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Page 1 of 12

1. ECN **615960**

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2. ECN Category (mark one) Supplemental ☐ Direct Revision ☒ Change ECN ☐ Temporary ☐ Standby ☐ Supersedure ☐ Cancel/Void ☐	3. Originator's Name, Organization, MSIN, and Telephone No. EC Ocoma / Civil-Struc. Engr. H5-57 / 6-0332 <i>57200</i>	3a. USQ Required? ☐ Yes ☒ No	4. Date 4/26/95
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12. Description of Change Revision 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 ☒ 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].			
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7. Abstract <p>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.</p>		
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SEISMIC ANALYSES OF EQUIPMENT IN 2736-Z COMPLEX

200 W AREA

April 1995

Prepared & :	<u>M. A. Islam, Principal Engineer</u>	<u>5-2-95</u>
Checked by	<u>Civil/Structural Engineering</u>	Date
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	<u>TWRS Analytical Services</u>	Date
	<u>G. R. Wagenblast, Sr. Principal Engr.</u>	<u>5-2-95</u>
	<u>Civil/Structural Engineering</u>	Date
	<u>D. E. Barlow, Principal Engineer</u>	<u>5-2-95</u>
	<u>Equipment Stress Analysis</u>	Date
for	<u>E. C. Ocoma, Principal Engineer</u>	<u>5-2-95</u>
	<u>Equipment Stress Analysis</u>	Date
for	<u>E. C. Ocoma, Engineer</u>	<u>5-2-95</u>
	<u>Component Stress Analysis</u>	Date
Reviewed & :	<u>E. C. Ocoma, Principal Engineer</u>	<u>5-2-95</u>
Authored by	<u>Civil/Structural Engineering</u>	Date
Approved by:	<u>R. W. Szempruch, Staff Manager</u>	<u>5-2-95</u>
	<u>Plutonium Finishing Plant</u>	Date
Approved by:	<u>S. K. Farnworth, Dep. Manager</u>	<u>5-2-95</u>
	<u>Civil/Structural Engineering</u>	Date

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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 facility 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 contributory 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

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

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 contributory 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.	<u>Rooms 3 and 4</u>			
	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	
	<u>Room 1</u>			
	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.	<u>Rooms 3 and 4</u>			
	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	
	<u>Room 1</u>			
	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.	<u>Bolted, Room 1</u>			
	If HKB used	3.5	C-265	
	If unistrut used	3.18	C-266	
	<u>Welded, Rooms 3 and 4</u>			
	Channel welds	.20	C-282	
	Channel	>10	C-332	
f. Pedestals in Wall Mounted Cubicles 2736-Z Bldg.	<u>Bolted, Room 1</u>			
	If HKB used	.33	C-372	
	If Unistrut stud	.57	C-372	
	<u>Welded, Rooms 3 and 4</u>			
	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	<u>Exhaust Stack</u>			
	Duct stress	1.64	D7	
	Welded stud	1.32	D9	
	Embedded plate	1.5	D11	
	<u>HEPA Filter & Fan Base</u>			
	Bolts between snubber and frame	.24	D23	
	Embedded plate	.2	D24	
	<u>Diesel Engine</u>			
	Mounting bolt	.49	D38	
	Bolt between snubber and frame	.15	D40	
	Embedded plate	.25	D41	
	<u>Duct between Buildings 2736Z and 2736-ZA</u>			
	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 glovebox 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.

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DESIGN VERIFICATION METHOD

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

<u> x </u>	Independent Review
<u> </u>	Alternate Calculations
<u> </u>	Qualification Testing
<u> </u>	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

☒	☐	☐	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.

Reviewer Comments:

The analysis for the 1ard 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

Page 18 of

Subject INDEPENDENT REVIEW COMMENTS

Originator _____ Date _____

Checker E.C. Oconnor 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. = .68g

REVISION 1 ACCEL. = .33g

$$\text{NEW } V = 229 \left(1.33 \right) \left(\frac{.33}{.68} \right) \quad \text{ONLY 2/3 OF BOLTS ACTING}$$

$$= 148\#$$

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

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

7-IN CAN STORAGE RACK:

$$V_1 = 147\# , V_2 = 294\#$$

(B-6)

REV. 0 ACCEL. = .68g

(B-92)

REV. 1 ACCEL. = .36g

(B-92)

$$\text{NEW } V = \sqrt{(147)^2 + (294)^2} (1.33) \left(\frac{.36}{.68} \right) = 231\#$$

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

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

APPENDIX A
REPACKAGING GLOVEBOX EVALUATION

ANALYTICAL CALCULATIONS

REV ~~10~~ PAGEPage A-2 of Subject Glovebox 2736-ZB Bldg.Originator M. A. ISLAMDate 5/23/94Checker E. C. O'ConnorDate 6/7/94Objective

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., $F_y = 36 \text{ ksi}$

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

ANALYTICAL CALCULATIONS

REV 10 PAGE

Page A-3 of

Subject Glovebox, 2736-ZB Bldg.Originator M.A. ISLAMDate 5/23/94Checker E.C. DeonDate 6/7/94Discussion on Computer Runs used for the evaluation of the glovebox

There are five independent computer runs. Three comp. runs determined the stiffnesses of the glovebox 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

REV 1 PAGE

Page A-4 of

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

BD-6400-060.1 (07/93)

ANALYTICAL CALCULATIONS

REV 15 PAGE

Page A-6 of

Subject Glove Box, 2736-ZB Bldg.Originator M. A. ISLAMDate 2/18/94Checker E.C. O'ConnorDate 6/7/94ANALYSIS PLAN GLOVE BOX ELEVATION

ANALYTICAL CALCULATIONS

REV1# PAGE

Page A-7 of

Subject Glove Box, 2736-ZB Bldg.Originator M. A. ISLAMDate 2/18/94Checker E. C. O'ConnorDate 6/7/94Calculation of Weights of Glove Box
(Item nos. shown on Page A-6)

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

deduct open.:

$$\begin{aligned} \text{Window} &= 20.5 \times 12.5 \times 3 = 1275 \text{ in}^2 \\ \text{"} &= 10.5 \times 6.5 \times 3 \\ \text{"} &= \pi/4 \times 8^2 \times 6 \end{aligned} \quad \left. \begin{array}{l} \text{SST wall} \\ \text{cladding} \end{array} \right\} \quad \left. \begin{array}{l} \text{Lead} \end{array} \right\}$$

$$\frac{1797.1 \text{ in}^2}{1797.1} \left[\left(\frac{3}{16} + 0.635 \right) \times 283 + \frac{1}{4} \times 411 \right]$$

$$= 312.3 \text{ \#} \times 2 \text{ sides} = \underline{624.6 \text{ \#}}$$

② Bottom Wall $96 \times 32 \left[\left(\frac{3}{16} + 0.635 \right) \times 283 + \frac{1}{4} \times 411 \right]$

$$= 533.9 \text{ \#}$$

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

$$= 205.5 \text{ \#}$$

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

Top Wall 96×32

deduct opng.

$$\begin{aligned} \text{Window} &= 21.625 \times 6.5 \times 4 = 679.25 \text{ in}^2 \\ \text{"} &= 9 \times 6.5 \times 2 \\ \frac{2392.75 \times \frac{3}{16} \times 283}{2392.75 \times \frac{3}{16} \times 283} &= \underline{127.0} \end{aligned}$$

(Ignore cover stiff.)

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

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

$$\frac{976.3 \times 17378}{976.3 \times 17378} = \underline{169.7 \text{ \#}}$$

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

ANALYTICAL CALCULATIONS

WHC-SD-CP-SA-026

Page REV 1 of 8 PAGESubject Glove Box, 2736-ZB Bldg.Originator M. A. ISLAMDate 2/18/94Checker E. C. O'ConnorDate 6/7/94

⑤ & ⑥ Load in Hood

$$\begin{aligned}
 \text{Wall} &= 2(28+18) \times 28 \times 3/16 \\
 \text{Top \& Bot.} &= 2(28 \times 18) \times 3/16 \\
 \text{Tube} &= \frac{\pi}{4} \times 8^2 \times \frac{1}{8} \times (8+19+7) \\
 \text{Opng.} &= \frac{\pi}{4} (6^2 \times 2 + 8^2 \times 2) \times \frac{7}{16} \\
 &\quad (20.5 \times 12.5 + 2 \times 6.5 \times 21.5) \times \frac{1}{8} \\
 \Sigma &= (885.5 - 96.4) \times .283 = \underline{223.3}^{\#}
 \end{aligned}$$

⑦ Load out Hood

$$\begin{aligned}
 \text{Wall} &= 2 \left(\frac{18+14}{2} \right) \times 30 \times 3/16 \\
 \text{Top \& Bot.} &= (14+18) \times 36 \times 3/16 \\
 \text{Front} &= 36 \times 30 \times 3/16 \\
 \text{Opng.} &= 2 \times 6.5 \times 21.625 \times 3/16 \\
 &\quad 25.5 \times 31.5 \times 3/16 \\
 \Sigma &= (598.5 - 203.3) \times .283 = \underline{111.8}^{\#}
 \end{aligned}$$

⑧ Flander Assembly (14 gauge, $t = .0785''$)

Approximate Wt.:

$$\begin{aligned}
 \text{Flander } 15'' \phi &= \pi (15) (.0785) \times 19 \times .283 \\
 2'' \text{sch 40S pipe} &= 1' \times 3.65^{\#}/' \\
 \text{Flange} &= 2 \times 9^{\#} \\
 \text{'T's} &= 2^{\#} \\
 \text{Misc. pipe} &= 10^{\#} \\
 \Sigma &= \underline{53.5}^{\#}
 \end{aligned}$$

⑨ Flander Assembly (other end)

Same as in ⑧ except some additional pipe

Use $W = 55^{\#}$

Approx.

$$\begin{aligned}
 \text{⑩} \wedge \text{Leaded Glass in all openings } (1/2'' \times 160^{\#}/\text{CF} = 6.67^{\#}/\text{SF}) \\
 \Sigma &= [1275 + 679.25 + 291.2 + 100 + \left(\frac{96.4 + 203.3}{1875} \right)] \times \frac{6.67}{144} = \underline{182.7}^{\#} \\
 \Sigma \text{ thru 10} &= \underline{2,490}^{\#}
 \end{aligned}$$

ANALYTICAL CALCULATIONS

REV16 PAGE

Page A-9 of Subject Glove Box, 2736-ZB Bldg.Originator M. A. ISLAMDate 2/22/94Checker E.C. O'ConnorDate 4/7/94

⑪ Glove Box Support Frame

$$L3 \times 3 \times 3/8 \text{ Post} = 6 \times 29 \times 7.2 \times \frac{1}{12} = 104.4 \#$$

$$\text{" Horiz.} = 2(39+93) \times 7.2 / 12 = 158.4 \#$$

$$L2 \times 2 \times 3/8 \text{ brace} = 4 \times 4 \times 4.7 \times \frac{1}{12} = 75 \#$$

⑫ Load out Hood Support

$$L3 \times 3 \times 3/8 \text{ Post} = 2 \times 41.5 \times 7.2 / 12 = 50 \#$$

$$L2 \times 2 \times 3/8 \text{ Horiz.} = 2 \times 18 \times 4.7 / 12 = 14 \#$$

⑬ Load in Hood Support

$$L3 \times 3 \times 3/8 \text{ Post} = 4 \times 41.5 \times 7.2 / 12 = 100 \#$$

$$L4 \times 3 \times 3/8 \text{ Horiz.} = 2(26+24) \times 8.5 / 12 = 71 \#$$

$$\Sigma \text{ Support} = 572.8 \#$$

Approximate Location of C.G.

$$\Sigma \text{ Glove box Wt.} = 2,490 \#$$

$$\text{Add 5\% Misc.} = 125 \# \quad \left. \vphantom{\Sigma \text{ Glove box Wt.}} \right\} = 2,615 \#$$

$$\Sigma \text{ Support Wt.} = 572.8 \#$$

$$\bar{y} = \frac{2615 \times (40.5 + 21.3) + 572.8 \times 20.25}{2615 + 572.8}$$

$$= 54.3 \text{ in}$$

$$\Sigma W = 2615 + 572.8$$

$$= 3,188 \#$$

$$\approx 3,200 \#$$

ANALYTICAL CALCULATIONS

Page A-10 of REV 1 PAGESubject Glove Box, 2736-ZB Bldg.Originator M.A. ISLAMDate 2/22/94Checker E.C. OconnorDate 6/7/94AccelerationRefer to WHC-SD-GN-DGS-30006, Rev 1,
Table 2.5

$$A_H = .68 g$$

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

Overturning (Transverse direction)

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

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

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

overturning would occur if not anchored !

Forces (due to seismic)

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

$$\text{" " } F_{H2} = \text{" " } =$$

$$\text{Vertical Force, } F_{V1} = .45 \times 3200 = 1,440 \# \uparrow \downarrow$$

$$F_{V2} = 3200 \# \downarrow$$

ANALYTICAL CALCULATIONS

REV 1.3 PAGE

Page A-11 of

Subject Glovebox, 2736-ZB Bldg.Originator M. A. ISLAMDate 5/20/94Checker E.C. OconnorDate 6/7/94Reactions at Glovebox top from Filter Housing LongitudinalTransverseReactions @ A, B, C, D (Glovebox & Hood top)A (refer AUTOPIPE Run 2; File: HOODIN, Page A-59)

Support Pt. B02

$$F_x = 183^{\#}; F_y = 0; F_z = 140^{\#}; M_x = 4 \times 12 = 48^{\#-in}$$

B, C, D (refer AUTOPIPE Run 1; File: HOODOUT, Page A-50)

$$\text{For B (Pt. B04): } F_x = 6^{\#}; F_y = 2^{\#}; F_z = 21^{\#}; M_x = 4 \times 12 = 48^{\#-in}$$

$$\text{For C (Pt. C03): } F_x = 6^{\#}; F_y = 5^{\#}; F_z = 6^{\#}; M_x = 4 \times 12 = 48^{\#-in}$$

$$\text{For D (Pt. A09): } F_x = 334^{\#}; F_y = 0; F_z = 208^{\#}; M_x = 4 \times 12 = 48^{\#-in}$$

$M_z = 2 \times 12 = 24^{\#-in}$

Reactions computed above are all summed for seismic loads.

6400-080.1 (07/93)

ANALYTICAL CALCULATIONS

REV 10 PAGE

Page A-12 of

Subject Glovebox, 2736-ZB Bldg.Originator M. A. ISLAMDate 5/23/94Checker E.C. OconnorDate 6/7/94INITIAL ANALYSISTransverse

$$\begin{aligned}
 &\text{Tension @ base of post} \\
 &\quad \text{Glovebox} \quad \text{A,D} \quad \text{B,C} \quad \text{Mx @ A, thru D} \\
 &\quad \frac{2176 \times 54.3}{3 \times 36} + \frac{(140+208) \times 69.5 + (21+6) \times 72.5 + (48+48+48+48)}{3 \times 36} \\
 &= 1,338 \#
 \end{aligned}$$

$$\begin{aligned}
 \text{shear @ base of Post} &= \frac{2176}{12} + \frac{(140+208) + (21+6)}{12} \\
 &= 213 \#
 \end{aligned}$$

Longitudinal

$$\begin{aligned}
 &\text{Tension @ base of Post} \\
 &\quad \text{G} \quad \text{A,D} \quad \text{B,C} \\
 &\quad \frac{2176 \times 54.3}{2 \times 90} + \frac{(183+334) \times 69.5 + (6+6) \times 72.5}{2 \times 90} \\
 &= 861 \#
 \end{aligned}$$

$$\begin{aligned}
 \text{shear @ base of Post} &= \frac{2176}{12} + \frac{(183+334) + (6+6)}{12} \\
 &= 225 \#
 \end{aligned}$$

Vertical

$$\text{Tension @ base} = \frac{1440}{6} + \frac{(2+5)}{6} = 241 \#$$

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

$$* \text{ Net Tension, } T = 1338 + 861 \times .4 + 241 \times .4 - 267 \times .85 = 1,552 \#$$

$$* \text{ Net Shear, } V = \sqrt{213^2 + 225^2} = 310 \#$$

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

ANALYTICAL CALCULATIONS

REV18 PAGE

Page A-13 of

Subject Glove Box, 2736-ZBOriginator M. A. ISLAMDate 5/23/94Checker E.C. OdomDate 6/7/94Prying in Bolt Anchorage Check Prying actionFor 5/8" ϕ bolt & 1/2" thick PL

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

$$L = \sqrt{1.5^2 + 1.5^2} - 1.125 \approx 1."$$

$$\text{Tension Force, } F = 1,552 \# \therefore T = \frac{F(L+x)}{x} = \frac{1,552(1+1.125)}{1.125} = 2,932 \#$$

$$\text{shear} = 310 \#$$

Allowable Values for STAR EXPANSION anchorRefer to Guideline, WHC-SD-GN-DGS-30006, Rev 1
Table 4.3, Page 4-31

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

$$V_{all} = 2340 \times \left[\frac{3000}{10000} + 0.65 \right] = 2698 \#$$

$$\left. \begin{array}{l} 5/8 \phi \times 23/4 \text{ Emb.} \\ \text{proported for} \\ f_c = 3000 \text{ Psi} \end{array} \right\}$$

ANALYTICAL CALCULATIONS

REV 18 PAGE

Page A-14 of

Subject Glovetox, 2736-ZB Bldg.Originator M.A. ISLAMDate 5/23/94Checker E.C. OdomDate 4/7/94

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

$$I = \frac{2932}{1785} + \frac{310}{2698} = 1.76 > 1. \quad \text{N.G.}$$

Try Final Analysis with 12 anchors in TensionRefer results from Initial analysis

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

$$\text{Longitudinal Tension} = 861 \times \frac{90}{(90 + 15 \times 2 + 9)} = 601^{\#}$$

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

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

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

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

$$\therefore \text{Interaction, } I = \frac{1264}{1785} + \frac{310}{2698} = .82 < 1. \quad \text{OK}$$

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

ANALYTICAL CALCULATIONS

REV 10 PAGE
Page A-15 ofSubject Glove Box, 2736-ZBOriginator M. A. ISLAMDate 5/23/94Checker E.C. O'ConnorDate 6/7/94Stress in Base FlBase Fl Bending

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

$$\text{section modulus, } s = \frac{bt^2}{6} = \frac{2.12 \times .5^2}{6} = .0883 \text{ in}^3$$

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

$$\therefore \sigma_b = \frac{M}{s} = \frac{1264}{.0883} = 14,315 \text{ Psi} < 27,000 \text{ Psi}$$

OK

Check Support Post

$$V = 310 \text{ #}$$

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

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

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

< 200 OK

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

$$\therefore \text{Interaction, } I = \frac{581}{7840} + \frac{12,555}{.833 / 27,000}$$

$$I = .63 < 1.0 \quad \text{OK}$$

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

ANALYTICAL CALCULATIONS

REV 10 PAGE
Page A-16 ofSubject Glove Box, 2736-ZBOriginator M. A. ISLAMDate 5/23/94Checker E. C. OdomDate 6/7/94Weld betn. L3x3 & base PL

$$A_w = 2 \times 3 = 6 \text{ in}$$

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

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

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

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

Weld betn. L3x3 & L3x3

$$A_w = 2(1.5 + 3) = 9 \text{ in}$$

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

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

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

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

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

Connection betn. Glove box & Support Frame

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

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

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

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

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

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

ANALYTICAL CALCULATIONS

REV ~~10~~ ¹¹ PAGE
Page A-17 of

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

Filter Housing Support

Approximate wt. of Filter Housing Assembly $\approx 60^{\#}$

Accln. $A_H = .68 g$

$A_V = .45 g \therefore$ No uplift for Filter Housing

Total Downward load, $W = 1.45 \times 60 = 87^{\#}$. This load is small. Therefore, $1/4"$ ~~thick~~ and angle, bolt, stud are adequate.

Max. lateral load, $F_H = 60 \times .68 = 41^{\#}$ 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

ANALYTICAL CALCULATIONS

REV 1.0 PAGE
Page A-19 ofSubject Glove box, 2736-ZB Bldg.Originator M. A. ISLAMDate 3/22/94Checker E.C. OdomDate 6/7/94

ANSYS RUN 1

stiffness of Glovebox SupportANSYS MODEL

$$\Sigma W = 3200 \text{ \#}$$

Refer ANSYS Output @ Node 24

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

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

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

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

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

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

Per SDX-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

/com

/com

et,1,4

Input by: MAI 5/23/94 Chk by: E.C.O. 6/7/96

WHC-SD-CP-SA-026

/com

kan,0

mp,ex,1,29e6

mp,dens,1,.000734

mp,ex,2,29e6

mp,dens,2,.00000001

/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

r,2,1,36,.479,.479,2.728,2.728,,, .07

r,3,100,10000,1000,25,25,,,100

*L3x3x3/8

*L2x2x3/8

*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

f,24,fx,1

!write

- dead loads
- Unit load along X

REV18 PAGE

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fdele,24,fx
f,24,fy,1
lwrite
fdele,24,fy
f,24,fz,1
nlist,all
elist,all
lwrite
afwrite

* Unit load along Y

• Unit load along Z

WHC-SD-CP-SA-026

REV18 PAGE

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

XU =1
YU =1
ZU =1
DIST=52.676
XF =45
YF =27.15
ZF =-18

ANSYS-PC 4.4A1
MAR 22 1993
14:56:23
PREP7 ELEMENTS
ELEM NUM
TDIS
FORC

XU =1
YU =1
ZU =1
DIST=52.676
XF =45
YF =27.15
ZF =-18

Page A-24

WHC-SD-CP-SA-026

REV18 PAGE

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= 0.000000E+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	UX	UY	UZ	ROTX	ROTY	ROTZ
	24	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= 0.00000E+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	UX	UY	UZ	ROTX	ROTY	ROTZ
	24	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

ANALYTICAL CALCULATIONS

REV 1.0 PAGE
Page 1 of 26Subject Glove Box, 2736-ZB Bldg.Originator M. A. ISLAMDate 3/3/94Checker E. C. OdomDate 6/7/94Filter Housing Support Stiffness

ANSYS RUN 2

ANSYS MODELSection PropertiesElement 1 thru 36, $t = 3/16"$ SST

$$\text{mass density} = .283/386.4 = .000734$$

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

$$\text{mass density} = .283/386.4 = .000734$$

Element 45 - Rigid Link

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

ANALYTICAL CALCULATIONS

REV ~~10~~ PAGE

Page A-27 of

Subject Glove box, 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

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

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

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

$$R_{OTX} = \frac{1}{.9445E-5} = 1.1E5 \text{ \#-in/radian}$$

$$R_{OTY} = \frac{1}{.0003852} = 2596 \text{ \#-in/rad.}$$

$$R_{OTZ} = \frac{1}{.002116} = 473 \text{ \#-in/rad}$$

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
```

```
/com
```

```
/com
```

```
et,1,63
```

```
et,2,4
```

```
/com
```

```
kan,0
```

```
mp,ex,1,29e6
```

```
mp,dens,1,.000734
```

```
mp,ex,2,29e6
```

```
mp,dens,2,.000000001
```

```
/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
```

```
r,2,.25
```

```
r,3,100,10000,1000,25,25,,,100
```

```
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
```

```
f,60,fx,1
```

```
lwrite
```

```
fdele,60,fx
```

```
f,60,fy,1
```

```
lwrite
```

```
fdele,60,fy
```

```
f,60,fz,1
```

```
lwrite
```

```
Input by: MAI
```

```
chk by: E.C.O.
```

3/23/94

6/7/94

```
WHC-SD-CP-SA-026
```

```
REV10 PAGE
```

```
* plate  
* beam element
```

```
* glovebox top & filter housing support
```

```
* weightless
```

```
*Glovebox top  
*Filter Housing  
*Rigid link
```

```
* dead loads  
* Unit load along X
```

```
* Unit load along Y
```

```
* Unit load along Z
```

fdele,60,fz
f,60,mx,1
lwrite
fdele,60,mx
f,60,my,1
lwrite
fdele,60,my
f,60,mz,1
nlist,all
elist,all
lwrite
afwrite

- Unit moment about X
- * Unit moment about Y
- Unit moment about Z

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REV1 PAGE

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= 0.000000E+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= 0.000000E+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= 0.000000E+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= 0.000000E+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= 0.000000E+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

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NODAL STRESSES AND TEMPS. STORED FOR 44 ELEMENTS

REV16 PAGE

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= 0.000000E+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

REV 1.0 PAGE

Page A34 of

Subject Glovebox, 2736-ZB Bldg.Originator M.A. ISLAMDate 3/15/94Checker E.C. OconnorDate 6/7/94Hood stiffness ANSYS MODEL

Element ① thru ④, $t = 3/16''$ sst
 mass density = 1000734

stiffnesses (Refer ANSYS output for displacements @ Node 5)

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

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

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

ANSYS RUN FOR HOOD TOP STIFFNESS

Page A-35

```
/title,Hood Top Stiffness
/show,ega256
/view,1,1,1,1
/com
/com
/com
/com
/com
et,1,63
/com
kan,0
mp,ex,1,29e6
mp,dens,1,.000734
/com
n,1
n,2,,,14
n,3,,,28
ngen,3,3,1,3,1,9
r,1,.1875
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
f,5,fx,1
lwrite
fdele,5,fx
f,5,fy,1
lwrite
fdele,5,fy
f,5,fz,1
lwrite
fdele,5,fz
f,5,mx,1
lwrite
fdele,5,mx
f,5,my,1
lwrite
fdele,5,my
f,5,mz,1
nlist,all
elist,all
lwrite
afwrite
```

Filename: Hood

Input by: MATI 5/28/94

chk by: ECO 6/7/94

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REV10 PAGE

* plate

* Hood top

*Hood top

• dead loads
• Unit load along X

* Unit load along Y

• Unit load along Z

• Unit moment about X

• Unit moment about Y

• Unit moment about Z

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= 0.000000E+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= 0.000000E+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= 0.000000E+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= 0.000000E+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= 0.000000E+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= 0.000000E+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	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

ANALYTICAL CALCULATIONS

REV10 PAGE
Page A-40 ofSubject Glovebox, 2736-ZB Bldg.Originator M.A. ISLAMDate 3/10/94Checker G.C. OermaDate 6/7/94

AUTOPIPE RUN 1

INPUT FOR AUTOPIPE MODEL
LOAD OUT HOOD (FILE: HOODOUT)

ANALYTICAL CALCULATIONS

REV 1 of PAGE
Page A-4 ofSubject Glove box, 2736-ZB Bldg.Originator M. A. ISLAMDate 3/4/94Checker E. C. OdomDate 6/7/94Filter Housing @ Load Out Hood16 ga. sheet metal closure, $t = .0635$ "Housing dimensions, $60 \times 34 \times 50$ "Refer
H-2-80172
Sht 1 of 2

Wt. of Housing per LFT

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

$$= 36.3 \text{ \# / Ft}$$

Equivalent Pipe size, 14" sch 10, $w = 36.7 \text{ \# /}$

(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, $t = .125$ "

$$\text{Wt. per LFT} = \pi (10 - .125) \times .125 \times \frac{490}{144} = 13.2 \text{ \#}$$

Equivalent Pipe section, 8 sch 10s, $w = 13.4 \text{ \# /}$ 8" ϕ Pipe (Hood)Use $t = .125$ "

$$\text{Wt. per LFT} = \pi (8 - .125) \times .125 \times \frac{490}{144} = 10.5 \text{ \#}$$

Equivalent pipe section, 4 sch 40, $w = 10.79 \text{ \# /}$ 2" ϕ sch 40s (Glovebox)

Refer Dwg. H-2-80175, Sht 1 of 2

OK as identified

Date 6/7/94

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

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REV10 PAGE

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

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 MODEL PAGE 2

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REV1 PAGE

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

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 MODEL PAGE 3

COMPONENT DATA LISTING

WHC-SD-CP-SA-026

REV 1 PAGE

POINT NAME	---COORDINATE(ft)---			DATA TYPE	DESCRIPTION
	X	Y	Z		
*** 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
From Page A-34 →					
*** 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 Thermal movements : None
From Page A-27 →					
*** 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-27 →					

From Page A-34

From Page A-27

From Page A-27

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 MODEL PAGE 4

Page A-46

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

WHC-SD-CP-SA-026

REV1, PAGE

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

Number of points in the system : 25

PIPE DATA LISTING

WHC-SU-CP-SA-026
 REV1 PAGE

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

WHC-SD-CP-SA-6

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

REV1 PAGE

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

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 MODEL PAGE 7

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REV 1 PAGE

TEMPERATURE AND PRESSURE DATA

POINT NAME	CASE 1			CASE 2			CASE 3		
	PRESS. psi	TEMPER deg F	EXPAN. in/100ft	PRESS. psi	TEMPER deg F	EXPAN. in/100ft	PRESS. psi	TEMPER deg F	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

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RESTRAINT REACTIONS

REV 1. PAGE

Point name	Load combination	FORCES (lb)				MOMENTS (ft-lb)			
		X	Y	Z	Result	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

AUTOPIPE RUN 2

ANALYTICAL CALCULATIONS

REV 1 PAGE

Page A-52 of --

Subject Glove box, 2736-ZB Bldg.Originator M.A. ISLAMDate 3/15/94Checker E. E. OermeierDate 6/7/94AUTOPIPE FILE : HOODIN PIPING ISOMETRIC

* Equivalent piping based on mass

HOODIN PIPE AND DUCT REACTIONS TO GLOVEBOX IN WESTINGHOUSE/BOEING CO
 04/08/94 2736-ZB BUILDING, 200 W AREA AutoPIPE+4.50 MODEL PAGE 2

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REV 1 PAGE

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

POINT NAME	TYPE	-----OFFSETS (ft)-----			PIPE ID	DESCRIPTION
		X	Y	Z		
*** 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

HOODIN PIPE AND DUCT REACTIONS TO GLOVEBOX IN WESTINGHOUSE/BOEING CO
 04/08/94 2736-ZB BUILDING, 200 W AREA AutoPIPE+4.50 MODEL PAGE 3

WHC-SD-CP-SA-026

REV 1 PAGE

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

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

HOODIN PIPE AND DUCT REACTIONS TO GLOVEBOX IN WESTINGHOUSE/BOEING CO
04/08/94 2736-ZB BUILDING, 200 W AREA AutoPIPE+4.50 MODEL PAGE 4

WHC-SD-CP-SA-026

PIPE DATA LISTING

REV 1 PAGE

Pipe ID/ Material	Nom/ Sch	O.D. inch	-----Thickness(inch)-----				Spec Grav	Weight(lb/ft)		
			W.Th.	Corr	Mill	Insu	Ling	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

HOODIN PIPE AND DUCT REACTIONS TO GLOVEBOX IN WESTINGHOUSE/BOEING CO
 04/08/94 2736-ZB BUILDING, 200 W AREA AutoPIPE+4.50 MODEL PAGE 5

WHC-SD-CP-SA-026

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

REV 1 PAGE

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

HOODIN PIPE AND DUCT REACTIONS TO GLOVEBOX IN WESTINGHOUSE/BOEING CO
04/08/94 2736-ZB BUILDING, 200 W AREA AutoPIPE+4.50 MODEL PAGE 6

WHC-SD-CP-SA-026

REV 1 PAGE

TEMPERATURE AND PRESSURE DATA

-----C A S E 1-----				-----C A S E 2-----				-----C A S E 3-----			
POINT	PRESS.	TEMPER	EXPAN.	PRESS.	TEMPER	EXPAN.	PRESS.	TEMPER	EXPAN.		
NAME	psi	deg F	in/100ft	psi	deg F	in/100ft	psi	deg F	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

HOODIN PIPE AND DUCT REACTIONS TO GLOVEBOX IN WESTINGHOUSE/BOEING CO
 04/08/94 2736-ZB BUILDING, 200 W AREA AutoPIPE+4.50 RESULT PAGE 7

WHC-SD-CP-SA-026

RESTRAINT REACTIONS

REV 1 PAGE

Point name	Load combination	FORCES (lb)				MOMENTS (ft-lb)			
		X	Y	Z	Result	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 E.C. Deom 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, WHC 1994)

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

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

$$K_z = \frac{1}{.6766E-4} = 1.48E4 \text{ " } \Rightarrow f_z = 6.7 \text{ "}$$

Based on $f_z = 6.7 \text{ Hz}$, 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.

WHC-SD-CP-SA-026

REV ~~01~~ PAGE A-62

/prep7
/title,Glovebox Support Stiffness
/show,ega256
/view,1,1,1,1

Filename: support

/com

/com

/com

/com

/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
lwrite
fdele,24,fy
f,24,fz,1
nlist,all
elist,all
lwrite
afwrite

• Unit load along Y

* Unit load along Z

SUPPORT.RES Wed Sep 14 10:51:56 1994 1

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REV ~~001~~ PAGE A-64

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

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

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

LOAD STEP 1 ITERATION= 1 SECTION= 1
TIME= .000000E+00 LOAD CASE= 1

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

NODE	UX	UY	UZ	ROTX	0	ROTY	ROTZ
24	26479926E-05	.33411861E-08	.33705749E-08	.915405C	0	.12777508E-08	-.13852414E-08

SUPPORT.RES

Wed Sep 14 10:51:56 1994

2

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REV ~~001~~ PAGE A-65

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

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Glovebox Support Stiffness

10.7283 SEP 14,1994 CP= .260

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

LOAD STEP 2 ITERATION= 1 SECTION= 1
TIME= .000000E+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

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REV ~~001~~ PAGE A-66

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

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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

Subject Glovebox, 2736-ZB Bldg.Originator M. A. ISLAMDate 12/19/94Checker E. C. OerinaDate 2/5/95Results 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)

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

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

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

The above stiffnesses have been input in AUTOPIPE analysis.

```

/prep7
/title,Filter Housing Support Stiffness
/show,ega256
/view,1,1,1,1

```

Filename: Glove

```

/com
/com
/com
/com
/com
/com

```

Input by: MAIchk by: Eco

```

et,1,63
et,2,4

```

- plate
- beam element

```

/com
kan,0

```

```

mp,ex,1,29e6
mp,dens,1,.000734
mp,ex,2,29e6
mp,dens,2,.000898
mp,ex,3,29e6
mp,dens,3,.000000001

```

- filter housing support
- glovebox top
- 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

```

```

r,2,.25

```

```

r,3,100,10000,1000,25,25,,,100

```

- *Glovebox top
- *Filter Housing
- *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
lwrite
fdele,60,fz
f,60,mx,1
lwrite
fdele,60,mx
f,60,my,1
lwrite
fdele,60,my
f,60,mz,1
nlist,all
elist,all
lwrite
afwrite

- Unit load along Z
- Unit moment about X
- Unit moment about Y
- Unit moment about Z

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

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F' UPPORT CALL BRAD COVERDELL PHONE (509) 376-1921 T

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GLOVE.RES

Wed Sep 14 14:55:14 1994

2

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

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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

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GLOVE.RES

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3

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REV 011 PAGE A-72

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

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Filter Housing Support Stiffness

14.7858 SEP 14,1994 CP= .370

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

LOAD STEP 3 ITERATION= 1 SECTION= 1

TIME= .000000E+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	.59284808E-08	-.90487086E-19

GLOVE.RES Wed Sep 14 14:55:14 1994 4

MAXIMUMS	60	60	60	60	60	60
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

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Filter Housing Support Stiffness

14.7858 SEP 14, 1994 CP= .400

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

LOAD STEP 4 ITERATION= 1 SECTION= 1

TIME= .000000E+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

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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

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Filter Housing Support Stiffness

14.7858 SEP 14,1994 CP= .420

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

LOAD STEP 5 ITERATION= 1 SECTION= 1

TIME= .000000E+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' TORED FOR 4 SELECTED ITEMS

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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

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Filter Housing Support Stiffness

14.7858 SEP 14,1994 CP= .450

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

LOAD STEP 6 ITERATION= 1 SECTION= 1
TIME= .000000E+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

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ANALYTICAL CALCULATIONS

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Page _____ of _____

Subject Glovebox, 2736-ZB Bldg.
 Originator M.A. ISLAM Date 12/19/94
 Checker E.C. Odom Date 2/5/95

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)

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

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

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

The above stiffnesses have been input in AUTOPIPE analysis.

```

/prep7
/title,Hood Top Stiffness
/show,ega256
/view,1,1,1,1
/com
/com
/com
/com
/com
/com
et,1,63
/com
kan,0
mp,ex,1,29e6
mp,dens,1,.000734
/com
n,1
n,2,14
n,3,28
ngen,3,3,1,3,1,,, -9
r,1,.1875
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
lwrite
fdele,5,fx
f,5,fy,1
lwrite
fdele,5,fy
f,5,fz,1
lwrite
fdele,5,fz
f,5,mx,1
lwrite
fdele,5,mx
f,5,my,1
lwrite
fdele,5,my
f,5,mz,1
nlist,all
elist,all
lwrite
afwrite

```

Filename: Hood

Input by: MAI

Chk by: EW

* plate

* Hood top

*Hood top

* Unit load along X

* Unit load along Y

* Unit load along Z

* Unit moment about X

* Unit moment about Y

* Unit moment about Z

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.

HOOD.RES

Thu Sep 29 10:37:37 1994

1

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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

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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

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HOOD.RES

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2

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

****OUTPUT SWITCHED FROM FILE06 TO FILE39 NAME=HOOD.RES
Ran ANSYS 4.4A on HP: hpl, 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

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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

NSKL FOR LABEL= NODE FROM 5 TO 5 BY 1

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

PRINT NODAL DISPLACEMENTS

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Hood Top Stiffness

8.6467 SEP 29,1994 CP= .270

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

LOAD STEP 3 ITERATION= 1 SECTION= 1
TIME= .000000E+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

HOOD.RES

Thu Sep 29 10:37:37 1994

3

REACTIONS STORED FOR 24 REACTIONS

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

NSKL FOR LABEL= NODE FROM 5 TO 5 BY 1

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

PRINT NODAL DISPLACEMENTS

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Hood Top Stiffness

8.6467 SEP 29, 1994 CP= .280

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

LOAD STEP 4 ITERATION= 1 SECTION= 1
TIME= .000000E+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

NSKL FOR LABEL= NODE FROM 5 TO 5 BY 1

1 YES (OF 9 DEFINED) SELECTED BY NSKL COMMAND.

PRINT NO. 1 DISPLACEMENTS

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4

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Hood Top Stiffness

8.6467 SEP 29,1994 CP= .290

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

LOAD STEP 5 ITERATION= 1 SECTION= 1
TIME= .000000E+00 LOAD CASE= 5

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

NODE	UX	UY	UZ	ROTX	ROTY	ROTZ
5	.000000000E+00	.000000000E+00	.000000000E+00	.000000000E+00	1.8245256	.000000000E+00

MAXIMUMS						
NODE	0	0	0	0	5	0
VALUE	.000000000E+00	.000000000E+00	.000000000E+00	.000000000E+00	1.8245256	.000000000E+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

NSSEL FOR LABEL= NODE FROM 5 TO 5 BY 1

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

PRINT NODAL DISPLACEMENTS

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Hood Top Stiffness

8.6467 SEP 29,1994 CP= .300

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

LOAD STEP 6 ITERATION= 1 SECTION= 1
TIME= .000000E+00 LOAD CASE= 6

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HOOD.RES

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5

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

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HOOD.RES

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4

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Hood Top Stiffness

15.6850 SEP 29,1994 CP= .300

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

LOAD STEP 5 ITERATION= 1 SECTION= 1
TIME= .000000E+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

NSSEL FOR LABEL= NODE FROM 5 TO 5 BY 1

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

PRINT NODAL DISPLACEMENTS

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Hood Top Stiffness

15.6850 SEP 29,1994 CP= .310

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

LOAD STEP 6 ITERATION= 1 SECTION= 1
TIME= .000000E+00 LOAD CASE= 6

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HOOD.RES

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5

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= fil07.dat
FOR POSSIBLE RESUME FROM THIS POINT

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

***** END OF INPUT ENCOUNTERED ON FILE18

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

WHC-SD-CP-SA-026

REV ~~001~~ PAGE A-84

HOODIN PIPE AND DUCT REACTIONS TO GLOVEBOX IN
02/07/95 2736-ZB BUILDING, 200 W AREA

AutoPIPE+4.50 MODEL PAGE 1

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REV ~~001~~ PAGE A-85

** 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 :

PIPING CODE : B31.3

AMBIENT TEMP. (deg F) : 70.0

COMPONENT LIBRARY : AUTOPIPE

MATERIAL LIBRARY : AUTOB313

MODEL REVISION NUMBER : 7

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

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POINT NAME	TYPE	-----OFFSETS (ft)-----			PIPE ID	DESCRIPTION
		X	Y	Z		
*** 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

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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	3.00	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

HOODIN PIPE AND DUCT REACTIONS TO GLOVEBOX IN
12/07/95 2736-ZB BUILDING, 200 W AREA

AutoPIPE+4.50 MODEL PAGE 4

C08 9.26 -9.22 -5.50

WHC-SD-CP-SA-026

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

REV ~~1-01~~ PAGE A-88

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

Number of points in the system : 26

HOODIN PIPE AND DUCT REACTIONS TO GLOVEBOX IN
02/07/95 2736-ZB BUILDING, 200 W AREA

AutoPIPE+4.50 MODEL PAGE 5

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PIPE DATA LISTING

REV ~~10A~~ PAGE A-89

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

HOODIN PIPE AND DUCT REACTIONS TO GLOVEBOX IN
02/07/95 2736-ZB BUILDING, 200 W AREA

AutoPIPE+4.50 MODEL PAGE 6

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

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REV4 ~~04~~ PAGE A-90

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

HOODIN PIPE AND DUCT REACTIONS TO GLOVEBOX IN
02/07/95 2736-ZB BUILDING, 200 W AREA

AutoPIPE+4.50 MODEL PAGE 7

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REV ~~104~~ PAGE A-91

TEMPERATURE AND PRESSURE DATA

	-----C A S E 1-----			-----C A S E 2-----			-----C A S E 3-----		
POINT	PRESS.	TEMPER	EXPAN.	PRESS.	TEMPER	EXPAN.	PRESS.	TEMPER	EXPAN.
NAME	psi	deg F	in/100ft	psi	deg F	in/100ft	psi	deg F	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

HOODIN PIPE AND DUCT REACTIONS TO GLOVEBOX IN
02/07/95 2736-ZB BUILDING, 200 W AREA

AutoPIPE+4.50 RESULT PAGE 1

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REV ~~10~~ PAGE A-92

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	

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REV10 PAGE A-93

CODE COMPLIANCE COMBINATIONS

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

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 Earth 2 Earth 3	1.00 1.00 1.00	User
TOTAL	Abs sum	Gravity SEIS	1.00 1.00	User

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

HOODIN PIPE AND DUCT REACTIONS TO GLOVEBOX IN
02/07/95 2736-ZB BUILDING, 200 W AREA

AutoPIPE+4.50 RESULT PAGE 3

*** NOTE ***

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REV ~~4~~ ~~0~~ PAGE A-94

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

WHC-SD-CP-SA-026

REV ~~1.0~~ PAGE A-95

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

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REV ~~10~~ PAGE A-96

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

Point name	Load combination	TRANSLATIONS (in)			ROTATIONS (deg)		
		X	Y	Z	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 ***

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

Point name	Load combination	TRANSLATIONS (in)			ROTATIONS (deg)		
		X	Y	Z	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

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REV 4.5.1 PAGE A-98

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

Point name	Load combination	TRANSLATIONS (in)			ROTATIONS (deg)		
		X	Y	Z	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

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

Point name	Load combination	TRANSLATIONS (in)			ROTATIONS (deg)		
		X	Y	Z	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 ***

REV ~~1-9~~ PAGE A-100

REV ~~10~~ PAGE A-100

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

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RESTRAINT REACTIONS

Point name	Load combination	FORCES (lb)				MOMENTS (ft-lb)			
		X	Y	Z	Result	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

GLOBAL FORCES & MOMENTS

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Point name	Load combination	FORCES (lb)				MOMENTS (ft-lb)			
		X	Y	Z	Result	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

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GLOBAL FORCES & MOMENTS

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

*** Segment B end ***

GLOBAL FORCES & MOMENTS

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Point name	Load combination	FORCES (lb)				MOMENTS (ft-lb)			
		X	Y	Z	Result	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

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Point name	Load combination	FORCES (lb)				MOMENTS (ft-lb)			
		X	Y	Z	Result	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

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GLOBAL FORCES & MOMENTS

Point name	Load combination	FORCES (lb)				MOMENTS (ft-lb)			
		X	Y	Z	Result	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 ***

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Point name	Load combination	(Moments in ft-lb)			(Stress in psi)					
		In-Pl. Moment	Out-Pl. Moment	Torsion Moment	S.I.F		Eq. Load no. type	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	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

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ASME B31.3c (1992) CODE COMPLIANCE

Point name	Load combination	(Moments in ft-lb)			S.I.F		Eq. Load no. type	(Stress in psi)	
		In-Pl. Moment	Out-Pl. Moment	Torsion Moment	In	Out		Code Stress	Code Allow.

*** 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

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REV ~~20~~ PAGE A-110

		ASME B31.3c (1992) CODE COMPLIANCE								
		(Moments in ft-lb)					(Stress in psi)			
Point name	Load combination	In-Pl. Moment	Out-Pl. Moment	Torsion Moment	S.I.F In	S.I.F Out	Eq. Load no.	Load type	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
J03	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

HOODIN PIPE AND DUCT REACTIONS TO GLOVEBOX IN
02/07/95 2736-ZB BUILDING, 200 W AREA

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Sus. + E3		219	26	1.00	1.00	(18)	OCC	242	22267
ASME B31.3c (1992) CODE COMPLIANCE									
		(Moments in ft-lb)			(Stress in psi)				
Point name	Load combination	In-Pl. Moment	Out-Pl. Moment	Torsion Moment	S.I.F In	S.I.F Out	Eq. Load no. type	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

HOODIN PIPE AND DUCT REACTIONS TO GLOVEBOX IN
02/07/95 2736-ZB BUILDING, 200 W AREA

AutoPIPE+4.50 RESULT PAGE 21

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ASME B31.3c (1992) CODE COMPLIANCE

Point name	Load combination	(Moments in ft-lb)			(Stress in psi)			Code Stress	Code Allow.
		In-Pl. Moment	Out-Pl. Moment	Torsion Moment	S.I.F In Out	Eq. Load no. type			

	Sus. + E3	0	0		1.00 1.00	(18) OCC	0	22267
--	-----------	---	---	--	-----------	----------	---	-------

*** Segment C end ***

SYSTEM SUMMARY

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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

HOODIN PIPE AND DUCT REACTIONS TO GLOVEBOX IN
02/07/95 2736-ZB BUILDING, 200 W AREA

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

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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

SYSTEM SUMMARY

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REV ~~40~~ ~~01~~ PAGE A-115

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 ***

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REV ~~104~~ PAGE A-116

**
** 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

CHECKED BY : E.C. Ocoma

PIPING CODE : B31.3

AMBIENT TEMP. (deg F) : 70.0

COMPONENT LIBRARY : AUTOPIPE

MATERIAL LIBRARY : AUTOB313

MODEL REVISION NUMBER : 13

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

REV 4.0A PAGE A-117

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

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REV4-03A PAGE A-118

COMPONENT DATA LISTING

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

HOODOUT PIPE AND DUCT REACTIONS TO GLOVEBOX AND
02/07/95 LOAD OUT HOOD, 2736-ZB, 200 W AREA AutoPIPE+4.50 MODEL PAGE 4

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

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REV ~~1.0~~ PAGE A-119

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

Number of points in the system : 25

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PIPE DATA LISTING

REV1024 PAGE A-120

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	37.57	0	37.57
2SCH40S AU	2.000 40S	2.375	0.154	0	0.02	0	0	3.74	0	3.74
8SCHNS AU	NS	8.625	0.125	0	0.02	0	0	11.61	0	11.61
10SCHNS AU	NS	10.750	0.125	0	0.02	0	0	14.52	0	14.52

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REV ~~4~~ ~~0~~ ~~1~~ PAGE A-121

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

HOODOUT PIPE AND DUCT REACTIONS TO GLOVEBOX AND
02/07/95 LOAD OUT HOOD, 2736-ZB, 200 W AREA AutoPIPE+4.50 MODEL PAGE 7

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REV1 ~~021~~ PAGE A-122

TEMPERATURE AND PRESSURE DATA

	-----C A S E 1-----			-----C A S E 2-----			-----C A S E 3-----		
POINT NAME	PRESS. psi	TEMPER deg F	EXPAN. in/100ft	PRESS. psi	TEMPER deg F	EXPAN. in/100ft	PRESS. psi	TEMPER deg F	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

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CODE COMPLIANCE COMBINATIONS

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

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 Earth 2 Earth 3	1.00 1.00 1.00	User
TOTAL	Abs sum	Gravity SEIS	1.00 1.00	User

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

HOODOUT PIPE AND DUCT REACTIONS TO GLOVEBOX AND
02/07/95 LOAD OUT HOOD, 2736-ZB, 200 W AREA AutoPIPE+4.50 RESULT PAGE 3

*** NOTE ***

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

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REV ~~10~~ 11 PAGE A-126

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

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REV 4 ~~SA~~ PAGE A-127

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

Point name	Load combination	TRANSLATIONS (in)			ROTATIONS (deg)		
		X	Y	Z	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

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

Point name	Load combination	TRANSLATIONS (in)			ROTATIONS (deg)		
		X	Y	Z	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

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

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Point name	Load combination	TRANSLATIONS (in)			ROTATIONS (deg)		
		X	Y	Z	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

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REV 4.0 PAGE A-130

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

Point name	Load combination	TRANSLATIONS (in)			ROTATIONS (deg)		
		X	Y	Z	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 ***

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REV ~~40~~ PAGE A-131

Point/ Supp. ID	Connect/ Type	Load Combination	Dirn	L O C A L Force	Deform	Dirn	G L O B A L Force	Deform
A00 A00 1 Stiff	Guide :RIGID	GR	down left	73 2	0.000 0.000	X Y Z	 -73 -2	-0.004 0.000 0.000
		E1	up left	69 41	0.000 0.000	X Y Z	 69 -41	0.042 0.000 0.000
		E2	up rght	66 2	0.000 0.000	X Y Z	 66 2	0.003 0.000 0.000
		E3	down rght	94 160	0.000 0.000	X Y Z	 -94 160	-0.048 0.000 0.000
		SEIS	down left	134 165	0.000 0.000	X Y Z	 134 165	0.064 0.000 0.000
		TOTAL	down left	207 167	0.000 0.000	X Y Z	 207 167	0.068 0.000 0.000
A06 A06 1 Stiff	Y - Stop :RIGID	GR	down	305	0.000	X Y Z	 -305	-0.004 0.000 0.007
		E1	up	18	0.000	X Y Z	 18	0.041 0.000 -0.055
		E2	up	274	0.000	X Y Z	 274	0.004 0.000 -0.007
		E3	up	881	0.000	X Y Z	 881	-0.046 0.000 0.086
		SEIS	down	923	0.000	X Y Z	 923	0.062 0.000 0.102
		TOTAL	down	1228	0.000	X Y Z	 1228	0.066 0.000 0.110

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RESTRAINT REACTIONS

REV 4.0A PAGE A-133

Point name	Load combination	FORCES (lb)				MOMENTS (ft-lb)			
		X	Y	Z	Result	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

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REV4 ~~001~~ PAGE A-134

GLOBAL FORCES & MOMENTS

Point name	Load combination	FORCES (lb)				MOMENTS (ft-lb)			
		X	Y	Z	Result	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

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GLOBAL FORCES & MOMENTS

REV 1.0A PAGE A-135

Point name	Load combination	FORCES (lb)				MOMENTS (ft-lb)			
		X	Y	Z	Result	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

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GLOBAL FORCES & MOMENTS

REV 108 PAGE A-136

Point name	Load combination	FORCES (lb)				MOMENTS (ft-lb)			
		X	Y	Z	Result	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

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REV 1.0A PAGE A-137

GLOBAL FORCES & MOMENTS

Point name	Load combination	FORCES (lb)				MOMENTS (ft-lb)			
		X	Y	Z	Result	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

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GLOBAL FORCES & MOMENTS

REV 1.0A PAGE A-138

Point name	Load combination	FORCES (lb)				MOMENTS (ft-lb)			
		X	Y	Z	Result	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 ***

WHC-SD-CP-SA-026

ASME B31.3c (1992) CODE COMPLIANCE

REV 4.04 PAGE A-139

Point name	Load combination	(Moments in ft-lb)			S.I.F		Eq. Load no. type	(Stress in psi)	
		In-Pl. Moment	Out-Pl. Moment	Torsion Moment	In	Out		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
A02 -	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

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ASME B31.3c (1992) CODE COMPLIANCE

Point name	Load combination	(Moments in ft-lb)			S.I.F		(Stress in psi)		Eq. Load no. type	Code Stress	Code Allow.
		In-Pl. Moment	Out-Pl. Moment	Torsion Moment	In	Out					
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

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ASME B31.3c (1992) CODE COMPLIANCE

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Point name	Load combination	(Moments in ft-lb)			(Stress in psi)			Eq. Load no. type	Code Stress	Code Allow.
		In-Pl. Moment	Out-Pl. Moment	Torsion Moment	S.I.F In	S.I.F Out				
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

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ASME B31.3c (1992) CODE COMPLIANCE

REV 1.04 PAGE A-142

Point name	Load combination	(Moments in ft-lb)			S.I.F		(Stress in psi)		Eq. Load no. type	Code Stress	Code Allow.
		In-Pl. Moment	Out-Pl. Moment	Torsion Moment	In	Out					
C02 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
C02 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
C02 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
C02 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
C02 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
C02 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
C03	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

WHC-SD-CP-SA-026

REV10 PAGE A143

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

HOODOUT PIPE AND DUCT REACTIONS TO GLOVEBOX AND
02/07/95 LOAD OUT HOOD, 2736-ZB, 200 W AREA AutoPIPE+4.50 RESULT PAGE 22

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SYSTEM SUMMARY

REV 1.0 PAGE A-144

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

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REV ~~1.0~~ PAGE A-145

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. Oelund 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 glove box support was found to be flexible. Therefore, multiply the peak accln. by 1.5 to determine the equivalent static load.

$$g_h = .43 \times 1.5 = .65 \text{ g}$$

$$g_v = 2/3 \times .65 = .43 \text{ g}$$

Overturning (Transverse direction)

$$\text{Moment due to force} = 3200 \times 54.3 \times .65$$

$$\text{Resisting Moment} = 3200 \times 18 \times (1 - .43)$$

$$\frac{3200 \times 18 (1 - .43)}{3200 \times 54.3 \times .65} = .29 < 1.$$

∴ Overturning would occur if not anchored

Forces (seismic)

$$\text{Lateral force, } F_{H1} = .65 \times 3200 = 2080 \text{ \#}$$

$$F_{H2} = \quad \quad = 2080$$

$$\text{Vertical force, } F_{V1} = .43 \times 3200 = 1376 \text{ \#} \uparrow \downarrow$$

$$F_{V2} = 3200 \downarrow$$

ANALYTICAL CALCULATIONS

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REV ~~1.0~~ PAGE A-147

Page ____ of ____

Subject Glovebox 2736-ZB Bldg.Originator M.A. ISLAMDate 12/20/94Checker E.E. O'ConnellDate 2/9/95Reactions at Glovebox top from Filter Housing LongitudinalTransverseReactions @ A, B, C, D (Glovebox & Hood Top)A (Refer AUTOPIPE Run, HOODIN, Page A-102)

Support Pt B02

$$F_x = 739^{\#}; F_y = 0; F_z = 276^{\#}; M_x = 18 \times 12 = 216^{\#-in}$$

$$M_z = 4 \times 12 = 48^{\#-in}$$

B, C, D (Refer AUTOPIPE Run, HOODOUT, Page A-133)

$$\text{For B (Pt. B04): } F_x = 18^{\#}; F_y = 156^{\#}; F_z = 65^{\#}; M_x = 28 \times 12 = 288^{\#-in}$$

$$M_z = 19 \times 12 = 228^{\#-in}$$

$$\text{For C (Pt. C03): } F_x = 49^{\#}; F_y = 47^{\#}; F_z = 9^{\#}; M_x = 14 \times 12 = 168^{\#-in}$$

$$M_z = 9 \times 12 = 108^{\#-in}$$

$$\text{For D (Pt. A09): } F_x = 531^{\#}; F_y = 0; F_z = 370^{\#}; M_x = 33 \times 12 = 396^{\#-in}$$

$$M_z = 11 \times 12 = 132^{\#-in}$$

ANALYTICAL CALCULATIONS

WHC-SD-CP-SA-026

REV ~~001~~ PAGE A-148Page of Subject Glove box, 2736-Z Bldg.Originator M.A. ISLAMDate 12/20/94Checker G.C. OelmannDate 2/9/95Refer to Page A-12, (WHC-SD-CP-SA-026, Rev 0)Transverse (consider all 12 anchors)Tension @ base of post

$$\frac{2080 \times 54.3}{2 \times 3 \times 36} + \frac{\overbrace{(276 + 370)}^{F_{zA,D}} \times 69.5 + \overbrace{(65 + 9)}^{F_{zB,C}} \times 72.5 + \overbrace{[288 + 168 + 396 + 216]}^{M_{x,B} \quad M_{x,C} \quad D \quad A}}{2 \times 3 \times 36}$$

$$= 761 \#$$

$$\text{shear @ base of Post} = \frac{2080}{12} + \frac{\overbrace{(276 + 370)}^{F_{zA,D}} + \overbrace{(65 + 9)}^{F_{zB,C}}}{12} = 233 \#$$

Longitudinal (consider all 12 anchors)Tension @ base Post

$$\frac{2080 \times 54.3}{2(90 + 15 \times 2 + 9)} + \frac{\overbrace{(739 + 531)}^{F_{xA,D}} \times 69.5 + \overbrace{(18 + 49)}^{F_{xB,C}} \times 72.5 + \overbrace{(48 + 228 + 108 + 132)}^{M_{zA} \quad B \quad C \quad D}}{2(90 + 15 \times 2 + 9)}$$

$$= 801 \#$$

$$\text{shear @ base of Post} = \frac{2080}{12} + \frac{(739 + 531) + (18 + 49)}{12} = 285 \#$$

Vertical

$$\text{Tension @ base} = \frac{1376}{12} + \frac{\overbrace{(156 + 47)}^{F_{yB,C}}}{12} = 132 \#$$

$$\text{Compression (No change)} = 267 \#$$

$$* \text{ Net Tension, } T = 801 + 761 \times .4 + 132 \times .4 - .85 \times 267 = 931 \#$$

$$* \text{ Net shear, } V = \sqrt{233^2 + 285^2} = 368 \#$$

* seismic component response combination per
UBRL-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. ISLAMDate 12/21/94Checker E.C. OumaDate 2/9/95Prying in Bolt Anchorage Check Prying Action

For 5/8" bolt & 1/2" thick plate

$$x = 1.25 \times \frac{1}{2} + \frac{1}{2} \text{ (P thick)} = 1.125"$$

$$\therefore L = \sqrt{1.5^2 + 1.5^2} - 1.125 \approx 1"$$

$$\text{Tension Force, } F = 931 \text{ \#} \quad \therefore T = \frac{F(L+x)}{x} = \frac{931(1+1.125)}{1.125} = 1759 \text{ \#}$$

$$V = 368 \text{ \#}$$

Find allowable anchor values per WHC-SD-GN-DGS-30006, Rev 1, Chapter 8 (Existing Safety Class 1)

ANALYTICAL CALCULATIONS

REV ~~1~~ PAGE A-150
Page ____ of ____Subject Glovebox, 2736-ZB Bldg.Originator M. A. ISLAMDate 12/21/94Checker E. C. O'ConnellDate 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)

$$T_a = T \cdot R_{Cp} \cdot R_{Tp} \cdot R_{Lp} \cdot R_{Sp} \cdot R_{Ep} \cdot R_{Fp} \cdot R_{Rp}$$

$$= T (R)$$

$$V_a = V (R)$$

where T_a, V_a allowable pullout & shear capacity

T, V Nominal " " "

R_{Cp} reduction for concrete cracking = 1.0

R_{Tp} anchor bolt type reduction = .75 (Star Exp.)

