	TEE	Unreinforced tee SIF - In = 3.17, Out = 3.89
A03	10.00	0.00	0.00		
A04	13.00	0.00	0.00		
A05	13.10	0.00	0.00		
A06	14.83	0.00	1.00	Y-STOP	ID : A06 1, Connected to Ground
A07	17.43	0.00	2.50	Y-STOP	ID : A07 1, Connected to Ground
A08	17.52	0.00	2.55		
A09	17.52	-3.25	2.55	ANCHOR	Translational stiffness lb/in X= 4700000 Y= 42 Z= 7000000 Rotational stiffness ft-lb/deg X= 103 Y= FREE Z= 86 Thermal movements : None
*** SEGMENT B					
A02	7.00	0.00	0.00	TEE	Unreinforced tee SIF - In = 3.17, Out = 3.89
B01	8.49	0.00	1.49		
B02 N	9.85	0.00	2.85		
B02	9.97	0.00	2.97	TI	
B02 M	9.93	-0.05	2.93		
B02 F	9.97	-0.17	2.97		
B03	9.97	-1.25	2.97	TEE	Unreinforced tee SIF - In = 2.77, Out = 3.36
B04	9.97	-2.50	2.97	ANCHOR	Translational stiffness lb/in X= 45 Y= 14 Z= 1186 Rotational stiffness ft-lb/deg X= 160 Y= 4 Z= 1
*** SEGMENT C					
B03	9.97	-1.25	2.97	TEE	Unreinforced tee SIF - In = 2.77, Out = 3.36
C01	11.97	-1.25	2.97		
C02 N	13.80	-1.25	2.97		
C02	13.97	-1.25	2.97	TI	
C02 M	13.92	-1.30	2.97		
C02 F	13.97	-1.42	2.97		
C03	13.97	-2.50	2.97	ANCHOR	Translational stiffness lb/in X= 45 Y= 14 Z= 1186 Rotational stiffness ft-lb/deg X= 160 Y= 4 Z= 1 Thermal movements : None

From Page A-34 →

From Page A-27 →

From Page A-27 →

COMPONENT DATA LISTING

POINT NAME	---COORDINATE(ft)--- X	Y	Z	DATA TYPE	DESCRIPTION

Number of points in the system : 25

P I P E D A T A L I S T I N G

Pipe ID/ Material	Nom/ Sch	O.D. inch	-----Thickness(inch)----- W.Th.	Corr	Mill	Insu	Ling	Spec Grav	Weight(lb/ft) Pipe	Other	Total
4SCH40 CS	4 40	4.500	0.237	0	0.03	0	0	0	10.78	0	10.78
14SCH10 CS	14 10	14.000	0.250	0	0.03	0	0	0	36.67	0	36.67
8SCH10S CS	8 10S	8.625	0.148	0	0.02	0	0	0	13.38	0	13.38
2SCH40S CS	2.000 40S	2.375	0.154	0	0.02	0	0	0	3.65	0	3.65

M A T E R I A L D A T A L I S T I N G

Material Name	Pipe ID	Density lb/cu.ft	Pois. Ratio	Temper. deg F	Modulus E6 psi	Expans. in/100ft	Allow. psi
CS	4SCH40	489.0	0.30	70.0	29.50		15000.0
CS	14SCH10	489.0	0.30	70.0	29.50		15000.0
CS	8SCH10S	489.0	0.30	70.0	29.50		15000.0
CS	2SCH40S	489.0	0.30	70.0	29.50		15000.0

TEMPERATURE AND PRESSURE DATA

POINT NAME	CASE 1 PRESS. psi	CASE 1 TEMPER deg F	CASE 1 EXPAN. in/100ft	CASE 2 PRESS. psi	CASE 2 TEMPER deg F	CASE 2 EXPAN. in/100ft	CASE 3 PRESS. psi	CASE 3 TEMPER deg F	CASE 3 EXPAN. in/100ft
*** SEGMENT A									
A00	0	70.00	0.000						
A09	0	70.00	0.000						
*** SEGMENT B									
A02	0	70.00	0.000						
B04	0	70.00	0.000						
*** SEGMENT C									
B03	0	70.00	0.000						
C03	0	70.00	0.000						

HOODOUT PIPE AND DUCT REACTIONS TO GLOVEBOX AND WESTINGHOUSE/BOEING CO
04/08/94 LOAD OUT HOOD, 2736-ZB, 200 W AREA AutoPIPE+4.50 RESULT PAGE 6

RESTRAINT REACTIONS

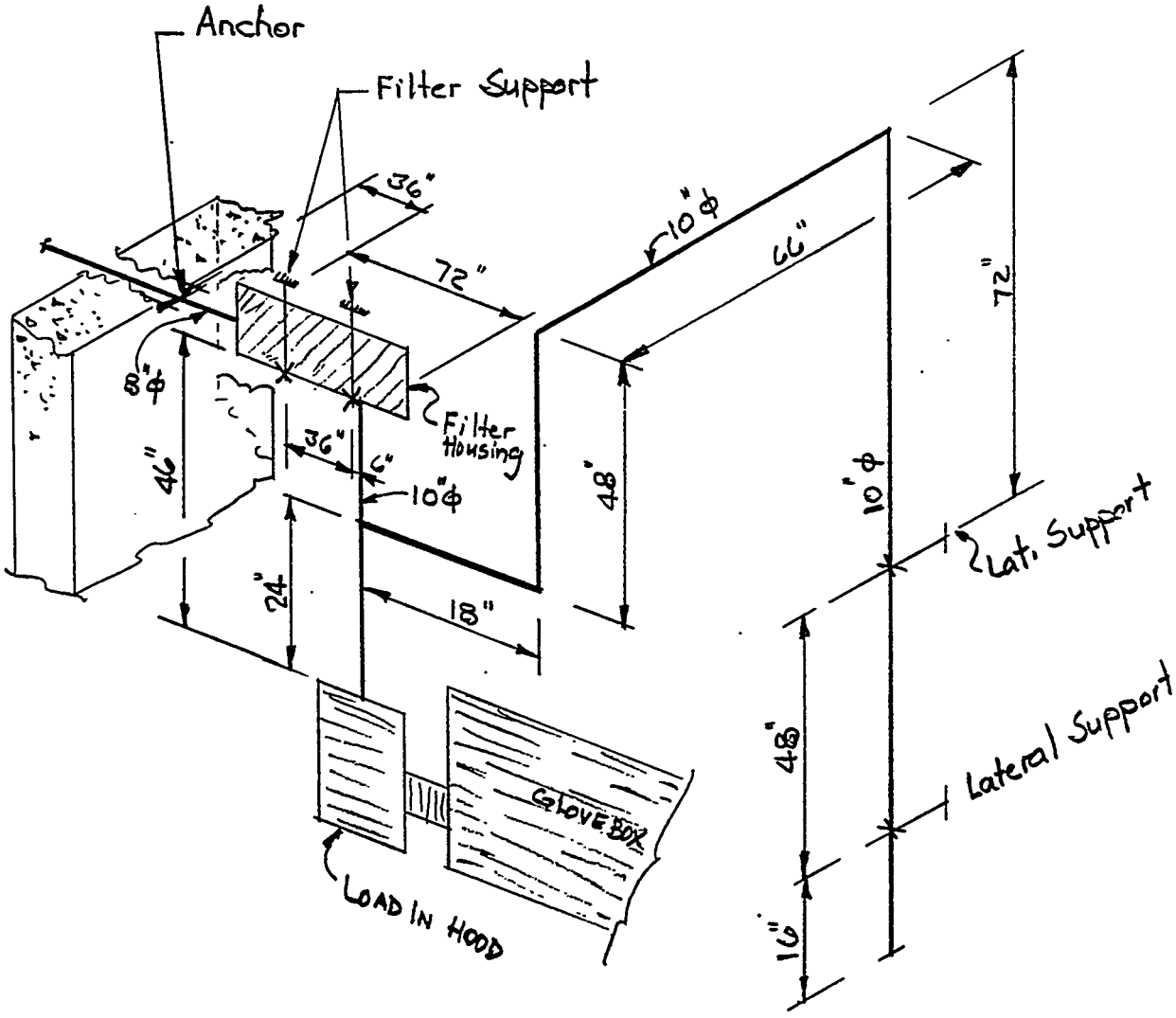
Point name	Load combination	FORCES (lb) X	Y	Z	Result	MOMENTS (ft-lb) X	Y	Z	Result
A00	Anchor								
	GR	-62	-88	-6	107	63	23	-237	246
	E1	252	7	17	253	-25	-64	32	76
	E2	28	40	3	48	-28	-10	107	111
	E3	-268	-17	53	274	51	-149	-75	175
	SEIS	11	29	73	79	-3	-224	63	232
	TOTAL	73	117	79	158	66	246	300	394
A06	Y - Stop								
	GR	0	-274	0	274	0	0	0	0
	E1	0	-26	0	26	0	0	0	0
	E2	0	123	0	123	0	0	0	0
	E3	0	425	0	425	0	0	0	0
	SEIS	0	523	0	523	0	0	0	0
	TOTAL	0	797	0	797	0	0	0	0
A07	Y - Stop								
	GR	0	-49	0	49	0	0	0	0
	E1	0	18	0	18	0	0	0	0
	E2	0	22	0	22	0	0	0	0
	E3	0	-407	0	407	0	0	0	0
	SEIS	0	-367	0	367	0	0	0	0
	TOTAL	0	416	0	416	0	0	0	0
A09	Anchor								
	GR	68	0	16	70	2	0	1	2
	E1	27	0	-14	31	-2	0	-1	2
	E2	-31	0	-7	32	-1	0	0	1
	E3	269	0	214	344	4	0	1	4
	SEIS	266	0	192	328	2	0	-1	2
	TOTAL	334	0	208	393	4	0	2	4
B04	Anchor								
	GR	-3	-1	-10	11	2	0	0	2
	E1	1	0	0	1	-2	0	0	2
	E2	1	1	5	5	-1	0	0	1
	E3	0	0	7	7	4	0	0	4
	SEIS	3	1	11	12	2	0	0	2
	TOTAL	6	2	21	22	4	0	0	4
C03	Anchor								
	GR	-3	-3	0	5	2	0	0	2
	E1	1	1	-3	3	-3	0	0	3
	E2	2	1	0	2	-1	0	0	1
	E3	0	0	9	9	6	0	0	6
	SEIS	3	2	6	7	2	0	0	2
	TOTAL	6	5	6	10	4	0	0	4

Subject Glovebox, 2736-ZB Bldg.

Originator M.A. ISLAM Date 3/10/94

Checker E.C. Oconnell Date 6/7/96

AUTOPIPE RUN 2



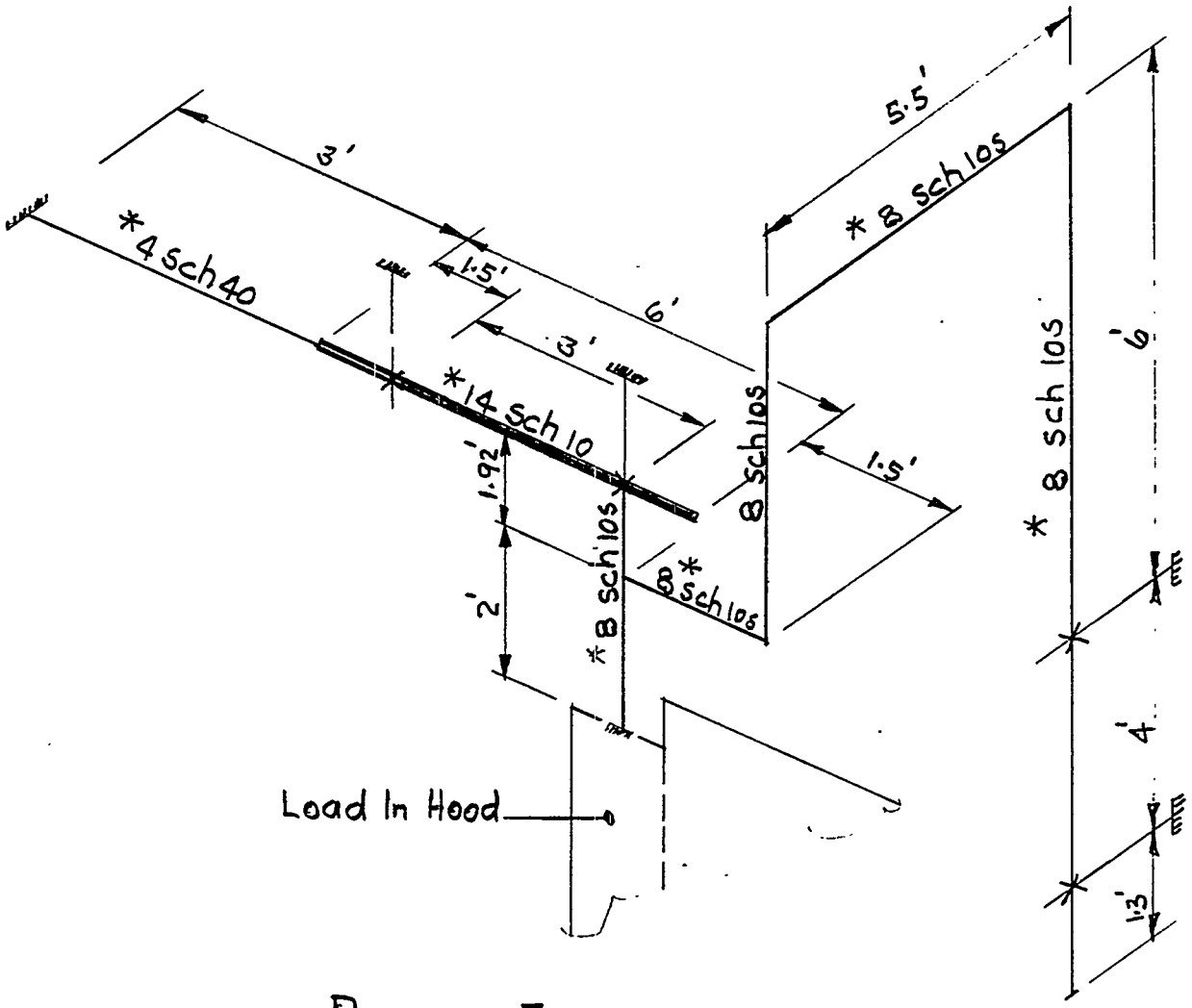
INPUT FOR AUTOPIPE MODEL

LOAD IN HOOD (FILE: HOODIN)

ANALYTICAL CALCULATIONS

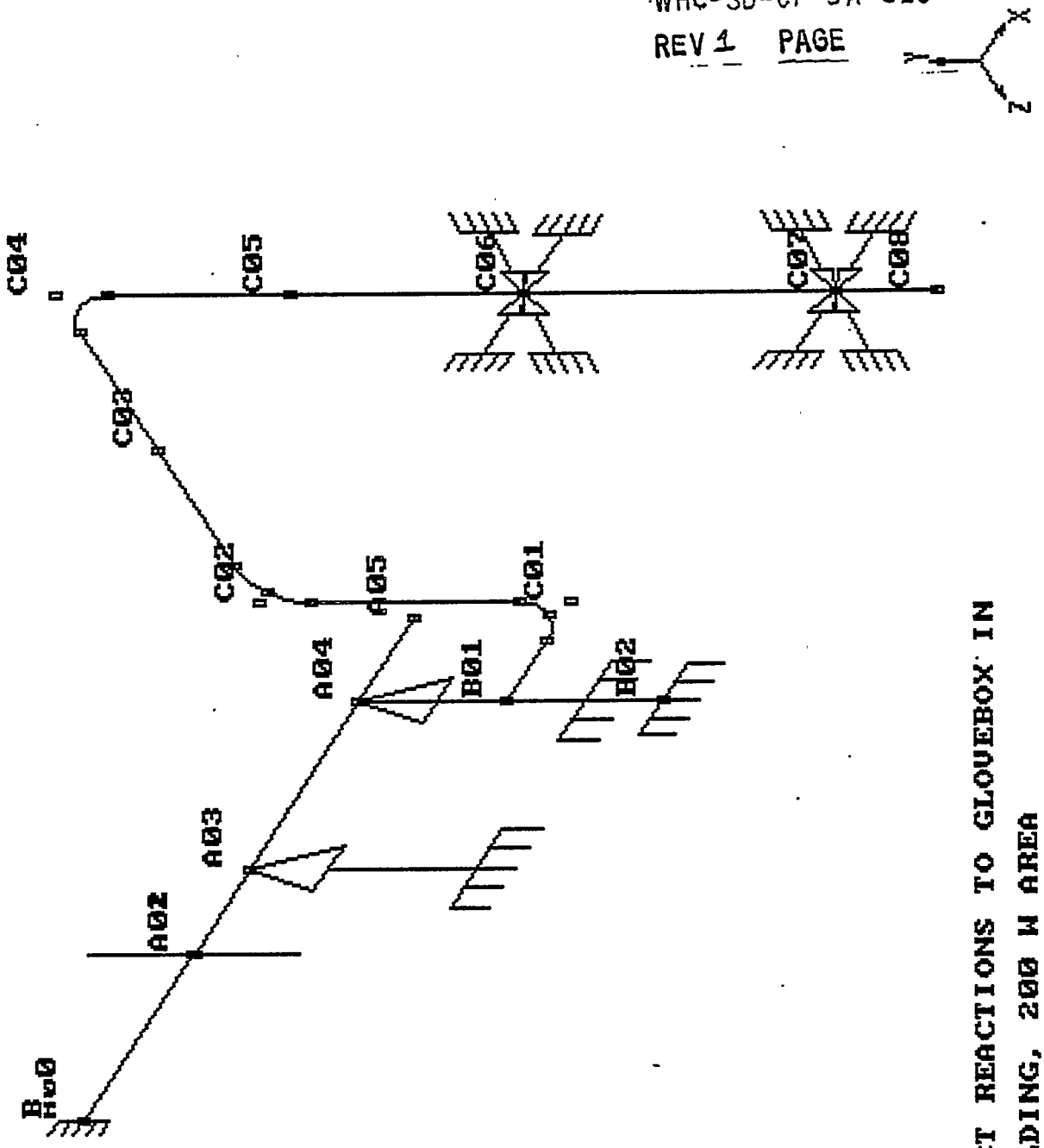
Subject Glove box, 2736-ZB Bldg.
Originator M.A. ISLAM Date 3/15/94
Checker G.E. Overmier Date 6/7/94

AUTOPIPE FILE : HOODIN



PIPING ISOMETRIC

* Equivalent piping based on mass



Point B02

PIPE AND DUCT REACTIONS TO GLOVEBOX IN
2736-ZB BUILDING, 200 W AREA

P O I N T D A T A L I S T I N G

POINT NAME	TYPE	-----OFFSETS (ft)----- X	Y	Z	PIPE ID	DESCRIPTION
*** SEGMENT A						
A00	Run	0	0	0	4SCH40	
A01	Redu	3.00	0	0		
A02	Run	0.01	0	0	14SCH10	
A03	Run	1.50	0	0		
A04	Tee	3.00	0	0		
A05	Run	1.50	0	0		
*** SEGMENT B						
A04	Tee	7.51	0	0	8SCH10S	
B01	Tee	0	-1.92	0		
B02	Run	0	-2.00	0		
*** SEGMENT C						
B01	Tee	7.51	-1.92	0	8SCH10S	
C01	Bend	1.75	0	0		Short Elbow, Radius = 8.00 inch Bend angle change = 90.00 deg Mid point at 50.00 percent SIF - In = 5.52, Out = 4.60
C02	Bend	0	4.00	0		Short Elbow, Radius = 8.00 inch Bend angle change = 90.00 deg Mid point at 50.00 percent SIF - In = 5.52, Out = 4.60
C03	Run	0	0	-2.75		
C04	Bend	0	0	-2.75		Short Elbow, Radius = 8.00 inch Bend angle change = 90.00 deg SIF - In = 5.52, Out = 4.60
C05	Run	0	-3.00	0		
C06	Run	0	-3.00	0		
C07	Run	0	-4.00	0		
C08	Run	0	-1.30	0		

Total weight of empty pipes : 595 lb

C O M P O N E N T D A T A L I S T I N G

POINT NAME	---COORDINATE(ft X	Y	Z)---	DATA TYPE	DESCRIPTION
*** SEGMENT A					
A00	0.00	0.00	0.00	ANCHOR	Rigid Thermal movements : None
A01	3.00	0.00	0.00		
A02	3.01	0.00	0.00		
A03	4.51	0.00	0.00	Y-STOP	ID : A03 1, Connected to Ground
A04	7.51	0.00	0.00	TEE	Unreinforced tee SIF - In = 6.40, Out = 8.20
				Y-STOP	ID : A04 1, Connected to Ground
A05	9.01	0.00	0.00		
*** SEGMENT B					
A04	7.51	0.00	0.00	TEE	Unreinforced tee SIF - In = 6.40, Out = 8.20
B01	7.51	-1.92	0.00	TEE	Unreinforced tee SIF - In = 6.57, Out = 8.42
B02	7.51	-3.92	0.00	ANCHOR	Translational stiffness lb/in X= 4700000 Y= 42 Z= 7000000 Rotational stiffness ft-lb/deg X= 103 Y= FREE Z= 86 Thermal movements : None
*** SEGMENT C					
B01	7.51	-1.92	0.00	TEE	Unreinforced tee SIF - In = 6.57, Out = 8.42
C01 N	8.59	-1.92	0.00		
C01	9.26	-1.92	0.00	TI	
C01 M	9.06	-1.72	0.00		
C01 F	9.26	-1.25	0.00		
C02 N	9.26	1.41	0.00		
C02	9.26	2.08	0.00	TI	
C02 M	9.26	1.88	-0.20		
C02 F	9.26	2.08	-0.67		
C03	9.26	2.08	-2.75		
C04 N	9.26	2.08	-4.83		
C04	9.26	2.08	-5.50	TI	
C04 F	9.26	1.41	-5.50		
C05	9.26	-0.92	-5.50		
C06	9.26	-3.92	-5.50	GUIDE	ID : C06 1, Connected to Ground Stiffness = RIGID
C07	9.26	-7.92	-5.50	GUIDE	ID : C07 1, Connected to Ground Stiffness = RIGID
C08	9.26	-9.22	-5.50		

From Page A-34

Number of points in the system : 26

P I P E D A T A L I S T I N G

Pipe ID/ Material	Nom/ Sch	O.D. inch	Thickness(inch) W.Th.	Corr	Mill	Insu	Ling	Spec Grav	Weight(lb/ft) Pipe	Other	Total
14SCH10 CS	14 10	14.000	0.250	0	0.03	0	0	0	36.67	0	36.67
8SCH10S CS	8 10S	8.625	0.148	0	0.02	0	0	0	13.38	0	13.38
4SCH40 CS	4 40	4.500	0.237	0	0.03	0	0	0	10.78	0	10.78

M A T E R I A L D A T A L I S T I N G

Material Name	Pipe ID	Density lb/cu.ft	Pois. Ratio	Temper. deg F	Modulus E6 psi	Expans. in/100ft	Allow. psi
CS	4SCH40	489.0	0.30	70.0	29.50		15000.0
CS	14SCH10	489.0	0.30	70.0	29.50		15000.0
CS	8SCH10S	489.0	0.30	70.0	29.50		15000.0

TEMPERATURE AND PRESSURE DATA

POINT NAME	CASE 1 PRESS. psi	CASE 1 TEMPER deg F	CASE 1 EXPAN. in/100ft	CASE 2 PRESS. psi	CASE 2 TEMPER deg F	CASE 2 EXPAN. in/100ft	CASE 3 PRESS. psi	CASE 3 TEMPER deg F	CASE 3 EXPAN. in/100ft
*** SEGMENT A									
A00	0	70.00	0.000						
A05	0	70.00	0.000						
*** SEGMENT B									
A04	0	70.00	0.000						
B02	0	70.00	0.000						
*** SEGMENT C									
B01	0	70.00	0.000						
C08	0	70.00	0.000						

RESTRAINT REACTIONS

Point name	Load combination	FORCES (lb) X	Y	Z	Result	MOMENTS (ft-lb) X	Y	Z	Result
A00	Anchor								
	GR	126	-19	-29	131	-34	71	-12	79
	E1	268	0	1	268	0	-2	0	2
	E2	-57	9	13	59	15	-32	5	36
	E3	-3	0	94	95	171	-281	0	329
	SEIS	208	9	109	235	187	-315	6	367
	TOTAL	334	28	137	362	222	386	18	445
A03	Y - Stop								
	GR	0	-136	0	136	0	0	0	0
	E1	0	-17	0	17	0	0	0	0
	E2	0	61	0	61	0	0	0	0
	E3	0	1	0	1	0	0	0	0
	SEIS	0	44	0	44	0	0	0	0
	TOTAL	0	180	0	180	0	0	0	0
A04	Y - Stop								
	GR	0	-440	0	440	0	0	0	0
	E1	0	17	0	17	0	0	0	0
	E2	0	198	0	198	0	0	0	0
	E3	0	-1	0	1	0	0	0	0
	SEIS	0	214	0	214	0	0	0	0
	TOTAL	0	655	0	655	0	0	0	0
B02	Anchor								
	GR	-119	0	90	149	-1	0	0	1
	E1	10	0	0	10	0	0	0	0
	E2	53	0	-41	67	0	0	0	0
	E3	0	0	91	91	3	0	0	3
	SEIS	64	0	50	81	3	0	0	3
	TOTAL	183	0	140	230	4	0	0	4
C06	Guide								
	GR	-5	0	-278	278	0	0	0	0
	E1	182	0	-2	182	0	0	0	0
	E2	2	0	125	125	0	0	0	0
	E3	6	0	388	388	0	0	0	0
	SEIS	190	0	511	545	0	0	0	0
	TOTAL	195	0	789	812	0	0	0	0
C07	Guide								
	GR	-2	0	216	216	0	0	0	0
	E1	-55	0	1	55	0	0	0	0
	E2	1	0	-97	97	0	0	0	0
	E3	-3	0	-169	169	0	0	0	0
	SEIS	-57	0	-265	271	0	0	0	0
	TOTAL	59	0	481	485	0	0	0	0

ANALYTICAL CALCULATIONS

Page _____ of _____

Subject Glovebox, 2736-ZB Bldg.

Originator M.A. Islam Date 12/05/94

Checker E.C. Ocoma Date 2/9/95

Scope

Re-analyze Repackaging Glovebox in Bldg. 2736-ZB, Room 636, to verify its adequacy during a DBE event. The glovebox is a safety class 1 component. The glovebox was previously analyzed as a safety class 3 component with safety class 1 seismic load. Refer to Supporting Document WHC-SD-CP-SA-026, Rev. 0, EDT 607226, for all information which will be used to prepare this ECN (Revision 0-A of WHC-SD-CP-SA-026).

The re-analysis of the glovebox adequacy also includes re-running all ANSYS and AUTOPIPE runs. The ANSYS re-runs eliminate self weight commands and re-determine stiffnesses of the glovebox support frame, glovebox top, and hood top. The AUTOPIPE re-runs use the revised stiffnesses computed in ANSYS re-runs to determine the reaction forces at the top of the glovebox and hood.

Criteria

Supporting Document WHC-SD-CP-SA-026, Revision 0 (WHC 1994).

Evaluation of steel and connections per AISC 1980 (AISC 1980).

Evaluation of expansion anchor per WHC-SD-GN-DGS-30006, Revision 1, Chap. 8 (WHC 1993).

Design and evaluation guidelines for natural phenomena hazards, UCRL-15910 (DOE 1990).

Hanford Plant Standards, SDC-4.1, Revision 12 (DOE-RL 1993).

Evaluation of piping and component supports per ASME B31.3 (ASME 1993).

Reference Drawings

H-2-80116 sheet 1
80169
80172
80174
80175 sheet 1 & 2
80176 thru 80179

ANALYTICAL CALCULATIONS

Page ____ of ____

Subject Glovebox, 2736-ZB Bldg.

Originator M.A. ISLAM Date 12/19/94

Checker G.C. Owens Date 2/5/95

Results of ANSYS Re-run (Glovebox Support)

This rerun was performed eliminating self weight of the frame (Refer to ACEL command, page A-20, (WHC 1994).

Refer to revised input and output, pages A-62 thru A-66.

New stiffnesses & Frequencies (Also refer to page A-19, WHC1994)

$$K_x = \frac{1}{.2648E\text{-}5} = 3.78E5\ \#/in \Rightarrow f_x = 34\ Hz$$

$$K_y = \frac{1}{.1219E\text{-}6} = 8.2E6\ " \Rightarrow f_y = 158\ "$$

$$K_z = \frac{1}{.6764E\text{-}4} = 1.48E4\ " \Rightarrow f_z = 6.7\ "$$

Based on $f_z = 6.7$ Hz, Glovebox support is flexible.

Therefore, no change in the conclusion of the results of glovebox support frequency for removing the dead load from the ANSYS input.

```
/prep7
/title,Glovebox Support Stiffness
/show,ega256
/view,1,1,1,1
/com                        Filename: support
/com
/com
/com
/com                        Input by: MAI     Chk by: EEO
/com
/com
et,1,4                      * beam element
/com
kan,0
mp,ex,1,29e6
mp,dens,1,.000734           * steel
mp,ex,2,29e6
mp,dens,2,.00000001         * weightless
/com
n,1
n,2,,6
n,3,,40.5
n,4,41,40.5
n,5,45,40.5
n,6,49,40.5
n,7,90,40.5
n,8,90,6
n,9,90
n,10,45
ngen,2,10,1,10,1,,,-36
n,21,,40.5,-18
n,22,45,40.5,-18
n,23,90,40.5,-18
n,24,45,54.3,-18
r,1,2.11,1.76,1.76,4.224,4.224,,,.105   *L3x3x3/8
r,2,1.36,.479,.479,2.728,2.728,,,.07    *L2x2x3/8
r,3,100,10000,1000,25,25,,,100          *Rigid Link
mat,1
type,1
real,1
e,1,2
egen,8,1,-1
e,5,10
egen,2,10,1,9
e,3,21
e,21,13
e,7,23
e,23,17
real,2
e,2,4
e,6,8
egen,2,10,23,24
mat,2
real,3
e,21,22
e,22,23
e,5,22
e,22,16
e,22,24
e,3,24
e,13,24
e,5,24
e,15,24
e,7,24
e,17,24
/com
/com
d,1,ux,,,11,10,uy,uz
d,9,ux,,,19,10,uy,uz
d,10,ux,,,20,10,uy,uz
iter,1,1,1
/com
f,24,fx,1                   * Unit load along X
lwrite
fdele,24,fx
```

```
f,24,fy,1          * Unit load along Y
lwrite
fdele,24,fy
f,24,fz,1          * Unit load along Z
nlist,all
elist,all
lwrite
afwrite
```

```
 POST DATA FILE12  NAME=dwt12.dat

 MAXIMUM NUMBER OF STORED LOAD SETS SET TO    1
  ALL PREVIOUSLY STORED SETS ERASED

 MAXIMUM NUMBER OF STORED LOAD SETS SET TO    3
  ALL PREVIOUSLY STORED SETS ERASED

 CURRENT LOAD CASE=    1

 USE LOAD STEP      1  ITERATION      1  SECTION    1  FOR LOAD CASE      1


 GEOMETRY STORED FOR      24  NODES      37  ELEMENTS
  TITLE= Glovebox Support Stiffness

 DISPLACEMENT STORED FOR    24 NODES

 ITERATION SUMMARY INFORMATION STORED

 NODAL FORCES STORED FOR    37 ELEMENTS

 REACTIONS STORED FOR    18 REACTIONS

 FOR LOAD STEP=      1  ITERATION=      1  SECTION=    1
  TIME=    .000000E+00   LOAD CASE=  1
  TITLE= Glovebox Support Stiffness

 NSEL  FOR LABEL= NODE  FROM     24 TO     24 BY     1

      1  NODES (OF      24  DEFINED) SELECTED BY  NSEL  COMMAND.

 PRINT NODAL DISPLACEMENTS
1            ANSYS - ENGINEERING ANALYSIS SYSTEM  REVISION 4.4      A137   WEST. HANFORD    MAY 1,1990
      ANSYS(R)  COPYRIGHT(C) 1971, 1978, 1982, 1983, 1985, 1987, 1989, 1990   SWANSON ANALYSIS SYSTEMS, INC. AS UNPUBLISHED WORK.
      PROPRIETARY DATA - UNAUTHORIZED USE, DISTRIBUTION OR DUPLICATION IS PROHIBITED.  ALL RIGHTS RESERVED.
      FOR SUPPORT CALL BRAD COVERDELL    PHONE (509) 376-1921    TWX

 Glovebox Support Stiffness                                          10.7283  SEP 14,1994 CP=       .250

          ***** POST1 NODAL DISPLACEMENT LISTING *****

  LOAD STEP      1  ITERATION=      1  SECTION=  1
  TIME=     .00000E+00      LOAD CASE=  1

  THE FOLLOWING X,Y,Z DISPLACEMENTS ARE IN GLOBAL COORDINATES

    NODE       UX              UY              UZ              ROTX            ROTY            ROTZ
     24     26479926E-05   .33411861E-08   .33705749E-08   .9154050     0   .12777508E-08  -.13852414E-08
```

```
SUPPORT.RES        Wed Sep 14 10:51:56 1994        2

 MAXIMUMS
 NODE          24              24              24              24              24              24
 VALUE     .26479926E-05   .33411861E-08   .33705749E-08   .91540506E-10   .12777508E-08  -.13852414E-08

 CURRENT LOAD CASE=   2

 USE LOAD STEP     2  ITERATION     1  SECTION   1  FOR LOAD CASE     2

 DISPLACEMENT STORED FOR   24 NODES

 ITERATION SUMMARY INFORMATION STORED

 NODAL FORCES STORED FOR   37 ELEMENTS

 REACTIONS STORED FOR   18 REACTIONS

 FOR LOAD STEP=     2  ITERATION=     1  SECTION=   1
  TIME=   .000000E+00   LOAD CASE=  2
  TITLE= Glovebox Support Stiffness

 NSEL  FOR LABEL= NODE  FROM    24 TO    24 BY    1

      1  NODES (OF     24  DEFINED) SELECTED BY  NSEL  COMMAND.

 PRINT NODAL DISPLACEMENTS
1           ANSYS - ENGINEERING ANALYSIS SYSTEM  REVISION 4.4      A137   WEST. HANFORD    MAY 1,1990
      ANSYS(R)  COPYRIGHT(C) 1971, 1978, 1982, 1983, 1985, 1987, 1989, 1990   SWANSON ANALYSIS SYSTEMS, INC. AS UNPUBLISHED WORK.
      PROPRIETARY DATA - UNAUTHORIZED USE, DISTRIBUTION OR DUPLICATION IS PROHIBITED.  ALL RIGHTS RESERVED.
      FOR SUPPORT CALL BRAD COVERDELL    PHONE (509) 376-1921    TWX

 Glovebox Support Stiffness                                                  10.7283  SEP 14,1994 CP=       .260

          ***** POST1 NODAL DISPLACEMENT LISTING *****

  LOAD STEP     2  ITERATION=     1  SECTION=  1
  TIME=    .00000E+00     LOAD CASE=  2

  THE FOLLOWING X,Y,Z DISPLACEMENTS ARE IN GLOBAL COORDINATES

    NODE      UX              UY              UZ              ROTX            ROTY            ROTZ
     24    .33411861E-08   .12190578E-06  -.89978283E-09   .22449812E-10  -.15855473E-09  -.36342469E-12

 MAXIMUMS
 NODE          24              24              24              24              24              24
 VALUE     .33411861E-08   .12190578E-06  -.89978283E-09   .22449812E-10  -.15855473E-09  -.36342469E-12

 CURRENT LOAD CASE=   3

 USE LOAD STEP     3  ITERATION     1  SECTION   1  FOR LOAD CASE     3

 DISPLACEMENT STORED FOR   24 NODES
```

```
SUPPORT.RES        Wed Sep 14 10:51:56 1994        3

 ITERATION SUMMARY INFORMATION STORED

 NODAL FORCES STORED FOR   37 ELEMENTS

 REACTIONS STORED FOR   18 REACTIONS

 FOR LOAD STEP=     3  ITERATION=     1  SECTION=   1
  TIME=   .000000E+00   LOAD CASE=  3
  TITLE= Glovebox Support Stiffness

 NSEL  FOR LABEL= NODE  FROM    24 TO    24 BY    1

      1  NODES (OF     24  DEFINED) SELECTED BY  NSEL  COMMAND.

 PRINT NODAL DISPLACEMENTS
1            ANSYS - ENGINEERING ANALYSIS SYSTEM  REVISION 4.4      A137   WEST. HANFORD    MAY 1,1990
      ANSYS(R)  COPYRIGHT(C) 1971, 1978, 1982, 1983, 1985, 1987, 1989, 1990   SWANSON ANALYSIS SYSTEMS, INC. AS UNPUBLISHED WORK.
      PROPRIETARY DATA - UNAUTHORIZED USE, DISTRIBUTION OR DUPLICATION IS PROHIBITED.  ALL RIGHTS RESERVED.
      FOR SUPPORT CALL BRAD COVERDELL    PHONE (509) 376-1921    TWX

 Glovebox Support Stiffness                                              10.7283  SEP 14,1994 CP=       .270

          ***** POST1 NODAL DISPLACEMENT LISTING *****

  LOAD STEP     3  ITERATION=     1  SECTION=  1
  TIME=    .00000E+00     LOAD CASE=  3

  THE FOLLOWING X,Y,Z DISPLACEMENTS ARE IN GLOBAL COORDINATES

    NODE      UX              UY              UZ              ROTX            ROTY            ROTZ
     24    .33705749E-08  -.89978283E-09   .67641727E-04   .19112930E-07   .74482744E-10   .90008475E-13

 MAXIMUMS
 NODE         24              24              24              24              24              24
 VALUE     .33705749E-08  -.89978283E-09   .67641727E-04   .19112930E-07   .74482744E-10   .90008475E-13

 ALL CURRENT POST1 DATA WRITTEN TO FILE07   NAME= file07.dat
  FOR POSSIBLE RESUME FROM THIS POINT


 ***** ROUTINE COMPLETED *****  CP =          .300

 ***** END OF INPUT ENCOUNTERED ON FILE18


 ***** RUN COMPLETED *****  CP=          .3000   TIME=   10.7283
```

ANALYTICAL CALCULATIONS

Page ____ of ____

Subject Glovebox, 2736-EB Bldg.

Originator M. A. ISLAM Date 12/19/94

Checker E. C. Oerman Date 2/5/95

Results of ANSYS Re-run (Filter Housing Support - Glovebox top)

The re-run was performed eliminating self weight of the support plate (Refer to ACEL command, page A-28, WHC 1994)

Refer to revised input and output, pages A-68 thru A-75.

New stiffnesses (Also refer to page A-26, WHC 1994)

$K_x = \frac{1}{.0002702} = 3.7E3$ #/in ; $ROT_x = \frac{1}{.551E-5} = 1.81E5$ #-in/rad

$K_y = \frac{1}{.00007643} = 1.3E4$ " ; $ROT_y = \frac{1}{.385E-3} = 2.6E3$ "

$K_z = \frac{1}{.0003656} = 2.7E3$ " ; $ROT_z = \frac{1}{.4162E-5} = 2.4E5$ "

The above stiffnesses have been input in AUTOPIPE analysis.

```
/prep7
/title,Filter Housing Support Stiffness
/show,ega256
/view,1,1,1,1
/com                    Filename: Glove
/com
/com
/com
/com                    Input by: MAI     Chk by: ECO
/com
/com
et,1,63                 * plate
et,2,4                  * beam element
/com
kan,0
mp,ex,1,29e6
mp,dens,1,.000734       * filter housing support
mp,ex,2,29e6
mp,dens,2,.000898       * glovebox top
mp,ex,3,29e6
mp,dens,3,.000000001    * weightless
/com
n,1
n,2,11.5
n,3,23
n,4,34.5
n,5,46
n,6,57.5
n,7,69
n,8,78
n,9,87
n,10,96
ngen,2,10,1,10,1,,,-16.5
ngen,3,10,11,20,1,,,-4.5
ngen,2,10,31,40,1,,,-16.5
n,51,69,3,-16.5
n,52,73.5,3,-16.5
n,53,78,3,-16.5
ngen,3,3,51,53,1,,,-4.5
n,60,73.5,11,-21
r,1,.5                          *Glovebox top
r,2,.25                         *Filter Housing
r,3,100,10000,1000,25,25,,,100  *Rigid link
mat,2
type,1
real,1
e,1,2,12,11
egen,9,1,-1
egen,4,10,1,9
mat,1
real,2
e,17,27,54,51
e,27,37,57,54
e,18,28,56,53
e,28,38,59,56
e,51,52,55,54
e,52,53,56,55
egen,2,3,41,42
mat,3
type,2
real,3
e,55,60
/com
/com
d,1,ux,,,10,1,uy,uz
d,41,ux,,,50,1,uy,uz
d,11,ux,,,31,10,uy,uz
d,20,ux,,,40,10,uy,uz
iter,1,1,1
/com
f,60,fx,1               * Unit load along X
lwrite
fdele,60,fx
f,60,fy,1               * Unit load along Y
lwrite
```

```
fdele,60,fy
f,60,fz,1                    * Unit load along Z
lwrite
fdele,60,fz
f,60,mx,1                    * Unit moment about X
lwrite
fdele,60,mx
f,60,my,1                    * Unit momemt about Y
lwrite
fdele,60,my
f,60,mz,1                    * Unit moment about Z
nlist,all
elist,all
lwrite
afwrite
```

```
GLOVE.RES        Wed Sep 14 14:55:14 1994        1

 POST DATA FILE12  NAME=DWT12.DAT

 MAXIMUM NUMBER OF STORED LOAD SETS SET TO    1
  ALL PREVIOUSLY STORED SETS ERASED

 MAXIMUM NUMBER OF STORED LOAD SETS SET TO    6
  ALL PREVIOUSLY STORED SETS ERASED

 CURRENT LOAD CASE=    1

 USE LOAD STEP      1  ITERATION      1  SECTION    1  FOR LOAD CASE      1


 ***  NOTE  ***
 ALL STRESSES ARE IN GLOBAL COORDINATES UNLESS
      THE COMMAND -- GLOBAL,0 --  IS ENTERED

 GEOMETRY STORED FOR      60  NODES      45  ELEMENTS
  TITLE= Filter Housing Support Stiffness

 DISPLACEMENT STORED FOR    60 NODES

 ***WARNING ***                              CP=       .270   TIME=  14.78583
 MODEL CONTAINS DIFFERENT MATERIAL TYPES, NODAL STRESS AVERAGING MAY
  BE INVALID AMONG DISSIMILAR MATERIALS

 STRESSES STORED FOR     4  SELECTED ITEMS

 NODAL STRESSES AND TEMPS. STORED FOR    44 ELEMENTS

 ITERATION SUMMARY INFORMATION STORED

 NODAL FORCES STORED FOR    45 ELEMENTS

 REACTIONS STORED FOR    78 REACTIONS

 FOR LOAD STEP=      1  ITERATION=      1  SECTION=    1
  TIME=    .000000E+00   LOAD CASE=  1
  TITLE= Filter Housing Support Stiffness

 NSEL  FOR LABEL= NODE  FROM     60 TO     60 BY     1

      1  NODES (OF      60  DEFINED) SELECTED BY  NSEL  COMMAND.

 PRINT NODAL DISPLACEMENTS
1            ANSYS - ENGINEERING ANALYSIS SYSTEM  REVISION 4.4       A137   WEST. HANFORD     MAY 1,1990
      ANSYS(R)  COPYRIGHT(C) 1971, 1978, 1982, 1983, 1985, 1987, 1989, 1990   SWANSON ANALYSIS SYSTEMS, INC. AS UNPUBLISHED WORK.
      PROPRIETARY DATA - UNAUTHORIZED USE, DISTRIBUTION OR DUPLICATION IS PROHIBITED.  ALL RIGHTS RESERVED.
      F'    'UPPORT CALL BRAD COVERDELL     PHONE (509) 376-1921     T
```

Filter Housing Support Stiffness 14.7858 SEP 14,1994 CP= .330

***** POST1 NODAL DISPLACEMENT LISTING *****

LOAD STEP 1 ITERATION= 1 SECTION= 1
TIME= .00000E+00 LOAD CASE= 1

THE FOLLOWING X,Y,Z DISPLACEMENTS ARE IN GLOBAL COORDINATES

NODE	UX	UY	UZ	ROTX	ROTY	ROTZ
60	.27021193E-03	.69709836E-05	.79292485E-18	.72003944E-19	.16758508E-19	-.32952657E-04
MAXIMUMS						
NODE	60	60	60	60	60	60
VALUE	.27021193E-03	.69709836E-05	.79292485E-18	.72003944E-19	.16758508E-19	-.32952657E-04

CURRENT LOAD CASE= 2

USE LOAD STEP 2 ITERATION 1 SECTION 1 FOR LOAD CASE 2

DISPLACEMENT STORED FOR 60 NODES

STRESSES STORED FOR 4 SELECTED ITEMS

NODAL STRESSES AND TEMPS. STORED FOR 44 ELEMENTS

ITERATION SUMMARY INFORMATION STORED

NODAL FORCES STORED FOR 45 ELEMENTS

REACTIONS STORED FOR 78 REACTIONS

FOR LOAD STEP= 2 ITERATION= 1 SECTION= 1
TIME= .000000E+00 LOAD CASE= 2
TITLE= Filter Housing Support Stiffness

NSEL FOR LABEL= NODE FROM 60 TO 60 BY 1

1 NODES (OF 60 DEFINED) SELECTED BY NSEL COMMAND.

PRINT NODAL DISPLACEMENTS

1 ANSYS - ENGINEERING ANALYSIS SYSTEM REVISION 4.4 A137 WEST. HANFORD MAY 1,1990

ANSYS(R) COPYRIGHT(C) 1971, 1978, 1982, 1983, 1985, 1987, 1989, 1990 SWANSON ANALYSIS SYSTEMS, INC. AS UNPUBLISHED WORK.
PROPRIETARY DATA - UNAUTHORIZED USE, DISTRIBUTION OR DUPLICATION IS PROHIBITED. ALL RIGHTS RESERVED.
FOR SUPPORT CALL BRAD COVERDELL PHONE (509) 376-1921 TWX

Filter Housing Support Stiffness 14.7858 SEP 14,1994 CP= .350

***** POST1 NODAL DISPLACEMENT LISTING *****

LOAD STEP 2 ITERATION= 1 SECTION= 1
TIME= .00000E+00 LOAD CASE= 2

THE FOLLOWING X,Y,Z DISPLACEMENTS ARE IN GLOBAL COORDINATES

NODE	UX	UY	UZ	ROTX	ROTY	ROTZ
60	.69709836E-05	.76425434E-04	.31936931E-17	.29076765E-18	.49874915E-19	-.63251915E-06
MAXIMUMS						
NODE	60	60	60	60	60	60
VALUE	.69709836E-05	.76425434E-04	.31936931E-17	.29076765E-18	.49874915E-19	-.63251915E-06

CURRENT LOAD CASE= 3

USE LOAD STEP 3 ITERATION 1 SECTION 1 FOR LOAD CASE 3

DISPLACEMENT STORED FOR 60 NODES

STRESSES STORED FOR 4 SELECTED ITEMS

NODAL STRESSES AND TEMPS. STORED FOR 44 ELEMENTS

ITERATION SUMMARY INFORMATION STORED

NODAL FORCES STORED FOR 45 ELEMENTS

REACTIONS STORED FOR 78 REACTIONS

FOR LOAD STEP= 3 ITERATION= 1 SECTION= 1
TIME= .000000E+00 LOAD CASE= 3
TITLE= Filter Housing Support Stiffness

NSEL FOR LABEL= NODE FROM 60 TO 60 BY 1

1 NODES (OF 60 DEFINED) SELECTED BY NSEL COMMAND.

PRINT NODAL DISPLACEMENTS

1 ANSYS - ENGINEERING ANALYSIS SYSTEM REVISION 4.4 A137 WEST. HANFORD MAY 1,1990

ANSYS(R) COPYRIGHT(C) 1971, 1978, 1982, 1983, 1985, 1987, 1989, 1990 SWANSON ANALYSIS SYSTEMS, INC. AS UNPUBLISHED WORK.
PROPRIETARY DATA - UNAUTHORIZED USE, DISTRIBUTION OR DUPLICATION IS PROHIBITED. ALL RIGHTS RESERVED.
FOR SUPPORT CALL BRAD COVERDELL PHONE (509) 376-1921 TWX

Filter Housing Support Stiffness 14.7858 SEP 14,1994 CP= .370

***** POST1 NODAL DISPLACEMENT LISTING *****

LOAD STEP 3 ITERATION= 1 SECTION= 1
TIME= .00000E+00 LOAD CASE= 3

THE FOLLOWING X,Y,Z DISPLACEMENTS ARE IN GLOBAL COORDINATES

NODE	UX	UY	UZ	ROTX	ROTY	ROTZ
60	.79292485E-18	.31936931E-17	.36562901E-03	.447479 04	.59284808E-08	-.90487086E-19

```
 MAXIMUMS
 NODE          60              60              60              60              60              60
 VALUE     .79292485E-18   .31936931E-17   .36562901E-03   .44747953E-04   .59284808E-08  -.90487086E-19

 CURRENT LOAD CASE=    4

 USE LOAD STEP      4  ITERATION      1  SECTION    1  FOR LOAD CASE      4

 DISPLACEMENT STORED FOR    60 NODES

 STRESSES STORED FOR     4  SELECTED ITEMS

 NODAL STRESSES AND TEMPS. STORED FOR    44 ELEMENTS

 ITERATION SUMMARY INFORMATION STORED

 NODAL FORCES STORED FOR    45 ELEMENTS

 REACTIONS STORED FOR    78 REACTIONS

 FOR LOAD STEP=      4  ITERATION=      1  SECTION=    1
  TIME=    .000000E+00   LOAD CASE=  4
  TITLE= Filter Housing Support Stiffness

 NSEL  FOR LABEL= NODE  FROM     60 TO     60 BY     1

      1  NODES (OF      60  DEFINED) SELECTED BY  NSEL  COMMAND.

 PRINT NODAL DISPLACEMENTS
1            ANSYS - ENGINEERING ANALYSIS SYSTEM  REVISION 4.4      A137   WEST. HANFORD    MAY 1,1990
      ANSYS(R)  COPYRIGHT(C) 1971, 1978, 1982, 1983, 1985, 1987, 1989, 1990   SWANSON ANALYSIS SYSTEMS, INC. AS UNPUBLISHED WORK.
      PROPRIETARY DATA - UNAUTHORIZED USE, DISTRIBUTION OR DUPLICATION IS PROHIBITED.  ALL RIGHTS RESERVED.
      FOR SUPPORT CALL BRAD COVERDELL     PHONE (509) 376-1921     TWX

 Filter Housing Support Stiffness                                          14.7858  SEP 14,1994 CP=        .400

          ***** POST1 NODAL DISPLACEMENT LISTING *****

  LOAD STEP      4  ITERATION=      1  SECTION=  1
  TIME=     .00000E+00      LOAD CASE=  4

  THE FOLLOWING X,Y,Z DISPLACEMENTS ARE IN GLOBAL COORDINATES

    NODE      UX              UY              UZ             ROTX            ROTY            ROTZ
     60    .72003944E-19   .29076765E-18   .44747953E-04   .55097548E-05   .56246737E-09  -.81994296E-20

 MAXIMUMS
 NODE          60              60              60              60              60              60
 VALUE     .72003944E-19   .29076765E-18   .44747953E-04   .55097548E-05   .56246737E-09  -.81994296E-20

 CURRENT LOAD CASE=    5
```

```
GLOVE.RES          Wed Sep 14 14:55:14 1994          5

 USE LOAD STEP      5  ITERATION      1  SECTION    1  FOR LOAD CASE      5

 DISPLACEMENT STORED FOR    60 NODES

 STRESSES STORED FOR     4  SELECTED ITEMS

 NODAL STRESSES AND TEMPS. STORED FOR    44 ELEMENTS

 ITERATION SUMMARY INFORMATION STORED

 NODAL FORCES STORED FOR    45 ELEMENTS

 REACTIONS STORED FOR    78 REACTIONS

 FOR LOAD STEP=      5  ITERATION=      1  SECTION=    1
  TIME=    .000000E+00   LOAD CASE=  5
  TITLE= Filter Housing Support Stiffness

 NSEL  FOR LABEL= NODE  FROM     60 TO     60 BY     1

      1  NODES (OF      60  DEFINED) SELECTED BY  NSEL  COMMAND.

 PRINT NODAL DISPLACEMENTS
1            ANSYS - ENGINEERING ANALYSIS SYSTEM  REVISION 4.4      A137   WEST. HANFORD    MAY 1,1990
      ANSYS(R)  COPYRIGHT(C) 1971, 1978, 1982, 1983, 1985, 1987, 1989, 1990   SWANSON ANALYSIS SYSTEMS, INC. AS UNPUBLISHED WORK.
      PROPRIETARY DATA - UNAUTHORIZED USE, DISTRIBUTION OR DUPLICATION IS PROHIBITED.  ALL RIGHTS RESERVED.
      FOR SUPPORT CALL BRAD COVERDELL     PHONE (509) 376-1921     TWX

 Filter Housing Support Stiffness                                    14.7858  SEP 14,1994 CP=       .420

          ***** POST1 NODAL DISPLACEMENT LISTING *****

  LOAD STEP      5  ITERATION=      1  SECTION=  1
  TIME=     .00000E+00      LOAD CASE=  5

  THE FOLLOWING X,Y,Z DISPLACEMENTS ARE IN GLOBAL COORDINATES

    NODE       UX              UY              UZ              ROTX            ROTY            ROTZ
     60    .16758508E-19   .49874915E-19   .59284808E-08   .56246737E-09   .38505415E-03  -.22822467E-20

 MAXIMUMS
 NODE          60              60              60              60              60              60
 VALUE     .16758508E-19   .49874915E-19   .59284808E-08   .56246737E-09   .38505415E-03  -.22822467E-20

 CURRENT LOAD CASE=    6

 USE LOAD STEP      6  ITERATION.     1  SECTION    1  FOR LOAD CASE      6

 DISPLACEMENT STORED FOR    60 NODES

 STRESS'     'ORED FOR     4  SELECTED ITEMS
```

```
GLOVE.RES        Wed Sep 14 14:55:14 1994        6

 NODAL STRESSES AND TEMPS. STORED FOR   44 ELEMENTS

 ITERATION SUMMARY INFORMATION STORED

 NODAL FORCES STORED FOR   45 ELEMENTS

 REACTIONS STORED FOR   78 REACTIONS

 FOR LOAD STEP=     6  ITERATION=     1  SECTION=   1
  TIME=   .000000E+00   LOAD CASE=  6
  TITLE= Filter Housing Support Stiffness

 NSEL  FOR LABEL= NODE  FROM    60 TO    60 BY    1

      1  NODES (OF     60  DEFINED) SELECTED BY  NSEL  COMMAND.

 PRINT NODAL DISPLACEMENTS
1            ANSYS - ENGINEERING ANALYSIS SYSTEM  REVISION 4.4      A137   WEST. HANFORD    MAY 1,1990
      ANSYS(R)  COPYRIGHT(C) 1971, 1978, 1982, 1983, 1985, 1987, 1989, 1990   SWANSON ANALYSIS SYSTEMS, INC. AS UNPUBLISHED WORK.
      PROPRIETARY DATA - UNAUTHORIZED USE, DISTRIBUTION OR DUPLICATION IS PROHIBITED.  ALL RIGHTS RESERVED.
      FOR SUPPORT CALL BRAD COVERDELL    PHONE (509) 376-1921    TWX

 Filter Housing Support Stiffness                                    14.7858  SEP 14,1994 CP=       .450

          ***** POST1 NODAL DISPLACEMENT LISTING *****

  LOAD STEP     6  ITERATION=     1  SECTION=  1
  TIME=    .00000E+00     LOAD CASE=  6

  THE FOLLOWING X,Y,Z DISPLACEMENTS ARE IN GLOBAL COORDINATES

    NODE      UX              UY              UZ              ROTX            ROTY            ROTZ
     60   -.32952657E-04  -.63251915E-06  -.90487086E-19  -.81994296E-20  -.22822467E-20   .41619955E-05

 MAXIMUMS
 NODE        60              60              60              60              60              60
 VALUE   -.32952657E-04  -.63251915E-06  -.90487086E-19  -.81994296E-20  -.22822467E-20   .41619955E-05

 ALL CURRENT POST1 DATA WRITTEN TO FILE07   NAME= file07.dat
  FOR POSSIBLE RESUME FROM THIS POINT


 ***** ROUTINE COMPLETED *****  CP =          .570

 ***** END OF INPUT ENCOUNTERED ON FILE18


 ***** RUN COMPLETED *****  CP=          .5700   TIME=   14.7858
```

ANALYTICAL CALCULATIONS

Page _____ of _____

Subject Glovebox, 2736-ZB Bldg.
Originator M.A. ISLAM Date 12/19/94
Checker E.E. Oleman Date 2/6/95

Results of ANSYS Re-run (Hood Top)

The re-run was performed eliminating self weight of the hood top plate (Refer to ACEL command, page A-35, WHC 1994)

Refer to revised input and output, pages A-77 thru A-84.

New stiffnesses (Also refer to page A-34, WHC 1994)

$K_x = \frac{1}{.12107E-6} = 8.2E6$ #/in ; ROTX $= \frac{1}{.6856E-5} = 1.46E5$ #-in/r

$K_y = \frac{1}{.3148E-3} = 3.2E3$ " ; ROTY $= 1.82$ #-in/rad

$K_z = \frac{1}{.743E-7} = 1.3E7$ " ; ROTZ $= \frac{1}{.1307E-4} = 7.7E4$ #-in/rad

The above stiffnesses have been input in AUTOPIPE analysis.

```
/prep7
/title,Hood Top Stiffness
/show,ega256
/view,1,1,1,1
/com                    Filename: Hood
/com
/com
/com                    Input by: MAI        Chk by: EGW
/com
/com
et,1,63                 * plate
/com
kan,0
mp,ex,1,29e6
mp,dens,1,.000734       * Hood top
/com
n,1
n,2,14
n,3,28
ngen,3,3,1,3,1,,,-9
r,1,.1875                       *Hood top
mat,1
type,1
real,1
e,1,2,5,4
e,2,3,6,5
egen,2,3,1,2
/com
/com
d,1,ux,,,3,1,uy,uz
d,4,ux,,,6,2,uy,uz
d,7,ux,,,9,1,uy,uz
iter,1,1,1
/com
f,5,fx,1                * Unit load along X   } *
lwrite
fdele,5,fx
f,5,fy,1                * Unit load along Y   }
lwrite
fdele,5,fy
f,5,fz,1                * Unit load along Z
lwrite
fdele,5,fz
f,5,mx,1                * Unit moment about X
lwrite
fdele,5,mx
f,5,my,1                * Unit momemt about Y
lwrite
fdele,5,my
f,5,mz,1                * Unit moment about Z
nlist,all
elist,all
lwrite
afwrite
```

Note: * Output from Post Process run did not provide any results for these loads. A second ANSYS run was performed indentifying these loads as Load step 5 & 6 for which post process output is also enclosed.

```
 POST DATA FILE12  NAME=DWT12.DAT

 MAXIMUM NUMBER OF STORED LOAD SETS SET TO    1
  ALL PREVIOUSLY STORED SETS ERASED

 MAXIMUM NUMBER OF STORED LOAD SETS SET TO    6
  ALL PREVIOUSLY STORED SETS ERASED

 CURRENT LOAD CASE
 THIS IS THE ANSYS(R) ENGINEERING ANALYSIS SYSTEM
 COPYRIGHT(C)  1971, 1978, 1982, 1983, 1985, 1987, 1989, 1990
 SWANSON ANALYSIS SYSTEMS, INC. AS AN UNPUBLISHED WORK.
 PROPRIETARY DATA - UNAUTHORIZED USE, DISTRIBUTION, OR DUPLICATION
 IS PROHIBITED.  ALL RIGHTS RESERVED.

 IF RUNNING INTERACTIVELY, ENTER  /INTER
1
                  **********  ANSYS INPUT DATA LISTING (FILE18)  **********

      1   /post1
      2   /OUTPUT,HOOD,RES
      3   NFILE,DWT12,DAT,0    *READ DEADWEIGHT FILE
      4   LCLIM,6              *SET LOAD CASE LIMIT TO 6
      5   LCASE,1
      6   SET,1,1
      7   NSEL,NODE,5
      8   PRDISP
      9   LCASE,2
     10   SET,2,1
     11   NSEL,NODE,5
     12   PRDISP
     13   LCASE,3
     14   SET,3,1
     15   NSEL,NODE,5
     16   PRDISP
     17   LCASE,4
     18   SET,4,1
     19   NSEL,NODE,5
     20   PRDISP
     21   LCASE,5
     22   SET,5,1
     23   NSEL,NODE,5
     24   PRDISP
     25   LCASE,6
     26   SET,6,1
     27   NSEL,NODE,5
     28   PRDISP
     29   SAVE
     30   FINISH
     31
1           ANSYS - ENGINEERING ANALYSIS SYSTEM  REVISION 4.4      A137   WEST. HANFORD    MAY 1,1990
      ANSYS(R)  COPYRIGHT(C) 1971, 1978, 1982, 1983, 1985, 1987, 1989, 1990   SWANSON ANALYSIS SYSTEMS, INC. AS UNPUBLISHED WORK.
      PROPRIETARY DATA - UNAUTHORIZED USE, DISTRIBUTION OR DUPLICATION IS PROHIBITED.  ALL RIGHTS RESERVED.
      FOR SUPPORT CALL BRAD COVERDELL    PHONE (509) 376-1921    TWX

                                                                8.6464  SEP 29,1994 CP=       .220
```

WHC-SD-CP-SA-026
REV ~~3~~ 4 PAGE A-79

***** ANSYS RESULTS INTERPRETATION (POST1) *****

****OUTPUT SWITCHED FROM FILE06 TO FILE39 NAME=HOOD.RES
Ran ANSYS 4.4A on HP: hp1, on: Thu Sep 29 08:38:48 PDT 1994
The ANSYS 5.0A HP Document is: WHC-SD-SQA-CSWD-30014, Rev. 0
The latest ANSYS Class 3 Error Report is 94-57 9/22/94
Class 3 Error Reports are in the file: ../ansys/class3_errors.
4 ELEMENTS

ITERATION SUMMARY INFORMATION STORED

NODAL FORCES STORED FOR 4 ELEMENTS

REACTIONS STORED FOR 24 REACTIONS

FOR LOAD STEP= 3 ITERATION= 1 SECTION= 1
TIME= .000000E+00 LOAD CASE= 3
TITLE= Hood Top Stiffness

NSEL FOR LABEL= NODE FROM 5 TO 5 BY 1

1 NODES (OF 9 DEFINED) SELECTED BY NSEL COMMAND.

PRINT NODAL DISPLACEMENTS
1 ANSYS - ENGINEERING ANALYSIS SYSTEM REVISION 4.4 A137 WEST. HANFORD MAY 1,1990
ANSYS(R) COPYRIGHT(C) 1971, 1978, 1982, 1983, 1985, 1987, 1989, 1990 SWANSON ANALYSIS SYSTEMS, INC. AS UNPUBLISHED WORK.
PROPRIETARY DATA - UNAUTHORIZED USE, DISTRIBUTION OR DUPLICATION IS PROHIBITED. ALL RIGHTS RESERVED.
FOR SUPPORT CALL BRAD COVERDELL PHONE (509) 376-1921 TWX

Hood Top Stiffness 8.6467 SEP 29,1994 CP= .270

***** POST1 NODAL DISPLACEMENT LISTING *****

LOAD STEP 3 ITERATION= 1 SECTION= 1
TIME= .00000E+00 LOAD CASE= 3

THE FOLLOWING X,Y,Z DISPLACEMENTS ARE IN GLOBAL COORDINATES

NODE	UX	UY	UZ	ROTX	ROTY	ROTZ
5	-.31417086E-23	.00000000E+00	.74301089E-07	.00000000E+00	.00000000E+00	.00000000E+00

MAXIMUMS

NODE	5	0	5	0	0	0
VALUE	-.31417086E-23	.00000000E+00	.74301089E-07	.00000000E+00	.00000000E+00	.00000000E+00

CURRENT LOAD CASE= 4

USE LOAD STEP 4 ITERATION 1 SECTION 1 FOR LOAD CASE 4

DISPLACEMENT STORED FOR 9 NODES

STRESSES STORED FOR 4 SELECTED ITEMS

NODAL STRESSES AND TEMPS. STORED FOR 4 ELEMENTS

ITERATION SUMMARY INFORMATION STORED

NODAL FORCES STORED FOR 4 ELEMENTS

```
 REACTIONS STORED FOR   24 REACTIONS

 FOR LOAD STEP=     4  ITERATION=     1  SECTION=   1
  TIME=   .000000E+00   LOAD CASE=  4
  TITLE= Hood Top Stiffness

 NSEL  FOR LABEL= NODE  FROM     5 TO     5 BY    1

      1  NODES (OF      9  DEFINED) SELECTED BY  NSEL  COMMAND.

 PRINT NODAL DISPLACEMENTS
1            ANSYS - ENGINEERING ANALYSIS SYSTEM  REVISION 4.4      A137   WEST. HANFORD    MAY 1,1990
      ANSYS(R)  COPYRIGHT(C) 1971, 1978, 1982, 1983, 1985, 1987, 1989, 1990   SWANSON ANALYSIS SYSTEMS, INC. AS UNPUBLISHED WORK.
      PROPRIETARY DATA - UNAUTHORIZED USE, DISTRIBUTION OR DUPLICATION IS PROHIBITED.  ALL RIGHTS RESERVED.
      FOR SUPPORT CALL BRAD COVERDELL    PHONE (509) 376-1921    TWX

 Hood Top Stiffness                                                    8.6467  SEP 29,1994 CP=       .280

          ***** POST1 NODAL DISPLACEMENT LISTING *****

  LOAD STEP     4  ITERATION=     1  SECTION=  1
  TIME=    .00000E+00     LOAD CASE=  4

  THE FOLLOWING X,Y,Z DISPLACEMENTS ARE IN GLOBAL COORDINATES

    NODE      UX              UY              UZ              ROTX            ROTY            ROTZ
      5    .00000000E+00  -.16940659E-20   .00000000E+00   .68564144E-05   .00000000E+00  -.11911401E-21

 MAXIMUMS
 NODE          0               5               0               5               0               5
 VALUE     .00000000E+00  -.16940659E-20   .00000000E+00   .68564144E-05   .00000000E+00  -.11911401E-21

 CURRENT LOAD CASE=   5

 USE LOAD STEP     5  ITERATION     1  SECTION    1  FOR LOAD CASE     5

 DISPLACEMENT STORED FOR    9 NODES

 STRESSES STORED FOR    4  SELECTED ITEMS

 NODAL STRESSES AND TEMPS. STORED FOR    4 ELEMENTS

 ITERATION SUMMARY INFORMATION STORED

 NODAL FORCES STORED FOR    4 ELEMENTS

 REACTIONS STORED FOR   24 REACTIONS

 FOR LOAD STEP=     5  ITERATION=     1  SECTION=   1
  TIME=   .000000E+00   LOAD CASE=  5
  TITLE= Hood Top Stiffness

 NSEL  FOR LABEL= NODE  FROM     5 TO     5 BY    1

      1    ES (OF      9  DEFINED) SELECTED BY  NSEL  COMMAND.

 PRINT N.  . DISPLACEMENTS
```

```
1           ANSYS - ENGINEERING ANALYSIS SYSTEM  REVISION 4.4      A137   WEST. HANFORD    MAY 1,1990
      ANSYS(R)  COPYRIGHT(C) 1971, 1978, 1982, 1983, 1985, 1987, 1989, 1990   SWANSON ANALYSIS SYSTEMS, INC. AS UNPUBLISHED WORK.
      PROPRIETARY DATA - UNAUTHORIZED USE, DISTRIBUTION OR DUPLICATION IS PROHIBITED.  ALL RIGHTS RESERVED.
      FOR SUPPORT CALL BRAD COVERDELL    PHONE (509) 376-1921    TWX

 Hood Top Stiffness                                                    8.6467  SEP 29,1994 CP=       .290

         ***** POST1 NODAL DISPLACEMENT LISTING *****

 LOAD STEP     5  ITERATION=     1  SECTION=  1
 TIME=    .00000E+00     LOAD CASE=  5

 THE FOLLOWING X,Y,Z DISPLACEMENTS ARE IN GLOBAL COORDINATES

    NODE      UX              UY              UZ              ROTX            ROTY            ROTZ
      5    .00000000E+00   .00000000E+00   .00000000E+00   .00000000E+00   1.8245256       .00000000E+00

 MAXIMUMS
 NODE          0               0               0               0               5               0
 VALUE     .00000000E+00   .00000000E+00   .00000000E+00   .00000000E+00   1.8245256       .00000000E+00

 CURRENT LOAD CASE=   6

 USE LOAD STEP     6  ITERATION     1  SECTION   1  FOR LOAD CASE     6

 DISPLACEMENT STORED FOR    9 NODES

 STRESSES STORED FOR    4  SELECTED ITEMS

 NODAL STRESSES AND TEMPS. STORED FOR    4 ELEMENTS

 ITERATION SUMMARY INFORMATION STORED

 NODAL FORCES STORED FOR    4 ELEMENTS

 REACTIONS STORED FOR   24 REACTIONS

 FOR LOAD STEP=     6  ITERATION=     1  SECTION=   1
  TIME=   .000000E+00   LOAD CASE=  6
  TITLE= Hood Top Stiffness

 NSEL  FOR LABEL= NODE  FROM     5 TO     5 BY    1

      1  NODES (OF     9  DEFINED) SELECTED BY  NSEL  COMMAND.

 PRINT NODAL DISPLACEMENTS
1           ANSYS - ENGINEERING ANALYSIS SYSTEM  REVISION 4.4      A137   WEST. HANFORD    MAY 1,1990
      ANSYS(R)  COPYRIGHT(C) 1971, 1978, 1982, 1983, 1985, 1987, 1989, 1990   SWANSON ANALYSIS SYSTEMS, INC. AS UNPUBLISHED WORK.
      PROPRIETARY DATA - UNAUTHORIZED USE, DISTRIBUTION OR DUPLICATION IS PROHIBITED.  ALL RIGHTS RESERVED.
      FOR SUPPORT CALL BRAD COVERDELL    PHONE (509) 376-1921    TWX

 Hood Top Stiffness                                                    8.6467  SEP 29,1994 CP=       .300

         ***** POST1 NODAL DISPLACEMENT LISTING *****

 LOAD STEP     6  ITERATION=     1  SECTION=  1
 TIME=    .00000E+00     LOAD CASE=  6
```

THE FOLLOWING X,Y,Z DISPLACEMENTS ARE IN GLOBAL COORDINATES

NODE	UX	UY	UZ	ROTX	ROTY	ROTZ
5	.00000000E+00	.17192283E-20	.00000000E+00	-.13234890E-21	.00000000E+00	.13066276E-04

MAXIMUMS

NODE	0	5	0	5	0	5
VALUE	.00000000E+00	.17192283E-20	.00000000E+00	-.13234890E-21	.00000000E+00	.13066276E-04

ALL CURRENT POST1 DATA WRITTEN TO FILE07 NAME= file07.dat
FOR POSSIBLE RESUME FROM THIS POINT

***** ROUTINE COMPLETED ***** CP = .330

***** END OF INPUT ENCOUNTERED ON FILE18

***** RUN COMPLETED ***** CP= .3300 TIME= 8.6467

1 ANSYS - ENGINEERING ANALYSIS SYSTEM REVISION 4.4 A137 WEST. HANFORD MAY 1,1990
ANSYS(R) COPYRIGHT(C) 1971, 1978, 1982, 1983, 1985, 1987, 1989, 1990 SWANSON ANALYSIS SYSTEMS, INC. AS UNPUBLISHED WORK.
PROPRIETARY DATA - UNAUTHORIZED USE, DISTRIBUTION OR DUPLICATION IS PROHIBITED. ALL RIGHTS RESERVED.
FOR SUPPORT CALL BRAD COVERDELL PHONE (509) 376-1921 TWX

Hood Top Stiffness 15.6850 SEP 29,1994 CP= .300

***** POST1 NODAL DISPLACEMENT LISTING *****

LOAD STEP 5 ITERATION= 1 SECTION= 1
TIME= .00000E+00 LOAD CASE= 5

THE FOLLOWING X,Y,Z DISPLACEMENTS ARE IN GLOBAL COORDINATES

NODE	UX	UY	UZ	ROTX	ROTY	ROTZ
5	.12107077E-06	.00000000E+00	-.31417086E-23	.00000000E+00	.00000000E+00	.00000000E+00
MAXIMUMS						
NODE	5	0	5	0	0	0
VALUE	.12107077E-06	.00000000E+00	-.31417086E-23	.00000000E+00	.00000000E+00	.00000000E+00

CURRENT LOAD CASE= 6

USE LOAD STEP 6 ITERATION 1 SECTION 1 FOR LOAD CASE 6

DISPLACEMENT STORED FOR 9 NODES

STRESSES STORED FOR 4 SELECTED ITEMS

NODAL STRESSES AND TEMPS. STORED FOR 4 ELEMENTS

ITERATION SUMMARY INFORMATION STORED

NODAL FORCES STORED FOR 4 ELEMENTS

REACTIONS STORED FOR 24 REACTIONS

FOR LOAD STEP= 6 ITERATION= 1 SECTION= 1
TIME= .000000E+00 LOAD CASE= 6
TITLE= Hood Top Stiffness

NSEL FOR LABEL= NODE FROM 5 TO 5 BY 1

1 NODES (OF 9 DEFINED) SELECTED BY NSEL COMMAND.

PRINT NODAL DISPLACEMENTS

1 ANSYS - ENGINEERING ANALYSIS SYSTEM REVISION 4.4 A137 WEST. HANFORD MAY 1,1990
ANSYS(R) COPYRIGHT(C) 1971, 1978, 1982, 1983, 1985, 1987, 1989, 1990 SWANSON ANALYSIS SYSTEMS, INC. AS UNPUBLISHED WORK.
PROPRIETARY DATA - UNAUTHORIZED USE, DISTRIBUTION OR DUPLICATION IS PROHIBITED. ALL RIGHTS RESERVED.
FOR SUPPORT CALL BRAD COVERDELL PHONE (509) 376-1921 TWX

Hood Top Stiffness 15.6850 SEP 29,1994 CP= .310

***** POST1 NODAL DISPLACEMENT LISTING *****

LOAD STEP 6 ITERATION= 1 SECTION= 1
TIME= .00000E+00 LOAD CASE= 6

THE FOLLOWING X,Y,Z DISPLACEMENTS ARE IN GLOBAL COORDINATES

NODE	UX	UY	UZ	ROTX	ROTY	ROTZ
5	.00000000E+00	.31475225E-03	.00000000E+00	-.16940659E-20	.00000000E+00	.25410988E-20

MAXIMUMS

NODE	0	5	0	5	0	5
VALUE	.00000000E+00	.31475225E-03	.00000000E+00	-.16940659E-20	.00000000E+00	.25410988E-20

ALL CURRENT POST1 DATA WRITTEN TO FILE07 NAME= file07.dat
FOR POSSIBLE RESUME FROM THIS POINT

***** ROUTINE COMPLETED ***** CP = .330

***** END OF INPUT ENCOUNTERED ON FILE18

***** RUN COMPLETED ***** CP= .3300 TIME= 15.6853

****
** **
** AUTOPIPE SYSTEM DATA LISTING **
** **
****

SYSTEM NAME : HOODIN

PROJECT ID : PIPE AND DUCT REACTIONS TO GLOVEBOX IN
2736-ZB BUILDING, 200 W AREA

PREPARED BY : M.A. ISLAM

CHECKED BY : E.C. Owens

PIPING CODE : B31.3

AMBIENT TEMP. (deg F) : 70.0

COMPONENT LIBRARY : AUTOPIPE

MATERIAL LIBRARY : AUTOB313

MODEL REVISION NUMBER : 7

POINT DATA LISTING

POINT NAME	TYPE	OFFSETS (ft) X	Y	Z	PIPE ID	DESCRIPTION
*** SEGMENT A						
A00	Run	0	0	0	8SCHNS	
A01	Redu	3.00	0	0		
A02	Run	0.01	0	0	14SCH10	
A03	Run	1.50	0	0		
A04	Tee	3.00	0	0		
A05	Run	1.50	0	0		
*** SEGMENT B						
A04	Tee	7.51	0	0	10SCHNS	
B01	Tee	0	-1.92	0		
B02	Run	0	-2.00	0		
*** SEGMENT C						
B01	Tee	7.51	-1.92	0	10SCHNS	
C01	Bend	1.75	0	0		Short Elbow, Radius = 8.00 inch Bend angle change = 90.00 deg Mid point at 50.00 percent SIF - In = 8.34, Out = 6.95
C02	Bend	0	4.00	0		Short Elbow, Radius = 8.00 inch Bend angle change = 90.00 deg Mid point at 50.00 percent SIF - In = 8.34, Out = 6.95
C03	Run	0	0	-2.75		
C04	Bend	0	0	-2.75		Short Elbow, Radius = 8.00 inch Bend angle change = 90.00 deg SIF - In = 8.34, Out = 6.95
C05	Run	0	-3.00	0		
C06	Run	0	-3.00	0		
C07	Run	0	-4.00	0		
C08	Run	0	-1.30	0		

Total weight of empty pipes : 632 lb

COMPONENT DATA LISTING

POINT NAME	X	Y	Z	DATA TYPE	DESCRIPTION
*** SEGMENT A					
A00	0.00	0.00	0.00	GUIDE	ID : A00 1, Connected to Ground Stiffness = RIGID
A01	3.00	0.00	0.00		
A02	3.01	0.00	0.00		
A03	4.51	0.00	0.00	Y-STOP	ID : A03 1, Connected to Ground
A04	7.51	0.00	0.00	TEE	Unreinforced tee SIF - In = 6.40, Out = 8.20
				Y-STOP	ID : A04 1, Connected to Ground
A05	9.01	0.00	0.00		
*** SEGMENT B					
A04	7.51	0.00	0.00	TEE	Unreinforced tee SIF - In = 6.40, Out = 8.20
B01	7.51	-1.92	0.00	TEE	Unreinforced tee SIF - In = 8.47, Out = 10.96
B02	7.51	-3.92	0.00	ANCHOR	Translational stiffness lb/in X= 8200000 Y= 3200 Z= 13000000 Rotational stiffness ft-lb/deg X= 212 Y= FREE Z= 112 Thermal movements : None
*** SEGMENT C					
B01	7.51	-1.92	0.00	TEE	Unreinforced tee SIF - In = 8.47, Out = 10.96
C01 N	8.59	-1.92	0.00		
C01	9.26	-1.92	0.00	TI	
C01 M	9.06	-1.72	0.00		
C01 F	9.26	-1.25	0.00		
C02 N	9.26	1.41	0.00		
C02	9.26	2.08	0.00	TI	
C02 M	9.26	1.88	-0.20		
C02 F	9.26	2.08	-0.67		
C03	9.26	2.08	-2.75		
C04 N	9.26	2.08	-4.83		
C04	9.26	2.08	-5.50	TI	
C04 F	9.26	1.41	-5.50		
C05	9.26	-0.92	-5.50		
C06	9.26	-3.92	-5.50	ANCHOR	Translational stiffness lb/in X= 443 Y= FREE Z= 1800000 Rotational stiffness ft-lb/deg X= FREE Y= FREE Z= FREE Thermal movements : None
C07	9.26	-7.92	-5.50	ANCHOR	Translational stiffness lb/in X= 443 Y= FREE Z= 1800000 Rotational stiffness ft-lb/deg X= FREE Y= FREE Z= FREE Thermal movements : None

This was an 'ANCHOR' in Rev 0. Field Walk down revealed that it is a guide in reality. MAI

These were GUIDE support with Rigid stiffness in Rev 0 stiffnesses revised per As-built data. MAI

C08 9.26 -9.22 -5.50

C O M P O N E N T D A T A L I S T I N G

POINT NAME	---COORDINATE(ft)--- X	Y	Z	DATA TYPE	DESCRIPTION

Number of points in the system : 26

P I P E D A T A L I S T I N G

Pipe ID/ Material	Nom/ Sch	O.D. inch	Thickness(inch) W.Th.	Corr	Mill	Insu	Ling	Spec Grav	Weight(lb/ft) Pipe	Other	Total
14SCH10 AU	14 10	14.000	0.250	0	0.03	0	0	0	37.57	0	37.57
8SCHNS AU	NS	8.625	0.125	0	0.02	0	0	0	11.61	0	11.61
10SCHNS AU	NS	10.750	0.125	0	0.02	0	0	0	14.52	0	14.52

MATERIAL DATA LISTING

Material Name	Pipe ID	Density lb/cu.ft	Pois. Ratio	Temper. deg F	Modulus E6 psi	Expans. in/100ft	Allow. psi
AU	8SCHNS	501.0	0.30	70.0	28.30		16700.0
AU	14SCH10	501.0	0.30	70.0	28.30		16700.0
AU	10SCHNS	501.0	0.30	70.0	28.30		16700.0

TEMPERATURE AND PRESSURE DATA

POINT NAME	CASE 1 PRESS. psi	CASE 1 TEMPER deg F	CASE 1 EXPAN. in/100ft	CASE 2 PRESS. psi	CASE 2 TEMPER deg F	CASE 2 EXPAN. in/100ft	CASE 3 PRESS. psi	CASE 3 TEMPER deg F	CASE 3 EXPAN. in/100ft
*** SEGMENT A									
A00	0	70.00	0.000						
A05	0	70.00	0.000						
*** SEGMENT B									
A04	0	70.00	0.000						
B02	0	70.00	0.000						
*** SEGMENT C									
B01	0	70.00	0.000						
C08	0	70.00	0.000						

ANALYSIS SUMMARY

Current model revision number : 7

Static -	Date and Time of analysis	Feb 7, 1995 2:59 PM
	Model Revision Number	7
	Number of load cases	4
	Load cases analyzed	GR E1 E2 E3
	Gaps/Friction/Yielding considered	No
	Hanger design run	No
	Cut short included	No
	Weight of contents included	Yes
	Pressure stiffening case	0
	Water elevation for buoyancy loads	Not considered

CODE COMPLIANCE COMBINATIONS

Combination	Category	Method	Load	Factor	Allowable	Remarks
GR	Sustain	Sum	Gravity	1.00	16700 psi	Default
			Max Long	1.00		
Sus. + E1	Occasion	Abs sum	Earth 1	1.00	22267 psi	Default
			Max Sus	1.00		
Sus. + E2	Occasion	Abs sum	Earth 2	1.00	22267 psi	Default
			Max Sus	1.00		
Sus. + E3	Occasion	Abs sum	Earth 3	1.00	22267 psi	Default
			Max Sus	1.00		

OTHER USER COMBINATIONS

Combination	Method	Load	Factor	Remarks
GR	Sum	Gravity	1.00	Default
E1	Sum	Earth 1	1.00	Default
E2	Sum	Earth 2	1.00	Default
E3	Sum	Earth 3	1.00	Default
SEIS	SRSS	Earth 1	1.00	User
		Earth 2	1.00	
		Earth 3	1.00	
TOTAL	Abs sum	Gravity	1.00	User
		SEIS	1.00	

CODE COMPLIANCE

Y - Factor 0.40
Weld efficiency factor 1.00
Range reduction factor 1.00
Design Pressure Factor 1.00
Minimum stress ratio used in reports... 0.00
Include corrosion in stress calcs. .... Y
Include torsion in code stress ..... N
Include axial force in code stress .... N
Longitudinal pressure calculation PD/4t
Include rigorous pressure ..... Not analyzed

*** NOTE ***

No operating loads analyzed. Maximum specified pressure will be used for sustained stress

EARTHQUAKE LOAD CASES :

Number of load cases analysed : 3

Load case 1 - E1

X-Multiplier= 1.350 Y-Multiplier= 0.000 Z-Multiplier= 0.000

Load case 2 - E2

X-Multiplier= 0.000 Y-Multiplier= 0.900 Z-Multiplier= 0.000

Load case 3 - E3

X-Multiplier= 0.000 Y-Multiplier= 0.000 Z-Multiplier= 1.350

D I S P L A C E M E N T S

Point name	Load combination	TRANSLATIONS (in) X	Y	Z	ROTATIONS (deg) X	Y	Z
*** Segment A begin ***							
A00	GR	0.004	0.000	0.000	-0.001	0.001	0.000
	E1	0.021	0.000	0.000	-0.019	0.013	0.000
	E2	-0.003	0.000	0.000	0.001	-0.001	0.000
	E3	0.000	0.000	0.000	0.085	-0.048	0.000
	SEIS	0.021	0.000	0.000	0.087	0.050	0.001
	TOTAL	0.025	0.000	0.000	0.088	0.051	0.001
A01	GR	0.004	0.000	-0.001	-0.001	0.000	0.000
	E1	0.021	0.000	-0.008	-0.019	0.009	0.000
	E2	-0.003	0.000	0.001	0.001	0.000	0.000
	E3	0.000	0.000	0.029	0.085	-0.043	0.000
	SEIS	0.021	0.000	0.030	0.087	0.044	0.000
	TOTAL	0.025	0.000	0.031	0.088	0.044	0.001
A02	GR	0.004	0.000	-0.001	-0.001	0.000	0.000
	E1	0.021	0.000	-0.008	-0.019	0.009	0.000
	E2	-0.003	0.000	0.001	0.001	0.000	0.000
	E3	0.000	0.000	0.030	0.085	-0.043	0.000
	SEIS	0.021	0.000	0.031	0.087	0.044	0.000
	TOTAL	0.025	0.000	0.031	0.088	0.044	0.001
A03	GR	0.004	0.000	-0.001	-0.001	0.000	0.000
	E1	0.021	0.000	-0.011	-0.019	0.009	0.001
	E2	-0.003	0.000	0.001	0.001	0.000	0.000
	E3	0.000	0.000	0.043	0.085	-0.043	0.000
	SEIS	0.021	0.000	0.044	0.087	0.043	0.001
	TOTAL	0.025	0.000	0.045	0.088	0.043	0.001
A04	GR	0.004	0.000	-0.001	-0.001	0.000	-0.001
	E1	0.021	0.000	-0.015	-0.019	0.007	-0.004
	E2	-0.003	0.000	0.000	0.001	0.000	0.001
	E3	0.000	0.000	0.069	0.085	-0.041	0.000
	SEIS	0.021	0.000	0.071	0.087	0.042	0.004
	TOTAL	0.025	0.000	0.072	0.088	0.042	0.005
A05	GR	0.004	0.000	0.000	-0.001	0.000	-0.001
	E1	0.021	-0.001	-0.018	-0.019	0.007	-0.004
	E2	-0.003	0.000	0.000	0.001	0.000	0.001
	E3	0.000	0.000	0.082	0.085	-0.041	0.000
	SEIS	0.021	0.001	0.084	0.087	0.042	0.004
	TOTAL	0.025	0.002	0.085	0.088	0.042	0.005
*** Segment A end ***							
*** Segment B begin ***							

DISPLACEMENTS

Point name	Load combination	TRANSLATIONS (in) X	Y	Z	ROTATIONS (deg) X	Y	Z
A04	GR	0.004	0.000	-0.001	-0.001	0.000	-0.001
	E1	0.021	0.000	-0.015	-0.019	0.007	-0.004
	E2	-0.003	0.000	0.000	0.001	0.000	0.001
	E3	0.000	0.000	0.069	0.085	-0.041	0.000
	SEIS	0.021	0.000	0.071	0.087	0.042	0.004
	TOTAL	0.025	0.000	0.072	0.088	0.042	0.005
B01	GR	0.002	0.000	0.000	-0.001	-0.002	-0.006
	E1	0.014	0.000	-0.008	-0.019	-0.002	-0.026
	E2	-0.002	0.000	0.000	0.001	0.002	0.005
	E3	0.000	0.000	0.035	0.083	-0.038	0.000
	SEIS	0.014	0.000	0.036	0.085	0.038	0.027
	TOTAL	0.016	0.000	0.036	0.086	0.041	0.033
B02	GR	0.000	0.000	0.000	0.000	-0.002	-0.006
	E1	0.000	0.000	0.000	-0.019	-0.002	-0.033
	E2	0.000	0.000	0.000	0.000	0.002	0.005
	E3	0.000	0.000	0.000	0.084	-0.038	0.000
	SEIS	0.000	0.000	0.000	0.086	0.038	0.034
	TOTAL	0.000	0.000	0.000	0.086	0.041	0.040
*** Segment B end ***							
*** Segment C begin ***							
B01	GR	0.002	0.000	0.000	-0.001	-0.002	-0.006
	E1	0.014	0.000	-0.008	-0.019	-0.002	-0.026
	E2	-0.002	0.000	0.000	0.001	0.002	0.005
	E3	0.000	0.000	0.035	0.083	-0.038	0.000
	SEIS	0.014	0.000	0.036	0.085	0.038	0.027
	TOTAL	0.016	0.000	0.036	0.086	0.041	0.033
C01 N	GR	0.002	-0.002	0.001	-0.003	-0.003	-0.007
	E1	0.014	-0.006	-0.007	-0.021	-0.006	-0.029
	E2	-0.002	0.002	-0.001	0.003	0.003	0.007
	E3	0.000	0.000	0.044	0.078	-0.037	0.000
	SEIS	0.014	0.007	0.044	0.081	0.038	0.030
	TOTAL	0.016	0.008	0.045	0.084	0.041	0.038
C01 M	GR	0.003	-0.003	0.001	-0.007	0.000	-0.019
	E1	0.017	-0.012	-0.003	0.003	-0.076	-0.096
	E2	-0.003	0.003	-0.001	0.006	0.000	0.017
	E3	0.000	0.000	0.049	0.060	-0.007	0.001
	SEIS	0.017	0.013	0.049	0.060	0.076	0.098
	TOTAL	0.020	0.016	0.050	0.068	0.077	0.117

D I S P L A C E M E N T S

Point name	Load combination	TRANSLATIONS (in) X	Y	Z	ROTATIONS (deg) X	Y	Z
C01 F	GR	0.005	-0.004	-0.001	-0.034	0.009	-0.018
	E1	0.030	-0.017	0.002	0.012	-0.088	-0.152
	E2	-0.005	0.004	0.001	0.030	-0.008	0.016
	E3	0.000	0.000	0.052	0.000	0.017	0.003
	SEIS	0.030	0.018	0.052	0.032	0.090	0.153
	TOTAL	0.035	0.022	0.053	0.066	0.099	0.171
C02 N	GR	0.015	-0.004	-0.021	-0.039	0.009	-0.018
	E1	0.115	-0.017	0.008	0.010	-0.102	-0.152
	E2	-0.014	0.004	0.019	0.035	-0.008	0.016
	E3	-0.002	0.000	0.050	-0.004	0.016	0.003
	SEIS	0.116	0.018	0.054	0.037	0.104	0.153
	TOTAL	0.131	0.022	0.075	0.075	0.113	0.171
C02 M	GR	0.016	-0.007	-0.028	-0.100	0.010	-0.015
	E1	0.134	-0.017	0.008	0.008	-0.110	-0.154
	E2	-0.015	0.007	0.025	0.090	-0.009	0.013
	E3	-0.003	0.000	0.049	0.004	0.017	0.005
	SEIS	0.135	0.018	0.056	0.091	0.112	0.155
	TOTAL	0.151	0.026	0.084	0.191	0.122	0.169
C02 F	GR	0.016	-0.020	-0.033	-0.155	0.009	-0.014
	E1	0.154	-0.016	0.009	0.009	-0.170	-0.173
	E2	-0.014	0.018	0.030	0.140	-0.008	0.013
	E3	-0.005	0.001	0.050	0.023	0.016	0.005
	SEIS	0.155	0.024	0.059	0.142	0.171	0.174
	TOTAL	0.171	0.045	0.092	0.297	0.180	0.188
C03	GR	0.012	-0.089	-0.033	-0.157	0.009	-0.014
	E1	0.230	-0.012	0.009	0.009	-0.175	-0.168
	E2	-0.011	0.080	0.030	0.141	-0.008	0.012
	E3	-0.012	0.012	0.050	0.024	0.015	0.005
	SEIS	0.231	0.082	0.059	0.144	0.176	0.169
	TOTAL	0.243	0.171	0.091	0.301	0.185	0.183
C04 N	GR	0.008	-0.157	-0.033	-0.154	0.009	-0.013
	E1	0.307	-0.008	0.009	0.009	-0.177	-0.163
	E2	-0.007	0.141	0.030	0.139	-0.008	0.012
	E3	-0.018	0.023	0.050	0.026	0.015	0.006
	SEIS	0.308	0.143	0.059	0.142	0.178	0.164
	TOTAL	0.316	0.301	0.091	0.296	0.187	0.177
C04 F	GR	0.006	-0.173	-0.022	-0.029	0.005	-0.008
	E1	0.314	-0.007	0.007	0.008	-0.208	-0.119
	E2	-0.005	0.156	0.020	0.026	-0.005	0.007
	E3	-0.019	0.028	0.043	0.047	0.013	0.009
	SEIS	0.314	0.158	0.048	0.055	0.209	0.120
	TOTAL	0.320	0.331	0.070	0.083	0.214	0.128

D I S P L A C E M E N T S

Point name	Load combination	TRANSLATIONS (in) X	Y	Z	ROTATIONS (deg) X	Y	Z
C05	GR	0.002	-0.173	-0.010	-0.021	0.005	-0.007
	E1	0.256	-0.007	0.003	0.007	-0.208	-0.117
	E2	-0.002	0.156	0.009	0.019	-0.005	0.007
	E3	-0.015	0.028	0.021	0.041	0.013	0.009
	SEIS	0.257	0.158	0.023	0.046	0.209	0.117
	TOTAL	0.259	0.331	0.032	0.067	0.214	0.125
C06	GR	-0.003	-0.173	0.000	-0.008	0.005	-0.007
	E1	0.183	-0.007	0.000	0.003	-0.208	-0.115
	E2	0.002	0.156	0.000	0.007	-0.005	0.006
	E3	-0.009	0.028	0.001	0.017	0.013	0.009
	SEIS	0.184	0.158	0.001	0.019	0.209	0.116
	TOTAL	0.186	0.331	0.001	0.027	0.214	0.123
C07	GR	-0.008	-0.173	0.000	0.002	0.005	-0.007
	E1	0.088	-0.007	0.000	-0.001	-0.208	-0.114
	E2	0.008	0.156	0.000	-0.002	-0.005	0.006
	E3	-0.001	0.028	0.000	-0.005	0.013	0.009
	SEIS	0.088	0.158	0.000	0.005	0.209	0.115
	TOTAL	0.096	0.331	0.000	0.008	0.214	0.122
C08	GR	-0.010	-0.173	0.000	0.002	0.005	-0.007
	E1	0.057	-0.007	0.000	-0.001	-0.208	-0.114
	E2	0.009	0.156	0.000	-0.002	-0.005	0.006
	E3	0.001	0.028	0.001	-0.005	0.013	0.009
	SEIS	0.057	0.158	0.001	0.005	0.209	0.115
	TOTAL	0.068	0.331	0.002	0.008	0.214	0.122

*** Segment C end ***

SUPPORT FORCES

Point/ Supp. ID	Connect/ Type	Load Combination	LOCAL Dirn	LOCAL Force	LOCAL Deform	GLOBAL Dirn	GLOBAL Force	GLOBAL Deform
A00		GR	down	22	0.000	X		0.004
A00 1	Guide		left	22	0.000	Y	-22	0.000
Stiff	:RIGID					Z	-22	0.000
		E1	down	20	0.000	X		0.021
			left	95	0.000	Y	-20	0.000
						Z	-95	0.000
		E2	up	20	0.000	X		-0.003
			rght	20	0.000	Y	20	0.000
						Z	20	0.000
		E3	up	0	0.000	X		0.000
			rght	134	0.000	Y	0	0.000
						Z	134	0.000
		SEIS	down	28	0.000	X		0.021
			left	165	0.000	Y	28	0.000
						Z	165	0.000
		TOTAL	down	50	0.000	X		0.025
			left	187	0.000	Y	50	0.000
						Z	187	0.000
A03		GR	up	44	0.000	X		0.004
A03 1	Y - Stop					Y	44	0.000
Stiff	:RIGID					Z		-0.001
		E1	up	952	0.000	X		0.021
						Y	952	0.000
						Z		-0.011
		E2	down	39	0.000	X		-0.003
						Y	-39	0.000
						Z		0.001
		E3	down	1	0.000	X		0.000
						Y	-1	0.000
						Z		0.043
		SEIS	down	953	0.000	X		0.021
						Y	953	0.000
						Z		0.044
		TOTAL	down	996	0.000	X		0.025
						Y	996	0.000
						Z		0.045

SUPPORT FORCES

Point/ Supp. ID	Connect/ Type	Load Combination	LOCAL Dirn	LOCAL Force	LOCAL Deform	GLOBAL Dirn	GLOBAL Force	GLOBAL Deform
A04		GR	down	654	0.000	X		0.004
A04 1	Y - Stop					Y	-654	0.000
Stiff	:RIGID					Z		-0.001
		E1	down	932	0.000	X		0.021
						Y	-932	0.000
						Z		-0.015
		E2	up	588	0.000	X		-0.003
						Y	588	0.000
						Z		0.000
		E3	up	1	0.000	X		0.000
						Y	1	0.000
						Z		0.069
		SEIS	down	1102	0.000	X		0.021
						Y	1102	0.000
						Z		0.071
		TOTAL	down	1756	0.000	X		0.025
						Y	1756	0.000
						Z		0.072

RESTRAINT REACTIONS

Point name	Load combination	FORCES (lb) X	Y	Z	Result	MOMENTS (ft-lb) X	Y	Z	Result
A00	Guide								
	GR	0	-22	-22	31	0	0	0	0
	E1	0	-20	-95	97	0	0	0	0
	E2	0	20	20	28	0	0	0	0
	E3	0	0	134	134	0	0	0	0
	SEIS	0	28	165	168	0	0	0	0
	TOTAL	0	50	187	194	0	0	0	0
A03	Y - Stop								
	GR	0	44	0	44	0	0	0	0
	E1	0	952	0	952	0	0	0	0
	E2	0	-39	0	39	0	0	0	0
	E3	0	-1	0	1	0	0	0	0
	SEIS	0	953	0	953	0	0	0	0
	TOTAL	0	996	0	996	0	0	0	0
A04	Y - Stop								
	GR	0	-654	0	654	0	0	0	0
	E1	0	-932	0	932	0	0	0	0
	E2	0	588	0	588	0	0	0	0
	E3	0	1	0	1	0	0	0	0
	SEIS	0	1102	0	1102	0	0	0	0
	TOTAL	0	1756	0	1756	0	0	0	0
B02	Anchor								
	GR	5	0	101	101	0	0	-1	1
	E1	734	0	30	734	-4	0	-4	6
	E2	-4	0	-91	91	0	0	1	1
	E3	4	0	147	147	18	0	0	18
	SEIS	734	0	175	754	18	0	4	19
	TOTAL	739	0	276	788	18	0	4	19
C06	Anchor								
	GR	-1	0	-332	332	0	0	0	0
	E1	81	0	158	178	0	0	0	0
	E2	1	0	299	299	0	0	0	0
	E3	-4	0	1077	1077	0	0	0	0
	SEIS	81	0	1128	1131	0	0	0	0
	TOTAL	83	0	1460	1463	0	0	0	0
C07	Anchor								
	GR	-4	0	253	253	0	0	0	0
	E1	39	0	-94	101	0	0	0	0
	E2	3	0	-228	228	0	0	0	0
	E3	0	0	-503	503	0	0	0	0
	SEIS	39	0	561	562	0	0	0	0
	TOTAL	43	0	814	815	0	0	0	0

G L O B A L F O R C E S & M O M E N T S

Point name	Load combination	FORCES (lb) X	Y	Z	Result	MOMENTS (ft-lb) X	Y	Z	Result
*** Segment A begin ***									
A00	GR	0	22	22	31	0	0	0	0
	E1	0	20	95	97	0	0	0	0
	E2	0	-20	-20	28	0	0	0	0
	E3	0	0	-134	134	0	0	0	0
	SEIS	0	28	165	168	0	0	0	0
	TOTAL	0	50	187	194	0	0	0	0
A01	GR	0	-13	22	25	0	66	-14	67
	E1	47	20	95	107	0	284	-59	290
	E2	0	11	-20	23	0	-59	13	61
	E3	0	0	-87	87	0	-331	0	331
	SEIS	47	23	130	140	0	440	60	444
	TOTAL	47	35	152	163	0	506	75	512
A02	GR	0	-13	22	25	0	66	-14	68
	E1	47	20	95	108	0	285	-59	291
	E2	0	12	-20	23	0	-59	13	61
	E3	0	0	-87	87	0	-332	0	332
	SEIS	47	23	130	140	0	441	61	446
	TOTAL	47	36	152	163	0	508	75	513
A03 -	GR	0	-69	22	73	0	99	47	110
	E1	123	20	95	157	0	427	-89	436
	E2	0	62	-20	65	0	-89	-43	99
	E3	0	0	-10	10	0	-405	0	405
	SEIS	123	65	97	170	0	595	98	603
	TOTAL	123	135	119	218	0	694	146	709
A03 +	GR	0	-113	22	115	0	99	47	110
	E1	123	-932	95	945	0	427	-89	436
	E2	0	102	-20	104	0	-89	-43	99
	E3	0	1	-10	10	0	-405	0	405
	SEIS	123	938	97	951	0	595	98	603
	TOTAL	123	1051	119	1065	0	694	146	709
A04 -	GR	0	-226	22	227	0	165	555	579
	E1	276	-932	95	977	0	711	2708	2800
	E2	0	203	-20	204	0	-148	-499	521
	E3	0	1	142	142	0	-208	-2	208
	SEIS	276	954	172	1008	0	755	2754	2855
	TOTAL	276	1180	194	1227	0	920	3309	3434

GLOBAL FORCES & MOMENTS

Point name		Load combination	FORCES (lb) X	Y	Z	Result	MOMENTS (ft-lb) X	Y	Z	Result
A04	+	GR	0	56	0	56	0	0	42	42
		E1	-76	0	0	76	0	0	0	0
		E2	0	-51	0	51	0	0	-38	38
		E3	0	0	-76	76	0	57	0	57
		SEIS	76	51	76	119	0	57	38	69
		TOTAL	76	107	76	152	0	57	80	99
A05		GR	0	0	0	0	0	0	0	0
		E1	0	0	0	0	0	0	0	0
		E2	0	0	0	0	0	0	0	0
		E3	0	0	0	0	0	0	0	0
		SEIS	0	0	0	0	0	0	0	0
		TOTAL	0	0	0	0	0	0	0	0
*** Segment A end ***										
*** Segment B begin ***										
A04		GR	0	372	22	372	0	165	513	539
		E1	352	0	95	364	0	711	2708	2800
		E2	0	-334	-20	335	0	-148	-461	485
		E3	0	0	218	218	0	-265	-2	265
		SEIS	352	334	238	541	0	773	2747	2854
		TOTAL	352	706	260	831	0	938	3260	3392
B01	-	GR	0	344	22	344	42	165	513	540
		E1	389	0	95	401	182	711	1997	2127
		E2	0	-309	-20	310	-38	-148	-461	486
		E3	0	0	255	255	454	-265	-2	526
		SEIS	389	309	273	567	491	773	2049	2244
		TOTAL	389	653	295	816	533	938	2562	2780
B01	+	GR	5	29	101	105	-202	0	9	202
		E1	694	0	30	695	-65	0	1424	1426
		E2	-4	-26	-91	94	181	0	-8	182
		E3	4	0	107	108	-236	0	9	236
		SEIS	694	26	144	710	305	0	1424	1456
		TOTAL	699	55	245	743	506	0	1433	1520
B02		GR	5	0	101	101	0	0	-1	1
		E1	734	0	30	734	-4	0	-4	6
		E2	-4	0	-91	91	0	0	1	1
		E3	4	0	147	147	18	0	0	18
		SEIS	734	0	175	754	18	0	4	19
		TOTAL	739	0	276	788	18	0	4	19
*** Segment B end ***										

GLOBAL FORCES & MOMENTS

Point name	Load combination	FORCES (lb) X	Y	Z	Result	MOMENTS (ft-lb) X	Y	Z	Result
B01	GR	-5	315	-79	325	244	165	504	583
	E1	-305	0	64	312	246	711	572	945
	E2	4	-283	71	292	-219	-148	-453	525
	E3	-4	0	148	148	691	-265	-11	740
	SEIS	305	283	176	452	765	773	730	1310
	TOTAL	310	598	255	720	1009	938	1234	1849
C01 N	GR	-5	299	-79	309	244	80	171	308
	E1	-284	0	64	291	246	780	572	999
	E2	4	-269	71	278	-219	-72	-154	277
	E3	-4	0	169	169	691	-93	-11	697
	SEIS	284	269	194	437	765	789	593	1249
	TOTAL	289	568	273	694	1009	869	764	1535
C01 M	GR	-5	292	-79	302	259	42	31	264
	E1	-274	0	64	281	234	811	518	990
	E2	4	-262	71	272	-233	-38	-28	238
	E3	-4	0	179	180	656	-11	-12	656
	SEIS	274	262	203	430	735	812	519	1212
	TOTAL	279	554	282	681	994	854	550	1421
C01 F	GR	-5	284	-79	295	296	27	-28	299
	E1	-263	0	64	271	203	823	392	934
	E2	4	-256	71	265	-267	-24	25	269
	E3	-4	0	190	190	569	25	-14	570
	SEIS	263	256	213	424	661	824	393	1127
	TOTAL	268	540	291	669	957	851	421	1348
C02 N	GR	-5	245	-79	258	506	27	-41	509
	E1	-211	0	64	221	32	823	-240	858
	E2	4	-221	71	232	-456	-24	37	458
	E3	-4	0	242	242	-6	25	-26	36
	SEIS	211	221	260	401	457	824	245	973
	TOTAL	216	466	339	615	963	851	286	1317
C02 M	GR	-5	238	-79	250	497	26	-44	499
	E1	-201	0	64	211	2	783	-338	853
	E2	4	-214	71	225	-447	-23	39	449
	E3	-4	0	252	252	-123	24	-28	128
	SEIS	201	214	270	399	463	784	341	973
	TOTAL	206	452	349	606	960	810	385	1314
C02 F	GR	-5	230	-79	243	402	24	-45	405
	E1	-191	0	64	201	-11	691	-376	787
	E2	4	-207	71	219	-362	-21	40	364
	E3	-4	0	262	263	-173	22	-29	177
	SEIS	191	207	279	397	401	692	379	885
	TOTAL	196	437	358	598	803	716	424	1156

GLOBAL FORCES & MOMENTS

Point name	Load combination	FORCES (lb) X	Y	Z	Result	MOMENTS (ft-lb) X	Y	Z	Result
C03	GR	-5	200	-79	215	-46	14	-45	65
	E1	-150	0	64	163	-11	337	-376	505
	E2	4	-180	71	193	41	-12	40	59
	E3	-4	0	303	303	-173	12	-29	176
	SEIS	150	180	318	395	178	337	379	538
	TOTAL	155	380	397	571	224	351	424	594
C04 N	GR	-5	170	-79	187	-431	3	-45	433
	E1	-109	0	64	126	-11	68	-376	382
	E2	4	-153	71	168	388	-3	40	390
	E3	-4	0	344	344	-173	3	-29	175
	SEIS	109	153	357	403	425	68	379	573
	TOTAL	114	322	436	554	855	71	424	957
C04 F	GR	-5	154	-79	173	-593	0	-41	594
	E1	-88	0	64	109	32	0	-312	314
	E2	4	-139	71	156	533	0	37	535
	E3	-4	0	365	365	65	0	-26	70
	SEIS	89	139	377	411	538	0	316	624
	TOTAL	93	293	456	550	1131	0	357	1186
C05	GR	-5	120	-79	144	-776	0	-30	777
	E1	-43	0	64	77	182	0	-160	242
	E2	4	-108	71	130	699	0	27	699
	E3	-4	0	410	410	970	0	-15	970
	SEIS	43	108	421	437	1209	0	163	1220
	TOTAL	48	229	500	552	1985	0	192	1995
C06 -	GR	-5	77	-79	110	-1013	0	-15	1013
	E1	16	0	64	66	375	0	-120	394
	E2	4	-69	71	99	912	0	14	912
	E3	-4	0	469	469	2289	0	-2	2289
	SEIS	17	69	479	484	2492	0	121	2495
	TOTAL	22	146	558	577	3505	0	136	3508
C06 +	GR	-4	77	253	265	-1013	0	-15	1013
	E1	-65	0	-94	114	375	0	-120	394
	E2	3	-69	-228	238	912	0	14	912
	E3	0	0	-607	607	2289	0	-2	2289
	SEIS	65	69	655	662	2492	0	121	2495
	TOTAL	69	146	909	923	3505	0	136	3508
C07 -	GR	-4	19	253	254	0	0	0	0
	E1	13	0	-94	95	0	0	-17	17
	E2	3	-17	-228	229	0	0	0	0
	E3	0	0	-529	529	17	0	0	17
	SEIS	14	17	584	584	17	0	17	23
	TOTAL	18	36	837	838	17	0	17	23

GLOBAL FORCES & MOMENTS

Point name	Load combination	FORCES (lb) X	Y	Z	Result	MOMENTS (ft-lb) X	Y	Z	Result
C07 +	GR	0	19	0	19	0	0	0	0
	E1	-25	0	0	25	0	0	-17	17
	E2	0	-17	0	17	0	0	0	0
	E3	0	0	-25	25	17	0	0	17
	SEIS	25	17	25	40	17	0	17	23
	TOTAL	25	36	25	51	17	0	17	23
C08	GR	0	0	0	0	0	0	0	0
	E1	0	0	0	0	0	0	0	0
	E2	0	0	0	0	0	0	0	0
	E3	0	0	0	0	0	0	0	0
	SEIS	0	0	0	0	0	0	0	0
	TOTAL	0	0	0	0	0	0	0	0

*** Segment C end ***

ASME B31.3c (1992) CODE COMPLIANCE

Point name	Load combination	In-Pl. Moment (Moments in ft-lb)	Out-Pl. Moment	Torsion Moment	S.I.F In	S.I.F Out	Eq. no.	Load type	Code Stress (Stress in psi)	Code Allow.
*** Segment A begin ***										
A00	GR	0	0		1.00	1.00	(18)	SUST	0	16700
	Sus. + E1	0	0		1.00	1.00	(18)	OCC	0	22267
	Sus. + E2	0	0		1.00	1.00	(18)	OCC	0	22267
	Sus. + E3	0	0		1.00	1.00	(18)	OCC	0	22267
A01 -	GR	14	66		1.00	1.00	(18)	SUST	116	16700
	Sus. + E1	73	350		1.00	1.00	(18)	OCC	613	22267
	Sus. + E2	27	125		1.00	1.00	(18)	OCC	220	22267
	Sus. + E3	14	397		1.00	1.00	(18)	OCC	684	22267
A01 +	GR	14	66		1.00	1.00	(18)	SUST	116	16700
	Sus. + E1	73	350		1.00	1.00	(18)	OCC	613	22267
	Sus. + E2	27	125		1.00	1.00	(18)	OCC	220	22267
	Sus. + E3	14	397		1.00	1.00	(18)	OCC	684	22267
A02	GR	14	66		1.00	1.00	(18)	SUST	22	16700
	Sus. + E1	74	351		1.00	1.00	(18)	OCC	118	22267
	Sus. + E2	27	126		1.00	1.00	(18)	OCC	42	22267
	Sus. + E3	14	398		1.00	1.00	(18)	OCC	131	22267
A03 -	GR	47	99		1.00	1.00	(18)	SUST	36	16700
	Sus. + E1	136	526		1.00	1.00	(18)	OCC	180	22267
	Sus. + E2	90	188		1.00	1.00	(18)	OCC	69	22267
	Sus. + E3	47	504		1.00	1.00	(18)	OCC	169	22267
A03 +	GR	47	99		1.00	1.00	(18)	SUST	36	16700
	Sus. + E1	136	526		1.00	1.00	(18)	OCC	180	22267
	Sus. + E2	90	188		1.00	1.00	(18)	OCC	69	22267
	Sus. + E3	47	504		1.00	1.00	(18)	OCC	169	22267
A04 -	GR	555	165		6.40	8.20	(18)	SUST	1250	16700
	Sus. + E1	3263	876		6.40	8.20	(18)	OCC	7266	22267
	Sus. + E2	1054	313		6.40	8.20	(18)	OCC	2376	22267
	Sus. + E3	557	373		6.40	8.20	(18)	OCC	1811	22267
A04 +	GR	42	0		6.40	8.20	(18)	SUST	89	16700
	Sus. + E1	42	0		6.40	8.20	(18)	OCC	89	22267
	Sus. + E2	80	0		6.40	8.20	(18)	OCC	169	22267
	Sus. + E3	42	57		6.40	8.20	(18)	OCC	243	22267
A05	GR	0	0		1.00	1.00	(18)	SUST	0	16700
	Sus. + E1	0	0		1.00	1.00	(18)	OCC	0	22267
	Sus. + E2	0	0		1.00	1.00	(18)	OCC	0	22267
	Sus. + E3	0	0		1.00	1.00	(18)	OCC	0	22267

ASME B31.3c (1992) CODE COMPLIANCE

Point name	Load combination	In-Pl. Moment (ft-lb)	Out-Pl. Moment (ft-lb)	Torsion Moment (ft-lb)	S.I.F In	S.I.F Out	Eq. no.	Load type	Code Stress (psi)	Code Allow. (psi)
*** Segment B begin ***										
A04	GR	513	0		6.40	8.20	(18)	SUST	1776	16700
	Sus. + E1	3221	0		6.40	8.20	(18)	OCC	11159	22267
	Sus. + E2	974	0		6.40	8.20	(18)	OCC	3375	22267
	Sus. + E3	515	0		6.40	8.20	(18)	OCC	1783	22267
B01 -	GR	513	42		8.47	10.96	(18)	SUST	4784	16700
	Sus. + E1	2509	224		8.47	10.96	(18)	OCC	23436	22267**
	Sus. + E2	974	80		8.47	10.96	(18)	OCC	9089	22267
	Sus. + E3	515	496		8.47	10.96	(18)	OCC	10238	22267
B01 +	GR	9	202		8.47	10.96	(18)	SUST	2421	16700
	Sus. + E1	1433	266		8.47	10.96	(18)	OCC	15657	22267
	Sus. + E2	17	383		8.47	10.96	(18)	OCC	4600	22267
	Sus. + E3	18	438		8.47	10.96	(18)	OCC	5259	22267
302	GR	0	1		1.00	1.00	(18)	SUST	1	16700
	Sus. + E1	4	4		1.00	1.00	(18)	OCC	7	22267
	Sus. + E2	0	1		1.00	1.00	(18)	OCC	1	22267
	Sus. + E3	18	1		1.00	1.00	(18)	OCC	20	22267
*** Segment B end ***										
*** Segment C begin ***										
B01	GR	504	165		8.47	10.96	(18)	SUST	5016	16700
	Sus. + E1	1076	876		8.47	10.96	(18)	OCC	14950	22267
	Sus. + E2	957	313		8.47	10.96	(18)	OCC	9530	22267
	Sus. + E3	514	430		8.47	10.96	(18)	OCC	8161	22267
C01 N-	GR	171	80		1.00	1.00	(18)	SUST	207	16700
	Sus. + E1	743	860		1.00	1.00	(18)	OCC	1267	22267
	Sus. + E2	325	151		1.00	1.00	(18)	OCC	392	22267
	Sus. + E3	182	173		1.00	1.00	(18)	OCC	309	22267
C01 N+	GR	171	80		8.34	6.95	(18)	SUST	1675	16700
	Sus. + E1	743	860		8.34	6.95	(18)	OCC	9592	22267
	Sus. + E2	325	151		8.34	6.95	(18)	OCC	3183	22267
	Sus. + E3	182	173		8.34	6.95	(18)	OCC	2391	22267
C01 M-	GR	31	153		8.34	6.95	(18)	SUST	1200	16700
	Sus. + E1	549	561		8.34	6.95	(18)	OCC	6864	22267
	Sus. + E2	58	291		8.34	6.95	(18)	OCC	2279	22267
	Sus. + E3	42	625		8.34	6.95	(18)	OCC	4794	22267

ASME B31.3c (1992) CODE COMPLIANCE

Point name	Load combination	(Moments in ft-lb) In-Pl. Moment	Out-Pl. Moment	Torsion Moment	S.I.F In	S.I.F Out	Eq. no.	Load type	(Stress in psi) Code Stress	Code Allow.
C01 M+	GR	31	153		8.34	6.95	(18)	SUST	1200	16700
	Sus. + E1	549	561		8.34	6.95	(18)	OCC	6864	22267
	Sus. + E2	58	291		8.34	6.95	(18)	OCC	2279	22267
	Sus. + E3	42	625		8.34	6.95	(18)	OCC	4794	22267
C01 F-	GR	28	296		8.34	6.95	(18)	SUST	2270	16700
	Sus. + E1	420	500		8.34	6.95	(18)	OCC	6172	22267
	Sus. + E2	53	563		8.34	6.95	(18)	OCC	4314	22267
	Sus. + E3	42	865		8.34	6.95	(18)	OCC	6606	22267
C01 F+	GR	296	28		1.00	1.00	(18)	SUST	326	16700
	Sus. + E1	500	420		1.00	1.00	(18)	OCC	810	22267
	Sus. + E2	563	53		1.00	1.00	(18)	OCC	619	22267
	Sus. + E3	865	42		1.00	1.00	(18)	OCC	949	22267
C02 N-	GR	506	41		1.00	1.00	(18)	SUST	556	16700
	Sus. + E1	538	282		1.00	1.00	(18)	OCC	822	22267
	Sus. + E2	962	78		1.00	1.00	(18)	OCC	1057	22267
	Sus. + E3	513	67		1.00	1.00	(18)	OCC	586	22267
C02 N+	GR	506	41		8.34	6.95	(18)	SUST	4637	16700
	Sus. + E1	538	282		8.34	6.95	(18)	OCC	6492	22267
	Sus. + E2	962	78		8.34	6.95	(18)	OCC	8811	22267
	Sus. + E3	513	67		8.34	6.95	(18)	OCC	4843	22267
C02 M-	GR	497	12		8.34	6.95	(18)	SUST	4538	16700
	Sus. + E1	498	327		8.34	6.95	(18)	OCC	6938	22267
	Sus. + E2	943	23		8.34	6.95	(18)	OCC	8623	22267
	Sus. + E3	619	15		8.34	6.95	(18)	OCC	5661	22267
C02 M+	GR	497	12		8.34	6.95	(18)	SUST	4538	16700
	Sus. + E1	498	327		8.34	6.95	(18)	OCC	6938	22267
	Sus. + E2	943	23		8.34	6.95	(18)	OCC	8623	22267
	Sus. + E3	619	15		8.34	6.95	(18)	OCC	5661	22267
C02 F-	GR	402	24		8.34	6.95	(18)	SUST	3676	16700
	Sus. + E1	413	715		8.34	6.95	(18)	OCC	8941	22267
	Sus. + E2	763	45		8.34	6.95	(18)	OCC	6984	22267
	Sus. + E3	575	45		8.34	6.95	(18)	OCC	5263	22267
C02 F+	GR	402	24		1.00	1.00	(18)	SUST	441	16700
	Sus. + E1	413	715		1.00	1.00	(18)	OCC	1198	22267
	Sus. + E2	763	45		1.00	1.00	(18)	OCC	838	22267
	Sus. + E3	575	45		1.00	1.00	(18)	OCC	632	22267
C03	GR	46	14		1.00	1.00	(18)	SUST	53	16700
	Sus. + E1	57	350		1.00	1.00	(18)	OCC	422	22267
	Sus. + E2	87	26		1.00	1.00	(18)	OCC	100	22267

	Sus. + E3	219	26		1.00	1.00	(18)	OCC	242	22267

ASME B31.3c (1992) CODE COMPLIANCE

Point name	Load combination	(Moments in ft-lb) In-Pl. Moment	Out-Pl. Moment	Torsion Moment	S.I.F In	S.I.F Out	Eq. no.	Load type	(Stress in psi) Code Stress	Code Allow.
C04 N-	GR	431	3		1.00	1.00	(18)	SUST	472	16700
	Sus. + E1	442	71		1.00	1.00	(18)	OCC	547	22267
	Sus. + E2	818	6		1.00	1.00	(18)	OCC	896	22267
	Sus. + E3	604	6		1.00	1.00	(18)	OCC	661	22267
C04 N+	GR	431	3		8.34	6.95	(18)	SUST	3936	16700
	Sus. + E1	442	71		8.34	6.95	(18)	OCC	4461	22267
	Sus. + E2	818	6		8.34	6.95	(18)	OCC	7479	22267
	Sus. + E3	604	6		8.34	6.95	(18)	OCC	5515	22267
C04 F-	GR	593	41		8.34	6.95	(18)	SUST	5425	16700
	Sus. + E1	624	354		8.34	6.95	(18)	OCC	7821	22267
	Sus. + E2	1126	78		8.34	6.95	(18)	OCC	10307	22267
	Sus. + E3	658	67		8.34	6.95	(18)	OCC	6054	22267
C04 F+	GR	593	41		1.00	1.00	(18)	SUST	651	16700
	Sus. + E1	624	354		1.00	1.00	(18)	OCC	995	22267
	Sus. + E2	1126	78		1.00	1.00	(18)	OCC	1236	22267
	Sus. + E3	658	67		1.00	1.00	(18)	OCC	728	22267
C05	GR	776	30		1.00	1.00	(18)	SUST	851	16700
	Sus. + E1	958	189		1.00	1.00	(18)	OCC	1116	22267
	Sus. + E2	1475	57		1.00	1.00	(18)	OCC	1617	22267
	Sus. + E3	1746	45		1.00	1.00	(18)	OCC	1913	22267
C06 -	GR	1013	15		1.00	1.00	(18)	SUST	1109	16700
	Sus. + E1	1388	135		1.00	1.00	(18)	OCC	1541	22267
	Sus. + E2	1924	29		1.00	1.00	(18)	OCC	2108	22267
	Sus. + E3	3302	17		1.00	1.00	(18)	OCC	3617	22267
C06 +	GR	1013	15		1.00	1.00	(18)	SUST	1109	16700
	Sus. + E1	1388	135		1.00	1.00	(18)	OCC	1541	22267
	Sus. + E2	1924	29		1.00	1.00	(18)	OCC	2108	22267
	Sus. + E3	3302	17		1.00	1.00	(18)	OCC	3617	22267
C07 -	GR	0	0		1.00	1.00	(18)	SUST	0	16700
	Sus. + E1	0	17		1.00	1.00	(18)	OCC	18	22267
	Sus. + E2	0	0		1.00	1.00	(18)	OCC	0	22267
	Sus. + E3	17	0		1.00	1.00	(18)	OCC	18	22267
C07 +	GR	0	0		1.00	1.00	(18)	SUST	0	16700
	Sus. + E1	0	17		1.00	1.00	(18)	OCC	18	22267
	Sus. + E2	0	0		1.00	1.00	(18)	OCC	0	22267
	Sus. + E3	17	0		1.00	1.00	(18)	OCC	18	22267
C08	GR	0	0		1.00	1.00	(18)	SUST	0	16700
	Sus. + E1	0	0		1.00	1.00	(18)	OCC	0	22267
	Sus. + E2	0	0		1.00	1.00	(18)	OCC	0	22267

ASME B31.3c (1992) CODE COMPLIANCE

Point name	Load combination	In-Pl. Moment (Moments in ft-lb)	Out-Pl. Moment	Torsion Moment	S.I.F In	S.I.F Out	Eq. no.	Load type	Code Stress (Stress in psi)	Code Allow.
	Sus. + E3	0	0		1.00	1.00	(18)	OCC	0	22267

*** Segment C end ***

SYSTEM SUMMARY

Maximum displacements (in)

Maximum X :	0.320	Point : C04 F	Load Comb.: TOTAL
Maximum Y :	0.331	Point : C08	Load Comb.: TOTAL
Maximum Z :	0.092	Point : C02 F	Load Comb.: TOTAL
Max. total:	0.466	Point : C04 F	Load Comb.: TOTAL

Maximum rotations (deg)

Maximum X :	0.301	Point : C03	Load Comb.: TOTAL
Maximum Y :	0.214	Point : C04 F	Load Comb.: TOTAL
Maximum Z :	0.188	Point : C02 F	Load Comb.: TOTAL
Max. total:	0.397	Point : C03	Load Comb.: TOTAL

Maximum restraint forces(lb)

Maximum X :	739	Point : B02	Load Comb.: TOTAL
Maximum Y :	1756	Point : A04	Load Comb.: TOTAL
Maximum Z :	1460	Point : C06	Load Comb.: TOTAL
Max. total:	1756	Point : A04	Load Comb.: TOTAL

Maximum restraint moments(ft-lb)

Maximum X :	18	Point : B02	Load Comb.: TOTAL
Maximum Z :	4	Point : B02	Load Comb.: TOTAL
Max. total:	19	Point : B02	Load Comb.: TOTAL

SYSTEM SUMMARY

Maximum pipe forces (lb)

Maximum X :	739	Point : B02	Load Comb.: TOTAL
Maximum Y :	1180	Point : A04	Load Comb.: TOTAL
Maximum Z :	909	Point : C06	Load Comb.: TOTAL
Max. total:	1227	Point : A04	Load Comb.: TOTAL

Maximum pipe moments (ft-lb)

Maximum X :	3505	Point : C06	Load Comb.: TOTAL
Maximum Y :	938	Point : A04	Load Comb.: TOTAL
Maximum Z :	3309	Point : A04	Load Comb.: TOTAL
Max. total:	3508	Point : C06	Load Comb.: TOTAL

S Y S T E M S U M M A R Y

Maximum sustained stress

Point	: C04 F
Stress psi	: 5425
Allowable psi	: 16700
Ratio	: 0.32
Load combination	: GR

Maximum occasional stress

Point	: B01
Stress psi	: 23436
Allowable psi	: 22267
Ratio	: 1.05
Load combination	: Sus. + E1

Maximum sustained stress ratio

Point	: C04 F
Stress psi	: 5425
Allowable psi	: 16700
Ratio	: 0.32
Load combination	: GR

Maximum occasional stress ratio

Point	: B01
Stress psi	: 23436
Allowable psi	: 22267
Ratio	: 1.05
Load combination	: Sus. + E1

* * * The system does not satisfy ASME B31.3 code requirements * * *
* * * for the selected options * * *

****
** **
** AUTOPIPE SYSTEM DATA LISTING **
** **
****

SYSTEM NAME : HOODOUT

PROJECT ID : PIPE AND DUCT REACTIONS TO GLOVEBOX AND
LOAD OUT HOOD, 2736-ZB, 200 W AREA

PREPARED BY : M.A. Islam
M.A. ISLAM

CHECKED BY : E.C. O'Connell

PIPING CODE : B31.3

AMBIENT TEMP. (deg F) : 70.0

COMPONENT LIBRARY : AUTOPIPE

MATERIAL LIBRARY : AUTOB313

MODEL REVISION NUMBER : 13

POINT DATA LISTING

POINT NAME	TYPE	-----OFFSETS (ft)----- X	Y	Z	PIPE ID	DESCRIPTION
*** SEGMENT A						
A00	Run	0	0	0	8SCHNS	
A01	Run	3.50	0	0		
A02	Tee	3.50	0	0		
A03	Run	3.00	0	0		
A04	Redu	3.00	0	0		
A05	Run	0.10	0	0	14SCH10	
A06	Run	1.73	0	1.00		
A07	Redu	2.60	0	1.50		
A08	Run	0.09	0	0.05	10SCHNS	
A09	Run	0	-3.25	0		
*** SEGMENT B						
A02	Tee	7.00	0	0	2SCH40S	
B01	Run	1.49	0	1.49		
B02	Bend	1.48	0	1.48		Short Elbow, Radius = 10.00 inch Bend angle change = 90.00 deg Mid point at 50.00 percent SIF - In = 1.00, Out = 1.00
B03	Tee	0	-1.25	0		
B04	Run	0	-1.25	0		
*** SEGMENT C						
B03	Tee	9.97	-1.25	2.97	2SCH40S	
C01	Run	2.00	0	0		
C02	Bend	2.00	0	0		Short Elbow, Radius = 10.00 inch Bend angle change = 90.00 deg Mid point at 50.00 percent SIF - In = 1.00, Out = 1.00
C03	Run	0	-1.25	0		

Total weight of empty pipes : 428 lb

COMPONENT DATA LISTING

POINT NAME	COORDINATE(ft) X	Y	Z	DATA TYPE	DESCRIPTION
*** SEGMENT A					
A00	0.00	0.00	0.00	GUIDE	ID : A00 1, Connected to Ground Stiffness = RIGID
A01	3.50	0.00	0.00		
A02	7.00	0.00	0.00	TEE	Unreinforced tee SIF - In = 7.33, Out = 9.45
A03	10.00	0.00	0.00		
A04	13.00	0.00	0.00		
A05	13.10	0.00	0.00		
A06	14.83	0.00	1.00	Y-STOP	ID : A06 1, Connected to Ground
A07	17.43	0.00	2.50	Y-STOP	ID : A07 1, Connected to Ground
A08	17.52	0.00	2.55		
A09	17.52	-3.25	2.55	ANCHOR	Translational stiffness lb/in X= 8200000 Y= 3200 Z= 13000000 Rotational stiffness ft-lb/deg X= 212 Y= FREE Z= 112 Thermal movements : None
*** SEGMENT B					
A02	7.00	0.00	0.00	TEE	Unreinforced tee SIF - In = 7.33, Out = 9.45
B01	8.49	0.00	1.49		
B02 N	9.38	0.00	2.38		
B02	9.97	0.00	2.97	TI	
B02 M	9.79	-0.24	2.79		
B02 F	9.97	-0.83	2.97		
B03	9.97	-1.25	2.97	TEE	Unreinforced tee SIF - In = 2.77, Out = 3.36
B04	9.97	-2.50	2.97	ANCHOR	Translational stiffness lb/in X= 3700 Y= 13000 Z= 2700 Rotational stiffness ft-lb/deg X= 263 Y= 4 Z= 349 Thermal movements : None
*** SEGMENT C					
B03	9.97	-1.25	2.97	TEE	Unreinforced tee SIF - In = 2.77, Out = 3.36
C01	11.97	-1.25	2.97		
C02 N	13.13	-1.25	2.97		
C02	13.97	-1.25	2.97	TI	
C02 M	13.72	-1.49	2.97		
C02 F	13.97	-2.08	2.97		
C03	13.97	-2.50	2.97	ANCHOR	Translational stiffness lb/in X= 3700 Y= 13000 Z= 2700 Rotational stiffness ft-lb/deg X= 263 Y= 4 Z= 349 Thermal movements : None

COMPONENT DATA LISTING

POINT NAME	---COORDINATE(ft)--- X	Y	Z	DATA TYPE	DESCRIPTION

Number of points in the system : 25

P I P E D A T A L I S T I N G

Pipe ID/ Material	Nom/ Sch	O.D. inch	-----Thickness(inch)----- W.Th.	Corr	Mill	Insu	Ling	Spec Grav	Weight(lb/ft) Pipe	Other	Total
14SCH10 AU	14 10	14.000	0.250	0	0.03	0	0	0	37.57	0	37.57
2SCH40S AU	2.000 40S	2.375	0.154	0	0.02	0	0	0	3.74	0	3.74
8SCHNS AU	NS	8.625	0.125	0	0.02	0	0	0	11.61	0	11.61
10SCHNS AU	NS	10.750	0.125	0	0.02	0	0	0	14.52	0	14.52

M A T E R I A L D A T A L I S T I N G

Material Name	Pipe ID	Density lb/cu.ft	Pois. Ratio	Temper. deg F	Modulus E6 psi	Expans. in/100ft	Allow. psi
AU	8SCHNS	501.0	0.30	70.0	28.30		16700.0
AU	14SCH10	501.0	0.30	70.0	28.30		16700.0
AU	10SCHNS	501.0	0.30	70.0	28.30		16700.0
AU	2SCH40S	501.0	0.30	70.0	28.30		16700.0

TEMPERATURE AND PRESSURE DATA

POINT NAME	CASE 1 PRESS. psi	CASE 1 TEMPER deg F	CASE 1 EXPAN. in/100ft	CASE 2 PRESS. psi	CASE 2 TEMPER deg F	CASE 2 EXPAN. in/100ft	CASE 3 PRESS. psi	CASE 3 TEMPER deg F	CASE 3 EXPAN. in/100ft
*** SEGMENT A									
A00	0	70.00	0.000						
A09	0	70.00	0.000						
*** SEGMENT B									
A02	0	70.00	0.000						
B04	0	70.00	0.000						
*** SEGMENT C									
B03	0	70.00	0.000						
C03	0	70.00	0.000						

A N A L Y S I S S U M M A R Y

Current model revision number : 13

Static -	Date and Time of analysis	Feb 7, 1995 1:50 PM
	Model Revision Number	13
	Number of load cases	4
	Load cases analyzed	GR E1 E2 E3
	Gaps/Friction/Yielding considered	No
	Hanger design run	No
	Cut short included	No
	Weight of contents included	Yes
	Pressure stiffening case	0
	Water elevation for buoyancy loads	Not considered

CODE COMPLIANCE COMBINATIONS

Combination	Category	Method	Load	Factor	Allowable	Remarks
GR	Sustain	Sum	Gravity	1.00	16700 psi	Default
			Max Long	1.00		
Sus. + E1	Occasion	Abs sum	Earth 1	1.00	22267 psi	Default
			Max Sus	1.00		
Sus. + E2	Occasion	Abs sum	Earth 2	1.00	22267 psi	Default
			Max Sus	1.00		
Sus. + E3	Occasion	Abs sum	Earth 3	1.00	22267 psi	Default
			Max Sus	1.00		

OTHER USER COMBINATIONS

Combination	Method	Load	Factor	Remarks
GR	Sum	Gravity	1.00	Default
E1	Sum	Earth 1	1.00	Default
E2	Sum	Earth 2	1.00	Default
E3	Sum	Earth 3	1.00	Default
SEIS	SRSS	Earth 1	1.00	User
		Earth 2	1.00	
		Earth 3	1.00	
TOTAL	Abs sum	Gravity	1.00	User
		SEIS	1.00	

CODE COMPLIANCE

Y - Factor 0.40
Weld efficiency factor 1.00
Range reduction factor 1.00
Design Pressure Factor 1.00
Minimum stress ratio used in reports... 0.00
Include corrosion in stress calcs. .... Y
Include torsion in code stress ..... N
Include axial force in code stress .... N
Longitudinal pressure calculation PD/4t
Include rigorous pressure ..... Not analyzed

*** NOTE ***

No operating loads analyzed. Maximum specified pressure will be used for sustained stress

EARTHQUAKE LOAD CASES :

Number of load cases analysed : 3

Load case 1 - E1

X-Multiplier= 1.350 Y-Multiplier= 0.000 Z-Multiplier= 0.000

Load case 2 - E2

X-Multiplier= 0.000 Y-Multiplier= 0.900 Z-Multiplier= 0.000

Load case 3 - E3

X-Multiplier= 0.000 Y-Multiplier= 0.000 Z-Multiplier= 1.350

D I S P L A C E M E N T S

Point name	Load combination	TRANSLATIONS (in) X	Y	Z	ROTATIONS (deg) X	Y	Z
*** Segment A begin ***							
A00	GR	-0.004	0.000	0.000	0.012	-0.002	-0.010
	E1	0.042	0.000	0.000	-0.072	0.031	0.018
	E2	0.003	0.000	0.000	-0.011	0.002	0.009
	E3	-0.048	0.000	0.000	0.097	-0.061	-0.025
	SEIS	0.064	0.000	0.000	0.121	0.069	0.032
	TOTAL	0.068	0.000	0.000	0.133	0.070	0.042
A01	GR	-0.004	-0.006	0.001	0.012	-0.002	-0.006
	E1	0.042	0.012	-0.022	-0.072	0.029	0.014
	E2	0.003	0.006	-0.001	-0.011	0.002	0.006
	E3	-0.048	-0.017	0.043	0.097	-0.053	-0.019
	SEIS	0.064	0.022	0.048	0.121	0.060	0.024
	TOTAL	0.068	0.028	0.050	0.133	0.062	0.031
A02	GR	-0.004	-0.008	0.003	0.012	-0.002	0.001
	E1	0.042	0.019	-0.041	-0.072	0.021	0.002
	E2	0.003	0.007	-0.003	-0.011	0.002	-0.001
	E3	-0.048	-0.026	0.075	0.097	-0.032	-0.003
	SEIS	0.064	0.033	0.085	0.121	0.039	0.003
	TOTAL	0.068	0.041	0.088	0.133	0.041	0.005
A03	GR	-0.004	-0.006	0.004	0.012	-0.003	0.007
	E1	0.042	0.016	-0.052	-0.075	0.013	-0.014
	E2	0.003	0.005	-0.004	-0.011	0.002	-0.006
	E3	-0.048	-0.022	0.089	0.102	-0.012	0.019
	SEIS	0.064	0.027	0.103	0.127	0.017	0.025
	TOTAL	0.068	0.033	0.107	0.139	0.020	0.031
A04	GR	-0.004	0.000	0.006	0.013	-0.003	0.008
	E1	0.042	-0.001	-0.056	-0.079	-0.002	-0.040
	E2	0.003	0.000	-0.006	-0.012	0.003	-0.008
	E3	-0.048	0.001	0.090	0.107	0.009	0.055
	SEIS	0.064	0.001	0.106	0.133	0.009	0.069
	TOTAL	0.068	0.001	0.112	0.146	0.012	0.077
A05	GR	-0.004	0.000	0.006	0.013	-0.003	0.008
	E1	0.042	-0.001	-0.056	-0.079	-0.002	-0.040
	E2	0.003	0.000	-0.006	-0.012	0.003	-0.008
	E3	-0.048	0.002	0.090	0.107	0.009	0.055
	SEIS	0.064	0.002	0.106	0.133	0.010	0.069
	TOTAL	0.068	0.002	0.112	0.146	0.013	0.077

D I S P L A C E M E N T S

Point name	Load combination	TRANSLATIONS (in) X	Y	Z	ROTATIONS (deg) X	Y	Z
A06	GR	-0.004	0.000	0.007	0.013	-0.003	0.008
	E1	0.041	0.000	-0.055	-0.079	-0.003	-0.043
	E2	0.004	0.000	-0.007	-0.012	0.003	-0.007
	E3	-0.046	0.000	0.086	0.107	0.011	0.060
	SEIS	0.062	0.000	0.102	0.134	0.011	0.074
	TOTAL	0.066	0.000	0.110	0.147	0.014	0.082
A07	GR	-0.005	0.000	0.009	0.013	-0.003	0.008
	E1	0.040	0.000	-0.053	-0.079	-0.004	-0.049
	E2	0.005	0.000	-0.008	-0.012	0.003	-0.007
	E3	-0.042	0.000	0.080	0.110	0.012	0.063
	SEIS	0.059	0.000	0.096	0.136	0.013	0.080
	TOTAL	0.064	0.000	0.105	0.149	0.016	0.087
A08	GR	-0.005	0.000	0.009	0.013	-0.003	0.008
	E1	0.040	0.000	-0.053	-0.079	-0.004	-0.049
	E2	0.005	0.000	-0.008	-0.012	0.003	-0.007
	E3	-0.042	0.000	0.079	0.110	0.012	0.063
	SEIS	0.059	0.000	0.096	0.136	0.013	0.080
	TOTAL	0.064	0.000	0.105	0.150	0.016	0.088
A09	GR	0.000	0.000	0.000	0.013	-0.003	0.008
	E1	0.000	0.000	0.000	-0.077	-0.004	-0.062
	E2	0.000	0.000	0.000	-0.012	0.003	-0.007
	E3	0.000	0.000	0.000	0.119	0.012	0.062
	SEIS	0.000	0.000	0.000	0.142	0.013	0.088
	TOTAL	0.000	0.000	0.000	0.155	0.016	0.096
*** Segment A end ***							
*** Segment B begin ***							
A02	GR	-0.004	-0.008	0.003	0.012	-0.002	0.001
	E1	0.042	0.019	-0.041	-0.072	0.021	0.002
	E2	0.003	0.007	-0.003	-0.011	0.002	-0.001
	E3	-0.048	-0.026	0.075	0.097	-0.032	-0.003
	SEIS	0.064	0.033	0.085	0.121	0.039	0.003
	TOTAL	0.068	0.041	0.088	0.133	0.041	0.005
B01	GR	-0.004	-0.007	0.003	-0.002	0.002	0.012
	E1	0.040	0.020	-0.039	-0.018	-0.030	-0.060
	E2	0.003	0.007	-0.002	0.002	-0.002	-0.010
	E3	-0.045	-0.027	0.072	0.027	0.041	0.088
	SEIS	0.060	0.034	0.082	0.032	0.051	0.107
	TOTAL	0.064	0.042	0.085	0.034	0.053	0.118

DISPLACEMENTS

Point name	Load combination	TRANSLATIONS (in) X	Y	Z	ROTATIONS (deg) X	Y	Z
B02 N	GR	-0.003	-0.004	0.002	-0.004	0.003	0.012
	E1	0.033	0.011	-0.032	-0.014	-0.042	-0.068
	E2	0.003	0.004	-0.002	0.004	-0.003	-0.011
	E3	-0.036	-0.013	0.063	0.028	0.056	0.098
	SEIS	0.049	0.018	0.070	0.032	0.070	0.119
	TOTAL	0.052	0.022	0.072	0.037	0.073	0.132
B02 M	GR	-0.002	-0.003	0.002	-0.003	0.004	0.010
	E1	0.026	0.007	-0.027	-0.022	-0.041	-0.061
	E2	0.002	0.003	-0.002	0.003	-0.003	-0.009
	E3	-0.026	-0.008	0.056	0.045	0.053	0.086
	SEIS	0.037	0.011	0.062	0.050	0.067	0.106
	TOTAL	0.039	0.014	0.064	0.053	0.071	0.115
B02 F	GR	-0.001	-0.003	0.002	0.000	0.003	0.006
	E1	0.018	0.005	-0.022	-0.032	-0.035	-0.046
	E2	0.001	0.002	-0.002	0.000	-0.003	-0.005
	E3	-0.015	-0.007	0.047	0.065	0.044	0.061
	SEIS	0.023	0.009	0.052	0.073	0.057	0.076
	TOTAL	0.024	0.012	0.054	0.073	0.060	0.082
B03	GR	-0.001	-0.003	0.002	0.001	0.003	0.004
	E1	0.014	0.005	-0.019	-0.035	-0.031	-0.036
	E2	0.001	0.002	-0.002	-0.001	-0.003	-0.003
	E3	-0.011	-0.007	0.041	0.073	0.038	0.046
	SEIS	0.018	0.009	0.045	0.081	0.049	0.058
	TOTAL	0.018	0.012	0.047	0.081	0.052	0.062
B04	GR	0.000	-0.003	0.002	0.002	0.003	0.003
	E1	0.005	0.005	-0.009	-0.038	-0.031	-0.034
	E2	0.000	0.002	-0.001	-0.002	-0.003	-0.003
	E3	0.000	-0.007	0.020	0.079	0.038	0.038
	SEIS	0.005	0.009	0.022	0.088	0.049	0.051
	TOTAL	0.005	0.012	0.024	0.090	0.052	0.054

*** Segment B end ***

*** Segment C begin ***

B03	GR	-0.001	-0.003	0.002	0.001	0.003	0.004
	E1	0.014	0.005	-0.019	-0.035	-0.031	-0.036
	E2	0.001	0.002	-0.002	-0.001	-0.003	-0.003
	E3	-0.011	-0.007	0.041	0.073	0.038	0.046
	SEIS	0.018	0.009	0.045	0.081	0.049	0.058
	TOTAL	0.018	0.012	0.047	0.081	0.052	0.062

D I S P L A C E M E N T S

Point name	Load combination	TRANSLATIONS (in) X	Y	Z	ROTATIONS (deg) X	Y	Z
C01	GR	-0.001	-0.002	0.001	0.000	0.002	0.002
	E1	0.014	-0.001	-0.009	-0.025	-0.019	-0.001
	E2	0.001	0.002	-0.001	0.000	-0.002	-0.002
	E3	-0.011	0.001	0.028	0.064	0.027	0.003
	SEIS	0.018	0.002	0.030	0.069	0.033	0.004
	TOTAL	0.018	0.004	0.031	0.069	0.035	0.006
C02 N	GR	-0.001	-0.001	0.000	0.000	0.002	0.003
	E1	0.014	-0.001	-0.005	-0.019	-0.016	-0.002
	E2	0.001	0.001	0.000	0.000	-0.002	-0.003
	E3	-0.011	0.001	0.022	0.059	0.026	0.000
	SEIS	0.018	0.002	0.022	0.062	0.031	0.003
	TOTAL	0.018	0.003	0.023	0.062	0.033	0.006
C02 M	GR	0.000	-0.001	0.000	0.000	0.002	0.003
	E1	0.014	-0.001	-0.002	-0.016	-0.015	-0.010
	E2	0.000	0.001	0.000	0.000	-0.002	-0.003
	E3	-0.010	0.002	0.016	0.056	0.027	0.007
	SEIS	0.017	0.002	0.016	0.059	0.031	0.012
	TOTAL	0.018	0.003	0.016	0.059	0.033	0.016
C02 F	GR	0.000	-0.001	0.000	0.000	0.002	0.003
	E1	0.012	-0.002	0.000	-0.013	-0.015	-0.017
	E2	0.000	0.001	0.000	0.000	-0.002	-0.003
	E3	-0.009	0.002	0.007	0.053	0.027	0.012
	SEIS	0.015	0.003	0.007	0.055	0.031	0.021
	TOTAL	0.015	0.004	0.008	0.055	0.033	0.024
C03	GR	0.000	-0.001	0.000	0.000	0.002	0.003
	E1	0.010	-0.002	0.002	-0.013	-0.015	-0.017
	E2	0.000	0.001	0.000	0.000	-0.002	-0.002
	E3	-0.008	0.002	0.003	0.051	0.027	0.013
	SEIS	0.013	0.003	0.003	0.052	0.031	0.022
	TOTAL	0.013	0.004	0.003	0.052	0.033	0.024

*** Segment C end ***

SUPPORT FORCES

Point/ Supp. ID	Connect/ Type	Load Combination	LOCAL Dirn	LOCAL Force	LOCAL Deform	GLOBAL Dirn	GLOBAL Force	GLOBAL Deform
A00		GR	down	73	0.000	X		-0.004
A00 1	Guide		left	2	0.000	Y	-73	0.000
Stiff	:RIGID					Z	-2	0.000
		E1	up	69	0.000	X		0.042
			left	41	0.000	Y	69	0.000
						Z	-41	0.000
		E2	up	66	0.000	X		0.003
			rght	2	0.000	Y	66	0.000
						Z	2	0.000
		E3	down	94	0.000	X		-0.048
			rght	160	0.000	Y	-94	0.000
						Z	160	0.000
		SEIS	down	134	0.000	X		0.064
			left	165	0.000	Y	134	0.000
						Z	165	0.000
		TOTAL	down	207	0.000	X		0.068
			left	167	0.000	Y	207	0.000
						Z	167	0.000
A06		GR	down	305	0.000	X		-0.004
A06 1	Y - Stop					Y	-305	0.000
Stiff	:RIGID					Z		0.007
		E1	up	18	0.000	X		0.041
						Y	18	0.000
						Z		-0.055
		E2	up	274	0.000	X		0.004
						Y	274	0.000
						Z		-0.007
		E3	up	881	0.000	X		-0.046
						Y	881	0.000
						Z		0.086
		SEIS	down	923	0.000	X		0.062
						Y	923	0.000
						Z		0.102
		TOTAL	down	1228	0.000	X		0.066
						Y	1228	0.000
						Z		0.110

SUPPORT FORCES

Point/ Supp. ID	Connect/ Type	Load Combination	LOCAL Dirn	LOCAL Force	LOCAL Deform	GLOBAL Dirn	GLOBAL Force	GLOBAL Deform
A07		GR	down	12	0.000	X		-0.005
A07 1	Y - Stop					Y	-12	0.000
Stiff	:RIGID					Z		0.009
		E1	down	130	0.000	X		0.040
						Y	-130	0.000
						Z		-0.053
		E2	up	11	0.000	X		0.005
						Y	11	0.000
						Z		-0.008
		E3	down	720	0.000	X		-0.042
						Y	-720	0.000
						Z		0.080
		SEIS	down	732	0.000	X		0.059
						Y	732	0.000
						Z		0.096
		TOTAL	down	744	0.000	X		0.064
						Y	744	0.000
						Z		0.105

RESTRAINT REACTIONS

Point name	Load combination	FORCES (lb) X	Y	Z	Result	MOMENTS (ft-lb) X	Y	Z	Result
A00	Guide								
	GR	0	-73	-2	73	0	0	0	0
	E1	0	69	-41	80	0	0	0	0
	E2	0	66	2	66	0	0	0	0
	E3	0	-94	160	186	0	0	0	0
	SEIS	0	134	165	213	0	0	0	0
	TOTAL	0	207	167	266	0	0	0	0
A06	Y - Stop								
	GR	0	-305	0	305	0	0	0	0
	E1	0	18	0	18	0	0	0	0
	E2	0	274	0	274	0	0	0	0
	E3	0	881	0	881	0	0	0	0
	SEIS	0	923	0	923	0	0	0	0
	TOTAL	0	1228	0	1228	0	0	0	0
A07	Y - Stop								
	GR	0	-12	0	12	0	0	0	0
	E1	0	-130	0	130	0	0	0	0
	E2	0	11	0	11	0	0	0	0
	E3	0	-720	0	720	0	0	0	0
	SEIS	0	732	0	732	0	0	0	0
	TOTAL	0	744	0	744	0	0	0	0
A09	Anchor								
	GR	-2	0	-2	3	3	0	1	3
	E1	529	0	62	532	-16	0	-7	18
	E2	1	0	2	3	-3	0	-1	3
	E3	29	0	362	363	25	0	7	26
	SEIS	530	0	367	644	30	0	10	32
	TOTAL	531	0	370	647	33	0	11	35
B04	Anchor								
	GR	1	-34	4	35	0	0	1	1
	E1	17	70	-25	76	-10	0	-12	16
	E2	-1	31	-4	31	0	0	-1	1
	E3	1	-95	55	109	21	0	13	25
	SEIS	17	122	60	137	23	0	18	29
	TOTAL	18	156	65	170	24	0	19	30
C03	Anchor								
	GR	1	-9	0	9	0	0	1	1
	E1	38	-26	4	47	-3	0	-6	7
	E2	-1	8	0	8	0	0	-1	1
	E3	-30	27	8	41	13	0	4	14
	SEIS	49	38	9	63	14	0	8	16
	TOTAL	49	47	9	69	14	0	9	16

G L O B A L F O R C E S & M O M E N T S

Point name	Load combination	FORCES (lb) X	Y	Z	Result	MOMENTS (ft-lb) X	Y	Z	Result
*** Segment A begin ***									
A00	GR	0	73	2	73	0	0	0	0
	E1	0	-69	41	80	0	0	0	0
	E2	0	-66	-2	66	0	0	0	0
	E3	0	94	-160	186	0	0	0	0
	SEIS	0	134	165	213	0	0	0	0
	TOTAL	0	207	167	266	0	0	0	0
A01	GR	0	33	2	33	0	7	-185	185
	E1	55	-69	41	97	0	143	241	280
	E2	0	-29	-2	29	0	-6	167	167
	E3	0	94	-105	141	0	-464	-328	569
	SEIS	55	120	113	174	0	486	440	655
	TOTAL	55	152	115	199	0	493	625	796
A02 -	GR	0	-8	2	8	0	13	-228	228
	E1	110	-69	41	136	0	285	482	560
	E2	0	7	-2	7	0	-12	205	205
	E3	0	94	-50	106	0	-737	-656	987
	SEIS	110	116	65	173	0	790	839	1153
	TOTAL	110	125	67	179	0	804	1067	1336
A02 +	GR	-2	-7	-2	7	-17	20	-213	215
	E1	110	-113	62	170	92	212	383	447
	E2	1	6	2	7	15	-18	192	193
	E3	29	161	-56	173	-129	-630	-510	821
	SEIS	114	197	83	242	160	665	666	954
	TOTAL	116	204	86	250	177	685	879	1129
A03	GR	-2	-42	-2	42	-17	14	-141	142
	E1	158	-113	62	203	92	397	722	829
	E2	1	37	2	38	15	-12	127	128
	E3	29	161	-9	164	-129	-728	-994	1238
	SEIS	160	200	62	264	160	829	1235	1496
	TOTAL	162	242	65	298	177	843	1376	1623
A04	GR	-2	-76	-2	77	-17	7	36	41
	E1	205	-113	62	242	92	581	1062	1214
	E2	1	69	2	69	15	-6	-33	37
	E3	29	161	38	168	-129	-685	-1477	1633
	SEIS	207	209	72	302	160	898	1819	2035
	TOTAL	208	285	75	361	177	905	1856	2072

GLOBAL FORCES & MOMENTS

Point name	Load combination	FORCES (lb) X	Y	Z	Result	MOMENTS (ft-lb) X	Y	Z	Result
A05	GR	-2	-79	-2	79	-17	6	44	48
	E1	208	-113	62	245	92	587	1073	1227
	E2	1	71	2	71	15	-6	-40	43
	E3	29	161	41	169	-129	-681	-1493	1646
	SEIS	210	209	74	306	160	899	1839	2054
	TOTAL	211	288	76	366	177	906	1883	2097
A06 -	GR	-2	-154	-2	154	-134	4	246	280
	E1	309	-113	62	335	-21	436	1269	1341
	E2	1	139	2	139	120	-3	-221	252
	E3	29	161	143	217	32	-551	-1772	1856
	SEIS	311	241	155	423	126	702	2191	2304
	TOTAL	312	395	158	527	260	706	2436	2550
A06 +	GR	-2	151	-2	151	-134	4	246	280
	E1	309	-131	62	341	-21	436	1269	1341
	E2	1	-136	2	136	120	-3	-221	252
	E3	29	-720	143	735	32	-551	-1772	1856
	SEIS	311	744	155	821	126	702	2191	2304
	TOTAL	312	895	158	961	260	706	2436	2550
A07 -	GR	-2	38	-2	38	8	0	0	8
	E1	461	-131	62	484	-217	18	1608	1623
	E2	1	-34	2	34	-7	0	0	7
	E3	29	-720	295	779	-1048	-25	100	1053
	SEIS	462	733	301	917	1070	31	1611	1935
	TOTAL	464	771	303	949	1078	31	1611	1939
A07 +	GR	-2	50	-2	50	8	0	0	8
	E1	461	0	62	466	-217	18	1608	1623
	E2	1	-45	2	45	-7	0	0	7
	E3	29	0	295	296	-1048	-25	100	1053
	SEIS	462	45	301	554	1070	31	1611	1935
	TOTAL	464	95	303	562	1078	31	1611	1939
A08	GR	-2	47	-2	47	10	0	-4	11
	E1	465	0	62	469	-217	0	1608	1623
	E2	1	-42	2	43	-9	0	4	10
	E3	29	0	298	300	-1048	0	100	1053
	SEIS	466	42	305	558	1070	0	1611	1934
	TOTAL	468	90	307	566	1081	0	1615	1944
A09	GR	-2	0	-2	3	3	0	1	3
	E1	529	0	62	532	-16	0	-7	18
	E2	1	0	2	3	-3	0	-1	3
	E3	29	0	362	363	25	0	7	26
	SEIS	530	0	367	644	30	0	10	32
	TOTAL	531	0	370	647	33	0	11	35

G L O B A L F O R C E S & M O M E N T S

Point name	Load combination	FORCES (lb) X	Y	Z	Result	MOMENTS (ft-lb) X	Y	Z	Result
*** Segment B begin ***									
A02	GR	2	-1	4	5	17	-7	-15	24
	E1	-1	44	-21	49	-92	74	99	154
	E2	-1	1	-4	4	-15	6	13	21
	E3	-29	-67	6	74	129	-107	-146	222
	SEIS	29	81	22	88	160	130	177	271
	TOTAL	30	82	26	91	177	137	191	294
B01	GR	2	-9	4	10	9	-3	-7	12
	E1	10	44	-21	50	-27	36	33	56
	E2	-1	8	-4	9	-8	3	6	11
	E3	-29	-67	16	75	29	-48	-46	72
	SEIS	30	81	27	91	40	60	57	92
	TOTAL	32	90	31	101	50	63	63	102
B02 N	GR	2	-14	4	15	-1	-1	4	4
	E1	16	44	-21	52	13	6	-6	15
	E2	-1	13	-4	13	1	1	-3	3
	E3	-29	-67	23	77	-31	-5	14	35
	SEIS	33	82	31	93	34	8	16	38
	TOTAL	35	96	35	108	35	8	20	41
B02 M	GR	2	-16	4	17	-6	0	9	11
	E1	20	44	-21	53	26	-10	-29	41
	E2	-1	15	-4	15	6	0	-9	10
	E3	-29	-67	26	78	-53	17	50	75
	SEIS	35	82	34	95	59	20	58	86
	TOTAL	36	98	38	111	66	20	68	96
B02 F	GR	2	-19	4	19	-7	1	12	13
	E1	23	44	-21	54	21	-18	-49	57
	E2	-1	17	-4	17	6	-1	-10	12
	E3	-29	-67	29	79	-48	27	78	96
	SEIS	37	82	36	97	53	32	93	112
	TOTAL	38	101	40	116	60	33	105	125
B03 -	GR	2	-20	4	21	-5	1	11	12
	E1	25	44	-21	55	13	-18	-59	63
	E2	-1	18	-4	19	4	-1	-10	11
	E3	-29	-67	31	80	-36	27	90	100
	SEIS	38	83	38	99	38	32	108	119
	TOTAL	40	103	42	118	43	33	119	131

GLOBAL FORCES & MOMENTS

Point name	Load combination	FORCES (lb) X	Y	Z	Result	MOMENTS (ft-lb) X	Y	Z	Result
B03 +	GR	1	-30	4	30	-5	0	2	5
	E1	11	70	-25	75	22	0	6	22
	E2	-1	27	-4	27	5	0	-2	5
	E3	1	-95	48	106	-43	0	15	46
	SEIS	11	121	55	133	49	0	16	51
	TOTAL	12	150	59	162	54	0	18	57
B04	GR	1	-34	4	35	0	0	1	1
	E1	17	70	-25	76	-10	0	-12	16
	E2	-1	31	-4	31	0	0	-1	1
	E3	1	-95	55	109	21	0	13	25
	SEIS	17	122	60	137	23	0	18	29
	TOTAL	18	156	65	170	24	0	19	30
*** Segment B end ***									
*** Segment C begin ***									
303	GR	1	9	0	9	0	1	9	9
	E1	14	-26	4	30	-9	-18	-65	68
	E2	-1	-8	0	8	0	-1	-8	8
	E3	-30	27	-17	43	8	26	75	80
	SEIS	33	38	17	53	12	32	100	106
	TOTAL	33	48	18	61	12	33	109	114
C01	GR	1	2	0	2	0	0	-2	2
	E1	24	-26	4	35	-9	-9	-14	18
	E2	-1	-2	0	2	0	0	2	2
	E3	-30	27	-7	41	8	3	21	23
	SEIS	38	37	8	54	12	9	25	29
	TOTAL	39	39	8	56	12	10	28	32
C02 N	GR	1	-3	0	3	0	0	-2	2
	E1	30	-26	4	40	-9	-4	16	19
	E2	-1	2	0	2	0	0	2	2
	E3	-30	27	-1	40	8	-1	-10	13
	SEIS	42	37	4	56	12	4	19	23
	TOTAL	43	40	5	59	12	4	21	25
C02 M	GR	1	-5	0	5	0	0	0	0
	E1	33	-26	4	42	-8	-1	24	25
	E2	-1	5	0	5	0	0	0	0
	E3	-30	27	3	40	8	-1	-19	20
	SEIS	44	38	5	58	11	1	30	32
	TOTAL	45	43	5	62	11	1	31	33

G L O B A L F O R C E S & M O M E N T S

Point name	Load combination	FORCES (lb) X	Y	Z	Result	MOMENTS (ft-lb) X	Y	Z	Result
C02 F	GR	1	-7	0	8	0	0	1	1
	E1	36	-26	4	45	-5	0	10	11
	E2	-1	7	0	7	0	0	-1	1
	E3	-30	27	6	41	10	0	-8	13
	SEIS	47	38	7	61	12	0	12	17
	TOTAL	48	45	8	66	12	0	14	18
C03	GR	1	-9	0	9	0	0	1	1
	E1	38	-26	4	47	-3	0	-6	7
	E2	-1	8	0	8	0	0	-1	1
	E3	-30	27	8	41	13	0	4	14
	SEIS	49	38	9	63	14	0	8	16
	TOTAL	49	47	9	69	14	0	9	16

*** Segment C end ***

ASME B31.3c (1992) CODE COMPLIANCE

Point name	Load combination	(Moments in ft-lb) In-Pl. Moment	Out-Pl. Moment	Torsion Moment	S.I.F In	S.I.F Out	Eq. no.	Load type	(Stress in psi) Code Stress	Code Allow.
*** Segment A begin ***										
A00	GR	0	0		1.00	1.00	(18)	SUST	0	16700
	Sus. + E1	0	0		1.00	1.00	(18)	OCC	0	22267
	Sus. + E2	0	0		1.00	1.00	(18)	OCC	0	22267
	Sus. + E3	0	0		1.00	1.00	(18)	OCC	0	22267
A01	- GR	185	7		1.00	1.00	(18)	SUST	318	16700
	Sus. + E1	426	149		1.00	1.00	(18)	OCC	798	22267
	Sus. + E2	352	13		1.00	1.00	(18)	OCC	604	22267
	Sus. + E3	513	471		1.00	1.00	(18)	OCC	1294	22267
A01	+ GR	185	7		1.00	1.00	(18)	SUST	318	16700
	Sus. + E1	426	149		1.00	1.00	(18)	OCC	798	22267
	Sus. + E2	352	13		1.00	1.00	(18)	OCC	604	22267
	Sus. + E3	513	471		1.00	1.00	(18)	OCC	1294	22267
\02	- GR	13	228		7.33	9.45	(18)	SUST	3696	16700
	Sus. + E1	299	710		7.33	9.45	(18)	OCC	12293	22267
	Sus. + E2	26	433		7.33	9.45	(18)	OCC	7023	22267
	Sus. + E3	750	884		7.33	9.45	(18)	OCC	17807	22267
A02	+ GR	20	213		7.33	9.45	(18)	SUST	3467	16700
	Sus. + E1	232	596		7.33	9.45	(18)	OCC	10224	22267
	Sus. + E2	39	405		7.33	9.45	(18)	OCC	6587	22267
	Sus. + E3	650	723		7.33	9.45	(18)	OCC	14922	22267
A03	GR	141	14		1.00	1.00	(18)	SUST	243	16700
	Sus. + E1	863	410		1.00	1.00	(18)	OCC	1657	22267
	Sus. + E2	267	26		1.00	1.00	(18)	OCC	461	22267
	Sus. + E3	1134	741		1.00	1.00	(18)	OCC	2357	22267
A04	GR	36	7		1.00	1.00	(18)	SUST	63	16700
	Sus. + E1	1098	588		1.00	1.00	(18)	OCC	2141	22267
	Sus. + E2	69	12		1.00	1.00	(18)	OCC	121	22267
	Sus. + E3	1514	692		1.00	1.00	(18)	OCC	2858	22267
A05	GR	47	6		1.00	1.00	(18)	SUST	16	16700
	Sus. + E1	929	594		1.00	1.00	(18)	OCC	364	22267
	Sus. + E2	89	12		1.00	1.00	(18)	OCC	30	22267
	Sus. + E3	1275	687		1.00	1.00	(18)	OCC	478	22267
A06	- GR	280	4		1.00	1.00	(18)	SUST	92	16700
	Sus. + E1	1388	439		1.00	1.00	(18)	OCC	484	22267
	Sus. + E2	531	7		1.00	1.00	(18)	OCC	175	22267
	Sus. + E3	1830	555		1.00	1.00	(18)	OCC	633	22267

ASME B31.3c (1992) CODE COMPLIANCE

Point name	Load combination	(Moments in ft-lb) In-Pl. Moment	Out-Pl. Moment	Torsion Moment	S.I.F In	S.I.F Out	Eq. no.	(Stress in psi) Load type	Code Stress	Code Allow.
A06 +	GR	280	4		1.00	1.00	(18)	SUST	92	16700
	Sus. + E1	1389	439		1.00	1.00	(18)	OCC	484	22267
	Sus. + E2	531	7		1.00	1.00	(18)	OCC	175	22267
	Sus. + E3	1831	555		1.00	1.00	(18)	OCC	634	22267
A07	GR	4	0		1.00	1.00	(18)	SUST	1	16700
	Sus. + E1	1515	18		1.00	1.00	(18)	OCC	498	22267
	Sus. + E2	7	0		1.00	1.00	(18)	OCC	2	22267
	Sus. + E3	600	25		1.00	1.00	(18)	OCC	198	22267
A08	GR	10	4		1.00	1.00	(18)	SUST	12	16700
	Sus. + E1	227	1612		1.00	1.00	(18)	OCC	1790	22267
	Sus. + E2	20	8		1.00	1.00	(18)	OCC	23	22267
	Sus. + E3	1059	104		1.00	1.00	(18)	OCC	1166	22267
A09	GR	3	1		1.00	1.00	(18)	SUST	3	16700
	Sus. + E1	19	8		1.00	1.00	(18)	OCC	23	22267
	Sus. + E2	5	2		1.00	1.00	(18)	OCC	6	22267
	Sus. + E3	28	8		1.00	1.00	(18)	OCC	32	22267
*** Segment A end ***										
*** Segment B begin ***										
A02	GR	7	22		7.33	9.45	(18)	SUST	5406	16700
	Sus. + E1	81	158		7.33	9.45	(18)	OCC	39762	22267**
	Sus. + E2	13	43		7.33	9.45	(18)	OCC	10272	22267
	Sus. + E3	114	217		7.33	9.45	(18)	OCC	54924	22267**
B01 -	GR	11	3		1.00	1.00	(18)	SUST	252	16700
	Sus. + E1	54	39		1.00	1.00	(18)	OCC	1438	22267
	Sus. + E2	22	6		1.00	1.00	(18)	OCC	480	22267
	Sus. + E3	64	51		1.00	1.00	(18)	OCC	1781	22267
B01 +	GR	11	3		1.00	1.00	(18)	SUST	252	16700
	Sus. + E1	54	39		1.00	1.00	(18)	OCC	1438	22267
	Sus. + E2	22	6		1.00	1.00	(18)	OCC	480	22267
	Sus. + E3	64	51		1.00	1.00	(18)	OCC	1781	22267
B02 N-	GR	3	1		1.00	1.00	(18)	SUST	69	16700
	Sus. + E1	17	6		1.00	1.00	(18)	OCC	382	22267
	Sus. + E2	6	1		1.00	1.00	(18)	OCC	132	22267
	Sus. + E3	35	6		1.00	1.00	(18)	OCC	768	22267
B02 N+	GR	3	1		1.00	1.00	(18)	SUST	69	16700
	Sus. + E1	17	6		1.00	1.00	(18)	OCC	382	22267
	Sus. + E2	6	1		1.00	1.00	(18)	OCC	132	22267
	Sus. + E3	35	6		1.00	1.00	(18)	OCC	768	22267

ASME B31.3c (1992) CODE COMPLIANCE

Point name	Load combination	In-Pl. Moment (Moments in ft-lb)	Out-Pl. Moment	Torsion Moment	S.I.F In	S.I.F Out	Eq. no.	Load type	Code Stress (Stress in psi)	Code Allow.
B02 M-	GR	11	2		1.00	1.00	(18)	SUST	240	16700
	Sus. + E1	50	11		1.00	1.00	(18)	OCC	1100	22267
	Sus. + E2	21	4		1.00	1.00	(18)	OCC	455	22267
	Sus. + E3	84	12		1.00	1.00	(18)	OCC	1810	22267
B02 M+	GR	11	2		1.00	1.00	(18)	SUST	240	16700
	Sus. + E1	50	11		1.00	1.00	(18)	OCC	1100	22267
	Sus. + E2	21	4		1.00	1.00	(18)	OCC	455	22267
	Sus. + E3	84	12		1.00	1.00	(18)	OCC	1810	22267
B02 F-	GR	13	3		1.00	1.00	(18)	SUST	284	16700
	Sus. + E1	63	23		1.00	1.00	(18)	OCC	1438	22267
	Sus. + E2	24	7		1.00	1.00	(18)	OCC	539	22267
	Sus. + E3	102	24		1.00	1.00	(18)	OCC	2250	22267
B02 F+	GR	7	12		1.00	1.00	(18)	SUST	284	16700
	Sus. + E1	28	61		1.00	1.00	(18)	OCC	1438	22267
	Sus. + E2	13	22		1.00	1.00	(18)	OCC	539	22267
	Sus. + E3	55	90		1.00	1.00	(18)	OCC	2250	22267
B03 -	GR	11	5		2.77	3.36	(18)	SUST	731	16700
	Sus. + E1	70	18		2.77	3.36	(18)	OCC	4371	22267
	Sus. + E2	21	9		2.77	3.36	(18)	OCC	1389	22267
	Sus. + E3	101	41		2.77	3.36	(18)	OCC	6653	22267
B03 +	GR	2	5		2.77	3.36	(18)	SUST	384	16700
	Sus. + E1	8	27		2.77	3.36	(18)	OCC	1970	22267
	Sus. + E2	4	10		2.77	3.36	(18)	OCC	730	22267
	Sus. + E3	17	48		2.77	3.36	(18)	OCC	3619	22267
B04	GR	0	1		1.00	1.00	(18)	SUST	24	16700
	Sus. + E1	10	13		1.00	1.00	(18)	OCC	358	22267
	Sus. + E2	1	2		1.00	1.00	(18)	OCC	45	22267
	Sus. + E3	21	14		1.00	1.00	(18)	OCC	553	22267
*** Segment B end ***										
*** Segment C begin ***										
B03	GR	9	1		2.77	3.36	(18)	SUST	496	16700
	Sus. + E1	74	18		2.77	3.36	(18)	OCC	4318	22267
	Sus. + E2	17	2		2.77	3.36	(18)	OCC	942	22267
	Sus. + E3	84	27		2.77	3.36	(18)	OCC	5060	22267
701	GR	2	0		1.00	1.00	(18)	SUST	48	16700
	Sus. + E1	16	9		1.00	1.00	(18)	OCC	396	22267
	Sus. + E2	4	1		1.00	1.00	(18)	OCC	91	22267
	Sus. + E3	24	3		1.00	1.00	(18)	OCC	509	22267

ASME B31.3c (1992) CODE COMPLIANCE

Point name	Load combination	In-Pl. Moment (ft-lb)	Out-Pl. Moment (ft-lb)	Torsion Moment (ft-lb)	S.I.F In	S.I.F Out	Eq. no.	Load type	Code Stress (psi)	Code Allow. (psi)
CO2 N-	GR	2	0		1.00	1.00	(18)	SUST	37	16700
	Sus. + E1	18	4		1.00	1.00	(18)	OCC	397	22267
	Sus. + E2	3	0		1.00	1.00	(18)	OCC	71	22267
	Sus. + E3	12	1		1.00	1.00	(18)	OCC	257	22267
CO2 N+	GR	2	0		1.00	1.00	(18)	SUST	37	16700
	Sus. + E1	18	4		1.00	1.00	(18)	OCC	397	22267
	Sus. + E2	3	0		1.00	1.00	(18)	OCC	71	22267
	Sus. + E3	12	1		1.00	1.00	(18)	OCC	257	22267
CO2 M-	GR	0	0		1.00	1.00	(18)	SUST	7	16700
	Sus. + E1	24	6		1.00	1.00	(18)	OCC	533	22267
	Sus. + E2	1	0		1.00	1.00	(18)	OCC	14	22267
	Sus. + E3	19	5		1.00	1.00	(18)	OCC	426	22267
CO2 M+	GR	0	0		1.00	1.00	(18)	SUST	7	16700
	Sus. + E1	24	6		1.00	1.00	(18)	OCC	533	22267
	Sus. + E2	1	0		1.00	1.00	(18)	OCC	14	22267
	Sus. + E3	19	5		1.00	1.00	(18)	OCC	426	22267
CO2 F-	GR	1	0		1.00	1.00	(18)	SUST	27	16700
	Sus. + E1	11	5		1.00	1.00	(18)	OCC	259	22267
	Sus. + E2	2	0		1.00	1.00	(18)	OCC	52	22267
	Sus. + E3	9	11		1.00	1.00	(18)	OCC	309	22267
CO2 F+	GR	0	1		1.00	1.00	(18)	SUST	27	16700
	Sus. + E1	5	11		1.00	1.00	(18)	OCC	259	22267
	Sus. + E2	0	2		1.00	1.00	(18)	OCC	52	22267
	Sus. + E3	11	9		1.00	1.00	(18)	OCC	309	22267
CO3	GR	0	1		1.00	1.00	(18)	SUST	21	16700
	Sus. + E1	3	7		1.00	1.00	(18)	OCC	169	22267
	Sus. + E2	0	2		1.00	1.00	(18)	OCC	39	22267
	Sus. + E3	13	5		1.00	1.00	(18)	OCC	321	22267

*** Segment C end ***

SYSTEM SUMMARY

Maximum displacements (in)

Maximum X :	0.068	Point : A00	Load Comb.: TOTAL
Maximum Y :	0.042	Point : B01	Load Comb.: TOTAL
Maximum Z :	0.112	Point : A04	Load Comb.: TOTAL
Max. total:	0.131	Point : A03	Load Comb.: TOTAL

Maximum rotations (deg)

Maximum X :	0.155	Point : A09	Load Comb.: TOTAL
Maximum Y :	0.073	Point : B02 N	Load Comb.: TOTAL
Maximum Z :	0.132	Point : B02 N	Load Comb.: TOTAL
Max. total:	0.183	Point : A09	Load Comb.: TOTAL

Maximum restraint forces(lb)

Maximum X :	531	Point : A09	Load Comb.: TOTAL
Maximum Y :	1228	Point : A06	Load Comb.: TOTAL
Maximum Z :	370	Point : A09	Load Comb.: TOTAL
Max. total:	1228	Point : A06	Load Comb.: TOTAL

Maximum restraint moments(ft-lb)

Maximum X :	33	Point : A09	Load Comb.: TOTAL
Maximum Y :	0	Point : B04	Load Comb.: TOTAL
Maximum Z :	19	Point : B04	Load Comb.: TOTAL
Max. total:	35	Point : A09	Load Comb.: TOTAL

SYSTEM SUMMARY

Maximum pipe forces (lb)

Maximum X :	531	Point : A09	Load Comb.: TOTAL
Maximum Y :	895	Point : A06	Load Comb.: TOTAL
Maximum Z :	370	Point : A09	Load Comb.: TOTAL
Max. total:	961	Point : A06	Load Comb.: TOTAL

Maximum pipe moments (ft-lb)

Maximum X :	1081	Point : A08	Load Comb.: TOTAL
Maximum Y :	906	Point : A05	Load Comb.: TOTAL
Maximum Z :	2436	Point : A06	Load Comb.: TOTAL
Max. total:	2550	Point : A06	Load Comb.: TOTAL

S Y S T E M S U M M A R Y

Maximum sustained stress

Point		: A02
Stress	psi	: 5406
Allowable	psi	: 16700
Ratio		: 0.32
Load combination		: GR

Maximum occasional stress

Point		: A02
Stress	psi	: 54924
Allowable	psi	: 22267
Ratio		: 2.47
Load combination		: Sus. + E3

Maximum sustained stress ratio

Point		: A02
Stress	psi	: 5406
Allowable	psi	: 16700
Ratio		: 0.32
Load combination		: GR

Maximum occasional stress ratio

Point		: A02
Stress	psi	: 54924
Allowable	psi	: 22267
Ratio		: 2.47
Load combination		: Sus. + E3

* * * The system does not satisfy ASME B31.3 code requirements * * *
* * * for the selected options * * *

ANALYTICAL CALCULATIONS

Page ____ of ____

Subject Glove box, 2736-ZB Bldg.
Originator M.A. ISLAM Date 12/5/94
Checker E.C. Oeoma Date 2/9/95

Acceleration

Refer to SDC-4.1, Rev 12, Fig. 3
At 5% damping peak accln., g = .43
From ANSYS reanalysis (page A-61), the glovebox support was found to be flexible. Therefore, multiply the peak accln. by 1.5 to determine the equivalent static load.

$$g_h = .43 \times 1.5 = .65\ g$$

$$g_v = 2/3 \times .65 = .43\ g$$

Overturning (Transverse direction)

Moment due to force = $3200 \times 54.3 \times .65$

Resisting Moment = $3200 \times 18 \times (1 - .43)$

$$\frac{3200 \times 18\,(1 - .43)}{3200 \times 54.3 \times .65} = .29 < 1.$$

∴ Overturning would occur if not anchored

Forces (seismic)

Lateral force, $F_{H1} = .65 \times 3200 = 2{,}080$ #

$F_{H2} =$ " $= 2080$

Vertical force, $F_{V1} = .43 \times 3200 = 1376$ # ↑↓

$F_{V2} = 3200$ ↓

ANALYTICAL CALCULATIONS

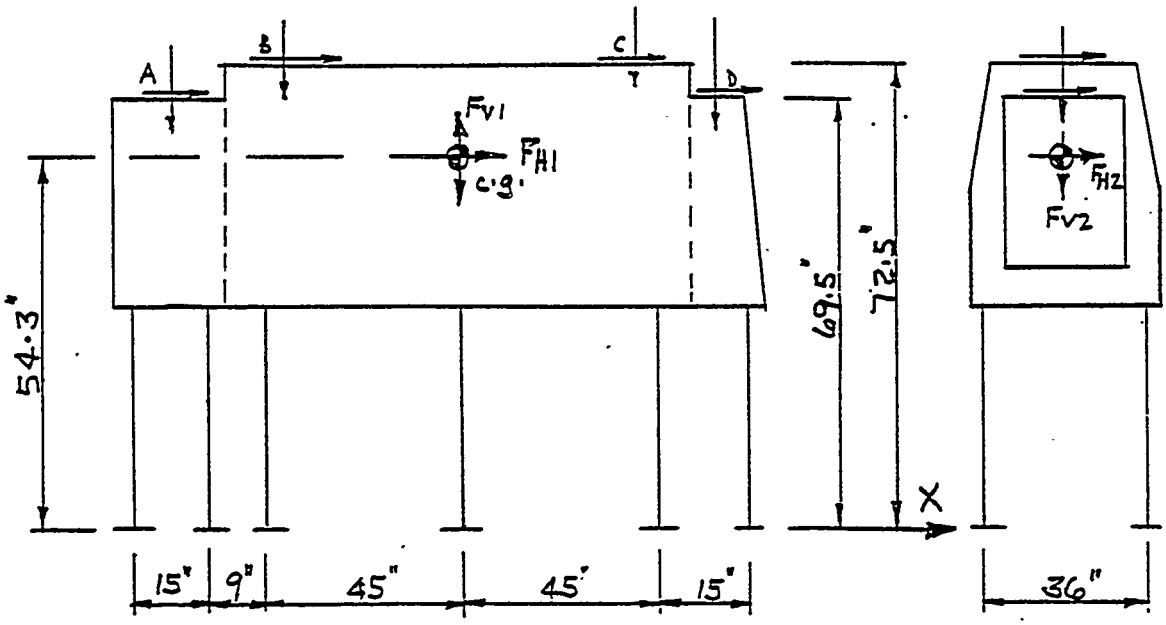
Page ____ of ____

Subject Glovebox 2736-ZB Bldg.

Originator M.A. ISLAM Date 12/20/94

Checker E.E. Ocampo Date 2/9/95

Reactions at Glovebox top from Filter Housing



Longitudinal Transverse

Reactions @ A,B,C,D (Glovebox & Hood Top)

A (Refer AUTOPIPE Run, HOODIN, Page A-102)

Support Pt B02

$F_x = 739^{\#}$; $F_y = 0$; $F_z = 276^{\#}$; $M_x = 18 \times 12 = 216$ #-in

$M_z = 4 \times 12 = 48$ "

B, C, D (Refer AUTOPIPE Run, HOODOUT, Page A-133)

For B (Pt. B04): $F_x = 18^{\#}$; $F_y = 156^{\#}$; $F_z = 65^{\#}$; $M_x = 24 \times 12 = 288$ #-in

$M_z = 19 \times 12 = 228$ "

For C (Pt. C03): $F_x = 49^{\#}$; $F_y = 47^{\#}$; $F_z = 9^{\#}$; $M_x = 14 \times 12 = 168$ "

$M_z = 9 \times 12 = 108$ "

For D (Pt. A09): $F_x = 531^{\#}$; $F_y = 0$; $F_z = 370^{\#}$; $M_x = 33 \times 12 = 396$ "

$M_z = 11 \times 12 = 132$ "

ANALYTICAL CALCULATIONS

Page ___ of ___

Subject Glovebox, 2736-Z Bldg.

Originator M.A. ISLAM Date 12/20/94

Checker C.C. Ocampo Date 2/9/95

Refer to Page A-12, (WHC-SD-CP-SA-026, Rev 0)

Transverse (Consider all 12 anchors)

Tension @ base of post

$$\frac{2080 \times 54.3}{2\times3\times36} + \frac{(276+370)\times69.5 + (65+9)\times72.5 + [288+168+396+216]}{2\times3\times36}$$

(2080: Glovebox; (276+370): F_z A, D; (65+9): F_z B, C; [288+168+396+216]: M_x B, M_x C, D, A)

$= 761^{\#}$

Shear @ base of Post $= \frac{2080}{12} + \frac{(276+370)+(65+9)}{12} = 233^{\#}$

(2080: G; (276+370): F_z A, D; (65+9): F_z B, C)

Longitudinal (consider all 12 anchors)

Tension @ base Post

$$\frac{2080 \times 54.3}{2(90+15\times2+9)} + \frac{(739+531)\times69.5 + (18+49)\times72.5 + (48+228+108+132)}{2(90+15\times2+9)}$$

(2080: G; (739+531): F_x A, D; (18+49): F_x B, C; (48+228+108+132): M_z A, B, C, D)

$= 801^{\#}$

Shear @ base of Post $= \frac{2080}{12} + \frac{(739+531)+(18+49)}{12} = 285^{\#}$

Vertical

Tension @ base $= \frac{1376}{12} + \frac{(156+47)}{12} = 132^{\#}$

(F_y B, C)

Compression (No change) $= 267^{\#}$

* Net Tension, $T = 801 + 761\times.4 + 132\times.4 - .85\times267 = 931^{\#}$

* Net shear, $V = \sqrt{233^2+285^2} = 368^{\#}$

* Seismic component response combination per UCRL-15910

Note: Revise calcs. per pages 13 thru 17 of WHC 1994 next.

ANALYTICAL CALCULATIONS

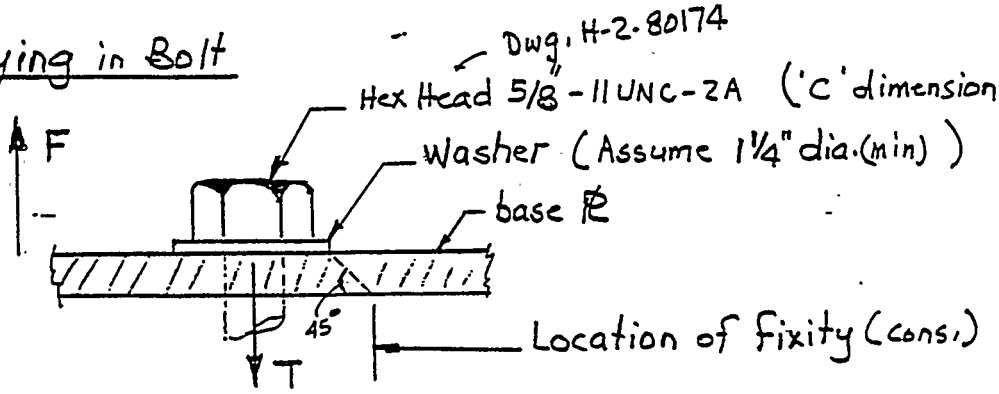
Page ____ of ____

Subject Glovebox, 2736-ZB Bldg.

Originator M.A. ISLAM Date 12/21/94

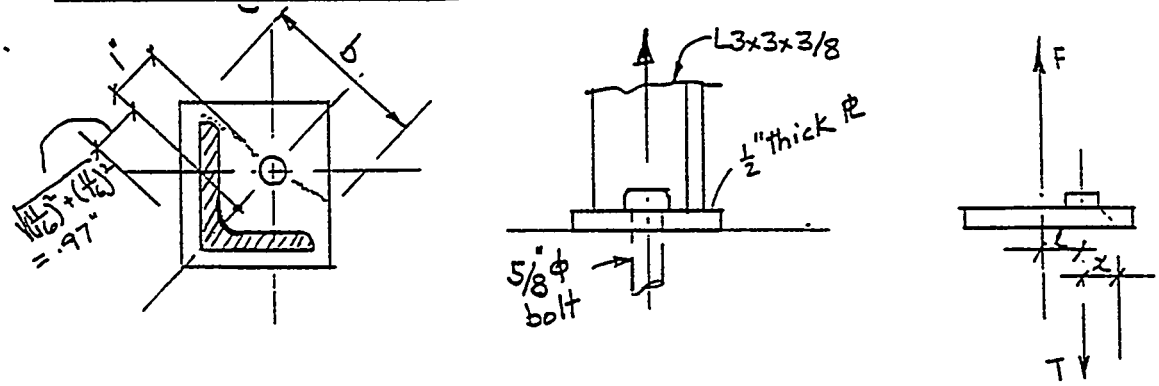
Checker E.C. Owen Date 2/9/95

Prying in Bolt



Ref. AISC

Anchorage Check



Prying Action

For 5/8" ϕ bolt & 1/2" thick plate

$$x = 1.25 \times \frac{1}{2} + \frac{1}{2} \quad (\text{℄ thick.}) = 1.125"$$

$$\therefore \ell = \sqrt{1.5^2 + 1.5^2} - 1.125 \approx 1"$$

Tension Force, F = 931 # $\therefore T = \frac{F(\ell + x)}{x} = \frac{931 \cdot (1 + 1.125)}{1.125}$

$= 1759$ #

V = 368 #

Find allowable anchor values per WHC-SD-GN-DGS-30006, Rev 1, chapter 8 (Existing Safety Class 1)

ANALYTICAL CALCULATIONS

Page ____ of ____

Subject Glovebox, 2736-ZB Bldg.

Originator M. A. ISLAM Date 12/21/94

Checker E. C. Olmsd Date 2/9/95

Per WHC-SD-GN-DGS-30006, Rev 1, chap. 8, page 8-2
(See also Anchor bolt Inspection sheet, page A-158)

$$T_a = T \cdot RC_p \cdot RT_p \cdot RL_p \cdot RS_p \cdot RE_p \cdot RF_p \cdot RR_p$$
$$= T(R)$$

$$V_a = V(R)$$

where T_a, V_a allowable pullout & shear capacity
T, V Nominal " " "
RC_p reduction for concrete cracking = 1.0
RT_p anchor bolt type reduction = .75 (Star Exp.*)
RL_p short embedment/tightness reduction = 1.
RS_p reduction for closely spaced anchors = 1. (N/A)
RE_p " " near edge = 1. (N/A)
RF_p " " low strength concrete = 1.0
($f'c$ = 4000 Psi, Ref. Dwg. H-2-80116, sh. 1)
RR_p reduction for securing equip. with essential relays = 1.0 (N/A)

* Star Exp. Shield (selfdrill), Shell type per Table 8.2 and Dwg. H-2-80174, PN 12

∴ Total Reduction, $R = .75$

∴ $T_a = T\,R$ where $T = 3170^{\#}$ per Table 8.3
$= 3170 \times .75 = \underline{2377^{\#}}$ (For 5/8" ϕ Anchor)

∴ $V_a = V \cdot R = 3790 \times .75 = \underline{2842^{\#}}$

Interaction, $I = \frac{1759}{2377} + \frac{368}{2842} = .87 < 1.0$ OK.
M.S. = .15

Subject Glovebox, 2736-ZB Bldg.
Originator M. A. ISLAM Date 12/29/94
Checker G.C. Ocon Date 2/9/95

stress in Base ℄

Base ℄ Bending

$b = \sqrt{1.5^2+1.5^2} = 2.12"$

Section Modulus, $S = \frac{bt^2}{6} = \frac{2.12\times.5^2}{6} = .0883\ in^3$

$M = T(1.0) = 1759\times1 = 1759$ #-in

$\therefore \sigma_b = \frac{1759}{.0883} = 19921$ Psi $< 36{,}000$ Psi ok (see below)

Allowable stresses

Material, A36, Fy = 36,000 Psi ; Fu = 58,500 Psi
Struc. Bolts, SST ; Weld, E70 Electrode

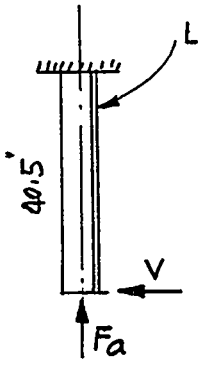
Refer to UCRL-15910, Table 4-5

AISC Allow. stress Design values for all steel design may be used. Because of seismic load, all allowables are increased by 33%.

Bending
℄ & solid bar, $\sigma_b = .75\times36000\times1.33 = 36000$ Psi
For shape, $\sigma_b = .6\times36000\times1.33 = 28{,}800$ Psi
shear stress, $\tau_a = .4\times36000\times1.33 = 19{,}200$ Psi
Weld Capacity, $F_w = .3\times70000\times1.33\times.707(w) = 19{,}800(w)$
" " from base metal shear, $F_w = .4F_y(1.33)(w)$
$F_w = .4\times36000\times1.4(w) = 19{,}200(w)$ ⇐
$\therefore F_w = 19{,}200(w)$

Subject Glovebox, 2736-EB Bldg.
Originator M.A. ISLAM Date 12/29/94
Checker E.C. Ocorner Date 2/9/95

Check Support Post



V = 368# (page A-148)

Fa = 801 (Page A-148) + .4×761 + .4×132 + 267 = 1425#

M @ top of post = 368 × 40.5 = 14,904 #-in

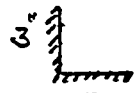
$f_a = \frac{1425}{2.11} = 675$ Psi ; $\frac{KL}{r} = \frac{2 \times 40.5}{.587} = 138 < 200$ OK

F_a (allow.) = 7840 Psi @ $\frac{KL}{r} = 138$ (ignore increase from seis.)

∴ Interaction, $I = \frac{675}{7840} + \frac{14,904}{.833} / 28800 = .71 < 1.$

M.S. = .41 OK

Weld betn. L3x3 & base pl



Aw = 2×3 = 6 in

Tension = 1759 # ; V = 368#

$f_w = \left[\left(\frac{1759}{6} \right)^2 + \left(\frac{368}{6} \right)^2 \right]^{\frac{1}{2}} = 300$ #/in

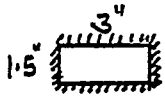
Fw (for 1/8" Fillet weld) = 19,200 × .125 = 2400 #/in

>> 300 #/in OK

ANALYTICAL CALCULATIONS

Subject Glovebox, 2736-ZB Bldg.
Originator M. A. ISLAM Date 12/29/94
Checker E. C. Oconnor Date 2/9/95

Weld betn. L3x3 & L3x3



$A_w = 2(1.5+3) = 9$ in

$S_w = \frac{1.5^2}{3} + 3\times1.5 = 5.25$ in^2

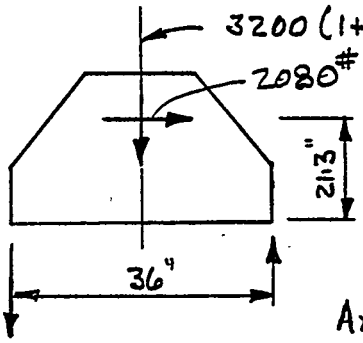
$F_a = 1425^{\#}$; $V = 368^{\#}$; $M = 14{,}904^{\#\text{-in}}$

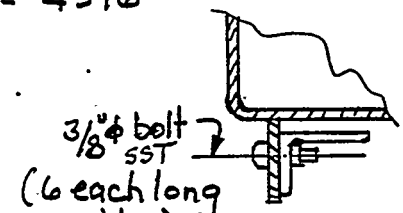
$f_w = \left[\left(\frac{1425}{9} + \frac{14904}{5.25}\right)^2 + \left(\frac{368}{9}\right)^2\right]^{\frac{1}{2}} = 2998^{\#}/\text{in}$

F_w (for 1/4" Fillet) $= 19{,}200(.25) = 4800^{\#}/\text{in} > 2998^{\#}/\text{in}$

M.S. = .6 OK

Connection betn. Glovebox & Support Frame





Axial force in bolt $= \frac{2080}{6} = 347^{\#}$

Shear $= \frac{4576}{2\times6} + \frac{2080\times21.3}{36\times6} = 586^{\#}$

(SST) Bolt allowables : (A307 Allow.)
Per ASME B31.3
For A193 ⇒ S_y = 30 KSI

$T = \left(\frac{30}{36}\times20^{KSI}\times1.33\right)\times.11 = 2438^{\#}$

$V = \left(\frac{30}{36}\times10^{KSI}\times1.33\right)\times.11 = 1219^{\#}$

Interaction, $I = \frac{347}{2438} + \frac{586}{1219} = .62 < 1.$ OK

M.S. = .61

Calculations for Filter Housing Support as performed in Page A-17 of WHC 1994 are adequate (accln. of .68g decreased to .65g). No further analysis is reqd.

ANALYTICAL CALCULATIONS

Page _____ of _____

Subject Glove box, 2736-ZB Bldg.

Originator M.A. ISLAM Date 1/11/95

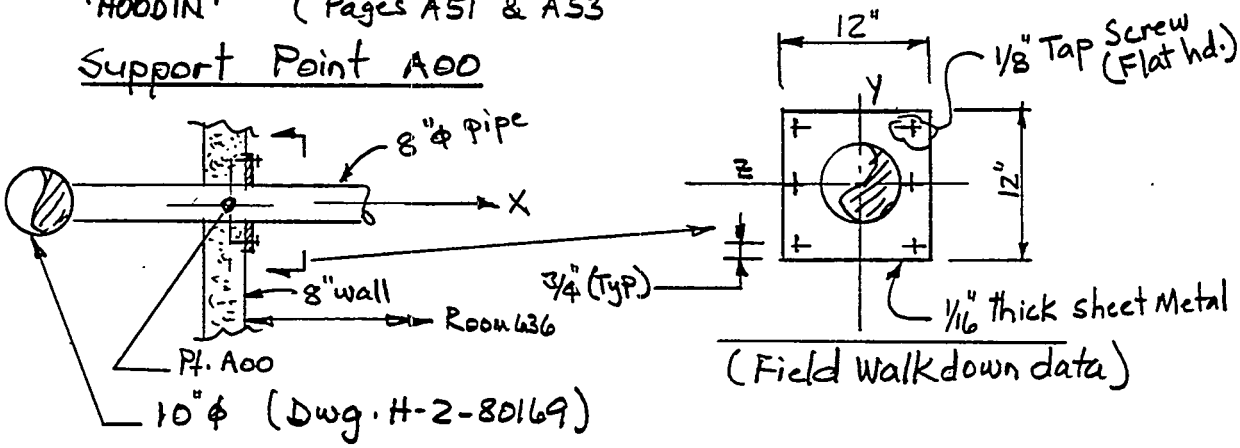
Checker E.C. Ocmond Date 2/2/95

Adequacy of support for Duct & Filter Housing

Refer to AUTOPIPE runs, HOODIN & HOODOUT

HOODOUT (Pages A40 & A-43 of WHC 1994)
'HOODIN' (Pages A51 & A53

Support Point A00



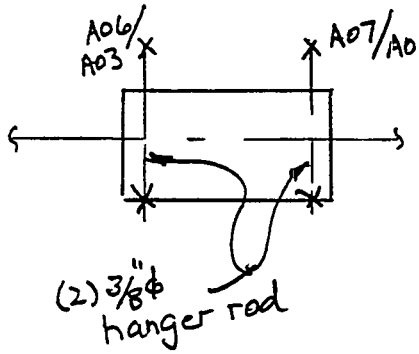
1/8"ϕ Tap Screws are not adequate to restrain the pipe axially; beside, base Pl (1/16" thick) is too thin for resisting bending. Therefore, current AUTOPIPE run modelled the point A00 as a guide (2-way restraint).

Reactions @ A00, $F_y = 207^{\#}$; $F_z = 187^{\#}$ (enveloped)

Reaction forces are small, 8" wall is adequate for bearing.

Filter Housing Support

Node Pts. A06, A07 (Hoodout); A03, A04 (Hoodin)



Largest F_y @ A04 = $1756^{\#}$

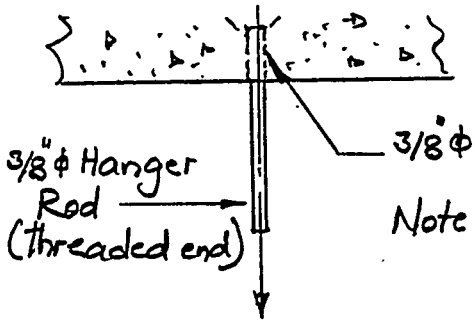
Force per hanger rod = $\frac{1756}{2} = 878^{\#}$

ANALYTICAL CALCULATIONS

Page ____ of ____

Subject Glovebox, 2736-ZB Bldg.
Originator M.A. ISLAM Date 1/11/95
Checker E.C. Ocon Date 2/9/95

Hanger Rod Support



Note: Concrete anchor is shell type for which maximum reduction factor per Table 8.2 (WHC 1993) = .6
Other reduction factors do not affect the capacity per evaluation in page A-150.

∴ Pullout Capacity of 3/8"ϕ anchor per Table 8.3
= 1460 x .6 = 876# ≃ 878# OK

(Seismic load response, Filter House load calc. are conservative)

3/8"ϕ Hanger rod capacity

Per AISC 1980, Capacity = .6 Fy (1.33)(Area)
Capacity = .6 x 36000 x 1.33 x .11 = 3168#

Per "POWER PIPING Catalog", Max. Rated Capacity of 3/8"ϕ rod @ 650°F = 610#

Prorate capacity for room temperature (ASME 1993)

C.steel, $E_{650°F} = 10^3 \times 25.9$ ksi ; $E_{70°F} = 29.5 \times 10^3$ ksi

∴ Capacity @ 70°F = $610 \times \frac{29.5}{25.9} = 695^{\#}$

Capacity @ DBE

Minm. Increase factor = 1.33 (Ref. AISC)

∴ Actual Capacity = 695 x 1.33 = 927# < 3168#

∴ 927# > 878# OK M.S. = .06

ANALYTICAL CALCULATIONS

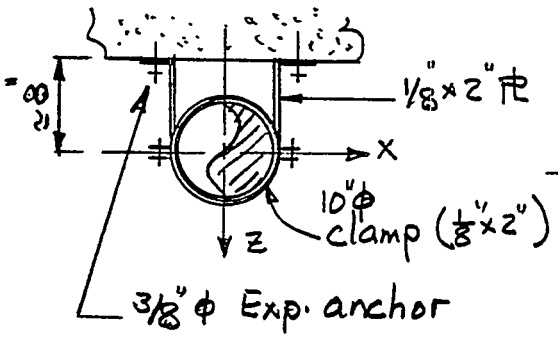
Page _____ of _____

Subject Glovebox, 2736-ZB Bldg.

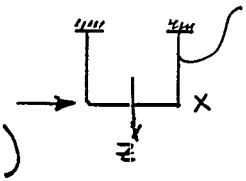
Originator M. A. ISLAM Date 1/11/95

Checker G. C. Owens Date 2/9/95

Guide Support @ Wall



Find stiffnesses along X & Z for Input into AUTOPIPE Run



$I = 2 \times .125^3/12 = .0003255\ in^4$

$A = 2 \times .125 = .25\ in^2$

$K_x = 2 \times \frac{12EI}{L^3} = 2 \times \frac{12 \times 29 \times 10^6 \times .0003255}{8^3}$

$= 443\ \#/in$

$K_z = 2\frac{AE}{L} = 2 \times \frac{.25 \times 29 \times 10^6}{8} = 1.8E6\ \#/in$

Note: The above information per walked-down

Refer to AUTOPIPE output, HOODIN
Max. Reactions @ Pt. C06
$F_x = 83^{\#}$; $F_z = 1460^{\#}$

Check 3/8" ϕ anchor

Shear/anchor = $83/2 = 42^{\#}$

Pullout/anchor = $1460/2 = 730^{\#}$

Capacity of 3/8" ϕ anchor

Per Table 8.3 of WHC 1993

Pullout = $1460 \times .6 = 876^{\#}$

Shear = $1420 \times .6 = 852^{\#}$

Interaction (Bilinear Formulation, page 8-16, WHC 1993)

$$\frac{V}{V_{all.}} = \frac{42}{852} = .05 < .3$$

$$\therefore \frac{P}{P_{all.}} = \frac{730}{876} = .83 < 1.0 \quad \text{OK}$$

M.S. = .2

PL 1/8 x 2"

Because the plate is thin, no bending will occur. However, Fz load will produce tension and Fx load will be in shear & resisted by the anchor through the plate.

ANALYTICAL CALCULATIONS

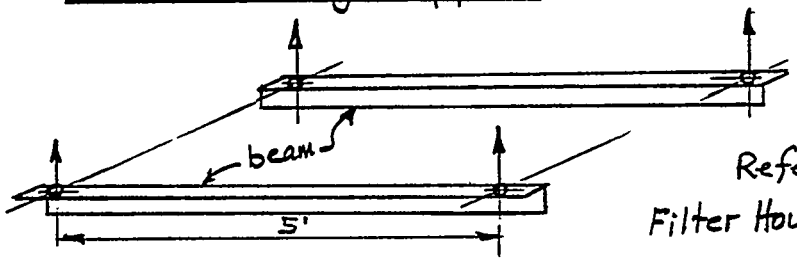
Page ____ of ____

Subject Glovebox, 2736-ZB Bldg.
Originator M.A. ISLAM Date 1/12/95
Checker G.C. Owen Date 1/19/95

shear stress, $\tau = \frac{83}{2 \times .125 \times 2} = 166$ Psi. Small ok

Tensile " , $\sigma = \frac{1460}{2 \times .125 \times 2} = 2920$ Psi $<<$ 28,800 Psi ok

Filter Housing Support



Refer to Page A-41, WHC 1994
Filter House Wt. = 36.3 #/,

For vert. accln., $A_v = .9$, Wt. of Filter House = $36.3 \times 1.9 \times \frac{1}{2}$ = 34.5 #/ per beam

$\therefore M = wL^2/8 = \frac{345 \times 5^2}{8} \times 12 = 1294$ #-in

per field Walkdown

Support beam equivalent to L2x2x$\frac{1}{8}$, $S = .131$ in^3

Bending stress, $\sigma_b = \frac{1294}{.131} = 9878$ Psi $<$ 28,800 Psi OK

M.S. = 1.92

Stress in Piping

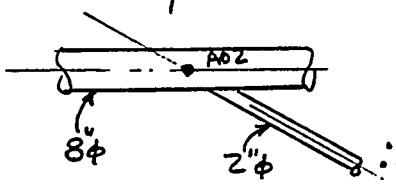
Refer to AUTOPIPE Output, HOODIN & HOODOUT

HOODIN

Max. stress interaction ratio = 1.05 > 1. See HOODOUT below

HOODOUT

All pipe stresses are less than allowable values except point A02 where σ = 54924 Psi exceeded allowable value.



Pipe is stainless steel, S_y = 25 Ksi; S_u = 70 Ksi

∴ Pipe stress of 54924 Psi exceeded yield, however, is less than ultimate strength = 70 Ksi.

∴ Joint between 8"ϕ & 2"ϕ will become plastic, and will remain in place.

ANCHORAGE INSPECTION AND ATTRIBUTES

I Facility PFP Building 2736-Z Equip. ID REPACKAGING GLOVEBOX Floor Elev. @ GRADE ~~ft.~~

Anchorage and Miscellaneous Attributes Evaluation Sheet 1 of 1

J Anchorage Attribute Review

		Attribute Reviewed
Expansion Anchor Review		
a.	Spacing, edge distance and concrete cracks reviewed.	OK
b.	Embedment and nuts bottomed out reviewed.	N/A
c.	Verify expansion anchors are not used to anchor rotating equipment	OK
d.	Tightness check, torque to 16-18 ft-lbs for 5/8 bolt (SEE COMMENTS)	OK
Welded Anchorage Review		
e.	Welded anchorage reviewed.	N/A
Unistrut Anchorage Review		
f.	Channel nuts spot checked for alignment of nut grooves with channel?	N/A
Richmond Inserts		
g.	Non-Seismic commodities anchored with Richmond Inserts identified?	N/A
General Anchorage Attributes		
h.	Gaps between attachments and concrete surface generally ≤ ¼ inch.	OK
i.	Bolts reviewed for full thread engagement or substantial thread engagement for light for lightly loaded anchors.	OK
j.	Anchorage reviewed for substantial rust or corrosion.	OK
k.	Anchorage reviewed for small washers on thin sheet metal.	N/A
l.	Anchorage reviewed for extremely thin equipment base framing.	N/A
m.	Anchorage reviewed for missing nuts, bolts or washers.	OK
n.	Anchorage reviewed for non-positive anchorage configurations.	OK
o.	Based on engineering judgement, anchorage appears adequate.	OK
p.	Other concerns.	OK

Concrete strength and Bolt Type

q. Concrete strength 4,000 psi per drawing H-2-80116 — OK

r. Anchor bolt type 5/8"ø DROP-IN per ☐ inspection ☒ drawing no. H-2-80174. — OK

Comments:

NW CORNER BOLT OF BAG-IN MOVED < 1/8 TURN THEN CLICKED/SET

+ + + +

APPENDIX B

METAL STORAGE RACKS EVALUATION

ANALYTICAL CALCULATIONS REV PAGE 1
Page B-2 of

Subject Storage Metal Rack, 2736-Z Bldg.
Originator M. A. ISLAM Date 4/11/94
Checker EO Weiner Date 4/21/94

Objective

Analyze 7 in. can storage metal rack in Building 2736-Z for seismic loads (DBE). The rack will be checked for its anchorage, and connection between the rack and the cross brace.

Criteria

Response spectra per Guideline, WHC-SD-GN-DGS-30006, Rev 1, Table 2.5.

Allowable stress per AISC 8th Ed., Fy = 33,000 Psi

Concrete Anchor allowable per Guideline, WHC-SD-GN-DGS-30006, Rev 1.

UCRL-15910

Reference Drawing

H-2-26822, Rev 1 & Walkdown sketch as enclosed

Conclusion

The storage metal rack is adequate if the panels are bound together. Walkdown report indicates that the panels are interconnected. Therefore, this evaluation concludes that no rework is needed.

Safety Margin List

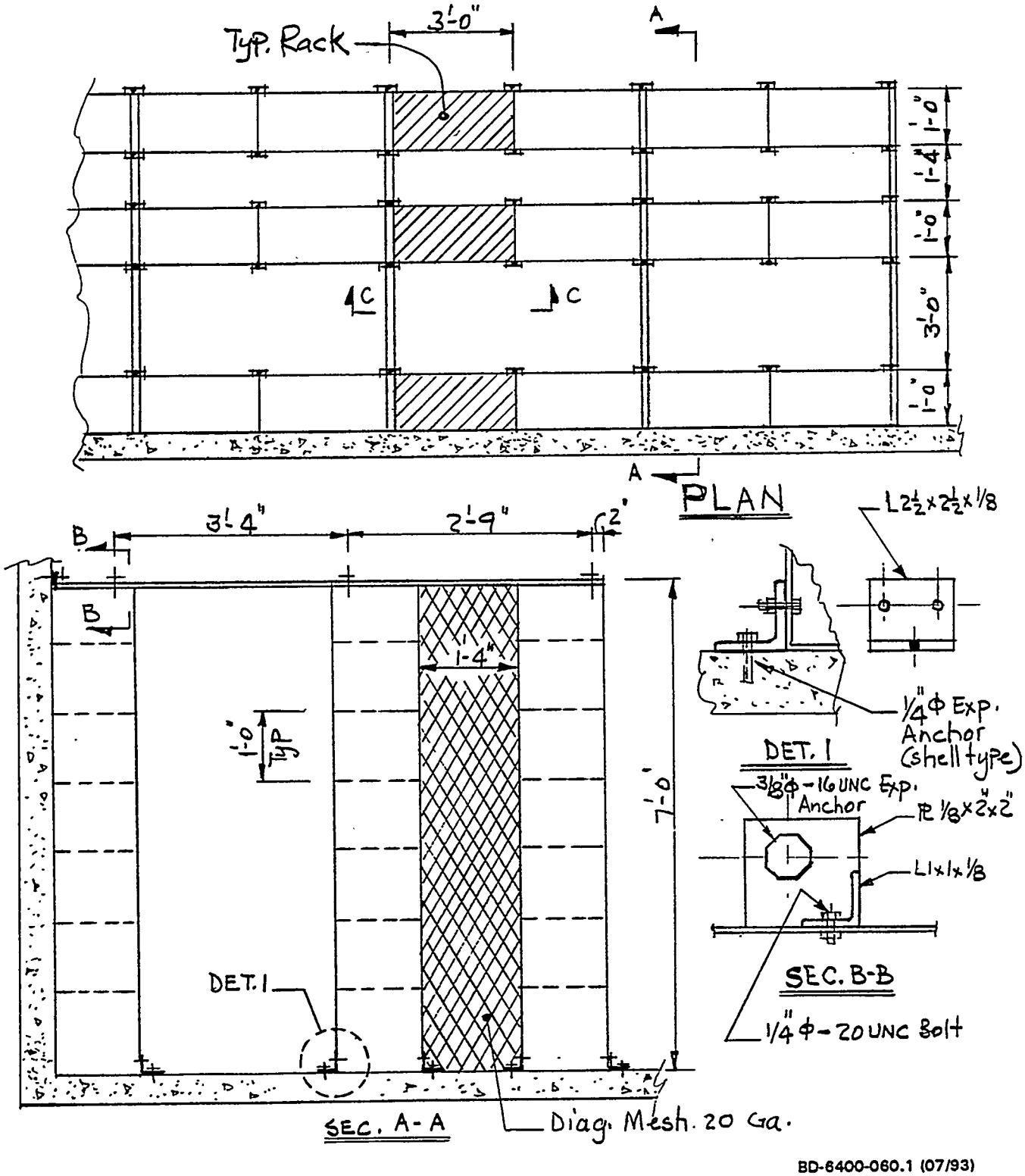
Anchor bolt @ base = .15 ; Anchor bolt @ Wall = .12
Connecting bolt = .67

ANALYTICAL CALCULATIONS

Subject: Storage Metal Rack, 2736-Z Bldg.

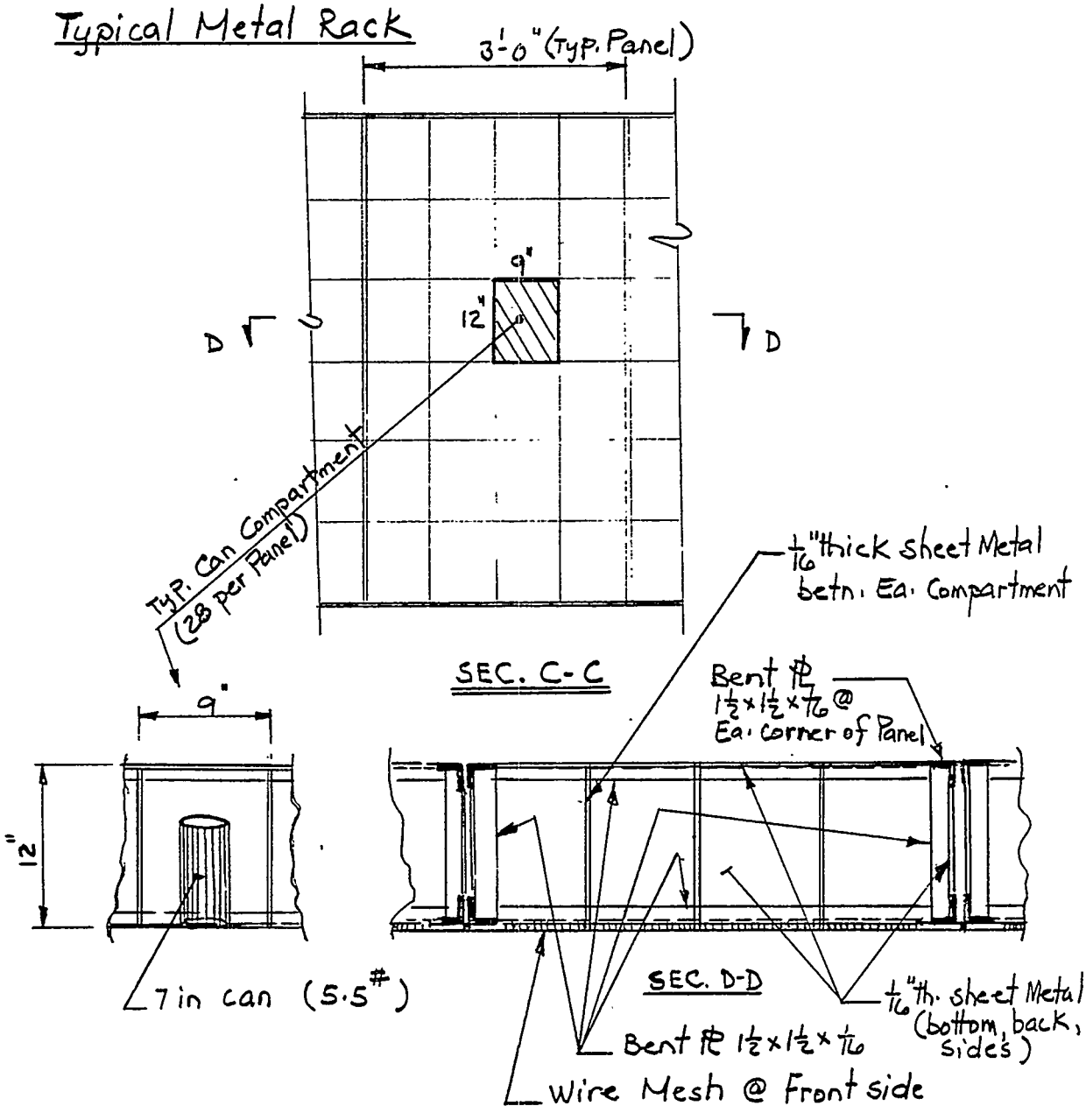
Originator: M. A. ISLAM Date: 3/29/94

Checker: E O Weimer Date: 4/22/94



Subject Storage Metal Rack, 2736-Z Bldg.
Originator M. A. ISLAM Date 4/5/94
Checker EO Weiner Date 4/21/94

Typical Metal Rack



Wt. of a typ. rack Panel

Bent ℄ 1½x1½x1/16 = .18 (85 (corner) x4 + 16 (Front & back) x36 + 16 (sides) x12) x .283 = 56 #

1/16" Sh. Metal = (36 (bot.) x12x8 + 12 (vertical) x85x5 + 36 (back) x85) x .0625x .283 = 205 #

Wire Mesh @ Front = 36x85 x 1/144 x .85 #/SF = 18 #

Table A-12, Nilson & Winter

Subject Storage Metal Rack, 2736-Z Bldg.
Originator M. A. ISLAM Date 4/6/94
Checker EO Weiner Date 4/21/94

∴ ΣW, Ea. Metal Rack Panel = 56 + 205 + 18 = 279#
Wt. of content/compartment = 5.5# in 7 in can
∴ wt. of contents/Panel = 5.5 × 4 (compt.) × 7 (rows) = 154#
∴ Wt. of Each Panel = 279# + 154# = 433#

Note: Use this wt. in Frequency & anchorage calc.

Acceleration (Refer to ANSYS Run for stiffness calculation)

Refer to WHC-SD-GN-DGS-30006, Rev 1. In lieu of inspection, testing on anchor bolt the SDC-4.1 response spectra must be substituted by Table 2.5 values of WHC-SD-GN-DGS-30006, Rev 1.
g_H = .68 g (*Flexible Equipt. located at grade)
$g_V = \frac{2}{3} \times .68 = .45\,g$ * See Page B-11

Forces (due to seismic)

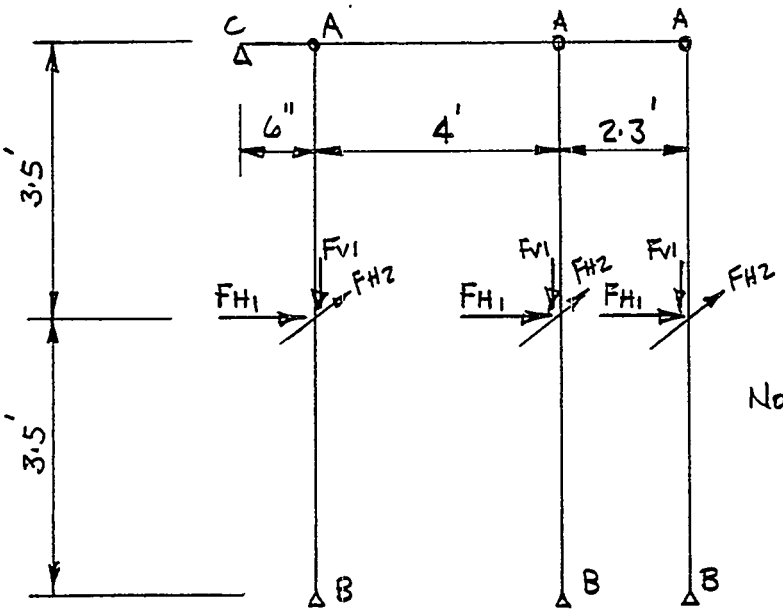
Lateral forces, F_{H1} = .68 × 433 = 294# per panel
∴ F_{H2} = 294# per panel

Vertical Force, F_V = .45 × 433 = 195#/panel
" " @ 1g. = 433#/panel

There are 5 Cross braces for 25 panels. Therefore, for evaluation of cross brace anchorage and connection to rack, use forces as follows:
$F_{H1} = F_{H2}$ = 294 × 25/5 = 1,470# per brace

Subject Storage Metal Rack, 2736-Z Bldg.
Originator M. A. ISLAM Date 4/6/94
Checker E O Weiner Date 4/21/94

Analysis



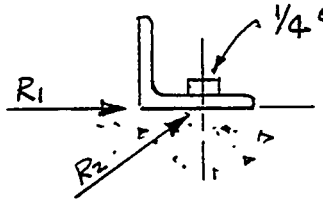
$F_{H1} = 1{,}470^{\#}$
$F_{H2} = 1{,}470^{\#}$
$F_{V1} = (195+433)\times\frac{25}{5} = 3{,}140^{\#}$

Note: F_{V1} is downwards, therefore, has no impact on anchor.
Because, stress in the metal rack frame is not a concern of this analysis, ignore F_{V1}.

Reactions: Due to F_{H1}, $R_A = R_B = 1470/2 = 735^{\#}$
" " F_{H2}, $*R_A = 0$; $R_B = 1{,}470^{\#}$

* Member AC is pinned and subject to rotation.

Evaluate B



Refer to Guideline, WHC-SD-GN-DGS-30006, Rev 1 (Table 4.3)

$T_{all.} = 360 \times \frac{3000}{4000} = 270^{\#}$

$V_{all.} = 400\left[\frac{3000}{10000} + .165\right] = 380^{\#}$

At bottom, 10 anchors are available with 6 panels, however, Panels by the walls have 2 anchors (for 2 panels)

$\therefore V_1 = \frac{294\times 2}{2\times 2} = 147^{\#}$; $V_2 = 294\times 2/2 = 294^{\#}$

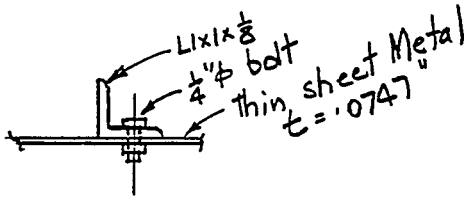
$\therefore$ Interaction from shear, $I = \frac{\sqrt{147^2+294^2}}{380} = .87 < 1.$ OK

$S.M. = \frac{1}{.87} - 1 = .15$

No Pullout exists

Subject Storage Metal Rack, 2736-Z Bldg.
Originator M. A. ISLAM Date 4/6/94
Checker E. O. Iverson Date 4/21/94

Evaluate A



One bolt is available at this location. Because F_{H2} is not resisted by this connection,

Net shear per bolt = $\frac{294 \times 2}{2}$ = 294 # (Max.)

Allowable shear for ¼"ϕ bolt, single shear, per AISC 8th Ed.

$V_{all.} = \frac{\pi}{4}(.25)^2 \times 10000\ ^{\#/in^2} = 490\ ^{\#} > 294\ ^{\#}$ OK

S.M. = $\frac{490}{294} - 1 = .67$

check bearing on sh. metal

Allow. bearing per AISC 8th Ed, $F_p = .9\,F_y$

$F_p = .9 \times 33000^{*} = 29{,}700$ Psi *(For A33 steel)

Bearing Stress = $\frac{294}{.0625 \times .25} = 18{,}816$ Psi < 29,700 Psi OK

Evaluate C

One Expansion anchor (shell type), 3/8"ϕ is available.
Per WHC-SD-GN-DGS-30006, Rev 1 (Table 4.3)

$V_{all.} = 1060 \times \left[\frac{3000}{10000} + .65\right] = 1{,}007\ ^{\#}$

$T_{all.} = 1100 \times \frac{3000}{4000} = 825\ ^{\#}$

Pullout @ C = 294 x 3 (from Pts. A) = 882 # (Max.)

Pullout @ C (if all 25 panels tied together) = 735 #
No shear exists

Interaction, $I = \frac{882}{825} = 1.07 > 1.$ (N.G.)

however, if panels tied together, $I = \frac{735}{825} = .89 < 1.$ (OK)

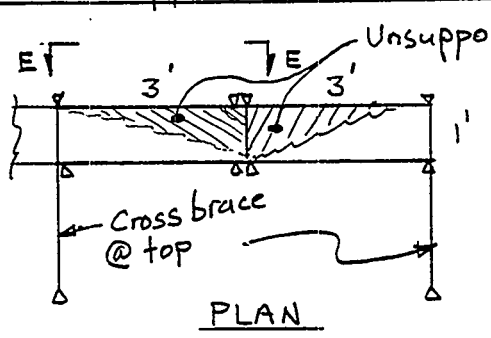
S.M. = $\frac{1}{.89} - 1 = .12$

Subject Storage Metal Rack, 2736-Z Bldg.

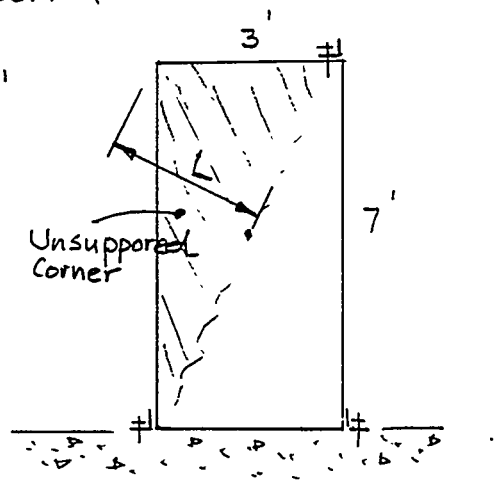
Originator M. A. ISLAM Date 4/8/94

Checker E.O. Wenner Date 4/21/94

Evaluation of Unsupported Panel Top corner



PLAN



SEC. E-E

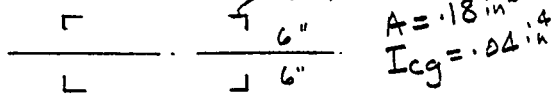
$L \simeq 3 \sin 45^\circ = 2.2'$

Max. Displacement @ corner $= \frac{wL^4}{8EI}$

$E = 29.7 \times 10^6$ Psi ;

$I = [.04 + .18 \times 6^2] \times 4$

$= 26$ in^4



Note : Because the vertical members ($1\frac{1}{2} \times 1\frac{1}{2} \times \frac{1}{4}$) are interconnected thru sheet metals at bottom and sides, use of a composite section is justified.

Max. Lateral load = 294# per panel

$\therefore w = \frac{294}{3 \times 7} = 14$ Psf

$\therefore$ Displacement, $\Delta = \frac{wL^4}{8EI} = \frac{14 \times 2.2^4 \times 12^3}{8 \times 29.7 \times 10^6 \times 26}$

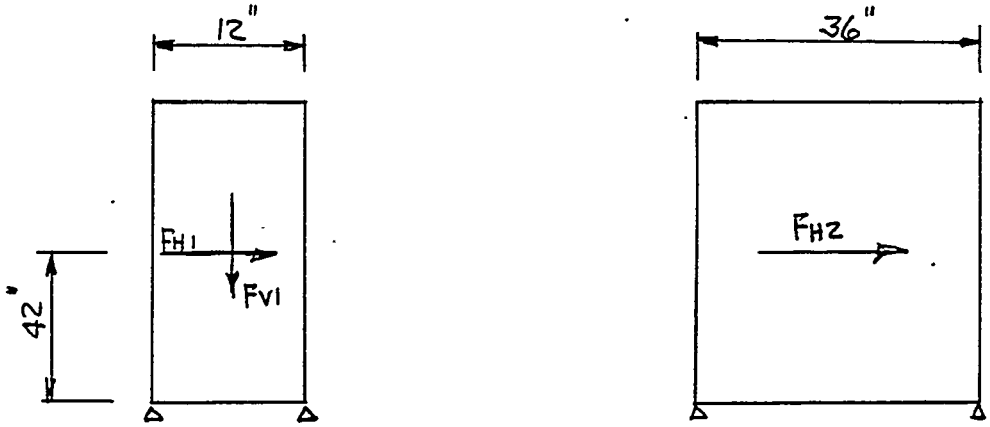
$\Delta = .00009$ in $\Rightarrow$ very insignificant

$\therefore$ Unsupported panel corner (top) will not have any adverse effect on the stability of the panel.

