RPP-RPT-32239, Rev. 0

Hanford Double-Shell Tank Thermal and Seismic Project - Seismic Analysis in Support of Increased Liquid Level in 241-AP Tank Farms

TC Mackey

Richland, WA 99352
U.S. Department of Energy Contract DE-AC27-99RL14047

EDT/ECN:	EDT 822360	UC:	
Cost Center:		Charge Code:	
B&R Code:		Total Pages:	738

Key Words: Double-Shell Tank, Tank, Integrity Project, Thermal, Seismic, TPA, M-48-14

Abstract: The overall scope of the project is to complete an up-to-date comprehensive analysis of record of the DST System at Hanford. The "Double-Shell Tank (DST) Integrity Project - DST Thermal and Seismic Project" is in support of Tri-Party Agreement Milestone M-48-14.

DATE: FEB 16 2007
STA: 4
HANFORD RELEASE
ID: 2

J.E. Bratton 2/16/07
Release Approval Date

Release Stamp

Approved For Public Release

SUBCONTRACTOR CALCULATION REVIEW CHECKLIST

Subject: Hanford Double-Shell Tank Thermal and Seismic Project – Seismic Analysis in Support of Increased Liquid Level in 241-AP Tank Farms

The subject document has been reviewed by the undersigned.
The reviewer reviewed and verified the following items as applicable.

Documents Reviewed: RPP-RPT-32239 Rev. 0

Analysis Performed By: M. Rinker et.al.

- Design Input
- Basic Assumptions
- Approach/Design Methodology
- Consistency with item or document supported by the calculation
- Conclusion/Results Interpretation
- Impact on existing requirements
- ______

TC Mackey [signature]
Reviewer (Print/Sign)

2/1/07
Date

C. DeFigh-Price [signature]
Organizational Manager (Print/Sign)

2/1/2007
Date

RPP-RPT-32239, Rev.0

PNNL-16394
Limited Distribution

Pacific Northwest National Laboratory
Operated by Battelle for the U.S. Department of Energy

Hanford Double-Shell Tank Thermal and Seismic Project – Seismic Analysis in Support of Increased Liquid Level in 241-AP Tank Farms

F.G. Abbott
B.G. Carpenter
M.W. Rinker

January 2007

Prepared for
CH2M HILL Hanford Group, Inc.
in Support of the
Double-Shell Tank Integrity Program

Sponsored by the U.S. Department of Energy
under Contract DE-AC05-76RL01830

PACIFIC NORTHWEST NATIONAL LABORATORY
operated by
BATTELLE
for the
UNITED STATES DEPARTMENT OF ENERGY
under Contract DE-AC05-76RL01830

Acknowledgments

The Double-Shell Tank Thermal and Seismic Project has been funded at PNNL for the past three and a half years by DOE and CH2M HILL. There has been a tremendous amount of work and progress made by many people from many organizations in order to get to this point.

In particular, one of the greatest challenges of this project has been the seismic analysis of the double-shell tanks. The project team would like to acknowledge the dedicated effort by M&D Professional Services technical staff in completing this work.

It is also important to acknowledge, that while this report has a PNNL cover on it, all of this work was completed by George Abatt, one of the senior technical staff at M&D.

Seismic Analysis in Support of Increased Liquid Level in 241-AP Tank Farms

F.G. Abatt
B.G. Carpenter

January 2007

Prepared by
M&D Professional Services, Inc.
for
Pacific Northwest National Laboratory

M&D PROFESSIONAL SERVICES INCORPORATED

Prepared by: F.G. Abatt 1/29/07

B.G. Carpenter 1/29/07

Checked by: C. Hendrix 1/29/07

K.R. Roberson 1/29/07

M&D Professional Services		**Page** ii
		Document No. M&D-2008-005-CALC-001
		Revision No. 0
		Total Pages 727

PROJECT NAME:	PROJECT NUMBER:	CLIENT:
DST Seismic Analysis	2008-005	PNNL

TITLE:

Seismic Analysis In Support of Increased Liquid Level in 241-AP Tank Farms

PROBLEM STATEMENT:

Perform a Seismic Analysis of a Hanford 241-AP Double Shell Tank to Support an Increase in the Maximum Operating Liquid Level in the 241-AP Tank Farms.

ANALYTICAL SOFTWARE USED:	PROGRAM/PACKAGE	VERSION	UNVERIFIED ASSUMPTIONS
Yes X No ___	ANSYS® Dytran®	ANSYS® 8.1 Dytran® 2006	Yes ___ No X

REV.	AFFECTED PAGES	REVISION DESCRIPTION	PREPARER(S)/ DATE	CHECKER(S)/ DATE	APPROVER/ DATE
0	All	Original Issue	F.G. Abatt 1/29/07 B.G. Carpenter 1/29/07	C. Hendrix 1/29/07 K.R. Roberson 1/29/07	C. Hendrix 1/29/07

Executive Summary

The work presented in this report is an extension of the baseline seismic analysis documented in Rinker et al. (2006a) and (2006d). The baseline analysis was for a bounding generic tank configuration based on the 241-AY Tanks having a bulk waste specific gravity of 1.7 and a waste level of 422 in. In this analysis, the bulk specific gravity and waste level were increased to 1.83 and 460 in., respectively. The previously developed models were used with minor modifications to represent the 241-AP tanks. Earlier studies documented in Rinker and Abatt (2006a) and (2006b), and Rinker et al. (2006b) and (2006c) provide the justification for the basic models and analysis techniques.

The fundamental difference between this analysis and the baseline liquid level analysis reported in Rinker et al. (2006a) and (2006d) is increased interaction between the liquid waste and the tank dome (more complex sloshing response). To address the more complex fluid-structure interaction analysis at the increased liquid level, sub-models of the primary tank were created in both Dytran® and ANSYS® and the results were compared. The Dytran sub-model analysis served as an alternate calculation for evaluating the stresses in the primary tank due to fluid-structure interaction. However, the seismic evaluation of all tank components was based directly on the results of the global ANSYS® model, just as in the baseline seismic analysis.

In the concrete shell, the ANSYS® global model showed that forces and moments are generally highest for the lower bound soil load case. Due to the higher relative stiffness of the tank as compared to the soil for the lower bound soil, loads are transmitted through the stiffer path. The lowest forces and moments are generally found in the fully cracked concrete case. In this case, the concrete is much more compliant and the load path is retained through the soil.

In the primary tank, the highest stresses occur for the upper bound soil case near the middle of the primary tank wall. The lowest stresses in the primary tank occur for the lower bound soil case. Primary tank stresses correlate well to the free-field soil response at the bottom of the DST (57 ft below grade). The free-field soil seismic response at the level of the bottom of the tank shows a pronounced drop in the lower bound soil for frequencies corresponding to the impulsive natural frequency of the tank/fluid system.

The primary tank sub-model study showed that the stresses in the primary tank are very similar for the Dytran® and ANSYS® sub-models except near the liquid free surface, which was the expected result based on earlier studies. Some differences also existed in the knuckle region of the primary tank, but these were at least partly due to a configurational difference between the two models in the knuckle region.

Agreement between the ANSYS® and Dytran® sub-models occurs in the majority of the tank because the total stresses are dominated by gravity loading, which should be captured sufficiently by either model, and the seismic stresses are dominated by the impulsive response, which is adequately captured by either model. Although the

ANSYS® model is deficient in its ability to properly simulate the convective effects of the contained liquid, this convective response is not a major contributor to the demands on the primary tank. Moreover, ANSYS® tends to overpredict the stress magnitudes near the free surface, so the results are conservative relative to the more accurate Dytran® solution. Given the available stress margins in the primary tank, it was acceptable to use the seismic demands from the global ANSYS® model for the ASME code evaluation of the 241-AP primary tank reported in Deibler et al. (2007).

CONTENTS

LIST OF FIGURES

LIST OF TABLES

Acronyms and Abbreviations

B	Bulk Modulus
BEC	Best Estimate Concrete
BES	Best Estimate Soil
BNL	Brookhaven National Laboratory
DST	Double Shell Tank
E	Elastic Modulus
FCC	Fully Cracked Concrete
G	Shear Modulus
g	Acceleration of Gravity
Hz	Hertz (cycles per second)
LBS	Lower Bound Soil
M&D	M&D Professional Services, Inc
PNNL	Pacific Northwest National Laboratory
psi	Pound per Square Inch
SRSS	Square Root of the Sum of the Squares
SSI	Soil Structure Interaction
TOLA	Thermal and Operating Loads Analysis
UBS	Upper Bound Soil
ϕ	Soil Internal Angle of Friction
ρ	Mass Density
ν	Poisson's Ratio
σ	Stress

1.0 INTRODUCTION

A seismic analysis of the Hanford Double Shell Tanks (DSTs) for a bounding generic configuration at the baseline liquid level of 422 in. was reported in Rinker et al. (2006a) and (2006d). This analysis extends that work and was performed in support of a proposed liquid level increase for the 241-AP tanks. The baseline seismic analysis was for a bounding generic tank configuration based on the 241-AY tanks having a bulk waste specific gravity of 1.7 and a waste level of 422 in. In this analysis, the bulk specific gravity and waste level were increased to 1.83 and 460 in., respectively. The previously developed models were used with minor modifications to represent the 241-AP tanks.

The biggest difference between the baseline seismic analysis and the seismic analysis for the proposed increased liquid level is the increased interaction between the waste and tank dome during a seismic event (more complex sloshing response). To address this more complex fluid-structure interaction behavior, sub-models of the primary tank were created and analyzed using both Dytran® [1] and ANSYS[2]. Development of the supporting methodologies and benchmarking of solutions is documented in Rinker and Abatt (2006a) and (2006b), and Rinker et al. (2006b), (2006c), and (2006d).

As in the baseline seismic analysis, the following four load cases were considered:

- Lower Bound Soil Properties, Best Estimate Concrete
- Best Estimate Soil Properties, Best Estimate Concrete
- Upper Bound Soil Properties, Best Estimate Concrete
- Best Estimate Soil Properties, Fully Cracked Concrete

1.1 DISCUSSION

The work presented in this report is an extension of the baseline seismic analysis documented in Rinker et al. (2006a) and Rinker et al. (2006d). Earlier studies documented in Rinker and Abatt (2006a) and (2006b), and Rinker et al. (2006b) and (2006c) provide the justification for the basic models and analysis techniques. The fundamental difference between this analysis and the baseline liquid level analysis reported in Rinker et al. (2006a) and Rinker et al. (2006d) is interaction between the liquid waste and the tank dome.

Based on the earlier studies, the global ANSYS® model is expected to give sufficiently accurate results for all tank components except for portions of the primary tank. The limit on the ability of the global ANSYS® model to accurately predict the convective response of the tank waste is recognized and has been documented in the earlier reports.

---

[1] Dytran® is a registered trademark of MSC.Software Corporation
[2] ANSYS® is a registered trademark of ANSYS, Inc.

The earlier reports also contain extensive benchmarking of the ability of Dytran® to adequately capture the fluid-structure interaction behavior in the tanks including convective effects. To address the more complex fluid-structure interaction analysis at the increased liquid level, sub-models of the primary tank were created in both Dytran® and ANSYS® and the results were compared.

Other than the change in waste level and density, and tank geometry, the only other changes in the global ANSYS® model were associated with contact elements. The contact elements between the primary tank and concrete shell dome, between the primary tank and insulating concrete, and between the insulating concrete and secondary liner were modified to decreases the contact stiffness normal to the contact face. This reduction was done to reduce or eliminate spurious high-frequency response associated with the contact elements (chattering). Contacts between the waste and primary tank were also modified. Multiple contact areas were defined covering the full contact area between the waste and the primary tank. This modification allowed for better local behavior in the contact surfaces and minimized local pressure variations.

Forces and moments in the concrete shell are generally highest for the lower bound soil case. Due to the higher stiffness of the concrete shell compared to the soil for the lower bound soil, loads are transmitted through the stiffer path. The lowest forces and moments in the concrete shell are generally found in the fully cracked concrete case. In this case, the concrete is much more compliant and the load path is retained through the soil.

The highest stresses occur in the primary tank for the upper bound soil case near the middle of the primary tank wall. The lowest stresses in the primary tank occur for the lower bound soil case. Primary tank stresses correlate well to the free-field soil response at the bottom of the DST (57 ft below grade). The free-field soil seismic response at the level of the bottom of the tank shows a pronounced drop in the lower bound soil for frequencies corresponding to the impulsive natural frequency of the tank/fluid system.

Of the contact surfaces used in the model, only two were shown to be important. The first is the contact interface between the soil and the concrete shell, which controls how the forces and displacements of the surrounding soil are transferred to the concrete shell. The second is the interface between the primary tank and the inside face of the concrete dome, where the presence of the contact interface is critical to obtaining the correct load path. Where the concrete dome and primary tank are in contact and the load path is in compression, the contact elements are in compression and transmit the load between these surfaces. Where separation occurs, the forces are transmitted through the J-bolt connections only.

The results also show that the displacement between the bottom of concrete wall and the tank footing (basemat) due to seismic loading is insignificant. The reason is twofold; the axial load in the wall generates a significant normal force between the wall and the footing, and the wall cylinder is stiff enough to prevent local displacements where higher shear forces occur, ie, the average shear at the interface does not exceed the friction capacity even though localized shear forces may exceed localized friction capacities.

No significant sliding occurs at the interfaces between the concrete wall and the footing, primary tank and concrete dome, primary tank and insulating concrete, or insulating concrete and secondary liner. The maximum displacements are as follows:

- Concrete Wall/Footing 0.00103 inch
- Primary Tank/Concrete Dome 0.063 inch
- Primary Tank/Insulating Concrete 0.076 inch
- Insulating Concrete/Secondary Liner 0.025 inch

While the sliding displacement between the primary tank and concrete dome is small, the inclusion of this contact surface is critical to obtaining the correct load path.

The primary tank sub-model study showed that the stresses in the primary tank are very similar for the Dytran® and ANSYS® sub-models except near the liquid free surface, which was the expected result based on earlier studies. Some differences also existed in the knuckle region of the primary tank, but these were at least partly due to a configurational difference between the two models in the knuckle region.

Near the liquid free surface, the ANSYS® sub-model consistently predicted hoop stresses and meridional stresses of higher magnitude than the Dytran® sub-model. The shear stresses from the two models were very similar and of low magnitude.

Agreement between the ANSYS® and Dytran® sub-models occurs in the majority of the tank because the total stresses are dominated by gravity loading, which should be captured sufficiently by either model, and the seismic stresses are dominated by the impulsive response, which is adequately captured by either model. Although the ANSYS® model is deficient in its ability to properly simulate the convective effects of the contained liquid, this convective response is not a major contributor to the demands on the primary tank. Moreover, ANSYS® tends to overpredict the stress magnitudes near the free surface, so the results are conservative relative to the more accurate Dytran® solution. Given the available stress margins in the primary tank, it was acceptable to use the seismic demands from the global ANSYS® model for the ASME code evaluation of the primary tank reported in Deibler et al. (2007).

1.2 CONCLUSIONS

Conclusions on the behavior of the DST to seismic and combined dead load and seismic loading are presented in this section. Overall conclusions regarding the evaluation of the 241-AP tanks for the proposed liquid level increase are presented in Deibler et al. (2007).

1. Two of the contact surfaces used in the gobal ANSYS® model were shown to be important. The first is the contact interface between the soil and the concrete

shell, which controls how the forces and displacements of the surrounding soil are transferred to the concrete shell. The second is the interface between the primary tank and the inside face of the concrete dome, where the presence of the contact interface is critical to obtaining the correct load path.

2. Other contact surfaces included in the model did not show significant non-linear behavior such as sliding, however, their behavior under higher loading can not be predicted based on the current excitation levels. Thus, they will need to be reevaluated if the seismic loading increases significantly.
3. The primary tank stresses are adequately predicted by the global ANSYS® model, except near the waste free surface, where the stress predictions were conservative.
4. Given the generally low stresses in the primary tank near the waste free surface, the primary tank can be successfully qualified for service using the conservative stresses reported by ANSYS®.
5. The stresses in the primary tank are dominated by gravity loading.

2.0 ANSYS® GLOBAL MODEL DESCRIPTION

The model used for the evaluation of the 241-AP tank configuration and increased liquid level is based on the model developed for the 241-AY tank and a liquid level of 422 inches (Rinker et al., 2006d). Key differences in the increased liquid level and the 241-AY model are as follows:

- 241-AP tank geometry used (geometry and wall thicknesses)
- Waste level increased to 460 inches
- Waste specific gravity increased to 1.83
- Selected contact element normal stiffnesses softened to reduce "chatter"
- Number of contact areas used for waste/primary tank interface increased

For completeness, a detailed description of the model development is provided below.

A model of a Hanford Double Shell Tank (DST) was created and analyzed using version 8.1 of the general-purpose finite element program ANSYS®. A half-symmetry model of the DST, including the concrete shell, primary tank, secondary liner, J-bolts, waste, and surrounding soil was developed to evaluate the seismic loading on the DST. Figure 2-2 shows the complete model. Details for each part of the model are discussed in the following sections.

The tank model geometry was based on the 241-AP tank configuration shown in Hanford Drawing Number H-2-90534. The primary tank has a 450 inch radius and a nominal height of the vertical wall is 422.3125 inches. The nominal dome apex is 561.5 inches above the bottom of the tank. The models were run using waste depth of 460 inches. An excerpt from Drawing Number H-2-90534 is shown as Figure 2-1. The complete model, including the DST and surrounding soil is shown in Figure 2-2.

Figure 2-1. 241-AP Primary Tank Dimensions.

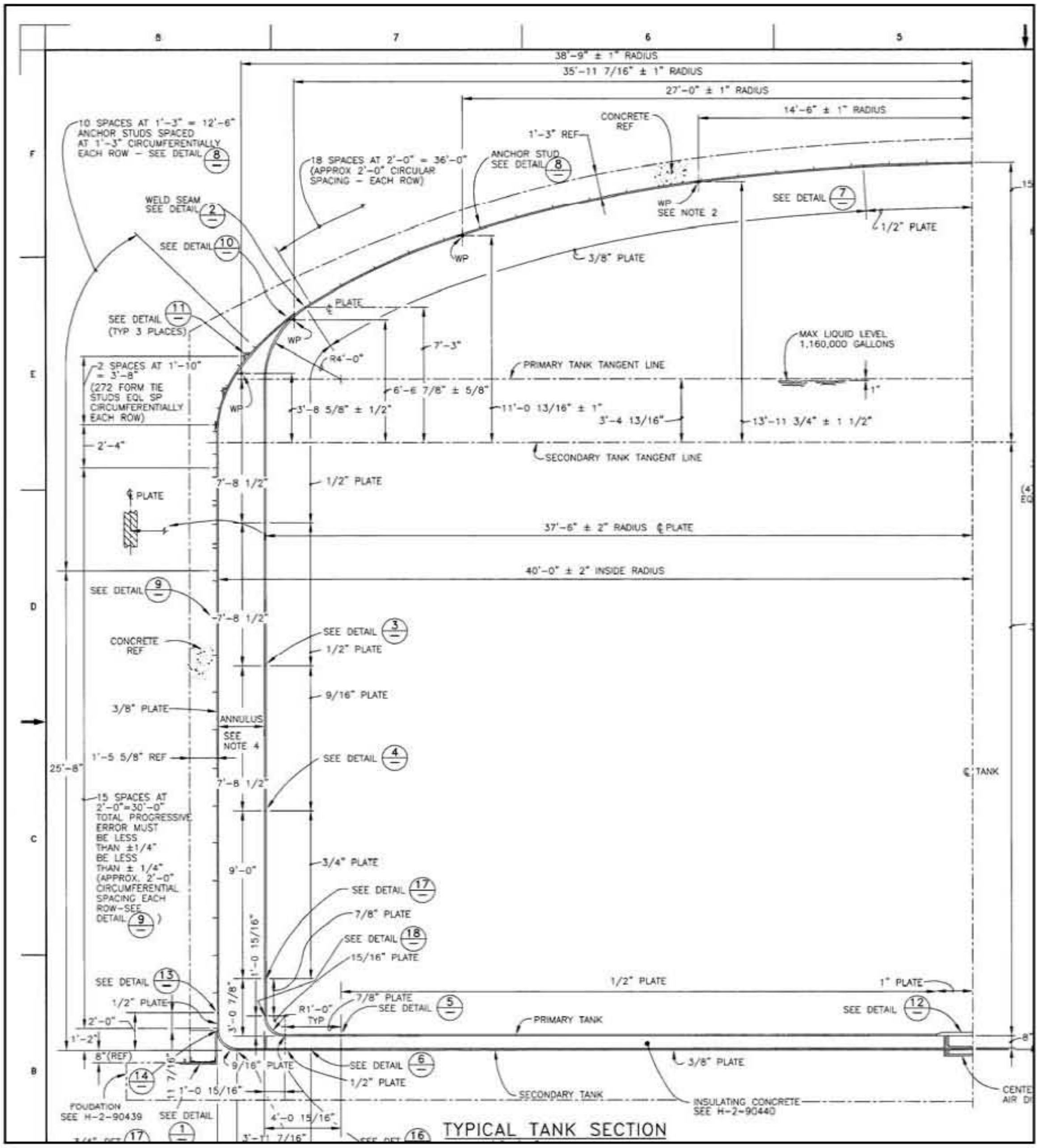
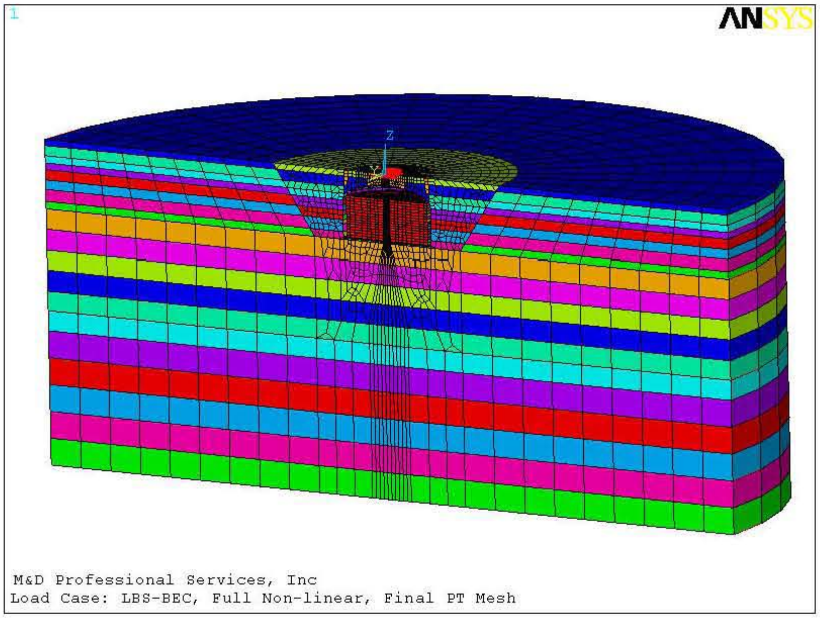


Figure 2-2. Composite Tank Model Detail.



The detailed ANSYS® model was developed based on coordinates used in the TOLA model. A series of input files were used to break the model creation into manageable parts. The files used, and a short description is provided in Table 2-1. Files that are common to all load cases are provided in Appendix E. Files that are unique to a specific load case are provided in the appendix for each load case.

Table 2-1. ANSYS® Model Input File Description.

File Name	Description
Run-Tank.txt	Calls each input for development of model
Tank-Coordinates-AP.txt	Defines key geometry and model parameters. Concrete geometry set to match PNNL section cut locations.
Tank-Props-###.txt	Defines concrete material and real properties for model. Uses properties based on best estimate or fully cracked conditions. Each tank layer can be assigned unique properties.
Tank-Mesh1.txt	Creates concrete shell mesh. Foundation and wall are separate entities
Primary-Props-AP.txt	Defines primary tank material and real properties.
Primary.txt	Creates primary tank mesh. Primary tank is not connected to concrete shell.
Insulate.txt	Creates insulating concrete mesh. Uses existing geometry from concrete and primary tanks, but is not connected.
Waste-Solid-AP.txt	Creates model of waste. Uses Solid45 elements with low shear modulus. Uses primary tank geometry.
Interface1.txt	Creates interface connections or contacts between pieces of model
Interface-gap1.txt	Creates interface connections or contacts between pieces of model
Bolts-friction.txt	Creates elements for J-bolts and contact surface between the primary tank and concrete shell in the dome
Liner.txt	Creates elements for Secondary Liner
Near-Soil-1.txt	Creates soil model for excavated region around tank. Merges coincident nodes with concrete shell.

File Name	Description
Soil-Props-###-Geo.txt	Defines all soil geometry and material properties. Excavated region and native soil have different material properties. Unique files are used for each soil condition (UB, BE, LB).
Far-Soil.txt	Creates far-field/native soil to a radius of 320 ft and depth of 266 ft. Merges coincident nodes with near soil and concrete shell. Places large mass at bottom of model for excitation force.
Fix-Soil.txt	Creates the contact interface between the excavated soil and native soil portions of the model
Slave.txt	Creates slaved boundary conditions around exterior of model.
Boundary.txt	Creates boundary conditions for symmetry. Does not set boundary conditions for solution phase.
Live_Load.txt	Applies surface concentrated load over center of dome
Outer-Spar.txt	Creates spar elements at edge of soil model to control shear behavior.

All components of the model are based on 9 degree slices over the half model, for a total of twenty slices. The following model description will address the tank components first, then the surrounding soil.

2.1 TANK MODEL

2.1.1 Concrete Shell

The first component developed in the model is the concrete shell and footing. Thirty-three sections are used between the dome and center of the floor for each 9 degree slice. In the detailed Thermal and Operating Loads Analysis (TOLA) model documented in Rinker et al. (2004), seventy sections were identified and used for extracting forces and moments. Using the profile coordinates for these seventy sections, a subset of 33 sections was developed for the profile of the ANSYS® seismic model (see Table 2-2). Based on the need to allow for connecting other portions of the full model, some coordinates were adjusted relative to the TOLA model.

The geometry of the concrete shell is based on a combination of data from drawings and the TOLA model. The basic geometry is based on drawings H-2-90534 and H-2-64307. Nodal locations were selected to correspond reasonably well to the TOLA model. This was done to simplify load combinations. Table 2-2 provides a listing comparison of nodal coordinates for the ANSYS® seismic model and TOLA model.

Input file "Tank-Coordinates-AP.txt" is used to read coordinate data for the concrete shell.

Table 2-2. Concrete Shell Centerline Coordinates.

		Coordinates			ANSYS		
	Section	R (inch)	H (inch)	t (Inch)	X	Z	Set #
		0	568.6	15	0	568.8	1
Dome	1	30.2	568.6	15			
				15	45	568	2

		Coordinates			ANSYS		
	Section	R (inch)	H (inch)	t (Inch)	X	Z	Set #
Dome	2	61.4	567.5	15			
Dome	3	90.4	565.8	15	90.4	565.8	3
Dome	4	120.72	563.21	15	120.72	563.21	4
Dome	5	152.9	559.7	15	152.9	559.7	5
Dome	6	184.14	555.34	15			
Dome	7	211.4	550.7	15	211.4	550.7	6
Dome	8	239.1	545.2	15	239.1	545.2	7
Dome	9	271.85	537.45	15			
Dome	10	306.63	527.68	15	306.63	527.68	8
Dome	11	316.22	524.68	15			
Dome	12	335.6	518.2	15	335.6	518.2	9
Dome	13	356.7	510.37	15			
Dome	14	371.86	504.24	15			
Dome	15	393.7	494.5	15	393.7	494.5	10
Dome	16	404.5	489.3	18.92			
Haunch	17	415.2	483.7	20.31			
Haunch	18	428.7	476.2	22.58	428.7	476.2	11
Haunch	19	441.8	468.2	25.56			
Haunch	20	454.5	459.5	29.46			
Haunch	21	469.9	447.4	36.36	469.9	447.4	12
Haunch	22	483.8	423.18	29.71			
Haunch	23	486.9	407.1	22.52	486.9	407.1	13
Haunch	24	488.47	393.5	19.07			
Wall	25	489	382.1	18	489	374.1	14
Wall	26	489	360.8	18			
Wall	27	489	345.6	18			
Wall	28	489	335	18	489	327	15
Wall	29	489	321	18			
Wall	30	489	306	18			
Wall	31	489	300	18			
Wall	32	489	281	18	489	273	16
Wall	33	489	260.5	18			
Wall	34	489	236	18	489	228.5	17
Wall	35	489	210.5	18			
Wall	36	489	201	18			
Wall	37	489	186.8	18	489	178.8	18
Wall	38	489	171	18			
Wall	39	489	150.5	18			
Wall	40	489	145.5	18	489	137.5	19
Wall	41	489	120.5	18			
Wall	42	489	100.5	18			
Wall	43	489	80	18			
Wall	44	489	60	18	489	62.0	20
Wall	45	489	39.9	18			
Wall	46	489	21	18	489	12	21
Wall	47	489	-4.5	18			

		Coordinates			ANSYS		
	Section	R (inch)	H (inch)	t (Inch)	X	Z	Set #
					489	-12.0	22
					531	-12.0	23
Slab	48	517	-18.4	23.5			
Slab	49	508.5	-18.4	23.5			
Slab	50	503	-18.4	23.5			
Slab	51	496.8	-19.1	23.5			
Slab	52	493	-19.1	23.5			
Slab	53	489	-19.1	22	489	-12.0	24
Slab	54	485.1	-19.1	22			
Slab	55	481	-19.1	22			
Slab	56	477	-19.1	22			
Slab	57	471	-19.1	22			
Slab	58	465	-19.1	22			
Slab	59	440	-19.1	19.38	438	-12.0	25
Slab	60	421.4	-17.9	17.05	423		
					400	-12.0	26
Slab	61	390	-15.9	13.12			
Slab	62	358	-13.9	9.13	340	-12.0	27
Slab	63	338	-13.4	8			
Slab	64	277.7	-13.4	8	280	-12.0	28
Slab	65	218.5	-13.4	8	220	-12.0	29
Slab	66	180	-13.4	8	160	-12.0	30
Slab	67	129.9	-13.4	8		-12.0	31
Slab	68	95.7	-13.4	8	100	-12.0	32
Slab	69	54	-17.1	15.43			
					36	-12.0	33
Slab	70	20	-20.1	21.5			
					0	-12.0	34

Element stiffnesses are also based on the TOLA model for best estimate concrete conditions for a maximum temperature of 250°F. Common properties for all concrete sections are provided below.

Poisson's Ratio (ν) = 0.18
Damping = 7%

Input file "Tank-Props-BEC-250.txt" defines the concrete shell material properties and real constants (thickness) for the best estimate concrete. Input file "Tank-Props-BEC-Crack.txt" defines the concrete shell material properties and real constants (thickness) for the fully cracked concrete. Table 2-3 provides a complete listing of section properties based on the TOLA model. Table 2-4 provides concrete section properties assuming all sections are cracked.

Table 2-3. Best Estimate Concrete Properites, 250°F.

Cracked	Eshl		Shell Thickness t-shl		Shell Density, Rho-shl		M&D Section No.	PNNL Section No.
Y/N	(psi)	(ksf)	(in)	(ft)	(lb/in^3)	(lbf/ft^3)		
N	4.502E+06	648,297	15.35	1.28	0.08484	147		1
N	4.352E+06	626,754	15.18	1.26	0.08578	148	1	2
N	4.306E+06	620,114	15.12	1.26	0.08609	149	2	3
N	4.282E+06	616,594	15.09	1.26	0.08627	149	3	4
N	4.262E+06	613,774	15.15	1.26	0.08595	149		5
N	4.243E+06	610,922	15.13	1.26	0.08609	149	4	6
N	4.315E+06	621,305	15.21	1.27	0.08559	148	5	7
N	4.295E+06	618,475	15.19	1.27	0.08572	148		8
N	4.216E+06	607,093	15.17	1.26	0.08583	148	6	9
N	4.201E+06	604,939	15.15	1.26	0.08594	148		10
N	4.439E+06	639,237	15.39	1.28	0.08463	146	7	11
N	4.425E+06	637,265	15.34	1.28	0.08487	147		12
N	4.405E+06	634,338	15.32	1.28	0.08497	147	8	13
N	4.392E+06	632,441	15.31	1.28	0.08504	147		14
N	4.316E+06	621,503	15.30	1.28	0.08510	147		15
N	4.406E+06	634,531	19.32	1.61	0.08499	147		16
N	4.366E+06	628,756	20.73	1.73	0.08505	147	9	17
N	4.323E+06	622,528	22.99	1.92	0.08527	147		18
Y	1.655E+06	238,350	26.72	2.23	0.08302	143		19
Y	1.345E+06	193,677	26.78	2.23	0.09548	165	10	20
N	4.000E+06	575,959	37.86	3.15	0.08337	144	11	21
N	3.960E+06	570,283	30.93	2.58	0.08339	144		22
Y	1.264E+06	182,025	21.60	1.80	0.09052	156		23
Y	1.409E+06	202,953	18.00	1.50	0.09197	159	12	24
Y	1.120E+06	161,221	15.28	1.27	0.10227	177		25
Y	1.093E+06	157,426	15.36	1.28	0.10170	176	13	26
Y	1.076E+06	155,010	15.42	1.28	0.10133	175		27
Y	1.068E+06	153,784	14.00	1.17	0.11163	193		28
Y	1.068E+06	153,784	14.00	1.17	0.11163	193		29
Y	1.068E+06	153,784	14.00	1.17	0.11163	193	14	30
Y	9.490E+05	136,651	13.53	1.13	0.11552	200		31
Y	9.490E+05	136,651	13.53	1.13	0.11552	200		32
Y	9.490E+05	136,651	13.53	1.13	0.11552	200	15	33
Y	9.490E+05	136,651	13.53	1.13	0.11552	200		34
Y	9.490E+05	136,651	13.53	1.13	0.11552	200	16	35
Y	9.490E+05	136,651	13.53	1.13	0.11552	200		36
Y	9.490E+05	136,651	13.53	1.13	0.11552	200		37
N	9.589E+05	138,084	14.89	1.24	0.10496	181	17	38
N	3.467E+06	499,310	18.08	1.51	0.08644	149		39
Y	3.435E+06	494,646	18.06	1.50	0.08652	150		40
Y	8.568E+05	123,378	12.89	1.07	0.12123	209	18	41
Y	8.568E+05	123,378	12.89	1.07	0.12123	209		42
Y	8.655E+05	124,633	14.21	1.18	0.10997	190	19	43
Y	8.655E+05	124,633	14.21	1.18	0.10997	190		44
Y	8.568E+05	123,378	12.89	1.07	0.12123	209		45
Y	8.638E+05	124,388	12.86	1.07	0.12149	210	20	46
Y	8.871E+05	127,746	14.12	1.18	0.11067	191		47
N	3.810E+06	548,683	23.64	1.97	0.09606	166	21	48
N	3.764E+06	542,010	23.65	1.97	0.09604	166		49
Y	1.038E+06	149,405	20.05	1.67	0.10680	185		50
Y	1.054E+06	151,733	20.06	1.67	0.10674	184		51
Y	1.075E+06	154,870	20.12	1.68	0.10643	184	22	52
Y	7.157E+05	103,055	14.04	1.17	0.13627	235		53
N	3.571E+06	514,287	17.19	1.43	0.09959	172	23	54
N	3.570E+06	514,043	13.20	1.10	0.10383	179		55
Y	1.140E+06	164,113	6.14	0.51	0.16690	288	24	56
N	3.632E+06	522,946	7.94	0.66	0.11656	201	25	57

Cracked	Eshl		Shell Thickness t-shl		Shell Density, Rho-shl		M&D Section No.	PNNL Section No.
Y/N	(psi)	(ksf)	(in)	(ft)	(lb/in^3)	(lbf/ft^3)		
Y	1.349E+06	194,254	4.96	0.41	0.18649	322	26	58
Y	1.387E+06	199,783	7.02	0.58	0.16289	281	27	59
Y	1.129E+06	162,553	6.61	0.55	0.17280	299	28	60
Y	1.393E+06	200,531	5.01	0.42	0.22800	394	29	61
Y	1.163E+06	167,538	4.81	0.40	0.23765	411	30	62
Y	8.719E+05	125,560	12.28	1.02	0.14557	252		63

Table 2-4. Fully Cracked Concrete Properites.

Is Section Cracked?	Eshl		Shell Thickness t-shl		Shell Density, Rho-shl		M&D Section No.	PNNL Section No.
	(psi)	(ksf)	(in)	(ft)	(lb/in^3)	(lbf/ft^3)		
Y	1.435E+06	206,708	14.64	1.22	0.08893	154		1
Y	1.084E+06	156,131	13.21	1.10	0.09854	170	1	2
Y	9.438E+05	135,907	12.40	1.03	0.10504	182	2	3
Y	8.552E+05	123,148	11.78	0.98	0.11053	191	3	4
Y	9.951E+05	143,289	12.81	1.07	0.10168	176		5
Y	9.318E+05	134,181	12.41	1.03	0.10491	181	4	6
Y	1.141E+06	164,239	13.58	1.13	0.09590	166	5	7
Y	1.089E+06	156,781	13.32	1.11	0.09774	169		8
Y	1.029E+06	148,115	13.08	1.09	0.09951	172	6	9
Y	9.768E+05	140,657	12.53	1.04	0.10391	180		10
Y	1.512E+06	217,769	14.64	1.22	0.08897	154	7	11
Y	1.482E+06	213,340	14.39	1.20	0.09048	156		12
Y	1.443E+06	207,751	14.28	1.19	0.09119	158	8	13
Y	1.417E+06	204,062	14.20	1.18	0.09168	158		14
Y	1.371E+06	197,485	14.12	1.18	0.09219	159		15
Y	1.544E+06	222,339	18.42	1.53	0.08916	154		16
Y	1.474E+06	212,206	19.67	1.64	0.08962	155	9	17
Y	1.394E+06	200,772	21.66	1.81	0.09047	156		18
Y	1.531E+06	220,469	27.13	2.26	0.08177	141		19
Y	1.240E+06	178,532	27.37	2.28	0.09343	161	10	20
Y	1.046E+06	150,644	34.88	2.91	0.09050	156	11	21
Y	1.270E+06	182,924	32.31	2.69	0.07982	138		22
Y	1.163E+06	167,483	22.03	1.84	0.08873	153		23
Y	1.302E+06	187,438	18.31	1.53	0.09041	156	12	24
Y	1.028E+06	147,988	15.59	1.30	0.10025	173		25
Y	1.004E+06	144,559	15.67	1.31	0.09972	172	13	26
Y	9.887E+05	142,377	15.72	1.31	0.09937	172		27
Y	9.808E+05	141,234	14.29	1.19	0.10936	189		28
Y	9.808E+05	141,234	14.29	1.19	0.10936	189		29
Y	9.808E+05	141,234	14.29	1.19	0.10936	189	14	30
Y	8.690E+05	125,131	13.83	1.15	0.11297	195		31
Y	8.690E+05	125,131	13.83	1.15	0.11297	195		32
Y	8.690E+05	125,131	13.83	1.15	0.11297	195	15	33
Y	8.690E+05	125,131	13.83	1.15	0.11297	195		34
Y	8.690E+05	125,131	13.83	1.15	0.11297	195	16	35

Is Section Cracked?	Eshl		Shell Thickness t-shl		Shell Density, Rho-shl		M&D Section No.	PNNL Section No.
	(psi)	(ksf)	(in)	(ft)	(lb/in^3)	(lbf/ft^3)		
Y	8.690E+05	125,131	13.83	1.15	0.11297	195		36
Y	8.690E+05	125,131	13.83	1.15	0.11297	195		37
Y	8.782E+05	126,463	15.21	1.27	0.10273	178	17	38
Y	8.690E+05	125,131	13.83	1.15	0.11297	195		39
Y	7.828E+05	112,717	13.20	1.10	0.11839	205		40
Y	7.828E+05	112,717	13.20	1.10	0.11839	205	18	41
Y	7.828E+05	112,717	13.20	1.10	0.11839	205		42
Y	7.908E+05	113,881	14.54	1.21	0.10747	186	19	43
Y	7.908E+05	113,881	14.54	1.21	0.10747	186		44
Y	7.828E+05	112,717	13.20	1.10	0.11839	205		45
Y	7.891E+05	113,629	13.17	1.10	0.11864	205	20	46
Y	8.104E+05	116,693	14.45	1.20	0.10813	187		47
Y	9.322E+05	134,235	21.54	1.79	0.10546	182	21	48
Y	9.324E+05	134,263	21.66	1.80	0.10488	181		49
Y	9.504E+05	136,857	20.46	1.71	0.10463	181		50
Y	9.659E+05	139,096	20.46	1.71	0.10465	181		51
Y	9.861E+05	141,998	20.52	1.71	0.10436	180	22	52
Y	6.510E+05	93,743	14.43	1.20	0.13263	229		53
Y	7.229E+05	104,097	14.13	1.18	0.12109	209	24	54
Y	8.420E+05	121,245	11.21	0.93	0.12227	211		55
Y	1.048E+06	150,866	6.25	0.52	0.16372	283	24	56
Y	1.147E+06	165,097	4.93	0.41	0.18777	324	25	57
Y	1.246E+06	179,441	5.05	0.42	0.18346	317	26	58
Y	1.283E+06	184,804	7.11	0.59	0.16072	278	27	59
Y	1.038E+06	149,438	6.73	0.56	0.16977	293	28	60
Y	1.288E+06	185,420	5.09	0.42	0.22441	388	29	61
Y	1.070E+06	154,101	4.90	0.41	0.23326	403	30	62
Y	7.964E+05	114,687	12.57	1.05	0.14218	246		63

Input file "Tank-Mesh1.txt" develops the concrete shell model. Element type SHELL143 is used for the concrete shell to be able to extract through-wall shear forces.

Figure 2-3 and Figure 2-4 show the profile and full concrete shell model respectively.

Figure 2-3. Concrete Shell Profile Inlcuding Shell Thickness.

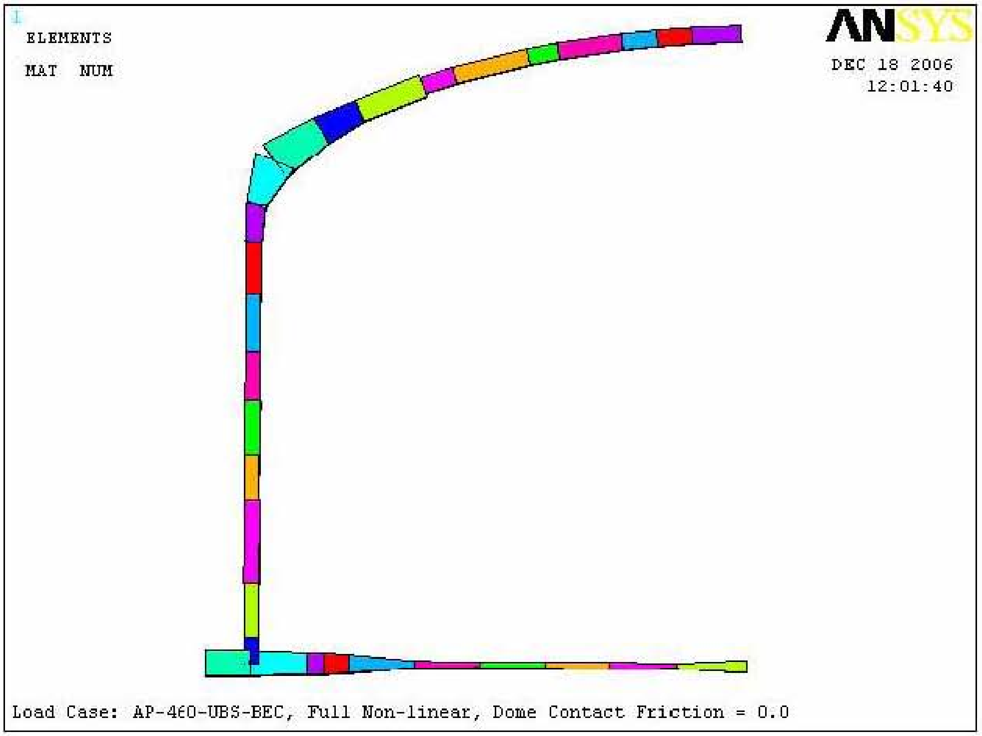
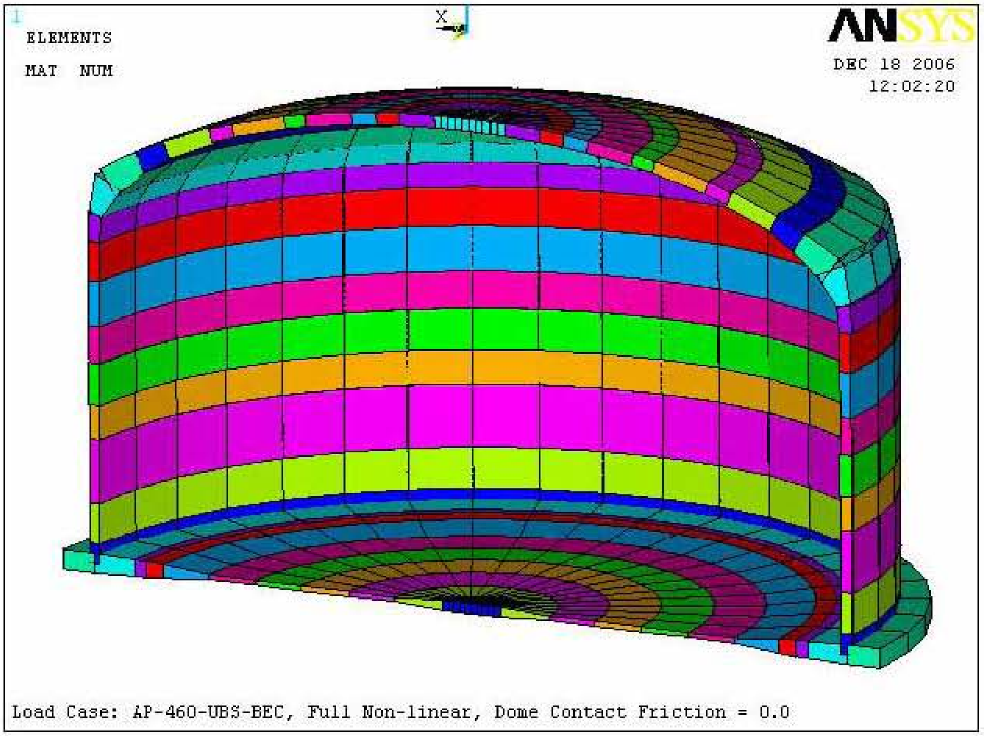


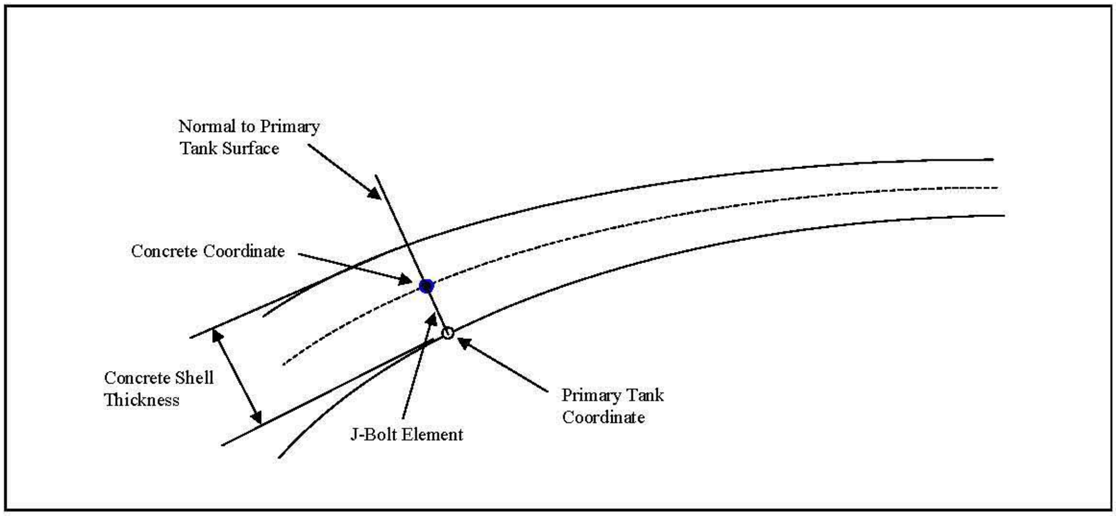
Figure 2-4. Concrete Shell Model Detail.



2.1.2 Primary Tank

The geometry of the primary tank is based on drawing H-2-90534. To ensure that the J-bolt elements are perpendicular to the primary tank, the primary tank dome coordinates were calculated based on the location of the corresponding concrete shell coordinate, taking into account the concrete shell thickness, and normal to the primary tank (see Figure 2-5). The concrete shell thickness used is based on the nominal concrete thickness.

Figure 2-5. Primary/Concrete Shell Node Geometry.



The location of the primary tank nodes were iteratively determined as follows:

Select a value for x (radial distance from center of the tank).

Calculate the respective location for y' based on the defined shape of the primary tank. The primary tank is an ellipse with a major axis of 80 ft and minor axis of 30 ft. The equation for the location of y' is as follows:

$$y' = a\sqrt{1-\frac{x^2}{b^2}} - a, \textit{ where}$$

$$a = \textit{Minor Radius} = 180\ \textit{in}$$

$$b = \textit{Major Radius} = 480\ \textit{in}$$

$$x = \textit{Test Location for } x$$

$$\textit{For } x = 61.0398, y' = 180\sqrt{1-\frac{61.0398^2}{480^2}} - 180 = -1.46$$

The slope of the ellipse can be calculated by taking the derivative of the equation for y'.

$$\frac{d}{dx}\left(a\sqrt{1-\frac{x^2}{b^2}}\right)=-\frac{x\frac{a}{b}}{\sqrt{b^2-x^2}}$$

For x = 61.0398 inches, the slope of the ellipse is –0.048 radians. The corresponding angle is the arctangent of the slope, or in this case, -0.048 radians. The length of line connecting the centerline of the concrete to the primary tank is half the thickness of the tank at that point. Therefore, to check the accuracy of the assumed x-location of the primary tank, back-calculate the location of the concrete coordinates. If the back-calculated concrete location is the same as the known location, the x-location of the primary tank must be correct, otherwise, reselect x until it is correct.

Following the example, for concrete location of (61.4 inches), the x-location of the primary tank is 61.0398 inches. y' was determined to be –1.46 inches. Adjusting this to value for the vertical location of the center of the ellipse, add 561.45 inches (elevation of the primary tank at the apex). For this case, y=559.99 inches. The check is as follows:

$$X_{conc} = X_{primary} + \frac{t}{2}\sin(\theta), \textit{ where } \theta \textit{ is the angle of the slope from horizontal}$$

$$X_{conc} = 61.0398 + \frac{15}{2}\sin(0.048) = 61.39966 \approx 61.4 \textit{ inches}$$

$$Y_{conc} = Y_{primary} + \frac{t}{2}\cos(\theta) = 559.99 + \frac{15}{2}\cos(0.048) = 567.48136 \approx 567.5 \textit{ inches}$$

Table 2-5. Primary Tank Dome Coordination Calculation.

Concrete				Primary Tank							
x	y	t		x	y	y'	Slope	Angle (rad)	Angle (Deg)		
0	568.95	15	0%	0	561.30	0.00	0.000	0.000	0.000	7.500	0.000
45	568.2	15	0%	44.7369	560..50	-0.78	-0.035	-0.035	-2.010	7.495	-0.263
90.4	565.8	15	0%	89.8653	558.32	-1.46	-0.048	-0.048	-2.753	7.491	-0.360
120.72	563.21	15	0%	119.9972	555.74	-5.72	-0.097	-0.097	-5.530	7.465	-0.723
152.9	559.7	15	0%	151.9685	552.26	-9.26	-0.125	-0.125	-7.134	7.442	-0.931
211.4	550.7	15	0%	210.0535	543.32	-18.15	-0.183	-0.181	-10.343	7.378	-1.347
239.1	545.2	15	0%	237.5336	537.86	-23.59	-0.214	-0.210	-12.055	7.335	-1.566
306.63	527.68	15	0%	304.4248	520.51	-40.83	-0.308	-0.298	-17.099	7.169	-2.205
335.6	518.2	15	0%	333.0513	511.15	-50.38	-0.361	-0.347	-19.866	7.054	-2.549
393.7	494.5	15	0%	390.2214	487.86	-75.18	-0.524	-0.482	-27.633	6.645	-3.479
428.7	476.2	22.58	0%	422.2643	466.93	-94.41	-0.694	-0.607	-34.752	9.276	-6.436
				432	460.20	-101.54	-0.774	-0.659	-37.750	0.000	0.000
				440	453.39	-108.06	-0.860	-0.710	-40.700	0.000	0.000
a	180										
b	480		Note: Y Coordinates (Vertical) are 8 inches higher in the ANSYS® Model								

Element thicknesses are based on the drawing H-2-90534 but with reduction of 0.06 inches for corrosion. General steel properties are used and are as follows:

Elastic Modulus (E) = 4,176,200 kip/ft^2
Poisson's Ratio (ν) = 0.30
Mass Density (ρ) = 0.001522 kip-sec^2/ft^4 = ((0.490 kip/ft^3)/(32.2 ft/sec^2))
Damping = 2%

Tank coordinates are developed in the model from input file "Tank-Coordinates-AP.txt." Tank element properties are from input file "Primary-Props-AP." The tank mesh is generated using "Primary.txt" and uses SHELL143 elements.

Figure 2-6 shows the full primary tank model and Figure 2-7 shows the detail in the knuckle region at the bottom of the tank.

Figure 2-6. Primary Tank Model Detail.

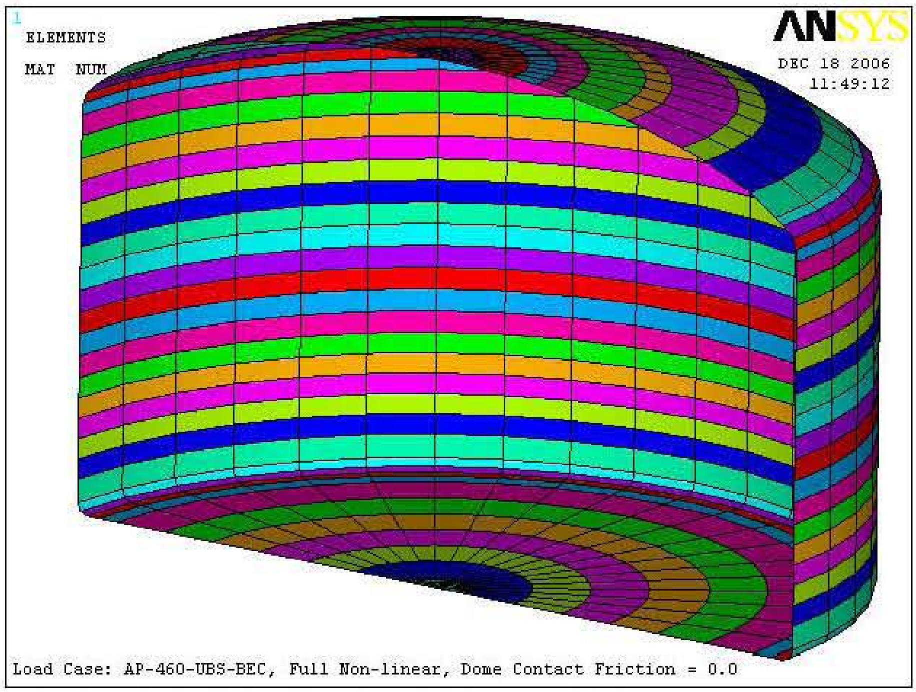
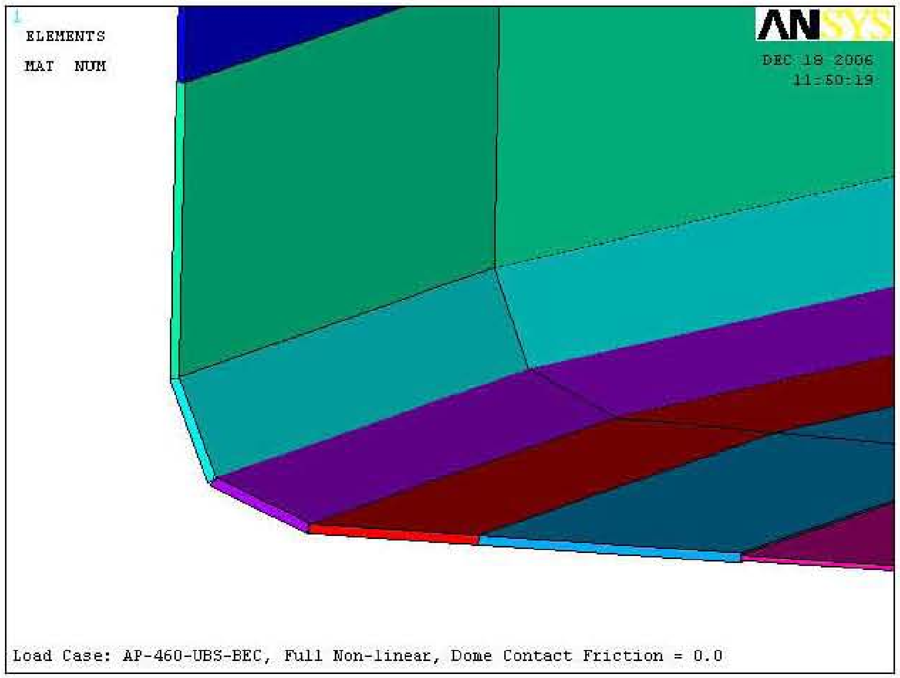


Figure 2-7. Primary Tank Model Detail – Knuckle Region.



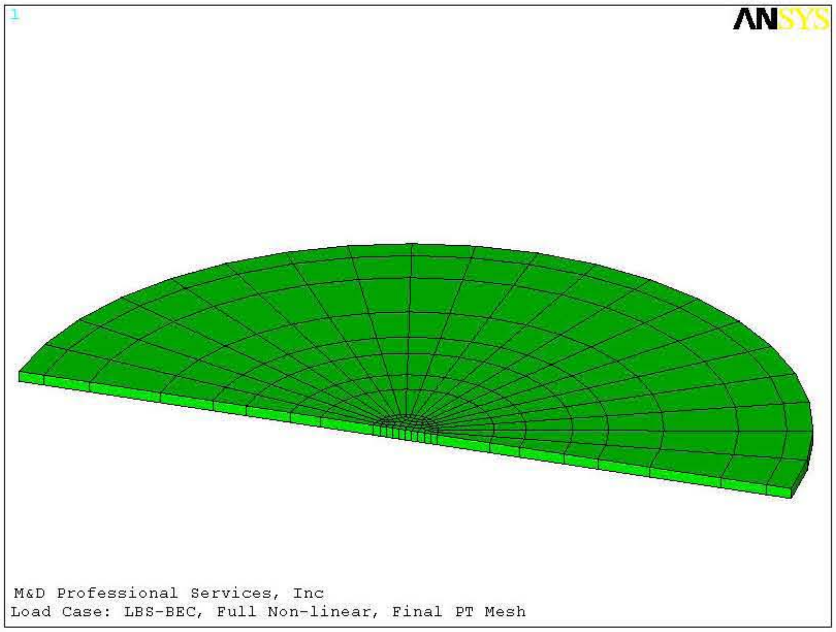
2.1.3 Insulating Concrete

The insulating concrete uses the geometry defined for the concrete and primary tanks and fills in the open volume with solid element (SOLID45). Concrete properties are taken from Rinker et al. (2004).

Elastic Modulus (E) = 23,760 kip/ft^2
Poisson's Ratio (ν) = 0.15
Mass Density (ρ) = 0.00155 kip-sec^2/ft^4 = ((0.050 kip/ft^3)/(32.2 ft/sec^2))
Damping = 7%

Material properties for the insulating concrete are in the file "Tank-Props-BEC-250.txt." The element mesh is generated using "Insulate.txt." Figure 2-8 shows the insulating concrete elements.

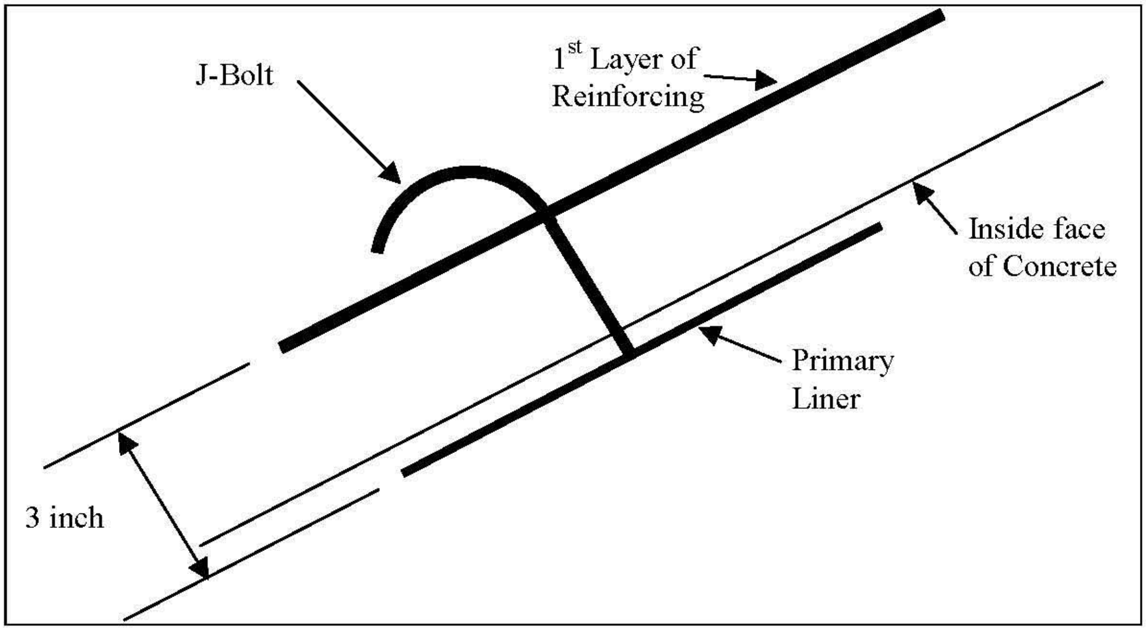
Figure 2-8. Insulating Concrete Model Detail.



2.1.4 J-bolts

The J-bolts connecting the primary tank to the concrete shell are modeled using beam elements (BEAM44) and spring elements (COMBIN14). The stiffness properties are calculated to provide an axial stiffness equal to the total stiffness related to the J-bolts in the attributed area. Based on drawing H-2-64310 the J-bolts are space on an average of 2 ft in each direction. Therefore, the stiffness of the bolts in the model is based on the number of 4 ft^2 areas associated with the element. The BEAM44 elements are modeled as essentially rigid, and three orthogonal springs included providing an appropriate stiffness.

Figure 2-9. J-bolt Geometry Detail.



The stiffness of a single J-bolt was initially based on the physical dimension for the installation. The bolt is ½ inch in diameter and is hooked around the first layer of reinforcing steel, which has a 3 in cover. Therefore, the stiffness is as follows:

$$k = \frac{EA}{L}$$

$$E = 29{,}000{,}000\,psi$$

$$A = \frac{\pi d^2}{4} = \frac{\pi\left(\frac{1}{2}\right)^2}{4} = 0.196\,in^2$$

$$L = 3\,in$$

$$k = \frac{(29{,}000{,}000)(0.196)}{3} = 1.895E6\,lbf/in = 22{,}736\,kip/ft$$

The required area is calculated based on the number of bolts to be represented and the thickness of the concrete at the bolt location.

Table 2-6. J-bolt Stiffness/Area Calculation.

Ring No.	1	2	3	4	5	6	7	8	9	10	11
x	0.00	44.72	89.87	120.00	151.97	210.05	237.53	304.42	333.05	390.22	422.26
y	561.45	560.77	558.37	555.83	552.29	543.40	537.96	520.72	511.17	486.37	467.14
	0.00	0.68	3.08	5.62	9.16	18.05	23.49	40.73	50.28	75.08	94.31
Delta Y	0.00	0.68	2.40	2.53	3.54	8.89	5.43	17.25	9.55	24.80	19.23
x'	0.00	44.72	89.92	120.13	152.24	210.83	238.69	307.14	336.83	397.38	432.67
x"	0.00	44.72	89.93	120.17	152.34	211.10	239.11	308.19	338.37	400.69	438.06
Horizontal Midpoint	22.36	67.33	105.05	136.26	181.72	225.11	273.65	323.28	369.53	419.37	443.88

Ring No.	1	2	3	4	5	6	7	8	9	10	11
Ring Area	785.52	6335.32	10214.81	11827.27	22708.34	27726.13	38033.10	46534.03	50329.54	61766.66	41420.22
Number of Bolts in Ring	1.36	11.00	17.73	20.53	39.42	48.14	66.03	80.79	87.38	107.23	71.91
Bolts per element (20 Sections)	1.36	0.55	0.89	1.03	1.97	2.41	3.30	4.04	4.37	5.36	3.60

After testing the model using gravity loads, it was determined that the stiffness calculated above did not provide a good match to the TOLA model for the same loading. Therefore, the stiffness of the bolts was "tuned" to provide similar results to the TOLA model. The J-bolt model is developed using input file "Bolt-Friction.txt". See Figure 2-10 for the distribution of J-bolts. Figure 2-11 shows the locations of spring elements connecting the end of each J-bolt to the primary tank.

Figure 2-10. J-bolt Model Detail.

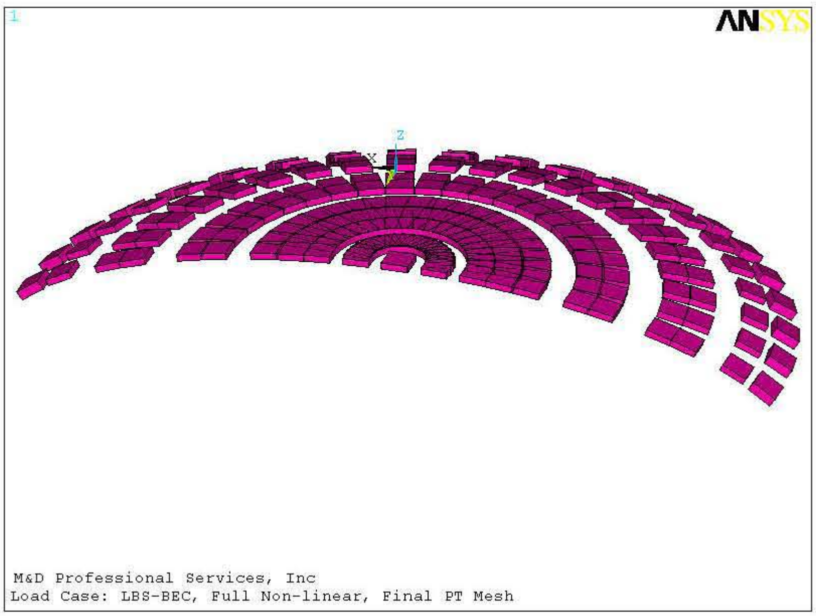
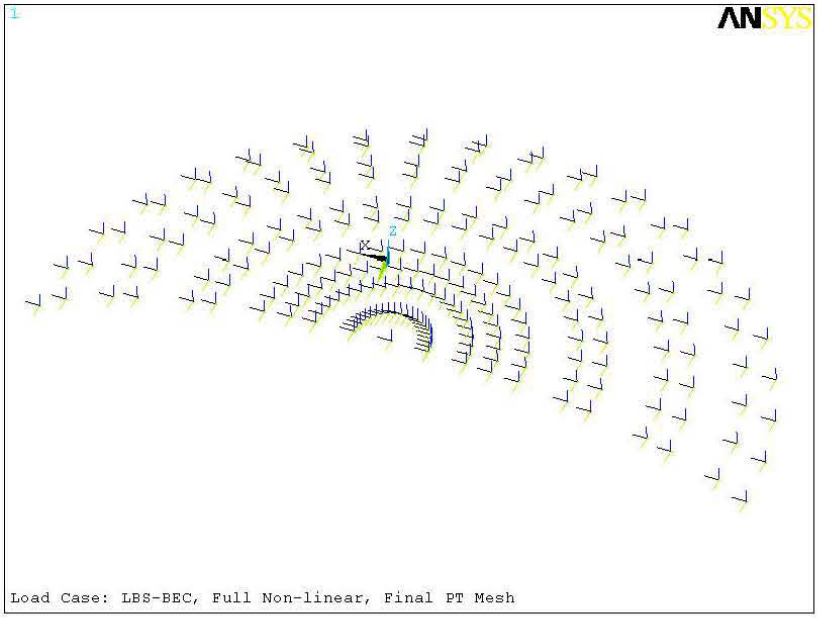


Figure 2-11. Spring Elements – J-bolts to Primary Tank.



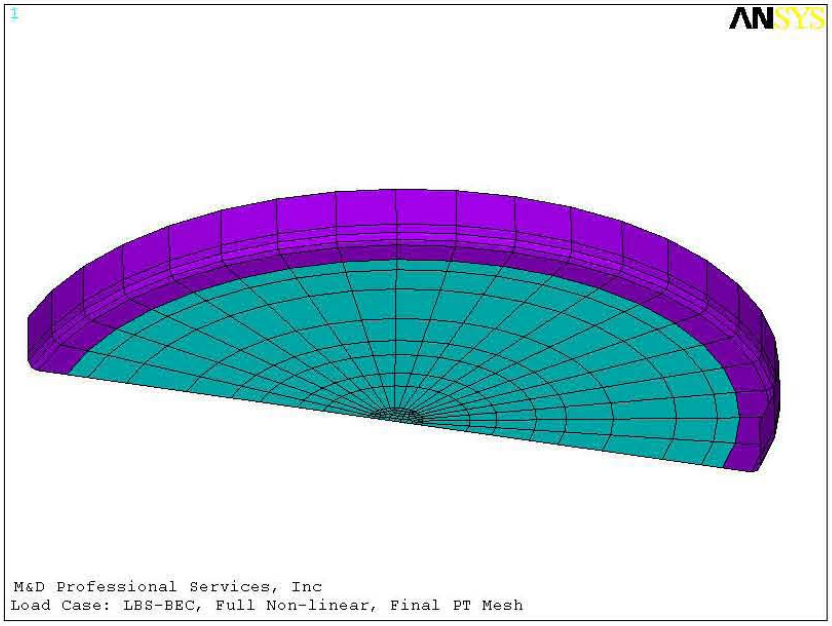
2.1.5 Secondary Liner

The secondary liner is modeled using SHELL143 elements and its geometry is taken from H-2-64449. The steel thickness is 0.25 inch throughout the liner. The model stops after the first full wall element coincident with the liner.

Input file "Liner.txt" develops the model for the liner using the geometry defined for the concrete shell in "Tank-Coordinates.txt." The following material properties are used for the steel liner.

Elastic Modulus (E) =4,176,200 kip/ft^2
Poisson's Ratio (ν) = 0.30
Mass Density (ρ) = 0.001522 kip-sec^2/ft^4 = ((0.490 kip/ft^3)/(32.2 ft/sec^2))
Damping = 2%

Figure 2-12. Secondary Liner Model Detail.



2.1.6 Waste

The waste is modeled using solid elements (SOLID45) with material properties defined to simulate a liquid. The waste elements are meshed such that there are no common nodes with the primary tank; however, those on the exterior (at the primary tank) are coincident with the primary tank nodes. Contact elements are used for the interface between the waste and the primary tank. The material properties are as follows:

Elastic Modulus (E) = 2.592 kip/ft^2
Poisson's Ratio (ν) = 0.49999
Mass Density (ρ) = 0.00355 kip-sec^2/ft^4 = ((1.83*0.0624 kip/ft^3)/(32.2 ft/sec^2))
Damping = 0
Shear Modulus (G) = 0.216 kip/ft^2

The elastic modulus was calculated based on the bulk modulus of water (~300,000 psi). Using a value of ν close to 0.5 (0.49990), the value of E can be calculated.

$$B = E/[3(1-2\nu)]\ or$$

$$E = B[3(1-2\nu)] = 300{,}000[3(1-2(0.49999))] = 18 lb/in^2 = 2.592 k/ft^2$$

The shear modulus can then be calculated based on E and ν, G=E/[2(1+ν)]. For the values shown above, this gives a value for G of 0.864 kip/ft^2. However, because a fluid cannot carry shear, a smaller value is used. The value was selected such that the solution remains mathematically stable, but does not transmit significant shear energy. Plots of the waste elements are shown in Figure 2-13 and Figure 2-14.

Figure 2-13. Waste Model Detail.

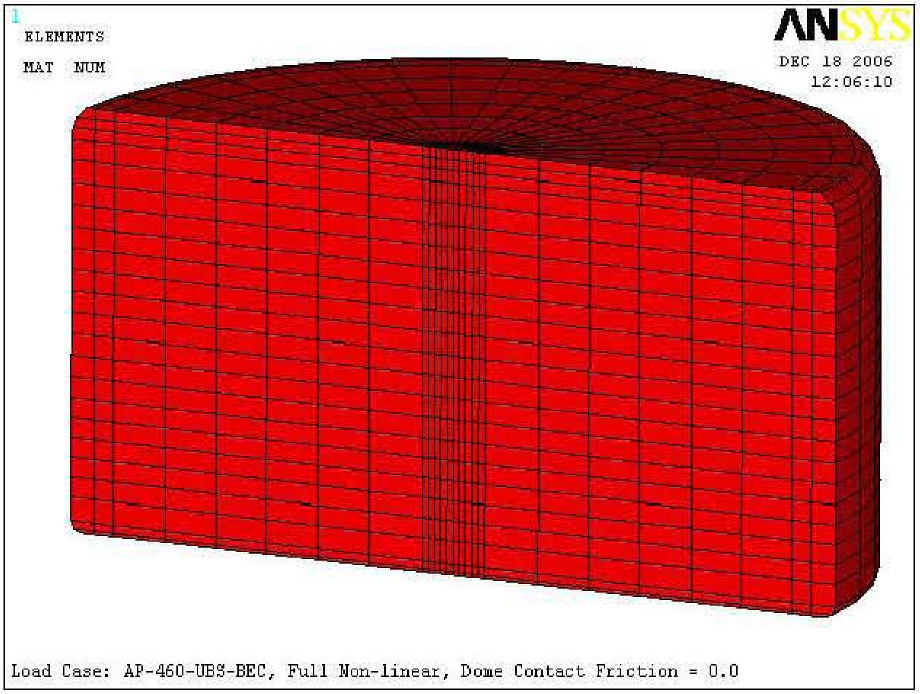
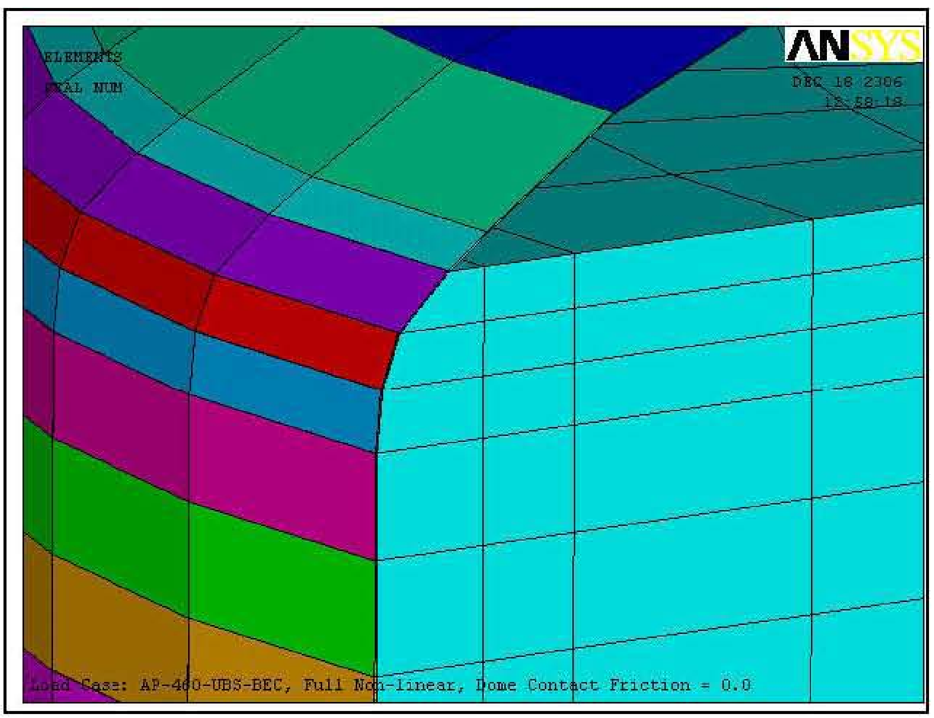


Figure 2-14. Waste Model Detail, Interface with Tank Dome.

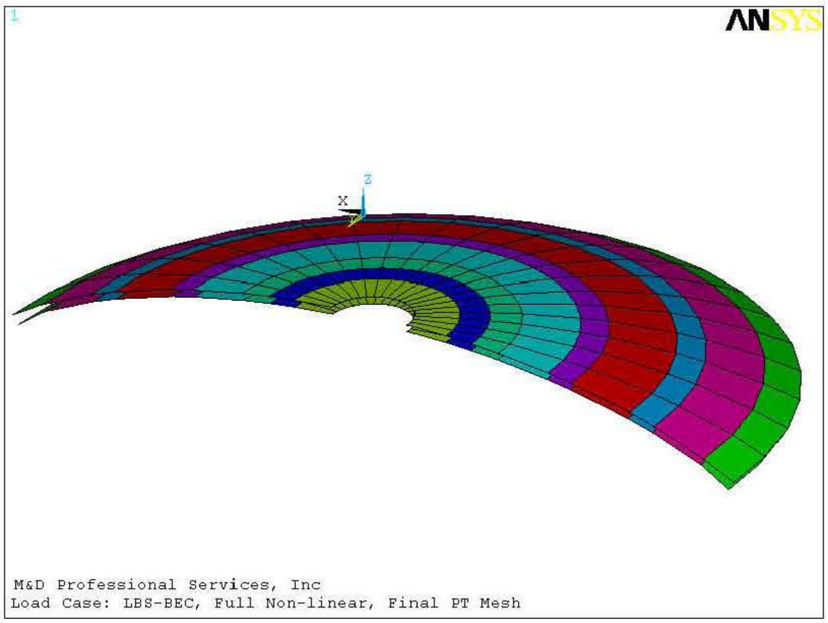


2.1.7 Primary Tank and Concrete Dome Interface

A combination of TARGE170 and CONTA173 elements are used to model the interface between the top of the primary tank and the inside face of the concrete dome. Key-option controls are used to place the interface location at the inside face of the concrete (or bottom of the concrete shell element). A coefficient of friction of 0.01 was used for the contact surface. A low friction value results in the primary load path for shear between the primary tank and the dome to be through the J-bolts. The small positive value is used to improve model solution stability without significantly affecting the solution.

The contact surface is developed using input file "bolt-friction.txt." Figure 2-15 shows the contact and target elements comprising the dome contact surface.

Figure 2-15. Contact Elements – Primary Tank to Concrete Dome.



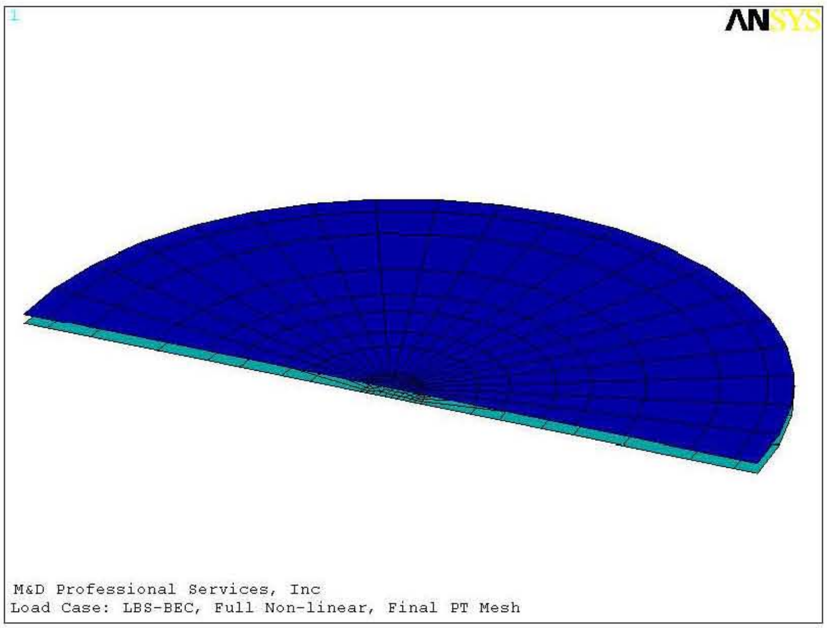
2.1.8 Primary Tank/Insulating Concrete Interface

A combination of TARGE170 and CONTA173 elements are used to model the interface between the bottom of the primary tank and the top of the insulating concrete. The contact and target surfaces are modeled as coincident (i.e., no offsets are included for shell thicknesses). A coefficient of friction of 0.4 was used for the contact surface. The contact surface is developed using input file "interface1.txt." See Figure 2-16 shows the contact elements (Top layer of elements)

2.1.9 Insulating Concrete/Secondary Liner Interface

A combination of TARGE170 and CONTA173 elements are used to model the interface between the bottom of the primary tank and the top of the insulating concrete. The contact and target surfaces are modeled as coincident (i.e., no offsets are included for shell thicknesses). A coefficient of friction of 0.4 was used for the contact surface. . The contact surface is developed using input file "interface1.txt." See Figure 2-16 shows the contact elements (Bottom layer of elements).

Figure 2-16. Contact Elements –Insulating Concrete Top and Bottom.



2.1.10 Interface Between Concrete Shell and Soil

A combination of TARGE170 and CONTA173 elements are used to model the interface between the soil and the concrete shell, and for the interface plane between the native and excavated soils. A coefficient of friction of 0.2 was used for the contact surface between the soil and the concrete shell during the static gravity loading to realistically simulate the distribution of geostatic loads. The friction coefficient was then increased to 0.6 for the transient portion of the solution to simulate the dynamic frictional response at this interface (see Rinker et al. [2006d] for additional discussion of soil friction). See Figure 2-17 for the contact surface model.

For the interface between the bottom of the footing and the native soil, COMBIN14 (spring) elements were used. Arbitrary high stiffness values were applied to these springs because the flexibility at the interface is already included in the material properties for the concrete and soil. See Figure 2-18.

Figure 2-17. Contact Elements – Soil to Concrete Shell.

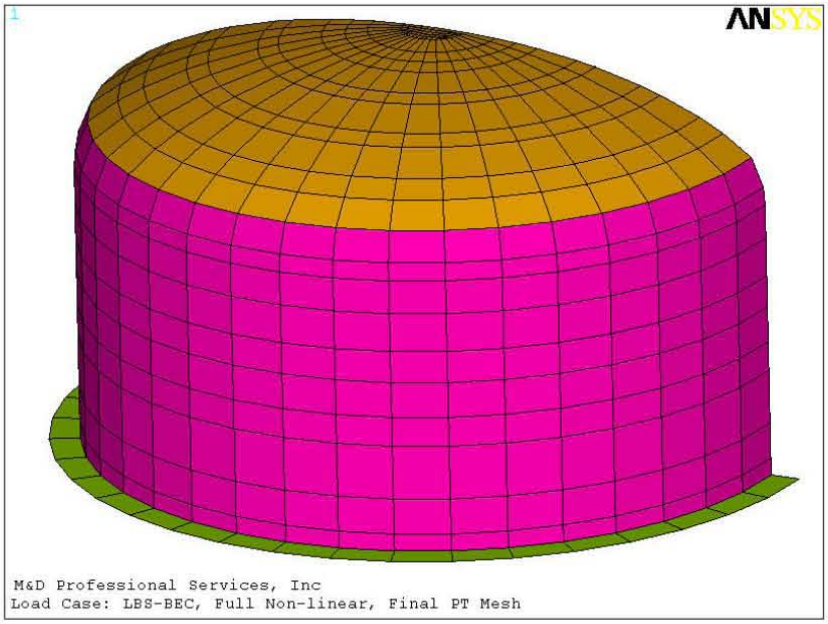
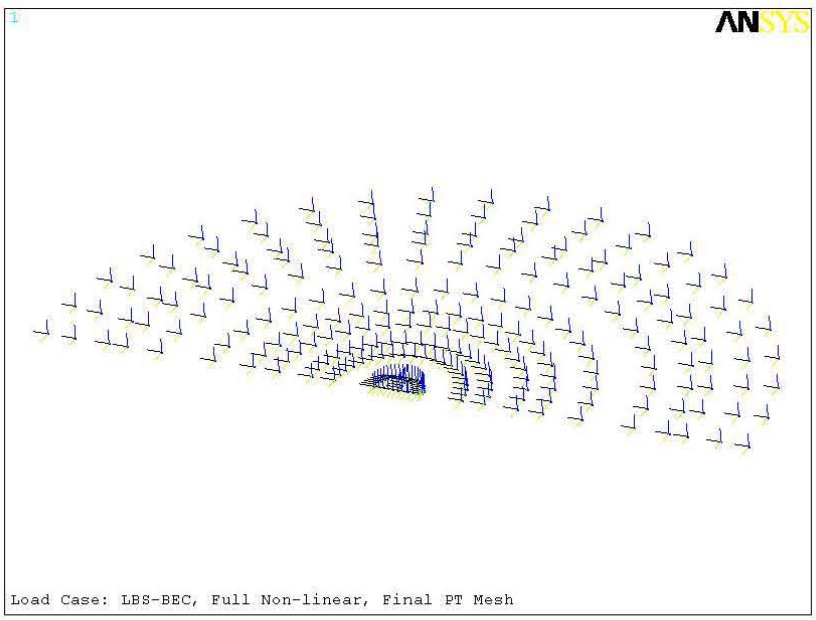


Figure 2-18. Spring Elements – Concrete Footing to Soil.

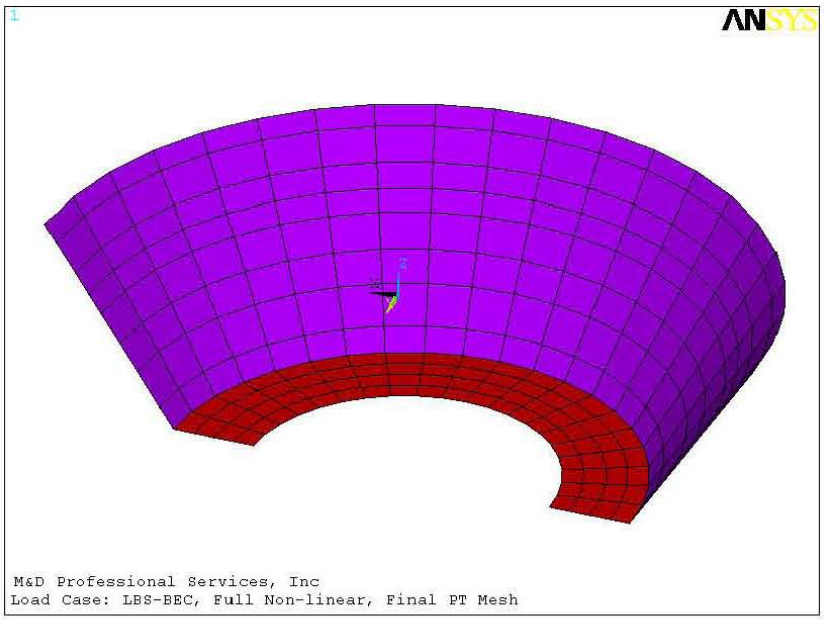


2.1.11 Interface Between Excavated Soil and Native Soil

A combination of TARGE170 and CONTA173 elements are used to model the interface between the native and excavated soils. An initial coefficient of friction for the soil-to-soil interface of 0.3 is used for the gravity (static) analysis. The coefficient of friction is changed to 0.7 for the transient analysis. This surface is included to improve the initial conditions for the transient analysis by allowing an initial displacement between the native and excavated soil but located far enough away that it does not have a significant affect on the tank behavior.

This surface is developed using the input file "fix-soil.txt".

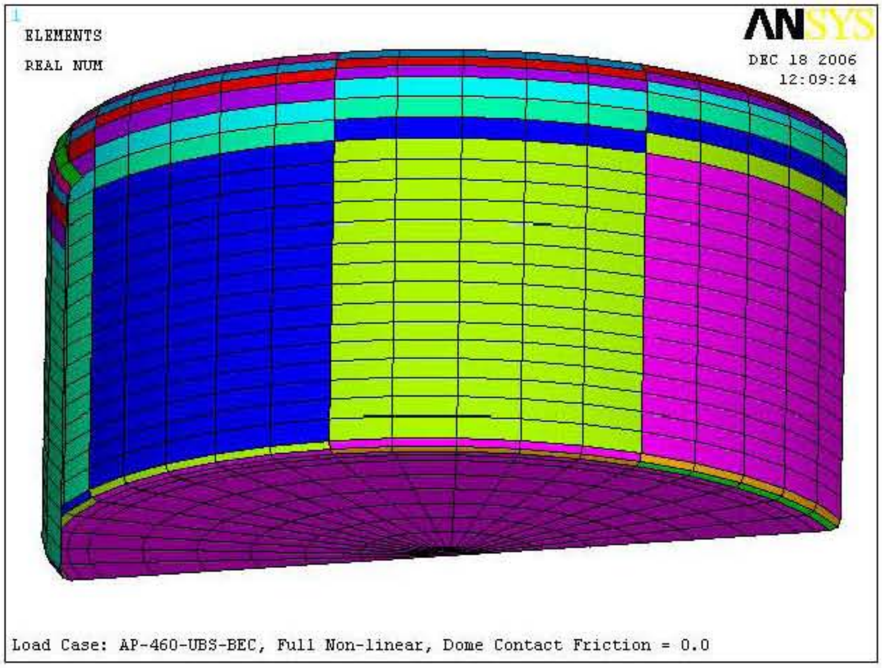
Figure 2-19. Contact Elements – Near Soil to Far Soil.



2.1.12 Interface Between Primary Tank and Waste

A combination of TARGE170 and CONTA173 elements are used to model the interface between waste and primary tank. No friction is included for this surface. A high stiffness was defined for this contact to obtain the correct hydrostatic pressure on the tank. The high stiffness of the contact was needed because the waste model was very soft. Excessive displacements occur without modifying the contact stiffness. The contact surface is divided into multiple zones to enhance the performance of the contacts. This approach captures more realistic waste pressures in areas of higher curvature (dome and knuckle regions). The contact surface is developed using input file "Waste-Soild-AP.txt."

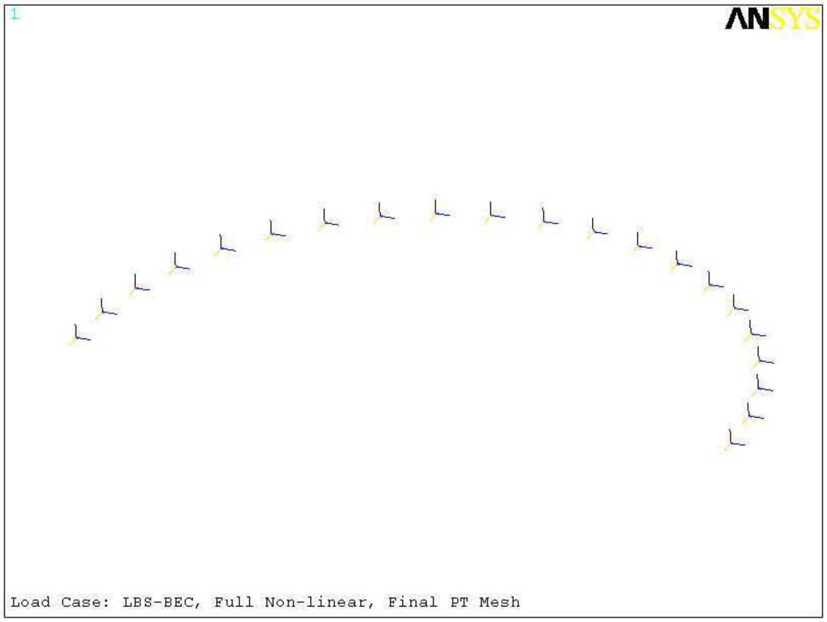
Figure 2-20. Contact Elements – Waste to Primary Tank.



2.1.13 Interface Between Concrete Wall and Tank Footing

The contact at the bottom of the wall was modeled using CONTA178 elements. A friction coefficient of 0.2 was used for this contact to reflect the steel on steel interface. Use of contact elements for this interface will be used to establish if displacement can occur during a seismic event. The contact elements allow only normal and shear forces (no moments) to be transferred to the footing.

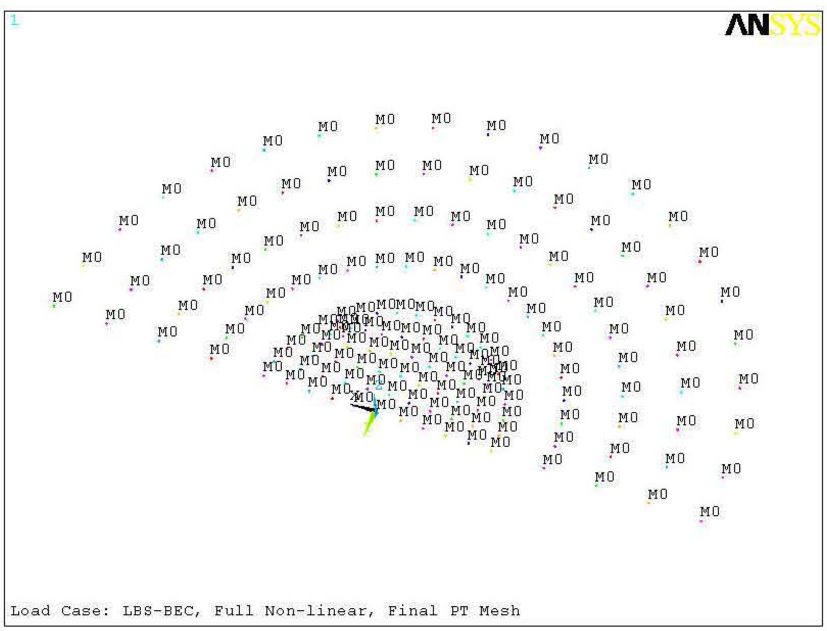
Figure 2-21. Contact Elements – Concrete Wall to Footing.



2.1.14 Surface Loads

MASS21 elements were added to the soil surface over the center of the dome to create a "live load" over the tank dome. The mass provides an equivalent weight of 200,000 lbf. Mass elements were used in lieu of forces to capture the dynamic participation of equipment that creates this load.

Figure 2-22. Mass Elements – Soil Surface.



2.2 SOIL MODEL

2.2.1 Soil Properties

The soil surrounding the tank is modeled in two groups, the excavated soil, and the far-field soil. The excavated soil fills the volume outside the concrete shell and bounded by the slope matching the soil removed during construction. The far-field soil is comprised of all other soil out to a radius of 320 ft and a depth of 266 ft. Both regions are modeled using SOLID45 elements.

Two SHAKE analyses were performed for each soil condition to obtain soil properties for the layering used in the model Rinker, et al. (2006b). One run used the native soil properties and is used for the far-field soil material properties. The second run used material properties associated with structural backfill and the results are used for the material properties in the excavated soil region.

Soil properties used for the model are listed in the following Tables:

- Table 2-7. Best Estimate Native Soil Iterated Soil Properties
- Table 2-8. Best Estimate Excavated Soil Iterated Soil Properties
- Table 2-9. Upper Bound Native Soil Iterated Soil Properties
- Table 2-10. Upper Bound Excavated Soil Iterated Soil Properties
- Table 2-11. Lower Bound Native Soil Iterated Soil Properties
- Table 2-12. Lower Bound Excavated Soil Iterated Soil Properties
-

Table 2-7. Best Estimate Native Soil Iterated Soil Properties.

Layer Depth (ft)	Damping	G (kip/ft^2)	Poisson's Ratio	E (kip/ft^2)	Density (lbf/ft^3)	Material Property No.
2.5	0.017	6622.3	0.24	16,423	110	901
9.2	0.025	6241.7	0.24	15,479	110	902
16.4	0.034	5839.1	0.24	14,481	110	903
22.1	0.028	5930.4	0.24	14,707	110	904
29	0.032	5724.9	0.19	13,625	110	905
37.2	0.033	6494.2	0.19	15,456	110	906
44.7	0.033	7366.4	0.19	17,532	110	907
52.9	0.025	8811.9	0.19	20,972	110	908
65.5	0.026	9851.5	0.19	23,447	110	909
82	0.027	9721.9	0.19	23,138	110	910
98.8	0.029	9560.1	0.19	22,753	110	911
115.5	0.033	9272.5	0.19	22,069	110	912
132	0.025	10831.8	0.19	25,780	110	913
148.3	0.027	10644	0.19	25,333	110	914
167.5	0.022	13867.4	0.28	35,501	120	915
189.5	0.021	15416	0.28	39,465	120	916
211.5	0.023	15064.3	0.28	38,565	120	917
233.5	0.025	14732.5	0.28	37,715	120	918

Layer Depth (ft)	Damping	G (kip/ft^2)	Poisson's Ratio	E (kip/ft^2)	Density (lbf/ft^3)	Material Property No.
255.5	0.024	16209.2	0.28	41,496	120	919

Table 2-8. Best Estimate Excavated Soil Iterated Soil Properties.

Layer Depth (ft)	Damping	G (kip/ft^2)	Poisson's Ratio	E (kip/ft^2)	Density (lbf/ft^3)	Material Property No.
2.5	0.019	3920.4	0.27	9,958	125	801
9.2	0.035	3463.4	0.27	8,797	125	802
16.4	0.048	3088.5	0.27	7,845	125	803
22.1	0.039	3231.8	0.27	8,209	125	804
29	0.048	3005.6	0.27	7,634	125	805
37.2	0.055	2829.8	0.27	7,188	125	806
44.7	0.059	2729.6	0.27	6,933	125	807
52.9	0.045	3018.4	0.27	7,667	125	808

Table 2-9. Upper Bound Native Soil Iterated Soil Properties.

Layer Depth (ft)	Damping	G (kip/ft^2)	Poisson's Ratio	E (kip/ft^2)	Density (lbf/ft^3)	Material Property No.
2.5	0.016	10004.3	0.24	24,811	110	901
9.2	0.022	9607.3	0.24	23,826	110	902
16.4	0.027	9268.4	0.24	22,986	110	903
22.1	0.022	9383.3	0.24	23,271	110	904
29	0.026	9068.8	0.19	21,584	110	905
37.2	0.027	10289.2	0.19	24,488	110	906
44.7	0.028	11649.1	0.19	27,725	110	907
52.9	0.022	13709.7	0.19	32,629	110	908
65.5	0.022	15284.2	0.19	36,376	110	909
82	0.024	15035.4	0.19	35,784	110	910
98.8	0.025	14863.1	0.19	35,374	110	911
115.5	0.026	14746.3	0.19	35,096	110	912
132	0.02	16982.4	0.19	40,418	110	913
148.3	0.021	16838.8	0.19	40,076	110	914
167.5	0.019	21821.5	0.28	55,863	120	915
189.5	0.019	23910.6	0.28	61,211	120	916
211.5	0.02	23673.5	0.28	60,604	120	917
233.5	0.02	23525	0.28	60,224	120	918
255.5	0.019	25917.8	0.28	66,350	120	919

Table 2-10. Upper Bound Excavated Soil Iterated Soil Properties

Layer Depth (ft)	Damping	G (kip/ft^2)	Poisson's Ratio	E (kip/ft^2)	Density (lbf/ft^3)	Material Property No.
2.5	0.017	5956.9	0.27	15,131	125	801
9.2	0.027	5554.3	0.27	14,108	125	802

16.4	0.039	5041.9	0.27	12,806	125	803
22.1	0.031	5191.5	0.27	13,186	125	804
29	0.035	5005.7	0.27	12,714	125	805
37.2	0.042	4747.8	0.27	12,059	125	806
44.7	0.047	4551.9	0.27	11,562	125	807
52.9	0.037	4864.9	0.27	12,357	125	808

Table 2-11. Lower Bound Native Soil Iterated Soil Properties.

Layer Depth (ft)	Damping	G (kip/ft^2)	Poisson's Ratio	E (kip/ft^2)	Density (lbf/ft^3)	Material Property No
2.5	0.018	4382.9	0.24	10,870	110	901
9.2	0.03	4004	0.24	9,930	110	902
16.4	0.043	3590.3	0.24	8,904	110	903
22.1	0.034	3739.6	0.24	9,274	110	904
29	0.04	3551.3	0.19	8,452	110	905
37.2	0.042	4004.4	0.19	9,530	110	906
44.7	0.042	4561.5	0.19	10,856	110	907
52.9	0.03	5629.7	0.19	13,399	110	908
65.5	0.03	6331	0.19	15,068	110	909
82	0.035	6066.4	0.19	14,438	110	910
98.8	0.039	5831.4	0.19	13,879	110	911
115.5	0.043	5633.7	0.19	13,408	110	912
132	0.032	6786.7	0.19	16,152	110	913
148.3	0.032	6763.3	0.19	16,097	110	914
167.5	0.028	8619.5	0.28	22,066	120	915
189.5	0.028	9445.3	0.28	24,180	120	916
211.5	0.029	9314.8	0.28	23,846	120	917
233.5	0.029	9320.7	0.28	23,861	120	918
255.5	0.026	10588.1	0.28	27,106	120	919
279	0.014	29929.7	0.3	77,817	125	920
304	0.014	29856.3	0.3	77,626	125	921
329	0.015	29714.3	0.3	77,257	125	922
354	0.015	29602.2	0.3	76,966	125	923

Table 2-12. Lower Bound Excavated Soil Iterated Soil Properties.

Layer Depth (ft)	Damping	G (kip/ft^2)	Poisson's Ratio	E (kip/ft^2)	Density (lbf/ft^3)	Material Property No
2.5	0.023	2547.2	0.27	6,470	125	801
9.2	0.044	2126.7	0.27	5,402	125	802
16.4	0.066	1782.2	0.27	4,527	125	803
22.1	0.053	1910.9	0.27	4,854	125	804
29	0.061	1777	0.27	4,514	125	805
37.2	0.067	1689.3	0.27	4,291	125	806
44.7	0.07	1628.4	0.27	4,136	125	807
52.9	0.056	1815.9	0.27	4,612	125	808

2.2.2 Excavated Soil

The excavated soil portion of the soil is developed using the input file "Near-Soil-1.txt." Figure 2-23 shows the detail of the excavated region of soil. Two zones in the soil above the dome are softened to break the potential arching that can occur in the soil model. This arching effect can occur because linear elastic properties are used for soil, which means that the soil as modeled can carry tension. For a detailed discussion of the development of these softened zones, see Rinker et al. (2006d).

Figure 2-23. Excavated Soil Model Detail.

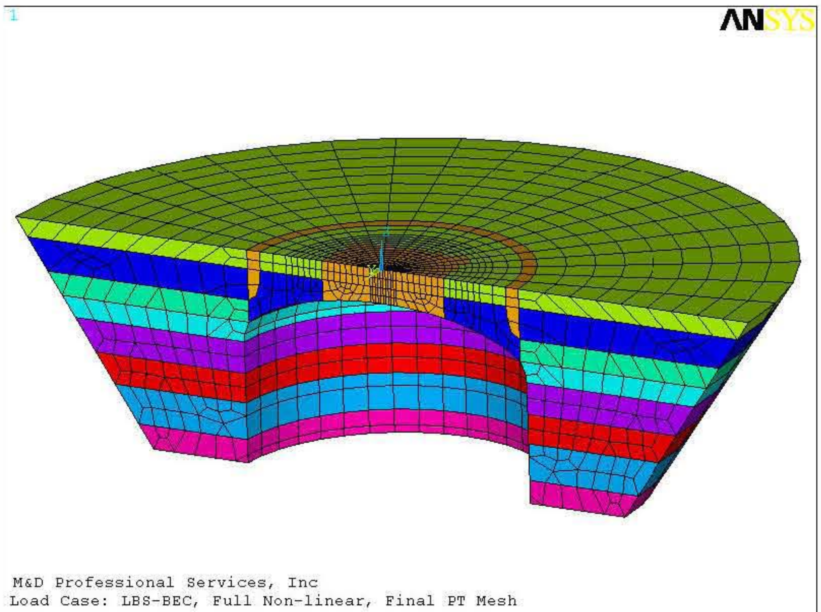


Figure 2-24. Excavated Soil - Softened Soil Zones.

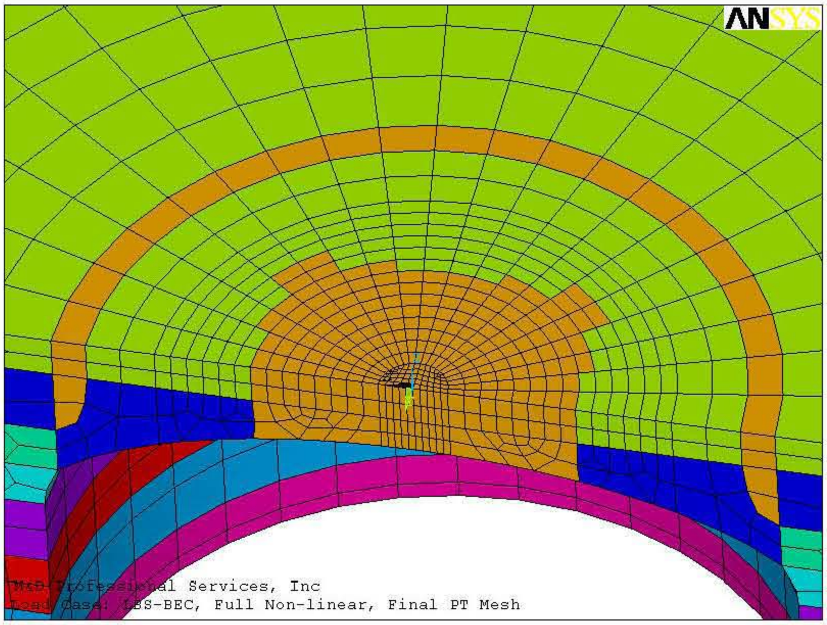
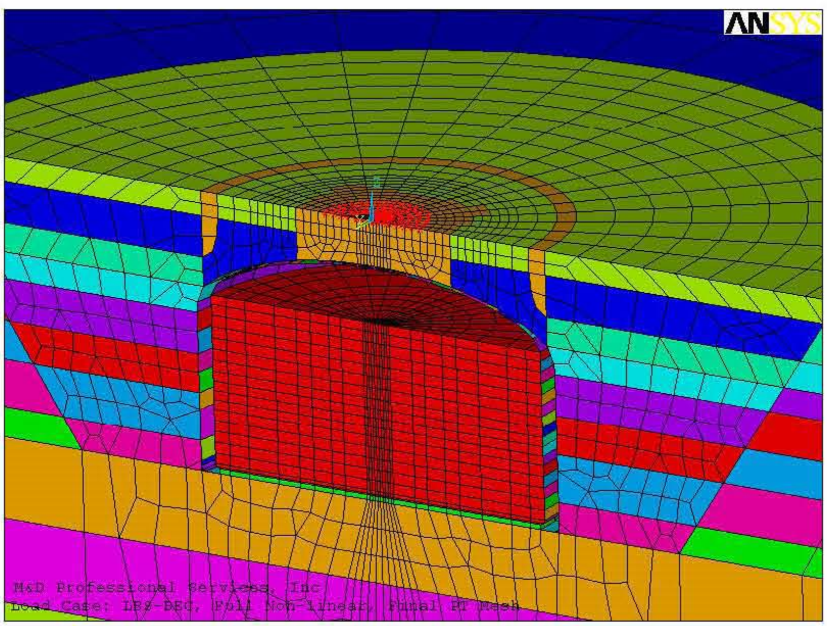


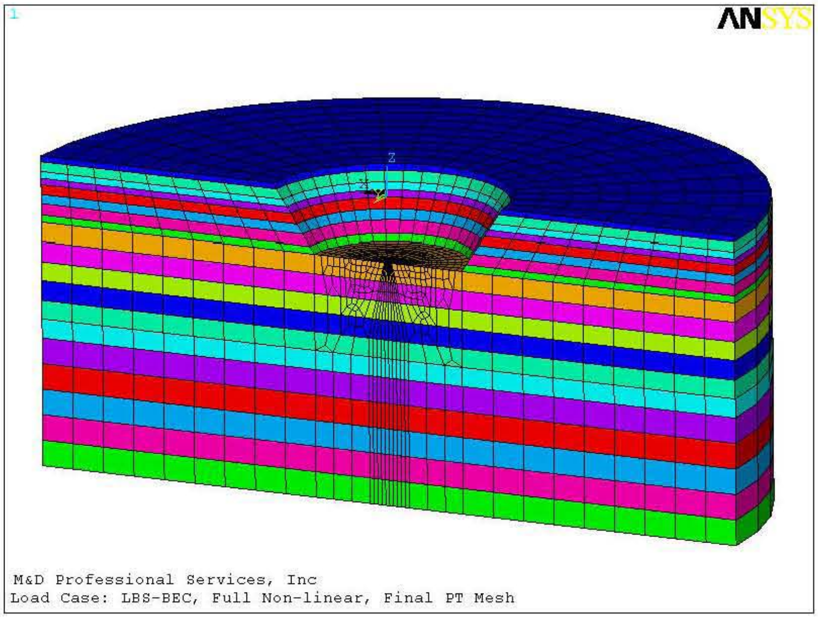
Figure 2-25. Detail Plot of ANSYS® Global Model Showing Soil Zones.



2.2.3 Native Soil

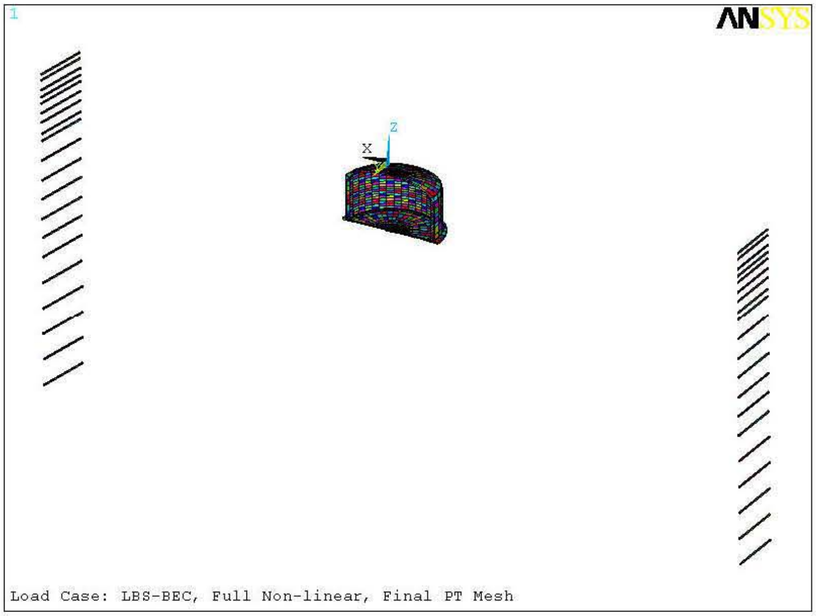
The native soil region of the model is developed using input file "Far-Soil.txt." SOLID45 elements are used and the material properties are discussed above. Figure 2-26 shows the native soil portion of the model.

Figure 2-26. Far-Field Soil Model Detail.



LINK8 elements are used to connect the native soil slaved nodes on each layer to the symmetry plane. These are required because the slaved node of a couple cannot have a boundary condition applied to it. Therefore, to maintain the desired soil behavior, the link elements effectively complete the coupling of the outside soil node at each layer. Figure 2-27 shows the locations of the link elements. Input file "Outer-Spar.txt" develops these elements.

Figure 2-27. Link Elements – Edges of Soil Model.



2.3 BOUNDARY CONDITIONS

2.3.1 Soil Boundary Conditions

All nodes on the outside edge (radius = 320 ft) have been "slaved" to a single node at each layer. Couples are used in each of the three translations to force the soil to behave essentially as a shear beam. This approach is used to create the appropriate conditions for vertical and horizontal waves to pass through the model (see Figure 2-29 and Figure 2-30). The effectiveness of this approach is documented in Rinker et al. (2006b). All nodes on the bottom of the model (-266 ft) are coupled together to create a rigid foundation (see Figure 2-28). The symmetry plane for the soil has all nodes fixed for y-translation, see Figure 2-31.

Figure 2-28. Boundary Conditions - Soil Base.

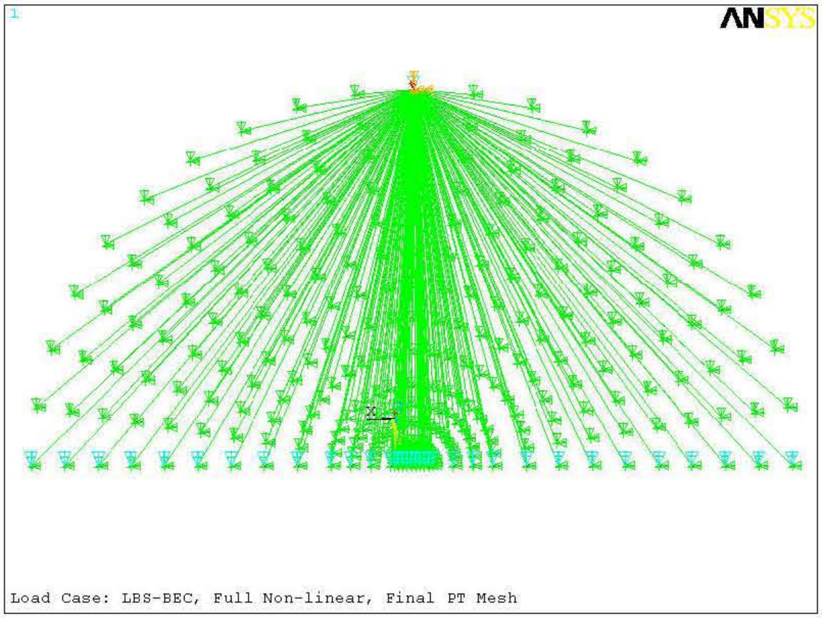


Figure 2-29. Boundary Conditions – Typical Soil Layer.

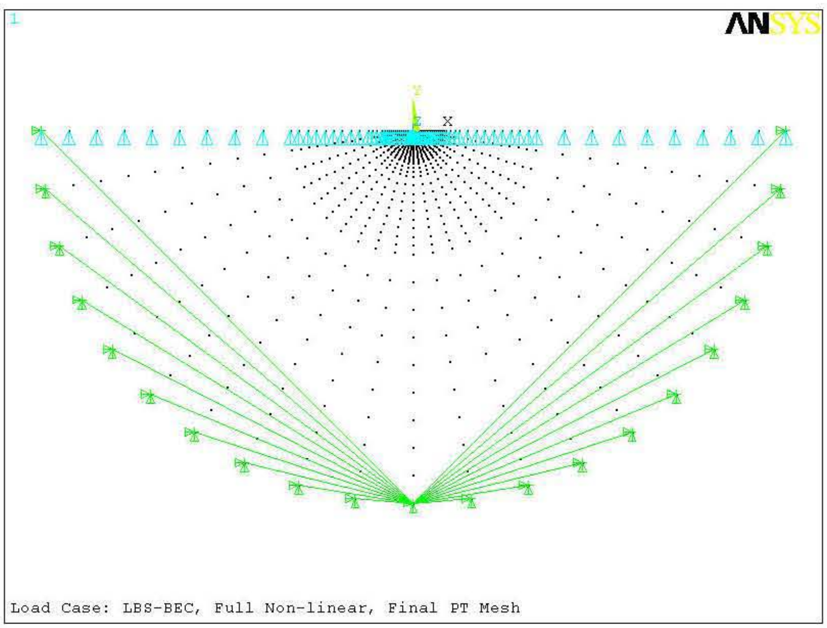


Figure 2-30. Boundary Conditions – Slaved Boundary Conditions.

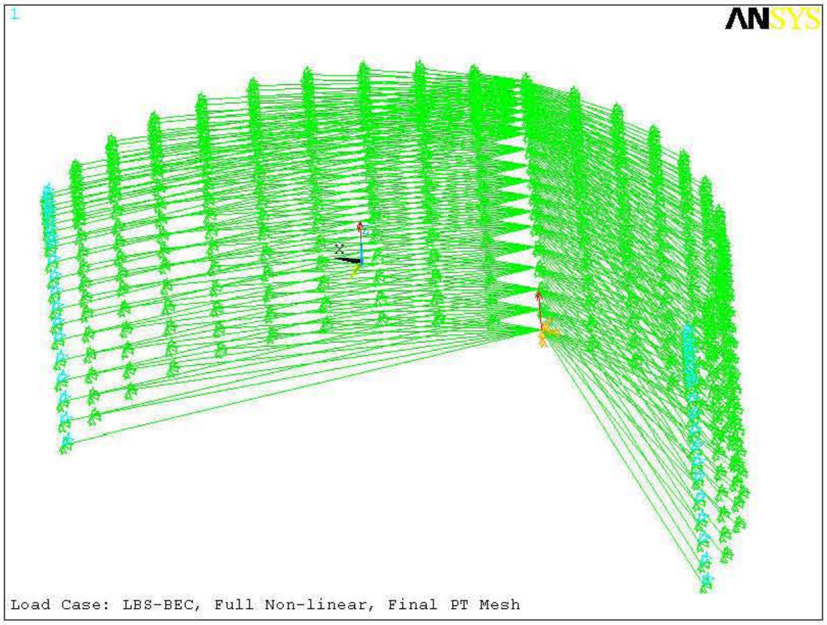
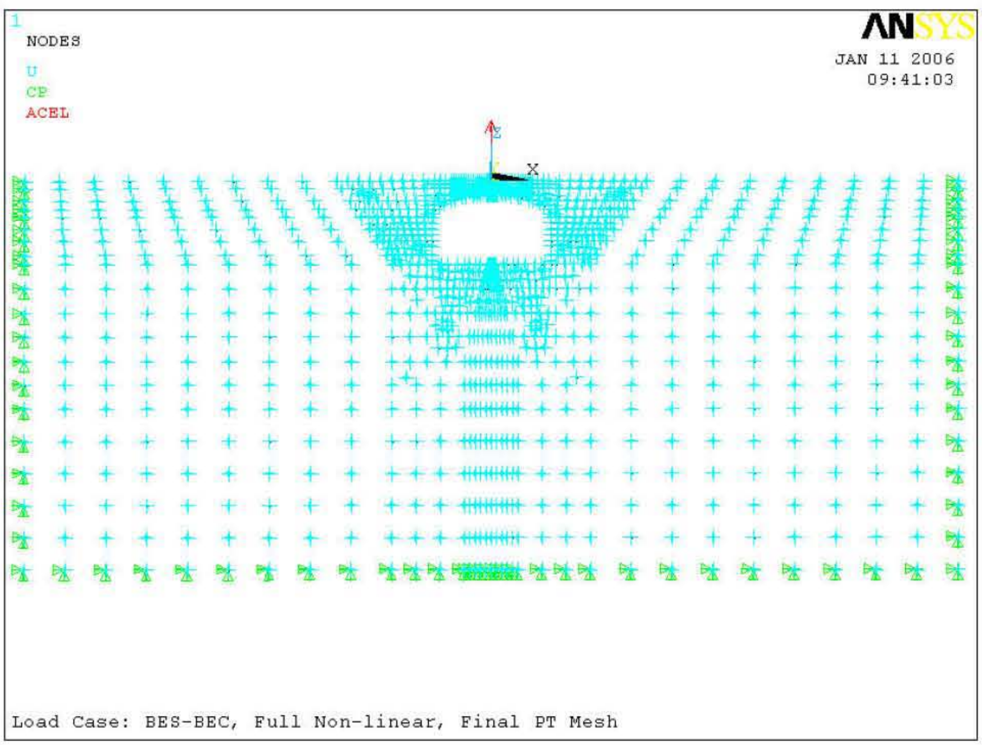


Figure 2-31. Boundary Conditions – Symmetry Plane.



2.3.2 Tank Boundary Conditions

The tank model has all nodes on the symmetry plane fixed to the y-translation, x-rotation and z-rotation (see Figure 2-32 and Figure 2-33). Couples have been used between some components to ensure that compatible displacements occur. Where no common nodes exist between the concrete shell and secondary liner, couples are used to control the deformation of the secondary liner where it is in contact with the concrete shell. This ensures that the secondary liner does not "pass through" the concrete on the footing and on the walls (See Figure 2-34).

Figure 2-32. Boundary Condition – Concrete Shell.

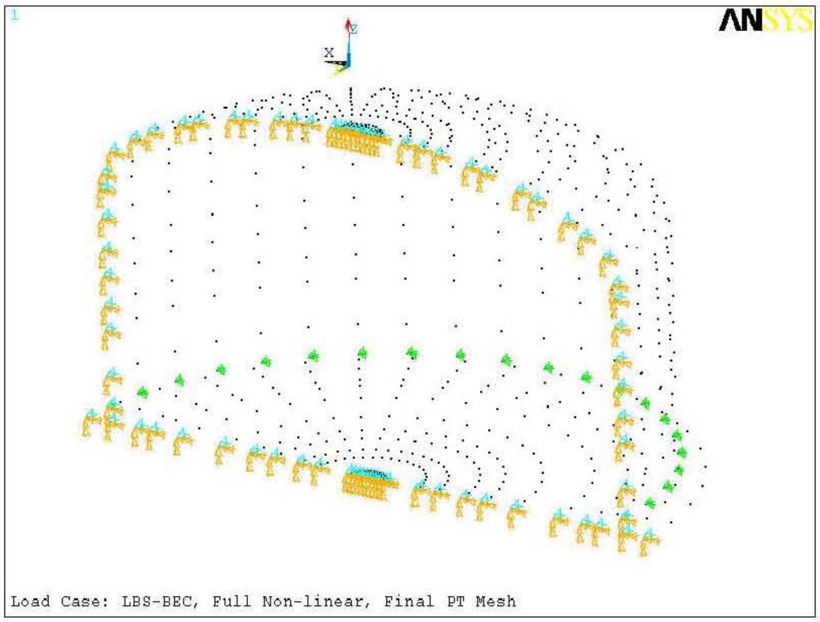


Figure 2-33. Boundary Conditions – Primary Tank.

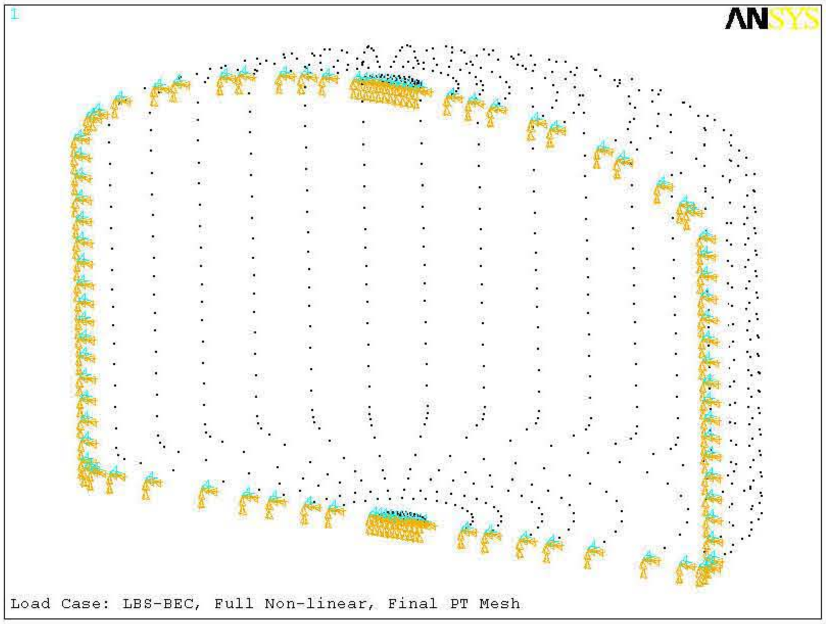
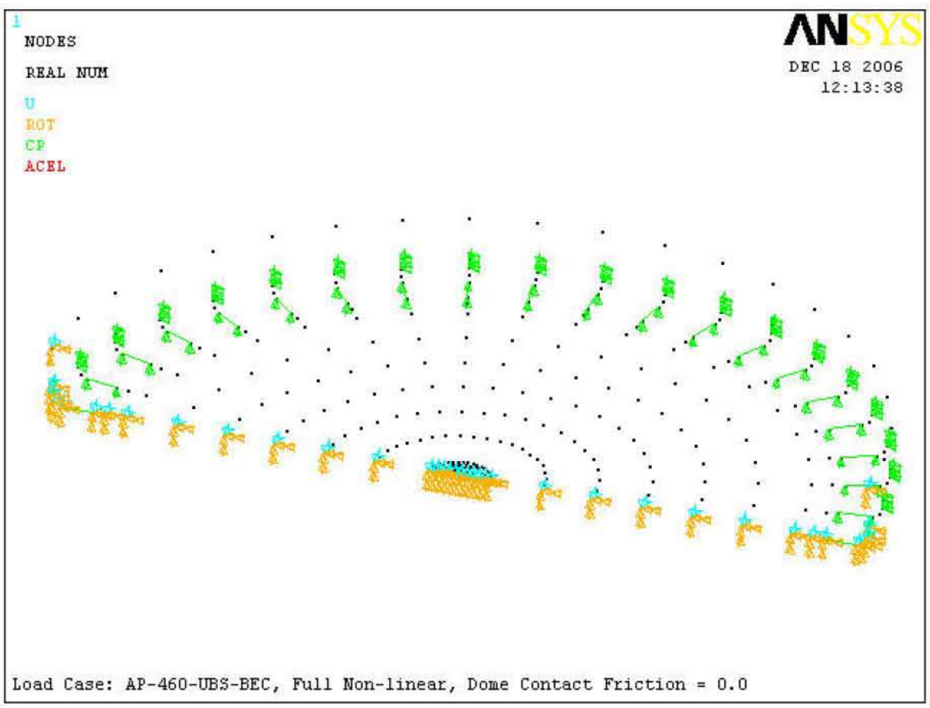


Figure 2-34. Boundary Conditions – Secondary Liner.



2.4 SEISMIC INPUT

The time histories used as input to the global ANSYS® model are the same as used for the baseline analysis described in Rinker et al. (2006a) and (2006d). As in the baseline analyses, the time histories are applied at the base of the model corresponding to a depth of 266 ft below grade. Horizontal and vertical time histories are applied at the base of the global model, and different time histories are used to represent mean, lower bound, and upper bound soil properties. A large mass element is located at the bottom of the soil model (-266 ft) and a force is applied to that node. The force is the product of the point mass and the acceleration for that time step of the time history. The point mass used is greater than 100 times the mass of the full global model to faithfully reflect the seismic input.

2.5 LOAD CASES

Four separate load cases have been considered in this analysis. These cases are:

- Lower Bound Soil (LBS), Best Estimate Concrete (BEC) Properties
- Best Estimate Soil (BES), Best Estimate Concrete Properties
- Upper Bound Soil (UBS), Best Estimate Concrete Properties
- Best Estimate Soil, Fully Cracked Concrete (FCC) Properties

These four cases are intended to cover the most significant areas of uncertainty for response of the DSTs to seismic loading. The three variations in soil properties address the variability and uncertainty in soil properties. The fully cracked concrete case addresses uncertainty in the concrete condition.

Each load case consists of two analyses. First a gravity case is analyzed. Results from the gravity only case will be used to determine the seismic-only results from the non-linear transient analysis. The second analysis for each case is a non-linear time history analysis. Two input motions (horizontal and vertical) have been defined as acceleration time histories consisting of 2,048 time steps to simulate the seismic motion.

2.6 RESULTS EXTRACTION

The following data is recorded for the gravity and transient analyses using the global model.

- Nodes — All active degrees of freedom
- Reactions — All reactions
- Concrete Shell — All element results
- Primary Tank — Element stresses
- Secondary Liner — Element strains
- Insulating Concrete — Element stresses
- J-bolts — All element results
- Soil Contacts — All element results
- Waste Contacts — All element results
- Primary tank contacts — All element results
- Liner contacts — All element results

- Footing contact — All element results
- Excavated Soil — Element stresses
- Excavated Soil Contacts — All element results
- Native Soil — Element stresses near tank
- Waste — Displacements Only

The following results have been extracted from the global ANSYS® model.

- Nodes — Displacements at selected locations
- Reactions — None
- Concrete Shell — Element Forces and Moment and Selected Strains
- Primary Tank — Element stresses (top, middle, bottom)
- Secondary Liner — Element strains (top, middle bottom)
- Insulating Concrete — None
- J-bolts — Selected element forces
- Soil Contacts — Pressures, displacements, status
- Waste Contacts — Pressures, displacements, status
- Primary tank contacts — Pressures, displacements, status
- Liner contacts — Pressures, displacements, status
- Footing contact — Pressures, displacements, status
- Excavated Soil — None
- Excavated Soil Contacts — None
- Native Soil — None
- Waste — Displacements at free surface

For each of the results listed above, all time history results have been extracted into text files. Minima and maxima data was also obtained for all the above listed results. In general, only the result minima and maxima data is used in this report. Results are obtained throughout the model and then summarized around the circumference for presentation.

3.0 DYTRAN PRIMARY TANK SUB-MODEL DESCRIPTION

A simplified sub-model of a Hanford Double Shell Tank (DST) primary tank was created using the 2005 version of MSC.Patran®, and was analyzed using the Dytran® 2006 Development Version.

The purpose of the Dytran® sub-model analysis was to investigate the fluid-structure interaction behavior within the primary tank during seismic excitation. Based on earlier studies (Rinker and Abatt 2006a, Rinker and Abatt 2006b, and Rinker et al. 2006c) it is expected that the global ANSYS® model will not accurately capture the convective response of the fluid within the primary tank during a seismic event. In particular, the pressures and stresses in the region of the primary tank near the liquid free surface may not be accurately predicted with the global ANSYS® model. However, the Dytran® sub-model is expected to give accurate results for the stresses in the tank, and the Dytran sub-model analysis serves as an alternate calculation for evaluating the stresses in the primary tank due to fluid-structure interaction.

The fundamental difference between this analysis and the earlier analysis at the baseline liquid level of 422 in. (Rinker et al. 2006d) is increased interaction between the contained waste and the curved dome area of the primary tank. Thus, the stresses induced by the interaction of the liquid and the dome are of particular interest. The results from the Dytran® sub-model analysis are compared to the results of a similar ANSYS® sub-model of a primary tank, as well as to the results from the global ANSYS® models.

The Dytran® models are full three-dimensional (3D) representations of the tanks. Applied loads include gravity loading and seismic loading, with seismic loading applied in the horizontal and vertical directions both as separate load cases and simultaneously.

3.1 MODEL GEOMETRY

The Dytran® sub-model geometry was based on the 241-AY tank configuration shown in Hanford Drawing Number H-2-64449. However, the primary tank wall thicknesses were representative of the 241-AP Tank configuration shown in Hanford Drawing Number H-2-90534. The rationale for using the 241-AY tank configuration as a bounding idealization is discussed in Chapter 2 of Rinker et al. (2004) and also in Rinker et al. (2006a). However, the primary tank thicknesses and material properties for the 241-AP tanks were incorporated into the models because those are the tanks being considered for an increased operating liquid level.

The primary tank has a 450 in. radius and the height of the vertical wall is 424 in. The dome apex is 561.5 in. above the bottom of the tank. Excerpts from Drawings H-2-64449 and H-2-90534 are shown as Figure 3-1 and Figure 3-2, respectively. Two dimensions of interest for the Dytran® primary tank sub-model are the elevation of the primary tank tangent line at 424.3125 in. above the bottom of the primary tank (Drawing H-2-64449), and the elevation of the first row of J-bolts at 467 in. above the bottom of the primary tank (estimated from Drawings H-2-64449, and H-2-90534.)

Figure 3-1. 241-AY Tank Dimensions.

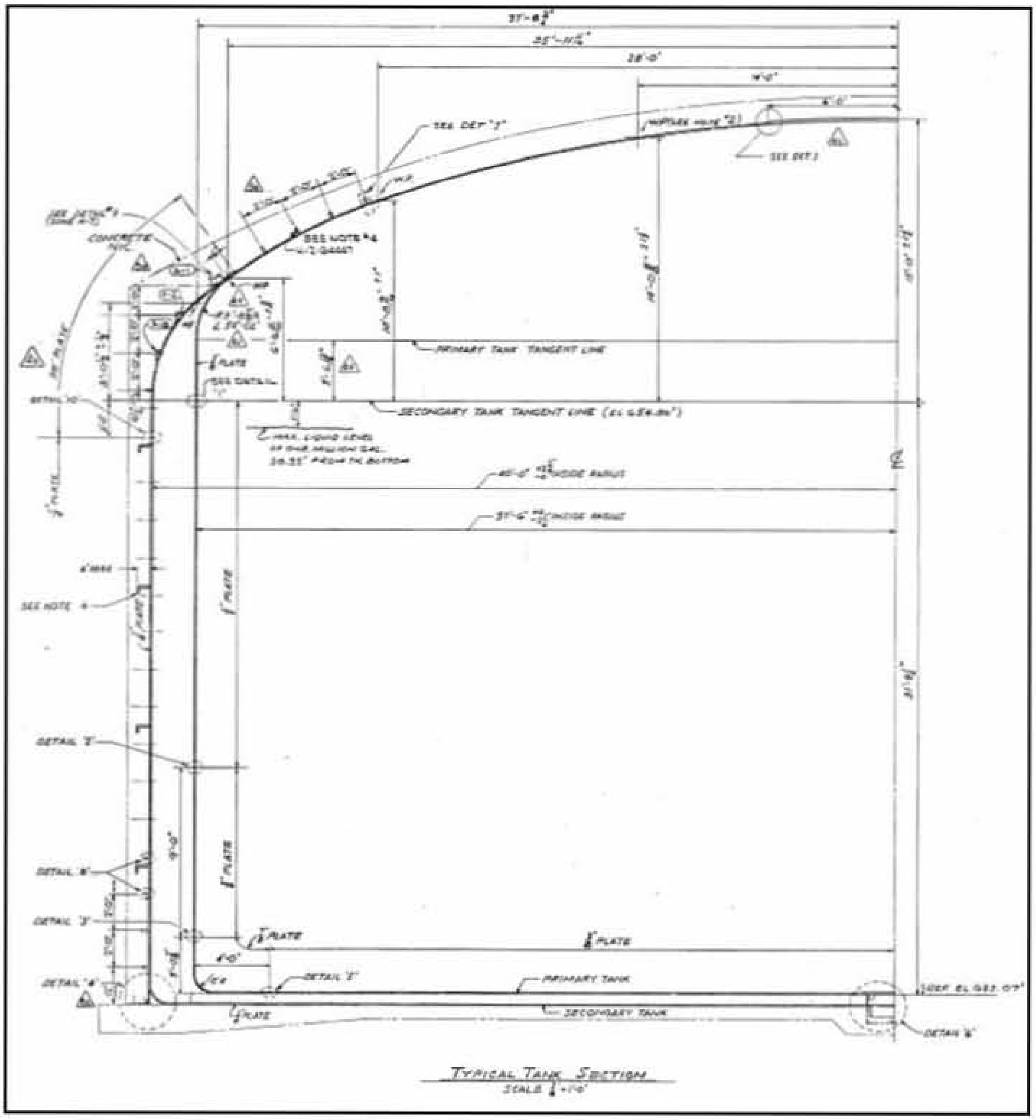
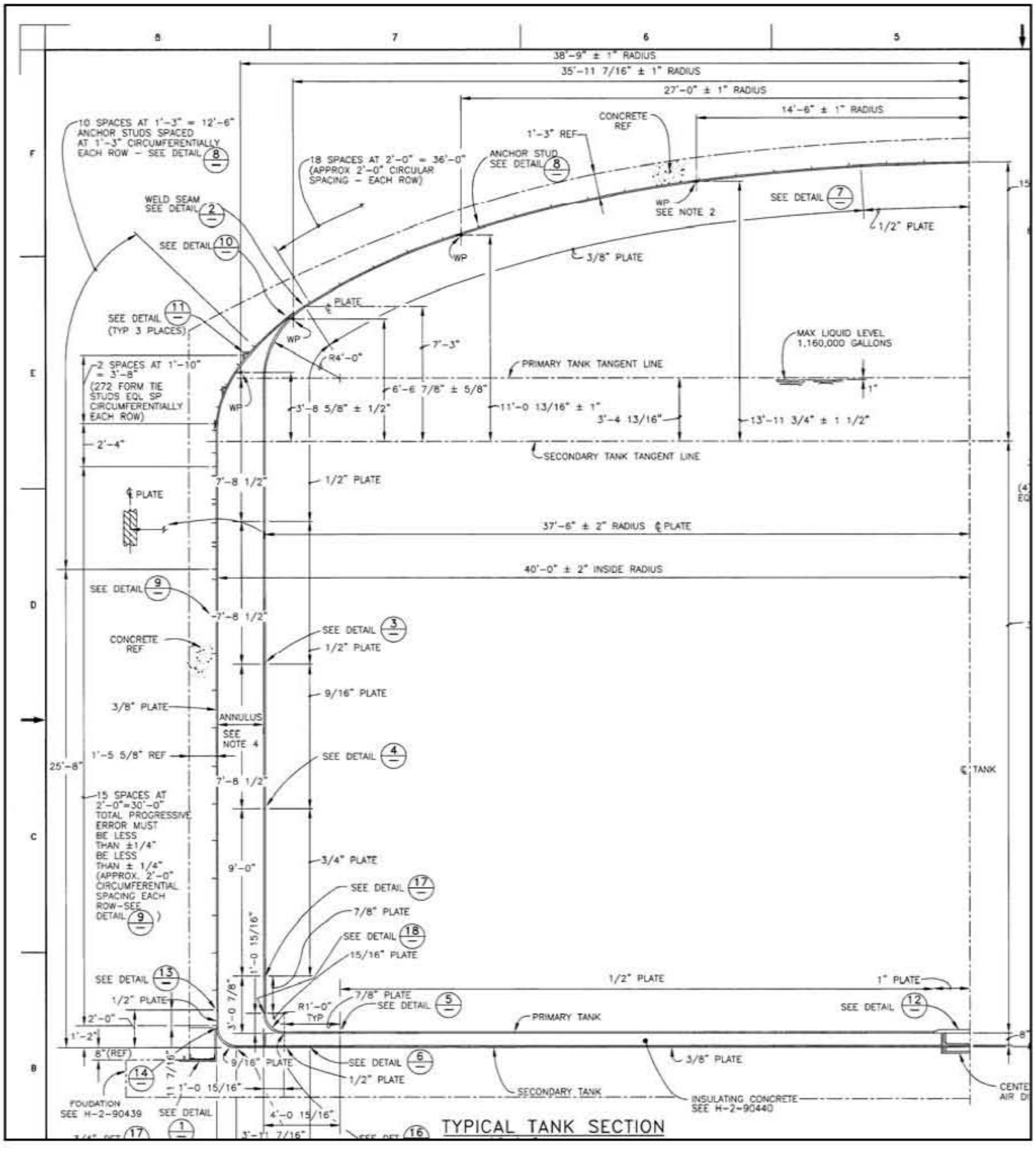


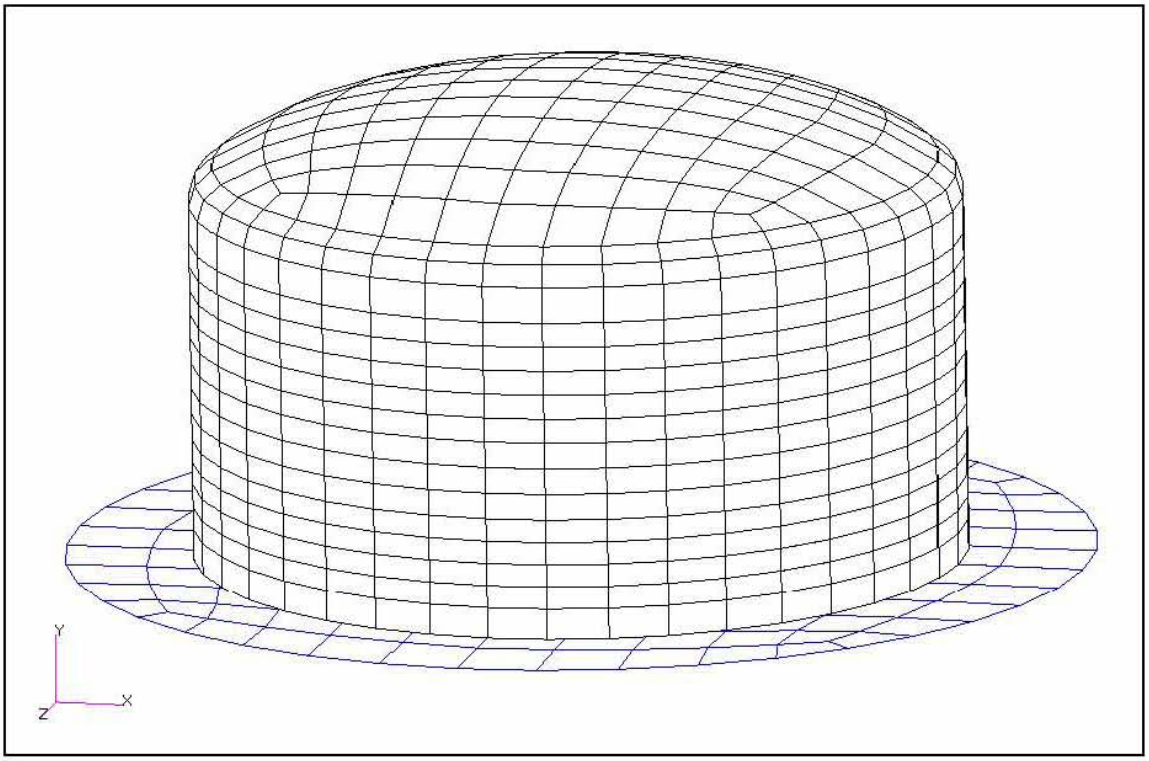
Figure 3-2. 241-AP Tank Dimensions.



When the Dytran® model is subjected to horizontal excitation only, the bottom of the primary tank is supported vertically by a fixed rigid base plate in contact with the tank bottom as shown in Figure 3-3. The purpose of the base plate is to provide the vertical support to the bottom of the primary tank model that is provided by the insulating concrete in the actual tank. The base is not present in the model when vertical excitation is applied.

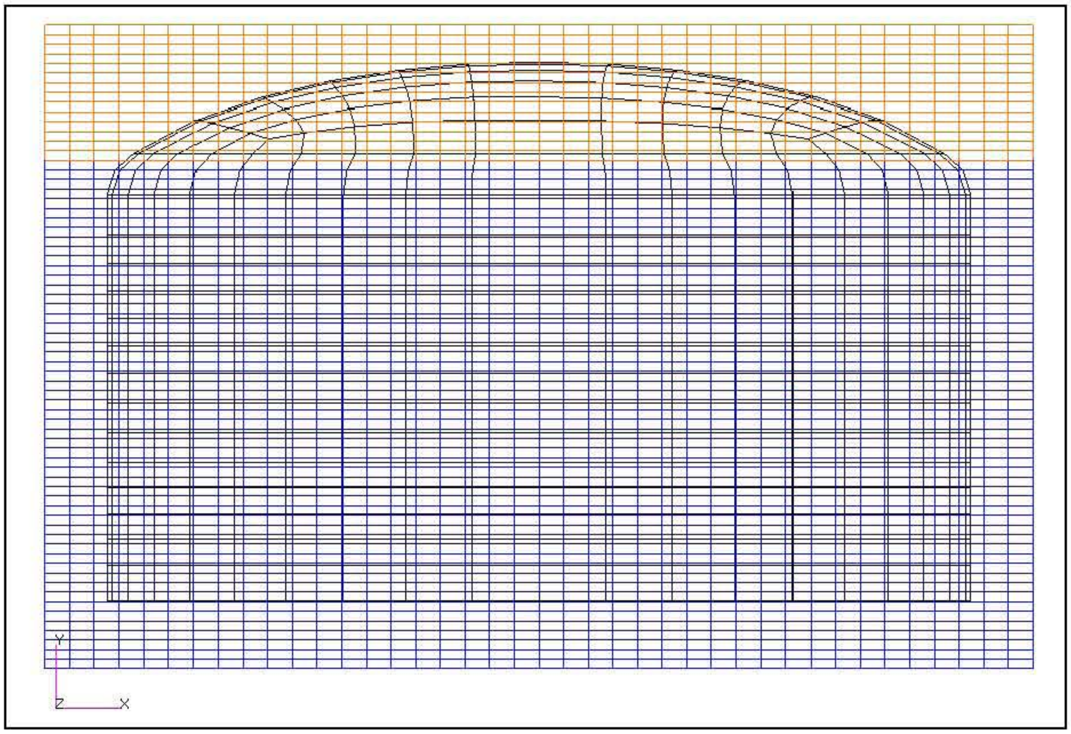
A notable difference between the Dytran® primary tank model and the actual tank as shown in Figure 3-3 is that the junction between the vertical wall and the tank bottom is modeled as a right angle. Consequently, the details of the tank lower knuckle region and its support by the insulating concrete have not been captured by this simplified Dytran® sub-model.

Figure 3-3. Plot of Dytran® Primary Tank and Base Model (Base Not Present When Vertical Excitation is Applied).



The relative height of the waste to the tank for the 460 in. waste level is shown in Figure 3-4. The tank floor and walls form what is known as a Dytran® coupling surface with the water. The coupling surface allows the Eulerian waste mesh to interact with the Lagrangian structural mesh, and although the Eulerian mesh extends beyond the tank boundary, all the fluid dynamics occur inside the tank.

Figure 3-4. Plot of Dytran® Tank, Waste, and Air Elements at 460 in. Waste Level.



Dynamic waste pressures are a function of depth, angular location and radial location of the fluid element. Waste pressures were extracted from five sets of fluid elements throughout the tank as shown in Figure 3-5. The element set "plusx_els" is located near the tank wall in the positive x-direction (θ=0) in the plane of the seismic excitation. Note that the angle θ is measured from the positive x-axis to the positive z-axis to describe the angular position of elements in the model. Element sets "press_45" and "plusz_els" are located near the tank wall at 45° (approximately) and 90° from the excitation direction. Element set "minusx_els" is near the tank wall in the negative x-direction, and the set "cent_press" is near the center of the tank at a radial location of approximately zero. As can be seen in Figure 3-5, there are 40 elements circumferentially in the tank wall, or 10 elements in each 90° sector.

Figure 3-6 and Figure 3-7 are elevation views that show the location and numbering of fluid element sets "plusx_els", "cent_press" and "minusx_els". Figure 3-8 and Figure 3-9 are elevation views showing the location and numbering of fluid element sets "press_45" and "plusx_els".

Figure 3-5. Top View of Dytran® Primary Tank Sub-Model Showing the Angular Locations of Fluid Elements at Which Pressures Were Monitored.

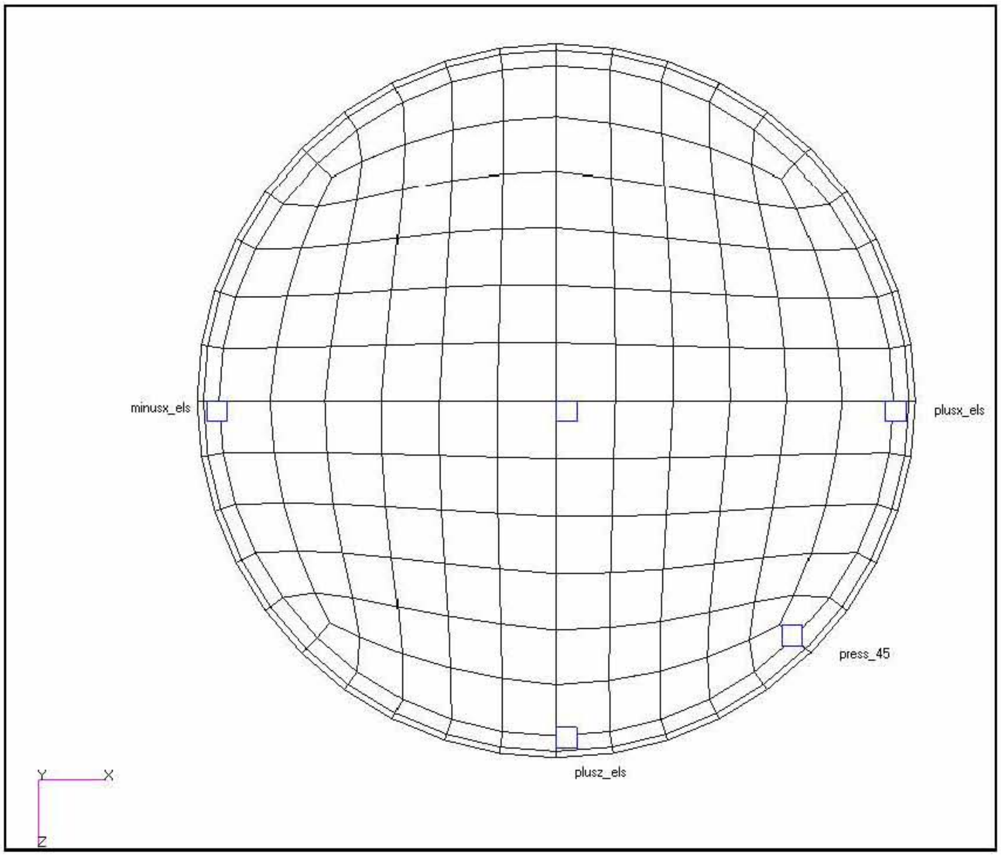


Figure 3-6. Elevation View of Dytran® Tank Mesh Showing the Locations of "Plusx_els", "Cent_Press", and "Minusx_els" Fluid Element Sets at Which Pressures Were Monitored.

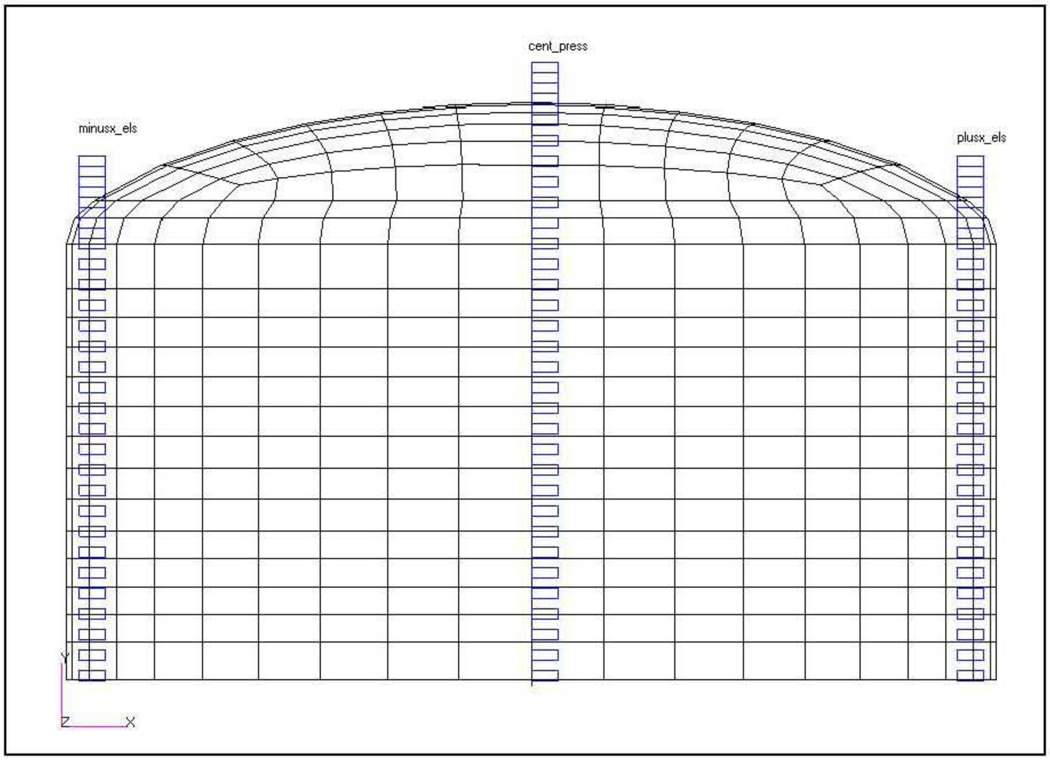


Figure 3-7. Waste Element Numbering for Element Sets "Plusx_els"," Minusx_els", and Cent_press".

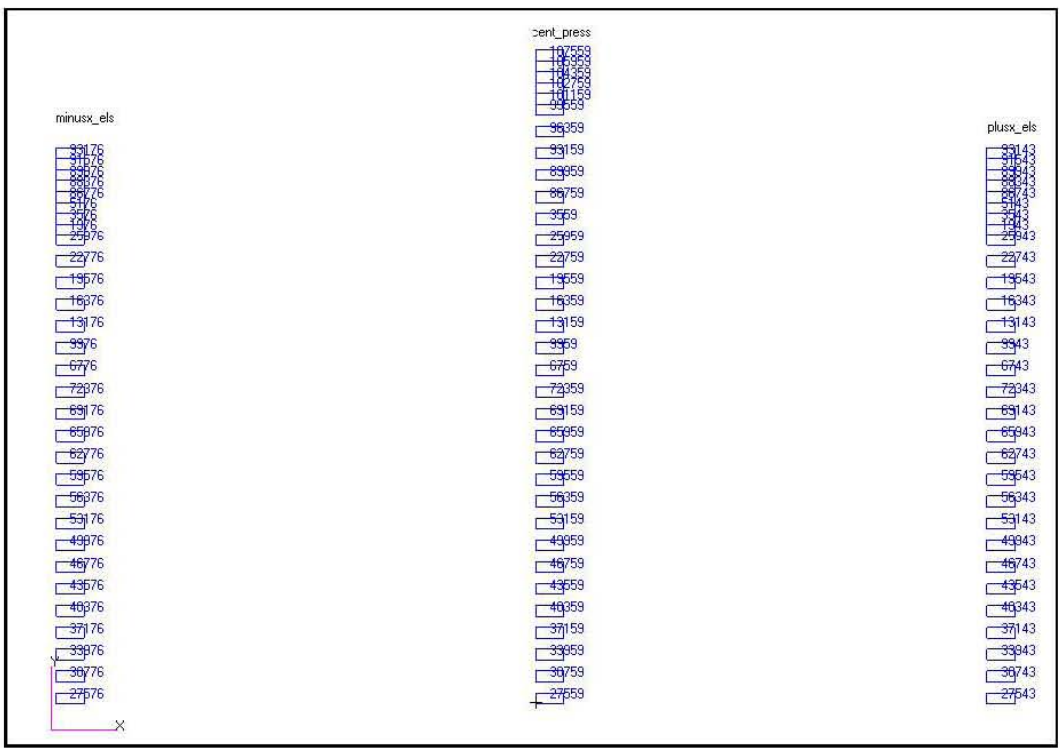


Figure 3-8. Elevation View of Dytran® Tank Mesh Showing the Locations of "Press45" and"Plusz_els", Fluid Element Sets at Which Pressures Were Monitored.