R_{Lp} short embedment/tightness reduction = 1.

R_{Sp} reduction for closely spaced anchors = 1. (N/A)

R_{Ep} " " near edge = 1. (N/A)

R_{Fp} " " low strength concrete = 1.0

($f'_c = 4000$ Psi, Ref. Dwg. H-2-80116, sh.1)

R_{Rp} 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

$\therefore$ Total Reduction, $R = .75$

$$\therefore T_a = T R \quad \text{where } T = 3170^{\#} \text{ per Table 8.3}$$

$$= 3170 \times .75 = \underline{2377^{\#}} \quad (\text{For } 5/8" \phi \text{ Anchor})$$

$$\therefore V_a = V R = 3790 \times .75 = \underline{2842^{\#}}$$

$$\text{Interaction, } I = \frac{1759}{2377} + \frac{368}{2842} = .87 < 1.0 \quad \text{OK}$$

M.S. = .15

ANALYTICAL CALCULATIONS

REV ~~0~~ 4 PAGE A-151
Page _____ of _____Subject Glove box, 2736-ZB Bldg.Originator M. A. ISLAMDate 12/29/94Checker G. C. O'ConnellDate 2/9/95Stress in Base PlBase Pl Bending

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

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

$$M = T(1.0) = 1759 \times 1 = 1759 \text{ #-in}$$

$$\therefore \sigma_b = \frac{1759}{.0883} = 19921 \text{ Psi} < 36,000 \text{ Psi OK}$$

(See below)

Allowable stressesMaterial, A36, $F_y = 36,000 \text{ Psi}$; $F_u = 58,500 \text{ Psi}$

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

$$\text{Pl & solid bar, } \sigma_b = .75 \times 36,000 \times 1.33 = 36,000 \text{ Psi}$$

$$\text{For shape, } \sigma_b = .6 \times 36,000 \times 1.33 = 28,800 \text{ Psi}$$

$$\text{shear stress, } \tau_a = .4 \times 36,000 \times 1.33 = 19,200 \text{ Psi}$$

$$\text{Weld Capacity, } F_w = .3 \times 70,000 \times 1.33 \times .707(w) = 19,800(w)$$

$$\text{" " from base metal shear, } F_w = .4 F_y (1.33) (w)$$

$$F_w = .4 \times 36,000 \times 1.4(w) = 19,200(w) \Leftarrow$$

$$\therefore F_w = 19,200(w)$$

ANALYTICAL CALCULATIONS

REV ~~1~~ PAGE A-152
Page _____ of _____Subject Glovebox, 2736-ZB Bldg.Originator M.A. ISLAMDate 12/29/94Checker E.C. OconnorDate 2/9/95Check Support Post

$$\sigma_a (\text{allow.}) = 7840 \text{ Psi @ } \frac{KL}{r} = 138 \text{ (ignore increase from seis.)}$$

$$\therefore \text{Interaction, } I = \frac{675}{7840} + \frac{14,904}{.833 / 28,800} = .71 < 1.$$

M.S. = .41 OK

Weld betn. L3x3 & base fl

$$A_w = 2 \times 3 = 6 \text{ in}$$

$$\text{Tension} = 1759 \text{ \#}; V = 368 \text{ \#}$$

$$f_w = \left[\left(\frac{1759}{6} \right)^2 + \left(\frac{368}{6} \right)^2 \right]^{\frac{1}{2}} = 300 \text{ \#/in}$$

$$F_w (\text{for } 1/8" \text{ Fillet weld}) = 19,200 \times .125 = 2400 \text{ \#/in}$$

$$>> 300 \text{ \#/in OK}$$

ANALYTICAL CALCULATIONS

REV ~~1~~ PAGE A-153
Page _____ of _____Subject Glovebox, 2736-ZB Bldg.Originator M.A. ISLAMDate 12/29/94Checker E.C. DeannaDate 2/9/95Weld betn. L3x3 & L3x3

$$A_w = 2(1.5 + 3) = 9 \text{ in}$$

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

$$F_a = 1425^\# ; V = 368^\# ; M = 14,904^\# \cdot \text{in}$$

$$f_w = \left[\left(\frac{1425}{9} + \frac{14,904}{5.25} \right)^2 + \left(\frac{368}{9} \right)^2 \right]^{\frac{1}{2}} = 2998^\#/\text{in}$$

$$F_w (\text{for } \frac{1}{4}'' \text{ Fillet}) = 19,200(.25) = 4800^\#/\text{in} > 2998^\#/\text{in}$$

M.S. = .6 OK

Connection betn. Glovebox & Support Frame

$$\text{Axial force in bolt} = \frac{2080}{6} = 347^\#$$

$$\text{Shear} = \frac{4576}{2 \times 6} + \frac{2080 \times 21.3}{36 \times 6} = 586^\#$$

(SST) Bolt allowables:

Per ASME B31.3

For A193 $\Rightarrow S_y = 30 \text{ KSI}$

$$T = \left(\frac{30}{36} \times 20 \times 1.33 \right) \times .11 = 2438^\#$$

$$V = \left(\frac{30}{36} \times 10 \times 1.33 \right) \times .11 = 1219^\#$$

$$\text{Interaction, } I = \frac{347}{2438} + \frac{586}{1219} = .62 < 1. \text{ OK}$$

M.S. = .61

Calculations for Filter Housing Support as performed in Page A-17 of WHC 1994 are adequate (acc'n. of .68g decreased to .65g). No further analysis is reqd.

ANALYTICAL CALCULATIONS

REV ~~001~~ PAGE A-154

Page ____ of ____

Subject Glove box, 2736-ZB Bldg.Originator M.A. ISLAMDate 1/11/95Checker E.C. O'BrienDate 2/2/95Adequacy of support for Duct & Filter HousingRefer 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)

ANALYTICAL CALCULATIONS

WHC-SD-CP-SA-026

REV ~~1.0~~ PAGE A-155

Page ____ of ____

Subject Glove box, 2736-ZB Bldg.Originator M.A. ISLAMDate 1/11/95Checker E.C. OconnorDate 2/9/95Hanger Rod Support

3/8" concrete anchor (Dwg. H-2-80172)

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.

 $\therefore$ Pullout Capacity of 3/8" anchor per Table 8.3

$$= 1460 \times .6 = 876^{\#} \approx 878^{\#} \text{ OK}$$

3/8" Hanger rod Capacity

(Seismic load response, Filter House load calc. are conservative)

Per AISC 1980, Capacity = .6 Fy (1.33) (Area)

$$\text{Capacity} = .6 \times 36000 \times 1.33 \times .11 = 3168^{\#}$$

Per 'POWER PIPING Catalog', Max. Rated Capacity of 3/8" rod @ 650°F = 610[#]

Prorate capacity for room temperature (ASME 1993)

$$\text{C. Steel, } E_{650^{\circ}\text{F}} = 10^3 \times 25.9 \text{ ksi} ; E_{70^{\circ}\text{F}} = 29.5 \times 10^3 \text{ ksi}$$

$$\therefore \text{Capacity @ } 70^{\circ}\text{F} = 610 \times \frac{29.5}{25.9} = 695^{\#}$$

Capacity @ DBE

Minm. Increase factor = 1.33 (Ref. AISC)

$$\therefore \text{Actual Capacity} = 695 \times 1.33 = 927^{\#} < 3168^{\#}$$

$$\therefore 927^{\#} > 878^{\#} \text{ OK M.S.} = .06$$

ANALYTICAL CALCULATIONS

WHC-SD-CP-SA-026

REV 1 ~~0~~ PAGE A-156

Page ____ of ____

Subject Glovebox, 2736-ZB Bldg.Originator M.A. ISLAMDate 1/11/95Checker G.C. OdomDate 2/9/95Guide Support @ Wall Find stiffnesses along X & Z for
Input into AUTOPIPE Run

$$I = 2 \times 125^3 / 12 = .0003255 \text{ in}^4$$

$$A = 2 \times 125 = .25 \text{ in}^2$$

$$K_x = 2 \times \frac{12EI}{L^3} = 2 \times \frac{12 \times 29 \times 10^6 \times .0003255}{83^3}$$

$$= 443 \text{ \#/in}$$

$$K_z = 2 \times \frac{AE}{L} = 2 \times \frac{.25 \times 29 \times 10^6}{8} = 1.86 \text{ \#/in}$$

Note: The above information per walked-down

Check 3/8" anchor

Refer to AUTOPIPE Output, HOODIN

Max. Reactions @ Pt. C06

$$F_x = 83 \text{ \#}; F_z = 1460 \text{ \#}$$

$$\text{shear/anchor} = 83/2 = 42 \text{ \#}$$

$$\text{Pullout/anchor} = 1460/2 = 730 \text{ \#}$$

Capacity of 3/8" anchor

Per Table 8.3 of WHC 1993

$$\text{Pullout} = 1460 \times .6 = 876 \text{ \#}$$

$$\text{Shear} = 1420 \times .6 = 852 \text{ \#}$$

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. = 12

Plate 1/8 x 2"

Because the plate is thin, no bending will occur. However, F_z load will produce tension and F_x load will be in shear & resisted by the anchor through the plate.

ANALYTICAL CALCULATIONS

Page ____ of ____

Subject Glovebox, 2736-ZB Bldg.Originator M.A. ISLAMDate 1/12/95Checker E.C. O'ConnorDate 2/9/95

$$\text{shear stress, } \tau = \frac{83}{2 \times 125 \times 2} = 166 \text{ Psi. Small OK}$$

$$\text{Tensile " , } \sigma = \frac{1460}{2 \times 125 \times 2} = 2920 \text{ Psi} < 28,800 \text{ Psi OK}$$

Filter Housing Support

Refer to Page A-41, WHC 1994

Filter House Wt. = 36.3 #/l

$$\text{For vert. accln., } A_v = .9, \text{ Wt. of Filter House} = 36.3 \times 1.9 \times \frac{1}{2} = 34.5 \text{ \#/, per beam}$$

$$\therefore M = \frac{wL^2}{8} = \frac{34.5 \times 5^2}{8} \times 12 = 1294 \text{ \#-in}$$

Support beam equivalent to $L \times 2 \times \frac{1}{8}$, $S = .131 \text{ in}^3$

$$\text{Bending stress, } \sigma_b = \frac{1294}{.131} = 9878 \text{ Psi} < 28,800 \text{ Psi OK}$$

M.S. = 1.92

Stress in Piping

Refer to AUTOPIPE Output, HOODIN & HOODOUT

HOODIN

Max. stress interaction ratio = 1.05 > 1. See HOODOUT below

HOODOUTAll pipe stresses are less than allowable values except point A02 where $\sigma = 54924 \text{ Psi}$ exceeded allowable value. Pipe is stainless steel, $S_y = 25 \text{ Ksi}$; $S_u = 70 \text{ Ksi}$

Pipe stress of 54924 Psi exceeded yield, however, is less than ultimate strength = 70 Ksi.

 $\therefore$ Joint between 8"φ & 2"φ will become plastic, and will remain in place.

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 ED 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., $F_y = 33,000$ Psi

Concrete Anchor allowable per Guideline, WHC-SD-GN-DGS-30006, Rev 1.

UCRL-15910

Reference Drawing

H-Z-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

REV 3 of PAGE B-3

Subject Storage Metal Rack, 2736-Z Bldg.
 Originator M. A. ISLAM Date 3/29/94
 Checker EO Wiener Date 4/22/94

ANALYTICAL CALCULATIONS

REV 4 PAGE
Page B-4 ofSubject Storage Metal Rack, 2736-Z Bldg.Originator M. A. ISLAMDate 4/5/94Checker EO WernerDate 4/21/94 Wt. of a typ. rack Panel

$$\begin{aligned}
 \text{Bent flange } 1\frac{1}{2} \times 1\frac{1}{2} \times \frac{1}{16} &= .18 \left(\begin{array}{l} \text{corner} \\ \text{Front \& back} \\ \text{Sides} \end{array} \right) (85 \times 4 + 16 \times 36 + 16 \times 12) \times .283 = 56 \# \\
 \frac{1}{16} \text{ sh. Metal} &= \left(\begin{array}{l} \text{bot.} \\ \text{Vertical} \\ \text{back} \end{array} \right) (36 \times 12 \times 8 + 12 \times 85 \times 5 + 36 \times 85) \times .0625 \times .283 = 205 \# \\
 \text{Wire Mesh @ Front} &= 36 \times 85 \times \frac{1}{44} \times .85 \#/\text{SF} = 18 \#
 \end{aligned}$$

Table A-12, Nilson & Winter

ANALYTICAL CALCULATIONS

Page REV 1 or 55 PAGE

Subject Storage Metal Rack, 2736-Z Bldg.
 Originator M. A. ISLAM Date 4/6/94
 Checker EO Werner Date 4/21/94

$$\therefore \Sigma W, \text{ Ea. Metal Rack Panel} = 56 + 205 + 18 = 279 \text{ \#}$$

$$\text{Wt. of content / compartment} = 5.5 \text{ \# in 7 in can}$$

$$\therefore \text{Wt. of Contents / Panel} = 5.5 \times 4 \times 7^{\text{compt. rows}} = 154 \text{ \#}$$

$$\therefore \text{Wt. of Each Panel} = 279 \text{ \#} + 154 \text{ \#} = \underline{433 \text{ \#}}$$

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.

$$g_H = .68 g \text{ (*Flexible Equip. located at grade)}$$

$$g_v = \frac{2}{3} \times .68 = .45 g \quad * \text{ See Page B-11}$$

Forces (due to seismic)

$$\text{Lateral forces, } F_{H1} = .68 \times 433 = 294 \text{ \# per panel}$$

$$F_{H2} = 294 \text{ \# per panel}$$

$$\text{Vertical Force, } F_v = .45 \times 433 = 195 \text{ \# / panel}$$

$$\text{" " @ } 1g = 433 \text{ \# / panel}$$

There are 5 Cross braces for 25 panels. Therefore, for evaluation of cross brace anchorage and connection to rack, use forces as follows:

$$F_{H1} = F_{H2} = 294 \times 25 / 5 = 1,470 \text{ \# per brace}$$

ANALYTICAL CALCULATIONS

Page B-6 of PAGESubject Storage Metal Rack, 2736-Z Bldg.Originator M. A. ISLAMDate 4/6/94Checker EO WernerDate 4/21/94Analysis

$$\begin{aligned}
 F_{H1} &= 1,470^{\#} \\
 F_{H2} &= 1,470^{\#} \\
 F_{V1} &= (195 + 433) \times \frac{25}{5} \\
 &= 3,140^{\#}
 \end{aligned}$$

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} , * $R_A = 0$; $R_B = 1,470^{\#}$

Evaluate B

* Member AC is pinned and subject to rotation.

Refer to Guideline, WHC-SD-GN-DGS-30006, Rev 1 (Table 4.3)

$$T_{all} = 360 \times \frac{3000}{4000} = 270^{\#}$$

$$V_{all} = 400 \left[\frac{3000}{10000} + 0.65 \right] = 380^{\#}$$

At bottom, 10 anchors are available with 6 panels, however, Panels by the walls have 2 anchors (for 2 panels)

$$\therefore V_1 = \frac{294 \times 2}{2 \times 2} = 147^{\#}; V_2 = 294 \times 2/2 = 294^{\#}$$

$$\therefore \text{Interaction from shear, } I = \frac{\sqrt{147^2 + 294^2}}{380} = 0.87 < 1. \text{ OK}$$

No Pullout exists

$$S.M. = \frac{1}{0.87} - 1 = 15$$

ANALYTICAL CALCULATIONS

REV 1
Page 5-7 of PAGE

Subject Storage Metal Rack, 2736-Z Bldg.
 Originator M. A. ISLAM Date 4/6/94
 Checker E.O. Lerner Date 4/21/94

Evaluate A

One bolt is available at this location. Because F_H is not resisted by this connection,

$$\text{Net shear per bolt} = \frac{294 \times 2}{2} = 294 \# (\text{Max.})$$

Allowable shear for $1/4"$ bolt, single shear, per AISC 8th Ed.

$$V_{all.} = \frac{\pi}{4} (.25)^2 \times 10000 \#/\text{in}^2 = 490 \# > 294 \# \text{ OK}$$

$$S.M. = \frac{490}{294} - 1 = .67$$

check bearing on sh. metal

Allow. bearing per AISC 8th Ed, $F_p = .9 F_y$

$$F_p = .9 \times 33000 = 29,700 \text{ Psi} \quad * (\text{For A33 steel})$$

$$\text{Bearing Stress} = \frac{294}{.0625 \times .25} = 18,316 \text{ Psi} < 29,700 \text{ Psi} \text{ OK}$$

Evaluate C

One Expansion anchor (shell type), $3/8"$ is available.

Per WHC-SD-GN-DGS-30006, Rev 1 (Table 4.3)

$$V_{all.} = 1060 \times \left[\frac{3000}{10000} + .65 \right] = 1,007 \#$$

$$T_{all.} = 1100 \times \frac{3000}{4000} = 825 \#$$

$$\text{Pullout @ C} = 294 \times 3 \text{ from Pts. A} = 882 \# (\text{Max.})$$

$$\text{Pullout @ C (if all 25 panels tied together)} = 735 \#$$

No shear exists

$$\text{Interaction, } I = \frac{882}{825} = 1.07 > 1. \quad (\text{N.G.})$$

$$\text{however, if panels tied together, } I = \frac{735}{825} = .89 < 1. \quad (\text{OK})$$

$$S.M. = \frac{1}{.89} - 1 = .12$$

ANALYTICAL CALCULATIONS

REV 1 PAGE
B-9 of

Subject Storage Metal Rack, 2736-Z Bldg.
 Originator M. A. ISLAM Date 4/11/94
 Checker E.O. Werner 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.

$$F_{H1} = F_{H2} = 294^{\#} ; F_{V1} = 195^{\#} \uparrow ; F_{V1} = 433^{\#} \downarrow$$

$$\text{Tension in anchor due to } F_{H1}, T_1 = \frac{294 \times 42}{12} = 1029^{\#}$$

$$\text{shear " " " " } V_1 = 294/2 = 147^{\#}$$

$$\text{Tension in anchor due to } F_{H2}, T_2 = \frac{294 \times 36}{36} = 294^{\#}$$

$$\text{shear " " " " } V_2 = 147^{\#}$$

$$\text{Compression in anchor due to } F_{V1}, C = \frac{433 - 195}{2} = 119^{\#}$$

Combine these loads using SRSS rule :

$$T = \sqrt{1029^2 + 294^2 - 119^2} = 1,064^{\#}$$

$$V = \sqrt{(294/2)^2 + (294/2)^2} = 208^{\#}$$

$$\text{For } 1/4" \phi \text{ Anchor, } T_{all.} = 270^{\#} ; V_{all.} = 380^{\#}$$

$$\therefore I = \frac{1064}{270} + \frac{208}{380} = 4.5 > 1.$$

(N.G.)

ANALYTICAL CALCULATIONS

REV 1 PAGE

Page B-10 of

Subject Storage Metal Rack, 7 in Can, 2736-Z Bldg.

Originator M.A. ISLAM Date 4/14/94

Checker G.O. Werner Date 4/21/94

Stiffness of 7 in Can Storage Rack

ANALYTICAL CALCULATIONS

REV 1 PAGE

Page B11 of

Subject Storage Metal Rack, 7 in Can, 2736-Z Bldg.
 Originator M. A. ISLAM Date 4/14/94
 Checker E. O. Werner Date 4/21/94

Section PropertiesBent Sheet Metal $1\frac{1}{2} \times 1\frac{1}{2} \times \frac{1}{16}$

$$\text{Area} \approx 1.5 \times 2 \times 0.06 = .18 \text{ in}^2$$

$$1.5 \times 0.06 \times 0.03 = .003$$

$$1.5 \times 0.06 \times .75 = .0675$$

$$\approx .07$$

$$\bar{y} = \frac{.07}{.18} = .39''$$

$$I \approx 1.5 \times 0.06 (.39 - .03)^2 + \frac{.06 \times 1.5^3}{12} + 1.5 \times 0.06 (.75 - .39)^2$$

$$\approx .04 \text{ in}^4$$

Stiffnesses

Refer ANSYS output for displacement @ Node 79

$$K_x = \frac{1}{.5754 \times 10^{-4}} = 1.74 \text{E}4 \text{ \#}/\text{in}$$

$$K_y = \frac{1}{.9688 \times 10^{-4}} = 1.0 \text{E}4$$

$$K_z = \frac{1}{.1117 \times 10^{-3}} = 9 \text{E}3$$

Frequency

$$\Sigma W = 433 \text{ \# per panel (} \dot{4} \times 3 \times 7')$$

$$f_x = 3.13 \sqrt{\frac{K_x}{W}} = 3.13 \sqrt{\frac{1.74 \text{E}4}{433}} = 19.8 \text{ Hz}$$

$$f_y = 3.13 \sqrt{\frac{1 \text{E}4}{433}} = 15 \text{ Hz}$$

$$f_z = 3.13 \sqrt{\frac{9 \text{E}3}{433}} = 14 \text{ Hz}$$

f_y & f_z are less than 16.7 Hz (Per WHC-SD-GN-DGS-30006, Rev1)
 Therefore, consider the metal rack flexible. Beside, a second panel even though is inter connected 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

Filename: rack

/com
/com
/com
/com
/com
/com

Input by: M.A. Islam Chk by: E. Weiner
4/13/94 4/21/94

et,1,4
et,2,63

* beam element
* 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
r,2,.0625

*Frame angle 1/16 in thick
*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

f,79,fx,1
lwrite

fdele,79,fx
f,79,fy,1

lwrite
fdele,79,fy

f,79,fz,1

* dead loads
* Unit load along X

* Unit load along Y

* Unit load along Z

nlist,all
elist,all
lwrite
afwrite

WNC-SD-CP-SA-026

REV 7 PAGE

Page B-13

Page B-14

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

WHC-SD-CP-SA-026

REV 4 PAGE

*** 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= 0.000000E+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

Page B-15

WHC-SD-CP-SA-026

REV 1 PAGE

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= 0.000000E+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= 0.000000E+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

ANALYTICAL CALCULATIONS

REV 1 of PAGE
Page 5 of 16

Subject Lard Can Storage Rack
Originator M.A. ISLAM Date 4/15/94
Checker E.O. Wernin 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, $F_y = 33,000$ 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 not adequate to withstand seismic loads.

Recommendation

Provide a cross brace on each panel similar to the 7 in can storage rack.

REV 0 PAGE
ANALYTICAL CALCULATIONS

REV 1 PAGE
Page 57 of 100

Subject Lard Can Storage Rack

Originator M. A. ISLAM

Date 4/15/94

Checker E. D. Werner

Date 4/22/94

PLAN

ANALYTICAL CALCULATIONS

REV 1 PAGE
Page B-18 of Subject Lard Can Storage RackOriginator M.A. ISLAMDate 4/15/94Checker S.O. WernerDate 4/22/94Acceleration

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-D43-30006, Rev 1.

The results from the stiffness analysis indicate that the storage rack is flexible. Hence,

$$g_H = .68g \text{ (*flexible eqipt. located at grade)}$$

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

* See Page B-22

Forces (due to seismic loads)

$$\text{Lateral Force, } F_{H1} = .68 \times 1900 = 1292^{\#}$$

$$\text{" " } F_{H2} = 1292^{\#}$$

$$\text{Vertical Force, } F_V = .45 \times 1900 = 855^{\#} \downarrow \uparrow$$

$$\text{" " } F_V @ 1.0g = 1900^{\#} \downarrow$$

ANALYTICAL CALCULATIONS

REV 1 PAGE
Page B-19 ofSubject Lard Can Storage RackOriginator M.A. ISLAMDate 4/15/94Checker E.O. WerniDate 4/21/94Anchor Evaluation Transverse

$$\text{Tension @ base} = \frac{1292 \times 41.5}{28 \times 2} = 957^{\#}$$

$$\text{shear @ " } = 1292 / 4 = 323^{\#}$$

Longitudinal

$$\text{Tension @ base} = \frac{1292 \times 41.5}{42 \times 2} = 638^{\#}$$

$$\text{Shear " " } = 323^{\#}$$

Vertical

$$\text{Tension @ base} = 855 / 4 = 214^{\#}$$

$$\text{Compression @ " (Gravity)} = \frac{1900}{4} = 475^{\#}$$

$$\therefore * \text{ Net Tension, } T = 957 + .4 \times 638 + .4 \times 214 - .85 \times 475 = \underline{\underline{894^{\#}}}$$

$$* \text{ Net Shear, } V = \sqrt{323^2 + 323^2} = \underline{\underline{457^{\#}}}$$

* Combination per WHC-SD-GN-DGS-30006, Rev 1

ANALYTICAL CALCULATIONS

REV 1 PAGE
Page B-20 ofSubject Lard Can Storage RackOriginator M.A. ISLAMDate 4/15/94Checker ED WeinerDate 4/21/94 Ref.
ESR No. 9539

$$L = \frac{2.5}{2} + \frac{2.5}{2} = 2.5"$$

Max. bolt head dimension for $\frac{1}{4}" \phi$ bolt = $\frac{1}{2}"$ $\therefore$ Consider Washer dia. = $1"$

$$\therefore x = \frac{1}{2}" + \frac{1}{4}" = .75"$$

$$\therefore T_p = T \frac{(L+x)}{x} ; \quad \frac{L+x}{x} = \frac{2.5 + .75}{.75} = 4.33 > 2$$

$\therefore$ Use $\frac{L+x}{x} = 2$

$$\therefore T_p = 894 \times 2 = 1788 \#$$

* per WHC-SD-GN-DGS-30006,
Rev 1, P 4-5Anchor AllowablesFor $\frac{1}{4}" \phi$ anchor, per WHC-SD-GN-DGS-30006, Rev 1
Table 4.3

$$\text{Allow. } T = 360 \times \frac{3000}{4000} = 270 \#$$

$$\text{„ } V = 400 \times \left[\frac{3000}{10000} + .65 \right] = 380 \#$$

* Reduction
due to
 $f'_c = 3000$
Psi

$$\text{Interaction, } I = \frac{1788}{270} + \frac{457}{380} = 7.8 > > > 1.$$

S.M. = $\frac{1}{7.8} - 1 = -0.87$

N.G.

Recommend Cross brace @ Top

ANALYTICAL CALCULATIONS

REV 1
Page 5-21 of PAGE

Subject Lard Can Storage Rack, 2736-Z Bldg.
 Originator M. A. ISLAM Date 4/14/94
 Checker F. O. Wemei Date 4/21/94

ANSYS MODEL

ANALYTICAL CALCULATIONS

REV 1 PAGE
Page 8-22 ofSubject Lard Can Storage RackOriginator M.A. ISLAMDate 4/15/94Checker E.O. WheelerDate 4/21/94weight of Rack

$$T_s 2\frac{1}{2} \times 2\frac{1}{2} \times \frac{1}{4} = (4 \times 83 + 5 \times 2 \times 42 + \sqrt{42^2 + 82^2}) / 12 \times 7.11 \frac{\#}{\text{in}} = 500 \frac{\#}{\text{in}}$$

$$L3 \times 2 \times \frac{1}{4} = (5 \times 2 \times 28) / 12 \times 4.1 \frac{\#}{\text{in}} = 96 \frac{\#}{\text{in}}$$

$$2L1\frac{1}{2} \times 1\frac{1}{2} \times \frac{1}{4} = (2 \times 4 \times 28) / 12 \times 4.38 \frac{\#}{\text{in}} = 82 \frac{\#}{\text{in}}$$

$$\Sigma W = 678 \frac{\#}{\text{in}}$$

$$\text{Contents} = 6 \text{ cans} \times 4 \text{ row} \times 50 \frac{\#}{\text{can}} = 1200 \frac{\#}{\text{in}}$$

$$\text{Total Wt. } \Sigma W = 678 + 1200 = 1878 \frac{\#}{\text{in}} \text{ plus chain}$$

$$\text{Use } W = 1900 \frac{\#}{\text{in}}$$

Stiffnesses (Refer ANSYS Output displacement @ Node 45)

$$K_x = \frac{1}{.0003578} = 2.8E3 \frac{\#}{\text{in}}$$

$$K_y = \frac{1}{.0002709} = 3.7E3 \frac{\#}{\text{in}}$$

$$K_z = \frac{1}{.000044} = 2.3E4 \frac{\#}{\text{in}}$$

Frequency

$$f_x = 3.13 \sqrt{\frac{2.8E3}{1900}} = 4 \text{ Hz} ; f_y = 3.13 \sqrt{\frac{3.7E3}{1900}} = 4 \text{ Hz}$$

$$f_z = 3.13 \sqrt{\frac{2.3E4}{1900}} = 11. \text{ Hz}$$

All frequencies are less than 16.7 Hz. Therefore, the lard can rack is flexible.

* Per WHC-SD-GN-DGS-3000L, Rev 1

REV 1 PAGE

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

/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

f,45,fx,1

lwrite

• dead loads

* Unit load along X

fdele,45,fx
f,45,fy,1
lwrite
fdele,45,fy
f,45,fz,1
nlist,all
elist,all
lwrite
afwrite

• Unit load along Y

* Unit load along Z

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WHC-SD-CP-SA-026

REV 1 PAGE

Page B-25

WHC-SD-CP-SA-026

REV 1 PAGE

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= 0.000000E+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

WHC-SD-CP-SA-026

REV 1 PAGE

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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= 0.00000E+00 LOAD CASE= 3
TITLE= Stiffness of metal rack for lard can

NSL FOR LABEL= NODE FROM 45 TO 45 BY 1

1 NODES (OF 45 DEFINED) SELECTED BY NSL 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*

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.

* 1 st Row is	18 feet long	* 2 nd Row	18 feet long
	28 inches wide		28 inches wide
	82 inches tall		82 inches tall

* 3 rd 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

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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

Corner pieces are 1/16" angle iron
Sides & back are thin sheet metal
Bolted to floor
Bolted to wall
Bolted to each other
Wire mesh covers the front

1/16" sheet Metal

1/16" sheet Metal

1/16" sheet Metal

L1x1x1/8"

7-in Can

L20 Ga. diagonal Mesh

7-IN METAL STORAGE CAN RACK IN BLDG. 2736-Z
VAULT 2 (INSIDE & OUTSIDE OF EACH COMPARTMENT
OF CAN STORAGE SHOWN)

$TS 2 \frac{1}{2} \times 2 \frac{1}{2} \times \frac{1}{4}$

$TS 2 \frac{1}{2} \times 2 \frac{1}{2} \times \frac{1}{4}$

Lard Can

LARD CAN METAL STORAGE RACK
(2736-Z BLDG.)

ANALYTICAL CALCULATIONS

Page ____ of ____

Subject Lard Can Storage Rack, 2736-Z Bldg.Originator M.A. Islam Date 9/28/94Checker E.O. Weiner Date 10/26/94Scope

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.

DESIGN ANALYSIS

Calc. No.

Revision

Page No.

Client

WO/Job No.

Subject LARD CAN RACK

Date 2/9/95

By Carleton J. Moore

ANSYS MODAL VIBRATION INPUT FILE

Checked 2/17/95

By MA Islam

Location PFP

Revised

By

WHC-SD-CP-SA-026

REV ~~10~~ ¹ PAGE B-32

```

/PREP7
/TITLE,DYNAMIC MODEL OF METAL RACK FOR LARD CAN

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antype,modal

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mxpand,2

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modort,subsp,2

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/view,1,1,1,1

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/com

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Filename: lard

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/com

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/com

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/com

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/com

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Input by: CJM

Chk by: MAI

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/com

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/com

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et,1,4

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* beam element

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et,2,mass21,,,2

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* mass element

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/com

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/com,kan,0

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mp,ex,1,29e6

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mp,dens,1,.000734

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* steel

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/com

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n,1

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n,2,,, -28

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n,3,42,,, -28

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n,4,42

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n,5,,1

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n,6,14,1

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n,7,28,1

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n,8,42,1

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ngen,5,8,5,12,1,,20.5

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n,45,21,83

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r,1,2.09,1.69,1.69,2.5,2.5,,,3.9

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*Columns & long horizontals

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r,2,1.19,1.09,1.09,4,4,,, .026

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*L3x2x1/4

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r,3,1.38,.277,.576,3,2.07,,, .03

```

*2L1 1/2 x 1 1/2 x 1/4

```

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```

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e,5,13

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e,2,9

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e,9,17

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egen,4,8,-1

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e,3,12

```

```

e,12,20

```

```

egen,4,8,-1

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AS-BUILT MODEL

DESIGN ANALYSIS

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~~0A.1~~

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Subject LARD CAN RACK	Date 2/9/95	By Carleton J. Moore
ANSYS MODAL VIBRATION INPUT FILE	Checked 2/17/95	By MA Islam
Location PFP	Revised	By

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 e,38,45
 e,45,39
 e,39,40
 e,41,42
 egen,3,1,-1
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 e,13,22
 egen,3,9,-1
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 egen,5,8,-1
 e,8,12
 egen,5,8,-1
 real,3
 e,6,10
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 en,92,10
 en,93,11

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Date 2/9/95

By Carleton J. Moore

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Checked 2/17/95

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Revised

By

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/post1
set,list

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1

* Unit load along X

* Unit load along Y

* Unit load along Z

1

DYNAMIC MODEL OF METAL RACK FOR LARD CAN

ANSYS 5.0 A
FEB 15 1995
11:21:04
PLOT NO. 2
DISPLACEMENT
STEP=1
SUB =1
FREQ=16.017
RSYS=0
DMX =0.756097
U

*DSCA=10
XV =1
YV =1
ZV =1
DIST=54.868
XF =21.329
YF =41.543
ZF =-10.233
CENTROID HIDDEN

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1

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

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Client	WO/Job No.
Subject LARD CAN RACK WITH TOP BRACING	Date 2/10/95
ANSYS MODAL VIBRATION INPUT FILE	By Carleton J. Moore
Location PFP	Checked 2/17/95
	By MA Islan
	Revised
	By

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/PREP7

/TITLE,DYNAMIC MODEL OF METAL RACK FOR LARD CAN (Ivib5.ans 2/10/95 CJM)

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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

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* beam element

et,2,mass21,,,2

* mass element

/com

/com,kan,0

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mp,dens,1,.000734

* steel

/com

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n,4,42

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n,8,42,1

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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

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r,7,.47,.175,.175,2.,2.

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real,1

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MODEL W/BRACE

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Subject LARD CAN RACK WITH TOP BRACING

Date 2/10/95

By Carleton J. Moore

ANSYS MODAL VIBRATION INPUT FILE

Checked 2/17/95

By MA Islam

Location PFP

Revised

By

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Subject LARD CAN RACK WITH TOP BRACING

Date 2/10/95

By Carleton J. Moore

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Checked 2/17/95

By MA Islam

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 /com,f,45,fy,1

* Unit load along X

* Unit load along Y

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ANSYS MODAL VIBRATION INPUT FILE

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/com,lwrite

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/com,f,45,fz,1

* Unit load along Z

/com,nlist,all

/com,elist,all

/com,lwrite

/com,afwrite

finish

/solu

solve

finish

/solu

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solve

finish

/post1

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1

DYNAMIC MODEL OF METAL RACK FOR LARD CAN (lvib5.ans 2/10/95 CJM)

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

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

1

DYNAMIC MODEL OF METAL RACK FOR LARD CAN (lvib5.ans 2/10/95 CJM)

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

1

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

spectra.c

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

WHC-SD-CP-SA-026

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Subject Lard Can Rack
Originator M.A. ISLAM Date 2/17/95
Checker E. E. O'Connor 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 $.33 g$ 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 $.33 g$ 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

Subject Lard Can Storage RackOriginator M.A. ISLAMDate 9/22/94Checker E.O. WeinerDate 10/26/94

Date 10/26/94

ANALYTICAL CALCULATIONS

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Subject Lard Can Storage RackOriginator M.A. ISLAMDate 9/23/94Checker E.O. WernerDate 10/26/94Anchor 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:

$$\text{Axial stiffness, } K_A = \frac{AE}{L} = \frac{.938 \times 29 \times 10^6}{30} = .907 \times 10^6 \text{ \#/in}$$

$$\text{Bending Stiffness, } K_B = \frac{3EI}{L^3} = \frac{3 \times 29 \times 10^6 \times .348}{30^3} = .0011 \times 10^6 \text{ \#/in}$$

$$\text{Axial distribution} = \frac{.907}{.907 + .0011} = .999$$

$$\text{Out of Plane} = .0012 \approx \text{Neglect}$$

This indicates that top support will provide in-plane support only. Therefore, no load will be transferred from one direction to other.

ANALYTICAL CALCULATIONS

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Subject Lard Can Storage RackOriginator M. A. ISLAMDate 9/23/94Checker E. O. WeinerDate 10/26/94Transverse3 panels @ $F_{H1} = 1292^*$ per panel

$$\therefore \Sigma F_{H1} = 3 \times 1292 = 3876^{\#}$$

* In reality this could be $1292 \times \frac{.33}{.68}$ New accln. = $627^{\#}$ previous accln.

$$\therefore R_T = \frac{3876}{2} = 1938^{\#} \text{ per row of panels}$$

$$R_B = \frac{3876}{2 \times (4 \times 3)} = 162^{\#} \text{ per anchor}$$

#s of anchors #s of panel

Longitudinal5 panels @ $F_{H2} = 1292^*$ per panel

$$\therefore \Sigma F_{H2} = 5 \times 1292 = 6460^{\#}$$

Similar to transverse direction,

$$R_T = \frac{6460}{2} = 3230^{\#} \text{ per row of panels}$$

$$R_B = \frac{6460}{2 \times (4 \times 5)} = 162^{\#} \text{ per anchor}$$

Vertical direction is inactive, because, no pullout will develop at the base anchors.

For braces and their bases, use $R_T = 3230^{\#} > 1938^{\#}$

$$\text{and } \Sigma R_B = \sqrt{(162)^2 + (162)^2} = 229^{\#} \text{ per anchor (shear)}$$

ANALYTICAL CALCULATIONS

WHC-SD-CP-SA-026

REV ~~107~~ PAGE B-51
Page _____ of _____Subject Lard Can Storage RackOriginator M. A. ISLAMDate 9/23/94Checker Ed WeinerDate 10/20/94Evaluate Reactions @ Braces by ANSYS, Rev 5.0(ANSYS Input and results are shown
in Pages B-58 thru B-61)

$$P_1 = \frac{3230}{2} = 1615 \text{ \#}$$

$$P_2 = 2 \times 1292 \times \frac{1}{2} = 1292 \text{ \#}$$

Refer to Ansys run output,

$$\text{Max. Reaction @ Node 5} = 3144 \text{ \#}$$

$$\text{" @ " 1} = 847 \text{ \#}$$

* This will be shear to base P_2 in addition
to pullout load from transverse direction

$$\text{Max. Bending Moment in elements 1 thru 8} \\ = 28,424 \text{ \#-in @ Elem 7 or 8}$$

Use these forces to design base P_2 , brace
and connections.

ANALYTICAL CALCULATIONS

WHC-SD-CP-SA-026

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Subject Lard Can storage RackOriginator M.A. ISLAMDate 9/23/94Checker EO WeinerDate 10/26/94Base anchorFor 1/4" ϕ anchor, per WHC-SD-GN-DGS-30006, Rev 1
Table 8.3 (Prorated) ^{3/8" ϕ capacity}

$$\text{Allow. } T = \left(\frac{1.46}{.11} \right) \times \frac{\pi}{4} (1.25)^2 \times .6 \times .75 = 293 \# \quad \begin{array}{l} * \text{ Reduction} \\ \text{due to} \\ \text{Unknown} \\ \text{type of} \\ \text{anchor} \end{array}$$

$$V = 293 \times \left(\frac{1.42}{1.46} \right) = 285 \#$$

** Reduction due to Reduced Inspection (Tightness, Emb. Length check ignored)

$$\therefore \text{Interaction, } I = \frac{229}{285} = .8 < 1 \quad \text{OK, M.S.} = .24$$

Top Base Φ

$$\text{Long. Direction, } T = \frac{3144}{4} = 786 \# \quad \text{and no shear} \quad \text{--- ANSYS}$$

$$\text{Trans. " " } T = \frac{1938}{4} = 485 \#; \text{ shear} = \frac{847}{4} = 212 \# \quad \text{--- ANSYS}$$

 $\therefore$ Use enveloped loads.For 1/2" ϕ x 2 3/4" Emb., per SDC-4.2, Rev 0
HKB II

$$\left. \begin{array}{l} T_{all.} = 1230 \# \\ V_{all.} = 1470 \# \end{array} \right\} \begin{array}{l} \text{for Carbon steel \& Emb.} = 2 \frac{3}{4}'' \\ \text{and } *f_c' = 3000 \text{ Psi} \end{array}$$

* conservative
actually, $f_c = 4000 \text{ Psi}$

$$\text{For } T = 786 \# \text{ and } V = 212 \#$$

$$\therefore \text{Interaction, } I = \frac{786}{1230} + \frac{212}{1470} = .78 < 1 \quad \text{OK}$$

M.S. = .28

check base Φ

$$M = 2T(\text{arm}) = 2 \times 786 \times 2'' = 3144 \# \cdot \text{in} \quad \begin{array}{l} \text{\#s anchor} \\ \text{max.} \end{array}$$

$$S = 8 \times \frac{.5^2}{6} = .33 \text{ in}^3$$

$$f_b = \frac{3144}{.33} = 9527 \text{ Psi} < .75 \times 36000 \quad \text{OK}$$

$$\text{M.S.} = \frac{.75 \times 36000}{9527} - 1 = 1.83$$

ANALYTICAL CALCULATIONS

WHC-SD-CP-SA-026

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Page _____ of _____Subject Lard Can Storage RackOriginator M.A. ISLAMDate 9/26/94Checker EO WernerDate 10/26/94check Top Connection L2x2x1/4 (New)

Max. axial load = 3144 # (from ANSYS)

$$KL/r_{min} = 1 \times 30 / .391 = 77 \Rightarrow F_{allow} = 15690 \text{ #/in}^2 \text{ (AISC 8th Ed.)}$$

$$\therefore \sigma = \frac{3144}{1.938} = 3352 \text{ Psi} < 15690 \text{ Psi OK}$$

area of L2x2

$$M.S. = \frac{15690}{3352} - 1 = 3.68$$

There are 5 panels at either side of exist. L2x2

$$\therefore \text{Max. Load} = 5 \times 1292 \times \frac{1}{2} \text{ (Top)} = 3230 \text{ #}$$

$$\text{Max. Moment} = \frac{28}{36} \times 3230 \times 8 = 20098 \text{ #-in}$$

$$\text{Bending stress, } \sigma_b = \frac{20098}{.247} = 81368 \text{ Psi} > \frac{16 \times 36000}{1.33} \text{ Psi}$$

(N.G.) = 28800 Psi

Replace exist. L2x2x1/4 by L4x4x3/8 (As input in ANSYS)Section Modulus of L4x4x3/8, $S = 1.52 \text{ in}^3$

$$\text{Max. Moment} = 28,424 \text{ #-in (from ANSYS)}$$

$$\sigma_b = \frac{28424}{1.52} = 18,700 \times 1.3 < 28,800 \text{ Psi OK}$$

increase for unsymmetrical bending

$$= 24,310 \text{ Psi} \quad M.S. = 1.8$$

* For seismic load, allow. stress can be increased by 33% (AISC 8th Ed.)

ANALYTICAL CALCULATIONS

WHC-SO-CP-SA-026

REV 103 PAGE B-54
Page ____ of ____Subject Lard Can Storage RackOriginator M. A. ISLAMDate 9/26/94Checker E.O. WernerDate 10/26/94Check Bolt betn. L2x2 & L4x4

Max. Load per bolt = 3144 #

Allowable bolt load in shear

$$= 10000 \frac{\#}{\text{in}^2} \times \frac{\pi}{4} (.75)^2$$

$$= 4400 \# > 3144 \# \quad \text{OK}$$

M.S. = .4

shear area in L2x2x1/4 = .25 x .25 x 2 = .625 in²

$$\tau = \frac{3144}{.625} = 5030 \frac{\#}{\text{in}^2} < .4 \times 36000 \times 1.33 \quad \text{OK}$$

bearing area in L2x2x1/4 = .25 x .75 = .1875 in²

$$\sigma_{\text{bear.}} = \frac{3144}{.1875} = 16,768 \text{ Psi}$$

$$< .9 F_y = .9 \times 36000 \times 1.33 = 43,100 \text{ Psi} \quad \text{OK}$$

Connection betn. L4x4 (New) & # 1/2 (exist.)

$$\text{Moment} = \frac{3144}{2} \times 1 = 1572 \frac{\# \cdot \text{in}}{2}$$

$$\text{Section Modulus, } S = \frac{2 \times .25^2}{6} = .0208 \text{ in}^3$$

$$\sigma_b = 1572 / .0208 = 75,577 \text{ Psi} > \frac{.75 \times 36000}{1.33} = 35,910 \text{ Psi}$$

(N.G.)

Disregard exist. # 1/2 and connect the new L4x4 to exist. tube steel of Lard frame by 2- 1/2" bolt

$$\text{Capacity of } 2 - \frac{1}{2} \text{ bolts in tension}$$

$$= 20000 \times \frac{\pi}{4} (.5)^2 \times 2 = 7840 \frac{\#}{\text{bolt}} \times 1.33$$

$$> 3144 \# \quad \text{OK}$$

ANALYTICAL CALCULATIONS

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Page REV 1 of 1 PAGE B-55Subject Lard Can Storage RackOriginator M. A. ISLAMDate 9/27/94Checker EO WeenerDate 10/26/94splice 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
 $M = 20787 \text{ \#-in}$ (very cons.)

$$\text{Tension per bolt (due to } M) = \frac{20787}{7 \times 2} = 1485 \text{ \#}$$

$$\text{Tension (allow.)} = 20000 \times \frac{\pi}{4} (.5)^2 \times 1.33 = 5054 \text{ \#} > 1485 \text{ \# OK}$$

Shear betn. Node 4 & 5

$$\therefore \text{Shear @ splice} = 1144 \text{ \#}$$

For 1/2 inch A307 bolt

$$\text{Shear (allow.)} = 10000 \times \frac{\pi}{4} (.5)^2 \times 1.33 \times 6 = 15162 \text{ \#} > 1144 \text{ \# OK}$$

$$I = \frac{1485}{5054} + \frac{1144}{15162} = .37; \text{ M.S.} = 1.7$$

Weld betn. splice plate 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.

 $\therefore$ Splice is OK.

ANALYTICAL CALCULATIONS

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Subject Lord Can Storage RackOriginator M. A. ISLAMDate 9/27/94Checker EO WeinerDate 10/26/94Frame to frame Connection

Long Direction

$$P_L = 4^{\text{Panels}} \times 1292 \times \frac{1}{2} \times \frac{1}{2}^{\text{Top one side}} = 1292^{\#}$$

Short Direction

$$P_S = 3^{\text{Panels}} \times 1292 \times \frac{1}{2}^{\text{Top}} = 1938^{\#}$$

Shear allowable of exist. $5/16"$ 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 $5/16"$ screw = $\frac{1938}{1020} + \frac{4 \times 1292}{2040} = 2.15 > 1$

Replace $5/16"$ screws by $1/2"$ A307 bolts

$$T_{all} = 20000 \times \frac{\pi}{4} (.5)^2 \times 1.33 = 5054^{\#}$$

$$V_{all} = 10000 \times " = 2527^{\#}$$

$$\text{Interaction} = \frac{1938}{2527} + \frac{4 \times 1292}{5054} = .87 < 1 \quad \text{OK}$$

$$M.S. = .15$$

per Guideline
WHC-SD-CP-SA-026-
30006, REV 0

ANALYTICAL CALCULATIONS

WHC-SD-CP-SA-026

REV 10A PAGE B-57

Page of

Subject Lard Can Storage Rack

Originator M. A. ISLAM

Date 9/27/94

Checker EO Werner

Date 10/26/94

Bending in Clip R (Include prying action due to bolt)

Refer to Blodgett's "Design of Welded Structure", Page 3.3-5

$$b = 1" ; d = .25"$$

$$M_1 = \frac{R_V b (3b + 2d)}{2 (3b + d)} = \frac{1292 \times 1 (3 \times 1 + 2 \times .25)}{2 (3 \times 1 + .25)} = 696 \text{ #-in}$$

$$M_2 = \frac{3 R_V b^2}{2 (3b + d)} = \frac{3 \times 1292 \times 1^2}{2 (3 \times 1 + .25)} = 596 \text{ #-in}$$

Section modulus of $1/4 \times 2$ R = $2 \times .25^2 / 6 = .0208 \text{ in}^3$

$$\sigma_b = \frac{696}{.0208} = 33,462 \text{ Psi}; \sigma_b (\text{allow.}) = .75 \times 36000 \times 1.33 \text{ seismic load increase} = 36000 \text{ Psi} > 33,462 \text{ Psi}$$

(Use a washer to increase the bending strength, See Detail Page B-48)

3/16" ϕ Chain

PLAN

This is approximately 1/3 height of lard can. Because lard can is not loaded all the way to the top, the c.g. of the can would be slightly off the chain location. Eccentricity will be insignificant.

Each chain resists 6 Cans, $\therefore \Sigma W = 6 \times 50 \times .68 = 204 \text{ \#}$

Assume 30°

Tension in Cable, $T = \frac{W}{\sin 30^\circ} = 408 \text{ \#}$

Capacity of the chain (2 3/16" ϕ) = $2 \times \frac{\pi}{4} (1.875)^2 \times .6 \times 33000 \times 1.33$ (yield (assume) stress increase)

= $1454 \text{ \#} > 408 \text{ \#}$ OK, M.S. = 28

Capacity of weld = $.3 \times 60000 \times 1" \times 3/32 \times 1.33 = 2244 \text{ \#} > 408 \text{ \#}$

Note: Cans are loaded such that there is no adequate space to cause impact. Beside, top frame member ($T_s 2 \frac{1}{2} \times 2 \frac{1}{2}$) will resist the can to tip over.