Subject Storage Metal Rack, 2736-Z Bldg.
Originator M. A. ISLAM Date 4/11/94
Checker E.O Weiner Date 4/21/94

Consider the Cross brace supports one row of panels

Because the force becomes half at the cross brace, by comparison, connections @ A & C will be adequate. However, the connection at B must be evaluated as if panel is separated from the cross brace.



$F_{H1} = F_{H2} = 294^{\#}$; $F_{V1} = 195^{\#}\uparrow$; $F_{V1} = 433^{\#}\downarrow$

Tension in anchor due to F_{H1}, $T_1 = \frac{294 \times 42}{12} = 1029^{\#}$

shear " " " " $V_1 = 294/2 = 147^{\#}$

Tension in anchor due to F_{H2}, $T_2 = \frac{294 \times 36}{36} = 294^{\#}$

shear " " " " $V_2 = 147^{\#}$

Compression in anchor due to F_V, $C = \frac{433 - 195}{2} = 119^{\#}$

Combine these loads using SRSS rule:

$$T = \sqrt{1029^2 + 294^2 - 119^2} = 1{,}064^{\#}$$

$$V = \sqrt{(294/2)^2 + (294/2)^2} = 208^{\#}$$

For 1/4"ϕ Anchor, $T_{all.} = 270^{\#}$; $V_{all.} = 380^{\#}$

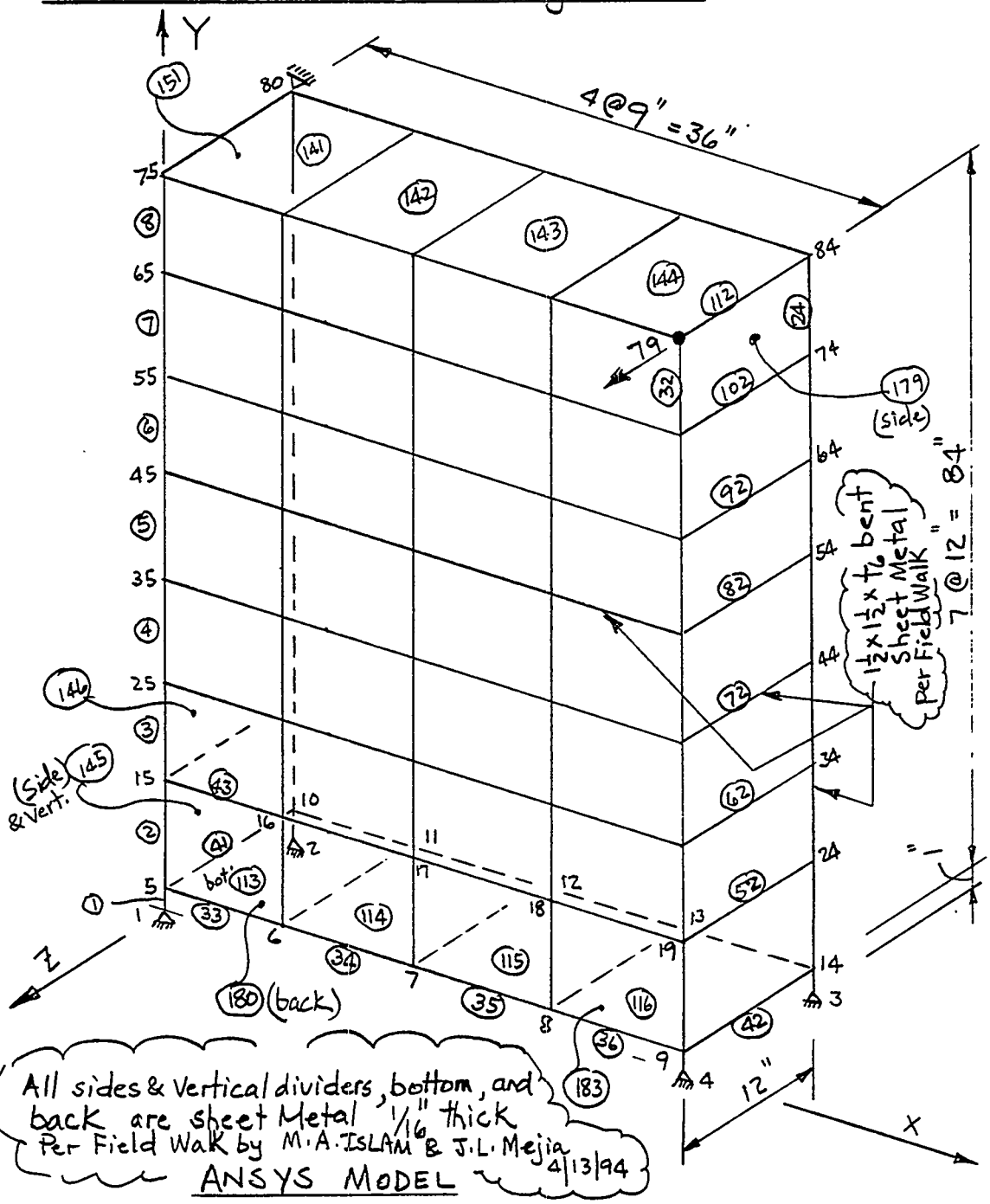
$\therefore I = \frac{1064}{270} + \frac{208}{380} = 4.5 >> 1.$ (N.G.)

Subject Storage Metal Rack, 7 in Can, 2736-Z Bldg.

Originator M. A. ISLAM Date 4/14/94

Checker G. O Wemer Date 4/21/94

Stiffness of 7 in Can Storage Rack



All sides & Vertical dividers, bottom, and back are sheet Metal 1/16" thick Per Field Walk by M.A. ISLAM & J.L. Mejia 4/13/94

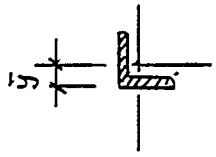
ANSYS MODEL

ANALYTICAL CALCULATIONS

Subject Storage Metal Rack, 7 in Can, 2736-Z Bldg.
Originator M. A. ISLAM Date 4/14/94
Checker E.O. Weimer Date 4/21/94

Section Properties

Bent sheet metal $1\frac{1}{2} \times 1\frac{1}{2} \times \frac{1}{16}$



Area $\simeq 1.5 \times 2 \times .06 = .18\ in^2$

$1.5 \times .06 \times .03 = .003$
$1.5 \times .06 \times .75 = .0675$
$\simeq .07$

$\therefore \bar{y} = \frac{.07}{.18} = .39"$

$$I \simeq 1.5 \times .06 (.39 - .03)^2 + \frac{.06 \times 1.5^3}{12} + 1.5 \times .06 (.75 - .39)^2$$
$$\simeq .04\ in^4$$

Stiffnesses

Refer ANSYS output for displacement @ Node 79

$$K_x = \frac{1}{.5754 \times 10^{-4}} = 1.74E4\ \#/in$$

$$K_y = \frac{1}{.9688 \times 10^{-4}} = 1.0E4$$

$$K_z = \frac{1}{.1117 \times 10^{-3}} = 9E3$$

Frequency

$\Sigma W = 433^{\#}$ per panel ($\dot{\downarrow}$ $1' \times 3' \times 7'$)

$$f_x = 3.13\sqrt{\frac{K_x}{W}} = 3.13\sqrt{\frac{1.74E4}{433}} = 19.8\ Hz$$

$$f_y = 3.13\sqrt{\frac{1.E4}{433}} = 15\ Hz$$

$$f_z = 3.13\sqrt{\frac{9E3}{433}} = 14\ Hz$$

f_y & f_z are less than 16.7 Hz (Per WHC-SD-GN-DGS-30006, Rev 1)
Therefore, consider the metal rack flexible. Beside, a second panel even though is interconnected with another panel, however, does not have top cross brace. Frequency in such a condition will further drop. Hence, using the metal rack being flexible is justified.

STIFFNESS OF 7 IN CAN STORAGE RACK

```
/title,Stiffness of metal rack for 7 in can
/show,ega256
/view,1,1,1,1
/com                        Filename: rack
/com
/com
/com
/com                        Input by: M. A. Islam Chk by: E O Weiner
/com                                  4/13/94          4/21/94
/com
et,1,4                      * beam element
et,2,63                     * plate element
/com
kan,0
mp,ex,1,29e6
mp,dens,1,.000734           * steel
/com
n,1
n,2,,,-12
n,3,36,,-12
n,4,36
n,5,,1
n,6,9,1
n,7,18,1
n,8,27,1
n,9,36,1
ngen,2,5,5,9,1,,,-12
ngen,8,10,5,14,1,,12
r,1,.18,.04,.04,2.22,2.22,,,.0002       *Frame angle 1/16 in thick
r,2,.0625                               *1/16 in pl. Bot. & Sides
mat,1
type,1
real,1
e,1,5
e,5,15
egen,7,10,-1
e,2,10
e,10,20
egen,7,10,-1
e,3,14
e,14,24
egen,7,10,-1
e,4,9
e,9,19
egen,7,10,-1
e,5,6
egen,4,1,-1
egen,2,5,33,36
e,5,10
e,9,14
egen,8,10,33,42
type,2
real,2
e,5,6,11,10
egen,4,1,-1
egen,8,10,113,116
e,5,10,20,15
egen,7,10,-1
egen,5,1,145,151
e,5,6,16,15
egen,4,1,-1
egen,7,10,180,183
/com
/com
d,1,ux,,,4,1,uy,uz
d,80,ux,,,,,uy,uz
/com
acel,,386.4                 * dead loads
f,79,fx,1                   * Unit load along X
lwrite
fdele,79,fx
f,79,fy,1                   * Unit load along Y
lwrite
fdele,79,fy
f,79,fz,1                   * Unit load along Z
```

```
nlist,all
elist,all
lwrite
afwrite
```

```
POST DATA FILE12  NAME=DWT12.DAT

MAXIMUM NUMBER OF STORED LOAD SETS SET TO   1
 ALL PREVIOUSLY STORED SETS ERASED

MAXIMUM NUMBER OF STORED LOAD SETS SET TO   3
 ALL PREVIOUSLY STORED SETS ERASED

CURRENT LOAD CASE=   1

USE LOAD STEP     1  ITERATION     1  SECTION.  1  FOR LOAD CASE     1


***  NOTE  ***
ALL STRESSES ARE IN GLOBAL COORDINATES UNLESS
     THE COMMAND -- GLOBAL,0 --  IS ENTERED

GEOMETRY STORED FOR     84  NODES    207  ELEMENTS
 TITLE= Stiffness of metal rack for 7 in can

DISPLACEMENT STORED FOR   84 NODES

STRESSES STORED FOR    4  SELECTED ITEMS

NODAL STRESSES AND TEMPS. STORED FOR   95 ELEMENTS

ITERATION SUMMARY INFORMATION STORED

NODAL FORCES STORED FOR  207 ELEMENTS

REACTIONS STORED FOR   15 REACTIONS

FOR LOAD STEP=     1  ITERATION=     1  SECTION=   1
 TIME=  0.000000E+00   LOAD CASE=  1
 TITLE= Stiffness of metal rack for 7 in can

NSEL   FOR LABEL= NODE   FROM    79 TO    79 BY    1

     1  NODES (OF     84  DEFINED) SELECTED BY  NSEL  COMMAND.

PRINT NODAL DISPLACEMENTS

        ***** POST1 NODAL DISPLACEMENT LISTING *****

 LOAD STEP     1  ITERATION=     1  SECTION=  1
 TIME=   0.00000E+00     LOAD CASE=  1

 THE FOLLOWING X,Y,Z DISPLACEMENTS ARE IN GLOBAL COORDINATES

   NODE      UX              UY              UZ              ROTX            ROTY            ROTZ
    79   0.57536564E-04 -0.99274474E-04 -0.16816779E-03 -0.94663587E-05  0.38533316E-05  0.78154849E-06

MAXIMUMS
NODE        79              79              79              79              79              79
VALUE    0.57536564E-04 -0.99274474E-04 -0.16816779E-03 -0.94663587E-05  0.38533316E-05  0.78154849E-06

CURRENT LOAD CASE=   2

USE LOAD STEP     2  ITERATION     1  SECTION.  1  FOR LOAD CASE     2

DISPLACEMENT STORED FOR   84 NODES

STRESSES STORED FOR    4  SELECTED ITEMS

NODAL STRESSES AND TEMPS. STORED FOR   95 ELEMENTS

ITERATION SUMMARY INFORMATION STORED

NODAL FORCES STORED FOR  207 ELEMENTS

REACTIONS STORED FOR   15 REACTIONS

FOR LOAD STEP=     2  ITERATION=     1  SECTION=   1
```

```
 TIME=  0.000000E+00   LOAD CASE=  2
 TITLE= Stiffness of metal rack for 7 in can

NSEL  FOR LABEL= NODE  FROM    79 TO    79 BY    1

     1  NODES (OF     84  DEFINED) SELECTED BY  NSEL  COMMAND.

PRINT NODAL DISPLACEMENTS

        ***** POST1 NODAL DISPLACEMENT LISTING *****

 LOAD STEP     2  ITERATION=     1  SECTION=  1
 TIME=   0.00000E+00     LOAD CASE=  2

 THE FOLLOWING X,Y,Z DISPLACEMENTS ARE IN GLOBAL COORDINATES

   NODE      UX              UY              UZ              ROTX            ROTY            ROTZ
    79   0.51748330E-04 -0.96878947E-04 -0.15495806E-03 -0.93615457E-05  0.34427109E-05  0.95676818E-06

MAXIMUMS
NODE         79              79              79              79              79              79
VALUE    0.51748330E-04 -0.96878947E-04 -0.15495806E-03 -0.93615457E-05  0.34427109E-05  0.95676818E-06

CURRENT LOAD CASE=   3

USE LOAD STEP     3  ITERATION     1  SECTION   1  FOR LOAD CASE     3

DISPLACEMENT STORED FOR   84 NODES

STRESSES STORED FOR    4  SELECTED ITEMS

NODAL STRESSES AND TEMPS. STORED FOR   95 ELEMENTS

ITERATION SUMMARY INFORMATION STORED

NODAL FORCES STORED FOR  207 ELEMENTS

REACTIONS STORED FOR   15 REACTIONS

FOR LOAD STEP=     3  ITERATION=     1  SECTION=   1
 TIME=  0.000000E+00   LOAD CASE=  3
 TITLE= Stiffness of metal rack for 7 in can

NSEL  FOR LABEL= NODE  FROM    79 TO    79 BY    1

     1  NODES (OF     84  DEFINED) SELECTED BY  NSEL  COMMAND.

PRINT NODAL DISPLACEMENTS

        ***** POST1 NODAL DISPLACEMENT LISTING *****

 LOAD STEP     3  ITERATION=     1  SECTION=  1
 TIME=   0.00000E+00     LOAD CASE=  3

 THE FOLLOWING X,Y,Z DISPLACEMENTS ARE IN GLOBAL COORDINATES

   NODE      UX              UY              UZ              ROTX            ROTY            ROTZ
    79   0.40055484E-04 -0.97757595E-04 -0.11174808E-03 -0.86131172E-05  0.21966955E-05  0.10182455E-05

MAXIMUMS
NODE         79              79              79              79              79              79
VALUE    0.40055484E-04 -0.97757595E-04 -0.11174808E-03 -0.86131172E-05  0.21966955E-05  0.10182455E-05

ALL CURRENT POST1 DATA WRITTEN TO FILE07 · NAME= FILE07.DAT
 FOR POSSIBLE RESUME FROM THIS POINT


***** ROUTINE COMPLETED *****  CP =       88.930

SYSTEM= 32053-PC/LT-4.4A   REVISION= 4.4     A  1
FOR SUPPORT CALL                  PHONE                  TWX
CURRENT JOBNAME=FILE

/EOF ENCOUNTERED ON FILE 5

DATA INPUT WRITTEN ON FILE18
```

Subject Lard Can Storage Rack

Originator M.A. ISLAM Date 4/15/94

Checker E.O. Wemin Date 4/22/94

Objective

Analyze lard can storage rack in Building 2736-Z for seismic loads (DBE). The rack will be checked for its anchorage, and connection between the rack and the anchorage.

Criteria

Response spectra per Guideline, WHC-SD-GN-DGS-30006, Rev 1, Table 2.5.

Allowable stress per AISC 8th Edition, Fy = 33,000 Psi

Concrete anchor allowable per Guideline, WHC-SD-GN-DGS-30006, Rev 1.

UCRL-15910

Reference Drawing

H-2-26822, Rev 1 EO 45369 ESR 9539, and walkdown sketches as enclosed.

Conclusion

The metal rack for lard can is <u>not</u> adequate to withstand seismic loads.

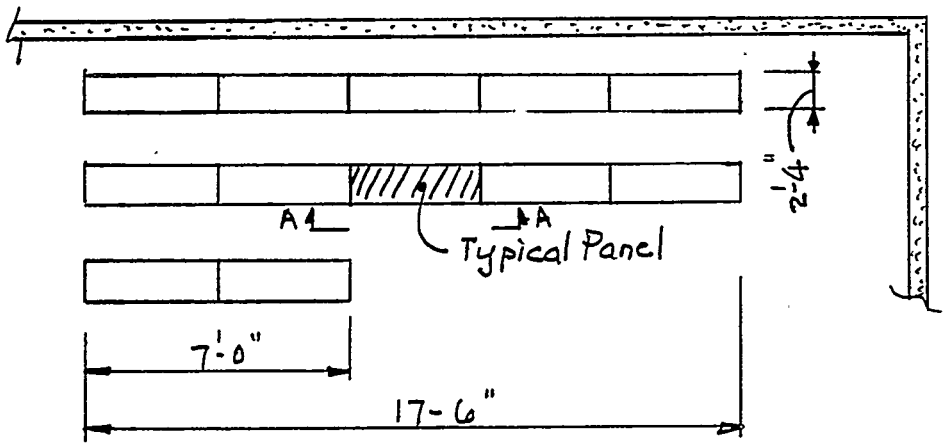
Recommendation

Provide a cross brace on each panel similar to the 7 in can storage rack.

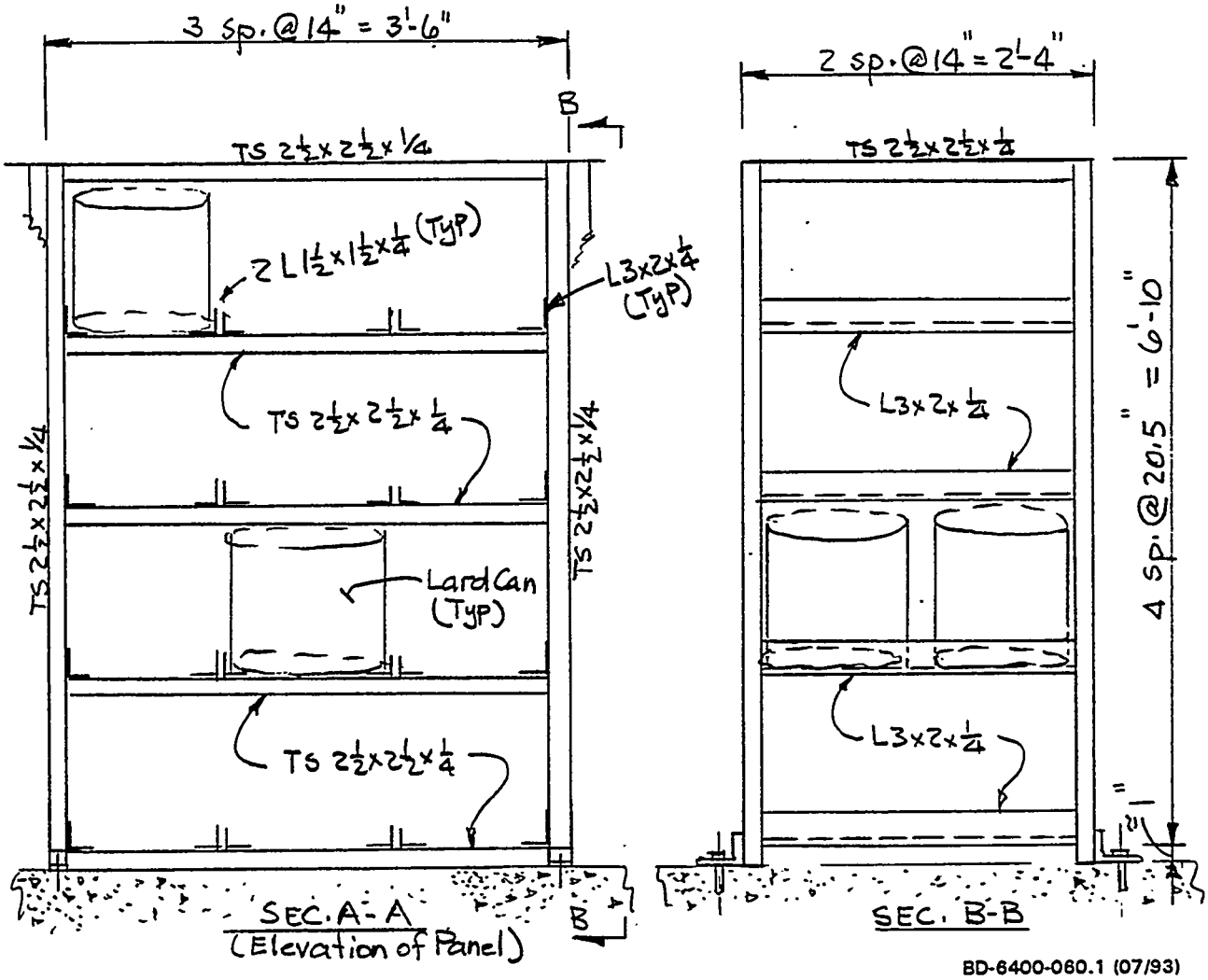
Subject Lard Can Storage Rack

Originator M. A. ISLAM Date 4/15/94

Checker E.O. Wemen Date 4/22/94



PLAN



Subject Lard Can Storage Rack

Originator M.A. ISLAM Date 4/15/94

Checker E.O. Wemer Date 4/22/94

Acceleration

In lieu of inspection, testing on anchor bolt, the SDC-4.1, Rev 12, response spectra must be substituted by Table 2.5 values of Guideline, WHC-SD-GN-DGS-30006, Rev 1.

The results from the stiffness analysis indicate that the storage rack is flexible. Hence,

$g_H = .68g$ (*flexible equipt. located at grade)

$g_V = \frac{2}{3} \times .68 = .45g$

*See Page B-22

Forces (due to seismic loads)

Lateral Force, $F_{H1} = .68 \times 1900 = 1292^{\#}$

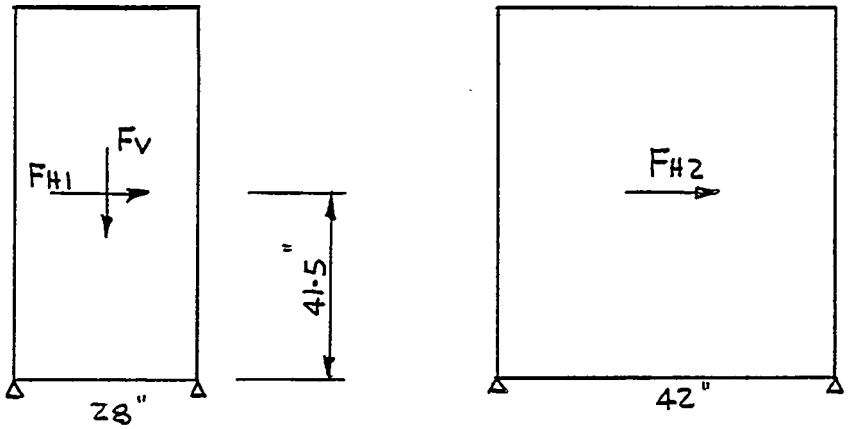
" " $F_{H2} = 1292^{\#}$

Vertical Force, $F_V = .45 \times 1900 = 855^{\#}$ ↓↑

" " $F_V @ 1.g = 1900^{\#}$ ↓

Subject Lard Can Storage Rack
Originator M.A. ISLAM Date 4/15/94
Checker E.O. Wemi Date 4/21/94

Anchor Evalution



Transverse Longitudinal

Transverse

Tension @ base = $\frac{1292 \times 41.5}{28 \times 2}$ = 957#

shear @ " = 1292/4 = 323#

Longitudinal

Tension @ base = $\frac{1292 \times 41.5}{42 \times 2}$ = 638#

Shear " " = 323#

Vertical

Tension @ base = 855/4 = 214#

Compression @ " (Gravity) = $\frac{1900}{4}$ = 475#

∴ *Net Tension, T = 957 + .4 × 638 + .4 × 214 − .85 × 475 = 894#

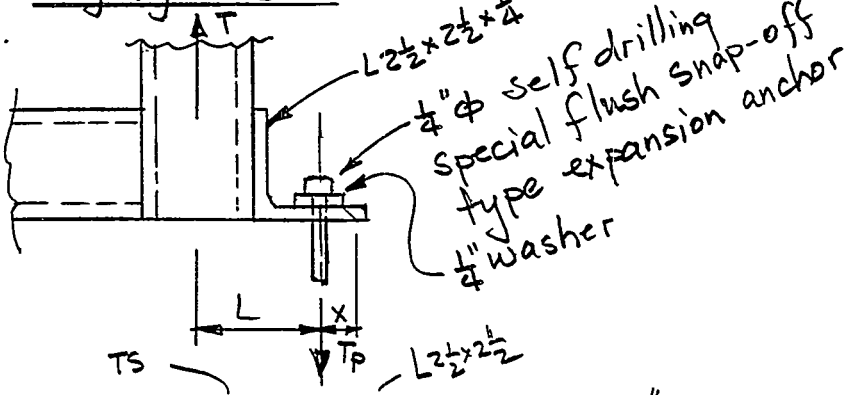
*Net Shear, V = $\sqrt{323^2 + 323^2}$ = 457#

* Combination per WHC-SD-GN-DGS-30006, Rev 1

ANALYTICAL CALCULATIONS

Subject Lard Can Storage Rack
Originator M.A. ISLAM Date 4/15/94
Checker E.O Weiner Date 4/21/94

Prying in Bolt



Ref.
ESR No. 9539

$L = \frac{2.5}{2} + \frac{2.5}{2} = 2.5''$

Max. bolt head dimension for ¼" ϕ bolt = ½"
∴ Consider Washer dia. = 1"

$\therefore x = \frac{1}{2}'' + \frac{1}{4}'' = .75''$

$\therefore T_p = \frac{T(L+x)}{x}$; $\frac{L+x}{x} = \frac{2.5+.75}{.75} = 4.33 > 2^*$

∴ Use $\frac{L+x}{x} = 2$

$\therefore T_p = 894 \times 2 = 1788^{\#}$

* per WHC-SD-GN-DGS-30006, Rev 1, P 4-5

Anchor Allowables

For ¼" ϕ anchor, per WHC-SD-GN-DGS-30006, Rev 1 Table 4.3

Allow. $T = 360 \times \frac{3000}{4000}^{*} = 270^{\#}$

" $V = 400 \times \left[\frac{3000}{10000} + .65\right]^{*} = 380^{\#}$

* Reduction due to $f_c' = 3000$ Psi

Interaction, $I = \frac{1788}{270} + \frac{457}{380} = 7.8 >>> 1.$

S.M. $= \frac{1}{7.8} - 1 = -.87$

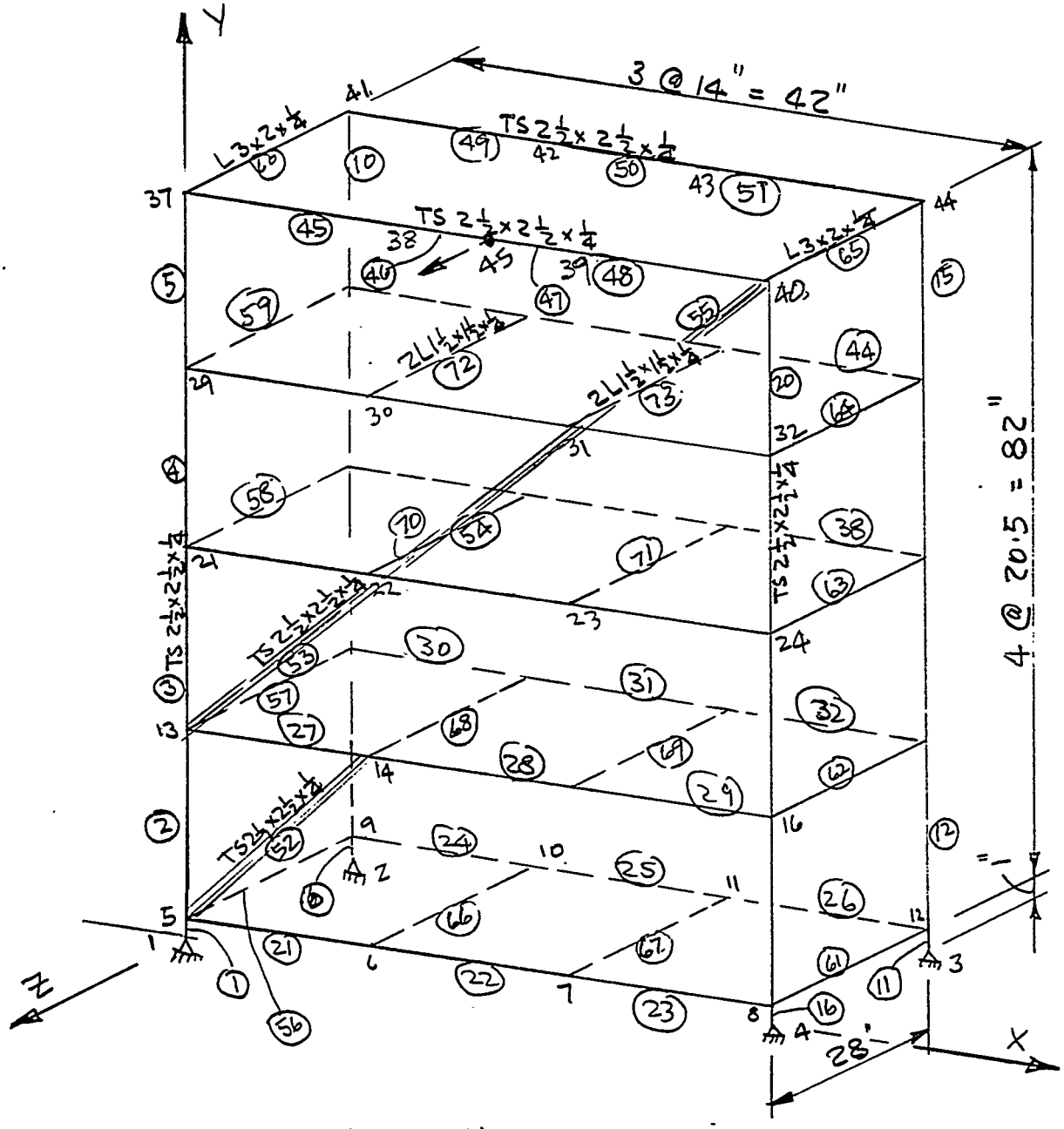
N.G.

Recommend Cross brace @ Top

Subject Land Can Storage Rack, 2736-Z Bldg.

Originator M. A. ISLAM Date 4/14/94

Checker F. O. Arsmei Date 4/21/94



ANSYS MODEL

ANALYTICAL CALCULATIONS REV 1 PAGE

Subject Lard Can Storage Rack

Originator M.A. ISLAM Date 4/15/94

Checker E.O Weems Date 4/21/94

weight of Rack

TS $2\frac{1}{2}\times2\frac{1}{2}\times\frac{1}{4}$ $= (4\times83 + 5\times2\times42 + \sqrt{42^2+82^2})/12 \times 7.11^{\#/'} = 500^{\#}$

$L3\times2\times1/4$ $= (5\times2\times28)/12 \times 4.1^{\#/'} = 96^{\#}$

$2L1\frac{1}{2}\times1\frac{1}{2}\times1/4$ $= (2\times4\times28)/12 \times 4.38^{\#/'} = 82^{\#}$

$\Sigma W = 678^{\#}$

Contents $= 6^{\text{cans}} \times 4^{\text{row}} \times 50^{\#/\text{con}} = 1200^{\#}$

Total Wt. $\Sigma W = 678 + 1200 = 1878^{\#}$ plus chain

Use $W = 1{,}900^{\#}$

Stiffnesses (Refer ANSYS Output displacement @ Node 45)

$K_x = \frac{1}{.0003578} = 2.8E3^{\#/in}$

$K_y = \frac{1}{.0002709} = 3.7E3^{\#/in}$

$K_z = \frac{1}{.000044} = 2.3E4^{\#/in}$

Frequency

$f_x = 3.13\sqrt{\frac{2.8E3}{1900}} = 4\ Hz$; $f_y = 3.13\sqrt{\frac{3.7E3}{1900}} = 4\ Hz$

$f_z = 3.13\sqrt{\frac{2.3E4}{1900}} = 11.\ Hz$

All frequencies are less than* 16.7 Hz. Therefore, the lard can rack is flexible.

* Per WHC-SD-GN-DGS-30006, Rev 1

LARD CAN RACK
STIFFNESS ANALYSIS

```
/title,Stiffness of metal rack for lard can
/show,ega256
/view,1,1,1,1
/com                    Filename: lard
/com
/com
/com
/com                    Input by: M.A Islam 4/14/94  Chk by: E O'Weeren 4/21/94
/com
/com
et,1,4                  * beam element
/com
kan,0
mp,ex,1,29e6
mp,dens,1,.000734       * steel
/com
n,1
n,2,,,-28
n,3,42,,-28
n,4,42
n,5,,1
n,6,14,1
n,7,28,1
n,8,42,1
ngen,2,4,5,8,1,,,-28
ngen,5,8,5,12,1,,20.5
n,45,21,83
r,1,2.09,1.69,1.69,2.5,2.5,,,3.9      *Columns & long horizontals
r,2,1.19,1.09,1.09,4,4,,,.026         *L3x2x1/4
r,3,1.38,.277,.576,3,2.07,,,.03       *2L1 1/2 x 1 1/2 x 1/4
mat,1
type,1
real,1
e,1,5
e,5,13
egen,4,8,-1
e,2,9
e,9,17
egen,4,8,-1
e,3,12
e,12,20
egen,4,8,-1
e,4,8
e,8,16
egen,4,8,-1
e,5,6
egen,3,1,-1
egen,2,4,21,23
egen,4,8,21,26
e,37,38
e,38,45
e,45,39
e,39,40
e,41,42

egen,3,1,-1
e,5,14
e,13,22
egen,3,9,-1
real,2
e,5,9
egen,5,8,-1
e,8,12
egen,5,8,-1
real,3
e,6,10
egen,2,1,-1
egen,4,8,66,67
/com
/com
d,1,ux,,,4,1,uy,uz
/com
acel,,386.4             * dead loads
f,45,fx,1               * Unit load along X
lwrite
```

```
fdele,45,fx
f,45,fy,1          * Unit load along Y
lwrite
fdele,45,fy
f,45,fz,1          * Unit load along Z
nlist,all
elist,all
lwrite
afwrite
```

```
POST DATA FILE12  NAME=DWT12.DAT

MAXIMUM NUMBER OF STORED LOAD SETS SET TO   1
 ALL PREVIOUSLY STORED SETS ERASED

MAXIMUM NUMBER OF STORED LOAD SETS SET TO   3
 ALL PREVIOUSLY STORED SETS ERASED

CURRENT LOAD CASE=   1

USE LOAD STEP     1  ITERATION     1  SECTION   1  FOR LOAD CASE     1


GEOMETRY STORED FOR     45  NODES     73  ELEMENTS
 TITLE= Stiffness of metal rack for lard can

DISPLACEMENT STORED FOR   45 NODES

ITERATION SUMMARY INFORMATION STORED

NODAL FORCES STORED FOR   73 ELEMENTS

REACTIONS STORED FOR   12 REACTIONS

FOR LOAD STEP=     1  ITERATION=     1  SECTION=   1
 TIME=  0.000000E+00   LOAD CASE=  1
 TITLE= Stiffness of metal rack for lard can

NSEL  FOR LABEL= NODE  FROM    45 TO    45 BY    1

     1  NODES (OF     45  DEFINED) SELECTED BY  NSEL  COMMAND.

PRINT NODAL DISPLACEMENTS

        ***** POST1 NODAL DISPLACEMENT LISTING *****

 LOAD STEP     1  ITERATION=     1  SECTION=  1
 TIME=   0.00000E+00     LOAD CASE=  1

 THE FOLLOWING X,Y,Z DISPLACEMENTS ARE IN GLOBAL COORDINATES

   NODE      UX              UY              UZ              ROTX            ROTY            ROTZ
    45   0.35784979E-03 -0.28391219E-03 -0.31734668E-04 -0.10371760E-05  0.59488184E-05 -0.34360284E-05

MAXIMUMS
NODE         45              45              45              45              45              45
VALUE    0.35784979E-03 -0.28391219E-03 -0.31734668E-04 -0.10371760E-05  0.59488184E-05 -0.34360284E-05

CURRENT LOAD CASE=   2

USE LOAD STEP     2  ITERATION     1  SECTION   1  FOR LOAD CASE     2

DISPLACEMENT STORED FOR   45 NODES

ITERATION SUMMARY INFORMATION STORED

NODAL FORCES STORED FOR   73 ELEMENTS

REACTIONS STORED FOR   12 REACTIONS

FOR LOAD STEP=     2  ITERATION=     1  SECTION=   1
 TIME=  0.000000E+00   LOAD CASE=  2
 TITLE= Stiffness of metal rack for lard can

NSEL  FOR LABEL= NODE  FROM    45 TO    45 BY    1

     1  NODES (OF     45  DEFINED) SELECTED BY  NSEL  COMMAND.

PRINT NODAL DISPLACEMENTS

        ***** POST1 NODAL DISPLACEMENT LISTING *****

 LOAD STEP     2  ITERATION=     1  SECTION=  1
```

```
 TIME=   0.00000E+00     LOAD CASE=  2

 THE FOLLOWING X,Y,Z DISPLACEMENTS ARE IN GLOBAL COORDINATES

   NODE      UX              UY              UZ              ROTX            ROTY            ROTZ
    45   0.34112088E-03 -0.27085966E-03 -0.34128612E-04 -0.10841691E-05  0.58063798E-05 -0.34427195E-05

MAXIMUMS
NODE         45              45              45              45              45              45
VALUE    0.34112088E-03 -0.27085966E-03 -0.34128612E-04 -0.10841691E-05  0.58063798E-05 -0.34427195E-05

CURRENT LOAD CASE=   3

USE LOAD STEP     3  ITERATION     1  SECTION   1  FOR LOAD CASE     3

DISPLACEMENT STORED FOR   45 NODES

ITERATION SUMMARY INFORMATION STORED

NODAL FORCES STORED FOR   73 ELEMENTS

REACTIONS STORED FOR   12 REACTIONS

FOR LOAD STEP=     3  ITERATION=     1  SECTION=   1
 TIME=  0.000000E+00   LOAD CASE=  3
 TITLE= Stiffness of metal rack for lard can

NSEL  FOR LABEL= NODE  FROM    45 TO    45 BY    1

     1  NODES (OF     45  DEFINED) SELECTED BY NSEL  COMMAND.

PRINT NODAL DISPLACEMENTS

        ***** POST1 NODAL DISPLACEMENT LISTING *****

 LOAD STEP     3  ITERATION=     1  SECTION=  1
 TIME=   0.00000E+00     LOAD CASE=  3

 THE FOLLOWING X,Y,Z DISPLACEMENTS ARE IN GLOBAL COORDINATES

   NODE      UX              UY              UZ              ROTX            ROTY            ROTZ
    45   0.34334118E-03 -0.28408584E-03  0.44013726E-04 -0.50799633E-06  0.58786265E-05 -0.34100264E-05

MAXIMUMS
NODE         45              45              45              45              45              45
VALUE    0.34334118E-03 -0.28408584E-03  0.44013726E-04 -0.50799633E-06  0.58786265E-05 -0.34100264E-05

ALL CURRENT POST1 DATA WRITTEN TO FILE07   NAME= FILE07.DAT
 FOR POSSIBLE RESUME FROM THIS POINT


***** ROUTINE COMPLETED *****  CP =        69.370

SYSTEM= 32053-PC/LT-4.4A   REVISION= 4.4      A  1
FOR SUPPORT CALL                   PHONE                TWX
CURRENT JOBNAME=FILE

/EOF ENCOUNTERED ON FILE 5

DATA INPUT WRITTEN ON FILE18


***** RUN COMPLETED *****  CP=       76.4600   TIME=   14.0275
```

84-3000-101 (5-89)

DON'T SAY IT --- *Write It!*

DATE 4/8/94

TO _____ FROM Jose Mejia

3 Rows of Land Can Racks with storage on both sides.

* 1ST Row is 18 feet long, 28 inches wide, 82 inches tall

* 2ND Row 18 feet long, 28 inches wide, 82 inches tall

* 3RD Row is 7 feet long, 28 inches wide, 82 inches tall. (over)

"TO MAKE LIFE LAST, PUT SAFETY FIRST"

The 18' Row is made up of 5 sections

The 7' Row is made up of 2 sections

Each Row is 4 land cans high

Each section has 24 pieces of angle iron, 28" long

Call me if you have any question.

Jose Mejia
373-2541

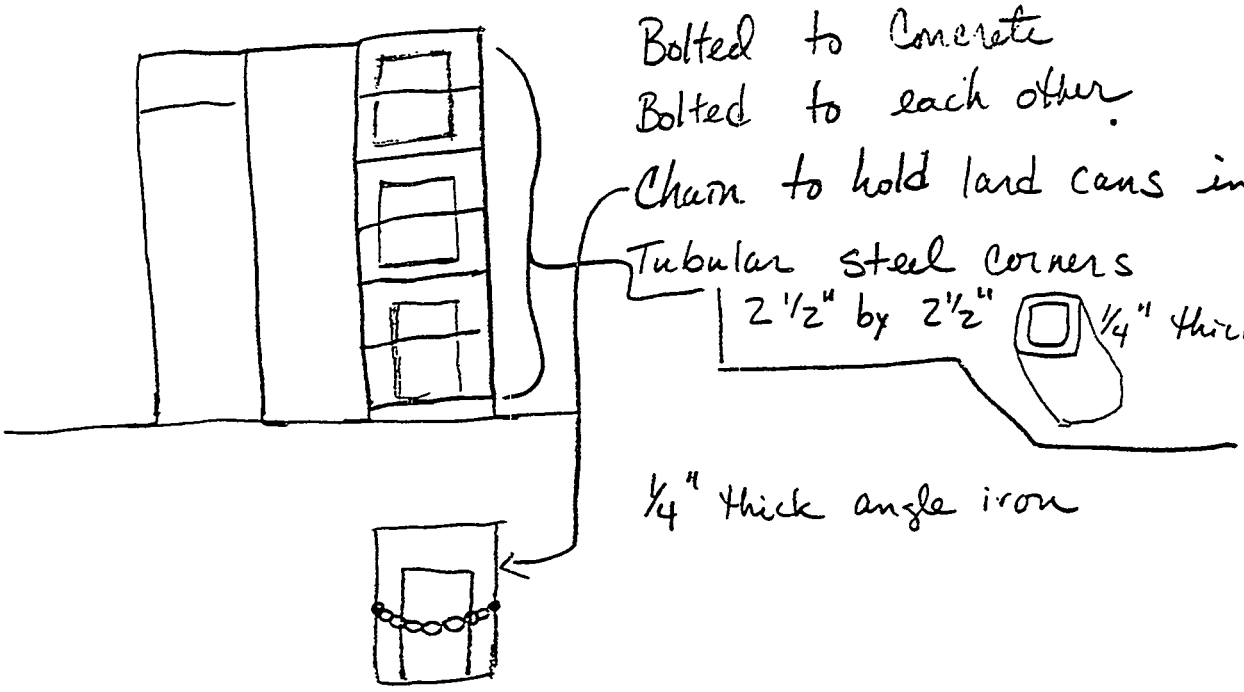
WHC-SD-CP-SA-026
Rev 1, Page B-27

2736Z Vault #2

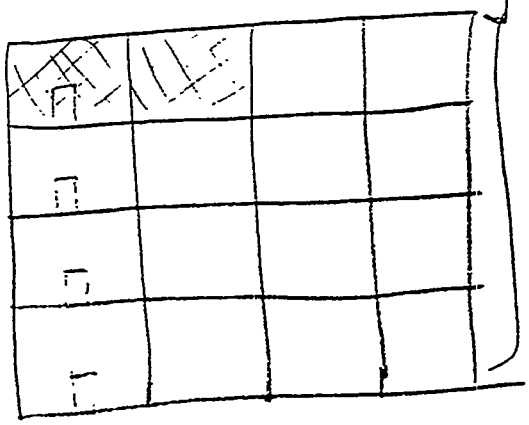
Call if any questions
Jose Mejia
373-2541

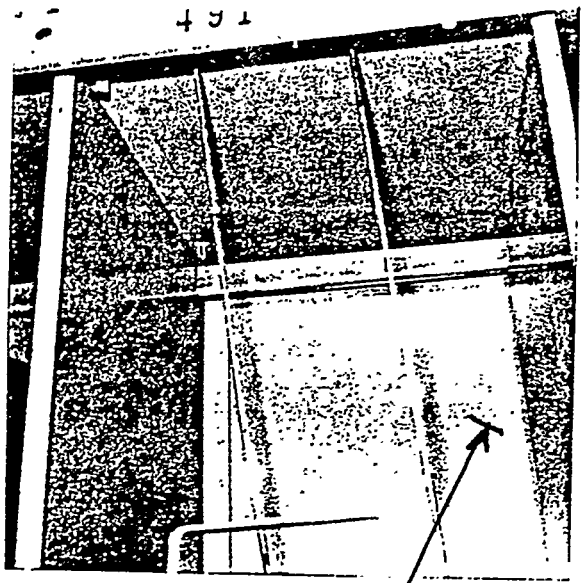
WHC-SD-CP-SA-02
Rev 1, Page B-28

Land can racks (5 gallon container) (3 Racks)

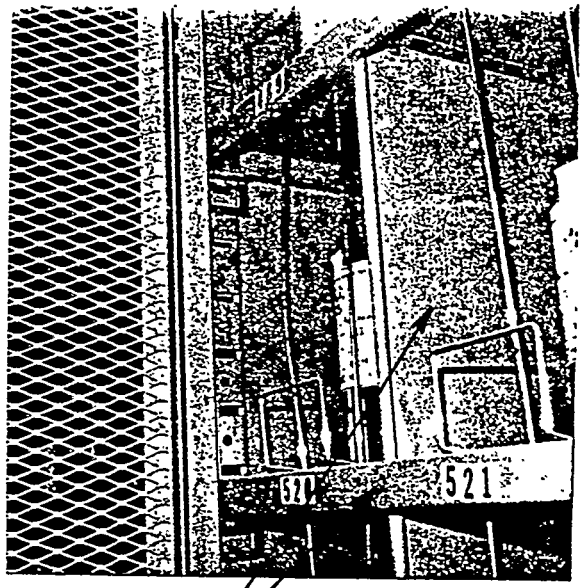


7" Can Storage





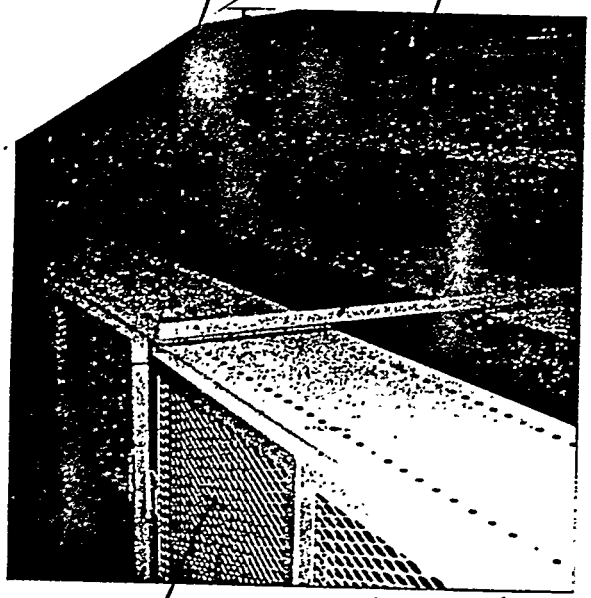
1/16" Sheet Metal



1/16" Sheet Metal

1/16" Sheet Metal

L 1x1x1/8

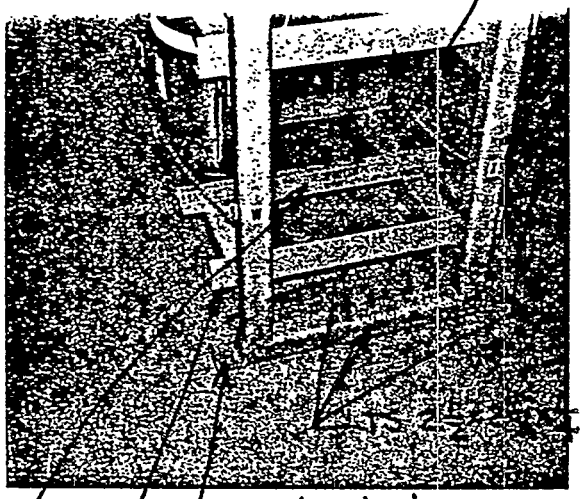


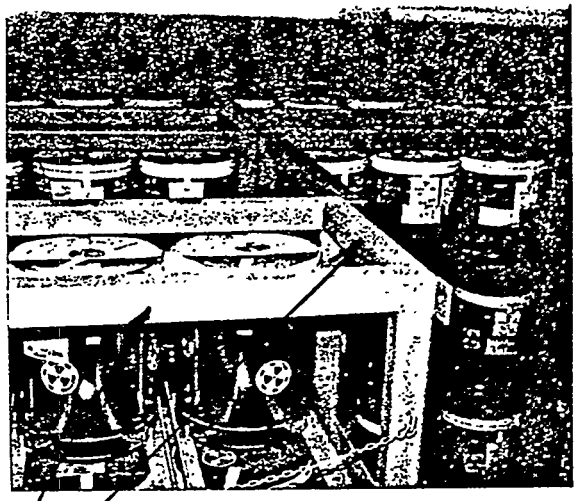
20 Ga. diagonal Mesh

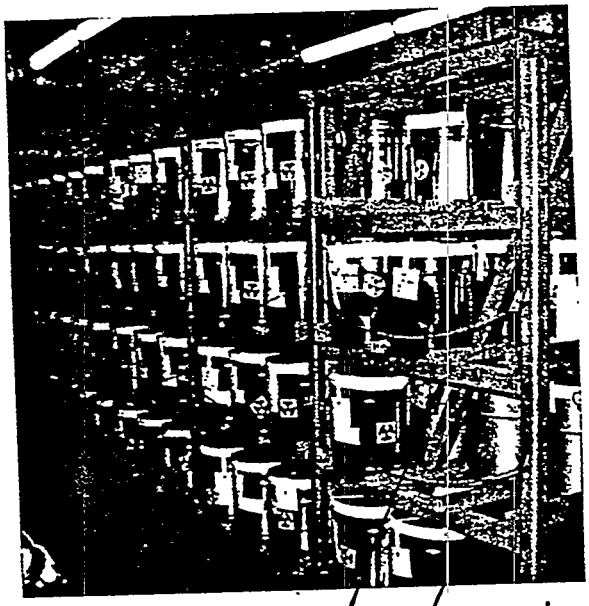


7-in Can

7-IN METAL STORAGE CAN RACK IN BLDG. 2736-Z VAULT 2 (INSIDE & OUTSIDE OF EACH COMPARTMENT OF CAN STORAGE SHOWN)









LARD CAN METAL STORAGE RACK
(2736-Z BLDG.)

ANALYTICAL CALCULATIONS

Subject Lard Can Storage Rack, 2736-Z Bldg.

Originator M.A. Islam Date 9/28/94

Checker E.O. Weiner Date 10/26/94

Scope

Re-analyze the lard can storage rack to satisfy the requirements of Safety Class 1. The earlier analysis (WHC-SD-CP-SA-026, Rev. 0) considered it to be a Safety Class 3 item and found that the rack was inadequate. Therefore, this analysis will first verify the as-built condition and later, will provide an analysis with braces at the top of the racks. The braces were recommended in the earlier analysis.

The re-analysis will use the seismic response spectra developed for Building 2736-Z.

Criteria

1. Seismic accelerations per response spectra of the Building 2736-Z.
2. Steel evaluations per AISC 8th Edition, F_y = 36,000 psi
3. Existing concrete anchor allowables per Guideline, WHC-SD-GN-DGS-30006, Rev. 1, Chapter 8.
4. New concrete anchors per SDC-4.2, Rev. 0
5. Seismic evaluation per UCRL-15910 and SDC-4.1, Rev. 12.

Reference Drawings: As shown in Rev. 0

Conclusions

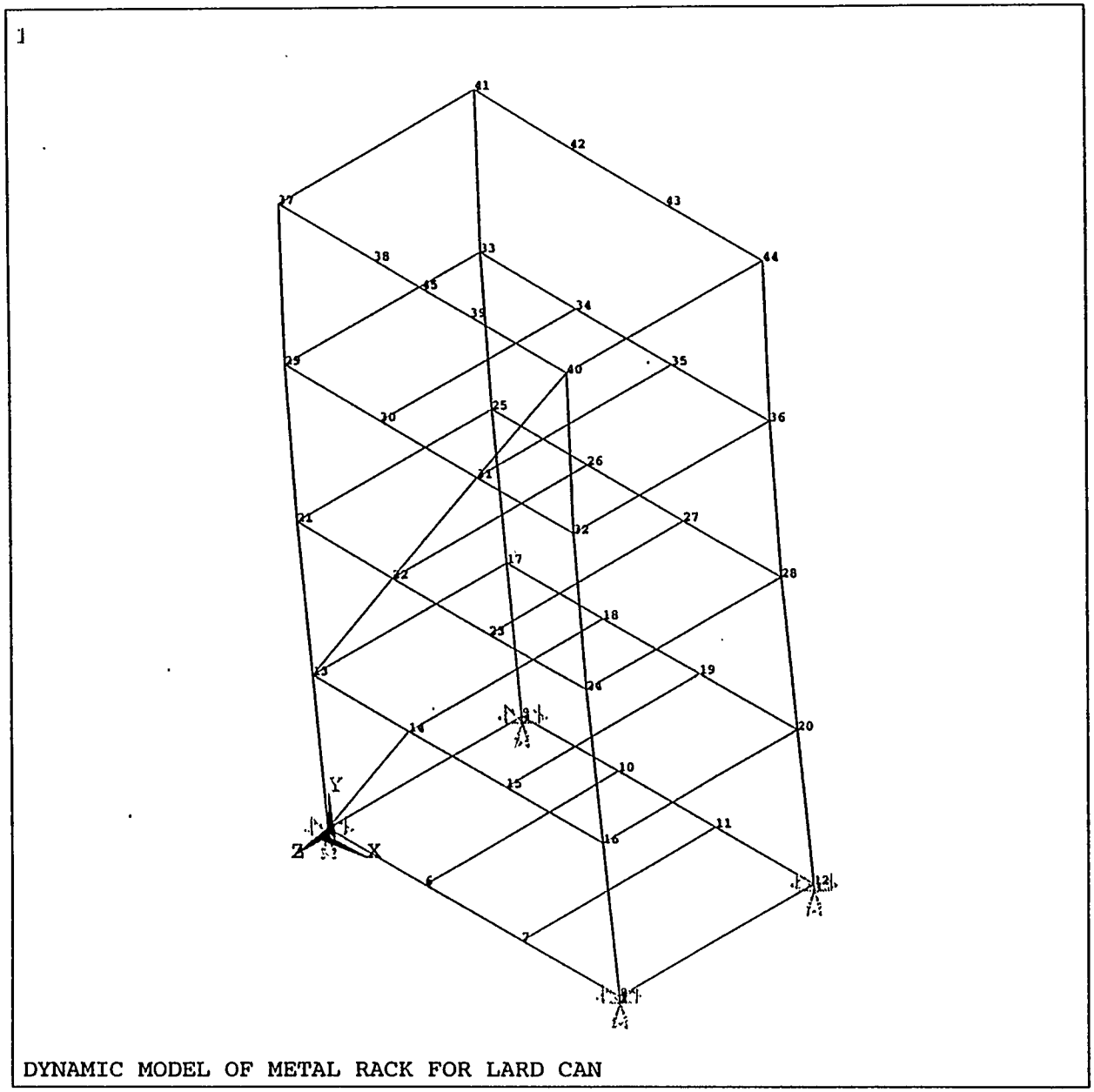
With the addition of the new braces at the top of the storage rack, the lard can storage rack and the chain are adequate to withstand seismic (DBE) loads.

```
/PREP7
/TITLE,DYNAMIC MODEL OF METAL RACK FOR LARD CAN
antype,modal
mxpand,2
modort,subsp,2
/view,1,1,1,1
/com                          Filename: lard
/com
/com
/com
/com                          Input by: CJM          Chk by: MAI
/com
/com
et,1,4                                * beam element
et,2,mass21,,,2                       * mass element
/com
/com,kan,0
mp,ex,1,29e6
mp,dens,1,.000734             * steel
/com
n,1
n,2,,,-28
n,3,42,,-28
n,4,42
n,5,,1
n,6,14,1
n,7,28,1
n,8,42,1
ngen,2,4,5,8,1,,,-28
ngen,5,8,5,12,1,,20.5
n,45,21,83
r,1,2.09,1.69,1.69,2.5,2.5,,,3.9      *Columns & long horizontals
r,2,1.19,1.09,1.09,4,4,,,.026         *L3x2x1/4
r,3,1.38,.277,.576,3,2.07,,,.03       *2L1 1/2 x 1 1/2 x 1/4
r,4,0.06475
r,5,0.1295
mat,1
type,1
real,1
e,1,5
e,5,13
egen,4,8,-1
e,2,9
e,9,17
egen,4,8,-1
e,3,12
e,12,20
egen,4,8,-1
```

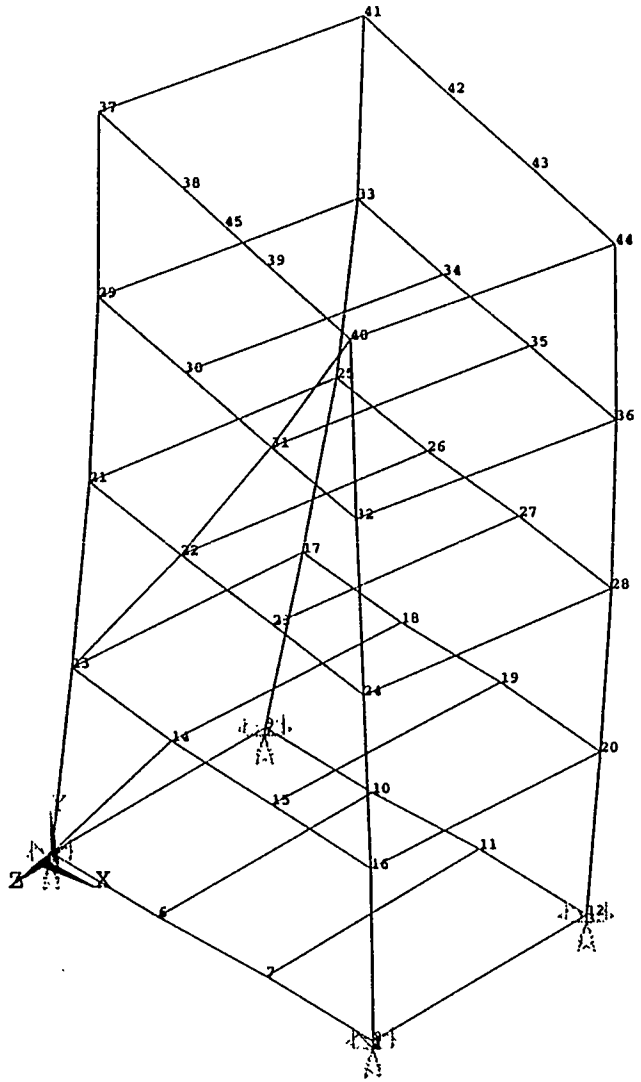
AS-BUILT MODEL

```
e,4,8
e,8,16
egen,4,8,-1
e,5,6
egen,3,1,-1
egen,2,4,21,23
egen,4,8,21,26
e,37,38
e,38,45
e,45,39
e,39,40
e,41,42
egen,3,1,-1
e,5,14
e,13,22
egen,3,9,-1
real,2
e,5,9
egen,5,8,-1
e,8,12
egen,5,8,-1
real,3
e,6,10
egen,2,1,-1
egen,4,8,66,67
type,2
real,4
en,74,5
en,75,8
en,76,9
en,77,12
en,78,13
en,79,16
en,80,17
en,81,20
en,82,21
en,83,24
en,84,25
en,85,28
en,86,29
en,87,32
en,88,33
en,89,36
real,5
en,90,6
en,91,7
en,92,10
en,93,11
```

```
en,94,14
en,95,15
en,96,18
en,97,19
en,98,22
en,99,23
en,100,26
en,101,27
en,102,30
en,103,31
en,104,34
en,105,35
/com
/com
d,1,ux,,,4,1,uy,uz
/com
/com,f,45,fx,1                  * Unit load along X
/com,lwrite
/com,fdele,45,fx
/com,f,45,fy,1                  * Unit load along Y
/com,lwrite
/com,fdele,45,fy
/com,f,45,fz,1                  * Unit load along Z
/com,nlist,all
/com,elist,all
/com,lwrite
/com,afwrite
finish
/solu
solve
finish
/solu
expass,on
mxpand,2
solve
finish
/postl
set,list
```



DYNAMIC MODEL OF METAL RACK FOR LARD CAN



DYNAMIC MODEL OF METAL RACK FOR LARD CAN

ANSYS 5.0 A
FEB 15 1995
11:21:44
PLOT NO. 3
DISPLACEMENT
STEP=1
SUB =2
FREQ=20.021
RSYS=0
DMX =1.01
U

*DSCA=10
XV =1
YV =1
ZV =1
DIST=57.06
XF =25.29
YF =41.527
ZF =-14.611
CENTROID HIDDEN

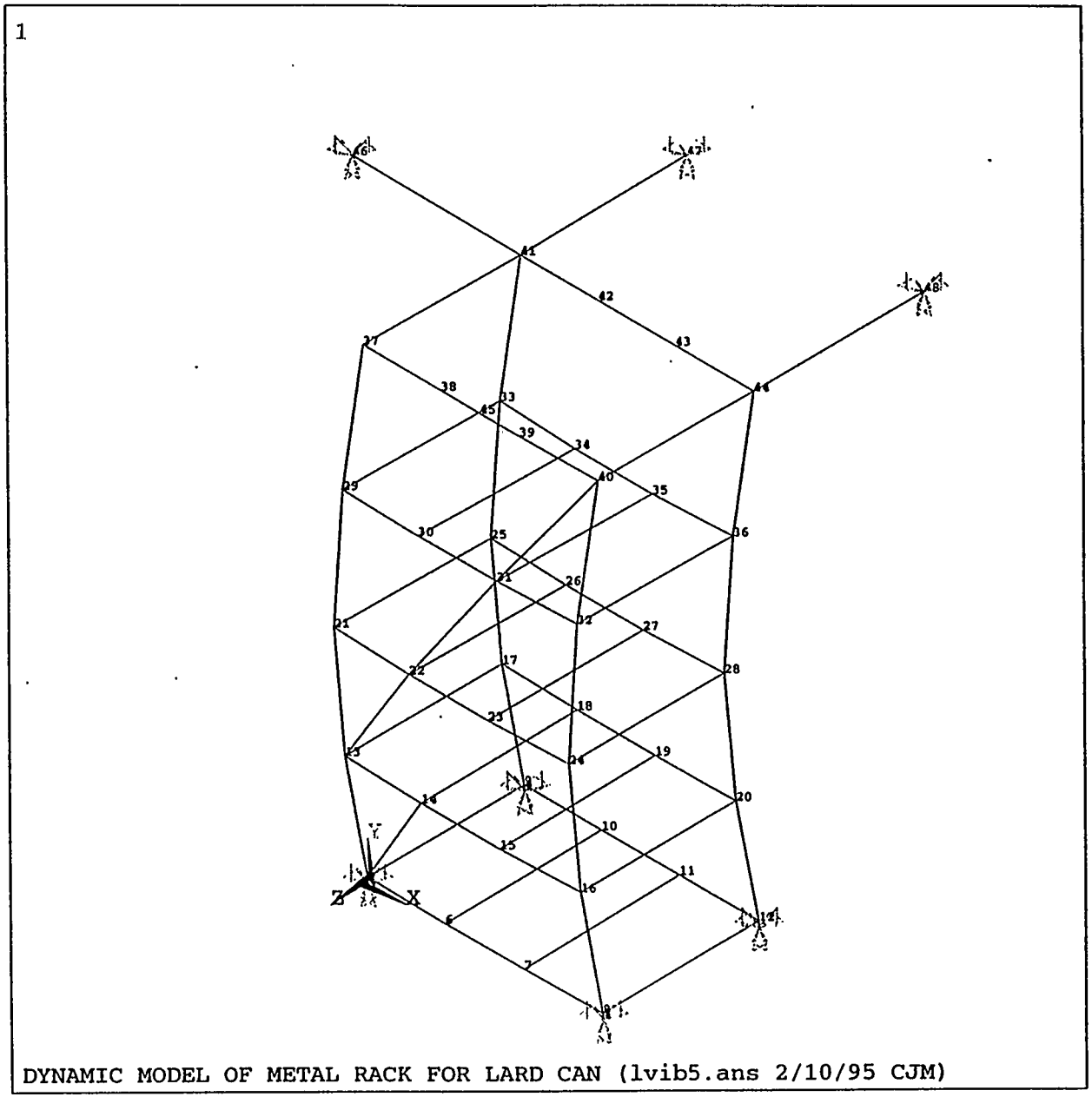
```
/PREP7
/TITLE,DYNAMIC MODEL OF METAL RACK FOR LARD CAN (lvib5.ans 2/10/95 CJM)
antype,modal
mxpand,4
modort,subsp,4
/view,1,1,1,1
/com                    Filename: lard
/com
/com
/com
/com                    Input by: CJM      Chk by:   MAI
/com
/com
et,1,4                      * beam element
et,2,mass21,,,2               * mass element
/com
/com,kan,0
mp,ex,1,29e6
mp,dens,1,.000734           * steel
/com
n,1
n,2,,,-28
n,3,42,,-28
n,4,42
n,5,,1
n,6,14,1
n,7,28,1
n,8,42,1
ngen,2,4,5,8,1,,,-28
ngen,5,8,5,12,1,,20.5
n,45,21,83
n,46,-30,83,-28
n,47,0,83,-58
n,48,42,83,-58
r,1,2.09,1.69,1.69,2.5,2.5,,,3.9      *Columns & long horizontals
r,2,1.19,1.09,1.09,4,4,,,.026         *L3x2x1/4
r,3,1.38,.277,.576,3,2.07,,,.03       *2L1 1/2 x 1 1/2 x 1/4
r,4,0.06475
r,5,0.1295
r,6,.94,.35,.35,2.,2.
r,7,.47,.175,.175,2.,2.
mat,1
type,1
real,1
e,1,5
```

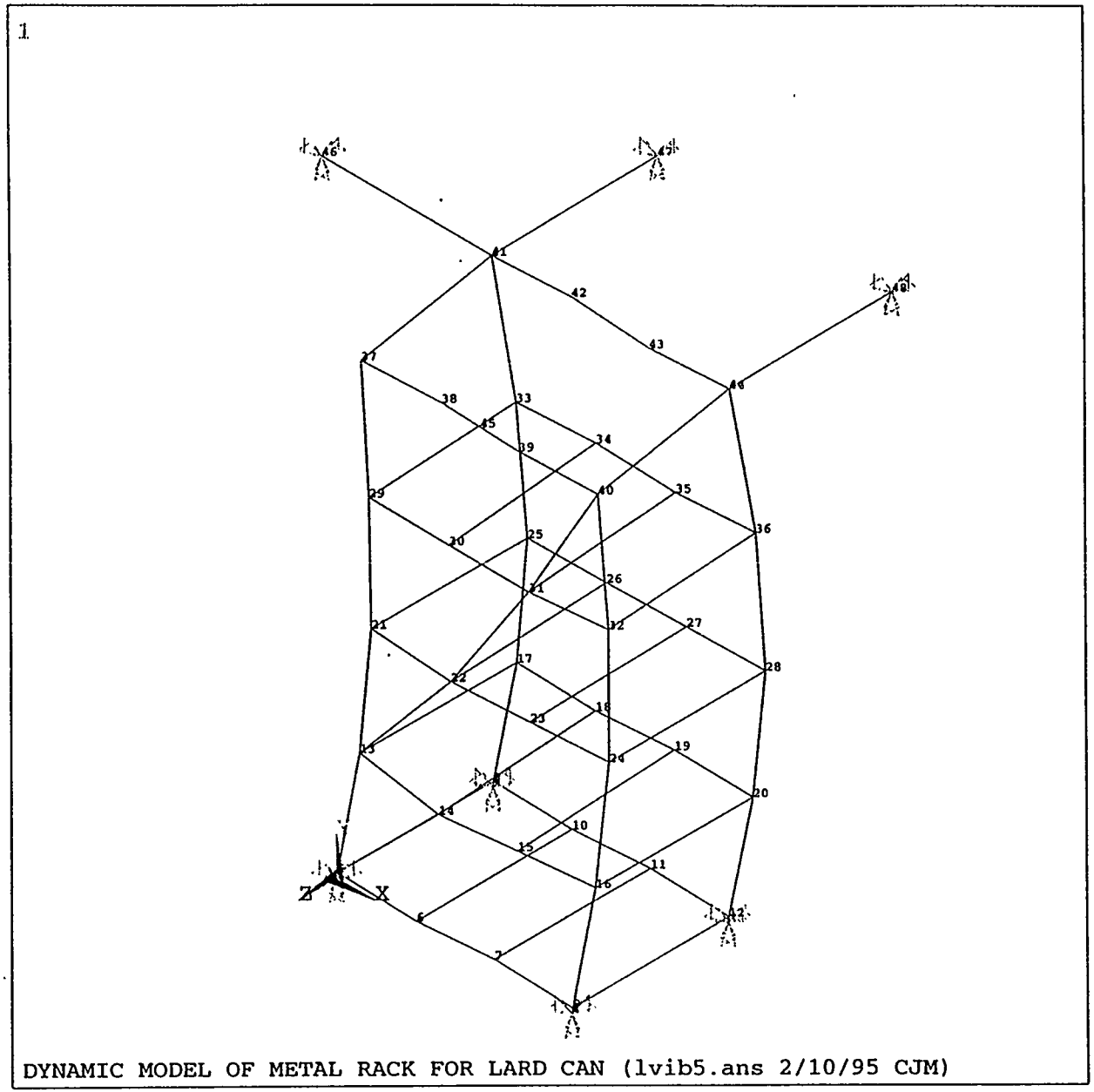
MODEL W/BRACE

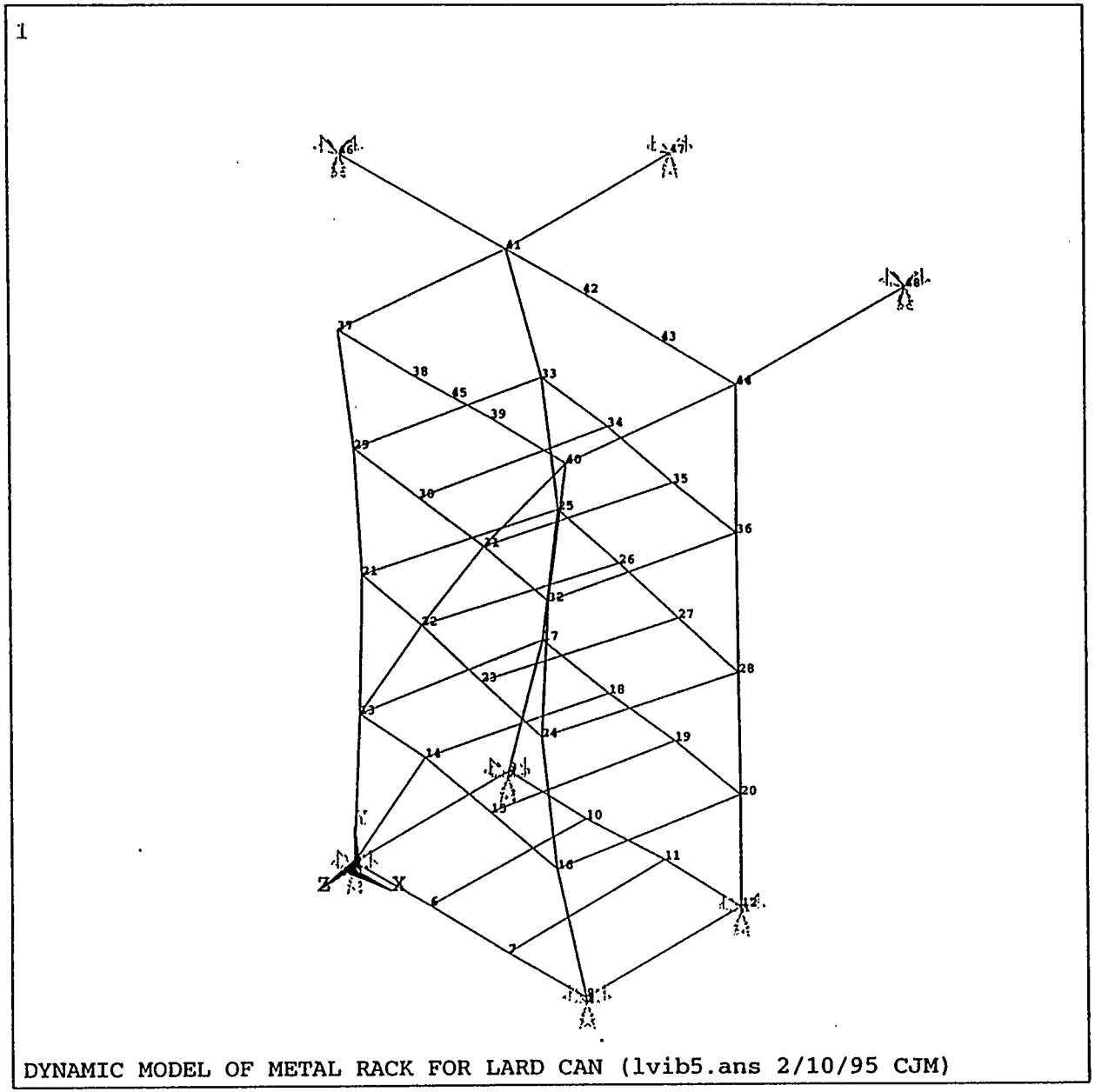
```
e,5,13
egen,4,8,-1
e,2,9
e,9,17
egen,4,8,-1
e,3,12
e,12,20
egen,4,8,-1
e,4,8
e,8,16
egen,4,8,-1
e,5,6
egen,3,1,-1
egen,2,4,21,23
egen,4,8,21,26
e,37,38
e,38,45
e,45,39
e,39,40
e,41,42
egen,3,1,-1
e,5,14
e,13,22
egen,3,9,-1
real,2
e,5,9
egen,5,8,-1
e,8,12
egen,5,8,-1
real,3
e,6,10
egen,2,1,-1
egen,4,8,66,67
real,6
en,106,46,41
en,107,47,41
real,7
en,108,48,44
type,2
real,4
en,74,5
en,75,8
en,76,9
en,77,12
en,78,13
```

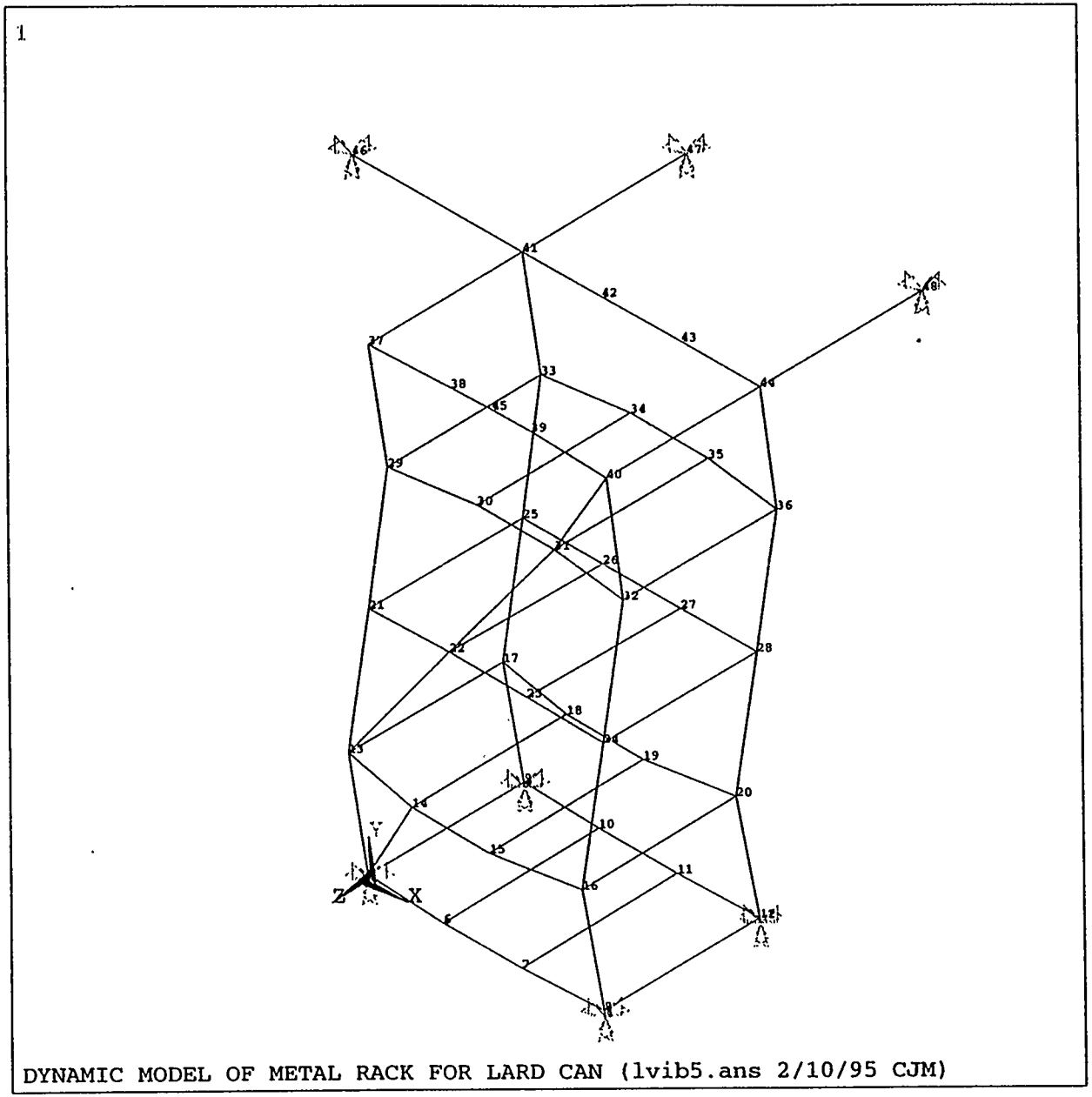
```
en,79,16
en,80,17
en,81,20
en,82,21
en,83,24
en,84,25
en,85,28
en,86,29
en,87,32
en,88,33
en,89,36
real,5
en,90,6
en,91,7
en,92,10
en,93,11
en,94,14
en,95,15
en,96,18
en,97,19
en,98,22
en,99,23
en,100,26
en,101,27
en,102,30
en,103,31
en,104,34
en,105,35
/com
/com
d,1,ux,,,4,1,uy,uz
d,46,ux,0.0
d,46,uy,0.0
d,46,uz,0.0
d,47,ux,0.0
d,47,uy,0.0
d,47,uz,0.0
d,48,ux,0.0
d,48,uy,0.0
d,48,uz,0.0
/com
/com,f,45,fx,1          * Unit load along X
/com,lwrite
/com,fdele,45,fx
/com,f,45,fy,1          * Unit load along Y
```

```
/com,lwrite
/com,fdele,45,fy
/com,f,45,fz,1          * Unit load along Z
/com,nlist,all
/com,elist,all
/com,lwrite
/com,afwrite
finish
/solu
solve
finish
/solu
expass,on
mxpand,4
solve
finish
/post1
set,list
```


1
ANSYS 5.0 A
FEB 15 1995
11:31:46
PLOT NO. 1
DISPLACEMENT
STEP=1
SUB =1
FREQ=32.442
RSYS=0
DMX =0.681471
U
DSCA=9.753
XV =1
YV =1
ZV =1
DIST=68.04
XF =6.066
YF =41.562
ZF =-25.678
CENTROID HIDDEN
DYNAMIC MODEL OF METAL RACK FOR LARD CAN (lvib5.ans 2/10/95 CJM)


1
ANSYS 5.0 A
FEB 15 1995
11:32:04
PLOT NO. 2
DISPLACEMENT
STEP=1
SUB =2
FREQ=32.785
RSYS=0
DMX =0.618411
U
DSCA=10.747
XV =1
YV =1
ZV =1
DIST=68.176
XF =9.268
YF =41.68
ZF =-28.814
CENTROID HIDDEN
Z
X
DYNAMIC MODEL OF METAL RACK FOR LARD CAN (lvib5.ans 2/10/95 CJM)

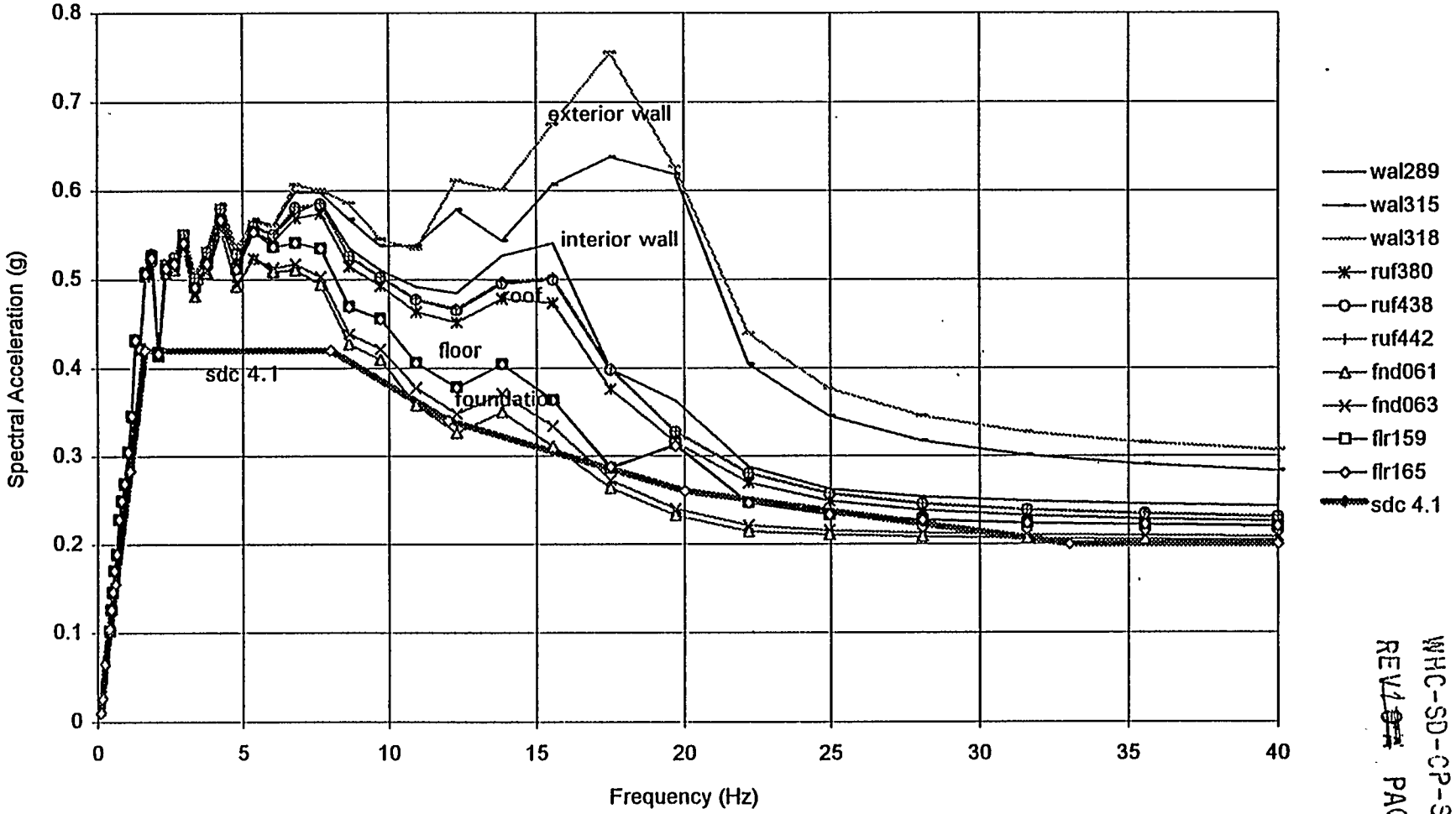

1
ANSYS 5.0 A
FEB 15 1995
11:32:47
PLOT NO. 3
DISPLACEMENT
STEP=1
SUB =3
FREQ=44.527
RSYS=0
DMX =0.848008
U
DSCA=7.838
XV =1
YV =1
ZV =1
DIST=68.685
XF =8.312
YF =41.625
ZF =-26.613
CENTROID HIDDEN
Z
X
DYNAMIC MODEL OF METAL RACK FOR LARD CAN (lvib5.ans 2/10/95 CJM)



ANSYS 5.0 A
FEB 15 1995
11:33:02
PLOT NO. 4
DISPLACEMENT
STEP=1
SUB =4
FREQ=68.77
RSYS=0
DMX =0.828097
U

DSCA=8.026
XV =1
YV =1
ZV =1
DIST=68.002
XF =6.105
YF =41.5
ZF =-25.678
CENTROID HIDDEN

PLUTONIUM VAULT ACCELERATIONS
X HORIZONTAL 0.216 g, SDC 4.1 REV. 12, SEISMIC TIME HISTORY #1
ABSOLUTE SPECTRAL ACCELERATIONS AT NODAL PTS
0.050 DAMPING, MAX g = 0.755 AT FREQ. = 17.5 HZ
(1/26/95 CJM)



Subject Lard Can Rack
Originator M.A. ISLAM Date 2/17/95
Checker E. E. O'Connell Date 2/18/95

AS-BUILT MODEL

Refer to modal analysis result, page B-35

Lowest frequency = 16 Hz

Applying this frequency to response spectra curve, page B-45

Acceleration > .7 g. This falls within the peak. This also implies that a dynamic analysis needs to be performed to satisfy the requirements of Safety Class (SC) 1 items.

However, earlier analysis per Rev. 0 determined that the rack is not adequate at seismic acceleration of .68 g which is less than .7 g. Therefore, providing braces at the top of the rack is justified.

MODEL w/BRACE @ TOP

Refer to modal analysis results, page B-41

Lowest frequency @ mode 1 = 32 Hz

Applying frequency of 32 Hz to response spectra curve, page B-45

Acceleration = .33 g (Rigid region)

This acceleration of .33g is much less than .68 g which was used to design the braces and connection at the top of the panel. This design was performed before the response spectra of the building was developed. Using .33g could downsize some steel and bolts, however, it will not be a cost-effective effort. Therefore, accept the design of the braces as shown in this report.

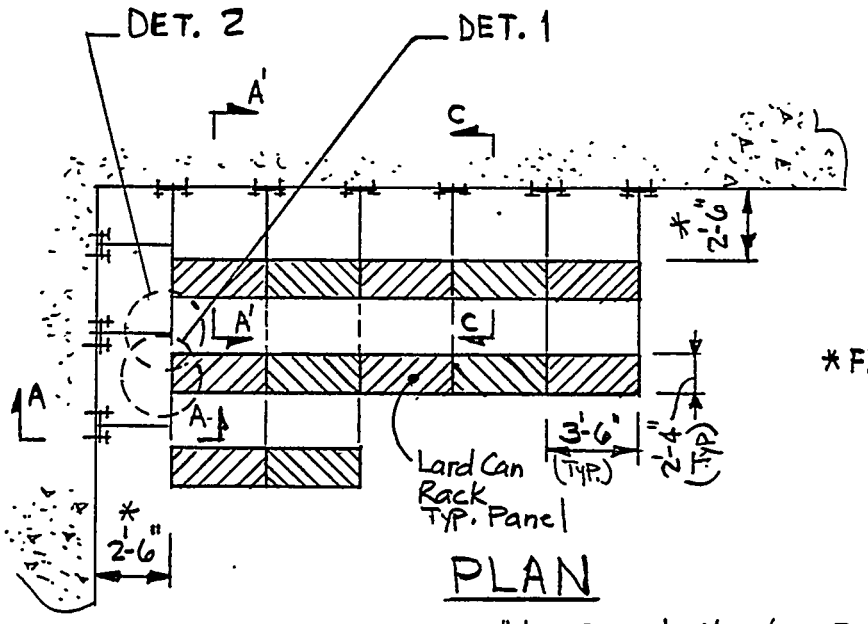
ANALYTICAL CALCULATIONS

Page ____ of ____

Subject Lard Can Storage Rack

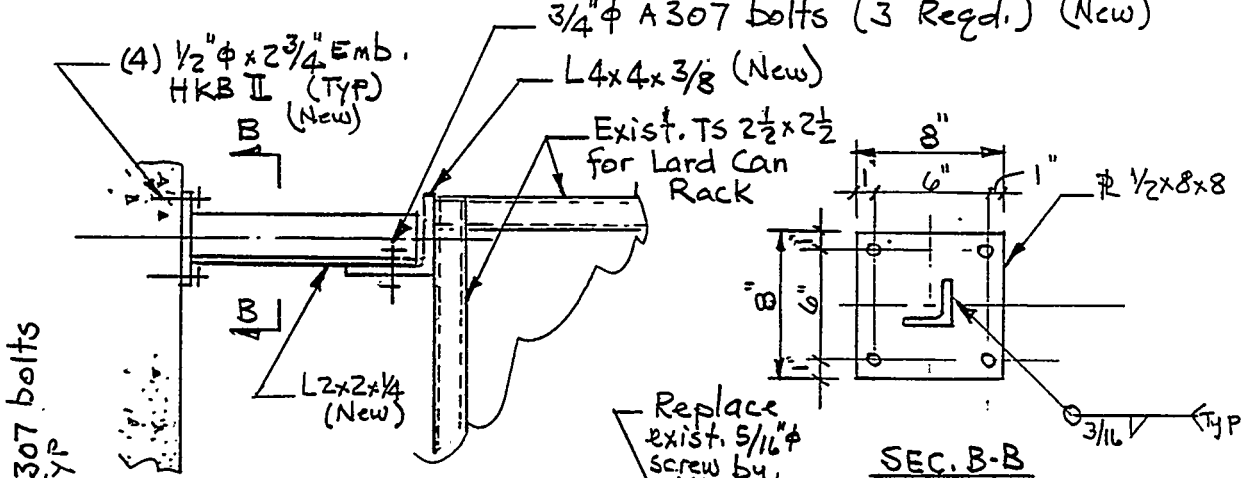
Originator M.A. ISLAM Date 9/22/94

Checker E.O. Werner Date 10/26/94



PLAN

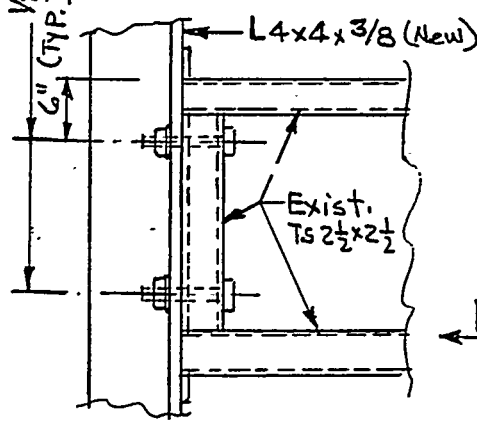
* Field Measured



SEC. A-A

SEC. B-B

SEC. C-C



DET. 1

(Note: All angles can be rotated for construction convenience)

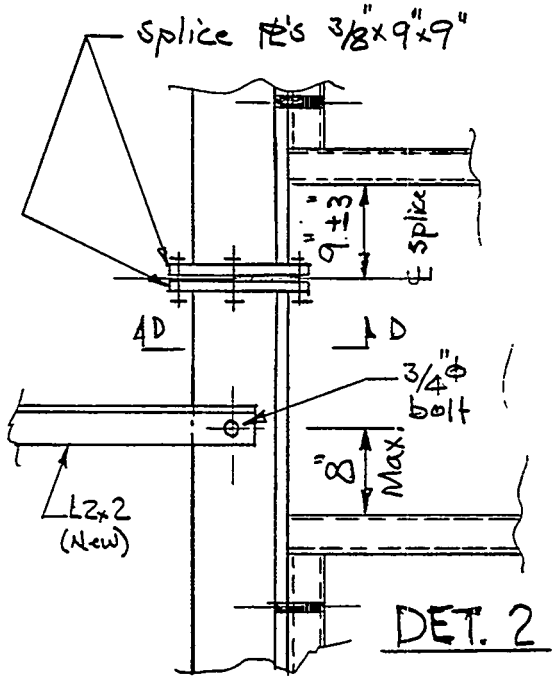
ANALYTICAL CALCULATIONS

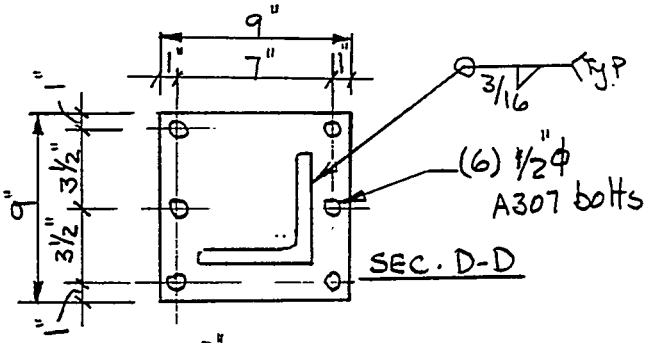
Page ____ of ____

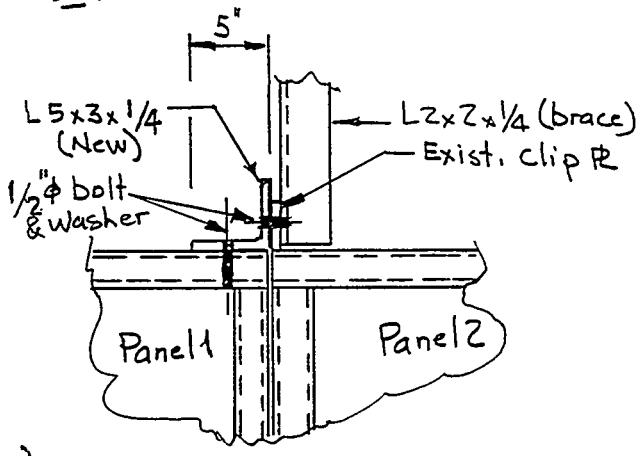
Subject Lard Can Storage Rack

Originator M.A. ISLAM Date 9/22/94

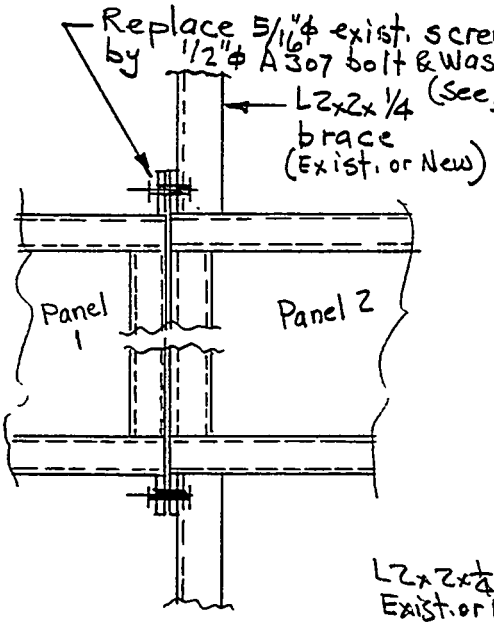
Checker E.D. Weaver Date 10/26/94



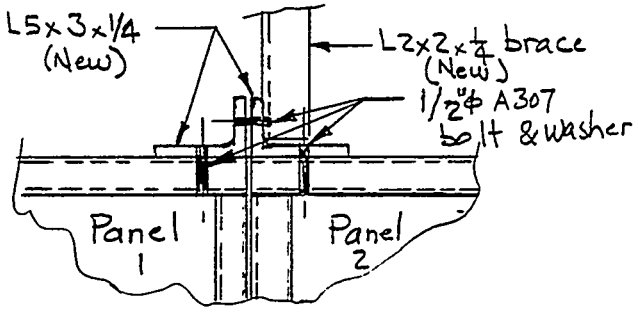




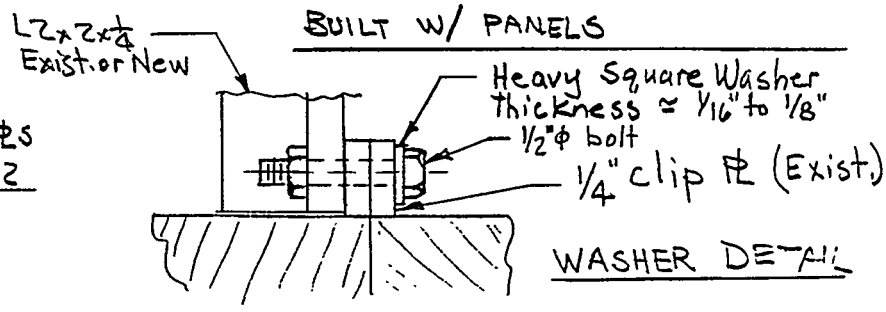
PLAN SHOWING CLIP Pls BUILT W/ PANEL 2 ONLY



PLAN SHOWING CLIP Pls BUILT W/ PANELS 1 & 2



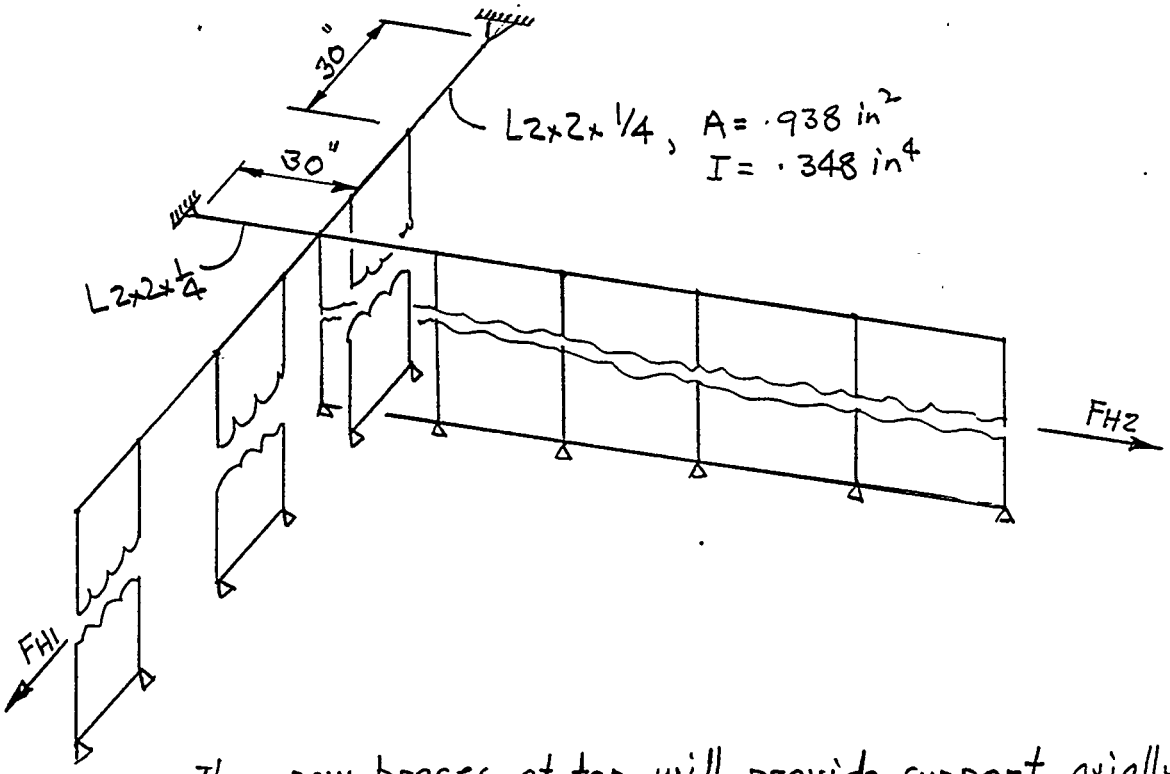
PLAN SHOWING NO CLIP Pl & BRACE BUILT W/ PANELS



WASHER DETAIL

Subject Lard Can Storage Rack
Originator M.A. ISLAM Date 9/23/94
Checker E.O. Werner Date 10/26/94

Anchor Evaluation



The new braces at top will provide support axially and out of plane which may be neglected because of insignificant bending stiffness. This may be demonstrated as follows:

Axial stiffness, $K_A = \frac{AE}{L} = \frac{.938 \times 29 \times 10^6}{30} = .907 \times 10^6$ #/in

Bending Stiffness, $K_B = \frac{3EI}{L^3} = \frac{3 \times 29 \times 10^6 \times .348}{30^3} = .0011 \times 10^6$ #/in

Axial distribution = $\frac{.907}{.907 + .0011} = .999$

Out of Plane = .0012 ≃ Neglect

This indicates that top support will provide in-plane support only. Therefore, no load will be transferred from one direction to other.

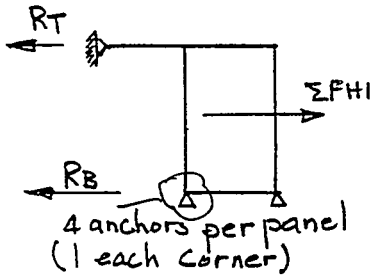
Subject Lard Can Storage Rack
Originator M. A. ISLAM Date 9/23/94
Checker E.O. Weiner Date 10/26/94

Transverse

3 panels @ $F_{H1} = 1292^{\#}$ per panel

$\therefore \Sigma F_{H1} = 3 \times 1292 = 3876^{\#}$

* In reality this could be $1292 \times \frac{.33}{.168} = 627^{\#}$ (New accln. / previous accln.)



$\therefore R_T = 3876/2 = 1938^{\#}$ per row of panels

$R_B = \frac{3876}{2 \times (4 \times 3)} = 162^{\#}$ per anchor

(2 = #s of anchors; (4×3) = #s of panel)

Longitudinal

5 panels @ $F_{H2} = 1292^{\#}$ per panel

$\therefore \Sigma F_{H2} = 5 \times 1292 = 6460^{\#}$

Similar to transverse direction,

$R_T = \frac{6460}{2} = 3230^{\#}$ per row of panels

$R_B = \frac{6460}{2 \times (4 \times 5)} = 162^{\#}$ per anchor

Vertical direction is inactive, because, no pullout will develop at the base anchors.

For braces and their bases, use $R_T = 3230^{\#} > 1938^{\#}$

and $\Sigma R_B = \sqrt{(162)^2 + (162)^2} = 229^{\#}$ per anchor (shear)

ANALYTICAL CALCULATIONS

Page ____ of ____

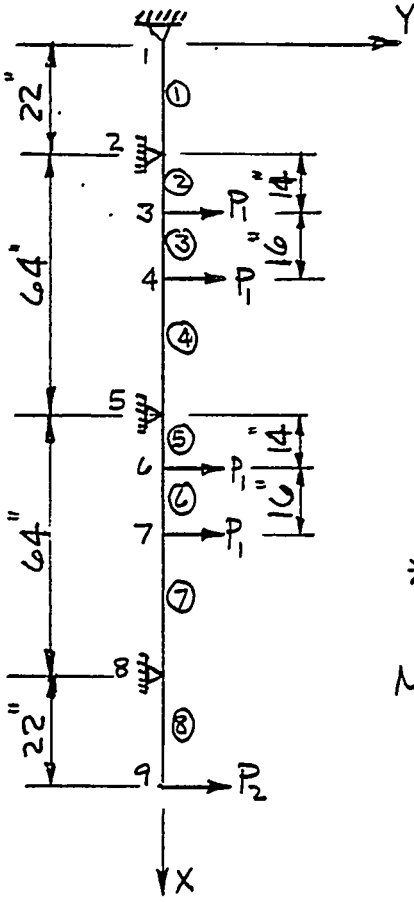
Subject Lard Can storage Rack

Originator M. A. ISLAM Date 9/23/94

Checker EO Weiner Date 10/26/94

Evaluate Reactions @ Braces by ANSYS, Rev 5.0

(ANSYS Input and results are shown in Pages B-58 thru B-61)



$$P_1 = \frac{3230}{2} = 1615^{\#}$$

$$P_2 = \underbrace{2}_{\text{Panels}} \times 1292 \times \underbrace{\frac{1}{2}}_{\text{Top}} = 1292^{\#}$$

Refer to ANSYS run output,

Max. Reaction @ Node 5 = $3144^{\#}$

" @ " 1 = $847^{\#}$ *

* this will be shear to base Pt in addition to pullout load from transverse direction

Max. Bending Moment in elements 1 thru 8

= $28{,}424^{\#\text{-in}}$ @ Elem ⑦ or ⑧

Use these forces to design base Pt, brace and connections.

ANALYTICAL CALCULATIONS

Page ____ of ____

Subject Lard Can Storage Rack

Originator M.A. ISLAM Date 9/23/94

Checker EO Weiner Date 10/26/94

Base anchor

For 1/4"ϕ anchor per WHC-SD-GN-DGS-30006, Rev 1
Table 8.3 (Prorated) 3/8"ϕ capacity

Allow. $T = \left(\frac{1.46}{.11}\right) \times \frac{\pi}{4}(.25)^2 \times .6 \times .75 = 293^{\#}$ | * Reduction due to Unknown type of anchor

(Area of 3/8" / Area of 1/4")

" $V = 293 \times \left(\frac{1.42}{1.46}\right) = 285^{\#}$ (for 3/8"ϕ)

** Reduction due to Reduced Inspection (Tightness, Emb. Length check ignored)

$\therefore$ Interaction, $I = \frac{229}{285} = .8 < 1.$ OK, M.S. = .24

Top Base Pl

Long. Direction, $T = \frac{3144}{4} = 786^{\#}$ (ANSYS) and no shear

Trans. " , $T = \frac{1938}{4} = 485^{\#}$; shear $= \frac{847}{4} = 212^{\#}$ (ANSYS)

$\therefore$ Use enveloped loads.

For $\frac{1}{2}$"ϕ x 2 3/4" Emb., per SDC-4.2, Rev 0
HKB II

$T_{all.} = 1230^{\#}$
$V_{all.} = 1470^{\#}$
} for Carbon steel & Emb. = 2 1/4" and *f_c' = 3000 Psi

* conservative actually, f_c' = 4000 Psi

For $T = 786^{\#}$ and $V = 212^{\#}$

$\therefore$ Interaction, $I = \frac{786}{1230} + \frac{212}{1470} = .78 < 1.$ OK

M.S. = .28

Check base Pl

$M = 2T(\text{arm}) = 2 \times 786 \times 2''$ (#s anchor, max.) $= 3144^{\#\text{-in}}$

$S = 8 \times \frac{.5^2}{6} = .33\ in^3$

$\sigma_b = \frac{3144}{.33} = 9527\ Psi < .75 \times 36000$ OK

M.S. = $\frac{.75 \times 36000}{9527} - 1 = 1.83$

Subject Lard Can Storage Rack
Originator M.A. ISLAM Date 9/26/94
Checker EO Weiner Date 10/26/94

Check Top Connection L2x2x1/4 (New)

Max. axial load = 3144 # (from ANSYS)

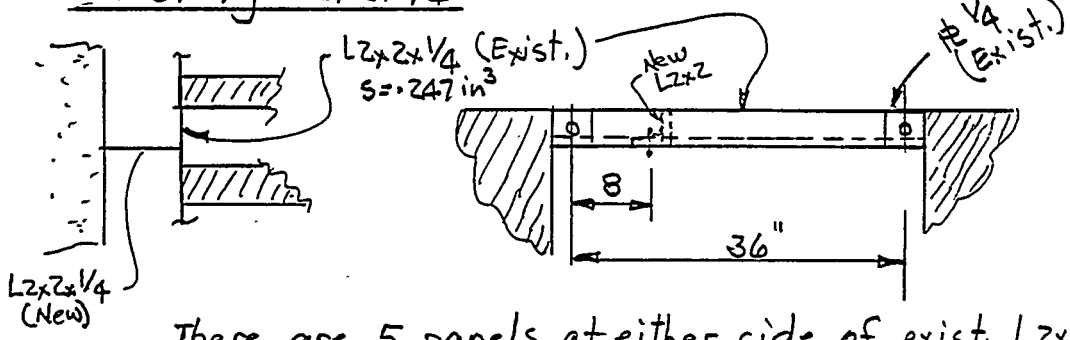
KL/r_{min} = 1x30/.391 = 77 $\Rightarrow$ $F_{allow.}$ = 15690 #/in² (AISC 8th Ed.)

$\therefore \sigma = \frac{3144}{1.938} = 3352$ Psi < 15690 Psi OK

(1.938 = area of L2x2)

M.S. = $\frac{15690}{3352} - 1 = 3.68$

Existing L2x2x1/4



There are 5 panels at either side of exist. L2x2

$\therefore$ Max. Load = 5x1292x$\frac{1}{2}$ (Top) = 3230 #

Max. Moment = $\frac{28}{36}$ x 3230 x 8 = 20098 #-in

Bending stress, $\sigma_b = \frac{20098}{.247} = 81368$ Psi > 1.6x36000 x1.33* (N.G.) = 28800 Psi

Replace exist. L2x2x1/4 by L4x4x3/8 (As input in ANSYS)

Section Modulus of L4x4x3/8, s = 1.52 in³

Max. Moment = 28,424 #-in (from ANSYS)

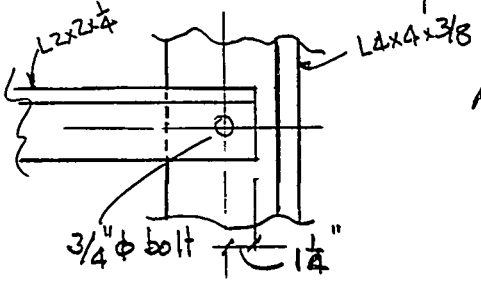
$\sigma_b = \frac{28424}{1.52} = 18,700$ x 1.3 (increase for unsymmetrical bending) = 24,310 Psi < 28,800 Psi OK M.S. = .18

* For seismic load, allow. stress can be increased by 33⅓% (AISC 8th Ed.)

Subject Lard Can Storage Rack
Originator M. A. ISLAM Date 9/26/94
Checker E.O. Weimer Date 10/26/94

Check Bolt betn. L2x2 & L4x4

Max. Load per bolt = 3144 #



Allowable bolt load in shear
= 10000 #/in² × $\frac{\pi}{4}(.75)^2$
= 4400 # > 3144 # OK
M.S. = .4

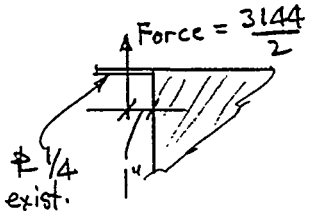
shear area in L2x2x1/4 = .25 x 1.25 x 2 = .625 in²

$\tau = \frac{3144}{.625} = 5030$ #/in² < .4 x 36000 x 1.33 OK

Bearing area in L2x2x1/4 = .25 x .75 = .1875 in²

$\sigma_{bear.} = \frac{3144}{.1875} = 16{,}768$ Psi
< .9 Fy = .9 x 36000 x 1.33 = 43,100 Psi OK

Connection betn. L4x4 (New) & ℄ 1/4 (exist.)

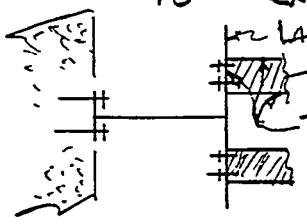


Moment = $\frac{3144}{2} \times 1 = 1572$ #-in

Section Modulus, $S = \frac{2 \times .25^2}{6} = .0208$ in³

$\sigma_b = 1572 / .0208 = 75{,}577$ Psi >> .75 x 36000 x 1.33 = 35,910 Psi (N.G.)

Disregard exist. ℄ 1/4 and connect the new L4x4 to exist. tubesteel of Lard frame by 2- 1/2" ϕ bolt



Capacity of 2- 1/2" ϕ bolts in tension
= 20000 x $\frac{\pi}{4}(.5)^2 \times 2$ = 7840 # x 1.33 increase
> 3144 # OK

ANALYTICAL CALCULATIONS

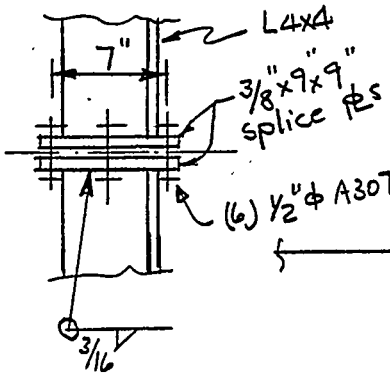
Page ____ of ____

Subject Lard Can Storage Rack

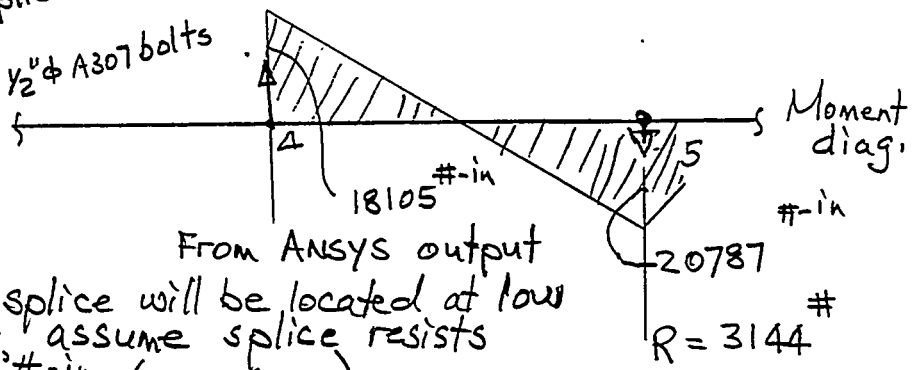
Originator M.A. ISLAM Date 9/27/94

Checker EO Weiner Date 10/26/94

Splice of new L4x4x3/8



Splice is recommended to be located betn. node 4 & 5



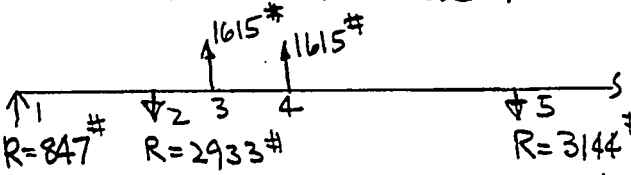
From ANSYS output

Even though splice will be located at low moment point, assume splice resists M = 20787 #-in (very Cons.).

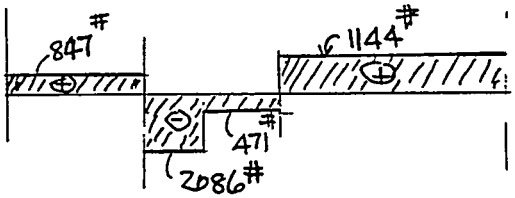
Tension per bolt (due to M) = $\frac{20787}{7 \times 2} = 1485^{\#}$

Tension (allow.) = $20000 \times \frac{\pi}{4}(.5)^2 \times 1.33 = 5054^{\#} > 1485^{\#}$ OK

Shear betn. Node 4 & 5



∴ shear @ splice = 1144#



← shear Diag.

For 1/2"ϕ A307 bolt

shear (allow.) = $10000 \times \frac{\pi}{4}(.5)^2 \times 1.33 \times 6$

= $15,162^{\#} > 1144^{\#}$ OK

$I = \frac{1485}{5054} + \frac{1144}{15162} = .37$; M.S = 1.7

Weld betwn. Splice ℞ and L4x4 is all around (3/16" Fillet governed by min. required by AISC). Splice is located theoretically at lower moment and shear is nominal. Weld is adequate.

∴ Splice is ok.

ANALYTICAL CALCULATIONS

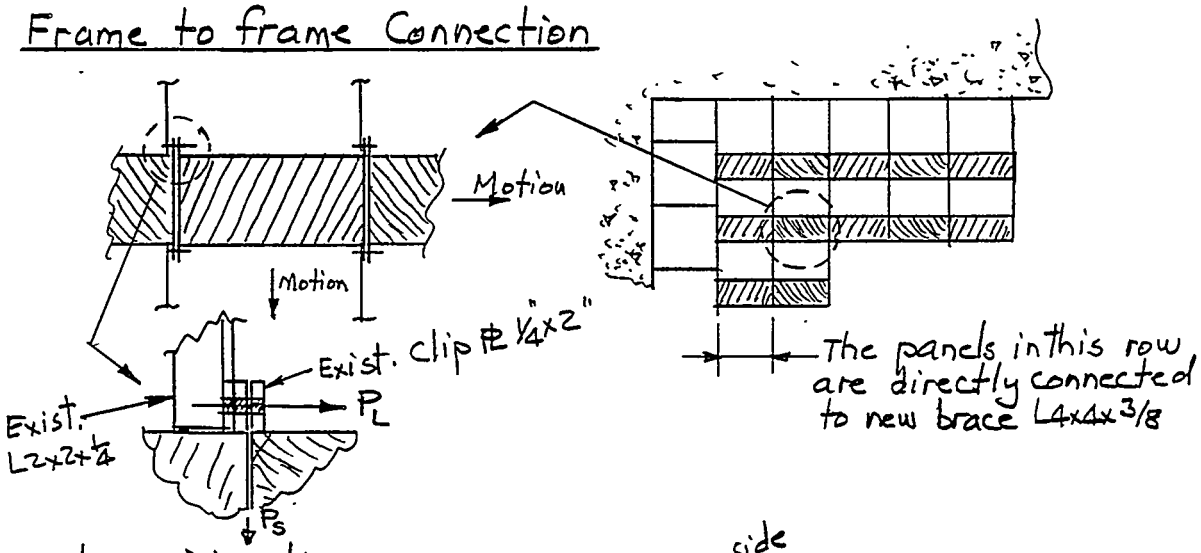
Page ____ of ____

Subject Lard Can Storage Rack

Originator M. A. ISLAM Date 9/27/94

Checker EO Weimer Date 10/26/94

Frame to frame Connection



Long Direction

$$P_L = 4^{\text{Panels}} \times 1292 \times \tfrac{1}{2}^{\text{Top}} \times \tfrac{1}{2}^{\text{one side}} = 1292\ \#$$

Short Direction

$$P_s = 3^{\text{Panels}} \times 1292 \times \tfrac{1}{2}^{\text{Top}} = 1938\ \#$$

Shear allowable of exist. 5/16"ϕ screw $= 10000 \times \frac{\pi}{4}(.3125)^2 = 767\ \#$

Tension " " " " $= 20000 \times$ " $= 1534\ \#$

For seismic load, increase allowable values by 33% (AISC 8th Ed.)

$\therefore$ $T_{all.} = 1534 \times 1.33 = 2040\ \#$

$V_{all.} = 767 \times 1.33 = 1020\ \#$

Interaction for the 5/16"ϕ screw $= \frac{1938}{1020} + \frac{.4 \times 1292}{2040} = 2.15 > 1$ (N.G.) (per Guideline WHC-SD-GN-DGS-30006, Rev 0)

Replace 5/16"ϕ screws by 1/2"ϕ A307 bolts

$T_{all.} = 20000 \times \pi/4\,(.5)^2 \times 1.33 = 5054\ \#$

$V_{all.} = 10000 \times$ " $= 2527\ \#$

Interaction $= \frac{1938}{2527} + \frac{.4 \times 1292}{5054} = .87 < 1.$ OK

M.S. = .15

ANALYTICAL CALCULATIONS

Page ____ of ____

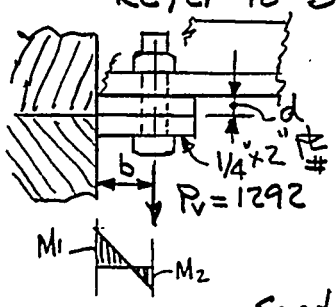
Subject Lard Can Storage Rack

Originator M. A. ISLAM Date 9/27/94

Checker EO Weimer Date 10/26/94

Bending in Clip ∠ (Include prying action due to bolt)

Refer to Blodgett's "Design of Welded Structure", Page 3.3-5



$b = 1"$; $d = .25"$

$$M_1 = \frac{P_v b(3b+2d)}{2(3b+d)} = \frac{1292\times1(3\times1+2\times.25)}{2(3\times1+.25)} = 696^{\#\text{-in}}$$

$$M_2 = \frac{3P_v b^2}{2(3b+d)} = \frac{3\times1292\times1^2}{2(3\times1+.25)} = 596^{\#\text{-in}}$$

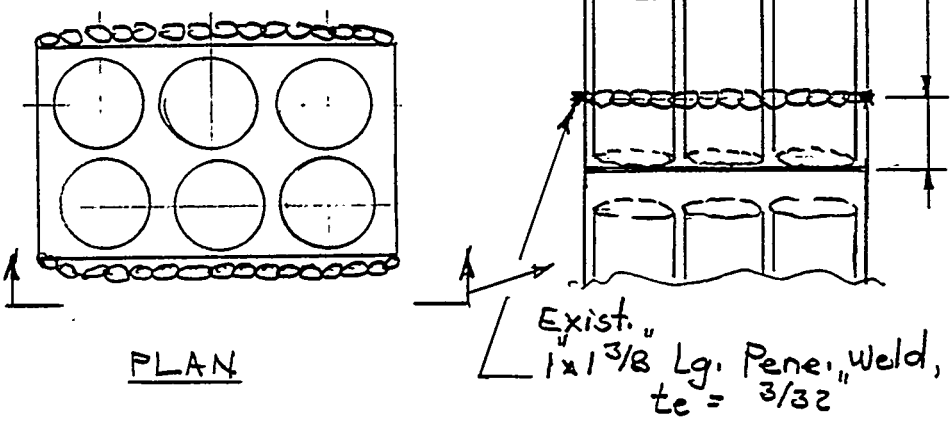
Section modulus of 1/4"x2" ∠ $= 2\times.25^2/6 = .0208\ in^3$

$\sigma_b = \frac{696}{.0208} = 33{,}462$ Psi ; σ_b (allow.) $= .75\times36000\times1.33$ (seismic load increase)

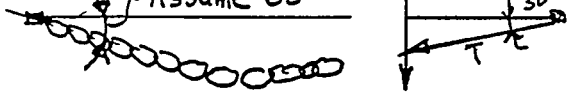
$= 36000$ Psi > 33462 Psi OK.

(Use a washer to increase the bending strength, See Detail Page B-48)

3/16" ϕ Chain



Each chain resists 6 Cans, $\therefore \Sigma W = 6\times50\times.68$ (accln.) $= 204^{\#}$



Tension in Cable, $T = \frac{W}{\sin30} = 408^{\#}$ (assume)

Capacity of the chain ( ) $= 2\times\frac{\pi}{4}(.1875)^2\times1.6\times33000\times1.33$ (2-3/16" ϕ, Yield Stress increase)

$= 1454^{\#} > 408^{\#}$ OK, M.S. = .28

Capacity of weld $= .3\times60000\times1"\times3/32\times1.33 = 2244^{\#} > 408^{\#}$

Note: Cans are loaded such that there is no adequate space to cause impact. Beside, top frame member (TS 2½x2½) will resist the can to tip over. OK

```
/prep7
/title,calculate forces in brace
/show,ega256
/view,,,,1
/com                          Filename: lard2
/com
/com
/com
/com                          Input by: MAI        Chk by: EOW
/com
/com
/com
et,1,beam3                    *beam
kan,0
mp,ex,1,29e6
mp,dens,1,.000733             * steel
/com
n,1
n,2,22
n,3,36
n,4,52
n,5,86
n,6,100
n,7,116
n,8,150
n,9,172
r,1,2.86,4.36,5.72            * L4x4x3/8
mat,1
type,1
real,1
e,1,2
egen,8,1,-1
finish
/com
/solve
d,1,ux,,,,,uy
d,2,ux,,,8,3,uy
/com
f,3,fy,1615
f,4,fy,1615
f,6,fy,1615
f,7,fy,1615
f,9,fy,1292
lswrite
solve
nlist,all
elist,all
finish
/exit
```

```
USE LOAD STEP     1  SUBSTEP     1  FOR LOAD CASE 0

SET COMMAND GOT LOAD STEP=     1  SUBSTEP=     1  CUMULATIVE ITERATION=     1
  TIME/FREQUENCY=  1.0000

PRINT DOF  NODAL SOLUTION PER NODE

 ***** POST1 NODAL DEGREE OF FREEDOM LISTING *****


 LOAD STEP=     1  SUBSTEP=     1

  TIME=    1.0000      LOAD CASE=   0


 THE FOLLOWING DEGREE OF FREEDOM RESULTS ARE IN GLOBAL COORDINATES


  NODE      UX          UY          ROTZ
     1   .00000E+00  .00000E+00 -.54050E-03
     2   .00000E+00  .00000E+00  .10810E-02
     3   .00000E+00  .22034E-01  .15278E-02
     4   .00000E+00  .33238E-01 -.28634E-03
     5   .00000E+00  .00000E+00  .74194E-04
     6   .00000E+00  .99147E-02  .82538E-03
     7   .00000E+00  .13733E-01 -.47814E-03
     8   .00000E+00  .00000E+00  .15440E-02
     9   .00000E+00  .70237E-01  .40168E-02

MAXIMUM VALUES
NODE         0           9           9
VALUE    .00000E+00  .70237E-01  .40168E-02

PRINT REACTION SOLUTIONS PER NODE

 ***** POST1 TOTAL REACTION SOLUTION LISTING *****


 LOAD STEP=     1  SUBSTEP=     1

  TIME=    1.0000      LOAD CASE=   0


 THE FOLLOWING X,Y,Z SOLUTIONS ARE IN GLOBAL COORDINATES


  NODE      FX          FY          MZ
     1   .00000E+00  847.19
     2   .00000E+00 -2933.3
     5   .00000E+00 -3144.2
     8   .00000E+00 -2521.6
```

```
 TOTAL VALUES
 VALUE    .00000E+00 -7752.0      .00000E+00

 PRINT M    ELEMENT SOLUTION PER ELEMENT

 ***** POST1 ELEMENT NODE TOTAL FORCE LISTING *****


  LOAD STEP=     1  SUBSTEP=     1

   TIME=    1.0000      LOAD CASE=   0


  THE FOLLOWING X,Y,Z FORCES ARE IN GLOBAL COORDINATES


  ELEM=     1  MZ

      1   .00000E+00
      2  -18638.

  ELEM=     2  MZ

      2   18638.
      3   10567.

  ELEM=     3  MZ

      3  -10567.
      4   18105.

  ELEM=     4  MZ

      4  -18105.
      5  -20787.

  ELEM=     5  MZ

      5   20787.
      6   7218.2

  ELEM=     6  MZ

      6  -7218.2
      7   13384.

  ELEM=     7  MZ

      7  -13384.
      8  -28424.

  ELEM=     8  MZ
```

```
8   28424.
9   -.14552E-10
```

This page is left blank intentionally

ANALYTICAL CALCULATIONS

Page _____ of _____

Subject 7-in Can Metal Storage Rack, 2736-Z Building

Originator Michael P. Weis Date 2/27/95

Checker Judith J. Moore Date 3/2/95

Scope

This analysis will re-analyze the 7-in can metal storage rack in Building 2736-Z to satisfy the requirements for Safety Class 1 (SC1) equipment. The earlier analysis (Rev. 0 of this report, pages B-2 to B-15) considered the rack to be Safety Class 3 (SC3) equipment and found the rack to be adequate under seismic loading. This analysis will demonstrate that the earlier analysis, an equivalent static analysis, will satisfy the SC1 requirements.

This analysis will use the seismic response spectra developed for Building 2736-Z (See Appendix E, Page E-11).

Approach

The approach taken here is to demonstrate that the fundamental frequency of a typical panel of the metal storage rack experiences an acceleration below the 0.68g horizontal acceleration of the equivalent static analysis, and that higher-mode frequencies are in the rigid region of the spectrum for this equipment. A modal analysis of an ANSYS model is used to calculate the frequencies and mode shapes. The ANSYS model developed for the SC1 analysis is similar to the one of the SC3 analysis; however it more accurately represents the storage rack's pinned connections. The entire metal storage rack consists of 25 panels that are interconnected with bolts and cross bracing members. This gives increased stiffness to the structure over and above that of a single panel. This justifies the modal analysis of a single panel.

First a potential issue must be addressed. The earlier analysis calculated a fundamental frequency of a typical panel near 16 Hz, which falls near the peak of the response spectra. This was a low estimate of the frequency because the entire mass of the panel was lumped at the node at which the unit forces were applied (page B-11). A modal analysis of the SC3 ANSYS model on page B-12 reveals a fundamental frequency of 29 Hz and a second mode frequency of 79 Hz. An edited and revised ANSYS input deck of the SC3 model, an element plot, and the modal analysis results follow on pages B-66 to B-71. (This model includes the mass of the 7-in cans and panel doors not included in the original SC3 model.) A hand calculation on page B-72 for the fundamental frequency of a cantilever beam with an equivalent stiffness verifies this ANSYS result.

ANALYTICAL CALCULATIONS

Page _____ of _____

Subject 7-in Can Metal Storage Rack, 2736-Z Building

Originator Michael Plumis Date 2/27/95

Checker Carleton J. Moore Date 3/2/95

ANSYS Model

The ANSYS model represents a typical panel of the 7-in can metal storage rack. To characterize it, one panel has a storage capacity for 28 7-in cans and has its own set of doors. The model was analyzed for two different sets of boundary conditions (ANSYS input deck and element plots, pages B-73 to B-81). The first set is for a panel away from the wall: it includes four pinned connections representing the floor anchors and a unidirectional support on the top to represent the effect of the cross bracing. The second set is for a panel against the wall: it includes two pinned connections on the floor and a pinned connection on the top for the cross bracing. A walkdown by this engineer indicated that two adjacent panels are connected by four bolts, two near the top, front and back, and two near the bottom, front and back. These bolted connections justify the use of the fixity on the top of the model for those panels directly adjacent to a panel connected to a cross bracing member (See drawing H-2-26822, Rev. 1).

The ANSYS model is broken down on pages B-82 to B-84. On page B-82 is an element plot of the back and side faces, including the columns in the four corners. The back and side faces extend to the floor, unlike the model in the SC3 analysis. Page B-83 shows an element plot of the shelves and vertical dividers and symbols representing coupled nodes for pinned connections. Each shelf is a single unit of four shell elements, adjacent elements sharing common nodes. A shelf's corners are pinned to the four columns of the panel. One shell element represents a vertical divider, its four corners pinned to the shelves above and below it. Each shell element representing a vertical divider is separate from adjacent dividers; they do not share common nodes. Also, the center of the back face is coupled to the center of each shelf edge. Page B-84 shows the beam elements at shelf edges. Their cross section is rectangular (1½" x 1/16") and they represent the bent edges of the shelves. (In the SC3 model, the shelf edges were represented by 1½" x 1½" x 1/16" bent plate.)

Criteria

1. Seismic accelerations per response spectra of Building 2736-Z (Appendix E).
2. Steel evaluations per AISC 8th Edition, F_y = 33,000 lbf/in^2.
3. Concrete anchor allowables per guideline, WHC-SD-GN-DGS-30006, Rev. 1.
4. Seismic evaluation per UCRL-15910 and SDC-4.1, Rev. 12.

ANALYTICAL CALCULATIONS

Page _____ of _____

Subject 7-in Can Metal Storage Rack, 2736-Z Building

Originator Michael P. Heeus Date 2/27/95

Checker Carlton J. Moore Date 3/2/95

Results

The modal analysis uses the Householder method in ANSYS to solve the frequencies and mode shapes. Page B-85 illustrates the definition of master degrees of freedom (DOF), all translational, for the model with 4 floor anchors. Masters can not be defined at fixed DOF. The first two frequencies for the 4-floor-anchor model are 31 and 80 Hz. Pages B-86 and B-87 illustrate the first mode shape for the 4-floor-anchor model and the participation factor table. Similarly, the first two frequencies are 27 and 88 Hz for the 2-floor-anchor model, and the mode shape and participation factor table are on pages B-88 to B-89. Given the lowest frequency of 27 Hz, the acceleration from the in-structure response spectrum for an exterior wall is 0.36g (page E-11). This is less than the 0.68g used in the equivalent static analysis previously; therefore the previous analysis is sufficient to qualify this equipment.

The fundamental frequency of the 4-floor-anchor model, 31 Hz, exceeds the fundamental frequency calculated for the model used in the SC3 analysis (29 Hz). Because the SC3 model (29 Hz) assumes welded connections one would expect the 4-floor-anchor SC1 model (31 Hz), using pinned connections, would be more flexible. However, the 4-floor-anchor SC1 model extends the back and side faces to the ground stiffening the structure.

ANALYTICAL CALCULATIONS

Page _____ of _____

Subject 7-in Can Metal Storage Rack, 2736-Z Building

Originator Michael P Weis Date 2/27/95

Checker Carleton J. Moe Date 3/2/95

```
/com
/com  ANSYS input deck for model of previous analysis
/com  (with mass added for cans and doors)
/com

/BATCH
/title, Metal Rack for 7-in Can in 2736-Z Building
/prep7

/com  beam constants
!1.5-in x 1.5-in x 1/16-in bent plate for columns
*set,area,0.18
*set,izz,0.04
*set,iyy,0.04
*set,tkz,2.22
*set,tky,2.22
*set,ixx,0.0002

/com  shell constants
*set,t,0.0625

/com  lumped mass constants
*set,mdoor,0.0466     ! 18 lbf
*set,mcans,0.399      ! 154 lbf
*set,mfront,mcans/80 + mdoor/40
*set,mback,mcans/80

/com  element types
et,1,4                ! 3D elastic beam
et,2,63               ! elastic shell
et,3,21,,0,2          ! lumped mass

/com  material properties and real constants
mp,ex,1,29e6
mp,dens,1,0.000734

r,1,area,izz,iyy,tkz,tky,,,ixx              ! beam for panel and door support
r,2,t,t,t,t                                 ! shell
r,3,mfront          ! lumped mass for cans and door on front-face nodes
r,4,mback           ! lumped mass for cans on back-face nodes

/com  nodes for four supports of one panel
n,1
```

ANALYTICAL CALCULATIONS

Page _____ of _____

Subject 7-in Can Metal Storage Rack, 2736-Z Building

Originator Michael D Weis Date 2/27/95

Checker Carleton J. Moore Date 3/2/95

```
n,2,,,-12
n,3,36,,-12
n,4,36

/com  nodes for one panel
n,5,,1
n,6,9,1
n,7,18,1
n,8,27,1
n,9,36,1
ngen,2,5,5,9,1,,,-12
ngen,8,10,5,14,1,,12

/com  vertical beam members of panel
mat,1
type,1
real,1
e,1,5
e,5,15
egen,7,10,-1
e,2,10
e,10,20
egen,7,10,-1
e,3,14
e,14,24
egen,7,10,-1
e,4,9
e,9,19
egen,7,10,-1

/com  horizontal beam members of panel
e,5,6
egen,4,1,-1
egen, 2,5,-4
e,5,10
e,9,14
egen,8,10,-10

/com  shelves of panel
type,2
real,2
e,5,6,11,10
egen,4,1,-1
```

ANALYTICAL CALCULATIONS

Page _____ of _____

Subject 7-in Can Metal Storage Rack, 2736-Z Building

Originator Michael Plvers Date 2/27/95

Checker Carleton J. Moore Date 3/2/95

```
egen,8,10,-4

/com  sides and dividers of panel
e,5,10,20,15
egen,7,10,-1
egen,5,1,-7

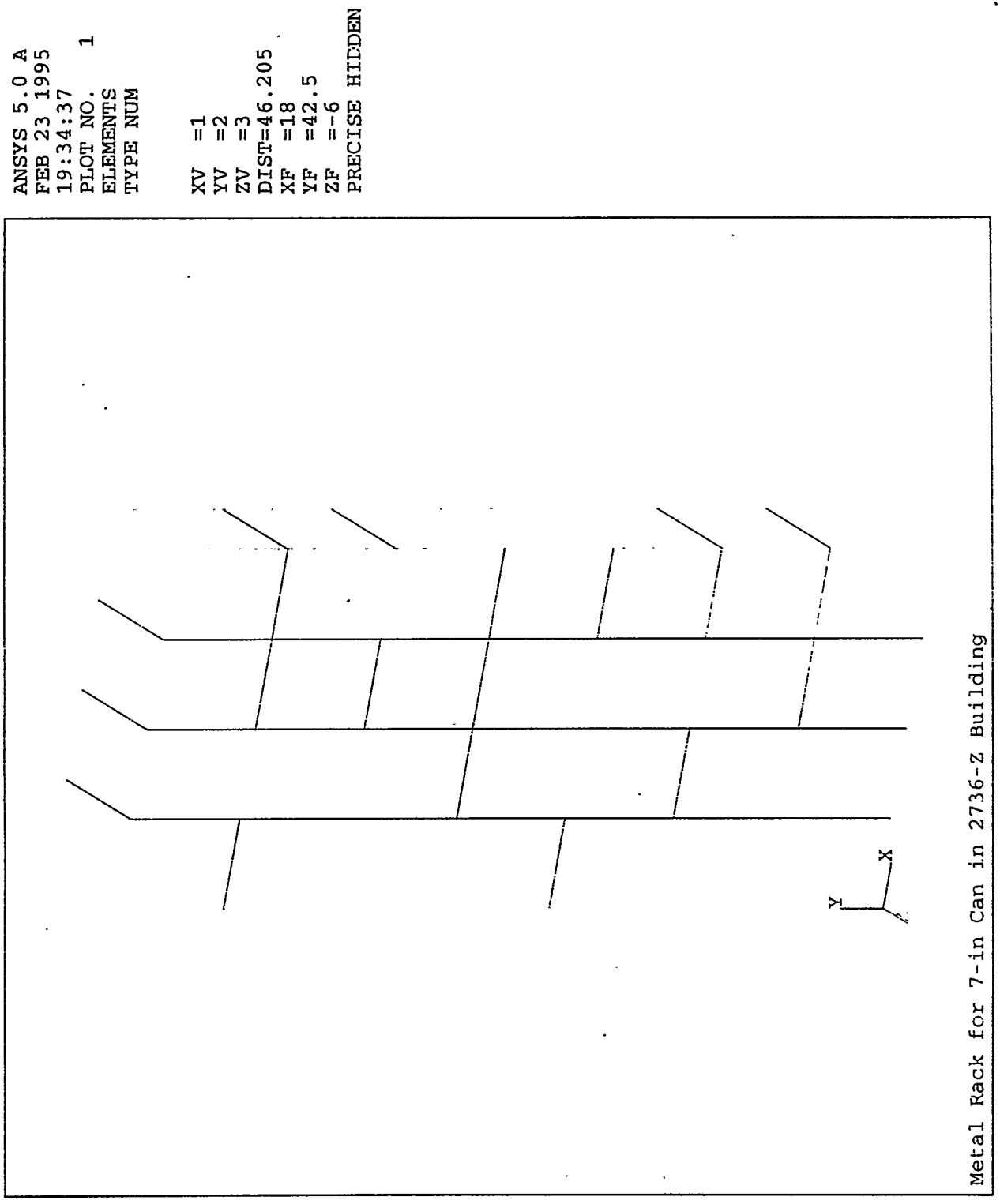
/com  back face of panel
e,5,6,16,15
egen,4,1,-1
egen, 7,10,-4

/com  lumped masses for cans and door
type,3
real,4
e,5
egen,5,1,-1
egen,8,10,-5
real,3
e,10
egen,5,1,-1
egen,8,10,-5

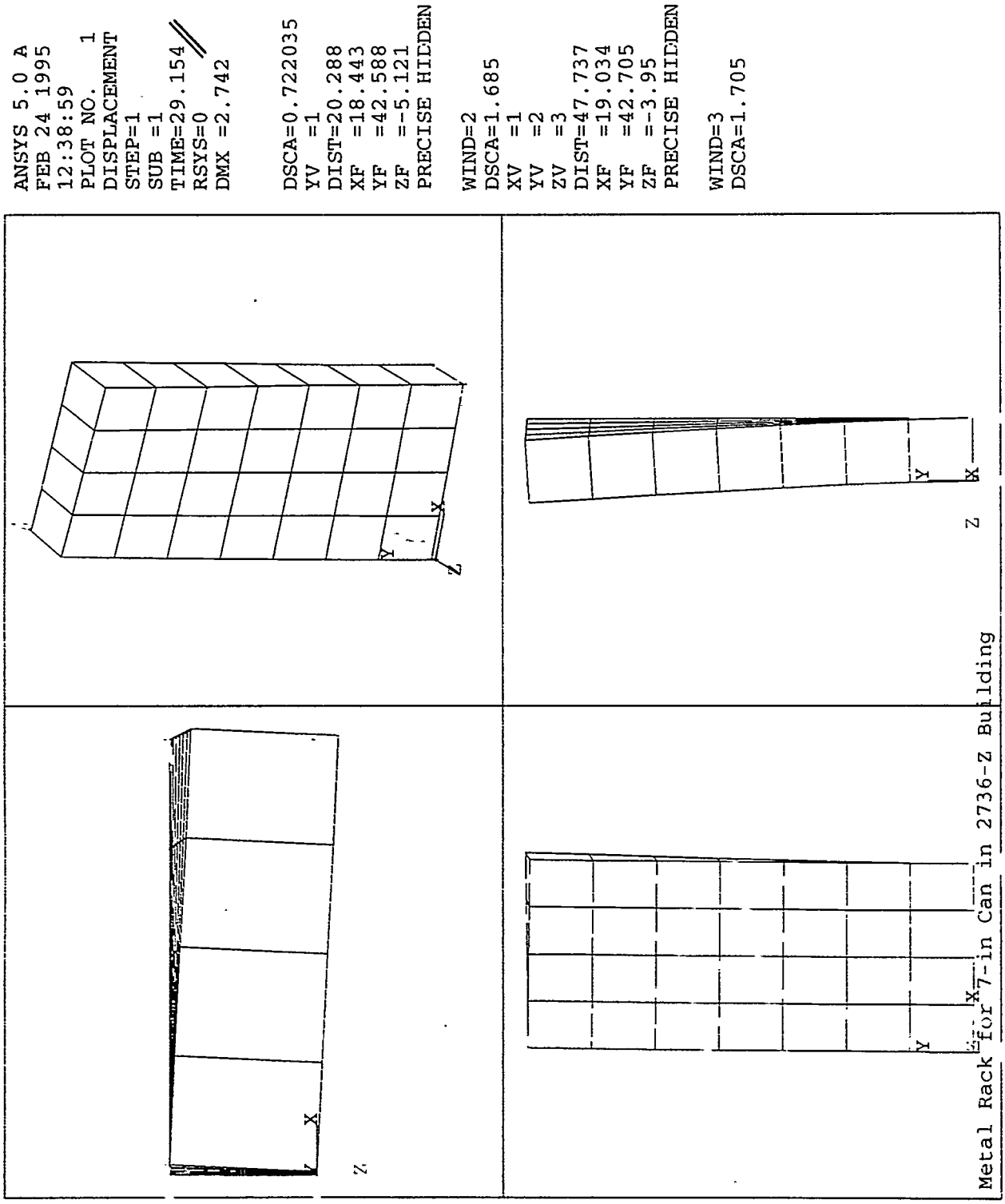
/com  anchors on floor and fixed node on top
d,1,ux,,,4,1,uy,uz
d,80,uz,,,80,1

/com . save database
save,save,db


/com   modal analysis, subspace method
fini
/solu
*set,NumModes,25
antype,modal,new
modopt,subsp,NumModes
outpr,basic,all
mxpand,NumModes
solve
fini
/exi,nosave
```



ANSYS Model Used in Safety Class 3 Rack Analysis.



Fundamental-Freqaency Mode Shape for ANSYS Model of Safety Class 3 Rack Analysis.

ANALYTICAL CALCULATIONS

Page _____ of _____

Subject 7-in' Can Metal Storage Rack, 2736-Z Building

Originator Michael P. Weis Date 2/24/95

Checker Carleton J. Moore Date 3/2/95

Participation Factor Table for ANSYS Model of Safety Class 3 Ranck Analysis.

***** PARTICIPATION FACTOR CALCULATION ***** X DIRECTION

MODE	FREQUENCY	PERIOD	PARTIC.FACTOR	RATIO	EFFECTIVE MASS	CUMULATIVE MASS FRACTION
1	29.1538	0.34301E-01	0.38615	0.471180	0.149113	0.137631
2	78.6880	0.12708E-01	0.81954	1.000000	0.671649	0.757562
3	134.808	0.74180E-02	-0.34011E-01	0.041500	0.115677E-02	0.758630
4	160.266	0.62396E-02	-0.19973	0.243709	0.398921E-01	0.795450
5	231.218	0.43249E-02	0.63539E-02	0.007753	0.403719E-04	0.795488
6	234.708	0.42606E-02	0.79839E-01	0.097419	0.637420E-02	0.801371
7	247.877	0.40343E-02	0.22698	0.276960	0.515202E-01	0.848924
8	252.048	0.39675E-02	-0.35978	0.438997	0.129439	0.968396
9	269.159	0.37153E-02	0.23112E-01	0.028201	0.534150E-03	0.968889
10	288.899	0.34614E-02	0.19745E-01	0.024092	0.389849E-03	0.969249
25	559.892	0.17861E-02	-0.22934E-01	0.027984	0.525969E-03	1.00000
			SUM OF EFFECTIVE MASSES=		1.08343	

***** PARTICIPATION FACTOR CALCULATION ***** Y DIRECTION

MODE	FREQUENCY	PERIOD	PARTIC.FACTOR	RATIO	EFFECTIVE MASS	CUMULATIVE MASS FRACTION
1	29.1538	0.34301E-01	0.18939E-01	0.020258	0.358672E-03	0.341726E-03
2	78.6880	0.12708E-01	-0.83555E-02	0.008937	0.698148E-04	0.408242E-03
3	134.808	0.74180E-02	-0.14259E-01	0.015252	0.203311E-03	0.601947E-03
4	160.266	0.62396E-02	0.69697E-01	0.074551	0.485767E-02	0.523011E-02
5	231.218	0.43249E-02	0.26398	0.282366	0.696860E-01	0.716236E-01
6	234.708	0.42606E-02	0.93489	1.000000	0.874021	0.904349
7	247.877	0.40343E-02	-0.12255	0.131086	0.150187E-01	0.918658
8	252.048	0.39675E-02	0.10275	0.109905	0.105573E-01	0.928717
9	269.159	0.37153E-02	-0.59865E-01	0.064035	0.358386E-02	0.932132
10	288.899	0.34614E-02	0.16964E-01	0.018145	0.287772E-03	0.932406
25	559.892	0.17861E-02	-0.62575E-02	0.006693	0.391568E-04	1.00000
			SUM OF EFFECTIVE MASSES=		1.04959	

***** PARTICIPATION FACTOR CALCULATION ***** Z DIRECTION

MODE	FREQUENCY	PERIOD	PARTIC.FACTOR	RATIO	EFFECTIVE MASS	CUMULATIVE MASS FRACTION
1	29.1538	0.34301E-01	0.61374	1.000000	0.376680	0.355116
2	78.6880	0.12708E-01	-0.39453	0.642822	0.155652	0.501858
3	134.808	0.74180E-02	0.38563	0.628328	0.148712	0.642056
4	160.266	0.62396E-02	-0.48762	0.794508	0.237777	0.866221
5	231.218	0.43249E-02	-0.24197E-01	0.039425	0.585490E-03	0.866773
6	234.708	0.42606E-02	0.11384E-01	0.018549	0.129602E-03	0.866895
7	247.877	0.40343E-02	0.31136E-02	0.005073	0.969481E-05	0.866904
8	252.048	0.39675E-02	-0.10165E-01	0.016562	0.103324E-03	0.867002
9	269.159	0.37153E-02	-0.49201E-01	0.080165	0.242073E-02	0.869284
10	288.899	0.34614E-02	0.10807E-01	0.017609	0.116794E-03	0.869394
25	559.892	0.17861E-02	-0.89971E-01	0.146594	0.809475E-02	1.000000
			SUM OF EFFECTIVE MASSES=		1.06072	

ANALYTICAL CALCULATIONS

Page _____ of _____

Subject 7-in Can Metal Storage Rack, 2736-Z Building

Originator Michael P Weis Date 2/24/95

Checker Carolyn J. Moore Date 3/2/95

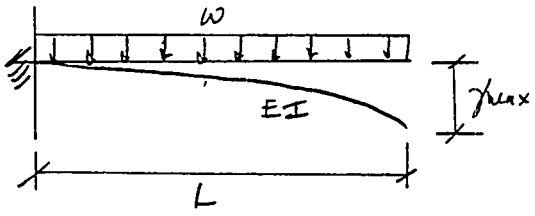
Verify Ansys calculation of fundamental frequency for Ansys model of Safety Class 3 Rack Analysis.

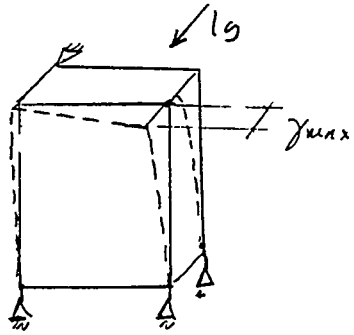
The fundamental frequency of a uniform cantilever beam is given in Timoshenko et al. as

$$f = \left(\frac{1.875}{2\pi}\right)^2 \sqrt{\frac{EI}{\rho A L^4}}$$

$$= \left(\frac{1.875}{2\pi}\right)^2 \sqrt{\frac{EIg}{wL^4}} \quad \text{where } \rho A = \bar{m} = \frac{w}{g}\ ;\ w = \text{weight per length},\ \bar{m} = \text{mass per unit length}$$

To calculate Moment of Inertia I, load the panel in Ansys with a 1g load & use the resulting displacement to estimate I from beam theory.





Ansys model of typical panel

$$\gamma_{max} = \frac{wL^4}{8EI} \Rightarrow I = \frac{wL^4}{8E\gamma_{max}}$$

$\gamma_{max} = 0.01759$ in (Ansys static analysis – 1g load)

$L = 85$ in ; $E = 29E6$ lbf/in^2

$W = 433$ lbf ; $w = W/L = 5.1$ lbf/in

$$I = \left[(5.1 \text{ lbf/in})(85 \text{ in})^4\right] / \left[8\,(29E6 \text{ lbf/in}^2)(0.01759 \text{ in})\right] = 65.2 \text{ in}^4$$

$$f = \frac{1.875^2}{2\pi}\left\{\left[(29E6 \text{ lbf/in}^2)(65.2 \text{ in}^4)(386.4 \text{ in/s}^2)\right] / \left[(5.1 \text{ lbf/in})(85 \text{ in})^4\right]\right\}^{1/2}$$

$f = 29.3$ Hz //

Reference: Timoshenko et al, 1974, Vibration Problems in Engineering, 4th Edn, John Wiley & Sons, NY.

ANALYTICAL CALCULATIONS

Page _____ of _____

Subject 7-in Can Metal Storage Rack, 2736-Z Building

Originator Michael Divers Date 2/27/95

Checker Carleton J. Moore Date 3/2/95

```
/com
/com  ANSYS input deck for revised model
/com

/BATCH
/title ,Metal Rack for 7-in Can in 2736-Z Building
/prep7

*set,mcan,0.01423                    ! one can (lbf s^2/in)
*set,mdoor,0.131                     ! doors including support beams
*set,mddoor,mdoor/12                 ! portion of door for lumped mass at
                                     ! nodes near hinges

/com  beam constants
!1.5-in x 1.5-in x 1/16-in bent plate for columns
*set,area,0.1875
*set,izz,0.04
*set,iyy,0.04
*set,tkz,2.22
*set,tky,2.22
*set,ixx,0.00024
!1.5-in 1/16-in plate for edges of shelves
*set,area2,0.09375
*set,izz2,0.0176
*set,iyy2,0.0000305
*set,tkz2,0.0625
*set,tky2,1.5
*set,ixx2,0.000122

/com  plate constants
!1/16-in thick plate
*set,t,0.0625

!vertical dividers
*set,tdiv,0.036

/com  element types (elastic beam, elastic shell, 3-d mass)
et,1,4               ! 3D elastic beam
et,2,63              ! elastic shell
et,3,21,,0,2         ! lumped mass
```

ANALYTICAL CALCULATIONS

Page _____ of _____

Subject 7-in Can Metal Storage Rack, 2736-Z Building

Originator Michael Plumis Date 2/27/95

Checker Carleton J. Moore Date 3/2/95

```
/com  material properties
mp,ex,1,29e6
mp,dens,1,0.000734

!density of shelf with can distributed evenly
mp,ex,2,29e6
mp,dens,2,0.000734 + mcan/(9*12*t)

/com  real constants
r,1,area,izz,iyy,tkz,tky,,,ixx          ! beam for panel
r,2,area2,izz2,iyy2,tkz2,tky2,,,ixx2    ! beam for shelve edges
r,3,t,t,t,t                             ! shell for panel
r,4,tdiv,tdiv,tdiv,tdiv                 ! thinner shell for vertical dividers
                                        ! (measured)
r,6,mddoor                              ! lumped mass for portion of door
                                        ! lumped at hinges


/com  nodes for shelves
n,1
ngen,5,1,1,1,1,9
ngen,2,5,1,5,1,,,12
ngen,8,10,1,10,1,,12

/com  nodes for sides and back
n,81,,,12
ngen,8,1,81,81,1,,12
ngen,2,8,81,88,1,,,-12
ngen,3,8,89,96,1,18
ngen,2,8,105,112,1,,,12

/com  nodes for dividers
n,121,9
ngen,2,1,121,121,1,,,12
ngen,2,2,121,122,1,,12
ngen,7,4,121,124,1,,12
ngen,3,28,121,148,1,9

/com  nodes resting on floor
n,205,,-1.5,12
n,206,,-1.5
n,207,18,-1.5
n,208,36,-1.5
```

ANALYTICAL CALCULATIONS

Page _____ of _____

Subject 7-in Can Metal Storage Rack, 2736-Z Building

Originator Michael P Weis Date 2/27/95

Checker Carleton J. Moore Date 3/2/95

```
n,209,36,-1.5,12


/com shelves
!beams at perimeter of each shelf
mat,1
type,1
real,2
e,1,2
egen,4,1,-1
egen,2,5,-4
e,1,6
egen,2,4,-1
egen,8,10,-10

!plates for each shelf
mat,2
type,2
real,3
e,1,2,7,6
egen,4,1,-1
egen,7,10,-4
!"top shelf" doesn't have cans lumped in
mat,1
e,71,72,77,76
egen,4,1,-1

/com  sides and back
!beams for columns
mat,1
type,1
real,1
e,81,82
egen,7,1,-1
egen,2,8,-7
e,105,106
egen,7,1,-1
egen,2,8,-7

!supports
e,205,81
e,206,89
e,208,105
```

ANALYTICAL CALCULATIONS

Page _____ of _____

Subject 7-in Can Metal Storage Rack, 2736-Z Building

Originator Michael P. Lewis Date 2/27/95

Checker Carlita J. Moore Date 3/2/95

```
e,209,113

!plates for sides and back
type,2
real,3
e,81,89,90,82
egen,7,1,-1
egen,4,8,-7
e,205,206,89,81
e,206,207,97,89
e,207,208,105,97
e,208,209,113,105

/com  plates for dividers
real,4
e,121,122,124,123
egen,7,4,-1
egen,3,28,-7

/com  portion of doors lumped into hinges on columns
type,3
real,6
e,81
egen,2,1,-1
egen,2,32,-2
e,84
egen,2,1,-1
egen,2,32,-2
e,87
egen,2,1,-1
egen,2,32,-2


/com  coupled nodes for connecting shelves to columns
*create,shelfcps,mac
!  function: couples nodes in a predefined pattern (not general purpose)
!  input:
!     arg1: last used nset number
!     arg2: starting node for set of primary (retained) nodes
!     arg3: starting nodes for set of coupled nodes
*set,ndsprshf,10
*do,count,1,8
  *set,nset,arg1 + 3*count-2
```

ANALYTICAL CALCULATIONS

Page _____ of _____

Subject 7-in Can Metal Storage Rack, 2736-Z Building

Originator Michael D Lewis Date 2/27/95

Checker Carlotta J. Moore Date 3/2/95

```
  *set,node1,arg2 + (count-1)
  *set,node2,arg3 + (count-1)*ndsprshf
  cp,nset,ux,node1,node2
  cplgen,nset,uy,uz
*enddo
*end

/com  couple shelves to columns in 3 translation DOFs
shelfcps,0,89,1
shelfcps,24,81,6
shelfcps,48,105,5
shelfcps,72,113,10


/com  coupled nodes for connecting dividers to shelves
*create,divcps,mac
!  function: couples nodes in a predefined pattern (not general purpose)
!  input:
!     arg1: last used nset number
!     arg2: starting node for set of primary (retained) nodes
!     arg3: starting node for 1st set of coupled nodes
!     arg4: starting node for 2nd set of coupled nodes
*set,ndsprshf,10
*set,ndsprdiv,4
*do,count,1,6
  *set,nset,arg1 + 3*count-2
  *set,node1,arg2 + (count-1)*ndsprshf
  *set,node2,arg3 + (count-1)*ndsprdiv
  *set,node3,arg4 + (count-1)*ndsprdiv
  cp,nset,ux,node1,node2,node3
  cplgen,nset,uy,uz
*enddo
*end

/com  couple dividers to shelves in 3 translation DOFs
*do,divset,1,3
  *set,nsetinc,(divset - 1)*36
  *set,shfinc,(divset - 1)*1
  *set,divinc,(divset - 1)*28
  divcps,96 + nsetinc,12 + shfinc,123 + divinc,125 + divinc
  divcps,114 + nsetinc,17 + shfinc,124 + divinc,126 + divinc
*enddo
```

ANALYTICAL CALCULATIONS

Subject 7-in Can Metal Storage Rack, 2736-Z Building

Originator Michael Plumis Date 2/27/95

Checker Carlton J. Moore Date 3/2/95

```
!don't forget top of structure ("top shelf") and bottom shelf
*do,divset,1,3
  *set,nsetinc,(divset - 1)*12
  *set,shfinc,(divset - 1)*1
  *set,divinc,(divset - 1)*28

  cp,205 + nsetinc,ux,2 + shfinc,121 + divinc
  cplgen,205 + nsetinc,uy,uz
  cp,208 + nsetinc,ux,7 + shfinc,122 + divinc
  cplgen,208 + nsetinc,uy,uz

  cp,211 + nsetinc,ux,72 + shfinc,147 + divinc
  cplgen,211 + nsetinc,uy,uz
  cp,214 + nsetinc,ux,77 + shfinc,148 + divinc
  cplgen,214 + nsetinc,uy,uz
*enddo


/com  add nodes in center of back panel to already existing coupled sets
*do,count,1,6
  *set,cpinc,(count-1)*3
  *set,nodeinc,(count-1)
  cp,133 + cpinc,ux,98 + nodeinc
  cp,134 + cpinc,uy,98 + nodeinc
  cp,135 + cpinc,uz,98 + nodeinc
*enddo

*do,count,1,2
  *set,cpinc,(count-1)*6
  *set,nodeinc,(count-1)*7
  cp,217 + cpinc,ux,97 + nodeinc
  cp,218 + cpinc,uy,97 + nodeinc
  cp,219 + cpinc,uz,97 + nodeinc
*enddo


/com anchors on floor of one panel
d,205,ux,,,206,1,uy,uz
d,208,ux,,,209,1,uy,uz
!for 2-floor-support model
!d,205,ux,,,205,1,uy,uz
!d,209,ux,,,209,1,uy,uz
```

ANALYTICAL CALCULATIONS

Page ___ of ___

Subject 7-in Can Metal Storage Rack, 2736-Z Building

Originator Michael P Weis Date 2/27/95

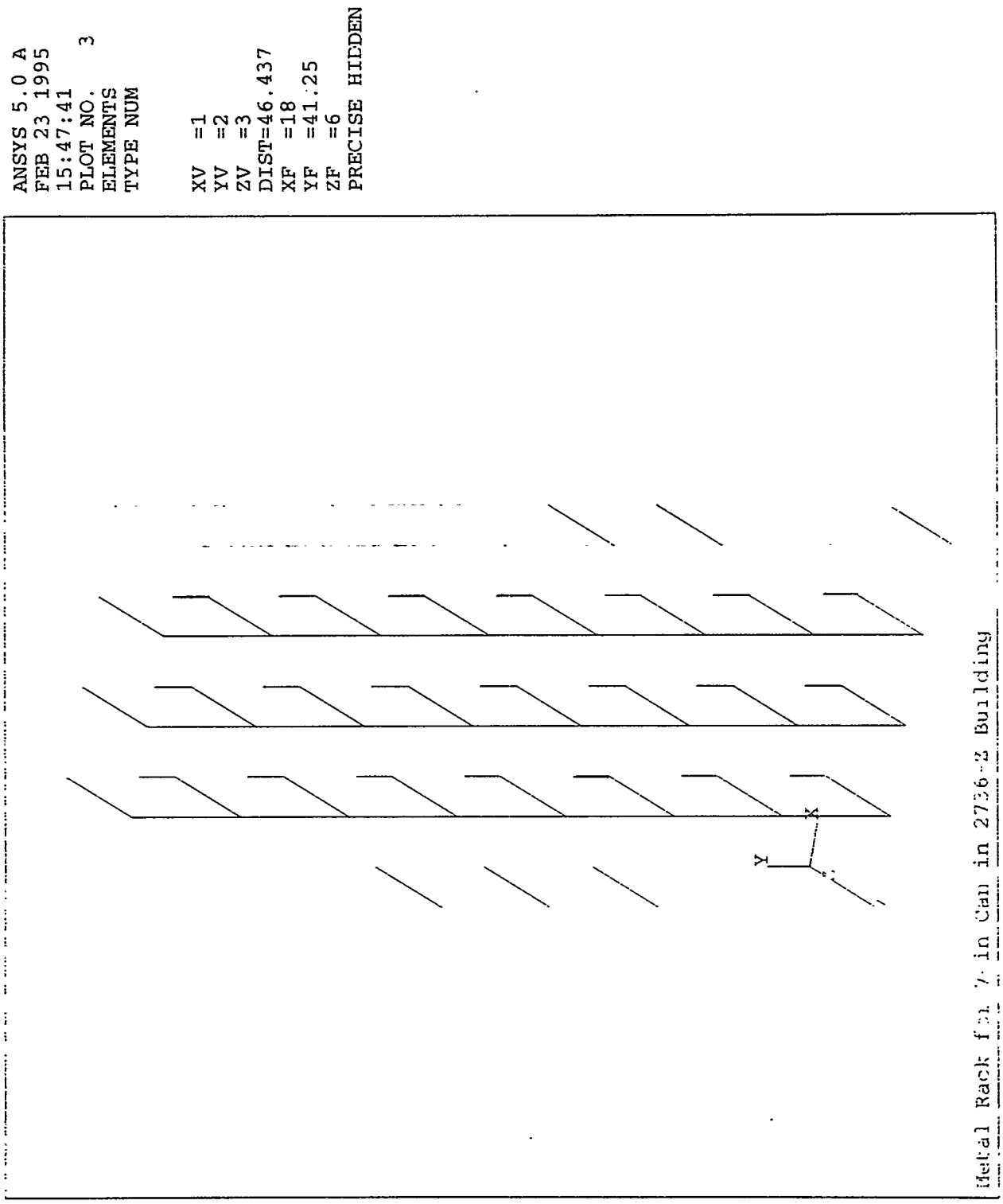
Checker Carleton J. Moore Date 3/2/95

```
/com  anchor to wall
d,96,uz,,,96,1
!for 2-floor-support model
!d,96,ux,,,96,1,uy,uz

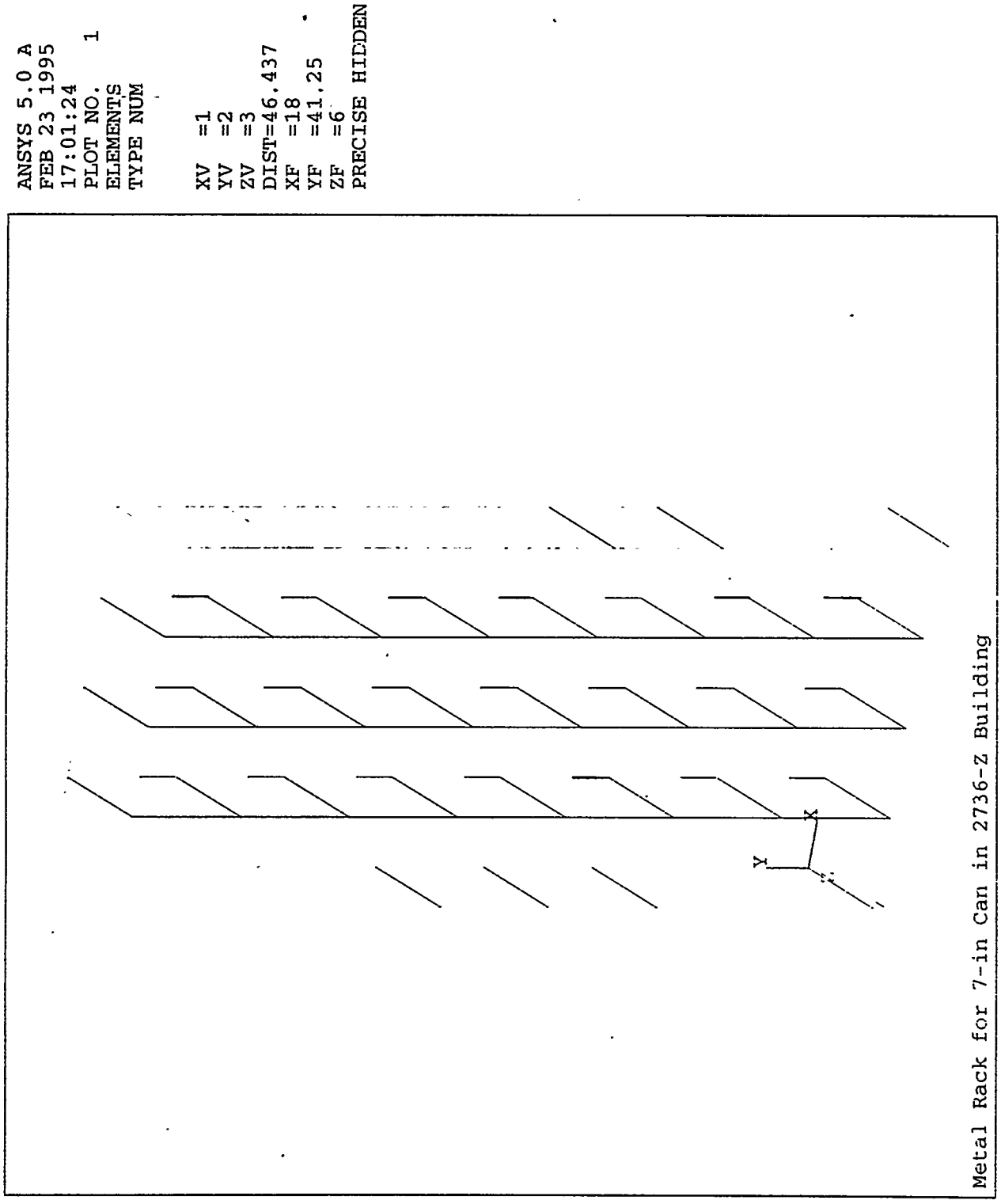

/com  masters for reduced householder modal analysis
!at centerline of panel on shelves' nodes
M,3,UX,73,10,UY,UZ
M,8,UX,78,10,UY,UZ
!on columns
M,81,UX,88,1,UY,UZ
M,105,UX,112,1,UY,UZ
M,113,UX,120,1,UY,UZ
M,89,UX,95,1,UY,UZ
M,96,UX,96,1,UY      !remove for 2-DOF constraint on this node for
                     !2-floor-support model
!at first and third dividers on shelves' nodes
M,2,UX,72,10,UY,UZ
M,7,UX,77,10,UY,UZ
M,4,UX,74,10,UY,UZ
M,9,UX,79,10,UY,UZ


/com  save database
save,save,db

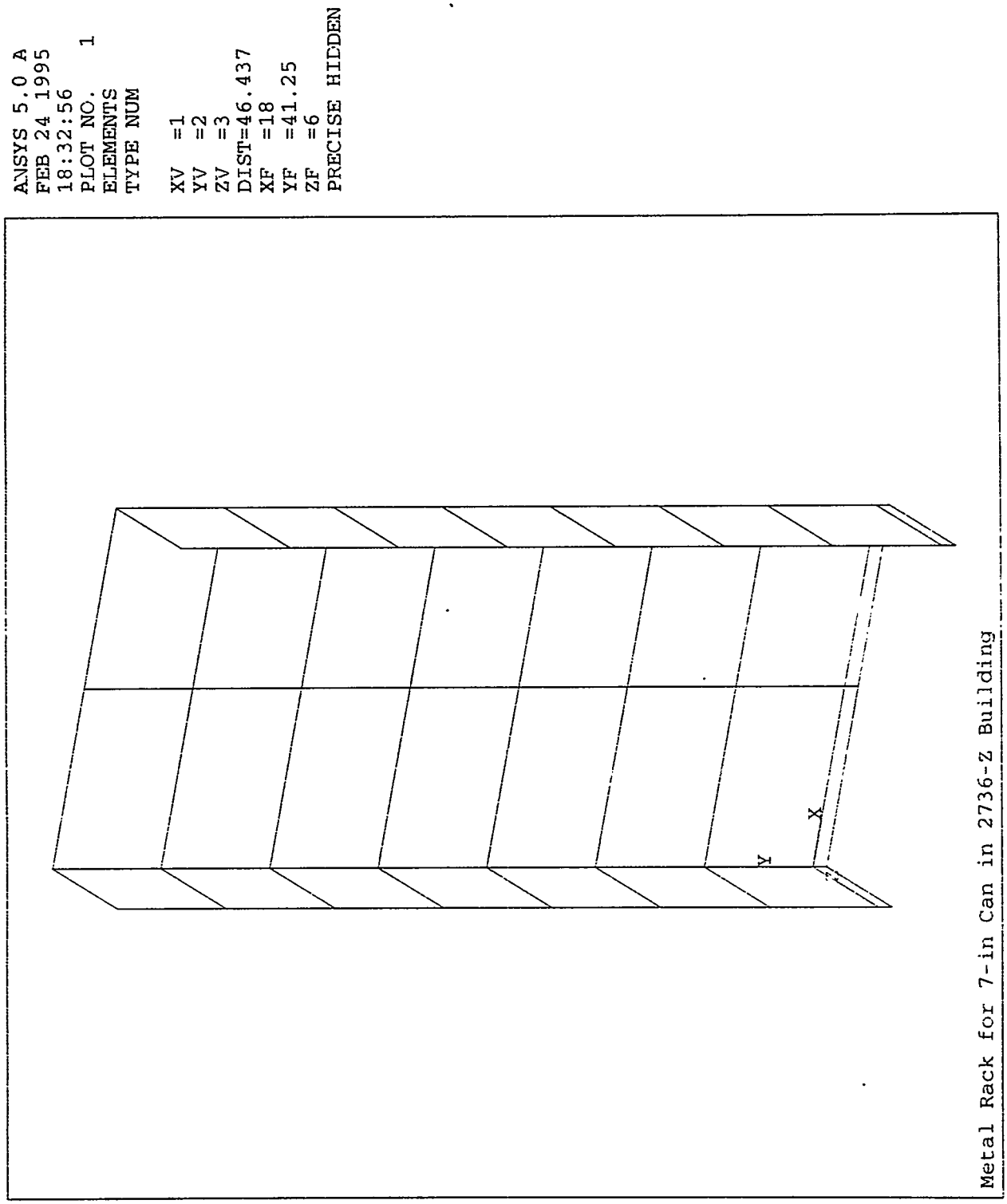

/com   modal analysis, reduced (Householder) method
fini
/solu
*set,NumModes,10
antype,modal,new
outpr,basic,all
mxpand,NumModes
modopt,redu
solve
fini
/exit,nosa
```



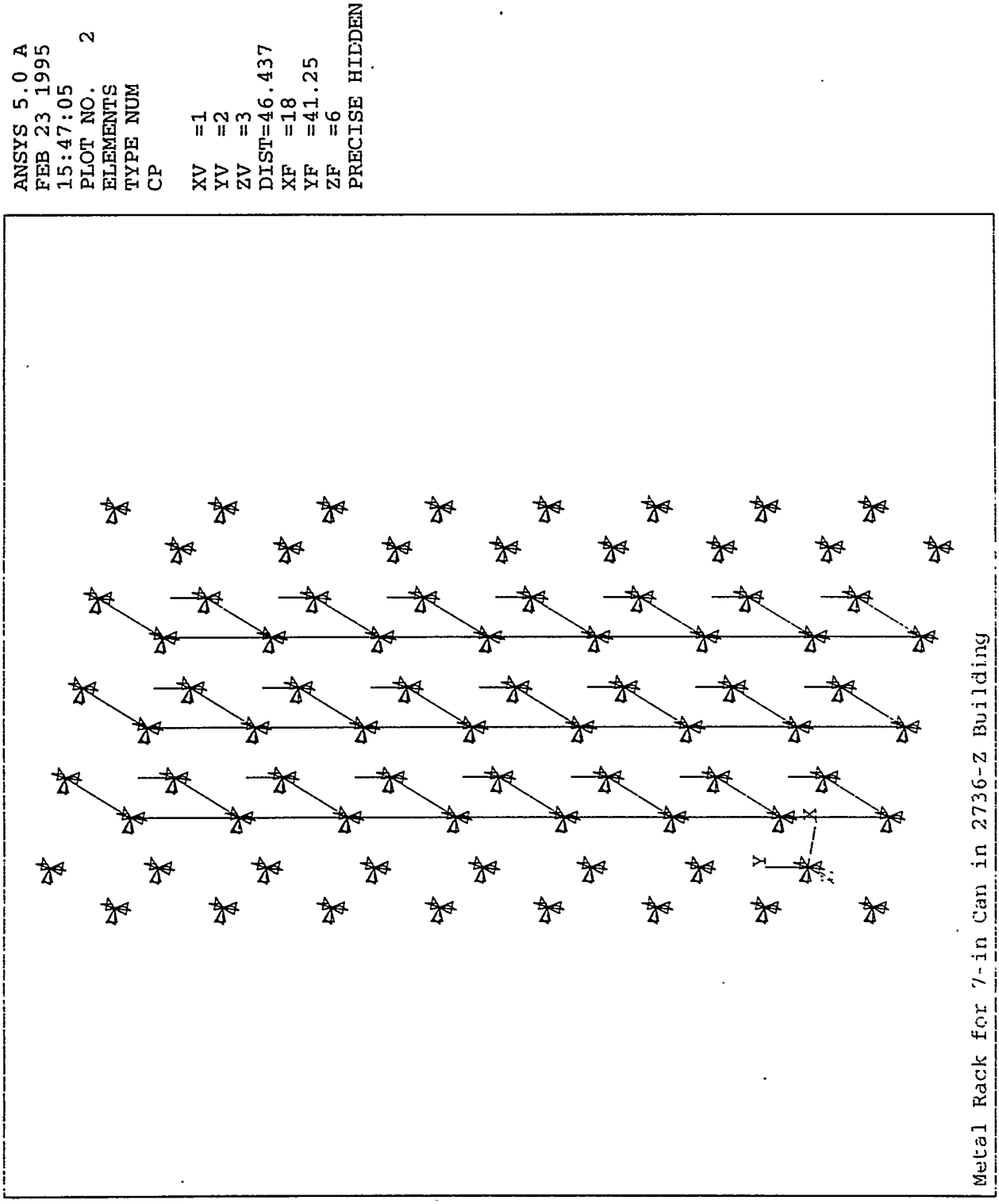
ANSYS Model Used in this Analysis (4 Pin Supports at Floor and Undirectional (Z) Pin Support for Cross Bracing).



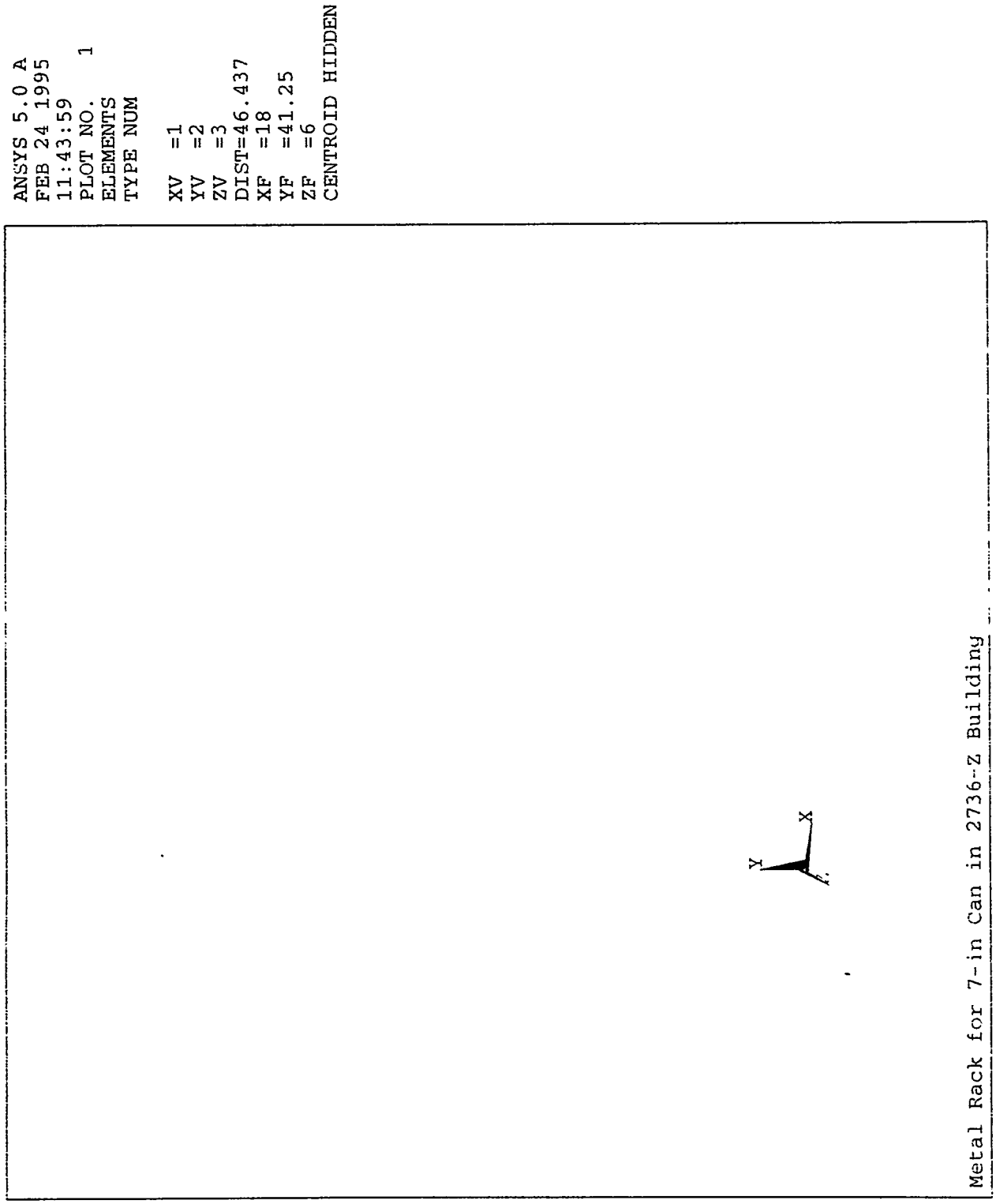
ANSYS Model Used in this Analysis (2 Pin Supports at Floor and Pin Support for Cross Bracing).



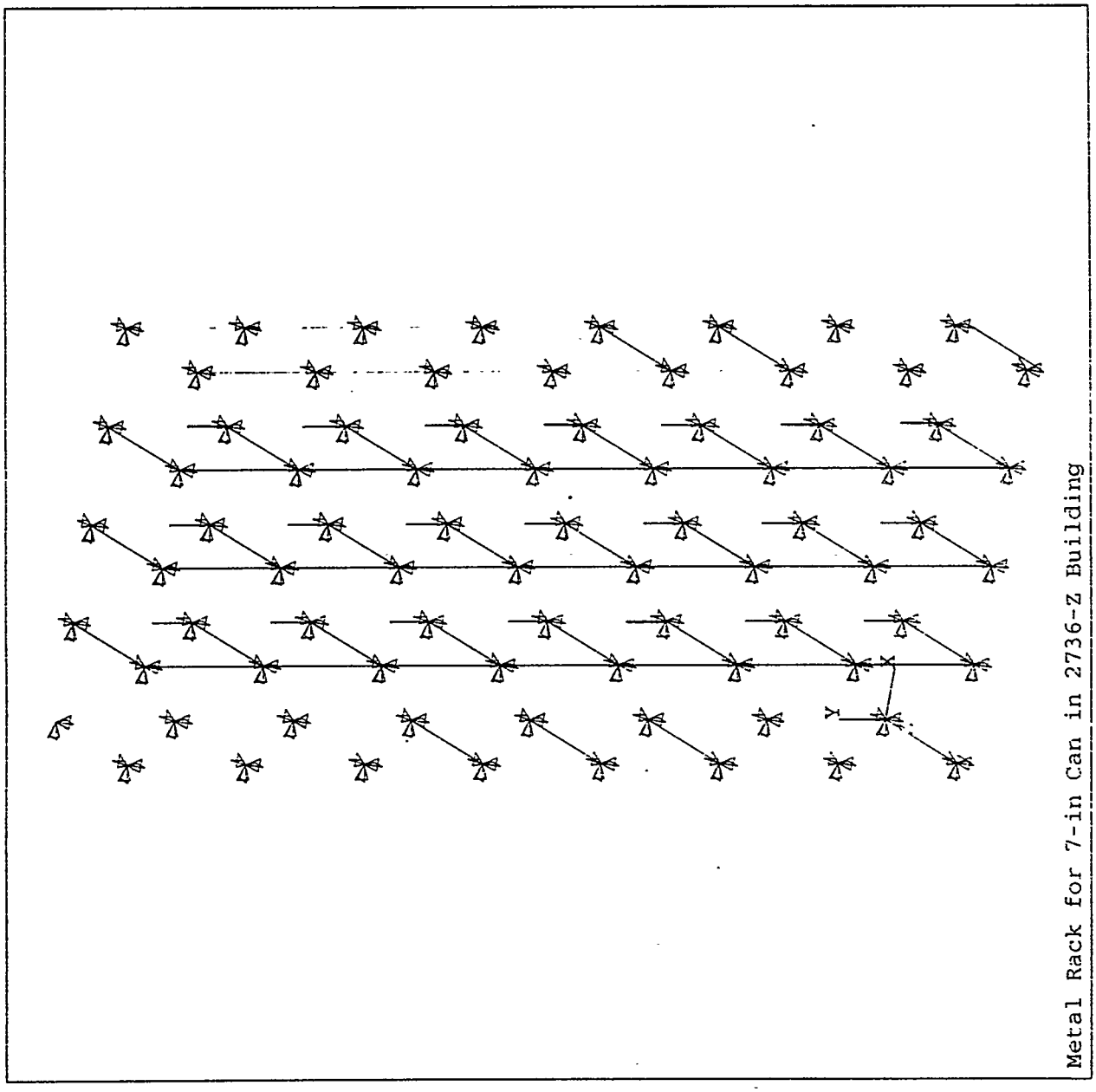
ANSYS Model: Back and Side Faces.



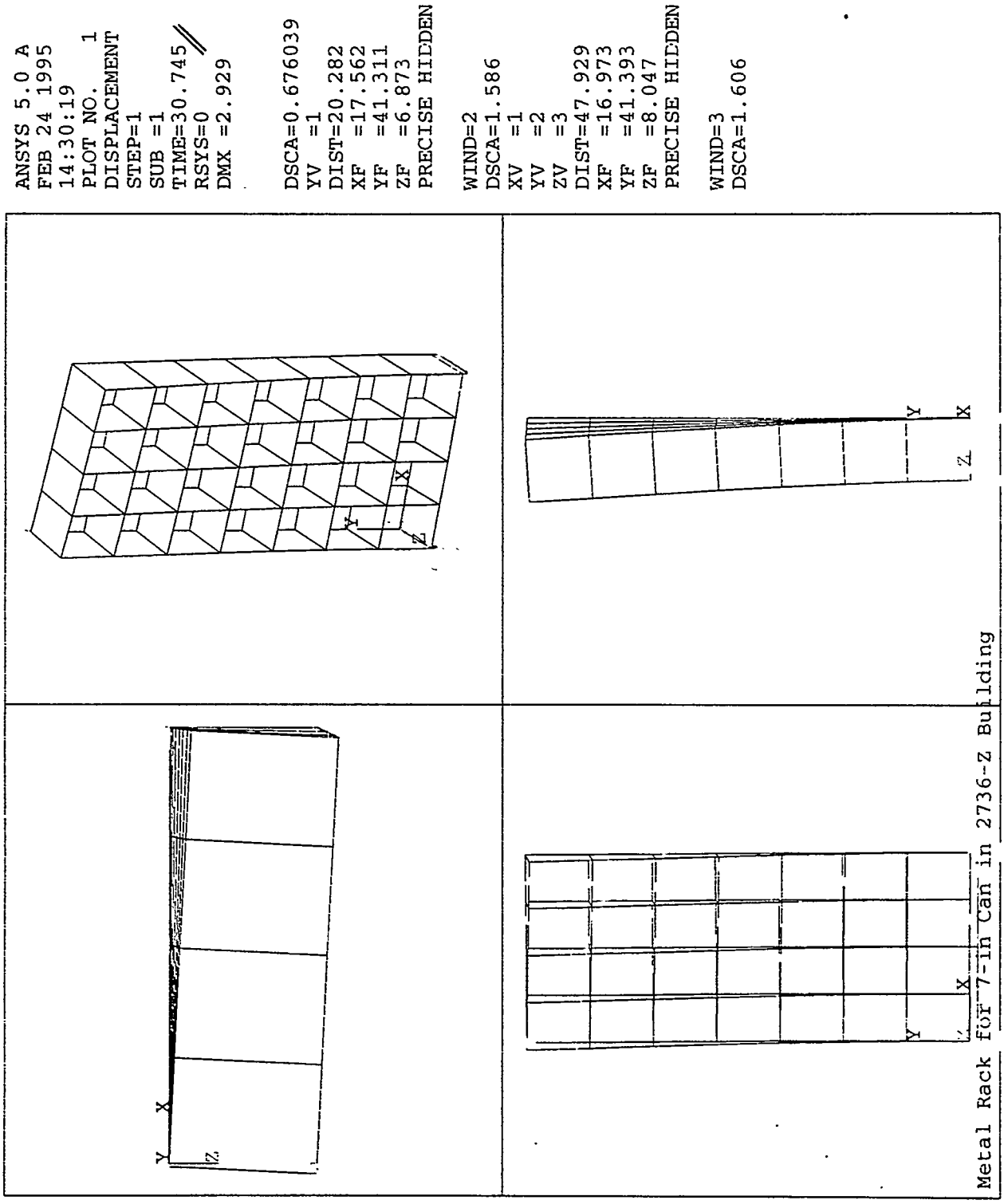
ANSYS Model: Shelves and Vertical Dividers and their Coupling.



ANSYS Model: Beam Elements Representing Bent Plate at Shelf Edges.



Master DOF used in Householder Modal Analysis for 4-Floor-Anchor Model.



Fundamental-Frequency Mode Shape for 4-Floor-Anchor Model

ANALYTICAL CALCULATIONS

Page _____ of _____

Subject 7-in Can Metal Storage Rack, 2736-Z Building

Originator Michael Plumis Date 2/27/95

Checker Calvin J. Moore Date 3/2/95

Participation Factor Table for 4-Floor-Anchor Model.

***** PARTICIPATION FACTOR CALCULATION ***** X DIRECTION

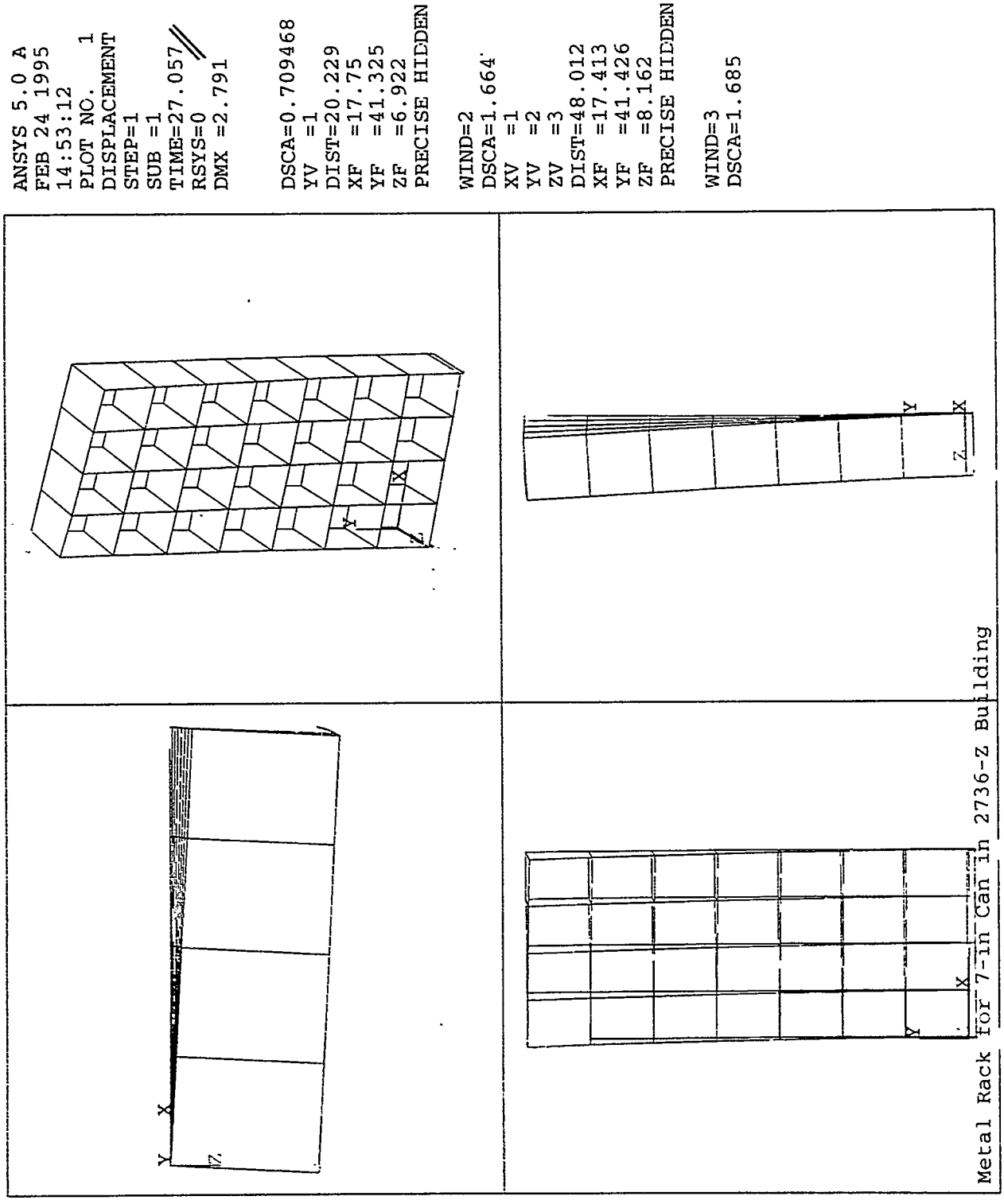
MODE	FREQUENCY	PERIOD	PARTIC.FACTOR	RATIO	EFFECTIVE MASS	CUMULATIVE MASS FRACTION
1	30.7455	0.32525E-01	-0.38053	0.451391	0.144806	0.127364
2	80.0271	0.12496E-01	0.84302	1.000000	0.710690	0.752449
3	99.9192	0.10008E-01	-0.15839	0.187881	0.250868E-01	0.774514
4	139.277	0.71799E-02	-0.79651E-01	0.094482	0.634429E-02	0.780094
5	143.318	0.69775E-02	0.15298E-02	0.001815	0.234021E-05	0.780096
6	159.761	0.62593E-02	0.22656	0.268752	0.513314E-01	0.825244
7	224.332	0.44577E-02	-0.40759	0.483483	0.166128	0.971361
8	351.303	0.28465E-02	-0.69358E-01	0.082273	0.481055E-02	0.975593
9	371.620	0.26909E-02	-0.27688E-01	0.032844	0.766633E-03	0.976267
10	389.391	0.25681E-02	-0.17387E-01	0.020624	0.302305E-03	0.976533
239	10373.8	0.96397E-04	-0.13927E-02	0.001652	0.193963E-05	1.00000
			SUM OF EFFECTIVE MASSES=		1.13695	

***** PARTICIPATION FACTOR CALCULATION ***** Y DIRECTION

MODE	FREQUENCY	PERIOD	PARTIC.FACTOR	RATIO	EFFECTIVE MASS	CUMULATIVE MASS FRACTION
1	30.7455	0.32525E-01	-0.35637E-01	0.046902	0.127000E-02	0.115093E-02
2	80.0271	0.12496E-01	-0.17118E-01	0.022530	0.293041E-03	0.141650E-02
3	99.9192	0.10008E-01	0.21558E-02	0.002837	0.464749E-05	0.142071E-02
4	139.277	0.71799E-02	0.25928	0.341242	0.672263E-01	0.623441E-01
5	143.318	0.69775E-02	0.75981	1.000000	0.577317	0.585534
6	159.761	0.62593E-02	0.90389E-01	0.118962	0.817013E-02	0.592938
7	224.332	0.44577E-02	-0.48014E-02	0.006319	0.230530E-04	0.592959
8	351.303	0.28465E-02	-0.23460E-01	0.030877	0.550395E-03	0.593458
9	371.620	0.26909E-02	-0.34319E-01	0.045167	0.117777E-02	0.594525
10	389.391	0.25681E-02	0.58411	0.768755	0.341185	0.903722
239	10373.8	0.96397E-04	0.13986E-07	0.000000	0.195595E-15	1.00000
			SUM OF EFFECTIVE MASSES=		1.10346	

***** PARTICIPATION FACTOR CALCULATION ***** Z DIRECTION

MODE	FREQUENCY	PERIOD	PARTIC.FACTOR	RATIO	EFFECTIVE MASS	CUMULATIVE MASS FRACTION
1	30.7455	0.32525E-01	0.58603	1.000000	0.343430	0.305066
2	80.0271	0.12496E-01	0.38113	0.650367	0.145263	0.434102
3	99.9192	0.10008E-01	-0.84696E-01	0.144525	0.717339E-02	0.440474
4	139.277	0.71799E-02	0.44050	0.751676	0.194044	0.612841
5	143.318	0.69775E-02	-0.51472E-01	0.087832	0.264939E-02	0.615195
6	159.761	0.62593E-02	-0.40803	0.696258	0.166486	0.763083
7	224.332	0.44577E-02	-0.35118E-01	0.059925	0.123326E-02	0.764179
8	351.303	0.28465E-02	0.17781	0.303410	0.316154E-01	0.792262
9	371.620	0.26909E-02	0.72909E-01	0.124411	0.531567E-02	0.796984
10	389.391	0.25681E-02	-0.50546E-02	0.008625	0.255492E-04	0.797007
239	10373.8	0.96397E-04	0.65113E-07	0.000000	0.423966E-14	1.00000
			SUM OF EFFECTIVE MASSES=		1.12576	



Fundamental-Frequency Mode Shape for 2-Floor-Anchor Model.

ANALYTICAL CALCULATIONS

Page _____ of _____

Subject 7-in Can Metal Storage Rack, 2736-Z Building

Originator Michael Plumb Date 2/27/95

Checker Carlton J. Moore Date 3/2/95

Participation Factor Table for 2-Floor-Anchor Model.

***** PARTICIPATION FACTOR CALCULATION ***** X DIRECTION

MODE	FREQUENCY	PERIOD	PARTIC.FACTOR	RATIO	EFFECTIVE MASS	CUMULATIVE MASS FRACTION
1	27.0567	0.36959E-01	-0.65577E-01	0.099571	0.430032E-02	0.387242E-02
2	88.3656	0.11317E-01	0.65859	1.000000	0.433745	0.394458
3	98.7332	0.10128E-01	0.93209E-01	0.141527	0.868783E-02	0.402281
4	117.239	0.85296E-02	0.64328	0.976756	0.413815	0.774920
5	131.178	0.76233E-02	0.18597	0.282369	0.345834E-01	0.806062
6	155.604	0.64266E-02	-0.23891	0.362757	0.570776E-01	0.857460
7	262.716	0.38064E-02	-0.21784	0.330767	0.474547E-01	0.900193
8	288.702	0.34638E-02	0.58649E-01	0.089052	0.343968E-02	0.903291
9	349.125	0.28643E-02	-0.19460	0.295475	0.378682E-01	0.937391
10	375.755	0.26613E-02	-0.13269	0.201472	0.176061E-01	0.953245
237	8770.30	0.11402E-03	-0.21005E-02	0.003189	0.441215E-05	1.000000
			SUM OF EFFECTIVE MASSES=		1.11050	

***** PARTICIPATION FACTOR CALCULATION ***** Y DIRECTION

MODE	FREQUENCY	PERIOD	PARTIC.FACTOR	RATIO	EFFECTIVE MASS	CUMULATIVE MASS FRACTION
1	27.0567	0.36959E-01	0.51644E-01	0.097056	0.266711E-02	0.243560E-02
2	88.3656	0.11317E-01	0.35102	0.659675	0.123213	0.114953
3	98.7332	0.10128E-01	0.50889E-01	0.095637	0.258969E-02	0.117318
4	117.239	0.85296E-02	-0.22711	0.426806	0.515772E-01	0.164418
5	131.178	0.76233E-02	0.53211	1.000000	0.283137	0.422979
6	155.604	0.64266E-02	0.49119	0.923111	0.241271	0.643307
7	262.716	0.38064E-02	-0.46584E-01	0.087546	0.217005E-02	0.645288
8	288.702	0.34638E-02	-0.43457E-01	0.081669	0.188847E-02	0.647013
9	349.125	0.28643E-02	0.31433	0.590727	0.988029E-01	0.737239
10	375.755	0.26613E-02	0.41071	0.771851	0.168680	0.891278
237	8770.30	0.11402E-03	-0.26966E-04	0.000051	0.727148E-09	1.000000
			SUM OF EFFECTIVE MASSES=		1.09505	

***** PARTICIPATION FACTOR CALCULATION ***** Z DIRECTION

MODE	FREQUENCY	PERIOD	PARTIC.FACTOR	RATIO	EFFECTIVE MASS	CUMULATIVE MASS FRACTION
1	27.0567	0.36959E-01	0.72136	1.000000	0.520356	0.474221
2	88.3656	0.11317E-01	0.36521	0.506281	0.133378	0.595773
3	98.7332	0.10128E-01	-0.20958E-01	0.029053	0.439235E-03	0.596174
4	117.239	0.85296E-02	-0.42291	0.586270	0.178853	0.759170
5	131.178	0.76233E-02	-0.66911E-01	0.092757	0.447704E-02	0.763250
6	155.604	0.64266E-02	-0.27983	0.387923	0.783054E-01	0.834612
7	262.716	0.38064E-02	0.82165E-01	0.113904	0.675113E-02	0.840765
8	288.702	0.34638E-02	0.23439	0.324934	0.549403E-01	0.890834
9	349.125	0.28643E-02	0.46153E-01	0.063981	0.213009E-02	0.892776
10	375.755	0.26613E-02	-0.22146	0.307004	0.490442E-01	0.937471
237	8770.30	0.11402E-03	-0.12530E-02	0.001737	0.156998E-05	1.000000
			SUM OF EFFECTIVE MASSES=		1.09729	

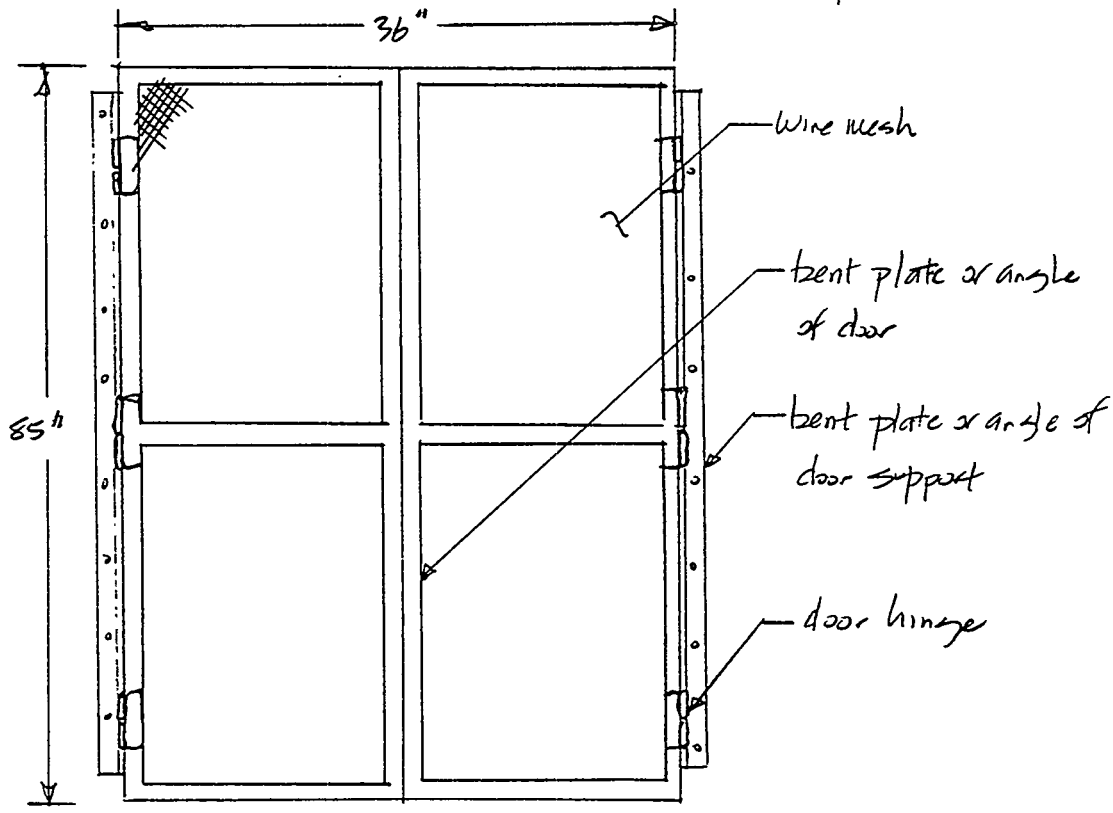
ANALYTICAL CALCULATIONS

Page ____ of ____

Subject 7-in Can Metal Storage Rack, 2736-Z Building
Originator Michael P. Weis Date 2/26/95
Checker Carlita J. Moore Date 3/2/95

Calculate Door Weight.

The door is constructed of wire mesh attached to bent plate or angle



Not To Scale

From the Safety Class 3 analysis, the wire mesh weighs 0.85 lbf/ft² (page B-4) Assuming the two door support beams and the door structural members are 1½" x 1½" x ⅛" bent plate, calculate weight:

$$W = (3" \times 1/16")(4 \times 85" + 3 \times 36" + 2 \times 80")(0.283\ lbf/in^3)$$

(4 × 85": door vertical; 3 × 36": door horizontal; 2 × 80": door supports)

$$(36" \times 85")\left(\frac{1}{144}\ \frac{ft^2}{in^2}\right)(0.85\ lbf/ft^2)$$

(wire mesh)

$$W = 50.5\ lbf$$

ANALYTICAL CALCULATIONS

Page _____ of _____

Subject 7-in Can Metal Storage Rack, 2736-Z Buildings

Originator Michael Plaus Date 2/26/95

Checker Carleton J. Moore Date 3/2/95

Verify mass of one panel as calculated by Ansys.

Ansys output (mass summary by element type):

type	mass ($lbf s^2/in$)	weight (lbf)
beam	0.100324	38.765
elastic shell	0.874165	337.777
lumped mass	0.131	50.618
total		427.2 lbf //

beam elements: columns of structure ($1\frac{1}{2}" \times 1\frac{1}{2}" \times \frac{1}{16}"$) & shelf edges ($1\frac{1}{2}" \times \frac{1}{16}"$)

$$W_{beam} = (28.5\,ft)(0.64\,lbf/ft) + (64\,ft)(0.32\,lbf/ft)$$
$$= 38.72\,lbf$$

shell elements: back & sides & shelves ($\frac{1}{16}"$) and vertical dividers (0.036") (Note: the vertical dividers were measured with a micrometer), and 7-in lumped into shelves

$$W_{shell} = (35.83\,ft^2)(2.56\,psf)_{\text{back \& sides}} + (24\,ft^2)(2.56\,psf)_{\text{shelves}} + (21\,ft^2)(1.48\,psf)_{\text{dividers}} + (28\,cans)(5.5\,lbf/can)_{\text{cans}}$$

$$W_{shell} = 338.32\,lbf$$

lumped mass elements: doors

$$W_{lmass} = 50.5\,lbf$$

$$W_{total} = 427.5\,lbf //$$

ANALYTICAL CALCULATIONS

Page _____ of _____

Subject 7 in Can Metal Storage Rack

Originator M. A. ISLAM Date 3/2/95

Checker E. C. Ocampo Date 3/2/95

Anchor Evaluation

The anchors were evaluated in Rev. 0 as safety class 3 items for which an acceleration of .68 g was used per Design Guide WHC-SD-GN-DGS-30006, Rev 1 (WHC 1993).

Per this evaluation (Rev 0-A), this acceleration was found to be .36 g (Page E-11). Therefore, the loads are reduced to approximately half.

The allowable anchor values were derived per REF [8] chap 4. However, change of safety classification requires to use chap. 8 of REF [8]

Per Rev 0, allow. values for 1/4" ϕ anchor

$T_{all.} = 270^{\#}$
$V_{all.} = 380^{\#}$
} chap. 4 REF [8]

Per this evaluation, (Rev 0-A), allowable values

$T_{all.} = 293^{\#}$
$V_{all.} = 285^{\#}$
} chap. 8 REF [8] See calc. In Page B-52

Because Load (shear only - no tension) is approximately half and allow. shear is 75% ($\frac{285}{380} = .75$), all anchors are adequate.

By comparison, all other items (base angle, struc. bolt, top brake etc.) are adequate.

APPENDIX C

CUBICLES AND PEDESTALS EVALUATION

Cubical Analysis

The 2736Z building use's cubicals as shielding and partitions for the storage of plutonium. The cubicals are concrete vault units about 8 ft high, 1.5 ft long and 2 ft wide with swinging concrete and steel doors. Inside the cubicals are metal pedestal units that hold cans of plutonium. Each pedestal holds 7 to 9 cans and each can is about the size of a small coffee can.

The 8 ft high concrete walls are 8-in. thick and are anchored to the floor to keep them from overturning during an earthquake. The pedestals are bolted to the cubical walls with concrete anchors. And the cans are held on to the pedestals with lipped shelves.

This evaluation will analyze two different configurations of cubicals, two configurations of pedestals, and the results of the shake table test for the retention of the can in the can holders.

Table of Contents

	PAGE
Load Calculation	C-3
Can Holder Testing	C-8
Seismic Acceleration Determination	C-14
Cubical Evaluation Older Configuration	C-16
Cubical Evaluation New Configuration	C-38
Results	C-56

(1) Drawing _____ (2) Doc. No. _____ (3) Page 23 of _____
(4) Building _____ (5) Rev. _____ (6) Job No. _____
(7) Subject 2736Z Cubicles, Rm 4 - Cubicle Wts
(8) Originator EOWeimer Date 5/9/94
(9) Checker MA ISLAM Date 5/10/94

(10) Load Calculation

Cubicle Weights - Rm 4

D-E-or F Panel. Dwg: H-2-26654

Concr:	1.67' x .667' x 8' x 150 pcf =	1340 #
MC 8x8.5	3.7' x 8.5 #/1 =	31
4 L 3x3x 1/4	4 x .667' x 4.9 #/1	13
Total:		1384

G Panel

Concr:	2.65' x .667' x 5.1' x 150 pcf =	2150 #
MC8:	2 x 2.65' x 8.5 #/1 =	45
Total:		2200

J Panel

Concrete: $(.667^2 - \frac{1}{2} \times .333^2) \times 7.5' \times 150$ 440

H - Panel (hinged door)

Concrete:	Use J panel	440
MC8:	7.5' x 8.5 #/1	64
Total		500

Door extension: Dwg H-2-80400

1/4" PL at 0.62 perforation

0.25" x (11" x 7.5 x 12" x 0.62) x .28 pci = 43 #

Pedestal ass'y. Dwg H-2-70010, 70158, 26649

14 cans/ass'y @ 5.5 #/can = 77 #

Holder, 16ga @ 6'Φ, 14 count

2.66 psf x $\frac{\pi}{4}$ x 6^2 ft²/144 x 14 = 7 #

(1) Drawing _____ (2) Doc. No. _____ (3) Page C-4 of _____
(4) Building _____ (5) Rev. _____ (6) Job No. _____
(7) Subject 2736-Z Cubicles, Rm 4
(8) Originator E.O. Werner Date 5/9/94
(9) Checker M.A. ISLAM Date 5/10/94

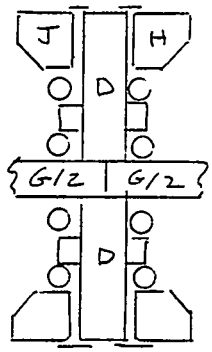
(10)

Instrument frame (photo), est. as
Thin cyl: 3x16 ga, 4.5"ϕ x 2" wall
3 x 2.66 psf x 4.5 x π x 2/144 = 1.6#
Base = wall 1.6#
Total 3.2 x 14 = 45#

Channel. 11 ga
5.16 psf x 3 x 1.75/12 x 7.5' = 17#
Total pedestal assy ≐ 146

One cubicle unit (2 back to back units):

2	D/E/F Panels	2 x 1384#
1	G Panel	2200
2	J Panels	2 x 440
2	H Panels	2 x 500
4	Pedestal assy	4 x 146
2	Door ext's	2 x 43
2	Hood (= door ext	2 x 43
	Total	7600



(1) Drawing _____ (2) Doc. No. _____ (3) Page 65 of _____

(4) Building _____ (5) Rev. _____ (6) Job No. _____

(7) Subject 2736Z Cubicles - Duct Weights - Rm 1.

(8) Originator E.O. Weiner Date 3/22/94

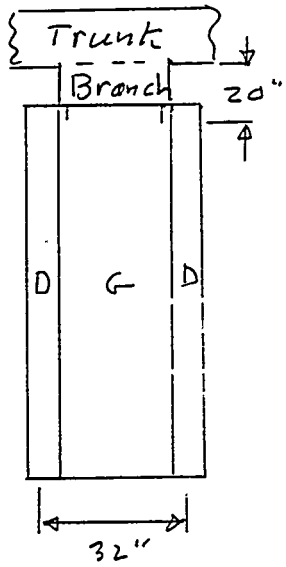
(9) Checker M A ISLAM Date 5/10/94

(10)

Duct Weights - Rm 1

Dwg: H 2 28077

One cubicle (not back/back)



Trunk 1'0" x 1'2" 22ga ASTM-A525

$2 \times (1.0' + 1.17') \times 2.67' \times 1.41$ psf

$= 12.6^{\#}$

Trunk flanges $1\frac{1}{4}" \times 1\frac{1}{4}" \times \frac{3}{16}$ ASTM A36

$2 \times 2 \times (1.0' + 1.17') \times 1.46^{\#/'} = 12.6^{\#}$

Branch 1'0" x 2'0"

$2 \times (1.0' + 2.0') \times 1.67' \times 1.41$ psf

$= 14.1^{\#}$

Branch flanges: 1.5 pr / branch

$1.5 \times 2 \times 2 \times (1.0' + 2.0') \times 1.46^{\#/'} = 26.3$

Total: $W = 12.6 + 12.6 + 14.1 + 26.3 = 66^{\#}$

Both sides (one analysis unit): $W = 66 \times 2 = 132^{\#}$

(1) Drawing _____ (2) Doc. No. _____ (3) Page C6 of _____
(4) Building _____ (5) Rev. _____ (6) Job No. _____
(7) Subject 2736 Z Cubicles - Door & Pedestal Wts - Rm 1
(8) Originator E.O. Weiner Date 3/29/94
(9) Checker MA ISLAM Date 5/11/94

(10)

Door Wts - Rm 1

Rm 1 doors fill in the 24" cubicle opening & are heavier than in Rm 4. Each door includes 3/16" plate on 3 sides. For 2 doors

Concrete: $150\ pcf \times 8" \times 24" \times 95"/1728$
$= 1580^{\#}$

Steel diff'l: $(1.28\ psi - .087) \times .187 \times 95 \times 2(8+24)$
$= 220^{\#}$

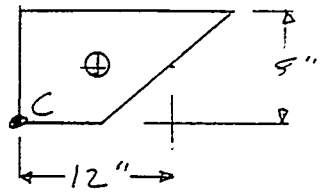
Total 2 doors $= 1580 + 220 = 1800^{\#}$ (Rm 1)
vs $990 + 43 = 1030^{\#}$ for J&H panels & door ext in Rm 4

Amplification: See Rm 4 for development

$$A = \sqrt{1+(2\Psi)^2} \qquad \Psi = \frac{1}{2 + \frac{I_c}{mb^2}}$$

$$I_c = \frac{m}{12}\left((2w_1)^2 + (2w_2)^2\right)$$

$w_1 = 8"$ $w_2 = 12"$



Lateral: $b = 6$ $w_1 = \frac{4}{3}b$ $w_2 = 2b$

$$I_c = \frac{(8/3)^2 + 16}{12} mb^2$$
$$= 1.93\ mb^2$$
$$\Psi = \frac{1}{2 + 1.93} = .255 \qquad A = \sqrt{1+(2\times.255)^2} = 1.12$$

Longitudinal: $b = 4$ $w_1 = 2b$ $w_2 = 3b$

$$I_c = \frac{16+36}{12} mb^2 = \frac{13}{3} mb^2 \qquad \Psi = \frac{1}{2 + \frac{13}{3}} = \frac{1}{6.33}$$

$$A = \sqrt{1+(2/6.33)^2} = 1.05 \qquad \text{Use } \underline{A = 1.15}$$

(1) Drawing _____ (2) Doc. No. _____ (3) Page C7 of _____
(4) Building _____ (5) Rev. _____ (6) Job No. _____
(7) Subject 2736-Z Cubicles - Door and Pedestal Wts - Rm 1
(8) Originator E.O. Weiner Date 5/10/94
(9) Checker MA ISLAM Date 5/11/94

(10)

Pedestal Ass'y - Rm 1

Assemblies are 18 can (sides) or 9 can (back) assemblies vs 14 can ass'y in Rm 4. Scale Rm 4 weights

Side ass'y, each: $W = \frac{18}{14} \times 146^{\#} = 188^{\#}$

Back ass'y: $W = \frac{9}{14} \times 146^{\#} = 94^{\#}$

Overturning, lateral - Rm 1

Follow Rm 4 calc using corrected wts for Rm 1. (Use $a_{max} = 0.34g$)*

Panel	W lb	h in	Ampl —	Ms K"
4 drs.	2×1800	48	1.15	67.6
2 D	2×1385	48	1.0	45.7
G	2200	48	1.0	35.9
Ped	4×188 + 2×94	48	1.0	15.3
Duct	132	106	2.0	9.5
Total	9630			173.5

$$V_1 = \frac{M_s - W h (1 - a_v)}{w} = \frac{173.5^{K''} - 9.63^{K} \times 24'' (1 - .23)}{48}$$

$$= -0.093 \quad (\text{no-uplift})$$

* $a_{max} = 0.34g$ justified because balance of report shows cubicles act as monolith which is quite stiff.

(10) Can/Holder Testing

Ref: Wyle 58060 (Myrick, 1976)

Testing by Wyle Labs of a holder-can configuration is described in the reference. In summary:

- Tests were carried out to the reactor spectrum of 50C-4.1
- Vertical and horizontal phase-incoherent motions were applied
- Test Response Spectra (TRS) envelope Required Response Spectra (RRS) for test cases with 0.25, 0.50, 0.75 and 1.0 g maximum base accelerations
- Duration of each test: T = 40 sec
- The vertical RRS is as severe as the horizontal RRS, whereas 50C-4.1 specifies a vertical spectrum equal to 2/3 of the horizontal.
- Two can weights were tested 1020 gm and 2239 gm
- No 1020 gm can fell out at any level of test
- The 2239 gm cans remained in the holder at levels of 0.25 g and 0.50 g. At 0.75 g

(10)

and 1.0g, the cans fell out from the X-position which has a wall only on one side in the direction of shaking.

Attached is p.I6 of the Wyle report showing the 0.50g test with the 2239 gm can in the X-position. This is the highest level test for which the can did not fall out. Superposed on the chart is the SDC-4.1 0.20g spectrum and it's scaling by x3 to 0.60g ZPA which still fits under the test spectrum. Consequently the allowable ZPA is taken at 0.60g. Using the amplified value of 0.34g in Table 2.5 of WHC-SD-GN-DGS-30006 and a 1.4 factor from UCRL 15910 Section 4.4.4:

$$M.S. = \frac{0.60}{0.34 \times 1.4} - 1 = \underline{0.26}$$

Photos show some form of instrumentation between the can and holder. Since the instrumentation assembly fills up the gap between the can and the holder and the instrumentation assembly provides a larger lip than does the holder, the test is considered still valid, and the above margin is not affected. Holder structural integrity is covered also by the test.

WHC-SD-CP-SA-026 C10 H3
REV 1 PAGE

WYLE LABORATORIES Report No. 58060

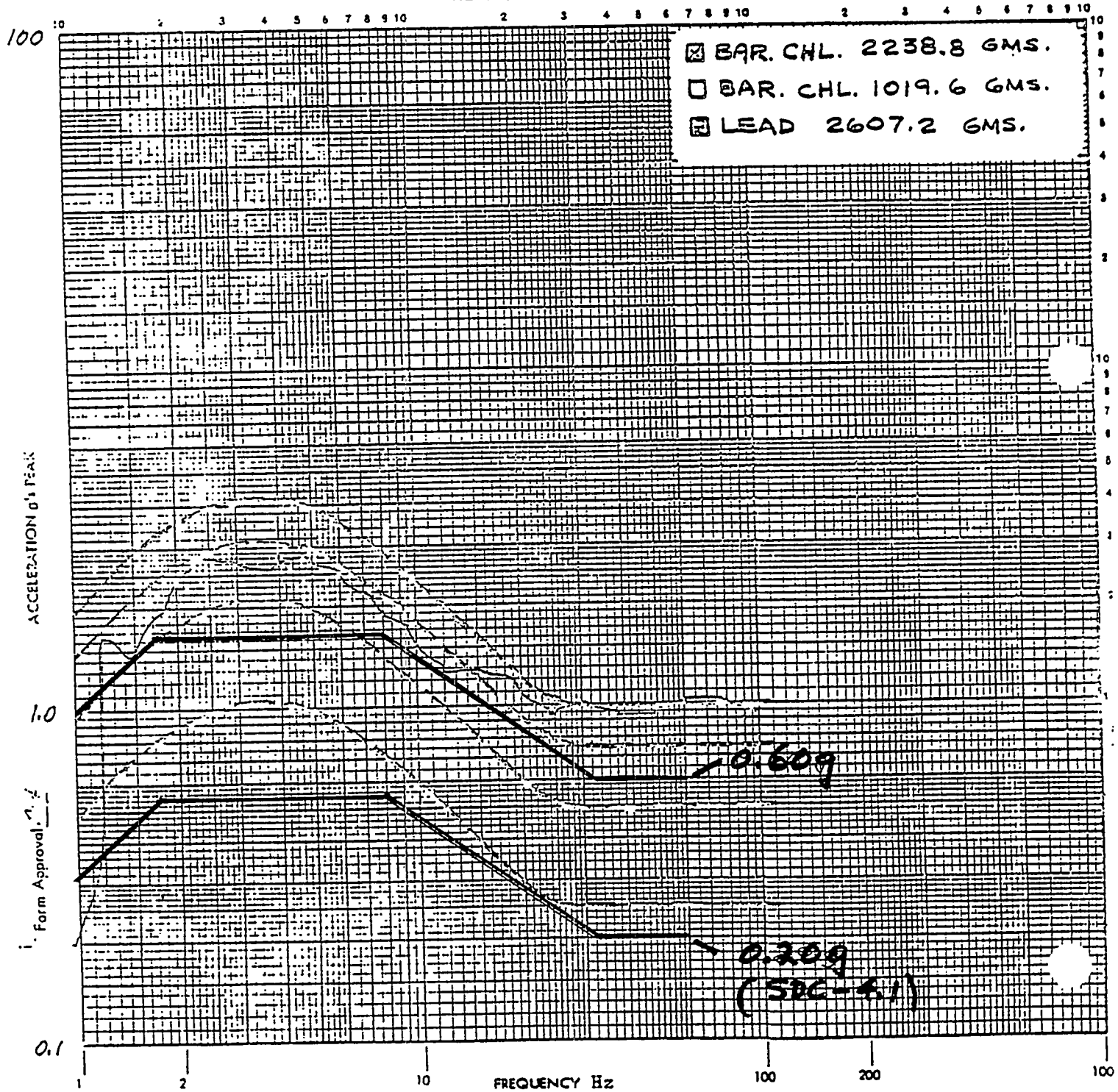
CUSTOMER ATLANTIC RICHFIELD Job No. 58060 Page No. I 6

Full Scale 100 g Accel. No. 1 Control (X) Response ( )

Operator MEEHAN Specimen SEE CHECK BELOW

Date 4/ /76 Damping 2.0 % Axis of Test HORIZ

RESPONSE SPECTRA Run #7



Form Approval

(1) Drawing _____ (2) Doc. No. _____ (3) Page C11 of _____
(4) Building _____ (5) Rev. _____ (6) Job No. _____
(7) Subject 2736-Z Cubicles - Pedestal Ass'y - Rm 4
(8) Originator E.D. Weiner Date 4/4/94
(9) Checker MA ISLAM Date 5/11/94

(10)

Pedestal Ass'y - Rm 4

Pedestal ass'y channels are welded to back panel at 4 places with 1/16" - 1" welds, Table 4 8 of 30006 gives $F_w = 2.7^{K/"}/2 = 1.35^{K/"}$ so

$$T_{all} = V_{all} = 4" \times 1.35^{K/"} = 5.4^K$$

Scale Rm 1 total bolt load by 2/3 (reflecting pedestal weight). Scaling is conservative because Rm 1 channel bolts are centered in web while Rm 4 fillets are located on both sides of web. ∴

$$T = \frac{2}{3} \times 158^\# = 106^\#$$
$$V = \frac{2}{3} \times 243^\# = 160^\#$$

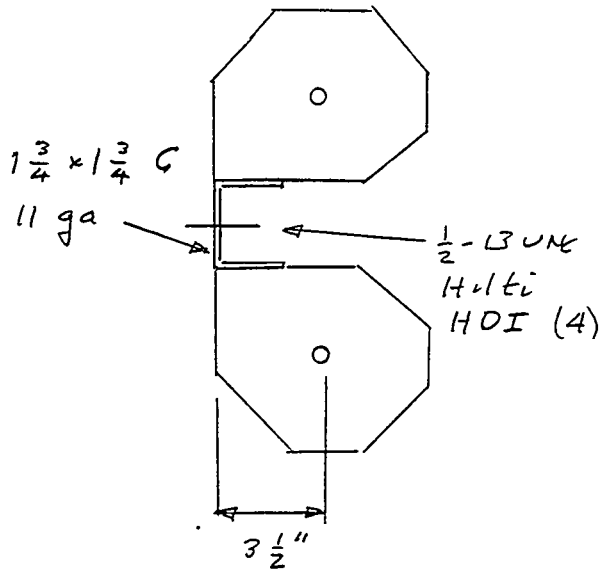
vs $T_{all} = V_{all} = 5.4^K$
M.S. = large, >10

(10)

Pedestal Ass'y Rm 1

See Rm 4 weights.
Pedestal Ass'y Rm 1 - Dwg H-2-70158.
Assembly with 14 cans in Rm 4 is 146 #
Add 6 cans:

$$W = 146 \frac{15}{14} = 188^{\#}$$



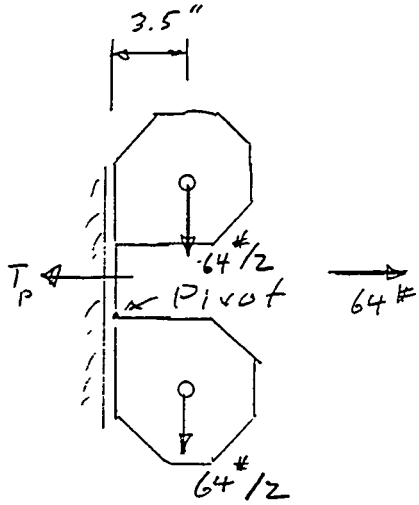
Bolt loads

30006 Table 2.5 $S_a = 0.34g$

$F_x = 188 \times 0.34 = 64^{\#}$/assy

Lateral shaking causes pivot about channel corner. Can next to pivot bears against wall, other holder doesn't

$$T_p = 32^{\#} \frac{3.5"}{1.75"/2} = 128^{\#}$$



Axial loading & shear

$T_a = 64^{\#}$ $V_h = 64^{\#}$ $V_{grav} = 188^{\#}$ $V_v = \frac{2}{3} V_h$

Taken up by 4 bolts:

$$T = 128 + 0.4 \times 64 = 154^{\#}$$

$$V = 64 \rightarrow (188 + \tfrac{2}{3} \times 64) = 239^{\#}$$

(1) Drawing _____ (2) Doc. No. _____ (3) Page C13 of _____

(4) Building _____ (5) Rev. _____ (6) Job No. _____

(7) Subject 2736 Z Cubicles - Pedestal Ass'y - Rm 1

(8) Originator E.O. Weiner Date 5/10/94

(9) Checker MA ISLAM Date 5/11/94

(10)

Bolt capacity (1): 30006 Table 4.3 1/2" bolt:

$T_{nom} = 1720^{\#}$

$V_{nom} = 1790^{\#}$

Section 8.18 for $f_c' = 3000$

$RF_p = \frac{3000}{4000} = .75$

$RF_s = \frac{3000}{10000} + .65 = .95$

Net allowables:

$T_{all} = 1720 \times 0.75 = 1290^{\#}$

$V_{all} = 1790 \times 0.95 = 1700^{\#}$

Interaction

$\frac{T}{T_{all}} + \frac{V}{V_{all}} = \frac{158/4}{1290} + \frac{243/4}{1700} = .066$

$MS = \frac{1}{.066} - 1 > 10$

(7) Subject 2736-Z Cubicles - Door Amplification (Rm 4)

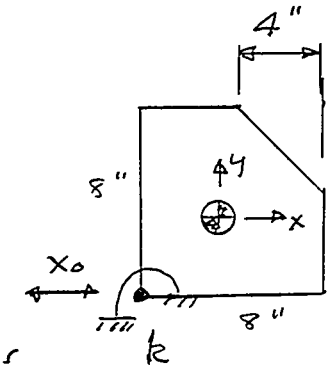
(8) Originator EO Weiner Date 3/30/94

(9) Checker MA ISLAM Date 5/11/94

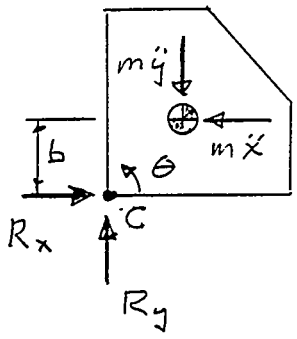
(10) Seismic Acceleration ~~Footing~~ Determination

Door amplification

Doors held with perforated 1/4" PL extensions may not be rigid, but participation is shown to be small:



Ref: Clough & Penzien, Dynamics of Structures, McGraw Hill 1975. Chaps 2, 27.