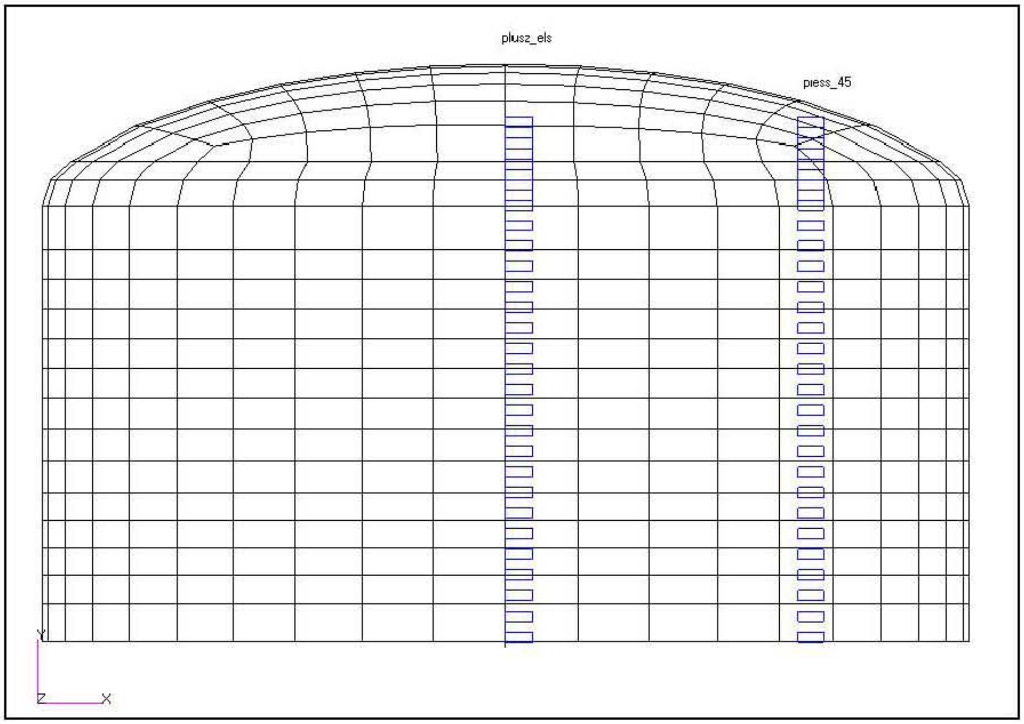
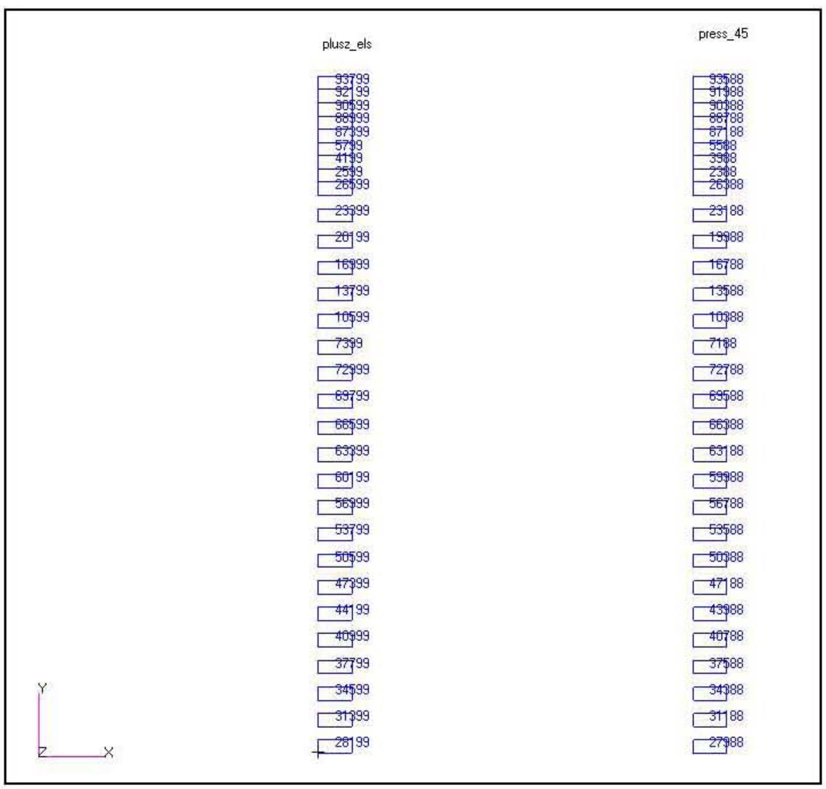


Figure 3-9. Waste Element Numbering for Dytran® Element Sets "Press_45" and Plusz_els".



Tank wall stresses were extracted at angular locations of θ=0, 45, 90, and 180°. The shell element numbering for the θ=0° and θ=90° sets is shown in Figure 3-10, with the elements at θ=0° and on the right, and the elements at θ=90° on the left. The numbering for the θ=45° and θ=180° sets is shown in Figure 3-11, with the elements at θ=45° and on the right, and the elements at θ=180° on the left.

Figure 3-10. Shell Element Numbering for Dytran® Tank Wall Stress Results at θ=0° and θ=90°.

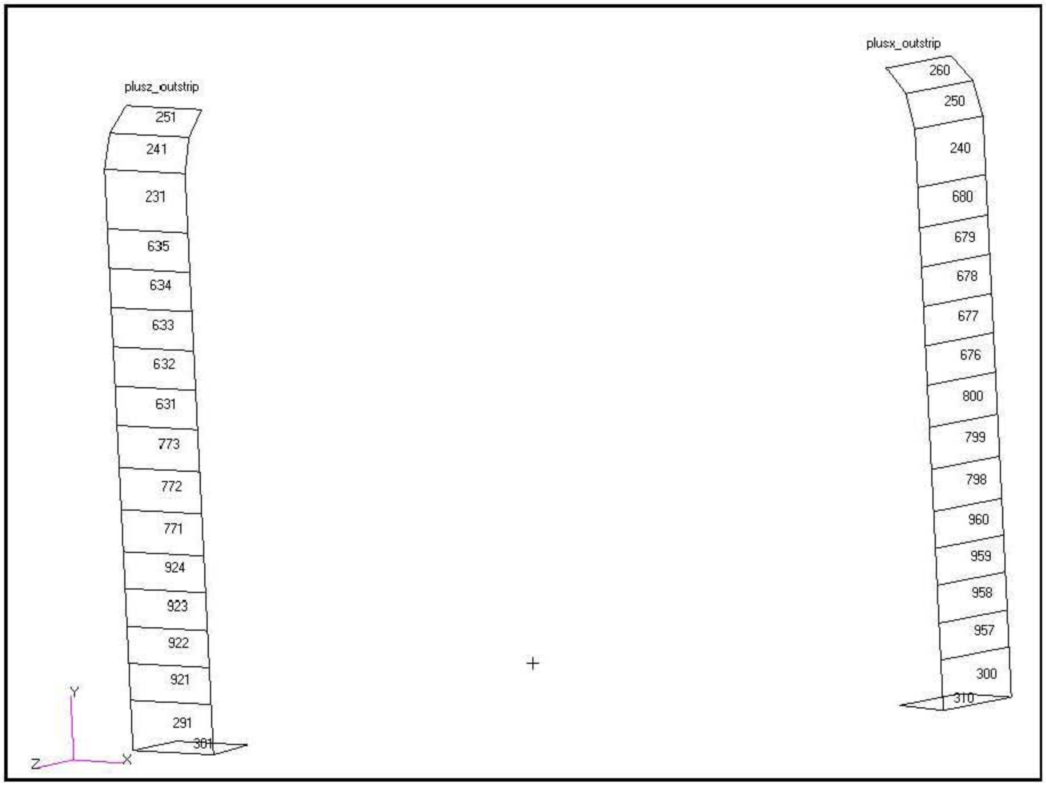
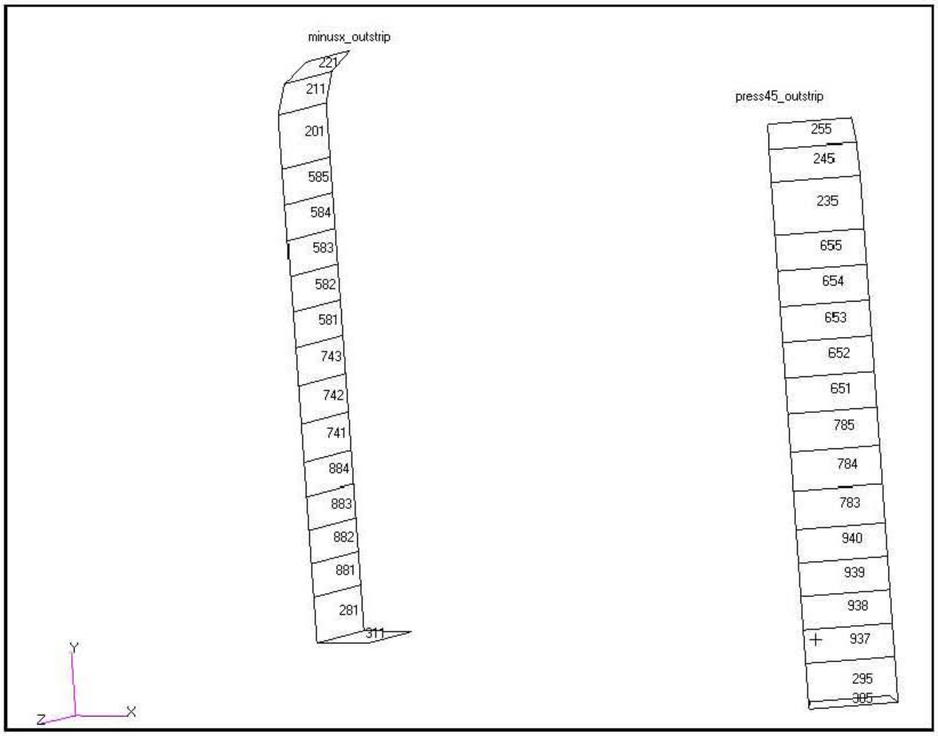


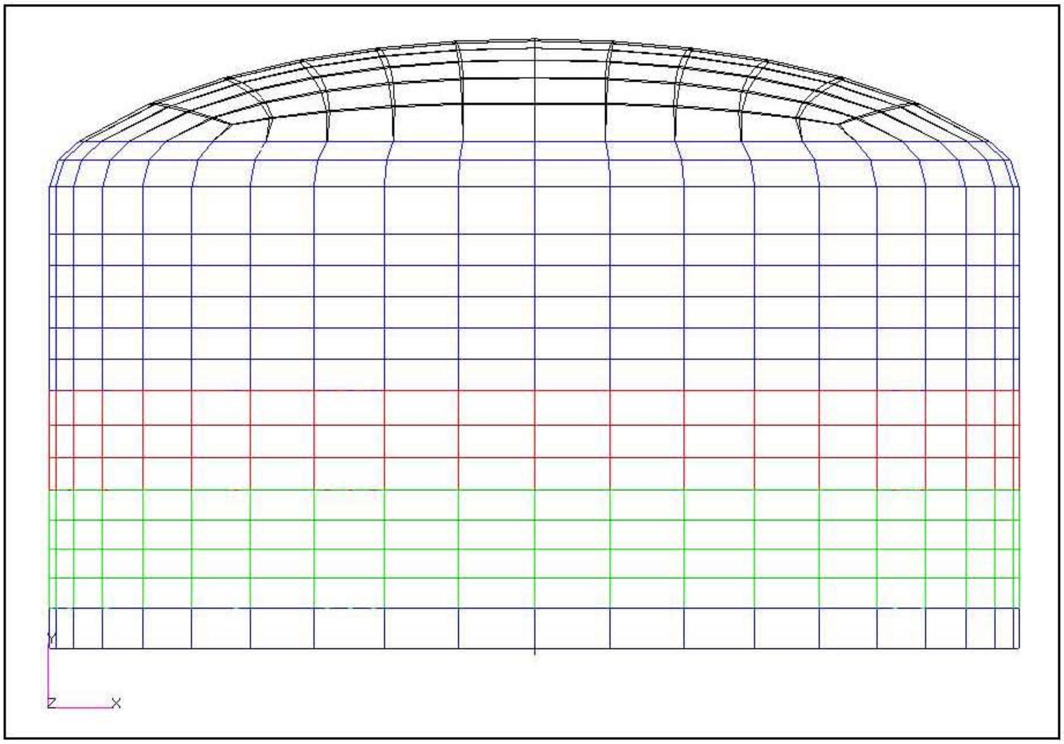
Figure 3-11. Shell Element Numbering for Dytran® Tank Wall Stress Results at θ=45° and θ=180°.



3.2 MATERIAL PROPERTIES AND ELEMENT TYPES

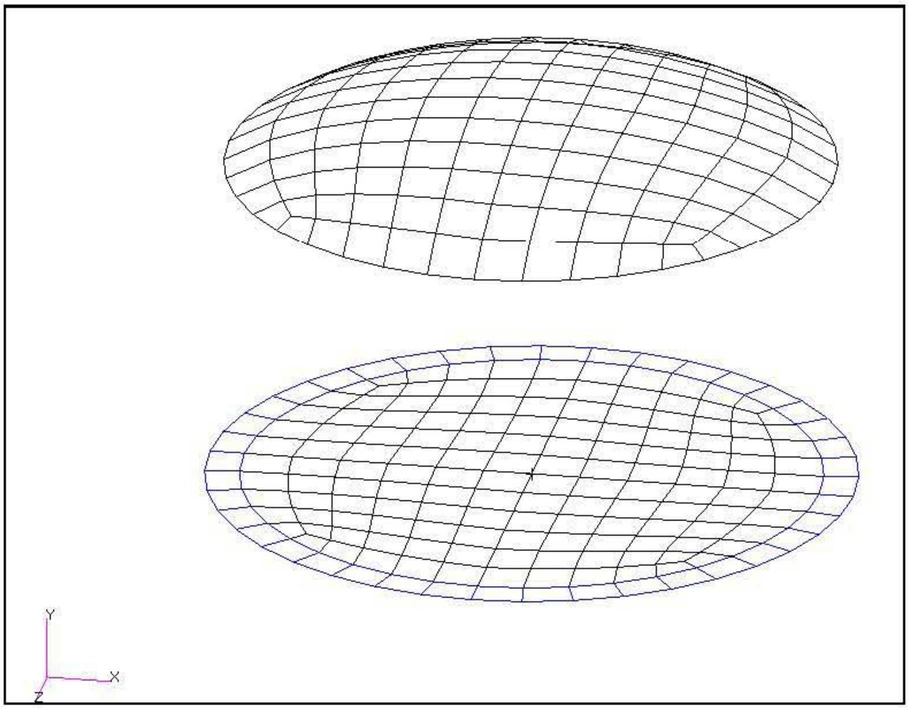
The primary tank was modeled in Dytran® using CQUAD4 shell elements. The elastic modulus, Poisson's ratio, and specific weight of the steel walls were set to 28.8 x 10^6 lbf/in^2, 0.3, and 0.284 lbf/in^3, respectively. The steel properties are for the 241-AP tanks per Section 3.3 of Rinker et al. (2004). The tank wall thicknesses are for the 241-AP tanks and are from Drawing H-2-90534, Rev. 4. The general configuration of the primary tank wall thickness is shown in Figure 3-12. In that plot, the blue band at the bottom represents the 7/8 in.-thick portion of the wall, the green band represents the ¾ in.-thick portion of the wall, the red represents the 9/16 in.-thick portion of the wall, and the light blue represents the ½ in.-thick portion of the wall. The black portion of the dome is modeled as rigid. It can be seen in Figure 3-12 that there are 16 elements vertically in the flexible portion of the tank wall giving an average element height of approximately 29 in.

Figure 3-12. Plot of Dytran® Primary Tank Mesh With Different Colors Representing Different Wall Thicknesses.



The dome was kept rigid above the attachment point of the first row of J-bolts (estimated at 467 in. above the floor of the primary tank per Drawing H-2-90534, Rev. 4). A rigid region was also defined for the bottom of the tank. In the case of horizontal excitation only, the central portion of the primary tank bottom was kept rigid and the outer ring of elements in the tank bottom was left flexible and assigned normal steel properties with a thickness of ½ in. Both of the rigid regions were assigned artificially high mass density to faithfully reflect the applied seismic motion. In the case of horizontal excitation only, the rigid regions are those shown in black in Figure 3-13. The flexible outer ring of elements in the tank floor is shown in blue. For the cases of vertical excitation only and two-component motion with horizontal and vertical excitation, the outer ring of elements in the floor was also specified as rigid, and the rigid base shown in blue in Figure 3-3 was removed from the model to allow for vertical motion. With the rigid base present, there are 1,100 CQUAD4 elements in the model. Without the rigid base, the number of CQUAD4 elements is reduced to 960.

Figure 3-13. Rigid Regions of the Dytran® Primary Tank Model (Shown in Black) for Horizontal Excitation Only.



The waste and air in the dome space were modeled using 107,200 8-node CHEXA Eulerian solid elements. Because two fluids are present, the Eulerian elements were assigned multi-material hydrodynamic material properties (MMHYDRO). Both the air and the waste were modeled as homogeneous, inviscid, fluids.

The waste was modeled using a polynomial equation of state (EOSPOL) that requires the initial mass density and the bulk modulus of the fluid as input. The initial density of the waste was set to 1.71×10^{-4} lbf-sec^2/in^4 (specific gravity=1.83). The bulk modulus of the waste was set to 305,000 lbf/in^2, which is a typical bulk modulus for water. However, the results are expected to be insensitive to the value of the bulk modulus since fluid compressibility is not critical to the response in this problem.

The air was modeled using the gamma law equation of state (EOSGAM), where the pressure is a function of the mass density ρ, the specific internal energy per unit mass e, and the ideal gas ratio of specific heats γ via $p = (\gamma - 1)\rho e$. The mass density of air is 1.167×10^{-7} lbf-sec^2/in^4, and the ratio of constant-pressure specific heat to constant-volume specific heat is 1.4. The specific internal energy per unit mass of the air was set to 3.15×10^8 in^2/sec^2, which corresponds to an air pressure of 14.7 lbf/in^2.

3.3 BOUNDARY CONDITIONS

In the case of horizontal seismic excitation only, the rigid regions were free in the x-direction, and fixed in the other five degrees-of-freedom. The rigid regions are those shown in black in Figure 3-13 and the rigid base shown in blue in Figure 3-3 was present in the model. In the cases of vertical excitation only and two-component motion (simultaneous horizontal and vertical excitation), the rigid regions included all elements shown in Figure 3-13. In these to cases, the rigid base shown in Figure 3-3 was removed from the model to allow for vertical motions. In the case of vertical motion, the rigid regions were excited in the vertical direction and were fixed in the other five degrees-of-freedom. For two-component motion, the rigid regions were excited in the x and y-directions and fixed in the other four degrees-of-freedom.

The Dytran® general coupling algorithm was used to allow the Eulerian waste mesh to interact with the Lagrangian structural mesh. The problem was set up to take advantage of the "fast coupling" option in Dytran®.

3.4 INITIAL CONDITIONS

All Dytran® simulations were performed at absolute pressure so that the initial air pressure was set to the atmospheric pressure of 14.7 lbf/in^2 in the parameters section of the input file. The specific internal energy per unit mass of the air was set to 3.15×10^8 in^2/sec^2 according to the gamma law equation of state

$$e = \frac{p}{(\gamma - 1)\rho}.$$

As a convenience, a balancing pressure of 14.7 lbf/in^2 was applied to the outside of the tank using the Dytran® COUOPT command (MSC 2005b) to keep the tank stresses in terms of gage pressures.

3.5 SEISMIC INPUT

The seismic time histories used to excite the primary tank sub-models (both Dytran® and ANSYS®) were output from the global ANSYS® model of the DST and surrounding soil described in Section 2.0. The time histories used as input to the primary tank sub-models were taken from node 495 in the concrete basemat of the global ANSYS® model as shown in Figure 3-14 and Figure 3-15. As shown in those figures, node 495 lies at the junction between the bottom of the concrete wall and the basemat 90° from the plane of horizontal excitation in the negative y-direction. Note that in Figure 3-14 and Figure 3-15, the tank wall elements near node 495 have been unselected for ease of visualization.

The extracted time histories consisted of 2,048 points defined at 0.01 second intervals giving seismic records with durations of 20.48 second. In all three cases, the seismic excitation was preceded by a 6 second quiet period to allow sufficient time for the gravity loading to equilibrate.

Figure 3-14. Plot of Junction of Concrete Wall and Concrete Basemat from Global ANSYS® Model Showing Node 495 from Which Sub-Model Input Time Histories Were Extracted.

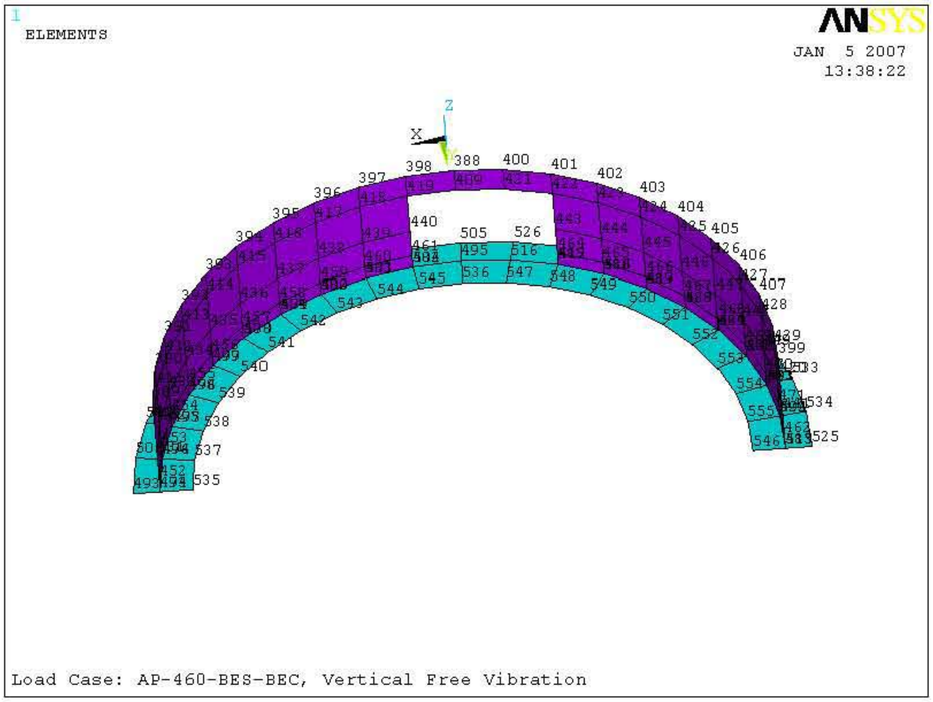
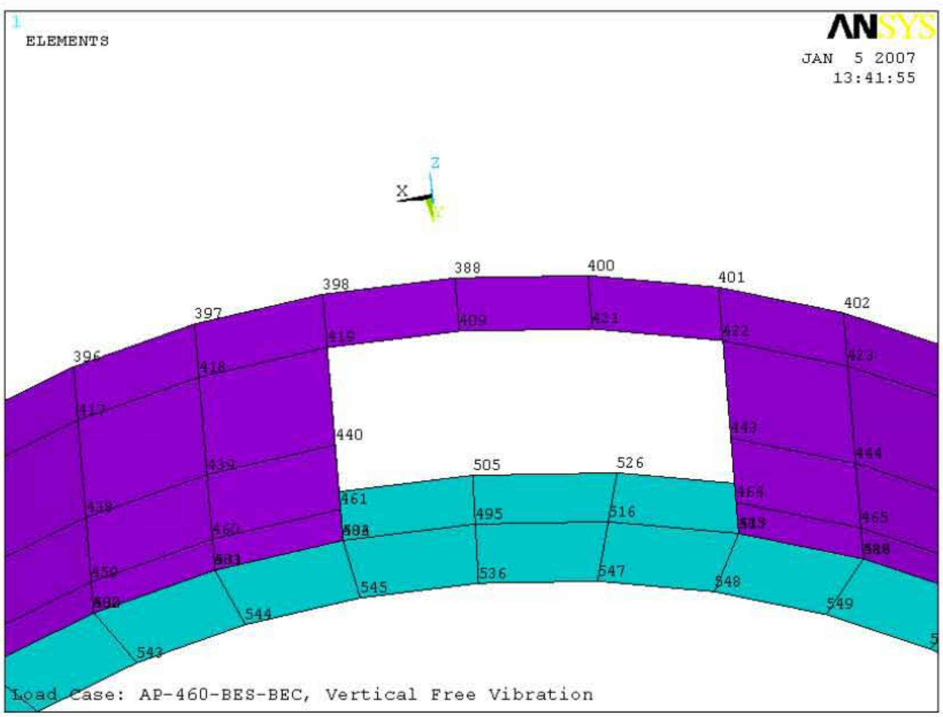
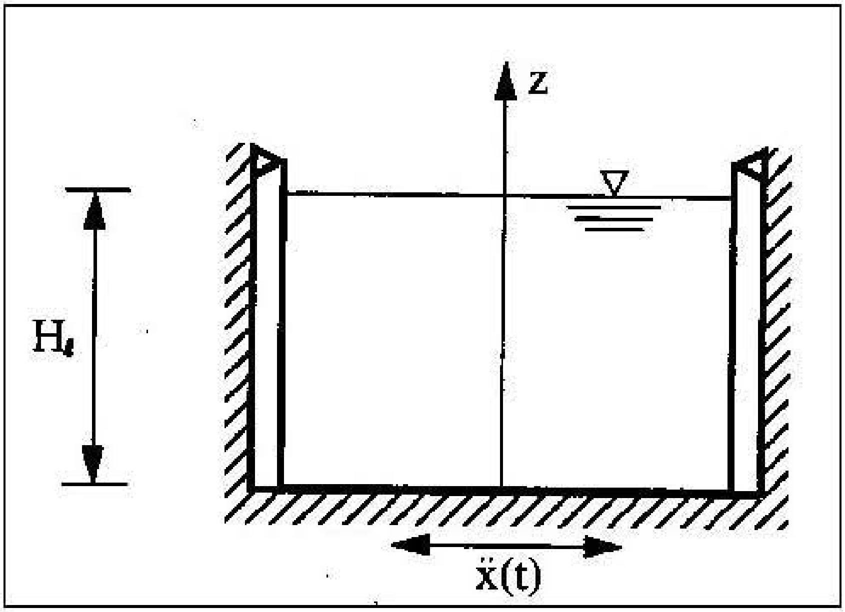


Figure 3-15. Detailed Plot of Junction of Concrete Wall and Concrete Basemat from Global ANSYS® Model Showing Node 495 from Which Sub-Model Input Time Histories Were Extracted.



In the case of horizontal (x-direction) excitation, the seismic time histories were applied as body force accelerations per unit mass on the nodes of the rigid portions of the tank that have artificially high mass. The vertical seismic time history was applied as a velocity time history to the rigid portions of the tank. The reason that the vertical input was applied as a velocity rather than an acceleration time history is that this approach precludes having to exactly balance the vertical gravity load with the vertical acceleration time history, thus preventing any vertical drift. In all cases, the same excitations were applied to all rigid elements simultaneously. That is, the top and bottom of the tank were excited together with the same seismic time histories. This represents the hinged top boundary condition discussed in BNL 1995 and shown in Figure 3-16.

Figure 3-16. Tank With Hinged Top Boundary Condition per BNL 1995.



The horizontal acceleration, vertical acceleration, and the velocity and displacement time histories for horizontal and vertical input are shown in Figure 3-17, Figure 3-18, Figure 3-19, and Figure 3-20, respectively. The 4% damped response spectra for the horizontal and vertical time histories are shown in Figure 3-21.

Figure 3-17. Horizontal Acceleration Time History Used as Input to the Primary Tank Sub-Models.

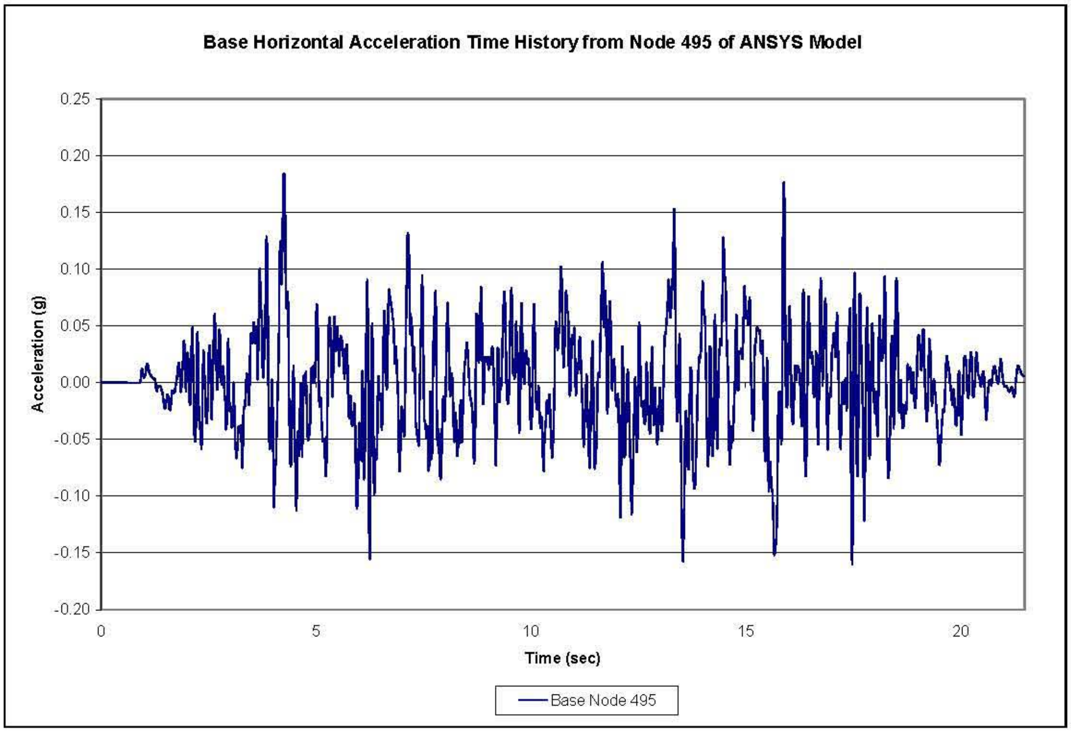


Figure 3-18. Vertical Acceleration Time History Used as Input to the Primary Tank Sub-Models.

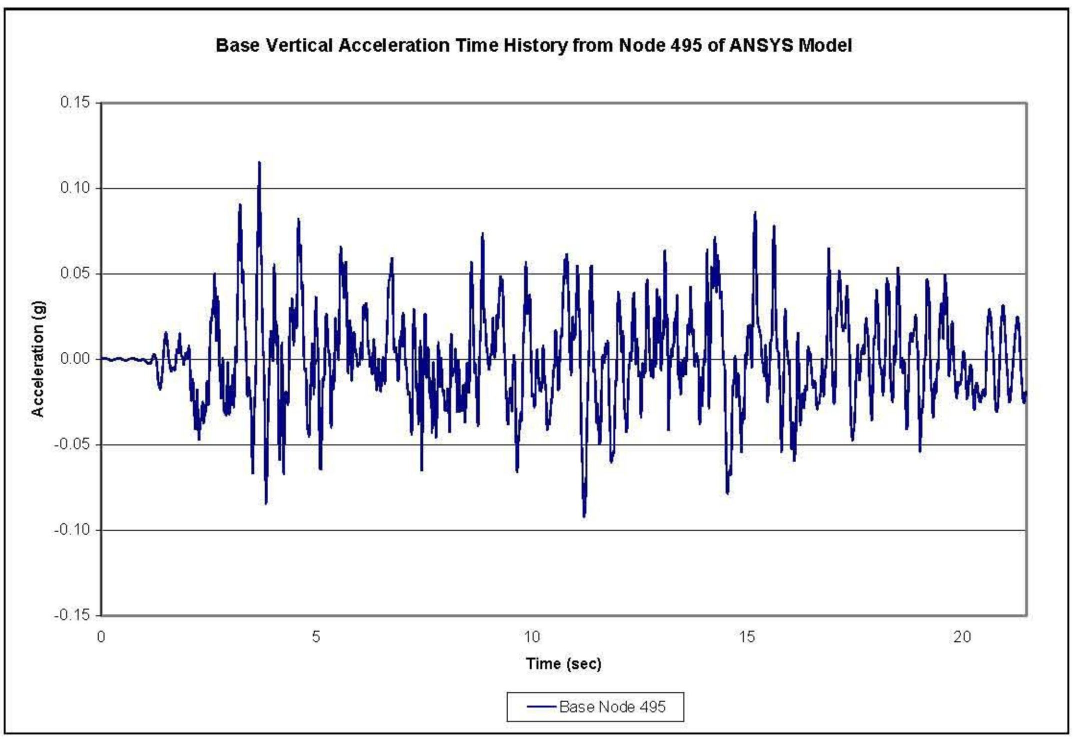


Figure 3-19. Velocity Time Histories – Vertical Time History Used as Input to the Dytran® Primary Tank Sub-Model.

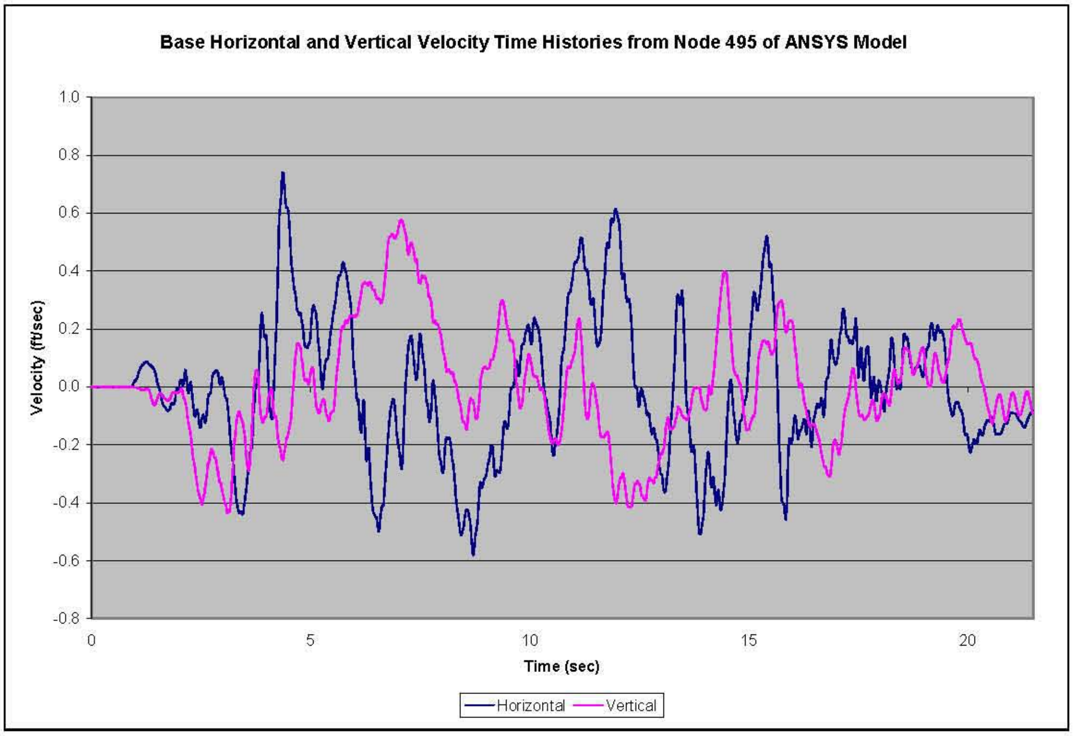


Figure 3-20. Displacement Time Histories Corresponding to Primary Tank Sub-Model Input.

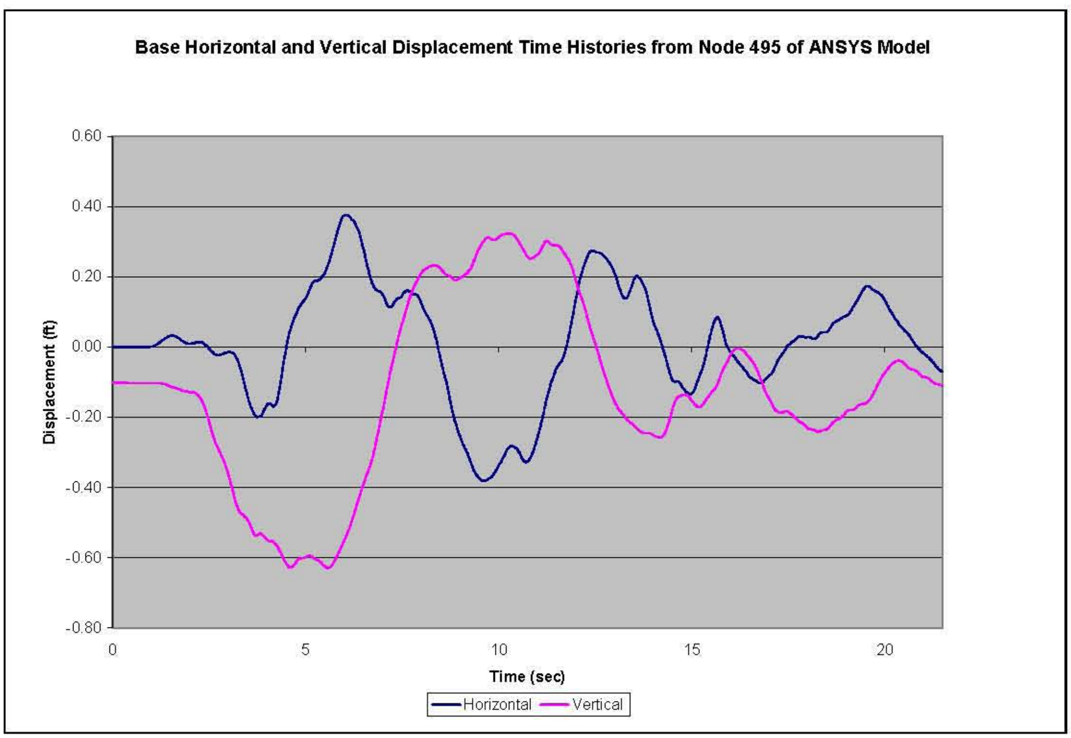
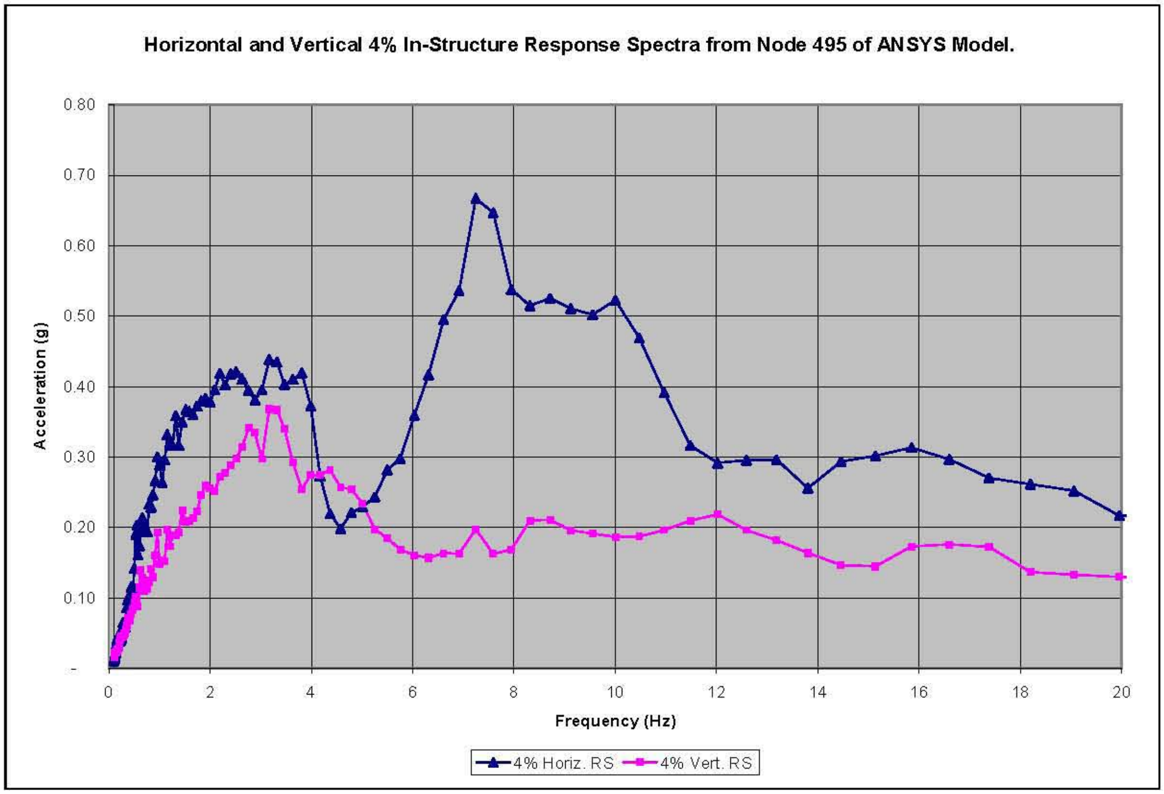


Figure 3-21. 4% Damped Response Spectra for Acceleration Time Histories Extracted from ANSYS® Model.



3.6 DIFFERENCES FROM EARLIER DYTRAN MODELS

The Dytran® models described in this report differ from the Dytran® flexible primary tank sub-models at the 460 in. liquid level described in Rinker and Abatt (2006a, Rev. 1) in the following respects:

1. The non-uniform wall thickness representative of the 241-AP tanks is incorporated in the present models.
2. The transition from flexible elements to rigid elements has been shifted up from approximately 458 in. to 467 in. to more accurately represent the elevation of the first row of J-bolts.
3. The time history input records used are different having been extracted from the tank base of the global ANSYS® model at the 460 in. waste level instead of from the dome of the global ANSYS® model at the 422 in. waste level.
4. The dynamic relaxation parameter was increased from 0.02 to 0.025 to achieve the desired effective damping.
5. The boundary conditions at the bottom of the tank in the presence of vertical excitation have been changed as described in Section 3.3.
6. Two-component motion (simultaneous horizontal and vertical seismic excitation) is incorporated in the present models.
7. The elastic modulus was reduced from 29.0 x 10^6 lbf/in^2 to 28.8 x 10^6 lbf/in^2.

4.0 RESULTS FROM DYTRAN PRIMARY TANK SUB-MODELS

Results from horizontal seismic excitation only, vertical seismic excitation only, and simultaneous application of horizontal and vertical seismic excitation (two-component motion) are described in this chapter.

Impulsive and convective frequencies, global reaction forces, waste pressures, maximum slosh heights, and primary tank stresses will be reported. Extensive benchmarking of Dytran® tank models was performed and reported in Rinker and Abatt (2006a) and Rinker and Abatt (2006b). In those reports, much emphasis was placed on documenting that the frequencies, reaction forces and waste pressures matched well to known solutions. In this report, there is less emphasis on frequencies, reaction forces, and waste pressures, and more emphasis on primary tank stresses. Thus, although frequencies, reaction forces, waste pressures, and slosh heights are reported to provide a basic check of the results, the primary tank stresses are of the most interest. Furthermore, due to the extensive data produced by the Dytran® simulations, not all results are shown in the body of this report. Additional results are included in Appendix B.

4.1 CHARACTERIZATION OF DAMPING IN DYTRAN SUB-MODEL

The intent of introducing dynamic relaxation (damping) into the solution is to achieve realistic effective damping values for the impulsive and convective response of the tank and waste system.

The target values are 2-4% for the impulsive response and 0.5% for the convective response of the tank and liquid system per DOE (2002). The value of the dynamic relaxation factor was set to 0.025 based on the initial decay of the vertical coupling surface reaction force during gravity loading. The initial decay of the vertical reaction force actually represents the effective damping of the breathing mode response of the system, but this was expected to be a good indicator of the impulsive response of the system. Based on the decay of the breathing mode response, the effective impulsive damping is approximately 3.5% of critical.

A more direct (but much more time consuming) way of determining the effective damping for the impulsive response is to quantify the decay of the horizontal reaction force immediately following the cessation of the seismic excitation. With this approach, the effective damping for the impulsive response is approximately 4.3% of critical damping. Based on the data displayed in Figure 4-2 and Figure 4-5, the effective damping for the convective response is approximately 0.6%. Both values are slightly higher than desired, but further reductions in the dynamic relaxation parameter introduced undesired noise and instabilities into the solution.

The artificial viscosities implemented in Dytran® are referred to as the linear (BULKL) and quadratic (BULKQ) bulk viscosities. The bulk viscosities act to control the formation of shock waves by introducing viscosity to the bulk straining of the fluid.

Experience with earlier models (Rinker and Abatt 2006a and 2006b) has shown that it is necessary to increase the bulk viscosity coefficients relative to the default values in order to properly calibrate the models. Consequently, all Dytran® simulations were run with the linear and quadratic bulk viscosity parameters set to 0.2 and 1.1, respectively. The default values for the bulk viscosity coefficients are 0.0 for the linear coefficient and 1.0 for the quadratic coefficient.

4.2 HYDRODYNAMIC FORCES FROM DYTRAN SUB-MODEL

4.2.1 Horizontal Excitation Only

The horizontal displacement of node 523 near the mid-height of the tank wall shown in Figure 4-1 during the initial equilibration phase exhibits a breathing mode frequency of 5.07 Hz. Also shown in the plot are decay curves representing 3%, 3.5%, and 4% critical damping. The best match appears to be from the 3.5% damping curve.

The peak horizontal hydrodynamic force is 3.05 x 10^6 lbf as shown in Figure 4-2 along with the convective response, which shows a fundamental frequency of 0.207 Hz. The convective response in Figure 4-2 shows an approximately 10% decay during the three cycles from 29 to 44 seconds, giving an effective damping of approximately 0.6% for the convective response. The "noise" in the horizontal reaction force trace between approximately 32 and 43 seconds is numerically spurious data, with no significant effect on the solution. The signal could have been smoothed by increasing the dynamic relaxation (damping), but this would have been counterproductive since the effective damping for the impulsive response is already slightly greater than desired.

Figure 4-3 shows the horizontal reaction force time history during the second free vibration period beginning at 26.5 seconds. According to that plot, the impulsive frequency is approximately 5.7 Hz, and the effective damping for the impulsive response is slightly greater than 4% of critical.

Figure 4-1. Horizontal Displacement of Tank Wall Node 523 (Mid-Height) vs. Time During Initial Gravity Loading.

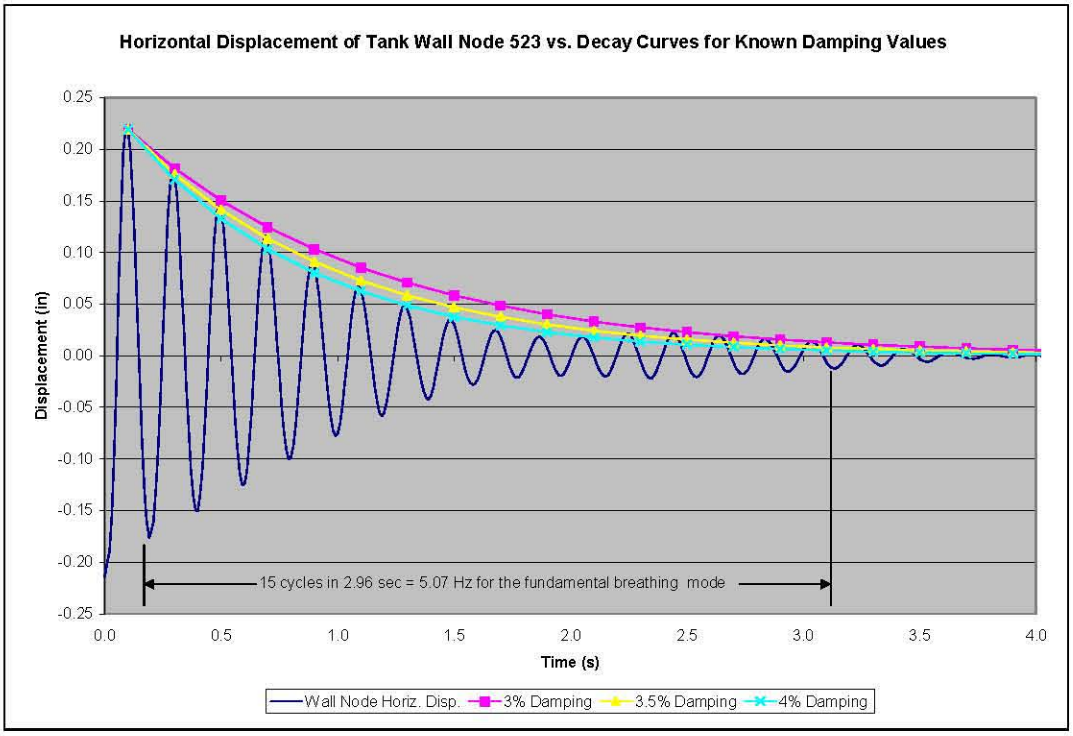


Figure 4-2. Horizontal Coupling Surface Reaction Force vs. Time for Horizontal Seismic Excitation.

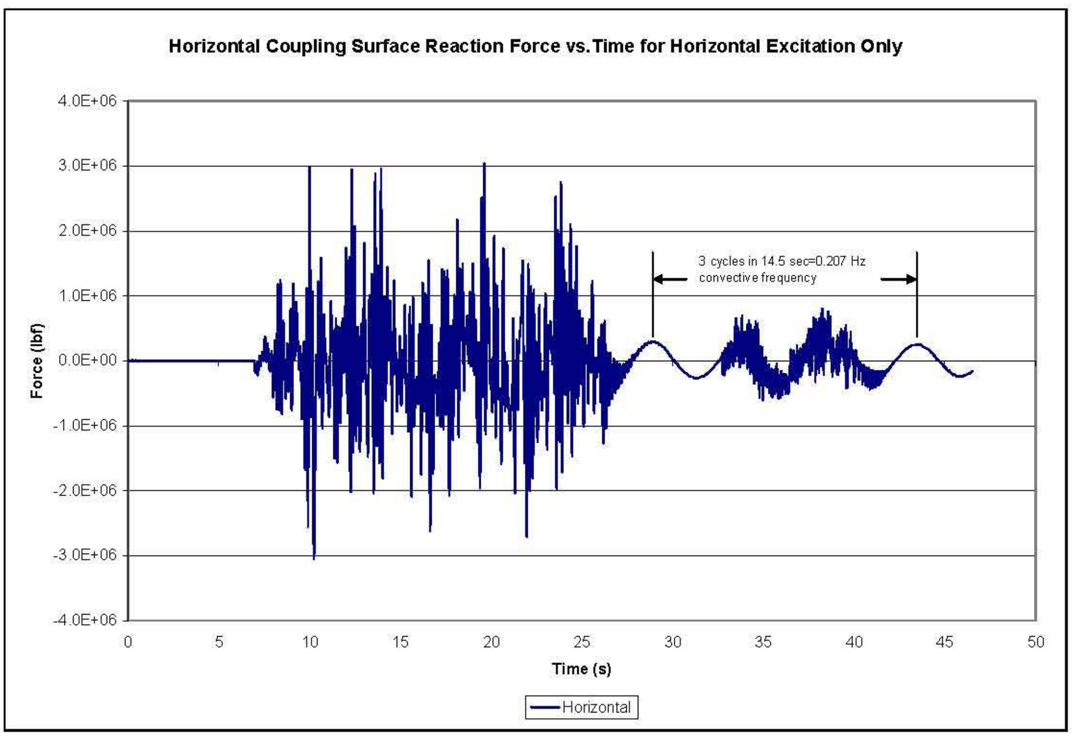
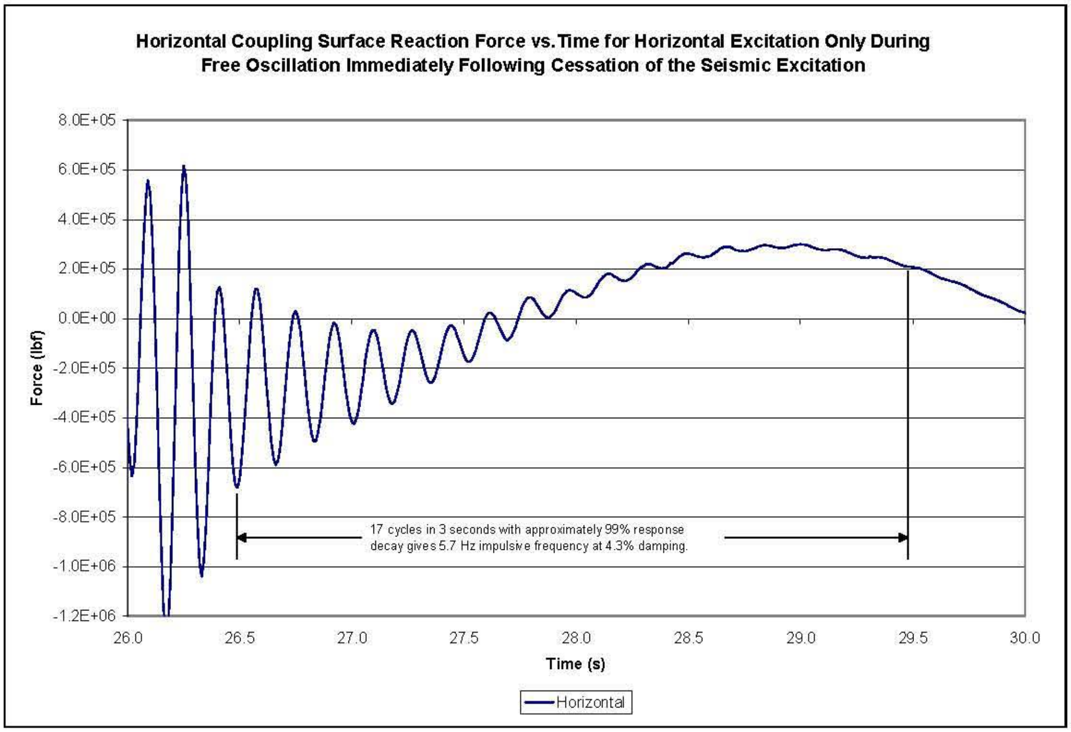


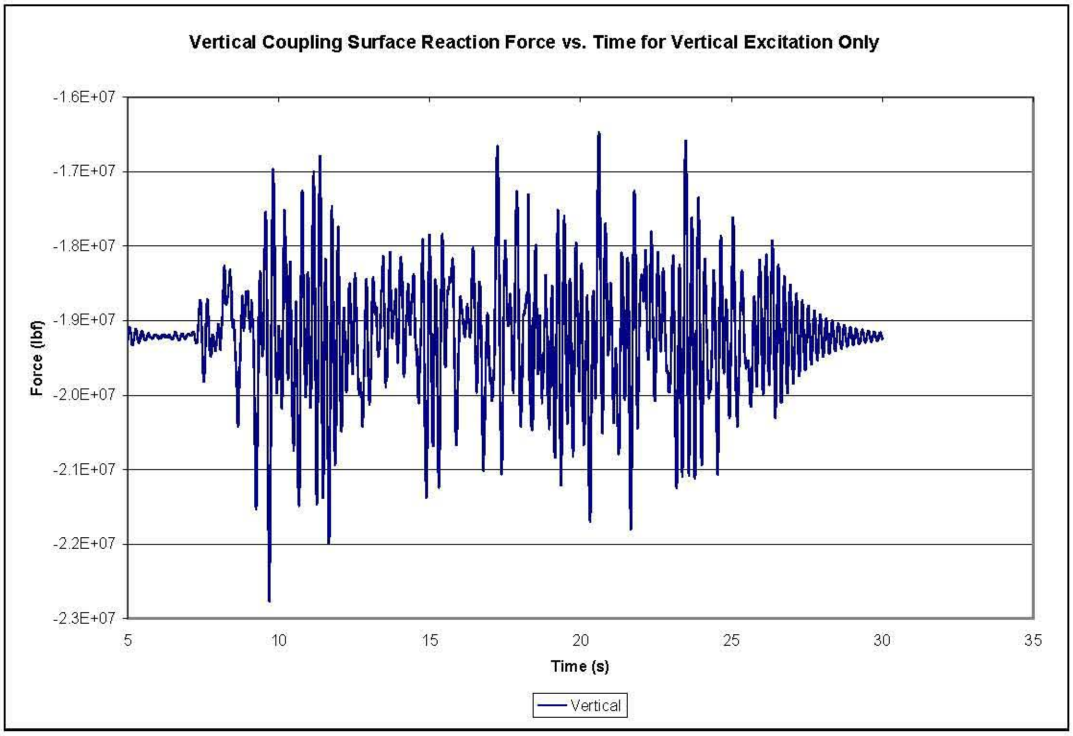
Figure 4-3. Horizontal Coupling Surface Reaction Force vs. Time for Horizontal Seismic Excitation During the Final Free Vibration Phase.



4.2.2 Vertical Excitation Only

As shown in Figure 4-4, the vertical reaction force varies between -1.65 x 10^7 lbf and -2.28 x 10^7 lbf. The weight of the contained fluid is 1.92 x 10^7 lbf, so that the maximum dynamic component of the vertical reaction force is 3.6 x 10^6 lbf (difference between peak reaction force and weight of fluid), which is greater than for horizontal excitation only.

Figure 4-4. Vertical Coupling Surface Reaction Force vs. Time for Vertical Seismic Excitation.



4.2.3 Two-Component Motion

The horizontal reaction force time history for two-component motion is shown in Figure 4-5. The maximum horizontal reaction force is 3.7 x 10^6 lbf, which is 21% greater than for horizontal motion only. The fundamental convective frequency is 0.207 Hz – the same as for horizontal excitation only.

The impulsive response and decay for the system is shown in Figure 4-6. In contrast to the case of horizontal motion only, the apparent impulsive frequency has increased from 5.7 Hz to 5.88 Hz. Depending on how peaks are counted, the effective damping for the impulsive response is between 3.9% and 5.2% of critical.

In the case of two-component motion, Figure 4-7 shows that the vertical reaction force varies between -1.65 x 10^7 lbf and -2.28 x 10^7 lbf – exactly the same as for vertical seismic excitation only. Based on the reaction forces, the presence of the vertical input couples in such a way as to increase the maximum horizontal reaction force, but the presence of the horizontal input has no effect on the peak vertical reaction force.

Figure 4-5. Horizontal Coupling Surface Reaction Force vs. Time for Two-Component Seismic Excitation.

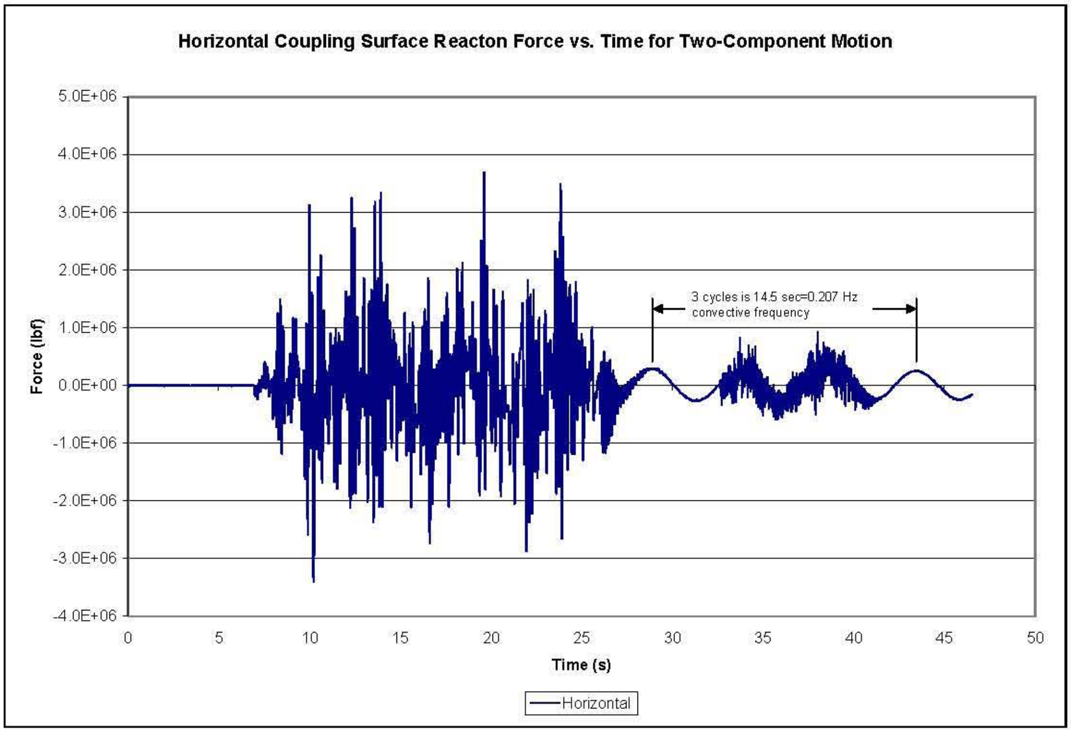


Figure 4-6. Horizontal Coupling Surface Reaction Force vs. Time for Two-Component Seismic Excitation During the Final Free Vibration Phase.

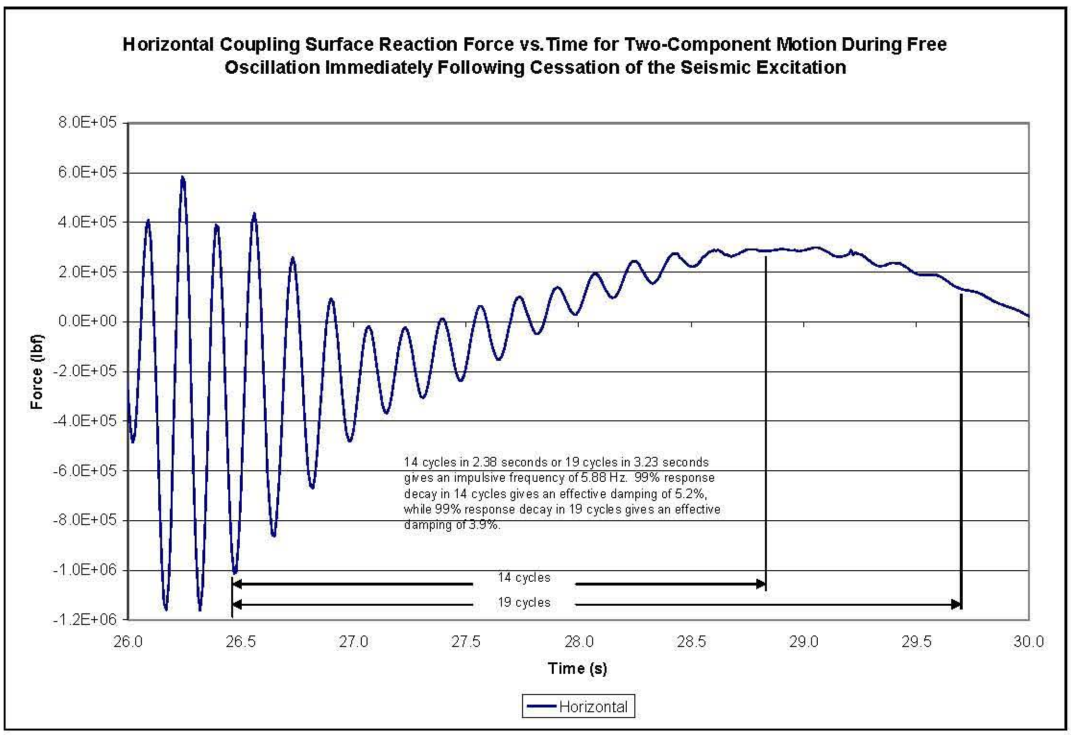
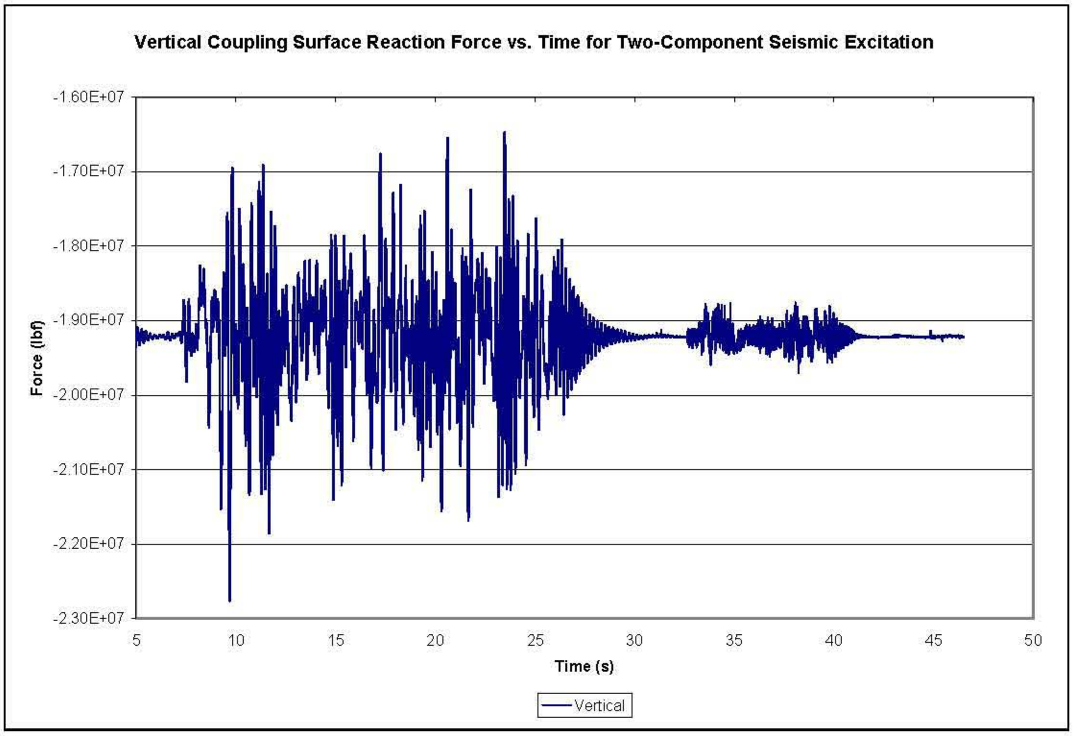


Figure 4-7. Vertical Coupling Surface Reaction Force vs. Time for Two-Component Seismic Excitation.



4.3 WASTE PRESSURES FROM DYTRAN SUB-MODEL

The total pressures are the sum of the hydrostatic pressures and the hydrodynamic pressures. The theoretical hydrostatic pressures for the elements in the sets "plusx_els", "press_45", "plusz_els", "cent_press" and "minusx_els" are shown in Table 4-1.

Table 4-1. Theoretical Hydrostatic Pressures for Selected Fluid Elements from the Dytran® Primary Tank Sub-Model.

"Plusx_els"	"Press_45"	"Plusz_els"	"Cent_press"	"Minusx_els"	Theoretical Hydrostatic Pressure (psi absolute)
Element	Element	Element	Element	Element	
5143	5588	5799	89959	86776	15.0
3543	3988	4199	86759	5176	15.7
1943	2388	2599	3559	3576	16.4
25943	26388	26599	25959	1976	17.0
22743	23188	23399	22759	22776	18.3
19543	19988	20199	19559	19576	19.7
16343	16788	16999	16359	16376	21.0
13143	13588	13799	13159	13176	22.3
9943	10388	10599	9959	9976	23.6
6743	7188	7399	6759	6776	24.9
72343	72788	72399	72359	72376	26.3
69143	69588	69799	69159	69176	27.6
65943	66388	66599	65959	65876	28.9
62743	63188	63399	62759	62776	30.2
59543	59988	60199	59559	59576	31.6
56343	56788	56999	56359	56376	32.9
53143	53588	53799	53159	53176	34.2
49943	50388	50599	49959	49876	35.5
46743	47188	47399	46759	46776	36.9
43543	43988	44199	43559	43576	38.2
40343	40788	40999	40359	40376	39.5
37143	37588	37799	37159	37176	40.9
33943	34388	34599	33959	33876	42.2
30743	31188	31399	30759	30776	43.5
27543	27988	28199	27559	27576	44.8

4.3.1 Horizontal Excitation Only

The pressure time histories for the elements adjacent to the tank wall at θ=0, 45, and 90° are shown in Figure 4-8, Figure 4-9, and Figure 4-10, respectively. In each plot, the hydrostatic pressures are stable and fall between approximately 16 and 44 lbf/in^2, in agreement with the values in Table 4-1. It is apparent that the pressure in the elements near the bottom of the tank is dominated by impulsive effects while the pressure in fluid elements near the free surface is dominated by convective effects, as expected.

It may also be observed that the highest dynamic pressures occur in the plane of excitation (θ=0°), and the minimum dynamic pressures occur normal to the plane of excitation (θ=90°) as expected. The dynamic pressures at θ=45° lie between the two extremes.

Figure 4-8. Waste Pressure Time Histories for Fluid Elements at θ=0° (Plusx_els) Subjected to Horizontal Seismic Excitation Only.

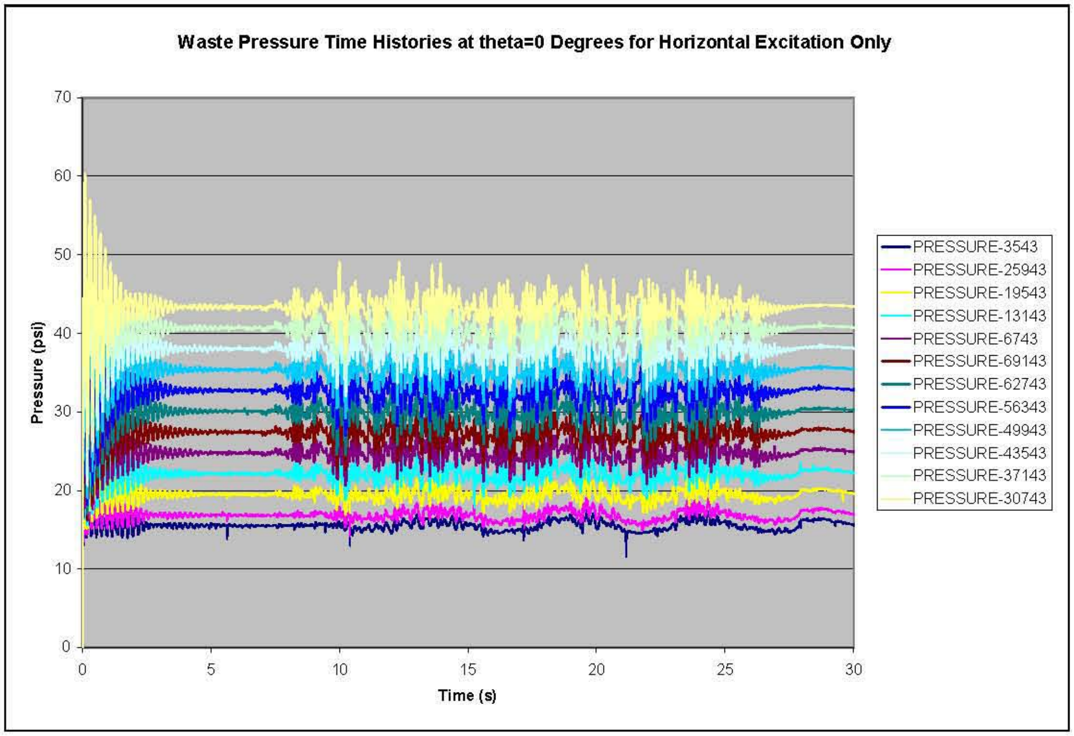


Figure 4-9. Waste Pressure Time Histories for Fluid Elements at θ=45° (Press_45) Subjected to Horizontal Seismic Excitation Only.

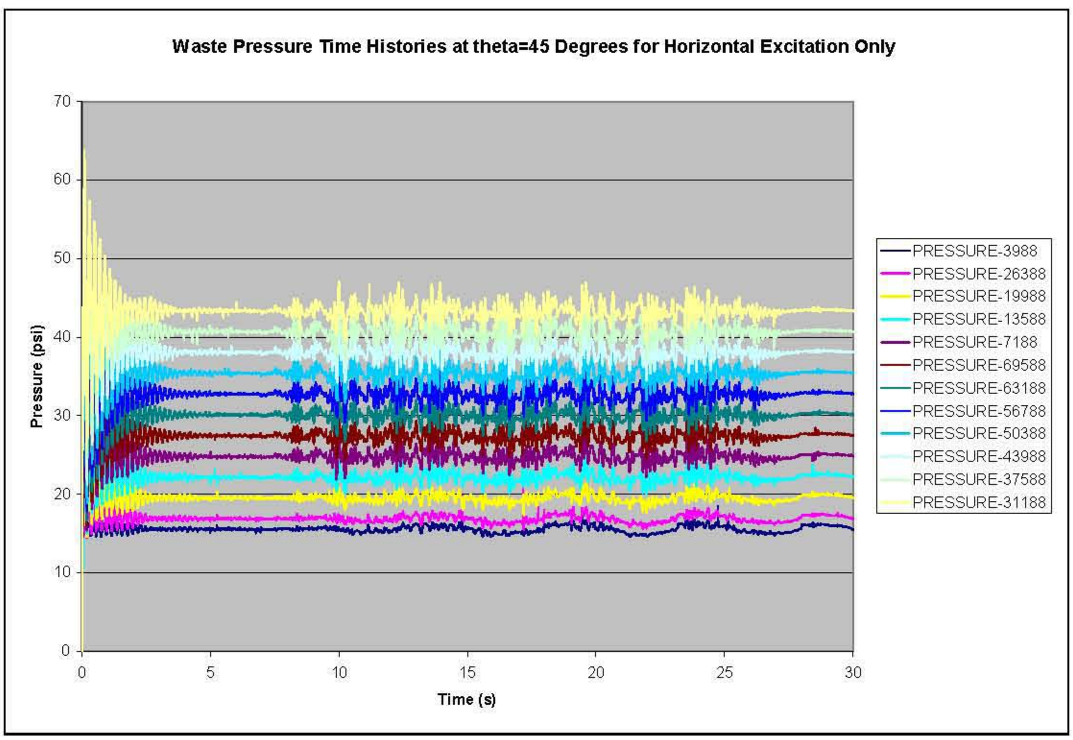
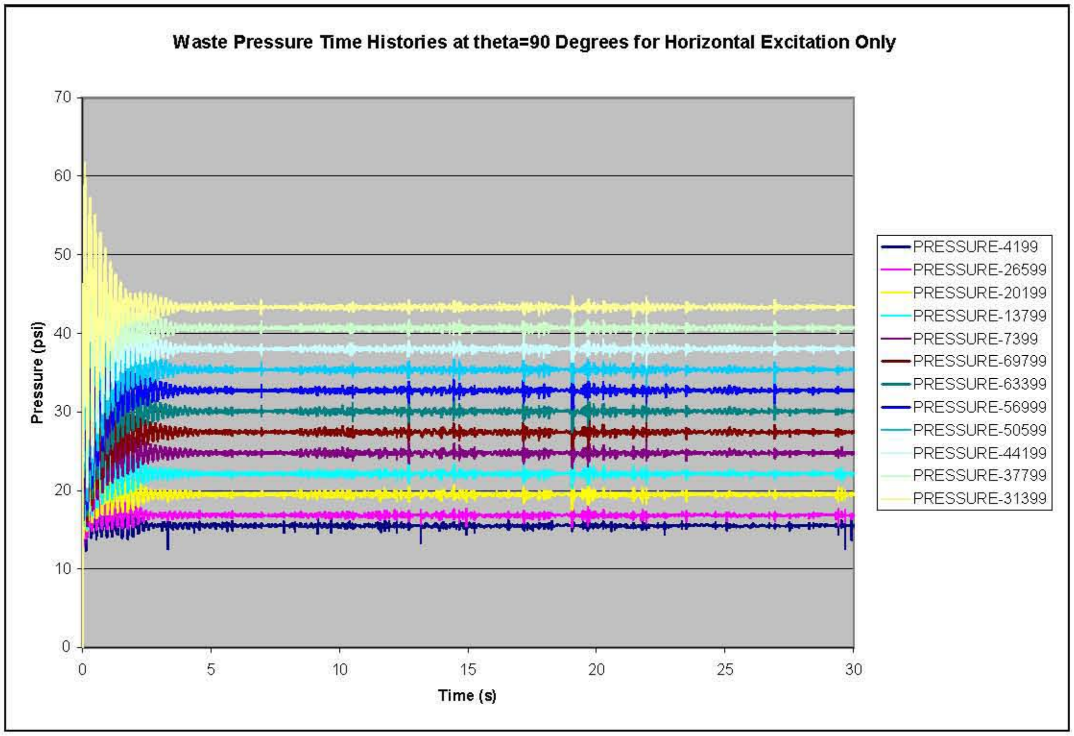


Figure 4-10. Waste Pressure Time Histories for Fluid Elements at θ=90° (Plusz_els) Subjected to Horizontal Seismic Excitation Only.



4.3.2 Vertical Excitation Only

The pressure time histories for the waste elements adjacent to the tank wall at θ=0° and at θ=45° are shown in Figure 4-11 and Figure 4-12, respectively. The two plots are essentially the same, indicating that the solution for vertical excitation is independent of the angular position, as required.

Figure 4-11. Waste Pressure Time Histories for Fluid Elements at θ=0° (Plusx_els) Subjected to Vertical Seismic Excitation Only.

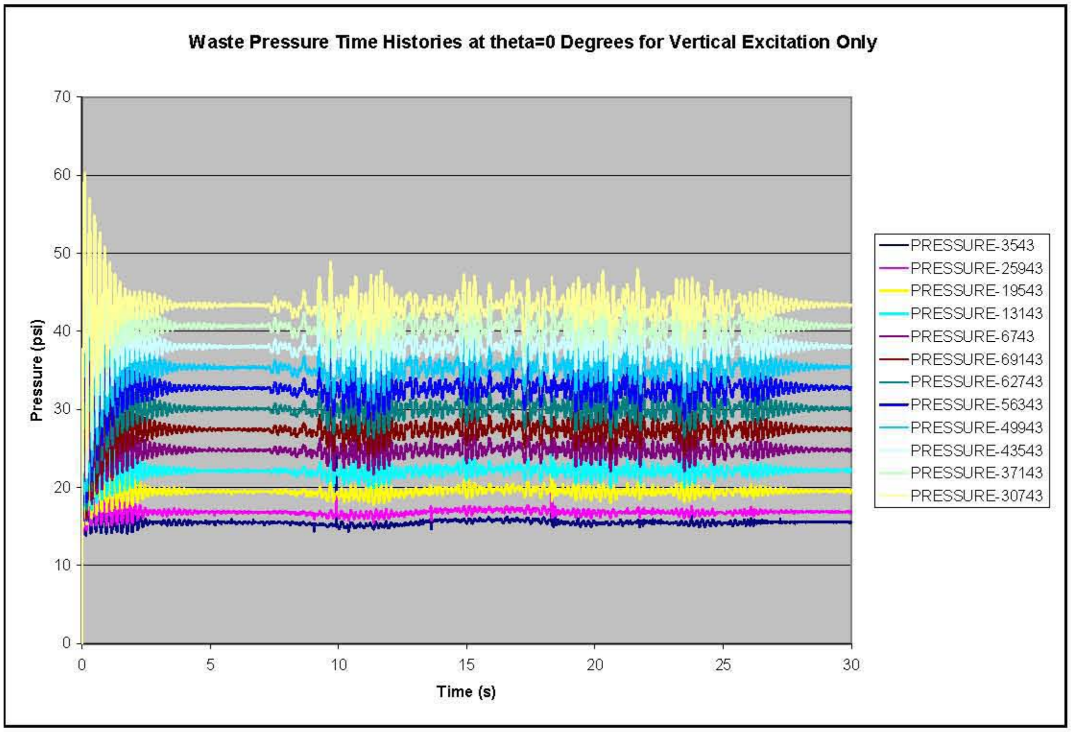
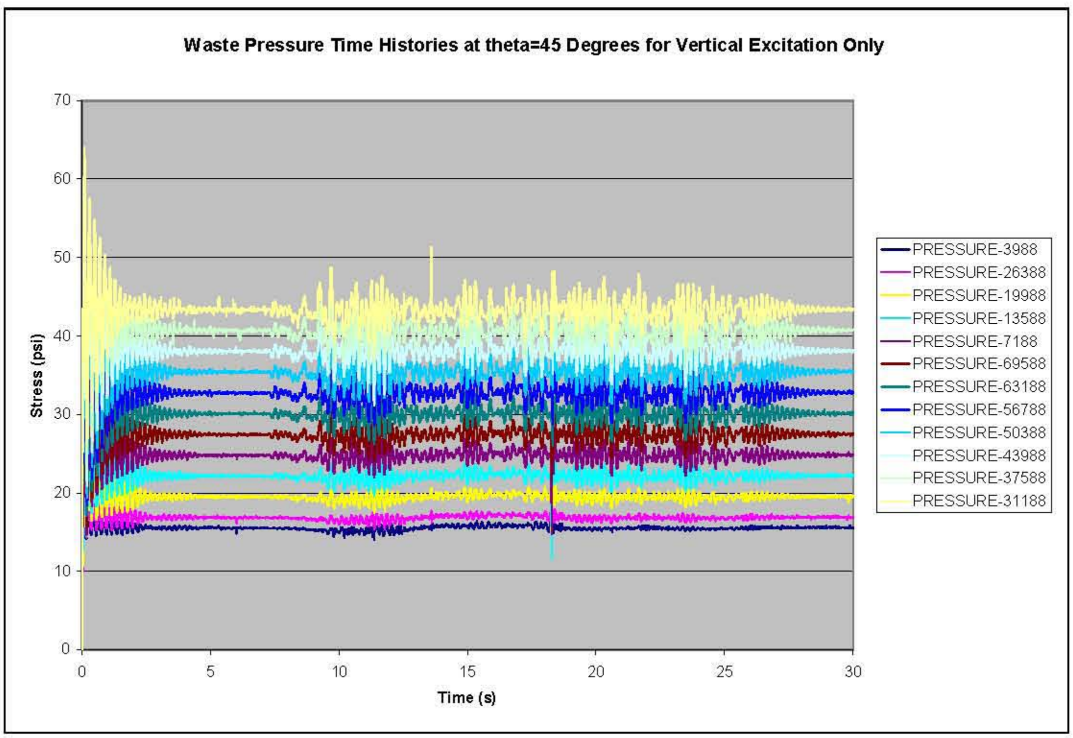


Figure 4-12. Waste Pressure Time Histories for Fluid Elements at θ=45° (Press_45) Subjected to Vertical Seismic Excitation Only.



4.3.3 Two-Component Motion

Waste pressure time histories for fluid elements located along the tank wall at θ=0, 45, and 90° when subjected to two-component seismic excitation are shown in Figure 4-13, Figure 4-14, and Figure 4-15, respectively. The plots show that the peak dynamic pressures are greater for the case of two-component motion than for either horizontal or vertical motion acting alone. The dynamic pressures for two-component motion appear to be consistent with square-root-sum-of-the squares (SRSS) combination of the dynamic pressures from the horizontal and vertical cases. For example, the peak dynamic pressure (difference between peak total pressure and hydrostatic pressure) for element 30473 shown in Figure 4-8 for horizontal excitation only is approximately 5.5-6 lbf/in^2. The peak dynamic pressure for that element for vertical excitation only is also approximately 5.5-6 lbf/in^2 (Figure 4-11). The peak dynamic pressure for that element for two-component motion is approximately 8 lbf/in^2 as shown in Figure 4-13, which is consistent with an SRSS directional combination.

The traces show that the peak pressures for two-component motion occur later in the event than the peaks for horizontal or vertical motion acting alone. That is, the timing of the peaks changes when horizontal and vertical motion are combined. As expected, the magnitude of the dynamic pressures decreases as the angle from the plane of excitation increases. The data also illustrate that the waste pressure time history at θ=90° for two-component motion (Figure 4-15) is very similar to the pressure time histories for vertical excitation only (Figure 4-11 and Figure 4-12). This also is expected since the contribution from the horizontal component of motion should be negligible in the plane normal to the plane of excitation.

In Figure 4-14 and Figure 4-15 a few isolated peaks occur that are characteristic of a high-frequency response that may be due to spurious numerics, and that in any case are unimportant to the structural analysis. This phenomenon is discussed in greater detail in in Rinker and Abatt (2006a and 2006b).

Figure 4-13. Waste Pressure Time Histories for Fluid Elements at θ=0° (Plusx_els) Subjected to Two-Component Seismic Excitation.

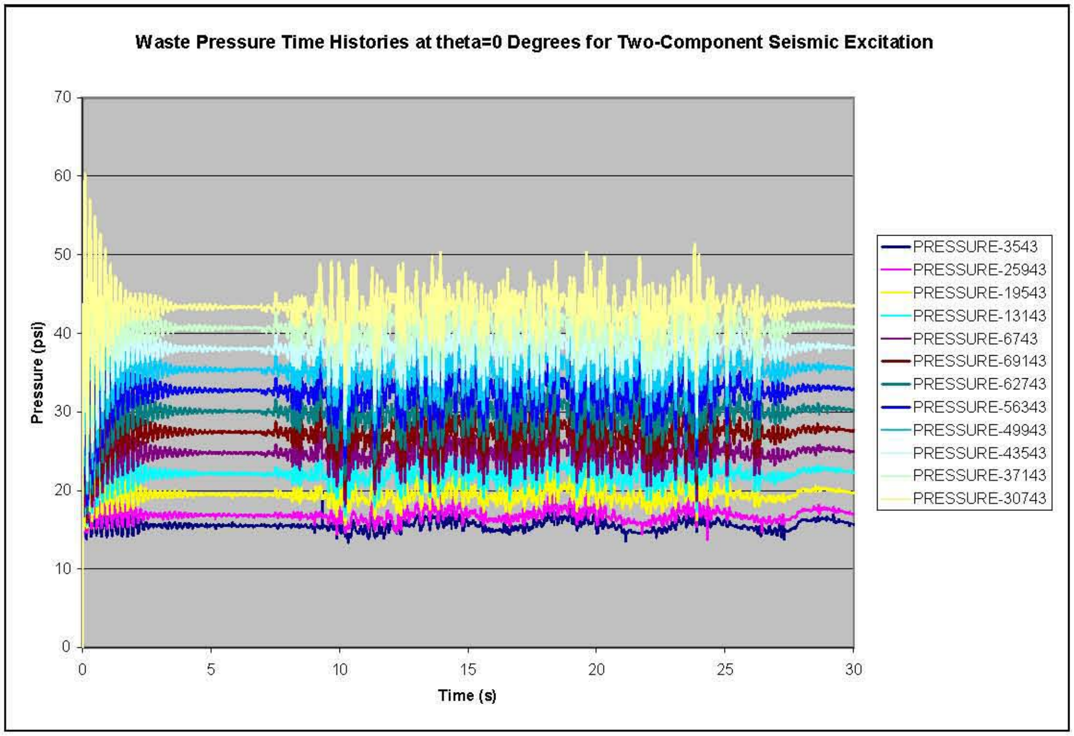


Figure 4-14. Waste Pressure Time Histories for Fluid Elements at θ=45° (Press_45) Subjected to Two-Component Seismic Excitation.

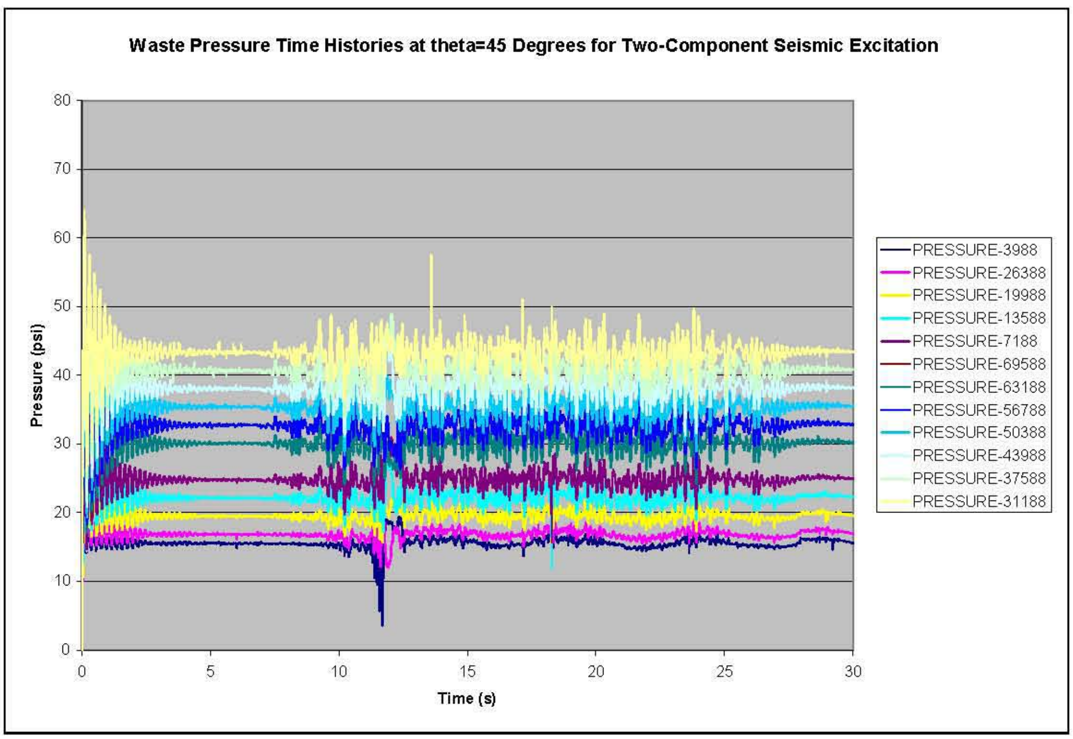
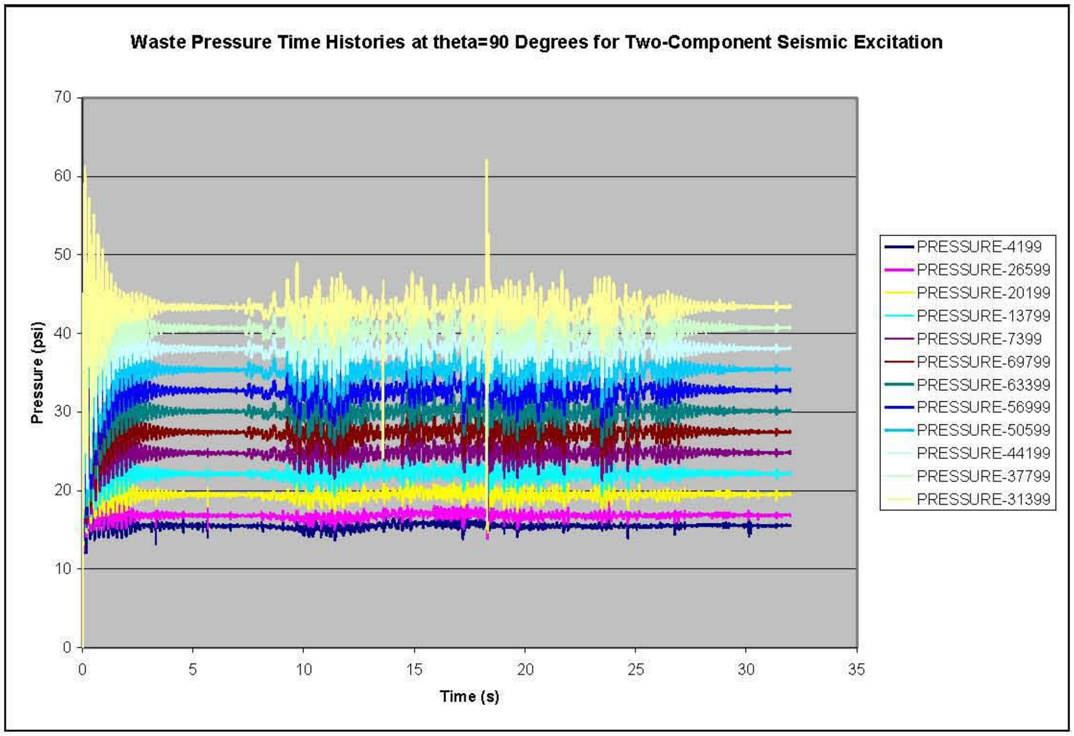


Figure 4-15. Waste Pressure Time Histories for Fluid Elements at θ=90° (Plusz_els) Subjected to Two-Component Seismic Excitation.

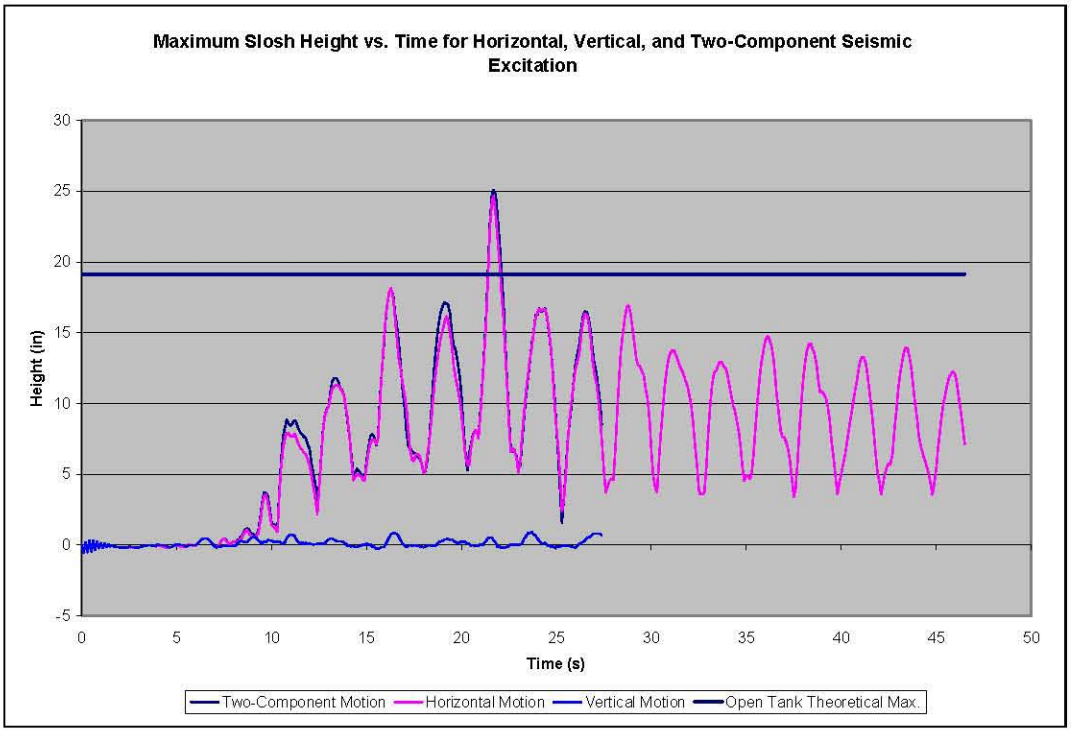


4.4 MAXIMUM SLOSH HEIGHT RESULTS FROM DYTRAN SUB-MODEL

Plots of the maximum free-surface height vs. time for horizontal, vertical, and two-component motion are presented in Figure 4-16. The traces for the vertical motion and two-component motion input have had the vertical displacement of the tank subtracted out so that the net slosh height is depicted. The peak slosh height for horizontal or two-component motion is approximately 25 in. The maximum slosh height associated with vertical motion only is less than 1 in.

The maximum theoretical slosh height for an open top tank without a dome is also shown in the plot. Note that the presence of the curved dome acts to increase the maximum slosh height in the tank relative to the open top solution.

Figure 4-16. Maximum Slosh Height Time-History for Horizontal, Vertical, and Two-Component Seismic Excitation.



4.5 PRIMARY TANK STRESSES FROM DYTRAN SUB-MODEL

The following three sections present primary tank stress distributions for the Dytran® sub-model when subjected to horizontal, vertical, and two-component motion. The plots show maximum and minimum stresses vs. path length from the dome apex. Important values of the path length are the beginning of the flexible portion of the tank at 438.1 in., the top of the vertical portion of the tank wall at 490.9 in., and the bottom of the tank wall at 915.2 in (zero elevation). A summary of the tank regions by path length and elevation is provided in Table 4-2.

Table 4-2. Primary Tank Regions Parameterized by Path Length from Dome Apex and Elevation from Tank Bottom.

Path Length from Dome Apex (in)	Elevation from Tank Bottom (in)	Tank Region	Wall Thickness (in)
0 to 438.1	467.0 to 561.5	Rigid dome	Rigid
438.1 to 490.9	424.3 to 467.0	Haunch portion of flexible wall	½
490.9 to 677.3	237.9 to 424.3	Vertical portion of wall	½
677.3 to 770.3	144.9 to 237.9	Vertical portion of wall	9/16
770.3 to 878.3	36.9 to 144.9	Vertical portion of wall	¾
878.3 to 915.2	0 to 36.9	Vertical portion of wall	7/8

4.5.1 Horizontal Excitation Only

Hoop, meridional, and shear stress distributions for the tank shell elements at θ=0° are presented as Figure 4-17, Figure 4-18, and Figure 4-19, respectively. The hoop stresses shown in Figure 4-17 indicate that the hoop response is dominated by membrane stresses with little contribution from bending. The meridional stress distributions shown in Figure 4-18 indicate that the meridional stresses are low in the majority of the tank wall, but higher in the haunch and bottom of the wall. The meridional response is dominated by bending in the haunch and bottom of the wall, but consists primarily of membrane stress in the majority of the wall. The mid-surface in-plane shear stresses are low as shown in Figure 4-19.

The hoop stresses at 45° from the plane of excitation are approximately 10% lower than at θ=0° as shown in Figure 4-20. Likewise, the meridional stresses at θ=45° are 5 to 10% lower than at θ=0° as seen in Figure 4-21. In contrast, the mid-surface shear stresses are approximately 10 times higher at θ=45° than at θ=0° (Figure 4-22), and the peak shear stresses occur at θ=90°, as expected and shown Figure 4-23.

Figure 4-17. Maximum and Minimum Hoop Stress vs. Path Length for Element Set "Plusx_Outstrip" at θ=0° for Horizontal Seismic Excitation Only.

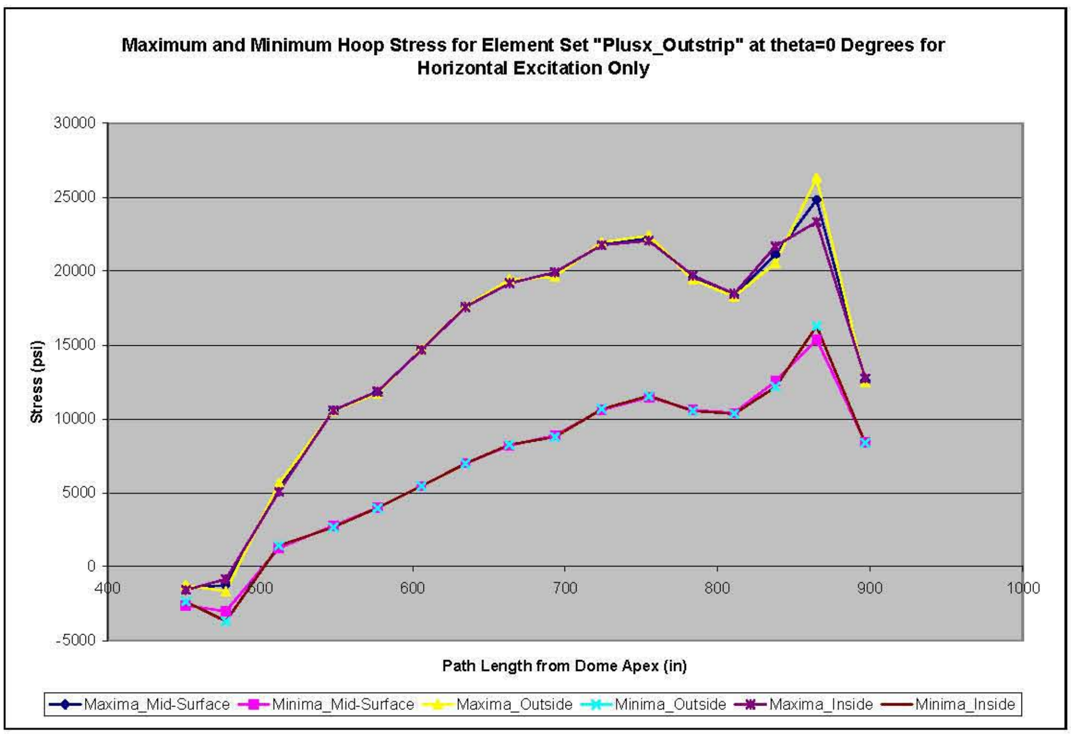


Figure 4-18. Maximum and Minimum Meridional Stress vs. Path Length for Element Set "Plusx_Outstrip" at θ=0° for Horizontal Seismic Excitation Only.

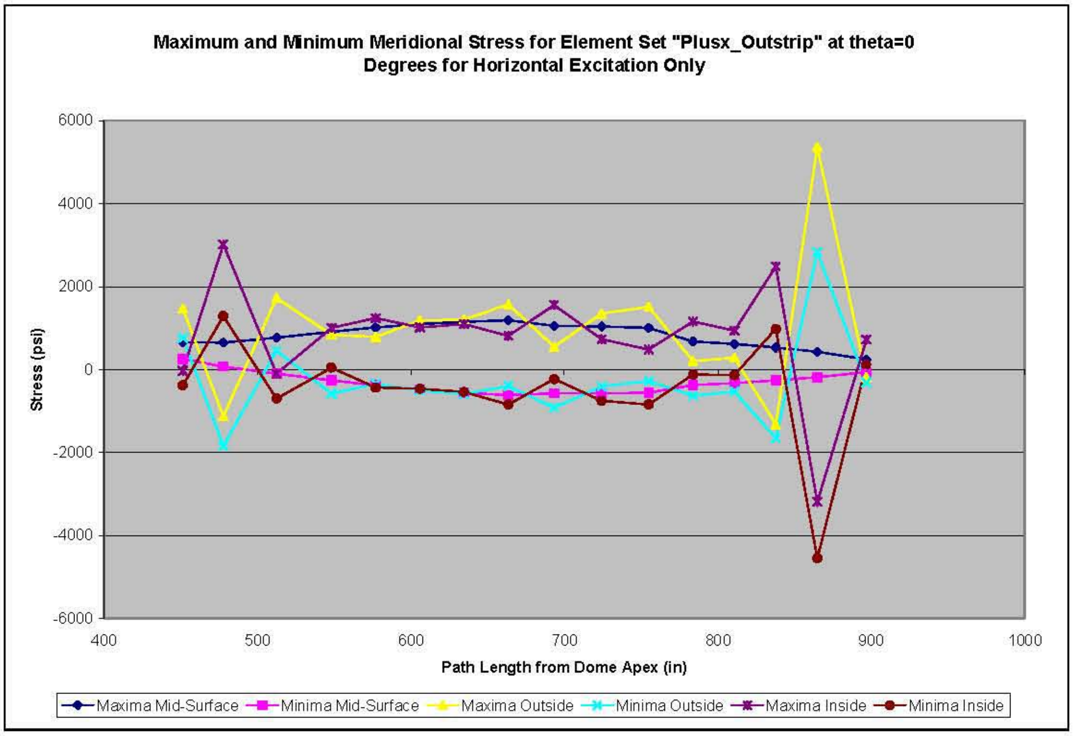


Figure 4-19. Maximum and Minimum Shear Stress vs. Path Length for Element Set "Plusx_Outstrip" at θ=0° for Horizontal Seismic Excitation Only.

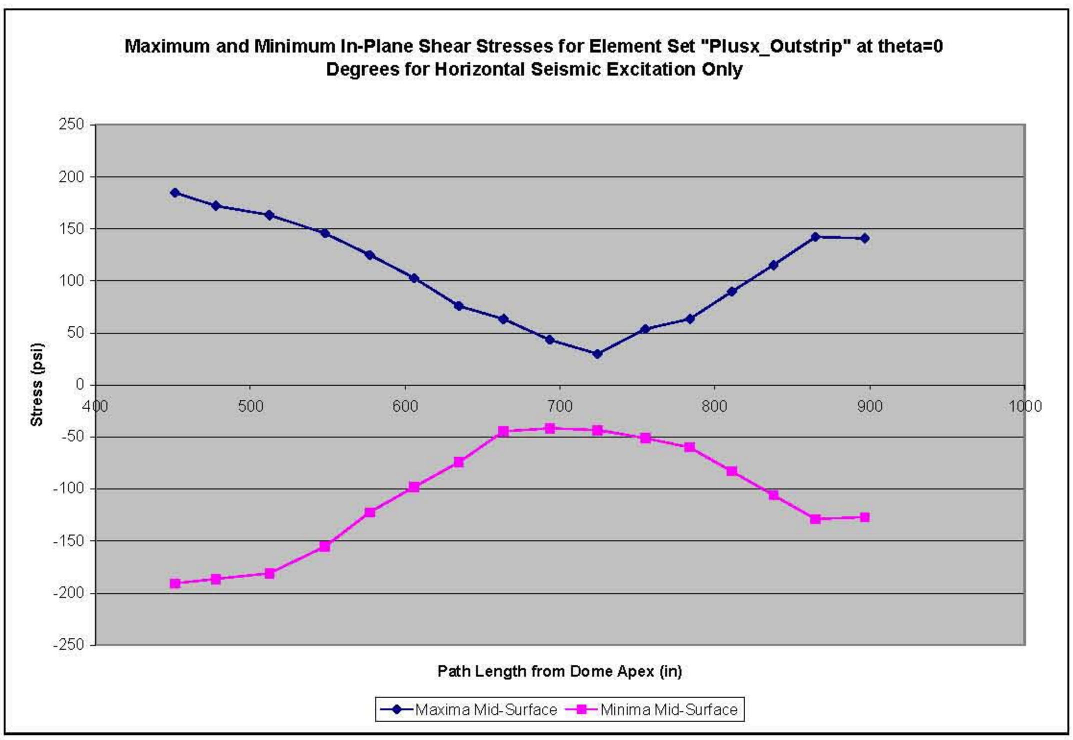


Figure 4-20. Maximum and Minimum Hoop Stress vs. Path Length for Element Set "Press45_Outstrip" at θ=45° for Horizontal Seismic Excitation Only.

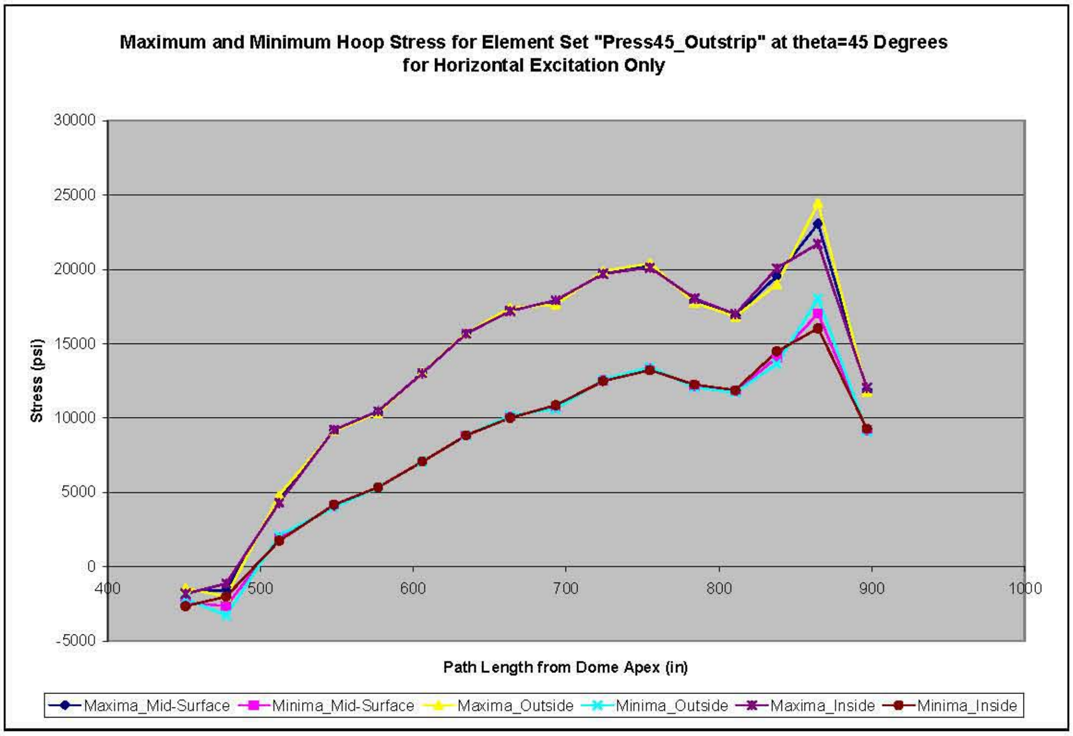


Figure 4-21. Maximum and Minimum Meridional Stress vs. Path Length for Element Set "Press45_Outstrip" at θ=45° for Horizontal Seismic Excitation Only.

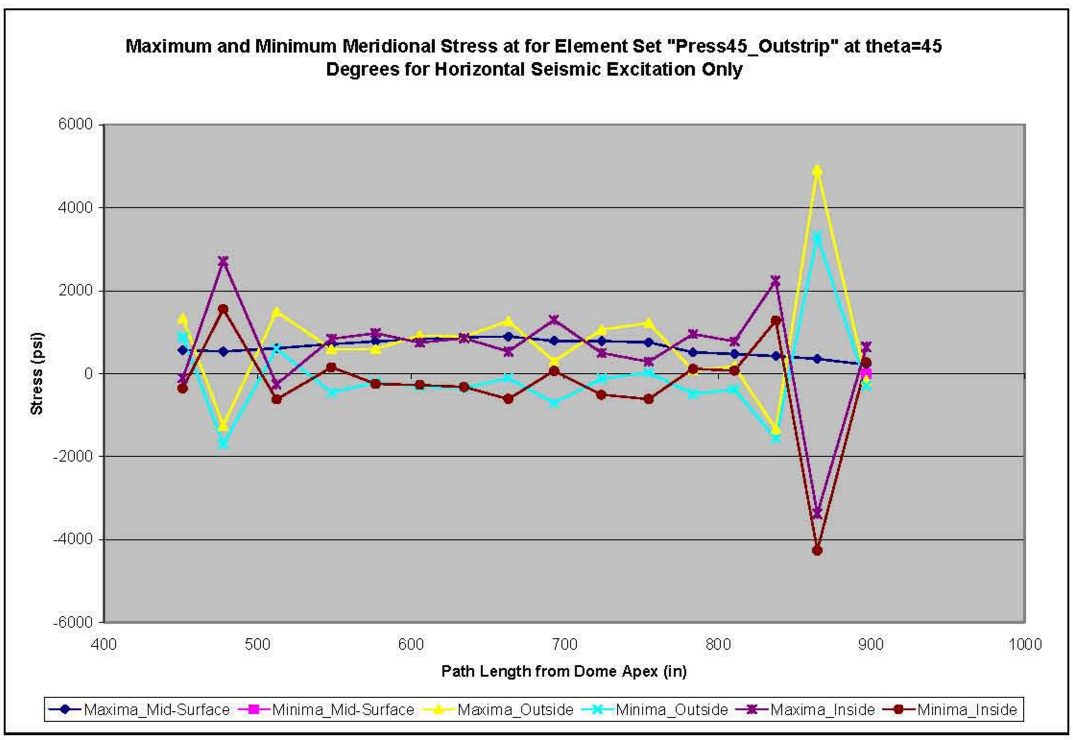
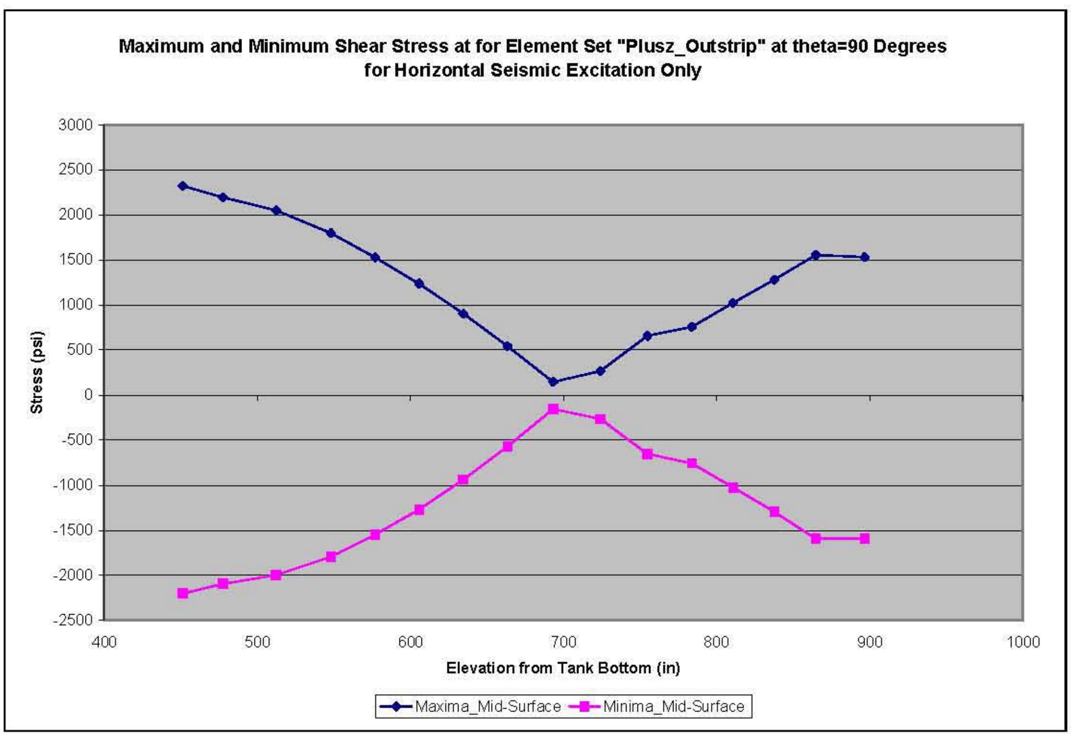


Figure 4-22. Maximum and Minimum Shear Stress vs. Path Length for Element Set "Press45_Outstrip" at θ=45° for Horizontal Seismic Excitation Only.

Figure 4-23. Maximum and Minimum Shear Stress vs. Path Length for Element Set "Plusz_Outstrip" at θ=90° for Horizontal Seismic Excitation Only.



4.5.2 Vertical Excitation

The hoop, meridional, and shear stress distributions at θ=0° for vertical excitation only are shown in Figure 4-24, Figure 4-25, and Figure 4-26, respectively. The plots indicate that the hoop stress is dominated by the membrane response, the hoop and meridional stress distributions and magnitudes are similar to that for horizontal excitation, and the shear stress is negligible. Plots at other angular locations are not shown due to the axisymmetric response for vertical excitation.

Figure 4-24. Maximum and Minimum Hoop Stress vs. Path Length for Element Set "Plusx_Outstrip" at θ=0° for Vertical Seismic Excitation Only.

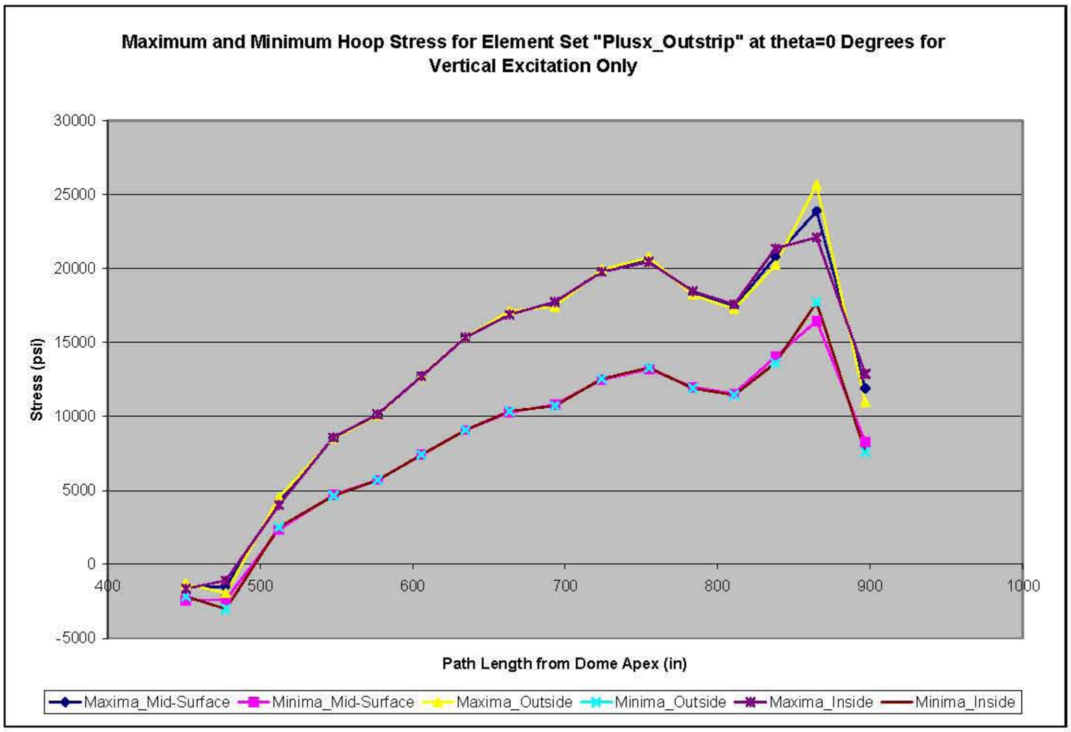


Figure 4-25. Maximum and Minimum Meridional Stress vs. Path Length for Element Set "Plusx_Outstrip" at θ=0° for Vertical Seismic Excitation Only.

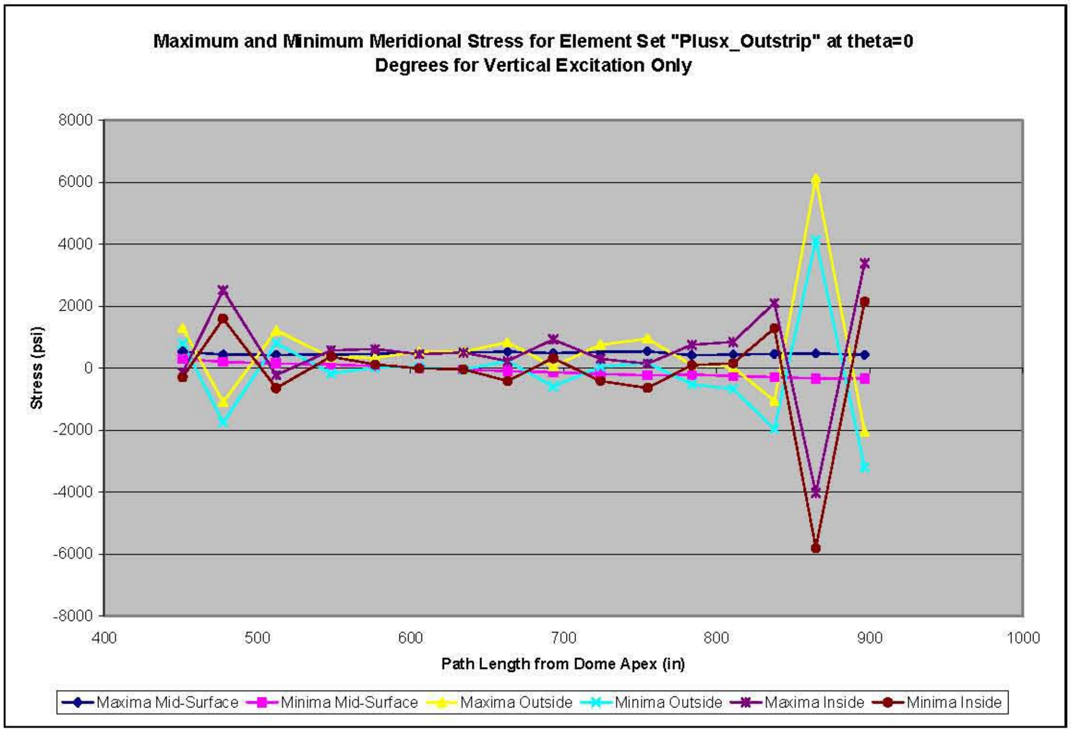
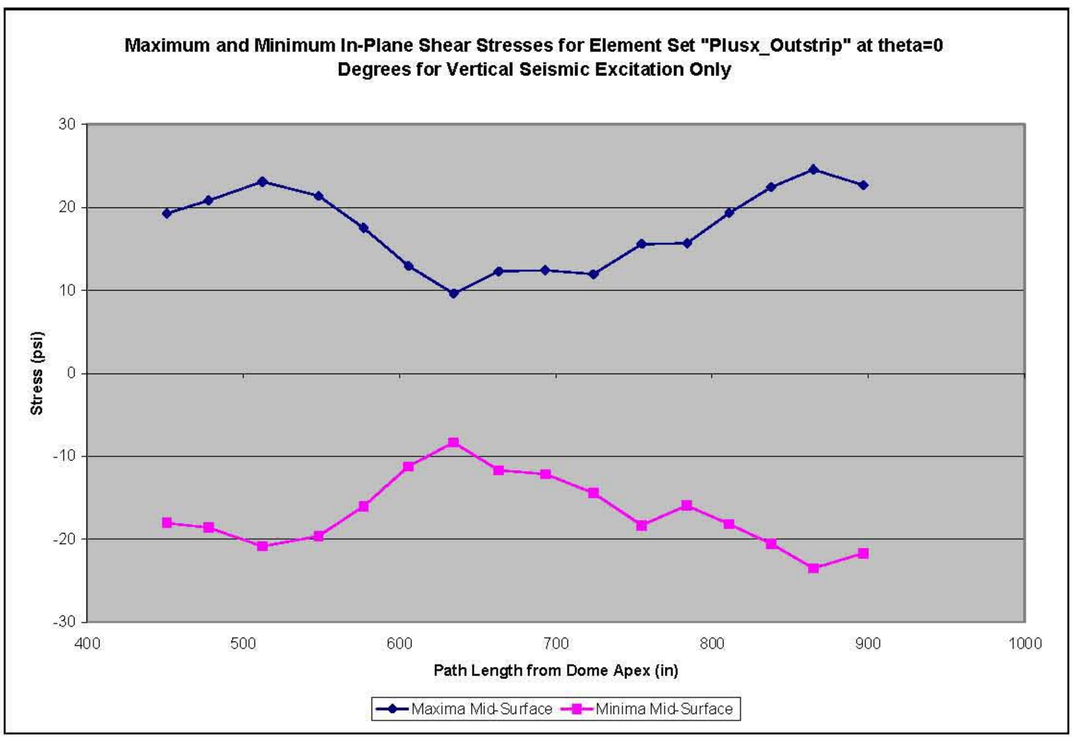


Figure 4-26. Maximum and Minimum Shear Stress vs. Path Length for Element Set "Plusx_Outstrip" at θ=0° for Vertical Seismic Excitation Only.



4.5.3 Two-Component Motion

Hoop, meridional and shear stress distributions at θ=0° are presented in Figure 4-27, Figure 4-28, and Figure 4-29, respectively. The stress distributions at θ=45° are shown in Figure 4-30, Figure 4-31, and Figure 4-32. The shear stress distribution at θ=90° is shown in Figure 4-33.

In general, the hoop stress distributions for two-component motion are similar to those for horizontal excitation only, but the magnitudes are somewhat higher. As in the cases of horizontal motion and vertical motion only, the hoop stress is dominated by the membrane response. The meridional stress distributions for two-component motion also are similar to those for horizontal excitation only, but with somewhat higher peak stress especially near the bottom of the tank wall.

Figure 4-27. Maximum and Minimum Hoop Stress vs. Path Length for Element Set “Plusx_Outstrip” at θ=0° for Two-Component Seismic Excitation.

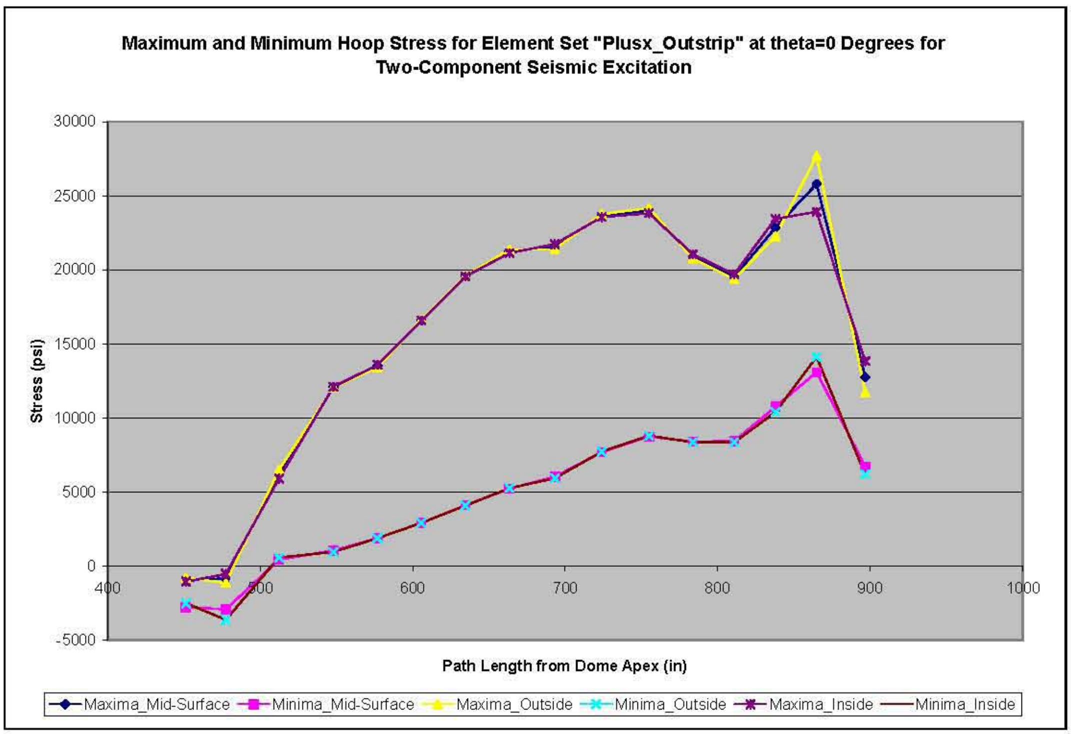


Figure 4-28. Maximum and Minimum Meridional Stress vs. Path Length for Element Set "Plusx_Outstrip" at θ=0° for Two-Component Seismic Excitation.

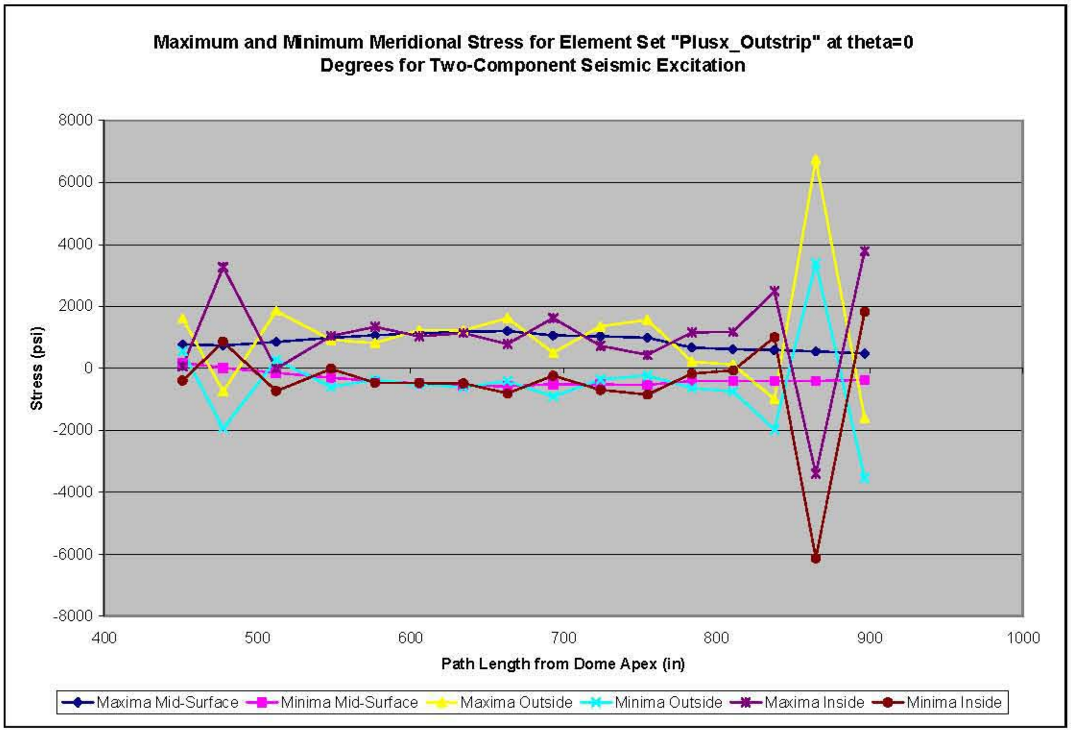


Figure 4-29. Maximum and Minimum Shear Stress vs. Path Length for Element Set "Plusx_Outstrip" at θ=0° for Two-Component Seismic Excitation.

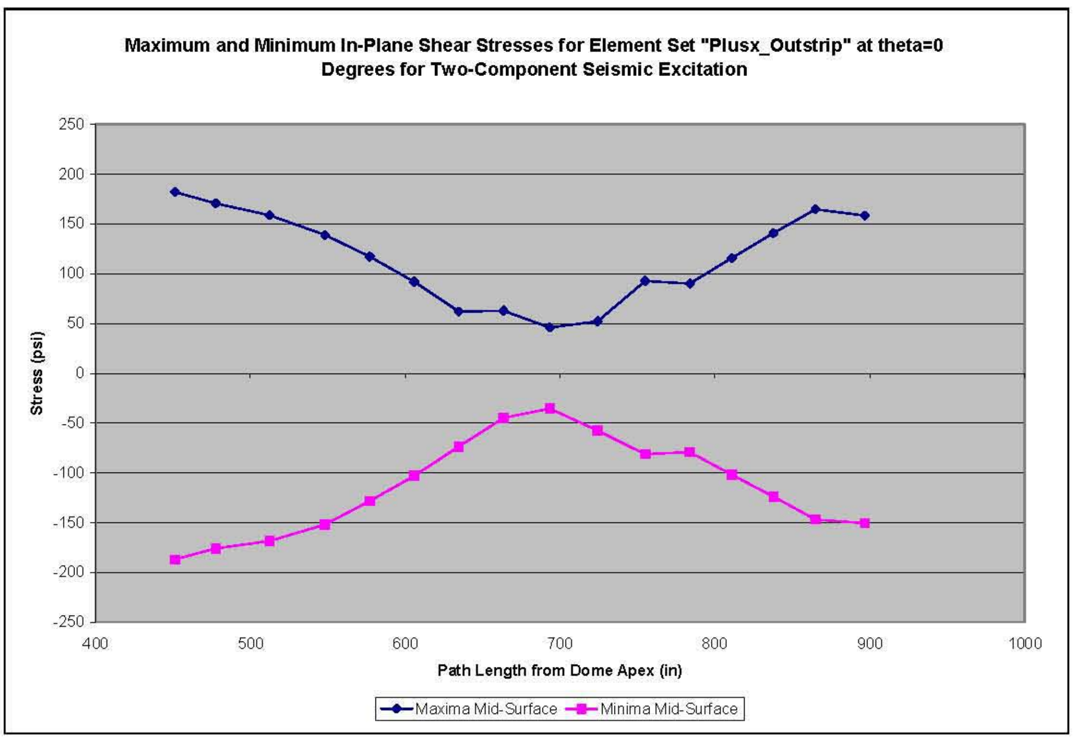


Figure 4-30. Maximum and Minimum Hoop Stress vs. Path Length for Element Set "Press45_Outstrip" at θ=45° for Two-Component Seismic Excitation.

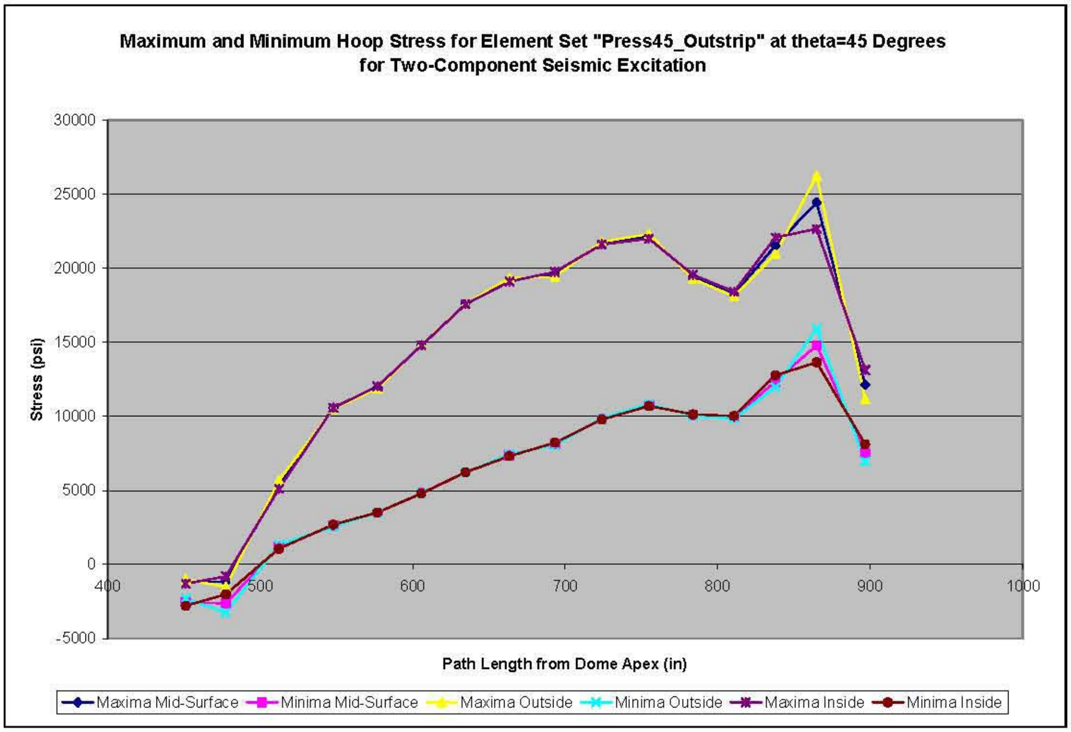


Figure 4-31. Maximum and Minimum Meridional Stress vs. Path Length for Element Set "Press45_Outstrip" at θ=45° for Two-Component Seismic Excitation.

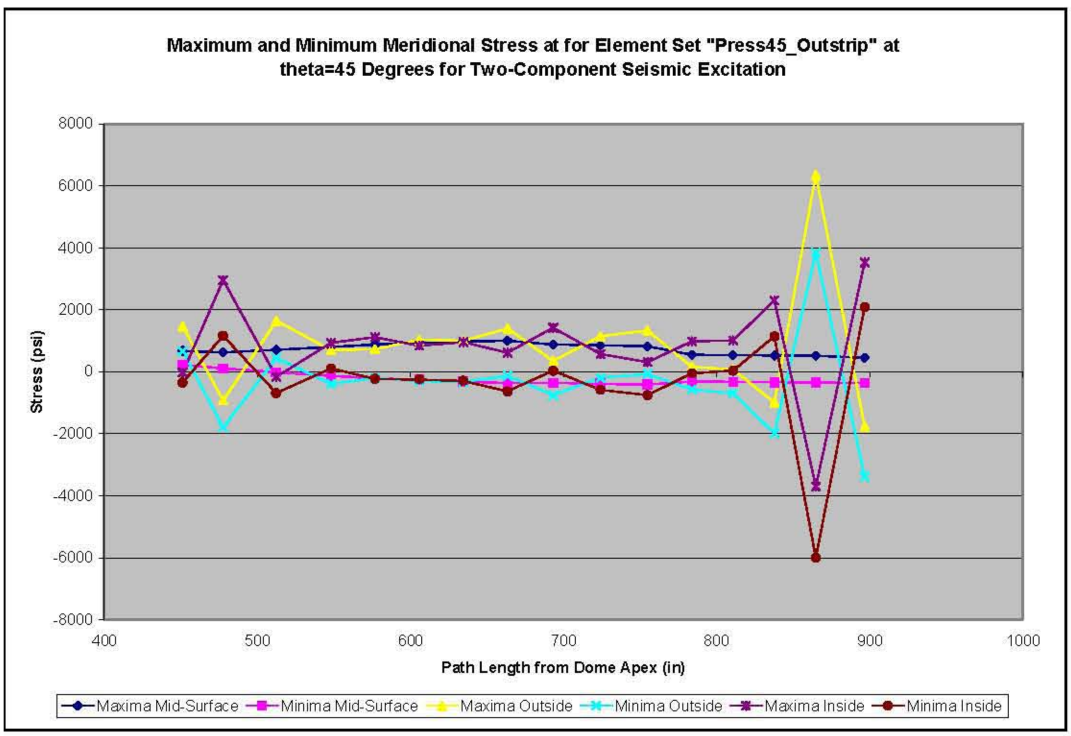


Figure 4-32. Maximum and Minimum Shear Stress vs. Path Length for Element Set "Press45_Outstrip" at θ=45° for Two-Component Seismic Excitation.

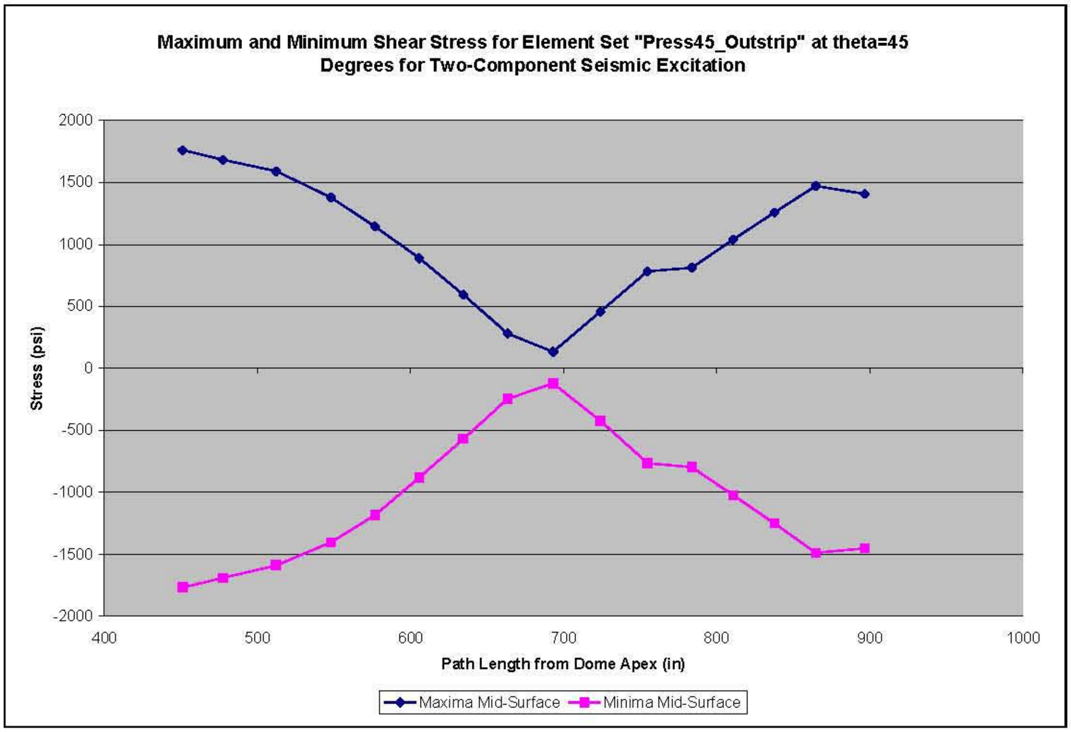
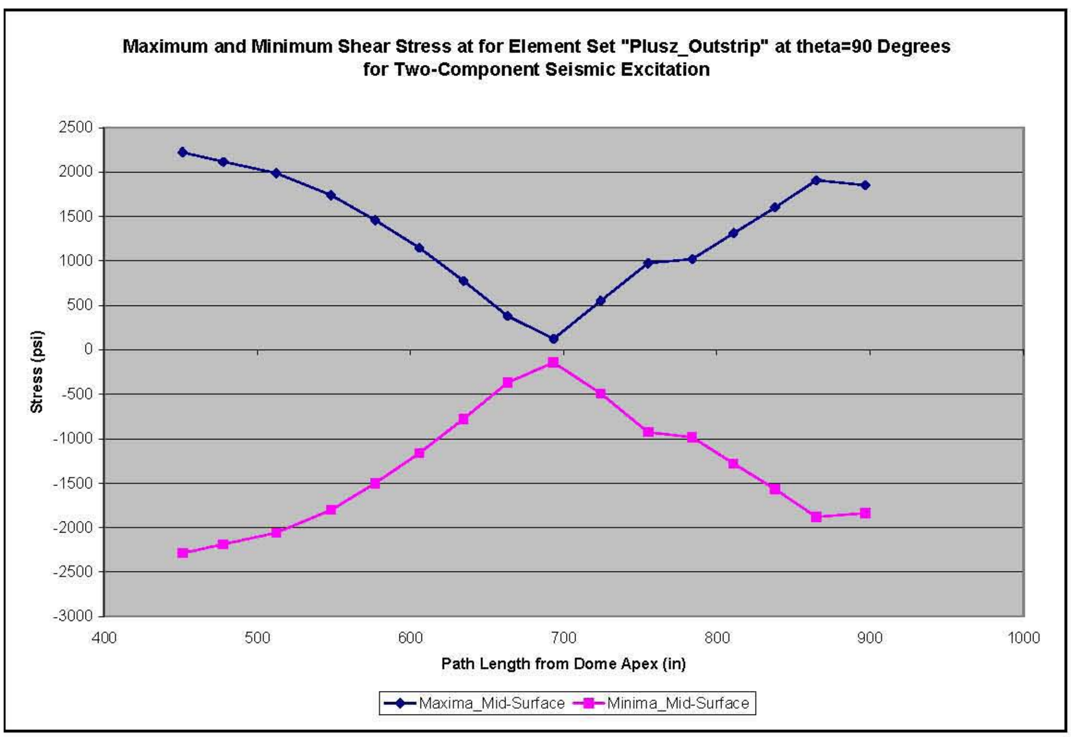


Figure 4-33. Maximum and Minimum Shear Stress vs. Path Length for Element Set "Plusz_Outstrip" at θ=90° for Two-Component Seismic Excitation.



Inspection of the primary tank stresses for the previous cases shows that the hoop and meridional stresses are similar in magnitude and distribution for horizontal, vertical, and two-component motion. The shear stresses are similar for horizontal and two-component motion, but negligible for vertical. These observations support the conclusion that the stresses in the primary tank sub-models are dominated by dead weight loading.

5.0 ANSYS® PRIMARY TANK SUB-MODEL DESCRIPTION

The global ANSYS® model was used as the starting point for the development of the primary tank sub-model. Those features not needed for the sub-model were unselected. For the elements used, properties and element options were changed as needed to obtain a model with geometry and dynamic characteristic similar to the Dytran® sub-model. The key modifications to the full model are described below.

All elements related to the modeling of the soil were unselected for the sub-model. This includes the soil (element types 8, 9, 90 and 91), contact elements between the soil and the concrete shell (element types, 60 through 63), spring elements between the concrete basemat and the underlying soil (element types 21, 22 and 23), the links used at the exterior surface of the soil (element type 30), and the mass elements used for applying the surface load (element type 10).

For the concrete shell elements, the modulus of elasticity was increased by a factor of 10,000 to obtain “rigid” behavior. The same increase in stiffness was also applied to the insulating concrete elements. This will ensure that the full sub-model is excited uniformly top and bottom, consistent with the Dytran® sub-model.

The geometry and properties for the majority of the primary tank were not changed in the sub-model. The only changes were to the elements in the dome region, where the modulus of elasticity was increased by a factor of 10,000. The geometry of the knuckle region for the ANSYS® and Dytran® models are different. The ANSYS® model explicitly includes the curvature of the knuckle whereas the Dytran® model does not. Retaining the curvature in the ANSYS® model provided a better match of the impulsive frequencies of the two models than using a square corner. It also improved the solution behavior for the contact element in the knuckle region.

The liner, J-bolts and contact elements associated with the dome, primary tank to insulating concrete, and insulating concrete to liner were all modified to obtain “rigid” behavior. For the liner and J-bolt elements, the modulus of elasticity was increased by a factor of 10,000. The contact element key options were modified to obtain bonded behavior, i.e., they are “locked” together. Bonding the contact surfaces creates the same condition as if the nodes on the two surfaces were merged.

No changes were made to the waste elements or the waste to primary tank contact elements.

A large mass is required at the location of excitation to properly simulate the seismic excitation. This mass was located at the apex of the concrete shell. The boundary conditions of the node at the apex are adjusted depending on the direction of excitation.

5.1 MODEL GEOMETRY

A plot of the ANSYS® primary tank sub-model is shown in Figure 5-1. Although the concrete portion of the DST is shown in the plot, the concrete was effectively rigid as stated in the previous section. A slice plot of the rigid regions of the model is shown in Figure 5-2. Flexible portions of the primary tank are shown in Figure 5-3, though the portion of the primary tank bottom in contact with the underlying insulation concrete is effectively rigid.

Shell element numbers at locations for which primary tank stresses are extracted are shown in Figure 5-4 and Figure 5-5.

Figure 5-1. Plot of ANSYS® Primary Tank Sub-Model.

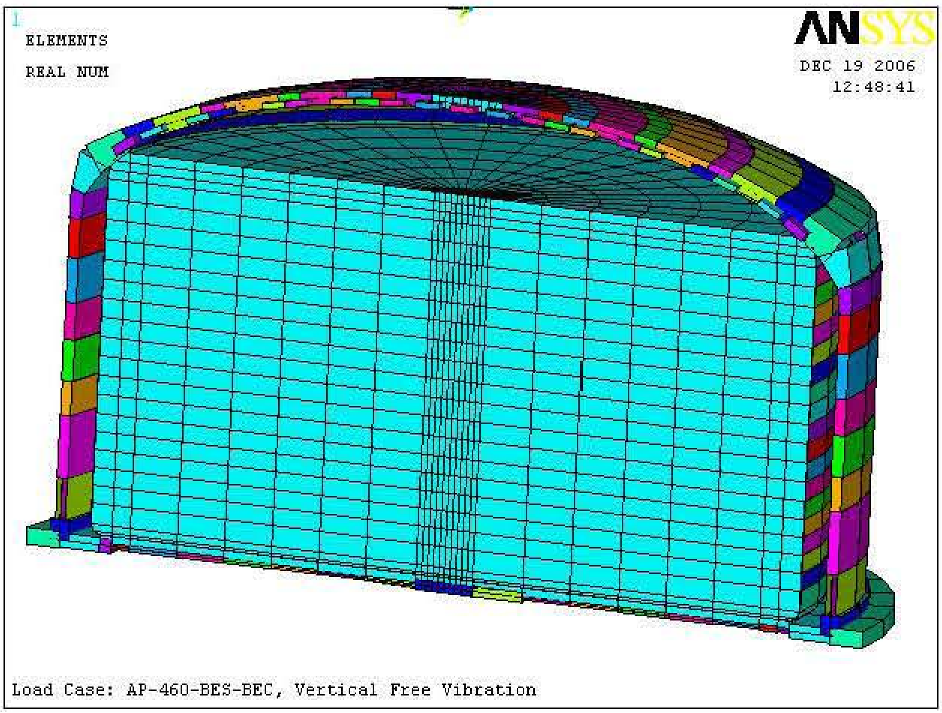


Figure 5-2. Slice Plot Showing Rigid Regions of the ANSYS® Primary Tank Sub-Model.

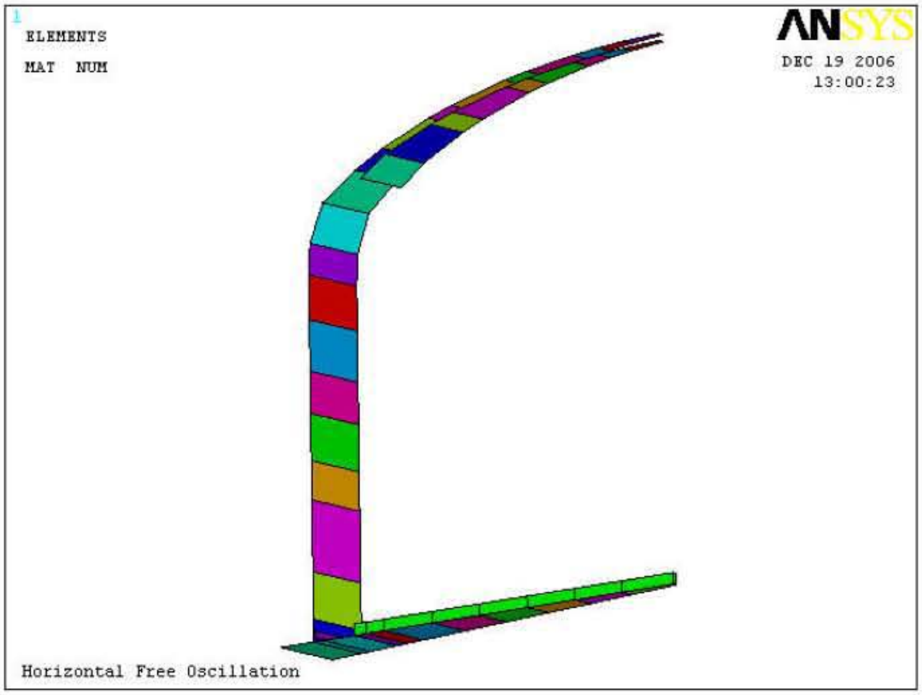


Figure 5-3. Plot of Flexible Primary Tank of ANSYS® Sub-Model.

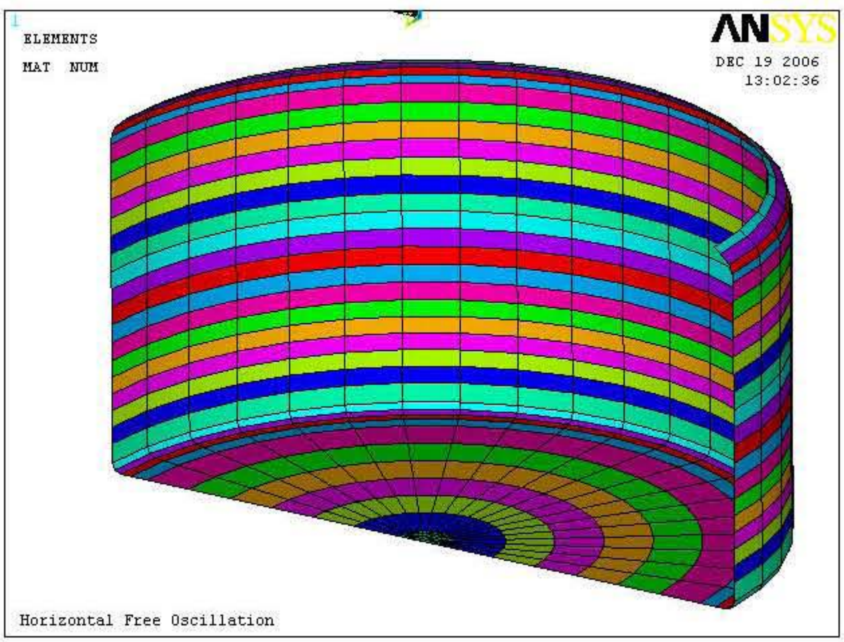


Figure 5-4. Shell Element Numbering for Tank Wall Stress Results at θ=0° and θ=90°.