```
/prep7
/title,calculate forces in brace
/show,ega256
/view,,,,1
/com                               Filename: lard2
/com
/com
/com
/com                               Input by: MAI
/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
!swrite
solve
nlist,all
elist,all
finish
/exit
```

Chk by: EOW

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

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WHC-SD-CP-3A-023

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ANALYTICAL CALCULATIONS

Page _____ of _____

Subject 7-in Can Metal Storage Rack, 2736-Z BuildingOriginator Michael P. WiersDate 2/27/95Checker William J. MooreDate 3/2/95Scope

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 BuildingOriginator Michael PlueisDate 2/27/95Checker Carlton J. MooreDate 3/2/95ANSYS 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 ($1\frac{1}{2}$ " x $1/16$ ") and they represent the bent edges of the shelves. (In the SC3 model, the shelf edges were represented by $1\frac{1}{2}$ " x $1\frac{1}{2}$ " 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/in².
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 BuildingOriginator Michael PheasDate 2/27/95Checker Carlton J. MoreDate 3/2/95Results

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 BuildingOriginator Michael P. WesDate 2/27/95Checker Carlton J. MooreDate 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 BuildingOriginator Michael D WeisDate 2/27/95Checker Carlton J. MooreDate 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 BuildingOriginator Michael Pluers Date 2/27/95Checker Clinton 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 5.0 A
FEB 23 1995
19:34:37
PLOT NO. 1
ELEMENTS
TYPE NUM

XV =1
YV =2
ZV =3
DIST=46.205
XF =18
YF =42.5
ZF =-6
PRECISE HIDDEN

Metal Rack for 7-in Can in 2736-Z Building

ANSYS Model Used in Safety Class 3 Rack Analysis.

Fundamental-Frequency Mode Shape for ANSYS Model of Safety Class 3
Rack Analysis.

ANSYS 5.0 A
FEB 24 1995
12:38:59
PLOT NO. 1
DISPLACEMENT
STEP=1
SUB =1
TIME=29.154
RSYS=0
DMX =2.742

DSCA=0.722035
YV =1
DIST=20.288
XF =18.443
YF =42.588
ZF =-5.121
PRECISE HIDDEN

WIND=2
DSCA=1.685
XV =1
YV =2
ZV =3
DIST=47.737
XF =19.034
YF =42.705
ZF =-3.95
PRECISE HIDDEN

WIND=3
DSCA=1.705

ANALYTICAL CALCULATIONS

Page ____ of ____

Subject 7-in Can Metal Storage Rack, 2736-Z Building
 Originator Michael P. Weiss Date 2/24/95
 Checker Carlton J. Moore Date 3/2/95

Participation Factor Table for ANSYS Model of Safety Class 3 Rack 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 BuildingOriginator Michael P Weis Date 2/24/95Checker Carlton 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

$$f = \left(\frac{1.875}{2\pi} \right)^2 \sqrt{\frac{EI}{\rho A L^4}}$$

$$= \left(\frac{1.875}{2\pi} \right)^2 \sqrt{\frac{EI \gamma}{WL^4}} \quad \text{where } \rho A = \bar{m} = \frac{W}{g}; \quad W = \text{weight per length}$$

$$\bar{m} = \text{mass per unit length}$$

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.

$$\gamma_{\max} = \frac{WL^4}{8EI} \Rightarrow I = \frac{WL^4}{8E\gamma_{\max}}$$

Ansys model of typical panel

$$\gamma_{\max} = 0.01759 \text{ in (Ansys static analysis - 1g load)}$$

$$L = 85 \text{ in}; \quad E = 29 \times 10^6 \text{ lbf/in}^2$$

$$W = 433 \text{ lbf}; \quad w = W/L = 5.1 \text{ lbf/in}$$

$$I = \left[\frac{(5.1 \text{ lbf/in})(85 \text{ in})^4}{8(29 \times 10^6 \text{ lbf/in}^2)(0.01759 \text{ in})} \right] = 65.2 \text{ in}^4$$

$$f = \frac{1.875^2}{2\pi} \left\{ \left[\frac{(29 \times 10^6 \text{ lbf/in}^2)(65.2 \text{ in}^4)(386.4 \text{ in/s}^2)}{(5.1 \text{ lbf/in})(85 \text{ in})^4} \right] \right\}^{1/2}$$

$$f = 29.3 \text{ Hz}$$

Reference: Timoshenko et al, 1974, Vibration Problems in Engineering, 4th Edn, John Wiley & Sons, N.Y.

ANALYTICAL CALCULATIONS

Page _____ of _____

Subject 7-in Can Metal Storage Rack, 2736-Z BuildingOriginator Michael D. Weiss Date 2/27/95Checker Carlton 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 BuildingOriginator Michael Plueis Date 2/27/95Checker Carlton 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

r,2,area2,izz2,iyy2,tkz2,tky2,,,ixx2

r,3,t,t,t,t

r,4,tdiv,tdiv,tdiv,tdiv

r,6,mddoor

! beam for panel

! beam for shelf edges

! shell for panel

! thinner shell for vertical dividers

! (measured)

! 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 Weiss Date 2/27/95

Checker Carlton 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. Wiers

Date 2/27/95

Checker Carlotta 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 BuildingOriginator Michael D. Lewis Date 2/27/95Checker Carlton 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

Page _____ of _____

Subject 7-in Can Metal Storage Rack, 2736-Z Building

Originator Michael P. Weiss 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

cpngen,205 + nsetinc,uy,uz

cp,208 + nsetinc,ux,7 + shfinc,122 + divinc

cpngen,208 + nsetinc,uy,uz

cp,211 + nsetinc,ux,72 + shfinc,147 + divinc

cpngen,211 + nsetinc,uy,uz

cp,214 + nsetinc,ux,77 + shfinc,148 + divinc

cpngen,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. Weiss Date 2/27/95

Checker Carlton 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 5.0 A
FEB 23 1995
15:47:41
PLOT NO. 3
ELEMENTS
TYPE NUM

XV =1
YV =2
ZV =3
DIST=46.437
XF =18
YF =41.25
ZF =6
PRECISE HIDDEN

Metal Rack for 7-in Can in 2736-Z Building

ANSYS Model Used in this Analysis (4 Pin Supports at Floor and
Unidirectional (Z) Pin Support for Cross Bracing).

WHC-SD-CP-SA-006
REV1 ~~1~~ PAGE 2-80

ANSYS 5.0 A
FEB 23 1995
17:01:24
PLOT NO. 1
ELEMENTS
TYPE NUM

XV =1
YV =2
ZV =3
DIST=46.437
XF =18
YF =41.25
ZF =6
PRECISE HIDDEN

ANSYS Model Used in this Analysis (2 Pin Supports at Floor and
Pin Support for Cross Bracing).

ANSYS Model: Back and Side Faces.

Metal Rack for 7-in Can in 2736-Z Building

ANSYS 5.0 A
FEB 24 1995
18:32:56
PLOT NO. 1
ELEMENTS
TYPE NUM

XV =1
YV =2
ZV =3
DIST=46.437
XF =18
YF =41.25
ZF =6
PRECISE HIDDEN

ANSYS 5.0 A
FEB 23 1995
15:47:05
PLOT NO. 2
ELEMENTS
TYPE NUM
CP
XV =1
YV =2
ZV =3
DIST=46.437
XF =18
YF =41.25
ZF =6
PRECISE HIDDEN

ANSYS Model: Shelves and Vertical Dividers and their Coupling.

ANSYS Model: Beam Elements Representing Bent Plate at Shelf Edges.

Metal Rack for 7-in Can in 2736-Z Building

ANSYS 5.0 A
FEB 24 1995
11:43:59
PLOT NO. 1
ELEMENTS
TYPE NUM

XV =1
YV =2
ZV =3
DIST=46.437
XF =18
YF =41.25
ZF =6
CENTROID HIDDEN

WHIC-SD-CP-SA-026
REV ~~1~~ PAGE 8-84

ANSYS 5.0 A
 FEB 24 1995
 18:36:50
 PLOT NO. 1
 ELEMENTS
 TYPE NUM
 MAST
 XV =1
 YV =2
 ZV =3
 DIST=46.437
 XF =18
 YF =41.25
 ZF =6
 PRECISE HIDDEN

Master DOF used in Householder Modal Analysis for 4-Floor-Anchor Model.

Fundamental-Frequency Mode Shape for 4-Floor-Anchor Model

ANSYS 5.0 A
FEB 24 1995
14:30:19
PLOT NO. 1
DISPLACEMENT
STEP=1
SUB =1
TIME=30.745
RSYS=0
DMX =2.929

DSCA=0.676039
YV =1
DIST=20.282
XF =17.562
YF =41.311
ZF =6.873
PRECISE HIDDEN

WIND=2
DSCA=1.586
XV =1
YV =2
ZV =3
DIST=47.929
XF =16.973
YF =41.393
ZF =8.047
PRECISE HIDDEN

WIND=3
DSCA=1.606

Metal Rack for 7-in Can in 2736-Z Building

ANALYTICAL CALCULATIONS

Page _____ of _____

Subject 7-in Can Metal Storage Rack, 2736-Z Building
 Originator Michael P. Weiss Date 2/21/95
 Checker Cathy 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.

ANSYS 5.0 A
FEB 24 1995
14:53:12
PLOT NO. 1
DISPLACEMENT
STEP=1
SUB =1
TIME=27.057
RSYS=0
DMX =2.791

DSCA=0.709468
YV =1
DIST=20.229
XF =17.75
YF =41.325
ZF =6.922
PRECISE HIDDEN

WIND=2
DSCA=1.664
XV =1
YV =2
ZV =3
DIST=48.012
XF =17.413
YF =41.426
ZF =8.162
PRECISE HIDDEN

WIND=3
DSCA=1.685

ANALYTICAL CALCULATIONS

Page _____ of _____

Subject 7-in Can Metal Storage Rack, 2736-Z Building

Originator Michael P. Plus

Date 2/22/95

Checker Carlton J. Moore

Date 3/22/95

Participation Factor Table for 2-Fl oor-A nchor 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, 2736-2 Building

Originator Michael P. Wees Date 2/26/95

Checker Carlota J. Morris 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 lb/ft² (page B-4). Assuming the two door support beams and the door structural members are 1 1/2" x 1 1/2" x 1/8" bent plate, calculate weight:

$$W = (3 \times 1/8") (4 \times 85" + 3 \times 36" + 2 \times 80") (0.283 \text{ lb/in}^3)$$

door vertical
door horizontal
door supports

$$(36" \times 85") \left(\frac{1}{144} \frac{\text{ft}^2}{\text{in}^2} \right) (0.85 \text{ lb/ft}^2)$$

wire mesh

$$W = 50.5 \text{ lb}$$

$$W_{tot1} = 427.5 \text{ lb}$$

$$W_{mass} = 50.5 \text{ lb}$$

lumped mass elements: doors

$$W_{shell} = 338.32 \text{ lb}$$

$$+ (28 \text{ cans}) (5.5 \text{ lb/can})$$

$$W_{shell} = (35.83 \text{ ft}^2) (2.56 \text{ psf}) + (24 \text{ ft}^2) (2.56 \text{ psf}) + (21 \text{ ft}^2) (1.48 \text{ psf})$$

(Note: the vertical divider were measured with a ruler, and 7-in shell elements: back 3/4 sides 3/4 shelves (7/16") and vertical dividers (0.036")

$$= 387.2 \text{ lb}$$

$$W_{beam} = (28.5 \text{ ft}) (0.64 \text{ lb/ft}) + (64 \text{ ft}) (0.32 \text{ lb/ft})$$

beam elements: columns structure (1 1/2" x 1 1/2" x 7/8") 3/4 shelf edge (1 1/2" x 7/8")

$$Total = 427.2 \text{ lb}$$

Type	Mass (lb/ft ² /in)	Weight (lb/ft)
beam	0.100324	38.765
elastic shell	0.874165	337.777
lumped mass	0.131	50.618
Total		427.2

Verify mass of one panel as calculated by Kustys.

Kustys output mass summary by element type:

Subject: 7-in Can Metal Storage Rack, 2236-7 Building
 Originator: Michael P. Ples
 Date: 2/26/93
 Checker: *Calvin J. Morn*
 Date: 3/2/93

ANALYTICAL CALCULATIONS

ANALYTICAL CALCULATIONS

Page ____ of ____

Subject 7 in Can Metal Storage RackOriginator M. A. ISLAMDate 3/2/95Checker E. C. OconnorDate 3/2/95Anchor Evaluation

The anchors were evaluated in Rev. 0 as safety class 3 items for which an acceleration of .68g 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 .36g (Page F-11). Therefore, the loads are reduced to approximately half.

The allowable anchor values were derived per REF [18] chap 4. However, change of safety classification requires to use chap. 8 of REF [18]

Per Rev 0, allow. values for 1/4" anchor

$$\left. \begin{array}{l} T_{all.} = 270 \# \\ V_{all.} = 380 \# \end{array} \right\} \text{ Chap. 4 REF [18]}$$

Per this evaluation, (Rev 0-A), allowable values

$$\left. \begin{array}{l} T_{all.} = 293 \# \\ V_{all.} = 285 \# \end{array} \right\} \begin{array}{l} \text{Chap. 8 REF [18]} \\ \text{See Calc. in Page B-52} \end{array}$$

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 brace etc.) are adequate.

APPENDIX C
CUBICLES AND PEDESTALS EVALUATION

DESIGN CALCULATION

WHC-SD-CP-SA-026

(1) Drawing _____ (2) Doc. No. _____ (3) Page REV 1 2 of PAGE
 (4) Building _____ (5) Rev. _____ (6) Job No. _____
 (7) Subject _____
 (8) Originator R.A. Miller Date 4-13-94
 (9) Checker M.A. ISLAM Date 5-25-94

(10)

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.

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	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

DESIGN CALCULATION

WHC-SD-CP-SA-026

REV 1 PAGE

(1) Drawing _____ (2) Doc. No. _____ (3) Page 23 of _____
 (4) Building _____ (5) Rev. _____ (6) Job No. _____
 (7) Subject 27367 Cubicles, Rm 4 - Cubicle Wts
 (8) Originator EOWemer 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

$$\text{Concr: } 1.67' \times .667' \times 8' \times 150 \text{ pcf} = 1340^{\#}$$

$$\text{MC } 8 \times 8.5 \quad 3.7' \times 8.5^{\#/1} = 31$$

$$4 \text{ L } 3 \times 3 \times \frac{1}{4} \quad 4 \times .667' \times 4.9^{\#/1} = 13$$

$$\text{Total: } 1384$$

G Panel

$$\text{Concr: } 2.65' \times .667' \times 8.1' \times 150 \text{ pcf} = 2150^{\#}$$

$$\text{MC } 8: \quad 2 \times 2.65' \times 8.5^{\#/1} = 45$$

$$\text{Total: } 2200$$

J Panel

$$\text{Concrete: } (.667^2 - \frac{1}{2} \times .333^2) \times 7.5' \times 150 = 440$$

H - Panel (hinged door)

$$\text{Concrete: Use J panel } 440$$

$$\text{MC } 8: \quad 7.5' \times 8.5^{\#/1} = 64$$

$$\text{Total } 500$$

Door extension: Dwg H-2-80400

 $\frac{1}{4}"$ PL at 0.62 perforation

$$0.25" \times (11" \times 7.5 \times 12" \times 0.62) \times .28 \text{ pci} = 43^{\#}$$

Pedestal ass'y. Dwg H-2-70010, 70158, 26649

$$14 \text{ cans/ass'y @ } 5.5^{\#/\text{can}} = 77^{\#}$$

Holder, 16 ga @ 6" ϕ , 14 count

$$2.66 \text{ pcf} \times \frac{7}{4} \times 6^2 \text{ ft}^2 / 144 \times 14 = 7^{\#}$$

DESIGN CALCULATION

REY 4 PAGE

(1) Drawing _____ (2) Doc. No. _____ (3) Page _____ of _____
(4) Building _____ (5) Rev. _____ (6) Job No. _____
(7) Subject 2736-2 Cubicles, 12m²
(8) Originator E.O. Werner Date 5/19/94
(9) Checker M.A. ISLHM Date 5/10/94

(10)

Instrument frame (photo), est. as
Thin cyl: 3x16 ga, 4.5" ϕ x 2" wall
 $3 \times 2.66 \text{ psf} \times 4.5 \times \pi \times 2/144 = 1.6 \#$
Base = wall
1.6 #

Total $3.2 \times 14 = 45 \#$

Channel .11 ga

$5.16 \text{ psf} \times 3 \times 1.75/12 \times 7.5'$

$= 17 \#$

Total pedestal assembly

$= 146$

One cubic 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	K Panels	2 x 500
4	Pedestal assembly	4 x 146
2	Door ext's	2 x 43
2	Hood (= door ext)	2 x 43
Total		7600

DESIGN CALCULATION

WHC-SD-CP-SA-026

REV 1 PAGE

(1) Drawing _____ (2) Doc. No. _____ (3) Page CS of _____
 (4) Building _____ (5) Rev. _____ (6) Job No. _____
 (7) Subject 2736 z Cubicles - Duct Weights - Rm 1
 (8) Originator E.O. Werner Date 3/24/94
 (9) Checker MA 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

$$2 \times (1.0' + 1.17') \times 2.67' \times 1.41 \text{ psf} = 12.6 \#$$

Trunk flanges $1\frac{1}{4}" \times 1\frac{1}{4}" \times \frac{3}{16}$ ASTM A36

$$2 \times 2 \times (1.0' + 1.17') \times 1.46 \#/\text{ft} = 12.6 \#$$

Branch 1'0" x 2'0"

$$2 \times (1.0' + 2.0') \times 1.67' \times 1.41 \text{ psf} = 14.1 \#$$

Branch flanges: 1.5 pr / branch

$$1.5 \times 2 \times 2 \times (1.0' + 2.0') \times 1.46 \#/\text{ft} = 26.3$$

$$\text{Total: } W = 12.6 + 12.6 + 14.1 + 26.3 = 66 \#$$

$$\text{Both sides (one analysis unit): } W = 66 \times 2 = 132 \#$$

DESIGN CALCULATION

WHC-SD-CP-SA-03

(1) Drawing _____ (2) Doc. No. _____ (3) Page 66 of REV 1 PAGE
 (4) Building _____ (5) Rev. _____ (6) Job No. _____
 (7) Subject 2736 E Cubicles - Door & Pedestal Wts - Rm 1
 (8) Originator E.O. Werner Date 3/21/94
 (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

$$\text{Concrete: } 150 \text{ pcf} \times 8" \times 24" \times 95" / 1728 \\ = 1580 \#$$

$$\text{Steel diff'l: } (1.28 \text{ pci} - .087) \times .187 \times 95 \times 2 (8+24) \\ = 220 \#$$

$$\text{Total 2 doors} = 1580 + 220 = 1800 \# \quad (\text{Rm 1})$$

$$\text{vs } 990 + 43 = 1030 \# \text{ for J4H panels \& door ext in Rm 4}$$

Amplification: See Rm 4 for development

$$A = \sqrt{1 + (24)^2} \quad \Psi = \frac{1}{2 + \frac{I_c}{mb^2}}$$

$$I_c = \frac{m}{12} ((2w_1)^2 + (2w_2)^2)$$

$$w_1 = 8" \quad w_2 = 12"$$

$$\text{Lateral: } b = 6 \quad w_1 = \frac{4}{3}b \quad w_2 = 2b$$

$$I_c = \frac{(8/3)^2 + 16}{12} mb^2$$

$$= 1.93 mb^2$$

$$\Psi = \frac{1}{2 + 1.93} = .255$$

$$A = \sqrt{1 + (2 \times .255)^2} = 1.12$$

$$\text{Longitudinal: } b = 4 \quad w_1 = 2b \quad w_2 = 3b$$

$$I_c = \frac{16 + 36}{12} mb^2 = \frac{13}{3} mb^2 \quad \Psi = \frac{1}{2 + \frac{13}{3}} = \frac{1}{6.33}$$

$$A = \sqrt{1 + (2/6.33)^2} = 1.05$$

$$\text{Use } A = 1.15$$

DESIGN CALCULATION

WHC-SD-CP-SA-026

(1) Drawing _____ (2) Doc. No. _____ (3) Page REV 1 of PAGE 7
 (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 Assy - Rm 1

Assemblies are 18 can (sides) or 9 can (back) assemblies vs 14 can ass'y in Rm 4. Scale Rm 4 weights

$$\text{Side ass'y, each: } W = \frac{18}{14} \times 146^{\#} = 188^{\#}$$

$$\text{Back ass'y : } W = \frac{9}{14} \times 146^{\#} = 94^{\#}$$

Overturning, lateral - Rm 1

Follow Rm 4 calc using corrected wts for Rm 1.
 (Use $a_{max} = 0.34g$)*

Panel	W	h	Ampl	Ms
	lb	in	-	K "
4 drs.	2x1800	48	1.15	67.6
2 L	2x1385	40	1.0	45.2
G	2200	48	1.0	35.9
Ped	4x188. + 2x94	48	1.0	15.3
Duit	132	106	2.0	9.5
Total	9630			173.5

$$V_1 = \frac{M_s - W b (1 - a_y)}{W} = \frac{173.5 - 9.63 \times 24 (1 - .23)}{48}$$

$$= -0.093 \quad (\text{no uplift})$$

* $a_{max} = 0.34g$ justified because balance of report shows cubicles act as monolith which is quite stiff.

(1) Drawing _____ (2) Doc. No. _____ (3) REV ¹ ~~68~~ PAGE _____
(4) Building _____ (5) Rev. _____ (6) Job No. _____
(7) Subject 2736 2 Cubicles - Can/Holder Testing
(8) Originator Eowiner Date 5/10/94
(9) Checker MA ISLAM Date 5/11/94

(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 SDC-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 1.0g maximum base accelerations
- Duration of each test: $T = 40 \text{ sec}$
- The vertical RRS is as severe as the horizontal RRS, whereas SDC-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 0.25g and 0.50g. At 0.75g

(1) Drawing _____ (2) Doc. No. _____ (3) Page REV 1/9 of PAGE
 (4) Building _____ (5) Rev. _____ (6) Job No. _____
 (7) Subject 2736 Cubicles - Can/Holder Testing
 (8) Originator E.O. Weiner Date 5/10/94
 (9) Checker MA ISLAM Date 5/11/94

(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.I.G 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.

WYLE LABORATORIES

WLC-SJ-CP-SA-026

C10

H3

Report No. 58060

CUSTOMER ATLANTIC RICHFIELD

REV 1 PAGE

Job No. 58060

Page No. 16

Full Scale 100 g

Accel. No. 1

Control (X)

Response ()

Operator MEEHAN

Specimen SEE CHECK BELOW

Date 4/1/76

Damping 2.0 %

Axis of Test HRRB

RESPONSE SPECTRA Run 7

DESIGN CALCULATION

WHC-SD-CP-SA-026

(1) Drawing _____ (2) Doc. No. _____ (3) REV ¹ CU PAGE C11 of _____
 (4) Building _____ (5) Rev. _____ (6) Job No. _____
 (7) Subject 2736-2 Cubicles - Pedestal Assy - Rm 4
 (8) Originator ED. Weiner Date 4/4/94
 (9) Checker MA ISLAM Date 5/11/94

(10)

Pedestal Assy - Rm 4

Pedestal ass'y channels are welded to back panel at 4 places with $\frac{1}{16}$ " - 1" welds. Table 4.8 of 30006 gives $F_w = 2.7 \text{ K}/\frac{1}{2} = 1.35 \text{ K}/\text{in}$ so

$$T_{all} = V_{all} = 4 \times 1.35 \text{ K}/\text{in} = 5.4 \text{ K}$$

Scale Rm 1 total bolt load by $\frac{2}{3}$ (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. $\therefore$

$$\left. \begin{aligned} T &= \frac{2}{3} \times 158^\# = 106^\# \\ V &= \frac{2}{3} \times 243^\# = 160^\# \end{aligned} \right\} \begin{aligned} &\text{vs } T_{all} = V_{all} = 5.4 \text{ K} \\ &\text{M.S.} = \underline{\text{large, } > 10} \end{aligned}$$

DESIGN CALCULATION

WHC-SD-CP-SA-026

(1) Drawing _____ (2) Doc. No. _____ (3) Page REV 1 of PAGE C12
 (4) Building _____ (5) Rev. _____ (6) Job No. _____
 (7) Subject 2736Z Cubicles - Pedestal Assy - Rm 1
 (8) Originator EO Weiner Date 5/16/94
 (9) Checker MA ISLAM Date 5/11/94

(10)

Pedestal Assy Rm 1

See Rm 4 weights.

Pedestal Assy Rm 1 -
 Dwg 14-2-70158.

Assembly with 14
 cans in Rm 4 is 146 #
 Add 6 cans:

$$WT = 146 \frac{15}{14} = 188 \#$$

Bolt loads

30006 Table 2.5 $S_a = 0.34g$

$$F_x = 188 \times 0.34 = 64 \# / \text{assy}$$

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

$$T_a = 64 \# \quad V_h = 64 \# \quad V_{grav} = 188 \# \quad V_v = \frac{2}{3} V_h$$

Taken up by 4 bolts:

$$T = 128 + 0.4 \times 64 = 154 \#$$

$$V = 64 + (188 + \frac{2}{3} \times 64) = 239 \#$$

DESIGN CALCULATION

WHC-SD-CP-SA-026

(1) Drawing _____ (2) Doc. No. _____ (3) Page REV 1 C13 of PAGE
 (4) Building _____ (5) Rev. _____ (6) Job No. _____
 (7) Subject 2736 ± Cubicles - Pedestal Assy - 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

$$\frac{T}{T_{all}} + \frac{V}{V_{all}} = \frac{158/4}{1290} + \frac{243/4}{1700} = .066$$

$$MS = \frac{1}{.066} - 1 > 10$$

(1) Drawing _____ (2) Doc. No. _____ (3) Page REV 4 of PAGE
 (4) Building _____ (5) Rev. _____ (6) Job No. _____
 (7) Subject 2736-Z Cubicles - Door Amplification (Rm 4)
 (8) Originator EO Werner Date 3/30/94
 (9) Checker MA ISLAM Date 5/11/94

(10) **Seismic Acceleration ~~Testing~~ 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.

$$y = y_0 + b\theta \quad R_x = m\ddot{x}$$

$$x = x_0 - b\theta \quad R_y = m\ddot{y}$$

$$I_c \ddot{\theta} = m\ddot{x}b - m\ddot{y}b - k\theta \quad (\sum M_c = 0)$$

Substitute for $\ddot{x}$ and $\ddot{y}$

$$(I_c + 2mb^2) b\ddot{\theta} + kb\theta = mb^2\ddot{x}_0$$

Frequency and participation for DOF $b\theta$:

$$f = \frac{1}{2\pi} \sqrt{\frac{k}{I_c + 2mb^2}} \quad \psi = \frac{1}{2 + \frac{I_c}{mb^2}}$$

$$R_x = m\ddot{x} = \underbrace{m\ddot{x}_0}_{\text{Rigid Resp.}} - \underbrace{b\ddot{\theta}}_{\text{Flexible Resp.}}$$

DESIGN CALCULATION

WHC-SD-CP-SA-026

(1) Drawing _____ (2) Doc. No. _____ (3) Page REV 1 015 of PAGE
 (4) Building _____ (5) Rev. _____ (6) Job No. _____
 (7) Subject 2736-Z Cubicles - Door Amplification (Run 4)
 (8) Originator E.O. Warner 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:

$$R_{rig} = m \ddot{x}_o_{max} \quad R_{flex} = \psi m S_a = 2\psi m \ddot{x}_o_{max}$$

$$\therefore R_{x_{max}} = m \ddot{x}_o_{max} \sqrt{1 + (2\psi)^2}$$

Estimate ψ from 8x8 cross-section

$$I_c = m \frac{(2w)^2}{6} \quad w = 2b \quad I_c = \frac{8}{3} m b^2$$

$$\psi = \frac{1}{2 + \frac{8}{3}} = \frac{3}{14}$$

$$R_{x_{max}} = m \ddot{x}_o_{max} \sqrt{1 + \left(\frac{2 \times 3}{14}\right)^2} = 1.09 m \ddot{x}_o_{max}$$

This shows that full door amplification raises the rigid response by about 10%

DESIGN CALCULATION

WHC-SD-CP-SA-026

(1) Drawing _____ (2) Doc. No. _____ (3) REV 4 PAGE 16 of _____
(4) Building _____ (5) Rev. _____ (6) Job No. _____
(7) Subject _____
(8) Originator RA Hilla Date 4-13-94
(9) Checker MA ISLAM Date 5/12/94

(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.

Room 3 & 4

Wall Supported Arrangement :

Rooms 3 & 4

Free Standing Arrangement :

H-2-26651

H-2-26651

Older type cubicals

Review Details on Drawings

(1) Drawing	(2) Doc. No.	(3) Page No.	(4) Building	(5) Rev.	(6) Job No.	(7) Subject	(8) Originator	(9) Checker
							R. A. H. K.	M. A. ISLAM
							4-0-94	5/17/94

REV 17 of PAGE

DESIGN CALCULATION

WHC-SD-CF-SA-026

DESIGN CALCULATION

WHC-SD-CP-SA-026

REV 1. PAGE
(1) Drawing _____ (2) Doc. No. _____ (3) Page C18 of _____
(4) Building _____ (5) Rev. _____ (6) Job No. _____
(7) Subject _____
(8) Originator R.A. Miller Date 4-6-94
(9) Checker MA ISLAM Date 5/17/94

(10) Overturning Moment "Rigid Response" Loads

* Panel E or D	1370 [#]	x 18 pands	= 24660 [#]
Panel G	2200	x 8	= 17600
Panel J	440	x 16	= 7040
Panel H	500	x 16	= 8000
Door Ext.	43	x 16	= 688
* Pedestals	127	x 64	= 8128
Hood	43	x 16	= 688
			<u>66804[#]</u>

$$\text{OTM} = 66804 \times 0.34_g \times 48''$$

$$= \underline{\underline{1,090,241'' \cdot \#}}$$

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

DESIGN CALCULATION

WHC-SD-CP-SA-026

(1) Drawing _____ (2) Doc. No. _____ (3) Page REV 1 619 of PAGE
 (4) Building _____ (5) Rev. _____ (6) Job No. _____
 (7) Subject _____
 (8) Originator R.A. Miller Date 4-6-94
 (9) Checker MA ISLAM Date 5/17/94

(10) Assume Monolithic Unit, Rigid Response

Vertical Uplift: NS-direction

$$OTM = 1,090,241 \text{ " \#}$$

Dead Wt. Resist. Moment

$$DWRM = 66804 \text{ \#} \cdot \frac{48 \text{ "}}{2} = 1,603,296 \text{ " \#}$$

Vertical Seismic Moment

$$VSM = 66804 \text{ \#} \left(0.34_g \frac{3}{3}\right) \frac{48 \text{ "}}{2} = 363414 \text{ " \#}$$

$$\text{Uplift} = OTM + VSM - DWRM$$

$$= 1090241 + 363414 - 1603296$$

$$= \underline{\underline{-149641 \text{ " \#}}}$$

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.

DESIGN CALCULATION

WHC-SD-CP-SA-023

(1) Drawing _____ (2) Doc. No. _____ (3) Page REV 1 220 of 220 PAGE
 (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

$$\tau = \frac{Vay}{I t} \quad @ \text{ interface between D \& G / E \& G}$$

$$\begin{aligned} V &= \text{vert. shear } W \\ &= 66804 \times .349 \div 9 \text{ units} \\ &= 2524 \# \end{aligned}$$

$$\begin{aligned} a &= \text{area} = 8" \times 20" \\ &= 160 \text{ si} \end{aligned}$$

$$y = 4" + 10" = 14"$$

$$I = \frac{8(48)^3}{12} = 73728 \text{ in}^4$$

$$t = 8"$$

$$\tau = 9.59 \text{ psi}$$

The connection between D or E & G is 6" of $\frac{3}{16}$ " weld, 3" at top & 3" at bottom. Detail 67 on H-2-26654

$$\text{Shear Force } f_v = 96" \times 8" \times 9.59 \text{ psi} = 7365 \# / \text{wall pair unit}$$

DESIGN CALCULATION

WHC-SD-CP-SA-025

(1) Drawing _____ (2) Doc. No. _____ (3) Page REV 1 of PAGE C21
 (4) Building _____ (5) Rev. _____ (6) Job No. _____
 (7) Subject _____
 (8) Originator RA Miller 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 ∴

$$\text{bolt tension} = .707 \times 1841$$

$$= 1301\#$$

$$\text{bolt shear} = 1301\#$$

$$\text{bolt allowable} = .6F_y(.049\text{si})1.33 = 1955\# > 1301\# \text{ tension}$$

[Nelson studs]
 $F_y = 50\text{ksi}$

$$.4F_y(.049)1.33 = 1303\# > 1301\# \text{ shear}$$

$$\text{S.M.} = \frac{1303}{1301} - 1 = .002 \text{ O.K.}$$

Shear Stress in welds :

$$\text{area} = \frac{3}{16} \times .707 \times 6'' \text{ long} = .795\text{ si}$$

$$7365\# \div .795 = 9264\text{psi} < 18,000\text{psi}$$

$$\text{S.M.} = \frac{18000}{9264} - 1 = .94 \text{ for E 60 electrode}$$

[Monolithic Design is Valid] O.K.

33% allowable increase used, 60% is allowed per N690

DESIGN CALCULATION

WHC-SD-CP-3A-023

REV 1 PAGE

(1) Drawing _____ (2) Doc. No. _____ (3) Page 222 of _____

(4) Building _____ (5) Rev. _____ (6) Job No. _____

(7) Subject _____

(8) Originator RA Hutter 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 ;

$$\tau = \frac{Vay}{It}$$

$$V = 66804 \times .34g = 22713^{\#}$$

$$a = 8'' \times 127'' = 1016 \text{ si}$$

$$y = 127'' \div 2 = 63.5''$$

$$I = 8 \cdot (254)^3 / 12 = 10924709$$

$$t = 8''$$

$$\tau = 16.77 \text{ psi}$$

$$\text{Shear force } f_v = 16.77 \times 96'' \times 8'' = 12879^{\#}$$

DESIGN CALCULATION

WHC-SJ-EP-SA-023

(1) Drawing _____ (2) Doc. No. _____ (3) Page REV 1 of 223 PAGE
 (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) Shear Force Transfer:

See Detail 67
 H-2-26654

Shear Stress in Concrete:

$$2\phi\sqrt{f'_c} = 93\text{psi} > 16.77\text{psi}$$

OK

Shear Force in Wall G Anchors:

4 @ top & 4 @ bott.

$$12879\# \div 8 = 1610\#$$

$$\text{bolt tension} = .707(1610) = 1138\#$$

$$\text{bolt shear} = 1138\#$$

$$1138\# < 1955\# \& < 1303\#$$

O.K.

Shear Stress in Weld:

$$\text{area} = \frac{3}{16}'' (.707) 10'' = 1.326\text{ si}$$

$$12879\# \div 1.326 = 9713\text{ psi} < 18,000\text{ psi}$$

$$\text{S.M.} = \frac{18000}{9713} - 1 = .85$$

O.K.

[Monolithic Assumption is Valid]

DESIGN CALCULATION

WHC-SD-CP-SA-026

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 (1) Drawing _____ (2) Doc. No. _____ (3) Page 14 of 24
 (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

$$A_s F_y = ab .85 f_c'$$

$$a = \frac{A_s F_y}{b .85 f_c'} = .863"$$

$$M = A_s F_y (d - a/2) \phi$$

$$= (.11) F_y [(43 - a/2) + (38 - a/2) + (33 - a/2) + (28 - a/2)] .9$$

$$= 555 \text{ "K capacity}$$

$$M_{\text{reqd.}} = \frac{wl^2}{2} = \frac{Wl}{2}$$

$$= \frac{66805 (.349) 96"}{2 (9 \text{ wall pairs})} \left(\frac{1}{1000} \right)$$

$$= 121 \text{ "K demand O.K.}$$

$$S.M. = \frac{555}{121} - 1 = 3.59$$

Wall pair

$$f_c' = 3000$$

$$F_y = 40000$$

$$A = .11 / \text{bar}$$

$$b = 8"$$

DESIGN CALCULATION

WHC-SD-CP-SA-026

(1) Drawing _____ (2) Doc. No. _____ (3) Page REV 1 of C25 PAGE **C25**
 (4) Building _____ (5) Rev. _____ (6) Job No. _____
 (7) Subject _____
 (8) Originator RA Milla 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

DESIGN CALCULATION

WHC-SD-CP-SA-026

(1) Drawing _____ (2) Doc. No. _____ (3) Page REV 1 226 of PAGE
 (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) Concrete Details for Anchors & Reinf.

$$f'_c = 3,000 \text{ psi}$$

$$f_y = 40,000 \text{ psi}$$

$$A_b = .11$$

$$d_b = .375$$

A corner break-out from the head of the anchor would have to cut across 1 horz. and 1 vert. rebar. Min. embedment into shear cone / corner break-out region is 3"

ACI development length :

$$0.04 A_b f_y / \sqrt{f'_c} = 3.21 \text{ "}$$

$$\text{or } 0.03 d_b f_y / \sqrt{f'_c} = 8.2 \text{ "}$$

$$\text{or Section 12.2.1} = 12 \text{ "}$$

> 3" check for excess reinf. provided

$$8.2 \text{ " } \left(\frac{A_s \text{ reqd}}{A_s \text{ provided}} \right) = 8.2 \text{ " } \left(\frac{121}{617} \right) = 1.61 \text{ " } < 3 \text{ "}$$

$$S.M. = \frac{3}{1.61} - 1 = .86$$

OK except for 12.2.1

DESIGN CALCULATION

WHC-SD-CP-SA-026

(1) Drawing _____ (2) Doc. No. _____ (3) Page REV 1 of C27 PAGE C27
 (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) Wall G, Detail :

END VIEW

SIDE VIEW

A break-out from the head of the anchor bolt would cut across all vertical rebars. Min. embedment into shear-break-out region is 3".

ACI development length values and requirements are the same as for Wall E & D and thus O.K.

DESIGN CALCULATION

REV. 1 WHC-SD-CP-SA-026

(1) Drawing _____ (2) Doc. No. _____ (3) Page REV 1 of PAGE C28
 (4) Building _____ (5) Rev. _____ (6) Job No. _____
 (7) Subject _____
 (8) Originator R.A. Miller Date 4-5-94
 (9) Checker MA ISLAM Date 5/17/94

(10) Base Plate Detail :

Wall anchor bolts are 6" long @ 45° which gives 4" embedment 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 arrangement, the uplift of wall in the right hand view above has no prying action.

DESIGN CALCULATION

WHC-SD-GP-34-026

(1) Drawing _____ (2) Doc. No. _____ (3) Page REV 1 of PAGE C29
 (4) Building _____ (5) Rev. _____ (6) Job No. _____
 (7) Subject _____
 (8) Originator R. A. P. Islam Date 4-5-94
 (9) Checker MA. ISLAM Date 5/17/94

(10) Embedded floor Δ Capacity

H-2-26651

L3 x 2 x 3/16

1/4" studs 4" long @ 16" o.c.

bolt-tension cap.

$$.6 F_y (\text{gross bolt area}) 1.33 = 1955 \#$$

bolt-shear cap.

$$.4 F_y (\text{gross bolt area}) 1.33 = 1303 \#$$

assume 2"
from other
details on
same drawing

concrete shear cone cap.

from WHC-SD-GN-DGS-30006 Table 8.8

a stud with 3 3/4" embed & 4 3/4" spacing

$$\left. \begin{array}{l} \text{tension cap} = 3740 \# > 1955 \# \\ \text{shear cap} = 1870 \# > 1303 \# \end{array} \right\} \text{ductile failure O.K.}$$

Total Δ capacity :

$$\frac{22.33'}{16"/12"} = 16.7 \Rightarrow 16 \text{ bolts}$$

$$\text{tension} = 16 \times 1955 \# = 31280 \#$$

$$\text{shear} = 16 \times 1303 \# = 20848 \#$$

DESIGN CALCULATION

WHC-SD-CP-SA-J26

(1) Drawing _____ (2) Doc. No. _____ (3) Page REV 1 of 30 PAGE
 (4) Building _____ (5) Rev. _____ (6) Job No. _____
 (7) Subject _____
 (8) Originator RA Miller Date 4-6-94
 (9) Checker MATSLAM Date 5/17/94

(10) Base Plate Shear:

Loads:

$$\begin{aligned} NS &= 66804 \text{ #} \times 0.34g = 22713 \text{ #} \\ EW &= 22713 \text{ #} \end{aligned}$$

Number of Anchors:

$$16 \text{ anchors} \times 4 \text{ base } \phi = 64$$

Combined stresses:

$$\begin{aligned} &= \sqrt{\left(\frac{22713}{64}\right)^2 + \left(\frac{22713}{64}\right)^2} \\ &= 502 \text{ #} < 1955 \text{ #} \quad \text{O.K.} \end{aligned}$$

DESIGN CALCULATION

WHC-SD-CP-SA-026

(1) Drawing _____ (2) Doc. No. _____ (3) Page REV 1 of 31 PAGE
 (4) Building _____ (5) Rev. _____ (6) Job No. _____
 (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 Φ .

Check:

- Cubical Wall Bending
- Building Wall Bending
- Base Shear
- Embeded Φ Shear

DESIGN CALCULATION

WHC-SD-CP-SA-028

(1) Drawing _____ (2) Doc. No. _____ (3) Page REV 1 33 of PAGE C32
 (4) Building _____ (5) Rev. _____ (6) Job No. _____
 (7) Subject _____
 (8) Originator RA Miller Date 4-11-94
 (9) Checker MA ISLAM Date 5/17/94

(10) Loads per Building Wall :

Panel D or E	1370 #	$\times 8$ cubicals	= 10960 #
Panel J	440 #	$\times 8$	= 3520 #
Panel H	500 #	$\times 8$	= 4000 #
Door Ext.	43 #	$\times 8$	= 344 #
Pedestals	127 #	$\times 32$	= 4064 #
Hood	43 #	$\times 10$	= 430 #
			<u>23318</u> / 2 walls
			11659 #

$$\text{Building Wall} \\ (150 \text{ pcf}) \left(\frac{8''}{12''} \right) (13.16' \times 10.5') = 13818 \#$$

Lateral load :

$$4 \text{ cubical Walls} = 11659 \times .34g = 3964 \#$$

$$1 \text{ building wall} = 13818 \times .34g = 4698 \#$$

Resisted by embedded R's (Floor & Wall)

$$3964 \div 2 = 1982 \# \text{ / 4 cubical walls}$$

Resisted by building wall

$$\frac{3964}{2} + 4698 = 6680 \#$$

DESIGN CALCULATION

WHC-SD-CP-SA-026

(1) Drawing _____ (2) Doc. No. _____ (3) Page REV 1 of PAGE C33
 (4) Building _____ (5) Rev. _____ (6) Job No. _____
 (7) Subject _____
 (8) Originator RA Miller Date 4-11-94
 (9) Checker MA ISLAM Date 5/17/94

(10) Cubical Wall Bending:

$$M = \frac{wl^2}{8} = \frac{Wl}{8} = \frac{39.64^{\#}(96'')}{8}$$

$$| = 47568 \text{ ''}\cdot\#$$

Capacity for 4 walls:

$$A_{stf} = ab.85f_c'$$

$$a = \frac{A_{stf}}{b.85f_c'} = \frac{(3 \times .11) 40}{8''(.85) 3}$$

$$| = .647''$$

$$M = A_{stf} \left(d - \frac{a}{2}\right) (4 \text{ walls}) \phi$$

$$| = (.11) 40 \left[\left(17.5 - \frac{.647}{2}\right) + \left(12.5 - \frac{.647}{2}\right) + \left(7.5 - \frac{.647}{2}\right) \right] (4) .9$$

$$| = 578.63 \text{ ''}\cdot\text{K}$$

$$| = 578,630 \text{ ''}\cdot\# > 47568 \text{ ''}\cdot\# \text{ OK}$$

DESIGN CALCULATION

WHC-SD-CP-SA-026

WHC-SD-CP-SA-026

REV. 1

(1) Drawing _____ (2) Doc. No. _____ (3) Page ~~34~~ of PAGE
 (4) Building _____ (5) Rev. _____ (6) Job No. _____
 (7) Subject _____
 (8) Originator R.A. Miller 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 $3.03 \text{ }^1\text{K}/\text{ft}$. A load of 66.5 psf produces $1.04 \text{ }^1\text{K}/\text{ft}$ bending moment

Adding the cubical load to the building wall load of 66.5 psf gives;

$$66.5 \text{ psf} + \frac{1982}{(13.16 \times 10.5)} = 80.8 \text{ psf}$$

The new bending moment is;

$$1.04 \text{ }^1\text{K}/\text{ft} \left(\frac{80.8}{66.5} \right) = 1.26 \text{ }^1\text{K}/\text{ft} < 3.03 \text{ }^1\text{K}/\text{ft}$$

$$\text{S.M.} = \frac{3.03}{1.26} - 1 = 1.4 \quad \text{O.K.}$$

See page A4-9 of WHC-SD-CP-SA-023

DESIGN CALCULATION

WHC-SD-CP-SA-023

REV 1 PAGE
(1) Drawing _____ (2) Doc. No. _____ (3) Page 633 of _____
(4) Building _____ (5) Rev. _____ (6) Job No. _____
(7) Subject _____
(8) Originator R. A. Miller Date 4-11-94
(9) Checker MA ISLAM Date 5/18/94

(10) Building Column Bending

lateral cubical loads.

$$1370 + 2 \times 500 + 2 \times 43 + 4 \times 127 = 2964^{\#}$$

$$(2964 \times .349) \div 2 = 504^{\#} \text{ point load}$$

lateral load from adj. bldg walls;

$$(6680^{\#} \times 2 \text{ walls}) 35\%$$

$$= 4676^{\#} \text{ distributed load}$$

length 10'-10" = 130"

WHC-SD-CP-SA-023

page AS-11

Moment;

$$M = \frac{Pl}{4} + \frac{Wl}{8}$$

$$= \frac{504(130)}{4} + \frac{4676(130)}{8}$$

$$= 92365 \text{ in.}^{\#}$$

$$92.4 \text{ in.}^{\#}$$

From WHC-SD-CP-SA-023 page AS-10 thru AS-17 this column has been qualified for a 86 in. K moment at the column top with a M.S. of 0.92, by comparison 92.4 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

WHC-SL-CP-SK-029

(1) Drawing _____ (2) Doc. No. _____ (3) Page REV 1 C38 of PAGE
 (4) Building _____ (5) Rev. _____ (6) Job No. _____
 (7) Subject _____
 (8) Originator RA Miller 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 ϕ Shear (@ outside wall):

$$1303 \text{ \# / stud} \times 21 \text{ studs / angle} \times 2 \text{ angles} \\ = 54726 \text{ \#}$$

$$54726 \text{ \#} \div 11 \text{ cubical walls} = 4975 \text{ \# / wall}$$

$$4975 \text{ \#} > 504 \text{ \#} \quad \text{O.K.}$$

Wall Embed ϕ tension : ($\frac{1}{4}$ " studs @ 16" O.C.)

$$1955 \text{ \# / stud} \times 10 \text{ studs / angle} \div 4 \text{ cubicals} \\ = 4888 \text{ \# / cubical}$$

$$4888 \text{ \#} > 504 \text{ \#} \quad \text{O.K.}$$

DESIGN CALCULATION

WHC-SD-CP-SA-026

REV ¹/₁ of PAGE
 (1) Drawing _____ (2) Doc. No. _____ (3) Page C37 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) Margins of Safety

Embedments @ wall corners

$$\frac{1303}{1301} \text{ -il bolt shear} = 0.002$$

$$\frac{1955}{1301} \text{ -I bolt tension} = 0.50$$

welds @ wall corners

$$\frac{18000}{9264} \text{ -I} = 0.94$$

Wall Bending

$$\frac{555}{121} \text{ -I} = 3.59$$

Rebar development length

$$\frac{3}{1.67} \text{ -I} = 0.86$$

Embedded R shear

$$\frac{1955}{502} \text{ -I} = 2.89$$

Buiding Wall bending

$$\frac{3.03}{1.26} \text{ -I} = 1.40$$

Building Col. bending

$$= 0.79$$

DESIGN CALCULATION

WHC-SJ-CP-SA-023

(1) Drawing _____ (2) Doc. No. _____ (3) Page REV 1 of 238 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.

DESIGN CALCULATION

WHC-SD-CP-3A-026

(1) Drawing _____ (2) Doc. No. _____ (3) Page REV 1 C39 of PAGE
 (4) Building _____ (5) Rev. _____ (6) Job No. _____
 (7) Subject _____
 (8) Originator RA 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 1/2 concrete and 1/2 metal.

New Type cubical:

Room 1

5 pedestals / cubical.

9 cans per pedestal.

Door are all concrete and inter lock for better shielding.

DESIGN CALCULATION

WHC-SL-CP-3A-026

REV 1 PAGE

(1) Drawing _____ (2) Doc. No. _____ (3) Page C40 of _____
 (4) Building _____ (5) Rev. _____ (6) Job No. _____
 (7) Subject _____
 (8) Originator RA Miller Date 4-13-94
 (9) Checker MA ISLAM Date 5/18/94

(10) Overturning Moment "Rigid Response

Loads

Panel A or C	$1370^{\#} \times 18 \text{ panels} = 24660^{\#}$
Panel B or F	$2200 \times 8 = 17600$
Panel D	$900 \times 16 = 14400$
Panel E	$900 \times 16 = 14400$
Pedestals	$191 \times 32 = 6112$
	$95 \times 16 = 1520$
Duct	$66 \times 16 = 1056$
	<hr/> 79748 [#]

$$OTM = 79748^{\#} \times 0.34 g \times 48''$$

$$= \underline{\underline{1,301,487 \text{ in.}^{\#}}}$$

NS & EW directions

DESIGN CALCULATION

WHC-SD-CP-SA-026

(1) Drawing _____ (2) Doc. No. _____ (3) Page REV 1 of 41 PAGE
 (4) Building _____ (5) Rev. _____ (6) Job No. _____
 (7) Subject _____
 (8) Originator RA Kittle 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:

$$OTM = 1301487 \text{ \#}$$

$$DWRM = 79748 \text{ \#} \times \frac{48''}{2} = 1,913,952 \text{ \#}$$

$$VSM = 79748 \left(0.34 \times \frac{2}{3}\right) \frac{48}{2} = 433,829 \text{ \#}$$

$$Uplift = OTM + VSM - DWRM$$

$$= -178,636 \therefore \text{No Uplift.}$$

Check In-line Shear:

$$\tau = \frac{Vay}{It}$$

$$V = 79748 \times .34 \div 9 \text{ units}$$

$$I = 3013 \text{ \#}$$

$$a = 160 \text{ si} \quad y = 14''$$

$$I = 73728 \text{ in}^4 \quad t = 8''$$

$$\tau = 11.44 \text{ psi}$$

$$\text{Shear Force } f_v = 11.44 \times 96'' \times 8'' = 8786 \text{ \#}$$

DESIGN CALCULATION

WHC-SU-CP-SA-026

REV 2 PAGE
(1) Drawing _____ (2) Doc. No. _____ (3) Page C42 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) In-Line Shear Cont. :

$$\text{Shear force, } f_v = 96'' \times 8'' \times 11.44 \text{ psi} = 8786 \text{ \#}$$

— wall pair unit

$$\text{weld area} = \frac{3}{16}'' \times .707 \times 7'' = .928 \text{ si}$$

$$8786 \text{ \#} \div .928 = 9468 \text{ psi} < 18,000$$

$$\text{S.M.} = \frac{18000}{9468} - 1 = .9 \text{ O.K.}$$

Check Shear in Studs :

2 studs @ top &
2 studs @ bott
resist shear force

force per stud

$$8786 \text{ \#} \div 4 \text{ studs} = 2197 \text{ \#}$$

because studs are
at 45° to force,
the tens & shears
are :

$$.707 \times 2197 \text{ \#} = 1553 \text{ \#}$$

$$.6F_y(.11) 1.33 = 4389 \text{ \#} > 1553 \text{ \#}$$

$$AF_y(.11) 1.33 = 2926 \text{ \#} > 1553 \text{ \#}$$

$$\text{S.M.} = \frac{2926}{1553} - 1 = .88$$

$\frac{3}{8}''$ Anchors x 6" @ 1" o.c.

Detail II & III on H-2-70010

Detail 3 on H-2-70011

$$\frac{3}{8}'' \phi \text{ area} = .110$$

[Monolithic Design
is valid]

DESIGN CALCULATION

WHC-SD-CP-SA-026

(1) Drawing _____ (2) Doc. No. _____ (3) Page REV 1 43 of PAGE
 (4) Building _____ (5) Rev. _____ (6) Job No. _____
 (7) Subject _____
 (8) Originator RA Miller Date 4-14-94
 (9) Checker MA ISLAM Date 5/18/94

(10) Shear Force Transfer:
 Wall A or C to B or F

Shear Stress in Concrete

$$2\phi\sqrt{f'_c} = 93 \text{ psi} > 11.44 \text{ psi}$$

O.K.

Shear Force in Anchors:

4 @ Top 0 @ bott

$$8786^\# \div 4 = 2197^\#$$

anchors are @ 45° so:

$$\text{tension} = .707(2197) = 1553^\#$$

$$\text{shear} = 1553^\#$$

Allowable

$$T = .6F_y(.11 \text{ si})1.33 = 4389^\# > 1553$$

$$V = .4F_y(.11 \text{ si})1.33 = 2926 > 1553$$

O.K.

Shear Stress in welds:

$$\frac{3}{16} \text{\"} (.707) 4 \text{\"} \text{long} = .530 \text{ si}$$

$$8786 \div .530 = 16577 \text{ psi} < 18000 \text{ psi} \quad \text{O.K.}$$

$$\text{S.M.} = \frac{18000}{16577} - 1 = .09$$

[Monolithic Assumption is valid]

DESIGN CALCULATION

WHC-SD-CP-SA-026

(1) Drawing _____ (2) Doc. No. _____ (3) Page REV 1 C44 of PAGE
 (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) Check uplift EW direction :

$$W = 79748^{\#} \times .34g$$

$$| = 27114^{\#}$$

$$\tau = \frac{Vay}{It}$$

$$V = 27114^{\#} \quad a = 1016 \text{ si}$$

$$y = 63.5" \quad I = 10,924,709 \text{ in}^4$$

$$t = 8"$$

$$\tau = 20.02 \text{ psi}$$

$$\text{Shear force } F_v = 20.02 \times 96" \times 8" = 15375^{\#}$$

DESIGN CALCULATION

WHC-SD-CP-3A-026

(1) Drawing _____ (2) Doc. No. _____ (3) Page REV 7 245 of PAGE
 (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) 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

$$15375 \# \div 8 = 1922 \#$$

$$t_{en} = .707(1922) = 1359 \#$$

$$4389 \# > 1359 \# \text{ O.K.}$$

$$\text{Shear} = 1359 \#$$

$$2926 \# > 1359 \# \text{ O.K.}$$

Shear Stress in welds :

$$\frac{3}{16} \text{ \" } (.707) 7 \text{ \"} = .928 \text{ si}$$

$$15375 \# \div .928 = 16568 \text{ psi} < 18000 \text{ psi O.K.}$$

[Monolithic Assumption is Valid]

DESIGN CALCULATION

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 (8) Originator RA Hilla Date 4-13-94
 (9) Checker MA ISLAM Date 5/18/94

(10) Wall Bending NS direction

use 10 of the 24 wires

$$A_s = 10 \times .04 = .4 \text{ si}$$

$$a = \frac{A_s F_y}{b .85 f_c'} = .784''$$

$$M = A_s F_y (d - a/2) \phi$$

$$= (.08) F_y \left[(46 - a/2) + (42 - a/2) + (38 - a/2) + (34 - a/2) + (30 - a/2) \right] .9$$

$$= 542 \text{ ''} \cdot \text{K}$$

$$M_{\text{reqd.}} = \frac{Wl}{2}$$

$$= \frac{79748 (.349) 96''}{2 (9 \text{ pairs}) 1000}$$

$$= 145 \text{ ''} \cdot \text{K} < 542 \text{ ''} \cdot \text{K}$$

$$S.M. = \frac{542}{145} - 1 = 2.74$$

O.K.

DESIGN CALCULATION

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(1) Drawing _____ (2) Doc. No. _____ (3) Page REV 1 C47 of 2 PAGE
 (4) Building _____ (5) Rev. _____ (6) Job No. _____
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 (8) Originator RA Hille Date 5-18-94
 (9) Checker MA ISLAM Date 5/18/94

(10) Wall Shear

$$V = 79748^{\#} \times 0.349 \div 9 \text{ pairs} = 3013^{\#}$$

$$V_c = 2\sqrt{f_c'} b d$$

$$I = 39436^{\#}$$

$$\phi V_c = 33521^{\#} > 3013^{\#} \quad \text{O.K.}$$

EW-direction O.K. by comparison to NS.

Concrete Details

#4 wire mesh

ACI development length

$$\left. \begin{aligned} 0.04 A_b f_y / \sqrt{f_c'} &= 1.17'' \\ 0.0004 d_b f_y &= 3.6'' \end{aligned} \right\} < \text{anchor embedment}$$

S.M. = 186 as in old configuration O.K.
 Page C-26

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 (7) Subject _____
 (8) Originator RA Miller 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

$$= \sqrt{\left(\frac{27114}{64 \text{ anchors}}\right)^2 + \left(\frac{27114}{64}\right)^2}$$

$$= 599^{\#} < 2926^{\#} \quad \text{O.K.}$$

DESIGN CALCULATION

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(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 $1370^{\#} \times 8^{\text{cubicals}} = 10960^{\#}$

Wall D $900 \times 8 = 7200$

Wall E $900 \times 8 = 7200$

Pedestals $191 \times 16 = 3056$

$95 \times 10 = 950$

Duct $66 \times 8 = 528$