$y = \cancel{y_o}^{0} + b\theta \qquad R_x = m\ddot{x}$

$x = x_o - b\theta \qquad R_y = m\ddot{y}$

$I_c\ddot{\theta} = m\ddot{x}b - m\ddot{y}b - k\theta \qquad (\Sigma M_c = 0)$

Substitute for $\ddot{x}$ and $\ddot{y}$

$$(I_c + 2mb^2)b\ddot{\theta} + kb\theta = mb^2\ddot{x}_o$$

Frequency and participation for DOF $b\theta$:

$$f = \frac{1}{2\pi}\sqrt{\frac{k}{I_c + 2mb^2}} \qquad \psi = \frac{1}{2 + \frac{I_c}{mb^2}}$$

$$R_x = m\ddot{x} = \underbrace{m\ddot{x}_o}_{\text{Rigid Resp.}} - \underbrace{b\ddot{\theta}}_{\text{Flexible Resp.}}$$

(1) Drawing _____ (2) Doc. No. _____ (3) Page C15 of _____
(4) Building _____ (5) Rev. _____ (6) Job No. _____
(7) Subject 2736-Z Cubicles - Door Amplification (Rm 4)
(8) Originator E.O. Weimer Date 3/30/94
(9) Checker MA ISLAM Date 5/11/94

(10)

Rigid and flexible responses are combined as separate modes (SRSS), and flexible response is amplified fully by a factor of two:

$$R_{rig} = m\ddot{x}_{o\,max} \qquad R_{flex} = \psi m S_{a_{max}} = 2\psi m \ddot{x}_{o\,max}$$

$$\therefore \quad R_{x_{max}} = m\ddot{x}_{o_{max}}\sqrt{1+(2\psi)^2}$$

Estimate ψ from 8x8 cross-section

$$I_c = m\frac{(2w)^2}{6} \qquad w = 2b \qquad I_c = \frac{8}{3}mb^2$$

$$\psi = \frac{1}{2+\frac{8}{3}} = \frac{3}{14}$$

$$R_{x_{max}} = m\ddot{x}_{o_{max}}\sqrt{1+\left(\frac{2\times 3}{14}\right)^2} = 1.09\, m\ddot{x}_{o_{max}}$$

This shows that full door amplification raises the rigid response by about 10%

(1) Drawing _____ (2) Doc. No. _____ (3) Page C16 of _____

(4) Building _____ (5) Rev. _____ (6) Job No. _____

(7) Subject _____

(8) Originator R S Little Date 4-13-94

(9) Checker M A ISLAM Date 5/17/94

(10)

Cubical Evaluation, Older Configuration

Evaluation Agenda:

- Review Details on drawings H-2-26651 & H-2-26654
- Overturning moment, based on rigid seismic response accelerations.
- Assume "monolithic freestanding cubical unit", for both the EW and NS directions, and validate the assumption.
- Wall bending and base shear.
- Concrete details for anchors, reinforcing.
- Base plate detail, for the embedded plate.
- Wall supported cubical unit.
- Building walls bending, and columns bending, due to cubical loads.

(1) Drawing _____ (2) Doc. No. _____ (3) Page 17 of PAGE

(4) Building _____ (5) Rev. _____ (6) Job No. _____

(7) Subject _____

(8) Originator R. A. Hill Date 4-6-94

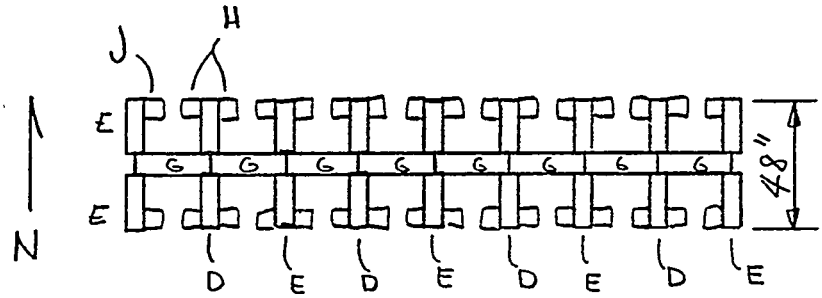
(9) Checker MA ISLAM Date 5/17/94

(10) Review Details on Drawings

Older type cubicals H-2-26651

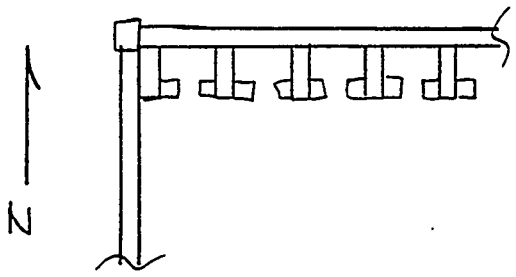
H-2-26651

Free Standing Arrangement:



Rooms 3 & 4

Wall Supported Arrangement:



Room 3 & 4

DESIGN CALCULATION

(1) Drawing _____ (2) Doc. No. _____ (3) Page C18 of _____
(4) Building _____ (5) Rev. _____ (6) Job No. _____
(7) Subject _____
(8) Originator R. A. Gilbert Date 4-6-94
(9) Checker MA ISLAM Date 5/17/94

(10) Overturning Moment "Rigid Response"

Loads

*	Panel E or D	1370#	× 18 panels	=	24660#
	Panel G	2200	× 8	=	17600
	Panel J	440	× 16	=	7040
	Panel H	500	× 16	=	8000
	Door Ext.	43	× 16	=	688
*	Pedestals	127	× 64	=	8128
	Hood	43	× 16	=	688
					66804#

$OTM = 66804 \times 0.34_g \times 48''$

$= 1,090,241\ ''\cdot\#$

NS & EW directions

* Panel E, D has increased to 1384#, Pedestal has increased to 146#;
Total increase is from 66804# to 68272#
2.2% increase

(1) Drawing _____ (2) Doc. No. _____ (3) Page 619 of PAGE

(4) Building _____ (5) Rev. _____ (6) Job No. _____

(7) Subject _____

(8) Originator R. A. Dillon Date 4-6-94

(9) Checker MA ISLAM Date 5/17/94

(10) Assume Monolithic Unit, Rigid Response

Vertical Uplift : NS-direction

OTM = 1,090,241 ft-#

Dead Wt. Resist. Moment

$DWRM = 66804^{\#} \cdot \frac{48''}{2} = 1,603,296$ in-#

Vertical Seismic Moment

$VSM = 66804^{\#}(.34_g \, 3/3)\frac{48''}{2} = 363414$ in-#

$Uplift = OTM + VSM - DWRM$

$= 1090241 + 363414 - 1603296$

$= -149641$ in-# No Uplift

To validate the monolithic wall unit assumption, the in-line wall shear forces must be checked and within allowable stress limits.

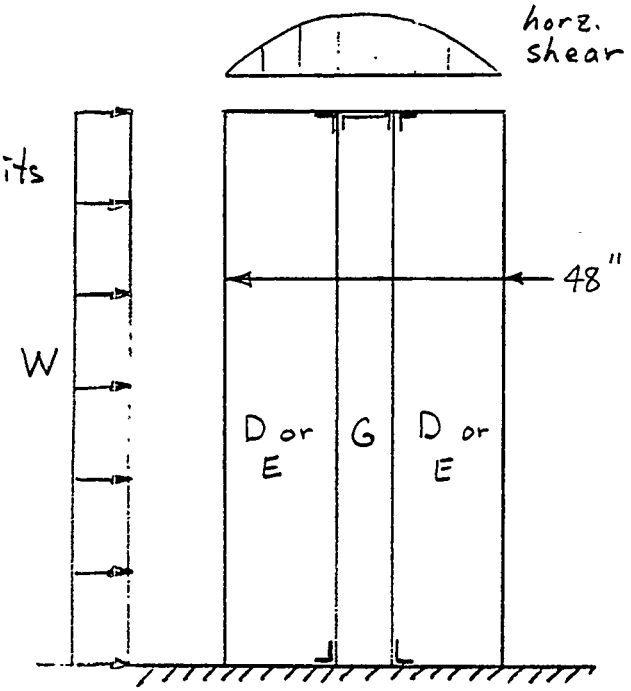
For vertical beams such as the cubical wall units, the in-line shear forces are vertical shear forces.

(1) Drawing _____ (2) Doc. No. _____ (3) Page C20 of _____
(4) Building _____ (5) Rev. _____ (6) Job No. _____
(7) Subject _____
(8) Originator RA Miller Date 4-6-94
(9) Checker MA ISLAM Date 5/17/94

(10) Check In-line (Horizontal) Shear :

Ref. Blodgett 2.4

$\tau = \frac{Vay}{It}$ @ interface between D & G / E & G



V = vert. shear W
= 66804 x .34g ÷ 9units
= 2524 #

a = area = 8" x 20"

I = 160 si

y = 4" + 10" = 14"

$I = \frac{8(48)^3}{12} = 73728\ in^4$

t = 8"

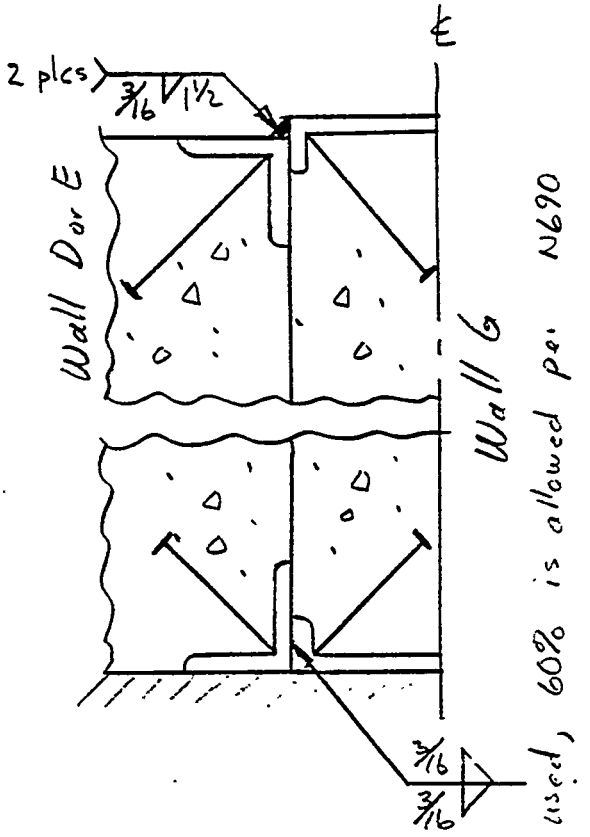
τ = 9.59 psi

The connection between D or E & G is 6" of 3/16" weld, 3" at top & 3" at bottom. Detail 67 on H-2-26654

Shear Force f_v = 96" x 8" x 9.59 psi = 7365 #/wall pair unit

(1) Drawing _____ (2) Doc. No. _____ (3) Page C21 of PAGE C21
(4) Building _____ (5) Rev. _____ (6) Job No. _____
(7) Subject _____
(8) Originator R A Gillespie Date 4-14-94
(9) Checker MA ISLAM Date 5/17/94

(10) Shear Force Transfer :
Wall D or E to Wall G



Shear Stress in Concrete :

$2\phi\sqrt{f'_c} = 93\text{psi} > 9.59\text{psi}$

O.K.

Shear Force Wall D/E Anchors :

2 @ top & 2 @ bott.

$7365^{\#} \div 4 = 1841^{\#}$

anchors are @ 45° so ∴

bolt tension $= .707 \times 1841$
$= 1301^{\#}$

bolt shear $= 1301^{\#}$

bolt allowable $= .6F_y(.049\,si)1.33 = 1955^{\#} > 1301^{\#}$ tension

[Nelson studs $F_y = 50$ ksi] $.4F_y(.049)1.33 = 1303^{\#} > 1301^{\#}$ shear

$S.M. = \frac{1303}{1301} - 1 = .002$ O.K.

33% allowable increase used, 60% is allowed per N690

Shear Stress in welds :

area $= \frac{3}{16} \times .707 \times 6''\text{long} = .795\,si$

$7365^{\#} \div .795 = 9264\,osi < 18{,}000\text{psi}$

$S.M. = \frac{18000}{9264} - 1 = .94$ for E60 electrode

[Monolithic Design is Valid] O.K.

DESIGN CALCULATION

(1) Drawing _____ (2) Doc. No. _____ (3) Page C22 of _____

(4) Building _____ (5) Rev. _____ (6) Job No. _____

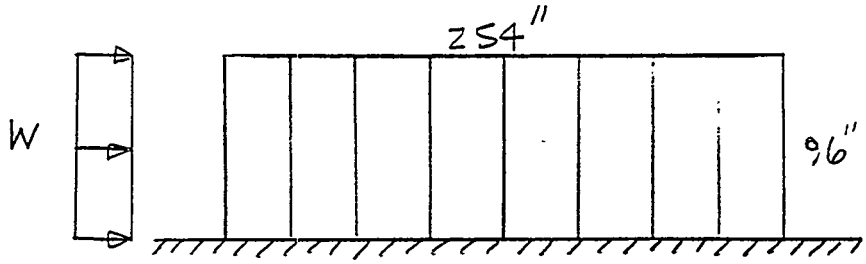
(7) Subject _____

(8) Originator RA Little Date 4-6-94

(9) Checker MA ISLAM Date 5/17/94

(10) Vertical Uplift; EW direction:

$W = 66804^{\#} \times .34g = 22713^{\#}$



From NS-direction calc. no uplift occurs.

In-line shear stress;

$\tau = \frac{Vay}{It}$

$V = 66804 \times .34g = 22713^{\#}$

$a = 8" \times 127" = 1016 \text{ si}$

$y = 127" \div 2 = 63.5"$

$I = 8 \cdot (254)^3/12 = 10\,924\,709$

$t = 8"$

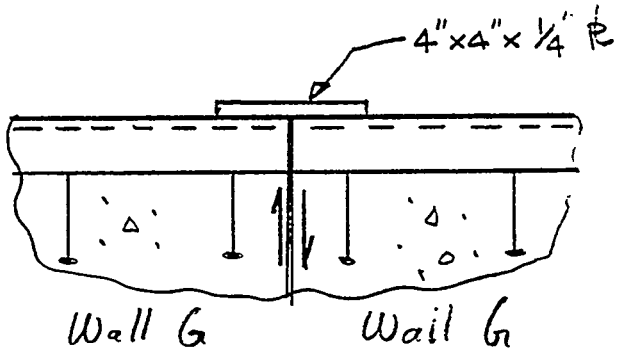
$\tau = 16.77 \text{ psi}$

Shear force $f_v = 16.77 \times 96" \times 8" = 12879^{\#}$

(1) Drawing _____ (2) Doc. No. _____ (3) Page C23 of _____
(4) Building _____ (5) Rev. _____ (6) Job No. _____
(7) Subject _____
(8) Originator RA Hillen Date 4-6-94
(9) Checker MA ISLAM Date 5/17/94

(10) Shear Force Transfer:

See Detail 67
H-2-26654



Shear Stress in Concrete:

$2\phi\sqrt{f'_c} = 93psi > 16.77psi$

OK

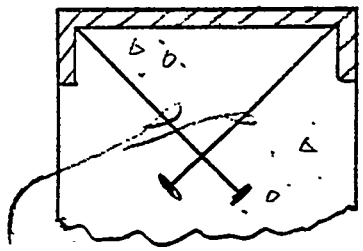
Shear Force in Wall G Anchors:

4 @ top & 4 @ bott.

$12879^{\#} \div 8 = 1610^{\#}$

bolt tension $= .707(1610) = 1138^{\#}$

bolt shear $= 1138^{\#}$



1/4" stud @ 9" O.C.

$1138^{\#} < 1955^{\#}$ & $< 1303^{\#}$

O.K.

Shear Stress in Weld:

$area = \frac{3}{16}"(.707)\ 10" = 1.326\ si$

$12879^{\#} \div 1.326 = 9713\ psi < 18{,}000\ psi$

$S.M. = \frac{18000}{9713} - 1 = .85$ O.K.

[Monolithic Assumption is Valid]

(1) Drawing _____ (2) Doc. No. _____ (3) Page C24 of _____
(4) Building _____ (5) Rev. _____ (6) Job No. _____
(7) Subject _____
(8) Originator R. A. Hill Date 4-6-94
(9) Checker MA ISLAM Date 5/17/94

(10) Wall Bending N.S. direction

Use 4 of the 8 rebars, check capacity & demand

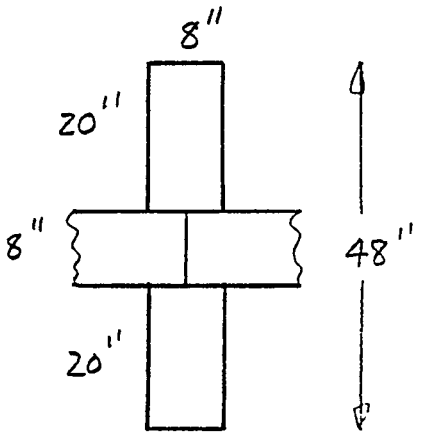
$A_s F_y = ab\ .85 f_c'$

$a = \frac{A_s F_y}{b\ .85 f_c'} = .863''$

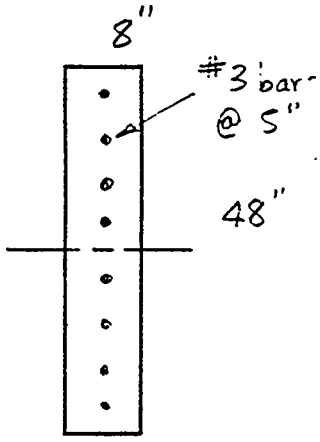
$M = A_s F_y (d - a/2)\ \phi$

$= (.11) F_y \left[(43 - a/2) + (38 - a/2) + (33 - a/2) + (28 - a/2) \right] .9$

$= 555^{\text{ft-K}}$ capacity



wall pair



$M_{reqd.} = \frac{wl^2}{2} = \frac{Wl}{2}$

$= \frac{66805 (.349)\ 96''}{2 (9 \text{ wall pairs})} \left(\frac{1}{1000}\right)$

$= 121^{\text{ft-K}}$ demand O.K.

$S.M. = \frac{555}{121} - 1 = 3.59$

$f_c' = 3000$
$f_y = 40000$
$A = .11/\text{bar}$
$b = 8''$

(1) Drawing _____ (2) Doc. No. _____ (3) Page C25 of _____
(4) Building _____ (5) Rev. _____ (6) Job No. _____
(7) Subject _____
(8) Originator R A Villa Date 4-13-94
(9) Checker MA ISLAM Date 5/17/94

(10) Wall Shear

$V = .66804^{\#} \times .34_g \div 9 \text{ wall pairs} = 2524^{\#}$

$V_c = 2\sqrt{f'_c}\, bd = 2\sqrt{3000}\,(8)(48-3)$

$= 39436^{\#}$

$\phi V_c = .85 \times 39436 = 33521^{\#} > 2524^{\#}$

O.K.

EW-direction Bending & Shear:

O.K. by comparison to NS direction

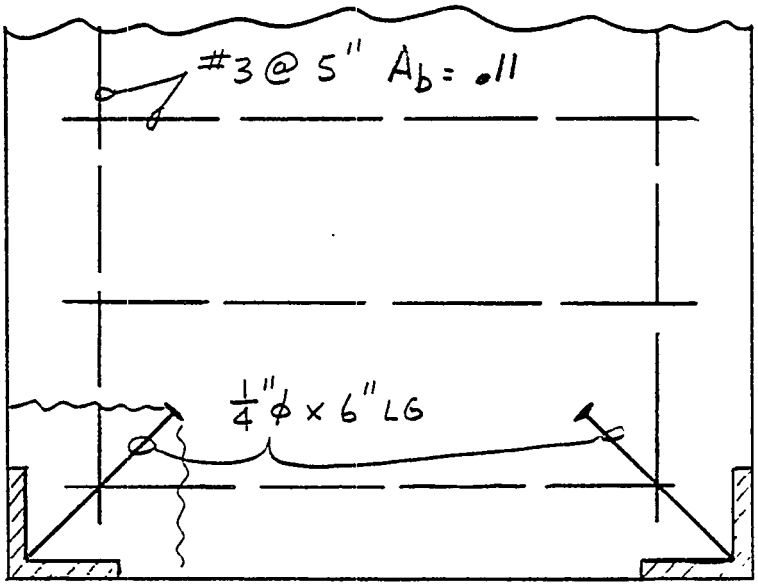
(10) Concrete Details for Anchors & Reinf.

$f_c' = 3{,}000$ psi

$f_y = 40{,}000$ psi

$A_b = .11$

$d_b = .375$



20" Wall

A corner break-out from the head of the anchor would have to cut accross 1 horz. and 1 vert. rebar. Min. embedment into shear cone / corner break-out region is 3"

ACI development length:

$0.04 A_b f_y / \sqrt{f_c'} = 3.21$"

or

$0.03 d_b f_y / \sqrt{f_c'} = 8.2$"

or

Section 12.2.1 = 12"

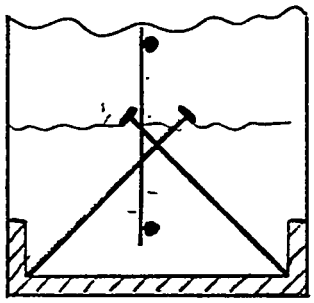
} > 3" check for excess reinf. provided

$8.2" \frac{(A_s \text{ reqd})}{(A_s \text{ provided})} = 8.2" \left(\frac{121}{617}\right) = 1.61" < 3"$

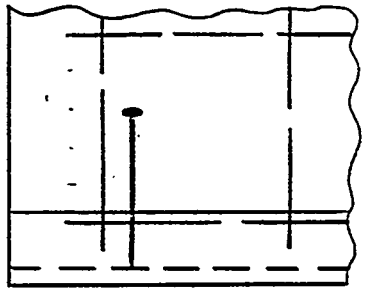
S.M. $= \frac{3}{1.61} - 1 = .86$ OK except for 12.2.1

(7) Subject _____
(8) Originator RS Lillie Date 4-6-94
(9) Checker MA ISLAM Date 5/17/94

(10) Wall G, Detail :



END VIEW

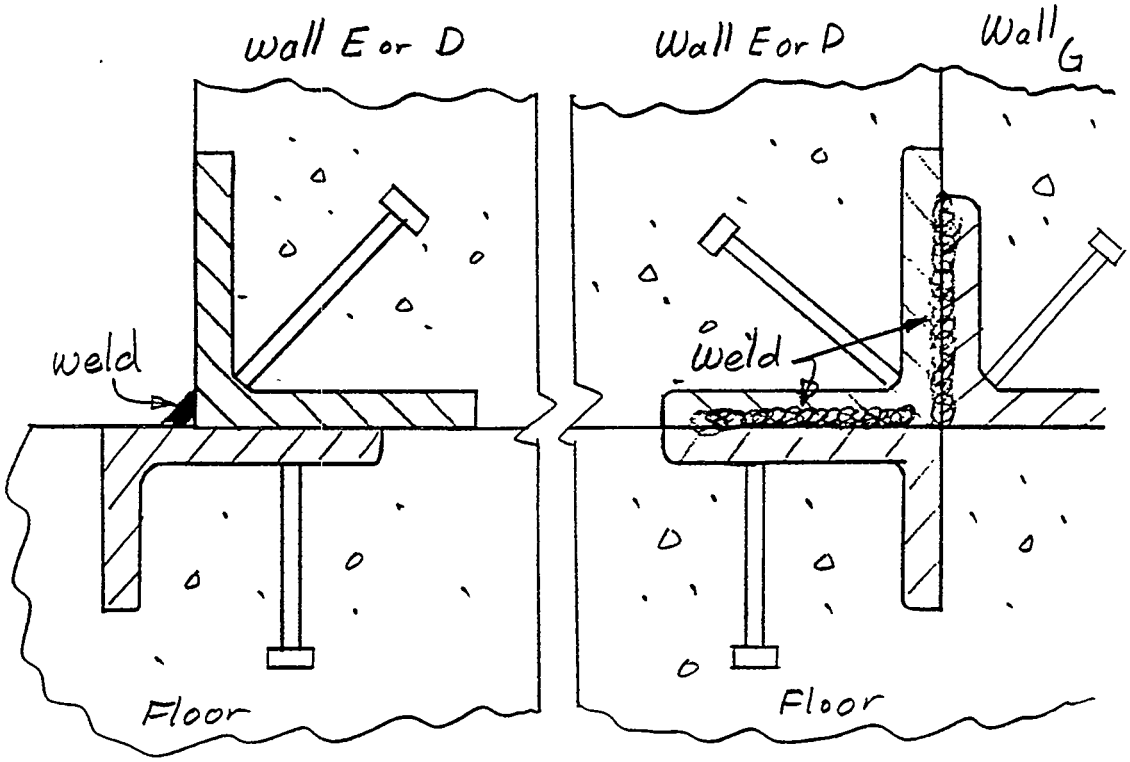


SIDE VIEW

A break-out from the head of the anchor bolt would cut across all vertical rebars. Min. embeddment into shear-break-out region is 3".

ACI development length values and requirement are the same as for Wall E & D and thus O.K.

(10) Base Plate Detail :



Wall anchor bolts are 6" long @ 45° which gives 4" embeddment and 4" edge distance which is deep enough to yield full shear cone capacity.

Uplift of wall left hand view above causes prying action in floor anchor bolt. Because on weld arangement, the uplift of wall in the right hand view above has no prying action.

DESIGN CALCULATION

(1) Drawing _____ (2) Doc. No. _____ (3) Page C29 of ____

(4) Building _____ (5) Rev. _____ (6) Job No. _____

(7) Subject _____

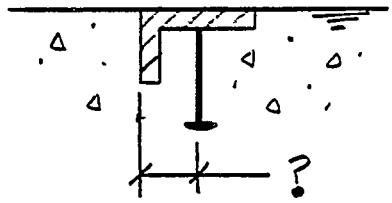
(8) Originator R. A. Gilbert Date 4-5-94

(9) Checker MA. ISLAM Date 5/17/94

(10) Embeded floor Δ Capacity H-2-26651

L3×2×3/16

1/4" studs 4" long @ 16" o.c.



assume 2" from other details on same drawing

bolt-tension cap.

.6 F_y (gross bolt area) 1.33 = 1955#

bolt-shear cap.

.4 F_y (gross bolt area) 1.33 = 1303#

concrete shear cone cap.
from WHC-SD-GN-DGS-30006 Table 8.8
a stud with 3 3/4" embed & 4 3/4 spacing

tension cap = 3740# > 1955# } ductile failure
shear cap = 1870# > 1303# } O.K.

Total Δ capacity:

$\frac{22.33'}{16"/12"} = 16.7 \Rightarrow$ 16 bolts

tension = 16 × 1955# = 31280#

shear = 16 × 1303# = 20848#

DESIGN CALCULATION

(1) Drawing _____ (2) Doc. No. _____ (3) Page C30 of _____

(4) Building _____ (5) Rev. _____ (6) Job No. _____

(7) Subject _____

(8) Originator R S Hill Date 4-6-94

(9) Checker MATSLAM Date 5/17/94

(10) Base Plate Shear:

Loads:

NS = $66804^{\#} \times .34_g = 22713^{\#}$

EW = $22713^{\#}$

Number of Anchors:

16 anchors × 4 base pl = 64

Combined stresses:

$$= \sqrt{\left(\frac{22713}{64}\right)^2 + \left(\frac{22713}{64}\right)^2}$$

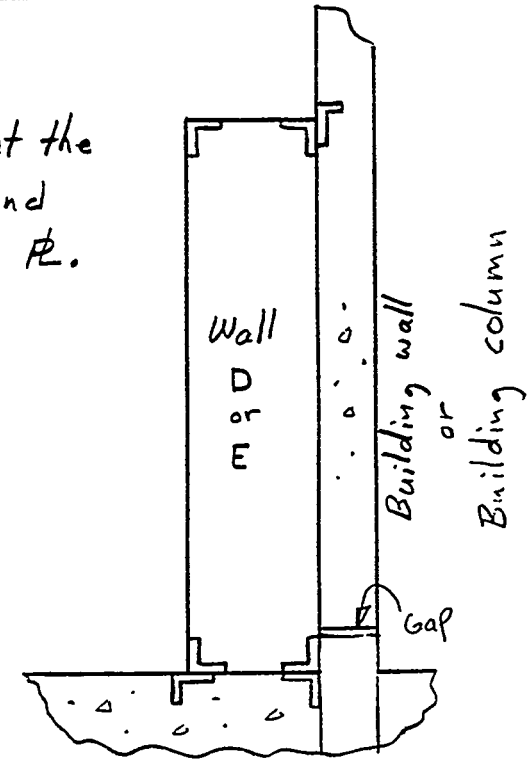
$= 502^{\#} < 1955^{\#}$ O.K.

(7) Subject _____
(8) Originator R. A. Miller Date 4-11-94
(9) Checker MA ISLAM Date 5/17/94

(10) Wall Supported Cubicals

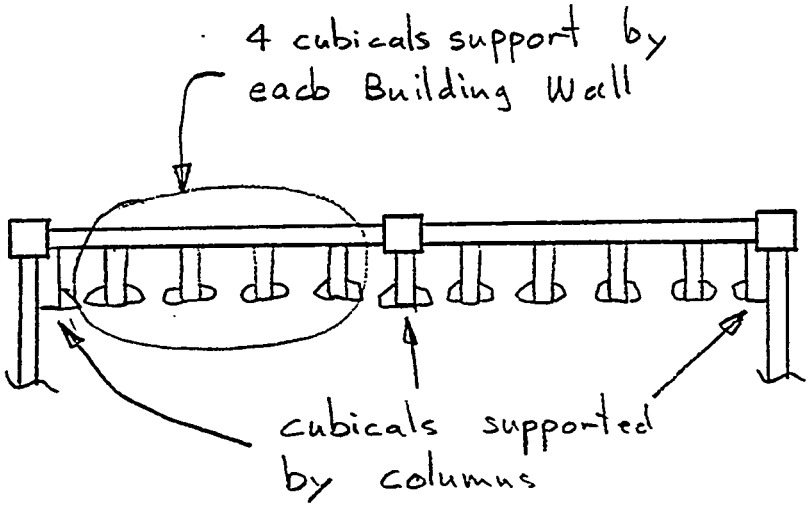
H-2-26654, 26651

Cubical wall is supported at the top by the building wall and at the bottom by embeded ℄.



Check:

- Cubical Wall Bending
- Building Wall Bending
- Base Shear
- Embeded ℄ Shear



(1) Drawing _____ (2) Doc. No. _____ (3) Page C32 of PAGE C32
(4) Building _____ (5) Rev. _____ (6) Job No. _____
(7) Subject _____
(8) Originator RA Gilbert Date 4-11-94
(9) Checker MA ISLAM Date 5/17/94

(10) Loads per Building Wall :

Panel D or E	1370 #	× 8 cubicals	= 10960 #
Panel J	440 #	× 8	= 3520 #
Panel H	500 #	× 8	= 4000 #
Door Ext.	43 #	× 8	= 344 #
Pedestals	127 #	× 32	= 4064 #
Hood	43 #	× 10	= 430 #
			23318 / 2 walls
			11659 #

Building Wall
$(150\ pcf)\left(\frac{8"}{12"}\right)(13.16' \times 10.5')$ = 13818 #

Lateral load :

4 cubical Walls = 11659 × .34g = 3964 #
1 building wall = 13818 × .34g = 4698 #

Resisted by embeded #'s (Floor & Wall)

3964 ÷ 2 = 1982 # / 4 cubical walls

Resisted by building wall

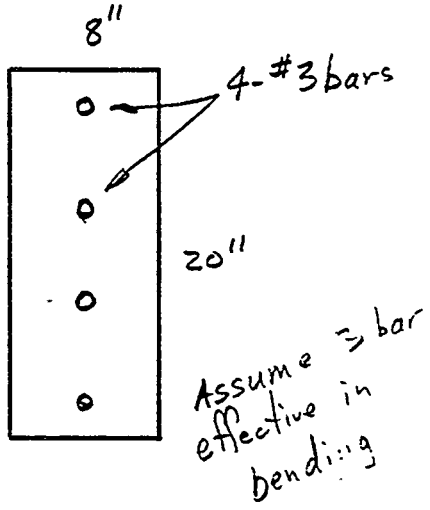
$\frac{3964}{2} + 4698 = 6680$ #

(1) Drawing _____ (2) Doc. No. _____ (3) Page C33 of PAGE C33
(4) Building _____ (5) Rev. _____ (6) Job No. _____
(7) Subject _____
(8) Originator RA Gilles Date 4-11-94
(9) Checker MA ISLAM Date 5/17/94

(10) Cubical Wall Bending:

$$M = \frac{wl^2}{8} = \frac{Wl}{8} = \frac{3964^{\#}(96'')}{8}$$

$$= 47568^{\text{in.}\#}$$



Capacity for 4 walls:

$$A_s f_y = a\,b\,.85 f_c'$$

$$a = \frac{A_s f_y}{b\,.85 f_c'} = \frac{(3\times.11)\,40}{8''(.85)\,3}$$

$$= .647''$$

$$M = A_s f_y (d - a/2)(4\text{ walls})\,\phi$$

$$= (.11)\,40\left[\left(17.5 - \frac{.647}{2}\right) + \left(12.5 - \frac{.647}{2}\right) + \left(7.5 - \frac{.647}{2}\right)\right](4)\,.9$$

$$= 578.63^{\text{in.K}}$$

$$= 578{,}630^{\text{in.}\#} > 47568^{\text{in.}\#} \quad \text{OK}$$

DESIGN CALCULATION

(1) Drawing _____ (2) Doc. No. _____ (3) Page A34 of PAGE

(4) Building _____ (5) Rev. _____ (6) Job No. _____

(7) Subject _____

(8) Originator R.A. Gilla Date 4-11-94

(9) Checker MA ISLAM Date 5/18/94

(10) Building Wall Bending :

Out-of-Plane Bending :

From WHC-SD-CP-SA-023 2736Z building analysis the wall bending capacity is 3.03 $^{1.K}/_{ft}$. A load of 66.5 psf produces 1.04 $^{1.K}/_{ft}$ bending moment

Adding the cubical load to the building wall load of 66.5 psf gives;

$$66.5 \text{ psf} + \frac{1982}{(13.16 * 10.5)} = 80.8 \text{ psf}$$

The new bending moment is;

$$1.04 \, {}^{1.K}/_{ft} \left({}^{80.8}/_{66.5}\right) = 1.26 \, {}^{1.K}/_{ft} < 3.03 \, {}^{1.K}/_{ft}$$

$$S.M. = \frac{3.03}{1.26} - 1 = 1.4 \qquad \text{O.K.}$$

See page A4-9 of WHC-SD-CP-SA-023

DESIGN CALCULATION

(1) Drawing _____ (2) Doc. No. _____ (3) Page 635 of _____

(4) Building _____ (5) Rev. _____ (6) Job No. _____

(7) Subject _____

(8) Originator R. A. Gilla Date 4-11-94

(9) Checker M A ISLAM Date 5/18/94

(10) Building Column Bending

lateral cubical loads.

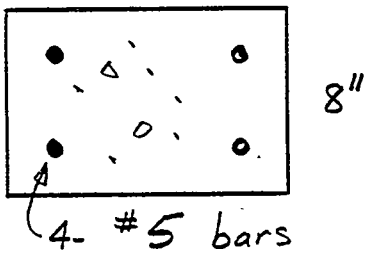
$1370 + 2\times500 + 2\times43 + 4\times127 = 2964^{\#}$

$(2964 \times .34g) \div 2 = 504^{\#}$ point load

lateral load from adj. bldg walls;

$(6680^{\#} \times 2 \text{ walls})\ 35\%^{*}$

$= 4676^{\#}$ distributed load



length $10'-10" = 130"$

WHC-SD-CP-SA-023

page A5-11

Moment;

$$M = \frac{Pl}{4} + \frac{Wl}{8}$$

$$= \frac{504(130)}{4} + \frac{4676(130)}{8}$$

$= 92\,365^{\text{in.\#}}$

$92.4^{\text{in.K}}$

From WHC-SD-CP-SA-023 page A5-10 thru A5-17 this column has been qualified for a $86^{\text{in.K}}$ moment at the column top with a M.S. of 0.92, by comparison $92.4^{\text{in.K}}$ is O.K. with a M.S. of 0.79

* Based on tributary area 35% of wall load is supt. @ wall ends and 30% @ roof, 0% @ floor

DESIGN CALCULATION

(1) Drawing _____ (2) Doc. No. _____ (3) Page C36 of _____

(4) Building _____ (5) Rev. _____ (6) Job No. _____

(7) Subject _____

(8) Originator RA Hill Date 4-6-94

(9) Checker MA ISLAM Date 5/18/94

(10) Base Shear

From wall analysis, the base shear of the cubical wall is developed in reinforcing and embedment of weld studs. O.K.

Floor Embed Pt Shear (@ outside wall):

1303 #/stud × 21 studs/angle × 2 angles

= 54726 #

54726 # ÷ 11 cubical walls = 4975 #/wall

4975 # > 504 # O.K.

Wall Embed Pt tension: (¼" studs @ 16" o...)

1955 #/stud × 10 studs/angle ÷ 4 cubicals

= 4888 #/cubical

4888 # > 504 # O.K.

(1) Drawing _____ (2) Doc. No. _____ (3) Page C37 of _____
(4) Building _____ (5) Rev. _____ (6) Job No. _____
(7) Subject _____
(8) Originator R A Tillen Date 4-18-94
(9) Checker MA ISLAM Date 5/18/94

(10) Margins of Safety

Embedments @ wall corners

$\frac{1303^{\#}}{1301}$ -1 bolt shear = 0.002

$\frac{1955}{1301}$ -1 bolt tension = 0.50

welds @ wall corners

$\frac{18000}{9264}$ -1 = 0.94

Wall Bending

$\frac{555}{121}$ -1 = 3.59

Rebar development length

$\frac{3}{1.67}$ -1 = 0.86

Embeded Pl shear

$\frac{1955}{502}$ -1 = 2.89

Buiding Wall bending

$\frac{3.03}{1.26}$ -1 = 1.40

Building Col. bending = 0.79

(1) Drawing _____ (2) Doc. No. _____ (3) Page C38 of PAGE

(4) Building _____ (5) Rev. _____ (6) Job No. _____

(7) Subject _____

(8) Originator RA Miller Date 4-18-94

(9) Checker MA ISLAM Date 5/18/94

(10)

Cubical Evaluation, Newer Configuration

Evaluation Agenda:

- Review Details on drawings H-2-70010 & H-2-70011
- Overturning moment, based on rigid seismic response accelerations.
- Assume "monolithic freestanding cubical unit", for both the EW and NS directions, and validate the assumption.
- Wall bending and base shear.
- Concrete details for anchors, reinforcing.
- Base plate detail, for the embedded plate.
- Wall supported cubical unit.
- Building walls bending, and columns bending, due to cubical loads.

(1) Drawing _____ (2) Doc. No. _____ (3) Page C39 of _____

(4) Building _____ (5) Rev. _____ (6) Job No. _____

(7) Subject _____

(8) Originator R A Miller Date 4-13-94

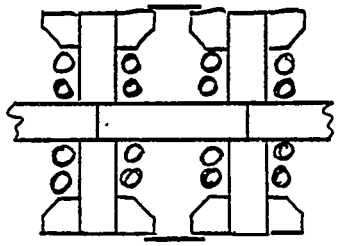
(9) Checker MA ISLAM Date 5/18/94

(10) Review Details on Drawings

New type cubicals H-2- 70010

H-2- 70011

Old type cubical: Room 3 & 4

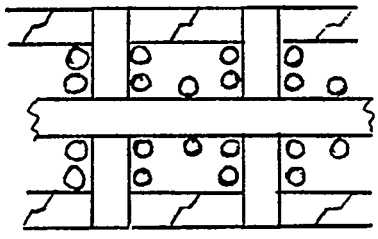


4 pedestals per cubical.

7 cans per pedestal.

Doors are ½ concrete and ½ metal.

New type cubical: Room 1



5 pedestals / cubical.

9 cans per pedestal.

Door are all concrete and interlock for better shielding.

DESIGN CALCULATION

(1) Drawing _____ (2) Doc. No. _____ (3) Page C40 of _____
(4) Building _____ (5) Rev. _____ (6) Job No. _____
(7) Subject _____
(8) Originator R S Lillo Date 4-13-94
(9) Checker MA ISLAM Date 5/18/94

(10) Overturning Moment "Rigid Response

Loads

Panel A or C	1370# × 18 panels	= 24660#
Panel B or F	2200 × 8	= 17600
Panel D	900 × 16	= 14400
Panel E	900 × 16	= 14400
Pedestals	191 × 32	= 6112
	95 × 16	= 1520
Duct	66 × 16	= 1056
		79748#

$$OTM = 79748^{\#} \times 0.34g \times 48''$$

$$= \underline{1,301,487\ ''\cdot\#}$$

NS & EW directions

(1) Drawing _____ (2) Doc. No. _____ (3) Page C41 of _____
(4) Building _____ (5) Rev. _____ (6) Job No. _____
(7) Subject _____
(8) Originator RA Hill Date 4-14-94
(9) Checker MA ISLAM Date 5/18/94

(10) Note: The remaining calculations follow the same methods as the older type cubicals.

Assume Monolithic Unit

Check N.S. direction:

OTM = 1 301 487 ft.#

DWRM = $79748^{\#} \times \frac{48''}{2} = 1,913,952$ ft.#

VSM = $79748\left(0.34 \times \frac{2}{3}\right)\frac{48}{2} = 433,829$ ft.#

Uplift = OTM + VSM − DWRM

= − 178,636 ∴ No Uplift.

Check In-line Shear:

$\tau = \frac{V a y}{I t}$

V = 79748 × .34g ÷ 9 units

I = 3013#

a = 160 si y = 14"

I = 73728 in^4 t = 8"

τ = 11.44 psi

Shear Force f_v = 11.44 × 96" × 8" = 8786 #

DESIGN CALCULATION

(1) Drawing _____ (2) Doc. No. _____ (3) Page C42 of _____
(4) Building _____ (5) Rev. _____ (6) Job No. _____
(7) Subject _____
(8) Originator R.A. Gilbert Date 4-14-94
(9) Checker MA ISLAM Date 5/18/94

(10) In-Line Shear Cont. :

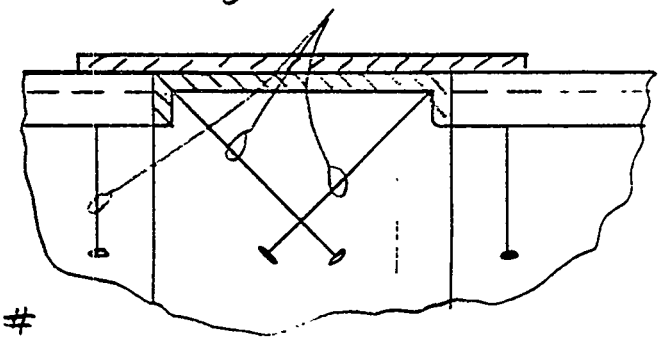
Shear force, f_v = 96" x 8" x 11.44 psi = 8786 # / wall pair unit

weld area = $\frac{3}{16}$" x .707 x 7" = .928 si

8786 # ÷ .928 = 9468 psi < 18,000

S.M.$_1$ = $\frac{18000}{9468} - 1 = .9$ O.K.

Check Shear in Studs :



2 studs @ top &
2 studs @ bott
resist shear force

force per stud

8786 # ÷ 4 studs = 2197 #

Detail II & III on H-2-70010
Detail 3 on H-2-70011
3/8" ø area = .110

because studs are at 45° to force, the tens & shears are:

.707 x 2197 # = 1553 #

.6Fy(.11) 1.33 = 4389 # > 1553 #

.4Fy(.11) 1.33 = 2926 # > 1553 #

S.M.$_2$ = $\frac{2926}{1553} - 1 = .88$

[Monolithic Design is valid]

(10) Shear Force Transfer:
Wall A or C to B or F

Shear Stress in Concrete

$2\phi\sqrt{f'_c} = 93 psi > 11.44 psi$

O.K.

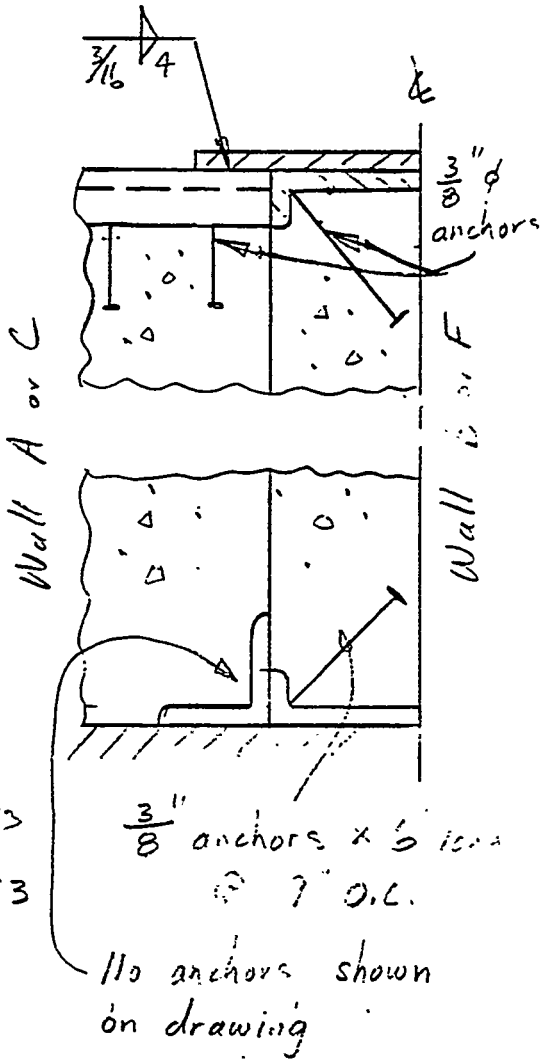
Shear Force in Anchors:
4 @ Top 0 @ bott

$8786^{\#} \div 4 = 2197^{\#}$

anchors are @ 45° so:.
tension = .707 (2197) = $1553^{\#}$
shear = $1553^{\#}$

Allowable
$T = .6F_y(.11si)1.33 = 4389^{\#} > 1553$
$V = .4F_y(.11si)1.33 = 2926 > 1553$

O.K.



Shear Stress in welds:

$\frac{3}{16}"(.707)4"long = .530 si$

$8786 \div .530 = 16577 psi < 18000 ps$: O.K.

S.M. = $\frac{18000}{16577} - 1 = .09$

[Monolithic Assumption is valid]

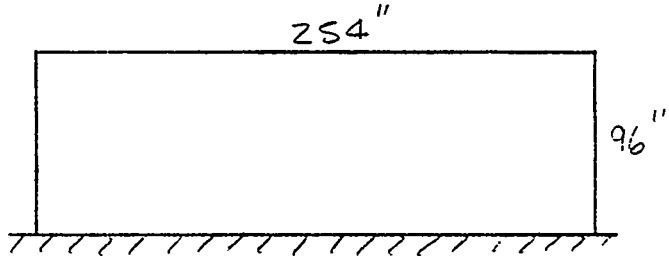
DESIGN CALCULATION

(7) Subject _____
(8) Originator R.A Hille Date 4-13-94
(9) Checker MA ISLAM Date 5/18/94

(10) Check Uplift EW direction:

$W = 79748^{\#} \times .34_g$

$= 27114^{\#}$



$\tau = \frac{Vay}{It}$

$V = 27114^{\#}$ $a = 1016$ si

$y = 63.5"$ $I = 10,924,709\ in^4$

$t = 8"$

$\tau = 20.02$ psi

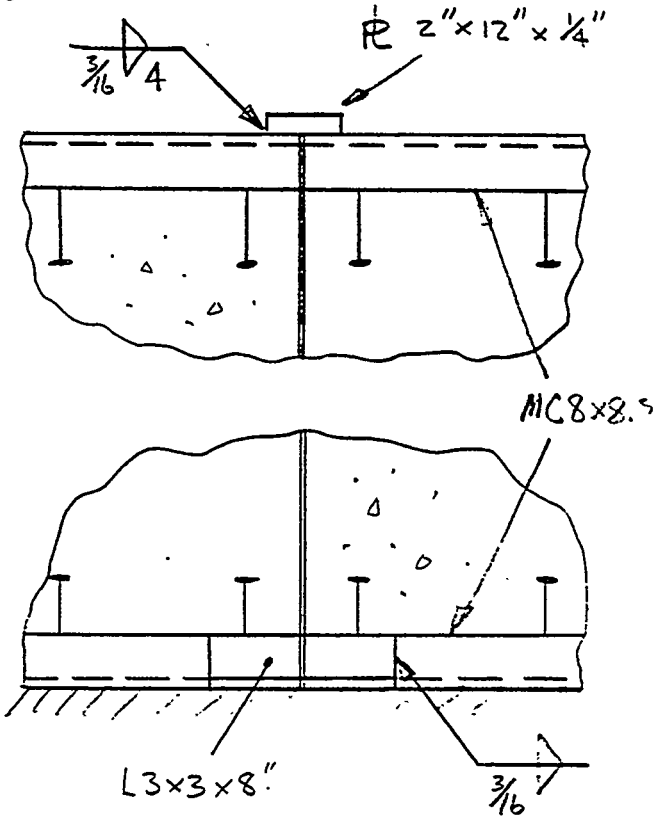
Shear force $f_v = 20.02 \times 96" \times 8" = 15375^{\#}$

(7) Subject _____

(8) Originator RA Gill Date 4-15-94

(9) Checker MA ISLAM Date 5/18/94

(10) Shear Force Transfer :



Shear Stress in Concrete:

$2\phi\sqrt{f_c'} = 93\text{psi} > 20.02\text{psi}$

O.K.

Shear Force in Anchors

4 top & 4 bott

$15375^{\#} \div 8 = 1922^{\#}$

$\text{ten} = .707(1922) = 1359^{\#}$

$4389^{\#} > 1359^{\#}$ O.K.

Shear $= 1359^{\#}$

$2926^{\#} > 1359^{\#}$ O.K.

Shear Stress in welds :

$\frac{3}{16}" (.707)\ 7" = .928$ si

$15375^{\#} \div .928 = 16568$ psi < 18000 psi O.K.

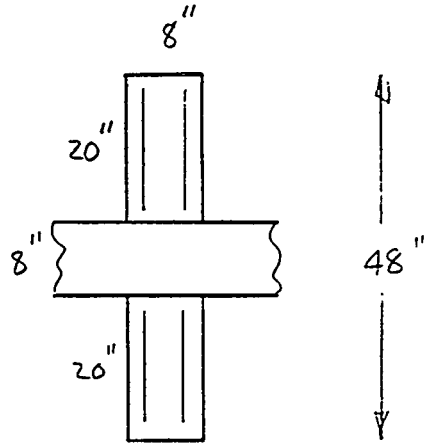
[Monolithic Assumption is Valid]

(10) Wall Bending NS direction

use 10 of the 24 wires

$A_s = 10 \times .04 = .4$ si

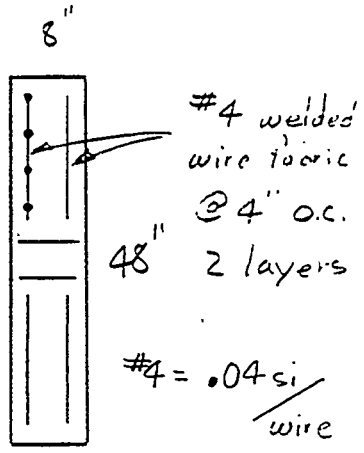
$$a = \frac{A_s F_y}{b\ .85\ f_c'} = .784''$$



$$M = A_s F_y (d - a/2)\ \phi$$

$$= (.08) F_y \left[(46 - a/2) + (42 - a/2) + (38 - a/2) + (34 - a/2) + (30 - a/2) \right] .9$$

$$= 542^{11.K}$$



$$M_{reqd.} = \frac{Wl}{2}$$

$$= \frac{79748\ (.34_g)\ 96''}{2(9\ \text{pairs})\ 1000}$$

$$= 145^{11.K} < 542^{11.K}$$

$$S.M. = \frac{542}{145} - 1 = 2.74$$ O.K.

(1) Drawing ____ (2) Doc. No. ____ (3) Page C47 of ____
(4) Building ____ (5) Rev. ____ (6) Job No. ____
(7) Subject ____
(8) Originator RA Lillo Date 5-18-94
(9) Checker MA ISLAM Date 5/18/94

(10) Wall Shear

$V = 79748^{\#} \times .34_g \div 9 \text{ pairs} = 3013^{\#}$

$V_c = 2\sqrt{f_c'}\, bd$

$\phi = 39436^{\#}$

$\phi V_c = 33521^{\#} > 3013^{\#}$ O.K.

EW-direction O.K. by comparison to NS.

Concrete Details #4 wire mesh

ACI development length

$0.04 A_b f_y / \sqrt{f_c'} = 1.17''$
$.0004 d_b f_y = 3.6''$
} < anchor embedment

S.M. = .186 as in old configuration O.K.
Page C-26

(1) Drawing _____ (2) Doc. No. _____ (3) Page C48 of PAGE

(4) Building _____ (5) Rev. _____ (6) Job No. _____

(7) Subject _____

(8) Originator RA Sullivan Date 4-13-94

(9) Checker MA ISLAM Date 5/18/94

(10) Base Shear :

NS = $79748^{\#} \times .34_g = 27114^{\#}$

EW = $= 27114^{\#}$

Combined Stresses

$$= \sqrt{\left(\frac{27114}{64 \text{ anchors}}\right)^2 + \left(\frac{27114}{64}\right)^2}$$

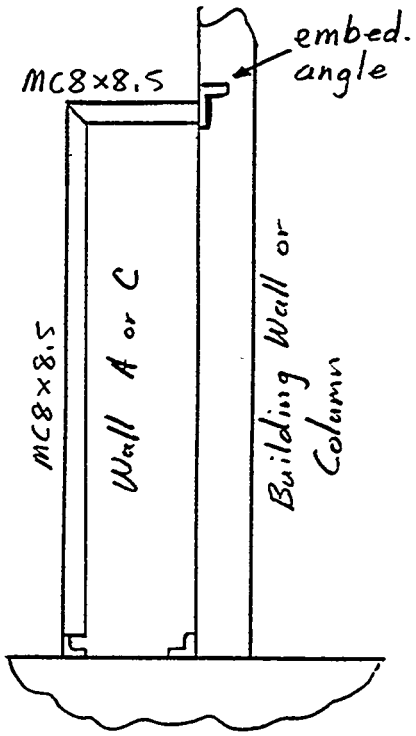
$= 599^{\#} < 2926^{\#}$ O.K.

(1) Drawing _____ (2) Doc. No. _____ (3) Page C49 of _____
(4) Building _____ (5) Rev. _____ (6) Job No. _____
(7) Subject _____
(8) Originator RA Miller Date 4-15-94
(9) Checker MA ISLAM Date 5/18/94

(10) Wall Supported Cubicals

Loads per Wall:

Wall A & C	1370# × 8 cubicals	= 10960#
Wall D	900 × 8	= 7200
Wall E	900 × 8	= 7200
Pedestals	191 × 16	= 3056
	95 × 10	= 950
Duct	66 × 8	= 528
		29894# / 2
		14947#



Building Wall = 13818#

Lateral loads:

14947# × .34g = 5082#

13818# × .34g = 4698#

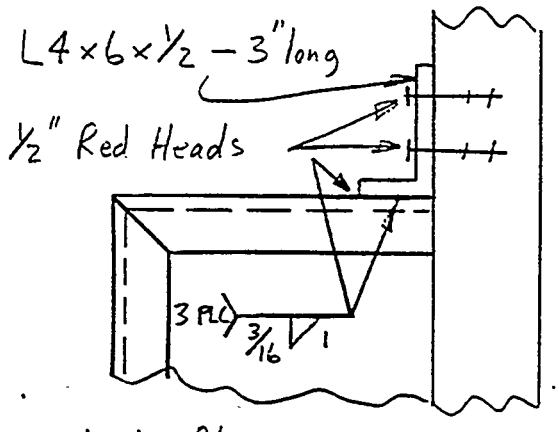
Resisted By embed Rs:

5082 ÷ 2 = 2541#

Resisted By Building Wall:

2541 + 4698 = 7239#

H-2-70010, 11



Detail for embeded angle, from document – CA-77-1268

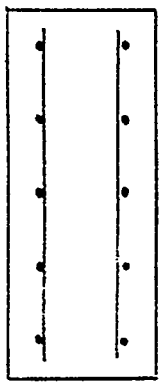
(10) Cubical Wall Bending:

$$M = \frac{Wl}{8} = \frac{5082(96")}{8} = 60984\ ".\#$$

Capacity for 4 walls:

$$a = \frac{A_s f_y}{b\ .85\ f_c'} = \frac{(8 \times .04)\ 40}{8"(.85)\ 3}$$

$$= .627"$$



$$M = A_s f_y (d - a/2)(4\ \text{walls})\ \phi$$

$$= (.04 + .04)\ 40 \left[\left(18 - \frac{.627}{2}\right) + \left(14 - \frac{.627}{2}\right) + \left(10 - \frac{.627}{2}\right) + \left(6 - \frac{.627}{2}\right) \right] (4)\ .9$$

$$= 538{,}514\ ".\# > 60984\ ".\#$$ O.K.

Building Wall Bending:

$$w = 66.5\ psf + \frac{2541}{(13.16 * 10.5)} = 84.9\ psf$$

$$M = 1.04 \left(\frac{84.8}{66.5}\right) = 1.33 < 3.03$$ O.K.

1.K/ft

S.M.I. $= \frac{3.03}{1.33} - 1 = 1.28$

See page A4-9 of WHC-SD-CP-SA-023 and earlier page of this calculation.

(1) Drawing _____ (2) Doc. No. _____ (3) Page C51 of _____
(4) Building _____ (5) Rev. _____ (6) Job No. _____
(7) Subject _____
(8) Originator R A Hill Date 4-15-94
(9) Checker MA ISLAM Date 5/18/94

(10) Building Column Bending

lateral load for 1 cubical wall

$\frac{2541^{\#}}{4} = 635^{\#}$ point load

lateral load for adj bldg walls:

$4490^{\#}$ distributed load

Moment:

$$M = \frac{Pl}{4} + \frac{Wl}{8}$$

$$= \frac{635(130")}{4} + \frac{4490(130")}{8}$$

$$= 93600^{\text{in.}\#} = 93.6^{\text{in.}K}$$

From WHC-SD-CP-SA-023

column capacity $= 187^{\text{in.}K} > 93.5^{\text{in.}K}$

page A5-10 thru 17 O.K.

DESIGN CALCULATION

(1) Drawing _____ (2) Doc. No. _____ (3) Page C52 of _____

(4) Building _____ (5) Rev. _____ (6) Job No. _____

(7) Subject _____

(8) Originator R.A. Miller Date 4-15-94

(9) Checker MA ISLAM Date 5/18/94

(10) Embeded Rt Shear

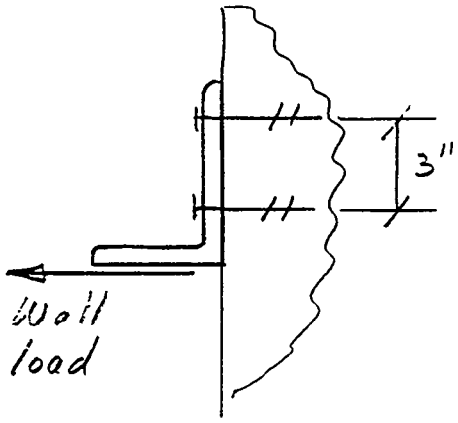
floor Rt capacity = 2696# > 635 # O.K.

wall Rt capacity = 2645# > 635 # O.K.

Check Expansion Anchors:

½" Red Heads w/ min embed

@ 3" spacing



tension capacity for 5" spacing
in 4000psi concrete = 1720#

reduce by $\sqrt{\frac{f_c'}{4000}}$ = .87 for 3000psi conc

reduce by 3"/5" = .6 for close spacing

1720# × .87 × .6 = 898#

Add 25% for prying

635 × 1.25 = 794# < 898# O.K.

(1) Drawing _____ (2) Doc. No. _____ (3) Page C53 of ____

(4) Building _____ (5) Rev. _____ (6) Job No. _____

(7) Subject _____

(8) Originator RA Miller Date 4-18-94

(9) Checker MA ISLAM Date 5/18/94

(10) Margins of Safety

Embedded A bolt shear $\frac{4389}{1553} - 1 = 1.83$

bolt tension $\frac{2926}{1553} - 1 = 0.88$

Welds @ corners $\frac{18000}{9468} - 1 = 0.90$

Wall bending $\frac{542}{145} - 1 = 2.74$

Rebar development length same

Building wall bending

$\frac{3.03}{1.33} - 1 = 1.28$

Building column bending

$\frac{165}{93.5} - 1 = 0.77$

RL-144 (5-76)
54-2040-144

RECORD OF DESIGN / FIELD CHANGE

(1) PROJECT NUMBER AND TITLE	(2) RECORDING DATE	(3) APPROVAL DATE	(4) CHANGE NUMBE
Work Order XX-0624 2736-Z Modifications	12-7-77		CA-7 [illegible]68

(5) DOCUMENTS AFFECTED

H-2-70010 "Plutonium Storage Vaults, Cubicle Installation"

(6) DETAILED DESCRIPTION AND JUSTIFICATION

Problem: According to the detail shown in zone A-9 of H-2-70010, cubicle panels A and G will be welded to steel angle embedded in the building wall. There is no such angle in the north wall of Room 1, 2736-Z Building, between columns 16.5 and 17.3, although it is shown in zone E-8 of H-2-26653, an "as-built" drawing of structural details. A method of attaching the cubicle panels to this section of the building wall is needed. In addition, a method of attaching panel A to column 16.5 is needed for two locations in Room 1; no detail shown on H-2-70010.

Solution: Attach a 3" long piece of steel angle to the wall (or column 16.5) above cubicle panel A (or G) with anchor bolts; weld the angle to the cubicle panel. A sketch is attached.

(17) DISTRIBUTION:

G. A. Beitel
P. M. Bodmer
M. A. Cahill
R. D. Carrell
J. E. Hammond
J. McIntyre
R. J. Staudacher
M C Fraser

WHC-SD-CP-SA-026
REV 1 PAGE C54

(18) ALL DOCUMENTS REVISED ☐

BY: _____ (DAT

(7) EFFECT ON COST: $ 500 ☒ ADDITIONAL ☐ SAVINGS

BASIS OR REMARKS: 16 man-hours Ironworker labo plus $100 material and equipment usage. Work can proceed elsewhere in Room 1 without being delayed by above.

(8) EFFECT ON SCHEDULE: None ☐ DELAY ☐ IMPROVEMENT

(9) CONTRACTS, PROJECTS OR WORK ORDER AFFECTED:

Work Order XX-0624

(10) INITIATOR	(11) PHONE	(12) ORGANIZATION	(13) DATE
J. E. Hammond J. E. Hammond	2-2697	Equipment Development	12-7-77

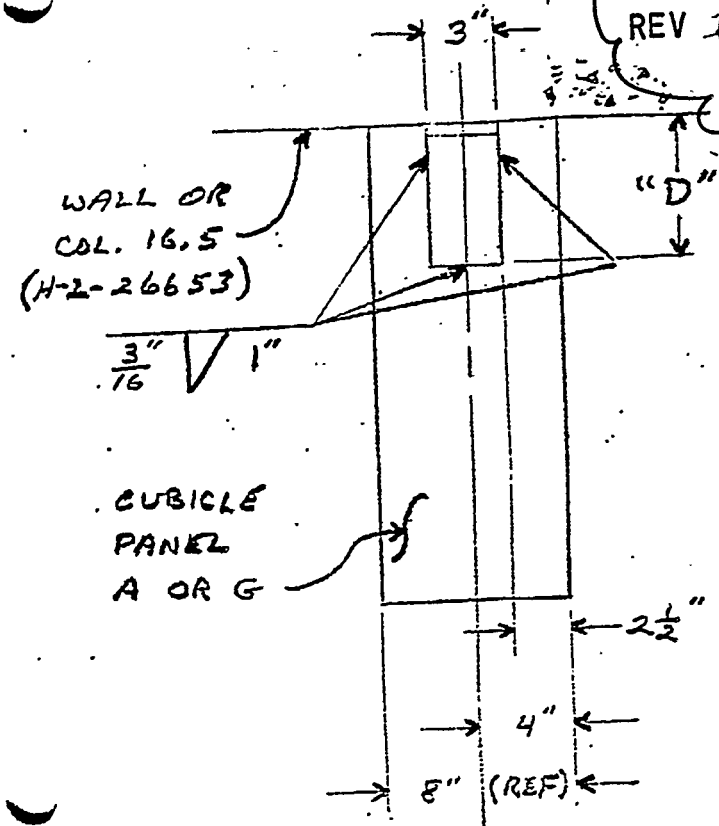
APPROVALS

(14) ARCHITECT ENGINEER	(15) OPERATING CONTRACTOR	(16) ERDA
1) J. E. Hammond	1) MA Cahill 12/8/77	1)
2) MC Fraser 12/8/77	2) [illegible]	2)

WHC-SD-CP-SA-026
REV 1 PAGE C55

555

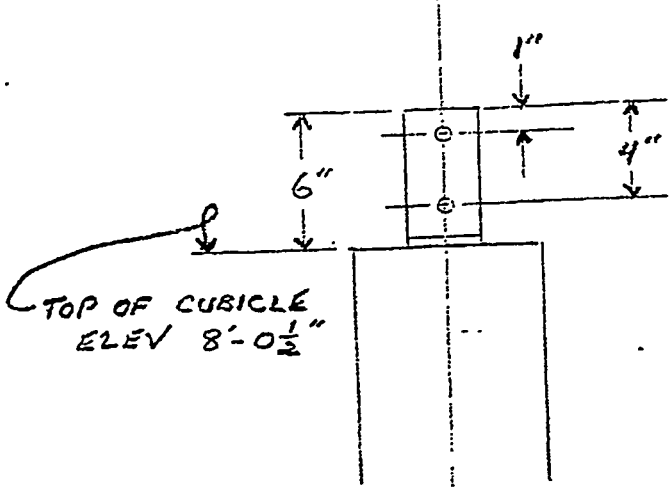
ATTACHMENT FOR
DFC # CA-77-1268

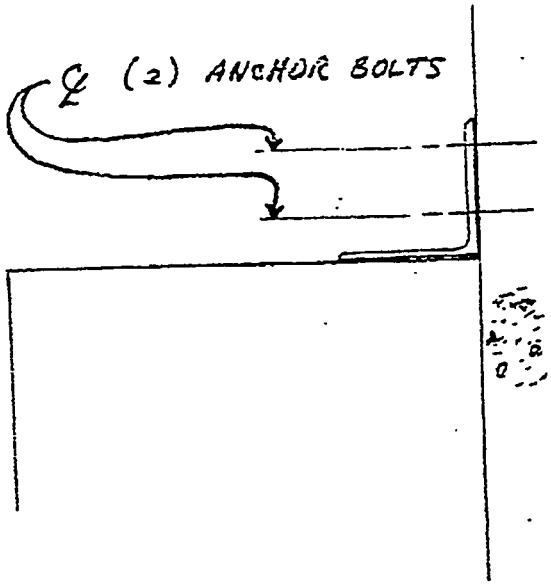


STEEL ANGLE: TYPE A-36 CARBON STEEL, MAXIMUM THICKNESS ½"; DIMENSION "D" TO BE 4" TO 6."

ANCHOR BOLTS: PHILLIPS "RED HEAD," ½"

J. E. Hammond
7 December 1977





℄ CUBICLE
AND ANGLE

(1) Drawing _____ (2) Doc. No. _____ (3) Page 52 of _____

(4) Building _____ (5) Rev. _____ (6) Job No. _____

(7) Subject _____

(8) Originator R A Hill Date 5-23-94

(9) Checker M.A. ISLAM Date 5-25-94

(10)

Results

- **Load calculation;** The dead weight of all components attached to the cubicals have been calculated and reported.

- **Can/Holder testing;** The test report for seismic shake table testing of the can/holder arrangement has been reviewed and found acceptable. The cans remain in the holders during the safety class 2 earthquake assuming a rigid response for the cubical with a margin of safety of;

  M.S. = 0.26

- **Seismic acceleration response;** The flexibility of the cubical doors was evaluated and determined to not add significantly to the overall cubical response. The cubical walls are assumed to be rigid and this assumption will be validated in the following sections. To be considered rigid, the cubical must be shown to act as a monolithic unit, The seismic acceleration for existing rigid equipment at the ground level is;

  accl. = 0.34 g

- **Cubical evaluation, older configuration;** The cubicals act as a monolithic unit and all members are acceptable with the following margins of safety;

Embedment bolt shear @ wall corners	M.S	=	0.002
Embedment bolt tension @ wall corners	M.S.	=	0.50
Welds @ wall corners	M.S.	=	0.94
Wall Bending stress	M.S.	=	3.59
Rebar development length	M.S.	=	0.86
Embedded plate anchor shear	M.S.	=	2.89
Building wall bending	M.S.	=	1.40

- **Cubical evaluation, newer configuration;** The cubicals act as a unit and all members have acceptable margins of safety as follows;

Embedment bolt shear @ wall corners	M.S.	=	1.83
Embedment bolt tension @ wall corners	M.S.	=	0.88
Welds @ wall corners	M.S.	=	0.90
Wall bending stress	M.S.	=	2.74
Rebar development length	M.S.	=	same as above
Building wall bending	M.S.	=	1.28
Building column bending	M.S.	=	0.77

ANALYTICAL CALCULATIONS

Page ____ of ____

Subject 2736Z Building Cubicals SC-1 Analysis

Originator RA Gill Date 12-30-94

Checker MA ISLAM Date 2/24/95

Objective:

Evaluate the free standing cubicals of the 2736Z building as Safety Class 1 structures, systems and components (SSC). The cubicals attached to building walls will be evaluated elsewhere. It should be noted that these cubicals were evaluated in May 1994 as Safety Class 3 SSCs subjected to Safety Class 1 load conditions, and this document will be used as a reference.

Criteria:

The U.S. Department of Energy design criteria documents to be used in the evaluation of Safety Class 1 components are as follows:

DOE Order 6430.1A	General design Criteria.
UCRL-15910	Design and Evaluation Guidelines for Department of Energy Facilities Subjected to Natural Phenomena.
SDC-4.1	Site Design Criteria.

The design code used in this evaluation in conjunction with the listed criteria documents is as follows:

ACI-349-90	Code requirements for Nuclear Safety related Concrete structures.

Given:

Given, the dimensions and material properties as shown on the design drawings of the building and cubicals. These drawings show two types of cubicals, an old type cubical in rooms 3 and 4, and a new type cubical in rooms 1 and 2. Field walkdown verified the arrangements in rooms 1, 3, and 4 but found that room 2 has no cubicals, racks were found in their place.

Old type cubicals; drawings H-2-26651 and H-2-26654

New type cubicals; drawings H-2-70010 and H-2-70011.

ANALYTICAL CALCULATIONS

Subject _____

Originator RS Little Date 12-30-94

Checker MA ISLAM Date 2/24/95

Assumptions:

The main assumption is that concrete and steel strengths are the specified values shown on the design drawings. This assumption is supported by field walkdown of the structures. This field walkdown found no visual deterioration of the concrete members such as cracks, spalls, or surface defects. Steel members also were without surface rust or defects.

Method:

The previous safety class 3 over safety class 1 seismic analysis of the cubicals used simplified dynamic methods to calculated the seismic loads on a monolithic structure. This required the use of the peak of the response spectra curve reduced 20% for existing structures.

For the safety class 1 analysis it was desirable to perform an analysis of a more detailed model using individual members coupled at the top and with gap elements along the contact surfaces inplace of a monolithic model. It was also desirable to calculate actual frequencies and acceleration values in place of using the peak of the seismic response spectra.

References:

Previous safety class 3 over 1 seismic cubical analysis, WHC-SD-CP-SA-026.

Seismic Verification of Equipment Anchorage, June 1991, EPRI NP-5228-SL, R1, V3.

ACI-349-90 Code Requirements for Nuclear Safety related concrete structures.

ANALYTICAL CALCULATIONS

Subject _____

Originator R A Miller Date 12-30-94

Checker MA ISLAM Date 2/24/95

Index:

Old Type Cubical Analysis

- Construction Details
- Self weight
- Seismic Response
- Seismic Loads
- Anchor Capacities
- Strength Check, Panels D & E
- Strength Check, Panel G
- Check Base Plate
- Check Detail Connections

New Type Cubical Analysis

- Construction Details
- Self Weight
- Seismic Response
- Seismic Loads
- Anchor Capacities
- Strength Check, Panel A & C
- Strength Check, Panel B & F
- Check Base Plate
- Check Connection @ Panel Top

Margins of Safety

Computer Printout

- N-S Direction
  - Geometry
  - Old Type Cubical Results
  - New Type Cubical Results, Assume All Anchors Active
  - New Type Cubical Results, Only Shown Anchors Active
- E-W Direction
  - Geometry
  - Old Type Cubical Results
  - New Type Cubical Results

Evaluation for missing welds

ANALYTICAL CALCULATIONS

Page ____ of ____

Subject _____

Originator R.A. Miller Date 12-12-94

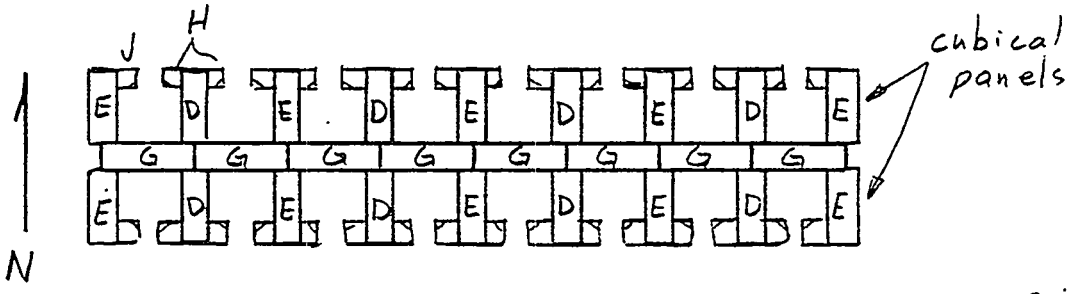
Checker MA ISLAM Date 2/24/95

Construction Details

OTd Type Cubicals

2736Z Building, Rooms 3 & 4

floor mounted (free standing) Arrangement:



Room 3&4

Plan

Drawings: H-2-26651

H-2-26654

Note: The cubical panels have embeded steel angles at their corners which in-turn are welded to each other and to embeded floor plates.

ANALYTICAL CALCULATIONS

Page ____ of ____

Subject _____

Originator RA Gilbert Date 12-12-94

Checker MA ISLAM Date 2/24/95

Self Weight

Panel	E	1384# × 10 panels	= 13840
Panel	D	1384# × 8 panels	= 11072
Panel	G	2200# × 8 panels	= 17600
Panel	J	440# × 16 panels	= 7040
Panel	H	500# × 16 panels	= 8000
Door Extension		43# × 16	= 688
Pedestals		146# × 64	= 9344
Hood		43# × 16	= 688
			68272#

ANALYTICAL CALCULATIONS

Page _____ of _____

Subject _____

Originator R A Miller Date 12-15-94

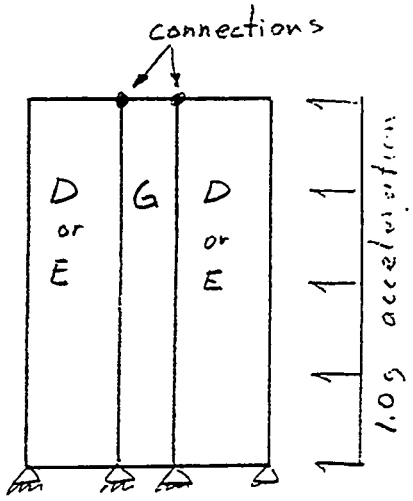
Checker MA ISLAM Date 2/24/95

Seismic Response

Lateral Seismic Loads:

- Assume that all N-S seismic loads are resisted by the 18 panels D & E and that there is no N-S resistance contributed by the G panels. Likewise the 8 - G panels resist all of the E-W loads without help from the D & E panels. See computer model for N-S & E-W directions.

N.S-Dir Response :



From computer output, the lateral displacement for a 1.0g acceleration is .016662 = Δ

$$\text{frequency} = 3.13\sqrt{\frac{1}{\Delta}}$$

$$f = 24.2\ \text{hz}$$

From SDC-4.1 Table 2 this near rigid freq. gives a .24g acceleration @ 5% damping. all other freq. will yield lower accelerations.

for simple conservative analysis use .24g for all modes.

Subject _____

Originator RA Gilbert Date 12-15-94

Checker MA ISLAM Date 2/24/95

Seismic Response Continued

- The calculated seismic response using equipment criteria assumes that the equipment is much lighter than the supporting member, in this case the equipment is the cubical and the supporting member is the floor slab.
- Actually, the cubicals are heavier than the floor slab, so, the seismic response of the cubicals according to facility criteria must also be evaluated

	Facility Criteria	Equip. Criteria
frequency	16 hz estimated using SSI effects	25 hz calculated
Damping	10% for Reinf. Concrete	5% for Equip.
Seismic Accel.	.33g peak of response curve	.24g response curve value
F_μ	1.4 for R.C. shear wall	unity - not used for equipment
Design Accel E/F_μ	.24g	.24g

Conclusion: Use Equipment Criteria.

ANALYTICAL CALCULATIONS

Page ____ of ____

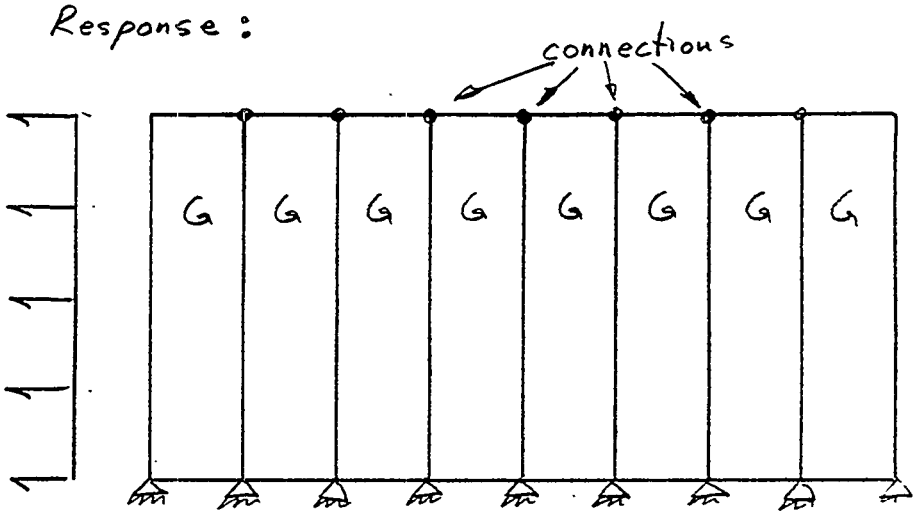
Subject _____

Originator RA Gill Date 12-15-94

Checker MA ISLAM Date 2/24/95

Seismic Response Cont.

E-W-Dir Response:



From computer output the lateral displacement for a 1.0g acceleration is .00838" = Δ

$$freq = 3.13\sqrt{\frac{1}{\Delta}} = 3.13\sqrt{\frac{1}{.00838}} = 34.2 \text{ hz}$$

From SDC-4.1 Table 2 this is a rigid freq. which yields a 0.2g acceleration. Accelerate all modes at 0.2g.

Subject _____

Originator R A Miller Date 12-22-94

Checker M A ISLAM Date 2/24/95

Seismic Loads

Vertical Loads :

$W = 68272^{\#}$

length of wall panels

$8 \times 31.75'' + 18 \times 20'' = 614''$

$\frac{W}{614''} = 111.2\ ^{\#}/_{11}$

Vertical Dead Wt. :

DW use $0.85W$

Vertical EQ :

$E_v = \frac{2}{3}(.24g)(\text{combine @ } 40\%)W = .064W$

Combined Vert. :

$.85D + E = .85W - .064W = .786W$

$.786(111.2\ ^{\#}/_{11}) = 87.4\ ^{\#}/_{11}$

ANALYTICAL CALCULATIONS

Page _____ of _____

Subject _____

Originator R A Little Date 12-13-94

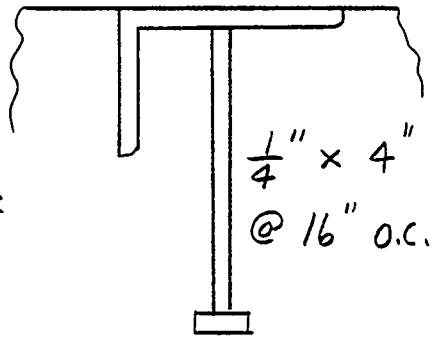
Checker M A ISLAM Date 2/24/95

Anchor Capacities

ACI-349 Appendix B Methods

Utimate steel strength $= f_u A_{bolt}$

$(.049 si)(60{,}000 psi) = 2940^{\#}$



Base Plate Anchor

Shear Cone Strength

$4 \phi 1 \sqrt{f_c'} A_{cone}$

$4(.65)\sqrt{3000}\ \pi R^2$

$447 R^2$

R= embedment length

$447R^2 > 2940^{\#}$

$R > 2.56"$

$4" > 2.56"$ O.K.

Design Strength

$T_A = .9 A F_y = .9(.049)\,50{,}000 = 2205^{\#}$

$V_A = \phi \mu A_v F_y = .85(.9)(.049)50000 = 1874^{\#}$

ANALYTICAL CALCULATIONS

Page _____ of _____

Subject _____

Originator RA Gilbert Date 12-13-94

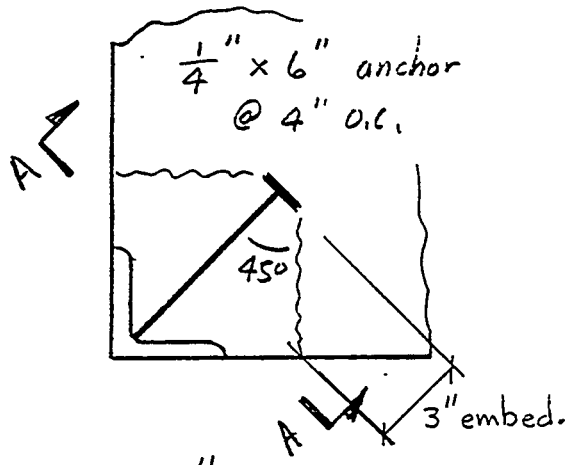
Checker MA ISLAM Date 2/24/95

Anchor Capacities Cont.

Panel Anchor:

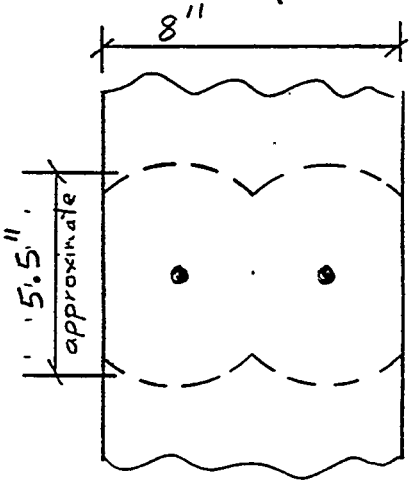
Steel Strength

$f_u A_{bolt} = 2940^{\#}$



Shear Cone Area

$A_{cone} = 8" \times 5.5" = 44 si$



Section A-A

Shear Cone Strength

$= 4\phi\sqrt{f_c'}\, A_{cone}$

$= 4(.65)\sqrt{3000}\,(44)$

$= 6266^{\#}$

overlapped shear cones for 3" embeddment

$A_{cone} = 8" \times 5.5" = 44 si$

$6266^{\#} > 2 \text{ bolts} \times 2940^{\#}$

$6266^{\#} > 5880^{\#}$ O.K.

steel failure assured.

ANALYTICAL CALCULATIONS

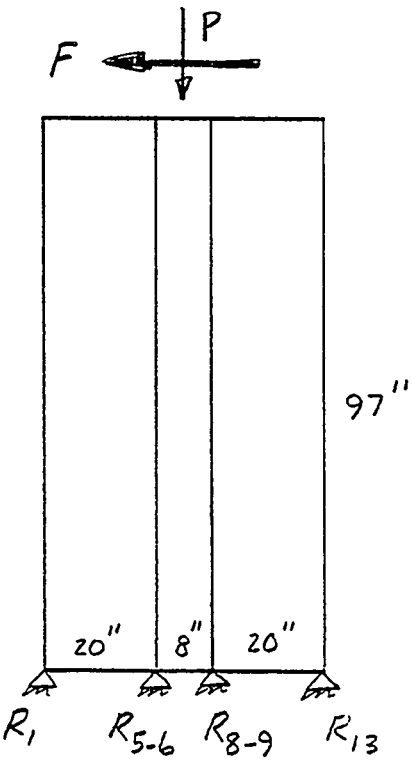
Page _____ of _____

Subject _____

Originator RA Hill Date 12-16-94

Checker MA ISLAM Date 2/24/95

Strength Check, Panel D or E



$P = .85D + E$

$P = 87.4\,\#/11 \times 40"$

$P = 3496\,\#$

Reactions @ Base : (Computer output)

$R_{1y} = 1311\,\# + \frac{3496\,\#}{4} = 2185\,\#$ comp

$R_{1x} = 356\,\#$

$R_{56y} = -1626 + 414 + \frac{3496}{4} = -338\,\#$ ten.

$R_{56x} = 566 + 69 = 635\,\#$

$R_{89y} = -419 + 839 + \frac{3496}{4} = 1294\,\#$ comp.

$R_{89x} = 72 + 114 = 186\,\#$

$R_{13y} = -1912 + \frac{3496}{4} = -1038$ ten.

$R_{13x} = 643\,\#$

Shear @ Base :

$V = 356 + 635 + 186 + 643 = 1820\,\#$

check $\frac{68272 \times .249}{9 \text{ walls}} = 1820.6\,\#$ O.K.

ANALYTICAL CALCULATIONS

Page ____ of ____

Subject _____

Originator R A Miller Date 12-16-94

Checker M A ISLAM Date 2/24/95

Panel D or E Cont.

Stress & Moment @ Base :

from computer output max stress = 151 psi

$$\text{Moment} = \sigma S_b = \frac{151\, bh^2}{6} = \frac{151(8")(20")^2}{6(1000)}$$

$$M = 80.53^{\text{ft-K}}$$

Check Concrete shear:

$$v = \frac{V}{bh} = \frac{1820}{8(48)} = 4.7 \text{ psi} < 2\phi\sqrt{f_c'} \text{ of } 93 \text{ psi}$$

@ $f_c' = 3000$ psi

$$MS = \frac{93}{4.7} - 1 = 18.8$$

O.K.

Check Concrete bending:

$$a = \frac{A_s f_y}{.85 f_c' b} = \frac{3(.11)40}{.85(3)8} = .647"$$

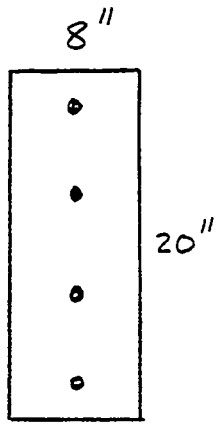
$$M_n = (.11 \times 40)\left[(18" - 9/2) + (13" - 9/2) + (8" - 9/2)\right]$$

$$= 167.3^{\text{ft-K}}$$

$$\phi M_n = .9(167.3) = 150.6^{\text{ft-K}}$$

$$M_u = 80.53^{\text{ft-K}} < 150.6^{\text{ft-K}} \quad \text{O.K.}$$

$$M.S. = \frac{150.6}{80.53} - 1 = 0.87$$



4-#3 bars @ 5" O.C.

Subject _____
Originator RA Hill Date 12-13-94
Checker MA ISLAM Date 2/27/95

Panel D or E Continued

Anchor Loads :

Reactions @ Base

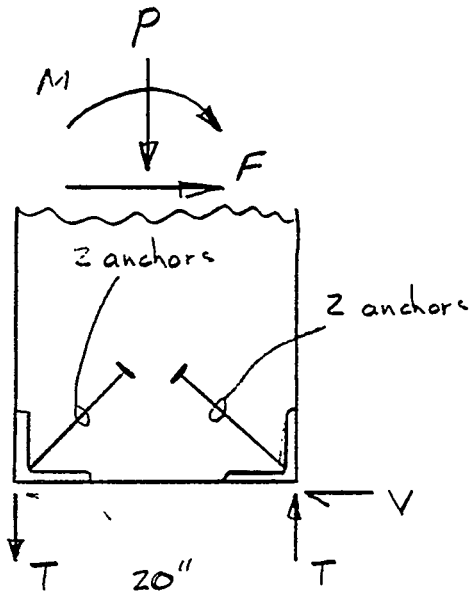
$T = 1038^{\#}$ max

$V = 643^{\#}$ max

Anchor Capacities

$T_{Allow} = 2205^{\#}$

$V_{Allow} = 1874^{\#}$



Shear Loads are transfered from the panel to the bottom angle by bearing on the vertical leg of the angle. Welds transfer the shear loads from the bottom angle to the base Pl. And base plate anchors transfer the shear into the foundation, and thus no shear is applied to panel bottom anchors.

Tension in anchors : (shear is the same)

$$\frac{\text{Sin } 45^\circ (T)}{2 \text{ anchors}} = 367^{\#}$$

$$\frac{\pm}{T_A} + \frac{V}{V_A} = \frac{367}{2205} + \frac{367}{1874} = 0.36 \leq 1.0$$

$$MS = \frac{1.0}{0.36} - 1 = 1.78 \qquad \text{O.K.}$$

ANALYTICAL CALCULATIONS

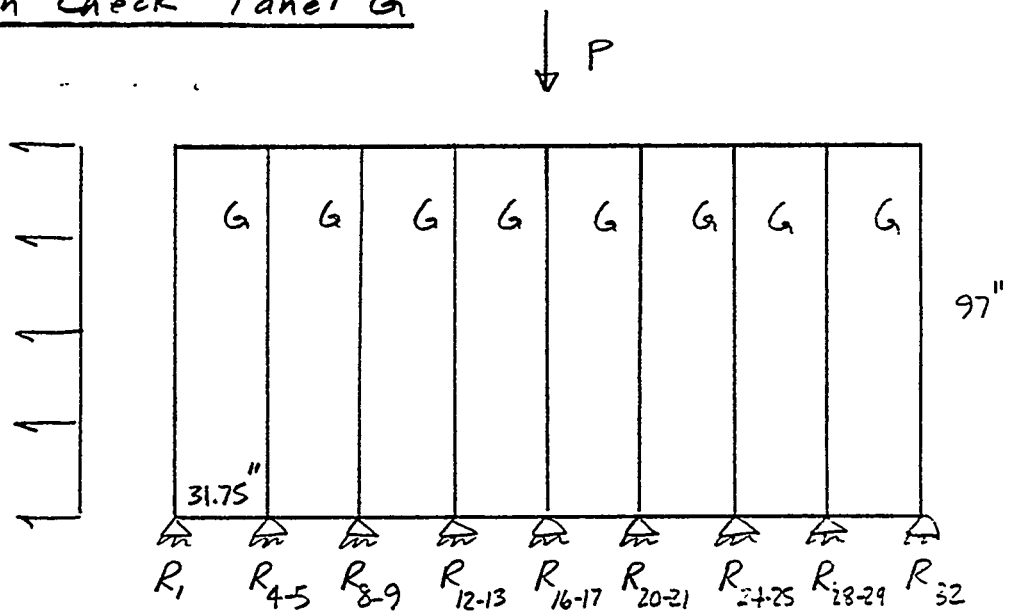
Page _____ of _____

Subject _____

Originator RA Dillen Date 12-16-94

Checker MA ISLAM Date 2/27/95

Strength Check Panel G



$P = .85D + E$

$P = 87.4\ ^{\#}/_{11} \times 254"$

$P = 22200\ ^{\#}$

Reactions @ Base: (from computer output)

$R_{1_y} = 1562\ ^{\#} + \frac{22200\ ^{\#}}{16} = 2950\ ^{\#}$ comp

$R_{4\text{-}5_y} = -1566 + 1488 + \frac{22200}{16} \times 2 = 2697\ ^{\#}$ comp

$R_{8\text{-}9_y} = -2003 + 1469 + \frac{22200}{16} \times 2 = 2241\ ^{\#}$ comp

$R_{12\text{-}13_y} = -2008 + 1463 + \frac{22200}{16} \times 2 = 2230\ ^{\#}$ comp

$R_{16\text{-}17_y} = -1996 + 1466 + \frac{22200}{16} \times 2 = 2245\ ^{\#}$ comp

Subject _____

Originator R A Lilla Date 12-16-94

Checker M A ISLAM Date 2/27/95

Strength Check, Pane 6 Cont.

Reactions:

$$R_{20\text{-}21_y} = -1994 + 1478 + \frac{22200}{16} \times 2 = 2259^{\#} \text{ comp}$$

$$R_{24\text{-}25_y} = -2005 + 1474 + \frac{22200}{16} \times 2 = 2244^{\#} \text{ comp}$$

$$R_{28\text{-}29_y} = -2036 + 1142 + \frac{22200}{16} \times 2 = 1881^{\#} \text{ comp}$$

$$R_{32_y} = -2145 + \frac{22200}{16} = -757^{\#} \text{ ten}$$

Shear @ Base:

$R_{1x} = 737^{\#}$

$R_{4\text{-}5x} = 827 + 736 = 1563^{\#}$

$R_{89x} = 1023 + 733 = 1756^{\#}$

$R_{12\text{-}13} = 1028 + 732 = 1760^{\#}$

$R_{16\text{-}17} = 1024 + 733 = 1757^{\#}$

$R_{20\text{-}21} = 1023 + 736 = 1759^{\#}$

$R_{24\text{-}25} = 1027 + 729 = 1756^{\#}$

$R_{28\text{-}29} = 1034 + 542 = 1576^{\#}$

$R_{32} = 1005^{\#}$

Stress & Moment @ Base:

$\sigma = 79$ psi $\quad M = \sigma S_b$

$$M = \frac{79\,bh^2}{6} = \frac{79\,(8")(31.75)^2}{6(1000)} = 106^{"\cdot K}$$

ANALYTICAL CALCULATIONS

Subject _____

Originator RA Hill Date 12-16-94

Checker MA ISLAM Date 2/27/95

Strength Check, Panel G Cont.

Check Concrete Shear:

$$v = \frac{V}{bh} = \frac{1760^{\#}}{8(31.75)} = 6.9 \text{ psi} < 93 \text{ psi}$$

O.K.

$$M.S = \frac{93}{6.9} - 1 = 12.5$$

Check Concrete Bending:

$$a = \frac{A_s F_y}{.85 f_c' b} = \frac{5(.11)40}{.85(3)8} = 1.08''$$

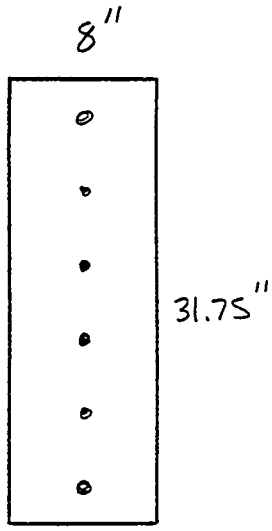
$$M_n = .11(40)\left[(26 - 9/2) + (21 - 9/2) + (16 - 9/2) + (11 - 9/2) + (6 - 9/2)\right]$$

$$M_n = 340.1^{\text{ft-K}}$$

$$\phi M_n = .9(340.1) = 306^{\text{ft-K}}$$

$$306 > 106^{\text{ft-K}} \quad \text{O.K.}$$

$$M.S = \frac{306}{106} - 1 = 1.89$$



6- #3 bars @ 5" O.C.

ANALYTICAL CALCULATIONS

Page ____ of ____

Subject _____

Originator R.A. Hill Date 12-13-94

Checker M A ISLAM Date 2/27/95

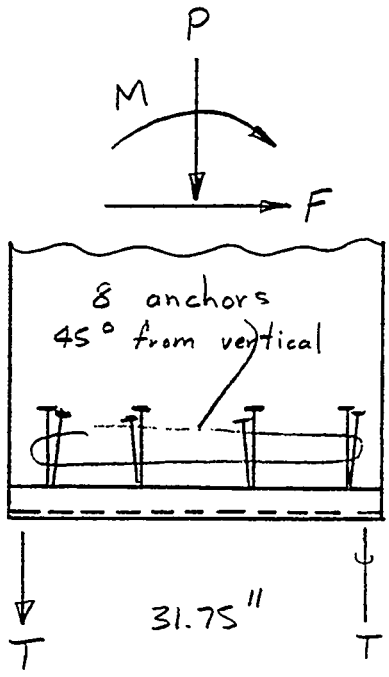
Panel G Cont.

Anchor Loads:

Reactions @ Base

$T = 757^{\#}$ @ R_1

$V = 1760^{\#}$ @ $R_{13\text{-}14}$.



Anchor Capacities

$T_A = 2205^{\#}$

$V_A = 1874^{\#}$

tension in anchors:

$$\frac{(T)}{\sin 45^\circ (4 \text{ anchors})} = 268^{\#}/\text{anchor}$$

Shear in anchors:

$$268^{\#} + \frac{(V)}{8 \text{ anchors}} = 488^{\#}/\text{anch}$$

Bolt interaction:

$$\frac{t}{T_A} + \frac{V}{V_A} = \frac{268}{2205} + \frac{488}{1874} = 0.38 \leq 1.0$$

$$MS = \frac{1.0}{.38} - 1 = 1.63 \qquad \text{O.K.}$$

ANALYTICAL CALCULATIONS

Page ____ of ____

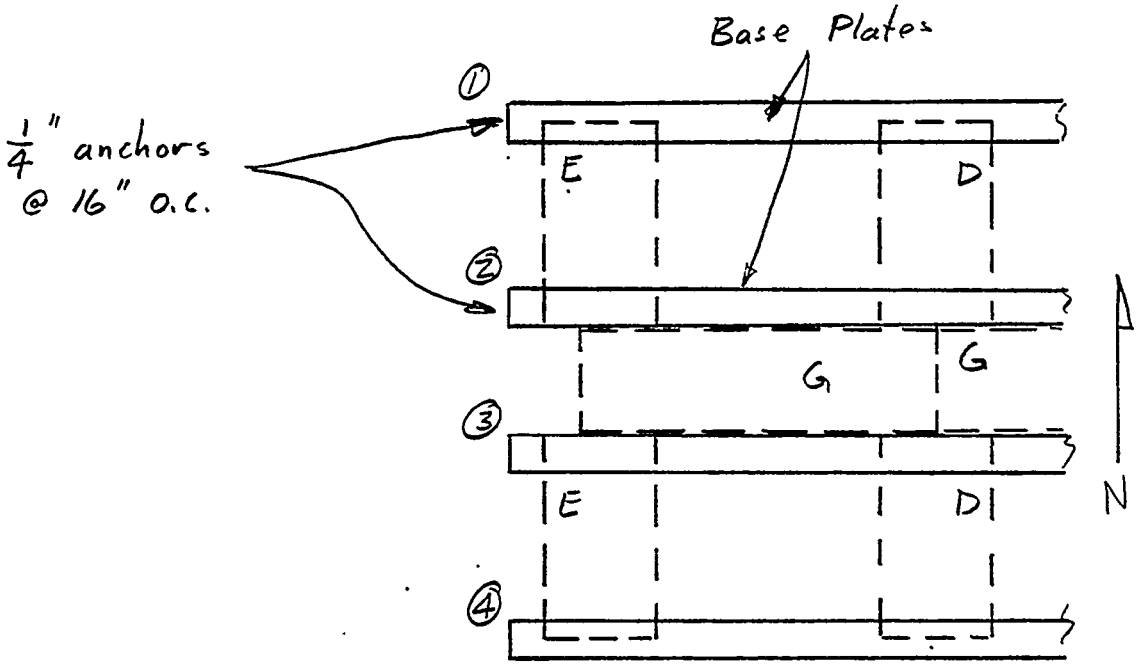
Subject _____

Originator RA Miller Date 12-13-94

Checker MA ISLAM Date 2/27/95

Check Base Plate

Base plate resists loads from all panels and thus must be analyzed for multi-directional loads using 100-40-40



PLAN VIEW

Shear Load per anchor:

4 plates × 17 anchors/plate = 68 anchors

Note: All plates resist N-S loads, and since cubical wall panels "G" resist all E-W loads, then embeded plates 2 & 3 resist all E-W loads.

ANALYTICAL CALCULATIONS

Page ____ of ____

Subject _____

Originator RA Hill Date 12-16-94

Checker MA ISLAM Date 2/27/95

Base Plate Cont.

Shear in plate ① & ④ :

from Panel D or E

$$V = \frac{643^{\#} \times 9 \text{ panels}}{17 \text{ anchors}} = 340^{\#}/\text{anchor}$$

Shear in plate ② & ③ :

from Panel D or E

$$V = \frac{635 \times 9 \text{ panels}}{17 \text{ anchors}} = 336^{\#}/\text{anchor}$$

Shear in plate ② & ③ :

from Panel G

$$V = \frac{1760^{\#} \times 8 \text{ panels}}{17 \text{ anchors (2 plates)}} = 414^{\#}/\text{anchor}$$

Shear Resultant. SRSS & 100-40-40

$V_R = 340^{\#}$ OR

$$V_R = \sqrt{(414)^2 + (40\%(336))^2} = 435^{\#}/\text{anchor}$$

ANALYTICAL CALCULATIONS

Page _____ of _____

Subject _____

Originator RS Hill Date 12-21-94

Checker MA ISLAM Date 2/27/95

Base Plate Cont.

tension in plate ① & ④ (from panel D or E)

$$T = \frac{1038^{\#} \times 9 \text{ panels}}{17 \text{ anchors/plate}} = 550^{\#}/\text{anchor}$$

tension in plate ② & ③. (from panel D or E)

$$T = \frac{338^{\#} \times 9 \text{ panels}}{17 \text{ anch/plate}} = 179^{\#}/\text{anchor}$$

(from panel G)

$$T = 757^{\#}/2 \text{ plates} \times 2 \text{ anchors} = 189^{\#}/\text{anchor}$$

Anchor Interaction :

Plate ① & ④

$$\frac{T}{T_A} + \frac{V}{V_A} = \frac{550}{2205} + \frac{340}{1874} = 0.43 < 1.0 \quad O.K$$

$$M.S. = \frac{1.0}{.43} - 1 = 1.33$$

Plate ② & ③

$$\frac{T}{T_A} + \frac{V}{V_A} = \frac{179+189}{2205} + \frac{435}{1874} = 0.40 < 1.0 \quad O.K$$

$$M.S. = \frac{1.0}{0.40} - 1 = 1.50$$

Subject _____

Originator R A Hill Date 3-23-95

Checker E C. O'Connor Date 3-27-95

Check Detail Connections

Check welds to base plate : (H-2-26654 (67))

drawing shows 4" of 3/16" weld
field walkdown shows 1½" of ⅛ weld

$(1/8)(.707)(1.5)(60\,ksi)(.3)(1.4) = 3.34^{K}$

3.34^{K} is much greater than anchor DEMAND, and thus weld is O.K.

Welds between panels D & G or E & G are O.K by comparison to the above calc.

Welds between panels @ Top are also O.K by comparison

ANALYTICAL CALCULATIONS

Page _____ of _____

Subject _____

Originator RA Gilbert Date 12-16-94

Checker MA ISLAM Date 2/27/95

Check Details Connections Cont.

Panel G top connection forces from computer output.

$F_x = 355^{\#}$ $F_y = 198^{\#}$

OR

$F_x = 108^{\#}$ $F_y = 953^{\#}$

Panel D-E top connection forces

$F_x = 441^{\#}$ $F_y = 213^{\#}$

OR

$F_x = 322^{\#}$ $F_y = 755^{\#}$

Shear & tension Maximums

$F_x = 355^{\#} + 441^{\#} = 796^{\#}$ shear

$F_y = 953^{\#} + 755^{\#} = 1708^{\#}$ ten - comp

Compare to anchor bolt allowables:

$$\frac{T}{T_A} + \frac{V}{V_A} = \frac{796^{\#}}{2 \text{ bolts } (2205^{\#})} + \frac{1708^{\#}}{2(1874)} = 0.64 < 1.0$$

O.K.

$$MS = \frac{1.0}{.64} - 1 = 0.56$$

ANALYTICAL CALCULATIONS

Subject _____

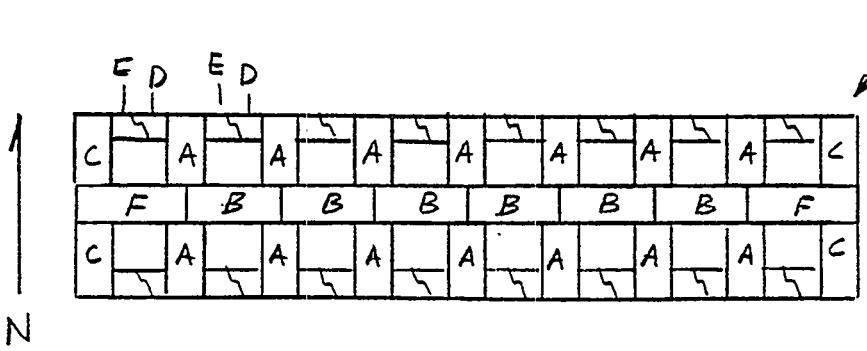
Originator RA Gille Date 12-19-94

Checker MA ISLAM Date 2/27/95

Construction Details New Type Cubicals

Drawings H-2-70010, H-2-70011

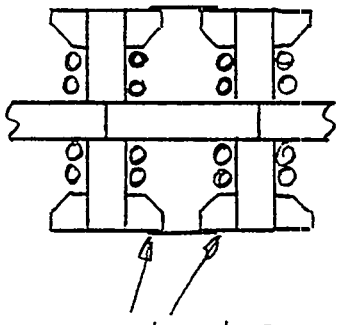
floor mounted - free standing



PLAN

2736Z Building
Room 1

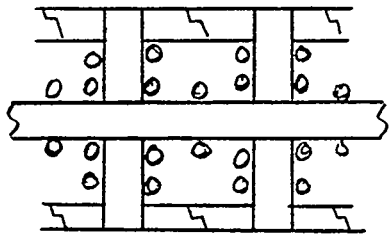
Old Type Cubical



Cubical Doors

4 pedestals w/7 cans per pedestals

New Type Cubical



5 pedestals / cubical

9 cans / pedestal

ANALYTICAL CALCULATIONS

Page _____ of _____

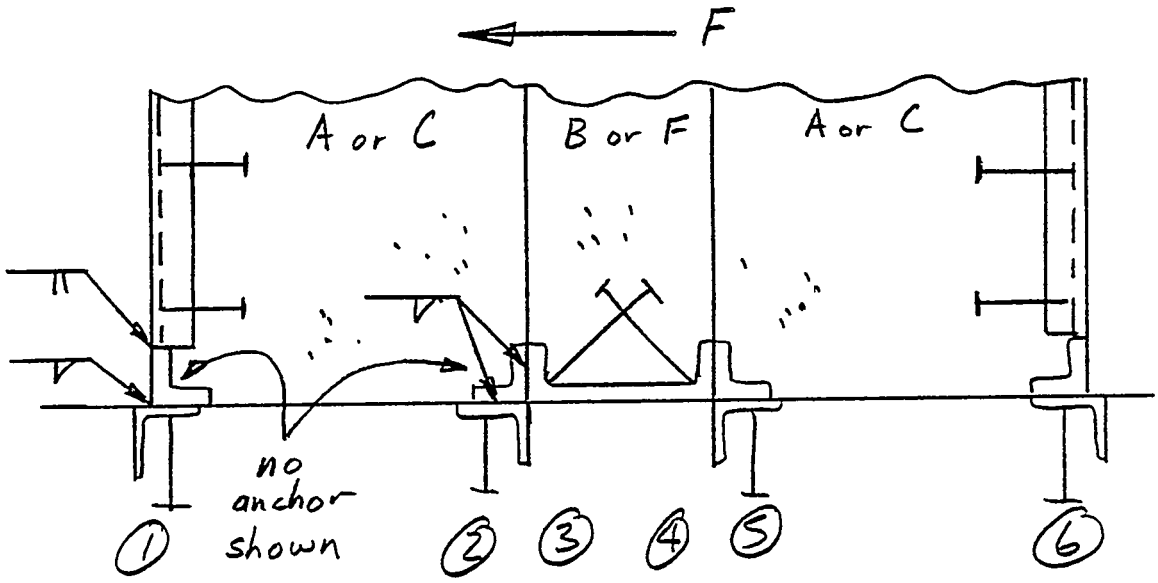
Subject _____

Originator RA Lillie Date 12-19-94

Checker MA ISLAM Date 2/27/95

Construction Details Cont.

Drawing H-2-70011 does not show concrete anchors at the bottom of Panel A & C. However, it is likely that anchors exist similar to the older type cubicals.



- For the N-S cubical walls, analyze both with & without the anchors in question.
- When all anchors are assumed to exist similar to the old type cubicals, then use the old type cubical analysis scaled up for the new loads.
- When anchors are assumed missing, change the constraint ② to no restraint and the constraint at ⑥ to be vertical restraint only, and then reanalyze.

ANALYTICAL CALCULATIONS

Page ____ of ____

Subject _____

Originator R.A. Lille Date 12-27-94

Checker MA ISLAM Date 2/27/95

Self Weight

Panel A or C	1370# × 18	=	24660#
Panel B or F	2200 × 8	=	17600
Panel D or E	900 × 32	=	28800
Pedestals	191 × 32	=	6112
	95 × 16	=	1520
Duct	66 × 16	=	1056
			79748#

Seismic Response

N-S (all anchors active)

$\Delta = .019476''$

$f = 3.13\sqrt{1/\Delta} = 22.4$ .25g

N-S (only shown anchors active)

$\Delta = .028168$

$f = 3.13\sqrt{1/\Delta} = 18.7$ .27g

EW - Direction

$\Delta = .0097933''$

$f = 3.13\sqrt{1/\Delta} = 31.63$ hz ∴ .20g

ANALYTICAL CALCULATIONS

Page _____ of _____

Subject _____

Originator RA Rille Date 12-19-94

Checker MA ISLAM Date 2/27/95

Seismic Loads

Vertical Loads :

$W = 79748^{\#}$

length of panels $= 614''$

$\frac{W}{614} = 129.9\ ^{\#}/_{''}$

$E_V = \frac{2}{3}(.27)W$ (combine @ 40%) $= .072\ W$

$.85DW - E_V = .85W - .072W = .778W$

$.778\ (79748) = 62044^{\#}$

$.778(129.9) = 101.1\ ^{\#}/_{''}$

Lateral Load :

$E_h = .20_g\ W$

or $.25_g\ W$

or $.27_g\ W$

ANALYTICAL CALCULATIONS

Page _____ of _____

Subject _____

Originator RS Hill Date 12-19-94

Checker MA ISLAM Date 2/27/95

Anchor Capacities

Using ACI-349 Appendix B

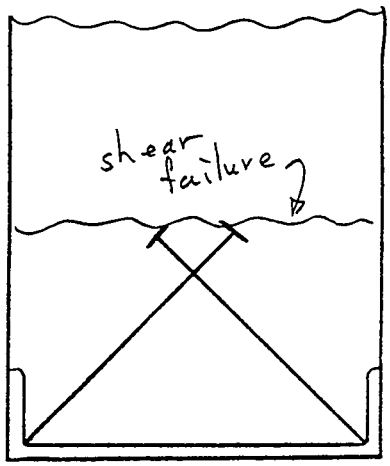
Panel Anchor Capacity:

Steel strength

$T_s = f_u A_b$

$= 60 ksi\ (.11 si)$

$= 6600^{\#}$



3/8" x 6" long @ 9" o.c.

Concrete strength

$4\phi 1\sqrt{f_c'}\ A_{proj}$

$4(.85)\sqrt{3000}\ A_{proj}$

$186\ A_{proj}$

$A_{proj} = \pi R^2 = 113 si \times$ 2 cones

OR

$A_{proj} = (8" \text{ panel} \times 9" \text{ o.c.}) = 72 si$

use $186 \times 72 si = 13392^{\#}$

use $\phi = .85$ since concrete tensile stresses are less than $5\sqrt{f_c'}$

$13392 > 2 \times 6600$ O.K.

$T_A = .9 A F_y = .9(.11)50000 = 4950^{\#}$

$V_A = \phi \mu A_v F_y = .85(.9)(.11)50000 = 4208^{\#}$

ANALYTICAL CALCULATIONS

Page ____ of ____

Subject _____

Originator RA Hill Date 12-19-94

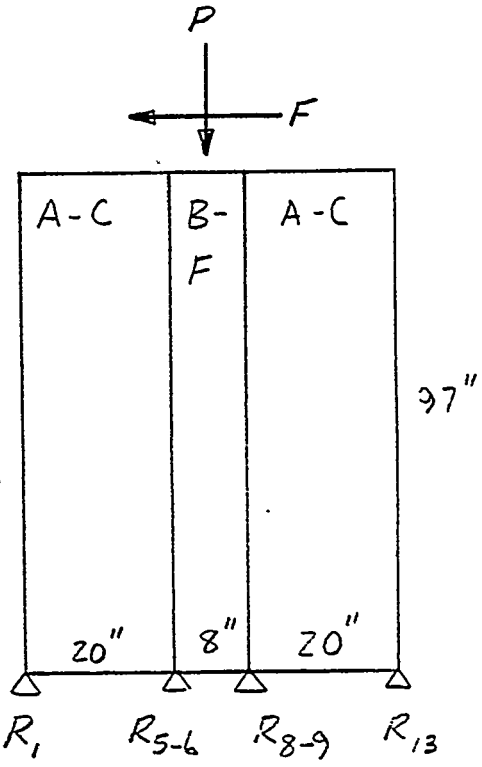
Checker MA ISLAM Date 2/27/95

Strength Check, Panel A-C

$P = 101.1\ ^{\#}/_{in} \times 40''$

$P = 4044^{\#}$

F = lateral acceleration



- Reactions @ Base, all anchor active:

$R_{1y} = 1601 + \frac{4044}{4} = 2612^{\#}$ comp

$R_{1x} = 435^{\#}$

$R_{5-6y} = -1987 + 505 + \frac{4044}{4} = 471^{\#}$ tens.

$R_{5-6x} = 692 + 85 = 777^{\#}$

$R_{8-9y} = -512 + 1025 + \frac{4044}{4} = 1524^{\#}$ comp

$R_{8-9x} = 87 + 139 = 226^{\#}$

$R_{13y} = -2336 + \frac{4044}{4} = 1325^{\#}$ ten. $R_{13x} = 786^{\#}$

- Reactions @ Base, only shown anchors active:

$R_{1y} = 1697 + \frac{4044}{4} = 2708^{\#}$ comp | $R_{1x} = 966^{\#}$

$R_{5-6y} = 818 + \frac{4044}{4} = 1829^{\#}$ comp | $R_{5-6x} = 82^{\#}$

$R_{8-9y} = -1129 + 1770 + \frac{4044}{4} = 1652^{\#}$ comp | $R_{8-9y} = 207 + 1138 = 1345^{\#}$

$R_{13y} = -3082 - \frac{4404}{4} = 2071^{\#}$ tens | $R_{13x} = 0$

$\Sigma R_x = 2393^{\#}$

ANALYTICAL CALCULATIONS

Page _____ of _____

Subject _____

Originator RA Hill Date 12-19-94

Checker MA ISLAM Date 2/27/95

Check Panel A-C Cont.

Stress & Moment @ Base:

σ = 185 psi or 252 psi

$$\text{Moment} = \sigma S_b = \frac{252\, bh^2}{6(1000)} = \frac{252(8)(20)^2}{6000}$$

$$M = 134.4^{\text{ft-K}}$$

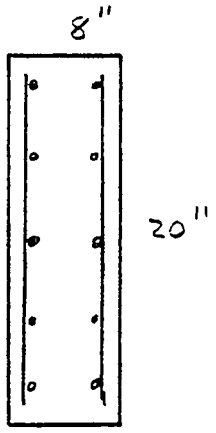
Check Concrete Bending:

$$a = \frac{A_s F_y}{.85 f'_c b} = \frac{8(.04)40}{.85(3)8"} = .627"$$

$$M = A_s F_y \left[\sum (d - a/2)\right]$$

$$= .08(40)\left[(18 - a/2) + (14 - a/2) + (10 - a/2) + (6 - a/2)\right]$$

$$= 149.6^{\text{ft-K}}$$



#4 wire mesh
.04 si/wire
4" grid

$\phi M_n = .9(149.6) = 135^{\text{ft-K}} > 134^{\text{ft-K}}$

$M.S. = \frac{135}{134} - 1 = .007$ O.K.

Check Concrete Shear:

$$v = \frac{V}{bh} = \frac{2393}{8"(48")} = 6.2 \text{ psi} < 93 \text{ psi}$$ O.K.

$$M.S = \frac{93}{6.2} = 14.0$$

ANALYTICAL CALCULATIONS

Subject _____

Originator R A Sitton Date 12-19-94

Checker MA ISLAM Date 2/27/95

Panel A-C Continued

Check Anchors :

Reactions

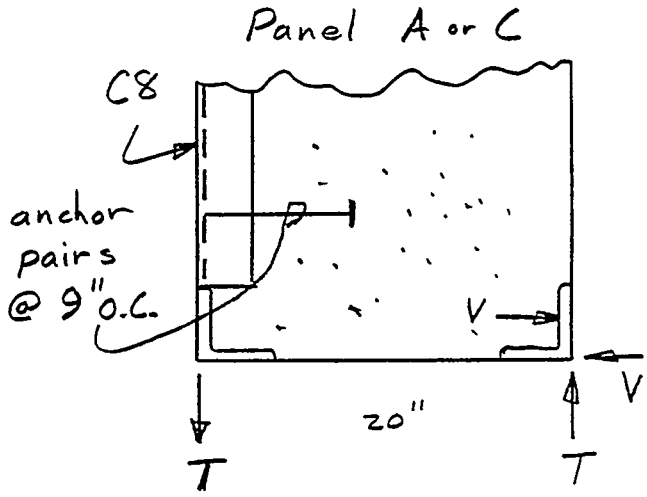
$T = 2071^{\#}$

$V = 2393^{\#}$

Capacities

$T_A = 4950^{\#}$

$V_A = 4208^{\#}$



Shear reaction is resisted by bearing on the vertical leg of the right-hand angle shown above.

Tension reaction is resisted by the anchors welded to the C8 channel thru shear action.

Shear in anchors

$$V = \frac{2071.}{2 \text{ anchors}} = 1036^{\#} < 4208^{\#} \quad \text{O.K.}$$

$$MS = \frac{4208}{1036} - 1 = 3.06$$

ANALYTICAL CALCULATIONS

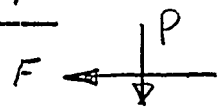
Page _____ of _____

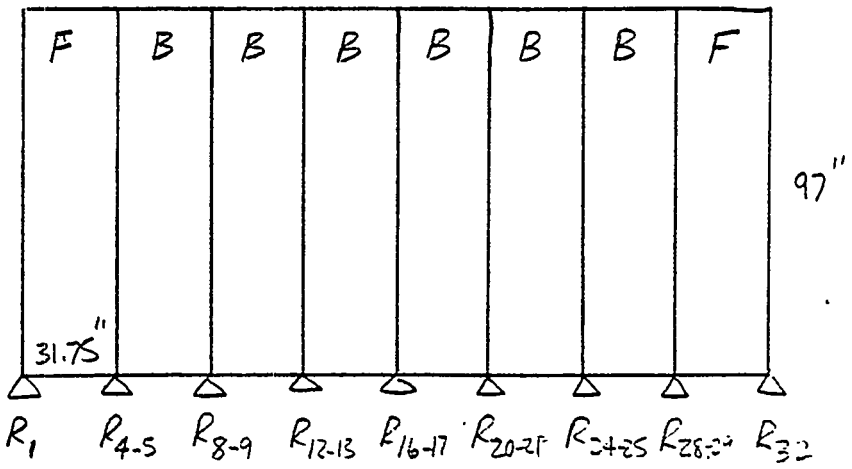
Subject _____

Originator RA H. Ho Date 12-19-94

Checker MA ISLAM Date 2/27/95

Strength Check Panel B-F





$P = .85D + E$

$P = 101.1 \times 254''$

$P = 25679^{\#}$

$R_{1y} = 1823 + \frac{25679}{16} = 3428^{\#}$ comp $\quad R_{1x} = 861^{\#}$

$R_{4-5y} = -1827 + 1736 + \frac{25679}{16} \times 2$

$= 3119^{\#}$ comp $\quad R_{45x} = 965 + 859 = 1824^{\#}$

$R_{8-9y} = -2337 + 1714 + \frac{25679}{16} \times 2$

$= 2587^{\#}$ comp $\quad R_{8-9x} = 1194 + 855 = 2049^{\#}$

$R_{12-13y} = -2344 + 1707 + \frac{25679}{16} \times 2$

$= 2573^{\#}$ comp $\quad R_{12-13x} = 1200 + 854 = 2054^{\#}$

$R_{16-17y} = -2329 + 1711 + \frac{25679}{16} \times 2$

$= 2592^{\#}$ $\quad R_{16-17x} = 1195 + 855 = 2050^{\#}$

$R_{32y} = -2504 + \frac{25679}{16} = 899^{\#}$ tens. $\quad R_{32x} = 1173^{\#}$

$\Sigma R_x = 15952^{\#}$

ANALYTICAL CALCULATIONS

Page ____ of ____

Subject _____

Originator RS Miller Date 12-19-94

Checker MA ISLAM Date 2/27/95

Strength Check Panel B-F Cont.

Shear @ Base:

$V = 15952^{\#} = .2 \times 79748^{\#}$ O.K.

$v = \frac{15952}{8"(254")} = 7.9$ psi

Stress & Moment @ Base:

$\sigma = 91.8$ psi

$M = \sigma S_b = \sigma bh^2/6000 = 123.4^{"\cdot K}$

Check Concrete Shear:

$v = 7.9$ psi < 93.5 psi O.K

$MS = \frac{93.5}{7.9} - 1 = 10.8$

Check Concrete Bending:

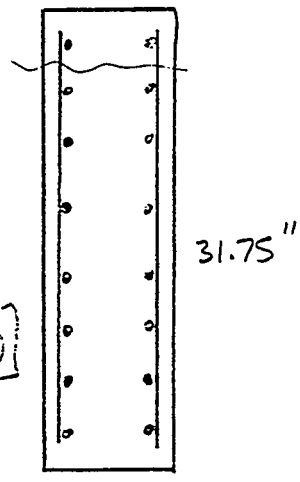
$a = \frac{A_s F_y}{.85 f'_c b} = \frac{14(.04)40}{.85(3)8"} = 1.098"$

$\phi M_n = \phi A_s F_y \sum(d - a/2)$

$= .9(.08)(40)\left[(29.5 - a/2) + (25.5 - a/2) + (21.5 - a/2) + (17.5 - a/2) + (13.5 - a/2) + (9.5 - a/2) + (5.5 - a/2)\right]$

$= 342^{"\cdot K} > 123.4^{"\cdot K}$ O.K.

$MS = \frac{342}{123.4} - 1 = 1.77$

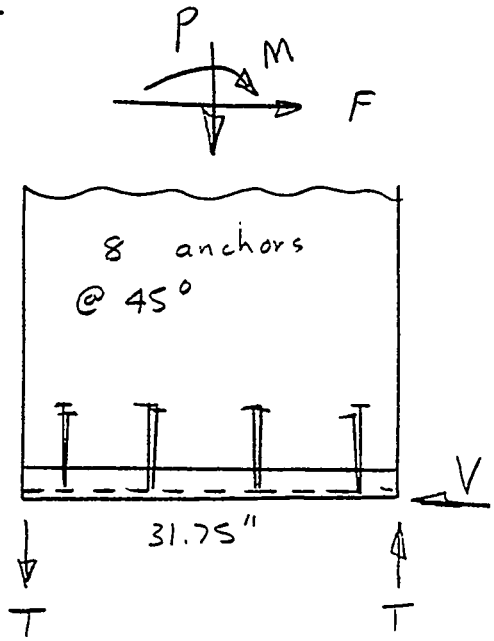


Subject _____

Originator R A Hille Date 12-19-94

Checker M A ISLAM Date 2/27/95

Strength Check, Panel B - F



Anchor Loads:

$T = .899^{\#}$

$V = 2054^{\#}$

tension in anchors:

$$\frac{(T)}{\sin 45^\circ\ (4\ \text{anch.})} = 318^{\#}$$

shear in anchors:

$$318^{\#} + \frac{(V)}{8\ \text{anchors}} = 575^{\#}$$

bolt Interaction:

$$\frac{T}{T_A} + \frac{V}{V_A} = \frac{318}{4950} + \frac{575}{4208} = 0.20 < 1.0$$

O.K.

$$M.S. = \frac{1.0}{.20} - 1 = 4.0$$

Subject _____

Originator RS Lilla Date 12-21-94

Checker MA ISLAM Date 2/27/95

Check Base Plate

Refer to sketch shown previously

Shear in Plate ①:

Panel A-C ∴ $V = \frac{966 \times 9 \text{ panels}}{17 \text{ anchors}} = 511^{\#}/\text{anch}$

Shear in Plate ②:

Panel A-C ∴ $V = \frac{777 \times 9 \text{ panel}}{17 \text{ anchors}} = 411^{\#}/\text{anch.}$

Panel B-F ∴ $V = \frac{2054^{\#} \times 8 \text{ panels}}{17 \text{ anchor (2 plates)}} = 483^{\#}/\text{anch}$

Shear in Plate ③:

Panel A-C ∴ $V = \frac{1345 \times 9}{17} = 712^{\#}/\text{anch}$

Panel B-F ∴ V = = $483^{\#}/\text{anch}$

Shear in Plate ④:

Panel A-C ∴ $V = \frac{786 \times 9 \text{ pl}}{17 \text{ anchors}} = 416^{\#}/\text{anch.}$

Shear Resultant: SRSS & 100-40-40

Plate ① $V_R = 511^{\#}$

Plate ② $V_R = \sqrt{(483)^2 + (40\% \times 411)^2} = 510^{\#}/\text{anch}$

Plate ③ $V_R = \sqrt{(712)^2 + (40\% \times 483)^2} = 738^{\#}/\text{anch}$

Plate ④ $V_R = 416^{\#}$

ANALYTICAL CALCULATIONS

Page ____ of ____

Subject _____

Originator RA Gilla Date 12-21-94

Checker MA ISLAM Date 2/27/95

Base Plate Cont.

Ten. or Comp. in Plate ①:

Panel A-C ∴ $C = \frac{2708^{\#} \times 9pl}{17\ anch} = 1434\ ^{\#}/anch$

Ten. or Comp. in Plate ②:

Panel A-C ∴ $T = 471 \times 9/17 = 249\ ^{\#}/anch$

Panel B-F ∴ $T = 899 \div 2 = 450\ ^{\#}/anch$

Ten or Comp in Plate ③:

Panel A-C ∴ $C = 1652^{\#} \times 9/17 = 875\ ^{\#}/anch$

Panel B-F ∴ $T = 899 \div 2 = 450\ ^{\#}/anch$

Ten. or Comp in Plate ④:

Panel A-C ∴ $T = 2071 \times 9/17 = 1096\ ^{\#}/anch$

Plate Interaction:

Plate ① ∴ $\frac{T}{T_A} + \frac{V}{V_A} = 0 + \frac{511}{1874} = .27 < 1.0$

C.-

$MS = \frac{1.0}{.27} - 1 = 2.7$

ANALYTICAL CALCULATIONS

Subject _____

Originator RA Lilla Date 12-30-97

Checker MA ISLAM Date 2/27/95

Base Plate Cont.

Plate Interaction :

Plate ② $\frac{T}{T_A} + \frac{V}{V_A} = \frac{450 + .4(249)}{2205} + \frac{510}{1874} = .54$

$MS = \frac{1.0}{.54} - 1 = 0.85$

Plate ③ $\frac{T}{T_A} + \frac{V}{V_A} = 0 + \frac{738}{1874} = .39$

$MS = \frac{1.0}{.39} - 1 = 1.56$

Plate ④ $\frac{T}{T_A} + \frac{V}{V_A} = \frac{1096}{2205} + \frac{416}{1874} = .72$

M.S. = .39

ANALYTICAL CALCULATIONS

Page ____ of ____

Subject _____

Originator RA Little Date 12-30-94

Checker MA ISLAM Date 2/27/95

Check Connection @ Panel Top

Panel A - C :

$F_x = 1021^{\#}$ & $F_y = 491^{\#}$

or $772^{\#}$ $1697^{\#}$

Panel B - F :

$F_x = 399^{\#}$ & $F_y = 224^{\#}$

or $126^{\#}$ $1112^{\#}$

Shear & tension Maximums :

$F_x = 1021^{\#} + 399^{\#} = 1420^{\#}$

$F_y = 1697 + 1112^{\#} = 2809^{\#}$

Compare to anchor bolt allowables

$$\frac{T}{T_A} + \frac{V}{V_A} = \frac{1420}{4950(2\text{bolt})} + \frac{2809}{4208(2\text{bolt})} = .48 < 1.0$$

$$M.S. = \frac{1.0}{.48} - 1 = 1.08 \quad O.K.$$

ANALYTICAL CALCULATIONS

Page ____ of ____

Subject _____

Originator R A Gilla Date 12-30-94

Checker MA ISLAM Date 2/27/95

Margins of Safety

N-S, Old Type Cubical ;

Bending MS = 0.87

Shear MS = 18.8

Anchor MS = 1.78

E-W, Old Type Cubical ;

Bending MS = 1.89

Shear MS = 12.5

Anchor MS = 1.63

Embeded PL, Old Type Cubical :

Anchor MS = 1.33

N-S, New Type Cubical ;

Bending MS = .007

Shear MS = 14.0

Anchor MS = 3.06

EW, New Type Cubical ;

Bending MS = 1.77

Shear MS = 10.8

Anchors MS = 4.0

Embeded PL

Anchor MS = 0.39

ANALYTICAL CALCULATIONS

Subject _____

Originator R A Hill Date 12-30-94

Checker M A ISLAM Date 2/27/95

Computer Printout

N-S Direction

Geometry

ANSYS 5.0 Computer Program Used on the CEA4 workstation located in the ETC-2 Building, 2920 GWW.

Element type SHELL63 elements used as concrete shear walls.

Element type CONTAC48 elements used as contact elements between panels.

Density set at .000527 to model the total mass applied to just the N-S panels.

$$\frac{68272^{\#}}{8"(48")(97")(9\text{ panels})\,386.4\ in/s^2} = .000527$$

Lateral acceleration to the right, (positive X direction).

Coupled nodes used to tie panel tops together.

X and Y constraints at bottom nodes 1, 5, 6, 8, 9, & 13

Y only constraints at bottom nodes 2 & 10

Results for N-S, Old Type Cubical

```
 LIST ELEMENT TYPES FROM    1 TO    1 BY    1

 ELEMENT TYPE    1 IS SHELL63     ELASTIC SHELL                INOPR
  KEYOPT(1-12)=    1  0  0    0  0  0    0  0  0    0  0  0      0

 ELEMENT TYPE    2 IS CONTAC48    2D GENERAL CONTACT ELEMENT   INOPR
  KEYOPT(1-12)=    0  0  0    0  0  0    0  0  0    0  0  0      0


 LIST REAL SETS      1 TO     1 BY     1

 REAL CONSTANT SET      1  ITEMS  1 TO  6
   8.0000      0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00


 LIST MATERIALS    1 TO    1 BY  1
  PROPERTY= ALL

 PROPERTY TABLE EX    MAT=   1  NUM. POINTS=  1
  TEMPERATURE    DATA   TEMPERATURE    DATA   TEMPERATURE    DATA
  0.00000E+00 0.30000E+07

 PROPERTY TABLE DENS  MAT=   1  NUM. POINTS=  1
  TEMPERATURE    DATA   TEMPERATURE    DATA   TEMPERATURE    DATA
  0.00000E+00 0.52700E-03


 LIST ALL COUPLED SETS WITH ANY  NODES SELECTED

 COUPLED SET=     1  DIRECTION= UX   TOTAL NODES=     2
 NODES=     265    266

 COUPLED SET=     2  DIRECTION= UX   TOTAL NODES=     2
 NODES=     269    268

 COUPLED SET=     3  DIRECTION= UY   TOTAL NODES=     2
 NODES=     265    266

 COUPLED SET=     4  DIRECTION= UY   TOTAL NODES=     2
 NODES=     269    268
 MAXIMUM COUPLED SET NUMBER=     4


 LIST CONSTRAINTS FOR SELECTED NODES      1 TO    273 BY     1
 CURRENTLY SELECTED DOF SET= UX  UY  UZ

    NODE  LABEL    REAL          IMAG
       1  UX    0.000000000E+00 0.000000000E+00
       1  UY    0.000000000E+00 0.000000000E+00
       2  UY    0.000000000E+00 0.000000000E+00
       5  UX    0.000000000E+00 0.000000000E+00
       5  UY    0.000000000E+00 0.000000000E+00
       6  UX    0.000000000E+00 0.000000000E+00
       6  UY    0.000000000E+00 0.000000000E+00
       8  UX    0.000000000E+00 0.000000000E+00
       8  UY    0.000000000E+00 0.000000000E+00
       9  UX    0.000000000E+00 0.000000000E+00
       9  UY    0.000000000E+00 0.000000000E+00
      10  UY    0.000000000E+00 0.000000000E+00
      13  UX    0.000000000E+00 0.000000000E+00
      13  UY    0.000000000E+00 0.000000000E+00
```

LIST ALL SELECTED NODES. DSYS= 0

NODE	X	Y	Z	THXY	THYZ	THZX
1	0.00000E+00	0.00000E+00	0.00000E+00	0.00	0.00	0.00
2	5.0000	0.00000E+00	0.00000E+00	0.00	0.00	0.00
3	10.000	0.00000E+00	0.00000E+00	0.00	0.00	0.00
4	15.000	0.00000E+00	0.00000E+00	0.00	0.00	0.00
5	20.000	0.00000E+00	0.00000E+00	0.00	0.00	0.00
6	20.000	0.00000E+00	0.00000E+00	0.00	0.00	0.00
7	24.000	0.00000E+00	0.00000E+00	0.00	0.00	0.00
8	28.000	0.00000E+00	0.00000E+00	0.00	0.00	0.00
9	28.000	0.00000E+00	0.00000E+00	0.00	0.00	0.00
10	33.000	0.00000E+00	0.00000E+00	0.00	0.00	0.00
11	38.000	0.00000E+00	0.00000E+00	0.00	0.00	0.00
12	43.000	0.00000E+00	0.00000E+00	0.00	0.00	0.00
13	48.000	0.00000E+00	0.00000E+00	0.00	0.00	0.00
14	0.00000E+00	4.8500	0.00000E+00	0.00	0.00	0.00
15	5.0000	4.8500	0.00000E+00	0.00	0.00	0.00
16	10.000	4.8500	0.00000E+00	0.00	0.00	0.00
17	15.000	4.8500	0.00000E+00	0.00	0.00	0.00
18	20.000	4.8500	0.00000E+00	0.00	0.00	0.00
19	20.000	4.8500	0.00000E+00	0.00	0.00	0.00
20	24.000	4.8500	0.00000E+00	0.00	0.00	0.00
21	28.000	4.8500	0.00000E+00	0.00	0.00	0.00
22	28.000	4.8500	0.00000E+00	0.00	0.00	0.00
23	33.000	4.8500	0.00000E+00	0.00	0.00	0.00
24	38.000	4.8500	0.00000E+00	0.00	0.00	0.00
25	43.000	4.8500	0.00000E+00	0.00	0.00	0.00
26	48.000	4.8500	0.00000E+00	0.00	0.00	0.00
27	0.00000E+00	9.7000	0.00000E+00	0.00	0.00	0.00
28	5.0000	9.7000	0.00000E+00	0.00	0.00	0.00
29	10.000	9.7000	0.00000E+00	0.00	0.00	0.00
30	15.000	9.7000	0.00000E+00	0.00	0.00	0.00
31	20.000	9.7000	0.00000E+00	0.00	0.00	0.00
32	20.000	9.7000	0.00000E+00	0.00	0.00	0.00
33	24.000	9.7000	0.00000E+00	0.00	0.00	0.00
34	28.000	9.7000	0.00000E+00	0.00	0.00	0.00
35	28.000	9.7000	0.00000E+00	0.00	0.00	0.00
36	33.000	9.7000	0.00000E+00	0.00	0.00	0.00
37	38.000	9.7000	0.00000E+00	0.00	0.00	0.00
38	43.000	9.7000	0.00000E+00	0.00	0.00	0.00
39	48.000	9.7000	0.00000E+00	0.00	0.00	0.00
40	0.00000E+00	14.550	0.00000E+00	0.00	0.00	0.00
41	5.0000	14.550	0.00000E+00	0.00	0.00	0.00
42	10.000	14.550	0.00000E+00	0.00	0.00	0.00
43	15.000	14.550	0.00000E+00	0.00	0.00	0.00
44	20.000	14.550	0.00000E+00	0.00	0.00	0.00
45	20.000	14.550	0.00000E+00	0.00	0.00	0.00
46	24.000	14.550	0.00000E+00	0.00	0.00	0.00
47	28.000	14.550	0.00000E+00	0.00	0.00	0.00
48	28.000	14.550	0.00000E+00	0.00	0.00	0.00
49	33.000	14.550	0.00000E+00	0.00	0.00	0.00
50	38.000	14.550	0.00000E+00	0.00	0.00	0.00
51	43.000	14.550	0.00000E+00	0.00	0.00	0.00
52	48.000	14.550	0.00000E+00	0.00	0.00	0.00
53	0.00000E+00	19.400	0.00000E+00	0.00	0.00	0.00
54	5.0000	19.400	0.00000E+00	0.00	0.00	0.00
55	10.000	19.400	0.00000E+00	0.00	0.00	0.00
56	15.000	19.400	0.00000E+00	0.00	0.00	0.00
57	20.000	19.400	0.00000E+00	0.00	0.00	0.00
58	20.000	19.400	0.00000E+00	0.00	0.00	0.00
59	24.000	19.400	0.00000E+00	0.00	0.00	0.00
60	28.000	19.400	0.00000E+00	0.00	0.00	0.00

NODE	X	Y	Z	THXY	THYZ	THZX
61	28.000	19.400	0.00000E+00	0.00	0.00	0.00
62	33.000	19.400	0.00000E+00	0.00	0.00	0.00
63	38.000	19.400	0.00000E+00	0.00	0.00	0.00
64	43.000	19.400	0.00000E+00	0.00	0.00	0.00
65	48.000	19.400	0.00000E+00	0.00	0.00	0.00
66	0.00000E+00	24.250	0.00000E+00	0.00	0.00	0.00
67	5.0000	24.250	0.00000E+00	0.00	0.00	0.00
68	10.000	24.250	0.00000E+00	0.00	0.00	0.00
69	15.000	24.250	0.00000E+00	0.00	0.00	0.00
70	20.000	24.250	0.00000E+00	0.00	0.00	0.00
71	20.000	24.250	0.00000E+00	0.00	0.00	0.00
72	24.000	24.250	0.00000E+00	0.00	0.00	0.00
73	28.000	24.250	0.00000E+00	0.00	0.00	0.00
74	28.000	24.250	0.00000E+00	0.00	0.00	0.00
75	33.000	24.250	0.00000E+00	0.00	0.00	0.00
76	38.000	24.250	0.00000E+00	0.00	0.00	0.00
77	43.000	24.250	0.00000E+00	0.00	0.00	0.00
78	48.000	24.250	0.00000E+00	0.00	0.00	0.00
79	0.00000E+00	29.100	0.00000E+00	0.00	0.00	0.00
80	5.0000	29.100	0.00000E+00	0.00	0.00	0.00
81	10.000	29.100	0.00000E+00	0.00	0.00	0.00
82	15.000	29.100	0.00000E+00	0.00	0.00	0.00
83	20.000	29.100	0.00000E+00	0.00	0.00	0.00
84	20.000	29.100	0.00000E+00	0.00	0.00	0.00
85	24.000	29.100	0.00000E+00	0.00	0.00	0.00
86	28.000	29.100	0.00000E+00	0.00	0.00	0.00
87	28.000	29.100	0.00000E+00	0.00	0.00	0.00
88	33.000	29.100	0.00000E+00	0.00	0.00	0.00
89	38.000	29.100	0.00000E+00	0.00	0.00	0.00
90	43.000	29.100	0.00000E+00	0.00	0.00	0.00
91	48.000	29.100	0.00000E+00	0.00	0.00	0.00
92	0.00000E+00	33.950	0.00000E+00	0.00	0.00	0.00
93	5.0000	33.950	0.00000E+00	0.00	0.00	0.00
94	10.000	33.950	0.00000E+00	0.00	0.00	0.00
95	15.000	33.950	0.00000E+00	0.00	0.00	0.00
96	20.000	33.950	0.00000E+00	0.00	0.00	0.00
97	20.000	33.950	0.00000E+00	0.00	0.00	0.00
98	24.000	33.950	0.00000E+00	0.00	0.00	0.00
99	28.000	33.950	0.00000E+00	0.00	0.00	0.00
100	28.000	33.950	0.00000E+00	0.00	0.00	0.00
101	33.000	33.950	0.00000E+00	0.00	0.00	0.00
102	38.000	33.950	0.00000E+00	0.00	0.00	0.00
103	43.000	33.950	0.00000E+00	0.00	0.00	0.00
104	48.000	33.950	0.00000E+00	0.00	0.00	0.00
105	0.00000E+00	38.800	0.00000E+00	0.00	0.00	0.00
106	5.0000	38.800	0.00000E+00	0.00	0.00	0.00
107	10.000	38.800	0.00000E+00	0.00	0.00	0.00
108	15.000	38.800	0.00000E+00	0.00	0.00	0.00
109	20.000	38.800	0.00000E+00	0.00	0.00	0.00
110	20.000	38.800	0.00000E+00	0.00	0.00	0.00
111	24.000	38.800	0.00000E+00	0.00	0.00	0.00
112	28.000	38.800	0.00000E+00	0.00	0.00	0.00
113	28.000	38.800	0.00000E+00	0.00	0.00	0.00
114	33.000	38.800	0.00000E+00	0.00	0.00	0.00
115	38.000	38.800	0.00000E+00	0.00	0.00	0.00
116	43.000	38.800	0.00000E+00	0.00	0.00	0.00
117	48.000	38.800	0.00000E+00	0.00	0.00	0.00
118	0.00000E+00	43.650	0.00000E+00	0.00	0.00	0.00
119	5.0000	43.650	0.00000E+00	0.00	0.00	0.00
120	10.000	43.650	0.00000E+00	0.00	0.00	0.00

NODE	X	Y	Z	THXY	THYZ	THZX
121	15.000	43.650	0.00000E+00	0.00	0.00	0.00
122	20.000	43.650	0.00000E+00	0.00	0.00	0.00
123	20.000	43.650	0.00000E+00	0.00	0.00	0.00
124	24.000	43.650	0.00000E+00	0.00	0.00	0.00
125	28.000	43.650	0.00000E+00	0.00	0.00	0.00
126	28.000	43.650	0.00000E+00	0.00	0.00	0.00
127	33.000	43.650	0.00000E+00	0.00	0.00	0.00
128	38.000	43.650	0.00000E+00	0.00	0.00	0.00
129	43.000	43.650	0.00000E+00	0.00	0.00	0.00
130	48.000	43.650	0.00000E+00	0.00	0.00	0.00
131	0.00000E+00	48.500	0.00000E+00	0.00	0.00	0.00
132	5.0000	48.500	0.00000E+00	0.00	0.00	0.00
133	10.000	48.500	0.00000E+00	0.00	0.00	0.00
134	15.000	48.500	0.00000E+00	0.00	0.00	0.00
135	20.000	48.500	0.00000E+00	0.00	0.00	0.00
136	20.000	48.500	0.00000E+00	0.00	0.00	0.00
137	24.000	48.500	0.00000E+00	0.00	0.00	0.00
138	28.000	48.500	0.00000E+00	0.00	0.00	0.00
139	28.000	48.500	0.00000E+00	0.00	0.00	0.00
140	33.000	48.500	0.00000E+00	0.00	0.00	0.00
141	38.000	48.500	0.00000E+00	0.00	0.00	0.00
142	43.000	48.500	0.00000E+00	0.00	0.00	0.00
143	48.000	48.500	0.00000E+00	0.00	0.00	0.00
144	0.00000E+00	53.350	0.00000E+00	0.00	0.00	0.00
145	5.0000	53.350	0.00000E+00	0.00	0.00	0.00
146	10.000	53.350	0.00000E+00	0.00	0.00	0.00
147	15.000	53.350	0.00000E+00	0.00	0.00	0.00
148	20.000	53.350	0.00000E+00	0.00	0.00	0.00
149	20.000	53.350	0.00000E+00	0.00	0.00	0.00
150	24.000	53.350	0.00000E+00	0.00	0.00	0.00
151	28.000	53.350	0.00000E+00	0.00	0.00	0.00
152	28.000	53.350	0.00000E+00	0.00	0.00	0.00
153	33.000	53.350	0.00000E+00	0.00	0.00	0.00
154	38.000	53.350	0.00000E+00	0.00	0.00	0.00
155	43.000	53.350	0.00000E+00	0.00	0.00	0.00
156	48.000	53.350	0.00000E+00	0.00	0.00	0.00
157	0.00000E+00	58.200	0.00000E+00	0.00	0.00	0.00
158	5.0000	58.200	0.00000E+00	0.00	0.00	0.00
159	10.000	58.200	0.00000E+00	0.00	0.00	0.00
160	15.000	58.200	0.00000E+00	0.00	0.00	0.00
161	20.000	58.200	0.00000E+00	0.00	0.00	0.00
162	20.000	58.200	0.00000E+00	0.00	0.00	0.00
163	24.000	58.200	0.00000E+00	0.00	0.00	0.00
164	28.000	58.200	0.00000E+00	0.00	0.00	0.00
165	28.000	58.200	0.00000E+00	0.00	0.00	0.00
166	33.000	58.200	0.00000E+00	0.00	0.00	0.00
167	38.000	58.200	0.00000E+00	0.00	0.00	0.00
168	43.000	58.200	0.00000E+00	0.00	0.00	0.00
169	48.000	58.200	0.00000E+00	0.00	0.00	0.00
170	0.00000E+00	63.050	0.00000E+00	0.00	0.00	0.00
171	5.0000	63.050	0.00000E+00	0.00	0.00	0.00
172	10.000	63.050	0.00000E+00	0.00	0.00	0.00
173	15.000	63.050	0.00000E+00	0.00	0.00	0.00
174	20.000	63.050	0.00000E+00	0.00	0.00	0.00
175	20.000	63.050	0.00000E+00	0.00	0.00	0.00
176	24.000	63.050	0.00000E+00	0.00	0.00	0.00
177	28.000	63.050	0.00000E+00	0.00	0.00	0.00
178	28.000	63.050	0.00000E+00	0.00	0.00	0.00
179	33.000	63.050	0.00000E+00	0.00	0.00	0.00
180	38.000	63.050	0.00000E+00	0.00	0.00	0.00

NODE	X	Y	Z	THXY	THYZ	THZX
181	43.000	63.050	0.00000E+00	0.00	0.00	0.00
182	48.000	63.050	0.00000E+00	0.00	0.00	0.00
183	0.00000E+00	67.900	0.00000E+00	0.00	0.00	0.00
184	5.0000	67.900	0.00000E+00	0.00	0.00	0.00
185	10.000	67.900	0.00000E+00	0.00	0.00	0.00
186	15.000	67.900	0.00000E+00	0.00	0.00	0.00
187	20.000	67.900	0.00000E+00	0.00	0.00	0.00
188	20.000	67.900	0.00000E+00	0.00	0.00	0.00
189	24.000	67.900	0.00000E+00	0.00	0.00	0.00
190	28.000	67.900	0.00000E+00	0.00	0.00	0.00
191	28.000	67.900	0.00000E+00	0.00	0.00	0.00
192	33.000	67.900	0.00000E+00	0.00	0.00	0.00
193	38.000	67.900	0.00000E+00	0.00	0.00	0.00
194	43.000	67.900	0.00000E+00	0.00	0.00	0.00
195	48.000	67.900	0.00000E+00	0.00	0.00	0.00
196	0.00000E+00	72.750	0.00000E+00	0.00	0.00	0.00
197	5.0000	72.750	0.00000E+00	0.00	0.00	0.00
198	10.000	72.750	0.00000E+00	0.00	0.00	0.00
199	15.000	72.750	0.00000E+00	0.00	0.00	0.00
200	20.000	72.750	0.00000E+00	0.00	0.00	0.00
201	20.000	72.750	0.00000E+00	0.00	0.00	0.00
202	24.000	72.750	0.00000E+00	0.00	0.00	0.00
203	28.000	72.750	0.00000E+00	0.00	0.00	0.00
204	28.000	72.750	0.00000E+00	0.00	0.00	0.00
205	33.000	72.750	0.00000E+00	0.00	0.00	0.00
206	38.000	72.750	0.00000E+00	0.00	0.00	0.00
207	43.000	72.750	0.00000E+00	0.00	0.00	0.00
208	48.000	72.750	0.00000E+00	0.00	0.00	0.00
209	0.00000E+00	77.600	0.00000E+00	0.00	0.00	0.00
210	5.0000	77.600	0.00000E+00	0.00	0.00	0.00
211	10.000	77.600	0.00000E+00	0.00	0.00	0.00
212	15.000	77.600	0.00000E+00	0.00	0.00	0.00
213	20.000	77.600	0.00000E+00	0.00	0.00	0.00
214	20.000	77.600	0.00000E+00	0.00	0.00	0.00
215	24.000	77.600	0.00000E+00	0.00	0.00	0.00
216	28.000	77.600	0.00000E+00	0.00	0.00	0.00
217	28.000	77.600	0.00000E+00	0.00	0.00	0.00
218	33.000	77.600	0.00000E+00	0.00	0.00	0.00
219	38.000	77.600	0.00000E+00	0.00	0.00	0.00
220	43.000	77.600	0.00000E+00	0.00	0.00	0.00
221	48.000	77.600	0.00000E+00	0.00	0.00	0.00
222	0.00000E+00	82.450	0.00000E+00	0.00	0.00	0.00
223	5.0000	82.450	0.00000E+00	0.00	0.00	0.00
224	10.000	82.450	0.00000E+00	0.00	0.00	0.00
225	15.000	82.450	0.00000E+00	0.00	0.00	0.00
226	20.000	82.450	0.00000E+00	0.00	0.00	0.00
227	20.000	82.450	0.00000E+00	0.00	0.00	0.00
228	24.000	82.450	0.00000E+00	0.00	0.00	0.00
229	28.000	82.450	0.00000E+00	0.00	0.00	0.00
230	28.000	82.450	0.00000E+00	0.00	0.00	0.00
231	33.000	82.450	0.00000E+00	0.00	0.00	0.00
232	38.000	82.450	0.00000E+00	0.00	0.00	0.00
233	43.000	82.450	0.00000E+00	0.00	0.00	0.00
234	48.000	82.450	0.00000E+00	0.00	0.00	0.00
235	0.00000E+00	87.300	0.00000E+00	0.00	0.00	0.00
236	5.0000	87.300	0.00000E+00	0.00	0.00	0.00
237	10.000	87.300	0.00000E+00	0.00	0.00	0.00
238	15.000	87.300	0.00000E+00	0.00	0.00	0.00
239	20.000	87.300	0.00000E+00	0.00	0.00	0.00
240	20.000	87.300	0.00000E+00	0.00	0.00	0.00

NODE	X	Y	Z	THXY	THYZ	THZX
241	24.000	87.300	0.00000E+00	0.00	0.00	0.00
242	28.000	87.300	0.00000E+00	0.00	0.00	0.00
243	28.000	87.300	0.00000E+00	0.00	0.00	0.00
244	33.000	87.300	0.00000E+00	0.00	0.00	0.00
245	38.000	87.300	0.00000E+00	0.00	0.00	0.00
246	43.000	87.300	0.00000E+00	0.00	0.00	0.00
247	48.000	87.300	0.00000E+00	0.00	0.00	0.00
248	0.00000E+00	92.150	0.00000E+00	0.00	0.00	0.00
249	5.0000	92.150	0.00000E+00	0.00	0.00	0.00
250	10.000	92.150	0.00000E+00	0.00	0.00	0.00
251	15.000	92.150	0.00000E+00	0.00	0.00	0.00
252	20.000	92.150	0.00000E+00	0.00	0.00	0.00
253	20.000	92.150	0.00000E+00	0.00	0.00	0.00
254	24.000	92.150	0.00000E+00	0.00	0.00	0.00
255	28.000	92.150	0.00000E+00	0.00	0.00	0.00
256	28.000	92.150	0.00000E+00	0.00	0.00	0.00
257	33.000	92.150	0.00000E+00	0.00	0.00	0.00
258	38.000	92.150	0.00000E+00	0.00	0.00	0.00
259	43.000	92.150	0.00000E+00	0.00	0.00	0.00
260	48.000	92.150	0.00000E+00	0.00	0.00	0.00
261	0.00000E+00	97.000	0.00000E+00	0.00	0.00	0.00
262	5.0000	97.000	0.00000E+00	0.00	0.00	0.00
263	10.000	97.000	0.00000E+00	0.00	0.00	0.00
264	15.000	97.000	0.00000E+00	0.00	0.00	0.00
265	20.000	97.000	0.00000E+00	0.00	0.00	0.00
266	20.000	97.000	0.00000E+00	0.00	0.00	0.00
267	24.000	97.000	0.00000E+00	0.00	0.00	0.00
268	28.000	97.000	0.00000E+00	0.00	0.00	0.00
269	28.000	97.000	0.00000E+00	0.00	0.00	0.00
270	33.000	97.000	0.00000E+00	0.00	0.00	0.00
271	38.000	97.000	0.00000E+00	0.00	0.00	0.00
272	43.000	97.000	0.00000E+00	0.00	0.00	0.00
273	48.000	97.000	0.00000E+00	0.00	0.00	0.00

LIST ALL SELECTED ELEMENTS. (LIST NODES)

ELEM	MAT	TYP	REL	ESY	NODES			
1	1	1	1	0	1	2	15	14
2	1	1	1	0	2	3	16	15
3	1	1	1	0	3	4	17	16
4	1	1	1	0	4	5	18	17
5	1	1	1	0	6	7	20	19
6	1	1	1	0	7	8	21	20
7	1	1	1	0	9	10	23	22
8	1	1	1	0	10	11	24	23
9	1	1	1	0	11	12	25	24
10	1	1	1	0	12	13	26	25
11	1	1	1	0	14	15	28	27
12	1	1	1	0	15	16	29	28
13	1	1	1	0	16	17	30	29
14	1	1	1	0	17	18	31	30
15	1	1	1	0	19	20	33	32
16	1	1	1	0	20	21	34	33
17	1	1	1	0	22	23	36	35
18	1	1	1	0	23	24	37	36
19	1	1	1	0	24	25	38	37
20	1	1	1	0	25	26	39	38
21	1	1	1	0	27	28	41	40
22	1	1	1	0	28	29	42	41
23	1	1	1	0	29	30	43	42
24	1	1	1	0	30	31	44	43
25	1	1	1	0	32	33	46	45
26	1	1	1	0	33	34	47	46
27	1	1	1	0	35	36	49	48
28	1	1	1	0	36	37	50	49
29	1	1	1	0	37	38	51	50
30	1	1	1	0	38	39	52	51
31	1	1	1	0	40	41	54	53
32	1	1	1	0	41	42	55	54
33	1	1	1	0	42	43	56	55
34	1	1	1	0	43	44	57	56
35	1	1	1	0	45	46	59	58
36	1	1	1	0	46	47	60	59
37	1	1	1	0	48	49	62	61
38	1	1	1	0	49	50	63	62
39	1	1	1	0	50	51	64	63
40	1	1	1	0	51	52	65	64
41	1	1	1	0	53	54	67	66
42	1	1	1	0	54	55	68	67
43	1	1	1	0	55	56	69	68
44	1	1	1	0	56	57	70	69
45	1	1	1	0	58	59	72	71
46	1	1	1	0	59	60	73	72
47	1	1	1	0	61	62	75	74
48	1	1	1	0	62	63	76	75
49	1	1	1	0	63	64	77	76
50	1	1	1	0	64	65	78	77
51	1	1	1	0	66	67	80	79
52	1	1	1	0	67	68	81	80
53	1	1	1	0	68	69	82	81
54	1	1	1	0	69	70	83	82
55	1	1	1	0	71	72	85	84
56	1	1	1	0	72	73	86	85
57	1	1	1	0	74	75	88	87
58	1	1	1	0	75	76	89	88
59	1	1	1	0	76	77	90	89
60	1	1	1	0	77	78	91	90

ELEM	MAT	TYP	REL	ESY	NODES			
61	1	1	1	0	79	80	93	92
62	1	1	1	0	80	81	94	93
63	1	1	1	0	81	82	95	94
64	1	1	1	0	82	83	96	95
65	1	1	1	0	84	85	98	97
66	1	1	1	0	85	86	99	98
67	1	1	1	0	87	88	101	100
68	1	1	1	0	88	89	102	101
69	1	1	1	0	89	90	103	102
70	1	1	1	0	90	91	104	103
71	1	1	1	0	92	93	106	105
72	1	1	1	0	93	94	107	106
73	1	1	1	0	94	95	108	107
74	1	1	1	0	95	96	109	108
75	1	1	1	0	97	98	111	110
76	1	1	1	0	98	99	112	111
77	1	1	1	0	100	101	114	113
78	1	1	1	0	101	102	115	114
79	1	1	1	0	102	103	116	115
80	1	1	1	0	103	104	117	116
81	1	1	1	0	105	106	119	118
82	1	1	1	0	106	107	120	119
83	1	1	1	0	107	108	121	120
84	1	1	1	0	108	109	122	121
85	1	1	1	0	110	111	124	123
86	1	1	1	0	111	112	125	124
87	1	1	1	0	113	114	127	126
88	1	1	1	0	114	115	128	127
89	1	1	1	0	115	116	129	128
90	1	1	1	0	116	117	130	129
91	1	1	1	0	118	119	132	131
92	1	1	1	0	119	120	133	132
93	1	1	1	0	120	121	134	133
94	1	1	1	0	121	122	135	134
95	1	1	1	0	123	124	137	136
96	1	1	1	0	124	125	138	137
97	1	1	1	0	126	127	140	139
98	1	1	1	0	127	128	141	140
99	1	1	1	0	128	129	142	141
100	1	1	1	0	129	130	143	142
101	1	1	1	0	131	132	145	144
102	1	1	1	0	132	133	146	145
103	1	1	1	0	133	134	147	146
104	1	1	1	0	134	135	148	147
105	1	1	1	0	136	137	150	149
106	1	1	1	0	137	138	151	150
107	1	1	1	0	139	140	153	152
108	1	1	1	0	140	141	154	153
109	1	1	1	0	141	142	155	154
110	1	1	1	0	142	143	156	155
111	1	1	1	0	144	145	158	157
112	1	1	1	0	145	146	159	158
113	1	1	1	0	146	147	160	159
114	1	1	1	0	147	148	161	160
115	1	1	1	0	149	150	163	162
116	1	1	1	0	150	151	164	163
117	1	1	1	0	152	153	166	165
118	1	1	1	0	153	154	167	166
119	1	1	1	0	154	155	168	167
120	1	1	1	0	155	156	169	168

ELEM	MAT	TYP	REL	ESY	NODES			
121	1	1	1	0	157	158	171	170
122	1	1	1	0	158	159	172	171
123	1	1	1	0	159	160	173	172
124	1	1	1	0	160	161	174	173
125	1	1	1	0	162	163	176	175
126	1	1	1	0	163	164	177	176
127	1	1	1	0	165	166	179	178
128	1	1	1	0	166	167	180	179
129	1	1	1	0	167	168	181	180
130	1	1	1	0	168	169	182	181
131	1	1	1	0	170	171	184	183
132	1	1	1	0	171	172	185	184
133	1	1	1	0	172	173	186	185
134	1	1	1	0	173	174	187	186
135	1	1	1	0	175	176	189	188
136	1	1	1	0	176	177	190	189
137	1	1	1	0	178	179	192	191
138	1	1	1	0	179	180	193	192
139	1	1	1	0	180	181	194	193
140	1	1	1	0	181	182	195	194
141	1	1	1	0	183	184	197	196
142	1	1	1	0	184	185	198	197
143	1	1	1	0	185	186	199	198
144	1	1	1	0	186	187	200	199
145	1	1	1	0	188	189	202	201
146	1	1	1	0	189	190	203	202
147	1	1	1	0	191	192	205	204
148	1	1	1	0	192	193	206	205
149	1	1	1	0	193	194	207	206
150	1	1	1	0	194	195	208	207
151	1	1	1	0	196	197	210	209
152	1	1	1	0	197	198	211	210
153	1	1	1	0	198	199	212	211
154	1	1	1	0	199	200	213	212
155	1	1	1	0	201	202	215	214
156	1	1	1	0	202	203	216	215
157	1	1	1	0	204	205	218	217
158	1	1	1	0	205	206	219	218
159	1	1	1	0	206	207	220	219
160	1	1	1	0	207	208	221	220
161	1	1	1	0	209	210	223	222
162	1	1	1	0	210	211	224	223
163	1	1	1	0	211	212	225	224
164	1	1	1	0	212	213	226	225
165	1	1	1	0	214	215	228	227
166	1	1	1	0	215	216	229	228
167	1	1	1	0	217	218	231	230
168	1	1	1	0	218	219	232	231
169	1	1	1	0	219	220	233	232
170	1	1	1	0	220	221	234	233
171	1	1	1	0	222	223	236	235
172	1	1	1	0	223	224	237	236
173	1	1	1	0	224	225	238	237
174	1	1	1	0	225	226	239	238
175	1	1	1	0	227	228	241	240
176	1	1	1	0	228	229	242	241
177	1	1	1	0	230	231	244	243
178	1	1	1	0	231	232	245	244
179	1	1	1	0	232	233	246	245
180	1	1	1	0	233	234	247	246

ELEM	MAT	TYP	REL	ESY	NODES			
181	1	1	1	0	235	236	249	248
182	1	1	1	0	236	237	250	249
183	1	1	1	0	237	238	251	250
184	1	1	1	0	238	239	252	251
185	1	1	1	0	240	241	254	253
186	1	1	1	0	241	242	255	254
187	1	1	1	0	243	244	257	256
188	1	1	1	0	244	245	258	257
189	1	1	1	0	245	246	259	258
190	1	1	1	0	246	247	260	259
191	1	1	1	0	248	249	262	261
192	1	1	1	0	249	250	263	262
193	1	1	1	0	250	251	264	263
194	1	1	1	0	251	252	265	264
195	1	1	1	0	253	254	267	266
196	1	1	1	0	254	255	268	267
197	1	1	1	0	256	257	270	269
198	1	1	1	0	257	258	271	270
199	1	1	1	0	258	259	272	271
200	1	1	1	0	259	260	273	272

ELEM	MAT	TYP	REL	ESY	NODES		
201	2	2	2	0	252	239	253
202	2	2	2	0	239	226	240
203	2	2	2	0	226	213	227
204	2	2	2	0	213	200	214
205	2	2	2	0	200	187	201
206	2	2	2	0	187	174	188
207	2	2	2	0	174	161	175
208	2	2	2	0	161	148	162
209	2	2	2	0	148	135	149
210	2	2	2	0	135	122	136
211	2	2	2	0	122	109	123
212	2	2	2	0	109	96	110
213	2	2	2	0	96	83	97
214	2	2	2	0	83	70	84
215	2	2	2	0	70	57	71
216	2	2	2	0	57	44	58
217	2	2	2	0	44	31	45
218	2	2	2	0	31	18	32
219	2	2	2	0	18	5	19

ANALYTICAL CALCULATIONS

Subject _____

Originator RA Hill Date 12-30-94

Checker _____ Date _____

Computer Printout

N-S Direction

Old Type Cubical Results

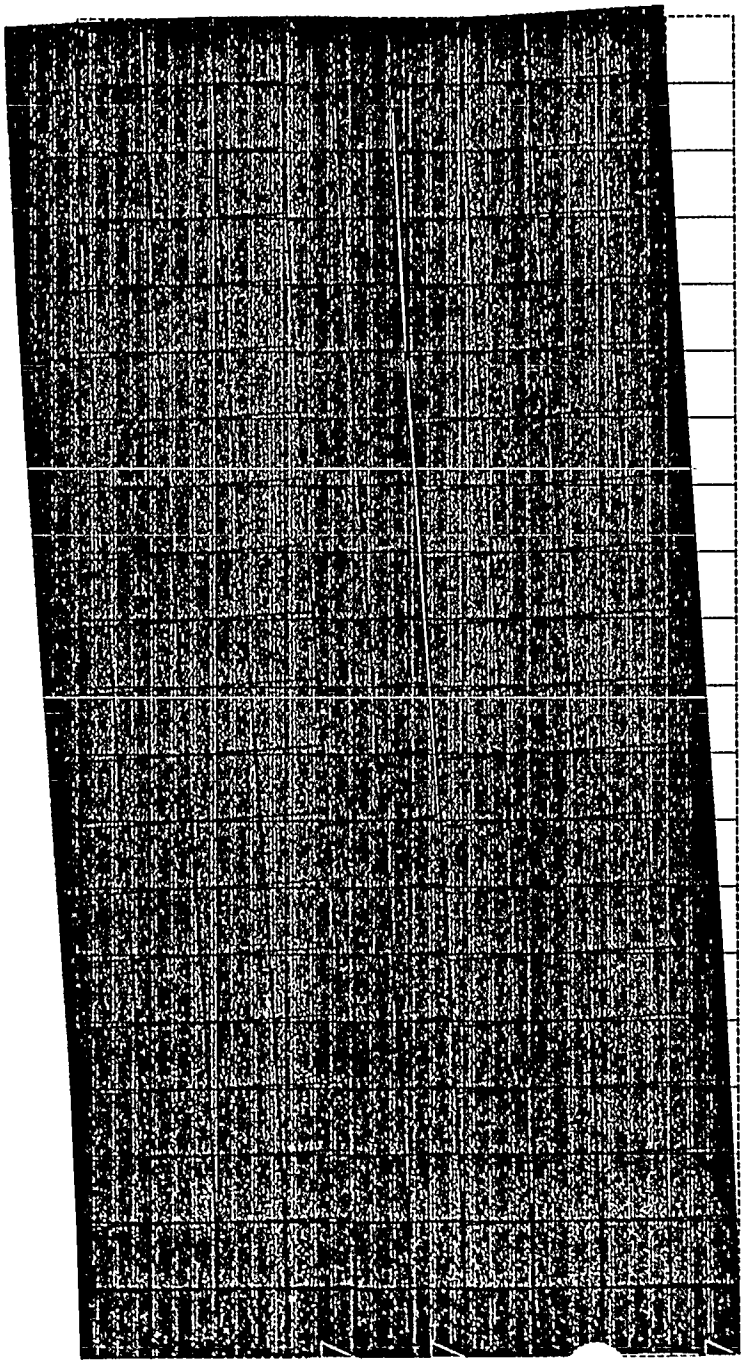
New Type Cubical Results, All Anchors Active

Change density to .000616 to account for higher total weight of the new cubicals.

$$\frac{79748\ \#}{8"(48")(97")(9\text{panels})\ 386.4} = .000616$$

New Type Cubical Results, Shown Anchors Active

Change constraints at nodes 2, 5, & 13 to reflect missing anchors condition.



ANSYS 5.0 A
DEC 29 1994
09:38:02
PLOT NO. 1
DISPLACEMENT
STEP=1
SUB =1
TIME=1
RSYS=0
DMX =0.019585
SEPC=27.695

DSCA=272.404
ZV =1
DIST=53.767
XF =21.347
YF =48.879
CENTROID HIDDEN

Displacements for a 1.0g Lateral Acceleration

PRINT U NODAL SOLUTION PER NODE

***** POST1 NODAL DEGREE OF FREEDOM LISTING *****

THE FOLLOWING DEGREE OF FREEDOM RESULTS ARE IN GLOBAL COORDINATES

NODE	UX
1	0.00000E+00
2	-0.68073E-05
3	0.29220E-04
4	-0.34212E-05
5	0.00000E+00
6	0.00000E+00
7	0.13398E-04
8	0.00000E+00
9	0.00000E+00
10	0.63684E-04
.	
.	
.	
261	-0.16662E-01
262	-0.16652E-01
263	-0.16592E-01
264	-0.16422E-01
265	-0.16141E-01
266	-0.16141E-01
267	-0.16086E-01
268	-0.15999E-01
269	-0.15999E-01
270	-0.16127E-01
271	-0.16226E-01
272	-0.16263E-01
273	-0.16270E-01

MAXIMUM VALUES
NODE 261
VALUE -0.16662E-01

Results for a 0.24g Lateral Acceleration

PRINT REACTION SOLUTIONS PER NODE

***** POST1 TOTAL REACTION SOLUTION LISTING *****

THE FOLLOWING X,Y,Z SOLUTIONS ARE IN GLOBAL COORDINATES

NODE	FX	FY	FZ
1	355.69	1310.5	
2		1071.4	
5	566.44	-1626.4	
6	69.383	413.54	
8	71.532	-418.91	
9	113.58	838.57	
10		323.19	
13	643.05	-1911.8	

TOTAL VALUES
VALUE 1819.7 -0.27262E-09 0.00000E+00

PRINT S NODAL SOLUTION PER NODE

***** POST1 NODAL STRESS LISTING *****

NODE	S1	S2	S3	SINT	SEQV
1	0.00000E+00	-15.206	-75.014	75.014	68.685
2	0.00000E+00	-5.7783	-27.159	27.159	24.780
3	3.9003	0.00000E+00	-2.1060	6.0063	5.2784
4	6.4879	0.00000E+00	-12.823	19.311	17.021
5	104.93	11.148	0.00000E+00	104.93	99.819
6	0.00000E+00	-2.7468	-34.975	34.975	33.686
7	2.0818	0.00000E+00	-2.0852	4.1670	3.6087
8	35.376	2.7887	0.00000E+00	35.376	34.068
9	0.87241	0.00000E+00	-53.230	54.102	53.671
10	2.4575	0.00000E+00	-5.5157	7.9731	7.0722

.
.
.

MINIMUM VALUES					
NODE	1	1	1	176	176
VALUE	0.00000E+00	-15.206	-75.014	0.50114	0.43826

MAXIMUM VALUES					
NODE	13	266	5	13	13
VALUE	122.43	18.489	0.00000E+00	122.43	117.69

***** ESTIMATED BOUNDS CONSIDERING THE EFFECT OF DISCRETIZATION ERROR *****

MINIMUM VALUES					
NODE	12	26	1	3	3
VALUE	-19.917	-25.718	-84.077	0.00000E+00	0.00000E+00

MAXIMUM VALUES					
NODE	13	13	13	13	13
VALUE	151.14	38.829	28.714	151.14	146.41

PRINT F ELEMENT SOLUTION PER ELEMENT

***** POST1 ELEMENT NODE TOTAL FORCE LISTING *****

THE FOLLOWING X,Y,Z FORCES ARE IN GLOBAL COORDINATES

.
.
.

ELEM= 191	FX	FY	FZ
248	42.285	49.351	0.00000E+00
249	3.8543	-1.4203	0.00000E+00
262	-55.616	-47.931	0.00000E+00
261	0.26872E-11	-0.54570E-11	0.00000E+00

ELEM= 192	FX	FY	FZ
249	154.79	88.992	0.00000E+00
250	-18.372	-75.234	0.00000E+00
263	-201.51	-61.689	0.00000E+00
262	55.616	47.931	0.00000E+00

ELEM= 193	FX	FY	FZ
250	262.56	165.73	0.00000E+00
251	-32.846	-14.819	0.00000E+00
264	-440.71	-212.60	0.00000E+00
263	201.51	61.689	0.00000E+00

ELEM= 194	FX	FY	FZ
251	55.129	-332.30	0.00000E+00
252	-183.27	-635.73	0.00000E+00
265	-322.04	755.43	0.00000E+00
264	440.71	212.60	0.00000E+00

ELEM= 195	FX	FY	FZ
253	-0.51892	535.19	0.00000E+00
254	-184.91	453.32	0.00000E+00
267	-144.19	-233.08	0.00000E+00
266	322.04	-755.43	0.00000E+00

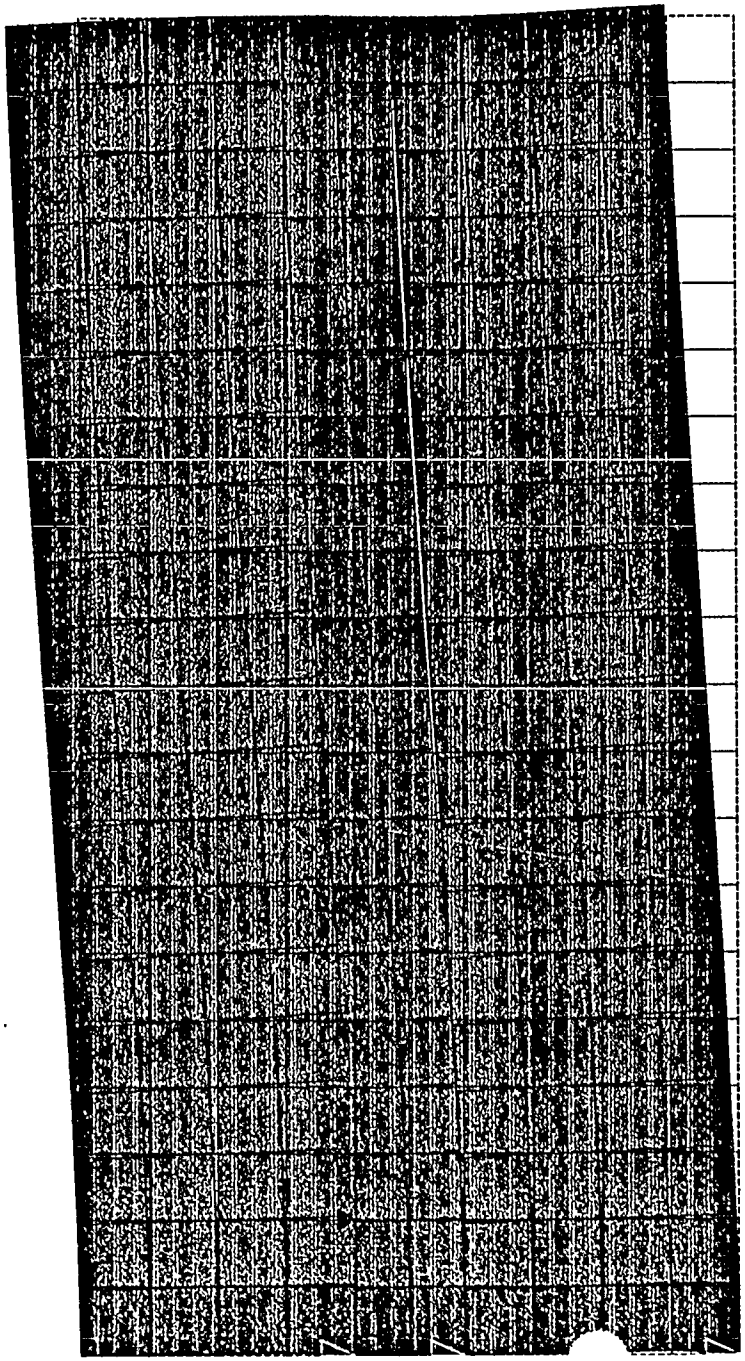
ELEM= 196	FX	FY	FZ
254	-58.378	-414.40	0.00000E+00
255	-94.958	-568.75	0.00000E+00
268	1.5640	750.08	0.00000E+00
267	144.19	233.08	0.00000E+00

ELEM= 197	FX	FY	FZ
256	-134.67	515.67	0.00000E+00
257	-111.72	375.75	0.00000E+00
270	238.48	-141.35	0.00000E+00
269	-1.5640	-750.08	0.00000E+00

ELEM= 198	FX	FY	FZ
257	-2.8596	-25.126	0.00000E+00
258	117.94	-92.556	0.00000E+00
271	113.92	-23.666	0.00000E+00
270	-238.48	141.35	0.00000E+00

ELEM= 199	FX	FY	FZ
258	-10.358	48.554	0.00000E+00
259	80.073	-43.670	0.00000E+00
272	34.730	-28.549	0.00000E+00
271	-113.92	23.666	0.00000E+00

ELEM= 200	FX	FY	FZ
259	1.6572	0.54260	0.00000E+00
260	23.596	-29.092	0.00000E+00
273	0.31228E-11	0.00000E+00	0.00000E+00
272	-34.730	28.549	0.00000E+00



ANSYS 5.0 A
DEC 29 1994
09:38:02
PLOT NO. 1
DISPLACEMENT
STEP=1
SUB =1
TIME=1
RSYS=0
DMX =0.019585
SEPC=27.695

DSCA=272.404
ZV =1
DIST=53.767
XF =21.347
YF =48.879
CENTROID HIDDEN

Results for N-S, New Type Cubical
Anchors not shown are assumed to be Active
Similar to Old Type Cubical

LIST CONSTRAINTS FOR SELECTED NODES 1 TO 273 BY 1
CURRENTLY SELECTED DOF SET= UX UY UZ

NODE	LABEL	REAL	IMAG
1	UX	0.000000000E+00	0.000000000E+00
1	UY	0.000000000E+00	0.000000000E+00
2	UY	0.000000000E+00	0.000000000E+00
5	UX	0.000000000E+00	0.000000000E+00
5	UY	0.000000000E+00	0.000000000E+00
6	UX	0.000000000E+00	0.000000000E+00
6	UY	0.000000000E+00	0.000000000E+00
8	UX	0.000000000E+00	0.000000000E+00
8	UY	0.000000000E+00	0.000000000E+00
9	UX	0.000000000E+00	0.000000000E+00
9	UY	0.000000000E+00	0.000000000E+00
10	UY	0.000000000E+00	0.000000000E+00
13	UX	0.000000000E+00	0.000000000E+00
13	UY	0.000000000E+00	0.000000000E+00

Displacements for a 1.0g Lateral Acceleration

PRINT U NODAL SOLUTION PER NODE

***** POST1 NODAL DEGREE OF FREEDOM LISTING *****

THE FOLLOWING DEGREE OF FREEDOM RESULTS ARE IN GLOBAL COORDINATES

NODE	UX
1	0.00000E+00
2	-0.79584E-05
3	0.34153E-04
4	-0.40002E-05
5	0.00000E+00
6	0.00000E+00
7	0.15662E-04
8	0.00000E+00
9	0.00000E+00
10	0.74439E-04
.	
.	
.	
261	-0.19476E-01
262	-0.19464E-01
263	-0.19393E-01
264	-0.19196E-01
265	-0.18867E-01
266	-0.18867E-01
267	-0.18802E-01
268	-0.18701E-01
269	-0.18701E-01
270	-0.18851E-01
271	-0.18966E-01
272	-0.19009E-01
273	-0.19018E-01

MAXIMUM VALUES
NODE 261
VALUE -0.19476E-01

Results for a 0.25g Lateral Acceleration

PRINT REACTION SOLUTIONS PER NODE

***** POST1 TOTAL REACTION SOLUTION LISTING *****

THE FOLLOWING X,Y,Z SOLUTIONS ARE IN GLOBAL COORDINATES

NODE	FX	FY	FZ
1	434.59	1601.3	
2		1309.0	
5	692.10	-1987.3	
6	84.774	505.27	
8	87.400	-511.84	
9	138.77	1024.6	
10		394.89	
13	785.71	-2336.0	

TOTAL VALUES
VALUE 2223.3 -0.38290E-09 0.00000E+00

PRINT S NODAL SOLUTION PER NODE

***** POST1 NODAL STRESS LISTING *****

NODE	S1	S2	S3	SINT	SEQV
1	0.00000E+00	-18.580	-91.655	91.655	83.922
2	0.00000E+00	-7.0601	-33.184	33.184	30.278
3	4.7656	0.00000E+00	-2.5731	7.3387	6.4494
4	7.9272	0.00000E+00	-15.668	23.595	20.797
5	128.20	13.621	0.00000E+00	128.20	121.96
6	0.00000E+00	-3.3561	-42.734	42.734	41.158
7	2.5436	0.00000E+00	-2.5477	5.0914	4.4092
8	43.224	3.4073	0.00000E+00	43.224	41.625
9	1.0659	0.00000E+00	-65.038	66.104	65.578
10	3.0026	0.00000E+00	-6.7392	9.7418	8.6411

.
.
.

MINIMUM VALUES

NODE	1	1	1	176	176
VALUE	0.00000E+00	-18.580	-91.655	0.61233	0.53550

MAXIMUM VALUES

NODE	13	266	5	13	13
VALUE	149.58	22.590	0.00000E+00	149.58	143.80

***** ESTIMATED BOUNDS CONSIDERING THE EFFECT OF DISCRETIZATION ERROR *****

MINIMUM VALUES

NODE	12	26	1	3	3
VALUE	-24.336	-31.423	-102.73	0.00000E+00	0.00000E+00

MAXIMUM VALUES

NODE	13	13	13	13	13
VALUE	184.67	47.443	35.084	184.67	178.89

PRINT F ELEMENT SOLUTION PER ELEMENT

***** POST1 ELEMENT NODE TOTAL FORCE LISTING *****

THE FOLLOWING X,Y,Z FORCES ARE IN GLOBAL COORDINATES

ELEM= 191 FX FY FZ
248 51.665 60.299 0.00000E+00
249 4.7093 -1.7354 0.00000E+00
262 -67.954 -58.564 0.00000E+00
261 -0.23954E-11 0.90949E-12 0.00000E+00

ELEM= 192 FX FY FZ
249 189.13 108.73 0.00000E+00
250 -22.447 -91.924 0.00000E+00
263 -246.22 -75.374 0.00000E+00
262 67.954 58.564 0.00000E+00

ELEM= 193 FX FY FZ
250 320.81 202.50 0.00000E+00
251 -40.132 -18.106 0.00000E+00
264 -538.47 -259.77 0.00000E+00
263 246.22 75.374 0.00000E+00

ELEM= 194 FX FY FZ
251 67.359 -406.02 0.00000E+00
252 -223.93 -776.76 0.00000E+00
265 -393.48 923.01 0.00000E+00
264 538.47 259.77 0.00000E+00

ELEM= 195 FX FY FZ
253 -0.63383 653.91 0.00000E+00
254 -225.94 553.88 0.00000E+00
267 -176.18 -284.79 0.00000E+00
266 393.48 -923.01 0.00000E+00

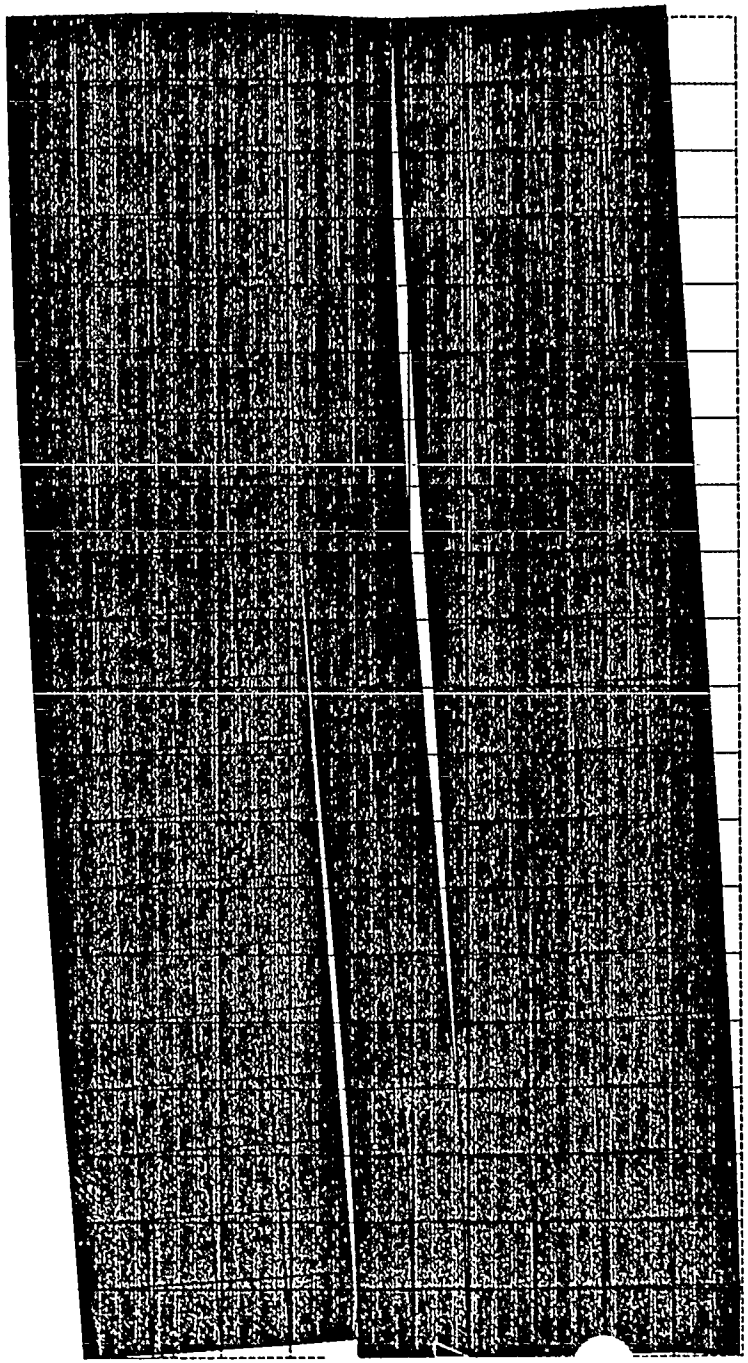
ELEM= 196 FX FY FZ
254 -71.329 -506.33 0.00000E+00
255 -116.02 -694.93 0.00000E+00
268 1.9114 916.47 0.00000E+00
267 176.18 284.79 0.00000E+00

ELEM= 197 FX FY FZ
256 -164.55 630.07 0.00000E+00
257 -136.50 459.11 0.00000E+00
270 291.38 -172.71 0.00000E+00
269 -1.9114 -916.47 0.00000E+00

ELEM= 198 FX FY FZ
257 -3.4940 -30.700 0.00000E+00
258 144.10 -113.09 0.00000E+00
271 139.20 -28.916 0.00000E+00
270 -291.38 172.71 0.00000E+00

ELEM= 199 FX FY FZ
258 -12.656 59.325 0.00000E+00
259 97.837 -53.358 0.00000E+00
272 42.435 -34.883 0.00000E+00
271 -139.20 28.916 0.00000E+00

ELEM= 200 FX FY FZ
259 2.0249 0.66296 0.00000E+00
260 28.830 -35.546 0.00000E+00
273 -0.55334E-12 -0.22737E-12 0.00000E+00
272 -42.435 34.883 0.00000E+00



ANSYS 5.0 A
DEC 29 1994
09:49:39
PLOT NO. 2
DISPLACEMENT
STEP=1
SUB =1
TIME=1
RSYS=0
DMX =0.028187
SEPC=27.079

DSCA=189.269
ZV =1
DIST=53.785
XF =21.255
YF =48.896
CENTROID HIDDEN

Results for N-S, New Type Cubical
Anchors not-shown are assumed to be Non-Active

LIST CONSTRAINTS FOR SELECTED NODES 1 TO 273 BY 1
CURRENTLY SELECTED DOF SET= UX UY UZ

NODE	LABEL	REAL	IMAG
1	UX	0.000000000E+00	0.000000000E+00
1	UY	0.000000000E+00	0.000000000E+00
6	UX	0.000000000E+00	0.000000000E+00
6	UY	0.000000000E+00	0.000000000E+00
8	UX	0.000000000E+00	0.000000000E+00
8	UY	0.000000000E+00	0.000000000E+00
9	UX	0.000000000E+00	0.000000000E+00
9	UY	0.000000000E+00	0.000000000E+00
10	UY	0.000000000E+00	0.000000000E+00
13	UY	0.000000000E+00	0.000000000E+00

Displacements for a 1.0g Lateral Acceleration

PRINT U NODAL SOLUTION PER NODE

***** POST1 NODAL DEGREE OF FREEDOM LISTING *****

THE FOLLOWING DEGREE OF FREEDOM RESULTS ARE IN GLOBAL COORDINATES

NODE	UX
1	0.00000E+00
2	-0.14758E-03
3	-0.12584E-03
4	-0.10959E-03
5	-0.10580E-03
6	0.00000E+00
7	0.32693E-04
8	0.00000E+00
9	0.00000E+00
10	-0.22854E-03
.	
.	
.	
261	-0.28168E-01
262	-0.28147E-01
263	-0.28024E-01
264	-0.27678E-01
265	-0.27096E-01
266	-0.27096E-01
267	-0.26971E-01
268	-0.26782E-01
269	-0.26782E-01
270	-0.26933E-01
271	-0.27068E-01
272	-0.27121E-01
273	-0.27131E-01

MAXIMUM VALUES
NODE 261
VALUE -0.28168E-01

Results for a 0.27g Lateral Acceleration

PRINT REACTION SOLUTIONS PER NODE

***** POST1 TOTAL REACTION SOLUTION LISTING *****

THE FOLLOWING X,Y,Z SOLUTIONS ARE IN GLOBAL COORDINATES

NODE	FX	FY	FZ
1	966.06	1697.0	
6	82.373	818.06	
8	206.91	-1129.4	
9	1137.8	1769.8	
10		-73.651	
13		-3081.8	

TOTAL VALUES
VALUE 2393.1 -0.73169E-09 0.00000E+00

PRINT S NODAL SOLUTION PER NODE

***** POST1 NODAL STRESS LISTING *****

NODE	S1	S2	S3	SINT	SEQV
1	0.00000E+00	-29.726	-105.21	105.21	93.940
2	14.122	0.00000E+00	-21.059	35.181	30.664
3	3.4710	0.00000E+00	-3.7558	7.2269	6.2603
4	1.4921	0.40158	0.00000E+00	1.4921	1.3373
5	0.95047	0.69531E-01	0.00000E+00	0.95047	0.91768
6	0.00000E+00	-4.4145	-71.642	71.642	69.540
7	4.5366	0.00000E+00	-4.7303	9.2669	8.0259
8	94.833	6.9057	0.00000E+00	94.833	91.576
9	0.00000E+00	-43.366	-111.49	111.49	97.348
10	8.4050	0.00000E+00	-37.226	45.631	42.063

.
.
.

MINIMUM VALUES					
NODE	1	9	265	5	5
VALUE	0.00000E+00	-43.366	-126.78	0.95047	0.91768

MAXIMUM VALUES					
NODE	13	266	4	13	13
VALUE	209.26	43.769	0.00000E+00	259.43	238.34

***** ESTIMATED BOUNDS CONSIDERING THE EFFECT OF DISCRETIZATION ERROR *****

MINIMUM VALUES					
NODE	12	9	265	3	3
VALUE	-36.857	-68.739	-145.79	0.00000E+00	0.00000E+00

MAXIMUM VALUES					
NODE	~~13~~	266	26	13	~~13~~
VALUE	252.23	64.965	42.972	~~302.40~~	~~281.31~~

not used

PRINT F ELEMENT SOLUTION PER ELEMENT

***** POST1 ELEMENT NODE TOTAL FORCE LISTING *****

THE FOLLOWING X,Y,Z FORCES ARE IN GLOBAL COORDINATES

ELEM= 191 FX FY FZ
248 100.11 115.73 0.00000E+00
249 12.970 -2.7828 0.00000E+00
262 -125.55 -112.95 0.00000E+00
261 -0.79936E-14 0.90949E-12 0.00000E+00

ELEM= 192 FX FY FZ
249 364.95 210.98 0.00000E+00
250 -37.227 -176.61 0.00000E+00
263 -465.73 -147.33 0.00000E+00
262 125.55 112.95 0.00000E+00

ELEM= 193 FX FY FZ
250 619.95 385.60 0.00000E+00
251 -76.779 -41.934 0.00000E+00
264 -1021.4 -490.99 0.00000E+00
263 465.73 147.33 0.00000E+00

ELEM= 194 FX FY FZ
251 152.83 -738.60 0.00000E+00
252 -414.33 -1449.4 0.00000E+00
265 -772.34 1697.0 0.00000E+00
264 1021.4 490.99 0.00000E+00

ELEM= 195 FX FY FZ
253 13.356 1175.5 0.00000E+00
254 -448.44 1014.6 0.00000E+00
267 -347.22 -493.13 0.00000E+00
266 772.34 -1697.0 0.00000E+00

ELEM= 196 FX FY FZ
254 -20.853 -749.64 0.00000E+00
255 -195.68 -1129.2 0.00000E+00
268 -140.66 1385.7 0.00000E+00
267 347.22 493.13 0.00000E+00

ELEM= 197 FX FY FZ
256 -229.12 899.65 0.00000E+00
257 -278.21 716.44 0.00000E+00
270 354.21 -230.38 0.00000E+00
269 140.66 -1385.7 0.00000E+00

ELEM= 198 FX FY FZ
257 13.116 -60.088 0.00000E+00
258 156.21 -140.68 0.00000E+00
271 172.42 -29.614 0.00000E+00
270 -354.21 230.38 0.00000E+00

ELEM= 199 FX FY FZ
258 -10.446 79.365 0.00000E+00
259 116.56 -63.377 0.00000E+00
272 53.836 -45.602 0.00000E+00
271 -172.42 29.614 0.00000E+00

ELEM= 200 FX FY FZ
259 4.8992 0.57401 0.00000E+00
260 36.473 -46.176 0.00000E+00
273 0.86549E-11 0.25011E-11 0.00000E+00
272 -53.836 45.602 0.00000E+00

ANALYTICAL CALCULATIONS

Page _____ of _____

Subject _____

Originator RD Tillett Date 12-30-94

Checker _____ Date _____

Computer Printout

E-W Direction

Geometry

ANSYS 5.0 Computer program used.

Element SHELL63 used for shear walls.

Density set at .000896 to model the total mass applied to just the E-W panels.

$$\frac{68272^{\#}}{8"(254")(97")\ 386.4} = .000896$$

Lateral acceleration to the right, (positive X direction)

Coupled nodes used to tie panel tops together

X and Y constraints at bottom nodes 1, 4, 5, 8, 9, 12, 13, 16, 17, 20, 21, 24, 25, 28, 29, & 32.

Y only constraints at bottom nodes 2, 6, 10, 14, 18, 22, 26, 30.