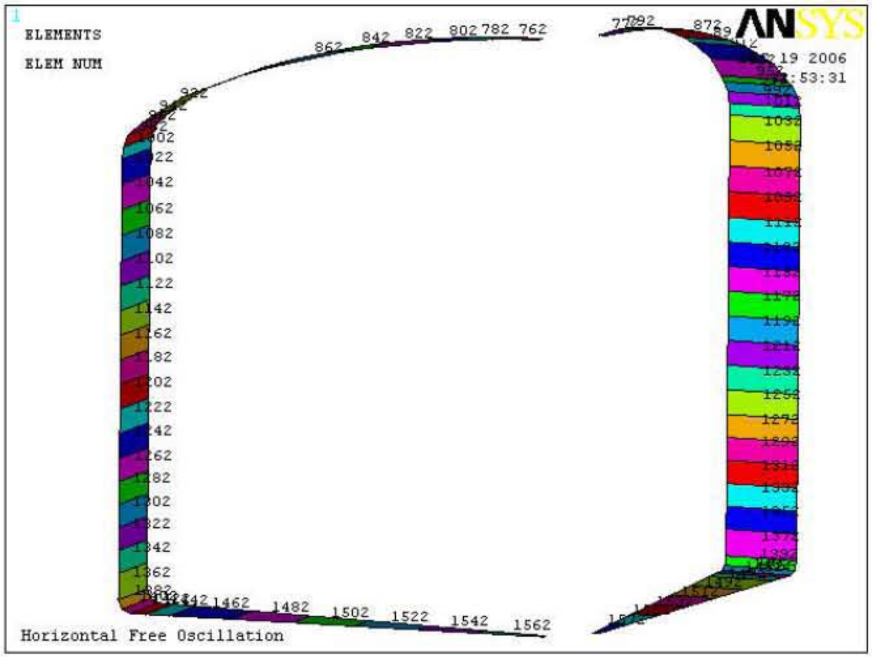
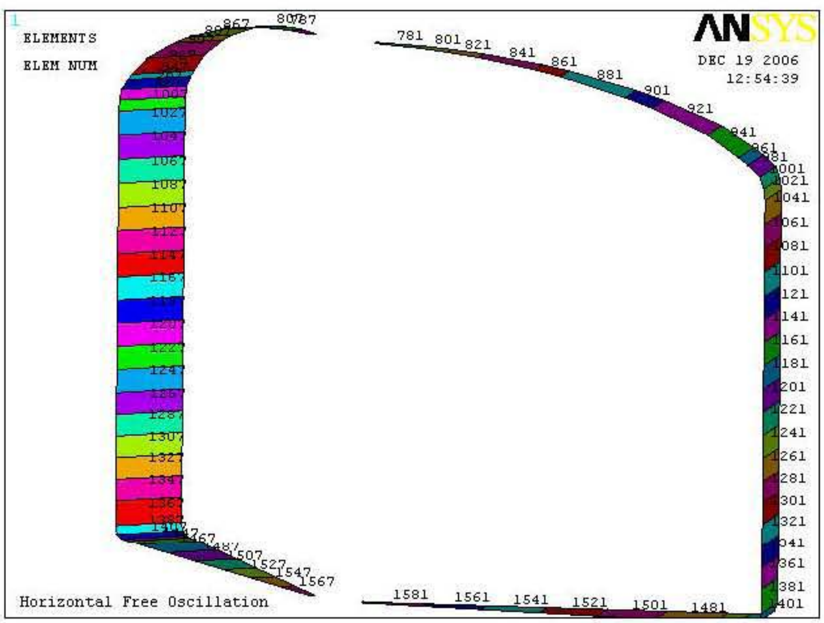


Figure 5-5. Shell Element Numbering for Tank Wall Stress Results at θ=45° and θ=180°.



5.2 DAMPING CHARACTERIZATON AND FREQUENCY TUNING WITH THE DYTRAN MODEL

The objective of frequency tuning was to obtain an impulsive frequency for the tank/waste system as close as practical to that of the Dytran® sub-model so that the input time histories would have essentially the same effect on both models. That is, the goal was that both sub-models should be experiencing the same spectral accelerations.

Tuning of the ANSYS® sub-model was performed by activating or de-activating various features from the full global model. Model features tested included the J-bolts, contact behavior in the dome and at the bottom, presence of the radius on the knuckle, and the inclusion of tank floor flexibility.

The configuration providing the best match was essentially the same as the Dytran® sub-model except for the inclusion of the knuckle curvature at the bottom of the primary tank as shown in Figure 5-3, Figure 5-4, and Figure 5-5. In this configuration, the ANSYS® sub-model displayed a horizontal impulsive frequency of 5.78 Hz, and an associated effective damping of 3.77%.

The convective and impulsive fundamental frequencies were determined in a two step process. A rigid primary tank model is used in the first step and a flexible primary tank model is used in the second. For each step, the sub-model was solved in the initial time step with a 0.05*g* lateral acceleration applied. This induced an initial displacement in the sub-model. The lateral acceleration was then removed and the sub-model allowed to oscillate freely. The total hydrodynamic response is tracked for each step. The waste convective frequency was determined with the primary tank modeled as "rigid." A combined response, convective and impulsive, is determined with the flexible model. The impulsive portion of the total response is the difference between the flexible model total response and the rigid model total response.

Figure 5-6 shows the total hydrodynamic response for free oscillation initiated by the 0.05*g* horizontal accelerations with the primary tank modeled as "rigid." From this, a fundamental convective frequency of 0.21 Hz can be determined (2/(13.9-4.45) = 0.21 Hz).

Figure 5-6. Free Horizontal Oscillation Total Reaction.

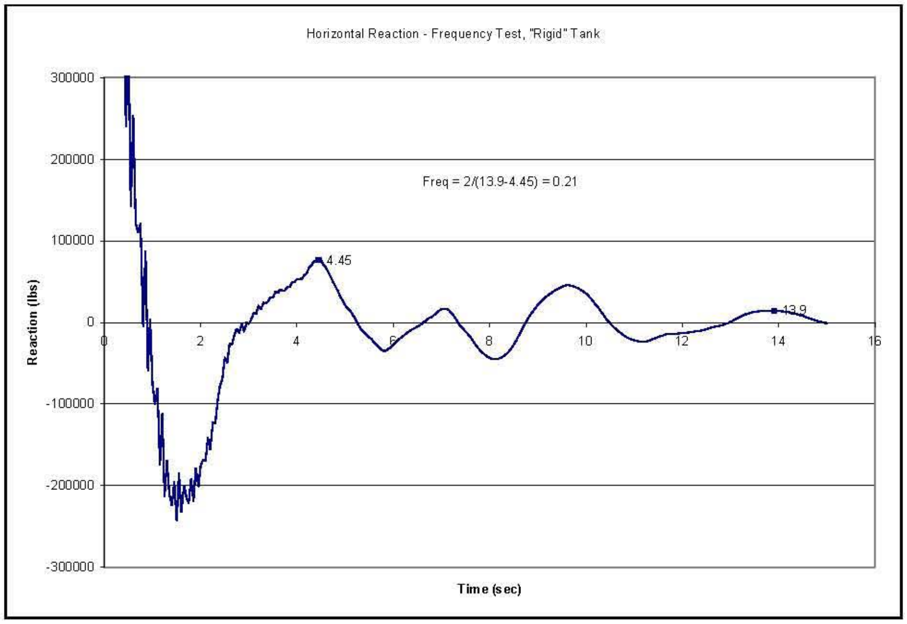


Figure 5-7 shows the total hydrodynamic response for free oscillation initiated by the 0.05*g* horizontal acceleration for the flexible-wall model. The response shows 5 cycles in 0.87 seconds, for a frequency of 5.78 Hz.

Figure 5-8 shows three lines, the total hydrodynamic response of the flexible-wall sub-model, the response of the rigid sub-model, and the difference between the two – that is, the impulsive portion of the reaction. From this difference, the damping can be calculated based on the decrease in response over three cycles. A damping value of 3.77% corresponds well with the Dytran® damping of 4.3%.

Figure 5-7. Total Reaction from ANSYS® Primary Tank Sub-Model for Free Horizontal Oscillation.

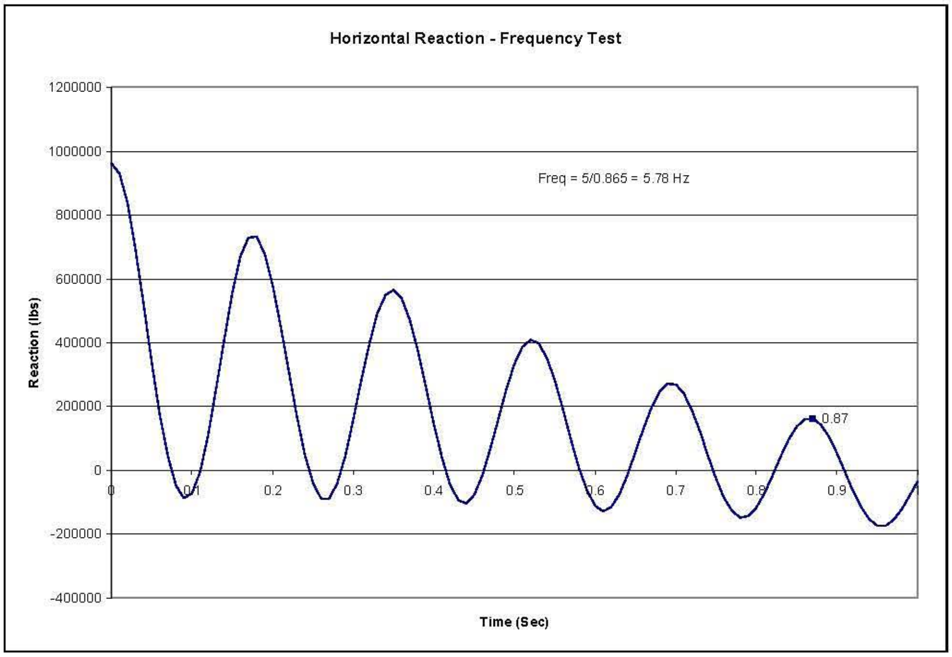


Figure 5-8. Total Reaction Force Comparison Between Rigid and Flexible ANSYS® Primary Tank Sub-Models for Free Horizontal Oscillation.

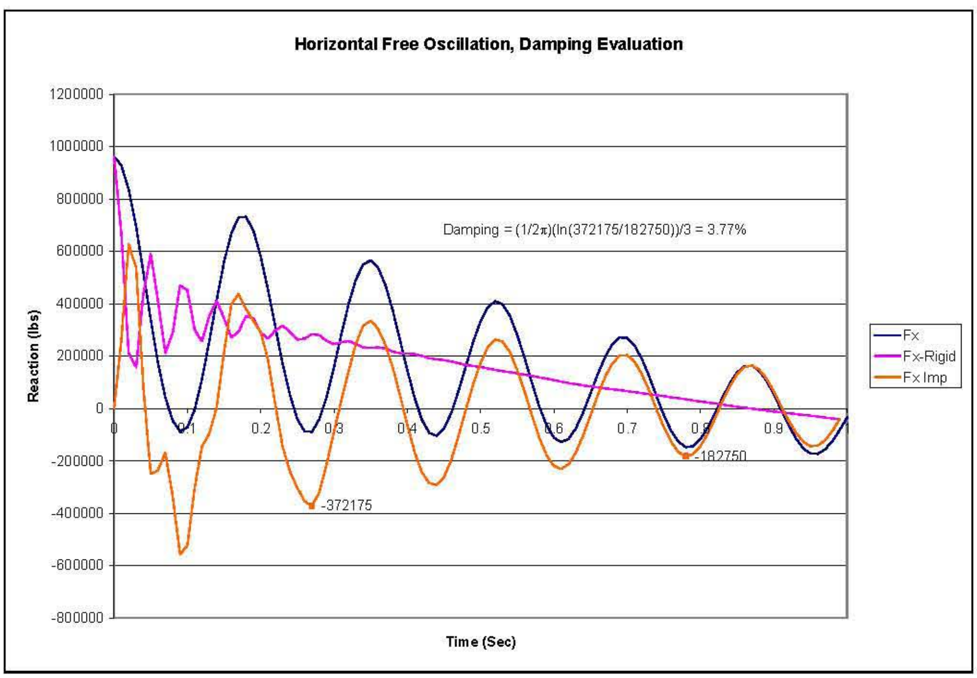
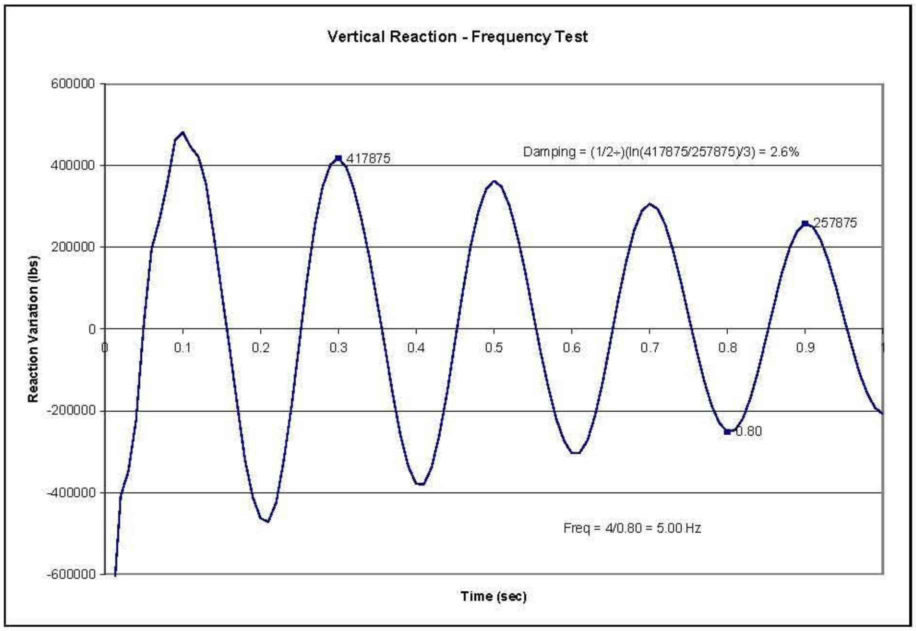


Figure 5-9 shows the total hydrodynamic response for free oscillation initiated by a 0.05*g* vertical acceleration. The response shows 3 cycles in 0.8 seconds, for a frequency of 5.0 Hz (vs. 5.07 Hz for Dytran®). The damping associated with the "breathing" mode can be calculated based on the decrease in response over three cycles. A damping value of 2.6% is less than shown in Dytran® with a damping of 3.5%.

Figure 5-9. Total Reaction Force for ANSYS® Primary Tank Sub-Model for Free Vertical Oscillation.



6.0 RESULTS FROM ANSYS® PRIMARY TANK SUB-MODELS

Results from horizontal seismic excitation only, vertical seismic excitation only, and simultaneous application of horizontal and vertical seismic excitation (two-component motion) are described in this chapter.

Impulsive and convective frequencies, global reaction forces, waste pressures, maximum slosh heights, and primary tank stresses will be reported. Benchmarking of ANSYS® primary tank sub-models was performed and reported in Rinker et al. (2006c). Thus, although frequencies, reaction forces, waste pressures, and slosh heights are reported to provide a basic check of the results, the primary tank stresses are of the most interest. Furthermore, due to the extensive data produced by the ANSYS® simulations, some results appear in Appendix D rather than in the main body of this report.

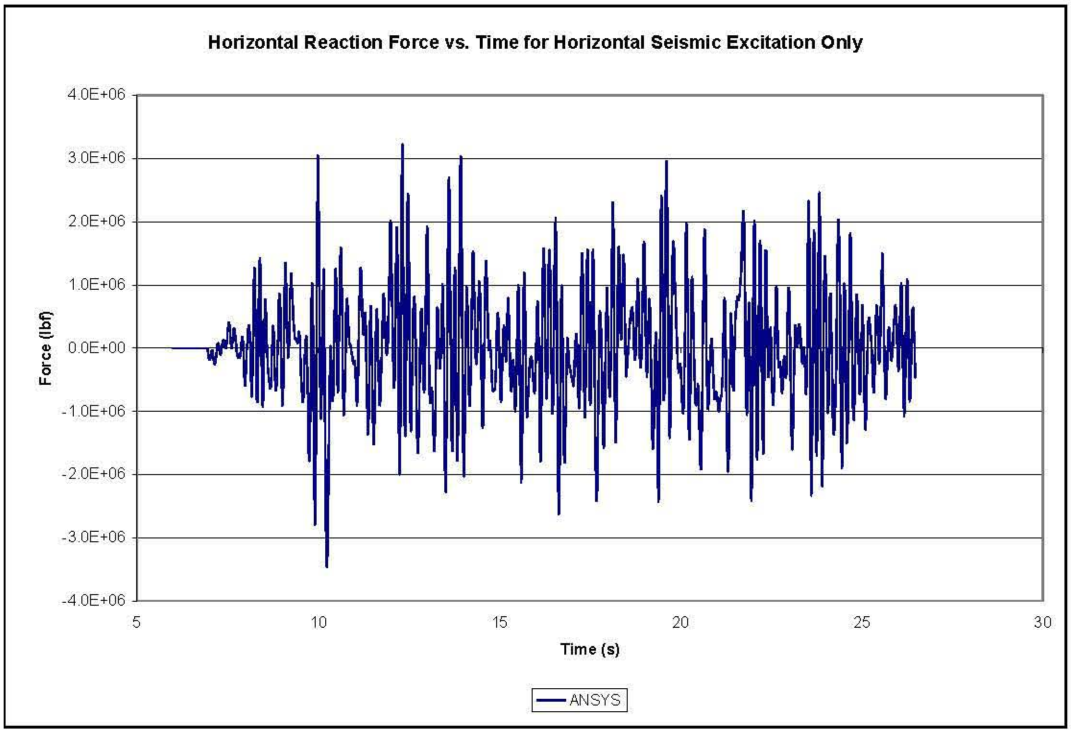
6.1 HYDRODYNAMIC FORCES FROM ANSYS® SUB-MODEL

The total horizontal and vertical reaction forces for horizontal excitation, vertical excitation, and two-component motion are presented in the following sections.

6.1.1 Horizontal Excitation Only

The maximum reaction force for horizontal excitation only is 3.47 x 10^6 lbf, as shown in Figure 6-1. This is approximately 14% greater than the value of 3.05 x 10^6 lbf from the Dytran® model. This is consistent with a reduced convective response and increased impulsive response for the ANSYS® sub-model.

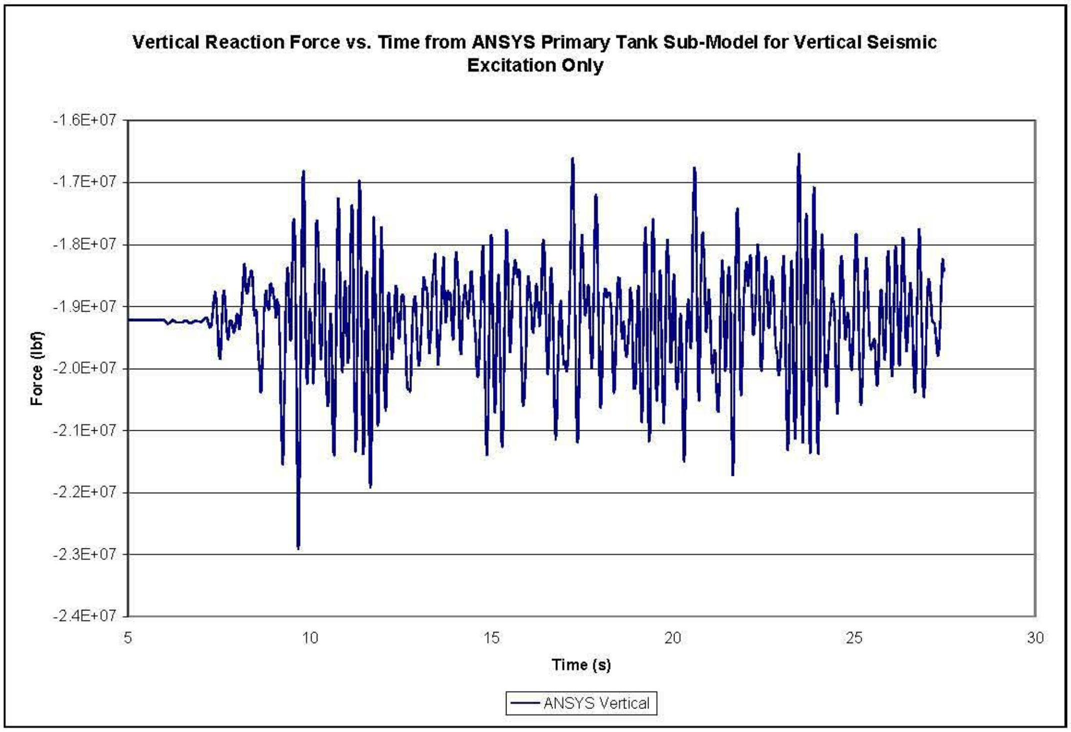
Figure 6-1. Horizontal Coupling Surface Reaction Force vs. Time from ANSYS® Primary Tank Sub-Model for Horizontal Seismic Excitation.



6.1.2 Vertical Excitation Only

According to Figure 6-2, the vertical reaction force varies between -1.65 x 10^7 lbf and -2.29 x 10^7 lbf. The weight of the contained fluid is 1.92 x 10^7 lbf, so that the maximum dynamic component of the vertical reaction force is 3.7 x 10^6 lbf, which is greater than for horizontal excitation only, and nearly the same as the value of 3.6 x 10^6 lbf from the Dytran® model. Good agreement between the ANSYS® and Dytran® sub-models is expected for vertical excitation since the response does not involve fluid sloshing.

Figure 6-2. Vertical Reaction Force vs. Time from ANSYS® Primary Tank Sub-Model for Vertical Seismic Excitation.



6.1.3 Two-Component Motion

The horizontal reaction force time-history plot presented as Figure 6-3 shows that the maximum horizontal force is 3.47×10^6 lbf, exactly the same as for horizontal motion only. Similarly, the Figure 6-4 shows that the vertical reaction force varies between -1.65×10^7 lbf and -2.29×10^7 lbf – the same as for vertical excitation only, giving a maximum dynamic component of the vertical reaction force of 3.7×10^6 lbf, as before. That is, the peak reaction forces for two-component motion are the same as for the individual component directions run separately.

Figure 6-3. Horizontal Reaction Force vs. Time from ANSYS® Primary Tank Sub-Model for Two-Component Seismic Excitation.

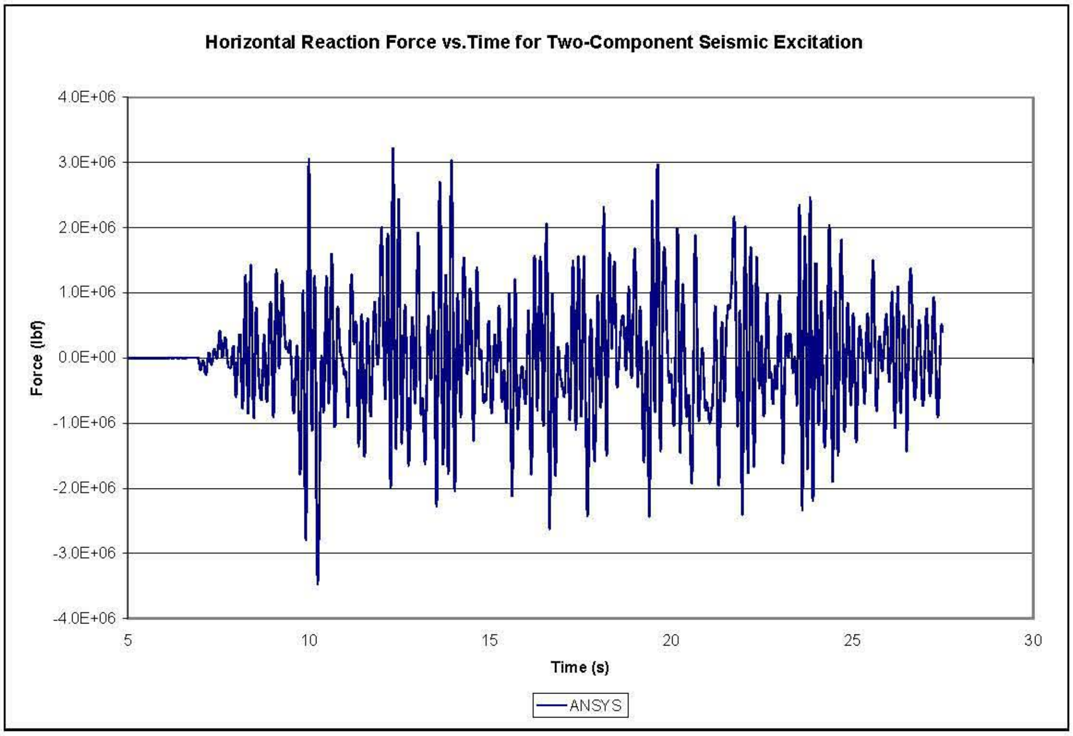
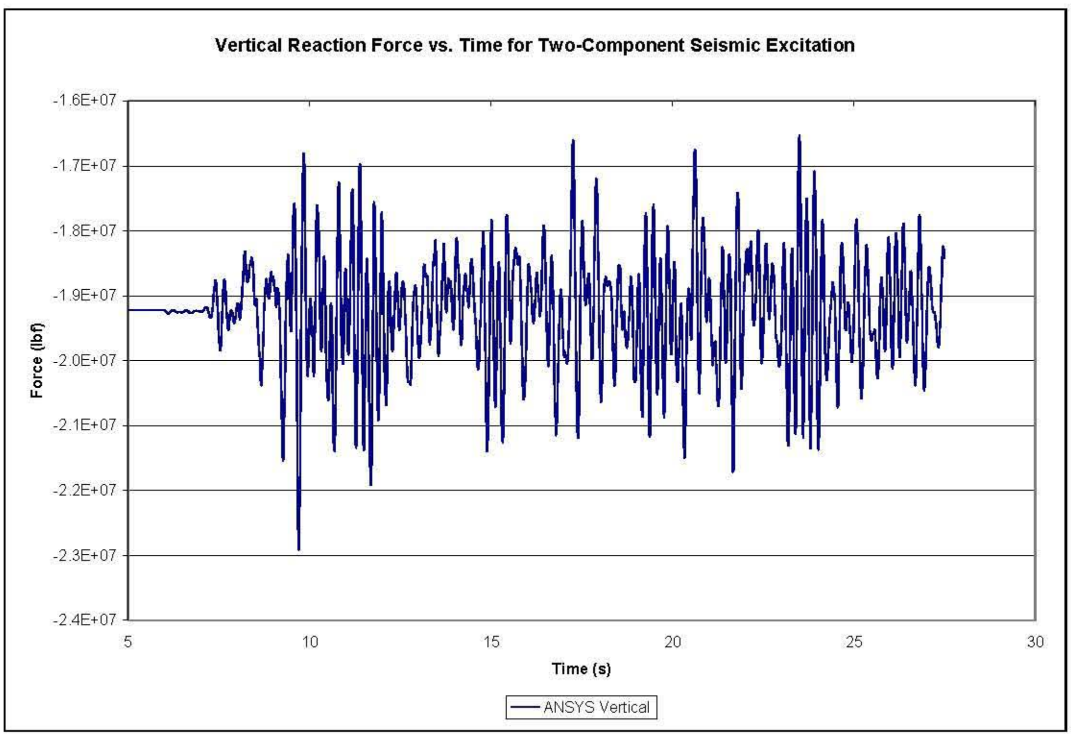


Figure 6-4. Vertical Reaction Force vs. Time from ANSYS® Primary Tank Sub-Model for Two-Component Seismic Excitation.



6.2 WASTE PRESSURES FROM ANSYS® SUB-MODEL

The theoretical hydrostatic pressures for the waste elements at θ=0, 45, and 90° from the plane of excitation are shown in Table 6-1. The hydrostatic pressures from the sub-model simulations are reflected in the initial portion of the waste pressure time-history plots.

Table 6-1. Theoretical Hydrostatic Pressures for Selected Fluid Elements from ANSYS® Primary Tank Sub-Model.

θ=0°	θ=45°	θ=90°	Theoretical Hydrostatic Pressure (psi absolute)
Element	Element	Element	
7722	7727	7732	15.1
8382	8387	8392	15.8
9042	9047	9052	16.6
9702	9707	9712	17.7
10362	10367	10372	19.3
11022	11027	11032	20.9
12482	12557	12632	22.5
12487	12562	12637	24.1
12492	12567	12642	25.6
12497	12572	12647	27.1
12502	12577	12562	28.6
12507	12582	12657	30.2
12512	12587	12662	31.7
12517	12592	12667	33.2
12522	12597	12672	34.8
12527	12602	12677	36.2
12532	12607	12682	37.7
12537	12612	12687	39.1
12542	12617	12692	40.5
12547	12622	12697	41.9
12552	12627	12702	43.5
13102	13107	13112	44.6
13522	13527	13532	45.0

6.2.1 Horizontal Excitation Only

Pressure time histories and maximum and minimum pressure plots for horizontal excitation only are shown in Figure 6-5 through Figure 6-10. The hydrostatic pressures match well with the theoretical values shown in Table 6-1. Comparisons to the pressure time history plots from the Dytran® sub-model are presented in Section 7.3.

Figure 6-5. Waste Pressure Time Histories from ANSYS® Primary Tank Sub-Model for Fluid Elements at θ=0° Subjected to Horizontal Seismic Excitation Only.

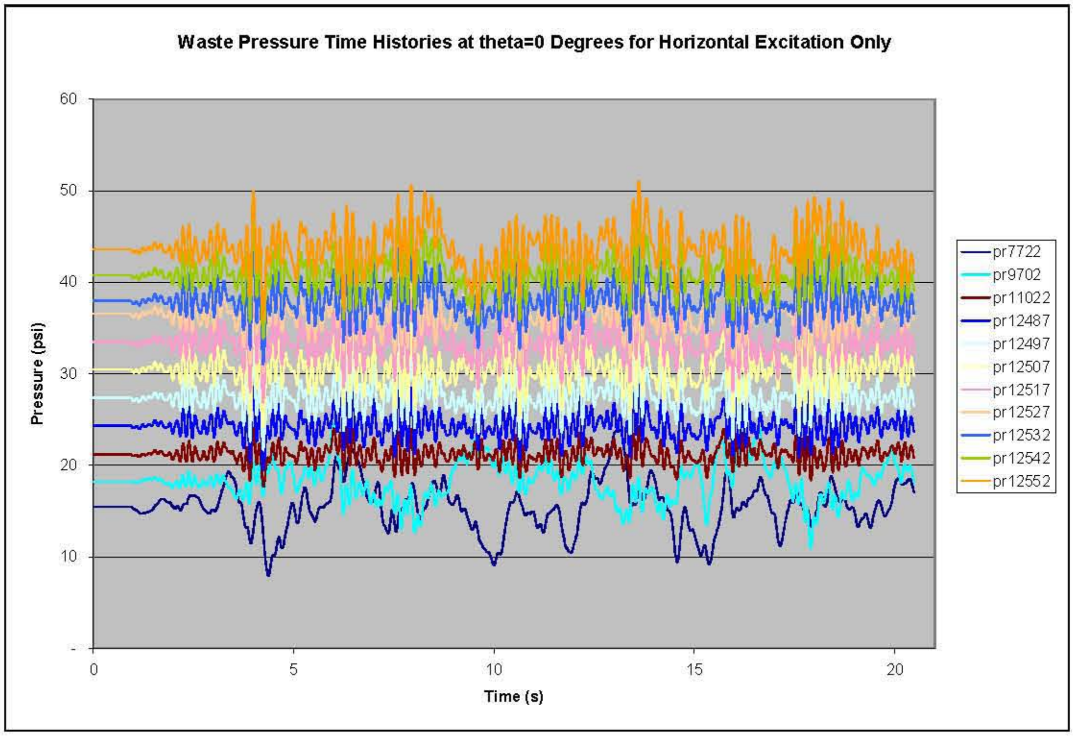


Figure 6-6. Maximum and Minimum Waste Pressures vs. Normalized Height from Tank Bottom from ANSYS® Primary Tank Sub-Model for Waste Elements at θ=0° Subjected to Horizontal Seismic Excitation Only.

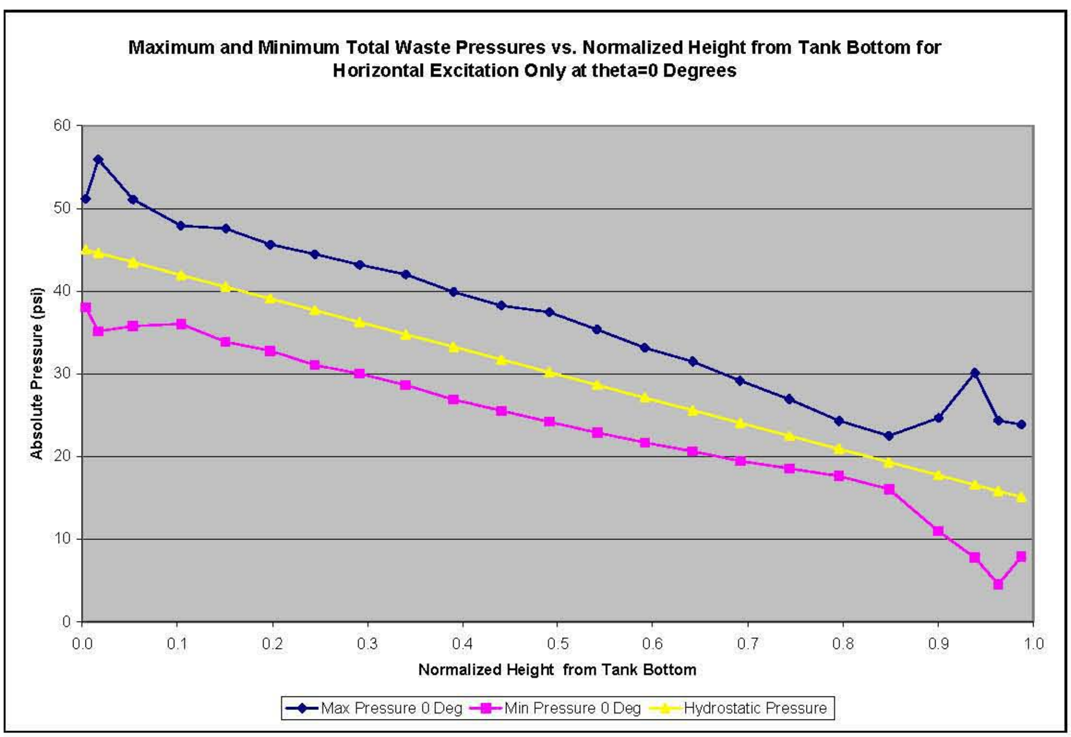


Figure 6-7. Waste Pressure Time Histories from ANSYS® Primary Tank Sub-Model for Fluid Elements at θ=45° Subjected to Horizontal Seismic Excitation Only.

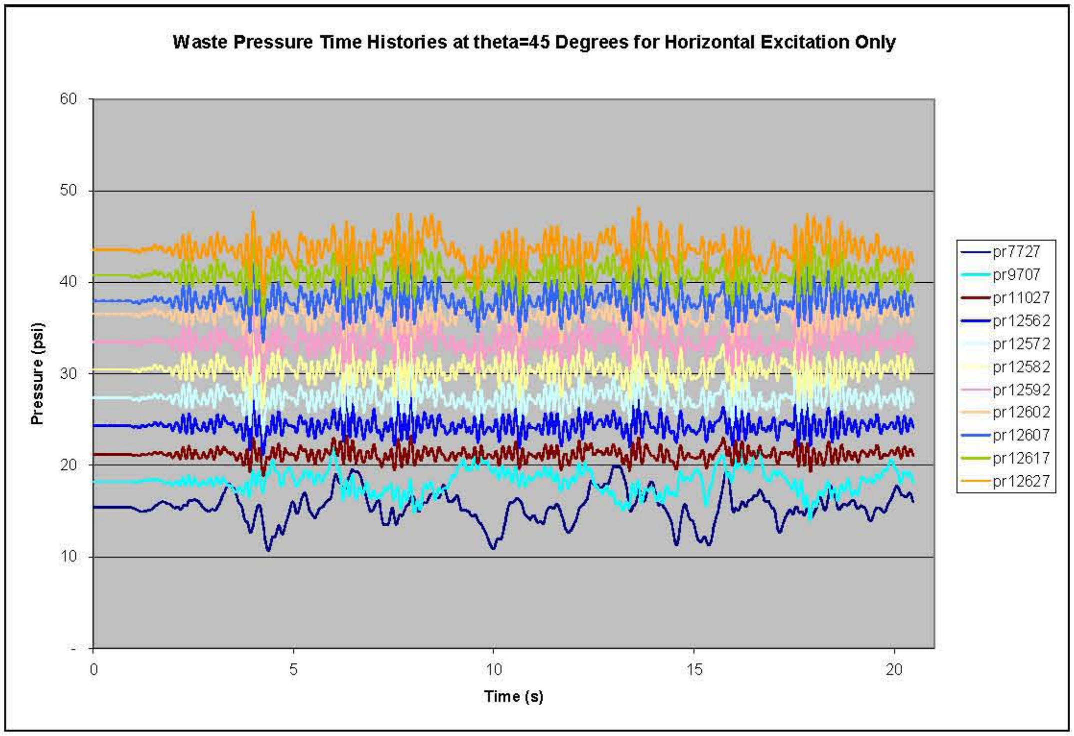


Figure 6-8. Waste Pressure Variation from ANSYS® Primary Tank Sub-Model for Waste Elements at θ=45° Subjected to Horizontal Seismic Excitation Only.

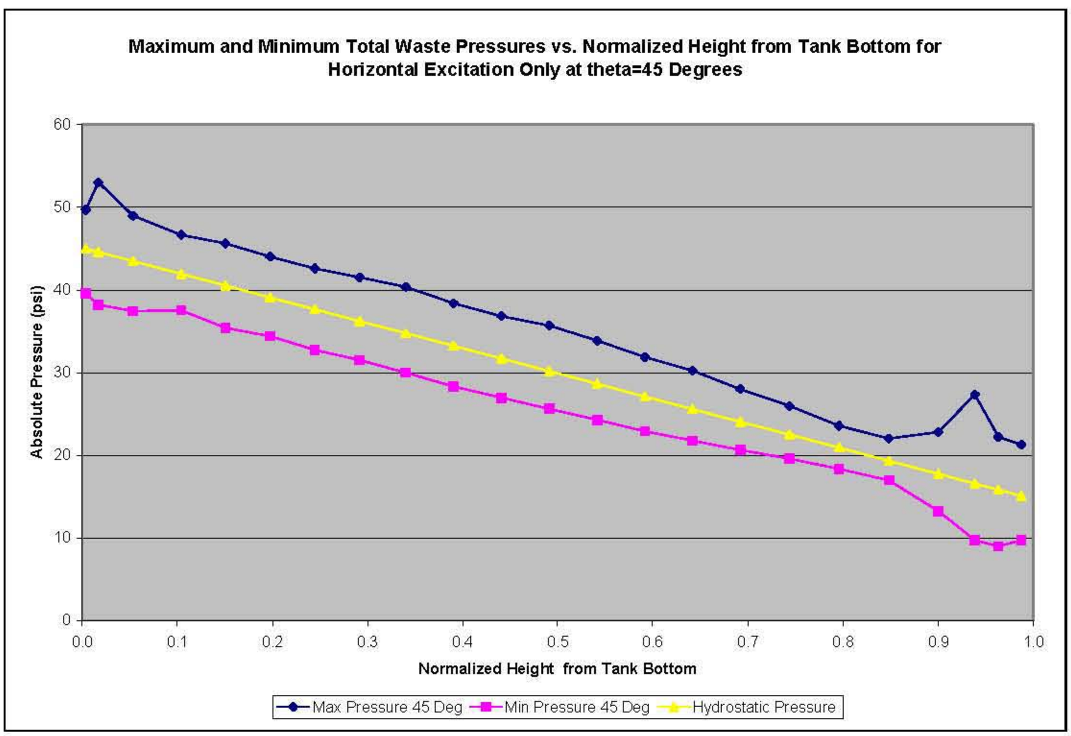


Figure 6-9. Waste Pressure Time Histories from ANSYS® Primary Tank Sub-Model for Fluid Elements at θ=90° Subjected to Horizontal Seismic Excitation Only.

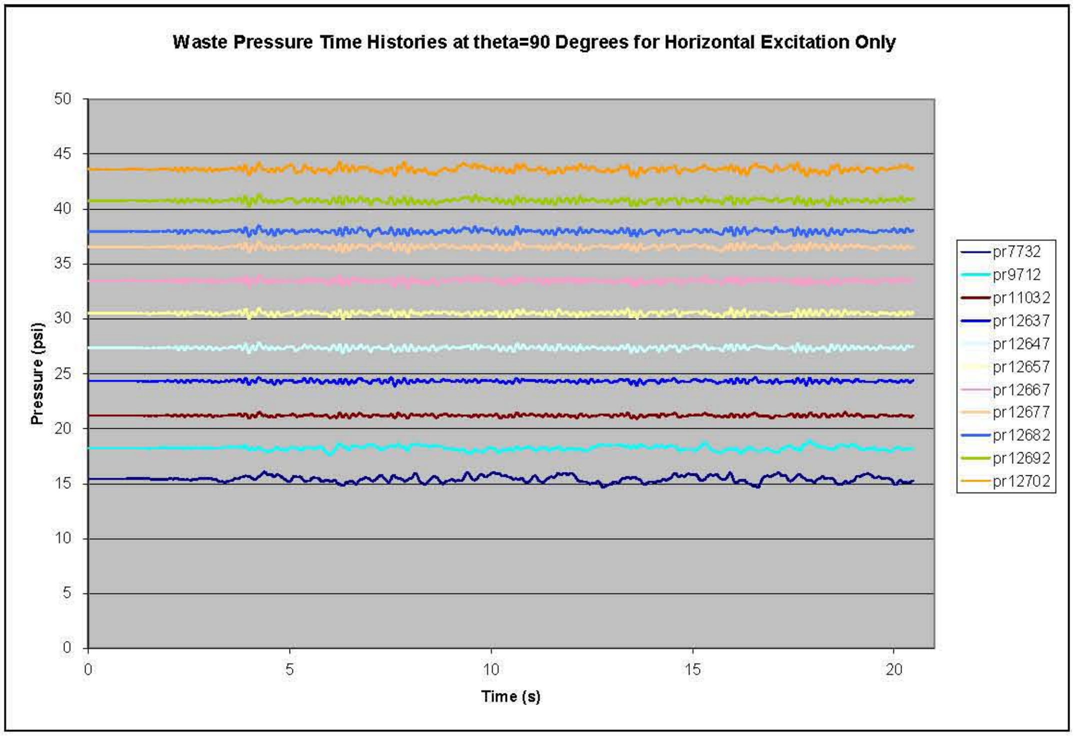
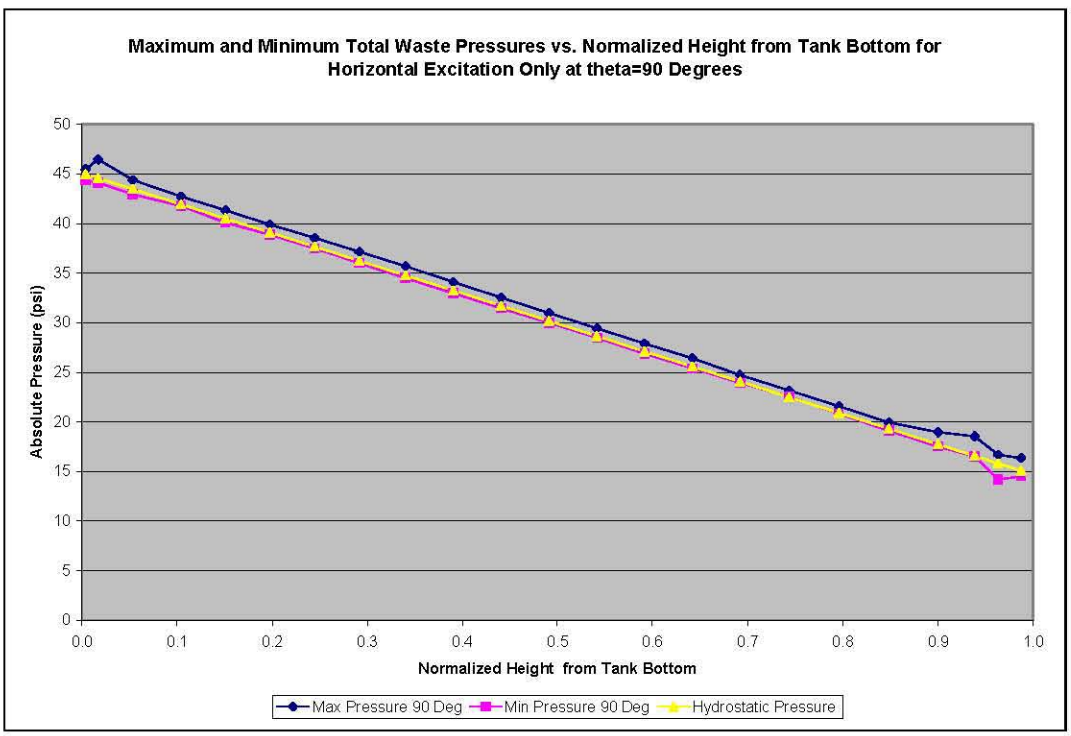


Figure 6-10. Waste Pressure Variation from ANSYS® Primary Tank Sub-Model for Waste Elements at θ=90° Subjected to Horizontal Seismic Excitation Only.



6.2.2 Vertical Excitation Only

Plots of waste pressure time histories and maximum and minimum stresses at θ=0° and θ=45° are shown in Figure 6-11, Figure 6-12, Figure 6-13, and Figure 6-14. The stress distributions are independent of the angular location and the dynamic pressures increase with depth, both of which are required for vertical excitation only. Figure 6-11 and Figure 6-13 appear very similar to the Figure 4-11 and Figure 4-12 from the Dytran® sub-model simulation for vertical excitation.

Figure 6-11. Waste Pressure Time Histories from ANSYS® Primary Tank Sub-Model for Fluid Elements at θ=0° Subjected to Vertical Seismic Excitation Only.

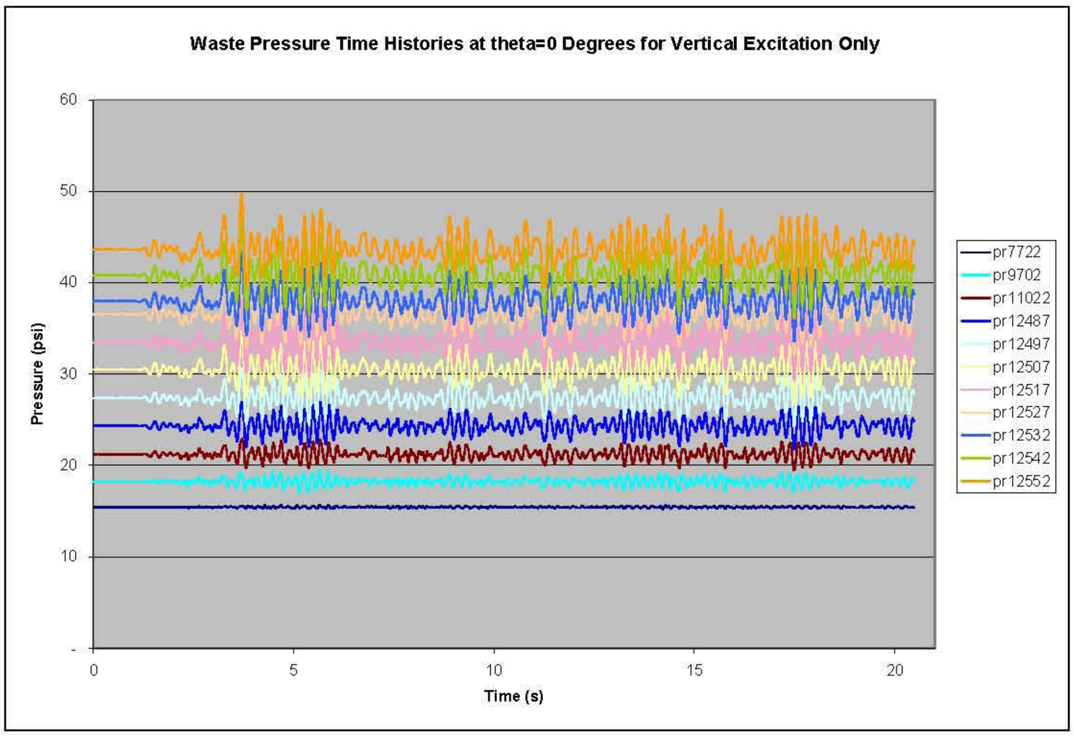


Figure 6-12. Waste Pressure Variation from ANSYS® Primary Tank Sub-Model for Waste Elements at θ=0° Subjected to Vertical Seismic Excitation Only.

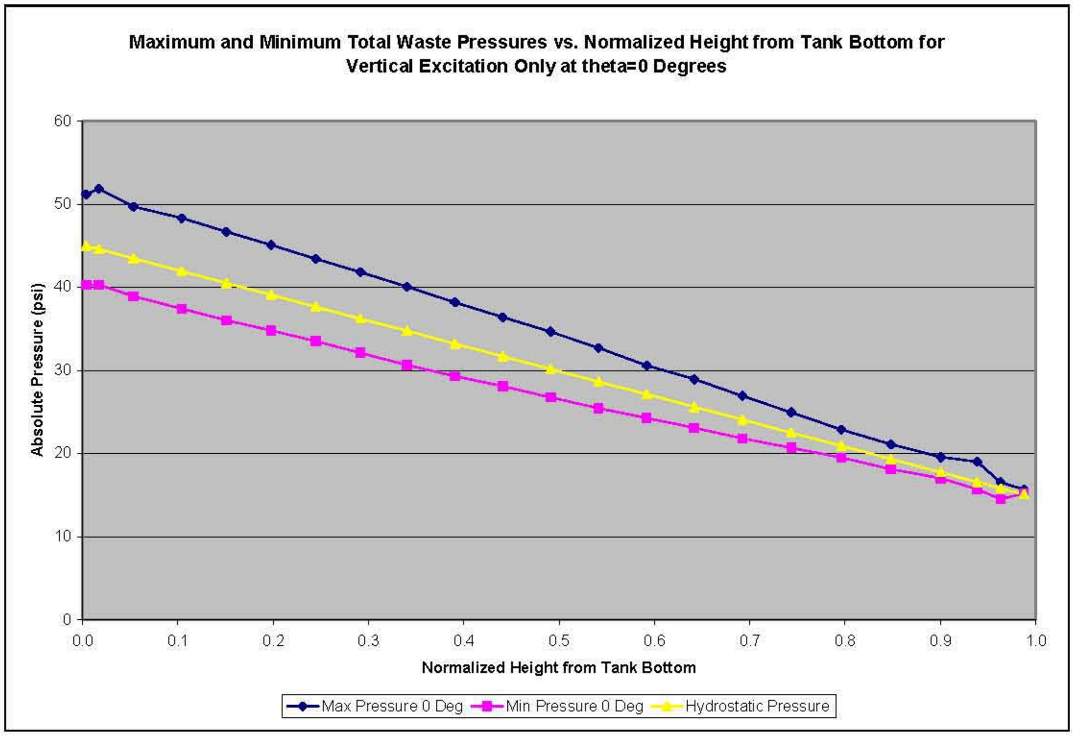


Figure 6-13. Waste Pressure Time Histories from ANSYS® Primary Tank Sub-Model for Fluid Elements at θ=45° Subjected to Vertical Seismic Excitation Only.

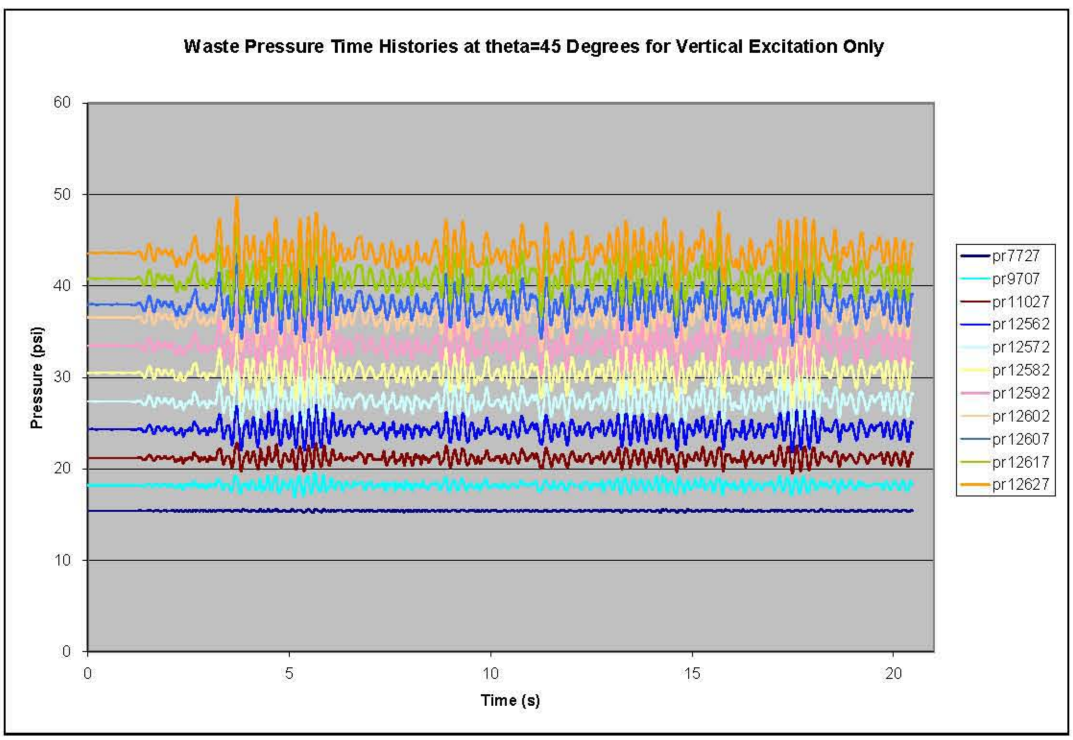
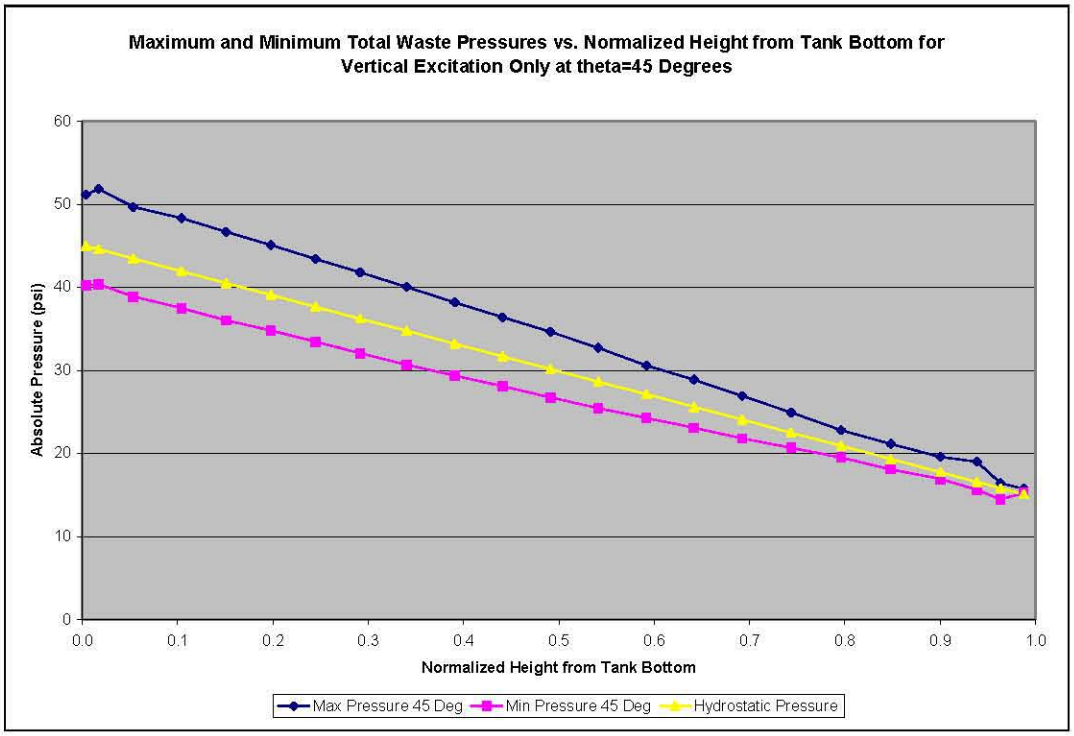


Figure 6-14. Waste Pressure Variation from ANSYS® Primary Tank Sub-Model for Waste Elements at θ=45° Subjected to Vertical Seismic Excitation Only.



6.2.3 Two-Component Motion

Waste pressure time histories for fluid elements located along the tank wall at θ=0, 45, and 90° when subjected to two-component seismic excitation are shown in Figure 6-15, Figure 6-17, and Figure 6-19, respectively. Maximum and minimum pressure distributions are shown in Figure 6-16, Figure 6-18, and Figure 6-20, respectively. The peak pressures are higher for two-component motion than for either horizontal motion or vertical motion separately and the timing of the peaks is different. The waste pressure time histories at θ=90° are nearly the same as for vertical motion only as expected since the contribution to dynamic pressure from horizontal excitation is nearly zero at θ=90°.

Figure 6-15. Waste Pressure Time Histories from ANSYS® Primary Tank Sub-Model for Fluid Elements at θ=0° Subjected to Two-Component Seismic Excitation.

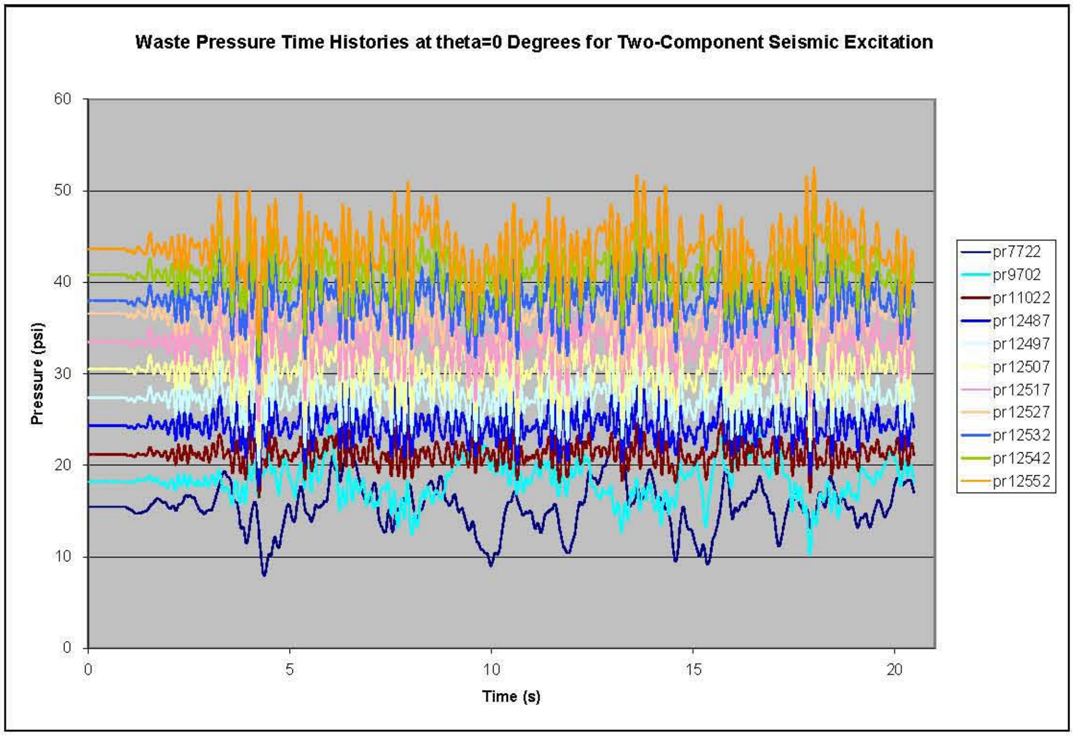


Figure 6-16. Waste Pressure Variation from ANSYS® Primary Tank Sub-Model for Waste Elements at θ=0° Subjected to Two-Component Seismic Excitation.

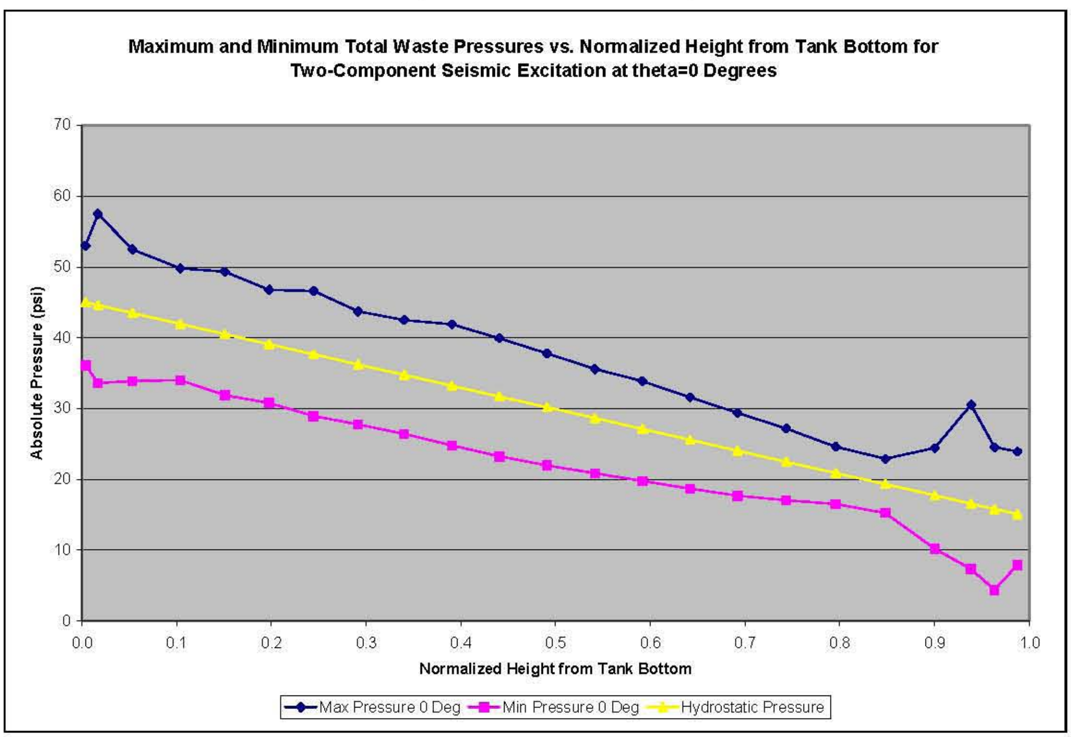


Figure 6-17. Waste Pressure Time Histories from ANSYS® Primary Tank Sub-Model for Fluid Elements at θ=45° Subjected to Two-Component Seismic Excitation.

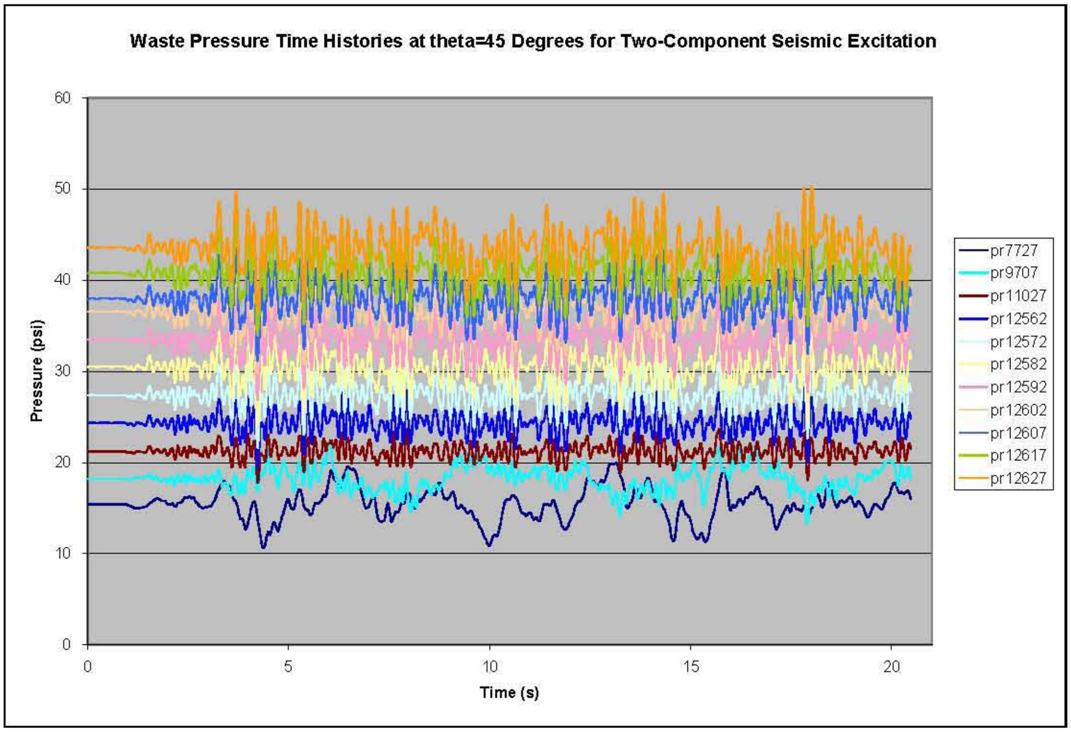


Figure 6-18. Waste Pressure Variation from ANSYS® Primary Tank Sub-Model for Waste Elements at θ=45° Subjected to Two-Component Seismic Excitation.

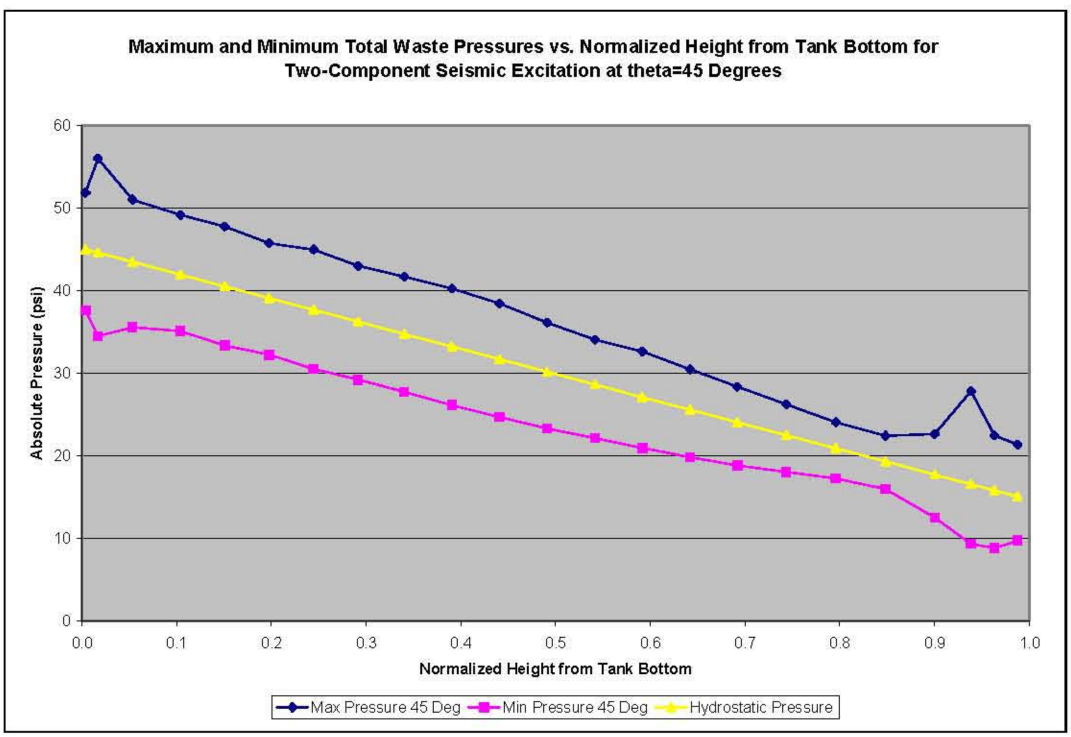


Figure 6-19. Waste Pressure Time Histories from ANSYS® Primary Tank Sub-Model for Fluid Elements at θ=90° Subjected to Two-Component Seismic Excitation.

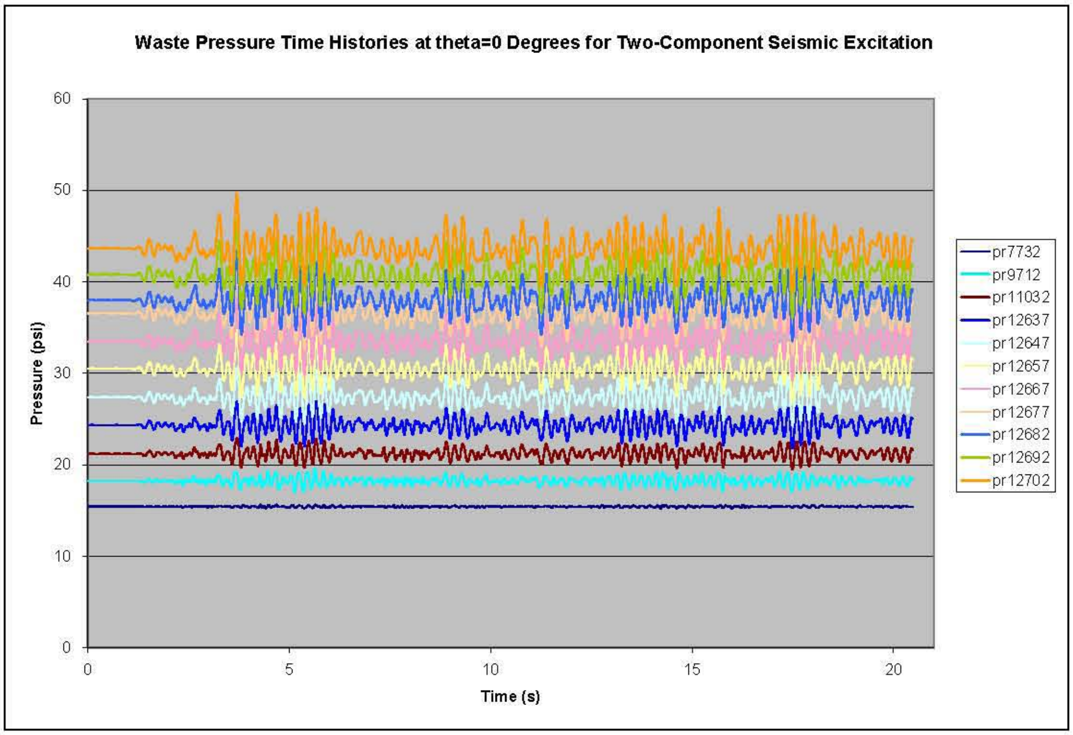
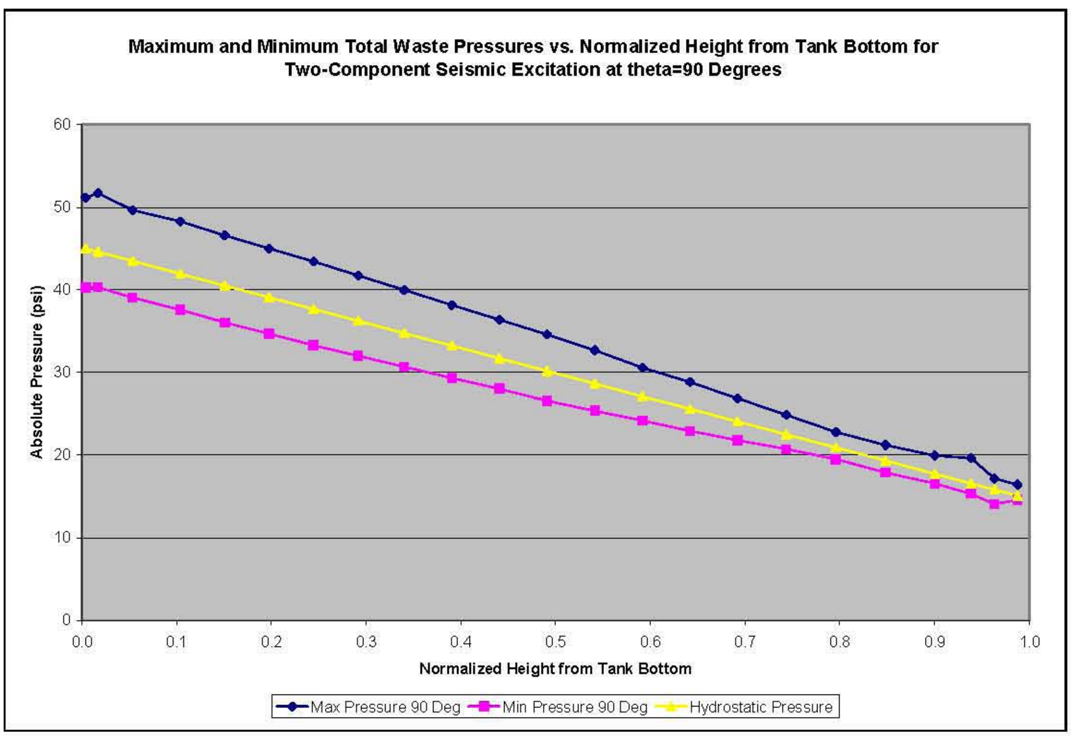


Figure 6-20. Waste Pressure Variation from ANSYS® Primary Tank Sub-Model for Waste Elements at θ=90° Subjected to Two-Component Seismic Excitation.



6.3 PRIMARY TANK STRESSES FROM ANSYS® SUB-MODEL

Primary tank stresses from the ANSYS® sub-model for horizontal excitation, vertical excitation, and two-component excitation are presented and discussed in the next three sections.

6.3.1 Horizontal Excitation Only

Maximum and minimum stresses in the primary tank for horizontal excitation only are plotted in Figure 6-21 through Figure 6-27. The plots show that there is very little bending in the hoop response at θ=0 and 45° except near the free-surface. The data also show that the meridional stresses are fairly low and are dominated by membrane response except near free surface and knuckle. The shear stresses are low in the plane of excitation and increase with increasing angle from the plane of excitation as expected.

Figure 6-21. Maximum and Minimum Hoop Stress vs. Path Length at θ=0° for Horizontal Seismic Excitation Only.

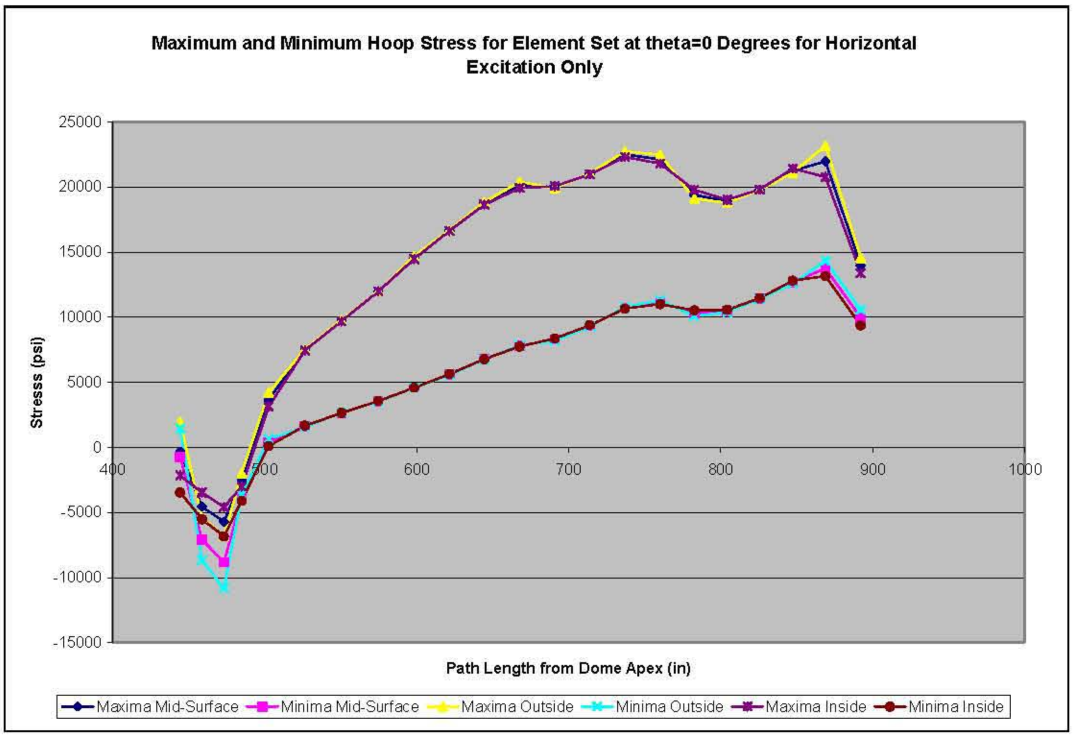


Figure 6-22. Maximum and Minimum Meridional Stress vs. Path Length at θ=0° for Horizontal Seismic Excitation Only.

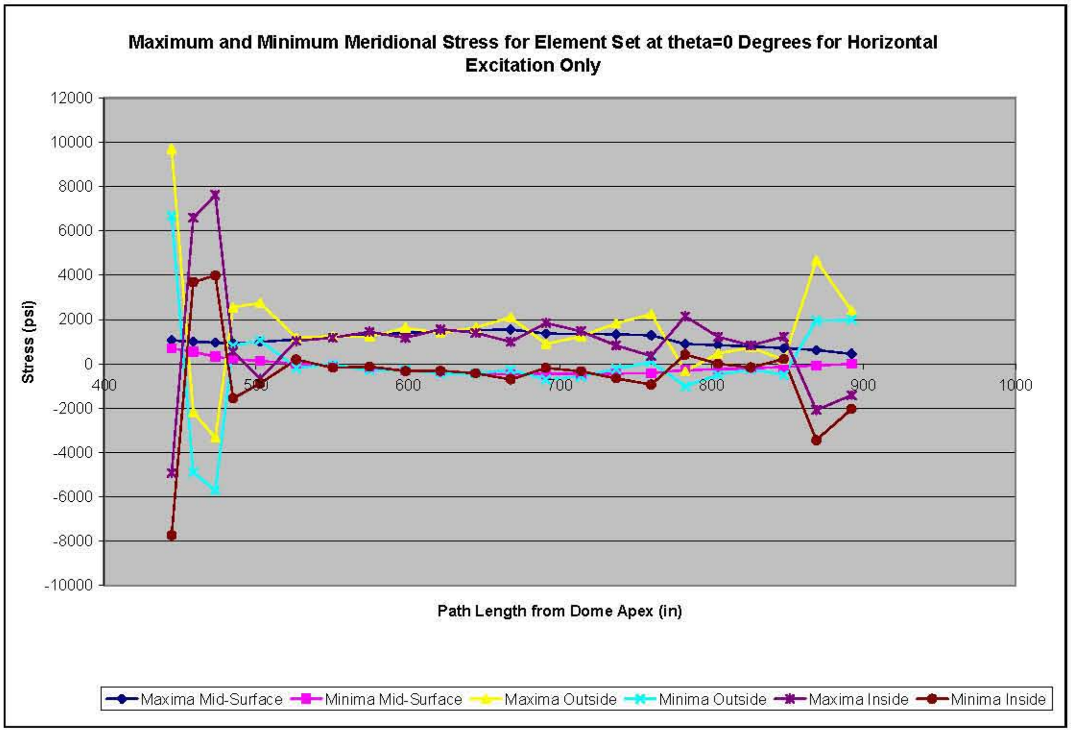


Figure 6-23. Maximum and Minimum Shear Stress vs. Path Length at θ=0° for Horizontal Seismic Excitation Only.

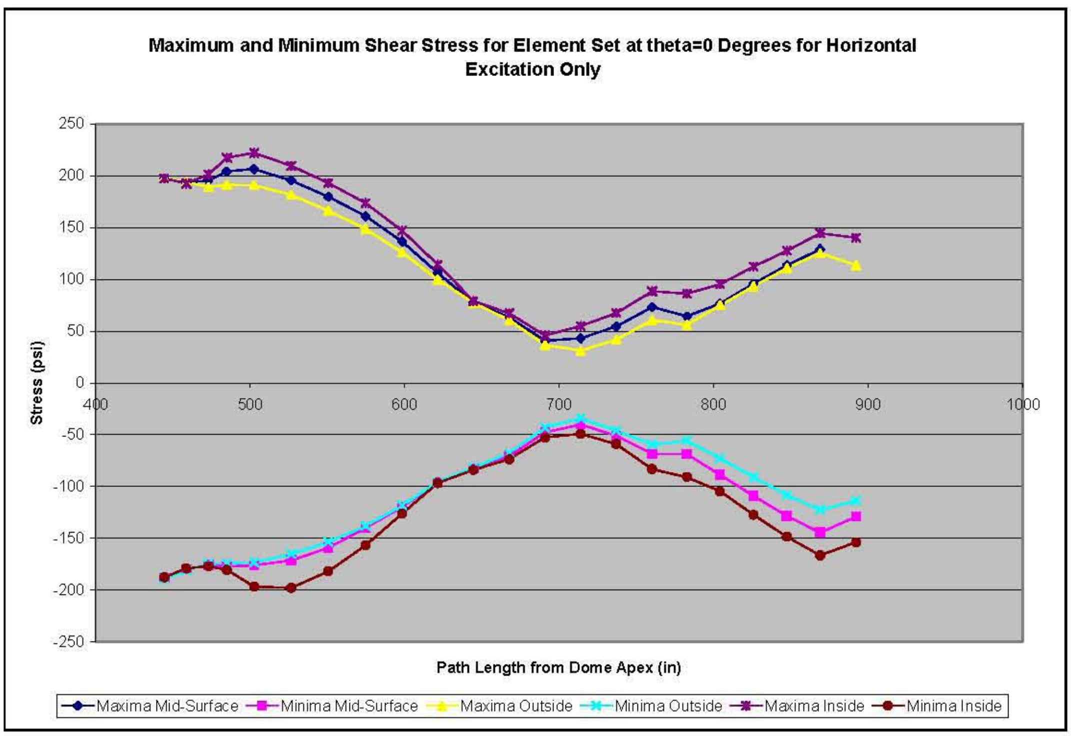


Figure 6-24. Maximum and Minimum Hoop Stress vs. Path Length at θ=45° for Horizontal Seismic Excitation Only.

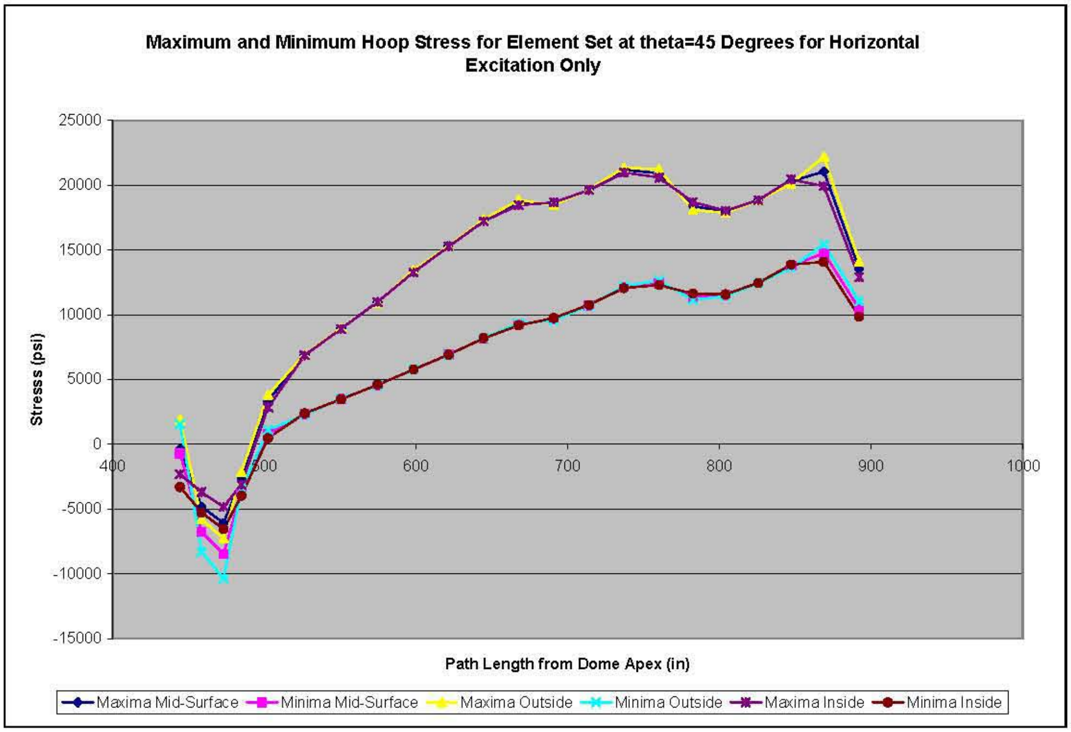


Figure 6-25. Maximum and Minimum Meridional Stress vs. Path Length at θ=45° for Horizontal Seismic Excitation Only.

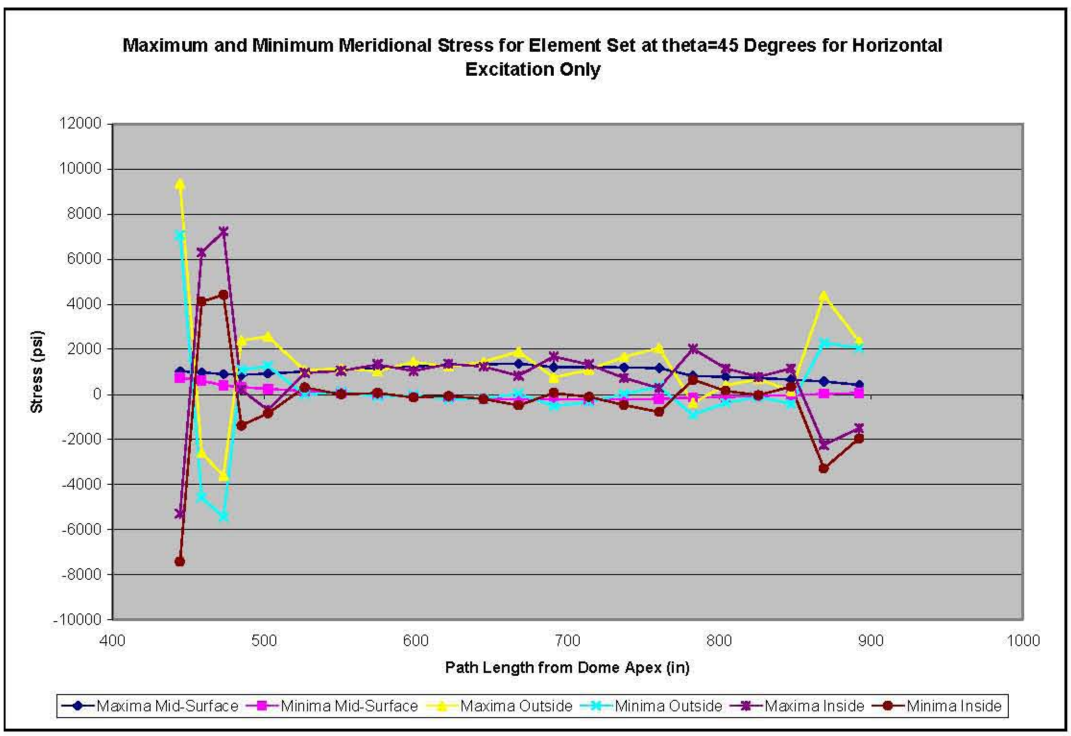


Figure 6-26. Maximum and Minimum Shear Stress vs. Path Length at θ=45° for Horizontal Seismic Excitation Only.

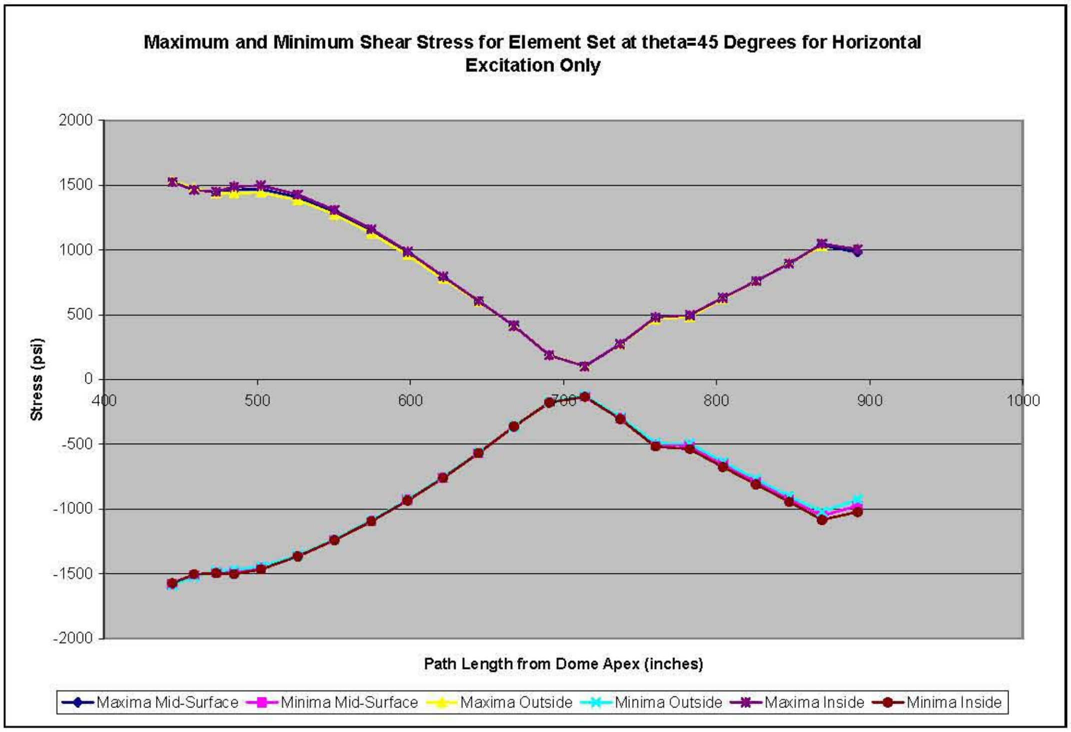
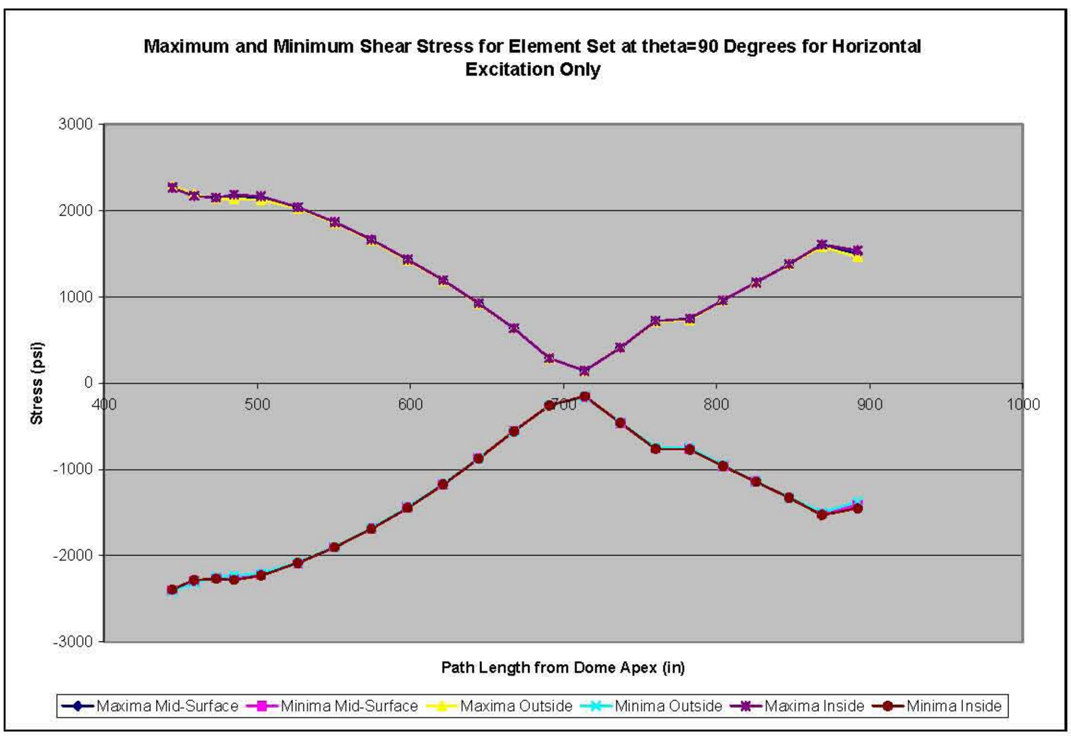


Figure 6-27. Maximum and Minimum Shear Stress vs. Path Length at θ=90° for Horizontal Seismic Excitation Only.



6.3.2 Vertical Excitation Only

In the case of vertical excitation only, maximum and minimum stress distributions for hoop, meridional, and shear components at θ=0° are shown in Figure 6-28, Figure 6-29, and Figure 6-30. The stress distributions for vertical excitation only are very similar to those for horizontal excitation only, except that shear stresses are negligible for the vertical case. This indicates that primary tank stresses are dominated by gravity loading.

Figure 6-28. Maximum and Minimum Hoop Stress vs. Path Length at θ=0° for Vertical Seismic Excitation Only.

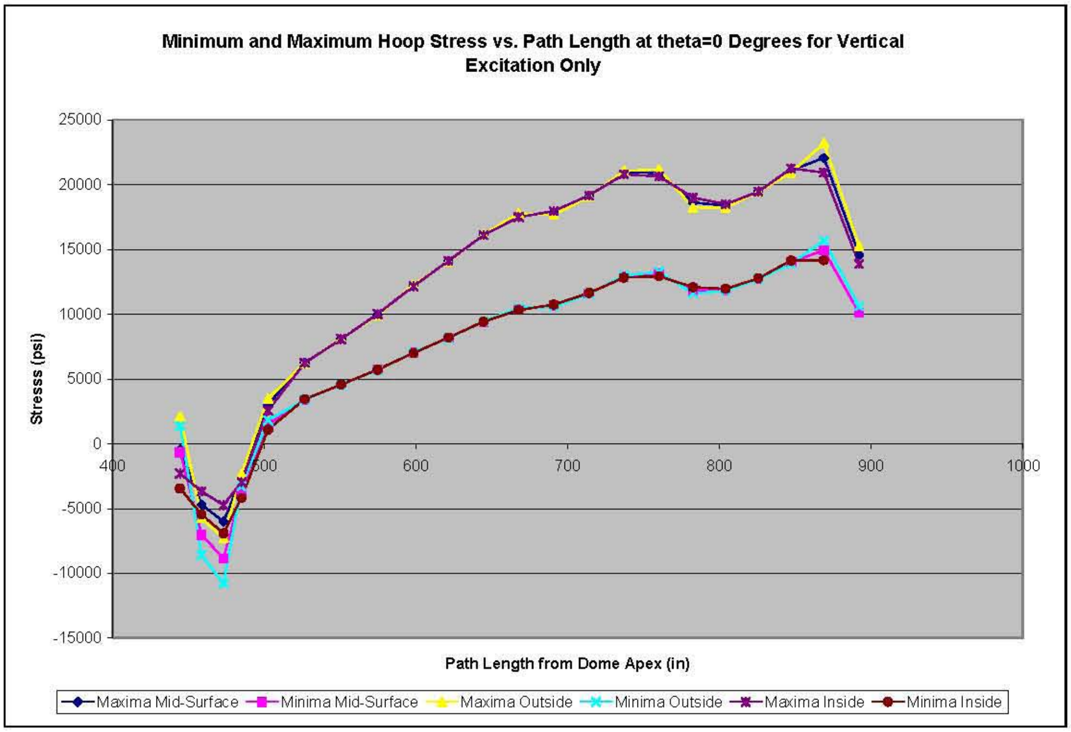


Figure 6-29. Maximum and Minimum Meridional Stress vs. Path Length at θ=0° for Vertical Seismic Excitation Only.

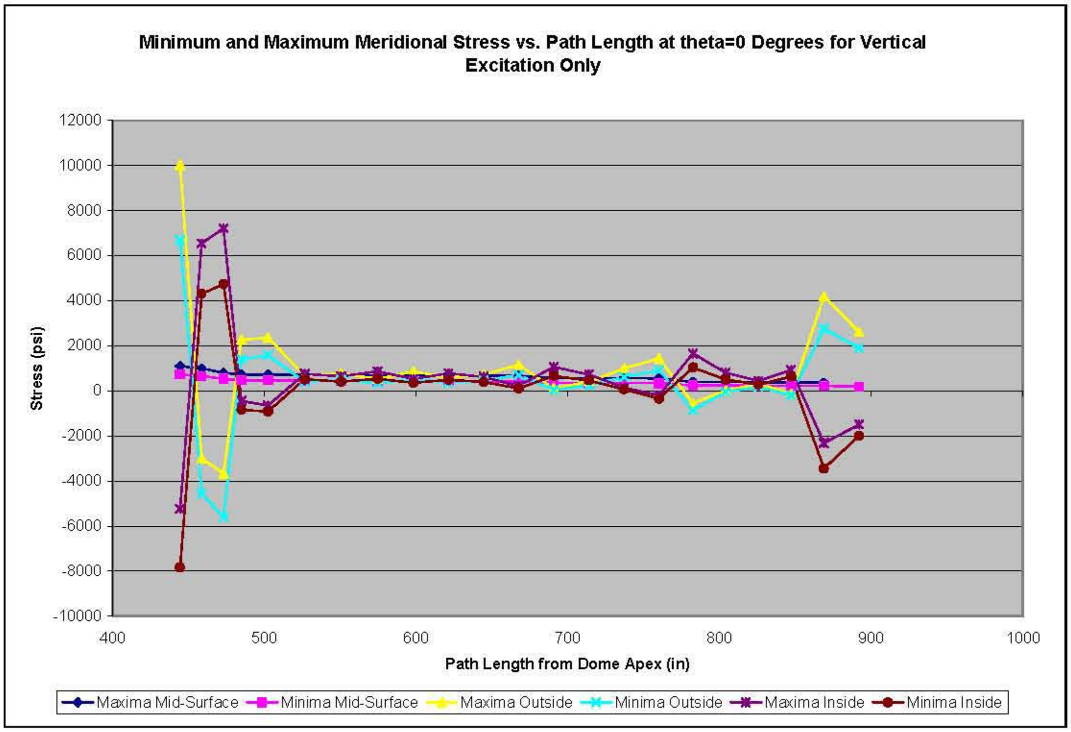
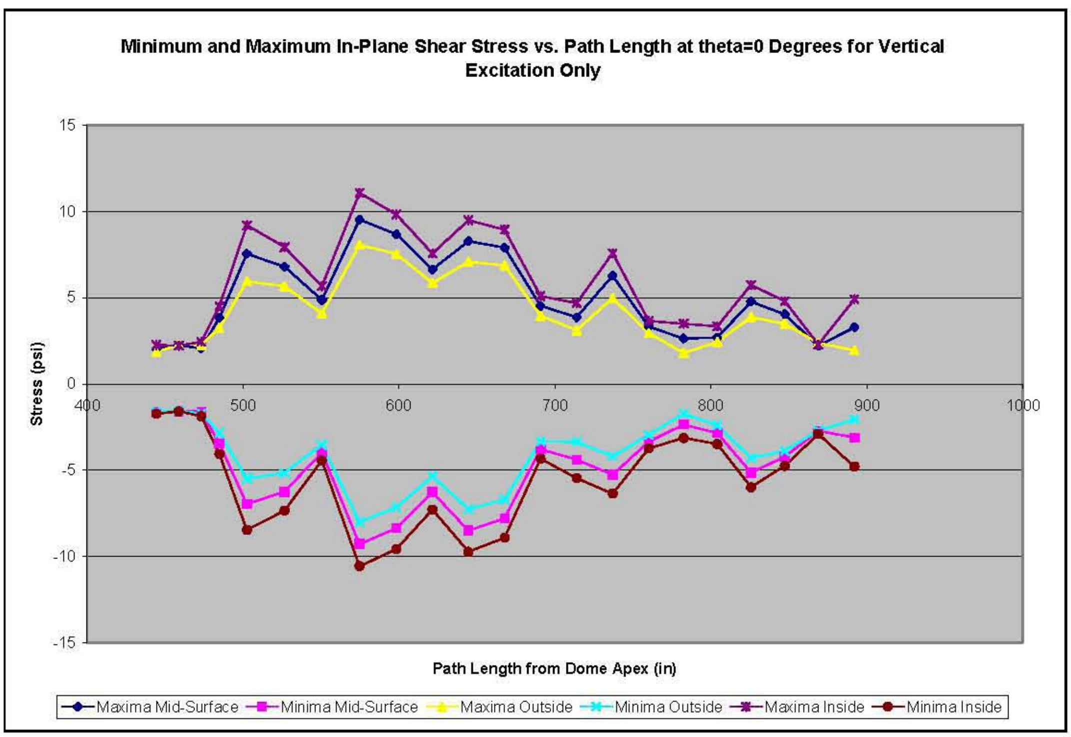


Figure 6-30. Maximum and Minimum Shear Stress vs. Path Length at θ=0° for Vertical Seismic Excitation Only.



6.3.3 Two-Component Motion

Maximum and minimum stress distributions for the case of two-component motion are shown in Figure 6-31 through Figure 6-37. Generally the plots show that the hoop and meridional stress distributions are very similar in character to those for horizontal and vertical excitation only, but the magnitudes are slightly higher. The shear stresses are essentially the same as for the horizontal case, which makes sense because the shear stresses were negligible in the case of vertical excitation only.

Figure 6-31. Maximum and Minimum Hoop Stress vs. Path Length at θ=0° for Two-Component Seismic Excitation.

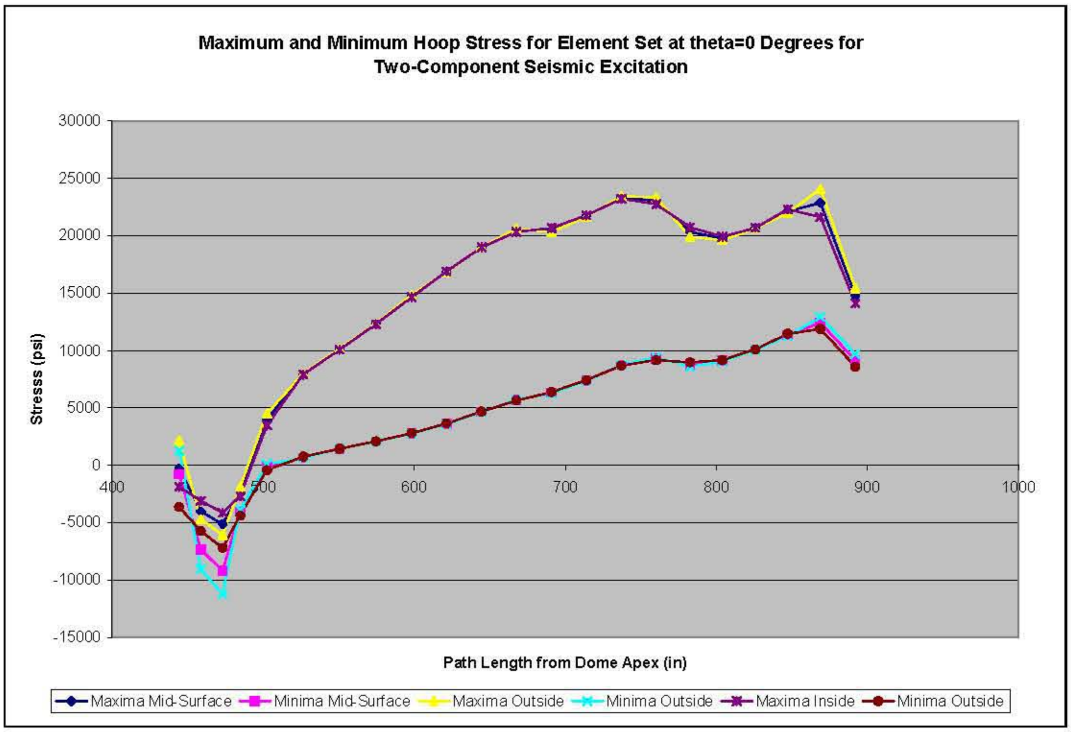


Figure 6-32. Maximum and Minimum Meridional Stress vs. Path Length at θ=0° for Two-Component Seismic Excitation.

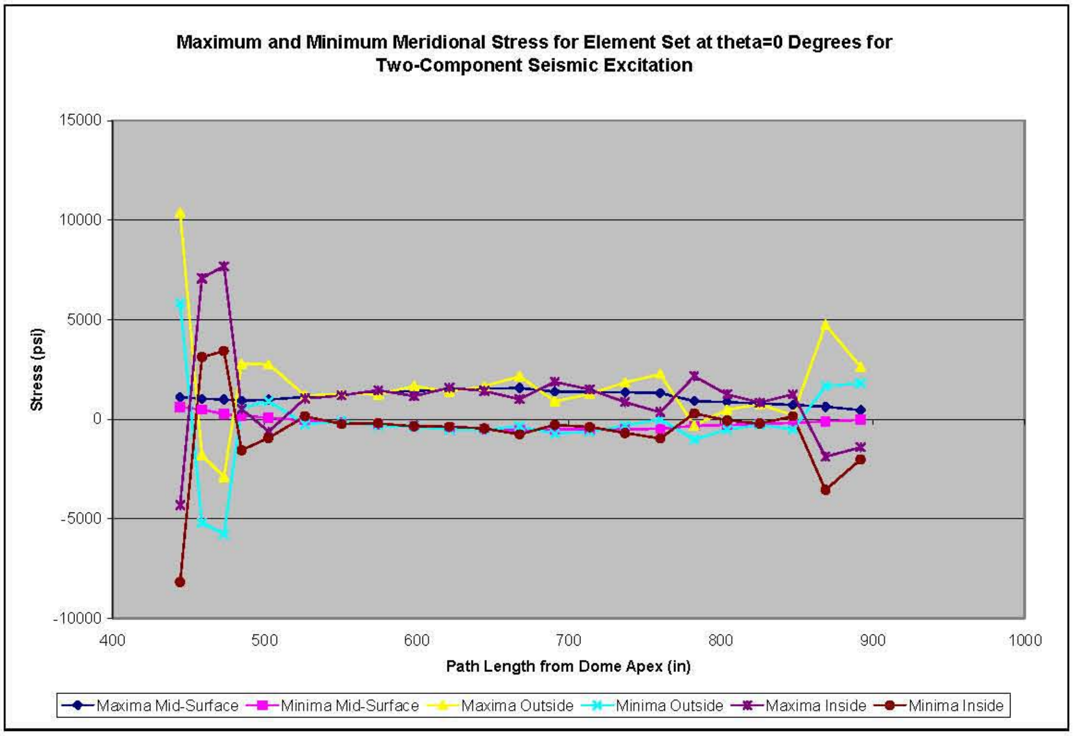


Figure 6-33. Maximum and Minimum Shear Stress vs. Path Length at θ=0° for Two-Component Seismic Excitation.

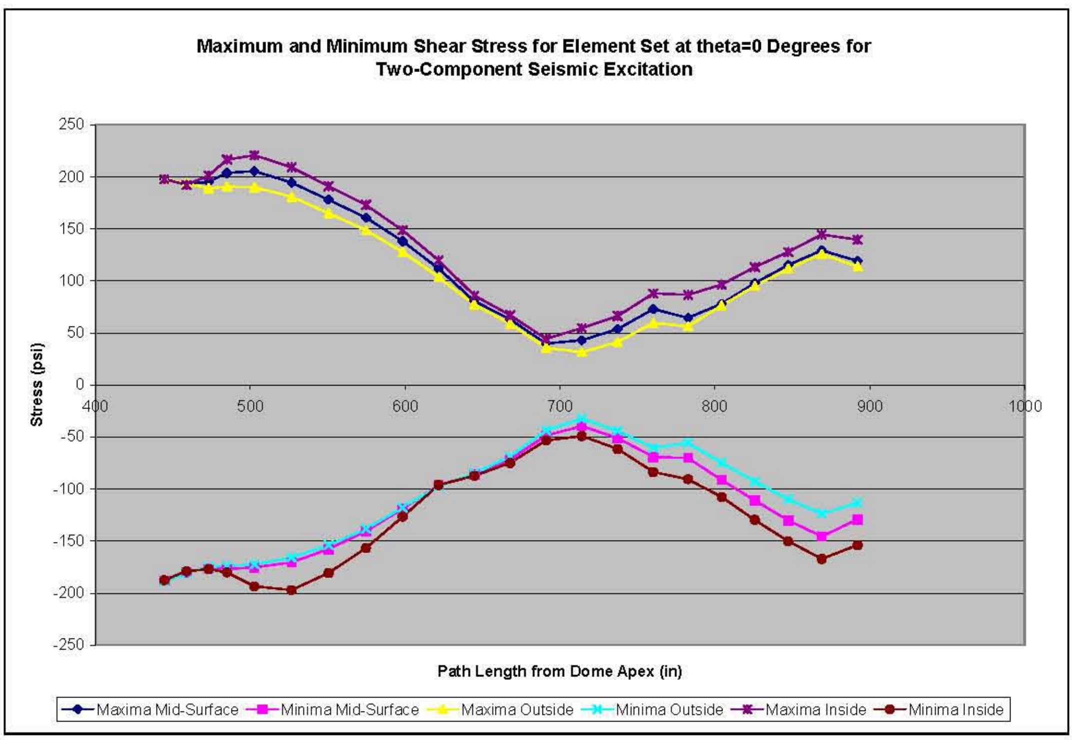


Figure 6-34. Maximum and Minimum Hoop Stress vs. Path Length at θ=45° for Two-Component Seismic Excitation.

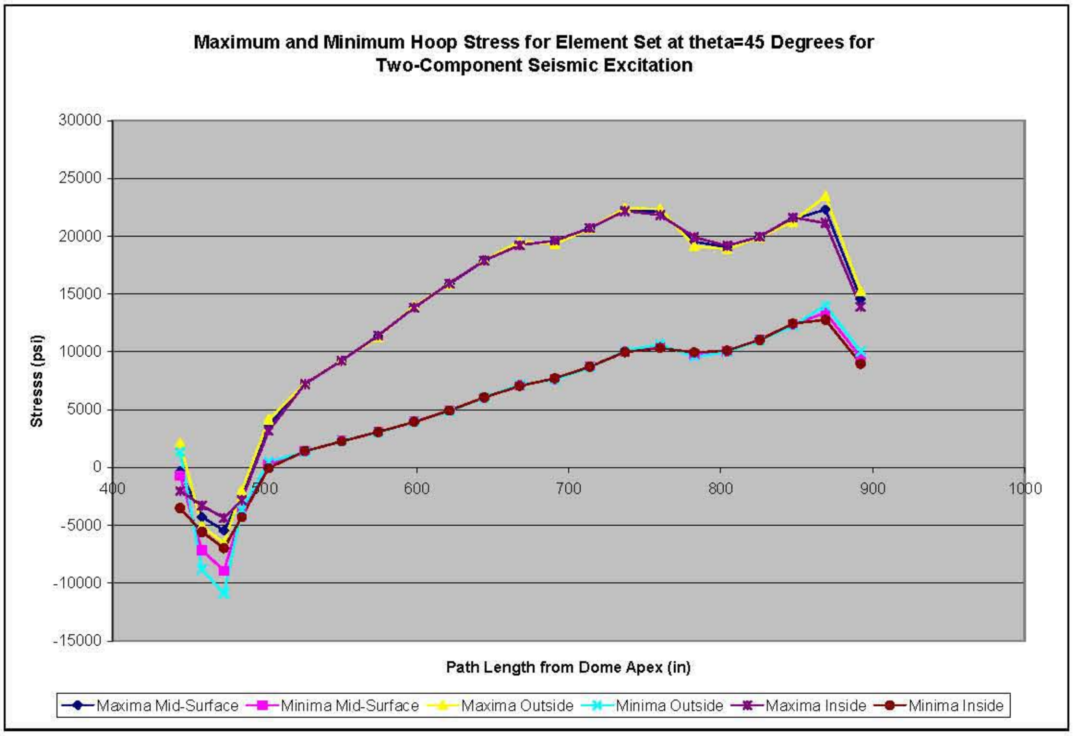


Figure 6-35. Maximum and Minimum Meridional Stress vs. Path Length at θ=45° for Two-Component Seismic Excitation.

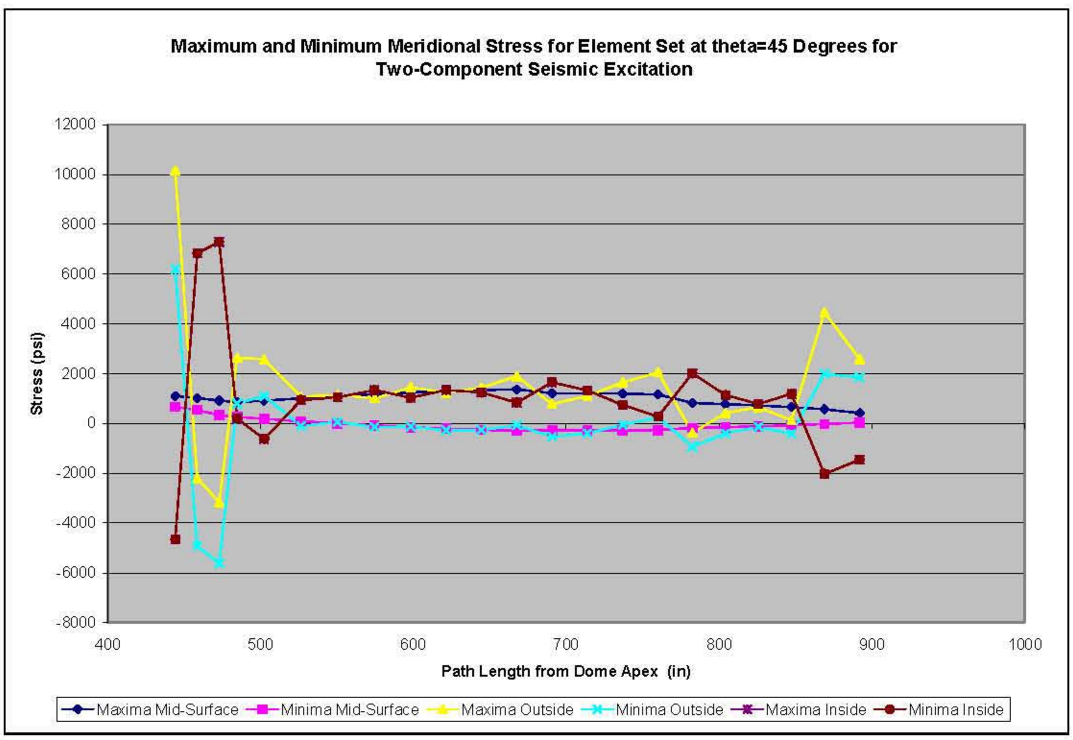


Figure 6-36. Maximum and Minimum Shear Stress vs. Path Length at θ=45° for Two-Component Seismic Excitation.

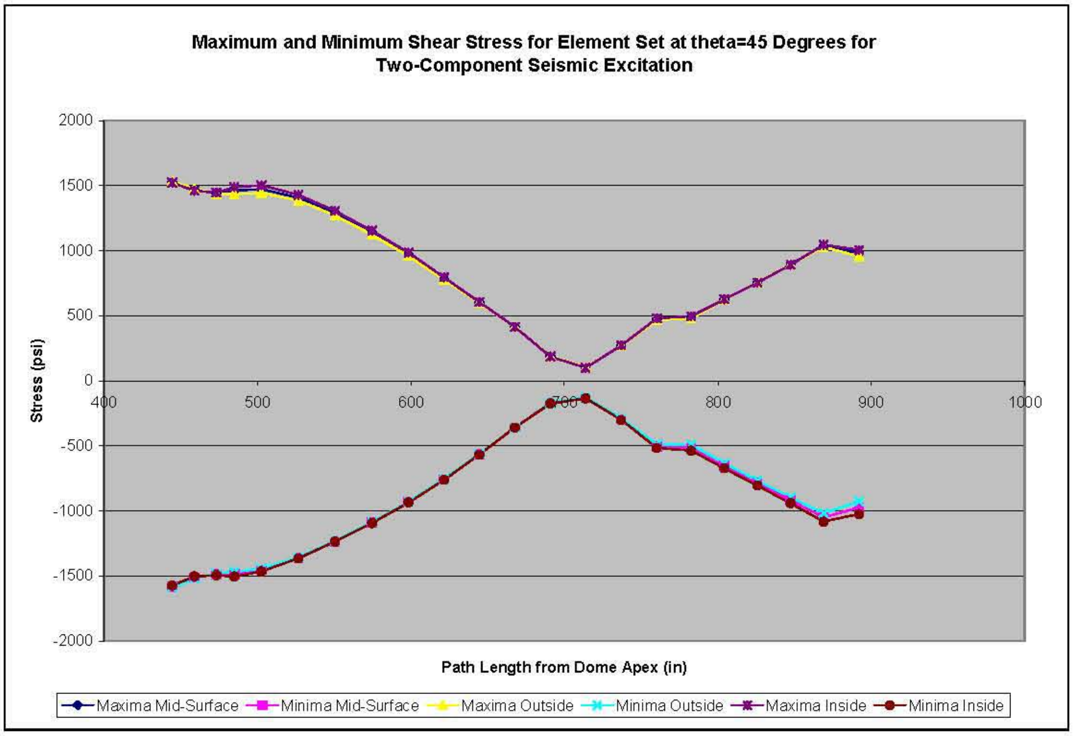
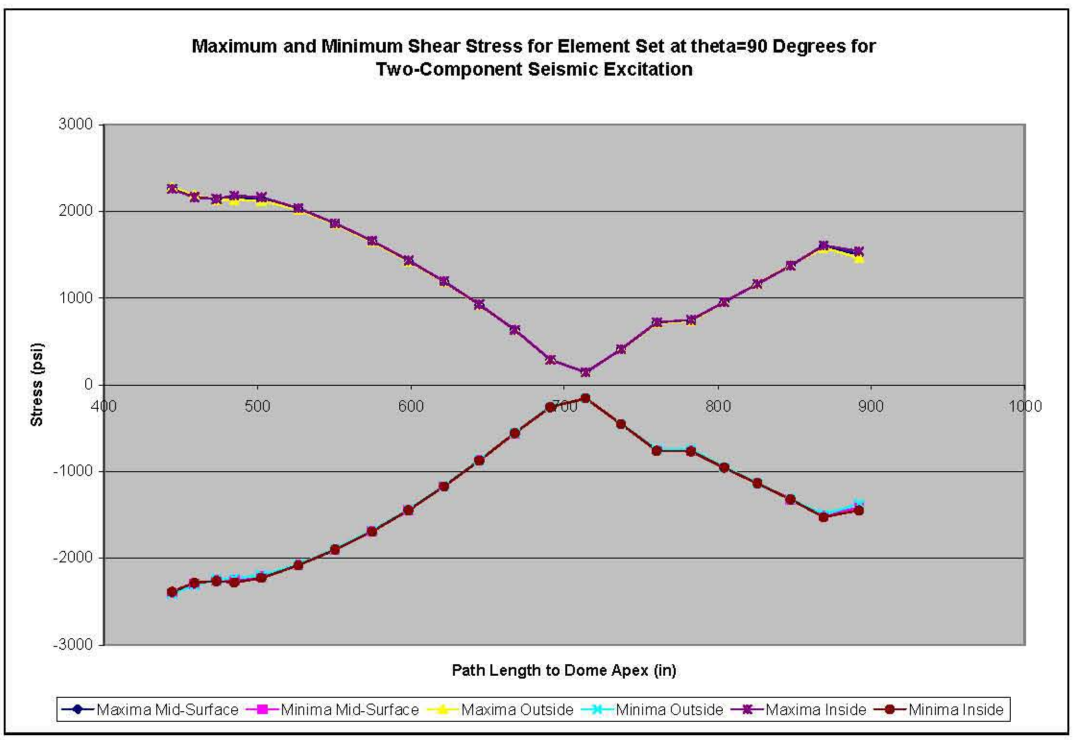


Figure 6-37. Maximum and Minimum Shear Stress vs. Path Length at θ=90° for Two-Component Seismic Excitation.



7.0 ANSYS® TO DYTRAN COMPARISONS FOR PRIMARY TANK SUB-MODELS

In the following sections, comparisons of frequencies, hydrodynamic forces, waste pressures, and tank stresses are presented for the ANSYS® and Dytran® sub-models. Comparisons with stresses predicted by the global ANSYS® model are presented in Section 7.4.4. The intent of the comparisons is to show that the stresses predicted by the ANSYS® models are either nearly the same as the Dytran® model, are small in magnitude, or small relative to the available margin.

7.1 FREQUENCY COMPARISONS

A summary of fundamental frequencies predicted by both ANSYS® and Dytran® appears as Table 7-1. The convective, impulsive, and breathing mode frequencies are within approximately 1% between the ANSYS® and Dytran® models.

Table 7-1. Comparison of ANSYS® and Dytran® Frequencies for Primary Tank Sub-Models.

First Convective Mode Frequency (Hz)		Impulsive Mode Frequency (Hz)			Breathing Mode Frequency (Hz)	
Dytran®	ANSYS	Dytran® Horizontal Excitation	Dytran® Two-Component Motion	ANSYS	Dytran®	ANSYS
0.207	0.21	5.7	5.88	5.78	5.07	5.0

7.2 HYDRODYNAMIC FORCE COMPARISONS

Comparisons of hydrodynamic reaction forces for the ANSYS® and Dytran® sub-models subjected to horizontal excitation, vertical excitation, and two-component excitation are presented in the following three sections.

7.2.1 Horizontal Excitation Only

Figure 7-1 and Figure 7-2 show a comparison Dytran® and ANSYS® horizontal reaction force time histories for horizontal excitation only. The Dytran® and ANSYS® traces are quite similar with the ANSYS® reaction force time history tending to have slightly higher peaks than the Dytran® time history.

Figure 7-1. Comparison of Horizontal Reaction Forces Between ANSYS® and Dytran® Primary Tank Sub-Models for Horizontal Excitation Only - BES-BEC Time History.

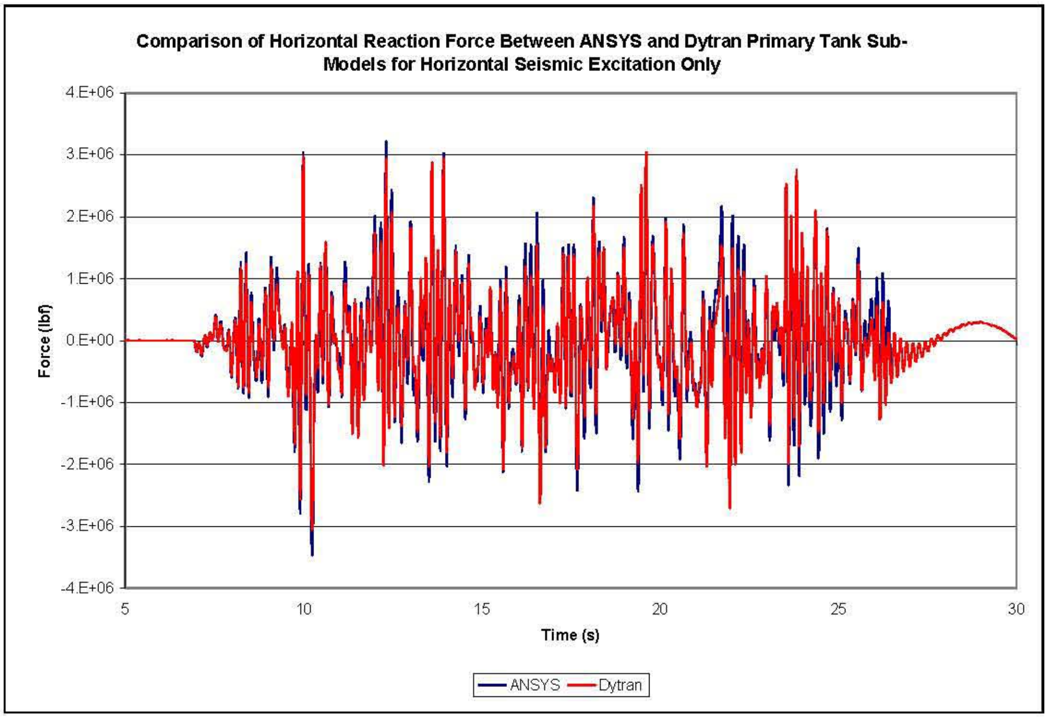
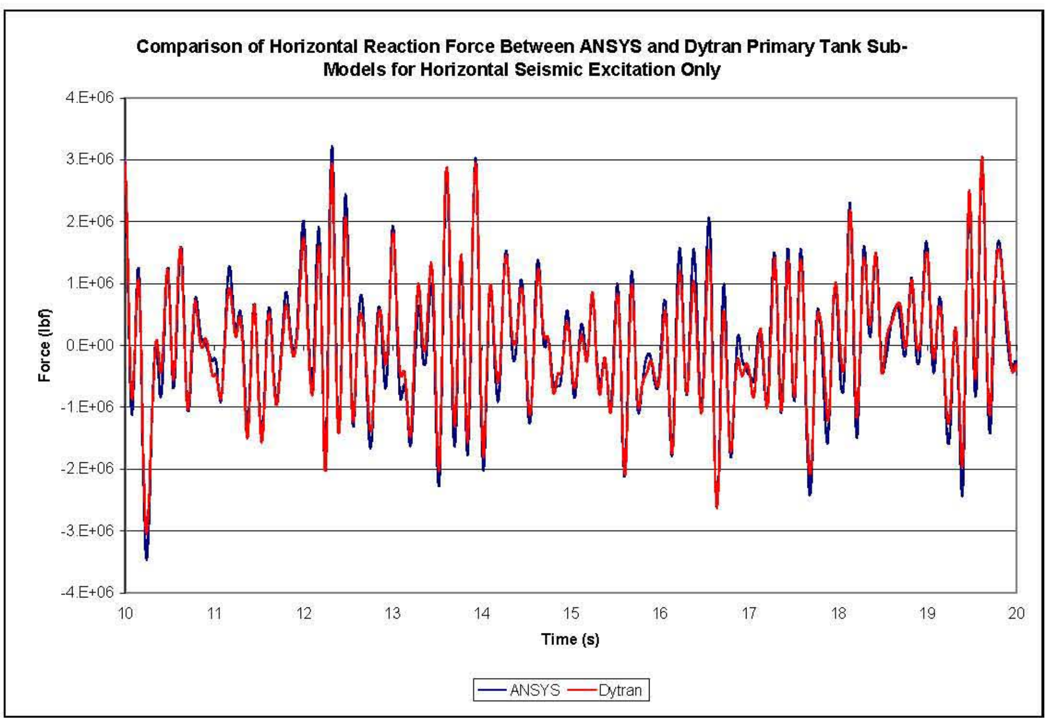


Figure 7-2. Comparison of Horizontal Reaction Forces Between ANSYS® and Dytran® Primary Tank Sub-Models for Horizontal Excitation During Strong Motion Portion of Excitation - BES-BEC Time History.



7.2.2 Vertical Excitation Only

The time history comparisons of the vertical reaction force for vertical excitation only are shown in Figure 7-3 and Figure 7-4. As in the case of the horizontal reaction forces, the Dytran® and ANSYS® reaction force time histories are quite similar. Neither the Dytran® nor ANSYS® model exhibits peaks that are consistently higher than the other model.

Figure 7-3. Comparison of Vertical Reaction Forces Between ANSYS® and Dytran® Primary Tank Sub-Models for Vertical Excitation Only - BES-BEC Time History.

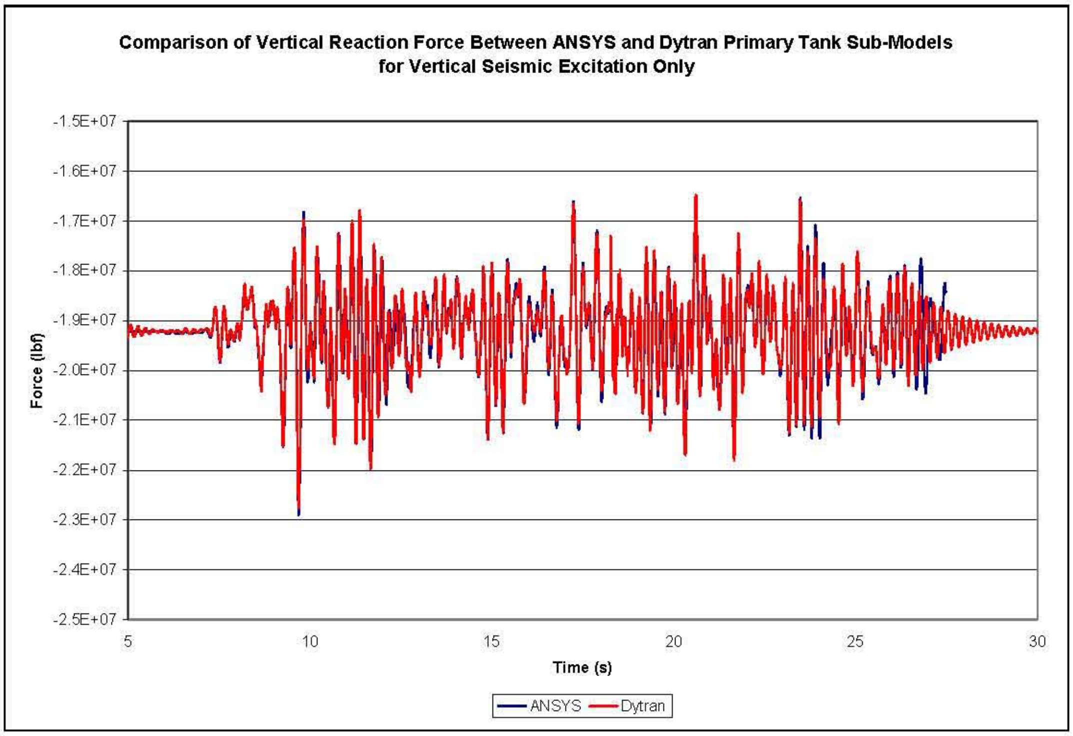
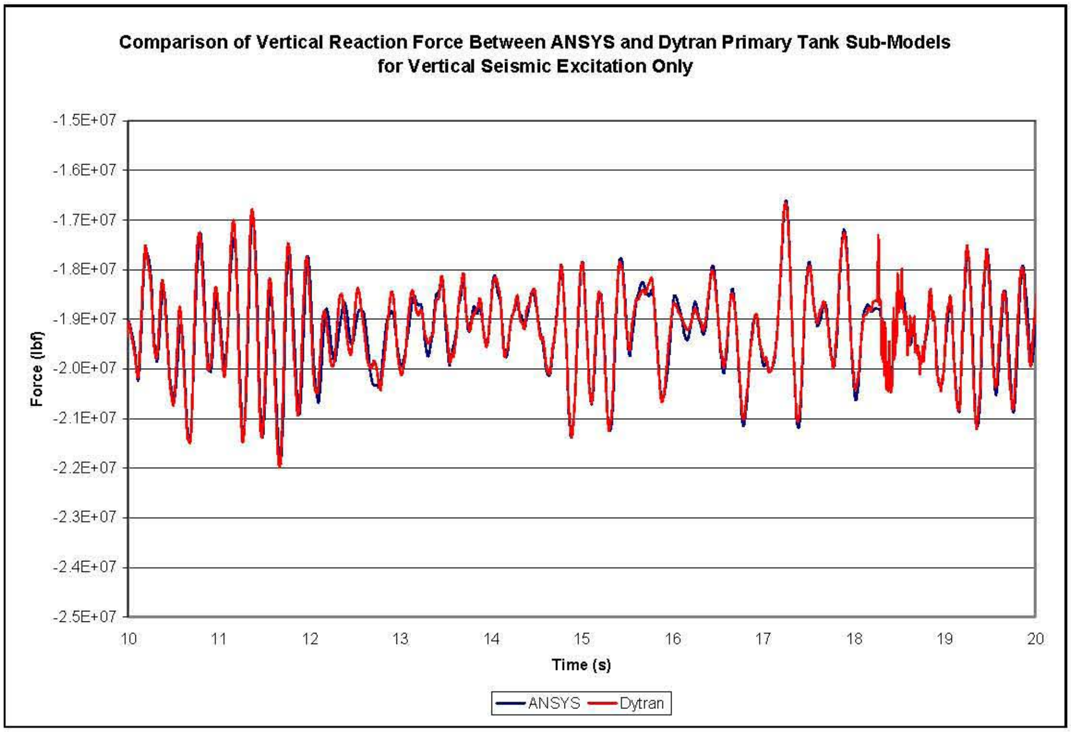


Figure 7-4. Comparison of Vertical Reaction Forces Between ANSYS® and Dytran® Primary Tank Sub-Models for Vertical Excitation During Strong Motion Portion of Excitation - BES-BEC Time History.



7.2.3 Two-Component Motion

In the case of two-component motion, both the horizontal and vertical reaction forces are compared for the Dytran® and ANSYS® sub-models. The comparisons of the horizontal reaction forces are shown in Figure 7-5 and Figure 7-6, and the comparisons of the vertical reaction force are presented in Figure 7-7 and Figure 7-8.

The peak reaction forces indicate that directional coupling exists in the Dytran® model in the sense that the peak horizontal reaction force for two-component motion is higher than for the case of horizontal excitation only. That is, the presence of vertical motion increases the peak horizontal reaction force. However, the presence of horizontal motion has no effect on the peak vertical reaction force, since that value is the same for two-component motion as it is in the case of vertical excitation only.

On the other hand, the results from the ANSYS® sub-model show that the peak horizontal and vertical reaction forces are the same for two-component motion as they are when the seismic excitations are applied in one direction at a time. The complete independence of the horizontal and vertical responses in two-component motion does not seem plausable, and it suggests an inability of the ANSYS® model to resolve the responses in sufficient detail to capture any directional coupling in the reaction forces.

Because of the directional coupling in Dytran®, the peak horizontal reaction force from the Dytran® model subjected to two-component excitation is higher than for ANSYS®, even though the individual direction components are higher from the ANSYS® model when the excitations are applied separately.

Figure 7-5. Comparison of Horizontal Reaction Forces Between ANSYS® and Dytran® Primary Tank Sub-Models for Two-Component Seismic Excitation – BES-BEC Time History.

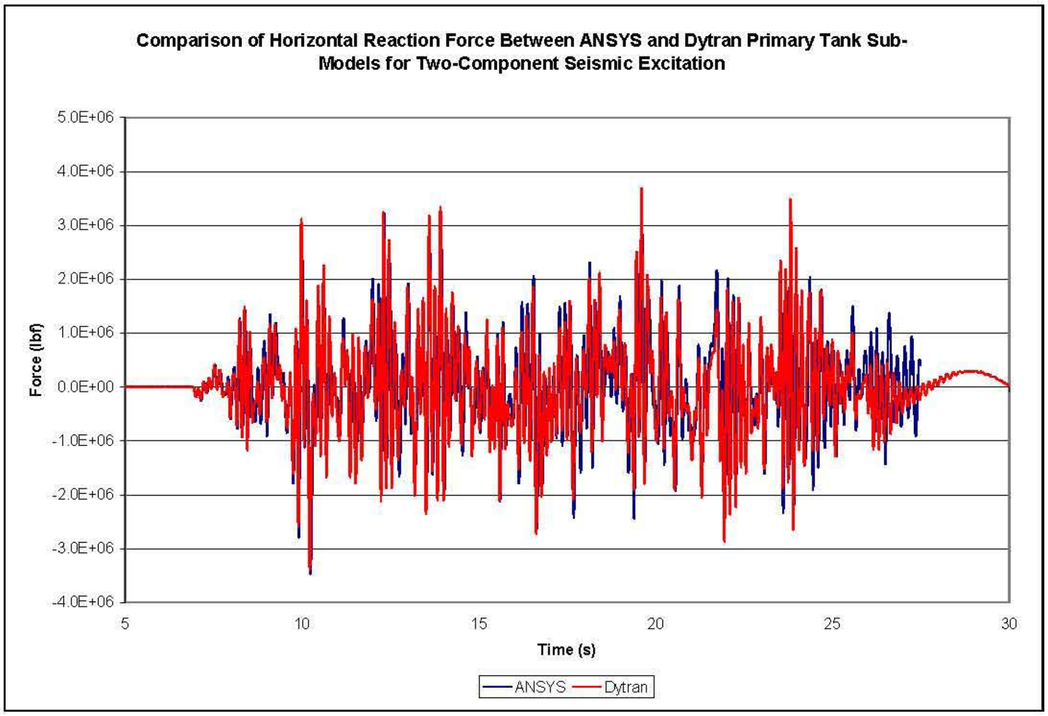


Figure 7-6. Comparison of Horizontal Reaction Forces Between ANSYS® and Dytran® Primary Tank Sub-Models for Two-Component Seismic Excitation During Strong Motion Portion of Excitation - BES-BEC Time History.

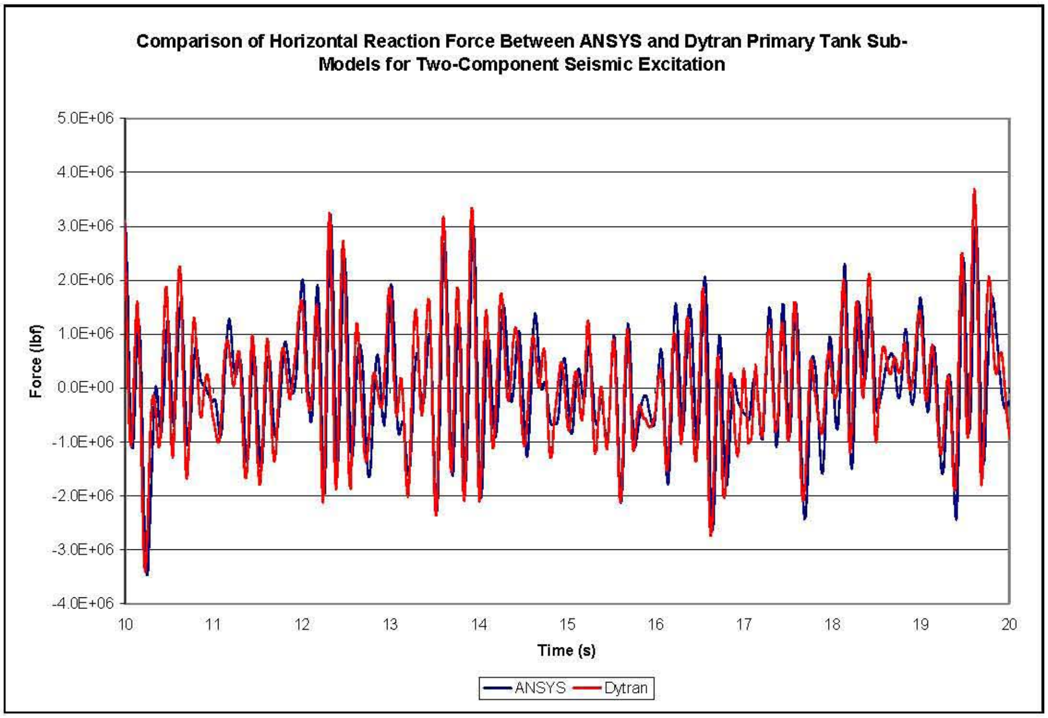


Figure 7-7. Comparison of Vertical Reaction Forces Between ANSYS® and Dytran® Primary Tank Sub-Models for Two-Component Seismic Excitation - BES-BEC Time History.

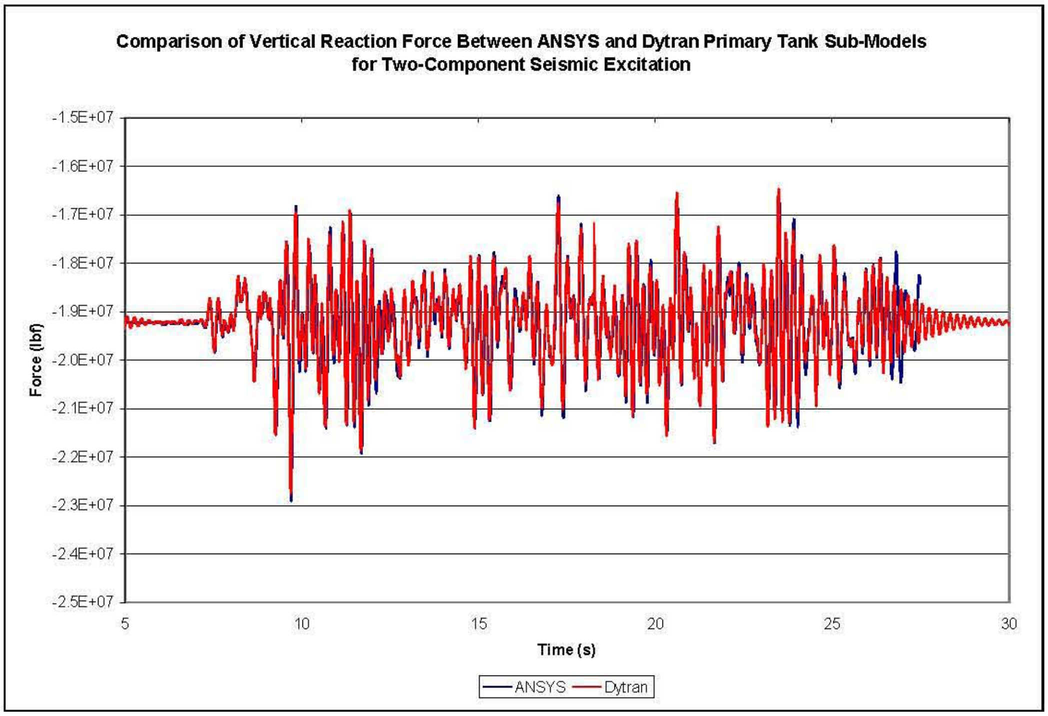
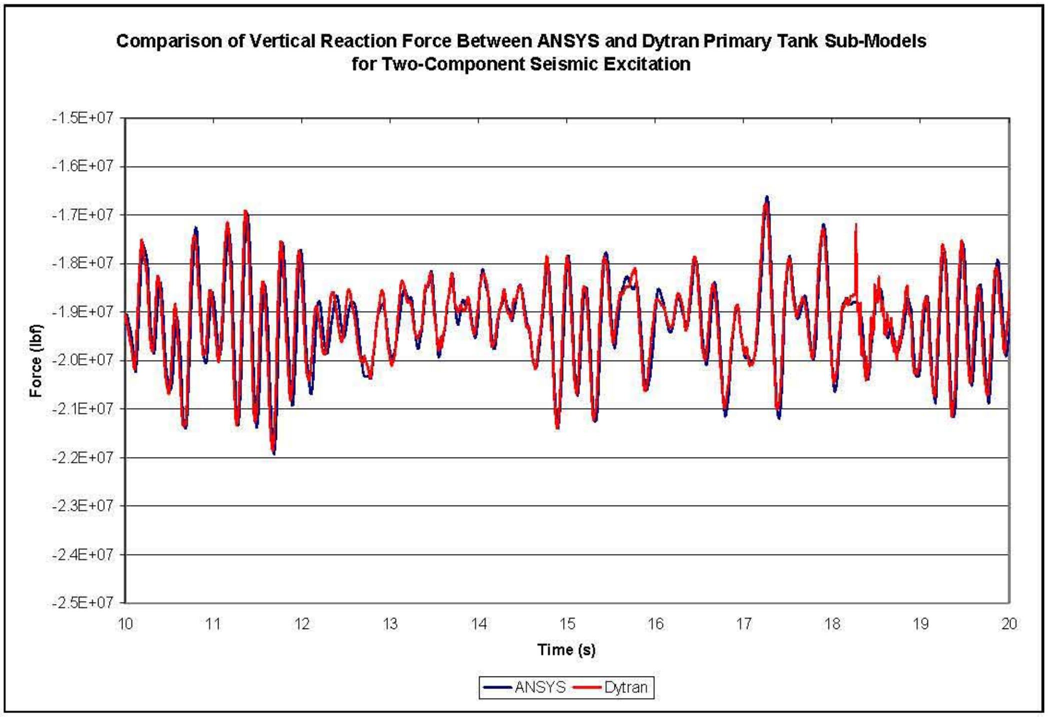


Figure 7-8. Comparison of Vertical Reaction Forces Between ANSYS® and Dytran® Primary Tank Sub-Models for Two-Component Seismic Excitation During Strong Motion Portion of Excitation - BES-BEC Time History.



A summary of the peak reaction forces from the various simulations is included as Table 7-2.

Table 7-2. Summary of Peak Reaction Forces from Primary Tank Sub-Models.

Excitation Direction(s)	Peak Horizontal Reaction Force (lbf)		Peak Vertical Reaction Force (lbf)	
	Dytran®	ANSYS	Dytran®	ANSYS
Horizontal Only	3.05×10^6	3.47×10^6	Not Calculated	Not Calculated
Vertical Only	Not Calculated	Not Calculated	3.6×10^6	3.7×10^6
Two-Component Motion	3.7×10^6	3.47×10^6	3.6×10^6	3.7×10^6

7.3 WASTE PRESSURE COMPARISONS

Comparisons of selected waste pressure time histories from the ANSYS® and Dytran® sub-models for horizontal excitation only, vertical excitation only, and two-component excitation are shown in Figure 7-9, Figure 7-10, and Figure 7-11, respectively. The centroidal elevation of the upper two elements (Dytran® element 5143 and ANSYS® element 7722) is approximately 455 in. from the tank bottom giving a normalized height of 0.99. The centroidal elevation of the lower two elements (Dytran® element 30743 and ANSYS® element 12552) is approximately 24 in. from the tank bottom giving a normalized height of 0.05.

In the case of horizontal excitation only, the pressures predicted by ANSYS® near the bottom of the tank appear to be slightly higher than those predicted by Dytran® a shown in Figure 7-9. In the case of vertical motion only, the pressures predicted by ANSYS® near the bottom of the tank appear to be slightly less than those predicted by Dytran® (Figure 7-10). In the case of two-component motion, the peak pressures near the bottom of the tank are similar from the two models, but the character of the time histories is noticeably different.

The most striking difference between the ANSYS® and Dytran® results is the pressures near the free-surface when horizontal excitation is present. In those two cases the peak pressures predicted by ANSYS® are significantly higher than those predicted by Dytran® as shown in Figure 7-9 and Figure 7-11. Some of the difference between the pressures in Dytran® element 5143 and ANSYS® element 7722 are can be attributed to the fact that the Dytran® pressure results are in the Eulerian formulation while the ANSYS® results are in the Lagrangian formulation, but the two results are still significantly different.

In the case of vertical motion only, the ANSYS® sub-model predicts nearly zero dynamic pressure near the free surface while the Dytran® sub-model shows dynamic pressures of approximately +/- 1 lbf/in^2 as shown in Figure 7-10.

Figure 7-9. Comparison of Selected ANSYS® and Dytran® Waste Pressures at θ=0° for Horizontal Excitation Only.

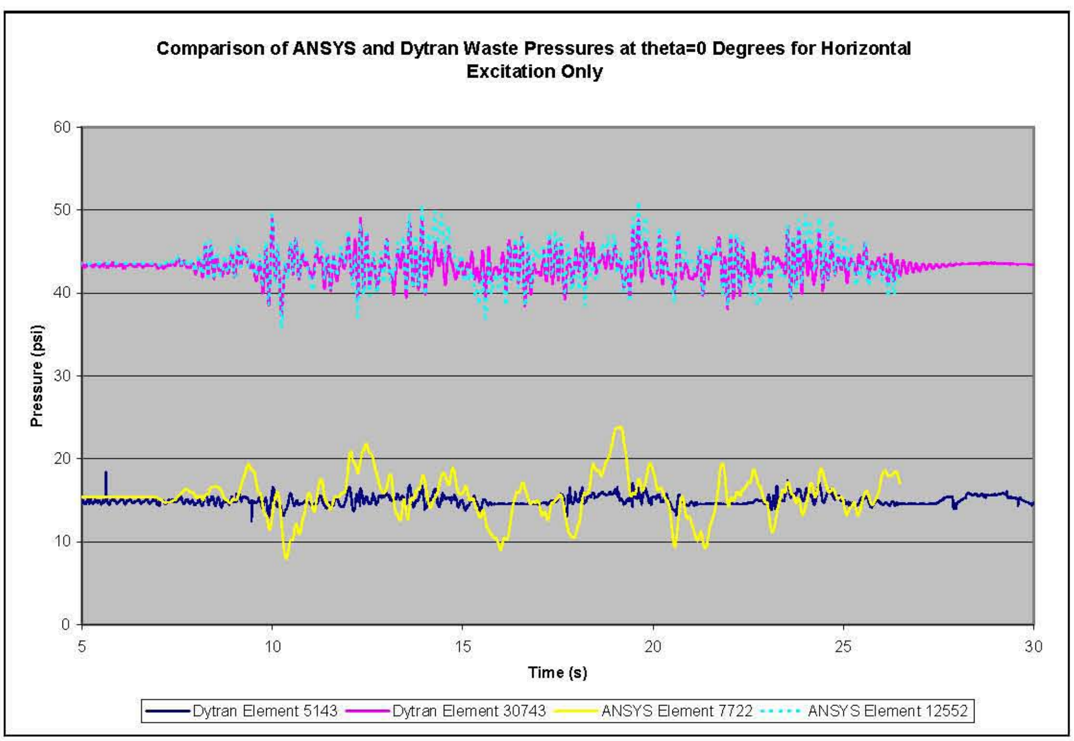


Figure 7-10. Comparison of Selected ANSYS® and Dytran® Waste Pressures at θ=0° for Vertical Excitation Only.

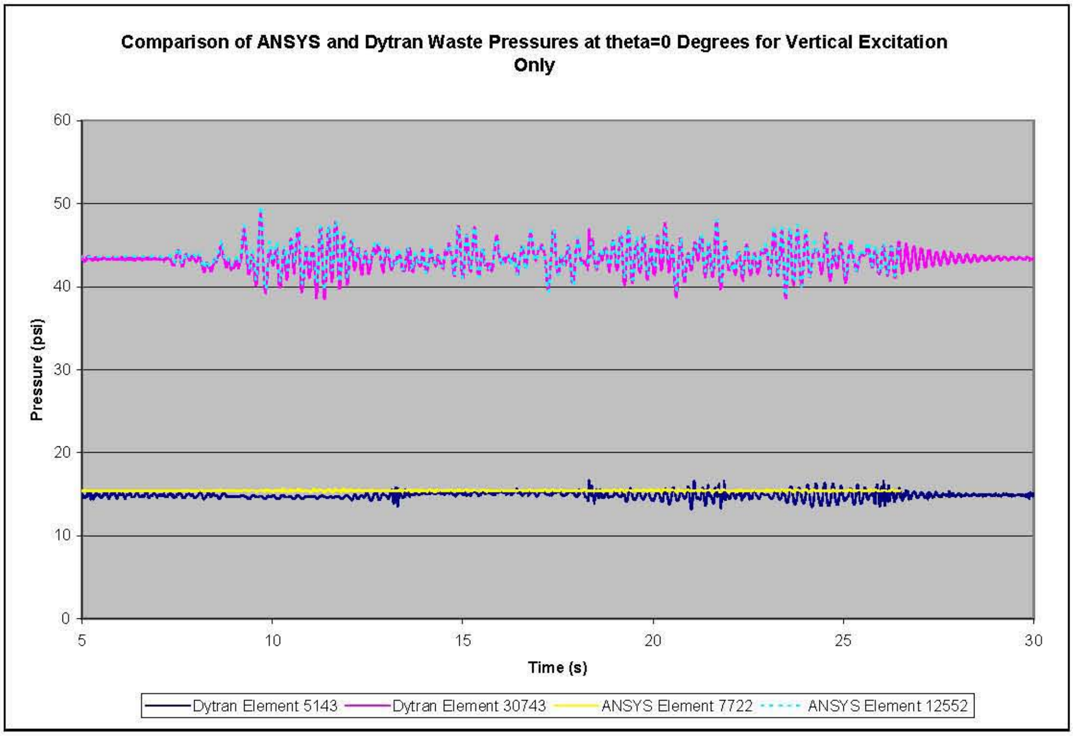
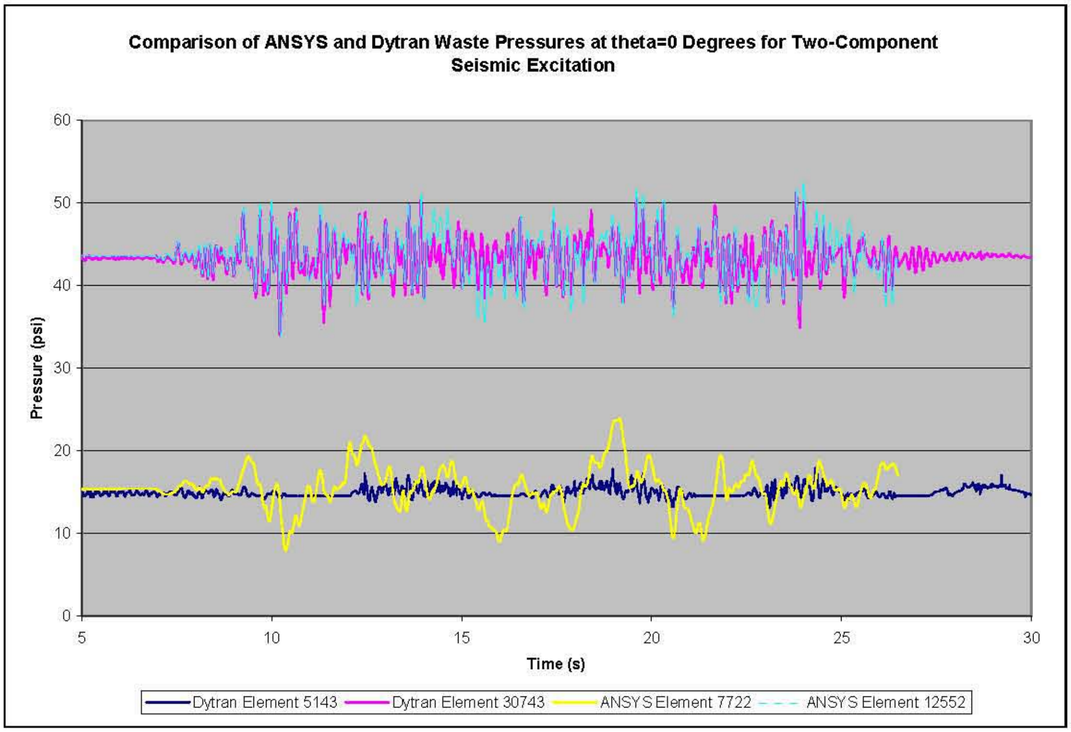


Figure 7-11. Comparison of Selected ANSYS® and Dytran® Waste Pressures at θ=0° for Two-Component Seismic Excitation.



7.4 STRESS COMPARISONS

The following three sections include comparisons of maximum and minimum stress distributions for the ANSYS® and Dytran® primary tank sub-models. Section 7.4.4 also includes stress results from the global ANSYS® model. The data show that the stresses predicted by the two sub-models are very similar except near the free surface and to some degree near the tank knuckle.