$29894^{\#} / 2$

$14947^{\#}$

Building Wall = $13818^{\#}$

Lateral loads:

$14947^{\#} \times .34g = 5082^{\#}$

$13818^{\#} \times .34g = 4698^{\#}$

Resisted By embed Rs:

$5082 \div 2 = 2541^{\#}$

Resisted By Building Wall:

$2541 + 4698 = 7239^{\#}$

H-2-70010, 11

Detail for embedded angle, from document -

CA-77-1268

DESIGN CALCULATION

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 (8) Originator RA Miller Date 4-15-94
 (9) Checker MA ISLAM Date 5/18/94

(10) Cubical Wall Bending:

$$M = \frac{Wl}{8} = \frac{5082(96'')}{8} = 60984 \text{ ''}\cdot\#$$

Capacity for 4 walls:

$$a = \frac{A_s f_y}{b \cdot 85 f_c'} = \frac{(8 \times .04) 40}{8''(.85) 3} = .627''$$

$$M = A_s f_y (d - \frac{a}{2}) (4 \text{ walls}) \phi$$

$$= (.04 + .04) 40 \left[\left(18 - \frac{.627}{2} \right) + \left(14 - \frac{.627}{2} \right) + \left(10 - \frac{.627}{2} \right) + \left(6 - \frac{.627}{2} \right) \right] (4) .9$$

$$= 538,514 \text{ ''}\cdot\# > 60984 \text{ ''}\cdot\# \quad \text{O.K.}$$

#4 x 4"
welded
wire
fabric

20"

8"

Building Wall Bending:

$$w = 66.5 \text{ psf} + \frac{2541}{(13.16 \times 10.5)} = 84.9 \text{ psf}$$

$$M = 1.04 \left(\frac{84.9}{66.5} \right) = 1.33 < 3.03$$

1-K
#

$$S.M. = \frac{3.03}{1.33} - 1 = 1.28$$

O.K.

See page A4-9 of WHC-SD-CP-SA-023
 and earlier page of this calculation.

DESIGN CALCULATION

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 (9) Checker MA ISLAM Date 5/18/94

(10) Building Column Bending

lateral load for 1 cubical wall

$$\frac{2541^{\#}}{4} = 635^{\#} \text{ point load}$$

lateral load for adj bldg walls:

4490[#] distributed load

Moment :

$$\begin{aligned} M &= \frac{Pl}{4} + \frac{Wl}{8} \\ &= \frac{635(130'')}{4} + \frac{4490(130'')}{8} \\ &= 93600 \text{ ''}\cdot\text{''} = 93.6 \text{ ''}\cdot\text{K} \end{aligned}$$

From WHC-SD-CP-SA-023

column capacity = 187''·K > 93.5''·K

page AS-10 thru 17

O.K.

DESIGN CALCULATION

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 (9) Checker MA ISLAM Date 5/18/94

(10) Embedded Φ Shear

floor Φ capacity = $2696^{\#} > 635^{\#}$ O.K.

wall Φ capacity = $2645^{\#} > 635^{\#}$ O.K.

Check Expansion Anchors :

$\frac{1}{2}$ " Red Heads w/ min embed
 Φ 3" spacing

tension capacity for 5" spacing
 in 4000psi concrete = $1720^{\#}$

reduce by $\sqrt{\frac{f_c'}{4000}} = .87$ for 3000psi conc

reduce by $\frac{3}{5} = .6$ for close spacing

$$1720^{\#} \times .87 \times .6 = \underline{\underline{898^{\#}}}$$

Add 25% for prying

$$635 \times 1.25 = 794^{\#} < 898^{\#} \quad \text{O.K.}$$

DESIGN CALCULATION

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 (8) Originator RA Miller Date 4-18-94
 (9) Checker MA ISLAM Date 5/18/94

(10) Margins of Safety

$$\text{Embedded } \phi \text{ bolt shear } \frac{4389}{1553} - 1 = 1.83$$

$$\text{bolt tension } \frac{2926}{1553} - 1 = 0.88$$

$$\text{Welds @ corners } \frac{18000}{9468} - 1 = 0.90$$

$$\text{Wall bending } \frac{542}{145} - 1 = 2.74$$

Rebar development length same

Building wall bending

$$\frac{3.03}{1.33} - 1 = 1.28$$

Building column bending

$$\frac{165}{93.5} - 1 = 0.77$$

RECORD OF DESIGN / FIELD CHANGE

<p>(1) PROJECT NUMBER AND TITLE</p> <p>Work Order XX-0624 2736-Z Modifications</p>	<p>(2) RECORDING DATE</p> <p>12-7-77</p>	<p>(3) APPROVAL DATE</p>	<p>(4) CHANGE NUMBER</p> <p>CA-7- 768</p>
<p>(5) DOCUMENTS AFFECTED</p> <p>H-2-70010 "Plutonium Storage Vaults, Cubicle Installation"</p>		<p>(17) DISTRIBUTION:</p> <p>G. A. Beitel P. M. Bodmer M. A. Cahill R. D. Carrell J. E. Hammond J. McIntyre R. J. Staudacher M C Fraser</p>	
<p>(6) DETAILED DESCRIPTION AND JUSTIFICATION</p> <p>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.</p> <p>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.</p>		<div style="border: 1px solid black; border-radius: 50%; padding: 10px; width: fit-content; margin: 10px auto;"> <p>WHC-SD-CP-SA-026 REV 1 PAGE C54</p> </div>	
<p>(7) EFFECT ON COST: \$ <u>500</u></p> <p>☒ ADDITIONAL ☐ SAVINGS</p>		<p>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.</p>	
<p>(8) EFFECT ON SCHEDULE: <u>None</u></p> <p>☐ DELAY ☐ IMPROVEMENT</p>		<p>(18) ALL DOCUMENTS REVISED ☐</p> <p>BY: _____ DATE: _____</p>	
<p>(9) CONTRACTS, PROJECTS OR WORK ORDER AFFECTED:</p> <p>Work Order XX-0624</p>			
<p>(10) INITIATOR</p> <p>J. E. Hammond <i>J. E. Hammond</i></p>	<p>(11) PHONE</p> <p>2-2697</p>	<p>(12) ORGANIZATION</p> <p>Equipment Development</p>	<p>(13) DATE</p> <p>12-7-77</p>
<p>APPROVALS</p>			
<p>(14) ARCHITECT ENGINEER</p> <p><i>J. E. Hammond</i> <i>M C Fraser 12/8/77</i></p>	<p>(15) OPERATING CONTRACTOR</p> <p><i>M A Bodmer 12/8/77</i> <i>21</i></p>	<p>(16) ERDA</p>	

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ATTACHMENT FOR
DFC # CA-77-1268

WALL OR
COL. 16.5
(H-2-26653)

$\frac{3}{16}$ " ∇ 1"

CUBICLE
PANEL
A OR G

STEEL ANGLE: TYPE A-36
CARBON STEEL, MAXIMUM
THICKNESS $\frac{1}{2}$ "; DIMENSID.
"D" TO BE 4" TO 6."

ANCHOR BOLTS: PHILLIPS
"RED HEAD," $\frac{1}{2}$ "

J. E. Hammond
7 December 1977

TOP OF CUBICLE
ELEV 8'-0 1/2"

CL CUBICLE
AND ANGLE

DESIGN CALCULATION

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(8) Originator RA 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;

$$acc1. = 0.34 \text{ g}$$

- **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-i Analysis
Originator RA Hill 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

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Originator RA Miller Date 12-30-94
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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 calculate 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 in place 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

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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

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Subject _____

Originator RA. MillerDate 12-12-94Checker MA ISLAMDate 2/24/95Construction Details

OTd Type Cubicals

2736Z Building, Rooms 3 & 4

floor mounted (free standing) Arrangement:

Drawings: H-2-266S1

H-2-266S4

Note: The cubical panels have embedded steel angles at their corners which in-turn are welded to each other and to embedded floor plates.

ANALYTICAL CALCULATIONS

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Subject _____

Originator RA MillerDate 12-12-94Checker MA ISLAMDate 2/24/95Self Weight

Panel E	$1384^{\#} \times 10 \text{ panels} = 13840$
Panel D	$1384^{\#} \times 8 \text{ panels} = 11072$
Panel G	$2200^{\#} \times 8 \text{ panels} = 17600$
Panel J	$440^{\#} \times 16 \text{ panels} = 7040$
Panel H	$500^{\#} \times 16 \text{ panels} = 8000$
Door Extension	$43^{\#} \times 16 = 688$
Pedestals	$146^{\#} \times 64 = 9344$
Hood	$43^{\#} \times 16 = 688$
	<hr/>
	$68272^{\#}$

ANALYTICAL CALCULATIONS

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Subject _____

Originator

RA 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 $.016662 = \Delta$

$$\text{frequency} = 3.13 \sqrt{\frac{1}{\Delta}}$$

$$f = 24.2 \text{ Hz}$$

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.

ANALYTICAL CALCULATIONS

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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	24 hz calculated
Damping	10% for Reinf. Concrete	5% for Equip.
Seismic Accel.	.33g peak of response curve	.24g response curve value
F_u	1.4 for R.C. shear wall	unity - not used for equipment
Design Accel E/F_u	.24g	.24g

Conclusion: Use Equipment Criteria.

ANALYTICAL CALCULATIONS

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Originator RA Hill Date 12-15-94
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Seismic Response Cont.

E-W-Dir Response:

From computer output the lateral displacement for a 1.0g acceleration is .00838" = Δ

$$f_{req} = 3.13 \sqrt{\frac{1}{\Delta}} = 3.13 \sqrt{\frac{1}{.00838}} = 34.2 \text{ Hz}$$

From SDC-4.1 Table 2 this is a rigid freq. which yields a 0.2g acceleration. Accelerate all modes at 0.2g.

ANALYTICAL CALCULATIONS

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Originator

RA Miller

Date

12-22-94

Checker

MA ISLAM

Date

2/24/95

Seismic Loads

Vertical Loads :

$$W = 68272 \#$$

length of wall panels

$$8 \times 31.75'' + 18 \times 20'' = 614''$$

$$\frac{W}{614''} = 111.2 \#/'$$

Vertical Dead Wt. :

DW use $0.85W$

Vertical EQ :

$$E_v = \frac{2}{3}(.24g)(\text{combine @ 40\%})W = .064W$$

Combined Verto :

$$.85D + E = .85W - .064W = .786W$$

$$.786(111.2 \#/') = \underline{\underline{87.4 \#/'}}$$

ANALYTICAL CALCULATIONS

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Originator RA Miller

Date

12-13-94Checker MA ISLAM

Date

2/24/95Anchor Capacities

ACI-349 Appendix B methods

Ultimate
Steel strength = $f_u A_{bolt}$

$$(.049 \text{ si})(60,000 \text{ psi}) = 2940^{\#}$$

Shear Cone strength

$$4 \phi \sqrt{f'_c} A_{cone}$$

$$4(.65) \sqrt{3000} \pi R^2$$

$$447 R^2$$

$$447 R^2 > 2940^{\#}$$

$$R > 2.56"$$

$$4" > 2.56" \quad \text{O.K.}$$

Base Plate Anchor $R =$ embedment length

Design Strength

$$T_A = .9 A F_y = .9(.049) 50,000 = 2205^{\#}$$

$$V_A = \phi \mu A_v F_y = .85(.9)(.049) 50,000 = 1874^{\#}$$

ANALYTICAL CALCULATIONS

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Originator RA Miller

Date 12-13-94

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Date 2/24/95

Anchor Capacities Cont.

Panel Anchor:

Steel Strength

$$f_u A_{bolt} = 2940 \#$$

Shear Cone Area

$$A_{cone} = 8" \times 5.5" = 44 \text{ si}$$

Shear Cone Strength

$$= 4 \phi \sqrt{f'_c} A_{cone}$$

$$= 4(.65) \sqrt{3000} (44)$$

$$= 6266 \#$$

$$6266 \# > 2 \text{ bolts} \times 2940 \#$$

$$6266 \# > 5880 \# \quad \text{O.K.}$$

steel failure assured.

Section A-A

overlapped shear
cones for 3"
embedment

$$A_{cone} = 8" \times 5.5" = 44 \text{ si}$$

ANALYTICAL CALCULATIONS

WHC-82-CP-SA-026

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Subject _____

Originator RA MillerDate 12-16-94Checker MA ISLAMDate 2/24/95Strength Check, Panel D or E

$$P = .85D + E$$

$$P = 87.4 \text{ #/ft} \times 40''$$

$$P = 3496 \text{ #}$$

Reactions @ Base : (Computer output)

$$R_{1y} = 1311 \text{ #} + \frac{3496 \text{ #}}{4} = 2185 \text{ # comp}$$

$$R_{1x} = 356 \text{ #}$$

$$R_{56y} = -1626 + 414 + \frac{3496}{4} = -338 \text{ # ten.}$$

$$R_{56x} = 566 + 69 = 635 \text{ #}$$

$$R_{89y} = -419 + 839 + \frac{3496}{4} = 1294 \text{ # comp.}$$

$$R_{89x} = 72 + 114 = 186 \text{ #}$$

$$R_{13y} = -1912 + \frac{3496}{4} = -1038 \text{ ten.}$$

$$R_{13x} = 643 \text{ #}$$

Shear @ Base :

$$V = 356 + 635 + 186 + 643 = 1820 \text{ #}$$

$$\text{check } \frac{68272 \times .249}{9 \text{ walls}} = 1820.6 \text{ #}$$

O.K.

ANALYTICAL CALCULATIONS

WnC-SJ-CP-SA-026

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Subject _____

Originator RA MillerDate 12-16-94Checker MA ISLAMDate 2/24/95Panel D or E Cont.

Stress & Moment @ Base :

from computer output max stress = 151 psi

$$\text{Moment} = \sigma S_b = \frac{151 b h^2}{6} = \frac{151 (8") (20")^2}{6 (1000)}$$

$$M = 80.53 \text{ "·K}$$

Check Concrete shear:

$$v = \frac{V}{b h} = \frac{1820}{8(48)} = 4.7 \text{ psi} < 2\phi \sqrt{f'_c} \text{ of } 93 \text{ psi}$$

$$MS = \frac{93}{4.7} - 1 = 18.8$$

@ $f'_c = 3000 \text{ psi}$
O.K.

Check Concrete bending:

$$a = \frac{A_s f_y}{.85 f'_c b} = \frac{3(.11)40}{.85(3)8} = .647"$$

$$M_n = (.11 \times 40) \left[(18" - \frac{1}{2}) + (13" - \frac{1}{2}) + (8" - \frac{1}{2}) \right]$$

$$= 167.3 \text{ "·K}$$

$$\phi M_n = .9(167.3) = 150.6 \text{ "·K}$$

$$M_u = 80.53 \text{ "·K} < 150.6 \text{ "·K} \quad \text{O.K.}$$

$$M.S. = \frac{150.6}{80.53} - 1 = 0.87$$

4-#3 bars
@ 5" O.C.

ANALYTICAL CALCULATIONS

Subject _____
 Originator RA Hill Date 12-13-94
 Checker MA ISLAM Date 2/27/95

Panel D or E Continued

Anchor Loads :

Reactions @ Base

$$T = 1038 \# \text{ max}$$

$$V = 643 \# \text{ max}$$

Anchor Capacities

$$T_{\text{ALLOW}} = 2205 \#$$

$$V_{\text{ALLOW}} = 1874 \#$$

Shear Loads are transferred 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 plate. 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)

$$\frac{\sin 45^\circ (T)}{2 \text{ anchors}} = 367 \#$$

$$\frac{T}{T_A} + \frac{V}{V_A} = \frac{367}{2205} + \frac{367}{1874} = 0.36 \leq 1.0$$

$$MS = \frac{1.0}{0.36} - 1 = 1.78 \quad \text{O.K.}$$

ANALYTICAL CALCULATIONS

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Subject _____

Originator RA MillerDate 12-16-94Checker MA ISLAMDate 2/27/95Strength Check Panel G

$$P = .85D + E$$

$$P = 87.4 \text{ #/in} \times 254''$$

$$P = 22200 \text{ #}$$

Reactions @ Base : (from computer output)

$$R_{1y} = 1562 \text{ #} + \frac{22200 \text{ #}}{16} = 2950 \text{ # comp}$$

$$R_{4-5y} = -1566 + 1488 + \frac{22200}{16} \times 2 = 2697 \text{ # comp}$$

$$R_{8-9y} = -2003 + 1469 + \frac{22200}{16} \times 2 = 2241 \text{ # comp}$$

$$R_{12-13y} = -2008 + 1463 + \frac{22200}{16} \times 2 = 2230 \text{ # comp}$$

$$R_{16-17y} = -1996 + 1466 + \frac{22200}{16} \times 2 = 2245 \text{ # comp}$$

ANALYTICAL CALCULATIONS

Subject _____
 Originator RA Miller Date 12-16-94
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Strength Check, Pane G Cont.

Reactions :

$$R_{20-21y} = -1994 + 1478 + \frac{22200}{16} \times 2 = 2259^{\#} \text{ comp}$$

$$R_{24-25y} = -2005 + 1474 + \frac{22200}{16} \times 2 = 2244^{\#} \text{ comp}$$

$$R_{28-29y} = -2036 + 1142 + \frac{22200}{16} \times 2 = 1881^{\#} \text{ comp}$$

$$R_{32y} = -2145 + \frac{22200}{16} = -757^{\#} \text{ ten}$$

Shear @ Base :

$$R_{1x} = 737^{\#}$$

$$R_{20-21} = 1023 + 736 = 1759^{\#}$$

$$R_{45x} = 827 + 736 = 1563^{\#}$$

$$R_{24-25} = 1027 + 729 = 1756^{\#}$$

$$R_{89x} = 1023 + 733 = 1756^{\#}$$

$$R_{28-29} = 1034 + 542 = 1576^{\#}$$

$$R_{12-13} = 1028 + 732 = 1760^{\#}$$

$$R_{32} = 1005^{\#}$$

$$R_{16-17} = 1024 + 733 = 1757^{\#}$$

Stress & Moment @ Base :

$$\sigma = 79 \text{ psi}$$

$$M = \sigma S_b$$

$$M = \frac{79 b h^2}{6} = \frac{79 (8") (31.75)^2}{6 (1000)} = 106 \text{ in} \cdot \text{K}$$

ANALYTICAL CALCULATIONS

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Subject _____
 Originator RA Hill Date 12-16-94
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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 :

$$a = \frac{A_s F_y}{.85 f'_c b} = \frac{5(.11)40}{.85(3)8} = 1.08"$$

$$M_n = .11(40) \left[(26 - \frac{9}{2}) + (21 - \frac{9}{2}) + (16 - \frac{9}{2}) + (11 - \frac{9}{2}) + (6 - \frac{9}{2}) \right]$$

$$M_n = 340.1 \text{ "K}$$

$$\phi M_n = .9(340.1) = 306 \text{ "K}$$

$$306 > 106 \text{ "K} \quad \text{O.K.}$$

$$M.S. = \frac{306}{106} - 1 = 1.89$$

6- #3 bars
 @ 5" O.C.

ANALYTICAL CALCULATIONS

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Subject _____

Originator RA. MillerDate 12-13-94Checker MA ISLAMDate 2/27/95Panel G Cont.

Anchor Loads:

Reactions @ Base

$$T = 757 \text{ #} @ R_1$$

$$V = 1760 \text{ #} @ R_{13-14}$$

Anchor Capacities

$$T_A = 2205 \text{ #}$$

$$V_A = 1874 \text{ #}$$

tension in anchors :

$$\frac{(T)}{\sin 45^\circ (4 \text{ anchors})} = 268 \text{ #/anchor}$$

Shear in anchors :

$$268 \text{ #} + \frac{(V)}{8 \text{ anchors}} = 488 \text{ #/anch}$$

Bolt interaction :

$$\frac{T}{T_A} + \frac{V}{V_A} = \frac{268}{2205} + \frac{488}{1874} = 0.38 \leq 1.0$$

$$NIS = \frac{1.0}{.38} - 1 = 1.63$$

O.K.

ANALYTICAL CALCULATIONS

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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:

$$4 \text{ plates} \times 17 \text{ anchors/plate} = 68 \text{ anchors}$$

Note: All plates resist NS loads, and since cubical wall panels "G" resist all E-W loads, then embedded plates 2 & 3 resist all E-W loads.

ANALYTICAL CALCULATIONS

Subject _____
 Originator RA Miller 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

$$V = \frac{7760^{\#} \times 8 \text{ panels}}{17 \text{ anchors (2 plates)}} = 414^{\#}/\text{anchor}$$

Shear Resultant. SRSS & 100-40-40

$$V_R = 340^{\#} \quad \text{OR}$$

$$V_R = \sqrt{(414)^2 + (40\% (336))^2} = 435^{\#}/\text{anchor}$$

ANALYTICAL CALCULATIONS

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Subject _____
 Originator RA Miller 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

$$\frac{T}{T_A} + \frac{V}{V_A} = \frac{550}{2205} + \frac{340}{1874} = 0.43 < 1.0 \quad \text{O.K.}$$

$$M.S. = \frac{1.0}{.43} - 1 = 1.33$$

Plate ② & ③

$$\frac{T}{T_A} + \frac{V}{V_A} = \frac{179+189}{2205} + \frac{435}{1874} = 0.40 < 1.0 \quad \text{O.K.}$$

$$M.S. = \frac{1.0}{0.40} - 1 = 1.50$$

ANALYTICAL CALCULATIONS

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Subject _____

Originator

RA Hill

Date

3-23-95

Checker

E C. Ocoma

Date

3-27-95Check Detail Connections

Check welds to base plate : (H-2-26654 (67))

drawing shows 4" of $\frac{3}{16}$ " weldfield walkdown shows $1\frac{1}{2}$ " of $\frac{1}{8}$ weld

$$(\frac{1}{8})(.707)(1.5)(60\text{ksi})(.3)(1.4) = 3.34^{\text{K}}$$

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

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Subject _____

Originator

RA Miller

Date

12-16-94

Checker

MA ISLAM

Date

2/27/95

Check Details Connections Cont.

Panel G top connection forces from computer output.

$$F_x = 355^\# \quad F_y = 198^\#$$

OR

$$F_x = 108^\# \quad F_y = 953^\#$$

Panel D-E top connection forces

$$F_x = 441^\# \quad F_y = 213^\#$$

OR

$$F_x = 322^\# \quad F_y = 755^\#$$

Shear & tension Maximums

$$F_x = 355^\# + 441^\# = 796^\# \quad \text{shear}$$

$$F_y = 953^\# + 755^\# = 1708^\# \quad \text{ten-comp}$$

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

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Subject _____
Originator RA Miller Date 12-19-94
Checker MA ISLAM Date 2/27/95

Construction Details New Type Cubicals
Drawings H-Z-70010, H-Z-70011

floor mounted - free standing

PLAN

2736 Z 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

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Originator RA Hille 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

WHC-SD-CP-SA-026

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Subject _____
 Originator R. A. Miller Date 12-27-94
 Checker MA ISLAM Date 2/27/95

Self Weight

Panel A or C	$1370^{\#} \times 18 = 24660^{\#}$
Panel B or F	$2200 \times 8 = 17600$
Panel D or E	$900 \times 32 = 28800$
Pedestals	$191 \times 32 = 6112$
	$95 \times 16 = 1520$
Duct	$66 \times 16 = 1056$
	<u>$79748^{\#}$</u>

Seismic Response

N-S (all anchors active)

$$\Delta = .019476''$$

$$f = 3.13 \sqrt{1/\Delta} = 22.4$$

$$\underline{.25g}$$

N-S (only shown anchors active)

$$\Delta = .028168$$

$$f = 3.13 \sqrt{1/\Delta} = 18.7$$

$$\underline{.27g}$$

EW - Direction

$$\Delta = .0097933''$$

$$f = 3.13 \sqrt{1/\Delta} = 31.63 \text{ Hz} \therefore \underline{.20g}$$

ANALYTICAL CALCULATIONS

Subject _____

Originator RA MillerDate 12-19-94Checker MA ISLAMDate 2/27/95Seismic Loads

Vertical Loads :

$$W = 79748 \#$$

$$\text{length of panels} = 614''$$

$$\frac{W}{614} = 129.9 \#/'$$

$$E_v = \frac{2}{3} (.27) W (\text{combine @ 40\%}) = .072 W$$

$$.85 DW - E_v = .85 W - .072 W = .778 W$$

$$.778 (79748) = 62044 \#$$

$$.778 (129.9) = 101.1 \#/'$$

Lateral Load :

$$E_h = .20_g W$$

$$.25_g W \quad \text{or}$$

$$.27_g W \quad \text{or}$$

$$V_A = \phi_u A_v F_y = .85(.9)(.11) 50000 = 4208 \#$$

$$T_A = .9 A F_y = .9(.11) 50000 = 4950 \#$$

$$13392 > 2 \times 6600 \quad O.K.$$

use $186 \times 72 \text{ si} = 13392 \#$
 since concrete tensile stresses are less than 5 ksi
 use $\phi = .85$
 $A_{proj} = \pi R^2 = 113 \text{ si} \times 2 \text{ cones}$
 or $A_{proj} = (8 \text{ panel} \times 9 \text{ o.c.}) = 72 \text{ si}$

$3/8" \times 6" \text{ long}$
 $@ 9" \text{ o.c.}$
 $8"$

Steel strength

$$T_s = f_u A_b$$

$$= 60 \text{ ksi} (.11 \text{ si})$$

$$= 6600 \#$$

Concrete strength

$$4 \phi \sqrt{f'_c} A_{proj}$$

$$4(.85) \sqrt{3000} A_{proj}$$

$$186 A_{proj}$$

Anchor Capacities
 Using ACI-349 Appendix B
 Panel Anchor Capacity:

Subject	RA HILL
Originator	MA ISLAM
Checker	MA ISLAM
Date	12-19-94
Date	2/27/95

ANALYTICAL CALCULATIONS

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Subject

Originator

RA Hill

Date

12-19-94

Checker

MA ISLAM

Date

2/27/95

Strength Check, Panel A-C

$$P = 101.1 \text{ \#/in} \times 40''$$

$$P = 4044 \text{ \#}$$

$$F = \text{lateral acceleration}$$

- Reactions @ Base, all anchor active:

$$R_{1y} = 1601 + \frac{4044}{4} = 2612 \text{ \# comp}$$

$$R_{1x} = 435 \text{ \#}$$

$$R_{5-6y} = -1987 + 505 + \frac{4044}{4} = 471 \text{ \# tens.}$$

$$R_{5-6x} = 692 + 85 = 777 \text{ \#}$$

$$R_{8-9y} = -512 + 1025 + \frac{4044}{4} = 1524 \text{ \# comp}$$

$$R_{8-9x} = 87 + 139 = 226 \text{ \#}$$

$$R_{13y} = -2336 + \frac{4044}{4} = 1325 \text{ \# tens.} \quad R_{13x} = 786 \text{ \#}$$

- Reactions @ Base, only shown anchors active:

$$R_{1y} = 1697 + \frac{4044}{4} = 2708 \text{ \# comp} \quad R_{1x} = 966 \text{ \#}$$

$$R_{5-6y} = 818 + \frac{4044}{4} = 1829 \text{ \# comp} \quad R_{5-6x} = 82 \text{ \#}$$

$$R_{8-9y} = -1129 + 1770 + \frac{4044}{4} = 1652 \text{ \# comp} \quad R_{8-9x} = 207 + 1138 = 1345 \text{ \#}$$

$$R_{13y} = -3082 - \frac{4404}{4} = 2071 \text{ \# tens}$$

$$R_{13x} = 0$$

$$\sum R_x = 2393 \text{ \#}$$

ANALYTICAL CALCULATIONS

Subject _____
 Originator RA Hille Date 12-19-94
 Checker MA ISLAM Date 2/27/95

Check Panel A-C Cont.

Stress & Moment @ Base :

$$\sigma = 185 \text{ psi or } 252 \text{ psi}$$

$$\text{Moment} = \sigma S_b = \frac{252 b h^2}{6(1000)} = \frac{252(8)(20)^2}{6000}$$

$$M = 134.4 \text{ "K}$$

Check Concrete Bending :

$$a = \frac{A_s F_y}{.85 f'_c b} = \frac{8(.04)40}{.85(8)8"} = .627"$$

$$M = A_s F_y \left[\sum (d - \frac{a}{2}) \right]$$

$$= .08(40) \left[(18 - \frac{a}{2}) + (14 - \frac{a}{2}) + (10 - \frac{a}{2}) + (6 - \frac{a}{2}) \right]$$

$$= 149.6 \text{ "K}$$

$$\phi M_n = .9(149.6) = 135 \text{ "K} > 134 \text{ "K}$$

$$M.S. = \frac{135}{134} - 1 = .007 \quad \text{O.K.}$$

#4 wire mesh
 .04 si/wire
 4" grid

Check Concrete Shear :

$$v = \frac{V}{bh} = \frac{2393}{8"(48")} = 6.2 \text{ psi} < 93 \text{ psi} \quad \text{O.K.}$$

$$M.S. = \frac{93}{6.2} = 14.0$$

ANALYTICAL CALCULATIONS

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 Originator RA Miller 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

$$V = \frac{2071}{2 \text{ anchors}} = 1036^{\#} < 4208^{\#} \text{ O.K.}$$

$$MS = \frac{4208}{1036} - 1 = 3.06$$

ANALYTICAL CALCULATIONS

WHC-SD-CP-SA-026

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Subject _____
 Originator RA H. He Date 12-19-94
 Checker MA ISLAM Date 2/27/95

Strength Check Panel B-F

$$P = .85D + E$$

$$P = 101.1 \times 254''$$

$$P = 25679 \#$$

$$R_{1y} = 1823 + \frac{25679}{16} = 3428 \# \text{ comp } R_{1x} = 861 \#$$

$$R_{4-5y} = -1827 + 1736 + \frac{25679}{16} \times 2 = 3119 \# \text{ comp}$$

$$R_{4-5x} = 965 + 859 = 1824 \#$$

$$R_{8-9y} = -2337 + 1714 + \frac{25679}{16} \times 2 = 2587 \# \text{ comp}$$

$$R_{8-9x} = 1194 + 855 = 2049 \#$$

$$R_{12-13y} = -2344 + 1707 + \frac{25679}{16} \times 2 = 2573 \# \text{ comp}$$

$$R_{12-13x} = 1200 + 854 = 2054 \#$$

$$R_{16-17y} = -2329 + 1711 + \frac{25679}{16} \times 2 = 2592 \#$$

$$R_{16-17x} = 1195 + 855 = 2050 \#$$

$$R_{32y} = -2504 + \frac{25679}{16} = 899 \# \text{ tens.}$$

$$R_{32x} = 1173 \#$$

$$\Sigma R_x = 15952 \#$$

ANALYTICAL CALCULATIONS

WHC-SD-CP-SA-026

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Subject _____

Originator RA MillerDate 12-19-94Checker MA ISLAMDate 2/27/95Strength Check Panel B - F Cont.

Shear @ Base :

$$V = 15952^{\#} = .2 \times 79748^{\#} \text{ O.K.}$$

$$v = \frac{15952}{8''(254'')} = 7.9 \text{ psi}$$

Stress & Moment @ Base :

$$\sigma = 91.8 \text{ psi}$$

$$M = \sigma S_b = \sigma b h^2 / 6000 = 123.4 \text{ ''}\cdot\text{K}$$

Check Concrete Shear :

$$v = 7.9 \text{ psi}$$

$$< 93.5 \text{ psi O.K.}$$

$$MS = \frac{93.5}{7.9} - 1 = 10.8$$

Check Concrete Bending :

$$a = \frac{A_s F_y}{.85 f'_c b} = \frac{14(.04) 40}{.85(3) 8''} = 1.098''$$

$$\phi M_n = \phi A_s F_y \sum (d - \frac{a}{2})$$

$$= .9(.08)(40) \left[(29.5 - \frac{a}{2}) + (25.5 - \frac{a}{2}) + (21.5 - \frac{a}{2}) \right. \\ \left. + (17.5 - \frac{a}{2}) + (13.5 - \frac{a}{2}) + (9.5 - \frac{a}{2}) + (5.5 - \frac{a}{2}) \right] \\ = 342 \text{ ''}\cdot\text{K} > 123.4 \text{ ''}\cdot\text{K} \text{ O.K.}$$

8"

4x4x #4
wire mesh

$$MS = \frac{342}{123.4} - 1 = 1.77$$

ANALYTICAL CALCULATIONS

Subject _____
 Originator RA Miller Date 12-19-94
 Checker MA 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.

$$M.S. = \frac{1.0}{.20} - 1 = 4.0$$

ANALYTICAL CALCULATIONS

WHC-SO-CP-SA-026

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Subject _____

Originator RA HillDate 12-21-94Checker MA ISLAMDate 2/27/95Check Base Plate

Refer to sketch shown previously

Shear in Plate ①:

$$\text{Panel A-C} \therefore V = \frac{966 \times 9 \text{ panels}}{17 \text{ anchors}} = 511 \#/\text{anch}$$

Shear in Plate ②:

$$\text{Panel A-C} \therefore V = \frac{777 \times 9 \text{ panel}}{17 \text{ anchors}} = 411 \#/\text{anch.}$$

$$\text{Panel B-F} \therefore V = \frac{2054 \# \times 8 \text{ panels}}{17 \text{ anchor (2 plates)}} = 483 \#/\text{anch}$$

Shear in Plate ③:

$$\text{Panel A-C} \therefore V = \frac{1345 \times 9}{17} = 712 \#/\text{anch}$$

$$\text{Panel B-F} \therefore V = 483 \#/\text{anch}$$

Shear in Plate ④:

$$\text{Panel A-C} \therefore V = \frac{786 \times 9 \text{ pl}}{17 \text{ anchors}} = 416 \#/\text{anch.}$$

Shear Resultant: SRSS & 100-40-40

$$\text{Plate ①} \quad V_R = 511 \#$$

$$\text{Plate ②} \quad V_R = \sqrt{(483)^2 + (40\% \times 411)^2} = 510 \#/\text{anch}$$

$$\text{Plate ③} \quad V_R = \sqrt{(712)^2 + (40\% \times 483)^2} = 738 \#/\text{anch}$$

$$\text{Plate ④} \quad V_R = 416 \#$$

ANALYTICAL CALCULATIONS

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 Originator RA Miller Date 12-21-94
 Checker MA ISLAM Date 2/27/95

Base Plate Cont.

Ten. or Comp. in Plate ①:

$$\text{Panel A-C} \therefore C = \frac{2708^{\#} \times 9 \text{ pl}}{17 \text{ anch}} = 1434^{\#} / \text{anch}$$

Ten. or Comp. in Plate ②:

$$\text{Panel A-C} \therefore T = 471 \times \frac{9}{17} = 249^{\#} / \text{anch}$$

$$\text{Panel B-F} \therefore T = 899 \div 2 = 450^{\#} / \text{anch}$$

Ten or Comp in Plate ③:

$$\text{Panel A-C} \therefore C = 1652^{\#} \times \frac{9}{17} = 875^{\#} / \text{anch}$$

$$\text{Panel B-F} \therefore T = 899 \div 2 = 450^{\#} / \text{anch}$$

Ten. or Comp in Plate ④:

$$\text{Panel A-C} \therefore T = 2071 \times \frac{9}{17} = 1096^{\#} / \text{anch}$$

Plate Interaction:

$$\text{Plate ①} \therefore \frac{T}{T_A} + \frac{V}{V_A} = 0 + \frac{511}{1874} = .27 < 1.0$$

C.-

$$MS = \frac{1.0}{.27} - 1 = 2.7$$

ANALYTICAL CALCULATIONS

Subject _____
 Originator RA Hill Date 12-30-97
 Checker MA ISLAM Date 2/27/98

Base Plate Cont.

Plate Interaction :

$$\text{Plate (2)} \quad \frac{T}{T_A} + \frac{V}{V_A} = \frac{450 + .4(249)}{2205} + \frac{510}{1874} = .54$$

$$MS = \frac{1.0}{.54} - 1 = 0.85$$

$$\text{Plate (3)} \quad \frac{T}{T_A} + \frac{V}{V_A} = 0 + \frac{738}{1874} = .39$$

$$MS = \frac{1.0}{.39} - 1 = 1.56$$

$$\text{Plate (4)} \quad \frac{T}{T_A} + \frac{V}{V_A} = \frac{1096}{2205} + \frac{416}{1874} = .72$$

$$MS = .39$$

ANALYTICAL CALCULATIONS

REV ~~10~~ PAGE ~~C94~~
Page ____ of ____

Subject _____
 Originator RA Miller Date 12-30-94
 Checker MA ISLAM Date 2/27/95

Check Connection @ Panel Top

Panel A - C :

$$F_x = 1021^{\#} \quad \& \quad F_y = 491^{\#}$$

$$\text{or} \quad 772^{\#} \quad \quad 1697^{\#}$$

Panel B - F :

$$F_x = 399^{\#} \quad \& \quad F_y = 224^{\#}$$

$$\text{or} \quad 126^{\#} \quad \quad 1112^{\#}$$

Shear & tension Maximums :

$$F_x = 1021^{\#} + 399^{\#} = 1420^{\#}$$

$$F_y = 1697 + 1112^{\#} = 2809^{\#}$$

Compare to anchor bolt allowables

$$\frac{T}{T_A} + \frac{V}{V_A} = \frac{1420}{4950(2\text{bolt})} + \frac{2809}{4208(2\text{bolt})} = .48 < 1.0$$

$$M.S. = \frac{1.0}{.48} - 1 = 1.08 \quad \text{O.K.}$$

ANALYTICAL CALCULATIONS

WHC-SD-CP-SA-026

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Page _____ of _____

Subject _____
Originator RA Miller 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

Embedded R, 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

Embedded R

Anchor MS = 0.39

ANALYTICAL CALCULATIONS

Page _____ of _____

Subject _____
 Originator RA Hill Date 12-30-94
 Checker MA 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.

$$\frac{68272^{\#}}{8"(48")(97")(9 \text{ panels}) 386.4 \text{ in/s}^2} = .000527$$

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

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

LIST REAL SETS 1 TO 1 BY 1

REAL CONSTANT SET 1 ITEMS 1 TO 8
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= 265 268

COUPLED SET= 2 DIRECTION= UX TOTAL NODES= 2
NODES= 269 268

COUPLED SET= 3 DIRECTION= UY TOTAL NODES= 2
NODES= 265 268

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	0.00
2	5.0000	0.00000E+00	0.00000E+00	0.00	0.00	0.00	0.00
3	10.000	0.00000E+00	0.00000E+00	0.00	0.00	0.00	0.00
4	15.000	0.00000E+00	0.00000E+00	0.00	0.00	0.00	0.00
5	20.000	0.00000E+00	0.00000E+00	0.00	0.00	0.00	0.00
6	20.000	0.00000E+00	0.00000E+00	0.00	0.00	0.00	0.00
7	24.000	0.00000E+00	0.00000E+00	0.00	0.00	0.00	0.00
8	28.000	0.00000E+00	0.00000E+00	0.00	0.00	0.00	0.00
9	28.000	0.00000E+00	0.00000E+00	0.00	0.00	0.00	0.00
10	33.000	0.00000E+00	0.00000E+00	0.00	0.00	0.00	0.00
11	38.000	0.00000E+00	0.00000E+00	0.00	0.00	0.00	0.00
12	43.000	0.00000E+00	0.00000E+00	0.00	0.00	0.00	0.00
13	48.000	0.00000E+00	0.00000E+00	0.00	0.00	0.00	0.00
14	0.00000E+00	4.8500	0.00000E+00	0.00	0.00	0.00	0.00
15	5.0000	4.8500	0.00000E+00	0.00	0.00	0.00	0.00
16	10.000	4.8500	0.00000E+00	0.00	0.00	0.00	0.00
17	15.000	4.8500	0.00000E+00	0.00	0.00	0.00	0.00
18	20.000	4.8500	0.00000E+00	0.00	0.00	0.00	0.00
19	20.000	4.8500	0.00000E+00	0.00	0.00	0.00	0.00
20	24.000	4.8500	0.00000E+00	0.00	0.00	0.00	0.00
21	28.000	4.8500	0.00000E+00	0.00	0.00	0.00	0.00
22	28.000	4.8500	0.00000E+00	0.00	0.00	0.00	0.00
23	33.000	4.8500	0.00000E+00	0.00	0.00	0.00	0.00
24	38.000	4.8500	0.00000E+00	0.00	0.00	0.00	0.00
25	43.000	4.8500	0.00000E+00	0.00	0.00	0.00	0.00
26	48.000	4.8500	0.00000E+00	0.00	0.00	0.00	0.00
27	0.00000E+00	9.7000	0.00000E+00	0.00	0.00	0.00	0.00
28	5.0000	9.7000	0.00000E+00	0.00	0.00	0.00	0.00
29	10.000	9.7000	0.00000E+00	0.00	0.00	0.00	0.00
30	15.000	9.7000	0.00000E+00	0.00	0.00	0.00	0.00
31	20.000	9.7000	0.00000E+00	0.00	0.00	0.00	0.00
32	20.000	9.7000	0.00000E+00	0.00	0.00	0.00	0.00
33	24.000	9.7000	0.00000E+00	0.00	0.00	0.00	0.00
34	28.000	9.7000	0.00000E+00	0.00	0.00	0.00	0.00
35	28.000	9.7000	0.00000E+00	0.00	0.00	0.00	0.00
36	33.000	9.7000	0.00000E+00	0.00	0.00	0.00	0.00
37	38.000	9.7000	0.00000E+00	0.00	0.00	0.00	0.00
38	43.000	9.7000	0.00000E+00	0.00	0.00	0.00	0.00
39	48.000	9.7000	0.00000E+00	0.00	0.00	0.00	0.00
40	0.00000E+00	14.550	0.00000E+00	0.00	0.00	0.00	0.00
41	5.0000	14.550	0.00000E+00	0.00	0.00	0.00	0.00
42	10.000	14.550	0.00000E+00	0.00	0.00	0.00	0.00
43	15.000	14.550	0.00000E+00	0.00	0.00	0.00	0.00
44	20.000	14.550	0.00000E+00	0.00	0.00	0.00	0.00
45	20.000	14.550	0.00000E+00	0.00	0.00	0.00	0.00
46	24.000	14.550	0.00000E+00	0.00	0.00	0.00	0.00
47	28.000	14.550	0.00000E+00	0.00	0.00	0.00	0.00
48	28.000	14.550	0.00000E+00	0.00	0.00	0.00	0.00
49	33.000	14.550	0.00000E+00	0.00	0.00	0.00	0.00
50	38.000	14.550	0.00000E+00	0.00	0.00	0.00	0.00
51	43.000	14.550	0.00000E+00	0.00	0.00	0.00	0.00
52	48.000	14.550	0.00000E+00	0.00	0.00	0.00	0.00
53	0.00000E+00	19.400	0.00000E+00	0.00	0.00	0.00	0.00
54	5.0000	19.400	0.00000E+00	0.00	0.00	0.00	0.00
55	10.000	19.400	0.00000E+00	0.00	0.00	0.00	0.00
56	15.000	19.400	0.00000E+00	0.00	0.00	0.00	0.00
57	20.000	19.400	0.00000E+00	0.00	0.00	0.00	0.00
58	20.000	19.400	0.00000E+00	0.00	0.00	0.00	0.00
59	24.000	19.400	0.00000E+00	0.00	0.00	0.00	0.00
60	28.000	19.400	0.00000E+00	0.00	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	0.00
242	28.000	87.300	0.00000E+00	0.00	0.00	0.00	0.00
243	28.000	87.300	0.00000E+00	0.00	0.00	0.00	0.00
244	33.000	87.300	0.00000E+00	0.00	0.00	0.00	0.00
245	38.000	87.300	0.00000E+00	0.00	0.00	0.00	0.00
246	43.000	87.300	0.00000E+00	0.00	0.00	0.00	0.00
247	48.000	87.300	0.00000E+00	0.00	0.00	0.00	0.00
248	0.00000E+00	92.150	0.00000E+00	0.00	0.00	0.00	0.00
249	5.0000	92.150	0.00000E+00	0.00	0.00	0.00	0.00
250	10.000	92.150	0.00000E+00	0.00	0.00	0.00	0.00
251	15.000	92.150	0.00000E+00	0.00	0.00	0.00	0.00
252	20.000	92.150	0.00000E+00	0.00	0.00	0.00	0.00
253	20.000	92.150	0.00000E+00	0.00	0.00	0.00	0.00
254	24.000	92.150	0.00000E+00	0.00	0.00	0.00	0.00
255	28.000	92.150	0.00000E+00	0.00	0.00	0.00	0.00
256	28.000	92.150	0.00000E+00	0.00	0.00	0.00	0.00
257	33.000	92.150	0.00000E+00	0.00	0.00	0.00	0.00
258	38.000	92.150	0.00000E+00	0.00	0.00	0.00	0.00
259	43.000	92.150	0.00000E+00	0.00	0.00	0.00	0.00
260	48.000	92.150	0.00000E+00	0.00	0.00	0.00	0.00
261	0.00000E+00	97.000	0.00000E+00	0.00	0.00	0.00	0.00
262	5.0000	97.000	0.00000E+00	0.00	0.00	0.00	0.00
263	10.000	97.000	0.00000E+00	0.00	0.00	0.00	0.00
264	15.000	97.000	0.00000E+00	0.00	0.00	0.00	0.00
265	20.000	97.000	0.00000E+00	0.00	0.00	0.00	0.00
266	20.000	97.000	0.00000E+00	0.00	0.00	0.00	0.00
267	24.000	97.000	0.00000E+00	0.00	0.00	0.00	0.00
268	28.000	97.000	0.00000E+00	0.00	0.00	0.00	0.00
269	28.000	97.000	0.00000E+00	0.00	0.00	0.00	0.00
270	33.000	97.000	0.00000E+00	0.00	0.00	0.00	0.00
271	38.000	97.000	0.00000E+00	0.00	0.00	0.00	0.00
272	43.000	97.000	0.00000E+00	0.00	0.00	0.00	0.00
273	48.000	97.000	0.00000E+00	0.00	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

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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

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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

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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

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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

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Subject _____

Originator RA Miller 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

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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	0.28220E-04
4	-0.34212E-05
5	0.00000E+00
6	0.00000E+00
7	0.13399E-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	-0.15998E-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

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REV16 PAGE C-110

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

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ELEM= 191 FX FY FZ
248 42.285 49.351 0.00000E+00
249 3.8543 -1.4203 0.00000E+00
282 -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
283 -201.51 -61.689 0.00000E+00
262 55.616 47.931 0.00000E+00

ELEM= 193 FX FY FZ
250 282.56 165.73 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 23.598 -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

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REV 1 ~~2~~ PAGE 2-112

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	4.7658	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
282 -67.954 -58.564 0.00000E+00
281 -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
283 -246.22 -75.374 0.00000E+00
282 67.954 58.564 0.00000E+00

ELEM= 193 FX FY FZ
250 320.81 202.50 0.00000E+00
251 -40.132 -18.108 0.00000E+00
284 -538.47 -259.77 0.00000E+00
283 246.22 75.374 0.00000E+00

ELEM= 194 FX FY FZ
251 67.359 -408.02 0.00000E+00
252 -223.93 -776.76 0.00000E+00
265 -393.48 923.01 0.00000E+00
284 538.47 259.77 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 0.68296 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

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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	968.06	1697.0	
6	82.373	818.06	
8	208.91	-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	-38.857	-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
249 364.85 210.98 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
250 618.95 385.60 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 -1448.4 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 -140.68 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
269 140.68 -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 -10.448 79.365 0.00000E+00
259 116.58 -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

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Subject _____
Originator RD Miller 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

LIST REAL SETS 1 TO 1 BY 1

REAL CONSTANT SET 1 ITEMS 1 TO 8
8.0000 0.00000E+00 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
8 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	180.50	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	38.375	0.00000E+00	0.00	0.00	0.00
122	10.583	38.375	0.00000E+00	0.00	0.00	0.00
123	21.168	38.375	0.00000E+00	0.00	0.00	0.00
124	31.750	38.375	0.00000E+00	0.00	0.00	0.00
125	31.750	38.375	0.00000E+00	0.00	0.00	0.00
126	42.333	38.375	0.00000E+00	0.00	0.00	0.00
127	52.916	38.375	0.00000E+00	0.00	0.00	0.00
128	63.500	38.375	0.00000E+00	0.00	0.00	0.00
129	63.500	38.375	0.00000E+00	0.00	0.00	0.00
130	74.083	38.375	0.00000E+00	0.00	0.00	0.00
131	84.668	38.375	0.00000E+00	0.00	0.00	0.00
132	95.250	38.375	0.00000E+00	0.00	0.00	0.00
133	95.250	38.375	0.00000E+00	0.00	0.00	0.00
134	105.83	38.375	0.00000E+00	0.00	0.00	0.00
135	116.42	38.375	0.00000E+00	0.00	0.00	0.00
136	127.00	38.375	0.00000E+00	0.00	0.00	0.00
137	127.00	38.375	0.00000E+00	0.00	0.00	0.00
138	137.58	38.375	0.00000E+00	0.00	0.00	0.00
139	148.17	38.375	0.00000E+00	0.00	0.00	0.00
140	158.75	38.375	0.00000E+00	0.00	0.00	0.00
141	158.75	38.375	0.00000E+00	0.00	0.00	0.00
142	169.33	38.375	0.00000E+00	0.00	0.00	0.00
143	179.92	38.375	0.00000E+00	0.00	0.00	0.00
144	190.50	38.375	0.00000E+00	0.00	0.00	0.00
145	190.50	38.375	0.00000E+00	0.00	0.00	0.00
146	201.08	38.375	0.00000E+00	0.00	0.00	0.00
147	211.67	38.375	0.00000E+00	0.00	0.00	0.00
148	222.25	38.375	0.00000E+00	0.00	0.00	0.00
149	222.25	38.375	0.00000E+00	0.00	0.00	0.00
150	232.83	38.375	0.00000E+00	0.00	0.00	0.00
151	243.42	38.375	0.00000E+00	0.00	0.00	0.00
152	254.00	38.375	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	21.168	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	84.668	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	21.168	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	21.168	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	0.00000E+00	0.00	0.00
250	74.083	72.750	0.00000E+00	0.00000E+00	0.00	0.00
251	84.666	72.750	0.00000E+00	0.00000E+00	0.00	0.00
252	95.250	72.750	0.00000E+00	0.00000E+00	0.00	0.00
253	95.250	72.750	0.00000E+00	0.00000E+00	0.00	0.00
254	105.83	72.750	0.00000E+00	0.00000E+00	0.00	0.00
255	116.42	72.750	0.00000E+00	0.00000E+00	0.00	0.00
256	127.00	72.750	0.00000E+00	0.00000E+00	0.00	0.00
257	127.00	72.750	0.00000E+00	0.00000E+00	0.00	0.00
258	137.58	72.750	0.00000E+00	0.00000E+00	0.00	0.00
259	148.17	72.750	0.00000E+00	0.00000E+00	0.00	0.00
260	158.75	72.750	0.00000E+00	0.00000E+00	0.00	0.00
261	158.75	72.750	0.00000E+00	0.00000E+00	0.00	0.00
262	169.33	72.750	0.00000E+00	0.00000E+00	0.00	0.00
263	179.92	72.750	0.00000E+00	0.00000E+00	0.00	0.00
264	190.50	72.750	0.00000E+00	0.00000E+00	0.00	0.00
265	190.50	72.750	0.00000E+00	0.00000E+00	0.00	0.00
266	201.08	72.750	0.00000E+00	0.00000E+00	0.00	0.00
267	211.67	72.750	0.00000E+00	0.00000E+00	0.00	0.00
268	222.25	72.750	0.00000E+00	0.00000E+00	0.00	0.00
269	222.25	72.750	0.00000E+00	0.00000E+00	0.00	0.00
270	232.83	72.750	0.00000E+00	0.00000E+00	0.00	0.00
271	243.42	72.750	0.00000E+00	0.00000E+00	0.00	0.00
272	254.00	72.750	0.00000E+00	0.00000E+00	0.00	0.00
281	0.00000E+00	84.875	0.00000E+00	0.00000E+00	0.00	0.00
282	10.583	84.875	0.00000E+00	0.00000E+00	0.00	0.00
283	21.166	84.875	0.00000E+00	0.00000E+00	0.00	0.00
284	31.750	84.875	0.00000E+00	0.00000E+00	0.00	0.00
285	31.750	84.875	0.00000E+00	0.00000E+00	0.00	0.00
286	42.333	84.875	0.00000E+00	0.00000E+00	0.00	0.00
287	52.916	84.875	0.00000E+00	0.00000E+00	0.00	0.00
288	63.500	84.875	0.00000E+00	0.00000E+00	0.00	0.00
289	63.500	84.875	0.00000E+00	0.00000E+00	0.00	0.00
290	74.083	84.875	0.00000E+00	0.00000E+00	0.00	0.00
291	84.666	84.875	0.00000E+00	0.00000E+00	0.00	0.00
292	95.250	84.875	0.00000E+00	0.00000E+00	0.00	0.00
293	95.250	84.875	0.00000E+00	0.00000E+00	0.00	0.00
294	105.83	84.875	0.00000E+00	0.00000E+00	0.00	0.00
295	116.42	84.875	0.00000E+00	0.00000E+00	0.00	0.00
296	127.00	84.875	0.00000E+00	0.00000E+00	0.00	0.00
297	127.00	84.875	0.00000E+00	0.00000E+00	0.00	0.00
298	137.58	84.875	0.00000E+00	0.00000E+00	0.00	0.00
299	148.17	84.875	0.00000E+00	0.00000E+00	0.00	0.00
300	158.75	84.875	0.00000E+00	0.00000E+00	0.00	0.00
301	158.75	84.875	0.00000E+00	0.00000E+00	0.00	0.00
302	169.33	84.875	0.00000E+00	0.00000E+00	0.00	0.00
303	179.92	84.875	0.00000E+00	0.00000E+00	0.00	0.00
304	190.50	84.875	0.00000E+00	0.00000E+00	0.00	0.00
305	190.50	84.875	0.00000E+00	0.00000E+00	0.00	0.00
306	201.08	84.875	0.00000E+00	0.00000E+00	0.00	0.00
307	211.67	84.875	0.00000E+00	0.00000E+00	0.00	0.00
308	222.25	84.875	0.00000E+00	0.00000E+00	0.00	0.00
309	222.25	84.875	0.00000E+00	0.00000E+00	0.00	0.00
310	232.83	84.875	0.00000E+00	0.00000E+00	0.00	0.00
311	243.42	84.875	0.00000E+00	0.00000E+00	0.00	0.00
312	254.00	84.875	0.00000E+00	0.00000E+00	0.00	0.00
321	0.00000E+00	97.000	0.00000E+00	0.00000E+00	0.00	0.00
322	10.583	97.000	0.00000E+00	0.00000E+00	0.00	0.00
323	21.166	97.000	0.00000E+00	0.00000E+00	0.00	0.00
324	31.750	97.000	0.00000E+00	0.00000E+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	48	49	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	58	98	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	208
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	188	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	738.42	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	98.868	0.00000E+00	
282	0.88228	-35.382	0.00000E+00	
322	-120.14	-61.488	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	61.488	0.00000E+00	

ELEM=	171	FX	FY	FZ
283	-101.04	-458.90	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	468.00	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	-833.43	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	-142.89	-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	38.008	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
28	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	-0.91384E-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	-8.2803	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 -102.93 780.98 0.00000E+00
290 -223.11 582.50 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	-787.34	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	-89.984	-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	189.08	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	-108.88	536.50	0.00000E+00	
350	413.86	-231.35	0.00000E+00	
349	-189.08	-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	

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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	75.828	0.00000E+00	

ANALYTICAL CALCULATIONS

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Subject _____