Old Type Cubical Results

New Type Cubical Results

Change density to .001047 to account for a higher total load of the new cubicals.

$$\frac{79748}{8"(254")(97")\ 386.4} = .001047$$

Results for E-W Cubical, Old Type

```
LIST ELEMENT TYPES FROM    1 TO    1 BY    1

ELEMENT TYPE    1 IS SHELL63     ELASTIC SHELL              INOPR
 KEYOPT(1-12)=    1 0 0   0 0 0   0 0 0   0 0 0     0

LIST REAL SETS      1 TO     1 BY     1

REAL CONSTANT SET      1  ITEMS  1 TO  6
  8.0000     0.00000E+00 0.00000E+00 0.00000E+00 0.00000E+00 0.00000E+00

LIST MATERIALS   1 TO   1 BY  1
 PROPERTY= ALL

PROPERTY TABLE EX   MAT=   1  NUM. POINTS=  1
 TEMPERATURE    DATA  TEMPERATURE    DATA  TEMPERATURE    DATA
 0.00000E+00 0.30000E+07

PROPERTY TABLE DENS  MAT=   1  NUM. POINTS=  1
 TEMPERATURE    DATA  TEMPERATURE    DATA  TEMPERATURE    DATA
 0.00000E+00 0.89600E-03

LIST CONSTRAINTS FOR SELECTED NODES      1 TO    352 BY     1
CURRENTLY SELECTED DOF SET= UX  UY  UZ

   NODE  LABEL    REAL         IMAG
      1  UX   0.000000000E+00 0.000000000E+00
      1  UY   0.000000000E+00 0.000000000E+00
      2  UY   0.000000000E+00 0.000000000E+00
      4  UX   0.000000000E+00 0.000000000E+00
      4  UY   0.000000000E+00 0.000000000E+00
      5  UX   0.000000000E+00 0.000000000E+00
      5  UY   0.000000000E+00 0.000000000E+00
      6  UY   0.000000000E+00 0.000000000E+00
      8  UX   0.000000000E+00 0.000000000E+00
      8  UY   0.000000000E+00 0.000000000E+00
      9  UX   0.000000000E+00 0.000000000E+00
      9  UY   0.000000000E+00 0.000000000E+00
     10  UY   0.000000000E+00 0.000000000E+00
     12  UX   0.000000000E+00 0.000000000E+00
     12  UY   0.000000000E+00 0.000000000E+00
     13  UX   0.000000000E+00 0.000000000E+00
     13  UY   0.000000000E+00 0.000000000E+00
     14  UY   0.000000000E+00 0.000000000E+00
     16  UX   0.000000000E+00 0.000000000E+00
     16  UY   0.000000000E+00 0.000000000E+00
     17  UX   0.000000000E+00 0.000000000E+00
     17  UY   0.000000000E+00 0.000000000E+00
     18  UY   0.000000000E+00 0.000000000E+00
     20  UX   0.000000000E+00 0.000000000E+00
     20  UY   0.000000000E+00 0.000000000E+00
     21  UX   0.000000000E+00 0.000000000E+00
     21  UY   0.000000000E+00 0.000000000E+00
     22  UY   0.000000000E+00 0.000000000E+00
     24  UX   0.000000000E+00 0.000000000E+00
     24  UY   0.000000000E+00 0.000000000E+00
     25  UX   0.000000000E+00 0.000000000E+00
     25  UY   0.000000000E+00 0.000000000E+00
     26  UY   0.000000000E+00 0.000000000E+00
     28  UX   0.000000000E+00 0.000000000E+00
     28  UY   0.000000000E+00 0.000000000E+00
     29  UX   0.000000000E+00 0.000000000E+00
     29  UY   0.000000000E+00 0.000000000E+00
     30  UY   0.000000000E+00 0.000000000E+00
     32  UX   0.000000000E+00 0.000000000E+00
     32  UY   0.000000000E+00 0.000000000E+00
```

LIST ALL COUPLED SETS WITH ANY NODES SELECTED

COUPLED SET= 1 DIRECTION= UX TOTAL NODES= 2
NODES= 324 325

COUPLED SET= 2 DIRECTION= UX TOTAL NODES= 2
NODES= 328 329

COUPLED SET= 3 DIRECTION= UX TOTAL NODES= 2
NODES= 332 333

COUPLED SET= 4 DIRECTION= UX TOTAL NODES= 2
NODES= 336 337

COUPLED SET= 5 DIRECTION= UX TOTAL NODES= 2
NODES= 340 341

COUPLED SET= 6 DIRECTION= UX TOTAL NODES= 2
NODES= 344 345

COUPLED SET= 7 DIRECTION= UX TOTAL NODES= 2
NODES= 348 349

COUPLED SET= 8 DIRECTION= UY TOTAL NODES= 2
NODES= 324 325

COUPLED SET= 9 DIRECTION= UY TOTAL NODES= 2
NODES= 328 329

COUPLED SET= 10 DIRECTION= UY TOTAL NODES= 2
NODES= 332 333

COUPLED SET= 11 DIRECTION= UY TOTAL NODES= 2
NODES= 336 337

COUPLED SET= 12 DIRECTION= UY TOTAL NODES= 2
NODES= 340 341

COUPLED SET= 13 DIRECTION= UY TOTAL NODES= 2
NODES= 344 345

COUPLED SET= 14 DIRECTION= UY TOTAL NODES= 2
NODES= 348 349
MAXIMUM COUPLED SET NUMBER= 14

LIST ALL SELECTED NODES. DSYS= 0

NODE	X	Y	Z	THXY	THYZ	THZX
1	0.00000E+00	0.00000E+00	0.00000E+00	0.00	0.00	0.00
2	10.583	0.00000E+00	0.00000E+00	0.00	0.00	0.00
3	21.166	0.00000E+00	0.00000E+00	0.00	0.00	0.00
4	31.750	0.00000E+00	0.00000E+00	0.00	0.00	0.00
5	31.750	0.00000E+00	0.00000E+00	0.00	0.00	0.00
6	42.333	0.00000E+00	0.00000E+00	0.00	0.00	0.00
7	52.916	0.00000E+00	0.00000E+00	0.00	0.00	0.00
8	63.500	0.00000E+00	0.00000E+00	0.00	0.00	0.00
9	63.500	0.00000E+00	0.00000E+00	0.00	0.00	0.00
10	74.083	0.00000E+00	0.00000E+00	0.00	0.00	0.00
11	84.666	0.00000E+00	0.00000E+00	0.00	0.00	0.00
12	95.250	0.00000E+00	0.00000E+00	0.00	0.00	0.00
13	95.250	0.00000E+00	0.00000E+00	0.00	0.00	0.00
14	105.83	0.00000E+00	0.00000E+00	0.00	0.00	0.00
15	116.42	0.00000E+00	0.00000E+00	0.00	0.00	0.00
16	127.00	0.00000E+00	0.00000E+00	0.00	0.00	0.00
17	127.00	0.00000E+00	0.00000E+00	0.00	0.00	0.00
18	137.58	0.00000E+00	0.00000E+00	0.00	0.00	0.00
19	148.17	0.00000E+00	0.00000E+00	0.00	0.00	0.00
20	158.75	0.00000E+00	0.00000E+00	0.00	0.00	0.00

NODE	X	Y	Z	THXY	THYZ	THZX	
21	158.75	0.00000E+00	0.00000E+00	0.00	0.00	0.00	
22	169.33	0.00000E+00	0.00000E+00	0.00	0.00	0.00	
23	179.92	0.00000E+00	0.00000E+00	0.00	0.00	0.00	
24	190.50	0.00000E+00	0.00000E+00	0.00	0.00	0.00	
25	190.50	0.00000E+00	0.00000E+00	0.00	0.00	0.00	
26	201.08	0.00000E+00	0.00000E+00	0.00	0.00	0.00	
27	211.67	0.00000E+00	0.00000E+00	0.00	0.00	0.00	
28	222.25	0.00000E+00	0.00000E+00	0.00	0.00	0.00	
29	222.25	0.00000E+00	0.00000E+00	0.00	0.00	0.00	
30	232.83	0.00000E+00	0.00000E+00	0.00	0.00	0.00	
31	243.42	0.00000E+00	0.00000E+00	0.00	0.00	0.00	
32	254.00	0.00000E+00	0.00000E+00	0.00	0.00	0.00	
41	0.00000E+00	12.125	0.00000E+00	0.00	0.00	0.00	
42	10.583	12.125	0.00000E+00	0.00	0.00	0.00	
43	21.166	12.125	0.00000E+00	0.00	0.00	0.00	
44	31.750	12.125	0.00000E+00	0.00	0.00	0.00	
45	31.750	12.125	0.00000E+00	0.00	0.00	0.00	
46	42.333	12.125	0.00000E+00	0.00	0.00	0.00	
47	52.916	12.125	0.00000E+00	0.00	0.00	0.00	
48	63.500	12.125	0.00000E+00	0.00	0.00	0.00	
49	63.500	12.125	0.00000E+00	0.00	0.00	0.00	
50	74.083	12.125	0.00000E+00	0.00	0.00	0.00	
51	84.666	12.125	0.00000E+00	0.00	0.00	0.00	
52	95.250	12.125	0.00000E+00	0.00	0.00	0.00	
53	95.250	12.125	0.00000E+00	0.00	0.00	0.00	
54	105.83	12.125	0.00000E+00	0.00	0.00	0.00	
55	116.42	12.125	0.00000E+00	0.00	0.00	0.00	
56	127.00	12.125	0.00000E+00	0.00	0.00	0.00	
57	127.00	12.125	0.00000E+00	0.00	0.00	0.00	
58	137.58	12.125	0.00000E+00	0.00	0.00	0.00	
59	148.17	12.125	0.00000E+00	0.00	0.00	0.00	
60	158.75	12.125	0.00000E+00	0.00	0.00	0.00	
61	158.75	12.125	0.00000E+00	0.00	0.00	0.00	
62	169.33	12.125	0.00000E+00	0.00	0.00	0.00	
63	179.92	12.125	0.00000E+00	0.00	0.00	0.00	
64	190.50	12.125	0.00000E+00	0.00	0.00	0.00	
65	190.50	12.125	0.00000E+00	0.00	0.00	0.00	
66	201.08	12.125	0.00000E+00	0.00	0.00	0.00	
67	211.67	12.125	0.00000E+00	0.00	0.00	0.00	
68	222.25	12.125	0.00000E+00	0.00	0.00	0.00	
69	222.25	12.125	0.00000E+00	0.00	0.00	0.00	
70	232.83	12.125	0.00000E+00	0.00	0.00	0.00	
71	243.42	12.125	0.00000E+00	0.00	0.00	0.00	
72	254.00	12.125	0.00000E+00	0.00	0.00	0.00	
81	0.00000E+00	24.250	0.00000E+00	0.00	0.00	0.00	
82	10.583	24.250	0.00000E+00	0.00	0.00	0.00	
83	21.166	24.250	0.00000E+00	0.00	0.00	0.00	
84	31.750	24.250	0.00000E+00	0.00	0.00	0.00	
85	31.750	24.250	0.00000E+00	0.00	0.00	0.00	
86	42.333	24.250	0.00000E+00	0.00	0.00	0.00	
87	52.916	24.250	0.00000E+00	0.00	0.00	0.00	
88	63.500	24.250	0.00000E+00	0.00	0.00	0.00	
89	63.500	24.250	0.00000E+00	0.00	0.00	0.00	
90	74.083	24.250	0.00000E+00	0.00	0.00	0.00	
91	84.666	24.250	0.00000E+00	0.00	0.00	0.00	
92	95.250	24.250	0.00000E+00	0.00	0.00	0.00	
93	95.250	24.250	0.00000E+00	0.00	0.00	0.00	
94	105.83	24.250	0.00000E+00	0.00	0.00	0.00	
95	116.42	24.250	0.00000E+00	0.00	0.00	0.00	
96	127.00	24.250	0.00000E+00	0.00	0.00	0.00	

NODE	X	Y	Z	THXY	THYZ	THZX
97	127.00	24.250	0.00000E+00	0.00	0.00	0.00
98	137.58	24.250	0.00000E+00	0.00	0.00	0.00
99	148.17	24.250	0.00000E+00	0.00	0.00	0.00
100	158.75	24.250	0.00000E+00	0.00	0.00	0.00
101	158.75	24.250	0.00000E+00	0.00	0.00	0.00
102	169.33	24.250	0.00000E+00	0.00	0.00	0.00
103	179.92	24.250	0.00000E+00	0.00	0.00	0.00
104	190.50	24.250	0.00000E+00	0.00	0.00	0.00
105	190.50	24.250	0.00000E+00	0.00	0.00	0.00
106	201.08	24.250	0.00000E+00	0.00	0.00	0.00
107	211.67	24.250	0.00000E+00	0.00	0.00	0.00
108	222.25	24.250	0.00000E+00	0.00	0.00	0.00
109	222.25	24.250	0.00000E+00	0.00	0.00	0.00
110	232.83	24.250	0.00000E+00	0.00	0.00	0.00
111	243.42	24.250	0.00000E+00	0.00	0.00	0.00
112	254.00	24.250	0.00000E+00	0.00	0.00	0.00
121	0.00000E+00	36.375	0.00000E+00	0.00	0.00	0.00
122	10.583	36.375	0.00000E+00	0.00	0.00	0.00
123	21.166	36.375	0.00000E+00	0.00	0.00	0.00
124	31.750	36.375	0.00000E+00	0.00	0.00	0.00
125	31.750	36.375	0.00000E+00	0.00	0.00	0.00
126	42.333	36.375	0.00000E+00	0.00	0.00	0.00
127	52.916	36.375	0.00000E+00	0.00	0.00	0.00
128	63.500	36.375	0.00000E+00	0.00	0.00	0.00
129	63.500	36.375	0.00000E+00	0.00	0.00	0.00
130	74.083	36.375	0.00000E+00	0.00	0.00	0.00
131	84.666	36.375	0.00000E+00	0.00	0.00	0.00
132	95.250	36.375	0.00000E+00	0.00	0.00	0.00
133	95.250	36.375	0.00000E+00	0.00	0.00	0.00
134	105.83	36.375	0.00000E+00	0.00	0.00	0.00
135	116.42	36.375	0.00000E+00	0.00	0.00	0.00
136	127.00	36.375	0.00000E+00	0.00	0.00	0.00
137	127.00	36.375	0.00000E+00	0.00	0.00	0.00
138	137.58	36.375	0.00000E+00	0.00	0.00	0.00
139	148.17	36.375	0.00000E+00	0.00	0.00	0.00
140	158.75	36.375	0.00000E+00	0.00	0.00	0.00
141	158.75	36.375	0.00000E+00	0.00	0.00	0.00
142	169.33	36.375	0.00000E+00	0.00	0.00	0.00
143	179.92	36.375	0.00000E+00	0.00	0.00	0.00
144	190.50	36.375	0.00000E+00	0.00	0.00	0.00
145	190.50	36.375	0.00000E+00	0.00	0.00	0.00
146	201.08	36.375	0.00000E+00	0.00	0.00	0.00
147	211.67	36.375	0.00000E+00	0.00	0.00	0.00
148	222.25	36.375	0.00000E+00	0.00	0.00	0.00
149	222.25	36.375	0.00000E+00	0.00	0.00	0.00
150	232.83	36.375	0.00000E+00	0.00	0.00	0.00
151	243.42	36.375	0.00000E+00	0.00	0.00	0.00
152	254.00	36.375	0.00000E+00	0.00	0.00	0.00
161	0.00000E+00	48.500	0.00000E+00	0.00	0.00	0.00
162	10.583	48.500	0.00000E+00	0.00	0.00	0.00
163	21.166	48.500	0.00000E+00	0.00	0.00	0.00
164	31.750	48.500	0.00000E+00	0.00	0.00	0.00
165	31.750	48.500	0.00000E+00	0.00	0.00	0.00
166	42.333	48.500	0.00000E+00	0.00	0.00	0.00
167	52.916	48.500	0.00000E+00	0.00	0.00	0.00
168	63.500	48.500	0.00000E+00	0.00	0.00	0.00
169	63.500	48.500	0.00000E+00	0.00	0.00	0.00
170	74.083	48.500	0.00000E+00	0.00	0.00	0.00
171	84.666	48.500	0.00000E+00	0.00	0.00	0.00
172	95.250	48.500	0.00000E+00	0.00	0.00	0.00

NODE	X	Y	Z	THXY	THYZ	THZX	
173	95.250	48.500	0.00000E+00	0.00	0.00	0.00	
174	105.83	48.500	0.00000E+00	0.00	0.00	0.00	
175	116.42	48.500	0.00000E+00	0.00	0.00	0.00	
176	127.00	48.500	0.00000E+00	0.00	0.00	0.00	
177	127.00	48.500	0.00000E+00	0.00	0.00	0.00	
178	137.58	48.500	0.00000E+00	0.00	0.00	0.00	
179	148.17	48.500	0.00000E+00	0.00	0.00	0.00	
180	158.75	48.500	0.00000E+00	0.00	0.00	0.00	
181	158.75	48.500	0.00000E+00	0.00	0.00	0.00	
182	169.33	48.500	0.00000E+00	0.00	0.00	0.00	
183	179.92	48.500	0.00000E+00	0.00	0.00	0.00	
184	190.50	48.500	0.00000E+00	0.00	0.00	0.00	
185	190.50	48.500	0.00000E+00	0.00	0.00	0.00	
186	201.08	48.500	0.00000E+00	0.00	0.00	0.00	
187	211.67	48.500	0.00000E+00	0.00	0.00	0.00	
188	222.25	48.500	0.00000E+00	0.00	0.00	0.00	
189	222.25	48.500	0.00000E+00	0.00	0.00	0.00	
190	232.83	48.500	0.00000E+00	0.00	0.00	0.00	
191	243.42	48.500	0.00000E+00	0.00	0.00	0.00	
192	254.00	48.500	0.00000E+00	0.00	0.00	0.00	
201	0.00000E+00	60.625	0.00000E+00	0.00	0.00	0.00	
202	10.583	60.625	0.00000E+00	0.00	0.00	0.00	
203	21.166	60.625	0.00000E+00	0.00	0.00	0.00	
204	31.750	60.625	0.00000E+00	0.00	0.00	0.00	
205	31.750	60.625	0.00000E+00	0.00	0.00	0.00	
206	42.333	60.625	0.00000E+00	0.00	0.00	0.00	
207	52.916	60.625	0.00000E+00	0.00	0.00	0.00	
208	63.500	60.625	0.00000E+00	0.00	0.00	0.00	
209	63.500	60.625	0.00000E+00	0.00	0.00	0.00	
210	74.083	60.625	0.00000E+00	0.00	0.00	0.00	
211	84.666	60.625	0.00000E+00	0.00	0.00	0.00	
212	95.250	60.625	0.00000E+00	0.00	0.00	0.00	
213	95.250	60.625	0.00000E+00	0.00	0.00	0.00	
214	105.83	60.625	0.00000E+00	0.00	0.00	0.00	
215	116.42	60.625	0.00000E+00	0.00	0.00	0.00	
216	127.00	60.625	0.00000E+00	0.00	0.00	0.00	
217	127.00	60.625	0.00000E+00	0.00	0.00	0.00	
218	137.58	60.625	0.00000E+00	0.00	0.00	0.00	
219	148.17	60.625	0.00000E+00	0.00	0.00	0.00	
220	158.75	60.625	0.00000E+00	0.00	0.00	0.00	
221	158.75	60.625	0.00000E+00	0.00	0.00	0.00	
222	169.33	60.625	0.00000E+00	0.00	0.00	0.00	
223	179.92	60.625	0.00000E+00	0.00	0.00	0.00	
224	190.50	60.625	0.00000E+00	0.00	0.00	0.00	
225	190.50	60.625	0.00000E+00	0.00	0.00	0.00	
226	201.08	60.625	0.00000E+00	0.00	0.00	0.00	
227	211.67	60.625	0.00000E+00	0.00	0.00	0.00	
228	222.25	60.625	0.00000E+00	0.00	0.00	0.00	
229	222.25	60.625	0.00000E+00	0.00	0.00	0.00	
230	232.83	60.625	0.00000E+00	0.00	0.00	0.00	
231	243.42	60.625	0.00000E+00	0.00	0.00	0.00	
232	254.00	60.625	0.00000E+00	0.00	0.00	0.00	
241	0.00000E+00	72.750	0.00000E+00	0.00	0.00	0.00	
242	10.583	72.750	0.00000E+00	0.00	0.00	0.00	
243	21.166	72.750	0.00000E+00	0.00	0.00	0.00	
244	31.750	72.750	0.00000E+00	0.00	0.00	0.00	
245	31.750	72.750	0.00000E+00	0.00	0.00	0.00	
246	42.333	72.750	0.00000E+00	0.00	0.00	0.00	
247	52.916	72.750	0.00000E+00	0.00	0.00	0.00	
248	63.500	72.750	0.00000E+00	0.00	0.00	0.00	

NODE	X	Y	Z	THXY	THYZ	THZX	
249	63.500	72.750	0.00000E+00	0.00	0.00	0.00	
250	74.083	72.750	0.00000E+00	0.00	0.00	0.00	
251	84.666	72.750	0.00000E+00	0.00	0.00	0.00	
252	95.250	72.750	0.00000E+00	0.00	0.00	0.00	
253	95.250	72.750	0.00000E+00	0.00	0.00	0.00	
254	105.83	72.750	0.00000E+00	0.00	0.00	0.00	
255	116.42	72.750	0.00000E+00	0.00	0.00	0.00	
256	127.00	72.750	0.00000E+00	0.00	0.00	0.00	
257	127.00	72.750	0.00000E+00	0.00	0.00	0.00	
258	137.58	72.750	0.00000E+00	0.00	0.00	0.00	
259	148.17	72.750	0.00000E+00	0.00	0.00	0.00	
260	158.75	72.750	0.00000E+00	0.00	0.00	0.00	
261	158.75	72.750	0.00000E+00	0.00	0.00	0.00	
262	169.33	72.750	0.00000E+00	0.00	0.00	0.00	
263	179.92	72.750	0.00000E+00	0.00	0.00	0.00	
264	190.50	72.750	0.00000E+00	0.00	0.00	0.00	
265	190.50	72.750	0.00000E+00	0.00	0.00	0.00	
266	201.08	72.750	0.00000E+00	0.00	0.00	0.00	
267	211.67	72.750	0.00000E+00	0.00	0.00	0.00	
268	222.25	72.750	0.00000E+00	0.00	0.00	0.00	
269	222.25	72.750	0.00000E+00	0.00	0.00	0.00	
270	232.83	72.750	0.00000E+00	0.00	0.00	0.00	
271	243.42	72.750	0.00000E+00	0.00	0.00	0.00	
272	254.00	72.750	0.00000E+00	0.00	0.00	0.00	
281	0.00000E+00	84.875	0.00000E+00	0.00	0.00	0.00	
282	10.583	84.875	0.00000E+00	0.00	0.00	0.00	
283	21.166	84.875	0.00000E+00	0.00	0.00	0.00	
284	31.750	84.875	0.00000E+00	0.00	0.00	0.00	
285	31.750	84.875	0.00000E+00	0.00	0.00	0.00	
286	42.333	84.875	0.00000E+00	0.00	0.00	0.00	
287	52.916	84.875	0.00000E+00	0.00	0.00	0.00	
288	63.500	84.875	0.00000E+00	0.00	0.00	0.00	
289	63.500	84.875	0.00000E+00	0.00	0.00	0.00	
290	74.083	84.875	0.00000E+00	0.00	0.00	0.00	
291	84.666	84.875	0.00000E+00	0.00	0.00	0.00	
292	95.250	84.875	0.00000E+00	0.00	0.00	0.00	
293	95.250	84.875	0.00000E+00	0.00	0.00	0.00	
294	105.83	84.875	0.00000E+00	0.00	0.00	0.00	
295	116.42	84.875	0.00000E+00	0.00	0.00	0.00	
296	127.00	84.875	0.00000E+00	0.00	0.00	0.00	
297	127.00	84.875	0.00000E+00	0.00	0.00	0.00	
298	137.58	84.875	0.00000E+00	0.00	0.00	0.00	
299	148.17	84.875	0.00000E+00	0.00	0.00	0.00	
300	158.75	84.875	0.00000E+00	0.00	0.00	0.00	
301	158.75	84.875	0.00000E+00	0.00	0.00	0.00	
302	169.33	84.875	0.00000E+00	0.00	0.00	0.00	
303	179.92	84.875	0.00000E+00	0.00	0.00	0.00	
304	190.50	84.875	0.00000E+00	0.00	0.00	0.00	
305	190.50	84.875	0.00000E+00	0.00	0.00	0.00	
306	201.08	84.875	0.00000E+00	0.00	0.00	0.00	
307	211.67	84.875	0.00000E+00	0.00	0.00	0.00	
308	222.25	84.875	0.00000E+00	0.00	0.00	0.00	
309	222.25	84.875	0.00000E+00	0.00	0.00	0.00	
310	232.83	84.875	0.00000E+00	0.00	0.00	0.00	
311	243.42	84.875	0.00000E+00	0.00	0.00	0.00	
312	254.00	84.875	0.00000E+00	0.00	0.00	0.00	
321	0.00000E+00	97.000	0.00000E+00	0.00	0.00	0.00	
322	10.583	97.000	0.00000E+00	0.00	0.00	0.00	
323	21.166	97.000	0.00000E+00	0.00	0.00	0.00	
324	31.750	97.000	0.00000E+00	0.00	0.00	0.00	

NODE	X	Y	Z	THXY	THYZ	THZX	
325	31.750	97.000	0.00000E+00		0.00	0.00	0.00
326	42.333	97.000	0.00000E+00		0.00	0.00	0.00
327	52.916	97.000	0.00000E+00		0.00	0.00	0.00
328	63.500	97.000	0.00000E+00		0.00	0.00	0.00
329	63.500	97.000	0.00000E+00		0.00	0.00	0.00
330	74.083	97.000	0.00000E+00		0.00	0.00	0.00
331	84.666	97.000	0.00000E+00		0.00	0.00	0.00
332	95.250	97.000	0.00000E+00		0.00	0.00	0.00
333	95.250	97.000	0.00000E+00		0.00	0.00	0.00
334	105.83	97.000	0.00000E+00		0.00	0.00	0.00
335	116.42	97.000	0.00000E+00		0.00	0.00	0.00
336	127.00	97.000	0.00000E+00		0.00	0.00	0.00
337	127.00	97.000	0.00000E+00		0.00	0.00	0.00
338	137.58	97.000	0.00000E+00		0.00	0.00	0.00
339	148.17	97.000	0.00000E+00		0.00	0.00	0.00
340	158.75	97.000	0.00000E+00		0.00	0.00	0.00
341	158.75	97.000	0.00000E+00		0.00	0.00	0.00
342	169.33	97.000	0.00000E+00		0.00	0.00	0.00
343	179.92	97.000	0.00000E+00		0.00	0.00	0.00
344	190.50	97.000	0.00000E+00		0.00	0.00	0.00
345	190.50	97.000	0.00000E+00		0.00	0.00	0.00
346	201.08	97.000	0.00000E+00		0.00	0.00	0.00
347	211.67	97.000	0.00000E+00		0.00	0.00	0.00
348	222.25	97.000	0.00000E+00		0.00	0.00	0.00
349	222.25	97.000	0.00000E+00		0.00	0.00	0.00
350	232.83	97.000	0.00000E+00		0.00	0.00	0.00
351	243.42	97.000	0.00000E+00		0.00	0.00	0.00
352	254.00	97.000	0.00000E+00		0.00	0.00	0.00

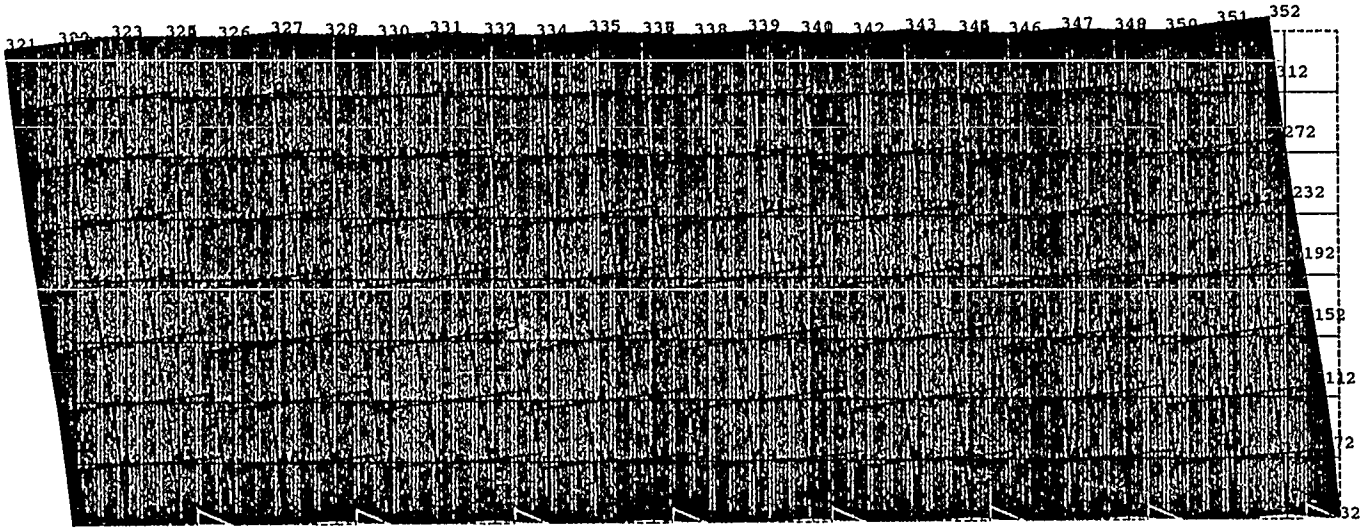
LIST ALL SELECTED ELEMENTS. (LIST NODES)

ELEM	MAT	TYP	REL	ESY	NODES			
1	1	1	1	0	1	2	42	41
2	1	1	1	0	2	3	43	42
3	1	1	1	0	3	4	44	43
4	1	1	1	0	5	6	46	45
5	1	1	1	0	6	7	47	46
6	1	1	1	0	7	8	48	47
7	1	1	1	0	9	10	50	49
8	1	1	1	0	10	11	51	50
9	1	1	1	0	11	12	52	51
10	1	1	1	0	13	14	54	53
11	1	1	1	0	14	15	55	54
12	1	1	1	0	15	16	56	55
13	1	1	1	0	17	18	58	57
14	1	1	1	0	18	19	59	58
15	1	1	1	0	19	20	60	59
16	1	1	1	0	21	22	62	61
17	1	1	1	0	22	23	63	62
18	1	1	1	0	23	24	64	63
19	1	1	1	0	25	26	66	65
20	1	1	1	0	26	27	67	66
21	1	1	1	0	27	28	68	67
22	1	1	1	0	29	30	70	69
23	1	1	1	0	30	31	71	70
24	1	1	1	0	31	32	72	71
25	1	1	1	0	41	42	82	81
26	1	1	1	0	42	43	83	82
27	1	1	1	0	43	44	84	83
28	1	1	1	0	45	46	86	85
29	1	1	1	0	46	47	87	86
30	1	1	1	0	47	48	88	87
31	1	1	1	0	49	50	90	89
32	1	1	1	0	50	51	91	90
33	1	1	1	0	51	52	92	91
34	1	1	1	0	53	54	94	93

ELEM	MAT	TYP	REL	ESY	NODES			
35	1	1	1	0	54	55	95	94
36	1	1	1	0	55	56	96	95
37	1	1	1	0	57	58	98	97
38	1	1	1	0	58	59	99	98
39	1	1	1	0	59	60	100	99
40	1	1	1	0	61	62	102	101
41	1	1	1	0	62	63	103	102
42	1	1	1	0	63	64	104	103
43	1	1	1	0	65	66	106	105
44	1	1	1	0	66	67	107	106
45	1	1	1	0	67	68	108	107
46	1	1	1	0	69	70	110	109
47	1	1	1	0	70	71	111	110
48	1	1	1	0	71	72	112	111
49	1	1	1	0	81	82	122	121
50	1	1	1	0	82	83	123	122
51	1	1	1	0	83	84	124	123
52	1	1	1	0	85	86	126	125
53	1	1	1	0	86	87	127	126
54	1	1	1	0	87	88	128	127
55	1	1	1	0	89	90	130	129
56	1	1	1	0	90	91	131	130
57	1	1	1	0	91	92	132	131
58	1	1	1	0	93	94	134	133
59	1	1	1	0	94	95	135	134
60	1	1	1	0	95	96	136	135
61	1	1	1	0	97	98	138	137
62	1	1	1	0	98	99	139	138
63	1	1	1	0	99	100	140	139
64	1	1	1	0	101	102	142	141
65	1	1	1	0	102	103	143	142
66	1	1	1	0	103	104	144	143
67	1	1	1	0	105	106	146	145
68	1	1	1	0	106	107	147	146
69	1	1	1	0	107	108	148	147
70	1	1	1	0	109	110	150	149
71	1	1	1	0	110	111	151	150
72	1	1	1	0	111	112	152	151
73	1	1	1	0	121	122	162	161
74	1	1	1	0	122	123	163	162
75	1	1	1	0	123	124	164	163
76	1	1	1	0	125	126	166	165
77	1	1	1	0	126	127	167	166
78	1	1	1	0	127	128	168	167
79	1	1	1	0	129	130	170	169
80	1	1	1	0	130	131	171	170
81	1	1	1	0	131	132	172	171
82	1	1	1	0	133	134	174	173
83	1	1	1	0	134	135	175	174
84	1	1	1	0	135	136	176	175
85	1	1	1	0	137	138	178	177
86	1	1	1	0	138	139	179	178
87	1	1	1	0	139	140	180	179
88	1	1	1	0	141	142	182	181
89	1	1	1	0	142	143	183	182
90	1	1	1	0	143	144	184	183
91	1	1	1	0	145	146	186	185
92	1	1	1	0	146	147	187	186
93	1	1	1	0	147	148	188	187
94	1	1	1	0	149	150	190	189
95	1	1	1	0	150	151	191	190
96	1	1	1	0	151	152	192	191
97	1	1	1	0	161	162	202	201
98	1	1	1	0	162	163	203	202
99	1	1	1	0	163	164	204	203
100	1	1	1	0	165	166	206	205

ELEM	MAT	TYP	REL	ESY	NODES			
101	1	1	1	0	166	167	207	206
102	1	1	1	0	167	168	208	207
103	1	1	1	0	169	170	210	209
104	1	1	1	0	170	171	211	210
105	1	1	1	0	171	172	212	211
106	1	1	1	0	173	174	214	213
107	1	1	1	0	174	175	215	214
108	1	1	1	0	175	176	216	215
109	1	1	1	0	177	178	218	217
110	1	1	1	0	178	179	219	218
111	1	1	1	0	179	180	220	219
112	1	1	1	0	181	182	222	221
113	1	1	1	0	182	183	223	222
114	1	1	1	0	183	184	224	223
115	1	1	1	0	185	186	226	225
116	1	1	1	0	186	187	227	226
117	1	1	1	0	187	188	228	227
118	1	1	1	0	189	190	230	229
119	1	1	1	0	190	191	231	230
120	1	1	1	0	191	192	232	231
121	1	1	1	0	201	202	242	241
122	1	1	1	0	202	203	243	242
123	1	1	1	0	203	204	244	243
124	1	1	1	0	205	206	246	245
125	1	1	1	0	206	207	247	246
126	1	1	1	0	207	208	248	247
127	1	1	1	0	209	210	250	249
128	1	1	1	0	210	211	251	250
129	1	1	1	0	211	212	252	251
130	1	1	1	0	213	214	254	253
131	1	1	1	0	214	215	255	254
132	1	1	1	0	215	216	256	255
133	1	1	1	0	217	218	258	257
134	1	1	1	0	218	219	259	258
135	1	1	1	0	219	220	260	259
136	1	1	1	0	221	222	262	261
137	1	1	1	0	222	223	263	262
138	1	1	1	0	223	224	264	263
139	1	1	1	0	225	226	266	265
140	1	1	1	0	226	227	267	266
141	1	1	1	0	227	228	268	267
142	1	1	1	0	229	230	270	269
143	1	1	1	0	230	231	271	270
144	1	1	1	0	231	232	272	271
145	1	1	1	0	241	242	282	281
146	1	1	1	0	242	243	283	282
147	1	1	1	0	243	244	284	283
148	1	1	1	0	245	246	286	285
149	1	1	1	0	246	247	287	286
150	1	1	1	0	247	248	288	287
151	1	1	1	0	249	250	290	289
152	1	1	1	0	250	251	291	290
153	1	1	1	0	251	252	292	291
154	1	1	1	0	253	254	294	293
155	1	1	1	0	254	255	295	294
156	1	1	1	0	255	256	296	295
157	1	1	1	0	257	258	298	297
158	1	1	1	0	258	259	299	298
159	1	1	1	0	259	260	300	299
160	1	1	1	0	261	262	302	301

ELEM	MAT	TYP	REL	ESY	NODES			
161	1	1	1	0	262	263	303	302
162	1	1	1	0	263	264	304	303
163	1	1	1	0	265	266	306	305
164	1	1	1	0	266	267	307	306
165	1	1	1	0	267	268	308	307
166	1	1	1	0	269	270	310	309
167	1	1	1	0	270	271	311	310
168	1	1	1	0	271	272	312	311
169	1	1	1	0	281	282	322	321
170	1	1	1	0	282	283	323	322
171	1	1	1	0	283	284	324	323
172	1	1	1	0	285	286	326	325
173	1	1	1	0	286	287	327	326
174	1	1	1	0	287	288	328	327
175	1	1	1	0	289	290	330	329
176	1	1	1	0	290	291	331	330
177	1	1	1	0	291	292	332	331
178	1	1	1	0	293	294	334	333
179	1	1	1	0	294	295	335	334
180	1	1	1	0	295	296	336	335
181	1	1	1	0	297	298	338	337
182	1	1	1	0	298	299	339	338
183	1	1	1	0	299	300	340	339
184	1	1	1	0	301	302	342	341
185	1	1	1	0	302	303	343	342
186	1	1	1	0	303	304	344	343
187	1	1	1	0	305	306	346	345
188	1	1	1	0	306	307	347	346
189	1	1	1	0	307	308	348	347
190	1	1	1	0	309	310	350	349
191	1	1	1	0	310	311	351	350
192	1	1	1	0	311	312	352	351



ANSYS 5.0 A
DEC 20 1994
07:39:32
PLOT NO. 1
DISPLACEMENT
STEP=1
SUB =1
TIME=1
RSYS=0
DMX =0.003596
SEPC=38.774

DSCA=3884
ZV =1
DIST=147.157
XF =120.221
YF =49.93
CENTROID HIDDEN

Displacements for 1.0g Lateral Acceleration

PRINT U NODAL SOLUTION PER NODE

***** POST1 NODAL DEGREE OF FREEDOM LISTING *****

THE FOLLOWING DEGREE OF FREEDOM RESULTS ARE IN GLOBAL COORDINATES

NODE	UX
1	0.00000E+00
2	-0.13264E-03
3	-0.14117E-03
4	0.00000E+00
5	0.00000E+00
6	-0.13285E-03
7	-0.15337E-03
8	0.00000E+00
9	0.00000E+00
10	-0.13317E-03
321	-0.83100E-02
322	-0.82788E-02
323	-0.81425E-02
324	-0.79094E-02
325	-0.79094E-02
326	-0.79729E-02
327	-0.79210E-02
328	-0.77237E-02
329	-0.77237E-02
330	-0.78219E-02
331	-0.77967E-02
332	-0.76299E-02
333	-0.76299E-02
334	-0.77535E-02
335	-0.77469E-02
336	-0.76053E-02
337	-0.76053E-02
338	-0.77525E-02
339	-0.77633E-02
340	-0.76455E-02
341	-0.76455E-02
342	-0.78187E-02
343	-0.78489E-02
344	-0.77574E-02
345	-0.77574E-02
346	-0.79629E-02
347	-0.80208E-02
348	-0.79653E-02
349	-0.79653E-02
350	-0.82083E-02
351	-0.83489E-02
352	-0.83809E-02

MAXIMUM VALUES
NODE 352
VALUE -0.83809E-02

Results for a 0.20g Lateral Acceleration

PRINT REACTION SOLUTIONS PER NODE

***** POST1 TOTAL REACTION SOLUTION LISTING *****

THE FOLLOWING X,Y,Z SOLUTIONS ARE IN GLOBAL COORDINATES

NODE	FX	FY	FZ
1	737.37	1562.2	
2		909.86	
4	826.83	-1565.6	
5	736.42	1487.9	
6		556.79	
8	1023.1	-2002.6	
9	732.80	1468.7	
10		528.75	
12	1028.1	-2008.3	
13	731.60	1462.8	
14		528.59	
16	1023.8	-1995.5	
17	732.99	1466.2	
18		533.72	
20	1023.3	-1993.7	
21	736.23	1477.5	
22		541.03	
24	1027.3	-2005.2	
25	729.00	1474.3	
26		522.19	
28	1033.8	-2036.3	
29	541.91	1141.8	
30		90.321	
32	1004.7	-2145.2	

TOTAL VALUES
VALUE 13669. 0.18190E-10 0.00000E+00

PRINT S NODAL SOLUTION PER NODE

***** POST1 NODAL STRESS LISTING *****

NODE	S1	S2	S3	SINT	SEQV
MINIMUM VALUES					
NODE	1	1	1	271	271
VALUE	0.00000E+00	-13.514	-41.857	1.8520	1.6591
MAXIMUM VALUES					
NODE	32	24	4	32	32
VALUE	61.226	13.263	0.00000E+00	61.226	56.327
MINIMUM VALUES					
NODE	25	5	5	70	30
VALUE	-10.313	-22.638	-51.453	0.00000E+00	0.00000E+00
MAXIMUM VALUES					
NODE	32	28	32	32	32
VALUE	78.701	30.038	17.475	78.701	73.802

PRINT F ELEMENT SOLUTION PER ELEMENT

***** POST1 ELEMENT NODE TOTAL FORCE LISTING *****

ELEM= 169	FX	FY	FZ
281	48.071	96.868	0.00000E+00
282	0.88228	-35.382	0.00000E+00
322	-120.14	-61.486	0.00000E+00
321	0.27853E-11	0.00000E+00	0.00000E+00

ELEM= 170	FX	FY	FZ
282	139.69	151.90	0.00000E+00
283	10.968	-21.672	0.00000E+00
323	-341.99	-191.72	0.00000E+00
322	120.14	61.486	0.00000E+00

ELEM= 171	FX	FY	FZ
283	-101.04	-458.80	0.00000E+00
284	-167.69	-639.35	0.00000E+00
324	-144.45	906.43	0.00000E+00
323	341.99	191.72	0.00000E+00

ELEM= 172	FX	FY	FZ
285	-69.445	629.43	0.00000E+00
286	-207.92	466.00	0.00000E+00
326	61.724	-189.00	0.00000E+00
325	144.45	-906.43	0.00000E+00

ELEM= 173	FX	FY	FZ
286	177.48	141.07	0.00000E+00
287	75.020	-105.38	0.00000E+00
327	-261.97	-224.69	0.00000E+00
326	-61.724	189.00	0.00000E+00

ELEM= 174	FX	FY	FZ
287	-105.80	-458.39	0.00000E+00
288	-133.80	-714.82	0.00000E+00
328	-93.564	948.53	0.00000E+00
327	261.97	224.69	0.00000E+00

ELEM= 175	FX	FY	FZ
289	-88.199	669.22	0.00000E+00
290	-191.18	482.00	0.00000E+00
330	114.62	-202.70	0.00000E+00
329	93.564	-948.53	0.00000E+00

ELEM= 176	FX	FY	FZ
290	156.76	133.76	0.00000E+00
291	101.31	-117.81	0.00000E+00
331	-214.64	-218.65	0.00000E+00
330	-114.62	202.70	0.00000E+00

ELEM= 177	FX	FY	FZ
291	-126.83	-457.98	0.00000E+00
292	-117.68	-698.27	0.00000E+00
332	-41.320	937.60	0.00000E+00
331	214.64	218.65	0.00000E+00

ELEM= 178	FX	FY	FZ
293	-98.457	676.14	0.00000E+00
294	-165.35	469.36	0.00000E+00
334	151.29	-207.91	0.00000E+00
333	41.320	-937.60	0.00000E+00

ELEM= 179	FX	FY	FZ
294	136.10	127.91	0.00000E+00
295	121.42	-123.80	0.00000E+00
335	-177.41	-212.02	0.00000E+00
334	-151.29	207.91	0.00000E+00

ELEM= 180	FX	FY	FZ
295	-147.96	-462.22	0.00000E+00
296	-106.04	-683.23	0.00000E+00
336	5.3896	933.43	0.00000E+00
335	177.41	212.02	0.00000E+00

ELEM= 181	FX	FY	FZ
297	-108.59	686.02	0.00000E+00
298	-142.95	460.78	0.00000E+00
338	185.74	-213.37	0.00000E+00
337	-5.3896	-933.43	0.00000E+00

ELEM= 182	FX	FY	FZ
298	116.84	122.47	0.00000E+00
299	140.70	-129.15	0.00000E+00
339	-142.99	-206.70	0.00000E+00
338	-185.74	213.37	0.00000E+00

ELEM= 183	FX	FY	FZ
299	-171.07	-471.98	0.00000E+00
300	-96.099	-674.39	0.00000E+00
340	52.980	939.67	0.00000E+00
339	142.99	206.70	0.00000E+00

ELEM= 184	FX	FY	FZ
301	-120.82	702.58	0.00000E+00
302	-121.71	457.47	0.00000E+00
342	224.32	-220.38	0.00000E+00
341	-52.980	-939.67	0.00000E+00

ELEM= 185	FX	FY	FZ
302	96.054	116.21	0.00000E+00
303	162.13	-135.14	0.00000E+00
343	-105.05	-201.45	0.00000E+00
342	-224.32	220.38	0.00000E+00

ELEM= 186	FX	FY	FZ
303	-198.48	-486.18	0.00000E+00
304	-85.658	-668.22	0.00000E+00
344	107.89	952.95	0.00000E+00
343	105.05	201.45	0.00000E+00

ELEM= 187	FX	FY	FZ
305	-137.84	721.54	0.00000E+00
306	-99.740	458.70	0.00000E+00
346	274.28	-227.29	0.00000E+00
345	-107.89	-952.95	0.00000E+00

ELEM= 188	FX	FY	FZ
306	68.870	103.69	0.00000E+00
307	184.42	-143.12	0.00000E+00
347	-50.205	-187.86	0.00000E+00
346	-274.28	227.29	0.00000E+00

ELEM= 189	FX	FY	FZ
307	-217.00	-471.75	0.00000E+00
308	-66.407	-629.28	0.00000E+00
348	162.00	913.17	0.00000E+00
347	50.205	187.86	0.00000E+00

ELEM= 190	FX	FY	FZ
309	-170.54	651.69	0.00000E+00
310	-93.281	459.72	0.00000E+00
350	354.63	-198.24	0.00000E+00
349	-162.00	-913.17	0.00000E+00

ELEM= 191	FX	FY	FZ
310	11.583	25.503	0.00000E+00
311	148.11	-158.77	0.00000E+00
351	123.75	-64.974	0.00000E+00
350	-354.63	198.24	0.00000E+00

ELEM=	192 FX	FY	FZ
311	1.7967	36.006	0.00000E+00
312	50.750	-100.98	0.00000E+00
352	0.52580E-11	0.13074E-11	0.00000E+00
351	-123.75	64.974	0.00000E+00

Results for E-W Cubical, New Type

LIST CONSTRAINTS FOR SELECTED NODES 1 TO 352 BY 1
CURRENTLY SELECTED DOF SET= UX UY UZ

NODE	LABEL	REAL	IMAG
1	UX	0.000000000E+00	0.000000000E+00
1	UY	0.000000000E+00	0.000000000E+00
2	UY	0.000000000E+00	0.000000000E+00
4	UX	0.000000000E+00	0.000000000E+00
4	UY	0.000000000E+00	0.000000000E+00
5	UX	0.000000000E+00	0.000000000E+00
5	UY	0.000000000E+00	0.000000000E+00
6	UY	0.000000000E+00	0.000000000E+00
8	UX	0.000000000E+00	0.000000000E+00
8	UY	0.000000000E+00	0.000000000E+00
9	UX	0.000000000E+00	0.000000000E+00
9	UY	0.000000000E+00	0.000000000E+00
10	UY	0.000000000E+00	0.000000000E+00
12	UX	0.000000000E+00	0.000000000E+00
12	UY	0.000000000E+00	0.000000000E+00
13	UX	0.000000000E+00	0.000000000E+00
13	UY	0.000000000E+00	0.000000000E+00
14	UY	0.000000000E+00	0.000000000E+00
16	UX	0.000000000E+00	0.000000000E+00
16	UY	0.000000000E+00	0.000000000E+00

NODE	LABEL	REAL	IMAG
17	UX	0.000000000E+00	0.000000000E+00
17	UY	0.000000000E+00	0.000000000E+00
18	UY	0.000000000E+00	0.000000000E+00
20	UX	0.000000000E+00	0.000000000E+00
20	UY	0.000000000E+00	0.000000000E+00
21	UX	0.000000000E+00	0.000000000E+00
21	UY	0.000000000E+00	0.000000000E+00
22	UY	0.000000000E+00	0.000000000E+00
24	UX	0.000000000E+00	0.000000000E+00
24	UY	0.000000000E+00	0.000000000E+00
25	UX	0.000000000E+00	0.000000000E+00
25	UY	0.000000000E+00	0.000000000E+00
26	UY	0.000000000E+00	0.000000000E+00
28	UX	0.000000000E+00	0.000000000E+00
28	UY	0.000000000E+00	0.000000000E+00
29	UX	0.000000000E+00	0.000000000E+00
29	UY	0.000000000E+00	0.000000000E+00
30	UY	0.000000000E+00	0.000000000E+00
32	UX	0.000000000E+00	0.000000000E+00
32	UY	0.000000000E+00	0.000000000E+00

Displacements for a 1.0g Lateral Acceleration

PRINT U NODAL SOLUTION PER NODE

***** POST1 NODAL DEGREE OF FREEDOM LISTING *****

THE FOLLOWING DEGREE OF FREEDOM RESULTS ARE IN GLOBAL COORDINATES

NODE	UX
1	0.00000E+00
2	-0.15500E-03
3	-0.16496E-03
4	0.00000E+00
5	0.00000E+00
6	-0.15524E-03
7	-0.17922E-03
8	0.00000E+00
9	0.00000E+00
10	-0.15561E-03
321	-0.97105E-02
322	-0.96740E-02
323	-0.95147E-02
324	-0.92424E-02
325	-0.92424E-02
326	-0.93165E-02
327	-0.92559E-02
328	-0.90254E-02
329	-0.90254E-02
330	-0.91401E-02
331	-0.91106E-02
332	-0.89158E-02
333	-0.89158E-02
334	-0.90601E-02
335	-0.90525E-02
336	-0.88870E-02
337	-0.88870E-02
338	-0.90591E-02
339	-0.90717E-02
340	-0.89340E-02
341	-0.89340E-02
342	-0.91364E-02
343	-0.91716E-02
344	-0.90647E-02
345	-0.90647E-02
346	-0.93048E-02
347	-0.93725E-02
348	-0.93077E-02
349	-0.93077E-02
350	-0.95916E-02
351	-0.97559E-02
352	-0.97933E-02

MAXIMUM VALUES
NODE 352
VALUE -0.97933E-02

Results for a 0.20g Lateral Acceleration

PRINT REACTION SOLUTIONS PER NODE

***** POST1 TOTAL REACTION SOLUTION LISTING *****

THE FOLLOWING X,Y,Z SOLUTIONS ARE IN GLOBAL COORDINATES

NODE	FX	FY	FZ
1	860.53	1823.1	
2		1061.8	
4	964.92	-1827.1	
5	859.41	1736.4	
6		649.79	
8	1194.0	-2337.1	
9	855.19	1713.9	
10		617.06	
12	1199.8	-2343.8	
13	853.79	1707.1	
14		616.87	
16	1194.7	-2328.8	
17	855.41	1711.1	
18		622.86	
20	1194.2	-2326.7	
21	859.20	1724.2	
22		631.39	
24	1198.9	-2340.1	
25	850.75	1720.5	
26		609.40	
28	1206.4	-2376.4	
29	632.41	1332.4	
30		105.41	
32	1172.6	-2503.5	

TOTAL VALUES

VALUE	15952.	0.16826E-10	0.00000E+00

PRINT S NODAL SOLUTION PER NODE

***** POST1 NODAL STRESS LISTING *****

NODE	S1	S2	S3	SINT	SEQV
1	0.00000E+00	-15.771	-48.848	48.848	43.180
2	0.00000E+00	-4.4188	-14.674	14.674	13.039
3	9.7605	0.00000E+00	-7.4194	17.180	14.924
4	52.074	13.556	0.00000E+00	52.074	46.792
5	0.00000E+00	-14.434	-48.062	48.062	42.715
6	0.00000E+00	-0.28631	-12.191	12.191	12.050
7	11.327	0.00000E+00	-9.2803	20.607	17.875
8	66.415	15.425	0.00000E+00	66.415	60.203
9	0.00000E+00	-14.287	-47.516	47.516	42.226
10	0.35908E-01	0.00000E+00	-12.018	12.054	12.038

MINIMUM VALUES					
NODE	1	1	1	271	271
VALUE	0.00000E+00	-15.771	-48.848	2.1614	1.9362

MAXIMUM VALUES					
NODE	32	24	4	32	32
VALUE	71.452	15.478	0.00000E+00	71.452	65.735

***** ESTIMATED BOUNDS CONSIDERING THE EFFECT OF DISCRETIZATION ERROR *****

MINIMUM VALUES					
NODE	25	5	5	70	30
VALUE	-12.035	-26.419	-60.047	0.00000E+00	0.00000E+00

MAXIMUM VALUES					
NODE	32	28	32	32	32
VALUE	91.845	35.054	20.393	91.845	86.128

PRINT F ELEMENT SOLUTION PER ELEMENT

***** POST1 ELEMENT NODE TOTAL FORCE LISTING *****
THE FOLLOWING X,Y,Z FORCES ARE IN GLOBAL COORDINATES

ELEM= 169	FX	FY	FZ
281	56.100	113.05	0.00000E+00
282	1.0286	-41.292	0.00000E+00
322	-140.21	-71.755	0.00000E+00
321	-0.32543E-11	-0.18190E-11	0.00000E+00

ELEM= 170	FX	FY	FZ
282	163.02	177.27	0.00000E+00
283	12.800	-25.292	0.00000E+00
323	-399.11	-223.74	0.00000E+00
322	140.21	71.755	0.00000E+00

ELEM= 171	FX	FY	FZ
283	-117.92	-535.43	0.00000E+00
284	-195.70	-746.13	0.00000E+00
324	-168.58	1057.8	0.00000E+00
323	399.11	223.74	0.00000E+00

ELEM= 172	FX	FY	FZ
285	-81.043	734.56	0.00000E+00
286	-242.65	543.83	0.00000E+00
326	72.033	-220.57	0.00000E+00
325	168.58	-1057.8	0.00000E+00

ELEM= 173	FX	FY	FZ
286	207.12	164.63	0.00000E+00
287	87.550	-122.98	0.00000E+00
327	-305.72	-262.22	0.00000E+00
326	-72.033	220.57	0.00000E+00

ELEM= 174	FX	FY	FZ
287	-123.47	-534.95	0.00000E+00
288	-156.14	-834.21	0.00000E+00
328	-109.19	1106.9	0.00000E+00
327	305.72	262.22	0.00000E+00

ELEM= 175	FX	FY	FZ
289	-102.93	780.99	0.00000E+00
290	-223.11	562.50	0.00000E+00
330	133.77	-236.55	0.00000E+00
329	109.19	-1106.9	0.00000E+00

ELEM= 176	FX	FY	FZ
290	182.94	156.10	0.00000E+00
291	118.23	-137.48	0.00000E+00
331	-250.48	-255.17	0.00000E+00
330	-133.77	236.55	0.00000E+00

ELEM= 177	FX	FY	FZ
291	-148.02	-534.47	0.00000E+00
292	-137.33	-814.89	0.00000E+00
332	-48.221	1094.2	0.00000E+00
331	250.48	255.17	0.00000E+00

ELEM= 178	FX	FY	FZ
293	-114.90	789.07	0.00000E+00
294	-192.96	547.76	0.00000E+00
334	176.56	-242.63	0.00000E+00
333	48.221	-1094.2	0.00000E+00

ELEM= 179	FX	FY	FZ
294	158.83	149.27	0.00000E+00
295	141.69	-144.47	0.00000E+00
335	-207.05	-247.43	0.00000E+00
334	-176.56	242.63	0.00000E+00

ELEM= 180	FX	FY	FZ
295	-172.68	-539.42	0.00000E+00
296	-123.75	-797.34	0.00000E+00
336	6.2897	1089.3	0.00000E+00
335	207.05	247.43	0.00000E+00

ELEM= 181	FX	FY	FZ
297	-126.72	800.59	0.00000E+00
298	-166.83	537.74	0.00000E+00
338	216.76	-249.01	0.00000E+00
337	-6.2897	-1089.3	0.00000E+00

ELEM= 182	FX	FY	FZ
298	136.35	142.93	0.00000E+00
299	164.20	-150.72	0.00000E+00
339	-166.87	-241.22	0.00000E+00
338	-216.76	249.01	0.00000E+00

ELEM= 183	FX	FY	FZ
299	-199.64	-550.81	0.00000E+00
300	-112.15	-787.02	0.00000E+00
340	61.828	1096.6	0.00000E+00
339	166.87	241.22	0.00000E+00

ELEM= 184	FX	FY	FZ
301	-141.00	819.92	0.00000E+00
302	-142.04	533.87	0.00000E+00
342	261.79	-257.18	0.00000E+00
341	-61.828	-1096.6	0.00000E+00

ELEM= 185	FX	FY	FZ
302	112.10	135.62	0.00000E+00
303	189.21	-157.71	0.00000E+00
343	-122.60	-235.09	0.00000E+00
342	-261.79	257.18	0.00000E+00

ELEM= 186	FX	FY	FZ
303	-231.64	-567.38	0.00000E+00
304	-99.964	-779.83	0.00000E+00
344	125.91	1112.1	0.00000E+00
343	122.60	235.09	0.00000E+00

ELEM= 187	FX	FY	FZ
305	-160.86	842.05	0.00000E+00
306	-116.40	535.32	0.00000E+00
346	320.09	-265.25	0.00000E+00
345	-125.91	-1112.1	0.00000E+00

ELEM= 188	FX	FY	FZ
306	80.373	121.01	0.00000E+00
307	215.22	-167.02	0.00000E+00
347	-58.590	-219.24	0.00000E+00
346	-320.09	265.25	0.00000E+00

ELEM= 189	FX	FY	FZ
307	-253.24	-550.54	0.00000E+00
308	-77.498	-734.38	0.00000E+00
348	189.06	1065.7	0.00000E+00
347	58.590	219.24	0.00000E+00

ELEM= 190	FX	FY	FZ
309	-199.02	760.53	0.00000E+00
310	-108.86	536.50	0.00000E+00
350	413.86	-231.35	0.00000E+00
349	-189.06	-1065.7	0.00000E+00

ELEM= 191	FX	FY	FZ
310	13.518	29.762	0.00000E+00
311	172.85	-185.29	0.00000E+00
351	144.41	-75.826	0.00000E+00
350	-413.86	231.35	0.00000E+00

ELEM= 192	FX	FY	FZ
311	2.0967	42.020	0.00000E+00
312	59.227	-117.85	0.00000E+00
352	0.10949E-10	0.29559E-11	0.00000E+00
351	-144.41	75.826	0.00000E+00

ANALYTICAL CALCULATIONS

Subject _____

Originator R A Hill Date 2-9-95

Checker M.A-ISLAM Date 3/9/95

Objective:

Evaluate the wall-supported cubicles of the 2736Z building as Safety Class 1 structures, systems and components (SSC). The free-standing cubicles have been evaluated elsewhere. It should be noted that these cubicles were evaluated in May 1994 as Safety Class 3 SSCs subjected to Safety Class 1 load conditions, and this previous document will be used as a reference.

Criteria:

The U.S. Department of Energy design criteria documents to be used in the evaluation of Safety Class 1 components are as follows:

DOE Order 6430.1A	General design Criteria.
UCRL-15910	Design and Evaluation Guidelines for Department of Energy Facilities Subjected to Natural Phenomena.
SDC-4.1	Site Design Criteria.

The design code used in this evaluation in conjunction with the listed criteria documents is as follows:

ACI-349-90	Code requirements for Nuclear Safety related Concrete structures.

Given:

Given, the dimensions and material properties as shown on the design drawings of the building and cubicals. These drawings show two types of cubicles, an old type cubical in rooms 3 and 4, and a new type cubicle in rooms 1 and 2. Field walkdown verified the arrangements in rooms 1, 3, and 4 but found that room 2 has no cubicles, racks were found in their place.

Old type cubicles; drawings H-2-26651 and H-2-26654

New type cubicles; drawings H-2-70010 and H-2-70011.

ANALYTICAL CALCULATIONS

Subject _____

Originator RB Lilla Date 2-9-95

Checker MA ISLAM Date 3/9/95

Assumptions:

The main assumption is that concrete and steel strengths are the specified values shown on the design drawings. This assumption is supported by field walkdown of the structures. This field walkdown found no visual deterioration of the concrete members such as cracks, spalls, or surface defects. Steel members also were without surface rust or defects.

Method:

The previous safety class 3 over safety class 1 seismic analysis of the cubicles used simplified dynamic methods to calculated the seismic loads on a monolithic structure. This required the use of the peak of the response spectra curve reduced 20% for existing structures.

For the safety class 1 analysis it was desirable to perform an analysis of a more detailed model using individual members with coupling between the cubicle top and the building wall, inplace of a monolithic model. It was also desirable to calculate actual frequencies and acceleration values in place of using the peak of the seismic response spectra.

References:

Previous safety class 3 over 1 seismic cubicle analysis, WHC-SD-CP-SA-026.

Seismic Verification of Equipment Anchorage, June 1991, EPRI NP-5228-SL, R1, V3.

ACI-349-90 Code Requirements for Nuclear Safety related concrete structures.

ANALYTICAL CALCULATIONS

Page _____ of _____

Subject _____

Originator RA Hill Date 2-9-95

Checker MA ISLAM Date 3/9/95

Index:

Old Type Cubicle Analysis

- Construction Details
- Self weight
- Floor Spring Rate
- Modal Response
- Wall/Cubicle Stresses
- Connections

New Type Cubicle Analysis

- Construction Details
- Self Weight
- Floor Spring Rate
- Modal Response
- Wall/Cubicle Stresses
- Connections

Margins of Safety

Computer Printout

- Geometry
- Modal Results
- Seismic Acceleration Results
- Seismic Displacement Results

In-Building Spectra and Displacements

ANALYTICAL CALCULATIONS

Page _____ of _____

Subject _____

Originator R.A. Miller Date 1-25-95

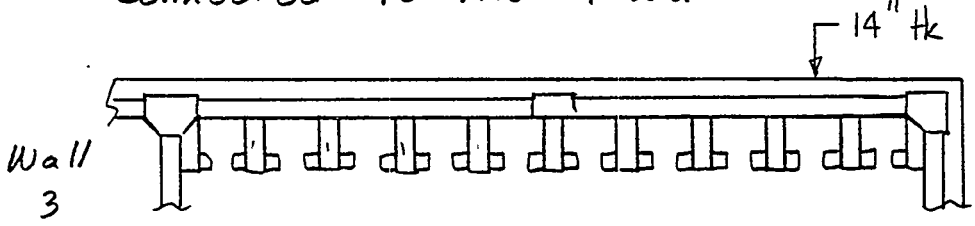
Checker M A ISLAM Date 3/9/95

Construction Details

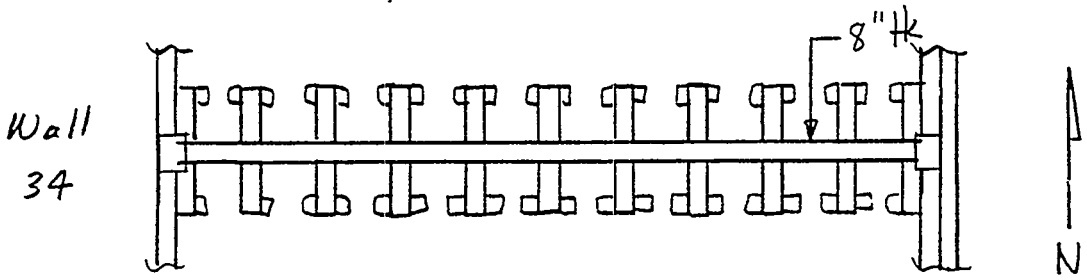
Old Type Cubicles

2736 Z Building, Room 3 & 4

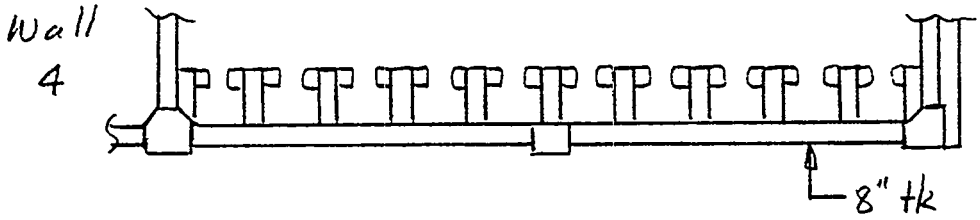
Connected to floor & Wall



Room 3



Room 4



Drawings H-2-26651
H-2-26654

ANALYTICAL CALCULATIONS

Page ____ of ____

Subject _____

Originator RA Bitter Date 1-25-95

Checker MA ISLAM Date 3/9/95

Self Weight

Panel E	1384#	× 4	=	5536#
Panel D	1384	× 5	=	6920
Panel J	440	× 8	=	3520
Panel H	500	× 10	=	5000
Door Extension	43	× 10	=	430
Pedestals	146	× 36	=	5256
Hood	43	× 10	=	430
				27092

Density : $\frac{27092}{9(8")(20")(96")\,386.4} = .000507$

Self Wt. North Wall :

Wall = $28' \times 10.5' \times \frac{14"}{12} \times 150pcf$ = 51450#

Density = $\frac{51450}{8"(336")(126")\,386.4}$ = .000393

Wall + Cubicle = 51450 + 27092 = 78542#

Self Wt. Interior Wall :

Wall = $28' \times 10.5' \times \frac{8"}{12} \times 150pcf$ = 29400#

Density = $\frac{29400}{8(336)(126)\,386.4}$ = .000225

Wall + 2 Cubicles = 29400 + 2 × 27092 = 83584#

Self Wt. South Wall :

Wall + Cubicals = 29400 + 27092 = 56492#

Wall Density = .000225

ANALYTICAL CALCULATIONS

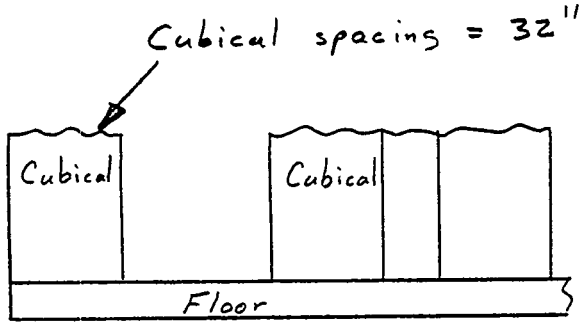
Page _____ of _____

Subject _____

Originator RS Hill Date 1-26-95

Checker MA ISLAM Date 3/9/95

Floor Spring Rate

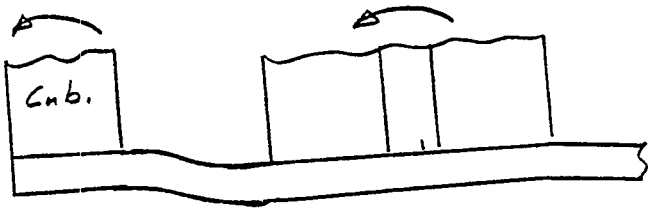


$$\Delta = \frac{Pl^3}{12EI}$$

$E = 3{,}000{,}000$ psi

$$I = \frac{(6")^3(32")}{12}$$

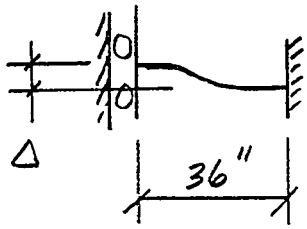
$= 576\ in^4$



$$K = \frac{P}{\Delta}$$

$$= \frac{12EI}{l^3}$$

$= 444{,}444\ \#/"$



ANSYS ELEM, LINK 8:

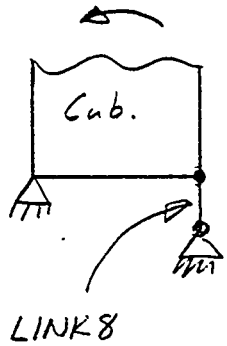
$$K = \frac{AE}{l} = 444{,}444\ \#/"$$

use $E = 29{,}000{,}000$ psi

& $l = 3"$

find A

$$A = \frac{444{,}444\,l}{E} = .046\ in^2$$



ANALYTICAL CALCULATIONS

Subject _____

Originator RA Gilbert Date 1-26-95

Checker MA ISLAM Date 3/9/95

Modal Response

- The In-building seismic response has been calculated in a separte analysis performed by Carlton Moore (see attached spectra). For the wall mounted cubicals the appropriate response curve to be used for accelerations is the roof level curve. This is appropriate for the cubicles since the cubicle/wall model is attached at the roof.

  From the computer output, the first mode response frequencies are listed below. In all three walls the first significant mode in each direction was dominant with 80% or more of the total mass participating. All other modes are well within the rigid region of the spectra curve.

Wall 3,	X-direction	50.57 hz
	Z-direction	22.65 hz
Wall 34,	X-direction	164.2 hz
	Z-direction	37.72 hz
Wall 4,	X-direction	50.60 hz
	Z-direction	23.01 hz

- Referring to the In-Building response spectra (Attached), the design seismic acceleration to be used is as follows;

  X-direction @ 50.57 hz = 0.22g

  Z-direction @ 22.65 hz = 0.28g

ANALYTICAL CALCULATIONS

Page ____ of ____

Subject _____

Originator RA Gilbert Date 2-6-95

Checker MA ISLAM Date 3/9/95

Wall/Cubical Stresses

Building wall, Out-of-Plane Bending:
(z-direction loading)

130.0 psi (Seismic acceleration stress plot for wall 4

9.7 psi (Seismic displacement stress plot for wall 34

139.7 psi

$$M_u = \sigma S_b = \frac{139.7(8")^2(5")}{6}$$

$$M_u = 7451\ ^{"\cdot\#}$$

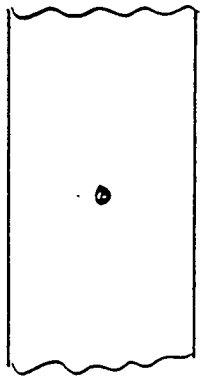
$$\phi M_n = \phi A_s F_y (d - a/2)$$

$$a = \frac{A_s F_y}{.85 f'_c b} = \frac{.11(40)}{.85(3)5} = .345"$$

$$\phi M_n = .9(.11)40\left(4 - \frac{.345}{2}\right)1000$$

$$\phi M_n = 15157\ ^{"\cdot\#} > 7451\ ^{"\cdot\#}$$

$$MS = \frac{15157}{7451} - 1 = 1.03$$



#3 bars
@ 5" o.c.
d = 4"

ANALYTICAL CALCULATIONS

Page ____ of ____

Subject _____

Originator R.A. Hill Date 2-9-95

Checker M A ISLAM Date 3/9/95

Wall/Cubical Stresses Cont.

Building Wall, In-Plane Shear:
(x-direction loading)

$83584^{\#} \times .22g = 18388^{\#}$ shear

$2\sqrt{f'_c}\, bd = 2\sqrt{3000}\,(8")(320") = 280\,434^{\#} > 18\,388^{\#}$

O.K.

$M.S. = \frac{280\,434}{18\,388} - 1 = 14.3$

Cubicle Wall, In-Plane Shear:
(z-direction loading)

$83584^{\#} \times .28g \div 18 \text{ walls} = 1300^{\#}$

$2\sqrt{f'_c}\, bd = 2\sqrt{3000}\,(8")(20") = 17527^{\#} > 1300^{\#}$

$M.S. = \frac{17527}{1300} - 1 = 12.5$

ANALYTICAL CALCULATIONS

Page ____ of ____

Subject _____

Originator R A Gilbert Date 2-7-95

Checker MA ISLAM Date 3/9/95

Wall/Cubicle Stresses Cont.

Cubicle Wall, In-Plane Bending: (z-direction)

74.3 psi (Seismic acceleration stress plot, for wall 34)

10.8 psi

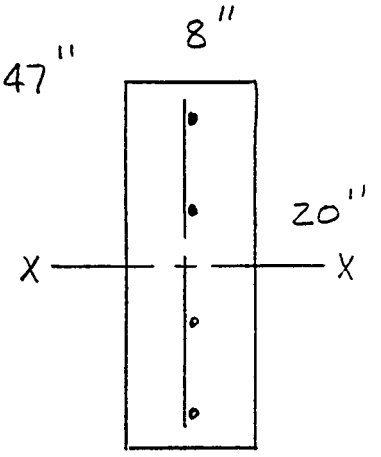
85.1 psi (Seismic displacement stress plot for wall 1)

$$M_u = \sigma S_b = \frac{(85.1)(20")^2(8")}{6} = 45387\ ".\#$$

$$\phi M_n = \Sigma \phi A_s F_y (d - a/2)$$

$$a = \frac{A_s F_y}{.85 f'_c b} = \frac{.33(40)}{.85(3)8} = .647"$$

$$\phi M_n = \phi(.11)40\left[\left(18" - \frac{.647}{2}\right) + \left(13 - \frac{.647}{2}\right) + \left(7 - \frac{.647}{2}\right)\right]1000$$



4- #3 bars assume only 3 are in tension

$$\phi M_n = 146{,}637\ ".\# > 45387\ ".\#$$

$$M.S = \frac{146637}{45387} - 1 = 2.23$$

ANALYTICAL CALCULATIONS

Page _____ of _____

Subject _____

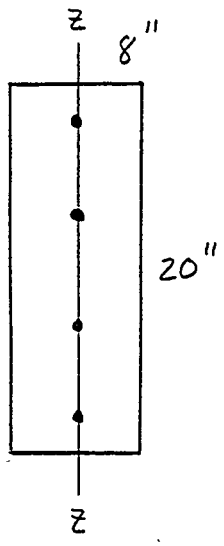
Originator R.A. Lilla Date 2-9-95

Checker MA ISLAM Date 3/9/95

Wall/Cubicle Stresses Cont.

Cubicle Wall, Out-of-Plane Bending:
(x-direction)

47.6 psi (Seismic acceleration stress plot, x-direction)



4-#3 bars

d = 4"

$$M_u = \sigma S_b = \frac{47.6(8)^2(20)}{6}$$

$$M_u = 10{,}155\ \text{in.\#}$$

$$\phi M_n = \phi A_s F_y (d - a/2)$$

$$a = \frac{A_s F_y}{.85 f'_c b} = \frac{.44(40)}{.85(3)20} = .345"$$

$$\phi M_n = .9(.44)(40)\left(4 - \frac{.345}{2}\right)1000$$

$$\phi M_n = 60{,}600\ \text{in.\#} > 10{,}155\ \text{in.\#}$$

$$\text{RIS} = \frac{60600}{10155} - 1 = 4.9$$

ANALYTICAL CALCULATIONS

Page _____ of _____

Subject _____

Originator RA Gilbert Date 2-8-95

Checker MA ISLAM Date 3/9/95

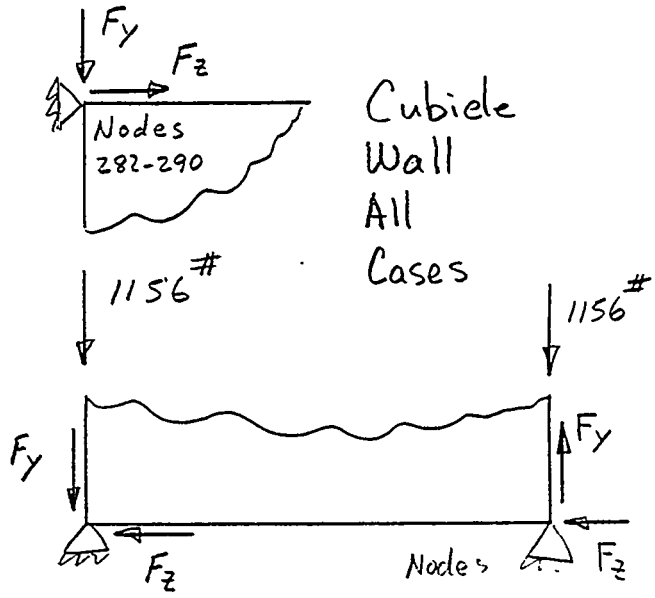
Support Reactions

Dead Wt.

1384#
440
440
43
584
2891#

.85D - 2/3(.2g)(40%)W

= .80W = $\left(.8 \frac{2891}{2}\right)$ = 1156



Worse Case Loads

Nodes	Force	DW	Accel	Disp	Total	
202-210	Fx	0	226#	0	226#	V
	Fy	1156	577	159	1892	C
	Fz	0	269	17	286	V
	Mz	0	4910 in.#	0	4910	M
212-220	Fx	0	292	0	292	V
	Fz	0	265	54	319	V
	Mz	0	5395	0	5395	M
302-310	Fy	1156	-543	-338	275	C
282-290	Fx	0	306	0	306	V
	Fy	0	239	184	423	V
	Fz	0	-368	-70	-438	T

ANALYTICAL CALCULATIONS

Page ____ of ____

Subject _____

Originator RS Little Date 2-10-93

Checker MA ISLAM Date 3/9/95

Floor Anchor Plate

Max tension, F_y = $0^{\#}$

Max shear, $\sqrt{F_x^2+F_z^2} = \sqrt{319^2+292^2} = 432^{\#}$

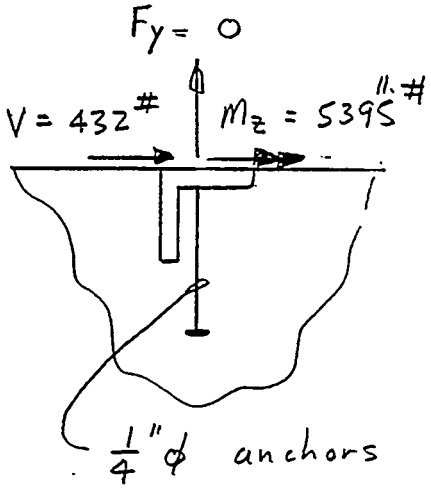
Max moment, M_z = $5395^{\#\cdot}$

Anchor shear:

$$\frac{(11 \text{ Cubicles})\ 432^{\#}}{(17 \text{ anch.})/\text{Cubicle}} = 280^{\#}/\text{anch}$$

Anchor tension:

$$\frac{(5395^{\#\cdot})}{16'' \text{ anch spacing}} = 337^{\#}/\text{anch}$$



Anchor Capacity:

(From floor mounted cubicle analysis)

$T_A = 2205^{\#}$ $V_A = 1874^{\#}$ for 1/4" ϕ anchors

Bolt Interaction:

$$\frac{T}{T_A} + \frac{V}{V_A} = \frac{337}{2205} + \frac{280}{1874} = .30 < 1.0$$

$$M.S. = \frac{1.0}{0.3} - 1 = 2.3$$

ANALYTICAL CALCULATIONS

Page ____ of ____

Subject _____

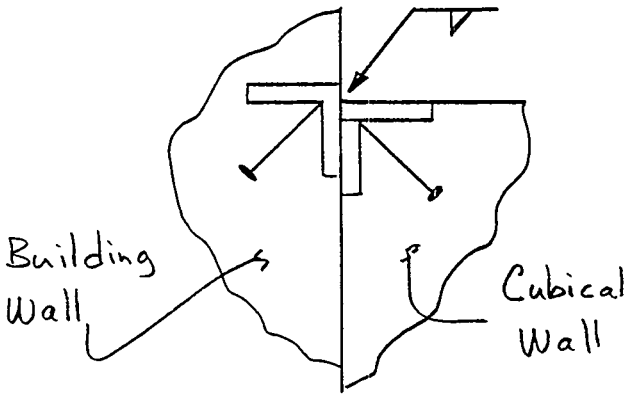
Originator RA Hill Date 2-8-95

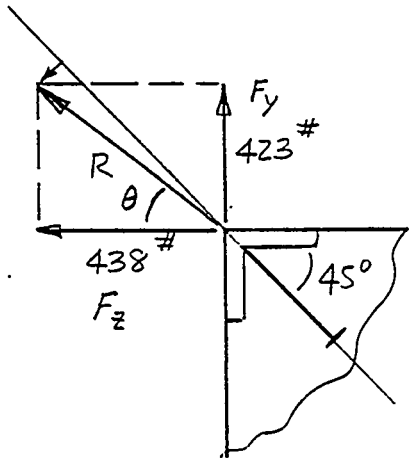
Checker MA ISLAM Date 3/9/95

Cubicle Wall Anchors

Max tension, $F_z = -438^{\#}$

Max shears, $F_x = 306^{\#}$ $F_y = 423^{\#}$





$$R = \sqrt{438^2 + 423^2} = 609^{\#}$$

$$\sin^{-1}\left(\frac{423}{609}\right) = \theta = 44.0^{\circ}$$

Resultant Anchor Loads:

$$\sqrt{\left[609^{\#} \sin(45^{\circ} - 44)\right]^2 + 306^2} = 306^{\#} \text{ shear}$$

$$609^{\#} \cos(45^{\circ} - 44^{\circ}) = 609^{\#} \text{ tension}$$

Bolt Interaction:

$$IC = \frac{T}{T_A} + \frac{V}{V_A} = \frac{609}{2205} + \frac{306}{1874} = .44 < 1.0$$

$$M.S. = \frac{1.0}{.44} - 1 = 1.3$$

bolt allowables calculated in free standing cubicles

ANALYTICAL CALCULATIONS

Subject _____

Originator RS Lilla Date 7-9-95

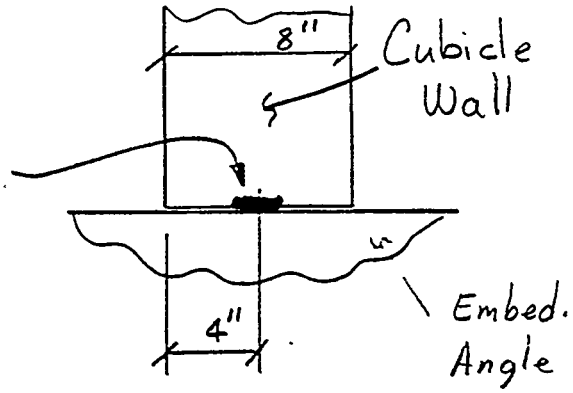
Checker MA ISLAM Date 3/9/95

Weld Check

Note: field walkdown shows undersized and under length welds see attached notes.

Min. weld size is
⅛" fillet - 1.5" long
located @ wall center

$l_w = 1.5"$

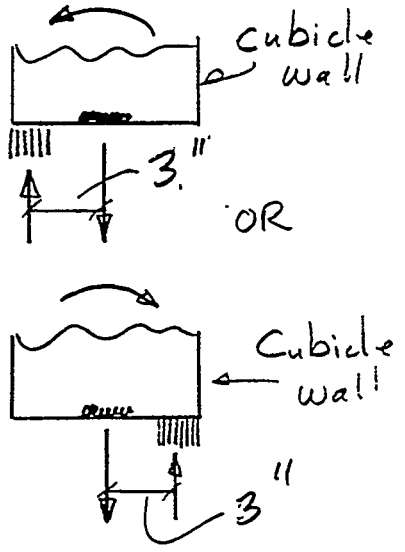


Because the Cubicle Wall is in contact with the Embed Angle the weld will develop only shear & tension stress. An equivalent S_w is calculated based on couple action between the weld in tension & the contact region at either edge:

equivalent S_w

$S_w = bd$
$= 1.5"(3")$
$= 4.5"$

use about 60% for conservatism $4.5(.6) = \underline{2.7}$



ANALYTICAL CALCULATIONS

Page _____ of _____

Subject _____

Originator R A Gill Date 2-9-95

Checker M A ISLAM Date 3/9/95

Weld Check

As-Built weld strength :

$(\frac{1}{8}"\text{weld})(.707)(.3 \times 60000\text{psi})(1.4\text{ factor}) = 2227\ ^{\#}/_{11}$

Welds @ Nodes 282-290 :

$f_w = \sqrt{\left(\frac{F_x}{l_w}\right)^2 + \left(\frac{F_y}{l_w}\right)^2 + \left(\frac{F_z}{l_w}\right)^2} = \sqrt{\left(\frac{306}{1.5}\right)^2 + \left(\frac{423}{1.5}\right)^2 + \left(\frac{438}{1.5}\right)^2}$

$f_w = 454\ ^{\#}/_{11} < 2227\ ^{\#}/_{11}$ O.K.

Weld @ Nodes 202-210 :

$f_w = \sqrt{\left(\frac{F_y}{1.5} + \frac{M_z}{S_w}\right)^2 + \left(\frac{F_x}{1.5}\right)^2 + \left(\frac{F_z}{1.5}\right)^2} = \sqrt{\left(0 + \frac{4910}{2.7}\right)^2 + \left(\frac{226}{1.5}\right)^2 + \left(\frac{286}{1.5}\right)^2}$

$f_w = 1835\ ^{\#}/_{11} < 2227\ ^{\#}/_{11}$

Welds @ Node 212-200 & 302-310 :

$f_w = \sqrt{\left(\frac{F_y}{1.5} + \frac{111_z}{S_w}\right)^2 + \left(\frac{F_x}{1.5}\right)^2 + \left(\frac{F_z}{1.5}\right)^2} = \sqrt{\left(0 + \frac{5395}{2.7}\right)^2 + \left(\frac{292}{1.5}\right)^2 + \left(\frac{319}{1.5}\right)^2}$

$f_w = 2019\ ^{\#}/_{11} < 2227\ ^{\#}/_{11}$ O.K.

$M.S. = \frac{2227}{2019} - 1 = .10$

ANALYTICAL CALCULATIONS

Page _____ of _____

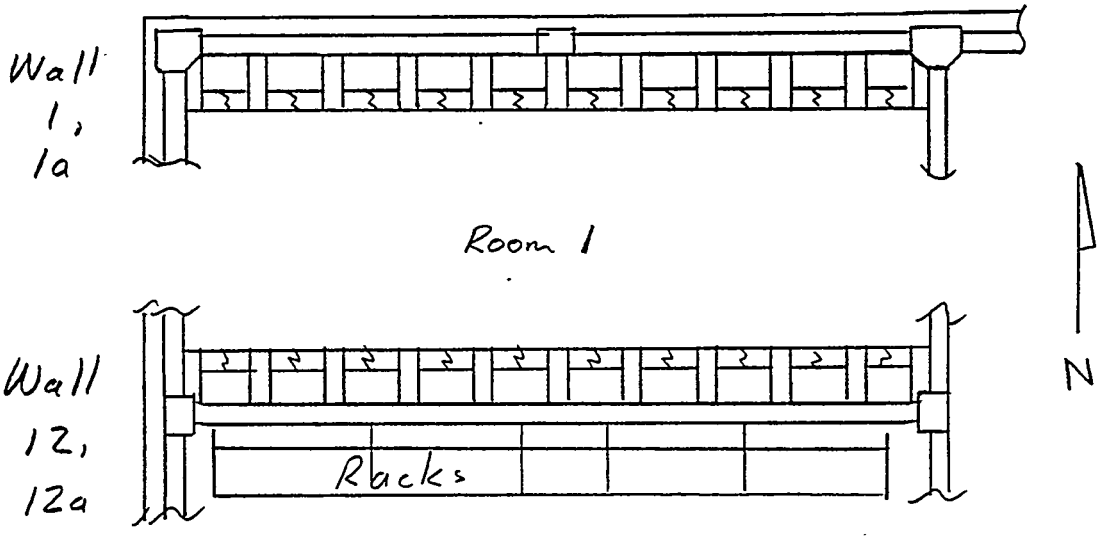
Subject _____

Originator RA Hill Date 1-30-95

Checker MA ISLAM Date 3/9/95

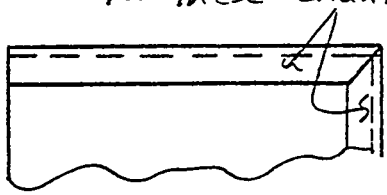
Construction Details

New Type Cubicles
2736 Z Building, Room 1
Drawings H-2-70010, H-2-70011

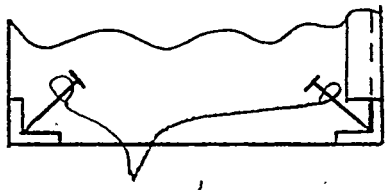


Note: The design drawings for the new type cubicles do not show anchors in all locations. Walls 1 & 12 assume ¼"ϕ anchors are in-place. Walls 1a & 12a assume no anchor at these locations.

anchors are shown for these channels



Cubical Wall



No anchors shown at these locations

ANALYTICAL CALCULATIONS

Page ____ of ____

Subject _____

Originator RA Miller Date 1-26-95

Checker MA ISLAM Date 3/9/95

Self Weight

Panel A	1370#	× 9	=	12330#
Panel D	900#	× 9	=	8100
Panel E	900#	× 9	=	8100
Pedestals	191#	× 18	=	3438
	95#	× 10	=	950
Duct	66#	× 10	=	660
				33578#

Self Wt. North Wall (Room 1)

$$\text{Wall} = 28' \times 10.5' \times \frac{14}{12} \times 150\ pcf = 51450^{\#}$$

$$\text{density} = \frac{51450^{\#}}{8"(126")(336")\,386.4} = .000393\ pci$$

Cubicle = 33578#

$$\text{density} = \frac{33578^{\#}}{8"(20")(96")(9)386.4} = .000629\ pci$$

Self Wt. Interior Wall (Room 1)

$$\text{Wall} = 28' \times 10.5' \times \frac{8}{12} \times 150\ pcf = 29400^{\#}$$

$$\text{density} = \frac{29400}{8"(126")(336")\,386.4} = .000225\ pci$$

Cubicle = 33578#

= .000629 pci

ANALYTICAL CALCULATIONS

Page ____ of ____

Subject _____

Originator R A Gille Date 1-26-95

Checker MA ISLAM Date 3/9/95

Self Weight

Room 2 has Lard-can racks attached to the interior wall. ½ of this mass will be added to the interior wall mass (Wall 12). The remaining ½ of the Lard-can racks is attached to the floor slab and not a part of this analysis.

Lard-can racks:

$1900^{\#}/\text{unit} \times 12 \text{ units} = 22800^{\#}$

(WHC-SD-CP-SA-026 page B22)

$\frac{1}{2} \times 22800 = 11400^{\#}$

$$\text{density} = \frac{11400}{8"(126")(336")\,386.4} = .000087$$

Total density for Wall $= .000087 + .000225 = .000312$

ANALYTICAL CALCULATIONS

Page _____ of _____

Subject _____

Originator RB Hill Date 1-26-95

Checker M.A. ISLAM Date 3/9/95

Computer Density Input

North wall:

$$\frac{51450^{\#}}{(8)(126")(336")\ 386.4} = .000393$$

Interior wall:
& South wall

$$\frac{29400^{\#}}{(8")(126")(336")\ 386.4} = .000312$$

Cubicles:

$$\frac{27092^{\#}}{(8")(96")(20")(9)\ 386.4} = .000507$$

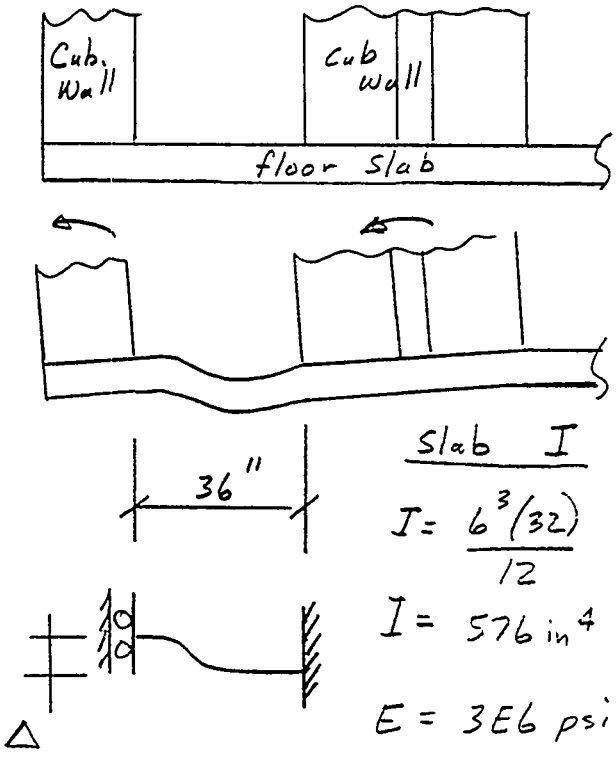
Floor Spring Rate

$$\Delta = \frac{Pl^3}{12EI}$$

$$K = \frac{P}{\Delta}$$

$$K = \frac{12EI}{l^3}$$

$$K = 444{,}444\ \#/in$$



Slab I

$$I = \frac{6^3(32)}{12}$$

$$I = 576\ in^4$$

$$E = 3E6\ psi$$

ANALYTICAL CALCULATIONS

Page _____ of _____

Subject _____

Originator RA Hillis Date 2-10-95

Checker MA ISLAM Date 3/9/95

Modal Response

- From the computer output, the first mode response frequencies are listed below. In both walls the first significant mode in each direction was dominate with 80% or more of the total mass participating. All other modes are well within the rigid region of the spectra curve.

  Note: wall 1 and 1a are the same wall with different support conditions, and wall 12 and 12a are also the identical walls with different supports.

Wall 1,	X-direction	45.42 hz
	Z-direction	22.18 hz
Wall 1a,	X-direction	42.62 hz
	Z-direction	21.89 hz
Wall 12,	X-direction	45.42 hz
	Z-direction	19.73 hz
Wall 12a,	X-direction	42.63 hz
	Z-direction	19.51 hz

- Refering to the In-Building response spectra (Attached), the design seismic acceleration to be used is as follows;

  X-direction @ 42.62 hz = 0.22g

  Z-direction @ 19.51 hz = 0.35g

ANALYTICAL CALCULATIONS

Page ____ of ____

Subject _____

Originator R.A. Miller Date 2-6-95

Checker M.A. ISLAM Date 3/9/95

Wall/Cubical Stresses

Building Wall, Out-of-Plane bending:

224.8 psi (Seismic acceleration stress plot for wall 12a)

4.2 psi (Seismic displacement stress plot for wall 1)

229.0 psi

$$M_u = \sigma S_b = \frac{229(8")^2(5")}{6} = 12213\ "\cdot\#$$

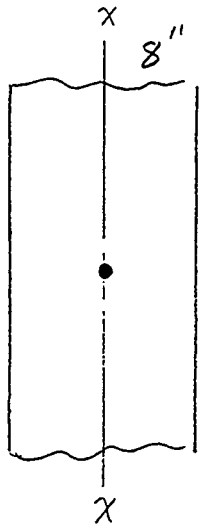
$$\phi M_n = \phi A_s F_y (d - a/2)$$

$$a = \frac{A_s F_y}{.85 f_c' b} = \frac{.11(40)}{.85(3)(5)} = .345"$$

$$\phi M_n = .9(.11)40\left(4 - \frac{.345}{2}\right)1000$$

$$\phi M_n = 15157\ "\cdot\# > 12213\ "\cdot\#$$

$$M.S = \frac{15157}{12213} - 1 = 0.24$$



#3 bars @5" o.c.

d = 4"

ANALYTICAL CALCULATIONS

Page ____ of ____

Subject _____

Originator RA Hill Date 2-10-95

Checker MA ISLAM Date 3/9/95

Wall / Cubicle Stresses Cont.

Building Wall, In-Plane Shear:
(x-direction)

$(51450^{\#} + 33578^{\#}) .22g = 18\,706^{\#}$ shear

$2\sqrt{f_c'}\, b\, d = 280\,434^{\#} > 18\,706^{\#}$

$M.S. = \frac{280\,434}{18\,706} - 1 = 14.0$

Cubicle Wall, In-Plane Shear:
(z-direction)

$\frac{(51450 + 33578) \cdot 35g}{9 \text{ walls}} = 3307^{\#}$

$2\sqrt{f_c'}\, b\, d = 17527^{\#} > 3307^{\#}$

$M.S. \quad \frac{17527}{3307} - 1 = 4.3$

ANALYTICAL CALCULATIONS

Page _____ of _____

Subject _____

Originator R.A. Hillis Date 2-7-95

Checker MA ISLAM Date 3/9/95

Wall / Cubicle Stresses Cont.

Cubicle Wall, In-Plane Bending:

45.7 psi (Seismic acceleration Stress plot for wall 12a)

+10.8 psi (Seismic displacement stress plot for wall 1)

56.5 psi

$$M_u = \sigma S_b = \frac{56.5\,psi\,(20")^2(8")}{6} = 30133\ in.\#$$

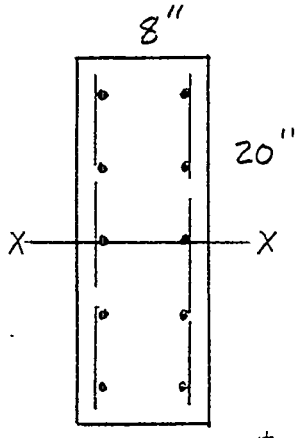
$$\phi M_n = \sum \phi A_s F_y (d - a/2)$$

$$a = \frac{A_s F_y}{.85 f'_c b} = \frac{8(.04)\,40}{.85(3)\,8"} = .627"$$

$$\phi M_n = \phi(.08)40\left[\left(18 - \frac{.627}{2}\right) + \left(14 - \frac{.627}{2}\right) + \left(10 - \frac{.627}{2}\right) + \left(6 - \frac{.627}{2}\right)\right]1000$$

$$\phi M_n = 134{,}630\ in.\# > 30{,}133\ in.\#$$

$$M.S. = \frac{134\,630}{30133} - 1 = 3.4$$



4" x 4" x #4 wire mesh

#4 = .04 si

ANALYTICAL CALCULATIONS

Subject _____

Originator R.A. Kilb Date 2-9-95

Checker MA ISLAM Date 3/9/95

Wall/Cubicle Stresses Cont.

Cubicle Wall, Out-of-Plane Bending:

40.5 psi (Seismic acceleration stress plot, x-direction)

$$M_u = \sigma S_b = \frac{40.5(8)^2 20}{6}$$

$$M_u = 8640\ ''\cdot\#$$

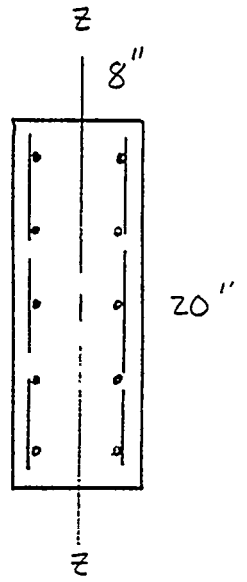
$$\phi M_n = \phi A_s F_y (d - a/2)$$

$$a = \frac{A_s F_y}{.85 f'_c b} = \frac{(5)(.04)(40)}{.85(3)(20)} = .157''$$

$$\phi M_n = .9(.20)40\left(6 - \frac{.157}{2}\right)1000$$

$$\phi M_n = 42635\ ''\cdot\# > 8640\ ''\cdot\#$$

$$M.S = \frac{42635}{8640} - 1 = 3.9$$



4"x4"x #4 wire mesh

$d = 6''$

#4 = .04 si

ANALYTICAL CALCULATIONS

Page _____ of _____

Subject _____

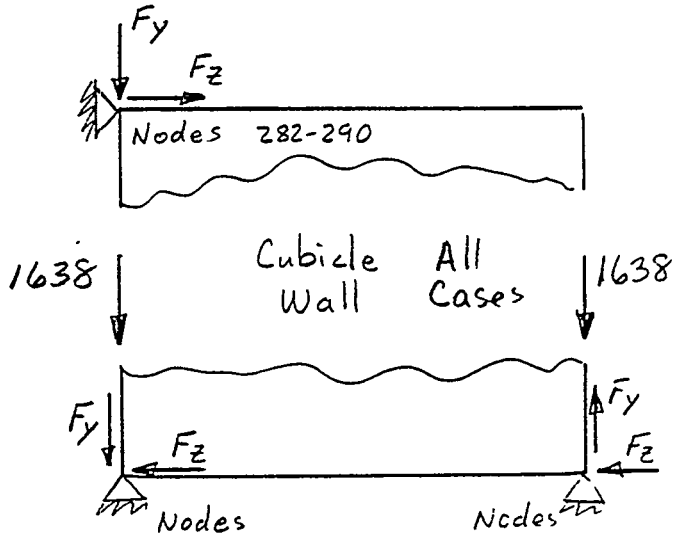
Originator R.A. Hill Date 2-8-95

Checker MA ISLAM Date 3/9/95

Support Reactions

Dead Wt.

1370 #
900
900
764
95
66
4095 #



$.85\,DW - E_V = .8\,DW$

$.8\left(\frac{4095}{2}\right) = 1638^{\#}$

Worst Case Loads

Nodes	Force	DW	Accel	Disp	Total	
202-210	F_x	0	226 #	0	226 #	V
	F_y	1638	860	159	2657	C
	F_z	0	414	17	431	V
	M_z	0	4910 in.#	0	4910 in.#	M
212-220	F_x	0	292	0	292	V
	F_z	0	456	54	510	V
	M_z	0	5395	0	5395	M
302-310	F_y	1638	-749	-338	551	C
282-290	F_x	0	306	0	306	V
	F_y	0	607	184	791	V
	F_z	0	-604	-70	-674	T

ANALYTICAL CALCULATIONS

Page ____ of ____

Subject _____

Originator R A Miller Date 2-10-95

Checker MA ISLAM Date 3/9/95

Floor Anchor Plate

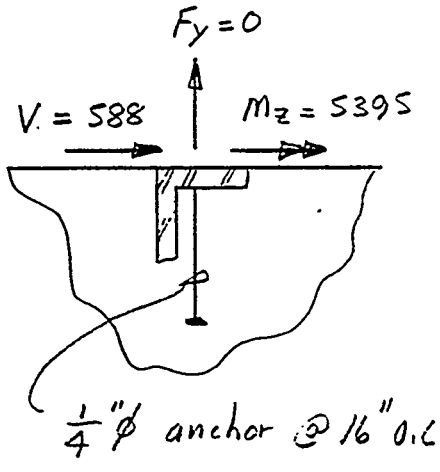
Max tension, F_y = $0^{\#}$

Max shear, $\sqrt{F_x^2 + F_z^2} = \sqrt{292^2 + 510^2}$ = $588^{\#}$

Max moment, M_z = $5395^{\#\cdot}$

Anchor shear:

$$\frac{(11\ \text{Cubicals})\ 588^{\#}}{17\ \text{anch.}} = 380^{\#}/\text{anch.}$$



Anchor tension:

$$\frac{(5395^{\#\cdot})}{16\text{" spacing}} = 337^{\#}/\text{anch}$$

Anchor Capacity:

$T_A = 2205^{\#}$ $V_A = 1874^{\#}$

Bolt Interaction:

$$\frac{T}{T_A} + \frac{V}{V_A} = \frac{380}{2205} + \frac{337}{1874} = .35 < 1.0$$

$$M.S. = \frac{1.0}{.35} - 1 = 1.8$$

$\frac{3}{8}$" Anchor Capacity:

(From floor mounted cubicle analysis)

$T_A = 4950^{\#}$

$V_A = 4208^{\#}$

ANALYTICAL CALCULATIONS

Page _____ of _____

Subject _____

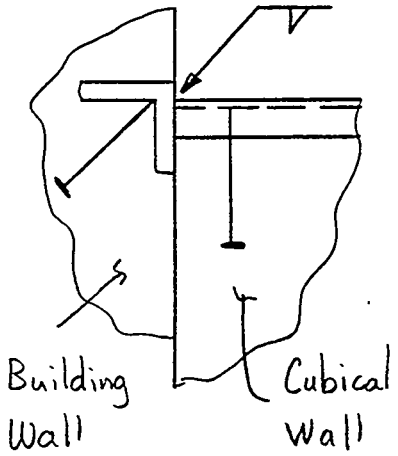
Originator RA Lille Date 2-8-95

Checker MA ISLAM Date 3/9/95

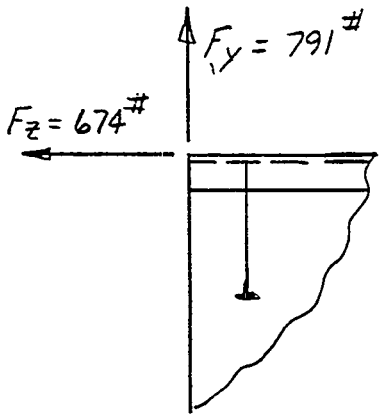
Cubicle Wall Anchors

Max tension, F_z = $674^{\#}$

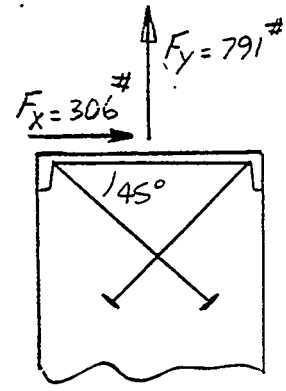
Max shear, F_x & F_y = $306^{\#}$ & $791^{\#}$



Side



Side



End

Tension in anchors:

$$T = (306 \sin 45^\circ)\tfrac{1}{2} + (791 \sin 45^\circ)\tfrac{1}{2} = 388^{\#}$$

Shear in anchors:

$$V = \sqrt{388^2 + \left(\frac{674}{2}\right)^2} = 514^{\#}$$

Bolt Interaction:

$$IC = \frac{T}{T_A} + \frac{V}{V_A} = \frac{388}{4950} + \frac{514}{4208} = .20 < 1.0$$

$$M.S. = \frac{1.0}{.20} - 1 = 4.0$$

ANALYTICAL CALCULATIONS

Page ____ of ____

Subject _____

Originator R A Hill Date 2-9-95

Checker MA ISLAM Date 3/9/95

Weld Check

As-Built weld strength:
2227 #/11

Welds @ Nodes 282-290:

$$f_w = \sqrt{\left(\frac{F_x}{l_w}\right)^2 + \left(\frac{F_y}{l_w}\right)^2 + \left(\frac{F_z}{l_w}\right)^2} = \sqrt{\left(\frac{306}{1.5}\right)^2 + \left(\frac{791}{1.5}\right)^2 + \left(\frac{674}{1.5}\right)^2}$$

$f_w = 722\ \#/11 < 2227\ \#/11$

Welds @ Nodes 202-210:

$$f_w = \sqrt{\left(0 + \frac{M_z}{S_w}\right)^2 + \left(\frac{F_x}{l_w}\right)^2 + \left(\frac{F_z}{l_w}\right)^2} = \sqrt{\left(\frac{4910}{2.7}\right)^2 + \left(\frac{226}{1.5}\right)^2 + \left(\frac{431}{1.5}\right)^2}$$

$f_w = 1847\ \#/11 < 2227\ \#/11$

Welds @ Nodes 212-220 & 302-310:

$$f_w = \sqrt{\left(0 + \frac{M_z}{S_w}\right)^2 + \left(\frac{F_x}{l_w}\right)^2 + \left(\frac{F_z}{l_w}\right)^2} = \sqrt{\left(\frac{5395}{2.7}\right)^2 + \left(\frac{292}{1.5}\right)^2 + \left(\frac{513}{1.5}\right)^2}$$

$f_w = 2036\ \#/11 < 2227\ \#/11$

$$M.S. = \frac{2227}{2036} - 1 = .09$$

Subject _____

Originator RA Gilbert Date 2-9-95

Checker MA ISLAM Date 3/9/95

Margins of Safety

Building Wall Stress:

Out-of-Plane Bending	M.S.	=	0.24
In-Plane Shear	M.S.	=	14.0

Cubicle Wall Stress:

Out-of Plane Bending	M.S.	=	3.9
In-Plane Bending	M.S	=	2.2
In-Plane Shear	M.S.	=	4.3

Anchor Loads:

Floor Plate Anchors	M.S.	=	1.8
Wall Angle Anchors	M.S	=	3.5

Welds

@ Connections (As-Build)	M.S	=	.09

Vault #1 and #4 Weld Examinations
K6058

1. Dwg H-2-26649: The welding of the PU storage racks, top and bottom, look acceptable.

   Finding: No detrimental conditions were noted.

2. Dwg. H-2-26654: View 69, elevation at 0'0" and elevation at 8'1": Completed weld examination of welds in vaults 1 and 4 as shown on the referenced detail.
   NOTE: Size of these welds could not be accurately measured due to presence of a thick coating of paint on welds. Paint may also mask defects such as cracks or porosity. Because of this, the following is an observation based on those things visible and past weld examination experience.

   Findings: Vault 1, Row E, G and F storage cubicles welds appear to meet the requirements of structural welding codes. These welds appear to be approximately 1/4" in size with no severe undercut.

   Findings: Vault 4, Rows D, H and G storage cubicle welds **do not** appear to meet structural welding codes or requirements for weld size and length shown on the referenced drawing detail weld symbol. These welds appear smaller than the required 3/16" size. Actual size for most of these welds appears to be approximately 1/8". Most of the welds at the 0'0" level show large areas of undercut and/or underfill. At the 8'1" level most welds are short, not a full 3" in length as required. These short welds very from 1 1/2" to 2 1/2" long.

See attached drawings for welds examined. Welds and areas examined are circled in red ink.

During installation of IAEA security racks in Vault #3 in the near future, welds in those areas will be examined to determine that conditions noted in vault #4 do not exist there. Should Vault #3 welds appear to be of poor quality, an additional report will be made and forwarded to Mr. Ocoma and Mr. Bonadie.

Weld examinations were performed by HF Morris of PFP QA.
This report completed by RR Thorne of PFP QA.

Original is signed as below:
Signature of Examiner Hope F.Morris HF Morris 1-30-95 Date 1-30-95

Signature of preparer Rodney R. Thorne Date 1-30-95

** CC:
EP BONADIE
EC OCOMA

ANALYTICAL CALCULATIONS

Subject _____

Originator RA Hill Date 2-10-95

Checker MA ISLAM Date 3/9/95

Computer Printout

Geometry,	pages
Walls 1, 1a, 12, 12a, 3, 34, & 4.	~~A2 - A12~~ C-177 — C187
Modal Results	pages
Walls 1, 1a, 12, 12a, 3, 34, & 4.	~~A13 - A40~~ C188 — C215
Stress Reactions	pages
Walls 1, 1a, 12, 12a, 3, 34, & 4.	~~A41 - A62~~ C216 - C237
Stress Reactions, X-Direction	pages
All Walls	~~A63 - A66~~ C238 — C241
Seismic Displacement Reactions	pages
All Walls	~~A67 - A74~~ C242 — C249

Geometry Walls 1, 1a, 12, 12a, 3, & 4

LIST ELEMENT TYPES FROM 1 TO 2 BY 1

ELEMENT TYPE 1 IS SHELL63 ELASTIC SHELL INOPR
KEYOPT(1-12)= 0 0 0 0 0 0 0 0 0 0 0 0 . 0

ELEMENT TYPE 2 IS LINK8 3-D SPAR (OR TRUSS) INOPR
KEYOPT(1-12)= 0 0 0 0 0 0 0 0 0 0 0 0 0

LIST REAL SETS 1 TO 2 BY 1

REAL CONSTANT SET 1 ITEMS 1 TO 6
8.0000 0.00000E+00 0.00000E+00 0.00000E+00 0.00000E+00 0.00000E+00

REAL CONSTANT SET 2 ITEMS 1 TO 6
0.46000E-01 0.00000E+00 0.00000E+00 0.00000E+00 0.00000E+00 0.00000E+00

LIST ALL SELECTED NODES. DSYS= 0

NODE	X	Y	Z	THXY	THYZ	THZX
1	0.00000E+00	0.00000E+00	0.00000E+00	0.00	0.00	0.00
2	32.000	0.00000E+00	0.00000E+00	0.00	0.00	0.00
3	64.000	0.00000E+00	0.00000E+00	0.00	0.00	0.00
4	96.000	0.00000E+00	0.00000E+00	0.00	0.00	0.00
5	128.00	0.00000E+00	0.00000E+00	0.00	0.00	0.00
6	160.00	0.00000E+00	0.00000E+00	0.00	0.00	0.00
7	192.00	0.00000E+00	0.00000E+00	0.00	0.00	0.00
8	224.00	0.00000E+00	0.00000E+00	0.00	0.00	0.00
9	256.00	0.00000E+00	0.00000E+00	0.00	0.00	0.00
10	288.00	0.00000E+00	0.00000E+00	0.00	0.00	0.00
11	320.00	0.00000E+00	0.00000E+00	0.00	0.00	0.00
21	0.00000E+00	24.000	0.00000E+00	0.00	0.00	0.00
22	32.000	24.000	0.00000E+00	0.00	0.00	0.00
23	64.000	24.000	0.00000E+00	0.00	0.00	0.00
24	96.000	24.000	0.00000E+00	0.00	0.00	0.00
25	128.00	24.000	0.00000E+00	0.00	0.00	0.00
26	160.00	24.000	0.00000E+00	0.00	0.00	0.00
27	192.00	24.000	0.00000E+00	0.00	0.00	0.00
28	224.00	24.000	0.00000E+00	0.00	0.00	0.00
29	256.00	24.000	0.00000E+00	0.00	0.00	0.00
30	288.00	24.000	0.00000E+00	0.00	0.00	0.00
31	320.00	24.000	0.00000E+00	0.00	0.00	0.00
41	0.00000E+00	48.000	0.00000E+00	0.00	0.00	0.00
42	32.000	48.000	0.00000E+00	0.00	0.00	0.00
43	64.000	48.000	0.00000E+00	0.00	0.00	0.00
44	96.000	48.000	0.00000E+00	0.00	0.00	0.00
45	128.00	48.000	0.00000E+00	0.00	0.00	0.00
46	160.00	48.000	0.00000E+00	0.00	0.00	0.00
47	192.00	48.000	0.00000E+00	0.00	0.00	0.00
48	224.00	48.000	0.00000E+00	0.00	0.00	0.00
49	256.00	48.000	0.00000E+00	0.00	0.00	0.00
50	288.00	48.000	0.00000E+00	0.00	0.00	0.00
51	320.00	48.000	0.00000E+00	0.00	0.00	0.00
61	0.00000E+00	72.000	0.00000E+00	0.00	0.00	0.00
62	32.000	72.000	0.00000E+00	0.00	0.00	0.00
63	64.000	72.000	0.00000E+00	0.00	0.00	0.00
64	96.000	72.000	0.00000E+00	0.00	0.00	0.00
65	128.00	72.000	0.00000E+00	0.00	0.00	0.00
66	160.00	72.000	0.00000E+00	0.00	0.00	0.00
67	192.00	72.000	0.00000E+00	0.00	0.00	0.00

NODE	X	Y	Z	THXY	THYZ	THZX
68	224.00	72.000	0.00000E+00	0.00	0.00	0.00
69	256.00	72.000	0.00000E+00	0.00	0.00	0.00
70	288.00	72.000	0.00000E+00	0.00	0.00	0.00
71	320.00	72.000	0.00000E+00	0.00	0.00	0.00
81	0.00000E+00	96.000	0.00000E+00	0.00	0.00	0.00
82	32.000	96.000	0.00000E+00	0.00	0.00	0.00
83	64.000	96.000	0.00000E+00	0.00	0.00	0.00
84	96.000	96.000	0.00000E+00	0.00	0.00	0.00
85	128.00	96.000	0.00000E+00	0.00	0.00	0.00
86	160.00	96.000	0.00000E+00	0.00	0.00	0.00
87	192.00	96.000	0.00000E+00	0.00	0.00	0.00
88	224.00	96.000	0.00000E+00	0.00	0.00	0.00
89	256.00	96.000	0.00000E+00	0.00	0.00	0.00
90	288.00	96.000	0.00000E+00	0.00	0.00	0.00
91	320.00	96.000	0.00000E+00	0.00	0.00	0.00
101	0.00000E+00	126.00	0.00000E+00	0.00	0.00	0.00
102	32.000	126.00	0.00000E+00	0.00	0.00	0.00
103	64.000	126.00	0.00000E+00	0.00	0.00	0.00
104	96.000	126.00	0.00000E+00	0.00	0.00	0.00
105	128.00	126.00	0.00000E+00	0.00	0.00	0.00
106	160.00	126.00	0.00000E+00	0.00	0.00	0.00
107	192.00	126.00	0.00000E+00	0.00	0.00	0.00
108	224.00	126.00	0.00000E+00	0.00	0.00	0.00
109	256.00	126.00	0.00000E+00	0.00	0.00	0.00
110	288.00	126.00	0.00000E+00	0.00	0.00	0.00
111	320.00	126.00	0.00000E+00	0.00	0.00	0.00
202	32.000	0.00000E+00	0.00000E+00	0.00	0.00	0.00
203	64.000	0.00000E+00	0.00000E+00	0.00	0.00	0.00
204	96.000	0.00000E+00	0.00000E+00	0.00	0.00	0.00
205	128.00	0.00000E+00	0.00000E+00	0.00	0.00	0.00
206	160.00	0.00000E+00	0.00000E+00	0.00	0.00	0.00
207	192.00	0.00000E+00	0.00000E+00	0.00	0.00	0.00
208	224.00	0.00000E+00	0.00000E+00	0.00	0.00	0.00
209	256.00	0.00000E+00	0.00000E+00	0.00	0.00	0.00
210	288.00	0.00000E+00	0.00000E+00	0.00	0.00	0.00
212	32.000	0.00000E+00	20.000	0.00	0.00	0.00
213	64.000	0.00000E+00	20.000	0.00	0.00	0.00
214	96.000	0.00000E+00	20.000	0.00	0.00	0.00
215	128.00	0.00000E+00	20.000	0.00	0.00	0.00
216	160.00	0.00000E+00	20.000	0.00	0.00	0.00
217	192.00	0.00000E+00	20.000	0.00	0.00	0.00
218	224.00	0.00000E+00	20.000	0.00	0.00	0.00
219	256.00	0.00000E+00	20.000	0.00	0.00	0.00
220	288.00	0.00000E+00	20.000	0.00	0.00	0.00
222	32.000	24.000	0.00000E+00	0.00	0.00	0.00
223	64.000	24.000	0.00000E+00	0.00	0.00	0.00
224	96.000	24.000	0.00000E+00	0.00	0.00	0.00
225	128.00	24.000	0.00000E+00	0.00	0.00	0.00
226	160.00	24.000	0.00000E+00	0.00	0.00	0.00
227	192.00	24.000	0.00000E+00	0.00	0.00	0.00
228	224.00	24.000	0.00000E+00	0.00	0.00	0.00
229	256.00	24.000	0.00000E+00	0.00	0.00	0.00
230	288.00	24.000	0.00000E+00	0.00	0.00	0.00
232	32.000	24.000	20.000	0.00	0.00	0.00
233	64.000	24.000	20.000	0.00	0.00	0.00
234	96.000	24.000	20.000	0.00	0.00	0.00
235	128.00	24.000	20.000	0.00	0.00	0.00
236	160.00	24.000	20.000	0.00	0.00	0.00
237	192.00	24.000	20.000	0.00	0.00	0.00
238	224.00	24.000	20.000	0.00	0.00	0.00

NODE	X	Y	Z	THXY	THYZ	THZX
239	256.00	24.000	20.000	0.00	0.00	0.00
240	288.00	24.000	20.000	0.00	0.00	0.00
242	32.000	48.000	0.00000E+00	0.00	0.00	0.00
243	64.000	48.000	0.00000E+00	0.00	0.00	0.00
244	96.000	48.000	0.00000E+00	0.00	0.00	0.00
245	128.00	48.000	0.00000E+00	0.00	0.00	0.00
246	160.00	48.000	0.00000E+00	0.00	0.00	0.00
247	192.00	48.000	0.00000E+00	0.00	0.00	0.00
248	224.00	48.000	0.00000E+00	0.00	0.00	0.00
249	256.00	48.000	0.00000E+00	0.00	0.00	0.00
250	288.00	48.000	0.00000E+00	0.00	0.00	0.00
252	32.000	48.000	20.000	0.00	0.00	0.00
253	64.000	48.000	20.000	0.00	0.00	0.00
254	96.000	48.000	20.000	0.00	0.00	0.00
255	128.00	48.000	20.000	0.00	0.00	0.00
256	160.00	48.000	20.000	0.00	0.00	0.00
257	192.00	48.000	20.000	0.00	0.00	0.00
258	224.00	48.000	20.000	0.00	0.00	0.00
259	256.00	48.000	20.000	0.00	0.00	0.00
260	288.00	48.000	20.000	0.00	0.00	0.00
262	32.000	72.000	0.00000E+00	0.00	0.00	0.00
263	64.000	72.000	0.00000E+00	0.00	0.00	0.00
264	96.000	72.000	0.00000E+00	0.00	0.00	0.00
265	128.00	72.000	0.00000E+00	0.00	0.00	0.00
266	160.00	72.000	0.00000E+00	0.00	0.00	0.00
267	192.00	72.000	0.00000E+00	0.00	0.00	0.00
268	224.00	72.000	0.00000E+00	0.00	0.00	0.00
269	256.00	72.000	0.00000E+00	0.00	0.00	0.00
270	288.00	72.000	0.00000E+00	0.00	0.00	0.00
272	32.000	72.000	20.000	0.00	0.00	0.00
273	64.000	72.000	20.000	0.00	0.00	0.00
274	96.000	72.000	20.000	0.00	0.00	0.00
275	128.00	72.000	20.000	0.00	0.00	0.00
276	160.00	72.000	20.000	0.00	0.00	0.00
277	192.00	72.000	20.000	0.00	0.00	0.00
278	224.00	72.000	20.000	0.00	0.00	0.00
279	256.00	72.000	20.000	0.00	0.00	0.00
280	288.00	72.000	20.000	0.00	0.00	0.00
282	32.000	96.000	0.00000E+00	0.00	0.00	0.00
283	64.000	96.000	0.00000E+00	0.00	0.00	0.00
284	96.000	96.000	0.00000E+00	0.00	0.00	0.00
285	128.00	96.000	0.00000E+00	0.00	0.00	0.00
286	160.00	96.000	0.00000E+00	0.00	0.00	0.00
287	192.00	96.000	0.00000E+00	0.00	0.00	0.00
288	224.00	96.000	0.00000E+00	0.00	0.00	0.00
289	256.00	96.000	0.00000E+00	0.00	0.00	0.00
290	288.00	96.000	0.00000E+00	0.00	0.00	0.00
292	32.000	96.000	20.000	0.00	0.00	0.00
293	64.000	96.000	20.000	0.00	0.00	0.00
294	96.000	96.000	20.000	0.00	0.00	0.00
295	128.00	96.000	20.000	0.00	0.00	0.00
296	160.00	96.000	20.000	0.00	0.00	0.00
297	192.00	96.000	20.000	0.00	0.00	0.00
298	224.00	96.000	20.000	0.00	0.00	0.00
299	256.00	96.000	20.000	0.00	0.00	0.00
300	288.00	96.000	20.000	0.00	0.00	0.00
302	32.000	-3.0000	20.000	0.00	0.00	0.00
303	64.000	-3.0000	20.000	0.00	0.00	0.00
304	96.000	-3.0000	20.000	0.00	0.00	0.00
305	128.00	-3.0000	20.000	0.00	0.00	0.00
306	160.00	-3.0000	20.000	0.00	0.00	0.00
307	192.00	-3.0000	20.000	0.00	0.00	0.00
308	224.00	-3.0000	20.000	0.00	0.00	0.00
309	256.00	-3.0000	20.000	0.00	0.00	0.00
310	288.00	-3.0000	20.000	0.00	0.00	0.00

LIST ALL SELECTED ELEMENTS. (LIST NODES)

ELEM	MAT	TYP	REL	ESY	NODES			
1	1	1	1	0	1	2	22	21
2	1	1	1	0	2	3	23	22
3	1	1	1	0	3	4	24	23
4	1	1	1	0	4	5	25	24
5	1	1	1	0	5	6	26	25
6	1	1	1	0	6	7	27	26
7	1	1	1	0	7	8	28	27
8	1	1	1	0	8	9	29	28
9	1	1	1	0	9	10	30	29
10	1	1	1	0	10	11	31	30
11	1	1	1	0	21	22	42	41
12	1	1	1	0	22	23	43	42
13	1	1	1	0	23	24	44	43
14	1	1	1	0	24	25	45	44
15	1	1	1	0	25	26	46	45
16	1	1	1	0	26	27	47	46
17	1	1	1	0	27	28	48	47
18	1	1	1	0	28	29	49	48
19	1	1	1	0	29	30	50	49
20	1	1	1	0	30	31	51	50
21	1	1	1	0	41	42	62	61
22	1	1	1	0	42	43	63	62
23	1	1	1	0	43	44	64	63
24	1	1	1	0	44	45	65	64
25	1	1	1	0	45	46	66	65
26	1	1	1	0	46	47	67	66
27	1	1	1	0	47	48	68	67
28	1	1	1	0	48	49	69	68
29	1	1	1	0	49	50	70	69
30	1	1	1	0	50	51	71	70
31	1	1	1	0	61	62	82	81
32	1	1	1	0	62	63	83	82
33	1	1	1	0	63	64	84	83
34	1	1	1	0	64	65	85	84
35	1	1	1	0	65	66	86	85
36	1	1	1	0	66	67	87	86
37	1	1	1	0	67	68	88	87
38	1	1	1	0	68	69	89	88
39	1	1	1	0	69	70	90	89
40	1	1	1	0	70	71	91	90
41	1	1	1	0	81	82	102	101
42	1	1	1	0	82	83	103	102
43	1	1	1	0	83	84	104	103
44	1	1	1	0	84	85	105	104
45	1	1	1	0	85	86	106	105
46	1	1	1	0	86	87	107	106
47	1	1	1	0	87	88	108	107
48	1	1	1	0	88	89	109	108
49	1	1	1	0	89	90	110	109
50	1	1	1	0	90	91	111	110
51	2	1	1	0	202	212	232	222
52	2	1	1	0	203	213	233	223
53	2	1	1	0	204	214	234	224
54	2	1	1	0	205	215	235	225
55	2	1	1	0	206	216	236	226
56	2	1	1	0	207	217	237	227
57	2	1	1	0	208	218	238	228
58	2	1	1	0	209	219	239	229
59	2	1	1	0	210	220	240	230
60	2	1	1	0	222	232	252	242

ELEM	MAT	TYP	REL	ESY	NODES			
61	2	1	1	0	223	233	253	243
62	2	1	1	0	224	234	254	244
63	2	1	1	0	225	235	255	245
64	2	1	1	0	226	236	256	246
65	2	1	1	0	227	237	257	247
66	2	1	1	0	228	238	258	248
67	2	1	1	0	229	239	259	249
68	2	1	1	0	230	240	260	250
69	2	1	1	0	242	252	272	262
70	2	1	1	0	243	253	273	263
71	2	1	1	0	244	254	274	264
72	2	1	1	0	245	255	275	265
73	2	1	1	0	246	256	276	266
74	2	1	1	0	247	257	277	267
75	2	1	1	0	248	258	278	268
76	2	1	1	0	249	259	279	269
77	2	1	1	0	250	260	280	270
78	2	1	1	0	262	272	292	282
79	2	1	1	0	263	273	293	283
80	2	1	1	0	264	274	294	284
81	2	1	1	0	265	275	295	285
82	2	1	1	0	266	276	296	286
83	2	1	1	0	267	277	297	287
84	2	1	1	0	268	278	298	288
85	2	1	1	0	269	279	299	289
86	2	1	1	0	270	280	300	290
87	3	2	2	0	302	212		
88	3	2	2	0	303	213		
89	3	2	2	0	304	214		
90	3	2	2	0	305	215		
91	3	2	2	0	306	216		
92	3	2	2	0	307	217		
93	3	2	2	0	308	218		
94	3	2	2	0	309	219		
95	3	2	2	0	310	220		

Geometry Wall 34

LIST ELEMENT TYPES FROM 1 TO 2 BY 1

ELEMENT TYPE 1 IS SHELL63 ELASTIC SHELL INOPR
KEYOPT(1-12)= 0 0 0 0 0 0 0 0 0 0 0 0 0

ELEMENT TYPE 2 IS LINK8 3-D SPAR (OR TRUSS) INOPR
KEYOPT(1-12)= 0 0 0 0 0 0 0 0 0 0 0 0 0

LIST REAL SETS 1 TO 2 BY 1

REAL CONSTANT SET 1 ITEMS 1 TO 6
8.0000 0.00000E+00 0.00000E+00 0.00000E+00 0.00000E+00 0.00000E+00

REAL CONSTANT SET 2 ITEMS 1 TO 6
0.46000E-01 0.00000E+00 0.00000E+00 0.00000E+00 0.00000E+00 0.00000E+00

LIST ALL SELECTED NODES. DSYS= 0

NODE	X	Y	Z	THXY	THYZ	THZX
1	0.00000E+00	0.00000E+00	0.00000E+00	0.00	0.00	0.00
2	32.000	0.00000E+00	0.00000E+00	0.00	0.00	0.00
3	64.000	0.00000E+00	0.00000E+00	0.00	0.00	0.00
4	96.000	0.00000E+00	0.00000E+00	0.00	0.00	0.00
5	128.00	0.00000E+00	0.00000E+00	0.00	0.00	0.00
6	160.00	0.00000E+00	0.00000E+00	0.00	0.00	0.00
7	192.00	0.00000E+00	0.00000E+00	0.00	0.00	0.00
8	224.00	0.00000E+00	0.00000E+00	0.00	0.00	0.00
9	256.00	0.00000E+00	0.00000E+00	0.00	0.00	0.00
10	288.00	0.00000E+00	0.00000E+00	0.00	0.00	0.00
11	320.00	0.00000E+00	0.00000E+00	0.00	0.00	0.00
21	0.00000E+00	24.000	0.00000E+00	0.00	0.00	0.00
22	32.000	24.000	0.00000E+00	0.00	0.00	0.00
23	64.000	24.000	0.00000E+00	0.00	0.00	0.00
24	96.000	24.000	0.00000E+00	0.00	0.00	0.00
25	128.00	24.000	0.00000E+00	0.00	0.00	0.00
26	160.00	24.000	0.00000E+00	0.00	0.00	0.00
27	192.00	24.000	0.00000E+00	0.00	0.00	0.00
28	224.00	24.000	0.00000E+00	0.00	0.00	0.00
29	256.00	24.000	0.00000E+00	0.00	0.00	0.00
30	288.00	24.000	0.00000E+00	0.00	0.00	0.00
31	320.00	24.000	0.00000E+00	0.00	0.00	0.00
41	0.00000E+00	48.000	0.00000E+00	0.00	0.00	0.00
42	32.000	48.000	0.00000E+00	0.00	0.00	0.00
43	64.000	48.000	0.00000E+00	0.00	0.00	0.00
44	96.000	48.000	0.00000E+00	0.00	0.00	0.00
45	128.00	48.000	0.00000E+00	0.00	0.00	0.00
46	160.00	48.000	0.00000E+00	0.00	0.00	0.00
47	192.00	48.000	0.00000E+00	0.00	0.00	0.00
48	224.00	48.000	0.00000E+00	0.00	0.00	0.00
49	256.00	48.000	0.00000E+00	0.00	0.00	0.00
50	288.00	48.000	0.00000E+00	0.00	0.00	0.00
51	320.00	48.000	0.00000E+00	0.00	0.00	0.00
61	0.00000E+00	72.000	0.00000E+00	0.00	0.00	0.00
62	32.000	72.000	0.00000E+00	0.00	0.00	0.00
63	64.000	72.000	0.00000E+00	0.00	0.00	0.00
64	96.000	72.000	0.00000E+00	0.00	0.00	0.00
65	128.00	72.000	0.00000E+00	0.00	0.00	0.00
66	160.00	72.000	0.00000E+00	0.00	0.00	0.00
67	192.00	72.000	0.00000E+00	0.00	0.00	0.00

NODE	X	Y	Z	THXY	THYZ	THZX
68	224.00	72.000	0.00000E+00	0.00	0.00	0.00
69	256.00	72.000	0.00000E+00	0.00	0.00	0.00
70	288.00	72.000	0.00000E+00	0.00	0.00	0.00
71	320.00	72.000	0.00000E+00	0.00	0.00	0.00
81	0.00000E+00	96.000	0.00000E+00	0.00	0.00	0.00
82	32.000	96.000	0.00000E+00	0.00	0.00	0.00
83	64.000	96.000	0.00000E+00	0.00	0.00	0.00
84	96.000	96.000	0.00000E+00	0.00	0.00	0.00
85	128.00	96.000	0.00000E+00	0.00	0.00	0.00
86	160.00	96.000	0.00000E+00	0.00	0.00	0.00
87	192.00	96.000	0.00000E+00	0.00	0.00	0.00
88	224.00	96.000	0.00000E+00	0.00	0.00	0.00
89	256.00	96.000	0.00000E+00	0.00	0.00	0.00
90	288.00	96.000	0.00000E+00	0.00	0.00	0.00
91	320.00	96.000	0.00000E+00	0.00	0.00	0.00
101	0.00000E+00	126.00	0.00000E+00	0.00	0.00	0.00
102	32.000	126.00	0.00000E+00	0.00	0.00	0.00
103	64.000	126.00	0.00000E+00	0.00	0.00	0.00
104	96.000	126.00	0.00000E+00	0.00	0.00	0.00
105	128.00	126.00	0.00000E+00	0.00	0.00	0.00
106	160.00	126.00	0.00000E+00	0.00	0.00	0.00
107	192.00	126.00	0.00000E+00	0.00	0.00	0.00
108	224.00	126.00	0.00000E+00	0.00	0.00	0.00
109	256.00	126.00	0.00000E+00	0.00	0.00	0.00
110	288.00	126.00	0.00000E+00	0.00	0.00	0.00
111	320.00	126.00	0.00000E+00	0.00	0.00	0.00
202	32.000	0.00000E+00	20.000	0.00	0.00	0.00
203	64.000	0.00000E+00	20.000	0.00	0.00	0.00
204	96.000	0.00000E+00	20.000	0.00	0.00	0.00
205	128.00	0.00000E+00	20.000	0.00	0.00	0.00
206	160.00	0.00000E+00	20.000	0.00	0.00	0.00
207	192.00	0.00000E+00	20.000	0.00	0.00	0.00
208	224.00	0.00000E+00	20.000	0.00	0.00	0.00
209	256.00	0.00000E+00	20.000	0.00	0.00	0.00
210	288.00	0.00000E+00	20.000	0.00	0.00	0.00
222	32.000	24.000	20.000	0.00	0.00	0.00
223	64.000	24.000	20.000	0.00	0.00	0.00
224	96.000	24.000	20.000	0.00	0.00	0.00
225	128.00	24.000	20.000	0.00	0.00	0.00
226	160.00	24.000	20.000	0.00	0.00	0.00
227	192.00	24.000	20.000	0.00	0.00	0.00
228	224.00	24.000	20.000	0.00	0.00	0.00
229	256.00	24.000	20.000	0.00	0.00	0.00
230	288.00	24.000	20.000	0.00	0.00	0.00
242	32.000	48.000	20.000	0.00	0.00	0.00
243	64.000	48.000	20.000	0.00	0.00	0.00
244	96.000	48.000	20.000	0.00	0.00	0.00
245	128.00	48.000	20.000	0.00	0.00	0.00
246	160.00	48.000	20.000	0.00	0.00	0.00
247	192.00	48.000	20.000	0.00	0.00	0.00
248	224.00	48.000	20.000	0.00	0.00	0.00
249	256.00	48.000	20.000	0.00	0.00	0.00
250	288.00	48.000	20.000	0.00	0.00	0.00
262	32.000	72.000	20.000	0.00	0.00	0.00
263	64.000	72.000	20.000	0.00	0.00	0.00
264	96.000	72.000	20.000	0.00	0.00	0.00
265	128.00	72.000	20.000	0.00	0.00	0.00
266	160.00	72.000	20.000	0.00	0.00	0.00
267	192.00	72.000	20.000	0.00	0.00	0.00
268	224.00	72.000	20.000	0.00	0.00	0.00

NODE	X	Y	Z	THXY	THYZ	THZX
269	256.00	72.000	20.000	0.00	0.00	0.00
270	288.00	72.000	20.000	0.00	0.00	0.00
282	32.000	96.000	20.000	0.00	0.00	0.00
283	64.000	96.000	20.000	0.00	0.00	0.00
284	96.000	96.000	20.000	0.00	0.00	0.00
285	128.00	96.000	20.000	0.00	0.00	0.00
286	160.00	96.000	20.000	0.00	0.00	0.00
287	192.00	96.000	20.000	0.00	0.00	0.00
288	224.00	96.000	20.000	0.00	0.00	0.00
289	256.00	96.000	20.000	0.00	0.00	0.00
290	288.00	96.000	20.000	0.00	0.00	0.00
302	32.000	0.00000E+00	-20.000	0.00	0.00	0.00
303	64.000	0.00000E+00	-20.000	0.00	0.00	0.00
304	96.000	0.00000E+00	-20.000	0.00	0.00	0.00
305	128.00	0.00000E+00	-20.000	0.00	0.00	0.00
306	160.00	0.00000E+00	-20.000	0.00	0.00	0.00
307	192.00	0.00000E+00	-20.000	0.00	0.00	0.00
308	224.00	0.00000E+00	-20.000	0.00	0.00	0.00
309	256.00	0.00000E+00	-20.000	0.00	0.00	0.00
310	288.00	0.00000E+00	-20.000	0.00	0.00	0.00
322	32.000	24.000	-20.000	0.00	0.00	0.00
323	64.000	24.000	-20.000	0.00	0.00	0.00
324	96.000	24.000	-20.000	0.00	0.00	0.00
325	128.00	24.000	-20.000	0.00	0.00	0.00
326	160.00	24.000	-20.000	0.00	0.00	0.00
327	192.00	24.000	-20.000	0.00	0.00	0.00
328	224.00	24.000	-20.000	0.00	0.00	0.00
329	256.00	24.000	-20.000	0.00	0.00	0.00
330	288.00	24.000	-20.000	0.00	0.00	0.00
342	32.000	48.000	-20.000	0.00	0.00	0.00
343	64.000	48.000	-20.000	0.00	0.00	0.00
344	96.000	48.000	-20.000	0.00	0.00	0.00
345	128.00	48.000	-20.000	0.00	0.00	0.00
346	160.00	48.000	-20.000	0.00	0.00	0.00
347	192.00	48.000	-20.000	0.00	0.00	0.00
348	224.00	48.000	-20.000	0.00	0.00	0.00
349	256.00	48.000	-20.000	0.00	0.00	0.00
350	288.00	48.000	-20.000	0.00	0.00	0.00
362	32.000	72.000	-20.000	0.00	0.00	0.00
363	64.000	72.000	-20.000	0.00	0.00	0.00
364	96.000	72.000	-20.000	0.00	0.00	0.00
365	128.00	72.000	-20.000	0.00	0.00	0.00
366	160.00	72.000	-20.000	0.00	0.00	0.00
367	192.00	72.000	-20.000	0.00	0.00	0.00
368	224.00	72.000	-20.000	0.00	0.00	0.00
369	256.00	72.000	-20.000	0.00	0.00	0.00
370	288.00	72.000	-20.000	0.00	0.00	0.00
382	32.000	96.000	-20.000	0.00	0.00	0.00
383	64.000	96.000	-20.000	0.00	0.00	0.00
384	96.000	96.000	-20.000	0.00	0.00	0.00
385	128.00	96.000	-20.000	0.00	0.00	0.00
386	160.00	96.000	-20.000	0.00	0.00	0.00
387	192.00	96.000	-20.000	0.00	0.00	0.00
388	224.00	96.000	-20.000	0.00	0.00	0.00
389	256.00	96.000	-20.000	0.00	0.00	0.00
390	288.00	96.000	-20.000	0.00	0.00	0.00
502	32.000	-3.0000	20.000	0.00	0.00	0.00
503	64.000	-3.0000	20.000	0.00	0.00	0.00
504	96.000	-3.0000	20.000	0.00	0.00	0.00
505	128.00	-3.0000	20.000	0.00	0.00	0.00

NODE	X	Y	Z	THXY	THYZ	THZX
506	160.00	-3.0000	20.000	0.00	0.00	0.00
507	192.00	-3.0000	20.000	0.00	0.00	0.00
508	224.00	-3.0000	20.000	0.00	0.00	0.00
509	256.00	-3.0000	20.000	0.00	0.00	0.00
510	288.00	-3.0000	20.000	0.00	0.00	0.00
552	32.000	-3.0000	-20.000	0.00	0.00	0.00
553	64.000	-3.0000	-20.000	0.00	0.00	0.00
554	96.000	-3.0000	-20.000	0.00	0.00	0.00
555	128.00	-3.0000	-20.000	0.00	0.00	0.00
556	160.00	-3.0000	-20.000	0.00	0.00	0.00
557	192.00	-3.0000	-20.000	0.00	0.00	0.00
558	224.00	-3.0000	-20.000	0.00	0.00	0.00
559	256.00	-3.0000	-20.000	0.00	0.00	0.00
560	288.00	-3.0000	-20.000	0.00	0.00	0.00

LIST ALL SELECTED ELEMENTS. (LIST NODES)

ELEM	MAT	TYP	REL	ESY	NODES			
1	1	1	1	0	1	2	22	21
2	1	1	1	0	2	3	23	22
3	1	1	1	0	3	4	24	23
4	1	1	1	0	4	5	25	24
5	1	1	1	0	5	6	26	25
6	1	1	1	0	6	7	27	26
7	1	1	1	0	7	8	28	27
8	1	1	1	0	8	9	29	28
9	1	1	1	0	9	10	30	29
10	1	1	1	0	10	11	31	30
11	1	1	1	0	21	22	42	41
12	1	1	1	0	22	23	43	42
13	1	1	1	0	23	24	44	43
14	1	1	1	0	24	25	45	44
15	1	1	1	0	25	26	46	45
16	1	1	1	0	26	27	47	46
17	1	1	1	0	27	28	48	47
18	1	1	1	0	28	29	49	48
19	1	1	1	0	29	30	50	49
20	1	1	1	0	30	31	51	50
21	1	1	1	0	41	42	62	61
22	1	1	1	0	42	43	63	62
23	1	1	1	0	43	44	64	63
24	1	1	1	0	44	45	65	64
25	1	1	1	0	45	46	66	65
26	1	1	1	0	46	47	67	66
27	1	1	1	0	47	48	68	67
28	1	1	1	0	48	49	69	68
29	1	1	1	0	49	50	70	69
30	1	1	1	0	50	51	71	70
31	1	1	1	0	61	62	82	81
32	1	1	1	0	62	63	83	82
33	1	1	1	0	63	64	84	83
34	1	1	1	0	64	65	85	84
35	1	1	1	0	65	66	86	85
36	1	1	1	0	66	67	87	86
37	1	1	1	0	67	68	88	87
38	1	1	1	0	68	69	89	88
39	1	1	1	0	69	70	90	89
40	1	1	1	0	70	71	91	90

ELEM	MAT	TYP	REL	ESY	NODES			
41	1	1	1	0	81	82	102	101
42	1	1	1	0	82	83	103	102
43	1	1	1	0	83	84	104	103
44	1	1	1	0	84	85	105	104
45	1	1	1	0	85	86	106	105
46	1	1	1	0	86	87	107	106
47	1	1	1	0	87	88	108	107
48	1	1	1	0	88	89	109	108
49	1	1	1	0	89	90	110	109
50	1	1	1	0	90	91	111	110
197	3	2	2	0	502	202		
198	3	2	2	0	503	203		
199	3	2	2	0	504	204		
200	3	2	2	0	505	205		
201	3	2	2	0	506	206		
202	3	2	2	0	507	207		
203	3	2	2	0	508	208		
204	3	2	2	0	509	209		
205	3	2	2	0	510	210		
206	3	2	2	0	552	302		
207	3	2	2	0	553	303		
208	3	2	2	0	554	304		
209	3	2	2	0	555	305		
210	3	2	2	0	556	306		
211	3	2	2	0	557	307		
212	3	2	2	0	558	308		
213	3	2	2	0	559	309		
214	3	2	2	0	560	310		
215	2	1	1	0	2	202	222	22
216	2	1	1	0	3	203	223	23
217	2	1	1	0	4	204	224	24
218	2	1	1	0	5	205	225	25
219	2	1	1	0	6	206	226	26
220	2	1	1	0	7	207	227	27
221	2	1	1	0	8	208	228	28
222	2	1	1	0	9	209	229	29
223	2	1	1	0	10	210	230	30
224	2	1	1	0	22	222	242	42
225	2	1	1	0	23	223	243	43
226	2	1	1	0	24	224	244	44
227	2	1	1	0	25	225	245	45
228	2	1	1	0	26	226	246	46
229	2	1	1	0	27	227	247	47
230	2	1	1	0	28	228	248	48
231	2	1	1	0	29	229	249	49
232	2	1	1	0	30	230	250	50
233	2	1	1	0	42	242	262	62
234	2	1	1	0	43	243	263	63
235	2	1	1	0	44	244	264	64
236	2	1	1	0	45	245	265	65
237	2	1	1	0	46	246	266	66
238	2	1	1	0	47	247	267	67
239	2	1	1	0	48	248	268	68
240	2	1	1	0	49	249	269	69
241	2	1	1	0	50	250	270	70
242	2	1	1	0	62	262	282	82
243	2	1	1	0	63	263	283	83
244	2	1	1	0	64	264	284	84
245	2	1	1	0	65	265	285	85
246	2	1	1	0	66	266	286	86

ELEM	MAT	TYP	REL	ESY	NODES			
247	2	1	1	0	67	267	287	87
248	2	1	1	0	68	268	288	88
249	2	1	1	0	69	269	289	89
250	2	1	1	0	70	270	290	90
251	2	1	1	0	302	2	22	322
252	2	1	1	0	303	3	23	323
253	2	1	1	0	304	4	24	324
254	2	1	1	0	305	5	25	325
255	2	1	1	0	306	6	26	326
256	2	1	1	0	307	7	27	327
257	2	1	1	0	308	8	28	328
258	2	1	1	0	309	9	29	329
259	2	1	1	0	310	10	30	330
260	2	1	1	0	322	22	42	342
261	2	1	1	0	323	23	43	343
262	2	1	1	0	324	24	44	344
263	2	1	1	0	325	25	45	345
264	2	1	1	0	326	26	46	346
265	2	1	1	0	327	27	47	347
266	2	1	1	0	328	28	48	348
267	2	1	1	0	329	29	49	349
268	2	1	1	0	330	30	50	350
269	2	1	1	0	342	42	62	362
270	2	1	1	0	343	43	63	363
271	2	1	1	0	344	44	64	364
272	2	1	1	0	345	45	65	365
273	2	1	1	0	346	46	66	366
274	2	1	1	0	347	47	67	367
275	2	1	1	0	348	48	68	368
276	2	1	1	0	349	49	69	369
277	2	1	1	0	350	50	70	370
278	2	1	1	0	362	62	82	382
279	2	1	1	0	363	63	83	383
280	2	1	1	0	364	64	84	384
281	2	1	1	0	365	65	85	385
282	2	1	1	0	366	66	86	386
283	2	1	1	0	367	67	87	387
284	2	1	1	0	368	68	88	388
285	2	1	1	0	369	69	89	389
286	2	1	1	0	370	70	90	390

Modal Results, @ wall 1

LIST MATERIALS 1 TO 3 BY 1
PROPERTY= ALL

PROPERTY TABLE EX MAT= 1 NUM. POINTS= 1
TEMPERATURE DATA TEMPERATURE DATA TEMPERATURE DATA
0.00000E+00 0.30000E+07

PROPERTY TABLE DENS MAT= 1 NUM. POINTS= 1
TEMPERATURE DATA TEMPERATURE DATA TEMPERATURE DATA
0.00000E+00 0.39300E-03

PROPERTY TABLE EX MAT= 2 NUM. POINTS= 1
TEMPERATURE DATA TEMPERATURE DATA TEMPERATURE DATA
0.00000E+00 0.30000E+07

PROPERTY TABLE DENS MAT= 2 NUM. POINTS= 1
TEMPERATURE DATA TEMPERATURE DATA TEMPERATURE DATA
0.00000E+00 0.62900E-03

PROPERTY TABLE EX MAT= 3 NUM. POINTS= 1
TEMPERATURE DATA TEMPERATURE DATA TEMPERATURE DATA
0.00000E+00 0.29000E+08

LIST CONSTRAINTS FOR SELECTED NODES 1 TO 310 BY 1
CURRENTLY SELECTED DOF SET= UX UY UZ ROTX ROTY ROTZ

NODE	LABEL	REAL	IMAG
1	UX	0.000000000E+00	0.000000000E+00
1	UY	0.000000000E+00	0.000000000E+00
1	UZ	0.000000000E+00	0.000000000E+00
2	UZ	0.000000000E+00	0.000000000E+00
3	UZ	0.000000000E+00	0.000000000E+00
4	UZ	0.000000000E+00	0.000000000E+00
5	UZ	0.000000000E+00	0.000000000E+00
6	UX	0.000000000E+00	0.000000000E+00
6	UY	0.000000000E+00	0.000000000E+00
6	UZ	0.000000000E+00	0.000000000E+00
7	UZ	0.000000000E+00	0.000000000E+00
8	UZ	0.000000000E+00	0.000000000E+00
9	UZ	0.000000000E+00	0.000000000E+00
10	UZ	0.000000000E+00	0.000000000E+00
11	UX	0.000000000E+00	0.000000000E+00
11	UY	0.000000000E+00	0.000000000E+00
11	UZ	0.000000000E+00	0.000000000E+00
21	UX	0.000000000E+00	0.000000000E+00
21	UZ	0.000000000E+00	0.000000000E+00
31	UZ	0.000000000E+00	0.000000000E+00
41	UX	0.000000000E+00	0.000000000E+00
41	UZ	0.000000000E+00	0.000000000E+00
51	UZ	0.000000000E+00	0.000000000E+00
61	UX	0.000000000E+00	0.000000000E+00
61	UZ	0.000000000E+00	0.000000000E+00
71	UZ	0.000000000E+00	0.000000000E+00
81	UX	0.000000000E+00	0.000000000E+00
81	UZ	0.000000000E+00	0.000000000E+00
91	UZ	0.000000000E+00	0.000000000E+00
101	UX	0.000000000E+00	0.000000000E+00
101	UZ	0.000000000E+00	0.000000000E+00
102	UZ	0.000000000E+00	0.000000000E+00
103	UZ	0.000000000E+00	0.000000000E+00
104	UZ	0.000000000E+00	0.000000000E+00
105	UZ	0.000000000E+00	0.000000000E+00
106	UZ	0.000000000E+00	0.000000000E+00
107	UZ	0.000000000E+00	0.000000000E+00
108	UZ	0.000000000E+00	0.000000000E+00
109	UZ	0.000000000E+00	0.000000000E+00
110	UZ	0.000000000E+00	0.000000000E+00

NODE	LABEL	REAL	IMAG
111	UZ	0.000000000E+00	0.000000000E+00
202	UX	0.000000000E+00	0.000000000E+00
202	UY	0.000000000E+00	0.000000000E+00
202	UZ	0.000000000E+00	0.000000000E+00
202	ROTZ	0.000000000E+00	0.000000000E+00
203	UX	0.000000000E+00	0.000000000E+00
203	UY	0.000000000E+00	0.000000000E+00
203	UZ	0.000000000E+00	0.000000000E+00
203	ROTZ	0.000000000E+00	0.000000000E+00
204	UX	0.000000000E+00	0.000000000E+00
204	UY	0.000000000E+00	0.000000000E+00
204	UZ	0.000000000E+00	0.000000000E+00
204	ROTZ	0.000000000E+00	0.000000000E+00
205	UX	0.000000000E+00	0.000000000E+00
205	UY	0.000000000E+00	0.000000000E+00
205	UZ	0.000000000E+00	0.000000000E+00
205	ROTZ	0.000000000E+00	0.000000000E+00
206	UX	0.000000000E+00	0.000000000E+00
206	UY	0.000000000E+00	0.000000000E+00
206	UZ	0.000000000E+00	0.000000000E+00
206	ROTZ	0.000000000E+00	0.000000000E+00
207	UX	0.000000000E+00	0.000000000E+00
207	UY	0.000000000E+00	0.000000000E+00
207	UZ	0.000000000E+00	0.000000000E+00
207	ROTZ	0.000000000E+00	0.000000000E+00
208	UX	0.000000000E+00	0.000000000E+00
208	UY	0.000000000E+00	0.000000000E+00
208	UZ	0.000000000E+00	0.000000000E+00
208	ROTZ	0.000000000E+00	0.000000000E+00
209	UX	0.000000000E+00	0.000000000E+00
209	UY	0.000000000E+00	0.000000000E+00
209	UZ	0.000000000E+00	0.000000000E+00
209	ROTZ	0.000000000E+00	0.000000000E+00
210	UX	0.000000000E+00	0.000000000E+00
210	UY	0.000000000E+00	0.000000000E+00
210	UZ	0.000000000E+00	0.000000000E+00
210	ROTZ	0.000000000E+00	0.000000000E+00
212	UX	0.000000000E+00	0.000000000E+00
212	UZ	0.000000000E+00	0.000000000E+00
212	ROTZ	0.000000000E+00	0.000000000E+00
213	UX	0.000000000E+00	0.000000000E+00
213	UZ	0.000000000E+00	0.000000000E+00
213	ROTZ	0.000000000E+00	0.000000000E+00
214	UX	0.000000000E+00	0.000000000E+00
214	UZ	0.000000000E+00	0.000000000E+00
214	ROTZ	0.000000000E+00	0.000000000E+00
215	UX	0.000000000E+00	0.000000000E+00
215	UZ	0.000000000E+00	0.000000000E+00
215	ROTZ	0.000000000E+00	0.000000000E+00
216	UX	0.000000000E+00	0.000000000E+00
216	UZ	0.000000000E+00	0.000000000E+00
216	ROTZ	0.000000000E+00	0.000000000E+00
217	UX	0.000000000E+00	0.000000000E+00
217	UZ	0.000000000E+00	0.000000000E+00
217	ROTZ	0.000000000E+00	0.000000000E+00
218	UX	0.000000000E+00	0.000000000E+00
218	UZ	0.000000000E+00	0.000000000E+00
218	ROTZ	0.000000000E+00	0.000000000E+00
219	UX	0.000000000E+00	0.000000000E+00
219	UZ	0.000000000E+00	0.000000000E+00

NODE	LABEL	REAL	IMAG
219	ROTZ	0.000000000E+00	0.000000000E+00
220	UX	0.000000000E+00	0.000000000E+00
220	UZ	0.000000000E+00	0.000000000E+00
220	ROTZ	0.000000000E+00	0.000000000E+00
302	UX	0.000000000E+00	0.000000000E+00
302	UY	0.000000000E+00	0.000000000E+00
302	UZ	0.000000000E+00	0.000000000E+00
303	UX	0.000000000E+00	0.000000000E+00
303	UY	0.000000000E+00	0.000000000E+00
303	UZ	0.000000000E+00	0.000000000E+00
304	UX	0.000000000E+00	0.000000000E+00
304	UY	0.000000000E+00	0.000000000E+00
304	UZ	0.000000000E+00	0.000000000E+00
305	UX	0.000000000E+00	0.000000000E+00
305	UY	0.000000000E+00	0.000000000E+00
305	UZ	0.000000000E+00	0.000000000E+00
306	UX	0.000000000E+00	0.000000000E+00
306	UY	0.000000000E+00	0.000000000E+00
306	UZ	0.000000000E+00	0.000000000E+00
307	UX	0.000000000E+00	0.000000000E+00
307	UY	0.000000000E+00	0.000000000E+00
307	UZ	0.000000000E+00	0.000000000E+00
308	UX	0.000000000E+00	0.000000000E+00
308	UY	0.000000000E+00	0.000000000E+00
308	UZ	0.000000000E+00	0.000000000E+00
309	UX	0.000000000E+00	0.000000000E+00
309	UY	0.000000000E+00	0.000000000E+00
309	UZ	0.000000000E+00	0.000000000E+00
310	UX	0.000000000E+00	0.000000000E+00
310	UY	0.000000000E+00	0.000000000E+00
310	UZ	0.000000000E+00	0.000000000E+00

S O L U T I O N O P T I O N S

PROBLEM DIMENSIONALITY. 3-D
DEGREES OF FREEDOM. . . . . UX UY UZ ROTX ROTY ROTZ
ANALYSIS TYPE . . . . . .MODAL
  EXTRACTION METHOD. . . . . .REDUCED
NUMBER OF MODES TO EXTRACT. 15
NUMBER OF REDUCED MODES TO PRINT. 0
NUMBER OF MASTER DOF. 36

L O A D S T E P O P T I O N S

LOAD STEP NUMBER. 1
INERTIA LOADS X Y Z
  ACEL . . . . . 0.00000E+00 0.00000E+00 386.40

***** CENTROID, MASS, AND MASS MOMENTS OF INERTIA *****

CALCULATIONS ASSUME ELEMENT MASS AT ELEMENT CENTROID

TOTAL MASS = 213.72

***** PARTICIPATION FACTOR CALCULATION ***** X DIRECTION

MODE	FREQUENCY	PERIOD	PARTIC.FACTOR	RATIO	CUMULATIVE EFFECTIVE MASS	MASS FRACTION
1	22.1842	0.45077E-01	0.66961E-03	0.000136	0.448372E-06	0.155462E-07
2	30.5188	0.32767E-01	-0.61971E-01	0.012558	0.384039E-02	0.133172E-03
3	43.3212	0.23083E-01	0.16118E-01	0.003266	0.259800E-03	0.142180E-03
4	45.4182	0.22018E-01	4.9348	1.000000	24.3526	0.844507
5	45.7173	0.21874E-01	0.15708	0.031830	0.246732E-01	0.845363
6	45.8042	0.21832E-01	0.55473	0.112411	0.307724	0.856032
7	45.8413	0.21814E-01	0.49427E-01	0.010016	0.244307E-02	0.856117
8	45.8582	0.21806E-01	0.72256	0.146421	0.522095	0.874219
9	45.8704	0.21801E-01	-0.48677E-01	0.009864	0.236944E-02	0.874301
10	45.8753	0.21798E-01	-1.7213	0.348803	2.96283	0.977030
11	45.9525	0.21762E-01	0.80456	0.163036	0.647313	0.999474
12	46.7228	0.21403E-01	0.94558E-01	0.019161	0.894120E-02	0.999784
13	61.7944	0.16183E-01	-0.69319E-01	0.014047	0.480509E-02	0.999951
14	68.0112	0.14703E-01	-0.15869E-01	0.003216	0.251837E-03	0.999959
15	74.4813	0.13426E-01	0.34264E-01	0.006943	0.117400E-02	1.000000

SUM OF EFFECTIVE MASSES= 28.8413

***** PARTICIPATION FACTOR CALCULATION ***** Y DIRECTION

MODE	FREQUENCY	PERIOD	PARTIC.FACTOR	RATIO	CUMULATIVE EFFECTIVE MASS	MASS FRACTION
1	22.1842	0.45077E-01	0.00000E+00	0.000000	0.000000E+00	0.000000E+00
2	30.5188	0.32767E-01	0.00000E+00	0.000000	0.000000E+00	0.000000E+00
3	43.3212	0.23083E-01	0.00000E+00	0.000000	0.000000E+00	0.000000E+00
4	45.4182	0.22018E-01	0.00000E+00	0.000000	0.000000E+00	0.000000E+00
5	45.7173	0.21874E-01	0.00000E+00	0.000000	0.000000E+00	0.000000E+00
6	45.8042	0.21832E-01	0.00000E+00	0.000000	0.000000E+00	0.000000E+00
7	45.8413	0.21814E-01	0.00000E+00	0.000000	0.000000E+00	0.000000E+00
8	45.8582	0.21806E-01	0.00000E+00	0.000000	0.000000E+00	0.000000E+00
9	45.8704	0.21801E-01	0.00000E+00	0.000000	0.000000E+00	0.000000E+00
10	45.8753	0.21798E-01	0.00000E+00	0.000000	0.000000E+00	0.000000E+00
11	45.9525	0.21762E-01	0.00000E+00	0.000000	0.000000E+00	0.000000E+00
12	46.7228	0.21403E-01	0.00000E+00	0.000000	0.000000E+00	0.000000E+00
13	61.7944	0.16183E-01	0.00000E+00	0.000000	0.000000E+00	0.000000E+00
14	68.0112	0.14703E-01	0.00000E+00	0.000000	0.000000E+00	0.000000E+00
15	74.4813	0.13426E-01	0.00000E+00	0.000000	0.000000E+00	0.000000E+00

***** PARTICIPATION FACTOR CALCULATION ***** Z DIRECTION

MODE	FREQUENCY	PERIOD	PARTIC.FACTOR	RATIO	CUMULATIVE EFFECTIVE MASS	MASS FRACTION
1	22.1842	0.45077E-01	10.964	1.000000	120.207	0.845374
2	30.5188	0.32767E-01	-0.32745E-03	0.000030	0.107224E-06	0.845374
3	43.3212	0.23083E-01	-3.0277	0.276152	9.16697	0.909842
4	45.4182	0.22018E-01	-0.10522	0.009597	0.110712E-01	0.909920
5	45.7173	0.21874E-01	-0.24877E-01	0.002269	0.618851E-03	0.909925
6	45.8042	0.21832E-01	0.15182	0.013847	0.230480E-01	0.910087
7	45.8413	0.21814E-01	0.12795E-01	0.001167	0.163717E-03	0.910088
8	45.8582	0.21806E-01	0.10807	0.009857	0.116787E-01	0.910170
9	45.8704	0.21801E-01	-0.74993E-02	0.000684	0.562390E-04	0.910170
10	45.8753	0.21798E-01	-0.21358	0.019480	0.456159E-01	0.910491
11	45.9525	0.21762E-01	0.81712E-01	0.007453	0.667683E-02	0.910538
12	46.7228	0.21403E-01	-1.7132	0.156257	2.93501	0.931179
13	61.7944	0.16183E-01	0.90304E-02	0.000824	0.815472E-04	0.931179
14	68.0112	0.14703E-01	-3.1280	0.285303	9.78464	0.999991
15	74.4813	0.13426E-01	-0.35093E-01	0.003201	0.123154E-02	1.000000

SUM OF EFFECTIVE MASSES= 142.194

Modal Results, @ wall 1a

LIST MATERIALS 1 TO 3 BY 1
PROPERTY= ALL

PROPERTY TABLE EX MAT= 1 NUM. POINTS= 1
TEMPERATURE DATA TEMPERATURE DATA TEMPERATURE DATA
0.00000E+00 0.30000E+07

PROPERTY TABLE DENS MAT= 1 NUM. POINTS= 1
TEMPERATURE DATA TEMPERATURE DATA TEMPERATURE DATA
0.00000E+00 0.39300E-03

PROPERTY TABLE EX MAT= 2 NUM. POINTS= 1
TEMPERATURE DATA TEMPERATURE DATA TEMPERATURE DATA
0.00000E+00 0.30000E+07

PROPERTY TABLE DENS MAT= 2 NUM. POINTS= 1
TEMPERATURE DATA TEMPERATURE DATA TEMPERATURE DATA
0.00000E+00 0.62900E-03

PROPERTY TABLE EX MAT= 3 NUM. POINTS= 1
TEMPERATURE DATA TEMPERATURE DATA TEMPERATURE DATA
0.00000E+00 0.29000E+08

LIST CONSTRAINTS FOR SELECTED NODES 1 TO 310 BY 1
CURRENTLY SELECTED DOF SET= UX UY UZ ROTX ROTY ROTZ

NODE	LABEL	REAL	IMAG
1	UX	0.000000000E+00	0.000000000E+00
1	UY	0.000000000E+00	0.000000000E+00
1	UZ	0.000000000E+00	0.000000000E+00
2	UZ	0.000000000E+00	0.000000000E+00
3	UZ	0.000000000E+00	0.000000000E+00
4	UZ	0.000000000E+00	0.000000000E+00
5	UZ	0.000000000E+00	0.000000000E+00
6	UX	0.000000000E+00	0.000000000E+00
6	UY	0.000000000E+00	0.000000000E+00
6	UZ	0.000000000E+00	0.000000000E+00
7	UZ	0.000000000E+00	0.000000000E+00
8	UZ	0.000000000E+00	0.000000000E+00
9	UZ	0.000000000E+00	0.000000000E+00
10	UZ	0.000000000E+00	0.000000000E+00
11	UX	0.000000000E+00	0.000000000E+00
11	UY	0.000000000E+00	0.000000000E+00
11	UZ	0.000000000E+00	0.000000000E+00
21	UX	0.000000000E+00	0.000000000E+00
21	UZ	0.000000000E+00	0.000000000E+00
31	UZ	0.000000000E+00	0.000000000E+00
41	UX	0.000000000E+00	0.000000000E+00
41	UZ	0.000000000E+00	0.000000000E+00
51	UZ	0.000000000E+00	0.000000000E+00
61	UX	0.000000000E+00	0.000000000E+00
61	UZ	0.000000000E+00	0.000000000E+00
71	UZ	0.000000000E+00	0.000000000E+00
81	UX	0.000000000E+00	0.000000000E+00
81	UZ	0.000000000E+00	0.000000000E+00
91	UZ	0.000000000E+00	0.000000000E+00
101	UX	0.000000000E+00	0.000000000E+00
101	UZ	0.000000000E+00	0.000000000E+00
102	UZ	0.000000000E+00	0.000000000E+00
103	UZ	0.000000000E+00	0.000000000E+00
104	UZ	0.000000000E+00	0.000000000E+00
105	UZ	0.000000000E+00	0.000000000E+00
106	UZ	0.000000000E+00	0.000000000E+00
107	UZ	0.000000000E+00	0.000000000E+00
108	UZ	0.000000000E+00	0.000000000E+00
109	UZ	0.000000000E+00	0.000000000E+00
110	UZ	0.000000000E+00	0.000000000E+00

X 42 62 Hz

Z 21 21 Hz

NODE	LABEL	REAL	IMAG
111	UZ	0.000000000E+00	0.000000000E+00
202	UZ	0.000000000E+00	0.000000000E+00
203	UZ	0.000000000E+00	0.000000000E+00
204	UZ	0.000000000E+00	0.000000000E+00
205	UZ	0.000000000E+00	0.000000000E+00
206	UZ	0.000000000E+00	0.000000000E+00
207	UZ	0.000000000E+00	0.000000000E+00
208	UZ	0.000000000E+00	0.000000000E+00
209	UZ	0.000000000E+00	0.000000000E+00
210	UZ	0.000000000E+00	0.000000000E+00
212	UX	0.000000000E+00	0.000000000E+00
212	UZ	0.000000000E+00	0.000000000E+00
212	ROTZ	0.000000000E+00	0.000000000E+00
213	UX	0.000000000E+00	0.000000000E+00
213	UZ	0.000000000E+00	0.000000000E+00
213	ROTZ	0.000000000E+00	0.000000000E+00
214	UX	0.000000000E+00	0.000000000E+00
214	UZ	0.000000000E+00	0.000000000E+00
214	ROTZ	0.000000000E+00	0.000000000E+00
215	UX	0.000000000E+00	0.000000000E+00
215	UZ	0.000000000E+00	0.000000000E+00
215	ROTZ	0.000000000E+00	0.000000000E+00
216	UX	0.000000000E+00	0.000000000E+00
216	UZ	0.000000000E+00	0.000000000E+00
216	ROTZ	0.000000000E+00	0.000000000E+00
217	UX	0.000000000E+00	0.000000000E+00
217	UZ	0.000000000E+00	0.000000000E+00
217	ROTZ	0.000000000E+00	0.000000000E+00
218	UX	0.000000000E+00	0.000000000E+00
218	UZ	0.000000000E+00	0.000000000E+00
218	ROTZ	0.000000000E+00	0.000000000E+00
219	UX	0.000000000E+00	0.000000000E+00
219	UZ	0.000000000E+00	0.000000000E+00
219	ROTZ	0.000000000E+00	0.000000000E+00
220	UX	0.000000000E+00	0.000000000E+00
220	UZ	0.000000000E+00	0.000000000E+00
220	ROTZ	0.000000000E+00	0.000000000E+00
302	UX	0.000000000E+00	0.000000000E+00
302	UY	0.000000000E+00	0.000000000E+00
302	UZ	0.000000000E+00	0.000000000E+00
303	UX	0.000000000E+00	0.000000000E+00
303	UY	0.000000000E+00	0.000000000E+00
303	UZ	0.000000000E+00	0.000000000E+00
304	UX	0.000000000E+00	0.000000000E+00
304	UY	0.000000000E+00	0.000000000E+00
304	UZ	0.000000000E+00	0.000000000E+00
305	UX	0.000000000E+00	0.000000000E+00
305	UY	0.000000000E+00	0.000000000E+00
305	UZ	0.000000000E+00	0.000000000E+00
306	UX	0.000000000E+00	0.000000000E+00
306	UY	0.000000000E+00	0.000000000E+00
306	UZ	0.000000000E+00	0.000000000E+00
307	UX	0.000000000E+00	0.000000000E+00
307	UY	0.000000000E+00	0.000000000E+00
307	UZ	0.000000000E+00	0.000000000E+00
308	UX	0.000000000E+00	0.000000000E+00
308	UY	0.000000000E+00	0.000000000E+00
308	UZ	0.000000000E+00	0.000000000E+00
309	UX	0.000000000E+00	0.000000000E+00
309	UY	0.000000000E+00	0.000000000E+00

NODE	LABEL	REAL	IMAG
309	UZ	0.000000000E+00	0.000000000E+00
310	UX	0.000000000E+00	0.000000000E+00
310	UY	0.000000000E+00	0.000000000E+00
310	UZ	0.000000000E+00	0.000000000E+00

S O L U T I O N O P T I O N S

PROBLEM DIMENSIONALITY. 3-D
DEGREES OF FREEDOM. . . . . UX UY UZ ROTX ROTY ROTZ
ANALYSIS TYPE . . . . . .MODAL
  EXTRACTION METHOD. . . . . .REDUCED
NUMBER OF MODES TO EXTRACT. 15
NUMBER OF REDUCED MODES TO PRINT. 0
NUMBER OF MASTER DOF. 36

L O A D S T E P O P T I O N S

LOAD STEP NUMBER. 1
INERTIA LOADS X Y Z
  ACEL . . . . . 0.00000E+00 0.00000E+00 -386.40

***** CENTROID, MASS, AND MASS MOMENTS OF INERTIA *****

CALCULATIONS ASSUME ELEMENT MASS AT ELEMENT CENTROID

TOTAL MASS = 213.72

CENTROID	MOM. OF INERTIA ABOUT ORIGIN	MOM. OF INERTIA ABOUT CENTROID
XC = 160.00	IXX = 0.9356E+06	IXX = 0.2402E+06
YC = 56.897	IYY = 0.7144E+07	IYY = 0.1670E+07
ZC = 4.0686	IZZ = 0.8063E+07	IZZ = 0.1900E+07
	IXY = -0.1946E+07	IXY = -0.2328E-09
	IYZ = -0.4174E+05	IYZ = 7736.
	IZX = -0.1391E+06	IZX = -0.2910E-10

*** MASS SUMMARY BY ELEMENT TYPE ***

TYPE	MASS
1	213.719

Range of element maximum matrix coefficients in global coordinates
Maximum= 289692366 at element 40.
Minimum= 444666.667 at element 95.

*** ELEMENT MATRIX FORMULATION TIMES

TYPE	NUMBER	ENAME	TOTAL CP	AVE CP
1	86	SHELL63	0.530	0.006
2	9	LINK8	0.020	0.002

Time at end of element matrix formulation CP= 2.78999996.

Estimated number of active DOF= 823.
Maximum wavefront= 102.
Number of Master DOF= 36.

Time at end of matrix triangularization CP= 3.75.
Equation solver maximum pivot= 1.121640747E+09 at node 68 ROTX.
Equation solver minimum pivot= 78.7684888 at node 288 ROTX.

***** PARTICIPATION FACTOR CALCULATION ***** X DIRECTION

MODE	FREQUENCY	PERIOD	PARTIC.FACTOR	RATIO	CUMULATIVE EFFECTIVE MASS	MASS FRACTION
1	21.8885	0.45686E-01	0.31320E-02	0.000631	0.980921E-05	0.341291E-06
2	29.8186	0.33536E-01	-0.97436E-02	0.001965	0.949386E-04	0.364448E-05
3	42.0021	0.23808E-01	0.13353E-01	0.002692	0.178311E-03	0.984844E-05
4	42.6221	0.23462E-01	4.9597	1.000000	24.5985	0.855862
5	43.0540	0.23227E-01	1.5441	0.311340	2.38440	0.938822
6	43.1351	0.23183E-01	0.98120	0.197835	0.962751	0.972319
7	43.1745	0.23162E-01	-0.55956	0.112821	0.313103	0.983213
8	43.2053	0.23145E-01	-0.47430	0.095631	0.224960	0.991040
9	43.2389	0.23127E-01	0.33366	0.067274	0.111329	0.994913
10	43.2738	0.23109E-01	-0.31403	0.063316	0.986121E-01	0.998344
11	43.3061	0.23091E-01	0.17878	0.036047	0.319621E-01	0.999456
12	43.3291	0.23079E-01	0.12489	0.025181	0.155973E-01	0.999999
13	53.9823	0.18525E-01	-0.33929E-02	0.000684	0.115119E-04	0.999999
14	59.4183	0.16830E-01	-0.18422E-02	0.000371	0.339381E-05	0.999999
15	60.0891	0.16642E-01	-0.40139E-02	0.000809	0.161115E-04	1.000000

SUM OF EFFECTIVE MASSES = 28.7415

***** PARTICIPATION FACTOR CALCULATION ***** Y DIRECTION

MODE	FREQUENCY	PERIOD	PARTIC.FACTOR	RATIO	CUMULATIVE EFFECTIVE MASS	MASS FRACTION
1	21.8885	0.45686E-01	0.00000E+00	0.000000	0.000000E+00	0.000000E+00
2	29.8186	0.33536E-01	0.00000E+00	0.000000	0.000000E+00	0.000000E+00
3	42.0021	0.23808E-01	0.00000E+00	0.000000	0.000000E+00	0.000000E+00
4	42.6221	0.23462E-01	0.00000E+00	0.000000	0.000000E+00	0.000000E+00
5	43.0540	0.23227E-01	0.00000E+00	0.000000	0.000000E+00	0.000000E+00
6	43.1351	0.23183E-01	0.00000E+00	0.000000	0.000000E+00	0.000000E+00
7	43.1745	0.23162E-01	0.00000E+00	0.000000	0.000000E+00	0.000000E+00
8	43.2053	0.23145E-01	0.00000E+00	0.000000	0.000000E+00	0.000000E+00
9	43.2389	0.23127E-01	0.00000E+00	0.000000	0.000000E+00	0.000000E+00
10	43.2738	0.23109E-01	0.00000E+00	0.000000	0.000000E+00	0.000000E+00
11	43.3061	0.23091E-01	0.00000E+00	0.000000	0.000000E+00	0.000000E+00
12	43.3291	0.23079E-01	0.00000E+00	0.000000	0.000000E+00	0.000000E+00
13	53.9823	0.18525E-01	0.00000E+00	0.000000	0.000000E+00	0.000000E+00
14	59.4183	0.16830E-01	0.00000E+00	0.000000	0.000000E+00	0.000000E+00
15	60.0891	0.16642E-01	0.00000E+00	0.000000	0.000000E+00	0.000000E+00

***** PARTICIPATION FACTOR CALCULATION ***** Z DIRECTION

MODE	FREQUENCY	PERIOD	PARTIC.FACTOR	RATIO	CUMULATIVE EFFECTIVE MASS	MASS FRACTION
1	21.8885	0.45686E-01	11.009	1.000000	121.195	0.831183
2	29.8186	0.33536E-01	0.77797E-03	0.000071	0.605232E-06	0.831183
3	42.0021	0.23808E-01	-3.5295	0.320605	12.4574	0.916618
4	42.6221	0.23462E-01	-0.57336E-01	0.005208	0.328744E-02	0.916641
5	43.0540	0.23227E-01	0.13881	0.012609	0.192689E-01	0.916773
6	43.1351	0.23183E-01	0.48867E-01	0.004439	0.238800E-02	0.916789
7	43.1745	0.23162E-01	0.14977E-01	0.001360	0.224314E-03	0.916791
8	43.2053	0.23145E-01	0.10298E-02	0.000094	0.106045E-05	0.916791
9	43.2389	0.23127E-01	0.12921	0.011737	0.166949E-01	0.916905
10	43.2738	0.23109E-01	-0.10034E-01	0.000911	0.100677E-03	0.916906
11	43.3061	0.23091E-01	0.13852	0.012582	0.191869E-01	0.917038
12	43.3291	0.23079E-01	0.74926E-02	0.000681	0.561387E-04	0.917038
13	53.9823	0.18525E-01	0.47593E-03	0.000043	0.226513E-06	0.917038
14	59.4183	0.16830E-01	-1.3905	0.126311	1.93360	0.930299
15	60.0891	0.16642E-01	3.1880	0.289581	10.1631	1.000000

SUM OF EFFECTIVE MASSES = 145.810

Modal Results, @ Wall 12

LIST MATERIALS 1 TO 3 BY 1
PROPERTY= ALL

PROPERTY TABLE EX MAT= 1 NUM. POINTS= 1
TEMPERATURE DATA TEMPERATURE DATA TEMPERATURE DATA
0.00000E+00 0.30000E+07

PROPERTY TABLE DENS MAT= 1 NUM. POINTS= 1
TEMPERATURE DATA TEMPERATURE DATA TEMPERATURE DATA
0.00000E+00 0.31200E-03

PROPERTY TABLE EX MAT= 2 NUM. POINTS= 1
TEMPERATURE DATA TEMPERATURE DATA TEMPERATURE DATA
0.00000E+00 0.30000E+07

PROPERTY TABLE DENS MAT= 2 NUM. POINTS= 1
TEMPERATURE DATA TEMPERATURE DATA TEMPERATURE DATA
0.00000E+00 0.62900E-03

PROPERTY TABLE EX MAT= 3 NUM. POINTS= 1
TEMPERATURE DATA TEMPERATURE DATA TEMPERATURE DATA
0.00000E+00 0.29000E+08

LIST CONSTRAINTS FOR SELECTED NODES 1 TO 310 BY 1
CURRENTLY SELECTED DOF SET= UX UY UZ ROTX ROTY ROTZ

NODE	LABEL	REAL	IMAG
1	UX	0.000000000E+00	0.000000000E+00
1	UY	0.000000000E+00	0.000000000E+00
1	UZ	0.000000000E+00	0.000000000E+00
6	UX	0.000000000E+00	0.000000000E+00
6	UY	0.000000000E+00	0.000000000E+00
6	UZ	0.000000000E+00	0.000000000E+00
11	UX	0.000000000E+00	0.000000000E+00
11	UY	0.000000000E+00	0.000000000E+00
11	UZ	0.000000000E+00	0.000000000E+00
21	UX	0.000000000E+00	0.000000000E+00
21	UZ	0.000000000E+00	0.000000000E+00
31	UZ	0.000000000E+00	0.000000000E+00
41	UX	0.000000000E+00	0.000000000E+00
41	UZ	0.000000000E+00	0.000000000E+00
51	UZ	0.000000000E+00	0.000000000E+00
61	UX	0.000000000E+00	0.000000000E+00
61	UZ	0.000000000E+00	0.000000000E+00
71	UZ	0.000000000E+00	0.000000000E+00
81	UX	0.000000000E+00	0.000000000E+00
81	UZ	0.000000000E+00	0.000000000E+00
91	UZ	0.000000000E+00	0.000000000E+00
101	UX	0.000000000E+00	0.000000000E+00
101	UZ	0.000000000E+00	0.000000000E+00
102	UZ	0.000000000E+00	0.000000000E+00
103	UZ	0.000000000E+00	0.000000000E+00
104	UZ	0.000000000E+00	0.000000000E+00
105	UZ	0.000000000E+00	0.000000000E+00
106	UZ	0.000000000E+00	0.000000000E+00
107	UZ	0.000000000E+00	0.000000000E+00
108	UZ	0.000000000E+00	0.000000000E+00
109	UZ	0.000000000E+00	0.000000000E+00
110	UZ	0.000000000E+00	0.000000000E+00
111	UZ	0.000000000E+00	0.000000000E+00
202	UX	0.000000000E+00	0.000000000E+00
202	UY	0.000000000E+00	0.000000000E+00
202	UZ	0.000000000E+00	0.000000000E+00
202	ROTZ	0.000000000E+00	0.000000000E+00
203	UX	0.000000000E+00	0.000000000E+00
203	UY	0.000000000E+00	0.000000000E+00
203	UZ	0.000000000E+00	0.000000000E+00

NODE	LABEL	REAL	IMAG
203	ROTZ	0.000000000E+00	0.000000000E+00
204	UX	0.000000000E+00	0.000000000E+00
204	UY	0.000000000E+00	0.000000000E+00
204	UZ	0.000000000E+00	0.000000000E+00
204	ROTZ	0.000000000E+00	0.000000000E+00
205	UX	0.000000000E+00	0.000000000E+00
205	UY	0.000000000E+00	0.000000000E+00
205	UZ	0.000000000E+00	0.000000000E+00
205	ROTZ	0.000000000E+00	0.000000000E+00
206	UX	0.000000000E+00	0.000000000E+00
206	UY	0.000000000E+00	0.000000000E+00
206	UZ	0.000000000E+00	0.000000000E+00
206	ROTZ	0.000000000E+00	0.000000000E+00
207	UX	0.000000000E+00	0.000000000E+00
207	UY	0.000000000E+00	0.000000000E+00
207	UZ	0.000000000E+00	0.000000000E+00
207	ROTZ	0.000000000E+00	0.000000000E+00
208	UX	0.000000000E+00	0.000000000E+00
208	UY	0.000000000E+00	0.000000000E+00
208	UZ	0.000000000E+00	0.000000000E+00
208	ROTZ	0.000000000E+00	0.000000000E+00
209	UX	0.000000000E+00	0.000000000E+00
209	UY	0.000000000E+00	0.000000000E+00
209	UZ	0.000000000E+00	0.000000000E+00
209	ROTZ	0.000000000E+00	0.000000000E+00
210	UX	0.000000000E+00	0.000000000E+00
210	UY	0.000000000E+00	0.000000000E+00
210	UZ	0.000000000E+00	0.000000000E+00
210	ROTZ	0.000000000E+00	0.000000000E+00
212	UX	0.000000000E+00	0.000000000E+00
212	UZ	0.000000000E+00	0.000000000E+00
212	ROTZ	0.000000000E+00	0.000000000E+00
213	UX	0.000000000E+00	0.000000000E+00
213	UZ	0.000000000E+00	0.000000000E+00
213	ROTZ	0.000000000E+00	0.000000000E+00
214	UX	0.000000000E+00	0.000000000E+00
214	UZ	0.000000000E+00	0.000000000E+00
214	ROTZ	0.000000000E+00	0.000000000E+00
215	UX	0.000000000E+00	0.000000000E+00
215	UZ	0.000000000E+00	0.000000000E+00
215	ROTZ	0.000000000E+00	0.000000000E+00
216	UX	0.000000000E+00	0.000000000E+00
216	UZ	0.000000000E+00	0.000000000E+00
216	ROTZ	0.000000000E+00	0.000000000E+00
217	UX	0.000000000E+00	0.000000000E+00
217	UZ	0.000000000E+00	0.000000000E+00
217	ROTZ	0.000000000E+00	0.000000000E+00
218	UX	0.000000000E+00	0.000000000E+00
218	UZ	0.000000000E+00	0.000000000E+00
218	ROTZ	0.000000000E+00	0.000000000E+00
219	UX	0.000000000E+00	0.000000000E+00
219	UZ	0.000000000E+00	0.000000000E+00
219	ROTZ	0.000000000E+00	0.000000000E+00
220	UX	0.000000000E+00	0.000000000E+00
220	UZ	0.000000000E+00	0.000000000E+00
220	ROTZ	0.000000000E+00	0.000000000E+00
302	UX	0.000000000E+00	0.000000000E+00
302	UY	0.000000000E+00	0.000000000E+00
302	UZ	0.000000000E+00	0.000000000E+00
303	UX	0.000000000E+00	0.000000000E+00

NODE	LABEL	REAL	IMAG
303	UY	0.000000000E+00	0.000000000E+00
303	UZ	0.000000000E+00	0.000000000E+00
304	UX	0.000000000E+00	0.000000000E+00
304	UY	0.000000000E+00	0.000000000E+00
304	UZ	0.000000000E+00	0.000000000E+00
305	UX	0.000000000E+00	0.000000000E+00
305	UY	0.000000000E+00	0.000000000E+00
305	UZ	0.000000000E+00	0.000000000E+00
306	UX	0.000000000E+00	0.000000000E+00
306	UY	0.000000000E+00	0.000000000E+00
306	UZ	0.000000000E+00	0.000000000E+00
307	UX	0.000000000E+00	0.000000000E+00
307	UY	0.000000000E+00	0.000000000E+00
307	UZ	0.000000000E+00	0.000000000E+00
308	UX	0.000000000E+00	0.000000000E+00
308	UY	0.000000000E+00	0.000000000E+00
308	UZ	0.000000000E+00	0.000000000E+00
309	UX	0.000000000E+00	0.000000000E+00
309	UY	0.000000000E+00	0.000000000E+00
309	UZ	0.000000000E+00	0.000000000E+00
310	UX	0.000000000E+00	0.000000000E+00
310	UY	0.000000000E+00	0.000000000E+00
310	UZ	0.000000000E+00	0.000000000E+00

SOLUTION OPTIONS

PROBLEM DIMENSIONALITY. 3-D
DEGREES OF FREEDOM. . . . . UX UY UZ ROTX ROTY ROTZ
ANALYSIS TYPE . . . . . .MODAL
  EXTRACTION METHOD. . . . . .REDUCED
NUMBER OF MODES TO EXTRACT. 15
NUMBER OF REDUCED MODES TO PRINT. 0
NUMBER OF MASTER DOF. 36

LOAD STEP OPTIONS

LOAD STEP NUMBER. 1
INERTIA LOADS X Y Z
  ACEL . . . . . 0.00000E+00 0.00000E+00 386.40

***** CENTROID, MASS, AND MASS MOMENTS OF INERTIA *****

CALCULATIONS ASSUME ELEMENT MASS AT ELEMENT CENTROID

TOTAL MASS = 187.59

CENTROID	MOM. OF INERTIA ABOUT ORIGIN	MOM. OF INERTIA ABOUT CENTROID
XC = 160.00	IXX = 0.7987E+06	IXX = 0.2054E+08
YC = 56.047	IYY = 0.6255E+07	IYY = 0.1448E+07
ZC = 4.6352	IZZ = 0.7036E+07	IZZ = 0.1645E+07
	IXY = -0.1682E+07	IXY = 0.6985E-09
	IYZ = -0.4174E+05	IYZ = 6997.
	IZX = -0.1391E+06	IZX = -0.1164E-09

*** MASS SUMMARY BY ELEMENT TYPE ***

TYPE	MASS
1	187.592

***** PARTICIPATION FACTOR CALCULATION ***** X DIRECTION

MODE	FREQUENCY	PERIOD	PARTIC.FACTOR	CUMULATIVE RATIO	EFFECTIVE MASS	MASS FRACTION
1	19.1608	0.52190E-01	0.27923E-01	0.005655	0.779706E-03	0.270428E-04
2	19.7262	0.50694E-01	0.68435E-03	0.000139	0.468341E-06	0.270591E-04
3	38.2539	0.26141E-01	-0.10910E-02	0.000221	0.119022E-05	0.271004E-04
4	45.4239	0.22015E-01	4.9381	1.000000	24.3850	0.845783
5	45.6999	0.21882E-01	0.56767E-03	0.000115	0.322251E-06	0.845783
6	45.7602	0.21853E-01	-0.13369	0.027073	0.178725E-01	0.846403
7	45.8071	0.21831E-01	0.67035	0.135750	0.449367	0.861989
8	45.8431	0.21814E-01	0.57089	0.115609	0.325915	0.873293
9	45.8545	0.21808E-01	1.1017	0.223105	1.21379	0.915391
10	45.8672	0.21802E-01	0.96308	0.195029	0.927514	0.947560
11	45.8718	0.21800E-01	-0.32771	0.066363	0.107394	0.951285
12	45.9762	0.21750E-01	1.1824	0.239437	1.39800	0.999772
13	52.5063	0.19045E-01	-0.44956E-01	0.009104	0.202105E-02	0.999842
14	56.3867	0.17735E-01	0.10588E-01	0.002144	0.112104E-03	0.999846
15	61.7474	0.16195E-01	-0.66574E-01	0.013482	0.443210E-02	1.00000

SUM OF EFFECTIVE MASSES = 28.8322

***** PARTICIPATION FACTOR CALCULATION ***** Y DIRECTION

MODE	FREQUENCY	PERIOD	PARTIC.FACTOR	CUMULATIVE RATIO	EFFECTIVE MASS	MASS FRACTION
1	19.1608	0.52190E-01	0.00000E+00	0.000000	0.000000E+00	0.000000E+00
2	19.7262	0.50694E-01	0.00000E+00	0.000000	0.000000E+00	0.000000E+00
3	38.2539	0.26141E-01	0.00000E+00	0.000000	0.000000E+00	0.000000E+00
4	45.4239	0.22015E-01	0.00000E+00	0.000000	0.000000E+00	0.000000E+00
5	45.6999	0.21882E-01	0.00000E+00	0.000000	0.000000E+00	0.000000E+00
6	45.7602	0.21853E-01	0.00000E+00	0.000000	0.000000E+00	0.000000E+00
7	45.8071	0.21831E-01	0.00000E+00	0.000000	0.000000E+00	0.000000E+00
8	45.8431	0.21814E-01	0.00000E+00	0.000000	0.000000E+00	0.000000E+00
9	45.8545	0.21808E-01	0.00000E+00	0.000000	0.000000E+00	0.000000E+00
10	45.8672	0.21802E-01	0.00000E+00	0.000000	0.000000E+00	0.000000E+00
11	45.8718	0.21800E-01	0.00000E+00	0.000000	0.000000E+00	0.000000E+00
12	45.9762	0.21750E-01	0.00000E+00	0.000000	0.000000E+00	0.000000E+00
13	52.5063	0.19045E-01	0.00000E+00	0.000000	0.000000E+00	0.000000E+00
14	56.3867	0.17735E-01	0.00000E+00	0.000000	0.000000E+00	0.000000E+00
15	61.7474	0.16195E-01	0.00000E+00	0.000000	0.000000E+00	0.000000E+00

***** PARTICIPATION FACTOR CALCULATION ***** Z DIRECTION

MODE	FREQUENCY	PERIOD	PARTIC.FACTOR	CUMULATIVE RATIO	EFFECTIVE MASS	MASS FRACTION
1	19.1608	0.52190E-01	0.30192E-03	0.000030	0.911568E-07	0.706455E-09
2	19.7262	0.50694E-01	10.230	1.000000	104.657	0.811078
3	38.2539	0.26141E-01	1.0112	0.098847	1.02256	0.819003
4	45.4239	0.22015E-01	-0.10296	0.010064	0.106002E-01	0.819085
5	45.6999	0.21882E-01	0.11796E-01	0.001153	0.139141E-03	0.819086
6	45.7602	0.21853E-01	-0.21439E-01	0.002096	0.459636E-03	0.819090
7	45.8071	0.21831E-01	0.58166E-02	0.000569	0.338332E-04	0.819090
8	45.8431	0.21814E-01	-0.48951E-01	0.004785	0.239618E-02	0.819109
9	45.8545	0.21808E-01	-0.10978	0.010731	0.120522E-01	0.819202
10	45.8672	0.21802E-01	-0.10462	0.010226	0.109444E-01	0.819287
11	45.8718	0.21800E-01	0.38876E-01	0.003800	0.151136E-02	0.819299
12	45.9762	0.21750E-01	0.52360	0.051182	0.274153	0.821423
13	52.5063	0.19045E-01	0.15741E-02	0.000154	0.247787E-05	0.821423
14	56.3867	0.17735E-01	4.8003	0.469225	23.0425	1.000000
15	61.7474	0.16195E-01	0.11051E-02	0.000108	0.122125E-05	1.00000

SUM OF EFFECTIVE MASSES = 129.034

Modal Results, @ wall 12a

LIST MATERIALS 1 TO 3 BY 1
PROPERTY= ALL

PROPERTY TABLE EX MAT= 1 NUM. POINTS= 1
TEMPERATURE DATA TEMPERATURE DATA TEMPERATURE DATA
0.00000E+00 0.30000E+07

PROPERTY TABLE DENS MAT= 1 NUM. POINTS= 1
TEMPERATURE DATA TEMPERATURE DATA TEMPERATURE DATA
0.00000E+00 0.31200E-03

PROPERTY TABLE EX MAT= 2 NUM. POINTS= 1
TEMPERATURE DATA TEMPERATURE DATA TEMPERATURE DATA
0.00000E+00 0.30000E+07

PROPERTY TABLE DENS MAT= 2 NUM. POINTS= 1
TEMPERATURE DATA TEMPERATURE DATA TEMPERATURE DATA
0.00000E+00 0.62900E-03

PROPERTY TABLE EX MAT= 3 NUM. POINTS= 1
TEMPERATURE DATA TEMPERATURE DATA TEMPERATURE DATA
0.00000E+00 0.29000E+08

LIST CONSTRAINTS FOR SELECTED NODES 1 TO 310 BY 1
CURRENTLY SELECTED DOF SET= UX UY UZ ROTX ROTY ROTZ

NODE	LABEL	REAL	IMAG
1	UX	0.000000000E+00	0.000000000E+00
1	UY	0.000000000E+00	0.000000000E+00
1	UZ	0.000000000E+00	0.000000000E+00
6	UX	0.000000000E+00	0.000000000E+00
6	UY	0.000000000E+00	0.000000000E+00
6	UZ	0.000000000E+00	0.000000000E+00
11	UX	0.000000000E+00	0.000000000E+00
11	UY	0.000000000E+00	0.000000000E+00
11	UZ	0.000000000E+00	0.000000000E+00
21	UX	0.000000000E+00	0.000000000E+00
21	UZ	0.000000000E+00	0.000000000E+00
31	UZ	0.000000000E+00	0.000000000E+00
41	UX	0.000000000E+00	0.000000000E+00
41	UZ	0.000000000E+00	0.000000000E+00
51	UZ	0.000000000E+00	0.000000000E+00
61	UX	0.000000000E+00	0.000000000E+00
61	UZ	0.000000000E+00	0.000000000E+00
71	UZ	0.000000000E+00	0.000000000E+00
81	UX	0.000000000E+00	0.000000000E+00
81	UZ	0.000000000E+00	0.000000000E+00
91	UZ	0.000000000E+00	0.000000000E+00
101	UX	0.000000000E+00	0.000000000E+00
101	UZ	0.000000000E+00	0.000000000E+00
102	UZ	0.000000000E+00	0.000000000E+00
103	UZ	0.000000000E+00	0.000000000E+00
104	UZ	0.000000000E+00	0.000000000E+00
105	UZ	0.000000000E+00	0.000000000E+00
106	UZ	0.000000000E+00	0.000000000E+00
107	UZ	0.000000000E+00	0.000000000E+00
108	UZ	0.000000000E+00	0.000000000E+00
109	UZ	0.000000000E+00	0.000000000E+00
110	UZ	0.000000000E+00	0.000000000E+00
111	UZ	0.000000000E+00	0.000000000E+00
202	UZ	0.000000000E+00	0.000000000E+00
203	UZ	0.000000000E+00	0.000000000E+00
204	UZ	0.000000000E+00	0.000000000E+00
205	UZ	0.000000000E+00	0.000000000E+00
206	UZ	0.000000000E+00	0.000000000E+00
207	UZ	0.000000000E+00	0.000000000E+00
208	UZ	0.000000000E+00	0.000000000E+00

NODE	LABEL	REAL	IMAG
209	UZ	0.000000000E+00	0.000000000E+00
210	UZ	0.000000000E+00	0.000000000E+00
212	UX	0.000000000E+00	0.000000000E+00
212	UZ	0.000000000E+00	0.000000000E+00
212	ROTZ	0.000000000E+00	0.000000000E+00
213	UX	0.000000000E+00	0.000000000E+00
213	UZ	0.000000000E+00	0.000000000E+00
213	ROTZ	0.000000000E+00	0.000000000E+00
214	UX	0.000000000E+00	0.000000000E+00
214	UZ	0.000000000E+00	0.000000000E+00
214	ROTZ	0.000000000E+00	0.000000000E+00
215	UX	0.000000000E+00	0.000000000E+00
215	UZ	0.000000000E+00	0.000000000E+00
215	ROTZ	0.000000000E+00	0.000000000E+00
216	UX	0.000000000E+00	0.000000000E+00
216	UZ	0.000000000E+00	0.000000000E+00
216	ROTZ	0.000000000E+00	0.000000000E+00
217	UX	0.000000000E+00	0.000000000E+00
217	UZ	0.000000000E+00	0.000000000E+00
217	ROTZ	0.000000000E+00	0.000000000E+00
218	UX	0.000000000E+00	0.000000000E+00
218	UZ	0.000000000E+00	0.000000000E+00
218	ROTZ	0.000000000E+00	0.000000000E+00
219	UX	0.000000000E+00	0.000000000E+00
219	UZ	0.000000000E+00	0.000000000E+00
219	ROTZ	0.000000000E+00	0.000000000E+00
220	UX	0.000000000E+00	0.000000000E+00
220	UZ	0.000000000E+00	0.000000000E+00
220	ROTZ	0.000000000E+00	0.000000000E+00
302	UX	0.000000000E+00	0.000000000E+00
302	UY	0.000000000E+00	0.000000000E+00
302	UZ	0.000000000E+00	0.000000000E+00
303	UX	0.000000000E+00	0.000000000E+00
303	UY	0.000000000E+00	0.000000000E+00
303	UZ	0.000000000E+00	0.000000000E+00
304	UX	0.000000000E+00	0.000000000E+00
304	UY	0.000000000E+00	0.000000000E+00
304	UZ	0.000000000E+00	0.000000000E+00
305	UX	0.000000000E+00	0.000000000E+00
305	UY	0.000000000E+00	0.000000000E+00
305	UZ	0.000000000E+00	0.000000000E+00
306	UX	0.000000000E+00	0.000000000E+00
306	UY	0.000000000E+00	0.000000000E+00
306	UZ	0.000000000E+00	0.000000000E+00
307	UX	0.000000000E+00	0.000000000E+00
307	UY	0.000000000E+00	0.000000000E+00
307	UZ	0.000000000E+00	0.000000000E+00
308	UX	0.000000000E+00	0.000000000E+00
308	UY	0.000000000E+00	0.000000000E+00
308	UZ	0.000000000E+00	0.000000000E+00
309	UX	0.000000000E+00	0.000000000E+00
309	UY	0.000000000E+00	0.000000000E+00
309	UZ	0.000000000E+00	0.000000000E+00
310	UX	0.000000000E+00	0.000000000E+00
310	UY	0.000000000E+00	0.000000000E+00
310	UZ	0.000000000E+00	0.000000000E+00

SOLUTION OPTIONS

PROBLEM DIMENSIONALITY. 3-D
DEGREES OF FREEDOM. . . . . UX UY UZ ROTX ROTY ROTZ
ANALYSIS TYPE . . . . . .MODAL
  EXTRACTION METHOD. . . . . .REDUCED
NUMBER OF MODES TO EXTRACT. 15
NUMBER OF REDUCED MODES TO PRINT. 0
NUMBER OF MASTER DOF. 36

LOAD STEP OPTIONS

LOAD STEP NUMBER. 1
INERTIA LOADS X Y Z
  ACEL . . . . . 0.00000E+00 0.00000E+00 -386.40

***** CENTROID, MASS, AND MASS MOMENTS OF INERTIA *****

CALCULATIONS ASSUME ELEMENT MASS AT ELEMENT CENTROID

TOTAL MASS = 187.59

***** PARTICIPATION FACTOR CALCULATION ***** X DIRECTION

MODE	FREQUENCY	PERIOD	PARTIC.FACTOR	RATIO	CUMULATIVE EFFECTIVE MASS	MASS FRACTION
1	18.9217	0.52849E-01	0.25945E-02	0.000523	0.673128E-05	0.234269E-06
2	19.5144	0.51244E-01	0.23259E-02	0.000469	0.541002E-05	0.422555E-06
3	37.3051	0.26806E-01	0.86775E-02	0.001750	0.752982E-04	0.304316E-05
4	42.6293	0.23458E-01	4.9592	1.000000	24.5937	0.855938
5	43.0542	0.23227E-01	1.5435	0.311245	2.38247	0.938855
6	43.1349	0.23183E-01	0.96810	0.195214	0.937226	0.971474
7	43.1735	0.23162E-01	-0.58010	0.116975	0.336518	0.983185
8	43.2055	0.23145E-01	-0.47429	0.095639	0.224955	0.991015
9	43.2392	0.23127E-01	0.33239	0.067025	0.110482	0.994860
10	43.2743	0.23108E-01	-0.31488	0.063493	0.991465E-01	0.998310
11	43.3066	0.23091E-01	0.17824	0.035942	0.317711E-01	0.999416
12	43.3297	0.23079E-01	0.12541	0.025288	0.157278E-01	0.999963
13	48.6637	0.20549E-01	-0.32065E-01	0.006466	0.102819E-02	0.999999
14	51.6793	0.19350E-01	-0.36866E-02	0.000743	0.135911E-04	1.000000
15	54.2983	0.18417E-01	0.31868E-02	0.000643	0.101555E-04	1.000000

SUM OF EFFECTIVE MASSES = 28.7331

***** PARTICIPATION FACTOR CALCULATION ***** Y DIRECTION

MODE	FREQUENCY	PERIOD	PARTIC.FACTOR	RATIO	CUMULATIVE EFFECTIVE MASS	MASS FRACTION
1	18.9217	0.52849E-01	0.00000E+00	0.000000	0.000000E+00	0.000000E+00
2	19.5144	0.51244E-01	0.00000E+00	0.000000	0.000000E+00	0.000000E+00
3	37.3051	0.26806E-01	0.00000E+00	0.000000	0.000000E+00	0.000000E+00
4	42.6293	0.23458E-01	0.00000E+00	0.000000	0.000000E+00	0.000000E+00
5	43.0542	0.23227E-01	0.00000E+00	0.000000	0.000000E+00	0.000000E+00
6	43.1349	0.23183E-01	0.00000E+00	0.000000	0.000000E+00	0.000000E+00
7	43.1735	0.23162E-01	0.00000E+00	0.000000	0.000000E+00	0.000000E+00
8	43.2055	0.23145E-01	0.00000E+00	0.000000	0.000000E+00	0.000000E+00
9	43.2392	0.23127E-01	0.00000E+00	0.000000	0.000000E+00	0.000000E+00
10	43.2743	0.23108E-01	0.00000E+00	0.000000	0.000000E+00	0.000000E+00
11	43.3066	0.23091E-01	0.00000E+00	0.000000	0.000000E+00	0.000000E+00
12	43.3297	0.23079E-01	0.00000E+00	0.000000	0.000000E+00	0.000000E+00
13	48.6637	0.20549E-01	0.00000E+00	0.000000	0.000000E+00	0.000000E+00
14	51.6793	0.19350E-01	0.00000E+00	0.000000	0.000000E+00	0.000000E+00
15	54.2983	0.18417E-01	0.00000E+00	0.000000	0.000000E+00	0.000000E+00

***** PARTICIPATION FACTOR CALCULATION ***** Z DIRECTION

MODE	FREQUENCY	PERIOD	PARTIC.FACTOR	RATIO	CUMULATIVE EFFECTIVE MASS	MASS FRACTION
1	18.9217	0.52849E-01	0.51350E-02	0.000499	0.263683E-04	0.203260E-06
2	19.5144	0.51244E-01	10.300	1.000000	106.095	0.817837
3	37.3051	0.26806E-01	0.87399	0.084851	0.763863	0.823726
4	42.6293	0.23458E-01	-0.47576E-01	0.004619	0.226347E-02	0.823743
5	43.0542	0.23227E-01	0.65374E-01	0.006347	0.427375E-02	0.823776
6	43.1349	0.23183E-01	-0.14221E-01	0.001381	0.202237E-03	0.823778
7	43.1735	0.23162E-01	-0.11704	0.011363	0.136992E-01	0.823883
8	43.2055	0.23145E-01	-0.60563E-02	0.000588	0.366791E-04	0.823884
9	43.2392	0.23127E-01	0.15873	0.015410	0.251947E-01	0.824078
10	43.2743	0.23108E-01	-0.11209E-01	0.001088	0.125631E-03	0.824079
11	43.3066	0.23091E-01	0.14365	0.013947	0.206365E-01	0.824238
12	43.3297	0.23079E-01	0.74127E-02	0.000720	0.549485E-04	0.824238
13	48.6637	0.20549E-01	0.29111E-04	0.000003	0.847442E-09	0.824238
14	51.6793	0.19350E-01	4.7750	0.463584	22.8010	1.000000
15	54.2983	0.18417E-01	-0.25927E-04	0.000003	0.672214E-09	1.000000

SUM OF EFFECTIVE MASSES = 129.727

Modal Results, @ wall 3

LIST MATERIALS 1 TO 3 BY 1
PROPERTY= ALL

PROPERTY TABLE EX MAT= 1 NUM. POINTS= 1
TEMPERATURE DATA TEMPERATURE DATA TEMPERATURE DATA
0.00000E+00 0.30000E+07

PROPERTY TABLE DENS MAT= 1 NUM. POINTS= 1
TEMPERATURE DATA TEMPERATURE DATA TEMPERATURE DATA
0.00000E+00 0.39300E-03

PROPERTY TABLE EX MAT= 2 NUM. POINTS= 1
TEMPERATURE DATA TEMPERATURE DATA TEMPERATURE DATA
0.00000E+00 0.30000E+07

PROPERTY TABLE DENS MAT= 2 NUM. POINTS= 1
TEMPERATURE DATA TEMPERATURE DATA TEMPERATURE DATA
0.00000E+00 0.50700E-03

PROPERTY TABLE EX MAT= 3 NUM. POINTS= 1
TEMPERATURE DATA TEMPERATURE DATA TEMPERATURE DATA
0.00000E+00 0.29000E+08

LIST CONSTRAINTS FOR SELECTED NODES 1 TO 310 BY 1
CURRENTLY SELECTED DOF SET= UX UY UZ ROTX ROTY ROTZ

NODE	LABEL	REAL	IMAG
1	UX	0.000000000E+00	0.000000000E+00
1	UY	0.000000000E+00	0.000000000E+00
1	UZ	0.000000000E+00	0.000000000E+00
2	UZ	0.000000000E+00	0.000000000E+00
3	UZ	0.000000000E+00	0.000000000E+00
4	UZ	0.000000000E+00	0.000000000E+00
5	UZ	0.000000000E+00	0.000000000E+00
6	UX	0.000000000E+00	0.000000000E+00
6	UY	0.000000000E+00	0.000000000E+00
6	UZ	0.000000000E+00	0.000000000E+00
7	UZ	0.000000000E+00	0.000000000E+00
8	UZ	0.000000000E+00	0.000000000E+00
9	UZ	0.000000000E+00	0.000000000E+00
10	UZ	0.000000000E+00	0.000000000E+00
11	UX	0.000000000E+00	0.000000000E+00
11	UY	0.000000000E+00	0.000000000E+00
11	UZ	0.000000000E+00	0.000000000E+00
21	UX	0.000000000E+00	0.000000000E+00
21	UZ	0.000000000E+00	0.000000000E+00
31	UZ	0.000000000E+00	0.000000000E+00
41	UX	0.000000000E+00	0.000000000E+00
41	UZ	0.000000000E+00	0.000000000E+00
51	UZ	0.000000000E+00	0.000000000E+00
61	UX	0.000000000E+00	0.000000000E+00
61	UZ	0.000000000E+00	0.000000000E+00
71	UZ	0.000000000E+00	0.000000000E+00
81	UX	0.000000000E+00	0.000000000E+00
81	UZ	0.000000000E+00	0.000000000E+00
91	UZ	0.000000000E+00	0.000000000E+00
101	UX	0.000000000E+00	0.000000000E+00
101	UZ	0.000000000E+00	0.000000000E+00
102	UZ	0.000000000E+00	0.000000000E+00
103	UZ	0.000000000E+00	0.000000000E+00
104	UZ	0.000000000E+00	0.000000000E+00
105	UZ	0.000000000E+00	0.000000000E+00
106	UZ	0.000000000E+00	0.000000000E+00
107	UZ	0.000000000E+00	0.000000000E+00
108	UZ	0.000000000E+00	0.000000000E+00
109	UZ	0.000000000E+00	0.000000000E+00
110	UZ	0.000000000E+00	0.000000000E+00

NODE	LABEL	REAL	IMAG
111	UZ	0.000000000E+00	0.000000000E+00
202	UX	0.000000000E+00	0.000000000E+00
202	UY	0.000000000E+00	0.000000000E+00
202	UZ	0.000000000E+00	0.000000000E+00
202	ROTZ	0.000000000E+00	0.000000000E+00
203	UX	0.000000000E+00	0.000000000E+00
203	UY	0.000000000E+00	0.000000000E+00
203	UZ	0.000000000E+00	0.000000000E+00
203	ROTZ	0.000000000E+00	0.000000000E+00
204	UX	0.000000000E+00	0.000000000E+00
204	UY	0.000000000E+00	0.000000000E+00
204	UZ	0.000000000E+00	0.000000000E+00
204	ROTZ	0.000000000E+00	0.000000000E+00
205	UX	0.000000000E+00	0.000000000E+00
205	UY	0.000000000E+00	0.000000000E+00
205	UZ	0.000000000E+00	0.000000000E+00
205	ROTZ	0.000000000E+00	0.000000000E+00
206	UX	0.000000000E+00	0.000000000E+00
206	UY	0.000000000E+00	0.000000000E+00
206	UZ	0.000000000E+00	0.000000000E+00
206	ROTZ	0.000000000E+00	0.000000000E+00
207	UX	0.000000000E+00	0.000000000E+00
207	UY	0.000000000E+00	0.000000000E+00
207	UZ	0.000000000E+00	0.000000000E+00
207	ROTZ	0.000000000E+00	0.000000000E+00
208	UX	0.000000000E+00	0.000000000E+00
208	UY	0.000000000E+00	0.000000000E+00
208	UZ	0.000000000E+00	0.000000000E+00
208	ROTZ	0.000000000E+00	0.000000000E+00
209	UX	0.000000000E+00	0.000000000E+00
209	UY	0.000000000E+00	0.000000000E+00
209	UZ	0.000000000E+00	0.000000000E+00
209	ROTZ	0.000000000E+00	0.000000000E+00
210	UX	0.000000000E+00	0.000000000E+00
210	UY	0.000000000E+00	0.000000000E+00
210	UZ	0.000000000E+00	0.000000000E+00
210	ROTZ	0.000000000E+00	0.000000000E+00
212	UX	0.000000000E+00	0.000000000E+00
212	UZ	0.000000000E+00	0.000000000E+00
212	ROTZ	0.000000000E+00	0.000000000E+00
213	UX	0.000000000E+00	0.000000000E+00
213	UZ	0.000000000E+00	0.000000000E+00
213	ROTZ	0.000000000E+00	0.000000000E+00
214	UX	0.000000000E+00	0.000000000E+00
214	UZ	0.000000000E+00	0.000000000E+00
214	ROTZ	0.000000000E+00	0.000000000E+00
215	UX	0.000000000E+00	0.000000000E+00
215	UZ	0.000000000E+00	0.000000000E+00
215	ROTZ	0.000000000E+00	0.000000000E+00
216	UX	0.000000000E+00	0.000000000E+00
216	UZ	0.000000000E+00	0.000000000E+00
216	ROTZ	0.000000000E+00	0.000000000E+00
217	UX	0.000000000E+00	0.000000000E+00
217	UZ	0.000000000E+00	0.000000000E+00
217	ROTZ	0.000000000E+00	0.000000000E+00
218	UX	0.000000000E+00	0.000000000E+00
218	UZ	0.000000000E+00	0.000000000E+00
218	ROTZ	0.000000000E+00	0.000000000E+00
219	UX	0.000000000E+00	0.000000000E+00
219	UZ	0.000000000E+00	0.000000000E+00

NODE	LABEL	REAL	IMAG
219	ROTZ	0.000000000E+00	0.000000000E+00
220	UX	0.000000000E+00	0.000000000E+00
220	UZ	0.000000000E+00	0.000000000E+00
220	ROTZ	0.000000000E+00	0.000000000E+00
302	UX	0.000000000E+00	0.000000000E+00
302	UY	0.000000000E+00	0.000000000E+00
302	UZ	0.000000000E+00	0.000000000E+00
303	UX	0.000000000E+00	0.000000000E+00
303	UY	0.000000000E+00	0.000000000E+00
303	UZ	0.000000000E+00	0.000000000E+00
304	UX	0.000000000E+00	0.000000000E+00
304	UY	0.000000000E+00	0.000000000E+00
304	UZ	0.000000000E+00	0.000000000E+00
305	UX	0.000000000E+00	0.000000000E+00
305	UY	0.000000000E+00	0.000000000E+00
305	UZ	0.000000000E+00	0.000000000E+00
306	UX	0.000000000E+00	0.000000000E+00
306	UY	0.000000000E+00	0.000000000E+00
306	UZ	0.000000000E+00	0.000000000E+00
307	UX	0.000000000E+00	0.000000000E+00
307	UY	0.000000000E+00	0.000000000E+00
307	UZ	0.000000000E+00	0.000000000E+00
308	UX	0.000000000E+00	0.000000000E+00
308	UY	0.000000000E+00	0.000000000E+00
308	UZ	0.000000000E+00	0.000000000E+00
309	UX	0.000000000E+00	0.000000000E+00
309	UY	0.000000000E+00	0.000000000E+00
309	UZ	0.000000000E+00	0.000000000E+00
310	UX	0.000000000E+00	0.000000000E+00
310	UY	0.000000000E+00	0.000000000E+00
310	UZ	0.000000000E+00	0.000000000E+00

S O L U T I O N O P T I O N S

PROBLEM DIMENSIONALITY. 3-D
DEGREES OF FREEDOM. . . . . UX UY UZ ROTX ROTY ROTZ
ANALYSIS TYPE . . . . . .MODAL
  EXTRACTION METHOD. . . . . .REDUCED
NUMBER OF MODES TO EXTRACT. 15
NUMBER OF REDUCED MODES TO PRINT. 0
NUMBER OF MASTER DOF. 36

L O A D S T E P O P T I O N S

LOAD STEP NUMBER. 1
INERTIA LOADS X Y Z
  ACEL . . . . . 0.00000E+00 0.00000E+00 386.40

***** CENTROID, MASS, AND MASS MOMENTS OF INERTIA *****

CALCULATIONS ASSUME ELEMENT MASS AT ELEMENT CENTROID

TOTAL MASS = 196.85

CENTROID	MOM. OF INERTIA ABOUT ORIGIN	MOM. OF INERTIA ABOUT CENTROID
XC = 160.00	IXX = 0.8829E+06	IXX = 0.2259E+06
YC = 57.659	IYY = 0.6596E+07	IYY = 0.1554E+07
ZC = 3.5604	IZZ = 0.7465E+07	IZZ = 0.1771E+07
	IXY = -0.1816E+07	IXY = 0.2328E-09
	IYZ = -0.3364E+05	IYZ = 6770.
	IZX = -0.1121E+06	IZX = 0.5821E-10

***** PARTICIPATION FACTOR CALCULATION ***** X DIRECTION

MODE	FREQUENCY	PERIOD	PARTIC.FACTOR	CUMULATIVE RATIO	EFFECTIVE MASS	MASS FRACTION
1	22.6519	0.44146E-01	0.68585E-03	0.000155	0.470391E-06	0.202278E-07
2	31.2436	0.32007E-01	-0.46742E-01	0.010575	0.218484E-02	0.939726E-04
3	45.0389	0.22203E-01	0.13081E-02	0.000296	0.171124E-05	0.940461E-04
4	50.5740	0.19773E-01	4.4201	1.000000	19.5374	0.840242
5	50.8750	0.19656E-01	0.24909	0.056354	0.620456E-01	0.842911
6	51.0094	0.19604E-01	0.52677	0.119175	0.277485	0.854843
7	51.0562	0.19586E-01	0.15118E-01	0.003420	0.228562E-03	0.854853
8	51.0757	0.19579E-01	0.82329	0.186259	0.677804	0.884000
9	51.0908	0.19573E-01	0.97653	0.220929	0.953613	0.925007
10	51.0913	0.19573E-01	0.96469	0.218251	0.930634	0.965026
11	51.1641	0.19545E-01	0.88680	0.200629	0.786423	0.998844
12	51.4978	0.19418E-01	0.13713	0.031024	0.188045E-01	0.999652
13	64.4681	0.15512E-01	0.84014E-01	0.019007	0.705828E-02	0.999956
14	71.2667	0.14032E-01	-0.15776E-01	0.003569	0.248893E-03	0.999967
15	78.1683	0.12793E-01	0.27848E-01	0.006300	0.775526E-03	1.000000

SUM OF EFFECTIVE MASSES= 23.2547

***** PARTICIPATION FACTOR CALCULATION ***** Y DIRECTION

MODE	FREQUENCY	PERIOD	PARTIC.FACTOR	CUMULATIVE RATIO	EFFECTIVE MASS	MASS FRACTION
1	22.6519	0.44146E-01	0.00000E+00	0.000000	0.000000E+00	0.000000E+00
2	31.2436	0.32007E-01	0.00000E+00	0.000000	0.000000E+00	0.000000E+00
3	45.0389	0.22203E-01	0.00000E+00	0.000000	0.000000E+00	0.000000E+00
4	50.5740	0.19773E-01	0.00000E+00	0.000000	0.000000E+00	0.000000E+00
5	50.8750	0.19656E-01	0.00000E+00	0.000000	0.000000E+00	0.000000E+00
6	51.0094	0.19604E-01	0.00000E+00	0.000000	0.000000E+00	0.000000E+00
7	51.0562	0.19586E-01	0.00000E+00	0.000000	0.000000E+00	0.000000E+00
8	51.0757	0.19579E-01	0.00000E+00	0.000000	0.000000E+00	0.000000E+00
9	51.0908	0.19573E-01	0.00000E+00	0.000000	0.000000E+00	0.000000E+00
10	51.0913	0.19573E-01	0.00000E+00	0.000000	0.000000E+00	0.000000E+00
11	51.1641	0.19545E-01	0.00000E+00	0.000000	0.000000E+00	0.000000E+00
12	51.4978	0.19418E-01	0.00000E+00	0.000000	0.000000E+00	0.000000E+00
13	64.4681	0.15512E-01	0.00000E+00	0.000000	0.000000E+00	0.000000E+00
14	71.2667	0.14032E-01	0.00000E+00	0.000000	0.000000E+00	0.000000E+00
15	78.1683	0.12793E-01	0.00000E+00	0.000000	0.000000E+00	0.000000E+00

***** PARTICIPATION FACTOR CALCULATION ***** Z DIRECTION

MODE	FREQUENCY	PERIOD	PARTIC.FACTOR	CUMULATIVE RATIO	EFFECTIVE MASS	MASS FRACTION
1	22.6519	0.44146E-01	10.507	1.000000	110.397	0.851624
2	31.2436	0.32007E-01	-0.23332E-03	0.000022	0.544366E-07	0.851624
3	45.0389	0.22203E-01	-3.2041	0.304948	10.2662	0.930819
4	50.5740	0.19773E-01	-0.10050	0.009565	0.101003E-01	0.930897
5	50.8750	0.19656E-01	-0.22063E-01	0.002100	0.486786E-03	0.930901
6	51.0094	0.19604E-01	0.14739	0.014028	0.217249E-01	0.931068
7	51.0562	0.19586E-01	0.61201E-02	0.000582	0.374558E-04	0.931069
8	51.0757	0.19579E-01	0.10854	0.010330	0.117800E-01	0.931160
9	51.0908	0.19573E-01	0.10242	0.009748	0.104896E-01	0.931240
10	51.0913	0.19573E-01	0.10268	0.009772	0.105427E-01	0.931322
11	51.1641	0.19545E-01	0.81804E-01	0.007786	0.669197E-02	0.931373
12	51.4978	0.19418E-01	-0.80926	0.077021	0.654905	0.936425
13	64.4681	0.15512E-01	-0.64497E-02	0.000614	0.415986E-04	0.936426
14	71.2667	0.14032E-01	-2.8707	0.273214	8.24069	0.999996
15	78.1683	0.12793E-01	-0.22143E-01	0.002107	0.490325E-03	1.00000

SUM OF EFFECTIVE MASSES= 129.631

Modal Results, @ wall 34

LIST MATERIALS 1 TO 3 BY 1
PROPERTY= ALL

PROPERTY TABLE EX MAT= 1 NUM. POINTS= 1
TEMPERATURE DATA TEMPERATURE DATA TEMPERATURE DATA
0.00000E+00 0.30000E+07

PROPERTY TABLE DENS MAT= 1 NUM. POINTS= 1
TEMPERATURE DATA TEMPERATURE DATA TEMPERATURE DATA
0.00000E+00 0.22500E-03

PROPERTY TABLE EX MAT= 2 NUM. POINTS= 1
TEMPERATURE DATA TEMPERATURE DATA TEMPERATURE DATA
0.00000E+00 0.30000E+07

PROPERTY TABLE DENS MAT= 2 NUM. POINTS= 1
TEMPERATURE DATA TEMPERATURE DATA TEMPERATURE DATA
0.00000E+00 0.50700E-03

PROPERTY TABLE EX MAT= 3 NUM. POINTS= 1
TEMPERATURE DATA TEMPERATURE DATA TEMPERATURE DATA
0.00000E+00 0.29000E+08

X 164.2 in
Z 37.72 in

LIST CONSTRAINTS FOR SELECTED NODES 1 TO 560 BY 1
CURRENTLY SELECTED DOF SET= UX UY UZ ROTX ROTY ROTZ

NODE	LABEL	REAL	IMAG
1	UX	0.000000000E+00	0.000000000E+00
1	UY	0.000000000E+00	0.000000000E+00
1	UZ	0.000000000E+00	0.000000000E+00
2	UX	0.000000000E+00	0.000000000E+00
2	UY	0.000000000E+00	0.000000000E+00
2	UZ	0.000000000E+00	0.000000000E+00
3	UX	0.000000000E+00	0.000000000E+00
3	UY	0.000000000E+00	0.000000000E+00
3	UZ	0.000000000E+00	0.000000000E+00
4	UX	0.000000000E+00	0.000000000E+00
4	UY	0.000000000E+00	0.000000000E+00
4	UZ	0.000000000E+00	0.000000000E+00
5	UX	0.000000000E+00	0.000000000E+00
5	UY	0.000000000E+00	0.000000000E+00
5	UZ	0.000000000E+00	0.000000000E+00
6	UX	0.000000000E+00	0.000000000E+00
6	UY	0.000000000E+00	0.000000000E+00
6	UZ	0.000000000E+00	0.000000000E+00
7	UX	0.000000000E+00	0.000000000E+00
7	UY	0.000000000E+00	0.000000000E+00
7	UZ	0.000000000E+00	0.000000000E+00
8	UX	0.000000000E+00	0.000000000E+00
8	UY	0.000000000E+00	0.000000000E+00
8	UZ	0.000000000E+00	0.000000000E+00
9	UX	0.000000000E+00	0.000000000E+00
9	UY	0.000000000E+00	0.000000000E+00
9	UZ	0.000000000E+00	0.000000000E+00
10	UX	0.000000000E+00	0.000000000E+00
10	UY	0.000000000E+00	0.000000000E+00
10	UZ	0.000000000E+00	0.000000000E+00
11	UX	0.000000000E+00	0.000000000E+00
11	UY	0.000000000E+00	0.000000000E+00
11	UZ	0.000000000E+00	0.000000000E+00
21	UX	0.000000000E+00	0.000000000E+00
21	UZ	0.000000000E+00	0.000000000E+00
31	UZ	0.000000000E+00	0.000000000E+00
41	UX	0.000000000E+00	0.000000000E+00
41	UZ	0.000000000E+00	0.000000000E+00
51	UZ	0.000000000E+00	0.000000000E+00
61	UX	0.000000000E+00	0.000000000E+00

NODE	LABEL	REAL	IMAG
61	UZ	0.000000000E+00	0.000000000E+00
71	UZ	0.000000000E+00	0.000000000E+00
81	UX	0.000000000E+00	0.000000000E+00
81	UZ	0.000000000E+00	0.000000000E+00
91	UZ	0.000000000E+00	0.000000000E+00
101	UX	0.000000000E+00	0.000000000E+00
101	UZ	0.000000000E+00	0.000000000E+00
102	UZ	0.000000000E+00	0.000000000E+00
103	UZ	0.000000000E+00	0.000000000E+00
104	UZ	0.000000000E+00	0.000000000E+00
105	UZ	0.000000000E+00	0.000000000E+00
106	UZ	0.000000000E+00	0.000000000E+00
107	UZ	0.000000000E+00	0.000000000E+00
108	UZ	0.000000000E+00	0.000000000E+00
109	UZ	0.000000000E+00	0.000000000E+00
110	UZ	0.000000000E+00	0.000000000E+00
111	UZ	0.000000000E+00	0.000000000E+00
202	UX	0.000000000E+00	0.000000000E+00
202	UZ	0.000000000E+00	0.000000000E+00
203	UX	0.000000000E+00	0.000000000E+00
203	UZ	0.000000000E+00	0.000000000E+00
204	UX	0.000000000E+00	0.000000000E+00
204	UZ	0.000000000E+00	0.000000000E+00
205	UX	0.000000000E+00	0.000000000E+00
205	UZ	0.000000000E+00	0.000000000E+00
206	UX	0.000000000E+00	0.000000000E+00
206	UZ	0.000000000E+00	0.000000000E+00
207	UX	0.000000000E+00	0.000000000E+00
207	UZ	0.000000000E+00	0.000000000E+00
208	UX	0.000000000E+00	0.000000000E+00
208	UZ	0.000000000E+00	0.000000000E+00
209	UX	0.000000000E+00	0.000000000E+00
209	UZ	0.000000000E+00	0.000000000E+00
210	UX	0.000000000E+00	0.000000000E+00
210	UZ	0.000000000E+00	0.000000000E+00
302	UX	0.000000000E+00	0.000000000E+00
302	UZ	0.000000000E+00	0.000000000E+00
303	UX	0.000000000E+00	0.000000000E+00
303	UZ	0.000000000E+00	0.000000000E+00
304	UX	0.000000000E+00	0.000000000E+00
304	UZ	0.000000000E+00	0.000000000E+00
305	UX	0.000000000E+00	0.000000000E+00
305	UZ	0.000000000E+00	0.000000000E+00
306	UX	0.000000000E+00	0.000000000E+00
306	UZ	0.000000000E+00	0.000000000E+00
307	UX	0.000000000E+00	0.000000000E+00
307	UZ	0.000000000E+00	0.000000000E+00
308	UX	0.000000000E+00	0.000000000E+00
308	UZ	0.000000000E+00	0.000000000E+00
309	UX	0.000000000E+00	0.000000000E+00
309	UZ	0.000000000E+00	0.000000000E+00
310	UX	0.000000000E+00	0.000000000E+00
310	UZ	0.000000000E+00	0.000000000E+00
502	UX	0.000000000E+00	0.000000000E+00
502	UY	0.000000000E+00	0.000000000E+00
502	UZ	0.000000000E+00	0.000000000E+00
503	UX	0.000000000E+00	0.000000000E+00
503	UY	0.000000000E+00	0.000000000E+00
503	UZ	0.000000000E+00	0.000000000E+00
504	UX	0.000000000E+00	0.000000000E+00

NODE	LABEL	REAL	IMAG
504	UY	0.000000000E+00	0.000000000E+00
504	UZ	0.000000000E+00	0.000000000E+00
505	UX	0.000000000E+00	0.000000000E+00
505	UY	0.000000000E+00	0.000000000E+00
505	UZ	0.000000000E+00	0.000000000E+00
506	UX	0.000000000E+00	0.000000000E+00
506	UY	0.000000000E+00	0.000000000E+00
506	UZ	0.000000000E+00	0.000000000E+00
507	UX	0.000000000E+00	0.000000000E+00
507	UY	0.000000000E+00	0.000000000E+00
507	UZ	0.000000000E+00	0.000000000E+00
508	UX	0.000000000E+00	0.000000000E+00
508	UY	0.000000000E+00	0.000000000E+00
508	UZ	0.000000000E+00	0.000000000E+00
509	UX	0.000000000E+00	0.000000000E+00
509	UY	0.000000000E+00	0.000000000E+00
509	UZ	0.000000000E+00	0.000000000E+00
510	UX	0.000000000E+00	0.000000000E+00
510	UY	0.000000000E+00	0.000000000E+00
510	UZ	0.000000000E+00	0.000000000E+00
552	UX	0.000000000E+00	0.000000000E+00
552	UY	0.000000000E+00	0.000000000E+00
552	UZ	0.000000000E+00	0.000000000E+00
553	UX	0.000000000E+00	0.000000000E+00
553	UY	0.000000000E+00	0.000000000E+00
553	UZ	0.000000000E+00	0.000000000E+00
554	UX	0.000000000E+00	0.000000000E+00
554	UY	0.000000000E+00	0.000000000E+00
554	UZ	0.000000000E+00	0.000000000E+00
555	UX	0.000000000E+00	0.000000000E+00
555	UY	0.000000000E+00	0.000000000E+00
555	UZ	0.000000000E+00	0.000000000E+00
556	UX	0.000000000E+00	0.000000000E+00
556	UY	0.000000000E+00	0.000000000E+00
556	UZ	0.000000000E+00	0.000000000E+00
557	UX	0.000000000E+00	0.000000000E+00
557	UY	0.000000000E+00	0.000000000E+00
557	UZ	0.000000000E+00	0.000000000E+00
558	UX	0.000000000E+00	0.000000000E+00
558	UY	0.000000000E+00	0.000000000E+00
558	UZ	0.000000000E+00	0.000000000E+00
559	UX	0.000000000E+00	0.000000000E+00
559	UY	0.000000000E+00	0.000000000E+00
559	UZ	0.000000000E+00	0.000000000E+00
560	UX	0.000000000E+00	0.000000000E+00
560	UY	0.000000000E+00	0.000000000E+00
560	UZ	0.000000000E+00	0.000000000E+00

S O L U T I O N O P T I O N S

PROBLEM DIMENSIONALITY. 3-D
DEGREES OF FREEDOM. . . . . UX UY UZ ROTX ROTY ROTZ
ANALYSIS TYPE . . . . . .MODAL
  EXTRACTION METHOD. . . . . .REDUCED
NUMBER OF MODES TO EXTRACT. 15
NUMBER OF REDUCED MODES TO PRINT. 0
NUMBER OF MASTER DOF. 36

L O A D S T E P O P T I O N S

LOAD STEP NUMBER. 1
INERTIA LOADS X Y Z
  ACEL . . . . . 0.00000E+00 0.00000E+00 386.40

***** CENTROID, MASS, AND MASS MOMENTS OF INERTIA *****

CALCULATIONS ASSUME ELEMENT MASS AT ELEMENT CENTROID

TOTAL MASS = 72.576

***** PARTICIPATION FACTOR CALCULATION ***** X DIRECTION

MODE	FREQUENCY	PERIOD	PARTIC.FACTOR	RATIO	EFFECTIVE MASS	CUMULATIVE MASS FRACTION
1	37.7229	0.26509E-01	0.52559E-15	0.000000	0.276241E-30	0.768759E-32
2	42.5738	0.23489E-01	-0.35009E-15	0.000000	0.122564E-30	0.110984E-31
3	51.2784	0.19501E-01	0.48850E-15	0.000000	0.238630E-30	0.177393E-31
4	63.9391	0.15640E-01	0.23818E-15	0.000000	0.567310E-31	0.193181E-31
5	80.1029	0.12484E-01	0.30023E-14	0.000000	0.901379E-29	0.270165E-30
6	98.8642	0.10115E-01	0.17304E-14	0.000000	0.299443E-29	0.353498E-30
7	118.807	0.84170E-02	0.46830E-15	0.000000	0.219305E-30	0.359601E-30
8	137.715	0.72614E-02	0.96092E-13	0.000000	0.923376E-26	0.257328E-27
9	154.382	0.64774E-02	0.10439E-13	0.000000	0.108965E-27	0.260360E-27
10	156.800	0.63776E-02	0.12575E-13	0.000000	0.158139E-27	0.264761E-27
11	164.213	0.60897E-02	5.9945	1.000000	35.9334	1.00000
12	181.474	0.55104E-02	-0.20589E-12	0.000000	0.423919E-25	1.00000
13	184.302	0.54259E-02	0.28004E-14	0.000000	0.784228E-29	1.00000
14	186.731	0.53553E-02	0.15599E-13	0.000000	0.243317E-27	1.00000
15	189.057	0.52894E-02	0.31821E-16	0.000000	0.101259E-32	1.00000

SUM OF EFFECTIVE MASSES= 35.9334

***** PARTICIPATION FACTOR CALCULATION ***** Y DIRECTION

MODE	FREQUENCY	PERIOD	PARTIC.FACTOR	RATIO	EFFECTIVE MASS	CUMULATIVE MASS FRACTION
1	37.7229	0.26509E-01	0.00000E+00	0.000000	0.000000E+00	0.000000E+00
2	42.5738	0.23489E-01	0.00000E+00	0.000000	0.000000E+00	0.000000E+00
3	51.2784	0.19501E-01	0.00000E+00	0.000000	0.000000E+00	0.000000E+00
4	63.9391	0.15640E-01	0.00000E+00	0.000000	0.000000E+00	0.000000E+00
5	80.1029	0.12484E-01	0.00000E+00	0.000000	0.000000E+00	0.000000E+00
6	98.8642	0.10115E-01	0.00000E+00	0.000000	0.000000E+00	0.000000E+00
7	118.807	0.84170E-02	0.00000E+00	0.000000	0.000000E+00	0.000000E+00
8	137.715	0.72614E-02	0.00000E+00	0.000000	0.000000E+00	0.000000E+00
9	154.382	0.64774E-02	0.00000E+00	0.000000	0.000000E+00	0.000000E+00
10	156.800	0.63776E-02	0.00000E+00	0.000000	0.000000E+00	0.000000E+00
11	164.213	0.60897E-02	0.00000E+00	0.000000	0.000000E+00	0.000000E+00
12	181.474	0.55104E-02	0.00000E+00	0.000000	0.000000E+00	0.000000E+00
13	184.302	0.54259E-02	0.00000E+00	0.000000	0.000000E+00	0.000000E+00
14	186.731	0.53553E-02	0.00000E+00	0.000000	0.000000E+00	0.000000E+00
15	189.057	0.52894E-02	0.00000E+00	0.000000	0.000000E+00	0.000000E+00

***** PARTICIPATION FACTOR CALCULATION ***** Z DIRECTION

MODE	FREQUENCY	PERIOD	PARTIC.FACTOR	RATIO	EFFECTIVE MASS	CUMULATIVE MASS FRACTION
1	37.7229	0.26509E-01	11.206	1.000000	125.579	0.857417
2	42.5738	0.23489E-01	0.13959E-11	0.000000	0.194849E-23	0.857417
3	51.2784	0.19501E-01	-3.3820	0.301797	11.4379	0.935512
4	63.9391	0.15640E-01	-0.32330E-12	0.000000	0.104521E-24	0.935512
5	80.1029	0.12484E-01	1.7233	0.153780	2.96972	0.955788
6	98.8642	0.10115E-01	0.57954E-13	0.000000	0.335862E-26	0.955788
7	118.807	0.84170E-02	-0.98030	0.087479	0.960996	0.962349
8	137.715	0.72614E-02	-0.56011E-13	0.000000	0.313720E-26	0.962349
9	154.382	0.64774E-02	0.80527	0.071859	0.648462	0.966777
10	156.800	0.63776E-02	0.16653E-15	0.000000	0.277334E-31	0.966777
11	164.213	0.60897E-02	-0.72121E-15	0.000000	0.520149E-30	0.966777
12	181.474	0.55104E-02	-2.1174	0.188947	4.48332	0.997388
13	184.302	0.54259E-02	-0.10947E-12	0.000000	0.119832E-25	0.997388
14	186.731	0.53553E-02	0.18641E-13	0.000000	0.347487E-27	0.997388
15	189.057	0.52894E-02	-0.61854	0.055197	0.382598	1.00000

SUM OF EFFECTIVE MASSES= 146.462

Modal Results, @ wall 4

```
LIST MATERIALS   1 TO   3 BY  1
 PROPERTY= ALL

PROPERTY TABLE EX   MAT=  1  NUM. POINTS=  1
 TEMPERATURE    DATA   TEMPERATURE    DATA   TEMPERATURE    DATA
 0.00000E+00 0.30000E+07

PROPERTY TABLE DENS  MAT=  1  NUM. POINTS=  1
 TEMPERATURE    DATA   TEMPERATURE    DATA   TEMPERATURE    DATA
 0.00000E+00 0.22500E-03

PROPERTY TABLE EX   MAT=  2  NUM. POINTS=  1
 TEMPERATURE    DATA   TEMPERATURE    DATA   TEMPERATURE    DATA
 0.00000E+00 0.30000E+07

PROPERTY TABLE DENS  MAT=  2  NUM. POINTS=  1
 TEMPERATURE    DATA   TEMPERATURE    DATA   TEMPERATURE    DATA
 0.00000E+00 0.50700E-03

PROPERTY TABLE EX   MAT=  3  NUM. POINTS=  1
 TEMPERATURE    DATA   TEMPERATURE    DATA   TEMPERATURE    DATA
 0.00000E+00 0.29000E+08


LIST CONSTRAINTS FOR SELECTED NODES      1 TO    310 BY     1
CURRENTLY SELECTED DOF SET= UX  UY  UZ  ROTX ROTY ROTZ

  NODE  LABEL    REAL          IMAG
     1  UX    0.000000000E+00 0.000000000E+00
     1  UY    0.000000000E+00 0.000000000E+00
     1  UZ    0.000000000E+00 0.000000000E+00
     6  UX    0.000000000E+00 0.000000000E+00
     6  UY    0.000000000E+00 0.000000000E+00
     6  UZ    0.000000000E+00 0.000000000E+00
    11  UX    0.000000000E+00 0.000000000E+00
    11  UY    0.000000000E+00 0.000000000E+00
    11  UZ    0.000000000E+00 0.000000000E+00
    21  UX    0.000000000E+00 0.000000000E+00
    21  UZ    0.000000000E+00 0.000000000E+00
    31  UZ    0.000000000E+00 0.000000000E+00
    41  UX    0.000000000E+00 0.000000000E+00
    41  UZ    0.000000000E+00 0.000000000E+00
    51  UZ    0.000000000E+00 0.000000000E+00
    61  UX    0.000000000E+00 0.000000000E+00
    61  UZ    0.000000000E+00 0.000000000E+00
    71  UZ    0.000000000E+00 0.000000000E+00
    81  UX    0.000000000E+00 0.000000000E+00
    81  UZ    0.000000000E+00 0.000000000E+00
    91  UZ    0.000000000E+00 0.000000000E+00
   101  UX    0.000000000E+00 0.000000000E+00
   101  UZ    0.000000000E+00 0.000000000E+00
   102  UZ    0.000000000E+00 0.000000000E+00
   103  UZ    0.000000000E+00 0.000000000E+00
   104  UZ    0.000000000E+00 0.000000000E+00
   105  UZ    0.000000000E+00 0.000000000E+00
   106  UZ    0.000000000E+00 0.000000000E+00
   107  UZ    0.000000000E+00 0.000000000E+00
   108  UZ    0.000000000E+00 0.000000000E+00
   109  UZ    0.000000000E+00 0.000000000E+00
   110  UZ    0.000000000E+00 0.000000000E+00
   111  UZ    0.000000000E+00 0.000000000E+00
   202  UX    0.000000000E+00 0.000000000E+00
   202  UY    0.000000000E+00 0.000000000E+00
   202  UZ    0.000000000E+00 0.000000000E+00
   202  ROTZ  0.000000000E+00 0.000000000E+00
   203  UX    0.000000000E+00 0.000000000E+00
   203  UY    0.000000000E+00 0.000000000E+00
   203  UZ    0.000000000E+00 0.000000000E+00
```

X 50.60 Hz

Z 23.01 Hz

NODE	LABEL	REAL	IMAG
203	ROTZ	0.000000000E+00	0.000000000E+00
204	UX	0.000000000E+00	0.000000000E+00
204	UY	0.000000000E+00	0.000000000E+00
204	UZ	0.000000000E+00	0.000000000E+00
204	ROTZ	0.000000000E+00	0.000000000E+00
205	UX	0.000000000E+00	0.000000000E+00
205	UY	0.000000000E+00	0.000000000E+00
205	UZ	0.000000000E+00	0.000000000E+00
205	ROTZ	0.000000000E+00	0.000000000E+00
206	UX	0.000000000E+00	0.000000000E+00
206	UY	0.000000000E+00	0.000000000E+00
206	UZ	0.000000000E+00	0.000000000E+00
206	ROTZ	0.000000000E+00	0.000000000E+00
207	UX	0.000000000E+00	0.000000000E+00
207	UY	0.000000000E+00	0.000000000E+00
207	UZ	0.000000000E+00	0.000000000E+00
207	ROTZ	0.000000000E+00	0.000000000E+00
208	UX	0.000000000E+00	0.000000000E+00
208	UY	0.000000000E+00	0.000000000E+00
208	UZ	0.000000000E+00	0.000000000E+00
208	ROTZ	0.000000000E+00	0.000000000E+00
209	UX	0.000000000E+00	0.000000000E+00
209	UY	0.000000000E+00	0.000000000E+00
209	UZ	0.000000000E+00	0.000000000E+00
209	ROTZ	0.000000000E+00	0.000000000E+00
210	UX	0.000000000E+00	0.000000000E+00
210	UY	0.000000000E+00	0.000000000E+00
210	UZ	0.000000000E+00	0.000000000E+00
210	ROTZ	0.000000000E+00	0.000000000E+00
212	UX	0.000000000E+00	0.000000000E+00
212	UZ	0.000000000E+00	0.000000000E+00
212	ROTZ	0.000000000E+00	0.000000000E+00
213	UX	0.000000000E+00	0.000000000E+00
213	UZ	0.000000000E+00	0.000000000E+00
213	ROTZ	0.000000000E+00	0.000000000E+00
214	UX	0.000000000E+00	0.000000000E+00
214	UZ	0.000000000E+00	0.000000000E+00
214	ROTZ	0.000000000E+00	0.000000000E+00
215	UX	0.000000000E+00	0.000000000E+00
215	UZ	0.000000000E+00	0.000000000E+00
215	ROTZ	0.000000000E+00	0.000000000E+00
216	UX	0.000000000E+00	0.000000000E+00
216	UZ	0.000000000E+00	0.000000000E+00
216	ROTZ	0.000000000E+00	0.000000000E+00
217	UX	0.000000000E+00	0.000000000E+00
217	UZ	0.000000000E+00	0.000000000E+00
217	ROTZ	0.000000000E+00	0.000000000E+00
218	UX	0.000000000E+00	0.000000000E+00
218	UZ	0.000000000E+00	0.000000000E+00
218	ROTZ	0.000000000E+00	0.000000000E+00
219	UX	0.000000000E+00	0.000000000E+00
219	UZ	0.000000000E+00	0.000000000E+00
219	ROTZ	0.000000000E+00	0.000000000E+00
220	UX	0.000000000E+00	0.000000000E+00
220	UZ	0.000000000E+00	0.000000000E+00
220	ROTZ	0.000000000E+00	0.000000000E+00
302	UX	0.000000000E+00	0.000000000E+00
302	UY	0.000000000E+00	0.000000000E+00
302	UZ	0.000000000E+00	0.000000000E+00
303	UX	0.000000000E+00	0.000000000E+00

NODE	LABEL	REAL	IMAG
303	UY	0.000000000E+00	0.000000000E+00
303	UZ	0.000000000E+00	0.000000000E+00
304	UX	0.000000000E+00	0.000000000E+00
304	UY	0.000000000E+00	0.000000000E+00
304	UZ	0.000000000E+00	0.000000000E+00
305	UX	0.000000000E+00	0.000000000E+00
305	UY	0.000000000E+00	0.000000000E+00
305	UZ	0.000000000E+00	0.000000000E+00
306	UX	0.000000000E+00	0.000000000E+00
306	UY	0.000000000E+00	0.000000000E+00
306	UZ	0.000000000E+00	0.000000000E+00
307	UX	0.000000000E+00	0.000000000E+00
307	UY	0.000000000E+00	0.000000000E+00
307	UZ	0.000000000E+00	0.000000000E+00
308	UX	0.000000000E+00	0.000000000E+00
308	UY	0.000000000E+00	0.000000000E+00
308	UZ	0.000000000E+00	0.000000000E+00
309	UX	0.000000000E+00	0.000000000E+00
309	UY	0.000000000E+00	0.000000000E+00
309	UZ	0.000000000E+00	0.000000000E+00
310	UX	0.000000000E+00	0.000000000E+00
310	UY	0.000000000E+00	0.000000000E+00
310	UZ	0.000000000E+00	0.000000000E+00

S O L U T I O N O P T I O N S

PROBLEM DIMENSIONALITY. 3-D
DEGREES OF FREEDOM. . . . . UX UY UZ ROTX ROTY ROTZ
ANALYSIS TYPE . . . . . .MODAL
  EXTRACTION METHOD. . . . . .REDUCED
NUMBER OF MODES TO EXTRACT. 15
NUMBER OF REDUCED MODES TO PRINT. 0
NUMBER OF MASTER DOF. 36

L O A D S T E P O P T I O N S

LOAD STEP NUMBER. 1
INERTIA LOADS X Y Z
  ACEL . . . . . 0.00000E+00 0.00000E+00 386.40

***** CENTROID, MASS, AND MASS MOMENTS OF INERTIA *****

CALCULATIONS ASSUME ELEMENT MASS AT ELEMENT CENTROID

TOTAL MASS = 142.66

CENTROID	MOM. OF INERTIA ABOUT ORIGIN	MOM. OF INERTIA ABOUT CENTROID
XC = 160.00	IXX = 0.5991E+06	IXX = 0.1541E+06
YC = 55.631	IYY = 0.4751E+07	IYY = 0.1095E+07
ZC = 4.9128	IZZ = 0.5336E+07	IZZ = 0.1242E+07
	IXY = -0.1270E+07	IXY = 0.4657E-09
	IYZ = -0.3364E+05	IYZ = 5348.
	IZX = -0.1121E+06	IZX = 0.0000E+00

*** MASS SUMMARY BY ELEMENT TYPE ***

TYPE	MASS
1	142.664

***** PARTICIPATION FACTOR CALCULATION ***** X DIRECTION

MODE	FREQUENCY	PERIOD	PARTIC.FACTOR	RATIO	CUMULATIVE EFFECTIVE MASS	MASS FRACTION
1	22.4591	0.44525E-01	0.26973E-01	0.006072	0.727529E-03	0.313086E-04
2	23.0137	0.43452E-01	0.59281E-03	0.000133	0.351426E-06	0.313237E-04
3	44.4131	0.22516E-01	-0.22122E-03	0.000050	0.489368E-07	0.313258E-04
4	50.6009	0.19762E-01	4.4423	1.000000	19.7345	0.849287
5	50.9281	0.19636E-01	0.53354E-01	0.012010	0.284664E-02	0.849409
6	50.9899	0.19612E-01	-0.27270	0.061386	0.743652E-01	0.852609
7	51.0264	0.19598E-01	-0.48486	0.109145	0.235089	0.862726
8	51.0636	0.19583E-01	0.36806	0.082853	0.135468	0.868556
9	51.0796	0.19577E-01	0.68746	0.154752	0.472606	0.888894
10	51.0929	0.19572E-01	0.50837	0.114437	0.258439	0.900016
11	51.0979	0.19570E-01	1.3095	0.294784	1.71488	0.973814
12	51.2792	0.19501E-01	0.77770	0.175066	0.604825	0.999842
13	60.0787	0.16645E-01	-0.28572E-01	0.006432	0.816349E-03	0.999877
14	64.5636	0.15489E-01	0.83119E-02	0.001871	0.690881E-04	0.999880
15	71.1055	0.14064E-01	-0.52707E-01	0.011865	0.277806E-02	1.00000

SUM OF EFFECTIVE MASSES = 23.2374

***** PARTICIPATION FACTOR CALCULATION ***** Y DIRECTION

MODE	FREQUENCY	PERIOD	PARTIC.FACTOR	RATIO	CUMULATIVE EFFECTIVE MASS	MASS FRACTION
1	22.4591	0.44525E-01	0.00000E+00	0.000000	0.000000E+00	0.000000E+00
2	23.0137	0.43452E-01	0.00000E+00	0.000000	0.000000E+00	0.000000E+00
3	44.4131	0.22516E-01	0.00000E+00	0.000000	0.000000E+00	0.000000E+00
4	50.6009	0.19762E-01	0.00000E+00	0.000000	0.000000E+00	0.000000E+00
5	50.9281	0.19636E-01	0.00000E+00	0.000000	0.000000E+00	0.000000E+00
6	50.9899	0.19612E-01	0.00000E+00	0.000000	0.000000E+00	0.000000E+00
7	51.0264	0.19598E-01	0.00000E+00	0.000000	0.000000E+00	0.000000E+00
8	51.0636	0.19583E-01	0.00000E+00	0.000000	0.000000E+00	0.000000E+00
9	51.0796	0.19577E-01	0.00000E+00	0.000000	0.000000E+00	0.000000E+00
10	51.0929	0.19572E-01	0.00000E+00	0.000000	0.000000E+00	0.000000E+00
11	51.0979	0.19570E-01	0.00000E+00	0.000000	0.000000E+00	0.000000E+00
12	51.2792	0.19501E-01	0.00000E+00	0.000000	0.000000E+00	0.000000E+00
13	60.0787	0.16645E-01	0.00000E+00	0.000000	0.000000E+00	0.000000E+00
14	64.5636	0.15489E-01	0.00000E+00	0.000000	0.000000E+00	0.000000E+00
15	71.1055	0.14064E-01	0.00000E+00	0.000000	0.000000E+00	0.000000E+00

***** PARTICIPATION FACTOR CALCULATION ***** Z DIRECTION

MODE	FREQUENCY	PERIOD	PARTIC.FACTOR	RATIO	CUMULATIVE EFFECTIVE MASS	MASS FRACTION
1	22.4591	0.44525E-01	0.22664E-03	0.000025	0.513640E-07	0.522416E-09
2	23.0137	0.43452E-01	8.9241	1.000000	79.6401	0.810010
3	44.4131	0.22516E-01	0.83496	0.093562	0.697163	0.817100
4	50.6009	0.19762E-01	-0.10014	0.011222	0.100285E-01	0.817202
5	50.9281	0.19636E-01	0.80064E-02	0.000897	0.641025E-04	0.817203
6	50.9899	0.19612E-01	-0.39444E-01	0.004420	0.155584E-02	0.817219
7	51.0264	0.19598E-01	-0.32904E-01	0.003687	0.108267E-02	0.817230
8	51.0636	0.19583E-01	-0.19384E-02	0.000217	0.375738E-05	0.817230
9	51.0796	0.19577E-01	-0.14696E-01	0.001647	0.215974E-03	0.817232
10	51.0929	0.19572E-01	-0.11284E-01	0.001264	0.127326E-03	0.817233
11	51.0979	0.19570E-01	-0.34730E-01	0.003892	0.120618E-02	0.817246
12	51.2792	0.19501E-01	0.47769	0.053528	0.228189	0.819567
13	60.0787	0.16645E-01	0.95555E-03	0.000107	0.913082E-06	0.819567
14	64.5636	0.15489E-01	4.2119	0.471969	17.7402	1.000000
15	71.1055	0.14064E-01	0.13626E-02	0.000153	0.185666E-05	1.000000