Based on earlier studies documented in Rinker and Abatt (2006a), and Rinker et al. (2006c), it is expected that the convective response of the contained liquid will not be captured properly by the ANSYS® model. Thus, differences in the stresses near the liquid free surface are expected. Some differences in the stresses between the ANSYS® and Dytran® models are also expected in the tank knuckle if for no other reason than the fact that in the Dytran® sub-model the junction of the wall with the floor is a right angle as shown in Figure 3-10 and Figure 3-11, while in the ANSYS® sub-model the knuckle radius is approximated with two elements as shown in Figure 5-3, Figure 5-4, and Figure 5-5.

Although the convective response may not be captured properly by the ANSYS® sub-model, it is expected that the impulsive response will be represented with sufficient accuracy, and will tend to be overpredicted by the ANSYS® model due to the constitutive model for the waste. Because the total response is dominated by the impulsive response, it is expected that the stresses from the ANSYS® sub-model should be very similar to those from the Dytran® sub-model in the majority of the tank wall. Another point to note is that the stresses from the primary tank sub-models are due to combined effects of gravity loading and seismic loading. Because the demands from gravity loading tend to dominate those from seismic loading only, and the models are expected to give very similar results for gravity loading, the differences in the predictions for seismic stresses only will be less apparent in the stress plots.

In the stress comparison plots, only mid-surface stresses are plotted for the hoop and shear components since bending is not a significant contributor to these components. In the case of the meridional component, the stresses on the inside and outside surface of the primary tank are plotted.

7.4.1 Horizontal Excitation Only

Comparison plots of the maximum and minimum hoop, meridional, and shear stress distributions in the plane of excitation at $\theta=0°$ for horizontal excitation only are shown in Figure 7-12, Figure 7-13, and Figure 7-14, respectively. Plots of the same stress components at $\theta=45°$ are shown in Figure 7-15, Figure 7-16, and Figure 7-17. The mid-surface shear stress distribution at $\theta=90°$ is shown as Figure 7-18.

The plots show that the hoop stresses from the two sub-models are very similar, except at the waste free surface, as expected. The meridional stresses are similar in the majority of the tank wall, but differ somewhat in the knuckle region, and especially near the waste free surface. The shear stresses are nearly the same or are of negligible magnitude.

Figure 7-12. Comparison of Dytran® and ANSYS® Mid-Surface Hoop Stresses at θ=0° for Horizontal Seismic Excitation.

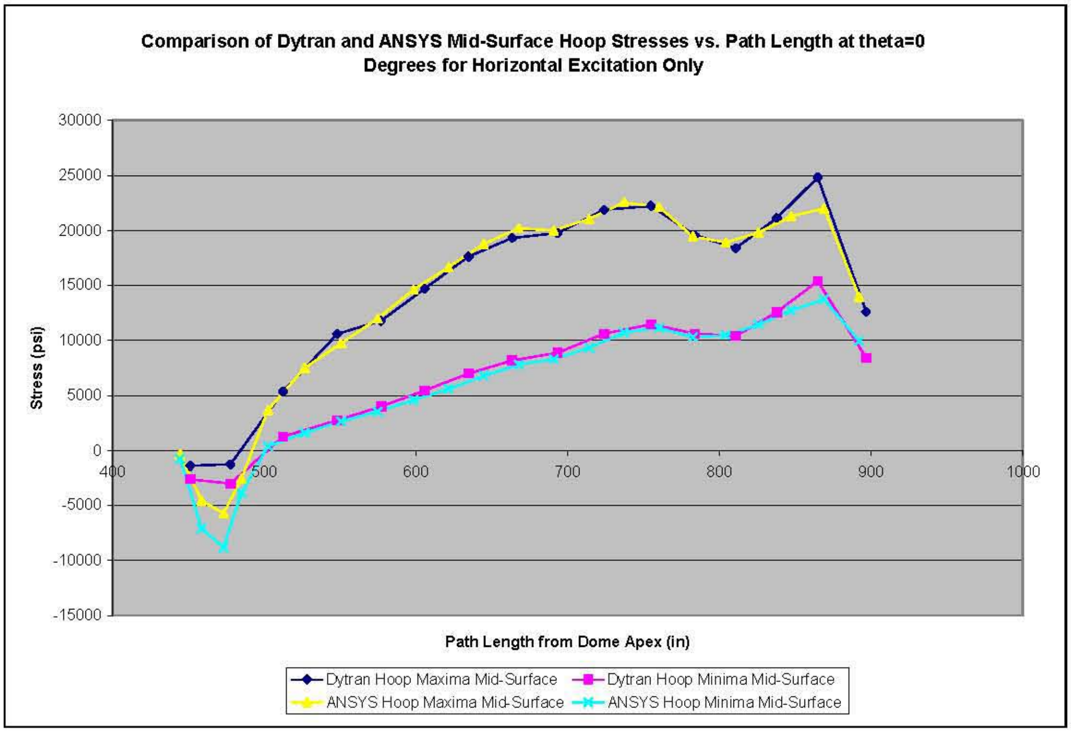


Figure 7-13. Comparison of Dytran® and ANSYS® Outside and Inside Surface Meridional Stresses at θ=0° for Horizontal Seismic Excitation.

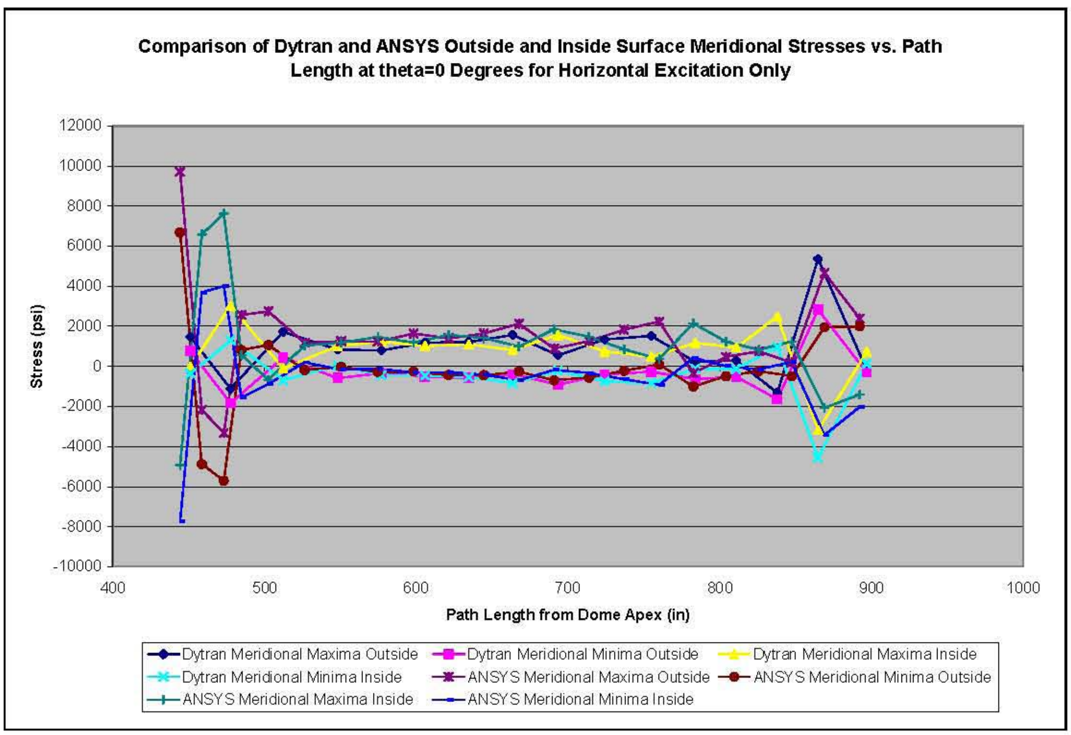


Figure 7-14. Comparison of Dytran® and ANSYS® Mid-Surface In-Plane Shear Stresses at θ=0° for Horizontal Seismic Excitation.

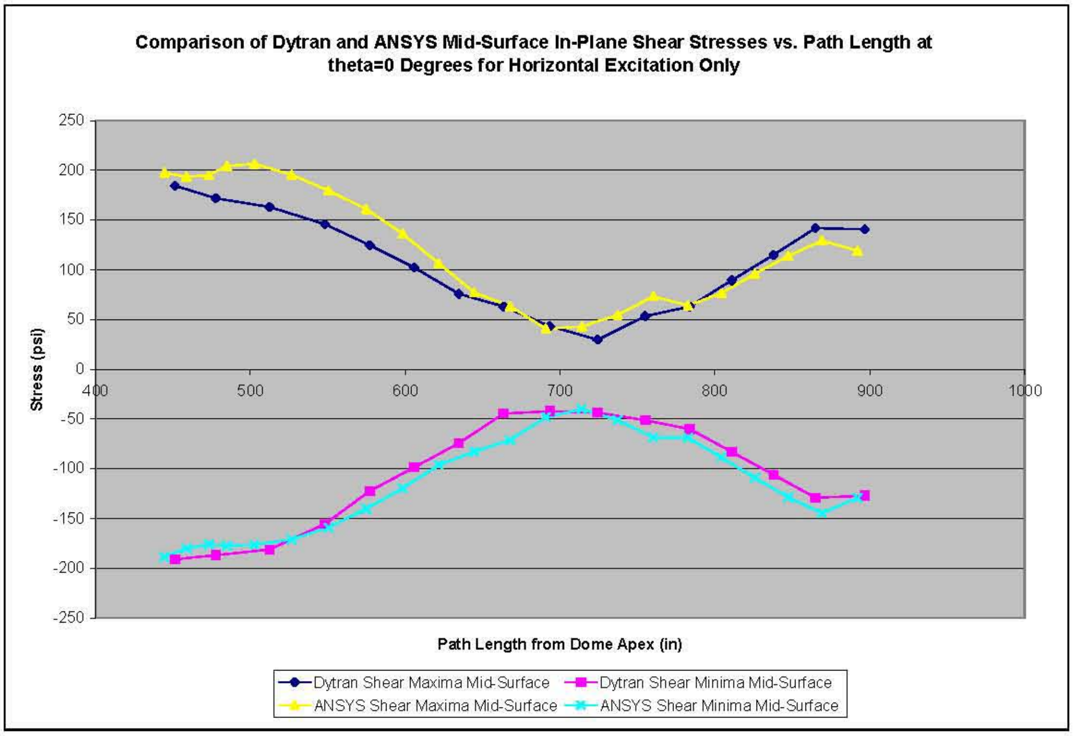


Figure 7-15. Comparison of Dytran® and ANSYS® Mid-Surface Hoop Stresses at θ=45° for Horizontal Seismic Excitation.

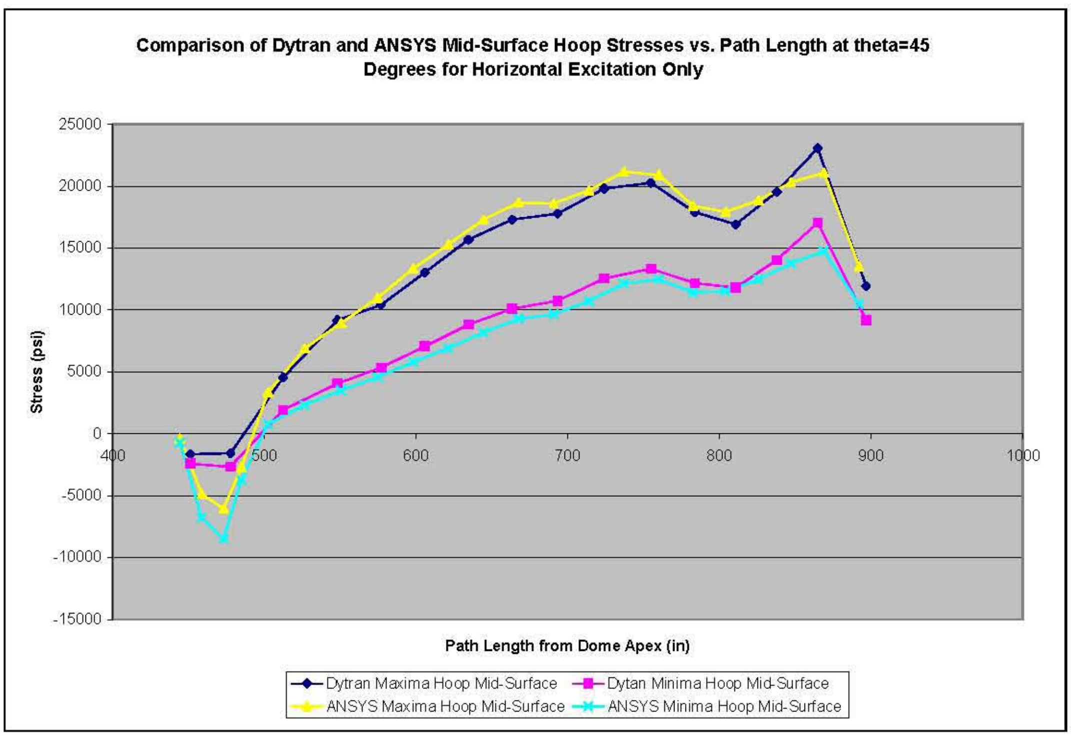


Figure 7-16. Comparison of Dytran® and ANSYS® Outside and Inside Surface Meridional Stresses at θ=45° for Horizontal Seismic Excitation.

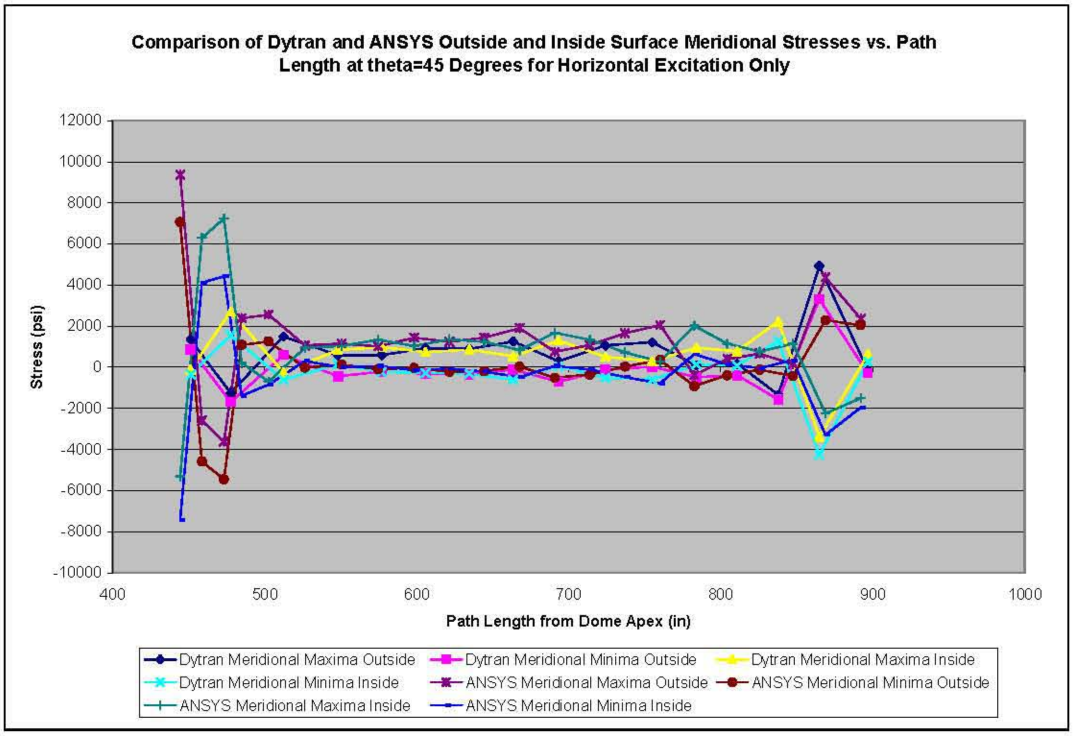


Figure 7-17. Comparison of Dytran® and ANSYS® Mid-Surface In-Plane Shear Stresses at θ=45° for Horizontal Seismic Excitation.

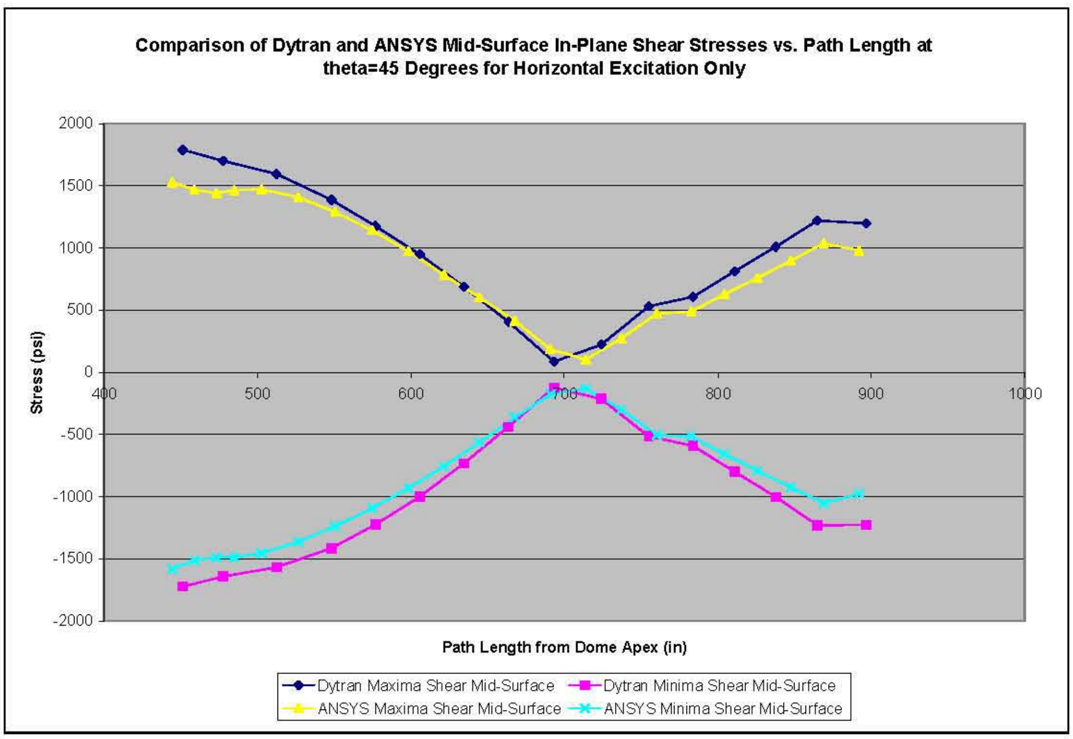
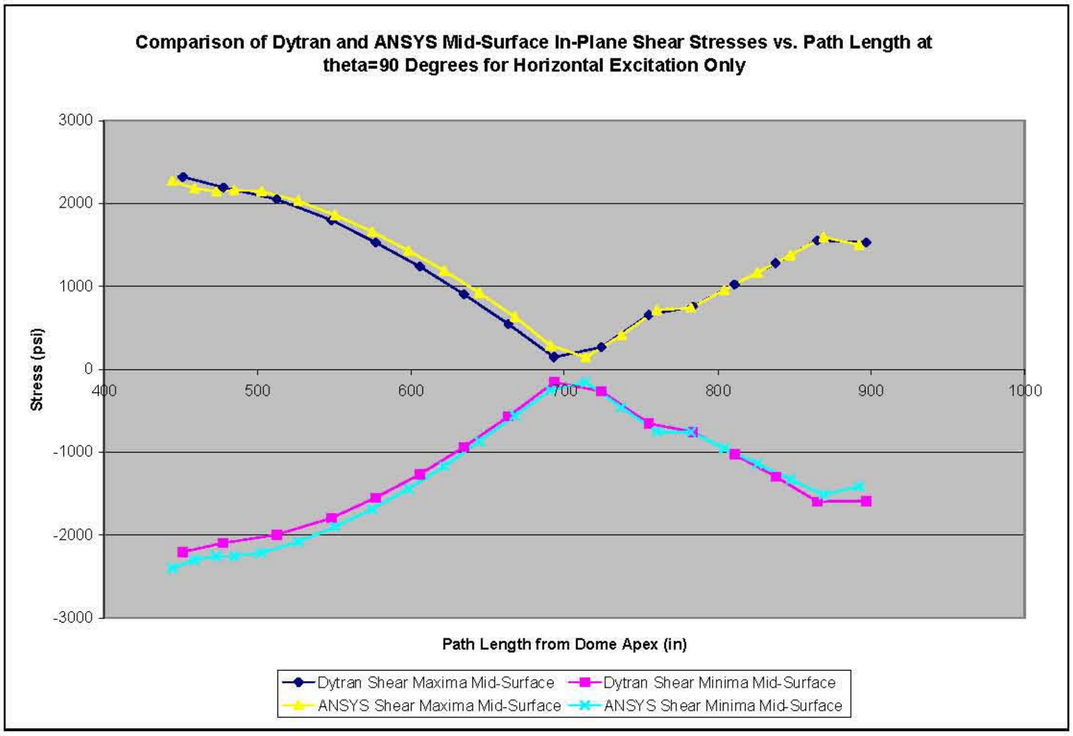


Figure 7-18. Comparison of Dytran® and ANSYS® Mid-Surface In-Plane Shear Stresses at θ=90° for Horizontal Seismic Excitation.



7.4.2 Vertical Excitation Only

Plots of the hoop, meridional, and shear stress distributions at θ=0° for vertical excitation only are shown as Figure 7-19, Figure 7-20, and Figure 7-21, respectively. The same observations made for the case of horizontal excitation only apply in this case.

Figure 7-19. Comparison of Dytran® and ANSYS® Mid-Surface Hoop Stresses at θ=0° for Vertical Seismic Excitation.

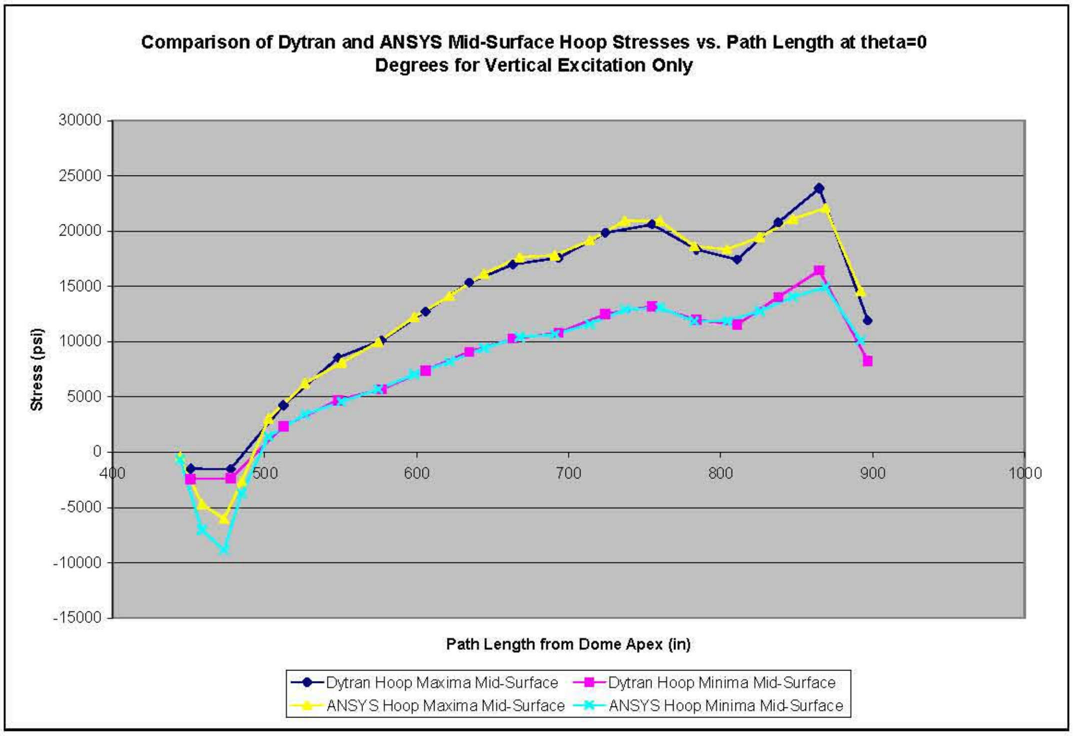


Figure 7-20. Comparison of Dytran® and ANSYS® Outside and Inside Surface Meridional Stresses at θ=0° for Vertical Seismic Excitation.

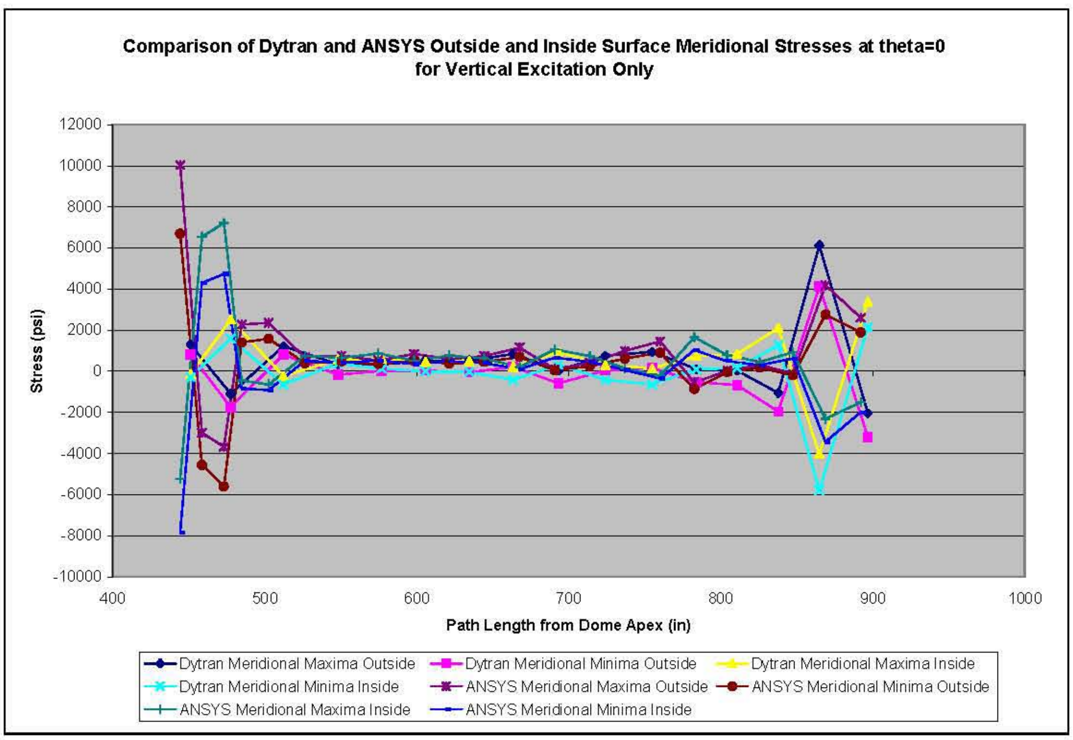
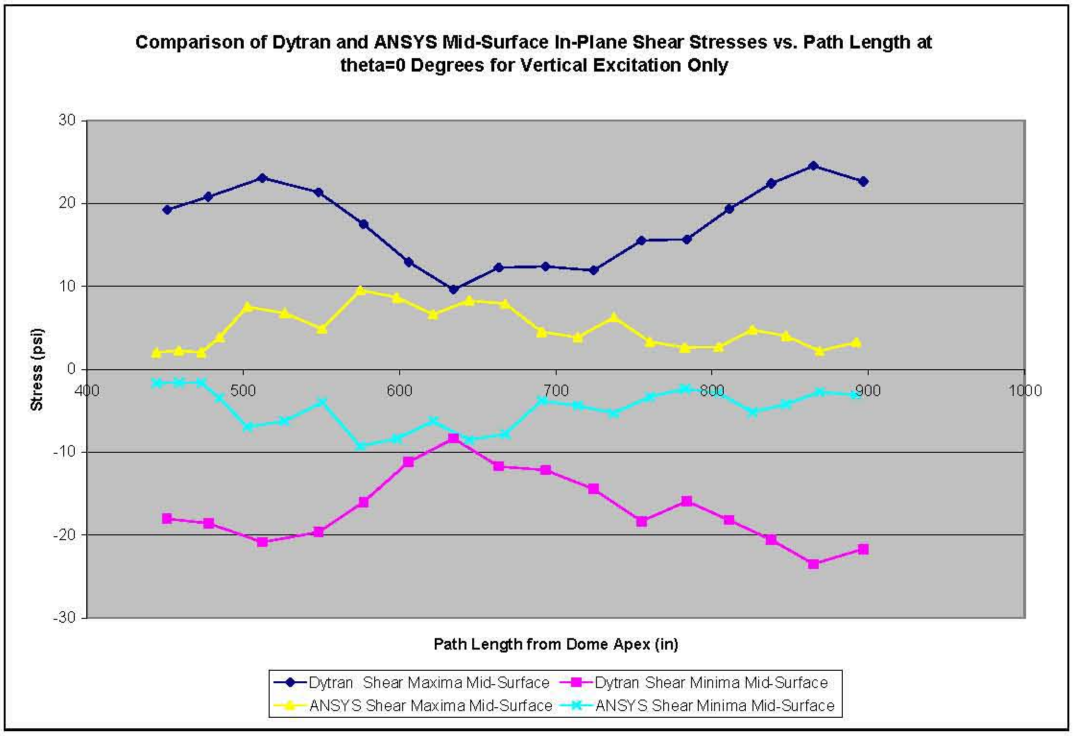


Figure 7-21. Comparison of Dytran® and ANSYS® Mid-Surface In-Plane Shear Stresses at θ=0° for Vertical Seismic Excitation.



7.4.3 Two-Component Motion

Comparison plots of the maximum and minimum hoop, meridional, and shear stress distributions in the plane of excitation at θ=0° for horizontal excitation only are shown in Figure 7-22, Figure 7-23, and Figure 7-24, respectively. Plots of the same stress components at θ=45° are shown in Figure 7-25, Figure 7-26, and Figure 7-27. The mid-surface shear stress distribution at θ=90° is shown as Figure 7-28.

The same observations made for the cases of horizontal excitation only and vertical excitation only apply to the case of two-component excitation.

Figure 7-22. Comparison of Dytran® and ANSYS® Mid-Surface Hoop Stresses at θ=0° for Two-Component Seismic Excitation.

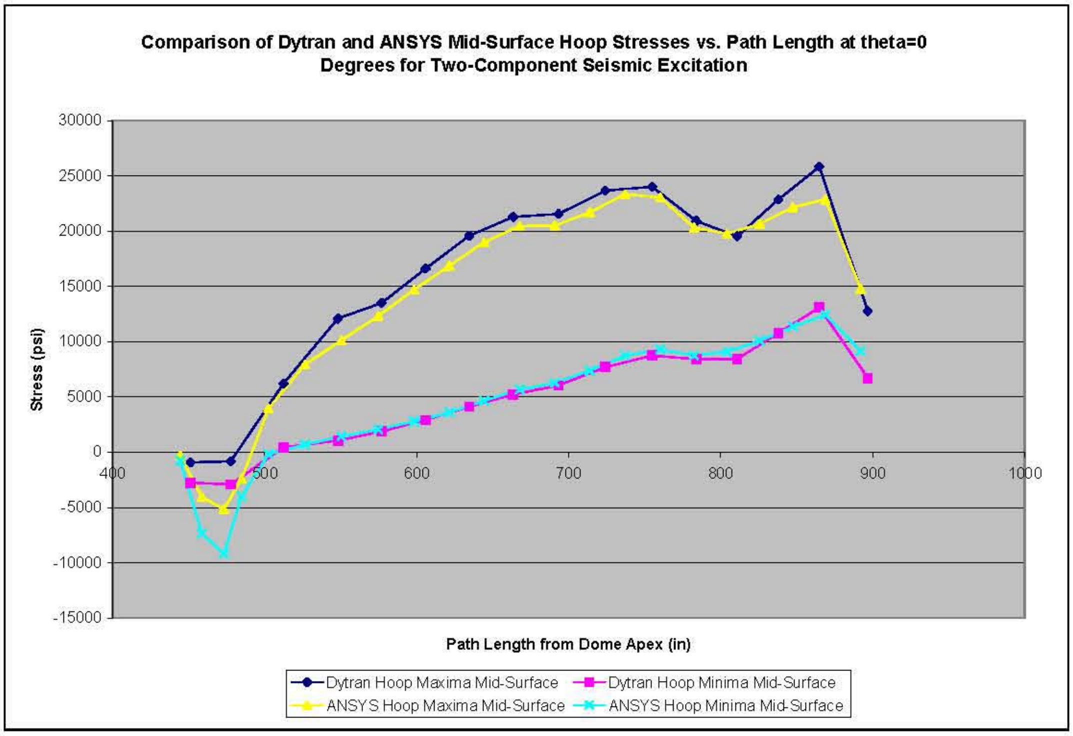


Figure 7-23. Comparison of Dytran® and ANSYS® Outside and Inside Surface Meridional Stresses at θ=0° for Two-Component Seismic Excitation.

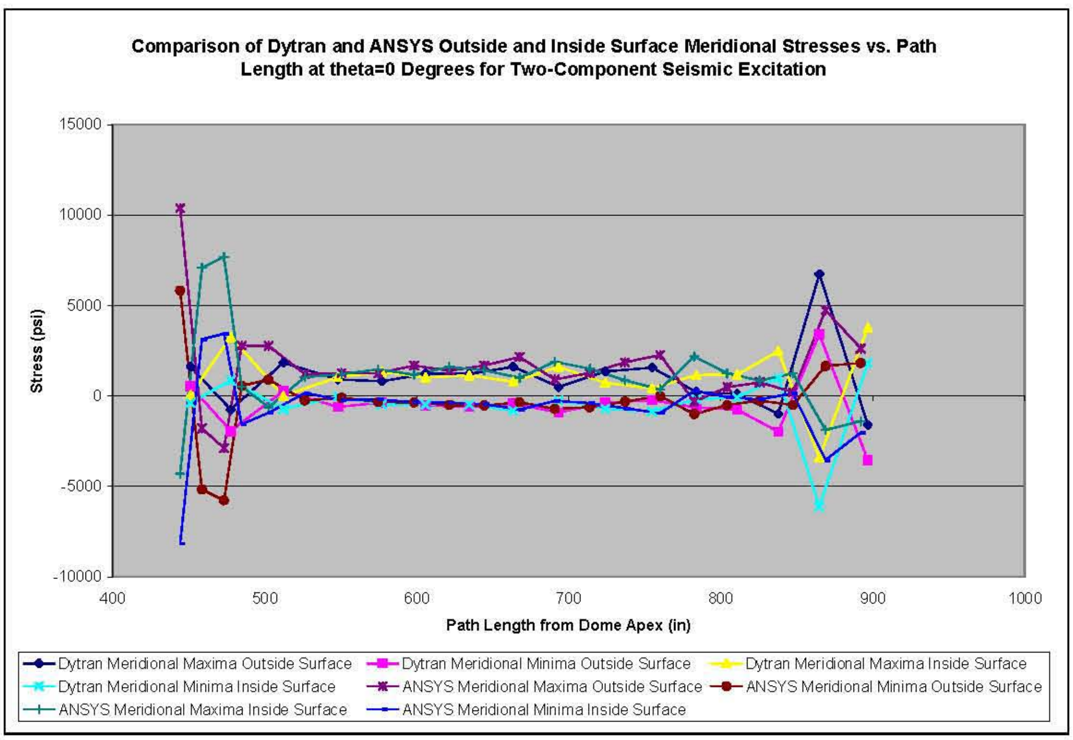


Figure 7-24. Comparison of Dytran® and ANSYS® Mid-Surface In-Plane Shear Stresses at θ=0° for Two-Component Seismic Excitation.

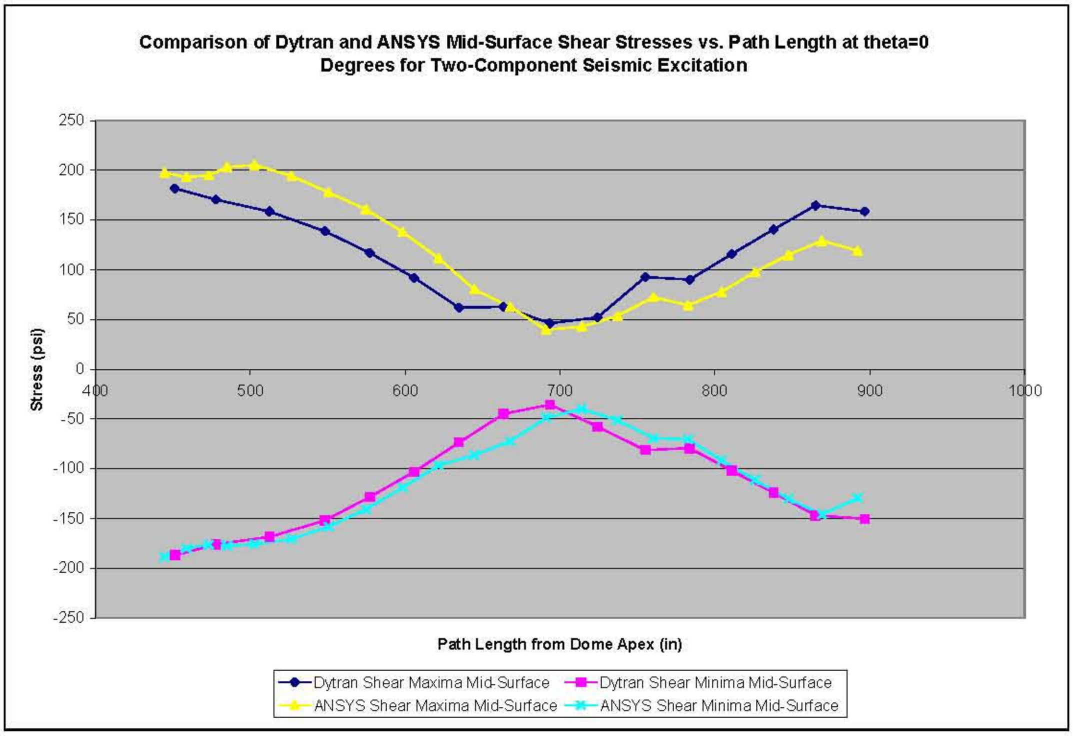


Figure 7-25. Comparison of Dytran® and ANSYS® Mid-Surface Hoop Stresses at θ=45° for Two-Component Seismic Excitation.

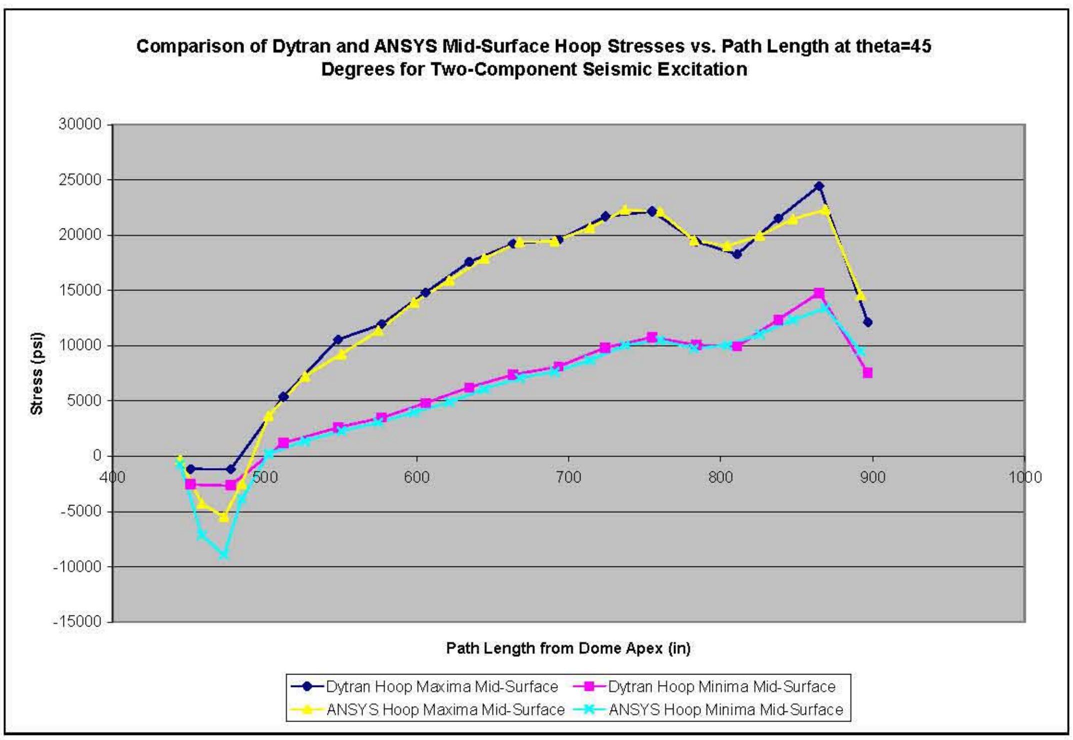


Figure 7-26. Comparison of Dytran® and ANSYS® Outside and Inside Surface Meridional Stresses at θ=45° for Two-Component Seismic Excitation.

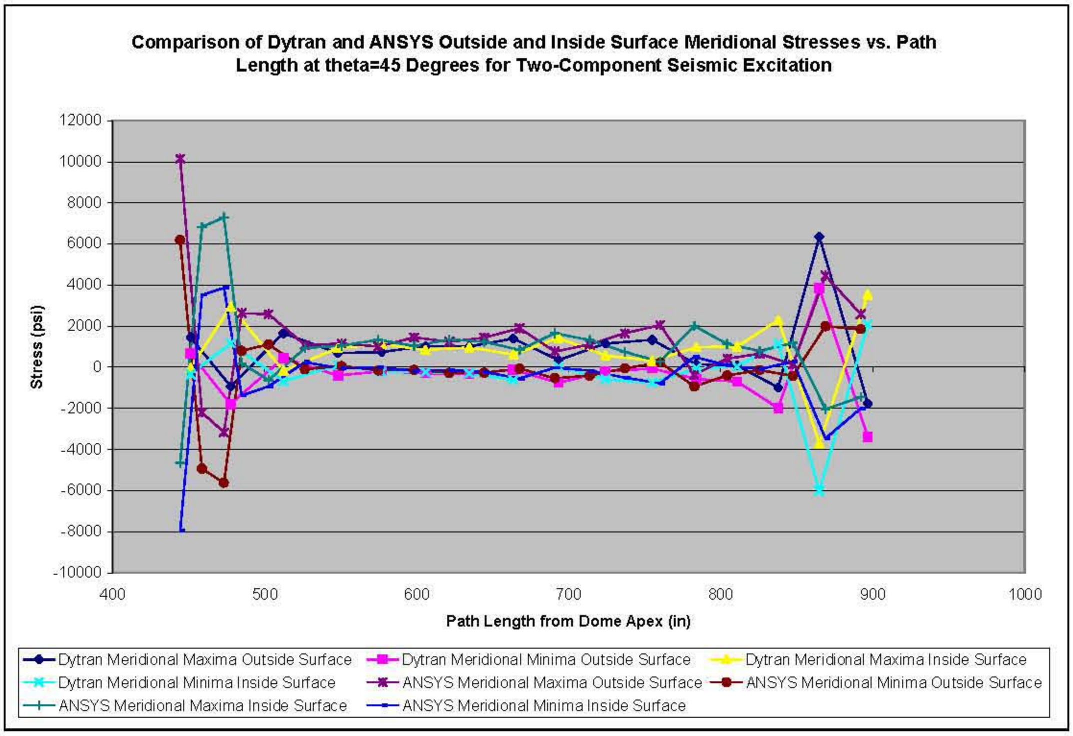


Figure 7-27. Comparison of Dytran® and ANSYS® Mid-Surface In-Plane Shear Stresses at θ=45° for Two-Component Seismic Excitation.

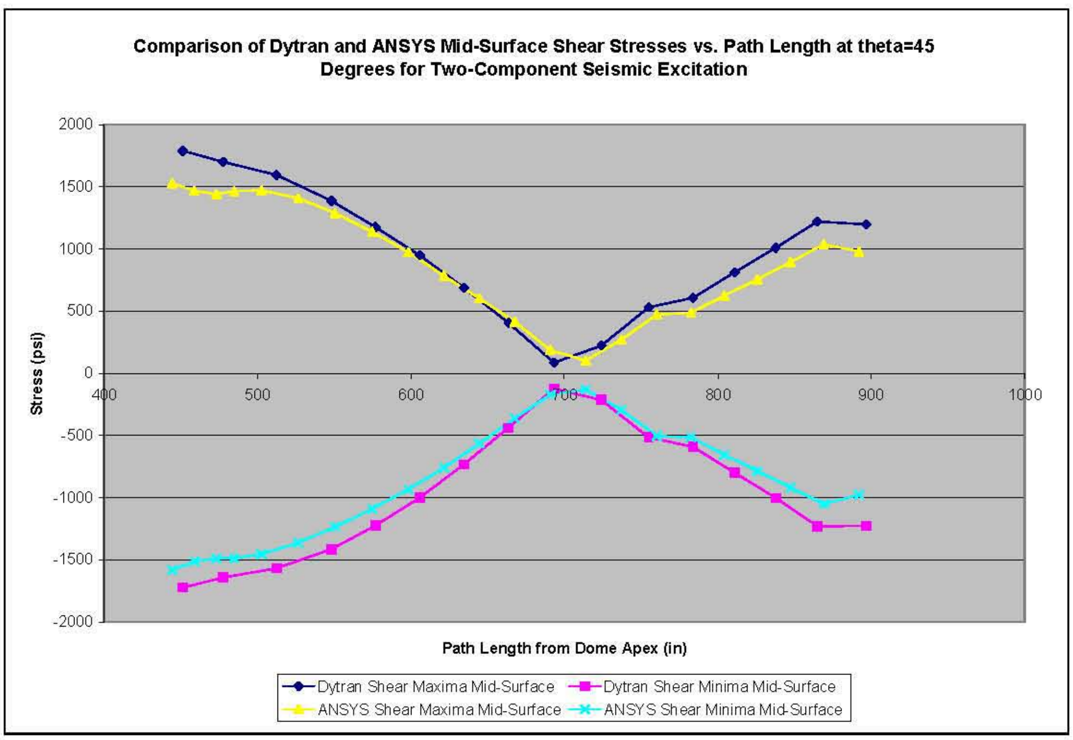
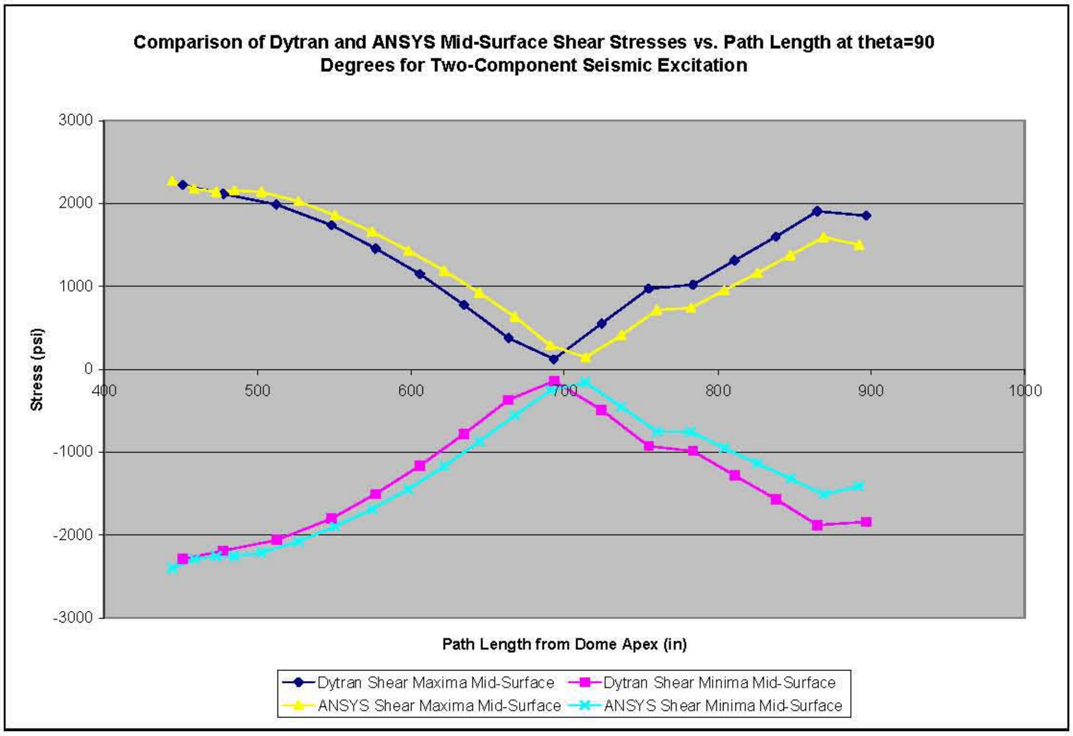


Figure 7-28. Comparison of Dytran® and ANSYS® Mid-Surface In-Plane Shear Stresses at θ=90° for Two-Component Seismic Excitation.



7.4.4 Two-Component Motion Comparisons for Various Models

The data in this section are presented to illustrate the differences in stress results that are attributable to the differences between the global model and the sub-models, and to differences in primary tank stresses due to different soil and concrete conditions. Differences between the global ANSYS® model and the sub-models include the method of excitation, a slight shifting of fundamental impulsive frequency between the models, and model configuration differences including J-bolts, soil, and the lack of or presence of rigid regions.

A minor point that was considered while reviewing the ANSYS® data presented in Figure 7-29 and Figure 7-30 is that the maximum stresses shown actually represent the maximum signed magnitude of the stresses extracted from the ANSYS® model. That is, in regions where the ANSYS® stresses are negative, the ANSYS® traces could represent the minimum rather than the maximum stress. This potential inconsistency does not appear in the stress distributions used for the actual primary tank evaluation, and it does not affect the data in Figure 7-31 because all those stresses are positive.

Figure 7-29. Primary Tank Maximum Mid-Surface Hoop Stress Comparisons for Various Models at θ=0°.

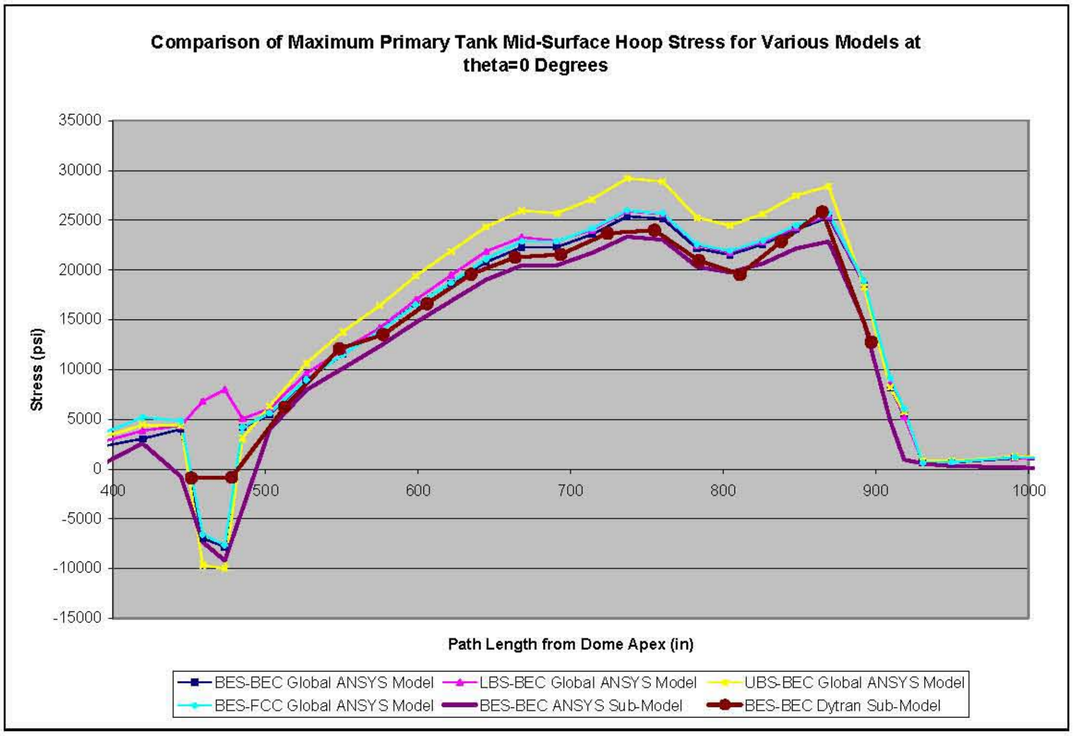


Figure 7-30. Primary Tank Maximum Mid-Surface Meridional Stress Comparisons for Various Models at θ=0°.

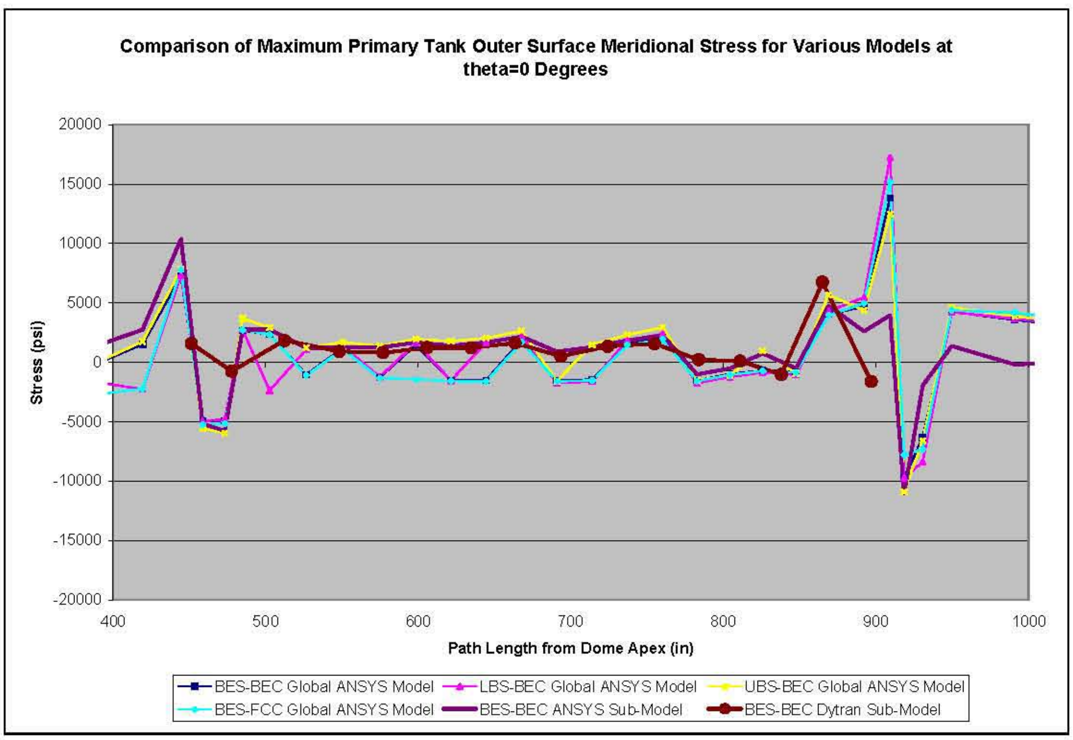
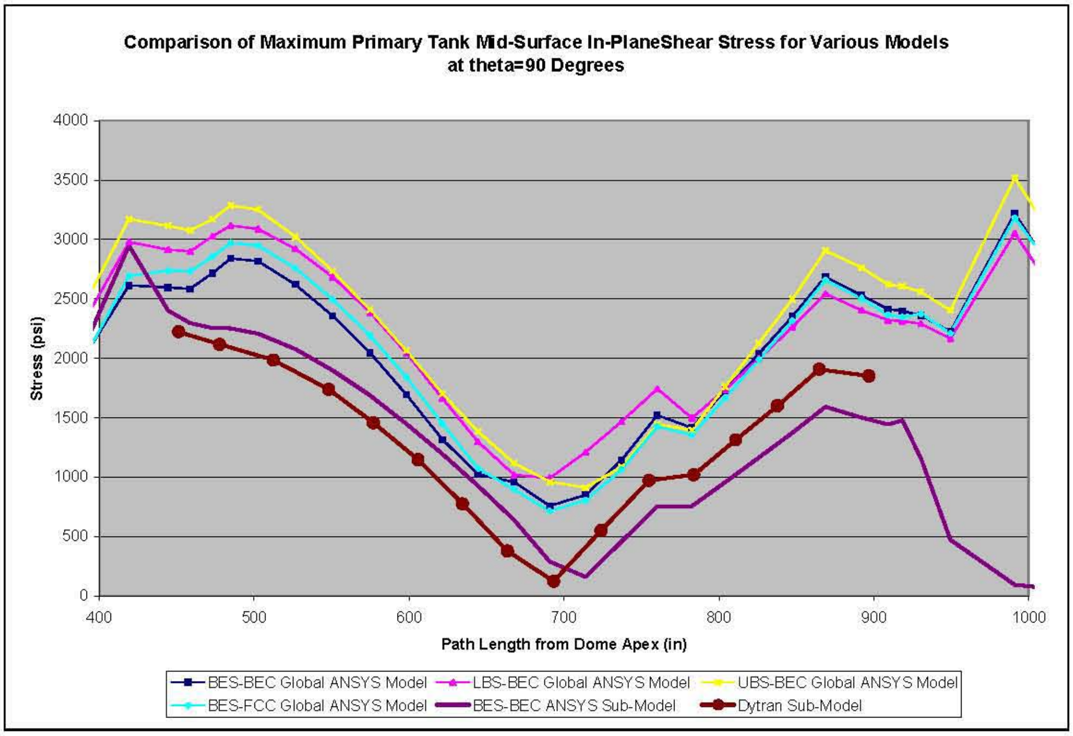


Figure 7-31. Primary Tank Maximum Mid-Surface Shear Stress Comparisons for Various Models at θ=0°.



8.0 ANSYS® GLOBAL MODEL FREE-FIELD SPECTRA

This section presents a comparison between response spectra extracted at the lateral boundary of the global model, and free-field spectra from SHAKE. The intent is to demonstrate that the spectra extractred from the global ANSYS model meet the spectral requirements discussed in Rinker et al. (2006a, 2006b, and 2006d) and that the lateral boundary of the global model is sufficiently far from the tank structure to essentially reproduce the free-field response. Further discussion of the extent of the lateral boundary of the model is presented in Rinker et al. (2006b).

Similar spectral comparisons are presented in Rinker et al. (2006d) for the baseline liquid level of 422 in. at a specific gravity of 1.7, but the spectra shown in the following sections are from the global model with the increased liquid level of 460 in. and the increased specific gravity of 1.83.

Due to the large amount of data, only plots summarizing the results are presented in this section. For more detailed results, see the following appendices:

- Lower Bound Soil, Best Estimate Concrete — Appendix F
- Best Estimate Soil, Best Estimate Concrete — Appendix G
- Upper Bound Soil, Best Estimate Concrete — Appendix H
- Best Estimate Soil, Fully Cracked Concrete — Appendix I

All data was extracted for the full transient analysis (gravity loading plus 2,048 step seismic loading) and summarized using ANSYS® ® to obtain the minimum and maximum values. Both the full time history data and summary data are available electronically.

As discussed in Section 2.5, four separate load cases have been run. One check to ensure that the correct loading was applied during the transient analysis is to compare the response spectra at the edge of the model to the free-field, or design basis response spectra. For each load case, horizontal and vertical spectra have been extracted at both the surface and at -57 ft (base of tank) for comparison.

8.1 LOWER BOUND SOIL, BEST ESTIMATE CONCRETE

For the lower bound soil case, the ANSYS spectra are compared to the SHAKE spectra at the surface and tank base. In the lower bound soil, the time histories at the base of the model have been increased by scale factors of 1.175 and 1.12 for horizontal and vertical accelerations respectively in order to meet the minimum spectral requirements. Further discussion of scale factors and requirements for the response spectra is presented in the baseline seismic analysis reported in Rinker et al. (2006a, 2006b, and 2006d). As can be seen in Figure 8-1 through Figure 8-4, there is a good match between the ANSYS model free-field response and the free-field response from SHAKE. This demonstrates that the desired ground motions occur in the ANSYS model.

Figure 8-1. 5% Damped Horizontal Response Spectra Comparison, Surface (LBS-BEC).

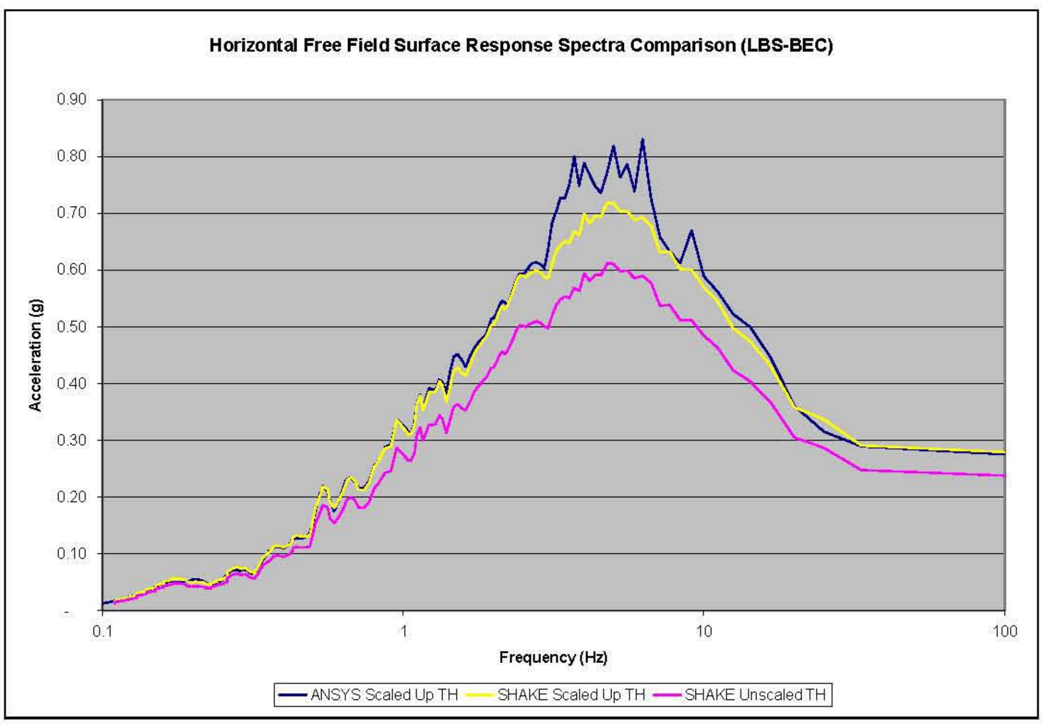


Figure 8-2. 5% Damped Horizontal Response Spectra, Tank Bottom (LBS-BEC).

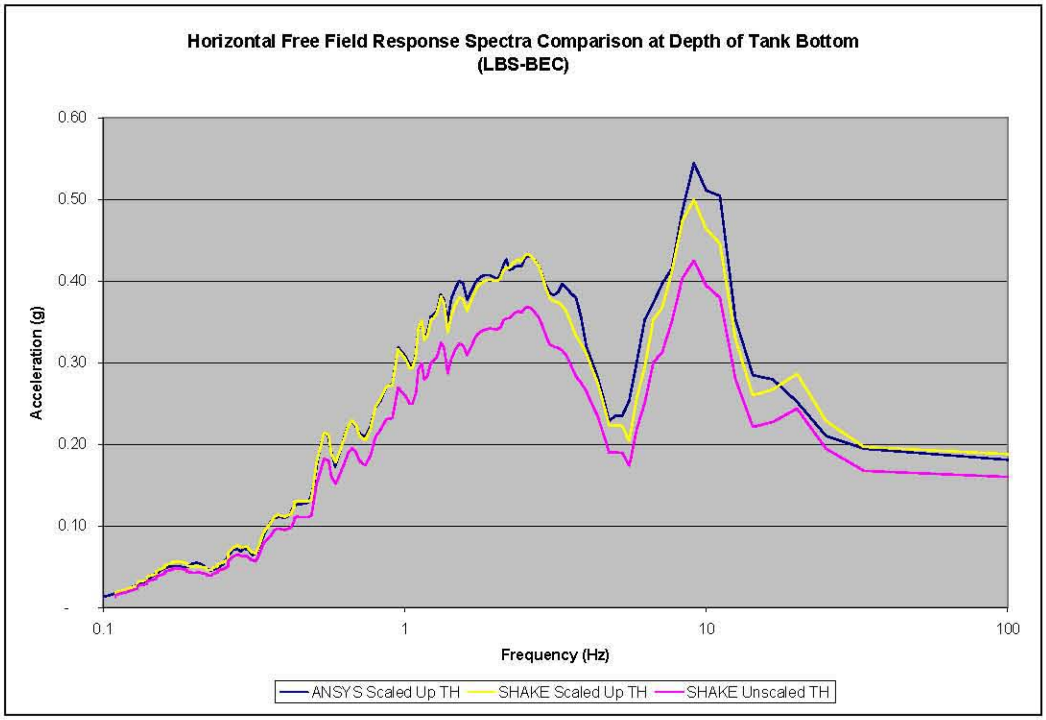


Figure 8-3. 5% Damped Vertical Response Spectra Comparison, Surface (LBS-BEC).

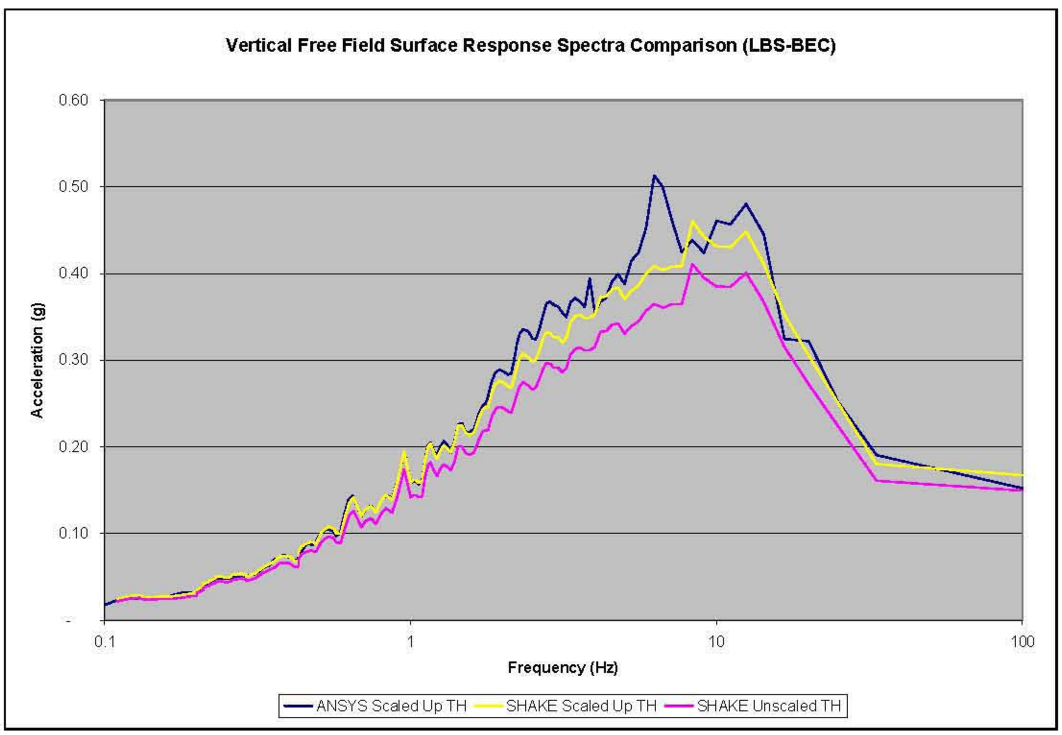
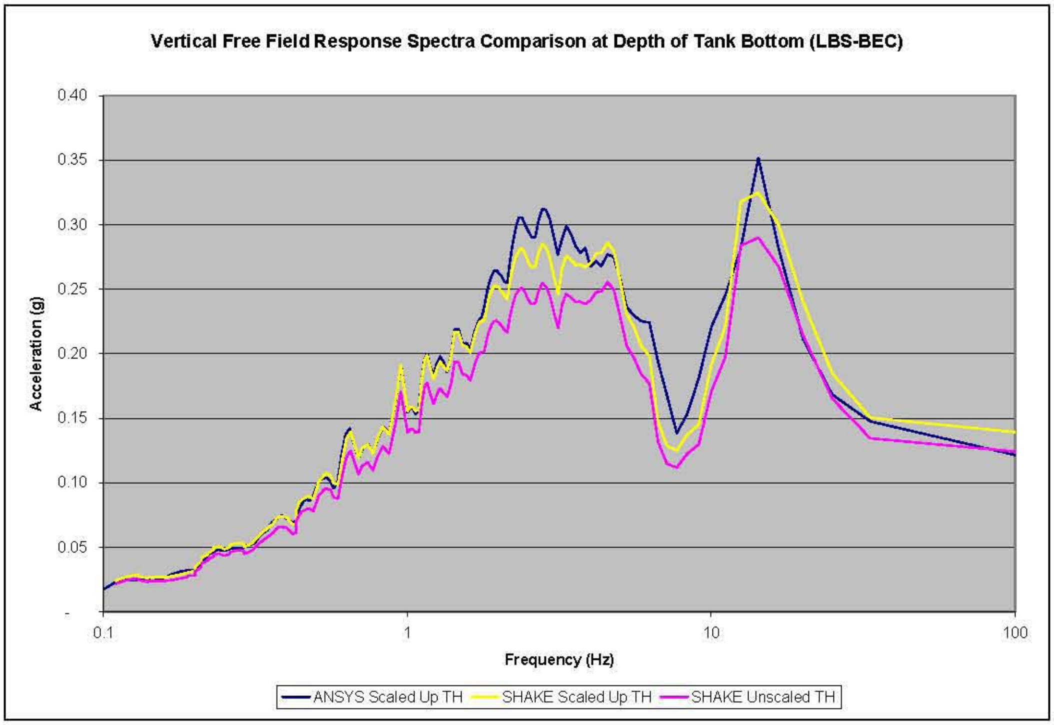


Figure 8-4. 5% Damped Vertical Response Spectra, Tank Bottom (LBS-BEC).



8.2 BEST ESTIMATE SOIL, BEST ESTIMATE CONCRETE

For the best estimate soil, no scale factors have been applied to the base acceleration time histories. As can be seen in Figure 8-5 through Figure 8-8, there is a good match between the free-field response from the ANSYS model and the free-field response from SHAKE.

Figure 8-5. 5% Damped Horizontal Response Spectra Comparison, Surface (BES-BEC).

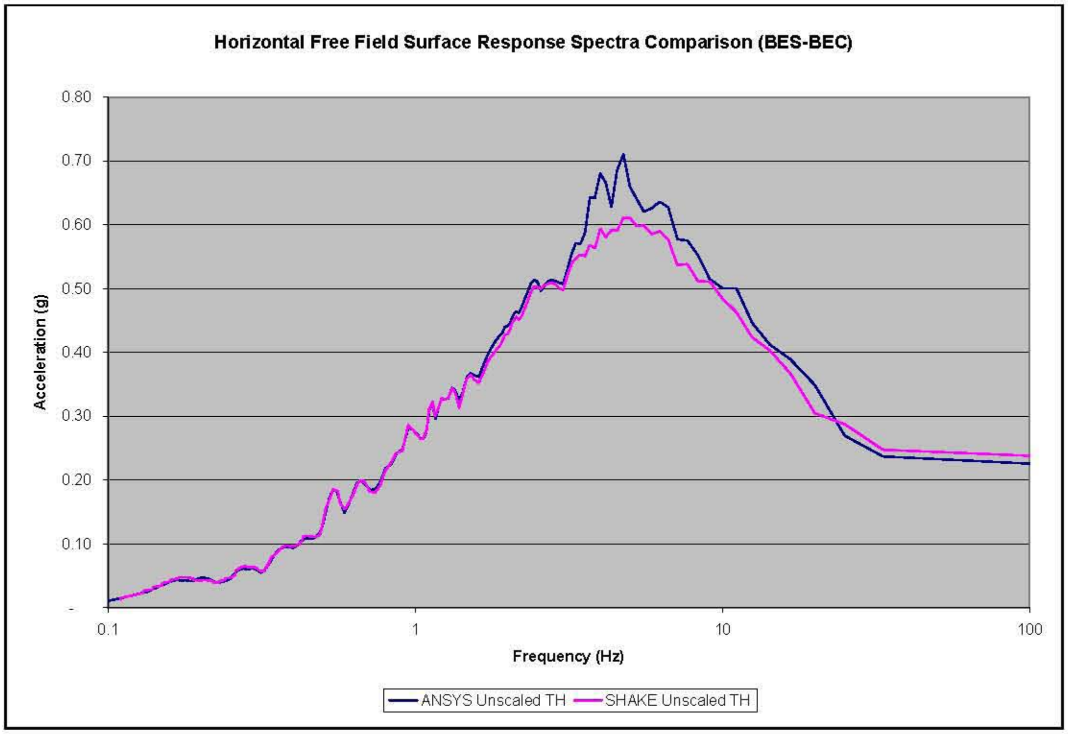


Figure 8-6. 5% Damped Horizontal Response Spectra, Tank Bottom (BES-BEC).

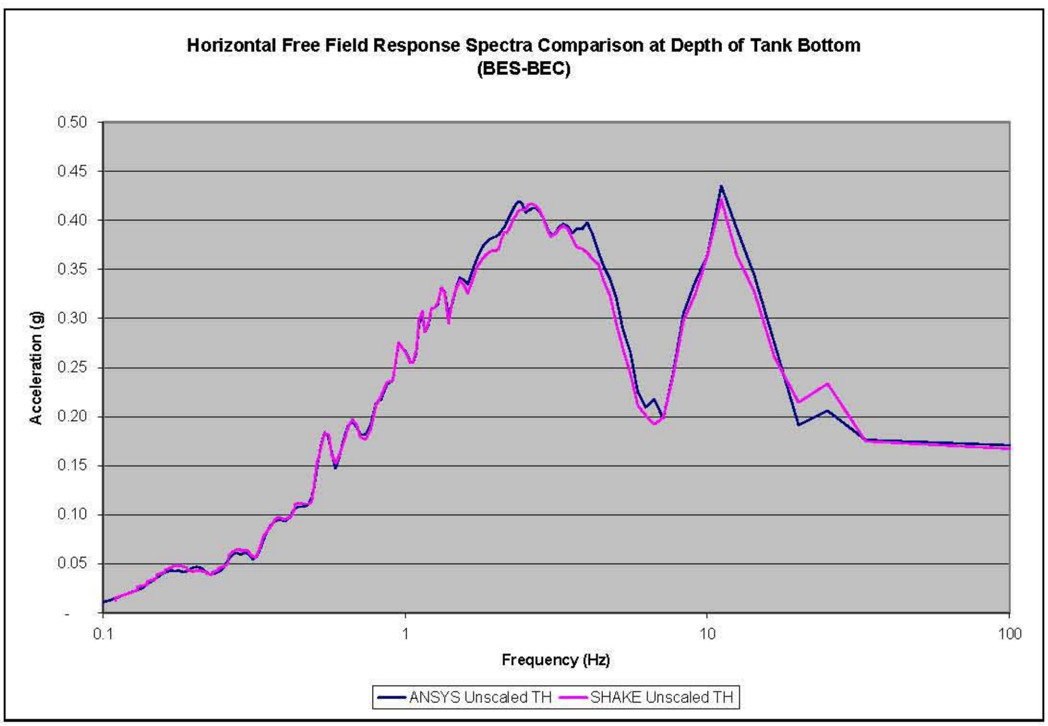


Figure 8-7. 5% Damped Vertical Response Spectra Comparison, Surface (BES-BEC).

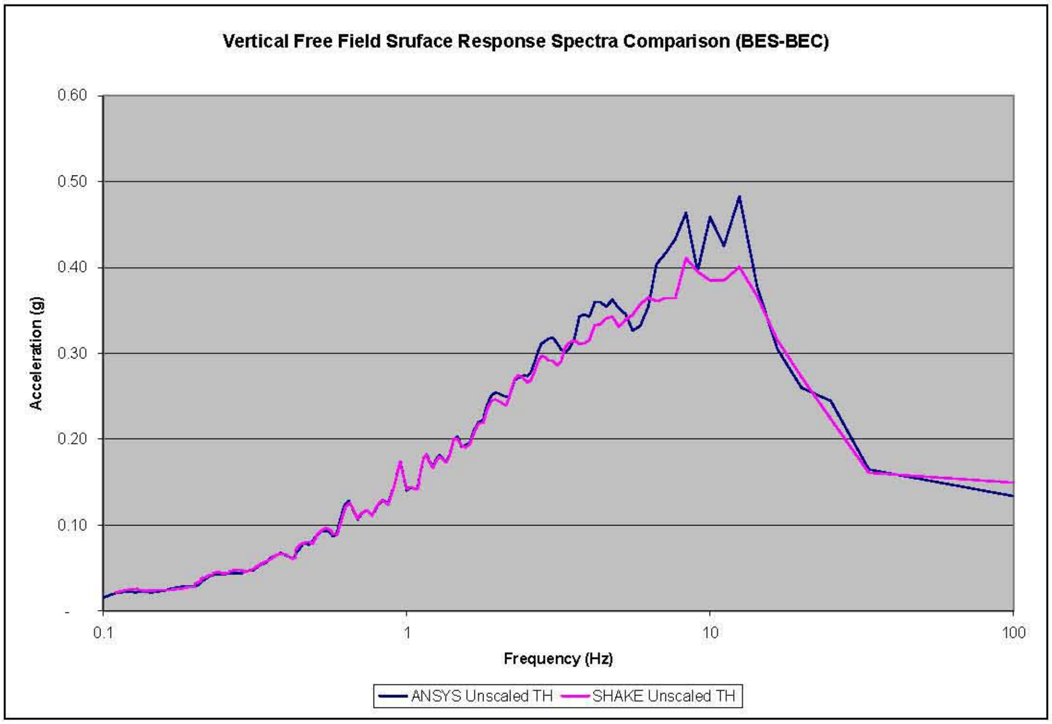
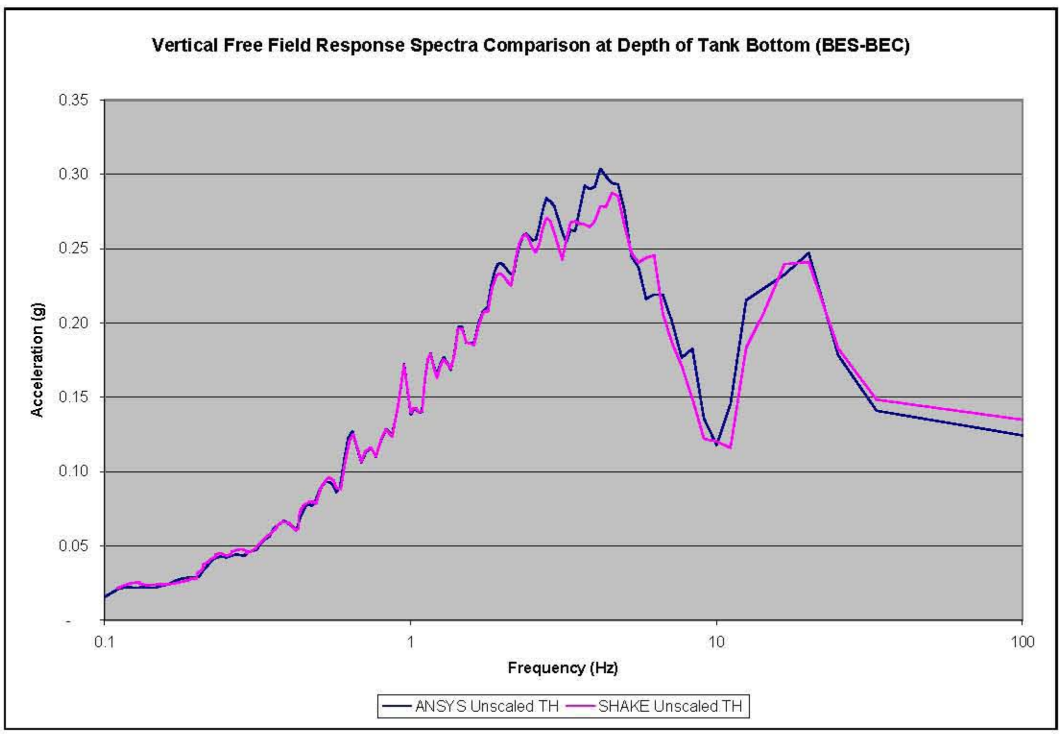


Figure 8-8. 5% Damped Vertical Response Spectra, Tank Bottom (BES-BEC).



8.3 UPPER BOUND SOIL, BEST ESTIMATE CONCRETE

For the upper bound soil case, the ANSYS spectra are compared to the SHAKE spectra at the surface and tank base. In the upper bound soil, the time histories at the base of the model have been increased by scale factors of 1.12 and 1.19 for horizontal and vertical accelerations respectively in order to meet the minimum spectral requirements. Further discussion of scale factors and requirements for the response spectra is presented in the baseline seismic analysis reported in Rinker et al. (2006a, 2006b, and 2006d). As can be seen in Figure 8-9 through Figure 8-12, there is a good match between the ANSYS model free-field response and the free-field response from SHAKE. This demonstrates that the desired ground motions occur in the ANSYS model.

Figure 8-9. 5% Damped Horizontal Response Spectra Comparison, Surface (UBS-BEC).

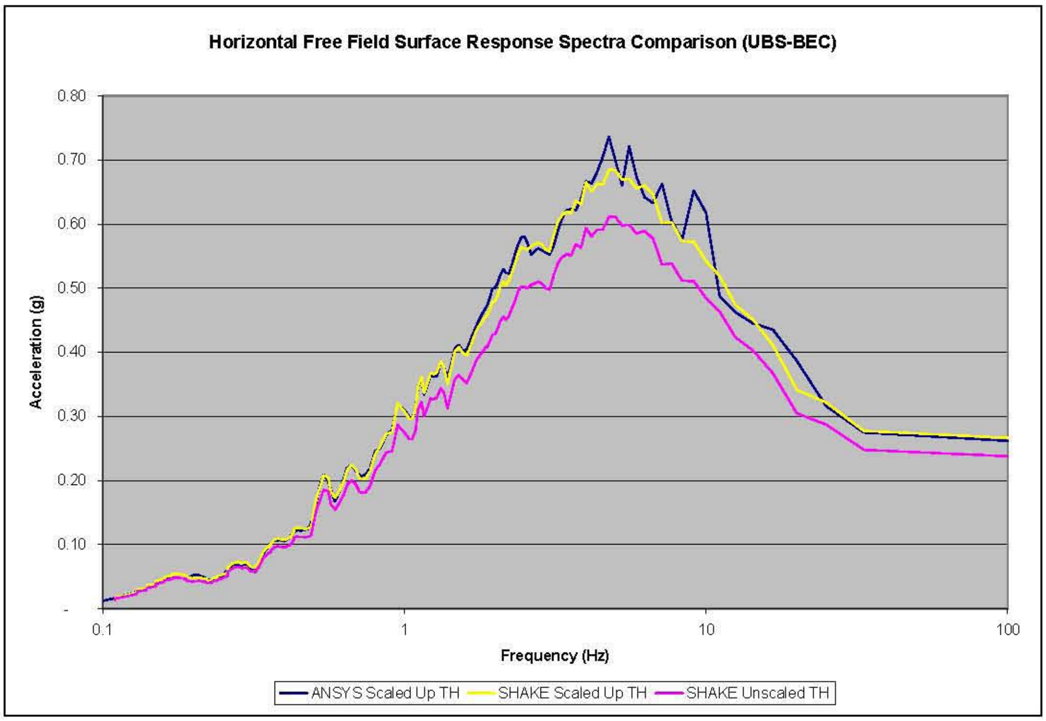


Figure 8-10. 5% Damped Horizontal Response Spectra, Tank Bottom (UBS-BEC).

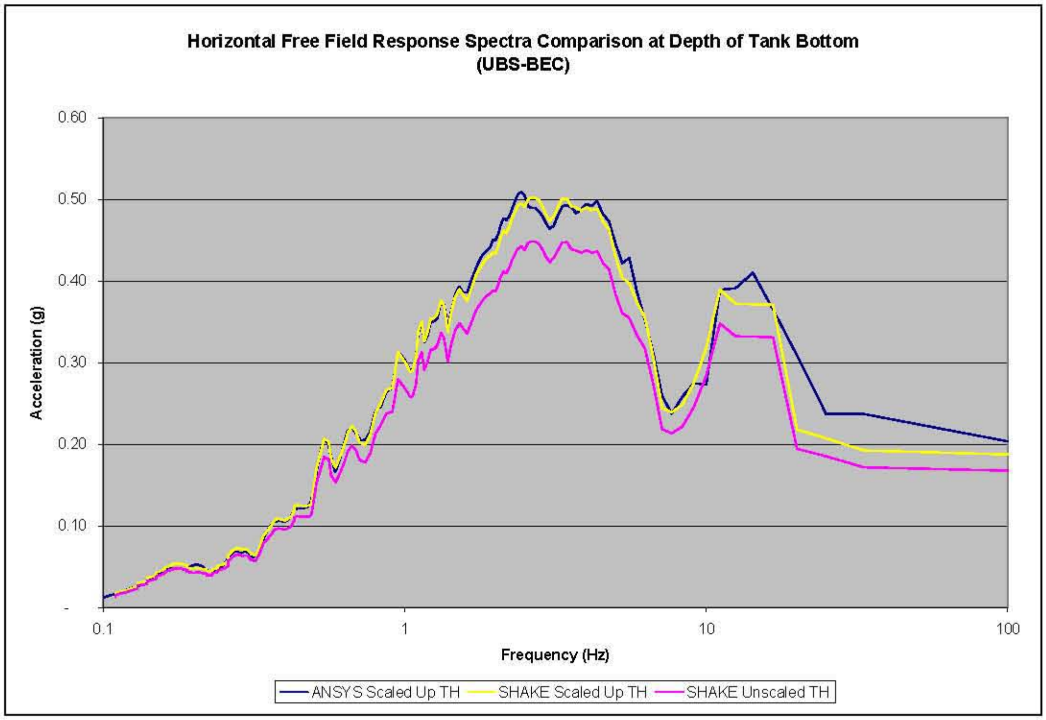


Figure 8-11. 5% Damped Vertical Response Spectra Comparison, Surface (UBS-BEC).

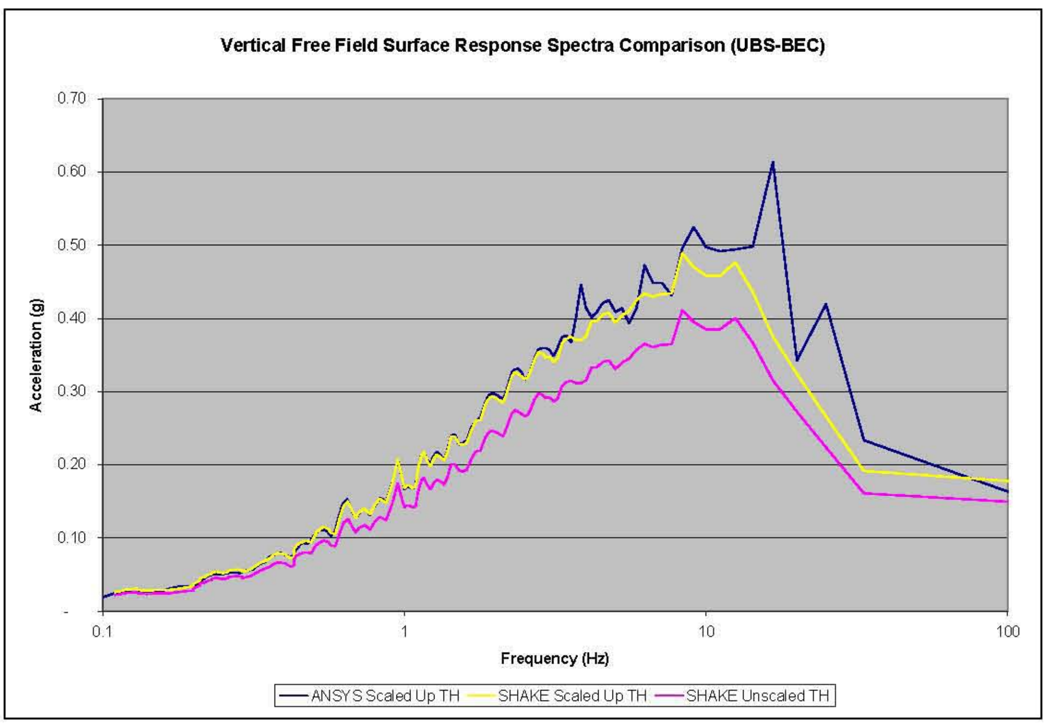
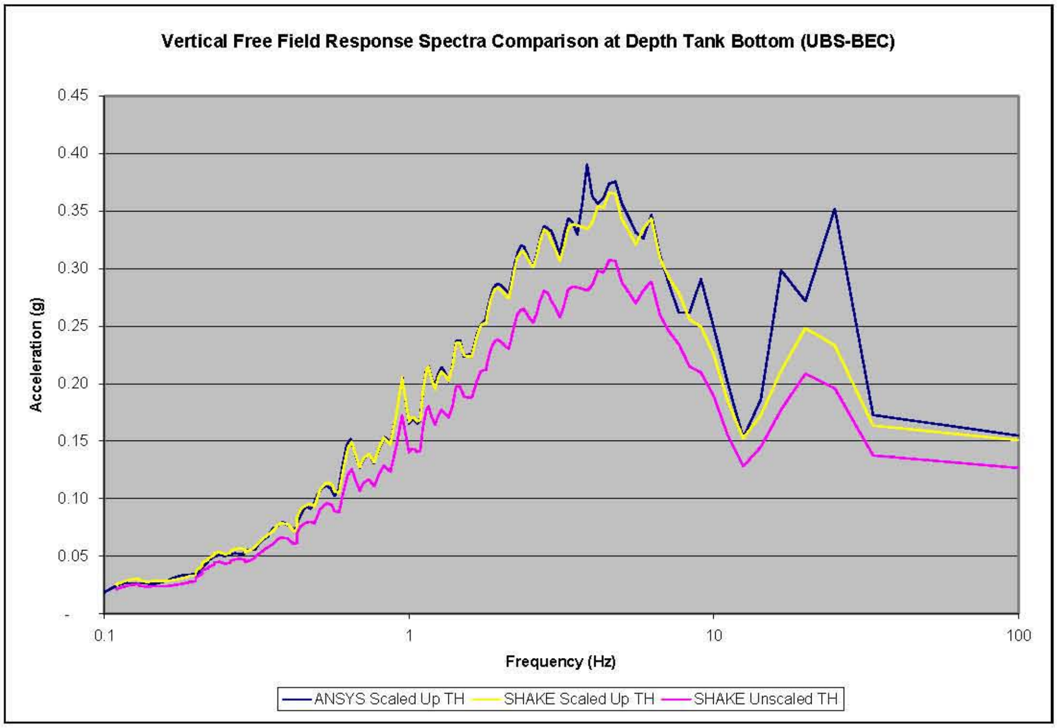


Figure 8-12. 5% Damped Vertical Response Spectra, Tank Bottom (UBS-BEC).



8.4 BEST ESTIMATE SOIL, FULLY CRACKED CONCRETE

For the best estimate soil case, the spectra are compared against the surface and tank base spectra with the appropriate scale factors applied. For the best estimate soil, no scale factors have been applied to the base acceleration time history. As can be seen in Figure 8-13 through Figure 8-16, there is a good match between the model response and the response of the free field as developed by SHAKE. This demonstrates that the size of the soil model is sufficient to capture appropriate behavior and that the desired ground motions occur throughout the model.

Figure 8-13. 5% Damped Horizontal Response Spectra Comparison, Surface (BES-FCC).

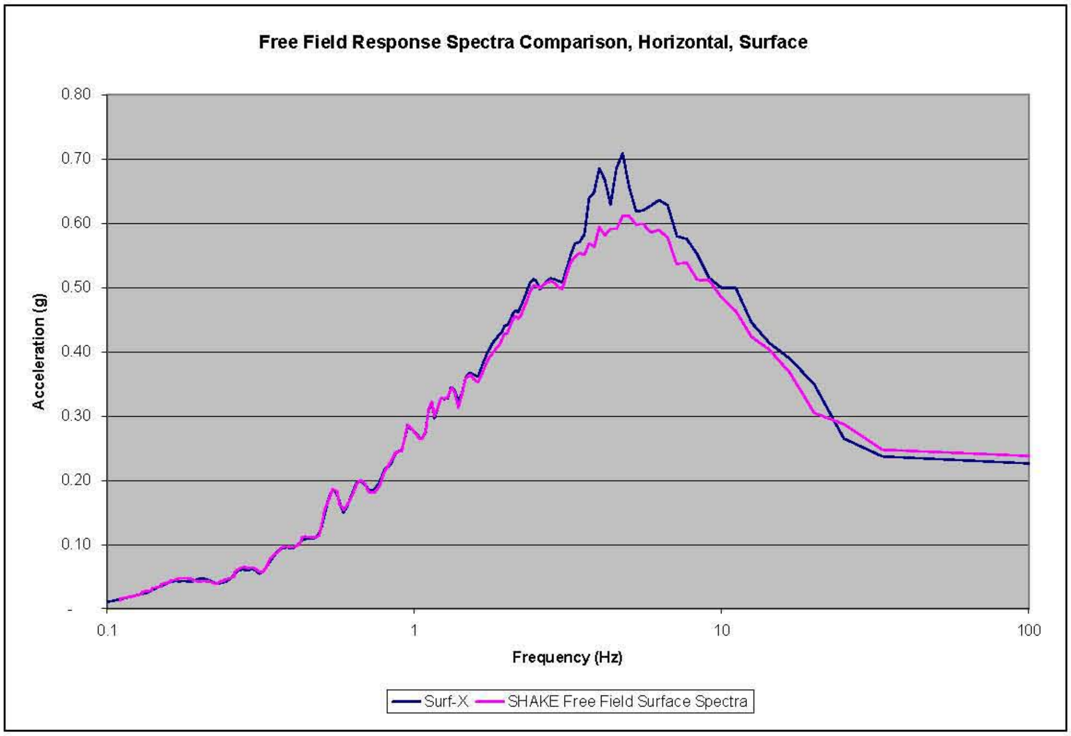


Figure 8-14. 5% Damped Horizontal Response Spectra, Tank Bottom (BES-FCC).

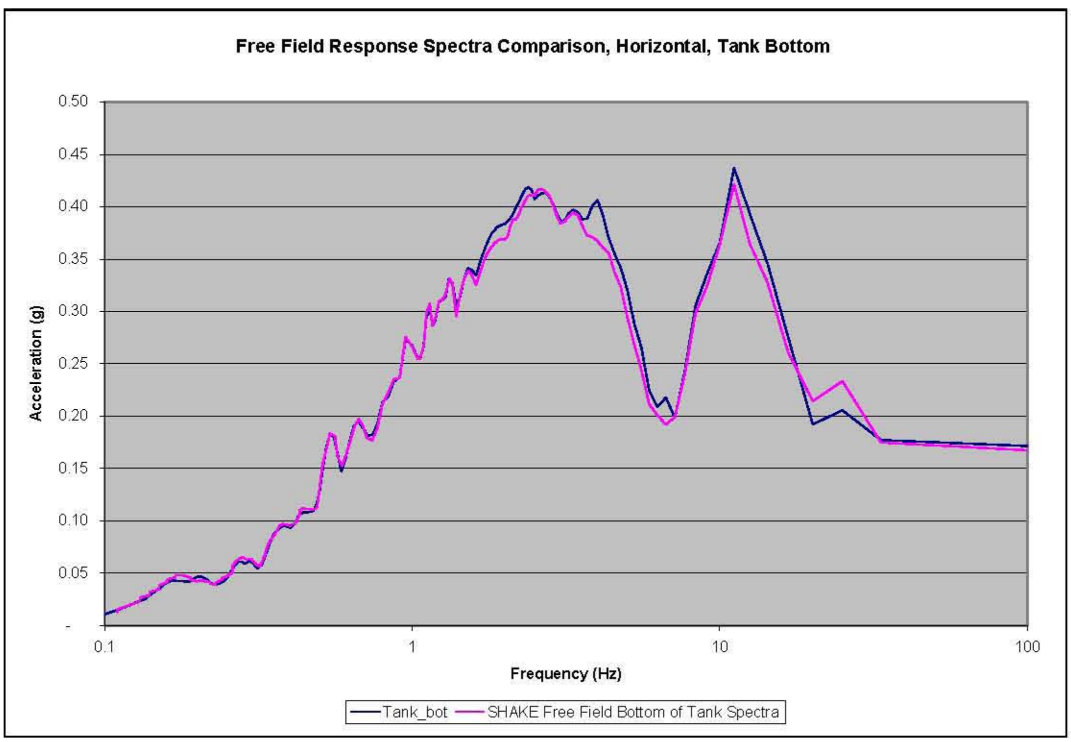


Figure 8-15. 5% Damped Vertical Response Spectra Comparison, Surface (BES-FCC).

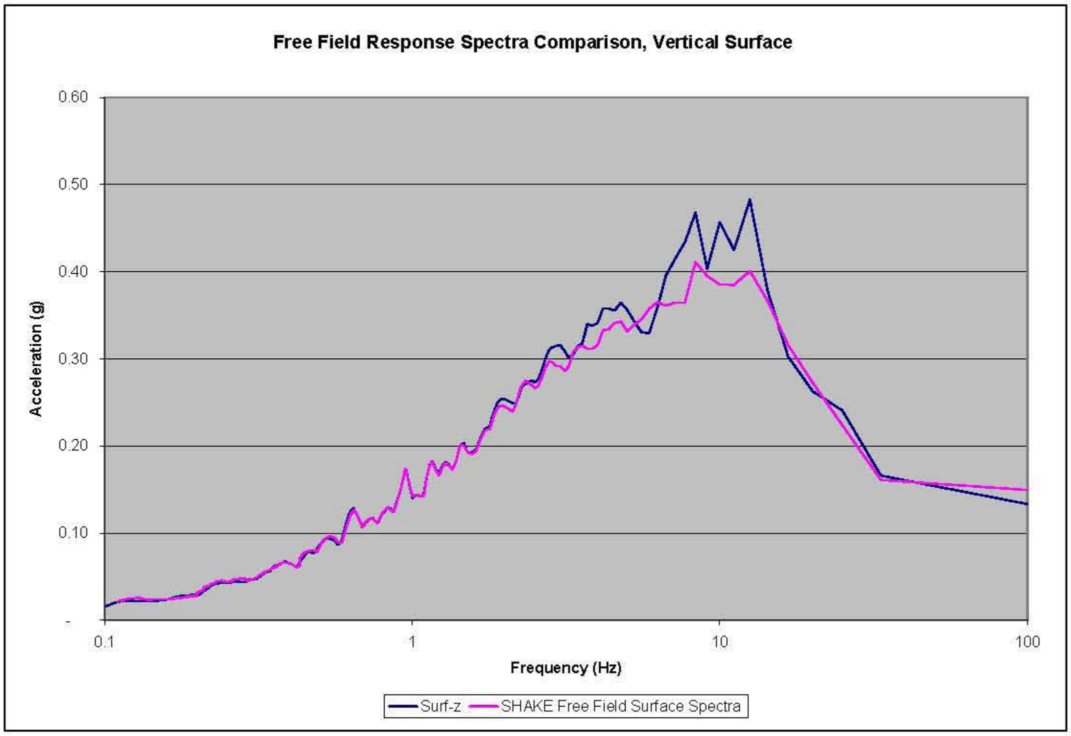
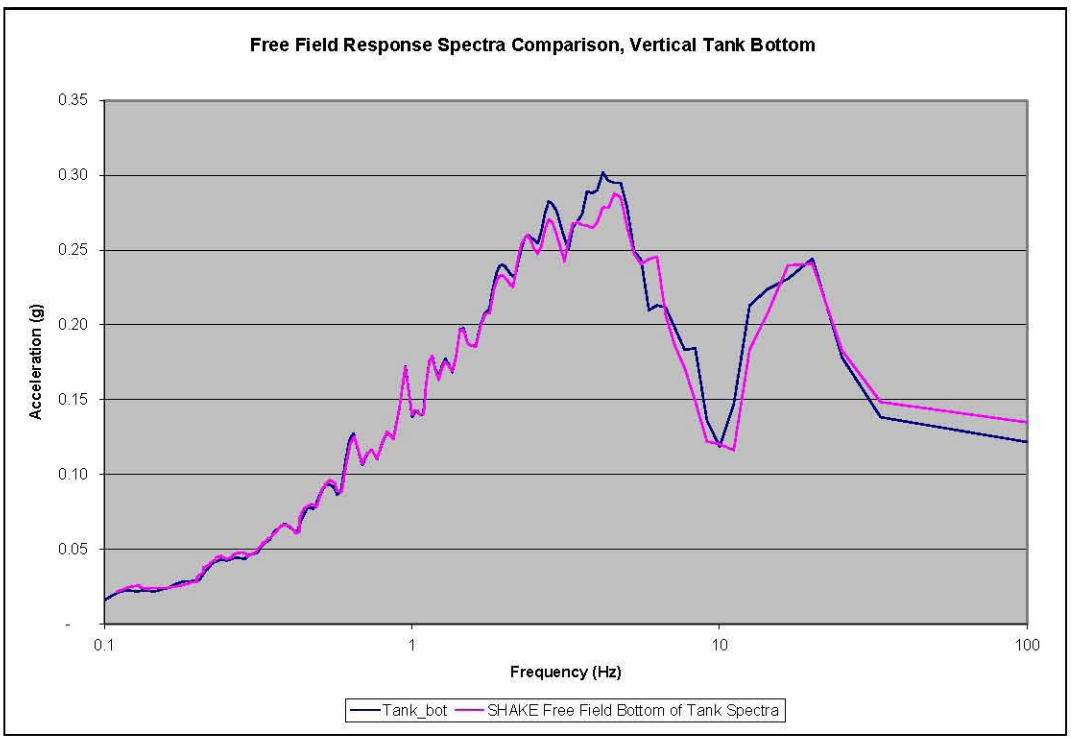


Figure 8-16. 5% Damped Vertical Response Spectra, Tank Bottom (BES-FCC).



9.0 TANK RESULTS

9.1 CONCRETE SHELL

Concrete shell forces and moments are extracted from the model in 9 degree slices, starting near the top of the dome and moving down the wall and across the footing from the outside to the center of the tank. Figure 9-1 show the 1st slice, with element numbers. Each of the subsequent figures shows one component of force or moment, comparing the results from each load case. The results presented for the concrete forces and moments are enveloped minima/maxima around the circumference of the tank.

The following forces/moments for SHELL143 elements were extracted from the model

- SMISC1 Hoop force (Meridional in footing)
- SMISC2 Meridional force (Hoop in footing)
- SMISC3 In-Plane shear force
- SMISC4 Hoop Moment (Meridional in footing)
- SMISC5 Meridional Moment (Hoop in footing)
- SMISC6 Twisting Moment
- SMISC7 Through Wall Shear Force (XZ)
- SMISC8 Through Wall Shear Force (YZ)

Figures are grouped in sets showing the force or moment for gravity only first, total demand from the transient analysis (gravity plus seismic), and then only the seismic portion. The seismic only load is simply the difference between the full transient loading and gravity only. The forces and moments are plotted against a "path" which starts at 0 at the top of the dome, increasing to the center of the footing. Forces and moment have been enveloped circumferentially for these plots. Concrete force/moment plots are as follows:

- Figure 9-2. Concrete Shell Hoop Forces – Gravity Only
- Figure 9-3. Concrete Shell Hoop Forces – Gravity Plus Seismic
- Figure 9-4. Concrete Shell Hoop Forces – Seismic Only
- Figure 9-5. Concrete Shell Meridional Forces – Gravity Only
- Figure 9-6. Concrete Shell Meridional Forces – Gravity Plus Seismic
- Figure 9-7. Concrete Shell Meridional Forces – Seismic Only
- Figure 9-8. Concrete Shell Hoop Moments – Gravity Only
- Figure 9-9. Concrete Shell Hoop Moments – Gravity Plus Seismic
- Figure 9-10. Concrete Shell Hoop Moments – Seismic Only
- Figure 9-11. Concrete Shell Meridional Moments – Gravity Only
- Figure 9-12. Concrete Shell Meridional Moments – Gravity Plus Seismic
- Figure 9-13. Concrete Shell Meridional – Seismic Only
- Figure 9-14. Concrete Shell In-Plane Shear Forces – Gravity Only
- Figure 9-15. Concrete Shell In-Plane Shear Forces – Gravity Plus Seismic
- Figure 9-16. Concrete Shell In-Plane Shear Forces – Seismic Only
- Figure 9-17. Concrete Shell Through-Wall Shear Forces – Gravity Only

- Figure 9-18. Concrete Shell Through-Wall Shear Forces – Gravity Plus Seismic
- Figure 9-19. Concrete Shell Through-Wall Shear Forces – Seismic Only

Results for through wall shear forces are the envelope of SMISC7 and SMISC8. No results are presented for SMISC6, the element XY moment.

Figure 9-1. Concrete Shell Element Retreival Sequence Starting Numbers.

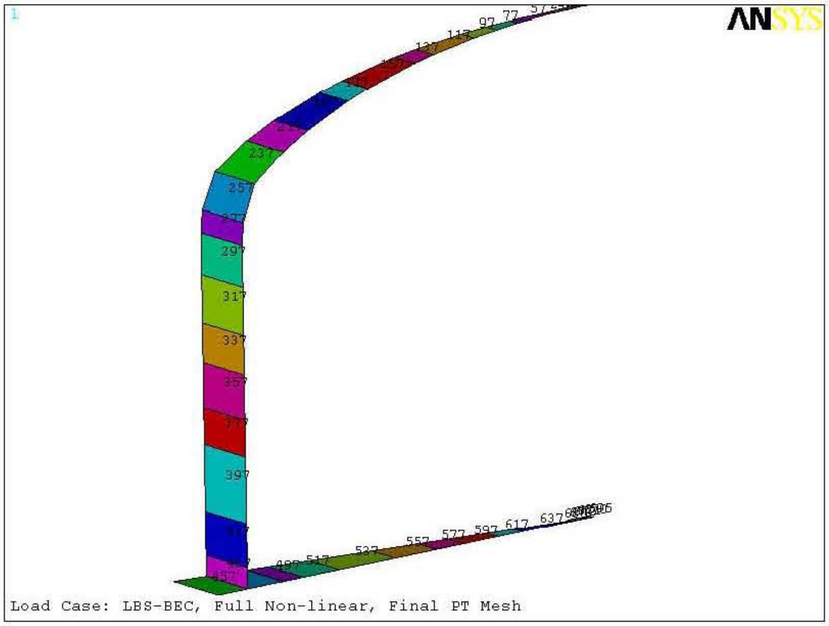


Figure 9-2. Concrete Shell Hoop Forces – Gravity Only.

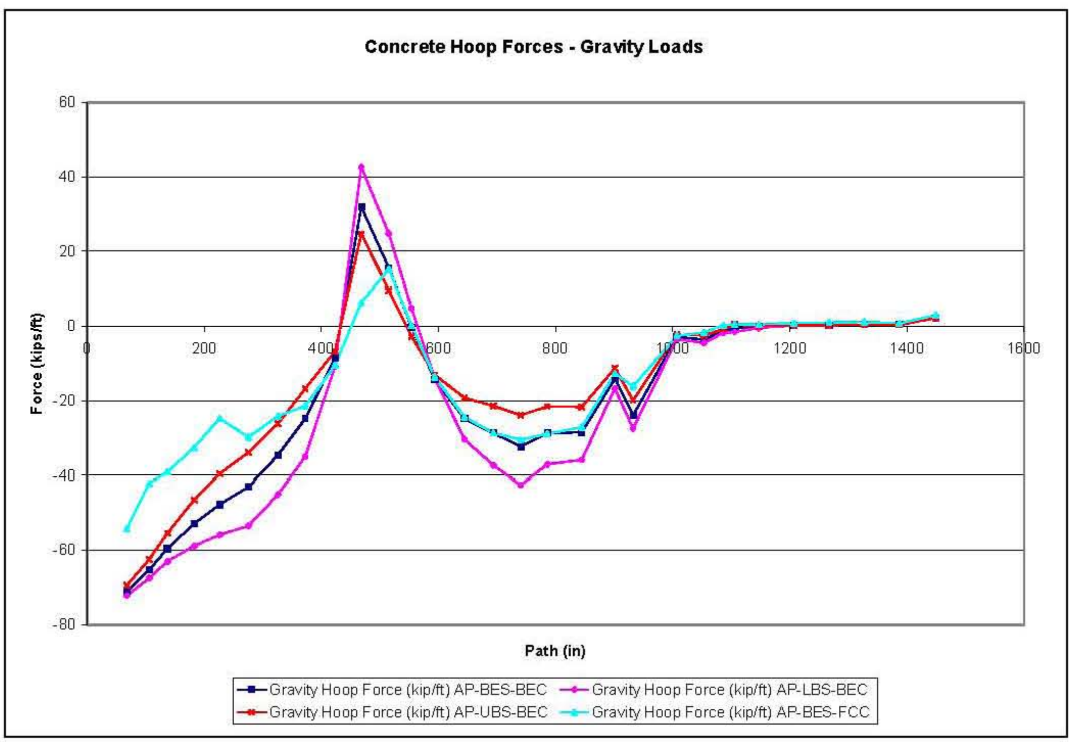


Figure 9-3. Concrete Shell Hoop Forces – Gravity Plus Seismic.

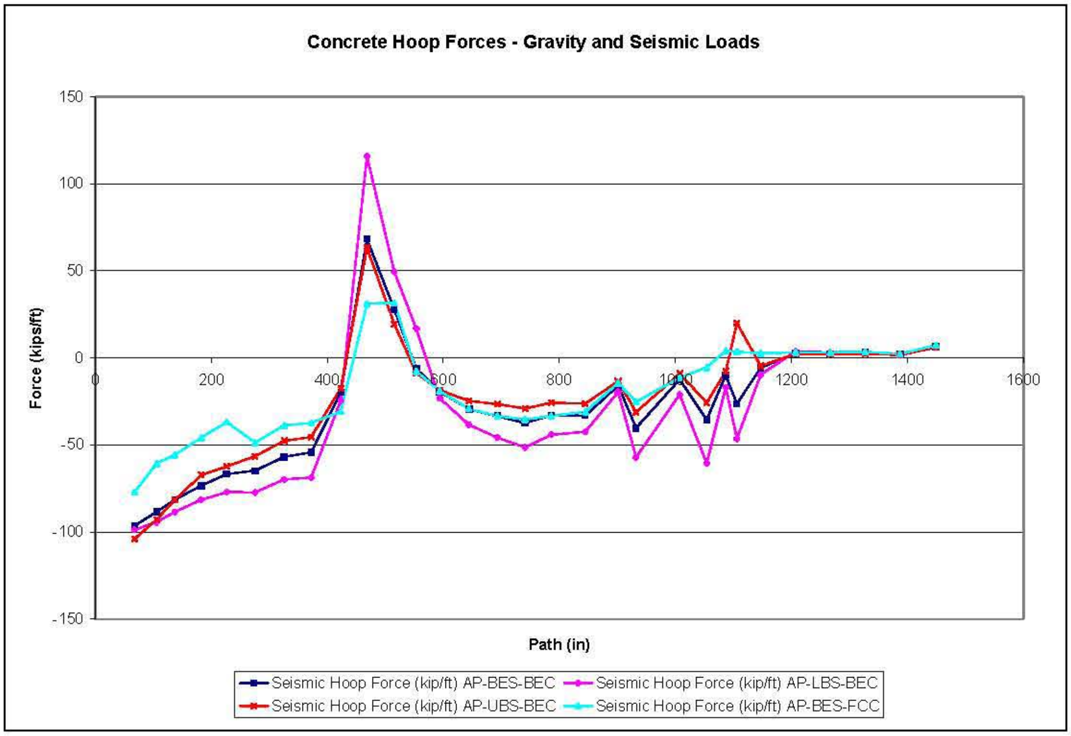


Figure 9-4. Concrete Shell Hoop Forces – Seismic Only.

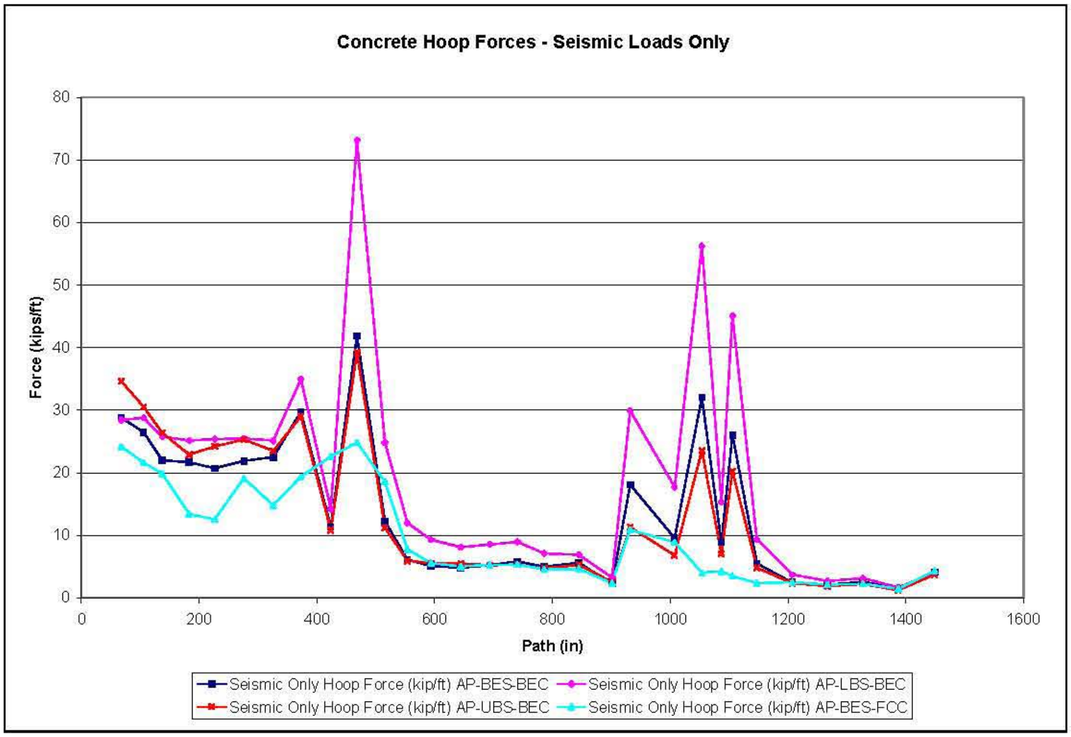


Figure 9-5. Concrete Shell Meridional Forces – Gravity Only.

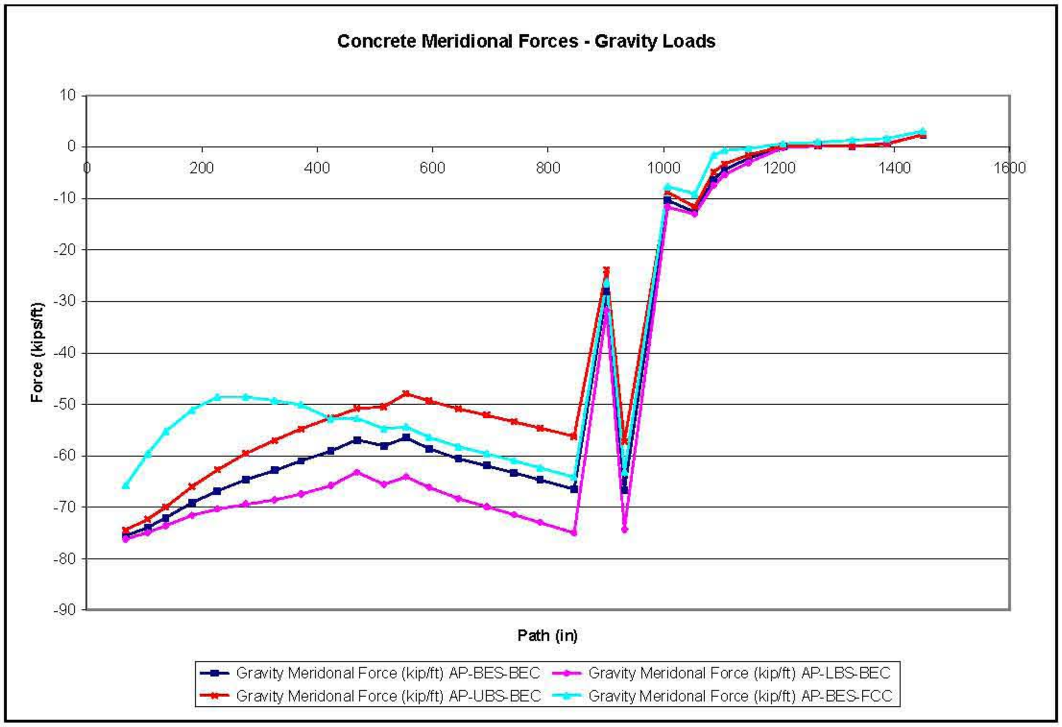


Figure 9-6. Concrete Shell Meridional Forces – Gravity Plus Seismic.

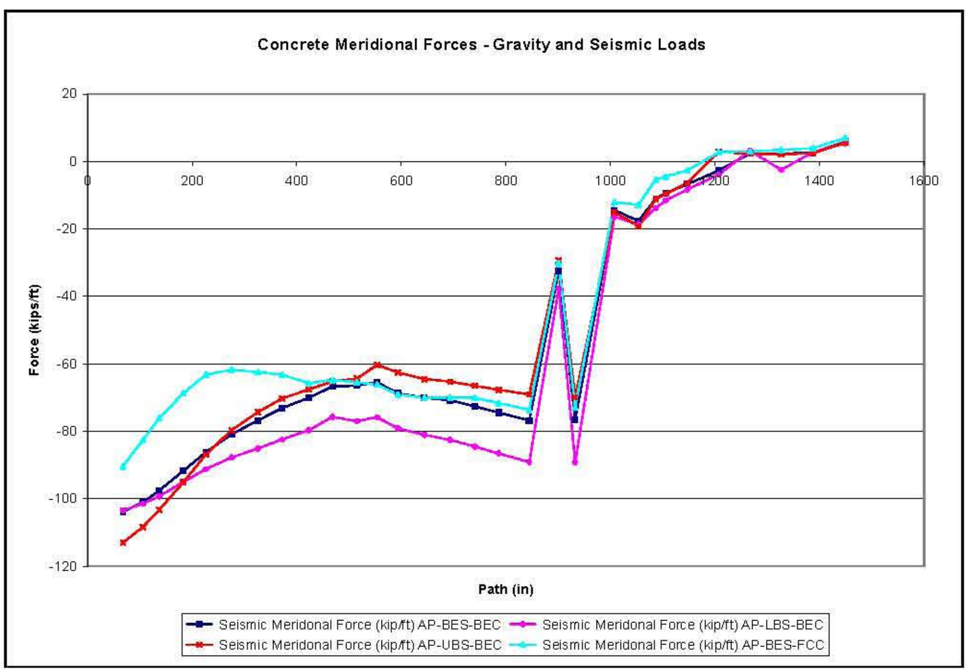


Figure 9-7. Concrete Shell Meridional Forces – Seismic Only.

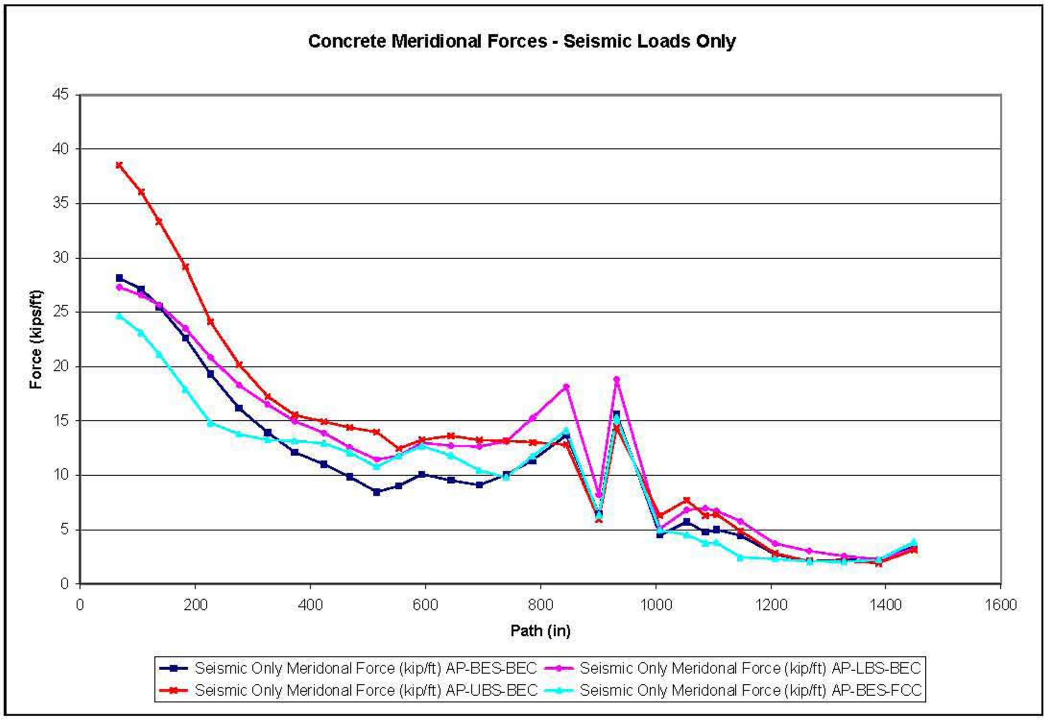


Figure 9-8. Concrete Shell Hoop Moments – Gravity Only.

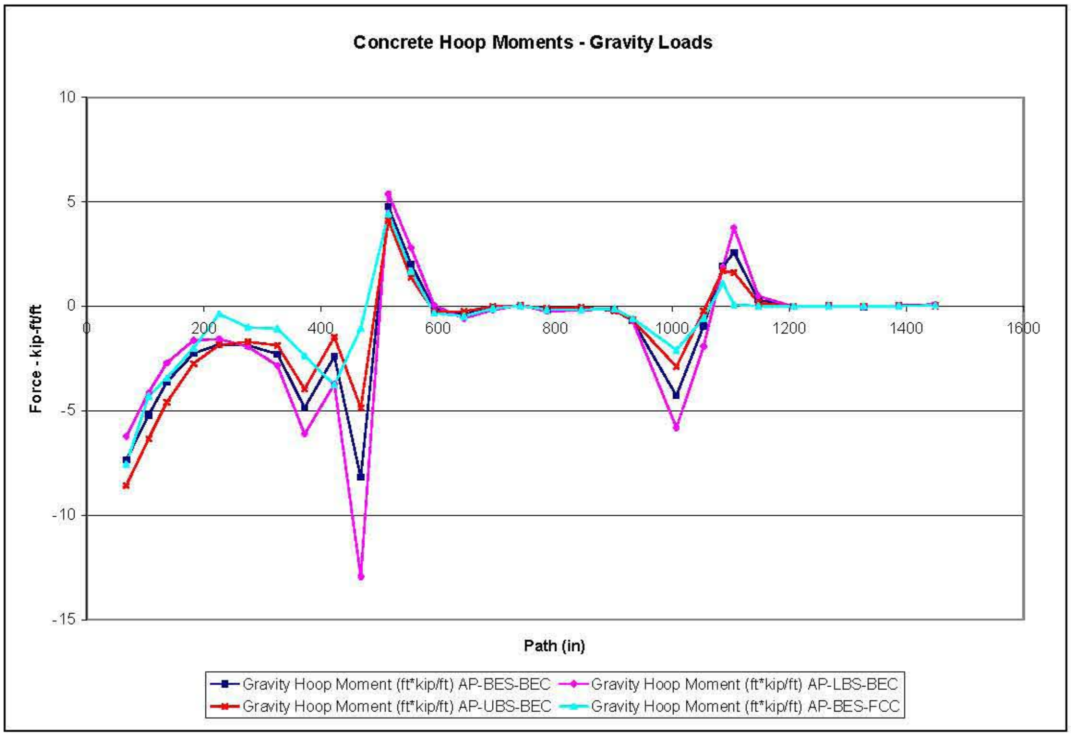


Figure 9-9. Concrete Shell Hoop Moments – Gravity Plus Seismic.

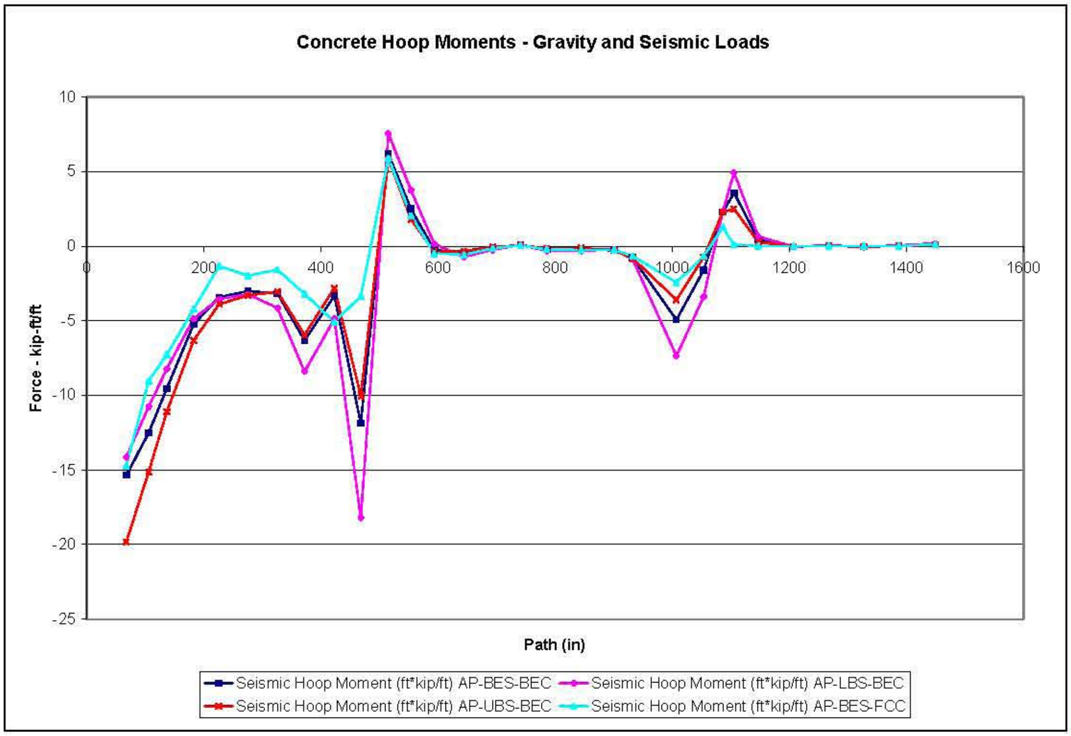


Figure 9-10. Concrete Shell Hoop Moments – Seismic Only.

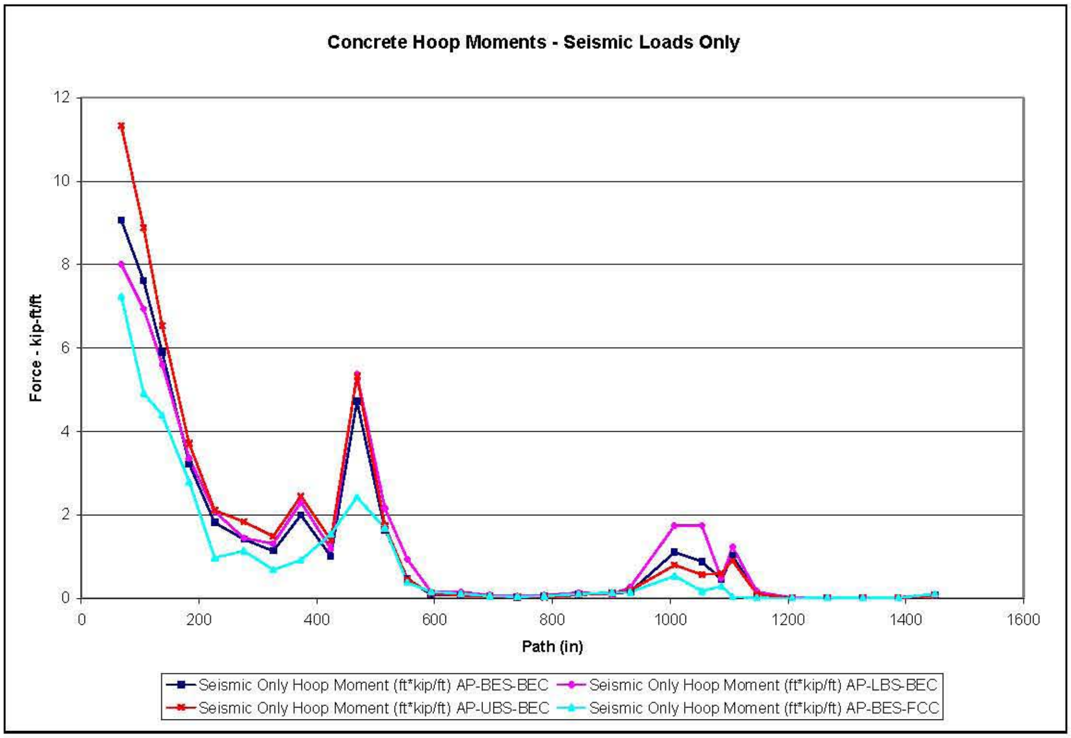


Figure 9-11. Concrete Shell Meridional Moments – Gravity Only.

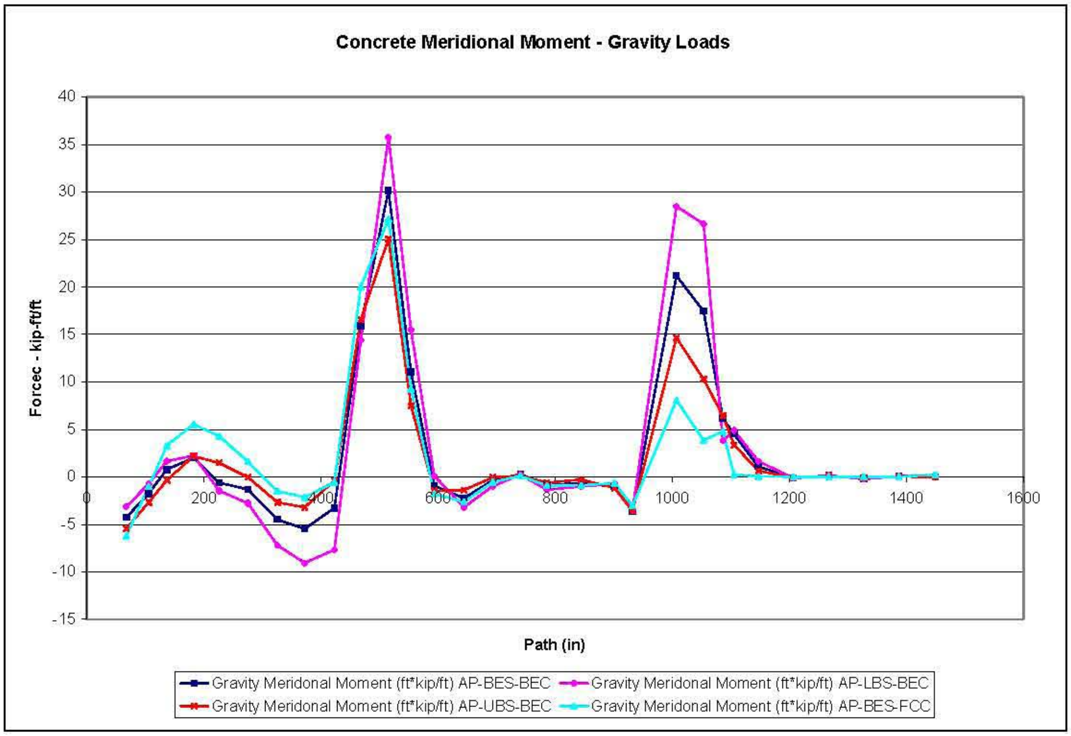


Figure 9-12. Concrete Shell Meridional Moments – Gravity Plus Seismic.

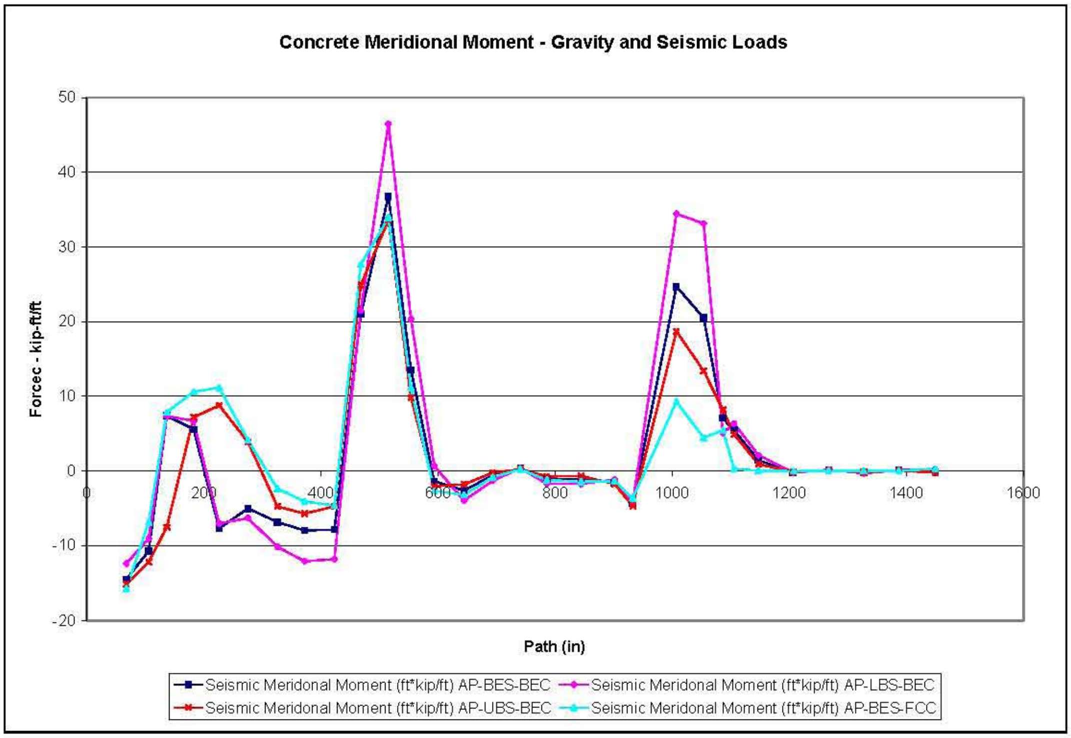


Figure 9-13. Concrete Shell Meridional – Seismic Only.

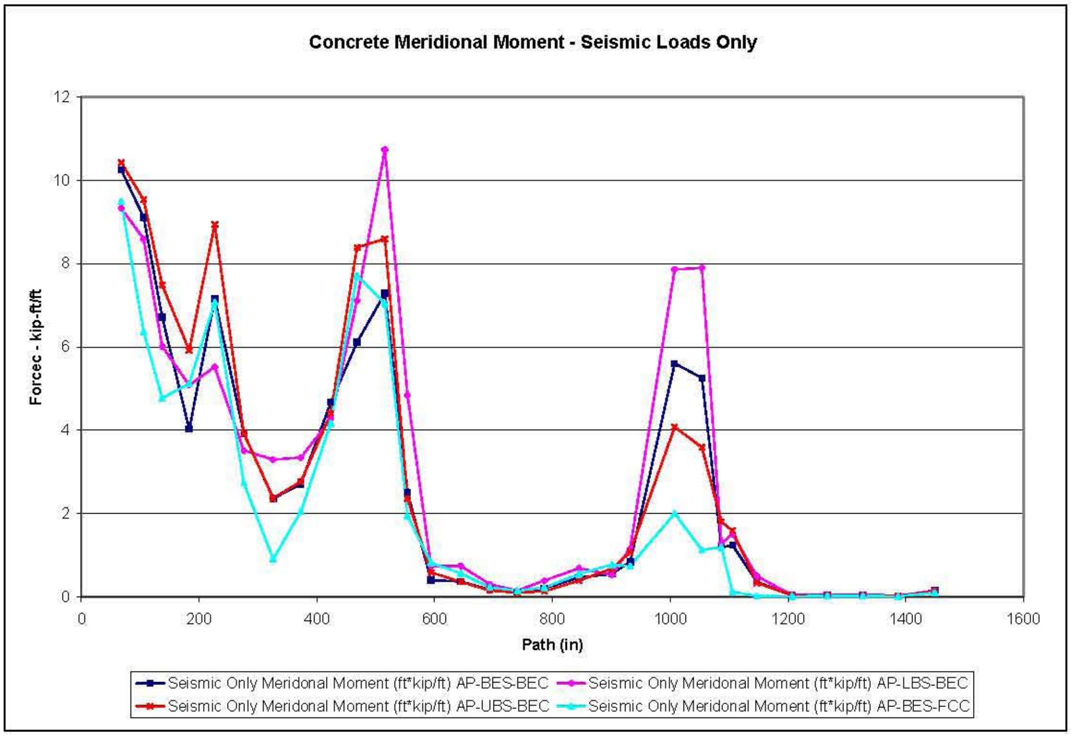


Figure 9-14. Concrete Shell In-Plane Shear Forces – Gravity Only.

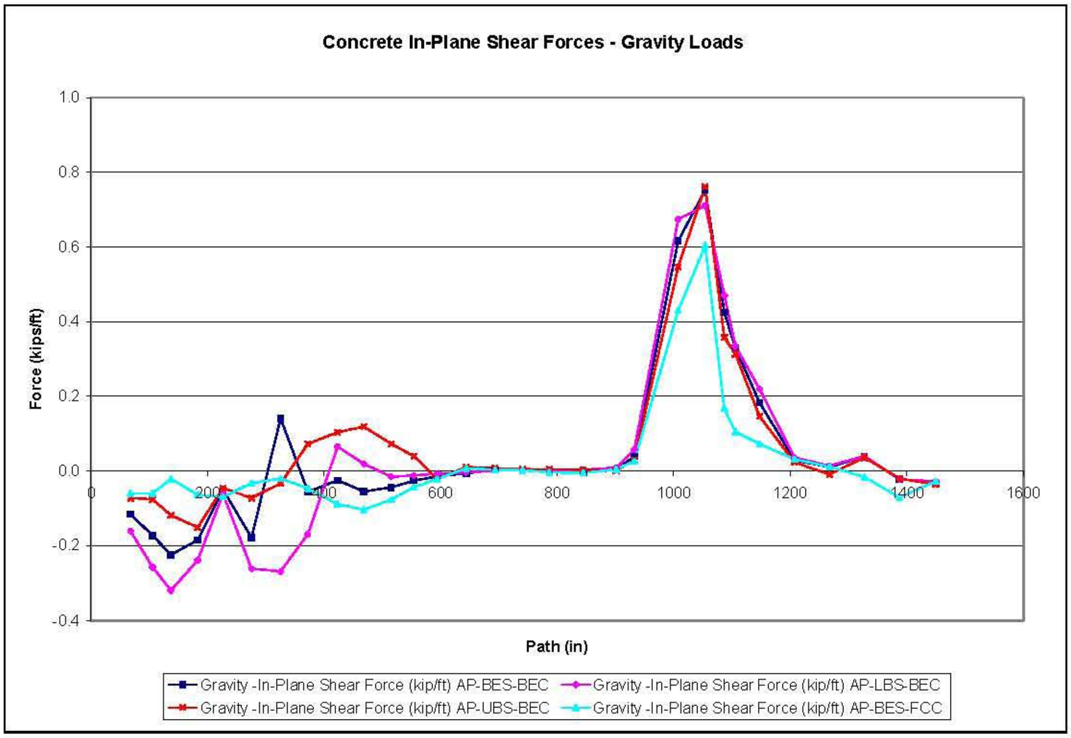


Figure 9-15. Concrete Shell In-Plane Shear Forces – Gravity Plus Seismic.

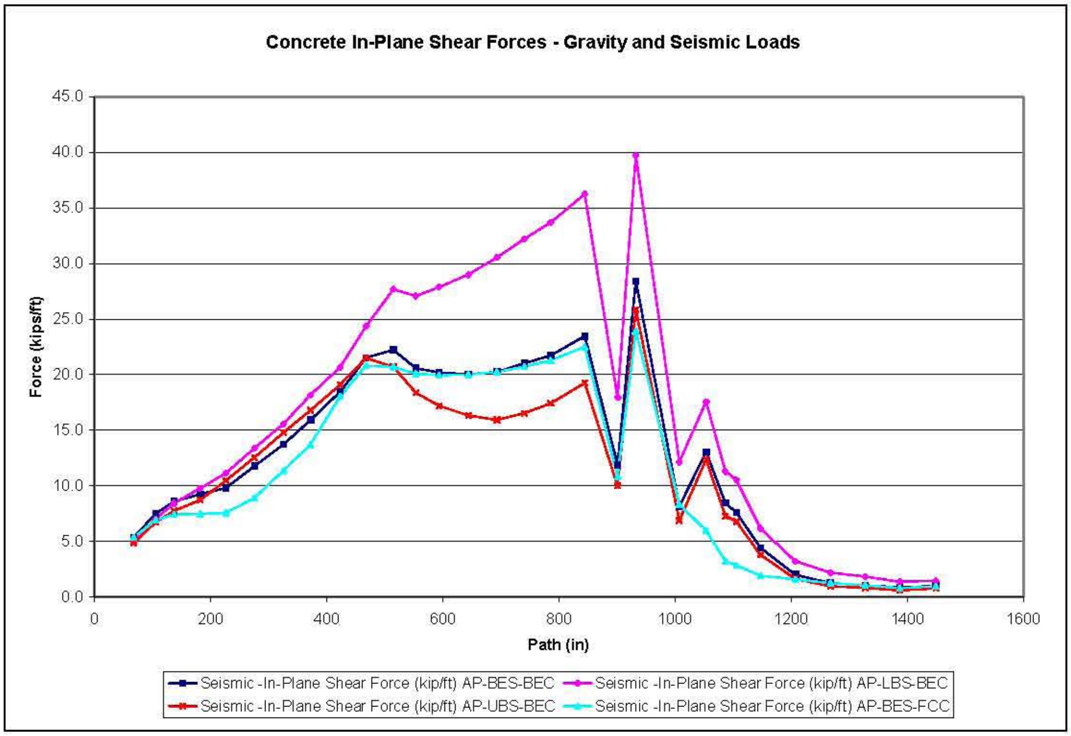


Figure 9-16. Concrete Shell In-Plane Shear Forces – Seismic Only.

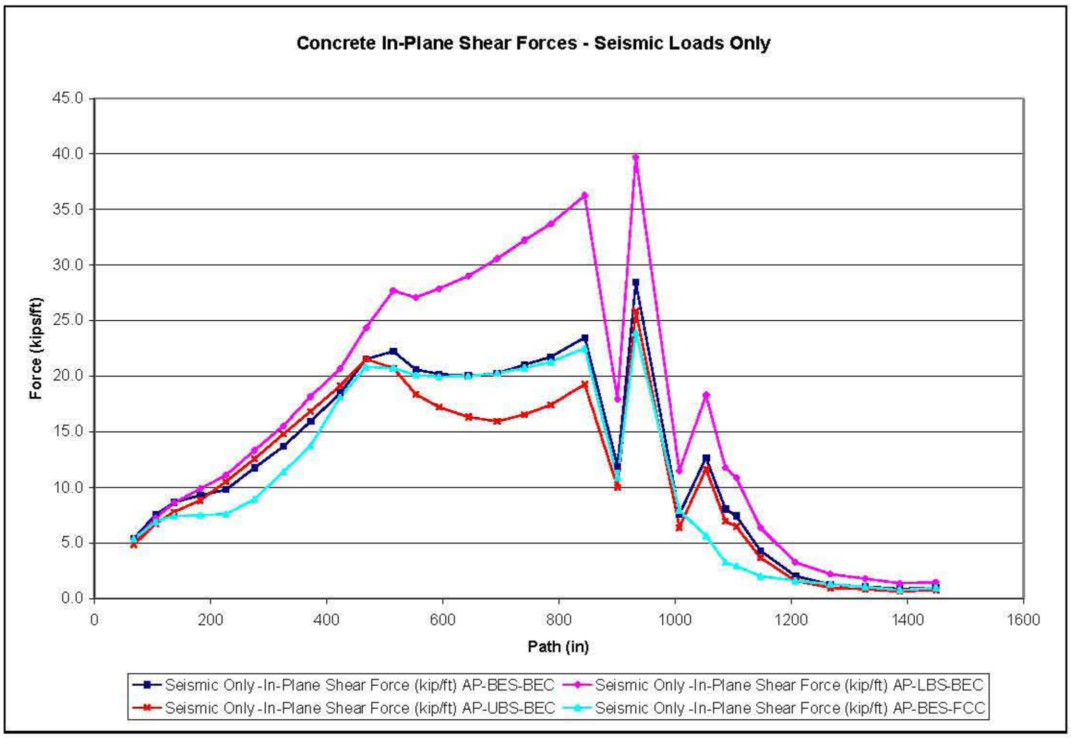


Figure 9-17. Concrete Shell Through-Wall Shear Forces – Gravity Only.

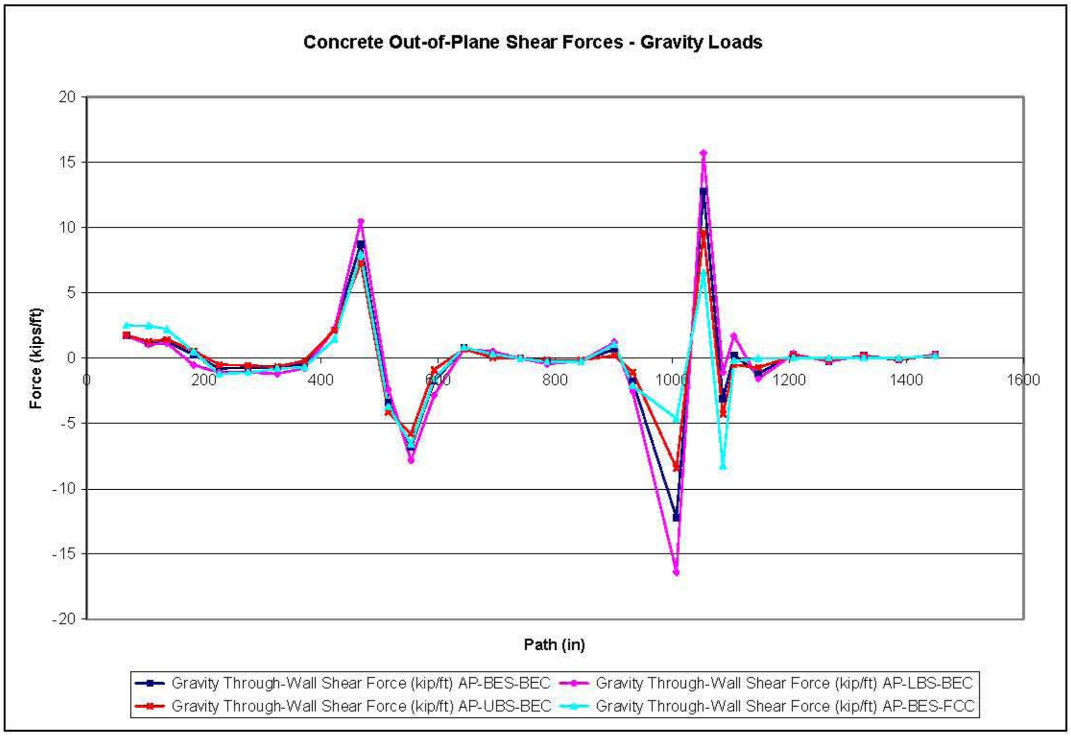


Figure 9-18. Concrete Shell Through-Wall Shear Forces – Gravity Plus Seismic.

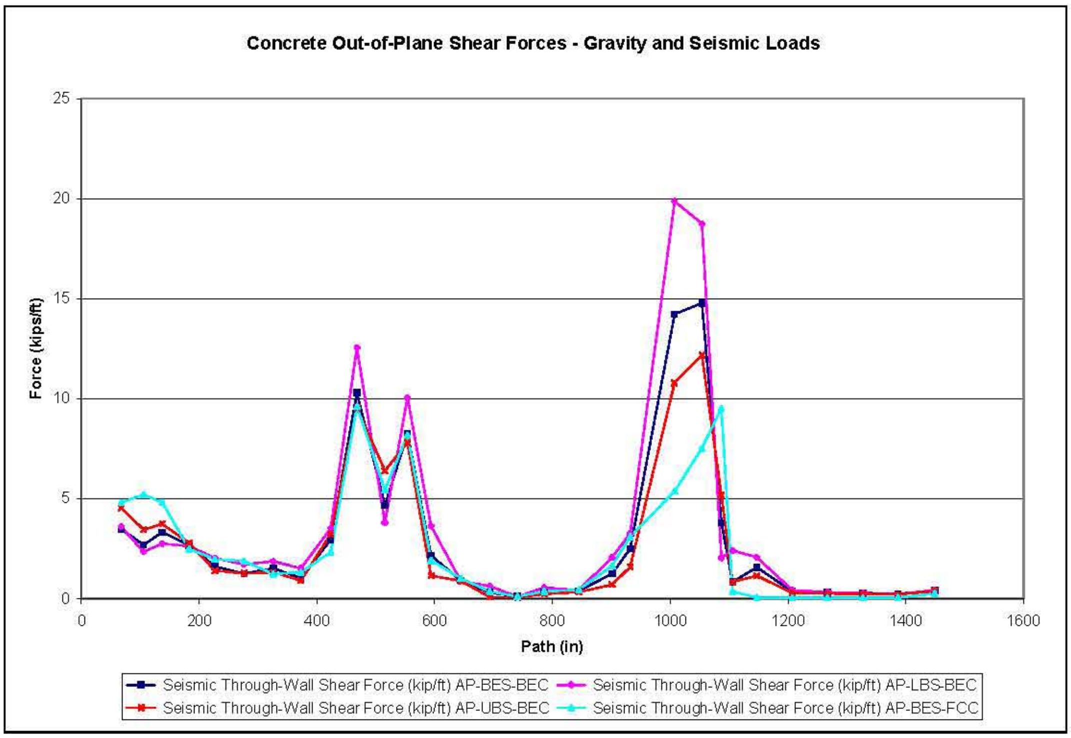
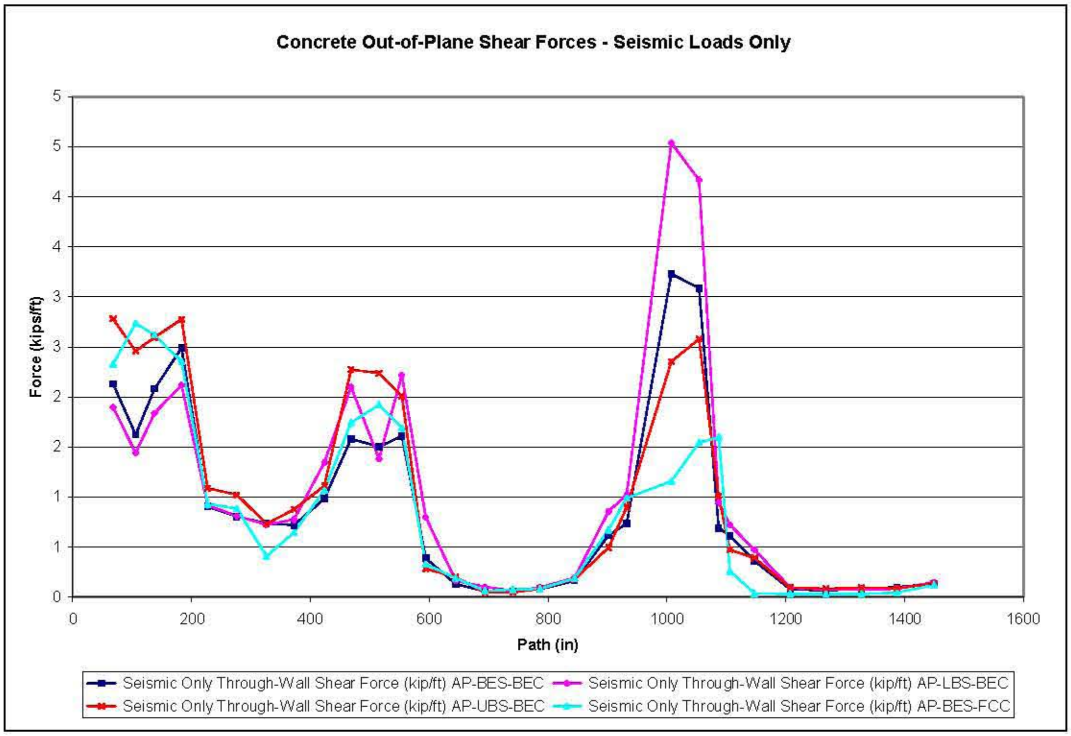


Figure 9-19. Concrete Shell Through-Wall Shear Forces – Seismic Only.



9.2 PRIMARY TANK

Primary tank stresses are extracted from the model in 9 degree slices, starting near the top of the dome and moving down the wall and across the footing from the outside to the center of the tank. Stresses were extracted for the top, middle, and bottom of each shell element. Figure 9-20 shows the first slice, with element numbers. Each of the subsequent figures shows one component of stress, comparing the results from each load case. The results presented for the primary tank stresses are enveloped minima/maxima around the circumference of the tank. The gravity comparison includes a comparison to the TOLA model. This comparison demonstrates that for the majority of the primary tank, the model provides very similar results to the more detailed model. The meridional stresses in the knuckle are under-predicted in the global model. This is due to the lack of resolution in the knuckle.

The following stresses are extracted for the primary tank SHELL143 elements at the top, middle, and bottom for each element.

- SX Hoop Stress (Meridional in floor)
- SY Meridional Stress (Hoop in floor)
- SINT Stress Intensity
- SXY In-Plane Shear Stress
- SYZ Shear Stress
- SXZ Shear Stress

Figures are grouped in sets showing the stress for gravity only first, total demand from the transient analysis (gravity plus seismic), and then only the seismic portion. The seismic only load is simply the difference between the full transient loading and gravity only. For the primary tank, hoop stresses at the shell middle, Meridional stresses at the shell top and bottom, and in-plane shear stresses at the shell middle are presented in the following figures.