Originator RA 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.
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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

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Subject _____
Originator RA Miller 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 calculate 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, in place 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.

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Originator RA Hille 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

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Subject _____
Originator RA Miller Date 1-25-95
Checker MA 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

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Subject _____

Originator RA MillerDate 1-25-95Checker MA ISLAMDate 3/9/95Self Weight

Panel E	1384 [#]	x	4	=	5536 [#]
Panel D	1384	x	5	=	6920
Panel J	440	x	8	=	3520
Panel H	500	x	10	=	5000
Door Extension	43	x	10	=	430
Pedestals	146	x	36	=	5256
Hood	43	x	10	=	430
					<u>27092</u>

$$\text{Density} = \frac{27092}{9(8'')(20'')(96'') 386.4} = .000507$$

Self Wt. North Wall:

$$\text{Wall} = 28' \times 10.5' \times \frac{14''}{12} \times 150 \text{pcf} = 51450^{\#}$$

$$\text{Density} = \frac{51450}{8''(336'')(126'') 386.4} = .000393$$

$$\text{Wall} + \text{Cubicle} = 51450 + 27092 = 78542^{\#}$$

Self Wt. Interior Wall:

$$\text{Wall} = 28' \times 10.5' \times \frac{8''}{12} \times 150 \text{pcf} = 29400^{\#}$$

$$\text{Density} = \frac{29400}{8(336)(126) 386.4} = .000225$$

$$\text{Wall} + 2 \text{ Cubicles} = 29400 + 2 \times 27092 = 83584^{\#}$$

Self Wt. South Wall:

$$\text{Wall} + \text{Cubicals} = 29400 + 27092 = 56492^{\#}$$

$$\text{Wall Density} = .000225$$

ANALYTICAL CALCULATIONS

Subject _____

Originator RA MillsDate 1-26-95Checker MA ISLAMDate 3/9/95Floor Spring Rate

$$\Delta = \frac{Pl^3}{12EI}$$

$$E = 3,000,000 \text{ psi}$$

$$I = \frac{(6'')^3(32'')}{12}$$

$$= 576 \text{ in}^4$$

$$K = \frac{P}{\Delta}$$

$$= \frac{12EI}{l^3}$$

$$= 444,444 \text{ \#}/\text{in}$$

ANSYS ELEM, LINK 8:

$$K = \frac{AE}{l} = 444,444 \text{ \#}/\text{in}$$

$$\text{use } E = 29,000,000 \text{ psi}$$

$$\& \quad l = 3''$$

find A

$$A = \frac{444,444 l}{E} = \underline{\underline{.046 \text{ in}^2}}$$

ANALYTICAL CALCULATIONS

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Subject _____
Originator RA Miller Date 1-26-95
Checker MA ISLAM Date 3/9/95

Modal Response

- The In-building seismic response has been calculated in a separate 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

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Subject _____
 Originator RA Hill 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

$$M_u = \sigma S_b = \frac{139.7(8'')^2(5'')}{6}$$

$$M_u = 7451 \text{ ''}\cdot\#$$

$$\phi M_n = \phi A_s F_y (d - a/2)$$

$$a = \frac{A_s F_y}{.85 f_c' b} = \frac{.11(40)}{.85(3)5} = .345''$$

$$\phi M_n = .9(.11)40\left(4 - \frac{.345}{2}\right)1000$$

$$\phi M_n = 15157 \text{ ''}\cdot\# > 7451 \text{ ''}\cdot\#$$

$$MS = \frac{15157}{7451} - 1 = 1.03$$

#3 bars
 @ 5" o.c.
 d = 4"

ANALYTICAL CALCULATIONS

Subject _____

Originator R.A. KilleDate 2-9-95Checker MA ISLAMDate 3/9/95Wall/Cubical Stresses Cont.

Building Wall, In-Plane Shear:
(X-direction loading)

$$83584^{\#} \times .22g = 18388^{\#} \text{ shear}$$

$$2\sqrt{f'_c} bd = 2\sqrt{3000} (8")(320") = 280434^{\#} > 18388^{\#}$$

O.K.

$$M.S. = \frac{280434}{18388} - 1 = 14.3$$

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

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Subject _____

Originator RA HillDate 2-7-95Checker MA ISLAMDate 3/9/95Wall/Cubicle Stresses Cont.

Cubicle Wall, In-Plane Bending: (z-direction)

74.3 psi (Seismic acceleration stress)
plot, for wall 34 $\frac{10.8 \text{ psi}}{85.1 \text{ psi}}$ (Seismic displacement stress)
plot for wall 1

$$M_u = \sigma S_b = \frac{(85.1)(20'')^2(8'')}{6} = 45387 \text{ in}\cdot\#$$

$$\phi M_n = \sum \phi A_s F_y (d - a/2)$$

$$a = \frac{A_s F_y}{.85 f'_c b} = \frac{.33(40)}{.85(3)8} = .647''$$

$$\phi M_n = \phi (.11) 40 \left[\left(18'' - \frac{.647}{2} \right) + \left(13 - \frac{.647}{2} \right) + \left(7 - \frac{.647}{2} \right) \right] 1000$$

$$\phi M_n = 146,637 \text{ in}\cdot\# > 45387 \text{ in}\cdot\#$$

$$M.S. = \frac{146637}{45387} - 1 = 2.23$$

4- #3 bars
assume only
3 are in
tension

ANALYTICAL CALCULATIONS

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Subject _____

Originator RA. MillerDate 2-9-95Checker MA ISLAMDate 3/9/95Wall/Cubicle Stresses Cont.Cubicle Wall, Out-of-Plane Bending :
(x-direction)47.6 psi (Seismic acceleration
stress plot, x-direction)

$$M_u = \sigma S_b = \frac{47.6(8)^2(20)}{6}$$

$$M_u = 10,155 \text{ in.}\cdot\#$$

$$\phi M_n = \phi A_s F_y (d - \frac{a}{2})$$

$$a = \frac{A_s F_y}{.85 f'_c b} = \frac{.44(40)}{.85(3)20} = .345 \text{ in.}$$

$$\phi M_n = .9(.44)(40)(4 - \frac{.345}{2})1000$$

$$\phi M_n = 60,600 \text{ in.}\cdot\# > 10,155 \text{ in.}\cdot\#$$

$$IIS = \frac{60600}{10155} - 1 = 4.9$$

4-#3 bars

 $d = 4 \text{ in.}$

ANALYTICAL CALCULATIONS

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Subject _____
 Originator RA Hill Date 2-8-95
 Checker MA ISLAM Date 3/9/95

Support Reactions

Dead Wt.

1384[#]
 440
 440
 43
 584
 2891[#]

$$.8SD - \frac{2}{3}(.2g)(40\%)W$$

$$= .80W = (.8 \frac{2891}{2}) = 1156$$

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 ^{"#}	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

WHC-SP-CP-3A-026

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Page ____ of ____

Subject _____

Originator RA MillerDate 2-10-93Checker MA ISLAMDate 3/9/95Floor Anchor Plate

$$\text{Max tension, } F_y = 0 \#$$

$$\text{Max shear, } \sqrt{F_x^2 + F_z^2} = \sqrt{319^2 + 292^2} = 432 \#$$

$$\text{Max moment, } M_z = 5395 \text{ "}\cdot\#$$

Anchor shear:

$$\frac{(11 \text{ Cubicles}) 432 \#}{(17 \text{ anch.}) / \text{ft}} = 280 \# / \text{anch}$$

Anchor tension:

$$\frac{(5395 \text{ "}\cdot\#)}{16 \text{ " anch spacing}} = 337 \# / \text{anch}$$

Anchor Capacity:

(From floor mounted cubicle analysis)

$$T_A = 2205 \# \quad V_A = 1874 \# \quad \text{for } \frac{1}{4} \text{ " } \phi \text{ anchors}$$

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

REV ~~10~~ PAGE C-158

Page ____ of ____

Subject _____

Originator RA MillerDate 2-8-95Checker MA ISLAMDate 3/9/95Cubicle Wall AnchorsMax 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:

$$\sqrt{[609^\# \sin(45^\circ - 44^\circ)]^2 + 306^2} = 306^\# \text{ shear}$$

$$609^\# \cos(45^\circ - 44^\circ) = 609^\# \text{ tension}$$

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

WHC-SD-TP-3A-026

Page REV 1 of PAGE C-159

Subject _____
 Originator RS Miller Date 2-9-95
 Checker MA ISLAM Date 3/9/95

Weld Check

Note: field walkdown shows under sized and under length welds see attached notes.

Min. weld size is
 $\frac{1}{8}$ " 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

$$\begin{aligned} S_w &= bd \\ &= 1.5"(3") \\ &= 4.5" \end{aligned}$$

use about 60% for conservatism

$$4.5(.6) = \underline{\underline{2.7}}$$

$$MS = \frac{2227}{2019} - 1 = .10$$

$$f_w = 2019 \#/\text{in} > 2227 \#/\text{in} \quad 0.12$$

$$f_w = \sqrt{\left(\frac{F_x}{S_w} + \frac{M_z}{S_w}\right)^2 + \left(\frac{F_x}{S_x}\right)^2 + \left(\frac{F_z}{S_z}\right)^2} = \sqrt{0 + \frac{5395}{2.7} + \left(\frac{1.5}{292}\right)^2 + \left(\frac{319}{1.5}\right)^2}$$

Welds @ Node 212-200 & 302-310 :

$$f_w = 1835 \#/\text{in} > 2227 \#/\text{in}$$

$$f_w = \sqrt{\left(\frac{F_x}{S_w} + \frac{M_z}{S_w}\right)^2 + \left(\frac{F_x}{S_x}\right)^2 + \left(\frac{F_z}{S_z}\right)^2} = \sqrt{0 + \frac{4910}{2.7} + \left(\frac{1.5}{226}\right)^2 + \left(\frac{1.5}{286}\right)^2}$$

Weld @ Nodes 202-210 :

$$f_w = 454 \#/\text{in} > 2227 \#/\text{in} \quad 0.12$$

$$f_w = \sqrt{\left(\frac{F_x}{S_w} + \frac{M_z}{S_w}\right)^2 + \left(\frac{F_x}{S_x}\right)^2 + \left(\frac{F_z}{S_z}\right)^2} = \sqrt{\left(\frac{306}{1.5}\right)^2 + \left(\frac{423}{1.5}\right)^2 + \left(\frac{438}{1.5}\right)^2}$$

Welds @ Nodes 282-290 :

$$\text{As-Built weld strength : } (1/8 \text{ weld}) \times (.707) \times (.3 \times 60000 \text{ psi}) \times (1.4 \text{ factor}) = 2227 \#/\text{in}$$

Weld Check

Subject	RA R.11	Checker	MA ISLAM
Originator	RA R.11	Date	2-9-95
		Date	3/9/95

Page of

ANALYTICAL CALCULATIONS

ANALYTICAL CALCULATIONS

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Subject _____

Originator RA MillerDate 1-30-95Checker MA ISLAMDate 3/9/95Construction Details

New Type Cubicles

2736 Z Building, Room 1

Drawings H-Z-70010, H-Z-70011

anchors are shown
for these channels

Cubical Wall

No anchors shown
at these locations

Note: The design drawings for the new type cubicles, do not show anchors in all locations. Walls 1 & 12 assume $\frac{1}{4}" \phi$ anchors are in-place. Walls 1a & 12a assume no anchor at these locations.

ANALYTICAL CALCULATIONS

Page ____ of ____

Subject _____
 Originator RA Hilin Date 1-26-95
 Checker MA ISLAM Date 3/9/95

Self Weight

Panel A	$1370^{\#}$	$\times 9$	$=$	$12330^{\#}$
Panel D	$900^{\#}$	$\times 9$	$=$	8100
Panel E	$900^{\#}$	$\times 9$	$=$	8100
Pedestals	$191^{\#}$	$\times 18$	$=$	3438
	$95^{\#}$	$\times 10$	$=$	950
Duct	$66^{\#}$	$\times 10$	$=$	660
				<u>$33578^{\#}$</u>

Self Wt. North Wall (Room 1)

$$\text{Wall} = 28' \times 10.5' \times \frac{14}{12} \times 150 \text{ pcf} = 51450^{\#}$$

$$\text{density} = \frac{51450^{\#}}{8"(126")(336") 386.4} = .000393 \text{ pci}$$

$$\text{Cubicle} = 33578^{\#}$$

$$\text{density} = \frac{33578^{\#}}{8"(20")(96")(9) 386.4} = .000629 \text{ pci}$$

Self Wt. Interior Wall (Room 1)

$$\text{Wall} = 28' \times 10.5' \times \frac{8}{12} \times 150 \text{ pcf} = 29400^{\#}$$

$$\text{density} = \frac{29400}{8"(126")(336") 386.4} = .000225 \text{ pci}$$

$$\text{Cubicle} = 33578^{\#}$$

$$= .000629 \text{ pci}$$

ANALYTICAL CALCULATIONS

Subject _____
 Originator RA Miller Date 1-26-95
 Checker MA ISLAM Date 3/9/95

Self Weight

Room 2 has Lard-can racks attached to the interior wall. $\frac{1}{2}$ of this mass will be added to the interior wall mass (Wall 12). The remaining $\frac{1}{2}$ of the Lard-can racks is attached to the floor slab and not a part of this analysis.

Lard-can racks:

$$1900 \text{ \# / unit} \times 12 \text{ units} = 22800 \text{ \#}$$

(WHC-SD-CP-SA-026 page B22)

$$\frac{1}{2} \times 22800 = 11400 \text{ \#}$$

$$\text{density} = \frac{11400}{8"(126")(336") 386.4} = .000087$$

$$\begin{array}{l} \text{Total} \\ \text{density} \\ \text{for Wall} \end{array} = .000087 + .000225 = \underline{\underline{.000312}}$$

ANALYTICAL CALCULATIONS

WHC-CD-CP-DA-026

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Page ____ of ____

Subject _____

Originator RA MillerDate 1-26-95Checker M/A ISLAMDate 3/9/95Computer 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

$$\Delta = \frac{Pl^3}{12EI}$$

$$K = \frac{P}{\Delta}$$

$$K = \frac{12EI}{l^3}$$

$$K = 444,444 \text{ \#}/\text{in}$$

$$\text{Slab } I$$

$$I = \frac{6^3(32)}{12}$$

$$I = 576 \text{ in}^4$$

$$E = 3E6 \text{ psi}$$

ANALYTICAL CALCULATIONS

WHC-SD-CP-SA-026

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Subject _____
Originator RA Miller 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

- Referring 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

WHC-02-12-BA-026

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Subject

Originator

RA. Miller

Date

2-6-95

Checker

MA 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

$$M_u = \sigma S_b = \frac{229 (8'')^2 (5'')}{6} = 12213 \text{ ''}\cdot\#$$

$$\phi M_n = \phi A_s F_y (d - \frac{a}{2})$$

$$a = \frac{A_s F_y}{.85 f_c' b} = \frac{.11 (40)}{.85 (3) (5)} = .345''$$

$$\phi M_n = .9 (.11) 40 (4 - \frac{.345}{2}) 1000$$

$$\phi M_n = 15157 \text{ ''}\cdot\# > 12213 \text{ ''}\cdot\#$$

$$M.S. = \frac{15157}{12213} - 1 = 0.24$$

#3 bars
@ 5" o.c.
d = 4"

ANALYTICAL CALCULATIONS

Page ____ of ____

Subject _____

Originator RA Miller

Date

2-10-95

Checker MA ISLAM

Date

3/9/95

Wall / Cubicle Stresses Cont.

Building Wall, In-Plane Shear:
(x-direction)

$$(51450^{\#} + 33578^{\#}) \cdot 22g = 18706^{\#} \text{ shear}$$

$$2\sqrt{f'_c} b d = 280434^{\#} > 18706^{\#}$$

$$M.S. = \frac{280434}{18706} - 1 = 14.0$$

Cubicle Wall, In-Plane Shear:
(z-direction)

$$\frac{(51450 + 33578) \cdot 35g}{9 \text{ walls}} = 3307^{\#}$$

$$2\sqrt{f'_c} b d = 17527^{\#} > 3307^{\#}$$

$$M.S. = \frac{17527}{3307} - 1 = 4.3$$

ANALYTICAL CALCULATIONS

WHC-SD-CP-31-026

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Subject _____
 Originator R.A. Miller 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

$$M_u = \sigma S_b = \frac{56.5 \text{ psi} (20'')^2 (8'')}{6} = 30133 \text{ in} \cdot \#$$

$$\phi M_n = \sum \phi A_s F_y (d - a/2)$$

$$a = \frac{A_s F_y}{.85 f'_c b} = \frac{8(.04) 40}{.85(3) 8''} = .627''$$

$$\phi M_n = \phi (.08) 40 \left[\left(18 - \frac{.627}{2} \right) + \left(14 - \frac{.627}{2} \right) + \left(10 - \frac{.627}{2} \right) + \left(6 - \frac{.627}{2} \right) \right] 1000$$

$$\phi M_n = 134,630 \text{ in} \cdot \# > 30,133 \text{ in} \cdot \#$$

$$M.S. = \frac{134,630}{30,133} - 1 = 3.4$$

4" x 4" x #4

wire mesh

#4 = .04 si

ANALYTICAL CALCULATIONS

WHC-SD-CP-SA-020

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Page _____ of _____

Subject _____

Originator RA. K. H.Date 2-9-95Checker MA ISLAMDate 3/9/95Wall/Cubicle Stresses Cont.

Cubicle Wall, Out-of-Plane Bending:

40.5 psi (Seismic acceleration)
(stress plot, x-direction)

$$M_u = \sigma S_b = \frac{40.5 (8)^2 20}{6}$$

$$M_u = 8640 \text{ "}\cdot\text{"}$$

$$\phi M_n = \phi A_s F_y (d - a/2)$$

$$a = \frac{A_s F_y}{.85 f'_c b} = \frac{(5)(.04)(40)}{.85(3)(20)} = .157 \text{ "}$$

$$\phi M_n = .9(.20) 40 \left(6 - \frac{.157}{2} \right) 1000$$

$$\phi M_n = 42635 \text{ "}\cdot\text{"} > 8640 \text{ "}\cdot\text{"}$$

$$M.S. = \frac{42635}{8640} - 1 = 3.9$$

4" x 4" x #4

wire mesh

d = 6"

#4 = .04 si

Nodes	Force	DW	Accel	Disp	Total
202-210	Fx	0	226	0	226
	Fy	1638	860	159	2657
	Fz	0	414	17	431
	Mz	0	4910	0	4910
212-220	Fx	0	292	0	292
	Fz	0	456	54	510
	Mz	0	5395	0	5395
302-310	Fy	1638	-749	-338	551
	Fx	0	306	0	306
	Fy	0	607	184	791
	Fz	0	-604	-70	-674
282-290	Fx	0	306	0	306
	Fy	0	607	184	791
	Fz	0	-604	-70	-674

$$.85 DW - E_v = .8 DW$$

$$.8 \left(\frac{2}{4095} \right) = 1638 \#$$

4095 #
66
95
764
900
900
1370 #

Dead Wt.

Support Reactions

Subject: R.A. K.L.
Originator: MA ISLAM
Checker: MA ISLAM
Date: 2-8-95
Date: 3/9/95

ANALYTICAL CALCULATIONS

ANALYTICAL CALCULATIONS

WHC-SD-CP-SA-026

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Page ____ of ____

Subject _____

Originator RA MillerDate 2-10-95Checker MA ISLAMDate 3/9/95Floor Anchor Plate

$$\text{Max tension, } F_y = 0 \#$$

$$\text{Max shear, } \sqrt{F_x^2 + F_z^2} = \sqrt{292^2 + 510^2} = 588 \#$$

$$\text{Max moment, } M_z = 5395 \text{ in.}\#$$

Anchor shear :

$$\frac{(11 \text{ Cubicals}) 588 \#}{17 \text{ anch.}} = 380 \#/\text{anch.}$$

Anchor tension :

$$\frac{(5395 \text{ in.}\#)}{16 \text{ spacing}} = 337 \#/\text{anch}$$

Anchor Capacity :

$$T_A = 2205 \# \quad V_A = 1874 \#$$

Bolt Interaction :

$$\frac{T}{T_A} + \frac{V}{V_A} = \frac{380}{2205} + \frac{337}{1874} = .35 < 1.0$$

$$\text{M.S.} = \frac{1.0}{.35} - 1 = 1.8$$

 $\frac{3}{8}$ inch Anchor Capacity :

(From floor mounted cubicle analysis)

$$T_A = 4950 \#$$

$$V_A = 4208 \#$$

ANALYTICAL CALCULATIONS

Subject _____

Originator RA HilleDate 2-8-95Checker MA ISLAMDate 3/9/95Cubicle Wall AnchorsMax tension, F_z

$$= 674^\#$$

Max shear, F_x & $F_y = 306^\#$ & $791^\#$

Tension in anchors:

$$T = (306 \sin 45^\circ)^{\frac{1}{2}} + (791 \sin 45^\circ)^{\frac{1}{2}} = 388^\#$$

Shear in anchors:

$$V = \sqrt{388^2 + \left(\frac{674}{2}\right)^2} = 514^\#$$

Bolt Interaction:

$$IE = \frac{T}{T_A} + \frac{V}{V_A} = \frac{388}{4950} + \frac{514}{4208} = .20 < 1.0$$

$$M.S. = \frac{1.0}{.20} - 1 = 4.0$$

ANALYTICAL CALCULATIONS

WHC-SD-CP-SA-026

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Subject _____

Originator RA KithDate 2-9-95Checker MA ISLAMDate 3/9/95Weld CheckAs-Built weld strength:
2227 #/11

Welds @ Nodes 282-290 :

$$f_w = \sqrt{\left(\frac{F_x}{l_w}\right)^2 + \left(\frac{F_y}{l_w}\right)^2 + \left(\frac{F_z}{l_w}\right)^2} = \sqrt{\left(\frac{306}{1.5}\right)^2 + \left(\frac{791}{1.5}\right)^2 + \left(\frac{674}{1.5}\right)^2}$$

$$f_w = 722 \text{ #/11} < 2227 \text{ #/11}$$

Welds @ Nodes 202-210 :

$$f_w = \sqrt{\left(0 + \frac{M_z}{S_w}\right)^2 + \left(\frac{F_x}{l_w}\right)^2 + \left(\frac{F_z}{l_w}\right)^2} = \sqrt{\left(\frac{4910}{2.7}\right)^2 + \left(\frac{226}{1.5}\right)^2 + \left(\frac{431}{1.5}\right)^2}$$

$$f_w = 1847 \text{ #/11} < 2227 \text{ #/11}$$

Welds @ Nodes 212-220 & 302-310 :

$$f_w = \sqrt{\left(0 + \frac{M_z}{S_w}\right)^2 + \left(\frac{F_x}{l_w}\right)^2 + \left(\frac{F_z}{l_w}\right)^2} = \sqrt{\left(\frac{5395}{2.7}\right)^2 + \left(\frac{292}{1.5}\right)^2 + \left(\frac{513}{1.5}\right)^2}$$

$$f_w = 2036 \text{ #/11} < 2227 \text{ #/11}$$

$$M.S. = \frac{2227}{2036} - 1 = .09$$

Margins of Safety

Subject	RA HLL	Date	2-9-95
Originator	MA ISLAM	Date	3/9/95
Checker			

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-Built) M.S = 0.09

ANALYTICAL CALCULATIONS

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 vary 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* Date 1-30-95

Signature of preparer Rodney R. Thorne *Rodney R Thorne* Date 1-30-95

** CC:
EP BONADIE
EC OCOMA

ANALYTICAL CALCULATIONS

WHC-SD-CP-SA-026

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Subject _____
Originator RA Hille 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	128.00	0.00000E+00	0.00	0.00	0.00
102	32.000	128.00	0.00000E+00	0.00	0.00	0.00
103	64.000	128.00	0.00000E+00	0.00	0.00	0.00
104	96.000	128.00	0.00000E+00	0.00	0.00	0.00
105	128.00	128.00	0.00000E+00	0.00	0.00	0.00
106	160.00	128.00	0.00000E+00	0.00	0.00	0.00
107	192.00	128.00	0.00000E+00	0.00	0.00	0.00
108	224.00	128.00	0.00000E+00	0.00	0.00	0.00
109	256.00	128.00	0.00000E+00	0.00	0.00	0.00
110	288.00	128.00	0.00000E+00	0.00	0.00	0.00
111	320.00	128.00	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

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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

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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

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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

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

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	THX	THY	THZ	THZX
269	256.00	72.000	20.000	0.00	0.00	0.00	0.00
270	288.00	72.000	20.000	0.00	0.00	0.00	0.00
282	32.000	96.000	20.000	0.00	0.00	0.00	0.00
283	64.000	96.000	20.000	0.00	0.00	0.00	0.00
284	96.000	96.000	20.000	0.00	0.00	0.00	0.00
285	128.00	96.000	20.000	0.00	0.00	0.00	0.00
286	160.00	96.000	20.000	0.00	0.00	0.00	0.00
287	192.00	96.000	20.000	0.00	0.00	0.00	0.00
288	224.00	96.000	20.000	0.00	0.00	0.00	0.00
289	256.00	96.000	20.000	0.00	0.00	0.00	0.00
290	288.00	96.000	20.000	0.00	0.00	0.00	0.00
302	32.000	0.00000E+00	-20.000	0.00	0.00	0.00	0.00
303	64.000	0.00000E+00	-20.000	0.00	0.00	0.00	0.00
304	96.000	0.00000E+00	-20.000	0.00	0.00	0.00	0.00
305	128.00	0.00000E+00	-20.000	0.00	0.00	0.00	0.00
306	160.00	0.00000E+00	-20.000	0.00	0.00	0.00	0.00
307	192.00	0.00000E+00	-20.000	0.00	0.00	0.00	0.00
308	224.00	0.00000E+00	-20.000	0.00	0.00	0.00	0.00
309	256.00	0.00000E+00	-20.000	0.00	0.00	0.00	0.00
310	288.00	0.00000E+00	-20.000	0.00	0.00	0.00	0.00
322	32.000	24.000	-20.000	0.00	0.00	0.00	0.00
323	64.000	24.000	-20.000	0.00	0.00	0.00	0.00
324	96.000	24.000	-20.000	0.00	0.00	0.00	0.00
325	128.00	24.000	-20.000	0.00	0.00	0.00	0.00
326	160.00	24.000	-20.000	0.00	0.00	0.00	0.00
327	192.00	24.000	-20.000	0.00	0.00	0.00	0.00
328	224.00	24.000	-20.000	0.00	0.00	0.00	0.00
329	256.00	24.000	-20.000	0.00	0.00	0.00	0.00
330	288.00	24.000	-20.000	0.00	0.00	0.00	0.00
342	32.000	48.000	-20.000	0.00	0.00	0.00	0.00
343	64.000	48.000	-20.000	0.00	0.00	0.00	0.00
344	96.000	48.000	-20.000	0.00	0.00	0.00	0.00
345	128.00	48.000	-20.000	0.00	0.00	0.00	0.00
346	160.00	48.000	-20.000	0.00	0.00	0.00	0.00
347	192.00	48.000	-20.000	0.00	0.00	0.00	0.00
348	224.00	48.000	-20.000	0.00	0.00	0.00	0.00
349	256.00	48.000	-20.000	0.00	0.00	0.00	0.00
350	288.00	48.000	-20.000	0.00	0.00	0.00	0.00
362	32.000	72.000	-20.000	0.00	0.00	0.00	0.00
363	64.000	72.000	-20.000	0.00	0.00	0.00	0.00
364	96.000	72.000	-20.000	0.00	0.00	0.00	0.00
365	128.00	72.000	-20.000	0.00	0.00	0.00	0.00
366	160.00	72.000	-20.000	0.00	0.00	0.00	0.00
367	192.00	72.000	-20.000	0.00	0.00	0.00	0.00
368	224.00	72.000	-20.000	0.00	0.00	0.00	0.00
369	256.00	72.000	-20.000	0.00	0.00	0.00	0.00
370	288.00	72.000	-20.000	0.00	0.00	0.00	0.00
382	32.000	96.000	-20.000	0.00	0.00	0.00	0.00
383	64.000	96.000	-20.000	0.00	0.00	0.00	0.00
384	96.000	96.000	-20.000	0.00	0.00	0.00	0.00
385	128.00	96.000	-20.000	0.00	0.00	0.00	0.00
386	160.00	96.000	-20.000	0.00	0.00	0.00	0.00
387	192.00	96.000	-20.000	0.00	0.00	0.00	0.00
388	224.00	96.000	-20.000	0.00	0.00	0.00	0.00
389	256.00	96.000	-20.000	0.00	0.00	0.00	0.00
390	288.00	96.000	-20.000	0.00	0.00	0.00	0.00
502	32.000	-3.00000	20.000	0.00	0.00	0.00	0.00
503	64.000	-3.00000	20.000	0.00	0.00	0.00	0.00
504	96.000	-3.00000	20.000	0.00	0.00	0.00	0.00
505	128.00	-3.00000	20.000	0.00	0.00	0.00	0.00

NODE	X	Y	Z	THXY	THYZ	THZX
508	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

X 45 12 13
Z 22.12 13

NODE	LABEL	REAL	IMAG
111	UZ	0.00000000E+00	0.00000000E+00
202	UX	0.00000000E+00	0.00000000E+00
202	UY	0.00000000E+00	0.00000000E+00
202	UZ	0.00000000E+00	0.00000000E+00
202	ROTZ	0.00000000E+00	0.00000000E+00
203	UX	0.00000000E+00	0.00000000E+00
203	UY	0.00000000E+00	0.00000000E+00
203	UZ	0.00000000E+00	0.00000000E+00
203	ROTZ	0.00000000E+00	0.00000000E+00
204	UX	0.00000000E+00	0.00000000E+00
204	UY	0.00000000E+00	0.00000000E+00
204	UZ	0.00000000E+00	0.00000000E+00
204	ROTZ	0.00000000E+00	0.00000000E+00
205	UX	0.00000000E+00	0.00000000E+00
205	UY	0.00000000E+00	0.00000000E+00
205	UZ	0.00000000E+00	0.00000000E+00
205	ROTZ	0.00000000E+00	0.00000000E+00
206	UX	0.00000000E+00	0.00000000E+00
206	UY	0.00000000E+00	0.00000000E+00
206	UZ	0.00000000E+00	0.00000000E+00
206	ROTZ	0.00000000E+00	0.00000000E+00
207	UX	0.00000000E+00	0.00000000E+00
207	UY	0.00000000E+00	0.00000000E+00
207	UZ	0.00000000E+00	0.00000000E+00
207	ROTZ	0.00000000E+00	0.00000000E+00
208	UX	0.00000000E+00	0.00000000E+00
208	UY	0.00000000E+00	0.00000000E+00
208	UZ	0.00000000E+00	0.00000000E+00
208	ROTZ	0.00000000E+00	0.00000000E+00
209	UX	0.00000000E+00	0.00000000E+00
209	UY	0.00000000E+00	0.00000000E+00
209	UZ	0.00000000E+00	0.00000000E+00
209	ROTZ	0.00000000E+00	0.00000000E+00
210	UX	0.00000000E+00	0.00000000E+00
210	UY	0.00000000E+00	0.00000000E+00
210	UZ	0.00000000E+00	0.00000000E+00
210	ROTZ	0.00000000E+00	0.00000000E+00
212	UX	0.00000000E+00	0.00000000E+00
212	UZ	0.00000000E+00	0.00000000E+00
212	ROTZ	0.00000000E+00	0.00000000E+00
213	UX	0.00000000E+00	0.00000000E+00
213	UZ	0.00000000E+00	0.00000000E+00
213	ROTZ	0.00000000E+00	0.00000000E+00
214	UX	0.00000000E+00	0.00000000E+00
214	UZ	0.00000000E+00	0.00000000E+00
214	ROTZ	0.00000000E+00	0.00000000E+00
215	UX	0.00000000E+00	0.00000000E+00
215	UZ	0.00000000E+00	0.00000000E+00
215	ROTZ	0.00000000E+00	0.00000000E+00
216	UX	0.00000000E+00	0.00000000E+00
216	UZ	0.00000000E+00	0.00000000E+00
216	ROTZ	0.00000000E+00	0.00000000E+00
217	UX	0.00000000E+00	0.00000000E+00
217	UZ	0.00000000E+00	0.00000000E+00
217	ROTZ	0.00000000E+00	0.00000000E+00
218	UX	0.00000000E+00	0.00000000E+00
218	UZ	0.00000000E+00	0.00000000E+00
218	ROTZ	0.00000000E+00	0.00000000E+00
219	UX	0.00000000E+00	0.00000000E+00
219	UZ	0.00000000E+00	0.00000000E+00

NODE	LABEL	REAL	IMAG
219	ROTZ	0.00000000E+00	0.00000000E+00
220	UX	0.00000000E+00	0.00000000E+00
220	UZ	0.00000000E+00	0.00000000E+00
220	ROTZ	0.00000000E+00	0.00000000E+00
302	UX	0.00000000E+00	0.00000000E+00
302	UY	0.00000000E+00	0.00000000E+00
302	UZ	0.00000000E+00	0.00000000E+00
303	UX	0.00000000E+00	0.00000000E+00
303	UY	0.00000000E+00	0.00000000E+00
303	UZ	0.00000000E+00	0.00000000E+00
304	UX	0.00000000E+00	0.00000000E+00
304	UY	0.00000000E+00	0.00000000E+00
304	UZ	0.00000000E+00	0.00000000E+00
305	UX	0.00000000E+00	0.00000000E+00
305	UY	0.00000000E+00	0.00000000E+00
305	UZ	0.00000000E+00	0.00000000E+00
306	UX	0.00000000E+00	0.00000000E+00
306	UY	0.00000000E+00	0.00000000E+00
306	UZ	0.00000000E+00	0.00000000E+00
307	UX	0.00000000E+00	0.00000000E+00
307	UY	0.00000000E+00	0.00000000E+00
307	UZ	0.00000000E+00	0.00000000E+00
308	UX	0.00000000E+00	0.00000000E+00
308	UY	0.00000000E+00	0.00000000E+00
308	UZ	0.00000000E+00	0.00000000E+00
309	UX	0.00000000E+00	0.00000000E+00
309	UY	0.00000000E+00	0.00000000E+00
309	UZ	0.00000000E+00	0.00000000E+00
310	UX	0.00000000E+00	0.00000000E+00
310	UY	0.00000000E+00	0.00000000E+00
310	UZ	0.00000000E+00	0.00000000E+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 = 213.72

***** PARTICIPATION FACTOR CALCULATION ***** X DIRECTION

CUMULATIVE						
MODE	FREQUENCY	PERIOD	PARTIC.FACTOR	RATIO	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	0.48427E-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

CUMULATIVE						
MODE	FREQUENCY	PERIOD	PARTIC.FACTOR	RATIO	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

CUMULATIVE						
MODE	FREQUENCY	PERIOD	PARTIC.FACTOR	RATIO	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	0.278152	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 13
Z 21 22 13

NODE	LABEL	REAL	IMAG
111	UZ	0.00000000E+00	0.00000000E+00
202	UZ	0.00000000E+00	0.00000000E+00
203	UZ	0.00000000E+00	0.00000000E+00
204	UZ	0.00000000E+00	0.00000000E+00
205	UZ	0.00000000E+00	0.00000000E+00
206	UZ	0.00000000E+00	0.00000000E+00
207	UZ	0.00000000E+00	0.00000000E+00
208	UZ	0.00000000E+00	0.00000000E+00
209	UZ	0.00000000E+00	0.00000000E+00
210	UZ	0.00000000E+00	0.00000000E+00
212	UX	0.00000000E+00	0.00000000E+00
212	UZ	0.00000000E+00	0.00000000E+00
212	ROTZ	0.00000000E+00	0.00000000E+00
213	UX	0.00000000E+00	0.00000000E+00
213	UZ	0.00000000E+00	0.00000000E+00
213	ROTZ	0.00000000E+00	0.00000000E+00
214	UX	0.00000000E+00	0.00000000E+00
214	UZ	0.00000000E+00	0.00000000E+00
214	ROTZ	0.00000000E+00	0.00000000E+00
215	UX	0.00000000E+00	0.00000000E+00
215	UZ	0.00000000E+00	0.00000000E+00
215	ROTZ	0.00000000E+00	0.00000000E+00
216	UX	0.00000000E+00	0.00000000E+00
216	UZ	0.00000000E+00	0.00000000E+00
216	ROTZ	0.00000000E+00	0.00000000E+00
217	UX	0.00000000E+00	0.00000000E+00
217	UZ	0.00000000E+00	0.00000000E+00
217	ROTZ	0.00000000E+00	0.00000000E+00
218	UX	0.00000000E+00	0.00000000E+00
218	UZ	0.00000000E+00	0.00000000E+00
218	ROTZ	0.00000000E+00	0.00000000E+00
219	UX	0.00000000E+00	0.00000000E+00
219	UZ	0.00000000E+00	0.00000000E+00
219	ROTZ	0.00000000E+00	0.00000000E+00
220	UX	0.00000000E+00	0.00000000E+00
220	UZ	0.00000000E+00	0.00000000E+00
220	ROTZ	0.00000000E+00	0.00000000E+00
302	UX	0.00000000E+00	0.00000000E+00
302	UY	0.00000000E+00	0.00000000E+00
302	UZ	0.00000000E+00	0.00000000E+00
303	UX	0.00000000E+00	0.00000000E+00
303	UY	0.00000000E+00	0.00000000E+00
303	UZ	0.00000000E+00	0.00000000E+00
304	UX	0.00000000E+00	0.00000000E+00
304	UY	0.00000000E+00	0.00000000E+00
304	UZ	0.00000000E+00	0.00000000E+00
305	UX	0.00000000E+00	0.00000000E+00
305	UY	0.00000000E+00	0.00000000E+00
305	UZ	0.00000000E+00	0.00000000E+00
306	UX	0.00000000E+00	0.00000000E+00
306	UY	0.00000000E+00	0.00000000E+00
306	UZ	0.00000000E+00	0.00000000E+00
307	UX	0.00000000E+00	0.00000000E+00
307	UY	0.00000000E+00	0.00000000E+00
307	UZ	0.00000000E+00	0.00000000E+00
308	UX	0.00000000E+00	0.00000000E+00
308	UY	0.00000000E+00	0.00000000E+00
308	UZ	0.00000000E+00	0.00000000E+00
309	UX	0.00000000E+00	0.00000000E+00
309	UY	0.00000000E+00	0.00000000E+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

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
 ACCEL.....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	88	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
CUMULATIVE

MODE	FREQUENCY	PERIOD	PARTIC.FACTOR	RATIO	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	0.998456
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
CUMULATIVE

MODE	FREQUENCY	PERIOD	PARTIC.FACTOR	RATIO	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
CUMULATIVE

MODE	FREQUENCY	PERIOD	PARTIC.FACTOR	RATIO	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	3.1890	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	ROTX	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 45.42 h
Z 19.73 h

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  0.00000000E+00  0.00000000E+00
303 UZ  0.00000000E+00  0.00000000E+00
304 UX  0.00000000E+00  0.00000000E+00
304 UY  0.00000000E+00  0.00000000E+00
304 UZ  0.00000000E+00  0.00000000E+00
305 UX  0.00000000E+00  0.00000000E+00
305 UY  0.00000000E+00  0.00000000E+00
305 UZ  0.00000000E+00  0.00000000E+00
306 UX  0.00000000E+00  0.00000000E+00
306 UY  0.00000000E+00  0.00000000E+00
306 UZ  0.00000000E+00  0.00000000E+00
307 UX  0.00000000E+00  0.00000000E+00
307 UY  0.00000000E+00  0.00000000E+00
307 UZ  0.00000000E+00  0.00000000E+00
308 UX  0.00000000E+00  0.00000000E+00
308 UY  0.00000000E+00  0.00000000E+00
308 UZ  0.00000000E+00  0.00000000E+00
309 UX  0.00000000E+00  0.00000000E+00
309 UY  0.00000000E+00  0.00000000E+00
309 UZ  0.00000000E+00  0.00000000E+00
310 UX  0.00000000E+00  0.00000000E+00
310 UY  0.00000000E+00  0.00000000E+00
310 UZ  0.00000000E+00  0.00000000E+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	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	-0.13389	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	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	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	0.11786E-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

X 42.6
Z 19.1

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 TYPEMODAL
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	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	0.000489	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	-0.59010	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	0.035842	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	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	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	0.004819	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
0.00000E+00 0.30000E+07

PROPERTY TABLE DENS MAT= 1 NUM. POINTS= 1
TEMPERATURE DATA TEMPERATURE DATA
0.00000E+00 0.39300E-03

PROPERTY TABLE EX MAT= 2 NUM. POINTS= 1
TEMPERATURE DATA TEMPERATURE DATA
0.00000E+00 0.30000E+07

PROPERTY TABLE DENS MAT= 2 NUM. POINTS= 1
TEMPERATURE DATA TEMPERATURE DATA
0.00000E+00 0.50700E-03

PROPERTY TABLE EX MAT= 3 NUM. POINTS= 1
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 UY 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	ROTX	0.00000000E+00	0.00000000E+00
220	UX	0.00000000E+00	0.00000000E+00
220	UZ	0.00000000E+00	0.00000000E+00
220	ROTX	0.00000000E+00	0.00000000E+00
302	UX	0.00000000E+00	0.00000000E+00
302	UY	0.00000000E+00	0.00000000E+00
302	UZ	0.00000000E+00	0.00000000E+00
303	UX	0.00000000E+00	0.00000000E+00
303	UY	0.00000000E+00	0.00000000E+00
303	UZ	0.00000000E+00	0.00000000E+00
304	UX	0.00000000E+00	0.00000000E+00
304	UY	0.00000000E+00	0.00000000E+00
304	UZ	0.00000000E+00	0.00000000E+00
305	UX	0.00000000E+00	0.00000000E+00
305	UY	0.00000000E+00	0.00000000E+00
305	UZ	0.00000000E+00	0.00000000E+00
306	UX	0.00000000E+00	0.00000000E+00
306	UY	0.00000000E+00	0.00000000E+00
306	UZ	0.00000000E+00	0.00000000E+00
307	UX	0.00000000E+00	0.00000000E+00
307	UY	0.00000000E+00	0.00000000E+00
307	UZ	0.00000000E+00	0.00000000E+00
308	UX	0.00000000E+00	0.00000000E+00
308	UY	0.00000000E+00	0.00000000E+00
308	UZ	0.00000000E+00	0.00000000E+00
309	UX	0.00000000E+00	0.00000000E+00
309	UY	0.00000000E+00	0.00000000E+00
309	UZ	0.00000000E+00	0.00000000E+00
310	UX	0.00000000E+00	0.00000000E+00
310	UY	0.00000000E+00	0.00000000E+00
310	UZ	0.00000000E+00	0.00000000E+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 = 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	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	0.953813	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	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	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	0.488786E-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	0.989996
15	78.1683	0.12793E-01	-0.22143E-01	0.002107	0.490325E-03	1.000000
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

X 164.2 17

PROPERTY TABLE DENS MAT= 1 NUM. POINTS= 1
TEMPERATURE DATA TEMPERATURE DATA TEMPERATURE DATA
0.00000E+00 0.22500E-03

Z 37.72 17

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 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	0.00000000E+00	0.00000000E+00
504	UZ	0.00000000E+00	0.00000000E+00
505	UX	0.00000000E+00	0.00000000E+00
505	UY	0.00000000E+00	0.00000000E+00
505	UZ	0.00000000E+00	0.00000000E+00
506	UX	0.00000000E+00	0.00000000E+00
506	UY	0.00000000E+00	0.00000000E+00
506	UZ	0.00000000E+00	0.00000000E+00
507	UX	0.00000000E+00	0.00000000E+00
507	UY	0.00000000E+00	0.00000000E+00
507	UZ	0.00000000E+00	0.00000000E+00
508	UX	0.00000000E+00	0.00000000E+00
508	UY	0.00000000E+00	0.00000000E+00
508	UZ	0.00000000E+00	0.00000000E+00
509	UX	0.00000000E+00	0.00000000E+00
509	UY	0.00000000E+00	0.00000000E+00
509	UZ	0.00000000E+00	0.00000000E+00
510	UX	0.00000000E+00	0.00000000E+00
510	UY	0.00000000E+00	0.00000000E+00
510	UZ	0.00000000E+00	0.00000000E+00
552	UX	0.00000000E+00	0.00000000E+00
552	UY	0.00000000E+00	0.00000000E+00
552	UZ	0.00000000E+00	0.00000000E+00
553	UX	0.00000000E+00	0.00000000E+00
553	UY	0.00000000E+00	0.00000000E+00
553	UZ	0.00000000E+00	0.00000000E+00
554	UX	0.00000000E+00	0.00000000E+00
554	UY	0.00000000E+00	0.00000000E+00
554	UZ	0.00000000E+00	0.00000000E+00
555	UX	0.00000000E+00	0.00000000E+00
555	UY	0.00000000E+00	0.00000000E+00
555	UZ	0.00000000E+00	0.00000000E+00
556	UX	0.00000000E+00	0.00000000E+00
556	UY	0.00000000E+00	0.00000000E+00
556	UZ	0.00000000E+00	0.00000000E+00
557	UX	0.00000000E+00	0.00000000E+00
557	UY	0.00000000E+00	0.00000000E+00
557	UZ	0.00000000E+00	0.00000000E+00
558	UX	0.00000000E+00	0.00000000E+00
558	UY	0.00000000E+00	0.00000000E+00
558	UZ	0.00000000E+00	0.00000000E+00
559	UX	0.00000000E+00	0.00000000E+00
559	UY	0.00000000E+00	0.00000000E+00
559	UZ	0.00000000E+00	0.00000000E+00
560	UX	0.00000000E+00	0.00000000E+00
560	UY	0.00000000E+00	0.00000000E+00
560	UZ	0.00000000E+00	0.00000000E+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 = 72.576

***** PARTICIPATION FACTOR CALCULATION ***** X DIRECTION

MODE	FREQUENCY	PERIOD	PARTIC.FACTOR	RATIO	EFFECTIVE MASS	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-28	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	1.000000
12	181.474	0.55104E-02	-0.20589E-12	0.000000	0.423919E-25	1.000000
13	184.302	0.54259E-02	0.29004E-14	0.000000	0.784228E-29	1.000000
14	186.731	0.53553E-02	0.15599E-13	0.000000	0.243317E-27	1.000000
15	189.057	0.52894E-02	0.31821E-16	0.000000	0.101259E-32	1.000000

SUM OF EFFECTIVE MASSES = 35.9334

***** PARTICIPATION FACTOR CALCULATION ***** Y DIRECTION

MODE	FREQUENCY	PERIOD	PARTIC.FACTOR	RATIO	EFFECTIVE MASS	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	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	0.335882E-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	0.648482	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	1.000000

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	0.00000000E+00	0.00000000E+00
303	UZ	0.00000000E+00	0.00000000E+00
304	UX	0.00000000E+00	0.00000000E+00
304	UY	0.00000000E+00	0.00000000E+00
304	UZ	0.00000000E+00	0.00000000E+00
305	UX	0.00000000E+00	0.00000000E+00
305	UY	0.00000000E+00	0.00000000E+00
305	UZ	0.00000000E+00	0.00000000E+00
306	UX	0.00000000E+00	0.00000000E+00
306	UY	0.00000000E+00	0.00000000E+00
306	UZ	0.00000000E+00	0.00000000E+00
307	UX	0.00000000E+00	0.00000000E+00
307	UY	0.00000000E+00	0.00000000E+00
307	UZ	0.00000000E+00	0.00000000E+00
308	UX	0.00000000E+00	0.00000000E+00
308	UY	0.00000000E+00	0.00000000E+00
308	UZ	0.00000000E+00	0.00000000E+00
309	UX	0.00000000E+00	0.00000000E+00
309	UY	0.00000000E+00	0.00000000E+00
309	UZ	0.00000000E+00	0.00000000E+00
310	UX	0.00000000E+00	0.00000000E+00
310	UY	0.00000000E+00	0.00000000E+00
310	UZ	0.00000000E+00	0.00000000E+00

SOLUTION OPTIONS

PROBLEM DIMENSIONALITY.....3-D
 DEGREES OF FREEDOM..... UX UY UZ ROTX ROTY ROTZ
 ANALYSIS TYPEMODAL
 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 = 142.66

CENTROID	MOM. OF INERTIA ABOUT ORIGIN	MOM. OF INERTIA ABOUT CENTROID
XC = 160.00	IXX = 0.5991E+08	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	EFFECTIVE MASS	MASS FRACTION
					CUMULATIVE	
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	EFFECTIVE MASS	MASS FRACTION
					CUMULATIVE	
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	EFFECTIVE MASS	MASS FRACTION
					CUMULATIVE	
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 363.70 -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 -60.363 270.68 25.033
274 62.384 -420.60 162.19
294 0.24425E-12 0.11333E-11-0.39881E-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

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	-529.48	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 -0.12078E-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			-588.11
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			0.69080
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 0.14278E-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 -401.07 151.84
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 -2.5198 -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	768.66			
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	-84.086	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

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		88.188			
51			88.188			
61	-0.64892E-12		130.88			
71			130.88			
81	-0.22745E-12		310.36			
91			310.36			
101	0.38731E-12		-57.638			
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			-57.638			
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 64.415 155.88
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 -0.49981E-13 0.50928E-11-0.12051E-10
88 -3.0584 229.15 -249.14

ELEM= 249 FX FY FZ
69 47.514 64.415 155.88
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 0.18828E-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	82.672	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 0.78454E-10 15438. 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	2.2538	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 -0.55851
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 Cut-off 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			5.3738			
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 -0.84369E-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 -28.113
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	8.6582	-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 -0.66813E-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

spectra.c

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)

$$f_c' = 3000 \text{ psi}$$

WIC-5 - 2-31-026
REV 10 PAGE C-250

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)

$f'_c = 5000 \text{ psi}$

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
 w/ 6" wall add-on
 stiffness

interior.c

$f'_c = 3000 \text{ psi}$

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 C/JM)

exterior.c

$f'_c = 3000 \text{ psi}$

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 C/JM)

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 been 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 is 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 follows: 1) attachment weld is equal to 0.20 2) bending stress in channel is greater than 1.8. The margin of safety for exterior wall mounted cubical pedestals in rooms are as follows: 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

☒	☐	☐	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 NA

R.A. Hille
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 unistrut 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

WHC-SD-CP-SA-026

----- Message Contents -----

Lou

REV 10 PAGE C-261

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*

WAC-SD-CF-SA-016

REV 1 ~~Page~~ PAGE C-262

Subject

RM-1 PEDESTALS

Checked By

H-2-70158 (1 & 2)

REF: WHC-SD-CT-SA-026 REV-0

PP C-7 & C-12 { 18 CANS ON SIDE
 { 9 CANS ON BACK
 # ASSEMBLY

SIDE ASSY. = 188# EACH

$$\text{BACK ASSY.} = 188^{\#} - 9(5.5^{\#}/\text{CAN}) = 139^{\#} \text{ EFC-}$$

FOR PEDESTALS MOUNTED ON RIGID WALL - CUBICAL
THAT ARE FLOOR MOUNTED — PEAK ACCEL.
IS 0.42 G FROM RESPONSE

SPECTRA PER SDC 4.1 REV. 12 FIG 3.0
PP-27

CHANNEL IS RIGID IN ALL DIRECTIONS

NOTE: ASTM-A-569
DOES NOT HAVE TENSILE
REQUIREMENT (MIN.)
CALLED OUT. USE T_y A
FROM PYREX (C) CATALOG
T_y $\approx$ 27000 PSI

ANALYSIS

WHC-SD-CP-SA-026

Page 1 of 1
REV 1.0 PAGE C-263

For
Location 2736-Z
Subject RM-1 PEDESTALS

Date 1-16-95
By D. J. K. O'Neil
Checked By W. Barber

NOTE 0.42G ROUNDED TO 0.45G FOR THESE CALCS. (CONS.)

$$F_x = \text{SIDE LOAD} \leftarrow 0.45G \text{ ACCEL.} = \ddot{x}$$

$$F_x = W_{\text{TOTAL}} \times \ddot{x} = 188 \# \times 0.45 = 84.6 \# \text{ SHEAR}$$

$$\frac{F_x(d)}{2 L/2} = \text{Pry LOAD} = \frac{84.6 \# (3.5")}{2 (1.75/2)} = 169.2 \# \text{ TENSION}$$

1/2 OF TOTAL CANS CREATE THE PRY LOAD
OTHER CANS ARE BRACED AGAINST WALL

$$F_z \quad \text{NORMAL LOAD} \quad \swarrow 0.45G \text{ ACCEL.} (\ddot{z})$$

$$W_{\text{TOTAL}} \times \ddot{z} = 188 \# (0.45) = 84.6 \# \text{ TENS.}$$

$$F_y \quad \text{VERTICAL LOAD} \quad 188 \# \text{ DEAD WEIGHT}$$

2/3 HORIZONTAL PER SDCH.1

$$W_{\text{TOTAL}} \times \ddot{y} = 188 (0.45) (2/3) = 56.4 \# \text{ SHEAR}$$

$$F_z \text{ PULL OUT FROM } F_y \text{ LOAD} = \frac{188 \# (0.45) (3.5")}{20"} \left(\frac{6}{18} \right) \left(\frac{2}{3} \right) \approx 3.3 \# \text{ TENSION BOLT (SMALL)}$$

6 CANS FOR 20" SPACING

ANALYSIS

WHC-SD-CP-SA-025

REV 10 PAGE 6264

For

Location

Subject

2736-Z
RM-1 PEDESTAL

Date

By

Checked By

1-16-95

D. L. SO

Star

LOAD
SUMMATION

1/2" HDI

BOLT
LOAD
(4 BOLTS)

$$\frac{188\# + 56.4\#}{4 \text{ BOLTS}} = 61\#/\text{BOLT SHEAR}$$

$$\frac{84.6\# + 169.2\# + 3.3\#}{4 \text{ BOLTS}} \approx 68.5\#/\text{BOLT PULL OUT.}$$

$$\frac{84.6}{4 \text{ BOLTS}} = 21.1\#/\text{BOLT SHEAR}$$

FOR LOAD COMBINATI
ASSUME
100% / 100% / 100%
CONSERVATIVE

$$\frac{I}{\text{BOLT}} = \frac{TENS}{T_{ALLOW}} + \frac{V_{SHEAR}}{V_{ALLOW}} \leq 1.0$$

WHC-SD-GN-DGS-30006
SECTION 8.1.1.13

where

WHC-SD-GN-DGS-30006
(PP 8-1 → 8-16)

$$\left. \begin{aligned} T_{nom.} &= 1460\# \\ V_{SHEAR \text{ nominal}} &= 1420\# \end{aligned} \right\} \text{Table 8.3}$$

(H-2-7001)

FOR

3000PSI

CONCRETE

$$R_{Fp} = \frac{3000}{4000} = .75$$

$$R_{Fs} = \frac{3000}{10000} + .65 = .95$$