SUM OF EFFECTIVE MASSES = 98.3200

Reactions @ Wall 1

PRINT REACTION SOLUTIONS PER NODE

***** POST1 TOTAL REACTION SOLUTION LISTING *****

THE FOLLOWING X,Y,Z SOLUTIONS ARE IN GLOBAL COORDINATES

NODE	FX	FY	FZ	MX	MY	MZ
1	-232.89	-491.39	-627.73			
2		710.79				
3		899.10				
4		965.88				
5		982.61				
6	-19.729	-858.48	985.70			
7		982.61				
8		965.88				
9		899.10				
10		710.79				
11	204.93	-474.23	-627.73			
21	31.992	520.86				
31		520.86				
41	31.041	711.56				
51		711.56				
61	-37.861	806.21				
71		806.21				
81	-11.548	923.91				
91		923.90				
101	34.211	-660.88				
102		978.51				
103		1165.8				
104		1222.5				
105		1236.9				
106		1239.3				
107		1236.9				
108		1222.5				
109		1165.8				
110		978.51				
111		-660.87				
202	164.84	732.20	399.77			-923.41
203	100.43	783.88	405.39			-562.47
204	54.291	818.72	409.15			-303.46
205	23.283	840.82	411.52			-129.47
206	-0.10046E-01	848.61	412.35			0.79169
207	-23.303	840.92	411.53			131.07
208	-54.313	818.77	409.16			305.12
209	-100.45	783.75	405.38			564.24
210	-164.86	732.09	399.75			925.07
212	-170.93	330.12				1508.0
213	-104.14	364.33				918.96
214	-56.312	383.29				497.49
215	-24.164	392.01				214.12
216	-0.61535E-02	394.44				0.76350
217	24.152	391.99				-212.58
218	56.300	383.28				-495.90
219	104.13	364.35				-917.27
220	170.91	330.14				-1506.4
302	0.00000E+00	-368.50	0.00000E+00			
303	0.00000E+00	-559.70	0.00000E+00			
304	0.00000E+00	-668.80	0.00000E+00			
305	0.00000E+00	-722.00	0.00000E+00			
306	0.00000E+00	-737.64	0.00000E+00			
307	0.00000E+00	-721.97	0.00000E+00			
308	0.00000E+00	-668.78	0.00000E+00			
309	0.00000E+00	-559.73	0.00000E+00			
310	0.00000E+00	-368.53	0.00000E+00			

TOTAL VALUES

VALUE	-0.62528E-12	0.10931E-09	28895.	0.00000E+00	0.00000E+00	14.666

PRINT F ELEMENT SOLUTION PER ELEMENT

***** POST1 ELEMENT NODE TOTAL FORCE LISTING *****

THE FOLLOWING X,Y,Z FORCES ARE IN GLOBAL COORDINATES

ELEM=	78	FX	FY	FZ
262		-183.26	131.98	48.326
272		189.35	-495.68	201.46
292		0.11191E-11	0.29492E-11	0.48885E-11
282		-6.0900	383.70	-576.34

ELEM=	79	FX	FY	FZ
263		-111.66	223.70	33.489
273		115.37	-447.88	176.46
293		0.51692E-12	0.59046E-11	-0.20265E-10
283		-3.7134	224.18	-536.51

ELEM=	80	FX	FY	FZ
264		-60.383	270.68	25.033
274		62.384	-420.60	162.19
294		0.24425E-12	0.11333E-11	-0.39861E-10
284		-2.0211	149.92	-513.78

ELEM=	81	FX	FY	FZ
265		-25.888	288.48	20.919
275		26.770	-407.30	155.22
295		0.22160E-12	0.46860E-11	-0.18190E-10
285		-0.88179	118.82	-502.70

ELEM=	82	FX	FY	FZ
266		0.93837E-02	292.42	19.712
276		0.68162E-02	-403.39	153.17
296		0.00000E+00	-0.17906E-11	-0.55010E-10
286		-0.16200E-01	110.97	-499.44

ELEM=	83	FX	FY	FZ
267		25.907	288.36	20.921
277		-26.756	-407.31	155.22
297		-0.13056E-12	-0.89919E-11	-0.56559E-11
287		0.84911	118.95	-502.70

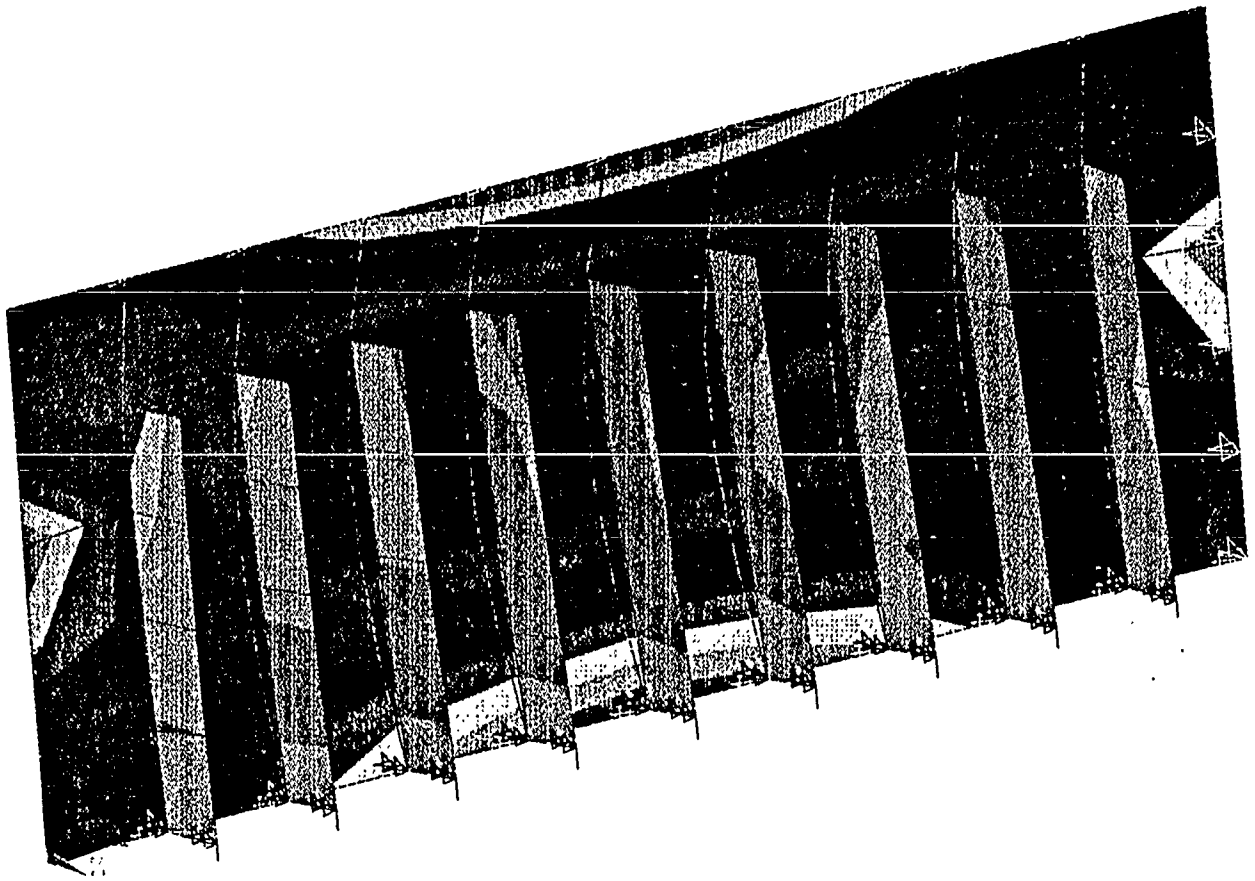
ELEM=	84	FX	FY	FZ
268		60.383	270.62	25.034
278		-62.370	-420.61	162.19
298		-0.28422E-12	-0.80718E-11	-0.89955E-11
288		1.9873	149.98	-513.78

ELEM=	85	FX	FY	FZ
269		111.68	223.86	33.486
279		-115.36	-447.87	176.46
299		-0.83666E-12	-0.71596E-11	-0.10928E-10
289		3.6774	224.01	-536.50

ELEM=	86	FX	FY	FZ
270		183.28	132.11	48.323
280		-189.34	-495.67	201.46
300		-0.95213E-12	-0.36975E-11	-0.51443E-11
290		6.0559	363.56	-576.34

~~Wall 11~~

Acceleration Plot Wall 1



ANSYS 5.0 A
FEB 3 1995
09:38:57
PLOT NO. 1
NODAL SOLUTION
STEP=1
SUB =1
TIME=1
SEQV (AVG)
TOP
DMX =0.011449
SMN =1.329
SMX =82.456
SMXB=93.377

ROT

1.329
10.343
19.357
28.371
37.386
46.4
55.414
64.428
73.442
82.456

Reactions @ Wall 1a

PRINT REACTION SOLUTIONS PER NODE

***** POST1 TOTAL REACTION SOLUTION LISTING *****

THE FOLLOWING X,Y,Z SOLUTIONS ARE IN GLOBAL COORDINATES

NODE	FX	FY	FZ	MX	MY	MZ
1	543.69	941.95	-638.41			
2		714.95				
3		907.21				
4		976.74				
5		993.93				
6	30.104	2359.3	996.94			
7		993.91				
8		976.71				
9		907.17				
10		714.92				
11	-512.86	847.12	-638.37			
21	68.915	524.27				
31		524.26				
41	-0.61297	715.68				
51		715.65				
61	48.202	815.35				
71		815.25				
81	-54.601	889.91				
91		889.76				
101	-123.32	-674.39				
102		975.55				
103		1209.1				
104		1259.9				
105		1272.0				
106		1272.9				
107		1271.9				
108		1259.8				
109		1208.9				
110		975.33				
111		-674.30				
202		323.50				
203		323.75				
204		323.89				
205		323.96				
206		323.98				
207		323.96				
208		323.89				
209		323.75				
210		323.51				
212	-13.122	379.10			1259.7	
213	-7.9771	417.59			765.80	
214	-4.2606	439.45			409.01	
215	-1.7848	450.51			171.34	
216	0.45783E-01	453.92			-4.3951	
217	1.8788	450.54			-180.36	
218	4.3619	439.53			-418.74	
219	8.0910	417.79			-776.74	
220	13.248	379.65			-1271.8	
302	0.00000E+00	-237.55	0.00000E+00			
303	0.00000E+00	-423.48	0.00000E+00			
304	0.00000E+00	-529.09	0.00000E+00			
305	0.00000E+00	-582.50	0.00000E+00			
306	0.00000E+00	-598.97	0.00000E+00			
307	0.00000E+00	-582.65	0.00000E+00			
308	0.00000E+00	-529.46	0.00000E+00			
309	0.00000E+00	-424.45	0.00000E+00			
310	0.00000E+00	-240.22	0.00000E+00			

TOTAL VALUES

VALUE	-0.31442E-11	0.11767E-10	28895.	0.00000E+00	0.00000E+00	-46.151

PRINT F ELEMENT SOLUTION PER ELEMENT

***** POST1 ELEMENT NODE TOTAL FORCE LISTING *****

THE FOLLOWING X,Y,Z FORCES ARE IN GLOBAL COORDINATES

ELEM= 78	FX	FY	FZ
262	-1.4217	765.96	57.195
272	14.544	-528.42	219.87
292	0.93792E-12	0.12081E-11	0.27853E-11
282	-13.122	-237.55	-603.62

ELEM= 79	FX	FY	FZ
263	-0.86426	905.41	42.673
273	8.8414	-481.93	195.66
293	-0.61817E-12	0.24780E-11	0.11269E-10
283	-7.9771	-423.48	-564.89

ELEM= 80	FX	FY	FZ
264	-0.46160	984.62	34.425
274	4.7222	-455.53	181.90
294	-0.14921E-12	-0.17458E-10	0.15646E-10
284	-4.2606	-529.09	-542.89

ELEM= 81	FX	FY	FZ
265	-0.19337	1024.7	30.253
275	1.9782	-442.18	174.95
295	0.16875E-12	-0.18936E-11	0.14637E-11
285	-1.7848	-582.50	-531.76

ELEM= 82	FX	FY	FZ
266	0.49602E-02	1037.0	28.967
276	-0.50743E-01	-438.06	172.80
296	0.26368E-14	0.52225E-12	-0.50164E-11
286	0.45783E-01	-598.97	-528.33

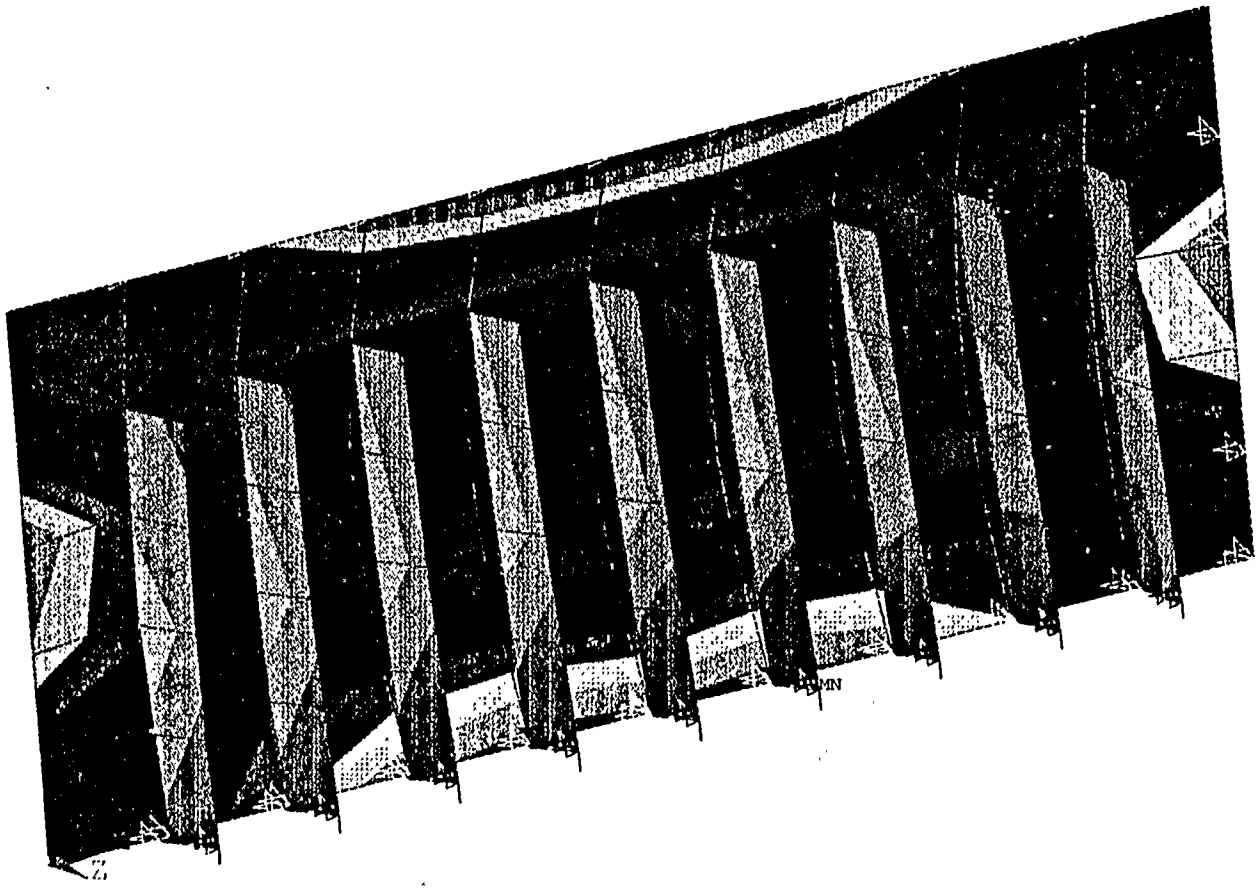
ELEM= 83	FX	FY	FZ
267	0.20355	1024.8	30.242
277	-2.0824	-442.14	174.93
297	-0.12079E-12	-0.40234E-12	0.14211E-12
287	1.8788	-582.65	-531.73

ELEM= 84	FX	FY	FZ
268	0.47257	984.90	34.396
278	-4.8344	-455.44	181.86
298	0.29843E-12	0.95479E-12	0.46185E-11
288	4.3619	-529.46	-542.81

ELEM= 85	FX	FY	FZ
269	0.87659	906.14	42.597
279	-8.9676	-481.69	195.53
299	0.31974E-12	-0.14309E-11	0.18048E-11
289	8.0910	-424.45	-564.69

ELEM= 86	FX	FY	FZ
270	1.4353	767.97	56.986
280	-14.683	-527.75	219.52
300	0.41211E-12	0.24314E-13	0.83986E-11
290	13.248	-240.22	-603.07

Acceleration Plot Wall #1a



ANSYS 5.0 A
FEB 3 1995
09:45:17
PLOT NO. 1
NODAL SOLUTION
STEP=1
SUB =1
TIME=1
SEQV (AVG)
TOP
DMX =0.011703
SMN =6.264
SMX =87.929
SMXB=90.647

ROT

6.264
15.338
24.412
33.486
42.56
51.633
60.707
69.781
78.855
87.929

Reactions @ Wall 12

PRINT REACTION SOLUTIONS PER NODE

***** POST1 TOTAL REACTION SOLUTION LISTING *****

THE FOLLOWING X,Y,Z SOLUTIONS ARE IN GLOBAL COORDINATES

NODE	FX	FY	FZ	MX	MY	MZ
1	-202.47	-429.71	469.55			
6	-17.519	-747.71	4508.6			
11	177.48	-415.42	469.55			
21	29.684		432.65			
31			432.65			
41	28.474		642.28			
51			642.28			
61	-33.393		681.66			
71			681.66			
81	-10.945		811.34			
91			811.33			
101	28.819		-814.12			
102			920.58			
103			1090.7			
104			1096.1			
105			1044.0			
106			1013.8			
107			1044.0			
108			1096.1			
109			1090.7			
110			920.57			
111			-814.12			
202	195.76	756.55	402.36			-1096.7
203	104.64	815.95	408.82			-586.11
204	32.646	846.42	412.12			-182.28
205	-0.79052E-01	857.55	413.30			1.3055
206	-0.87072E-02	859.69	413.52			0.68080
207	0.61358E-01	857.64	413.31			0.67542E-01
208	-32.664	846.46	412.12			183.69
209	-104.66	815.80	408.81			587.61
210	-195.78	756.34	402.34			1098.1
212	-202.99		338.10			1790.9
213	-108.51		376.88			957.44
214	-33.866		393.36			299.37
215	0.62535E-01		395.91			0.28016
216	-0.52126E-02		395.20			0.65550
217	-0.72892E-01		395.90			1.0397
218	33.855		393.35			-298.01
219	108.50		376.90			-956.00
220	202.98		338.13			-1789.6
302	0.00000E+00	-419.28	0.00000E+00			
303	0.00000E+00	-636.43	0.00000E+00			
304	0.00000E+00	-731.33	0.00000E+00			
305	0.00000E+00	-749.26	0.00000E+00			
306	0.00000E+00	-746.91	0.00000E+00			
307	0.00000E+00	-749.24	0.00000E+00			
308	0.00000E+00	-731.32	0.00000E+00			
309	0.00000E+00	-636.47	0.00000E+00			
310	0.00000E+00	-419.33	0.00000E+00			

TOTAL VALUES

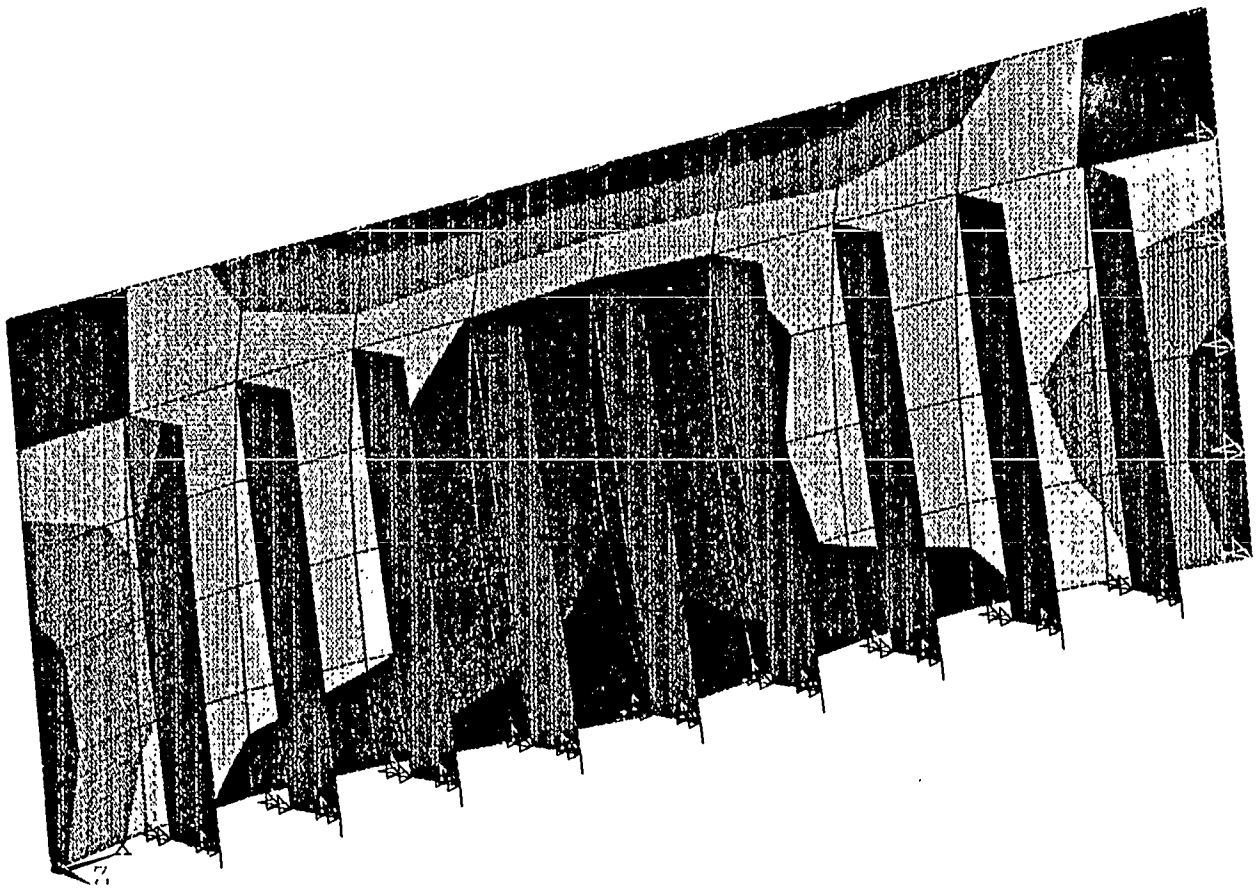
VALUE	0.17053E-11	0.14279E-09	25362.	0.00000E+00	0.00000E+00	12.509

PRINT F ELEMENT SOLUTION PER ELEMENT

***** POST1 ELEMENT NODE TOTAL FORCE LISTING *****

ELEM= 78	FX	FY	FZ
262	-217.64	145.71	44.405
272	224.88	-482.98	194.80
292	0.49738E-12	-0.14291E-11	-0.13969E-10
282	-7.2318	337.27	-565.76
ELEM= 79	FX	FY	FZ
263	-116.34	249.17	27.555
273	120.21	-428.69	166.41
293	0.74429E-12	-0.16858E-11	-0.11966E-10
283	-3.8680	179.52	-520.52
ELEM= 80	FX	FY	FZ
264	-36.297	289.87	20.200
274	37.517	-404.97	154.00
294	0.84377E-13	-0.12369E-10	-0.17323E-10
284	-1.2198	115.10	-500.75
ELEM= 81	FX	FY	FZ
265	0.85795E-01	292.20	18.820
275	-0.69278E-01	-400.49	151.64
295	0.97145E-16	0.19540E-12	-0.10374E-11
285	-0.16517E-01	108.28	-497.02
ELEM= 82	FX	FY	FZ
266	0.81458E-02	288.29	19.008
276	0.57740E-02	-401.07	151.94
296	0.50654E-15	-0.86633E-11	-0.38597E-10
286	-0.13920E-01	112.78	-497.51
ELEM= 83	FX	FY	FZ
267	-0.69216E-01	292.10	18.822
277	0.80750E-01	-400.49	151.64
297	0.12559E-14	0.61942E-11	-0.26574E-10
287	-0.11534E-01	108.40	-497.02
ELEM= 84	FX	FY	FZ
268	36.314	289.83	20.201
278	-37.505	-404.97	154.00
298	-0.30420E-12	-0.88285E-12	-0.93792E-11
288	1.1908	115.14	-500.75
ELEM= 85	FX	FY	FZ
269	116.36	249.35	27.552
279	-120.20	-428.68	166.41
299	-0.87397E-12	-0.46416E-11	-0.45759E-11
289	3.8374	179.34	-520.52
ELEM= 86	FX	FY	FZ
270	217.66	145.95	44.401
280	-224.86	-482.97	194.80
300	-0.14779E-11	0.12763E-11	-0.21188E-10
290	7.2031	337.02	-565.75

Acceleration Plot Wall #12



ANSYS 5.0 A
FEB 3 1995
09:50:46
PLOT NO. 1
NODAL SOLUTION
STEP=1
SUB =1
TIME=1
SEQV (AVG)
TOP
DMX =0.013627
SMN =4.057
SMX =184.128
SMXB=220.699

ROT

4.057
24.065
44.072
64.08
84.088
104.096
124.104
144.112
164.12
184.128

Reactions @ Wall 12a

PRINT REACTION SOLUTIONS PER NODE

***** POST1 TOTAL REACTION SOLUTION LISTING *****

THE FOLLOWING X,Y,Z SOLUTIONS ARE IN GLOBAL COORDINATES

NODE	FX	FY	FZ	MX	MY	MZ
1	599.11	1052.7	469.18			
6	33.929	2566.1	4568.7			
11	-563.12	952.19	469.16			
21	65.785		436.64			
31			436.63			
41	-4.9619		647.63			
51			647.60			
61	56.127		692.25			
71			692.15			
81	-54.070		770.60			
91			770.45			
101	-133.31		-832.96			
102			918.42			
103			1146.1			
104			1139.7			
105			1075.4			
106			1038.3			
107			1075.3			
108			1139.6			
109			1145.9			
110			918.19			
111			-832.85			
202			323.57			
203			323.85			
204			323.97			
205			323.99			
206			323.99			
207			323.99			
208			323.97			
209			323.85			
210			323.57			
212	-15.629		389.05			1500.4
213	-8.3288		433.05			799.57
214	-2.5196		451.96			241.88
215	0.99861E-01		455.64			-9.5867
216	0.49325E-01		455.28			-4.7352
217	0.12602E-02		455.67			-0.12098
218	2.6282		452.04			-252.31
219	8.4504		433.25			-811.24
220	15.762		389.62			-1513.2
302	0.00000E+00	-285.60	0.00000E+00			
303	0.00000E+00	-498.17	0.00000E+00			
304	0.00000E+00	-589.52	0.00000E+00			
305	0.00000E+00	-607.28	0.00000E+00			
306	0.00000E+00	-605.54	0.00000E+00			
307	0.00000E+00	-607.43	0.00000E+00			
308	0.00000E+00	-589.90	0.00000E+00			
309	0.00000E+00	-499.16	0.00000E+00			
310	0.00000E+00	-288.35	0.00000E+00			

TOTAL VALUES

VALUE	0.84270E-11	0.30411E-10	25362.	0.00000E+00	0.00000E+00	-49.356

PRINT F ELEMENT SOLUTION PER ELEMENT

***** POST1 ELEMENT NODE TOTAL FORCE LISTING *****

ELEM=	78	FX	FY	FZ
262		-1.6932	802.00	53.442
272		17.322	-516.40	213.61
292		0.13216E-11	0.30809E-11	0.10544E-10
282		-15.629	-285.60	-593.61

ELEM=	79	FX	FY	FZ
263		-0.90236	961.43	36.839
273		9.2312	-463.26	185.93
293		0.14211E-13	0.98090E-11	0.11426E-10
283		-8.3288	-498.17	-549.33

ELEM=	80	FX	FY	FZ
264		-0.27298	1029.9	29.705
274		2.7926	-440.42	174.03
294		0.11013E-12	-0.11369E-12	0.58975E-11
284		-2.5196	-589.52	-530.30

ELEM=	81	FX	FY	FZ
265		0.10819E-01	1043.3	28.318
275		-0.11068	-435.98	171.72
295		0.58842E-14	0.15771E-10	0.25622E-10
285		0.99861E-01	-607.28	-526.60

ELEM=	82	FX	FY	FZ
266		0.53439E-02	1042.0	28.454
276		-0.54669E-01	-436.42	171.95
296		0.35805E-14	0.38494E-11	0.16769E-10
286		0.49325E-01	-605.54	-526.96

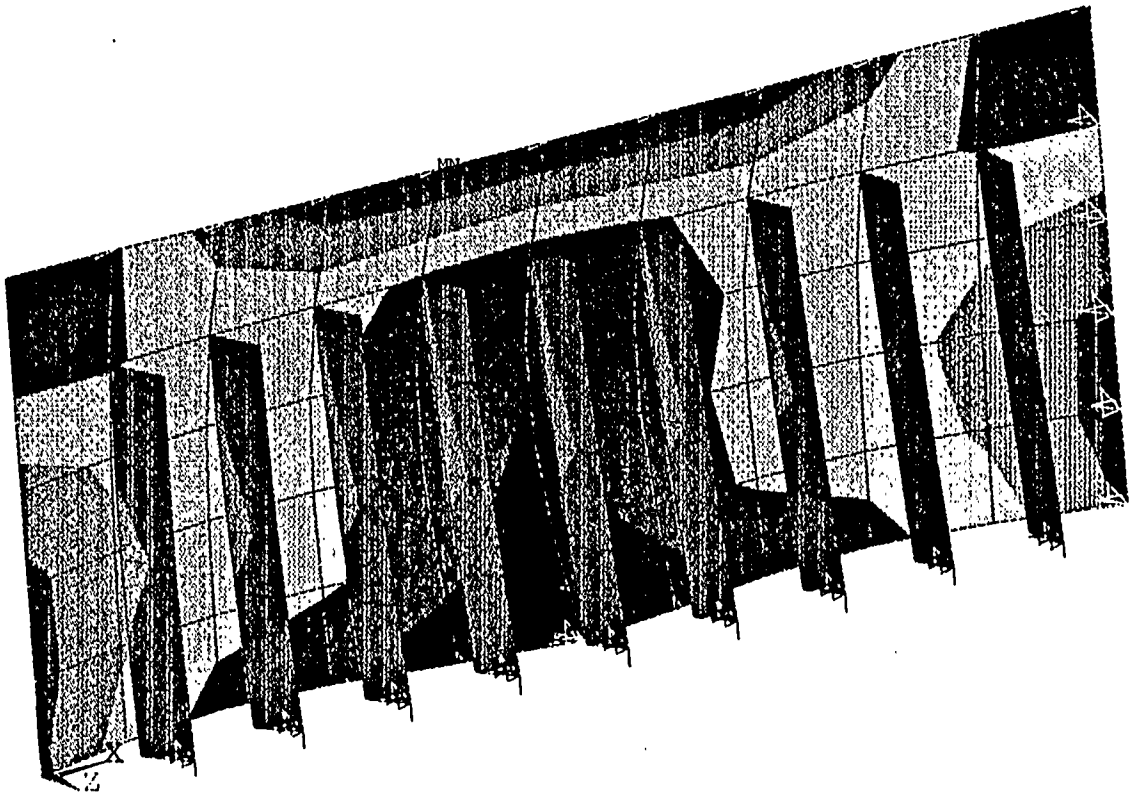
ELEM=	83	FX	FY	FZ
267		0.13653E-03	1043.4	28.307
277		-0.13967E-02	-435.94	171.70
297		0.36264E-14	0.11106E-10	0.18602E-10
287		0.12602E-02	-607.43	-526.57

ELEM=	84	FX	FY	FZ
268		0.28475	1030.2	29.675
278		-2.9130	-440.33	173.98
298		-0.21316E-13	-0.32818E-11	-0.12392E-10
288		2.6282	-589.90	-530.22

ELEM=	85	FX	FY	FZ
269		0.91554	962.17	36.763
279		-9.3660	-463.01	185.80
299		-0.63949E-13	-0.65228E-11	-0.24016E-11
289		8.4504	-499.16	-549.12

ELEM=	86	FX	FY	FZ
270		1.7077	804.06	53.227
280		-17.470	-515.71	213.26
300		0.12363E-11	-0.45095E-11	0.16115E-10
290		15.762	-288.35	-593.04

Acceleration Plot Wall #12a



ANSYS 5.0 A
FEB 3 1995
09:56:15
PLOT NO. 1
NODAL SOLUTION
STEP=1
SUB =1
TIME=1
SEQV (AVG)
TOP
DMX =0.013901
SMN =5.731
SMX =185.767
SMXB=224.808

ROT

5.731
25.735
45.739
65.743
85.747
105.751
125.755
145.759
165.763
185.767

Reactions @ Wall 3

PRINT REACTION SOLUTIONS PER NODE

***** POST1 TOTAL REACTION SOLUTION LISTING *****

THE FOLLOWING X,Y,Z SOLUTIONS ARE IN GLOBAL COORDINATES

NODE	FX	FY	FZ	MX	MY	MZ
1	-118.25	-262.57	-478.58			
2		557.93				
3		701.39				
4		751.81				
5		764.35				
6	-10.793	-413.13	766.66			
7		764.35				
8		751.81				
9		701.39				
10		557.93				
11	101.86	-257.06	-478.57			
21	25.386		409.85			
31		409.85				
41	20.317		554.32			
51		554.31				
61	-21.852		614.16			
71		614.15				
81	-11.157		690.40			
91		690.39				
101	14.546		-492.42			
102		730.42				
103		866.18				
104		909.48				
105		920.15				
106		921.95				
107		920.15				
108		909.48				
109		866.18				
110		730.41				
111		-492.41				
202	123.66	489.00	259.65			-692.69
203	75.640	529.27	264.02			-423.64
204	40.964	556.07	266.92			-229.11
205	17.582	572.32	268.66			-98.009
206	-0.44673E-02	577.85	269.25			0.33922
207	-17.591	572.37	268.66			98.687
208	-40.973	556.05	266.91			229.79
209	-75.649	529.03	264.00			424.34
210	-123.66	488.45	259.59			693.27
212	-128.22		216.99			1131.3
213	-78.436		242.49			692.12
214	-42.485		256.71			375.20
215	-18.243		263.35			161.42
216	-0.24475E-02		265.24			0.32459
217	18.238		263.34			-160.78
218	42.481		256.71			-374.55
219	78.431		242.53			-691.45
220	128.22		217.08			-1130.8
302	0.00000E+00	-265.60	0.00000E+00			
303	0.00000E+00	-409.00	0.00000E+00			
304	0.00000E+00	-491.12	0.00000E+00			
305	0.00000E+00	-531.38	0.00000E+00			
306	0.00000E+00	-543.27	0.00000E+00			
307	0.00000E+00	-531.37	0.00000E+00			
308	0.00000E+00	-491.12	0.00000E+00			
309	0.00000E+00	-409.05	0.00000E+00			
310	0.00000E+00	-265.74	0.00000E+00			

TOTAL VALUES

VALUE	-0.25580E-12	0.56446E-10	21300.	0.00000E+00	0.00000E+00	5.8412

PRINT F ELEMENT SOLUTION PER ELEMENT

***** POST1 ELEMENT NODE TOTAL FORCE LISTING *****

ELEM=	78	FX	FY	FZ
262		-137.48	89.381	29.026
272		142.05	-312.77	126.29
292		0.59330E-12	-0.87752E-12	-0.38369E-11
282		-4.5692	223.39	-365.97

ELEM=	79	FX	FY	FZ
263		-84.096	156.65	17.901
273		86.893	-276.92	107.54
293		0.25402E-12	-0.49827E-12	-0.20435E-10
283		-2.7966	120.27	-336.10

ELEM=	80	FX	FY	FZ
264		-45.544	191.44	11.538
274		47.066	-256.40	96.799
294		0.21583E-12	0.11799E-10	0.69633E-12
284		-1.5218	64.951	-318.99

ELEM=	81	FX	FY	FZ
265		-19.549	205.39	8.4231
275		20.210	-246.33	91.525
295		0.88374E-13	0.73985E-12	-0.28095E-10
285		-0.66058	40.939	-310.60

ELEM=	82	FX	FY	FZ
266		0.42037E-02	208.78	7.5044
276		0.27110E-02	-243.36	89.966
296		0.49613E-15	-0.19877E-11	-0.14417E-10
286		-0.69148E-02	34.577	-308.12

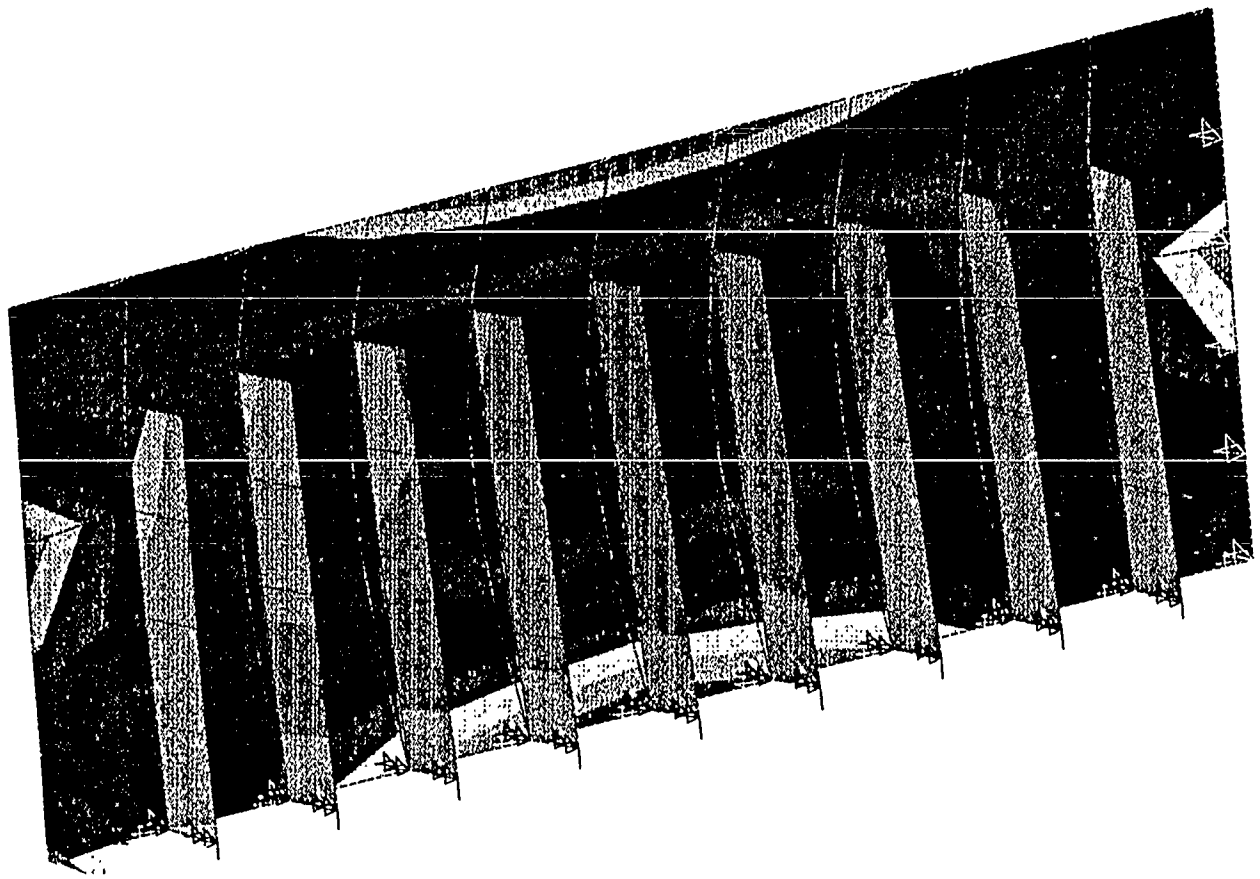
ELEM=	83	FX	FY	FZ
267		19.558	205.33	8.4242
277		-20.205	-246.33	91.526
297		-0.17608E-12	0.22391E-11	0.40501E-12
287		0.64677	41.003	-310.60

ELEM=	84	FX	FY	FZ
268		45.553	191.46	11.537
278		-47.061	-256.39	96.798
298		-0.16120E-12	0.10010E-11	-0.15469E-10
288		1.5079	64.933	-318.99

ELEM=	85	FX	FY	FZ
269		84.105	156.93	17.897
279		-86.887	-276.91	107.54
299		-0.80558E-12	-0.37153E-11	-0.18332E-11
289		2.7824	119.98	-336.08

ELEM=	86	FX	FY	FZ
270		137.49	90.025	29.015
280		-142.04	-312.74	126.28
300		-0.84910E-12	0.25970E-11	0.56559E-11
290		4.5572	222.71	-365.94

Acceleration Plot Wall #3



ANSYS 5.0 A
FEB 3 1995
10:01:53
PLOT NO. 1
NODAL SOLUTION
STEP=1
SUB =1
TIME=1
SEQV (AVG)
TOP
DMX =0.008653
SMN =0.144457
SMX =62.598
SMXB=69.705

ROT

0.144457
7.084
14.023
20.962
27.902
34.841
41.78
48.719
55.659
62.598

WIC-[illegible]-SA-026
REV 1
PAGE C-230

Reactions @ Wall 34

PRINT REACTION SOLUTIONS PER NODE

NODE	FX	FY	FZ	MX	MY	MZ
1	-0.33815E-12	-0.78267E-12	-10.297			
2	-0.56843E-12	-0.11909E-10	221.19			
3	-0.10658E-12	-0.36579E-10	200.58			
4	0.20606E-12	-0.13117E-10	200.89			
5	-0.52047E-12	-0.16826E-10	201.43			
6	0.12747E-12	-0.32529E-10	201.60			
7	0.46541E-12	-0.12506E-10	201.43			
8	-0.13856E-12	-0.78302E-11	200.89			
9	0.56133E-12	-0.29459E-10	200.58			
10	0.10232E-11	-0.75460E-11	221.19			
11	0.44761E-12	-0.75998E-12	-10.297			
21	-0.56787E-12		88.828			
31			88.828			
41	-0.67301E-12		86.188			
51			86.188			
61	-0.64892E-12		130.88			
71			130.88			
81	-0.22745E-12		310.36			
91			310.36			
101	0.38731E-12		-57.636			
102			333.09			
103			336.29			
104			354.59			
105			360.75			
106			362.63			
107			360.75			
108			354.59			
109			336.29			
110			333.09			
111			-57.636			
202	-152.38		85.880			
203	-63.927		97.123			
204	-27.077		102.67			
205	-10.029		105.04			
206	-0.18075E-11		105.69			
207	10.029		105.04			
208	27.077		102.67			
209	63.927		97.123			
210	152.38		85.880			
302	152.38		85.880			
303	63.927		97.123			
304	27.077		102.67			
305	10.029		105.04			
306	0.18108E-11		105.69			
307	-10.029		105.04			
308	-27.077		102.67			
309	-63.927		97.123			
310	-152.38		85.880			
502	0.00000E+00	-47.012	0.00000E+00			
503	0.00000E+00	-64.352	0.00000E+00			
504	0.00000E+00	-71.654	0.00000E+00			
505	0.00000E+00	-74.640	0.00000E+00			
506	0.00000E+00	-75.448	0.00000E+00			
507	0.00000E+00	-74.640	0.00000E+00			
508	0.00000E+00	-71.654	0.00000E+00			
509	0.00000E+00	-64.352	0.00000E+00			
510	0.00000E+00	-47.012	0.00000E+00			

```
 552 0.00000E+00 47.012    0.00000E+00
 553 0.00000E+00 64.352    0.00000E+00
 554 0.00000E+00 71.654    0.00000E+00
 555 0.00000E+00 74.640    0.00000E+00
 556 0.00000E+00 75.448    0.00000E+00
 557 0.00000E+00 74.640    0.00000E+00
 558 0.00000E+00 71.654    0.00000E+00
 559 0.00000E+00 64.352    0.00000E+00
 560 0.00000E+00 47.012    0.00000E+00

TOTAL VALUES
VALUE -0.85265E-12-0.17043E-09 7852.7    0.00000E+00 0.00000E+00 0.00000E+00


PRINT F   ELEMENT SOLUTION PER ELEMENT

***** POST1 ELEMENT NODE TOTAL FORCE LISTING *****

ELEM=   242 FX       FY       FZ
  62 -116.75     52.115     122.18
 262  99.439    -224.73     65.095
 282 0.40900E-12 0.30704E-11 0.30118E-11
  82  17.310     172.62    -187.28

ELEM=   243 FX       FY       FZ
  63 -47.514     64.415     155.86
 263  40.371    -276.25     74.348
 283 0.20775E-12 0.91580E-11-0.15969E-10
  83  7.1427     211.83    -230.20

ELEM=   244 FX       FY       FZ
  64 -19.971     69.820     170.39
 264  16.912    -298.97     78.753
 284 0.84004E-13 0.10308E-10-0.12228E-10
  84  3.0584     229.15    -249.14

ELEM=   245 FX       FY       FZ
  65 -7.3929     72.114     176.49
 265  6.2607    -308.63     80.708
 285 0.53507E-13 0.71214E-11-0.28280E-11
  85  1.1322     236.52    -257.19

ELEM=   246 FX       FY       FZ
  66 -0.15029E-11  72.737     178.14
 266  0.12817E-11 -311.26     81.241
 286  0.44074E-26 0.12518E-10 0.22249E-11
  86  0.22118E-12  238.52    -259.38

ELEM=   247 FX       FY       FZ
  67  7.3929     72.114     176.49
 267 -6.2607    -308.63     80.708
 287 0.16456E-13 0.61195E-11-0.10027E-10
  87 -1.1322     236.52    -257.19

ELEM=   248 FX       FY       FZ
  68  19.971     69.820     170.39
 268 -16.912    -298.97     78.753
 288 -0.49961E-13 0.50928E-11-0.12051E-10
  88 -3.0584     229.15    -249.14

ELEM=   249 FX       FY       FZ
  69  47.514     64.415     155.86
 269 -40.371    -276.25     74.348
 289 -0.12992E-12 0.20570E-11 0.27920E-10
  89 -7.1427     211.83    -230.20

ELEM=   250 FX       FY       FZ
  70  116.75     52.115     122.18
 270 -99.439    -224.73     65.095
 290 0.28514E-12 0.45377E-11 0.33049E-11
  90 -17.310     172.62    -187.28
```

ELEM= 278	FX	FY	FZ
362	-99.439	224.73	65.095
62	116.75	-52.115	122.18
82	-17.310	-172.62	-187.28
382	-0.14211E-12	0.74252E-12	0.12275E-11

ELEM= 279	FX	FY	FZ
363	-40.371	276.25	74.348
63	47.514	-64.415	155.86
83	-7.1427	-211.83	-230.20
383	-0.32685E-12	-0.15092E-10	-0.18641E-10

ELEM= 280	FX	FY	FZ
364	-16.912	298.97	78.753
64	19.971	-69.820	170.39
84	-3.0584	-229.15	-249.14
384	0.18829E-12	-0.40608E-11	-0.30063E-10

ELEM= 281	FX	FY	FZ
365	-6.2607	308.63	80.708
65	7.3929	-72.114	176.49
85	-1.1322	-236.52	-257.19
385	-0.63061E-13	-0.45546E-11	-0.22588E-10

ELEM= 282	FX	FY	FZ
366	-0.12812E-11	311.26	81.241
66	0.15224E-11	-72.737	178.14
86	-0.24117E-12	-238.52	-259.38
386	-0.68662E-26	-0.55032E-11	-0.27626E-10

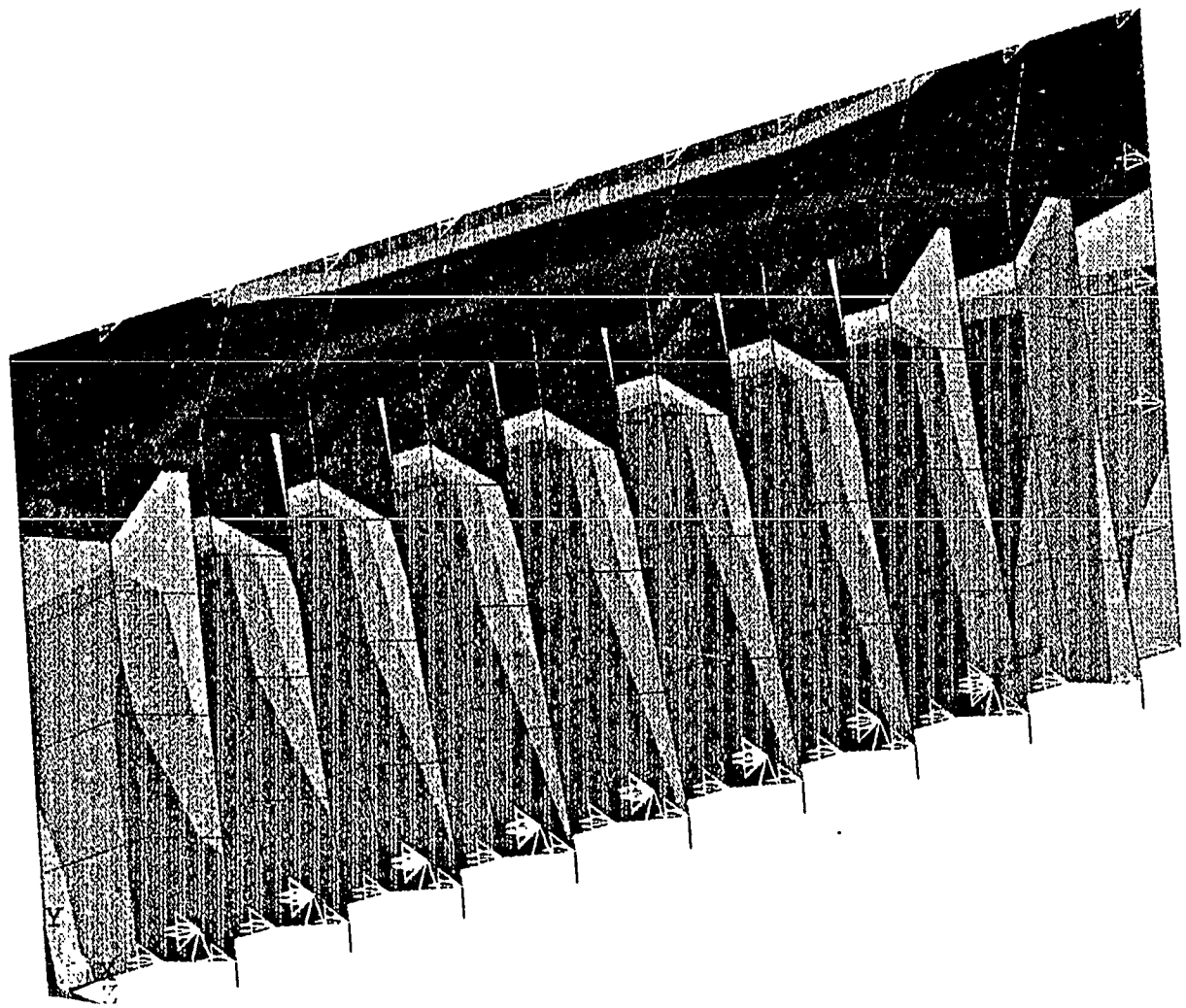
ELEM= 283	FX	FY	FZ
367	6.2607	308.63	80.708
67	-7.3929	-72.114	176.49
87	1.1322	-236.52	-257.19
387	0.19540E-13	-0.52687E-11	-0.14566E-12

ELEM= 284	FX	FY	FZ
368	16.912	298.97	78.753
68	-19.971	-69.820	170.39
88	3.0584	-229.15	-249.14
388	-0.10303E-12	-0.14566E-12	-0.21949E-10

ELEM= 285	FX	FY	FZ
369	40.371	276.25	74.348
69	-47.514	-64.415	155.86
89	7.1427	-211.83	-230.20
389	0.00000E+00	-0.39222E-11	-0.20535E-11

ELEM= 286	FX	FY	FZ
370	99.439	224.73	65.095
70	-116.75	-52.115	122.18
90	17.310	-172.62	-187.28
390	0.11368E-12	-0.10587E-11	-0.14220E-10

Acceleration Plot Wall 34



ANSYS 5.0 A
FEB 8 1995
09:29:03
PLOT NO. 2
NODAL SOLUTION
STEP=1
SUB =1
TIME=1
SEQV (AVG)
TOP
DMX =0.002842
SMN =2.138
SMX =41.25
SMXB=74.307

2.138
6.483
10.829
15.175
19.521
23.867
28.213
32.559
36.904
41.25

Reactions @ Wall 4

PRINT REACTION SOLUTIONS PER NODE

***** POST1 TOTAL REACTION SOLUTION LISTING *****

THE FOLLOWING X,Y,Z SOLUTIONS ARE IN GLOBAL COORDINATES

NODE	FX	FY	FZ	MX	MY	MZ
1	-145.88	-303.75	270.55			
6	-12.246	-548.19	2653.6			
11	128.90	-292.02	270.55			
21	17.272		252.86			
31			252.86			
41	18.392		377.89			
51			377.89			
61	-22.885		407.01			
71			407.01			
81	-5.5267		489.84			
91			489.83			
101	22.081		-488.40			
102			555.13			
103			659.55			
104			663.10			
105			632.74			
106			614.97			
107			632.74			
108			663.10			
109			659.55			
110			555.13			
111			-488.40			
202	117.17	479.58	258.66			-656.44
203	62.672	514.52	262.46			-351.03
204	19.789	532.60	264.41			-110.43
205	0.20272	539.56	265.15			-0.51838
206	-0.65098E-02	541.05	265.30			0.51787
207	-0.21599	539.62	265.16			1.5659
208	-19.802	532.64	264.42			111.52
209	-62.687	514.49	262.46			352.20
210	-117.19	479.65	258.66			657.57
212	-121.50		215.93			1072.0
213	-64.988		239.23			573.43
214	-20.529		249.17			181.53
215	-0.22412		250.74			2.5727
216	-0.40971E-02		250.32			0.50040
217	0.21595		250.73			-1.5620
218	20.521		249.16			-180.48
219	64.979		239.24			-572.31
220	121.49		215.92			-1070.9
302	0.00000E+00	-255.75	0.00000E+00			
303	0.00000E+00	-385.85	0.00000E+00			
304	0.00000E+00	-442.92	0.00000E+00			
305	0.00000E+00	-454.00	0.00000E+00			
306	0.00000E+00	-452.75	0.00000E+00			
307	0.00000E+00	-453.98	0.00000E+00			
308	0.00000E+00	-442.91	0.00000E+00			
309	0.00000E+00	-385.86	0.00000E+00			
310	0.00000E+00	-255.73	0.00000E+00			

TOTAL VALUES

VALUE	0.11084E-11	0.76454E-10	15436.	0.00000E+00	0.00000E+00	9.7242

PRINT F ELEMENT SOLUTION PER ELEMENT

***** POST1 ELEMENT NODE TOTAL FORCE LISTING *****

ELEM=	78	FX	FY	FZ
262	-130.27		91.407	29.778
272	134.60		-315.24	127.59
292	0.98233E-12		0.26552E-11	-0.81641E-11
282	-4.3285		223.83	-368.02

ELEM=	79	FX	FY	FZ
263	-69.678		154.05	19.682
273	71.995		-282.71	110.58
293	0.61995E-12		-0.20970E-11	0.60396E-12
283	-2.3167		128.66	-340.92

ELEM=	80	FX	FY	FZ
264	-22.002		178.77	15.258
274	22.742		-268.44	103.12
294	0.23426E-12		-0.15250E-11	-0.11312E-10
284	-0.74061		89.679	-329.03

ELEM=	81	FX	FY	FZ
265	-0.22689		180.11	14.406
275	0.24829		-265.68	101.66
295	0.37886E-14		0.25313E-11	-0.13259E-10
285	-0.21399E-01		85.561	-326.72

ELEM=	82	FX	FY	FZ
266	0.60686E-02		177.68	14.506
276	0.45383E-02		-265.99	101.82
296	0.34694E-15		0.91038E-12	-0.80007E-11
286	-0.10607E-01		88.304	-326.98

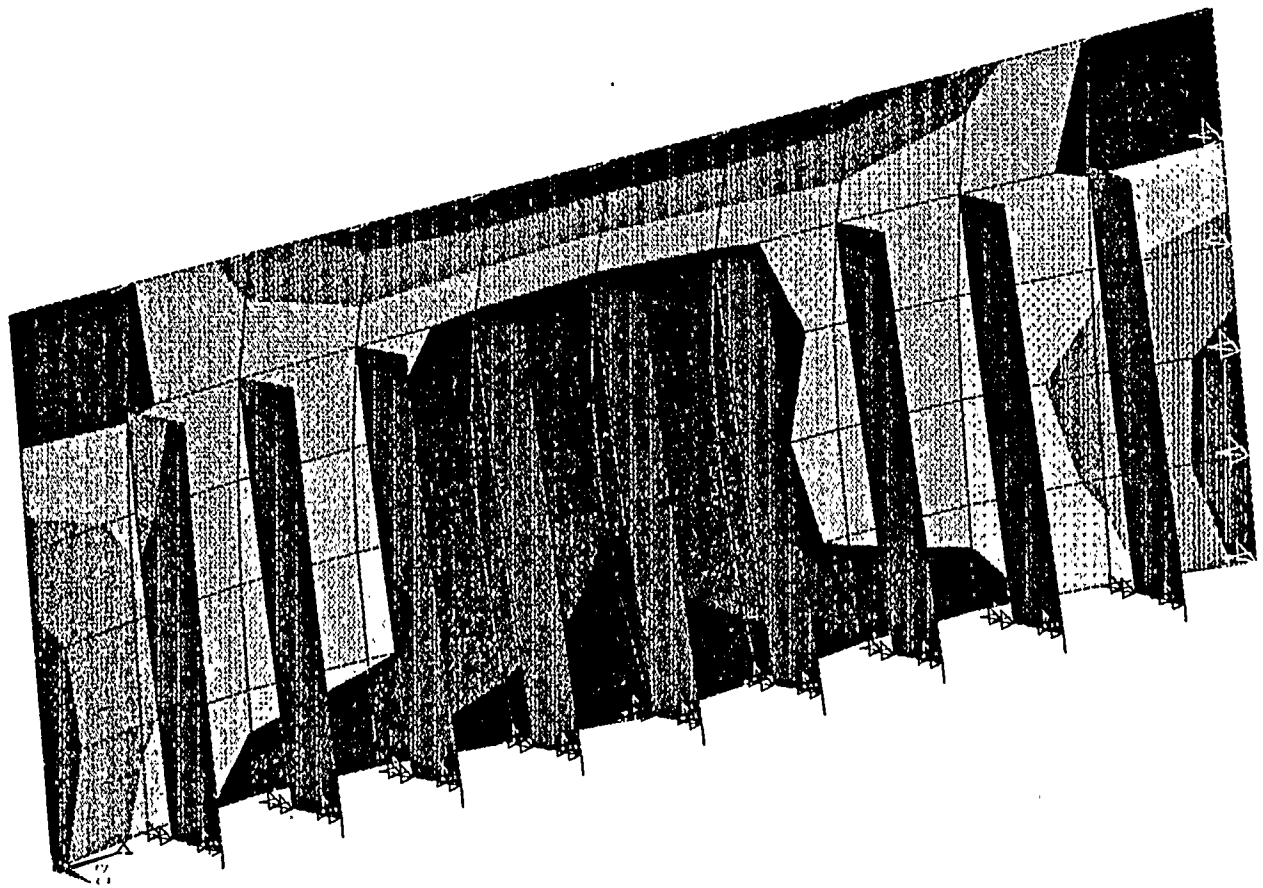
ELEM=	83	FX	FY	FZ
267	0.23927		180.04	14.407
277	-0.23923		-265.68	101.67
297	-0.24460E-14		-0.51870E-12	-0.49170E-11
287	-0.40301E-04		85.642	-326.73

ELEM=	84	FX	FY	FZ
268	22.015		178.71	15.259
278	-22.733		-268.45	103.12
298	-0.28977E-12		0.78559E-11	-0.23299E-10
288	0.71833		89.733	-329.03

ELEM=	85	FX	FY	FZ
269	69.692		154.08	19.681
279	-71.985		-282.71	110.58
299	-0.65192E-12		-0.72298E-12	-0.10886E-10
289	2.2928		128.63	-340.92

ELEM=	86	FX	FY	FZ
270	130.29		91.322	29.780
280	-134.59		-315.24	127.60
300	-0.11386E-11		-0.14078E-12	-0.98908E-11
290	4.3054		223.92	-368.03

Acceleration Plot Wall 4



ANSYS 5.0 A
FEB 3 1995
10:34:42
PLOT NO. 1
NODAL SOLUTION
STEP=1
SUB =1
TIME=1
SEQV (AVG)
TOP
DMX =0.008092
SMN =2.204
SMX =108.384
SMXB=130.035

ROT

2.204
14.001
25.799
37.597
49.395
61.193
72.99
84.788
96.586
108.384

X-Direction Reactions, All Walls

PRINT REACTION SOLUTIONS PER NODE

***** POST1 TOTAL REACTION SOLUTION LISTING *****

THE FOLLOWING X,Y,Z SOLUTIONS ARE IN GLOBAL COORDINATES

NODE	FX	FY	FZ	MX	MY	MZ
1	-1020.3	-748.89	2.4818			
2		-1.9849				
3		-2.2503				
4		-1.2115				
5		-0.59702				
6	-3024.0	-675.53	-0.20897			
7		0.20085				
8		0.88917				
9		2.0419				
10		1.8908				
11	-2084.3	1565.5	-2.1862			
21	-1320.6	-0.52814				
31		0.44319				
41	-1394.0	-3.7808				
51		3.5927				
61	-1621.3	-6.1178				
71		5.9227				
81	-1954.9	-44.014				
91		43.600				
101	-1094.1	6.5061				
102		-24.543				
103		-1.6607				
104		-2.7904				
105		-1.4806				
106		-0.67362				
107		0.12965				
108		1.5608				
109		1.0366				
110		24.434				
111		-6.1702				
202	-224.27	-40.338	-4.1825			4773.3
203	-224.38	-51.934	-5.3829			4805.2
204	-224.81	-55.312	-5.7320			4834.7
205	-225.15	-43.073	-4.4633			4859.5
206	-225.39	-19.980	-2.0702			4878.3
207	-225.53	0.94768	0.98569E-01			4891.8
208	-225.58	13.234	1.3723			4901.2
209	-225.59	25.757	2.6707			4908.6
210	-226.01	55.856	5.7899			4916.6
212	-290.80		5.6543			5255.0
213	-291.39		7.5849			5290.5
214	-291.56		8.2427			5318.2
215	-291.72		6.4738			5341.6
216	-291.87		3.0245			5359.7
217	-292.01		-0.84607E-01			5373.2
218	-292.16		-1.8418			5383.4
219	-292.32		-3.6067			5391.8
220	-292.00		-8.0807			5394.5
302	0.00000E+00	-7.0647	0.00000E+00			
303	0.00000E+00	-10.570	0.00000E+00			
304	0.00000E+00	-12.052	0.00000E+00			
305	0.00000E+00	-9.6508	0.00000E+00			
306	0.00000E+00	-4.5809	0.00000E+00			
307	0.00000E+00	-0.67015E-01	0.00000E+00			
308	0.00000E+00	2.2536	0.00000E+00			
309	0.00000E+00	4.4929	0.00000E+00			
310	0.00000E+00	10.996	0.00000E+00			

TOTAL VALUES

VALUE	-18166.	0.23554E-11	0.53113E-12	0.00000E+00	0.00000E+00	91877.

PRINT F ELEMENT SOLUTION PER ELEMENT

***** POST1 ELEMENT NODE TOTAL FORCE LISTING *****

ELEM=	78	FX	FY	FZ
262		-70.782	45.637	-0.62662
272		-30.062	1.7662	-0.84520
292		0.49027E-12	0.15016E-13	0.12840E-12
282		306.15	-47.403	1.4718

ELEM=	79	FX	FY	FZ
263		-70.736	59.861	-0.92188
273		-29.405	2.6424	-1.2801
293		0.78870E-12	-0.68168E-13	0.15904E-13
283		305.45	-62.504	2.2020

ELEM=	80	FX	FY	FZ
264		-70.331	64.351	-1.0439
274		-29.215	3.0129	-1.4669
294		0.47606E-12	-0.43909E-13	-0.21594E-13
284		304.85	-67.364	2.5107

ELEM=	81	FX	FY	FZ
265		-70.002	50.311	-0.83367
275		-29.043	2.4127	-1.1769
295		-0.92371E-13	-0.19429E-13	-0.33945E-13
285		304.35	-52.724	2.0106

ELEM=	82	FX	FY	FZ
266		-69.783	23.415	-0.39485
276		-28.877	1.1452	-0.55951
296		0.94502E-12	-0.15821E-13	-0.13392E-13
286		303.97	-24.561	0.95436

ELEM=	83	FX	FY	FZ
267		-69.655	-0.89741	-0.34755E-02
277		-28.725	0.16753E-01	-0.10486E-01
297		-0.49738E-13	-0.11241E-14	-0.18006E-14
287		303.69	0.88066	0.13962E-01

ELEM=	84	FX	FY	FZ
268		-69.625	-14.925	0.20057
278		-28.550	-0.56340	0.26893
298		0.19185E-12	0.29005E-14	-0.24175E-13
288		303.48	15.488	-0.46950

ELEM=	85	FX	FY	FZ
269		-69.628	-29.127	0.39870
279		-28.381	-1.1232	0.53733
299		0.36238E-12	0.10020E-13	-0.76730E-13
289		303.31	30.250	-0.93603

ELEM=	86	FX	FY	FZ
270		-69.171	-64.103	0.96246
280		-28.728	-2.7490	1.3284
300		-0.71054E-14	-0.82157E-14	-0.14591E-12
290		303.20	66.852	-2.2908

ELEM=	78	MX	MY	MZ
262	0.29156E-04	263.01	2446.9	
272	0.29156E-04	-4.9454	2437.1	
292	0.00000E+00	0.26432E-11	0.11653E-11	
282	0.00000E+00	2396.2	-0.88107E-12	

ELEM=	79	MX	MY	MZ
263	0.38028E-04	260.85	2438.4	
273	0.38028E-04	-4.0615	2428.7	
293	0.00000E+00	0.88107E-12	0.28422E-13	
283	0.00000E+00	2384.4	0.27569E-11	

ELEM=	80	MX	MY	MZ
264	0.40766E-04	259.09	2431.3	
274	0.40766E-04	-2.6734	2421.5	
294	-0.88818E-15	0.42633E-12	-0.17906E-11	
284	-0.17764E-14	2381.0	0.93792E-12	

ELEM=	81	MX	MY	MZ
265	0.31833E-04	257.60	2425.2	
275	0.31833E-04	-1.5235	2415.5	
295	-0.88818E-15	0.34390E-11	-0.24727E-11	
285	-0.17764E-14	2377.8	-0.63380E-11	

ELEM=	82	MX	MY	MZ
266	0.14801E-04	256.46	2420.6	
276	0.14801E-04	-0.69996	2410.9	
296	-0.66613E-15	0.82423E-12	-0.85265E-13	
286	-0.22204E-15	2374.8	0.45759E-11	

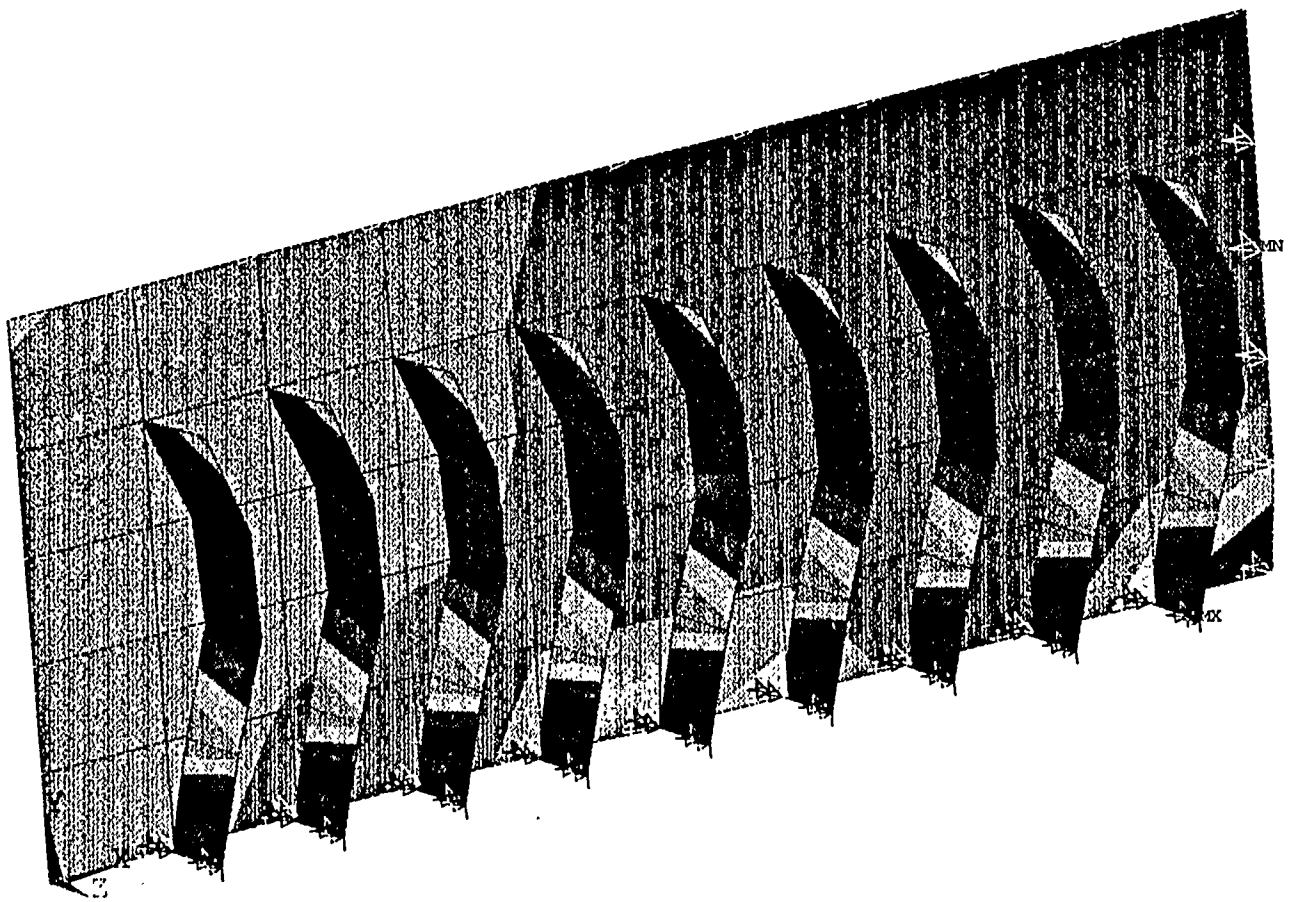
ELEM=	83	MX	MY	MZ
267	-0.60756E-06	255.62	2417.2	
277	-0.60756E-06	-0.15628	2407.5	
297	-0.11102E-15	0.59401E-11	0.93792E-12	
287	-0.16653E-15	2372.1	0.27569E-11	

ELEM=	84	MX	MY	MZ
268	-0.95445E-05	254.99	2414.8	
278	-0.95445E-05	0.12921	2405.1	
298	0.44409E-15	0.74749E-11	0.16200E-11	
288	0.66613E-15	2368.9	-0.45191E-11	

ELEM=	85	MX	MY	MZ
269	-0.18611E-04	254.48	2412.8	
279	-0.18611E-04	0.31339	2403.1	
299	0.88818E-15	0.20179E-11	0.14211E-12	
289	0.13323E-14	2365.9	-0.99760E-11	

ELEM=	86	MX	MY	MZ
270	-0.40776E-04	254.23	2411.5	
280	-0.40776E-04	1.2389	2401.8	
300	0.26645E-14	0.39222E-11	-0.47464E-11	
290	0.35527E-14	2372.2	0.27569E-11	

Acceleration Plot Wall 3
Out-of-Plane



ANSYS 5.0 A
FEB 9 1995
15:04:30
PLOT NO. 1
NODAL SOLUTION
STEP=1
SUB =1
TIME=1
SEQV (AVG)
TOP
DMX =0.001695
SMN =0.55669
SMX =40.454
SMXB=47.642

ROT
0.55669
4.99
9.423
13.856
18.289
22.722
27.155
31.588
36.021
40.454

Seismic Displacement Reactions, Walls 1, 1a, 12, 12a, 3, 4

PRINT REACTION SOLUTIONS PER NODE

***** POST1 TOTAL REACTION SOLUTION LISTING *****

THE FOLLOWING X,Y,Z SOLUTIONS ARE IN GLOBAL COORDINATES

NODE	FX	FY	FZ	MX	MY	MZ
1	199.67	377.47	14.057			
2		-8.0064				
3		-13.366				
4		-15.609				
5		-16.222				
6	14.305	812.32	-16.344			
7		-16.223				
8		-15.613				
9		-13.371				
10		-8.0103				
11	-183.07	352.01	14.063			
21	3.2338	5.3752				
31		5.3736				
41	-11.325	-21.981				
51		-21.985				
61	23.651	-20.191				
71		-20.204				
81	-7.8453	-34.140				
91		-34.160				
101	-38.806	25.938				
102		-38.844				
103		-49.205				
104		-50.694				
105		-51.325				
106		-51.417				
107		-51.329				
108		-50.703				
109		-49.226				
110		-38.873				
111		25.950				
202	-6.0523	155.88	16.645			33.998
203	-3.4793	158.82	16.940			19.469
204	-1.8253	159.42	16.998			9.7379
205	-0.76717	157.27	16.772			3.4791
206	0.10735E-01	155.85	16.624			-0.88896
207	0.78915	157.18	16.762			-5.2958
208	1.8490	159.24	16.979			-11.677
209	3.5063	158.36	16.893			-21.628
210	6.0839	154.34	16.486			-36.324
212	6.2738	53.697				-55.264
213	3.6084	51.742				-31.857
214	1.9038	50.817				-17.267
215	0.81396	50.743				-7.9708
216	0.75437E-02	50.841				-0.86585
217	-0.79859	50.757				6.2020
218	-1.8875	50.844				15.381
219	-3.5911	51.811				29.768
220	-6.2581	53.934				53.052
302	0.00000E+00	-337.64	0.00000E+00			
303	0.00000E+00	-329.67	0.00000E+00			
304	0.00000E+00	-325.51	0.00000E+00			
305	0.00000E+00	-324.07	0.00000E+00			
306	0.00000E+00	-323.83	0.00000E+00			
307	0.00000E+00	-324.09	0.00000E+00			
308	0.00000E+00	-325.55	0.00000E+00			
309	0.00000E+00	-329.78	0.00000E+00			
310	0.00000E+00	-338.01	0.00000E+00			

TOTAL VALUES

VALUE	0.10667E-11	0.40131E-10	-0.27903E-09	0.00000E+00	0.00000E+00	-17.952

PRINT F ELEMENT SOLUTION PER ELEMENT

***** POST1 ELEMENT NODE TOTAL FORCE LISTING *****

THE FOLLOWING X,Y,Z FORCES ARE IN GLOBAL COORDINATES

ELEM=	78	FX	FY	FZ
262		6.7287	97.354	-26.081
272		-6.9502	84.411	-44.262
292		-0.13212E-13	0.57465E-12	-0.64659E-11
282		0.22152	-181.76	70.343

ELEM=	79	FX	FY	FZ
263		3.8684	88.438	-25.453
273		-3.9974	82.418	-43.229
293		-0.13989E-13	0.34648E-11	-0.21759E-10
283		0.12905	-170.86	68.682

ELEM=	80	FX	FY	FZ
264		2.0306	84.711	-25.127
274		-2.1090	81.378	-42.688
294		-0.16848E-13	0.30411E-11	-0.33662E-12
284		0.78427E-01	-166.09	67.815

ELEM=	81	FX	FY	FZ
265		0.85493	85.787	-25.019
275		-0.90172	81.018	-42.496
295		-0.86875E-14	-0.75406E-12	-0.15439E-10
285		0.46788E-01	-166.80	67.515

ELEM=	82	FX	FY	FZ
266		-0.99230E-02	87.020	-25.003
276		-0.83562E-02	80.958	-42.462
296		-0.94369E-15	-0.39586E-11	-0.65157E-11
286		0.18279E-01	-167.98	67.465

ELEM=	83	FX	FY	FZ
267		-0.87525	85.892	-25.020
277		0.88469	81.023	-42.499
297		0.66770E-14	0.22933E-11	0.16545E-10
287		-0.94393E-02	-166.91	67.519

ELEM=	84	FX	FY	FZ
268		-2.0525	84.917	-25.130
278		2.0910	81.387	-42.693
298		0.22107E-13	0.47899E-11	-0.10358E-10
288		-0.38582E-01	-166.30	67.823

ELEM=	85	FX	FY	FZ
269		-3.8935	88.973	-25.462
279		3.9782	82.444	-43.242
299		0.86597E-14	0.21458E-11	-0.12171E-10
289		-0.84790E-01	-171.42	68.704

ELEM=	86	FX	FY	FZ
270		-6.7586	99.169	-26.113
280		6.9328	84.504	-44.307
300		0.10436E-13	0.24851E-11	-0.24114E-11
290		-0.17425	-183.67	70.420

Seismic Displacement Reactions, Wall 34

LIST CONSTRAINTS FOR SELECTED NODES 1 TO 560 BY 1
CURRENTLY SELECTED DOF SET= UX UY UZ ROTX ROTY ROTZ

NODE	LABEL	REAL	IMAG
21	UZ	-0.114000000E-02	0.000000000E+00
31	UZ	-0.114000000E-02	0.000000000E+00
41	UZ	-0.229000000E-02	0.000000000E+00
51	UZ	-0.229000000E-02	0.000000000E+00
61	UZ	-0.343000000E-02	0.000000000E+00
71	UZ	-0.343000000E-02	0.000000000E+00
81	UZ	-0.457000000E-02	0.000000000E+00
91	UZ	-0.457000000E-02	0.000000000E+00
101	UX	0.000000000E+00	0.000000000E+00
101	UZ	-0.600000000E-02	0.000000000E+00
102	UX	0.000000000E+00	0.000000000E+00
102	UZ	-0.600000000E-02	0.000000000E+00
103	UX	0.000000000E+00	0.000000000E+00
103	UZ	-0.600000000E-02	0.000000000E+00
104	UX	0.000000000E+00	0.000000000E+00
104	UZ	-0.600000000E-02	0.000000000E+00
105	UX	0.000000000E+00	0.000000000E+00
105	UZ	-0.600000000E-02	0.000000000E+00
106	UX	0.000000000E+00	0.000000000E+00
106	UZ	-0.600000000E-02	0.000000000E+00
107	UX	0.000000000E+00	0.000000000E+00
107	UZ	-0.600000000E-02	0.000000000E+00
108	UX	0.000000000E+00	0.000000000E+00
108	UZ	-0.600000000E-02	0.000000000E+00
109	UX	0.000000000E+00	0.000000000E+00
109	UZ	-0.600000000E-02	0.000000000E+00
110	UX	0.000000000E+00	0.000000000E+00
110	UZ	-0.600000000E-02	0.000000000E+00
111	UX	0.000000000E+00	0.000000000E+00
111	UZ	-0.600000000E-02	0.000000000E+00

PRINT REACTION SOLUTIONS PER NODE

THE FOLLOWING X,Y,Z SOLUTIONS ARE IN GLOBAL COORDINATES

NODE	FX	FY	FZ	MX	MY	MZ
1	0.41352E-12	0.70464E-12	22.715			
2	0.62705E-12	0.47748E-11	-50.259			
3	0.23448E-12	0.84270E-11	-65.466			
4	0.39546E-12	0.48743E-11	-61.763			
5	0.35111E-12	0.45048E-11	-60.087			
6	-0.14059E-12	0.49596E-11	-59.581			
7	-0.33773E-12	0.44764E-11	-60.087			
8	-0.16587E-12	0.33822E-11	-61.763			
9	-0.22560E-12	0.50875E-11	-65.466			
10	-0.71765E-12	0.52012E-11	-50.259			
11	-0.43288E-12	0.69811E-12	22.715			
21			-15.337			
31			-15.337			
41			-32.953			
51			-32.953			
61			-26.463			
71			-26.463			
81			-62.976			
91			-62.976			

NODE	FX	FY	FZ
101	-0.10585E-13		38.115
102	-0.30799E-12		-77.856
103	-0.28493E-12		-110.03
104	-0.23383E-12		-113.19
105	-0.59615E-13		-112.79
106	0.17756E-12		-112.46
107	0.10393E-12		-112.79
108	-0.40782E-13		-113.19
109	0.20329E-12		-110.03
110	0.37605E-12		-77.856
111	0.30825E-13		38.115
202	16.585		105.14
203	4.9421		88.517
204	1.4503		85.748
205	0.32934		85.206
206	-0.26917E-14		85.135
207	-0.32934		85.206
208	-1.4503		85.748
209	-4.9421		88.517
210	-16.585		105.14
302	-16.585		105.14
303	-4.9421		88.517
304	-1.4503		85.748
305	-0.32934		85.206
306	0.50813E-16		85.135
307	0.32934		85.206
308	1.4503		85.748
309	4.9421		88.517
310	16.585		105.14
502	0.00000E+00	-370.46	0.00000E+00
503	0.00000E+00	-357.20	0.00000E+00
504	0.00000E+00	-352.97	0.00000E+00
505	0.00000E+00	-351.82	0.00000E+00
506	0.00000E+00	-351.61	0.00000E+00
507	0.00000E+00	-351.82	0.00000E+00
508	0.00000E+00	-352.97	0.00000E+00
509	0.00000E+00	-357.20	0.00000E+00
510	0.00000E+00	-370.46	0.00000E+00
552	0.00000E+00	370.46	0.00000E+00
553	0.00000E+00	357.20	0.00000E+00
554	0.00000E+00	352.97	0.00000E+00
555	0.00000E+00	351.82	0.00000E+00
556	0.00000E+00	351.61	0.00000E+00
557	0.00000E+00	351.82	0.00000E+00
558	0.00000E+00	352.97	0.00000E+00
559	0.00000E+00	357.20	0.00000E+00
560	0.00000E+00	370.46	0.00000E+00

TOTAL VALUES
VALUE -0.35527E-13 0.49056E-10 0.41076E-09 0.00000E+00 0.00000E+00 0.00000E+00

PRINT F ELEMENT SOLUTION PER ELEMENT

***** POST1 ELEMENT NODE TOTAL FORCE LISTING *****

THE FOLLOWING X,Y,Z FORCES ARE IN GLOBAL COORDINATES

ELEM= 242	FX	FY	FZ
62	6.6582	-22.958	-44.609
262	-4.6226	101.91	-40.316
282	0.76001E-13	0.20099E-11	0.89360E-11
82	-2.0356	-78.952	84.925

ELEM= 243	FX	FY	FZ
63	3.8029	-32.581	-66.865
263	-3.0593	143.50	-52.721
283	0.16724E-13	0.59632E-11	0.27240E-11
83	-0.74351	-110.92	119.59

```
ELEM=  244 FX        FY        FZ
  64  1.2965     -35.129     -73.602
 264 -1.1036      154.25     -54.941
 284  0.12072E-13 0.46905E-11-0.13314E-11
  84 -0.19282     -119.12     128.54

ELEM=  245 FX        FY        FZ
  65  0.33370    -35.715     -75.275
 265 -0.29333     156.68     -55.295
 285  0.19318E-14 0.97851E-11-0.10504E-10
  85 -0.40377E-01 -120.97     130.57

ELEM=  246 FX        FY        FZ
  66 -0.29812E-12 -35.810     -75.565
 266  0.28627E-12  157.07     -55.327
 286 -0.18003E-26 0.38840E-11 0.23093E-13
  86  0.11852E-13 -121.26     130.89

ELEM=  247 FX        FY        FZ
  67 -0.33370     -35.715     -75.275
 267  0.29333      156.68     -55.295
 287 -0.11632E-14 0.91012E-11-0.32259E-11
  87  0.40377E-01 -120.97     130.57

ELEM=  248 FX        FY        FZ
  68 -1.2965      -35.129     -73.602
 268  1.1036      154.25     -54.941
 288 -0.46733E-14 0.18998E-11 0.59970E-11
  88  0.19282     -119.12     128.54

ELEM=  249 FX        FY        FZ
  69 -3.8029      -32.581     -66.865
 269  3.0593      143.50     -52.721
 289 -0.96314E-14 0.11049E-11-0.11759E-10
  89  0.74351     -110.92     119.59

ELEM=  250 FX        FY        FZ
  70 -6.6582      -22.958     -44.609
 270  4.6226      101.91     -40.316
 290 -0.13277E-12 0.11280E-10-0.55724E-11
  90  2.0356      -78.952     84.925


ELEM=  278 FX        FY        FZ
 362  4.6226     -101.91     -40.316
  62 -6.6582      22.958     -44.609
  82  2.0356      78.952     84.925
 382  0.25757E-13-0.14669E-10-0.37357E-11

ELEM=  279 FX        FY        FZ
 363  3.0593     -143.50     -52.721
  63 -3.8029      32.581     -66.865
  83  0.74351     110.92     119.59
 383 -0.44409E-15-0.20233E-11-0.16858E-11

ELEM=  280 FX        FY        FZ
 364  1.1036     -154.25     -54.941
  64 -1.2965      35.129     -73.602
  84  0.19282     119.12     128.54
 384 -0.66613E-15-0.61142E-11-0.20632E-11

ELEM=  281 FX        FY        FZ
 365  0.29333    -156.68     -55.295
  65 -0.33370     35.715     -75.275
  85  0.40377E-01 120.97     130.57
 385  0.77716E-15-0.99147E-11-0.70495E-11

ELEM=  282 FX        FY        FZ
 366 -0.28724E-12 -157.07     -55.327
  66  0.30264E-12  35.810     -75.565
  86 -0.15398E-13  121.26     130.89
 386 -0.14136E-26-0.38201E-11 0.40927E-11
```

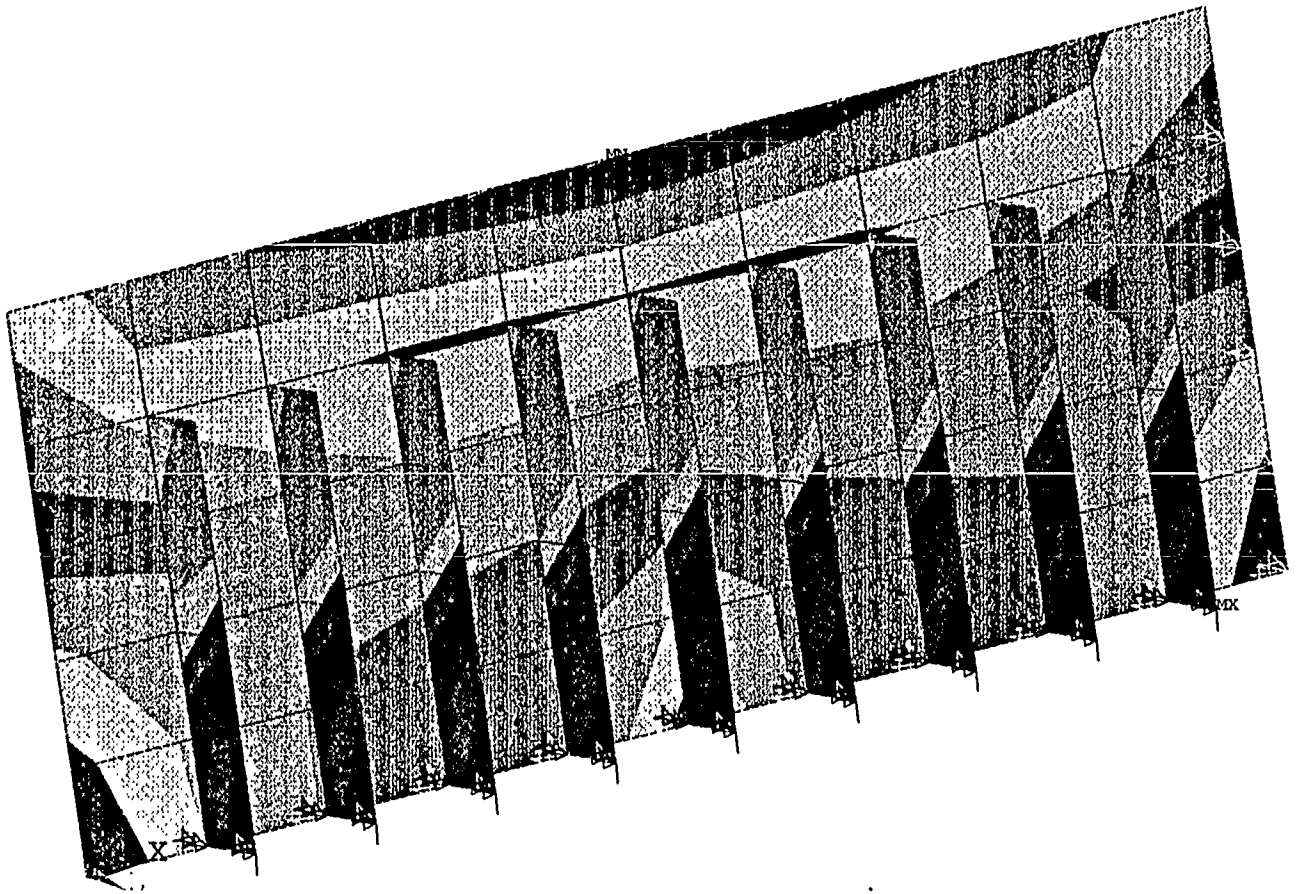
ELEM= 283	FX	FY	FZ
367	-0.29333	-156.68	-55.295
67	0.33370	35.715	-75.275
87	-0.40377E-01	120.97	130.57
387	0.25535E-14	-0.60920E-11	-0.56826E-11

ELEM= 284	FX	FY	FZ
368	-1.1036	-154.25	-54.941
68	1.2965	35.129	-73.602
88	-0.19282	119.12	128.54
388	0.26645E-14	-0.12266E-10	-0.13253E-10

ELEM= 285	FX	FY	FZ
369	-3.0593	-143.50	-52.721
69	3.8029	32.581	-66.865
89	-0.74351	110.92	119.59
389	-0.24425E-13	-0.82609E-11	-0.93090E-11

ELEM= 286	FX	FY	FZ
370	-4.6226	-101.91	-40.316
70	6.6582	22.958	-44.609
90	-2.0356	78.952	84.925
390	-0.59508E-13	-0.74882E-11	-0.11091E-10

Displacement Plot
Wall 1

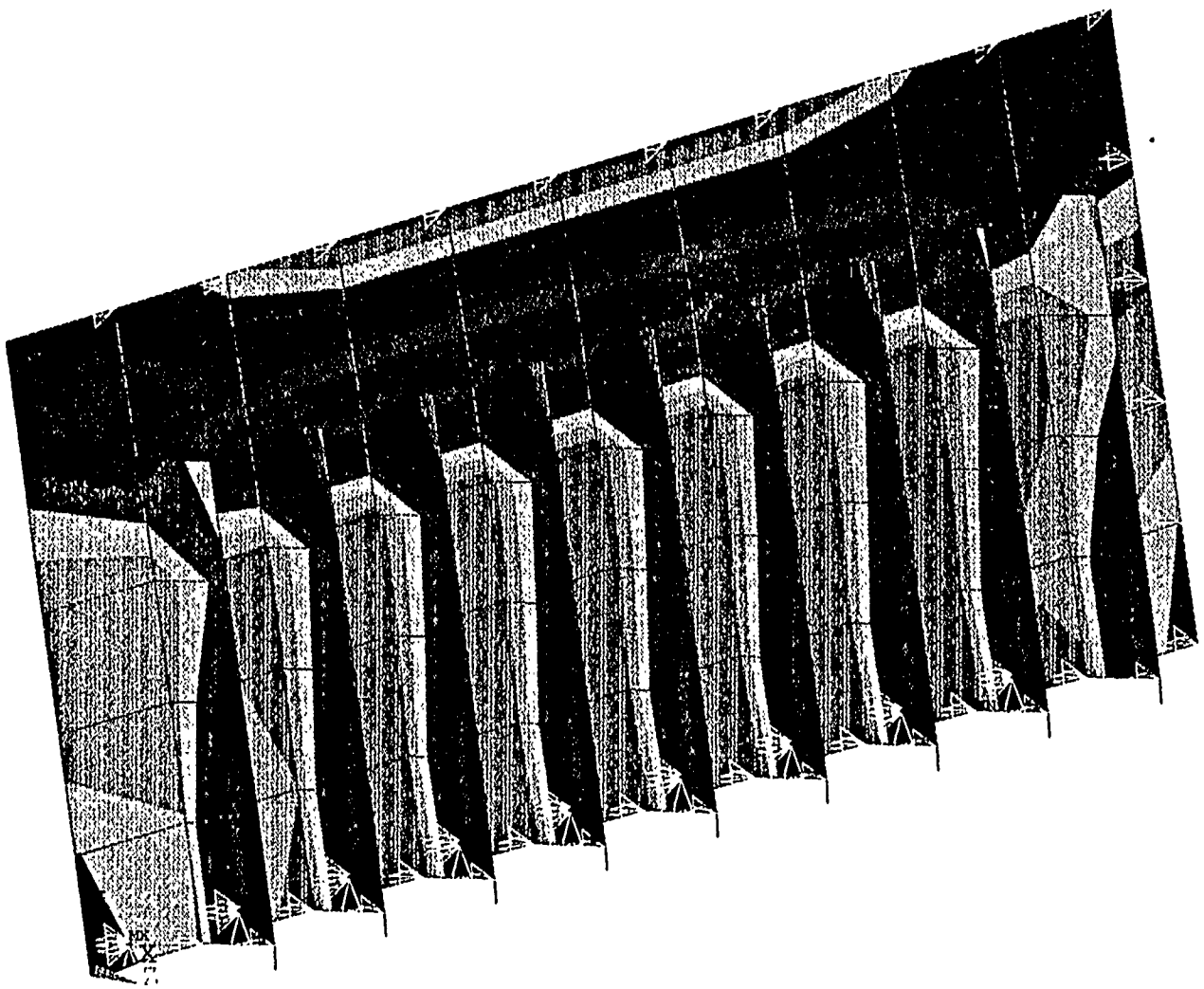


ANSYS 5.0 A
FEB 8 1995
09:42:30
PLOT NO. 1
NODAL SOLUTION
STEP=1
SUB =1
TIME=1
SEQV (AVG)
TOP
DMX =0.006
SMN =0.198592
SMX =9.138
SMXB=10.841

ROT

0.198592
1.192
2.185
3.178
4.172
5.165
6.158
7.151
8.145
9.138

Displacement
Wall 34

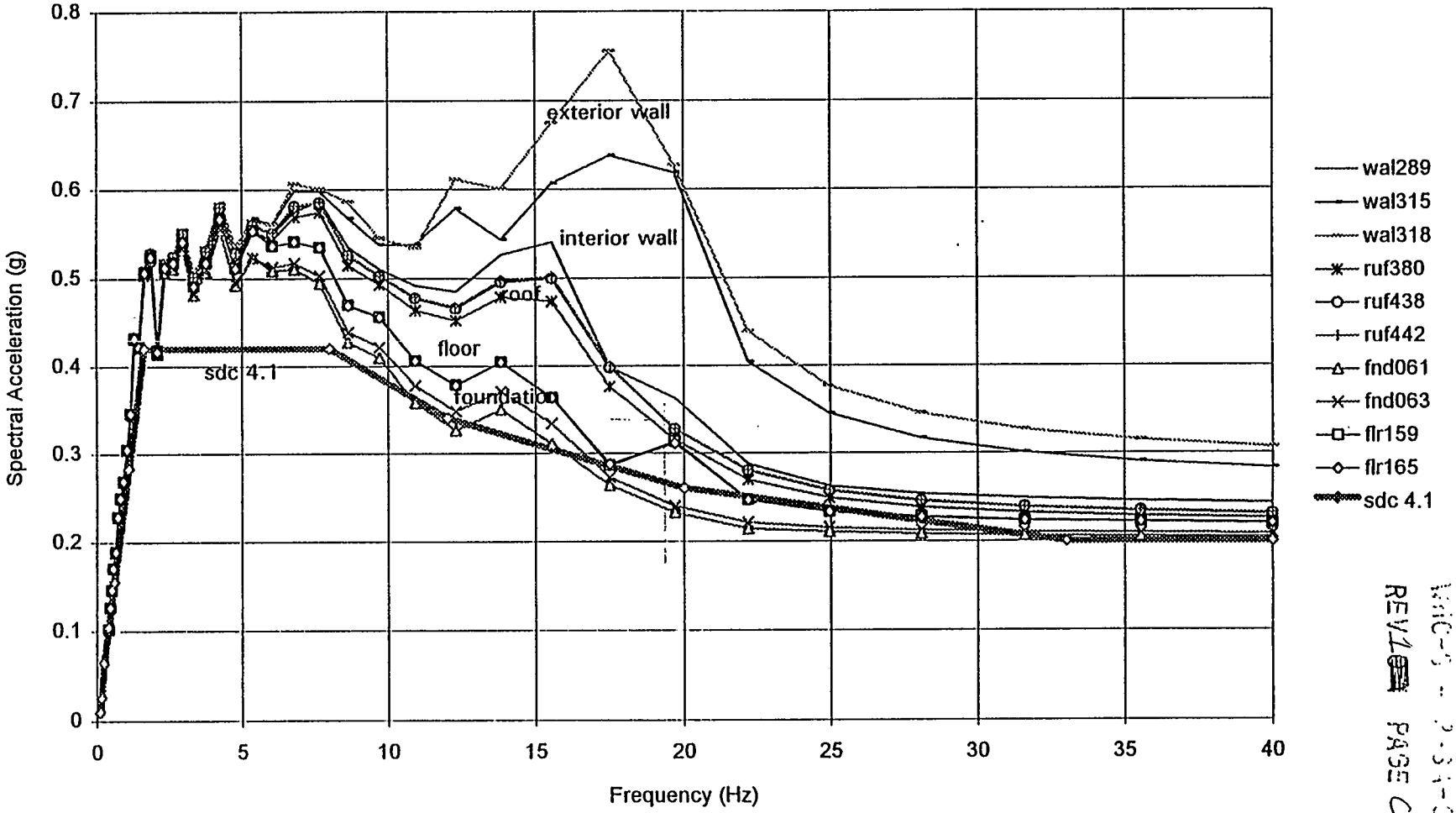


ANSYS 5.0 A
FEB 8 1995
09:21:33
PLOT NO. 1
NODAL SOLUTION
STEP=1
SUB =1
TIME=1
SEQV (AVG)
TOP
DMX =0.006
SMN =0.283201
SMX =5.766
SMXB=9.712

0.283201
0.892415
1.502
2.111
2.72
3.329
3.938
4.548
5.157
5.766

$f_c' = 3000 psi$

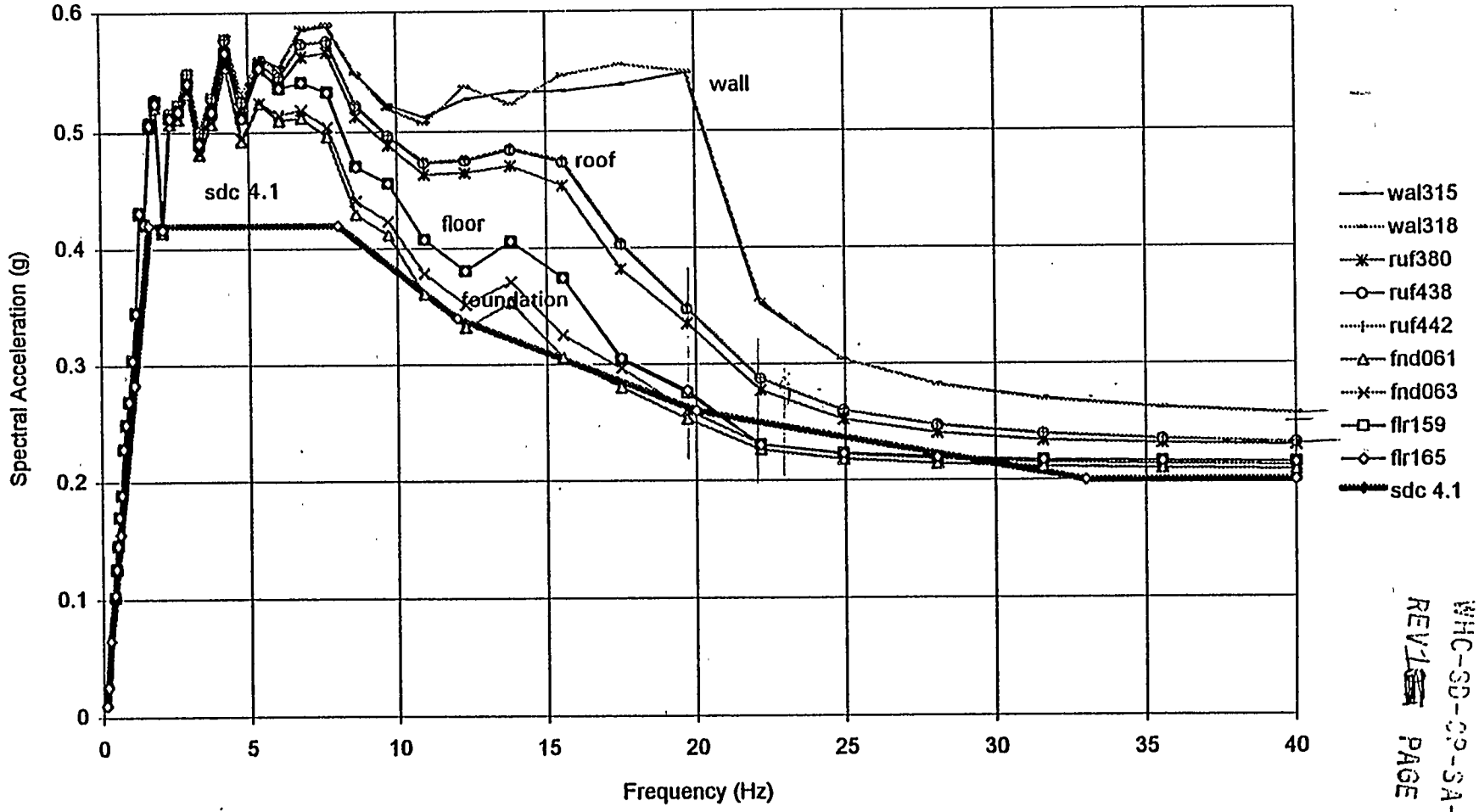
PLUTONIUM VAULT ACCELERATIONS
X HORIZONTAL 0.216 g, SDC 4.1 REV. 12, SEISMIC TIME HISTORY #1
ABSOLUTE SPECTRAL ACCELERATIONS AT NODAL PTS
0.050 DAMPING, MAX g = 0.755 AT FREQ. = 17.5 HZ
(1/26/95 CJM)



REV 1 PAGE C-250

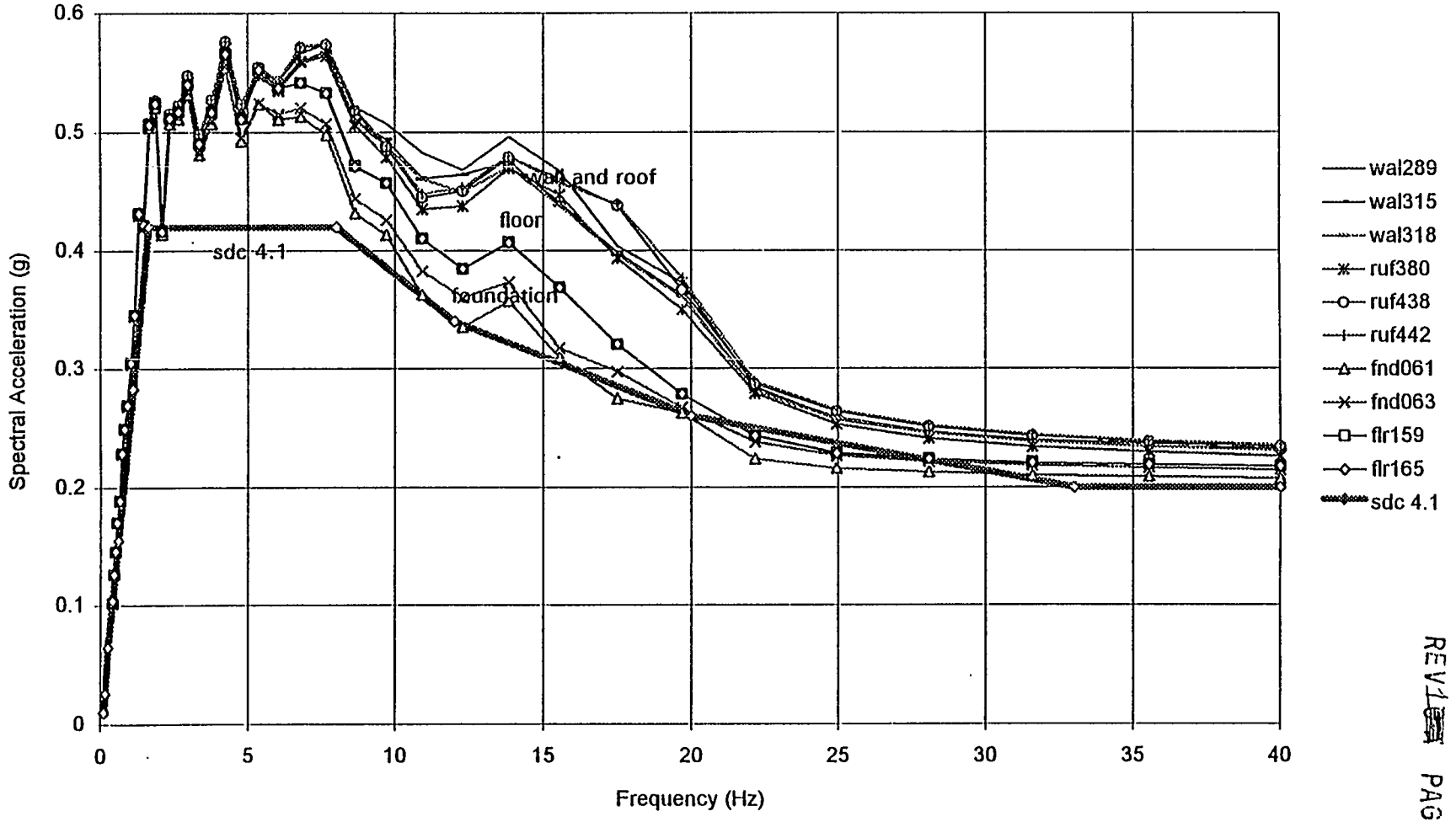
$f_c' = 5000 psi$

PLUTONIUM VAULT ACCELERATIONS
X HORIZONTAL 0.216 g, SDC 4.1 REV. 12, SEISMIC TIME HISTORY #1
ABSOLUTE SPECTRAL ACCELERATIONS AT NODAL PTS
0.050 DAMPING, MAX g = 0.590 AT FREQ. = 7.66 HZ
(1/26/95 CJM)



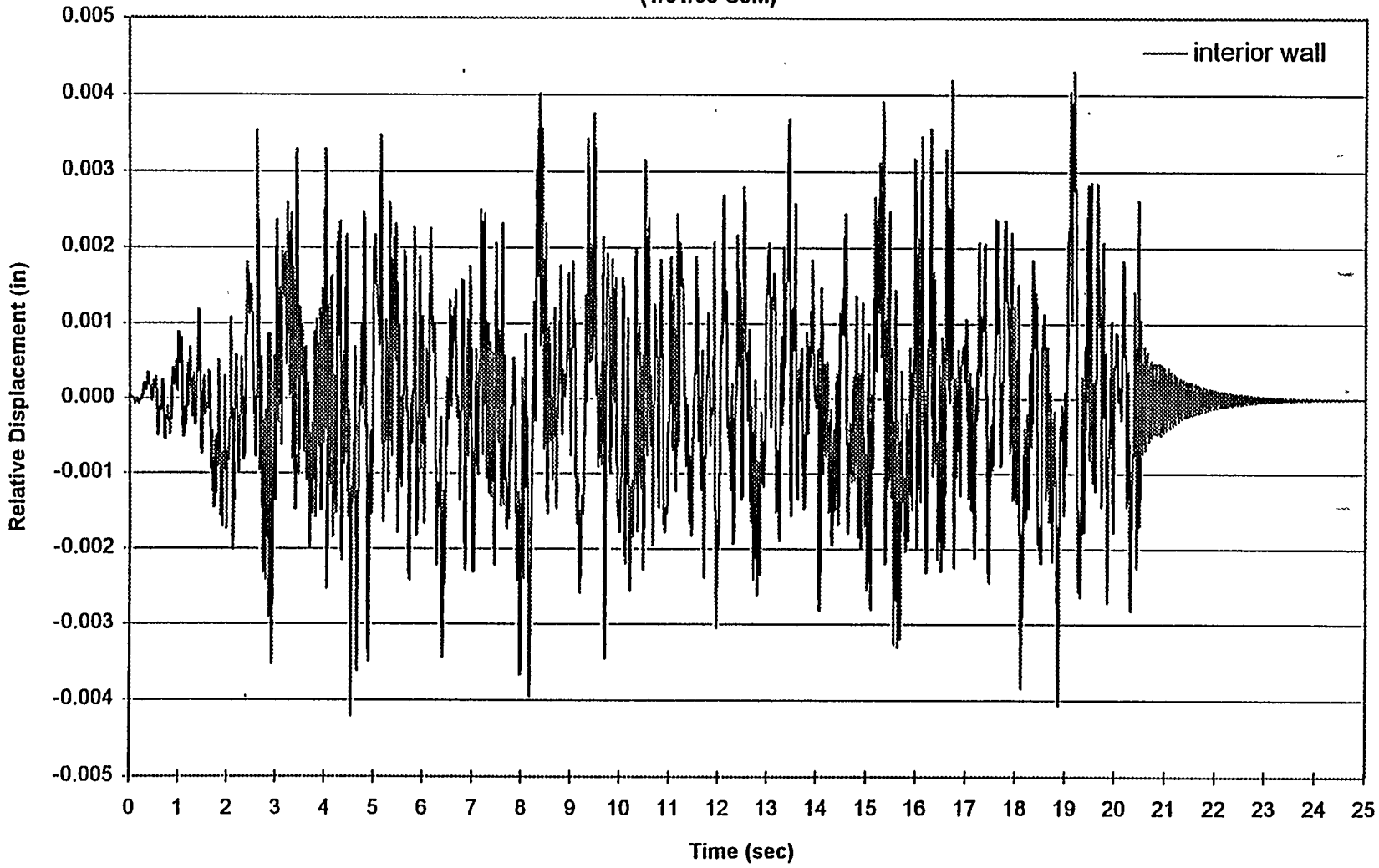
$f_c' = 3000$ psi
w/6" wall add-on
stiffness

PLUTONIUM VAULT ACCELERATIONS (STIFFNESS DUE TO 6-IN SHELL)
X HORIZONTAL 0.216 g, SDC 4.1 REV. 12, SEISMIC TIME HISTORY #1
ABSOLUTE SPECTRAL ACCELERATIONS AT NODAL PTS
0.050 DAMPING, MAX g = 0.577 AT FREQ. = 4.24 HZ
(2/1/95 CJM)



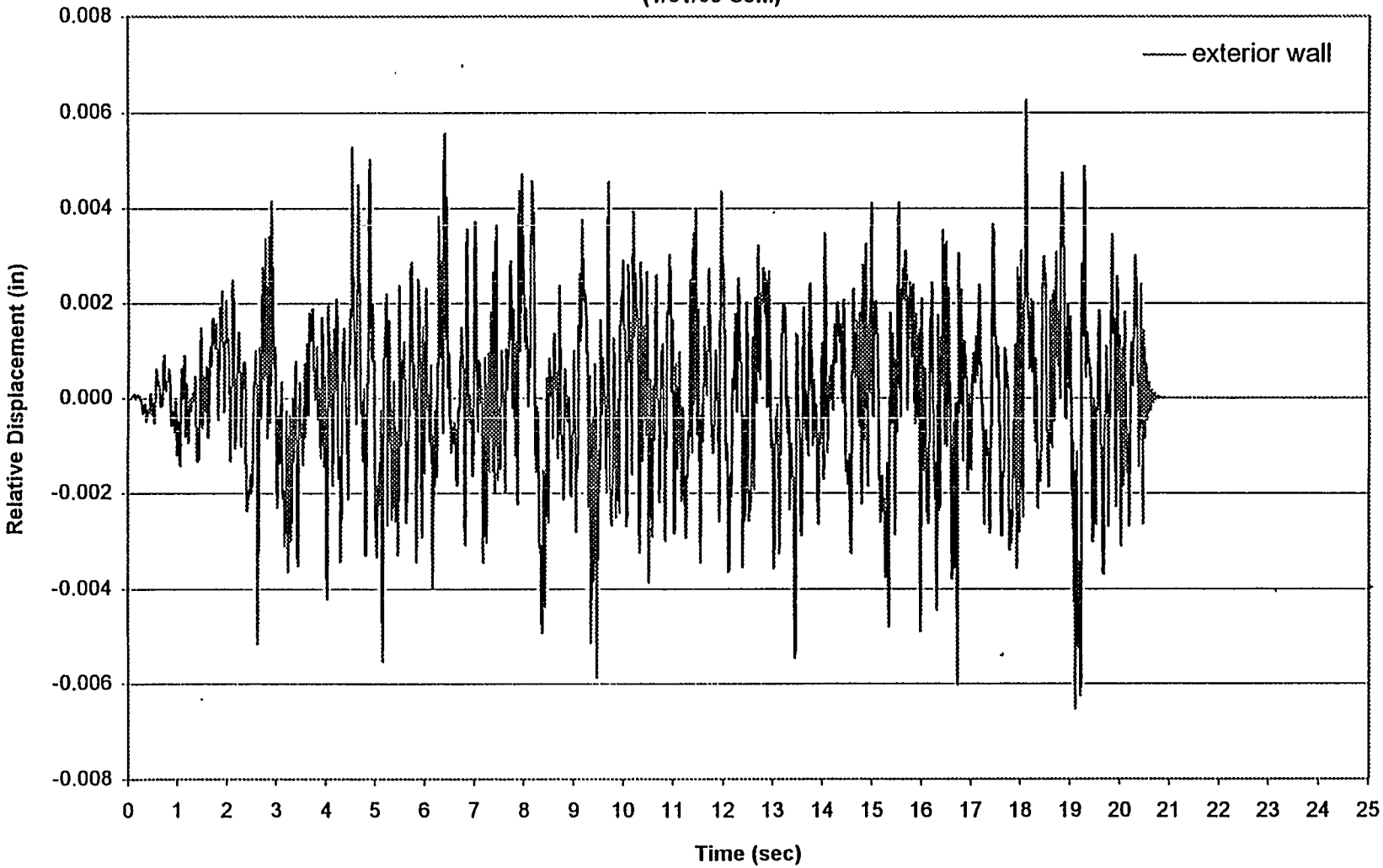
$f_c' = 3000 psi$

RELATIVE DISPLACEMENT TIME HISTORY BETWEEN FLOOR AND WALL AT HEIGHT 7 FEET
X HORIZONTAL 0.216 g, SDC 4.1 REV. 12, SEISMIC TIME HISTORY #1
(1/31/95 CJM)



$f_c' = 3000 psi$

RELATIVE DISPLACEMENT TIME HISTORY BETWEEN FLOOR AND WALL AT HEIGHT 7 FEET
X HORIZONTAL 0.216 g, SDC 4.1 REV. 12, SEISMIC TIME HISTORY #1
(1/31/95 CJM)



WNC-[illegible]-SA-026
REV 1 PAGE C-254

2736-Z Facility Storage Pedestal Seismic Qualification

1.0 Introduction

The purpose of the following analysis is to seismically qualify the plutonium storage pedestals in the 2736-Z building. This qualification pertains to the floor and exterior wall mounted cubicals in rooms #1, #3 and #4. Room #1 uses a pedestal design for the floor mounted cubicals and exterior walls that is bolted to the cubical walls with 3/8 in. fasteners. The type of fastener used has not be identified at this time. Rooms #3 and #4 cubicals and exterior wall cubical walls use pedestals that are welded to embedded plates cast into the cubical walls. Analysis of the floor mounted cubical walls has shown that they are seismically rigid. Therefore the use of ground response spectra for floor mounted cubicals at ground level is acceptable. The exterior wall mounted cubicals use the exterior wall response spectra.

The pedestals have been classified as Safety Class 1. These pedestals were previously analyzed as Safety Class 3 over Safety Class 1 as reported in WHC-SD-CP-SA-026.

2.0 Summary & Conclusions

The bolted pedestals in room #1 were assumed to be bolted to the cubical walls with either Hilti Kwik Bolts (HKB) or attached to embedded Unistrut using Unistrut Stud Nuts (see drawings H-2-70010 and H-2-70158). The margin of safety for either HKBs or Unistrut Stud Nuts is in excess of 2.0. A field walk down indicated a bolted configuration (3/8 threaded rod and nut) different from what is shown on either of the above two drawings. The margin of safety for beam bending in the pedestals for the flat bar configuration (3/16 in. x 6 in.) is 3.9. Final qualification of these pedestals will require identification of the actual attachment mechanism or a qualification load test on a typical pedestal to verify load capacity.

The welded pedestals in rooms #3 and #4 that are attached to floor mounted cubical walls show a margin of safety of 0.20 for the welds attaching the pedestal channel to embedded plate in the cubical wall, a margin of safety greater than 10 for the bending stress in the pedestal channel and a margin of safety of 1.8 for the cast in place stud welded to the embedded plate that is cast in the cubical wall. The floor mounted cubical pedestals in rooms #3 and #4 qualify seismically as Safety Class 1 equipment.

The welded pedestals that are attached to exterior wall mounted cubical walls show a margin of safety of 0.30 for the welds attaching the pedestal channel to embedded plate in the cubical wall. A margin of safety greater than 5. for the bending stress in the pedestal channel and a margin of safety of 1.4 for the cast in place stud welded to the embedded plate that in the cubical wall. The exterior wall mounted cubical pedestals in rooms #1, #3, and #4 qualify seismically as Safety Class 1 equipment.

3.0 Discussion

A seismic analysis was performed on the Safety Class 1 pedestal assemblies installed in room #1. This room contains two types of pedestal configurations that are bolted to floor mounted cubical walls. The 90 inch tall pedestals consist of: 1) 18 can holders welded to a 11 gauge carbon steel channel (ASTM A-569) bolted to the cubical wall with four bolts 2) nine can holders welded to a 3/16 in. plate 6 in. wide (ASTM A-569) bolted to the cubical wall with 4 bolts. Since the bolts are space along the channel at spacings ranging from 20 to 30 inches, the channel is assumed to be rigid and an equivalent static analysis is chosen as the analysis method. The analysis uses the peak of the ground response spectra for Safety Class 1 structures per SDC 4.1 rev 12 (G=0.45). Previous analysis of the floor mounted cubical walls showed that the wall are rigid. The floor is at grade level.

The rooms also have pedestals in cubicals that are mounted on the exterior walls of the building. The pedestals that are attached directly to the exterior walls are the bolted type. They are qualified using the peak exterior wall acceleration of 0.755 g's normal to the wall. The pedestals that are mounted on the exterior wall cubical walls are the welded type. These pedestals are qualified using the roof response of 0.32 g's at 19 Hz normal to the cubical walls and the exterior wall response of 0.315 g's at 36 Hz in the plane of the cubical wall.

Two drawings (H-2-70010 and H-2-70158) show conflicting information for the bolting arrangement of the pedestals on the cubical walls. The first drawing calls for Unistrut nuts and 3/8 in. ASTM A-307 bolts, The second drawing calls for 1/2 in. Hilti Drop-In (HDI) concrete expansion anchors. A field walk down to visually verify the correct arrangement identified a different configuration than what the drawings indicated. The field inspection showed a 3/8 in. threaded rod with a nut attached. The two most obvious configuration would be a 3/8 in. HKB or a 3/8 in. Unistrut Stud Nut since H-2-70010 pictorially indicates a Unistrut configuration. Other configurations are possible, therefore it is recommended that the actual configuration be identified or that the configuration be load tested to verify load carrying capability.

The analysis for the pedestal bolts in room #1 showed that the margin of safety for the Unistrut Stud nut to be greater than 3 and the margin of safety for HKB to be greater than 2.0. The flat bar configuration (3/16 in. x 6 in.) used on the back side of the cubicals has a margin of safety for beam bending of 3.9. The channel configurations would have a larger margin of safety.

Rooms #3 & #4 have floor mounted cubicals with pedestals holding 14 cans each. The pedestals are made of 16 gauge channel (ASTM A-36) welded to embedded plates cast into the concrete cubical walls (see H-2-26649). The embedded plates are 4 in. x 4 in. x 1/4 in. with a 1/4 in. x 6 in. long weld stud. These rooms have security bar attached to some of the pedestals. These security bars were analyzed as safety class 3/1 in inter office memorandum SA:ECO:94:047. The seismic analysis for the welded pedestals consisted of a response spectra analysis to determine loads on the attachment welds, the bending stress in the channel and the loads on the embedded plate weld stud. Crippling calculations and unbraced length calculations are per SA:ECO:94:047.

The margin of safety for floor mounted cubical pedestals in rooms #3 & #4 are as follow: 1) attachment weld is equal to 0.20 2) bending stress in channel is greater than 10 and 3) the weld stud is 1.8. The margin of safety for exterior wall mounted cubical pedestals in rooms are as follow: 1) attachment weld is equal to 0.30 2) bending stress in channel is greater than 5.6 and 3) the weld stud is 1.4.

4.0 References

4.1 WHC-SD-CP-SA-026, rev.0, "Seismic Qualification of SC 3 Equipment in 2736-Z Complex for SC 1 Seismic loads", 1994

4.2 WHC-SD-GN-DGS-30006, Rev. 1, "Guidelines for Assessing Seismic Adequacy of Safety Class 3 and 4 Equipment at the Hanford Site", 1993

4.3 Blodgett "Design of Welded Structure",1966

4.4 SDC 4.1 rev. 12 "Standard Arch-Civil Design Criteria Design Loads for Facilities", 1993

4.5 UCRL-15910, "Design and Evaluation guidelines for Department of Energy Facilities Subject to Natural Phenomena Hazards" 6/1990

TYPICAL CHECKLIST FOR INDEPENDENT REVIEW

Document Reviewed 2736Z Facility Storage Pedestals

Author D.L. Koreis & D. Barlow

Yes	No	N/A	
X	[ ]	[ ]	Problem completely defined.
X	[ ]	[ ]	Necessary assumptions explicitly stated and supported.
[ ]	[ ]	X	Computer codes and data files documented.
X	[ ]	[ ]	Data used in calculations explicitly stated in document.
X	[ ]	[ ]	Data checked for consistency with original source information as applicable.
X	[ ]	[ ]	Mathematical derivations checked including dimensional consistency of results.
X	[ ]	[ ]	Models appropriate and used within range of validity or use outside range of established validity justified.
X	[ ]	[ ]	Hand calculations checked for errors.
[ ]	[ ]	X	Code run streams correct and consistent with analysis documentation.
[ ]	[ ]	X	Code output consistent with input and with results reported in analysis documentation.
X	[ ]	[ ]	Acceptability limits on analytical results applicable and supported. Limits checked against sources.
X	[ ]	[ ]	Safety margins consistent with good engineering practices.
X	[ ]	[ ]	Conclusions consistent with analytical results and applicable limits.
X	[ ]	[ ]	Results and conclusions address all points required in the problem statement.

MANDATORY Software QA Log Number NA

R.A. Lillo
Reviewer

2-24-95
Date

DON'T SAY IT --- *Write It!*

DATE: January 10, 1995

TO: L. H. Rodgers

FROM: E. C. Ocoma H5-55

Telephone: 6-0332

cc: E. P. Bonadie
D. M. Bogen
T. J. Conrads
S. K. Farnworth
D. L. Koreis
R. W. Szempruch
R. J. Thomas
E. C. Vogt

SUBJECT: STORAGE VAULT PEDESTAL ANCHORAGE IN 2736-Z BUILDING

Verification of the anchor bolt size used to install the can holder pedestals is needed. The anchorage in drawing H-2-70158 shows a 1/2" hilti-drop-in anchor bolt while H-2-70010 calls out 3/8" hex bolt with P1008 unistrut nut. This implies that for the 3/8" bolt, a unistrut channel is embedded in the cubicle walls with some form of concrete anchor but no details could be found. Both assembly configuration will show the bolt hex head exposed.

A field verification was conducted by E. P. Bonadie (Sys. Cog. Engr.) and a millwright on January 5, 1995 to verify the size of the anchor bolts in Room 1 of 2736-Z building. According to Mr. Bonadie, only Room 1 has pedestals that are bolted to the cubicle walls. Rooms 3 and 4 have welded attachments and Room 2 has storage racks instead of cubicles. The inspection was performed visually and by measurements. The anchor bolts in a cubicle were measured and found to be 3/8" diameter, which agreed with the bolt size called out in drawing H-2-70010. The visual inspection also revealed that the exposed part of the anchor is not a hex head as expected but an assembly of hex nut and a threaded portion protruding over the nut. Based on this configuration, we can assume two possibilities. The first is that the anchor bolts are the hilti-kwik stud type anchors and the other is that a unistrut stud nut with spring and a regular hex nut were installed. Without removal of the pedestal assembly, the configuration cannot be assured.

In our structural qualification, the two assumptions will be analyzed. The preliminary analysis shows the anchor bolts have large margin of safety for both configuration because the calculated pullout load per bolt is small. For the hilti assembly it can be shown by analysis that it is acceptable. The unistrut stud nut assembly can also be shown as acceptable, however there is one concern. This concern is the embedded unustrut channel shown on drawing H-2-70010, detail V. The unistrut embedment detail is not shown on the drawing, therefore the pullout load allowable of the embedded unistrut cannot be determined and in this case, even if the pedestal is removed, there is still no assurance about the unistrut channel anchorage to the cubicle wall but then again the pullout load is small. One method which will assure the pullout capacity of the embeds is to conduct a pull test on the assembly by applying the calculated load times a factor of safety appropriate for existing anchor bolts.

The analysis can be as discussed above and these paragraphs will be included in the analysis.

Please let us know as soon as possible if you agree with this analysis approach and whether you are going to do the pull test to address the uncertainty.

[1] From: Ernesto C (Ernie) Ocoma at ~WHC240 12/29/94 9:23AM (1046 bytes: 16 ln)
To: Louis H Rodgers at ~WHC28
Receipt Requested
cc: Errol P Bonadie at ~WHC120, Susan K Farnworth at ~WHC208, Dennis L Koreis at ~WHC208, Ernesto C (Ernie) Ocoma
Subject: 2736-Z STORAGE VAULT PEDESTAL

---------- Message Contents ----------

Lou

Need verification of the bolt size used to install the single row can holder pedestal. Drawing H-2-70158 shows mounting plate with 1/2" Hilti Drop-In anchor boly while H-2-70010 calls out 3/8" hex bolt with unistrut nut. This implies that for the 3/8" bolt, a unistrut channel was embedded in the cubicle walls. Please provide a field verification of what size/s of bolts are installed ASAP. The 1/2" bolt hex head has 3/4" across flats and the 3/8" hex has 9/16" across flats.

Thanks

E. C. Ocoma

Field walk down shows 3/8 in stud bolt & nuts installed:

POSSIBLE COMBINATIONS

1) 3/8 UNISTRUT STUD NUT

2) 3/8 HILTI KWIK BOLT

3) OTHERS TBD

For
Location 2736Z
Subject RM-1 PEDESTALS

Job No.
Date 1-14-95
By DE Lee
Checked By dlarlow

SAFETY CLASS 1.0 H-2-70158 (IEC)

RM#1 PEDESTAL WEIGHT (NEW STYLE)

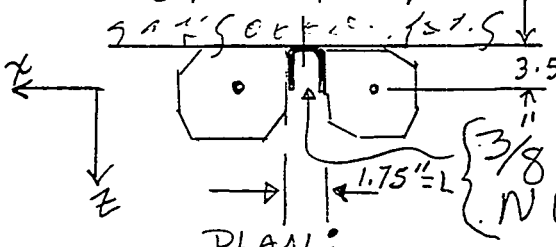
REF: WHC-SD-CP-SA-026 REV-0
PP C-7 & C-12 { 18 CANS ON SIDE, 9 CANS ON BACK ASSEMBLY

SIDE ASSY. = 188# EACH

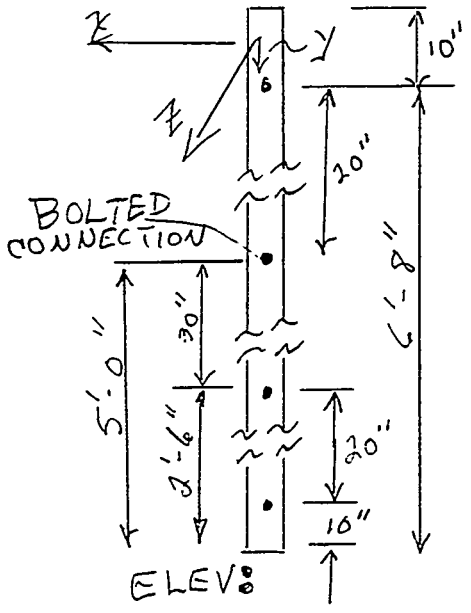
BACK ASSY. = 188# - 9(5.5#/CAN) = 139# EACH

FOR PEDESTALS MOUNTED ON RIGID WALL - CUBICAL PEAK ACCEL. RESPONSE THAT ARE FLOOR MOUNTED IS 0.42G FROM SPECTRA PER SDC 4.1 REV. 12 FIG 3.0 PP-27

BOLTED SIDE ASSY.



CHANNEL 11ga. 1¾" x 1¾"
ASTM-A-569
H-2-70158
THICKNESS = 0.1196"



CHANNEL IS RIGID IN ALL DIRECTIONS

NOTE: ASTM-A-569 DOES NOT HAVE [illegible] REQUIREMENT (M.N.) CALLED OUT. USE TY A FROM FYFE CO CATALOG $I_y \approx 27000$ FT

For
Location 2736-Z
Subject RM-1 PEDESTALS

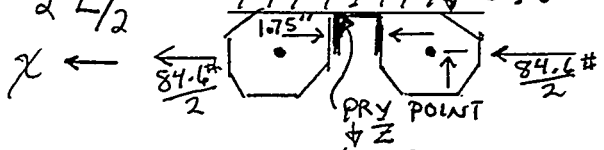
Date 1-16-95
By D.Z. Koreis
Checked By D.Barber

NOTE 0.42G ROUNDED TO 0.45G FOR THESE CALCS. (CONS.)

F_X = SIDE LOAD ⟸ .45G ACCEL. = $\ddot{x}$

$F_X = W_{TOTAL} \ddot{x} = 188^{\#} \times 0.45^{G} = 84.6^{\#}$ SHEAR

$\frac{F_X(d)}{2\,L/2}$ = Pry LOAD = $\frac{84.6^{\#}(3.5'')}{2\,(1.75/2)} = 169.2^{\#}$ TENSION



½ OF TOTAL CANS CREATE THE PRY LOAD
OTHER CANS ARE BRACED AGAINST WALL

F_Z NORMAL LOAD // 0.45G ACCEL. ($\ddot{z}$)

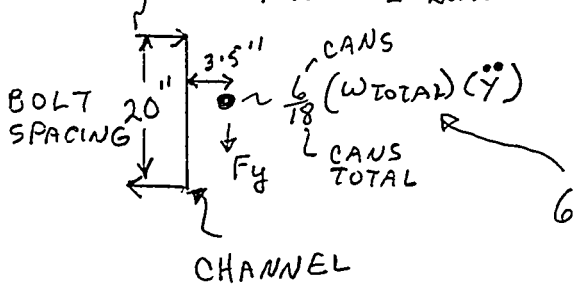
$W_{TOTAL} \times \ddot{z} = 188^{\#}(0.45^{G}) = 84.6^{\#}$ TENS.

F_Y VERTICAL LOAD 188# DEAD WEIGHT

$W_{TOTAL} \times \ddot{y}$ (⅔ HORIZONTAL PER SDC 4.1) $= 188\,(0.45)(\tfrac{2}{3}) = 56.4^{\#}$ SHEAR

F_Z PULL OUT FROM F_Y LOAD $= \frac{188^{\#}(.45)(3.5'')}{20''}\left(\frac{6}{18}\right)\left(\frac{1}{3}\right) \approx 3.3^{\#}$ TENSION/BOLT (SMALL)

(6 CAN / 2 BOLT SPACING)



$\frac{6}{18}$ (CANS / CANS TOTAL) $(W_{TOTAL})(\ddot{y})$

6 CANS FOR 20" SPACING

For
Location 2736-Z
Subject RM-1 PEDESTAL

Date 1-16-95
By DLLSO
Checked By ~~DFarlow~~

LOAD SUMMATION

½" HDI → BOLT LOAD (4 BOLTS)

$\frac{188^{\#} + 56.4^{\#}}{4 \text{ BOLTS}} = 61^{\#}/\text{BOLT}$ SHEAR

$\frac{84.6^{\#} + 169.2^{\#}}{4 \text{ BOLTS}} + \frac{3.3^{\#}}{\text{BOLT}} \approx 68.5^{\#}/\text{BOLT}$ PULL OUT.

$\frac{84.6}{4 \text{ BOLTS}} = 21.^{\#}/\text{BOLT}$ SHEAR

FOR LOAD COMBINATI
ASSUME
100%/100%/100%
CONSERVATIVE

$$I_{bolt} = \frac{T_{ENS}}{T_{ALLOW}} + \frac{V_{SHEAR}}{V_{ALLOW}} \leq 1.0$$

WHC-SD-GN-DGS-30006
SECTION 8.1.1.13

where

WHC-SD-GN-DGS-30006
(PP 8-1 → 8-16)

$T_{nom.} = 1460^{\#}$
$V_{SHEAR\ nominal} = 1420^{\#}$
} Table 8.3

(H-2-70011) FOR 3000PSI CONCRETE

REV I 3/8 HKB

REDUCTION FACTORS
$RT_p = RT_s = 1.0$
$RL_p = RL_s = 1.0$
$RS_p = RS_s = 1.0$
$RE_p = RE_s = 1.0$
$RR_p = RR_s = 1.0$
$RC_p = 1.0$
$RI_p = RI_s = .75$ (TENSILE)

$RF_p = \frac{3000}{4000} = .75$

$RF_s = \frac{3000}{10000} + .65 = .95$

$T_{ALLOW} = (.75)(.75)(T_{nom}) = .75 \times .75 \times 1460 = 821^{\#}$

$V_{SHEAR} = (.75).95\ (V_{nom} = .75 \times .95 \times 1420 = 1012^{\#}$

↑ reduced injection

For
Location 2736-Z
Subject RM-1 PEDESTAL

Date 1-16-95
By DR Koeis
Checked By

FOR CONSERVATISM ASSUME 1/3 OF BOLTS ARE NOT ACTIVE $4^{\text{BOLTS}}/3 \approx 1$ BOLT NOT ACTIVE

$$I_{\text{BOLTS}} = \frac{68.5\left(\frac{4}{3}\right)}{.75(.75)\,T_{nom}} + \frac{(61+21)\,4/3}{.75(.95)\,V_{nom.}}$$

$$= \frac{68.5 \times \frac{4}{3}}{821} + \frac{(61+21)\,\frac{4}{3}}{1012}$$

$$= .22 < 1. \quad \text{OK}$$

$$M.S. = \frac{1}{.22} - 1 = 3.5 \leftarrow \text{large}$$

Westinghouse Hanford Company

ANALYSIS

WHC-SD-CP-SA-026

REV 1 Page PAGE C-260

Job No.

Date 1-16-95

By D.E.K.

Checked By

For

Location 2736-Z

Subject RM-1 PEDESTAL

ASSUME UNISTRUT STUD NUTS (SEE ATTACH. BELOW) 3/8" - ASSUME P-2380 UNISTRUT (WORKING LOAD)

$T_{TENS.} = 1000\ \#$

$V_{SLIP} = 500\ \#$ (LONG. SLIP) ← NOT APPLICABLE

(ASSUME $V_{TRANS} = V_{SLIP}$) CONS.

$$I_T = \frac{T}{T_{ALLOW}} = \frac{68(4/3)}{(.75)^2 1000\#} = 0.16 < 1.0$$

$$I_S = \frac{V_{SHEAR}}{V_{ALLOW}} = \frac{21\#(4/3)}{500\#(.75)(.95)} \approx 0.079 < 1.0$$

$$M.S = \frac{1}{(.16+.079)} - 1 \geq 3.18 \text{ (LARGE}$$

Westinghouse Hanford Company

ANALYSIS

WHC-SD-CP-SA-026
REV 1 PAGE C-267

For
Location 2736-Z
Subject RM-1 PEDESTAL

Page
Job No.
Date 1-16-95
By
Checked By

FINAL VERIFICATION OF ANCHORAGE IS REQUIRED FOR THIS S.C.-1 PIECE OF EQUIPMENT OR A LOAD TEST BASED ON 1.5 X THE CALCULATED LOAD WILL BE REQUIRED

FAX

WNC-5D-CP-3A-C25
REV ~~1~~ PAGE C-248

UNISTRUT CORPORATION

WAYNE MANUFACTURING DIVISION • 35660 CLINTON • WAYNE, MI 48184
TELEPHONE (313) 721-4040 FAX (313) 721-4106
TOLL FREE 1-800-521-7730

DATE 1/9/95 SENDER David Abbott

SEND TO Westinghouse FAX NO. (509) 373-6975

ATTEN. Dennis Koreis TOTAL PAGES THIS MESSAGE 4

MESSAGE:

Here is our test Data regarding P2380 Series stud NUT.

If you need any more help please call

(313) 721-7570

David Abbott
Industrial Engineer.

TEST RESULTS

SLIP TESTS

5/8" - 11 @ 125 Ft.-Lbs. Torque

	First Slip	Ultimate Load
Test #1:	3800 Lbs.	7920 Lbs.
#2:	4300 Lbs.	7850 Lbs.
#3:	---	7620 Lbs.
#4:	3800 Lbs.	7780 Lbs.
#5:	---	7350 Lbs.

Design Load = 1500 Lbs.

1/2" - 13 @ 40 Ft.-Lbs. Torque

	First Slip	Ultimate Load
Test #1:	1700 Lbs.	5160 Lbs.
#2:	1500 Lbs.	4880 Lbs.
#3:	1600 Lbs.	4350 Lbs.
#4:	1400 Lbs.	3000 Lbs.
#5:	1200 Lbs.	3050 Lbs.

Design Load = 1000 Lbs.

3/8" - 16 @ 19 Ft.-Lbs. Torque

	First Slip	Ultimate Load
Test #1:	---	1850 Lbs.
#2:	775 Lbs.	1925 Lbs.
#3:	775 Lbs.	1500 Lbs.
#4:	800 Lbs.	1650 Lbs.
#5:	675 Lbs.	1700 Lbs.

Design Load = 500 Lbs.

PULL-OUT TESTS

5/8" - 11 @ 125 Ft.-Lbs. Torque

	Ultimate Load
Test #1:	8350 Lbs.
#2:	8160 Lbs.
#3:	7160 Lbs.

Design Load = 2000 Lbs.

1/2" - 13 @ 40 Ft.-Lbs. Torque

	Ultimate Load
Test #1:	7150 Lbs.
#2:	7130 Lbs.
#3:	7320 Lbs.

Design Load = 2000 Lbs.

3/8" - 16 @ 19 Ft.-Lbs. Torque

	Ultimate Load
Test #1:	5800 Lbs.
#2:	6450 Lbs.
#3:	5780 Lbs.

Design Load = 1000 Lbs.

TEST REPORT A-77
Page Three

TEST RESULTS CONT.

SLIP TESTS

5/16" - 18 @ 11 Ft.-Lbs. Torque

	First Slip	Ultimate Load
Test #1	550 Lbs.	1275 Lbs.
#2	575 Lbs.	1900 Lbs.
#3:	650 Lbs.	1730 Lbs.
#4:	600 Lbs.	1675 Lbs.
#5:	----	1900 Lbs.

Design Load = 400 Lbs.

1/4" - 20 @ 6 Ft.-Lbs. Torque

	First Slip	Ultimate Load
Test #1:	----	260 Lbs.
#2:	----	255 Lbs.
#3:	----	370 Lbs.
#4:	----	365 Lbs.
#5:	----	350 Lbs.

Design Load = 100 Lbs.

PULL-OUT TESTS

5/16" - 18 @ 11 Ft.-Lbs. Torque

	Ultimate Load
Test #1:	4080 Lbs
#2:	3950 Lbs.
#3:	4340 Lbs.

Design Load = 800 Lbs.

1/4" - 20 @ 6 Ft.-Lbs. Torque

	Ultimate Load
Test #1:	2430 Lbs.
#2:	2385 Lbs.
#3:	2350 Lbs.

Design Load = 600 Lbs.

Note: In above pull-out tests for 5/8" and 1/2" sizes, failure occurred due to stud nut pulling out of channel. For 3/8", 5/16", and 1/4", failure occurred due to stud breaking in half in tension.

Thomas Tuday
Technical Design Group

Ellwood Irish
Chief Engineer
Technical Design Group

UNISTRUT
35005 Michigan Avenue West
Wayne, Michigan 48184

T E S T R E P O R T N O . A - 7 7

Test Specimens: Unistrut P-2378, P-2379, P-2380, P-2381, P-2382
Stud Nuts

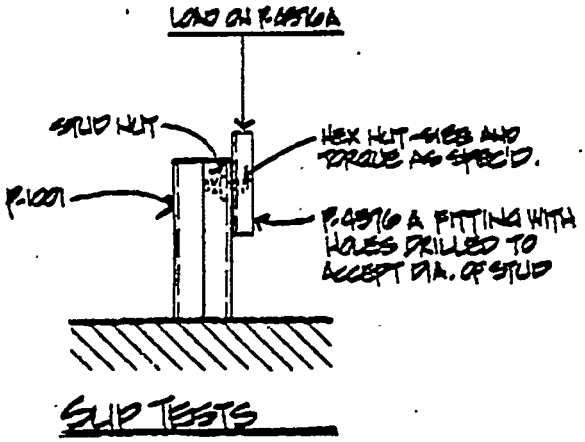
Date: April 26, 1982

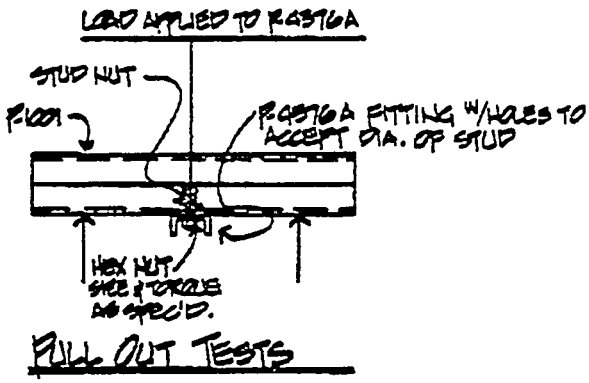
OBJECT OF TESTS:

To determine allowable design loads in slip and pull-out on all sizes of "Unistrut" stud nuts.

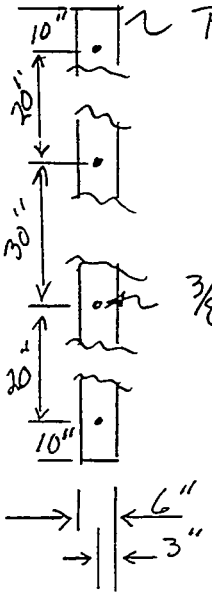
DESCRIPTION OF TESTS:

"Unistrut" stud nuts were assembled in P-1001 channel on a P-4376A fitting with holes drilled for stud size, as shown in illustrations. Assemblies were then placed in a Baldwin tension compression testing machine and loaded until failure, noting ultimate load attained in pull-out tests; and the first slip point and ultimate loading in slip tests, and noting mode of failure in all tests. Results are tabulated on the following sheets.





RM # 1 BACK ASSYMBLE 139# (9 CANS) BOLTED



PL 3/16" ASTM A-569

3/8" TBD (4 TYP)

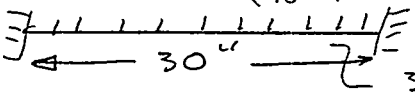
BOLT LOADS ARE LESS THAN WITH CHANNEL ASSEMBLY FOR RCCM I. (9 CANS INSTEAD OF 18 CANS)

(SEE PREVIOUS CALCS)

$W = 139\#$

CALC: BENDING STRESS (WORST CASE

$M = \frac{wl^2}{12}$ $w = 139\left(\frac{30"}{90"}\right)/30" = 1.54\#/in$



3/16 PL x 6" WIDE

$I = \frac{bh^3}{12} = \frac{6 \times (.1875)^3}{12} = .0033\ in^4$

$\frac{wl^2}{12} = M = \frac{1.54(30^2)}{12} = 115.5\ in\#$

$\sigma_b = \frac{Mc}{I} = \frac{115\ (3/32)}{.0033} = 3271\ PSI$

$M.S. = \frac{1}{\frac{3281}{.6(27000)}} - 1 \geq 3.9 \leftarrow$

ASTM-A569

$\sigma_{b\,ALLOW} = .6\,\sigma_y$
$= .6(27000)$ ← TYPICAL PER RIVERSON-
$= 16200\ PSI$

Westinghouse Hanford Company

ANALYSIS

WHC-SD-CP-SA-026

Page REV 1 PAGE C-273

Job No

Date 1-16-95

By

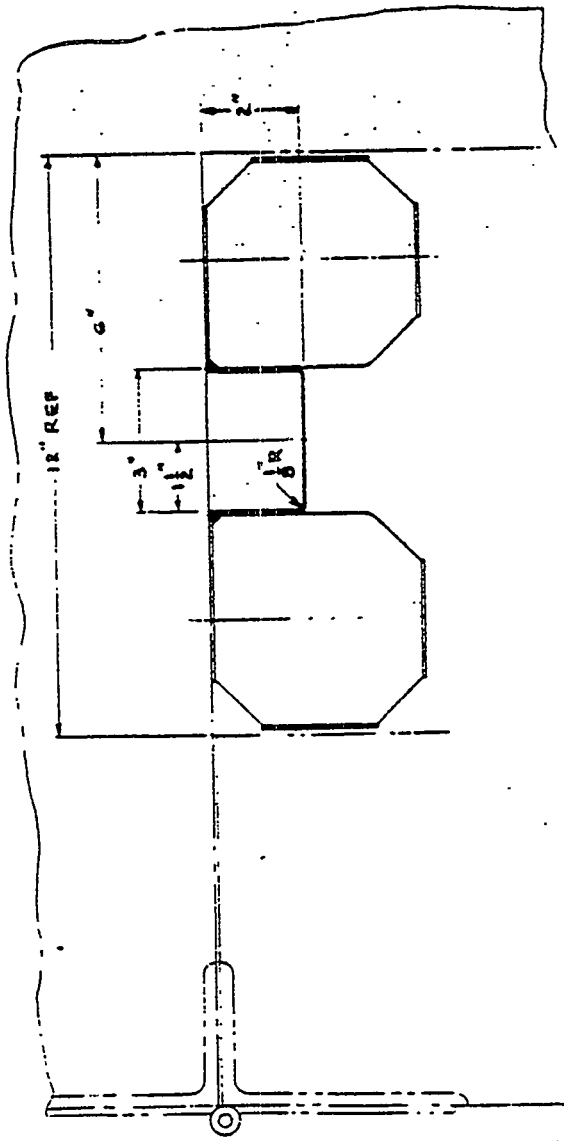
Checked By

For

Location 2736-Z

Subject RM 3 & 4 PEDESTAL

RM 3 & 4 WELDED PEDESTAL CALCS

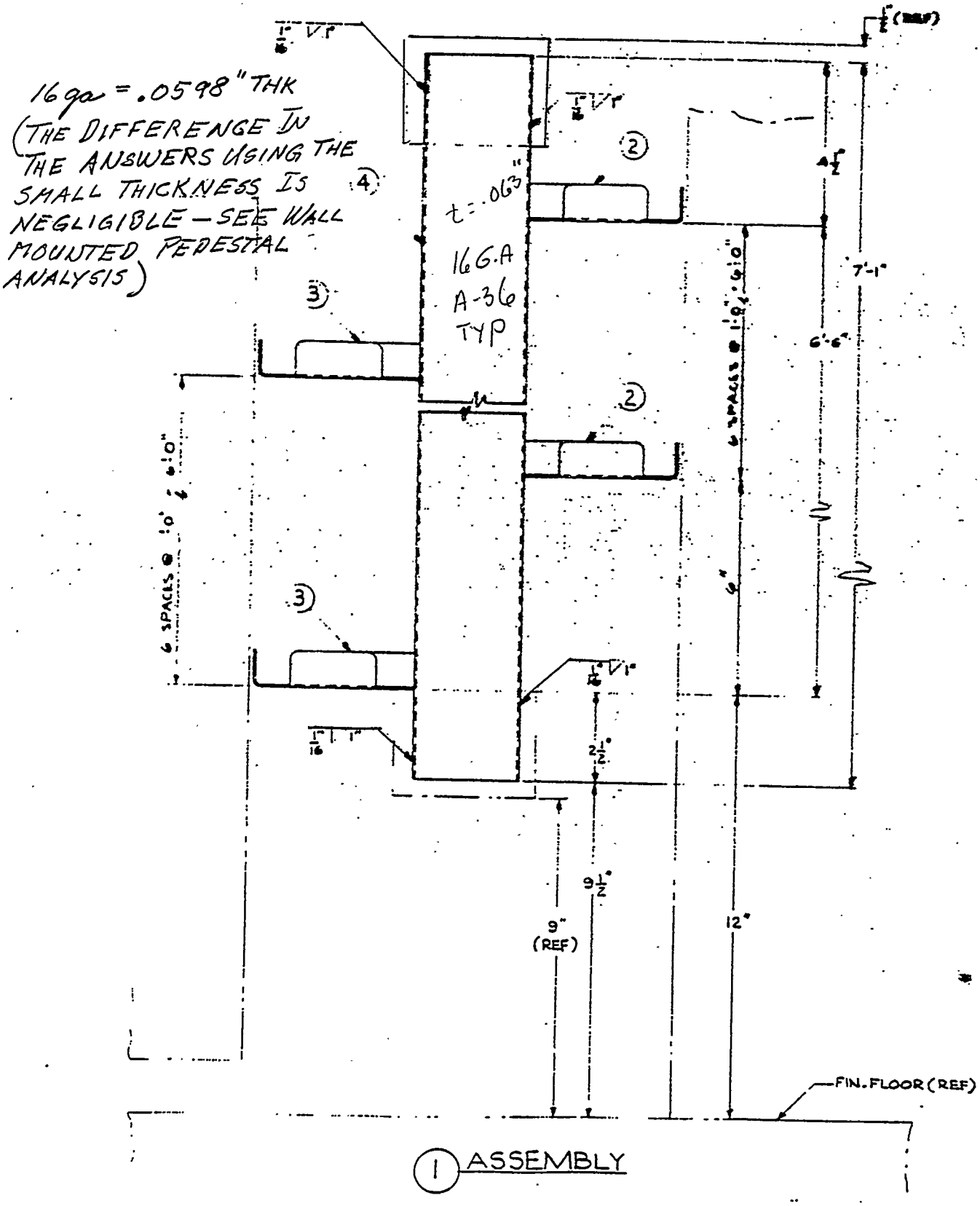


PLAN VIEW

H-2-26649
Rev 1

H-2-26649
REV-1
ROOM 3

16ga = .0598" THK
(THE DIFFERENCE IN THE ANSWERS USING THE SMALL THICKNESS IS NEGLIGIBLE — SEE WALL MOUNTED PEDESTAL ANALYSIS)



(1) ASSEMBLY

USED IN ANALYSIS PER UCRL 15910 (EQUIPMENT)

TABLE 2. 0.2 *g* Response-Spectra Control Points (Corresponds to Figure 3).

Control Point	2% Damping		5% Damping		7% Damping		10% Damping		12% Damping	
	f(Hz)	*g*	f(Hz)	*g*	f(Hz)	*g*	f(Hz)	*g*	f(Hz)	*g*
E	0.10	0.012	0.10	0.0102	0.10	0.0095	0.10	0.0088	0.10	0.0083
	0.16	0.031	0.16	0.026	0.16	0.024	0.16	0.023	0.16	0.021
D	0.26	0.084	0.25	0.065	0.25	0.059	0.24	0.052	0.24	0.048
	0.40	0.129	0.40	0.104	0.40	0.095	0.40	0.087	0.40	0.080
	0.60	0.192	0.60	0.155	0.60	0.142	0.60	0.130	0.60	0.120
	1.10	0.351	1.10	0.283	1.10	0.261	1.10	0.237	1.10	0.220
C	1.73	0.550	1.64	0.420	1.60	0.380	1.53	0.330	1.50	0.300
B	8.00	0.550	8.00	0.420	8.00	0.380	8.00	0.330	8.00	0.300
	12.00	0.412	12.00	0.340	12.00	0.316	12.00	0.286	12.00	0.267
	20.00	0.286	20.00	0.260	20.00	0.251	20.00	0.239	20.00	0.231
A	33.00	0.200	33.00	0.200	33.00	0.200	33.00	0.200	33.00	0.200
A'	100.0	0.200	100.0	0.200	100.0	0.200	100.0	0.200	100.0	0.200

The response spectra accelerations for the Safety Class 1 0.20 *g* DBE shall be
- scaled by 0.60 to obtain the response spectra accelerations for the Safety Class 2 and 3 0.12 *g* DBE ; and
- scaled by 0.45 to obtain the response spectra accelerations for the Safety Class 4 0.09 *g* DBE.

WHC-SD-CP-SA-026
REV 1 PAGE C-277

Table 9-7(c)

NATURAL FREQUENCIES OF COMMONLY USED SYSTEMS

BEAMS OF UNIFORM SECTION AND UNIFORMLY DISTRIBUTED LOAD

ANGULAR NATURAL FREQUENCY $\omega_n = A\sqrt{\frac{EI}{\mu L^4}}$ radians/s

WHERE E = YOUNG'S MODULUS, lb/in^2

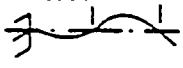
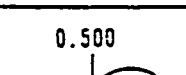
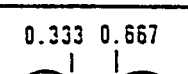
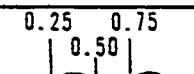
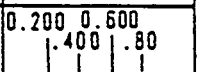
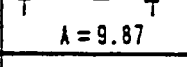
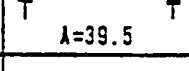
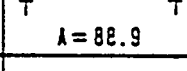
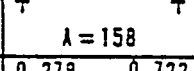
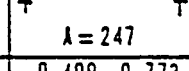
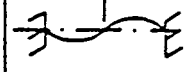
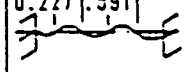
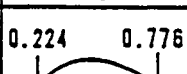
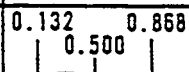
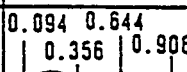
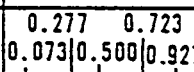
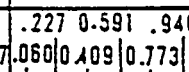
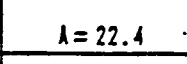
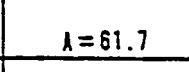
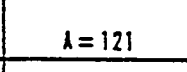
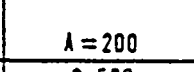
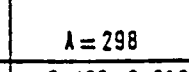
I = AREA MOMENT OF INERTIA OF BEAM CROSS SECTION, in^4

L = LENGTH OF BEAM, in

μ = MASS PER UNIT LENGTH OF BEAM, lb-s^2/in^2

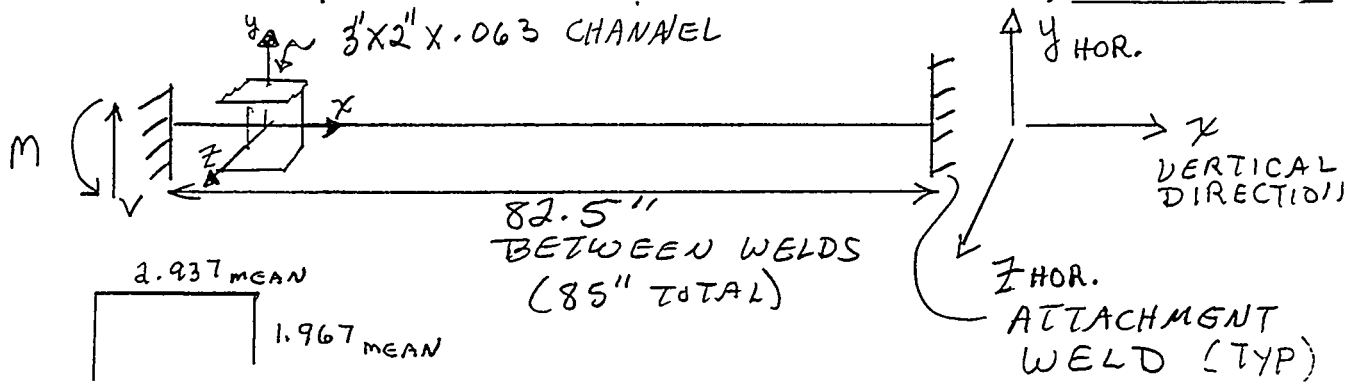
A = COEFFICIENT FROM TABLE BELOW

NODES ARE INDICATED IN TABLE BELOW AS A PROPORTION OF LENGTH L MEASURED FROM LEFT END

FIXED-FREE (CANTILEVER)	 A = 3.52	 0.774 A = 22.4	 0.500 0.868 A = 61.7	 0.644 0.356 0.906 A = 121.0	 0.500 0.926 0.279 0.723 A = 200.0
HINGED-HINGED (SIMPLE)	A = 9.87	 0.500 A = 39.5	 0.333 0.667 A = 88.9	 0.25 0.75 0.50 A = 158	 0.200 0.600 .400 .80 A = 247
FIXED-FIXED (BUILT-IN)	 A = 22.4	 0.500 A = 61.7	 0.359 0.641 A = 121	 0.278 0.722 0.500 A = 200	 0.409 0.773 0.227 .591 A = 298
FREE-FREE	 0.224 0.776 A = 22.4	 0.132 0.868 0.500 A = 61.7	 0.094 0.644 0.356 0.906 A = 121	 0.277 0.723 0.073 0.500 0.927 A = 200	 .227 0.591 .940 .060 0.409 0.773 A = 298
FIXED-HINGED	 A = 15.4	 0.560 A = 50.0	 0.384 0.692 A = 104	 0.529 0.294 0.765 A = 178	 0.429 0.810 0.238 .619 A = 272
HINGED-FREE	 0.736 A = 15.4	 0.446 0.853 A = 50.0	 0.308 0.898 0.616 A = 104	 0.471 0.922 0.235 0.707 A = 178	 0.381 0.763 0.190 0.581 0.937 A = 272

For
Location 2736-Z
Subject RM 384 PEDESTAL

Job No.
Date 1-16-95
By D.L.
Checked By Brian Low

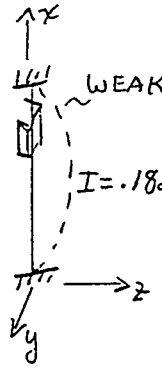


FREQUENCY CALC. CHANNEL

$$I_y = I_{WEAK\ AXIS} = .182\ IN^4 = \frac{.063(1.967^3)(2(2.937)+1.967)}{3(2.937+2(1.967))}$$

$$I_z = I_{STRONG\ AXIS} = .667\ IN^4 = \frac{.063(2.937^3)(2.937+6(1.967))}{12}$$

BLODGET "DESIGN OF WELD STRUCTURES" P-2.7-8



MODE 1.0 (Y-AXIS ROTATON AT WELD)

$$\omega_n = \frac{A}{2\pi}\sqrt{\frac{EI}{\mu L^4}}\ HZ$$ CYCLES/SEC

SA: ECO: 94:047 P-8 (ATTACHED)

$$\mu = 128^{\#}/(82.5"(386.4\ IN/SEC^2))$$

PP-5 SA: ECO: 94:47

$\mu = .004$ # SEC^2/IN^2

$L = 82.5"$ BETWEEN WELDS

$A = 22.4$ TABLE 9-7C (ATTACHED)

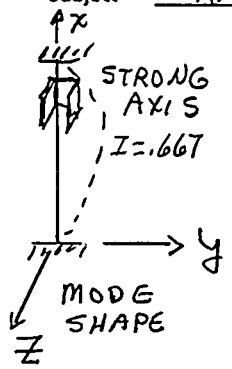
$$\omega_n = \frac{22.4}{6.28}\sqrt{\frac{30\times10^6\ (.182)}{.004\ (82.5)^4}} = 19.36\ \frac{CYC}{SEC}$$

$\ddot{Z} = 0.26G$ 5% DAMP. ← MOD. 1

S-C-1 RESPONSE SPECTRA
SDC 4.1 R-12

For
Location 2736-Z
Subject RM 3 & 4 PEDESTAL

Job No.
Date 1-16-95
By [illegible]
Checked By [illegible]



MODE 2.0 (Z-AXIS ROTATION)

$$\omega_n = \frac{22.4}{2\pi}\sqrt{\frac{30\times10^6(.667)}{.004(82.5)^4}} = 37\ \frac{CYC}{SEC}$$

$\ddot{y} = 0.20G$ RIGID ← MODE 2.0 S.C-1 RESPONSE SPECTRA
5% DAMP.

19.36 HZ = MODE 1 SEISMIC LOAD
100% Z DIRECTION LOAD $\ddot{Z} = .26G$ (WORST CASE) 40%/40%/100%

$$M_y = \frac{(\ddot{z}\,\omega)L^2}{(L)12}$$

$$\frac{\ddot{z}\,w}{L} = [.26^{\#}/_{IN}(108^{\#}) + .68^{\#}/_{IN}(20^{\#})]/82.5''$$

(.26 ↑ CHANNEL & CANS; .68 ↑ FLEXIBLE SECURITY BAR SA:ECO:94:047)

$$F_Z = \ddot{z}\,w = 42^{\#} \text{ ON TWO WELDS}$$

$$M_y = \left(42^{\#}/_{82.5''}\right)\frac{82.5^2}{12} = 288\ IN^{\#}\ \text{PER WELD}$$

37 HZ = MODE 2.0 SEISMIC LOAD
40% y DIRECTION LOAD $\ddot{y} = .2G$ MODE 2.0

$$M_Z = (\ddot{y}\,w/L)L^2/12$$

$$^{\#}/_{IN} = \ddot{y}\,w/L = \frac{[2(108^{\#}) + .68(20^{\#})] \times 40\%}{82.5}$$

$$= 14^{\#}/82.5 = .17\ ^{\#}/_{IN}$$

$M_{Z} = .17(82.5)^2/12 = 96.8$ # IN (PER WELD)

$F_Y = .4\left(.2(108) + .68(20)\right) = 14.1$ # (ON TWO WELDS)

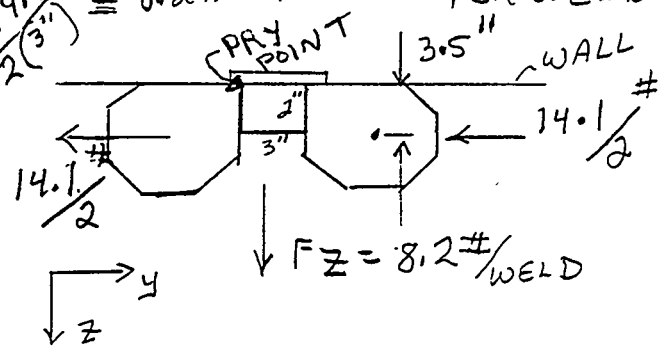
(.2(108): channel & cans; .68(20): security Bar)

PRYING = M_X = 14.1 (3.5") = 49.4 IN # ON TWO WELDS

(FROM y DIRECTON)
(SEISMIC 40%)

$F_Z = \frac{49.4}{2(3")} = 8.2$ # PER WELD

1/2 OF 14 CANS
ACT IN PRYING ACTION
OTHER CANS BRACED
AGAINST WALL



40% X DIRECTION LOAD (RIGID)

$\ddot{x}_{VERT.} = 2/3\,(40\%)(.2)$ RIGID

$F_X = 2/3\,(.2)(.4)\,108^{\#}$ CHANNEL $+ .68(20)^{\#}$ SECURITY BAR

$F_X = 19.4$ # ON TWO WELDS

CALCULATE LOADS ON ONE ATTACHMENT WELD

For
Location 2736-Z
Subject RM 3&4 PEDESTALS

Job No.
Date 1-16-95
By D. T. Lo...
Checked By D. Barlow

Σ MODES — LOADS ON ATTACHMENT WELD

~DEAD WEIGHT

$F_x = 19.4/2 + 128/2 = 74\#$ · ASSUME 75#

$F_y = 14.1\#/2 = 7\#$ ASSUME 10#

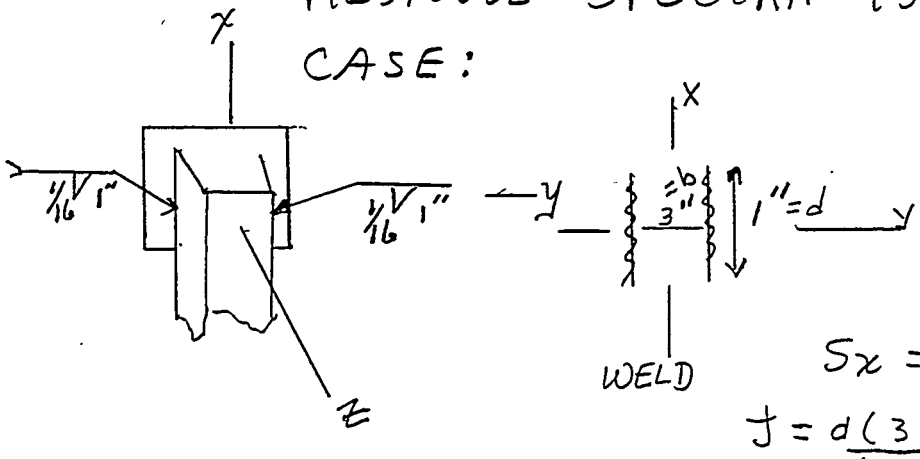
$F_z = 42\#/2$ & 2 WELDS $+ 8.2\# = 29.2\#$ ASSUME 30#

$M_x = 49.2/2 = 24.6$ IN#

$M_y = 288$ IN#

$M_z = 96.8$ IN#

NOTE: FOR THE ATTACHMENT WELD 40% X / 40% Y / 100% Z RESPONSE SPECTRA IS THE WORST CASE:



L = 2" ←

$S_y = d^2/3 = (1)^2/3$

$S_y = .33$ IN^2 ←

$S_x = bd = 1 \times 3 = 3$ IN^2 ←

$J = \frac{d(3b^2 + d^2)}{6} = \frac{1(3(3)^2 + 1^2)}{6}$

$J = 4.6$ IN^3 ←

BLODGET P 7.4-7
TABLE 5.0

For
Location 2736-Z
Subject RM 3 & 4 PEDESTAL

Job No.
Date 1-16-95
By DJ Kosu
Checked By

$$f_T = \frac{F_z}{L} + \frac{M_x}{S_x} + \frac{M_y}{S_y} = \frac{30}{2} + \frac{24.6}{3} + \frac{288}{.33} = 896\#/1$$

$$f_{Sx} = \frac{F_{Sx}}{L} + \frac{M_z r_x}{J} = \frac{75}{2} + \frac{96.8(1/2)}{4.6} = 48\ \#/IN$$

$$f_{Sy} = \frac{F_{Sy}}{L} + \frac{M_z r_y}{J} = \frac{7.0}{2} + \frac{96.8(3/2)}{4.6} = 35\ \#/IN$$

$$f_R = \sqrt{896^2 + 48.0^2 + 35^2} \simeq 900\ \#/IN$$

$$W_{REQ} = \frac{f_R}{.707\,\tau} = \frac{900}{.707(.4 \times 36000)(1.7)}$$

(EXIST. FACILITY UCRL 15910 P 4.35 ANCHORAGE)

$$= .052'' < 1/16'' = (.0625'')$$

$\therefore$ OK

$$M.S. = \frac{1}{\left(\frac{.052}{.0625}\right)} - 1 = 0.20 \leftarrow$$

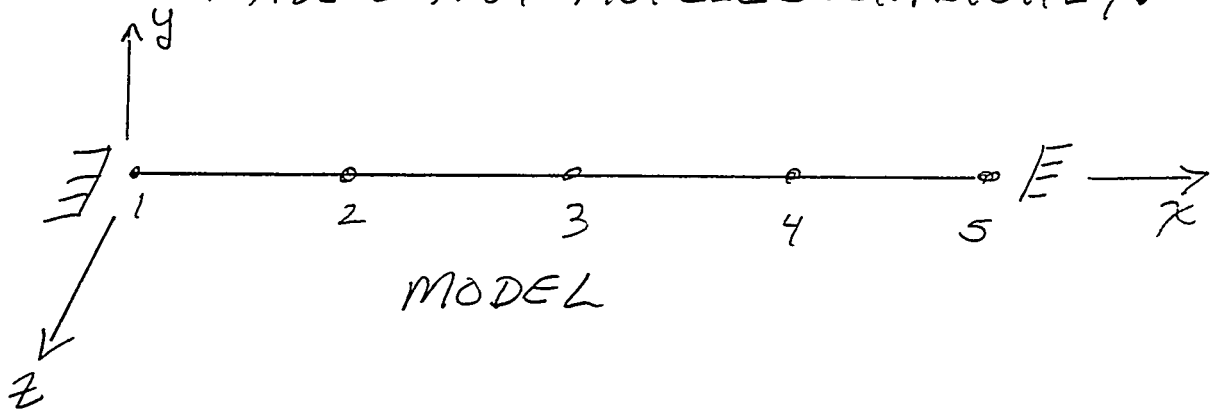
For
Location 2736-Z
Subject RM 384 PEDESTALS

Job No.
Date 1-16-95
By DZ Kosen
Checked By JBarlow

CONFIRM HAND CALCS WITH A SIMPLE COMPUTER MODEL

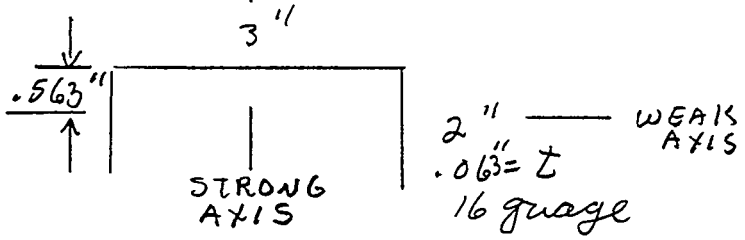
IMAGES 3D MODEL OF CHANNEL FOR FIUE MODES. SHAPES

ASSUME UNIFORM MASS SPREAD OVER CHANNEL - SMALL EXCENTRIC MASSES NOT MODELED EXPLICITLY.



MODEL

For
Location 2736-Z
Subject RM 3&4 PEDESTALS
Job No.
Date 1-16-95
By D.L. Kao
Checked By



$b = 3 - .063 = 2.937"$

$d = 2 - .063/2 = 1.967"$

$$I_{WEAK} = \frac{t d^3 (2b + d)}{3(b + 2d)} = \frac{.063(1.967^3)(2(2.937)+1.9}{3(2.937+2(1.967))}$$

$$= .182 \text{ IN}^4 \leftarrow$$

$$I_{STRONG} = \frac{t b^2 (b + 6d)}{12} = \frac{.063(2.937)^2(2.937+6(1.967))}{12}$$

$$= .667 \text{ IN}^4 \leftarrow$$

$$N.A._{FROM\ TOP} = \frac{d^2}{b+2d} = \frac{1.967^2}{2.937+2(1.967)}$$

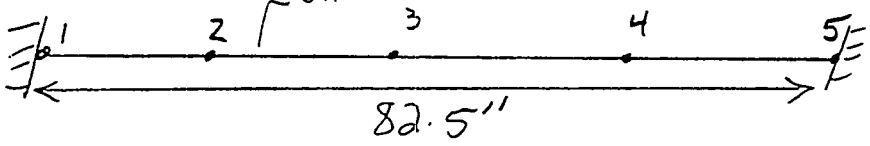
$$= .563" \leftarrow$$

$$2" - N.A. = 2 - .563 = 1.437" \leftarrow$$

$$\rho_{eff} = \frac{w}{A \times L} = 128/.42(82.5") = 3.69\#/\text{IN}^3$$

A = [2(1.967).063 + 2.937(.063)]

CHANNEL MODEL (UNIFORM LOAD)



(CARBON STEEL)

For
Location 2736-Z
Subject RM-1 PEDESTALS

Job No.
Date 1-16-95
By
Checked By

RM #1 PEDESTAL CALCS — BOLTED — 3/8" BOLTS

UNKNOWS

1) EMBED MENT LENGTH, MAKE, MODEL & MATERIAL OF 3/8" CONCRETE CONNECTION (IF APPLICABLE)

2) IF EMBEDDED UNISTRUT IS USED - TYPE OF CAST-IN-PLACE BOLT WELDED TO BACK OF UNISTRUT IS UNDEFINED (TYPE OF WELD IS ALSO UNDEFINED)

GUIDE TO SELECTION

HOT ROLLED SHEET & COIL

LOW CARBON (COMMERCIAL QUALITY)—A low cost steel sheet, soft enough to bend flat on itself in any direction without cracking, ductile enough for shallow drawing. Carbon is .10 max. (instead of .15 max.) for improved welding and forming. Surface has normal mill oxide. Conforms to ASTM A569. Used for tanks, barrels, farm implements and other applications where surface finish is not critical.

PICKLED AND OILED—Acid pickling provides smoother, more uniform surface. Paint and enamel adhere well. Properties and characteristics same as low carbon sheets. Conforms to ASTM A569. Typical applications: auto parts, appliances, toys, etc.

.40/.50 CARBON sheets have about 50% more yield strength and abrasion resistance than Low Carbon Commercial Quality. Still higher strength and hardness through heat treatment. Far less formable and weldable than low carbon sheets. Used for scrapers, blades, tools and other applications requiring a strong, moderate cost sheet. Identification color: yellow.

ABRASION RESISTING—Medium carbon content plus higher manganese greatly improve resistance to abrasion. 210 min. Brinell. For scrapers, liners, chutes, conveyors—outlasting low carbon steel by two to ten times. Moderate formability. Ident. color: pink.

HIGH STRENGTH/LOW ALLOY SHEETS

Much higher minimum yield strength than ordinary low carbon steel. This added strength permits weight savings to 25% in the design of many pieces and parts.

A607 specification. Lowest cost HSLA steels made to specific minimum yield strengths. Low carbon content for good formability. Excellent weldability. Typical applications: transmission towers, formed utility poles, auto parts, truck trailers. Also conforms to SAE J410C (945X & 950X). Ident. colors: white/green/white (INX 45), white and green (INX 50, Ex-Ten 50).

A606 specification. Four or five times more resistant to atmospheric corrosion than low carbon steel. Unpainted, Cor-Ten has tightly adherent oxide surface which stops further oxidation. Excellent weldability and formability. Also conforms to SAE J410C (Grade 950D). Identification colors: white (Cor-Ten), white and orange (Kaisaloy 50 CV).

A715 (HI-FORM™) specification. Low-carbon, low or intermediate manganese, low sulfur, aluminum killed, fine-grain columbium bearing series of High Strength Steel providing greatly enhanced forming and bending properties with improved toughness and fatigue resistance. Grades are furnished with minimum yield point levels ranging from 40,000 psi to 80,000 psi. HI-FORM™ Steels are readily weldable by all welding processes.

MINIMUM MECHANICAL PROPERTIES

	Yield Point psi	Strength psi Tensile	Cold Formability	Approx. Relative Cost
Low Carbon (Commercial Quality)	27,500*	50,000*	1T	100
A607				
INX 45	45,000	60,000	1T	106
INX 50, Ex-Ten 50	50,000	65,000	1½T	107
A606				
Cor-Ten	50,000	70,000	1T	128
A715 (HI-FORM)				
Grade 50	50,000	60,000	½T	115
Grade 80	80,000	90,000	1½T	128

*Typical

COLD ROLLED SHEET & COIL

LOW CARBON (COMMERCIAL QUALITY)—A continuous mill product made with a high degree of gauge accuracy and uniformity of physical characteristics. The smooth deoxidized matte finish gives an excellent base for paint, lacquer and enamel. Box annealing and absence of scale permit stamping and moderate drawing operations. Sheets bend flat on themselves without cracking. Oiling protects surface against rust. Conforms to ASTM A366—with carbon content held to .10 max. (instead of .15 max. as the spec permits) for improved welding and forming. Among the many uses are refrigerators, ranges, washing machines, truck bodies, signs, panels, etc.

SPECIAL KILLED (Drawing Quality)—A sheet with extra-low carbon and maximum uniformity used for severe drawing or forming operations. Has maximum ductility plus freedom from age hardening and fluting. Conforms to ASTM specification A365.

AUTO PROTOTYPE (Special Killed—Drawing Quality)—A special killed drawing quality sheet made within closely restricted thickness tolerances. Used for prototype work and for other deep drawing requirements when closer than commercial tolerances are required.

VITREOUS ENAMELING—Cold rolled from commercially pure iron ingots for porcelain enameled products. Textured surface provides a strong bond between the steel and the vitrified coating. Suitable for forming and moderate drawing operations, and all flatwork requirements. Conforms to ASTM A424, Gr. A.

PLATING QUALITY—Two finishes suitable for most plating applications: **Commercial Bright**, rolled with ground and polished rolls, has a relatively bright finish; and **Extra Light Matte**, produced with lightly blasted rolls, has a slightly duller finish than Commercial Bright.

STRETCHER LEVELED—A uniform, high quality matte sheet further processed by stretching to obtain superior flatness. Furnished resquared or not resquared. When resquared, sheets have the gripper marks removed. Conforms to ASTM A366. Widely used in the manufacture of table tops, truck body panels, partitions, templates, etc.

WHC-SD-CP-SA-025 REV 1 PAGE C-286

IMAGES 3D

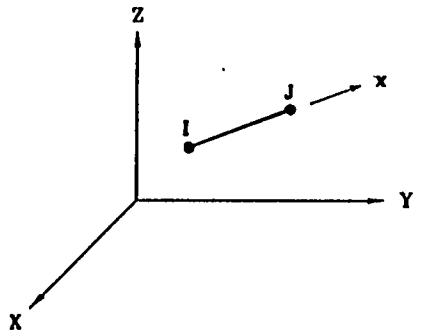
3.1.4 Define Elements

Once the node points of a model are defined, element types (trusses/beams, plane elements, plates/shells, springs, solids, and axisymmetric shells/solids) can be defined using the guidelines presented below. Alternatively, you can use the Generate Nodes and Elements Module to define nodes and elements at the same time.

- When defining elements, you can display the node numbers by using the # command. Refer to Appendix B — COMMON COMMANDS section in this manual for a complete explanation.
- Enter **H** to display the general information on element input.
- Enter **G** to use the element generation option.
  Refer to Appendix B — COMMON COMMANDS section in this manual for a complete explanation on the generation command.

3.1.4.1 Define Truss Elements

This option is used to define truss element connectivities, cross-section property numbers and material property numbers.



The program prompts:

Next Truss (T) 1
?

- Enter Truss Elements in the form:

1/2/3/4/5
I, J, K, Pro, Mat

Where:

I and J = Node numbers connecting the two ends of the truss.

K = Reference node. K is ignored as input. This field is included for consistency only.

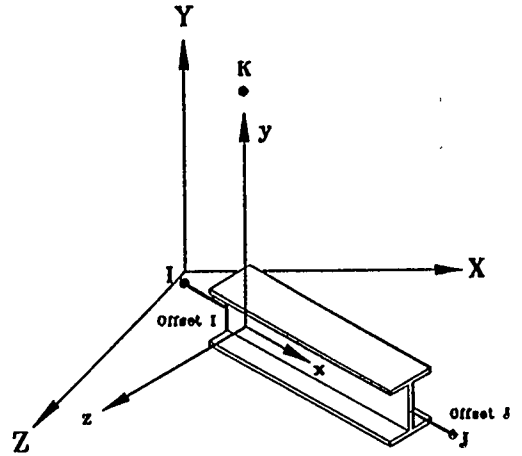
Pro = Cross-section property number. Cross-section properties are referenced by the number assigned in Option 2 of the Create/Edit Menu.

Mat = Material number. Material properties are referenced by the number assigned in Option 2 of the Create/Edit Geometry Menu.

- Enter **H,Field No.** to display help information.

3.1.4.2 Define Beam Elements

This option is used to define beam element connectivity, cross section property numbers, material property numbers, any member end releases and any rigid end offsets.



WHC-SD-CP-SA-025
REV 1 PAGE C-287

IMAGES-3D

01-09-1995 Filename=2736 Run ID=IA01929 14:45:01

```
IIIII     AAAAA     00000      1      99999     22222     99999
IIIII     AAAAA     00000      1      99999     22222     99999
  I     AA     AA 00     00    11     99     99 22     22 99     99
  I     AA     AA 00     00    11     99     99 22     22 99     99
  I     AA     AA 00    0000   1 1    99     99        22 99     99
  I     AA     AA 00    0000   1 1    99     99        22 99     99
  I     AA     AA 00  0  00     1      9999999       22     9999999
  I     AA     AA 00  0  00     1      9999999       22     9999999
  I     AAAAAAAAA 0000   00     1           99     2             99
  I     AAAAAAAAA 0000   00     1           99     2             99
  I     AA     AA 00     00     1           99   22              99
  I     AA     AA 00     00     1           99   22              99
IIIII   AA     AA   00000      11111     99999   222222222   99999
IIIII   AA     AA   00000      11111     99999   222222222   99999
```

WESTINGHOUSE HANFORD COMPANY S/N:802408

Job Information

Project : 2736Z

Client : PFP

Job Name : _____

Remarks : RM 3 & 4 PEDESTALS

_____

Engineer : DL Koreis / 2/3/95
DL KOREIS

Chk'd by : L. Hyde / 2/3/95

Appr'd by : _____ / _____

Comments : _____

_____

```
==================== I M A G E S - 3 D ====================
= Copyright (c) 1984-1993.    RLCA/Celestial Software =
============================================================

Interactive Microcomputer Analysis & Graphics of Engineering Systems

IMAGES-3D              Version 3.0              12/31/93

Filename=2736                                RUN ID=IA01929

============================================================
=                          NOTICE                          =
=----------------------------------------------------------=
=     RLCA/Celestial Software assumes no responsi-         =
=     bility for the validity, accuracy, or                =
=     applicability of the results obtained from           =
=     IMAGES-3D.                                           =
============================================================

============================================================
=     Any questions or comments concerning the use         =
=     of IMAGES-3D or the users manual should              =
=     be addressed to:                                     =
=                                                          =
=               RLCA/Celestial Software                    =
=                 2150 Shattuck Ave.                       =
=                    Suite 1200                            =
=                  Berkeley, CA                            =
=                      94704                               =
=                                                          =
=                   510-843-0977                           =
============================================================
```

= I M A G E S - 3 D =
= Copyright (c) 1984-1993. RLCA/Celestial Software =

CHECK GEOMETRY Version 3.0 12/31/93

Filename=2736
Title =2736Z PEDESTAL WELDED

Acceleration of Gravity = 3.864E+02

Force Multiplier	Length Multiplier	Temp. Multiplier
1.0000E+00	1.0000E+00	1.0000E+00

(For database properties only)

MATERIAL PROPERTIES

Mat No	Ex / Gxy	Ey / Gyz	Ez / Gzx	nxy / axy	nyz / ayz	nzx / azx	Density
1	3.000E+07	3.000E+07	3.000E+07	3.000E-01	3.000E-01	3.000E-01	3.690E+00
	1.154E+07	1.154E+07	1.154E+07	6.500E-06	6.500E-06	6.500E-06	

BEAM CROSS SECTION PROPERTIES

Pr. No.	X-Section Area	Moment of Inertia Iy / Iz		Torsional Const.- J	Iyz	Shear Shape Fact. SFy / SFz	
1	4.200E-01	1.820E-01	6.670E-01	1.000E-02	0.000E+00	0.00E+00	0.00E+00

Pr. No.	Bending Stress Recovery Distances Cy- / Cy+ / Cz- / Cz+				Ctors	Shear Stress Fact. SSFy / SSFz	
1	1.50E+00	1.50E+00	5.63E-01	1.44E+00	1.00E+00	1.00E+00	1.00E+00

NODE COORDINATES

Node	X-Coord.	Y-Coord.	Z-Coord.
1	0.00000E+00	0.00000E+00	0.00000E+00
2	2.00000E+01	0.00000E+00	0.00000E+00
3	4.00000E+01	0.00000E+00	0.00000E+00
4	6.00000E+01	0.00000E+00	0.00000E+00
5	8.25000E+01	0.00000E+00	0.00000E+00

========== I M A G E S - 3 D ==========
= Copyright (c) 1984-1993. RLCA/Celestial Software =
==========

CHECK GEOMETRY Version 3.0 12/31/93

Filename=2736
Title =2736Z PEDESTAL WELDED

BEAM CONNECTIVITY

Beam No	Nodes From/ To / Ref			Prop No	Mat No	Pincodes I / J	Rigid End Offset I	/ J	Length	Beam Type
1	1	2	0	1	1		0.00E+00	0.00E+00	2.0000E+01	Beam
2	2	3	0	1	1		0.00E+00	0.00E+00	2.0000E+01	Beam
3	3	4	0	1	1		0.00E+00	0.00E+00	2.0000E+01	Beam
4	4	5	0	1	1		0.00E+00	0.00E+00	2.2500E+01	Beam

RESTRAINTS

Node No	Global/Local	Restraint Directions
1	GLOBAL	X Y Z RX RY RZ
5	GLOBAL	X Y Z RX RY RZ

========== I M A G E S - 3 D ==========
= Copyright (c) 1984-1993. RLCA/Celestial Software =
==========

ASSEMBLE STIFFNESS MATRIX Version 3.0 12/31/93

Filename=2736
Title =2736Z PEDESTAL WELDED

STIFFNESS ASSEMBLY SUMMARY

Number of Node Points.....	5
Number of Truss and Beam Elements.....	4
Number of Plate Elements.....	0
Number of Spring Elements.....	0
Number of Solid Elements.....	0
Number of Axisymmetric Elements.....	0
Number of Nodes with Restraints.....	2
Number of Equations to be Solved.....	18
Number of Blocks in the Matrix.....	1

B L O C K I N F O R M A T I O N

BLCK NO	SIZE (Byte)	BLCK NO	SIZE (Byte)	BLCK NO	SIZE (Byte)	BLCK NO	SIZE (Byte)
1	1080						

========== I M A G E S - 3 D ==========
= Copyright (c) 1984-1993. RLCA/Celestial Software =
==========

ASSEMBLE STIFFNESS MATRIX Version 3.0 12/31/93

Filename=2736
Title =2736Z PEDESTAL WELDED

E Q U A T I O N N U M B E R L I S T

NODE WAS	NODE IS	TRANSLATION X	TRANSLATION Y	TRANSLATION Z	ROTATION X	ROTATION Y	ROTATION Z
1	1	0	0	0	0	0	0
2	2	1	2	3	4	5	6
3	3	7	8	9	10	11	12
4	4	13	14	15	16	17	18
5	5	0	0	0	0	0	0

STIFFNESS SUMMARY IN 1 BLOCKS

Minimum Diagonal Stiffness.....	.1090D+05
Eq No of Minimum Diagonal.....	16
Maximum Diagonal Stiffness.....	.8004D+07
Eq No of Maximum Diagonal.....	6

========== I M A G E S - 3 D ==========
= Copyright (c) 1984-1993. RLCA/Celestial Software =
==========

SOLVE FREQUENCIES Version 3.0 12/31/93

Filename=2736
Title =2736Z PEDESTAL WELDED

Number of frequencies requested 5
Number of frequencies printed 5
Acceleration of gravity 386.40

Mode	Eigenvalue	Frequency	Period	Error
1	.144101E+05	.191053E+02	.523415E-01	.120657E-09
2	.528107E+05	.365747E+02	.273413E-01	.000000E+00
3	.101017E+06	.505845E+02	.197689E-01	.900153E-07
4	.295198E+06	.864723E+02	.115644E-01	.980680E-06
5	.370211E+06	.968378E+02	.103265E-01	.000000E+00

WESTINGHOUSE HANFORD COMPANY S/N:802408 01/09/95
PAGE 2 Run ID=IA01929 14:28:37

IMAGES - 3D

= Copyright (c) 1984-1993. RLCA/Celestial Software =

SOLVE MODE SHAPES Version 3.0 12/31/93

Filename=2736
Title =2736Z PEDESTAL WELDED

Number of modes 5

Mode 1 Eigenvalue= .144101E+05

Node	Translations X	Y	Z	Rotations X	Y	Z
1	.000000	.000000	.000000	.000000	.000000	.000000
2	.000000	.000000	.519747	.000000	-.036653	.000000
3	.000000	.000000	1.000000	.000000	-.003386	.000000
4	.000000	.000000	.618060	.000000	.035452	.000000
5	.000000	.000000	.000000	.000000	.000000	.000000

Mode 2 Eigenvalue= .528107E+05

Node	Translations X	Y	Z	Rotations X	Y	Z
1	.000000	.000000	.000000	.000000	.000000	.000000
2	.000000	.519747	.000000	.000000	.000000	.036653
3	.000000	1.000000	.000000	.000000	.000000	.003386
4	.000000	.618060	.000000	.000000	.000000	-.035452
5	.000000	.000000	.000000	.000000	.000000	.000000

Mode 3 Eigenvalue= .101017E+06

Node	Translations X	Y	Z	Rotations X	Y	Z
1	.000000	.000000	.000000	.000000	.000000	.000000
2	.000000	.000000	-.965662	.000000	.026332	.000000
3	.000000	.000000	-.154789	.000000	-.082109	.000000
4	.000000	.000000	1.000000	.000000	.007255	.000000
5	.000000	.000000	.000000	.000000	.000000	.000000

Mode 4 Eigenvalue= .295198E+06

Node	Translations X	Y	Z	Rotations X	Y	Z
1	.000000	.000000	.000000	.000000	.000000	.000000
2	.000001	.000000	-.981268	.000000	-.034366	.000000
3	-.000001	.000000	1.000000	.000000	-.012536	.000000

WESTINGHOUSE HANFORD COMPANY S/N:802408 01/09/95
PAGE 3 Run ID=IA01929 14:28:43

========== I M A G E S - 3 D ==========
= Copyright (c) 1984-1993. RLCA/Celestial Software =
==========

SOLVE MODE SHAPES Version 3.0 12/31/93

Filename=2736
Title =2736Z PEDESTAL WELDED

Node	Translations X	Y	Z	Rotations X	Y	Z
4	.000001	.000000	-.746150	.000000	.049242	.000000
5	.000000	.000000	.000000	.000000	.000000	.000000

Mode 5 Eigenvalue= .370211E+06

Node	Translations X	Y	Z	Rotations X	Y	Z
1	.000000	.000000	.000000	.000000	.000000	.000000
2	.000000	-.965662	.000000	.000000	.000000	-.026332
3	.000000	-.154789	.000000	.000000	.000000	.082109
4	.000000	1.000000	.000000	.000000	.000000	-.007255
5	.000000	.000000	.000000	.000000	.000000	.000000

========== I M A G E S - 3 D ==========
= Copyright (c) 1984-1993. RLCA/Celestial Software =
==========

SOLVE PARTICIPATION Version 3.0 12/31/93

Filename=2736
Title =2736Z PEDESTAL WELDED

Mode	Generalized Weight	PARTICIPATION FACTORS X	Y	Z
1	.5195E+02	-.2355E-10	-.2891E-18	.1299E+01
2	.5195E+02	-.2659E-18	.1299E+01	-.1682E-14
3	.6258E+02	-.1085E-07	.2682E-15	-.2870E-01
4	.7918E+02	.1579E-06	-.4894E-14	-.3030E+00
5	.6258E+02	-.3176E-17	-.2870E-01	.5655E-15

Mode	EFFECTIVE MODAL WEIGHTS X	Y	Z	% TOTAL SYSTEM WEIGHTS X	Y	Z
1	.2881E-19	.4343E-35	.8760E+02	.00	.00	92.29
2	.3672E-35	.8760E+02	.1470E-27	.00	92.29	.00
3	.7364E-14	.4500E-29	.5156E-01	.00	.00	.05
4	.1974E-11	.1896E-26	.7270E+01	.00	.00	7.66
5	.6314E-33	.5156E-01	.2001E-28	.00	.05	.00
		Summation:		.00	92.34	100.00

WESTINGHOUSE HANFORD COMPANY S/N:802408 01/10/95
PAGE 1 Run ID=LJ08215 14:10:02

========== I M A G E S - 3 D ==========
= Copyright (c) 1984-1993. RLCA/Celestial Software =
==========

SOLVE SEISMIC RESPONSE Version 3.0 12/31/93

Filename=2736
Title =2736Z PEDESTAL WELDED

S.C.-1 2736Z

X / Y / Z SPECTRA
40% / 40% / 100%

Spectrum Multipliers

X-Direction = .4000E+00
Y-Direction = .4000E+00
Z-Direction = .1000E+01

INPUT RESPONSE SPECTRA

	X-Direction		/ Y-Direction		/ Z-Direction	
1	.1000E+00	.102000E-01	.1000E+00	.102000E-01	.1000E+00	.102000E-01
2	.1600E+00	.260000E-01	.1600E+00	.260000E-01	.1600E+00	.260000E-01
3	.2500E+00	.650000E-01	.2500E+00	.650000E-01	.2500E+00	.650000E-01
4	.4000E+00	.104000E+00	.4000E+00	.104000E+00	.4000E+00	.104000E+00
5	.6000E+00	.155000E+00	.6000E+00	.155000E+00	.6000E+00	.155000E+00
6	.1100E+01	.283000E+00	.1100E+01	.283000E+00	.1100E+01	.283000E+0
7	.1640E+01	.420000E+00	.1640E+01	.420000E+00	.1640E+01	.420000E+0
8	.8000E+01	.420000E+00	.8000E+01	.420000E+00	.8000E+01	.420000E+00
9	.1200E+02	.340000E+00	.1200E+02	.340000E+00	.1200E+02	.340000E+00
10	.2000E+02	.260000E+00	.2000E+02	.260000E+00	.2000E+02	.260000E+00
11	.3300E+02	.200000E+00	.3300E+02	.200000E+00	.3300E+02	.200000E+00
12	.1000E+03	.200000E+00	.1000E+03	.200000E+00	.1000E+03	.200000E+00

Interpolated Accelerations

Mode	Frequency	X-Direction	Y-Direction	Z-Direction
1	.1911E+02	.10758E+00	.10758E+00	.26895E+00
2	.3657E+02	.80000E-01	.80000E-01	.20000E+00
3	.5058E+02	.80000E-01	.80000E-01	.20000E+00

Cut-off Frequency (Hz) = .65000E+02

WESTINGHOUSE HANFORD COMPANY S/N:802408 01/10/95
PAGE 2 Run ID=LJ08215 14:10:02

========== I M A G E S - 3 D ==========
= Copyright (c) 1984-1993. RLCA/Celestial Software =
==========

SOLVE SEISMIC RESPONSE Version 3.0 12/31/93

Filename=2736
Title =2736Z PEDESTAL WELDED

S.C.-1 2736Z

Generalized Displacements

Mode	Frequency	X-Direction	Y-Direction	Z-Direction	A B S Combination
1	.1911E+02	.67936E-13	.83404E-21	.93649E-02	.93649E-02
2	.3657E+02	.15562E-21	.76011E-03	.24613E-17	.76011E-03
3	.5058E+02	.33194E-11	.82056E-19	.21959E-04	.21959E-04

Generalized Accelerations

Mode	Frequency	X-Direction	Y-Direction	Z-Direction	A B S Combination
1	.1911E+02	.97897E-09	.12019E-16	.13495E+03	.13495E+03
2	.3657E+02	.82186E-17	.40142E+02	.12999E-12	.40142E+02
3	.5058E+02	.33532E-06	.82891E-14	.22182E+01	.22182E+01

DISPLACEMENTS for MODE 1

	Translations			/	Rotations		
Node	X	Y	Z	/	X	Y	Z
1	.0000E+00	.0000E+00	.0000E+00	/	.0000E+00	.0000E+00	.0000E+00
2	-.7817E-12	-.6901E-20	.4867E-02	/	.0000E+00	-.3433E-03	-.2314E-21
3	.1288E-11	-.2868E-20	.9365E-02	/	.0000E+00	-.3171E-04	.4953E-21
4	-.8244E-12	.4924E-20	.5788E-02	/	.0000E+00	.3320E-03	.2381E-22
5	.0000E+00	.0000E+00	.0000E+00	/	.0000E+00	.0000E+00	.0000E+00

DISPLACEMENTS for MODE 2

	Translations			/	Rotations		
Node	X	Y	Z	/	X	Y	Z
1	.0000E+00	.0000E+00	.0000E+00	/	.0000E+00	.0000E+00	.0000E+00
2	-.8938E-22	.3951E-03	-.2576E-17	/	.0000E+00	-.9971E-19	.2786E-04
3	-.1390E-21	.7601E-03	.2805E-17	/	.0000E+00	-.2193E-19	.2574E-05

WESTINGHOUSE HANFORD COMPANY S/N:802408 01/10/95
PAGE 3 Run ID=LJ08215 14:10:06

========== I M A G E S - 3 D ==========
= Copyright (c) 1984-1993. RLCA/Celestial Software =
==========

SOLVE SEISMIC RESPONSE Version 3.0 12/31/93

Filename=2736
Title =2736Z PEDESTAL WELDED

S.C.-1 2736Z

	Translations			/	Rotations		
Node	X	Y	Z	/	X	Y	Z
4	-.1039E-21	.4698E-03	-.2232E-17	/	.0000E+00	.1358E-18	-.2695E-04
5	.0000E+00	.0000E+00	.0000E+00	/	.0000E+00	.0000E+00	.0000E+00

DISPLACEMENTS for MODE 3

	Translations			/	Rotations		
Node	X	Y	Z	/	X	Y	Z
1	.0000E+00	.0000E+00	.0000E+00	/	.0000E+00	.0000E+00	.0000E+00
2	-.1021E-11	.2183E-20	-.2120E-04	/	.0000E+00	.5782E-06	.1827E-21
3	.1684E-11	.5374E-20	-.3399E-05	/	.0000E+00	-.1803E-05	.7518E-22
4	-.1077E-11	.4077E-20	.2196E-04	/	.0000E+00	.1593E-06	-.1993E-21
5	.0000E+00	.0000E+00	.0000E+00	/	.0000E+00	.0000E+00	.0000E+0[illegible]

RSS DISPLACEMENTS

	Translations			/	Rotations		
Node	X	Y	Z	/	X	Y	Z
1	.0000E+00	.0000E+00	.0000E+00	/	.0000E+00	.0000E+00	.0000E+00
2	.1286E-11	.3951E-03	.4867E-02	/	.0000E+00	.3433E-03	.2786E-04
3	.2120E-11	.7601E-03	.9365E-02	/	.0000E+00	.3176E-04	.2574E-05
4	.1356E-11	.4698E-03	.5788E-02	/	.0000E+00	.3320E-03	.2695E-04
5	.0000E+00	.0000E+00	.0000E+00	/	.0000E+00	.0000E+00	.0000E+00

ACCELERATIONS for MODE 1

	Translational			/	Rotational		
Node	X	Y	Z	/	X	Y	Z
1	.0000E+00	.0000E+00	.0000E+00	/	.0000E+00	.0000E+00	.0000E+00
2	-.2915E-10	-.2574E-18	.1815E+00	/	.0000E+00	-.1280E-01	-.8630E-20
3	.4803E-10	-.1070E-18	.3492E+00	/	.0000E+00	-.1183E-02	.1847E-19
4	-.3074E-10	.1836E-18	.2159E+00	/	.0000E+00	.1238E-01	.8879E-21
5	.0000E+00	.0000E+00	.0000E+00	/	.0000E+00	.0000E+00	.0000E+00

WESTINGHOUSE HANFORD COMPANY S/N:802408 01/10/95
PAGE 4 Run ID=LJ08215 14:10:09

IMAGES-3D

= Copyright (c) 1984-1993. RLCA/Celestial Software =

SOLVE SEISMIC RESPONSE Version 3.0 12/31/93

Filename=2736
Title =2736Z PEDESTAL WELDED

S.C.-1 2736Z

ACCELERATIONS for MODE 2

Node	Translational X	Y	Z	/	Rotational X	Y	Z
1	.0000E+00	.0000E+00	.0000E+00	/	.0000E+00	.0000E+00	.0000E+00
2	-.1222E-19	.5399E-01	-.3521E-15	/	.0000E+00	-.1363E-16	.3808E-02
3	-.1899E-19	.1039E+00	.3834E-15	/	.0000E+00	-.2997E-17	.3518E-03
4	-.1419E-19	.6421E-01	-.3051E-15	/	.0000E+00	.1856E-16	-.3683E-02
5	.0000E+00	.0000E+00	.0000E+00	/	.0000E+00	.0000E+00	.0000E+00

ACCELERATIONS for MODE 3

Node	Translational X	Y	Z	/	Rotational X	Y	Z
1	.0000E+00	.0000E+00	.0000E+00	/	.0000E+00	.0000E+00	.0000E+00
2	-.2668E-09	.5706E-18	-.5544E-02	/	.0000E+00	.1512E-03	.4777E-19
3	.4403E-09	.1405E-17	-.8886E-03	/	.0000E+00	-.4714E-03	.1965E-19
4	-.2816E-09	.1066E-17	.5741E-02	/	.0000E+00	.4165E-04	-.5210E-19
5	.0000E+00	.0000E+00	.0000E+00	/	.0000E+00	.0000E+00	.0000E+00

Node	Translational X	Y	Z	/	Rotational X	Y	Z
1	.0000E+00	.0000E+00	.0000E+00	/	.0000E+00	.0000E+00	.0000E+00
2	.1720E-04	.2324E+00	.4325E+00	/	.0000E+00	.1138E+00	.6171E-01
3	.2210E-04	.3223E+00	.5917E+00	/	.0000E+00	.4067E-01	.1876E-01
4	.1767E-04	.2534E+00	.4707E+00	/	.0000E+00	.1115E+00	.6069E-01
5	.0000E+00	.0000E+00	.0000E+00	/	.0000E+00	.0000E+00	.0000E+00

TOTAL COMBINED ACCELERATIONS (INCLUDING ZPA)

Node	Translational X	Y	Z	/	Rotational X	Y	Z
1	.8000E-01	.8000E-01	.2000E+00	/	.0000E+00	.0000E+00	.0000E+00

WESTINGHOUSE HANFORD COMPANY S/N:802408 01/10/95
PAGE 5 Run ID=LJ08215 14:10:10

========== I M A G E S - 3 D ==========
= Copyright (c) 1984-1993. RLCA/Celestial Software =
==========

SOLVE SEISMIC RESPONSE Version 3.0 12/31/93

Filename=2736
Title =2736Z PEDESTAL WELDED

S.C.-1 2736Z

Node	Translational X	Translational Y	Translational Z	/	Rotational X	Rotational Y	Rotational Z
2	.8000E-01	.2458E+00	.4765E+00	/	.0000E+00	.1138E+00	.6171E-01
3	.8000E-01	.3321E+00	.6246E+00	/	.0000E+00	.4067E-01	.1876E-01
4	.8000E-01	.2657E+00	.5115E+00	/	.0000E+00	.1115E+00	.6069E-01
5	.8000E-01	.8000E-01	.2000E+00	/	.0000E+00	.0000E+00	.0000E+00

WESTINGHOUSE HANFORD COMPANY S/N:802408 01/10/95
PAGE 6 Run ID=LJ08215 14:10:26

========== I M A G E S - 3 D ==========
= Copyright (c) 1984-1993. RLCA/Celestial Software =
==========

SOLVE DISPLACEMENTS Version 3.0 12/31/93

Filename=2736
Title =2736Z PEDESTAL WELDED

MISSING MASS RESPONSE / X - DIRECTION SPECTRUM

DISPLACEMENTS

	Translations			/	Rotations		
Node	X	Y	Z	/	X	Y	Z
1	.0000E+00	.0000E+00	.0000E+00	/	.0000E+00	.0000E+00	.0000E+00
2	-.6150E-05	-.8089E-22	.3179E-11	/	.0000E+00	-.8555E-13	-.5704E-23
3	-.8364E-05	-.1556E-21	.4633E-12	/	.0000E+00	.2727E-12	-.5270E-24
4	-.6642E-05	-.9619E-22	-.3351E-11	/	.0000E+00	-.2587E-13	.5517E-23
5	.0000E+00	.0000E+00	.0000E+00	/	.0000E+00	.0000E+00	.0000E+00

========== I M A G E S - 3 D ==========
= Copyright (c) 1984-1993. RLCA/Celestial Software =
==========

SOLVE DISPLACEMENTS Version 3.0 12/31/93

Filename=2736
Title =2736Z PEDESTAL WELDED

MISSING MASS RESPONSE / Y - DIRECTION SPECTRUM

DISPLACEMENTS

Node	Translations X	Y	Z	/	Rotations X	Y	Z
1	.0000E+00	.0000E+00	.0000E+00	/	.0000E+00	.0000E+00	.0000E+00
2	-.1139E-23	-.1081E-04	-.4879E-18	/	.0000E+00	-.1710E-19	.2344E-06
3	-.1677E-23	.8287E-05	.4974E-18	/	.0000E+00	-.6213E-20	.3053E-06
4	-.1281E-23	-.4064E-05	-.3715E-18	/	.0000E+00	.2449E-19	-.4437E-06
5	.0000E+00	.0000E+00	.0000E+00	/	.0000E+00	.0000E+00	.0000E+00

========== I M A G E S - 3 D ==========
= Copyright (c) 1984-1993. RLCA/Celestial Software =
==========

SOLVE DISPLACEMENTS Version 3.0 12/31/93

Filename=2736
Title =2736Z PEDESTAL WELDED

MISSING MASS RESPONSE / Z - DIRECTION SPECTRUM

DISPLACEMENTS

Node	Translations X	Y	Z	/	Rotations X	Y	Z
1	.0000E+00	.0000E+00	.0000E+00	/	.0000E+00	.0000E+00	.0000E+00
2	.2572E-14	-.1285E-17	-.7784E-04	/	.0000E+00	-.2726E-05	-.9062E-19
3	-.6918E-14	-.2472E-17	.7933E-04	/	.0000E+00	-.9945E-06	-.8373E-20
4	.3498E-14	-.1528E-17	-.5919E-04	/	.0000E+00	.3906E-05	.8764E-19
5	.0000E+00	.0000E+00	.0000E+00	/	.0000E+00	.0000E+00	.0000E+00

WESTINGHOUSE HANFORD COMPANY S/N:802408 01/10/95
PAGE 9 Run ID=LJ08215 14:10:29

========== I M A G E S - 3 D ==========
= Copyright (c) 1984-1993. RLCA/Celestial Software =
==========

SOLVE DISPLACEMENTS Version 3.0 12/31/93

Filename=2736
Title =2736Z PEDESTAL WELDED

COMPLETE ABS COMBINATION

DISPLACEMENTS

Node	Translations X	Y	Z	/	Rotations X	Y	Z
1	.0000E+00	.0000E+00	.0000E+00	/	.0000E+00	.0000E+00	.0000E+00
2	.6150E-05	.3952E-03	.4868E-02	/	.0000E+00	.3433E-03	.2786E-04
3	.8364E-05	.7602E-03	.9365E-02	/	.0000E+00	.3178E-04	.2592E-05
4	.6642E-05	.4698E-03	.5788E-02	/	.0000E+00	.3320E-03	.2695E-04
5	.0000E+00	.0000E+00	.0000E+00	/	.0000E+00	.0000E+00	.0000E+00

WESTINGHOUSE HANFORD COMPANY S/N:802408 01/10/95
PAGE 10 Run ID=LJ08215 14:10:46

========== I M A G E S - 3 D ==========
= Copyright (c) 1984-1993. RLCA/Celestial Software =
==========

SOLVE BEAM LOADS/STRESSES Version 3.0 12/31/93

Filename=2736
Title =2736Z PEDESTAL WELDED

Mode No. 1:

BEAM LOADS AND/OR STRESSES

Stress	Node	Axial Corner1	Y-Shear Corner2	Z-Shear Corner3	Torsion Corner4	Y-Bending Maximum	Z-Bending Minimum
			BEAM NO. 1				
Stress	1	-.1173E-05	.3278E-15	-.2798E+02	.0000E+00	.1741E+04	.3465E-14
		.1741E+04	.1741E+04	-.1741E+04	-.1741E+04	.1741E+04	-.1741E+04
Stress	2	-.1173E-05	.3278E-15	-.2798E+02	.0000E+00	-.1962E+03	-.2468E-14
		-.1962E+03	-.1962E+03	.1962E+03	.1962E+03	.1962E+03	-.1962E+03
			BEAM NO. 2				
Stress	2	.3105E-05	-.9958E-16	-.1458E+02	.0000E+00	-.1962E+03	-.2468E-14
		-.1962E+03	-.1962E+03	.1962E+03	.1962E+03	.1962E+03	-.1962E+03
Stress	3	.3105E-05	-.9958E-16	-.1458E+02	.0000E+00	-.1206E+04	-.6655E-15
		-.1206E+04	-.1206E+04	.1206E+04	.1206E+04	.1206E+04	-.1206E+04
			BEAM NO. 3				
Stress	3	-.3169E-05	-.1859E-15	.1119E+02	.0000E+00	-.1206E+04	-.6655E-15
		-.1206E+04	-.1206E+04	.1206E+04	.1206E+04	.1206E+04	-.1206E+04
Stress	4	-.3169E-05	-.1859E-15	.1119E+02	.0000E+00	-.4310E+03	.2698E-14
		-.4310E+03	-.4310E+03	.4310E+03	.4310E+03	.4310E+03	-.4310E+03
			BEAM NO. 4				
Stress	4	.1099E-05	.2606E-15	.2812E+02	.0000E+00	-.4310E+03	.2698E-14
		-.4310E+03	-.4310E+03	.4310E+03	.4310E+03	.4310E+03	-.4310E+03
Stress	5	.1099E-05	.2606E-15	.2812E+02	.0000E+00	.1759E+04	-.2607E-14
		.1759E+04	.1759E+04	-.1759E+04	-.1759E+04	.1759E+04	-.1759E+04

WESTINGHOUSE HANFORD COMPANY S/N:802408 01/10/95
PAGE 11 Run ID=LJ08215 14:10:47

========== I M A G E S - 3 D ==========
= Copyright (c) 1984-1993. RLCA/Celestial Software =
==========

SOLVE BEAM LOADS/STRESSES Version 3.0 12/31/93

Filename=2736
Title =2736Z PEDESTAL WELDED

Mode No. 1:

MAXIMUM STRESS SUMMARY FOR BEAMS/TRUSSES
WITHIN SPECIFIED RANGE 1- 4

Element	Type	Stress Type	Value
2	BEAM	Axial Tension	.3105E-05
3	BEAM	Axial Compression	-.3169E-05
4	BEAM	Transv. Shear	.2812E+02
1	BEAM	Torsion Shear	.0000E+00
4	BEAM	Bending Stress	.1759E+04
4	BEAM	Max. Comb. Normal	.1759E+04
4	BEAM	Min. Comb. Normal	-.1759E+04

========== I M A G E S - 3 D ==========
= Copyright (c) 1984-1993. RLCA/Celestial Software =
==========

SOLVE REACTIONS Version 3.0 12/31/93

Filename=2736
Title =2736Z PEDESTAL WELDED

Mode No. 1:

REACTIONS

Node	Fx	Fy	Fz	Mx	My	Mz
1	.4925E-06	.1377E-15	-.1175E+02	.0000E+00	.2112E+03	.1608E-14
5	.4617E-06	-.1094E-15	-.1181E+02	.0000E+00	-.2134E+03	.1210E-14
Total	.9542E-06	.2824E-16	-.2356E+02	.0000E+00	-.2200E+01	.2818E-14

WESTINGHOUSE HANFORD COMPANY S/N:802408 01/10/95
PAGE 13 Run ID=LJ08215 14:10:48

========== I M A G E S - 3 D ==========
= Copyright (c) 1984-1993. RLCA/Celestial Software =
==========

SOLVE BEAM LOADS/STRESSES Version 3.0 12/31/93

Filename=2736
Title =2736Z PEDESTAL WELDED

Mode No. 2:

BEAM LOADS AND/OR STRESSES

Stress	Node	Axial Corner1	Y-Shear Corner2	Z-Shear Corner3	Torsion Corner4	Y-Bending Maximum	Z-Bending Minimum
			BEAM NO. 1				
Stress	1	-.1341E-15	-.8323E+01	.6968E-13	.0000E+00	-.2188E-11	-.1354E+03
		-.1354E+03	.5303E+02	.5303E+02	-.1354E+03	.5303E+02	-.1354E+03
Stress	2	-.1341E-15	-.8323E+01	.6968E-13	.0000E+00	.2636E-11	.1525E+02
		.1525E+02	-.5976E+01	-.5976E+01	.1525E+02	.1525E+02	-.5976E+01
			BEAM NO. 2				
Stress	2	-.7438E-16	-.4338E+01	-.8122E-13	.0000E+00	.2636E-11	.1525E+02
		.1525E+02	-.5976E+01	-.5976E+01	.1525E+02	.1525E+02	-.5976E+01
Stress	3	-.7438E-16	-.4338E+01	-.8122E-13	.0000E+00	-.2986E-11	.9376E+02
		.9376E+02	-.3673E+02	-.3673E+02	.9376E+02	.9376E+02	-.3673E+02
			BEAM NO. 3				
Stress	3	.5267E-16	.3329E+01	.7602E-13	.0000E+00	-.2986E-11	.9376 2
		.9376E+02	-.3673E+02	-.3673E+02	.9376E+02	.9376E+02	-.3673E+02
Stress	4	.5267E-16	.3329E+01	.7602E-13	.0000E+00	.2277E-11	.3351E+02
		.3351E+02	-.1313E+02	-.1313E+02	.3351E+02	.3351E+02	-.1313E+02
			BEAM NO. 4				
Stress	4	.1385E-15	.8364E+01	-.5149E-13	.0000E+00	.2277E-11	.3351E+02
		.3351E+02	-.1313E+02	-.1313E+02	.3351E+02	.3351E+02	-.1313E+02
Stress	5	.1385E-15	.8364E+01	-.5149E-13	.0000E+00	-.1734E-11	-.1368E+03
		-.1368E+03	.5359E+02	.5359E+02	-.1368E+03	.5359E+02	-.1368E+03

========== I M A G E S - 3 D ==========
= Copyright (c) 1984-1993. RLCA/Celestial Software =
==========

SOLVE BEAM LOADS/STRESSES Version 3.0 12/31/93

Filename=2736
Title =2736Z PEDESTAL WELDED

Mode No. 2:

MAXIMUM STRESS SUMMARY FOR BEAMS/TRUSSES
WITHIN SPECIFIED RANGE 1- 4

Element	Type	Stress Type	Value
4	BEAM	Axial Tension	.1385E-15
1	BEAM	Axial Compression	-.1341E-15
4	BEAM	Transv. Shear	.8364E+01
1	BEAM	Torsion Shear	.0000E+00
4	BEAM	Bending Stress	-.1368E+03
2	BEAM	Max. Comb. Normal	.9376E+02
4	BEAM	Min. Comb. Normal	-.1368E+03

========== I M A G E S - 3 D ==========
= Copyright (c) 1984-1993. RLCA/Celestial Software =
==========

SOLVE REACTIONS Version 3.0 12/31/93

Filename=2736
Title =2736Z PEDESTAL WELDED

Mode No. 2:

REACTIONS

Node	Fx	Fy	Fz	Mx	My	Mz
1	.5631E-16	-.3495E+01	.2927E-13	.0000E+00	-.2654E-12	-.6283E+02
5	.5816E-16	-.3513E+01	.2163E-13	.0000E+00	.2103E-12	.6348E+02
Total	.1145E-15	-.7008E+01	.5089E-13	.0000E+00	-.5510E-13	.6545E+00

WESTINGHOUSE HANFORD COMPANY S/N:802408 01/10/95
PAGE 16 Run ID=LJ08215 14:11:09

========== I M A G E S - 3 D ==========
= Copyright (c) 1984-1993. RLCA/Celestial Software =
==========

SOLVE BEAM LOADS/STRESSES Version 3.0 12/31/93

Filename=2736
Title =2736Z PEDESTAL WELDED

Mode No. 3:

BEAM LOADS AND/OR STRESSES

Stress	Node	Axial Corner1	Y-Shear Corner2	Z-Shear Corner3	Torsion Corner4	Y-Bending Maximum	Z-Bending Minimum
			BEAM NO. 1				
Stress	1	-.1531E-05	-.2540E-16	.3007E+00	.0000E+00	-.1171E+02	-.6237E-15
		-.1171E+02	-.1171E+02	.1171E+02	.1171E+02	.1171E+02	-.1171E+02
Stress	2	-.1531E-05	-.2540E-16	.3007E+00	.0000E+00	.9109E+01	-.1640E-15
		.9109E+01	.9109E+01	-.9109E+01	-.9109E+01	.9109E+01	-.9109E+01
			BEAM NO. 2				
Stress	2	.4057E-05	-.4374E-16	-.1084E+00	.0000E+00	.9109E+01	-.1640E-15
		.9109E+01	.9109E+01	-.9109E+01	-.9109E+01	.9109E+01	-.9109E+01
Stress	3	.4057E-05	-.4374E-16	-.1084E+00	.0000E+00	.1606E+01	.6276E-15
		.1606E+01	.1606E+01	-.1606E+01	-.1606E+01	.1606E+01	-.1606E+01
			BEAM NO. 3				
Stress	3	-.4142E-05	.3978E-17	-.1740E+00	.0000E+00	.1606E+01	.6276E-15
		.1606E+01	.1606E+01	-.1606E+01	-.1606E+01	.1606E+01	-.1606E+01
Stress	4	-.4142E-05	.3978E-17	-.1740E+00	.0000E+00	-.1044E+02	.5556E-15
		-.1044E+02	-.1044E+02	.1044E+02	.1044E+02	.1044E+02	-.1044E+02
			BEAM NO. 4				
Stress	4	.1436E-05	.9209E-16	.2762E+00	.0000E+00	-.1044E+02	.5556E-15
		-.1044E+02	-.1044E+02	.1044E+02	.1044E+02	.1044E+02	-.1044E+02
Stress	5	.1436E-05	.9209E-16	.2762E+00	.0000E+00	.1107E+02	-.1319E-14
		.1107E+02	.1107E+02	-.1107E+02	-.1107E+02	.1107E+02	-.1107E+02

========== I M A G E S - 3 D ==========
= Copyright (c) 1984-1993. RLCA/Celestial Software =
==========

SOLVE BEAM LOADS/STRESSES Version 3.0 12/31/93

Filename=2736
Title =2736Z PEDESTAL WELDED

Mode No. 3:

MAXIMUM STRESS SUMMARY FOR BEAMS/TRUSSES
WITHIN SPECIFIED RANGE 1- 4

Element	Type	Stress Type	Value
2	BEAM	Axial Tension	.4057E-05
3	BEAM	Axial Compression	-.4142E-05
1	BEAM	Transv. Shear	.3007E+00
1	BEAM	Torsion Shear	.0000E+00
1	BEAM	Bending Stress	.1171E+02
1	BEAM	Max. Comb. Normal	.1171E+02
1	BEAM	Min. Comb. Normal	-.1171E+02

========== I M A G E S - 3 D ==========
= Copyright (c) 1984-1993. RLCA/Celestial Software =
==========

SOLVE REACTIONS Version 3.0 12/31/93

Filename=2736
Title =2736Z PEDESTAL WELDED

Mode No. 3:

REACTIONS

Node	Fx	Fy	Fz	Mx	My	Mz
1	.6430E-06	-.1067E-16	.1263E+00	.0000E+00	-.1421E+01	-.2895E-15
5	.6032E-06	-.3868E-16	-.1160E+00	.0000E+00	-.1344E+01	.6124E-15
Total	.1246E-05	-.4935E-16	.1031E-01	.0000E+00	-.2765E+01	.3229E-15

WESTINGHOUSE HANFORD COMPANY S/N:802408 01/10/95
PAGE 19 Run ID=LJ08215 14:11:24

========== I M A G E S - 3 D ==========
= Copyright (c) 1984-1993. RLCA/Celestial Software =
==========

SOLVE BEAM LOADS/STRESSES Version 3.0 12/31/93

Filename=2736
Title =2736Z PEDESTAL WELDED

RSS

BEAM LOADS AND/OR STRESSES

Stress	Node	Axial Corner1	Y-Shear Corner2	Z-Shear Corner3	Torsion Corner4	Y-Bending Maximum	Z-Bending Minimum
			BEAM NO. 1				
Stress	1	.1928E-05	.8323E+01	.2798E+02	.0000E+00	.1741E+04	.1354E+03
		.1746E+04	.1742E+04	.1742E+04	.1746E+04	.1742E+04	.1746E+04
Stress	2	.1928E-05	.8323E+01	.2798E+02	.0000E+00	.1964E+03	.1525E+02
		.1970E+03	.1965E+03	.1965E+03	.1970E+03	.1970E+03	.1965E+03
			BEAM NO. 2				
Stress	2	.5109E-05	.4338E+01	.1458E+02	.0000E+00	.1964E+03	.1525E+02
		.1970E+03	.1965E+03	.1965E+03	.1970E+03	.1970E+03	.1965E+03
Stress	3	.5109E-05	.4338E+01	.1458E+02	.0000E+00	.1206E+04	.9376E+02
		.1209E+04	.1206E+04	.1206E+04	.1209E+04	.1209E+04	.1206E+04
			BEAM NO. 3				
Stress	3	.5215E-05	.3329E+01	.1119E+02	.0000E+00	.1206E+04	.9376 2
		.1209E+04	.1206E+04	.1206E+04	.1209E+04	.1209E+04	.1206E+04
Stress	4	.5215E-05	.3329E+01	.1119E+02	.0000E+00	.4311E+03	.3351E+02
		.4324E+03	.4313E+03	.4313E+03	.4324E+03	.4324E+03	.4313E+03
			BEAM NO. 4				
Stress	4	.1809E-05	.8364E+01	.2812E+02	.0000E+00	.4311E+03	.3351E+02
		.4324E+03	.4313E+03	.4313E+03	.4324E+03	.4324E+03	.4313E+03
Stress	5	.1809E-05	.8364E+01	.2812E+02	.0000E+00	.1759E+04	.1368E+03
		.1764E+04	.1760E+04	.1760E+04	.1764E+04	.1760E+04	.1764E+04

========== I M A G E S - 3 D ==========
= Copyright (c) 1984-1993. RLCA/Celestial Software =
==========

SOLVE BEAM LOADS/STRESSES Version 3.0 12/31/93

Filename=2736
Title =2736Z PEDESTAL WELDED

RSS

MAXIMUM STRESS SUMMARY FOR BEAMS/TRUSSES
WITHIN SPECIFIED RANGE 1- 4

Element	Type	Stress Type	Value
3	BEAM	Axial Tension	.5215E-05
1	BEAM	Axial Compression	.0000E+00
4	BEAM	Transv. Shear	.2812E+02
1	BEAM	Torsion Shear	.0000E+00
4	BEAM	Bending Stress	.1759E+04
4	BEAM	Max. Comb. Normal	.1764E+04
2	BEAM	Min. Comb. Normal	.1965E+03

========== I M A G E S - 3 D ==========
= Copyright (c) 1984-1993. RLCA/Celestial Software =
==========

SOLVE REACTIONS Version 3.0 12/31/93

Filename=2736
Title =2736Z PEDESTAL WELDED

RSS

REACTIONS

Node	Fx	Fy	Fz	Mx	My	Mz
1	.8100E-06	.3495E+01	.1175E+02	.0000E+00	.2112E+03	.6283E+02
5	.7596E-06	.3513E+01	.1181E+02	.0000E+00	.2134E+03	.6348E+02
Total	.1570E-05	.7008E+01	.2356E+02	.0000E+00	.4247E+03	.1263E+03

WESTINGHOUSE HANFORD COMPANY S/N:802408 01/10/95
PAGE 22 Run ID=LJ08215 14:11:47

========== I M A G E S - 3 D ==========
= Copyright (c) 1984-1993. RLCA/Celestial Software =
==========

SOLVE BEAM LOADS/STRESSES Version 3.0 12/31/93

Filename=2736
Title =2736Z PEDESTAL WELDED

MISSING MASS RESP. / X - DIR. SPECTRUM

BEAM LOADS AND/OR STRESSES

Stress	Node	Axial Corner1	Y-Shear Corner2	Z-Shear Corner3	Torsion Corner4	Y-Bending Maximum	Z-Bending Minimum
			BEAM NO. 1				
Stress	1	-.9225E+01	.1704E-17	-.4531E-07	.0000E+00	.1761E-05	.2771E-16
		-.9225E+01	-.9225E+01	-.9225E+01	-.9225E+01	-.9225E+01	-.9225E+01
Stress	2	-.9225E+01	.1704E-17	-.4531E-07	.0000E+00	-.1376E-05	-.3123E-17
		-.9225E+01	-.9225E+01	-.9225E+01	-.9225E+01	-.9225E+01	-.9225E+01
			BEAM NO. 2				
Stress	2	-.3321E+01	.8881E-18	.1646E-07	.0000E+00	-.1376E-05	-.3123E-17
		-.3321E+01	-.3321E+01	-.3321E+01	-.3321E+01	-.3321E+01	-.3321E+01
Stress	3	-.3321E+01	.8881E-18	.1646E-07	.0000E+00	-.2363E-06	-.1920E-16
		-.3321E+01	-.3321E+01	-.3321E+01	-.3321E+01	-.3321E+01	-.3321E+01
			BEAM NO. 3				
Stress	3	.2583E+01	-.6816E-18	.2624E-07	.0000E+00	-.2363E-06	-.1920E-16
		.2583E+01	.2583E+01	.2583E+01	.2583E+01	.2583E+01	.2583E+01
Stress	4	.2583E+01	-.6816E-18	.2624E-07	.0000E+00	.1580E-05	-.6861E-17
		.2583E+01	.2583E+01	.2583E+01	.2583E+01	.2583E+01	.2583E+01
			BEAM NO. 4				
Stress	4	.8856E+01	-.1712E-17	-.4190E-07	.0000E+00	.1580E-05	-.6861E-17
		.8856E+01	.8856E+01	.8856E+01	.8856E+01	.8856E+01	.8856E+01
Stress	5	.8856E+01	-.1712E-17	-.4190E-07	.0000E+00	-.1684E-05	.2800E-16
		.8856E+01	.8856E+01	.8856E+01	.8856E+01	.8856E+01	.8856E+01

========== I M A G E S - 3 D ==========
= Copyright (c) 1984-1993. RLCA/Celestial Software =
==========

SOLVE BEAM LOADS/STRESSES Version 3.0 12/31/93

Filename=2736
Title =2736Z PEDESTAL WELDED

MISSING MASS RESP. / X - DIR. SPECTRUM

MAXIMUM STRESS SUMMARY FOR BEAMS/TRUSSES
WITHIN SPECIFIED RANGE 1- 4

Element	Type	Stress Type	Value
4	BEAM	Axial Tension	.8856E+01
1	BEAM	Axial Compression	-.9225E+01
4	BEAM	Transv. Shear	-.4190E-07
1	BEAM	Torsion Shear	.0000E+00
1	BEAM	Bending Stress	.1761E-05
4	BEAM	Max. Comb. Normal	.8856E+01
1	BEAM	Min. Comb. Normal	-.9225E+01

========== I M A G E S - 3 D ==========
= Copyright (c) 1984-1993. RLCA/Celestial Software =
==========

SOLVE REACTIONS Version 3.0 12/31/93

Filename=2736
Title =2736Z PEDESTAL WELDED

MISSING MASS RESP. / X - DIR. SPECTRUM

REACTIONS

Node	Fx	Fy	Fz	Mx	My	Mz
1	.3875E+01	.7157E-18	-.1903E-07	.0000E+00	.2137E-06	.1286E-16
5	.3720E+01	.7192E-18	.1760E-07	.0000E+00	.2043E-06	-.1300E-16
Total	.7594E+01	.1435E-17	-.1432E-08	.0000E+00	.4179E-06	-.1340E-18

WESTINGHOUSE HANFORD COMPANY S/N:802408 01/10/95
PAGE 25 Run ID=LJ08215 14:12:15

========== I M A G E S - 3 D ==========
= Copyright (c) 1984-1993. RLCA/Celestial Software =
==========

SOLVE BEAM LOADS/STRESSES Version 3.0 12/31/93

Filename=2736
Title =2736Z PEDESTAL WELDED

MISSING MASS RESP. / Y - DIR. SPECTRUM

BEAM LOADS AND/OR STRESSES

Stress	Node	Axial Corner1	Y-Shear Corner2	Z-Shear Corner3	Torsion Corner4	Y-Bending Maximum	Z-Bending Minimum
			BEAM NO. 1				
Stress	1	-.1709E-17	.9401E+00	.1285E-13	.0000E+00	-.4063E-12	.8001E+01
		.8001E+01	-.3135E+01	-.3135E+01	.8001E+01	.8001E+01	-.3135E+01
Stress	2	-.1709E-17	.9401E+00	.1285E-13	.0000E+00	.4832E-12	-.9012E+01
		-.9012E+01	.3531E+01	.3531E+01	-.9012E+01	.3531E+01	-.9012E+01
			BEAM NO. 2				
Stress	2	-.8070E-18	-.9791E+00	-.1467E-13	.0000E+00	.4832E-12	-.9012E+01
		-.9012E+01	.3531E+01	.3531E+01	-.9012E+01	.3531E+01	-.9012E+01
Stress	3	-.8070E-18	-.9791E+00	-.1467E-13	.0000E+00	-.5322E-12	.8706E+01
		.8706E+01	-.3411E+01	-.3411E+01	.8706E+01	.8706E+01	-.3411E+01
			BEAM NO. 3				
Stress	3	.5946E-18	.7837E+00	.1338E-13	.0000E+00	-.5322E-12	.8706 1
		.8706E+01	-.3411E+01	-.3411E+01	.8706E+01	.8706E+01	-.3411E+01
Stress	4	.5946E-18	.7837E+00	.1338E-13	.0000E+00	.3940E-12	-.5477E+01
		-.5477E+01	.2146E+01	.2146E+01	-.5477E+01	.2146E+01	-.5477E+01
			BEAM NO. 4				
Stress	4	.1708E-17	-.4545E+00	-.8861E-14	.0000E+00	.3940E-12	-.5477E+01
		-.5477E+01	.2146E+01	.2146E+01	-.5477E+01	.2146E+01	-.5477E+01
Stress	5	.1708E-17	-.4545E+00	-.8861E-14	.0000E+00	-.2961E-12	.3777E+01
		.3777E+01	-.1480E+01	-.1480E+01	.3777E+01	.3777E+01	-.1480E+01

========== I M A G E S - 3 D ==========
= Copyright (c) 1984-1993. RLCA/Celestial Software =
==========

SOLVE BEAM LOADS/STRESSES Version 3.0 12/31/93

Filename=2736
Title =2736Z PEDESTAL WELDED

MISSING MASS RESP. / Y - DIR. SPECTRUM

MAXIMUM STRESS SUMMARY FOR BEAMS/TRUSSES
WITHIN SPECIFIED RANGE 1- 4

Element	Type	Stress Type	Value
4	BEAM	Axial Tension	.1708E-17
1	BEAM	Axial Compression	-.1709E-17
3	BEAM	Transv. Shear	.7837E+00
1	BEAM	Torsion Shear	.0000E+00
2	BEAM	Bending Stress	.8706E+01
2	BEAM	Max. Comb. Normal	.8706E+01
2	BEAM	Min. Comb. Normal	-.9012E+01

========== I M.A G E S - 3 D ==========
= Copyright (c) 1984-1993. RLCA/Celestial Software =
==========

SOLVE REACTIONS Version 3.0 12/31/93

Filename=2736
Title =2736Z PEDESTAL WELDED

MISSING MASS RESP. / Y - DIR. SPECTRUM

REACTIONS

Node	Fx	Fy	Fz	Mx	My	Mz
1	.7176E-18	.3948E+00	.5396E-14	.0000E+00	-.4929E-13	.3714E+01
5	.7172E-18	.1909E+00	.3722E-14	.0000E+00	.3592E-13	-.1753E+01
Total	.1435E-17	.5858E+00	.9118E-14	.0000E+00	-.1337E-13	.1961E+01

WESTINGHOUSE HANFORD COMPANY S/N:802408 01/10/95
PAGE 28 Run ID=LJ08215 14:12:31

========== I M A G E S - 3 D ==========
= Copyright (c) 1984-1993. RLCA/Celestial Software =
==========

SOLVE BEAM LOADS/STRESSES Version 3.0 12/31/93

Filename=2736
Title =2736Z PEDESTAL WELDED

MISSING MASS RESP. / Z - DIR. SPECTRUM

BEAM LOADS AND/OR STRESSES

Stress	Node	Axial Corner1	Y-Shear Corner2	Z-Shear Corner3	Torsion Corner4	Y-Bending Maximum	Z-Bending Minimum
			BEAM NO. 1				
Stress	1	.3858E-08	.2707E-13	.2050E+01	.0000E+00	-.6481E+02	.4403E-12
		-.6481E+02	-.6481E+02	.6481E+02	.6481E+02	.6481E+02	-.6481E+02
Stress	2	.3858E-08	.2707E-13	.2050E+01	.0000E+00	.7708E+02	-.4961E-13
		.7708E+02	.7708E+02	-.7708E+02	-.7708E+02	.7708E+02	-.7708E+02
			BEAM NO. 2				
Stress	2	-.1423E-07	.1411E-13	-.2339E+01	.0000E+00	.7708E+02	-.4961E-13
		.7708E+02	.7708E+02	-.7708E+02	-.7708E+02	.7708E+02	-.7708E+02
Stress	3	-.1423E-07	.1411E-13	-.2339E+01	.0000E+00	-.8487E+02	-.3049E-12
		-.8487E+02	-.8487E+02	.8487E+02	.8487E+02	.8487E+02	-.8487E+02
			BEAM NO. 3				
Stress	3	.1562E-07	-.1083E-13	.2133E+01	.0000E+00	-.8487E+02	-.3049E-12
		-.8487E+02	-.8487E+02	.8487E+02	.8487E+02	.8487E+02	-.8487E+02
Stress	4	.1562E-07	-.1083E-13	.2133E+01	.0000E+00	.6282E+02	-.1090E-12
		.6282E+02	.6282E+02	-.6282E+02	-.6282E+02	.6282E+02	-.6282E+02
			BEAM NO. 4				
Stress	4	-.4664E-08	-.2720E-13	-.1413E+01	.0000E+00	.6282E+02	-.1090E-12
		.6282E+02	.6282E+02	-.6282E+02	-.6282E+02	.6282E+02	-.6282E+02
Stress	5	-.4664E-08	-.2720E-13	-.1413E+01	.0000E+00	-.4719E+02	.4448E-12
		-.4719E+02	-.4719E+02	.4719E+02	.4719E+02	.4719E+02	-.4719E+02

WESTINGHOUSE HANFORD COMPANY S/N:802408 01/10/95
PAGE 29 Run ID=LJ08215 14:12:52

========== I M A G E S - 3 D ==========
= Copyright (c) 1984-1993. RLCA/Celestial Software =
==========

SOLVE BEAM LOADS/STRESSES Version 3.0 12/31/93

Filename=2736
Title =2736Z PEDESTAL WELDED

MISSING MASS RESP. / Z - DIR. SPECTRUM

MAXIMUM STRESS SUMMARY FOR BEAMS/TRUSSES
WITHIN SPECIFIED RANGE 1- 4

Element	Type	Stress Type	Value
3	BEAM	Axial Tension	.1562E-07
2	BEAM	Axial Compression	-.1423E-07
3	BEAM	Transv. Shear	.2133E+01
1	BEAM	Torsion Shear	.0000E+00
3	BEAM	Bending Stress	.8487E+02
3	BEAM	Max. Comb. Normal	.8487E+02
2	BEAM	Min. Comb. Normal	-.8487E+02

========== I M A G E S - 3 D ==========
= Copyright (c) 1984-1993. RLCA/Celestial Software =
==========

SOLVE REACTIONS Version 3.0 12/31/93

Filename=2736
Title =2736Z PEDESTAL WELDED

MISSING MASS RESP. / Z - DIR. SPECTRUM

REACTIONS

Node	Fx	Fy	Fz	Mx	My	Mz
1	-.1620E-08	.1137E-13	.8608E+00	.0000E+00	-.7864E+01	.2043E-12
5	-.1959E-08	.1143E-13	.5933E+00	.0000E+00	.5726E+01	-.2065E-12
Total	-.3579E-08	.2279E-13	.1454E+01	.0000E+00	-.2138E+01	-.2134E-14

========== I M A G E S - 3 D ==========
= Copyright (c) 1984-1993. RLCA/Celestial Software =
==========

SOLVE BEAM LOADS/STRESSES Version 3.0 12/31/93

Filename=2736
Title =2736Z PEDESTAL WELDED

COMPLETE RSS COMBINATION

BEAM LOADS AND/OR STRESSES

Stress	Node	Axial Corner1	Y-Shear Corner2	Z-Shear Corner3	Torsion Corner4	Y-Bending Maximum	Z-Bending Minimum
			BEAM NO. 1				
Stress	1	.3037E+01	.8379E+01	.2802E+02	.0000E+00	.1741E+04	.1354E+03
		.1746E+04	.1742E+04	.1742E+04	.1746E+04	.1742E+04	.1746E+04
Stress	2	.3037E+01	.8379E+01	.2802E+02	.0000E+00	.1966E+03	.1555E+02
		.1972E+03	.1967E+03	.1967E+03	.1972E+03	.1972E+03	.1967E+03
			BEAM NO. 2				
Stress	2	.1822E+01	.4449E+01	.1466E+02	.0000E+00	.1966E+03	.1555E+02
		.1972E+03	.1967E+03	.1967E+03	.1972E+03	.1972E+03	.1967E+03
Stress	3	.1822E+01	.4449E+01	.1466E+02	.0000E+00	.1206E+04	.9380E+02
		.1209E+04	.1206E+04	.1206E+04	.1209E+04	.1209E+04	.1206E+04
			BEAM NO. 3				
Stress	3	.1607E+01	.3445E+01	.1129E+02	.0000E+00	.1206E+04	.938( )2
		.1209E+04	.1206E+04	.1206E+04	.1209E+04	.1209E+04	.1206E+04
Stress	4	.1607E+01	.3445E+01	.1129E+02	.0000E+00	.4312E+03	.3359E+02
		.4325E+03	.4314E+03	.4314E+03	.4325E+03	.4325E+03	.4314E+03
			BEAM NO. 4				
Stress	4	.2976E+01	.8391E+01	.2814E+02	.0000E+00	.4312E+03	.3359E+02
		.4325E+03	.4314E+03	.4314E+03	.4325E+03	.4325E+03	.4314E+03
Stress	5	.2976E+01	.8391E+01	.2814E+02	.0000E+00	.1759E+04	.1368E+03
		.1764E+04	.1760E+04	.1760E+04	.1764E+04	.1760E+04	.1764E+04

========== I M A G E S - 3 D ==========
= Copyright (c) 1984-1993. RLCA/Celestial Software =
==========

SOLVE BEAM LOADS/STRESSES Version 3.0 12/31/93

Filename=2736
Title =2736Z PEDESTAL WELDED

COMPLETE RSS COMBINATION

MAXIMUM STRESS SUMMARY FOR BEAMS/TRUSSES
WITHIN SPECIFIED RANGE 1- 4

Element	Type	Stress Type	Value
1	BEAM	Axial Tension	.3037E+01
1	BEAM	Axial Compression	.0000E+00
4	BEAM	Transv. Shear	.2814E+02
1	BEAM	Torsion Shear	.0000E+00
4	BEAM	Bending Stress	.1759E+04
4	BEAM	Max. Comb. Normal	.1764E+04
2	BEAM	Min. Comb. Normal	.1967E+03

========== I M A G E S - 3 D ==========
= Copyright (c) 1984-1993. RLCA/Celestial Software =
==========

SOLVE REACTIONS Version 3.0 12/31/93

Filename=2736
Title =2736Z PEDESTAL WELDED

COMPLETE RSS COMBINATION

REACTIONS

Node	Fx	Fy	Fz	Mx	My	Mz
1	.1968E+01	.3552E+01	.1179E+02	.0000E+00	.2112E+03	.6286E+02
5	.1929E+01	.3540E+01	.1184E+02	.0000E+00	.2134E+03	.6350E+02
Total	.3897E+01	.7091E+01	.2362E+02	.0000E+00	.4247E+03	.1264E+03

For
Location 2736-Z
Subject RM 3 & 4 PEDESTAL

Job No.
Date 1-16-95
By D.E. Kovach
Checked By W.B. Barton

Σ OF LOADS ON WELD/IMAGES-3D

$F_x = 20^{\#} + 128/2 = 84^{\#}$

$F_y = 3.5^{\#}$

$F_z = 11.8^{\#}$

$M_x = 0$

$M_y = 212$ IN#

$M_z = 63$ IN#

(NOTE: HAND CALCS ARE SLIGHTLY LARGE IN GENERAL)

For
Location 2736-Z
Subject RM 3 & 4 PEDESTAL

Job No.
Date 1-16-95
By D. Erkes
Checked By D. Barlow

CHECK STRESS IN CHANNEL FROM COMPUTER MODEL

RESPONSE FROM MODE 1
PP-32
COMPUTER RUN
COMBINED STRESS

$f_b = 1759\ PSI < \frac{2}{3}(36000)(1.33)$ LA.36

$1759\ PSI < 31900\ PSI$

$$M.S. = \frac{1}{\left(1759/31900\right)^{-1}} > 10$$

- FOR CRIPPLING (CONS. ANALYSIS)
- FOR UNBRACE LENGTH

} SA:ECO:94. {ATTACHED} PP 12-13

- CAST IN PLACE-STUD / EMBEDDED PLATE

SEE SA:ECO:94:047 PP 14-15

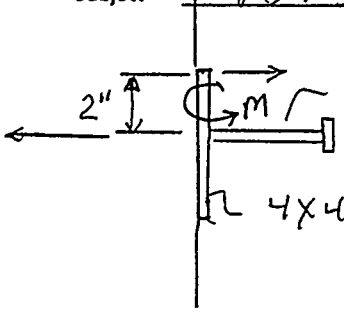
$P_{all} = 1.03^K$

$V_{all} = .59^K$

CONNECT MAX [illegible] OUT LOADS ON EMBEDDED PLT (SEE ATTACH. WELD LOADS)

For
Location 2736-Z
Subject RM 3 & 4 PEDESTAL

Job No.
Date 1-16-85
By D.E.K.
Checked By N.H.