- Figure 9-21. Primary Hoop Stress (Middle) – Gravity Only
- Figure 9-22. Primary Tank Hoop Stress (Middle) – Gravity Plus Seismic
- Figure 9-23. Primary Tank Hoop Stress (Middle) – Seismic Only
- Figure 9-24. Primary Meridional Stress (Inside) – Gravity Only
- Figure 9-25. Primary Tank Meridional Stress (Inside) – Gravity Plus Seismic
- Figure 9-26. Primary Tank Meridional Stress (Inside) – Seismic Only
- Figure 9-27. Primary Meridional Stress (Outside) – Gravity Only
- Figure 9-28. Primary Tank Meridional Stress (Outside) – Gravity Plus Seismic
- Figure 9-29. Primary Tank Meridional Stress (Outside) – Seismic Only
- Figure 9-30. Primary Tank In-Plane Shear Stress (Middle) – Gravity Only
- Figure 9-31. Primary Tank In-Plane Shear Stress (Middle) – Gravity Plus Seismic
- Figure 9-32. Primary Tank In-Plane Shear Stress (Middle) – Seismic Only

Figure 9-20. Primary Tank Element Retreival Sequence Starting Numbers.

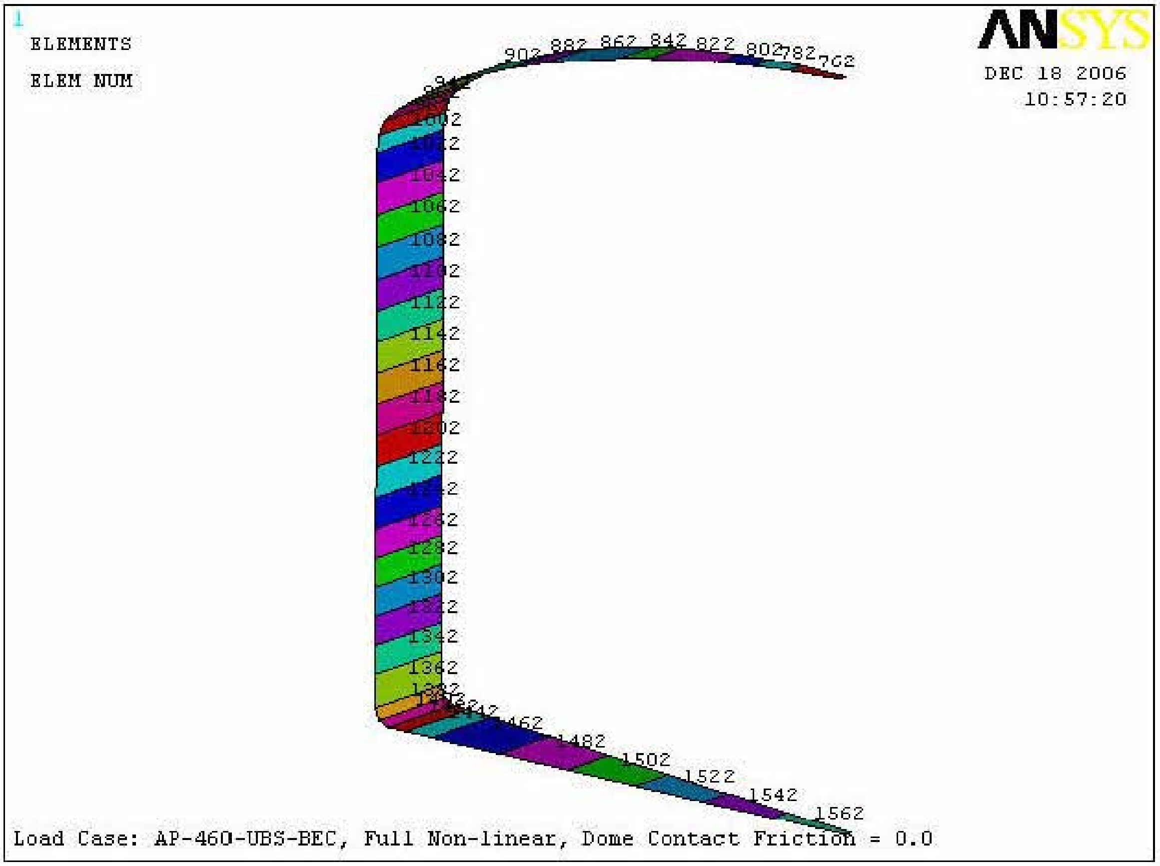


Figure 9-21. Primary Hoop Stress (Middle) – Gravity Only.

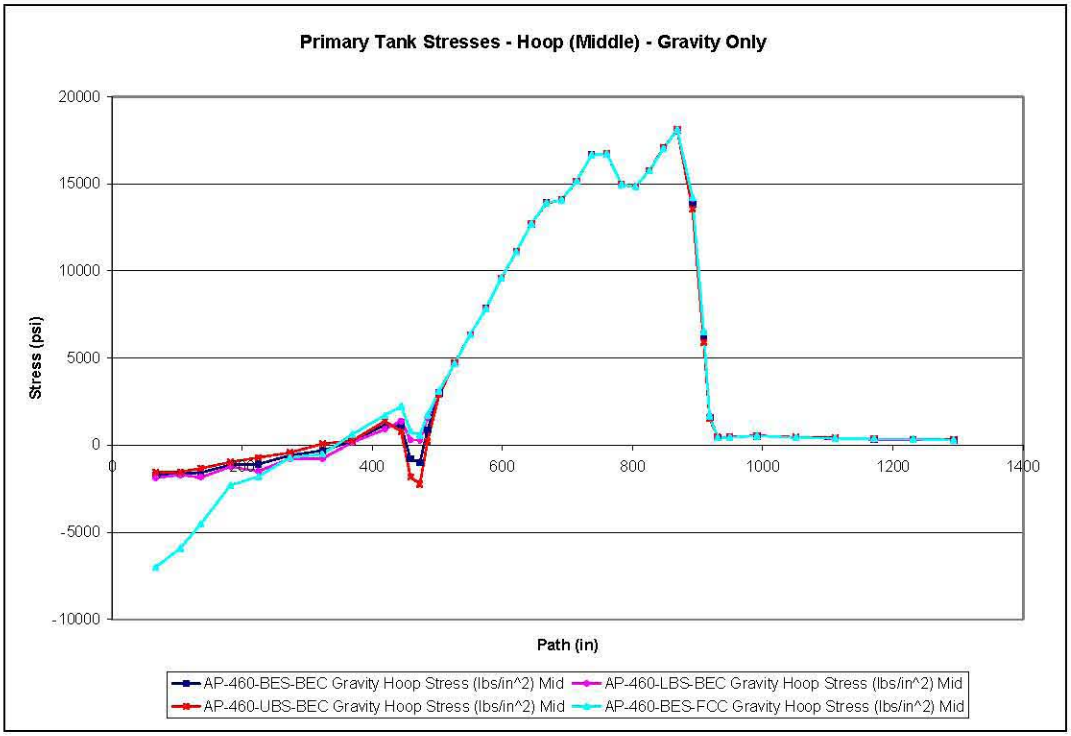


Figure 9-22. Primary Tank Hoop Stress (Middle) – Gravity Plus Seismic.

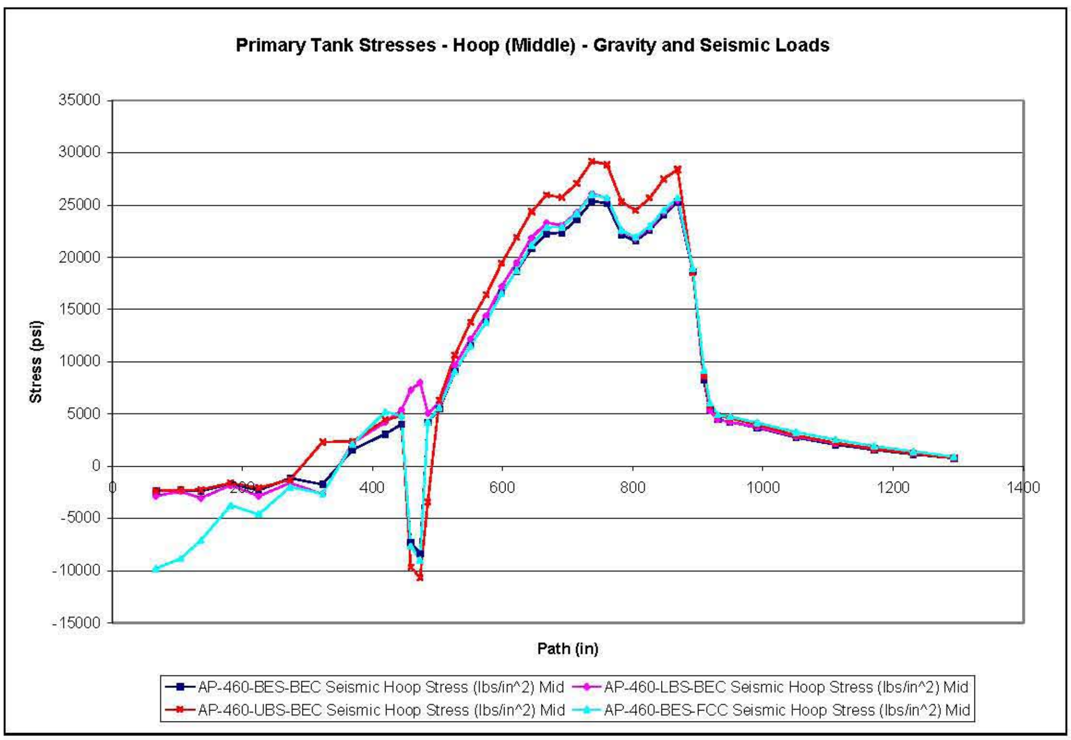


Figure 9-23. Primary Tank Hoop Stress (Middle) – Seismic Only.

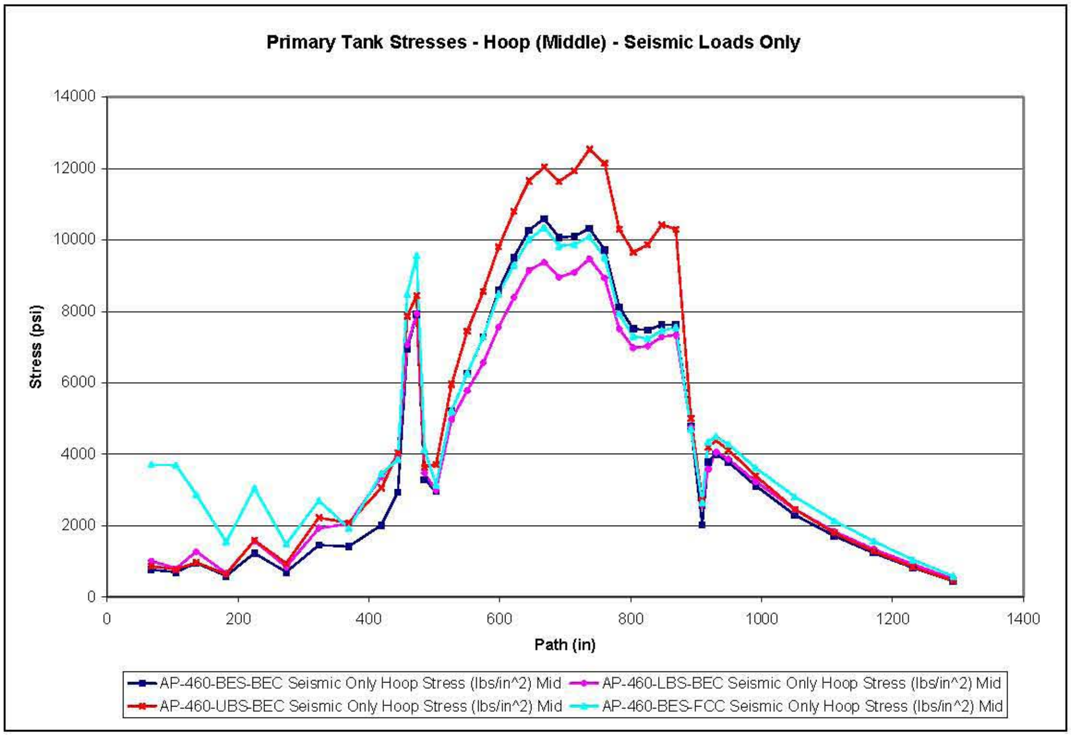


Figure 9-24. Primary Meridional Stress (Inside) – Gravity Only.

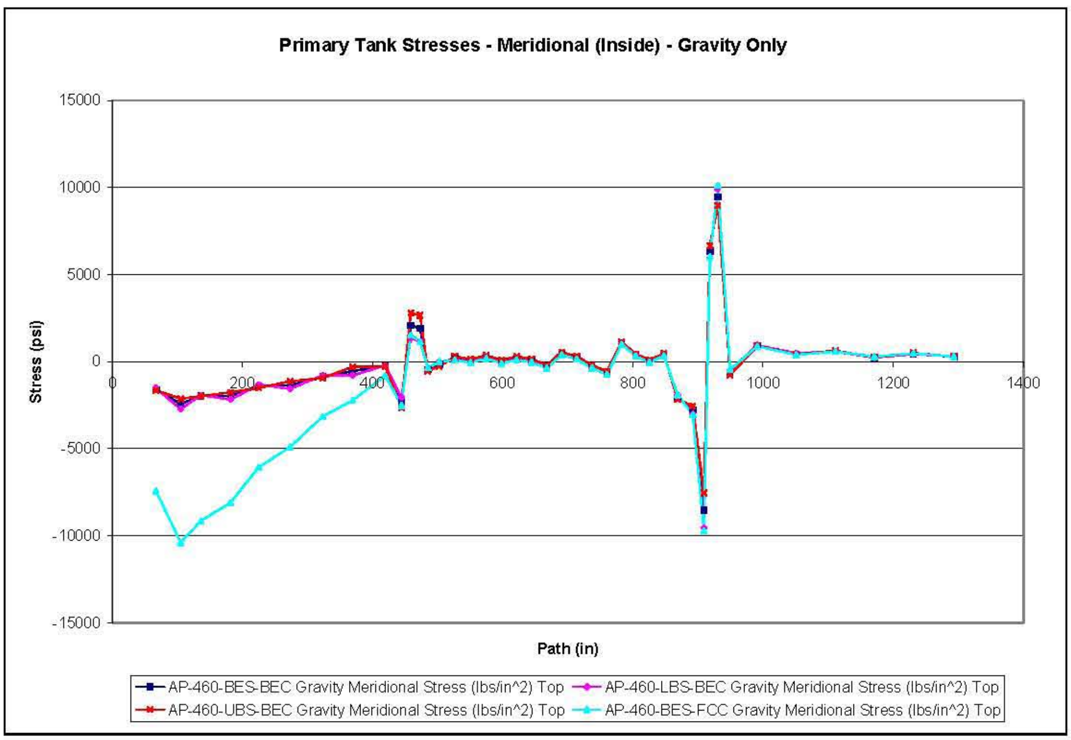


Figure 9-25. Primary Tank Meridional Stress (Inside) – Gravity Plus Seismic.

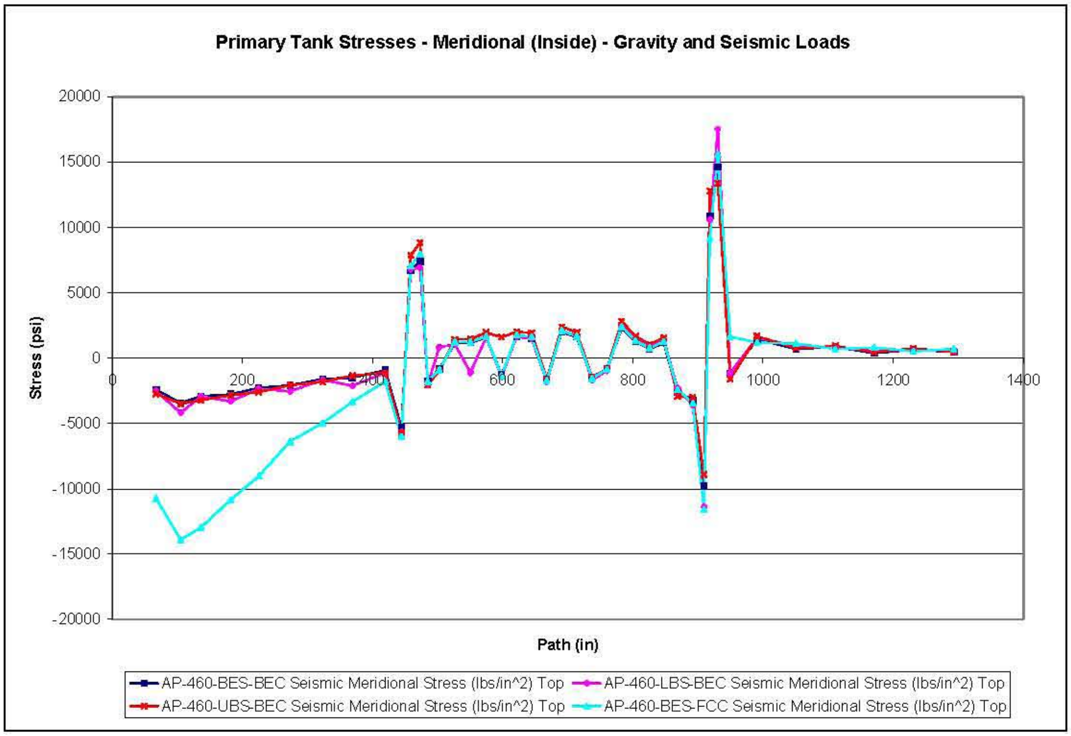


Figure 9-26. Primary Tank Meridional Stress (Inside) – Seismic Only.

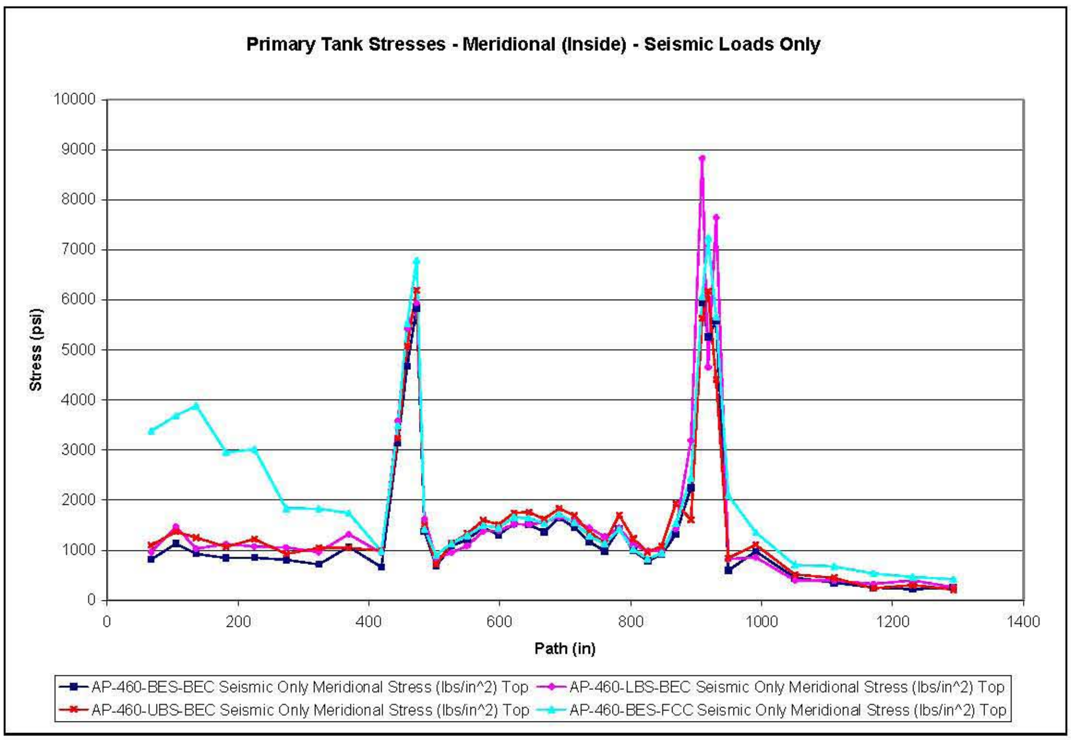


Figure 9-27. Primary Meridional Stress (Outside) – Gravity Only.

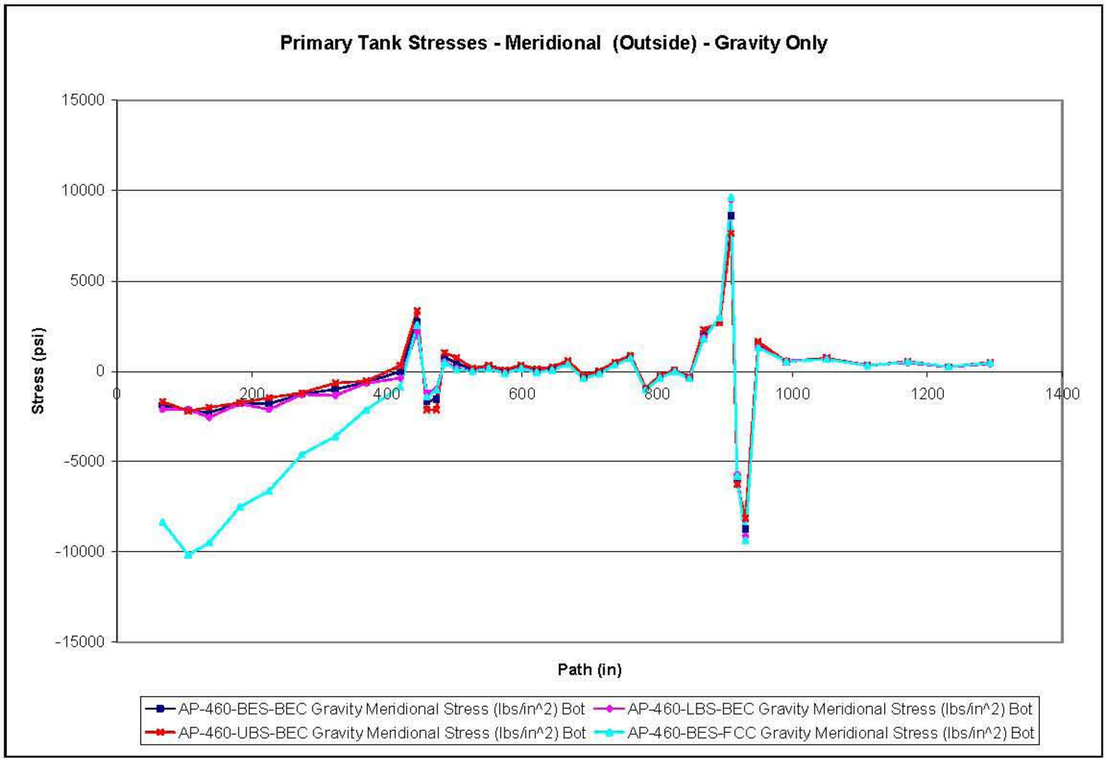


Figure 9-28. Primary Tank Meridional Stress (Outside) – Gravity Plus Seismic.

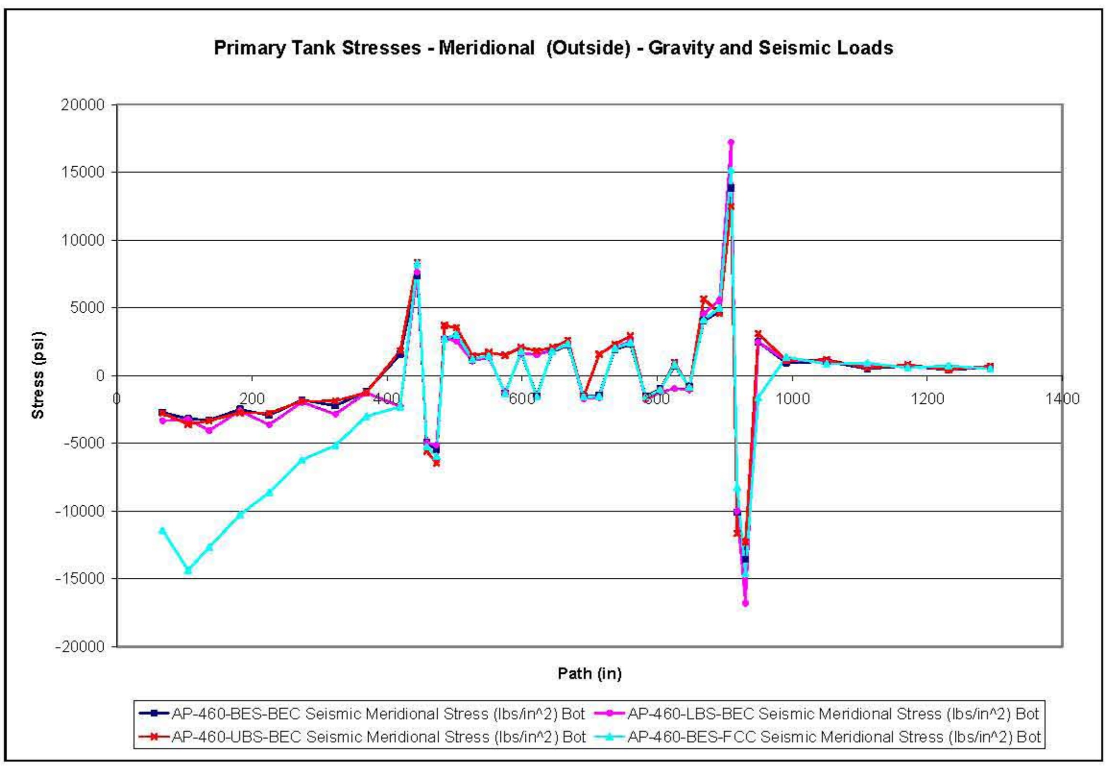


Figure 9-29. Primary Tank Meridional Stress (Outside) – Seismic Only.

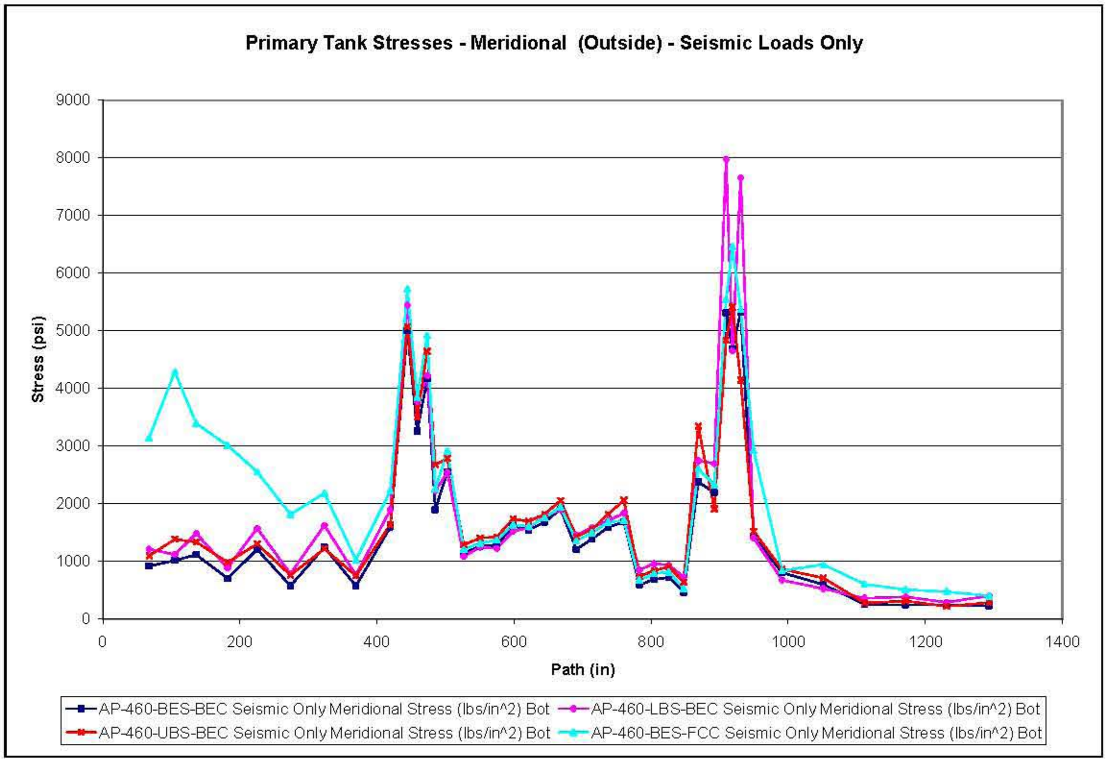


Figure 9-30. Primary Tank In-Plane Shear Stress (Middle) – Gravity Only.

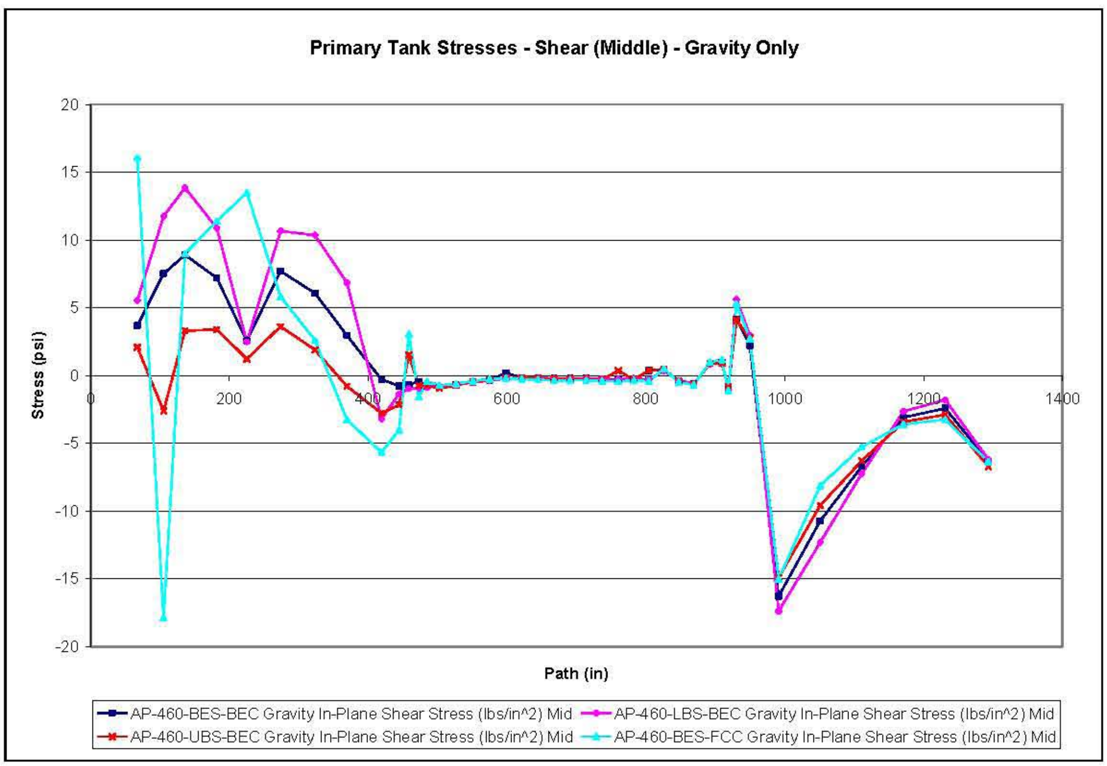


Figure 9-31. Primary Tank In-Plane Shear Stress (Middle) – Gravity Plus Seismic.

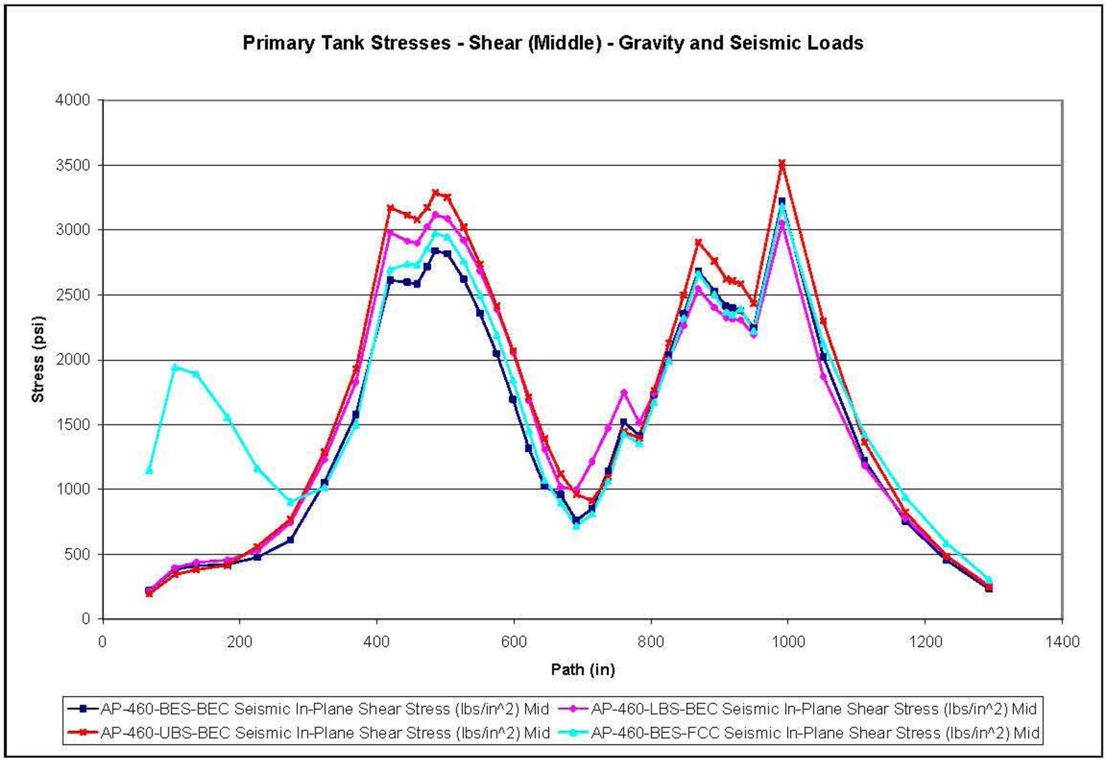
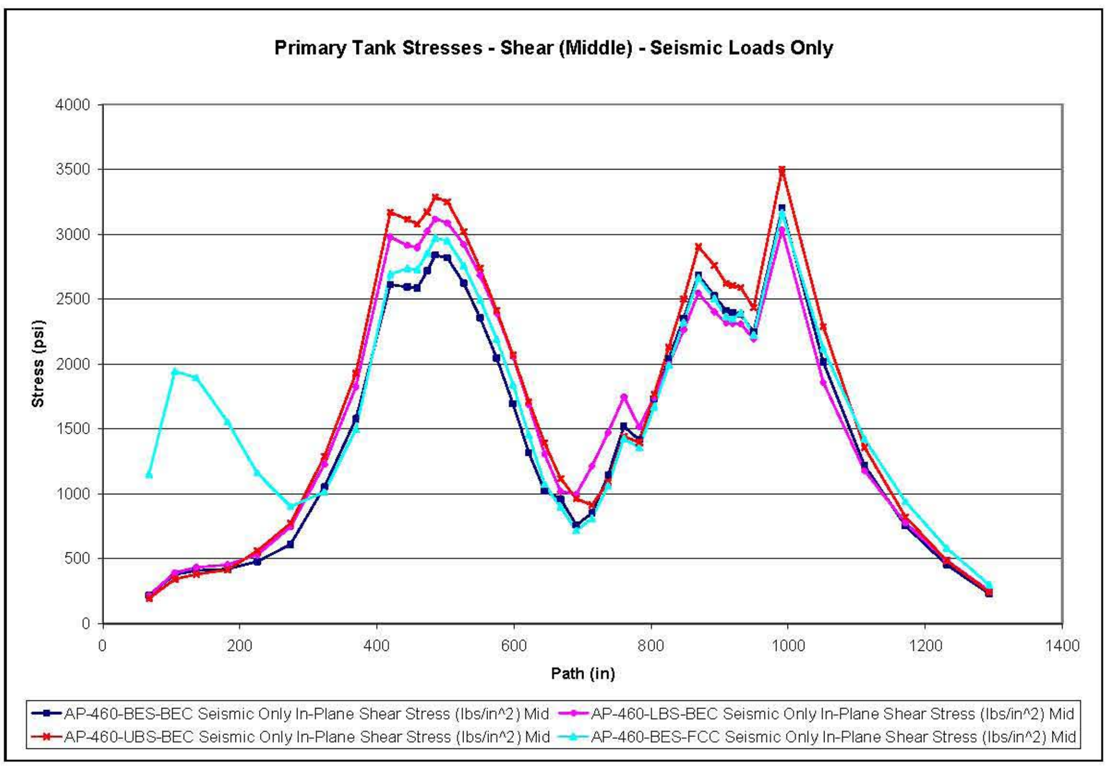


Figure 9-32. Primary Tank In-Plane Shear Stress (Middle) – Seismic Only.



9.3 J-BOLTS

Axial and shear forces were extracted for the J-bolt elements. Figure 9-33 shows the element numbers for the first five set of J-bolts. Because J-bolt elements are placed at the edges of each slice, a total of twenty-one sets are extracted, but are extracted by radius instead of angle as was done for the concrete and primary tank. The following forces were extracted from the BEAM44 element results.

- SMISC7 Axial force (Element X)
- SMISC8 Shear force (Element Y)
- SMISC9 Shear force (Element Z)

After enveloping the forces around the circumference of the tank, the forces are re-allocated on a per-bolt basis using the information from Table 2-6. The total shear force is calculated by combining the two orthogonal shears extracted from the model by the SRSS method. The results are presented in the following figures:

- Figure 9-34. J-bolts – Maximum Axial Force - Gravity Only
- Figure 9-35. J-bolts – Minimum Axial Force - Gravity Only
- Figure 9-36. J-bolts – Maximum Axial Force - Gravity Plus Seismic
- Figure 9-37. J-bolts – Minimum Axial Force - Gravity Plus Seismic
- Figure 9-38. J-bolts – Maximum Axial Force - Seismic Only
- Figure 9-39. J-bolts – Minimum Axial Force - Seismic Only
- Figure 9-40. J-bolts – Shear Force - Gravity Only
- Figure 9-41. J-bolts – Shear Force - Gravity Plus Seismic
- Figure 9-42. J-bolts – Shear Force - Seismic Only

Figure 9-33. J-bolt Element Retreival Sequence Starting Numbers.

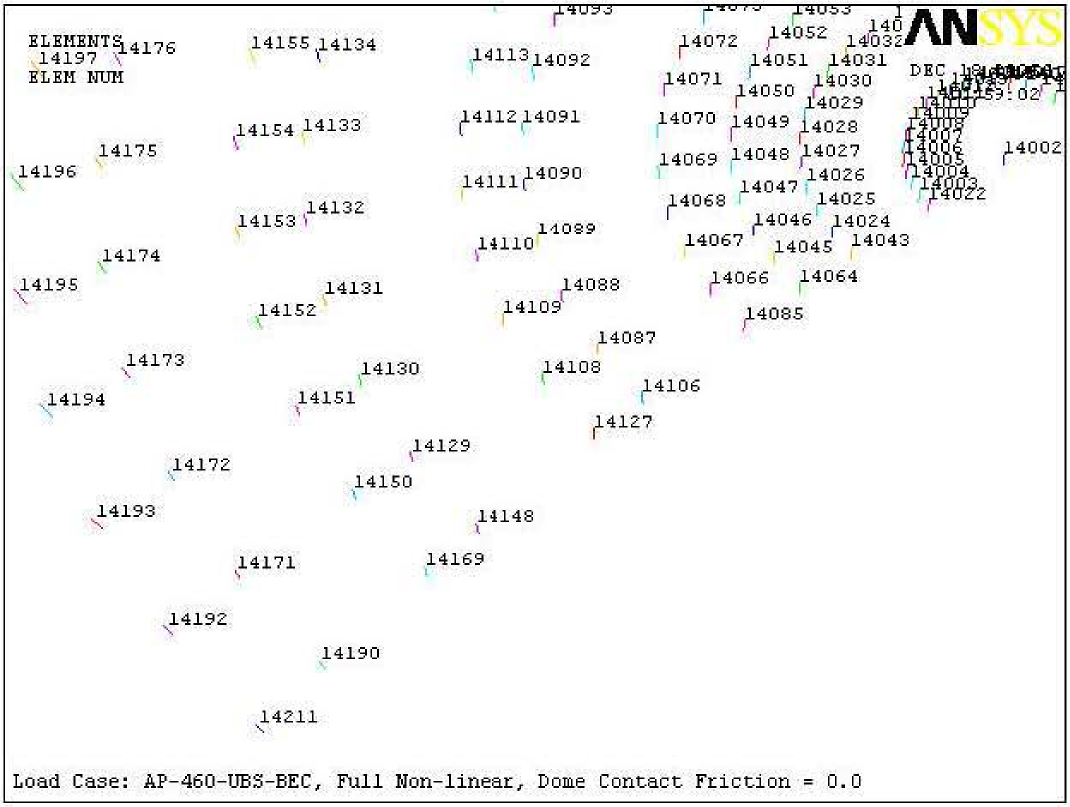


Figure 9-34. J-bolts – Maximum Axial Force - Gravity Only.

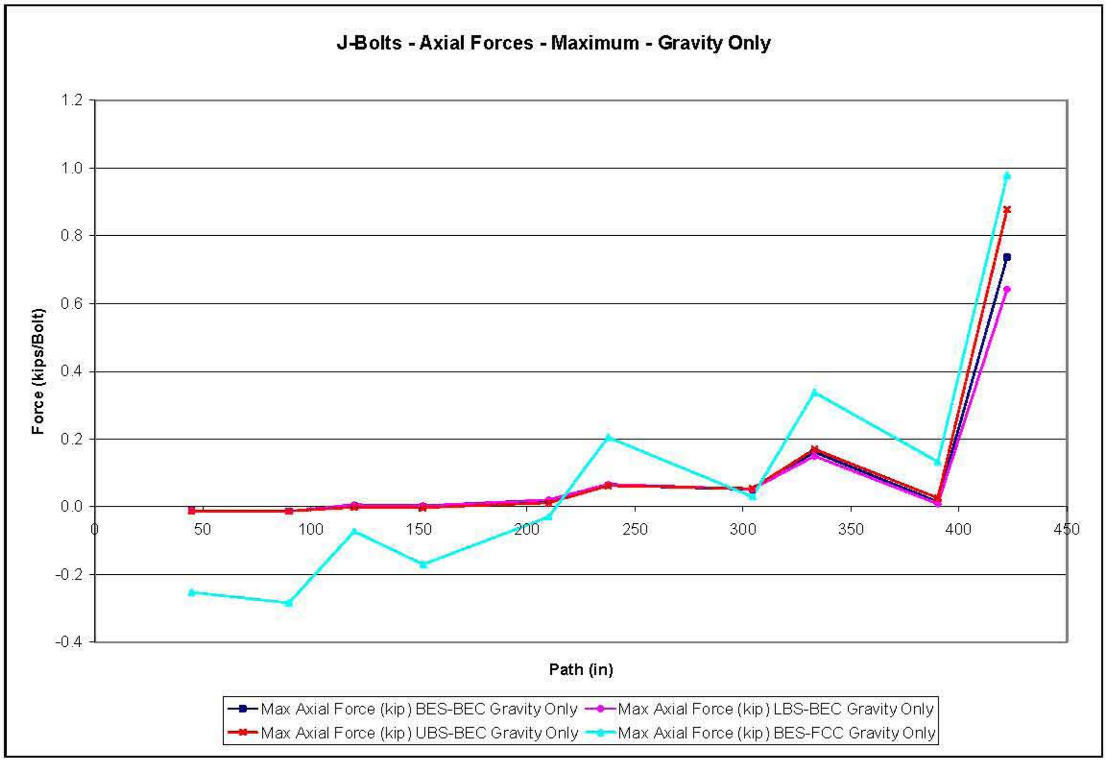


Figure 9-35. J-bolts – Minimum Axial Force - Gravity Only.

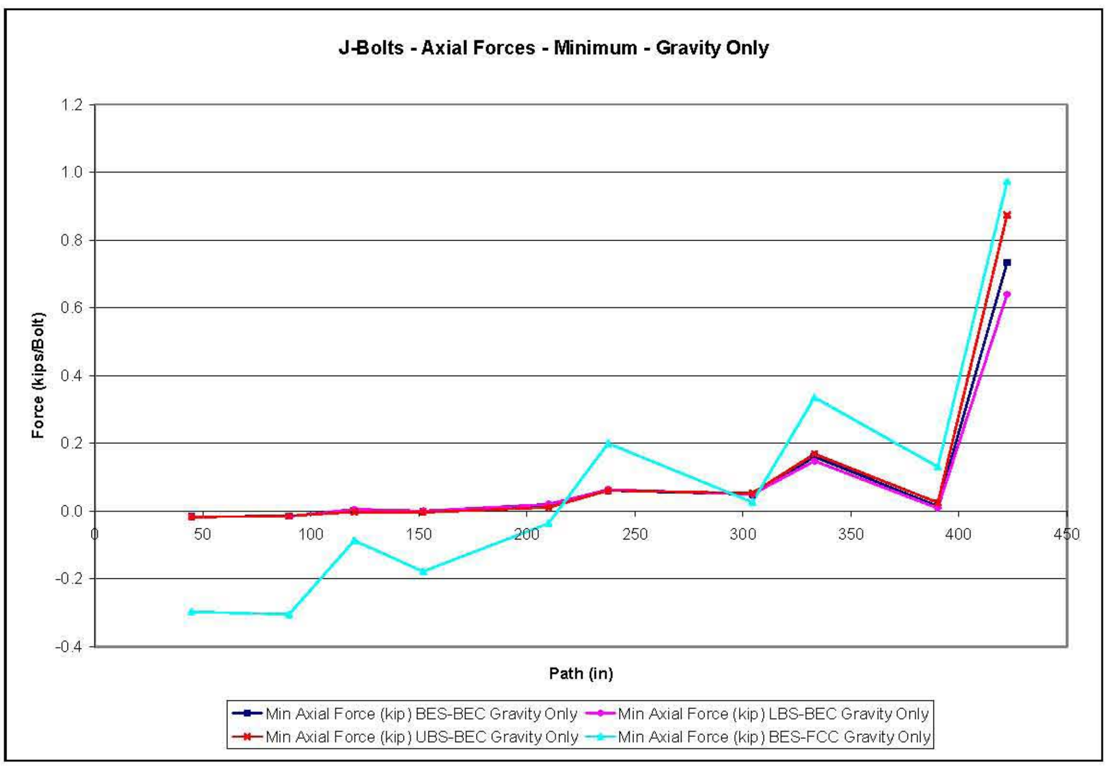


Figure 9-36. J-bolts – Maximum Axial Force - Gravity Plus Seismic.

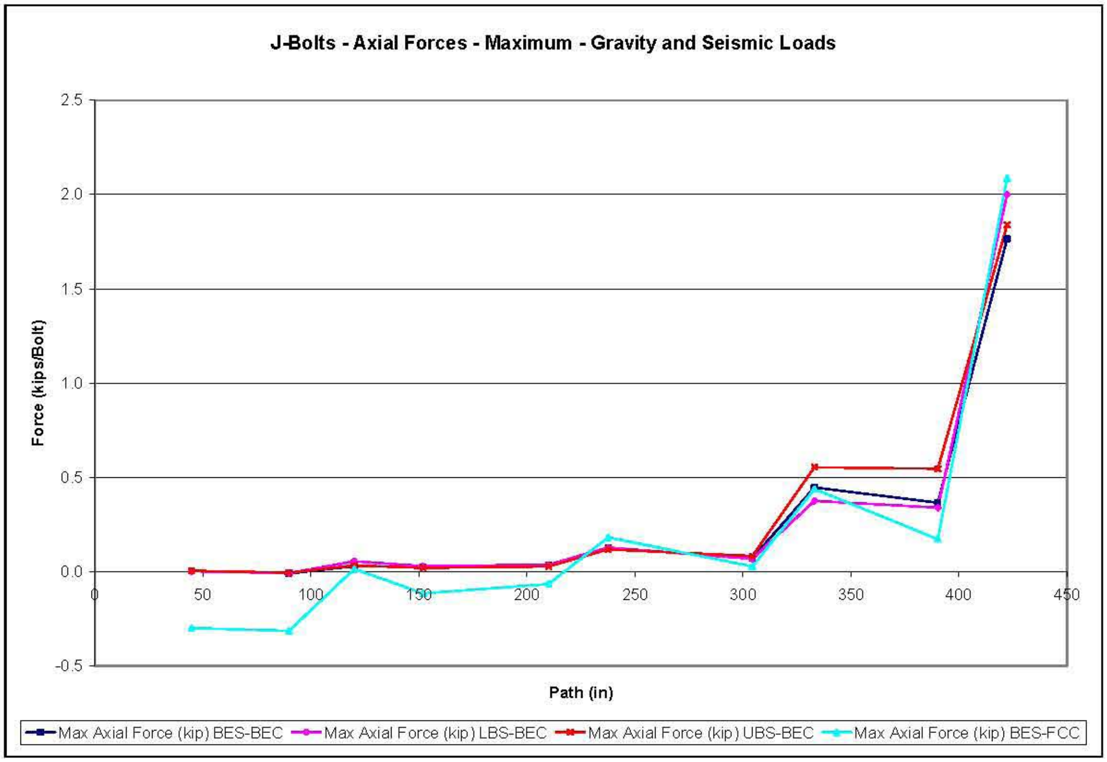


Figure 9-37. J-bolts – Minimum Axial Force - Gravity Plus Seismic.

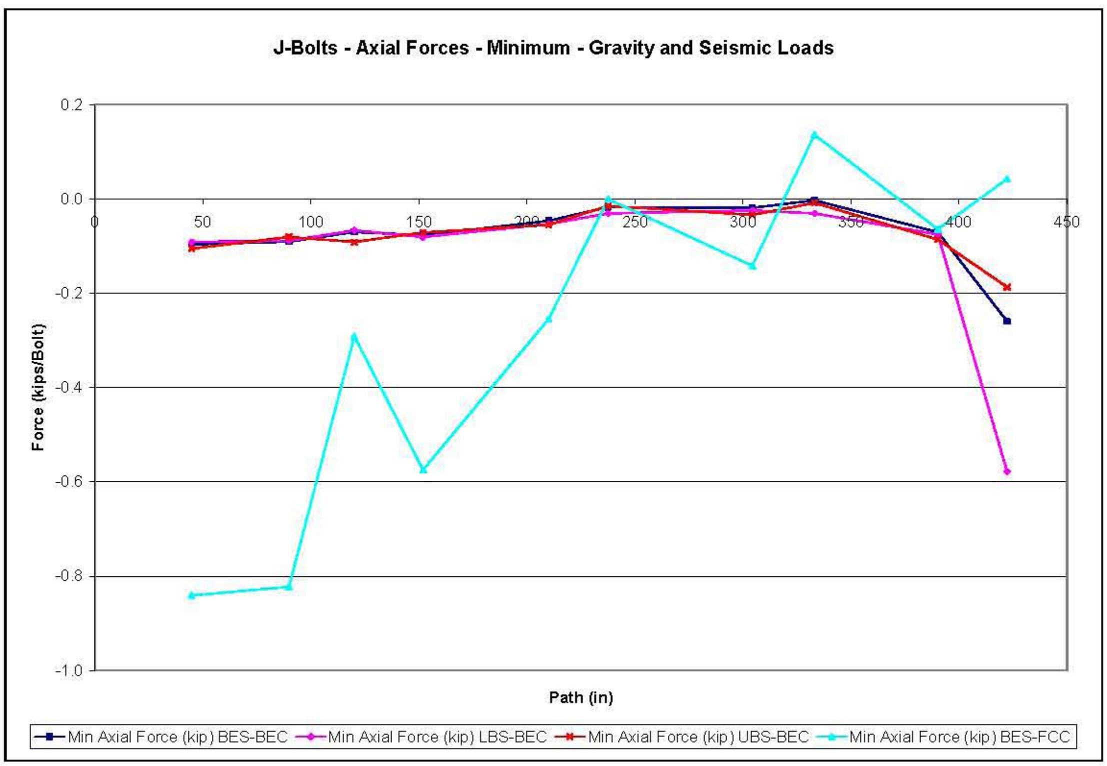


Figure 9-38. J-bolts – Maximum Axial Force - Seismic Only.

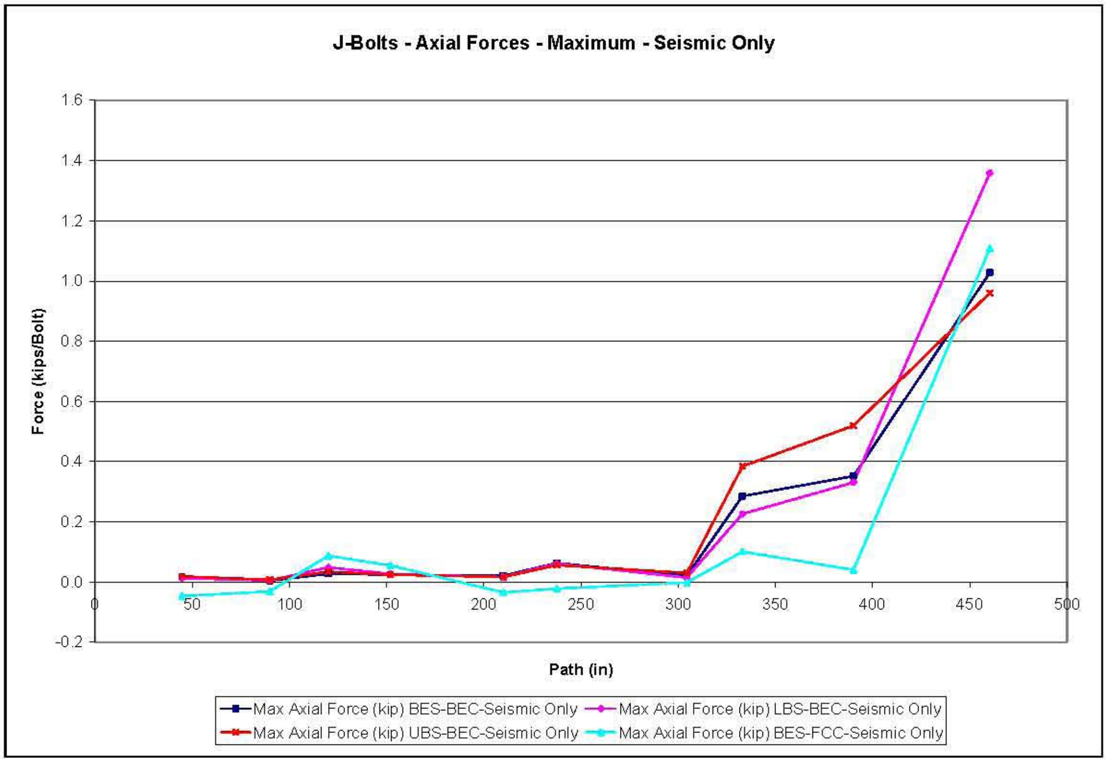


Figure 9-39. J-bolts – Minimum Axial Force - Seismic Only.

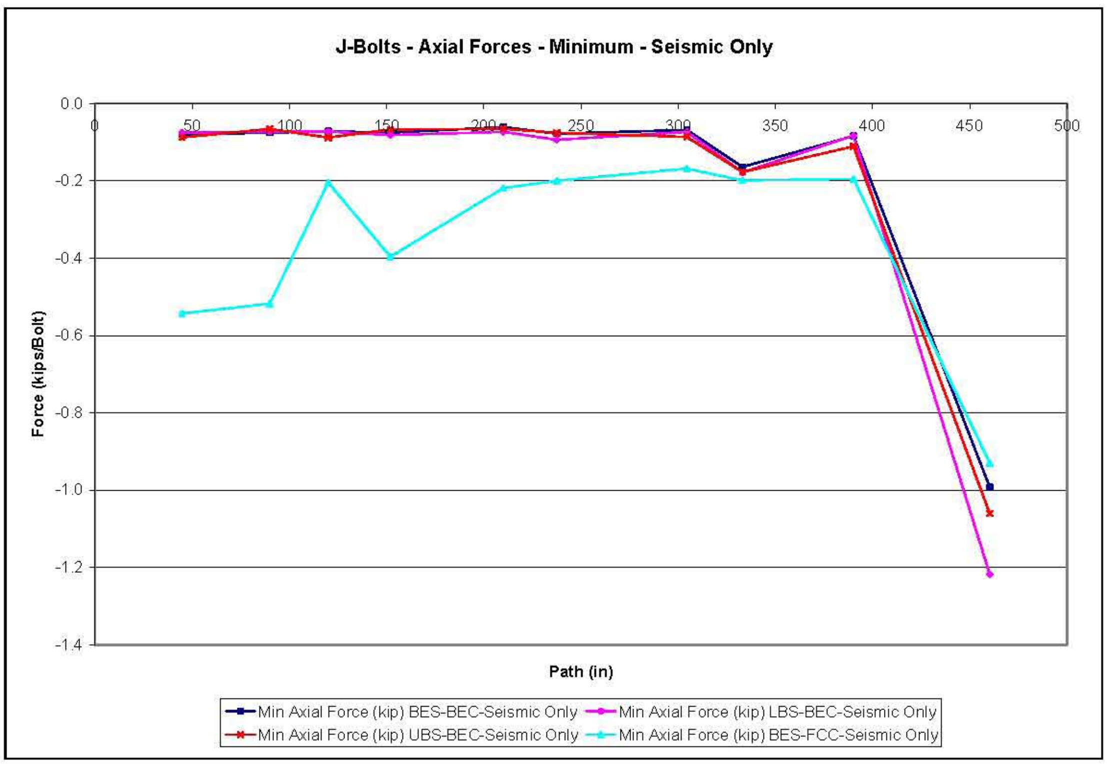


Figure 9-40. J-bolts – Shear Force - Gravity Only.

Figure 9-41. J-bolts – Shear Force - Gravity Plus Seismic.

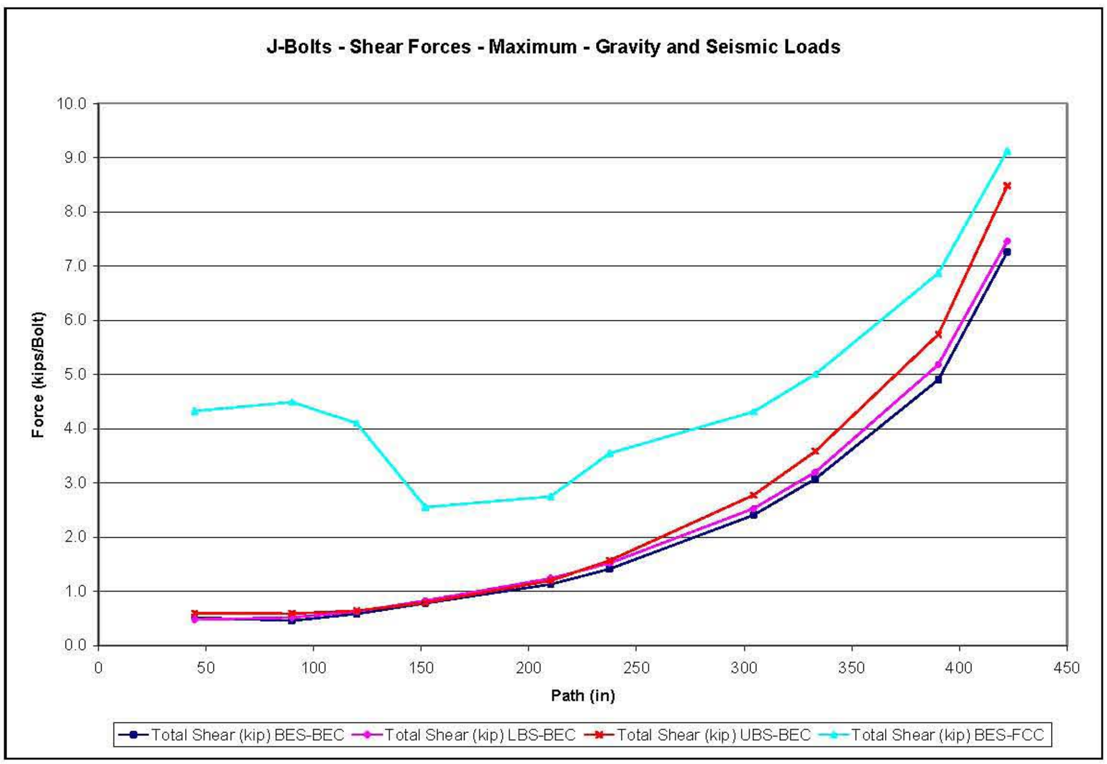
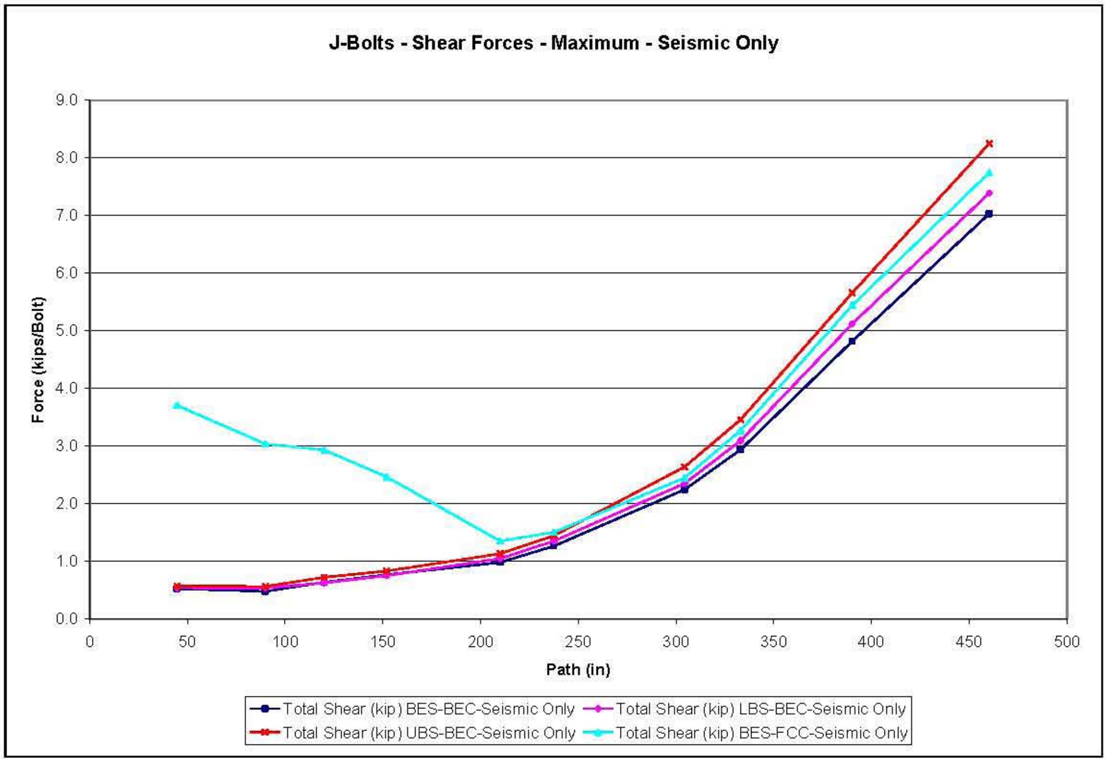


Figure 9-42. J-bolts – Shear Force - Seismic Only.



9.4 CONCRETE BACKED STEEL

Concrete backed steel strains are extracted from the model in 9 degree slices, starting near the center of the dome, down the wall and across the footing from the outside to the center of the liner. However, to obtain strains for all concrete backed steel, results were extracted from different groups of elements, including the primary tank, concrete, and liner elements. Principal strains were extracted for the top, middle, and bottom of each shell element representing the primary tank in the dome region. Principal strains were extracted for the inside face of the concrete shell elements in the haunch, wall and floor. These strains will be considered to be mid-plane strains for the liner. Principal strains were extracted from the secondary liner where it was explicitly modeled at the footing/wall interface. Figure 9-43 and Figure 9-44 show the 1st slice, with element numbers.

The following strains were extracted for the SHELL143 primary tank dome and the secondary liner elements for the top, middle, and bottom of each element.

- EPEL1 1st Principal Strain (Top, Middle, Bottom)
- EPEL2 2nd Principal Strain (Top, Middle, Bottom)
- EPEL3 3rd Principal Strain (Top, Middle, Bottom)

The following strains were extracted for the SHELL143 concrete shell elements for the bottom of each element in the wall and the top of each element in the floor

- EPEL1 1st Principal Strain
- EPEL2 2nd Principal Strain
- EPEL3 3rd Principal Strain

Figures are grouped in sets showing the strain for gravity only first, total demand from the transient analysis (gravity plus seismic), and then only the seismic portion. The seismic only load is simply the difference between the full transient loading and gravity only. For the concrete backed steel, each of the three principal strains is shown in the following figures:

- Figure 9-43. Element Retrieval Sequence Starting Numbers for Strain
- Figure 9-44. Element Retrieval Sequence Starting Numbers for Strain (Detail)
- Figure 9-45. Concrete Backed Steel Strain, Principal 1Gravity Only
- Figure 9-46. Concrete Backed Steel Strain, Principal 1, Min, Gravity Plus Seismic
- Figure 9-47. Concrete Backed Steel Strain, Principal 1, Max, Gravity Plus Seismic
- Figure 9-48. Concrete Backed Steel Strain, Principal 1, Min, Seismic Only
- Figure 9-49. Concrete Backed Steel Strain, Principal 1, Max, Seismic Only
- Figure 9-50. Concrete Backed Steel Strain, Principal 2, Gravity Only
- Figure 9-51. Concrete Backed Steel Strain, Principal 2, Min, Gravity Plus Seismic
- Figure 9-52. Concrete Backed Steel Strain, Principal 2, Max, Gravity Plus Seismic
- Figure 9-53. Concrete Backed Steel Strain, Principal 2, Min, Seismic Only
- Figure 9-54. Concrete Backed Steel Strain, Principal 2, Max, Seismic Only
- Figure 9-55. Concrete Backed Steel Strain, Principal 3, Gravity Only
- Figure 9-56. Concrete Backed Steel Strain, Principal 3. Min, Gravity Plus Seismic
- Figure 9-57. Concrete Backed Steel Strain, Principal 3, Max, Gravity Plus Seismic
- Figure 9-58. Concrete Backed Steel Strain, Principal 3, Min, Seismic Only
- Figure 9-59. Concrete Backed Steel Strain, Principal 3, Max, Seismic Only

Figure 9-43. Element Retrieval Sequence Starting Numbers for Strain.

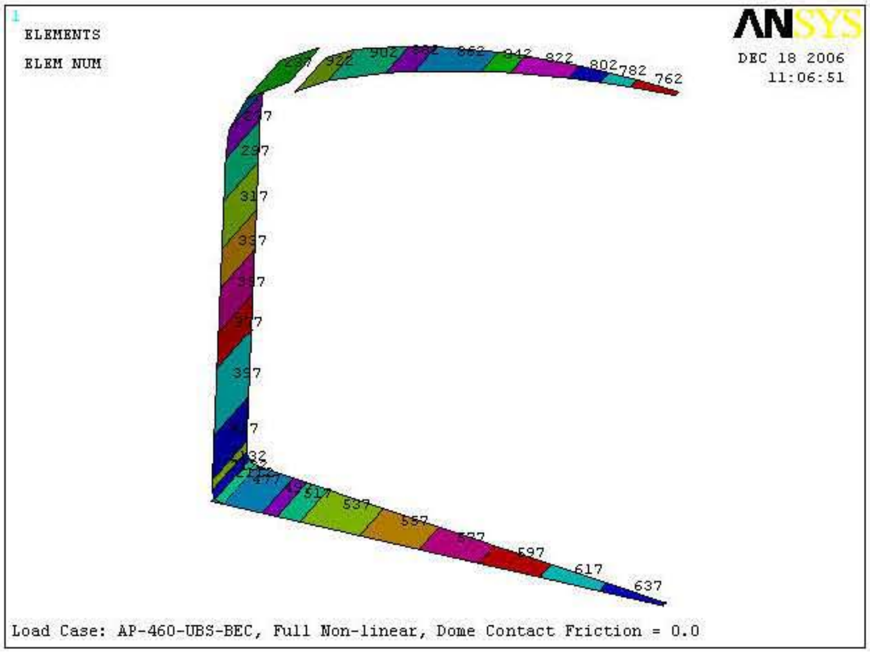


Figure 9-44. Element Retrieval Sequence Starting Numbers for Strain (Detail).

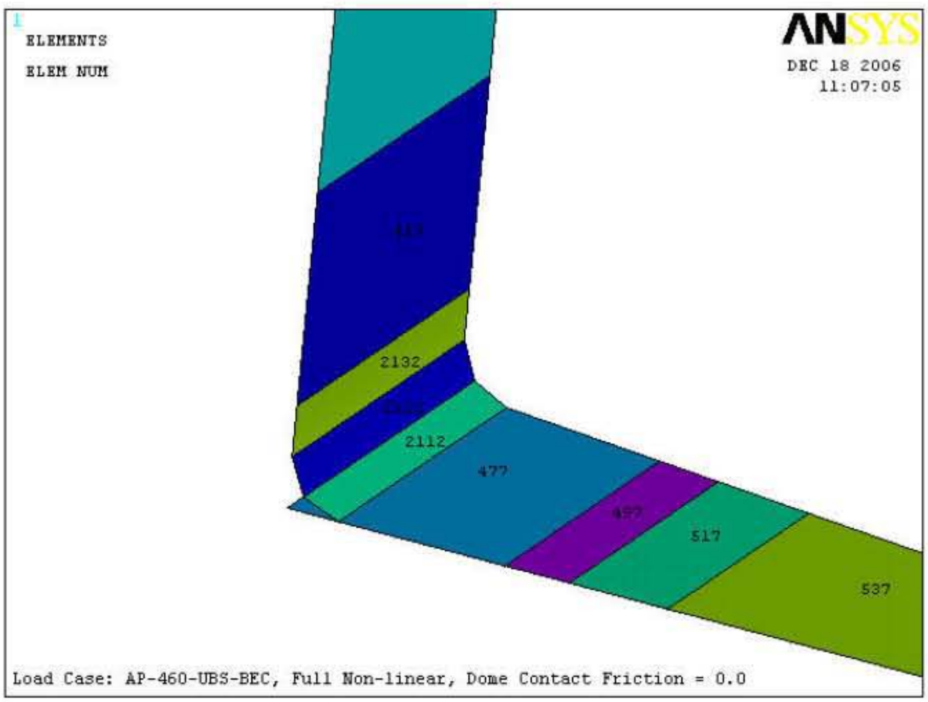


Figure 9-45. Concrete Backed Steel Strain, Principal 1Gravity Only.

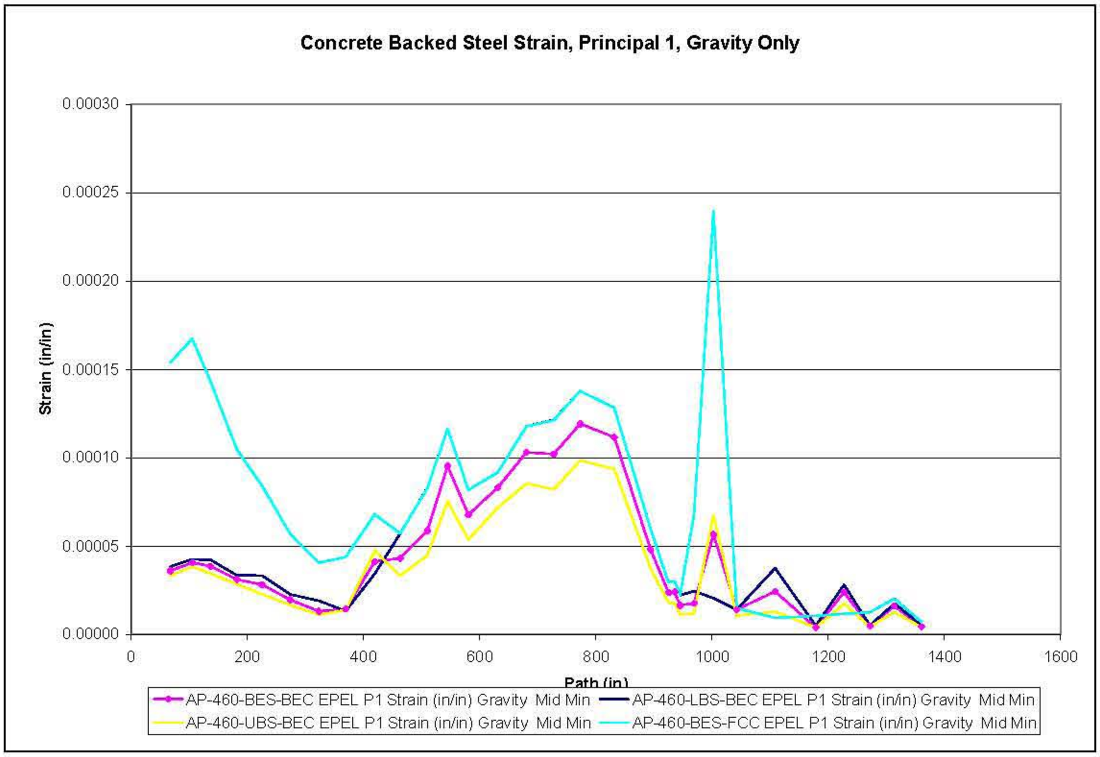


Figure 9-46. Concrete Backed Steel Strain, Principal 1, Min, Gravity Plus Seismic.

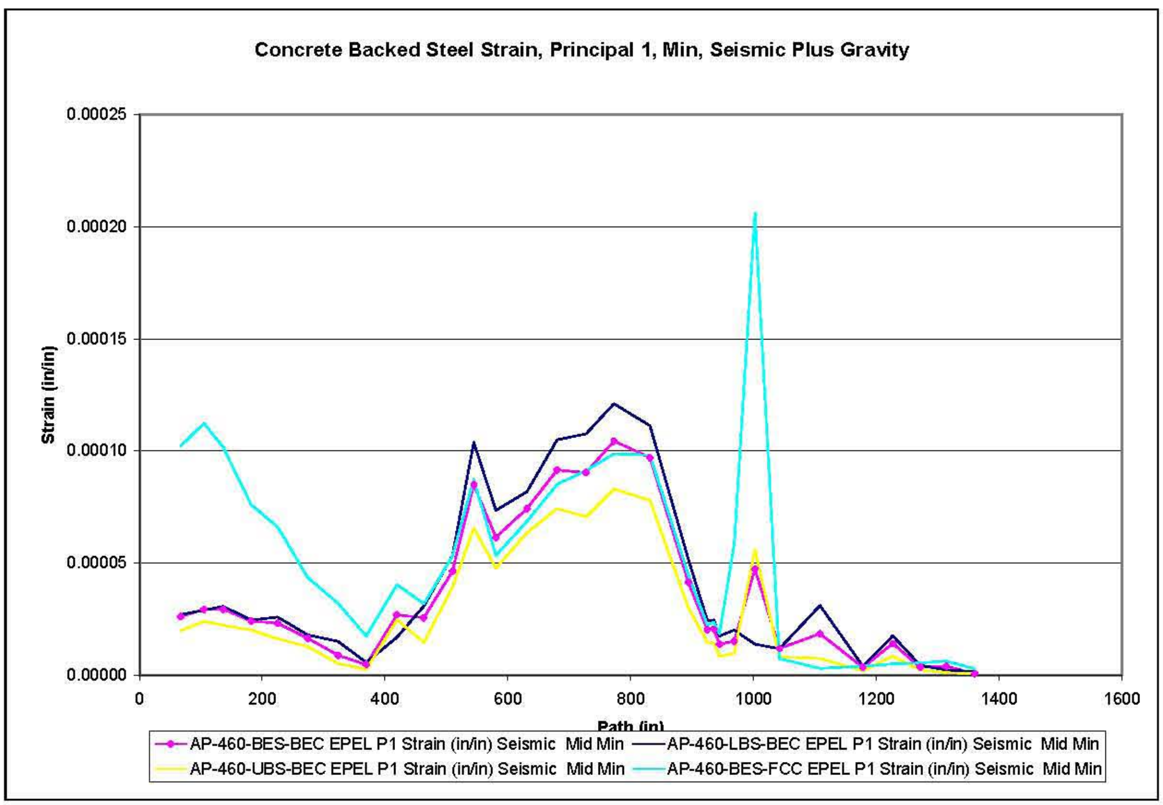


Figure 9-47. Concrete Backed Steel Strain, Principal 1, Max, Gravity Plus Seismic.

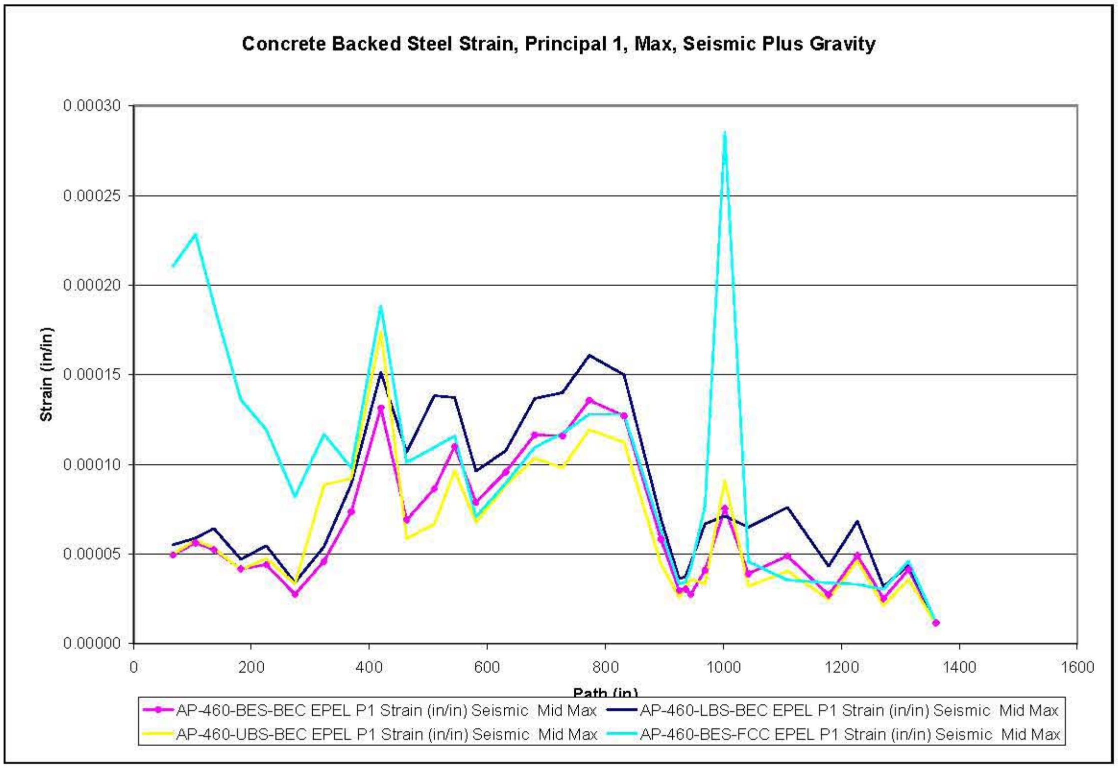


Figure 9-48. Concrete Backed Steel Strain, Principal 1, Min, Seismic Only.

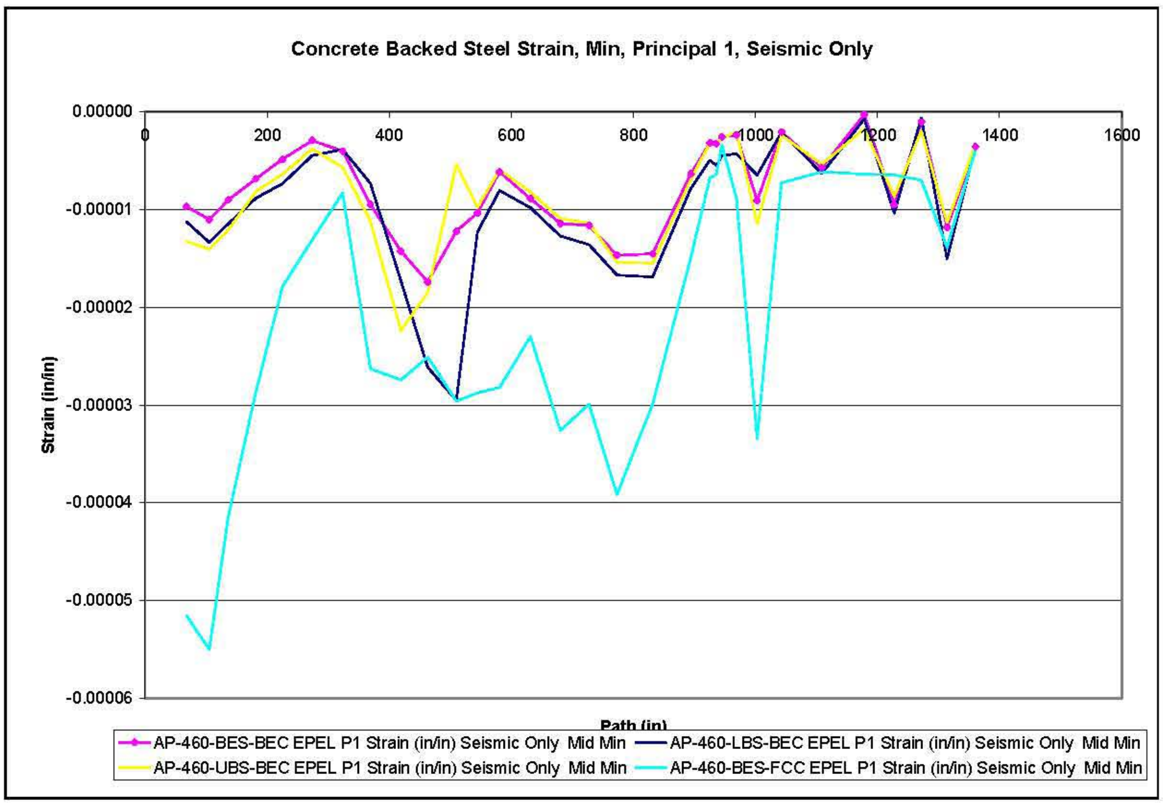


Figure 9-49. Concrete Backed Steel Strain, Principal 1, Max, Seismic Only.

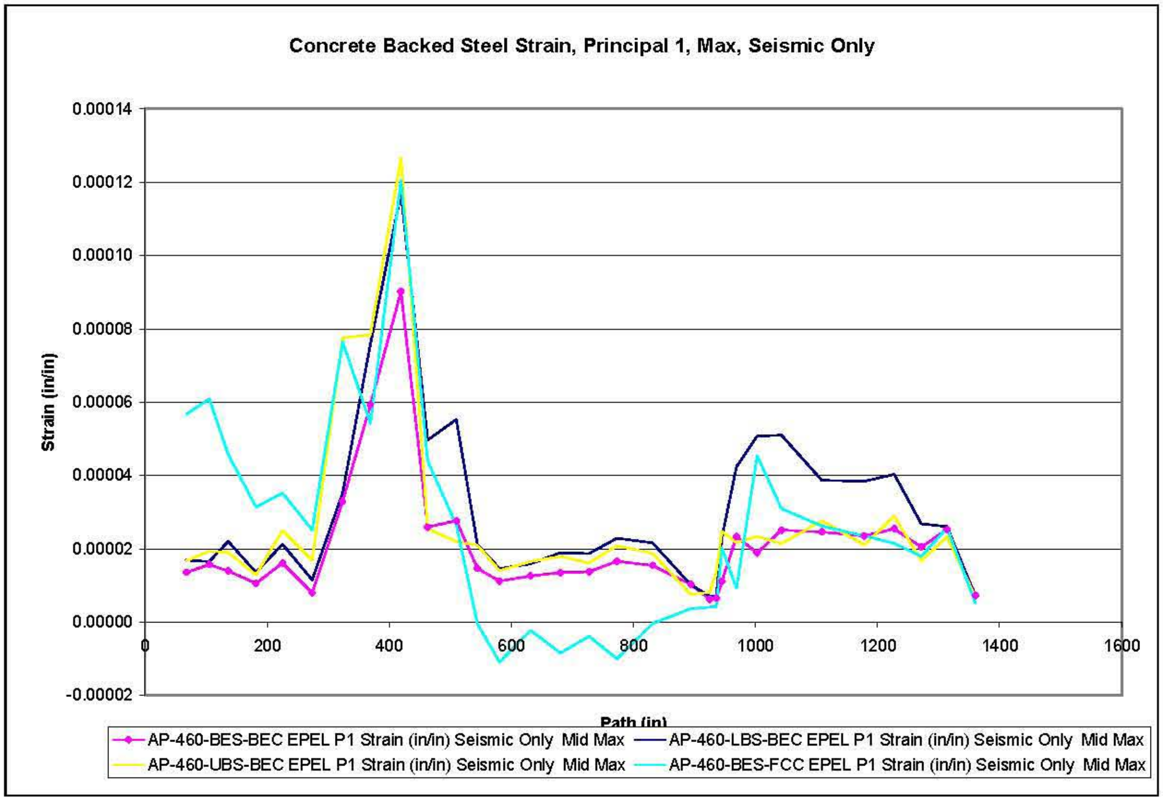


Figure 9-50. Concrete Backed Steel Strain, Principal 2, Gravity Only.

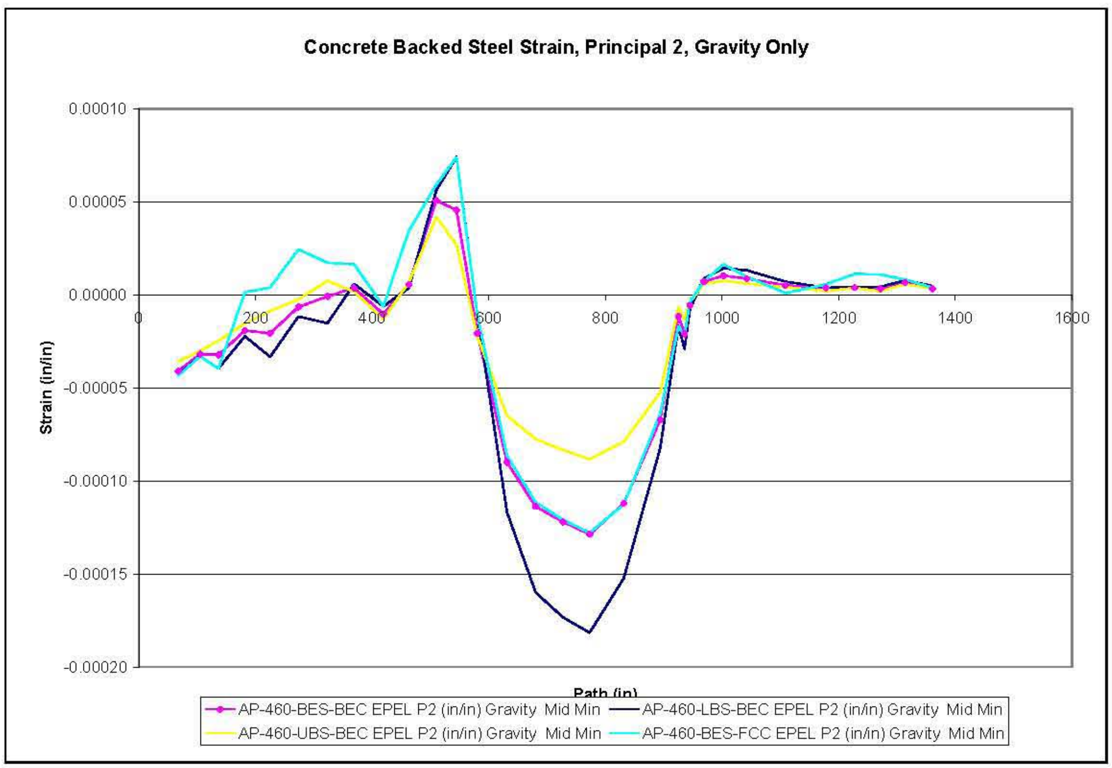


Figure 9-51. Concrete Backed Steel Strain, Principal 2, Min, Gravity Plus Seismic.

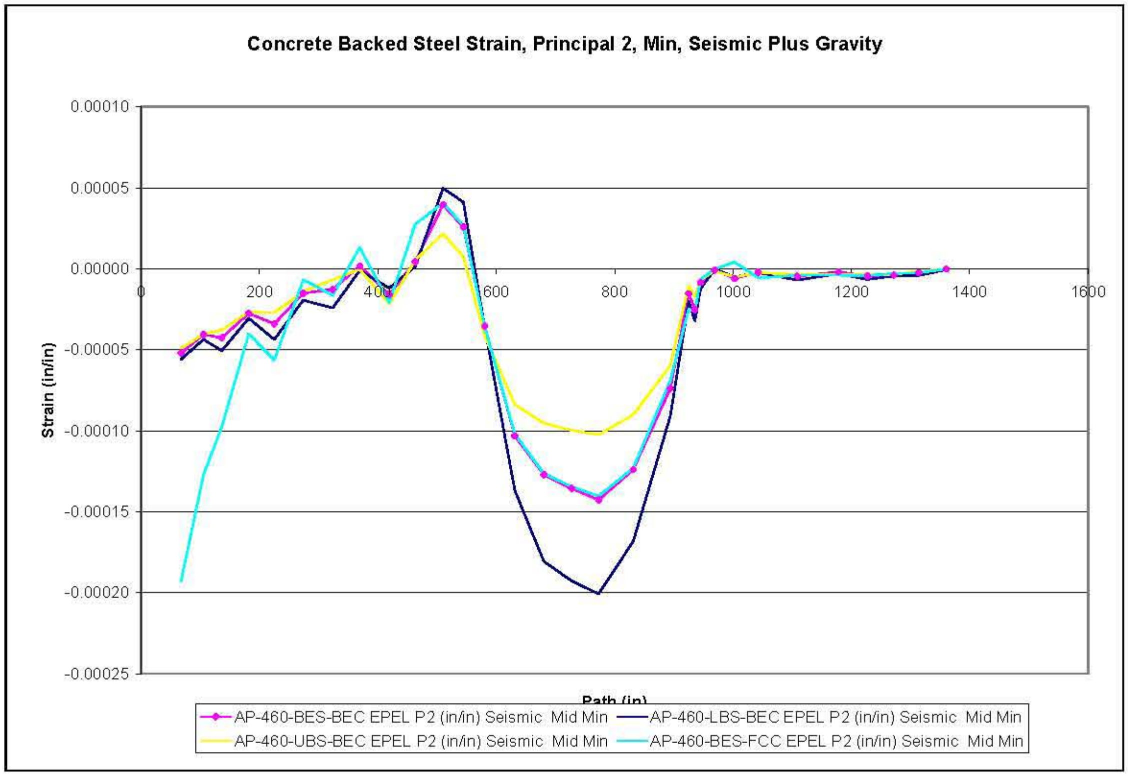


Figure 9-52. Concrete Backed Steel Strain, Principal 2, Max, Gravity Plus Seismic.

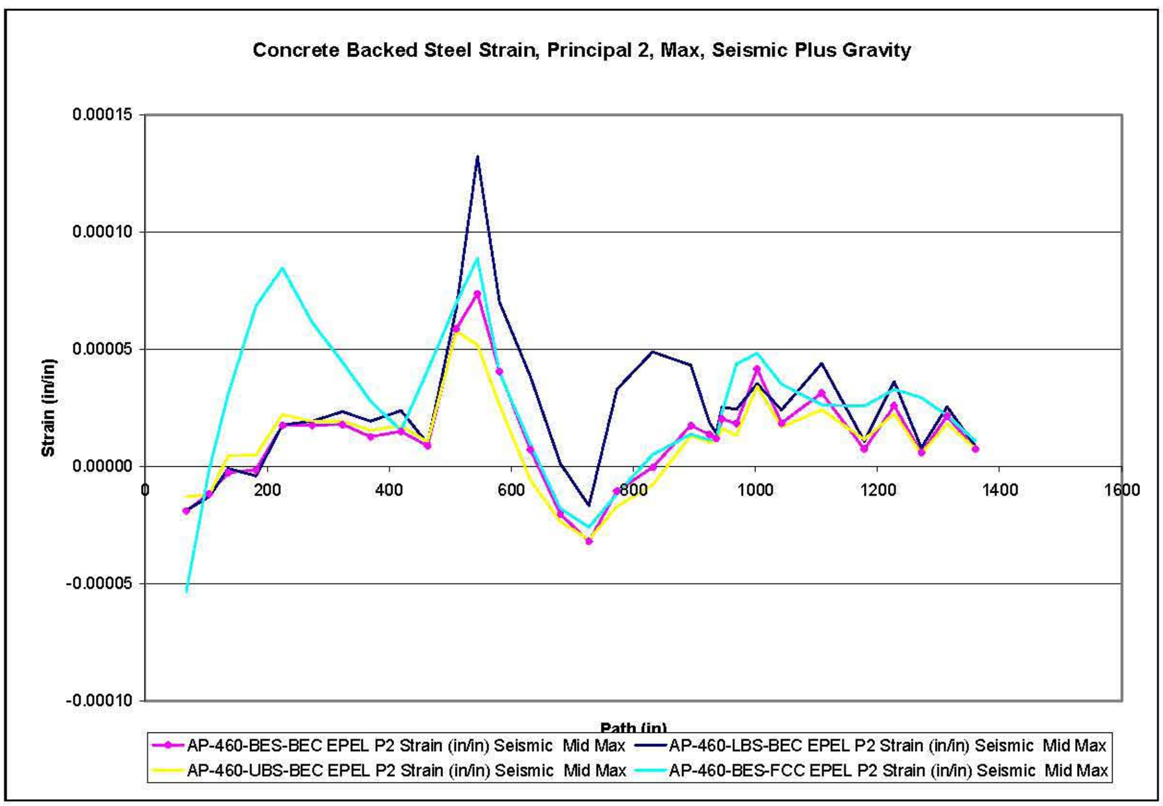


Figure 9-53. Concrete Backed Steel Strain, Principal 2, Min, Seismic Only.

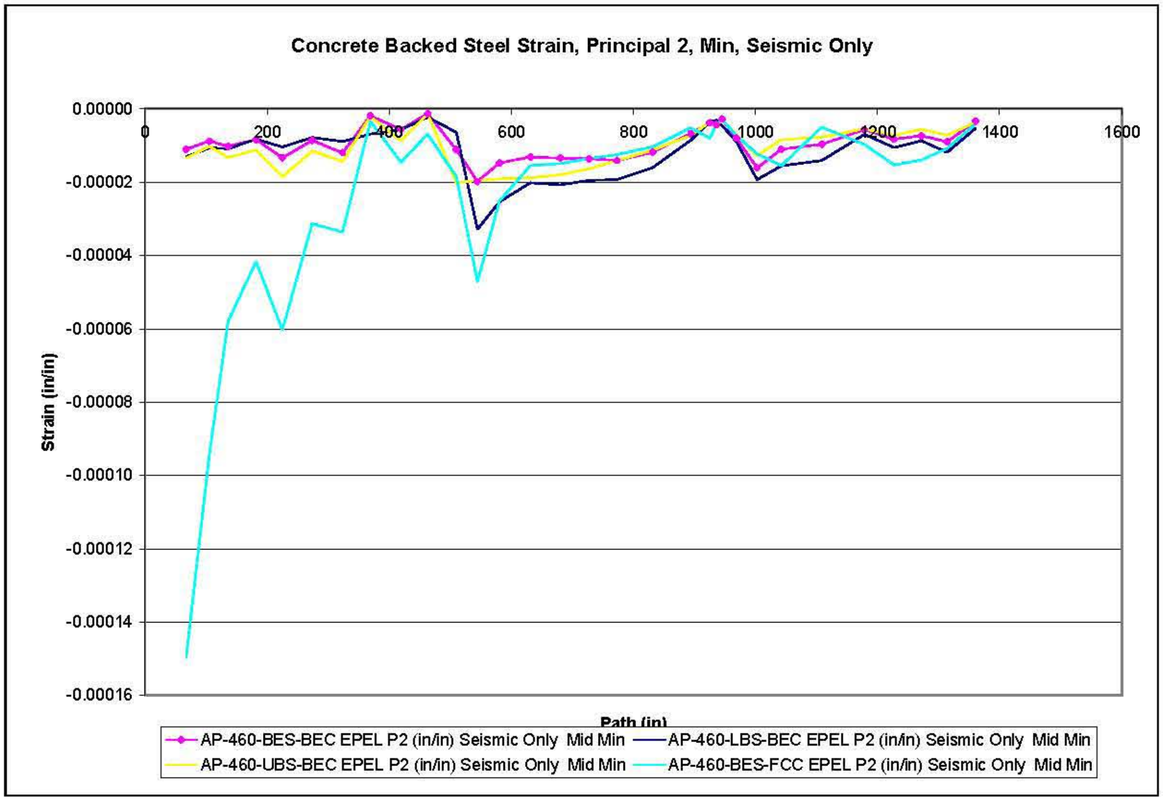


Figure 9-54. Concrete Backed Steel Strain, Principal 2, Max, Seismic Only.

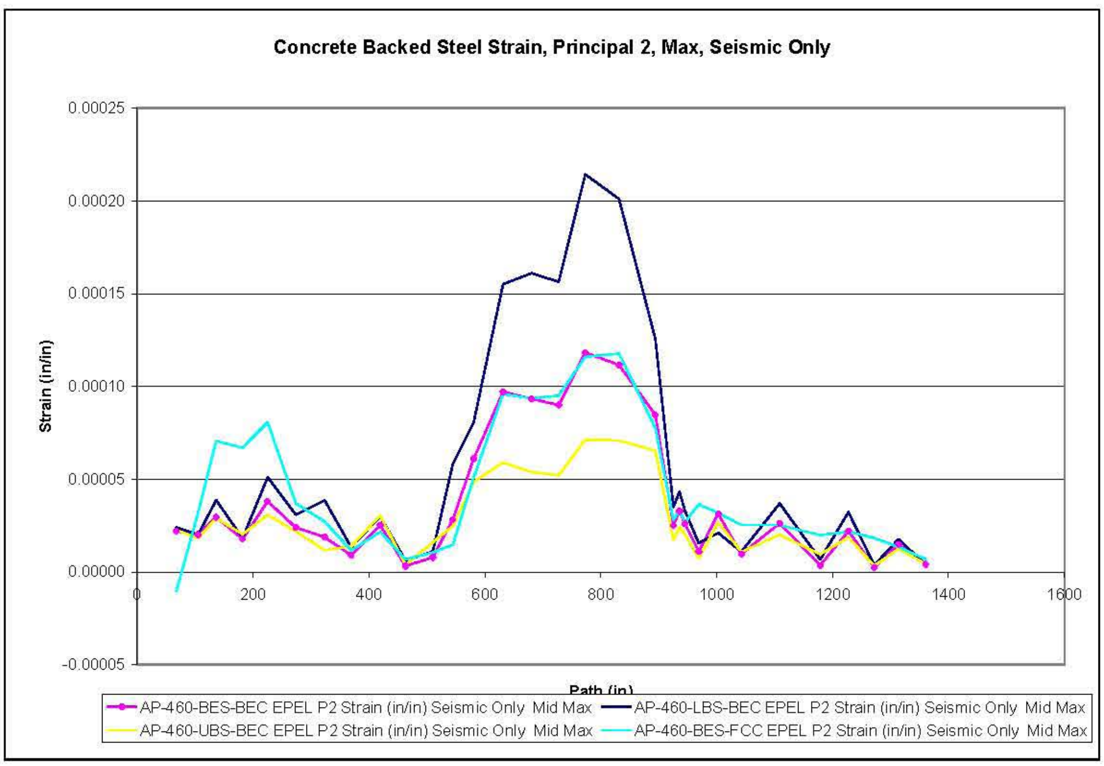


Figure 9-55. Concrete Backed Steel Strain, Principal 3, Gravity Only.

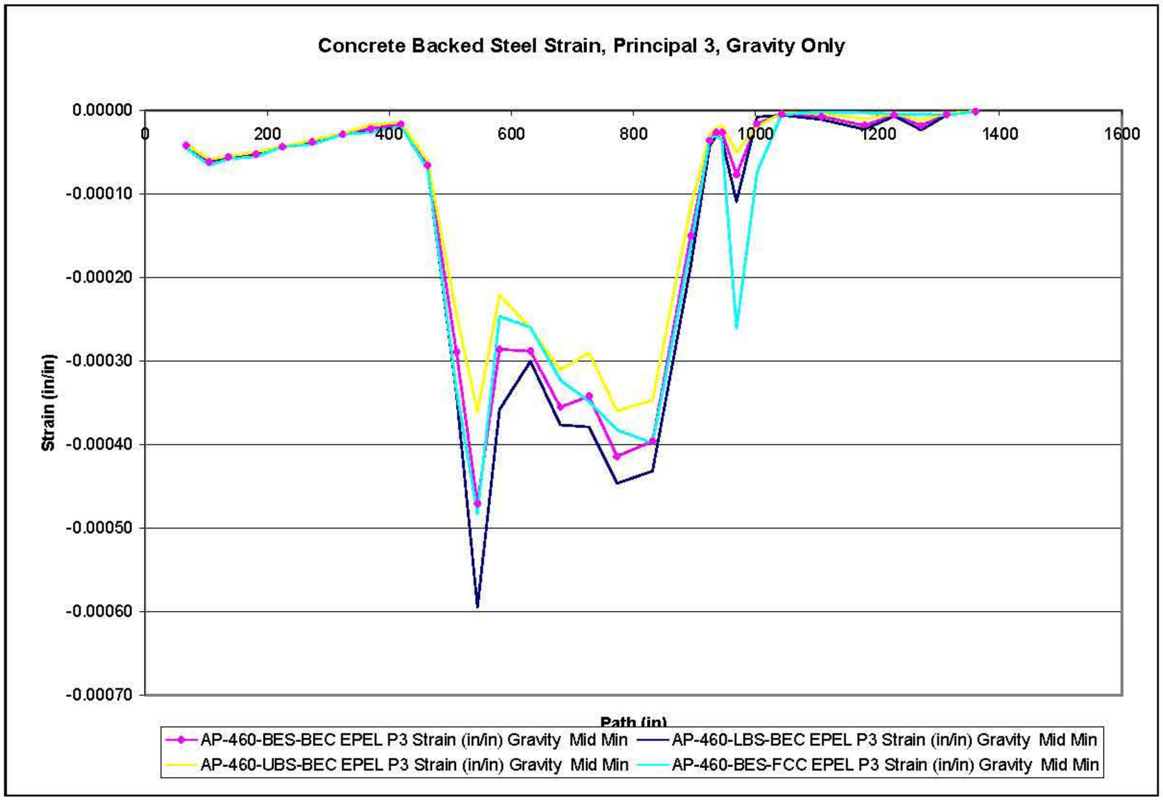


Figure 9-56. Concrete Backed Steel Strain, Principal 3. Min, Gravity Plus Seismic.

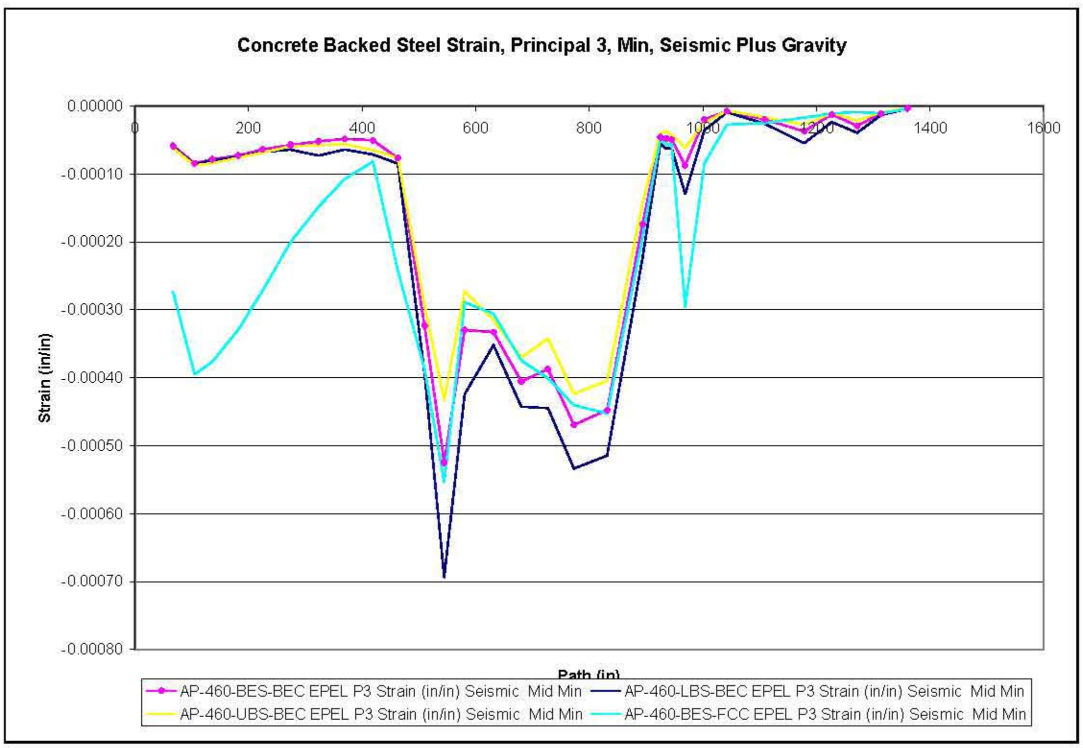


Figure 9-57. Concrete Backed Steel Strain, Principal 3, Max, Gravity Plus Seismic.

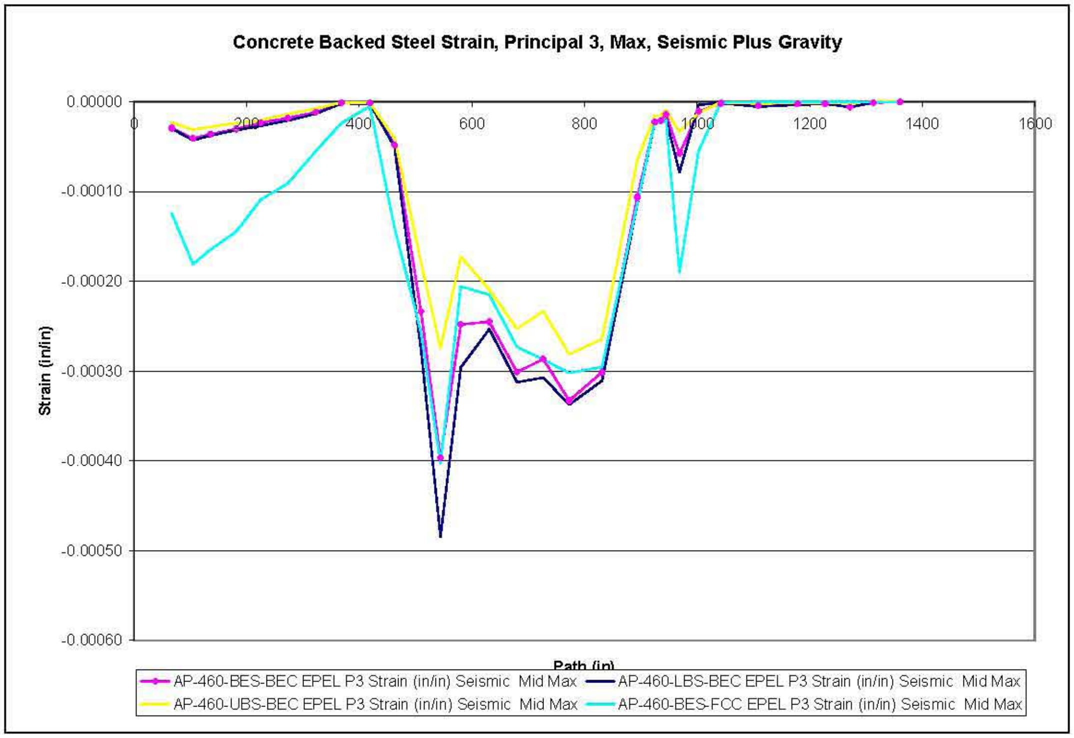


Figure 9-58. Concrete Backed Steel Strain, Principal 3, Min, Seismic Only.

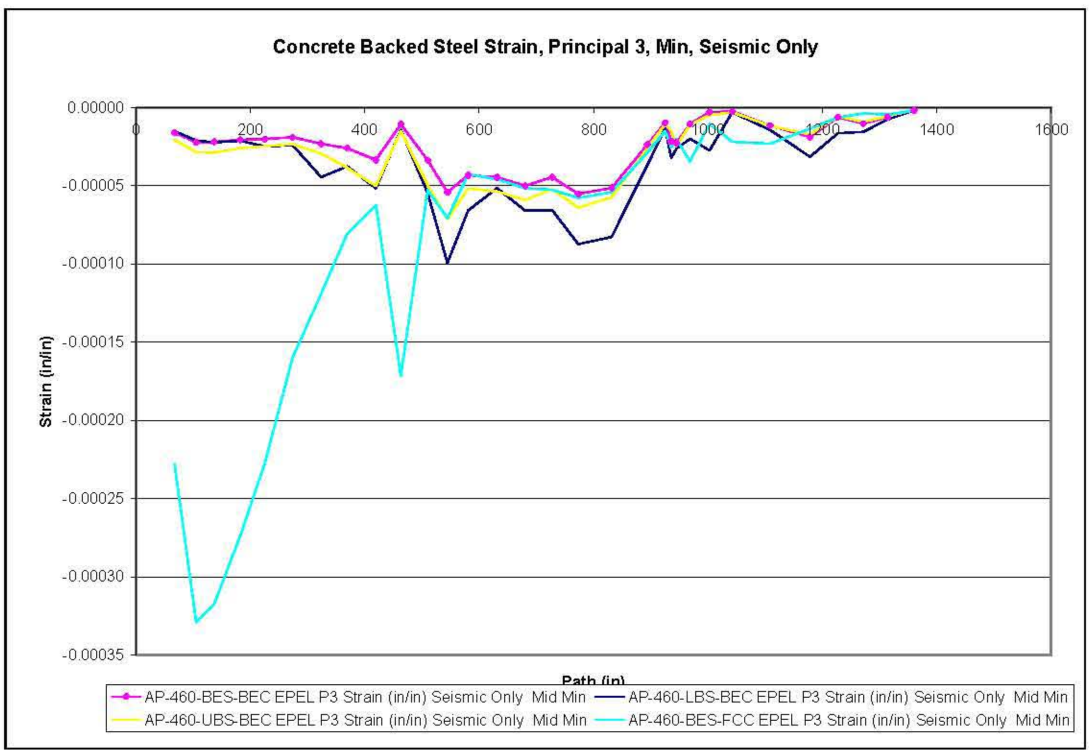
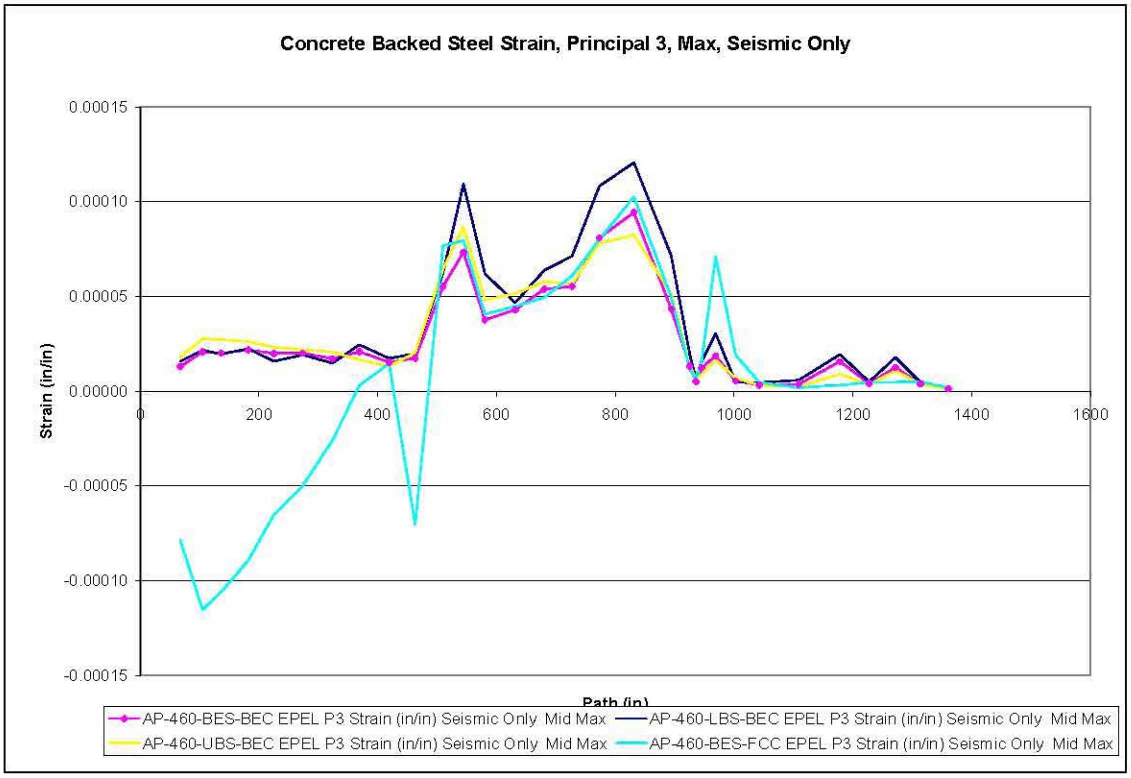


Figure 9-59. Concrete Backed Steel Strain, Principal 3, Max, Seismic Only.



10.0 CONTACT ELEMENT RESULTS

10.1 CONCRETE FOOTING CONTACTS

Contact normal and shear forces, and other contact data were extracted for the interface between the bottom of the concrete wall and the footing. Data for each of the twenty-one contact elements was extracted. Figure 10-1 shows the location and element numbers for each contact element.

The following contact data was extracted for each of the CONTAC178 elements.

- SMISC1 Normal contact force
- CONT-SLIDE Contact lateral displacement
- CONT-GAP Contact gap distance
- CONT-STAT Contact status (open, closed, sliding)
- SMISC2 Shear force (element Y)
- SMISC3 Shear force (element Z)

Results for the contacts were then calculated on a force per foot basis for evaluation and plotting. The following figures present the footing contact data.

- Figure 10-2. Concrete Footing Contact Force - Gravity Only
- Figure 10-3. Maximum Concrete Footing Contact Force - Gravity Plus Seismic
- Figure 10-4. Minimum Concrete Footing Contact Force - Gravity Plus Seismic
- Figure 10-5. Maximum Concrete Footing Contact Force - Seismic Only
- Figure 10-6. Minimum Concrete Footing Contact Force - Seismic Only
- Figure 10-7. Concrete Footing Contact Shear - Gravity Only
- Figure 10-8. Concrete Footing Contact Shear - Gravity Plus Seismic
- Figure 10-9. Concrete Footing Contact Shear - Seismic Only

Figure 10-1. Footing Contact Element Retreival Numbers.

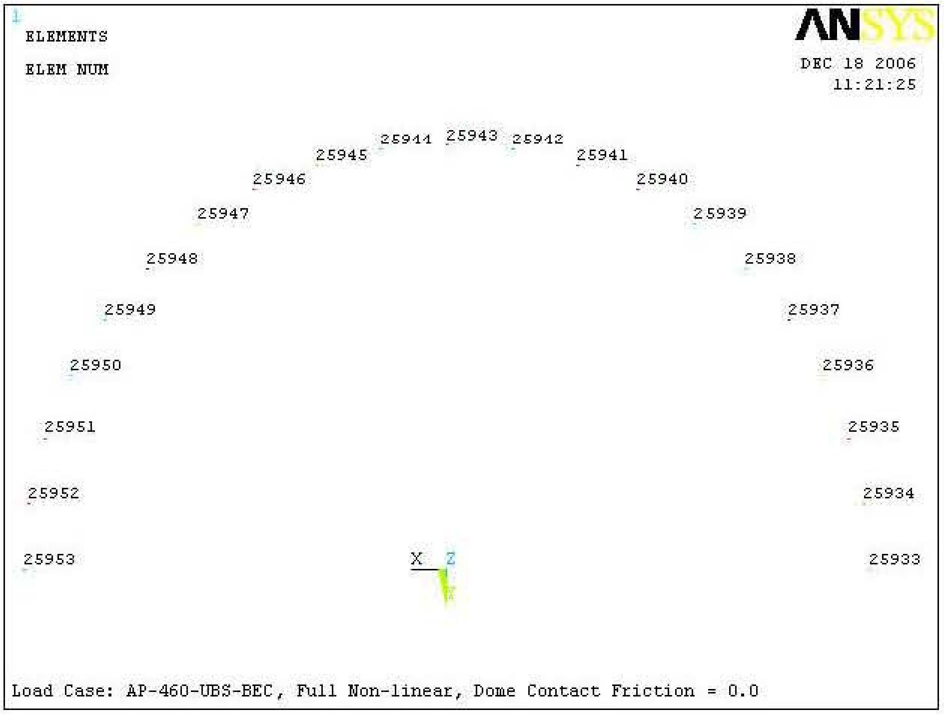


Figure 10-2. Concrete Footing Contact Force - Gravity Only.

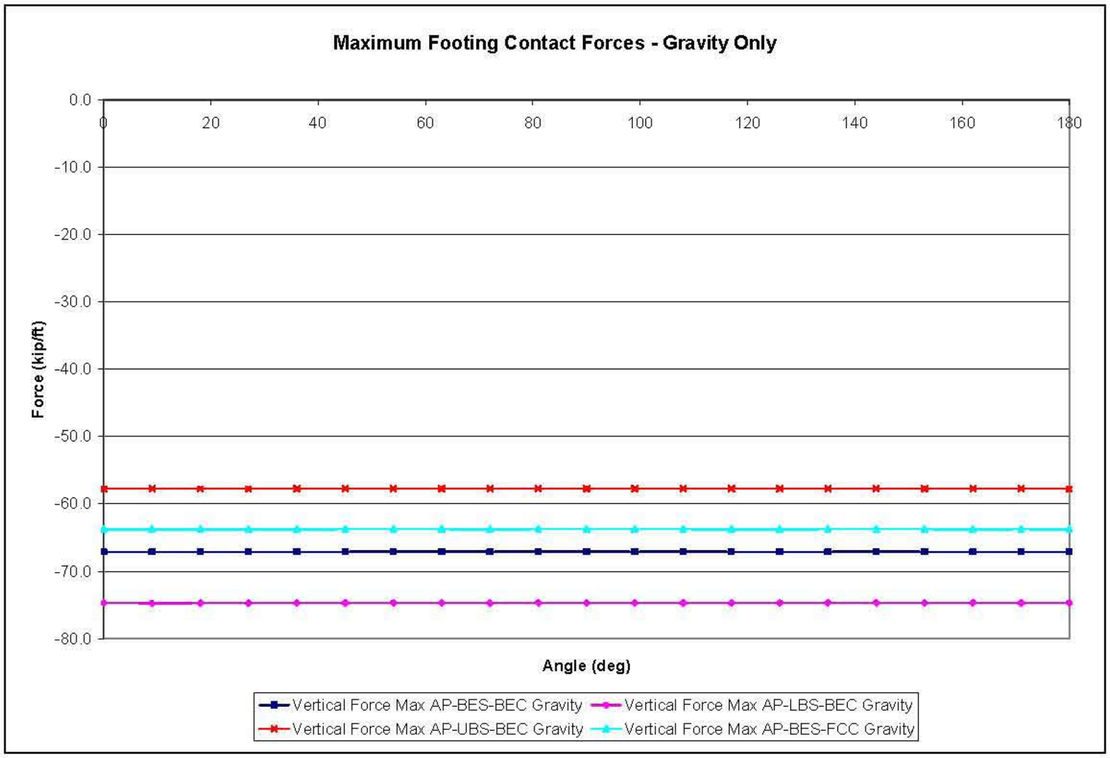


Figure 10-3. Maximum Concrete Footing Contact Force - Gravity Plus Seismic.

Figure 10-4. Minimum Concrete Footing Contact Force - Gravity Plus Seismic.

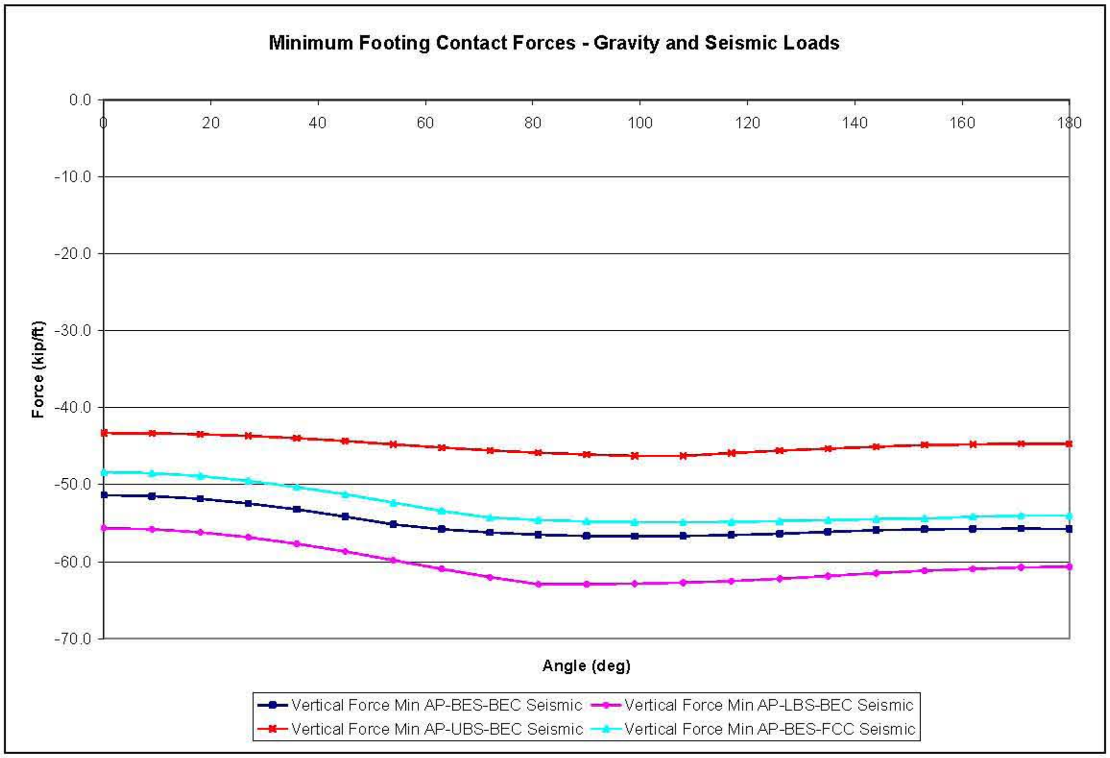


Figure 10-5. Maximum Concrete Footing Contact Force - Seismic Only.

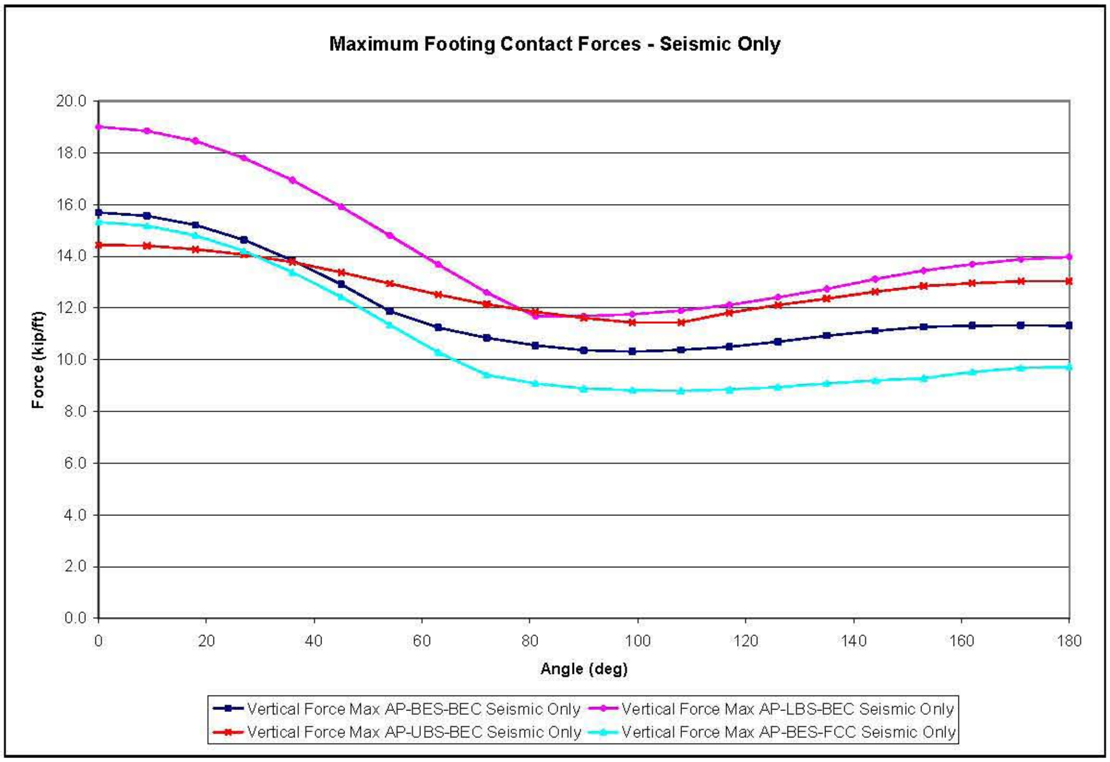


Figure 10-6. Minimum Concrete Footing Contact Force - Seismic Only.

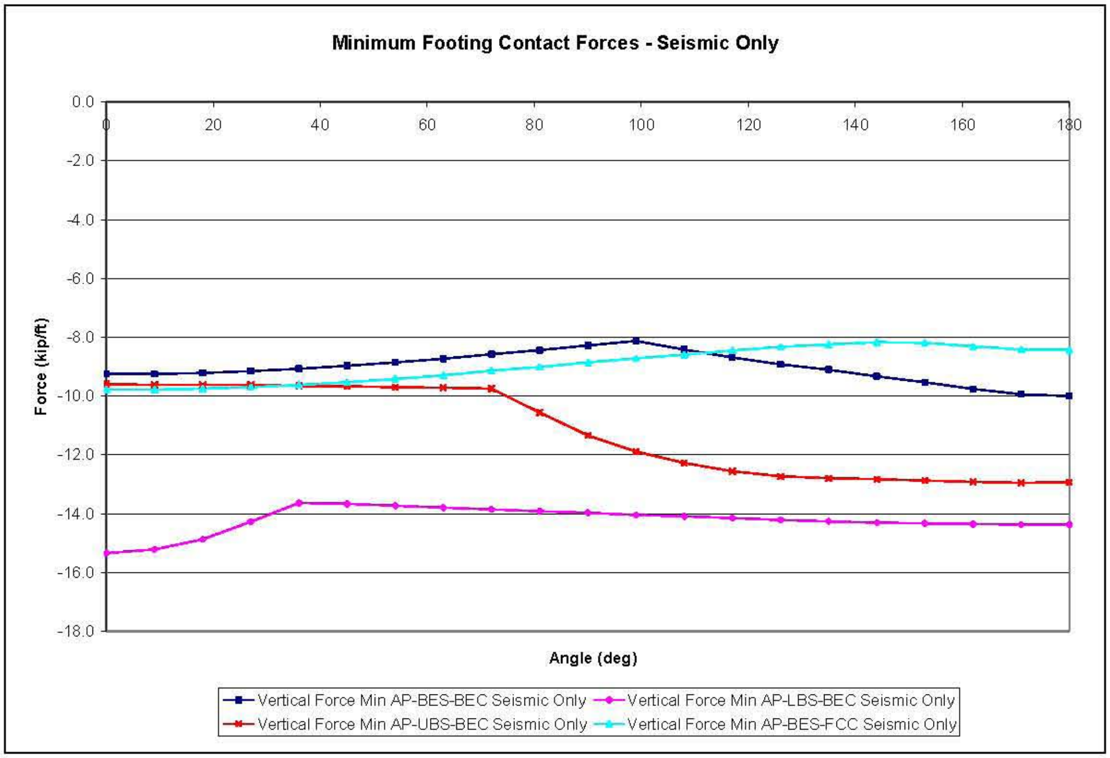


Figure 10-7. Concrete Footing Contact Shear - Gravity Only.

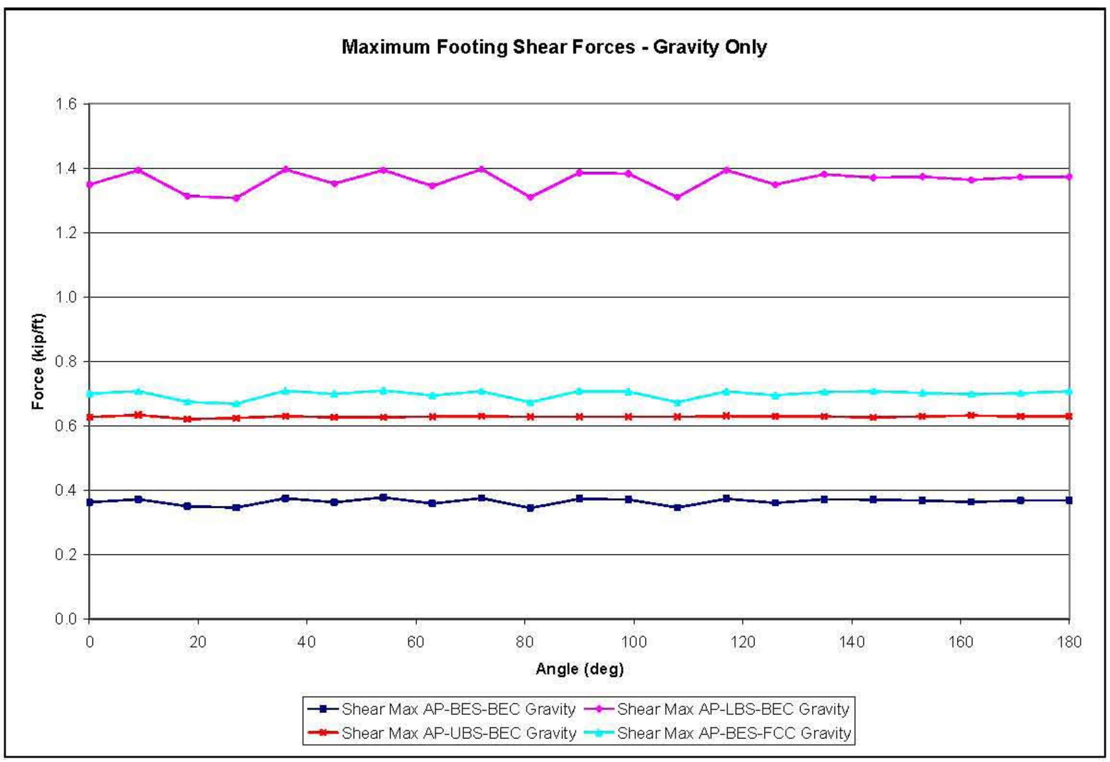
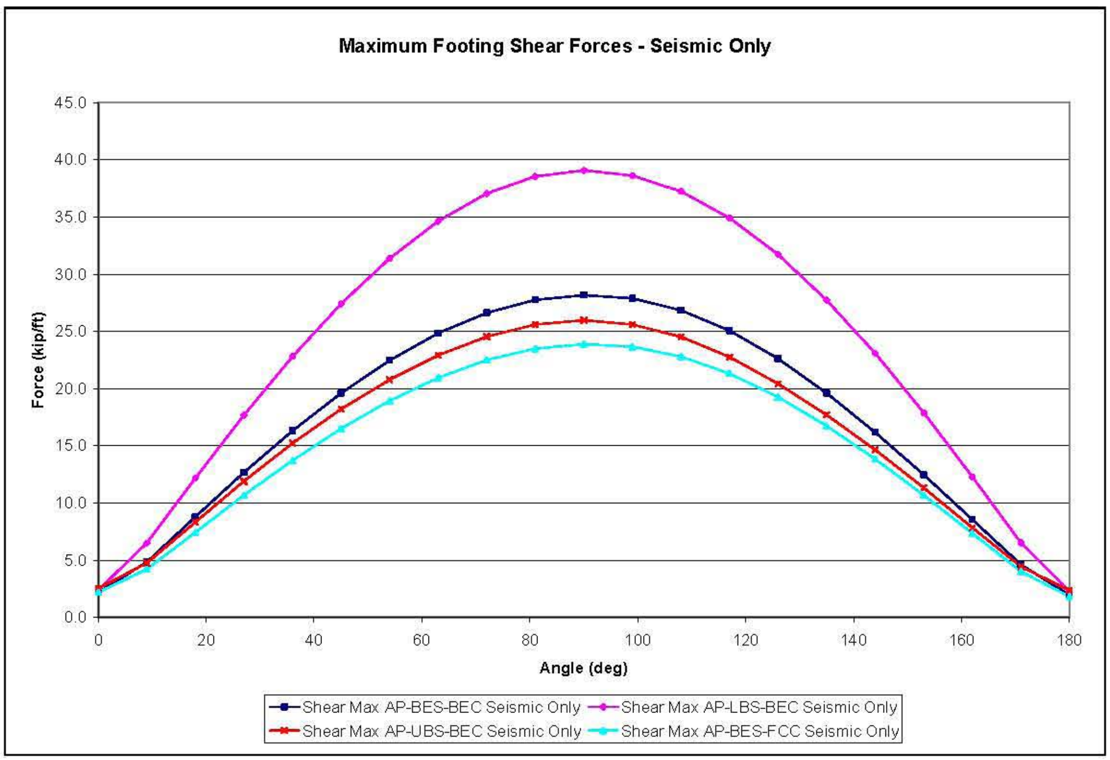


Figure 10-8. Concrete Footing Contact Shear - Gravity Plus Seismic.

Figure 10-9. Concrete Footing Contact Shear - Seismic Only.



Time history results were evaluated for the contact elements located at 9 degrees and 180 degrees. The resultant shear and normal forces were compared over the full time history to determine the potential for sliding. There were no cases in which ANSYS® showed any sliding to occur. It is noted that at times during the transient analysis; the shear force exceeded the friction capacity of the contact element. This is because the total displacement occurring at any time did not meet the ANSYS® criteria for sliding to occur. The maximum elastic displacement for any load case was 0.00009 inches (Best Estimate Soil, Fully Cracked Concrete). Each plot comparing the shear force and normal force include the contact normal force (pr# in plots), the shear force, and the ratio of the shear to normal force (V/N). The following figures are provided for the time histories.

- Figure 10-10. Concrete Footing Time History, θ=9 Deg– LBS-BEC
- Figure 10-11. Concrete Footing Time History, θ=90 Deg– LBS-BEC
- Figure 10-12. Concrete Footing Displacment Time History, θ=90 Deg – BES-FCC
- Figure 10-13. Concrete Footing Time History, θ=9 Deg – BES-BEC
- Figure 10-14. Concrete Footing Time History, θ=90 Deg – BES-BEC
- Figure 10-15. Concrete Footing Time History, θ=9 Deg – UBS-BEC
- Figure 10-16. Concrete Footing Time History, θ=90 Deg – UBS-BEC
- Figure 10-17. Concrete Footing Time History, θ=9 Deg – BES-FCC
- Figure 10-18. Concrete Footing Time History, θ=90 Deg – BES-FCC

Figure 10-10. Concrete Footing Time History, θ=9 Deg– LBS-BEC.

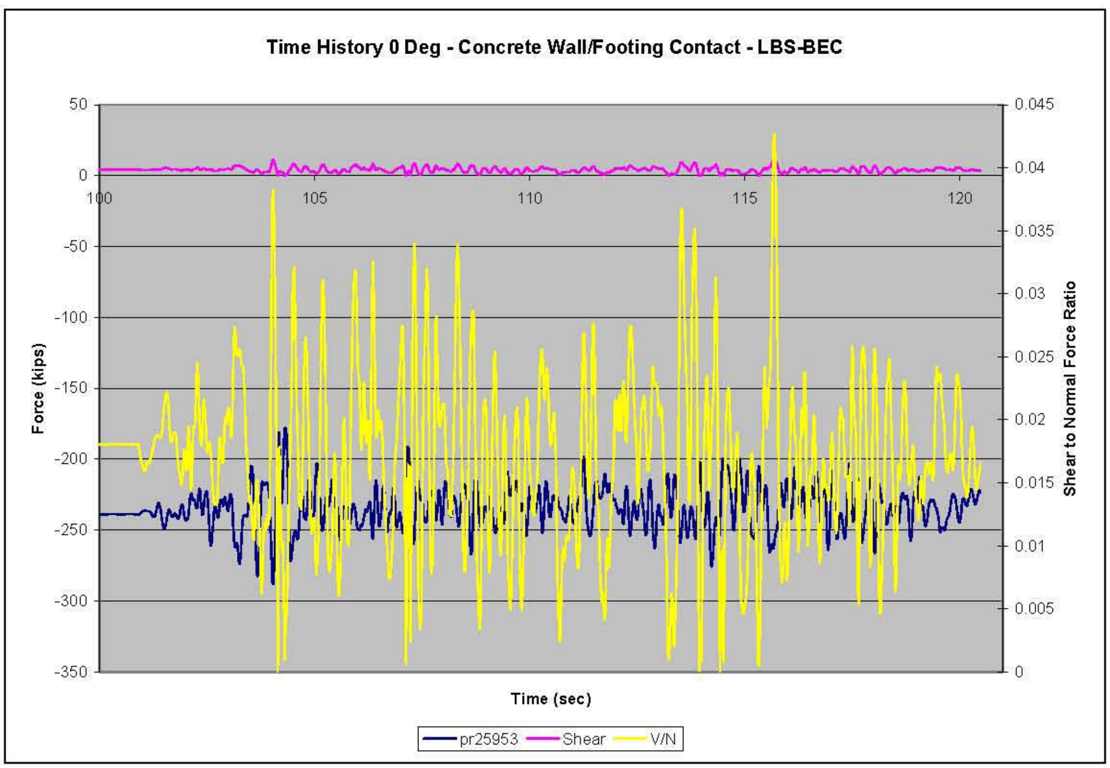


Figure 10-11. Concrete Footing Time History, θ=90 Deg– LBS-BEC.

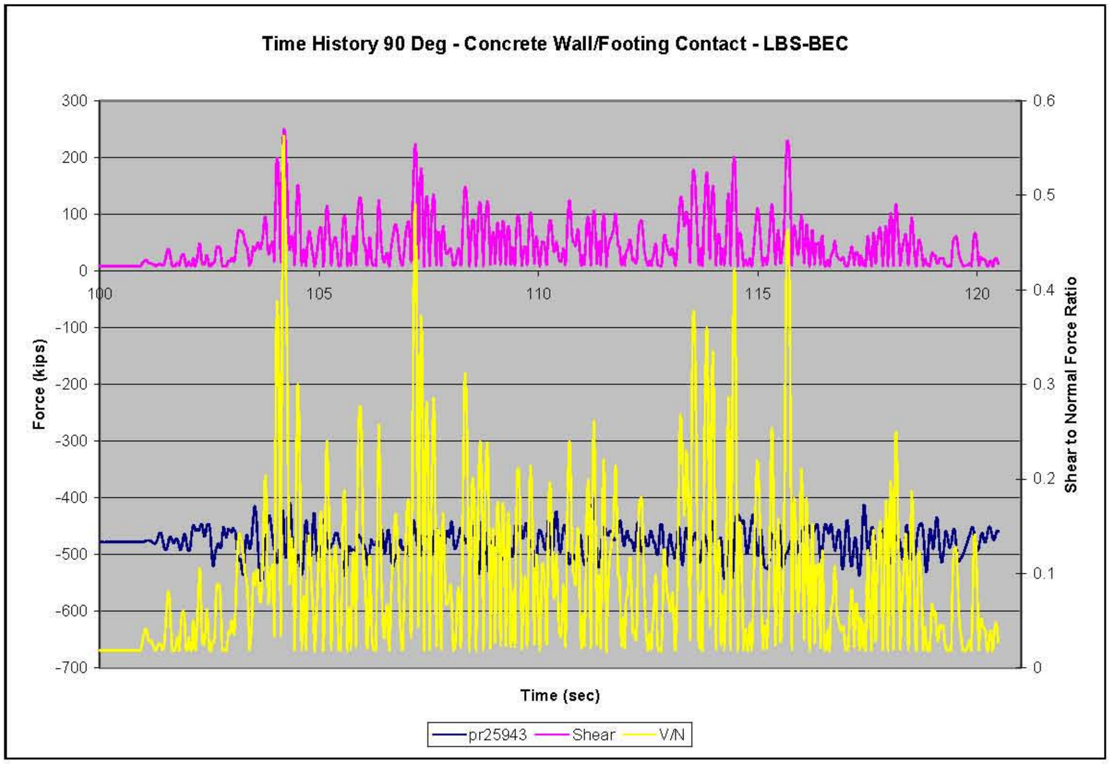


Figure 10-12. Concrete Footing Displacment Time History, θ=90 Deg – BES-FCC.

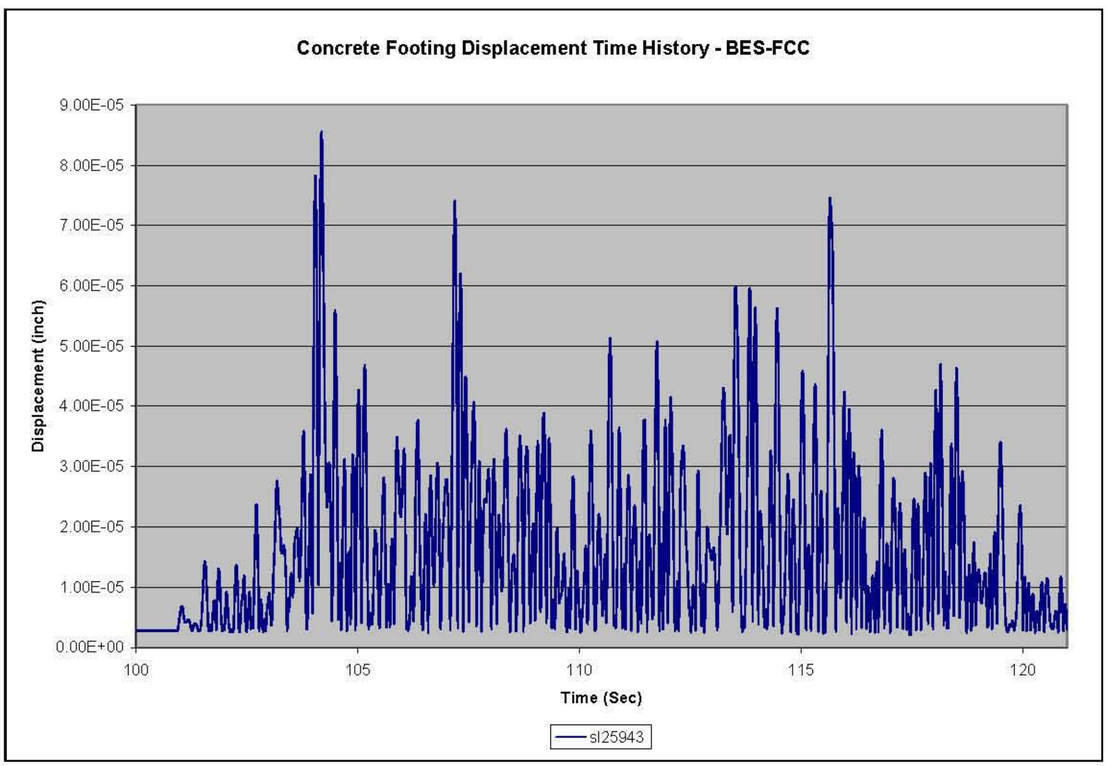


Figure 10-13. Concrete Footing Time History, θ=9 Deg – BES-BEC.

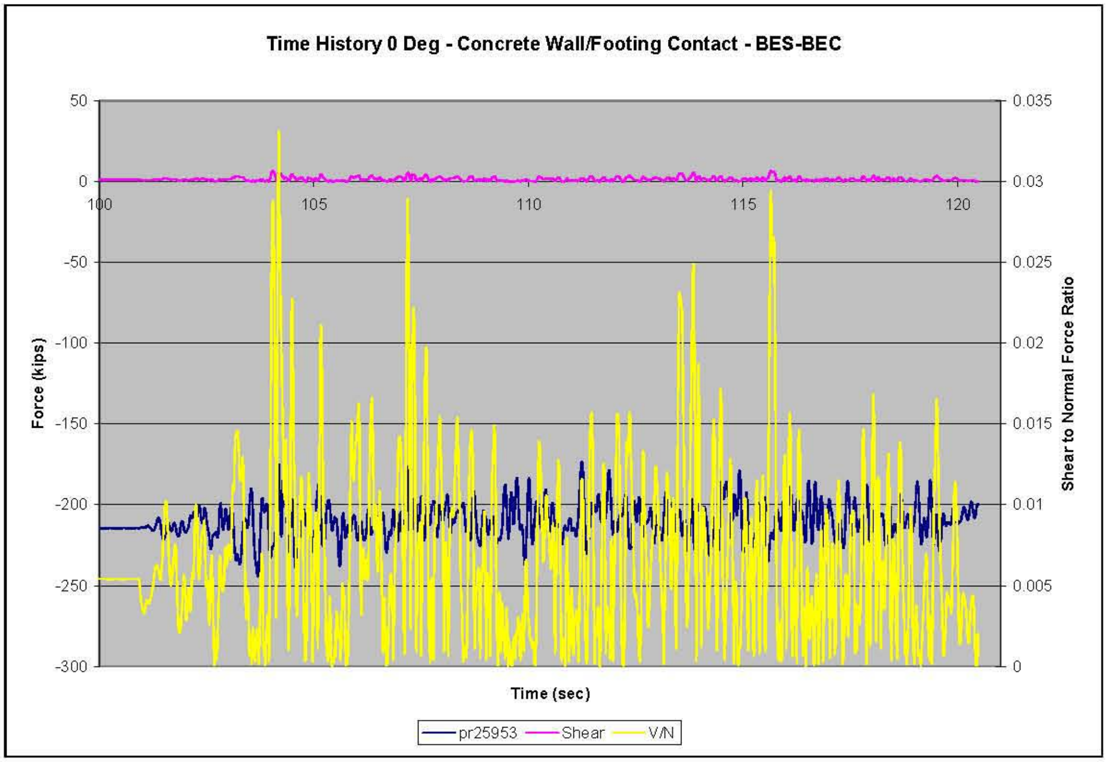


Figure 10-14. Concrete Footing Time History, θ=90 Deg – BES-BEC.

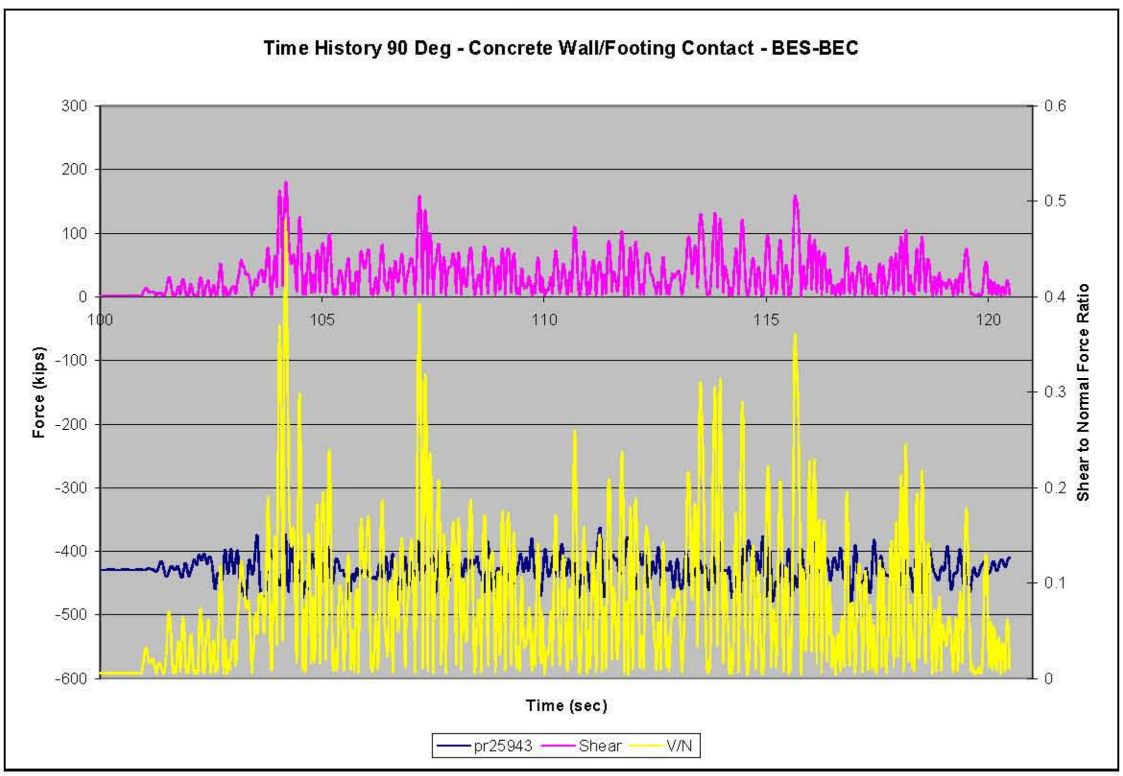


Figure 10-15. Concrete Footing Time History, θ=9 Deg – UBS-BEC.

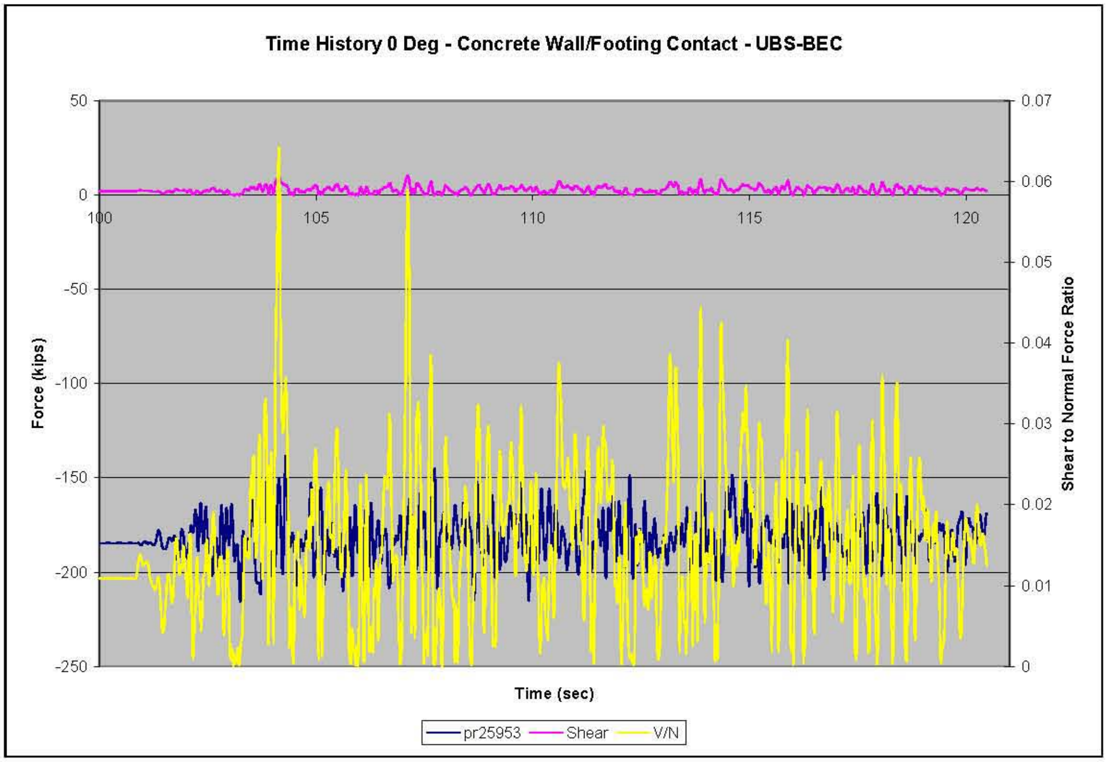


Figure 10-16. Concrete Footing Time History, θ=90 Deg – UBS-BEC.

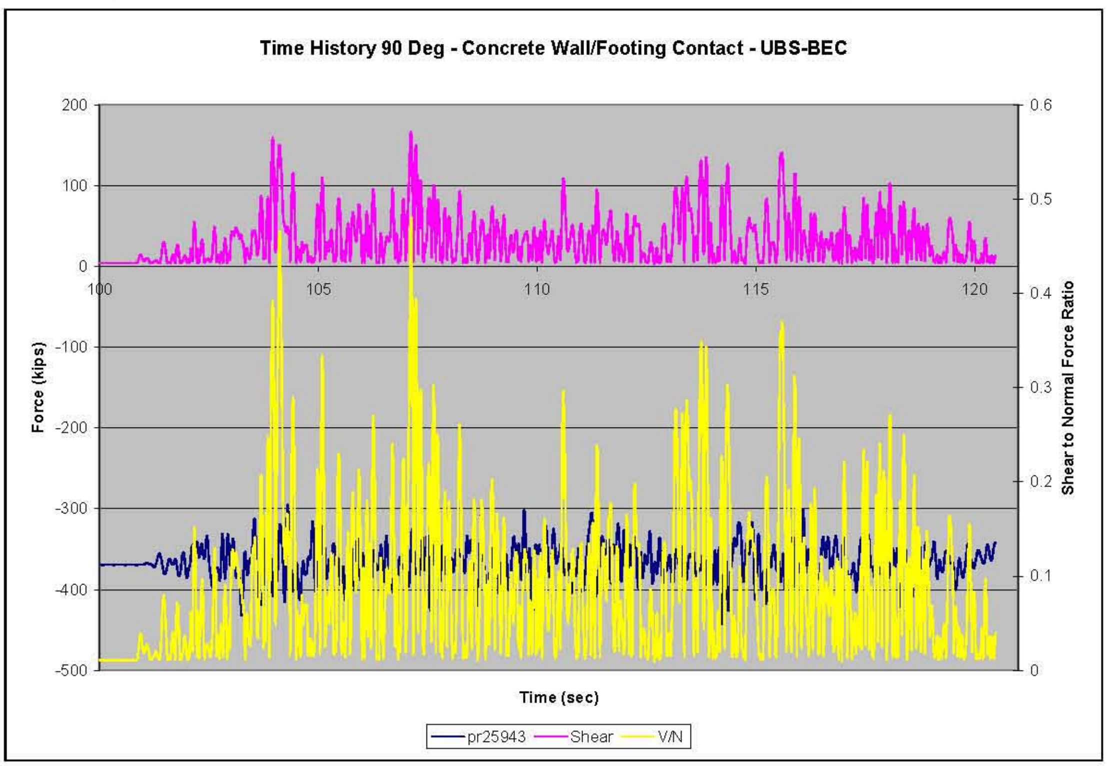


Figure 10-17. Concrete Footing Time History, θ=9 Deg – BES-FCC.