$$\left. \begin{aligned} R_{Tp} &= R_{Ts} = 1.0 \\ R_{Lp} &= R_{Ls} = 1.0 \\ R_{Sp} &= R_{Ss} = 1.0 \\ R_{Ep} &= R_{Es} = 1.0 \\ R_{Rp} &= R_{Rs} = 1.0 \\ R_{Cp} &= 1.0 \\ R_{Ip} &= R_{Is} = .75 \end{aligned} \right\} \text{REDUCTION FACTOR}$$

(TENSILE)

$$T_{ALLOW} = (.75)(.75)(T_{nom.}) = .75 \times .75 \times 1460 = 821\#$$

$$V_{SHEAR} = (.75)(.95)(V_{nom.}) = .75 \times .95 \times 1420 = 1012\#$$

reduced inspection

ANALYSIS

WHC-SB-CP-SA-028

Page
REV 1.0 No. PAGE C-265
Date 1-16-95
By DR Kowin
Checked By [Signature]

For
Location 2736-Z
Subject RM-1 PEDESTAL

FOR CONSERVATISM ASSUME $\frac{1}{3}$ OF BOLTS
ARE NOT ACTIVE $\frac{4^{bolts}}{3} \approx 1$ BOLT NOT ACTIVE

$$I_{bolts} = \frac{68.5 \left(\frac{4}{3} \right)}{.75(.75) T_{nom}} + \frac{(61+21) \frac{4}{3}}{.75(.95) V_{nom}}$$

$$= \frac{68.5 \times \frac{4}{3}}{821} + \frac{(61+21) \frac{4}{3}}{1012}$$

$$= .22 < 1. \text{ OK}$$

$$M.S. = \frac{1}{.22} - 1 = 3.5 \leftarrow \text{Large}$$

Westinghouse
Hanford Company

ANALYSIS

WHC-SD-CP-SA-026

REV 16 Page 266
Job No. 1-16-85
Date 1-16-85
By J. K. O.
Checked By [Signature]

For
Location 2736-Z
Subject RM-1 PEDESTAL

ASSUME:

UNISTRUT STUD NUTS
(SEE ATTACH. BELOW)

$$T_{TENS.} = 1000 \#$$

3/8 - ASSUME P-2380
UNISTRUT
(WORKING LOAD)

(ASSUME $V_{SLIP} = 500 \#$ (LONG.) $\leftarrow$ NOT APPLICABLE
 $V_{TRANS} = V_{SLIP}$) 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-SG-CP-SA-026

Page
REVISED PAGE C-267
Abb No
Date 1-16-95
By D. K. Kosi
Checked By D. K. Kosi

For
Location 2736-Z
Subject RM-1 PEDESTAL

FINAL VERIFICATION OF
ANCHORAGE IS REQUIRED
FOR THIS S.C.-1 PIECE OF
EQUIPMENT OR A LOAD TEST
BASED ON 1.5X THE CALCULATED
LOAD WILL BE REQUIRED

FAX

WHC-SD-CP-3A-G28

REV ~~10~~ PAGE C-268

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

	<u>First Slip</u>	<u>Ultimate Load</u>
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

	<u>First Slip</u>	<u>Ultimate Load</u>
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

	<u>First Slip</u>	<u>Ultimate Load</u>
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

	<u>Ultimate Load</u>
Test #1:	8350 Lbs.
#2:	8160 Lbs.
#3:	7160 Lbs.

Design Load = 2000 Lbs.

1/2" - 13 @ 40 Ft.-Lbs. Torque

	<u>Ultimate Load</u>
Test #1:	7150 Lbs.
#2:	7130 Lbs.
#3:	7320 Lbs.

Design Load = 2000 Lbs.

3/8" - 16 @ 19 Ft.-Lbs. Torque

	<u>Ultimate Load</u>
Test #1:	5800 Lbs.
#2:	6450 Lbs.
#3:	5780 Lbs.

Design Load = 1000 Lbs.

TEST REPORT A-77

Page Three

WNC-SO-CP-SA-026
REV ~~1~~ PAGE G-271TEST RESULTS CONT.SLIP TESTS5/16" - 18 @ 11 Ft.-Lbs. Torque

	<u>First Slip</u>	<u>Ultimate Load</u>
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

	<u>First Slip</u>	<u>Ultimate Load</u>
Test #1:	----	260 Lbs.
#2:	----	255 Lbs.
#3:	----	370 Lbs.
#4:	----	365 Lbs.
#5:	----	350 Lbs.

Design Load = 100 Lbs.

PULL-OUT TESTS5/16" - 18 @ 11 Ft.-Lbs. Torque

	<u>Ultimate Load</u>
Test #1:	4080 Lbs
#2:	3950 Lbs.
#3:	4340 Lbs.
Design Load = 800 Lbs.	

1/4" - 20 @ 6 Ft.-Lbs. Torque

	<u>Ultimate Load</u>
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

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TEST REPORT NO. 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.

For
Location 2736-Z
Subject RM-1 PEDESTAL

Page
REV 10 PAGE C-272
Date 1-16-95
By DE 1-5
Checked By DE 1-5

RM # 1 BACK ASSYMBLE 139#
(9 CANS) BOLTED

BOLT LOADS ARE
LESS THAN WITH
CHANNEL ASSEMBLY
FOR ROOM 1.

(9 CANS INSTEAD OF
18 CANS)

(SEE PREVIOUS CALCS)

$$W = 139\#$$

CALC: BENDING STRESS (WSP: - 7A: E)

$$M = \frac{wl^2}{12} \quad w = 139 \left(\frac{30''}{90''} \right) / 30'' = 1.54\# / \text{IN}$$

$$I = \frac{bh^3}{12} = \frac{6 \times (.1875)^3}{12} = .0033 \text{ IN}^4$$

$$\frac{wl^2}{12} = M = 1.54 (30^2) / 12 = 115.5 \text{ IN}\#$$

$$\sigma_b = \frac{Mc}{I} = \frac{115 (3/32)}{.0033} = 3281 \text{ PSI}$$

$$M.S. = \frac{1}{\frac{3281}{.6(27000)}} - 1 \geq 3.9 \leftarrow$$

ASTM-A569

$$\bar{U}_{b \text{ allow}} = .6 \sigma_y$$

$$= .6 (27000)$$

$$= 16200 \text{ PSI}$$

TYPICAL PER
RYERSON-

Westinghouse
Hanford Company

ANALYSIS

WHC-SD-CP-SA-026

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Job No
Date 7-16-95
By D. K. Miller
Checked By O. K. Miller

For
Location 2736-Z
Subject RM 3 & 4 PEDESTAL

RM 3 & 4

WELDED PEDESTAL
CALCS

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PLAN VIEW

H-2-26649
Rev I

H-2-26649
 REV-1
 ROOM 3

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16ga = .0598" THK
 (THE DIFFERENCE IN
 THE ANSWERS USING THE
 SMALL THICKNESS IS
 NEGLIGIBLE - SEE WALL
 MOUNTED PEDESTAL
 ANALYSIS)

7 12
34

USED IN
ANALYSIS

PER UCR 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
	0.26	0.084	0.25	0.065	0.25	0.059	0.24	0.052	0.24	0.048
D	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

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Table 9-7(c)

NATURAL FREQUENCIES OF COMMONLY USED SYSTEMS

BEAMS OF UNIFORM SECTION AND UNIFORMLY DISTRIBUTED LOAD

$$\text{ANGULAR NATURAL FREQUENCY } \omega_n = \lambda \sqrt{\frac{EI}{\mu L^4}} \text{ radians/s}$$

WHERE E = YOUNG'S MODULUS, lb/in²I = AREA MOMENT OF INERTIA OF BEAM CROSS SECTION, in⁴

L = LENGTH OF BEAM, in

 μ = MASS PER UNIT LENGTH OF BEAM, lb-s²/in² λ = COEFFICIENT FROM TABLE BELOW

NODES ARE INDICATED IN TABLE BELOW AS A PROPORTION OF LENGTH L MEASURED FROM LEFT END

FIXED-FREE (CANTILEVER)	 $\lambda = 3.52$	 $\lambda = 22.4$	 $\lambda = 61.7$	 $\lambda = 121.0$	 $\lambda = 200.0$
HINGED-HINGED (SIMPLE)	 $\lambda = 9.87$	 $\lambda = 39.5$	 $\lambda = 82.9$	 $\lambda = 158$	 $\lambda = 247$
FIXED-FIXED (BUILT-IN)	 $\lambda = 22.4$	 $\lambda = 61.7$	 $\lambda = 121$	 $\lambda = 200$	 $\lambda = 298$
FREE-FREE	 $\lambda = 22.4$	 $\lambda = 61.7$	 $\lambda = 121$	 $\lambda = 200$	 $\lambda = 298$
FIXED-HINGED	 $\lambda = 15.4$	 $\lambda = 50.0$	 $\lambda = 104$	 $\lambda = 178$	 $\lambda = 272$
HINGED-FREE	 $\lambda = 15.4$	 $\lambda = 50.0$	 $\lambda = 104$	 $\lambda = 178$	 $\lambda = 272$

For
Location 2736-Z
Subject RM 324 PEDESTAL

Job No.
Date 1-16-05
By
Checked By

FREQUENCY CALC. CHANNEL

$$I_y = I_{WEAK \text{ AXIS}} = .182 \text{ IN}^4 = \frac{.063(1.967^3)(2(2.937) + 1.967)}{3(2.937 + 2(1.967))}$$

$$I_z = I_{STRONG \text{ AXIS}} = .667 \text{ IN}^4 = \frac{.063(2.937^3)(2.937 + 6(1.967))}{12}$$

BLODGET "DESIGN OF WELD STRUCTURES" P-2.7-8

MODE 1.0

(Y-AXIS ROTATION)
(AT WELD)
CYCLES/SEC

$$\omega_n = \frac{A}{2\pi} \sqrt{\frac{EI}{\mu L^4}} \text{ HZ}$$

SA: ECO: 94: 047 P-8 (ATTACHED)

$$\mu = 128 \# / (82.5" (386.4 \text{ IN/SEC}^2))$$

$$\left. \begin{array}{l} \text{PP-5} \\ \text{SA: ECO: 94: 47} \end{array} \right\} \mu = .004 \# \text{ SEC}^2/\text{IN}^2$$

$$L = 82.5" \text{ BETWEEN WELDS}$$

$$A = 22.4 \text{ TABLE 9-7C (ATTACHED)}$$

$$\omega_n = \frac{22.4}{6.28} \sqrt{\frac{30 \times 10^6 (.182)}{.004 (82.5)^4}} = 19.36 \frac{\text{C/C}}{\text{SEC}}$$

$$\ddot{Z} = 0.26 G$$

5% DAMP. $\triangle$ MOE. $\perp$
S.C-1 RESPONSE SPECTRA
SDC 4.1 R-12 54-7400-276 (2'88)

For
Location 2736-Z
Subject RM 3 & 4 PEDESTAL

Job No.
Date 1-16-95
By D. K. Koser
Checked By D. K. Koser

MODE 2.0

(Z-AXIS ROTATION)

$$W_n = \frac{22.4}{2\pi} \sqrt{\frac{30 \times 10^6 (0.667)}{0.004 (82.5)^4}} = 37 \frac{\text{CYC}}{\text{SEC}}$$

$$\ddot{y} = 0.20 G \quad \text{RIGID} \\ 5\% \text{ DAMP.}$$

MODE 2.0
S.O.-1 RESPONSE
SPECTRA

19.36 Hz = MODE 1 SEISMIC LOAD
100% Z DIRECTION LOAD $\ddot{z} = .26 G$

$$M_y = \frac{(\ddot{z} W) L^2}{(L) 12}$$

(WORST CASE)
40% / 40% / 100%

$$\frac{\ddot{z} W}{L} = \left[.26 (108\#) + .68 (20\#) \right] / 82.5'$$

CHANNEL
& CAUS

FLEXIBLE
SECURITY
BAR

SA: ECO: 94:047

$$F_z = \ddot{z} W = 42\# \text{ ON TWO WELDS}$$

$$M_y = \left(\frac{42\#}{82.5''} \right) \frac{82.5^2}{12} = 288 \text{ IN}\#$$

PER
WELD

37 Hz = MODE 2.0 SEISMIC LOAD
40% y DIRECTION LOAD $\ddot{y} = .2 G$
MODE 2.0

$$M_z = \frac{(\ddot{y} W) L^2}{12}$$

$$\frac{\#}{\text{IN}} = \ddot{y} \frac{W}{L} = \frac{[.2 (108\#) + .68 (20\#)] \times 40\%}{82.5} \\ = 14\# / 82.5 = .17 \# / \text{IN}$$

ANALYSIS

WHC-SD-CP-SA-026

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For _____
Location 2736-Z
Subject RM 384 PEDESTAL

Job No. _____
Date 1-16-85
By DJL
Checked By Charles

$$M_z = .17 (82.5)^2 / 12 = 96.8 \text{ \# IN (PER WELD)}$$

$$F_y = .4 \left(\underset{\substack{\text{channel} \\ \& \text{ cans}}}{.2 (108)} + \underset{\substack{\text{security} \\ \text{Bar}}}{.68 (20)} \right) = 14.1 \text{ \# (ON TWO WELDS)}$$

PRYING = $M_x = 14.1 (3.5") = 49.4 \text{ IN \# ON TWO WELDS}$
(FROM y DIRECTION)
(SEISMIC 40%)

1/2 OF 14 CANS
ACT IN PRYING ACTION
OTHER CANS BRACED
AGAINST WALL

40% X DIRECTION LOAD (RIGID)

$$\ddot{x}_{\text{VERT.}} = 2/3 (40%) (.2) \text{ RIGID}$$

$$F_x = 2/3 (.2) (.4) \underset{\text{CHANNEL}}{108 \text{ \#}} + \underset{\substack{\text{SECURITY} \\ \text{BAR}}}{.68 (20) \text{ \#}}$$

$$F_x = 19.4 \text{ \# ON TWO WELDS}$$

CALCULATE LOADS ON ONE ATTACHMENT
WELD

ANALYSIS

WHC-SD-CP-SA-026

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For

Location

Subject

2736-Z
RM 3 & 4 PEDESTALS

Job No.

Date

By

Checked By

1-16-95
D. J. KO...
D. Barba

Σ MODES - LOADS ON ATTACHMENT
~ DEAD WEIGHT WELD

$$F_x = 19.4/2 + 128/2 = 74\# \quad \text{ASSUME } 75\#$$

$$F_y = 14.1\#/2 = 7\# \quad \text{ASSUME } 10\#$$

$$F_z = 42\#/2 + 8.2\# = 29.2\# \quad \text{ASSUME } 30\#$$

$$M_x = 49.2/2 = 24.6 \text{ IN}\#$$

$$M_y = 288 \text{ IN}\#$$

$$M_z = 96.8 \text{ IN}\#$$

NOTE: FOR THE ATTACHMENT WELD 40% X / 40% Y / 100% Z
RESPONSE SPECTRA IS THE WORST
CASE:

$$L = 2'' \leftarrow$$

$$S_y = d^2/3 = (1)^2/3$$

$$S_y = .33 \text{ IN}^2 \leftarrow$$

$$S_x = bd = 1 \times 3 = 3 \text{ IN}^2 \leftarrow$$

$$J = \frac{d(3b^2 + d^2)}{6} = \frac{1(3(3)^2 + 1^2)}{6}$$

$$J = 4.6 \text{ IN}^3 \leftarrow$$

BLOGGET P 7.4-7
TABLE 5.0

Westinghouse
Hanford Company

ANALYSIS

WHC-SD-CP-SA-026

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For

Location

Subject

2736-Z
AM 3 & 4 PEDESTAL

Job No.

Date

By

Checked By

1-16-95

OZ Kow

Shelton

$$f_T = \frac{F_z}{L} + \frac{M_x}{S_x} + \frac{M_y}{S_y} = \frac{30}{2} + \frac{24.6}{3} + \frac{288}{.33} = 896 \# / \text{IN}$$

$$f_{sx} = \frac{F_{sx}}{L} + \frac{M_z r_x}{J} = \frac{75}{2} + \frac{96.8(1/2)}{4.6} = 48 \# / \text{IN}$$

$$f_{sy} = \frac{F_{sy}}{L} + \frac{M_z r_y}{J} = \frac{70}{2} + \frac{96.8(3/2)}{4.6} = 35 \# / \text{IN}$$

$$f_R = \sqrt{896^2 + 48.0^2 + 35^2} \approx 900 \# / \text{IN}$$

$$W_{REQ} = \frac{f_R}{.707 Z} = \frac{900}{.707(.4 \times 36000)(1.7)}$$

$$= .052" < \frac{1}{16}" = (.0625")$$

OK

EXIST.
FACILITY
UCRL 15910
P 4.35
ANCHORAGE

$$M.S. = \left(\frac{.052}{.0625} \right) - 1 = 0.20 \leftarrow$$

ANALYSIS

WHC-SD-CP-SA-026

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Job No.

Date

By

Checked By

For

Location

Subject

2736-Z
RM 384 PEDESTALS

1-16-95

OZ K. J. J.

Shelton

CONFIRM HAND CALCS WITH A
SIMPLE COMPUTER MODEL

IMAGES 3D MODEL
OF CHANNEL FOR FIVE
MODES. SHAPES

ASSUME UNIFORM MASS SPREAD
OVER CHANNEL - SMALL EXCENTRIC
MASSES NOT MODELED EXPLICITLY.

ANALYSIS

For
Location 2736-Z
Subject RM 3 & 4 PEDESTALS

Job No. _____
Date 1-16-85
By D. J. Koz
Checked By Decker

$$b = 3 - .063 = 2.937"$$

$$d = 2 - \frac{.063}{2} = 1.967"$$

$$I_{WEAK} = \frac{t d^3 (2b + d)}{3 (b + 2d)} = \frac{.063 (1.967^3) (2(2.937) + 1.967)}{3 (2.937 + 2(1.967))}$$

$$= .182 \text{ IN}^4 \leftarrow$$

$$I_{STRONG} = \frac{t b^3 (b + 6d)}{12} = \frac{.063 (2.937^3) (2.937 + 6(1.967))}{12}$$

$$= .667 \text{ IN}^4 \leftarrow$$

$$N.A. \text{ FROM TOP} = \frac{d^2}{b + 2d} = \frac{1.967^2}{2.937 + 2(1.967)}$$

$$= .563" \leftarrow$$

$$2" - N.A. = 2 - .563 = 1.437" \leftarrow$$

$$P_{eff} = \frac{W}{A \times L} = \frac{128}{2(1.967)(.063) + 2.937(.063)} = 3.69 \text{ #/IN}^3$$

(CARBON STEEL)

ANALYSIS

WHC-SD-CP-SA-026

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Job No.

Date

By

Checked By

For

Location

Subject

2736-Z
-RM-1 PEDESTALS

1-16-05
12/15/05

RM # 1
PEDESTAL CALCS
— BOLTED — $\frac{3}{8}$ " BOLTS

- UNKNOWN
- 1) EMBEDMENT LENGTH,
MAKE, MODEL &
MATERIAL OF $\frac{3}{8}$ " 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.

STRUCT.
Construct
Products

PLATE

SHEET
& COIL

available
when we

■ Unequ
producti
metalwo
drill, bev
order. We
furnish c
specifica

■ Streng
nearly 14
industry-
capable
tradition
compani

■ Servic
full-line s
local peo
points for
We're ret

F
al

BARS
HR, CF

TUBING
& PIPE

WHC-SD-CP-SA-025
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SECTION 3

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) I
?

- Enter Truss Elements in the form:

SECTION 3

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.

I M A G E S - 3 D

14:45:01

WESTINGHOUSE HANFORD COMPANY S/N:802408

Job Information

Comments :

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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	=
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=		=
=	RLCA/Celestial Software	=
=	2150 Shattuck Ave.	=
=	Suite 1200	=
=	Berkeley, CA	=
=	94704	=
=		=
=	510-843-0977	=
=	=====	=

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 PAGE 45 RUN ID=IA01929

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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 Cy-	Cy+	Recovery Distances 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

WESTINGHOUSE HANFORD COMPANY S/N:802408

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RUN ID=IA01929

14:45:05

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CHECK GEOMETRY

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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

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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						

WESTINGHOUSE HANFORD COMPANY S/N:802408

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Run ID=AD46312

01/09/95

09:13:25

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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		TRANSLATION			ROTATION		
WAS	IS	X	Y	Z	X	Y	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

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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

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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	T r a n s l a t i o n s			/	R o t a t i o n s		
	X	Y	Z		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	T r a n s l a t i o n s			/	R o t a t i o n s		
	X	Y	Z		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	T r a n s l a t i o n s			/	R o t a t i o n s		
	X	Y	Z		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	T r a n s l a t i o n s			/	R o t a t i o n s		
	X	Y	Z		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

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SOLVE MODE SHAPES

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Node	T r a n s l a t i o n s			/	R o t a t i o n s		
	X	Y	Z		X	Y	Z
4	.000001	.000000	-.746150	/	.000000	.049242	.000000
5	.000000	.000000	.000000	/	.000000	.000000	.000000

Mode 5 Eigenvalue= .370211E+06

Node	T r a n s l a t i o n s			/	R o t a t i o n s		
	X	Y	Z		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

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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			% TOTAL SYSTEM WEIGHTS		
	X	Y	Z	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

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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+00
7	.1640E+01	.420000E+00		.1640E+01	.420000E+00		.1640E+01	.420000E+00
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

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Run ID=LJ08215

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14:10:02

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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	Combination	A B S
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	Combination	A B S
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

Node	T r a n s l a t i o n s			/	R o t a t i o n s		
	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

Node	T r a n s l a t i o n s			/	R o t a t i o n s		
	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

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S.C.-1 2736Z

Node	T r a n s l a t i o n s			/	R o t a t i o n s		
	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

Node	T r a n s l a t i o n s			/	R o t a t i o n s		
	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+00

RSS DISPLACEMENTS

Node	T r a n s l a t i o n s			/	R o t a t i o n s		
	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

Node	T r a n s l a t i o n a l			/	R o t a t i o n a l		
	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

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Version 3.0 12/31/93

Filename=2736

Title =2736Z PEDESTAL WELDED

S.C.-1 2736Z

ACCELERATIONS for MODE 2

Node	T r a n s l a t i o n a l			/	R o t a t i o n a l		
	X	Y	Z		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	T r a n s l a t i o n a l			/	R o t a t i o n a l		
	X	Y	Z		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	T r a n s l a t i o n a l			/	R o t a t i o n a l		
	X	Y	Z		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	T r a n s l a t i o n a l			/	R o t a t i o n a l		
	X	Y	Z		X	Y	Z
1	.8000E-01	.8000E-01	.2000E+00	/	.0000E+00	.0000E+00	.0000E+00

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SOLVE SEISMIC RESPONSE

Version 3.0 12/31/93

Filename=2736

Title =2736Z PEDESTAL WELDED

S.C.-1 2736Z

Node	T r a n s l a t i o n a l			/	R o t a t i o n a l		
	X	Y	Z		X	Y	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

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SOLVE DISPLACEMENTS

Version 3.0 12/31/93

Filename=2736

Title =2736Z PEDESTAL WELDED

MISSING MASS RESPONSE / X - DIRECTION SPECTRUM

DISPLACEMENTS

Node	T r a n s l a t i o n s			/	R o t a t i o n s		
	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

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Version 3.0 12/31/93

Filename=2736

Title =2736Z PEDESTAL WELDED

MISSING MASS RESPONSE / Y - DIRECTION SPECTRUM

DISPLACEMENTS

Node	T r a n s l a t i o n s			/	R o t a t i o n s		
	X	Y	Z		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

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Version 3.0 12/31/93

Filename=2736

Title =2736Z PEDESTAL WELDED

MISSING MASS RESPONSE / Z - DIRECTION SPECTRUM

DISPLACEMENTS

Node	T r a n s l a t i o n s			/	R o t a t i o n s		
	X	Y	Z		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

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COMPLETE ABS COMBINATION

DISPLACEMENTS

Node	T r a n s l a t i o n s			/	R o t a t i o n s		
	X	Y	Z		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

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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

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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

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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

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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

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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

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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

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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

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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

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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

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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

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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

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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

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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

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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

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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

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SOLVE BEAM LOADS/STRESSES

Version 3.0

12/31/93

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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

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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

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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

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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

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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

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Filename=2736
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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 .1746E+04	.8379E+01 .1742E+04	.2802E+02 .1742E+04	.0000E+00 .1746E+04	.1741E+04 .1742E+04	.1354E+03 .1746E+04
Stress	2	.3037E+01 .1972E+03	.8379E+01 .1967E+03	.2802E+02 .1967E+03	.0000E+00 .1972E+03	.1966E+03 .1972E+03	.1555E+02 .1967E+03
BEAM NO. 2							
Stress	2	.1822E+01 .1972E+03	.4449E+01 .1967E+03	.1466E+02 .1967E+03	.0000E+00 .1972E+03	.1966E+03 .1972E+03	.1555E+02 .1967E+03
Stress	3	.1822E+01 .1209E+04	.4449E+01 .1206E+04	.1466E+02 .1206E+04	.0000E+00 .1209E+04	.1206E+04 .1209E+04	.9380E+02 .1206E+04
BEAM NO. 3							
Stress	3	.1607E+01 .1209E+04	.3445E+01 .1206E+04	.1129E+02 .1206E+04	.0000E+00 .1209E+04	.1206E+04 .1209E+04	.9380E+02 .1206E+04
Stress	4	.1607E+01 .4325E+03	.3445E+01 .4314E+03	.1129E+02 .4314E+03	.0000E+00 .4325E+03	.4312E+03 .4325E+03	.3359E+02 .4314E+03
BEAM NO. 4							
Stress	4	.2976E+01 .4325E+03	.8391E+01 .4314E+03	.2814E+02 .4314E+03	.0000E+00 .4325E+03	.4312E+03 .4325E+03	.3359E+02 .4314E+03
Stress	5	.2976E+01 .1764E+04	.8391E+01 .1760E+04	.2814E+02 .1760E+04	.0000E+00 .1764E+04	.1759E+04 .1760E+04	.1368E+03 .1764E+04

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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

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SOLVE REACTIONS

Version 3.0 12/31/93

Filename=2736

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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

ANALYSIS

For _____
Location 2736-Z
Subject RM 3 & 4 PEDESTAL

Job No. _____
Date 1-16-85
By D. L. K. G. G. G.
Checked By W. B. G. G. G.

Σ OF LOADS ON WELD/IMAGES-3D

$$F_x = 20^\# + 128/2 = 84^\#$$

$$F_y = 3.5^\#$$

$$F_z = 11.8^\#$$

$$M_x = 0$$

$$M_y = 212 \text{ IN}^\#$$

$$M_z = 63 \text{ IN}^\#$$

(NOTE: HAND CALCS ARE SLIGHTLY
LARGE IN GENERAL)

ANALYSIS

WHC-SD-CP-SA-026

REV 1.0 PAGE C-332

Job No.

Date

By

Checked By

For

Location

Subject

2736-E
RM 3 & 4 PEDESTAL

1-16-95

J. J. K. O.

D. J. K. O.

CHECK STRESS IN CHANNEL FROM COMPUTER MODEL

RESPONSE FROM
MODE 1

PP-32

COMPUTER RUN

COMBINED STRESS

$$\sigma_b = 1759 \text{ PSI} < \frac{2}{3} (36000) (1.33)$$

$$1759 \text{ PSI} < 31900 \text{ PSI} \quad \text{LA.36}$$

$$M.S. = \frac{1}{\left(\frac{1759}{31900}\right)^{-1}} > 10$$

- FOR CRIPPLING
(CONS. ANALYSIS)

- FOR UNBRACE LENGTH

SA: ECO: 94: 14-15
{ ATTACHED
PF 14-13 }

- CAST IN PLACE STUD / EMBEDDED PLATE

SEE SA: ECO: 94: 047
F 14-15

$$P_{all} = 1.03 \text{ K}$$

$$V_{all} = .59 \text{ K}$$

CONVERT M_y & M_z TO P & V OUT LOADS
IN EMBEDDED JOINT (SEE ATTACH. WELD
LOADS)

ANALYSIS

Job No.

Date

By

Checked By

For

Location

Subject

2736-Z
RM 3 & 4 PEDESTAL

SEE LOADS ON ATTACHMENT
WELD "ABOVE".

$$\begin{aligned} \text{PULLOUT} &= \frac{M_y}{2"} = \frac{288 \text{ in}^{\#}}{2"} = 144^{\#} \\ &= \frac{M_z}{2"} = \frac{96.8 \text{ in}^{\#}}{2"} = 49^{\#} \end{aligned}$$

$$F_z = 30^{\#}$$

$$\Sigma \text{ PULLOUT} = 144^{\#} + 49^{\#} + 30^{\#} = 223^{\#}$$

$$\text{SHEAR LOAD} = 75^{\#} + 70^{\#} \approx 145^{\#}$$

$$I = \frac{P_{act}}{P_{allow}} + \frac{V_{act}}{V_{allow}} \leq 1.0$$

$$\frac{223^{\#}}{1030} + \frac{85}{590} \leq 1.0$$

$$.22 + .191 = .36 \leq 1.0$$

$$M.S. = \frac{1}{(.36)} - 1 = 1.8 \leftarrow \text{EMB. TEST}$$

**Westinghouse
Hanford Company****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. O'Connell

~~E. C. O'Connell~~

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

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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 additional 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 attachment 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

DESIGN CALCULATION

WHC-SD-CP-SA-026

(1) Drawing _____ (2) Doc. No. _____ (3) Page REV 1 OF 1 PAGE C-340
 (4) Building 2776 Z (5) Rev. _____ (6) Job No. _____
 (7) Subject IAEA Security Bars
 (8) Originator EO Womer Date 10/28/94
 (9) Checker E.C. Olom 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)

WHC-SD-CP-SA-026

(10)

Ass'y 3, ea

	wt	$\bar{x}$	$\bar{y}$
3 - $1\frac{3}{4} \times \frac{1}{4} \times 3\frac{1}{2}$ @ .10 pci	16 .5	in .125	in 2P
1 - $1 \times \frac{1}{2} \times 6\frac{3}{4}$	1.6	-.5	.25
	<u>3.1</u>		

Ass'y 1, ea

1 - 2x1 tube 80.5" t = 1/8 3.0 3.75 4.0

3 - Sub ass'y 6

2 - 4.5 x 2 x 1/4 = .5

4 - 2 x 7.7 x 1/4 = .4

2 x 1 x 3/4 x 1/4 = .1

1.0 x 3 = 3.0 1.5 2.0

7- $5.1 \times 1 \times \frac{1}{4}$ 09 3.75 2.4

Bar
 $3 - 3\frac{1}{2} \times \frac{1}{4} \times 2\frac{1}{2}$ 0.7 3.75 1.5

Total ($\Sigma W, \Sigma W\bar{x}, \Sigma W\bar{y}$): 9.7[#] 21.0^{11#} 23.2^{11#}

$$EW = 9.7^* \quad \bar{x} = \frac{21.0}{9.7} = 2.2'' \quad \bar{y} = \frac{23.2}{9.7} = 2.4''$$

DESIGN CALCULATION

WHC-SD-CP-SA-026

(1) Drawing _____ (2) Doc. No. _____ (3) Page ~~REV 1.0~~ **PAGE C-342**
 (4) Building _____ (5) Rev. _____ (6) Job No. _____
 (7) Subject 27362 TACA Security Bars
 (8) Originator EO Weiner Date 10/28/94
 (9) Checker EC O'Brien Date 11/7/94

(10)

Capacity #14 sheet metal screw:

$$D_{maj} = .24 \quad D_{min} = .17 \quad (\text{measure})$$

Use 60° thread
 shear area at
 mean diameter,
 one thread

$$t_m = \frac{D_{max} - D_{min}}{2} \frac{2 \sin 30^\circ}{2}$$

$$= \frac{.24 - .17}{2} \times .5 = .0175"$$

$$\bar{D} = \frac{D_{maj} + D_{min}}{2} = \frac{.24 + .17}{2} = .205"$$

$$A_{shear} = \pi \bar{D} t_m = \pi \times .205 \times .0175 = .0113 \text{ in}^2$$

$$F_y = 36 \text{ Ksi} \quad (\text{screw cuts A36})$$

$$T_{cap} = 0.6 \times 36 \text{ K} \times .0113 = .244 \text{ K} = 244 \text{ \#}$$

Screw pull-out was
 tested (not to failure)

$$W_{TOT} = 21 \text{ \#}$$

$$T = \frac{19}{1.5} \times 21 = 266 \text{ \#}$$

showing T_{cap} is
 conservative. Use $\frac{1}{2} T_{cap}$
 for allowable:

$$T_{all} = \frac{244}{2} = 122 \text{ \#}$$

(1) Drawing _____ (2) Doc. No. _____ (3) Page REV 1 of 3 PAGE C-34
 (4) Building _____ (5) Rev. _____ (6) Job No. _____
 (7) Subject 2736 E IAEA Security Bars
 (8) Originator EO Weiner Date 10/28/94
 (9) Checker G.C. Oconnor Date 11/7/94

(10)

Seismic Loading

Following WHC-SD-6N-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

$$T = \frac{3.2}{.5} V + V + 0.4 \frac{2.4}{.5} H$$

$$= \frac{3.2}{.5} 9.2 + 9.2 + 0.4 \frac{2.4}{.5} 9.2$$

$$= 86^{\#}$$

For all 6 screws. One screw:

$$T_1 = \frac{86}{6} = 14^{\#} < T_{all} = 122^{\#}$$

OK

M.S. = 7.7

Sheet metal is 16 ga = .062" vs screw
 $t_m = .0175$. Screw pull-out is checked
 on p.7

DESIGN CALCULATION

WHC-SD-CP-SA-025

(1) Drawing _____ (2) Doc. No. _____ (3) Page ~~REV 1~~ PAGE C-344
 (4) Building _____ (5) Rev. _____ (6) Job No. _____
 (7) Subject 2136 Z IAEA Security Govt
 (8) Originator EO Weiner Date 10/28/94
 (9) Checker E.C. O'Connell Date 11/7/94

(10)

Other pull-outs:

Screw head : $D = .24$ $t = .12$

Al bar : $D = .38$ $t = .25$

are much less likely (negligible)

Bearing:

$$A_{brg} = .062 \times .24 = .015 \text{ in}^2$$

$$F_{brg} = H = 10^{\#}$$

$$\sigma_{brg} = \frac{10}{.015} = 67 \text{ psi} \quad \text{negligible}$$

Clevis: $\frac{1}{4}$ " clevis pins are used at 3 places between subassemblies 1 & 3

$$V = \frac{10}{3} = 3^{\#} \quad \text{negligible}$$

DESIGN CALCULATION

WHC-SD-CP-SA-026

(1) Drawing _____ (2) Doc. No. _____ (3) Page REV of ~~1~~ PAGE C-345
 (4) Building _____ (5) Rev. _____ (6) Job No. _____
 (7) Subject 2736 Z IAEA Security Bars
 (8) Originator EO Weiner Date 10/28/94
 (9) Checker E.C. O'Connell Date 11/7/94

(10)

Pedestal Channel Moment H-2-26649

Moment M from security bar is reacted by shear in channel legs (pedestal ass'y)
 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

$$S = \frac{bt^2}{6} = \frac{.75 \times .062^2}{6} = .00048 \text{ in}^3$$

$$\sigma_b = \frac{M_1}{S} = \frac{7.2}{.00048} = 15 \text{ KSI}$$

$$\text{Allow.} = 0.75 \times 36 \times 1.33 = 36 \text{ KSI} > 15 \text{ KSI} \quad \text{OK}$$

(AISC 8th)

$$M.S. = 1.4$$

DESIGN CALCULATION

WHC-SD-CP-SA-C26

(1) Drawing _____ (2) Doc. No. _____ (3) Page REV 001 PAGE C-346
 (4) Building _____ (5) Rev. _____ (6) Job No. _____
 (7) Subject 2736 Z INEA Security Bars
 (8) Originator EO Weiner Date 11/7/97
 (9) Checker G.C. Deema Date 11/7/97

(10)

Check pull-out wrt plate deformation.
 Roark 4th ed Table X.18

$$b = \bar{D}/2 = .205/2 = .102"$$

$$a = 0.5 \text{ (to bar edge)}$$

$$m = \frac{1}{\mu} = 3.33 \quad t = .0625"$$

$$WT = T_1 = 14 \#$$

$$S_t = \frac{3WT}{2\pi t^2 m} \left[1 + \frac{ma^2(m-1) - mb^2(m+1) - 2(m^2-1)a^2 \ln \frac{a}{b}}{a^2(m-1) + b^2(m+1)} \right]$$

$$= \frac{3 \times 14}{6.28 \times .0625^2 \times 3.33} \times$$

$$\left[1 + \frac{.5^2 \frac{2.33}{3} - .102^2 \frac{4.33}{3} - 2(3.33^2 - 1) .5^2 \ln \frac{.5}{.102}}{.5^2 \times 2.33 + .102^2 \times 4.33} \right]$$

$$= 514 \left[1 + \frac{-7.94}{.628} \right] = 514 \times 11.7 = 6000 \text{ psi}$$

$$= 6 \text{ ksi} < .75 \times 36 \times 1.37 = 36 \text{ ksi} \quad \text{OK}$$

Calc is grossly overconservative per test:

$$266 \# >> \frac{.36}{6} \times 14 = 84 \#$$

DESIGN CALCULATION

WHC-SD-CP-SA-026

(1) Drawing _____ (2) Doc. No. _____ (3) Page ~~REV 0~~ **REV. 1** PAGE C-347
 (4) Building _____ (5) Rev. _____ (6) Job No. _____
 (7) Subject 27362 IAEA Security Bars
 (8) Originator EO Weiner Date 11/7/94
 (9) Checker G.C. Owen Date 11/7/90

(10)

Effect on Pedestal Assy

Security bars add weight to the existing pedestal assembly.

Wts: (WHC-SD-CP-SA-026, Rev 0 pp C3-4)
 Also: H-2-26649 Dwg)

14 cans @ 5.5 #/can	77 #
Holders, 14	7
Channel 16 ga 2"x3"x84"	
.28 ^{PLI} 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-GM-30006, Rev.1) but the security bars are considered flexible (in existing structure) with $a = 0.68g$
 Mass center

Compt	Wt, #	a, g	$\bar{y}$, in
Channel	10	.34	1.4
Cans, etc	98	.34	2.2
Sec Bars	20	.68	2.4

$$\sum W a \bar{y} = 111 \quad \sum W a = 50.3 \quad \bar{y} = \frac{111}{50.3} = 2.21$$

DESIGN CALCULATION

WHC-SU-CP-SH-026

(1) Drawing _____ (2) Doc. No. _____ (3) Page **REV 1** PAGE G348
 (4) Building 2736 Z (5) Rev. _____ (6) Job No. _____
 (7) Subject EACA Security Bars
 (8) Originator E.O. Weiner Date 11/7/94
 (9) Checker E.C. O'Brien Date 11/7/94

(10)

Symmetry plane loading:

Welds are $\frac{1}{16} \times 1"$ (4)

E70:

$$f = \frac{aW}{l} = \frac{50^{\#}}{4"} = 12.5^{\#}/"$$

$$\ll \phi 11 = 0.3 \times \frac{0.62 \times 70}{\sqrt{2}} = 930 \text{ OK}$$

Note negative moment on 1" welds omitted because pinned end rotations are acceptable.

$$\theta = \frac{1}{24} \frac{aWL^2}{EI}$$

$$E = 29e6 \text{ psi} \quad L = 84" \quad aW = 50^{\#}$$

$$I = I_x = \frac{.0625 \times 2^3 (2 \times 3 + 2)}{3(3 + 2 \times 2)} = .190 \text{ in}^4$$

(Bogett 22-8)

$$\theta = \frac{1}{24} \frac{50 \times 84^2}{29e6 \times .190} = .0027$$

$$\text{Weld displ} = \frac{1}{2} \times .0027 = .0013$$

Salmon & Johnson Fig 5.13.4 shows $\frac{1}{4}"$ E70 fillet weld with min ductile displacement $\Delta = .03$. $\therefore \frac{1}{16}"$ E70.

$$\Delta = .03/4 = .0075 > .0013 \text{ OK}$$

DESIGN CALCULATION

WHC-SD-CP-SA-026

(1) Drawing _____ (2) Doc. No. _____ (3) Page ~~REV~~ of ~~1~~ ¹ PAGE C-349
 (4) Building 2TJGZ (5) Rev. _____ (6) Job No. REV. 1
 (7) Subject IACA Security Bar
 (8) Originator EO Weiner Date 11/7/94
 (9) Checker E.C. Oconnor Date 11/7/94

(10)

Beam bending:

$$S_x = \frac{.0625 \times 2^2}{3} \times \frac{2 \times 3 + 2}{3 + 2} = .133$$

$$M = \frac{aWL}{8} = \frac{50' \times 84''}{8} = 525'' \#$$

$$\sigma_b = \frac{M}{S_x} = \frac{525}{.133} = 3950 \text{ psi}$$

$$= 3.95 \text{ ksi} < .75 \times 36 \times 1.33 = 36 \text{ ksi} \quad \underline{\text{OK}}$$

Crippling:

$$\text{check } b/t \leq \frac{95}{\sqrt{F_y}} = \frac{95}{\sqrt{36}} = 15.8 \quad \begin{matrix} 8^{th} \text{ AISC} \\ 1.9.1.2 \end{matrix}$$

$$b/t = \frac{2}{.0625} = 32 > 15.8 \Rightarrow \text{Use Sect C2}$$

$$Q_s = \frac{20000}{F_y (b/t)^2} = \frac{20000}{36 \times 32^2} = .542$$

$$\text{Allow: } .6 \times 36 \text{ ksi} \times .542 \times 1.33 = 15.6 \text{ ksi} > 3.95 \text{ ksi} \quad \underline{\text{OK}}$$

$$M.S. = 2.95$$

DESIGN CALCULATION

WHC-SD-CP-3A-026

(1) Drawing _____ (2) Doc. No. _____ (3) Page REV 061 PAGE C-350
 (4) Building 27362 (5) Rev. _____ (6) Job No. REV. 1
 (7) Subject IAEA Security BDR
 (8) Originator EO Weiner Date 11/7/94
 (9) Checker G.C. O'Brien Date 11/7/94

(10)

Lateral loading:

Bending

$$S_y = \frac{.0625 \times 3}{6} (3 + 6 \times 2) = .469 \text{ in}^3$$

$$I_y = S_y^{2/3} = .469 \times 1.5 = .704 \text{ in}^4$$

$$M = \frac{aWL}{8} = \frac{50 \times 8}{8} = 525 \text{ in} \cdot \text{lb}$$

$$\sigma_b = \frac{M}{S_x} = \frac{525}{.469} = 1120 \text{ psi}$$

$$= 1.1 \text{ ksi} < 36 \text{ ksi}$$

OK

Unbraced length AISC 8^{+4} , 1.5, 1.4.5

$$F_b = \frac{12000 C_b}{l d / I_f}$$

$$l = 84" \quad d = 3" \quad C_b = 1$$

$$I_f = 2" \times .0625$$

$$F_b = \frac{12000 \times 1}{84 \times 3 / (2 \times .0625)} = 5.95 \text{ ksi}$$

$\times 1.33$ for seismic:

$$F_b = 5.95 \times 1.33 = 7.92 \text{ ksi} > \sigma_b = 1.1 \text{ ksi} \quad \underline{\text{OK}}$$

Shear center (Balogh)

$$e = \frac{b d^2 t}{4 I_y} = \frac{3 \times 2^2 \times .0625}{4 \times .704} = .274$$

Mass center is close: at 0.21"

$\therefore$ neglect torsional effects

DESIGN CALCULATION

WHC-SO-CP-SA-026

(1) Drawing	2-736 Z	(2) Doc. No.	(3) Page REV	PAGE C-351
(4) Building	2-736 Z	(5) Rev.	(6) Job No.	
(7) Subject	IEA SA Security Bar			
(8) Originator	EO Lauer	Date	11/7/97	
(9) Checker	E.C. O'Connell	Date	11/7/97	

(10)

Flange bending at ends

Use 45° eff. width line

$$M = \frac{50 \times 2^2}{4} = 25 \text{ in}^2$$

$$S = 3 \times .0625^2 / 6 = .00195$$

$$D_b = \frac{25}{.00195} = 12800 \text{ psi} = 12.8 \text{ ksi} < 16 \text{ ksi OK}$$

Welds:

$$f_s = \frac{Q}{A} = \frac{50}{4} = 12.5 \text{ ksi}$$

$$f_t = \frac{I_y c}{A L^2 (d+e)^2}$$

$$I_y = 2 \times 1 \times 1.5^2 = 4.5 \text{ in}^4$$

$$c = 1.5 \text{ in}$$

$$f_t = \frac{50 \times (2.21)^2 / 2}{4.5 \times 1.5} = 8 \text{ ksi}$$

Welds stresses are very small (allow 9500)

DESIGN CALCULATION

WHC-SD-CP-SA-026

(1) Drawing _____ (2) Doc. No. _____ (3) Page ~~REV 10~~ of PAGE C-352
 (4) Building 2726 Z (5) Rev. _____ (6) Job No. _____
 (7) Subject IAEA Security Bars
 (8) Originator EO Weiner Date 11/7/94
 (9) Checker E.C. O'Connor Date 11/7/94

(10)

Interaction (Symmetry & Lateral Loading)

Use 100-40-40 combination

Beam bending

$$\sigma_b = 3.95 + 0.4 \times 1.1 = 4.4 \text{ ksi}$$

$$< .75 \times 36 \times 1.33 = 36 \text{ ksi} \quad \underline{\text{OK}}$$

(P10, bending)

$$< 15.6 \text{ ksi} \quad \underline{\text{OK}}$$

(P10, crippling)

Fillet welds:

Gravity + seismic load (vertical)

$$P = 108^{\#} \left(1 + \frac{2}{3} \times 0.34\right) + 20 \left(1 + \frac{2}{3} \times 0.68\right)$$

$$= 162^{\#}$$

$$\text{Over 4 welds: } f_g = \frac{162^{\#}}{4"} = 41^{\#}/"$$

P offset 2.2" from wall induces a pull-out:

$$f_p = \frac{162^{\#} \times 2.2" / 84"}{2"} = 2^{\#}$$

Net:

$$f = f_g + (0.4(f_{sym} + f_T + f_p)) + 0.4 f_s$$

$$= 41 + 0.4(13 + 8 + 2) + 0.4 \times 13$$

$$= 42^{\#}/" < 930^{\#}/" \quad \underline{\text{OK}}$$

(1) Drawing _____ (2) Doc. No. _____ (3) Page REV 1 of 3 PAGE 353
 (4) Building 2736 Z (5) Rev. _____ (6) Job No. _____
 (7) Subject IAEA Security Bar
 (8) Originator EO Weiner Date 11/5/94
 (9) Checker E.C. Dorn Date 11/8/94

(10)

Anchor plate:

Edge dist = 2"

 $f_c' = 2500 \text{ psi}$

Per WHC-SD-GN-DGS-3000G

Table 8.8:

$$P_{nom} = 1.66^K \quad V_{nom} = 0.83^K$$

$$E_{min} = 2.3'' \quad L = 6'' \quad D = .25'' \quad E = 2''$$

Section 8.2:

$$RE_p = A_{red}/A_{nom}$$

$$A_{nom} = .96 \frac{\pi}{4} (2L + D)^2 = .96 \frac{\pi}{4} (2 \times 6 + .25)^2 = 113 \text{ in}^2$$

$$A_{red} = \pi r^2 - \frac{1}{2} \left(r^2 \theta - 2rE \sin \theta/2 \right)$$

$$\theta = 2 \cos^{-1} \left(\frac{2E}{2L + D} \right) = 2 \cos^{-1} \left(\frac{2 \times 2}{2 \times 6 + .25} \right)$$

$$= 142^\circ$$

$$r = \frac{2L + D}{2} = \frac{12.25}{2} = 6.12''$$

$$A_{red} = \pi \times 6.12^2 - \frac{1}{2} \left(6.12^2 \times \frac{142}{57.3} - 2 \times 6.12 \times 2 \times \sin 71 \right)$$

$$= 83 \text{ in}^2$$

$$RE_p = 83/113 = .73$$

$$RE_s = .0131 (E/D)^2 = .0131 (2/.25)^2 = .84$$

$$RF_p = RF_s = \sqrt{f_c'/3500} = \sqrt{2500/3500} = .85$$

DESIGN CALCULATION

WHC-SD-CP-SA-026

(1) Drawing _____ (2) Doc. No. _____ (3) Page REV 1 of 1 PAGE C-354
 (4) Building 2736-Z (5) Rev. _____ (6) Job No. _____
 (7) Subject IEEA Security Bars
 (8) Originator E.O. Weiner Date 11/8/94
 (9) Checker E.C. O'Connor Date 11/8/90

(10)

$$P_{all} = P_{nom} R E_p R F_p = 1.66^K \times .73 \times .85 = 1.03^K$$

$$P_{act} = aW/2 + 2^{\#} = 50^{\#}/2 + 2 = 27^{\#} < 1030^{\#}$$

$$V_{all} = V_{nom} R E_s R F_s = 0.83^K \times .84 \times .85 = 0.59^K$$

$$V_{act} = V_{grav}/2 = 162/2 = 81^{\#} < 590^{\#} \quad OK$$

6.0 DESIGN SKETCHES AND COPIES OF SELECTED REFERENCES

Westinghouse
Hanford Company

WHC-SD-CP-SA-026 Internal
REV ~~1~~ PAGE C-356 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.

ANALYTICAL CALCULATIONS

REVISION PAGE G358
Page 7 of 7

Subject 2736-B IAEA SUPPORT

Originator Sgt D. ELLINGTON

Date _____

Checker _____

Date _____

REFERENCE

SHOWN WITH DOOR OPEN

REFERENCE

WHC-SD-PP-SA-026

REV100A PAGE C-360

J-10		FABRICATION REQUEST		WHC-SS-CP-3A-028 REV 1 PAGE C-361
1. Originator Tracking No. SDE 10-24-94		23. Servicing Tracking No. 2H-		
2. WO/PCN (If WO, please attach copy) E25699		7. Deliver To BILL RUSSELL 3-5714 / DEAN 3-3997 PFP		
3. Issuing Organization Code ENGINEERING SUPPORT 8D380		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 ESD
5. Equipment Identification No. ASSEMBLY 1 AND 2		12. Authorized Amount AS REQUIRED		
6. Originator SCOTT ELLINGSON MSIN 10-24-94 3-2035		13. Funding Approval D.D. SCOTT SD. Ellington 10-24-94		
14. Title PLUTONIUM STORAGE RACK SECURITY DEVICE				
15. Description of Work <ul style="list-style-type: none"> • FABRICATE ONE EACH OF ASSEMBLIES 1, 2, 3 AND 4 AS DEPICTED ON THE ATTACHED SKETCHES. 				
16. Additional Fabrication Information (restrictions/special conditions, inspection criteria, material requirements, special tests, records or documentation required) <ul style="list-style-type: none"> • 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 • <u>OVERTIME IS APPROVED!</u> THE REQUIRED COMPLETION DATE IS MANDATORY... 				
17. Cognizant Engineer SCOTT ELLINGTON 10-24-94 372-2035		22. Comments		
18. Cognizant Manager N/A		24. Assigned To		
19. Environmental Assurance		25. Accepted By		
20. Health and Safety Assurance		26. Work Completed By		
21. Quality Assurance				

FABRICATION NOTES

1. Material...The material ~~of type~~ is aluminum. If aluminum cannot be obtained quick enough to meet schedule requirements, carbon steel may be substituted. All material except the 2x1 tubing should be available in WHC stores. Plate may be substituted for bar stock. The 2x1 tubing is available at Twin City, Nev. for insulating aluminum and carbon steel (reference).
2. Tolerances should be held to a minimum. A $\pm 1/16$ " is desired.
3. Avoid excess heat during welding to minimize warpage.
4. Weld per AWS D1.1/2.1 as required. ~~No inspection required.~~
5. Break all sharp edges. If carbon steel is employed, degrease and wire brush final assembly to remove oil, scale and rust.
6. ~~No QC inspection is required due to time constraints but it is essential that the depicted configurations be obtained.~~
7. ~~Any concerns, problems or questions can and should be brought to the attention of the design engineer immediately; Scott Errington 572-2035 (wk) 792-1003 (h).~~

ALL NOTES WILL BE REVISED!

WHC-SD-CP-SA-026

REV 10 PAGE C-363

DIMENSIONS ARE
TO BOTTOM OF 1/4
BAR (REF)

ASSEMBLY 1

ASSEMBLY 2

ALL MATERIAL IS ALUMINUM
TYPE 6061-T6, ASTM-B-221

DRILL $\phi 1/4$, $\phi 5/16$; $\phi 3/8$ HOLEs THRU
USING ASSSEMBLY 2 AS TEMPLATE.
SEE DETAIL 1, PAGE 5, FOR REF.

DRILL $\phi 3/8$, $\phi 5/16$; $\phi 1/4$ HOLES THRU
USING ASSEMBLY 1 AS TEMPLATE.
SEE DETAIL 1, PAGES 5, FOR REF.

SIDE - ELEVATION - FRONT

FRONT - ELEVATION - SIDE
ASSEMBLY 3

PLAN

TUBING IS ALUMINUM,
.125 WALL, TYPE 6063-T5

WHC-SD-CP-SA-026

REV 1 ~~0~~ PAGE C-365

A

ELEVATION

VIEW A-A

SUB-ASSY 5

ALL MATERIAL IS ALUMINUM
TYPE 6061-T6, ASTM-B-1

WHC-SD-CP-SA-026

REV 1 ~~0~~ PAGE C-366

PLAN

FRONT ELEVATION

VIEW A-A

SUB-ASSY 6

WHC-SD-CP-SA-026
REVISED PAGE C-367

2 X 1 TUBING REF

1 X 1/4 X LAR BAR
BEND AS SHOWN

ALUMINUM TYPE
6061-T6, ASTM B-22

SECTION B-B
SUB-ASSY 5

DETAIL 1

ASSEMBLY 1/3 SHOWN. ASSEMBLY 2/4 ARE OPPOSITE HAND AND HOLE ARGMT.

DESIGN CALCULATIONS

WHC-SD-CP-SA-026

REV ~~104~~ PAGE C-368

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 RA Miller 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 ($2/3 \times 0.755 = 0.503$ 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

spectra.c

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)

$$f_c' = 3000 \text{ psi}$$

ANALYTICAL CALCULATIONS

WnC-SG-CP-SA-026

Page REV 1 ~~67~~ PAGE C-37C

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 $\frac{3}{8}$ " 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

WHC-SD-CP-SA-026

Page REV 1 of PAGE C-371

Subject

Originator D. BARLOWDate 2-15-95Checker RA MillerDate 2-24-95BOLT LOADS

THE MAX. WALL ACCELERATION IS .755 g .
CONSERVATIVELY ASSUME 100% OF THE
MAX. ACCELERATION IN EACH OF THE COORDINATE
DIRECTIONS.

$$F_X = F_Z = .755 \times 188 \text{ #} \times \frac{30''}{90''} = \underline{48 \text{ #/BOLT}}$$

$$F_Y = (1 + .503) 188 \times \frac{30''}{90''} = \underline{94 \text{ #/BOLT}}$$

F_{ZX} (CAUSE BY F_X PRYING)

$$F_{ZX} = \frac{F_X(d)}{b/2} = \frac{48 \text{ #}(3.5'')}{\frac{1.75''}{2}} = \underline{192 \text{ #/BOLT}}$$

F_{ZY} (CAUSED BY F_Y OVERTURNING MOMENT)

$$F_{ZY} = \frac{F_Y(d)}{h} = \frac{192 \text{ #}(3.5'')}{30''} = \underline{23 \text{ #/BOLT}}$$

LOAD SUMMARY:

$F_Y = 94 \text{ #/BOLT}$

 $F_X = 48 \text{ #/BOLT} = T$
 $F_Z = 48 + 192 + 23 = \underline{263 \text{ #/BOLT}}$

$$SHEAR = V = \sqrt{48^2 + 94^2} = \underline{106 \text{ #/BOLT}}$$

ANALYTICAL CALCULATIONS

WHC-SD-CP-SA-026

Page REV 1 of PAGE C372

Subject _____

Originator D. BARLOWDate 2-15-95Checker RA MillerDate 2-24-95BOLT CAPACITY3/8" ϕ HKB

$$TENSION CAPACITY: (.75)^2 (1100^{\#})^* = \underline{618. \# / BOLT}$$