SEE LOADS ON ATTACHMENT WELD "ABOVE".

$$\text{PULLOUT} = \frac{M_y}{2"} = \frac{288^{IN\#}}{2"} = 144^{\#}$$

$$= \frac{M_z}{2"} = \frac{96.8^{IN\#}}{2"} = 49^{\#}$$

$$F_z = 30^{\#}$$

$$\Sigma \text{ PULLOUT} = 144^{\#} + 49^{\#} + 30^{\#} = 223^{\#}$$

$$\text{SHEAR LOAD} = 75^{\#} + 10^{\#} \approx 85^{\#}$$

$$I = \frac{P_{ACT}}{P_{ALLOW}} + \frac{V_{ACT}}{V_{ALLOW}} \leq 1.0$$

$$\frac{223^{\#}}{1030} + \frac{85}{580} \leq 1.0$$

$$.22 + .191 - .36 \leq 1.0$$

$$M.S. = \frac{1}{\left(\frac{.36}{1.0}\right)} - 1 = 1.8$$

EMB. TEST

Westinghouse Hanford Company — **Internal Memo**

From: Structural Assessments SA:ECO:94:047
Phone: 6-0332 H5-55
Date: November 30, 1994
Subject: SEISMIC ANALYSIS OF THE IEAE SECURITY BAR ASSEMBLY FOR SDC-4.1 SAFETY CLASS 3/1 SEISMIC REQUIREMENTS

To: S. D. Ellingson H5-72

cc:

E. P. Bonadie	T5-54	R. D. Redekopp	T5-50
T. J. Conrads	H5-55	L. H. Rodgers	T5-54
S. K. Farnworth	H5-55	R. W. Szempruch	T4-18
M. W. Gibson	T5-55	E. C. Vogt	T5-50
E. J. Renkey	H5-72	E. O. Weiner	H5-55

The seismic evaluation of the safety class 3 security bar assembly to verify the anchorage adequacy when subjected to safety class 1 seismic loads was performed in accordance to the requirements of SDC-4.1. The results of the evaluation indicate that the assembly is acceptable as designed and will not compromise the structural integrity of the existing pedestal by attaching to it.

This letter transmits the evaluation report. This effort has been funded by work order no. E25699. If you have any questions, or need further assistance on seismic issues, please call me on 6-0332.

E. C. Oesmel
E. C. [redacted]
Principal Engineer

Attachment

TYPICAL CHECKLIST FOR INDEPENDENT REVIEW

Document Reviewed Seismic Analysis of the IEAE Security Bar Assembly

Author E. O. Weiner

Yes	No	N/A	
[✓]	[ ]	[ ]	Problem completely defined.
[✓]	[ ]	[ ]	Necessary assumptions explicitly stated and supported.
[ ]	[ ]	[✓]	Computer codes and data files documented.
[✓]	[ ]	[ ]	Data used in calculations explicitly stated in document.
[✓]	[ ]	[ ]	Data checked for consistency with original source information as applicable.
[✓]	[ ]	[ ]	Mathematical derivations checked including dimensional consistency of results.
[✓]	[ ]	[ ]	Models appropriate and used within range of validity or use outside range of established validity justified.
[✓]	[ ]	[ ]	Hand calculations checked for errors.
[ ]	[ ]	[✓]	Code run streams correct and consistent with analysis documentation.
[ ]	[ ]	[✓]	Code output consistent with input and with results reported in analysis documentation.
[✓]	[ ]	[ ]	Acceptability limits on analytical results applicable and supported. Limits checked against sources.
[✓]	[ ]	[ ]	Safety margins consistent with good engineering practices.
[✓]	[ ]	[ ]	Conclusions consistent with analytical results and applicable limits.
[✓]	[ ]	[ ]	Results and conclusions address all points required in the problem statement.

MANDATORY Software QA Log Number N/A

E. C. OCOMA E. C. Ocoma
Reviewer

11/29/94
Date

SEISMIC ANALYSIS OF THE IAEA SECURITY UPGRADE PLUTONIUM STORAGE CUBICLES IN 2736-Z BUILDING 200 W AREA

November 1994

Prepared by: E. O. Weiner 11-30-94
E. O. Weiner
Structural Assessments

Reviewed by: E. C. Ocoma 11-30-94
E. C. Ocoma
Structural Assessments

Approved by: S. K. Farnworth 11-30-94
S. K. Farnworth, Manager
Structural Assessments

WESTINGHOUSE HANFORD COMPANY
Hanford Operations and Engineering Contractor
for the
U.S. Department Of Energy
Field Office, Richland, Washington

TABLE OF CONTENTS

PAGE

1.0 INTRODUCTION.....3
2.0 SUMMARY 3
3.0 CONCLUSION.....3
4.0 REFERENCES.....3
5.0 CALCULATIONS.....4
6.0 DESIGN SKETCHES.....20

1.0 INTRODUCTION

Security bars proposed for installation in the plutonium storage cubicles in the Plutonium Finishing Plant (PFP) 2736-Z vault, Room 3, are analyzed herein for seismic loading. Other loads are considered negligible. The bars are attached to each pedestal assembly and envelope the cans in the holders in the assembly. The security bars are analysed herein as Safety Class 3/1 (Reference 4.3); only attachment to the pedestal assembly is considered important with regard to the bars themselves. Analysis of the pedestal and other 2736-Z equipment has been carried out in WHC-SD-CP-SA-026, Rev 0 (Reference 4.1) as Safety Class 3 equipment with Safety Class 1 seismic loads. The pedestal assemblies now have addtional loads from the security bars. The integrity of the existing pedestal assemblies with the added load is treated herein using the same 3/1 analysis procedures of Reference 4.1. However, since the bars are clearly flexible, their contribution to the inertial load is taken as that of a flexible structure. Ongoing efforts treat the 2736-Z equipment as Safety Class 1. Those efforts should include the additional loads on the pedestal assemblies.

2.0 Summary

All checks herein prove satisfactory with a minimum margin of safety of about 8 (screw pull-out) for the bar attachement and 1.4 (channel prying at the attachment) for the pedestal assembly.

3.0 CONCLUSION

The analysis show that the security bar design is acceptable for SC 3/1 seismic loads required in Reference 4.3 and that it does not compromise the integrity of the safety class 3 pedestal assemblies.

4.0 REFERENCES

4.1 WHC-SD-CP-SA-026, Rev. 0, "Seismic Qualification of SC 3 Equipment in 2736-Z Complex to SC 1 SEismic Loads", 1994.

4.2 WHC-SD-GN-DGS-30006, Revision 1, "Guidelines for Assessing Seismic Adequacy of Safety Class 3 and 4 Equipment at the Hanford Site, 1993.

4.3 Internal Memo No. 15530-94-EPB-148, "Safety Class Assignment for IAEA Storage Pedestal Restraints".

4.4 DSI, dated 10/27/94, from S. D. Ellingson to E. C. Ocoma, " Seismic Analysis Support for 2736-Z".

4.5 Formulas for Stress and Strain by Roark and Young, 4th Edition.

4.6 Manual of Steel Construction, 8th Edition, American Institute of Steel Construction.

5.0 CALCULATIONS

(1) Drawing _____ (2) Doc. No. _____ (3) Page ____ of ____
(4) Building 2736 Z (5) Rev. _____ (6) Job No. _____
(7) Subject IAEA Security Bars
(8) Originator E.O. Wemer Date 10/28/94
(9) Checker E.C. Olson Date 11/7/94

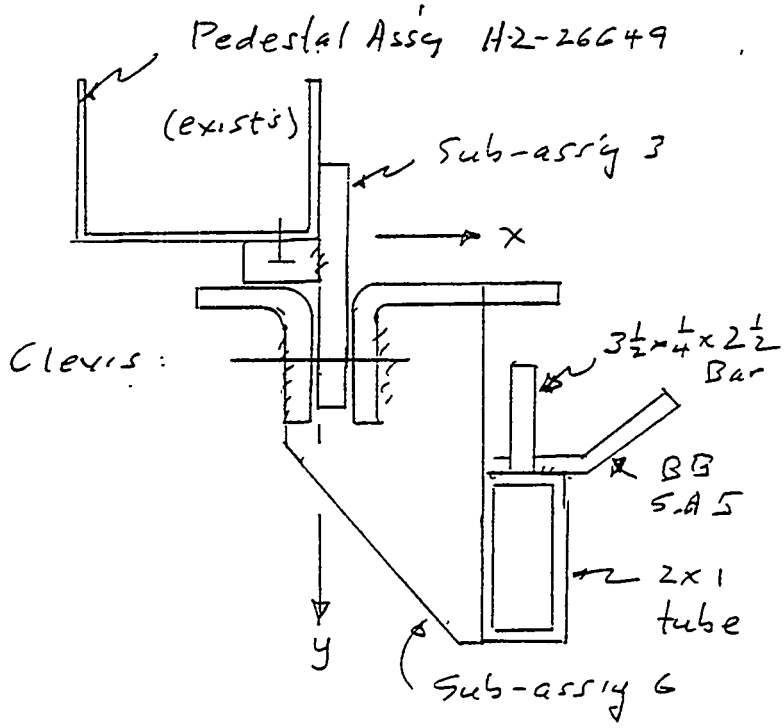
(10)

Ref: E.P. Bonadie Internal Memo 15530-94-EPB-148

Safety Class: 3/1

Material: 6061-T52 or -T6511 anodized.
2x1 tubing wall is 1/8"

Weights (one side of pedestal assy)



(4) Building 2736 Z (5) Rev. _____ (6) Job No. _____

(7) Subject IMEA Security Bars

(8) Originator EO Weiner Date 10/28/94

(9) Checker E.C. Ocmer Date 11/7/94

(10)

Weights (con'd)

	wt lb	$\bar{x}$ in	$\bar{y}$ in
Ass'y 3, ea			
3 - $1\frac{3}{4} \times \frac{1}{4} \times 3\frac{1}{2}$ @ .10 pci	.5	.125	2P
1 - $1 \times \frac{1}{2} \times 61\frac{3}{4}$	1.6	-.5	.25
	2.1		
Ass'y 1, ea			
1 - 2x1 tube 80.5" t = 1/8	3.0	3.75	4.0
3 - Sub assy 6			
2 - $4.5 \times 2 \times \frac{1}{4}$ = .5			
∠ $2 \times 7.3 \times \frac{1}{4}$ = .4			
$2 \times 1 \times \frac{3}{4} \times \frac{1}{4}$ = .1			
1.0 x 3 = 3.0		1.5	2.0
Sect BB S.A.5			
7 - $5.1 \times 1 \times \frac{1}{4}$	0.9	3.75	2.4
Bar			
3 - $3\frac{1}{2} \times \frac{1}{4} \times 2\frac{1}{2}$	0.7	3.75	1.8
Total (ΣW, $\Sigma W\bar{x}$, $\Sigma W\bar{y}$):	9.7#	21.0 in#	23.2 in#

$W = 9.7$ # $\quad \bar{x} = \frac{21.0}{9.7} = 2.2$" $\quad \bar{y} = \frac{23.2}{9.7} = 2.4$"

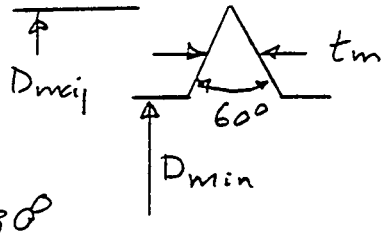
(1) Drawing _____ (2) Doc. No. _____ (3) Page 1 of 1
(4) Building _____ (5) Rev. _____ (6) Job No. _____
(7) Subject 27562 TACA Security Bars
(8) Originator EO Weiner Date 10/28/94
(9) Checker E C. Ocrmon Date 11/7/94

(10)

Capacity #14 sheet metal screws:

$D_{maj} = .24$ $D_{min} = .17$ (measure)

Use 60° thread shear area at mean diameter, one thread



$$t_m = \frac{D_{max} - D_{min}}{2} \frac{2 \sin 30}{2}$$

$$= \frac{.24 - .17}{2} \times .5 = .0175"$$

$$\bar{D} = \frac{D_{max} + D_{maj}}{2} = \frac{.24 + .17}{2} = .205"$$

$$A_{shear} = \pi \bar{D} t_m = \pi \times .205 \times .0175 = .0113 in^2$$

$F_y = 36$ KSi (screw cuts A36)

$$T_{cap} = 0.6 \times 36^K \times .0113 = .244^K = 244^\#$$

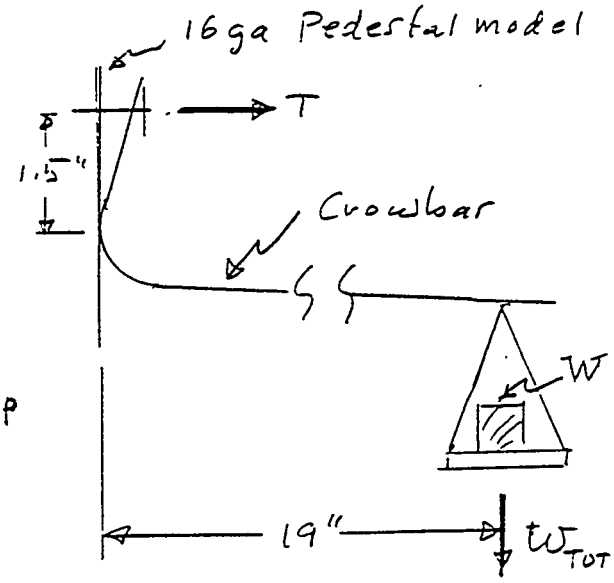
Screw pull-out was tested (not to failure)

$W_{TOT} = 21^\#$

$$T = \frac{19}{1.5} \times 21 = 266^\#$$

Showing T_{CAP} is conservative. Use $\frac{1}{2} T_{cap}$ for allowable:

$$T_{all} = \frac{244}{2} = 122^\#$$



(1) Drawing _____ (2) Doc. No. _____ (3) Page ____ of ____

(4) Building _____ (5) Rev. _____ (6) Job No. _____

(7) Subject 2736 Z IAEA Security Bars

(8) Originator E.O. Weiner Date 10/28/94

(9) Checker G.C. Owens Date 11/7/94

(10)

Seismic Loading

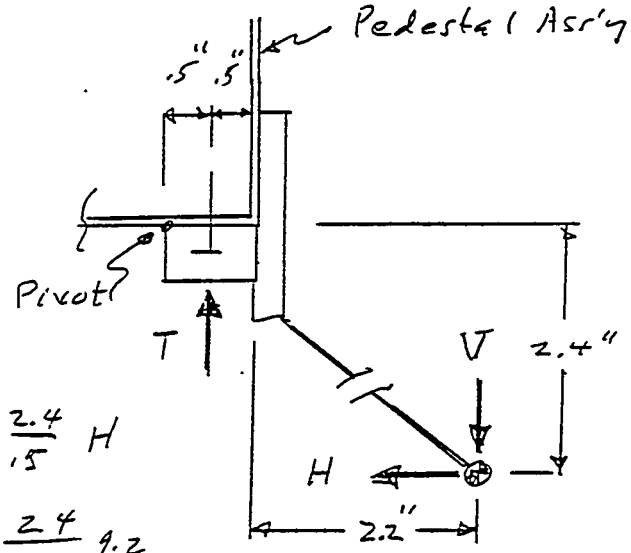
Following WHC-SD-GN-30006 Rev 1, consider the bar as flexible equipment at grade, new installation Table 2.3 gives

$$A_h = 0.95\ g$$

Screw Pull-out

$$H = V = 9.7^{\#} \times .95\ g = 9.2^{\#}$$

Combine H and V with 100-40-40 rule



$$T = \frac{3.2}{.5} V + V + 0.4 \frac{2.4}{.5} H$$

$$= \frac{3.2}{.5} 9.2 + 9.2 + 0.4 \frac{2.4}{.5} 9.2$$

$$= 96^{\#}$$

For all 6 screws. One screw:

$$T_1 = \frac{86}{6} = 14^{\#} \ll T_{all} = 122^{\#}$$ OK

M.S. = 7.7

Sheet metal is 16 ga = .062" vs screw t_m = .0175. Screw pull-out is checked on p.7

(1) Drawing _____ (2) Doc. No. _____ (3) Page _____

(4) Building _____ (5) Rev. _____ (6) Job No. _____

(7) Subject 2736Z IAEA Security Govt

(8) Originator EO Weiner Date 10/28/94

(9) Checker E.C. Ozinsky Date 11/7/94

(10)

Other pull-outs:

Screw head : D = .24 t = .2

Al bar : D = .38 t = .25

are much less likely (negligible)

Bearing:

$A_{brg} = .062 \times .24 = .015 \text{ in}^2$

$F_{brg} = H = 10\#$

$\sigma_{brg} = = \frac{10}{.015} = 67 \text{ psi}$ negligible

Clevis: 1/4" clevis pins are used at 3 places between subassys 1 & 3

$V = \frac{10}{3} = 3\#$ negligible

(7) Subject 2736 Z IAEA Security Bars

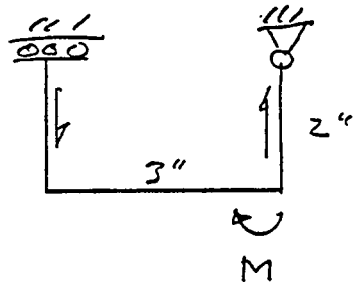
(8) Originator EO Weiner Date 10/28/94

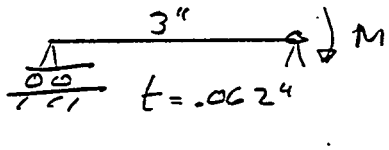
(9) Checker E.C. Olson Date 11/7/94

(10)

Pedestal Channel Moment H-2-26649

Moment M from security bar is reacted by shear in channel legs (pedestal assy) Configuration is same as pin-pin beam





$M = 0.5" T = 0.5 \times 86$

$= 43"\#$ $M_1 = M/6 = 7.2"\#$

Use 3/4" eff depth each screw

$$S = \frac{bt^2}{6} = \frac{.75 \times .062^2}{6} = .00048\ in^3$$

$$\sigma_b = \frac{M_1}{S} = \frac{7.2}{.00048} = 15\ KSI$$

Allow. $= 0.75 \times 36 \times 1.33 = 36\ ksi > 15\ KSI$ OK

(AISC 8th)

M.S. $= 1.4$

DESIGN CALCULATION

(1) Drawing _____ (2) Doc. No. _____ (3) Page _____

(4) Building _____ (5) Rev. _____ (6) Job No. _____

(7) Subject 2736 Z IAEA Security Bars

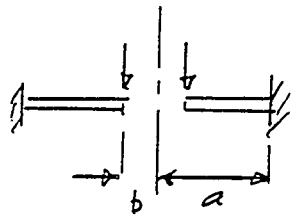
(8) Originator E.O. Weiner Date 11/7/94

(9) Checker G.C. Ocon Date 11/7/94

(10)

Check pull-out wrt plate deformation.

Roarke 4th ed Table X.18



$b = D/2 = .205/2 = .102"$

$a = 0.5$ (to bar edge)

$m = \frac{1}{\mu} = 3.33 \qquad t = .0625"$

$W = T_1 = 14^{\#}$

$$S_t = \frac{3W}{2\pi t^2 m}\left[1 + \frac{ma^2(m-1) - mb^2(m+1) - 2(m^2-1)a^2 \ln\frac{a}{b}}{a^2(m-1) + b^2(m+1)}\right]$$

$$= \frac{3\times 14}{6.28\times .0625^2 \times 3.33} \times$$

$$\left[1 + \frac{.5^2\,\frac{2.33}{3} - .102^2\,\frac{4.33}{3} - 2\left(3.33^2-1\right).5^2 \ln\frac{.5}{.102}}{.5^2\times 2.33 + .102^2\times 4.33}\right]$$

$$= 514\left[1 + \frac{-7.94}{.628}\right] = 514\times 11.7 = 6000 psi$$

$= 6^{ksi} < .75 \times 36 \times 1.33 = 36^{ksi}$ OK

Calc is grossly overconservative per test:

$266^{\#} >> \frac{36}{6} \times 14 = 84^{\#}$

(1) Drawing _____ (2) Doc. No. _____ (3) Page REV 0 ~~1~~ PAGE C-347

(4) Building _____ (5) Rev. _____ (6) Job No. REV. 1

(7) Subject 27362 IAEA Security Bars

(8) Originator EO Weiner Date 11/7/94

(9) Checker G.C Owens Date 11/7/94

(10)

Effect on Pedestal Assy

Security bars add weight to the existing pedestal assembly.

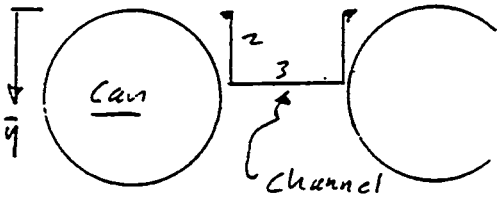
Wts: (WHC-SD-CP-SA-026, Rev 0 pg C3-4)
Also: H-2-26649 Dwg)

14 cans @ 5.5 #/can	77 #
Holders, 14	7
Channel 16 ga 2"x3"x84"	
.28 pcf x .0625 x 7 x 84	10
CMU: 14 @ 1 #	14
Total	108 #

Following SA-026, the pedestal ass'y is considered rigid with $a = 0.34g$ (WHC-SD-GN-30006, Rev.1) but the security bars are considered flexible (in existing structure) with $a = 0.68g$

Mass center

Cmpt	wt, #	a, g	$\bar{y}$, in
Channel	10	.34	1.4
Cans, etc	98	.34	2.2
Sec Bars	20	.68	2.4



$\Sigma Wa\bar{y} = 111$ $\Sigma Wa = 50.3$ # $\bar{y} = \frac{111}{50.3} = 2.21$ "

DESIGN CALCULATION

(1) Drawing _____ (2) Doc. No. _____ (3) Page _____

(4) Building 2736Z (5) Rev. _____ (6) Job No. _____

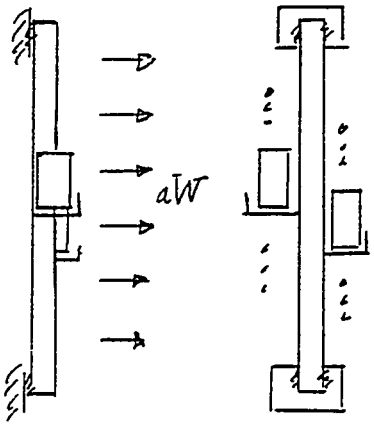
(7) Subject IACA Security Bars

(8) Originator E O Weimer Date 11/7/94

(9) Checker G.C. Owen Date 11/7/94

(10)

Symmetry plane loading:



Welds are $\frac{1}{16} \times 1''$ (4)

E70:

$$f = \frac{aW}{l} = \frac{50^{\#}}{4''} = 12.5^{\#/''}$$

$$<< all = 0.3 \times \frac{.062}{\sqrt{2}} \times 70 = 930^{\#/''} \quad \underline{OK}$$

Note negative moment on 1" welds omitted because pinned end rotations are acceptable.

$$\theta = \frac{1}{24} \frac{aWL^2}{EI}$$

$E = 29e6$ psi $\quad L = 84'' \quad aW = 50^{\#}$

$$I = I_x = \frac{.0625 \times 2^3 (2 \times 3 + 2)}{3(3 + 2 \times 2)} = .190 \text{ in}^4$$

(Blodgett 22-8)

$$\theta = \frac{1}{24} \frac{50 \times 84^2}{29e6 \times .190} = .0027$$

Weld displ $= \frac{1}{2}^{''} \times .0027 = .0013$

Salmon & Johnson Fig 5.13.4 shows 1/4" E70 fillet weld with min ductile displacement $\Delta = .03$. ∴ 1/16" E70.

$\Delta = .03/4 = .007' > .0013$ $\underline{OK}$

(1) Drawing _____ (2) Doc. No. _____ (3) Page REV. 9 of # 1 PAGE

(4) Building 2TJ62 (5) Rev. _____ (6) Job No. Rev. 1

(7) Subject IACA Security Bars

(8) Originator EO Weiner Date 11/7/94

(9) Checker E.C. Ocon Date 11/7/94

(10)

Beam bending:

$$S_x = \frac{.0625 \times 2^2}{3} \times \frac{2 \times 3 + 2}{3 + 2} = .133$$

$$M = \frac{aWL}{8} = \frac{50^{\#} \times 84''}{8} = 525^{''\#}$$

$$\sigma_b = \frac{M}{S_x} = \frac{525}{.133} = 3950 \text{ psi}$$

$$= 3.95^{KSI} < .75 \times 36 \times 1.33 = 36^{KSI} \quad \underline{OK}$$

Crippling:

$$\text{check } b/t \leq \frac{95}{\sqrt{F_y}} = \frac{95}{\sqrt{36}} = 15.8 \quad 8^{th} \text{ AISC } 1.9.1.2$$

$$b/t = \frac{2}{.0625} = 32 > 15.8 \Rightarrow \text{Use Sect C2}$$

$$Q_s = \frac{20000}{F_y (b/t)^2} = \frac{20000}{36 \times 32^2} = .542$$

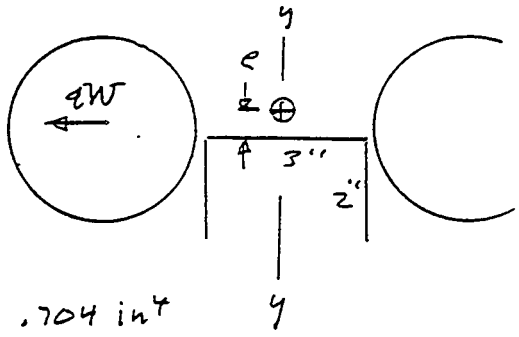
$$\text{Allows: } .6 \times 36^{KSI} \times .542 \times 1.33 = 15.6^{KSI} > 3.95^{KSI} \quad \underline{OK}$$

$$M.S. = 2.95$$

(1) Drawing _____ (2) Doc. No. _____ (3) Page _____ of _____
(4) Building 27362 (5) Rev. _____ (6) Job No. Rev. 1
(7) Subject IAEA Security Door
(8) Originator E O Weiner Date 11/7/94
(9) Checker G. C Oerman Date 11/7/94

(10)

Lateral loading:



Bending

$S_y = \frac{.0625 \times 3}{6}(3 + 6 \times 2)$

$= .469\ in^3$

$I_y = S_y\, b/2 = .469 \times 1.5 = .704\ in^4$

$M = \frac{qwL}{8} = \frac{50^{\#} \times 84''}{8} = 525''\#$

$\sigma_b = \frac{M}{S_x} = \frac{525}{.469} = 1120\ psi$

$= 1.1\ ^{KSI} < 36\ ^{KSI}$ OK

Unbraced length AISC 8th, 1.5.1.4.5

$F_b = \frac{12000\, C_b}{l d / H_f}$ $l = 84''$ $d = 3''$ $C_b = 1$

$A_f = 2'' \times .0625''$

$F_b = \frac{12000 \times 1}{84 \times 3/(2 \times .0625)} = 5.95\ ^{KSI}$

$\times 1.33$ for seismic:

$F_b = 5.95 \times 1.33 = 7.92\ ^{KSI} > \sigma_b = 1.1\ ^{KSI}$ OK

Shear center (Bleich)

$e = \frac{b d^2 t}{4 I_y} = \frac{3 \times 2^2 \times .0625}{4 \times .704} = .27''$

Mass center is close: at 0.21"

∴ neglect torsional effects

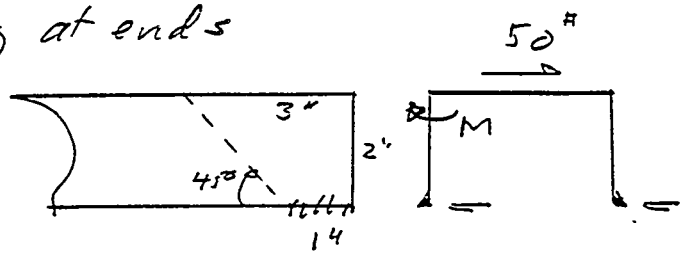
(7) Subject IAEA Security Bars

(8) Originator E O Weiner Date 11/7/97

(9) Checker E. C. O'connor Date 11/7/97

(10)

Flange bending at ends



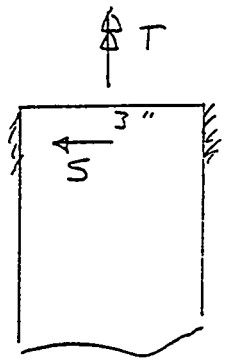
Use 45° eff. width line

$$M = \frac{50^{\#} \times 2''}{4} = 25''^{\#}$$

$$S = 3 \times .0625^2 / 6 = .00195$$

$$\sigma_b = \frac{25}{.00195} = 12800 \text{ psi} = 12.8^{KSI} < 36^{KSI} \text{ OK}$$

Welds:



$$f_S = \frac{qw}{l} = \frac{50^{\#}}{4''} = 12.5^{\#/''}$$

$$f_T = \frac{qS(d+e)/2}{I_y c}$$

$I_y = 2 \times 1'' \times 1.5''^2 = 4.5 \text{ in}^3$ $\quad c = 1.5''$

$$f_T = \frac{50^{\#}(2.21'')/2}{4.5 \times 1.5} = 8^{\#/''}$$

Welds stresses are very small (allow $930^{\#/''}$)

(1) Drawing _____ (2) Doc. No. _____ (3) Page ____ of ____
(4) Building 2726 Z (5) Rev. _____ (6) Job No. _____
(7) Subject IDEA Seismic Bars
(8) Originator EO Weimer Date 11/7/94
(9) Checker E C. Ocorr Date 11/7/94

(10)

Interaction (Symmetry + Lateral Loading)
Use 100-40-40 combination
Beam bending

$$\sigma_b = 3.95 + 0.4 \times 1.1 = 4.4^{KSI}$$

$$< .75 \times 36 \times 1.33 = 36^{KSI} \quad \underline{OK}$$
(CP 10, bending)

$$< 15.6^{KSI} \quad \underline{OK}$$
(" 10, crippling)

Fillet welds:

Gravity + seismic load (vertical)

$$P = 108^{\#}\left(1 + \tfrac{2}{3} \times 0.34\right) + 20\left(1 + \tfrac{2}{3} \times 0.68\right)$$
$$= 162^{\#}$$

Over 4 welds: $f_q = \frac{162^{\#}}{4"} = 41^{\#/"}$

P offset 2.2" from wall induces a pull-out:

$$f_p = \frac{162^{\#} \times 2.2"/84"}{2"} = 2^{\#}$$

Net:

$$f = f_q + (0.4(f_{sym} + f_T + f_p) + 0.4 f_s$$
$$= 41 + 0.4(13 + 8 + 2) + 0.4 \times 13$$
$$= 42^{\#/"} << 930^{\#/"} \quad \underline{OK}$$

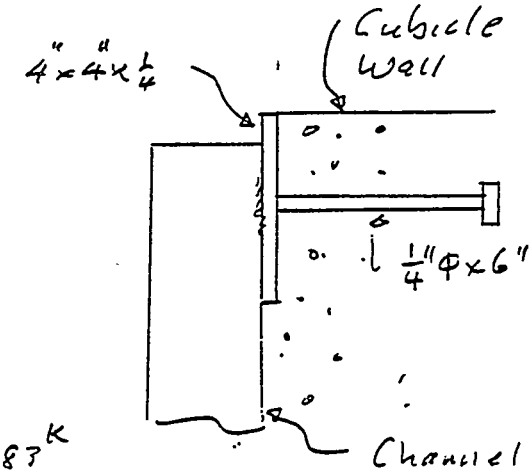
(1) Drawing _____ (2) Doc. No. _____ (3) Page ____ of ____
(4) Building 2736Z (5) Rev. _____ (6) Job No. _____
(7) Subject IAEA Security Bars
(8) Originator EO Weiner Date 11/8/94
(9) Checker E.C. Jarman Date 11/8/94

(10)

Anchor plate:

Edge dist = 2"

$f_c' = 2500$ psi



Per WHC-SD-GN-DGS-30006

Table 8.8:

$P_{nom} = 1.66^K$ $V_{nom} = 0.87^K$

$E_{min} = 2.3"$ $L = 6"$ $D = .25"$ $E = 2"$

Section 8.2:

$RE_p = A_{red}/A_{nom}$

$A_{nom} = .96\frac{\pi}{4}(2L+D)^2 = .96\frac{\pi}{4}(2\times6+.25)^2 = 113\ in^2$

$A_{red} = \pi r^2 - \frac{1}{2}\left(r^2\theta - 2rE\sin\theta/2\right)$

$\theta = 2\cos^{-1}\left(\frac{2E}{2L+D}\right) = 2\cos^{-1}\left(\frac{2\times2}{2\times6+.25}\right)$

$= 142°$

$r = \frac{2L+D}{2} = \frac{12.25}{2} = 6.12"$

$A_{red} = \pi\times6.12^2 - \frac{1}{2}\left(6.12^2\times\frac{142}{57.3} - 2\times6.12\times2\times\sin 71\right)$

$= 83\ in^2$

$RE_p = 83/113 = .73$

$RE_s = .0131(E/D)^2 = .0131(2/.25)^2 = .84$

$RF_p = RF_s = \sqrt{f_c'/3500} = \sqrt{2500/3500} = .85$

(1) Drawing _____ (2) Doc. No. _____ (3) Page ____ of ____
(4) Building 2736-Z (5) Rev. _____ (6) Job No. _____
(7) Subject IAEA Security Bars
(8) Originator E.O. Werner Date 11/8/94
(9) Checker E.C. Ocampo Date 11/8/94

(10)

$P_{all} = P_{nom} RE_p RF_p = 1.66^K \times .73 \times .85 = 1.03^K$

$P_{act} = qW/2 + 2^\# = 50^\#/2 + 2 = 27^\# << 1030^\#$ OK

$V_{all} = V_{nom} RE_s RF_s = 0.83^K \times .84 \times .85$

$= 0.59^K$

$V_{act} = V_{grav}/2 = 162/2 = 81^\# << 590^\#$ OK

6.0 DESIGN SKETCHES AND COPIES OF SELECTED REFERENCES

Westinghouse Hanford Company **Internal Memo**

15530-94-EPB-148

From: Errol P. Bonadie
Phone: 373-2545 T5-54
Date: October 27, 1994
Subject: Safety Class Assignment for IAEA Storage Pedestal Restraints

cc:

W. D. Bartlett	T5-08
S. D. Ellingson	H5-72
M. W. Gibson	T5-55
S. B. Merrick	T4-20
E. C. Ocoma	H5-55
R. D. Redekopp	T5-50
L. H. Rodgers	T5-54
E. C. Vogt	T5-50

The PFP Safety Equipment List, WHC-SD-CP-TI-108 is currently being revised (ie. Rev. 14) and will include the new IAEA Security Bar as a Safety Class 3 device. An Engineering Change Notice (ECN No.616640) of Rev. 13 has been issued to allow the expedient installation of these security bars.

JUSTIFICATION FOR SAFETY CLASS 3 ASSIGNMENT

While Plutonium storage arrays are Safety Class 1 providing double contingency against nuclear criticality, these security bars do not affect the storage array, the vault structure or the criticalityt analysis. The criticality analysis of the pedestals considered a fully moderated array. These bars are to made of aluminum and will only prevent unauthorized removal of stored items. A 3 over 1 seismic analysis demonstrates that failure of these devices do not pose an unacceptable onsite or offsite risk to the environment.

[Original Signed by]

Errol P. Bonadie,
PFP SNM Storage Cognizant Engineer

DON'T SAY IT --- *Write It!*

DATE: October 27, 1994

TO: Ernie C. Ocoma H5-55

FROM: Scott D. Ellingson H5-72

Telephone: 372-2035

cc:

	W.D. Bartlett	T5-08
	T.J. Conrads	H5-55
	L.P. McRae	L4-11
	E.J. Renkey	H5-72
	W.F. Russell	T5-51
	D.D. Scott	L6-09
	R.W. Szempruch	T4-18
	E.O. Weiner	H5-55

SUBJECT: SEISMIC ANALYSIS SUPPORT FOR 2736-Z

The Plutonium Finishing Plant (PFP) is scheduled to modify the plutonium storage racks in vault #3, of 2736-Z, as shown on the attached sketches. The modification includes the attachment of two separate hanger devices, with tamperproof security bars, to approximately 40 of the existing storage racks. This is in support of an agreement with the United Nations to turn over excess nuclear material to the International Atomic Energy Agency (IAEA).

Please initiate and provide seismic analysis to support this effort. The safety class of the new hanger and security devices have been designated Safety Class 3 by the cognizant engineering groups at PFP. Please verify that the existing Safety Class 1 storage rack integrity and function is not compromised.

Approval of the depicted application, or disapproval with recommendation to meet acceptance, is requested from your organization by November 9, 1994. Fabrication of the required devices must be initiated by November 14, 1994, to assure field installation by December 5, 1994. Please let me know if work cannot initiate immediately. The charge code for this effort is E25699.

Please feel free to contact me at any time for additional information if desired.

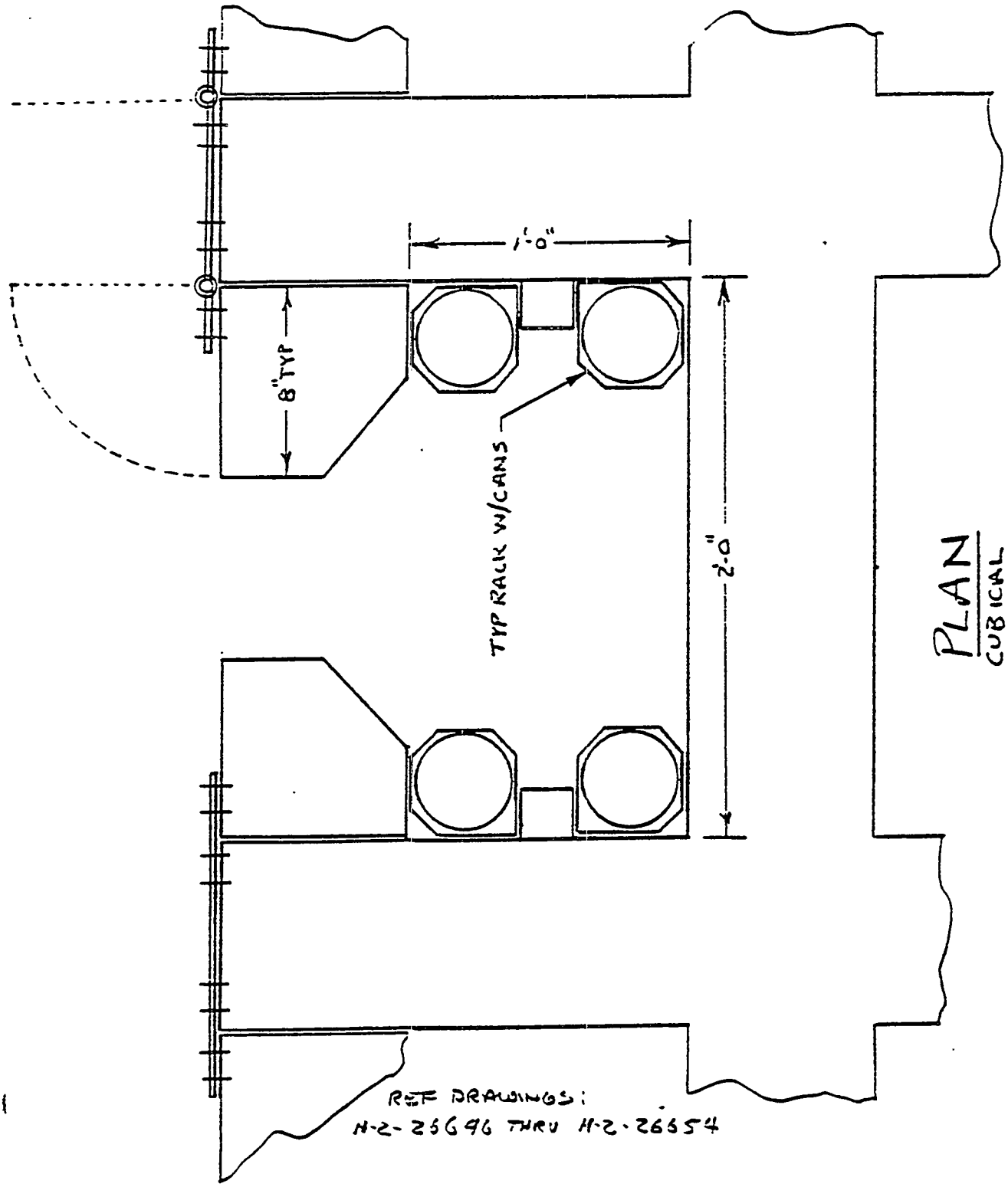
Scott

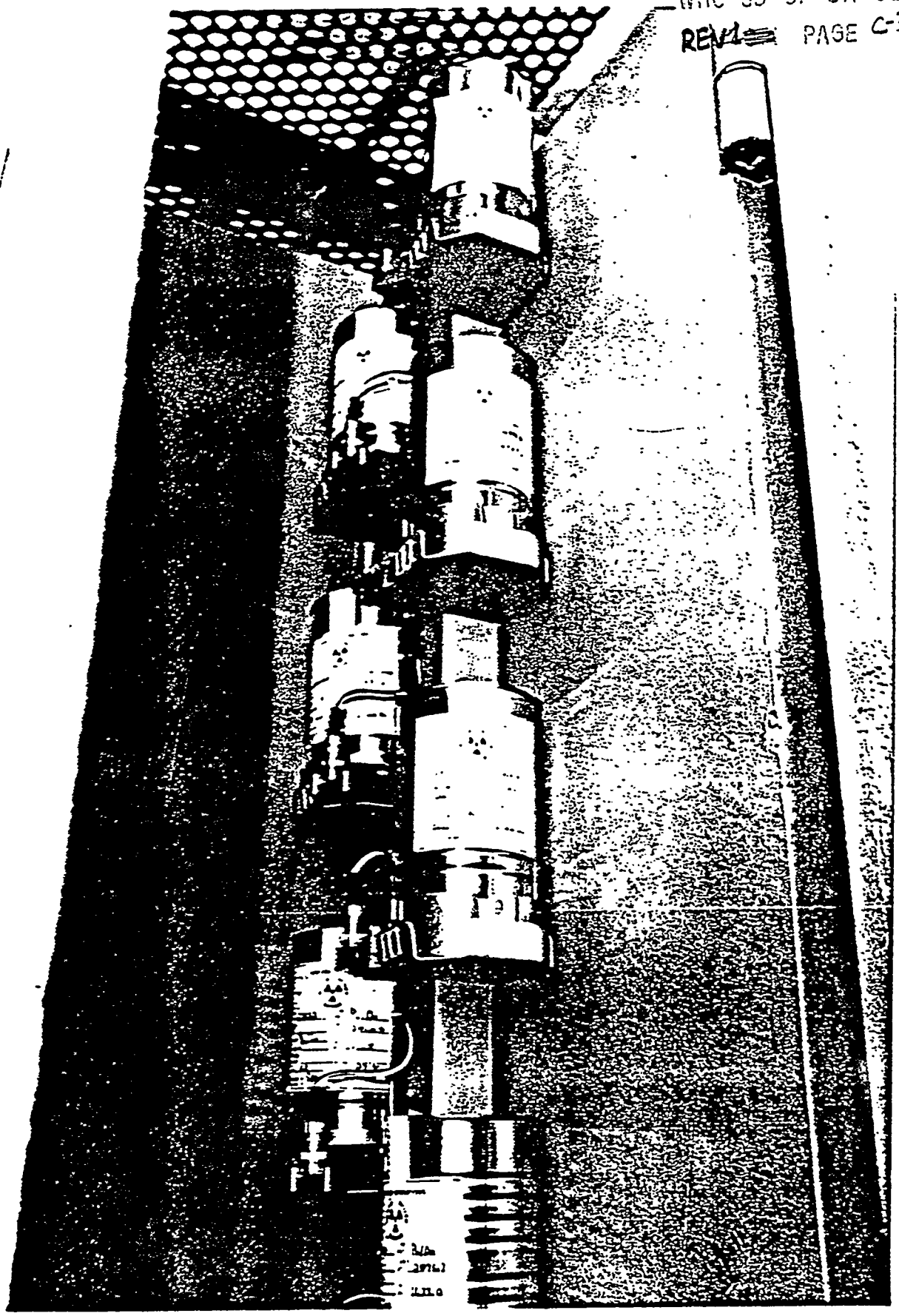
ANALYTICAL CALCULATIONS

Subject 2736-Z IAEA SUPPORT

Originator SCOTT D. ELLINGSON Date

Checker Date

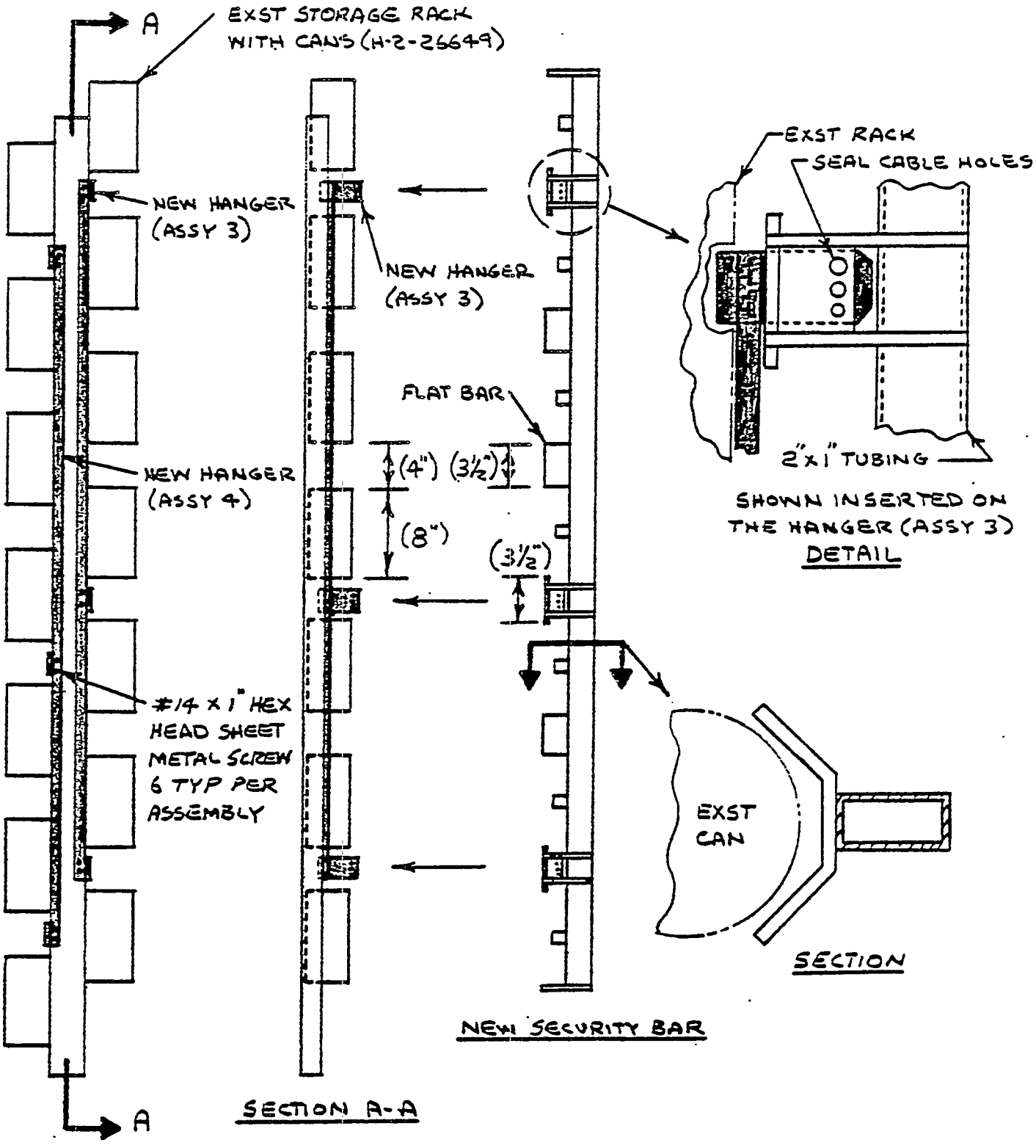




REFERENCE

SHOWN WITH DOOR OPEN

REFERENCE


A
EXST STORAGE RACK WITH CANS (H-2-25649)
NEW HANGER (ASSY 3)
NEW HANGER (ASSY 4)
#14 x 1" HEX HEAD SHEET METAL SCREW 6 TYP PER ASSEMBLY
A
ELEVATION
NEW HANGER (ASSY 3)
FLAT BAR
(4")
(3½")
(8")
(3½")
SECTION A-A
NEW SECURITY BAR
EXST RACK
SEAL CABLE HOLES
2"x1" TUBING
SHOWN INSERTED ON THE HANGER (ASSY 3)
DETAIL
EXST CAN
SECTION

WHC-SD-CP-SA-029 REV 1 PAGE C-361

J-10 FABRICATION REQUEST

Originator Tracking No.: SDE 10-24-94	23. Servicing Tracking No.: 2H-
2. WO/TPCN (If WO, please attach copy): E25699	7. Deliver To: BILL RUSSELL 3-5714/DEAN BARTLETT 3-3997 Phone: PFP
3. Issuing Organization Code: ENGINEERING SUPPORT 80380	8. Delivery Location: 2736-Z PFP
4. Required Completion Date: THURSDAY 10-27-94	9. Priority: 1 / 10. Safety Class: 4 / 11. Impact Level (Circle required approvals): NONE E S Q
5. Equipment Identification No.: ASSEMBLY 1 AND 2	12. Authorized Amount: AS REQUIRED
6. Originator: SCOTT ELLINGSON MSIN: H5-72 Date: 10-24-94 Phone: 3-2035	13. Funding Approval: D.D. SCOTT S.D. Ellingson Date: 10-24-94

14. Title: PLUTONIUM STORAGE RACK SECURIND DEVICE

15. Description of Work

- FABRICATE ONE EACH OF ASSEMBLIES 1,2,3 AND 4 AS DEPICTED ON THE ATTACHED SKETCHES.

Additional Fabrication Information (restrictions/special conditions, inspection criteria, material requirements, special tests, records or documentation required)

- SEE ATTACHED FABRICATION NOTES.
- CONTACTS: SCOTT ELLINGSON - DESIGN - 373-2035 (WK) 783-1685 (HM)
  BILL RUSSELL/DEAN BARTLETT - USER - 3-5714/3-3997
  DEAN SCOTT - FUNDING - 376-8229
- ATTACHMENTS: 5 PAGES OF DESIGN SKETCHES
  1 PAGE OF FABRICATION NOTES
- OVERTIME IS APPROVED! THE REQUIRED COMPLETION DATE IS MANDATORY...

APPROVAL SIGNATURES ACCORDING TO MRP 5.43			22. Comments
17. Cognizant Engineer: SCOTT ELLINGSON	Date: 10-24-94	Phone: 372-2035	
18. Cognizant Manager: N/A	Date:		FABRICATION SERVICES USE ONLY
19. Environmental Assurance	Date:		24. Assigned To
20. Health and Safety Assurance	Date:		25. Accepted By / Date:
21. Quality Assurance	Date:		26. Work Completed By / Date:

FABRICATION NOTES

1. Material...The material [redacted] is aluminum. [redacted] (reference).

2. Tolerances should be held to a minimum. A +/-1/16" is desired.

3. Avoid excess heat during welding to minimize warpage.

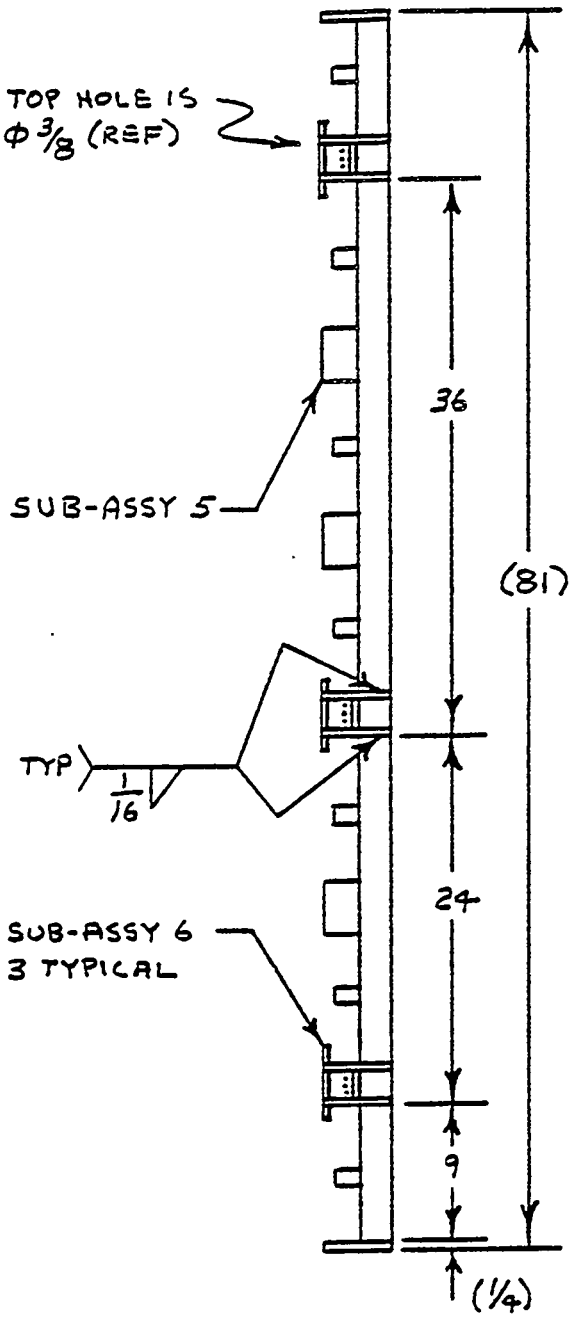
4. Weld per AWS D1.1/2.1 as required. [redacted].

5. Break all sharp edges. [redacted].

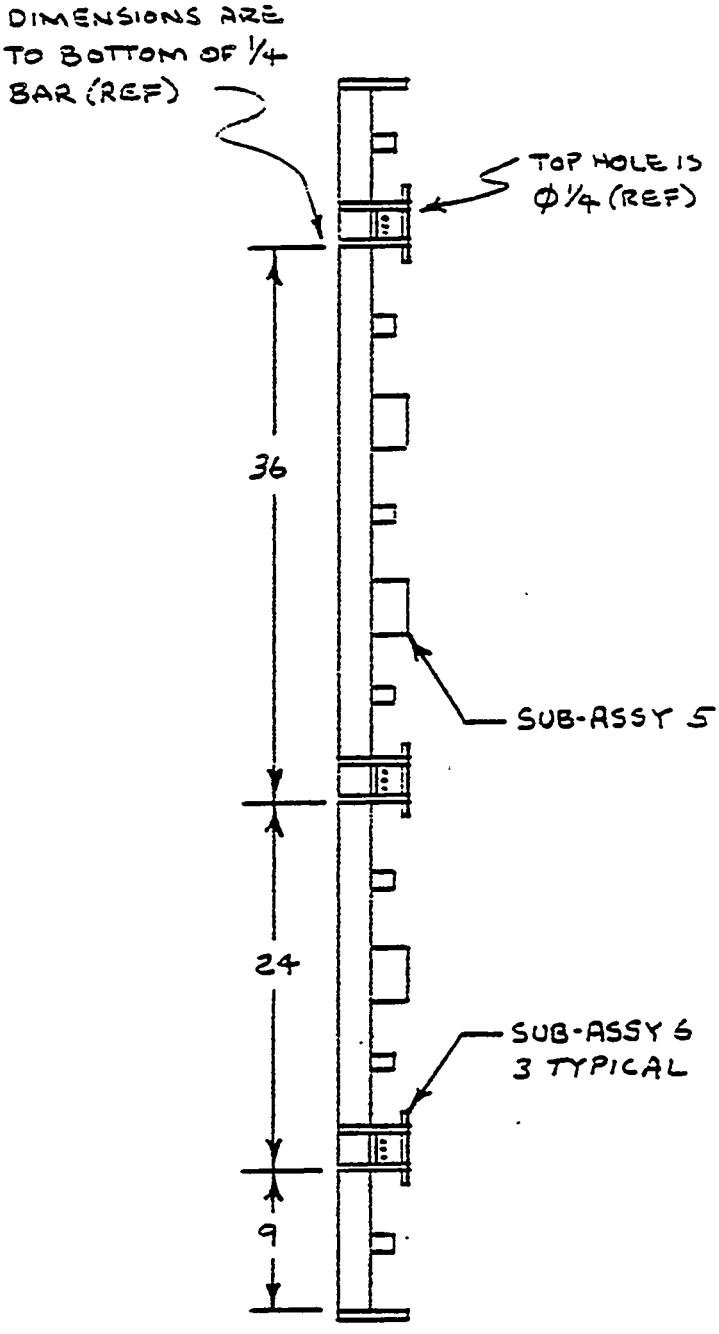
6. [redacted]

7. [redacted]

ALL NOTES WILL BE REVISED!



ASSEMBLY 1

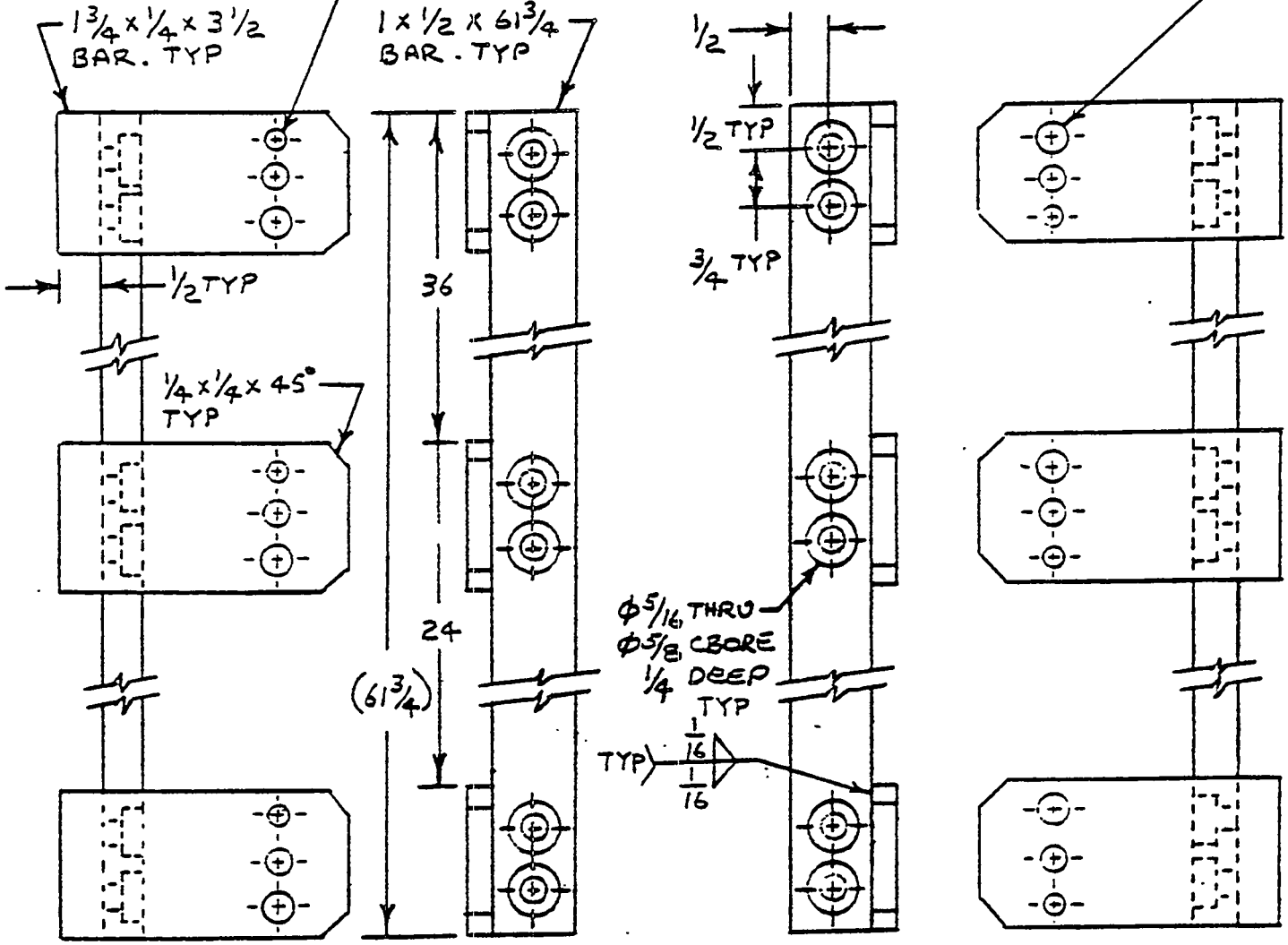


ASSEMBLY 2

ALL MATERIAL IS ALUMINUM
TYPE 6061-T6, ASTM-B-221

DRILL Ø1/4, Ø5/16 & Ø3/8 HOLES THRU USING ASSEMBLY 2 AS TEMPLATE. SEE DETAIL 1, PAGE 5, FOR REF.

DRILL Ø3/8, Ø5/16 & Ø1/4 HOLES THRU USING ASSEMBLY 1 AS TEMPLATE. SEE DETAIL 1, PAGE 5, FOR REF.

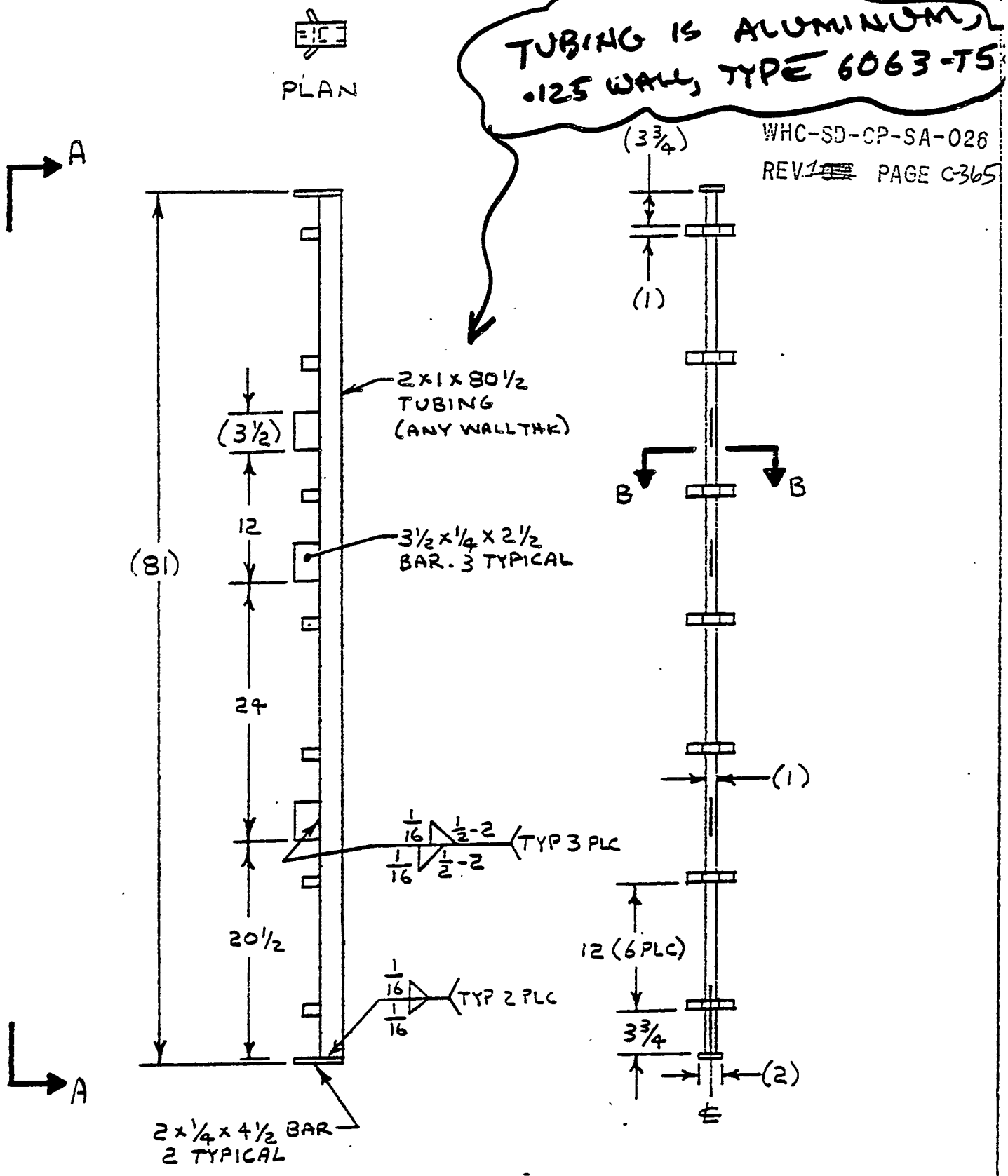


SIDE - ELEVATION - FRONT

ASSEMBLY 4

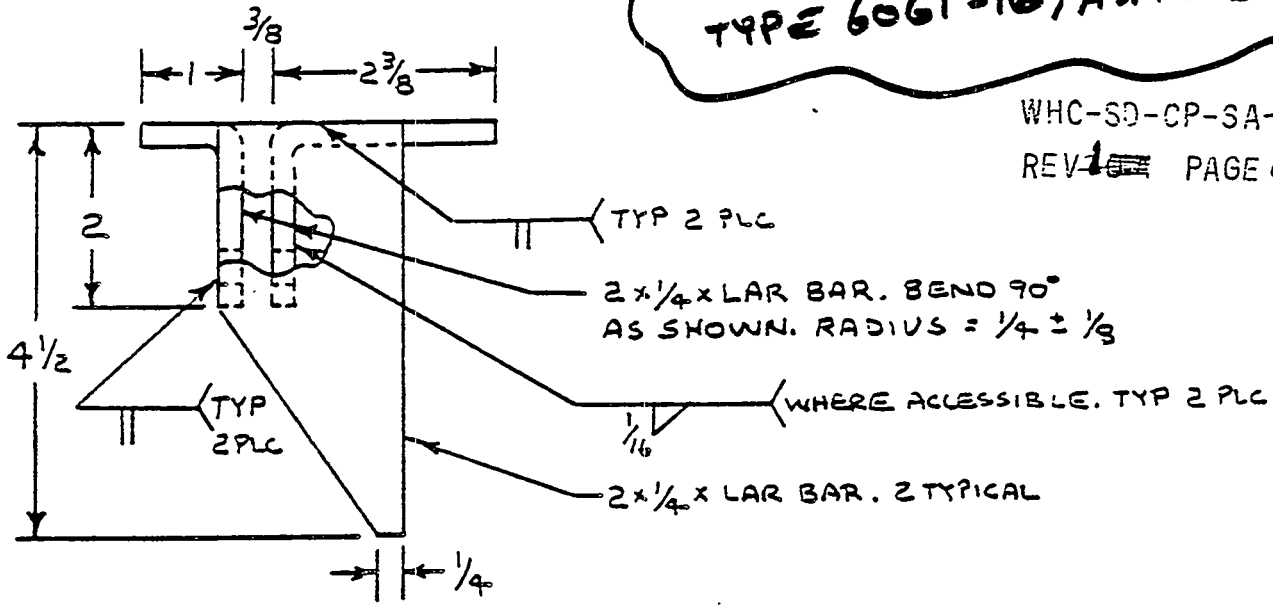
FRONT - ELEVATION - SIDE

ASSEMBLY 3

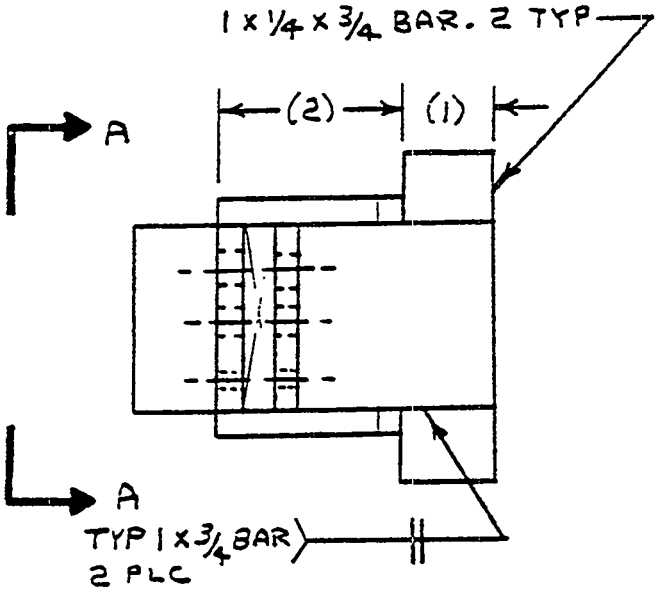

PLAN
TUBING IS ALUMINUM .125 WALL, TYPE 6063-T5
WHC-SD-CP-SA-026
REV 1 PAGE C-365
A
A
(81)
(3½)
12
24
20½
2 x 1 x 80½ TUBING (ANY WALL THK)
3½ x ¼ x 2½ BAR. 3 TYPICAL
1/16 1/2-2 TYP 3 PLC
1/16 1/2-2
1/16 1/16 TYP 2 PLC
2 x ¼ x 4½ BAR 2 TYPICAL
(3¾)
(1)
B
B
(1)
12 (6 PLC)
3¾
(2)
ELEVATION
VIEW A-A

SUB-ASSY 5

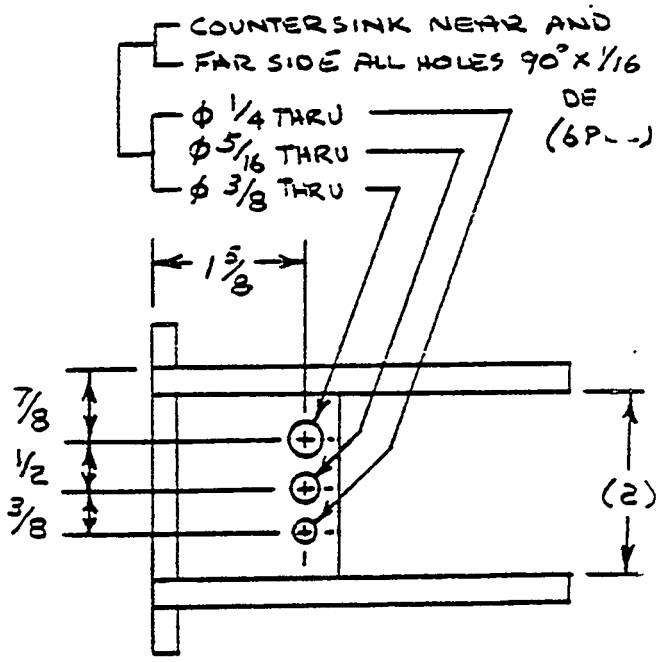
ALL MATERIAL IS ALUMINUM TYPE 6061-T6, ASTM-B-1



PLAN

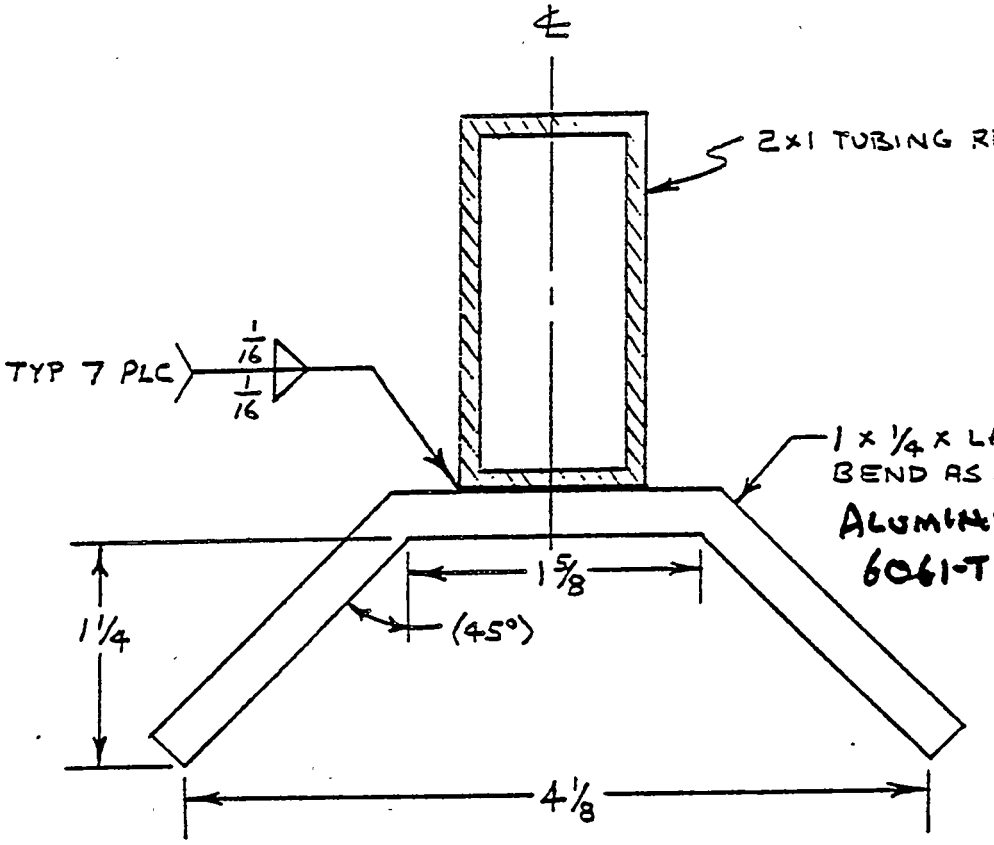


FRONT ELEVATION

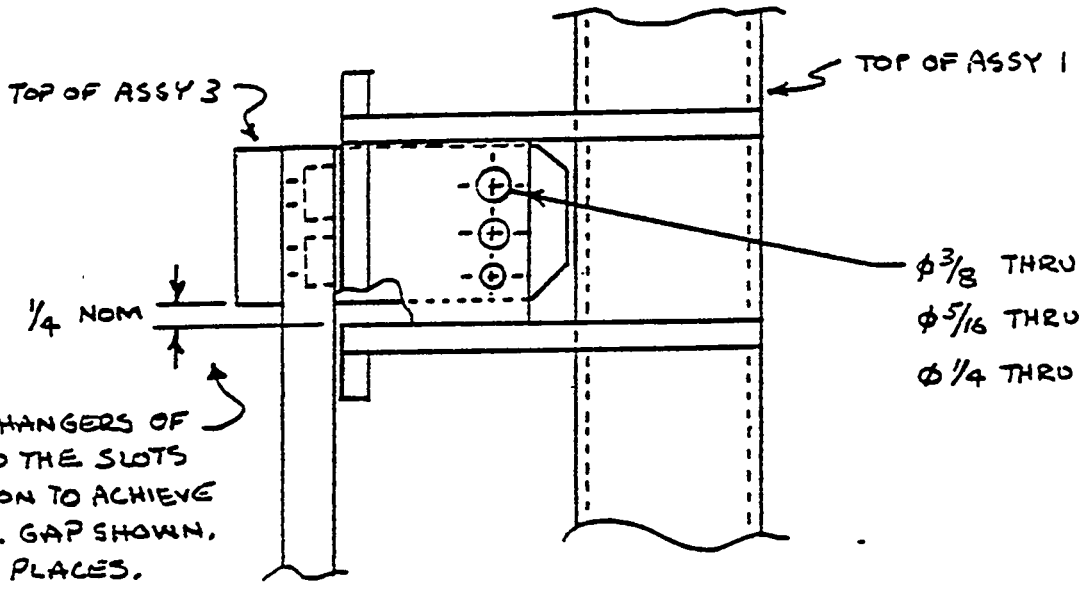


VIEW A-A

SUB-ASSY 6



SECTION B-B
SUB-ASSY 5



DETAIL 1
ASSEMBLY 1 & 3 SHOWN. ASSEMBLY 2 & 4 ARE OPPOSITE HAND AND HOLE ARGMT.

DESIGN CALCULATIONS

Drawing_____ Doc.No._____ Page_____ of_____
Building 2736-Z Rev._____ Job No._____
Subject Rooms 1,3,4 Plutonium Pedestals
Originator D. Barlow Date 2-15-95
Checker R A Hiller Date 2-24-95

EXTERIOR WALL MOUNTED PEDESTALS

Seismic Acceleration Loads

Ref: "Plutonium Vault Accelerations" (1/26/95), Carlton Moore (attached).

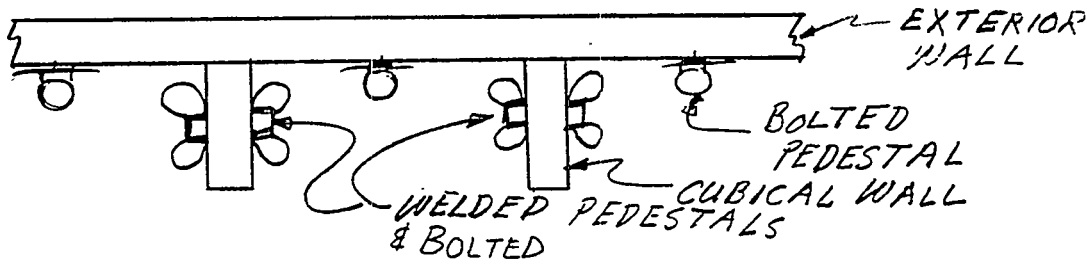
The peak horizontal accelerations are used for the "bolted" configuration pedestal analyses in both horizontal directions (0.755 g's). This is conservative. The vertical acceleration is 2/3 of the horizontal acceleration (2/3 x 0.755 = 0.503 g's).

For the "welded" pedestal configuration the horizontal acceleration corresponding to the natural frequency of the pedestal channels in each direction is used. Because the welded pedestals are attached to the cubical walls (see sketch below) that are attached perpendicular to the exterior walls, the normal-to-the-wall (Z) direction for the channel is actually in the plane of the exterior wall. The exterior wall response from the response chart is for the direction normal to the wall. Thus the Z direction response for the channels is better represented by the roof response. The cubical walls have been determined to be a rigid part of the exterior wall. So the Z acceleration is 0.32 g's from the roof line at 19 Hz. The lateral (X) direction acceleration is based on the "exterior wall" line on the response chart (0.315 g's at 36 Hz).

Pedestal Structural Properties

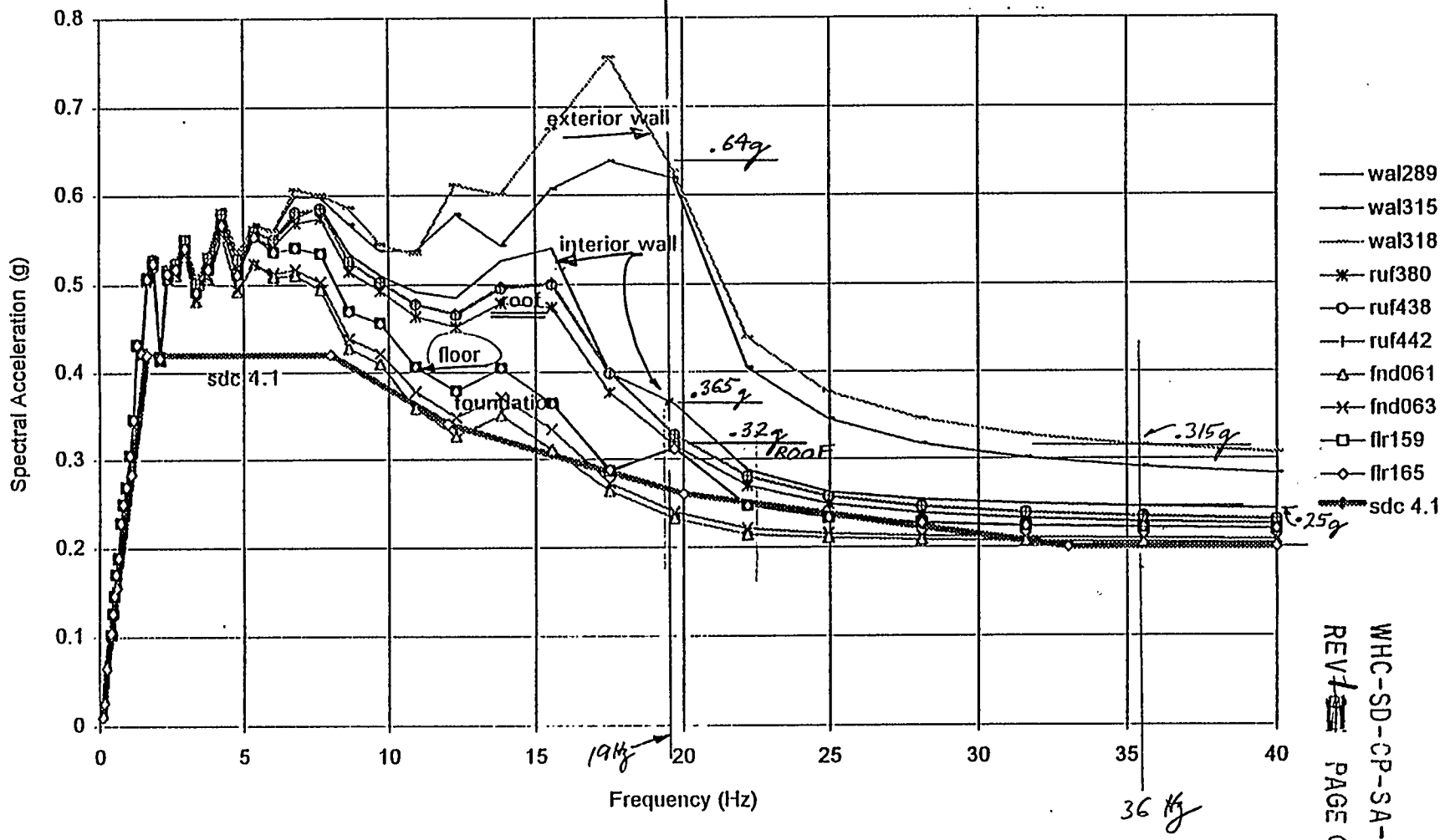
The same configurations of pedestals (bolted and welded) are used on the external walls as were used in the floor mounted cubicals. Thus the same structural properties are used with the exception of the welded channel metal thickness. The exterior wall calculations are done using a thickness of 0.0598 in. as opposed to the 0.63 in. thickness used in the floor mounted cubical section.. The 0.0598 in thickness corresponds more closely to the specified thickness of 16 ga. sheet metal. But the change is found to make no significant difference in the resulting calculations.

Sketch - Plan view of exterior wall cubicals



$f_c' = 3000 psi$

PLUTONIUM VAULT ACCELERATIONS
X HORIZONTAL 0.216 g, SDC 4.1 REV. 12, SEISMIC TIME HISTORY #1
ABSOLUTE SPECTRAL ACCELERATIONS AT NODAL PTS
0.050 DAMPING, MAX g = 0.755 AT FREQ. = 17.5 HZ
(1/26/95 CJM)



ANALYTICAL CALCULATIONS

Subject

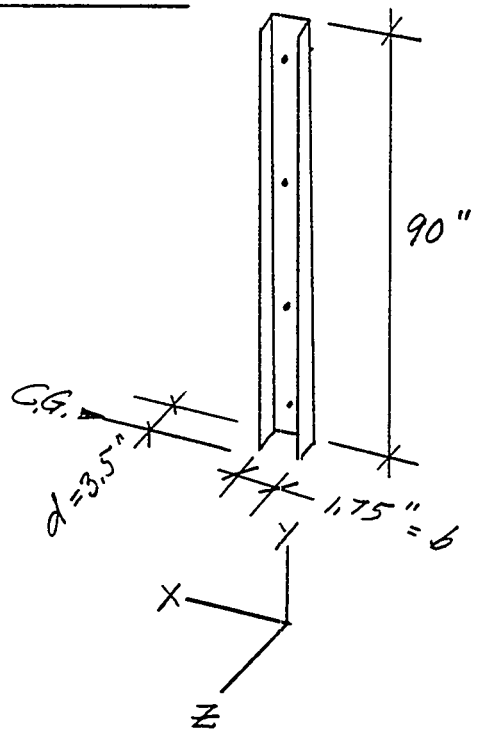
Originator D. BARLOW Date 2-15-95

Checker R.A. Miller Date 2-24-95

BOLTED PEDESTALS

THESE PEDESTALS CONSIST OF A UNISTRUT CHANNEL, WITH WELDED ON TRAYS, THAT IS ATTACHED TO THE WALL WITH 4 BOLTS. THE BOLTS ARE 3/8" DIA. THREADED RODS WITH A NUT. THE EMBEDDED PORTION OF THE ROD IS OF UNKNOWN QUALITY. LOAD TESTING IS THE ONLY WAY TO QUALIFY THE BOLTS. THE CHANNEL IS RIGID IN ALL DIRECTIONS.

GEOMETRY



MAX. DISTANCE BETWEEN BOLTS IS 30". = h

TOTAL WEIGHT = 188. LBS

ANALYTICAL CALCULATIONS

Page ____ of ____

Subject _____

Originator D. BARLOW Date 2-15-95

Checker RA Miller Date 2-24-95

BOLT LOADS

THE MAX. WALL ACCELERATION IS .755 g's. CONSERVATIVELY ASSUME 100% OF THE MAX. ACCELERATION IN EACH OF THE COORDINATE DIRECTIONS.

$FX = FZ = .755 \times 188.\# \times \frac{30''}{90''} = 48.\ \#/BOLT$

$FY = (1.+.503)\ 188 \times \frac{30''}{90''} = 94.\ \#/BOLT$

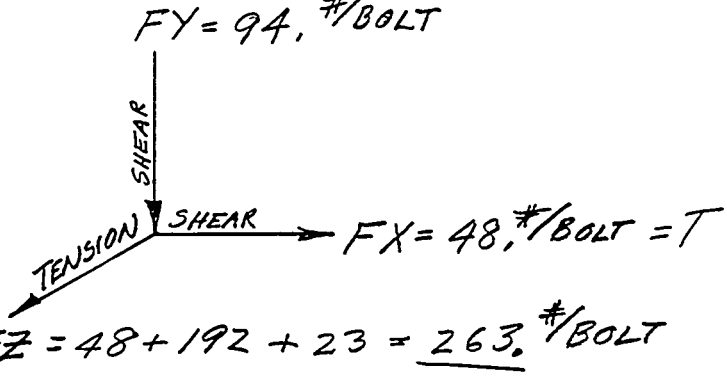
FZX (CAUSE BY FX PRYING)

$FZX = \frac{FX(d)}{b/2} = \frac{48.\#(3.5'')}{\frac{1.75''}{2}} = 192.\ \#/BOLT$

FZY (CAUSED BY FY OVERTURNING MOMENT)

$FZY = \frac{FY(d)}{h} = \frac{192.\#(3.5'')}{30.''} = 23.\ \#/BOLT$

LOAD SUMMARY:



$FZ = 48 + 192 + 23 = 263.\ \#/BOLT$

$SHEAR = V = \sqrt{48^2 + 94^2} = 106.\ \#/BOLT$

ANALYTICAL CALCULATIONS

Subject _____

Originator D. BARLOW. Date 2-15-95

Checker R A Hiller Date 2-24-95

BOLT CAPACITY

3/8" ϕ HKB

TENSION CAPACITY: $(.75)^2(1{,}100.^{\#}) = 618.^{\#}$/BOLT

SHEAR CAPACITY: $(.75 \times .95)(1{,}060^{\#}) = 755.^{\#}$/BOLT

*WHC-SD-DGS-30006, TABLE 4.3, p.4-31. ALSO p. 8-1 TO 8-16.

ACCEPTABILITY:

CRITERIA $I \leq 1.0$

ASSUME ONLY 3 OF THE 4 BOLTS CARRY ALL THE LOAD — TO COVER CONTINGENCIES.

$$I = \frac{4/3 \times 263}{618.} + \frac{4/3 \times 106.}{755.} = .75 < 1.0 \quad \text{(OK)}$$

$$MS = \frac{1}{.75} - 1 = .33$$

UNISTRUT STUD

3/8" DIA.

WORKING LOADS: $T = 1{,}000^{\#}$ $V = 500^{\#}$

$$I = \frac{4/3 \times 263}{1{,}000.} + \frac{4/3 \times 106}{500.} = .63 < 1.0 \quad \text{(OK)}$$

$$MS = \frac{1}{.63} - 1 = .57$$

ANALYTICAL CALCULATIONS

Page ____ of ____

Subject _____

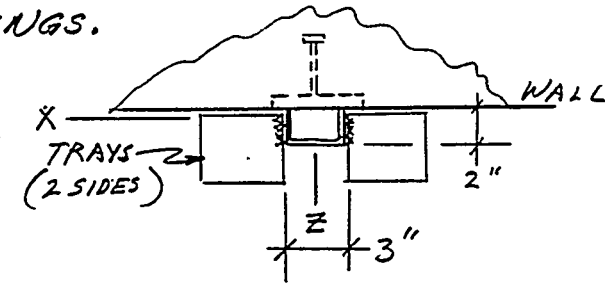
Originator D. BARLOW Date 2-15-95

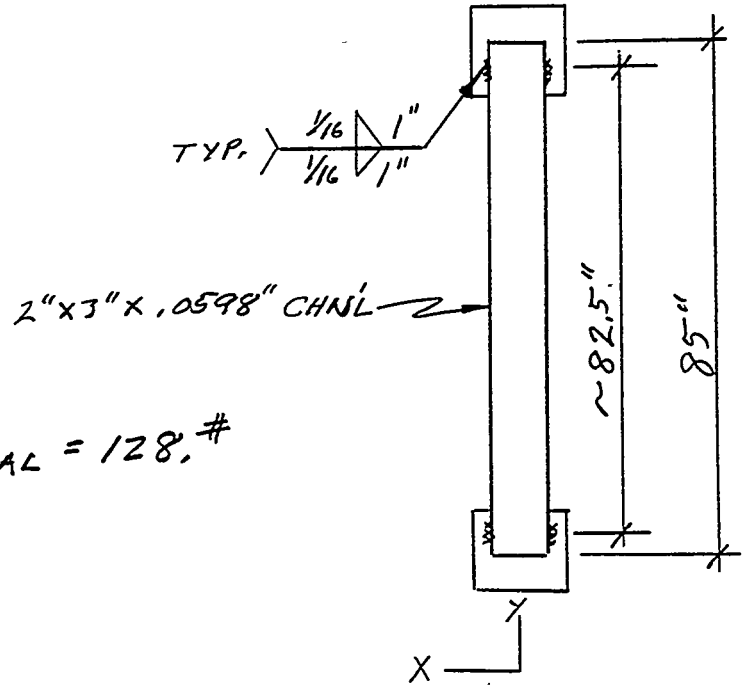
Checker R A Hill Date 2-24-95

WELDED PEDESTALS

THESE PEDESTALS CONSIST OF A FORMED SHEET METAL CHANNEL, WITH WELDED ON TRAYS, THAT IS WELDED TO A STEEL BASE PLATE AT EACH END. THE BASE PLATES ARE EMBEDDED IN THE CONCRETE WALL AND ATTACHED TO A CAST-IN-PLACE HEADED ANCHOR. THE CHANNELS ARE 16 ga (.0598" THK.) A-36 STEEL. THE PRECISE LOCATION OF THE ATTACHMENT WELDS IS NOT SPECIFIED ON THE DRAWINGS.

GEOMETRY





$W_{TOTAL} = 128.^{\#}$

ANALYTICAL CALCULATIONS

Page ____ of ____

Subject _____

Originator D. BARLOW Date 2-15-95

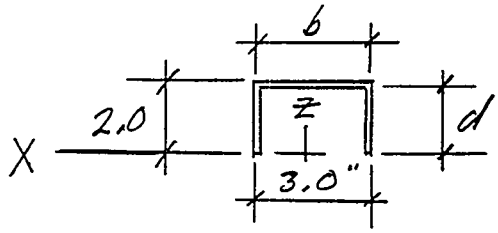
Checker RA Miller Date 2-24-95

BECAUSE THE WELD LOCATIONS ARE NOT SPECIFIED, THE WORST CASE IS ASSUMED WHERE THE ATTACHMENT WELDS MUST REACT THE FIXED END MOMENTS END BEAM MOMENTS CAUSED BY THE CHANNEL (MX).

CHANNEL SECTION PROPERTIES

16 ga = .0598" THK

2" DEEP x 3" WIDE CHANNEL



$b = 3.0 - .0598 = \underline{2.9402"}$

$d = 2.0 - \frac{.0598}{2} = \underline{1.9701"}$

$$I_X = \frac{t d^3 (2b+d)}{3(b+2d)} = \frac{(.0598)(1.9701)^3(2\times 2.9402 + 1.9701)}{3(2.9402 + 2\times 1.9701)}$$

$= \underline{0.1739 \text{ IN}^4}$

$$I_Z = \frac{t b^2}{12}[b + 6d] = \frac{(.0598)(2.9402)^2}{12}[2.9402 + 6\times 1.9701]$$

$= \underline{0.6359 \text{ IN}^4}$

NOTE THAT THESE I VALUES ARE ESSENTIALLY THE SAME AS THOSE FOR $t = .063"$ vs $t = .0598"$

Subject _____

Originator D. BARLOW Date 2-15-95

Checker R A Lillen Date 2-24-95

$$f_{nx} = \frac{A}{2\pi}\sqrt{\frac{EI_x}{\mu L^4}}$$ FIXED END BEAM

$A = 22.4$ FROM ATTACHED TABLE

$E = 30.E6$

$I_X = 0.1739$, $I_Z = .6359$

$\mu = .004$ (SEE PREVIOUS CALCS)

$L = 82.5"$

$$f_x = \frac{22.4}{2\pi}\sqrt{\frac{30E6 \times .1739}{.004 \times 82.5^4}} = \underline{18.9\ Hz} \sim 19\ Hz$$

$$f_z = \frac{22.4}{2\pi}\sqrt{\frac{30E6 \times .6359}{.004 \times 82.5^4}} = \underline{36.17\ Hz} \sim 36.\ Hz$$

ATTACHMENT LOADS ON WELDS

Z DIRECTION LOADS (WEAK AXIS)

COMBINE SEISMIC LOADS — Z = 100%, Y = X = 40%

MAX. HORIZONTAL ACCEL. = 0.32 g's AT 19. Hz

CHANNEL + CANS: $W_1 = 108.\#$

FLEXIBLE SECURITY BAR: $W_2 = 20\#$

$\Sigma W = \underline{128\#}$ TOTAL

ACCEL. FOR THE SECURITY BAR IS 0.68g

(1) Drawing _____ (2) Doc. No. _____ (3) Page ____ of ____
(4) Building _____ (5) Rev. _____ (6) Job No. _____
(7) Subject _____
(8) Originator D. BARLOW Date 2-15-95
(9) Checker RA Miller Date 2-24-95

(10) $FZ = AZ(\Sigma W) = (.32g \times 108.^{\#} + .68 \times 20^{\#}) = 48.^{\#}$
$= 24.^{\#}/END$

$MX_Z = \frac{FZ \times L}{12} = \frac{48.^{\#} \times 82.5"}{12} = 330."\#$

X DIRECTION LOADS (STRONG AXIS)

MAX. HORIZONTAL ACCEL. = 0.315g AT 36. Hz
THE FACTOR OF 40% IS APPLIED TO THE X DIR.
THUS, $AX = .4 \times .315g = 0.126g's$

$FX = AX(\Sigma W) = (.315g \times 108.^{\#} + .68g \times 20.^{\#})(.4) = 19.^{\#}$
$= 9.5^{\#}/END$

$MZ_X = \frac{FX \times L}{12} = \frac{19^{\#} \times 82.5"}{12} = 131."\#$

$MY_X = FX \times d = 9.5^{\#} \times 3.5" = 34."\#$

Y DIRECTION LOADS

MAX. VERTICAL ACCEL. $= (2/3)(.315g)(.4) = .084g$

$FY = AY(\Sigma W) = (2/3)(.315 \times 108^{\#} + .68 \times 20^{\#})(.4) = 13.^{\#}$
$= 6.5^{\#}/END$

DESIGN CALCULATION

(1) Drawing _____ (2) Doc. No. _____ (3) Page _____ of _____
(4) Building _____ (5) Rev. _____ (6) Job No. _____
(7) Subject _____
(8) Originator D. BARLOW Date 2-15-95
(9) Checker RA Rikke Date 2-24-95

(10) WELD LOADS (ONE END)

$FX = 6.5^{\#} + \frac{128^{\#}}{2} = 71.^{\#}$ VERT. SHEAR

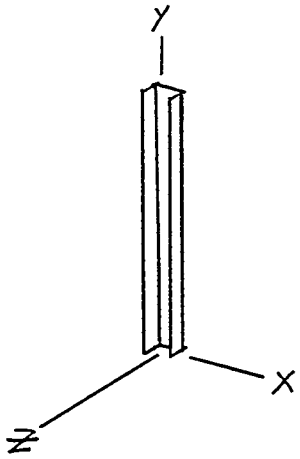
$FX = 9.5^{\#}$ HORIZ. SHEAR

$FZ = 24.^{\#}$ TENSION

$MX = 330.\ "\#$

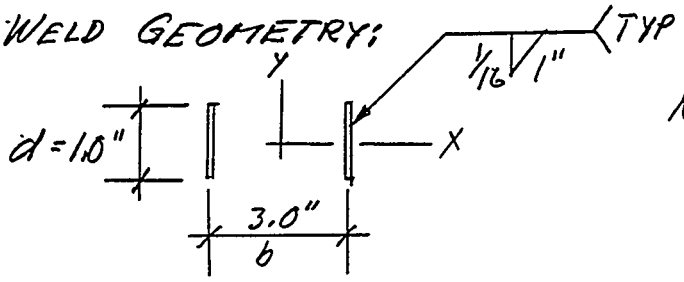
$MY = 34.\ "\#$

$MZ = 131.\ "\#$



WELD SIZE

WELD GEOMETRY:



NOTE: 1/16" FILLET DOES NOT MEET THE AISC MIN. WELD SIZE TABLE J2.4 SO SPECIAL PROCEDURES ARE REQUIRED.

$L = 2.\ "$

$S_X = \frac{d^2}{3} = \frac{1^2}{3} = .33$

$S_Y = bd = 3 \times 1 = 3.$

$J = \frac{d}{6}(3b^2 + d^2) = \frac{1}{6}(3 \times 3^2 + 1^2) = 4.67$

[BLODGETT, p. 7.4-7, TABLE 5.0]

(7) Subject _____

(8) Originator D. BARLOW Date 2-15-95

(9) Checker RA Miller Date 2-24-95

(10)

$$f_t = FZ + \frac{My}{Sy} + \frac{Mx}{Sx} = 24. + \frac{34.}{3} + \frac{330.}{.333} = \underline{1,026.\ \#/IN}$$

$$f_{VY} = \frac{FY}{L_W} + \frac{Mz\,r_y}{J_W} = \frac{71.}{2} + \frac{131 \times 1.5}{4.67} = \underline{49.\ \#/IN.}$$

$$f_{VX} = \frac{FX}{L_W} + \frac{Mz\,r_x}{J_W} = \frac{9.5}{2} + \frac{131. \times 1.5}{4.67} = \underline{47.\ \#/IN}$$

$$f_r = \sqrt{1,026.^2 + 49^2 + 47^2} = \underline{1,028.\ \#/IN.}$$

$$W_{req} = \frac{fr}{(.707)(.3Fu)(1.7)}\ * = \frac{1,028.}{(.707)(.3 \times 60.ksi)(1.7)} = \underline{0.0475"}$$

$0.0475" < 0.0625"$ (EXISTING WELD) (OK)

$$MS = \frac{.0625}{.0475} - 1 = \underline{.3153}$$ (OK)

* AISC

WELD METAL CHECK AT THROAT: TABLE J2.5, p. 5-70,

FILLET WELD: $\sigma \leq (.707)(.3\,Fu_{WELD})$

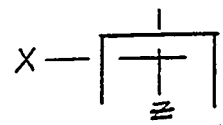
BASE METAL CHECK ON LEG: SECT. 4, p. 5-164

$\sigma \leq (.3\,Fu_{BASE})$

(1) Drawing _____ (2) Doc. No. _____ (3) Page 1 of 1
(4) Building _____ (5) Rev. _____ (6) Job No. _____
(7) Subject _____
(8) Originator D. BARLOW Date 2-15-95
(9) Checker R A Rillo Date 2-24-95

(10) CHANNEL STRESSES

$L = 82.5''$ BETWEEN FIXED ENDS



$$S_X = \frac{td^2(2b+d)}{3(b+d)} = \frac{.0598(1.9702)^2(2\times 2.9402 + 1.9702)}{3(2.9402+1.9702)}$$

$= .1237$ [BLODGETT, p. 2.2-8, TABLE 2]

$$S_Z = \frac{tb}{6}(b+6d) = \frac{(.0598)(2.9402)}{6}(2.9402 + 6\times 1.9702)$$

$= 0.4326$

THE MAX. BENDING MOMENTS OCCUR AT THE FIXED ENDS. BUT THE WALL PREVENTS BENDING ABOUT THE X AXIS THAT WOULD PUT THE CHANNEL FLANGES IN COMPRESSION. THUS THE MAX. COMPRESSION IN THE FLANGE WILL OCCUR AT THE CHANNEL MID-SPAN.

$MX_{MID} = \frac{1}{2} MX = \frac{1}{2}(330.) = 165''\#$

$MZ_{MID} = \frac{1}{2} MZ = \frac{131}{2} = 66.''\#$

$$\sigma = \frac{MX}{SX} + \frac{MZ}{SZ} + \frac{FY}{A} = \frac{165.}{.1237} + \frac{66.}{.4326} + \frac{71}{.4114} = 1659.\ PSI$$

$A = [2(1.9701) + 2.9402]\ .0598 = .4114\ IN^2$

$FY = 71.\#$ (ref p. 10)

(1) Drawing _____ (2) Doc. No. _____ (3) Page _____
(4) Building _____ (5) Rev. _____ (6) Job No. _____
(7) Subject _____
(8) Originator D. BARLOW Date 2-15-95
(9) Checker RA Miller Date 2-24-95

(10) WIDTH TO THICKNESS RATIO

$\frac{b_f}{t_f} = \frac{1.9701}{.0598} = 33.$

MAX. ALLOWABLE W/t RATIO FOR STEM OF TEES
IS $\frac{127}{\sqrt{F_y}} = \frac{127}{\sqrt{36.}} = 21.$ [AISC, SECT. 1.9.1.2]

$33 > 21$: THUS SEE SECT. C2.

WHEN $\frac{b}{t} \geq 176/\sqrt{36.} = 29.3$, THE:

$Q_3 = \frac{20,000}{F_y\left(\frac{b}{t}\right)^2} = \frac{29,000.}{36(33.)^2} = .5102$

ALLOWABLE FLANGE COMPRESSION:

$F_b' = .6 F_y Q_s = (.6)(36.)(.51) = 11.0$ ksi

$11.0 > 1.659$ (OK)

$\frac{11.}{1.659} - 1 = 5.6$ (OK)

COMPRESSION FLANGE WON'T BUCKLE.

DESIGN CALCULATION

(1) Drawing _____ (2) Doc. No. _____ (3) Page _____ of _____

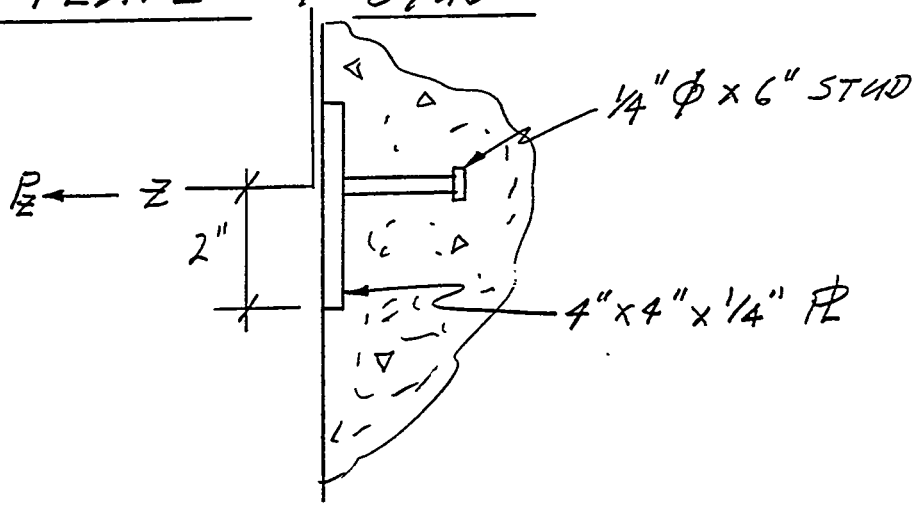
(4) Building _____ (5) Rev. _____ (6) Job No. _____

(7) Subject _____

(8) Originator D. BARLOW Date 2-15-95

(9) Checker RA Hille Date 2-24-95

(10) BASE PLATE Y STUD



PULLOUT (FZ)

$$P_Z = FZ + \frac{MX}{2} + \frac{MY}{2}$$

$$= 42. + \frac{569.}{2} + \frac{34.}{2} = 344.\ \#$$

SHEAR (FX, FZ)

$$V = \sqrt{9.5^2 + 42.^2} = 43\ \#$$

$$I = \frac{344}{1030} + \frac{43}{590} = .41 < 1.0$$ OK

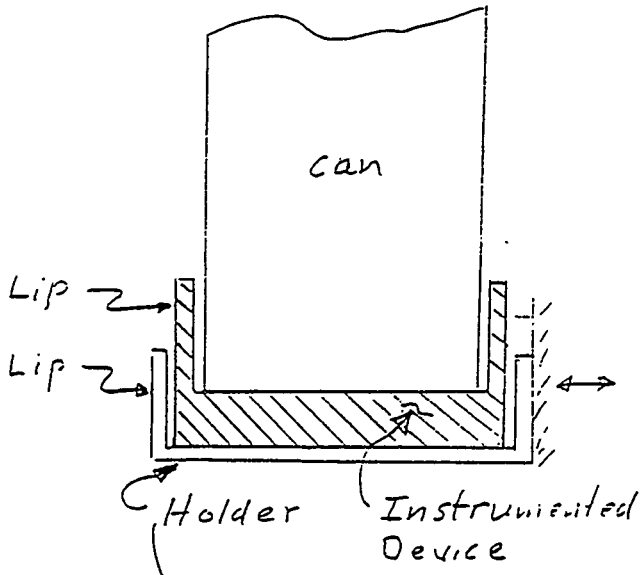
$$MS = \frac{1.0}{.41} - 1 = 1.4$$ OK

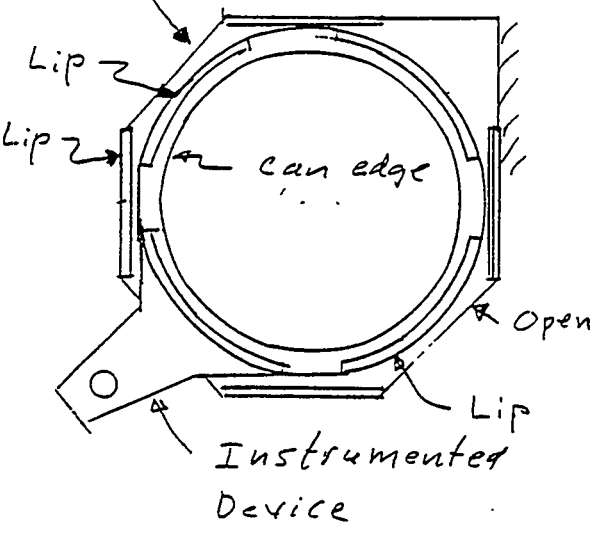
DESIGN CALCULATION

(1) Drawing _____ (2) Doc. No. _____ (3) Page _____ of _____
(4) Building _____ (5) Rev. _____ (6) Job No. _____
(7) Subject 2736-Z Cubicles - Can Holder Testing
(8) Originator E.O. Weiner Date 9-14-94
(9) Checker G.L. O'Connor Date 9-16-94
(THIS IS A RESOLUTION TO REVISION 0 REVIEW COMMENT #19)
(10)

Justification continues for the presence of an instrumented device (CMU) between the can and the holder. Photos suggest:

- The instrumented device lip height is at least that of the holder.
- The instrumented device fills in much of the can-holder rattle space
- The instrumented device lips cover the openings between those of the holder lips





Two possibilities are considered during a seismic event

1. The can pops out while the device remains in place.
2. The can and device pop out together as a unit

DESIGN CALCULATION

(1) Drawing _____ (2) Doc. No. _____ (3) Page _____ of _____

(4) Building _____ (5) Rev. _____ (6) Job No. _____

(7) Subject 2736 Cubicles - Door Amplification

(8) Originator E O Lerner Date 9/13/94

(9) Checker E C Ozone Date 9/14/94

(10)

Justification for SRSS combination of rigid and flexible responses is provide as follows. The two contributions are associated with widely separated frequencies. Rigid response is associated with 33 Hz, and flexible response must be associated with a much lower frequency, because the door closure system is clearly not rigid. The 6" opening between the two doors is covered with a perforated $\frac{1}{4}$" steel plate bolted to one door and latched to the other. If this system were considered rigid, it would not have been necessary to consider flexibility effects, and the 10% amplification derived above would be unnecessary.

(1) Drawing _____ (2) Doc. No. _____ (3) Page _____ of _____
(4) Building _____ (5) Rev. _____ (6) Job No. _____
(7) Subject 2736-Z Cubicles - Can Holder Testing
(8) Originator EO Weiner Date 9/14/94
(9) Checker G.C. O'Connor Date 9/16/94

(10)

In the first case, the excitation presented to the can is no more severe than the test configuration and the lip height is the same provided the can label (H-2-95165) stays with the can.

In the case, the tendency to pop out is analyzed by comparing the c.g. height to base diameter change to the remaining margin of safety. This conservatively ignores the take-up of rattlespace by the CMU.

$\Delta h_{c.g.}$ = 0.310 casting H-2-95161
+ 0.075 } scaled from ass'y H-2-95168
+ 0.190 }
+ 0.125 card H-2-95164
+ 0.250 label H2-95165
= 0.97"

Note that the remaining casting lip is

$$1.75 - 0.97 = 0.78"$$

so that the original can holder lip height of 1" is achieved by having the 0.25" label stay with the can (note, however, little rattlespace remains between the casting lip and can). Weight of the CMU is estimated from the aluminum casting (H-2-95161):

(1) Drawing _____ (2) Doc. No. _____ (3) Page _____ of _____
(4) Building _____ (5) Rev. _____ (6) Job No. _____
(7) Subject 2736-Z Cubicles - Can Holder
(8) Originator E.O. Loewen Date 9/14/94
(9) Checker E.E. Oconnor Date 9/16/94

(10)

$$\text{Volume} = \pi \times 1.6^2 \times .06 + 2\pi \times \frac{1.6+2.3}{2}(2.3-1.6)(.31-.06) + 2\pi \times 2.1 \times .4 \times (.575-.31) + 2\pi^{**} \times 2.25\,(1.75-.58)\,.15$$

$$= .48 + 2.14 + 1.37 + 2.48 = 6.5\ in^3$$

Note: ** slots in casting lip are compensated by the weight of other components

$$\text{Weight} = 6.5 \times 0.11 = .71^{\#} = .32\ kg$$

Can weight = 2.2 kg

From holder up: (est CMU c.g., can c.g.)

$$h_{c.g.} = \frac{0.6 \times 0.32 + 3.57 \times 2.2}{2.2 + .32} = 3.54"$$

Can dia: 3.9" CMU Dia: 4.2" (min)
Can ht: 6.0"
∴ Change in hcg/D is

$$\frac{\Delta(hcg/D)}{hcg/D} = \frac{\frac{3.54}{4.2} - \frac{3.00}{3.9}}{\frac{3.00}{3.9}} = 0.10$$

The remaining margin is

$$MS = 0.26 - 0.10 = 0.16$$

ANALYTICAL CALCULATIONS

Subject _____

Originator RA Gilbert Date 4-27-95

Checker MA. ISLAM Date 4/27/95

Objective:

Evaluate the floor mounted cubicles of the 2736Z building as Safety Class 1 structures, systems and components (SSC) for the assumed weld details. These cubicles are attached to building walls with connections different than shown on the available drawings (some welds are missing).

Criteria:

The U.S. Department of Energy design criteria documents to be used in the evaluation of Safety Class 1 components are as follows:

DOE Order 6430.1A	General design Criteria.
UCRL-15910	Design and Evaluation Guidelines for Department of Energy Facilities Subjected to Natural Phenomena.
SDC-4.1	Site Design Criteria.

The design code used in this evaluation in conjunction with the listed criteria documents is as follows:

ACI-349-90	Code requirements for Nuclear Safety related Concrete structures.

Given:

Given, the dimensions and material properties as shown on the design drawings of the building and cubicles. These drawings show two types of cubicles, an old type cubical in rooms 3 and 4, and a new type cubicle in rooms 1 and 2. Field walkdown verified the arrangements in rooms 1, 3, and 4 but found that room 2 has no cubicles; racks were found in their place.

Also the welds shown on the drawings do not reflect exactly what was found during the field walkdowns. See calculations for the welded conditions to be analyzed.

Old type; drawings H-2-26651 and H-2-26654

New type; drawings H-2-70010 and H-2-70011.

ANALYTICAL CALCULATIONS

Subject _____

Originator RA Hill Date 4-27-95

Checker MA ISLAM Date 4/27/95

Assumptions:

The main assumption is that concrete and steel strengths are the specified values shown on the design drawings. This assumption is supported by field walkdown of the structures. This field walkdown found no visual deterioration of the concrete members such as cracks, spalls, or surface defects. Steel members also were without surface rust or defects.

Method:

This analysis assumes that some welds are missing at the floor level where the cubicle "common wall" (panels G in rooms 3 & 4, and panels B & F in room 1) is attached to the floor.

Case 1 assumes that 4 out of the 9 floor connection points (every other floor connection) is missing which moves the loads and reactions to the other support points.

Case 2 assumes that 4 out of 9 floor connection points are missing including 2 in a row.

Case 3 assumes that only the two end panels have connection welds.

References:

Previous safety class 3 over 1 seismic cubicle analysis, WHC-SD-CP-SA-026.

Seismic Verification of Equipment Anchorage, June 1991, EPRI NP-5228-SL, R1, V3.

ACI-349-90 Code Requirements for Nuclear Safety related concrete structures.

Design of Welded Structures, by Omer Blodgett, sections on impact design.

Bechtel Topical Report, BC-TOP-9, 1974, Design of Structures for Missile impact.

ANALYTICAL CALCULATIONS

Subject _____

Originator R A Gilla Date 4-27-95

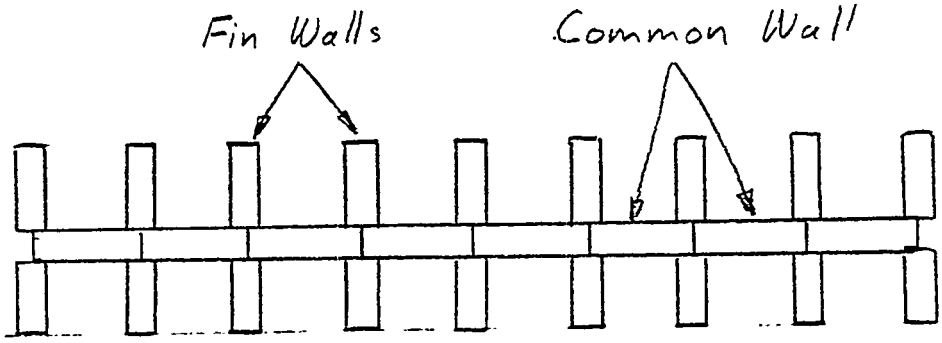
Checker M A ISLAM Date 4/27/95

Conclusions:

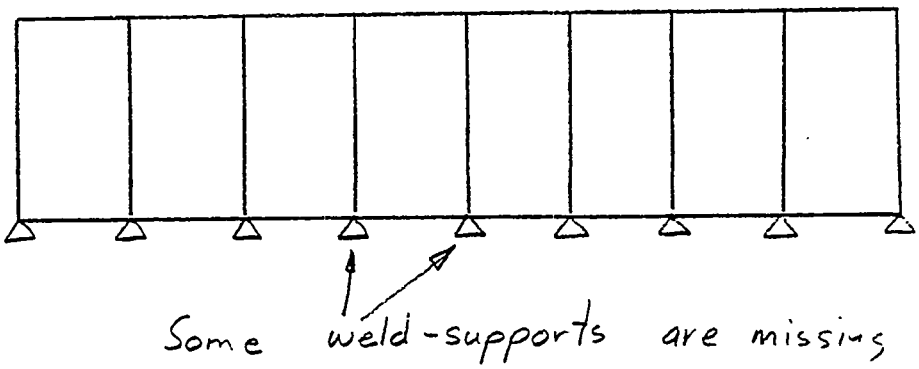
This analysis evaluates the floor mounted cubicles in 2736Z rooms 1, 3 and 4; where welds are missing. The welds in question are located at the floor level where the cubicle common wall intersects with and connects to the cubicle fin walls.

Case 1 and case 2 have acceptable stress levels, but case 3 shows an overstressed condition. This indicates that if more than half of the cubicle floor welds exist at the common wall to fin wall location; then the cubicles are acceptable. Also, if more than 2 panels in a row or if less than half of the welds exist; then this analysis is not valid.

Field walkdown of random cubicles indicate that some bottom welds are missing but that most welds (more than half of all welds) do exist.



PLAN

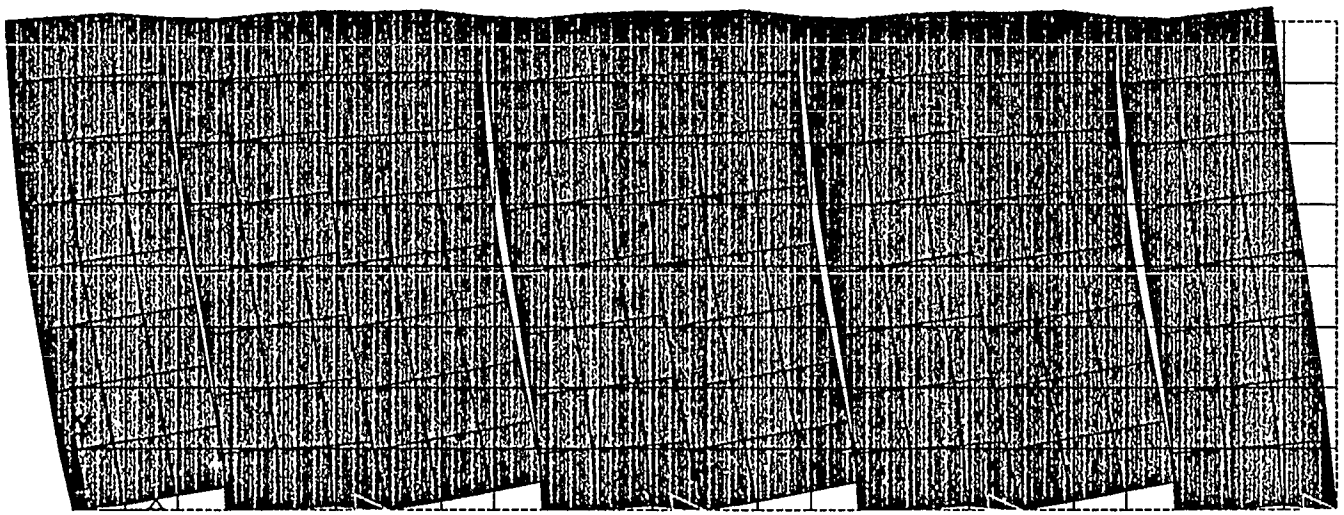


Missing Welds, Case 1

pg C 389

LIST CONSTRAINTS FOR SELECTED NODES 1 TO 352 BY 1
CURRENTLY SELECTED DOF SET= UX UY UZ

NODE	LABEL	REAL	IMAG
1	UX	0.000000000E+00	0.000000000E+00
1	UY	0.000000000E+00	0.000000000E+00
6	UY	0.000000000E+00	0.000000000E+00
6	UY	0.000000000E+00	0.000000000E+00
8	UX	0.000000000E+00	0.000000000E+00
8	UY	0.000000000E+00	0.000000000E+00
9	UX	0.000000000E+00	0.000000000E+00
9	UY	0.000000000E+00	0.000000000E+00
13	UY	0.000000000E+00	0.000000000E+00
14	UY	0.000000000E+00	0.000000000E+00
16	UX	0.000000000E+00	0.000000000E+00
16	UY	0.000000000E+00	0.000000000E+00
17	UX	0.000000000E+00	0.000000000E+00
17	UY	0.000000000E+00	0.000000000E+00
21	UY	0.000000000E+00	0.000000000E+00
22	UY	0.000000000E+00	0.000000000E+00
24	UX	0.000000000E+00	0.000000000E+00
24	UY	0.000000000E+00	0.000000000E+00
25	UX	0.000000000E+00	0.000000000E+00
25	UY	0.000000000E+00	0.000000000E+00
29	UY	0.000000000E+00	0.000000000E+00
30	UY	0.000000000E+00	0.000000000E+00
32	UX	0.000000000E+00	0.000000000E+00
32	UY	0.000000000E+00	0.000000000E+00



ANSYS 5.0 A
APR 27 1995
07:52:53
PLOT NO. 1
DISPLACEMENT
STEP=1
SUB =1
TIME=1
RSYS=0
DMX =0.012754
SEPC=38.224

DSCA=1095
ZV =1
DIST=147.383
XF =120.015
YF =49.95
CENTROID HIDDEN

Pg C 391

PRINT U NODAL SOLUTION PER NODE

***** POST1 NODAL DEGREE OF FREEDOM LISTING *****

THE FOLLOWING DEGREE OF FREEDOM RESULTS ARE IN GLOBAL COORDINATES

NODE	UX
1	0.00000E+00
2	-0.37994E-03
3	-0.45279E-03
4	-0.45871E-03
5	-0.84925E-03
6	-0.63247E-03
7	-0.45736E-03
8	0.00000E+00
9	0.00000E+00
10	-0.48625E-03

321	-0.12754E-01
322	-0.12697E-01
323	-0.12433E-01
324	-0.11979E-01
325	-0.11979E-01
326	-0.12142E-01
327	-0.12227E-01
328	-0.12166E-01
329	-0.12166E-01
330	-0.12225E-01
331	-0.12033E-01
332	-0.11601E-01
333	-0.11601E-01
334	-0.11815E-01
335	-0.11939E-01
336	-0.11918E-01
337	-0.11918E-01
338	-0.12008E-01
339	-0.11842E-01
340	-0.11444E-01
341	-0.11444E-01
342	-0.11681E-01
343	-0.11822E-01
344	-0.11824E-01
345	-0.11824E-01
346	-0.11933E-01
347	-0.11782E-01
348	-0.11406E-01
349	-0.11406E-01
350	-0.11655E-01
351	-0.11838E-01
352	-0.11882E-01

MAXIMUM VALUES
NODE 321
VALUE -0.12754E-01

PRINT REACTION SOLUTIONS PER NODE

***** POST1 TOTAL REACTION SOLUTION LISTING *****

P9 C 392

THE FOLLOWING X,Y,Z SOLUTIONS ARE IN GLOBAL COORDINATES

NODE	FX	FY	FZ
1	7126.2	8741.1	
5		6974.8	
6		2817.2	
8	10024.	-15553.	
9	7312.3	6329.8	
13		6782.1	
14		2471.3	
16	10071.	-15660.	
17	7261.7	6252.0	
21		6712.1	
22		2450.0	
24	9993.4	-15506.	
25	7179.6	6092.5	
29		5832.6	
30		839.11	
32	9271.8	-15576.	

TOTAL VALUES
VALUE 68240. -0.20555E-09 0.00000E+00

PRINT S NODAL SOLUTION PER NODE

***** POST1 NODAL STRESS LISTING *****

NODE	SX	SY	SZ	SXY	SYZ	SXZ
MINIMUM VALUES						
NODE	9	332	1	16	1	1
VALUE	-157.38	-301.50	0.00000E+00	-91.308	0.00000E+00	0.00000E+00
MAXIMUM VALUES						
NODE	16	32	1	322	1	1
VALUE	187.63	410.82	0.00000E+00	17.706	0.00000E+00	0.00000E+00

***** ESTIMATED BOUNDS CONSIDERING THE EFFECT OF DISCRETIZATION ERROR *****

MINIMUM VALUES						
NODE	9	332	16	16	16	16
VALUE	-224.48	-355.45	0.00000E+00	-217.37	0.00000E+00	0.00000E+00
MAXIMUM VALUES						
NODE	16	32	16	112	16	16
VALUE	313.69	535.76	0.00000E+00	70.193	0.00000E+00	0.00000E+00

****

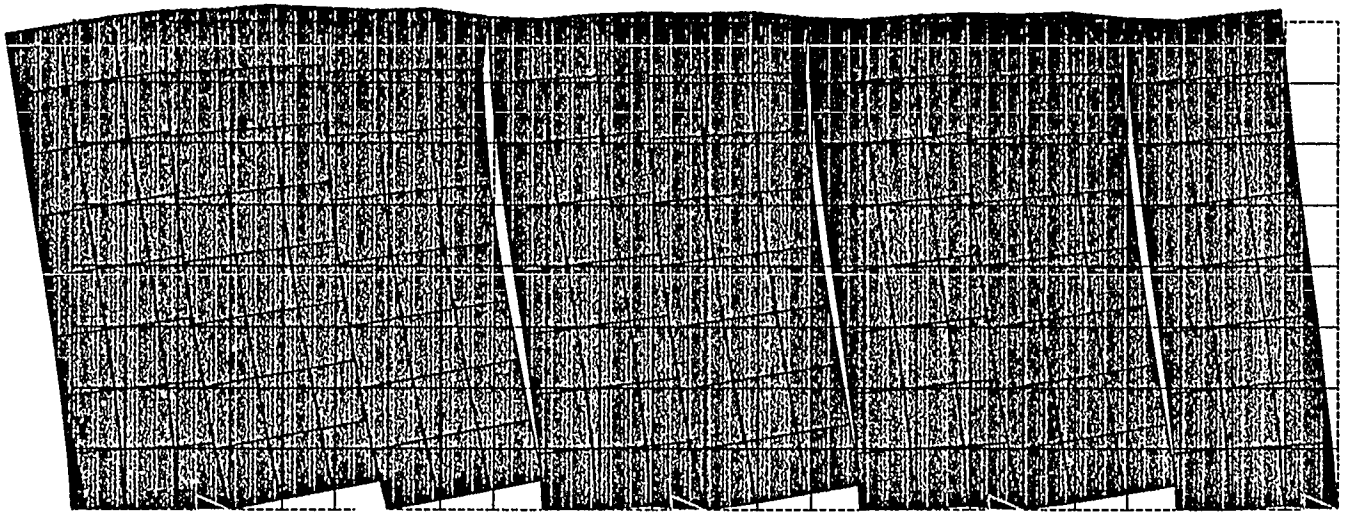
***** ENTER HELP,ERROR FOR AN EXPLANATION OF ANSYS ERROR ESTIMATION *****

Missing Welds, Case 2

Pg C 393

LIST CONSTRAINTS FOR SELECTED NODES 1 TO 352 BY 1
CURRENTLY SELECTED DOF SET= UX UY UZ

NODE	LABEL	REAL	IMAG
1	UX	0.000000000E+00	0.000000000E+00
1	UY	0.000000000E+00	0.000000000E+00
2	UY	0.000000000E+00	0.000000000E+00
4	UX	0.000000000E+00	0.000000000E+00
4	UY	0.000000000E+00	0.000000000E+00
5	UX	0.000000000E+00	0.000000000E+00
5	UY	0.000000000E+00	0.000000000E+00
9	UX	0.000000000E+00	0.000000000E+00
9	UY	0.000000000E+00	0.000000000E+00
13	UY	0.000000000E+00	0.000000000E+00
14	UY	0.000000000E+00	0.000000000E+00
16	UX	0.000000000E+00	0.000000000E+00
16	UY	0.000000000E+00	0.000000000E+00
17	UX	0.000000000E+00	0.000000000E+00
17	UY	0.000000000E+00	0.000000000E+00
21	UY	0.000000000E+00	0.000000000E+00
22	UY	0.000000000E+00	0.000000000E+00
24	UX	0.000000000E+00	0.000000000E+00
24	UY	0.000000000E+00	0.000000000E+00
25	UX	0.000000000E+00	0.000000000E+00
25	UY	0.000000000E+00	0.000000000E+00
29	UY	0.000000000E+00	0.000000000E+00
32	UX	0.000000000E+00	0.000000000E+00
32	UY	0.000000000E+00	0.000000000E+00



ANSYS 5.0 A
APR 27 1995
08:16:31
PLOT NO. 2
DISPLACEMENT
STEP=1
SUB =1
TIME=1
RSYS=0
DMX =0.015101
SEPC=36.808

DSCA=925.094
ZV =1
DIST=147.253
XF =120.134
YF =49.978
CENTROID HIDDEN

pg C 395

PRINT U NODAL SOLUTION PER NODE

***** POST1 NODAL DEGREE OF FREEDOM LISTING *****

THE FOLLOWING DEGREE OF FREEDOM RESULTS ARE IN GLOBAL COORDINATES

NODE	UX	UY	UZ	USUM
1	0.00000E+00	0.00000E+00	0.00000E+00	0.00000E+00
2	-0.61406E-04	0.00000E+00	0.00000E+00	0.61406E-04
3	-0.84529E-04	0.60455E-03	0.00000E+00	0.61043E-03
4	0.00000E+00	0.00000E+00	0.00000E+00	0.00000E+00
5	0.00000E+00	0.00000E+00	0.00000E+00	0.00000E+00
6	-0.48644E-03	0.21433E-02	0.00000E+00	0.21979E-02
7	-0.65370E-03	0.42532E-02	0.00000E+00	0.43031E-02
8	-0.68184E-03	0.63833E-02	0.00000E+00	0.64196E-02
9	0.00000E+00	0.00000E+00	0.00000E+00	0.00000E+00
10	-0.57706E-03	0.19912E-02	0.00000E+00	0.20731E-02
321	-0.14845E-01	-0.27698E-02	0.00000E+00	0.15101E-01
322	-0.14829E-01	-0.96978E-03	0.00000E+00	0.14861E-01
323	-0.14769E-01	0.82967E-03	0.00000E+00	0.14792E-01
324	-0.14681E-01	0.22437E-02	0.00000E+00	0.14851E-01
325	-0.14681E-01	0.22437E-02	0.00000E+00	0.14851E-01
326	-0.14729E-01	0.25592E-02	0.00000E+00	0.14950E-01
327	-0.14562E-01	0.33033E-02	0.00000E+00	0.14932E-01
328	-0.14136E-01	0.29586E-02	0.00000E+00	0.14443E-01
329	-0.14136E-01	0.29586E-02	0.00000E+00	0.14443E-01
330	-0.14029E-01	0.24985E-02	0.00000E+00	0.14250E-01
331	-0.13687E-01	0.27707E-02	0.00000E+00	0.13964E-01
332	-0.13002E-01	0.10465E-02	0.00000E+00	0.13044E-01
333	-0.13002E-01	0.10465E-02	0.00000E+00	0.13044E-01
334	-0.13095E-01	0.53642E-03	0.00000E+00	0.13106E-01
335	-0.13139E-01	0.15240E-02	0.00000E+00	0.13227E-01
336	-0.12991E-01	0.19048E-02	0.00000E+00	0.13129E-01
337	-0.12991E-01	0.19048E-02	0.00000E+00	0.13129E-01
338	-0.12989E-01	0.17707E-02	0.00000E+00	0.13110E-01
339	-0.12745E-01	0.21606E-02	0.00000E+00	0.12927E-01
340	-0.12237E-01	0.86340E-03	0.00000E+00	0.12267E-01
341	-0.12237E-01	0.86340E-03	0.00000E+00	0.12267E-01
342	-0.12421E-01	0.41783E-03	0.00000E+00	0.12428E-01
343	-0.12527E-01	0.13779E-02	0.00000E+00	0.12603E-01
344	-0.12477E-01	0.18506E-02	0.00000E+00	0.12613E-01
345	-0.12477E-01	0.18506E-02	0.00000E+00	0.12613E-01
346	-0.12555E-01	0.16942E-02	0.00000E+00	0.12668E-01
347	-0.12375E-01	0.20783E-02	0.00000E+00	0.12548E-01
348	-0.11956E-01	0.90477E-03	0.00000E+00	0.11990E-01
349	-0.11956E-01	0.90477E-03	0.00000E+00	0.11990E-01
350	-0.12206E-01	0.60375E-03	0.00000E+00	0.12221E-01
351	-0.12395E-01	0.16833E-02	0.00000E+00	0.12509E-01
352	-0.12440E-01	0.27433E-02	0.00000E+00	0.12739E-01

MAXIMUM VALUES				
NODE	321	8	0	321
VALUE	-0.14845E-01	0.63833E-02	0.00000E+00	0.15101E-01

p9 C 396

PRINT REACTION SOLUTIONS PER NODE

***** POST1 TOTAL REACTION SOLUTION LISTING *****

THE FOLLOWING X,Y,Z SOLUTIONS ARE IN GLOBAL COORDINATES

NODE	FX	FY	FZ
1	3510.5	9839.2	
2		4910.3	
4	5046.6	-12185.	
5	6129.0	3130.0	
9	7946.4	5552.5	
13		7337.5	
14		2311.8	
16	10853.	-17421.	
17	7527.1	6491.0	
21		7061.0	
22		2490.2	
24	10382.	-16366.	
25	7370.6	6336.1	
29		6431.1	
32	9475.7	-15919.	

TOTAL VALUES
VALUE 68240. -0.94224E-09 0.00000E+00

PRINT S NODAL SOLUTION PER NODE

THE FOLLOWING X,Y,Z VALUES ARE IN GLOBAL COORDINATES

NODE	SX	SY	SZ	SXY	SYZ	SXZ
MINIMUM VALUES						
NODE	9	332	1	16	1	1
VALUE	-179.16	-376.56	0.00000E+00	-100.44	0.00000E+00	0.00000E+00
MAXIMUM VALUES						
NODE	16	16	1	346	1	1
VALUE	198.71	456.39	0.00000E+00	16.649	0.00000E+00	0.00000E+00

***** ESTIMATED BOUNDS CONSIDERING THE EFFECT OF DISCRETIZATION ERROR *****

MINIMUM VALUES						
NODE	9	332	56	16	56	56
VALUE	-244.06	-440.93	0.00000E+00	-240.37	0.00000E+00	0.00000E+00
MAXIMUM VALUES						
NODE	16	16	56	96	56	56
VALUE	338.64	596.32	0.00000E+00	77.196	0.00000E+00	0.00000E+00

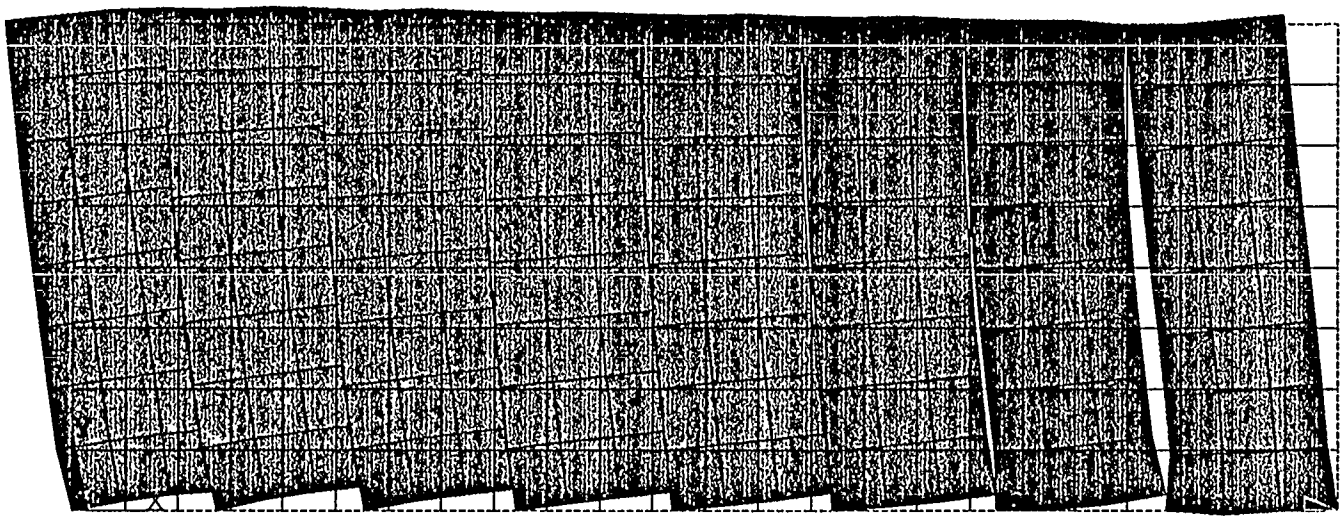
****

***** ENTER HELP,ERROR FOR AN EXPLANATION OF ANSYS ERROR ESTIMATION *****

Missing Welds, Case 3

LIST CONSTRAINTS FOR SELECTED NODES 1 TO 352 BY 1
CURRENTLY SELECTED DOF SET= UX UY UZ

NODE	LABEL	REAL	IMAG
1	UX	0.000000000E+00	0.000000000E+00
1	UY	0.000000000E+00	0.000000000E+00
5	UY	0.000000000E+00	0.000000000E+00
9	UY	0.000000000E+00	0.000000000E+00
13	UY	0.000000000E+00	0.000000000E+00
17	UY	0.000000000E+00	0.000000000E+00
21	UY	0.000000000E+00	0.000000000E+00
25	UY	0.000000000E+00	0.000000000E+00
29	UY	0.000000000E+00	0.000000000E+00
32	UX	0.000000000E+00	0.000000000E+00
32	UY	0.000000000E+00	0.000000000E+00



ANSYS 5.0 A
APR 27 1995
08:23:12
PLOT NO. 3
DISPLACEMENT
STEP=1
SUB =1
TIME=1
RSYS=0
DMX =0.036569
SEPC=33.239

DSCA=382.021
ZV =1
DIST=147.315
XF =120.078
YF =49.705
CENTROID HIDDEN

C 398

pg C399

PRINT U NODAL SOLUTION PER NODE

***** POST1 NODAL DEGREE OF FREEDOM LISTING *****

THE FOLLOWING DEGREE OF FREEDOM RESULTS ARE IN GLOBAL COORDINATES

NODE	UX	UY	UZ	USUM
1	0.00000E+00	0.00000E+00	0.00000E+00	0.00000E+00
2	-0.27821E-02	0.45248E-02	0.00000E+00	0.53117E-02
3	-0.46374E-02	0.82984E-02	0.00000E+00	0.95062E-02
4	-0.70487E-02	0.10251E-01	0.00000E+00	0.12441E-01
5	-0.70487E-02	0.00000E+00	0.00000E+00	0.70487E-02
6	-0.94074E-02	0.58777E-02	0.00000E+00	0.11093E-01
7	-0.10906E-01	0.98789E-02	0.00000E+00	0.14715E-01
8	-0.12541E-01	0.12733E-01	0.00000E+00	0.17872E-01
9	-0.12541E-01	0.00000E+00	0.00000E+00	0.12541E-01
10	-0.14132E-01	0.50190E-02	0.00000E+00	0.14997E-01
321	-0.36241E-01	0.93727E-03	0.00000E+00	0.36253E-01
322	-0.36176E-01	0.37493E-02	0.00000E+00	0.36370E-01
323	-0.35885E-01	0.65986E-02	0.00000E+00	0.36487E-01
324	-0.35420E-01	0.76605E-02	0.00000E+00	0.36239E-01
325	-0.35420E-01	0.76605E-02	0.00000E+00	0.36239E-01
326	-0.35706E-01	0.70605E-02	0.00000E+00	0.36397E-01
327	-0.35638E-01	0.81994E-02	0.00000E+00	0.36569E-01
328	-0.35170E-01	0.74691E-02	0.00000E+00	0.35955E-01
329	-0.35170E-01	0.74691E-02	0.00000E+00	0.35955E-01
330	-0.35395E-01	0.64481E-02	0.00000E+00	0.35978E-01
331	-0.35298E-01	0.71060E-02	0.00000E+00	0.36006E-01
332	-0.34775E-01	0.60735E-02	0.00000E+00	0.35301E-01
333	-0.34775E-01	0.60735E-02	0.00000E+00	0.35301E-01
334	-0.34814E-01	0.52812E-02	0.00000E+00	0.35213E-01
335	-0.34596E-01	0.57951E-02	0.00000E+00	0.35078E-01
336	-0.33945E-01	0.47055E-02	0.00000E+00	0.34270E-01
337	-0.33945E-01	0.47055E-02	0.00000E+00	0.34270E-01
338	-0.33764E-01	0.42287E-02	0.00000E+00	0.34028E-01
339	-0.33388E-01	0.47153E-02	0.00000E+00	0.33720E-01
340	-0.32560E-01	0.35158E-02	0.00000E+00	0.32749E-01
341	-0.32560E-01	0.35158E-02	0.00000E+00	0.32749E-01
342	-0.32179E-01	0.32383E-02	0.00000E+00	0.32341E-01
343	-0.31638E-01	0.37376E-02	0.00000E+00	0.31858E-01
344	-0.30617E-01	0.21811E-02	0.00000E+00	0.30694E-01
345	-0.30617E-01	0.21811E-02	0.00000E+00	0.30694E-01
346	-0.30157E-01	0.16268E-02	0.00000E+00	0.30201E-01
347	-0.29476E-01	0.20570E-02	0.00000E+00	0.29548E-01
348	-0.28308E-01	-0.75628E-03	0.00000E+00	0.28318E-01
349	-0.28308E-01	-0.75628E-03	0.00000E+00	0.28318E-01
350	-0.28455E-01	-0.49976E-03	0.00000E+00	0.28459E-01
351	-0.28682E-01	0.21127E-02	0.00000E+00	0.28760E-01
352	-0.28744E-01	0.47015E-02	0.00000E+00	0.29126E-01

MAXIMUM VALUES

NODE	321	88	0	327
VALUE	-0.36241E-01	0.13338E-01	0.00000E+00	0.36569E-01

P3 C400

PRINT REACTION SOLUTIONS PER NODE

***** POST1 TOTAL REACTION SOLUTION LISTING *****

THE FOLLOWING X,Y,Z SOLUTIONS ARE IN GLOBAL COORDINATES

NODE	FX	FY	FZ
1	30882.	11260.	
5		-61.059	
9		-1781.6	
13		-1370.6	
17		-329.42	
21		1833.9	
25		8588.1	
29		10768.	
32	37359.	-28908.	

TOTAL VALUES
VALUE 68240. -0.81855E-09 0.00000E+00

PRINT S NODAL SOLUTION PER NODE

***** POST1 NODAL STRESS LISTING *****

THE FOLLOWING X,Y,Z VALUES ARE IN GLOBAL COORDINATES

NODE	SX	SY	SZ	SXY	SYZ	SXZ
MINIMUM VALUES						
NODE	1	348	1	32	1	1
VALUE	-817.98	-604.70	0.00000E+00	-213.48	0.00000E+00	0.00000E+00
MAXIMUM VALUES						
NODE	32	32	1	4	1	1
VALUE	904.38	646.04	0.00000E+00	59.825	0.00000E+00	0.00000E+00

***** ESTIMATED BOUNDS CONSIDERING THE EFFECT OF DISCRETIZATION ERROR *****

NODE	SX	SY	SZ	SXY	SYZ	SXZ
MINIMUM VALUES						
NODE	1	348	32	32	32	32
VALUE	-954.27	-715.60	0.00000E+00	-442.13	0.00000E+00	0.00000E+00
MAXIMUM VALUES						
NODE	32	32	32	30	32	32
VALUE	1133.0	874.68	0.00000E+00	165.24	0.00000E+00	0.00000E+00

****

***** ENTER HELP,ERROR FOR AN EXPLANATION OF ANSYS ERROR ESTIMATION *****

ANALYTICAL CALCULATIONS

Subject ____

Originator R A Hill Date 4-27-95

Checker MA ISLAM Date 4/27/95

Check Frequency (Rooms 3 & 4)

Ref. page C-64;

$f = 3.13\sqrt{\frac{1}{\Delta}}$

Case 1; Δ = .01275"

Case 2; Δ = .01484"

Case 3; Δ = .03624"

Case 1; $f = 3.13\sqrt{\frac{1}{.01275}} = 27.7$ hz

Case 2; $f = 3.13\sqrt{\frac{1}{.01484}} = 25.7$ hz

Case 3; $f = 3.13\sqrt{\frac{1}{.03624}} = 16.44$ hz

Seismic Accel (SDC-4.1 Table 2) 5% Damping

Case 1; a = .225 g

Case 2; a = .234 g

Case 3; a = .296 g

ANALYTICAL CALCULATIONS

Subject ____

Originator R A Gilbert Date 4-27-95

Checker MA ISLAM Date 4/27/95

Check Frequency (Room 1)

Ref. page C-82;

Case 1; $\Delta = .01275'' \left(\frac{79748}{68272}\right) = .01489''$

Case 2; $\Delta = .01484\ (1.168) = .01733''$

Case 3; $\Delta = .03624\ (1.168) = .04233''$

Case 1; $f = 3.13\sqrt{\frac{1}{\Delta}} = 25.7$ hz

Case 2; $f =$ 23.8 hz

Case 3; $f =$ 15.2 hz

Case 1; $a =$ .234 g

Case 2; $a =$ .242 g

Case 3; $a =$ .308 g

ANALYTICAL CALCULATIONS

Subject _____

Originator RA Gilbert Date 4-27-95

Checker MA ISLAM Date 4/27/95

Check Bending Stress (Rooms 3 & 4)

Ref. Page C-72 ;

Case 1 ; $f_b = 536 psi \times \frac{.225g}{1.0g} = 120.6 psi$

$$M = \frac{120.6\,(8)(31.75)^2}{6\,(1000)} = 162 \text{ in-K}$$

$M_{Allow} = 306$ in-K Ref. page C-73

$$M.S = \frac{306}{162} - 1 = .89 \quad O.K.$$

Case 2 ; $f_b = 596 \times .234g = 139.5 psi$

$$M = \frac{139.5\,(8)(31.75)^2}{6\,(1000)} = 187.5 \text{ in-K}$$

$$M.S = \frac{306}{187.5} - 1 = .63 \quad O.K$$

Case 3 ; $f_b = 1133 \times .296 = 335 psi$

$$M = \frac{335\,(8)\,(31.75)^2}{6\,(1000)} = 450 > 306$$

No Good

ANALYTICAL CALCULATIONS

Subject ____

Originator RA Gilbert Date 4-27-95

Checker MA ISLAM Date 4/27/95

Check Bending Stress (Room 1)

Ref. Page C-72 & C89;

Case 1; $f_b = 536\,psi \times 1.168 \times .234_g = 147\,psi$

$$M = \frac{147(8)(31.75)^2}{6\ (1000)} = 197.6^{11.K}$$

$$M_{allow} = 342^{11.K}$$

$$M.S = \frac{342}{197.2} - 1 = .73 \quad O.K.$$

Case 2; $f_b = 596 \times 1.168 \times .242_g = 168.5\,psi$

$$M = \frac{168.5\,(8)(31.75)^2}{6\ (1000)} = 226^{11.K}$$

$$M.S = \frac{342}{226} - 1 = .51 \quad O.K.$$

Case 3; $f_b = 1133 \times 1.168 \times .308 = 408 psi$

$$M = \frac{408\,(8)(31.75)^2}{6\ (1000)} = 548^{11.K} > 342$$

No Good

ANALYTICAL CALCULATIONS

Subject ____

Originator R A Hill Date 4-27-95

Checker M A ISLAM Date 4/27/95

Check Anchors (Rooms 3 & 4)

Ref. Page C-72 ;

Case 1; $Tension = -15576\left(\frac{.225}{1.0}\right) + \frac{22200}{16}$

$= -2195^{\#}$

$T = \frac{2195}{\sin 45^\circ (4)} = 776^{\#}/anch$

$V = \sqrt{\left(\frac{10071 \times .225}{8\ anch}\right)^2 + 776^2} = 828^{\#}/anch$

$\frac{T}{T_A} + \frac{V}{V_A} = \frac{776}{2205} + \frac{828}{1875} = .79 < 1.0$

C.K.

Case 2; $Ten. = -17421(.234) + \frac{22200}{16}$

$Ten. = -2689^{\#}$

$T = \frac{-2689}{\sin 45^\circ (4\ anch)} = 951^{\#}/anch$

$V = \sqrt{\left(\frac{10853 \times .234}{8\ anch}\right)^2 + 951^2} = 1003^{\#}/anch$

$\frac{T}{T_A} + \frac{V}{V_A} = \frac{951}{2205} + \frac{1003}{1875} = .97 < 1.0$

O.K.

Case 3; No Good by Judgement

ANALYTICAL CALCULATIONS

Subject ____

Originator R A Kilb Date 4-27-95

Checker M A ISLAM Date 4/27/95

Check Anchors (Room 1)

Ref. Page C-88

Case 1; $\text{Tens.} = -15576 \times 1.168 \times .234 + \frac{25679}{16}$

$= -2653^{\#}$

$T = \frac{-2653}{\sin 45^\circ (4 \text{ anch})} = 938^{\#}/\text{anch}$

$V = \sqrt{\left(\frac{10071 \times 1.168 \times .834}{8}\right)^2 + 938^2} = 999^{\#}/\text{anch}$

$\frac{T}{T_A} + \frac{V}{V_A} = \frac{938}{4950} + \frac{999}{4208} = .427$ O.K.

Case 2; $\text{Tens.} = -17421 \times 1.168 \times .242 + \frac{25679}{16}$

$= -3319^{\#}$

$T = \frac{-3319}{\sin 45^\circ (4 \text{ anch})} = 1174^{\#}/\text{anch}$

$V = \sqrt{\left(\frac{10853 \times 1.168 \times .242}{8}\right)^2 + 1174^2} = 1235^{\#}/\text{anch}$

$\frac{T}{T_A} + \frac{V}{V_A} = \frac{1174}{4950} + \frac{1235}{4208} = .531$

Case 3; Need not check, stress has already failed.

APPENDIX D

2736-ZA BUILDING VENTILATION OPERABILITY EVALUATION

DESIGN CALCULATION

(1) Drawing _____ (2) Doc. No. _____ (3) Page D2 of _____

(4) Building _____ (5) Rev. _____ (6) Job No. _____

(7) Subject _____

(8) Originator RA Gilbert Date 4-4-94

(9) Checker M. A-ISLAM Date 5/27/94

(10)

Exhaust Stack Analysis

The MASON INDUSTRIES INC. dynamic analysis of the exhaust stack dated 9-16-77 provides the masses, accelerations, and support forces listed on the next page. However, this analysis assumes that the top of the stack is free to translate and has no restraint.

The actual condition as shown on the drawings H-2-27967 & H-2-27970 and verified by field walkdown, is a very rigid support at the roof level near the top of the stack.

For the evaluation of the exhaust stack two acceleration levels will be compared for use. First, the accelerations and support forces from the Mason Industries analysis and second, the dynamic accelerations from WHC-SD-GN-DGS-30006 Rev. 1 for flexible equipment will be used.

For conservatism and simplicity the dynamic analysis methods offered in the seismic design guide "WHC-SD-GN-DGS-30006 Rev 1" will be used. The design guide uses amplified accelerations that are statically applied to account for the dynamic effects. Table 2.5 gives the accelerations values to be used for existing installations of safety class 3/4 equipment in safety class 1/2 facilities.

For rigid equipment and suspended HVAC systems above grade an acceleration of ~~0.99~~ g is recommended for use.

1.35g

Results: Acceptable.

Minimum Margin of Safety = 1.32
in duct weld stud capacity

(7) Subject _____
(8) Originator P A Miller Date 4-4-94
(9) Checker M. A. ISLAM Date 5/27/94

(10) Dynamic Analysis by:

MASON INDUSTRIES INC dated 9-16-77

Mass Pt. 1 = 200# Pt. 3 = 450#
Pt. 2 = 435# Pt. 4 = 250#
Ref. CVI 20369 Sht. 6

Acceleration

Pt. 1	X =	1.839	Pt. 3	X =	2.314
	Y =	2.008		Y =	1.887
	Z =	.3722		Z =	.1926
Pt. 2	X =	1.648	Pt. 4	X =	2.123
	Y =	1.818		Y =	1.754
	Z =	.09468		Z =	.5081

Ref. CVI 20369 Sht 16

Supt. Forces

		X	Y	Z
Spring	1	91#	75#	183#
"	2	91	78	180
"	3	91	77	179
"	4	91	75	183
Snubber	5	1050	746	2340
"	6	1050	769	2290
"	7	1050	769	2290
"	8	1050	746	2340
Remote Pt.	9	0	0	0
"	10	0	0	0

DESIGN CALCULATION

(1) Drawing _____ (2) Doc. No. _____ (3) Page D4 of _____

(4) Building _____ (5) Rev. _____ (6) Job No. _____

(7) Subject _____

(8) Originator RA Dillon Date 4-4-94

(9) Checker M.A-ISLAM Date 5/27/94

(10) Exhaust Stack

Spec. B-125-C1/H-2-27970

Duct Material:

18Ga = .0478"

carbon steel

ASTM A366 or A569 or
A570 or A611

Fy min. = 25,000 psi

Stiffening Angles:

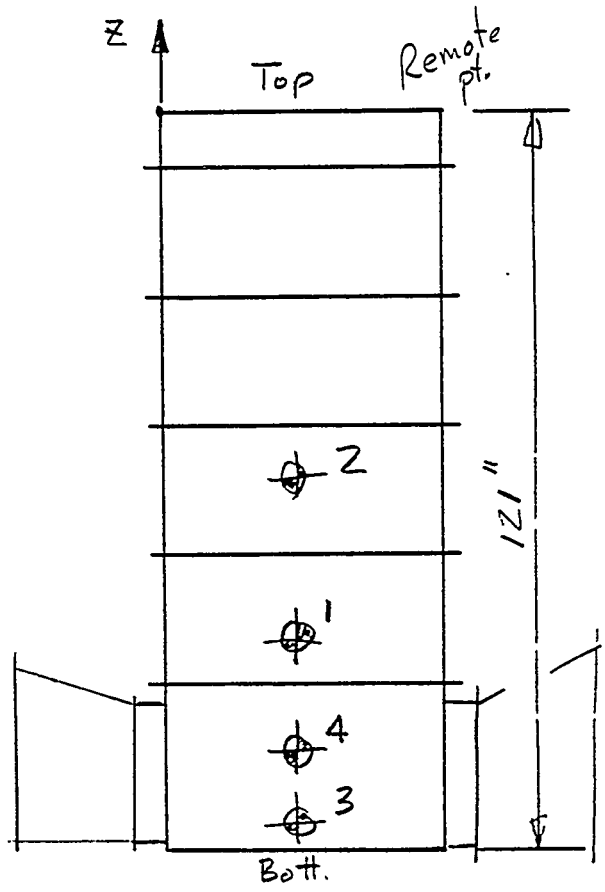
∠ 2 × 2 × 1/8 A36

Fy = 36,000 psi

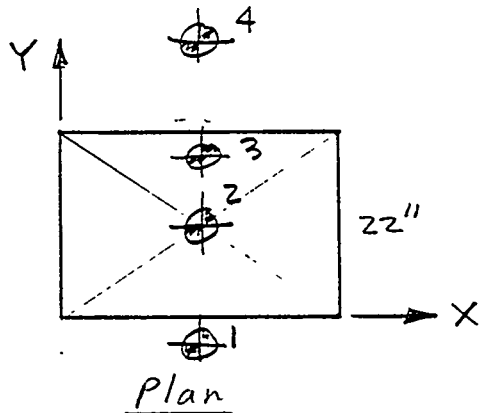
Weld studs:

A108 1010 to 1020

Fy = 26,000 psi



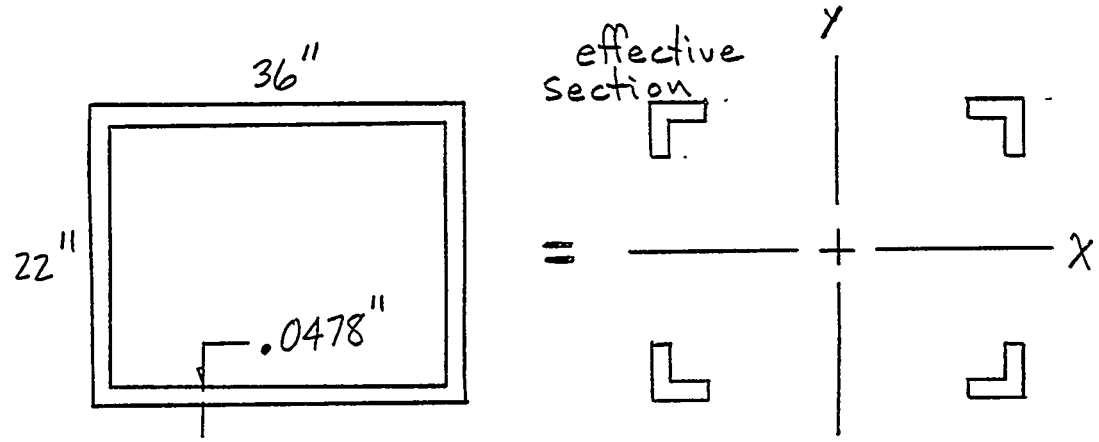
Elevation



Plan

(1) Drawing _____ (2) Doc. No. _____ (3) Page D5 of _____
(4) Building _____ (5) Rev. _____ (6) Job No. _____
(7) Subject _____
(8) Originator R.S. Lilla Date 4-5-94
(9) Checker M. A. ISLAM Date 5/27/94

(10) Duct Strength Capacity

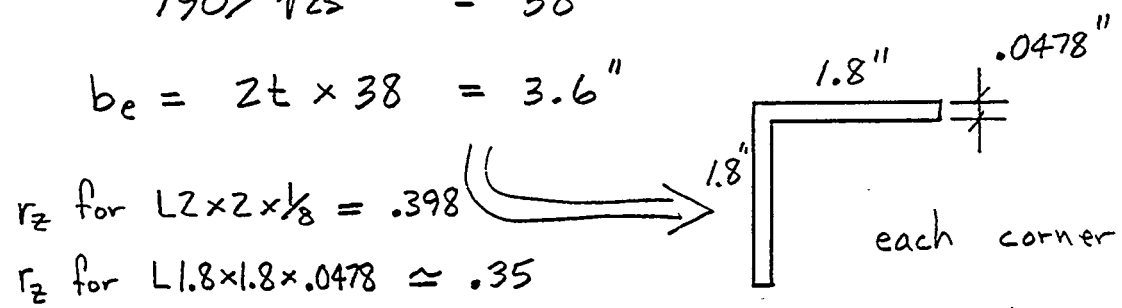


$b_f/2t_f = 22"/2\times.0478 = 230$

AISC 8th Ed page 5-66
allows $190/\sqrt{f_y}$ for box shapes

$190/\sqrt{25} = 38$

$b_e = 2t \times 38 = 3.6"$



r_z for L2×2×⅛ = .398
r_z for L1.8×1.8×.0478 ≃ .35

$area = (1.8+1.8-.0478).0478$
$= .174\ si$

$I_y = \Sigma Ar^2 = 4(.174)(17.5)^2 = 213\ in^4$
$S_y = I/c = 213/18 = 11.8\ in^3$
$I_x = \Sigma Ar^2 = 4(.174)(10.5")^2 = 76.7\ in^4$
$S_x = I/c = 76.7/11 = 7.0\ in^3$

(10)

Moment Capacity of Duct

$f_b \times S_b$ ∴ f_b = axial stress allowable of effective duct corner

max. distance between side stiffeners = 30"

$\frac{Kl}{r} = \frac{0.65(30")}{\approx .35} = 55.7$

AISC 8th Ed / Table 3-36

$F_a = 17.81$ ksi

$F_a \times S_{bx} =$ 124 in. kips

$F_a \times S_{by} =$ 210 in. kips

Shear Capacity of Duct

equals the compressive strength of the stiffening angles

4 2 × 2 × 1/8 pairs 36" long

AISC 8th Ed / Table 3-36

$\frac{Kl}{r} = \frac{1.0(36)}{.398} = 90.45$ $F_a = 14.15$ ksi

Cap = (14.15 ksi)(.484 si)(2 4)

= 13.7 K

(1) Drawing _____ (2) Doc. No. _____ (3) Page C7 of _____

(4) Building _____ (5) Rev. _____ (6) Job No. _____

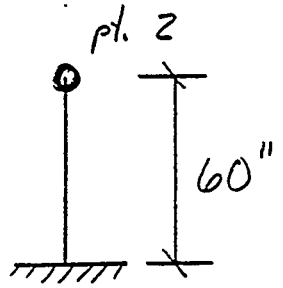
(7) Subject _____

(8) Originator R A Miller Date 4-5-94

(9) Checker M.A-ISLAM Date 5/27/94

(10) Duct Stress Check

dynamic analysis by MASON



Duct Stresses:

Mass @ 2. = 435#

X accel. @2 = 1.648 g

Y accel. @2 = 1.818 g

$Moment_x = 435^{\#} \times 1.648_g \times 60'' = 43010\ ''.\#$

$Moment_y = 435^{\#} \times 1.818\ g \times 60'' = 47450\ ''.\#$

$Shear_x = 435^{\#} \times 1.648 = 717^{\#}$

$Shear_y = 435^{\#} \times 1.818 = 791^{\#}$

Check Strength:

$M_x = 43^{''.K} < 124^{''.K}$ M.S = 3.88 O.K.

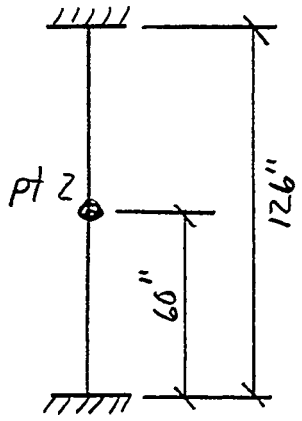
$M_y = 47^{''.K} < 124^{''.K}$ MS = 1.64 O.K.

$V_x = .7^{K} < 13.7^{K}$ M.S = 18.6 O.K

$V_y = .8^{K} < 13.7^{K}$ M.S = 16.1 O.K

(1) Drawing _____ (2) Doc. No. _____ (3) Page 58 of _____
(4) Building _____ (5) Rev. _____ (6) Job No. _____
(7) Subject _____
(8) Originator RA Hill Date 4-5-94
(9) Checker M.A-ISLAM Date 5/27/94

(10) Duct Stress Check
dynamic analysis by Design Guide



Duct Stresses:

Mass @ 2 = 435#

X & Y accel = 1.35 g

$$\text{Moment}_{X\&Y} = \frac{Pl}{8} = \frac{435^{\#} \times 1.35g \times 126''}{8}$$

$$= 9250^{11.\#}$$

$$\text{Shear}_{X\&Y} = \frac{P}{2} = \frac{435^{\#} \times 1.35g}{2} = 294^{\#}$$

Check Strength:

$M = 9.3^{11.K} < 124^{11.K}$ M.S. = 12.3 O.K.

$V = .3^{K} < 13.7^{K}$ M.S. = 44.7 O.K.

DESIGN CALCULATION

(1) Drawing _____ (2) Doc. No. _____ (3) Page D9 of _____
(4) Building _____ (5) Rev. _____ (6) Job No. _____
(7) Subject _____
(8) Originator R A Tilla Date 4-5-94
(9) Checker M. A - ISLAM Date 5/27/94

(10) Weld Stud Check
@ stiffening X's

tension = .5 F_y = 13,000 psi

shear = .5 T_A = 6,500 psi

3/8" weld stud area = .078 si

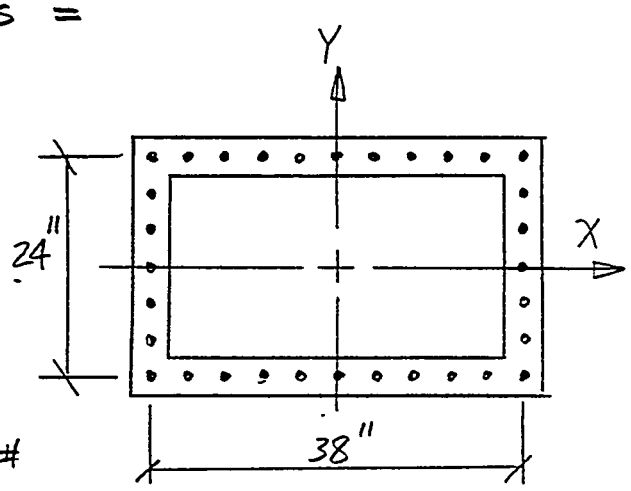
T_A = 13,000 × .078 = 1014 #

V_A = 6,500 × .078 = 507 #

Max. shear force on bolts =

x-dir $\frac{717\#}{32 \text{ bolts}} = 22.4\#$ & y-dir $\frac{791}{32 \text{ bolts}} = 24.7\#$

Max tension force on bolts =



x-dir $\frac{43010^{11.\#}}{38"(7 \text{ bolts})} = 162\#$

y-dir $\frac{47450}{24"(11 \text{ bolts})} = 180\#$

T = 162 + 180 = 342 # < 1014 #

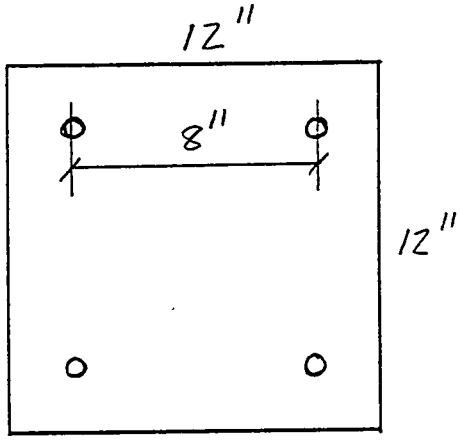
V = 22.4 + 24.7 = 47.1 # < 507 #

$\frac{T}{T_A} + \frac{V}{V_A} = .43 < 1.0$ / MS = 1.32

DESIGN CALCULATION

(1) Drawing _____ (2) Doc. No. _____ (3) Page D10 of _____
(4) Building _____ (5) Rev. _____ (6) Job No. _____
(7) Subject _____
(8) Originator R A Hill Date 4-5-94
(9) Checker M. A. ISLAM Date 5/27/94

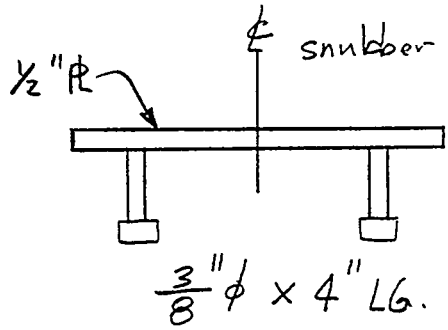
(10) Embed. Pl Capacity
H-2-27966
Detail (16)
$f_c' = 3{,}000$ psi



Bolt Capacities from
WHC-SD-GN-DGS-30006 R1

$\frac{3}{8}\phi \times 3\frac{3}{4}$" LG w $4\frac{3}{4}$" spacing
in 3,500 psi conc.

$P_A = 3740$ #
$V_A = 1870$ #



$\frac{3}{8}\phi \times 4$" LG w/ 8" spacing
in 3,000 psi conc.

$$P_A = 3740 \frac{\sqrt{3000}}{\sqrt{3500}} = \underline{3462}\ \#$$

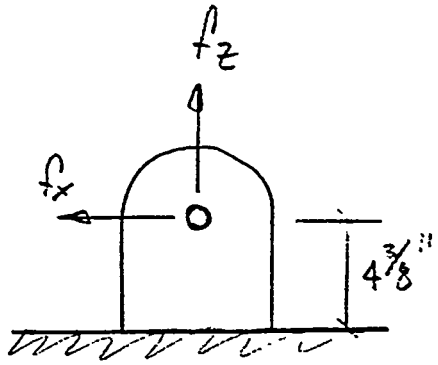
$$V_A = 1870 \frac{\sqrt{3000}}{\sqrt{3500}} = \underline{1731}\ \#$$

(10) Embed Pl bolt loads:

$$V = \sqrt{\left(\frac{f_x}{4}\right)^2 + \left(\frac{f_z}{4}\right)^2}$$

$$= \sqrt{\left(\frac{1050}{4}\right)^2 + \left(\frac{746}{4}\right)^2}$$

$$= 322^{\#}$$



$f_x = 1050^{\#}$

$f_y = 746^{\#}$

$f_z = 2340^{\#}$

$$P = \frac{f_z}{4} + \frac{f_x(4\frac{3}{8}")}{8"(2)} + \frac{f_y(4\frac{3}{8})}{8(2)}$$

$$= 585^{\#} + 287^{\#} + 204^{\#}$$

$$= 1076^{\#}$$

$$\frac{V}{V_{all}} = \frac{322}{1731} = .186 \qquad \frac{P}{P_{all}} = \frac{1076}{3462} = .31$$

From Interaction Graph

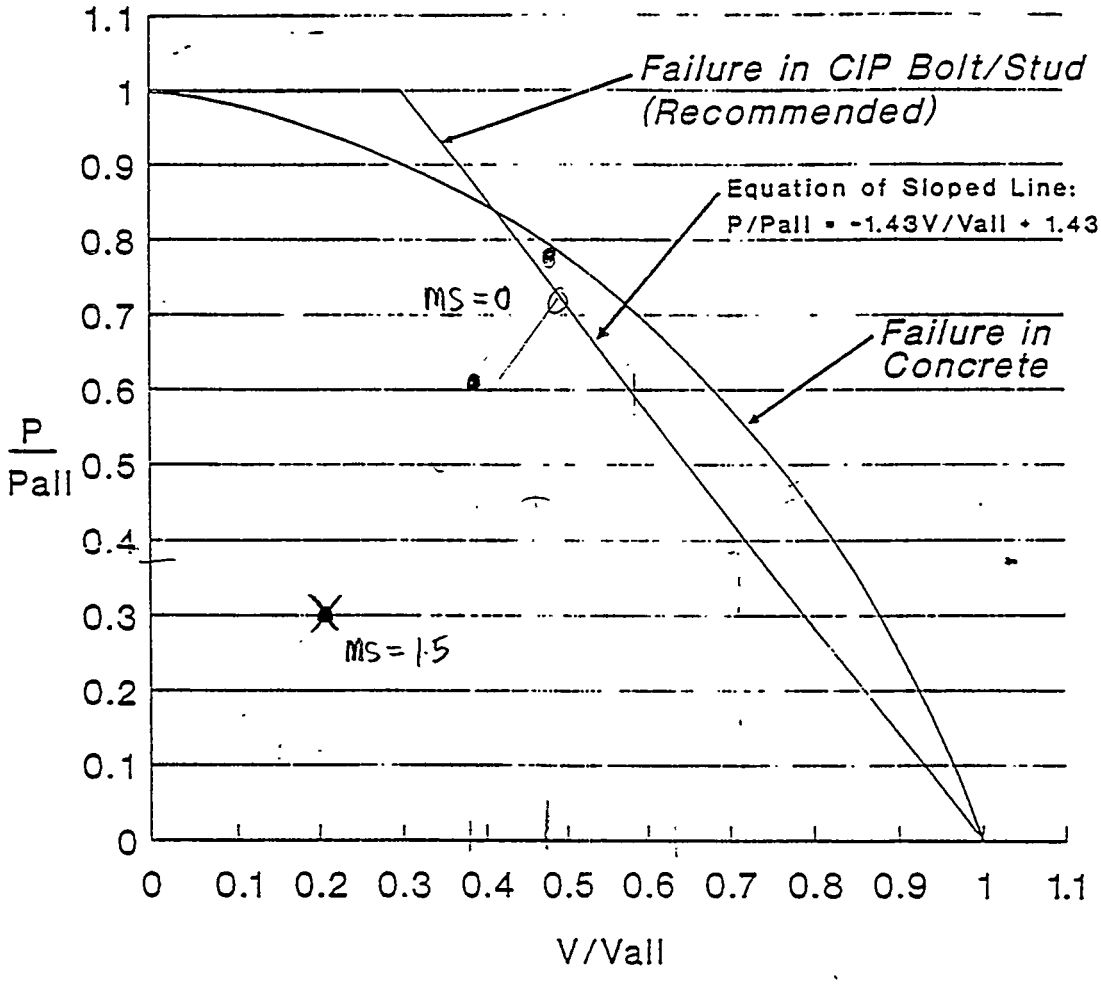
M.S. $\cong$ 1.5

WELD:

THE ALL AROUND 1/4" FILLET WELD BETWEEN THE SNUBBER BRACKET AND THE EMBEDDED PLATE IS ACCEPTABLE BY INSPECTION.

(1) Drawing _____ (2) Doc. No. _____ (3) Page D12 of _____
(4) Building _____ (5) Rev. _____ (6) Job No. _____
(7) Subject _____
(8) Originator RA Gilla Date 4-19-94
(9) Checker M.A. ISLAM Date 5/27/94

(10)



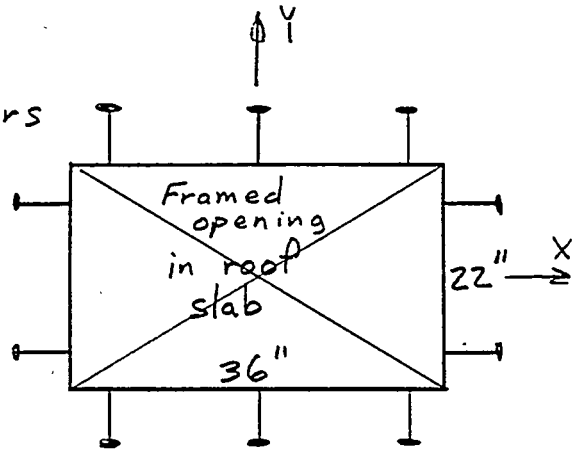
V/Vall	0.0	0.1	0.3	0.5	0.7	0.9	1.0
P/Pall - CIP Bolt/Stud	1.0	1.0	1.0	.71	.43	.14	0.0
P/Pall - Concrete	1.0	.99	.91	.79	.60	.30	0.0

WHC-SD-GN-DGS-30006 R1
Page 8-37

(1) Drawing _____ (2) Doc. No. _____ (3) Page D13 of _____
(4) Building _____ (5) Rev. _____ (6) Job No. _____
(7) Subject _____
(8) Originator RA Hille Date 4-5-94
(9) Checker M. A. ISLAM Date 5/27/94

(10) Support Strength Check
Top Support @ roof level

10-3/8" anchors



from embed pl calc.
3/8" anchors have a shear allowable of:
$V_A = 1731^{\#}$

Moment Capacity

x-dir $\frac{43010^{\text{in.}\#}}{36"\,(2\text{ bolts})} = 597^{\#} < 1731^{\#}$

M.S = 1.9

Y-dir $\frac{47450^{\text{in.}\#}}{22"\,(3\text{ bolts})} = 719^{\#} < 1731^{\#}$

M.S. = 1.4

(1) Drawing _____ (2) Doc. No. _____ (3) Page D14 of _____
(4) Building _____ (5) Rev. _____ (6) Job No. _____
(7) Subject _____
(8) Originator RA Miller Date 4-5-94
(9) Checker M. A - ISLAM Date 5/27/94

(10) Check Snubber

From Smith-Emery Co. test report 11-17-75
Neopreme bushing bottom out @ / Fails @

$X = 2500^{\#} \;/\; 7900^{\#}$
$Y = 1000^{\#} \;/\; 9700^{\#}$
$Z = 2000^{\#} \;/\; 10700^{\#}$

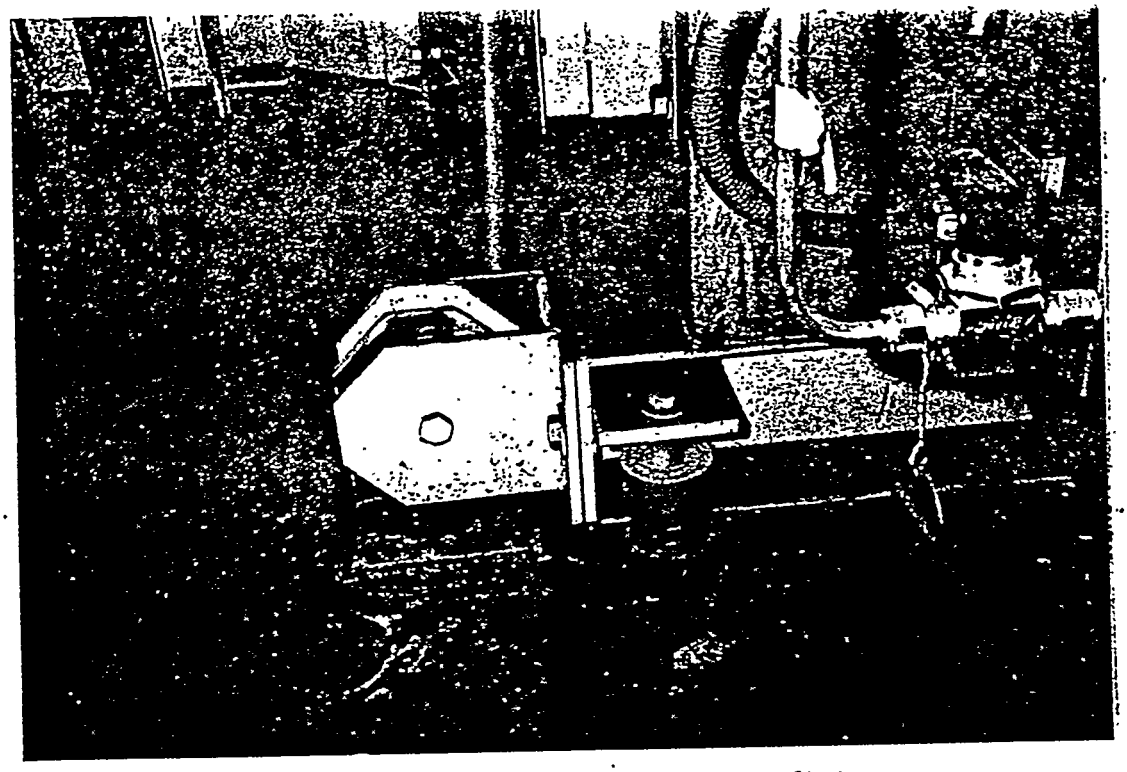
Actual loads are:

$X=(Y) = 769^{\#} < 7900^{\#}$
$Y(x) = 1050^{\#} < 9700^{\#}$
$Z = 2340^{\#} < 10700^{\#}$

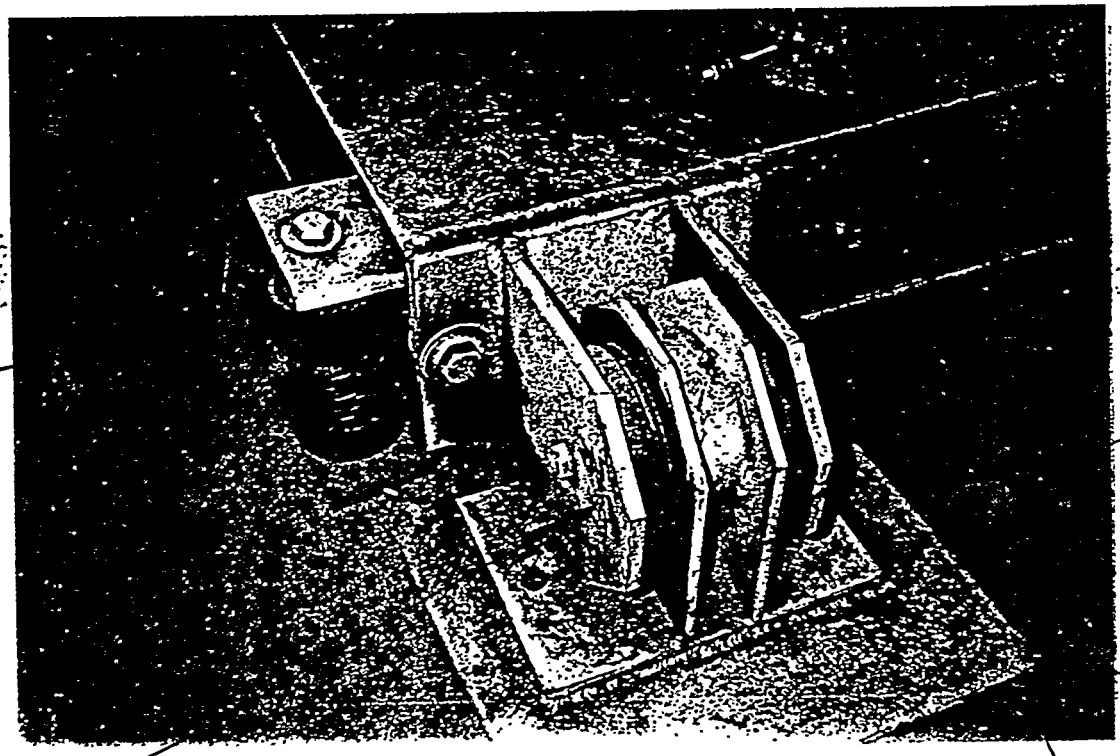
O.K.

Check Spring

From Mason Industries Data
Rated load = $450^{\#} > 183^{\#}$ O.K.



EXHAUST DUCT MOUNTING & SPRING
(2736-ZA)



1 EXHAUST DUCT MOUNTING & SPRING
(2736-ZA)

(1) Drawing _____ (2) Doc. No. _____ (3) Page D16 of _____

(4) Building _____ (5) Rev. _____ (6) Job No. _____

(7) Subject _____

(8) Originator R A Hijia Date 4-4-94

(9) Checker M. A-ISLAM Date 5/27/94

(10)

EF-1-1, 2 Filter Housing Analysis

The MASON INDUSTRIES INC. dynamic analysis of the EF-1-1 and EF-1-2 filter housing dated 9-16-77 provides the masses, accelerations, and support forces listed on the next page.

The as-built conditions are shown on the drawings H-2-27967 & H-2-27970 and verified by field walkdown.

For conservatism and simplicity the dynamic analysis methods offered in the seismic design guide "WHC-SD-GN-DGS-30006 Rev 1" will be used. The design guide uses amplified accelerations that are statically applied to account for the dynamic effects. Table 2.5 gives the accelerations values to be used for existing installations of safety class 3/4 equipment in safety class 1/2 facilities.

For rigid equipment and suspended HVAC systems above grade a minimum acceleration of ~~0.99 g~~ 1.35 g is recommended for use by the 30006 design guide.

THE EXHAUST FAN/MOTOR ASSEMBLY AND THE FILTER HOUSING ASSY. HAVE A COMMON BASE FRAME SUPPORT. PFP OPERATIONS ASSIGNED SAFETY CLASS (SC) 3 TO THE FAN/MOTOR ASSY. BUT REQUIRE OPERABILITY AFTER DBE AND ANCHORAGE ADEQUACY USING SC 1 SEISMIC DEMAND. QUALIFICATION FOR OPERABILITY IS PRESENTED HEREIN USING THE SEISMIC QUALIFICATION UTILITIES GROUP/ GENERIC IMPLEMENTATION PROCEDURE (SQUG/GIP) METHODOLOGY. AS AGREED IN THE APPROVED WORK PLAN (SEE APPENDIX E) A FACILITY SPECIFIC SEISMIC WALKDOWN PROCEDURE WAS NOT GENERATED FOR THIS SINGLE APPLICATION OF THE SQUG/GIP METHOD. EARTHQUAKE EXPERIENCE DATA WAS USED TO VERIFY OPERABILITY AFTER DBE BY FOLLOWING THE SCREENING EVALUATION WORK SHEET (SEWS) OF THE GIP FOR THIS EQUIPMENT CLASS. THE SEISMIC CAPACITY IS BASED ON THE GENERIC BOUNDING SPECTRUM WHICH EXCEEDS THE SEISMIC DEMAND BASED ON THE GROUND RESPONSE SPECTRA AS SHOWN ON PAGES D 20

RESULTS: ACCEPTABLE.
MIN. MARGIN OF SAFETY = 0.2 (EMBEDDED PLATE ANCHORS)

SCREENING EVALUATION WORK SHEET (SEWS) Sheet 1 of 2

Equip. ID No. EF-1-1, EF-1-2 Equip. Class 9 - Fans

Equipment Description CENTRIFUGAL EXHAUST FANS

Location: Bldg. 2736-ZA Floor El. GRADE Room, Row/Col

Manufacturer, Model, Etc. (optional) ALADDIN HEATING CORPORATION

SEISMIC CAPACITY VS DEMAND

1.	Elevation where equipment receives seismic input		GRADE
2.	Elevation of seismic input below about 40' from grade		Y (N) U
3.	Equipment has fundamental frequency above about 8 Hz		(Y) N U N/A
4.	Capacity based on:	Existing Documentation	DOC
		Bounding Spectrum	(BS)
5.	Demand based on:	Ground Response Spectrum	(GRS)
		1.5 x Bounding Spectrum	ABS
		Conserv. Des. In-Str. Resp. Spec.	CRS
		Realistic M-Ctr. In-Str. Resp. Spec.	RRS

Does capacity exceed demand? SEE PAGE D19 AND D20 (Y) N U
THE FANS & MOTORS ARE SC 3 BUT ARE BEING EVALUATED FOR SC 1 SEISMIC LOADS ∴ USE 1.2 g SPECTRA CURVE

CAVEATS - BOUNDING SPECTRUM (Identify with an asterisk (*) those caveats which are met by intent without meeting the specific wording of the caveat rule and explain the reason for this conclusion in the COMMENTS section below)

1.	Equipment is included in earthquake experience equipment class	(Y) N U N/A
2.	Drive motor and fan mounted on common base	(Y) N U N/A
3.	For axial fan with long shaft between fan and motor, shaft supported at fan as well as motor	Y N U (N/A)
4.	No possibility of excessive duct distortion causing binding or misalignment of fan	Y (N) U N/A
5.	Base vibration isolators adequate for seismic loads	(Y) N U N/A
6.	Attached lines (electrical) have adequate flexibility	(Y) N U N/A
7.	Anchorage adequate (See checklist below for details)	(Y) N U N/A
8.	Have you looked for and found no other adverse concerns?	(Y) N U N/A

Is the intent of all the caveats met for Bounding Spectrum? (Y) N U N/A

ANCHORAGE

1.	Appropriate equipment characteristics determined (mass, CG, natural freq., damping, center of rotation)	(Y) N U N/A
2.	Type of anchorage covered by GIP	(Y) N U N/A
3.	Sizes and locations of anchors determined	(Y) N U N/A
4.	Adequacy of anchorage installation evaluated (weld quality and length, nuts and washers, expansion anchor tightness, etc.)	(Y) N U N/A

SCREENING EVALUATION WORK SHEET (SEWS) Sheet 2 of 2

Equip. ID No. EF-1-1, EF-1-2 Equip. Class 9 - Fans

Equipment Description CENTRIFUGAL EXHAUST FANS

ANCHORAGE (Cont'd)

5.	Factors affecting anchorage capacity or margin of safety considered: embedment length, anchor spacing, free-edge distance, concrete strength/condition, and concrete cracking	(Y) N U N/A
6.	For bolted anchorages, gap under base less than 1/4-inch	Y N U (N/A)
7.	Base has adequate stiffness and effect of prying action on anchors considered	(Y) N U N/A
8.	Strength of equipment base and load path to CG adequate	(Y) N U N/A
9.	Embedded steel, grout pad or large concrete pad adequacy evaluated	(Y) N U N/A

Are anchorage requirements met? (Y) N U

INTERACTION EFFECTS

1.	Soft targets free from impact by nearby equipment or structures	(Y) N U N/A
2.	Distribution lines have adequate flexibility	(Y) N U N/A
3.	Overhead equipment or distribution systems are ~~not~~ likely to collapse	Y (N) U N/A
4.	Have you looked for and found no other adverse concerns?	(Y) N U N/A

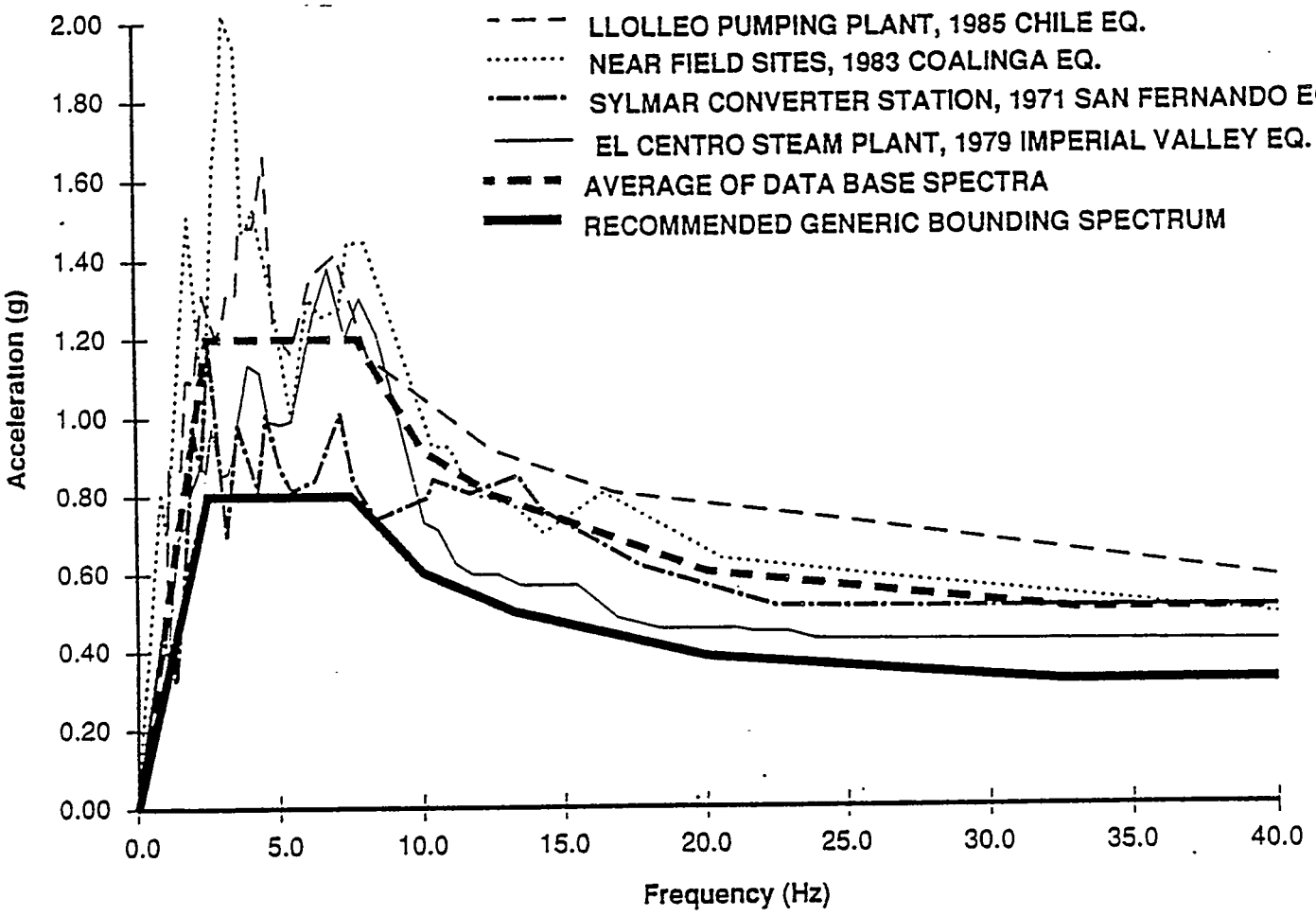
Is equipment free of interaction effects? (Y) N U

IS EQUIPMENT SEISMICALLY ADEQUATE? (Y) N U

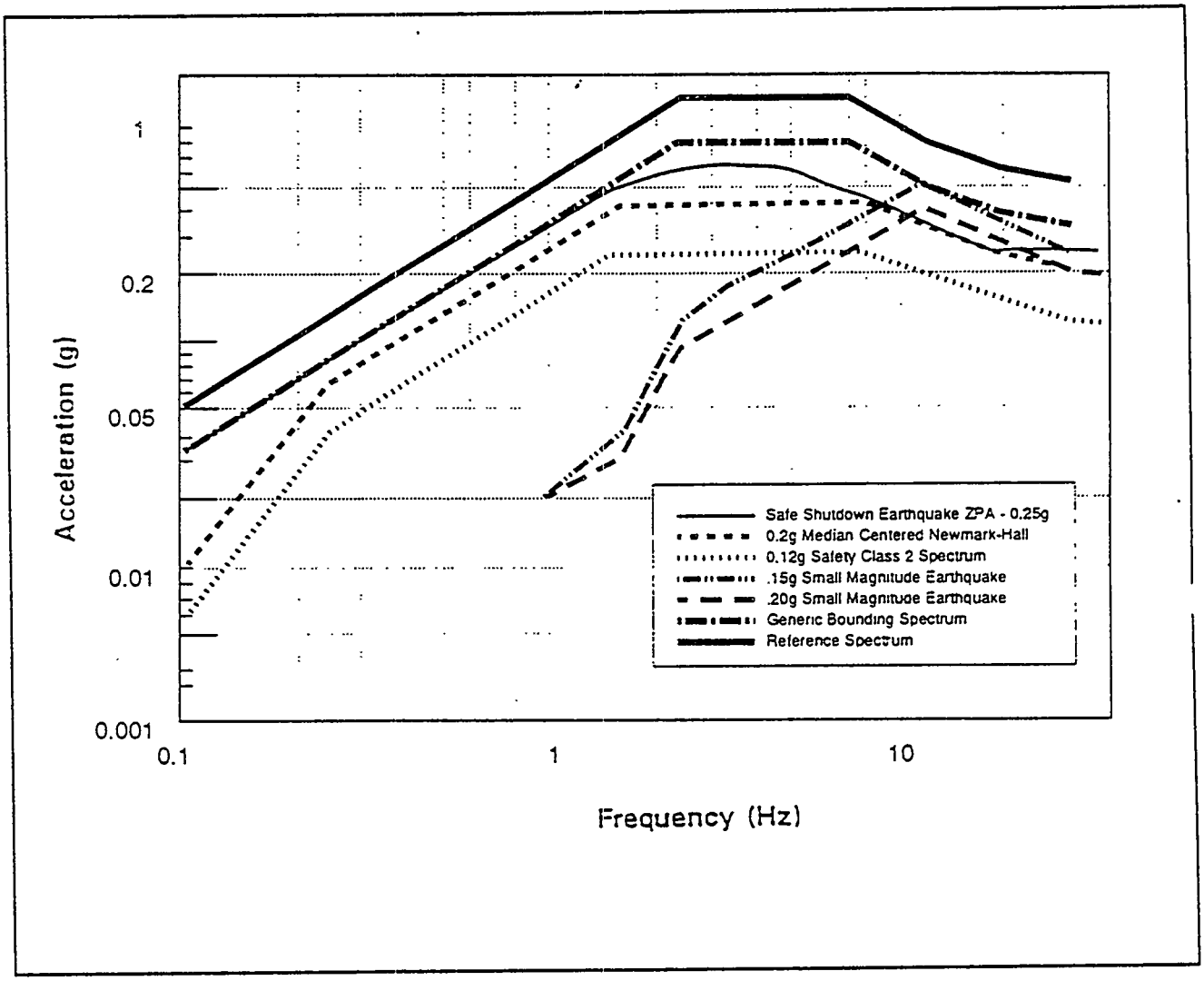
COMMENTS

THE CONDUITS FROM THE RELAY SWITCH BOX IN THE OTHER ROOM TO THE DRIVE MOTORS ARE EMBEDDED IN THE CONCRETE FLOOR, THEREFORE THERE IS NO INTERACTION CONCERN FOR THE CONDUITS. THE CONDUITS FROM THE FLOOR TO THE MOTORS ARE FLEXIBLE CONDUITS. THE FANS ARE ISOLATED FROM THE SUPPLY AND EXHAUST DUCT LOADS BY FLEXIBLE CONNECTIONS.

Evaluated by: E.C. Ocoma Date: 6/3/94



Free-Field Ground Motion Response Spectra for Selected Database Sites and the Recommended Generic Qualification Spectrum. Spectra are Plotted at 5% Damping



Note that Hanford site ground motion spectra are easily enveloped by the reference spectrum. Also, USI A-46 bounding spectrum envelopes Hanford site ground motion spectra.

Generic Bounding Spectrum Comparison to Hanford Site Ground Spectra

(1) Drawing _____ (2) Doc. No. _____ (3) Page D21 of _____
(4) Building _____ (5) Rev. _____ (6) Job No. _____
(7) Subject _____
(8) Originator R A Gilla Date 4-4-94
(9) Checker M. A - ISLAM Date 5/27/94

(10) SSE Loads

Snub. #1	X = 1530#	Y = 1500#	Z = 2710#
Snub #2	X = 1690	Y = 970	Z = 4050
Snub #3	X = 1530	Y = 867	Z = 1640
Snub #4	X = 1650	Y = 970	Z = 4050

Ref. CVI 20369 sht. 27

SSE Accelerations

maximums

Mass Pt. 7 A_x = 1.420 g
Mass Pt. 8 A_y = 1.493 g
Mass Pt. 1 A_z = 1.961 g

WHC-SD-GN-DGS-30006 Accelerations

From Table 2-5

$A_x = A_y$ = .20g PGA Curve } .34g peak
A_z = = .13g PGA Curve }

SSE accelerations are higher and will be used from here-on.

DESIGN CALCULATION

(1) Drawing _____ (2) Doc. No. _____ (3) Page D22 of _____

(4) Building _____ (5) Rev. _____ (6) Job No. _____

(7) Subject _____

(8) Originator RA Miller Date 4-4-94

(9) Checker M. A. ISLAM Date 5/27/94

(10) Snubber Check

Smith-Emery Co. Test Data

X = 2500# elastic / 7900# failure

Y = 1000# " / 9700# "

Z = 2000# " / 10700# "

Loads

X = 1690# } < 7900#

Y = 1690# }

Z = 4050# < 10700#

O.K.

(1) Drawing _____ (2) Doc. No. _____ (3) Page D-23 of _____

(4) Building _____ (5) Rev. _____ (6) Job No. _____

(7) Subject _____

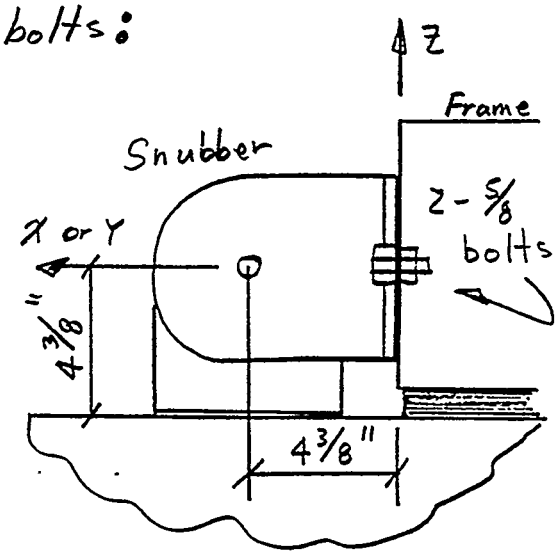
(8) Originator R. A. Hill Date 4-18-94

(9) Checker M. A. ISLAM Date 5/27/94

(10) Check Snubber to Frame bolts:

A307 bolts 5/8" ϕ

T_a = 6.1 K
V_a = 3.1 K } allowable



$$V = \sqrt{\left(\frac{f_x}{2}\right)^2 + \left(\frac{f_z}{2}\right)^2}$$

$$= \sqrt{\left(\frac{1690^{\#}}{2}\right)^2 + \left(\frac{4050}{2}\right)^2}$$

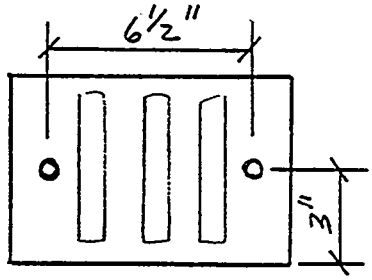
$$= 2{,}194^{\#} < 3{,}100^{\#} \quad O.K.$$

$$T = \frac{f_x}{2} + \frac{f_y(4.375)}{6.5''} + \frac{f_z(4.375)}{3''(2\ bolts)}$$

$$= \frac{1690}{2} + \frac{1690(4.375)}{6.5} + \frac{4050(4.375)}{6}$$

$$= 4{,}936^{\#} < 6{,}100^{\#} \quad O.K.$$

$$M.S. = \frac{6100}{4936} - 1 = .24$$



$f_x = 1690^{\#}$

$f_y = 1690^{\#}$

$f_z = 4050^{\#}$

(1) Drawing _____ (2) Doc. No. _____ (3) Page D24 of _____
(4) Building _____ (5) Rev. _____ (6) Job No. _____
(7) Subject _____
(8) Originator R A Miller Date 4-4-94
(9) Checker M. A. ISLAM Date 5/27/94

(10) Check Embaded Base Pl

Plate tension = 4050#
Plate shear ≅ 1690# ea direction

$$P = \frac{4050}{4\ \text{bolts}} + \frac{1690^{\#}(4\,3/8)}{2(8")} \times 2 = 1937^{\#}$$

$$V = \frac{1690 + 1690}{4} = 845^{\#}$$

$$\frac{P}{P_A} = \frac{1937}{3462} = .56 \qquad \frac{V}{V_A} = \frac{845}{1731} = .49$$

Check interaction chart on next page

O.K. MS ≅ 0.2

V_A & P_A are from Exhaust Stack Analysis

(1) Drawing _____ (2) Doc. No. _____ (3) Page D25 of _____

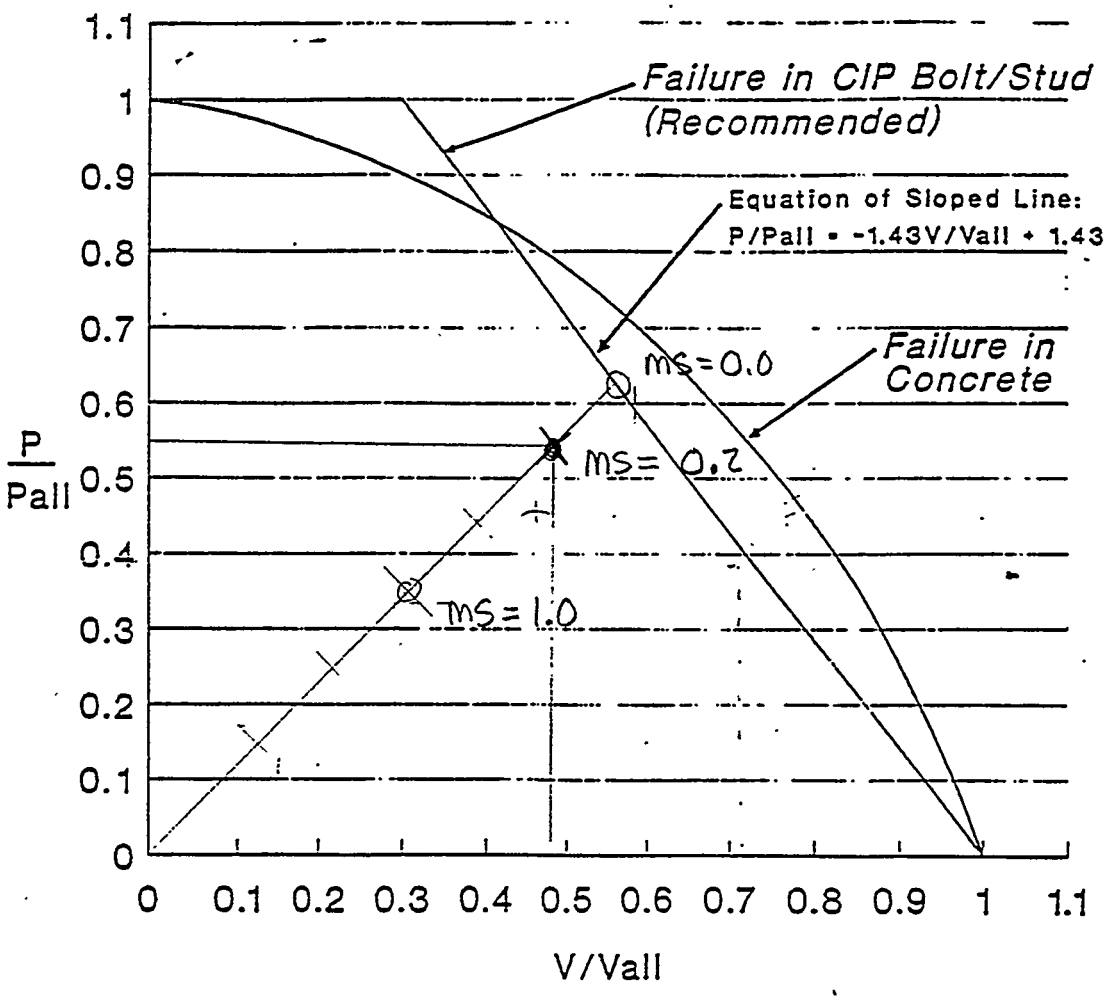
(4) Building _____ (5) Rev. _____ (6) Job No. _____

(7) Subject _____

(8) Originator RA Hill Date 4-4-94

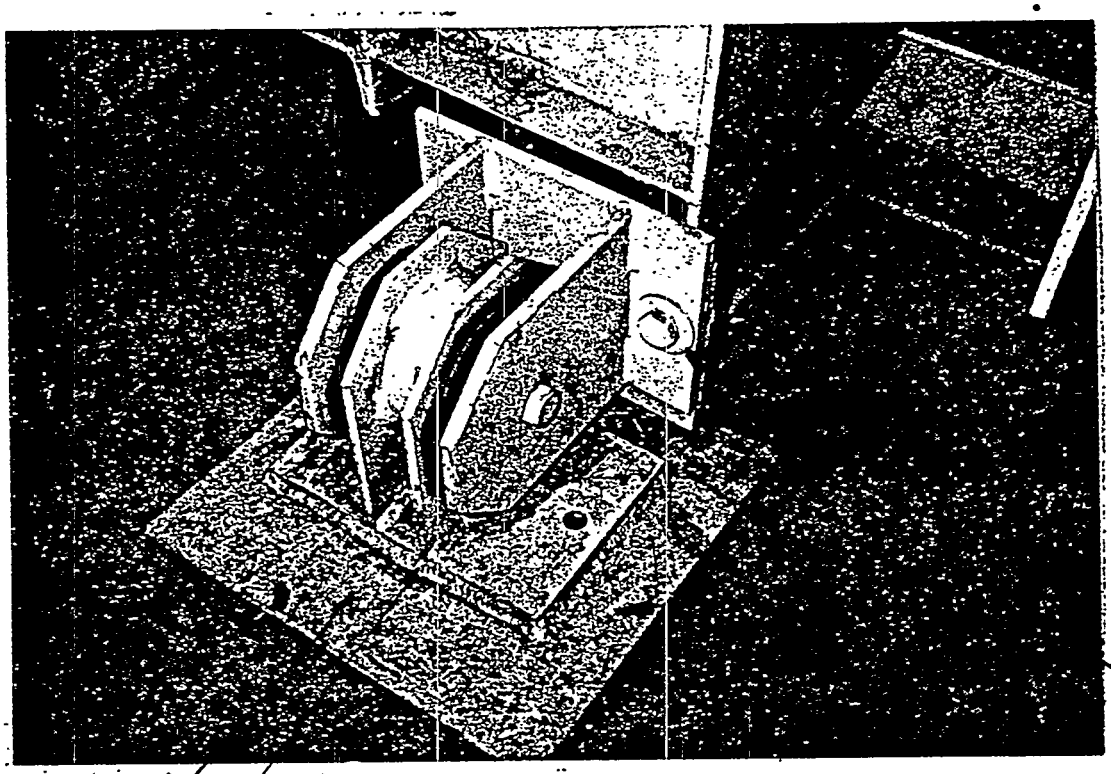
(9) Checker M.A. ISLAM Date 5/27/94

(10)



V/Vall	0.0	0.1	0.3	0.5	0.7	0.9	1.0
P/Pall - CIP Bolt/Stud	1.0	1.0	1.0	.71	.43	.14	0.0
P/Pall - Concrete	1.0	.99	.91	.79	.60	.30	0.0

WHC-SD-GN-DGS-30006 R1
Page 8-37

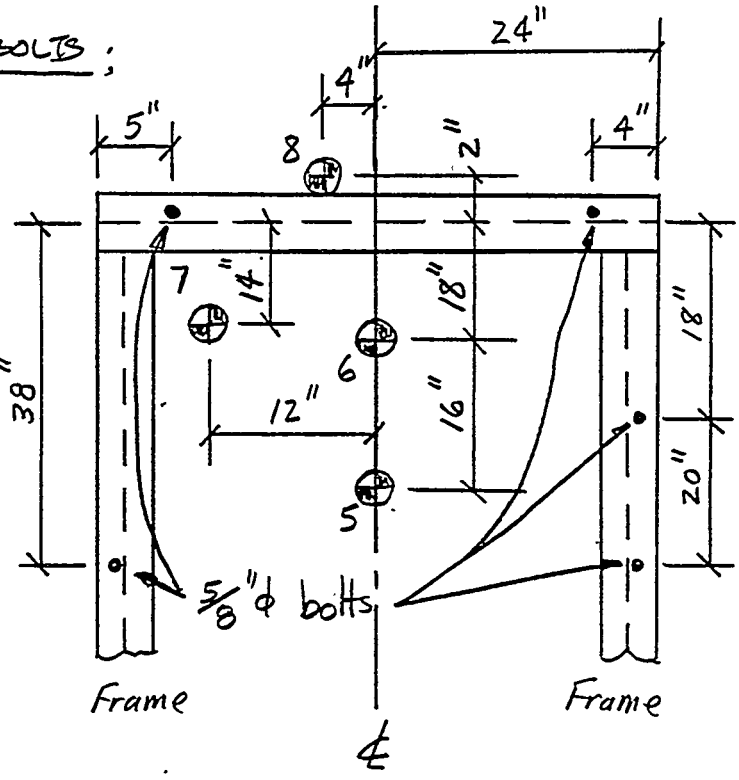


EXHAUST FAN & FILTER HOUSING BASE FRAME ANCHORS
(2736-ZA)

(10) FAN/MOTOR MOUNT BOLTS:

5	Fan =	300#
6	Pedistal =	150#
7	Motor =	120#
8	Drive =	30#
		600#

Ref. CVI 20369



Field Dimensions

lateral force

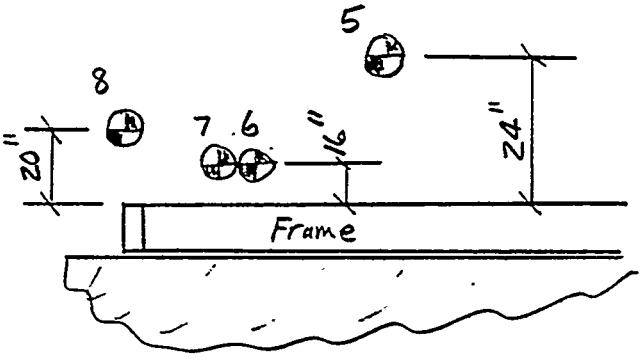
use 1.5 g

$600^{\#} \times 1.5 = 900^{\#}$

Vertical Force

use 2.0 g

$600^{\#} \times 2 = 1200^{\#}$



Assume total load is 24" above frame, @ the Frame ℄, above Pedistal "6".