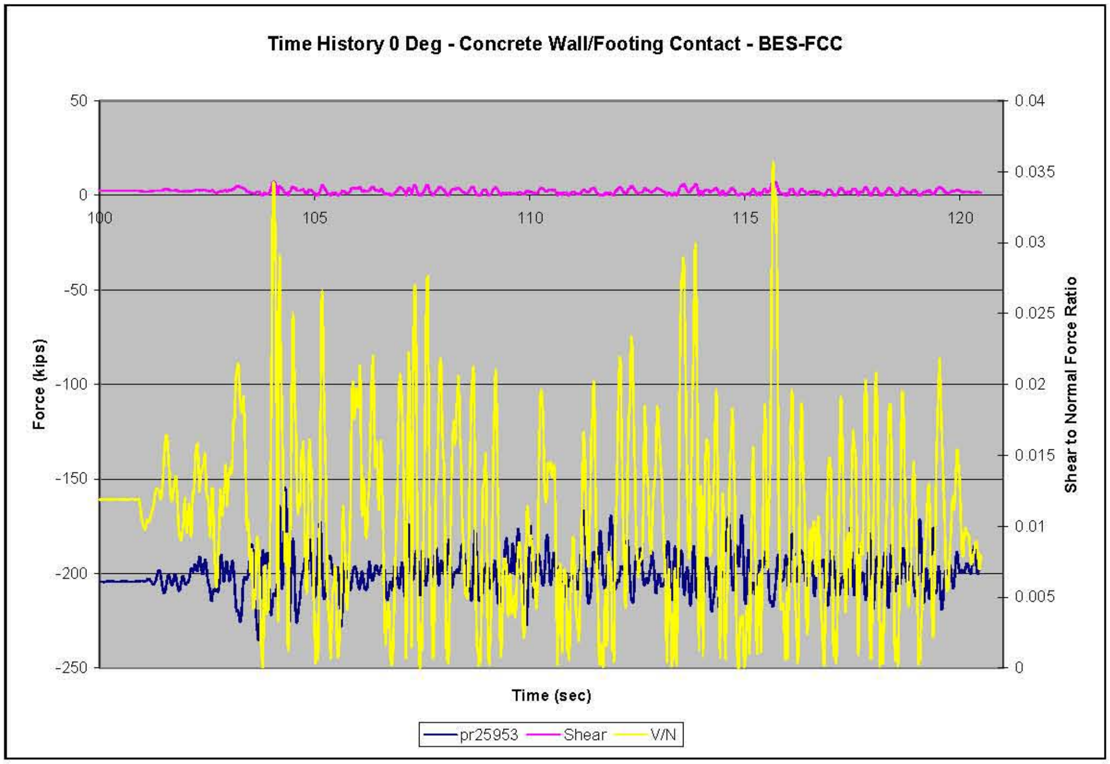
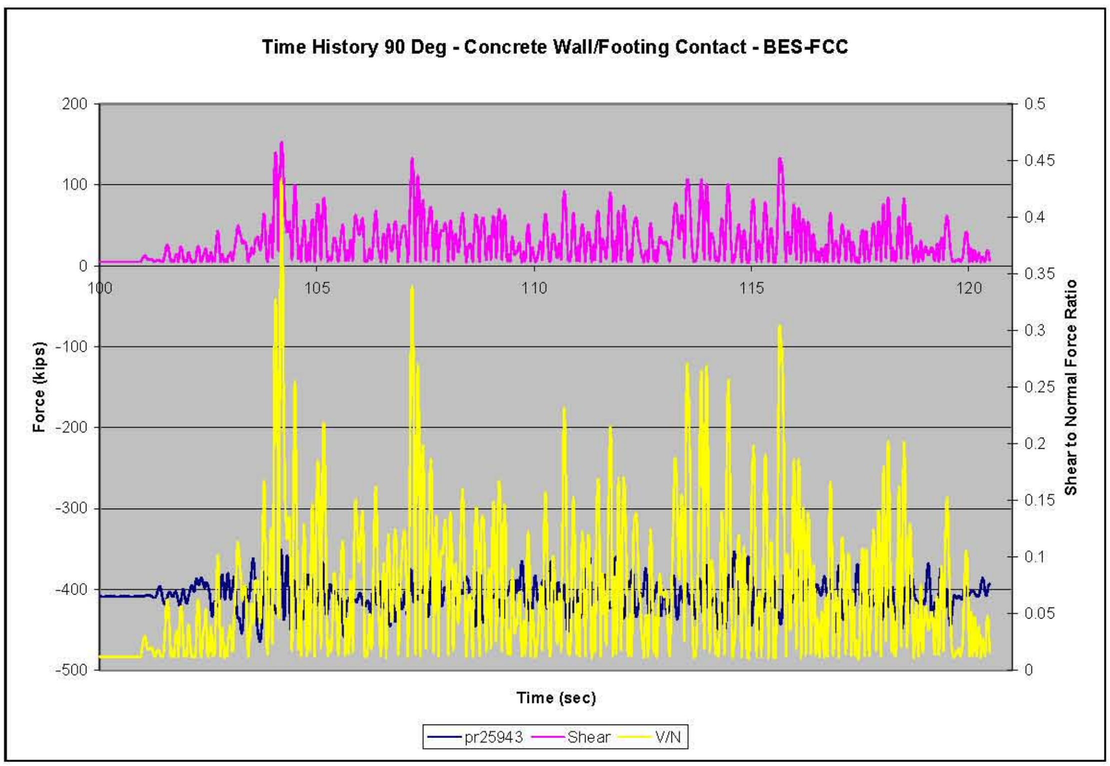


Figure 10-18. Concrete Footing Time History, θ=90 Deg – BES-FCC.



Based on the results presented above for the contact interface between the concrete wall and footing, no displacements are expected to occur. Therefore, future models of the DSTs do not need to incorporate this feature.

10.2 SOIL CONTACT

Soil contact data are extracted from the model in 9 degree slices, starting near the top of the dome and moving down the wall. Contact normal and shear forces, and other contact data were extracted for the interface between soil and the concrete shell. Figure 10-19 shows the location and element numbers for first slice of contact elements. The following data was extracted for each CONTA173 element

- CONT-PRES Normal Contact Pressure
- CONT-SLIDE Contact Lateral Displacement
- CONT-GAP Contact Gap Distance
- CONT-STAT Contact Status (Open, Closed, Sliding)
- SMISC8 Tangential Friction (Element Y)
- SMISC12 Tangential Friction (Element Z)

For each load case, the minimum and maximum contact pressure, tangential shear pressures, and lateral displacements are compared. The figures for each component are grouped by gravity only, gravity plus seismic, and seismic only. For the soil contact interface, the following figures are provided.

- Figure 10-20. Soil/Concrete Contact Element Normal Pressure – Gravity Only
- Figure 10-21. Soil/Concrete Contact Element Maximum Normal Pressure – Gravity Plus Seismic
- Figure 10-22. Soil/Concrete Contact Element Minimum Normal Pressure – Gravity Plus Seismic
- Figure 10-23. Soil/Concrete Contact Element Maximum Normal Pressure – Seismic Only
- Figure 10-24. Soil/Concrete Contact Element Minimum Normal Pressure – Seismic Only
- Figure 10-26. Soil/Concrete Contact Element Meridional Shear – Gravity Plus Seismic
- Figure 10-27. Soil/Concrete Contact Element Meridional Shear – Seismic Only
- Figure 10-29. Soil/Concrete Contact Element Tangential Shear – Gravity Plus Seismic
- Figure 10-30. Soil/Concrete Contact Element Gap Tangential Shear – Seismic Only
- Figure 10-32. Soil/Concrete Contact Element Gap Lateral Displacement (Slide) – Gravity Plus Seismic
- Figure 10-33. Soil/Concrete Contact Element Gap Lateral Displacement (Slide) – Seismic Only

Figure 10-19. Soil/Concrete Contact Element Retreival Sequence Starting Numbers.

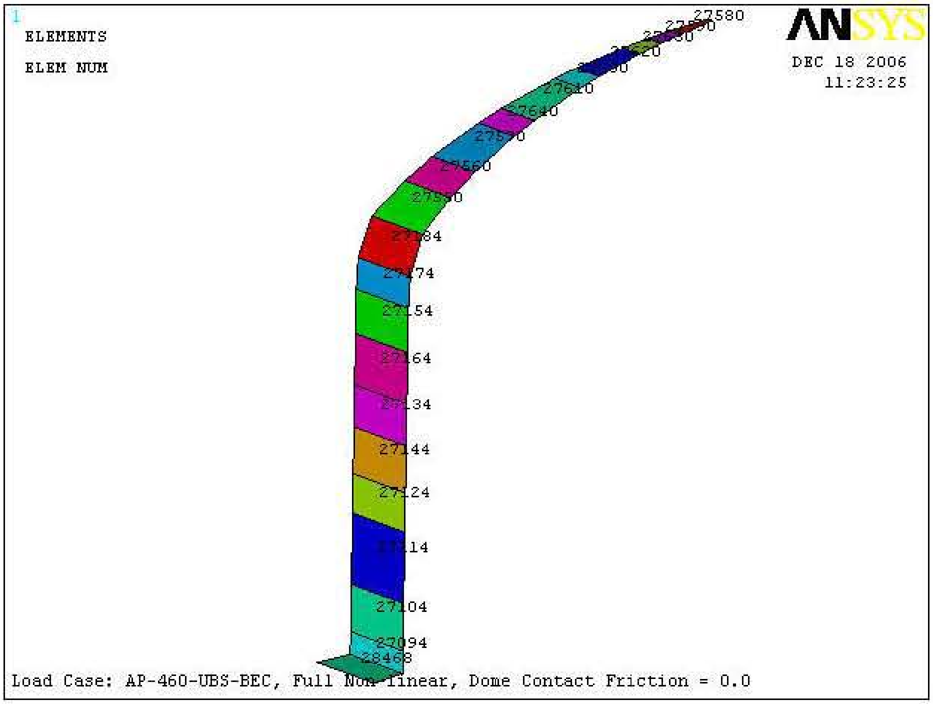


Figure 10-20. Soil/Concrete Contact Element Normal Pressure – Gravity Only.

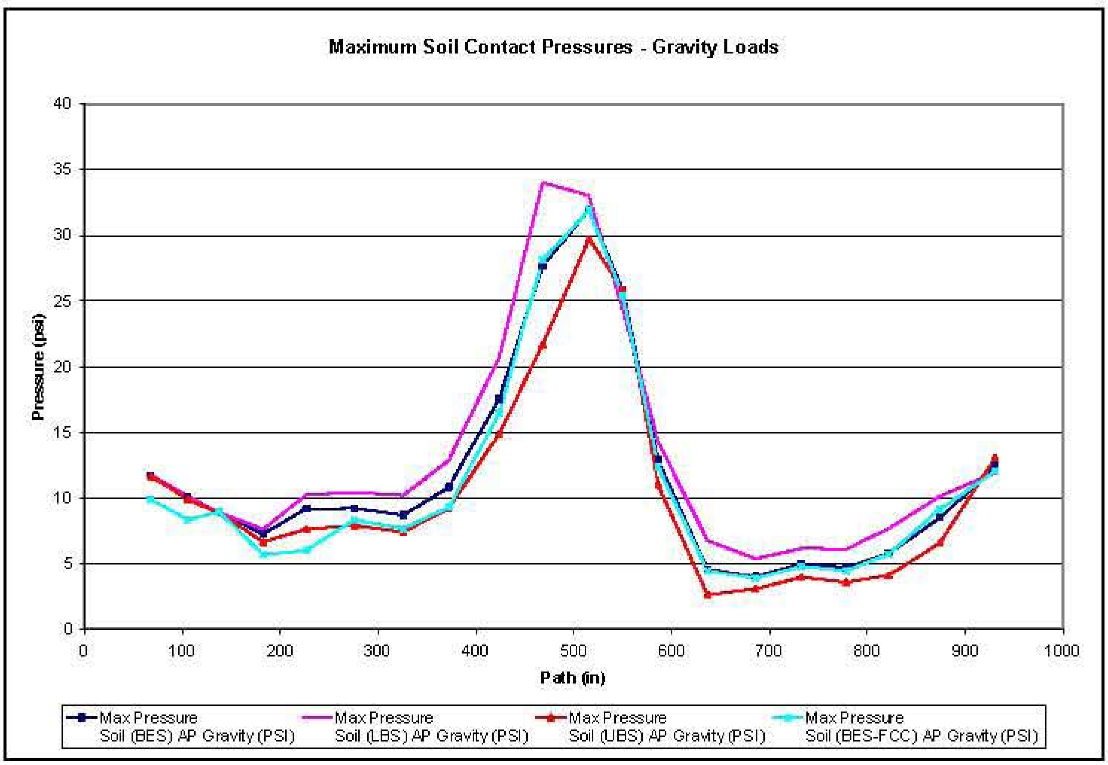


Figure 10-21. Soil/Concrete Contact Element Maximum Normal Pressure – Gravity Plus Seismic.

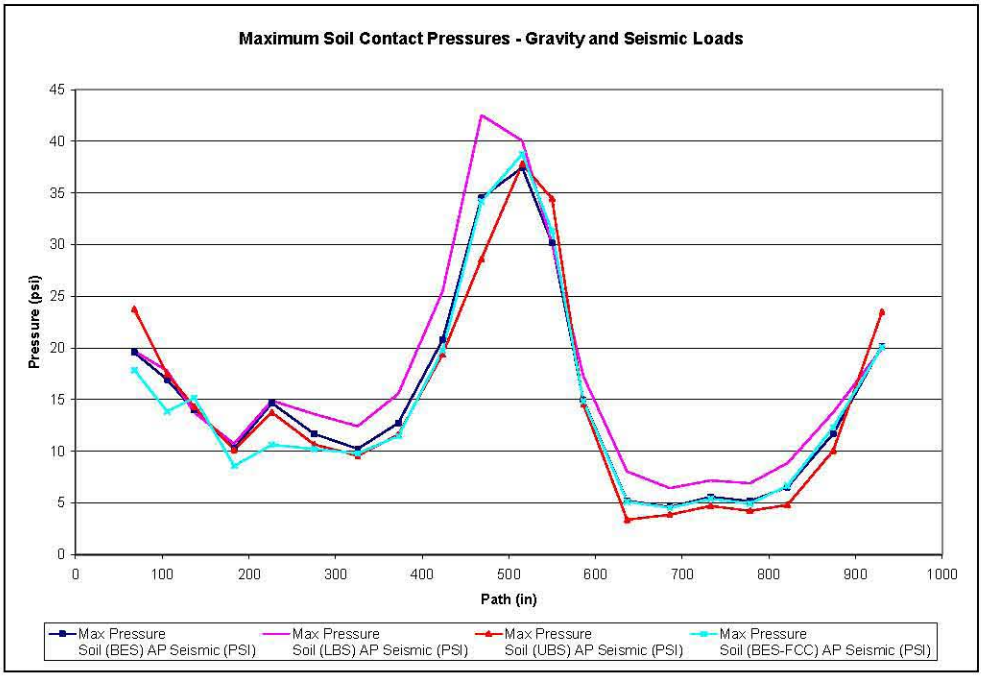


Figure 10-22. Soil/Concrete Contact Element Minimum Normal Pressure – Gravity Plus Seismic.

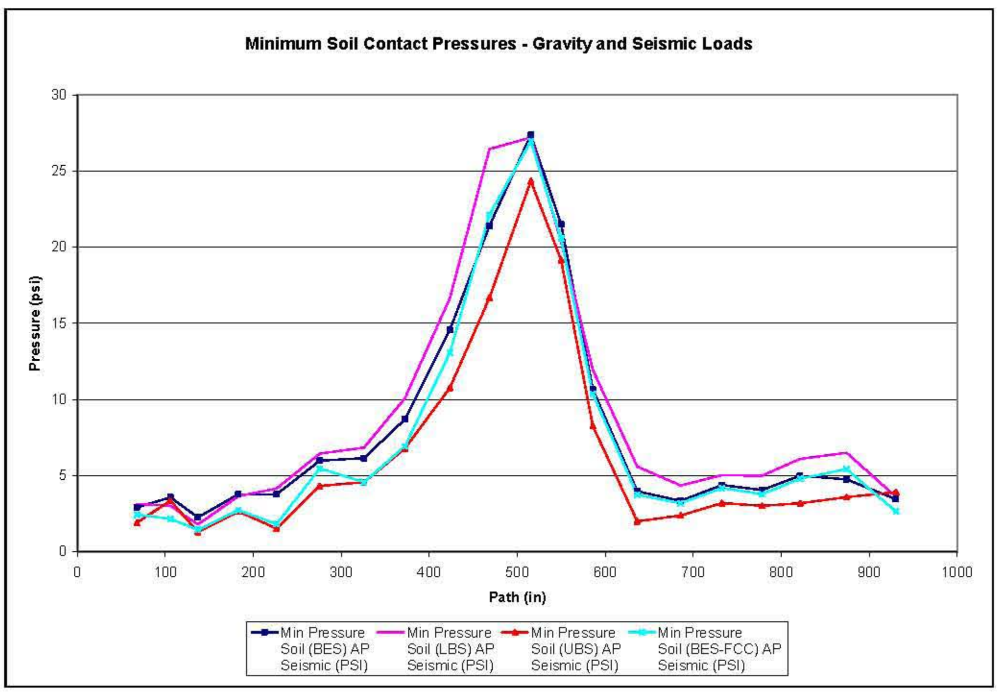


Figure 10-23. Soil/Concrete Contact Element Maximum Normal Pressure – Seismic Only.

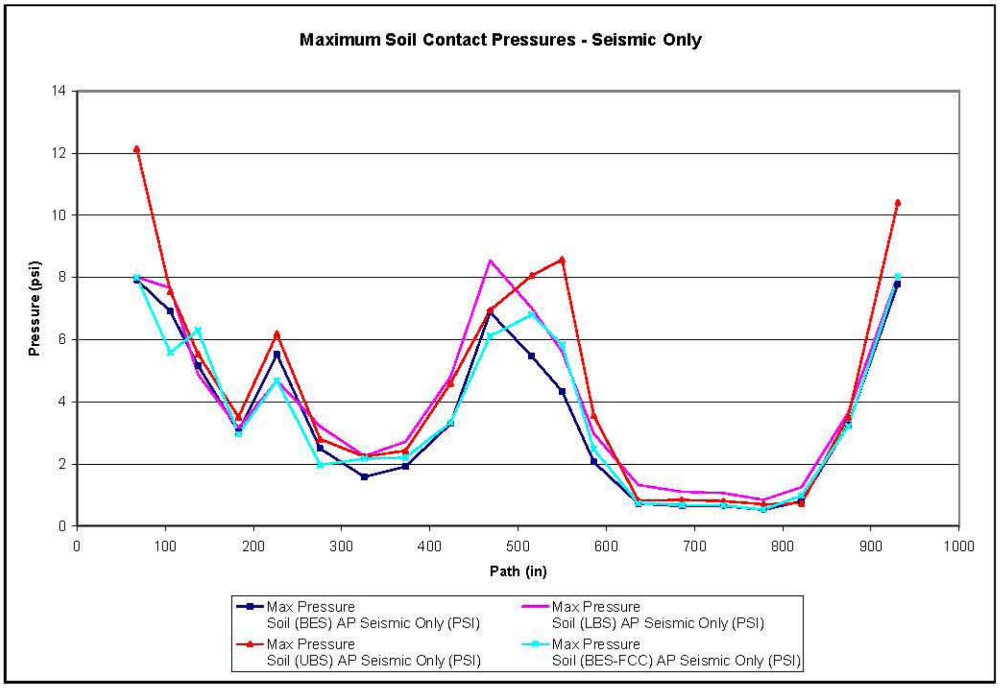


Figure 10-24. Soil/Concrete Contact Element Minimum Normal Pressure – Seismic Only.

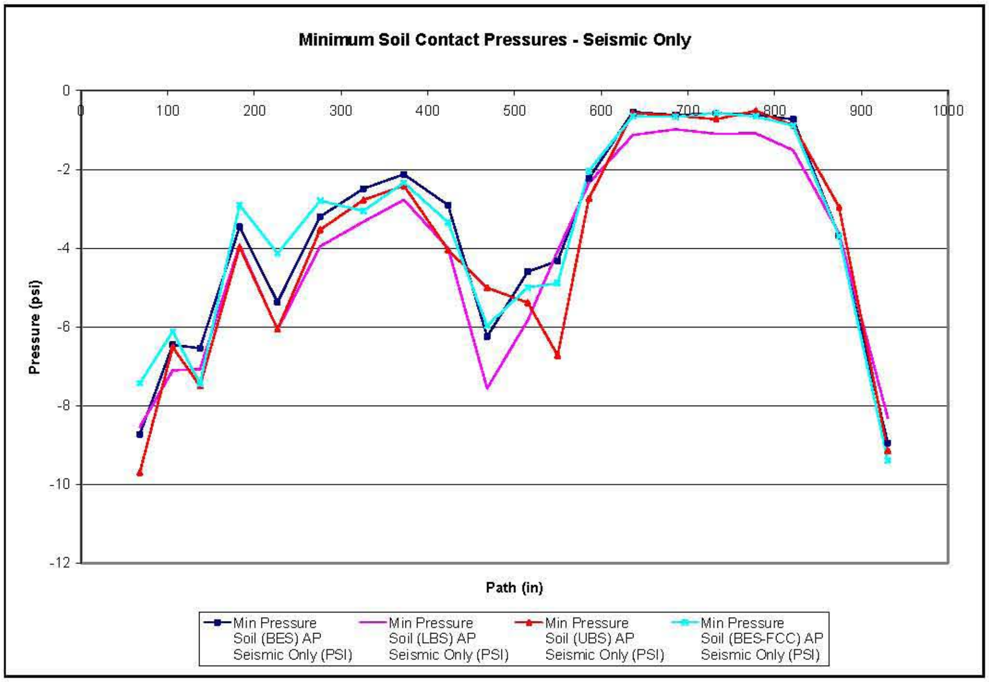


Figure 10-25. Soil/Concrete Contact Element Meridional Shear – Gravity Only.

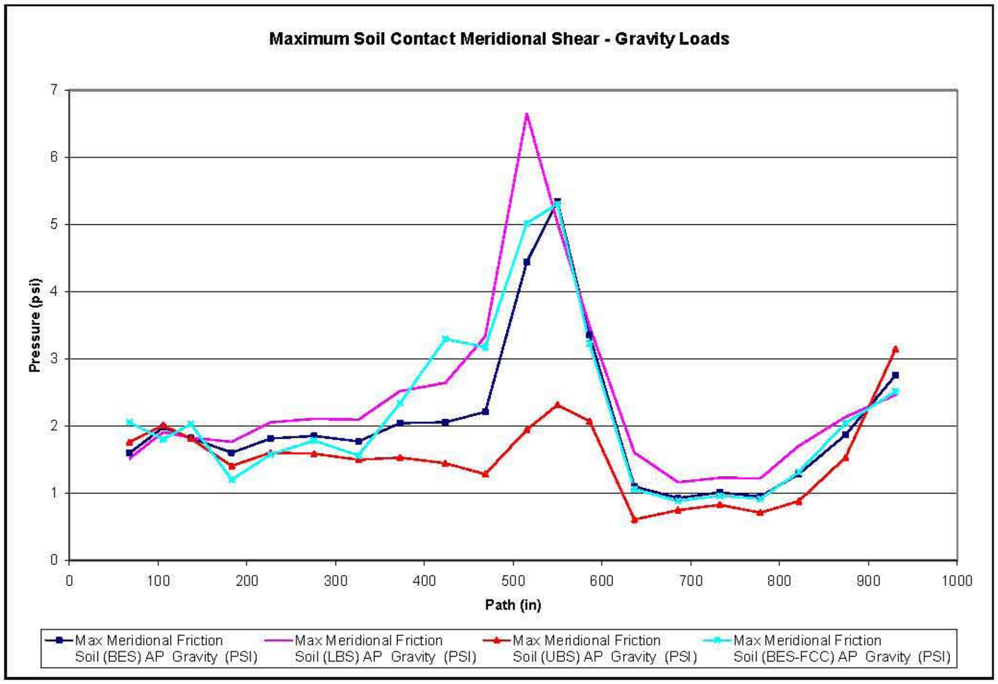


Figure 10-26. Soil/Concrete Contact Element Meridional Shear – Gravity Plus Seismic.

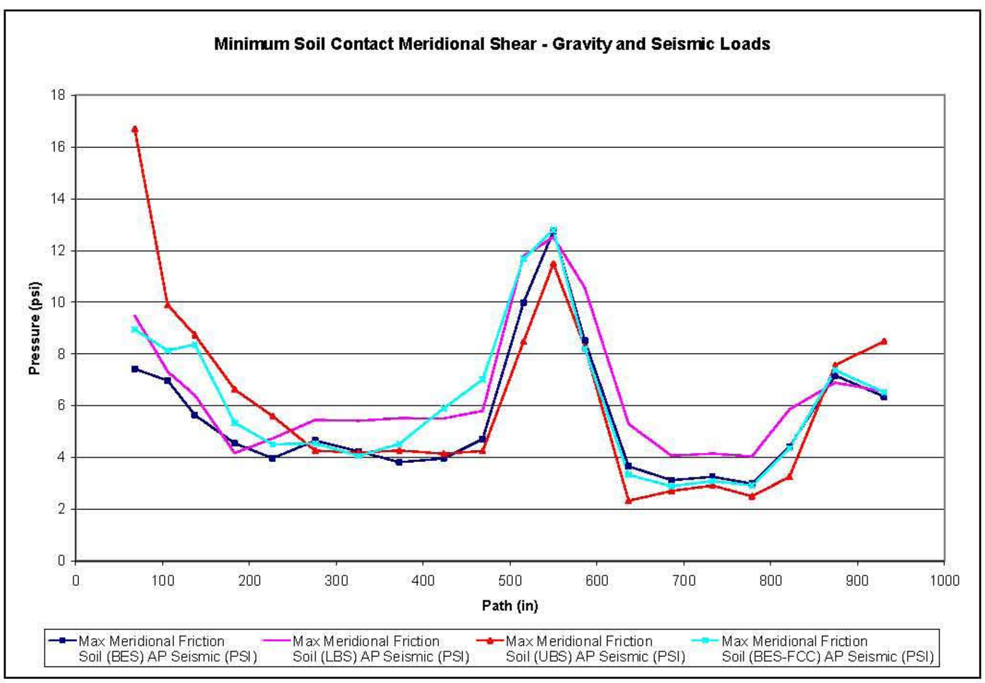


Figure 10-27. Soil/Concrete Contact Element Meridional Shear – Seismic Only.

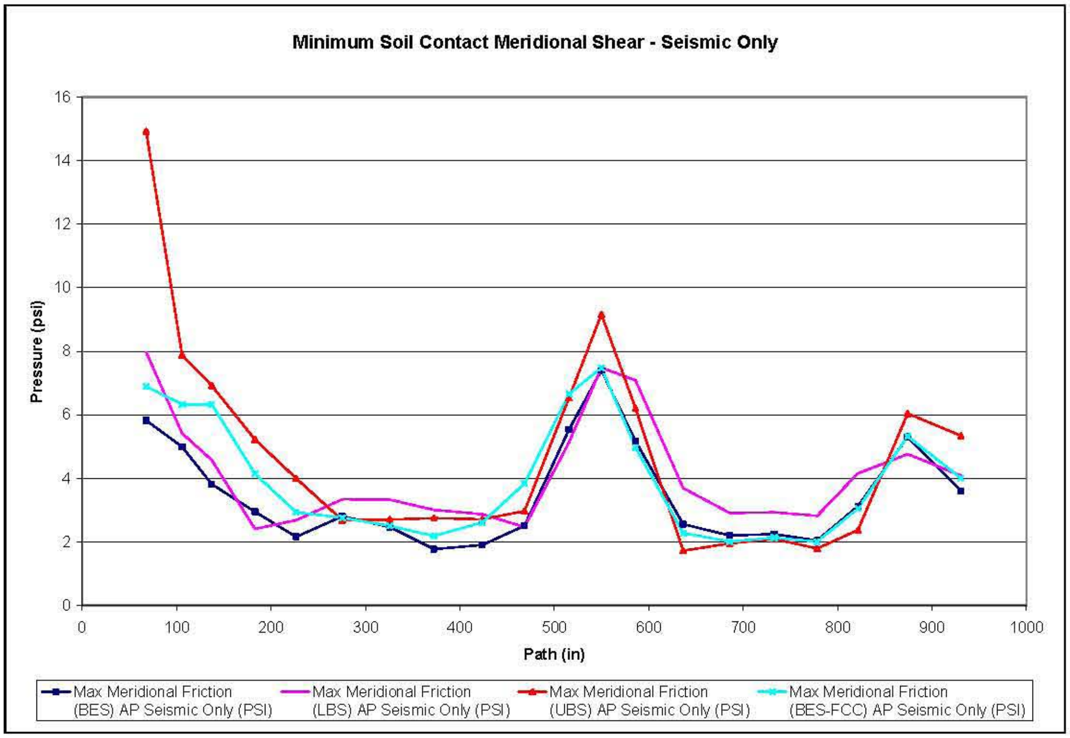


Figure 10-28. Soil/Concrete Contact Element Tangential Shear – Gravity Only.

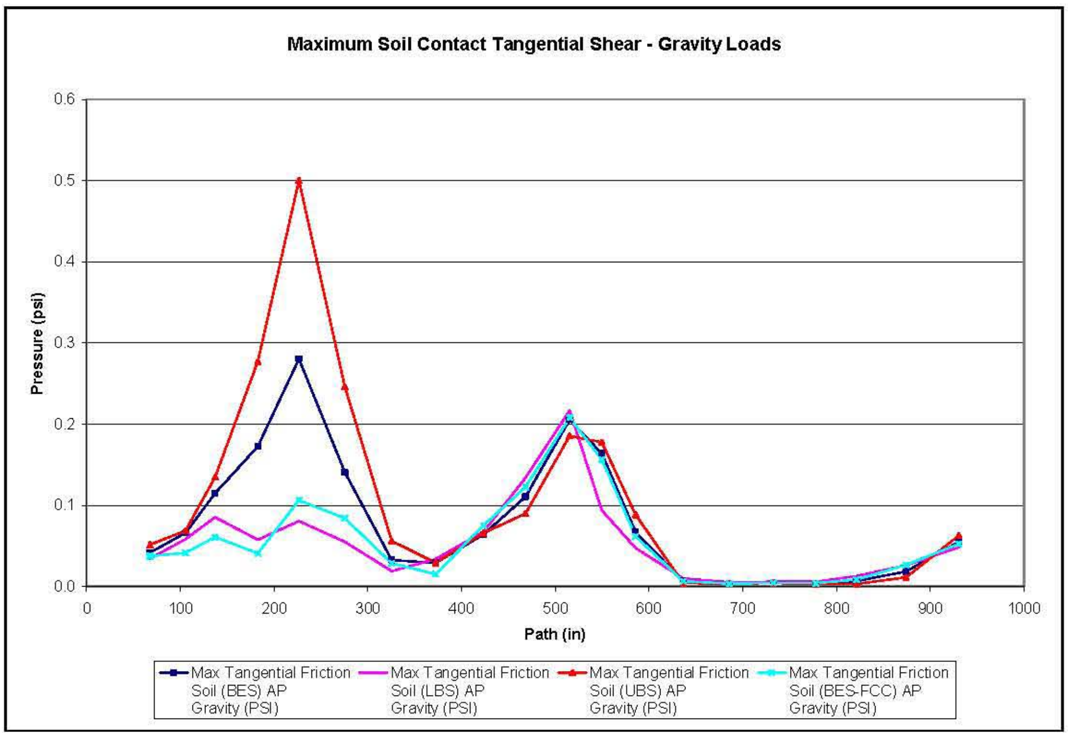


Figure 10-29. Soil/Concrete Contact Element Tangential Shear – Gravity Plus Seismic.

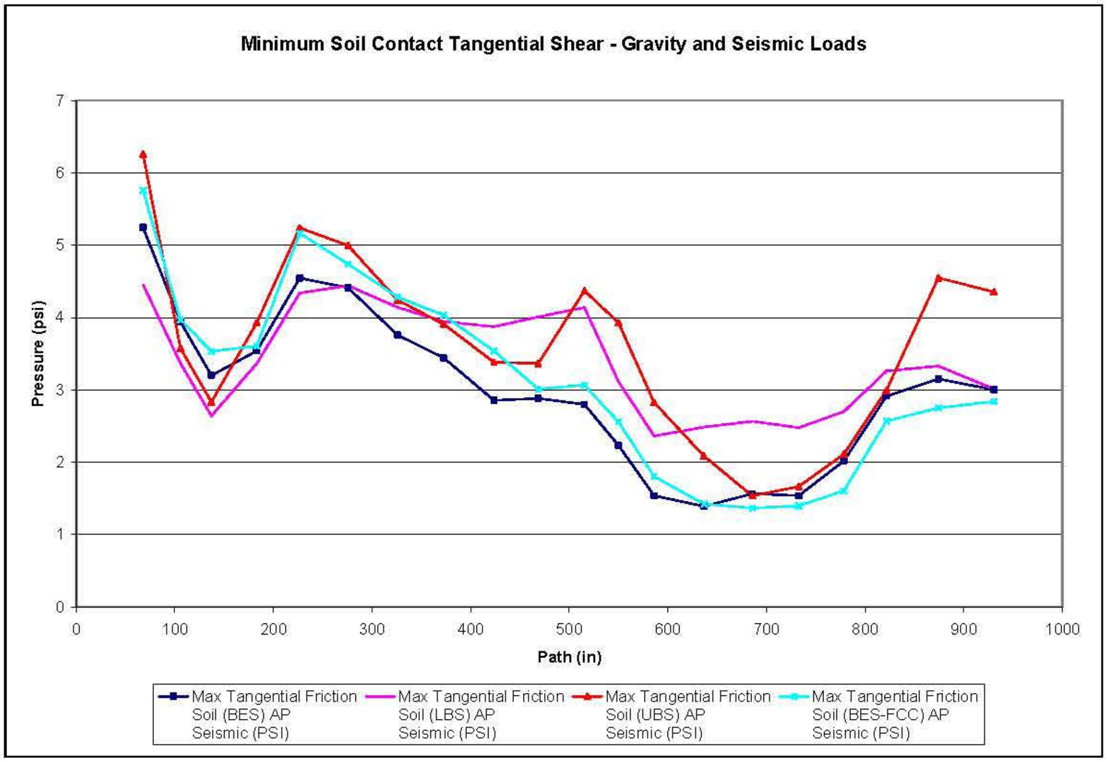


Figure 10-30. Soil/Concrete Contact Element Gap Tangential Shear – Seismic Only.

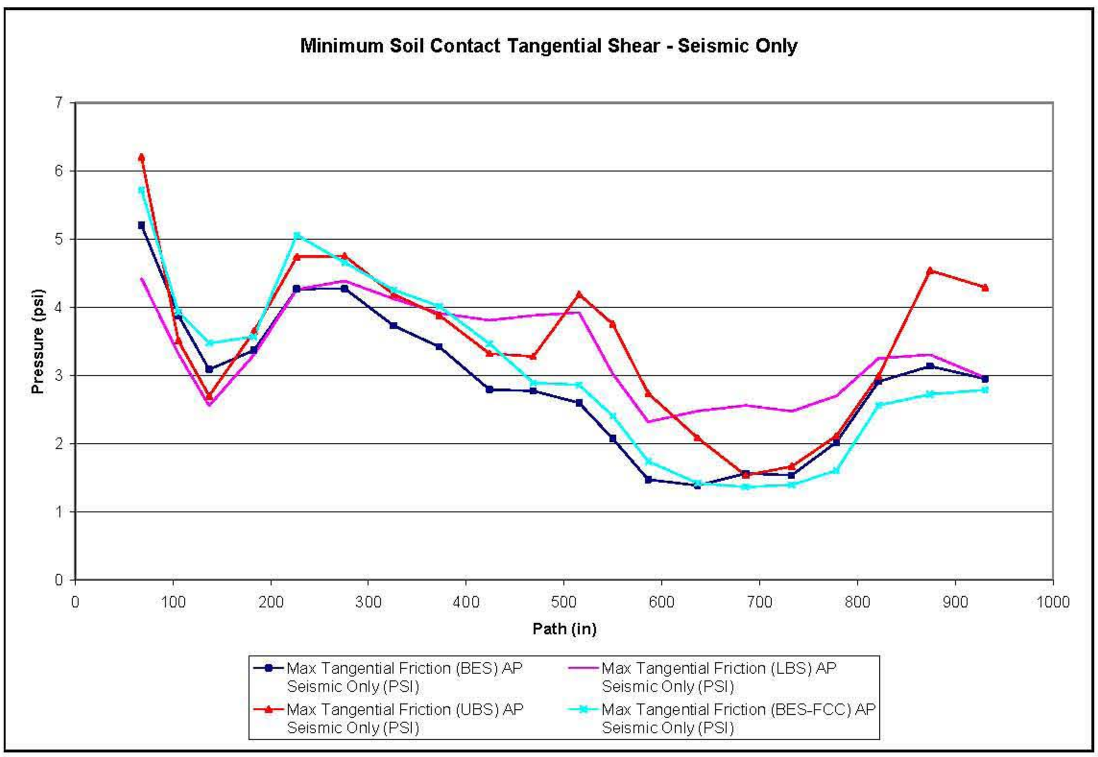


Figure 10-31. Soil/Concrete Contact Element Gap Lateral Displacement (Slide) – Gravity Only.

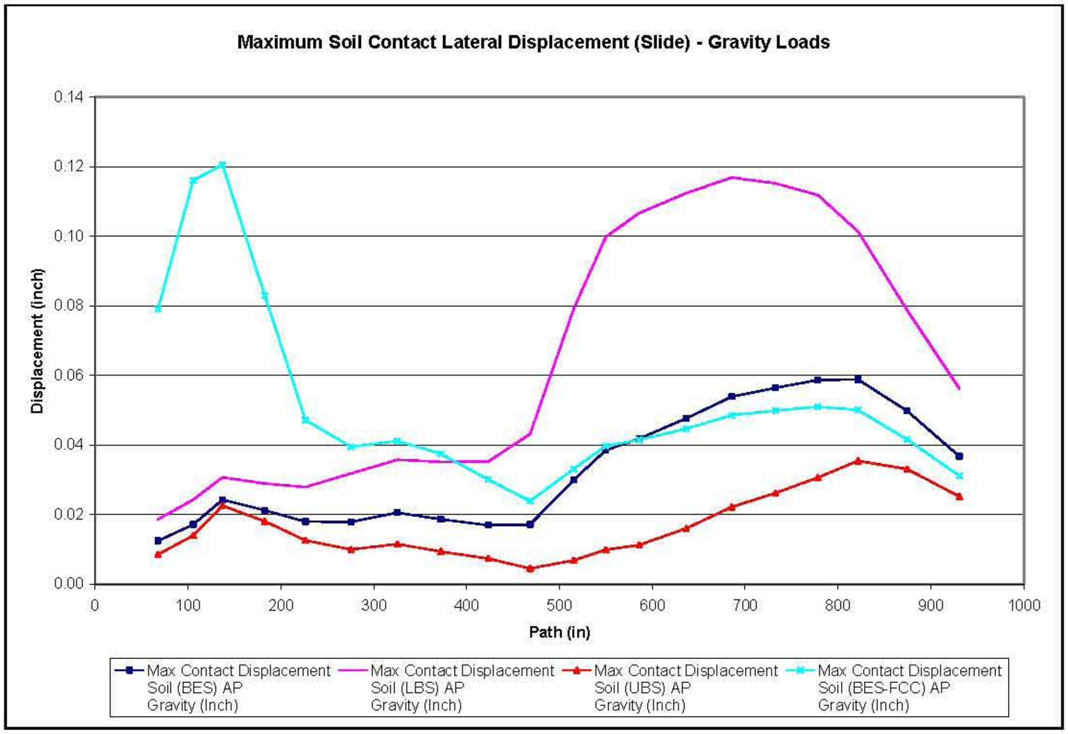


Figure 10-32. Soil/Concrete Contact Element Gap Lateral Displacement (Slide) – Gravity Plus Seismic.

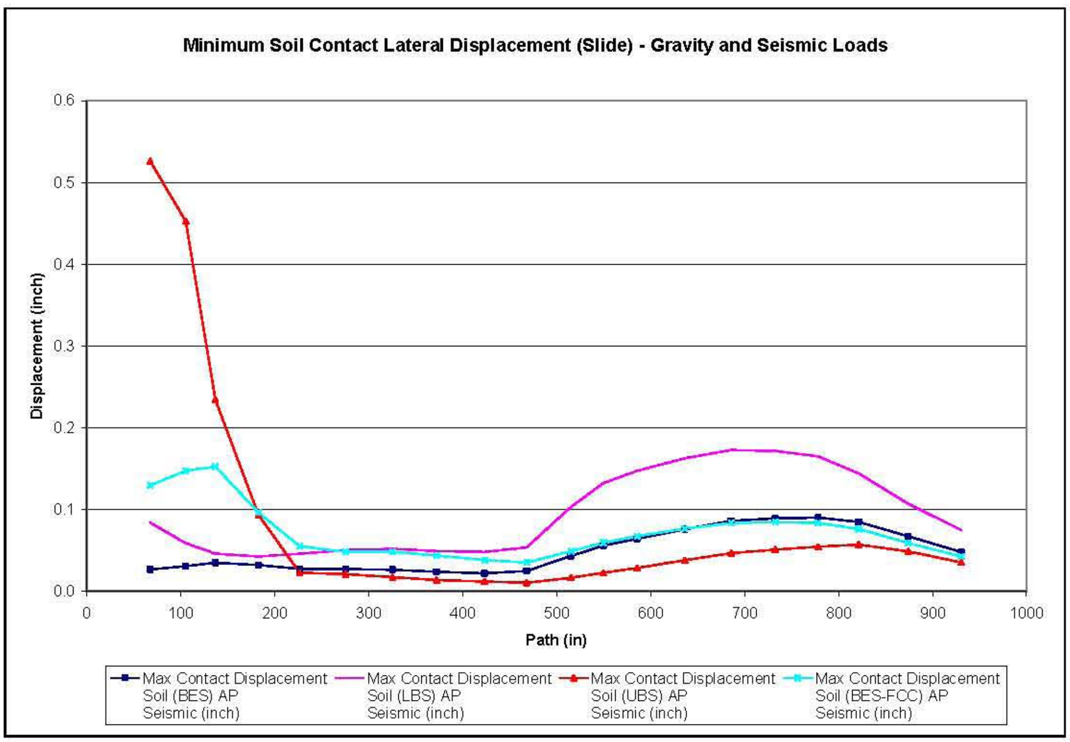
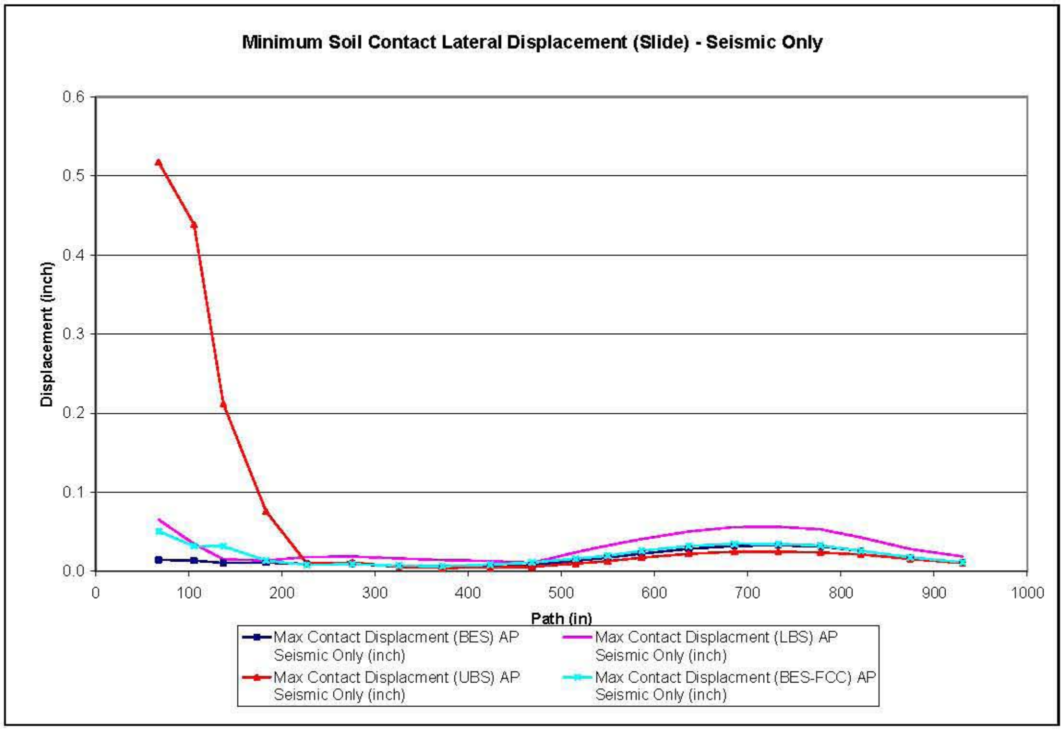


Figure 10-33. Soil/Concrete Contact Element Gap Lateral Displacement (Slide) – Seismic Only.



To evaluate the soil loads on the concrete dome due to seismic loading, a comparison was made between the seismic soil pressure and gravity only soil pressures scaled by accelerations taken from the dome. For this comparison, soil pressures due to gravity load only were scaled by the vertical spectral accelerations at a frequency of 20 Hz taken at the haunch and center of the dome. The scaled gravity pressures provide an approximation of the pressure on the dome due to vertical excitation. The center of the dome can be expected to see a pressure associated with the acceleration at the center of the some, decreasing towards the haunch. At the haunch and on the vertical wall, the pressures should correspond to the spectral acceleration at the haunch. Figure 10-34 through Figure 10-37 show this comparison for each load case. These comparisons demonstrate that there is not significant arching in the soil.

Figure 10-34. Seismic Soil Pressure Comparison to Scaled Gravity Soil Pressures, LBS-BEC.

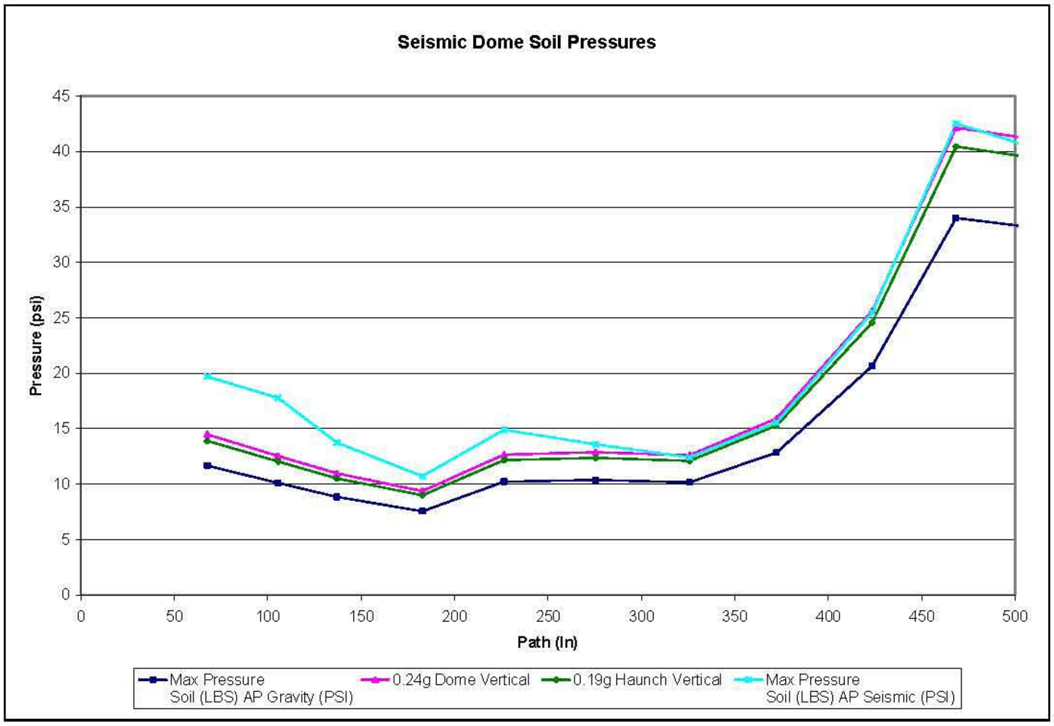


Figure 10-35. Seismic Soil Pressure Comparison to Scaled Gravity Soil Pressures, BES-BEC.

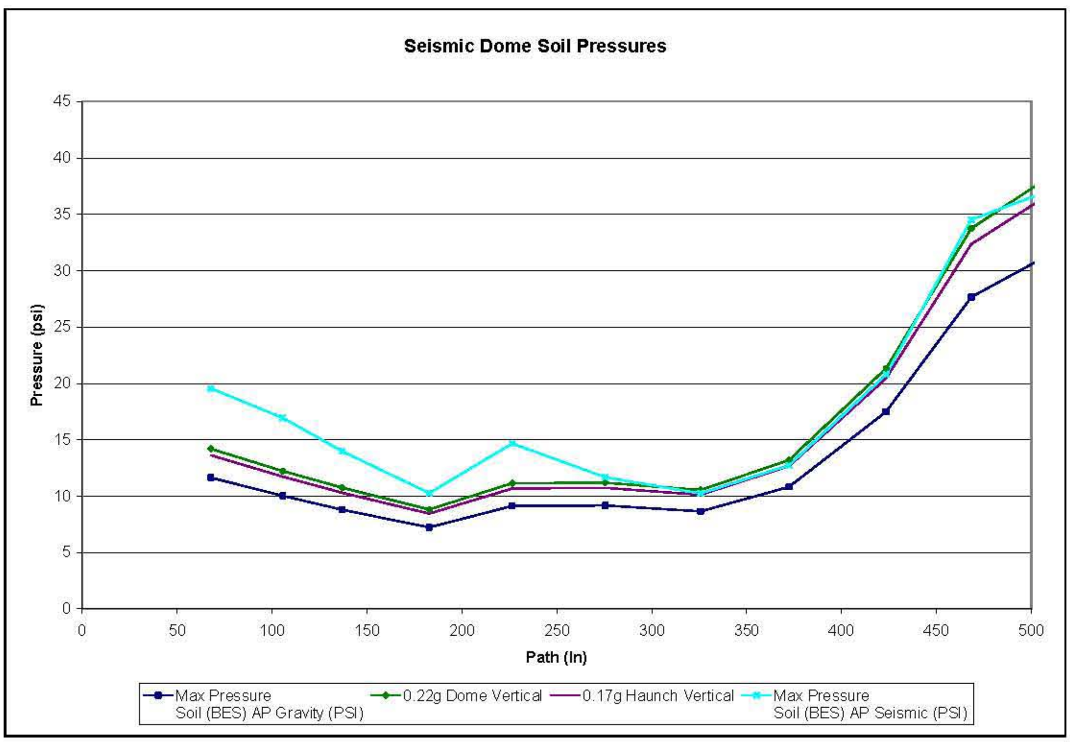


Figure 10-36. Seismic Soil Pressure Comparison to Scaled Gravity Soil Pressures, UBS-BEC.

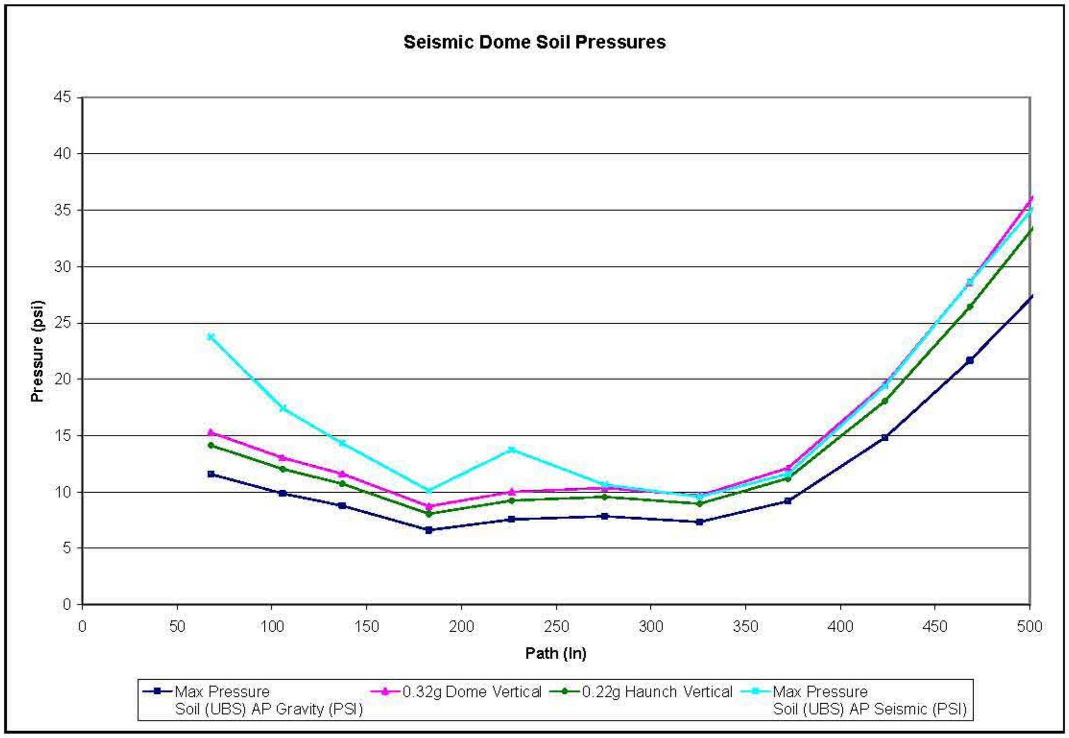
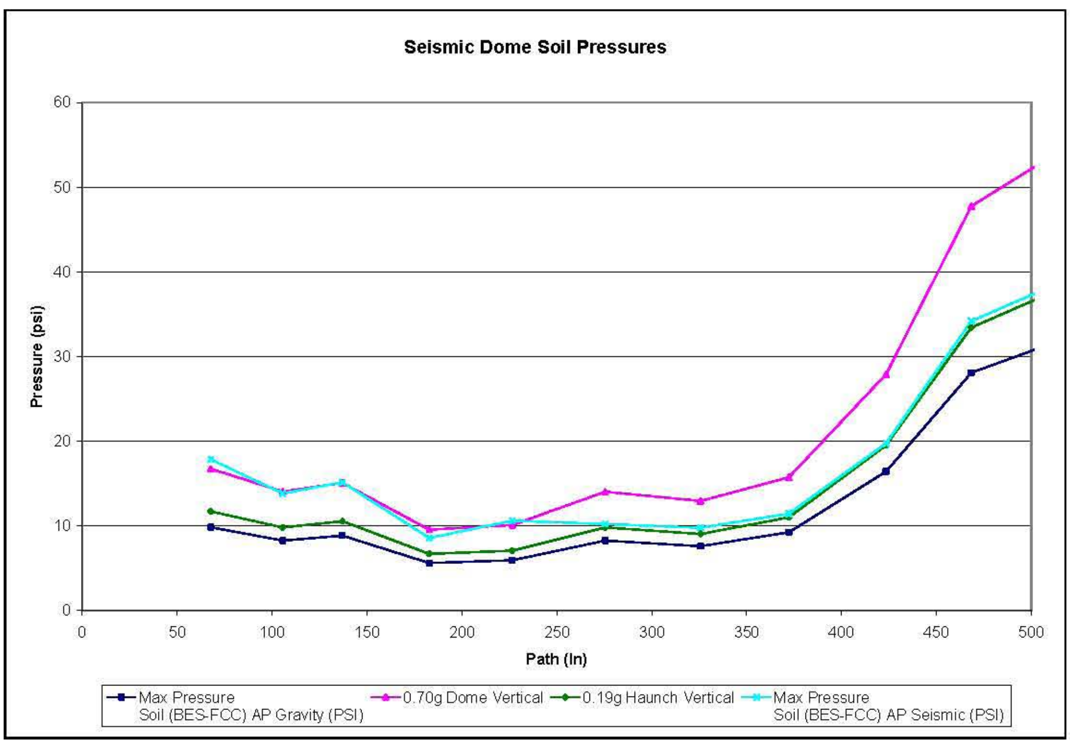


Figure 10-37. Seismic Soil Pressure Comparison to Scaled Gravity Soil Pressures, BES-FCC.



10.3 DOME CONTACTS

Dome contact data are extracted from the model in 9 degree slices, starting near the top of the dome and moving out to the tangent point of the primary tank. Contact normal and other contact data were extracted for the interface between primary tank and concrete dome. Figure 10-38 shows the location and element numbers for 1st slice of contact elements. The following data was extracted for each CONTA173 element

- CONT-PRES Normal Contact Pressure
- CONT-SLIDE Contact Lateral Displacement
- CONT-GAP Contact Gap Distance
- CONT-STAT Contact Status (Open, Closed, Sliding)

For each load case, the minimum and maximum contact pressure, lateral displacements, and gaps are compared. The figures for each component are grouped by gravity only, gravity plus seismic, and seismic only. For the dome contact interface, the following figures are provided.

- Figure 10-39. Primary Tank/Concrete Dome Contact Element Contact Pressure – Gravity Only
- Figure 10-40. Primary Tank/Concrete Dome Contact Element Maximum Contact Pressure – Gravity Plus Seismic
- Figure 10-41. Primary Tank/Concrete Dome Contact Element Minimum Contact Pressure – Gravity Plus Seismic
- Figure 10-42. Primary Tank/Concrete Dome Contact Element Maximum Contact Pressure – Seismic Only
- Figure 10-43. Primary Tank/Concrete Dome Contact Element Maximum Contact Pressure Relief – Seismic Only
- Figure 10-44. Primary Tank/Concrete Dome Contact Element Maximum Contact Gap – Gravity Only
- Figure 10-45. Primary Tank/Concrete Dome Contact Element Maximum Contact Gap – Gravity Plus Seismic
- Figure 10-46. Primary Tank/Concrete Dome Contact Element Maximum Contact Gap – Seismic Only
- Figure 10-47. Primary Tank/Concrete Dome Contact Element Maximum Contact Lateral Displacement (Slide) – Gravity Only
- Figure 10-48. Primary Tank/Concrete Dome Contact Element Maximum Contact Lateral Displacement (Slide)– Gravity Plus Seismic
- Figure 10-49. Primary Tank/Concrete Dome Contact Element Maximum Contact Lateral Displacement (Slide)– Seismic Only

Figure 10-38. Primary Tank Dome Contact Element Retreival Sequence Starting Numbers.

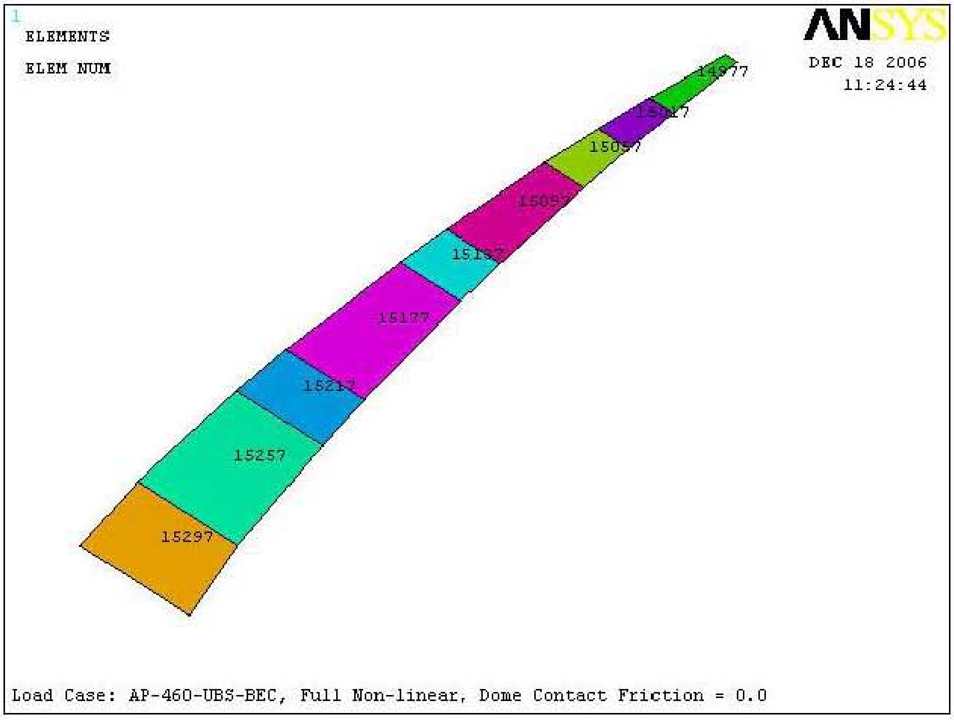


Figure 10-39. Primary Tank/Concrete Dome Contact Element Contact Pressure – Gravity Only.

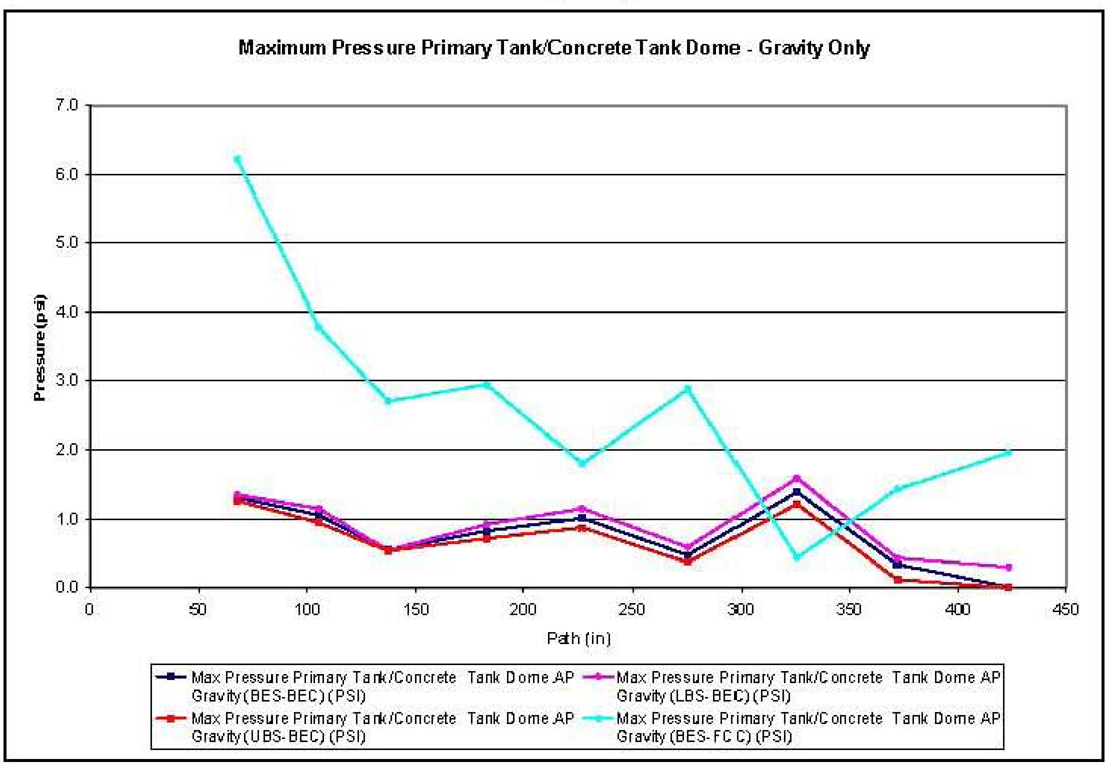


Figure 10-40. Primary Tank/Concrete Dome Contact Element Maximum Contact Pressure – Gravity Plus Seismic.

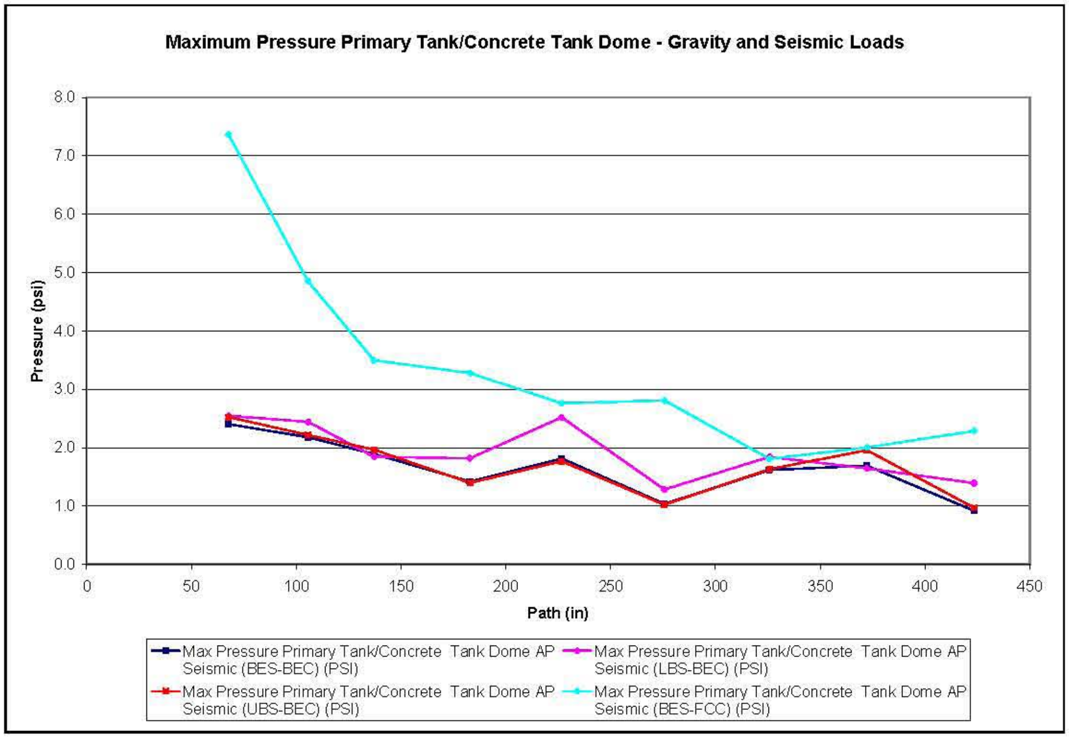


Figure 10-41. Primary Tank/Concrete Dome Contact Element Minimum Contact Pressure – Gravity Plus Seismic.

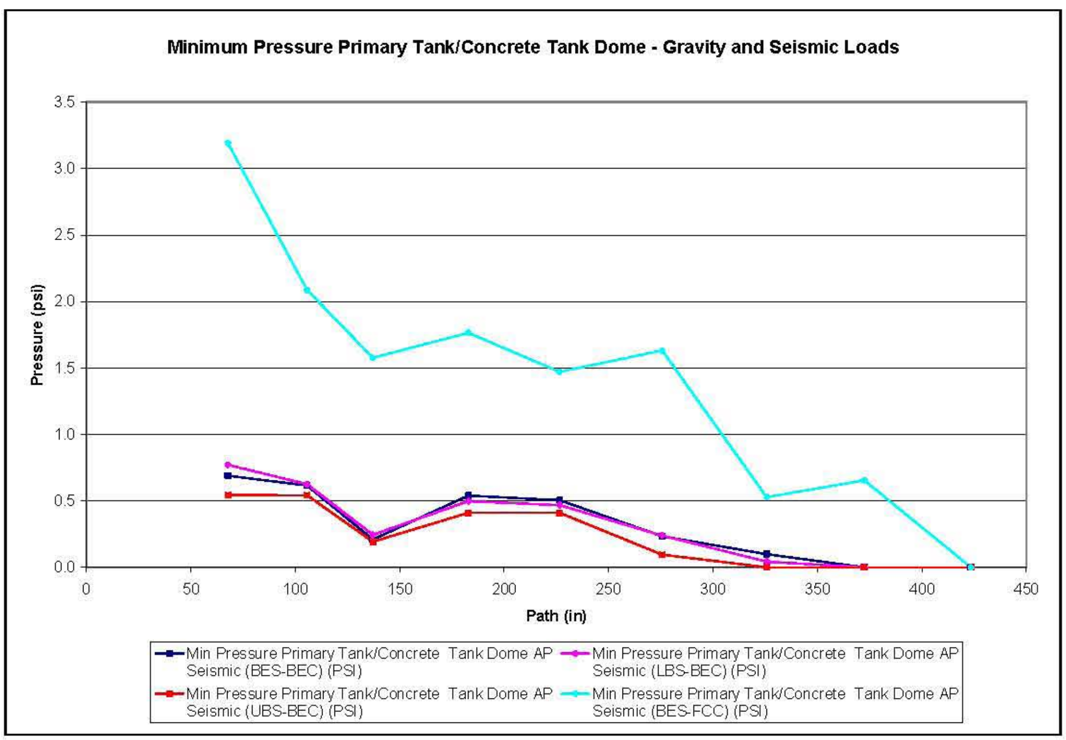


Figure 10-42. Primary Tank/Concrete Dome Contact Element Maximum Contact Pressure – Seismic Only.

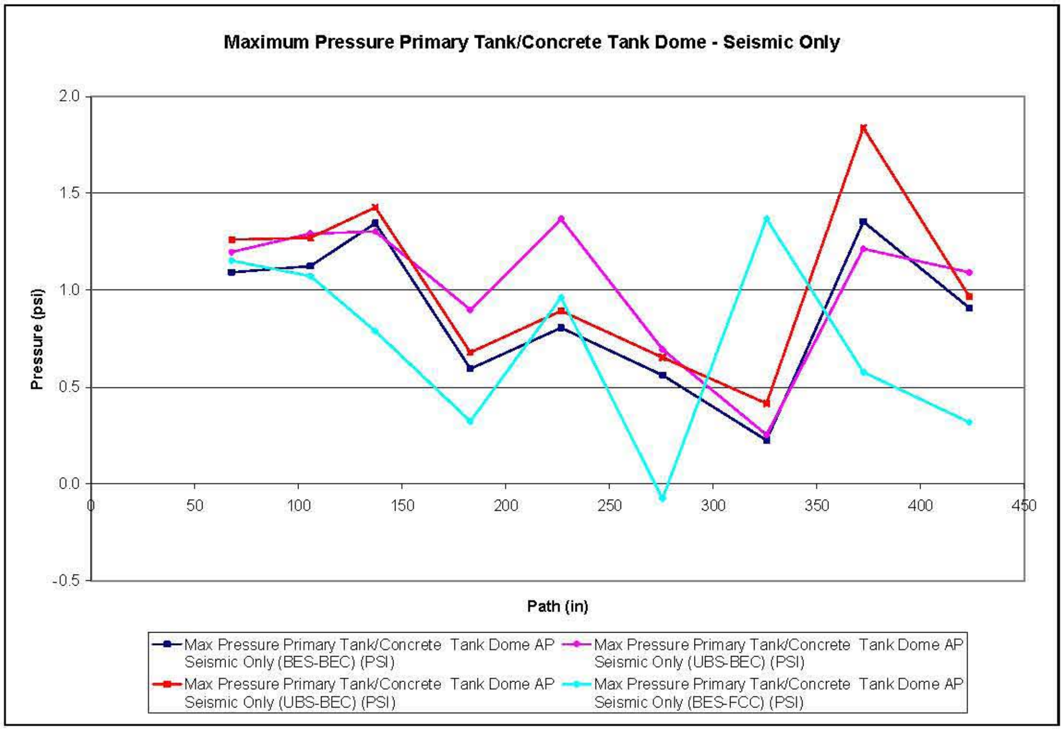


Figure 10-43. Primary Tank/Concrete Dome Contact Element Maximum Contact Pressure Relief – Seismic Only.

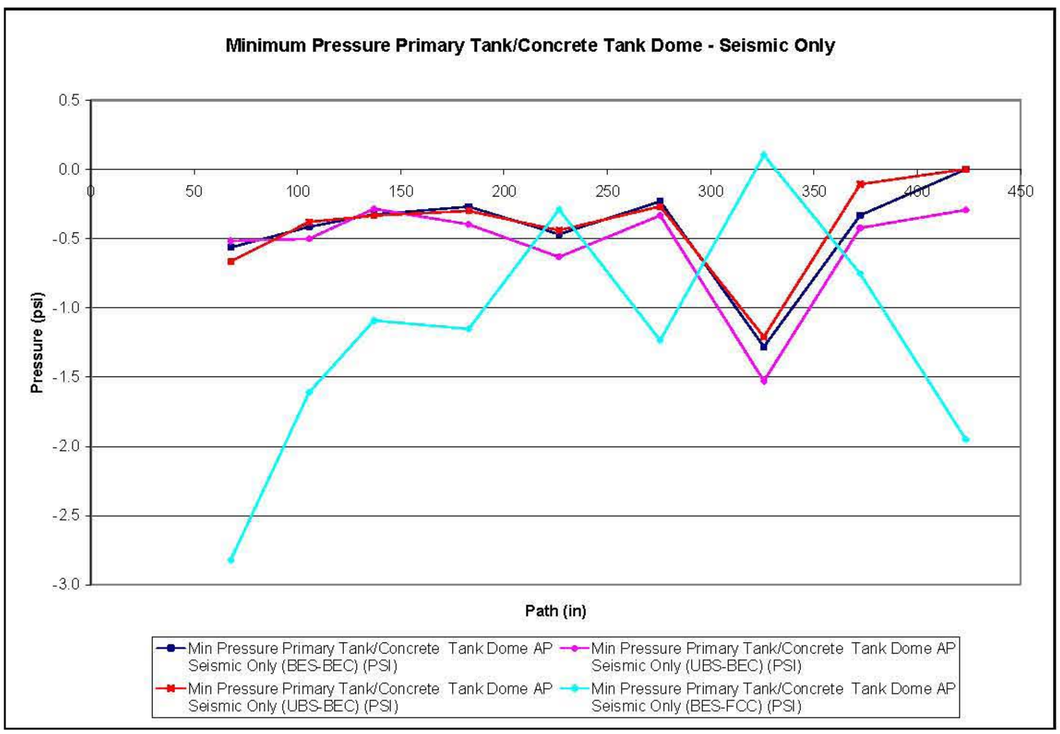


Figure 10-44. Primary Tank/Concrete Dome Contact Element Maximum Contact Gap – Gravity Only.

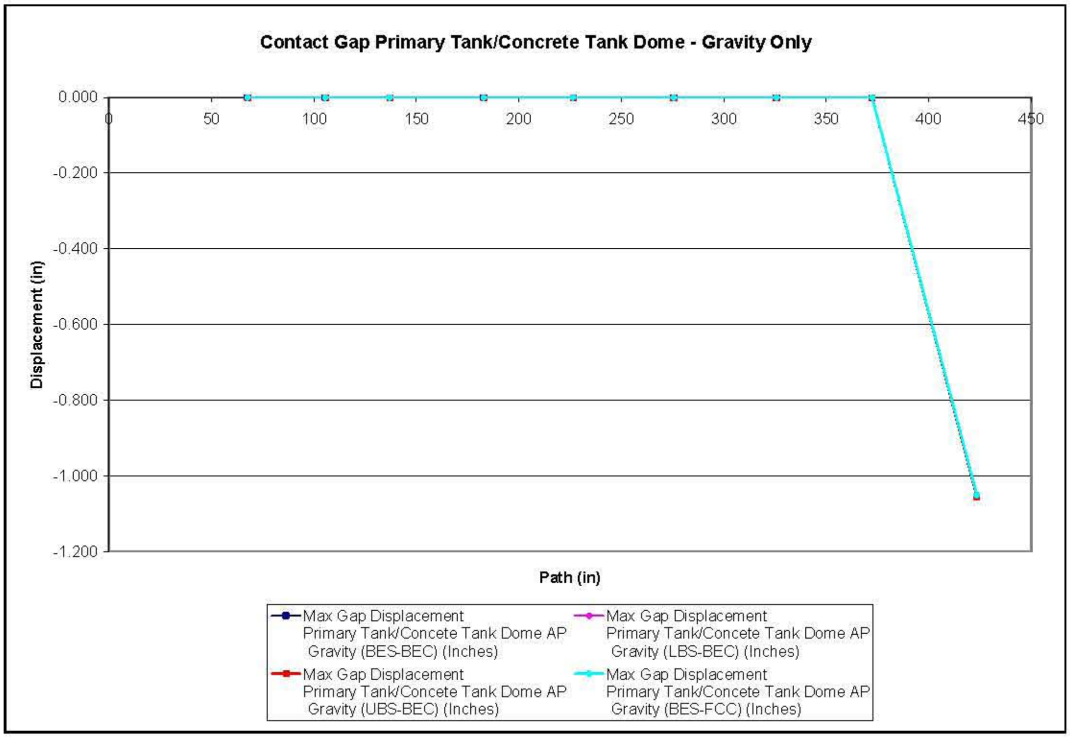


Figure 10-45. Primary Tank/Concrete Dome Contact Element Maximum Contact Gap – Gravity Plus Seismic.

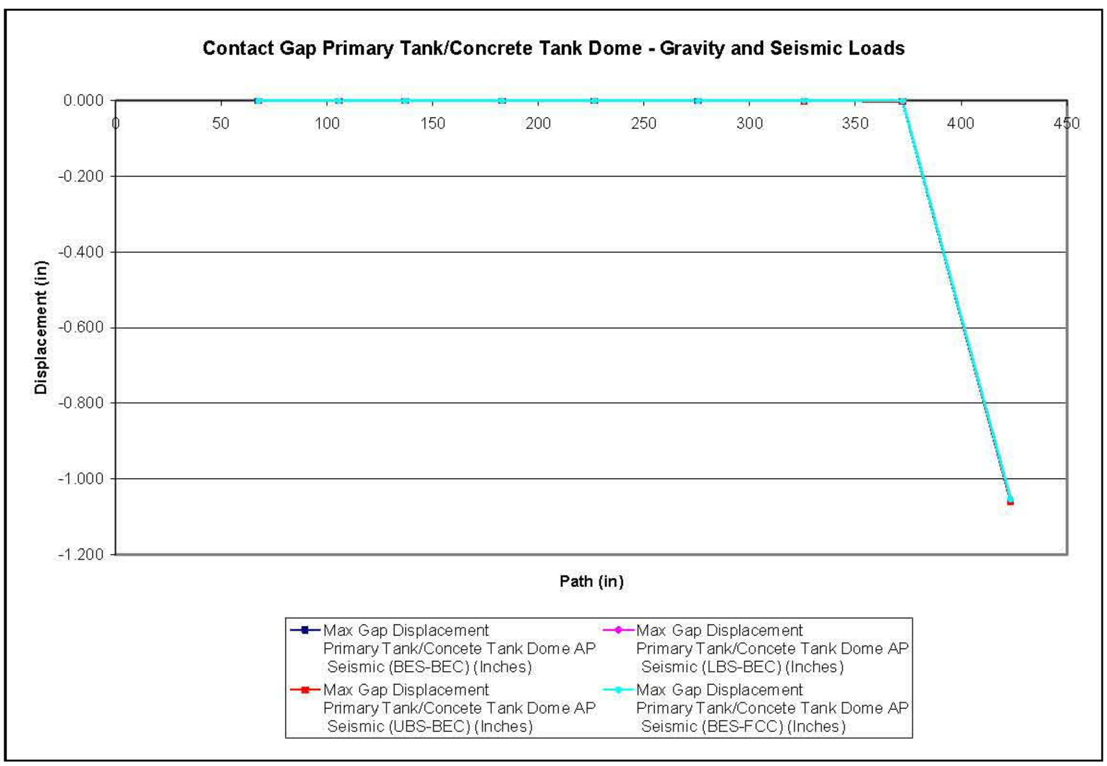


Figure 10-46. Primary Tank/Concrete Dome Contact Element Maximum Contact Gap – Seismic Only.

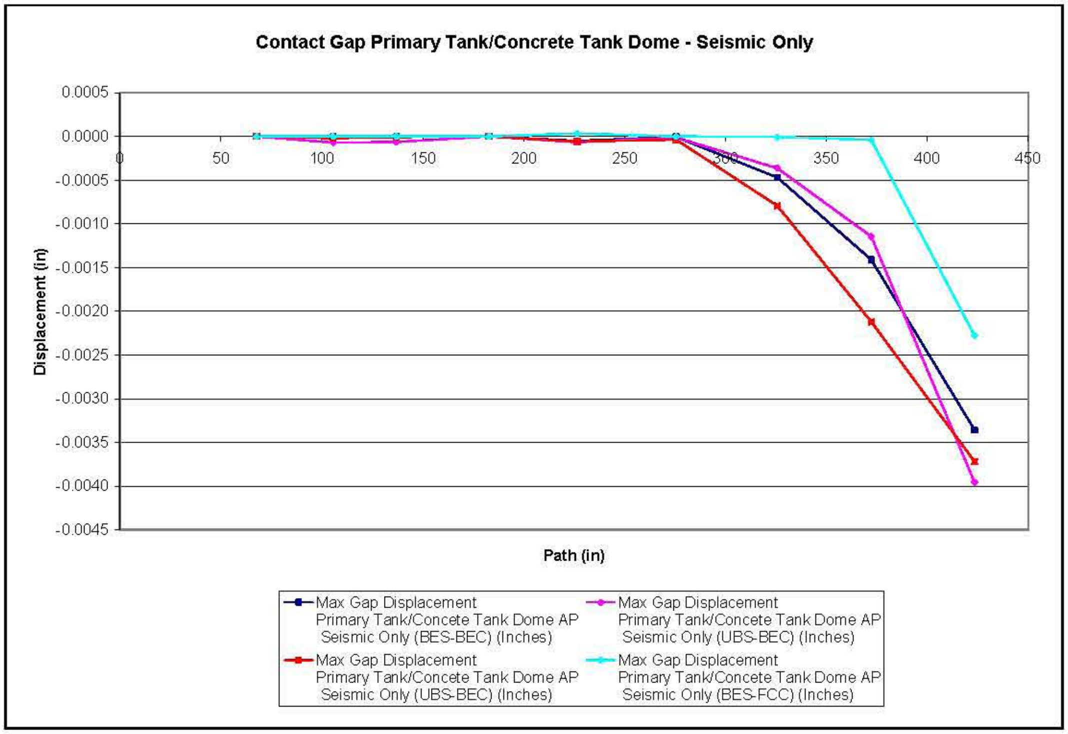


Figure 10-47. Primary Tank/Concrete Dome Contact Element Maximum Contact Lateral Displacement (Slide) – Gravity Only.

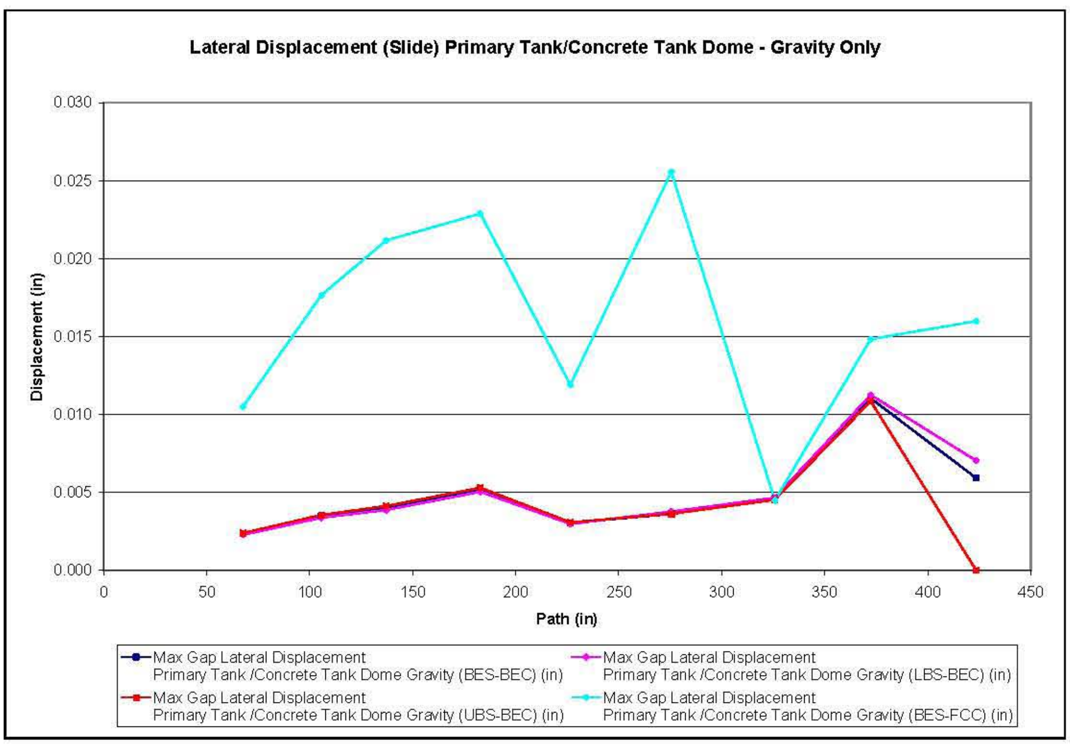


Figure 10-48. Primary Tank/Concrete Dome Contact Element Maximum Contact Lateral Displacement (Slide)– Gravity Plus Seismic.

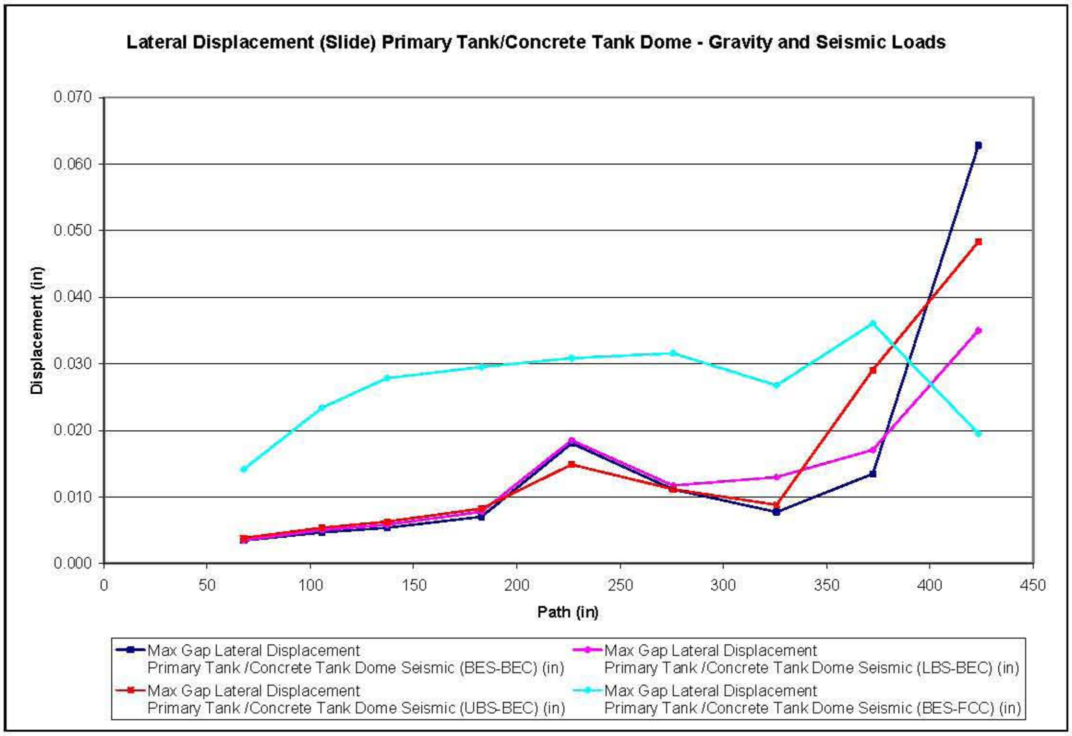


Figure 10-49. Primary Tank/Concrete Dome Contact Element Maximum Contact Lateral Displacement (Slide)– Seismic Only.

10.4 PRIMARY TANK/INSULATING CONCRETE CONTACTS

Primary Tank/Insulating Concrete contact data are extracted from the model in 9 degree slices, starting at the outside radius of the primary tank, moving in towards the center. Contact normal and other contact data were extracted for the interface between primary tank and insulating concrete. Figure 10-50 shows the location and element numbers for 1st slice of contact elements. The following data was extracted for each CONTA173 element

- CONT-PRES Normal Contact Pressure
- CONT-SLIDE Contact Lateral Displacement
- CONT-GAP Contact Gap Distance
- CONT-STAT Contact Status (Open, Closed, Sliding)

For each load case, the minimum and maximum contact pressure, lateral displacements, and gaps are compared. The figures for each component are grouped by gravity only, gravity plus seismic, and seismic only. For the primary tank/insulating concrete contact interface, the following figures are provided.

- Figure 10-51. Primary Tank/Insulating Concrete Contact Element Contact Pressure – Gravity Only
- Figure 10-52. Primary Tank/Insulating Concrete Contact Element Maximum Contact Pressure – Gravity Plus Seismic
- Figure 10-53. Primary Tank/Insulating Concrete Contact Element Minimum Contact Pressure – Gravity Plus Seismic
- Figure 10-54. Primary Tank/Insulating Concrete Contact Element Maximum Contact Pressure – Seismic Only
- Figure 10-55. Primary Tank/Insulating Concrete Contact Element Minimum Contact Pressure – Seismic Only
- Figure 10-56. Primary Tank/Insulating Concrete Contact Element Maximum Contact Gap – Gravity Only
- Figure 10-57. Primary Tank/Insulating Concrete Contact Element Maximum Contact Gap – Gravity Plus Seismic
- Figure 10-58. Primary Tank/Insulating Concrete Contact Element Maximum Contact Gap – Seismic Only
- Figure 10-59. Primary Tank/Insulating Concrete Contact Element Maximum Contact Lateral Displacement (Slide) – Gravity Only
- Figure 10-60. Primary Tank/Insulating Concrete Contact Element Maximum Contact Lateral Displacement (Slide)– Gravity Plus Seismic
- Figure 10-61. Primary Tank/Insulating Concrete Contact Element Maximum Contact Lateral Displacement (Slide)– Seismic Only

Figure 10-50. Primary Tank Bottom Contact Element Retreival Sequence Starting Numbers.

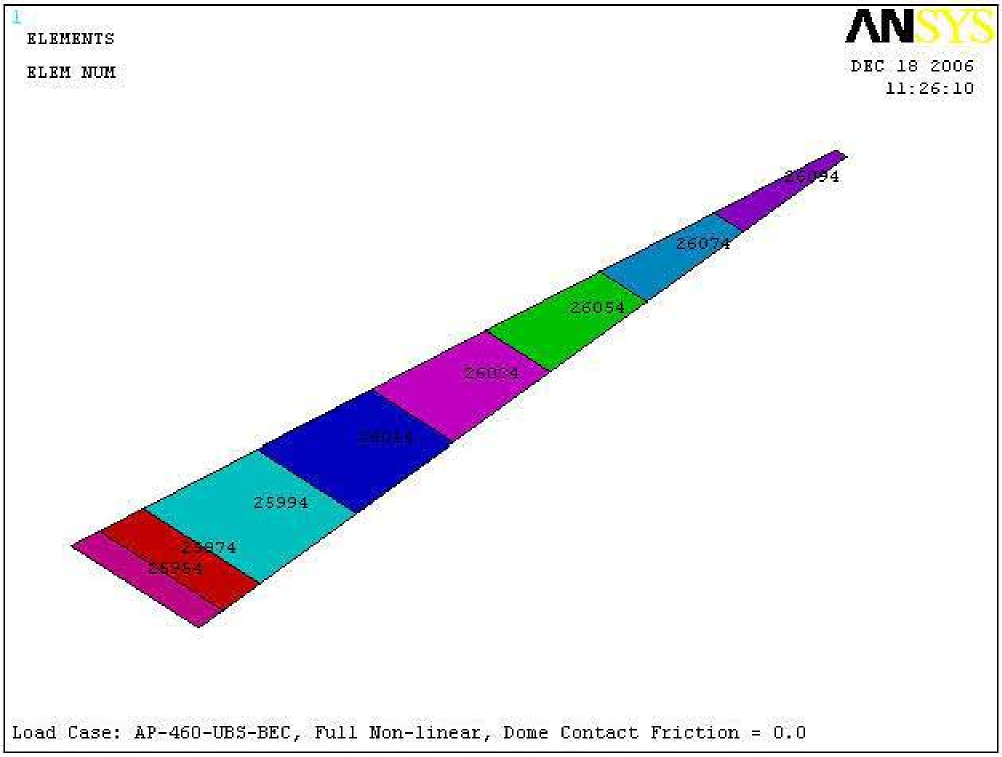


Figure 10-51. Primary Tank/Insulating Concrete Contact Element Contact Pressure – Gravity Only.

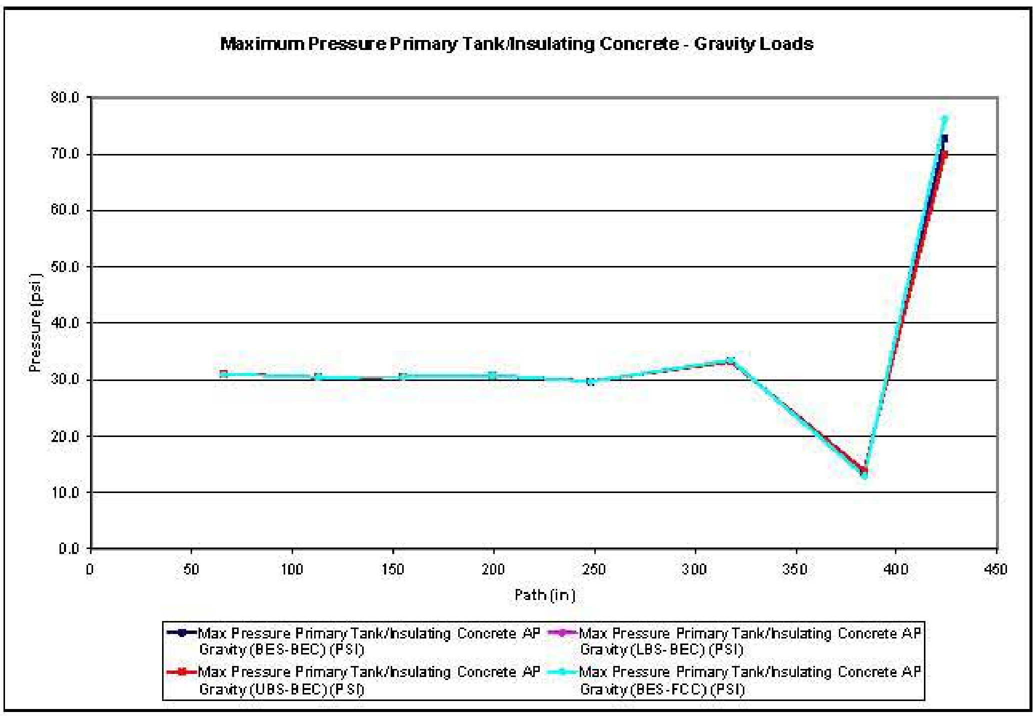


Figure 10-52. Primary Tank/Insulating Concrete Contact Element Maximum Contact Pressure – Gravity Plus Seismic.

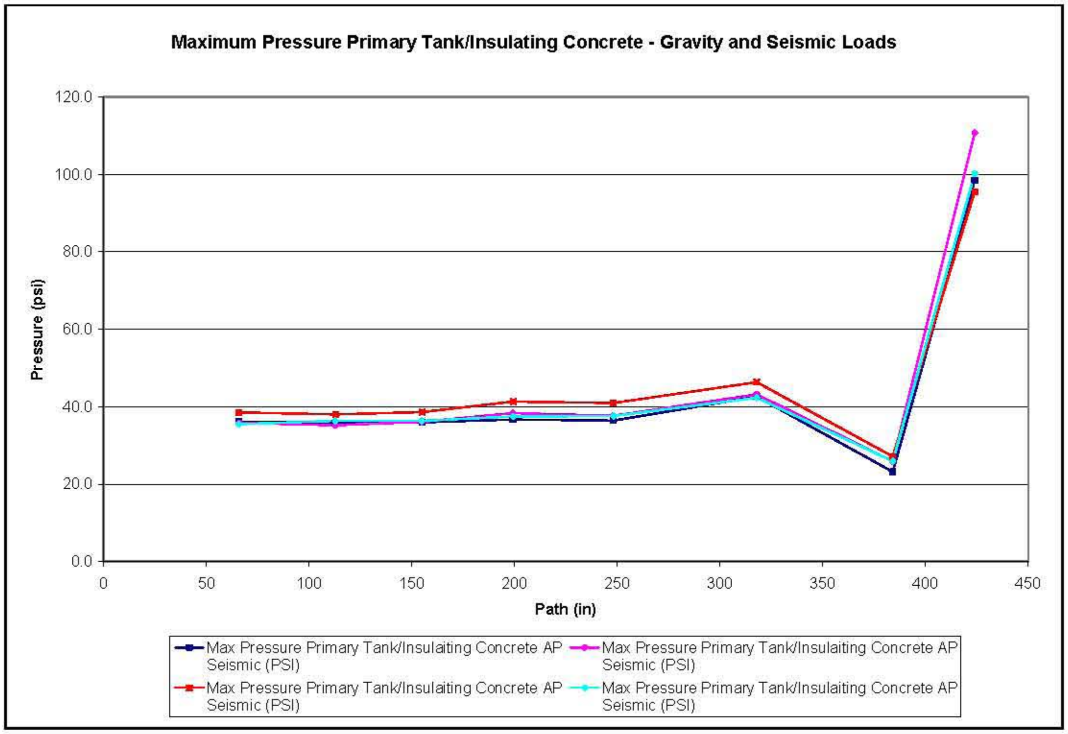


Figure 10-53. Primary Tank/Insulating Concrete Contact Element Minimum Contact Pressure – Gravity Plus Seismic.

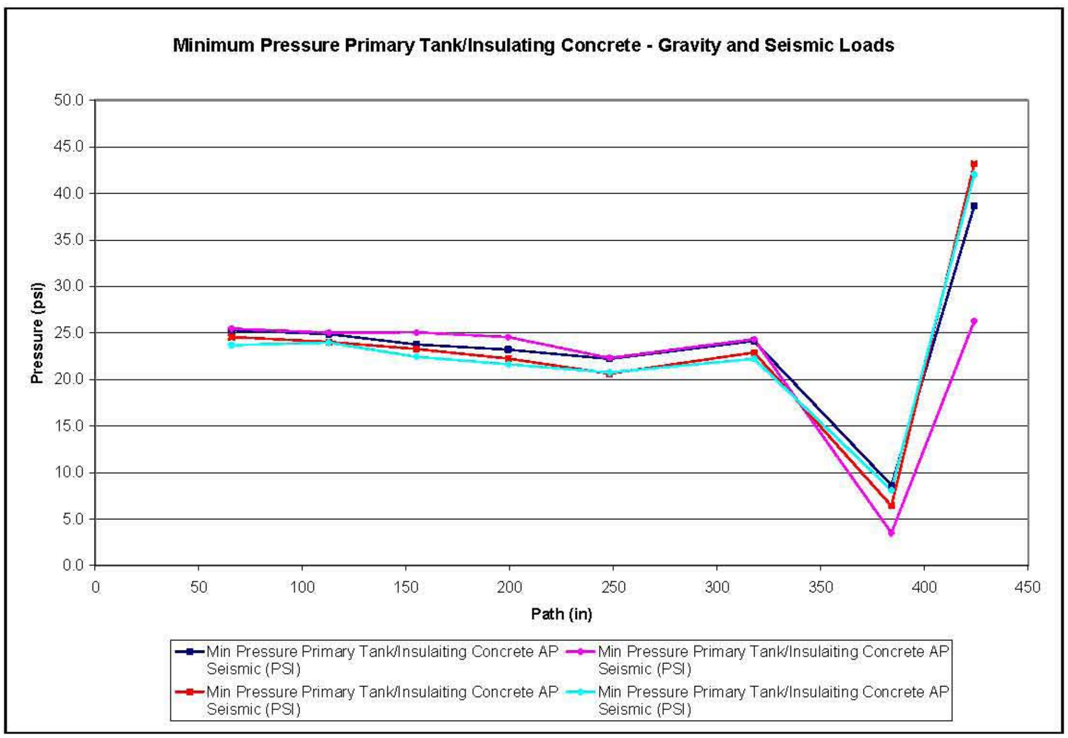


Figure 10-54. Primary Tank/Insulating Concrete Contact Element Maximum Contact Pressure – Seismic Only.

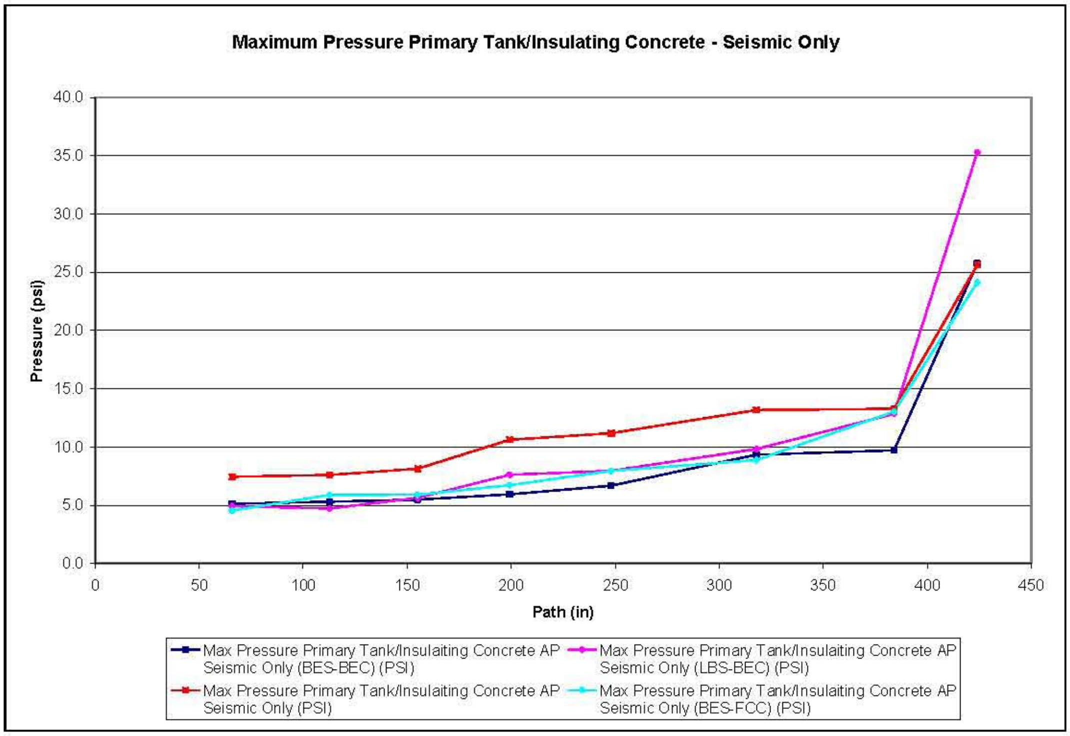


Figure 10-55. Primary Tank/Insulating Concrete Contact Element Minimum Contact Pressure – Seismic Only.

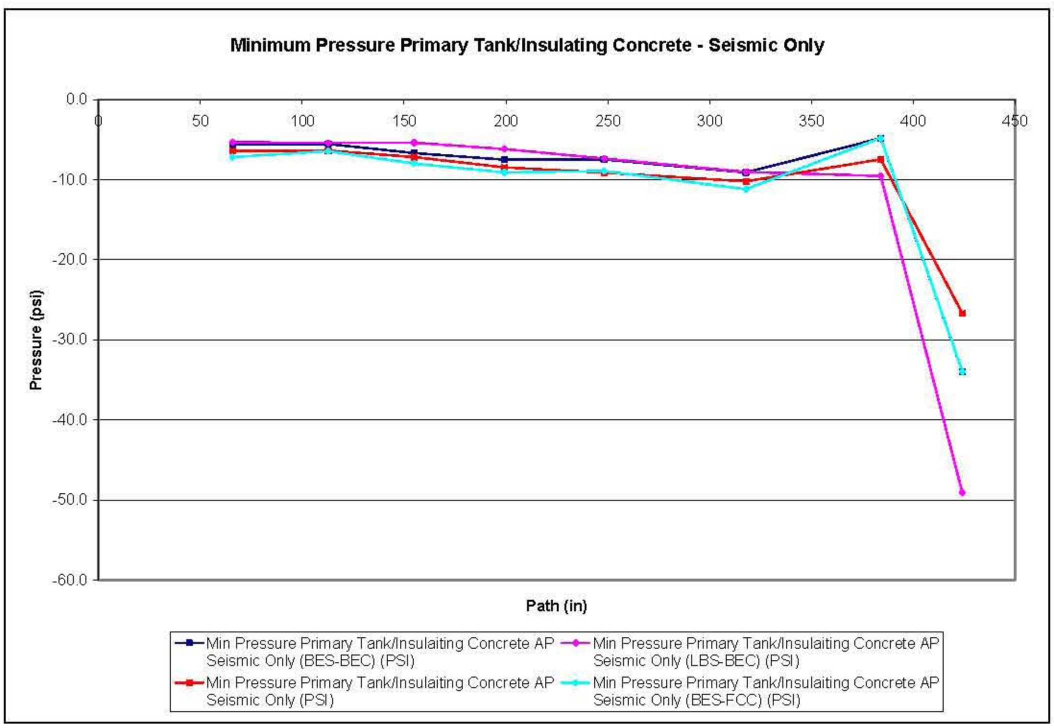


Figure 10-56. Primary Tank/Insulating Concrete Contact Element Maximum Contact Gap – Gravity Only.

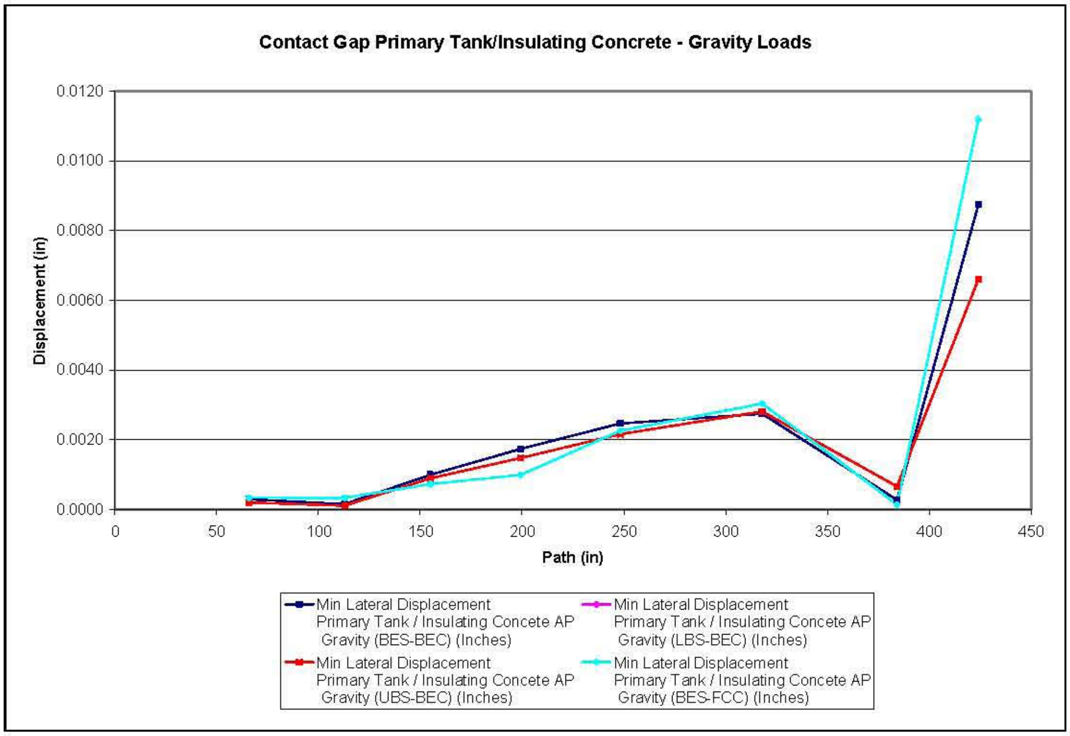


Figure 10-57. Primary Tank/Insulating Concrete Contact Element Maximum Contact Gap – Gravity Plus Seismic.

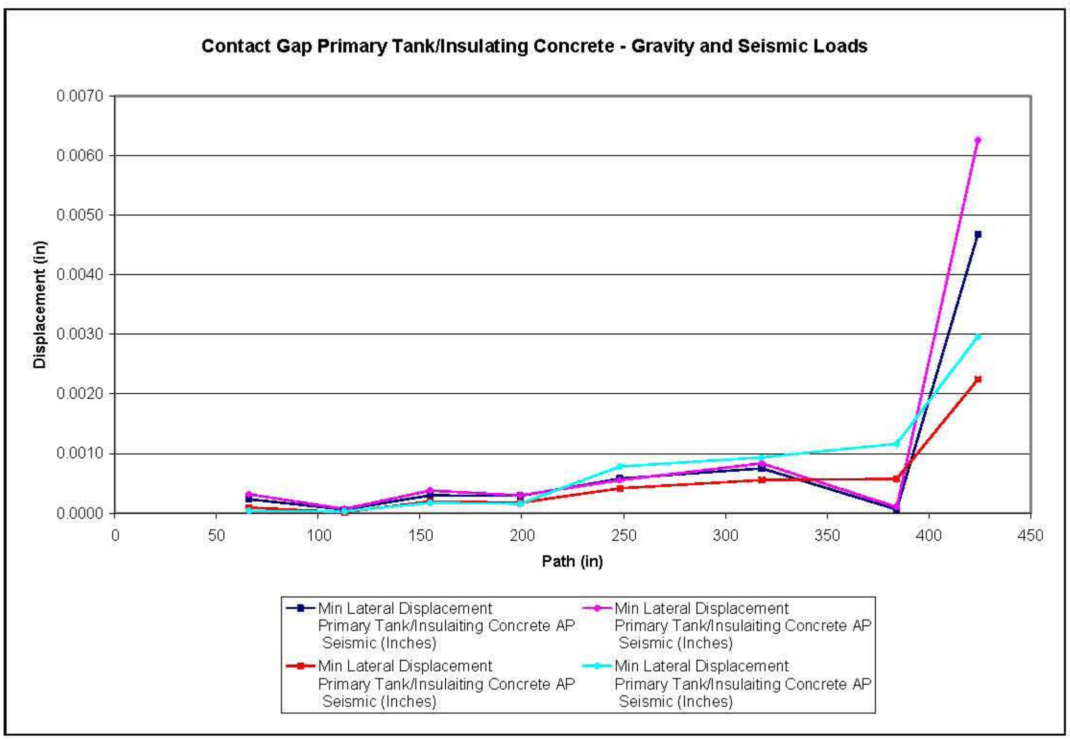


Figure 10-58. Primary Tank/Insulating Concrete Contact Element Maximum Contact Gap – Seismic Only.

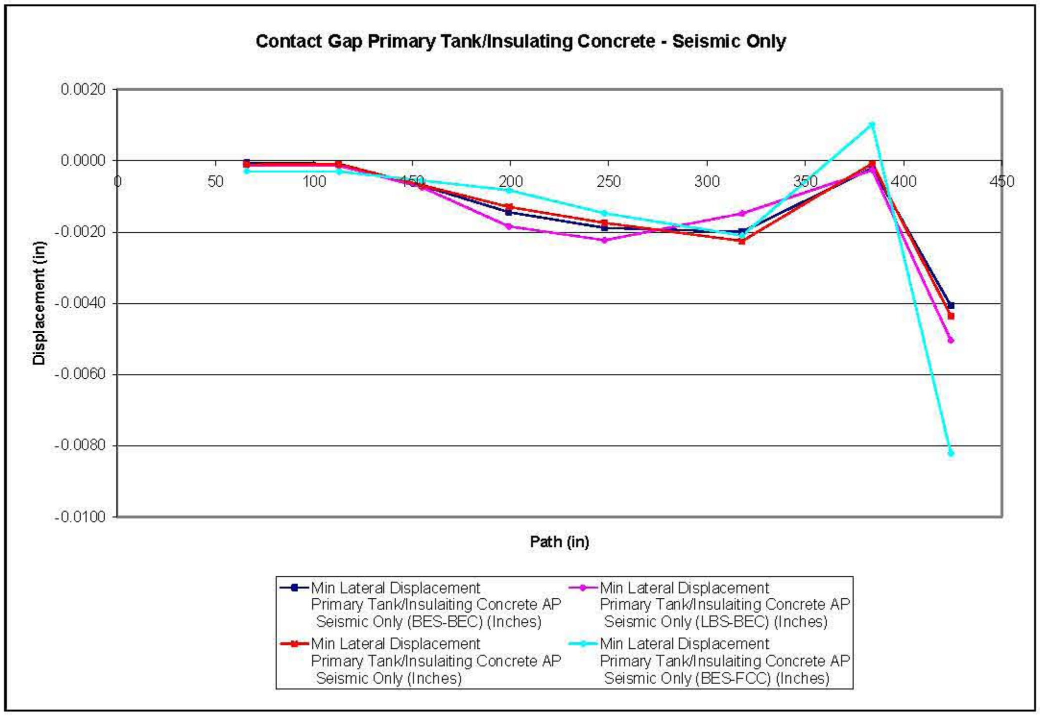


Figure 10-59. Primary Tank/Insulating Concrete Contact Element Maximum Contact Lateral Displacement (Slide) – Gravity Only.

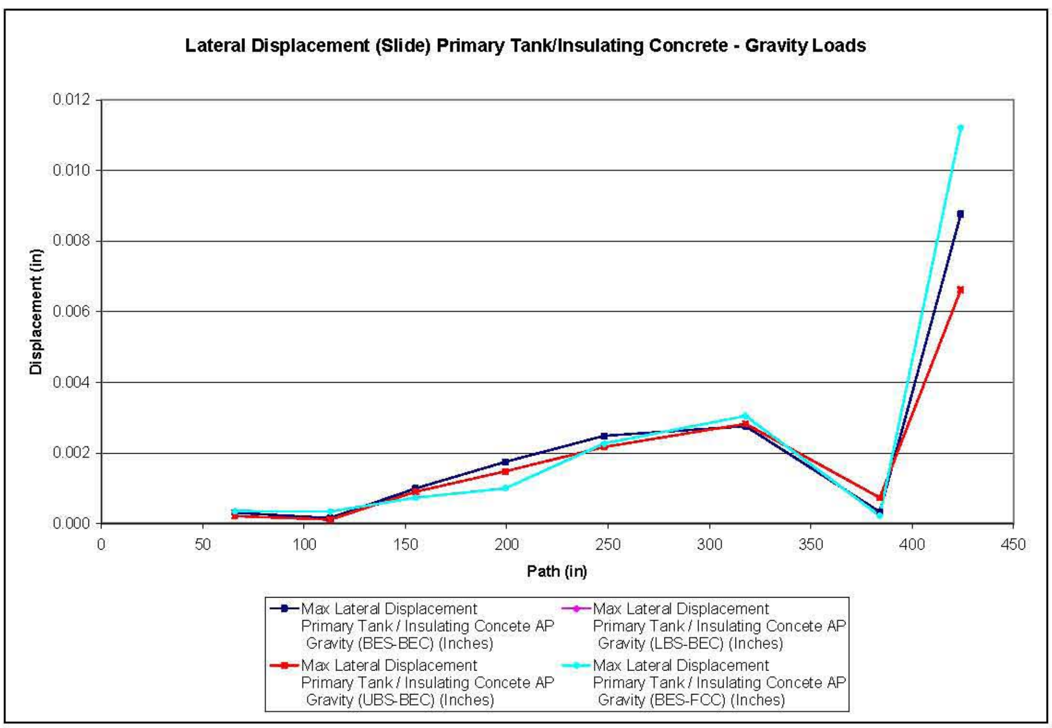


Figure 10-60. Primary Tank/Insulating Concrete Contact Element Maximum Contact Lateral Displacement (Slide)– Gravity Plus Seismic.

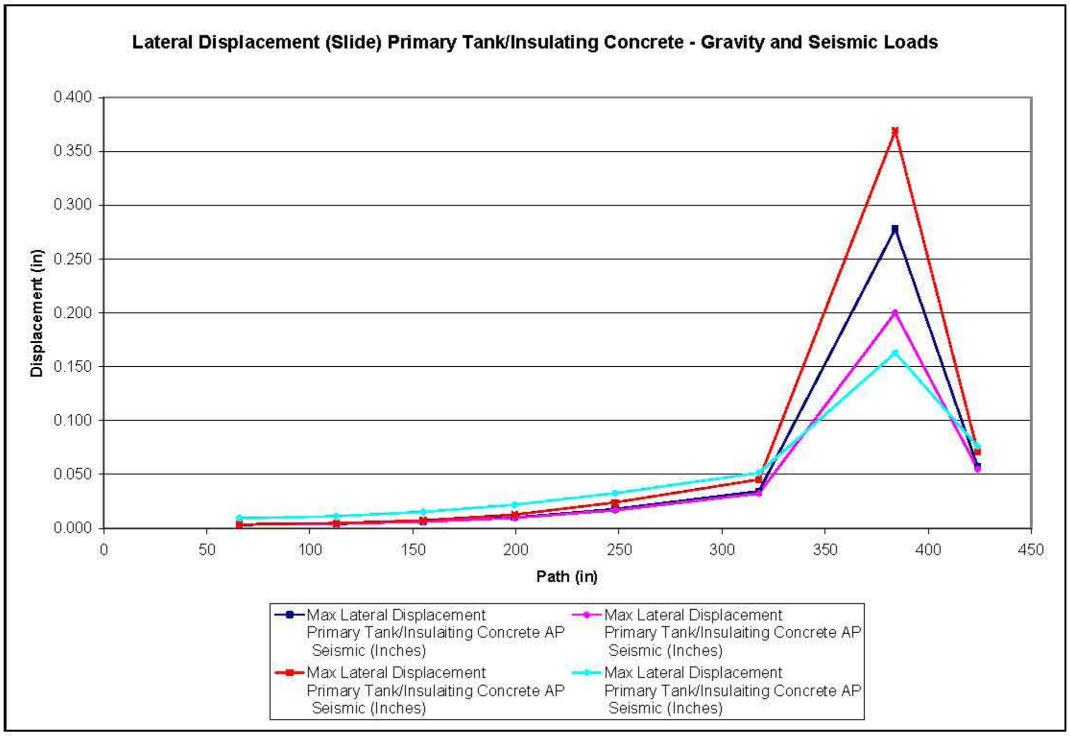


Figure 10-61. Primary Tank/Insulating Concrete Contact Element Maximum Contact Lateral Displacement (Slide)– Seismic Only.

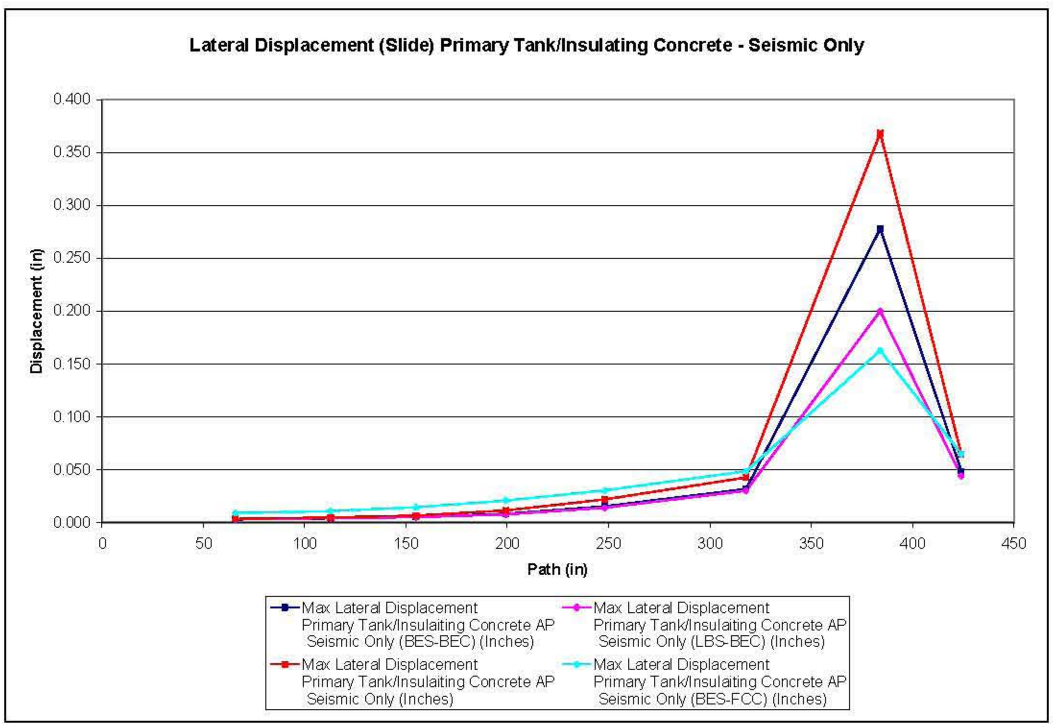


Figure 10-60 and Figure 10-61 show high sliding displacements for a radius of 384 inches. These displacements are very localized and occur in regions of low contact pressures. When separation occurs on an ANSYS® contact element, relative displacements, or sliding is not tracked. The apparent high local displacements are due separation, not due to real relative displacements.

10.5 INSULATING CONCRETE/SECONDARY LINER CONTACTS

Insulating concrete/secondary liner contact data are extracted from the model in 9 degree slices, starting at the outside radius of the insulating concrete, moving in towards the center. Contact normal and other contact data were extracted for the interface between insulating concrete and secondary liner. Figure 10-62 shows the location and element numbers for first slice of contact elements. The following data was extracted for each CONTA173 element

- CONT-PRES Normal Contact Pressure
- CONT-SLIDE Contact Lateral Displacement
- CONT-GAP Contact Gap Distance
- CONT-STAT Contact Status (Open, Closed, Sliding)

For each load case, the minimum and maximum contact pressure, lateral displacements, and gaps are compared. The figures for each component are grouped by gravity only, gravity plus seismic, and seismic only. For the insulating concrete/secondary liner contact interface, the following figures are provided.

- Figure 10-63. Insulating Concrete/Secondary Liner Contact Element Contact Pressure – Gravity Only
- Figure 10-64. Insulating Concrete/Secondary Liner Contact Element Maximum Contact Pressure – Gravity Plus Seismic
- Figure 10-65. Insulating Concrete/Secondary Liner Contact Element Minimum Contact Pressure – Gravity Plus Seismic
- Figure 10-66. Insulating Concrete/Secondary Liner Contact Element Maximum Contact Pressure – Seismic Only
- Figure 10-67. Insulating Concrete/Secondary Liner Contact Element Minimum Contact Pressure – Seismic Only
- Figure 10-68. Insulating Concrete/Secondary Liner Contact Element Maximum Contact Lateral Displacement (Slide) – Gravity Only
- Figure 10-69. Insulating Concrete/Secondary Liner Contact Element Maximum Contact Lateral Displacement (Slide)– Gravity Plus Seismic
- Figure 10-70. Insulating Concrete/Secondary Liner Contact Element Maximum Contact Lateral Displacement (Slide)– Seismic Only

Figure 10-62. Insulating Concrete Contact Element Retreival Sequence Starting Numbers.

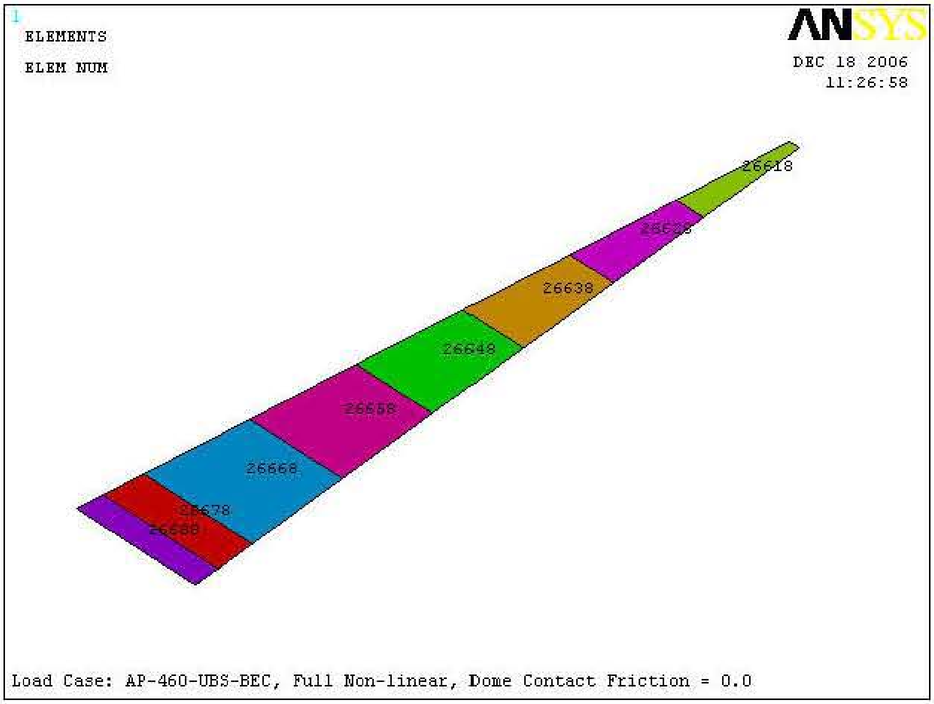


Figure 10-63. Insulating Concrete/Secondary Liner Contact Element Contact Pressure – Gravity Only.

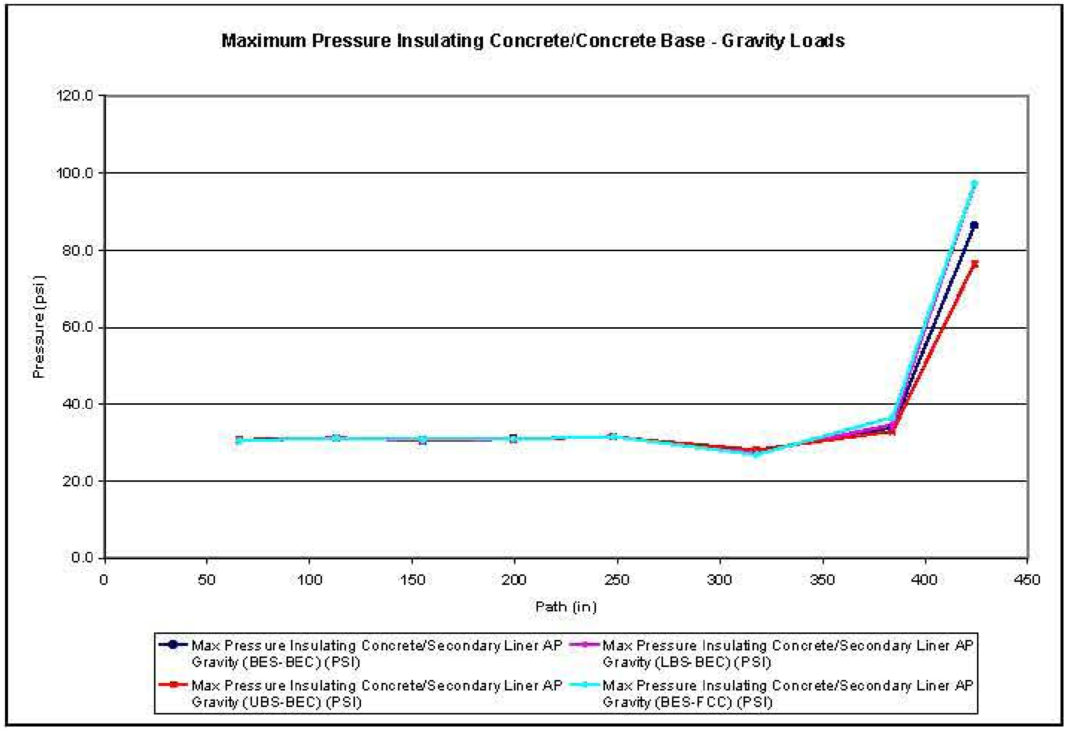


Figure 10-64. Insulating Concrete/Secondary Liner Contact Element Maximum Contact Pressure – Gravity Plus Seismic.

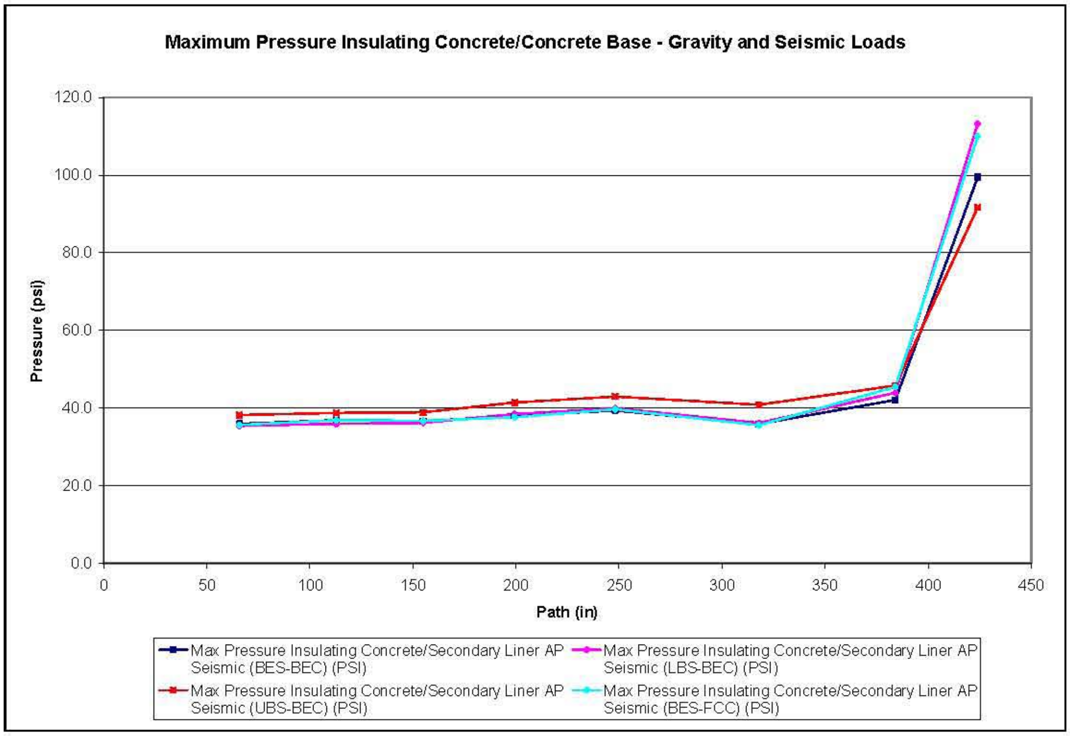


Figure 10-65. Insulating Concrete/Secondary Liner Contact Element Minimum Contact Pressure – Gravity Plus Seismic.

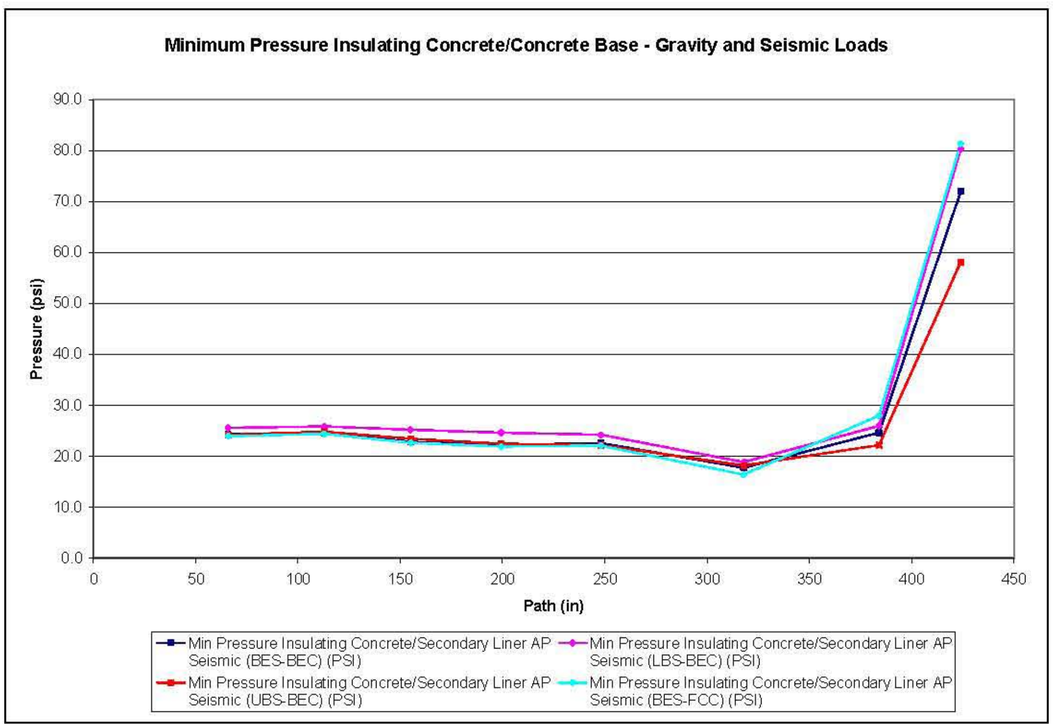


Figure 10-66. Insulating Concrete/Secondary Liner Contact Element Maximum Contact Pressure – Seismic Only.

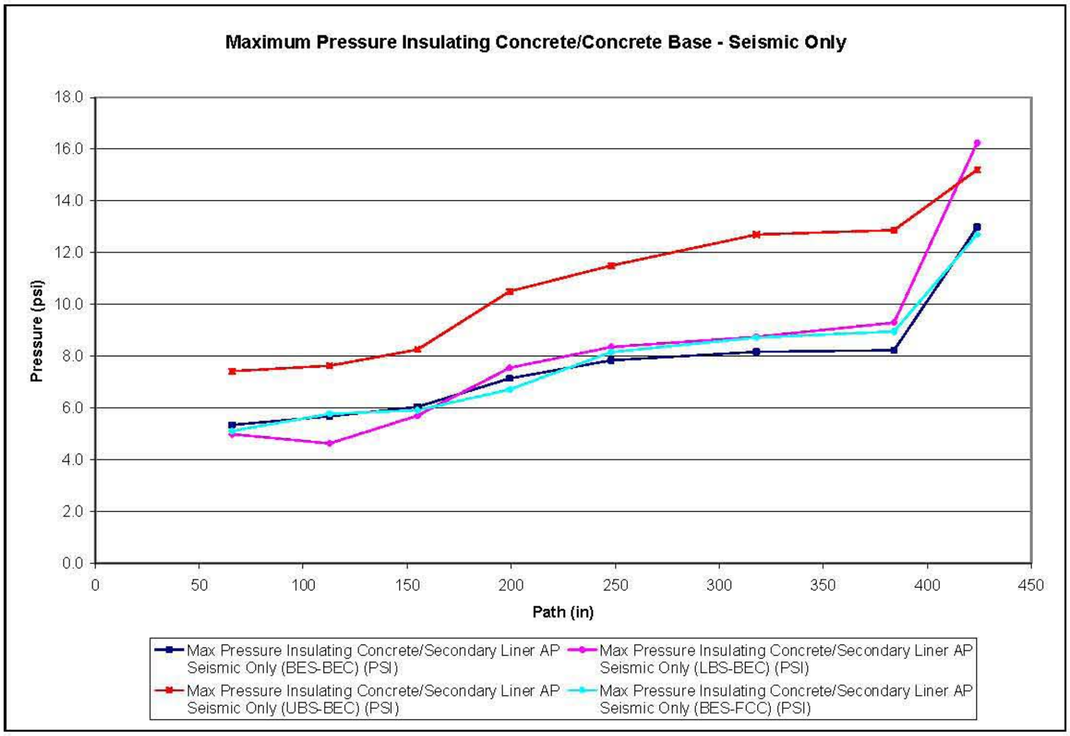


Figure 10-67. Insulating Concrete/Secondary Liner Contact Element Minimum Contact Pressure – Seismic Only

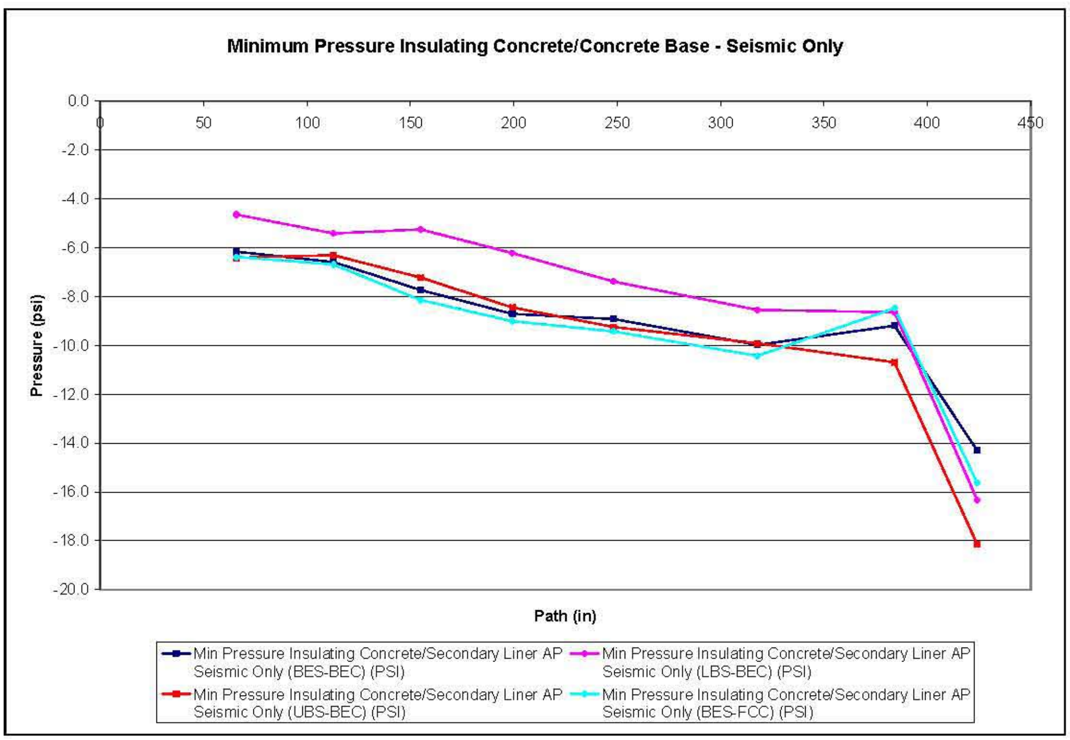


Figure 10-68. Insulating Concrete/Secondary Liner Contact Element Maximum Contact Lateral Displacement (Slide) – Gravity Only.

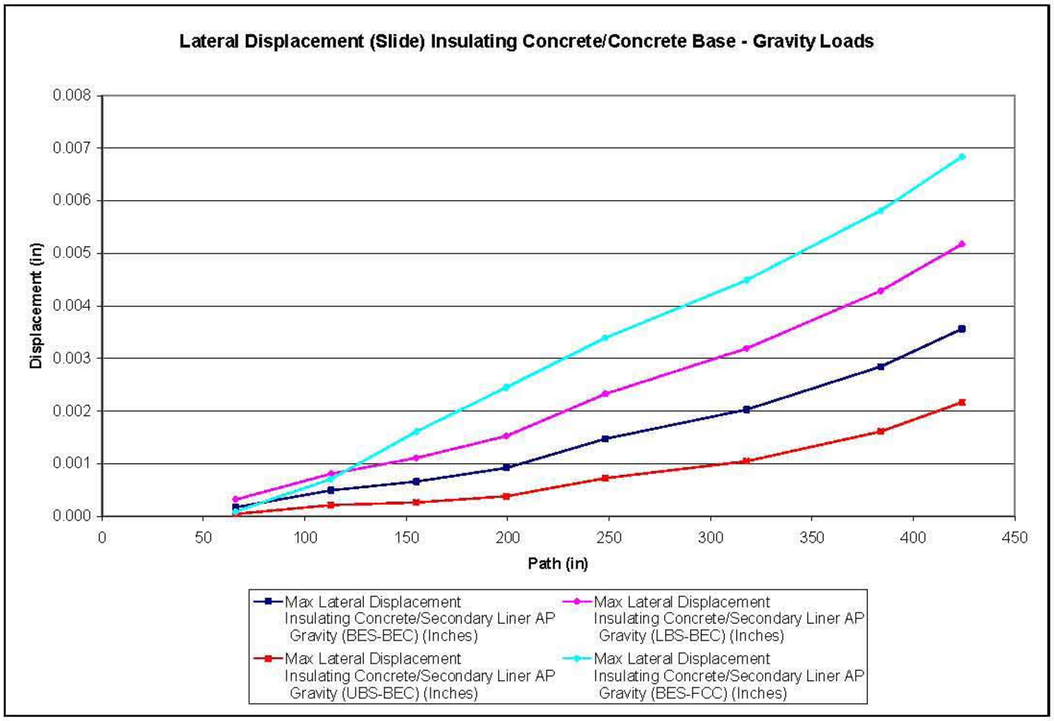


Figure 10-69. Insulating Concrete/Secondary Liner Contact Element Maximum Contact Lateral Displacement (Slide)– Gravity Plus Seismic.

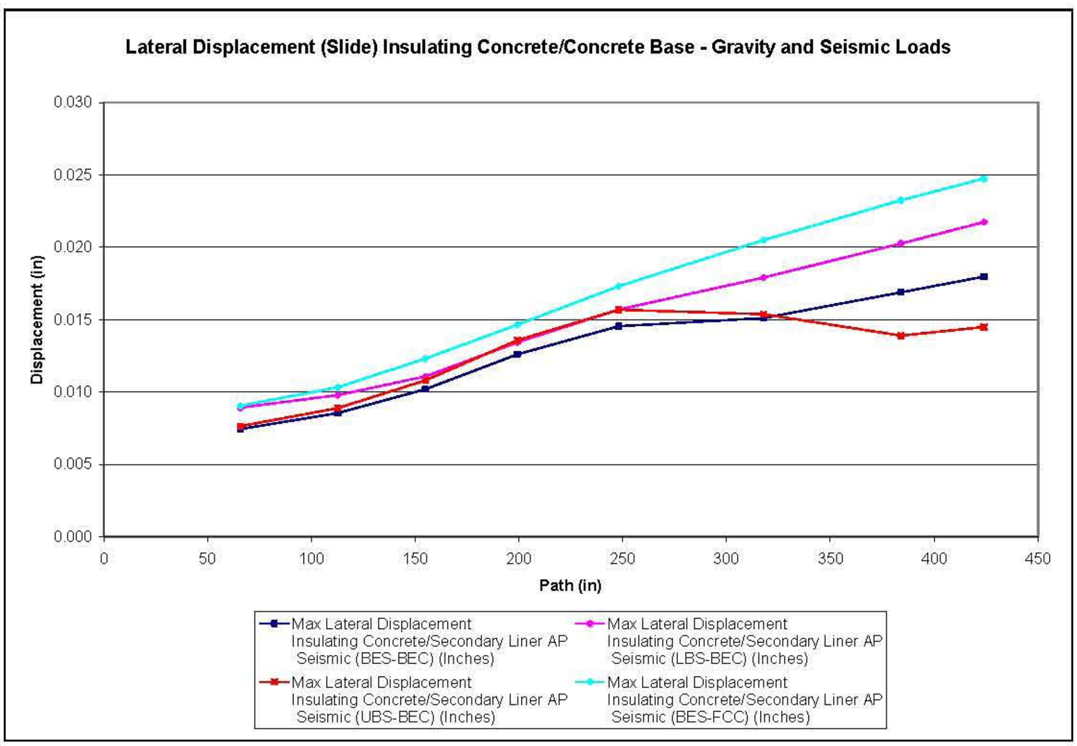
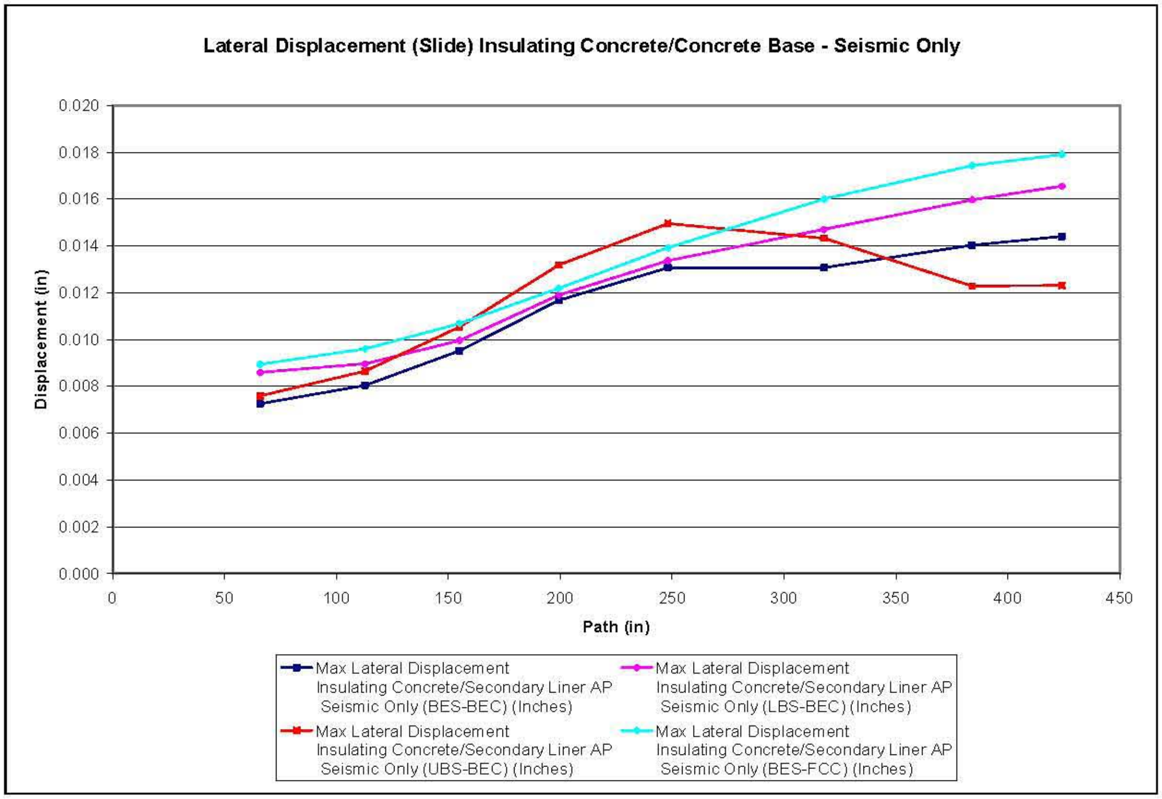


Figure 10-70. Insulating Concrete/Secondary Liner Contact Element Maximum Contact Lateral Displacement (Slide)– Seismic Only.



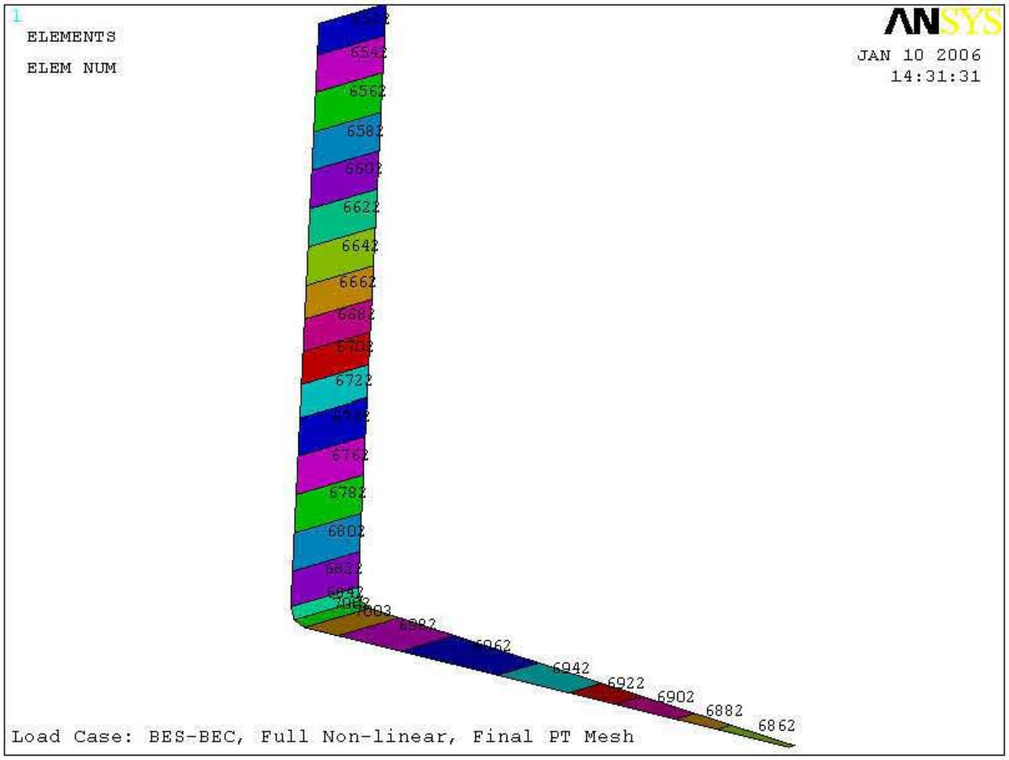
11.0 WASTE RESULTS

Waste pressure distributions were extracted from the model for comparison against a theoretical solution. This comparison helps demonstrate that the seismic motions were correctly transmitted to the waste. Theoretical waste pressures were calculated using a horizontal spectral acceleration for the impulsive mode of the tank/waste system using a horizontal response spectrum from the center bottom of the concrete wall at 90 degrees. Theoretical horizontal waste pressures were calculated using a vertical spectral acceleration for the impulsive mode of the tank/waste system using a vertical response spectrum from the bottom of the concrete shell wall. Theoretical waste pressures were developed for an open top tank with a radius of 450 inches, a waste depth of 460 inches, and a uniform wall thickness of 0.65 inches (average thickness for AY tank used). While the theoretical solution does not address the influence of the interaction with the dome or the variable primary tank wall thickness, it does provide a reasonable basis for comparison to see that the hydrodynamic forces are correct.

Waste/Primary tank contact data are extracted from the model in 9 degree slices, starting at the free surface of the waste, moving down the wall and then in towards the center. Contact normal and other contact data were extracted for the interface between waste and the primary tank. Figure 11-1 shows the location and element numbers for first slice of contact elements. The following data was extracted for each CONTA173 element

- CONT-PRES — Normal Contact Pressure
- CONT-SLIDE — Contact Lateral Displacement
- CONT-GAP — Contact Gap Distance
- CONT-STAT — Contact Status (Open, Closed, Sliding)

Figure 11-1. Waste Contact Element Retrieval Sequence Starting Element Numbers.



The hydrodynamic pressures in the tank are caused by impulsive and convective components and depend on the location of the fluid element within the tank. In the case of horizontal excitation, both the impulsive and convective components vary in the circumferential direction as the cosine of the angle θ, with the maximum values occurring at θ=0 measured from the plane of excitation, and decreasing to zero hydrodynamic pressure at θ=90° to the plane of excitation. The impulsive hydrodynamic pressure increases with depth, while the convective dynamic pressure is a maximum at the top of the waste.

In the case of an open top tank with no dome, the theoretical peak hydrodynamic pressures due to horizontal excitation are given by Equation 4.24 of BNL 1995. The maximum hydrodynamic pressures induced by the waste on the tank wall due to vertical excitation depend on the vertical location in the waste and are given by Equation 4.52 of BNL 1995. The total pressures are the sum of the hydrostatic pressures and the hydrodynamic pressures. Details for the calculation of theoretical waste pressures are provided in Appendices F through I.

For comparison, the theoretical hydrodynamic pressures for an open top tank with a waste depth of 460 inches and a radius of 450 inches are shown. The hydrostatic, peak hydrodynamic and peak total pressures for the elements located on the plane of excitation are shown in Table 11-1 though Table 11-4.

11.1 LOWER BOUND SOIL

S_{ah} = 0.32*g* (Horizontal Spectral Acceleration)
S_{av} = 0.29*g* (Vertical Spectra Acceleration)

Table 11-1. Theoretical Waste Pressures, LBS-BEC.