$$SHEAR CAPACITY: (.75 \times .95) (1060^{\#})^* = \underline{755. \# / BOLT}$$

* 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.

$$I = \frac{\frac{4}{3} \times 263}{618.} + \frac{\frac{4}{3} \times 106.}{755.} = \underline{.75} < 1.0 \quad \text{OK}$$

$$MS = \frac{1}{.75} - 1 = \underline{.33}$$

UNISTRUT STUD3/8" DIA.WORKING LOADS: $T = 1000^{\#}$ $V = 500^{\#}$

$$I = \frac{\frac{4}{3} \times 263}{1000.} + \frac{\frac{4}{3} \times 106.}{500.} = \underline{.63} < 1.0 \quad \text{OK}$$

$$MS = \frac{1}{.63} - 1 = \underline{.57}$$

ANALYTICAL CALCULATIONS

WHC-SD-CP-SA-026

REV 101 PAGE C-373
Page ____ of ____

Subject

Originator D. BARLOWDate 2-15-95Checker RA MillerDate 2-24-95WELDED 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.

ANALYTICAL CALCULATIONS

WHC-SD-CP-SA-026

Page REV 1 of PAGE C-374

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

$$16 \text{ ga} = .0598" \text{ THK}$$

2" DEEP x 3" WIDE CHANNEL

$$b = 3.0 - .0598 = \underline{2.9402"} \quad "$$

$$d = 2.0 - \frac{.0598}{2} = \underline{1.9701"} \quad "$$

$$I_X = \frac{t d^3 (2b + d)}{3(b + 2d)} = \frac{(.0598)(1.9701)^3 (2 \times 2.9402 + 1.9701)}{3(2.9402 + 2 \times 1.9701)}$$

$$= \underline{0.1739 \text{ in}^4}$$

$$I_Z = \frac{t b^3}{12} [b + 6d] = \frac{(.0598)(2.9402)^3}{12} [2.9402 + 6 \times 1.9701]$$

$$= \underline{0.6359 \text{ in}^4}$$

NOTE THAT THESE I VALUES ARE ESSENTIALLY
 THE SAME AS THOSE FOR $t = .063"$ vs $t = .0598"$

ANALYTICAL CALCULATIONS

WHC-SD-CP-SA-026

Page REV 1 of PAGE C-375

Subject _____

Originator D. BARLOWDate 2-15-95Checker RA MillerDate 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"

$$f_x = \frac{22.4}{2\pi} \sqrt{\frac{30E6 \times .1739}{.004 \times 82.5^4}} = \underline{18.9 \text{ Hz}} \sim 19 \text{ Hz}$$

$$f_z = \frac{22.4}{2\pi} \sqrt{\frac{30E6 \times .6359}{.004 \times 82.5^4}} = \underline{36.17 \text{ Hz}} \sim 36 \text{ Hz}$$

ATTACHMENT LOADS ON WELDSZ DIRECTION LOADS (WEAK AXIS)

COMBINE SEISMIC LOADS - Z=100%, Y=X=40%

MAX. HORIZONTAL ACCEL. = 0.32 g's AT 19 Hz

CHANNEL + CANS: $W_1 = 108 \text{ \#}$ FLEXIBLE SECURITY BAR: $W_2 = 20 \text{ \#}$ $\Sigma W = \underline{128 \text{ \#}}$ TOTAL

ACCEL. FOR THE SECURITY BAR IS 0.68g

DESIGN CALCULATION

WEC-SD-CP-SA-026

(1) Drawing _____ (2) Doc. No. _____ (3) Page REV 1 of PAGE C-376
 (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

$$(10) FZ = AZ(\Sigma W) = (.32g \times 108.^{\#} + .68 \times 20.^{\#}) = 48.^{\#}$$

$$= 24.^{\#}/END$$

$$MXZ = \frac{FZ \times L}{12} = \frac{48.^{\#} \times 82.5''}{12} = 330.^{\#}$$

X DIRECTION LOADS (STRONG AXIS)

MAX. HORIZONTAL ACCEL. = 0.315g AT 36. Hz
 THE FACTOR OF 40% IS APPLIED TO THE X DIR.
 THUS, $AX = .4 \times .315g = 0.126g$

$$FX = AX(\Sigma W) = (.315g \times 108.^{\#} + .68g \times 20.^{\#})(.4) = 19.^{\#}$$

$$= 9.5^{\#}/END$$

$$MZ_X = \frac{FX \times L}{12} = \frac{19.^{\#} \times 82.5''}{12} = 131.^{\#}$$

$$MY_X = FX \times d = 9.5^{\#} \times 3.5'' = 34.^{\#}$$

Y DIRECTION LOADS

$$MAX. VERTICAL ACCEL. = \left(\frac{2}{3}\right)(.315g)(.4) = .084g$$

$$FY = AY(\Sigma W) = \left(\frac{2}{3}\right)(.315 \times 108.^{\#} + .68 \times 20.^{\#})(.4) = 13.^{\#}$$

$$= 6.5^{\#}/END$$

DESIGN CALCULATION

WHC-SD-CP-SA-026

REV ~~104~~ PAGE C-377

(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) WELD LOADS (ONE END)

$$F_X = 6.5^{\#} + \frac{128^{\#}}{2} = \underline{71.}^{\#} \quad \text{VERT. SHEAR}$$

$$F_X = \underline{9.5}^{\#} \quad \text{HORIZ. SHEAR}$$

$$F_Z = \underline{24.}^{\#} \quad \text{TENSION}$$

$$M_X = \underline{330.}^{\#}$$

$$M_Y = \underline{34.}^{\#}$$

$$M_Z = \underline{131.}^{\#}$$

WELD SIZE

NOTE: $\frac{1}{16}$ " FILLET DOES NOT MEET THE AISC MIN. WELD SIZE TABLE J2.4 SO SPECIAL PROCEDURES ARE REQUIRED.

$$L = 2. \text{ "}$$

$$S_X = \frac{d^2}{3} = \frac{1^2}{3} = \underline{.33}$$

$$S_Y = bd = 3 \times 1 = \underline{3.}$$

$$J = \frac{d}{6} (3b^2 + d^2) = \frac{1}{6} (3 \times 3^2 + 1^2) = \underline{4.67}$$

[BLODGETT, p. 7.4-7, TABLE 5.0]

DESIGN CALCULATION

WHC-SD-CP-SA-026

(1) Drawing _____ (2) Doc. No. _____ (3) Page REV 1 of PAGE C-378
 (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)

$$f_z = FZ + \frac{M_y}{S_y} + \frac{M_x}{S_x} = 24. + \frac{34.}{3} + \frac{330.}{.333} = \underline{1,026. \text{ #/IN}}$$

$$f_{VY} = \frac{F_y}{L_w} + \frac{M_z r_y}{J_w} = \frac{71.}{2} + \frac{131 \times .5}{4.67} = \underline{49. \text{ #/IN.}}$$

$$f_{VX} = \frac{F_x}{L_w} + \frac{M_z r_x}{J_w} = \frac{9.5}{2} + \frac{131 \times .65}{4.67} = \underline{47. \text{ #/IN}}$$

$$f_r = \sqrt{1,026.^2 + 49^2 + 47^2} = \underline{1,028. \text{ #/IN.}}$$

$$W_{req} = \frac{f_r}{(.707)(.3 F_u)(1.7)} = \frac{1,028.}{(.707)(.3 \times 60,000)(1.7)} = \underline{0.0475"}^*$$

$$0.0475" < 0.0625" \text{ (EXISTING WELD)} \quad \text{OK}$$

$$MS = \frac{0.0625}{0.0475} - 1 = \underline{.3153} \quad \text{OK}$$

* AISC

WELD METAL CHECK AT THROAT: TABLE J2.5, p. 5-70,

$$\text{FILLET WELD: } \sigma \leq (.707)(.3 F_{u \text{ WELD}})$$

BASE METAL CHECK ON LEG: SECT. 4, p. 5-164

$$\sigma \leq (.3 F_{u \text{ BASE}})$$

DESIGN CALCULATION

WHC-SD-CP-SA-026

(1) Drawing _____ (2) Doc. No. _____ (3) Page REV 107 of PAGE C-379
 (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) CHANNEL STRESSES $L = 82.5''$ BETWEEN FIXED ENDS

$$S_X = \frac{t d^2 (2b + d)}{3(b + d)} = \frac{.0598 (1.9702)^2 (2 \times 2.9402 + 1.9702)}{3(2.9402 + 1.9702)}$$

$$= .1237$$

[BLODGETT, p. 2.2-8, TABLE 2]

$$S_Z = \frac{t b}{6} (b + 6d) = \frac{(.0598)(2.9402)}{6} (2.9402 + 6 \times 1.9702)$$

$$= 0.4326$$

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.

$$M_{X_{MID}} = \frac{1}{2} M_X = \frac{1}{2} (330.) = 165''\#$$

$$M_{Z_{MID}} = \frac{1}{2} M_Z = \frac{131}{2} = 66''\#$$

$$\sigma = \frac{M_X}{S_X} + \frac{M_Z}{S_Z} + \frac{F_Y}{A} = \frac{165.}{.1237} + \frac{66.}{.4326} + \frac{71}{.4114} = 1659. \text{ PSI}$$

$$\left[\begin{aligned} A &= [2(1.9701) + 2.9402] .0598 = .4114 \text{ IN}^2 \\ F_Y &= 71. \# \text{ (ref p. 10)} \end{aligned} \right.$$

DESIGN CALCULATION

WHC-SD-CP-SA-026

(1) Drawing _____ (2) Doc. No. _____ (3) Page ~~REV 1~~ PAGE C-380
 (4) Building _____ (5) Rev. _____ (6) Job No. _____
 (7) Subject _____
 (8) Originator D. BARLOW Date 2-15-95
 (9) Checker RA Hiller Date 2-24-95

(10) WIDTH TO THICKNESS RATIO

$$\frac{b_f}{t_s} = \frac{1.9701}{.0598} = \underline{33.}$$

MAX. ALLOWABLE W/T RATIO FOR STEM OF TEES
 IS $\frac{127}{\sqrt{F_y}} = \frac{127}{\sqrt{36.}} = \underline{21}$ [AISC, SECT. 1.9.1.2]

$33 > 21$: THUS SEE SECT. C2.

WHEN $\frac{b}{t} \geq 176/\sqrt{36.} = 29.3$, THE:

$$Q_s = \frac{20,000}{F_y \left(\frac{b}{t}\right)^2} = \frac{20,000}{36(33.)^2} = \underline{.5102}$$

ALLOWABLE FLANGE COMPRESSION:

$$F_b = .6 F_y Q_s = (.6)(36.)(.51) = \underline{11.0 \text{ ksi}}$$

$$11.0 > 1.659$$

(OK)

$$\frac{11.0}{1.659} - 1 = \underline{5.6}$$

(OK)

COMPRESSION FLANGE WON'T BUCKLE.

DESIGN CALCULATION

WHC-SD-CP-SA-026

REV ~~10~~ PAGE C-381

(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)

$$P_Z = FZ + \frac{MX}{2} + \frac{MY}{2}$$

$$= 42. + \frac{569.}{2} + \frac{34.}{2} = \underline{344. \#}$$

SHEAR (FX, FZ)

$$V = \sqrt{9.5^2 + 42.^2} = \underline{43 \#}$$

$$I = \frac{344}{1030} + \frac{43}{590} = \underline{.41} < 1.0$$

OK

$$MS = \frac{1.0}{.41} - 1 = \underline{1.4}$$

OK

DESIGN CALCULATION

WHC-SD-CP-SA-026
REV. 1.0 ~~1.0~~ PAGE C-382

(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 ED Weiner Date 9-14-94
(9) Checker E.C. O'Conor 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

WHC-SD-CP-SA-026
REV 1 ~~18~~ PAGE C-383

(1) Drawing _____ (2) Doc. No. _____ (3) Page _____ of _____
(4) Building _____ (5) Rev. _____ (6) Job No. _____
(7) Subject 2736 Cubicles - Door Amplification
(8) Originator EO Weiner Date 9/13/94
(9) Checker E C. Odom 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.

DESIGN CALCULATION

WHC-3D-CP-SA-026
REV ~~101~~ PAGE C-384

(1) Drawing _____ (2) Doc. No. _____ (3) Page _____ of _____
 (4) Building _____ (5) Rev. _____ (6) Job No. _____
 (7) Subject 2736-2 Cubicles - Can Holder Testing
 (8) Originator EO Weiner Date 9/14/94
 (9) Checker E.C. Dorner Date 9/10/94

(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.

$$\begin{array}{rcl}
 \Delta h_{c.g.} & = & 0.310 \quad \text{casting H-2-95161} \\
 & + & 0.075 \quad \left. \begin{array}{l} \text{scaled} \\ \text{from ass'y} \end{array} \right\} \text{H-2-95168} \\
 & + & 0.190 \\
 & + & 0.125 \quad \text{card H-2-95164} \\
 & + & 0.250 \quad \text{label H-2-95165} \\
 & = & 0.97"
 \end{array}$$

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):

DESIGN CALCULATION

WAC-SD-CP-3A-026
REV. 101A PAGE C-385

(1) Drawing _____ (2) Doc. No. _____ (3) Page _____ of _____
(4) Building _____ (5) Rev. _____ (6) Job No. _____
(7) Subject 2736-2 Cubicles - Can Holder
(8) Originator EO. Wooner Date 9/14/94
(9) Checker E.C. O'Connor Date 9/16/94

(10)

$$\begin{aligned} \text{Volume} &= \pi \times 1.6^2 \times .06 \\ &+ 2\pi \times \frac{1.6 + 2.3}{2} (2.3 - 1.6) (.31 - .06) \\ &+ 2\pi \times 2.1 \times .4 \times (.575 - .31) \\ &+ 2\pi \times 2.25 (1.75 - .58) .15 \\ &= .48 + 2.14 + 1.37 + 2.48 = 6.5 \text{ in}^3 \end{aligned}$$

Note: ~~xx~~ slots in casting lip are compensated by the weight of other components

$$\text{Weight} = 6.5 \times 0.11 = .71^{\#} = .32 \text{ kg}$$

$$\text{Can weight} = 2.2 \text{ kg}$$

From holder up:

$$h_{c.g.} = \frac{\begin{matrix} \text{est CMU c.g.} & \text{can c.g.} \\ 0.6 \times 0.32 + 3.97 \times 2.2 \end{matrix}}{2.2 + .32} = 3.54"$$

$$\text{Can dia: } 3.9" \quad \text{CMU Dia: } 4.2" \text{ (min)}$$

$$\text{Can ht: } 6.0"$$

$\therefore$ change in $h_{c.g.}/D$ is

$$\frac{\Delta(h_{c.g.}/D)}{h_{c.g.}/D} = \frac{\frac{3.54}{4.2} - \frac{3.00}{3.9}}{\frac{3.00}{3.9}} = 0.10$$

The remaining margin is

$$MS = 0.26 - 0.10 = \underline{\underline{0.16}}$$

ANALYTICAL CALCULATIONS

Page C-386 of _____

Subject _____
 Originator RA Miller 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

Page C-387 of _____

Subject _____
Originator RA Hille 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

Page C 388 of

Subject _____
 Originator RA Hill Date 4-27-95
 Checker MA JSL/AM Date 4/27/95

Originator RA Miller

Date 4-27-95

Checker MA 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.

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
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
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 390

PRINT U NODAL SOLUTION PER NODE

Pg C 391

***** POST1 NODAL DEGREE OF FREEDOM LISTING *****

THE FOLLOWING DEGREE OF FREEDOM RESULTS ARE IN GLOBAL COORDINATES

NODE	UX
1	0.00000E+00
2	-0.37984E-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 *****

Pg 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 394

PRINT U NODAL SOLUTION PER NODE

***** POST1 NODAL DEGREE OF FREEDOM LISTING *****

Pg C 395

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	-0.48844E-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

P2 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	348	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

Pg C 397

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

93 C 398

PRINT U NODAL SOLUTION PER NODE

pg C399

***** 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	-0.48374E-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	-0.38241E-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	-0.38241E-01	0.13338E-01	0.00000E+00	0.36569E-01

PRINT REACTION SOLUTIONS PER NODE

P3 C400

***** POST1 TOTAL REACTION SOLUTION LISTING *****

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

NODE	FX	FY	FZ
1	30882.	11260.	
5		-81.059	
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 *****

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

Page C40 of

Subject
 Originator RA Miller Date 4-27-95
 Checker MA ISLAM Date 4/27/95

Check Frequency (Rooms 3 & 4)

Ref. page C-64;

$$f = 3.13 \sqrt{\frac{1}{\Delta}}$$

$$\text{Case 1; } \Delta = .01275''$$

$$\text{Case 2; } \Delta = .01484''$$

$$\text{Case 3; } \Delta = .03624''$$

$$\text{Case 1; } f = 3.13 \sqrt{\frac{1}{.01275}} = 27.7 \text{ Hz}$$

$$\text{Case 2; } f = 3.13 \sqrt{\frac{1}{.01484}} = 25.7 \text{ Hz}$$

$$\text{Case 3; } f = 3.13 \sqrt{\frac{1}{.03624}} = 16.44 \text{ Hz}$$

Seismic Accel (SDC-4.1 Table 2) 5% Damping

$$\text{Case 1; } a = .225 \text{ g}$$

$$\text{Case 2; } a = .234 \text{ g}$$

$$\text{Case 3; } a = .296 \text{ g}$$

ANALYTICAL CALCULATIONS

Page 0402 of _____

Subject _____
 Originator RA Hill 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; $f = 3.13 \sqrt{\frac{1}{\Delta}} = 25.7 \text{ Hz}$

Case 2; $f = 23.8 \text{ Hz}$

Case 3; $f = 15.2 \text{ Hz}$

Case 1; $a = .234 \text{ g}$

Case 2; $a = 0.242 \text{ g}$

Case 3; $a = .308$ g

ANALYTICAL CALCULATIONS

Page C405 of Subject Originator RA MillerDate 4-27-95Checker MA ISLAMDate 4/27/95Check Anchors (Rooms 3 & 4)

Ref. Page C-72 ;

$$\text{Case 1; Tension} = -15576 \left(\frac{.225}{1.0} \right) + \frac{22200}{16}$$

$$= -2195 \#$$

$$T = \frac{2195}{\sin 45^\circ (4)} = 776 \#/\text{anch}$$

$$V = \sqrt{\left(\frac{10071 \times .225}{8 \text{ anch}} \right)^2 + 776^2} = 828 \#/\text{anch}$$

$$\frac{T}{T_A} + \frac{V}{V_A} = \frac{776}{2205} + \frac{828}{1875} = .79 < 1.0$$

C/K

$$\text{Case 2; Ten.} = -17421 (.234) + \frac{22200}{16}$$

$$\text{Ten.} = -2689 \#$$

$$T = \frac{-2689}{\sin 45^\circ (4 \text{ anch})} = 951 \#/\text{anch}$$

$$V = \sqrt{\left(\frac{10853 \times .234}{8 \text{ anch}} \right)^2 + 951^2} = 1003 \#/\text{anch}$$

$$\frac{T}{T_A} + \frac{V}{V_A} = \frac{951}{2205} + \frac{1003}{1875} = .97 < 1.0$$

O.K.

Case 3 ; No Good by Judgment

ANALYTICAL CALCULATIONS

Page C406 of

Subject
 Originator RA Hill Date 4-27-95
 Checker MA ISLAM Date 4/27/95

Check Anchors (Room 1)

Ref. Page C-88

$$\text{Case 1 ; Tens.} = -15576 \times 1.168 \times .234 + \frac{25679}{16} \\ = -2653 \#$$

$$T = \frac{-2653}{\sin 45^\circ (4 \text{ anch})} = 938 \#/\text{anch}$$

$$V = \sqrt{\left(\frac{10071 \times 1.168 \times .234}{8}\right)^2 + 938^2} = 999 \#/\text{anch}$$

$$\frac{T}{T_A} + \frac{V}{V_A} = \frac{938}{4950} + \frac{999}{4208} = .427$$

O.K.

$$\text{Case 2 ; Tens.} = -17421 \times 1.168 \times .242 + \frac{25679}{16} \\ = -3319 \#$$

$$T = \frac{-3319}{\sin 45^\circ (4 \text{ anch})} = 1174 \#/\text{anch}$$

$$V = \sqrt{\left(\frac{10853 \times 1.168 \times .242}{8}\right)^2 + 1174^2} = 1235 \#/\text{anch}$$

$$\frac{T}{T_A} + \frac{V}{V_A} = \frac{1174}{4950} + \frac{1235}{4208} = .531$$

Case 3 ; Need not check, stress has already failed.

APPENDIX D

2736-ZA BUILDING VENTILATION OPERABILITY EVALUATION

DESIGN CALCULATION

WHC-SD-CP-SA-026

REV 1 PAGE

(1) Drawing _____ (2) Doc. No. _____ (3) Page D2 of _____
(4) Building _____ (5) Rev. _____ (6) Job No. _____
(7) Subject _____
(8) Originator RA Miller Date 4-4-94
(9) Checker N. A. ISLAM Date 5/27/94

Exhaust Stack Analysis

(10)

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

DESIGN CALCULATION

WHC-SD-CP-SA-026

REV 1
REV 1

(1) Drawing _____ (2) Doc. No. _____ (3) Page REV 1 of PAGE D3
 (4) Building _____ (5) Rev. _____ (6) Job No. _____
 (7) Subject _____
 (8) Originator PA 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 Sh. 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

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

Ref. CVI 20369 Sh. 16

DESIGN CALCULATION

WHC-SD-CP-SA-026

REV 1 PAGE

(1) Drawing _____ (2) Doc. No. _____ (3) Page D4 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) Exhaust Stack

Spec. B-125-C1/H-2-27970

Duct Material:

$$186a = .0478''$$

carbon steel

ASTM A366 or A569 or
A570 or A611

$$F_y \text{ min.} = 25,000 \text{ psi}$$

Stiffening Angles:

$$4 \times 2 \times 2 \times \frac{1}{8} \text{ A36}$$

$$F_y = 36,000 \text{ psi}$$

Weld studs:

$$A108 \quad 1010 \text{ to } 1020$$

$$F_y = 26,000 \text{ psi}$$

(1) Drawing _____ (2) Doc. No. _____ (3) REV 55 PAGE _____ 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) 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

$$190 / \sqrt{25} = 38$$

$$b_e = 2t \times 38 = 3.6"$$

$$r_z \text{ for } L2 \times 2 \times \frac{1}{8} = .398$$

$$r_z \text{ for } L1.8 \times 1.8 \times .0478 \approx .35$$

$$\begin{aligned} \text{area} &= (1.8 + 1.8 - .0478) \cdot .0478 \\ &= .174 \text{ in}^2 \end{aligned}$$

$$I_y = \sum A r^2 = 4(.174)(17.5)^2 = 213 \text{ in}^4$$

$$S_y = I/c = 213 / 18 = 11.8 \text{ in}^3$$

$$I_x = \sum A r^2 = 4(.174)(10.5)^2 = 76.7 \text{ in}^4$$

$$S_x = I/c = 76.7 / 11 = 7.0 \text{ in}^3$$

DESIGN CALCULATION

WHC-SD-CP-SA-026

REV 1
REV 2

PAGE D6

- (1) Drawing _____ (2) Doc. No. _____ (3) Page DE of PAGE D6
 (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)

Moment Capacity of Duct

$$f_b \times S_b \quad \therefore f_b = \text{axial stress allowable of effective duct corner}$$

max. distance between side stiffeners = 30"

$$\frac{Kl}{r} = \frac{0.65(30")}{\approx .35} = 55.7$$

AISC 8th Ed / Table 3-36

$$F_a = 17.81 \text{ ksi}$$

$$F_a \times S_{bx} = \underline{124 \text{ in. kips}}$$

$$F_a \times S_{by} = \underline{210 \text{ in. kips}}$$

Shear Capacity of Duct

equals the compressive strength of the stiffening angles

2 x 2 x 1/8 pairs 36" long

AISC 8th Ed / Table 3-36

$$\frac{Kl}{r} = \frac{1.0(36)}{.398} = 90.45 \quad F_a = 14.15 \text{ ksi}$$

$$Cap = (14.15 \text{ ksi})(.484 \text{ si})(2 \times)$$

$$= \underline{13.7 \text{ K}}$$

DESIGN CALCULATION

WHC-SD-CP-SA-026

REV 1 REV 1 PAGE 07

(1) Drawing _____ (2) Doc. No. _____ (3) Page 07 of 07
 (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 MASON

Duct Stresses :

$$\text{Mass @ 2} = 435^\#$$

$$X \text{ accel. @2} = 1.648 g$$

$$Y \text{ accel. @2} = 1.818 g$$

$$\text{Moment}_x = 435^\# \times 1.648 g \times 60" = 43010 \text{ "}\cdot\#$$

$$\text{Moment}_y = 435^\# \times 1.818 g \times 60" = 47450 \text{ "}\cdot\#$$

$$\text{Shear}_x = 435^\# \times 1.648 = 717^\#$$

$$\text{Shear}_y = 435^\# \times 1.818 = 791^\#$$

Check strength :

$$M_x = 43 \text{ "}\cdot\text{K} < 124 \text{ "}\cdot\text{K}$$

$$M_y = 47 \text{ "}\cdot\text{K} < 124 \text{ "}\cdot\text{K}$$

$$V_x = .7^{\text{K}} < 13.7^{\text{K}}$$

$$V_y = .8^{\text{K}} < 13.7^{\text{K}}$$

$$M.S = 3.88 \quad \text{O.K.}$$

$$M.S = 1.64 \quad \text{O.K.}$$

$$M.S = 18.6 \quad \text{O.K.}$$

$$M.S = 16.1 \quad \text{O.K.}$$

DESIGN CALCULATION

WHC-SD-CP-SA-026

(1) Drawing _____ (2) Doc. No. _____ (3) Page 58 of 58
 (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) Duct Stress Check dynamic analysis by Design Guide

Duct Stresses:

$$\text{Mass @ 2} = 435 \#$$

$$X \& Y \text{ accel} = 1.35 g$$

$$\text{Moment}_{X \& Y} = \frac{Pl}{8} = \frac{435 \# \times 1.35g \times 126''}{8}$$

$$= 9250 \text{ ''}\cdot\#$$

$$\text{Shear}_{X \& Y} = \frac{P}{2} = \frac{435 \# \times 1.35g}{2} = 294 \#$$

Check Strength:

$$M = 9.3 \text{ ''}\cdot\text{K} < 124 \text{ ''}\cdot\text{K}$$

$$V = .3 \text{ K} < 13.7 \text{ K}$$

$$M.S. = 12.3 \quad \text{O.K.}$$

$$M.S. = 44.7 \quad \text{O.K.}$$

DESIGN CALCULATION

WHC-SD-CP-SA-026

REV 2 PAGE 9

(1) Drawing _____ (2) Doc. No. _____ (3) Page 9 of _____
 (4) Building _____ (5) Rev. _____ (6) Job No. _____
 (7) Subject _____
 (8) Originator RA Killa Date 4-5-94
 (9) Checker M.A. ISLAM Date 5/27/94

(10) Weld Stud Check

@ stiffening Δ s

$$\text{tension} = .5 F_y = 13,000 \text{ psi}$$

$$\text{shear} = .5 T_A = 6,500 \text{ psi}$$

$$\frac{3}{8}'' \text{ weld stud area} = .078 \text{ si}$$

$$T_A = 13,000 \times .078 = 1014 \text{ \#}$$

$$V_A = 6,500 \times .078 = 507 \text{ \#}$$

Max. shear force on bolts =

$$\text{x-dir. } \frac{717 \text{ \#}}{32 \text{ bolts}} = 22.4 \text{ \#} \quad \& \quad \text{y-dir. } \frac{791}{32 \text{ bolts}} = 24.7 \text{ \#}$$

Max tension force on bolts =

$$\text{x-dir. } \frac{43010 \text{ \#}}{38'' (7 \text{ bolts})} = 162 \text{ \#}$$

$$\text{y-dir } \frac{47450}{24'' (11 \text{ bolts})} = 180 \text{ \#}$$

$$T = 162 + 180 = 342 \text{ \#} < 1014 \text{ \#}$$

$$V = 22.4 + 24.7 = 47.1 \text{ \#} < 507 \text{ \#}$$

$$\frac{T}{T_A} + \frac{V}{V_A} = .43 < 1.0 \quad \boxed{MS = 1.32}$$

DESIGN CALCULATION

WHC-SD-CP-SA-026

(1) Drawing _____ (2) Doc. No. _____ (3) Page D10 of _____
 (4) Building _____ (5) Rev. _____ (6) Job No. _____
 (7) Subject _____
 (8) Originator RA Hilla Date 4-5-94
 (9) Checker M.A. ISLAM Date 5/27/94

(10) Embed. & Capacity

H-2-27966

Detail (16)

$f_c' = 3,000 \text{ psi}$

Bolt Capacities from
 WHC-SD-GN-DGS-30006 R1

$\frac{3}{8} \phi \times 3\frac{3}{4}'' \text{ LG w } 4\frac{3}{4}'' \text{ spacing}$
 in 3,500 psi conc.

$$P_A = 3740 \#$$

$$V_A = 1870 \#$$

$\frac{3}{8} \phi \times 4'' \text{ LG w } 8'' \text{ spacing}$
 in 3,000 psi conc.

$$P_A = 3740 \frac{\sqrt{3000}}{\sqrt{3500}} = \underline{\underline{3462 \#}}$$

$$V_A = 1870 \frac{\sqrt{3000}}{\sqrt{3500}} = \underline{\underline{1731 \#}}$$

DESIGN CALCULATION

WHC-SD-CP-SA-026

(1) Drawing _____ (2) Doc No. REV 0 PAGE _____ (3) Page 1 of 1
 (4) Building _____ (5) Rev. _____ (6) Job No. _____
 (7) Subject _____ REV 0 PAGE _____
 (8) Originator RA Miller Date 4-19-94
 (9) Checker M. A-ISLAM Date 5/27/94

(10) Embed R bolt loads:

$$V = \sqrt{\left(\frac{f_x}{4}\right)^2 + \left(\frac{f_z}{4}\right)^2}$$

$$= \sqrt{\left(\frac{1050}{4}\right)^2 + \left(\frac{746}{4}\right)^2}$$

$$= 322 \#$$

$$P = \frac{f_z}{4} + \frac{f_x (4\frac{3}{8})}{8(2)} + \frac{f_y (4\frac{3}{8})}{8(2)}$$

$$= 585 \# + 287 \# + 204 \#$$

$$= 1076 \#$$

$$f_x = 1050 \#$$

$$f_y = 746 \#$$

$$f_z = 2340 \#$$

$$\frac{V}{V_{all}} = \frac{322}{1731} = .186 \quad \frac{P}{P_{all}} = \frac{1076}{3462} = .31$$

From Interaction Graph

$$M.S. \cong 1.5$$

WELD:

THE ALL AROUND $\frac{1}{4}$ " FILLET WELD BETWEEN THE SNUBBER BRACKET AND THE EMBEDDED PLATE IS ACCEPTABLE BY INSPECTION.

DESIGN CALCULATION

WHC-SD-CP-SA-026

(1) Drawing _____ (2) Doc. No. _____ (3) Page REV 1 DIZ of PAGE
 (4) Building _____ (5) Rev. _____ (6) Job No. _____
 (7) Subject _____
 (8) Originator RA Miller 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 R 1

page 8-37

DESIGN CALCULATION

WHC-SD-CP-SA-026

(1) Drawing _____ (2) Doc. No. _____ (3) REV ² 513 PAGE _____ of _____
 (4) Building _____ (5) Rev. _____ (6) Job No. _____
 (7) Subject _____
 (8) Originator RA Killa Date 4-5-94
 (9) Checker M. A. ISLAM Date 5/27/94

(10) Support Strength Check
Top Support @ roof level

10- $\frac{3}{8}$ " anchors

from embed ϕ calc.
 $\frac{3}{8}$ " anchors have a
 shear allowable of:
 $V_A = 1731^\#$

Moment Capacity

X-dir $\frac{43010 \text{ "}\cdot\#}{36" (2 \text{ bolts})} = 597^\# < 1731^\#$
 $M.S. = 1.9$

Y-dir $\frac{47450 \text{ "}\cdot\#}{22" (3 \text{ bolts})} = 719^\# < 1731^\#$
 $M.S. = 1.4$

DESIGN CALCULATION

WHC-SD-CP-SA-026

(1) Drawing _____ (2) Doc. No. _____ (3) Page REV 2 of 4 PAGE
 (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 @

$$\begin{array}{lcl} X = 2500^{\#} & / & 7900^{\#} \\ Y = 1000^{\#} & / & 9700^{\#} \\ Z = 2000^{\#} & / & 10700^{\#} \end{array}$$

Actual loads are:

$$X(Y) = 769^{\#} < 7900^{\#}$$

$$Y(X) = 1050^{\#} < 9700^{\#}$$

$$Z = 2340^{\#} < 10700^{\#}$$

O.K.

Check Spring

From Mason Industries Data

$$\text{Rated load} = 450^{\#} > 183^{\#} \quad \text{O.K.}$$

EXHAUST DUCT MOUNTING & SPRING
(2736-ZA)

SNUBBER

1 EXHAUST DUCT MOUNTING & SPRING
(2736-ZA)

FLOOR

DESIGN CALCULATION

WHC-SD-CP-SA-026

(1) Drawing _____ (2) Doc. No. _____ (3) Page REV 1 DIG of PAGE
 (4) Building _____ (5) Rev. _____ (6) Job No. _____
 (7) Subject _____
 (8) Originator RAH Date 4-4-94
 (9) Checker M.A-ISLAM Date 5/27/94

EF-1-1, 2 Filter Housing Analysis

(10)

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 is recommended for use by the 30006 design guide.

1.35g

THE EXHAUST FAN/MOTOR ASSEMBLY AND THE FILTER HOUSING ASSY. HAVE A COMMON BASE FRAME SUPPORT. PFP OPERATIONS DESIGNED 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 BASED ON THE GENERIC BOUNDING SPECTRUM WHICH EXCEEDS THE SEISMIC DEMAND BASED ON THE GROUND RESPONSE SPECTRA AS SHOWN ON PAGES D20

RESULTS: ACCEPTABLE.

MIN. MARGIN OF SAFETY = 0.2 (EMBEDDED RIGID 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. 2736-2A Floor El. GRADE Room, Row/Col _____

Manufacturer, Model, Etc. (optional) ALADDIN HEATING CORPORATION

SEISMIC CAPACITY VS DEMAND

1. Elevation where equipment receives seismic input	<u>GRADE</u>
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
THE FANS & MOTORS ARE SC 3 BUT ARE BEING EVALUATED FOR SC 1 SEISMIC LOADS. USE 1.25 SPECTRA CURVES

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

DESIGN CALCULATION

WHC-SD-CP-SA-026

(1) Drawing _____ (2) Doc. No. _____ (3) Page 12 of 12 **REV 1 PAGE D21**
 (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) 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 $X = 1650$ $Y = 970$ $Z = 4050$

SSE Accelerations

maximums

Mass Pt. 7 $A_x = 1.420 g$

Mass Pt. 8 $A_y = 1.493 g$

Mass Pt. 1 $A_z = 1.961 g$

Ref. CVI 20369 sh. 27

WHC-SD-GN-DGS-30006 Accelerations

From Table Z-5

$A_x = A_y = .20g$ PGA Curve } $.34g$
 $A_z = .13g$ PGA Curve } peak

SSE accelerations are higher
and will be used from here-on.

DESIGN CALCULATION

WHC-SD-CP-SA-026

REV 1 PAGE D22 of
 (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#
 Y = 1690# } < 7900#
 Z = 4050# < 10700#

O.K.

DESIGN CALCULATION

WHC-SD-CP-SA-026

(1) Drawing _____ (2) Doc. No. _____ (3) Page REV 1 of 23 PAGE 023
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 (7) Subject _____
 (8) Originator R. A. Miller Date 4-18-94
 (9) Checker M. A. ISLAM Date 5/27/94

(10) Check Snubber to Frame bolts:

A307 bolts $\frac{5}{8}" \phi$
 $T_a = 6.1^k$
 $V_a = 3.1^k$ } allowable

$$V = \sqrt{\left(\frac{f_x}{2}\right)^2 + \left(\frac{f_z}{2}\right)^2}$$

$$= \sqrt{\left(\frac{1690}{2}\right)^2 + \left(\frac{4050}{2}\right)^2}$$

$$= 2,194^\# < 3,100^\# \text{ O.K.}$$

$$T = \frac{f_x}{2} + \frac{f_y(4.375)}{6.5"} + \frac{f_z(4.375)}{3"(2 \text{ bolts})}$$

$$= \frac{1690}{2} + \frac{1690(4.375)}{6.5} + \frac{4050(4.375)}{6}$$

$$= 4,936^\# < 6,100^\# \text{ O.K.}$$

$$M.S. = \frac{6100}{4936} - 1 = .24$$

$$f_x = 1690^\#$$

$$f_y = 1690^\#$$

$$f_z = 4050^\#$$

DESIGN CALCULATION

WHC-SD-CP-SA-026

(1) Drawing _____ (2) Doc. No. _____ (3) Page REV 1 024 of PAGE 024
 (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) Check Base ^{Embedded} PL

$$\text{Plate tension} = 4050^{\#}$$

$$\text{Plate shear} = 1690^{\#} \text{ ea direction}$$

$$P = \frac{4050}{4 \text{ bolts}} + \frac{1690^{\#} (4 \frac{3}{8})}{2 (8'')} \times 2 = 1937^{\#}$$

$$V = \frac{1690 + 1690}{4} = 845^{\#}$$

$$\frac{P}{P_A} = \frac{1937}{3462} = .56 \quad \frac{V}{V_A} = \frac{845}{1731} = .49$$

Check interaction chart on next page

O.K. MS $\cong$ 0.2

V_A & P_A are from Exhaust Stack Analysis

DESIGN CALCULATION

WHC-SD-CP-SA-026

REV ⁷/₂₅ PAGE
 (1) Drawing _____ (2) Doc. No. _____ (3) Page 025 of _____
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 (7) Subject _____
 (8) Originator RA Hille 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

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page 8-37

5/8" bolt

Emb. R

EXHAUST FAN & FILTER HOUSING BASE FRAME ANCHORS
(2736-ZA)

DESIGN CALCULATION

WHC-SD-CP-SA-026

(1) Drawing _____ (2) Doc. No. _____ REV 1 Page 1 of 1
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 (8) Originator RA Miller Date 4-18-94
 (9) Checker M. A. ISLAM Date 5/27/94

(10) FAN/MOTOR MOUNT BOLTS ;

5 Fan = 300#
 6 Pedestal = 150#
 7 Motor = 120#
 8 Drive = 30#
600# Ref. CUI 20369

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 Pedestal "6".

Field Dimensions

A307 bolts
 (ASSUME)

$$T_a = 6.1^K \quad V_a = 3.1^K$$

DESIGN CALCULATION

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 (7) Subject _____
 (8) Originator RA Miller 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 :

$$T = \frac{f_z}{5} + \frac{f_x(24")}{.38"(2 \text{ bolts})} + \frac{f_y(24")}{38(2)}$$

$$= 240 \# + 284 \# + 284 \#$$

$$= 808 \# < 6,100 \#$$

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

D29

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REV 1 PAGE

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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

<u>APPLIED LOAD</u> <u>POUNDS</u>	<u>MOVEMENT</u> <u>INCHES</u>	<u>OBSERVATION</u>
0	0.000	NEOPRENE TOUCHING BRACKET
400	0.121	
800	0.228	
1250	0.342	
1600	0.430	
2000	0.522	NEOPRENE BUSHING BOTTOMED OUT, AND SIDE PLATE ON OUTER BRACKET BEGAN TO DEFORM.
2500	0.628	
3000	0.694	
3500	0.777	
4000	0.857	
4500	0.948	INNER BRACKET BASE PLATE BEGAN TO DEFORM AROUND ANCHOR BOLT.
5000	1.026	
5500	1.114	
6000	1.195	
6500	1.271	
7000	1.358	MAXIMUM LOAD. ONE (1) BOTTOM ANCHOR BOLT SHEARED ON INNER BRACKET BASE PLATE.
7500	1.464	
7900		

SMITH-EMERY COMPANY

OBSERVATION OF SEISMIC SNUBBER AFTER TEST:

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- (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

<u>APPLIED LOAD</u> <u>POUNDS</u>	<u>MOVEMENT</u> <u>INCHES</u>	<u>OBSERVATIONS</u>
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 CLEARANCE 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.

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TEST No. 3 - 2 POSITION

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<u>APPLIED LOAD</u> <u>POUNDS</u>	<u>MOVEMENT</u> <u>INCHES</u>	<u>OBSERVATION</u>
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	INNER BRACKET BASE PLATE BEGAN TO DEFORM.
7000	0.581	SLIGHT BOW IN INNER BRACKET BASE PLATES AT ANCHOR BOLT.
8000	0.628	
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

George E. Battey

6 ADDRESSEE

File No.: 1875-77
Lab No.: L-75-1992

SMITH-EMERY COMPANY

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REV 1 PAGE

EF-1-1

Fan - Motor - Filter Unit

Field Notes

Snubber

2 - $\frac{5}{8}$ " bolts -

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REV 1 PAGE

EF-1-1

Fan - Motor - Filter Unit

Field Notes

DESIGN CALCULATION

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REV 2 PAGE

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(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 @ EMBEDDED 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) PAVID MFG. CO.

SEISMIC CAPACITY VS DEMAND

1. Elevation where equipment receives seismic input	@ GRADE
2. Elevation of seismic input below about 40' from grade	Y ☒ U
3. Equipment has fundamental frequency above about 8 Hz	☒ 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) ☒ N U
THE D-G IS SC 3 BUT IS BEING EVALUATED FOR SC1 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	☒ N U N/A
2. Main driver and driven equipment connected by a rigid support or skid	☒ N U N/A
3. Base vibration isolators adequate for seismic loads	☒ N U N/A
4. Attached lines have adequate flexibility	☒ N U N/A
5. Anchorage adequate (See checklist below for details)	☒ 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?	☒ N U N/A
- Is the intent of all the caveats met for Bounding Spectrum? ☒ N U N/A

ANCHORAGE

1. Appropriate equipment characteristics determined (mass, CG, natural freq., damping, center of rotation)	☒ N U N/A
2. Type of anchorage covered by GIP	☒ N U N/A
3. Sizes and locations of anchors determined	☒ N U N/A
4. Adequacy of anchorage installation evaluated (weld quality and length, nuts and washers, expansion anchor tightness, etc.)	☒ 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	☒ N U N/A

SCREENING EVALUATION WORK SHEET (SEWS)

Sheet 2 of 2

Equip. ID No. _____ Equip. Class 13 - Motor-GeneratorsEquipment Description DIESEL GENERATOR UNIT - 65 KWANCHORAGE (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	
<u>IS EQUIPMENT SEISMICALLY ADEQUATE?</u>	(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 DBE, 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. Deerna

Date:

6/3/94

DESIGN CALCULATION

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 (8) Originator RA Miller Date 4-19-94
 (9) Checker M. A. ISLAM Date 5/27/94

(10) Forces on diesel mounting bolts :

$$f_x = f_y = \frac{4160 \times 1g}{6 \text{ bolts}} = 693^{\#}$$

$$f_z = \frac{4160 \times 1g}{6} = 693^{\#}$$

$$\text{Shear } V = \sqrt{693^2 + 693^2} = 980^{\#} < 2000^{\#} \text{ O.K.}$$

$$\text{tension } T = 693^{\#} < 3900^{\#} \text{ O.K.}$$

$$I = \frac{980}{2000} + \frac{693}{3900} = .67 ; M.S. = \frac{1}{.67} = 1.49$$

Forces on snubber :

$$f_x = f_y = f_z = 1,040^{\#}$$

Ref. CVI 20370 Sht 98

From CVI Analysis Info

$$1,040^{\#} > \text{max capacity of Mason } \approx 1011 - 350 \text{ (350 lbs)}$$

$$* \text{Wt. of Diesel Gen.} = 1040^{\#} \times 4 \text{ snubbers} = 4160^{\#}$$

DESIGN CALCULATION

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(1) Drawing _____ (2) Doc. No. _____ (3) Page 39 of
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 (7) Subject _____
 (8) Originator RA Miller Date 4-19-94
 (9) Checker M.A. ISLAM Date 5/27/94

(10) Dieset Mounting

$\frac{1}{2}$ " SAE bolts

use A307
allowables

$V_a = 2.0K$

$T_a = 3.9K$

Diesel Frame

From CUI Information:

max acceleration = $1g$

max snubber load = 1,040 lb

Find Diesel Weight:

$$(1g)(1040^{\#})(4 \text{ snubbers}) = 4,160 \text{ lb}$$

DESIGN CALCULATION

WHC-SD-CP-SA-026

(1) Drawing _____ (2) Doc. No. _____ (3) Page REV 1 of 40 PAGE
 (4) Building _____ (5) Rev. _____ (6) Job No. _____
 (7) Subject _____
 (8) Originator RA Miller Date 4-19-94
 (9) Checker M. A. ISLAM Date 5/27/94

(10) Check Snubber to Frame Bolts:

$$\text{Shear } V = \sqrt{\left(\frac{f_x}{2}\right)^2 + \left(\frac{f_y}{2}\right)^2}$$

$$= \sqrt{\left(\frac{1040}{2}\right)^2 + \left(\frac{1040}{2}\right)^2}$$

$$= 735^\# < 2000^\# \text{ O.K.}$$

$$\text{Tension } T = \frac{f_y}{2} + \frac{f_z(4\frac{3}{8})}{6.5} + \frac{f_x(4\frac{3}{8})}{3(2)}$$

$$= 520^\# + 700^\# + 758^\#$$

$$= 1978^\# < 3900^\# \text{ O.K.}$$

$$I = \frac{735}{2000} + \frac{1978}{3900} = .87$$

$$M.S. = \frac{1}{.87} - 1 = .15$$

$$f_x = f_y = f_z = 1,040^\#$$

Check Embed ϕ :

steel anchor capacity;

$$T_a = .11(20000) = 2200^\#$$

$$V_a = .11(10000) = 1100^\#$$

Ref H-2-27966

DESIGN CALCULATION

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 (7) Subject _____
 (8) Originator RA Kelle Date 4-19-94
 (9) Checker M.A-ISLAM Date 5/27/94

(10) concrete shear cone capacity:

$$P_a = 3740^{\#} (.9 \text{ for } 3000 \text{ psi}) (.8 \text{ close spacing})$$

shear cone overlap

$$= 2690^{\#}$$

$$V_a = 1870^{\#} (.9 \text{ for } 3000 \text{ psi}) (1.0 \text{ close spacing})$$

$$= 1683^{\#}$$

$\sqrt{\frac{f_c'}{3500}}$

Shear load

$$V = \sqrt{\left(\frac{f_x}{4 \text{ studs}}\right)^2 + \left(\frac{f_z}{4}\right)^2}$$

$$= 368^{\#}$$

steel capacity:

$\frac{3}{8}$ stud A307
 tension = 2200[#]
 shear = 1100[#]

Tension load

$$P = \frac{f_y}{4} + \frac{f_x (4 \frac{3}{8})}{2 \frac{1}{2}'' (2)} + \frac{f_z (4 \frac{3}{8})}{11'' (2 \text{ bolts})}$$

$$= 260 + 910 + 207$$

$$= 1377^{\#}$$

$$\frac{P}{P_{all}} = \frac{1377}{2200} = .63 \quad \frac{V}{V_{all}} = \frac{368}{1100} = .33$$

From Interaction graph: M.S. $\approx$ 0.25

WELD TO EMBED:

THE $\frac{1}{4}$ " FIL. WELD AT SNUBBER BASE TO EMBED ϕ . IS ACCEPTABLE BY INSPECTION.

DESIGN CALCULATION

WHC-SD-CP-SA-026

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 (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

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2-1011-350
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**

TYPE Z-1011 LOAD RATINGS and DIMENSIONS

Size	Load Rating	A	AB	B	C	D	E	F	G	T
360	350	3-1/8	3/8	7-1/2	1-1/2	1/2	3	2-1/2	3	1/4
1260	1250	3-3/8	1/2	8-1/4	3	5/8	6	4-3/8	4-3/8	3/8
360	169	79	10	191	38	13	78	64	76	6
1260	568	86	13	210	76	16	152	111	111	10

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.

DWN

CHKD

DATE

DWG NO

DIESEL ENGINE BASE
(2736-ZA)

3/8" ϕ bolt

3/8" ϕ bolt

Emb. PL

DIESEL ENGINE BASE (2736-ZA BLDG.)

REINFORCED
CONCRETE WALL

D-G. CONTROL BOX

DIESEL ENGINE (2736-ZA BLDG)

Diesel Snubber

D46

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REV 1 PAGE

Field Notes

Diesel

Field Notes

CVI 20370		EQUIPMENT TITLE Diesel Generator Unit				EQUIPMENT NO.			COST
DATE 6-1-78		VENDOR Cummins Diesel							PROJECT NO.
P. O. NUMBER RHO P.O. #W7N-XSB-11337		EQUIPMENT MANUFACTURER							BLOG NO. 21.3-ZA
SHEET NO.	VENDOR DWG.	SUPERSEDED BY HAN. DWG.	REV.	HAN. MODIFIED DWG.	CURVES	VENDOR SPEC.	INSTR.	PARTS LIST	MISC.
116	RHO P.O. #W7N-XSB-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								
	2. Universal Engine Heater Thermostat - Specs., Wiring Diagram								
	3. LaMarche Battery Chargers - Specs., Parts List								
	4. White Engines, Inc. - Diesel Engines - Operator's Manual								
☐ COMPLETE ☐ PARTIAL		APPROVED: D. S. Beetle				FOR DESIGN FOR CONTRACTOR			
COPIES	DISTRIBUTION	ADDRESS	COPIES	DISTRIBUTION	ADDRESS	COPIES	DISTRIBUTION	ADDRESS	
2	CVI Files	RHO/FB	2	DL Eisele	RHO/234-5	0	JM Johnston	Vitro 31-M	WHC-SD-QP-SA-026 REV 1 PAGE D48
1	Ill Jacques	RHO/271-T	1	RJ Thomas	RHO/234-5	0	DS Beetle	Vitro 18	
1	*DL Chase	RHO/2704-W	1	LH Rodgers	RHO/234-5Z, TR#1				
	*Plus extras		1	Central Files	JAJ/1262				

PERMANENT FILE

CVI. 20370 SHT. 98

P.O. No. _____

DATE 6-1-78 Bldg. 2736-2A

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
Generator Sales

GF:mp

CVI. 20370 SHT. 99
P.O. No. _____
DATE 6-1-78 Bldg. 2736-24
E.P.N. _____

PSEUDO RELATIVE RESPONSE VELOCITY, S_v IN./SEC

RESPONSE SPECTRA,
SAFE SHUTDOWN EARTHQUAKE

ATTACHMENT "A"

DESIGN CALCULATION

WHC-SD-CP-SA-Q26

(1) Drawing _____ (2) Doc. No. _____ (3) Page REV 1 D51 of PAGE
(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 approximately 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.

DESIGN CALCULATION

WHC-SD-CP-SA-026

(1) Drawing _____ (2) Doc. No. _____ (3) Page REV 1 of 52 PAGE
 (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) In-Line Displacement Capacity

$$I_b = \frac{(28'' + 28'' + 30'' + 30'')(\cdot 0149'')^3}{12} = .000032 \text{ in}^4 \text{ @ knife edge}$$

$$S_b = \frac{I_b}{\cdot 0149} \left(\frac{12}{6} \right) = .00429 \text{ in}^3$$

$$F_b = 1.7 (.75 F_y)$$

$$F_b = 45.9 \text{ ksi}$$

1.7 is increase allowed by UCL
 .75 is AISC factor for rect. sect.

$$F_y = 36,000 \text{ psi}$$

$$M = \frac{Pl}{2} \quad 2\Delta = 2 \frac{Pl^3}{12EI}$$

AISC 9th Ed
 diagram 23
 pg 2-303

DESIGN CALCULATION

WHC-SD-CP-SA-026

(1) Drawing _____ (2) Doc. No. _____ (3) Page REV 2 of 53 PAGE
 (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

$$(10) \quad M = F_b S_b = \frac{Pl}{2}$$

$$M = 45.9(.00429) = \frac{P(4")}{2}$$

$$M = 0.197 = 2P \quad P = 0.098^K$$

$$\Delta = \frac{Pl^3}{12EI} = \frac{98^{\#}(4)^3}{12 E (.000032)} = .563"$$

$$2\Delta = 1.13" > 0.216" \quad \text{O.K.}$$

Lateral Disp. Capacity

$$l = 1" + 4" + 4" + 1"$$

$$\Delta = \frac{1.2 Pl}{AE_s} = \frac{1.2 P(10")}{(.0149 \times 30") 12E6} = .0000224 P$$

$$F_v = 1.4(.4 F_y) = 20.16 \text{ ksi}$$

$$f_v = P \div A \quad P = f_v A$$

DESIGN CALCULATION

WHC-SD-CP-SA-026

REV 1 PAGE 054

(1) Drawing _____ (2) Doc. No. _____ (3) Page 054 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

$$^{(10)} P = f_v A = 20.16 \text{ ksi} (.0149 \times 30")$$

$$= 9.01 \text{ K}$$

$$\Delta = \frac{1.2 P l}{A E_s} = \frac{1.2 (10.94^{\text{K}}) (10")}{(.0149 \times 30) 12 E_6} \times 1000 \frac{\#}{\text{K}}$$

$$= .024" < 0.171" \quad \underline{\text{No Good}}$$

$$M.S. = \frac{.024}{.171} - 1 = -.86$$

shear tearing may occur.

The thick portion of the duct ($\frac{3}{8}"$ R)
 should be checked for capacity.

$$Wt. = \frac{3}{8}" \times (44" \times 28" \times 2) \times 60" \times .283 \text{ pci} = 917^{\#}$$

$$EQ \text{ Load} = 1.35 S_g W = 1238^{\#}$$

$$\text{lateral load} = 1238^{\#}$$

$$\text{vertical load} = 917^{\#} + \frac{2}{3} (1238) = 1742^{\#}$$

flange & bolts are embedded 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

WHC-SD-CP-SA-026

REV 1 PAGE

(1) Drawing _____ (2) Doc. No. _____ (3) Page D55 of _____
 (4) Building _____ (5) Rev. _____ (6) Job No. _____
 (7) Subject _____
 (8) Originator RA Hill Date 5-27-94
 (9) Checker M. A. ISLAM Date 5/27/94

(10)

Duct Bending

$$I = \sum A r^2$$

$$I_x = 8(13)^2 \times 4 = 5408 \text{ in}^4$$

$$I_y = 8(21)^2 \times 4 = 14112 \text{ in}^4$$

$$f_{bx} = \frac{(M_x)c}{I} = \frac{1742 \times 60 \times 13}{5408} = 251 \text{ psi}$$

$$f_{by} = \frac{(M_y)c}{I} = \frac{908 \times 60 \times 21}{14112} = 81 \text{ psi}$$

$$\text{Interaction} = \frac{251 + 81}{45.9 \times 10^3} = .007$$

Very low Stresses

Duct will not fail.

assumed effective section base on

$$b/t = 190/\sqrt{F_y}$$

AISC 9th Ed Table BS.1

EXHAUST DUCT FROM 2736-Z TO 2736-ZA

APPENDIX E

**DYNAMIC EVALUATION OF
PLUTONIUM VAULT
SEISMIC SHOCK SPECTRUM**

DESIGN ANALYSIS

Revision 1
Page No. E-2

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 /JRW/ 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 translational (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.

DESIGN ANALYSIS

Revision 1Page No. E-3

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 2/18/95 J. J. W. By Gary R. Wagenblast

Location PFP

Revised

By

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	1	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	1	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

DESIGN ANALYSIS

Revision 1
Page No. E-4

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 12/8/95 <i>MAW</i> By Gary R. Wagenblast
Location PFP	Revised By

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 frequency 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 $\pm 15\%$ 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 $\pm 15\%$ 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 $\pm 10\%$.

Figure E-1. Top View of SASSI Quarter Model of 2736-Z.

ANSYS 5.0 A
FEB 16 1995
11:39:44
PLOT NO. 3
ELEMENTS
ESYS NUM

XV =1
YV =-1
ZV =1
DIST=24.956
XF =15
YF =-17.085
ZF =4.995
VUP =Z
CENTROID HIDDEN

QUARTER PVAULT MODEL (PVHOU5.INP 1/30/95 CJM)

1

ANSYS 5.0 A
 FEB 16 1995
 10:52:17
 PLOT NO. 2
 ELEMENTS
 TYPE NUM

XV =-0.967208
 YV =-0.81116
 ZV =-1.186
 DIST=25.509
 XF =15
 YF =-17.085
 ZF =4.995
 VUP =Z
 A-ZS=172.145
 PRECISE HIDDEN

Figure E-2. Bottom View of SASSI Quarter Model of 2736-Z.

QUARTER PVAULT MODEL (PVHOU5.INP 1/30/95 CJM)

1

QUARTER PVAULT MODEL (PVHOU5.INP 1/30/95 CJM)

ANSYS 5.0 A
FEB 16 1995
11:09:59
PLOT NO. 7
ELEMENTS
ESYS NUM

ZV =-1
DIST=18.794
XF =15
YF =-17.085
ZF =4.995
VUP =Z
A-ZS=-90
PRECISE HIDDEN

Figure E-3. Bottom View of SASSI Quarter Model of 2736-Z.

Figure E-4. Top View of SASSI Model With Element Shrink.

ANSYS 5.0 A
FEB 16 1995
11:45:32
PLOT NO. 5
ELEMENTS
ESYS NUM
XV =1
YV =-1
ZV =1
DIST=24.956
XF =15
YF =-17.085
ZF =4.995
VUP =Z
PRECISE HIDDEN

QUARTER PVAULT MODEL (PVH005.INP 1/30/95 CJM)

1

ANSYS 5.0 A
 FEB 16 1995
 10:28:12
 PLOT NO. 3
 ELEMENTS
 TYPE NUM

 XV =1
 YV =-1
 ZV =1
 DIST=24.956
 XF =15
 YF =-17.085
 ZF =4.995
 VUP =Z
 CENTROID HIDDEN

Figure E-5. Top View of SASSI Model With Node Numbering.

QUARTER PVAULT MODEL (PVHOU5.INP 1/30/95 CJM)

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.

DESIGN ANALYSIS

Revision

1

Page No.

E-19

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

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