A307 bolts (ASSUME) $T_a = 6.1^K$ $V_a = 3.1^K$

(1) Drawing _____ (2) Doc. No. _____ (3) Page D28 of _____

(4) Building _____ (5) Rev. _____ (6) Job No. _____

(7) Subject _____

(8) Originator RS Hill Date 4-18-94

(9) Checker M. A-ISLAM Date 5/27/94

(10) Bolt Shear:

$$V = \sqrt{\left(\frac{900}{5}\right)^2 + \left(\frac{900}{5}\right)^2}$$

$V = 255\#/ea < 3,100\#$

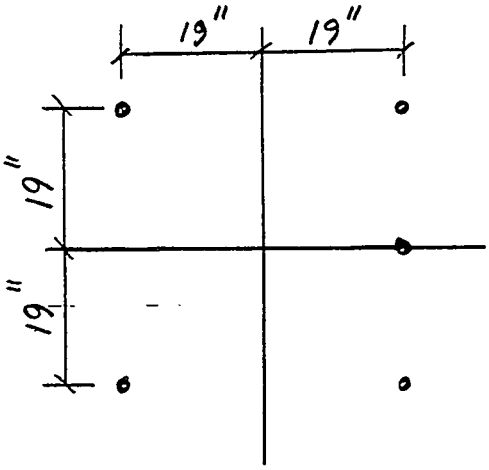
O.K.

Bolt Tension:

$$T = \frac{f_z}{5} + \frac{f_x(24")}{.38"(2\ bolts)} + \frac{f_y(24)}{38(2)}$$

$= 240\# + 284\# + 284\#$

$= 808\# < 6,100\#$ O.K



Assumed load points based on measured bolt pattern.

SMITH-EMERY COMPANY

CHEMISTS • TESTING • INSPECTION • ENGINEERS
781 EAST WASHINGTON BOULEVARD
LOS ANGELES 21, CALIFORNIA

ALL REPORTS ARE SUBMITTED AS THE CONFIDENTIAL PROPERTY OF CLIENTS. AUTHORIZATION FOR PUBLICATION OF OUR REPORTS, CONCLUSIONS, OR EXTRACTS FROM OR REGARDING THEM IS RESERVED PENDING OUR WRITTEN APPROVAL AS A MUTUAL PROTECTION TO CLIENTS, THE PUBLIC AND OURSELVES.

FILE NO.: 11875-75
LABORATORY NO.: L-75-1992

DATE: NOVEMBER 17, 1975

MASON INDUSTRIES INC.
3335 PICO BOULEVARD
LOS ANGELES, CALIFORNIA 90023

SUBJECT: LOAD TESTS ON SEISMIC SNUBBER MODEL Z-1011-1250.

SOURCE: SUBMITTED TO LABORATORY.

PROCEDURE: THE SEISMIC SNUBBER WAS MOUNTED IN A TEST FIXTURES IN VARIOUS POSITIONS AND PLACED IN A BALDWIN UNIVERSAL TESTING MACHINE. A DIAL INDICATOR WAS ATTACHED TO THE SEISMIC SNUBBER AND MOVEMENT RECORDED. SEE ATTACHED DRAWING FOR TEST POSITION, X, Y AND Z.

REPORT OF TESTS

TEST NO. 1 - X POSITION

APPLIED LOAD POUNDS	MOVEMENT INCHES	OBSERVATION
0	0.000	NEOPRENE TOUCHING BRACKET
400	0.121	
800	0.228	
1250	0.342	
1600	0.430	
2000	0.522	
2500	0.628	NEOPRENE BUSHING BOTTOMED OUT, AND SIDE PLATE ON OUTER BRACKET BEGAN TO DEFORM.
3000	0.694	
3500	0.777	
4000	0.857	
4500	0.948	
5000	1.026	
5500	1.114	
6000	1.195	
6500	1.271	INNER BRACKET BASE PLATE BEGAN TO DEFORM AROUND ANCHOR BOLT.
7000	1.358	
7500	1.464	
7900		MAXIMUM LOAD. ONE (1) BOTTOM ANCHOR BOLT SHEARED ON INNER BRACKET BASE PLATE.

SMITH-EMERY COMPANY

OBSERVATION OF SEISMIC SNUBBER AFTER TEST:

(1) INNER BRACKET BASE PLATE NOT DEFORMED.

(2) CENTER BOLT DEFORMED.

(3) NO CRACKING OF WELDING ON BASE PLATES.

(4) TOP NEOPRENE BUSHING HAS SMALL CRACKS PRESENT.

TEST NO. 2 - Y POSITION

APPLIED LOAD POUNDS	MOVEMENT INCHES	OBSERVATIONS
0	0.000	NEOPRENE TOUCHING BRACKET.
400	0.089	
800	0.162	
1000	0.196	NEOPRENE BUSHING BOTTOMED OUT ON BRACKET.
1250	0.230	
1600	0.284	
2000	0.363	
2500	0.457	
3000	0.518	
3750	0.603	
4000	0.637	
4500	0.689	ANCHOR BOLTS ON OUTER BRACKET BEGAN TO DEFORM AS CLEARENCE INDICATED UNDER BASE PLATE.
5000	0.738	
5500	0.795	
6000	0.841	INNER BRACKET BASE PLATE BEGAN TO DEFORM.
6500	0.904	
7000	0.957	
7500	1.016	
8000	1.075	
8500	1.145	OUTER BRACKET BASE PLATE BEGAN TO DEFORM.
9000	1.331	
9700		MAXIMUM LOAD. ONE (1) OUTER BRACKET ANCHOR BOLT FAILED.

OBSERVATION OF SEISMIC SNUBBER AFTER TEST:

(1) ONE ANCHOR BOLT FAILED.

Job No.: 11875-75
Lab No.: L-75-1992

SMITH-EMERY COMPANY

TEST NO. 3 - Z POSITION

APPLIED LOAD POUNDS	MOVEMENT INCHES	OBSERVATION
0	0.000	
400	0.061	
800	0.134	
1200	0.195	
1600	0.247	
2000	0.293	NEOPRENE BUSHING BOTTOMED OUT.
2400	0.312	
2800	0.344	
3200	0.380	
3600	0.396	
4000	0.421	
5000	0.487	CENTER BOLT BEGAN TO BEND.
6000	0.541	
7000	0.581	INNER BRACKET BASE PLATE BEGAN TO DEFORM.
8000	0.628	SLIGHT BOW IN INNER BRACKET BASE PLATES AT ANCHOR BOLT.
9000	0.668	
10000	0.709	
10700		MAXIMUM LOAD. CENTER BOLT FAILED.

OBSERVATION OF SEISMIC SNUBBER AFTER TEST:

(1) INNER BRACKET BASE PLATE SLIGHTLY DEFORMED AT ANCHOR BOLTS.

(2) NO DEFORMATION OF WELDING.

(3) SMALL CRACK IN NEOPRENE BUSHING.

RESPECTFULLY SUBMITTED,

SMITH - EMERY COMPANY

Jim Partridge

JIM PARTRIDGE
CIVIL ENGINEER

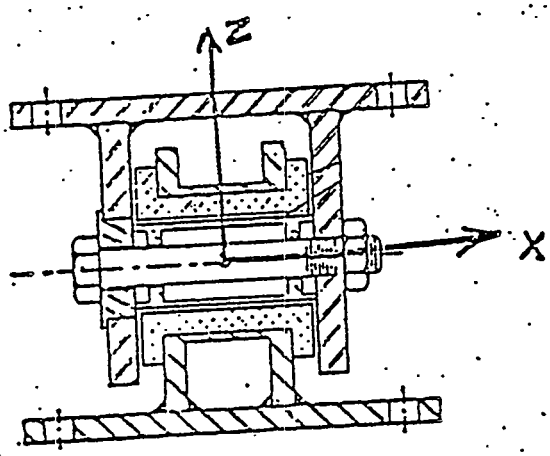
REGISTERED PROFESSIONAL ENGINEER
GEORGE E. BATTEY JR.
NO. 9143
CIVIL
STATE OF CALIFORNIA

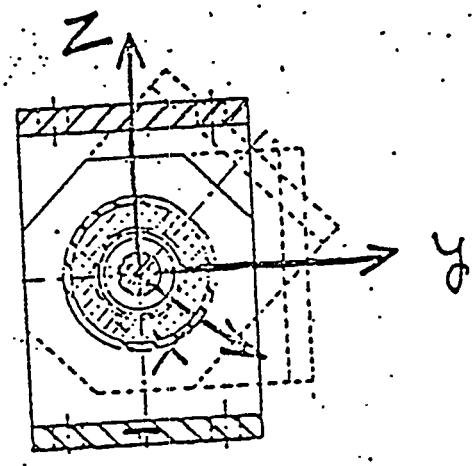
6 ADDRESSEE

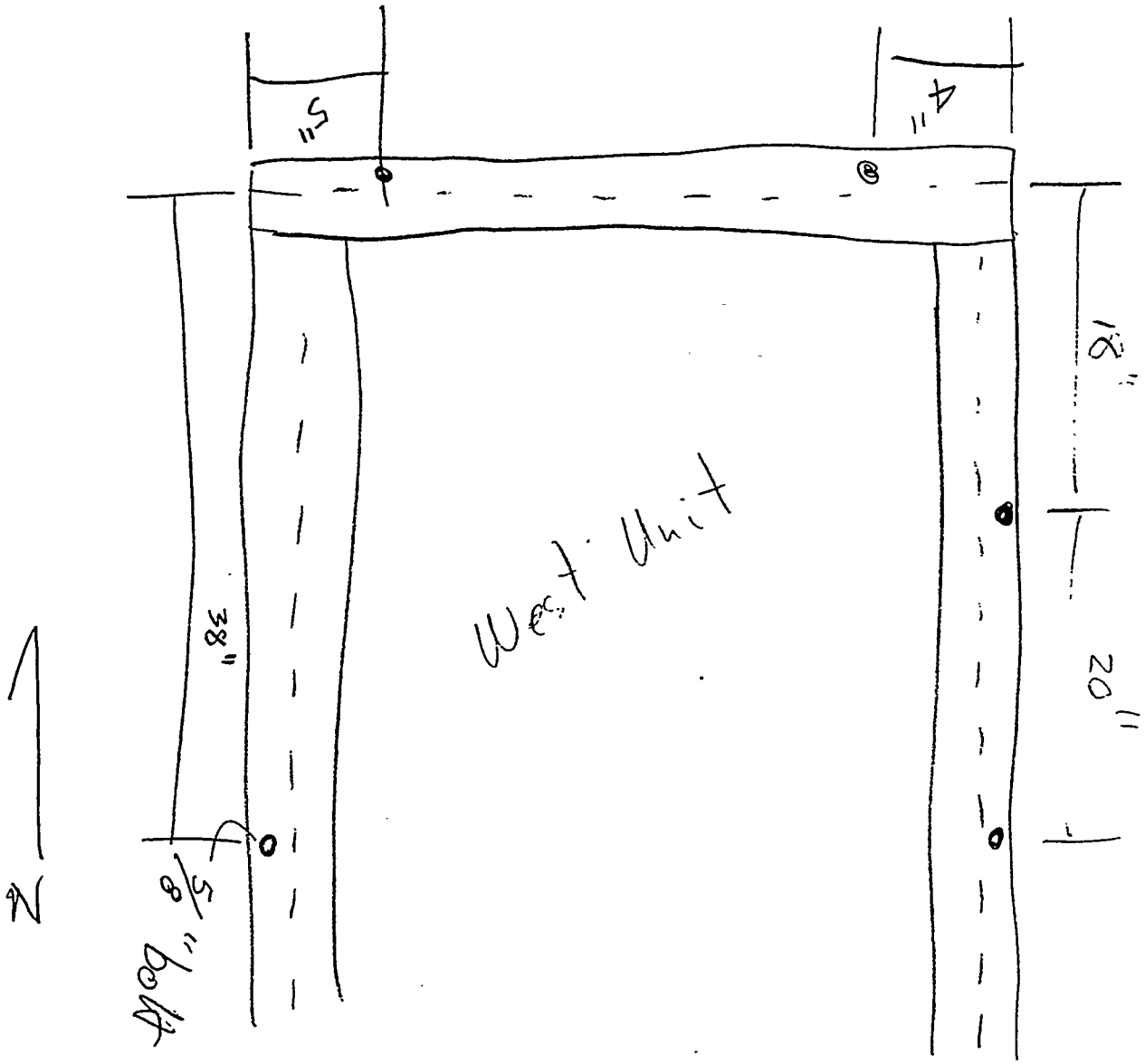
BW

File No.: 1875-75
Lab No.: L-75-1992

SMITH-EMERY COMPANY







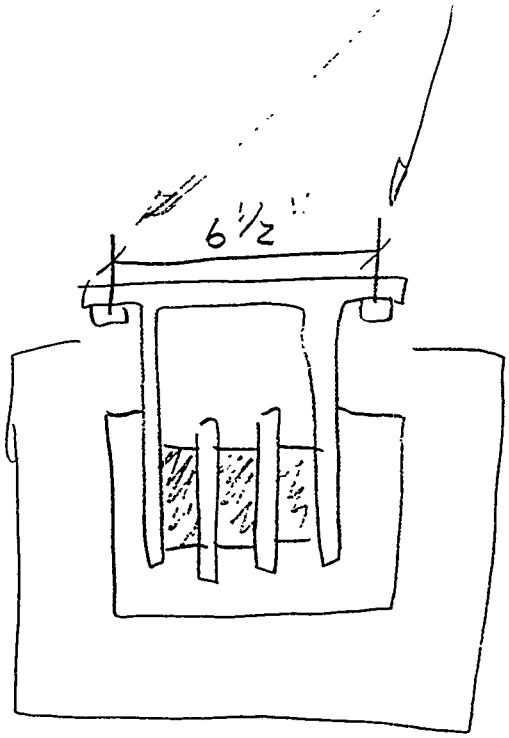
EF-1-1

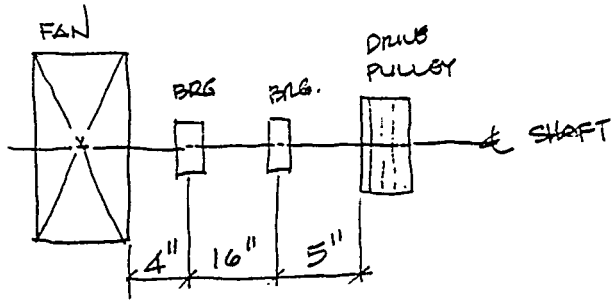
Fan-Motor-Filter Unit

Field Notes

Snubber

2- 5/8" bolts





EF-1-1

Fan - Motor - Filter Unit

Field Notes

(1) Drawing _____ (2) Doc. No. _____ (3) Page D 35 of _____

(4) Building _____ (5) Rev. _____ (6) Job No. _____

(7) Subject _____

(8) Originator R A Miller Date 5-4-94

(9) Checker M. A. ISLAM Date 5/27/94

(10)

Diesel Engine Anchorage

The results of the dynamic analysis for the diesel engine anchorage was found in the CVI file 20370, dated April 13, 1977. This report indicates that the snubber model Z 1011-350 is acceptable for the applied load of 1,040 lb. This compares well with the Exhaust Stack analysis which has about 30% more mass and a higher center of gravity.

The actual anchorage condition is shown on the drawings H-2-27966 and verified by field walkdown.

For the evaluation of the diesel two acceleration levels will be compared for use. First, the accelerations and support forces from the Mason Industries analysis and second, the dynamic accelerations from WHC-SD-GN-DGS-30006 Rev. 1 for flexible equipment will be used.

For conservatism and simplicity the dynamic analysis methods offered in the seismic design guide "WHC-SD-GN-DGS-30006 Rev 1" will be used. The design guide uses amplified accelerations that are statically applied to account for the dynamic effects. Table 2.5 gives the accelerations values to be used for existing installations of safety class 3/4 equipment in safety class 1/2 facilities.

For rigid equipment and suspended HVAC systems above grade an acceleration of 1.35 g is recommended for use.

PFP OPERATIONS ASSIGNED SC 3 TO THE D-E BUT REQUIRES OPERABILITY AFTER DBE AND ALSO ANCHORAGE ADEQUACY USING SC 1 SEISMIC DEMAND. QUALIFICATION FOR OPERABILITY IS PRESENTED HEREIN USING THE SEISMIC QUALIFICATION UTILITIES GROUP/ GENERIC IMPLEMENTATION PROCEDURE (SQUG/GIP) METHODOLOGY. FOLLOWING THE APPROVED WORK PLAN IN APPENDIX E, A SEISMIC WALKDOWN PROCEDURE WAS NOT GENERATED FOR THIS APPLICATION OF THE SQUG/GIP METHOD. EARTHQUAKE EXPERIENCE DATA WAS USED TO VERIFY OPERABILITY BY FOLLOWING THE SCREENING EVALUATION WORK SHEET (SEWS) OF THE GIP FOR THIS EQUIPMENT CLASS. THE SEISMIC CAPACITY BASED ON THE GENERIC BOUNDING SPECTRUM ENVELOPES THE DEMAND BASED ON THE GROUND RESPONSE SPECTRA AS SHOWN ON PAGE D 20

ACCEPTABLE MINIMUM M. OF S. IS 0.25 @ EMBEDED ANCHOR BOLTS

SCREENING EVALUATION WORK SHEET (SEWS) Sheet 1 of 2

Equip. ID No. _____ Equip. Class 13 - Motor-Generators

Equipment Description DIESEL GENERATOR UNIT - 65 KW

Location: Bldg. 2736ZA Floor El. GRADE Room, Row/Col _____

Manufacturer, Model, Etc. (optional) DAVID MFG. CO.

SEISMIC CAPACITY VS DEMAND

			@ GRADE
1.	Elevation where equipment receives seismic input		
2.	Elevation of seismic input below about 40' from grade		Y (N) U
3.	Equipment has fundamental frequency above about 8 Hz		(Y) N U N/A
4.	Capacity based on:	Existing Documentation	DOC
		Bounding Spectrum	(BS)
5.	Demand based on:	Ground Response Spectrum	(GRS)
		1.5 x Bounding Spectrum	ABS
		Conserv. Des. In-Str. Resp. Spec.	CRS
		Realistic M-Ctr. In-Str. Resp. Spec.	RRS

Does capacity exceed demand? (SEE PAGES D19 AND D20) (Y) N U
THE D-6 IS SC 3 BUT IS BEING EVALUATED FOR SC 1 SEISMIC LOAD ∴ USE THE .2g SPECTRA CURVE.

CAVEATS - BOUNDING SPECTRUM (Identify with an asterisk (*) those caveats which are met by intent without meeting the specific wording of the caveat rule and explain the reason for this conclusion in the COMMENTS section below)

1.	Equipment is included in earthquake experience equipment class	(Y) N U N/A
2.	Main driver and driven equipment connected by a rigid support or skid	(Y) N U N/A
3.	Base vibration isolators adequate for seismic loads	(Y) N U N/A
4.	Attached lines have adequate flexibility	(Y) N U N/A
5.	Anchorage adequate (See checklist below for details)	(Y) N U N/A
6.	Relays mounted on equipment evaluated	Y N U (N/A)
7.	Have you looked for and found no other adverse concerns?	(Y) N U N/A

Is the intent of all the caveats met for Bounding Spectrum? (Y) N U N/A

ANCHORAGE

1.	Appropriate equipment characteristics determined (mass, CG, natural freq., damping, center of rotation)	(Y) N U N/A
2.	Type of anchorage covered by GIP	(Y) N U N/A
3.	Sizes and locations of anchors determined	(Y) N U N/A
4.	Adequacy of anchorage installation evaluated (weld quality and length, nuts and washers, expansion anchor tightness, etc.)	(Y) N U N/A
5.	Factors affecting anchorage capacity or margin of safety considered: embedment length, anchor spacing, free-edge distance, concrete strength/condition, and concrete cracking	(Y) N U N/A

SCREENING EVALUATION WORK SHEET (SEWS) Sheet 2 of 2

Equip. ID No. _____ Equip. Class 13 - Motor-Generators

Equipment Description DIESEL GENERATOR UNIT - 65 KW

ANCHORAGE (Cont'd)

6.	For bolted anchorages, gap under base less than 1/4-inch	Y N U (N/A)
7.	Factors affecting essential relays considered: gap under base, capacity reduction for expansion anchors	Y N U (N/A)
8.	Base has adequate stiffness and effect of prying action on anchors considered	(Y) N U N/A
9.	Strength of equipment base and load path to CG adequate	(Y) N U N/A
10.	Embedded steel, grout pad or large concrete pad adequacy evaluated	(Y) N U N/A

Are anchorage requirements met? (Y) N U

INTERACTION EFFECTS

1.	Soft targets free from impact by nearby equipment or structures	(Y) N U N/A
2.	If equipment contains sensitive relays, equipment free from all impact by nearby equipment or structures	Y N U (N/A)
3.	Attached lines have adequate flexibility	(Y) N U N/A
4.	Overhead equipment or distribution systems are ~~not~~ likely to collapse	Y (N) U N/A
5.	Have you looked for and found no other adverse concerns?	(Y) N U N/A

Is equipment free of interaction effects? (Y) N U

IS EQUIPMENT SEISMICALLY ADEQUATE? (Y) N U

COMMENTS

THE BATTERY STARTER IS SECURED TO THE FLOOR BUT IS LOCATED RIGHT AGAINST THE D-G BASE FRAME. SINCE THE BASE FRAME IS RESTRAINED BY SO CALLED SNUBBERS WHICH ALLOW FOR SOME DISPLACEMENT DURING OBE, THE BATTERY CASING MAY BE DAMAGED BY THE FRAME.

THE CONDUIT FROM THE D-G TO THE CONTROL BOX IS EMBEDDED IN THE CONCRETE FLOOR THEREFORE THERE IS NO INTERACTION CONCERN FOR THE CONDUIT.

THE CONTROL BOX AND THE RELAY SWITCH ARE FASTENED TO THE REINFORCED CONCRETE WALL. A TUG TEST WAS PERFORMED TO QUALIFY THE ANCHORAGE OF THE BOXES.

Evaluated by: E. C. Ocorna Date: 6/3/91

(1) Drawing _____ (2) Doc. No. _____ (3) Page D38 of D38
(4) Building _____ (5) Rev. _____ (6) Job No. _____
(7) Subject _____
(8) Originator R A Hill Date 4-19-94
(9) Checker M.A-ISLAM Date 5/27/94

(10) Forces on diesel mounting bolts :

$f_x = f_y = \dfrac{4160 \times 1g}{6 \text{ bolts}} = 693^{\#}$ *

$f_z = \dfrac{4160 \times 1g}{6} = 693^{\#}$

Shear $V = \sqrt{693^2 + 693^2} = 980^{\#} < 2000^{\#}$ O.K

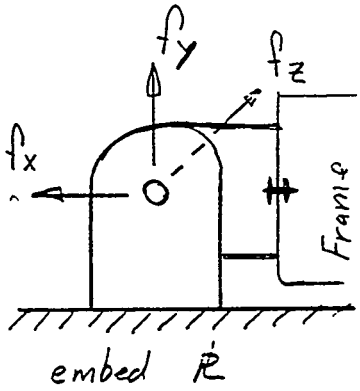
tension $T = 693^{\#} < 3900^{\#}$ O.K.

$I = \frac{980}{2000} + \frac{693}{3900} = .67$; M.S. $= \frac{1}{.67} - 1 = .49$

Forces on snubber :

$f_x = f_y = f_z = 1{,}040^{\#}$

Ref. CVI 20370 Sht 98



From CVI Analysis Info

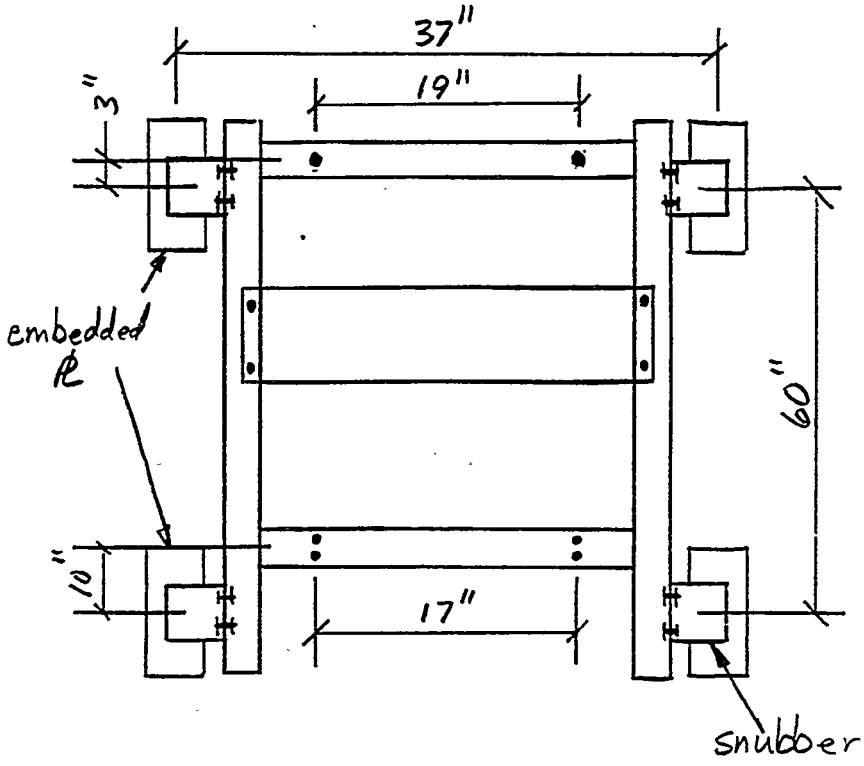
$1{,}040^{\#} >$ max capacity of Mason Z 1011-350 (350 lbs)

* Wt. of Diesel Gen. = $1040^{\#} \times 4$ snubbers $= 4160^{\#}$

(1) Drawing _____ (2) Doc. No. _____ (3) Page D39 of _____
(4) Building _____ (5) Rev. _____ (6) Job No. _____
(7) Subject _____
(8) Originator RA Hille Date 4-19-94
(9) Checker M.A-ISLAM Date 5/27/94

(10) Diesel Mounting

½" SAE bolts
use A307
allowables
V_a = 2.0 K
T_a = 3.9 K



Diesel Frame

From CVI Information:

max acceleration = 1g

max snubber load = 1,040 lb

Find Diesel Weight:

(1g)(1040#)(4 snubbers) = 4,160 lb

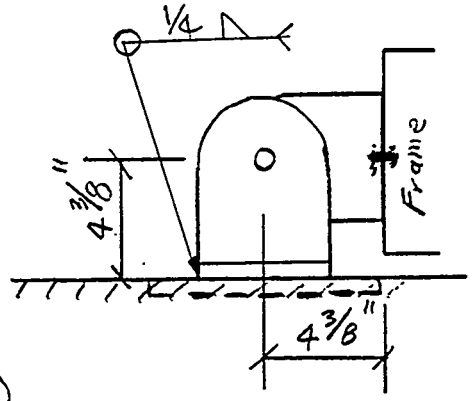
(1) Drawing _____ (2) Doc. No. _____ (3) Page B-40 of _____
(4) Building _____ (5) Rev. _____ (6) Job No. _____
(7) Subject _____
(8) Originator RA Dillen Date 4-19-94
(9) Checker M. A. ISLAM Date 5/27/94

(10) Check Snubber to Frame Bolts:

$$\text{Shear } V = \sqrt{\left(\frac{f_x}{2}\right)^2 + \left(\frac{f_z}{2}\right)^2}$$

$$= \sqrt{\left(\frac{1040}{2}\right)^2 + \left(\frac{1040}{2}\right)^2}$$

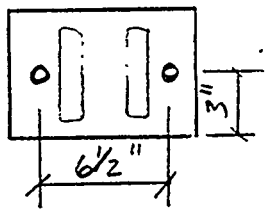
$$= 735^{\#} < 2000^{\#} \quad O.K.$$



$$\text{Tension } T = \frac{f_y}{2} + \frac{f_z(4\frac{3}{8})}{6.5} + \frac{f_x(4\frac{3}{8})}{3(2)}$$

$$= 520^{\#} + 700^{\#} + 758^{\#}$$

$$= 1978^{\#} < 3900^{\#} \quad O.K.$$



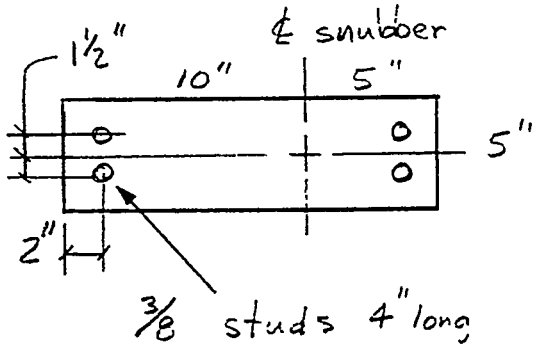
$$I = \frac{735}{2000} + \frac{1978}{3900} = .87$$

$$M.S. = \frac{1}{.87} - 1 = .15$$

$f_x = f_y = f_z = 1{,}040^{\#}$

Check Embed ℄:

steel anchor capacity;
$T_a = .11(20000) = 2200^{\#}$
$V_a = .11(10000) = 1100^{\#}$



Ref H-2-27966

(1) Drawing _____ (2) Doc. No. _____ (3) Page D41 of _____
(4) Building _____ (5) Rev. _____ (6) Job No. _____
(7) Subject _____
(8) Originator R A Hills Date 4-19-94
(9) Checker M.A-ISLAM Date 5/27/94

(10)

Concrete shear cone capacity:

$P_a = 3740^{\#}(.9 \text{ for } 3000\,psi)(.8 \text{ close spacing})$ ← shear cone overlap

$= 2690^{\#}$

$V_a = 1870^{\#}(.9 \text{ for } 3000\,psi)(1.0 \text{ close spacing})$

$= 1683^{\#}$ ← $\sqrt{\frac{f_c'}{3500}}$

steel capacity:
3/8 stud A307
tension = 2200#
shear = 1100#

Shear load

$V = \sqrt{\left(\frac{f_x}{4 \text{ studs}}\right)^2 + \left(\frac{f_z}{4}\right)^2}$

$= 368^{\#}$

Tension load

$P = \frac{f_y}{4} + \frac{f_x(4\,3/8)}{2\frac{1}{2}"(2)} + \frac{f_z(4\,3/8")}{11"(2 \text{ bolts})}$

$= 260 + 910 + 207$

$= 1377^{\#}$

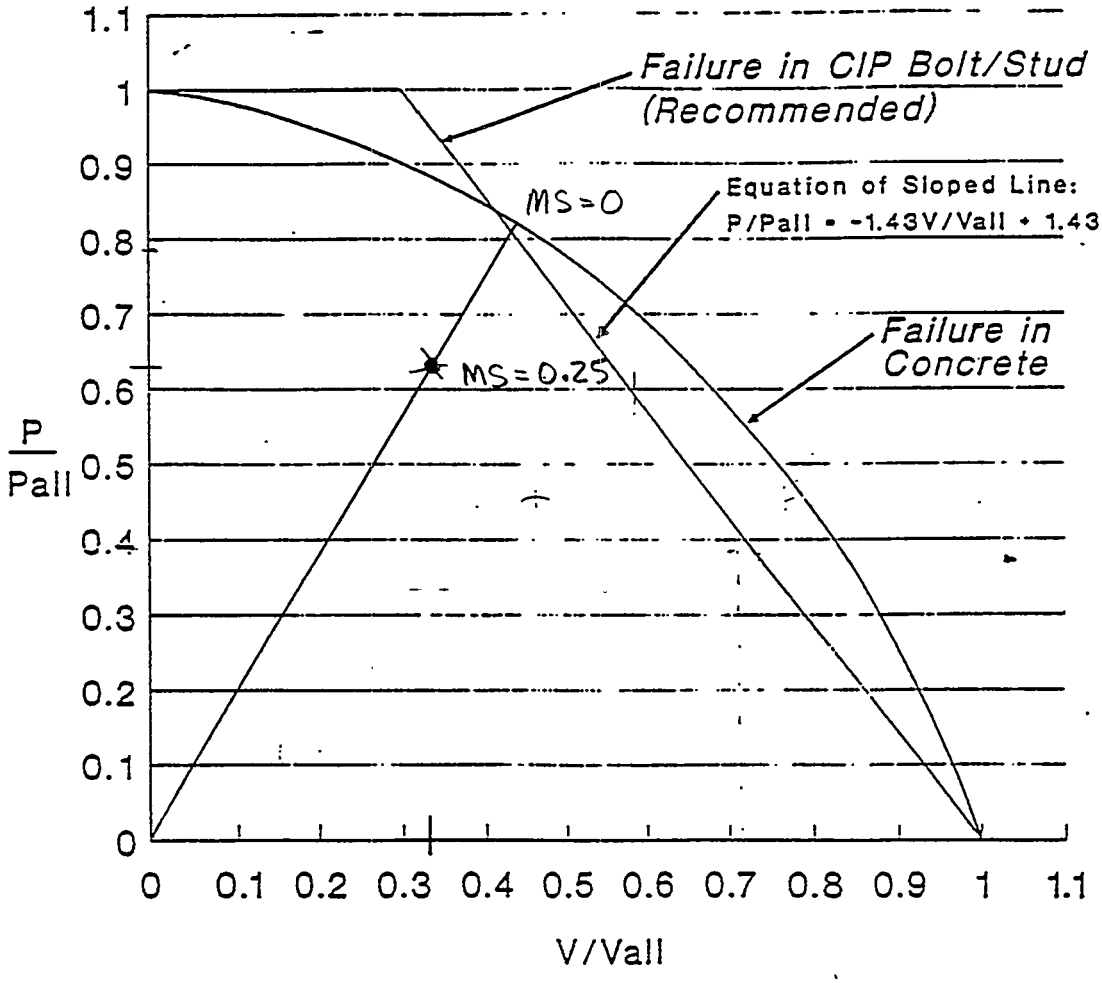
$\frac{P}{P_{all}} = \frac{1377}{2200} = .63 \qquad \frac{V}{V_{all}} = \frac{368}{1100} = .33$

From Interaction graph: M.S ≅ 0.25

WELD TO EMBED:
THE 1/4" FIL. WELD AT SNUBBER BASE TO EMBED PL. IS ACCEPTABLE BY INSPECTION.

(1) Drawing _____ (2) Doc. No. _____ (3) Page 242 of _____
(4) Building _____ (5) Rev. _____ (6) Job No. _____
(7) Subject _____
(8) Originator R B Hilla Date 4-19-94
(9) Checker M. A. ISLAM Date 5/27/94

(10)



V/Vall	0.0	0.1	0.3	0.5	0.7	0.9	1.0
P/Pall - CIP Bolt/Stud	1.0	1.0	1.0	.71	.43	.14	0.0
P/Pall - Concrete	1.0	.99	.91	.79	.60	.30	0.0

WHC-SD-GN-DGS-30006 R1
Page 8-37

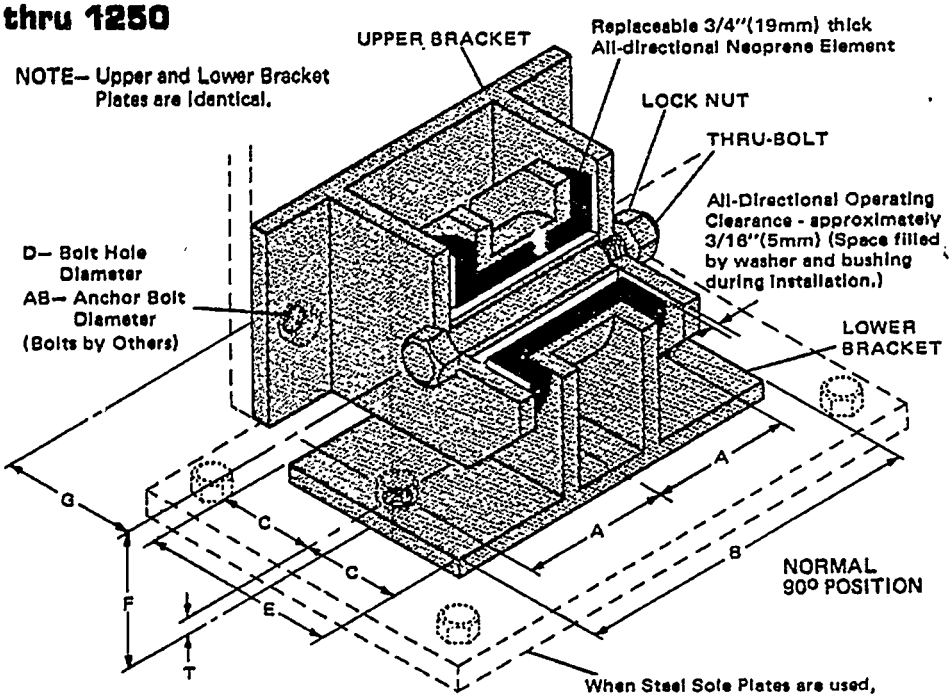
MASON INDUSTRIES, Inc.
Manufacturers of Vibration Control Products
350 Rabro Drive, Hauppauge, NY 11788, 516/348-0282, FAX 516/348-0279
708 N. Valley St., Suite K, Anaheim, CA 92801, 714/535-2727, FAX 714/535-5738
TELEX 96-8464

CERTIFIED FOR JOB NAME WHC-SD-CP-SA-026
CUSTOMER REV 1 PAGE
CUSTOMER P.O. _____ JOB NO. _____
MASON S.O. _____ DWG NO. _____

TYP
Z-101
ALL-DIRECTION SEISMIC SNUBI
Sizes 350-1

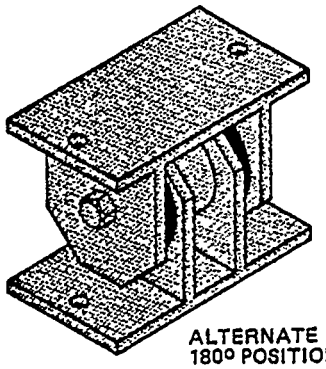
D43

Z-1011-350 thru 1250



NOTE— Upper and Lower Bracket Plates are identical.

When Steel Sole Plates are used, level and anchor Sole Plates properly to concrete. Snubber Baseplate may be bolted or welded to Sole Plate.



ALTERNATE 180° POSITION

INSTALLATION INSTRUCTIONS:

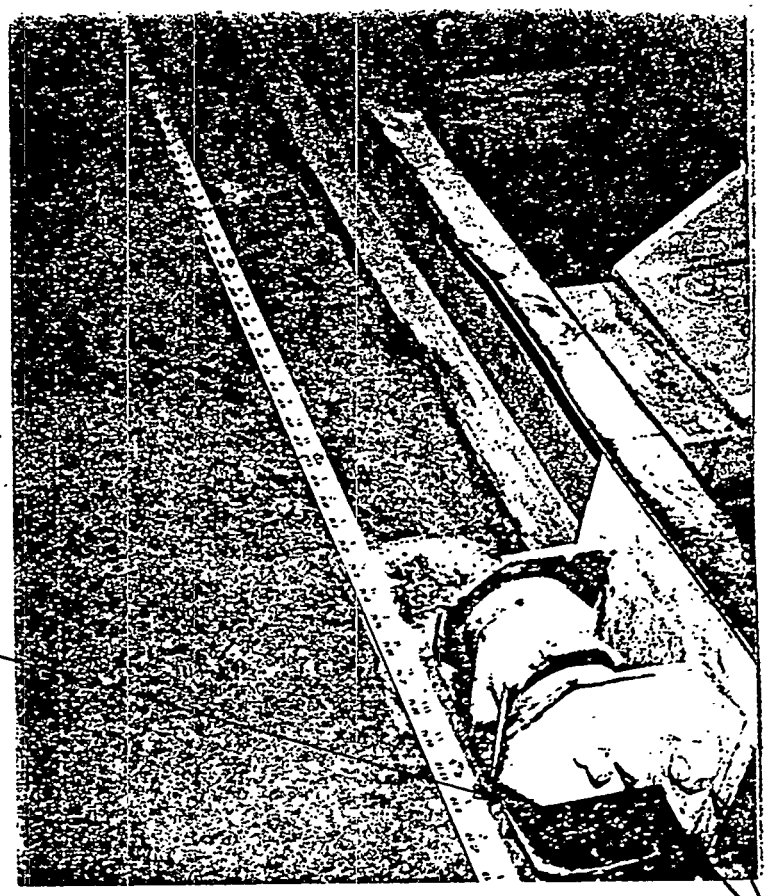
1. Snubbers are inactive during normal operation and clearance must be maintained.
2. To maintain clearances around isolation bushing, unit is furnished with spacer washers and spacer bushing, these to remain in unit during installation only.
3. If snubbers are installed on equipment such as blowers or pumps with flexible connections that move and remain in a different position during operation, final positioning and adjustment of snubbers must be made with equipment in operation.
4. Use shims at brackets as required so that units are installed without applying pressure on spacer washers or bushing.
5. After units are installed, remove spacer washers and bushing as follows:
   a. Remove lock nut from thru-bolt and remove thru-bolt.
   b. Remove anchor bolts from one bracket. If bracket was shimmed, note shim position.
   c. Remove bracket and remove spacer washers and spacer bushing.
   d. Reinstall bracket and thru-bolt. Shim as before if shims were used.
   e. Lock thru-bolt in place with jam nut.

TYPE Z-1011 LOAD RATINGS and DIMENSIONS

	Size	Load Rating	A	AB	B	C	D	E	F	G	T
U.S.A. or BRITISH (lbs. & inches)	350	350	3-1/8	3/8	7-1/2	1-1/2	1/2	3	2-1/2	3	1/4
	1250	1250	3-3/8	1/2	8-1/4	3	5/8	6	4-3/8	4-3/8	3/8
METRIC (kgs. & mm)	350	159	79	10	191	38	13	78	64	76	6
	1250	568	86	13	210	76	16	152	111	111	10

DWN	CHKD	DATE

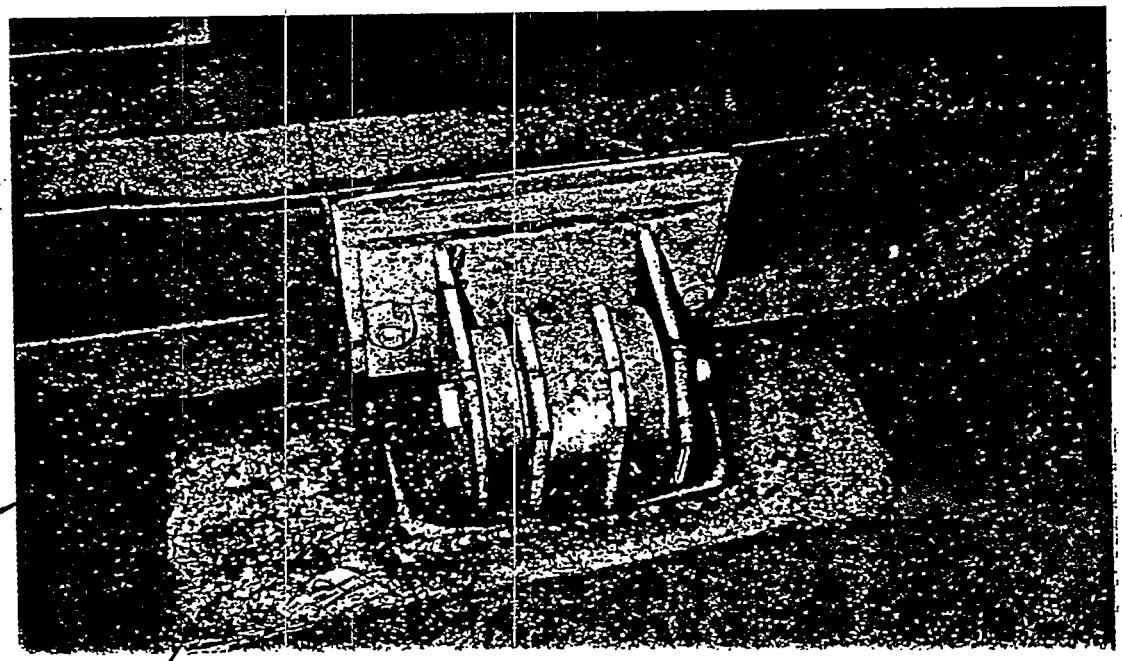
DWG NO



1/4

DIESEL ENGINE BASE
(2736-ZA)

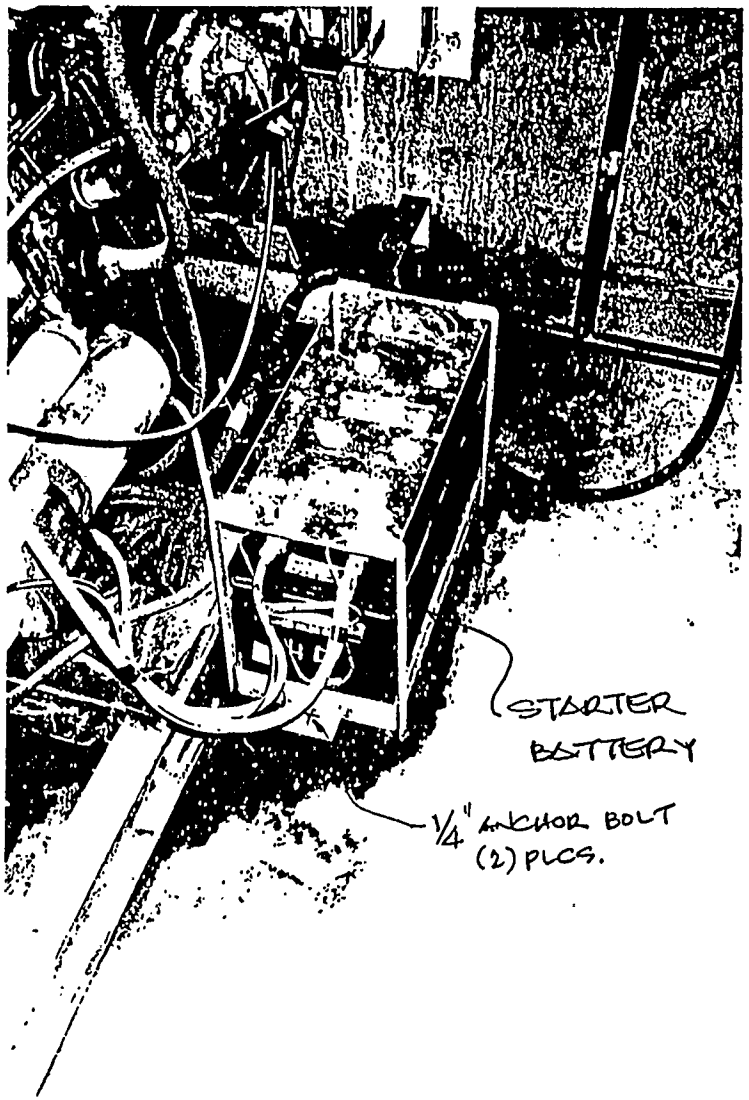
3/8" ϕ bolt



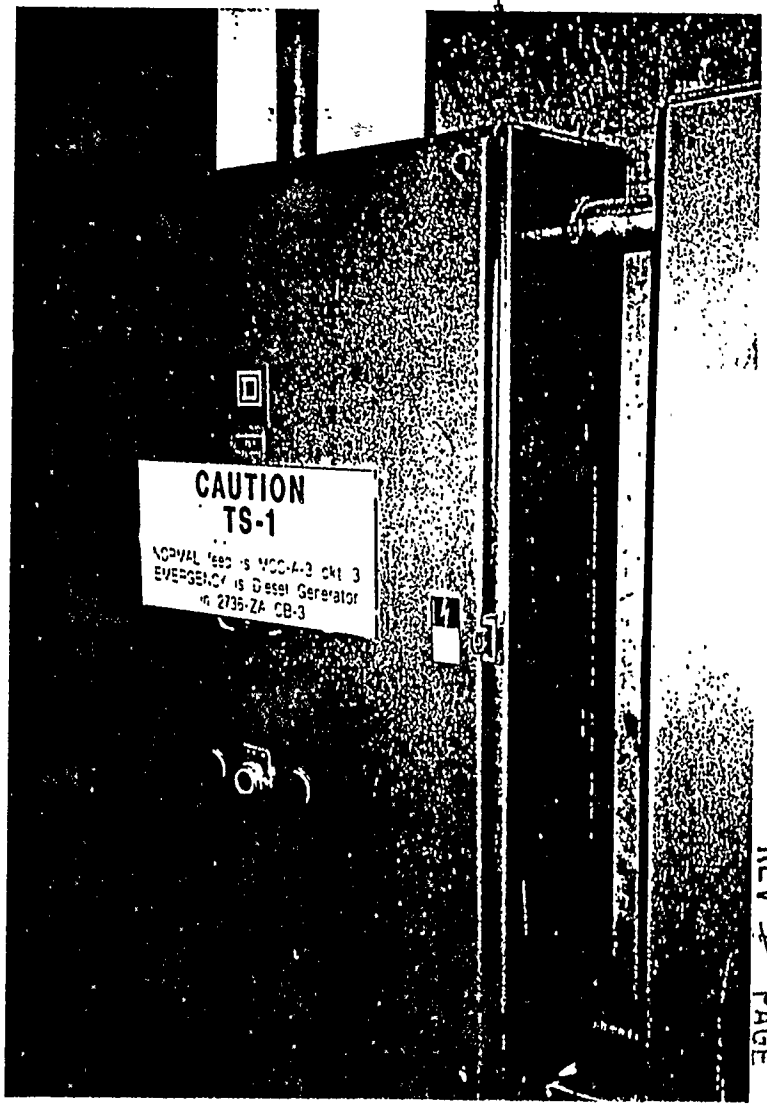
3/8" ϕ bolt

Emb. Pl

DIESEL ENGINE BASE (2736-ZA BLDG.)



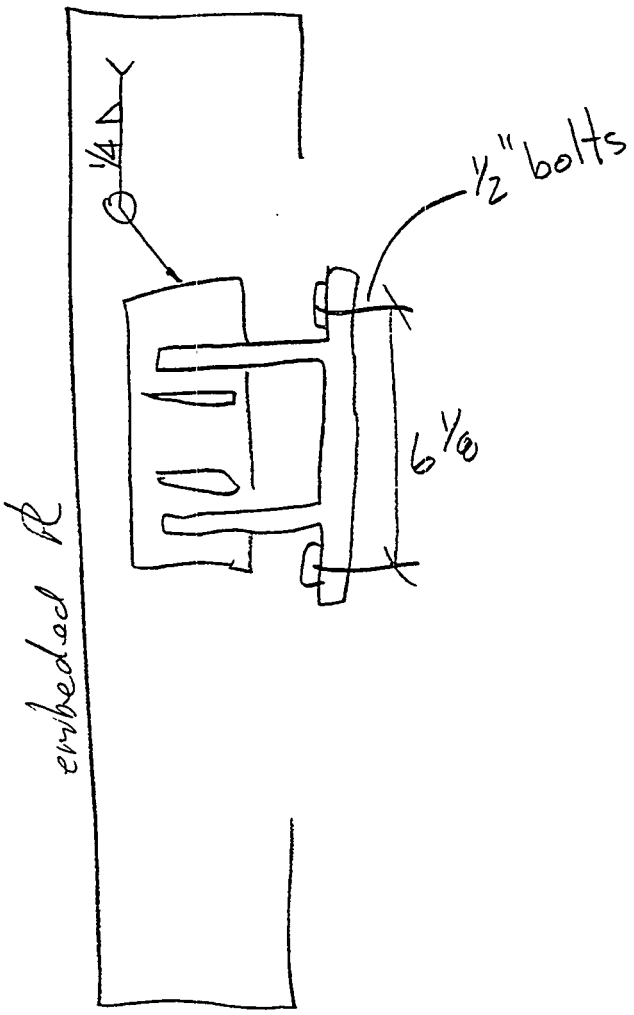
DIESEL ENGINE (2736-ZA BLDG)



D-G. CONTROL BOX

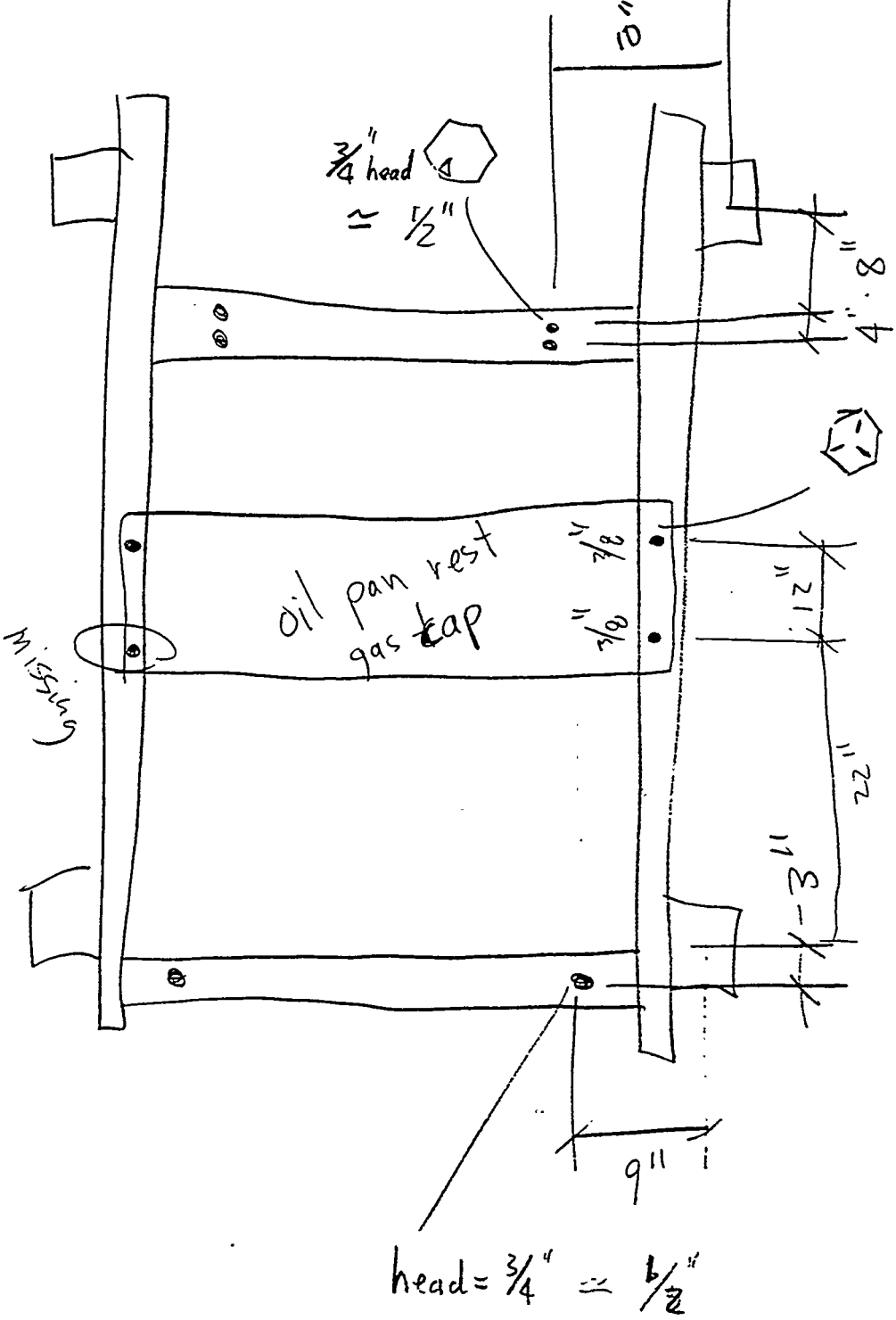
Diesel Snubber

D46



Field Notes

Diesel



Field Notes

CVI	EQUIPMENT TITLE	EQUIPMENT NO.	COST
20370	Diesel Generator Unit		
DATE	**VENDOR**		PROJ. NO.
6-1-78	Cummins Diesel		
P. O. NUMBER	**EQUIPMENT MANUFACTURER**		BLDG. NO.
RHO P.O. #W7N-XBB-11337			271-ZA

SHEET NO.	VENDOR DWG.	SUPERSEDED BY HAN. DWG.	REV.	HAN. MODIFIED DWG.	CURVES	VENDOR SPEC.	INSTR.	PARTS LIST	MISC.
1/16	RHO P.O. #W7N-XBB-11337								
	1. David Mfg. Co.								
	• Fuel Tank and Float Switch - Specifications								
	• Circuit Breakers - Specs. and Schematic Diagram								
	• Battery - Specifications								
	• Generator - Specifications								
	• Engine Connection and Control Diagrams								
	• Alternator - Bulletin #EB 77-03, Operation & Maint. Manual								
	• Generator Sets - Bulletin #EB 77-04-A, Operation & Maint. Manual								
	• System Dynamic Analysis								
							1111	1978	
	2. Universal Engine Heater Thermostat - Specs., Wiring Diagram								
	3. LaMarche Battery Chargers - Specs., Parts List								
	4. White Engines, Inc. - Diesel Engines - Operator's Manual								

DEPARTMENT FILE

WHC-SD-CP-SA-026 REV 1 PAGE D48

☐ COMPLETE
☐ PARTIAL

APPROVED: →

FOR DESIGN: D. S. Beetle DSB

FOR CONTRACTOR

COPIES	DISTRIBUTION	ADDRESS
2	CVI Files	RHO/FB
1	LH Jacques	RHO/271-T
1	*DL Chase	RHO/2704-W
	*Plus extras	

COPIES	DISTRIBUTION	ADDRESS
2	DL Eisele	RHO/234-5
1	RJ Thomas	RHO/234-5
1	LH Rodgers	RHO/234-5Z, TR#1
1	Central Files	JAJ/1262

COPIES	DISTRIBUTION	ADDRESS
0	JM Johnston	Vitro [illegible]31-M
0	DS Beetle	Vitro [illegible]B

PERMANENT FIL

CVI. 20370 SHT. 98
P.O. No.
DATE 6-1-78 Bldg. 2736-ZD

April 13, 1977

E.P.N.

SYSTEM DESCRIPTION

The system analyzed consists of a Pavid Model J65-DWH Generator Set mounted on Mason-type "W" pads. The attached illustration locates the X, Y and Z axis of orientation and the support numbers corresponding to the analysis.

DYNAMIC ANALYSIS

The Dynamic Analysis consists of four pages with the following information:

Page 1 - The seismic response data from "Attachment A" was entered with 8 frequency values and corresponding acceleration values from the 1% damping curve. The equipment weight and dimensions were entered.

Page 2 - The support locations and stiffnesses for the un-snubbed system were entered. The natural frequencies and spectral accelerations are shown.

Page 3 - The maximum support displacements are shown. Proceeding to the snubber analysis, the snubber gaps and stiffnesses were entered.

Page 4 - The natural frequencies, maximum accelerations, maximum support forces, and maximum support displacements are shown.

RESULTS

(1) The maximum acceleration of the equipment is 1 G which is less than the limit of 4 G's set forth in 3.1 h.

(2) The maximum force at a snubber is 1040# which is less than the maximum capacity of a Mason Z 1011-350 snubber.

(3) The maximum support displacement is 1/2" which is less than the limit of 5/8" set forth in 3.1 h and is within the displacement limits of a Mason Z 1011-350.

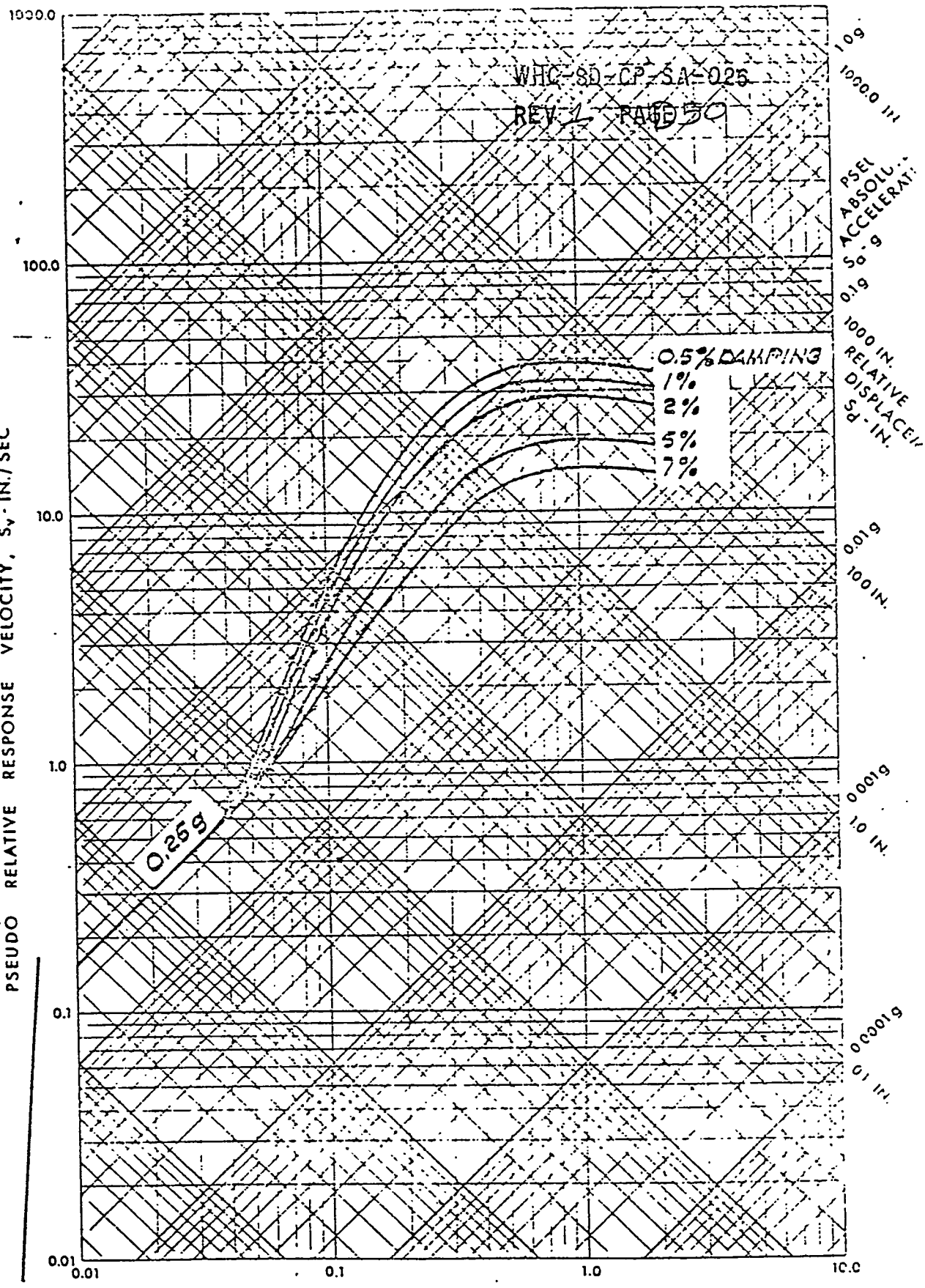
CONCLUSION

Using (4) Mason Z 1011-350 with zero gap, the system is within the specification 3.1 d through 1.

Glenn Foulkes

Glenn Foulkes
Generator Sales

GF:mp



CVI. 203770 SHT. 99
P.O. No.
DATE 6-1-77 Bldg. 2736-Z

E.P.N.

RESPONSE SPECTRA,
SAFE SHUTDOWN EARTHQUAKE

ATTACHMENT "A"

B-125-P8

(1) Drawing _____ (2) Doc. No. _____ (3) Page D5 of _____

(4) Building _____ (5) Rev. _____ (6) Job No. _____

(7) Subject _____

(8) Originator RA Miller Date 3-22-94

(9) Checker M.A. ISLAM Date 5/27/94

(10)

Duct Between Buildings 2736Z & 2736ZA

Differential building movements of 2736Z and 2736ZA must be absorbed by the inter-building duct. This duct has a thick rigid portion (3/8 in. material) and a thin flexible portion (28 Ga. 0.0149 in. material).

From the building seismic analyses each building moves in-line or toward and away from each other approximatly 0.1080 in. Each building also moves laterally 0.0855 in. Both the in-line and the lateral motions can be out-of-phase with each other, so the displacements are additive.

Maximum in-line displacement = 0.216 in.

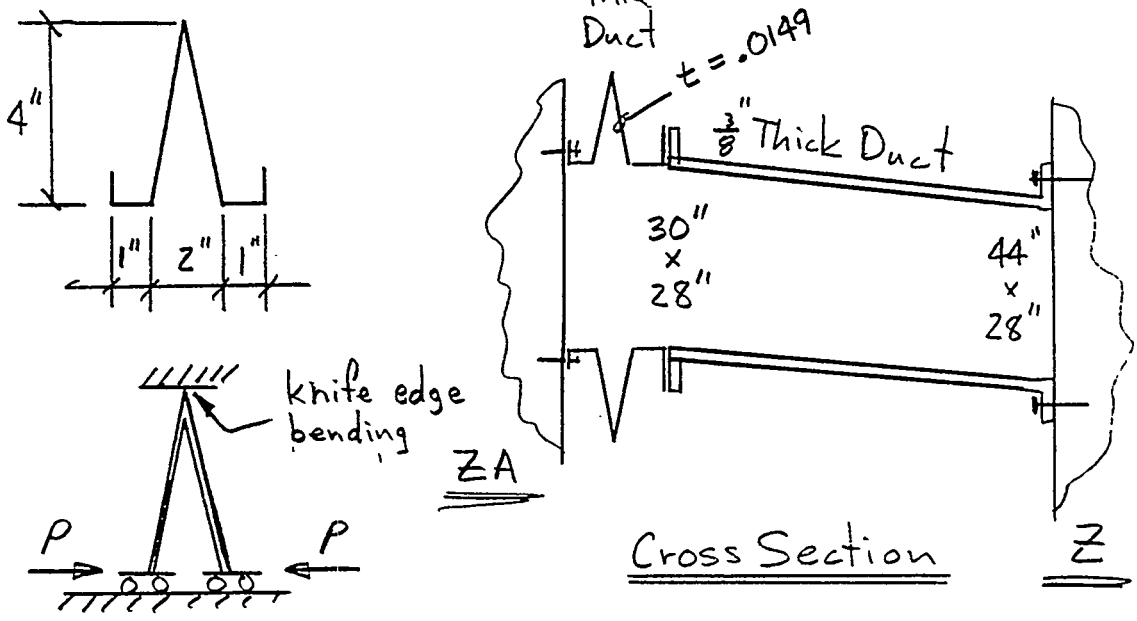
Maximum lateral displacement = 0.171 in.

Ref. Building Analyses WHC-SD-CP-SA-023 (2736Z)
WHC-SD-CP-SA-024 (2736ZA)

Results:
- The seismic motion of the Z buildings may cause some shear tearing in the light gage steel duct. Very small holes may open after the shear tearing.
- The duct will remain in place after an earthquake.

(1) Drawing _____ (2) Doc. No. _____ (3) Page D52 of _____
(4) Building _____ (5) Rev. _____ (6) Job No. _____
(7) Subject _____
(8) Originator RA Hill Date 3-22-94
(9) Checker M.A. ISLAM Date 5/27/94

(10) In-Line Displacement Capacity



$$I_b = \frac{(28" + 28" + 30" + 30")(.0149")^3}{12} = .000032 \text{ in}^4 \quad @ \text{knife edge}$$

$$S_b = \frac{I_b}{.0149}\left(\frac{12}{6}\right) = .00429 \text{ in}^3$$

$F_b = 1.7(.75 F_y)$ 1.7 is increase allowed by UCRL
| = 45.9 ksi .75 is AISC factor for rect. sect.
$F_y = 36{,}000$ psi

$$M = \frac{Pl}{2} \qquad 2\Delta = 2\frac{Pl^3}{12EI}$$

AISC 9th Ed
diagram 23
pg 2-303

(1) Drawing _____ (2) Doc. No. _____ (3) Page D53 of _____
(4) Building _____ (5) Rev. _____ (6) Job No. _____
(7) Subject _____
(8) Originator RA Hill Date 3-22-94
(9) Checker M. A-ISLAM Date 5/27/94

(10)

$$M = F_b S_b = \frac{Pl}{2}$$

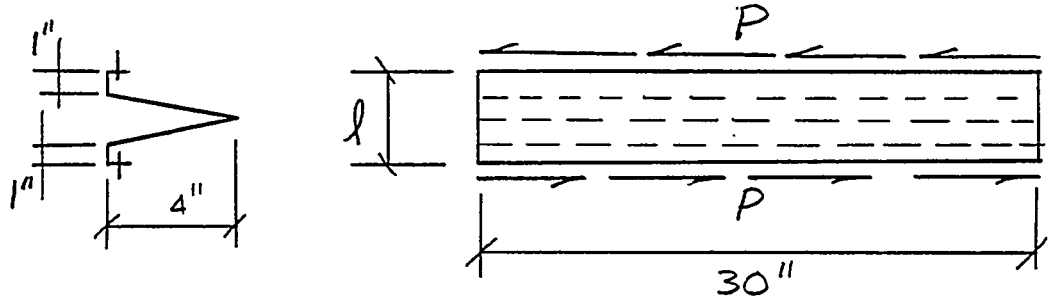
$$M = 45.9(.00429) = \frac{P(4")}{2}$$

$$M = 0.197 = 2P \qquad P = 0.098^{K}$$

$$\Delta = \frac{Pl^3}{12EI} = \frac{98^{\#}(4)^3}{12\,E\,(.000032)} = .563"$$

$$2\Delta = 1.13" > 0.216" \quad O.K.$$

Lateral Disp. Capacity



$$l = 1" + 4" + 4" + 1"$$

$$\Delta = \frac{1.2Pl}{A E_s} = \frac{1.2P(10")}{(.0149 \times 30")\,12E6} = .0000224P$$

$$F_v = 1.4(.4F_y) = 20.16 \text{ ksi}$$

$$f_v = P \div A \qquad P = f_v A$$

(1) Drawing _____ (2) Doc. No. _____ (3) Page D54 of _____
(4) Building _____ (5) Rev. _____ (6) Job No. _____
(7) Subject _____
(8) Originator RA Shilton Date 5-22-94
(9) Checker M.A-ISLAM Date 5/27/94

(10) $P = f_v A = 20.16\ ksi\ (.0149 \times 30")$

$= 9.01\ K$

$\Delta = \frac{1.2 P l}{A E_s} = \frac{1.2\,(10.94^{K})(10")}{(.0149 \times 30)\ 12E6} \times 1000^{\#/K}$

$= .024" < 0.171"$ No Good

$M.S. = \frac{.024}{.171} - 1 = -.86$ shear tearing may occur.

The thick portion of the duct (3/8" PL) should be checked for capacity.

$Wt. = \frac{3}{8}" \times (44" \times 28" \times 2) \times 60" \times .283\ pci = 917^{\#}$

EQ Load $= 1.35g\ W = 1238^{\#}$

lateral load $= 1238^{\#}$

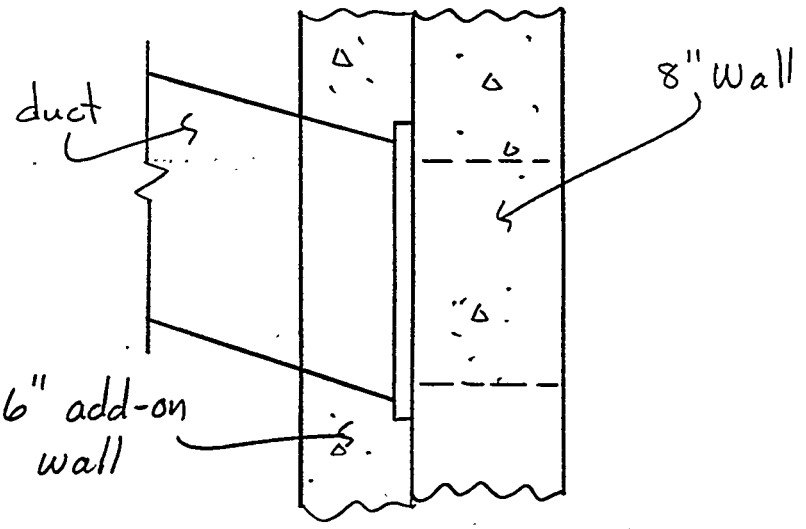
vertical load $= 917^{\#} + \frac{2}{3}(1238) = 1742^{\#}$

flange & bolts are embeded between the 8" original concrete wall and the 6" add-on concrete wall (see detail next page) so the duct bending is the weak link in the duct design.

DESIGN CALCULATION

(1) Drawing _____ (2) Doc. No. _____ (3) Page D55 of _____
(4) Building _____ (5) Rev. _____ (6) Job No. _____
(7) Subject _____
(8) Originator RA Dille Date 5-27-94
(9) Checker M.A. ISLAM Date 5/27/94

(10)



Duct Bending

$I = \Sigma Ar^2$

$I_x = 8(13)^2 \times 4 = 5408 \text{ in}^4$

$I_y = 8(21)^2 \times 4 = 14112 \text{ in}^4$

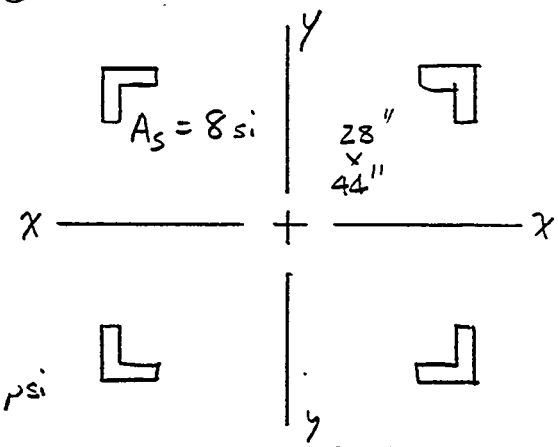
$f_{b_x} = \frac{(M_x)c}{I} = \frac{1742 \times 60'' \times 13''}{5408} = 251 \text{ psi}$

$f_{b_y} = \frac{(M_y)c}{I} = \frac{908 \times 60'' \times 21''}{14112} = 81 \text{ psi}$

Interaction = $\frac{251+81}{45.9 \times 10^3} = .007$ M.S. = 137

Very low Stresses

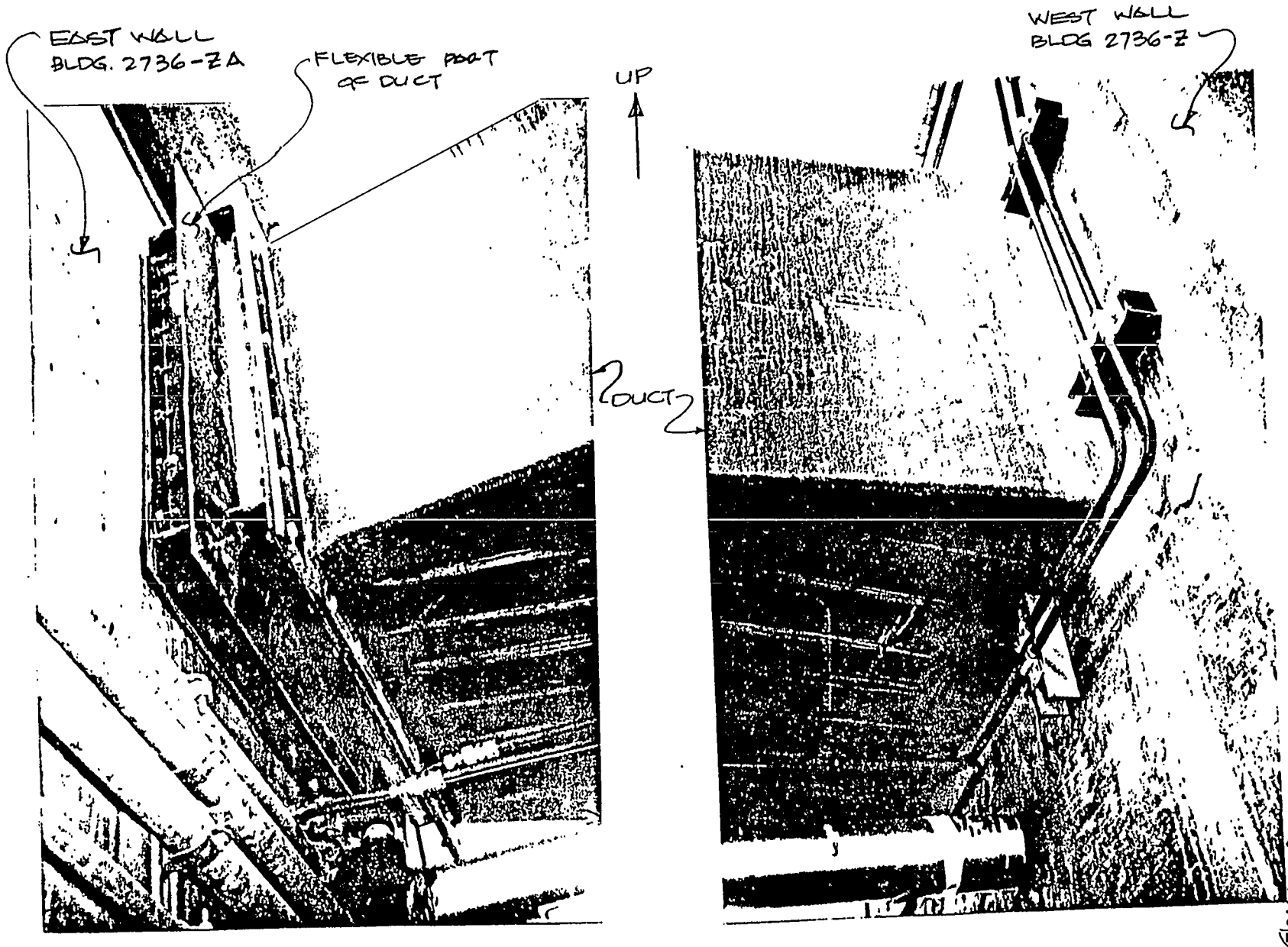
Duct will not fail.



assumed effective section base on

$b/t = 190/\sqrt{f_y}$

AISC 9th Ed Table B5.1



EXHAUST DUCT FROM 2736-Z TO 2736-ZA

APPENDIX E

DYNAMIC EVALUATION OF PLUTONIUM VAULT SEISMIC SHOCK SPECTRUM

Client	WO/Job No.	
Subject PLUTONIUM VAULT, BLDG. NO. 2736-Z	Date 2/24/95	By Carleton J. Moore
SASSI SEISMIC FINITE-ELEMENT MODEL	Checked 2/28/95	By Gary R. Wagenblast
Location PFP	Revised	By

SEISMIC SHOCK SPECTRUM EVALUATION OF PLUTONIUM VAULT

The nuclear safety class of the storage materials, in the 2736-Z plutonium vault, made it necessary to complete a dynamic analysis to evaluate the seismic shock spectrum and the relative storage rack anchor point motions inside the building. The dynamic tool selected for the seismic analysis was SASSI. A simplified quarter model of the building was generated for the SASSI finite-element evaluation.

The geotechnical investigation of the Z-Plant site, 200 West area, by Blume was used for shear and compression wave velocity data to 140 feet depth. The site soil at depths greater than 140 were assumed to be similar to the site evaluation for the MWTF. The nonlinear nature of soil makes it necessary to correct the modulus and damping to be consistent with the strains in the soil column during a specified seismic event.

The SDC 4.1 seismic requirement at PFP is 0.2 g horizontal (shear wave) and 0.133 g vertical (compression wave). The soil data used in the SASSI model must be corrected for nonlinearity due to the strains introduced during the 0.2 g seismic event. Correction of soil properties was completed with a PC program SHAKE91 with EPRI 1993 nonlinear sandy soil test data (input on pages E-19 and E-20). The Hanford Site time history used was th1.hst from WHC-SD-GN-DA-30018 (input on pages E-21 through E-25).

The building footings, precast panels, roof and roof beams are modeled in SASSI with shell elements. The columns are modeled with beam elements. The wall shells and columns that lie on the quarter symmetry planes have full thicknesses and cross sections, but the material modulus and density is adjusted to give half the stiffness and mass.

Degrees-of-freedom (DOF) were assigned to each node according to the type of element connected to it and according to the boundary conditions associated with the planes of symmetry and antisymmetry. Nodes used to define the shell elements depicting the reinforced concrete structure have six DOF, three transnational (ux, uy, and uz) and three rotational (rotx, roty, and rotz). Nodes having y=0 lie on a plane of symmetry in both horizontal and vertical evaluation models. Nodes having x=0 lie on a plane of symmetry in the vertical evaluation model and on a plane of antisymmetry in the horizontal evaluation model.

Shell element nodes on a symmetry plane have the out-of-plane translation and the rotations about the in-plane axes set to zero. Shell element nodes on an antisymmetry plane have rotations about the out-of-plane axis and the in-plane translations set to zero. Shell element nodes having x=y=0 lie on the centerline axis of the tank and have DOF constrained according to the sum of the symmetry/antisymmetry conditions. The remainder of the shell element nodes not lying on a plane of symmetry or antisymmetry have all six DOF free to displace, no DOF set to zero.

		Shell Element Nodes			
		x=0	y=0	x=0 y=0	x≠0 y≠0
Horiz. Model	sym type	asym	sym	℄	none
	translation DOF	uy=0 uz=0	uy=0	uy=0 uz=0	none
	rotation DOF	rotx=0	rotx=0 rotz=0	rotx=0 rotz=0	none
Vertical Model	sym type	sym	sym	℄	none
	translation DOF	ux=0	uy=0	ux=0 uy=0	none
	rotation DOF	roty=0 rotz=0	rotx=0 rotz=0	rotx=0 roty=0 rotz=0	none

The simplified quarter plutonium vault model can be seen in Figures E-1 through E-5. Figure E-1 shows the vault quarter model from an eye position looking down on the building roof and walls. Figures E-2 and E-3 show views looking up from below at the foundation and floor. It should be noted that the floor is not connected structurally to the building due to expansion joints. The floor was connected directly to the site soil like the foundation. Figure E-4 displays the finite-element mesh with a shrink on each element for visual checking of the elements both inside and outside. Figure E-5 shows the model nodal numbering of the roof and two walls.

Figures E-6 and E-7 show log and linear seismic plots of the conservative (minimum specification concrete with an extra 6 inches of extra concrete considered only as mass) shock spectrum. These plots show that the exterior wall has a maximum response. Figure E-8 shows that the maximum relative

displacement between the exterior wall and the floor is only 6 thousands of an inch. Relative displacements were determined by modeling a column cantilevered off the floor and attached to the wall using a weak spring having a stiffness of 12 lbf/ft. The maximum force in the spring represents the maximum relative displacement in inches. Figure E-9 shows that the maximum relative displacement between the interior wall and the floor is only 4 thousands of an inch.

Figures E-10 and E-11 show log and linear seismic plots of the vertical shock spectrum (minimum specification concrete). These plots show that the roof has a maximum response.

To verify that the shock spectrum show in Figures E-6 and E-7 is a conservative case additional studies were completed. Figures E-12 and E-13 show log and linear plots of the shock spectrum if the stiffness of the extra 6 inches exterior concrete is considered. While Figures E-14 and E-15 show log and linear plots of the shock spectrum if the concrete is assumed to reach maximum stiffness. Both of these two studies have lower response indicating that Figures E-6 and E-7 are conservative for seismic evaluation of the plutonium vault.

ASCE Standard 4-86 (pages 77 and 78) requires that in-structure seismic response spectrum peaks be broadened. The broadening accounts for effects of structural fequency variations due to uncertainties. ASCE recommends that for uniformity of design practice in the industry, it is recommended that the spectrum peaks be broadened by ±15% in the frequency domain when the system analyses use median soil condition properties. **Although, shock spectrum specified by Figures E-6, E-7, E-10, and E-11 employ a very conservative minimum concrete specification stiffness, the ASCE broadening of ±15% must be applied to these figures.** Additional soil parameter studies could be completed, but ASCE 4-86 would still require a minimum frequency broadening of ±10%.

Figure E-1. Top View of SASSI Quarter Model of 2736-Z.

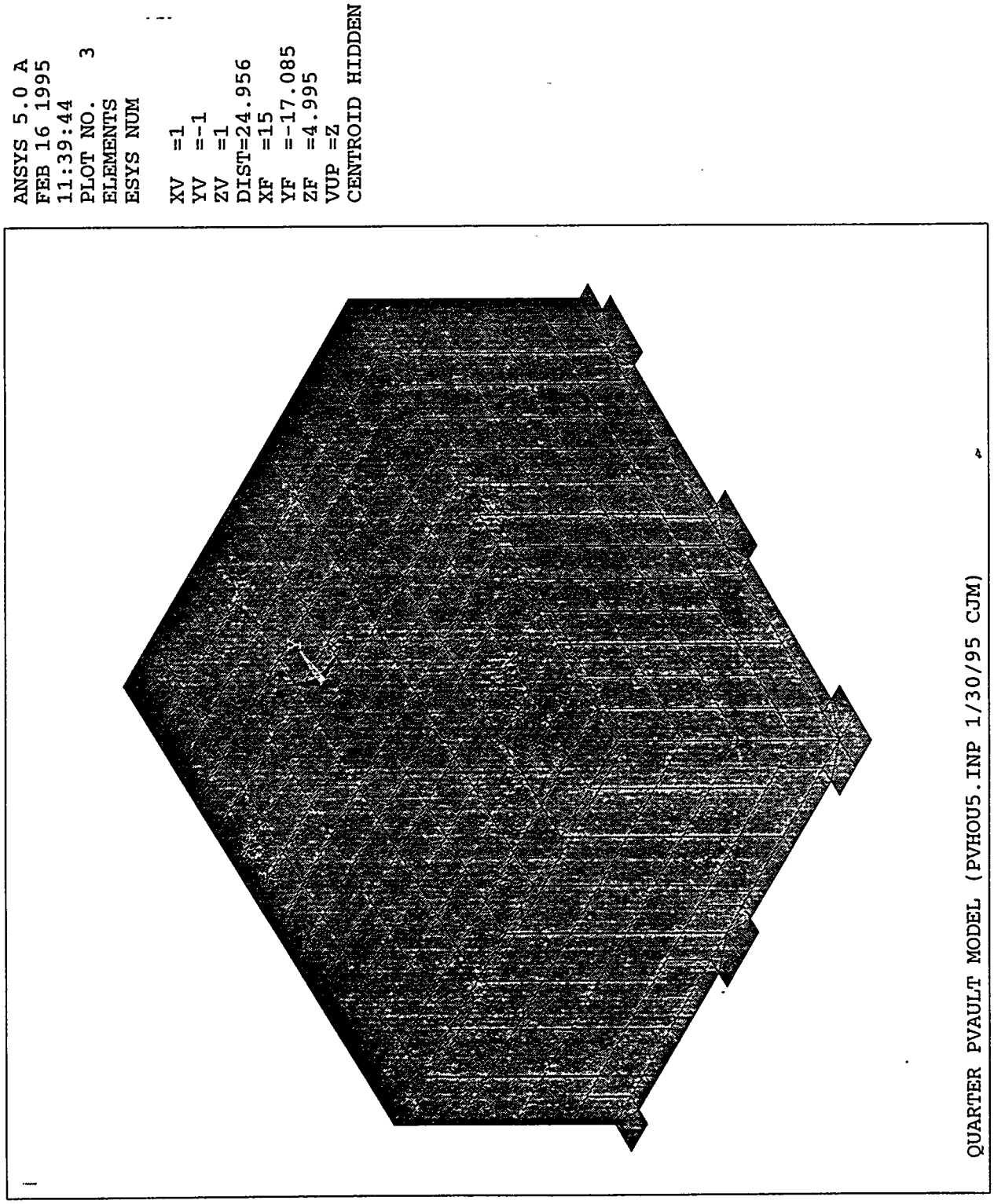


Figure E-2. Bottom View of SASSI Quarter Model of 2736-Z.

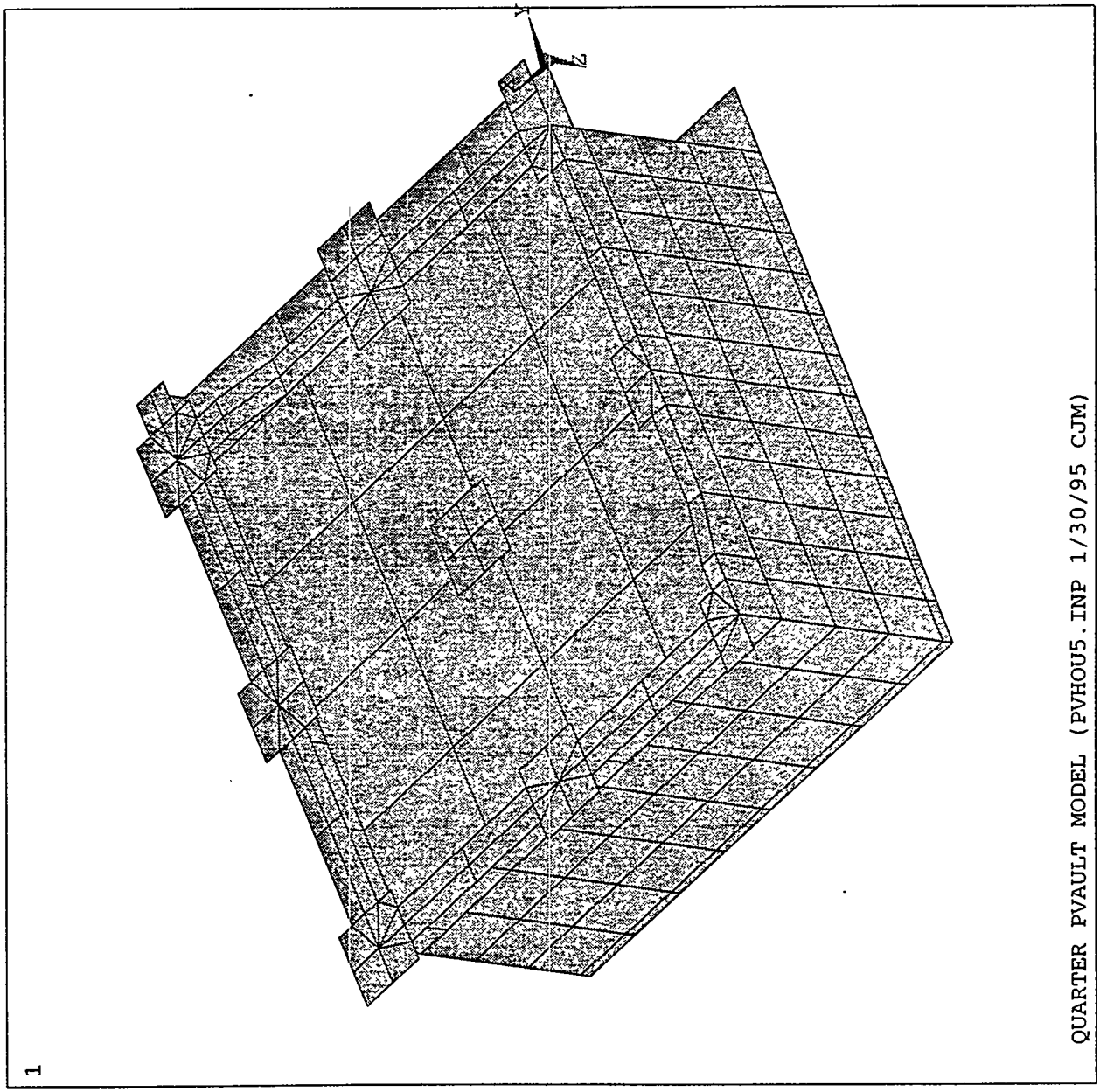


Figure E-3. Bottom View of SASSI Quarter Model of 2736-Z.

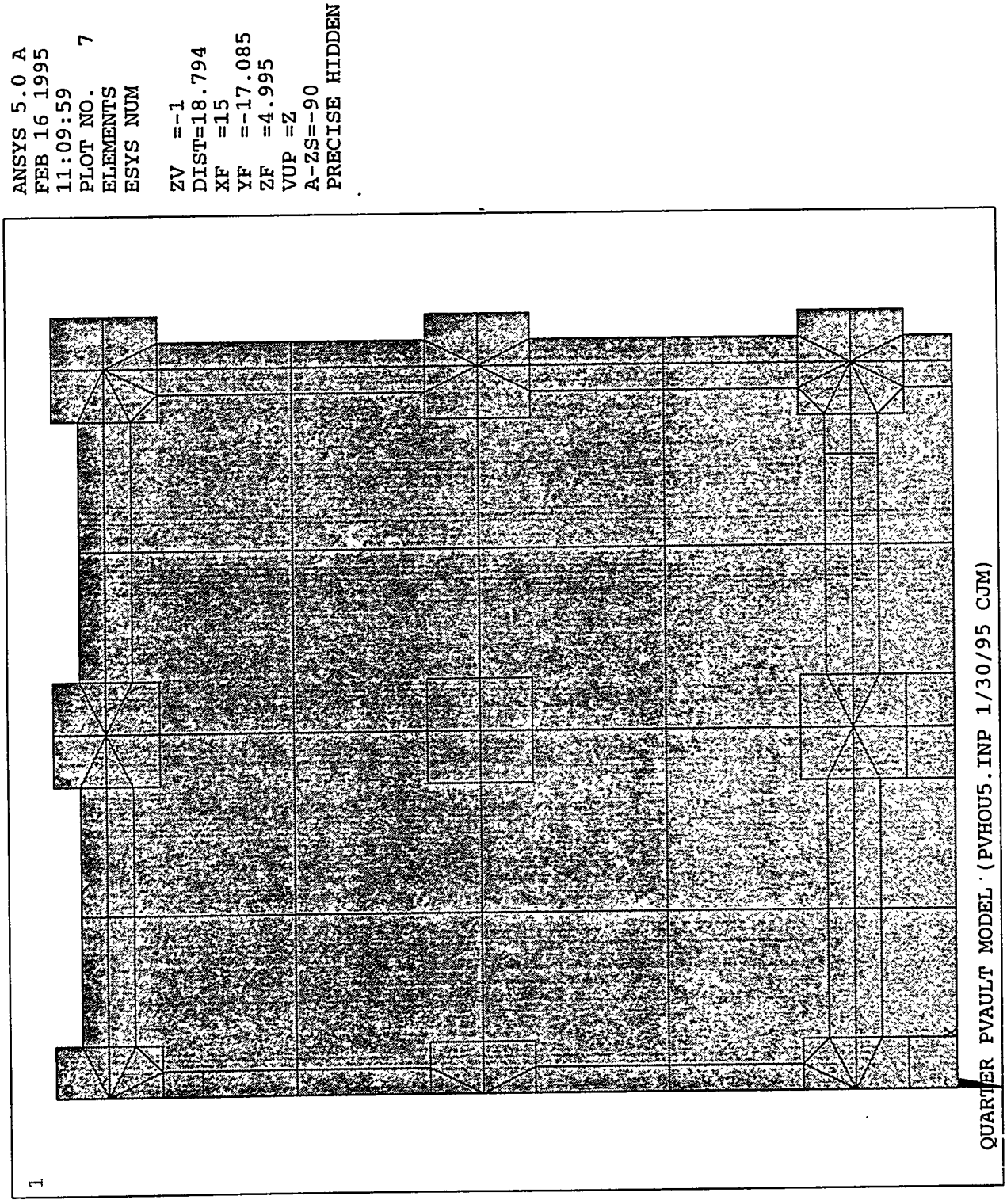


Figure E-4. Top View of SASSI Model With Element Shrink.

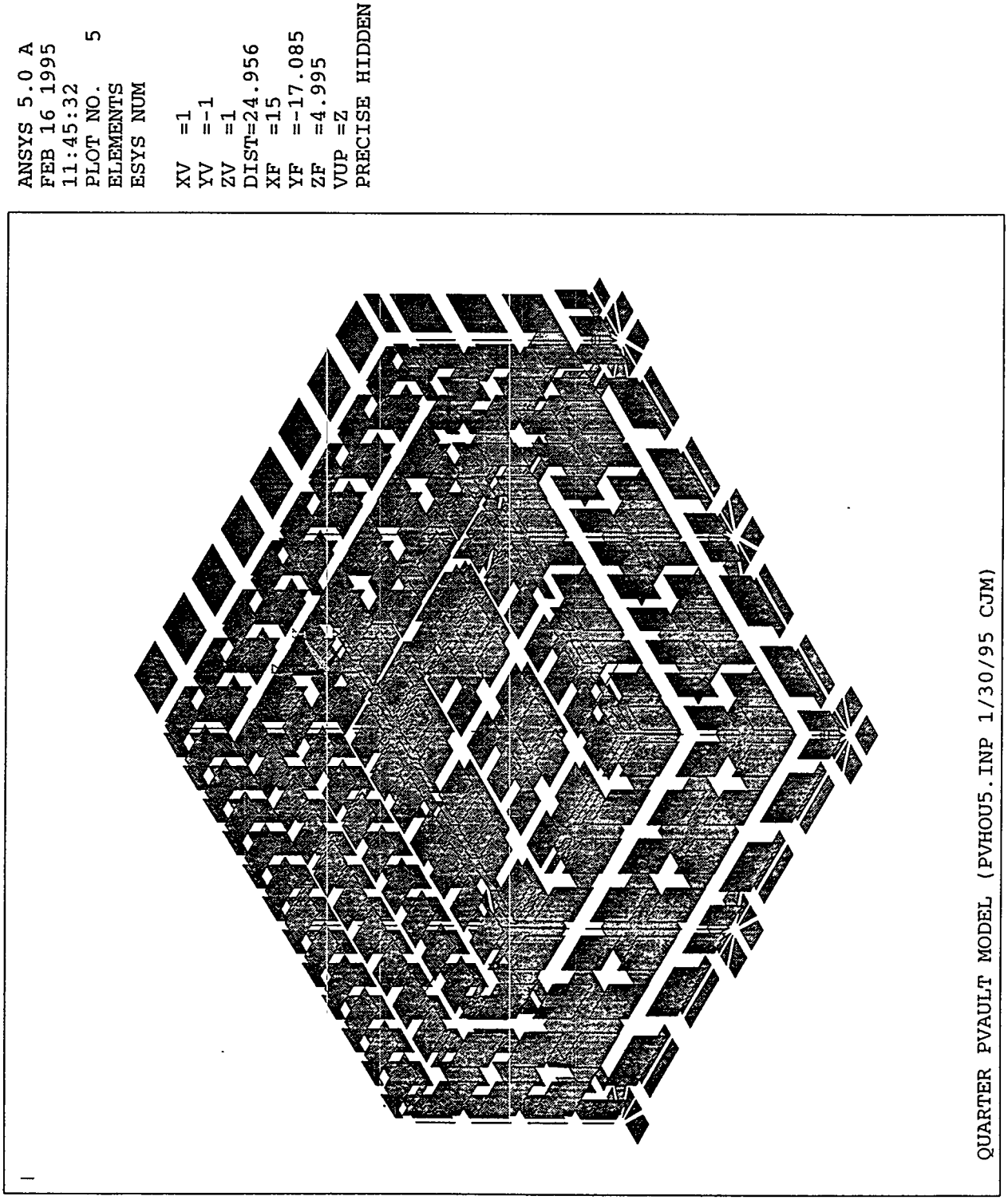


Figure E-5. Top View of SASSI Model With Node Numbering.

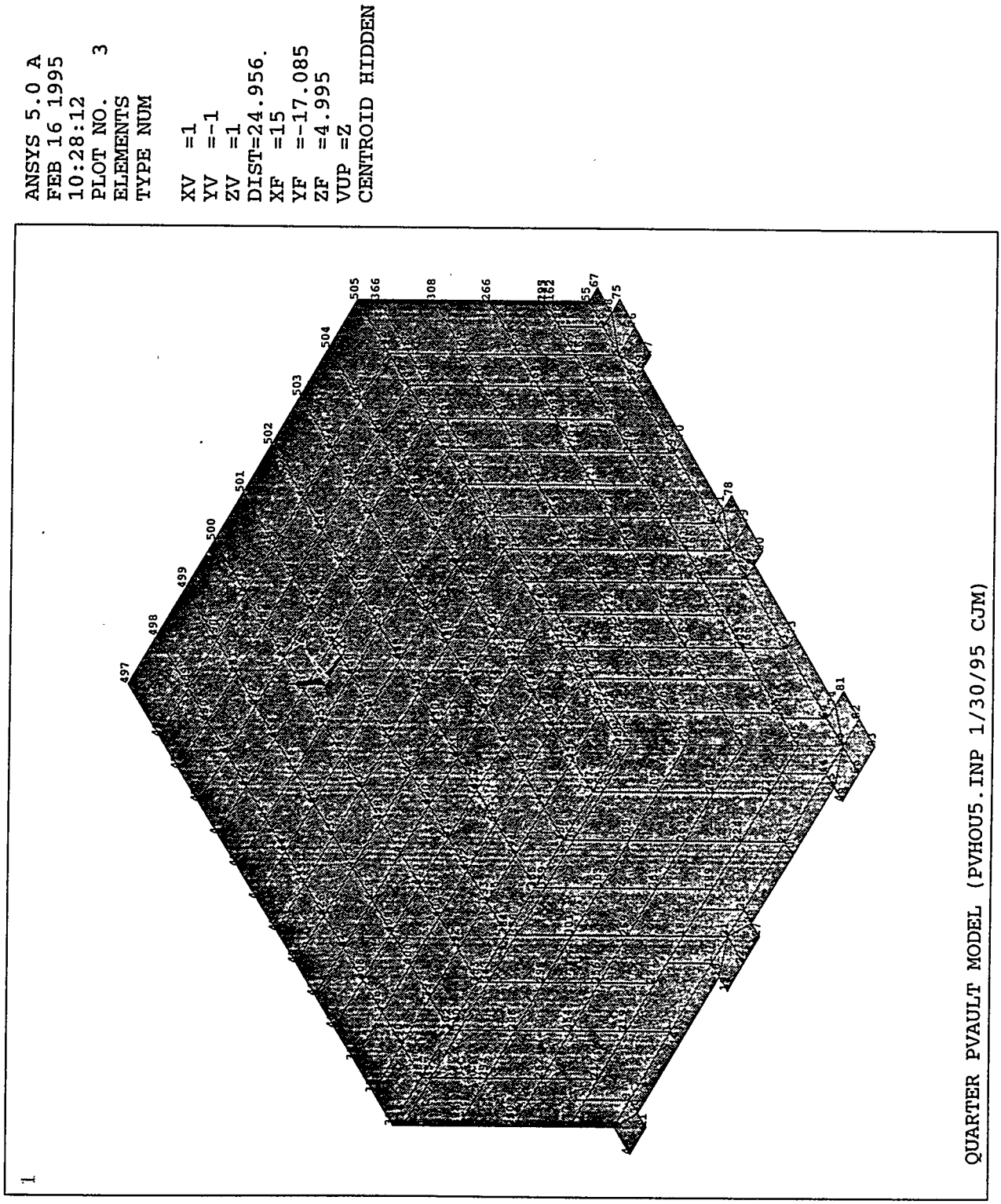


Figure E-6. Log Plot of Horizontal Shock Spectrum With Minimum Specification Concrete.

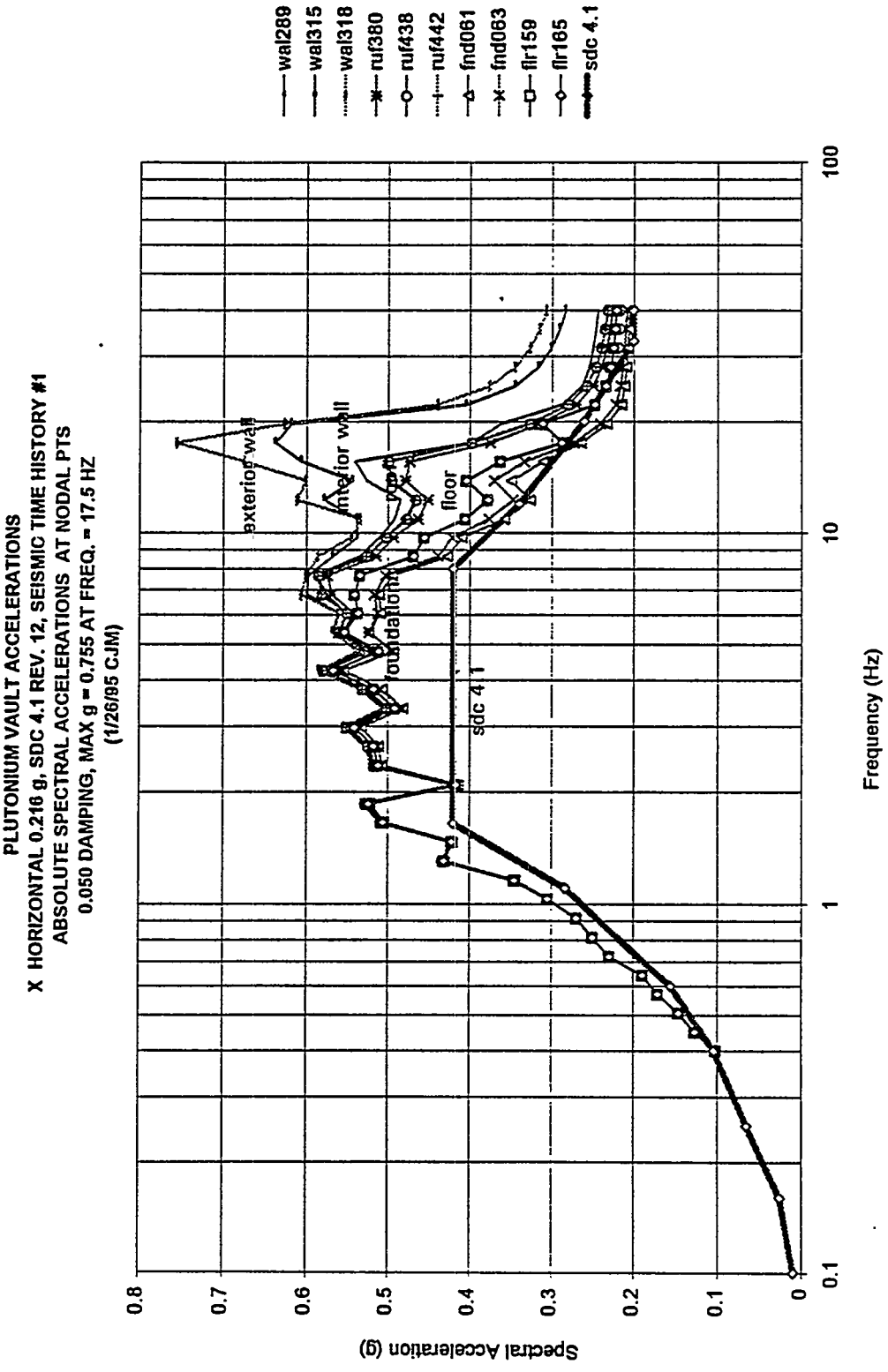


Figure E-7. Linear Plot of Horizontal Shock Spectrum With Minimum Specification Concrete.

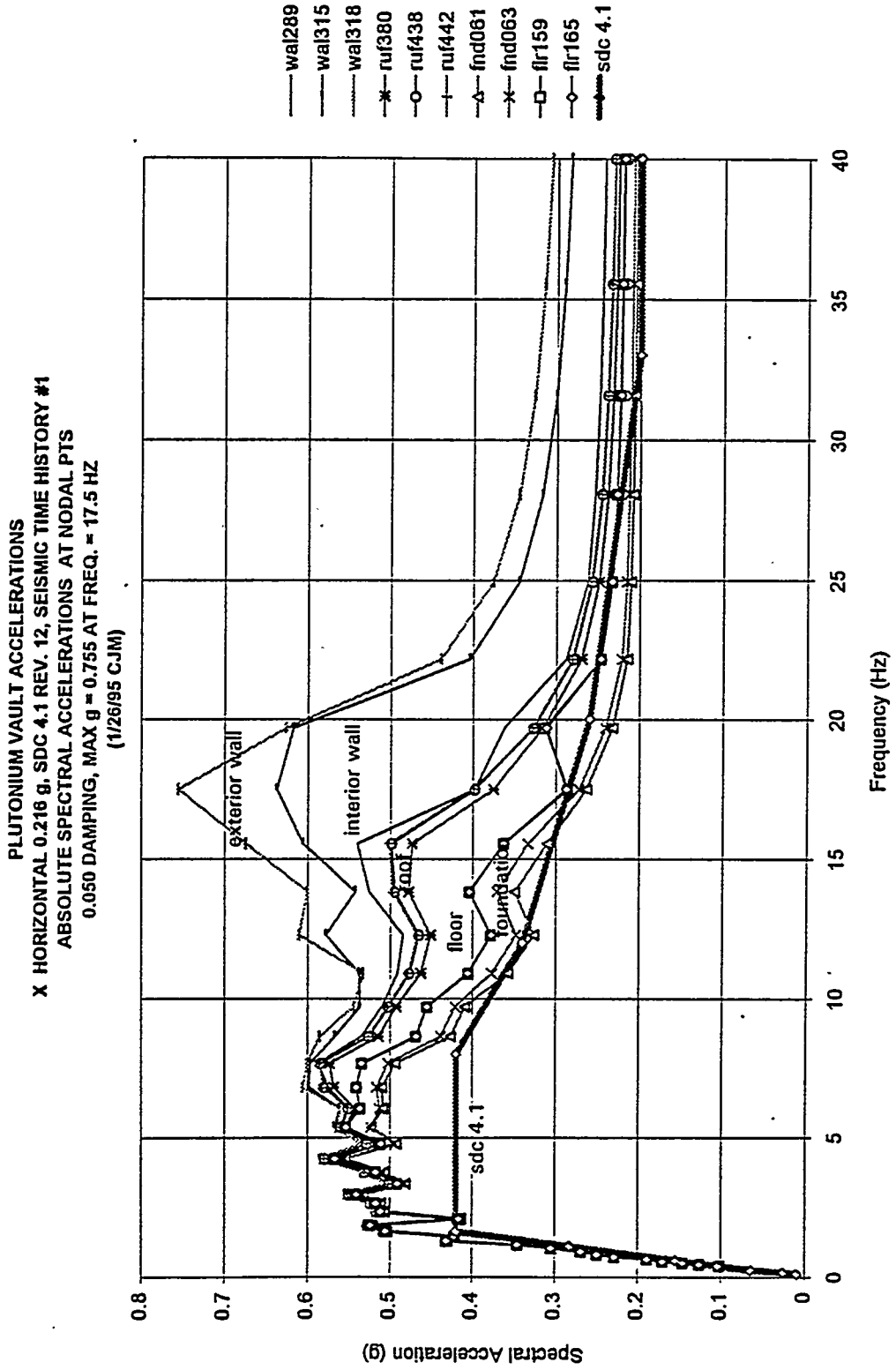


Figure E-8. Relative Displacement Between Exterior Wall and Floor.

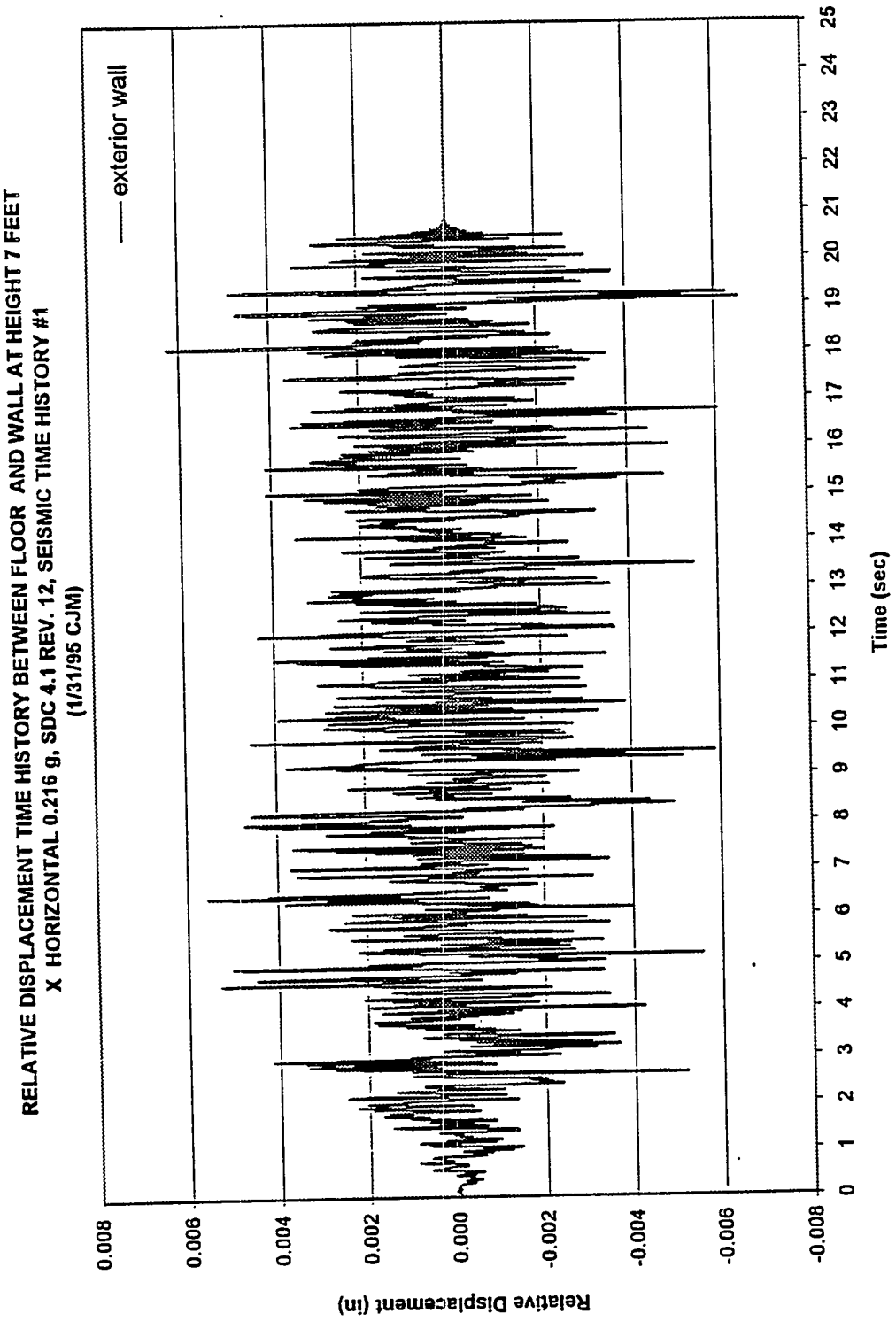


Figure E-9. Relative Displacement Between Interior Wall and Floor.

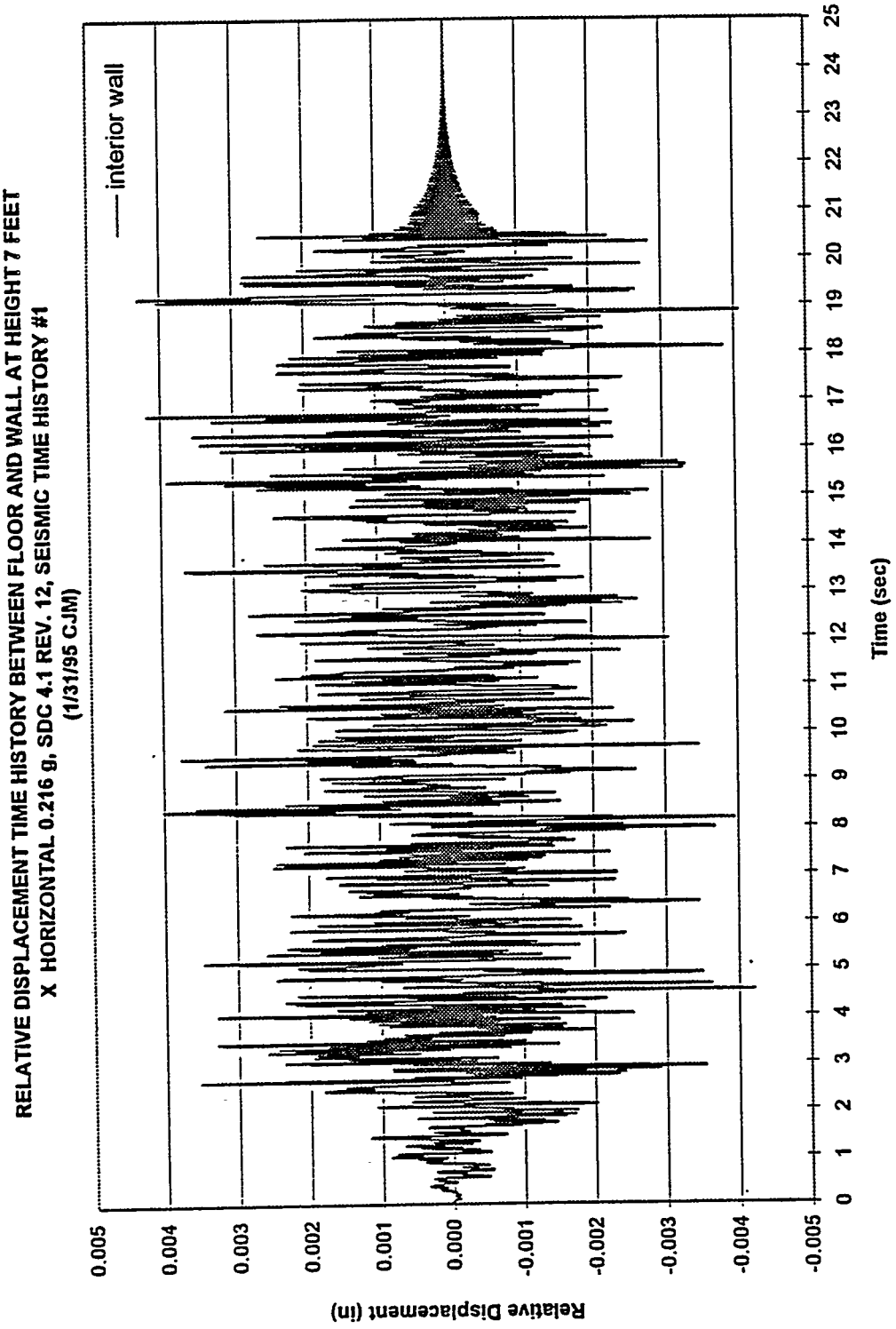


Figure E-10. Log Plot of Vertical Shock Spectrum With Minimum Specification Concrete.

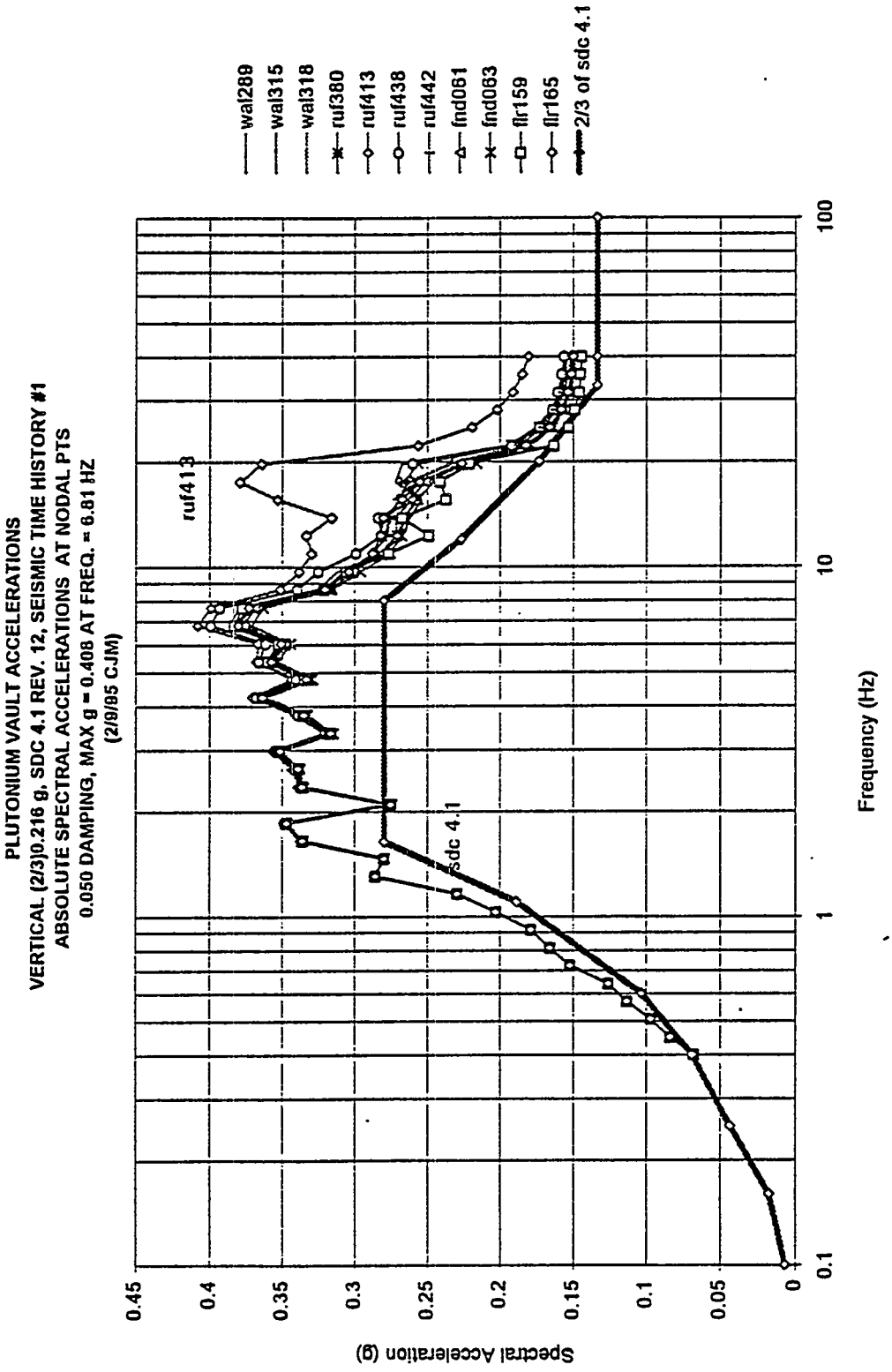


Figure E-11. Linear Plot of Vertical Shock Spectrum With Minimum Specification Concrete.

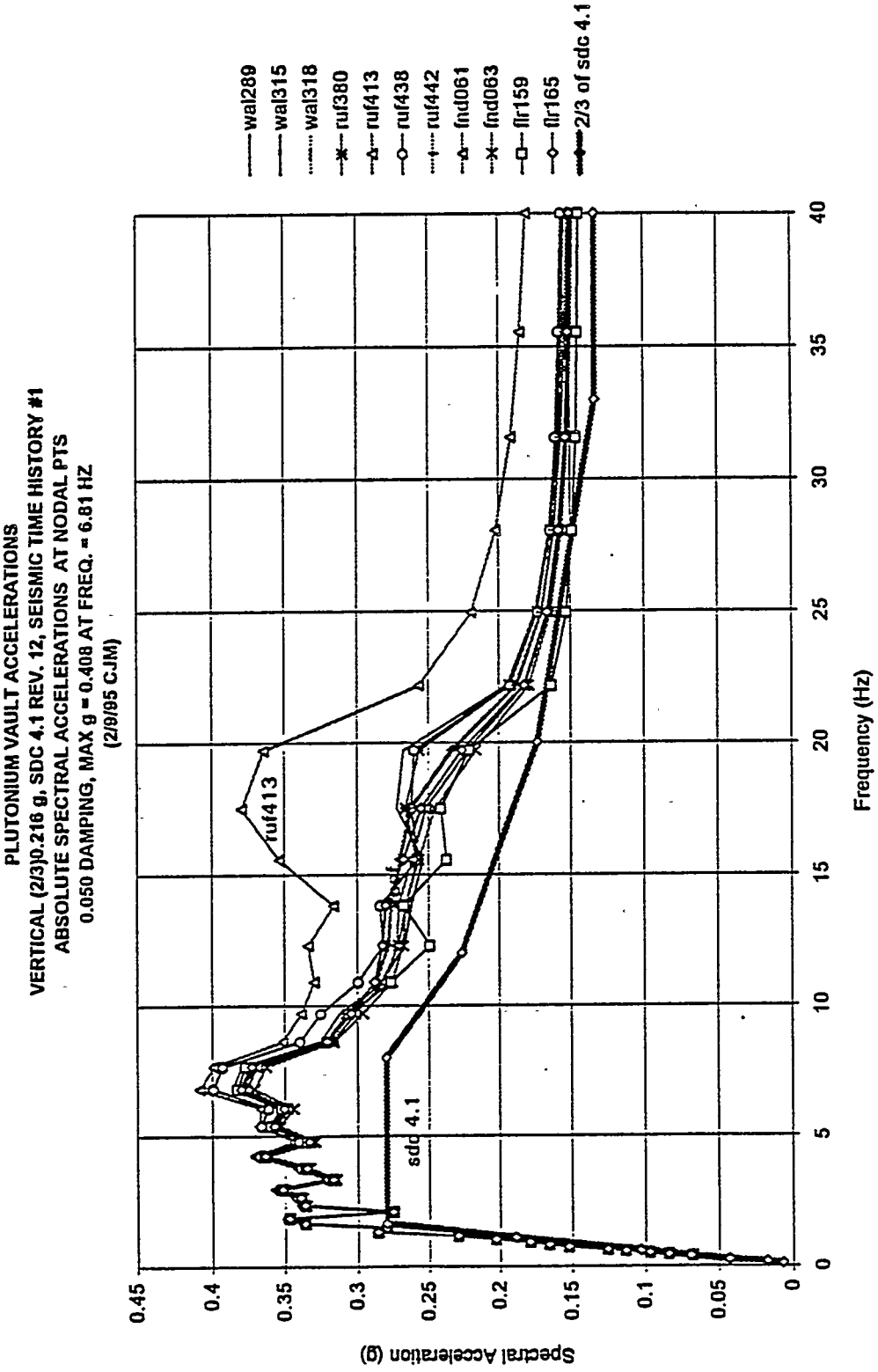


Figure E-12. Log Plot of Shock Spectrum With Additional 6 Inch Concrete Stiffness.

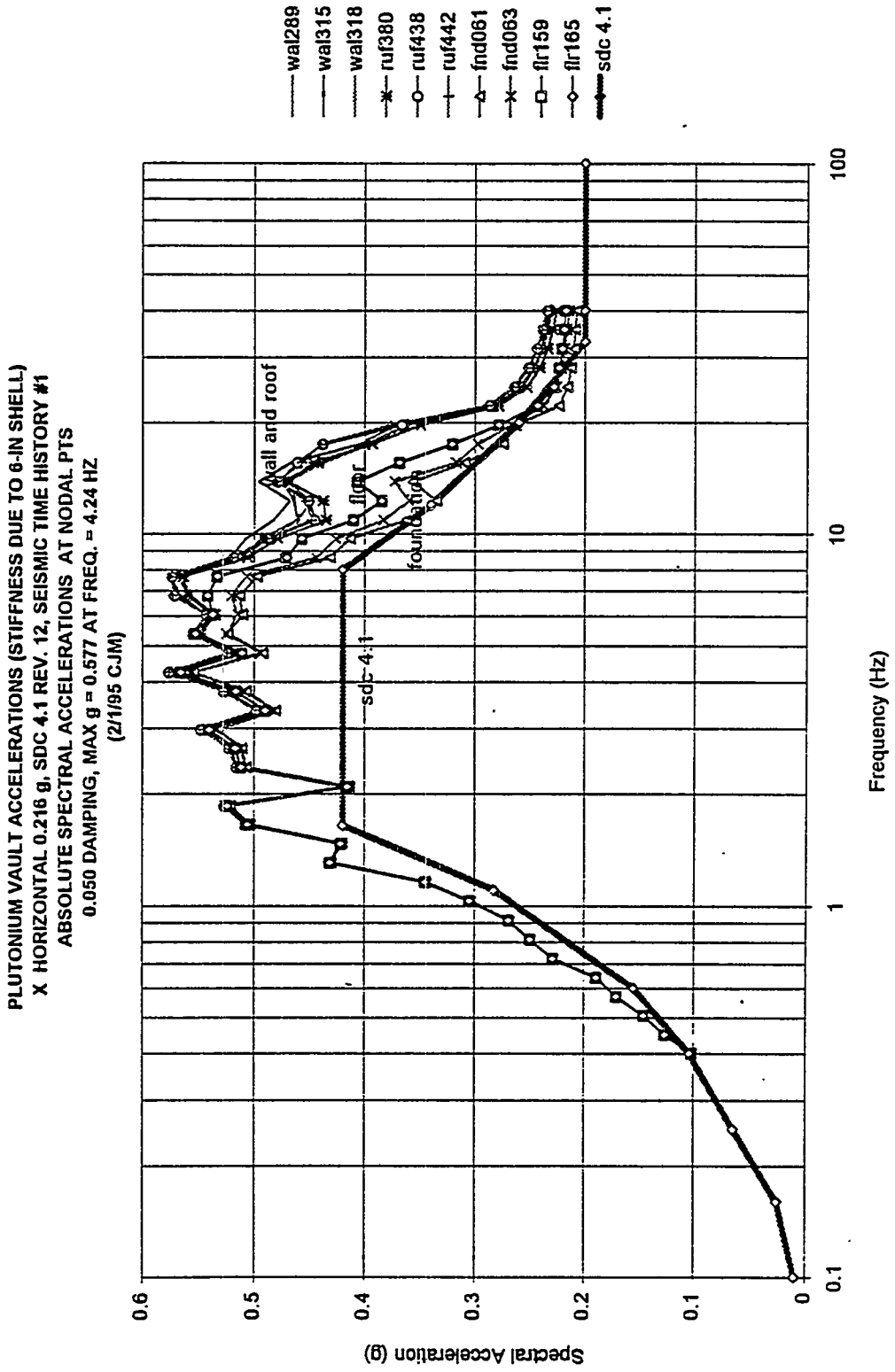


Figure E-13. Linear Plot of Shock Spectrum With Additional 6 Inch Concrete Stiffness.

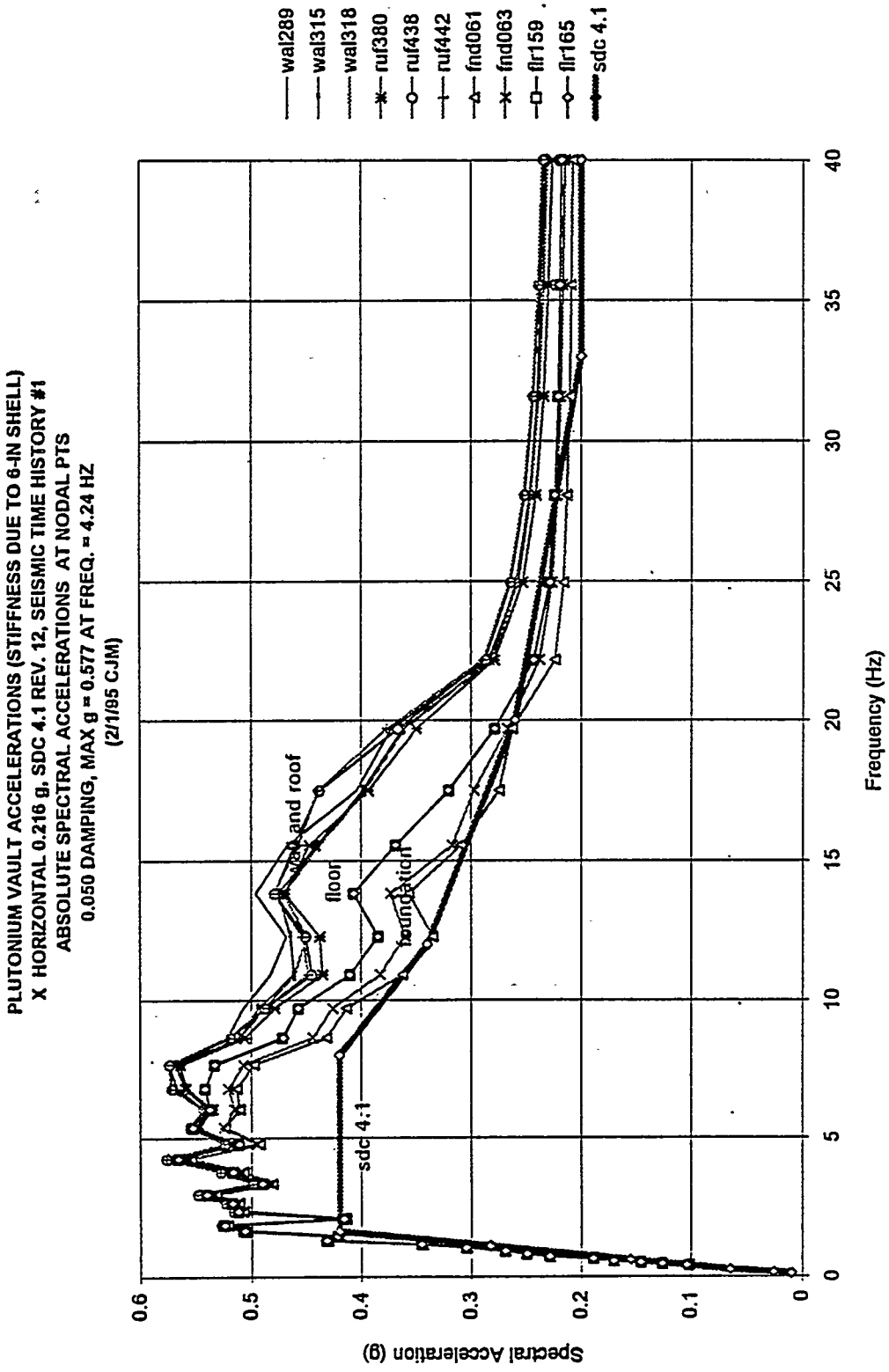


Figure E-14. Log Plot of Shock Spectrum With Maximum Stiffness Concrete.

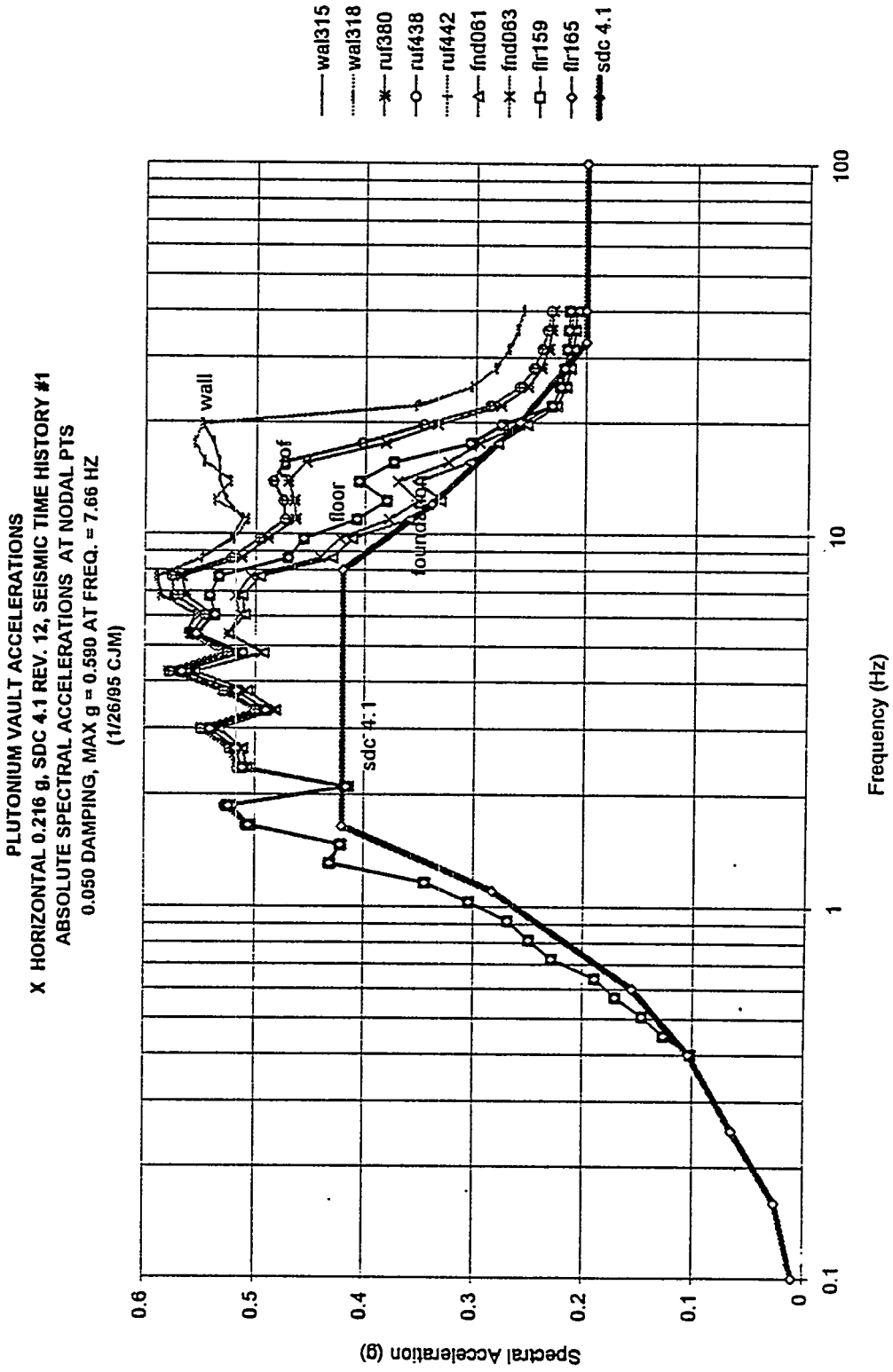
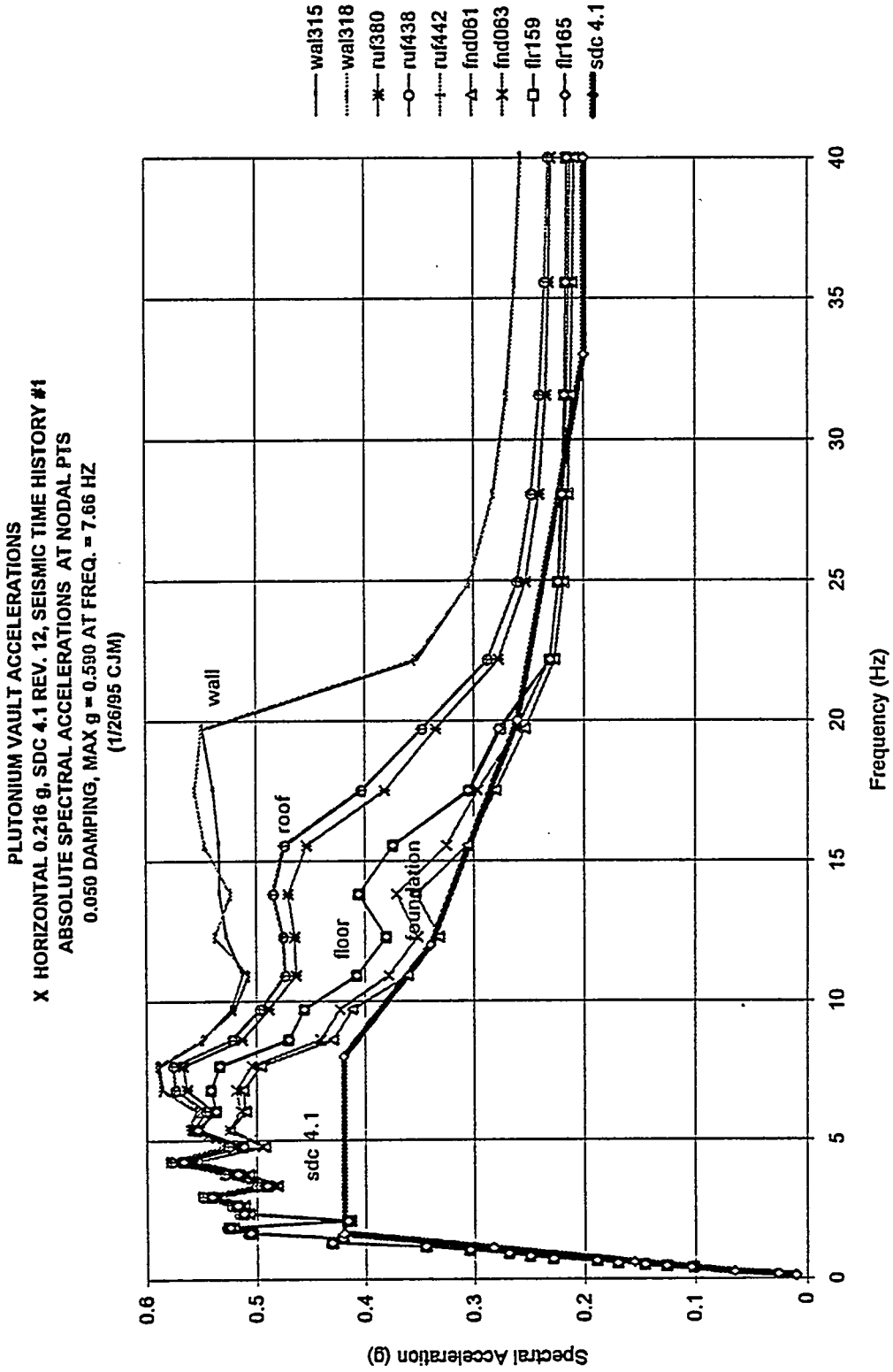


Figure E-15. Linear Plot of Shock Spectrum With Maximum Stiffness Concrete.



Client

WO/Job No.

Subject PLUTONIUM VAULT, BLDG. NO. 2736-Z

Date 12/22/94 By Carleton J. Moore

SHAKE91 SOIL DATA INPUT FILE

Checked 2/23/95 By Gary R. Wagenblast

Location PFP

Revised By

```
option 1 - dynamic soil properties - (max is thirteen):
    1
    5
   10    SHEAR MODULUS SAND :  EPRI 1993 - 0-20 Ft :
 .0001    .000316    .001     .00316      .01      .0316      .1       .316
 1.         3.16
   1.0       .99     .98         .92      .75        .53      .26       .12
  .04       .02
   10    DAMPING SAND    :  EPRI - 0-20 Ft :
 .0001    .000316    .001     .00316      .01      .0316      .1       .316
 1.00       3.16
 1.3        1.5       1.9       2.7       4.9        9.1     15.3      21.5
  26.9      30.
   10    SHEAR MODULUS SAND :  EPRI 1993 - 21-50 Ft :
 .0001    .000316    .001     .00316      .01      .0316      .1       .316
 1.         3.16
   1.0       1.0      .99         .95      .84        .62      .36       .17
  .06       .02
   10    DAMPING SAND    :  EPRI - 21-50 Ft :
 .0001    .000316    .001     .00316      .01      .0316      .1       .316
 1.00       3.16
 1.2        1.2       1.8       2.0       3.3        7.0     12.0      19.0
  25.0      28.
   10    SHEAR MODULUS SAND :  EPRI 1993 - 51-120 Ft :
 .0001    .000316    .001     .00316      .01      .0316      .1       .316
 1.         3.16
   1.0       1.0      1.0         .97      .87        .70      .43       .23
  .09       .05
   10    DAMPING SAND    :  EPRI - 51-120 Ft :
 .0001    .000316    .001     .00316      .01      .0316      .1       .316
 1.00       3.16
 .97        .97       1.2       1.6       2.7        5.2     10.2      16.1
  22.8      26.6
   10    SHEAR MODULUS SAND :  EPRI 1993 - 121-250 Ft :
 .0001    .000316    .001     .00316      .01      .0316      .1       .316
 1.         3.16
   1.0       1.0      1.0         .98      .90        .75      .50       .28
  .12       .08
   10    DAMPING SAND    :  EPRI - 121-250 Ft :
 .0001    .000316    .001     .00316      .01      .0316      .1       .316
 1.00       3.16
 .81        .81       .97       1.3       2.2        4.2      8.5      14.1
  21.1      24.8
   10    SHEAR MODULUS SAND :  EPRI 1993 - 251-500 Ft :
 .0001    .000316    .001     .00316      .01      .0316      .1       .316
 1.         3.16
   1.0       1.0      1.0         .99      .94        .80      .56       .33
  .15       .10
   10    DAMPING SAND    :  EPRI - 251-500 Ft :
 .0001    .000316    .001     .00316      .01      .0316      .1       .316
 1.00       3.16
 .73        .73       .81       1.1       1.8        3.3      7.0      12.3
  19.2      22.7
   5    1    2    3    4    5
Option 2 -- Soil Profile
   2
   1   31      Z Plant Site, 200 West, Blume rec 30 ft + MWTF below
   1    1          1.50                .050      .110      700.      0.27
   2    1          0.75                .050      .110      700.      0.27
   3    1          2.75                .050      .110      700.      0.27
   4    1          5.00                .050      .110      700.      0.27
   5    1         10.00                .050      .113      860.      0.27
   6    2         10.00                .050      .113      860.      0.27
   7    2         10.00                .050      .113     1500.      0.27
   8    2         10.00                .050      .113     1500.      0.27
```

Client WO/Job No.

Subject PLUTONIUM VAULT, BLDG. NO. 2736-Z Date 12/22/94 By Carleton J. Moore

SHAKE91 SOIL DATA INPUT FILE Checked 2/21/95 By Gary R. Wagenblast

Location PFP Revised By

```
 9    3          10.00              .050      .113     1500.     0.27
10    3          10.00              .050      .113     1500.     0.27
11    3          10.00              .050      .113     1750.     0.27
12    3          10.00              .050      .113     1750.     0.27
13    3          10.00              .050      .113     1750.     0.27
14    3          10.00              .050      .113     1750.     0.27
15    3          10.00              .050      .113     2000.     0.27
16    4          10.00              .050      .113     2000.     0.27
17    4          10.00              .050      .113     2000.     0.27
18    4          10.00              .050      .113     2000.     0.27
19    4          10.00              .050      .113     2000.     0.27
20    4          10.00              .050      .113     2000.     0.27
21    4          10.00              .050      .113     2000.     0.27
22    4          10.00              .050      .113     2000.     0.27
23    4          10.00              .050      .113     2000.     0.27
24    4          10.00              .050      .113     2000.     0.27
25    4          10.00              .050      .113     2000.     0.27
26    4          10.00              .050      .113     2000.     0.27
27    4          10.00              .050      .113     2000.     0.27
28    4          10.00              .050      .113     2000.     0.27
29    5          10.00              .050      .113     2000.     0.27
30    5          10.00              .050      .113     2000.     0.27
31    5                             .010      .140     4000.     0.27
Option 3 -- input motion:
   3
 2300 4096   .01      th1.hst                    (8f9.4)
            .216      20.          1    8
Option 4 -- sublayer for input motion (within (1) or outcropping (0):
   4
   1    0
Option 5 -- number of iterations & ratio of avg strain to max strain
   5
   0    8    0.65
Option 6 -- sublayers for which accn time histories are computed & saved:
   6
   1
   0
   1
option 9 -- compute & save response spectrum:
   9
   1    0
   3    0      32.2
     0.05      0.07      0.10
option 9 -- compute & save response spectrum:
   9
   2    1
   3    0      32.2
     0.05      0.07      0.10
execution will stop when program encounters 0
   0
```

Client

WO/Job No.

Subject PLUTONIUM VAULT; BLDG. NO. 2736-Z

Date 12/20/94 By Carleton J. Moore

SDC 4.1, Rev. 12, TIME HISTORY #1 FILE

Checked 2/21/95 By Gary R. Wagenblast

Location PFP

Revised By

Ref: WHC-SD-GN-DA-30018 th1.hst n=2300 (8f9.5) dt=.01 tl=1

-0.00030	-0.00070	-0.00075	-0.00096	-0.00109	-0.00058	0.00023	0.00107
0.00180	0.00223	0.00268	0.00263	0.00105	-0.00027	0.00050	0.00187
0.00204	0.00125	0.00070	0.00110	0.00141	0.00083	-0.00029	-0.00126
-0.00097	-0.00165	-0.00471	-0.00771	-0.00965	-0.01001	-0.00946	-0.00872
-0.00844	-0.01017	-0.01258	-0.01490	-0.01507	-0.01281	-0.01268	-0.01205
-0.00973	-0.00879	-0.00587	-0.00180	-0.00171	-0.00506	-0.00774	-0.00799
-0.00705	-0.00728	-0.00938	-0.01207	-0.01301	-0.00636	0.00556	0.01345
0.01387	0.01396	0.01754	0.01687	0.01087	0.00660	0.00706	0.00546
-0.00186	-0.00701	-0.00500	-0.00184	0.00178	0.01037	0.02048	0.02676
0.02610	0.02011	0.01487	0.01256	0.01002	0.00724	0.01155	0.01893
0.01957	0.01782	0.01660	0.01379	0.00527	-0.00952	-0.01908	-0.01671
-0.01184	-0.01511	-0.02109	-0.01952	-0.01893	-0.02160	-0.01861	-0.01362
-0.01477	-0.02539	-0.03350	-0.03288	-0.03059	-0.03097	-0.03582	-0.03987
-0.03593	-0.02353	-0.01111	-0.00214	0.00961	0.01467	0.00796	0.01087
0.02281	0.01869	-0.00275	-0.01672	-0.01209	-0.00048	0.00150	-0.01025
-0.02064	-0.01762	-0.01121	-0.01443	-0.01745	-0.01326	-0.00222	0.00556
-0.00432	-0.01137	-0.00195	0.00630	0.00684	0.00484	0.00352	0.00286
-0.00286	-0.02101	-0.04126	-0.04843	-0.04523	-0.04063	-0.04058	-0.03053
-0.00354	0.02449	0.03787	0.02587	0.00150	-0.00394	0.00743	0.00696
-0.00217	-0.00160	0.00882	0.01287	0.00946	0.01069	0.01130	0.00226
-0.00792	-0.00708	0.00060	0.01391	0.02989	0.03860	0.03514	0.03128
0.04193	0.05309	0.05697	0.05965	0.05751	0.05423	0.05136	0.05000
0.05283	0.05406	0.04734	0.02808	0.01074	0.01138	0.02086	0.03544
0.05332	0.05950	0.05808	0.06037	0.06407	0.06855	0.06927	0.05480
0.02913	0.01339	0.01865	0.03384	0.04442	0.05288	0.06123	0.05739
0.04715	0.04547	0.04081	0.01547	-0.01549	-0.02342	-0.01709	-0.01276
0.01233	0.05624	0.07748	0.07315	0.05364	0.02852	0.01320	-0.00730
-0.03215	-0.03363	-0.00794	0.01567	0.01774	0.01923	0.03877	0.05156
0.02733	-0.00956	-0.01880	-0.01469	-0.01968	-0.01482	-0.00239	0.00963
0.02685	0.02719	0.01123	0.00297	-0.00535	-0.03263	-0.06205	-0.07828
-0.08510	-0.08266	-0.08296	-0.08215	-0.07587	-0.07209	-0.06879	-0.06851
-0.07494	-0.07786	-0.06029	-0.03512	-0.02455	-0.01372	0.01004	0.02779
0.02951	0.01064	-0.03078	-0.07822	-0.11984	-0.14281	-0.13064	-0.08465
-0.02719	0.00576	0.00727	0.00537	0.01198	0.02475	0.04570	0.07319
0.07938	0.05384	0.04667	0.06784	0.08151	0.08382	0.07163	0.04668
0.02590	0.02498	0.05496	0.08416	0.07512	0.05428	0.04138	0.03046
0.04389	0.08585	0.11999	0.10886	0.06818	0.05043	0.05362	0.03992
0.01456	0.00073	-0.01156	-0.03307	-0.06004	-0.07566	-0.05438	-0.02834
-0.03802	-0.05441	-0.04845	-0.02472	-0.00705	-0.01983	-0.04567	-0.05696
-0.06206	-0.07345	-0.09217	-0.11137	-0.10549	-0.07271	-0.04850	-0.06030
-0.08346	-0.08768	-0.08781	-0.08570	-0.07623	-0.06471	-0.06151	-0.06958
-0.07685	-0.07582	-0.05525	-0.02639	-0.02069	-0.03682	-0.03996	-0.02660
-0.01082	0.00809	0.00764	-0.02534	-0.06101	-0.07600	-0.08522	-0.08566
-0.05007	-0.00774	-0.00244	-0.01202	-0.01687	-0.02777	-0.03662	-0.04074
-0.03598	-0.01717	-0.00106	0.00641	0.00057	-0.00645	-0.00391	0.00385
0.02746	0.03295	0.00747	0.00634	0.03121	0.04435	0.04406	0.04726
0.05824	0.06707	0.06487	0.05790	0.05942	0.05844	0.03843	0.02088
0.01455	0.00922	0.01516	0.02825	0.03126	0.01655	0.00168	0.00089
0.00425	-0.00063	-0.01869	-0.03017	-0.01565	0.00201	0.01103	0.01920
0.01365	-0.00405	-0.01756	-0.01531	-0.00550	-0.01965	-0.05926	-0.08895
-0.09568	-0.07650	-0.03345	0.01254	0.03638	0.02590	0.01413	0.02239
0.02155	0.00522	-0.01151	-0.02708	-0.02232	-0.00829	-0.00226	0.01969
0.03420	0.02485	0.02567	0.04525	0.04953	0.02528	-0.00235	-0.02570
-0.03869	-0.04674	-0.06604	-0.09174	-0.10398	-0.08481	-0.05592	-0.03509
-0.00213	0.02969	0.04934	0.05556	0.03596	0.01932	0.01525	0.00852
-0.01028	-0.03738	-0.05189	-0.04329	-0.01894	0.00003	0.01634	0.04336
0.06174	0.07295	0.10367	0.14132	0.15731	0.15379	0.13311	0.10246
0.08015	0.05374	0.03407	0.02048	0.00372	0.01904	0.06200	0.10034
0.12799	0.13603	0.10974	0.06854	0.03716	0.01078	-0.01119	-0.02591
-0.03047	-0.02798	-0.03213	-0.02495	-0.01369	-0.03741	-0.07620	-0.09048
-0.08669	-0.08197	-0.05798	-0.01545	0.02493	0.05800	0.09311	0.13804
0.15486	0.12096	0.08044	0.06783	0.06100	0.05035	0.04602	0.03578
0.00911	-0.02880	-0.06109	-0.08499	-0.10525	-0.11476	-0.11637	-0.10774
-0.09083	-0.08671	-0.09354	-0.08026	-0.05457	-0.04652	-0.05865	-0.09261

-0.13144	-0.14645	-0.13056	-0.09411	-0.04754	0.00608	0.04883	0.05165
0.04120	0.04749	0.02610	-0.03020	-0.05722	-0.03649	0.00073	0.02695
0.02737	0.01272	-0.01081	-0.04421	-0.06884	-0.07394	-0.06791	-0.04488
-0.01288	-0.01209	-0.04942	-0.07592	-0.06365	-0.04400	-0.05263	-0.09404
-0.10993	-0.06058	-0.00526	0.00976	0.01110	0.02323	0.02556	0.00352
-0.01256	-0.00076	0.01861	0.03795	0.04775	0.03565	0.01584	-0.00761
-0.03787	-0.06255	-0.07107	-0.06749	-0.06000	-0.04400	-0.00973	0.01321
0.01413	0.03655	0.08622	0.10696	0.08510	0.07067	0.07177	0.05520
0.02296	0.00756	0.01296	0.01058	-0.01807	-0.06018	-0.08614	-0.07500
-0.02046	0.03415	0.05012	0.05703	0.06493	0.05222	0.00804	-0.04113
-0.07040	-0.06877	-0.02579	0.01439	0.00092	-0.03043	-0.01631	0.00725
0.01173	0.02478	0.03622	0.03910	0.03474	0.01099	-0.01704	-0.02291
-0.01376	-0.00192	0.00177	-0.01699	-0.04384	-0.06674	-0.08531	-0.09014
-0.07555	-0.05184	-0.04033	-0.03949	-0.03527	-0.03314	-0.03337	-0.03026
-0.02284	0.00858	0.06070	0.09097	0.08702	0.08164	0.08500	0.08067
0.07338	0.05925	0.03090	0.03327	0.09071	0.13753	0.13521	0.11800
0.10833	0.11321	0.11848	0.10540	0.09378	0.08433	0.06063	0.03467
0.02118	0.01379	-0.00078	-0.01721	-0.02465	-0.03243	-0.04090	-0.03437
-0.02611	-0.03212	-0.03670	-0.02848	-0.03114	-0.05515	-0.06491	-0.05851
-0.06180	-0.05840	-0.03899	-0.02308	-0.01802	-0.01237	0.00394	0.02066
0.02607	0.03937	0.05282	0.04047	0.02448	0.00603	-0.02779	-0.06435
-0.07395	-0.03618	0.02134	0.06464	0.08044	0.06753	0.04167	0.01539
-0.00492	-0.00820	-0.00576	0.00244	0.00797	-0.01458	-0.04125	-0.04751
-0.03306	-0.01337	0.01867	0.07637	0.10995	0.10811	0.09426	0.05826
0.01899	-0.00151	-0.00320	0.01072	0.01679	0.00989	0.00793	0.01426
0.01090	-0.01005	-0.03169	-0.05552	-0.07953	-0.08716	-0.07372	-0.04090
-0.01167	-0.02135	-0.05763	-0.07263	-0.05598	-0.02673	-0.00836	-0.02004
-0.03176	-0.01093	0.01905	0.02754	0.01162	-0.00670	0.00026	0.02556
0.03593	0.02642	0.01026	-0.00046	0.00614	0.02816	0.05289	0.06426
0.04856	0.01683	-0.00741	-0.02696	-0.04102	-0.03561	-0.02215	-0.02304
-0.02376	0.00346	0.03232	0.02390	0.00022	-0.00971	-0.01831	-0.03736
-0.04866	-0.03226	-0.00693	0.01767	0.02650	0.01823	0.02271	0.02878
0.04089	0.06415	0.08149	0.08966	0.08727	0.07036	0.04630	0.03242
0.03656	0.04980	0.04174	0.01642	0.00055	-0.00213	0.01200	0.01207
-0.02634	-0.04521	-0.01082	0.03892	0.07370	0.08613	0.09033	0.08888
0.08471	0.09903	0.12820	0.14622	0.14445	0.13027	0.10118	0.07420
0.06538	0.06348	0.05489	0.05320	0.06155	0.04130	0.00793	0.00824
0.02453	0.01883	0.01006	0.03373	0.06556	0.09100	0.12019	0.14148
0.15574	0.14676	0.11676	0.08752	0.04074	-0.01171	-0.03264	-0.03565
-0.03371	-0.02400	-0.03575	-0.06636	-0.08261	-0.09543	-0.11865	-0.13410
-0.14222	-0.14961	-0.15963	-0.16601	-0.15269	-0.12331	-0.10516	-0.11748
-0.13627	-0.13073	-0.09538	-0.05376	-0.04147	-0.05823	-0.06425	-0.05262
-0.04105	-0.02196	0.00194	0.01133	0.01159	0.01309	0.00845	-0.00129
-0.01916	-0.02184	0.01590	0.04284	0.02894	0.00821	0.01568	0.03920
0.02426	-0.02608	-0.04336	-0.00474	0.02838	0.03099	0.03263	0.03394
0.02831	0.01289	-0.02070	-0.06083	-0.06576	-0.04522	-0.04521	-0.05536
-0.03400	0.00830	0.01729	-0.00310	-0.01921	-0.01962	-0.00815	-0.00394
-0.01042	-0.01654	-0.02137	-0.03278	-0.05763	-0.07758	-0.07002	-0.04878
-0.03595	-0.02482	0.00030	0.02058	0.00217	-0.04780	-0.07914	-0.06603
-0.05233	-0.07171	-0.07801	-0.03552	0.01235	0.02335	0.03181	0.06791
0.08148	0.06881	0.08131	0.10504	0.11127	0.11054	0.10921	0.09909
0.08336	0.07642	0.07963	0.07522	0.06419	0.04232	-0.00153	-0.03320
-0.03401	-0.02935	-0.02784	-0.04446	-0.08214	-0.11265	-0.12629	-0.11726
-0.09272	-0.07333	-0.08410	-0.10557	-0.08172	-0.03642	-0.04328	-0.09869
-0.13492	-0.13923	-0.13118	-0.11981	-0.10307	-0.06589	-0.03613	-0.02204
-0.00364	0.01879	0.02720	0.00795	-0.00081	0.01857	0.02862	0.01986
0.01157	0.00416	-0.00539	-0.02808	-0.05516	-0.03964	0.02603	0.08985
0.11012	0.08393	0.04025	0.00284	-0.04354	-0.09079	-0.10188	-0.08724
-0.07508	-0.04795	-0.01099	0.01113	0.01779	0.00235	-0.02465	-0.04704
-0.06223	-0.05884	-0.03220	-0.02042	-0.03821	-0.05464	-0.05274	-0.02193
0.02113	0.04842	0.05646	0.06347	0.09027	0.10568	0.08846	0.07965
0.07947	0.07228	0.06030	0.01660	-0.04628	-0.05915	-0.01902	0.00998
0.02500	0.05818	0.09276	0.08905	0.04493	-0.00026	-0.01700	-0.01014
0.01698	0.06422	0.09920	0.10232	0.09359	0.08651	0.08227	0.07471
0.07247	0.08740	0.09148	0.07006	0.03405	-0.01352	-0.05104	-0.05854

-0.03167	0.01653	0.04130	0.03264	0.01351	0.00147	-0.00064	0.00415
0.01686	0.01250	0.00287	0.00804	0.01002	0.02412	0.06193	0.07139
0.01033	-0.06937	-0.09333	-0.06034	-0.04165	-0.06060	-0.05646	-0.03424
-0.04716	-0.06844	-0.05680	-0.03096	-0.01251	-0.00659	-0.00021	0.02566
0.05996	0.06786	0.04430	0.02220	0.00548	-0.01257	-0.03103	-0.05002
-0.06031	-0.05019	-0.01557	0.01462	0.02196	0.02352	0.03334	0.03491
-0.00207	-0.05497	-0.08447	-0.07773	-0.04010	-0.01254	0.00309	0.03725
0.06808	0.08144	0.08211	0.07611	0.08608	0.08663	0.06018	0.03322
0.01863	0.03518	0.04983	0.01231	-0.04886	-0.07370	-0.04851	-0.02368
-0.02517	-0.02690	-0.01833	-0.01831	-0.02992	-0.02789	-0.00921	0.00858
0.00506	-0.02438	-0.05211	-0.06493	-0.05906	-0.03585	-0.02130	-0.02900
-0.04016	-0.04593	-0.06057	-0.08479	-0.10786	-0.09923	-0.06337	-0.05165
-0.05668	-0.04499	-0.01923	0.00660	0.03374	0.04649	0.03192	0.01272
0.01313	0.04368	0.07275	0.06866	0.05452	0.04848	0.05627	0.08501
0.09473	0.07096	0.04726	0.04118	0.04330	0.03218	0.00803	-0.01773
-0.03863	-0.05987	-0.07577	-0.06347	-0.02820	-0.01031	-0.02272	-0.01489
0.02229	0.04179	0.03679	0.02611	0.02274	0.02218	0.01162	0.00654
0.02764	0.05844	0.07383	0.07760	0.07398	0.05352	0.02360	0.00095
-0.01271	-0.02789	-0.03683	-0.03485	-0.02829	-0.01179	0.00584	0.01521
0.02007	0.02348	0.01837	-0.00088	-0.02633	-0.04622	-0.06483	-0.07090
-0.03900	0.01680	0.06877	0.10686	0.13165	0.13210	0.10594	0.09623
0.10159	0.06912	0.01980	-0.00275	-0.01230	-0.03217	-0.05360	-0.07482
-0.09557	-0.10694	-0.11353	-0.11021	-0.08879	-0.07531	-0.07955	-0.06654
-0.04687	-0.03530	-0.01561	0.00437	0.01049	0.01174	0.03231	0.05573
0.04538	0.01903	0.01005	0.02476	0.04590	0.05660	0.05745	0.05892
0.06087	0.04906	0.02444	-0.01098	-0.04900	-0.06880	-0.07652	-0.08195
-0.06943	-0.05024	-0.05299	-0.06869	-0.06348	-0.02548	0.01763	0.03014
0.00081	-0.03719	-0.05999	-0.07427	-0.07917	-0.08680	-0.09082	-0.05607
-0.00409	0.01175	-0.00584	-0.01876	-0.01765	-0.01572	-0.00578	0.01671
0.03489	0.03841	0.03829	0.03903	0.04938	0.07747	0.09289	0.07770
0.05557	0.04476	0.05047	0.07243	0.08193	0.07260	0.07710	0.09937
0.10543	0.08121	0.06808	0.08699	0.09917	0.08372	0.05642	0.04012
0.03188	0.02196	0.03755	0.06112	0.05786	0.04093	0.01506	-0.01098
-0.03121	-0.04491	-0.05521	-0.08237	-0.10884	-0.10509	-0.09482	-0.08134
-0.04754	-0.03192	-0.03216	-0.02006	-0.01431	-0.02607	-0.05562	-0.08412
-0.09125	-0.08495	-0.06975	-0.04343	-0.01037	0.02066	0.04067	0.05002
0.05271	0.06203	0.07981	0.07010	0.04670	0.04089	0.02220	-0.00491
-0.01077	-0.00936	-0.01971	-0.03657	-0.05015	-0.06323	-0.07312	-0.06781
-0.05573	-0.05123	-0.05603	-0.06890	-0.08156	-0.10271	-0.14473	-0.17596
-0.16003	-0.10101	-0.03923	-0.01039	0.00156	0.01276	0.01133	-0.01064
-0.04239	-0.05461	-0.05902	-0.07983	-0.09891	-0.09593	-0.06606	-0.03045
-0.00281	0.03051	0.04509	0.02557	0.00347	-0.00676	-0.00163	-0.00099
-0.01780	-0.02487	-0.01532	0.00237	0.02356	0.04551	0.06831	0.07436
0.05423	0.02453	-0.00187	-0.01546	-0.01187	-0.00435	-0.00180	-0.00175
-0.01180	-0.01935	-0.00747	-0.01263	-0.04402	-0.06661	-0.06392	-0.05541
-0.06590	-0.06058	-0.02872	-0.01585	-0.01581	0.00611	0.02393	0.00550
-0.02531	-0.02974	-0.00201	0.02692	0.05660	0.09502	0.10061	0.06303
0.02467	-0.00507	-0.02179	-0.00840	0.00904	0.00643	-0.00030	0.01629
0.02794	0.01151	0.00519	0.01127	0.01158	0.01249	0.01905	0.03165
0.04766	0.05094	0.03824	0.03831	0.05461	0.05780	0.06513	0.07328
0.06339	0.05993	0.05749	0.05194	0.05526	0.05309	0.03700	0.01981
0.01531	0.02907	0.04731	0.04796	0.03216	0.01801	-0.00853	-0.04205
-0.05136	-0.05626	-0.06433	-0.06062	-0.05413	-0.05440	-0.06554	-0.07664
-0.08264	-0.09643	-0.10485	-0.07220	-0.01175	0.03204	0.05139	0.05637
0.05827	0.05111	0.03578	0.03004	0.03515	0.05287	0.05647	0.02749
0.00477	0.00648	0.02631	0.04637	0.03394	-0.00312	-0.02330	-0.01666
0.00077	0.02427	0.04166	0.04080	0.02795	0.02351	0.03866	0.06047
0.06361	0.03712	0.00629	-0.00449	-0.00010	0.01204	0.03005	0.03495
0.03679	0.06177	0.09366	0.10770	0.09238	0.05533	0.02261	0.01722
0.03225	0.04043	0.04507	0.06939	0.08312	0.06266	0.04813	0.03994
0.01225	-0.01460	-0.03275	-0.06644	-0.09567	-0.08762	-0.06829	-0.07416
-0.09328	-0.09443	-0.08400	-0.08660	-0.09879	-0.11637	-0.13440	-0.12161
-0.09196	-0.08705	-0.10209	-0.11574	-0.12076	-0.12412	-0.11566	-0.06809
-0.00503	0.02186	0.02000	0.00961	0.00030	0.01415	0.03074	0.00485
-0.04829	-0.06297	-0.02947	-0.00371	-0.01248	-0.01886	0.00146	0.03183

Client WO/Job No.

Subject PLUTONIUM VAULT, BLDG. NO. 2736-Z Date 12/20/94 By Carleton J. Moore

SDC 4.1, Rev. 12; TIME HISTORY #1, FILE Checked 2/21/95 By Gary R. Wagenblast

Location PFP Revised By

0.06788	0.09337	0.09201	0.08673	0.07384	0.04038	0.01973	0.03130
0.06457	0.10104	0.10630	0.08463	0.07986	0.09754	0.11620	0.11015
0.08325	0.06630	0.06056	0.03778	0.01211	0.02613	0.05528	0.07597
0.08667	0.07956	0.06562	0.06029	0.05748	0.05150	0.05978	0.06565
0.04489	0.02428	0.02123	0.01962	0.02047	0.02775	0.02361	0.00886
0.01102	0.02098	0.00476	-0.03553	-0.08392	-0.11909	-0.10646	-0.05313
-0.00241	0.01148	-0.00496	-0.01652	-0.01820	-0.01928	-0.01558	-0.01114
-0.02060	-0.04669	-0.07105	-0.08660	-0.09806	-0.08416	-0.05085	-0.01807
0.01778	0.03330	0.03448	0.05308	0.07056	0.06639	0.04311	0.01495
-0.00386	-0.02957	-0.05790	-0.07686	-0.10711	-0.12870	-0.10383	-0.04818
-0.01057	-0.01218	-0.02837	-0.02868	-0.02525	-0.02773	-0.00600	0.02306
0.03428	0.05643	0.08232	0.07635	0.04654	0.03070	0.03344	0.04644
0.06895	0.06650	0.03732	0.01450	0.01151	0.02889	0.04621	0.04165
0.02967	0.00746	-0.04470	-0.09588	-0.11545	-0.10147	-0.07874	-0.07078
-0.07469	-0.08530	-0.08455	-0.06721	-0.05313	-0.07341	-0.12722	-0.15539
-0.12874	-0.07290	-0.01194	0.02911	0.03432	0.02903	0.04066	0.05397
0.03595	0.00370	-0.00060	0.01126	0.01286	0.00588	0.01188	0.04110
0.05001	0.02121	0.00035	-0.00698	-0.01981	-0.03729	-0.04284	-0.02390
-0.01368	-0.02282	-0.03141	-0.03934	-0.03897	-0.02152	0.00374	0.02098
0.02180	0.01696	0.02583	0.03281	0.02474	0.02749	0.04025	0.04055
0.03829	0.03070	0.02333	0.04855	0.07877	0.07467	0.05283	0.04030
0.03304	0.01537	-0.00462	-0.02229	-0.04849	-0.06472	-0.06359	-0.06883
-0.06954	-0.05206	-0.03434	-0.03052	-0.04477	-0.05850	-0.06104	-0.07162
-0.08456	-0.08803	-0.08035	-0.05423	-0.02938	-0.00743	0.03265	0.07709
0.10280	0.10519	0.09417	0.07451	0.06109	0.05360	0.03257	0.02132
0.03378	0.03989	0.02674	0.00842	0.00026	-0.01499	-0.06016	-0.09640
-0.09138	-0.07948	-0.08989	-0.09656	-0.07420	-0.04972	-0.04121	-0.03128
-0.00987	0.01627	0.02783	0.01553	0.00014	0.00247	-0.00740	-0.05231
-0.09316	-0.10007	-0.08761	-0.08798	-0.11110	-0.11115	-0.06248	-0.03251
-0.05874	-0.07222	-0.02441	0.01644	0.00113	-0.02652	-0.04518	-0.05668
-0.04320	-0.00455	0.01957	0.01512	0.00156	-0.01304	-0.00494	0.02806
0.04532	0.03002	0.00111	-0.01899	-0.02028	0.01273	0.05653	0.08888
0.13688	0.18099	0.19709	0.19005	0.15801	0.11756	0.09890	0.09158
0.06359	0.04058	0.04579	0.06622	0.07197	0.04894	0.03376	0.04067
0.05934	0.05890	0.02349	-0.00227	0.00169	0.01512	0.01476	-0.00780
-0.03186	-0.04329	-0.04830	-0.05762	-0.07226	-0.07050	-0.05087	-0.04595
-0.05297	-0.04081	-0.00417	0.03405	0.05580	0.07875	0.10127	0.10230
0.09981	0.09453	0.07500	0.05096	0.01184	-0.02801	-0.03838	-0.04254
-0.05310	-0.04850	-0.01059	0.03964	0.04512	0.00921	-0.01114	0.01365
0.04265	0.03890	0.02741	0.03350	0.03848	0.03283	0.04944	0.07925
0.07677	0.05519	0.06227	0.07141	0.05153	0.03074	0.02946	0.04423
0.06321	0.08555	0.11924	0.15520	0.16827	0.15487	0.12804	0.09644
0.06582	0.03601	0.00511	-0.00432	0.01580	0.03269	0.04392	0.05138
0.03466	0.01529	0.02062	0.03417	0.02543	-0.00883	-0.03991	-0.05789
-0.06822	-0.07200	-0.08964	-0.14155	-0.18495	-0.17386	-0.14917	-0.13785
-0.12684	-0.12806	-0.14191	-0.16011	-0.17285	-0.17524	-0.18293	-0.20000
-0.17174	-0.08058	-0.01462	0.01375	0.04897	0.08296	0.10632	0.11875
0.12429	0.12242	0.11049	0.08016	0.03963	0.03067	0.05372	0.06024
0.03849	0.02434	0.02814	0.03978	0.02975	-0.01141	-0.04252	-0.05679
-0.07032	-0.07627	-0.06810	-0.04756	-0.03020	-0.04820	-0.07629	-0.07822
-0.06162	-0.03560	-0.01878	-0.01222	0.00603	0.03286	0.04486	0.02793
0.00156	-0.01007	-0.03236	-0.07023	-0.09136	-0.10389	-0.11323	-0.09173
-0.05164	-0.02909	-0.02441	-0.00636	0.02544	0.02167	-0.02454	-0.05281
-0.04775	-0.04076	-0.03999	-0.03079	-0.00658	0.01391	0.03952	0.07208
0.08982	0.08711	0.07503	0.06900	0.05448	0.02222	-0.01250	-0.03463
-0.01772	0.02764	0.04890	0.03812	0.02594	0.03019	0.03433	0.01308
-0.02126	-0.05249	-0.06259	-0.03145	-0.00180	-0.01627	-0.04375	-0.03223
0.00303	0.01357	0.00558	-0.00576	-0.00733	0.00010	-0.01640	-0.05694
-0.07464	-0.05419	-0.04472	-0.06319	-0.06147	-0.01288	0.03617	0.04770
0.03169	0.01545	0.02486	0.04264	0.04961	0.05414	0.06913	0.10024
0.12385	0.10537	0.06572	0.05891	0.05672	0.01106	-0.03358	-0.03181
0.00688	0.04876	0.05388	0.03304	0.00696	-0.02793	-0.04886	-0.04399
-0.03863	-0.04592	-0.05553	-0.06629	-0.06965	-0.05100	-0.02734	-0.02235
-0.03616	-0.04933	-0.04714	-0.04392	-0.04894	-0.05466	-0.05980	-0.05307
-0.03783	-0.03451	-0.03798	-0.03497	-0.02792	-0.02659	-0.02296	-0.01531

Client

WO/Job No.

Subject PLUTONIUM VAULT, BLDG. NO. 2736-Z

Date 12/20/94 By Carleton J. Moore

SDC 4.1, Rev. 12, TIME HISTORY #1 FILE

Checked 12/21/95 By Gary R. Wagenblast

Location PFP

Revised By

-0.02011	-0.03250	-0.02319	0.00894	0.02677	0.04679	0.08566	0.10568
0.10012	0.06194	0.00219	-0.02136	0.00617	0.05828	0.10343	0.12543
0.12827	0.12508	0.12369	0.11958	0.11592	0.10808	0.08350	0.03817
-0.00725	-0.02812	-0.03448	-0.03430	-0.01181	0.01915	0.04757	0.08776
0.10702	0.08153	0.05081	0.04456	0.04757	0.03963	0.02836	0.02343
0.02105	0.02411	0.03383	0.03660	0.03267	0.03267	0.03124	0.02708
0.02340	0.02195	0.01833	0.01118	0.00422	-0.01040	-0.03481	-0.05658
-0.06442	-0.06328	-0.06315	-0.05607	-0.03116	-0.00300	0.00467	-0.01590
-0.03414	-0.02546	-0.01519	-0.00927	-0.00785	-0.02015	-0.03655	-0.04928
-0.04753	-0.03607	-0.02557	-0.01855	-0.02376	-0.04230	-0.05944	-0.05615
-0.03722	-0.01489	0.00661	0.01665	0.01820	0.02410	0.03552	0.03743
0.02524	0.01588	0.00984	-0.00337	-0.02609	-0.03577	-0.02342	-0.02651
-0.04141	-0.03900	-0.03996	-0.05987	-0.07288	-0.06972	-0.05630	-0.03898
-0.03238	-0.03061	-0.02836	-0.02761	-0.02560	-0.02267	-0.02237	-0.02819
-0.02926	-0.02017	-0.01678	-0.02066	-0.01874	-0.01229	-0.01250	-0.02941
-0.05520	-0.06286	-0.05180	-0.05143	-0.06669	-0.07635	-0.07409	-0.06564
-0.05432	-0.04222	-0.02764	-0.02106	-0.02980	-0.03730	-0.02935	-0.01766
-0.01587	-0.01467	-0.01077	-0.00717	0.00136	0.01851	0.03460	0.03787
0.03396	0.03195	0.03413	0.03584	0.03718	0.03524	0.02465	0.01546
0.01459	0.02073	0.03535	0.05370	0.05595	0.03385	0.00942	0.00554
0.01195	0.01092	0.00929	0.01135	0.01239	0.01567	0.02118	0.01909
0.01418	0.01688	0.01917	0.01486	0.00712	-0.00490	-0.02066	-0.03406
-0.03927	-0.03514	-0.02892	-0.02451	-0.02076	-0.02331	-0.02971	-0.02735
-0.02038	-0.01797	-0.01574	-0.00862	0.00126	0.00480	0.00055	-0.00321
-0.00232	0.00268	0.00693	0.00917	0.01203	0.01197	0.00972	0.01100
0.01228	0.01155	0.01210	0.01240	0.01244	0.01362	0.01399	0.01315
0.01086	0.00836	0.00741	0.00742	0.00771	0.00741	0.00663	0.00518
0.00362	0.00287	0.00283	0.00297	0.00307	0.00314	0.00299	0.00260
0.00197	0.00137	0.00112	0.00119				

Client

WO/Job No.

Subject PLUTONIUM VAULT, BLDG. NO. 2736-Z

Date 12/27/95 By Carleton J. Moore

SASSI HORIZONTAL SEISMIC SITE FILE

Checked 2/21/95 By Gary R. Wagenblast

Location PFP

Revised By

```
  1      BEST ESTIMATE Blume & SW SOIL PROPERTIES g=.216
 30   12    0
32.2
  1      1.50       110     694.1    1236.5    0.018     0.018
  2      0.75       110     681.9    1214.8    0.023     0.023
  3      2.75       110     662.4    1180.2    0.030     0.030
  4      5.00       110     613.2    1092.4    0.047     0.047
  5     10.00       113     728.8    1298.4    0.055     0.055
  6     10.00       113     731.8    1303.7    0.052     0.052
  7     10.00       113    1408.7    2509.7    0.028     0.028
  8     10.00       113    1386.6    2470.2    0.031     0.031
  9     10.00       113    1393.3    2482.3    0.028     0.028
 10     10.00       113    1371.3    2443.1    0.032     0.032
 11     10.00       113    1633.2    2909.5    0.027     0.027
 12     10.00       113    1618.3    2883.1    0.029     0.029
 13     10.00       113    1606.1    2861.4    0.031     0.031
 14     10.00       113    1596.0    2843.4    0.033     0.033
 15     10.00       113    1865.4    3323.2    0.027     0.027
 16     10.00       113    1896.0    3377.8    0.022     0.022
 17     10.00       113    1890.2    3367.5    0.023     0.023
 18     10.00       113    1885.2    3358.6    0.024     0.024
 19     10.00       113    1881.3    3351.6    0.024     0.024
 20     10.00       113    1878.3    3346.2    0.024     0.024
 21     10.00       113    1875.9    3342.0    0.025     0.025
 22     10.00       113    1874.2    3339.0    0.025     0.025
 23     10.00       113    1873.0    3336.8    0.025     0.025
 24     10.00       113    1872.2    3335.5    0.025     0.025
 25     10.00       113    1871.9    3334.9    0.025     0.025
 26     10.00       113    1872.1    3335.2    0.025     0.025
 27     10.00       113    1870.8    3332.9    0.025     0.025
 28     10.00       113    1865.9    3324.2    0.026     0.026
 29     10.00       113    1914.9    3411.5    0.020     0.020
 30     10.00       113    1912.6    3407.4    0.021     0.021
                    140    4000.0    7126.2    0.010     0.010
        .010       4096
 10   41   82  143  205  327  344  410  615  820 1024 1230
  2      PVAULT QUARTER MODEL - SITE MODE 2
  1
  0    1
  X    1    2
 10 1230
     1.        1.
  0
```

Client

WO/Job No.

Subject PLUTONIUM VAULT, BLDG. NO. 2736-Z

Date 12/27/94 By Carleton J. Moore

SASSI HORIZONTAL SEISMIC POINT FILE

Checked 2/21/95 By Gary R. Wagenblast

Location PFP

Revised By

```
1     PVAULT QUARTER MODEL - POINT
2    1.0
0
```

Client

WO/Job No.

Subject PLUTONIUM VAULT, BLDG. NO. 2736-Z — Date 1/30/95 — By Carleton J. Moore

SASSI HORIZONTAL SEISMIC HOUSE FILE — Checked 2/21/95 GRW By Gary R. Wagenblast

Location PFP

Revised By

```
 1    QUARTER PVAULT MODEL (PVHOU5.INP 1/30/95 CJM)

507  167    3    2    0    2    1    3
    32.2
    0.00
  1    1   47   67  195
  2   -1   86   87  168
  1    0    1    1    1    0    0     0.00   -28.67   -2.25
  2    0    1    1    1    0    0     0.00   -30.17   -2.25
  3    0    1    1    1    0    0     0.00   -32.17   -2.25
  4    0    1    1    1    0    0     0.00   -34.17   -2.25
  5    0    0    0    0    0    0     1.00   -28.67   -2.25
  6    0    0    0    0    0    0     1.00   -30.17   -2.25
  7    0    0    0    0    0    0     2.00   -30.17   -2.25
  8    0    0    0    0    0    0     2.00   -31.17   -2.25
  9    0    0    0    0    0    0     2.00   -32.17   -2.25
 10    0    0    0    0    0    0     2.00   -33.17   -2.25
 11    0    0    0    0    0    0     2.00   -34.17   -2.25
 12    0    0    0    0    0    0     7.00   -31.17   -2.25
 13    0    0    0    0    0    0     7.00   -32.17   -2.25
 14    0    0    0    0    0    0     7.00   -33.17   -2.25
 15    0    0    0    0    0    0    12.00   -30.17   -2.25
 16    0    0    0    0    0    0    12.00   -31.17   -2.25
 17    0    0    0    0    0    0    12.00   -32.17   -2.25
 18    0    0    0    0    0    0    12.00   -33.17   -2.25
 19    0    0    0    0    0    0    12.00   -34.17   -2.25
 20    0    0    0    0    0    0    14.00   -30.17   -2.25
 21    0    0    0    0    0    0    14.00   -32.17   -2.25
 22    0    0    0    0    0    0    14.00   -34.17   -2.25
 23    0    0    0    0    0    0    16.00   -30.17   -2.25
 24    0    0    0    0    0    0    16.00   -31.17   -2.25
 25    0    0    0    0    0    0    16.00   -32.17   -2.25
 26    0    0    0    0    0    0    16.00   -33.17   -2.25
 27    0    0    0    0    0    0    16.00   -34.17   -2.25
 28    0    0    0    0    0    0    21.00   -31.17   -2.25
 29    0    0    0    0    0    0    21.00   -32.17   -2.25
 30    0    0    0    0    0    0    21.00   -33.17   -2.25
 31    0    0    0    0    0    0    24.50    -2.83   -2.25
 32    0    0    0    0    0    0    24.50    -3.83   -2.25
 33    0    0    0    0    0    0    24.50    -4.83   -2.25
 34    0    0    0    0    0    0    26.00    -1.83   -2.25
 35    0    0    0    0    0    0    26.00    -2.83   -2.25
 36    0    0    0    0    0    0    26.00    -3.83   -2.25
 37    0    0    0    0    0    0    26.00    -4.83   -2.25
 38    0    0    0    0    0    0    26.00    -5.83   -2.25
 39    0    0    0    0    0    0    26.00   -16.00   -2.25
 40    0    0    0    0    0    0    26.00   -18.00   -2.25
 41    0    0    0    0    0    0    26.00   -20.00   -2.25
 42    0    0    0    0    0    0    26.00   -30.17   -2.25
 43    0    0    0    0    0    0    26.00   -31.17   -2.25
 44    0    0    0    0    0    0    26.00   -32.17   -2.25
 45    0    0    0    0    0    0    26.00   -33.17   -2.25
 46    0    0    0    0    0    0    26.00   -34.17   -2.25
 47    0    1    0    1    0    1    27.00     0.00   -2.25
 48    0    0    0    0    0    0    27.00    -1.83   -2.25
 49    0    0    0    0    0    0    27.00    -5.83   -2.25
 50    0    0    0    0    0    0    27.00   -10.92   -2.25
 51    0    0    0    0    0    0    27.00   -16.00   -2.25
 52    0    0    0    0    0    0    27.00   -20.00   -2.25
 53    0    0    0    0    0    0    27.00   -25.08   -2.25
 54    0    0    0    0    0    0    27.00   -30.17   -2.25
 55    0    1    0    1    0    1    28.00     0.00   -2.25
 56    0    0    0    0    0    0    28.00    -1.83   -2.25
 57    0    0    0    0    0    0    28.00    -3.83   -2.25
 58    0    0    0    0    0    0    28.00    -5.83   -2.25
```

Client WO/Job No.

Subject PLUTONIUM VAULT, BLDG. NO. 2736-Z Date 1/30/95 By Carleton J. Moore

SASSI HORIZONTAL SEISMIC HOUSE FILE Checked 2/13/95 By Gary R. Wagenblast

Location PFP Revised By

59	0	0	0	0	0	0	28.00	-10.92	-2.25
60	0	0	0	0	0	0	28.00	-16.00	-2.25
61	0	0	0	0	0	0	28.00	-18.00	-2.25
62	0	0	0	0	0	0	28.00	-20.00	-2.25
63	0	0	0	0	0	0	28.00	-25.08	-2.25
64	0	0	0	0	0	0	28.00	-30.17	-2.25
65	0	0	0	0	0	0	28.00	-32.17	-2.25
66	0	0	0	0	0	0	28.00	-34.17	-2.25
67	0	1	0	1	0	1	29.00	0.00	-2.25
68	0	0	0	0	0	0	29.00	-1.83	-2.25
69	0	0	0	0	0	0	29.00	-5.83	-2.25
70	0	0	0	0	0	0	29.00	-10.92	-2.25
71	0	0	0	0	0	0	29.00	-16.00	-2.25
72	0	0	0	0	0	0	29.00	-20.00	-2.25
73	0	0	0	0	0	0	29.00	-25.08	-2.25
74	0	0	0	0	0	0	29.00	-30.17	-2.25
75	0	0	0	0	0	0	30.00	-1.83	-2.25
76	0	0	0	0	0	0	30.00	-3.83	-2.25
77	0	0	0	0	0	0	30.00	-5.83	-2.25
78	0	0	0	0	0	0	30.00	-16.00	-2.25
79	0	0	0	0	0	0	30.00	-18.00	-2.25
80	0	0	0	0	0	0	30.00	-20.00	-2.25
81	0	0	0	0	0	0	30.00	-30.17	-2.25
82	0	0	0	0	0	0	30.00	-32.17	-2.25
83	0	0	0	0	0	0	30.00	-34.17	-2.25
84	0	1	1	1	0	1	0.00	0.00	-1.50
85	0	1	1	1	0	0	0.00	-1.83	-1.50
86	0	1	1	1	0	0	0.00	-3.83	-1.50
87	0	1	1	1	0	0	0.00	-5.83	-1.50
88	0	1	1	1	0	0	0.00	-10.92	-1.50
89	0	1	1	1	0	0	0.00	-16.00	-1.50
90	0	1	1	1	0	0	0.00	-18.00	-1.50
91	0	1	1	1	0	0	0.00	-20.00	-1.50
92	0	1	1	1	0	0	0.00	-25.08	-1.50
93	0	0	0	0	0	0	1.00	-5.83	-1.50
94	0	0	0	0	0	0	1.00	-10.92	-1.50
95	0	0	0	0	0	0	1.00	-16.00	-1.50
96	0	0	0	0	0	0	1.00	-20.00	-1.50
97	0	0	0	0	0	0	1.00	-25.08	-1.50
98	0	1	0	1	0	1	2.00	0.00	-1.50
99	0	0	0	0	0	0	2.00	-1.83	-1.50
100	0	0	0	0	0	0	2.00	-2.83	-1.50
101	0	0	0	0	0	0	2.00	-3.83	-1.50
102	0	0	0	0	0	0	2.00	-4.83	-1.50
103	0	0	0	0	0	0	2.00	-5.83	-1.50
104	0	0	0	0	0	0	2.00	-16.00	-1.50
105	0	0	0	0	0	0	2.00	-18.00	-1.50
106	0	0	0	0	0	0	2.00	-20.00	-1.50
107	0	0	0	0	0	0	7.00	-2.83	-1.50
108	0	0	0	0	0	0	7.00	-3.83	-1.50
109	0	0	0	0	0	0	7.00	-4.83	-1.50
110	0	1	0	1	0	1	12.00	0.00	-1.50
111	0	0	0	0	0	0	12.00	-1.83	-1.50
112	0	0	0	0	0	0	12.00	-2.83	-1.50
113	0	0	0	0	0	0	12.00	-3.83	-1.50
114	0	0	0	0	0	0	12.00	-4.83	-1.50
115	0	0	0	0	0	0	12.00	-5.83	-1.50
116	0	0	0	0	0	0	12.00	-16.00	-1.50
117	0	0	0	0	0	0	12.00	-18.00	-1.50
118	0	0	0	0	0	0	12.00	-20.00	-1.50
119	0	1	0	1	0	1	14.00	0.00	-1.50
120	0	0	0	0	0	0	14.00	-1.83	-1.50
121	0	0	0	0	0	0	14.00	-3.83	-1.50
122	0	0	0	0	0	0	14.00	-5.83	-1.50
123	0	0	0	0	0	0	14.00	-16.00	-1.50

124	0	0	0	0	0	0	14.00	-18.00	-1.50
125	0	0	0	0	0	0	14.00	-20.00	-1.50
126	0	1	0	1	0	1	16.00	0.00	-1.50
127	0	0	0	0	0	0	16.00	-1.83	-1.50
128	0	0	0	0	0	0	16.00	-2.83	-1.50
129	0	0	0	0	0	0	16.00	-3.83	-1.50
130	0	0	0	0	0	0	16.00	-4.83	-1.50
131	0	0	0	0	0	0	16.00	-5.83	-1.50
132	0	0	0	0	0	0	16.00	-16.00	-1.50
133	0	0	0	0	0	0	16.00	-18.00	-1.50
134	0	0	0	0	0	0	16.00	-20.00	-1.50
135	0	0	0	0	0	0	21.00	-2.83	-1.50
136	0	0	0	0	0	0	21.00	-3.83	-1.50
137	0	0	0	0	0	0	21.00	-4.83	-1.50
138	0	1	1	1	0	1	0.00	0.00	0.00
139	0	1	1	1	0	0	0.00	-3.83	0.00
140	0	1	1	1	0	0	0.00	-10.92	0.00
141	0	1	1	1	0	0	0.00	-18.00	0.00
142	0	1	1	1	0	0	0.00	-25.08	0.00
143	0	1	1	1	0	0	0.00	-32.17	0.00
144	0	1	0	1	0	1	7.00	0.00	0.00
145	0	0	0	0	0	0	7.00	-3.83	0.00
146	0	0	0	0	0	0	7.00	-10.92	0.00
147	0	0	0	0	0	0	7.00	-18.00	0.00
148	0	0	0	0	0	0	7.00	-25.08	0.00
149	0	0	0	0	0	0	7.00	-32.17	0.00
150	0	1	0	1	0	1	14.00	0.00	0.00
151	0	0	0	0	0	0	14.00	-3.83	0.00
152	0	0	0	0	0	0	14.00	-10.92	0.00
153	0	0	0	0	0	0	14.00	-18.00	0.00
154	0	0	0	0	0	0	14.00	-25.08	0.00
155	0	0	0	0	0	0	14.00	-32.17	0.00
156	0	1	0	1	0	1	21.00	0.00	0.00
157	0	0	0	0	0	0	21.00	-3.83	0.00
158	0	0	0	0	0	0	21.00	-10.92	0.00
159	0	0	0	0	0	0	21.00	-18.00	0.00
160	0	0	0	0	0	0	21.00	-25.08	0.00
161	0	0	0	0	0	0	21.00	-32.17	0.00
162	0	1	0	1	0	1	28.00	0.00	0.00
163	0	0	0	0	0	0	28.00	-3.83	0.00
164	0	0	0	0	0	0	28.00	-10.92	0.00
165	0	0	0	0	0	0	28.00	-18.00	0.00
166	0	0	0	0	0	0	28.00	-25.08	0.00
167	0	0	0	0	0	0	28.00	-32.17	0.00
168	0	1	1	1	0	0	0.00	-3.83	0.50
169	0	1	1	1	0	0	0.00	-5.83	0.50
170	0	1	1	1	0	0	0.00	-10.92	0.50
171	0	1	1	1	0	0	0.00	-16.00	0.50
172	0	1	1	1	0	0	0.00	-18.00	0.50
173	0	1	1	1	0	0	0.00	-20.00	0.50
174	0	1	1	1	0	0	0.00	-25.08	0.50
175	0	1	1	1	0	0	0.00	-28.67	0.50
176	0	1	1	1	0	0	0.00	-30.17	0.50
177	0	1	1	1	0	0	0.00	-32.17	0.50
178	0	0	0	0	0	0	2.00	-3.83	0.50
179	0	0	0	0	0	0	2.00	-32.17	0.50
180	0	0	0	0	0	0	7.00	-3.83	0.50
181	0	0	0	0	0	0	7.00	-32.17	0.50
182	0	0	0	0	0	0	12.00	-3.83	0.50
183	0	0	0	0	0	0	12.00	-32.17	0.50
184	0	0	0	0	0	0	14.00	-3.83	0.50
185	0	0	0	0	0	0	14.00	-18.00	0.50
186	0	0	0	0	0	0	14.00	-32.17	0.50
187	0	0	0	0	0	0	16.00	-3.83	0.50
188	0	0	0	0	0	0	16.00	-32.17	0.50

189	0	0	0	0	0	0	17.50	-32.17	0.50
190	0	0	0	0	0	0	21.00	-3.83	0.50
191	0	0	0	0	0	0	21.00	-32.17	0.50
192	0	0	0	0	0	0	24.50	-3.83	0.50
193	0	0	0	0	0	0	26.00	-3.83	0.50
194	0	0	0	0	0	0	26.00	-32.17	0.50
195	0	1	0	1	0	1	28.00	0.00	0.50
196	0	0	0	0	0	0	28.00	-1.83	0.50
197	0	0	0	0	0	0	28.00	-3.83	0.50
198	0	0	0	0	0	0	28.00	-5.83	0.50
199	0	0	0	0	0	0	28.00	-10.92	0.50
200	0	0	0	0	0	0	28.00	-16.00	0.50
201	0	0	0	0	0	0	28.00	-18.00	0.50
202	0	0	0	0	0	0	28.00	-20.00	0.50
203	0	0	0	0	0	0	28.00	-25.08	0.50
204	0	0	0	0	0	0	28.00	-30.17	0.50
205	0	0	0	0	0	0	28.00	-32.17	0.50
206	0	1	1	1	0	0	0.00	-6.19	0.52
207	0	1	1	1	0	0	0.00	-8.56	0.52
208	0	1	1	1	0	0	0.00	-10.92	0.52
209	0	1	1	1	0	0	0.00	-13.28	0.52
210	0	1	1	1	0	0	0.00	-15.64	0.52
211	0	1	1	1	0	0	0.00	-20.36	0.52
212	0	1	1	1	0	0	0.00	-22.72	0.52
213	0	1	1	1	0	0	0.00	-25.08	0.52
214	0	1	1	1	0	0	0.00	-27.44	0.52
215	0	1	1	1	0	0	0.00	-29.81	0.52
216	0	0	0	0	0	0	3.50	-3.83	0.52
217	0	0	0	0	0	0	3.50	-32.17	0.52
218	0	0	0	0	0	0	7.00	-3.83	0.52
219	0	0	0	0	0	0	7.00	-32.17	0.52
220	0	0	0	0	0	0	10.50	-3.83	0.52
221	0	0	0	0	0	0	10.50	-32.17	0.52
222	0	0	0	0	0	0	17.50	-3.83	0.52
223	0	0	0	0	0	0	21.00	-3.83	0.52
224	0	0	0	0	0	0	21.00	-32.17	0.52
225	0	0	0	0	0	0	24.50	-3.83	0.52
226	0	0	0	0	0	0	24.50	-32.17	0.52
227	0	1	0	1	0	1	28.00	0.00	0.52
228	0	0	0	0	0	0	28.00	-6.19	0.52
229	0	0	0	0	0	0	28.00	-8.56	0.52
230	0	0	0	0	0	0	28.00	-10.92	0.52
231	0	0	0	0	0	0	28.00	-13.28	0.52
232	0	0	0	0	0	0	28.00	-15.64	0.52
233	0	0	0	0	0	0	28.00	-20.36	0.52
234	0	0	0	0	0	0	28.00	-22.72	0.52
235	0	0	0	0	0	0	28.00	-25.08	0.52
236	0	0	0	0	0	0	28.00	-27.44	0.52
237	0	0	0	0	0	0	28.00	-29.81	0.52
238	0	1	1	1	0	0	0.00	-3.83	3.99
239	0	1	1	1	0	0	0.00	-6.19	3.99
240	0	1	1	1	0	0	0.00	-8.56	3.99
241	0	1	1	1	0	0	0.00	-10.92	3.99
242	0	1	1	1	0	0	0.00	-13.28	3.99
243	0	1	1	1	0	0	0.00	-15.64	3.99
244	0	1	1	1	0	0	0.00	-18.00	3.99
245	0	1	1	1	0	0	0.00	-20.36	3.99
246	0	1	1	1	0	0	0.00	-22.72	3.99
247	0	1	1	1	0	0	0.00	-25.08	3.99
248	0	1	1	1	0	0	0.00	-27.44	3.99
249	0	1	1	1	0	0	0.00	-29.81	3.99
250	0	1	1	1	0	0	0.00	-32.17	3.99
251	0	0	0	0	0	0	3.50	-3.83	3.99
252	0	0	0	0	0	0	3.50	-32.17	3.99
253	0	0	0	0	0	0	7.00	-3.83	3.99

254	0	0	0	0	0	0	7.00	-32.17	3.99
255	0	0	0	0	0	0	10.50	-3.83	3.99
256	0	0	0	0	0	0	10.50	-32.17	3.99
257	0	0	0	0	0	0	14.00	-3.83	3.99
258	0	0	0	0	0	0	14.00	-18.00	3.99
259	0	0	0	0	0	0	14.00	-32.17	3.99
260	0	0	0	0	0	0	17.50	-3.83	3.99
261	0	0	0	0	0	0	17.50	-32.17	3.99
262	0	0	0	0	0	0	21.00	-3.83	3.99
263	0	0	0	0	0	0	21.00	-32.17	3.99
264	0	0	0	0	0	0	24.50	-3.83	3.99
265	0	0	0	0	0	0	24.50	-32.17	3.99
266	0	1	0	1	0	1	28.00	0.00	3.99
267	0	0	0	0	0	0	28.00	-3.83	3.99
268	0	0	0	0	0	0	28.00	-6.19	3.99
269	0	0	0	0	0	0	28.00	-8.56	3.99
270	0	0	0	0	0	0	28.00	-10.92	3.99
271	0	0	0	0	0	0	28.00	-13.28	3.99
272	0	0	0	0	0	0	28.00	-15.64	3.99
273	0	0	0	0	0	0	28.00	-18.00	3.99
274	0	0	0	0	0	0	28.00	-20.36	3.99
275	0	0	0	0	0	0	28.00	-22.72	3.99
276	0	0	0	0	0	0	28.00	-25.08	3.99
277	0	0	0	0	0	0	28.00	-27.44	3.99
278	0	0	0	0	0	0	28.00	-29.81	3.99
279	0	0	0	0	0	0	28.00	-32.17	3.99
280	0	1	1	1	0	0	0.00	-3.83	7.45
281	0	1	1	1	0	0	0.00	-6.19	7.45
282	0	1	1	1	0	0	0.00	-8.56	7.45
283	0	1	1	1	0	0	0.00	-10.92	7.45
284	0	1	1	1	0	0	0.00	-13.28	7.45
285	0	1	1	1	0	0	0.00	-15.64	7.45
286	0	1	1	1	0	0	0.00	-18.00	7.45
287	0	1	1	1	0	0	0.00	-20.36	7.45
288	0	1	1	1	0	0	0.00	-22.72	7.45
289	0	1	1	1	0	0	0.00	-25.08	7.45
290	0	1	1	1	0	0	0.00	-27.44	7.45
291	0	1	1	1	0	0	0.00	-29.81	7.45
292	0	1	1	1	0	0	0.00	-32.17	7.45
293	0	0	0	0	0	0	3.50	-3.83	7.45
294	0	0	0	0	0	0	3.50	-32.17	7.45
295	0	0	0	0	0	0	7.00	-3.83	7.45
296	0	0	0	0	0	0	7.00	-32.17	7.45
297	0	0	0	0	0	0	10.50	-3.83	7.45
298	0	0	0	0	0	0	10.50	-32.17	7.45
299	0	0	0	0	0	0	14.00	-3.83	7.45
300	0	0	0	0	0	0	14.00	-18.00	7.45
301	0	0	0	0	0	0	14.00	-32.17	7.45
302	0	0	0	0	0	0	17.50	-3.83	7.45
303	0	0	0	0	0	0	17.50	-32.17	7.45
304	0	0	0	0	0	0	21.00	-3.83	7.45
305	0	0	0	0	0	0	21.00	-32.17	7.45
306	0	0	0	0	0	0	24.50	-3.83	7.45
307	0	0	0	0	0	0	24.50	-32.17	7.45
308	0	1	0	1	0	1	28.00	0.00	7.45
309	0	0	0	0	0	0	28.00	-3.83	7.45
310	0	0	0	0	0	0	28.00	-6.19	7.45
311	0	0	0	0	0	0	28.00	-8.56	7.45
312	0	0	0	0	0	0	28.00	-10.92	7.45
313	0	0	0	0	0	0	28.00	-13.28	7.45
314	0	0	0	0	0	0	28.00	-15.64	7.45
315	0	0	0	0	0	0	28.00	-18.00	7.45
316	0	0	0	0	0	0	28.00	-20.36	7.45
317	0	0	0	0	0	0	28.00	-22.72	7.45
318	0	0	0	0	0	0	28.00	-25.08	7.45

319	0	0	0	0	0	0	28.00	-27.44	7.45
320	0	0	0	0	0	0	28.00	-29.81	7.45
321	0	0	0	0	0	0	28.00	-32.17	7.45
322	0	1	1	1	0	0	0.00	-3.83	10.92
323	0	1	1	1	0	0	0.00	-6.19	10.92
324	0	1	1	1	0	0	0.00	-8.56	10.92
325	0	1	1	1	0	0	0.00	-10.92	10.92
326	0	1	1	1	0	0	0.00	-13.28	10.92
327	0	1	1	1	0	0	0.00	-15.64	10.92
328	0	1	1	1	0	0	0.00	-18.00	10.92
329	0	1	1	1	0	0	0.00	-20.36	10.92
330	0	1	1	1	0	0	0.00	-22.72	10.92
331	0	1	1	1	0	0	0.00	-25.08	10.92
332	0	1	1	1	0	0	0.00	-27.44	10.92
333	0	1	1	1	0	0	0.00	-29.81	10.92
334	0	1	1	1	0	0	0.00	-32.17	10.92
335	0	0	0	0	0	0	3.50	-3.83	10.92
336	0	0	0	0	0	0	3.50	-18.00	10.92
337	0	0	0	0	0	0	3.50	-32.17	10.92
338	0	0	0	0	0	0	7.00	-3.83	10.92
339	0	0	0	0	0	0	7.00	-18.00	10.92
340	0	0	0	0	0	0	7.00	-32.17	10.92
341	0	0	0	0	0	0	10.50	-3.83	10.92
342	0	0	0	0	0	0	10.50	-18.00	10.92
343	0	0	0	0	0	0	10.50	-32.17	10.92
344	0	0	0	0	0	0	14.00	-3.83	10.92
345	0	0	0	0	0	0	14.00	-6.19	10.92
346	0	0	0	0	0	0	14.00	-8.56	10.92
347	0	0	0	0	0	0	14.00	-10.92	10.92
348	0	0	0	0	0	0	14.00	-13.28	10.92
349	0	0	0	0	0	0	14.00	-15.64	10.92
350	0	0	0	0	0	0	14.00	-18.00	10.92
351	0	0	0	0	0	0	14.00	-20.36	10.92
352	0	0	0	0	0	0	14.00	-22.72	10.92
353	0	0	0	0	0	0	14.00	-25.08	10.92
354	0	0	0	0	0	0	14.00	-27.44	10.92
355	0	0	0	0	0	0	14.00	-29.81	10.92
356	0	0	0	0	0	0	14.00	-32.17	10.92
357	0	0	0	0	0	0	17.50	-3.83	10.92
358	0	0	0	0	0	0	17.50	-18.00	10.92
359	0	0	0	0	0	0	17.50	-32.17	10.92
360	0	0	0	0	0	0	21.00	-3.83	10.92
361	0	0	0	0	0	0	21.00	-18.00	10.92
362	0	0	0	0	0	0	21.00	-32.17	10.92
363	0	0	0	0	0	0	24.50	-3.83	10.92
364	0	0	0	0	0	0	24.50	-18.00	10.92
365	0	0	0	0	0	0	24.50	-32.17	10.92
366	0	1	0	1	0	1	28.00	0.00	10.92
367	0	0	0	0	0	0	28.00	-3.83	10.92
368	0	0	0	0	0	0	28.00	-6.19	10.92
369	0	0	0	0	0	0	28.00	-8.56	10.92
370	0	0	0	0	0	0	28.00	-10.92	10.92
371	0	0	0	0	0	0	28.00	-13.28	10.92
372	0	0	0	0	0	0	28.00	-15.64	10.92
373	0	0	0	0	0	0	28.00	-18.00	10.92
374	0	0	0	0	0	0	28.00	-20.36	10.92
375	0	0	0	0	0	0	28.00	-22.72	10.92
376	0	0	0	0	0	0	28.00	-25.08	10.92
377	0	0	0	0	0	0	28.00	-27.44	10.92
378	0	0	0	0	0	0	28.00	-29.81	10.92
379	0	0	0	0	0	0	28.00	-32.17	10.92
380	0	1	1	1	0	0	0.00	-32.17	11.57
381	0	0	0	0	0	0	3.50	-32.17	11.57
382	0	0	0	0	0	0	7.00	-32.17	11.57
383	0	0	0	0	0	0	10.50	-32.17	11.57

Client WO/Job No.

Subject PLUTONIUM VAULT, BLDG. NO. 2736-Z Date 1/30/95 By Carleton J. Moore

SASSI HORIZONTAL SEISMIC HOUSE FILE Checked 2/21/95 By Gary R. Wagenblast

Location PFP Revised By

384	0	0	0	0	0	0	14.00	-32.17	11.57
385	0	0	0	0	0	0	17.50	-32.17	11.57
386	0	0	0	0	0	0	21.00	-32.17	11.57
387	0	0	0	0	0	0	24.50	-32.17	11.57
388	0	0	0	0	0	0	28.00	-32.17	11.57
389	0	1	1	1	0	0	0.00	-29.81	11.62
390	0	0	0	0	0	0	3.50	-29.81	11.62
391	0	0	0	0	0	0	7.00	-29.81	11.62
392	0	0	0	0	0	0	10.50	-29.81	11.62
393	0	0	0	0	0	0	14.00	-29.81	11.62
394	0	0	0	0	0	0	17.50	-29.81	11.62
395	0	0	0	0	0	0	21.00	-29.81	11.62
396	0	0	0	0	0	0	24.50	-29.81	11.62
397	0	0	0	0	0	0	28.00	-29.81	11.62
398	0	1	1	1	0	0	0.00	-27.44	11.67
399	0	0	0	0	0	0	3.50	-27.44	11.67
400	0	0	0	0	0	0	7.00	-27.44	11.67
401	0	0	0	0	0	0	10.50	-27.44	11.67
402	0	0	0	0	0	0	14.00	-27.44	11.67
403	0	0	0	0	0	0	17.50	-27.44	11.67
404	0	0	0	0	0	0	21.00	-27.44	11.67
405	0	0	0	0	0	0	24.50	-27.44	11.67
406	0	0	0	0	0	0	28.00	-27.44	11.67
407	0	1	1	1	0	0	0.00	-25.08	11.72
408	0	0	0	0	0	0	3.50	-25.08	11.72
409	0	0	0	0	0	0	7.00	-25.08	11.72
410	0	0	0	0	0	0	10.50	-25.08	11.72
411	0	0	0	0	0	0	14.00	-25.08	11.72
412	0	0	0	0	0	0	17.50	-25.08	11.72
413	0	0	0	0	0	0	21.00	-25.08	11.72
414	0	0	0	0	0	0	24.50	-25.08	11.72
415	0	0	0	0	0	0	28.00	-25.08	11.72
416	0	1	1	1	0	0	0.00	-22.72	11.77
417	0	0	0	0	0	0	3.50	-22.72	11.77
418	0	0	0	0	0	0	7.00	-22.72	11.77
419	0	0	0	0	0	0	10.50	-22.72	11.77
420	0	0	0	0	0	0	14.00	-22.72	11.77
421	0	0	0	0	0	0	17.50	-22.72	11.77
422	0	0	0	0	0	0	21.00	-22.72	11.77
423	0	0	0	0	0	0	24.50	-22.72	11.77
424	0	0	0	0	0	0	28.00	-22.72	11.77
425	0	1	1	1	0	0	0.00	-20.36	11.82
426	0	0	0	0	0	0	3.50	-20.36	11.82
427	0	0	0	0	0	0	7.00	-20.36	11.82
428	0	0	0	0	0	0	10.50	-20.36	11.82
429	0	0	0	0	0	0	14.00	-20.36	11.82
430	0	0	0	0	0	0	17.50	-20.36	11.82
431	0	0	0	0	0	0	21.00	-20.36	11.82
432	0	0	0	0	0	0	24.50	-20.36	11.82
433	0	0	0	0	0	0	28.00	-20.36	11.82
434	0	1	1	1	0	0	0.00	-18.00	11.87
435	0	0	0	0	0	0	3.50	-18.00	11.87
436	0	0	0	0	0	0	7.00	-18.00	11.87
437	0	0	0	0	0	0	10.50	-18.00	11.87
438	0	0	0	0	0	0	14.00	-18.00	11.87
439	0	0	0	0	0	0	17.50	-18.00	11.87
440	0	0	0	0	0	0	21.00	-18.00	11.87
441	0	0	0	0	0	0	24.50	-18.00	11.87
442	0	0	0	0	0	0	28.00	-18.00	11.87
443	0	1	1	1	0	0	0.00	-15.64	11.92
444	0	0	0	0	0	0	3.50	-15.64	11.92
445	0	0	0	0	0	0	7.00	-15.64	11.92
446	0	0	0	0	0	0	10.50	-15.64	11.92
447	0	0	0	0	0	0	14.00	-15.64	11.92
448	0	0	0	0	0	0	17.50	-15.64	11.92

```
449   0   0   0   0   0   0   21.00   -15.64   11.92
450   0   0   0   0   0   0   24.50   -15.64   11.92
451   0   0   0   0   0   0   28.00   -15.64   11.92
452   0   1   1   1   0   0    0.00   -13.28   11.97
453   0   0   0   0   0   0    3.50   -13.28   11.97
454   0   0   0   0   0   0    7.00   -13.28   11.97
455   0   0   0   0   0   0   10.50   -13.28   11.97
456   0   0   0   0   0   0   14.00   -13.28   11.97
457   0   0   0   0   0   0   17.50   -13.28   11.97
458   0   0   0   0   0   0   21.00   -13.28   11.97
459   0   0   0   0   0   0   24.50   -13.28   11.97
460   0   0   0   0   0   0   28.00   -13.28   11.97
461   0   1   1   1   0   0    0.00   -10.92   12.02
462   0   0   0   0   0   0    3.50   -10.92   12.02
463   0   0   0   0   0   0    7.00   -10.92   12.02
464   0   0   0   0   0   0   10.50   -10.92   12.02
465   0   0   0   0   0   0   14.00   -10.92   12.02
466   0   0   0   0   0   0   17.50   -10.92   12.02
467   0   0   0   0   0   0   21.00   -10.92   12.02
468   0   0   0   0   0   0   24.50   -10.92   12.02
469   0   0   0   0   0   0   28.00   -10.92   12.02
470   0   1   1   1   0   0    0.00    -8.56   12.07
471   0   0   0   0   0   0    3.50    -8.56   12.07
472   0   0   0   0   0   0    7.00    -8.56   12.07
473   0   0   0   0   0   0   10.50    -8.56   12.07
474   0   0   0   0   0   0   14.00    -8.56   12.07
475   0   0   0   0   0   0   17.50    -8.56   12.07
476   0   0   0   0   0   0   21.00    -8.56   12.07
477   0   0   0   0   0   0   24.50    -8.56   12.07
478   0   0   0   0   0   0   28.00    -8.56   12.07
479   0   1   1   1   0   0    0.00    -6.19   12.12
480   0   0   0   0   0   0    3.50    -6.19   12.12
481   0   0   0   0   0   0    7.00    -6.19   12.12
482   0   0   0   0   0   0   10.50    -6.19   12.12
483   0   0   0   0   0   0   14.00    -6.19   12.12
484   0   0   0   0   0   0   17.50    -6.19   12.12
485   0   0   0   0   0   0   21.00    -6.19   12.12
486   0   0   0   0   0   0   24.50    -6.19   12.12
487   0   0   0   0   0   0   28.00    -6.19   12.12
488   0   1   1   1   0   0    0.00    -3.83   12.16
489   0   0   0   0   0   0    3.50    -3.83   12.16
490   0   0   0   0   0   0    7.00    -3.83   12.16
491   0   0   0   0   0   0   10.50    -3.83   12.16
492   0   0   0   0   0   0   14.00    -3.83   12.16
493   0   0   0   0   0   0   17.50    -3.83   12.16
494   0   0   0   0   0   0   21.00    -3.83   12.16
495   0   0   0   0   0   0   24.50    -3.83   12.16
496   0   0   0   0   0   0   28.00    -3.83   12.16
497   0   1   1   1   0   1    0.00     0.00   12.24
498   0   1   0   1   0   1    3.50     0.00   12.24
499   0   1   0   1   0   1    7.00     0.00   12.24
500   0   1   0   1   0   1   10.50     0.00   12.24
501   0   1   0   1   0   1   14.00     0.00   12.24
502   0   1   0   1   0   1   17.50     0.00   12.24
503   0   1   0   1   0   1   21.00     0.00   12.24
504   0   1   0   1   0   1   24.50     0.00   12.24
505   0   1   0   1   0   1   28.00     0.00   12.24
506   0   0   0   0   0   0   21.00   -25.08    7.45
507   0   0   0   0   0   0    7.00   -25.08    7.45
167
  1 167  -1   0
  1    1.50      110     694.1   1236.5   0.018   0.018
  2    0.75      110     681.9   1214.8   0.023   0.023
  3 445   3  -1
  1  478.2e6   0.15      150     0.05     0.05
```

2	239.1e6		0.15	75	0.05	0.05	
3	478.2e6		0.15	262.5	0.05	0.05	
1	4	11	10	3	1	1.00	
2	10	9	3		1	1.00	
3	3	9	8		1	1.00	
4	6	2	3		1	1.00	
5	6	8	7		1	1.00	
6	8	6	3		1	1.00	
7	10	14	13	9	1	1.00	
8	9	13	12	8	1	1.00	
9	14	18	17	13	1	1.00	
10	13	17	16	12	1	1.00	
11	18	19	22	21	1	1.00	
12	21	17	18		1	1.00	
13	16	17	21		1	1.00	
14	22	27	26	21	1	1.00	
15	26	25	21		1	1.00	
16	21	25	24		1	1.00	
17	20	15	16	21	1	1.00	
18	23	20	21	24	1	1.00	
19	26	30	29	25	1	1.00	
20	25	29	28	24	1	1.00	
21	30	45	44	29	1	1.00	
22	29	44	43	28	1	1.00	
23	46	66	65	45	1	1.00	
24	65	44	45		1	1.00	
25	44	65	43		1	1.00	
26	66	83	82	65	1	1.00	
27	43	54	42		1	1.00	
28	54	43	65		1	1.00	
29	64	54	65		1	1.00	
30	74	64	65		1	1.00	
31	65	82	81	74	1	1.00	
32	2	6	5	1	1	1.00	
33	1	5	97	92	1	1.00	
34	54	64	63	53	1	1.00	
35	64	74	73	63	1	1.00	
36	92	97	96	91	1	1.00	
37	53	63	62	52	1	1.00	
38	63	73	72	62	1	1.00	
39	91	96	90		1	1.00	
40	96	106	105	90	1	1.00	
41	118	125	124	117	1	1.00	
42	125	134	133	124	1	1.00	
43	41	52	61	40	1	1.00	
44	52	62	61		1	1.00	
45	62	72	61		1	1.00	
46	72	80	79	61	1	1.00	
47	95	89	90		1	1.00	
48	104	95	90	105	1	1.00	
49	123	116	117	124	1	1.00	
50	132	123	124	133	1	1.00	
51	51	39	40	61	1	1.00	
52	60	51	61		1	1.00	
53	71	60	61		1	1.00	
54	78	71	61	79	1	1.00	
55	89	95	94	88	1	1.00	
56	51	60	59	50	1	1.00	
57	60	71	70	59	1	1.00	
58	88	94	93	87	1	1.00	
59	50	59	58	49	1	1.00	
60	59	70	69	58	1	1.00	
61	87	93	86		1	1.00	
62	102	93	103		1	1.00	
63	93	102	86		1	1.00	

64	102	101	86		1	1.00
65	86	101	100		1	1.00
66	99	85	86	100	1	1.00
67	85	99	98	84	1	1.00
68	102	109	108	101	1	1.00
69	101	108	107	100	1	1.00
70	109	114	113	108	1	1.00
71	108	113	112	107	1	1.00
72	115	122	121	114	1	1.00
73	121	113	114		1	1.00
74	113	121	112		1	1.00
75	122	131	130	121	1	1.00
76	129	121	130		1	1.00
77	121	129	128		1	1.00
78	120	111	112	121	1	1.00
79	127	120	121	128	1	1.00
80	111	120	119	110	1	1.00
81	120	127	126	119	1	1.00
82	130	137	136	129	1	1.00
83	129	136	135	128	1	1.00
84	137	33	32	136	1	1.00
85	136	32	31	135	1	1.00
86	33	37	36	32	1	1.00
87	32	36	35	31	1	1.00
88	49	37	38		1	1.00
89	37	49	57		1	1.00
90	49	58	57		1	1.00
91	58	69	57		1	1.00
92	57	36	37		1	1.00
93	36	57	35		1	1.00
94	76	57	69	77	1	1.00
95	35	48	34		1	1.00
96	48	35	57		1	1.00
97	56	48	57		1	1.00
98	68	56	57		1	1.00
99	57	76	75	68	1	1.00
100	48	56	55	47	1	1.00
101	56	68	67	55	1	1.00
102	3	2	176	177	2	0.67
103	2	1	175	176	2	0.67
104	1	92	174	175	2	0.67
105	92	91	173	174	2	0.67
106	91	90	172	173	2	0.67
107	90	89	171	172	2	0.67
108	89	88	170	171	2	0.67
109	88	87	169	170	2	0.67
110	87	86	168	169	2	0.67
111	86	101	178	168	1	0.67
112	101	108	180	178	1	0.67
113	108	113	182	180	1	0.67
114	113	121	184	182	1	0.67
115	121	129	187	184	1	0.67
116	129	136	190	187	1	0.67
117	136	32	192	190	1	0.67
118	32	36	193	192	1	0.67
119	36	57	197	193	1	0.67
120	57	56	196	197	3	0.67
121	56	55	195	196	3	0.67
122	58	57	197	198	3	0.67
123	59	58	198	199	3	0.67
124	60	59	199	200	3	0.67
125	61	60	200	201	3	0.67
126	62	61	201	202	3	0.67
127	63	62	202	203	3	0.67
128	64	63	203	204	3	0.67

129	65	64	204	205	3	0.67
130	3	9	179	177	3	0.67
131	9	13	181	179	3	0.67
132	13	17	183	181	3	0.67
133	17	21	186	183	3	0.67
134	21	25	188	186	3	0.67
135	25	29	191	188	3	0.67
136	29	44	194	191	3	0.67
137	44	65	205	194	3	0.67
138	143	149	148	142	1	0.50
139	149	155	154	148	1	0.50
140	155	161	160	154	1	0.50
141	161	167	166	160	1	0.50
142	142	148	147	141	1	0.50
143	148	154	153	147	1	0.50
144	154	160	159	153	1	0.50
145	160	166	165	159	1	0.50
146	141	147	146	140	1	0.50
147	147	153	152	146	1	0.50
148	153	159	158	152	1	0.50
149	159	165	164	158	1	0.50
150	140	146	145	139	1	0.50
151	146	152	151	145	1	0.50
152	152	158	157	151	1	0.50
153	158	164	163	157	1	0.50
154	139	145	144	138	1	0.50
155	145	151	150	144	1	0.50
156	151	157	156	150	1	0.50
157	157	163	162	156	1	0.50
158	177	217	252	250	3	0.67
159	217	219	254	252	3	0.67
160	219	221	256	254	3	0.67
161	221	186	259	256	3	0.67
162	186	189	261	259	3	0.67
163	189	224	263	261	3	0.67
164	224	226	265	263	3	0.67
165	226	205	279	265	3	0.67
166	250	252	294	292	3	0.67
167	252	254	296	294	3	0.67
168	254	256	298	296	3	0.67
169	256	259	301	298	3	0.67
170	259	261	303	301	3	0.67
171	261	263	305	303	3	0.67
172	263	265	307	305	3	0.67
173	265	279	321	307	3	0.67
174	292	294	337	334	3	0.67
175	294	296	340	337	3	0.67
176	296	298	343	340	3	0.67
177	298	301	356	343	3	0.67
178	301	303	359	356	3	0.67
179	303	305	362	359	3	0.67
180	305	307	365	362	3	0.67
181	307	321	379	365	3	0.67
182	168	206	239	238	2	0.67
183	206	207	240	239	2	0.67
184	207	208	241	240	2	0.67
185	208	209	242	241	2	0.67
186	209	210	243	242	2	0.67
187	210	172	244	243	2	0.67
188	172	211	245	244	2	0.67
189	211	212	246	245	2	0.67
190	212	213	247	246	2	0.67
191	213	214	248	247	2	0.67
192	214	215	249	248	2	0.67
193	215	177	250	249	2	0.67

194	238	239	281	280	2	0.67
195	239	240	282	281	2	0.67
196	240	241	283	282	2	0.67
197	241	242	284	283	2	0.67
198	242	243	285	284	2	0.67
199	243	244	286	285	2	0.67
200	244	245	287	286	2	0.67
201	245	246	288	287	2	0.67
202	246	247	289	288	2	0.67
203	247	248	290	289	2	0.67
204	248	249	291	290	2	0.67
205	249	250	292	291	2	0.67
206	280	281	323	322	2	0.67
207	281	282	324	323	2	0.67
208	282	283	325	324	2	0.67
209	283	284	326	325	2	0.67
210	284	285	327	326	2	0.67
211	285	286	328	327	2	0.67
212	286	287	329	328	2	0.67
213	287	288	330	329	2	0.67
214	288	289	331	330	2	0.67
215	289	290	332	331	2	0.67
216	290	291	333	332	2	0.67
217	291	292	334	333	2	0.67
218	205	237	278	279	3	0.67
219	237	236	277	278	3	0.67
220	236	235	276	277	3	0.67
221	235	234	275	276	3	0.67
222	234	233	274	275	3	0.67
223	233	201	273	274	3	0.67
224	201	232	272	273	3	0.67
225	232	231	271	272	3	0.67
226	231	230	270	271	3	0.67
227	230	229	269	270	3	0.67
228	229	228	268	269	3	0.67
229	228	197	267	268	3	0.67
230	279	278	320	321	3	0.67
231	278	277	319	320	3	0.67
232	277	276	318	319	3	0.67
233	276	275	317	318	3	0.67
234	275	274	316	317	3	0.67
235	274	273	315	316	3	0.67
236	273	272	314	315	3	0.67
237	272	271	313	314	3	0.67
238	271	270	312	313	3	0.67
239	270	269	311	312	3	0.67
240	269	268	310	311	3	0.67
241	268	267	309	310	3	0.67
242	321	320	378	379	3	0.67
243	320	319	377	378	3	0.67
244	319	318	376	377	3	0.67
245	318	317	375	376	3	0.67
246	317	316	374	375	3	0.67
247	316	315	373	374	3	0.67
248	315	314	372	373	3	0.67
249	314	313	371	372	3	0.67
250	313	312	370	371	3	0.67
251	312	311	369	370	3	0.67
252	311	310	368	369	3	0.67
253	310	309	367	368	3	0.67
254	197	227	266	267	3	0.67
255	267	266	308	309	3	0.67
256	309	308	366	367	3	0.67
257	168	216	251	238	1	0.67
258	216	218	253	251	1	0.67

Client

WO/Job No.