Waste Height	nu	Horiz Conv (psi)	Horiz Imp (psi)	Vert (psi)	SRSS (psi)	Static (psi)	Theor Min (psi)	Theor Max (psi)
454.35	0.99	1.58	0.84	0.14	1.79	0.37	0	2.16
443.05	0.96	1.51	1.30	0.41	2.03	1.12	0	3.15
431.7625	0.94	1.44	1.73	0.68	2.35	1.87	0	4.21
414.125	0.90	1.34	2.33	1.10	2.91	3.03	0.13	5.94
390.125	0.85	1.22	3.05	1.67	3.69	4.62	0.93	8.30
366.125	0.80	1.12	3.68	2.22	4.44	6.20	1.77	10.64
342	0.74	1.02	4.22	2.77	5.15	7.80	2.65	12.94
318.325	0.69	0.94	4.68	3.28	5.80	9.36	3.57	15.16
295.225	0.64	0.86	5.08	3.76	6.38	10.89	4.50	17.27
272.125	0.59	0.80	5.43	4.22	6.93	12.41	5.49	19.34
248.975	0.54	0.74	5.74	4.65	7.43	13.94	6.52	21.37
225.825	0.49	0.69	6.01	5.06	7.89	15.47	7.59	23.36
202.725	0.44	0.65	6.25	5.43	8.30	17.00	8.70	25.30
179.625	0.39	0.61	6.45	5.77	8.67	18.53	9.85	27.20
156.475	0.34	0.57	6.62	6.07	9.00	20.06	11.06	29.05
134.075	0.29	0.55	6.76	6.33	9.28	21.54	12.26	30.81
112.475	0.24	0.53	6.88	6.54	9.50	22.96	13.46	32.46
90.875	0.20	0.51	6.97	6.71	9.69	24.39	14.70	34.08
69.275	0.15	0.49	7.04	6.86	9.84	25.82	15.98	35.66
47.7375	0.10	0.48	7.09	6.96	9.95	27.24	17.29	37.19
24.5	0.05	0.48	7.13	7.03	10.02	28.78	18.76	38.79
7.755	0.02	0.47	7.14	7.05	10.04	29.88	19.84	39.92
1.755	0.00	0.47	7.14	7.05	10.04	30.28	20.23	40.32

See Appendix F, Table 41 for calculation of theoretical waste pressures.

Figure 11-2. Waste Pressure Distribution, LBS-BEC.

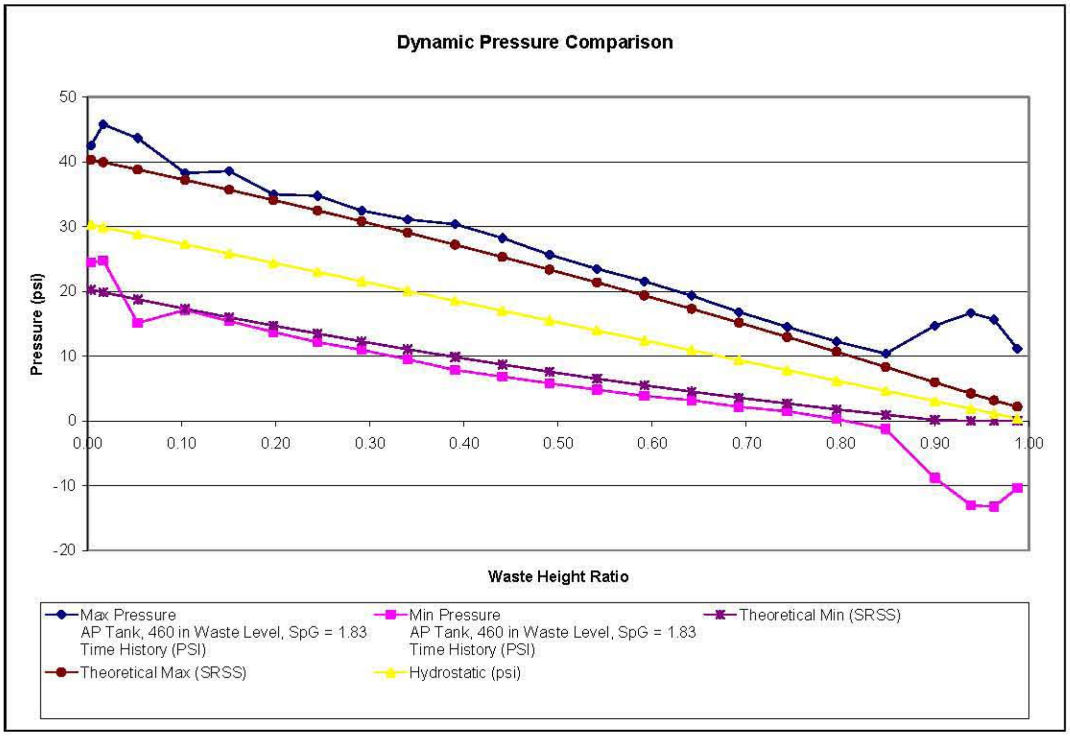
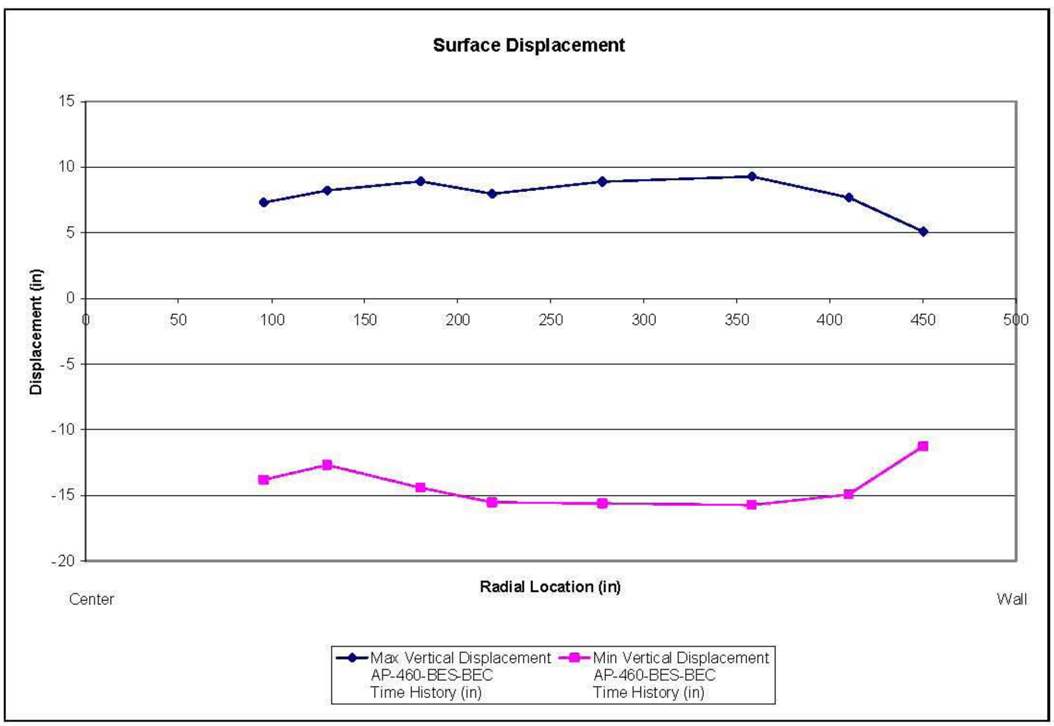


Figure 11-3. Waste Free Surface Displacement, LBS-BEC.



11.2 BEST ESTIMATE SOIL

$S_{ah} = 0.28g$
$S_{av} = 0.26g$

Table 11-2. Theoretical Waste Pressures, BES-BEC.

Waste Height	nu	Horiz Conv (psi)	Horiz Imp (psi)	Vert (psi)	SRSS (psi)	Static (psi)	Theor Min (psi)	Theor Max (psi)
454.35	0.99	1.58	0.73	0.12	1.74	0.37	0	2.12
443.05	0.96	1.51	1.14	0.37	1.92	1.12	0	3.04
431.7625	0.94	1.44	1.51	0.61	2.17	1.87	0	4.04
414.125	0.90	1.34	2.04	0.99	2.63	3.03	0.40	5.66
390.125	0.85	1.22	2.67	1.49	3.30	4.62	1.32	7.91
366.125	0.80	1.12	3.22	1.99	3.94	6.20	2.26	10.15
342	0.74	1.02	3.69	2.48	4.56	7.80	3.23	12.36
318.325	0.69	0.94	4.10	2.94	5.13	9.36	4.23	14.49
295.225	0.64	0.86	4.45	3.37	5.65	10.89	5.24	16.54
272.125	0.59	0.80	4.75	3.78	6.13	12.41	6.29	18.54
248.975	0.54	0.74	5.02	4.17	6.57	13.94	7.37	20.52
225.825	0.49	0.69	5.26	4.53	6.98	15.47	8.49	22.45
202.725	0.44	0.65	5.46	4.87	7.35	17.00	9.65	24.35
179.625	0.39	0.61	5.64	5.17	7.68	18.53	10.85	26.20
156.475	0.34	0.57	5.79	5.44	7.97	20.06	12.09	28.02
134.075	0.29	0.55	5.92	5.67	8.21	21.54	13.32	29.75
112.475	0.24	0.53	6.02	5.86	8.42	22.96	14.55	31.38
90.875	0.20	0.51	6.10	6.02	8.58	24.39	15.81	32.97
69.275	0.15	0.49	6.16	6.15	8.72	25.82	17.10	34.53
47.7375	0.10	0.48	6.20	6.24	8.81	27.24	18.43	36.05
24.5	0.05	0.48	6.23	6.30	8.88	28.78	19.90	37.65
7.755	0.02	0.47	6.24	6.32	8.90	29.88	20.98	38.78
1.755	0.00	0.47	6.25	6.32	8.90	30.28	21.38	39.18

See Appendix G, Table 41 for calculation of theoretical waste pressures.

Figure 11-4. Waste Pressure Distribution, BES-BEC.

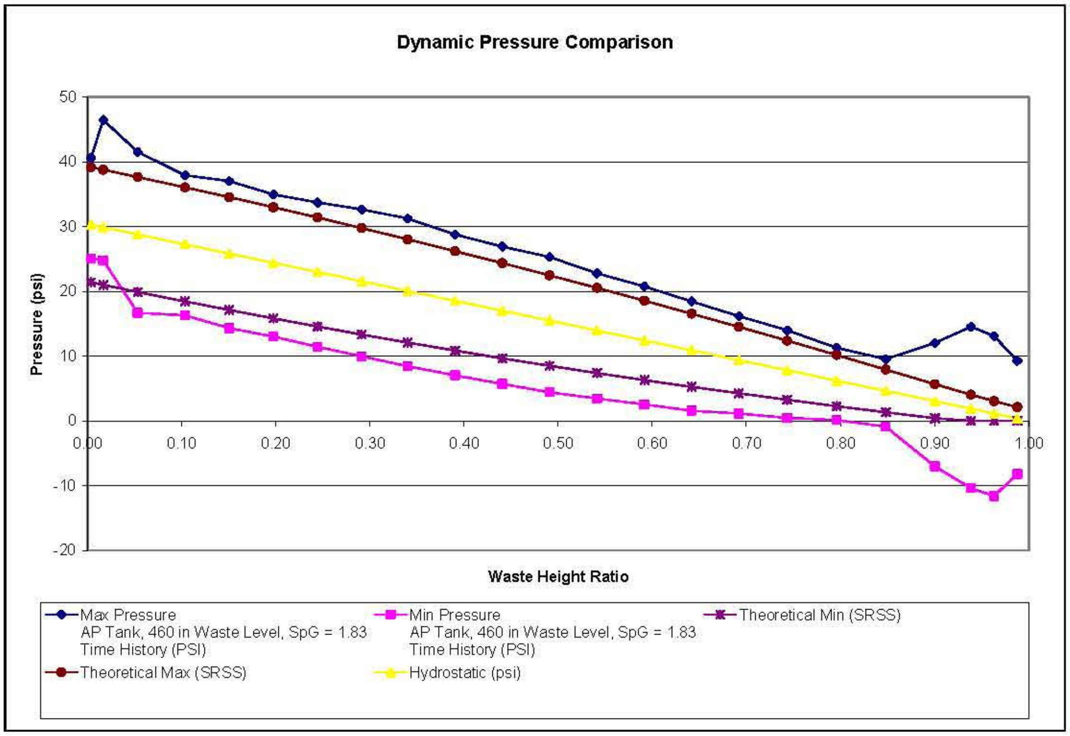
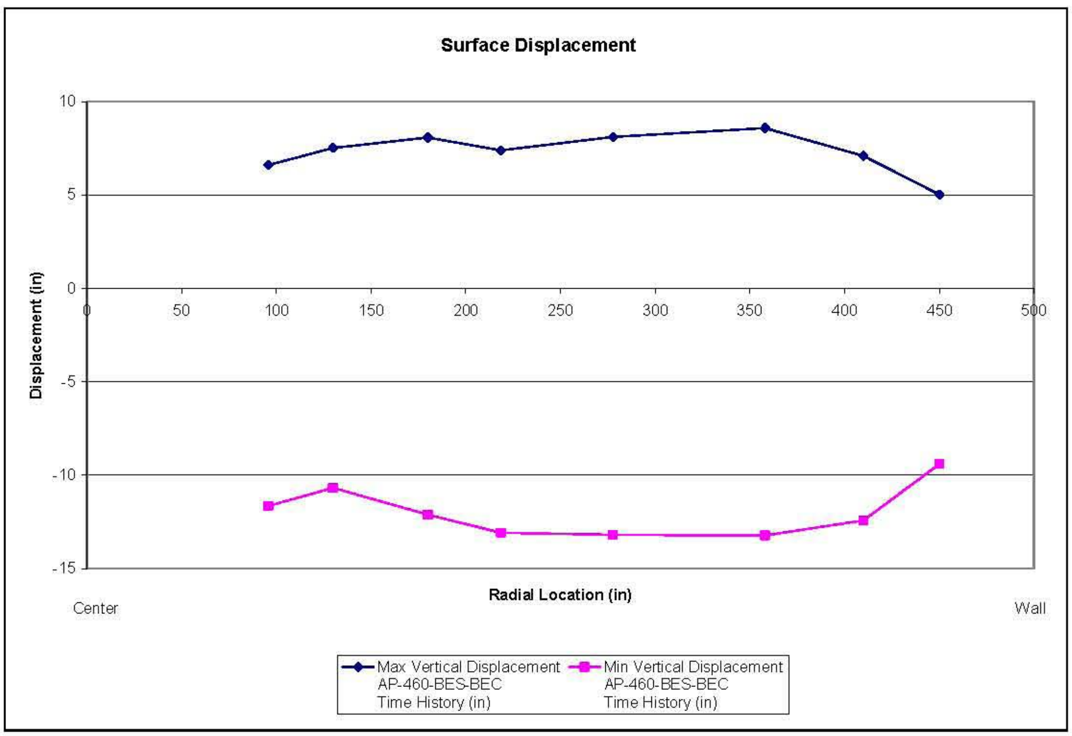


Figure 11-5. Waste Free Surface Displacement, BES-BEC.



11.3 UPPER BOUND SOIL

$S_{ah} = 0.36g$
$S_{av} = 0.32g$

Table 11-3. Theoretical Waste Pressures, UBS-BEC.

Waste Height	nu	Horiz Conv (psi)	Horiz Imp (psi)	Vert (psi)	SRSS (psi)	Static (psi)	Theor Min (psi)	Theor Max (psi)
454.35	0.99	1.58	0.94	0.15	1.84	0.37	0	2.22
443.05	0.96	1.51	1.46	0.45	2.15	1.12	0	3.27
431.7625	0.94	1.44	1.94	0.75	2.53	1.87	0	4.40
414.125	0.90	1.34	2.62	1.21	3.19	3.03	0.00	6.22
390.125	0.85	1.22	3.43	1.84	4.08	4.62	0.53	8.70
366.125	0.80	1.12	4.13	2.45	4.93	6.20	1.27	11.14
342	0.74	1.02	4.75	3.05	5.73	7.80	2.06	13.53
318.325	0.69	0.94	5.27	3.62	6.46	9.36	2.90	15.82
295.225	0.64	0.86	5.72	4.15	7.12	10.89	3.77	18.01
272.125	0.59	0.80	6.11	4.66	7.73	12.41	4.69	20.14
248.975	0.54	0.74	6.46	5.13	8.28	13.94	5.66	22.23
225.825	0.49	0.69	6.76	5.58	8.79	15.47	6.68	24.27
202.725	0.44	0.65	7.03	5.99	9.26	17.00	7.74	26.25
179.625	0.39	0.61	7.25	6.36	9.67	18.53	8.86	28.19
156.475	0.34	0.57	7.45	6.70	10.03	20.06	10.02	30.09
134.075	0.29	0.55	7.61	6.98	10.34	21.54	11.20	31.87
112.475	0.24	0.53	7.74	7.21	10.59	22.96	12.37	33.55
90.875	0.20	0.51	7.84	7.41	10.80	24.39	13.59	35.19
69.275	0.15	0.49	7.92	7.56	10.96	25.82	14.85	36.78
47.7375	0.10	0.48	7.98	7.68	11.08	27.24	16.16	38.32
24.5	0.05	0.48	8.02	7.75	11.16	28.78	17.61	39.94
7.755	0.02	0.47	8.03	7.78	11.19	29.88	18.69	41.07
1.755	0.00	0.47	8.03	7.78	11.19	30.28	19.09	41.47

See Appendix H, Table 41 for calculation of theoretical waste pressures.

Figure 11-6. Waste Pressure Distribution, UBS-BEC.

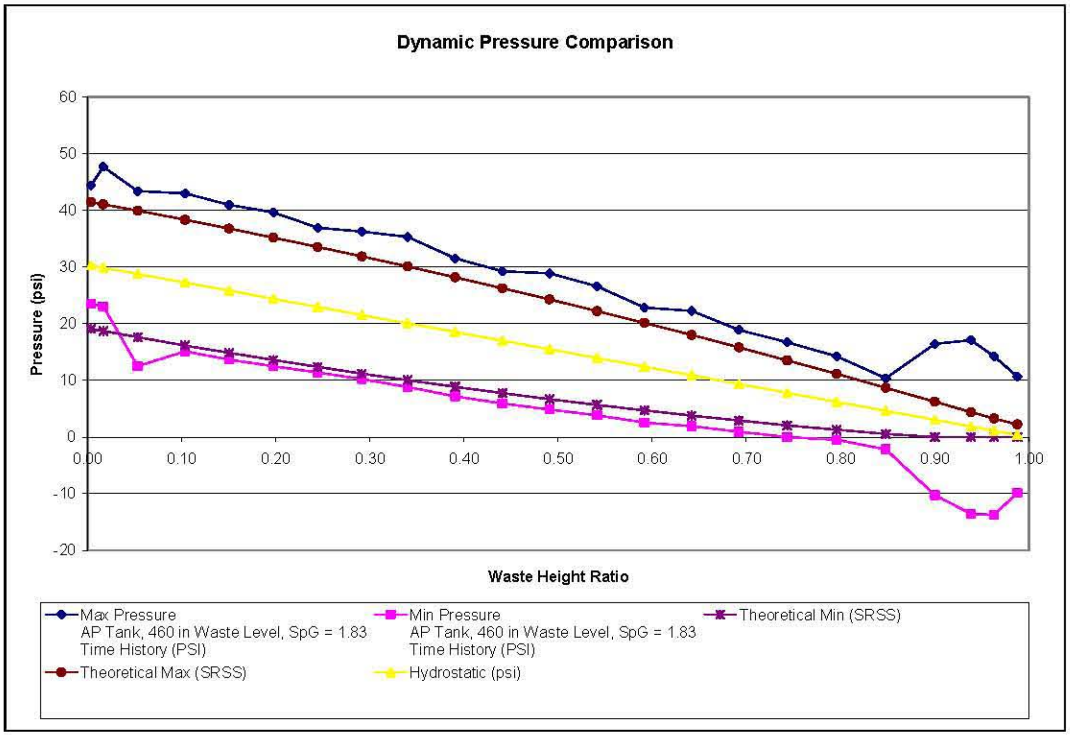
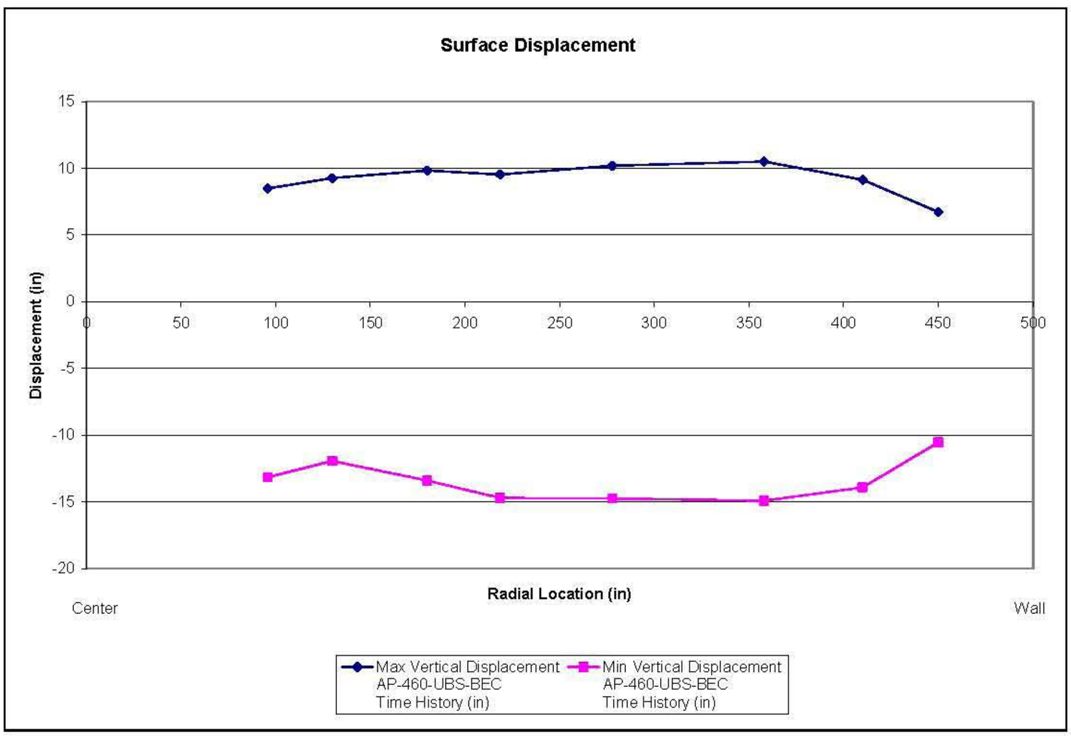


Figure 11-7. Waste Free Surface Displacement, UBS-BEC.



11.4 BEST ESTIMATE SOIL FULLY CRACKED CONCRETE

$S_{ah} = 0.29g$
$S_{av} = 0.25g$

Table 11-4. Theoretical Waste Pressures, BES-FCC.

Waste Height	nu	Horiz Conv (psi)	Horiz Imp (psi)	Vert (psi)	SRSS (psi)	Static (psi)	Theor Min (psi)	Theor Max (psi)
454.35	0.99	1.58	0.76	0.12	1.75	0.37	0	2.13
443.05	0.96	1.51	1.18	0.35	1.94	1.12	0	3.06
431.7625	0.94	1.44	1.56	0.59	2.20	1.87	0	4.07
414.125	0.90	1.34	2.11	0.95	2.68	3.03	0.35	5.71
390.125	0.85	1.22	2.77	1.44	3.35	4.62	1.27	7.97
366.125	0.80	1.12	3.33	1.92	4.00	6.20	2.20	10.20
342	0.74	1.02	3.82	2.38	4.62	7.80	3.18	12.42
318.325	0.69	0.94	4.25	2.83	5.19	9.36	4.17	14.55
295.225	0.64	0.86	4.61	3.24	5.70	10.89	5.19	16.59
272.125	0.59	0.80	4.92	3.64	6.17	12.41	6.24	18.59
248.975	0.54	0.74	5.20	4.01	6.61	13.94	7.33	20.56
225.825	0.49	0.69	5.45	4.36	7.01	15.47	8.46	22.48
202.725	0.44	0.65	5.66	4.68	7.37	17.00	9.63	24.37
179.625	0.39	0.61	5.84	4.97	7.70	18.53	10.83	26.22
156.475	0.34	0.57	6.00	5.23	7.98	20.06	12.07	28.04
134.075	0.29	0.55	6.13	5.45	8.22	21.54	13.31	29.76
112.475	0.24	0.53	6.23	5.64	8.42	22.96	14.54	31.38
90.875	0.20	0.51	6.31	5.79	8.58	24.39	15.81	32.97
69.275	0.15	0.49	6.38	5.91	8.71	25.82	17.11	34.53
47.7375	0.10	0.48	6.43	6.00	8.80	27.24	18.44	36.04
24.5	0.05	0.48	6.46	6.06	8.87	28.78	19.91	37.64
7.755	0.02	0.47	6.47	6.08	8.89	29.88	20.99	38.77
1.755	0.00	0.47	6.47	6.08	8.89	30.28	21.39	39.17

See Appendix I, Table 41 for calculation of theoretical waste pressures.

Figure 11-8. Waste Pressure Distribution, BES-FCC.

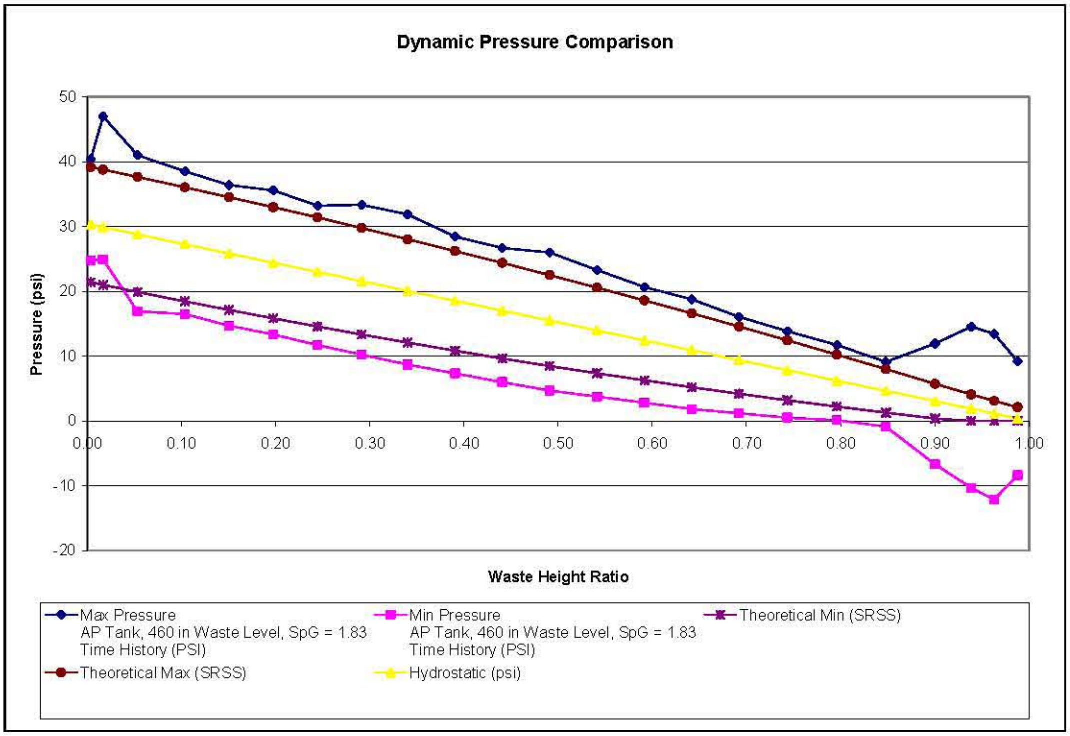
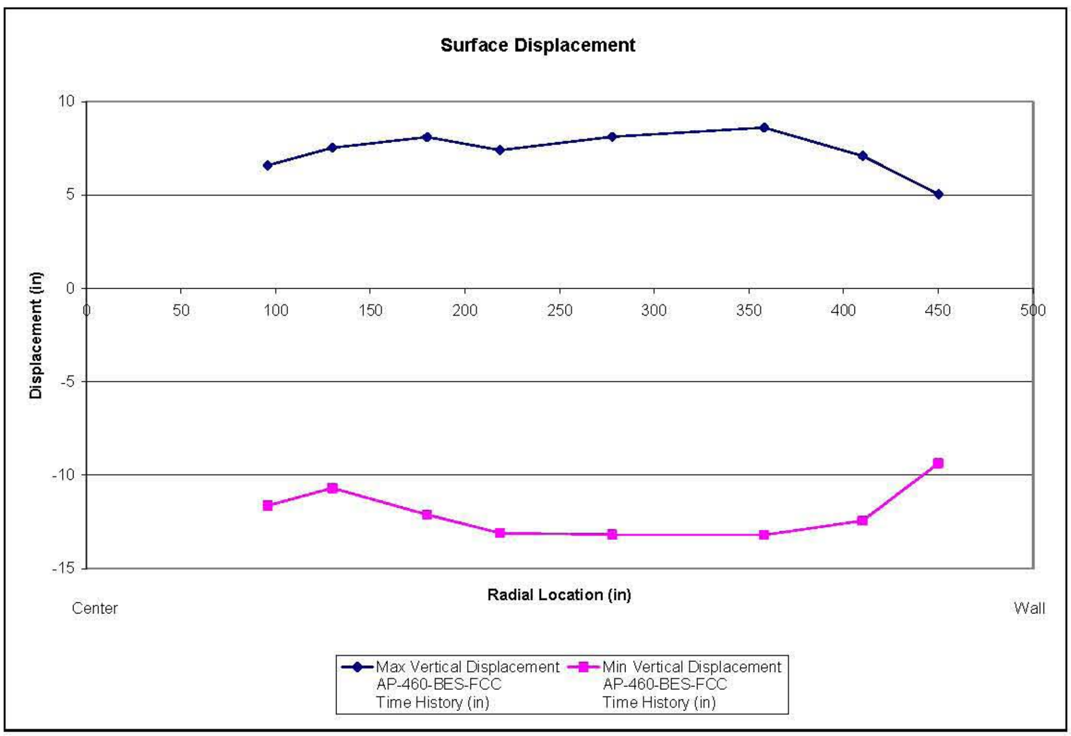


Figure 11-9. Waste Free Surface Displacement, BES-FCC.



12.0 REFERENCES

ASCE, 1998, *Seismic Analysis of Safety-Related Nuclear Structures and Commentary*, ASCE 4-98, American Society of Civil Engineers, Reston, Virginia.

BNL 1995, *Seismic Design and Evaluation Guidelines for the Department of Energy High Level Waste Storage Tanks and Appurtenances*, Report No. 52361, October, 1995, Engineering Research and Applications Division, Department of Advanced Technology, Brookhaven National Laboratory, Associated Universities, Inc. Upton, New York.

Bowles, Joseph E., 1982, *Foundation Analysis and Design*, Third Edition, McGraw-Hill Book Company, New York, New York.

CHG, 2003, *Design Loads for Tank Farm Facilities*, TFC-ENG-STD-06, Rev. B-1, CH2MHill Hanford Group, Richland, Washington.

Deibler, J.E., J.D. Holberry, K.I. Johnson, and M.W. Rinker, 2004, *DST Primary Tank Settlement Evaluation*, PNNL-14706, Pacific Northwest National Laboratory, Richland, Washington, June 2004.

Deibler, J.E., K.I. Johnson, S.P. Pilli, N.K. Karri, M.W. Rinker, F.G. Abatt, and B.G. Carpenter, 2007, *Hanford Double-Shell Tank Thermal and Seismic Project – Increased Liquid Level Analysis for 241-AP Tank Farms*, RPP-RPT-32237, Rev. 0, Pacific Northwest National Laboratory, Richland, Washington.

DOE, 2002, *Natural Phenomena Hazards Design and Evaluation Criteria for Department of Energy Facilities*, DOE-STD-1020-2002, U.S. Department of Energy, Washington, D.C.

Geomatrix, 2005, *Development of Surface Spectra for Double-Shell Tank Facilities, Rev. 0, DOE Hanford Site, Washington State*, Project 10406, Geomatrix Consultants, Inc., Oakland, California.

Hanford Drawing H-2-64306, Rev. 4, dated 12/4/1968, *Tank Foundation Plan, Building 241-AY,* Vitro Hanford Engineering Services, Richland, Washington.

Hanford Drawing H-2-64310, Rev. 1, dated 3/24/1970, *Concrete Tank Section and Details, Building 241-AY,* Vitro Hanford Engineering Services, Richland, Washington.

Hanford Drawing H-2-64449, Rev. 6, dated 5/12/1970, *Tank Elevation and Details, 241-AY*, Vitro Hanford Engineering Services, Richland, Washington.

Hanford Drawing H-2-90534, Rev. 4, dated 7/14/1998, *Tank Cross Section 241-AP Tanks*, Lockheed Martin Hanford Corporation, Richland, Washington.

MSC 2005a, *MSC.Dytran 2005 Theory Manual, Version 2005*, MSC Software Corporation, Santa Ana, California.

MSC 2005b, *MSC.Dytran Reference Manual, Version 2005*, MSC Software Corporation, Santa Ana, California.

NUREG-0800, USNRC Standard Review Plan 3.7.1, Seismic Design Parameters, Revision 2, August 1989. U.S. Nuclear Regulatory Commission, Washington, D.C.

PNNL, 2003, *Statement of Work, DST Seismic Analysis, RFP #1922*, Pacific Northwest National Laboratory, Richland, Washington.

Rinker, M.W., J.E. Deibler, K.I. Johnson, S.P. Pilli, C.E. Guzman-Leong, and O.D. Mullen, 2004, *Hanford Double-Shell Tank Thermal and Seismic Project – Thermal and Operating Loads Analysis*, RPP-RPT-23308, Rev. 0, Pacific Northwest National Laboratory, Richland, Washington.

Rinker, M.W., and F.G. Abatt, 2006a, *Dytran® Benchmark Analysis of Seismically Induced Fluid-Structure Interaction in a Hanford Double Shell Primary Tank*, RPP RPT-28963, Rev. 0a, prepared by M&D Professional Services, Inc. for Pacific Northwest National Laboratory, Richland, Washington.

Rinker, M.W., and F.G. Abatt, 2006b, *Dytran® Benchmark Analysis of Seismically Induced Fluid-Structure Interaction in Flat-Top Tanks*, RPP-RPT-30807, Rev. 0, prepared by M&D Professional Services, Inc. for Pacific Northwest National Laboratory, Richland, Washington.

Rinker, M.W., et al. 2006a, *Hanford Double-Shell Tank Thermal and Seismic Project – Summary of Combined Thermal and Operating Loads*, RPP-RPT-28968, Rev. 1, Prepared by Pacific Northwest National Laboratory, Richland, Washington.

Rinker, M.W., F.G. Abatt, B.G. Carpenter, and C.A. Hendrix, 2006b, *Establishment of Methodology for Time Domain Soil-Structure Interaction Analysis of a Hanford Double Shell Tank*, RPP-RPT-28964, Rev. 0, prepared by M&D Professional Services, Inc. for Pacific Northwest National Laboratory, Richland, Washington.

Rinker, M.W, B.G. Carpenter, and F.G. Abatt, 2006c, *ANSYS® Benchmark Analysis of Seismically Induced Fluid-Structure Interaction in a Hanford Double Shell Primary Tank*, RPP-RPT-28965, Rev. 0, Prepared by M&D Professional Services, Inc. for Pacific Northwest National Laboratory, Richland, Washington.

Rinker, M.W, B.G. Carpenter, C.A. Hendrix, and F.G. Abatt, 2006d, *ANSYS® Seismic Analysis of Hanford Double Shell Tank*, RPP-RPT-28966, Rev. 0, Prepared by M&D Professional Services, Inc. for Pacific Northwest National Laboratory, Richland, Washington.

RPP-13033, *Tank Farms Documented Safety Analysis, Rev. 0*, CH2MHill Hanford Group, Richland, Washington.

13.0 COMPUTER RUN LIST

Computer File Listing

Program Used: ____ANSYS® ______________________ Version Used: __8.1

V&V Reference: ___M&D-V&V-ANS-81-001, Revision 2______________

Workstation used: __F14Tomcat, P52 Mustang, Challenger_______________

Error Report Reviewed for Applicability: YES __X__ NO _______

Due to the large number of input and output files associated with each run, file listings are included in the appendix containing load case or study results data. The appendices are as follows:

- Appendix F Lower Bound Soil, Best Estimate Concrete
- Appendix G Best Estimate Soil, Best Estimate Concrete
- Appendix H Upper Bound Soil, Best Estimate Concrete
- Appendix I Best Estimate Soil, Fully Cracked Concrete

14.0 CALCULATION REVIEW CHECKLIST

Calculation Review Checklist

Yes	No	N/A	
X			1. Objective is clearly stated.
X			2. Design inputs and their sources are clearly identified, including revision and date of the source.
X			3. Assumptions are listed and identified as unverified as appropriate.
X			4. Analytical approach is described and appropriate to satisfy the stated objectives.
X			5. Software used is identified, including revision and workstation used.
X			6. Computer File Listing has been included and completed if software has been used (Separate listing for each program and version used).
X			7. Results are technically correct and consistent with design input and assumptions.
X			8. Calculations are sufficiently detailed that a technically qualified person can understand and verify the methodology without requiring outside or unreferenced information.
X			9. Results and conclusions address all points in the objective.
X			10. Each page in body of calculation identifies the calculation number, page number, preparer and checker. (Preparer and Checker have signed or initialed each page)
X			11. Each page in appendices or attachments identifies the calculation number and page number, and the first page identifies the preparer and checker. (Preparer and Checker have signed or initialed first page)
X			12. Total number of pages, including attachments or appendices has been included
		X	13. Alternate calculations, if used by the checker, have been included.
		X	14. Revised information has been clearly identified by use of markers such as clouds or revision bars, and a revision history included that describes the changes made and identifies pages changed.

APPENDIX A

Dytran Input Files for Primary Tank Sub-Models

Dytran Input File Horizontal Excitation Only

```
$ Direct Text Input for File Management Section
$ 460 Liquid Level, 1 Component Motion, VISCDMP=0.025
START
MEMORY-SIZE=15000000,15000000
CEND
$ Direct Text Input for Case Control Data
$
$ ------------------------------------------------------------
$ special setting for the calculation of fmatplt of the water
$ fmatplt of the water - FMATPLT2 = FMAT2*FVUNC
$ active the special output varibles
$
PARAM,VARACTIV,MULTIEULHYDRO,ELEM,FMATPLT2,FLT,ACTIVE,FMATPLT2
$
$ ------------------------------------------------------------
$ Call eexout routine for the calculation of fmatplt2
$ Call this routine at every timestep is requested
$
ELEXOUT (FP2)
ELEMENTS(FP2) = 101
SET 101 = 1140 THRU 5939 21940 THRU 26739 85940 THRU 95539
TIMES (FP2) = 0 THRU END BY 0.1
$ Output result for request: HEIGHT
TYPE (HEIGHT) = ARCHIVE
ELEMENTS (HEIGHT) = 100
SET 100 = 1140 THRU 5939 21940 THRU 26739 85940 THRU 95539
ELOUT (HEIGHT) = FMAT2,FMATPLT2
TIMES (HEIGHT) = 0 THRU END BY 0.1
SAVE (HEIGHT) = 10000
ENDTIME=46.5
ENDSTEP=9999999
CHECK=NO
TITLE= Jobname is: 460_1CM_025
TLOAD=1
TIC=1
SPC=1
$ Output result for request: Bot_Ctr_TH
TYPE (Bot_Ctr_TH) = TIMEHIS
GRIDS (Bot_Ctr_TH) = 1
SET 1 = 1146
GPOUT (Bot_Ctr_TH) = XPOS YPOS ZPOS XVEL YVEL ZVEL XACC YACC ZACC
TIMES (Bot_Ctr_TH) = 0 THRU END BY 0.01
SAVE (Bot_Ctr_TH) = 10000
$ Output result for request: cent_press
TYPE (cent_press) = TIMEHIS
ELEMENTS (cent_press) = 2
SET 2 = 3559 6759 9959 13159 16359 19559 22759 25959 27559 30759 33959 37159 ,
        40359 43559 46759 49959 53159 56359 59559 62759 65959 69159 72359 ,
        86759 89959 93159 96359 99559 101159 102759 104359 105959 107559
ELOUT (cent_press) = PRESSURE
TIMES (cent_press) = 0 THRU END BY 0.001
SAVE (cent_press) = 100000
$ Output result for request: couple_rxns
TYPE (couple_rxns) = TIMEHIS
CPLSURFS (couple_rxns) = 3
SET 3 = 1
CPLSOUT (couple_rxns) = XFORCE YFORCE ZFORCE
TIMES (couple_rxns) = 0 THRU END BY 0.01
SAVE (couple_rxns) = 10000
$ Output result for request: couple_rxns_001
TYPE (couple_rxns_001) = TIMEHIS
CPLSURFS (couple_rxns_001) = 4
SET 4 = 1
CPLSOUT (couple_rxns_001) = XFORCE YFORCE
TIMES (couple_rxns_001) = 0 THRU END BY 0.001
SAVE (couple_rxns_001) = 100000
$ Output result for request: euler_height_out
TYPE (euler_height_out) = ARCHIVE
```

```
ELEMENTS (euler_height_out) = 5
SET 5 = 1140 THRU 5939 21940 THRU 26739 85940 THRU 95539
ELOUT (euler_height_out) = FMATPLT
TIMES (euler_height_out) = 0 THRU END BY 0.1
SAVE (euler_height_out) = 10000
$ Output result for request: minusx_outstrip
TYPE (minusx_outstrip) = TIMEHIS
ELEMENTS (minusx_outstrip) = 6
SET 6 = 201 211 221 281 311 581 582 583 584 585 741 742 743 881 882 883 884
ELOUT (minusx_outstrip) = TXX-MID TXX-OUT TXX-IN TYY-MID TYY-OUT TYY-IN
TIMES (minusx_outstrip) = 0 THRU END BY 0.01
SAVE (minusx_outstrip) = 10000
$ Output result for request: minusx_press
TYPE (minusx_press) = TIMEHIS
ELEMENTS (minusx_press) = 7
SET 7 = 1976 3576 5176 6776 9976 13176 16376 19576 22776 25976 27576 30776 ,
        33976 37176 40376 43576 46776 49976 53176 56376 59576 62776 65976 ,
        69176 72376 86776 88376 89976 91576 93176
ELOUT (minusx_press) = PRESSURE
TIMES (minusx_press) = 0 THRU END BY 0.001
SAVE (minusx_press) = 100000
$ Output result for request: minusx_shear
TYPE (minusx_shear) = TIMEHIS
ELEMENTS (minusx_shear) = 8
SET 8 = 201 211 221 281 311 581 582 583 584 585 741 742 743 881 882 883 884
ELOUT (minusx_shear) = TXY-MID
TIMES (minusx_shear) = 0 THRU END BY 0.01
SAVE (minusx_shear) = 10000
$ Output result for request: plusx_outstrip
TYPE (plusx_outstrip) = TIMEHIS
ELEMENTS (plusx_outstrip) = 9
SET 9 = 240 250 260 300 310 676 677 678 679 680 798 799 800 957 958 959 960
ELOUT (plusx_outstrip) = TXX-MID TXX-OUT TXX-IN TYY-MID TYY-OUT TYY-IN
TIMES (plusx_outstrip) = 0 THRU END BY 0.01
SAVE (plusx_outstrip) = 10000
$ Output result for request: plusx_press
TYPE (plusx_press) = TIMEHIS
ELEMENTS (plusx_press) = 10
SET 10 = 1943 3543 5143 6743 9943 13143 16343 19543 22743 25943 27543 30743 ,
        33943 37143 40343 43543 46743 49943 53143 56343 59543 62743 65943 ,
        69143 72343 86743 88343 89943 91543 93143
ELOUT (plusx_press) = PRESSURE
TIMES (plusx_press) = 0 THRU END BY 0.01
SAVE (plusx_press) = 10000
$ Output result for request: plusx_press_001
TYPE (plusx_press_001) = TIMEHIS
ELEMENTS (plusx_press_001) = 11
SET 11 = 1943 3543 5143 6743 9943 13143 16343 19543 22743 25943 27543 30743 ,
        33943 37143 40343 43543 46743 49943 53143 56343 59543 62743 65943 ,
        69143 72343 86743 88343 89943 91543 93143
ELOUT (plusx_press_001) = PRESSURE
TIMES (plusx_press_001) = 0 THRU END BY 0.001
SAVE (plusx_press_001) = 100000
$ Output result for request: plusx_shear
TYPE (plusx_shear) = TIMEHIS
ELEMENTS (plusx_shear) = 12
SET 12 = 240 250 260 300 310 676 677 678 679 680 798 799 800 957 958 959 960
ELOUT (plusx_shear) = TXY-MID
TIMES (plusx_shear) = 0 THRU END BY 0.01
SAVE (plusx_shear) = 10000
$ Output result for request: plusx_strip_001
TYPE (plusx_strip_001) = TIMEHIS
ELEMENTS (plusx_strip_001) = 13
SET 13 = 240 250 260 300 310 676 677 678 679 680 798 799 800 957 958 959 960
ELOUT (plusx_strip_001) = TYY-MID TYY-OUT TYY-IN
TIMES (plusx_strip_001) = 0 THRU END BY 0.001
SAVE (plusx_strip_001) = 100000
$ Output result for request: plusx_strip_arc
TYPE (plusx_strip_arc) = ARCHIVE
GRIDS (plusx_strip_arc) = 14
```

```
SET 14 = 1 161 162 173 184 263 272 281 282 321 322 361 371 372 ,
        523 524 525 526 527 718 THRU 725 840 THRU 845 960 961 962
GPOUT (plusx_strip_arc) = XPOS XDIS RDIS
TIMES (plusx_strip_arc) = 0 THRU END BY 0.01
SAVE (plusx_strip_arc) = 10000
$ Output result for request: plusz_outstrip
TYPE (plusz_outstrip) = TIMEHIS
ELEMENTS (plusz_outstrip) = 15
SET 15 = 231 241 251 291 301 631 632 633 634 635 771 772 773 921 922 923 924
ELOUT (plusz_outstrip) = TXX-MID TXX-OUT TXX-IN TYY-MID TYY-OUT TYY-IN
TIMES (plusz_outstrip) = 0 THRU END BY 0.01
SAVE (plusz_outstrip) = 10000
$ Output result for request: plusz_press
TYPE (plusz_press) = TIMEHIS
ELEMENTS (plusz_press) = 16
SET 16 = 2599 4199 5799 7399 10599 13799 16999 20199 23399 26599 28199 31399 ,
        34599 37799 40999 44199 47399 50599 53799 56999 60199 63399 66599 ,
        69799 72999 87399 88999 90599 92199 93799
ELOUT (plusz_press) = PRESSURE
TIMES (plusz_press) = 0 THRU END BY 0.001
SAVE (plusz_press) = 100000
$ Output result for request: plusz_shear
TYPE (plusz_shear) = TIMEHIS
ELEMENTS (plusz_shear) = 17
SET 17 = 231 241 251 291 301 631 632 633 634 635 771 772 773 921 922 923 924
ELOUT (plusz_shear) = TXY-MID
TIMES (plusz_shear) = 0 THRU END BY 0.01
SAVE (plusz_shear) = 10000
$ Output result for request: press_45_out
TYPE (press_45_out) = TIMEHIS
ELEMENTS (press_45_out) = 18
SET 18 = 2388 3988 5588 7188 10388 13588 16788 19988 23188 26388 27988 31188 ,
        34388 37588 40788 43988 47188 50388 53588 56788 59988 63188 66388 ,
        69588 72788 87188 88788 90388 91988 93588
ELOUT (press_45_out) = PRESSURE
TIMES (press_45_out) = 0 THRU END BY 0.01
SAVE (press_45_out) = 10000
$ Output result for request: press45_outstrip
TYPE (press45_outstrip) = TIMEHIS
ELEMENTS (press45_outstrip) = 19
SET 19 = 235 245 255 295 305 651 652 653 654 655 783 784 785 937 938 939 940
ELOUT (press45_outstrip) = TXX-MID TXX-OUT TXX-IN TYY-MID TYY-OUT TYY-IN
TIMES (press45_outstrip) = 0 THRU END BY 0.01
SAVE (press45_outstrip) = 10000
$ Output result for request: press45_shear
TYPE (press45_shear) = TIMEHIS
ELEMENTS (press45_shear) = 20
SET 20 = 235 245 255 295 305 651 652 653 654 655 783 784 785 937 938 939 940
ELOUT (press45_shear) = TXY-MID
TIMES (press45_shear) = 0 THRU END BY 0.01
SAVE (press45_shear) = 10000
$ Output result for request: restart
TYPE (restart) = RESTART
TIMES (restart) = 0 THRU END BY 1
SAVE (restart) = -1
$ Output result for request: Tank_TH_out
TYPE (Tank_TH_out) = TIMEHIS
GRIDS (Tank_TH_out) = 21
SET 21 = 47 402
GPOUT (Tank_TH_out) = XVEL YVEL ZVEL XACC YACC ZACC XDIS YDIS ZDIS
TIMES (Tank_TH_out) = 0 THRU END BY 0.01
SAVE (Tank_TH_out) = 10000
$ Output result for request: Wall_Node_001
TYPE (Wall_Node_001) = TIMEHIS
GRIDS (Wall_Node_001) = 22
SET 22 = 1 162 173 184 523 524 525 526 527
GPOUT (Wall_Node_001) = XVEL YVEL XACC YACC XDIS YDIS
TIMES (Wall_Node_001) = 0 THRU END BY 0.001
SAVE (Wall_Node_001) = 100000
$ Output result for request: Wall_Node_01
```

```
TYPE (Wall_Node_01) = TIMEHIS
GRIDS (Wall_Node_01) = 23
SET 23 = 1 162 173 184 523 524 525 526 527
GPOUT (Wall_Node_01) = XVEL YVEL XACC YACC XDIS YDIS
TIMES (Wall_Node_01) = 0 THRU END BY 0.01
SAVE (Wall_Node_01) = 10000
$------- Parameter Section ------
PARAM,BULKL,0.2
PARAM,BULKQ,1.1
PARAM,CONTACT,THICK,0.0
PARAM,FASTCOUP
PARAM,INISTEP,1e-5
PARAM,MINSTEP,5.0e-7
PARAM,RBE2INFO,GRIDON
$------- BULK DATA SECTION -------
BEGIN BULK
$ Direct Text Input for Bulk Data
PARAM,EXTRAS,NOR-DIR,+2
PARAM,EXTRAS,RHOREF,1.71E-4
PARAM,EXTRAS,ACCG,386.4
PARAM,EXTRAS,FSURF,460
PARAM,EXTRAS,PATM,14.7
PARAM,EXTRAS,BULK,305000
PARAM,EXTRAS,TOLFMAT,0.01
PARAM,EULER-BOUNDARY,EXTRAPOLATION
PARAM,TOLCHK,6.0E-11
PARAM,ELDLTH,10
INCLUDE BaseTH.bdf
$INCLUDE vertvel.bdf
INCLUDE LL_460_1.bdf
$ ------- VISCDMP -----
VISCDMP,,,,,,,,,+
+       ,,,,0.025,,,,,+
+       ,,,,,,,,,+
+       ,,,,,,,,,+
+       ,,,,,,,,,+
+       ,,,,,,,,
$ ------- GRAVITATION -----
TLOAD1,1,444,,0
GRAV,444,,386.4,0,-1,0
$
$ ========== PROPERTY SETS ==========
$
$            * Rigid_Prop *
$
PSHELL,1,1,1
$
$            * Rigid_Prop_Base *
$
PSHELL,6,3,0.375
$
$            * waste_prop *
$
PEULER,7,2, MMHYDRO
$
$            * air_prop *
$
PEULER,8,4, MMHYDRO
$
$            * Rigid_Prop_Bot_Ctr *
$
PSHELL,10,6,0.375
$
$            * 78_Steel *
$
PSHELL,12,7,0.815
$
$            * 34_Steel *
$
PSHELL,13,7,0.69
```

```
$
$            * 916_Steel *
$
PSHELL,14,7,0.5025
$
$            * 12_Steel *
$
PSHELL,15,7,0.44
$
$
$ ========= MATERIAL DEFINITIONS ==========
$
$
$ -------- Material Rigid_Dome_Material id =1
MATRIG,1,735,2.9e+007,0.3,
$
$ -------- Material Water_Mat id =2
DMAT,2,0.000171,2
EOSPOL,2,305000
$
$ -------- Material Rigid_Base_Material id =3
MATRIG,3,0.000735,2.9e+007,0.3,
$
$ -------- Material air_mat id =4
DMAT,4,1.167e-007,4
EOSGAM,4,1.4,,,
$
$ -------- Material Rigid_Bot_Ctr_Material id =6
MATRIG,6,735,2.9e+007,0.3,
$
$ -------- Material steel_mat id =7
MAT1,7,2.88e+007,,0.3,0.000735
$
$ ======== Load Cases =======================
$
$
$ ------- Rigid Body Object Rigid_Tank -----
$ ---- No reference node is used.
TLOAD1,1,2,,12
FORCE,2,MR1,,0,,0,0
TLOAD1,1,1002,,12
MOMENT,1002,MR1,,0,0,0,0
$
$ ------- TICEL BC air_init_set -----
SET1,24,85940,THRU,86466,107985,THRU,108339,107579,+
+       ,THRU,107984,107173,THRU,107578,106767,THRU,107172,+
+       ,106361,THRU,106766,105955,THRU,106360,105549,THRU,+
+       ,105954,105143,THRU,105548,104737,THRU,105142,104331,+
+       ,THRU,104736,103925,THRU,104330,103519,THRU,103924,+
+       ,103113,THRU,103518,102707,THRU,103112,102301,THRU,+
+       ,102706,101895,THRU,102300,101489,THRU,101894,101083,+
+       ,THRU,101488,100677,THRU,101082,100271,THRU,100676,+
+       ,99865,THRU,100270,99459,THRU,99864,99053,THRU,+
+       ,99458,98647,THRU,99052,98241,THRU,98646,97835,+
+       ,THRU,98240,97429,THRU,97834,97023,THRU,97428,+
+       ,96617,THRU,97022,96211,THRU,96616,95805,THRU,+
+       ,96210,95399,THRU,95804,94993,THRU,95398,94587,+
+       ,THRU,94992,94181,THRU,94586,93775,THRU,94180,+
+       ,93369,THRU,93774,92963,THRU,93368,92557,THRU,+
+       ,92962,92151,THRU,92556,91745,THRU,92150,91339,+
+       ,THRU,91744,90933,THRU,91338,90527,THRU,90932,+
+       ,90121,THRU,90526,89715,THRU,90120,89309,THRU,+
+       ,89714,88903,THRU,89308,88497,THRU,88902,88091,+
+       ,THRU,88496,87685,THRU,88090,87279,THRU,87684,+
+       ,86873,THRU,87278,86467,THRU,86872
TICEL,1,24,DENSITY,1.167e-007,SIE,3.15e+008
$
$ ------- TICEL BC wat_init_set -----
SET1,25,44227,THRU,44632,10529,THRU,10934,28799,+
+       ,THRU,29204,28393,THRU,28798,27987,THRU,28392,+
```

```
+       ,27581,THRU,27986,27175,THRU,27580,26769,THRU,+
+       ,27174,26363,THRU,26768,25957,THRU,26362,25551,+
+       ,THRU,25956,25145,THRU,25550,24739,THRU,25144,+
+       ,24333,THRU,24738,23927,THRU,24332,23521,THRU,+
+       ,23926,23115,THRU,23520,22709,THRU,23114,22303,+
+       ,THRU,22708,21897,THRU,22302,21491,THRU,21896,+
+       ,21085,THRU,21490,20679,THRU,21084,20273,THRU,+
+       ,20678,19867,THRU,20272,19461,THRU,19866,19055,+
+       ,THRU,19460,18649,THRU,19054,18243,THRU,18648,+
+       ,17837,THRU,18242,17431,THRU,17836,17025,THRU,+
+       ,17430,16619,THRU,17024,16213,THRU,16618,15807,+
+       ,THRU,16212,15401,THRU,15806,14995,THRU,15400,+
+       ,14589,THRU,14994,14183,THRU,14588,13777,THRU,+
+       ,14182,13371,THRU,13776,12965,THRU,13370,12559,+
+       ,THRU,12964,12153,THRU,12558,11747,THRU,12152,+
+       ,11341,THRU,11746,10935,THRU,11340,10123,THRU,+
+       ,10528,9717,THRU,10122,9311,THRU,9716,8905,+
+       ,THRU,9310,8499,THRU,8904,8093,THRU,8498,+
+       ,7687,THRU,8092,7281,THRU,7686,6875,THRU,+
+       ,7280,6469,THRU,6874,6063,THRU,6468,5657,+
+       ,THRU,6062,5251,THRU,5656,4845,THRU,5250,+
+       ,4439,THRU,4844,4033,THRU,4438,3627,THRU,+
+       ,4032,3221,THRU,3626,2815,THRU,3220,2409,+
+       ,THRU,2814,2003,THRU,2408,1597,THRU,2002,+
+       ,1191,THRU,1596,1140,THRU,1190,43821,THRU,+
+       ,44226,43415,THRU,43820,43009,THRU,43414,42603,+
+       ,THRU,43008,42197,THRU,42602,41791,THRU,42196,+
+       ,41385,THRU,41790,40979,THRU,41384,40573,THRU,+
+       ,40978,40167,THRU,40572,39761,THRU,40166,39355,+
+       ,THRU,39760,38949,THRU,39354,38543,THRU,38948,+
+       ,38137,THRU,38542,37731,THRU,38136,37325,THRU,+
+       ,37730,36919,THRU,37324,36513,THRU,36918,36107,+
+       ,THRU,36512,35701,THRU,36106,35295,THRU,35700,+
+       ,34889,THRU,35294,34483,THRU,34888,34077,THRU,+
+       ,34482,33671,THRU,34076,33265,THRU,33670,32859,+
+       ,THRU,33264,32453,THRU,32858,32047,THRU,32452,+
+       ,31641,THRU,32046,31235,THRU,31640,30829,THRU,+
+       ,31234,30423,THRU,30828,30017,THRU,30422,29611,+
+       ,THRU,30016,29205,THRU,29610,44633,THRU,85939
$ TICEL,1,25,DENSITY,0.000171
TICEEX,1,25,INEL1
$
$ ------- General Coupling: couple -----
$
COUPLE,7,1,OUTSIDE,ON,ON,,7,STANDARD,+
+       ,,,,,
$
COUOPT,1,7,,,,,,,+
+       ,CONSTANT,14.7
$
SURFACE,1,,ELEM,26
SET1,26,1,THRU,105,918,THRU,960,512,+
+       ,THRU,917,106,THRU,511
$
$ ------- Rigid Body: Seismic_Accel
$
BODYFOR,9,GRID,27,,,,,,+
+       ,0,TABLE,1,1,0,0
SET1,27,1,THRU,161,362,THRU,522
$
$ -------- Contact : Bot_Contact
$
CONTACT,10,SURF,SURF,2,3,0,0,,+
+       ,V4,BOTTOM,,,,,
$
$ Slave contact surface for Bot_Contact
$
SURFACE,2,,ELEM,28
SET1,28,301,THRU,480
$
```

```
$ Master contact surface for Bot_Contact
$
SURFACE,3,,ELEM,29
SET1,29,1000,THRU,1139
$
$ ------- Rigid Body Object Rigid_Base -----
$ ---- Reference Node for Rigid body is 1146
TLOAD1,1,12,,12
FORCE,12,MR3,,1,0,0,0
TLOAD1,1,1012,,12
MOMENT,1012,MR3,,1,0,0,0
$
$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$
$ ------- Rigid Body Object Rigid_Tank_Vert_Vel -----
$ ---- No reference node is used.
$ TLOAD1,1,14,,12
$ FORCE,14,MR1,,1,,1,
$
$
ENDDATA
```

Dytran Input File Vertical Excitation Only

```
$ Direct Text Input for File Management Section

START
MEMORY-SIZE=15000000,15000000
CEND
$ Direct Text Input for Case Control Data
$
$ ----------------------------------------------------------
$ special setting for the calculation of fmatplt of the water
$ fmatplt of the water - FMATPLT2 = FMAT2*FVUNC
$ active the special output varibles
$
PARAM,VARACTIV,MULTIEULHYDRO,ELEM,FMATPLT2,FLT,ACTIVE,FMATPLT2
$
$ ----------------------------------------------------------
$ Call eexout routine for the calculation of fmatplt2
$ Call this routine at every timestep is requested
$
ELEXOUT (FP2)
ELEMENTS(FP2) = 101
SET 101 = 1140 THRU 5939 21940 THRU 26739 85940 THRU 95539
TIMES (FP2) = 0 THRU END BY 0.1
$ Output result for request: HEIGHT
TYPE (HEIGHT) = ARCHIVE
ELEMENTS (HEIGHT) = 100
SET 100 = 1140 THRU 5939 21940 THRU 26739 85940 THRU 95539
ELOUT (HEIGHT) = FMAT2,FMATPLT2
TIMES (HEIGHT) = 0 THRU END BY 0.1
SAVE (HEIGHT) = 10000
ENDTIME=30.0
ENDSTEP=9999999
CHECK=NO
TITLE= Jobname is: 1CM_025_Vert
TLOAD=1
TIC=1
SPC=1
$ Output result for request: cent_press
TYPE (cent_press) = TIMEHIS
ELEMENTS (cent_press) = 1
SET 1 = 3559 6759 9959 13159 16359 19559 22759 25959 27559 30759 33959 37159 ,
        40359 43559 46759 49959 53159 56359 59559 62759 65959 69159 72359 ,
        86759 89959 93159 96359 99559 101159 102759 104359 105959 107559
ELOUT (cent_press) = PRESSURE
TIMES (cent_press) = 0 THRU END BY 0.001
SAVE (cent_press) = 100000
$ Output result for request: couple_rxns
TYPE (couple_rxns) = TIMEHIS
CPLSURFS (couple_rxns) = 2
SET 2 = 1
CPLSOUT (couple_rxns) = XFORCE YFORCE ZFORCE
TIMES (couple_rxns) = 0 THRU END BY 0.01
SAVE (couple_rxns) = 10000
$ Output result for request: couple_rxns_001
TYPE (couple_rxns_001) = TIMEHIS
CPLSURFS (couple_rxns_001) = 3
SET 3 = 1
CPLSOUT (couple_rxns_001) = XFORCE YFORCE
TIMES (couple_rxns_001) = 0 THRU END BY 0.001
SAVE (couple_rxns_001) = 100000
$ Output result for request: euler_height_out
TYPE (euler_height_out) = ARCHIVE
ELEMENTS (euler_height_out) = 4
SET 4 = 1140 THRU 5939 21940 THRU 26739 85940 THRU 95539
ELOUT (euler_height_out) = FMATPLT
TIMES (euler_height_out) = 0 THRU END BY 0.1
SAVE (euler_height_out) = 10000
$ Output result for request: minusx_outstrip
TYPE (minusx_outstrip) = TIMEHIS
```

```
ELEMENTS (minusx_outstrip) = 5
SET 5 = 201 211 221 281 311 581 582 583 584 585 741 742 743 881 882 883 884
ELOUT (minusx_outstrip) = TXX-MID TXX-OUT TXX-IN TYY-MID TYY-OUT TYY-IN
TIMES (minusx_outstrip) = 0 THRU END BY 0.01
SAVE (minusx_outstrip) = 10000
$ Output result for request: minusx_press
TYPE (minusx_press) = TIMEHIS
ELEMENTS (minusx_press) = 6
SET 6 = 1976 3576 5176 6776 9976 13176 16376 19576 22776 25976 27576 30776 ,
        33976 37176 40376 43576 46776 49976 53176 56376 59576 62776 65976 ,
        69176 72376 86776 88376 89976 91576 93176
ELOUT (minusx_press) = PRESSURE
TIMES (minusx_press) = 0 THRU END BY 0.01
SAVE (minusx_press) = 10000
$ Output result for request: minusx_press_001
TYPE (minusx_press_001) = TIMEHIS
ELEMENTS (minusx_press_001) = 7
SET 7 = 1976 3576 5176 6776 9976 13176 16376 19576 22776 25976 27576 30776 ,
        33976 37176 40376 43576 46776 49976 53176 56376 59576 62776 65976 ,
        69176 72376 86776 88376 89976 91576 93176
ELOUT (minusx_press_001) = PRESSURE
TIMES (minusx_press_001) = 0 THRU END BY 0.001
SAVE (minusx_press_001) = 100000
$ Output result for request: minusx_shear
TYPE (minusx_shear) = TIMEHIS
ELEMENTS (minusx_shear) = 8
SET 8 = 201 211 221 281 311 581 582 583 584 585 741 742 743 881 882 883 884
ELOUT (minusx_shear) = TXY-MID
TIMES (minusx_shear) = 0 THRU END BY 0.01
SAVE (minusx_shear) = 10000
$ Output result for request: plusx_outstrip
TYPE (plusx_outstrip) = TIMEHIS
ELEMENTS (plusx_outstrip) = 9
SET 9 = 240 250 260 300 310 676 677 678 679 680 798 799 800 957 958 959 960
ELOUT (plusx_outstrip) = TXX-MID TXX-OUT TXX-IN TYY-MID TYY-OUT TYY-IN
TIMES (plusx_outstrip) = 0 THRU END BY 0.01
SAVE (plusx_outstrip) = 10000
$ Output result for request: plusx_press
TYPE (plusx_press) = TIMEHIS
ELEMENTS (plusx_press) = 10
SET 10 = 1943 3543 5143 6743 9943 13143 16343 19543 22743 25943 27543 30743 ,
        33943 37143 40343 43543 46743 49943 53143 56343 59543 62743 65943 ,
        69143 72343 86743 88343 89943 91543 93143
ELOUT (plusx_press) = PRESSURE
TIMES (plusx_press) = 0 THRU END BY 0.01
SAVE (plusx_press) = 10000
$ Output result for request: plusx_press_001
TYPE (plusx_press_001) = TIMEHIS
ELEMENTS (plusx_press_001) = 11
SET 11 = 1943 3543 5143 6743 9943 13143 16343 19543 22743 25943 27543 30743 ,
        33943 37143 40343 43543 46743 49943 53143 56343 59543 62743 65943 ,
        69143 72343 86743 88343 89943 91543 93143
ELOUT (plusx_press_001) = PRESSURE
TIMES (plusx_press_001) = 0 THRU END BY 0.001
SAVE (plusx_press_001) = 100000
$ Output result for request: plusx_shear
TYPE (plusx_shear) = TIMEHIS
ELEMENTS (plusx_shear) = 12
SET 12 = 240 250 260 300 310 676 677 678 679 680 798 799 800 957 958 959 960
ELOUT (plusx_shear) = TXY-MID
TIMES (plusx_shear) = 0 THRU END BY 0.01
SAVE (plusx_shear) = 10000
$ Output result for request: plusx_strip_001
TYPE (plusx_strip_001) = TIMEHIS
ELEMENTS (plusx_strip_001) = 13
SET 13 = 240 250 260 300 310 676 677 678 679 680 798 799 800 957 958 959 960
ELOUT (plusx_strip_001) = TYY-MID TYY-OUT TYY-IN
TIMES (plusx_strip_001) = 0 THRU END BY 0.001
SAVE (plusx_strip_001) = 100000
$ Output result for request: plusx_strip_arc
```

```
TYPE (plusx_strip_arc) = ARCHIVE
ELEMENTS (plusx_strip_arc) = 14
SET 14 = 240 250 260 300 310 676 677 678 679 680 798 799 800 957 958 959 960
ELOUT (plusx_strip_arc) = EFFST-MID EFFST-OUT EFFST-IN TXX-MID TXX-OUT TXX-IN ,
        TYY-MID TYY-OUT TYY-IN TXY-MID TXY-OUT TXY-IN
TIMES (plusx_strip_arc) = 0 THRU END BY 0.1
SAVE (plusx_strip_arc) = 10000
$ Output result for request: plusz_outstrip
TYPE (plusz_outstrip) = TIMEHIS
ELEMENTS (plusz_outstrip) = 15
SET 15 = 231 241 251 291 301 631 632 633 634 635 771 772 773 921 922 923 924
ELOUT (plusz_outstrip) = TXX-MID TXX-OUT TXX-IN TYY-MID TYY-OUT TYY-IN
TIMES (plusz_outstrip) = 0 THRU END BY 0.01
SAVE (plusz_outstrip) = 10000
$ Output result for request: plusz_press
TYPE (plusz_press) = TIMEHIS
ELEMENTS (plusz_press) = 16
SET 16 = 2599 4199 5799 7399 10599 13799 16999 20199 23399 26599 28199 31399 ,
        34599 37799 40999 44199 47399 50599 53799 56999 60199 63399 66599 ,
        69799 72999 87399 88999 90599 92199 93799
ELOUT (plusz_press) = PRESSURE
TIMES (plusz_press) = 0 THRU END BY 0.001
SAVE (plusz_press) = 100000
$ Output result for request: plusz_shear
TYPE (plusz_shear) = TIMEHIS
ELEMENTS (plusz_shear) = 17
SET 17 = 231 241 251 291 301 631 632 633 634 635 771 772 773 921 922 923 924
ELOUT (plusz_shear) = TXY-MID
TIMES (plusz_shear) = 0 THRU END BY 0.01
SAVE (plusz_shear) = 10000
$ Output result for request: press_45_out
TYPE (press_45_out) = TIMEHIS
ELEMENTS (press_45_out) = 18
SET 18 = 2388 3988 5588 7188 10388 13588 16788 19988 23188 26388 27988 31188 ,
        34388 37588 40788 43988 47188 50388 53588 56788 59988 63188 66388 ,
        69588 72788 87188 88788 90388 91988 93588
ELOUT (press_45_out) = PRESSURE
TIMES (press_45_out) = 0 THRU END BY 0.01
SAVE (press_45_out) = 10000
$ Output result for request: press45_outstrip
TYPE (press45_outstrip) = TIMEHIS
ELEMENTS (press45_outstrip) = 19
SET 19 = 235 245 255 295 305 651 652 653 654 655 783 784 785 937 938 939 940
ELOUT (press45_outstrip) = TXX-MID TXX-OUT TXX-IN TYY-MID TYY-OUT TYY-IN
TIMES (press45_outstrip) = 0 THRU END BY 0.01
SAVE (press45_outstrip) = 10000
$ Output result for request: press45_shear
TYPE (press45_shear) = TIMEHIS
ELEMENTS (press45_shear) = 20
SET 20 = 235 245 255 295 305 651 652 653 654 655 783 784 785 937 938 939 940
ELOUT (press45_shear) = TXY-MID
TIMES (press45_shear) = 0 THRU END BY 0.01
SAVE (press45_shear) = 10000
$ Output result for request: restart
TYPE (restart) = RESTART
TIMES (restart) = 0 THRU END BY 1
SAVE (restart) = -1
$ Output result for request: Tank_TH_out
TYPE (Tank_TH_out) = TIMEHIS
GRIDS (Tank_TH_out) = 21
SET 21 = 47 361 402
GPOUT (Tank_TH_out) = XVEL YVEL ZVEL XACC YACC ZACC XDIS YDIS ZDIS
TIMES (Tank_TH_out) = 0 THRU END BY 0.01
SAVE (Tank_TH_out) = 10000
$ Output result for request: Wall_Node_001
TYPE (Wall_Node_001) = TIMEHIS
GRIDS (Wall_Node_001) = 22
SET 22 = 1 162 173 184 523 524 525 526 527
GPOUT (Wall_Node_001) = XVEL YVEL XACC YACC XDIS YDIS
TIMES (Wall_Node_001) = 0 THRU END BY 0.001
```

```
SAVE (Wall_Node_001) = 100000
$ Output result for request: Wall_Node_01
TYPE (Wall_Node_01) = TIMEHIS
GRIDS (Wall_Node_01) = 23
SET 23 = 1 162 173 184 523 524 525 526 527
GPOUT (Wall_Node_01) = XVEL YVEL XACC YACC XDIS YDIS
TIMES (Wall_Node_01) = 0 THRU END BY 0.01
SAVE (Wall_Node_01) = 10000
$------- Parameter Section ------
PARAM,BULKL,0.2
PARAM,BULKQ,1.1
PARAM,CONTACT,THICK,0.0
PARAM,FASTCOUP
PARAM,INISTEP,1e-5
PARAM,MINSTEP,5.0e-7
PARAM,RBE2INFO,GRIDON
$------- BULK DATA SECTION -------
BEGIN BULK
$ Direct Text Input for Bulk Data
PARAM,EXTRAS,NOR-DIR,+2
PARAM,EXTRAS,RHOREF,1.71E-4
PARAM,EXTRAS,ACCG,386.4
PARAM,EXTRAS,FSURF,460
PARAM,EXTRAS,PATM,14.7
PARAM,EXTRAS,BULK,305000
PARAM,EXTRAS,TOLFMAT,0.01
PARAM,EULER-BOUNDARY,EXTRAPOLATION
PARAM,TOLCHK,6.0E-11
PARAM,ELDLTH,10
INCLUDE BaseVertVel.bdf
INCLUDE 1CM_025_Vert.bdf
$ ------- VISCDMP -----
VISCDMP,,,,,,,,,+
+       ,,,,0.025,,,,,+
+       ,,,,,,,,,+
+       ,,,,,,,,,+
+       ,,,,,,,,,+
+       ,,,,,,,,
$ ------- GRAVITATION -----
TLOAD1,1,444,,0
GRAV,444,,386.4,0,-1,0
$
$ ========== PROPERTY SETS ==========
$
$            * Rigid_Prop *
$
PSHELL,1,1,1
$
$            * waste_prop *
$
PEULER,7,2, MMHYDRO
$
$            * air_prop *
$
PEULER,8,4, MMHYDRO
$
$            * 78_Steel *
$
PSHELL,12,7,0.815
$
$            * 34_Steel *
$
PSHELL,13,7,0.69
$
$            * 916_Steel *
$
PSHELL,14,7,0.5025
$
$            * 12_Steel *
$
```

```
PSHELL,15,7,0.44
$
$
$ ========= MATERIAL DEFINITIONS ==========
$
$
$ -------- Material Rigid_Material id =1
MATRIG,1,735,2.9e+007,0.3,
$
$ -------- Material Water_Mat id =2
DMAT,2,0.000171,2
EOSPOL,2,305000
$
$ -------- Material air_mat id =4
DMAT,4,1.167e-007,4
EOSGAM,4,1.4,,,
$
$ -------- Material steel_mat id =7
MAT1,7,2.88e+007,,0.3,0.000735
$
$ ======== Load Cases ======================
$
$
$ ------- Rigid Body Object Rigid_Tank -----
$ ---- No reference node is used.
TLOAD1,1,2,,12
FORCE,2,MR1,,0,,,0
TLOAD1,1,1002,,12
MOMENT,1002,MR1,,0,0,0,0
$
$ ------- TICEL BC air_init_set -----
SET1,24,85940,THRU,86466,107985,THRU,108339,107579,+
+       ,THRU,107984,107173,THRU,107578,106767,THRU,107172,+
+       ,106361,THRU,106766,105955,THRU,106360,105549,THRU,+
+       ,105954,105143,THRU,105548,104737,THRU,105142,104331,+
+       ,THRU,104736,103925,THRU,104330,103519,THRU,103924,+
+       ,103113,THRU,103518,102707,THRU,103112,102301,THRU,+
+       ,102706,101895,THRU,102300,101489,THRU,101894,101083,+
+       ,THRU,101488,100677,THRU,101082,100271,THRU,100676,+
+       ,99865,THRU,100270,99459,THRU,99864,99053,THRU,+
+       ,99458,98647,THRU,99052,98241,THRU,98646,97835,+
+       ,THRU,98240,97429,THRU,97834,97023,THRU,97428,+
+       ,96617,THRU,97022,96211,THRU,96616,95805,THRU,+
+       ,96210,95399,THRU,95804,94993,THRU,95398,94587,+
+       ,THRU,94992,94181,THRU,94586,93775,THRU,94180,+
+       ,93369,THRU,93774,92963,THRU,93368,92557,THRU,+
+       ,92962,92151,THRU,92556,91745,THRU,92150,91339,+
+       ,THRU,91744,90933,THRU,91338,90527,THRU,90932,+
+       ,90121,THRU,90526,89715,THRU,90120,89309,THRU,+
+       ,89714,88903,THRU,89308,88497,THRU,88902,88091,+
+       ,THRU,88496,87685,THRU,88090,87279,THRU,87684,+
+       ,86873,THRU,87278,86467,THRU,86872
TICEL,1,24,DENSITY,1.167e-007,SIE,3.15e+008
$
$ ------- TICEL BC wat_init_set -----
SET1,25,44227,THRU,44632,10529,THRU,10934,28799,+
+       ,THRU,29204,28393,THRU,28798,27987,THRU,28392,+
+       ,27581,THRU,27986,27175,THRU,27580,26769,THRU,+
+       ,27174,26363,THRU,26768,25957,THRU,26362,25551,+
+       ,THRU,25956,25145,THRU,25550,24739,THRU,25144,+
+       ,24333,THRU,24738,23927,THRU,24332,23521,THRU,+
+       ,23926,23115,THRU,23520,22709,THRU,23114,22303,+
+       ,THRU,22708,21897,THRU,22302,21491,THRU,21896,+
+       ,21085,THRU,21490,20679,THRU,21084,20273,THRU,+
+       ,20678,19867,THRU,20272,19461,THRU,19866,19055,+
+       ,THRU,19460,18649,THRU,19054,18243,THRU,18648,+
+       ,17837,THRU,18242,17431,THRU,17836,17025,THRU,+
+       ,17430,16619,THRU,17024,16213,THRU,16618,15807,+
+       ,THRU,16212,15401,THRU,15806,14995,THRU,15400,+
+       ,14589,THRU,14994,14183,THRU,14588,13777,THRU,+
```

```
+       ,14182,13371,THRU,13776,12965,THRU,13370,12559,+
+       ,THRU,12964,12153,THRU,12558,11747,THRU,12152,+
+       ,11341,THRU,11746,10935,THRU,11340,10123,THRU,+
+       ,10528,9717,THRU,10122,9311,THRU,9716,8905,+
+       ,THRU,9310,8499,THRU,8904,8093,THRU,8498,+
+       ,7687,THRU,8092,7281,THRU,7686,6875,THRU,+
+       ,7280,6469,THRU,6874,6063,THRU,6468,5657,+
+       ,THRU,6062,5251,THRU,5656,4845,THRU,5250,+
+       ,4439,THRU,4844,4033,THRU,4438,3627,THRU,+
+       ,4032,3221,THRU,3626,2815,THRU,3220,2409,+
+       ,THRU,2814,2003,THRU,2408,1597,THRU,2002,+
+       ,1191,THRU,1596,1140,THRU,1190,43821,THRU,+
+       ,44226,43415,THRU,43820,43009,THRU,43414,42603,+
+       ,THRU,43008,42197,THRU,42602,41791,THRU,42196,+
+       ,41385,THRU,41790,40979,THRU,41384,40573,THRU,+
+       ,40978,40167,THRU,40572,39761,THRU,40166,39355,+
+       ,THRU,39760,38949,THRU,39354,38543,THRU,38948,+
+       ,38137,THRU,38542,37731,THRU,38136,37325,THRU,+
+       ,37730,36919,THRU,37324,36513,THRU,36918,36107,+
+       ,THRU,36512,35701,THRU,36106,35295,THRU,35700,+
+       ,34889,THRU,35294,34483,THRU,34888,34077,THRU,+
+       ,34482,33671,THRU,34076,33265,THRU,33670,32859,+
+       ,THRU,33264,32453,THRU,32858,32047,THRU,32452,+
+       ,31641,THRU,32046,31235,THRU,31640,30829,THRU,+
+       ,31234,30423,THRU,30828,30017,THRU,30422,29611,+
+       ,THRU,30016,29205,THRU,29610,44633,THRU,85939
$ TICEL,1,25,DENSITY,0.000171
TICEEX,1,25,INEL1
$
$ ------- General Coupling: couple -----
$
COUPLE,7,1,OUTSIDE,ON,ON,,7,STANDARD,+
+       ,,,,,
$
COUOPT,1,7,,,,,,,+
+       ,CONSTANT,14.7
$
SURFACE,1,,ELEM,26
SET1,26,1,THRU,105,918,THRU,960,512,+
+       ,THRU,917,106,THRU,511
$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$
$
$$ ------- Rigid Body: Seismic_Accel
$$
$ BODYFOR,9,GRID,27,,,,,,+
$ +       ,0,CONSTANT,1,1,0,0
$ SET1,27,1,THRU,161,362,THRU,522
$ Note that body force grid point set will have to be modified for two-comp. motion.
$$
$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$
$ ------- Rigid Body Object Rigid_Tank_Vert_Vel -----
$ ---- No reference node is used.
TLOAD1,1,14,,12,2
FORCE,14,MR1,,1,0,1,
$
$
ENDDATA
```

Dytran Input File Two-Component Motion (Horizontal and Vertical)

```
$ Direct Text Input for File Management Section

START
MEMORY-SIZE=15000000,15000000
CEND
$ Direct Text Input for Case Control Data
$
$ --------------------------------------------------------
$ special setting for the calculation of fmatplt of the water
$ fmatplt of the water - FMATPLT2 = FMAT2*FVUNC
$ active the special output varibles
$
PARAM,VARACTIV,MULTIEULHYDRO,ELEM,FMATPLT2,FLT,ACTIVE,FMATPLT2
$
$ --------------------------------------------------------
$ Call eexout routine for the calculation of fmatplt2
$ Call this routine at every timestep is requested
$
ELEXOUT (FP2)
ELEMENTS(FP2) = 101
SET 101 = 1140 THRU 5939 21940 THRU 26739 85940 THRU 95539
TIMES (FP2) = 0 THRU END BY 0.1
$ Output result for request: HEIGHT
TYPE (HEIGHT) = ARCHIVE
ELEMENTS (HEIGHT) = 100
SET 100 = 1140 THRU 5939 21940 THRU 26739 85940 THRU 95539
ELOUT (HEIGHT) = FMAT2,FMATPLT2
TIMES (HEIGHT) = 0 THRU END BY 0.1
SAVE (HEIGHT) = 10000
ENDTIME=46.5
ENDSTEP=9999999
CHECK=NO
TITLE= Jobname is: 2CM_025
TLOAD=1
TIC=1
SPC=1
$ Output result for request: cent_press
TYPE (cent_press) = TIMEHIS
ELEMENTS (cent_press) = 1
SET 1 = 3559 6759 9959 13159 16359 19559 22759 25959 27559 30759 33959 37159 ,
        40359 43559 46759 49959 53159 56359 59559 62759 65959 69159 72359 ,
        86759 89959 93159 96359 99559 101159 102759 104359 105959 107559
ELOUT (cent_press) = PRESSURE
TIMES (cent_press) = 0 THRU END BY 0.001
SAVE (cent_press) = 100000
$ Output result for request: couple_rxns
TYPE (couple_rxns) = TIMEHIS
CPLSURFS (couple_rxns) = 2
SET 2 = 1
CPLSOUT (couple_rxns) = XFORCE YFORCE ZFORCE
TIMES (couple_rxns) = 0 THRU END BY 0.01
SAVE (couple_rxns) = 10000
$ Output result for request: couple_rxns_001
TYPE (couple_rxns_001) = TIMEHIS
CPLSURFS (couple_rxns_001) = 3
SET 3 = 1
CPLSOUT (couple_rxns_001) = XFORCE YFORCE
TIMES (couple_rxns_001) = 0 THRU END BY 0.001
SAVE (couple_rxns_001) = 100000
$ Output result for request: euler_height_out
TYPE (euler_height_out) = ARCHIVE
ELEMENTS (euler_height_out) = 4
SET 4 = 1140 THRU 5939 21940 THRU 26739 85940 THRU 95539
ELOUT (euler_height_out) = FMATPLT
TIMES (euler_height_out) = 0 THRU END BY 0.1
SAVE (euler_height_out) = 10000
$ Output result for request: minusx_outstrip
TYPE (minusx_outstrip) = TIMEHIS
```

```
ELEMENTS (minusx_outstrip) = 5
SET 5 = 201 211 221 281 311 581 582 583 584 585 741 742 743 881 882 883 884
ELOUT (minusx_outstrip) = TXX-MID TXX-OUT TXX-IN TYY-MID TYY-OUT TYY-IN
TIMES (minusx_outstrip) = 0 THRU END BY 0.01
SAVE (minusx_outstrip) = 10000
$ Output result for request: minusx_press
TYPE (minusx_press) = TIMEHIS
ELEMENTS (minusx_press) = 6
SET 6 = 1976 3576 5176 6776 9976 13176 16376 19576 22776 25976 27576 30776 ,
        33976 37176 40376 43576 46776 49976 53176 56376 59576 62776 65976 ,
        69176 72376 86776 88376 89976 91576 93176
ELOUT (minusx_press) = PRESSURE
TIMES (minusx_press) = 0 THRU END BY 0.01
SAVE (minusx_press) = 10000
$ Output result for request: minusx_press_001
TYPE (minusx_press_001) = TIMEHIS
ELEMENTS (minusx_press_001) = 7
SET 7 = 1976 3576 5176 6776 9976 13176 16376 19576 22776 25976 27576 30776 ,
        33976 37176 40376 43576 46776 49976 53176 56376 59576 62776 65976 ,
        69176 72376 86776 88376 89976 91576 93176
ELOUT (minusx_press_001) = PRESSURE
TIMES (minusx_press_001) = 0 THRU END BY 0.001
SAVE (minusx_press_001) = 100000
$ Output result for request: minusx_shear
TYPE (minusx_shear) = TIMEHIS
ELEMENTS (minusx_shear) = 8
SET 8 = 201 211 221 281 311 581 582 583 584 585 741 742 743 881 882 883 884
ELOUT (minusx_shear) = TXY-MID
TIMES (minusx_shear) = 0 THRU END BY 0.01
SAVE (minusx_shear) = 10000
$ Output result for request: plusx_outstrip
TYPE (plusx_outstrip) = TIMEHIS
ELEMENTS (plusx_outstrip) = 9
SET 9 = 240 250 260 300 310 676 677 678 679 680 798 799 800 957 958 959 960
ELOUT (plusx_outstrip) = TXX-MID TXX-OUT TXX-IN TYY-MID TYY-OUT TYY-IN
TIMES (plusx_outstrip) = 0 THRU END BY 0.01
SAVE (plusx_outstrip) = 10000
$ Output result for request: plusx_press
TYPE (plusx_press) = TIMEHIS
ELEMENTS (plusx_press) = 10
SET 10 = 1943 3543 5143 6743 9943 13143 16343 19543 22743 25943 27543 30743 ,
        33943 37143 40343 43543 46743 49943 53143 56343 59543 62743 65943 ,
        69143 72343 86743 88343 89943 91543 93143
ELOUT (plusx_press) = PRESSURE
TIMES (plusx_press) = 0 THRU END BY 0.01
SAVE (plusx_press) = 10000
$ Output result for request: plusx_press_001
TYPE (plusx_press_001) = TIMEHIS
ELEMENTS (plusx_press_001) = 11
SET 11 = 1943 3543 5143 6743 9943 13143 16343 19543 22743 25943 27543 30743 ,
        33943 37143 40343 43543 46743 49943 53143 56343 59543 62743 65943 ,
        69143 72343 86743 88343 89943 91543 93143
ELOUT (plusx_press_001) = PRESSURE
TIMES (plusx_press_001) = 0 THRU END BY 0.001
SAVE (plusx_press_001) = 100000
$ Output result for request: plusx_shear
TYPE (plusx_shear) = TIMEHIS
ELEMENTS (plusx_shear) = 12
SET 12 = 240 250 260 300 310 676 677 678 679 680 798 799 800 957 958 959 960
ELOUT (plusx_shear) = TXY-MID
TIMES (plusx_shear) = 0 THRU END BY 0.01
SAVE (plusx_shear) = 10000
$ Output result for request: plusx_strip_001
TYPE (plusx_strip_001) = TIMEHIS
ELEMENTS (plusx_strip_001) = 13
SET 13 = 240 250 260 300 310 676 677 678 679 680 798 799 800 957 958 959 960
ELOUT (plusx_strip_001) = TYY-MID TYY-OUT TYY-IN
TIMES (plusx_strip_001) = 0 THRU END BY 0.001
SAVE (plusx_strip_001) = 100000
$ Output result for request: plusx_strip_arc
```

```
TYPE (plusx_strip_arc) = ARCHIVE
ELEMENTS (plusx_strip_arc) = 14
SET 14 = 240 250 260 300 310 676 677 678 679 680 798 799 800 957 958 959 960
ELOUT (plusx_strip_arc) = EFFST-MID EFFST-OUT EFFST-IN TXX-MID TXX-OUT TXX-IN ,
        TYY-MID TYY-OUT TYY-IN TXY-MID TXY-OUT TXY-IN
TIMES (plusx_strip_arc) = 0 THRU END BY 0.1
SAVE (plusx_strip_arc) = 10000
$ Output result for request: plusz_outstrip
TYPE (plusz_outstrip) = TIMEHIS
ELEMENTS (plusz_outstrip) = 15
SET 15 = 231 241 251 291 301 631 632 633 634 635 771 772 773 921 922 923 924
ELOUT (plusz_outstrip) = TXX-MID TXX-OUT TXX-IN TYY-MID TYY-OUT TYY-IN
TIMES (plusz_outstrip) = 0 THRU END BY 0.01
SAVE (plusz_outstrip) = 10000
$ Output result for request: plusz_press
TYPE (plusz_press) = TIMEHIS
ELEMENTS (plusz_press) = 16
SET 16 = 2599 4199 5799 7399 10599 13799 16999 20199 23399 26599 28199 31399 ,
        34599 37799 40999 44199 47399 50599 53799 56999 60199 63399 66599 ,
        69799 72999 87399 88999 90599 92199 93799
ELOUT (plusz_press) = PRESSURE
TIMES (plusz_press) = 0 THRU END BY 0.001
SAVE (plusz_press) = 100000
$ Output result for request: plusz_shear
TYPE (plusz_shear) = TIMEHIS
ELEMENTS (plusz_shear) = 17
SET 17 = 231 241 251 291 301 631 632 633 634 635 771 772 773 921 922 923 924
ELOUT (plusz_shear) = TXY-MID
TIMES (plusz_shear) = 0 THRU END BY 0.01
SAVE (plusz_shear) = 10000
$ Output result for request: press_45_out
TYPE (press_45_out) = TIMEHIS
ELEMENTS (press_45_out) = 18
SET 18 = 2388 3988 5588 7188 10388 13588 16788 19988 23188 26388 27988 31188 ,
        34388 37588 40788 43988 47188 50388 53588 56788 59988 63188 66388 ,
        69588 72788 87188 88788 90388 91988 93588
ELOUT (press_45_out) = PRESSURE
TIMES (press_45_out) = 0 THRU END BY 0.01
SAVE (press_45_out) = 10000
$ Output result for request: press45_outstrip
TYPE (press45_outstrip) = TIMEHIS
ELEMENTS (press45_outstrip) = 19
SET 19 = 235 245 255 295 305 651 652 653 654 655 783 784 785 937 938 939 940
ELOUT (press45_outstrip) = TXX-MID TXX-OUT TXX-IN TYY-MID TYY-OUT TYY-IN
TIMES (press45_outstrip) = 0 THRU END BY 0.01
SAVE (press45_outstrip) = 10000
$ Output result for request: press45_shear
TYPE (press45_shear) = TIMEHIS
ELEMENTS (press45_shear) = 20
SET 20 = 235 245 255 295 305 651 652 653 654 655 783 784 785 937 938 939 940
ELOUT (press45_shear) = TXY-MID
TIMES (press45_shear) = 0 THRU END BY 0.01
SAVE (press45_shear) = 10000
$ Output result for request: restart
TYPE (restart) = RESTART
TIMES (restart) = 0 THRU END BY 1
SAVE (restart) = -1
$ Output result for request: Tank_TH_out
TYPE (Tank_TH_out) = TIMEHIS
GRIDS (Tank_TH_out) = 21
SET 21 = 47 361 402
GPOUT (Tank_TH_out) = XVEL YVEL ZVEL XACC YACC ZACC XDIS YDIS ZDIS
TIMES (Tank_TH_out) = 0 THRU END BY 0.01
SAVE (Tank_TH_out) = 10000
$ Output result for request: Wall_Node_001
TYPE (Wall_Node_001) = TIMEHIS
GRIDS (Wall_Node_001) = 22
SET 22 = 1 162 173 184 523 524 525 526 527
GPOUT (Wall_Node_001) = XVEL YVEL XACC YACC XDIS YDIS
TIMES (Wall_Node_001) = 0 THRU END BY 0.001
```

```
SAVE (Wall_Node_001) = 100000
$ Output result for request: Wall_Node_01
TYPE (Wall_Node_01) = TIMEHIS
GRIDS (Wall_Node_01) = 23
SET 23 = 1 162 173 184 523 524 525 526 527
GPOUT (Wall_Node_01) = XVEL YVEL XACC YACC XDIS YDIS
TIMES (Wall_Node_01) = 0 THRU END BY 0.01
SAVE (Wall_Node_01) = 10000
$------- Parameter Section ------
PARAM,BULKL,0.2
PARAM,BULKQ,1.1
PARAM,CONTACT,THICK,0.0
PARAM,FASTCOUP
PARAM,INISTEP,1e-5
PARAM,MINSTEP,5.0e-7
PARAM,RBE2INFO,GRIDON
$------- BULK DATA SECTION -------
BEGIN BULK
$ Direct Text Input for Bulk Data
PARAM,EXTRAS,NOR-DIR,+2
PARAM,EXTRAS,RHOREF,1.71E-4
PARAM,EXTRAS,ACCG,386.4
PARAM,EXTRAS,FSURF,460
PARAM,EXTRAS,PATM,14.7
PARAM,EXTRAS,BULK,305000
PARAM,EXTRAS,TOLFMAT,0.01
PARAM,EULER-BOUNDARY,EXTRAPOLATION
PARAM,TOLCHK,6.0E-11
PARAM,ELDLTH,10
INCLUDE BaseVertVel.bdf
INCLUDE BaseTH.bdf
INCLUDE 2CM_025.bdf
$ ------- VISCDMP -----
VISCDMP,,,,,,,,,+
+       ,,,,0.025,,,,,+
+       ,,,,,,,,,+
+       ,,,,,,,,,+
+       ,,,,,,,,,+
+       ,,,,,,,,
$ ------- GRAVITATION -----
TLOAD1,1,444,,0
GRAV,444,,386.4,0,-1,0
$
$ ========== PROPERTY SETS ==========
$
$            * Rigid_Prop *
$
PSHELL,1,1,1
$
$            * waste_prop *
$
PEULER,7,2, MMHYDRO
$
$            * air_prop *
$
PEULER,8,4, MMHYDRO
$
$            * 78_Steel *
$
PSHELL,12,7,0.815
$
$            * 34_Steel *
$
PSHELL,13,7,0.69
$
$            * 916_Steel *
$
PSHELL,14,7,0.5025
$
$            * 12_Steel *
```

```
$
PSHELL,15,7,0.44
$
$
$ ========= MATERIAL DEFINITIONS ==========
$
$
$ -------- Material Rigid_Material id =1
MATRIG,1,735,2.9e+007,0.3,
$
$ -------- Material Water_Mat id =2
DMAT,2,0.000171,2
EOSPOL,2,305000
$
$ -------- Material air_mat id =4
DMAT,4,1.167e-007,4
EOSGAM,4,1.4,,,
$
$ -------- Material steel_mat id =7
MAT1,7,2.88e+007,,0.3,0.000735
$
$ ======== Load Cases ======================
$
$
$ ------- Rigid Body Object Rigid_Tank -----
$ ---- No reference node is used.
TLOAD1,1,2,,12
FORCE,2,MR1,,0,,,0
TLOAD1,1,1002,,12
MOMENT,1002,MR1,,0,0,0,0
$
$ ------- TICEL BC air_init_set -----
SET1,24,85940,THRU,86466,107985,THRU,108339,107579,+
+       ,THRU,107984,107173,THRU,107578,106767,THRU,107172,+
+       ,106361,THRU,106766,105955,THRU,106360,105549,THRU,+
+       ,105954,105143,THRU,105548,104737,THRU,105142,104331,+
+       ,THRU,104736,103925,THRU,104330,103519,THRU,103924,+
+       ,103113,THRU,103518,102707,THRU,103112,102301,THRU,+
+       ,102706,101895,THRU,102300,101489,THRU,101894,101083,+
+       ,THRU,101488,100677,THRU,101082,100271,THRU,100676,+
+       ,99865,THRU,100270,99459,THRU,99864,99053,THRU,+
+       ,99458,98647,THRU,99052,98241,THRU,98646,97835,+
+       ,THRU,98240,97429,THRU,97834,97023,THRU,97428,+
+       ,96617,THRU,97022,96211,THRU,96616,95805,THRU,+
+       ,96210,95399,THRU,95804,94993,THRU,95398,94587,+
+       ,THRU,94992,94181,THRU,94586,93775,THRU,94180,+
+       ,93369,THRU,93774,92963,THRU,93368,92557,THRU,+
+       ,92962,92151,THRU,92556,91745,THRU,92150,91339,+
+       ,THRU,91744,90933,THRU,91338,90527,THRU,90932,+
+       ,90121,THRU,90526,89715,THRU,90120,89309,THRU,+
+       ,89714,88903,THRU,89308,88497,THRU,88902,88091,+
+       ,THRU,88496,87685,THRU,88090,87279,THRU,87684,+
+       ,86873,THRU,87278,86467,THRU,86872
TICEL,1,24,DENSITY,1.167e-007,SIE,3.15e+008
$
$ ------- TICEL BC wat_init_set -----
SET1,25,44227,THRU,44632,10529,THRU,10934,28799,+
+       ,THRU,29204,28393,THRU,28798,27987,THRU,28392,+
+       ,27581,THRU,27986,27175,THRU,27580,26769,THRU,+
+       ,27174,26363,THRU,26768,25957,THRU,26362,25551,+
+       ,THRU,25956,25145,THRU,25550,24739,THRU,25144,+
+       ,24333,THRU,24738,23927,THRU,24332,23521,THRU,+
+       ,23926,23115,THRU,23520,22709,THRU,23114,22303,+
+       ,THRU,22708,21897,THRU,22302,21491,THRU,21896,+
+       ,21085,THRU,21490,20679,THRU,21084,20273,THRU,+
+       ,20678,19867,THRU,20272,19461,THRU,19866,19055,+
+       ,THRU,19460,18649,THRU,19054,18243,THRU,18648,+
+       ,17837,THRU,18242,17431,THRU,17836,17025,THRU,+
+       ,17430,16619,THRU,17024,16213,THRU,16618,15807,+
+       ,THRU,16212,15401,THRU,15806,14995,THRU,15400,+
```

```
+       ,14589,THRU,14994,14183,THRU,14588,13777,THRU,+
+       ,14182,13371,THRU,13776,12965,THRU,13370,12559,+
+       ,THRU,12964,12153,THRU,12558,11747,THRU,12152,+
+       ,11341,THRU,11746,10935,THRU,11340,10123,THRU,+
+       ,10528,9717,THRU,10122,9311,THRU,9716,8905,+
+       ,THRU,9310,8499,THRU,8904,8093,THRU,8498,+
+       ,7687,THRU,8092,7281,THRU,7686,6875,THRU,+
+       ,7280,6469,THRU,6874,6063,THRU,6468,5657,+
+       ,THRU,6062,5251,THRU,5656,4845,THRU,5250,+
+       ,4439,THRU,4844,4033,THRU,4438,3627,THRU,+
+       ,4032,3221,THRU,3626,2815,THRU,3220,2409,+
+       ,THRU,2814,2003,THRU,2408,1597,THRU,2002,+
+       ,1191,THRU,1596,1140,THRU,1190,43821,THRU,+
+       ,44226,43415,THRU,43820,43009,THRU,43414,42603,+
+       ,THRU,43008,42197,THRU,42602,41791,THRU,42196,+
+       ,41385,THRU,41790,40979,THRU,41384,40573,THRU,+
+       ,40978,40167,THRU,40572,39761,THRU,40166,39355,+
+       ,THRU,39760,38949,THRU,39354,38543,THRU,38948,+
+       ,38137,THRU,38542,37731,THRU,38136,37325,THRU,+
+       ,37730,36919,THRU,37324,36513,THRU,36918,36107,+
+       ,THRU,36512,35701,THRU,36106,35295,THRU,35700,+
+       ,34889,THRU,35294,34483,THRU,34888,34077,THRU,+
+       ,34482,33671,THRU,34076,33265,THRU,33670,32859,+
+       ,THRU,33264,32453,THRU,32858,32047,THRU,32452,+
+       ,31641,THRU,32046,31235,THRU,31640,30829,THRU,+
+       ,31234,30423,THRU,30828,30017,THRU,30422,29611,+
+       ,THRU,30016,29205,THRU,29610,44633,THRU,85939
$ TICEL,1,25,DENSITY,0.000171
TICEEX,1,25,INEL1
$
$ ------- General Coupling: couple -----
$
COUPLE,7,1,OUTSIDE,ON,ON,,7,STANDARD,+
+       ,,,,,
$
COUOPT,1,7,,,,,,,+
+       ,CONSTANT,14.7
$
SURFACE,1,,ELEM,26
SET1,26,1,THRU,105,918,THRU,960,512,+
+       ,THRU,917,106,THRU,511
$
$ ------- Rigid Body: Seismic_Accel
$
BODYFOR,9,GRID,27,,,,,,+
+       ,0,TABLE,1,1,0,0
SET1,27,1,THRU,161,322,THRU,522
$
$ ------- Rigid Body Object Rigid_Tank_Vert_Vel -----
$ ---- No reference node is used.
TLOAD1,1,14,,12,2
FORCE,14,MR1,,1,,1,
$
$
ENDDATA
```

APPENDIX B

Stress Time History Plots for Dytran Primary Tank Sub-Models

FIGURES

Figure 1. Mid-Plane Hoop Stress Time Histories for Element Set "Plusx_Outstrip" at θ=0° for Horizontal Seismic Excitation Only.

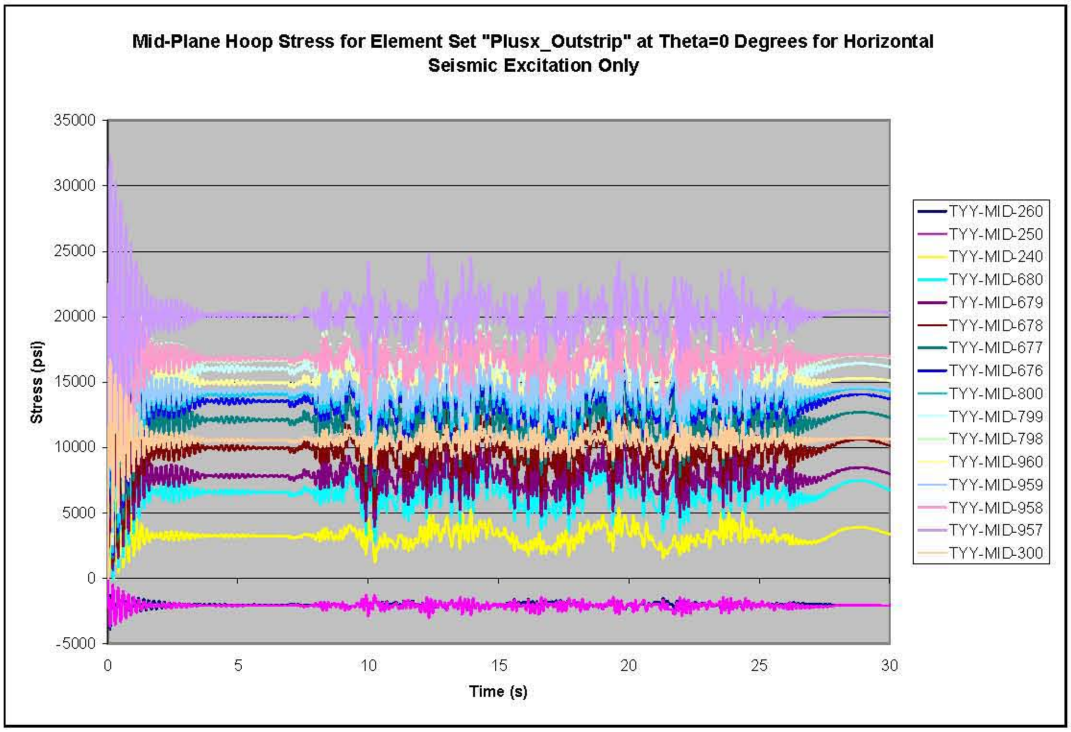


Figure 2. Mid-Plane Meridional Stress Time Histories for Element Set "Plusx_Outstrip" at θ=0° for Horizontal Excitation Only.

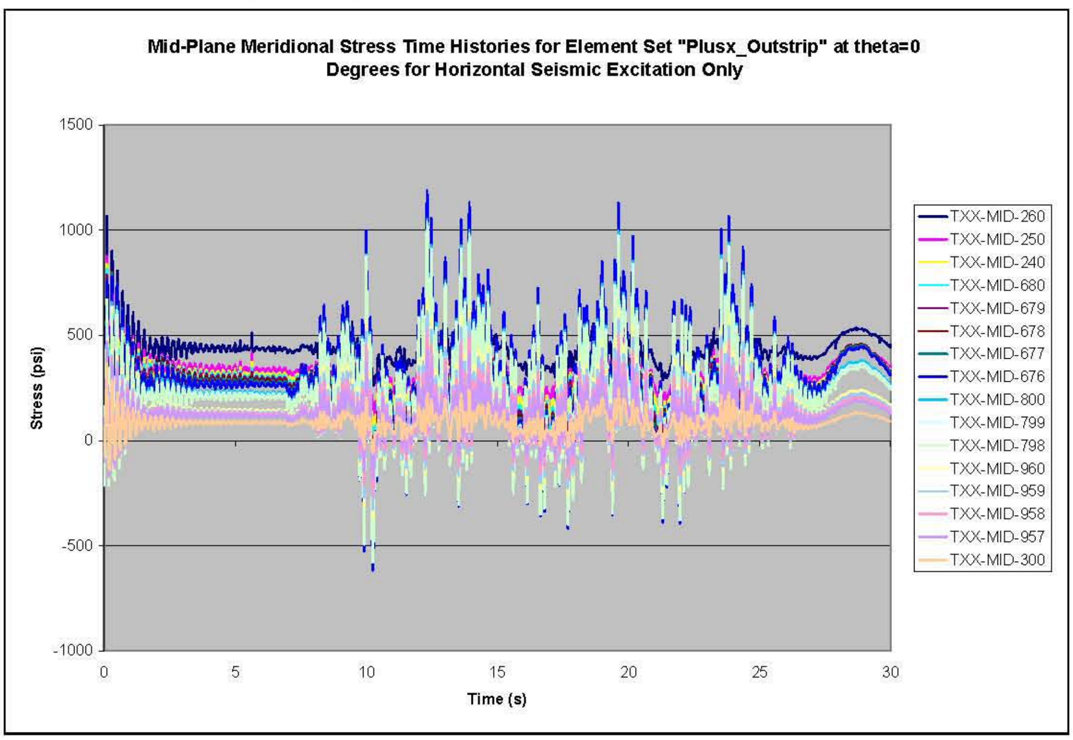


Figure 3. Shear Stress Time Histories for Element Set "Plusx_Outstrip" at θ=0° for Horizontal Excitation Only.

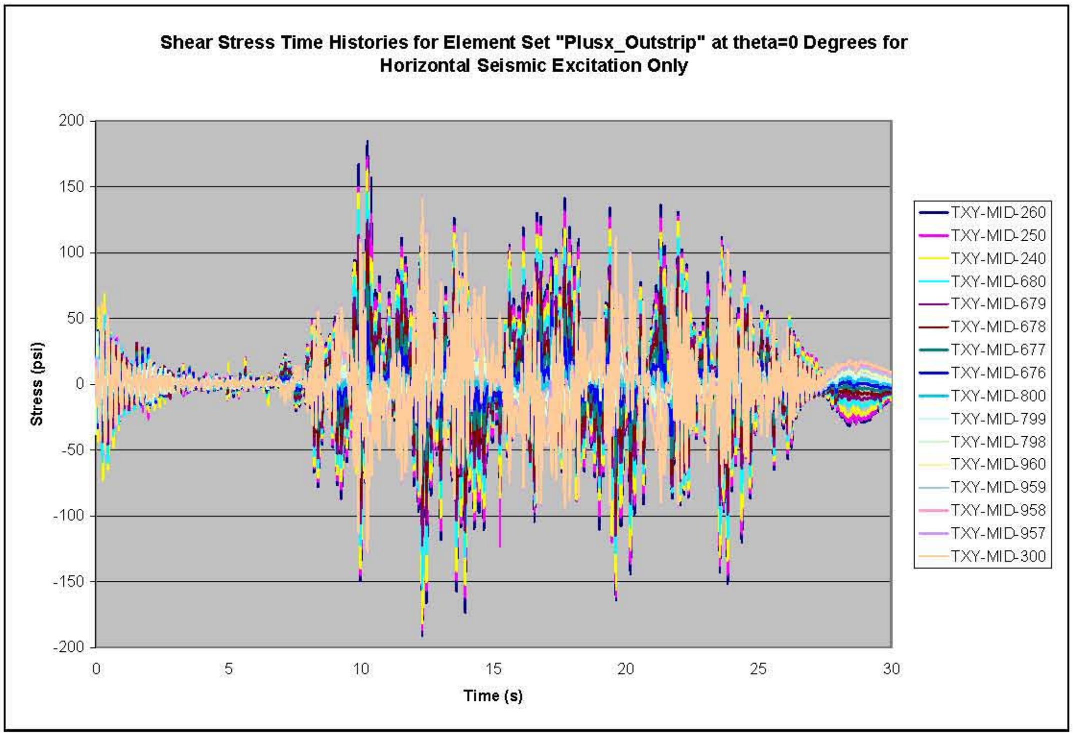


Figure 4. Mid-Plane Hoop Stress Time Histories for Element Set "Press45" at θ=45° for Horizontal Seismic Excitation Only.

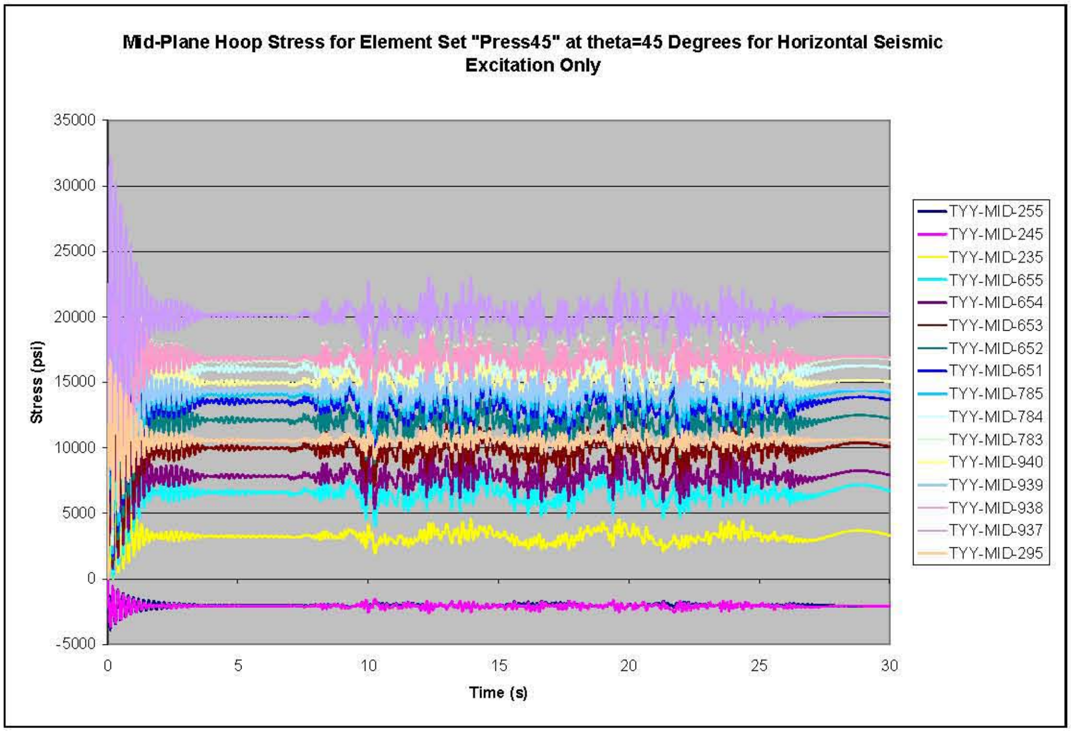


Figure 5. Mid-Plane Meridional Stress Time Histories for Element Set "Press45" at θ=45° for Horizontal Seismic Excitation Only.

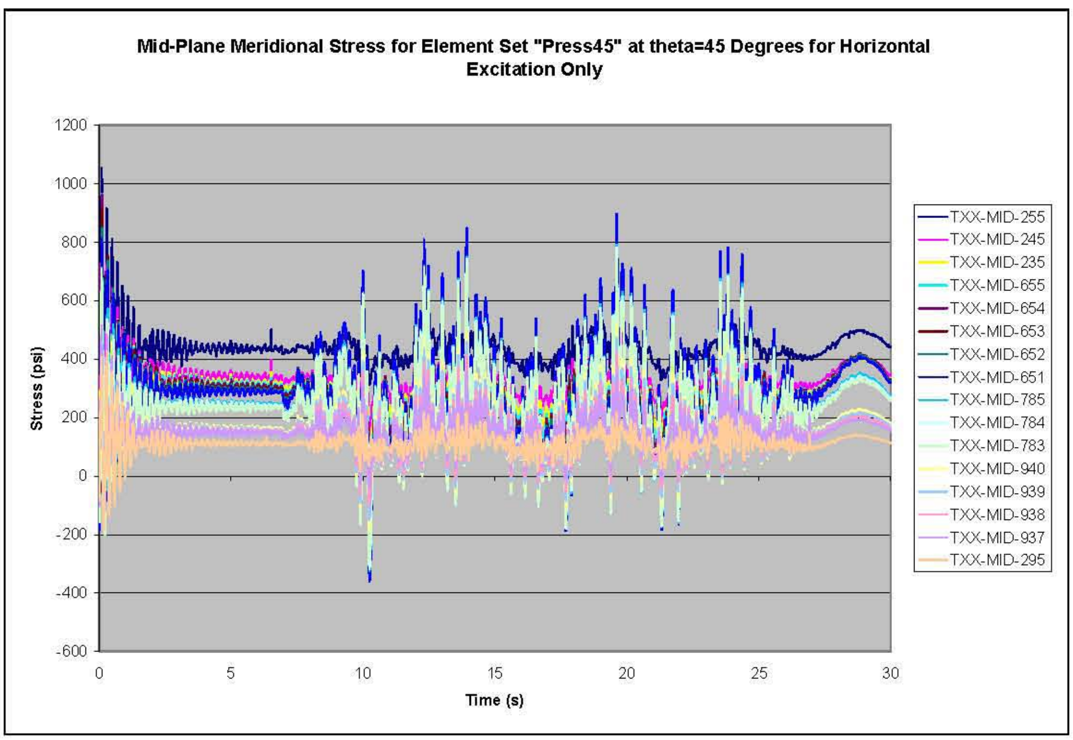


Figure 6. Shear Stress Time Histories for Element Set "Press45" at θ=45° for Horizontal Seismic Excitation Only.

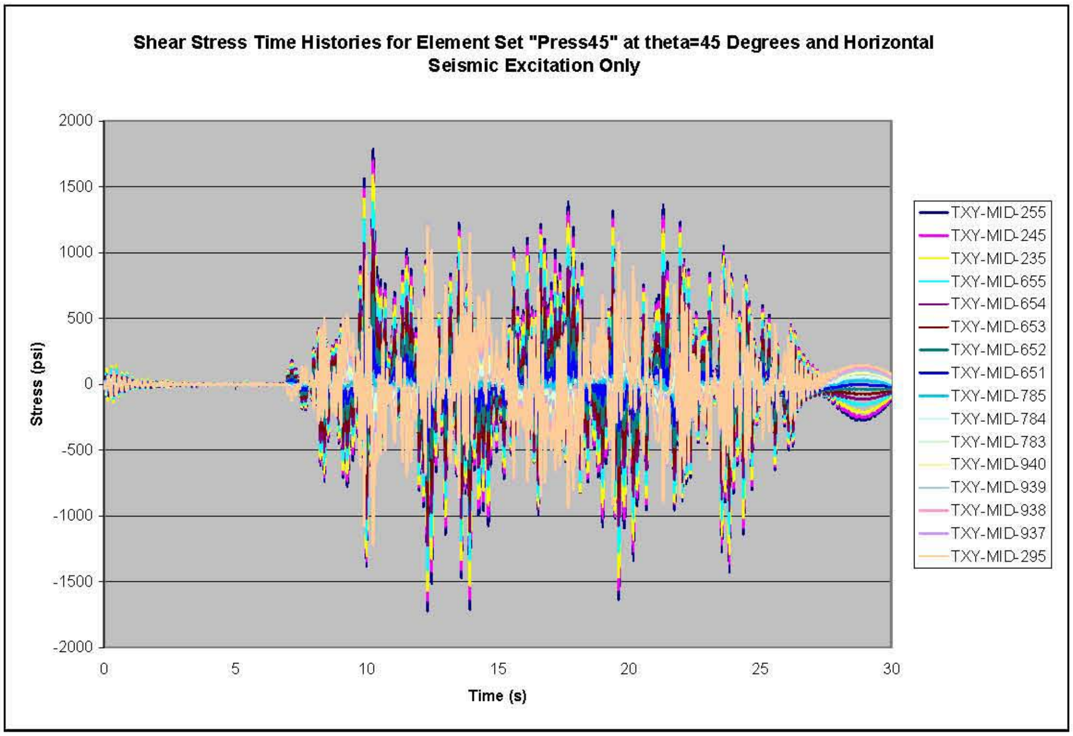


Figure 7. Mid-Plane Hoop Stress Time Histories for Element Set "Plusz_Outstrip" at θ=90° for Horizontal Seismic Excitation Only.

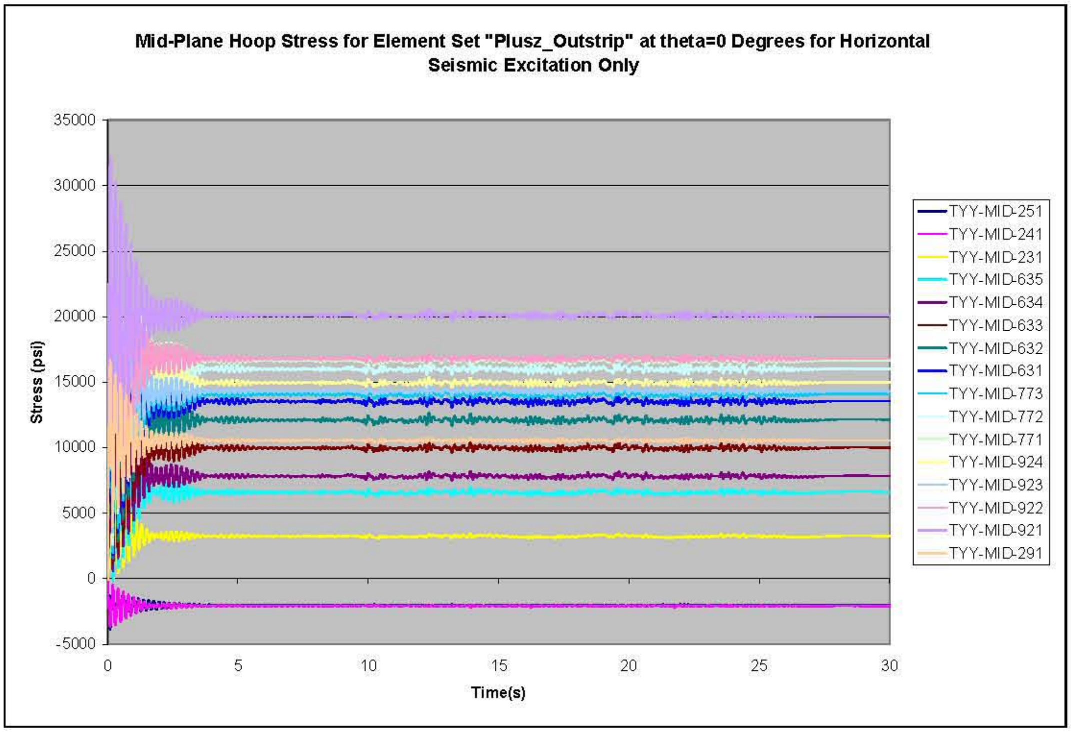


Figure 8. Mid-Plane Meridional Stress Time Histories for Element Set "Plusz_Outstrip" at θ=90° for Horizontal Seismic Excitation Only.

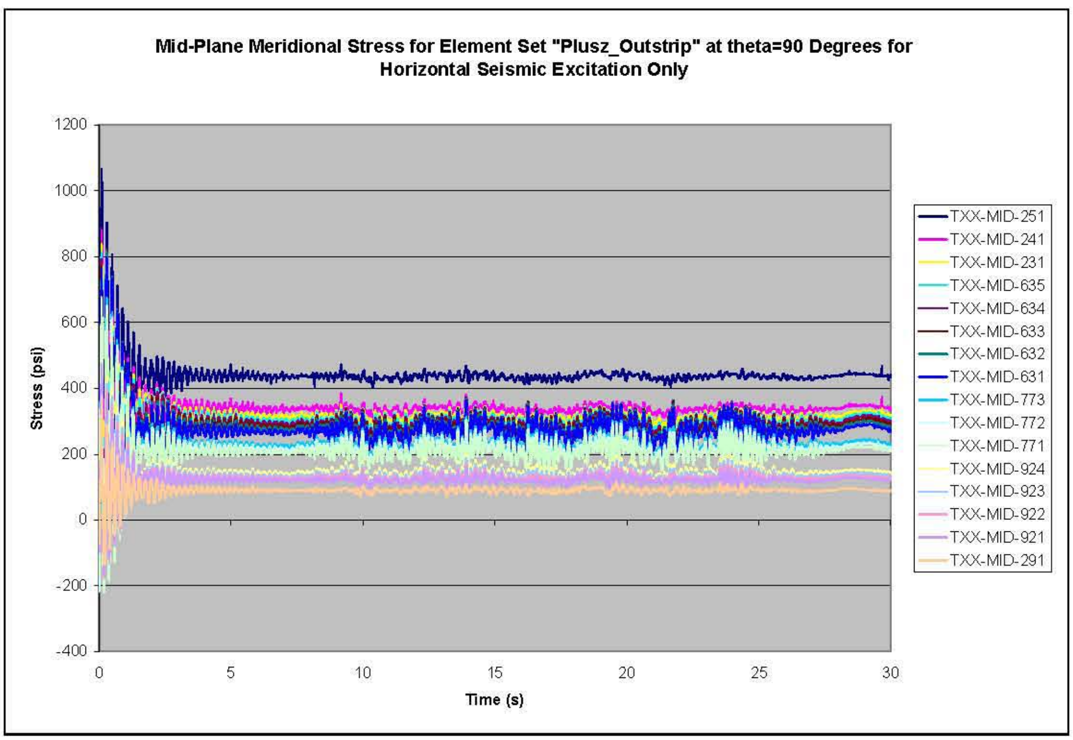


Figure 9. Shear Stress Time Histories for Element Set "Plusz_Outstrip" at θ=90° for Horizontal Seismic Excitation Only.

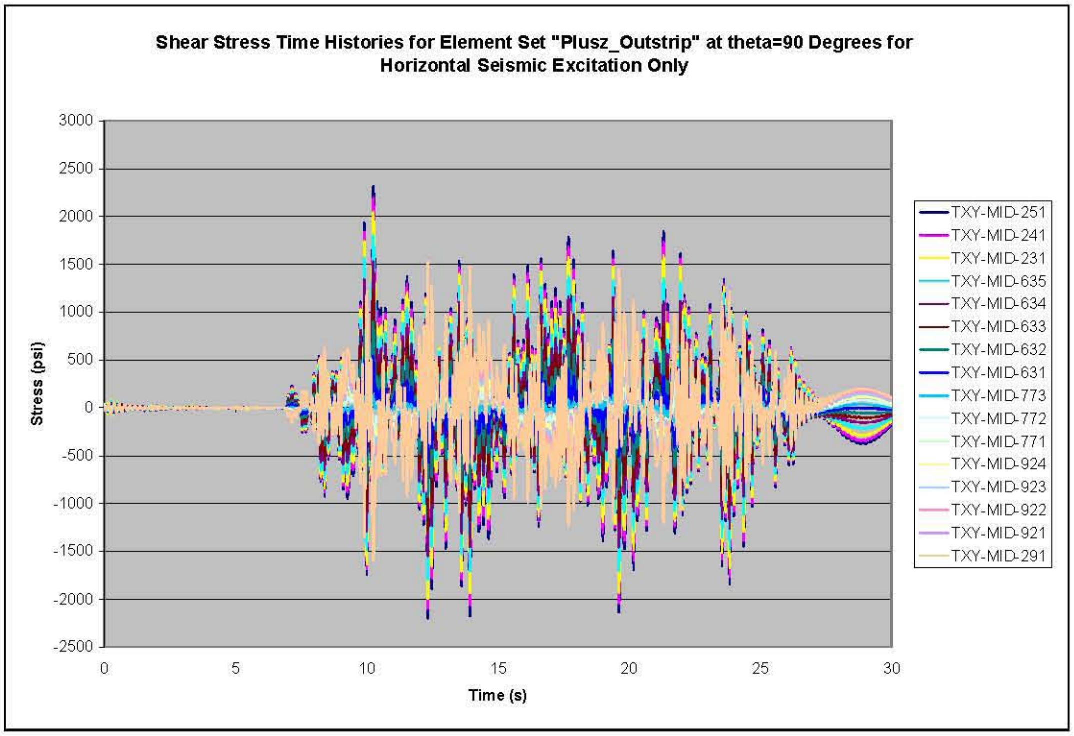


Figure 10. Mid-Plane Hoop Stress Time Histories for Element Set "Plusx_Outstrip" at θ=0° for Vertical Seismic Excitation Only.

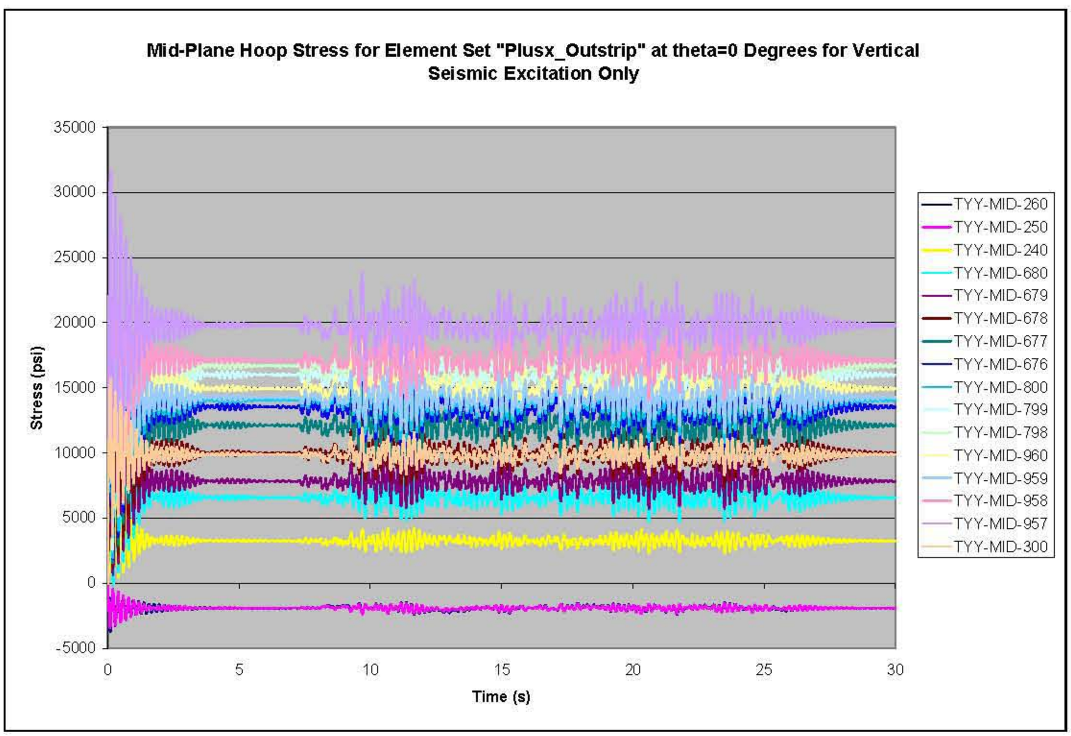


Figure 11. Mid-Plane Meridional Stress Time Histories for Element Set "Plusx_Outstrip" at θ=0° for Vertical Excitation Only.

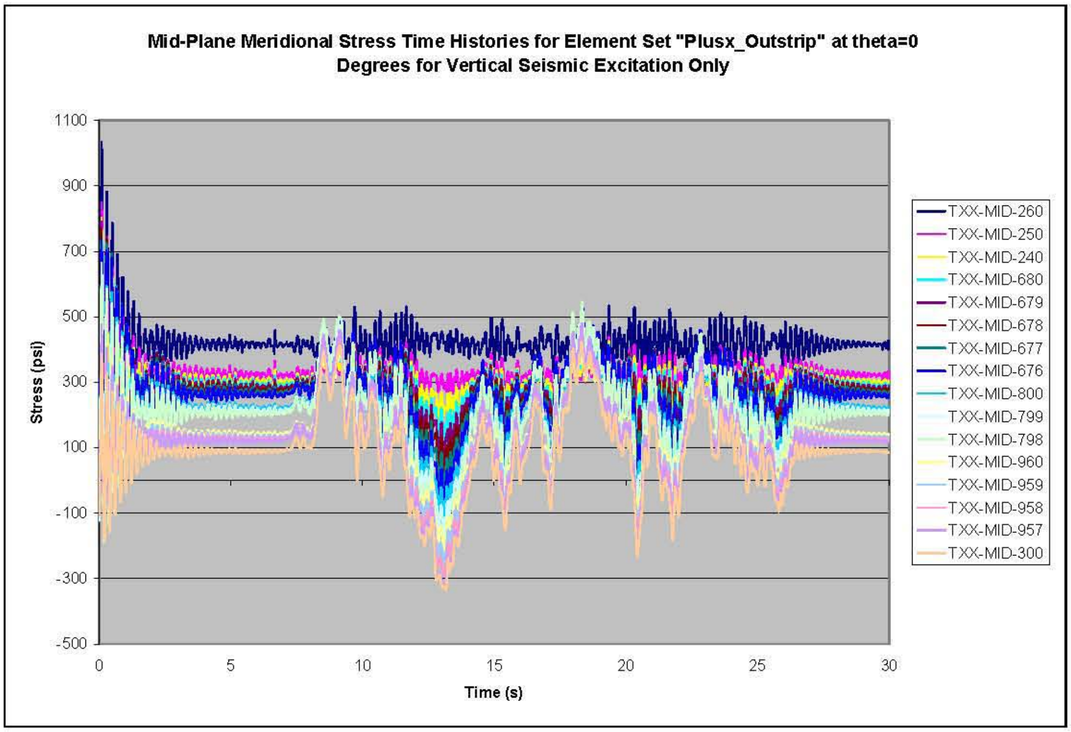


Figure 12. Shear Stress Time Histories for Element Set "Plusx_Outstrip" at θ=0° for Vertical Excitation Only.

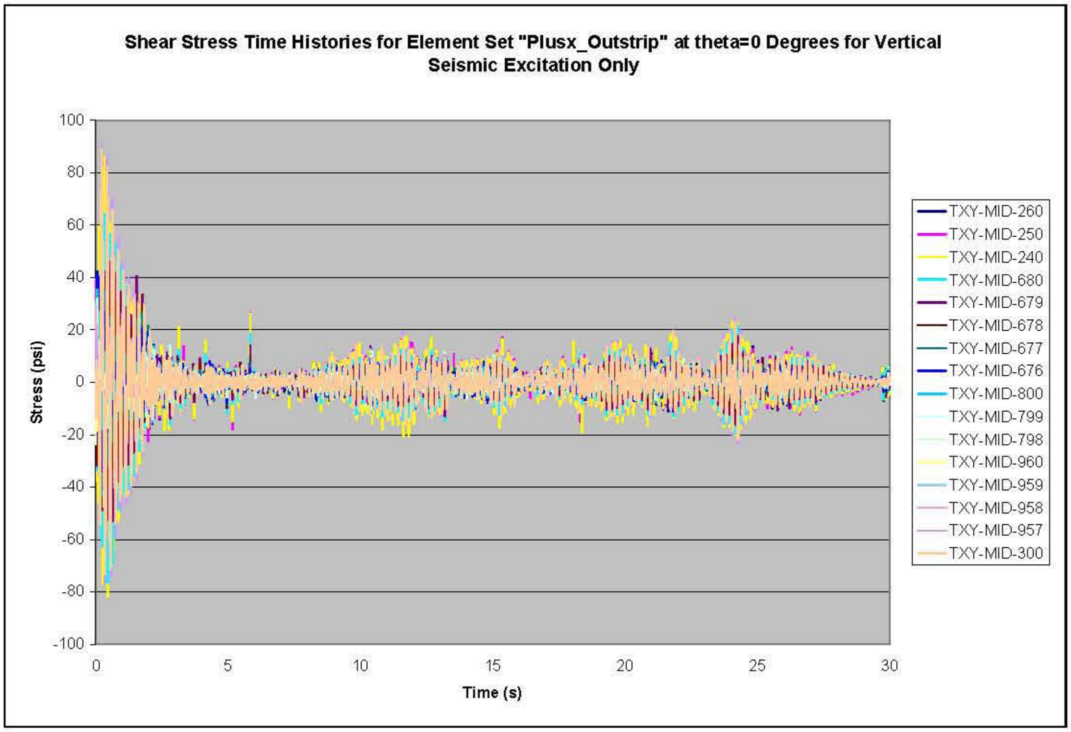


Figure 13. Mid-Plane Hoop Stress Time Histories for Element Set "Plusx_Outstrip" at θ=0° for Two-Component Seismic Excitation.

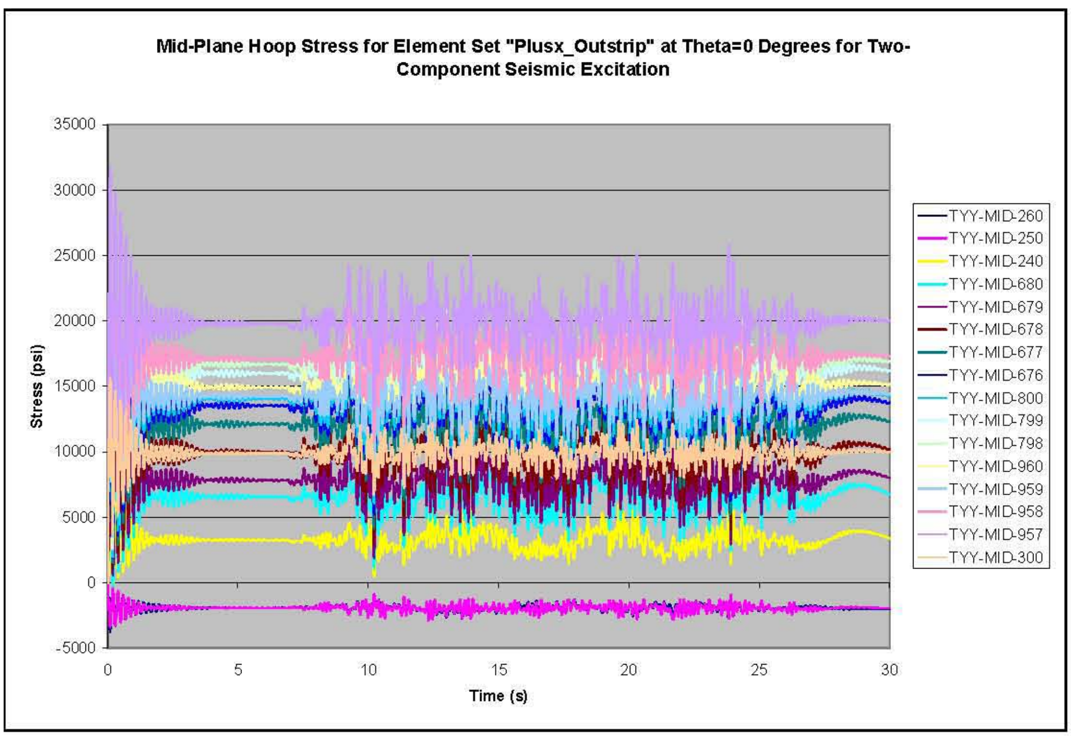


Figure 14. Mid-Plane Meridional Stress Time Histories for Element Set "Plusx_Outstrip" at θ=0° for Two-Component Seismic Excitation.

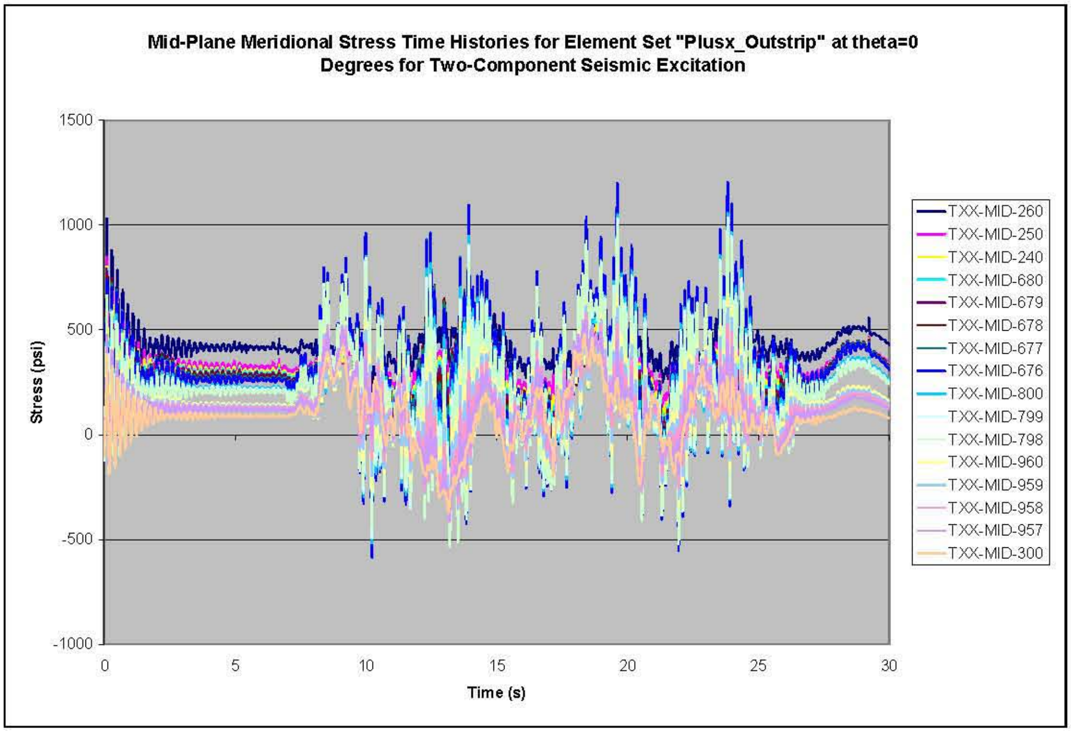


Figure 15. Mid-Plane Shear Stress Time Histories for Element Set "Plusx_Outstrip" at θ=0° for Two-Component Seismic Excitation.

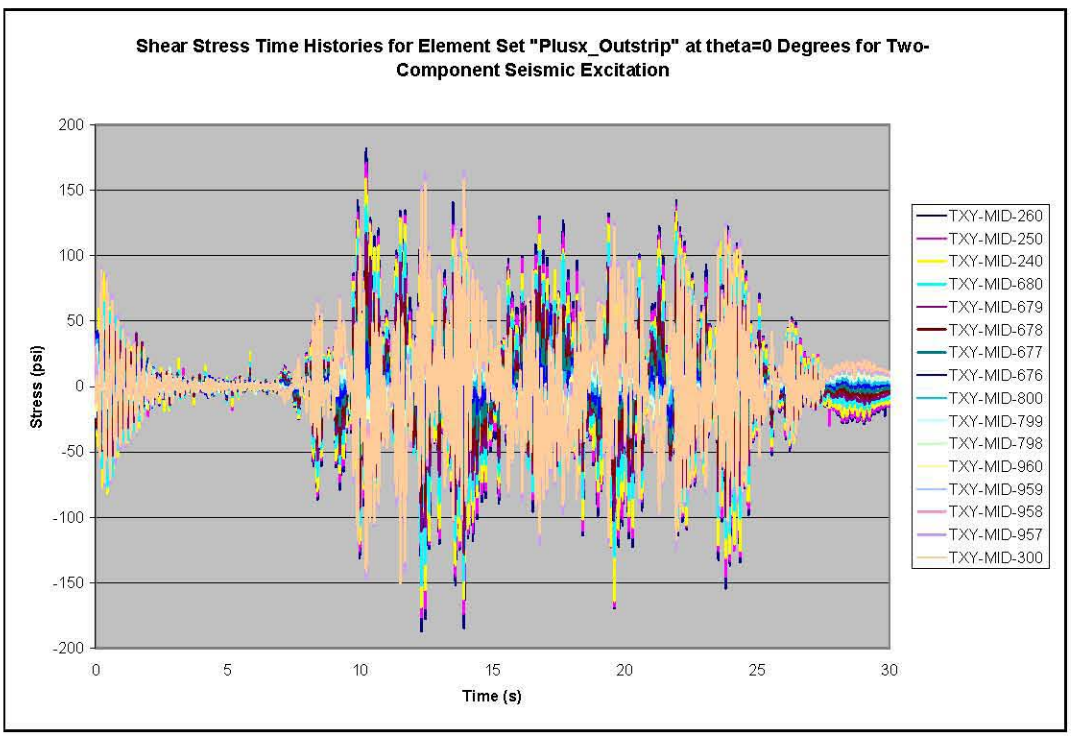


Figure 16. Mid-Plane Hoop Stress Time Histories for Element Set "Press45_Outstrip" at θ=45° for Two-Component Seismic Excitation.

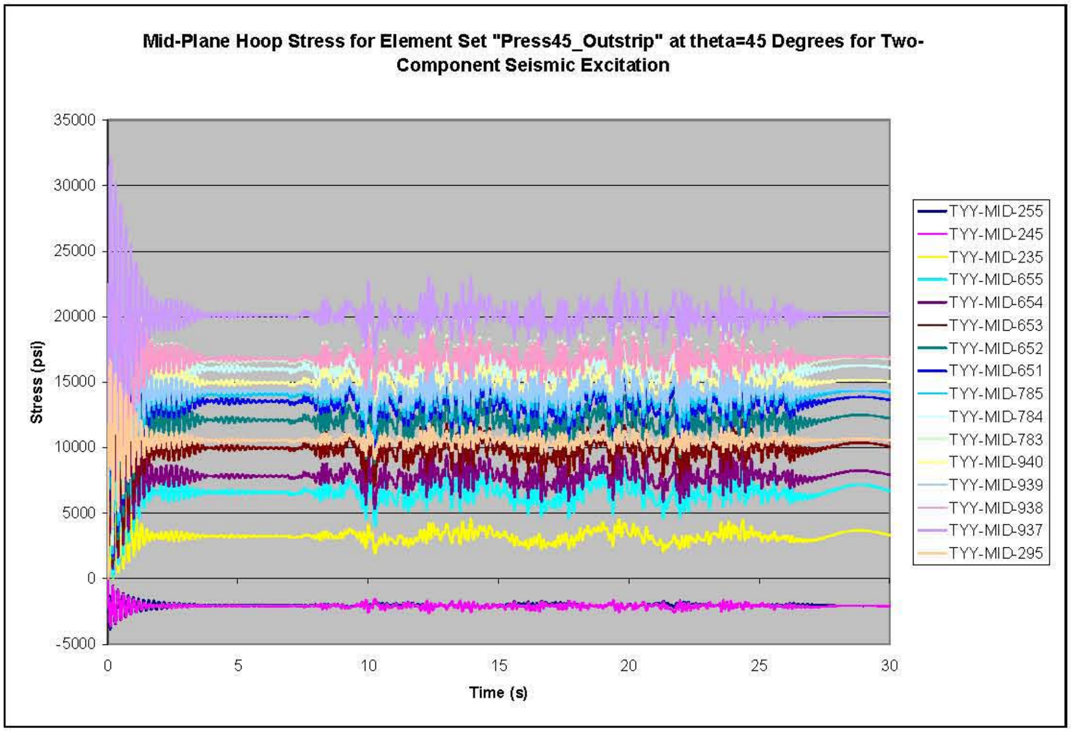


Figure 17. Mid-Plane Meridional Stress Time Histories for Element Set "Press45_Outstrip" at θ=45° for Two-Component Seismic Excitation.

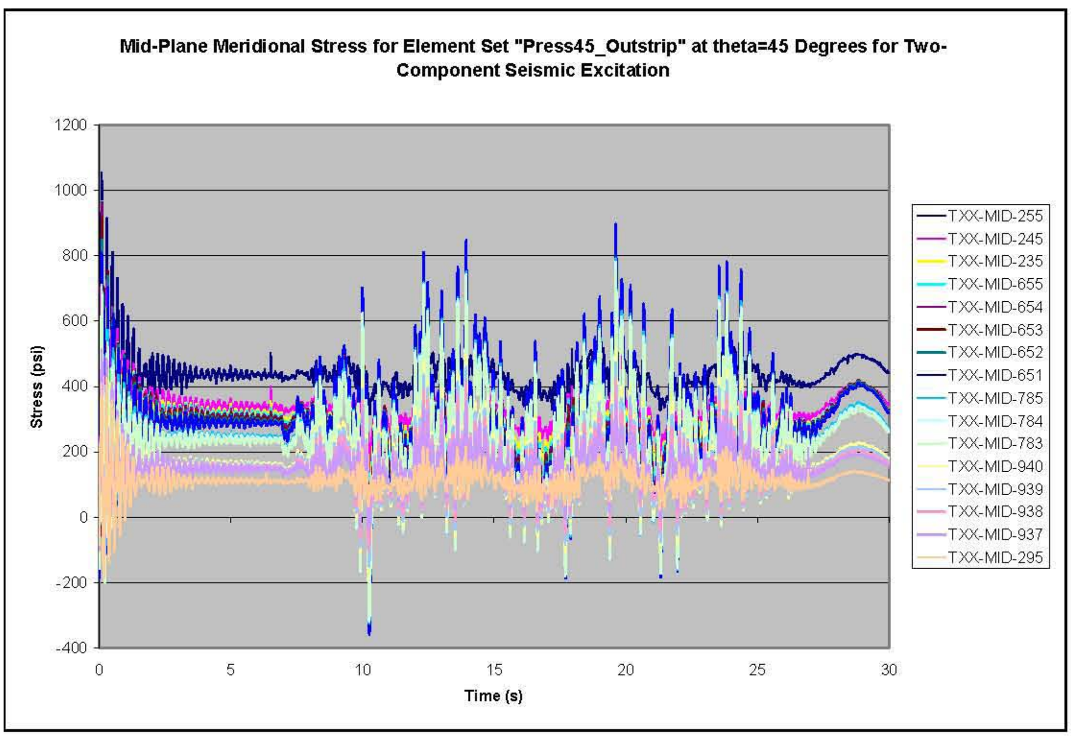


Figure 18. Mid-Plane Shear Stress Time Histories for Element Set "Press45_Outstrip" at θ=45° for Two-Component Seismic Excitation.

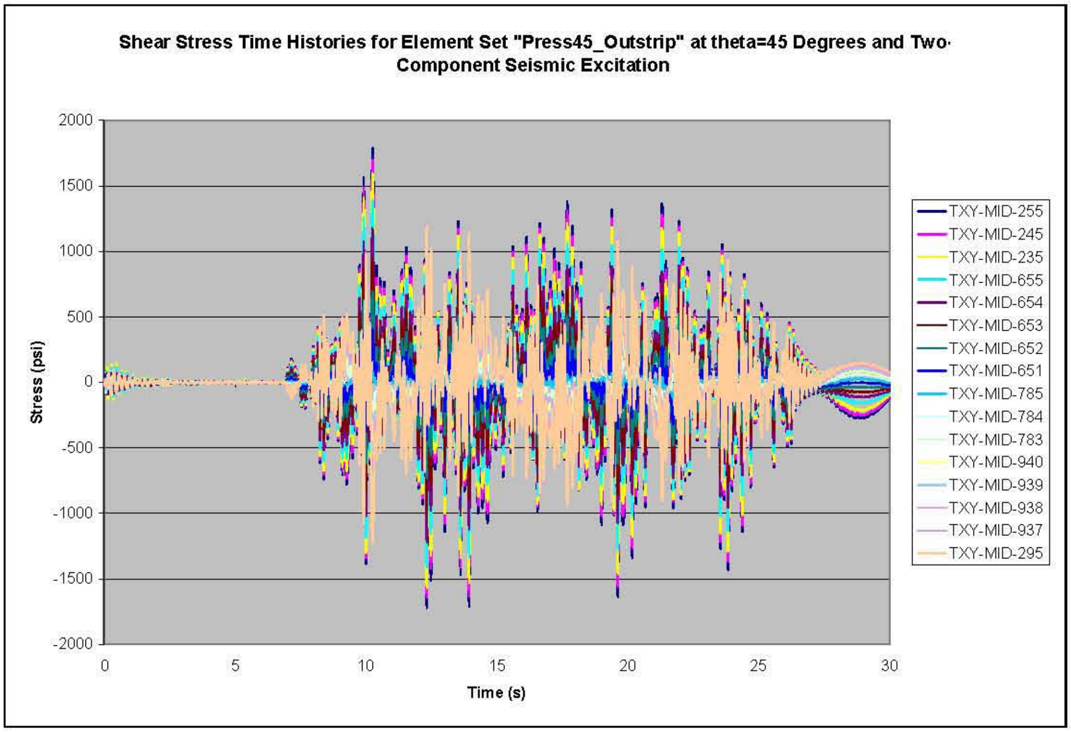


Figure 19. Mid-Plane Hoop Stress Time Histories for Element Set "Plusz_Outstrip" at θ=90° for Two-Component Seismic Excitation.

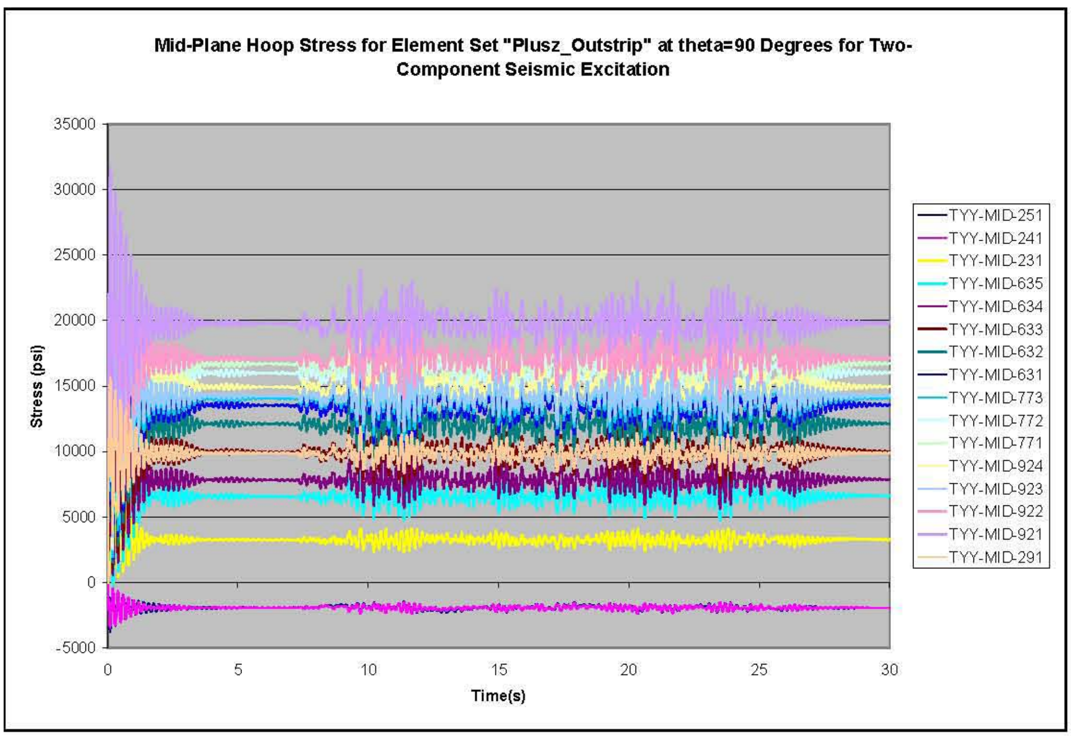


Figure 20. Mid-Plane Meridional Stress Time Histories for Element Set "Plusz_Outstrip" at θ=90° for Two-Component Seismic Excitation.

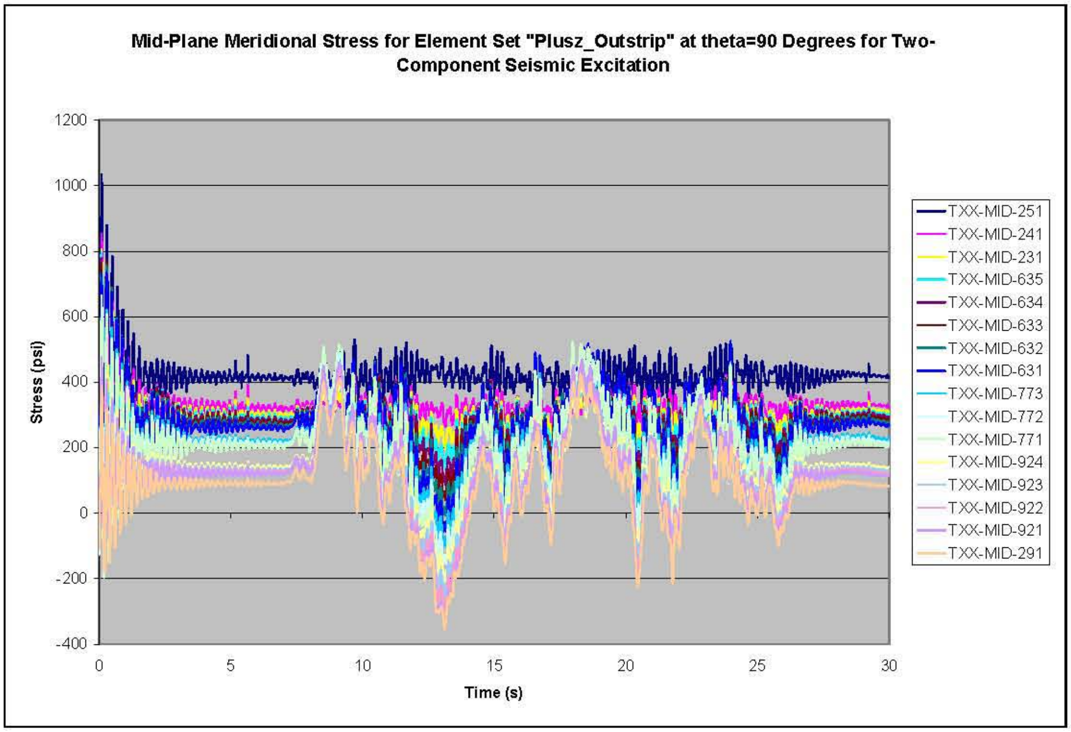


Figure 21. Mid-Plane Shear Stress Time Histories for Element Set "Plusz_Outstrip" at θ=90° for Two-Component Seismic Excitation.