```

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

```

DESIGN ANALYSIS

Revision 1Page No. E-20

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 /JLE 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

DESIGN ANALYSIS

Revision 1Page No. E-21

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 <u>2/21/95</u> <u>MM</u> 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

DESIGN ANALYSIS

Client	WO/Job No.
Subject PLUTONIUM VAULT, BLDG. NO. 2736-Z	Date 12/20/94
SDC 4.1, Rev. 12, TIME HISTORY #1 FILE	By Carleton J. Moore
Location PFP	Checked 2/21/95 JRU By Gary R. Wagenblast
	Revised By

-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

DESIGN ANALYSIS

Revision 1Page No. E-23

Client	WO/Job No.
Subject PLUTONIUM VAULT, BLDG. NO. 2736-Z	Date 12/20/94
SDC 4.1, Rev. 12, TIME HISTORY #1 FILE	By Carleton J. Mo
Location PFP	Checked <i>2/21/95 /mu</i> By Gary R. Wagenblast
	Revised By

-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

DESIGN ANALYSIS

Revision 1Page No. E-24

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/RLW		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

DESIGN ANALYSIS

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 ²12/25/94 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				

DESIGN ANALYSIS

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.
 0

WESTINGHOUSE HANFORD COMPANY

Calc. No. WHC-SD-CP-SA-026

DESIGN ANALYSIS

Revision 1

Page No. E-27

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 4/21/95 AKW By Gary R. Wagenblast

Location PFP

Revised

By

1 PVAULT QUARTER MODEL - POINT
2 1.0
0

DESIGN ANALYSIS

Revision 1Page No. E-28

Client	WO/Job No.
Subject PLUTONIUM VAULT, BLDG. NO. 2736-Z	Date 1/30/95
SASSI HORIZONTAL SEISMIC HOUSE FILE	Checked <u>2/21/95</u> By Gary R. Wagenblast
Location PFP	Revised By

1 QUARTER PVAULT MODEL (PVH05.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	

DESIGN ANALYSIS

Revision 1Page No. E-29

Client	WO/Job No.
Subject PLUTONIUM VAULT, BLDG. NO. 2736-Z	Date 1/30/95
SASSI HORIZONTAL SEISMIC HOUSE FILE	Checked <i>Thurs</i> <i>Alu</i> 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

DESIGN ANALYSIS

Revision 1Page No. E-30

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 ^{2/1/95} / 1/2/95		By Gary R. Wagenblast
Location PFP							Revised		By
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

DESIGN ANALYSIS

Revision 1Page No. E-31

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 ^{2/1/95} 2/1/95 ^{2/2/95}	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	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

DESIGN ANALYSIS

Revision 1Page No. E-32

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 J.L.W.		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	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

DESIGN ANALYSIS

Revision

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Page No.

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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 *new*

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	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

DESIGN ANALYSIS

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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 2/11/95 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

DESIGN ANALYSIS

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 2/1/95 JAW		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	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		

DESIGN ANALYSIS

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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 1/21/95 JRW By Gary R. Wagenblast
Location PFP	Revised By

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
2	10	9	3		1
3	3	9	8		1
4	6	2	3		1
5	6	8	7		1
6	8	6	3		1
7	10	14	13	9	1
8	9	13	12	8	1
9	14	18	17	13	1
10	13	17	16	12	1
11	18	19	22	21	1
12	21	17	18		1
13	16	17	21		1
14	22	27	26	21	1
15	26	25	21		1
16	21	25	24		1
17	20	15	16	21	1
18	23	20	21	24	1
19	26	30	29	25	1
20	25	29	28	24	1
21	30	45	44	29	1
22	29	44	43	28	1
23	46	66	65	45	1
24	65	44	45		1
25	44	65	43		1
26	66	83	82	65	1
27	43	54	42		1
28	54	43	65		1
29	64	54	65		1
30	74	64	65		1
31	65	82	81	74	1
32	2	6	5	1	1
33	1	5	97	92	1
34	54	64	63	53	1
35	64	74	73	63	1
36	92	97	96	91	1
37	53	63	62	52	1
38	63	73	72	62	1
39	91	96	90		1
40	96	106	105	90	1
41	118	125	124	117	1
42	125	134	133	124	1
43	41	52	61	40	1
44	52	62	61		1
45	62	72	61		1
46	72	80	79	61	1
47	95	89	90		1
48	104	95	90	105	1
49	123	116	117	124	1
50	132	123	124	133	1
51	51	39	40	61	1
52	60	51	61		1
53	71	60	61		1
54	78	71	61	79	1
55	89	95	94	88	1
56	51	60	59	50	1
57	60	71	70	59	1
58	88	94	93	87	1
59	50	59	58	49	1
60	59	70	69	58	1
61	87	93	86		1
62	102	93	103		1
63	93	102	86		1

DESIGN ANALYSIS

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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 J.R.W. By Gary R. Wagenblast

Location PFP

Revised

By

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

DESIGN ANALYSIS

Revision 1Page No. E-38

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 <u>2/21/95</u> <u>HR</u> By Gary R. Wagenblast
Location PFP	Revised By

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

DESIGN ANALYSIS

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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} ^{2/21/95} By Gary R. Wagenblast
Location PFP	Revised By

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

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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
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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

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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 JRM By Gary R. Wagenblast

Location PFP

Revised

By

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

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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 <i>1/31/95</i> By Gary R. Wagenblast
Location PFP	Revised By

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			

WESTINGHOUSE HANFORD COMPANY

WHC-SD-CP-SA-026
Calc. No.

DESIGN ANALYSIS

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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 JLR

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					

WESTINGHOUSE HANFORD COMPANY

Calc. No. WHC-SD-CP-SA-026

DESIGN ANALYSIS

Revision 1

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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 <u>2/2/95</u> <u>[Signature]</u> By Gary R. Wagenblast
Location PFP	Revised By

1	PVAULT		
1	1	1	
0	0.	0.	0.

WESTINGHOUSE HANFORD COMPANY

Calc. No. WHC-SD-CP-SA-026

DESIGN ANALYSIS

Revision 1

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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 <i>[Signature]</i> 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	

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Client	WO/Job No.
Subject PLUTONIUM VAULT, BLDG. NO. 2736-Z	Date 1/30/95
SASSI HORIZONTAL SPECTRUM MOTION WALL FILE	By Carleton J. Moore
Location PFP	Checked 2/21/95 By Gary R. Wagenblast
	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

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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 0.063157 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

DESIGN ANALYSIS

Revision 1Page No. E-47

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 ^{2/11/95} By Gary R. Wagenblast		
Location PFP	Revised	By

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
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 0.025001 0.027623 0.037425 0.048241 0.046716 0.027473-0.000753-0.024814 53
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 0.140961 0.145646 0.119410 0.076676 0.036538 0.008909-0.008935-0.023543 59
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 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
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 -0.003677 0.004598 0.019240 0.035570 0.046429 0.043462 0.022793-0.010438 70
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 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
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 -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

DESIGN ANALYSIS

Revision 1
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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
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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
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-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
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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
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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
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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

DESIGN ANALYSIS

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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

0.063093	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
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-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
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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

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Client	WO/Job No.
Subject PLUTONIUM VAULT, BLDG. NO. 2736-Z	Date 1/30/95
SASSI HORIZONTAL SPECTRUM MOTION WALL FILE	By Carleton J. Moore
Location PFP	Checked <i>h114c jlw</i> By Gary R. Wagenblast
	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

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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 JAW 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

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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 J.R.W. By Gary R. Wagenblast
Location PFP	Revised By

1 PVAULT QUARTER MODEL - POINT
2 1.0
0

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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 *Alw* 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	
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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	

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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 *[Signature]* 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

DESIGN ANALYSIS

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 2/27/95 PAUL By Gary R. Wagenblast

Location PFP

Revised

By

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

DESIGN ANALYSIS

Revision 1Page No. E-56

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 J.R.W.		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

DESIGN ANALYSIS

Revision 1Page No. E-57

Client	WO/Job No.
Subject PLUTONIUM VAULT, BLDG. NO. 2736-Z	Date 2/7/95
SASSI VERTICAL SEISMIC HOUSE FILE	By Carleton J. Moore
Location PFP	Checked 2/21/95 <i>MRW</i> By Gary R. Wagenblast
	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

DESIGN ANALYSIS

Revision 1
Page No. E-58

Client	WO/Job No.
Subject PLUTONIUM VAULT, BLDG. NO. 2736-Z	Date 2/7/95
SASSI VERTICAL SEISMIC HOUSE FILE	By Carleton J. Moore
Location PFP	Checked 2/21/95 JLR By Gary R. Wagenblast
	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

DESIGN ANALYSIS

Revision 1Page No. E-59

Client	WO/Job No.
•Subject PLUTONIUM VAULT, BLDG. NO. 2736-Z	Date 2/7/95
SASSI VERTICAL SEISMIC HOUSE FILE	By Carleton J. Moore
Location PFP	Checked 2/21/95 JRW By Gary R. Wagenblast
	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	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

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Client	WO/Job No.
Subject PLUTONIUM VAULT, BLDG. NO. 2736-Z	Date 2/7/95
SASSI VERTICAL SEISMIC HOUSE FILE	By Carleton J. Moore
Location PFP	Checked 2/22/95 J2W By Gary R. Wagenblast
	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		

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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 *AW* 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

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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 R/W 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

DESIGN ANALYSIS

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} *ARW* By Gary R. Wagenblast

Location PFP

Revised

By

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

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Client	WO/Job No.
Subject PLUTONIUM VAULT, BLDG. NO. 2736-Z	Date 2/7/95
SASSI VERTICAL SEISMIC HOUSE FILE	By Carleton J. Moore
Location PFP	Checked 2/21/95 JRM By Gary R. Wagenblast
	Revised By

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

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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 <u>2/21/95</u> <u>ALW</u>	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

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Client	WO/Job No.
Subject PLUTONIUM VAULT, BLDG. NO. 2736-Z	Date 2/7/95
SASSI VERTICAL SEISMIC HOUSE FILE	By Carleton J. Moore
Location PFP	Checked 2/21/95 <i>new</i> By Gary R. Wagenblast
	Revised By

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

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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 J/RW By Gary R. Wagenblast
Location PFP	Revised By

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

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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 JRM 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					

WESTINGHOUSE HANFORD COMPANY

Calc. No. WHC-SD-CP-SA-026

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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 JRW	By Gary R. Wagenblast
Location PFP	Revised	By

1 PVAULT
1 1 1
0 0. 0. 0.

Calc. No. WHC-SD-CP-SA-026

Revision 1

WO/Job No.

By Carleton J. Moore

By

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	

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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 <i>AW</i>	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

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0.001862 0.001745 0.001315 0.001024 0.000937 0.000719 0.000134-0.000672	3
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-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
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-0.017790-0.015948-0.017293-0.021629-0.024788-0.022975-0.017469-0.014244	12
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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
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-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

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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 <i>2/11/95 HAW</i>	By Gary R. Wagenblast
Location PFP	Revised	By
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		

DESIGN ANALYSIS

Revision 1Page No. E-73

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 <i>[Signature]</i>	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

DESIGN ANALYSIS

Revision 1Page No. E-74

Client	WO/Job No.	By
Subject PLUTONIUM VAULT, BLDG. NO. 2736-Z	Date 2/7/95	Carleton J. Moore
SASSI VERTICAL ROOF MOTION SPECTRUM FILE	Checked 2/21/95 By Gary R. Wagenblast	
Location PFP	Revised	By

-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
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 -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
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 0.047346 0.048045 0.046080 0.046854 0.052971 0.062985 0.072311 0.075907 179
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 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
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 -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
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 -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

DESIGN ANALYSIS

Calc. No.

Revision

Page No.

1E-75

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

APPENDIX F

SEISMIC INTERACTION WALKDOWN & EVALUATION RESULTS
MISCELLANEOUS INFORMATION

1. AREA SUMMARY SHEET

Facility <u>PFP</u> Building <u>2736-ZB</u> Room <u>636</u> Floor Elevation <u>@ grade</u>	
Seismic Input at Floor (horizontal, 5% damping):	Peak <u>0.42 g</u> , ZPA <u>0.20 g</u>
Seismic Input at Floor (vertical, 5% damping):	Peak <u>0.28 g</u> , ZPA <u>0.13 g</u>
Area Summary Sheet 1 of <u>4</u> Total Number of Sheets in Area Walkdown Package <u>9</u>	
Walkdown Start Date <u>3/30/95</u>	
Commodity Review Walkdown Sheets Attached:	Number of Sheets
▪ Piping and Tubing	<u>1</u>
▪ Raceways	<u>1</u>
▪ HVAC	<u>1</u>
▪ Equipment and Miscellaneous Commodities	<u>1</u>
Explain N/A's Entered Above, if Any: <u>NONE</u>	
Total Number of Candidates Identified in Area:	<u>1</u>
Commodity	Number of Candidates
▪ Piping and Tubing	<u>0</u>
▪ Raceways	<u>0</u>
▪ HVAC	<u>1</u>
▪ Equipment and Miscellaneous Commodities	<u>0</u>
Description of Revision:	
Revision <u>0</u>	
Team Leader <u>E.C. Oconnor</u>	Print <u>E.C. Oconnor</u> Date <u>3/30/95</u>
Team Member <u>R.J. Thomas</u>	Print <u>R.J. THOMAS</u> Date <u>3/30/95</u>
Team Member <u>M.A. Islam</u>	Print <u>M.A. ISLAM</u> Date <u>3/30/95</u>
Team Member _____	Print _____ Date _____
Area Walkdown Performed by Reviewer? Yes ☐ , No ☐	
Reviewer _____	Print _____ Date _____

AREA SUMMARY SHEET 2 OF 4

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 <u>PPF</u> Building <u>2736-28</u> Equip. ID <u>REPACKAGING GLOVES</u> Floor Elev. <u>@ GRANGE #1</u>																																																		
	Anchorage and Miscellaneous Attributes Evaluation Sheet <u>7</u> of <u>12</u>																																																		
	<u>AREA SUMMARY SHEET</u>																																																		
J	<table border="0"> <tr> <th>Anchorage Attribute Review</th> <th>Attribute Reviewed</th> </tr> <tr> <td colspan="2"><u>Expansion Anchor Review</u></td> </tr> <tr> <td>a. Spacing, edge distance and concrete cracks reviewed.</td> <td><u>OK</u></td> </tr> <tr> <td>b. Embedment and nuts bottomed out reviewed.</td> <td><u>N/A</u></td> </tr> <tr> <td>c. Verify expansion anchors are not used to anchor rotating equipment</td> <td><u>OK</u></td> </tr> <tr> <td>d. Tightness check, torque to 16-18 ft-lbs for 5/8 bolt (<u>SEE COMMENTS</u>)</td> <td><u>OK</u></td> </tr> <tr> <td colspan="2"><u>Welded Anchorage Review</u></td> </tr> <tr> <td>e. Welded anchorage reviewed.</td> <td><u>N/A</u></td> </tr> <tr> <td colspan="2"><u>Unistrut Anchorage Review</u></td> </tr> <tr> <td>f. Channel nuts spot checked for alignment of nut grooves with channel?</td> <td><u>N/A</u></td> </tr> <tr> <td colspan="2"><u>Richmond Inserts</u></td> </tr> <tr> <td>g. Non-Seismic commodities anchored with Richmond Inserts identified?</td> <td><u>N/A</u></td> </tr> <tr> <td colspan="2"><u>General Anchorage Attributes</u></td> </tr> <tr> <td>h. Gaps between attachments and concrete surface generally $\leq \frac{1}{4}$ inch.</td> <td><u>OK</u></td> </tr> <tr> <td>i. Bolts reviewed for full thread engagement or substantial thread engagement for light for lightly loaded anchors.</td> <td><u>OK</u></td> </tr> <tr> <td>j. Anchorage reviewed for substantial rust or corrosion.</td> <td><u>OK</u></td> </tr> <tr> <td>k. Anchorage reviewed for small washers on thin sheet metal.</td> <td><u>N/A</u></td> </tr> <tr> <td>l. Anchorage reviewed for extremely thin equipment base framing.</td> <td><u>N/A</u></td> </tr> <tr> <td>m. Anchorage reviewed for missing nuts, bolts or washers.</td> <td><u>OK</u></td> </tr> <tr> <td>n. Anchorage reviewed for non-positive anchorage configurations.</td> <td><u>OK</u></td> </tr> <tr> <td>o. Based on engineering judgement, anchorage appears adequate.</td> <td><u>OK</u></td> </tr> <tr> <td>p. Other concerns.</td> <td><u>OK</u></td> </tr> <tr> <td colspan="2"><u>Concrete strength and Bolt Type</u></td> </tr> <tr> <td>q. Concrete strength <u>4,000</u> psi per drawing <u>H-2-80116</u></td> <td><u>OK</u></td> </tr> <tr> <td>r. Anchor bolt type <u>5/8" x 6" DROP-IN</u> per inspection <u>drawing no. H-2-80174</u></td> <td><u>OK</u></td> </tr> </table>	Anchorage Attribute Review	Attribute Reviewed	<u>Expansion Anchor Review</u>		a. Spacing, edge distance and concrete cracks reviewed.	<u>OK</u>	b. Embedment and nuts bottomed out reviewed.	<u>N/A</u>	c. Verify expansion anchors are not used to anchor rotating equipment	<u>OK</u>	d. Tightness check, torque to 16-18 ft-lbs for 5/8 bolt (<u>SEE COMMENTS</u>)	<u>OK</u>	<u>Welded Anchorage Review</u>		e. Welded anchorage reviewed.	<u>N/A</u>	<u>Unistrut Anchorage Review</u>		f. Channel nuts spot checked for alignment of nut grooves with channel?	<u>N/A</u>	<u>Richmond Inserts</u>		g. Non-Seismic commodities anchored with Richmond Inserts identified?	<u>N/A</u>	<u>General Anchorage Attributes</u>		h. Gaps between attachments and concrete surface generally $\leq \frac{1}{4}$ inch.	<u>OK</u>	i. Bolts reviewed for full thread engagement or substantial thread engagement for light for lightly loaded anchors.	<u>OK</u>	j. Anchorage reviewed for substantial rust or corrosion.	<u>OK</u>	k. Anchorage reviewed for small washers on thin sheet metal.	<u>N/A</u>	l. Anchorage reviewed for extremely thin equipment base framing.	<u>N/A</u>	m. Anchorage reviewed for missing nuts, bolts or washers.	<u>OK</u>	n. Anchorage reviewed for non-positive anchorage configurations.	<u>OK</u>	o. Based on engineering judgement, anchorage appears adequate.	<u>OK</u>	p. Other concerns.	<u>OK</u>	<u>Concrete strength and Bolt Type</u>		q. Concrete strength <u>4,000</u> psi per drawing <u>H-2-80116</u>	<u>OK</u>	r. Anchor bolt type <u>5/8" x 6" DROP-IN</u> per inspection <u>drawing no. H-2-80174</u>	<u>OK</u>
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	<p>Comments:</p> <p>NW CORNER BOLT OF BSA-IN MOVED $\frac{1}{8}$ TURN THEN CLICKED/SET</p> <p>+ + + + +</p> <p>+ + (N) + + +</p> <p>PLAN + + + + +</p> <p>MOVED 1/8 TURN</p> <p>ALL OTHERS ARE TIGHT</p>																																																		
M	<table border="0"> <tr> <td>Team Leader/Date</td> <td><u>E.C. Oconnor</u></td> <td>/</td> <td><u>1-5-95</u></td> </tr> <tr> <td>Team Member/Date</td> <td><u>R.J. Thomas</u></td> <td>/</td> <td><u>1-5-95</u></td> </tr> <tr> <td>Team Member/Date</td> <td><u>SK Jambh</u></td> <td>/</td> <td><u>1/5/95</u></td> </tr> <tr> <td>Team Member/Date</td> <td><u>MA Islam</u></td> <td>/</td> <td><u>1/5/95</u></td> </tr> </table>	Team Leader/Date	<u>E.C. Oconnor</u>	/	<u>1-5-95</u>	Team Member/Date	<u>R.J. Thomas</u>	/	<u>1-5-95</u>	Team Member/Date	<u>SK Jambh</u>	/	<u>1/5/95</u>	Team Member/Date	<u>MA Islam</u>	/	<u>1/5/95</u>																																		
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2. PIPING AND TUBING

Facility <u>PFP</u> Building <u>2736-2B</u>		Room <u>636</u> Floor Elevation <u>@ Grade</u>	
Piping and Tubing Evaluation Sheet 1 of <u>1</u>			
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: <u>0</u>			
Candidate Number	No. Sheets	Candidate Number	No. Sheets
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
Comments:			
① 2"φ SCH 40 SS. PIPE BRANCHED OUT FROM 8"φ DUCT (t _a .125"). SEE HVAC EVALUATION SHEET FOR FURTHER DETAIL.			
Team Leader/Date <u>E.C. O'Connell</u> / <u>3/30/95</u>			
Team Member/Date <u>R. J. Thomas</u> / <u>3/30/95</u>			
Team Member/Date _____ / _____			

3. RACEWAYS

Facility <u>PFP</u> Building <u>2736-ZB</u>		Room <u>636</u> Floor Elevation <u>@ Grade</u>	
Raceway Evaluation Sheet 1 of <u>1</u>			
Raceways Attribute Review (Guidelines are provided in Attachment D):			Attribute Reviewed
<u>Conduit Specific Attributes</u>			
a. Undersized anchor bolts for one-hole finger clamps			<u>✓</u>
b. Large junction boxes			<u>✓</u>
<u>Cable Tray Specific Attributes</u>			
c. Customized parts			<u>✓</u>
d. Cable restraint			<u>✓</u>
e. Tray connector hardware			<u>✓</u>
<u>General Raceway Attributes</u>			
f. Span lengths			<u>✓</u>
g. Raceways member tie-downs			<u>✓</u>
h. Channel nuts			<u>✓</u>
i. Rigid boot connections			<u>✓</u>
j. Beam or friction clamps			<u>✓</u>
k. Atypical or unique support configuration			<u>✓</u>
l. Substantial visible corrosion			<u>✓</u>
m. Sagging			<u>✓</u>
n. Damaged, missing or loose hardware			<u>✓</u>
o. Stiff support along flexible run			<u>✓</u>
p. Short fixed-end rod hangers			<u>✓</u>
q. Heavily loaded supports			<u>✓</u>
r. Other concern			<u>✓</u>
Number of Raceways Candidates Identified in Area: <u>0</u>			
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 <u>E. C. O'Connor</u> / <u>3/30/95</u>			
Team Member/Date <u>R. J. Thomas</u> / <u>3/30/95</u>			
Team Member/Date _____ / _____			

4. HVAC

Facility <u>PPF</u> Building <u>2736-ZB</u>		Room <u>636</u> Floor Elevation <u>@ Grade</u>	
HVAC Evaluation Sheet 1 of <u>1</u>			
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		☒	
n. Other concerns		☒	
Number of HVAC Candidates Identified in Area: <u>1</u>			
Candidate Number	No. Sheets	Candidate Number	No. Sheets
<u>PPF-2736-ZB-636-H-001</u> <u>(2)</u>	<u> </u>	<u> </u>	<u> </u>
<u> </u>	<u> </u>	<u> </u>	<u> </u>
<u> </u>	<u> </u>	<u> </u>	<u> </u>
<p>Comments:</p> <p>GENERAL: THE ROOM VENTILATION DUCT IS OUTSIDE THE SAFETY CLASS 1 GLOVEBOX'S MISSILE ZONE OF INFLUENCE PER THE WINDDOWN PROCEDURE (WHC-SD-CP-SA-028). THE OTHER 2 DUCTS ARE EXHAUST DUCTS FOR THE GLOVEBOX.</p> <p>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.</p> <p>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.</p> <p>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.</p>			
Team Leader/Date	<u>E.C. Oelma</u>	<u>1</u>	<u>3/30/95</u>
Team Member/Date	<u>R.J. Thomas</u>	<u>1</u>	<u>3/30/95</u>
Team Member/Date	<u> </u>	<u>1</u>	<u> </u>

5. EQUIPMENT AND MISCELLANEOUS COMMODITIES

Facility <u>PFP</u>		Building <u>2736-ZB</u>		Room <u>636</u>		Floor Elevation <u>@ Grade</u>	
Equipment and Miscellaneous Commodities Evaluation Sheet 1 of <u>1</u>							
Equipment and Miscellaneous Commodities Attribute Review:						Attribute Reviewed	
a. Electrical equipment reviewed per Attachments F						<u>✓</u>	
b. Miscellaneous commodities, structural items and architectural features reviewed per Attachment G.						<u>✓</u>	
c. Other Concerns.						<u>✓</u>	
Number of Equipment and Miscellaneous Commodities Candidates Identified in Area: <u>0</u>							
Candidate Number		No. Sheets		Candidate Number		No. Sheets	
<u> </u>		<u> </u>		<u> </u>		<u> </u>	
<u> </u>		<u> </u>		<u> </u>		<u> </u>	
<u> </u>		<u> </u>		<u> </u>		<u> </u>	
Comments:							
Team Leader/Date		<u>E. G. O'Connell</u>				<u>3/30/95</u>	
Team Member/Date		<u>R. J. Thomas</u>				<u>3/30/95</u>	
Team Member/Date		<u> </u>				<u> </u>	

7. CANDIDATE IDENTIFICATION SHEET

Facility <u>PFP</u>	Building <u>2736-ZB</u>	Room <u>636</u>	Floor Elevation <u>@ Grade</u>
Candidate Number: <u>PFP-2736 ZB-636-H-001</u>		Sheet <u>1</u> of <u>1</u>	
<p>Description of candidate:</p> <p>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.</p>			
<p>Location of candidate:</p> <p>FROM THE WEST WALL PENETRATION TO THE TOP OF GLOVEBOX.</p>			
<p>Reason(s) for selecting candidate:</p> <p>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.</p>			
<p>Comments:</p> <p>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.</p>			
Team Leader/Date	<u>E.C. O'Connell</u>	<u>3/30/95</u>	
Team Member/Date	<u>R.J. Thomas</u>	<u>3/30/95</u>	
Team Member/Date			

SEE PAGE F-2 FOR LOCATION PLAN

1. AREA SUMMARY SHEET

Facility <u>PFP</u> Building <u>2736-Z</u> Room <u>1,2,3, & 4</u> Floor Elevation <u>@ Grade</u>	
Seismic Input at Floor (horizontal, 5% damping):	Peak <u>0.42 g</u> , ZPA <u>0.20 g</u>
Seismic Input at Floor (vertical, 5% damping):	Peak <u>0.28 g</u> , ZPA <u>0.13 g</u>
Area Summary Sheet 1 of <u>1</u> Total Number of Sheets in Area Walkdown Package _____	
Walkdown Start Date <u>3/30/95</u>	
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 <u>0</u>	
Team Leader <u>E.C. Ocoma</u>	Print <u>E.C. OCOMA</u> Date <u>3/30/95</u>
Team Member <u>R.A. Giller</u>	Print <u>R.A. Giller</u> Date <u>3-30-95</u>
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 <u>PPF</u> Building <u>2736 Z</u> Equip. ID <u>PEDESTALS ROOM 1</u> Floor Elev. <u>@ GRADE</u> ft.	
Anchorage and Miscellaneous Attributes Evaluation Sheet <u>2</u> of <u>2</u>	
Anchorage Attribute Review (Guidelines provided in Attach G)	Attribute Reviewed
<u>Expansion Anchor Review</u>	
a. Spacing, edge distance and concrete cracks reviewed.	<u>✓</u>
b. Embedment and nuts bottomed out reviewed.	<u>✓</u>
c. Verify expansion anchors are not used to anchor rotating equipment	<u>✓</u>
d. Tightness check	① <u>✓</u>
<u>Welded Anchorage Review</u>	
e. Welded anchorage reviewed.	<u>N/A</u>
<u>Unistrut Anchorage Review</u>	
f. Channel nuts spot checked for alignment of nut grooves with channel?	<u>✓</u>
<u>General Anchorage Attributes</u>	
h. Gaps between attachments and concrete surface generally $\leq \frac{1}{8}$ inch.	<u>✓</u>
i. Bolts reviewed for full thread engagement or substantial thread engagement for light for lightly loaded anchors.	<u>✓</u>
j. Anchorage reviewed for substantial rust or corrosion.	<u>✓</u>
k. Anchorage reviewed for small washers on thin sheet metal.	<u>✓</u>
l. Anchorage reviewed for extremely thin equipment base framing.	<u>✓</u>
m. Anchorage reviewed for missing nuts, bolts or washers.	<u>✓</u>
n. Anchorage reviewed for non-positive anchorage configurations.	<u>✓</u>
o. Based on engineering judgement, anchorage appears adequate.	② <u>✓</u>
p. Other concerns.	<u>✓</u>
<u>Concrete strength and Bolt Type</u>	
q. Concrete strength <u>3000</u> psi	<u>✓</u>
r. Anchor bolt type <u>②</u> per inspection <u>drawing no.</u>	<u>✓</u>
Candidates identified because of anchorage and miscellaneous attributes shall be included in the appropriate commodity review evaluation.	
<p>Comments:</p> <p>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.</p> <p>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.</p>	
Team Leader/Date	<u>E.C. O'connor</u> / <u>3/30/95</u>
Team Member/Date	<u>R.A. Miller</u> / <u>3-30-95</u>
Team Member/Date	/

AREA SUMMARY

6.0 ANCHORAGE AND MISCELLANEOUS ATTRIBUTES

Facility <u>PPF</u> Building <u>2736 Z</u> Equip. ID <u>PEDESTALS IN ROOMS 3 & 4</u> Floor Elev. <u>@ GRADS</u> ft.	
Anchorage and Miscellaneous Attributes Evaluation Sheet <u>1</u> of <u>7</u>	
Anchorage Attribute Review (Guidelines provided in Attach G)	Attribute Reviewed
<u>Expansion Anchor Review</u>	
a. Spacing, edge distance and concrete cracks reviewed.	<u>N/A</u>
b. Embedment and nuts bottomed out reviewed.	<u>N/A</u>
c. Verify expansion anchors are not used to anchor rotating equipment	<u>N/A</u>
d. Tightness check	<u>N/A</u>
<u>Welded Anchorage Review</u>	
e. Welded anchorage reviewed.	① <u>✓</u>
<u>Unistrut Anchorage Review</u>	
f. Channel nuts spot checked for alignment of nut grooves with channel?	<u>N/A</u>
<u>General Anchorage Attributes</u>	
h. Gaps between attachments and concrete surface generally $\leq \frac{1}{8}$ inch.	<u>✓</u>
i. Bolts reviewed for full thread engagement or substantial thread engagement for light for lightly loaded anchors.	<u>N/A</u>
j. Anchorage reviewed for substantial rust or corrosion.	<u>✓</u>
k. Anchorage reviewed for small washers on thin sheet metal.	<u>N/A</u>
l. Anchorage reviewed for extremely thin equipment base framing.	<u>✓</u>
m. Anchorage reviewed for missing nuts, bolts or washers.	<u>N/A</u>
n. Anchorage reviewed for non-positive anchorage configurations.	<u>✓</u>
o. Based on engineering judgement, anchorage appears adequate.	① <u>✓</u>
p. Other concerns.	<u>✓</u>
<u>Concrete strength and Bolt Type</u>	
q. Concrete strength <u>3000</u> psi	<u>✓</u>
r. Anchor base type <u>WELDED</u> per inspection drawing no. <u>H-2-26649</u>	<u>✓</u>
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 CURBIC WALLS EMBEDDED PLATES. DUE TO THE HIGH RADIATION DOSE RATES INSIDE THE CURBICLES, MEASUREMENTS OF THE WELD SIZE WILL NOT BE PERFORMED. INSTEAD DRAWING REVIEW AND VISUAL INSPECTION WERE USED. FURTHER EVALUATION REQUIRED.	
Team Leader/Date	<u>E.C. O'Connor</u> / <u>3/30/95</u>
Team Member/Date	<u>R.A. Miller</u> / <u>3-30-95</u>
Team Member/Date	/

AREA SUMMARY

6.0 ANCHORAGE AND MISCELLANEOUS ATTRIBUTES

Facility <u>PPF</u> Building <u>2736 Z</u> Equip. ID <u>CUBICLES IN RM. 1, 3, & 4</u> Floor Elev. <u>@ GRADE</u> #.	
Anchorage and Miscellaneous Attributes Evaluation Sheet <u>1</u> of <u>7</u>	
Anchorage Attribute Review (Guidelines provided in Attach G)	Attribute Reviewed
<u>Expansion Anchor Review</u>	
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 ✓
<u>Welded Anchorage Review</u>	
e. Welded anchorage reviewed.	② ✓
<u>Unistrut Anchorage Review</u>	
f. Channel nuts spot checked for alignment of nut grooves with channel?	N/A
<u>General Anchorage Attributes</u>	
h. Gaps between attachments and concrete surface generally $\leq \frac{1}{4}$ 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.	✓
<u>Concrete strength and Bolt Type</u>	
q. Concrete strength <u>3000</u> psi	✓
r. Anchor bolt type <u>REDUCED</u> per ☐ inspection ☒ drawing no. <u>H-2-70010</u>	✓
Candidates identified because of anchorage and miscellaneous attributes shall be included in the appropriate commodity review evaluation.	
<p>Comments:</p> <p>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'-0 1/2" LEVEL. TIGHTNESS CHECK WAS NOT PERFORMED DUE TO HIGH RADIATION DOSE RATES AND ACCESSABILITY.</p> <p>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 1 1/2" LG. FILLET WELDS. ROOM 4 WAS EXAMINED BY PPF QA (SEE PAGE F-15)</p>	
Team Leader/Date	<u>E.C. Oconnor</u> / <u>3/30/95</u>
Team Member/Date	<u>R.A. Allen</u> / <u>3-30-95</u>
Team Member/Date	/

AREA SUMMARY

8. CONTINUATION SHEET

Facility PPF 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 vary 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* Date 1-30-95

Signature of preparer Rodney R. Thorne *Rodney R. Thorne* Date 1-30-95

** CC:
EP BONADIE
EC OCOMA

AREB SUMMARY

6.0 ANCHORAGE AND MISCELLANEOUS ATTRIBUTES

Facility <u>PPF</u> Building <u>2736 Z</u> Equip. ID <u>7" CAN & LARGO CAN RACKS</u> Floor Elev. <u>2 GRADE</u> ft.	
Anchorage and Miscellaneous Attributes Evaluation Sheet <u>7</u> of <u>7</u>	
Anchorage Attribute Review (Guidelines provided in Attach G)	
Attribute Reviewed	
<u>Expansion Anchor Review</u>	
a. Spacing, edge distance and concrete cracks reviewed.	<u>✓</u>
b. Embedment and nuts bottomed out reviewed.	<u>✓</u>
c. Verify expansion anchors are not used to anchor rotating equipment	<u>✓</u>
d. Tightness check	① <u>✓</u>
<u>Welded Anchorage Review</u>	
e. Welded anchorage reviewed.	<u>✓</u>
<u>Unistrut Anchorage Review</u>	
f. Channel nuts spot checked for alignment of nut grooves with channel?	<u>N/A</u>
<u>General Anchorage Attributes</u>	
h. Gaps between attachments and concrete surface generally $\leq \frac{1}{8}$ inch.	<u>✓</u>
i. Bolts reviewed for full thread engagement or substantial thread engagement for light for lightly loaded anchors.	<u>✓</u>
j. Anchorage reviewed for substantial rust or corrosion.	<u>✓</u>
k. Anchorage reviewed for small washers on thin sheet metal.	<u>✓</u>
l. Anchorage reviewed for extremely thin equipment base framing.	<u>✓</u>
m. Anchorage reviewed for missing nuts, bolts or washers.	<u>✓</u>
n. Anchorage reviewed for non-positive anchorage configurations.	<u>✓</u>
o. Based on engineering judgement, anchorage appears adequate.	① <u>✓</u>
p. Other concerns.	<u>✓</u>
<u>Concrete strength and Bolt Type</u>	
q. Concrete strength <u>3000</u> psi	
r. Anchor bolt type <u>DROP-IN</u> per ☒ inspection ☐ drawing no. _____	① <u>✓</u>
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	<u>E.C. Ocoma</u> / <u>3/30/95</u>
Team Member/Date	<u>R.A. Hill</u> / <u>3-30-95</u>
Team Member/Date	_____ / _____

2. PIPING AND TUBING

Facility PPF Building 2736 Z Room 1234 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. O'Connell / 3/30/95
Team Member/Date R.A. Miller / 3-30-95
Team Member/Date _____ / _____

3. RACEWAYS

Facility PFP Building 2736 Z Room 1,2,3,4 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 <u>PPF</u> Building <u>2736 Z</u>		Room <u>1,2,3,4</u> Floor Elevation <u>@ GRADE</u>	
HVAC Evaluation Sheet 1 of <u>1</u>			
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: <u>1</u>			
Candidate Number	No. Sheets	Candidate Number	No. Sheets
<u>PPF-2736Z-3-H-001</u>	<u> </u>	<u> </u>	<u> </u>
<u> </u>	<u> </u>	<u> </u>	<u> </u>
<u> </u>	<u> </u>	<u> </u>	<u> </u>
Comments:			
<p>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.</p>			
Team Leader/Date	<u>E.C. O'connor</u>	/	<u>3/30/95</u>
Team Member/Date	<u>R.A. Miller</u>	/	<u>3-30-95</u>
Team Member/Date	<u> </u>	/	<u> </u>

5. EQUIPMENT AND MISCELLANEOUS COMMODITIES

Facility <u>PPF</u>		Building <u>2736 Z</u>		Room <u>1, 2, 3 & 4</u>	Floor Elevation <u>@ GRADE</u> ft.
Equipment and Miscellaneous Commodities Evaluation Sheet 1 of <u>6</u>					
Equipment and Miscellaneous Commodities Attribute Review:					Attribute Reviewed
a. Electrical equipment reviewed per Attachments F					<u>✓</u>
b. Miscellaneous commodities, structural items and architectural features reviewed per Attachment G.					<u>① ✓</u>
c. Other Concerns.					<u>② ✓</u>
Number of Equipment and Miscellaneous Commodities Candidates Identified in Area: <u>1</u>					
Candidate Number		No. Sheets		Candidate Number	
<u>PPF-2736Z-2-MISC-001</u>		<u> </u>		<u> </u>	
<u> </u>		<u> </u>		<u> </u>	
<u> </u>		<u> </u>		<u> </u>	
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		<u>E.C. O'Connor</u>		<u>3/30/95</u>	
Team Member/Date		<u>R.A. Hiller</u>		<u>3-30-95</u>	
Team Member/Date		<u> </u>		<u> </u>	

7. CANDIDATE IDENTIFICATION SHEET

Facility <u>PPF</u>	Building <u>2736 Z</u>	Room <u>3</u>	Floor Elevation <u>9' ABOVE GRD.</u>						
Candidate Number: <u>PPF-2736Z-3-H-001</u>		Sheet <u>1</u> of <u>2</u>							
<p>Description of candidate: THE EXISTING 12" x 18" & 16" x 20" DUCT ALONG EAST WALL SHOWN ON DRAWING H-2-26665 WAS CONNECTED TO BY A NEW 18" x 30" DUCT SHOWN ON H-2-27952 SHT. 1. 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.</p>									
<p>Location of candidate: 2736-Z BUILDING, ROOM 3, EAST WALL AS SHOWN ON DRAWING H-2-26665. SEE NEXT PAGE FOR SKETCH.</p>									
<p>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 12" x 18" AND 16" x 20" DUCT EXCEEDED THE CRITERIA.</p>									
<p>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.</p>									
<table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 50%;">Team Leader/Date <u>E. C. Ocoma</u></td> <td style="width: 50%; text-align: right;">/ <u>3/20/95</u></td> </tr> <tr> <td>Team Member/Date <u>R. A. Miller</u></td> <td style="text-align: right;">/ <u>3-30-95</u></td> </tr> <tr> <td>Team Member/Date _____</td> <td style="text-align: right;">/ _____</td> </tr> </table>				Team Leader/Date <u>E. C. Ocoma</u>	/ <u>3/20/95</u>	Team Member/Date <u>R. A. Miller</u>	/ <u>3-30-95</u>	Team Member/Date _____	/ _____
Team Leader/Date <u>E. C. Ocoma</u>	/ <u>3/20/95</u>								
Team Member/Date <u>R. A. Miller</u>	/ <u>3-30-95</u>								
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 <u>PFP</u>	Building <u>2736 E</u>	Room <u>2</u>	Floor Elevation <u>@ GRADES</u> ft.						
Candidate Number: <u>PFP-2736 Z-2-MISC-001</u>		Sheet <u>1</u> of <u>2</u>							
<p>Description of candidate:</p> <p>1) 55 GAL. DRUM WEIGHTS 480^{lb} EACH. 6 PCS.</p> <p>2) TWO-STACK HIGH DRUM WEIGHTS X 1000^{lb} EACH. 2 PCS.</p> <p>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'Connell 5/2/95</p>									
<p>Location of candidate:</p> <p>(1) DRUMS IN NE CORNER OF ROOM</p> <p>(2) DRUMS ABOUT MIDDLE OF ROOM</p> <p>(3) 2-STACK HIGH DRUMS ABOUT MIDDLE OF ROOM</p> <p>SEE SKETCH NEXT PAGE</p>									
<p>Reason(s) for selecting candidate:</p> <p>CONTAINERS ARE IN CLOSE PROXIMITY TO THE 7" CAN AND LBD CAN RACKS. CONTAINERS ARE NOT RESTRAINED.</p>									
<p>Comments:</p> <p>RECOMMEND RELOCATING THE CONTAINERS OUT OF THE ROOM OR PROVIDE RESTRAINT.</p> <p>SEE PAGE F-38 FOR SAFETY EVALUATION AND ACCEPTABILITY.</p> <p style="text-align: center;">E.C. O'Connell 5/2/95</p>									
<table border="0" style="width: 100%;"> <tr> <td style="width: 50%;">Team Leader/Date <u>E.C. O'Connell</u></td> <td style="width: 50%; text-align: right;"><u>3/30/95</u></td> </tr> <tr> <td>Team Member/Date <u>R.A. Miller</u></td> <td style="text-align: right;"><u>3-30-95</u></td> </tr> <tr> <td>Team Member/Date _____</td> <td style="text-align: right;">_____</td> </tr> </table>				Team Leader/Date <u>E.C. O'Connell</u>	<u>3/30/95</u>	Team Member/Date <u>R.A. Miller</u>	<u>3-30-95</u>	Team Member/Date _____	_____
Team Leader/Date <u>E.C. O'Connell</u>	<u>3/30/95</u>								
Team Member/Date <u>R.A. Miller</u>	<u>3-30-95</u>								
Team Member/Date _____	_____								

8. CONTINUATION SHEET

Facility PFP Building 2736-2 Room 2 Floor Elevation _____ ft.
Continuation of: PFP-2736 E.-2-MISC-001 Sheet 2 of 2

ANALYTICAL CALCULATIONS

Page F-25 of

Subject SCREENING CHART FOR HVAC SUPPORTS
Originator RA Hill Date 2-16-95
Checker E. E. Oconnor 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 — HVAC Modification Dated
August & September 1977
H-2-28077

H-2-70159 — HVAC Modification that
conflicts with H-2-27952 &
H-2-28077, dated April, 1976.

ANALYTICAL CALCULATIONS

Page F-26 of ____

Subject SCREENING CHART FOR HVAC SUPPORTS
 Originator RA Hille Date 2-16-95
 Checker EC Ocoma Date 2/21/95

Duct Weight

Largest Size Duct:

18" x 30" (22 ga)

$$\text{Duct} = \frac{(18" + 30")^2}{12} \times 1.25 \text{ spst} = 10 \# / \text{ft}$$

$$\text{Frames} = \frac{(21" + 33")^2}{12} \left(\frac{1.48 \# / \text{ft}}{2.67' \text{ spacing}} \right) 2 \text{ frames} = \frac{10 \# / \text{ft}}{20 \# / \text{ft}}$$

$$\begin{array}{l} \text{1- Set of} \\ \text{5 vanes} \end{array} = \frac{(5" \times 30") (5 \text{ vanes}) (1.25 \text{ spst})}{144} = 6.5 \#$$

$$\begin{array}{l} \text{1- Damper} \\ \text{16 ga} \end{array} \frac{(18" \times 30") (2.5 \text{ spst})}{144} = 9.4 \#$$

Assume: 10# for 1 set of vanes
 10# for each Damper

ANALYTICAL CALCULATIONS

Page F-28 of _____

Subject _____
 Originator RA Hill Date 2-16-95
 Checker EC Oconnor Date 3/21/95

Hanger Capacities

$\frac{1}{4}" \phi$ Thd Rod A36 steel (use Power Piping Catalog)

@ 650° & allowable stress = 9000 psi = 240#

@ 100° increase allowable 14% = 274#

$\frac{1}{4}" \phi$ Self-Drilling expansion anchor
 McMaster Carr # 970S1A029

From Seismic Design Guide
 WHC-SD-GN-DGS-30066
 and the attached page

tension capacity = 270#/each

$\Delta \frac{1}{4}" \times \frac{1}{4}" \times \frac{3}{16}$ Trapeze

$$f_b = \frac{Pl}{S_b} = \frac{270\#(3")}{.071 \text{ in}^3} = 11408 \text{ psi}$$

$$F_b = .6F_y = 21600 > 11408$$

allowable

O.K.

ANALYTICAL CALCULATIONS

Page F-29 of

Subject _____
 Originator RA Hilde Date 2-16-95
 Checker G.C. O'Connor 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.

NET/100						
Bolt Size	Anchor OD	Hole Depth	Pkg. Qty.	No.	Bkn. Pkg.	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"	1 1/16"	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"	1 1/16"	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; $\frac{3000}{4000} \times 360 = 270$ #

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ANALYTICAL CALCULATIONS

Page F-32 of _____

Subject _____
Originator RA Hilt Date 2-16-95
Checker EC Oconnor 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 Δ are good for more the 270[#] each.

Allowable load per support;

$$270^{\#} \times 2 = 540^{\#}$$

ANALYTICAL CALCULATIONS

Page F-34 of

Subject
Originator RA Hill Date 2-16-95
Checker EC Ocoma 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)
min. rod length is : - 8"
PAGE D-3

No Fatigue problem. because all hangers
should be 10" or longer based on duct
height.

ANALYTICAL CALCULATIONS

Page F-35 of ____

Subject _____
 Originator RA Miller Date 2-16-95
 Checker E.C. Oconnor Date 3/21/95

Hanger Spacing Table
 max hanger load = 540[#]

Duct Size	DW/ Ft.	Hanger Spacing			
		Duct only	Duct w/vanes	3 x DW only	3 x DW w/vanes
10 x 10	7 [#] / ₁	77'	74'	25'	22'
10 x 12	8	67'	65'	22'	20'
12 x 12	9	60'	57'	20'	17'
12 x 14	9	60'	57'	20'	17'
14 x 14	10	54'	52'	18'	16'
14 x 16	10	54'	52'	18'	16'
16 x 16	12	45'	43'	15'	13'
16 x 18	12	45'	43'	15'	13'
18 x 18	13	41'	40'	13'	12'
18 x 20	13	41'	40'	13'	12'
18 x 30	20	27'	26'	9'	8'

assume (2 sets of vanes) = 20[#]

spectra.c

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)

$$f_c' = 3000 \text{ psi}$$

WHE-SD-CF-SX-076
REV. 1

DESIGN CALCULATION WHC-SD-CP-SA-026 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-21)
 (8) Originator _____ Date _____
 (9) Checker E.E. Odom 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 224" LONG
CAPACITY = 2000 #/FT.

∴ ROD GOVERNS

$$\begin{aligned} \text{HANGER CAPACITY} &= 610 \times 2 \text{ RODS} \\ &= 1220 \# \end{aligned}$$

FOR 16" x 18" DUCT WITH 2 SETS OF VANES (20 #)

$$\begin{aligned} \text{SPACING FOR } 3 \times \text{DN} &= \frac{1220 - 3(20\#)}{12 \#/\text{FT} \times 3} \\ &= 32 \text{ FT SPACING} > 15'-8" \end{aligned}$$

FOR 16" x 20" DUCT WITH 2 SETS OF VANES (20 #)

$$\begin{aligned} \text{SPACING FOR } 3 \times \text{DN} &= \frac{1220 - 3(20\#)}{13 \#/\text{FT} \times 3} \\ &= 29.7 \text{ FT SPACING} > 15'-8" \therefore \text{OK} \end{aligned}$$

**Westinghouse
Hanford Company****Internal
Memo**

From: PFP Facility Engineering 15500-95-LTN-028
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

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

WHC-SD-CF-SA-026

REV. 1

PAGE F-39

15500-95-LTN-028

E. C. Ocoma
May 2, 1995
Page 2

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.

E. C. Ocoma
May 2, 1995
Page 3

WHC-SD-CP-SA-026

REV. 1

PAGE F-40

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	1994		1995	
					DEC	JAN	FEB	MAR
1K6058010A00	SOUTH CANYON WALL AND DOOR	15 D	11/28/94 12/16/94	0 0				01MAR95
1K6058010A01	2736-Z IMPACTS	35 D	12/01/94 01/23/95	0 0				
1K6058010A03	REPACKAGING GLOVESOX	41 D	11/28/94 02/08/95	0 0				
1K6058010A04	PREPARE BUILDING RESPONSE	36 D	12/09/94 02/01/95	0 0				
1K6058010A05	VAULT WALKDOWN PROCEDURE	63 D	12/09/94 03/09/95	12 0				
1K6058010A06	ANALYZE FLOOR CUBICLES	33 D	12/09/94 01/27/95	0 0				
1K6058010A07	ANALYZE WALL CUBICLES	18 D	01/30/95 02/22/95	1 0				
1K6058010A10	WALL CUBICLE PEDESTALS	20 D	01/26/95 02/28/95	0 0				
1K6058010A11	FLOOR CUBICLE PEDESTALS	21 D	12/27/94 02/03/95	0 0				
1K6058010A12	7 IN. CAN RACKS	29 D	01/23/95 02/17/95	2 0				
1K6058010A14	LARG CAN RACKS	23 D	01/23/95 02/17/95	0 0				
1K6058010A16	VELO INSPECTION (PFP ENG)	32 D	12/29/94 02/13/95	8 0				
1K6058010A18	2736-Z REPORT PREPARATION AND ISSUE	35 D	02/24/95 04/03/95	25 0				

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

STRIP 1

ACT ID	DESCRIPTION	DUR	START FINISH	REM DUR	1994				1995			
					DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL
1K6058010A10	WALL CUBICLE PEDESTALS	20 D	01/26/95 02/28/95	0 0								
1K6058010A100A	Model assembly, bolted	7 D	01/26/95 02/03/95	0 0								
1K6058010A100B	Analyze bolted configuration	4 D	02/06/95 02/13/95	0 0								
1K6058010A100C	Perform data reduction	3 D	02/13/95 02/16/95	0 0								
1K6058010A100D	Check analysis, bolted configuration	1 D	02/24/95 02/27/95	0 0								
1K6058010A100E	Model assembly, welded	7 D	01/26/95 02/03/95	0 0								
1K6058010A100G	Analyze welded configuration	4 D	02/06/95 02/13/95	0 0								
1K6058010A100H	Perform data reduction	3 D	02/13/95 02/16/95	0 0								
1K6058010A100M	Prepare document	2 D	02/17/95 02/24/95	0 0								
1K6058010A100N	Check analysis, welded configuration	2 D	02/27/95 02/28/95	0 0								
1K6058010A11	FLOOR CUBICLE PEDESTALS	21 D	12/27/94 02/03/95	0 0								
1K6058010A110A	Model assembly, bolted	5 D	12/27/94 01/03/95	0 0								
1K6058010A110B	Analyze bolted configuration	4 D	01/04/95 01/09/95	0 0								
1K6058010A110C	Perform data reduction	3 D	01/12/95 01/16/95	0 0								
1K6058010A110D	Check analysis, bolted configuration	7 D	01/28/95 02/03/95	0 0								
1K6058010A110E	Model assembly, welded	5 D	12/27/94 01/03/95	0 0								
1K6058010A110G	Analyze welded configuration	4 D	01/04/95 01/09/95	0 0								
1K6058010A110H	Perform data reduction	3 D	01/12/95 01/16/95	0 0								
1K6058010A110M	Prepare document	5 D	01/10/95 01/16/95	0 0								
1K6058010A110N	Check analysis, welded configuration	7 D	01/28/95 02/03/95	0 0								
1K6058010A12	7 IN. CAN RACKS	29 D	01/23/95 02/17/95	2 0								
1K6058010A120A	Model assembly	10 D	01/23/95 02/03/95	0 0								
1K6058010A120B	Perform calculations	2 D	02/06/95 02/07/95	0 0								
1K6058010A120C	Perform data reduction	3 D	02/07/95 02/10/95	0 0								
1K6058010A120H	Prepare document	4 D	02/10/95 02/15/95	0 0								
1K6058010A120J	Check can rack analysis	4 D	02/15/95 02/17/95	2 0								
1K6058010A14	LARD CAN RACKS	23 D	01/23/95 02/17/95	0 0								
1K6058010A140A	Model assembly	15 D	01/23/95 02/03/95	0 0								
1K6058010A140D	Perform calculations	2 D	02/06/95 02/07/95	0 0								
1K6058010A140G	Perform data reduction	2 D	02/07/95 02/10/95	0 0								
1K6058010A140J	Prepare document	2 D	02/10/95 02/15/95	0 0								
1K6058010A140K	Check lard can rack analysis	2 D	02/15/95 02/17/95	0 0								
1K6058010A16	VELO INSPECTION (PPF ENG)	32 D	12/29/94 02/13/95	9 0								
1K6058010A160A	Develop sample plan	10 D	12/29/94 01/26/95	0 0								
1K6058010A160D	Prepare work package	3 D	01/27/95 01/31/95	0 0								
1K6058010A160G	Approve work package	2 D	01/31/95 02/01/95	0 0								

STRIP 2

ACT ID	DESCRIPTION	DUR	START FINISH	REM DUR	1994				1995			
					DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL
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
▲	W4C-KEY Completed
⊙	HQ Completed
⊗	AL Completed
▷	OTHER Completed
●	TPA Completed
⊙	FO Completed
→	M7 Completed
▬	Early CPM Current
▬	Progress Percent Complete
◇	Milestone
△	W4C-KEY
⊙	HQ
⊗	AL
⊙	FO
◇	M7

HIGHLIGHTS

▬ NORMAL

Sort By: Activity Name
Select By: ACT
Status Date: 01MAR95
Date: 01MAR95
Start: 28NOV94
Finish: 05APR95

2736Z SEISMIC INVESTIGATION

PPF LOGIC NETWORK

STRIP 3

ENGINEERING ANALYSIS
WORK PLAN

WHE-SD-CP-SA-026
REVISION 1
F-45

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 12/2/94 COG. ENGR./SIGNATURE: W. G. RUFF 12/2/94

MANAGER/SIGNATURE S. K. FARNWORTH 12/2/94 MANAGER/SIGNATURE: W. G. RUFF 12/2/94

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 component in the 2736-Z Plutonium Storage Complex using Safety Class 1 seismic loads used in related building qualification.

- o 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.
- o 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.
- o 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 #		

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Workplan Schedule for Seismic Evaluation of Equipment in 2736-Z, ZA, & Zb

Building (1)		Z	ZA	ZB
Discovery		<u>1</u>	<u>1.5</u>	<u>1</u>
- 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
Evaluate seismic adequacy/Review of		<u>6.5</u>	<u>13</u>	<u>4</u>
- 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 (licensed 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

- Prepare report
- Peer review
- Customer, safety, QA review (2)
- DOE review (2)
- Follow up interaction with PFP & DOE staff
- Finalize report and issue SD

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REVISION 1
F-47

15
4
3
2
2
2
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

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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)~~ *LS*

- 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: $(63 \text{ days/man}) \times (8 \text{ hrs.}) \times (\$60.64/\text{hr}) \times (5.25 \text{ man}) = \$160,453$
G&A and CSP are not included in the estimate.

END DATE
8-18-95