Subject PLUTONIUM VAULT, BLDG. NO. 2736-Z

Date 1/30/95 By Carleton J. Moore

SASSI HORIZONTAL SEISMIC HOUSE FILE

Checked 2/21/95 By Gary R. Wagenblast

Location PFP

Revised By

259	218	220	255	253	1	0.67
260	220	184	257	255	1	0.67
261	184	222	260	257	1	0.67
262	222	223	262	260	1	0.67
263	223	225	264	262	1	0.67
264	225	197	267	264	1	0.67
265	238	251	293	280	1	0.67
266	251	253	295	293	1	0.67
267	253	255	297	295	1	0.67
268	255	257	299	297	1	0.67
269	257	260	302	299	1	0.67
270	260	262	304	302	1	0.67
271	262	264	306	304	1	0.67
272	264	267	309	306	1	0.67
273	280	293	335	322	1	0.67
274	293	295	338	335	1	0.67
275	295	297	341	338	1	0.67
276	297	299	344	341	1	0.67
277	299	302	357	344	1	0.67
278	302	304	360	357	1	0.67
279	304	306	363	360	1	0.67
280	306	309	367	363	1	0.67
281	334	333	389	380	2	1.17
282	333	332	398	389	2	1.17
283	332	331	407	398	2	1.17
284	331	330	416	407	2	1.17
285	330	329	425	416	2	1.17
286	329	328	434	425	2	1.17
287	328	327	443	434	2	1.17
288	327	326	452	443	2	1.17
289	326	325	461	452	2	1.17
290	325	324	470	461	2	1.17
291	324	323	479	470	2	1.17
292	323	322	488	479	2	1.17
293	367	366	505	496	3	1.17
294	379	378	397	388	3	1.17
295	378	377	406	397	3	1.17
296	377	376	415	406	3	1.17
297	376	375	424	415	3	1.17
298	375	374	433	424	3	1.17
299	374	373	442	433	3	1.17
300	373	372	451	442	3	1.17
301	372	371	460	451	3	1.17
302	371	370	469	460	3	1.17
303	370	369	478	469	3	1.17
304	369	368	487	478	3	1.17
305	368	367	496	487	3	1.17
306	356	355	393	384	1	1.17
307	355	354	402	393	1	1.17
308	354	353	411	402	1	1.17
309	353	352	420	411	1	1.17
310	352	351	429	420	1	1.17
311	351	350	438	429	1	1.17
312	350	349	447	438	1	1.17
313	349	348	456	447	1	1.17
314	348	347	465	456	1	1.17
315	347	346	474	465	1	1.17
316	346	345	483	474	1	1.17
317	345	344	492	483	1	1.17
318	322	335	489	488	1	1.17
319	335	338	490	489	1	1.17
320	338	341	491	490	1	1.17
321	341	344	492	491	1	1.17
322	344	357	493	492	1	1.17
323	357	360	494	493	1	1.17

324	360	363	495	494	1	1.17
325	363	367	496	495	1	1.17
326	328	336	435	434	1	1.17
327	336	339	436	435	1	1.17
328	339	342	437	436	1	1.17
329	342	350	438	437	1	1.17
330	350	358	439	438	1	1.17
331	358	361	440	439	1	1.17
332	361	364	441	440	1	1.17
333	364	373	442	441	1	1.17
334	380	381	390	389	1	0.54
335	381	382	391	390	1	0.54
336	382	383	392	391	1	0.54
337	383	384	393	392	1	0.54
338	384	385	394	393	1	0.54
339	385	386	395	394	1	0.54
340	386	387	396	395	1	0.54
341	387	388	397	396	1	0.54
342	389	390	399	398	1	0.54
343	390	391	400	399	1	0.54
344	391	392	401	400	1	0.54
345	392	393	402	401	1	0.54
346	393	394	403	402	1	0.54
347	394	395	404	403	1	0.54
348	395	396	405	404	1	0.54
349	396	397	406	405	1	0.54
350	398	399	408	407	1	0.54
351	399	400	409	408	1	0.54
352	400	401	410	409	1	0.54
353	401	402	411	410	1	0.54
354	402	403	412	411	1	0.54
355	403	404	413	412	1	0.54
356	404	405	414	413	1	0.54
357	405	406	415	414	1	0.54
358	407	408	417	416	1	0.54
359	408	409	418	417	1	0.54
360	409	410	419	418	1	0.54
361	410	411	420	419	1	0.54
362	411	412	421	420	1	0.54
363	412	413	422	421	1	0.54
364	413	414	423	422	1	0.54
365	414	415	424	423	1	0.54
366	416	417	426	425	1	0.54
367	417	418	427	426	1	0.54
368	418	419	428	427	1	0.54
369	419	420	429	428	1	0.54
370	420	421	430	429	1	0.54
371	421	422	431	430	1	0.54
372	422	423	432	431	1	0.54
373	423	424	433	432	1	0.54
374	425	426	435	434	1	0.54
375	426	427	436	435	1	0.54
376	427	428	437	436	1	0.54
377	428	429	438	437	1	0.54
378	429	430	439	438	1	0.54
379	430	431	440	439	1	0.54
380	431	432	441	440	1	0.54
381	432	433	442	441	1	0.54
382	434	435	444	443	1	0.54
383	435	436	445	444	1	0.54
384	436	437	446	445	1	0.54
385	437	438	447	446	1	0.54
386	438	439	448	447	1	0.54
387	439	440	449	448	1	0.54
388	440	441	450	449	1	0.54

```
389 441 442 451 450        1          0.54
390 443 444 453 452        1          0.54
391 444 445 454 453        1          0.54
392 445 446 455 454        1          0.54
393 446 447 456 455        1          0.54
394 447 448 457 456        1          0.54
395 448 449 458 457        1          0.54
396 449 450 459 458        1          0.54
397 450 451 460 459        1          0.54
398 452 453 462 461        1          0.54
399 453 454 463 462        1          0.54
400 454 455 464 463        1          0.54
401 455 456 465 464        1          0.54
402 456 457 466 465        1          0.54
403 457 458 467 466        1          0.54
404 458 459 468 467        1          0.54
405 459 460 469 468        1          0.54
406 461 462 471 470        1          0.54
407 462 463 472 471        1          0.54
408 463 464 473 472        1          0.54
409 464 465 474 473        1          0.54
410 465 466 475 474        1          0.54
411 466 467 476 475        1          0.54
412 467 468 477 476        1          0.54
413 468 469 478 477        1          0.54
414 470 471 480 479        1          0.54
415 471 472 481 480        1          0.54
416 472 473 482 481        1          0.54
417 473 474 483 482        1          0.54
418 474 475 484 483        1          0.54
419 475 476 485 484        1          0.54
420 476 477 486 485        1          0.54
421 477 478 487 486        1          0.54
422 479 480 489 488        1          0.54
423 480 481 490 489        1          0.54
424 481 482 491 490        1          0.54
425 482 483 492 491        1          0.54
426 483 484 493 492        1          0.54
427 484 485 494 493        1          0.54
428 485 486 495 494        1          0.54
429 486 487 496 495        1          0.54
430 488 489 498 497        1          0.54
431 489 490 499 498        1          0.54
432 490 491 500 499        1          0.54
433 491 492 501 500        1          0.54
434 492 493 502 501        1          0.54
435 493 494 503 502        1          0.54
436 494 495 504 503        1          0.54
437 495 496 505 504        1          0.54
438 334 337 381 380        3          1.17
439 337 340 382 381        3          1.17
440 340 343 383 382        3          1.17
441 343 356 384 383        3          1.17
442 356 359 385 384        3          1.17
443 359 362 386 385        3          1.17
444 362 365 387 386        3          1.17
445 365 379 388 387        3          1.17
  2  38   3   3  -1
  1  478.2e6      0.15      150      0.05      0.05
  2  239.1e6      0.15       75      0.05      0.05
  3  478.2e6      0.15      0.0      0.05      0.05
  1     1.36      1.13     1.13     0.308     0.154     0.154
  2     1.07      0.89     0.89     0.196    0.0749     0.121
  3    0.667      0.56     0.56    0.0803    0.0247    0.0556
  1   3 177   9   2   1
```

Client

WO/Job No.

Subject PLUTONIUM VAULT, BLDG. NO. 2736-Z

Date 1/30/95 By Carleton J. Moore

SASSI HORIZONTAL SEISMIC HOUSE FILE

Checked 2/21/95 By Gary R. Wagenblast

Location PFP

Revised By

```
 2  177  250    9    2    1
 3  250  292    9    2    1
 4  292  334    9    2    1
 5   21  186   25    1    2
 6  186  259   25    1    2
 7  259  301   25    1    2
 8  301  356   25    1    2
 9   65  205   82    1    1
10  205  279   82    1    1
11  279  321   82    1    1
12  321  379   82    1    1
13   90  172   91    2    2
14  172  244   91    2    2
15  244  286   91    2    2
16  286  328   91    2    2
17  124  185  125    1    3
18  185  258  125    1    3
19  258  300  125    1    3
20  300  350  125    1    3
21   61  201   62    1    2
22  201  273   62    1    2
23  273  315   62    1    2
24  315  373   62    1    2
25   86  168  101    2    1
26  168  238  101    2    1
27  238  280  101    2    1
28  280  322  101    2    1
29  121  184  129    1    2
30  184  257  129    1    2
31  257  299  129    1    2
32  299  344  129    1    2
33   57  197   76    1    1
34  197  267   76    1    1
35  267  309   76    1    1
36  309  367   76    1    1
37  160  506  166    3    1
38  148  507  154    3    1
 7    2    1
 1        12.0
 1  506  318    1
 2  289  507    1
 0
```

Client	WO/Job No.	
Subject PLUTONIUM VAULT, BLDG. NO. 2736-Z	Date 12/27/94	By Carleton J. Moore
SASSI HORIZONTAL SEISMIC ANALYSIS FILE	Checked 2/27/95	By Gary R. Wagenblast
Location PFP	Revised	By

```
1     PVAULT
1     1     1
     0.          0.          0.
0
```

Client

WO/Job No.

Subject PLUTONIUM VAULT, BLDG. NO. 2736-Z

Date 12/27/94

By Carleton J. Moore

SASSI SEISMIC MOTION TRANSFER FUNCTION FILE

Checked 2/21/95 GRW

By Gary R. Wagenblast

Location PFP

Revised

By

```
  1   TRANSFER FUNCTIONS
  0    9
292    1
296    1
301    1
305    1
321    1
318    1
315    1
312    1
309    1
  0
```

Client

WO/Job No.

Subject PLUTONIUM VAULT, BLDG. NO. 2736-Z Date 1/30/95 By Carleton J. Moore

SASSI HORIZONTAL SPECTRUM MOTION WALL FILE Checked 2/2/95 By Gary R. Wagenblast

Location PFP Revised By

```
  1   Response Spectra
  1   30    1
280    000100
283    000100
286    000100
289    000100
292    000100
296    000100
301    000100
305    000100
321    000100
318    000100
315    000100
312    000100
309    000100
304    000100
299    000100
295    000100
154    000100
155    000100
156    000100
157    000100
158    000100
159    000100
160    000100
161    000100
162    000100
163    000100
164    000100
165    000100
166    000100
167    000100

    0.05
4096 2048      0.01       1.0
 Ref: SHAKE OUTPUT PVAULT.TH1 n=2048 (8f9.6) dt=.01 tl=1
-0.000296-0.000663-0.000984-0.001095-0.000945-0.000561 0.000063 0.000964     1
 0.002023 0.002836 0.002917 0.002158 0.001076 0.000460 0.000689 0.001394     2
 0.001862 0.001745 0.001315 0.001024 0.000937 0.000719 0.000134-0.000672     3
-0.001515-0.002668-0.004698-0.007620-0.010364-0.011465-0.010529-0.008939     4
-0.008800-0.010968-0.014152-0.016116-0.015818-0.014256-0.013124-0.012793     5
-0.011901-0.009117-0.005098-0.002309-0.002663-0.005454-0.007986-0.008374     6
-0.007526-0.007991-0.010773-0.013555-0.012486-0.005862 0.004014 0.012693     7
 0.017188 0.017775 0.016623 0.015224 0.013420 0.010508 0.006569 0.002408     8
-0.001353-0.004423-0.005957-0.004185 0.002257 0.012342 0.022346 0.028062     9
 0.027687 0.022773 0.016632 0.011993 0.009970 0.010523 0.013171 0.017046    10
 0.020647 0.022034 0.019558 0.012675 0.002459-0.008375-0.016350-0.019197    11
-0.017790-0.015948-0.017293-0.021629-0.024788-0.022975-0.017469-0.014244    12
-0.018093-0.027286-0.034950-0.036228-0.033422-0.033075-0.037946-0.042952    13
-0.040061-0.026994-0.010063 0.002087 0.006859 0.008968 0.013575 0.019495    14
 0.020335 0.012186-0.001021-0.010625-0.011493-0.006631-0.003601-0.006956    15
-0.014494-0.020358-0.020863-0.017021-0.012235-0.008647-0.006115-0.003929    16
-0.002368-0.002031-0.002149-0.000571 0.003863 0.008987 0.010009 0.003264    17
-0.010386-0.026020-0.038663-0.046711-0.051121-0.051527-0.044368-0.026351    18
-0.000300 0.023500 0.033693 0.027060 0.011539-0.000476-0.002464 0.002189    19
 0.005820 0.005190 0.003954 0.006946 0.013337 0.016625 0.011490 0.000038    20
-0.009244-0.008651 0.002521 0.018164 0.030800 0.036948 0.038409 0.039734    21
 0.044523 0.052970 0.061706 0.066106 0.063929 0.057704 0.053202 0.054342    22
 0.058782 0.058984 0.048880 0.030501 0.013990 0.010133 0.021644 0.041003    23
 0.056847 0.063177 0.063157 0.064371 0.070267 0.075977 0.072651 0.056469    24
 0.033912 0.017921 0.017903 0.032299 0.050396 0.061476 0.062746 0.058981    25
 0.055180 0.050306 0.038623 0.017070-0.009004-0.027690-0.028393-0.008970    26
 0.023158 0.055519 0.076528 0.079522 0.064269 0.036608 0.006276-0.016978    27
-0.027401-0.024875-0.013171 0.003214 0.020655 0.035619 0.043640 0.040536    28
 0.025610 0.003749-0.016225-0.026383-0.024092-0.012716 0.001545 0.013672    29
```

0.021470	0.024186	0.020450	0.008260	-0.012673	-0.038847	-0.063817	-0.081816	30
-0.090925	-0.093010	-0.090967	-0.086592	-0.081065	-0.076488	-0.075417	-0.078068	31
-0.080567	-0.077190	-0.065082	-0.046526	-0.026266	-0.007083	0.010816	0.025539	32
0.029682	0.013065	-0.028356	-0.084912	-0.134765	-0.155235	-0.136518	-0.088259	33
-0.034154	0.002480	0.013057	0.008185	0.008138	0.025692	0.055050	0.077319	34
0.078723	0.064732	0.055348	0.064856	0.086053	0.096156	0.079920	0.046850	35
0.024107	0.031127	0.060898	0.086359	0.085452	0.060656	0.035555	0.033472	36
0.058423	0.093662	0.116145	0.113290	0.089716	0.061219	0.041960	0.034249	37
0.028173	0.011484	-0.018067	-0.049206	-0.066592	-0.064927	-0.053512	-0.046271	38
-0.047645	-0.049638	-0.042914	-0.028966	-0.019363	-0.023417	-0.039030	-0.056945	39
-0.071892	-0.086150	-0.101550	-0.111707	-0.106634	-0.085963	-0.064302	-0.059728	40
-0.076058	-0.098135	-0.106073	-0.094012	-0.074396	-0.064559	-0.070238	-0.081885	41
-0.085148	-0.073762	-0.053550	-0.036267	-0.030065	-0.033641	-0.037405	-0.031039	42
-0.013063	0.005079	0.005975	-0.019071	-0.060048	-0.093545	-0.100290	-0.079377	43
-0.046539	-0.019768	-0.007233	-0.007267	-0.015655	-0.029140	-0.042507	-0.047125	44
-0.036973	-0.016452	0.000982	0.004740	-0.002498	-0.007787	-0.001634	0.012539	45
0.023165	0.023494	0.018155	0.017195	0.025512	0.039299	0.051534	0.058842	46
0.062625	0.065449	0.067982	0.068932	0.066160	0.057538	0.042585	0.024922	47
0.012231	0.011042	0.019981	0.029271	0.029042	0.018693	0.006865	0.001386	48
0.000478	-0.004231	-0.015945	-0.026249	-0.022791	-0.003649	0.017815	0.024360	49
0.011529	-0.007915	-0.017069	-0.012589	-0.008892	-0.023885	-0.059545	-0.096270	50
-0.107371	-0.081358	-0.032058	0.012614	0.032975	0.030785	0.022206	0.019163	51
0.018556	0.009647	-0.009896	-0.028068	-0.029835	-0.013054	0.009140	0.022287	52
0.025001	0.027623	0.037425	0.048241	0.046716	0.027473	-0.000753	-0.024814	53
-0.040679	-0.055127	-0.074607	-0.095221	-0.105183	-0.095911	-0.068996	-0.033133	54
0.002772	0.032312	0.050296	0.053348	0.043366	0.027977	0.014373	0.002519	55
-0.013159	-0.034031	-0.050964	-0.050683	-0.029256	0.002473	0.028728	0.044031	56
0.057422	0.081294	0.116910	0.151618	0.169583	0.164455	0.142193	0.113671	57
0.085947	0.060075	0.035590	0.015977	0.009623	0.024736	0.061425	0.107155	58
0.140961	0.145646	0.119410	0.076676	0.036538	0.008909	-0.008935	-0.023543	59
-0.035139	-0.037918	-0.029882	-0.019885	-0.022232	-0.043397	-0.074614	-0.098261	60
-0.101603	-0.084588	-0.055489	-0.020867	0.018988	0.065147	0.112052	0.146150	61
0.154134	0.134119	0.099295	0.069490	0.056740	0.056956	0.054990	0.038282	62
0.006504	-0.030923	-0.064789	-0.092111	-0.113006	-0.125165	-0.124969	-0.114191	63
-0.101874	-0.096013	-0.093987	-0.085309	-0.066501	-0.051005	-0.059323	-0.096668	64
-0.142205	-0.163826	-0.144919	-0.096099	-0.041559	0.002795	0.035731	0.058902	65
0.065904	0.047912	0.008682	-0.031230	-0.048632	-0.036053	-0.005853	0.021653	66
0.031874	0.020231	-0.010069	-0.048903	-0.079576	-0.086007	-0.065812	-0.035955	67
-0.020541	-0.029662	-0.051074	-0.064604	-0.063981	-0.061729	-0.071793	-0.090179	68
-0.096279	-0.073948	-0.029319	0.013485	0.033296	0.027817	0.010903	-0.001906	69
-0.003677	0.004598	0.019240	0.035570	0.046429	0.043462	0.022793	-0.010438	70
-0.044348	-0.067884	-0.076728	-0.072976	-0.060708	-0.042701	-0.020526	0.004137	71
0.029491	0.054485	0.078095	0.096941	0.104533	0.095248	0.070869	0.042717	72
0.024549	0.020522	0.019825	0.005604	-0.027956	-0.066685	-0.085894	-0.070644	73
-0.027694	0.021546	0.058114	0.074767	0.071274	0.047189	0.004663	-0.042759	74
-0.071526	-0.065449	-0.032770	-0.001738	0.004742	-0.009909	-0.021736	-0.012187	75
0.014202	0.037786	0.045081	0.038285	0.025918	0.011169	-0.006258	-0.020854	76
-0.022272	-0.009203	0.002402	-0.008016	-0.043144	-0.081984	-0.099598	-0.090903	77
-0.071867	-0.058818	-0.052322	-0.043871	-0.033029	-0.029685	-0.037610	-0.042583	78
-0.024434	0.019028	0.065935	0.091760	0.093692	0.089181	0.091426	0.093168	79
0.079263	0.051826	0.034993	0.050955	0.094388	0.135498	0.148816	0.135983	80
0.119148	0.115409	0.121408	0.121800	0.107721	0.083947	0.060538	0.042171	81
0.026860	0.011757	-0.003120	-0.016388	-0.027426	-0.035747	-0.039877	-0.038863	82
-0.034611	-0.031216	-0.031582	-0.035743	-0.042697	-0.052209	-0.063157	-0.071022	83
-0.069789	-0.057919	-0.041194	-0.027607	-0.019325	-0.011213	0.002121	0.019475	84
0.034658	0.043699	0.047447	0.046071	0.034019	0.005001	-0.036319	-0.070151	85
-0.073356	-0.038366	0.018622	0.068360	0.088497	0.076052	0.044769	0.013264	86
-0.005566	-0.008744	-0.002064	0.004021	0.000274	-0.015585	-0.036623	-0.050075	87
-0.044428	-0.015723	0.030090	0.079005	0.113939	0.121819	0.100445	0.060874	88
0.022047	-0.000219	-0.002270	0.007213	0.015745	0.016793	0.012667	0.008802	89
0.005509	-0.004311	-0.028071	-0.062818	-0.092108	-0.096779	-0.072525	-0.037526	90
-0.019452	-0.031071	-0.057882	-0.071927	-0.059321	-0.032992	-0.016808	-0.018714	91
-0.023401	-0.012673	0.010935	0.026184	0.019029	0.001122	-0.002607	0.016357	92
0.038643	0.038627	0.014748	-0.006874	-0.000199	0.032843	0.064680	0.070020	93
0.047732	0.015803	-0.009566	-0.025518	-0.036062	-0.041419	-0.037762	-0.024677	94

Client WO/Job No.

Subject PLUTONIUM VAULT, BLDG. NO. 2736-Z Date 1/30/95 By Carleton J. Moore

SASSI HORIZONTAL SPECTRUM MOTION WALL FILE Checked 2/1/95 By Gary R. Wagenblast

Location PFP Revised By

-0.007824 0.006574 0.016354 0.020585 0.015315-0.003026-0.029302-0.048796	95
-0.048470-0.029041-0.003900 0.013896 0.021649 0.024565 0.027495 0.032652	96
0.043224 0.062815 0.087776 0.103867 0.097190 0.070500 0.044364 0.037611	97
0.047381 0.052748 0.039194 0.015458 0.002281 0.006420 0.011895 0.000081	98
-0.025036-0.037279-0.015335 0.033762 0.080558 0.101144 0.096933 0.088269	99
0.092931 0.112773 0.137301 0.154346 0.156185 0.140674 0.112355 0.082746	100
0.064761 0.062692 0.067917 0.066836 0.053854 0.035510 0.021921 0.016351	101
0.014909 0.014957 0.020413 0.037321 0.066015 0.099760 0.130457 0.153184	102
0.164574 0.159610 0.133731 0.089113 0.037249-0.006618-0.032361-0.039620	103
-0.036029-0.032661-0.039314-0.059822-0.088877-0.114949-0.129909-0.137081	104
-0.147410-0.165570-0.181415-0.179101-0.155971-0.129354-0.120694-0.132591	105
-0.144654-0.134330-0.100686-0.065305-0.049959-0.055817-0.065416-0.062100	106
-0.044238-0.021425-0.002061 0.011645 0.018811 0.016377 0.003846-0.010991	107
-0.015930-0.005734 0.012308 0.026011 0.030269 0.029276 0.027488 0.022209	108
0.008171-0.011677-0.024006-0.016480 0.009164 0.037009 0.050155 0.043364	109
0.023337-0.000670-0.024076-0.045676-0.062556-0.069220-0.062013-0.043263	110
-0.020627-0.002809 0.004504 0.000730-0.009370-0.017776-0.018195-0.011339	111
-0.005304-0.009110-0.024782-0.045814-0.063297-0.072497-0.072899-0.063817	112
-0.043695-0.015766 0.007768 0.011763-0.008771-0.042267-0.069502-0.079688	113
-0.076846-0.070324-0.061542-0.043020-0.010401 0.028053 0.057070 0.069283	114
0.072100 0.078731 0.094059 0.111199 0.120758 0.120345 0.113960 0.105257	115
0.095207 0.085753 0.080711 0.079296 0.071292 0.044947 0.002772-0.034402	116
-0.045392-0.032559-0.023501-0.044218-0.090665-0.130927-0.137573-0.115320	117
-0.093455-0.092301-0.102335-0.099189-0.075727-0.053160-0.058508-0.094747	118
-0.137083-0.157591-0.149393-0.125847-0.101035-0.076767-0.048514-0.017907	119
0.005831 0.016055 0.015856 0.013545 0.013791 0.015824 0.018321 0.021297	120
0.021745 0.011783-0.013084-0.042812-0.054296-0.029313 0.026840 0.085438	121
0.114412 0.100157 0.052780-0.005753-0.056565-0.090191-0.104387-0.100231	122
-0.080490-0.049785-0.015384 0.012201 0.021239 0.005595-0.027491-0.058129	123
-0.067340-0.053466-0.034314-0.030147-0.043478-0.056751-0.050409-0.021677	124
0.015319 0.045636 0.065972 0.081251 0.093672 0.099945 0.098460 0.093566	125
0.088925 0.079099 0.053444 0.010802-0.032470-0.052976-0.039565-0.001316	126
0.042281 0.075577 0.090722 0.083430 0.053196 0.010689-0.020531-0.018001	127
0.020053 0.070879 0.105767 0.112990 0.102441 0.090534 0.084797 0.083643	128
0.085321 0.090047 0.092590 0.079373 0.040322-0.015140-0.058480-0.063632	129
-0.030112 0.015644 0.042398 0.038349 0.016247-0.001719-0.002949 0.008252	130
0.017812 0.015410 0.004015-0.001641 0.012061 0.042203 0.065955 0.056747	131
0.008914-0.052790-0.091424-0.089152-0.061431-0.039983-0.042332-0.058899	132
-0.068300-0.061112-0.045984-0.034835-0.027566-0.014135 0.010767 0.039442	133
0.058356 0.060722 0.049857 0.032015 0.009795-0.016075-0.041177-0.057175	134
-0.057911-0.044261-0.022262 0.002076 0.024530 0.040087 0.041583 0.023610	135
-0.011378-0.051217-0.079161-0.082619-0.059803-0.020468 0.019792 0.048883	136
0.065107 0.075765 0.087676 0.098418 0.098110 0.081231 0.055825 0.038235	137
0.036870 0.042052 0.034340 0.004262-0.036527-0.064470-0.064713-0.043255	138
-0.020227-0.012357-0.020820-0.033207-0.035359-0.022719-0.003590 0.006995	139
-0.001517-0.026616-0.053711-0.066897-0.060938-0.044057-0.029725-0.026385	140
-0.034684-0.051699-0.073944-0.095362-0.106339-0.099956-0.080374-0.061187	141
-0.051641-0.045386-0.027297 0.006646 0.039671 0.049359 0.033021 0.013809	142
0.017768 0.045994 0.073545 0.077251 0.061144 0.050744 0.063195 0.087787	143
0.098546 0.083345 0.056042 0.039140 0.038341 0.037747 0.019220-0.017247	144
-0.053743-0.072290-0.069675-0.055727-0.040967-0.028330-0.015112 0.000756	145
0.017754 0.032115 0.039956 0.038663 0.028666 0.015285 0.007659 0.013477	146
0.033163 0.058867 0.079324 0.086254 0.077545 0.056463 0.029224 0.002614	147
-0.018207-0.031237-0.037114-0.036688-0.029442-0.015132 0.003140 0.018845	148
0.026169 0.023961 0.014607-0.000640-0.022995-0.050808-0.073519-0.074317	149
-0.042481 0.015380 0.077195 0.120391 0.136730 0.133992 0.124550 0.113255	150
0.096023 0.068410 0.033609 0.001121-0.021956-0.037559-0.054095-0.077239	151
-0.103182-0.121239-0.123453-0.111997-0.097018-0.086992-0.081258-0.072269	152
-0.054955-0.032842-0.014142-0.002332 0.007544 0.022025 0.039508 0.049728	153
0.044520 0.028488 0.016983 0.022237 0.041861 0.061795 0.070154 0.066750	154
0.058605 0.048109 0.028815-0.005436-0.048576-0.082633-0.092337-0.079767	155
-0.063167-0.059775-0.069210-0.074129-0.057933-0.022373 0.012027 0.022972	156
0.004427-0.030704-0.063736-0.084640-0.094091-0.094443-0.082944-0.056392	157
-0.021248 0.005241 0.008084-0.010126-0.028856-0.027185-0.002903 0.026229	158
0.040572 0.037630 0.032766 0.041912 0.064886 0.086215 0.091104 0.079209	159

0.063093	0.055377	0.058953	0.068601	0.078862	0.088120	0.096015	0.100267	160
0.098503	0.092629	0.088781	0.090917	0.094796	0.090268	0.071371	0.044473	161
0.025287	0.026009	0.043994	0.062693	0.064633	0.045025	0.014089	-0.013433	162
-0.031307	-0.045305	-0.064549	-0.090000	-0.111739	-0.117633	-0.104403	-0.080135	163
-0.056471	-0.039338	-0.027649	-0.019862	-0.019419	-0.031959	-0.057207	-0.085107	164
-0.101318	-0.097133	-0.074453	-0.042244	-0.009475	0.018688	0.040197	0.054705	165
0.063639	0.069786	0.074342	0.074120	0.063656	0.041866	0.016095	-0.002620	166
-0.009663	-0.011609	-0.019563	-0.037571	-0.058492	-0.071656	-0.073350	-0.068688	167
-0.064192	-0.061566	-0.060458	-0.065330	-0.084873	-0.121411	-0.161638	-0.181618	168
-0.164416	-0.114336	-0.054070	-0.007846	0.013432	0.013516	0.001705	-0.015321	169
-0.034665	-0.054642	-0.073577	-0.089815	-0.100211	-0.098407	-0.077701	-0.038780	170
0.005461	0.035933	0.041219	0.026400	0.007528	-0.002961	-0.005268	-0.007620	171
-0.014637	-0.021540	-0.019051	-0.002258	0.025370	0.054436	0.074192	0.076310	172
0.058535	0.027769	-0.001574	-0.016214	-0.013907	-0.004668	-0.000775	-0.005341	173
-0.011629	-0.013400	-0.013757	-0.021753	-0.040742	-0.062589	-0.074900	-0.072973	174
-0.062763	-0.052191	-0.041959	-0.026933	-0.005948	0.012481	0.016291	0.002114	175
-0.018970	-0.028128	-0.012211	0.026735	0.072018	0.101689	0.100943	0.070814	176
0.027797	-0.006389	-0.018633	-0.011574	0.001672	0.009962	0.011984	0.013065	177
0.016285	0.018606	0.015766	0.009137	0.005823	0.011722	0.025432	0.039537	178
0.047346	0.048045	0.046080	0.046854	0.052971	0.062985	0.072311	0.075907	179
0.071994	0.064199	0.058963	0.059191	0.060367	0.054549	0.039536	0.023487	180
0.018678	0.029447	0.046500	0.053894	0.042153	0.015018	-0.015524	-0.039556	181
-0.054642	-0.063157	-0.066980	-0.066173	-0.062004	-0.059349	-0.064461	-0.079489	182
-0.098694	-0.110094	-0.102009	-0.070439	-0.022532	0.026316	0.060244	0.071128	183
0.062312	0.045900	0.035281	0.037145	0.047523	0.054807	0.048910	0.030682	184
0.013133	0.010901	0.025454	0.040653	0.036198	0.008499	-0.022218	-0.028815	185
-0.003604	0.032792	0.050977	0.041749	0.024221	0.024252	0.046212	0.068339	186
0.066165	0.038167	0.006539	-0.005985	0.002964	0.018064	0.026466	0.031420	187
0.045336	0.072275	0.100211	0.110855	0.095886	0.063755	0.032602	0.017580	188
0.022894	0.041980	0.063107	0.076167	0.077346	0.069266	0.056505	0.040290	189
0.017803	-0.012780	-0.046928	-0.074842	-0.088927	-0.090258	-0.087070	-0.086883	190
-0.090556	-0.094204	-0.095938	-0.099265	-0.108920	-0.123629	-0.134290	-0.131180	191
-0.114410	-0.097155	-0.096236	-0.116304	-0.141892	-0.147026	-0.116626	-0.061011	192
-0.008794	0.016904	0.016740	0.010226	0.013099	0.021106	0.017205	-0.006456	193
-0.036842	-0.051932	-0.042948	-0.022133	-0.007903	-0.004414	0.001882	0.025772	194
0.065375	0.101532	0.113924	0.097465	0.065022	0.037158	0.029150	0.043686	195
0.071137	0.096005	0.106765	0.103658	0.097699	0.100011	0.110395	0.116727	196
0.106661	0.080022	0.049427	0.029431	0.026196	0.036832	0.055219	0.075304	197
0.089913	0.091577	0.078873	0.061209	0.052885	0.059248	0.069835	0.068222	198
0.049624	0.026770	0.016632	0.022345	0.030772	0.028429	0.017173	0.010939	199
0.016778	0.022290	0.005666	-0.040308	-0.095323	-0.124916	-0.109051	-0.059448	200
-0.009728	0.011974	0.003067	-0.016926	-0.026940	-0.021713	-0.011949	-0.011371	201
-0.025251	-0.049420	-0.075882	-0.096553	-0.103340	-0.089883	-0.057219	-0.016858	202
0.015847	0.034124	0.044446	0.056628	0.069783	0.071446	0.052291	0.018943	203
-0.012077	-0.033254	-0.054038	-0.085818	-0.121087	-0.134462	-0.108695	-0.057203	204
-0.015265	-0.007093	-0.024446	-0.039481	-0.035143	-0.017855	-0.001420	0.013367	205
0.036227	0.067153	0.088122	0.081276	0.052449	0.029361	0.033586	0.057845	206
0.074662	0.065857	0.039565	0.018479	0.016405	0.029119	0.043592	0.048807	207
0.037024	0.002997	-0.049341	-0.100415	-0.124486	-0.112739	-0.084944	-0.071584	208
-0.082332	-0.096787	-0.090470	-0.067038	-0.057668	-0.085621	-0.135651	-0.164283	209
-0.141209	-0.077463	-0.011953	0.025932	0.037094	0.039916	0.044886	0.046478	210
0.036459	0.017898	0.002895	-0.000252	0.006474	0.016422	0.025967	0.034365	211
0.038535	0.032459	0.013506	-0.012230	-0.032995	-0.040347	-0.035154	-0.025711	212
-0.020954	-0.024739	-0.034114	-0.041341	-0.038546	-0.023155	-0.000585	0.018949	213
0.027911	0.026954	0.023379	0.024261	0.030844	0.038754	0.042584	0.040332	214
0.034899	0.032500	0.038743	0.053844	0.070450	0.077553	0.068983	0.048861	215
0.027585	0.011537	-0.002512	-0.021826	-0.047194	-0.069903	-0.079828	-0.075278	216
-0.063507	-0.052618	-0.045381	-0.041459	-0.042638	-0.052274	-0.069301	-0.085848	217
-0.093229	-0.089507	-0.078921	-0.063889	-0.040484	-0.004089	0.041407	0.082837	218
0.107310	0.111638	0.101899	0.085720	0.067308	0.049386	0.036182	0.031373	219
0.033502	0.035810	0.031561	0.018424	-0.002531	-0.029748	-0.060437	-0.087871	220
-0.103337	-0.103517	-0.094570	-0.085966	-0.079957	-0.069677	-0.049044	-0.022247	221
-0.000401	0.010610	0.015129	0.018876	0.018418	0.004121	-0.026221	-0.061169	222
-0.086179	-0.098090	-0.104890	-0.111558	-0.111858	-0.098102	-0.075482	-0.059310	223
-0.055996	-0.052937	-0.034179	-0.004800	0.008642	-0.012405	-0.052138	-0.071400	224

Client WO/Job No.

Subject PLUTONIUM VAULT, BLDG. NO. 2736-Z Date 1/30/95 By Carleton J. Moore

SASSI HORIZONTAL SPECTRUM MOTION WALL FILE Checked 2/21/95 By Gary R. Wagenblast

Location PFP Revised By

```
-0.047917-0.001194 0.027384 0.017992-0.008841-0.017403 0.004247 0.034514   225
 0.044420 0.027079-0.000158-0.016306-0.012777 0.009256 0.048027 0.100795   226
 0.156555 0.197001 0.209215 0.195822 0.169911 0.141442 0.112080 0.082835   227
 0.061016 0.054621 0.061162 0.067427 0.063145 0.052271 0.047164 0.052221   228
 0.057349 0.049703 0.029414 0.010076 0.003592 0.007416 0.008321-0.003229   229
-0.024743-0.046555-0.061453-0.068347-0.069333-0.066719-0.062722-0.058603   230
-0.051923-0.036426-0.007824 0.029746 0.065138 0.089451 0.102691 0.109901   231
 0.112017 0.103630 0.080591 0.047102 0.012618-0.017030-0.041692-0.059368   232
-0.061191-0.039535-0.001653 0.029943 0.035943 0.019495 0.003730 0.008212   233
 0.029392 0.046407 0.045027 0.032589 0.028227 0.041296 0.062677 0.076689   234
 0.077603 0.072115 0.067958 0.064531 0.056360 0.043277 0.034042 0.039408   235
 0.062962 0.098747 0.135817 0.163726 0.175295 0.167668 0.142936 0.107262   236
 0.068271 0.033033 0.008414 0.000898 0.012388 0.034738 0.051655 0.050786   237
 0.035632 0.022674 0.023613 0.031022 0.025151-0.003623-0.041931-0.066852   238
-0.072048-0.076331-0.102637-0.149893-0.190203-0.196331-0.169840-0.139145   239
-0.130406-0.144052-0.161349-0.169885-0.176230-0.191756-0.210908-0.210175   240
-0.170807-0.099776-0.025289 0.028211 0.058684 0.081095 0.107045 0.132484   241
 0.144049 0.134018 0.107579 0.077812 0.056104 0.046640 0.046534 0.049005   242
 0.047841 0.041578 0.033863 0.027963 0.020271 0.001663-0.031645-0.068903   243
-0.090129-0.083999-0.060270-0.042082-0.044636-0.062265-0.076728-0.076053   244
-0.062974-0.046293-0.028940-0.007886 0.016245 0.034829 0.038831 0.028144   245
 0.009969-0.011225-0.037857-0.071355-0.103305-0.119317-0.112607-0.090547   246
-0.065643-0.042553-0.018064 0.006729 0.020023 0.010049-0.019107-0.047498   247
-0.057612-0.050027-0.038010-0.028619-0.014598 0.013229 0.050098 0.079524   248
 0.090965 0.089772 0.086317 0.079441 0.057738 0.018782-0.019052-0.030564   249
-0.009656 0.023443 0.043111 0.043132 0.036880 0.035138 0.030937 0.010510   250
-0.024493-0.053140-0.056252-0.037510-0.019235-0.017767-0.027240-0.029224   251
-0.015092 0.005084 0.014992 0.009002-0.005401-0.019042-0.030482-0.043566   252
-0.059053-0.071587-0.074187-0.063462-0.040630-0.010349 0.019622 0.039731   253
 0.043808 0.035082 0.025781 0.028294 0.045562 0.070054 0.091567 0.104985   254
 0.110583 0.108836 0.097246 0.072947 0.037934 0.001532-0.022296-0.022021   255
 0.002999 0.038041 0.058779 0.047421 0.008020-0.034570-0.054996-0.049696   256
    0
```

Client

WO/Job No.

Subject PLUTONIUM VAULT, BLDG. NO. 2736-Z — Date 1/30/95 — By Carleton J. Moore

SASSI VERTICAL SEISMIC SITE FILE — Checked 2/21/95 DRW — By Gary R. Wagenblast

Location PFP — Revised — By

```
  1      BEST ESTIMATE Blume & SW SOIL PROPERTIES g=.216
 30   12    0
32.2
  1     1.50       110     694.1    1236.5     0.018     0.018
  2     0.75       110     681.9    1214.8     0.023     0.023
  3     2.75       110     662.4    1180.2     0.030     0.030
  4     5.00       110     613.2    1092.4     0.047     0.047
  5    10.00       113     728.8    1298.4     0.055     0.055
  6    10.00       113     731.8    1303.7     0.052     0.052
  7    10.00       113    1408.7    2509.7     0.028     0.028
  8    10.00       113    1386.6    2470.2     0.031     0.031
  9    10.00       113    1393.3    2482.3     0.028     0.028
 10    10.00       113    1371.3    2443.1     0.032     0.032
 11    10.00       113    1633.2    2909.5     0.027     0.027
 12    10.00       113    1618.3    2883.1     0.029     0.029
 13    10.00       113    1606.1    2861.4     0.031     0.031
 14    10.00       113    1596.0    2843.4     0.033     0.033
 15    10.00       113    1865.4    3323.2     0.027     0.027
 16    10.00       113    1896.0    3377.8     0.022     0.022
 17    10.00       113    1890.2    3367.5     0.023     0.023
 18    10.00       113    1885.2    3358.6     0.024     0.024
 19    10.00       113    1881.3    3351.6     0.024     0.024
 20    10.00       113    1878.3    3346.2     0.024     0.024
 21    10.00       113    1875.9    3342.0     0.025     0.025
 22    10.00       113    1874.2    3339.0     0.025     0.025
 23    10.00       113    1873.0    3336.8     0.025     0.025
 24    10.00       113    1872.2    3335.5     0.025     0.025
 25    10.00       113    1871.9    3334.9     0.025     0.025
 26    10.00       113    1872.1    3335.2     0.025     0.025
 27    10.00       113    1870.8    3332.9     0.025     0.025
 28    10.00       113    1865.9    3324.2     0.026     0.026
 29    10.00       113    1914.9    3411.5     0.020     0.020
 30    10.00       113    1912.6    3407.4     0.021     0.021
                   140    4000.0    7126.2     0.010     0.010
       .010       4096
 10   41   82  143  205  327  344  410  615  820 1024 1230
  2      PVAULT QUARTER MODEL - SITE MODE 2
  1
  0    0    1
  2    1    2
 10 1230
     1.        1.
  0
```

Client WO/Job No.

Subject PLUTONIUM VAULT, BLDG. NO. 2736-Z Date 2/7/95 By Carleton J. Moore

SASSI VERTICAL SEISMIC POINT FILE Checked 2/7/95 By Gary R. Wagenblast

Location PFP Revised By

```
1     PVAULT QUARTER MODEL - POINT
2    1.0
0
```

Client — WO/Job No.

Subject PLUTONIUM VAULT, BLDG. NO. 2736-Z — Date 2/7/95 — By Carleton J. Moore

SASSI VERTICAL SEISMIC HOUSE FILE — Checked 2/21/95 — By Gary R. Wagenblast

Location PFP — Revised — By

```
  1    QUARTER PVAULT MODEL (PVHOU5V.INP 2/3/95 CJM)

505  167    3    2    0    2    1    3
     32.2
     0.00
  1    1   47   67  195
  2    1   86   87  168
  1    1    0    0    0    1    1     0.00   -28.67   -2.25
  2    1    0    0    0    1    1     0.00   -30.17   -2.25
  3    1    0    0    0    1    1     0.00   -32.17   -2.25
  4    1    0    0    0    1    1     0.00   -34.17   -2.25
  5    0    0    0    0    0    0     1.00   -28.67   -2.25
  6    0    0    0    0    0    0     1.00   -30.17   -2.25
  7    0    0    0    0    0    0     2.00   -30.17   -2.25
  8    0    0    0    0    0    0     2.00   -31.17   -2.25
  9    0    0    0    0    0    0     2.00   -32.17   -2.25
 10    0    0    0    0    0    0     2.00   -33.17   -2.25
 11    0    0    0    0    0    0     2.00   -34.17   -2.25
 12    0    0    0    0    0    0     7.00   -31.17   -2.25
 13    0    0    0    0    0    0     7.00   -32.17   -2.25
 14    0    0    0    0    0    0     7.00   -33.17   -2.25
 15    0    0    0    0    0    0    12.00   -30.17   -2.25
 16    0    0    0    0    0    0    12.00   -31.17   -2.25
 17    0    0    0    0    0    0    12.00   -32.17   -2.25
 18    0    0    0    0    0    0    12.00   -33.17   -2.25
 19    0    0    0    0    0    0    12.00   -34.17   -2.25
 20    0    0    0    0    0    0    14.00   -30.17   -2.25
 21    0    0    0    0    0    0    14.00   -32.17   -2.25
 22    0    0    0    0    0    0    14.00   -34.17   -2.25
 23    0    0    0    0    0    0    16.00   -30.17   -2.25
 24    0    0    0    0    0    0    16.00   -31.17   -2.25
 25    0    0    0    0    0    0    16.00   -32.17   -2.25
 26    0    0    0    0    0    0    16.00   -33.17   -2.25
 27    0    0    0    0    0    0    16.00   -34.17   -2.25
 28    0    0    0    0    0    0    21.00   -31.17   -2.25
 29    0    0    0    0    0    0    21.00   -32.17   -2.25
 30    0    0    0    0    0    0    21.00   -33.17   -2.25
 31    0    0    0    0    0    0    24.50    -2.83   -2.25
 32    0    0    0    0    0    0    24.50    -3.83   -2.25
 33    0    0    0    0    0    0    24.50    -4.83   -2.25
 34    0    0    0    0    0    0    26.00    -1.83   -2.25
 35    0    0    0    0    0    0    26.00    -2.83   -2.25
 36    0    0    0    0    0    0    26.00    -3.83   -2.25
 37    0    0    0    0    0    0    26.00    -4.83   -2.25
 38    0    0    0    0    0    0    26.00    -5.83   -2.25
 39    0    0    0    0    0    0    26.00   -16.00   -2.25
 40    0    0    0    0    0    0    26.00   -18.00   -2.25
 41    0    0    0    0    0    0    26.00   -20.00   -2.25
 42    0    0    0    0    0    0    26.00   -30.17   -2.25
 43    0    0    0    0    0    0    26.00   -31.17   -2.25
 44    0    0    0    0    0    0    26.00   -32.17   -2.25
 45    0    0    0    0    0    0    26.00   -33.17   -2.25
 46    0    0    0    0    0    0    26.00   -34.17   -2.25
 47    0    1    0    1    0    1    27.00     0.00   -2.25
 48    0    0    0    0    0    0    27.00    -1.83   -2.25
 49    0    0    0    0    0    0    27.00    -5.83   -2.25
 50    0    0    0    0    0    0    27.00   -10.92   -2.25
 51    0    0    0    0    0    0    27.00   -16.00   -2.25
 52    0    0    0    0    0    0    27.00   -20.00   -2.25
 53    0    0    0    0    0    0    27.00   -25.08   -2.25
 54    0    0    0    0    0    0    27.00   -30.17   -2.25
 55    0    1    0    1    0    1    28.00     0.00   -2.25
 56    0    0    0    0    0    0    28.00    -1.83   -2.25
 57    0    0    0    0    0    0    28.00    -3.83   -2.25
 58    0    0    0    0    0    0    28.00    -5.83   -2.25
```

Client WO/Job No.

Subject PLUTONIUM VAULT, BLDG. NO. 2736-Z Date 2/7/95 By Carleton J. Moore

SASSI VERTICAL SEISMIC HOUSE FILE Checked 2/22/95 By Gary R. Wagenblast

Location PFP Revised By

59	0	0	0	0	0	0	28.00	-10.92	-2.25
60	0	0	0	0	0	0	28.00	-16.00	-2.25
61	0	0	0	0	0	0	28.00	-18.00	-2.25
62	0	0	0	0	0	0	28.00	-20.00	-2.25
63	0	0	0	0	0	0	28.00	-25.08	-2.25
64	0	0	0	0	0	0	28.00	-30.17	-2.25
65	0	0	0	0	0	0	28.00	-32.17	-2.25
66	0	0	0	0	0	0	28.00	-34.17	-2.25
67	0	1	0	1	0	1	29.00	0.00	-2.25
68	0	0	0	0	0	0	29.00	-1.83	-2.25
69	0	0	0	0	0	0	29.00	-5.83	-2.25
70	0	0	0	0	0	0	29.00	-10.92	-2.25
71	0	0	0	0	0	0	29.00	-16.00	-2.25
72	0	0	0	0	0	0	29.00	-20.00	-2.25
73	0	0	0	0	0	0	29.00	-25.08	-2.25
74	0	0	0	0	0	0	29.00	-30.17	-2.25
75	0	0	0	0	0	0	30.00	-1.83	-2.25
76	0	0	0	0	0	0	30.00	-3.83	-2.25
77	0	0	0	0	0	0	30.00	-5.83	-2.25
78	0	0	0	0	0	0	30.00	-16.00	-2.25
79	0	0	0	0	0	0	30.00	-18.00	-2.25
80	0	0	0	0	0	0	30.00	-20.00	-2.25
81	0	0	0	0	0	0	30.00	-30.17	-2.25
82	0	0	0	0	0	0	30.00	-32.17	-2.25
83	0	0	0	0	0	0	30.00	-34.17	-2.25
84	1	1	0	1	1	1	0.00	0.00	-1.50
85	1	0	0	0	1	1	0.00	-1.83	-1.50
86	1	0	0	0	1	1	0.00	-3.83	-1.50
87	1	0	0	0	1	1	0.00	-5.83	-1.50
88	1	0	0	0	1	1	0.00	-10.92	-1.50
89	1	0	0	0	1	1	0.00	-16.00	-1.50
90	1	0	0	0	1	1	0.00	-18.00	-1.50
91	1	0	0	0	1	1	0.00	-20.00	-1.50
92	1	0	0	0	1	1	0.00	-25.08	-1.50
93	0	0	0	0	0	0	1.00	-5.83	-1.50
94	0	0	0	0	0	0	1.00	-10.92	-1.50
95	0	0	0	0	0	0	1.00	-16.00	-1.50
96	0	0	0	0	0	0	1.00	-20.00	-1.50
97	0	0	0	0	0	0	1.00	-25.08	-1.50
98	0	1	0	1	0	1	2.00	0.00	-1.50
99	0	0	0	0	0	0	2.00	-1.83	-1.50
100	0	0	0	0	0	0	2.00	-2.83	-1.50
101	0	0	0	0	0	0	2.00	-3.83	-1.50
102	0	0	0	0	0	0	2.00	-4.83	-1.50
103	0	0	0	0	0	0	2.00	-5.83	-1.50
104	0	0	0	0	0	0	2.00	-16.00	-1.50
105	0	0	0	0	0	0	2.00	-18.00	-1.50
106	0	0	0	0	0	0	2.00	-20.00	-1.50
107	0	0	0	0	0	0	7.00	-2.83	-1.50
108	0	0	0	0	0	0	7.00	-3.83	-1.50
109	0	0	0	0	0	0	7.00	-4.83	-1.50
110	0	1	0	1	0	1	12.00	0.00	-1.50
111	0	0	0	0	0	0	12.00	-1.83	-1.50
112	0	0	0	0	0	0	12.00	-2.83	-1.50
113	0	0	0	0	0	0	12.00	-3.83	-1.50
114	0	0	0	0	0	0	12.00	-4.83	-1.50
115	0	0	0	0	0	0	12.00	-5.83	-1.50
116	0	0	0	0	0	0	12.00	-16.00	-1.50
117	0	0	0	0	0	0	12.00	-18.00	-1.50
118	0	0	0	0	0	0	12.00	-20.00	-1.50
119	0	1	0	1	0	1	14.00	0.00	-1.50
120	0	0	0	0	0	0	14.00	-1.83	-1.50
121	0	0	0	0	0	0	14.00	-3.83	-1.50
122	0	0	0	0	0	0	14.00	-5.83	-1.50
123	0	0	0	0	0	0	14.00	-16.00	-1.50

124	0	0	0	0	0	0	14.00	-18.00	-1.50
125	0	0	0	0	0	0	14.00	-20.00	-1.50
126	0	1	0	1	0	1	16.00	0.00	-1.50
127	0	0	0	0	0	0	16.00	-1.83	-1.50
128	0	0	0	0	0	0	16.00	-2.83	-1.50
129	0	0	0	0	0	0	16.00	-3.83	-1.50
130	0	0	0	0	0	0	16.00	-4.83	-1.50
131	0	0	0	0	0	0	16.00	-5.83	-1.50
132	0	0	0	0	0	0	16.00	-16.00	-1.50
133	0	0	0	0	0	0	16.00	-18.00	-1.50
134	0	0	0	0	0	0	16.00	-20.00	-1.50
135	0	0	0	0	0	0	21.00	-2.83	-1.50
136	0	0	0	0	0	0	21.00	-3.83	-1.50
137	0	0	0	0	0	0	21.00	-4.83	-1.50
138	1	1	0	1	1	1	0.00	0.00	0.00
139	1	0	0	0	1	1	0.00	-3.83	0.00
140	1	0	0	0	1	1	0.00	-10.92	0.00
141	1	0	0	0	1	1	0.00	-18.00	0.00
142	1	0	0	0	1	1	0.00	-25.08	0.00
143	1	0	0	0	1	1	0.00	-32.17	0.00
144	0	1	0	1	0	1	7.00	0.00	0.00
145	0	0	0	0	0	0	7.00	-3.83	0.00
146	0	0	0	0	0	0	7.00	-10.92	0.00
147	0	0	0	0	0	0	7.00	-18.00	0.00
148	0	0	0	0	0	0	7.00	-25.08	0.00
149	0	0	0	0	0	0	7.00	-32.17	0.00
150	0	1	0	1	0	1	14.00	0.00	0.00
151	0	0	0	0	0	0	14.00	-3.83	0.00
152	0	0	0	0	0	0	14.00	-10.92	0.00
153	0	0	0	0	0	0	14.00	-18.00	0.00
154	0	0	0	0	0	0	14.00	-25.08	0.00
155	0	0	0	0	0	0	14.00	-32.17	0.00
156	0	1	0	1	0	1	21.00	0.00	0.00
157	0	0	0	0	0	0	21.00	-3.83	0.00
158	0	0	0	0	0	0	21.00	-10.92	0.00
159	0	0	0	0	0	0	21.00	-18.00	0.00
160	0	0	0	0	0	0	21.00	-25.08	0.00
161	0	0	0	0	0	0	21.00	-32.17	0.00
162	0	1	0	1	0	1	28.00	0.00	0.00
163	0	0	0	0	0	0	28.00	-3.83	0.00
164	0	0	0	0	0	0	28.00	-10.92	0.00
165	0	0	0	0	0	0	28.00	-18.00	0.00
166	0	0	0	0	0	0	28.00	-25.08	0.00
167	0	0	0	0	0	0	28.00	-32.17	0.00
168	1	0	0	0	1	1	0.00	-3.83	0.50
169	1	0	0	0	1	1	0.00	-5.83	0.50
170	1	0	0	0	1	1	0.00	-10.92	0.50
171	1	0	0	0	1	1	0.00	-16.00	0.50
172	1	0	0	0	1	1	0.00	-18.00	0.50
173	1	0	0	0	1	1	0.00	-20.00	0.50
174	1	0	0	0	1	1	0.00	-25.08	0.50
175	1	0	0	0	1	1	0.00	-28.67	0.50
176	1	0	0	0	1	1	0.00	-30.17	0.50
177	1	0	0	0	1	1	0.00	-32.17	0.50
178	0	0	0	0	0	0	2.00	-3.83	0.50
179	0	0	0	0	0	0	2.00	-32.17	0.50
180	0	0	0	0	0	0	7.00	-3.83	0.50
181	0	0	0	0	0	0	7.00	-32.17	0.50
182	0	0	0	0	0	0	12.00	-3.83	0.50
183	0	0	0	0	0	0	12.00	-32.17	0.50
184	0	0	0	0	0	0	14.00	-3.83	0.50
185	0	0	0	0	0	0	14.00	-18.00	0.50
186	0	0	0	0	0	0	14.00	-32.17	0.50
187	0	0	0	0	0	0	16.00	-3.83	0.50
188	0	0	0	0	0	0	16.00	-32.17	0.50

Client

WO/Job No.

Subject PLUTONIUM VAULT, BLDG. NO. 2736-Z

Date 2/7/95 By Carleton J. Moore

SASSI VERTICAL SEISMIC HOUSE FILE

Checked 4/21/95 By Gary R. Wagenblast

Location PFP

Revised By

189	0	0	0	0	0	0	17.50	-32.17	0.50
190	0	0	0	0	0	0	21.00	-3.83	0.50
191	0	0	0	0	0	0	21.00	-32.17	0.50
192	0	0	0	0	0	0	24.50	-3.83	0.50
193	0	0	0	0	0	0	26.00	-3.83	0.50
194	0	0	0	0	0	0	26.00	-32.17	0.50
195	0	1	0	1	0	1	28.00	0.00	0.50
196	0	0	0	0	0	0	28.00	-1.83	0.50
197	0	0	0	0	0	0	28.00	-3.83	0.50
198	0	0	0	0	0	0	28.00	-5.83	0.50
199	0	0	0	0	0	0	28.00	-10.92	0.50
200	0	0	0	0	0	0	28.00	-16.00	0.50
201	0	0	0	0	0	0	28.00	-18.00	0.50
202	0	0	0	0	0	0	28.00	-20.00	0.50
203	0	0	0	0	0	0	28.00	-25.08	0.50
204	0	0	0	0	0	0	28.00	-30.17	0.50
205	0	0	0	0	0	0	28.00	-32.17	0.50
206	1	0	0	0	1	1	0.00	-6.19	0.52
207	1	0	0	0	1	1	0.00	-8.56	0.52
208	1	0	0	0	1	1	0.00	-10.92	0.52
209	1	0	0	0	1	1	0.00	-13.28	0.52
210	1	0	0	0	1	1	0.00	-15.64	0.52
211	1	0	0	0	1	1	0.00	-20.36	0.52
212	1	0	0	0	1	1	0.00	-22.72	0.52
213	1	0	0	0	1	1	0.00	-25.08	0.52
214	1	0	0	0	1	1	0.00	-27.44	0.52
215	1	0	0	0	1	1	0.00	-29.81	0.52
216	0	0	0	0	0	0	3.50	-3.83	0.52
217	0	0	0	0	0	0	3.50	-32.17	0.52
218	0	0	0	0	0	0	7.00	-3.83	0.52
219	0	0	0	0	0	0	7.00	-32.17	0.52
220	0	0	0	0	0	0	10.50	-3.83	0.52
221	0	0	0	0	0	0	10.50	-32.17	0.52
222	0	0	0	0	0	0	17.50	-3.83	0.52
223	0	0	0	0	0	0	21.00	-3.83	0.52
224	0	0	0	0	0	0	21.00	-32.17	0.52
225	0	0	0	0	0	0	24.50	-3.83	0.52
226	0	0	0	0	0	0	24.50	-32.17	0.52
227	0	1	0	1	0	1	28.00	0.00	0.52
228	0	0	0	0	0	0	28.00	-6.19	0.52
229	0	0	0	0	0	0	28.00	-8.56	0.52
230	0	0	0	0	0	0	28.00	-10.92	0.52
231	0	0	0	0	0	0	28.00	-13.28	0.52
232	0	0	0	0	0	0	28.00	-15.64	0.52
233	0	0	0	0	0	0	28.00	-20.36	0.52
234	0	0	0	0	0	0	28.00	-22.72	0.52
235	0	0	0	0	0	0	28.00	-25.08	0.52
236	0	0	0	0	0	0	28.00	-27.44	0.52
237	0	0	0	0	0	0	28.00	-29.81	0.52
238	1	0	0	0	1	1	0.00	-3.83	3.99
239	1	0	0	0	1	1	0.00	-6.19	3.99
240	1	0	0	0	1	1	0.00	-8.56	3.99
241	1	0	0	0	1	1	0.00	-10.92	3.99
242	1	0	0	0	1	1	0.00	-13.28	3.99
243	1	0	0	0	1	1	0.00	-15.64	3.99
244	1	0	0	0	1	1	0.00	-18.00	3.99
245	1	0	0	0	1	1	0.00	-20.36	3.99
246	1	0	0	0	1	1	0.00	-22.72	3.99
247	1	0	0	0	1	1	0.00	-25.08	3.99
248	1	0	0	0	1	1	0.00	-27.44	3.99
249	1	0	0	0	1	1	0.00	-29.81	3.99
250	1	0	0	0	1	1	0.00	-32.17	3.99
251	0	0	0	0	0	0	3.50	-3.83	3.99
252	0	0	0	0	0	0	3.50	-32.17	3.99
253	0	0	0	0	0	0	7.00	-3.83	3.99

Client

WO/Job No.

Subject PLUTONIUM VAULT, BLDG. NO. 2736-Z

Date 2/7/95 By Carleton J. Moore

SASSI VERTICAL SEISMIC HOUSE FILE

Checked 2/21/95 By Gary R. Wagenblast

Location PFP

Revised By

254	0	0	0	0	0	0	7.00	-32.17	3.99
255	0	0	0	0	0	0	10.50	-3.83	3.99
256	0	0	0	0	0	0	10.50	-32.17	3.99
257	0	0	0	0	0	0	14.00	-3.83	3.99
258	0	0	0	0	0	0	14.00	-18.00	3.99
259	0	0	0	0	0	0	14.00	-32.17	3.99
260	0	0	0	0	0	0	17.50	-3.83	3.99
261	0	0	0	0	0	0	17.50	-32.17	3.99
262	0	0	0	0	0	0	21.00	-3.83	3.99
263	0	0	0	0	0	0	21.00	-32.17	3.99
264	0	0	0	0	0	0	24.50	-3.83	3.99
265	0	0	0	0	0	0	24.50	-32.17	3.99
266	0	1	0	1	0	1	28.00	0.00	3.99
267	0	0	0	0	0	0	28.00	-3.83	3.99
268	0	0	0	0	0	0	28.00	-6.19	3.99
269	0	0	0	0	0	0	28.00	-8.56	3.99
270	0	0	0	0	0	0	28.00	-10.92	3.99
271	0	0	0	0	0	0	28.00	-13.28	3.99
272	0	0	0	0	0	0	28.00	-15.64	3.99
273	0	0	0	0	0	0	28.00	-18.00	3.99
274	0	0	0	0	0	0	28.00	-20.36	3.99
275	0	0	0	0	0	0	28.00	-22.72	3.99
276	0	0	0	0	0	0	28.00	-25.08	3.99
277	0	0	0	0	0	0	28.00	-27.44	3.99
278	0	0	0	0	0	0	28.00	-29.81	3.99
279	0	0	0	0	0	0	28.00	-32.17	3.99
280	1	0	0	0	1	1	0.00	-3.83	7.45
281	1	0	0	0	1	1	0.00	-6.19	7.45
282	1	0	0	0	1	1	0.00	-8.56	7.45
283	1	0	0	0	1	1	0.00	-10.92	7.45
284	1	0	0	0	1	1	0.00	-13.28	7.45
285	1	0	0	0	1	1	0.00	-15.64	7.45
286	1	0	0	0	1	1	0.00	-18.00	7.45
287	1	0	0	0	1	1	0.00	-20.36	7.45
288	1	0	0	0	1	1	0.00	-22.72	7.45
289	1	0	0	0	1	1	0.00	-25.08	7.45
290	1	0	0	0	1	1	0.00	-27.44	7.45
291	1	0	0	0	1	1	0.00	-29.81	7.45
292	1	0	0	0	1	1	0.00	-32.17	7.45
293	0	0	0	0	0	0	3.50	-3.83	7.45
294	0	0	0	0	0	0	3.50	-32.17	7.45
295	0	0	0	0	0	0	7.00	-3.83	7.45
296	0	0	0	0	0	0	7.00	-32.17	7.45
297	0	0	0	0	0	0	10.50	-3.83	7.45
298	0	0	0	0	0	0	10.50	-32.17	7.45
299	0	0	0	0	0	0	14.00	-3.83	7.45
300	0	0	0	0	0	0	14.00	-18.00	7.45
301	0	0	0	0	0	0	14.00	-32.17	7.45
302	0	0	0	0	0	0	17.50	-3.83	7.45
303	0	0	0	0	0	0	17.50	-32.17	7.45
304	0	0	0	0	0	0	21.00	-3.83	7.45
305	0	0	0	0	0	0	21.00	-32.17	7.45
306	0	0	0	0	0	0	24.50	-3.83	7.45
307	0	0	0	0	0	0	24.50	-32.17	7.45
308	0	1	0	1	0	1	28.00	0.00	7.45
309	0	0	0	0	0	0	28.00	-3.83	7.45
310	0	0	0	0	0	0	28.00	-6.19	7.45
311	0	0	0	0	0	0	28.00	-8.56	7.45
312	0	0	0	0	0	0	28.00	-10.92	7.45
313	0	0	0	0	0	0	28.00	-13.28	7.45
314	0	0	0	0	0	0	28.00	-15.64	7.45
315	0	0	0	0	0	0	28.00	-18.00	7.45
316	0	0	0	0	0	0	28.00	-20.36	7.45
317	0	0	0	0	0	0	28.00	-22.72	7.45
318	0	0	0	0	0	0	28.00	-25.08	7.45

Client

WO/Job No.

Subject PLUTONIUM VAULT, BLDG. NO. 2736-Z

Date 2/7/95 By Carleton J. Moore

SASSI VERTICAL SEISMIC HOUSE FILE

Checked 2/21/95 By Gary R. Wagenblast

Location PFP

Revised By

319	0	0	0	0	0	0	28.00	-27.44	7.45
320	0	0	0	0	0	0	28.00	-29.81	7.45
321	0	0	0	0	0	0	28.00	-32.17	7.45
322	1	0	0	0	1	1	0.00	-3.83	10.92
323	1	0	0	0	1	1	0.00	-6.19	10.92
324	1	0	0	0	1	1	0.00	-8.56	10.92
325	1	0	0	0	1	1	0.00	-10.92	10.92
326	1	0	0	0	1	1	0.00	-13.28	10.92
327	1	0	0	0	1	1	0.00	-15.64	10.92
328	1	0	0	0	1	1	0.00	-18.00	10.92
329	1	0	0	0	1	1	0.00	-20.36	10.92
330	1	0	0	0	1	1	0.00	-22.72	10.92
331	1	0	0	0	1	1	0.00	-25.08	10.92
332	1	0	0	0	1	1	0.00	-27.44	10.92
333	1	0	0	0	1	1	0.00	-29.81	10.92
334	1	0	0	0	1	1	0.00	-32.17	10.92
335	0	0	0	0	0	0	3.50	-3.83	10.92
336	0	0	0	0	0	0	3.50	-18.00	10.92
337	0	0	0	0	0	0	3.50	-32.17	10.92
338	0	0	0	0	0	0	7.00	-3.83	10.92
339	0	0	0	0	0	0	7.00	-18.00	10.92
340	0	0	0	0	0	0	7.00	-32.17	10.92
341	0	0	0	0	0	0	10.50	-3.83	10.92
342	0	0	0	0	0	0	10.50	-18.00	10.92
343	0	0	0	0	0	0	10.50	-32.17	10.92
344	0	0	0	0	0	0	14.00	-3.83	10.92
345	0	0	0	0	0	0	14.00	-6.19	10.92
346	0	0	0	0	0	0	14.00	-8.56	10.92
347	0	0	0	0	0	0	14.00	-10.92	10.92
348	0	0	0	0	0	0	14.00	-13.28	10.92
349	0	0	0	0	0	0	14.00	-15.64	10.92
350	0	0	0	0	0	0	14.00	-18.00	10.92
351	0	0	0	0	0	0	14.00	-20.36	10.92
352	0	0	0	0	0	0	14.00	-22.72	10.92
353	0	0	0	0	0	0	14.00	-25.08	10.92
354	0	0	0	0	0	0	14.00	-27.44	10.92
355	0	0	0	0	0	0	14.00	-29.81	10.92
356	0	0	0	0	0	0	14.00	-32.17	10.92
357	0	0	0	0	0	0	17.50	-3.83	10.92
358	0	0	0	0	0	0	17.50	-18.00	10.92
359	0	0	0	0	0	0	17.50	-32.17	10.92
360	0	0	0	0	0	0	21.00	-3.83	10.92
361	0	0	0	0	0	0	21.00	-18.00	10.92
362	0	0	0	0	0	0	21.00	-32.17	10.92
363	0	0	0	0	0	0	24.50	-3.83	10.92
364	0	0	0	0	0	0	24.50	-18.00	10.92
365	0	0	0	0	0	0	24.50	-32.17	10.92
366	0	1	0	1	0	1	28.00	0.00	10.92
367	0	0	0	0	0	0	28.00	-3.83	10.92
368	0	0	0	0	0	0	28.00	-6.19	10.92
369	0	0	0	0	0	0	28.00	-8.56	10.92
370	0	0	0	0	0	0	28.00	-10.92	10.92
371	0	0	0	0	0	0	28.00	-13.28	10.92
372	0	0	0	0	0	0	28.00	-15.64	10.92
373	0	0	0	0	0	0	28.00	-18.00	10.92
374	0	0	0	0	0	0	28.00	-20.36	10.92
375	0	0	0	0	0	0	28.00	-22.72	10.92
376	0	0	0	0	0	0	28.00	-25.08	10.92
377	0	0	0	0	0	0	28.00	-27.44	10.92
378	0	0	0	0	0	0	28.00	-29.81	10.92
379	0	0	0	0	0	0	28.00	-32.17	10.92
380	1	0	0	0	1	1	0.00	-32.17	11.57
381	0	0	0	0	0	0	3.50	-32.17	11.57
382	0	0	0	0	0	0	7.00	-32.17	11.57
383	0	0	0	0	0	0	10.50	-32.17	11.57

384	0	0	0	0	0	0	14.00	-32.17	11.57
385	0	0	0	0	0	0	17.50	-32.17	11.57
386	0	0	0	0	0	0	21.00	-32.17	11.57
387	0	0	0	0	0	0	24.50	-32.17	11.57
388	0	0	0	0	0	0	28.00	-32.17	11.57
389	1	0	0	0	1	1	0.00	-29.81	11.62
390	0	0	0	0	0	0	3.50	-29.81	11.62
391	0	0	0	0	0	0	7.00	-29.81	11.62
392	0	0	0	0	0	0	10.50	-29.81	11.62
393	0	0	0	0	0	0	14.00	-29.81	11.62
394	0	0	0	0	0	0	17.50	-29.81	11.62
395	0	0	0	0	0	0	21.00	-29.81	11.62
396	0	0	0	0	0	0	24.50	-29.81	11.62
397	0	0	0	0	0	0	28.00	-29.81	11.62
398	1	0	0	0	1	1	0.00	-27.44	11.67
399	0	0	0	0	0	0	3.50	-27.44	11.67
400	0	0	0	0	0	0	7.00	-27.44	11.67
401	0	0	0	0	0	0	10.50	-27.44	11.67
402	0	0	0	0	0	0	14.00	-27.44	11.67
403	0	0	0	0	0	0	17.50	-27.44	11.67
404	0	0	0	0	0	0	21.00	-27.44	11.67
405	0	0	0	0	0	0	24.50	-27.44	11.67
406	0	0	0	0	0	0	28.00	-27.44	11.67
407	1	0	0	0	1	1	0.00	-25.08	11.72
408	0	0	0	0	0	0	3.50	-25.08	11.72
409	0	0	0	0	0	0	7.00	-25.08	11.72
410	0	0	0	0	0	0	10.50	-25.08	11.72
411	0	0	0	0	0	0	14.00	-25.08	11.72
412	0	0	0	0	0	0	17.50	-25.08	11.72
413	0	0	0	0	0	0	21.00	-25.08	11.72
414	0	0	0	0	0	0	24.50	-25.08	11.72
415	0	0	0	0	0	0	28.00	-25.08	11.72
416	1	0	0	0	1	1	0.00	-22.72	11.77
417	0	0	0	0	0	0	3.50	-22.72	11.77
418	0	0	0	0	0	0	7.00	-22.72	11.77
419	0	0	0	0	0	0	10.50	-22.72	11.77
420	0	0	0	0	0	0	14.00	-22.72	11.77
421	0	0	0	0	0	0	17.50	-22.72	11.77
422	0	0	0	0	0	0	21.00	-22.72	11.77
423	0	0	0	0	0	0	24.50	-22.72	11.77
424	0	0	0	0	0	0	28.00	-22.72	11.77
425	1	0	0	0	1	1	0.00	-20.36	11.82
426	0	0	0	0	0	0	3.50	-20.36	11.82
427	0	0	0	0	0	0	7.00	-20.36	11.82
428	0	0	0	0	0	0	10.50	-20.36	11.82
429	0	0	0	0	0	0	14.00	-20.36	11.82
430	0	0	0	0	0	0	17.50	-20.36	11.82
431	0	0	0	0	0	0	21.00	-20.36	11.82
432	0	0	0	0	0	0	24.50	-20.36	11.82
433	0	0	0	0	0	0	28.00	-20.36	11.82
434	1	0	0	0	1	1	0.00	-18.00	11.87
435	0	0	0	0	0	0	3.50	-18.00	11.87
436	0	0	0	0	0	0	7.00	-18.00	11.87
437	0	0	0	0	0	0	10.50	-18.00	11.87
438	0	0	0	0	0	0	14.00	-18.00	11.87
439	0	0	0	0	0	0	17.50	-18.00	11.87
440	0	0	0	0	0	0	21.00	-18.00	11.87
441	0	0	0	0	0	0	24.50	-18.00	11.87
442	0	0	0	0	0	0	28.00	-18.00	11.87
443	1	0	0	0	1	1	0.00	-15.64	11.92
444	0	0	0	0	0	0	3.50	-15.64	11.92
445	0	0	0	0	0	0	7.00	-15.64	11.92
446	0	0	0	0	0	0	10.50	-15.64	11.92
447	0	0	0	0	0	0	14.00	-15.64	11.92
448	0	0	0	0	0	0	17.50	-15.64	11.92

Client WO/Job No.

Subject PLUTONIUM VAULT, BLDG. NO. 2736-Z Date 2/7/95 By Carleton J. Moore

SASSI VERTICAL SEISMIC HOUSE FILE Checked 2/22/95 By Gary R. Wagenblast

Location PFP Revised By

```
449   0   0   0   0   0   0    21.00   -15.64   11.92
450   0   0   0   0   0   0    24.50   -15.64   11.92
451   0   0   0   0   0   0    28.00   -15.64   11.92
452   1   0   0   0   1   1     0.00   -13.28   11.97
453   0   0   0   0   0   0     3.50   -13.28   11.97
454   0   0   0   0   0   0     7.00   -13.28   11.97
455   0   0   0   0   0   0    10.50   -13.28   11.97
456   0   0   0   0   0   0    14.00   -13.28   11.97
457   0   0   0   0   0   0    17.50   -13.28   11.97
458   0   0   0   0   0   0    21.00   -13.28   11.97
459   0   0   0   0   0   0    24.50   -13.28   11.97
460   0   0   0   0   0   0    28.00   -13.28   11.97
461   1   0   0   0   1   1     0.00   -10.92   12.02
462   0   0   0   0   0   0     3.50   -10.92   12.02
463   0   0   0   0   0   0     7.00   -10.92   12.02
464   0   0   0   0   0   0    10.50   -10.92   12.02
465   0   0   0   0   0   0    14.00   -10.92   12.02
466   0   0   0   0   0   0    17.50   -10.92   12.02
467   0   0   0   0   0   0    21.00   -10.92   12.02
468   0   0   0   0   0   0    24.50   -10.92   12.02
469   0   0   0   0   0   0    28.00   -10.92   12.02
470   1   0   0   0   1   1     0.00    -8.56   12.07
471   0   0   0   0   0   0     3.50    -8.56   12.07
472   0   0   0   0   0   0     7.00    -8.56   12.07
473   0   0   0   0   0   0    10.50    -8.56   12.07
474   0   0   0   0   0   0    14.00    -8.56   12.07
475   0   0   0   0   0   0    17.50    -8.56   12.07
476   0   0   0   0   0   0    21.00    -8.56   12.07
477   0   0   0   0   0   0    24.50    -8.56   12.07
478   0   0   0   0   0   0    28.00    -8.56   12.07
479   1   0   0   0   1   1     0.00    -6.19   12.12
480   0   0   0   0   0   0     3.50    -6.19   12.12
481   0   0   0   0   0   0     7.00    -6.19   12.12
482   0   0   0   0   0   0    10.50    -6.19   12.12
483   0   0   0   0   0   0    14.00    -6.19   12.12
484   0   0   0   0   0   0    17.50    -6.19   12.12
485   0   0   0   0   0   0    21.00    -6.19   12.12
486   0   0   0   0   0   0    24.50    -6.19   12.12
487   0   0   0   0   0   0    28.00    -6.19   12.12
488   1   0   0   0   1   1     0.00    -3.83   12.16
489   0   0   0   0   0   0     3.50    -3.83   12.16
490   0   0   0   0   0   0     7.00    -3.83   12.16
491   0   0   0   0   0   0    10.50    -3.83   12.16
492   0   0   0   0   0   0    14.00    -3.83   12.16
493   0   0   0   0   0   0    17.50    -3.83   12.16
494   0   0   0   0   0   0    21.00    -3.83   12.16
495   0   0   0   0   0   0    24.50    -3.83   12.16
496   0   0   0   0   0   0    28.00    -3.83   12.16
497   1   1   0   1   1   1     0.00     0.00   12.24
498   0   1   0   1   0   1     3.50     0.00   12.24
499   0   1   0   1   0   1     7.00     0.00   12.24
500   0   1   0   1   0   1    10.50     0.00   12.24
501   0   1   0   1   0   1    14.00     0.00   12.24
502   0   1   0   1   0   1    17.50     0.00   12.24
503   0   1   0   1   0   1    21.00     0.00   12.24
504   0   1   0   1   0   1    24.50     0.00   12.24
505   0   1   0   1   0   1    28.00     0.00   12.24
167
  1 167  -1   0
  1      1.50      110     694.1   1236.5   0.018   0.018
  2      0.75      110     681.9   1214.8   0.023   0.023
  3 445   3  -1
  1   478.2e6     0.15       150     0.05     0.05
  2   239.1e6     0.15        75     0.05     0.05
  3   478.2e6     0.15     262.5     0.05     0.05
```

Client

WO/Job No.

Subject PLUTONIUM VAULT, BLDG. NO. 2736-Z — Date 2/7/95 — By Carleton J. Moore

SASSI VERTICAL SEISMIC HOUSE FILE — Checked 2/21/95 By Gary R. Wagenblast

Location PFP — Revised — By

1	4	11	10	3	1	1.00
2	10	9	3		1	1.00
3	3	9	8		1	1.00
4	6	2	3		1	1.00
5	6	8	7		1	1.00
6	8	6	3		1	1.00
7	10	14	13	9	1	1.00
8	9	13	12	8	1	1.00
9	14	18	17	13	1	1.00
10	13	17	16	12	1	1.00
11	18	19	22	21	1	1.00
12	21	17	18		1	1.00
13	16	17	21		1	1.00
14	22	27	26	21	1	1.00
15	26	25	21		1	1.00
16	21	25	24		1	1.00
17	20	15	16	21	1	1.00
18	23	20	21	24	1	1.00
19	26	30	29	25	1	1.00
20	25	29	28	24	1	1.00
21	30	45	44	29	1	1.00
22	29	44	43	28	1	1.00
23	46	66	65	45	1	1.00
24	65	44	45		1	1.00
25	44	65	43		1	1.00
26	66	83	82	65	1	1.00
27	43	54	42		1	1.00
28	54	43	65		1	1.00
29	64	54	65		1	1.00
30	74	64	65		1	1.00
31	65	82	81	74	1	1.00
32	2	6	5	1	1	1.00
33	1	5	97	92	1	1.00
34	54	64	63	53	1	1.00
35	64	74	73	63	1	1.00
36	92	97	96	91	1	1.00
37	53	63	62	52	1	1.00
38	63	73	72	62	1	1.00
39	91	96	90		1	1.00
40	96	106	105	90	1	1.00
41	118	125	124	117	1	1.00
42	125	134	133	124	1	1.00
43	41	52	61	40	1	1.00
44	52	62	61		1	1.00
45	62	72	61		1	1.00
46	72	80	79	61	1	1.00
47	95	89	90		1	1.00
48	104	95	90	105	1	1.00
49	123	116	117	124	1	1.00
50	132	123	124	133	1	1.00
51	51	39	40	61	1	1.00
52	60	51	61		1	1.00
53	71	60	61		1	1.00
54	78	71	61	79	1	1.00
55	89	95	94	88	1	1.00
56	51	60	59	50	1	1.00
57	60	71	70	59	1	1.00
58	88	94	93	87	1	1.00
59	50	59	58	49	1	1.00
60	59	70	69	58	1	1.00
61	87	93	86		1	1.00
62	102	93	103		1	1.00
63	93	102	86		1	1.00
64	102	101	86		1	1.00
65	86	101	100		1	1.00

Client WO/Job No.

Subject PLUTONIUM VAULT, BLDG. NO. 2736-Z Date 2/7/95 By Carleton J. Moore

SASSI VERTICAL SEISMIC HOUSE FILE Checked 2/21/95 By Gary R. Wagenblast

Location PFP Revised By

66	99	85	86	100	1	1.00
67	85	99	98	84	1	1.00
68	102	109	108	101	1	1.00
69	101	108	107	100	1	1.00
70	109	114	113	108	1	1.00
71	108	113	112	107	1	1.00
72	115	122	121	114	1	1.00
73	121	113	114		1	1.00
74	113	121	112		1	1.00
75	122	131	130	121	1	1.00
76	129	121	130		1	1.00
77	121	129	128		1	1.00
78	120	111	112	121	1	1.00
79	127	120	121	128	1	1.00
80	111	120	119	110	1	1.00
81	120	127	126	119	1	1.00
82	130	137	136	129	1	1.00
83	129	136	135	128	1	1.00
84	137	33	32	136	1	1.00
85	136	32	31	135	1	1.00
86	33	37	36	32	1	1.00
87	32	36	35	31	1	1.00
88	49	37	38		1	1.00
89	37	49	57		1	1.00
90	49	58	57		1	1.00
91	58	69	57		1	1.00
92	57	36	37		1	1.00
93	36	57	35		1	1.00
94	76	57	69	77	1	1.00
95	35	48	34		1	1.00
96	48	35	57		1	1.00
97	56	48	57		1	1.00
98	68	56	57		1	1.00
99	57	76	75	68	1	1.00
100	48	56	55	47	1	1.00
101	56	68	67	55	1	1.00
102	3	2	176	177	2	0.67
103	2	1	175	176	2	0.67
104	1	92	174	175	2	0.67
105	92	91	173	174	2	0.67
106	91	90	172	173	2	0.67
107	90	89	171	172	2	0.67
108	89	88	170	171	2	0.67
109	88	87	169	170	2	0.67
110	87	86	168	169	2	0.67
111	86	101	178	168	1	0.67
112	101	108	180	178	1	0.67
113	108	113	182	180	1	0.67
114	113	121	184	182	1	0.67
115	121	129	187	184	1	0.67
116	129	136	190	187	1	0.67
117	136	32	192	190	1	0.67
118	32	36	193	192	1	0.67
119	36	57	197	193	1	0.67
120	57	56	196	197	3	0.67
121	56	55	195	196	3	0.67
122	58	57	197	198	3	0.67
123	59	58	198	199	3	0.67
124	60	59	199	200	3	0.67
125	61	60	200	201	3	0.67
126	62	61	201	202	3	0.67
127	63	62	202	203	3	0.67
128	64	63	203	204	3	0.67
129	65	64	204	205	3	0.67
130	3	9	179	177	3	0.67

131	9	13	181	179	3	0.67
132	13	17	183	181	3	0.67
133	17	21	186	183	3	0.67
134	21	25	188	186	3	0.67
135	25	29	191	188	3	0.67
136	29	44	194	191	3	0.67
137	44	65	205	194	3	0.67
138	143	149	148	142	1	0.50
139	149	155	154	148	1	0.50
140	155	161	160	154	1	0.50
141	161	167	166	160	1	0.50
142	142	148	147	141	1	0.50
143	148	154	153	147	1	0.50
144	154	160	159	153	1	0.50
145	160	166	165	159	1	0.50
146	141	147	146	140	1	0.50
147	147	153	152	146	1	0.50
148	153	159	158	152	1	0.50
149	159	165	164	158	1	0.50
150	140	146	145	139	1	0.50
151	146	152	151	145	1	0.50
152	152	158	157	151	1	0.50
153	158	164	163	157	1	0.50
154	139	145	144	138	1	0.50
155	145	151	150	144	1	0.50
156	151	157	156	150	1	0.50
157	157	163	162	156	1	0.50
158	177	217	252	250	3	0.67
159	217	219	254	252	3	0.67
160	219	221	256	254	3	0.67
161	221	186	259	256	3	0.67
162	186	189	261	259	3	0.67
163	189	224	263	261	3	0.67
164	224	226	265	263	3	0.67
165	226	205	279	265	3	0.67
166	250	252	294	292	3	0.67
167	252	254	296	294	3	0.67
168	254	256	298	296	3	0.67
169	256	259	301	298	3	0.67
170	259	261	303	301	3	0.67
171	261	263	305	303	3	0.67
172	263	265	307	305	3	0.67
173	265	279	321	307	3	0.67
174	292	294	337	334	3	0.67
175	294	296	340	337	3	0.67
176	296	298	343	340	3	0.67
177	298	301	356	343	3	0.67
178	301	303	359	356	3	0.67
179	303	305	362	359	3	0.67
180	305	307	365	362	3	0.67
181	307	321	379	365	3	0.67
182	168	206	239	238	2	0.67
183	206	207	240	239	2	0.67
184	207	208	241	240	2	0.67
185	208	209	242	241	2	0.67
186	209	210	243	242	2	0.67
187	210	172	244	243	2	0.67
188	172	211	245	244	2	0.67
189	211	212	246	245	2	0.67
190	212	213	247	246	2	0.67
191	213	214	248	247	2	0.67
192	214	215	249	248	2	0.67
193	215	177	250	249	2	0.67
194	238	239	281	280	2	0.67
195	239	240	282	281	2	0.67

196	240	241	283	282	2	0.67
197	241	242	284	283	2	0.67
198	242	243	285	284	2	0.67
199	243	244	286	285	2	0.67
200	244	245	287	286	2	0.67
201	245	246	288	287	2	0.67
202	246	247	289	288	2	0.67
203	247	248	290	289	2	0.67
204	248	249	291	290	2	0.67
205	249	250	292	291	2	0.67
206	280	281	323	322	2	0.67
207	281	282	324	323	2	0.67
208	282	283	325	324	2	0.67
209	283	284	326	325	2	0.67
210	284	285	327	326	2	0.67
211	285	286	328	327	2	0.67
212	286	287	329	328	2	0.67
213	287	288	330	329	2	0.67
214	288	289	331	330	2	0.67
215	289	290	332	331	2	0.67
216	290	291	333	332	2	0.67
217	291	292	334	333	2	0.67
218	205	237	278	279	3	0.67
219	237	236	277	278	3	0.67
220	236	235	276	277	3	0.67
221	235	234	275	276	3	0.67
222	234	233	274	275	3	0.67
223	233	201	273	274	3	0.67
224	201	232	272	273	3	0.67
225	232	231	271	272	3	0.67
226	231	230	270	271	3	0.67
227	230	229	269	270	3	0.67
228	229	228	268	269	3	0.67
229	228	197	267	268	3	0.67
230	279	278	320	321	3	0.67
231	278	277	319	320	3	0.67
232	277	276	318	319	3	0.67
233	276	275	317	318	3	0.67
234	275	274	316	317	3	0.67
235	274	273	315	316	3	0.67
236	273	272	314	315	3	0.67
237	272	271	313	314	3	0.67
238	271	270	312	313	3	0.67
239	270	269	311	312	3	0.67
240	269	268	310	311	3	0.67
241	268	267	309	310	3	0.67
242	321	320	378	379	3	0.67
243	320	319	377	378	3	0.67
244	319	318	376	377	3	0.67
245	318	317	375	376	3	0.67
246	317	316	374	375	3	0.67
247	316	315	373	374	3	0.67
248	315	314	372	373	3	0.67
249	314	313	371	372	3	0.67
250	313	312	370	371	3	0.67
251	312	311	369	370	3	0.67
252	311	310	368	369	3	0.67
253	310	309	367	368	3	0.67
254	197	227	266	267	3	0.67
255	267	266	308	309	3	0.67
256	309	308	366	367	3	0.67
257	168	216	251	238	1	0.67
258	216	218	253	251	1	0.67
259	218	220	255	253	1	0.67
260	220	184	257	255	1	0.67

Client

WO/Job No.

Subject PLUTONIUM VAULT, BLDG. NO. 2736-Z

Date 2/7/95 By Carleton J. Moore

SASSI VERTICAL SEISMIC HOUSE FILE

Checked 2/21/95 By Gary R. Wagenblast

Location PFP

Revised By

261	184	222	260	257	1	0.67
262	222	223	262	260	1	0.67
263	223	225	264	262	1	0.67
264	225	197	267	264	1	0.67
265	238	251	293	280	1	0.67
266	251	253	295	293	1	0.67
267	253	255	297	295	1	0.67
268	255	257	299	297	1	0.67
269	257	260	302	299	1	0.67
270	260	262	304	302	1	0.67
271	262	264	306	304	1	0.67
272	264	267	309	306	1	0.67
273	280	293	335	322	1	0.67
274	293	295	338	335	1	0.67
275	295	297	341	338	1	0.67
276	297	299	344	341	1	0.67
277	299	302	357	344	1	0.67
278	302	304	360	357	1	0.67
279	304	306	363	360	1	0.67
280	306	309	367	363	1	0.67
281	334	333	389	380	2	1.17
282	333	332	398	389	2	1.17
283	332	331	407	398	2	1.17
284	331	330	416	407	2	1.17
285	330	329	425	416	2	1.17
286	329	328	434	425	2	1.17
287	328	327	443	434	2	1.17
288	327	326	452	443	2	1.17
289	326	325	461	452	2	1.17
290	325	324	470	461	2	1.17
291	324	323	479	470	2	1.17
292	323	322	488	479	2	1.17
293	367	366	505	496	3	1.17
294	379	378	397	388	3	1.17
295	378	377	406	397	3	1.17
296	377	376	415	406	3	1.17
297	376	375	424	415	3	1.17
298	375	374	433	424	3	1.17
299	374	373	442	433	3	1.17
300	373	372	451	442	3	1.17
301	372	371	460	451	3	1.17
302	371	370	469	460	3	1.17
303	370	369	478	469	3	1.17
304	369	368	487	478	3	1.17
305	368	367	496	487	3	1.17
306	356	355	393	384	1	1.17
307	355	354	402	393	1	1.17
308	354	353	411	402	1	1.17
309	353	352	420	411	1	1.17
310	352	351	429	420	1	1.17
311	351	350	438	429	1	1.17
312	350	349	447	438	1	1.17
313	349	348	456	447	1	1.17
314	348	347	465	456	1	1.17
315	347	346	474	465	1	1.17
316	346	345	483	474	1	1.17
317	345	344	492	483	1	1.17
318	322	335	489	488	1	1.17
319	335	338	490	489	1	1.17
320	338	341	491	490	1	1.17
321	341	344	492	491	1	1.17
322	344	357	493	492	1	1.17
323	357	360	494	493	1	1.17
324	360	363	495	494	1	1.17
325	363	367	496	495	1	1.17

326	328	336	435	434	1	1.17
327	336	339	436	435	1	1.17
328	339	342	437	436	1	1.17
329	342	350	438	437	1	1.17
330	350	358	439	438	1	1.17
331	358	361	440	439	1	1.17
332	361	364	441	440	1	1.17
333	364	373	442	441	1	1.17
334	380	381	390	389	1	0.54
335	381	382	391	390	1	0.54
336	382	383	392	391	1	0.54
337	383	384	393	392	1	0.54
338	384	385	394	393	1	0.54
339	385	386	395	394	1	0.54
340	386	387	396	395	1	0.54
341	387	388	397	396	1	0.54
342	389	390	399	398	1	0.54
343	390	391	400	399	1	0.54
344	391	392	401	400	1	0.54
345	392	393	402	401	1	0.54
346	393	394	403	402	1	0.54
347	394	395	404	403	1	0.54
348	395	396	405	404	1	0.54
349	396	397	406	405	1	0.54
350	398	399	408	407	1	0.54
351	399	400	409	408	1	0.54
352	400	401	410	409	1	0.54
353	401	402	411	410	1	0.54
354	402	403	412	411	1	0.54
355	403	404	413	412	1	0.54
356	404	405	414	413	1	0.54
357	405	406	415	414	1	0.54
358	407	408	417	416	1	0.54
359	408	409	418	417	1	0.54
360	409	410	419	418	1	0.54
361	410	411	420	419	1	0.54
362	411	412	421	420	1	0.54
363	412	413	422	421	1	0.54
364	413	414	423	422	1	0.54
365	414	415	424	423	1	0.54
366	416	417	426	425	1	0.54
367	417	418	427	426	1	0.54
368	418	419	428	427	1	0.54
369	419	420	429	428	1	0.54
370	420	421	430	429	1	0.54
371	421	422	431	430	1	0.54
372	422	423	432	431	1	0.54
373	423	424	433	432	1	0.54
374	425	426	435	434	1	0.54
375	426	427	436	435	1	0.54
376	427	428	437	436	1	0.54
377	428	429	438	437	1	0.54
378	429	430	439	438	1	0.54
379	430	431	440	439	1	0.54
380	431	432	441	440	1	0.54
381	432	433	442	441	1	0.54
382	434	435	444	443	1	0.54
383	435	436	445	444	1	0.54
384	436	437	446	445	1	0.54
385	437	438	447	446	1	0.54
386	438	439	448	447	1	0.54
387	439	440	449	448	1	0.54
388	440	441	450	449	1	0.54
389	441	442	451	450	1	0.54
390	443	444	453	452	1	0.54

```
391  444  445  454  453        1          0.54
392  445  446  455  454        1          0.54
393  446  447  456  455        1          0.54
394  447  448  457  456        1          0.54
395  448  449  458  457        1          0.54
396  449  450  459  458        1          0.54
397  450  451  460  459        1          0.54
398  452  453  462  461        1          0.54
399  453  454  463  462        1          0.54
400  454  455  464  463        1          0.54
401  455  456  465  464        1          0.54
402  456  457  466  465        1          0.54
403  457  458  467  466        1          0.54
404  458  459  468  467        1          0.54
405  459  460  469  468        1          0.54
406  461  462  471  470        1          0.54
407  462  463  472  471        1          0.54
408  463  464  473  472        1          0.54
409  464  465  474  473        1          0.54
410  465  466  475  474        1          0.54
411  466  467  476  475        1          0.54
412  467  468  477  476        1          0.54
413  468  469  478  477        1          0.54
414  470  471  480  479        1          0.54
415  471  472  481  480        1          0.54
416  472  473  482  481        1          0.54
417  473  474  483  482        1          0.54
418  474  475  484  483        1          0.54
419  475  476  485  484        1          0.54
420  476  477  486  485        1          0.54
421  477  478  487  486        1          0.54
422  479  480  489  488        1          0.54
423  480  481  490  489        1          0.54
424  481  482  491  490        1          0.54
425  482  483  492  491        1          0.54
426  483  484  493  492        1          0.54
427  484  485  494  493        1          0.54
428  485  486  495  494        1          0.54
429  486  487  496  495        1          0.54
430  488  489  498  497        1          0.54
431  489  490  499  498        1          0.54
432  490  491  500  499        1          0.54
433  491  492  501  500        1          0.54
434  492  493  502  501        1          0.54
435  493  494  503  502        1          0.54
436  494  495  504  503        1          0.54
437  495  496  505  504        1          0.54
438  334  337  381  380        3          1.17
439  337  340  382  381        3          1.17
440  340  343  383  382        3          1.17
441  343  356  384  383        3          1.17
442  356  359  385  384        3          1.17
443  359  362  386  385        3          1.17
444  362  365  387  386        3          1.17
445  365  379  388  387        3          1.17
  2   36    2    3   -1
  1  478.2e6        0.15      150      0.05       0.05
  2  239.1e6        0.15       75      0.05       0.05
  1     1.36        1.13     1.13     0.308      0.154      0.154
  2     1.07        0.89     0.89     0.196     0.0749      0.121
  3    0.667        0.56     0.56    0.0803     0.0247     0.0556
  1    3  177    9    2    1
  2  177  250    9    2    1
  3  250  292    9    2    1
  4  292  334    9    2    1
```

Client

WO/Job No.

Subject PLUTONIUM VAULT, BLDG. NO. 2736-Z

Date 2/7/95 By Carleton J. Moore

SASSI VERTICAL SEISMIC HOUSE FILE

Checked 2/21/95 By Gary R. Wagenblast

Location PFP

Revised By

```
 5  21  186  25  1  2
 6 186  259  25  1  2
 7 259  301  25  1  2
 8 301  356  25  1  2
 9  65  205  82  1  1
10 205  279  82  1  1
11 279  321  82  1  1
12 321  379  82  1  1
13  90  172  91  2  2
14 172  244  91  2  2
15 244  286  91  2  2
16 286  328  91  2  2
17 124  185 125  1  3
18 185  258 125  1  3
19 258  300 125  1  3
20 300  350 125  1  3
21  61  201  62  1  2
22 201  273  62  1  2
23 273  315  62  1  2
24 315  373  62  1  2
25  86  168 101  2  1
26 168  238 101  2  1
27 238  280 101  2  1
28 280  322 101  2  1
29 121  184 129  1  2
30 184  257 129  1  2
31 257  299 129  1  2
32 299  344 129  1  2
33  57  197  76  1  1
34 197  267  76  1  1
35 267  309  76  1  1
36 309  367  76  1  1
 7   5    1
 1       12.0
 1 160  413   1
 2 158  467   1
 3 153  439   1
 4 146  463   1
 5 148  409   1
 0
```

Client	WO/Job No.	
Subject PLUTONIUM VAULT, BLDG. NO. 2736-Z	Date 2/7/95	By Carleton J. Moore
SASSI VERTICAL SEISMIC ANALYSIS FILE	Checked 2/21/95	By Gary R. Wagenblast
Location PFP	Revised	By

```
1     PVAULT
1     1     1
     0.          0.          0.
0
```

Client

WO/Job No.

Subject PLUTONIUM VAULT, BLDG. NO. 2736-Z Date 2/7/95 By Carleton J. Moore

SASSI VERTICAL MOTION TRANFER FUNCTION FILE Checked 2/21/95 dew By Gary R. Wagenblast

Location PFP

Revised By

```
  1   TRANSFER FUNCTIONS
  0   14
292                       1
296                       1
301                       1
305                       1
321                       1
318                       1
315                       1
312                       1
309                       1
409                       1
413                       1
439                       1
463                       1
467                       1
  0
```

Client	WO/Job No.	
Subject PLUTONIUM VAULT, BLDG. NO. 2736-Z	Date 2/7/95	By Carleton J. Moore
SASSI VERTICAL ROOF MOTION SPECTRUM FILE	Checked 2/21/95	By Gary R. Wagenblast
Location PFP	Revised	By

```
  1   Response Spectra
  1   25    1
380                       000100
382                       000100
384                       000100
386                       000100
388                       000100
407                       000100
409                       000100
411                       000100
413                       000100
415                       000100
434                       000100
436                       000100
438                       000100
440                       000100
442                       000100
461                       000100
463                       000100
465                       000100
467                       000100
469                       000100
488                       000100
490                       000100
492                       000100
494                       000100
496                       000100

    0.05
4096 2048      0.01     0.667
 Ref: SHAKE OUTPUT PVAULT.TH1 n=2048 (8f9.6) dt=.01 tl=1
-0.000296-0.000663-0.000984-0.001095-0.000945-0.000561 0.000063 0.000964     1
 0.002023 0.002836 0.002917 0.002158 0.001076 0.000460 0.000689 0.001394     2
 0.001862 0.001745 0.001315 0.001024 0.000937 0.000719 0.000134-0.000672     3
-0.001515-0.002668-0.004698-0.007620-0.010364-0.011465-0.010529-0.008939     4
-0.008800-0.010968-0.014152-0.016116-0.015818-0.014256-0.013124-0.012793     5
-0.011901-0.009117-0.005098-0.002309-0.002663-0.005454-0.007986-0.008374     6
-0.007526-0.007991-0.010773-0.013555-0.012486-0.005862 0.004014 0.012693     7
 0.017188 0.017775 0.016623 0.015224 0.013420 0.010508 0.006569 0.002408     8
-0.001353-0.004423-0.005957-0.004185 0.002257 0.012342 0.022346 0.028062     9
 0.027687 0.022773 0.016632 0.011993 0.009970 0.010523 0.013171 0.017046    10
 0.020647 0.022034 0.019558 0.012675 0.002459-0.008375-0.016350-0.019197    11
-0.017790-0.015948-0.017293-0.021629-0.024788-0.022975-0.017469-0.014244    12
-0.018093-0.027286-0.034950-0.036228-0.033422-0.033075-0.037946-0.042952    13
-0.040061-0.026994-0.010063 0.002087 0.006859 0.008968 0.013575 0.019495    14
 0.020335 0.012186-0.001021-0.010625-0.011493-0.006631-0.003601-0.006956    15
-0.014494-0.020358-0.020863-0.017021-0.012235-0.008647-0.006115-0.003929    16
-0.002368-0.002031-0.002149-0.000571 0.003863 0.008987 0.010009 0.003264    17
-0.010386-0.026020-0.038663-0.046711-0.051121-0.051527-0.044368-0.026351    18
-0.000300 0.023500 0.033693 0.027060 0.011539-0.000476-0.002464 0.002189    19
 0.005820 0.005190 0.003954 0.006946 0.013337 0.016625 0.011490 0.000038    20
-0.009244-0.008651 0.002521 0.018164 0.030800 0.036948 0.038409 0.039734    21
 0.044523 0.052970 0.061706 0.066106 0.063929 0.057704 0.053202 0.054342    22
 0.058782 0.058984 0.048880 0.030501 0.013990 0.010133 0.021644 0.041003    23
 0.056847 0.063177 0.063157 0.064371 0.070267 0.075977 0.072651 0.056469    24
 0.033912 0.017921 0.017903 0.032299 0.050396 0.061476 0.062746 0.058981    25
 0.055180 0.050306 0.038623 0.017070-0.009004-0.027690-0.028393-0.008970    26
 0.023158 0.055519 0.076528 0.079522 0.064269 0.036608 0.006276-0.016978    27
-0.027401-0.024875-0.013171 0.003214 0.020655 0.035619 0.043640 0.040536    28
 0.025610 0.003749-0.016225-0.026383-0.024092-0.012716 0.001545 0.013672    29
 0.021470 0.024186 0.020450 0.008260-0.012673-0.038847-0.063817-0.081816    30
-0.090925-0.093010-0.090967-0.086592-0.081065-0.076488-0.075417-0.078068    31
-0.080567-0.077190-0.065082-0.046526-0.026266-0.007083 0.010816 0.025539    32
 0.029682 0.013065-0.028356-0.084912-0.134765-0.155235-0.136518-0.088259    33
-0.034154 0.002480 0.013057 0.008185 0.008138 0.025692 0.055050 0.077319    34
```

0.078723	0.064732	0.055348	0.064856	0.086053	0.096156	0.079920	0.046850	35
0.024107	0.031127	0.060898	0.086359	0.085452	0.060656	0.035555	0.033472	36
0.058423	0.093662	0.116145	0.113290	0.089716	0.061219	0.041960	0.034249	37
0.028173	0.011484	-0.018067	-0.049206	-0.066592	-0.064927	-0.053512	-0.046271	38
-0.047645	-0.049638	-0.042914	-0.028966	-0.019363	-0.023417	-0.039030	-0.056945	39
-0.071892	-0.086150	-0.101550	-0.111707	-0.106634	-0.085963	-0.064302	-0.059728	40
-0.076058	-0.098135	-0.106073	-0.094012	-0.074396	-0.064559	-0.070238	-0.081885	41
-0.085148	-0.073762	-0.053550	-0.036267	-0.030065	-0.033641	-0.037405	-0.031039	42
-0.013063	0.005079	0.005975	-0.019071	-0.060048	-0.093545	-0.100290	-0.079377	43
-0.046539	-0.019768	-0.007233	-0.007267	-0.015655	-0.029140	-0.042507	-0.047125	44
-0.036973	-0.016452	0.000982	0.004740	-0.002498	-0.007787	-0.001634	0.012539	45
0.023165	0.023494	0.018155	0.017195	0.025512	0.039299	0.051534	0.058842	46
0.062625	0.065449	0.067982	0.068932	0.066160	0.057538	0.042585	0.024922	47
0.012231	0.011042	0.019981	0.029271	0.029042	0.018693	0.006865	0.001386	48
0.000478	-0.004231	-0.015945	-0.026249	-0.022791	-0.003649	0.017815	0.024360	49
0.011529	-0.007915	-0.017069	-0.012589	-0.008892	-0.023885	-0.059545	-0.096270	50
-0.107371	-0.081358	-0.032058	0.012614	0.032975	0.030785	0.022206	0.019163	51
0.018556	0.009647	-0.009896	-0.028068	-0.029835	-0.013054	0.009140	0.022287	52
0.025001	0.027623	0.037425	0.048241	0.046716	0.027473	-0.000753	-0.024814	53
-0.040679	-0.055127	-0.074607	-0.095221	-0.105183	-0.095911	-0.068996	-0.033133	54
0.002772	0.032312	0.050296	0.053348	0.043366	0.027977	0.014373	0.002519	55
-0.013159	-0.034031	-0.050964	-0.050683	-0.029256	0.002473	0.028728	0.044031	56
0.057422	0.081294	0.116910	0.151618	0.169583	0.164455	0.142193	0.113671	57
0.085947	0.060075	0.035590	0.015977	0.009623	0.024736	0.061425	0.107155	58
0.140961	0.145646	0.119410	0.076676	0.036538	0.008909	-0.008935	-0.023543	59
-0.035139	-0.037918	-0.029882	-0.019885	-0.022232	-0.043397	-0.074614	-0.098261	60
-0.101603	-0.084588	-0.055489	-0.020867	0.018988	0.065147	0.112052	0.146150	61
0.154134	0.134119	0.099295	0.069490	0.056740	0.056956	0.054990	0.038282	62
0.006504	-0.030923	-0.064789	-0.092111	-0.113006	-0.125165	-0.124969	-0.114191	63
-0.101874	-0.096013	-0.093987	-0.085309	-0.066501	-0.051005	-0.059323	-0.096668	64
-0.142205	-0.163826	-0.144919	-0.096099	-0.041559	0.002795	0.035731	0.058902	65
0.065904	0.047912	0.008682	-0.031230	-0.048632	-0.036053	-0.005853	0.021653	66
0.031874	0.020231	-0.010069	-0.048903	-0.079576	-0.086007	-0.065812	-0.035955	67
-0.020541	-0.029662	-0.051074	-0.064604	-0.063981	-0.061729	-0.071793	-0.090179	68
-0.096279	-0.073948	-0.029319	0.013485	0.033296	0.027817	0.010903	-0.001906	69
-0.003677	0.004598	0.019240	0.035570	0.046429	0.043462	0.022793	-0.010438	70
-0.044348	-0.067884	-0.076728	-0.072976	-0.060708	-0.042701	-0.020526	0.004137	71
0.029491	0.054485	0.078095	0.096941	0.104533	0.095248	0.070869	0.042717	72
0.024549	0.020522	0.019825	0.005604	-0.027956	-0.066685	-0.085894	-0.070644	73
-0.027694	0.021546	0.058114	0.074767	0.071274	0.047189	0.004663	-0.042759	74
-0.071526	-0.065449	-0.032770	-0.001738	0.004742	-0.009909	-0.021736	-0.012187	75
0.014202	0.037786	0.045081	0.038285	0.025918	0.011169	-0.006258	-0.020854	76
-0.022272	-0.009203	0.002402	-0.008016	-0.043144	-0.081984	-0.099598	-0.090903	77
-0.071867	-0.058818	-0.052322	-0.043871	-0.033029	-0.029685	-0.037610	-0.042583	78
-0.024434	0.019028	0.065935	0.091760	0.093692	0.089181	0.091426	0.093168	79
0.079263	0.051826	0.034993	0.050955	0.094388	0.135498	0.148816	0.135983	80
0.119148	0.115409	0.121408	0.121800	0.107721	0.083947	0.060538	0.042171	81
0.026860	0.011757	-0.003120	-0.016388	-0.027426	-0.035747	-0.039877	-0.038863	82
-0.034611	-0.031216	-0.031582	-0.035743	-0.042697	-0.052209	-0.063157	-0.071022	83
-0.069789	-0.057919	-0.041194	-0.027607	-0.019325	-0.011213	0.002121	0.019475	84
0.034658	0.043699	0.047447	0.046071	0.034019	0.005001	-0.036319	-0.070151	85
-0.073356	-0.038366	0.018622	0.068360	0.088497	0.076052	0.044769	0.013264	86
-0.005566	-0.008744	-0.002064	0.004021	0.000274	-0.015585	-0.036623	-0.050075	87
-0.044428	-0.015723	0.030090	0.079005	0.113939	0.121819	0.100445	0.060874	88
0.022047	-0.000219	-0.002270	0.007213	0.015745	0.016793	0.012667	0.008802	89
0.005509	-0.004311	-0.028071	-0.062818	-0.092108	-0.096779	-0.072525	-0.037526	90
-0.019452	-0.031071	-0.057882	-0.071927	-0.059321	-0.032992	-0.016808	-0.018714	91
-0.023401	-0.012673	0.010935	0.026184	0.019029	0.001122	-0.002607	0.016357	92
0.038643	0.038627	0.014748	-0.006874	-0.000199	0.032843	0.064680	0.070020	93
0.047732	0.015803	-0.009566	-0.025518	-0.036062	-0.041419	-0.037762	-0.024677	94
-0.007824	0.006574	0.016354	0.020585	0.015315	-0.003026	-0.029302	-0.048796	95
-0.048470	-0.029041	-0.003900	0.013896	0.021649	0.024565	0.027495	0.032652	96
0.043224	0.062815	0.087776	0.103867	0.097190	0.070500	0.044364	0.037611	97
0.047381	0.052748	0.039194	0.015458	0.002281	0.006420	0.011895	0.000081	98
-0.025036	-0.037279	-0.015335	0.033762	0.080558	0.101144	0.096933	0.088269	99

Client WO/Job No.

Subject PLUTONIUM VAULT, BLDG. NO. 2736-Z Date 2/7/95 By Carleton J. Moore

SASSI VERTICAL ROOF MOTION SPECTRUM FILE Checked 2/21/95 By Gary R. Wagenblast

Location PFP Revised By

```
 0.092931 0.112773 0.137301 0.154346 0.156185 0.140674 0.112355 0.082746   100
 0.064761 0.062692 0.067917 0.066836 0.053854 0.035510 0.021921 0.016351   101
 0.014909 0.014957 0.020413 0.037321 0.066015 0.099760 0.130457 0.153184   102
 0.164574 0.159610 0.133731 0.089113 0.037249-0.006618-0.032361-0.039620   103
-0.036029-0.032661-0.039314-0.059822-0.088877-0.114949-0.129909-0.137081   104
-0.147410-0.165570-0.181415-0.179101-0.155971-0.129354-0.120694-0.132591   105
-0.144654-0.134330-0.100686-0.065305-0.049959-0.055817-0.065416-0.062100   106
-0.044238-0.021425-0.002061 0.011645 0.018811 0.016377 0.003846-0.010991   107
-0.015930-0.005734 0.012308 0.026011 0.030269 0.029276 0.027488 0.022209   108
 0.008171-0.011677-0.024006-0.016480 0.009164 0.037009 0.050155 0.043364   109
 0.023337-0.000670-0.024076-0.045676-0.062556-0.069220-0.062013-0.043263   110
-0.020627-0.002809 0.004504 0.000730-0.009370-0.017776-0.018195-0.011339   111
-0.005304-0.009110-0.024782-0.045814-0.063297-0.072497-0.072899-0.063817   112
-0.043695-0.015766 0.007768 0.011763-0.008771-0.042267-0.069502-0.079688   113
-0.076846-0.070324-0.061542-0.043020-0.010401 0.028053 0.057070 0.069283   114
 0.072100 0.078731 0.094059 0.111199 0.120758 0.120345 0.113960 0.105257   115
 0.095207 0.085753 0.080711 0.079296 0.071292 0.044947 0.002772-0.034402   116
-0.045392-0.032559-0.023501-0.044218-0.090665-0.130927-0.137573-0.115320   117
-0.093455-0.092301-0.102335-0.099189-0.075727-0.053160-0.058508-0.094747   118
-0.137083-0.157591-0.149393-0.125847-0.101035-0.076767-0.048514-0.017907   119
 0.005831 0.016055 0.015856 0.013545 0.013791 0.015824 0.018321 0.021297   120
 0.021745 0.011783-0.013084-0.042812-0.054296-0.029313 0.026840 0.085438   121
 0.114412 0.100157 0.052780-0.005753-0.056565-0.090191-0.104387-0.100231   122
-0.080490-0.049785-0.015384 0.012201 0.021239 0.005595-0.027491-0.058129   123
-0.067340-0.053466-0.034314-0.030147-0.043478-0.056751-0.050409-0.021677   124
 0.015319 0.045636 0.065972 0.081251 0.093672 0.099945 0.098460 0.093566   125
 0.088925 0.079099 0.053444 0.010802-0.032470-0.052976-0.039565-0.001316   126
 0.042281 0.075577 0.090722 0.083430 0.053196 0.010689-0.020531-0.018001   127
 0.020053 0.070879 0.105767 0.112990 0.102441 0.090534 0.084797 0.083643   128
 0.085321 0.090047 0.092590 0.079373 0.040322-0.015140-0.058480-0.063632   129
-0.030112 0.015644 0.042398 0.038349 0.016247-0.001719-0.002949 0.008252   130
 0.017812 0.015410 0.004015-0.001641 0.012061 0.042203 0.065955 0.056747   131
 0.008914-0.052790-0.091424-0.089152-0.061431-0.039983-0.042332-0.058899   132
-0.068300-0.061112-0.045984-0.034835-0.027566-0.014135 0.010767 0.039442   133
 0.058356 0.060722 0.049857 0.032015 0.009795-0.016075-0.041177-0.057175   134
-0.057911-0.044261-0.022262 0.002076 0.024530 0.040087 0.041583 0.023610   135
-0.011378-0.051217-0.079161-0.082619-0.059803-0.020468 0.019792 0.048883   136
 0.065107 0.075765 0.087676 0.098418 0.098110 0.081231 0.055825 0.038235   137
 0.036870 0.042052 0.034340 0.004262-0.036527-0.064470-0.064713-0.043255   138
-0.020227-0.012357-0.020820-0.033207-0.035359-0.022719-0.003590 0.006995   139
-0.001517-0.026616-0.053711-0.066897-0.060938-0.044057-0.029725-0.026385   140
-0.034684-0.051699-0.073944-0.095362-0.106339-0.099956-0.080374-0.061187   141
-0.051641-0.045386-0.027297 0.006646 0.039671 0.049359 0.033021 0.013809   142
 0.017768 0.045994 0.073545 0.077251 0.061144 0.050744 0.063195 0.087787   143
 0.098546 0.083345 0.056042 0.039140 0.038341 0.037747 0.019220-0.017247   144
-0.053743-0.072290-0.069675-0.055727-0.040967-0.028330-0.015112 0.000756   145
 0.017754 0.032115 0.039956 0.038663 0.028666 0.015285 0.007659 0.013477   146
 0.033163 0.058867 0.079324 0.086254 0.077545 0.056463 0.029224 0.002614   147
-0.018207-0.031237-0.037114-0.036688-0.029442-0.015132 0.003140 0.018845   148
 0.026169 0.023961 0.014607-0.000640-0.022995-0.050808-0.073519-0.074317   149
-0.042481 0.015380 0.077195 0.120391 0.136730 0.133992 0.124550 0.113255   150
 0.096023 0.068410 0.033609 0.001121-0.021956-0.037559-0.054095-0.077239   151
-0.103182-0.121239-0.123453-0.111997-0.097018-0.086992-0.081258-0.072269   152
-0.054955-0.032842-0.014142-0.002332 0.007544 0.022025 0.039508 0.049728   153
 0.044520 0.028488 0.016983 0.022237 0.041861 0.061795 0.070154 0.066750   154
 0.058605 0.048109 0.028815-0.005436-0.048576-0.082633-0.092337-0.079767   155
-0.063167-0.059775-0.069210-0.074129-0.057933-0.022373 0.012027 0.022972   156
 0.004427-0.030704-0.063736-0.084640-0.094091-0.094443-0.082944-0.056392   157
-0.021248 0.005241 0.008084-0.010126-0.028856-0.027185-0.002903 0.026229   158
 0.040572 0.037630 0.032766 0.041912 0.064886 0.086215 0.091104 0.079209   159
 0.063093 0.055377 0.058953 0.068601 0.078862 0.088120 0.096015 0.100267   160
 0.098503 0.092629 0.088781 0.090917 0.094796 0.090268 0.071371 0.044473   161
 0.025287 0.026009 0.043994 0.062693 0.064633 0.045025 0.014089-0.013433   162
-0.031307-0.045305-0.064549-0.090000-0.111739-0.117633-0.104403-0.080135   163
-0.056471-0.039338-0.027649-0.019862-0.019419-0.031959-0.057207-0.085107   164
```

-0.101318	-0.097133	-0.074453	-0.042244	-0.009475	0.018688	0.040197	0.054705	165
0.063639	0.069786	0.074342	0.074120	0.063656	0.041866	0.016095	-0.002620	166
-0.009663	-0.011609	-0.019563	-0.037571	-0.058492	-0.071656	-0.073350	-0.068688	167
-0.064192	-0.061566	-0.060458	-0.065330	-0.084873	-0.121411	-0.161638	-0.181618	168
-0.164416	-0.114336	-0.054070	-0.007846	0.013432	0.013516	0.001705	-0.015321	169
-0.034665	-0.054642	-0.073577	-0.089815	-0.100211	-0.098407	-0.077701	-0.038780	170
0.005461	0.035933	0.041219	0.026400	0.007528	-0.002961	-0.005268	-0.007620	171
-0.014637	-0.021540	-0.019051	-0.002258	0.025370	0.054436	0.074192	0.076310	172
0.058535	0.027769	-0.001574	-0.016214	-0.013907	-0.004668	-0.000775	-0.005341	173
-0.011629	-0.013400	-0.013757	-0.021753	-0.040742	-0.062589	-0.074900	-0.072973	174
-0.062763	-0.052191	-0.041959	-0.026933	-0.005948	0.012481	0.016291	0.002114	175
-0.018970	-0.028128	-0.012211	0.026735	0.072018	0.101689	0.100943	0.070814	176
0.027797	-0.006389	-0.018633	-0.011574	0.001672	0.009962	0.011984	0.013065	177
0.016285	0.018606	0.015766	0.009137	0.005823	0.011722	0.025432	0.039537	178
0.047346	0.048045	0.046080	0.046854	0.052971	0.062985	0.072311	0.075907	179
0.071994	0.064199	0.058963	0.059191	0.060367	0.054549	0.039536	0.023487	180
0.018678	0.029447	0.046500	0.053894	0.042153	0.015018	-0.015524	-0.039556	181
-0.054642	-0.063157	-0.066980	-0.066173	-0.062004	-0.059349	-0.064461	-0.079489	182
-0.098694	-0.110094	-0.102009	-0.070439	-0.022532	0.026316	0.060244	0.071128	183
0.062312	0.045900	0.035281	0.037145	0.047523	0.054807	0.048910	0.030682	184
0.013133	0.010901	0.025454	0.040653	0.036198	0.008499	-0.022218	-0.028815	185
-0.003604	0.032792	0.050977	0.041749	0.024221	0.024252	0.046212	0.068339	186
0.066165	0.038167	0.006539	-0.005985	0.002964	0.018064	0.026466	0.031420	187
0.045336	0.072275	0.100211	0.110855	0.095886	0.063755	0.032602	0.017580	188
0.022894	0.041980	0.063107	0.076167	0.077346	0.069266	0.056505	0.040290	189
0.017803	-0.012780	-0.046928	-0.074842	-0.088927	-0.090258	-0.087070	-0.086883	190
-0.090556	-0.094204	-0.095938	-0.099265	-0.108920	-0.123629	-0.134290	-0.131180	191
-0.114410	-0.097155	-0.096236	-0.116304	-0.141892	-0.147026	-0.116626	-0.061011	192
-0.008794	0.016904	0.016740	0.010226	0.013099	0.021106	0.017205	-0.006456	193
-0.036842	-0.051932	-0.042948	-0.022133	-0.007903	-0.004414	0.001882	0.025772	194
0.065375	0.101532	0.113924	0.097465	0.065022	0.037158	0.029150	0.043686	195
0.071137	0.096005	0.106765	0.103658	0.097699	0.100011	0.110395	0.116727	196
0.106661	0.080022	0.049427	0.029431	0.026196	0.036832	0.055219	0.075304	197
0.089913	0.091577	0.078873	0.061209	0.052885	0.059248	0.069835	0.068222	198
0.049624	0.026770	0.016632	0.022345	0.030772	0.028429	0.017173	0.010939	199
0.016778	0.022290	0.005666	-0.040308	-0.095323	-0.124916	-0.109051	-0.059448	200
-0.009728	0.011974	0.003067	-0.016926	-0.026940	-0.021713	-0.011949	-0.011371	201
-0.025251	-0.049420	-0.075882	-0.096553	-0.103340	-0.089883	-0.057219	-0.016858	202
0.015847	0.034124	0.044446	0.056628	0.069783	0.071446	0.052291	0.018943	203
-0.012077	-0.033254	-0.054038	-0.085818	-0.121087	-0.134462	-0.108695	-0.057203	204
-0.015265	-0.007093	-0.024446	-0.039481	-0.035143	-0.017855	-0.001420	0.013367	205
0.036227	0.067153	0.088122	0.081276	0.052449	0.029361	0.033586	0.057845	206
0.074662	0.065857	0.039565	0.018479	0.016405	0.029119	0.043592	0.048807	207
0.037024	0.002997	-0.049341	-0.100415	-0.124486	-0.112739	-0.084944	-0.071584	208
-0.082332	-0.096787	-0.090470	-0.067038	-0.057668	-0.085621	-0.135651	-0.164283	209
-0.141209	-0.077463	-0.011953	0.025932	0.037094	0.039916	0.044886	0.046478	210
0.036459	0.017898	0.002895	-0.000252	0.006474	0.016422	0.025967	0.034365	211
0.038535	0.032459	0.013506	-0.012230	-0.032995	-0.040347	-0.035154	-0.025711	212
-0.020954	-0.024739	-0.034114	-0.041341	-0.038546	-0.023155	-0.000585	0.018949	213
0.027911	0.026954	0.023379	0.024261	0.030844	0.038754	0.042584	0.040332	214
0.034899	0.032500	0.038743	0.053844	0.070450	0.077553	0.068983	0.048861	215
0.027585	0.011537	-0.002512	-0.021826	-0.047194	-0.069903	-0.079828	-0.075278	216
-0.063507	-0.052618	-0.045381	-0.041459	-0.042638	-0.052274	-0.069301	-0.085848	217
-0.093229	-0.089507	-0.078921	-0.063889	-0.040484	-0.004089	0.041407	0.082837	218
0.107310	0.111638	0.101899	0.085720	0.067308	0.049386	0.036182	0.031373	219
0.033502	0.035810	0.031561	0.018424	-0.002531	-0.029748	-0.060437	-0.087871	220
-0.103337	-0.103517	-0.094570	-0.085966	-0.079957	-0.069677	-0.049044	-0.022247	221
-0.000401	0.010610	0.015129	0.018876	0.018418	0.004121	-0.026221	-0.061169	222
-0.086179	-0.098090	-0.104890	-0.111558	-0.111858	-0.098102	-0.075482	-0.059310	223
-0.055996	-0.052937	-0.034179	-0.004800	0.008642	-0.012405	-0.052138	-0.071400	224
-0.047917	-0.001194	0.027384	0.017992	-0.008841	-0.017403	0.004247	0.034514	225
0.044420	0.027079	-0.000158	-0.016306	-0.012777	0.009256	0.048027	0.100795	226
0.156555	0.197001	0.209215	0.195822	0.169911	0.141442	0.112080	0.082835	227
0.061016	0.054621	0.061162	0.067427	0.063145	0.052271	0.047164	0.052221	228
0.057349	0.049703	0.029414	0.010076	0.003592	0.007416	0.008321	-0.003229	229

Client

WO/Job No.

Subject PLUTONIUM VAULT, BLDG. NO. 2736-Z

Date 2/7/95 By Carleton J. Moore

SASSI VERTICAL ROOF MOTION SPECTRUM FILE

Checked 2/21/95 By Gary R. Wagenblast

Location PFP

Revised By

```
-0.024743-0.046555-0.061453-0.068347-0.069333-0.066719-0.062722-0.058603   230
-0.051923-0.036426-0.007824 0.029746 0.065138 0.089451 0.102691 0.109901   231
 0.112017 0.103630 0.080591 0.047102 0.012618-0.017030-0.041692-0.059368   232
-0.061191-0.039535-0.001653 0.029943 0.035943 0.019495 0.003730 0.008212   233
 0.029392 0.046407 0.045027 0.032589 0.028227 0.041296 0.062677 0.076689   234
 0.077603 0.072115 0.067958 0.064531 0.056360 0.043277 0.034042 0.039408   235
 0.062962 0.098747 0.135817 0.163726 0.175295 0.167668 0.142936 0.107262   236
 0.068271 0.033033 0.008414 0.000898 0.012388 0.034738 0.051655 0.050786   237
 0.035632 0.022674 0.023613 0.031022 0.025151-0.003623-0.041931-0.066852   238
-0.072048-0.076331-0.102637-0.149893-0.190203-0.196331-0.169840-0.139145   239
-0.130406-0.144052-0.161349-0.169885-0.176230-0.191756-0.210908-0.210175   240
-0.170807-0.099776-0.025289 0.028211 0.058684 0.081095 0.107045 0.132484   241
 0.144049 0.134018 0.107579 0.077812 0.056104 0.046640 0.046534 0.049005   242
 0.047841 0.041578 0.033863 0.027963 0.020271 0.001663-0.031645-0.068903   243
-0.090129-0.083999-0.060270-0.042082-0.044636-0.062265-0.076728-0.076053   244
-0.062974-0.046293-0.028940-0.007886 0.016245 0.034829 0.038831 0.028144   245
 0.009969-0.011225-0.037857-0.071355-0.103305-0.119317-0.112607-0.090547   246
-0.065643-0.042553-0.018064 0.006729 0.020023 0.010049-0.019107-0.047498   247
-0.057612-0.050027-0.038010-0.028619-0.014598 0.013229 0.050098 0.079524   248
 0.090965 0.089772 0.086317 0.079441 0.057738 0.018782-0.019052-0.030564   249
-0.009656 0.023443 0.043111 0.043132 0.036880 0.035138 0.030937 0.010510   250
-0.024493-0.053140-0.056252-0.037510-0.019235-0.017767-0.027240-0.029224   251
-0.015092 0.005084 0.014992 0.009002-0.005401-0.019042-0.030482-0.043566   252
-0.059053-0.071587-0.074187-0.063462-0.040630-0.010349 0.019622 0.039731   253
 0.043808 0.035082 0.025781 0.028294 0.045562 0.070054 0.091567 0.104985   254
 0.110583 0.108836 0.097246 0.072947 0.037934 0.001532-0.022296-0.022021   255
 0.002999 0.038041 0.058779 0.047421 0.008020-0.034570-0.054996-0.049696   256
    0
```

APPENDIX F

SEISMIC INTERACTION WALKDOWN & EVALUATION RESULTS

MISCELLANEOUS INFORMATION

1. AREA SUMMARY SHEET

Facility PFP Building 2736-ZB Room 636 Floor Elevation @ grade

Seismic Input at Floor (horizontal, 5% damping): Peak 0.42 g, ZPA 0.20 g

Seismic Input at Floor (vertical, 5% damping): Peak 0.28 g, ZPA 0.13 g

Area Summary Sheet 1 of 4 Total Number of Sheets in Area Walkdown Package 9

Walkdown Start Date 3/30/95

Commodity Review Walkdown Sheets Attached:	Number of Sheets
▪ Piping and Tubing	1
▪ Raceways	1
▪ HVAC	1
▪ Equipment and Miscellaneous Commodities	1

Explain N/A's Entered Above, if Any: NONE

Total Number of Candidates Identified in Area: 1

Commodity	Number of Candidates
▪ Piping and Tubing	0
▪ Raceways	0
▪ HVAC	1
▪ Equipment and Miscellaneous Commodities	0

Description of Revision:

Revision 0

Team Leader E.C. Ocone Print E.C. OCONE Date 3/30/95

Team Member R.J. Thomas Print R.J. THOMAS Date 3/30/95

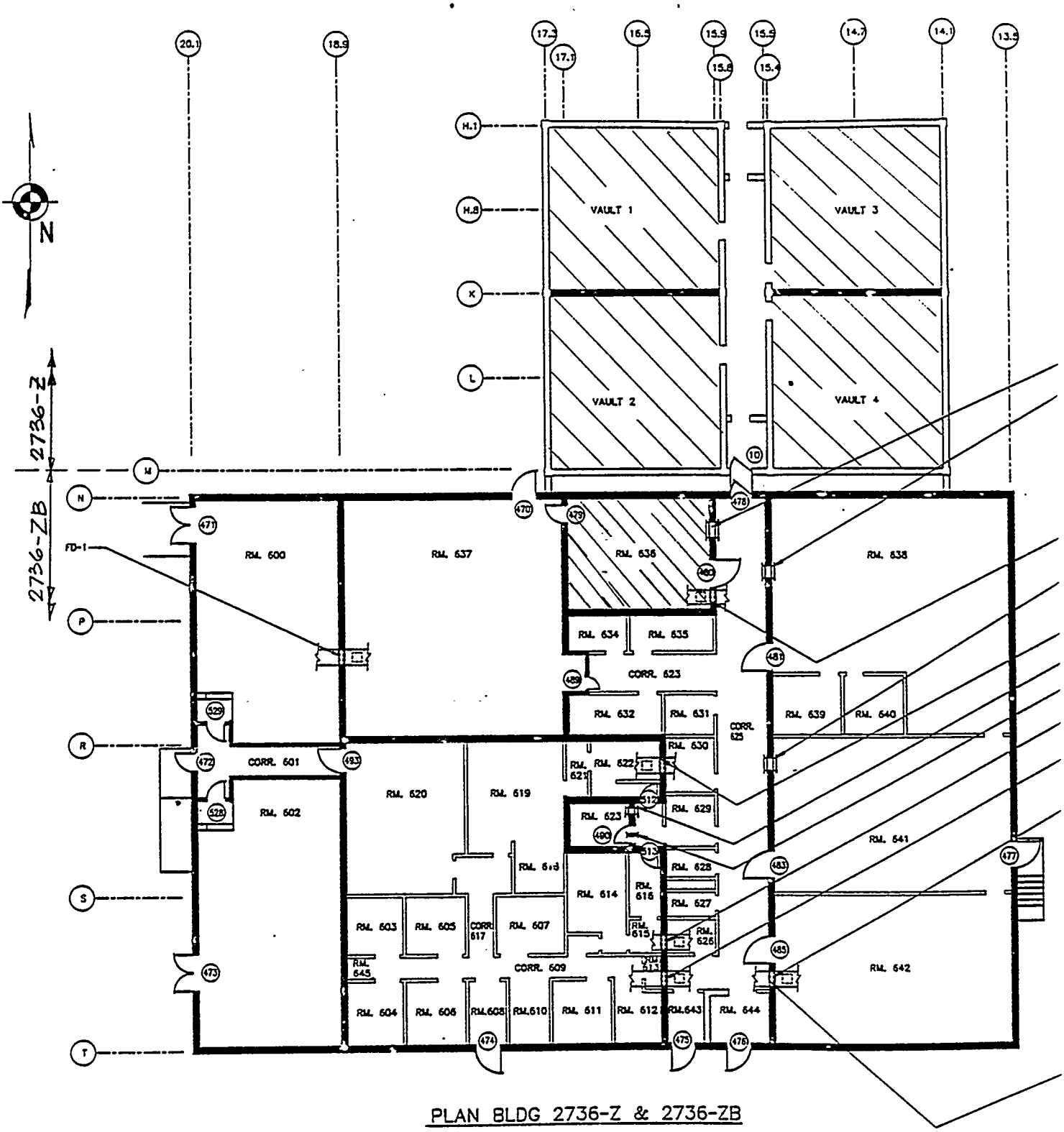
Team Member M. Islam Print M. A. ISLAM Date 3/30/95

Team Member _____ Print _____ Date _____

Area Walkdown Performed by Reviewer? Yes ___, No ___

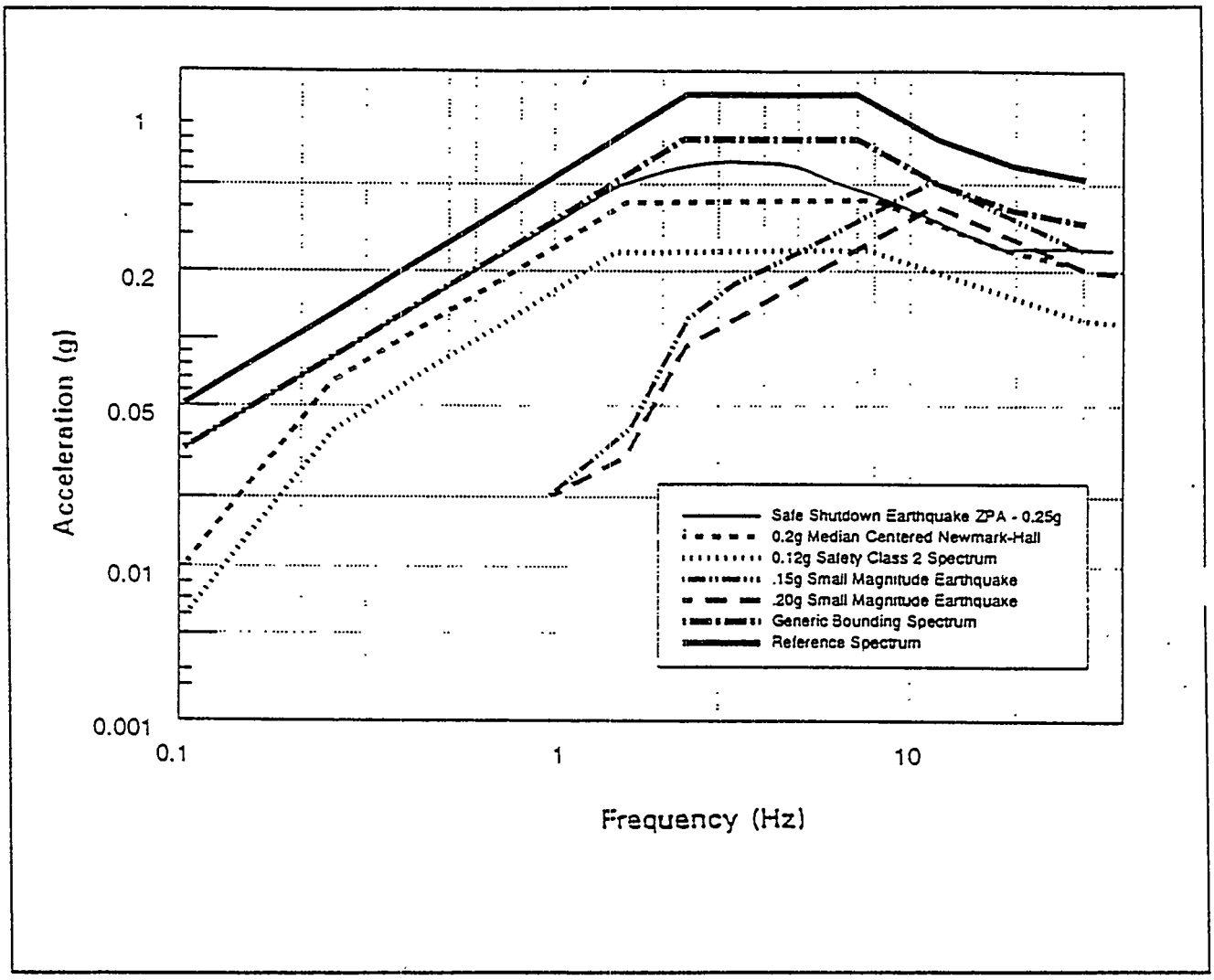
Reviewer _____ Print _____ Date _____

AREA SUMMARY SHEET 2 OF 4



PLAN BLDG 2736-Z & 2736-ZB

AREA SUMMARY SHEET 3 OF 4



Note that Hanford site ground motion spectra are easily enveloped by the reference spectrum. Also, USI A-46 bounding spectrum envelopes Hanford site ground motion spectra.

Generic Bounding Spectrum Comparison to Hanford Site Ground Spectra
(Reference 9.6)

ANCHORAGE INSPECTION AND ATTRIBUTES

I Facility PFP Building 2736-ZB Equip. ID REPACKAGING GLOVEBOX Floor Elev. @ GRADE ft.

Anchorage and Miscellaneous Attributes Evaluation Sheet 4 of 4

AREA SUMMARY SHEET

J

Anchorage Attribute Review	Attribute Reviewed
Expansion Anchor Review	
a. Spacing, edge distance and concrete cracks reviewed.	OK
b. Embedment and nuts bottomed out reviewed.	N/A
c. Verify expansion anchors are not used to anchor rotating equipment	OK
d. Tightness check, torque to 16-18 ft-lbs for 5/8 bolt (SEE COMMENTS)	OK
Welded Anchorage Review	
e. Welded anchorage reviewed.	N/A
Unistrut Anchorage Review	
f. Channel nuts spot checked for alignment of nut grooves with channel?	N/A
Richmond Inserts	
g. Non-Seismic commodities anchored with Richmond Inserts identified?	N/A
General Anchorage Attributes	
h. Gaps between attachments and concrete surface generally ≤ ¼ inch.	OK
i. Bolts reviewed for full thread engagement or substantial thread engagement for light for lightly loaded anchors.	OK
j. Anchorage reviewed for substantial rust or corrosion.	OK
k. Anchorage reviewed for small washers on thin sheet metal.	N/A
l. Anchorage reviewed for extremely thin equipment base framing.	N/A
m. Anchorage reviewed for missing nuts, bolts or washers.	OK
n. Anchorage reviewed for non-positive anchorage configurations.	OK
o. Based on engineering judgement, anchorage appears adequate.	OK
p. Other concerns.	OK
Concrete strength and Bolt Type	
q. Concrete strength 4,000 psi per drawing H-2-80116.	OK
r. Anchor bolt type 5/8"ø DROP-IN per ☒ inspection ☒ drawing no. H-2-80174.	OK

Comments:

NW CORNER BOLT OF BDG-IN MOVED < 1/8 TURN THEN CLICKED/SET

PLAN N

MOVED LESS THAN 1/8 TURN

ALL OTHERS ARE TIGHT

M

Team Leader/Date	E.C. Ocorna	1-5-95
Team Member/Date	R.J. Thomas	1-5-95
Team Member/Date	SK Jamadar	1/5/95
Team Member/Date	MA Islam	1/5/95

2. PIPING AND TUBING

Facility PFP Building 2736-ZB Room 636 Floor Elevation @ Grade
Piping and Tubing Evaluation Sheet 1 of 1

Piping and Tubing Attribute Review (Guidelines provided in Attachment C):	Attribute Reviewed
a. Unanchored, unrestrained or inadequately anchored commodities attached (anchor point displacement)	✓
b. Stiff branch lines attached to flexible headers	(1) ✓
c. In-line mass and/or eccentricity	✓
d. Fittings (bellows, expansion joints, etc.) which may be susceptible to seismic induced displacement	✓
e. Brittle mechanical joints (threaded, bell-and-spigot, victaulic, etc.)	✓
f. Substantial visible corrosion	✓
g. Non-ductile piping or fitting materials (cast-iron, PVC, etc.)	✓
h. Non-standard fittings, branch connections, or attachments	✓
i. Span Lengths	✓
j. Heavily loaded supports	✓
k. Multiple friction beam clamps in series	✓
l. One-way supports lacking guides	✓
m. Short fixed-end rod hangers	✓
n. Damaged, missing or loose hardware	✓
o. Support details with alterations such as coping out of members	✓
p. Customized parts which appear inadequate	✓
q. Other concerns	✓

Number of Piping and Tubing Candidates Identified in Area: 0

Candidate Number	No. Sheets	Candidate Number	No. Sheets

Comments:
(1) 2"ϕ SCH 40 S.S. PIPE BRANCHED OUT FROM 8"ϕ DUCT (t≈.125"). SEE HVAC EVALUATION SHEET FOR FURTHER DETAIL.

Team Leader/Date E.C. Quinn / 3/30/95
Team Member/Date R.J. Thomas / 3/30/95
Team Member/Date _____ / _____

3. RACEWAYS

Facility PFP Building 2736-ZB Room 636 Floor Elevation @ Grade
Raceway Evaluation Sheet 1 of 1

Raceways Attribute Review (Guidelines are provided in Attachment D):	Attribute Reviewed
Conduit Specific Attributes	
a. Undersized anchor bolts for one-hole finger clamps	✓
b. Large junction boxes	✓
Cable Tray Specific Attributes	
c. Customized parts	✓
d. Cable restraint	✓
e. Tray connector hardware	✓
General Raceway Attributes	
f. Span lengths	✓
g. Raceways member tie-downs	✓
h. Channel nuts	✓
i. Rigid boot connections	✓
j. Beam or friction clamps	✓
k. Atypical or unique support configuration	✓
l. Substantial visible corrosion	✓
m. Sagging	✓
n. Damaged, missing or loose hardware	✓
o. Stiff support along flexible run	✓
p. Short fixed-end rod hangers	✓
q. Heavily loaded supports	✓
r. Other concern	✓

Number of Raceways Candidates Identified in Area: 0

Candidate Number	No. Sheets	Candidate Number	No. Sheets

Comments:
GENERAL: NO CABLE TRAY IN ROOM 636. CONDUIT SUPPORTS ARE PROPERLY SPACED AND ADEQUATE.

Team Leader/Date E. C. Oconnell / 3/30/95
Team Member/Date R. J. Thomas / 3/30/95
Team Member/Date _____ / _____

4. HVAC

Facility PFP Building 2736-ZB Room 636 Floor Elevation @ Grade
HVAC Evaluation Sheet 1 of 1

HVAC Attribute Review (Guidelines are provided in Attachment E):	Attribute Reviewed
a. Span lengths	✓
b. Heavily loaded supports	✓
c. Attachment of ducting to supports	✓
d. Damaged, missing or loose hardware	✓
e. Substantial visible corrosion	✓
f. Beam or friction clamps	✓
g. Short fixed-end rod hangers	✓
h. Loose or incomplete duct joints	✓
i. Long cantilevered duct segments	✓
j. Appurtenances positively attached to duct	✓
k. Any visible construction quality deviation	✓
l. Heavy in-line mounted equipment (e.g. fans, coolers, dryers, blowers, etc.) independently supported and provided with adequate flexible joint	✓
m. HVAC related equipment	(1) ✓
n. Other concerns	(3) ✓

Number of HVAC Candidates Identified in Area: 1

Candidate Number	No. Sheets	Candidate Number	No. Sheets
PFP-2736ZB-636-H-001 (2)			

Comments:

GENERAL: THE ROOM VENTILATION DUCT IS OUTSIDE THE SAFETY CLASS 1 GLOVEBOX'S MISSILE ZONE OF INFLUENCE PER THE WALKDOWN PROCEDURE (WHC-SD-CP-SA-028). THE OTHER 2 DUCTS ARE EXHAUST DUCTS FOR THE GLOVEBOX.

(1) THE EXHAUST DUCTS CONNECTED AT THE TOP OF THE GLOVEBOX WILL TRANSFER LOADS TO THE GLOVEBOX DURING A DBE. THERE IS A HEPA FILTER BOX ASSY. MOUNTED IN-LINE WITH EACH DUCT. THIS IS A CANDIDATE FOR EVALUATION.

(2) FOR FIELD DATA AND ANALYTICAL EVALUATION OF THIS CANDIDATE AND FOR ACCEPTABILITY OF AS-IS CONFIGURATION, SEE APPENDIX "A" OF THIS DOCUMENT REV. 0 AND 0-A.

(3) THERE IS A SECURITY CAMERA (NOT PERMITTED TO SAY WHERE IN THE ROOM) IN THE ROOM WITH 4 ANCHOR BOLTS. ANCHOR ADEQUACY WAS EVALUATED BY TUG TEST AND TESTED OK.

Team Leader/Date E.C. Owens / 3/30/95
Team Member/Date R.J. Thurmes / 3/30/95
Team Member/Date _____ / _____

5. EQUIPMENT AND MISCELLANEOUS COMMODITIES

Facility PFP Building 2736-ZB Room 636 Floor Elevation @ Grade

Equipment and Miscellaneous Commodities Evaluation Sheet 1 of 1

Equipment and Miscellaneous Commodities Attribute Review:	Attribute Reviewed
a. Electrical equipment reviewed per Attachments F	✓
b. Miscellaneous commodities, structural items and architectural features reviewed per Attachment G.	✓
c. Other Concerns.	✓

Number of Equipment and Miscellaneous Commodities Candidates Identified in Area: 0

Candidate Number	No. Sheets	Candidate Number	No. Sheets

Comments:

Team Leader/Date E. G. Ocoma / 3/30/95
Team Member/Date R. J. Thomas / 3/30/95
Team Member/Date _____ / _____

7. CANDIDATE IDENTIFICATION SHEET

Facility PFP Building 2736-ZB Room 636 Floor Elevation @ Grade
Candidate Number: PFP-2736ZB-636-H-001 Sheet 1 of 1

Description of candidate:
GLOVEBOX EXHAUST DUCTS WITH IN-LINE HEPA FILTER ASSEMBLY SUSPENDED FROM THE CEILING WITH THREADED RODS. THERE ARE 2 EXHAUST DUCTS CONNECTED TO THE GLOVEBOX.

Location of candidate:
FROM THE WEST WALL PENETRATION TO THE TOP OF GLOVEBOX.

Reason(s) for selecting candidate:
THE EXHAUST DUCTS ARE ANCHORED AT THE TOP OF THE GLOVEBOX. THIS CONFIGURATION ALLOWS THE DUCTS TO TRANSFER LOAD TO THE GLOVEBOX AND SHOULD BE ACCOUNTED FOR WHEN EVALUATING THE SEISMIC ADEQUACY OF THE GLOVEBOX ANCHORAGE. THE SUPPORT SPACING CRITERIA WILL NOT APPLY BECAUSE OF THE IN-LINE HEPA FILTER ASSEMBLIES. THE EXISTING DUCT SUPPORTS WILL NEED EVALUATION ALSO FOR ADEQUACY.

Comments:
FOR FIELD DATA AND ANALYTICAL EVALUATION OF THIS CANDIDATE AND FOR ACCEPTABILITY OF AS-IS CONFIGURATION, SEE APPENDIX "A" OF THIS DOCUMENT REV. 0 AND 0-A.

Team Leader/Date E.C. O'Connell / 3/30/95
Team Member/Date R.J. Thomas / 3/30/95
Team Member/Date _____ / _____

SEE PAGE F-2 FOR LOCATION PLAN

1. AREA SUMMARY SHEET

Facility PFP Building 2736-Z Room 1,2,3, & 4 Floor Elevation @ Grade

Seismic Input at Floor (horizontal, 5% damping): Peak 0.42 g, ZPA 0.20 g

Seismic Input at Floor (vertical, 5% damping): Peak 0.28 g, ZPA 0.13 g

Area Summary Sheet 1 of 1 Total Number of Sheets in Area Walkdown Package _____

Walkdown Start Date 3/30/95

Commodity Review Walkdown Sheets Attached:	Number of Sheets
▪ Piping and Tubing	_____
▪ Raceways	_____
▪ HVAC	_____
▪ Equipment and Miscellaneous Commodities	_____

Explain N/A's Entered Above, if Any:

Total Number of Candidates Identified in Area: _____

Commodity	Number of Candidates
▪ Piping and Tubing	_____
▪ Raceways	_____
▪ HVAC	_____
▪ Equipment and Miscellaneous Commodities	_____

Description of Revision:

Revision 0

Team Leader E.C. Ocoma Print E.C. OCOMA Date 3/30/95

Team Member R.A. Giller Print R.A. Giller Date 3-30-95

Team Member _____ Print _____ Date _____

Team Member _____ Print _____ Date _____

Area Walkdown Performed by Reviewer? Yes ___, No ___

Reviewer _____ Print _____ Date _____

AREA SUMMARY

6.0 ANCHORAGE AND MISCELLANEOUS ATTRIBUTES

Facility PFP Building 27362 Equip. ID PEDESTALS ROOM 1 Floor Elev. @ GRADE ft.
Anchorage and Miscellaneous Attributes Evaluation Sheet 1/2 of 7

Anchorage Attribute Review (Guidelines provided in Attach G)	Attribute Reviewed
Expansion Anchor Review	
a. Spacing, edge distance and concrete cracks reviewed.	✓
b. Embedment and nuts bottomed out reviewed.	✓
c. Verify expansion anchors are not used to anchor rotating equipment	✓
d. Tightness check	(1) ✓
Welded Anchorage Review	
e. Welded anchorage reviewed.	N/A
Unistrut Anchorage Review	
f. Channel nuts spot checked for alignment of nut grooves with channel?	✓
General Anchorage Attributes	
h. Gaps between attachments and concrete surface generally ≤ ¼ inch.	✓
i. Bolts reviewed for full thread engagement or substantial thread engagement for light for lightly loaded anchors.	✓
j. Anchorage reviewed for substantial rust or corrosion.	✓
k. Anchorage reviewed for small washers on thin sheet metal.	✓
l. Anchorage reviewed for extremely thin equipment base framing.	✓
m. Anchorage reviewed for missing nuts, bolts or washers.	✓
n. Anchorage reviewed for non-positive anchorage configurations.	✓
o. Based on engineering judgement, anchorage appears adequate.	(2) ✓
p. Other concerns.	✓
Concrete strength and Bolt Type	
q. Concrete strength 3000 psi	✓
r. Anchor bolt type (2) per ☒ inspection ☒ drawing no. _____	✓

Candidates identified because of anchorage and miscellaneous attributes shall be included in the appropriate commodity review evaluation.

Comments:
(1) THE PEDESTAL ASSEMBLIES IN ROOM 1 ARE BOLTED TO THE CUBICLE WALLS. DUE TO HIGH RADIATION DOSE RATES INSIDE THE CUBICLES, THE TIGHTNESS & EMBEDMENT CHECKS WILL BE WAIVED AS ALLOWED BY THE SQUG/GIP SECTION 4.1.4 IF JUSTIFIED. INSTEAD A REDUCED INSPECTION ALTERNATIVE WILL BE USED BASED ON SQUG/GIP, APPENDIX C, SECT. C.2.10.

(2) DRAWING H-2-70010 CALLS FOR UNISTRUT NUTS AND 3/8" ASTM A-307 HEX BOLTS. DRAWING H-2-70158 CALLS OUT FOR 1/2" HILTI DROP-IN EXPANSION ANCHORS, THE INSTALLED CONFIGURATION IS DIFFERENT THAN WHAT BOTH DRAWINGS INDICATED. THE INSTALLED CONFIGURATION IS A 3/8" THREADED ROD WITH A HEX NUT ABOVE THE PLATE. WITHOUT DISASSEMBLY (DISASSEMBLY IS NOT ALLOWED BY SQUG/GIP), THE TWO MOST OBVIOUS CONFIGURATION WOULD BE A 3/8" HKB OR A 3/8" UNISTRUT STUD NUT. FURTHER EVALUATION REQUIRED.

Team Leader/Date G.C. O'Connor / 3/30/95
Team Member/Date R. A. Miller / 3-30-95
Team Member/Date _____ / _____

AREA SUMMARY

6.0 ANCHORAGE AND MISCELLANEOUS ATTRIBUTES

Facility PFP Building 2736Z Equip. ID PEDESTALS IN ROOMS 3 & 4 Floor Elev. @ GRADE ft.
Anchorage and Miscellaneous Attributes Evaluation Sheet 1/3 of 7

Anchorage Attribute Review (Guidelines provided in Attach G)	Attribute Reviewed
Expansion Anchor Review	
a. Spacing, edge distance and concrete cracks reviewed.	N/A
b. Embedment and nuts bottomed out reviewed.	N/A
c. Verify expansion anchors are not used to anchor rotating equipment	N/A
d. Tightness check	N/A
Welded Anchorage Review	
e. Welded anchorage reviewed.	(1) ✓
Unistrut Anchorage Review	
f. Channel nuts spot checked for alignment of nut grooves with channel?	N/A
General Anchorage Attributes	
h. Gaps between attachments and concrete surface generally ≤ ¼ inch.	✓
i. Bolts reviewed for full thread engagement or substantial thread engagement for light for lightly loaded anchors.	N/A
j. Anchorage reviewed for substantial rust or corrosion.	✓
k. Anchorage reviewed for small washers on thin sheet metal.	N/A
l. Anchorage reviewed for extremely thin equipment base framing.	✓
m. Anchorage reviewed for missing nuts, bolts or washers.	N/A
n. Anchorage reviewed for non-positive anchorage configurations.	✓
o. Based on engineering judgement, anchorage appears adequate.	(1) ✓
p. Other concerns.	✓
Concrete strength and Bolt Type	
q. Concrete strength 3000 psi	✓
r. Anchor ~~bolt~~ type WELDED per ☐ inspection ☒ drawing no. H-2-26649	✓

Candidates identified because of anchorage and miscellaneous attributes shall be included in the appropriate commodity review evaluation.

Comments:
(1) THE PEDESTAL ASSEMBLIES IN ROOMS 3 & 4 ARE WELDED TO THE CUBICLE WALLS EMBEDDED PLATES. DUE TO THE HIGH RADIATION DOSE RATES INSIDE THE CUBICLES, MEASUREMENTS OF THE WELD SIZE WILL NOT BE PERFORMED. INSTEAD DRAWING REVIEW AND VISUAL INSPECTION WERE USED. FURTHER EVALUATION REQUIRED.

Team Leader/Date E.C. O'Connor / 3/30/95
Team Member/Date R. A. Miller / 3-30-95
Team Member/Date _____ / _____

AREA SUMMARY

6.0 ANCHORAGE AND MISCELLANEOUS ATTRIBUTES

Facility PFP Building 2736 Z Equip. ID CUBICLES IN RM. 1, 3 & 4 Floor Elev. @ GRADE ft.
Anchorage and Miscellaneous Attributes Evaluation Sheet 1 of 7

Anchorage Attribute Review (Guidelines provided in Attach G)	Attribute Reviewed
Expansion Anchor Review	
a. Spacing, edge distance and concrete cracks reviewed.	✓
b. Embedment and nuts bottomed out reviewed.	✓
c. Verify expansion anchors are not used to anchor rotating equipment	✓
d. Tightness check	(1) ✓
Welded Anchorage Review	
e. Welded anchorage reviewed.	(2) ✓
Unistrut Anchorage Review	
f. Channel nuts spot checked for alignment of nut grooves with channel?	N/A
General Anchorage Attributes	
h. Gaps between attachments and concrete surface generally ≤ ¼ inch.	✓
i. Bolts reviewed for full thread engagement or substantial thread engagement for light for lightly loaded anchors.	✓
j. Anchorage reviewed for substantial rust or corrosion.	(3) ✓
k. Anchorage reviewed for small washers on thin sheet metal.	✓
l. Anchorage reviewed for extremely thin equipment base framing.	✓
m. Anchorage reviewed for missing nuts, bolts or washers.	✓
n. Anchorage reviewed for non-positive anchorage configurations.	✓
o. Based on engineering judgement, anchorage appears adequate.	(4) ✓
p. Other concerns.	✓
Concrete strength and Bolt Type	
q. Concrete strength 3000 psi	✓
r. Anchor bolt type REDHEAD per ☐ inspection ☒ drawing no. H-2-70010	✓

Candidates identified because of anchorage and miscellaneous attributes shall be included in the appropriate commodity review evaluation.

Comments:
(1) ANCHOR BOLTS APPLY TO WALL MOUNTED CUBICLES IN ROOM 1 ONLY BETWEEN COLUMN ROWS 16.5 AND 17.3 OF THE NORTH WALL AND LOCATED AT THE 8'-0½" LEVEL. TIGHTNESS CHECK WAS NOT PERFORMED DUE TO HIGH RADIATION DOSE RATES AND ACCESSABILITY.
(2) A RANDOM VISUAL WELD INSPECTION WAS PERFORMED. IN ROOM 1, MOST OF THE WELDS THAT ARE ACCESSIBLE AGREE WITH THE DRAWING. IN ROOM 3, FOR THE WALL MOUNTED CUBICLES, THE WELD BETWEEN TOP OF CUBICLE WALL AND THE BUILDING WALL IS MISSING IN ONE LOCATION BECAUSE OF A BIG GAP. MOST WELDS ARE NOT FILLET WELDS BUT APPEARS MORE LIKE TRYING TO CLOSE A 3/8" GAP SUCH THAT WELD CAPACITY IS NOT CONCLUSIVE. FOR THE FLOOR MOUNTED CUBICLES, THE ANCHOR WELDS INSIDE THE CUBICLES ARE MISSING AT SOME LOCATIONS. OTHERS HAVE WHAT APPEARS TO BE 1/8" x 1½" LG. FILLET WELDS. ROOM 4 WAS EXAMINED BY PFP QA (SEE PAGE F-15)

Team Leader/Date E.C. Ocone / 3/30/95
Team Member/Date R. A. Zeller / 3-30-95
Team Member/Date _____ / _____

AREA SUMMARY

8. CONTINUATION SHEET

Facility PFP Building 2736 Z Room 1,3,4 Floor Elevation _____ ft.

Continuation of: CUBICLES IN RM. 1, 3 & 4 Sheet 5 of 7

COMMENTS CONT'D:

(3) SOME WELD CONNECTIONS SHOW SIGNS OF CORROSION THAT LEAKED THROUGH THE PAINT. DEGRADATION WAS NOT ASSESSED.

(4) BASED ON ENGINEERING JUDGEMENT, ADEQUACY OF THE ANCHORAGE IN ROOMS 3 & 4 CANNOT BE DETERMINED. FURTHER EVALUATION IS REQUIRED.

AREA SUMMARY

SHT 6 OF 7

Vault #1 and #4 Weld Examinations
K6058

1. Dwg H-2-26649: The welding of the PU storage racks, top and bottom, look acceptable.

   Finding: No detrimental conditions were noted.

2. Dwg. H-2-26654: View 69, elevation at 0'0" and elevation at 8'1": Completed weld examination of welds in vaults 1 and 4 as shown on the referenced detail.
   NOTE: Size of these welds could not be accurately measured due to presence of a thick coating of paint on welds. Paint may also mask defects such as cracks or porosity. Because of this, the following is an observation based on those things visible and past weld examination experience.

   Findings: Vault 1, Row E, G and F storage cubicles welds appear to meet the requirements of structural welding codes. These welds appear to be approximately 1/4" in size with no severe undercut.

   Findings: Vault 4, Rows D, H and G storage cubicle welds do not appear to meet structural welding codes or requirements for weld size and length shown on the referenced drawing detail weld symbol. These welds appear smaller than the required 3/16" size. Actual size for most of these welds appears to be approximately 1/8". Most of the welds at the 0'0" level show large areas of undercut and/or underfill. At the 8'1" level most welds are short, not a full 3" in length as required. These short welds very from 1 1/2" to 2 1/2" long.

See attached drawings for welds examined. Welds and areas examined are circled in red ink.

During installation of IAEA security racks in Vault #3 in the near future, welds in those areas will be examined to determine that conditions noted in vault #4 do not exist there. Should Vault #3 welds appear to be of poor quality, an additional report will be made and forwarded to Mr. Ocoma and Mr. Bonadie.

Weld examinations were performed by HF Morris of PFP QA.
This report completed by RR Thorne of PFP QA.

Original is signed as below:
Signature of Examiner Hope F. Morris H F Morris 1-30-95 Date 1-30-95

Signature of preparer Rodney R. Thorne Rodney R Thorne Date 1-30-95

** CC:
EP BONADIE
EC OCOMA

AREA SUMMARY

6.0 ANCHORAGE AND MISCELLANEOUS ATTRIBUTES

Facility PFP Building 2736 Z Equip. ID 7" CAN & LSRD CAN RACKS Floor Elev. @ GRADE ft.
Anchorage and Miscellaneous Attributes Evaluation Sheet 1 of 7

Anchorage Attribute Review (Guidelines provided in Attach G)	Attribute Reviewed
Expansion Anchor Review	
a. Spacing, edge distance and concrete cracks reviewed.	✓
b. Embedment and nuts bottomed out reviewed.	✓
c. Verify expansion anchors are not used to anchor rotating equipment	✓
d. Tightness check	(1) ✓
Welded Anchorage Review	
e. Welded anchorage reviewed.	✓
Unistrut Anchorage Review	
f. Channel nuts spot checked for alignment of nut grooves with channel?	N/A
General Anchorage Attributes	
h. Gaps between attachments and concrete surface generally ≤ ¼ inch.	✓
i. Bolts reviewed for full thread engagement or substantial thread engagement for light for lightly loaded anchors.	✓
j. Anchorage reviewed for substantial rust or corrosion.	✓
k. Anchorage reviewed for small washers on thin sheet metal.	✓
l. Anchorage reviewed for extremely thin equipment base framing.	✓
m. Anchorage reviewed for missing nuts, bolts or washers.	✓
n. Anchorage reviewed for non-positive anchorage configurations.	✓
o. Based on engineering judgement, anchorage appears adequate.	(1) ✓
p. Other concerns.	✓
Concrete strength and Bolt Type	
q. Concrete strength 3000 psi	
r. Anchor bolt type DROP-IN per ☒inspection ☐drawing no.	(1) ✓

Candidates identified because of anchorage and miscellaneous attributes shall be included in the appropriate commodity review evaluation.

Comments:
(1) TIGHTNESS CHECK NOT PERFORMED AND ANCHOR BOLT BRAND NOT VERIFIED DUE TO HIGH RADIATION DOSE RATES. FURTHER EVALUATION IS REQUIRED IN THE EVALUATION, THE REDUCED INSPECTION ALTERNATIVE WILL BE CONSIDERED, WHICH REDUCES THE ALLOWABLE CAPACITIES AS A RESULT OF THE ABSENCE OF TIGHTNESS CHECK & BRAND NAME.

Team Leader/Date E.C. Oconner / 3/30/95
Team Member/Date R.S. Little / 3-30-95
Team Member/Date _____ / _____

2. PIPING AND TUBING

Facility PFP Building 2736 Z Room 123 4 Floor Elevation @ GRADE ft.

Piping and Tubing Evaluation Sheet 1 of 1

Piping and Tubing Attribute Review (Guidelines provided in Attachment C):	Attribute Reviewed
a. Unanchored, unrestrained or inadequately anchored commodities attached (anchor point displacement)	✓
b. Stiff branch lines attached to flexible headers	✓
c. In-line mass and/or eccentricity	✓
d. Fittings (bellows, expansion joints, etc.) which may be susceptible to seismic induced displacement	✓
e. Brittle mechanical joints (threaded, bell-and-spigot, victaulic, etc.)	✓
f. Substantial visible corrosion	✓
g. Non-ductile piping or fitting materials (cast-iron, PVC, etc.)	✓
h. Non-standard fittings, branch connections, or attachments	✓
i. Span Lengths	✓
j. Heavily loaded supports	✓
k. Multiple friction beam clamps in series	✓
l. One-way supports lacking guides	✓
m. Short fixed-end rod hangers	✓
n. Damaged, missing or loose hardware	✓
o. Support details with alterations such as coping out of members	✓
p. Customized parts which appear inadequate	✓
q. Other concerns	

Number of Piping and Tubing Candidates Identified in Area: 0

Candidate Number	No. Sheets	Candidate Number	No. Sheets

Comments:

Team Leader/Date E.C. Ocoma / 3/30/95

Team Member/Date R.A. Miller / 3-30-95

Team Member/Date _____ / _____

3. RACEWAYS

Facility PFP Building 2736Z Room 1234 Floor Elevation @ GRADE ~~ft.~~
Raceway Evaluation Sheet 1 of 1

Raceways Attribute Review (Guidelines are provided in Attachment D):	Attribute Reviewed
Conduit Specific Attributes	
a. Undersized anchor bolts for one-hole finger clamps	✓
b. Large junction boxes	✓
Cable Tray Specific Attributes	
c. Customized parts	✓
d. Cable restraint	✓
e. Tray connector hardware	✓
General Raceway Attributes	
f. Span lengths	✓
g. Raceways member tie-downs	✓
h. Channel nuts	✓
i. Rigid boot connections	✓
j. Beam or friction clamps	✓
k. Atypical or unique support configuration	✓
l. Substantial visible corrosion	✓
m. Sagging	✓
n. Damaged, missing or loose hardware	✓
o. Stiff support along flexible run	✓
p. Short fixed-end rod hangers	✓
q. Heavily loaded supports	✓
r. Other concern	✓

Number of Raceways Candidates Identified in Area: 0

Candidate Number	No. Sheets	Candidate Number	No. Sheets

Comments:

Team Leader/Date E.C. O'Connell / 3/30/95
Team Member/Date R.A. Miller / 3-30-95
Team Member/Date _____ / _____

4. HVAC

Facility PFP Building 2736 Z Room 1,2,3,4 Floor Elevation @ GRADE ~~EL.~~
HVAC Evaluation Sheet 1 of 1

HVAC Attribute Review (Guidelines are provided in Attachment E):	Attribute Reviewed
a. Span lengths	(1) ✓
b. Heavily loaded supports	✓
c. Attachment of ducting to supports	✓
d. Damaged, missing or loose hardware	✓
e. Substantial visible corrosion	✓
f. Beam or friction clamps	✓
g. Short fixed-end rod hangers	✓
h. Loose or incomplete duct joints	✓
i. Long cantilevered duct segments	✓
j. Appurtenances positively attached to duct	✓
k. Any visible construction quality deviation	✓
l. Heavy in-line mounted equipment (e.g. fans, coolers, dryers, blowers, etc.) independently supported and provided with adequate flexible joint	✓
m. HVAC related equipment	✓
n. Other concerns	✓

Number of HVAC Candidates Identified in Area: 1

Candidate Number	No. Sheets	Candidate Number	No. Sheets
PFP-2736Z-3-H-001			

Comments:
(1) IN ROOM 3, THE UNSUPPORTED SPAN LENGTH OF THE EXISTING EXHAUST DUCT EXCEEDED THE SCREENING CRITERIA AFTER THE NEW EXHAUST DUCT WAS CONNECTED TO IT. AT THE LOCATION WHERE THE TEE CONNECTION WAS MADE, THERE WAS A SUPPORT FOR THE EXISTING DUCT. THE SUPPORT WAS NOT REINSTALLED BECAUSE OF INTERFERENCE.

Team Leader/Date E.C. Owens / 3/30/95
Team Member/Date R.S. Zitlau / 3-30-95
Team Member/Date _____ / _____

5. EQUIPMENT AND MISCELLANEOUS COMMODITIES

Facility PFP Building 2736 Z Room 1, 2, 3 & 4 Floor Elevation @ GRADE ~~ft.~~
Equipment and Miscellaneous Commodities Evaluation Sheet 1 of 1

Equipment and Miscellaneous Commodities Attribute Review:	Attribute Reviewed
a. Electrical equipment reviewed per Attachments F	✓
b. Miscellaneous commodities, structural items and architectural features reviewed per Attachment G.	① ✓
c. Other Concerns.	② ✓

Number of Equipment and Miscellaneous Commodities Candidates Identified in Area: 1

Candidate Number	No. Sheets	Candidate Number	No. Sheets
PFP-2736Z-2-MISC-001			

Comments:

① THERE ARE NEUTRON DETECTORS BOLTED TO THE CEILING AND SECURITY CAMERAS IN ALL ROOMS. ANCHOR ADEQUACY WAS EVALUATED BY TUG TEST AND TESTED OK.

② IN ROOM 2 ONLY:
THERE ARE 55 GAL. DRUMS ON THE FLOOR THAT WEIGH 480# EACH WHICH ARE NOT RESTRAINED. THERE ARE ALSO 2 STACK HIGH (SINGLE CONTAINER THE HEIGHT OF 2 DRUMS) DRUMS WEIGHING APPROXIMATELY 1000# THAT ARE NOT RESTRAINED. THESE CONTAINERS ARE APPROXIMATELY 2'-6" AWAY FROM THE 7" CAN AND LARD CAN RACKS.

Team Leader/Date E.C. Oconnor / 3/30/95
Team Member/Date R.S. Miller / 3-30-95
Team Member/Date _____ / _____

7. CANDIDATE IDENTIFICATION SHEET

Facility PFP Building 2736 Z Room 3 Floor Elevation 9' ABOVE GRD ST.
Candidate Number: PFP-2736Z-3-H-001 Sheet 1 of 2

Description of candidate:
THE EXISTING 14"x18" & 16"x20" DUCT ALONG EAST WALL SHOWN ON DRAWING H-2-26665 WAS CONNECTED TO BY A NEW 18"x30" DUCT SHOWN ON H-2-27952 SHT. L. IT WAS OBSERVED DURING THE WALKDOWN THAT AT THE TEE CONNECTION, THERE USED TO BE A SUPPORT FOR THE EXISTING DUCT BUT WAS NOT COMPLETELY REINSTALLED (ONE ROD IS MISSING) AFTER THE NEW DUCT WAS CONNECTED BECAUSE OF INTERFERENCE.

Location of candidate:
2736-Z BUILDING, ROOM 3, EAST WALL AS SHOWN ON DRAWING H-2-26665. SEE NEXT PAGE FOR SKETCH.

Reason(s) for selecting candidate:
DRAWING H-2-26665 HAS NO DESCRIPTION OR SHOW NO DESIGN OF THE SUPPORTS FOR THE EXISTING DUCT, WHILE DRAWING H-2-27952 SHOWS 1/4"Ø ROD HANGERS AND EXPANSION ANCHORS. THE SPAN SCREENING CRITERIA WAS BASED ON THE 1/4"Ø RODS. THE UNSUPPORTED SPAN FOR THE 14"x18" AND 16"x20" DUCT EXCEEDED THE CRITERIA.

Comments:
1) THE WALKDOWN VERIFIED THE TYPE OF SUPPORT FOR THE EXISTING DUCT. THE SUPPORT RODS ARE 3/8"Ø AND THE CEILING ATTACHMENT IS BY UNISTRUT NUT AND EMBEDDED UNISTRUT.

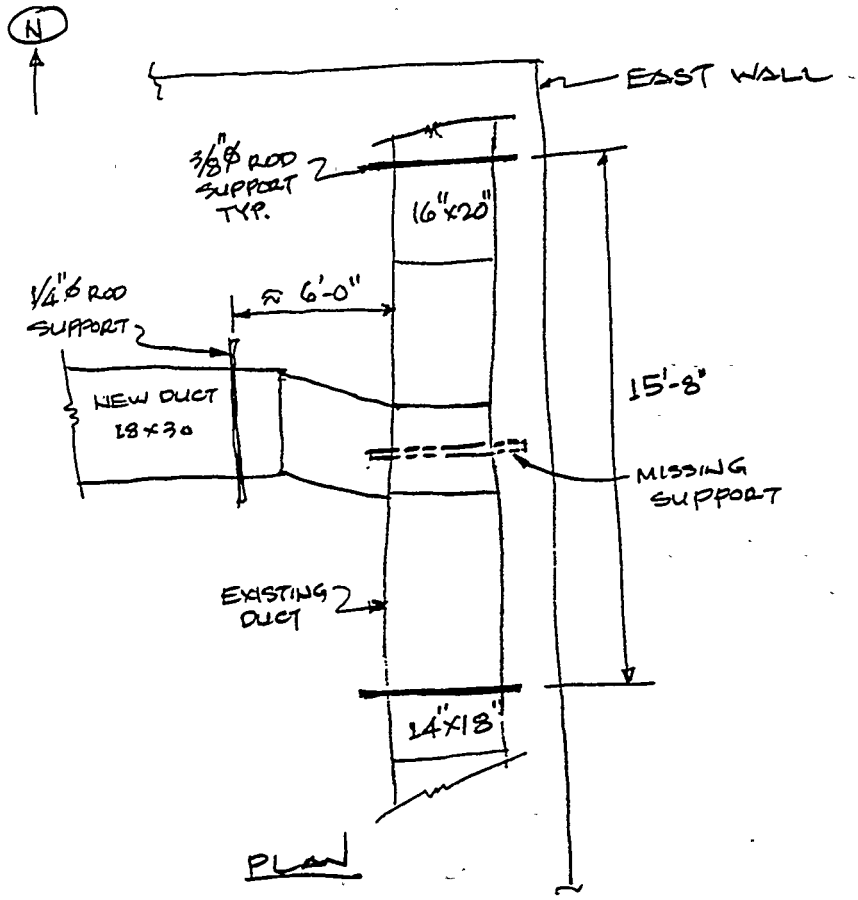
2) SEE PAGE F-37 FOR ANALYTICAL EVALUATION.

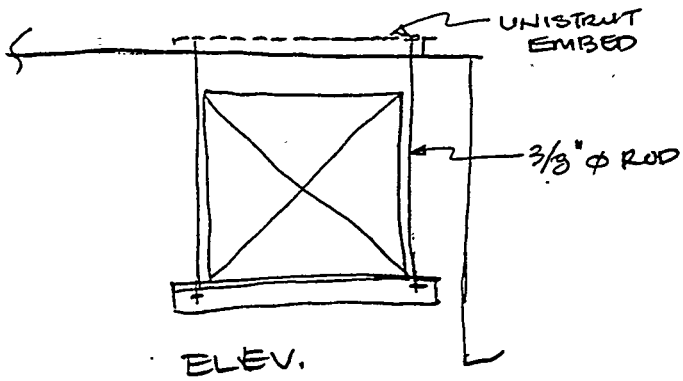
Team Leader/Date E. C. Ocoma / 3/30/95
Team Member/Date R. A. Miller / 3-30-95
Team Member/Date _____ / _____

8. CONTINUATION SHEET

Facility PFP Building 2736-Z Room 3 Floor Elevation _____ ft.

Continuation of: PFP-2736Z-3-H-001 Sheet 2 of 2





7. CANDIDATE IDENTIFICATION SHEET

Facility PFP Building 2736 Z Room 2 Floor Elevation @ GRADE ft.
Candidate Number: PFP-2736Z-2-MISC-001 Sheet 1 of 2

Description of candidate:

1) 55 GAL. DRUM WEIGHS 490# EACH. 6 PCS.

1) TWO-STACK HIGH DRUM WEIGHS ≈ 1000# EACH. 2 PCS.

NOTE: ON 5/1/95, PFP FACILITY REVEALED THAT THESE CONTAINERS ARE SAFETY CLASS 1. THEREFORE THESE WERE NOT IDENTIFIED IN THE WALKDOWN PROCEDURE AS SC 1 AND ALSO THE SEISMIC INTERACTION FOR SC 3 OVER SC 1 CRITERIA NO LONGER APPLIES. E.C. O'Connor 5/2/95

Location of candidate:

(4) DRUMS IN NE CORNER OF ROOM
(1) DRUMS ABOUT MIDDLE OF ROOM
(2) 2-STACK HIGH DRUMS ABOUT MIDDLE OF ROOM
SEE SKETCH NEXT PAGE

Reason(s) for selecting candidate:

CONTAINERS ARE IN CLOSE PROXIMITY TO THE 7" CAN AND LARD CAN RACKS. CONTAINERS ARE NOT RESTRAINED.

Comments:

~~RECOMMEND RELOCATING THE CONTAINERS OUT OF THE ROOM OR PROVIDE RESTRAINT.~~

SEE PAGE F-38 FOR SAFETY EVALUATION AND ACCEPTABILITY.

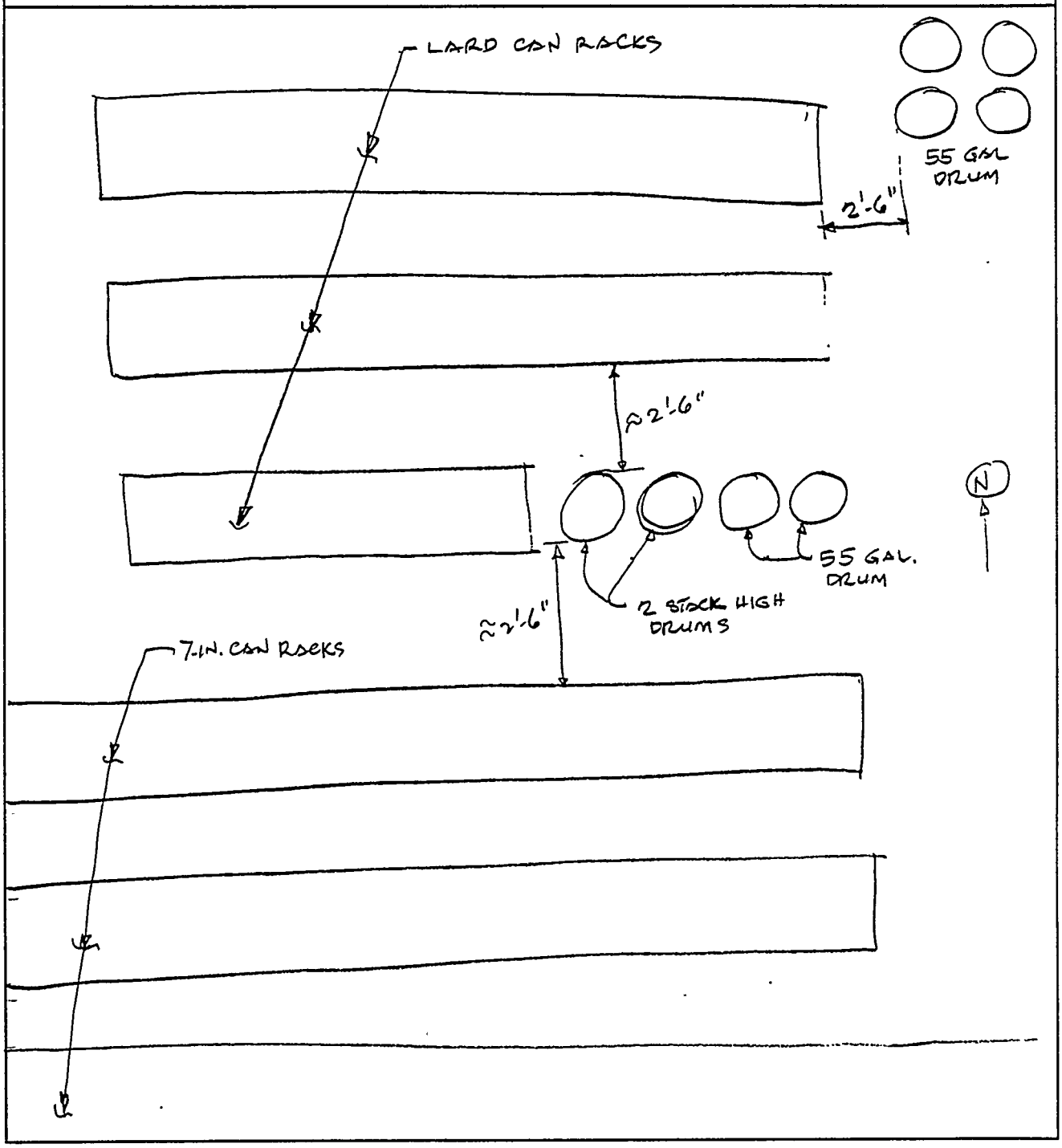
E. C. O'Connor
5/2/95

Team Leader/Date E.C. O'Connor / 3/30/95
Team Member/Date R. A. Miller / 3-30-95
Team Member/Date _____ / _____

8. CONTINUATION SHEET

Facility PFP Building 2736-Z Room 2 Floor Elevation _____ ft.

Continuation of: PFP-2736Z-2-MISC-001 Sheet 2 of 2



ANALYTICAL CALCULATIONS

Subject SCREENING CHART FOR HVAC SUPPORTS

Originator R A Hill Date 2-16-95

Checker E E. Ocon Date 3/21/95

Index:

Duct Weight
Hanger Capacities
Screening Checks
- Dead Load Check
- Vertical Capacity Check
- Ductility Check
- Lateral-Longitudinal Load Check
- Rod Hanger Fatigue Evaluation

Hanger Spacing Table

Reference Drawing:

H-2-26665 — Original HVAC Design

H-2-27952 & H-2-28077 — HVAC Modification Dated August & September 1977

H-2-70159 — HVAC Modification that conflicts with H-2-27952 & H-2-28077, dated April, 1976.

ANALYTICAL CALCULATIONS

Subject SCREENING CHART FOR HVAC SUPPORTS

Originator KA Gillis Date 2-16-95

Checker EC Ocorna Date 3/21/95

Duct Weight

Largest Size Duct:

18" x 30" (22 ga)

$$\text{Duct} = \frac{(18"+30")^2}{12} \times 1.25\,psf = 10\,\#/1$$

$$\text{Frames} = \frac{(21"+33")\frac{2}{12}(1.48\,\#/1)\ 2\ \text{frames}}{2.67'\ \text{spacing}} = \frac{10\,\#/1}{20\,\#/1}$$

$$\text{1- Set of 5 vanes} = \frac{(5" \times 30")(5\ \text{vanes})(1.25\,psf)}{144} = 6.5\,\#$$

$$\text{1- Damper 16 ga} \quad \frac{(18" \times 30")(2.5\,psf)}{144} = 9.4\,\#$$

Assume: 10# for 1 set of vanes
10# for each Damper

ANALYTICAL CALCULATIONS

Subject _____

Originator R.S. Hill Date 2-16-95

Checker G.C. O'Connor Date 3/21/95

Duct Weight Cont

use 22 ga for all other ducts : (1.25 psf)

use 2' spacing on all frames :

$$W = \frac{(\text{Outside circumference})\ \frac{1.48\ \#/_1}{12}}{2' \text{ spacing}} = C\,(.0617)$$

Duct Size	Duct Wt. $(W+H)\frac{2}{12}(1.25)$	Frame Wt. $(W+H+6")2(.0617)$
10 x 10	4 #/1	3 #/1
10 x 12	5 #/1	3 #/1
12 x 12	5 #/1	4 #/1
12 x 14	5 #/1	4 #/1
14 x 14	6 #/1	4 #/1
14 x 16	6 #/1	4 #/1
16 x 16	7 #/1	5 #/1
16 x 18	7 #/1	5 #/1
18 x 18	8 #/1	5 #/1
18 x 20	8 #/1	5 #/1

ANALYTICAL CALCULATIONS

Subject ____

Originator RA Hill Date 2-16-95

Checker GC O'Connor Date 3/21/95

Hanger Capacities

1/4" ϕ Thd Rod A36 steel (use Power Piping Catalog)

@ 650° & allowable stress = 9000 psi = 240#

@ 100° increase allowable 14% = 274#

1/4" ϕ Self-Drilling expansion anchor
McMaster Carr # 97051A029

From Seismic Design Guide
WHC-SD-GN-DGS-30006
and the attached page

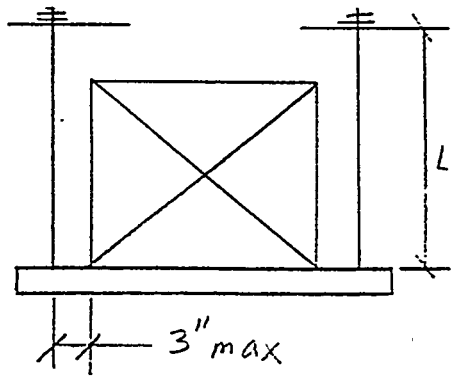
tension capacity = 270#/each

Δ 1 1/4" × 1 1/4" × 3/16 Trapeze

$$f_b = \frac{Pl}{S_b} = \frac{270^{\#}(3")}{.071\,si^3} = 11408\ psi$$

F_b allowable $= .6F_y = 21600 > 11408$

O.K.



ANALYTICAL CALCULATIONS

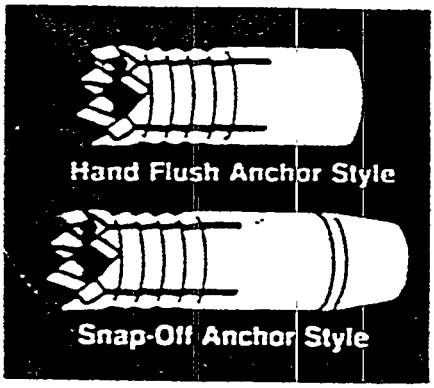
Subject _____

Originator R A Hinds Date 2-16-95

Checker S. C. Osborn Date 3/21/95

McMaster Carr Self-Drilling Expansion Anchors
Catalog # 97051A029 as shown below.

Self-Drilling Expansion Anchors



For all masonry, including granite. Consists of a self-drilling tubular steel expansion shield and a solid steel cone-shaped expander plug (not shown). The shield has internal bolt threads.

HAND FLUSH ANCHOR STYLE—Inserted with hammer and anchor hand holder shown at right.

SNAP-OFF ANCHOR STYLE—Inserted with power hammer and electric/air hammer chuck shown at right.

Bolt Size	Anchor OD	Hole Depth	Pkg. Qty.	No.	NET/100 Bkn. Pkg.	NET/100 Full Pkg.
HAND FLUSH ANCHOR						
1/4"	7/16"	1 1/4"	100	97051A029	$57.11	$45.45
5/16"	15/32"	1 7/32"	100	97051A030	71.59	56.98
3/8"	9/16"	1 7/16"	50	97051A031	84.96	67.62
1/2"	11/16"	1 15/16"	50	97051A033	128.23	102.06
5/8"	27/32"	2 3/8"	25	97051A035	223.47	177.86
3/4"	1"	3"	10	97051A036	396.28	315.40
SNAP-OFF ANCHOR						
1/4"	7/16"	1 1/8"	100	97052A029	$56.17	$44.71
5/16"	15/32"	1 9/32"	100	97052A030	75.33	59.96
3/8"	9/16"	1 17/32"	50	97052A031	83.65	66.58
1/2"	11/16"	2 1/32"	50	97052A033	124.86	99.38
5/8"	27/32"	2 15/32"	25	97052A035	234.03	186.27
3/4"	1"	3 1/4"	10	97052A036	393.85	313.47

Use Phillips 1/4" self-drilling anchors (known to be used at Hanford Site)

From the Seismic Design Guide WHC-SD-GN-DGS-30006, Table 4.3;

The allowable tension in 4000psi concrete is; 360#

In 3000psi concrete the allowable is; $\frac{3000}{4000} \times 360 = 270^{\#}$

This page intentionally left blank

This page intentionally left blank

ANALYTICAL CALCULATIONS

Subject _____

Originator RA Kitts Date 2-16-95

Checker EC Oconner Date 3/21/95

Dead Load Check

As-installed check: Some of the drawings have been as-built, but not all. Walkdown needed.

Connection Check: Assume rod Hanger resist all vertical loads.

Loading Check: Distributed and concentrated loads calculated.

Member Check:

Anchors are good for 270# each

1/4" Rods are good for 274# each

trapeze ∆ are good for more the 270# each.

Allowable load per support;

$270^{\#} \times 2 = 540^{\#}$

ANALYTICAL CALCULATIONS

Subject _____

Originator RA Gilla Date 2-16-95

Checker EC Ocoma Date 3/21/95

Vertical Capacity Check

3 x W must be less than the static load capacity of the supports. See supt spacing table.

Ductility Check

All supports are the ductile trapeze hanger type. Check rod fatigue only.

Lateral - Longitudinal Load Check

Not required for ductile hangers

ANALYTICAL CALCULATIONS

Subject _____

Originator RA Gilbert Date 2-16-95

Checker EC Ocorna Date 3/21/95

Rod Hanger Fatigue Evaluation

a) 5% damped spectra, see attached.

b) Check bounding curve, Figure D-6, APPENDIX F, PAGE D-13

Compare. spectra curve "a" to "b" @ .33g.
because "a" is envelops "b" proceed to d).

d) @ 540# & .33g check Figure D-1 (APPENDIX F) PAGE D-3
min. rod length is: - 8"

No Fatigue problem. because all hangers should be 10" or longer based on duct height.

ANALYTICAL CALCULATIONS

Subject ____

Originator R A Hiller Date 2-16-95

Checker E.C. Ocorr Date 3/21/95

Hanger Spacing Table

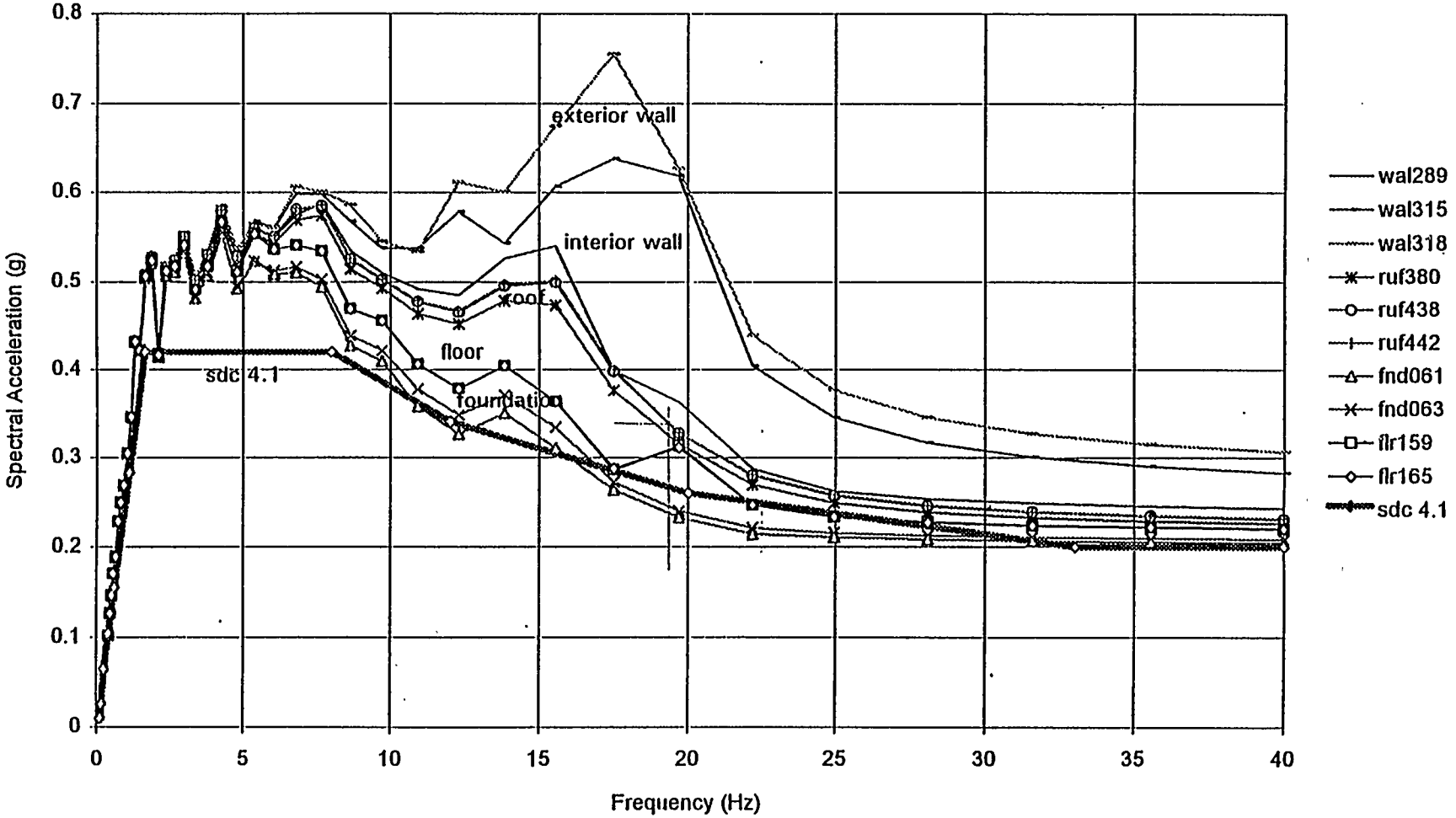
max hanger load = 540#

Duct Size	DW/Ft.	Hanger Spacing Duct only	Duct w/vanes	3×DW only	3×DW w/vanes
10 × 10	7#/1	77'	74'	25'	22'
10 × 12	8	67'	65'	22'	20'
12 × 12	9	60'	57'	20'	17'
12 × 14	9	60'	57'	20'	17'
14 × 14	10	54'	52'	18'	16'
14 × 16	10	54'	52'	18'	16'
16 × 16	12	45'	43'	15'	13'
16 × 18	12	45'	43'	15'	13'
18 × 18	13	41'	40'	13'	12'
18 × 20	13	41'	40'	13'	12'
18 × 30	20	27'	26'	9'	8'

assume (2 sets of vanes) = 20#

$f_c' = 3000 psi$

PLUTONIUM VAULT ACCELERATIONS
X HORIZONTAL 0.216 g, SDC 4.1 REV. 12, SEISMIC TIME HISTORY #1
ABSOLUTE SPECTRAL ACCELERATIONS AT NODAL PTS
0.050 DAMPING, MAX g = 0.755 AT FREQ. = 17.5 HZ
(1/26/95 CJM)



T-36

WHC-SD-CP-SD-006
REV. 1

(1) Drawing _____ (2) Doc. No. _____ (3) Page F-37 of _____

(4) Building _____ (5) Rev. _____ (6) Job No. _____

(7) Subject RESOLVE OUTLIER PFP-27362-3-H-001, (PAGE F-23)

(8) Originator _____ Date _____

(9) Checker E.E. Oconnor Date 3/31/95

(10) HANGER SPACING FOR 3/8"ϕ ROD AND EMBEDDED UNISTRUT

3/8"ϕ THREADED ROD:

MAX. RECOMMENDED LOAD @ 650°F = 610# (MIN. F.S=5)

UNISTRUT P3200 SERIES CONTINUOUS INSERTS ≥ 24" LONG

CAPACITY = 2000#/FT.

∴ ROD GOVERNS

HANGER CAPACITY = 610 x 2 RODS

= 1220#

FOR 16"x18" DUCT WITH 2 SETS OF VANES (20#)

$$\text{SPACING FOR 3xDW} = \frac{1220^{\#} - 3(20^{\#})}{12^{\#}/\text{FT} \times 3}$$

= 32 FT SPACING > 15'-8"

FOR 16"x20" DUCT WITH 2 SETS OF VANES (20#)

$$\text{SPACING FOR 3xDW} = \frac{1220^{\#} - 3(20^{\#})}{13^{\#}/\text{FT} \times 3}$$

= 29.7 FT SPACING > 15'-8" ∴ OK

Westinghouse Hanford Company — **Internal Memo**

From: PFP Facility Engineering
Phone: 373-3108
Date: May 2, 1995
Subject: Evaluation of Potential Impact of Unconstrained 55 Gallon Drums and Shipping Containers in Room 2, 2736-Z Building

15500-95-LTN-028

To: E. C. Ocoma H5-57

cc: C. M. Kronvall T5-53
L. H. Rodgers T5-54
File LTN/LB

Reference: DOE-STD-1021-92, "DOE Standard Natural Phenomena Hazards Performance Categorization Criteria for Structures, Systems and Components"

During the seismic qualification walkdown of 2736-Z Building that was started on March 30, 1995 unrestrained 55 gallon drums and 110 gallon size shipping containers in Room 2 of 2736-Z were identified as candidates for further evaluation. No impact analysis or other analytical evaluation was provided to demonstrate that these containers could knock over the 7 inch can or lard can storage racks in the room that have been seismically qualified.

The seismic interaction evaluation methodology described in the reference documents was used to evaluate this condition. Using this methodology, the unrestrained containers represent a source. The safety function; prevention of criticality, provided by the storage racks (both 7 inch can and lard can) is the target of significance.

The storage racks in Room 2, along with all storage arrays at PFP are classified as Safety Class 1 in Table 4.4.2 of the PFP FSAR because they serve an essential function in the prevention of criticality by virtue of the engineered spacing of stored containers they provide. The SC-1 designation is provided to assure that appropriate safety reviews are done on dimensional and other changes affecting the arrays so that their criticality prevention function is not negated. This evaluation considers the likelihood of the unrestrained containers negating the safety function of the storage racks (i.e. the occurrence of nuclear criticality). This evaluation considers three different conditions; relocation of the unrestrained containers to positions immediately adjacent to the storage racks, impact of the containers knocking over a lard can rack, and impact of the containers knocking over a 7 inch can rack.

Criticality Safety Evaluation Reports (CSERs) document the Effective Multiplication Factor of the numerous storage configurations used at PFP. Included in these reports are considerations of losing normally maintained spacing requirements. The nuclear reactivity of the unconstrained containers is such that no spacing between these containers is required because an infinite planar array of these containers at maximum loading with

some containers overloaded (a contingency evaluation) is well subcritical. Contingency evaluations of the storage racks consider losing the normally maintained spacing conditions of other containers, such as bringing 55 gallon drums loaded to the maximum permitted amount of plutonium next to the storage racks. These evaluations consider the containers in their upright position and all containers in the racks fully loaded with plutonium for maximum reactivity. Containers that might be on their side and roll against the racks are less reactive and are safer. The unconstrained containers are not stored in the aisle between the storage racks so these containers would have to slide or roll into the aisle for maximum influence on nuclear reactivity as considered in the CSERs. Most containers are loaded far less than the maximum considered thus the Effective Multiplication Factor would be even less than considered in the contingency analysis. The probability of criticality occurring from relocating the unconstrained containers next to the storage racks is highly unlikely if not incredible.

For the hypothetical case of the unconstrained container knocking over a lard can storage rack the reactivity of the lard cans needs to be considered. The criticality prevention specifications for lard can storage permit an infinite planar array of these containers stacked four high. The lard can racks provide for storage of the lard cans four high. Knocking over one or more racks would not result in an arrangement of higher reactivity than carefully stacking the lard cans four high as considered in the CSERs. Thus, knocking over a lard can rack does not result in criticality.

For the case of the unconstrained container knocking over a 7 inch can storage rack, it is envisioned that the locked steel mesh doors of the racks cannot be opened by the container impact and the rack would simply lean over. The spacing between 7 inch cans provided by the racks would not be negated. A potential increase in reactivity may occur if one rack fully leaned over onto a rack on the opposite side of an aisle, however, this increase is judged comparable to the contingency analysis of bringing fully loaded containers next to the storage racks. The actual storage conditions of most containers being far from the maximum allowed provides for additional margin. The likelihood of criticality occurring from a 7 inch can rack leaning over is highly unlikely if not incredible.

WHC-SD-CP-SA-026
REV. 1
PAGE F-10

15500-95-LTN-028

To summarize, the concern for unconstrained 55 and 110 gallon storage containers in Room 2 is not warranted since criticality occurring by relocation of these containers adjacent to either type storage rack or due to a rack being impacted and falling over is highly unlikely in of itself. Combined with the 10^{-4} annual likelihood of the Design Basis Earthquake, the occurrence of criticality from this cause is incredible.

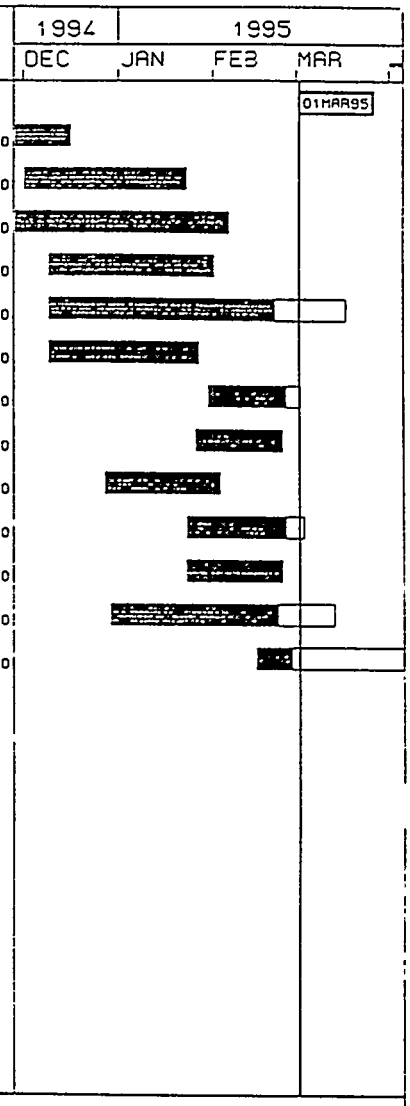
L. T. Nirider
PFP Criticality Safety Representative

Concurrence: _____
L. H. Rodgers, Deputy Manager
PFP Facility Engineering

kp

WESTINGHOUSE HANFORD COMPANY
PLUTONIUM FINISHING PLAN - PFP
2736-Z SEISMIC INVESTIGATION

ACT ID	DESCRIPTION	DUR	START / FINISH	REM DUR
1K60S8010A00	SOUTH CANYON WALL AND DOOR	15 D	11/28/94 12/16/94	0 D
1K60S8010A01	2736-Z IMPACTS	35 D	12/01/94 01/23/95	0 D
1K60S8010A03	REPACKAGING GLOVEBOX	41 D	11/28/94 02/08/95	0 D
1K60S8010A04	PREPARE BUILDING RESPONSE	36 D	12/09/94 02/01/95	0 D
1K60S8010A05	VAULT WALKDOWN PROCEDURE	63 D	12/09/94 03/09/95	12 D
1K60S8010A06	ANALYZE FLOOR CUBICLES	33 D	12/09/94 01/27/95	0 D
1K60S8010A07	ANALYZE WALL CUBICLES	18 D	01/30/95 02/22/95	1 D
1K60S8010A10	WALL CUBICLE PEDESTALS	20 D	01/26/95 02/28/95	0 D
1K60S8010A11	FLOOR CUBICLE PEDESTALS	21 D	12/27/94 02/03/95	0 D
1K60S8010A12	7 IN. CAN RACKS	29 D	01/23/95 02/17/95	2 D
1K60S8010A14	LARG CAN RACKS	23 D	01/23/95 02/17/95	0 D
1K60S8010A16	WELD INSPECTION (PFP ENG)	32 D	12/29/94 02/13/95	8 D
1K60S8010A18	2736-Z REPORT PREPARATION AND ISSUE	35 D	02/24/95 04/03/95	25 D



BAR TYPES

- OTHER
- TPA
- WHC-KEY Completed
- HQ Completed
- RL Completed
- OTHER Completed
- TPA Completed
- FO Completed
- M7 Completed
- Schedule Current
- Progress Percent Complete
- Milestone
- WHC-KEY
- HQ
- RL
- FO
- M7

HIGHLIGHTS

- NORMAL

Sort By: Activity_Name
Select By: Summary-2
Status Date: 01MAR95

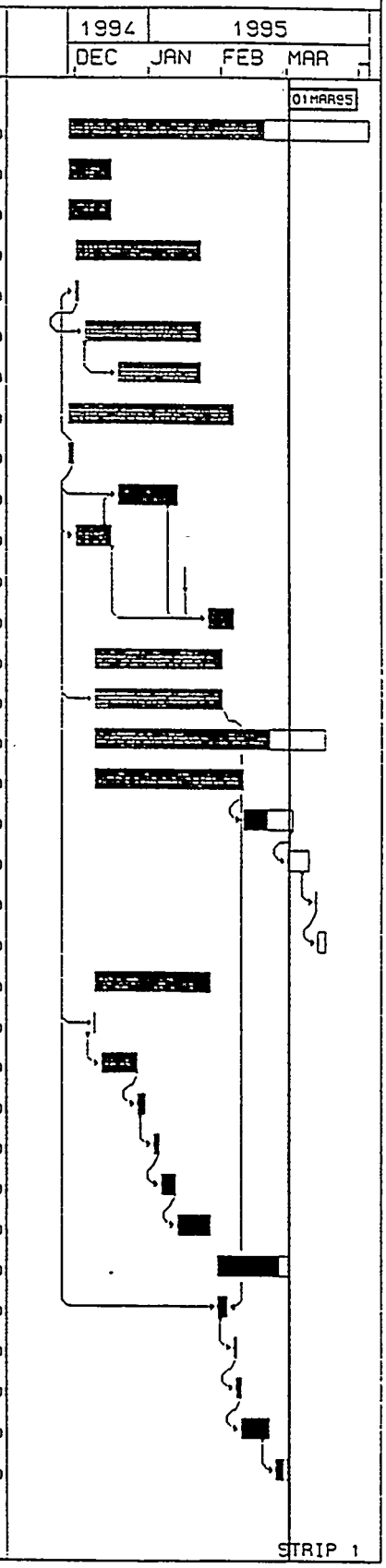
Date:	01MAR95
Start:	28NOV94
Finish:	05APR95

2736Z SEISMIC INVESTIGATION

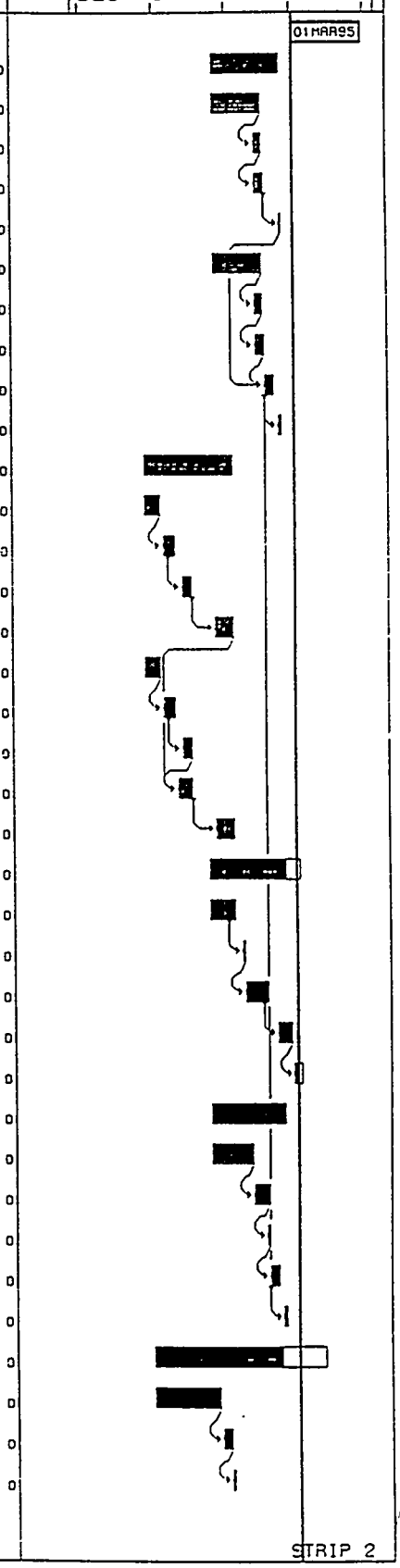
PFP LOGIC NETWORK

WESTINGHOUSE HANFORD COMPANY
PLUTONIUM FINISHING PLAN - PFP
2736-Z SEISMIC INVESTIGATION

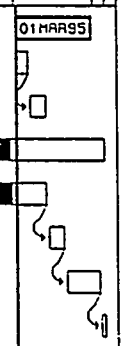
ACT ID	DESCRIPTION	DUR	START / FINISH	REM DUR
1K6058010A	2736-Z SEISMIC QUALIFICATION REPORT	89 D	11/28/94 04/03/95	25 D
1K6058010A00	SOUTH CANYON WALL AND DOOR	15 D	11/28/94 12/16/94	0 D
1K6058010A00A	Prepare report	15 D	11/28/94 12/16/94	0 D
1K6058010A01	2736-Z IMPACTS	35 D	12/01/94 01/23/95	0 D
1K6058010A01A	Complete & release IAEA security bar report	2 D	12/01/94 12/02/94	0 D
1K6058010A01D	Finalize 232-Z internal missle report	27 D	12/05/94 01/23/95	0 D
1K6058010A01G	Finalize 232-Z external missle report	21 D	12/19/94 01/23/95	0 D
1K6058010A03	REPACKAGING GLOVEBOX	41 D	11/28/94 02/08/95	0 D
1K6058010A03A	Prepare seismic analysis task description wrkpln	3 D	11/28/94 11/30/94	0 D
1K6058010A03D	Perform repackaging glovebox analysis	17 D	12/19/94 01/13/95	0 D
1K6058010A03G	Perform duct work analysis	12 D	12/01/94 12/16/94	0 D
1K6058010A03H	Perform duct work walkdown	1 D	01/16/95 01/16/95	0 D
1K6058010A03I	Check GB & duct work analysis	8 D	01/26/95 02/08/95	0 D
1K6058010A04	PREPARE BUILDING RESPONSE	36 D	12/09/94 02/01/95	0 D
1K6058010A04A	Prepare building respone	36 D	12/09/94 02/01/95	0 D
1K6058010A05	VAULT WALKDOWN PROCEDURE	63 D	12/09/94 03/09/95	12 D
1K6058010A05A	Prepare walkdown procedure	33 D	12/09/94 02/10/95	0 D
1K6058010A05D	Review/approve/issue procedure	10 D	02/10/95 02/24/95	2 D
1K6058010A05G	Perform walkdown	6 D	02/24/95 03/02/95	5 D
1K6058010A05H	Evaluate impact of walkdown	1 D	03/02/95 03/03/95	1 D
1K6058010A05J	Prepare final report	4 D	03/02/95 03/09/95	4 D
1K6058010A06	ANALYZE FLOOR CUBICLES	33 D	12/09/94 01/27/95	0 D
1K6058010A06A	Determine analysis method	1 D	12/09/94 12/09/94	0 D
1K6058010A06D	Model cubicle assembly	5 D	12/12/94 12/27/94	0 D
1K6058010A06G	Perform calculations	4 D	12/27/94 12/30/94	0 D
1K6058010A06J	Perform data reduction	3 D	01/03/95 01/05/95	0 D
1K6058010A06M	Prepare document	5 D	01/06/95 01/12/95	0 D
1K6058010A06N	Check floor cubicles	11 D	01/13/95 01/27/95	0 D
1K6058010A07	ANALYZE WALL CUBICLES	18 D	01/30/95 02/22/95	1 D
1K6058010A07A	Model cubicle assembly	5 D	01/30/95 02/03/95	0 D
1K6058010A07D	Perform calculations	2 D	02/06/95 02/07/95	0 D
1K6058010A07G	Perform data reduction	3 D	02/07/95 02/10/95	0 D
1K6058010A07J	Prepare document	5 D	02/10/95 02/17/95	0 D
1K6058010A07K	Check wall cubicles	2 D	02/17/95 02/22/95	1 D



ACT ID	DESCRIPTION	DUR	START / FINISH	REM DUR
1K6058010A10	WALL CUBICLE PEDESTALS	20 D	01/26/95 02/28/95	0 D
1K6058010A100A	Model assembly, bolted	7 D	01/26/95 02/03/95	0 D
1K6058010A100B	Analyze bolted configuration	4 D	02/06/95 02/13/95	0 D
1K6058010A100C	Perform data reduction	3 D	02/13/95 02/16/95	0 D
1K6058010A100D	Check analysis, bolted configuration	1 D	02/24/95 02/27/95	0 D
1K6058010A100E	Model assembly, welded	7 D	01/26/95 02/03/95	0 D
1K6058010A100G	Analyze welded configuration	4 D	02/06/95 02/13/95	0 D
1K6058010A100H	Perform data reduction	3 D	02/13/95 02/16/95	0 D
1K6058010A100M	Prepare document	2 D	02/17/95 02/24/95	0 D
1K6058010A100N	Check analysis, welded configuration	2 D	02/27/95 02/28/95	0 D
1K6058010A11	FLOOR CUBICLE PEDESTALS	21 D	12/27/94 02/03/95	0 D
1K6058010A110A	Model assembly, bolted	5 D	12/27/94 01/03/95	0 D
1K6058010A110B	Analyze bolted configuration	4 D	01/04/95 01/09/95	0 D
1K6058010A110C	Perform data reduction	3 D	01/12/95 01/16/95	0 D
1K6058010A110D	Check analysis, bolted configuration	7 D	01/26/95 02/03/95	0 D
1K6058010A110E	Model assembly, welded	5 D	12/27/94 01/03/95	0 D
1K6058010A110G	Analyze welded configuration	4 D	01/04/95 01/09/95	0 D
1K6058010A110H	Perform data reduction	3 D	01/12/95 01/16/95	0 D
1K6058010A110M	Prepare document	5 D	01/10/95 01/16/95	0 D
1K6058010A110N	Check analysis, welded configuration	7 D	01/26/95 02/03/95	0 D
1K6058010A12	7 IN. CAN RACKS	29 D	01/23/95 02/17/95	2 D
1K6058010A120A	Model assembly	10 D	01/23/95 02/03/95	0 D
1K6058010A120B	Perform calculations	2 D	02/06/95 02/07/95	0 D
1K6058010A120C	Perform data reduction	3 D	02/07/95 02/10/95	0 D
1K6058010A120H	Prepare document	4 D	02/10/95 02/15/95	0 D
1K6058010A120J	Check can rack analysis	4 D	02/15/95 02/17/95	2 D
1K6058010A14	LARD CAN RACKS	23 D	01/23/95 02/17/95	0 D
1K6058010A140A	Model assembly	15 D	01/23/95 02/03/95	0 D
1K6058010A140D	Perform calculations	2 D	02/06/95 02/07/95	0 D
1K6058010A140G	Perform data reduction	2 D	02/07/95 02/10/95	0 D
1K6058010A140J	Prepare document	2 D	02/10/95 02/15/95	0 D
1K6058010A140K	Check lard can rack analysis	2 D	02/15/95 02/17/95	0 D
1K6058010A16	WELD INSPECTION (PFP ENG)	32 D	12/29/94 02/13/95	9 D
1K6058010A160A	Develop sample plan	10 D	12/29/94 01/26/95	0 D
1K6058010A160D	Prepare work package	3 D	01/27/95 01/31/95	0 D
1K6058010A160G	Approve work package	2 D	01/31/95 02/01/95	0 D



ACT ID	DESCRIPTION	DUR	START / FINISH	REM DUR
1K6058010A160J	Perform visual inspect of cubicle/pedestal	3 D	02/02/95 02/06/95	3 D
1K6058010A160M	Prepare report	5 D	02/06/95 02/13/95	5 D
1K6058010A18	2736-Z REPORT PREPARATION AND ISSUE	35 D	02/24/95 04/03/95	25 D
1K6058010A180A	Prepare 2736-Z seismic qualification report	18 D	02/24/95 03/10/95	8 D
1K6058010A180D	Review report	5 D	03/10/95 03/16/95	5 D
1K6058010A180G	Incorporate comments/approve/issue	10 D	03/16/95 03/30/95	10 D
1K6058010A180J	Transmit report to DOE-HQ	2 D	03/30/95 04/03/95	2 D



BAR TYPES

- OTHER
- TPA
- WHC-KEY Completed
- HQ Completed
- RL Completed
- OTHER Completed
- TPA Completed
- FO Completed
- M7 Completed
- Early CPM Current
- Progress Percent Complete
- Milestone
- WHC-KEY
- HQ
- RL
- FO
- M7

HIGHLIGHTS

- NORMAL

Sort By: Activity_Name
Select By: ACT
Status Date: 01MAR95

Date:	01MAR95
Start:	28NOV94
Finish:	05APR95

2736Z SEISMIC INVESTIGATION

STRIP 3

PFP LOGIC NETWORK

WHC-SD-CP-SA-026
REVISION 1
F-45

ENGINEERING ANALYSIS
WORK PLAN

TITLE: 2736-Z, -ZA, -ZB VENTILATION SEISMIC ANALYSIS

DATE: 04-07-94 Rev. 0
11-18-94 Rev. 1

ENGR. GP/
ORG. CODE: Struct. Margins Assess. / 8D440 CUSTOMER/ORGCODE: OPS/PFP /15000

PERFORMER/SIGNATURE: E. C. OCOMA /E.C. Ocoma 12/2/94 COG. ENGR./SIGNATURE: NA

MANAGER/SIGNATURE S. K. FARNWORTH /S K Farnworth 12/2/94 MANAGER/SIGNATURE: W. G. RUFF

IMPACT LEVEL/WORK PLAN NO: SQ/ WORK ORDER/TASK PKG: E23205 (FY94)/ K6058 (FY 95)

ESR NO./WORK PLAN NO.: CLASSIFIED/UNCLASSIFIED:

SCOPE OF WORK: Document the structural seismic evaluation of the Safety Class 3 components in the 2736-Z Plutonium Storage Complex using Safety Class 1 seismic loads used in related building qualification.

- Storage container systems (racks and cubicles) to demonstrate container integrity is not significantly impacted and criticality does not occur as a result of the DBE.
- Repackaging Glovebox to verify seismic adequacy from overturning and sliding during a DBE such that building filters/ventilation duct penetrations in the confinement shell need not be seismically qualified.
- 2736-ZA Ventilation operability following the DBE to provide cooling of 2736-Z vaults. Cooling function is provided by exhausting air via ductwork connection between 2736-Z and 2736-ZA. Backup power, exhaust fan, HEPA filters housing, and ducting survivability needs to be addressed.

The evaluation shall be based on the seismic requirements of SDC-4.1, rev.12 and UCRL 15910 for systems and components. See attached workplan for schedule and detailed listing of tasks.

SCHEDULE/MILESTONES/DUE DATE:
Cubicles, pedestals, & containers due date for analysis: 4/29/94; checking: 5/11/94
Glovebox due date: 4/15/94
Metal racks due date: 5/6/94
HVAC due date: 6/10/94

COST ESTIMATE:
38 wk X 40 hr X $62.70 = $95,304

DELIVERABLE: Supporting Document

REFERENCE INFORMATION:
VITRO calculations by E.A. Goakey and S.M. Vertner, 1980.
Rockwell Internal letter 65432-81-059, Structural Qualification of 2736-Z Support Facility

KEY WORDS:
2736-Z Support Facility, HVAC Evaluation

DOES THIS WORK PLAN QUALIFY AS A POSSIBLE
IF YES, PLEASE FORWARD A COPY TO COLETTE C

Post-it® Fax Note 7671	Date 12/5/94	# of pages ▶ 4
To WALLY RUFF	From ERNIE OCO	
Co./Dept. PFP	Co.	
Phone #	Phone # 376-0332	
Fax # 372-3481	Fax #	

Workplan Schedule for Seismic Evaluation of Equipment in 2736-Z, ZA, & ZB

WHC-SD-CP-SA-026 REV. 1 F-46

Building (1)	Z	ZA	ZB
	1	1.5	1
Discovery			
- Collect and review of documents, drawings, and SAR. Basis = SDC-4.1, rev 12 and UCRL 15910; 0.20g PGA and 5% damping.	.5	.5	.5
- Collect as-built data and in situ conditions	.5	1.0	.5
	6.5	13	4
Evaluate seismic adequacy/Review of			
- Cubicles	1.5		
- Pedestals against walls	1		
- Containers remain in holder cups (review)	.5		
- Pedestals free standing	1.5		
- Metal racks must stay up	2		1
- Glove box must stay up			3.0
Glove box support and anchorage			
Flanders filters anchorage			
- HVAC 2736-ZA Bldg.			
HEPA filter housing		2	
Review shake test			
Check anchorage (embedded plates and studs, snubbers, and snubber to frame conn.			
Supply duct to filter must stay up (if item below fails)		1.5	
Exhaust duct from fan to roof must stay up (if item above fails)		1.5	
Wall mounted control panels anchorage		1	
Exhaust duct between Z & ZA (diff. motion)		2	
Elect. conduits from diesel to fan motor including seismic interaction items		2	
Diesel gen. oper. after DBE		2.5	
Utilize vendor's dynamics analysis results for anchorage seismic demand			
Use applicable DOE SQUG/EPRI/GIP (liscensed under DOE/LLNL) methodology for seismic capacity determination			
Verify adequacy of embeds, snubbers, snubber to frame conn.			
Site/Facility specific SQUG implementation and walkdown procedures will not be generated for this application			
Fan & motor oper. after DBE		2.5	
Utilize vendor's dynamic analysis results for anchorage seismic demand			
Use applicable DOE SQUG/EPRI/GIP methodology for seismic capacity determination			
Verify fan and motor connection to base support			
Site/Facility specific SQUG implementation and walkdown procedures will not be generated for this single application			

DOES THIS WORK PLAN QUALIFY AS A POSSIBLE PRICE ITEM? [ ] YES [ ] NO
IF YES, PLEASE FORWARD A COPY TO COLETTE CASEY, H5-60

Documentation	WHC-SD-CP-SA-046 REVISION 1 F-47			15
- Prepare report				4
- Peer review				3
- Customer, safety, QA review (2)				2
- DOE review (2)				2
- Follow up interaction with PFP & DOE staff				2
- Finalize report and issue SD				2
Effort totals (2), man-weeks		18.5	14.5	5

Notes: (1) Three engineers assigned to complete tasks.
(2) Not included in effort totals.
(3) Rate: $42.95/hr + 46% overhead.

DOES THIS WORK PLAN QUALIFY AS A POSSIBLE PRICE ITEM? [ ] YES [ ] NO
IF YES, PLEASE FORWARD A COPY TO COLETTE CASEY, H5-60

REASON FOR REVISION 1: Re-evaluation of all equipment except those in building 2736-ZA using upgraded seismic criteria to resolve review comments on the Rev. 0 analysis report. WHC-SD-CP-SA-026 REVISION 1

SCOPE OF WORK: Document the structural re-evaluation of the equipment, except the HVAC components, to safety class 1 (SC 1) criteria. This change in safety classification from safety class 3 (using SC 1 seismic loads) to a full safety class 1 has generated additional tasks that were not addressed in the Rev. 0 workplan. The evaluation shall be based on the seismic requirements of SDC-4.1, rev. 12 and UCRL 15910. The walkdown evaluation for the potential seismic interaction items that are within the zone of influence of the SC 1 equipment may be performed using the SQUG/DOE/EPRI methodology. The equipment that are attached or supported from the building wall shall use the dynamic response of the building at the particular support location, unless justified, when determining the seismic demand. The tasks are as follows:

1. *Reanalyze from safety class 3/1 to SC 1 criteria to verify the anchorage adequacy to withstands DBE loads.*

   - *Cubicles (both floor and wall supported configurations)*

   - *Pedestals with IAEA security bar*
     - *Pedestals bolted to the cubicles*
     - *Pedestals welded to the cubicles*

   - *Metal racks supported by the wall and the floor*
     - *7-inch can storage racks*
     - *Lard can storage racks*

   - *Repackaging glovebox*

2. *Potential seismic interaction (SC3 over SC1) items. Generate seismic walkdown evaluation procedure and acceptance criteria for the interaction items that are within the seismic zone of influence of the*
   - *Repackaging glovebox*
   - *Cubicles ~~(except those that are empty)~~* & LWS
   - *Lard can racks*
   - *7-inch can racks*

   Use SQUG/DOE/EPRI methodology. Provide fixes if required.

3. *Safety class 1 existing anchor bolts and welds inspection. Generate inspection procedure.*
   Option: • If the analysis can show that the anchor bolt seismic demand for a particular equipment is less than the derated (no inspection) allowable capacity, inspection will be waived for that equipment.

4. *Design and recommend seismic upgrade fixes if required.*

5. *Final documentation of the evaluation via ECN to the Rev. 0 analysis report.*

SCHEDULE/DUE DATE: See schedule generated by PFP (Amber Allen) for these tasks.

COST ESTIMATE: (63 days/man)x(8 hrs.)x($60.64/hr)x(5.25man) = $160,453
G&A and CSP are not included in the estimate.

\2736wrk4.r2

END DATE 8-18-95