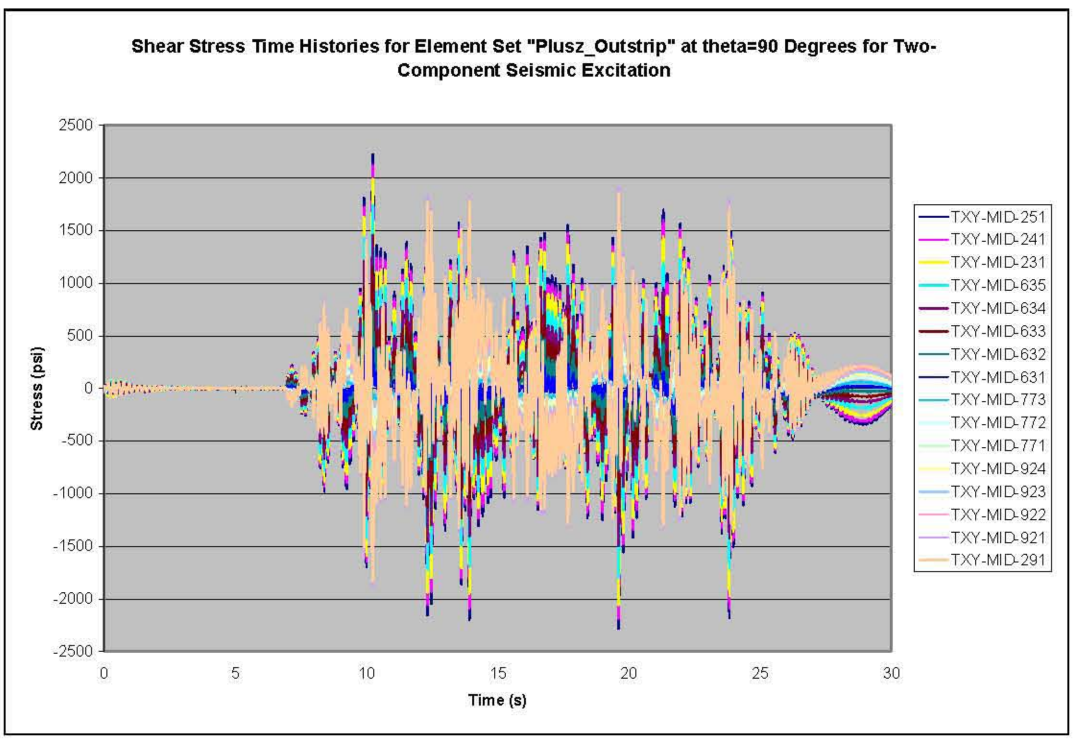


Figure 22. Mid-Plane Hoop Stress Time Histories for Element Set "Minusx_Outstrip" at θ=180° for Two-Component Seismic Excitation.

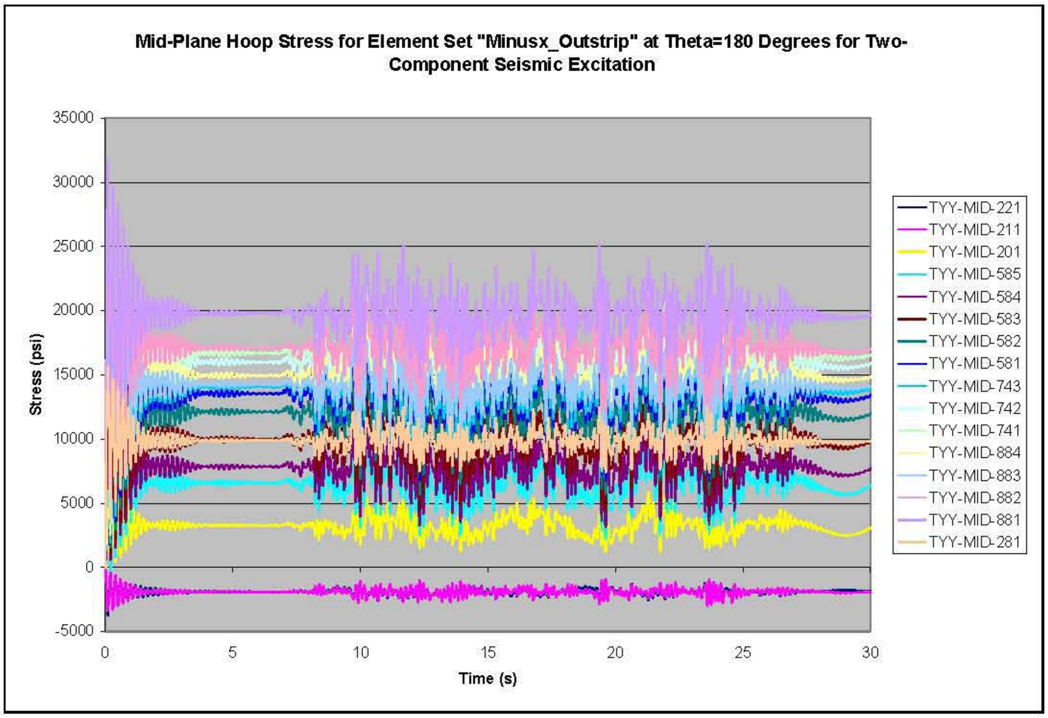


Figure 23. Mid-Plane Meridional Stress Time Histories for Element Set "Minusx_Outstrip" at θ=180° for Two-Component Seismic Excitation.

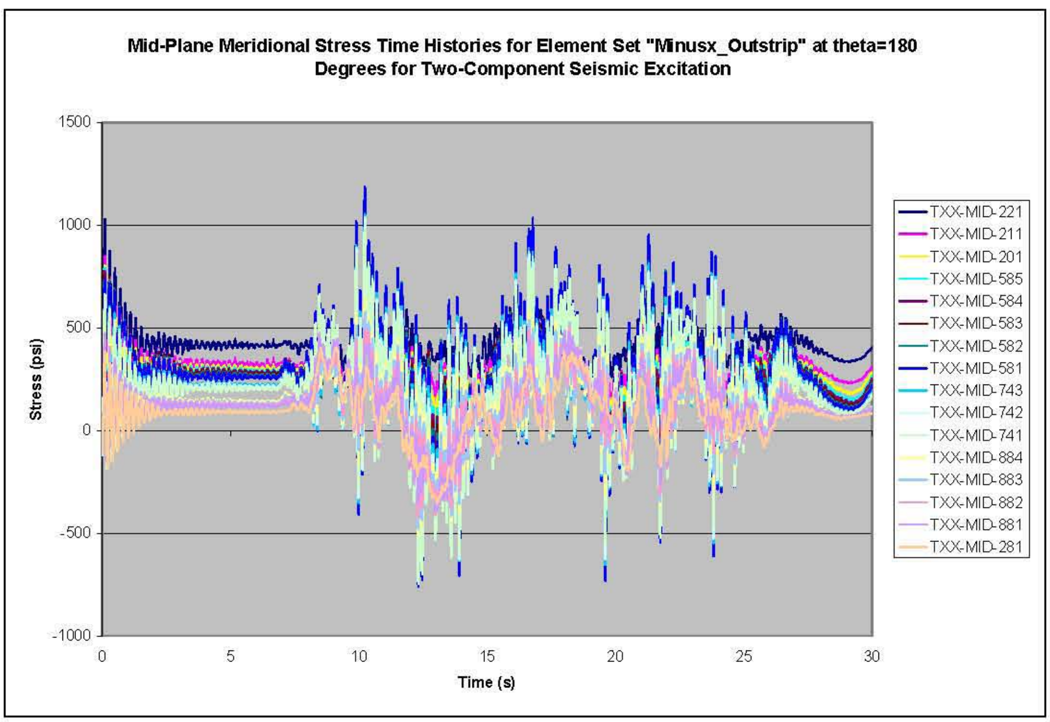
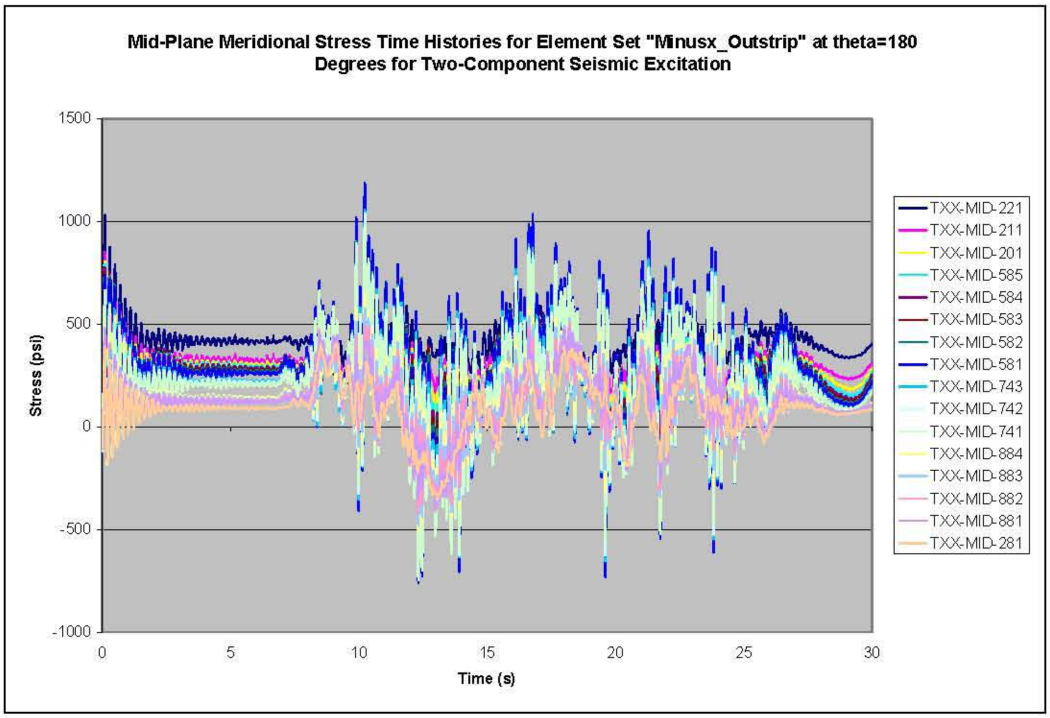


Figure 24. Mid-Plane Shear Stress Time Histories for Element Set "Minusx_Outstrip" at θ=180° for Two-Component Seismic Excitation.



APPENDIX C

Common ANSYS Sub-Model Files Listing

All-Forces.txt

```
!/input,force-c,txt
/input,stress-Primary,txt
/input,Force-J_bolt,txt
!/input,strain-liner,txt
```

Bolts-Friction.txt

```
pi=acos(-1)                    ! Define PI

!ET,4,BEAM44           ! Rigid Links
!KEYOPT,4,8,111
et,4,BEAM4
keyopt,4,6,1

et,31,combin14,,1
et,32,combin14,,2
et,33,combin14,,3

et,34,targe170
et,35,conta173
!keyopt,35,2,3
keyopt,35,5,3
keyopt,35,9,1
keyopt,35,11,1
!keyopt,35,12,4
r,701,0,0,0.01
r,702,0,0,0.01
r,703,0,0,0.01
r,704,0,0,0.01
r,705,0,0,0.01
r,706,0,0,0.01
r,707,0,0,0.01
r,708,0,0,0.01
r,709,0,0,0.01
r,710,0,0,0.01
r,711,0,0,0.01

BX=33333/20
BY=33333/20
BZ=22777/10
mp,mu,700,0.01

/COM - Create Rigid Links for J-Bolts
nj_bolt=11

mp,ex,401,4176000
mp,nuxy,401,0.30
mp,dens,401,0
r,401,1,10,10,2.5,2.5
rmore,,1e-3
r,402,1,10,10,2.5,2.5
rmore,,1e-3
r,403,1,10,10,2.5,2.5
rmore,,1e-3
r,404,1,10,10,2.5,2.5
rmore,,1e-3
r,405,1,10,10,2.5,2.5
rmore,,1e-3
r,406,1,10,10,2.5,2.5
rmore,,1e-3
r,407,1,10,10,2.5,2.5
rmore,,1e-3
r,408,1,10,10,2.5,2.5
rmore,,1e-3
r,409,1,10,10,2.5,2.5
rmore,,1e-3
r,410,1,10,10,2.5,2.5
rmore,,1e-3
r,411,1,10,10,2.5,2.5
rmore,,1e-3

r,421,1/2,10,10,2.5,2.5
rmore,,1e-3
r,422,1/2,10,10,2.5,2.5
rmore,,1e-3
r,423,1/2,10,10,2.5,2.5
rmore,,1e-3
r,424,1/2,10,10,2.5,2.5
rmore,,1e-3
r,425,1/2,10,10,2.5,2.5
rmore,,1e-3
r,426,1/2,10,10,2.5,2.5
rmore,,1e-3
r,427,1/2,10,10,2.5,2.5
rmore,,1e-3
r,428,1/2,10,10,2.5,2.5
rmore,,1e-3
r,429,1/2,10,10,2.5,2.5
rmore,,1e-3
r,430,1/2,10,10,2.5,2.5
rmore,,1e-3
r,431,1/2,10,10,2.5,2.5
rmore,,1e-3

r,501,1.364*BX
r,502,0.550*BX
r,503,0.887*BX
r,504,1.027*BX
r,505,1.971*BX
r,506,2.407*BX
r,507,3.301*BX
r,508,4.039*BX
r,509,4.369*BX
r,510,5.362*BX
r,511,3.596*BX

r,521,1.364*BY
r,522,0.550*BY
r,523,0.887*BY
r,524,1.027*BY
r,525,1.971*BY
r,526,2.407*BY
r,527,3.301*BY
r,528,4.039*BY
r,529,4.369*BY
r,530,5.362*BY
r,531,3.596*BY

r,541,1.364*BZ
r,542,0.550*BZ
r,543,0.887*BZ
r,544,1.027*BZ
r,545,1.971*BZ
r,546,2.407*BZ
r,547,3.301*BZ
r,548,4.039*BZ
r,549,4.369*BZ
r,550,5.362*BZ
r,551,3.596*BZ

R,601,1.364*BX/2
R,602,0.550*BX/2
R,603,0.887*BX/2
R,604,1.027*BX/2
```

```
R,605,1.971*BX/2
R,606,2.407*BX/2
R,607,3.301*BX/2
R,608,4.039*BX/2
R,609,4.369*BX/2
R,610,5.362*BX/2
R,611,3.596*BX/2

R,621,1.364*BY/2
R,622,0.550*BY/2
R,623,0.887*BY/2
R,624,1.027*BY/2
R,625,1.971*BY/2
R,626,2.407*BY/2
R,627,3.301*BY/2
R,628,4.039*BY/2
R,629,4.369*BY/2
R,630,5.362*BY/2
R,631,3.596*BY/2

R,641,1.364*BZ/2
R,642,0.550*BZ/2
R,643,0.887*BZ/2
R,644,1.027*BZ/2
R,645,1.971*BZ/2
R,646,2.407*BZ/2
R,647,3.301*BZ/2
R,648,4.039*BZ/2
R,649,4.369*BZ/2
R,650,5.362*BZ/2
R,651,3.596*BZ/2

cmsel,s,primary-tank
nsle
nsel,r,loc,z,ptz(1),ptz(11)
cm,bolt-primary-n,node
nsel,none
n,,0,0,ptz(1)
*do,i,2,nj_bolt
*do,j,0,180/arcsize
angley=-j*arcsize
n,,ptx(i),angley,ptz(i)
*enddo
*enddo
cm,bolt-node,node


/COM - Create link at top center of tanks
type,4
mat,401
real,401

nsel,s,loc,x,0                          !
Select nodes on model origin
nsel,r,loc,z,ptz(1),ctz(1)              !
Reselect nodes on concrete and primary
tanks
!nsel,u,node,,1
cmsel,u,bolt-primary-n
eintf,10                                !
Place link at dome center

csys,1
/COM - Create links for J-Bolts
*do,i,2,nj_bolt
        ! Cycle by radius
REAL,400+i
*do,j,1,180/arcsize-1                   !
Cycle by model slice
angley=-j*arcsize                       !
Define angle for node selection
nsel,s,loc,x,ctx(i),ptx(i)              !
Select nodes at radius
nsel,r,loc,z,ctz(i),ptz(i)
nsel,r,loc,y,angley                     !
Reselect nodes at angle "anlgey"
cmsel,u,bolt-primary-n
cmsel,u,waste-n
eintf,10                                !
Create rigid link
*enddo
real,420+i
nsel,s,loc,x,ctx(i),ptx(i)              !
Select nodes at radius
nsel,r,loc,z,ctz(i),ptz(i)
nsel,r,loc,y,0                          !
Reselect nodes at angle 0
cmsel,u,bolt-primary-n
cmsel,u,waste-n
eintf,10                                !
Create rigid link
nsel,s,loc,x,ctx(i),ptx(i)              !
Select nodes at radius
nsel,r,loc,z,ctz(i),ptz(i)
nsel,r,loc,y,180                        !
Reselect nodes at angle 180
cmsel,u,bolt-primary-n
cmsel,u,waste-n
eintf,10                                !
Create rigid link

*enddo

esel,s,type,,4
cm,j_bolts,elem
        ! Create component for J-Bolt
rigid links
allsel


/COM - Create link at top center of tanks
nsel,R,loc,x,0                          !
Select nodes on model origin
nsel,r,loc,z,ptz(1),ptz(1)              !
Reselect nodes on concrete and primary
tanks
TYPE,31
REAL,501
eintf                         ! Place
link at dome center
TYPE,32
REAL,521
eintf                         ! Place
link at dome center
TYPE,33
REAL,541
eintf                         ! Place
link at dome center

csys,1
/COM - Create links for J-Bolts
*do,j,0,2
type,31+j
*do,i,2,nj_bolt
        ! Cycle by radius
REAL,500+20*j+i
*do,k,1,180/arcsize-1                   !
Cycle by model slice
```

```
angley=-k*arcsize                          !
Define angle for node selection
nsel,s,loc,x,ptx(i),ptx(i)                 !
Select nodes at radius
nsel,r,loc,z,ptz(i),ptz(i)                 !
Select nodes at radius
nsel,r,loc,y,angley                        !
Reselect nodes at angle "anlgey"
cmsel,u,waste-n
eintf                              ! Create
rigid link
*enddo
real,600+j*20+i
nsel,s,loc,x,ptx(i),ptx(i)                 !
Select nodes at radius
nsel,r,loc,z,ptz(i),ptz(i)                 !
Select nodes at radius
nsel,r,loc,y,0                             !
Reselect nodes at angle 0
cmsel,u,waste-n
eintf                              ! Create
rigid link
nsel,s,loc,x,ptx(i),ptx(i)                 !
Select nodes at radius
nsel,r,loc,z,ptz(i),ptz(i)                 !
Select nodes at radius
nsel,r,loc,y,180                           !
Reselect nodes at angle 180
cmsel,u,waste-n
eintf                              ! Create
rigid link

*enddo
*enddo

esel,s,type,,31,33
cm,bolt-springs,elem

*do,i,1,10
cmsel,s,conc-tank
nsle
nsel,r,loc,x,ctx(i),ctx(i+1)
nsel,r,loc,z,ctz(i),ctz(i+1)
esln,r
real,700+i
type,34
esurf,,bottom
cmsel,s,primary-tank
nsle
nsel,r,loc,x,ptx(i),ptx(i+1)
nsel,r,loc,z,ptz(i),ptz(i+1)
esln,r
type,35
real,700+i
mat,700
esurf,,bottom
*enddo
esel,s,type,,35
cm,bolt-friction,elem

!*do,i,3,nj_bolt
!cmsel,s,primary-tank
!cmsel,a,conc-tank
!nsle
!nsel,r,loc,z,ptz(i),ctz(i)
!nsel,r,loc,x,ptx(i),ctx(i)
!type,35
!mat,700
!real,700
!eintf,1,high
!*enddo

*get,KMAXjb,KP,0,num,max         ! Get
maximum keypoint number
*get,LMAXjb,LINE,0,num,max       ! Get
maximum line number
*get,AMAXjb,AREA,0,num,max       ! Get
maximum area number
*get,VMAXjb,volu,0,num,max       ! Get
maximum volume number
```

Boundary.txt

```
/COM - Fix symmetry face
allsel
csys,0
nsel,s,loc,y,0
d,all,uy
csys,1

cmsel,s,conc-tank
cmsel,a,primary-tank
cmsel,a,liner
nsle
csys,0
nsel,r,loc,y,0
d,all,rotx
d,all,rotz
csys,1

allsel

!esel,s,type,,24
!nsle
!cmsel,u,conc-slab
!ddele,all,uy
!allsel
```

Contact-AP.txt

```
/input,waste-reaction,txt
/input,contact-waste-ap,txt
!/input,contact-insul,txt
!/input,contact-primary,txt
!/input,contact-j-bolts,txt
!/input,contact-soil,txt
!/input,waste-surface-ap,txt
!/input,contact-footing,txt
```

Contact-Waste-AP.txt

```
/post26
numvar,200
*do,z,2,200
VARDEL,z
*enddo

*do,i,1,20
*do,j,1,31
angley=-arcsize*(i-1)
cmsel,s,waste-surf
nsle
nsel,r,loc,y,angley,angley-arcsize
nsel,r,loc,x,ptx(j+wastet-
1),ptx(j+wastet)
```

```
nsel,r,loc,z,ptz(j+wastet-
1),ptz(j+wastet)
esln,r,1
*get,emax,elem,,num,max
esol,(2+j),(emax),,Cont,pres,pr%(emax)%
esol,(42+j),(emax),,Cont,slide,sl%(emax)%
esol,(82+j),(emax),,Cont,gap,gp%(emax)%
esol,(122+j),(emax),,Cont,stat,st%(emax)%
*enddo


LINES,2050
extrem
/OUT,Waste-Cont_%(9*i)%max,OUT
extrem,3,200
/OUT

/OUT,Waste-Cont_%(9*i)%th,OUT
*do,k,1,31
PRVAR,2+k,42+k,82+k,122+k
*enddo
/OUT

*enddo
```

Far-Soil.txt

```
et,9,solid45          ! Use Elment type
SOLID45 for Far Soil
et,10,mass21
r,1001,mass,mass,mass
type,9

asel,none      ! unselect all reas
vsel,none      ! unselect all volumes
lsel,none
nsel,none
ksel,none
esel,none

/COM - Generate Keypoints at full model
radius
*do,i,1,tanksoil
k,kmaxns+i,soil_radius,0,soilz(i)
*enddo

*do,i,1,9
k,kmaxns+tanksoil+i,Soilx(i),0,soilz(i)
*enddo

/COM - Generate areas outside excavated
soil
*do,i,1,tanksoil-1
kp1=kp(soilx(i),0,soilz(i))
kp2=kp(soil_radius,0,soilz(i))
kp3=kp(soil_radius,0,soilz(i+1))
kp4=kp(soilx(i+1),0,soilz(i+1))
a,kp1,kp2,kp3,kp4
*enddo
ksel,a,kp,,1,ct_kps,ct_kps-1
vrotat,all,,,,,,1,ct_kps,180,2
cm,far-soil-volu,volu
*do,i,1,tanksoil-1
cmsel,s,far-soil-volu
vsel,r,loc,z,soilz(i),soilz(i+1)
vatt,900+i,,9                          !
Assign attributes
aslv
lsla
lsel,r,loc,x,soilx(i)
lesize,all,,arcsize                    !
Match excavated soil meshing
lsla
lsel,r,loc,x,soilx(i+1)
lesize,all,,arcsize                    !
Match excavated soil meshing
lsla
lsel,r,loc,x,soil_radius
lsel,r,loc,z,soilz(i)
lesize,all,,arcsize                    !
Match excavated soil meshing
lsla
lsel,r,loc,x,soil_radius
lsel,r,loc,z,soilz(i+1)
lesize,all,,arcsize                    !
Match excavated soil meshing
*enddo

/COM - Mesh soil outside excavated soil
cmsel,s,far-soil-volu
esize,30
vmesh,all
csys,1
esel,s,type,,9
nsle
!nrotat,all                             !
Rotate all nodes to cylidrical
coordinates
cm,far-soil-top,elem

!/COM - Connect new soil elements to
excavated soil at interface
!*do,i,1,tanksoil
!nsel,s,loc,x,soilx(i)
!nsel,r,loc,z,soilz(i)
!cmsel,u,excav-wall
!nummrg,node
!*enddo

*get,KMAXtemp,KP,0,num,max
*get,LMAXtemp,LINE,0,num,max
*get,AMAXtemp,AREA,0,num,max
*get,VMAXtemp,VOLU,0,num,max

ksel,u,kp,,all
asel,u,area,,all
vsel,u,volu,,all

/COM - Generate Keypoint below tank for
five layers
*do,i,0,deepsoil-tanksoil-5
k,kmaxtemp+5*i+1,0,0,soilz(i+tanksoil)
                           ! Keypoint on
centerline
k,kmaxtemp+5*i+2,ctx(ct_kps-1-
i),0,soilz(i+tanksoil) ! Keypoint to
flare central area under tank
k,kmaxtemp+5*i+3,ctx(bm_kp+1),0,soilz(i+t
anksoil)       ! Keypoint under edge of
tank
k,kmaxtemp+5*i+4,soilx(tanksoil),0,soilz(
i+tanksoil)    ! Keypoint under edge of
excavated soil
k,kmaxtemp+5*i+5,soil_radius,0,soilz(i+ta
nksoil) ! Keypoint at edge of model
*enddo

/COM - Generate Keypoint below tank to
full depth
```

```
*do,i,5,deepsoil-tanksoil
k,kmaxtemp+5*i+1,0,0,soilz(i+tanksoil)
                        ! Keypoint on
centerline
k,kmaxtemp+5*i+2,ctx(ct_kps-
5),0,soilz(i+tanksoil) ! Keypoint for
central soil area
k,kmaxtemp+5*i+3,ctx(bm_kp+1),0,soilz(i+t
anksoil)       ! Keypoint under edge of
tank
k,kmaxtemp+5*i+4,soilx(tanksoil),0,soilz(
i+tanksoil)    ! Keypoint under edge of
excavated soil
k,kmaxtemp+5*i+5,soil_radius,0,soilz(i+ta
nksoil) ! Keypoint at edge of model
*enddo

*do,i,0,3               ! Area pattern for
1st 4 layers under tank
a,kmaxtemp+5*i+1,kmaxtemp+5*i+2,kmaxtemp+
5*(i+1)+2,kmaxtemp+5*(i+1)+1
a,kmaxtemp+5*i+2,kmaxtemp+5*i+3,kmaxtemp+
5*(i+1)+3,kmaxtemp+5*(i+1)+2
a,kmaxtemp+5*i+3,kmaxtemp+5*i+4,kmaxtemp+
5*(i+1)+4,kmaxtemp+5*(i+1)+3
a,kmaxtemp+5*i+4,kmaxtemp+5*i+5,kmaxtemp+
5*(i+1)+5,kmaxtemp+5*(i+1)+4
*enddo

! Area pattern for transition layer
a,kmaxtemp+5*4+1,kmaxtemp+5*4+2,kmaxtemp+
5*(4+1)+2,kmaxtemp+5*(4+1)+1
a,kmaxtemp+5*4+2,kmaxtemp+5*4+3,kmaxtemp+
5*4+4,kmaxtemp+5*(4+1)+4,kmaxtemp+5*(4+1)
+2
a,kmaxtemp+5*4+4,kmaxtemp+5*4+5,kmaxtemp+
5*(4+1)+5,kmaxtemp+5*(4+1)+4

*do,i,5,10              ! Area pattern to
bottom of model
a,kmaxtemp+5*i+1,kmaxtemp+5*i+2,kmaxtemp+
5*(i+1)+2,kmaxtemp+5*(i+1)+1
a,kmaxtemp+5*i+2,kmaxtemp+5*i+4,kmaxtemp+
5*(i+1)+4,kmaxtemp+5*(i+1)+2
a,kmaxtemp+5*i+4,kmaxtemp+5*i+5,kmaxtemp+
5*(i+1)+5,kmaxtemp+5*(i+1)+4
*enddo


/COM - divide line interfacing with
bottom of tank to match tank meshing
lsla
lsel,r,loc,z,soilz(tanksoil)
lsel,r,loc,x,ctx(ct_kps-1),ctx(bm_kp+1)
ratio=(ctx(ct_kps-1)-ctx(ct_kps-
2))/(ctx(ct_kps-1)-ctx(bm_kp+1))
ldiv,all,ratio
*get,LMAXtemp,LINE,0,num,max
*do,i,1,8
lsla
lsel,r,loc,z,soilz(tanksoil)
lsel,r,loc,x,ctx(ct_kps-1-i),ctx(bm_kp+1)
ratio=(ctx(ct_kps-1-i)-ctx(ct_kps-2-
i))/(ctx(ct_kps-1-i)-ctx(bm_kp+1))
ldiv,all,ratio
*enddo

!/COM - Move Keypoints to match tank
bottom vertical locations
!lsla
```

```
!*do,i,0,ct_kps-bm_kp-1
!kact=kp(ctx(ct_kps-i),0,soilz(tanksoil))
!kmodif,kact,ctx(ct_kps-i),0,ctz(ct_kps-
i)
!*enddo

ksel,a,kp,,1,ct_kps,ct_kps-1          !
Select Keypoints for rotation axis
vrotat,all,,,,,,1,ct_kps,180,2
        ! Develop volumes
cm,deep-soil-volu,volu
*do,i,tanksoil,deepsoil-1             !
Assign attributes
vsel,s,loc,z,soilz(i),soilz(i+1)
vatt,900+i,,9
*enddo

/COM - Control meshing to match model
slices
cmsel,s,deep-soil-volu
aslv
lsla
lsel,r,loc,x,soil_radius
lesize,all,,arcsize
lsla
lsel,r,loc,x,soilx(tanksoil)
lesize,all,,arcsize
lsla
lsel,r,loc,x,ctx(bm_kp+1)
lesize,all,,arcsize


vsel,u,loc,x,0,soilx(tanksoil)
vmesh,all
        ! Mesh outside volumes
vsel,s,loc,x,ctx(ct_kps-
5),soilx(tanksoil)
vsel,r,loc,z,soilz(tanksoil+5),soilz(deep
soil)
esize,22
vmesh,all
        ! Mesh under excavated soil and
tank except for central area

cmsel,s,deep-soil-volu
vsel,r,loc,x,0,ctx(ct_kps-3)
        ! Select volumes under center of
tank
aslv
asel,r,loc,z,soilz(tanksoil)
        ! Select soil area at bottom of
tank
lsla
lsel,r,loc,x,ctx(ct_kps-1)
        ! Select Lines on outside of
center area
lesize,all,,arcsize
        ! Control mesh for slices
lsla
lsel,u,loc,x,ctx(ct_kps-1)
lesize,all,,,midsize
        ! control mesh on inside of area
aslv
lsla
cmsel,s,deep-soil-volu
vsel,r,loc,x,0,ctx(ct_kps-3)
aslv
lsla
lsel,r,loc,z,soilz(tanksoil),soilz(tankso
il+1)
```

```
lsel,u,loc,z,soilz(tanksoil)
lsel,u,loc,z,soilz(tanksoil+1)
lesize,all,,,4
        ! Control meshing under tank
cmsel,s,deep-soil-volu
vsel,r,loc,x,0,ctx(ct_kps-3)
aslv
lsla
lsel,r,loc,z,soilz(tanksoil+1),soilz(tank
soil+2)
lsel,u,loc,z,soilz(tanksoil+1)
lsel,u,loc,z,soilz(tanksoil+2)
lesize,all,,,2
        ! Control meshing under tank
cmsel,s,deep-soil-volu
vsel,r,loc,x,0,ctx(ct_kps-3)
aslv
asel,r,loc,z,soilz(tanksoil)
type,1
amesh,all
        ! mesh area at tank/soil
interface
vsweep,all
        ! Sweep mesh to bottom of model
aclear,all
        ! Clear Pattern

cmsel,s,deep-soil-volu
aslv
lsla
lsel,r,loc,z,soilz(tanksoil+1)
lsel,r,loc,x,ctx(ct_kps-2),ctx(bm_kp+1)
lsel,u,loc,x,ctx(ct_kps-2)
lsel,u,loc,x,ctx(bm_kp+1)
lesize,all,,,8
        ! Control meshing under tank

lsla
lsel,r,loc,z,soilz(tanksoil+2)
lsel,r,loc,x,ctx(ct_kps-3),ctx(bm_kp+1)
lsel,u,loc,x,ctx(ct_kps-3)
lsel,u,loc,x,ctx(bm_kp+1)
lesize,all,,,6
        ! Control meshing under tank

lsla
lsel,r,loc,z,soilz(tanksoil+3)
lsel,r,loc,x,ctx(ct_kps-4),ctx(bm_kp+1)
lsel,u,loc,x,ctx(ct_kps-4)
lsel,u,loc,x,ctx(bm_kp+1)
lesize,all,,,4
        ! Control meshing under tank

lsla
lsel,r,loc,z,soilz(tanksoil+4)
lsel,r,loc,x,ctx(ct_kps-5),ctx(bm_kp+1)
lsel,u,loc,x,ctx(ct_kps-5)
lsel,u,loc,x,ctx(bm_kp+1)
lesize,all,,,2
        ! Control meshing under tank

*do,i,0,2
lsla
lsel,r,loc,z,soilz(tanksoil+i)
lsel,r,loc,x,ctx(bm_kp+1),soilx(tanksoil)
lsel,u,loc,x,ctx(bm_kp+1)
lsel,u,loc,x,soilx(tanksoil)
lesize,all,,,4-i
                ! Control meshing under
tank
*enddo

cmsel,s,deep-soil-volu
aslv
lsla
lsel,r,loc,x,ctx(bm_kp+1)
lsel,r,loc,z,soilz(tanksoil),soilz(tankso
il+1)
lsel,u,loc,z,soilz(tanksoil)
lsel,u,loc,z,soilz(tanksoil+1)
ldiv,all,2
        ! Control meshing under tank

cmsel,s,deep-soil-volu
aslv
lsla
lsel,r,loc,z,soilz(tanksoil)
lsel,r,loc,x,ctx(ct_kps-2),ctx(bm_kp+1)
lesize,all,,arcsize
                ! Control meshing for
slices

*do,i,0,4
vsel,s,loc,z,soilz(tanksoil+i),soilz(tank
soil+1+i)
vsel,r,loc,x,ctx(ct_kps-1-
i),soilx(tanksoil)
aslv
asel,r,loc,y,0
type,1
amesh,all
        ! Mesh area for sweep pattern
vsweep,all
        ! Mesh volumes
aclear,all
        ! Clear pattern
*enddo

esel,s,type,,9
nsle
nummrg,node                     ! Merge
bottom soil to rest of model

esel,s,type,,9
nsle
nsel,s,loc,x,soilx(1)
nsel,r,loc,z,soilz(1)
cm,far-soil-face-node,node
*do,i,2,9
esel,s,type,,9
nsle
nsel,r,loc,x,soilx(i)
nsel,r,loc,z,soilz(i)
cmsel,a,far-soil-face-node
cm,far-soil-face-node,node
*enddo

esel,s,type,,9
nsle
nsel,r,loc,z,soilz(9)
nsel,r,loc,x,41,68
cm,far-soil-bot-node,node

!nsel,s,loc,x,68,320
!nummrg,node

!esel,s,type,,8,9
!nsle
!nsel,r,loc,z,soilz(9)
!nsel,r,loc,x,41,67
```

```
!cpint,uz


type,10
real,1001

csys,0
nsel,s,loc,z,soilz(deepsoil)
csys,1
nsel,r,loc,x,320
csys,0
nsel,r,loc,x,0
*get,master_node,node,,num,max
d,master_node,all
allsel

e,master_node                    ! Large
mass for excitation

csys,1
nsel,s,loc,z,soilz(9),soilz(10)
nsel,r,loc,x,0,soilx(9)
esln,,1
esel,r,type,,9
cm,bottom-soil,elem
```

Fix-Soil.txt

```
!esel,s,type,,8,9
!nsle
!nsel,r,loc,z,soilz(9)
!nsel,r,loc,x,ctx(21)+1,68
!nummrg,node

et,90,targe170
et,91,conta173
keyopt,91,9,1
mp,mu,90,0.3
mp,mu,91,0.7
mp,mu,92,0.7
r,90,,,0.1
r,91,,,0.1

esel,s,type,,9
cmsel,s,far-soil-face-node
esln,r
type,90
real,90
mat,90
esurf
esel,s,type,,8
cmsel,s,near-soil-face-node
esln,r
type,91
esurf

esel,s,type,,9
cmsel,s,far-soil-bot-node
esln,r
type,90
real,91
mat,91
esurf
esel,s,type,,8
cmsel,s,near-soil-bot-node
esln,r
type,91
esurf
esel,s,type,,91
cm,far-soil-contact,elem
```

Insulate.txt

```
et,2,solid45   ! SOLID45 elements for
insulating concrete

mp,ex,50,23760
mp,dens,50,0.05/g
mp,prxy,50,0.15
mp,damp,50,0.07/DF

/COM - Key Points for Insulating Concrete
*do,i,0,tw,1
k,kmaxpt+1+i,ptx(pt_kps-i),0,ptz(pt_kps-
i)      ! Match Keypoint to Primary Tank
k,kmaxpt+2+tw+i,ctx(ct_kps-
i),0,ctz(ct_kps-i)     ! Match Keypoint
to Concrete Tank
*enddo

/COM - Areas for Insulating Concrete
*do,i,1,tw,1
a,kmaxpt+i,kmaxpt+tw+1+i,kmaxpt+tw+2+i,km
axpt+1+i
*enddo

/COM - Assign Material Properties
*do,i,1,tw,1
asel,s,area,,amaxpt+i
aatt,50,i,2
*enddo

asel,s,area,,amaxpt+1,amaxpt+tw
vrotat,all,,,,,,1,ct_kps,180,2

type,2
/COM - Elements in insulating concrete
*do,i,2,tw,1
vsel,s,volu,,i
vsel,a,volu,,tw+i
aslv
lsla
lsel,r,loc,x,ctx(ct_kps-i),ctx(ct_kps-i-
1)
lesize,all,,arcsize
vmesh,all
*enddo

/COM - Mesh center volume to match
primary tank
vsel,s,volu,,1,tw+1,tw
aslv
asel,r,loc,z,ptz(pt_kps)
cm,a2,area
cmsel,a,a1
mshcopy,2,a1,a2
type,2
vsweep,all,,all

allsel
esel,s,type,,2
mpchg,50,all
cm,insul-conc,elem
cmsel,a,primary-tank
nsle
```

```
nsel,r,loc,z,ptz(pt_kps)
cm,primary-int,node
allsel
cmsel,s,conc-tank
esel,a,type,,2
nsle
nsel,r,loc,z,ctz(ct_kps)
nsel,r,loc,x,ctx(ct_kps-tw),ctx(ct_kps)

cm,insul-vol,volu
cm,insul-int,node

cmsel,s,a2
aclear,all
allsel
*get,KMAXic,KP,0,num,max      ! Get
maximum Keypoint Number
*get,LMAXic,LINE,0,num,max    ! Get
maximum Line Number
*get,AMAXic,AREA,0,num,max    ! Get
maximum Area Number
*get,VMAXic,VOLU,0,num,max    ! Get
maximum Volume Number

cmsel,s,insul-conc
nsle
nsel,r,loc,z,ptz(pt_kps)
nsel,r,loc,x,ptx(pt_kps-tw)
csys,1
!nrotat,all
allsel
```

interface-gap1.txt

```
/COM, Create components for wall and dome
of concrete tank and excavated soil for
interface coupling
csys,1
cmsel,s,conc-dome_wall-n
nsel,r,loc,x,ctx(12),ctx(14)+.1
esln,s,1
cmsel,u,liner
cm,conc-wall-e,elem
cm,conc-wall-n,node

cmsel,s,conc-dome_wall-e
cmsel,s,conc-dome_wall-n
cmsel,u,conc-wall-e
nsle,s,1
nsel,u,loc,z,ctz(13),ctz(14)
esln,r,1
cm,conc-dome-e,elem
cm,conc-dome-n,node

cmsel,s,excav-soil
nsle,s,1
nsel,r,loc,x,ctx(12),ctx(14)
nsel,r,loc,z,ctz(12),ctz(22)
esln,s
cm,excav-wall-e,elem
cm,excav-wall-n,node

cmsel,s,excav-soil
nsle,s,1
CM,EXCAV-SOIL-N,NODE
!nsel,r,loc,x,0,ctx(14)
!nsel,u,loc,z,0,soilz(3)
!nsel,u,loc,z,ctz(14),ctz(22)
!cm,ntemp,node
!nsel,r,loc,z,-11,-13.4
!nsel,u,loc,x,0,28
!cm,ntemp1,node
!cmsel,s,ntemp
!cmsel,u,ntemp1
CMSEL,S,EXCAV-SOIL-N
NSEL,R,LOC,X,CTX(1),CTX(2)
NSEL,R,LOC,Z,CTZ(1),CTZ(2)
cm,excav-dome-n,node
*DO,I,3,12
CMSEL,S,EXCAV-SOIL-N
NSEL,R,LOC,X,CTX(I)
NSEL,R,LOC,Z,CTZ(I)
CMSEL,A,EXCAV-DOME-N
cm,excav-dome-n,node
*ENDDO
esln,
cm,excav-dome-e,elem

/COM, Create wall soil to concrete tank
interface elements
cmsel,s,conc-wall-n
cmsel,a,excav-wall-n
cm,conc-excav-wall-int,node

cmsel,s,conc-dome-n
cmsel,a,excav-dome-n
cm,conc-excav-dome-int,node

/COM, Define contact properteis
et,61,conta173                 ! Contact
Surface - Concrete Tank
keyopt,61,5,3                  ! Type of
constriant - Shell/Solid contact normal
direction
et,60,targe170         ! Contact Element
- Excavated Soil
!keyopt,60,8,2                 !
Asymmetric contact selection (all contact
elements on one surface and all target
elements on the other surface)
keyopt,61,12,4                         !
Behavior of contact surface (no
seperation, sliding permitted)
!keyopt,61,2,3

et,63,conta173
keyopt,63,5,3
et,62,targe170
!keyopt,62,8,2
!keyopt,63,12,4
!keyopt,63,2,3

mp,mu,60,0.2                   !
Coefficient of Friction between excavated
soil and concrete tank wall
MP,damp,60,0.07/DF
r,60,,,0.05

mp,mu,62,0.2                   !
Coefficient of Friction between excavated
soil and concrete tank dome
MP,damp,62,0.07/DF
r,62,,,0.05

r,61,,,0.05
```

```
r,63,,,0.025
mp,mu,64,0.6                    !
Coefficient of Friction between excavated
soil and concrete tank dome
MP,damp,64,0.07/DF


! add wall interface elements
! concrete tank surface target
cmsel,s,conc-wall-e
nsle,s,1
type,60
real,60
mat,60
esurf
esel,s,type,,60
nsle
nsel,r,loc,z,ctz(12),ctz(14)
esln,r,1
emodif,all,real,61
esel,s,type,,61
cmsel,u,conc-wall-e
cm,conc-target,elem

type,61
cmsel,s,excav-wall-e
cmsel,a,excav-wall-n
esurf
esel,s,type,,61
nsle
nsel,r,loc,z,ctz(12),ctz(14)
esln,r,1
emodif,all,real,61
esel,s,type,,61
cmsel,u,excav-wall-e
cmsel,u,excav-wall-n
cm,excav-contact,elem

cmsel,s,conc-target
cmsel,a,excav-contact
cm,conc-excav-wall-gap,elem

! add dome interface elements
! concrete tank surface target
cmsel,s,conc-dome-e
nsle,s,1
type,62
real,62
mat,62
esurf
esel,s,type,,62
nsle
nsel,r,loc,z,ctz(12),ctz(14)
esln,r,1
emodif,all,real,62
esel,s,type,,62
cmsel,u,conc-dome-e
cm,conc-dome-target,elem

type,63
cmsel,s,excav-dome-e
esel,u,type,,1
cmsel,s,excav-dome-n
esurf
cmsel,u,excav-dome-e
cm,excav-dome-contact,elem

cmsel,s,conc-dome-target
cmsel,a,excav-dome-contact
cm,conc-excav-dome-gap,elem
allsel

/COM, Create concrete slab to soil
interface elments
! spring constants
! slab
r,307,1e8
r,308,1e8
r,309,1e8
esel,none

esel,s,type,,9
nsle
nsel,r,loc,z,ctz(23)
nsel,r,loc,x,0,ctx(23)
cm,soil-slab,node
allsel
esel,none
cmsel,s,conc-slab
cmsel,a,soil-slab
type,21
real,307
eintf

type,22
real,308
eintf

type,23
real,309
eintf
cm,conc-soil-slab-spr,elem
esel,none
allsel

/COM - Create contact on top of footing
slab

cmsel,s,conc-tank
nsle
nsel,r,loc,x,ctx(23)
esln,r
nsle
type,60
real,63
mat,64
esurf,top

cmsel,s,excav-soil
nsle
nsel,r,loc,z,soilz(9)
nsel,r,loc,x,ctx(22),ctx(23)
esln,r
type,61
esurf
esel,s,real,,63
esel,r,type,,61
cm,soil-contact-foot-elem,elem
```

interface1.txt

```
et,21,combin14,,1
et,22,combin14,,2
et,23,combin14,,3

r,201,1e8
r,202,1e8
r,203,1e8
```

```
et,24,conta178
keyopt,24,2,1

R,204,,,,,,
RMORE,,1,,,,

mp,mu,64,0.20                !
Coefficient of Friction between concrete
tank wall and concrete tank slab
mp,damp,64,0.07/DF

/COM, Define contact properteis
et,65,targe170               ! Target
Surface
keyopt,65,5,3                ! Type of
constriant - Shell/Solid contact normal
direction
et,66,conta173               ! Contact
Element
keyopt,66,9,1

r,65,,,0.02

et,67,targe170               ! Target
Surface - Concrete Tank
keyopt,67,5,3                ! Type of
constriant - Shell/Solid contact normal
direction
et,68,conta173               ! Contact
Element - Secondary Line
keyopt,68,9,1
r,67,,,0.01

mp,mu,65,0.40                !
Coefficient of Friction between primary
tank and insulating concrete (PNNL
values)
MP,damp,65,0.3/DF

mp,mu,67,0.40                !
Coefficient of Friction between secondary
liner and concrete tank basemat (PNNL
values)
MP,damp,67,0.3/DF

esel,none
/COM - Create Interface Elements at
Bottom of Concrete Wall
cmsel,s,wall-int
type,24
real,204
mat,64
eintf,,,high
cm,wall-int-gap,elem

esel,none
/COM - Create Interface Elements between
primary tank and insulating concrete
cmsel,s,primary-tank
csys,1
nsle
nsel,r,loc,z,ptz(40)
!nsel,r,loc,x,ptx(41),ptx(39)
cm,primary-int-n,node
esln,r,1
cm,primary-int-e,elem

cmsel,s,insul-conc
nsle
nsel,r,loc,z,ptz(40)
!nsel,r,loc,x,ptx(31),ptx(39)
cm,insul-int-n,node

cmsel,s,primary-int-e
cmsel,s,primary-int-n
type,66
real,65
mat,65
esurf,,bottom
cmsel,u,primary-int-e
cm,pri-target,elem

cmsel,s,insul-conc
cmsel,s,insul-int-n
type,65
real,65
esurf
cmsel,u,insul-conc
cm,insul-contact,elem

cmsel,s,pri-target
cmsel,a,insul-contact
cm,primary-int-gap,elem
esel,none

!nsel,s,loc,z,ptz(34)
!nsel,r,loc,x,ptx(39)-.1,ptx(40)
!cpint,uz

/COM - Create Interface Elements between
concrete tank and insulating concrete
cmsel,s,conc-tank
cmsel,a,liner
cmsel,a,insul-int
esln,r,1
cm,etemp,elem

cmsel,s,etemp
esel,u,real,,51
cm,conc-temp,elem

cmsel,s,etemp
esel,r,real,,51
cm,liner-temp,elem

cmsel,s,conc-temp
nsle
type,67
real,67
mat,67
esurf,,top
cmsel,u,conc-temp
cm,conc-target,elem

cmsel,s,liner-temp
nsle
type,68
real,67
esurf,,bottom
cmsel,u,liner-temp
cm,liner-contact,elem

cmsel,s,conc-target
cmsel,a,liner-contact
cm,conc-liner-gap,elem
```

Liner.txt

```
ksel,u,kp,,all                 ! Clear
active Keypoints
asel,u,area,,all               ! Clear
active Areas
vsel,u,volu,,all               ! Clear
active Volumes
ksel,s,kp,,1,ct_kps,ct_kps-1  ! Activate
Keypoints for axis of rotation
esel,u,elem,,all
lsel,u,line,,all

et,21,combin14,,1
et,22,combin14,,2
et,23,combin14,,3

r,201,1e8
r,202,1e8
r,203,1e8


r,51,0.375/12
r,52,0.5/12
r,53,0.5625/12

cmsel,s,insul-vol
aslv
asel,r,loc,z,ctz(ct_kps)
cm,liner-a,area
aatt,101,51,1
asel,r,loc,x,ptx(pt_kps-tw),ptx(pt_kps-
tw+1)
aatt,101,52,1
cmsel,s,liner-a

asel,none
k,kmaxic+1,ctx(bm_kp+3),0,ctz(bm_kp+3)
k,kmaxic+2,ctx(bm_kp)-1,0,ctz(bm_kp)
k,kmaxic+3,ctx(bm_kp)-
0.2929,0,ctz(bm_kp)+0.2929
k,kmaxic+4,ctx(bm_kp),0,ctz(bm_kp)+1
k,kmaxic+5,ctx(bm_kp-1),0,ctz(bm_kp-1)
k,kmaxic+6,ctx(bm_kp-2),0,ctz(bm_kp-2)

l,kmaxic+1,kmaxic+2
l,kmaxic+2,kmaxic+3
l,kmaxic+3,kmaxic+4
l,kmaxic+4,kmaxic+5
l,kmaxic+5,kmaxic+6

arotat,all,,,,,,1,ct_kps,180,2
aatt,101,52,1
cm,liner-lines,line
cmsel,a,liner-a
cm,liner-a,area
asel,r,loc,x,ctx(bm_kp)-2,ctx(bm_kp)
asel,r,loc,z,ctz(bm_kp-1),ctz(bm_kp)
aatt,101,53,1
cmsel,s,liner-a


lsel,r,loc,x,ctx(bm_kp)
lesize,all,,arcsize
cmsel,s,liner-lines
lsel,r,loc,x,ctx(bm_kp+3)
lesize,all,,arcsize
cmsel,s,liner-lines
lsel,r,loc,x,ctx(bm_kp)-1
lesize,all,,arcsize
cmsel,s,liner-lines
lsel,r,loc,x,ctx(bm_kp)-0.2929
lesize,all,,arcsize


amesh,all
nsle
nummrg,node

cm,liner,elem
nsle
nsel,r,loc,x,ctx(bm_kp+3),ctx(bm_kp)-1
cpint,uz,3.5
cmsel,s,liner
nsle
nsel,r,loc,z,ctz(bm_kp-1),ctz(bm_kp)+1
cpintf,ux,3
cpintf,uy,3

allsel
nsel,s,loc,x,ctx(bm_kp)
nsel,r,loc,z,ctz(bm_kp-2),ctz(bm_kp-1)
cm,liner-wall,node

esel,none

/COM - Merge liner and concrete wall
nummrg,node


allsel
*get,KMAX1,KP,0,num,max        ! Get
maximum Keypoint Number
*get,LMAX1,LINE,0,num,max      ! Get
maximum Line Number
*get,AMAX1,AREA,0,num,max      ! Get
maximum Area Number
*get,VMAX1,VOLU,0,num,max      ! Get
maximum Volume Number
```

live_load.txt

```
! select nodes to apply concentrated live
load over - 10 ft radius
allsel
nsel,s,loc,z,0
nsel,r,loc,x,0,11
cm,n-live,node
*get,nodes,node,,count          ! count the
number of nodes selected
*get,nstart,node,,num,min       ! get min
node number

live_load=200000     ! live load 100 tons
(lbs)
live_mass=live_load/(2*g*1000*nodes)  !
convert live load to slugs/node selected

R,1002,live_mass,live_mass,live_mass
type,10
real,1002

cmsel,s,n-live
cm,nlive,node                   ! temporary
counter for nodes

*do,i,1,nodes
cmsel,s,nlive
*get,cnode,node,,num,min
e,cnode
```

```
nsel,u,node,,cnode
cm,nlive,node
*enddo

esel,s,real,,1002
cm,live-load,elem
allsel
```

Near-Soil-1.txt

```
et,8,solid45                              !
Use Element SOLID45 for Near Soil
Elements
/input,soil-prop-Mean-geo,txt             !
Read Soil Properties

ksel,u,kp,,1,kmaxjb                       !
Unselect existing Keypoints
asel,u,area,,1,amaxjb                     !
Unselect existing Area
lsel,u,line,,1,lmaxjb                     !
Unselect existing Lines
vsel,u,volu,,1,vmaxw                      !
Unselect existing Volumes

/COM - Create Keypoints to match concrete
tank profile
*do,i,1,bm_kp
k,kmaxjb+i,ctx(i),0,ctz(i)
*enddo

/COM - Create Keypoints above top of tank
k,kmaxjb+bm_kp+1,0,0,0        ! Keypoint
at origin (surface)
k,kmaxjb+bm_kp+2,0,0,soilz(2) ! Keypoint
at to divide soil above tank
*get,KMAXtemp1,KP,0,num,max   ! Get
maximum keypoint number for counter

/COM - Create Keypoints at outside of
excavated soil
*do,i,1,tanksoil
k,kmaxtemp1+i,soilx(i),0,soilz(i)
*enddo
*get,KMAXtemp2,KP,0,num,max
        ! Get maximum keypoint number for
counter

/COM - Create additional keypoint in soil
above tank
k,kmaxtemp2+1,ctx(2),0,soilz(1)
k,kmaxtemp2+2,ctx(9),0,soilz(1)
k,kmaxtemp2+3,ctx(12),0,soilz(1)
k,kmaxtemp2+4,ctx(2),0,soilz(2)
k,kmaxtemp2+5,ctx(9),0,soilz(2)
k,kmaxtemp2+6,ctx(12),0,soilz(2)
k,kmaxtemp2+7,ctx(12),0,soilz(3)
k,kmaxtemp2+8,ctx(bm_kp+1),0,ctz(bm_kp+1)

a,kmaxtemp2+1,kmaxtemp2+2,kmaxtemp2+5,kma
xtemp2+4
a,kmaxtemp2+2,kmaxtemp2+3,kmaxtemp2+6,kma
xtemp2+5
a,kmaxtemp2+3,kmaxtemp1+1,kmaxtemp1+2,kma
xtemp2+6
a,kmaxtemp2+4,kmaxtemp2+5,kmaxjb+9,kmaxjb
+8,kmaxjb+7,kmaxjb+6,kmaxjb+5,kmaxjb+4,km
axjb+3,kmaxjb+2!a,740,741,712,711,710,709
,708,707,706,705
a,kmaxtemp2+5,kmaxtemp2+6,kmaxtemp2+7,kma
xjb+12,kmaxjb+11,kmaxjb+10,kmaxjb+9
a,kmaxtemp2+6,kmaxtemp1+2,kmaxtemp1+3,kma
xtemp2+7
a,kmaxtemp2+7,kmaxtemp1+3,kmaxtemp1+4,kma
xjb+12
a,kmaxjb+12,kmaxtemp1+4,kmaxtemp1+5,kmaxj
b+14,kmaxjb+13
a,kmaxjb+14,kmaxtemp1+5,kmaxtemp1+6,kmaxj
b+16,kmaxjb+15
a,kmaxjb+16,kmaxtemp1+6,kmaxtemp1+7,kmaxj
b+18,kmaxjb+17
a,kmaxjb+18,kmaxtemp1+7,kmaxtemp1+8,kmaxj
b+20,kmaxjb+19
a,kmaxjb+20,kmaxtemp1+8,kmaxtemp1+9,kmaxt
emp2+8,kmaxjb+22,kmaxjb+21

cm,top-soil-area,area
lsla
cm,top-soil,line
type,1
real,1


/COM - Define line divisions to control
meshing
lsel,s,loc,z,soilz(1),soilz(2)
lsel,r,loc,x,ctx(3),ctx(8)
lesize,all,,,14                         !
soil above tank top, match tank meshing
lsel,s,loc,z,soilz(1),soilz(2)
lsel,r,loc,x,ctx(10),ctx(11)
lesize,all,,,3                  ! soil
above tank top, match tank meshing
cmsel,s,top-soil                ! Reselect
lines in near soil
lsel,r,loc,x,ctx(2)
lesize,all,,,2                  ! Control
vertical element size, above tank
cmsel,s,top-soil
lsel,s,loc,x,ctx(9)
lesize,all,,,2                  ! Control
vertical element size, above tank
cmsel,s,top-soil
lsel,r,loc,x,ctx(12)
lesize,all,,,2                  ! Control
vertical element size, above tank
cmsel,s,top-soil
lsel,r,loc,z,ctz(2),ctz(12)
lsel,r,loc,x,ctx(2),ctx(12)
lesize,all,,,1                  ! Control
vertical element size, outside excavation
mesh
lsel,s,line,,lmaxjb+8,lmaxjb+10,2
lsel,a,line,,lmaxjb+26,lmaxjb+28,2
lsel,a,line,,lmaxjb+30,lmaxjb+38,4
lesize,all,,,9
lsel,s,line,,lmaxjb+42,lmaxjb+42,4
lesize,all,,,7                  ! Control
horizontal meshing in soil
lsel,s,line,,lmaxjb+9
lsel,a,line,,lmaxjb+25,lmaxjb+27,2
lsel,a,line,,lmaxjb+29,lmaxjb+45,4
lesize,all,,,1                  ! Control
horizontal meshing in soil
lsel,s,line,,lmaxjb+6
lsel,a,line,,lmaxjb+20,lmaxjb+21
lsel,a,line,,lmaxjb+32,lmaxjb+44,4
lsel,a,line,,lmaxjb+31,lmaxjb+43,4
lsel,a,line,,lmaxjb+47,lmaxjb+49
```

```
lesize,all,,,1                ! Control
meshing to match tank
lsel,s,line,,lmaxjb+46
lesize,all,,,4                ! Control
mesh size at bottom of excavated soil

cmsel,s,top-soil-area

amesh,all                     ! Mesh area
to develop pattern for volume meshing

type,8
ksel,a,kp,,1                  ! Select
Keypoint for rotation axis
ksel,a,kp,,ct_kps             ! Select
Keypoint for rotation axis
vrotat,all,,,,,,1,ct_kps,180,2        !
Generate Volumes for excavated soil
lsla
lsel,r,loc,x,ctx(2)
lesize,all,,arcsize           ! Define
meshing for slices
lsla
lsel,r,loc,x,ctx(9)
lesize,all,,arcsize           ! Define
meshing for slices
lsla
lsel,r,loc,x,ctx(12)
lesize,all,,arcsize           ! Define
meshing for slices
vsweep,all                    ! Sweep
pattern into volume
aclear,all                    ! Delete
elements used for sweep
cm,top-soil-vol,volu

*get,VMAXtemp,VOLU,0,num,max
/COM - Generate element above top center
of tank
asel,u,area,,all
vsel,u,volu,,all
a,kmaxjb+bm_kp+1,kmaxtemp2+1,kmaxtemp2+4,
kmaxjb+bm_kp+2
a,kmaxjb+bm_kp+2,kmaxtemp2+4,kmaxjb+2,kma
xjb+1
vrotat,all,,,,,,1,ct_kps,180,2
vsel,s,volu,,vmaxtemp+1,vmaxtemp+3,2
vatt,801,,8                           !
Assign material properties
vsel,s,volu,,vmaxtemp+2,vmaxtemp+4,2
vatt,802,,8                           !
Assign material properties
vsel,s,volu,,vmaxtemp+1,vmaxtemp+4
allsel
asel,s,loc,z,ctz(1),ctz(2)
type,1
asel,r,loc,x,0,4
asel,r,loc,z,ctz(1),ctz(2)
cmsel,u,conc-tank-a
*get,atemp,area,,num,max
*get,atemp1,area,,num,min
asel,a,area,,1,22,21
mshcopy,2,1,atemp1            ! copy mesh
top match top of concrete tank
mshcopy,2,22,atemp            ! copy mesh
top match top of concrete tank
asel,u,area,,1,22,21
vsel,s,volu,,vmaxtemp+1,vmaxtemp+4
vsweep,all                            !
Generate elements by sweeping area
aclear,atemp
aclear,atemp1

/COM - Assign soil properties by layer
*do,i,1,tanksoil-1
cmsel,s,top-soil-vol
vsel,r,loc,z,soilz(i),soilz(i+1)
eslv
emodif,all,mat,800+i
esys,0
*enddo

cmsel,s,top-soil-vol
vsel,a,loc,z,soilz(1),ctz(2)
eslv
cm,excav-soil,elem
nsle
nummrg,node

/COM - Define component for excavated
soil - tank walls only
cmsel,s,excav-soil
nsle,s,1
nsel,r,loc,z,soilz(5),soilz(9)
esln,r,1
cm,excav-wall,elem


/COM - Define component for excavated
soil - tank dome only
cmsel,s,excav-soil
cmsel,u,excav-wall
cm,excav-dome,elem

csys,1
cmsel,s,excav-wall
nsle
nsel,r,loc,x,ctx(14)
cm,excav-wall-n,node

esel,s,type,,8
nsle
nsel,s,loc,x,soilx(1)
nsel,r,loc,z,soilz(1)
cm,near-soil-face-node,node
*do,i,2,9
esel,s,type,,8
nsle
nsel,r,loc,x,soilx(i)
nsel,r,loc,z,soilz(i)
cmsel,a,near-soil-face-node
cm,near-soil-face-node,node
*enddo

esel,s,type,,8
nsle
nsel,r,loc,z,soilz(9)
nsel,r,loc,x,41,68
cm,near-soil-bot-node,node


allsel
*get,KMAXns,KP,0,num,max       ! Get
maximum Keypoint number
*get,LMAXns,LINE,0,num,max     ! Get
maximum line number
*get,AMAXns,AREA,0,num,max     ! Get
maximum Area number
*get,VMAXns,volu,0,num,max     ! Get
maximum Volume number
```

outer-spar.txt

```
! deinfe element type, material and real
constants
et,30,link8           ! rigid link to be
place between couping and boundry
conditions

mp,ex,300,10e9        ! high modulus to
create a rigid link
mp,dens,300,0         ! massless rigid
link
r,300,1               ! cross-sectional
area of rigid link

! select elements and define rigid links
nsle
nsel,s,loc,x,soil_radius
nsel,u,loc,y,-10,-170
cm,ntemp,node

type,30
mat,300
real,300

*do,i,1,20
cmsel,s,ntemp
nsel,r,loc,z,soilz(i)
eintf,51
*enddo

allsel
```

Post-Tank.txt

```
/input,contact-ap,txt
!/input,force-c,txt
/input,stress-Primary,txt
!/input,Force-J_bolt,txt
```

Primary-Props-AP.txt

```
/COM - Material Definitions
/COM - Material 101, Tank Steel
mp,ex,101,4248000*1e4
mp,nuxy,101,0.30
mp,dens,101,490/(1000*g)
mp,damp,101,0.00135

/COM - Material 102, Tank Steel
mp,ex,102,4248000*1e4
mp,nuxy,102,0.30
mp,dens,102,490/(1000*g)
mp,damp,102,0.00135

/COM - Material 103, Tank Steel
mp,ex,103,4248000*1e4
mp,nuxy,103,0.30
mp,dens,103,490/(1000*g)
mp,damp,103,0.00135

/COM - Material 104, Tank Steel
mp,ex,104,4248000*1e4
mp,nuxy,104,0.30
mp,dens,104,490/(1000*g)
mp,damp,104,0.00135

/COM - Material  105, Tank Steel
mp,ex,105,4248000*1e4
mp,nuxy,105,0.30
mp,dens,105,490/(1000*g)
mp,damp,105,0.00135

/COM - Material 106, Tank Steel
mp,ex,106,4248000*1e4
mp,nuxy,106,0.30
mp,dens,106,490/(1000*g)
mp,damp,106,0.00135

/COM - Material 107, Tank Steel
mp,ex,107,4248000*1e4
mp,nuxy,107,0.30
mp,dens,107,490/(1000*g)
mp,damp,107,0.00135

/COM - Material 108, Tank Steel
mp,ex,108,4248000*1e4
mp,nuxy,108,0.30
mp,dens,108,490/(1000*g)
mp,damp,108,0.00135

/COM - Material 109, Tank Steel
mp,ex,109,4248000*1e4
mp,nuxy,109,0.30
mp,dens,109,490/(1000*g)
mp,damp,109,0.00135

/COM - Material,110, Tank Steel
mp,ex,110,4248000*1e4
mp,nuxy,110,0.30
mp,dens,110,490/(1000*g)
mp,damp,110,0.00135

/COM - Material,111, Tank Steel
mp,ex,111,4248000
mp,nuxy,111,0.30
mp,dens,111,490/(1000*g)
mp,damp,111,0.00135

/COM - Material,112, Tank Steel
mp,ex,112,4248000
mp,nuxy,112,0.30
mp,dens,112,490/(1000*g)
mp,damp,112,0.00135

/COM - Material,113, Tank Steel
mp,ex,113,4248000
mp,nuxy,113,0.30
mp,dens,113,490/(1000*g)
mp,damp,113,0.00135

/COM - Material,114, Tank Steel
mp,ex,114,4248000
mp,nuxy,114,0.30
mp,dens,114,490/(1000*g)
mp,damp,114,0.00135

/COM - Material,115, Tank Steel
mp,ex,115,4248000
mp,nuxy,115,0.30
mp,dens,115,490/(1000*g)
mp,damp,115,0.00135
```

```
/COM - Material,116, Tank Steel
mp,ex,116,4248000
mp,nuxy,116,0.30
mp,dens,116,490/(1000*g)
mp,damp,116,0.00135

/COM - Material,117, Tank Steel
mp,ex,117,4248000
mp,nuxy,117,0.30
mp,dens,117,490/(1000*g)
mp,damp,117,0.00135

/COM - Material,118, Tank Steel
mp,ex,118,4248000
mp,nuxy,118,0.30
mp,dens,118,490/(1000*g)
mp,damp,118,0.00135

/COM - Material,119, Tank Steel
mp,ex,119,4248000
mp,nuxy,119,0.30
mp,dens,119,490/(1000*g)
mp,damp,119,0.00135

/COM - Material,120, Tank Steel
mp,ex,120,4248000
mp,nuxy,120,0.30
mp,dens,120,490/(1000*g)
mp,damp,120,0.00135

/COM - Material,121, Tank Steel
mp,ex,121,4248000
mp,nuxy,121,0.30
mp,dens,121,490/(1000*g)
mp,damp,121,0.00135

/COM - Material,122, Tank Steel
mp,ex,122,4248000
mp,nuxy,122,0.30
mp,dens,122,490/(1000*g)
mp,damp,122,0.03/df

/COM - Material,123, Tank Steel
mp,ex,123,4248000
mp,nuxy,123,0.30
mp,dens,123,490/(1000*g)
mp,damp,123,0.00135

/COM - Material,124, Tank Steel
mp,ex,124,4248000
mp,nuxy,124,0.30
mp,dens,124,490/(1000*g)
mp,damp,124,0.00135

/COM - Material,125, Tank Steel
mp,ex,125,4248000
mp,nuxy,125,0.30
mp,dens,125,490/(1000*g)
mp,damp,125,0.00135

/COM - Material,126, Tank Steel
mp,ex,126,4248000
mp,nuxy,126,0.30
mp,dens,126,490/(1000*g)
mp,damp,126,0.00135

/COM - Material,127, Tank Steel
mp,ex,127,4248000
mp,nuxy,127,0.30
mp,dens,127,490/(1000*g)
mp,damp,127,0.00135

/COM - Material,128, Tank Steel
mp,ex,128,4248000
mp,nuxy,128,0.30
mp,dens,128,490/(1000*g)
mp,damp,128,0.00135

/COM - Material,129, Tank Steel
mp,ex,129,4248000
mp,nuxy,129,0.30
mp,dens,129,490/(1000*g)
mp,damp,129,0.00135

/COM - Material,130, Tank Steel
mp,ex,130,4248000
mp,nuxy,130,0.30
mp,dens,130,490/(1000*g)
mp,damp,130,0.00135

/COM - Material,131, Tank Steel
mp,ex,131,4248000
mp,nuxy,131,0.30
mp,dens,131,490/(1000*g)
mp,damp,131,0.00135

/COM - Material,132, Tank Steel
mp,ex,132,4248000
mp,nuxy,132,0.30
mp,dens,132,490/(1000*g)
mp,damp,132,0.00135

/COM - Material,133, Tank Steel
mp,ex,133,4248000
mp,nuxy,133,0.30
mp,dens,133,490/(1000*g)
mp,damp,133,0.00135

/COM - Material,134, Tank Steel
mp,ex,134,4248000
mp,nuxy,134,0.30
mp,dens,134,490/(1000*g)
mp,damp,134,0.00135

/COM - Material,135, Tank Steel
mp,ex,135,4248000
mp,nuxy,135,0.30
mp,dens,135,490/(1000*g)
mp,damp,135,0.00135

/COM - Material,136, Tank Steel
mp,ex,136,4248000
mp,nuxy,136,0.30
mp,dens,136,490/(1000*g)
mp,damp,136,0.00135

/COM - Material,137, Tank Steel
mp,ex,137,4248000
mp,nuxy,137,0.30
mp,dens,137,490/(1000*g)
mp,damp,137,0.00135

/COM - Material,138, Tank Steel
mp,ex,138,4248000
mp,nuxy,138,0.30
mp,dens,138,490/(1000*g)
mp,damp,138,0.00135

/COM - Material,139, Tank Steel
```

```
mp,ex,139,4248000
mp,nuxy,139,0.30
mp,dens,139,490/(1000*g)
mp,damp,139,0.00135

/COM - Material,140, Tank Steel
mp,ex,140,4248000
mp,nuxy,140,0.30
mp,dens,140,490/(1000*g)
mp,damp,140,0.00135

/COM - Material,141, Tank Steel
mp,ex,141,4248000
mp,nuxy,141,0.30
mp,dens,141,490/(1000*g)
mp,damp,141,0.00135

/COM - Material,142, Tank Steel
mp,ex,142,4248000
mp,nuxy,142,0.30
mp,dens,142,490/(1000*g)
mp,damp,142,0.00135

/COM - Material,143, Tank Steel
mp,ex,143,4248000
mp,nuxy,143,0.30
mp,dens,143,490/(1000*g)
mp,damp,143,0.00135

r,101,(0.5-0.06)/12
r,102,(0.5-0.06)/12
r,103,(0.375-0.06)/12
r,104,(0.375-0.06)/12
r,105,(0.375-0.06)/12
r,106,(0.375-0.06)/12
r,107,(0.375-0.06)/12
r,108,(0.375-0.06)/12
r,109,(0.375-0.06)/12
r,110,(0.375-0.06)/12
r,111,(0.5-0.06)/12
r,112,(0.5-0.06)/12
r,113,(0.5-0.06)/12
r,114,(0.5-0.06)/12
r,115,(0.5-0.06)/12
r,116,(0.5-0.06)/12
r,117,(0.5-0.06)/12
r,118,(0.5-0.06)/12
r,119,(0.5-0.06)/12
r,120,(0.5-0.06)/12
r,121,(0.5-0.06)/12
r,122,(0.5-0.06)/12
r,123,(0.5625-0.06)/12
r,124,(0.5625-0.06)/12
r,125,(0.5625-0.06)/12
r,126,(0.5625-0.06)/12
r,127,(0.75-0.06)/12
r,128,(0.75-0.06)/12
r,129,(0.75-0.06)/12
r,130,(0.75-0.06)/12
r,131,(0.75-0.06)/12
r,132,(0.875-0.06)/12
r,133,(0.9375-0.06)/12
r,134,(0.9375-0.06)/12
r,135,(0.875-0.06)/12
r,136,(0.875-0.06)/12
r,137,(0.5-0.06)/12
r,138,(0.5-0.06)/12
r,139,(0.5-0.06)/12
r,140,(0.5-0.06)/12
r,141,(0.5-0.06)/12
r,142,(0.5-0.06)/12
r,143,(0.5-0.06)/12
```

Primary.txt

```
/COM - Create KeyPoints for primarytank
*do,i,1,pt_kps,1
k,kmaxct+i,ptx(i),0,ptz(i)
*enddo

/COM - Create lines for primary tank
*do,i,1,pt_kps-1,1
l,kmaxct+i,kmaxct+i+1
*enddo

/COM - Create Areas for primary tank
lsel,s,line,,LMAXct+1,LMAXct+pt_kps-1
arotat,all,,,,,,1,ct_kps,180,2

/COM - Assign Material and Real
Properties to primary tank areas
csys,1
*do,i,1,pt_kps-1,1
asel,s,area,,AMAXct+i
asel,a,area,,AMAXct+pt_kps-1+i
aatt,100+i,100+i,1
*enddo
allsel

/COM - Elements at tank Top center
asel,s,loc,x,ptx(1),ptx(2)
asel,r,loc,z,ptz(1),ptz(2)
lsla
lsel,r,loc,x,ptx(2)
lesize,all,,arcsize
lsla
lsel,u,loc,x,ptx(2)
lesize,all,,,midsize
amesh,all

/COM - Elements in primary tank
*do,i,2,pt_kps-2,1
asel,s,area,,AMAXct+i
asel,a,area,,AMAXct+pt_kps-1+i
lsla
lsel,s,loc,x,ptx(i),ptx(i+1)
lsel,r,loc,z,ptz(i),ptz(i+1)
lesize,all,,arcsize
amesh,all
*enddo

/COM - Elements at tank floor center
asel,s,loc,x,ptx(pt_kps-1),ptx(pt_kps)
asel,r,loc,z,ptz(pt_kps)
cm,a1,area
lsla
lsel,r,loc,x,ptx(pt_kps-1)
lesize,all,,arcsize
lsla
lsel,u,loc,x,ptx(pt_kps-1)
lesize,all,,,midsize
amesh,all
asel,r,loc,y,0,-90
cm,a1a,area                    ! Component
for mesh mapping
cmsel,s,a1
cmsel,u,a1a
cm,a1b,area                    ! Compoment
for mesh mapping
```

```
allsel
cmsel,u,conc-tank
*get,emax,elem,,num,maxd
enorm,emax
cm,primary-tank,elem

allsel
*get,KMAXpt,KP,0,num,max      ! Get
maximum Keypoint number
*get,LMAXpt,LINE,0,num,max    ! Get
maximum Line Number
*get,AMAXpt,AREA,0,num,max    ! Get
maximum Area Number
```

Soil-Props-Mean-Geo.txt

```
Tanksoil=9
deepsoil=20
soil_radius=320
mass=1e8

*dim,soilx,,30
*dim,soilz,,30


soilz(1)=0
soilz(2)=-5
soilz(3)=ctz(9)
soilz(4)=ctz(12)
soilz(5)=ctz(14)
soilz(6)=ctz(16)
soilz(7)=ctz(18)
soilz(8)=ctz(20)
soilz(9)=ctz(23)
soilz(10)=-73.5
soilz(11)=-90.5
soilz(12)=-106.5
soilz(13)=-123.5
soilz(14)=-139.5
soilz(15)=-156
soilz(16)=-178
soilz(17)=-200
soilz(18)=-222
soilz(19)=-244
soilz(20)=-266

soilx(9)=68
soilx(8)=soilx(9)-(soilz(9)-soilz(8))/1.5
soilx(7)=soilx(9)-(soilz(9)-soilz(7))/1.5
soilx(6)=soilx(9)-(soilz(9)-soilz(6))/1.5
soilx(5)=soilx(9)-(soilz(9)-soilz(5))/1.5
soilx(4)=soilx(9)-(soilz(9)-soilz(4))/1.5
soilx(3)=soilx(9)-(soilz(9)-soilz(3))/1.5
soilx(2)=soilx(9)-(soilz(9)-soilz(2))/1.5
soilx(1)=soilx(9)-(soilz(9)-soilz(1))/1.5


/COM Excavated Soil Properties
mp,ex,801,18*144
mp,nuxy,801,0.27
mp,dens,801,125/(1000*g)
mp,damp,801,0.017/df

/COM - Material 802, Soil
mp,ex,802,22.5*144
mp,nuxy,802,0.27
mp,dens,802,125/(1000*g)
mp,damp,802,0.027/df

/COM - Material 803, Soil
mp,ex,803,29.25*144
mp,nuxy,803,0.27
mp,dens,803,125/(1000*g)
mp,damp,803,0.039/df

/COM - Material 804, Soil
mp,ex,804,36*144
mp,nuxy,804,0.27
mp,dens,804,125/(1000*g)
mp,damp,804,0.031/df

/COM - Material 805, Soil
mp,ex,805,42*144
mp,nuxy,805,0.27
mp,dens,805,125/(1000*g)
mp,damp,805,0.035/df

/COM - Material 806, Soil
mp,ex,806,48.75*144
mp,nuxy,806,0.27
mp,dens,806,125/(1000*g)
mp,damp,806,0.042/df

/COM - Material 807, Soil
mp,ex,807,55.5*144
mp,nuxy,807,0.27
mp,dens,807,125/(1000*g)
mp,damp,807,0.047/df

/COM - Material 808, Soil
mp,ex,808,60*144
mp,nuxy,808,0.27
mp,dens,808,125/(1000*g)
mp,damp,808,0.037/df

/COM - Material 810, Soil
mp,ex,810,250
mp,nuxy,810,0.27
mp,dens,810,125/(1000*g)
mp,damp,810,0.037/df


/COM - Material Definitions
/COM - Material 811, Soil     (Top Layer)
mp,ex,811,9958
mp,nuxy,811,0.27
mp,dens,811,125/(1000*g)
mp,damp,811,0.019/df

/COM - Material 812, Soil
mp,ex,812,8797
mp,nuxy,812,0.27
mp,dens,812,125/(1000*g)
mp,damp,812,0.035/df

/COM - Material 813, Soil
mp,ex,813,7845
mp,nuxy,813,0.27
mp,dens,813,125/(1000*g)
mp,damp,813,0.048/df

/COM - Material 814, Soil
mp,ex,814,8209
mp,nuxy,814,0.27
mp,dens,814,125/(1000*g)
mp,damp,814,0.039/df

/COM - Material 815, Soil
```

```
mp,ex,815,7634
mp,nuxy,815,0.27
mp,dens,815,125/(1000*g)
mp,damp,815,0.048/df

/COM - Material 816, Soil
mp,ex,816,7188
mp,nuxy,816,0.27
mp,dens,816,125/(1000*g)
mp,damp,816,0.055/df

/COM - Material 817, Soil
mp,ex,817,6933
mp,nuxy,817,0.27
mp,dens,817,125/(1000*g)
mp,damp,817,0.059/df

/COM - Material 818, Soil
mp,ex,818,7667
mp,nuxy,818,0.27
mp,dens,818,125/(1000*g)
mp,damp,818,0.045/df


/COM - Mean Soil Properties Geomatrix
Soil Data
/COM - 19 Layer Mode
/COM - Material Definitions

/COM - Material 901, Soil     (Top Layer)
mp,ex,901,16423
mp,nuxy,901,0.24
mp,dens,901,110/(1000*g)
mp,damp,901,0.017/df

/COM - Material 902, Soil
mp,ex,902,15479
mp,nuxy,902,0.24
mp,dens,902,110/(1000*g)
mp,damp,902,0.025/df

/COM - Material 903, Soil
mp,ex,903,14481
mp,nuxy,903,0.24
mp,dens,903,110/(1000*g)
mp,damp,903,0.034/df

/COM - Material 904, Soil
mp,ex,904,14707
mp,nuxy,904,0.24
mp,dens,904,110/(1000*g)
mp,damp,904,0.028/df

/COM - Material 905, Soil
mp,ex,905,13625
mp,nuxy,905,0.19
mp,dens,905,110/(1000*g)
mp,damp,905,0.032/df

/COM - Material 906, Soil
mp,ex,906,15456
mp,nuxy,906,0.19
mp,dens,906,110/(1000*g)
mp,damp,906,0.033/df

/COM - Material 907, Soil
mp,ex,907,17532
mp,nuxy,907,0.19
mp,dens,907,110/(1000*g)
mp,damp,907,0.033/df

/COM - Material 908, Soil
mp,ex,908,20972
mp,nuxy,908,0.19
mp,dens,908,110/(1000*g)
mp,damp,908,0.025/df

/COM - Material 909, Soil
mp,ex,909,23447
mp,nuxy,909,0.19
mp,dens,909,110/(1000*g)
mp,damp,909,0.026/df

/COM - Material 910, Soil
mp,ex,910,23138
mp,nuxy,910,0.19
mp,dens,910,110/(1000*g)
mp,damp,910,0.027/df

/COM - Material 911, Soil
mp,ex,911,22753
mp,nuxy,911,0.19
mp,dens,911,110/(1000*g)
mp,damp,911,0.029/df

/COM - Material 912, Soil
mp,ex,912,22069
mp,nuxy,912,0.19
mp,dens,912,110/(1000*g)
mp,damp,912,0.033/df

/COM - Material 913, Soil
mp,ex,913,25780
mp,nuxy,913,0.19
mp,dens,913,110/(1000*g)
mp,damp,913,0.025/df

/COM - Material 914, Soil
mp,ex,914,25333
mp,nuxy,914,0.19
mp,dens,914,110/(1000*g)
mp,damp,914,0.027/df

/COM - Material 915, Soil
mp,ex,915,35501
mp,nuxy,915,0.28
mp,dens,915,120/(1000*g)
mp,damp,915,0.022/df

/COM - Material 916, Soil
mp,ex,916,39465
mp,nuxy,916,0.28
mp,dens,916,120/(1000*g)
mp,damp,916,0.021/df

/COM - Material 917, Soil
mp,ex,917,38565
mp,nuxy,917,0.28
mp,dens,917,120/(1000*g)
mp,damp,917,0.023/df

/COM - Material 918, Soil
mp,ex,918,37715
mp,nuxy,918,0.28
mp,dens,918,120/(1000*g)
mp,damp,918,0.025/df

/COM - Material 919, Soil
mp,ex,919,41496
mp,nuxy,919,0.28
```

```
mp,dens,919,120/(1000*g)
mp,damp,919,0.024/df
```

Slave.txt

```
/COM - Develop Slave Boundarz Conditions
/COM - 20 Layer Model

csys,1                          ! Set
Cylindrical Coordinates
*get,CPMAX,CP,0,num,max                 !
Counter for Couple Set Numbers
nsel,s,loc,x,soil_radius        ! Select
soil exterior surface nodes
csys,0                          ! Set
Cartesian Coordinates
nrotat,all                      ! Rotate
into Global Cartesian Coordinates
nsel,s,loc,z,soilz(deepsoil)  ! Select
all Base nodes
nrotat,all                      ! Rotate
into Global Cartesian Coordinates

csys,1                          ! Set
Cylindrical Coordinates
*do,i,1,deepsoil-1,1            ! Cycle
through each soil layer
nsel,s,loc,x,soil_radius        ! Select
all exterior nodes
nsel,r,loc,z,soilz(i)           ! Select
nodes by layer
cp,3*i-2+cpmax,ux,all           ! Couple in
X
cp,3*i+cpmax,uz,all             ! Couple in
Z
nsel,u,loc,y,0                  ! Unselect
nodes on Symmetry Plane
nsel,u,loc,y,180
cp,3*i-1+cpmax,uy,all           ! Couple in
Y
*enddo

nsel,s,loc,z,soilz(deepsoil)  ! Select
base nodes
nsel,u,loc,z,320-.1,320+.1
cp,deepsoil*10+1+cpmax,ux,all ! Couple in
X
cp,deepsoil*10+2+cpmax,uy,all ! Couple in
Y
cp,deepsoil*10+3+cpmax,uz,all ! Couple in
Z

allsel
```

stress-compb.txt

```
/post26

*do,z,2,200
VARDEL,z
*enddo
csys,1
*do,i,1,20
angley=-arcsize*(i-1)
*do,j,2,42
cmsel,s,primary-tank
nsle
nsel,r,loc,y,angley,angley-arcsize
nsel,r,loc,x,ptx(j),ptx(j+1)
nsel,r,loc,z,ptz(j)+.1,ptz(j+1)-.1
esln,r,1
*get,emax,elem,,num,max
esol,(1+j),(emax),,s,x,sx%(emax)%-b
esol,(44+j),(emax),,s,y,sy%(emax)%-b
esol,(87+j),(emax),,s,int,sint%(emax)%-b
esol,(130+j),(emax),,s,xy,sxy%(emax)%-b
*enddo

LINES,2150
extrem
/OUT,Stress-pt_%(9*i)%max-b,OUT
extrem,2,200
/OUT

/OUT,Stress-pt_%(9*i)%th-b,OUT
*do,k,2,42
PRVAR,1+k,44+k,87+k,130+k
*enddo
/OUT

*enddo
```

stress-compm.txt

```
/post26
numvar,200
*do,z,2,200
VARDEL,z
*enddo
csys,1
*do,i,1,20
angley=-arcsize*(i-1)
*do,j,2,42
cmsel,s,primary-tank
nsle
nsel,r,loc,y,angley,angley-arcsize
nsel,r,loc,x,ptx(j),ptx(j+1)
nsel,r,loc,z,ptz(j)+.1,ptz(j+1)-.1
esln,r,1
*get,emax,elem,,num,max
esol,(1+j),(emax),,s,x,sx%(emax)%-m
esol,(44+j),(emax),,s,y,sy%(emax)%-m
esol,(87+j),(emax),,s,int,sint%(emax)%-m
esol,(130+j),(emax),,s,xy,sxy%(emax)%-m
*enddo

LINES,2150
extrem
/OUT,Stress-pt_%(9*i)%max-m,OUT
extrem,2,200
/OUT

/OUT,Stress-pt_%(9*i)%th-m,OUT
*do,k,2,42
PRVAR,1+k,44+k,87+k,130+k
*enddo
/OUT

*enddo
```

stress-compt.txt

```
/post26
```

```
*do,z,2,200
VARDEL,z
*enddo
csys,1
*do,i,1,20
angley=-arcsize*(i-1)
*do,j,2,42
cmsel,s,primary-tank
nsle
nsel,r,loc,y,angley,angley-arcsize
nsel,r,loc,x,ptx(j),ptx(j+1)
nsel,r,loc,z,ptz(j)+.1,ptz(j+1)-.1
esln,r,1
*get,emax,elem,,num,max
esol,(1+j),(emax),,s,x,sx%(emax)%-t
esol,(43+j),(emax),,s,y,sy%(emax)%-t
esol,(87+j),(emax),,s,int,sint%(emax)%-t
esol,(130+j),(emax),,s,xy,sxy%(emax)%-t
*enddo

LINES,2150
extrem
/OUT,Stress-pt_%(9*i)%max-t,OUT
extrem,2,200
/OUT

/OUT,Stress-pt_%(9*i)%th-t,OUT
*do,k,2,42
PRVAR,1+k,44+k,87+k,130+k
*enddo
/OUT

*enddo
```

Stress-Primary.txt

```
! extract primary tank stress components
at the top, middel and bottom surface of
the shell
/post26
numvar,200
shell,top
/input,stress-compt,txt

shell,mid
/input,stress-compm,txt

shell,bot
/input,stress-compb,txt
```

Tank-Coordinates-AP.txt

```
/COM - Definition of KeyPoints for
Primary tank

ct_kps=34      ! Total number of Concrete
tank Coordinate pairs
pt_kps=44      ! Total number of Primary
Tank Coordinate pairs
bm_kp=22       ! Coordinate pair at
bottom on concrete tank wall
tw=9           ! Rings in commmon for
insulating concrete
arcsize=9      ! Control for meshing,
section angle
Midsize=5      ! Control for meshing,
center areas
z_off=57.31    ! Vertical offset for tank
(bottom of primary tank is Z=0 for
coordinates)
C_Floor=-4


*dim,ctx,,ct_kps      ! Concrete Tank
Keypoint X Coordinates
*dim,ctz,,ct_kps      ! Concrete Tank
Keypoint Z Coordinates
*dim,ptx,,pt_kps      ! Primary Tank
Keypoint X Coordinates
*dim,ptz,,pt_kps      ! Primary Tank
Keypoint Z Coordinates

/COM - Define Horizontal Keypoint
Locations
ctx(1)=0
ctx(2)=45/12
ctx(3)=90.4/12
ctx(4)=120.72/12
ctx(5)=152.9/12
ctx(6)=211.4/12
ctx(7)=239.1/12
ctx(8)=306.63/12
ctx(9)=335.6/12
ctx(10)=393.7/12
ctx(11)=428.7/12
ctx(12)=469.9/12
ctx(13)=486.9/12
ctx(14)=489/12
ctx(15)=489/12
ctx(16)=489/12
ctx(17)=489/12
ctx(18)=489/12
ctx(19)=489/12
ctx(20)=489/12
ctx(21)=489/12
ctx(22)=489/12
ctx(23)=531/12
ctx(24)=489/12
ctx(25)=438/12
ctx(26)=423/12
ctx(27)=400/12
ctx(28)=340/12
ctx(29)=280/12
ctx(30)=220/12
ctx(31)=160/12
ctx(32)=100/12
ctx(33)=36/12
ctx(34)=0

/COM - Define Vertical Keypoint Locations

ctz(1)=576.8/12-z_off
ctz(2)=576/12-z_off
ctz(3)=573.8/12-z_off
ctz(4)=571.21/12-z_off
ctz(5)=567.7/12-z_off
ctz(6)=558.7/12-z_off
ctz(7)=553.2/12-z_off
ctz(8)=535.68/12-z_off
ctz(9)=526.2/12-z_off
ctz(10)=502.5/12-z_off
ctz(11)=484.2/12-z_off
ctz(12)=455.4/12-z_off
ctz(13)=415.1/12-z_off
ctz(14)=382.1/12-z_off
ctz(15)=335/12-z_off
ctz(16)=281/12-z_off
```

```
ctz(17)=236.5/12-z_off
ctz(18)=186.8/12-z_off
ctz(19)=145.5/12-z_off
ctz(20)=70/12-z_off
ctz(21)=(c_Floor+24)/12-z_off
ctz(22)=C_Floor/12-z_off
ctz(23)=C_Floor/12-z_off
ctz(24)=C_Floor/12-z_off
ctz(25)=C_Floor/12-z_off
ctz(26)=C_Floor/12-z_off
ctz(27)=C_Floor/12-z_off
ctz(28)=C_Floor/12-z_off
ctz(29)=C_Floor/12-z_off
ctz(30)=C_Floor/12-z_off
ctz(31)=C_Floor/12-z_off
ctz(32)=C_Floor/12-z_off
ctz(33)=C_Floor/12-z_off
ctz(34)=C_Floor/12-z_off

ptx(1)=0
ptx(2)=44.73689/12
ptx(3)=89.86533/12
ptx(4)=119.99721/12
ptx(5)=151.96854/12
ptx(6)=210.05344/12
ptx(7)=237.53366/12
ptx(8)=304.42488/12
ptx(9)=333.05132/12
ptx(10)=390.22141/12
ptx(11)=422.26434/12
ptx(12)=432/12
ptx(13)=444.36/12
ptx(14)=448.66/12
ptx(15)=450/12
ptx(16)=450/12
ptx(17)=450/12
ptx(18)=450/12
ptx(19)=450/12
ptx(20)=450/12
ptx(21)=450/12
ptx(22)=450/12
ptx(23)=450/12
ptx(24)=450/12
ptx(25)=450/12
ptx(26)=450/12
ptx(27)=450/12
ptx(28)=450/12
ptx(29)=450/12
ptx(30)=450/12
ptx(31)=450/12
ptx(32)=450/12
ptx(33)=450/12
ptx(34)=446.49/12
ptx(35)=438/12
ptx(36)=423/12
ptx(37)=400/12
ptx(38)=340/12
ptx(39)=280/12
ptx(40)=220/12
ptx(41)=160/12
ptx(42)=100/12
ptx(43)=36/12
ptx(44)=0

ptz(1)=569.30000/12-z_off
ptz(2)=568.50462/12-z_off
ptz(3)=566.31908/12-z_off
ptz(4)=563.74491/12-z_off
ptz(5)=560.25807/12-z_off
ptz(6)=551.32187/12-z_off
ptz(7)=545.86539/12-z_off
ptz(8)=528.51150/12-z_off
Ptz(9)=519.14633/12-z_off
ptz(10)=495.85550/12-z_off
ptz(11)=474.92388/12-z_off
ptz(12)=468/12-z_off
ptz(13)=456.7/12-z_off
ptz(14)=445.4/12-z_off
ptz(15)=432.3125/12-z_off
ptz(16)=410.125/12-z_off
ptz(17)=386.125/12-z_off
ptz(18)=362.125/12-z_off
ptz(19)=337.875/12-z_off
ptz(20)=314.775/12-z_off
ptz(21)=291.675/12-z_off
ptz(22)=268.575/12-z_off
ptz(23)=245.375/12-z_off
ptz(24)=222.275/12-z_off
ptz(25)=199.175/12-z_off
ptz(26)=176.075/12-z_off
ptz(27)=152.875/12-z_off
ptz(28)=131.275/12-z_off
ptz(29)=109.675/12-z_off
ptz(30)=88.075/12-z_off
ptz(31)=66.475/12-z_off
ptz(32)=45/12-z_off
ptz(33)=20/12-z_off
ptz(34)=11.51/12-z_off
ptz(35)=8/12-z_off
ptz(36)=8/12-z_off
ptz(37)=8/12-z_off
ptz(38)=8/12-z_off
ptz(39)=8/12-z_off
ptz(40)=8/12-z_off
ptz(41)=8/12-z_off
ptz(42)=8/12-z_off
ptz(43)=8/12-z_off
ptz(44)=8/12-z_off
```

Tank-Mesh1.txt

```
et,1,shell143         ! SHELL143
Elements for Concrete Tank
keyopt,1,3,2
keyopt,1,5,1


csys,1                 ! Cylindrical
Coordinates
/COM - Create KeyPoints for concrete tank
*do,i,1,ct_kps,1
k,i,ctx(i),0,ctz(i)
*enddo

/COM - Create lines from top of tank to
bottom of wall
*do,i,1,bm_kp-1,1
l,i,i+1
*enddo

/COM - Create lines from edge of
foundation to center
/COM - Wall and Foundation do not have
common lines
*do,i,bm_kp+1,ct_kps-1,1
l,i,i+1
*enddo
```

```
/COM - Create Areas for tank dome and
walls
lsel,s,line,,1,bm_kp-1
arotat,all,,,,,,1,ct_kps,180,2

/COM - Create areas for tank
foundation/floor
lsel,s,line,,bm_kp,ct_kps-2
arotat,all,,,,,,1,ct_kps,180,2

/COM - Assign Material and Real
Properties to areas
csys,1
*do,i,1,bm_kp-1,1
asel,s,loc,x,ctx(i),ctx(i+1)
asel,r,loc,z,ctz(i),ctz(i+1)
aatt,i,i,1
*enddo

asel,s,area,,1,2*(bm_kp-1)
CM,ctank-u,area

*do,i,bm_kp,ct_kps-2,1
asel,s,area,,bm_kp-1+i
asel,a,area,,ct_kps-2+i
aatt,i,i,1
*enddo

/COM - Create Elements
/COM - Elements at dome apex
esize,7                          ! Define
element maximum size
asel,s,loc,x,ctx(1),ctx(2)       ! Select
area at top
asel,r,loc,z,ctz(1),ctz(2)
lsla                             ! Select
lines from areas
lsel,r,loc,x,ctx(2)              ! Select
line at a radius of CTX(2)
lesize,all,,arcsize              ! Divide
line to match tank slices
lsla
lsel,u,loc,x,ctx(2)              ! Select
only interior lines
lesize,all,,,midsize             ! Define
element resolution
amesh,all                        ! Mesh area

/COM - Elements in dome and wall
*do,i,2,bm_kp-1,1
asel,s,loc,x,ctx(i),ctx(i+1)
asel,r,loc,z,ctz(i),ctz(i+1)
lsla
lsel,s,loc,x,ctx(i),ctx(i+1)
lsel,r,loc,z,ctz(i),ctz(i+1)
lesize,all,,arcsize
amesh,all
*enddo
cm,conc-dome_wall-n,node
cm,conc-dome_wall-e,elem

esel,none
nsel,none
*do,i,bm_kp+1,ct_kps-2,1
asel,s,area,,bm_kp-2+i
asel,a,area,,ct_kps-3+i
lsla
lsel,s,loc,x,ctx(i),ctx(i+1)
lsel,r,loc,z,ctz(i),ctz(i+1)
lesize,all,,arcsize
amesh,all
*enddo

/COM - Elements at floor center
asel,s,loc,x,ctx(ct_kps-1),ctx(ct_kps)
lsla
lsel,r,loc,x,ctx(ct_kps-1)
lesize,all,,arcsize
lsla
lsel,u,loc,x,ctx(ct_kps-1)
lesize,all,,,midsize
amesh,all
cm,conc-slab,node
cm,conc-floor-e,elem
allsel
cm,conc-tank,elem
cm,conc-tank-a,area

/COM - Create Component for Concrete
Wall/Floor Interface nodes
nsel,s,loc,z,ctz(bm_kp)
nsel,r,loc,x,ctx(bm_kp)
cm,Wall-int,node

allsel
*get,KMAXct,KP,0,num,max       ! Get
Maximum Keypoint Number
*get,LMAXct,LINE,0,num,max     ! Get
Maximum Line Number
*get,AMAXct,AREA,0,num,max     ! Get
Maximum Area Number
```

Tank-Props-Rigid.txt

```
/COM - Tank Concrete Properties

/COM - Material Definitions
! EX - Youngs Modulus, (k/ft2)
! NUXY - Poisons ratio
! DENS - Density (1000*slugs/ft3)
! DAMP - Beta (Stiffness) Damping

/COM - Material 1, Tank Concrete
mp,ex,1,626754*1e4
mp,nuxy,1,0.18
mp,dens,1,148/(1000*g)
mp,damp,1,0.07/df

/COM - Material 2, Tank Concrete
mp,ex,2,620114*1e4
mp,nuxy,2,0.18
mp,dens,2,149/(1000*g)
mp,damp,2,0.07/df

/COM - Material 3, Tank Concrete
mp,ex,3,616594*1e4
mp,nuxy,3,0.18
mp,dens,3,149/(1000*g)
mp,damp,3,0.07/df

/COM - Material 4, Tank Concrete
mp,ex,4,610922*1e4
mp,nuxy,4,0.18
mp,dens,4,149/(1000*g)
mp,damp,4,0.07/df

/COM - Material  5, Tank Concrete
mp,ex, 5,612305*1e4
```

```
mp,nuxy, 5,0.18
mp,dens, 5,148/(1000*g)
mp,damp,5,0.07/df

/COM - Material 6, Tank Concrete
mp,ex,6,607093*1e4
mp,nuxy,6,0.18
mp,dens,6,148/(1000*g)
mp,damp,6,0.07/df

/COM - Material 7, Tank Concrete
mp,ex,7,639237*1e4
mp,nuxy,7,0.18
mp,dens,7,146/(1000*g)
mp,damp,7,0.07/df

/COM - Material 8, Tank Concrete
mp,ex,8,634338*1e4
mp,nuxy,8,0.18
mp,dens,8,147/(1000*g)
mp,damp,8,0.07/df

/COM - Material 9, Tank Concrete
mp,ex,9,628756*1e4
mp,nuxy,9,0.18
mp,dens,9,147/(1000*g)
mp,damp,9,0.07/df

/COM - Material,10, Tank Concrete
mp,ex,10,193677*1e4
mp,nuxy,10,0.18
mp,dens,10,165/(1000*g)
mp,damp,10,0.07/df

/COM - Material,11, Tank Concrete
mp,ex,11,575959*1e4
mp,nuxy,11,0.18
mp,dens,11,144/(1000*g)
mp,damp,11,0.07/df

/COM - Material,12, Tank Concrete
mp,ex,12,202953*1e4
mp,nuxy,12,0.18
mp,dens,12,159/(1000*g)
mp,damp,12,0.07/df

/COM - Material,13, Tank Concrete
mp,ex,13,157426*1e4
mp,nuxy,13,0.18
mp,dens,13,176/(1000*g)
mp,damp,13,0.07/df

/COM - Material,14, Tank Concrete
mp,ex,14,153784*1e4
mp,nuxy,14,0.18
mp,dens,14,193/(1000*g)
mp,damp,14,0.07/df

/COM - Material,15, Tank Concrete
mp,ex,15,136651*1e4
mp,nuxy,15,0.18
mp,dens,15,200/(1000*g)
mp,damp,15,0.07/df

/COM - Material,16, Tank Concrete
mp,ex,16,136651*1e4
mp,nuxy,16,0.18
mp,dens,16,200/(1000*g)
mp,damp,16,0.07/df

/COM - Material,17, Tank Concrete
mp,ex,17,138084*1e4
mp,nuxy,17,0.18
mp,dens,17,181/(1000*g)
mp,damp,17,0.07/df

/COM - Material,18, Tank Concrete
mp,ex,18,123378*1e4
mp,nuxy,18,0.18
mp,dens,18,209/(1000*g)
mp,damp,18,0.07/df

/COM - Material,19, Tank Concrete
mp,ex,19,124633*1e4
mp,nuxy,19,0.18
mp,dens,19,190/(1000*g)
mp,damp,19,0.07/df

/COM - Material,20, Tank Concrete
mp,ex,20,124388*1e4
mp,nuxy,20,0.18
mp,dens,20,210/(1000*g)
mp,damp,20,0.07/df

/COM - Material,21, Tank Concrete
mp,ex,21,548683*1e4
mp,nuxy,21,0.18
mp,dens,21,166/(1000*g)
mp,damp,21,0.07/df

/COM - Material,22, Tank Concrete
mp,ex,22,154870*1e4
mp,nuxy,22,0.18
mp,dens,22,184/(1000*g)
mp,damp,22,0.07/df

/COM - Material,23, Tank Concrete
mp,ex,23,514287*1e4
mp,nuxy,23,0.18
mp,dens,23,172/(1000*g)
mp,damp,23,0.060/df

/COM - Material,24, Tank Concrete
mp,ex,24,164113*1e4
mp,nuxy,24,0.18
mp,dens,24,288/(1000*g)
mp,damp,24,0.07/df

/COM - Material,25, Tank Concrete
mp,ex,25,522946*1e4
mp,nuxy,25,0.18
mp,dens,25,201/(1000*g)
mp,damp,25,0.07/df

/COM - Material,26, Tank Concrete
mp,ex,26,194254*1e4
mp,nuxy,26,0.18
mp,dens,26,322/(1000*g)
mp,damp,26,0.07/df

/COM - Material,27, Tank Concrete
mp,ex,27,199783*1e4
mp,nuxy,27,0.18
mp,dens,27,281/(1000*g)
mp,damp,27,0.07/df

/COM - Material,28, Tank Concrete
mp,ex,28,162553*1e4
mp,nuxy,28,0.18
mp,dens,28,299/(1000*g)
```

```
mp,damp,28,0.07/df

/COM - Material,29, Tank Concrete
mp,ex,29,200531*1e4
mp,nuxy,29,0.18
mp,dens,29,3894/(1000*g)
mp,damp,29,0.07/df

/COM - Material,30, Tank Concrete
mp,ex,30,167538*1e4
mp,nuxy,30,0.18
mp,dens,30,411/(1000*g)
mp,damp,30,0.07/df

/COM - Material,31, Tank Concrete
mp,ex,31,731952*1e4
mp,nuxy,31,0.18
mp,dens,31,150/(1000*g)
mp,damp,31,0.07/df

/COM - Material,32, Tank Concrete
mp,ex,32,731952*1e4
mp,nuxy,32,0.18
mp,dens,32,150/(1000*g)
mp,damp,32,0.07/df

!/COM - Material,33, Tank Concrete
!mp,ex,33,731952*1e4
!mp,nuxy,33,0.18
!mp,dens,33,150/(1000*g)
!mp,damp,33,0.07/df

!/COM - Material,34, Tank Concrete
!mp,ex,34,731952*1e4
!mp,nuxy,34,0.18
!mp,dens,34,150/(1000*g)
!mp,damp,34,0.07/df

!/COM - Material,35, Tank Concrete
!mp,ex,35,731952*1e4
!mp,nuxy,35,0.18
!mp,dens,35,150/(1000*g)
!mp,damp,35,0.07/df

!/COM - Material,36, Tank Concrete
!mp,ex,36,731952*1e4
!mp,nuxy,36,0.18
!mp,dens,36,150/(1000*g)
!mp,damp,36,0.07/df

!/COM - Material,37, Tank Concrete
!mp,ex,37,731952*1e4
!mp,nuxy,37,0.18
!mp,dens,37,150/(1000*g)
!mp,damp,37,0.07/df

/COM - Concrete Real Values, t in ft
r,1,1.26                     ! 15 in
r,2,1.26                     ! 15 in
r,3,1.26                     ! 15 in
r,4,1.26                     ! 15 in
r,5,1.27                     ! 15 in
r,6,1.26                     ! 15 in
r,7,1.28                     ! 15 in
r,8,1.28                     ! 15 in
r,9,1.73                     ! 15 in
r,10,1.73,1.73,2.23,2.23     ! 15 in to
r,11,2.23,2.22,3.15,3.15     !
r,12,3.15,3.15,1.50,1.50     !
r,13,1.50,1.50,1.28,1.28     !
r,14,1.17                    ! 18 in
r,15,1.13                    ! 18 in
r,16,1.13                    ! 18 in
r,17,1.24                    ! 18 in
r,18,1.07                    ! 18 in
r,19,1.18                    ! 18 in
r,20,1.07                    ! 18 in
r,21,1.97                    ! 18 in
r,22,1.68                    ! 18 in
r,23,1.43                    ! 18 in
r,24,1.43,1.43,0.51,0.51     !
r,25,0.51,0.51,0.66,0.66     !
r,26,0.66,0.66,0.41,0.41     !
r,27,0.58                    ! 8 in
r,28,0.55                    ! 8 in
r,29,0.42                    ! 8 in
r,30,0.40                    ! 8 in
r,31,0.40,0.40,1.02,1.02     ! 8 in to
r,32,1.02                    !
!r,34,1
!r,35,1
!r,36,1
!r,37,1
!r,39,1


/COM - Material,50, Insulating Concrete
mp,ex,50,23760
mp,nuxy,50,0.15
mp,dens,50,50/(1000*g)
mp,damp,50,0.07/df
```

Waste-Reaction.txt

```
/post1
*dim,REACTX,,2149
*dim,REACTZ,,2149

cmsel,s,waste
cmsel,a,waste-surf
nsle
*do,i,1,2149
set,i
fsum,,cont
*get,REACTX(i),FSUM,0,ITEM,FX
*get,reactz(i),FSUM,0,ITEM,FZ
*enddo
/out,Waste-Reaction-460-SD3,out

*vwrite
('Total Waste Forces')
*vwrite
('     Fx        FZ')
*vwrite,reactx(1),reactz(1)
(f10.1,f10.1)
/out
```

Waste-solid-AP-S.txt

```
et,3,solid45    ! Solid45 Elements
Wastet=12       ! Primary tank coordinate
for top of waste (460 in for AP Tanks)
Wasteb=35       ! Primary tank coordinate
for bottom of waste

mp,ex,201,2.592                     !
Bulk Modulus = 300,000 psi
```

```
mp,ey,201,2.592
mp,ez,201,2.592
mp,prxy,201,0.49999
mp,pryz,201,0.49999
mp,prxz,201,0.49999
mp,gxy,201,0.464
mp,gyz,201,0.464
mp,gxz,201,0.464
mp,dens,201,1.83*62.4/(1000*g)        !
Waste Density
mp,damp,201,0.001

ksel,u,kp,,all                ! Clear
active Keypoints
asel,u,area,,all              ! Clear
active Areas
vsel,u,volu,,all              ! Clear
active Volumes
ksel,s,kp,,1,ct_kps,ct_kps-1  ! Activate
Keypoints for center of rotation

/COM - Create KeyPoints for waste in tank
*do,i,0,Wasteb-Wastet,1
                        ! Cycle on
vertical Keypoints
*do,j,0,tw-1
                ! Cycle on horizontal
Keypoints
k,kmaxl+i*(tw+1)+j+1,ptx(pt_kps-
j),0,ptz(i+Wastet)
*enddo
k,kmaxl+i*(tw+1)+j+2,ptx(i+Wastet),0,ptz(
i+Wastet)       !
*enddo


/COM - Create Areas for waste in tank
*do,i,0,Wasteb-Wastet-1,1
*do,j,0,tw-1
a,kmaxl+i*(tw+1)+j+1,kmaxl+i*(tw+1)+j+2,k
maxl+(i+1)*(tw+1)+j+2,kmaxl+(i+1)*(tw+1)+
j+1
*enddo
*enddo



/COM - Create Volumes for Waste
vrotat,all,,,,,,1,ct_kps,180,2

/COM - Assign attributes
vatt,201,,3

wastevols=(tw)*(wasteb-wastet)
/COM - Elements in waste
*do,i,0,Wasteb-Wastet-1,1
*do,j,1,tw-1,1
vsel,s,volu,,vmaxl+i*tw+j+1
vsel,a,volu,,vmaxl+wastevols+i*tw+j+1
aslv
lsla
lsel,r,loc,x,ptx(pt_kps-j),ptx(i+Wastet)
lesize,all,,arcsize
vmesh,all
*enddo
*enddo

allsel
/COM - Mesh center column to match
primary tank center
asel,s,loc,x,ptx(pt_kps-1),ptx(pt_kps)
asel,r,loc,z,ptz(wastet)
asel,r,loc,y,0,-90
cm,a3a,area
cmsel,s,a3a
cmsel,a,a1a
mshcopy,2,a1a,a3a,,,,ptz(wastet)-
ptz(wasteb)
allsel
asel,s,loc,x,ptx(pt_kps-1),ptx(pt_kps)
asel,r,loc,z,ptz(wastet)
cmsel,u,a3a
cm,a3b,area
cmsel,a,a1b
mshcopy,2,a1b,a3b,,,,ptz(wastet)-
ptz(wasteb)
vsel,s,volu,,vmaxl+1,vmaxl+2*wastevols+1,
tw
vsweep,all,,all
cmsel,u,a1b
cmsel,a,a3a
aclear,all


esel,s,type,,3
cm,waste,elem
nsle
cm,waste-n,node


/COM - Couple waste to primary tank
csys,1
allsel


et,44,targe170
et,45,conta173
et,46,conta173
r,800,,,400/1.5
r,801,,,400/1.5
r,802,,,400/1.5
r,803,,,400/1.5
r,804,,,380/1.5
r,805,,,360/1.5
r,806,,,340/1.5
r,807,,,320/1.5
r,808,,,300/1.5
r,809,,,280/1.5

r,810,,,400/1.5
r,811,,,400/1.5
r,812,,,400/1.5
r,813,,,400/1.5
r,814,,,380/1.5
r,815,,,360/1.5
r,816,,,340/1.5
r,817,,,320/1.5
r,818,,,300/1.5
r,819,,,280/1.5

r,820,,,400/1.5
r,821,,,400/1.5
r,822,,,400/1.5
r,823,,,400/1.5
r,824,,,380/1.5
r,825,,,360/1.5
r,826,,,340/1.5
r,827,,,320/1.5
r,828,,,300/1.5
r,829,,,280/1.5
```

```
r,830,,,400/1.5
r,831,,,400/1.5
r,832,,,400/1.5
r,833,,,400/1.5
r,834,,,380/1.5
r,835,,,360/1.5
r,836,,,340/1.5
r,837,,,320/1.5
r,838,,,300/1.5
r,839,,,280/1.5

keyopt,45,12,4
keyopt,46,12,4


! - Third Facet of Haunch
cmsel,s,primary-tank
nsle
nsel,r,loc,z,ptz(8),ptz(16)
nsel,r,loc,x,ptx(8),ptx(16)
esln,r,1
type,44
real,809
esurf
real,819
esurf
real,829
esurf
real,839
esurf
cmsel,s,waste
nsle
nsel,r,loc,z,ptz(12),ptz(13)
nsel,r,loc,x,ptx(12),ptx(13)
nsel,r,loc,y,0,-45
esln,r
real,809
type,46
esurf

cmsel,s,waste
nsle
nsel,r,loc,z,ptz(12),ptz(13)
nsel,r,loc,x,ptx(12),ptx(13)
nsel,r,loc,y,-45,-90
esln,r
real,819
type,46
esurf

cmsel,s,waste
nsle
nsel,r,loc,z,ptz(12),ptz(13)
nsel,r,loc,x,ptx(12),ptx(13)
nsel,r,loc,y,-90,-135
esln,r
real,829
type,46
esurf

cmsel,s,waste
nsle
nsel,r,loc,z,ptz(12),ptz(13)
nsel,r,loc,x,ptx(12),ptx(13)
nsel,r,loc,y,-135,-180
esln,r
real,839
type,46
esurf

! - Second Facet of Haunch
cmsel,s,primary-tank
nsle
nsel,r,loc,z,ptz(9),ptz(17)
nsel,r,loc,x,ptx(9),ptx(17)
esln,r,1
type,44
real,808
esurf
real,818
esurf
real,828
esurf
real,838
esurf
cmsel,s,waste
nsle
nsel,r,loc,z,ptz(13),ptz(14)
nsel,r,loc,x,ptx(13),ptx(14)
nsel,r,loc,y,0,-45
esln,r
real,808
type,46
esurf

cmsel,s,waste
nsle
nsel,r,loc,z,ptz(13),ptz(14)
nsel,r,loc,x,ptx(13),ptx(14)
nsel,r,loc,y,-45,-90
esln,r
real,818
type,46
esurf

cmsel,s,waste
nsle
nsel,r,loc,z,ptz(13),ptz(14)
nsel,r,loc,x,ptx(13),ptx(14)
nsel,r,loc,y,-90,-135
esln,r
real,828
type,46
esurf

cmsel,s,waste
nsle
nsel,r,loc,z,ptz(13),ptz(14)
nsel,r,loc,x,ptx(13),ptx(14)
nsel,r,loc,y,-135,-180
esln,r
real,838
type,46
esurf

! - First Facet of Haunch
cmsel,s,primary-tank
nsle
nsel,r,loc,z,ptz(10),ptz(18)
nsel,r,loc,x,ptx(10),ptx(18)
esln,r,1
type,44
real,807
esurf
real,817
esurf
real,827
esurf
real,837
```

```
esurf
cmsel,s,waste
nsle
nsel,r,loc,z,ptz(14),ptz(15)
nsel,r,loc,x,ptx(14),ptx(15)
nsel,r,loc,y,0,-45
esln,r
real,807
type,46
esurf

cmsel,s,waste
nsle
nsel,r,loc,z,ptz(14),ptz(15)
nsel,r,loc,x,ptx(14),ptx(15)
nsel,r,loc,y,-45,-90
esln,r
real,817
type,46
esurf

cmsel,s,waste
nsle
nsel,r,loc,z,ptz(14),ptz(15)
nsel,r,loc,x,ptx(14),ptx(15)
nsel,r,loc,y,-90,-135
esln,r
real,827
type,46
esurf

cmsel,s,waste
nsle
nsel,r,loc,z,ptz(14),ptz(15)
nsel,r,loc,x,ptx(14),ptx(15)
nsel,r,loc,y,-135,-180
esln,r
real,837
type,46
esurf

! - First Layer below Haunch
cmsel,s,primary-tank
nsle
nsel,r,loc,z,ptz(11),ptz(19)
nsel,r,loc,x,ptx(11),ptx(19)
esln,r,1
type,44
real,806
esurf
real,816
esurf
real,826
esurf
real,836
esurf
cmsel,s,waste
nsle
nsel,r,loc,z,ptz(15),ptz(16)
nsel,r,loc,x,ptx(15),ptx(16)
nsel,r,loc,y,0,-45
esln,r
real,806
type,46
esurf

cmsel,s,waste
nsle
nsel,r,loc,z,ptz(15),ptz(16)
nsel,r,loc,x,ptx(15),ptx(16)
nsel,r,loc,y,-45,-90
esln,r
real,816
type,46
esurf

cmsel,s,waste
nsle
nsel,r,loc,z,ptz(15),ptz(16)
nsel,r,loc,x,ptx(15),ptx(16)
nsel,r,loc,y,-90,-135
esln,r
real,826
type,46
esurf

cmsel,s,waste
nsle
nsel,r,loc,z,ptz(15),ptz(16)
nsel,r,loc,x,ptx(15),ptx(16)
nsel,r,loc,y,-135,-180
esln,r
real,836
type,46
esurf

! - First Facet of Haunch
cmsel,s,primary-tank
nsle
nsel,r,loc,z,ptz(12),ptz(20)
nsel,r,loc,x,ptx(12),ptx(20)
esln,r,1
type,44
real,805
esurf
real,815
esurf
real,825
esurf
real,835
esurf
cmsel,s,waste
nsle
nsel,r,loc,z,ptz(16),ptz(17)
nsel,r,loc,x,ptx(16),ptx(17)
nsel,r,loc,y,0,-45
esln,r
real,805
type,46
esurf

cmsel,s,waste
nsle
nsel,r,loc,z,ptz(16),ptz(17)
nsel,r,loc,x,ptx(16),ptx(17)
nsel,r,loc,y,-45,-90
esln,r
real,815
type,46
esurf

cmsel,s,waste
nsle
nsel,r,loc,z,ptz(16),ptz(17)
nsel,r,loc,x,ptx(16),ptx(17)
nsel,r,loc,y,-90,-135
esln,r
real,825
type,46
esurf
```

```
cmsel,s,waste
nsle
nsel,r,loc,z,ptz(16),ptz(17)
nsel,r,loc,x,ptx(16),ptx(17)
nsel,r,loc,y,-135,-180
esln,r
real,835
type,46
esurf

! - First Facet of Haunch
cmsel,s,primary-tank
nsle
nsel,r,loc,z,ptz(13),ptz(21)
nsel,r,loc,x,ptx(13),ptx(21)
esln,r,1
type,44
real,804
esurf
real,814
esurf
real,824
esurf
real,834
esurf
cmsel,s,waste
nsle
nsel,r,loc,z,ptz(17),ptz(18)
nsel,r,loc,x,ptx(17),ptx(18)
nsel,r,loc,y,0,-45
esln,r
real,804
type,46
esurf

cmsel,s,waste
nsle
nsel,r,loc,z,ptz(17),ptz(18)
nsel,r,loc,x,ptx(17),ptx(18)
nsel,r,loc,y,-45,-90
esln,r
real,814
type,46
esurf

cmsel,s,waste
nsle
nsel,r,loc,z,ptz(17),ptz(18)
nsel,r,loc,x,ptx(17),ptx(18)
nsel,r,loc,y,-90,-135
esln,r
real,824
type,46
esurf

cmsel,s,waste
nsle
nsel,r,loc,z,ptz(17),ptz(18)
nsel,r,loc,x,ptx(17),ptx(18)
nsel,r,loc,y,-135,-180
esln,r
real,834
type,46
esurf

cmsel,s,primary-tank
nsle
nsel,r,loc,z,ptz(15),ptz(33)
esln,r,1
nsle
type,44
real,803
esurf
real,813
esurf
real,823
esurf
real,833
esurf
cmsel,s,waste
nsle
nsel,r,loc,z,ptz(18),ptz(34)
nsel,r,loc,x,ptx(18)
nsel,r,loc,y,0,-45
esln,r
real,803
type,45
esurf

cmsel,s,waste
nsle
nsel,r,loc,z,ptz(18),ptz(34)
nsel,r,loc,x,ptx(18)
nsel,r,loc,y,-45,-90
esln,r
real,813
type,45
esurf

cmsel,s,waste
nsle
nsel,r,loc,z,ptz(18),ptz(34)
nsel,r,loc,x,ptx(18)
nsel,r,loc,y,-90,-135
esln,r
real,823
type,45
esurf

cmsel,s,waste
nsle
nsel,r,loc,z,ptz(18),ptz(34)
nsel,r,loc,x,ptx(18)
nsel,r,loc,y,-135,-180
esln,r
real,833
type,45
esurf

! - Second Facet of Knuckle
cmsel,s,primary-tank
nsle
nsel,r,loc,z,ptz(32),ptz(36)
nsel,r,loc,x,ptx(32),ptx(36)
esln,r,1
type,44
real,802
esurf
real,812
esurf
real,822
esurf
real,832
esurf
cmsel,s,waste
nsle
nsel,r,loc,z,ptz(33),ptz(34)
nsel,r,loc,x,ptx(33),ptx(34)
nsel,r,loc,y,0,-45
```

```
esln,r
real,802
type,46
esurf

cmsel,s,waste
nsle
nsel,r,loc,z,ptz(33),ptz(34)
nsel,r,loc,x,ptx(33),ptx(34)
nsel,r,loc,y,-45,-90
esln,r
real,812
type,46
esurf

cmsel,s,waste
nsle
nsel,r,loc,z,ptz(33),ptz(34)
nsel,r,loc,x,ptx(33),ptx(34)
nsel,r,loc,y,-90,-135
esln,r
real,822
type,46
esurf

cmsel,s,waste
nsle
nsel,r,loc,z,ptz(33),ptz(34)
nsel,r,loc,x,ptx(33),ptx(34)
nsel,r,loc,y,-135,-180
esln,r
real,832
type,46
esurf

! - First Facet of Knuckle
cmsel,s,primary-tank
nsle
nsel,r,loc,z,ptz(32),ptz(37)
nsel,r,loc,x,ptx(32),ptx(37)
esln,r,1
type,44
real,801
esurf
real,811
esurf
real,821
esurf
real,831
esurf
cmsel,s,waste
nsle
nsel,r,loc,z,ptz(34),ptz(35)
nsel,r,loc,x,ptx(34),ptx(35)
nsel,r,loc,y,0,-45
esln,r
real,801
type,46
esurf

cmsel,s,waste
nsle
nsel,r,loc,z,ptz(34),ptz(35)
nsel,r,loc,x,ptx(34),ptx(35)
nsel,r,loc,y,-45,-90
esln,r
real,811
type,46
esurf

cmsel,s,waste
nsle
nsel,r,loc,z,ptz(34),ptz(35)
nsel,r,loc,x,ptx(34),ptx(35)
nsel,r,loc,y,-90,-135
esln,r
real,821
type,46
esurf

cmsel,s,waste
nsle
nsel,r,loc,z,ptz(34),ptz(35)
nsel,r,loc,x,ptx(34),ptx(35)
nsel,r,loc,y,-135,-180
esln,r
real,831
type,46
esurf

! - Bottom of Waste
cmsel,s,primary-tank
nsle
nsel,r,loc,z,ptz(33),ptz(36)
esln,r,1
type,44
real,800
esurf
cmsel,s,waste
nsle
nsel,r,loc,z,ptz(36)
esln,r
type,45
esurf



esel,s,type,,45,46
cm,waste-surf,elem


!cmsel,s,waste-n
!nsel,r,loc,z,ptz(wastet+2),ptz(wastet)
!nsel,r,loc,x,ptx(36),ptx(21)
!esln,r,1
!emodif,mat,,202



!cmsel,s,waste
!nsle
!nsel,r,loc,z,ptz(wastet)

allsel
*get,KMAXw,KP,0,num,max
        ! Get maximum Keypoint number
*get,LMAXw,LINE,0,num,max            !
Get maximum Line number
*get,AMAXw,AREA,0,num,max            !
Get maximum Area number
*get,VMAXw,VOLU,0,num,max            !
Get maximum Volume number
```

Horizontal Excitation Only

Run-Tank.txt

```
/batch
! PNNL DST Seismic Analysis, Gravity
Inputs, Best Est Soil, Best Est Concrete
Properties, AP Primary Tank Geometry,
Dome Friction=0.0
!
fini
/clear
/filname,AP-460-Sub-Model-H,1
/config,nres,3000            ! Increase
allowable number of results to 3000
!/config,nproc,2                    !
Activate 2 processers for solution
/config,fsplit,1024          ! Split
binary file at 4.2GB
/prep7
g=32.2                       ! Gravity
(ft/sec)

DF=40                        ! Factor
for beta (stiffness) damping
ALPHA=0.4                    ! Alpha
damping

/out,tank-out,out
!/sys,"X:\07.00 - Quality Assurance\ANSYS
QA\usrcfg.bat" > QA.out
/out,QA,out,,append
/input,tank-coordinates-AP,txt       !
Run file defining tank coordinates
(concrete and primary)
/input,tank-props-Rigid,txt   ! Run file
defining fully cracked concrete
properties (PNNL Concrete Properties)
/input,tank-mesh1,txt         ! Develop
concrete tank
/input,primary-props-AP,txt   ! Run file
defining AP Primary tank properties
/input,primary,txt            ! Develop
Primary tank
/input,insulate,txt           ! Develop
insulating concrete model
/input,liner,txt              ! Develop
Liner model
/input,waste-solid-AP-S,txt   ! Develop
waste model
/input,bolts-friction,txt     ! Develop
J-Bolt model
/input,near-soil-1,txt        ! Develop
excavated soil model
/input,far-soil,txt           ! Develop
Far-Field soil model
/input,interface1,txt         ! Develop
Soil and Concrete Interfaces
/input,interface-gap1,txt     ! Develop
Primary Tank Interfaces
/input,slave,txt              ! Develop
slaved boundary conditions
/input,boundary,txt           ! Place
base and symmetry boundary conditions
/input,outer-spar,txt         ! Connect
soil model to symmetry plane
/input,live_load,txt          ! Apply
live load over a 10ft radius over dome
center
/input,fix-soil,txt
/out
ALLSEL

/out,Tank-th,out

save

!/input,solve-slosh-flex,txt
/input,solve-sub-horiz,txt             !
Run solution Phase!/input,post-sub,txt
/input,contact-waste-ap,txt
/input,waste-reaction,txt
/out
/exit
```

Solve-Sub-Horiz.txt

```
/prep7
master_node=1
massm_z=148414.59
d,master_node,all
allsel

cmsel,s,excav-soil
nsle
csys,0
nsel,r,loc,x,-ctx(6)-1,ctx(6)+1
nsel,r,loc,y,0,-ctx(6)-1
esln,r,1
mpchg,810,all

cmsel,s,excav-soil
nsle
csys,1
nsel,r,loc,x,ctx(11)-1,ctx(13)+1
nsel,r,loc,z,soilz(1),soilz(3)-1
esln,r,1
mpchg,810,all

*do,i,801,808
esel,s,mat,,i
mpchg,i+10,all
*enddo
allsel



/com - Create Reduced Model
esel,u,type,,8,10
esel,u,type,,21,24
esel,u,type,,30
esel,u,type,,60,63
esel,u,type,,90,91
esel,a,real,,1001

cm,slosh-model,elem
!cmsel,s,conc-tank
!nsle
!nsel,r,loc,z,ctz(34)
!d,all,all
allsel
cpdele,all
cmsel,s,conc-tank
nsle
```

```
cp,1001,ux,all
cp,1002,uy,all
cp,1003,uz,all


cmsel,s,slosh-model
nsle


/out,AP-460-Solve-Sub-Horiz,out
/solu
antype,trans
TRNOPT,FULL
lumpm,OFF
!nlgeom,on
NROPT,auto
NTIM=2048       !NUMBER OF TIME STEPS
DT=0.01
TIM=1e-06
autots,on
KBC,on
TIMINT,ON,STRU
solcontrol,ON,off,,
ncnv,0,200
LNSRCH,OFF
PRED,on,,on

/COM - Time File

/COM - Dimension Horizontal Input
*DIM,A_1_x,,2048
*DIM,A_1_Z,,2048

*VREAD,A_1_x(1),th-sub-model-h,txt
(8(F9.6))
!*VREAD,A_1_Z(1),th-266-Mean-geo-v,txt
!(8(F9.6))

/Title,Load Case: AP-460-BES-BEC,
Vertical Free Vibration
OUTPR,all,NONE,
OUTRES, ALL,NONE,
OUTRES,RSOL,last
OUTRES,NSOL,last
!OUTRES,ESOL,last,conc-tank
OUTRES,strs,last,Primary-tank
OUTRES,ESOL,last,J_bolts
!OUTRES,Epel,last,liner
!outres,esol,last,wall-int-gap
!outres,esol,last,conc-excav-wall-gap
!outres,esol,last,conc-excav-dome-gap
!outres,strs,last,excav-soil
!outres,strs,last,bottom-soil
outres,esol,last,bolt-friction
outres,esol,last,waste-surf
!outres,strs,last,insul-conc
outres,esol,last,primary-int-gap
outres,esol,last,conc-liner-gap
!outres,esol,last,far-soil-contact
!outres,esol,last,soil-contact-foot-elem

alphad,alpha
NSUBST,20,200,10,ON
TIME,100
TIMINT,off
acel,0,0,g
SOLVE
SAVE
TIMINT,on
ITIM=1
DS=TIM
NSUBST,1,20,1,ON

ddele,1,ux
acel,0,0,g
*DO,ITIM,1,NTIM,1

TIM=DT*ITIM

TIME,TIM+100

F,master_node,FX,A_1_X(itim)*mass*g
!F,master_node,Fz,(A_1_Z(itim)+1)*(mass+m
assm_z)*g

SOLVE
SAVE
*ENDDO
FINISH
/out
```

Vertical Excitation Only

Run-tank.txt

```
/batch
! PNNL DST Seismic Analysis, Gravity
Inputs, Best Est Soil, Best Est
Concrete Properties, AP Primary Tank
Geometry, Dome Friction=0.0
!
fini
/clear
/filname,AP-460-Sub-Model-V,1
/config,nres,3000          !
Increase allowable number of results
to 3000
!/config,nproc,2                !
Activate 2 processers for solution
/config,fsplit,1024        ! Split
binary file at 4.2GB
/prep7
g=32.2                     ! Gravity
(ft/sec)

DF=40                      ! Factor
for beta (stiffness) damping
ALPHA=0.4                  ! Alpha
damping

/out,tank-out,out
!/sys,"X:\07.00 - Quality
Assurance\ANSYS QA\usrcfg.bat" >
QA.out
/out,QA,out,,append
/input,tank-coordinates-AP,txt    !
Run file defining tank coordinates
(concrete and primary)
/input,tank-props-Rigid,txt       !
Run file defining fully cracked
concrete properties (PNNL Concrete
Properties)
/input,tank-mesh1,txt             !
Develop concrete tank
/input,primary-props-AP,txt       !
Run file defining AP Primary tank
properties
/input,primary,txt         ! Develop
Primary tank
/input,insulate,txt        ! Develop
insulating concrete model
/input,liner,txt           ! Develop
Liner model
/input,waste-solid-AP-S,txt       !
Develop waste model
/input,bolts-friction,txt  ! Develop
J-Bolt model
/input,near-soil-1,txt            !
Develop excavated soil model
/input,far-soil,txt        ! Develop
Far-Field soil model
/input,interface1,txt             !
Develop Soil and Concrete Interfaces
/input,interface-gap1,txt  ! Develop
Primary Tank Interfaces
/input,slave,txt           ! Develop
slaved boundary conditions
/input,boundary,txt        ! Place
base and symmetry boundary
conditions
/input,outer-spar,txt             !
Connect soil model to symmetry plane
/input,live_load,txt              !
Apply live load over a 10ft radius
over dome center
/input,fix-soil,txt
/out
ALLSEL

/out,Tank-th,out

save

!/input,solve-slosh-flex,txt
/input,solve-sub-vert,txt             !
Run solution Phase!/input,post-
sub,txt
/input,contact-waste-ap,txt
/input,waste-reaction,txt
/input,stress-primary,txt
/out
/exit
```

Solve-Sub-Vert.txt

```
/prep7
master_node=1
massm_z=148414.59
d,master_node,all
allsel

cmsel,s,excav-soil
nsle
csys,0
nsel,r,loc,x,-ctx(6)-1,ctx(6)+1
nsel,r,loc,y,0,-ctx(6)-1
esln,r,1
mpchg,810,all

cmsel,s,excav-soil
nsle
csys,1
nsel,r,loc,x,ctx(11)-1,ctx(13)+1
nsel,r,loc,z,soilz(1),soilz(3)-1
esln,r,1
mpchg,810,all

*do,i,801,808
esel,s,mat,,i
mpchg,i+10,all
*enddo
allsel


/com - Create Reduced Model
```

```
esel,u,type,,8,10
esel,u,type,,21,24
esel,u,type,,30
esel,u,type,,60,63
esel,u,type,,90,91
esel,a,real,,1001

cm,slosh-model,elem
!cmsel,s,conc-tank
!nsle
!nsel,r,loc,z,ctz(34)
!d,all,all
allsel
cpdele,all
cmsel,s,conc-tank
nsle

cp,1001,ux,all
cp,1002,uy,all
cp,1003,uz,all


cmsel,s,slosh-model
nsle


/out,AP-460-Solve-Sub-Vert,out
/solu
antype,trans
TRNOPT,FULL
lumpm,OFF
!nlgeom,on
NROPT,auto
NTIM=2048       !NUMBER OF TIME STEPS
DT=0.01
TIM=1e-06
autots,on
KBC,on
TIMINT,ON,STRU
solcontrol,ON,off,,
ncnv,0,200
LNSRCH,OFF
PRED,on,,on

/COM - Time File

/COM - Dimension Horizontal Input
*DIM,A_1_x,,2048
*DIM,A_1_Z,,2048

!*VREAD,A_1_x(1),th-sub-model-h,txt
!(8(F9.6))
*VREAD,A_1_Z(1),th-sub-model-v,txt
(8(F9.6))

/Title,Load Case: AP-460-BES-BEC,
Vertical Sub-Model
OUTPR,all,NONE,
OUTRES, ALL,NONE,
OUTRES,RSOL,last
OUTRES,NSOL,last
!OUTRES,ESOL,last,conc-tank
OUTRES,strs,last,Primary-tank
OUTRES,ESOL,last,J_bolts
!OUTRES,Epel,last,liner
!outres,esol,last,wall-int-gap
!outres,esol,last,conc-excav-wall-gap
!outres,esol,last,conc-excav-dome-gap
!outres,strs,last,excav-soil
!outres,strs,last,bottom-soil
outres,esol,last,bolt-friction
outres,esol,last,waste-surf
!outres,strs,last,insul-conc
outres,esol,last,primary-int-gap
outres,esol,last,conc-liner-gap
!outres,esol,last,far-soil-contact
!outres,esol,last,soil-contact-foot-elem

alphad,alpha
NSUBST,20,200,10,ON
TIME,100
TIMINT,off
acel,0,0,g
SOLVE
SAVE
TIMINT,on
ITIM=1
DS=TIM
NSUBST,1,20,1,ON

ddele,1,uz
acel,0,0,g
*DO,ITIM,1,NTIM,1

TIM=DT*ITIM

TIME,TIM+100

!F,master_node,FX,A_1_X(itim)*mass*g
F,master_node,Fz,(A_1_Z(itim)+1)*(mass+ma
ssm_z)*g

SOLVE
SAVE
*ENDDO
FINISH
/out
```

Horizontal and Vertical Excitation

Run-Tank.txt

```
/batch
! PNNL DST Seismic Analysis, Gravity
Inputs, Best Est Soil, Best Est Concrete
Properties, AP Primary Tank Geometry,
Dome Friction=0.0
!
fini
/clear
/filname,AP-460-Sub-Model-HV,1
/config,nres,3000             ! Increase
allowable number of results to 3000
!/config,nproc,2                      !
Activate 2 processers for solution
/config,fsplit,1024           ! Split
binary file at 4.2GB
/prep7
g=32.2                        ! Gravity
(ft/sec)

DF=40                         ! Factor
for beta (stiffness) damping
ALPHA=0.4                     ! Alpha
damping

/out,tank-out,out
!/sys,"X:\07.00 - Quality Assurance\ANSYS
QA\usrcfg.bat" > QA.out
/out,QA,out,,append
/input,tank-coordinates-AP,txt        !
Run file defining tank coordinates
(concrete and primary)
/input,tank-props-Rigid,txt   ! Run file
defining fully cracked concrete
properties (PNNL Concrete Properties)
/input,tank-mesh1,txt         ! Develop
concrete tank
/input,primary-props-AP,txt   ! Run file
defining AP Primary tank properties
/input,primary,txt            ! Develop
Primary tank
/input,insulate,txt           ! Develop
insulating concrete model
/input,liner,txt              ! Develop
Liner model
/input,waste-solid-AP-S,txt   ! Develop
waste model
/input,bolts-friction,txt     ! Develop
J-Bolt model
/input,near-soil-1,txt        ! Develop
excavated soil model
/input,far-soil,txt           ! Develop
Far-Field soil model
/input,interface1,txt         ! Develop
Soil and Concrete Interfaces
/input,interface-gap1,txt     ! Develop
Primary Tank Interfaces
/input,slave,txt              ! Develop
slaved boundary conditions
/input,boundary,txt           ! Place
base and symmetry boundary conditions
/input,outer-spar,txt         ! Connect
soil model to symmetry plane
/input,live_load,txt          ! Apply
live load over a 10ft radius over dome
center
/input,fix-soil,txt
/out
ALLSEL

/out,Tank-th,out

save

!/input,solve-slosh-flex,txt
/input,solve-sub-HV,txt                  !
Run solution Phase!/input,post-sub,txt
/input,contact-waste-ap,txt
/input,waste-reaction,txt
/input,stress-primary,txt
/out
/exit
```

Solve-Sub-HV.txt

```
/prep7
master_node=1
massm_z=148414.59
d,master_node,all
allsel

cmsel,s,excav-soil
nsle
csys,0
nsel,r,loc,x,-ctx(6)-1,ctx(6)+1
nsel,r,loc,y,0,-ctx(6)-1
esln,r,1
mpchg,810,all

cmsel,s,excav-soil
nsle
csys,1
nsel,r,loc,x,ctx(11)-1,ctx(13)+1
nsel,r,loc,z,soilz(1),soilz(3)-1
esln,r,1
mpchg,810,all

*do,i,801,808
esel,s,mat,,i
mpchg,i+10,all
*enddo
allsel



/com - Create Reduced Model
esel,u,type,,8,10
esel,u,type,,21,24
esel,u,type,,30
esel,u,type,,60,63
esel,u,type,,90,91
esel,a,real,,1001

cm,slosh-model,elem
!cmsel,s,conc-tank
!nsle
!nsel,r,loc,z,ctz(34)
!d,all,all
allsel
cpdele,all
cmsel,s,conc-tank
nsle
```

```
cp,1001,ux,all
cp,1002,uy,all
cp,1003,uz,all


cmsel,s,slosh-model
nsle


/out,AP-460-Solve-Sub-HV,out
/solu
antype,trans
TRNOPT,FULL
lumpm,OFF
!nlgeom,on
NROPT,auto
NTIM=2048      !NUMBER OF TIME STEPS
DT=0.01
TIM=1e-06
autots,on
KBC,on
TIMINT,ON,STRU
solcontrol,ON,off,,
ncnv,0,200
LNSRCH,OFF
PRED,on,,on

/COM - Time File

/COM - Dimension Horizontal Input
*DIM,A_1_x,,2048
*DIM,A_1_Z,,2048

*VREAD,A_1_x(1),th-sub-model-h,txt
(8(F9.6))
*VREAD,A_1_Z(1),th-sub-model-v,txt
(8(F9.6))

/Title,Load Case: AP-460-BES-BEC, Sub-
Model 2 Direction Input
OUTPR,all,NONE,
OUTRES, ALL,NONE,
OUTRES,RSOL,last
OUTRES,NSOL,last
!OUTRES,ESOL,last,conc-tank
OUTRES,strs,last,Primary-tank
OUTRES,ESOL,last,J_bolts
!OUTRES,Epel,last,liner
!outres,esol,last,wall-int-gap
!outres,esol,last,conc-excav-wall-gap
!outres,esol,last,conc-excav-dome-gap
!outres,strs,last,excav-soil
!outres,strs,last,bottom-soil
outres,esol,last,bolt-friction
outres,esol,last,waste-surf
!outres,strs,last,insul-conc
outres,esol,last,primary-int-gap
outres,esol,last,conc-liner-gap
!outres,esol,last,far-soil-contact
!outres,esol,last,soil-contact-foot-elem

alphad,alpha
NSUBST,20,200,10,ON
TIME,100
TIMINT,off
acel,0,0,g
SOLVE
SAVE
TIMINT,on
ITIM=1
DS=TIM
NSUBST,1,20,1,ON

ddele,1,ux
ddele,1,uz
acel,0,0,g
*DO,ITIM,1,NTIM,1

TIM=DT*ITIM

TIME,TIM+100

F,master_node,FX,A_1_X(itim)*mass*g
F,master_node,Fz,(A_1_Z(itim)+1)*(mass+ma
ssm_z)*g

SOLVE
SAVE
*ENDDO
FINISH
/out
```

Horizontal Frequency Check

Run-Tank.txt

```
/batch
! PNNL DST Seismic Analysis, Gravity
Inputs, Best Est Soil, Best Est Concrete
Properties, AP Primary Tank Geometry,
Dome Friction=0.0
!
fini
/clear
/filname,AP-460-Sub-Model-H,1
/config,nres,3000              ! Increase
allowable number of results to 3000
!/config,nproc,2                        !
Activate 2 processers for solution
/config,fsplit,1024            ! Split
binary file at 4.2GB
/prep7
g=32.2                         ! Gravity
(ft/sec)

DF=40                          ! Factor
for beta (stiffness) damping
ALPHA=0.4                      ! Alpha
damping

/out,tank-out,out
!/sys,"X:\07.00 - Quality Assurance\ANSYS
QA\usrcfg.bat" > QA.out
/out,QA,out,,append
/input,tank-coordinates-AP,txt         !
Run file defining tank coordinates
(concrete and primary)
/input,tank-props-Rigid,txt    ! Run file
defining fully cracked concrete
properties (PNNL Concrete Properties)
/input,tank-mesh1,txt          ! Develop
concrete tank
/input,primary-props-AP,txt    ! Run file
defining AP Primary tank properties
/input,primary,txt             ! Develop
Primary tank
/input,insulate,txt            ! Develop
insulating concrete model
/input,liner,txt               ! Develop
Liner model
/input,waste-solid-AP-S,txt    ! Develop
waste model
/input,bolts-friction,txt      ! Develop
J-Bolt model
/input,near-soil-1,txt         ! Develop
excavated soil model
/input,far-soil,txt            ! Develop
Far-Field soil model
/input,interface1,txt          ! Develop
Soil and Concrete Interfaces
/input,interface-gap1,txt      ! Develop
Primary Tank Interfaces
/input,slave,txt               ! Develop
slaved boundary conditions
/input,boundary,txt            ! Place
base and symmetry boundary conditions
/input,outer-spar,txt          ! Connect
soil model to symmetry plane
/input,live_load,txt           ! Apply
live load over a 10ft radius over dome
center
/input,fix-soil,txt
/out
ALLSEL

/out,Tank-th,out

save
/input,solve-slosh-flex,txt
!/input,solve-sub-horiz,txt           !
Run solution Phase!/input,post-sub,txt
!/input,contact-waste-ap,txt
/input,waste-reaction,txt
/out
/exit
```

Solve-Slosh-Flex.txt

```
/prep7
massm_z=148414.59
d,master_node,all
allsel

cmsel,s,excav-soil
nsle
csys,0
nsel,r,loc,x,-ctx(6)-1,ctx(6)+1
nsel,r,loc,y,0,-ctx(6)-1
esln,r,1
mpchg,810,all

cmsel,s,excav-soil
nsle
csys,1
nsel,r,loc,x,ctx(11)-1,ctx(13)+1
nsel,r,loc,z,soilz(1),soilz(3)-1
esln,r,1
mpchg,810,all

*do,i,801,808
esel,s,mat,,i
mpchg,i+10,all
*enddo
allsel

/com - Create Reduced Model
esel,u,type,,8,10
esel,u,type,,21,23
esel,u,type,,30
esel,u,type,,60,63
esel,u,type,,90,91

cm,slosh-model,elem
cmsel,s,conc-tank
nsle
nsel,r,loc,z,ctz(34)
d,all,all
cmsel,s,slosh-model
nsle

/out,AP-460-Slosh-Flex-V,out
/solu
antype,trans
TRNOPT,FULL
lumpm,OFF
!nlgeom,on
NROPT,auto
```

```
NTIM=100        !NUMBER OF TIME STEPS
DT=0.01
TIM=1e-06
autots,on
KBC,on
TIMINT,ON,STRU
solcontrol,ON,off,,
ncnv,0,200
LNSRCH,OFF
PRED,on,,on

/COM - Time File

/COM - Dimension Horizontal Input
*DIM,A_1_x,,2048
*DIM,A_1_Z,,2048

!*VREAD,A_1_x(1),th-266-Mean-geo,txt
!(8(F9.6))
!*VREAD,A_1_Z(1),th-266-Mean-geo-v,txt
!(8(F9.6))

/Title,Load Case: AP-460-BES-BEC,
Vertical Free Vibration
OUTPR,all,NONE,
OUTRES, ALL,NONE,
OUTRES,RSOL,last
OUTRES,NSOL,last
!OUTRES,ESOL,last,conc-tank
OUTRES,strs,last,Primary-tank
OUTRES,ESOL,last,J_bolts
!OUTRES,Epel,last,liner
!outres,esol,last,wall-int-gap
!outres,esol,last,conc-excav-wall-gap
!outres,esol,last,conc-excav-dome-gap
!outres,strs,last,excav-soil
!outres,strs,last,bottom-soil
outres,esol,last,bolt-friction
outres,esol,last,waste-surf
outres,strs,last,insul-conc
outres,esol,last,primary-int-gap
outres,esol,last,conc-liner-gap
!outres,esol,last,far-soil-contact
!outres,esol,last,soil-contact-foot-elem

alphad,alpha
NSUBST,20,200,10,ON
TIME,100
TIMINT,off
acel,0.05*g,0,g
SOLVE
SAVE
TIMINT,on
ITIM=1
DS=TIM
NSUBST,1,20,1,ON


acel,0,0,g
*DO,ITIM,1,NTIM,1

TIM=DT*ITIM

TIME,TIM+100

!F,master_node,FX,A_1_X(itim)*mass*g
!F,master_node,Fz,(A_1_Z(itim)+1)*(mass+m
assm_z)*g

SOLVE
SAVE
*ENDDO
FINISH
/out
```

Vertical Frequency Check

Run-Tank.txt

```
/batch
! PNNL DST Seismic Analysis, Gravity
Inputs, Best Est Soil, Best Est Concrete
Properties, AP Primary Tank Geometry,
Dome Friction=0.0
!
fini
/clear
/filname,AP-460-Sub-Model-V,1
/config,nres,3000               ! Increase
allowable number of results to 3000
!/config,nproc,2                        !
Activate 2 processers for solution
/config,fsplit,1024             ! Split
binary file at 4.2GB
/prep7
g=32.2                          ! Gravity
(ft/sec)

DF=40                           ! Factor
for beta (stiffness) damping
ALPHA=0.4                       ! Alpha
damping

/out,tank-out,out
!/sys,"X:\07.00 - Quality Assurance\ANSYS
QA\usrcfg.bat" > QA.out
/out,QA,out,,append
/input,tank-coordinates-AP,txt         !
Run file defining tank coordinates
(concrete and primary)
/input,tank-props-Rigid,txt   ! Run file
defining fully cracked concrete
properties (PNNL Concrete Properties)
/input,tank-mesh1,txt           ! Develop
concrete tank
/input,primary-props-AP,txt   ! Run file
defining AP Primary tank properties
/input,primary,txt              ! Develop
Primary tank
/input,insulate,txt             ! Develop
insulating concrete model
/input,liner,txt                ! Develop
Liner model
/input,waste-solid-AP-S,txt   ! Develop
waste model
/input,bolts-friction,txt      ! Develop
J-Bolt model
/input,near-soil-1,txt          ! Develop
excavated soil model
/input,far-soil,txt             ! Develop
Far-Field soil model
/input,interface1,txt           ! Develop
Soil and Concrete Interfaces
/input,interface-gap1,txt      ! Develop
Primary Tank Interfaces
/input,slave,txt                ! Develop
slaved boundary conditions
/input,boundary,txt             ! Place
base and symmetry boundary conditions
/input,outer-spar,txt           ! Connect
soil model to symmetry plane
/input,live_load,txt          ! Apply
live load over a 10ft radius over dome
center
/input,fix-soil,txt
/out
ALLSEL

/out,Tank-th,out

save
/input,solve-slosh-vert,txt
!/input,solve-sub-horiz,txt          !
Run solution Phase!/input,post-sub,txt
!/input,contact-waste-ap,txt
/input,waste-reaction,txt
/out
/exit
```

Solve-Slosh-Vert.txt

```
/prep7
massm_z=148414.59
d,master_node,all
allsel

cmsel,s,excav-soil
nsle
csys,0
nsel,r,loc,x,-ctx(6)-1,ctx(6)+1
nsel,r,loc,y,0,-ctx(6)-1
esln,r,1
mpchg,810,all

cmsel,s,excav-soil
nsle
csys,1
nsel,r,loc,x,ctx(11)-1,ctx(13)+1
nsel,r,loc,z,soilz(1),soilz(3)-1
esln,r,1
mpchg,810,all

*do,i,801,808
esel,s,mat,,i
mpchg,i+10,all
*enddo
allsel

/com - Create Reduced Model
esel,u,type,,8,10
esel,u,type,,21,23
esel,u,type,,30
esel,u,type,,60,63
esel,u,type,,90,91

cm,slosh-model,elem
cmsel,s,conc-tank
nsle
nsel,r,loc,z,ctz(34)
d,all,all
cmsel,s,slosh-model
nsle

/out,AP-460-Slosh-Flex-V,out
/solu
antype,trans
TRNOPT,FULL
lumpm,OFF
!nlgeom,on
NROPT,auto
```

```
NTIM=100        !NUMBER OF TIME STEPS
DT=0.01
TIM=1e-06
autots,on
KBC,on
TIMINT,ON,STRU
solcontrol,ON,off,,
ncnv,0,200
LNSRCH,OFF
PRED,on,,on

/COM - Time File

/COM - Dimension Horizontal Input
*DIM,A_1_x,,2048
*DIM,A_1_Z,,2048

!*VREAD,A_1_x(1),th-266-Mean-geo,txt
!(8(F9.6))
!*VREAD,A_1_Z(1),th-266-Mean-geo-v,txt
!(8(F9.6))

/Title,Load Case: AP-460-BES-BEC,
Vertical Free Vibration
OUTPR,all,NONE,
OUTRES, ALL,NONE,
OUTRES,RSOL,last
OUTRES,NSOL,last
!OUTRES,ESOL,last,conc-tank
OUTRES,strs,last,Primary-tank
OUTRES,ESOL,last,J_bolts
!OUTRES,Epel,last,liner
!outres,esol,last,wall-int-gap
!outres,esol,last,conc-excav-wall-gap
!outres,esol,last,conc-excav-dome-gap
!outres,strs,last,excav-soil
!outres,strs,last,bottom-soil
outres,esol,last,bolt-friction
outres,esol,last,waste-surf
outres,strs,last,insul-conc
outres,esol,last,primary-int-gap
outres,esol,last,conc-liner-gap
!outres,esol,last,far-soil-contact
!outres,esol,last,soil-contact-foot-elem

alphad,alpha
NSUBST,20,200,10,ON
TIME,100
TIMINT,off
acel,0,0,0.95*g
SOLVE
SAVE
TIMINT,on
ITIM=1
DS=TIM
NSUBST,1,20,1,ON


acel,0,0,g
*DO,ITIM,1,NTIM,1

TIM=DT*ITIM

TIME,TIM+100

!F,master_node,FX,A_1_X(itim)*mass*g
!F,master_node,Fz,(A_1_Z(itim)+1)*(mass+m
assm_z)*g

SOLVE
SAVE
*ENDDO
FINISH
/out
```

Convective Mode Frequency Check

Run-Tank.txt

```
/batch
! PNNL DST Seismic Analysis, Gravity
Inputs, Best Est Soil, Best Est Concrete
Properties, AP Primary Tank Geometry,
Dome Friction=0.0
!
fini
/clear
/filname,AP-460-Slosh-Rigid,1
/config,nres,3000              ! Increase
allowable number of results to 3000
/config,nproc,2                        !
Activate 2 processers for solution
/config,fsplit,1024            ! Split
binary file at 4.2GB
/prep7
g=32.2                         ! Gravity
(ft/sec)

DF=40                          ! Factor
for beta (stiffness) damping
ALPHA=0.4                      ! Alpha
damping

/out,tank-out,out
/sys,"X:\07.00 - Quality Assurance\ANSYS
QA\usrcfg.bat" > QA.out
/out,QA,out,,append
/input,tank-coordinates-AP,txt         !
Run file defining tank coordinates
(concrete and primary)
/input,tank-props-Rigid,txt    ! Run file
defining fully cracked concrete
properties (PNNL Concrete Properties)
/input,tank-mesh1,txt          ! Develop
concrete tank
/input,primary-props-AP-rigid,txt      !
Run file defining AP Primary tank
properties
/input,primary,txt             ! Develop
Primary tank
/input,insulate,txt            ! Develop
insulating concrete model
/input,liner,txt               ! Develop
Liner model
/input,waste-solid-AP-S,txt    ! Develop
waste model
/input,bolts-friction-rigid,txt        !
Develop J-Bolt model


/input,near-soil-1,txt         ! Develop
excavated soil model
/input,far-soil,txt            ! Develop
Far-Field soil model
/input,interface1,txt          ! Develop
Soil and Concrete Interfaces
/input,interface-gap1,txt      ! Develop
Primary Tank Interfaces
/input,slave,txt               ! Develop
slaved boundary conditions
/input,boundary,txt            ! Place
base and symmetry boundary conditions
/input,outer-spar,txt          ! Connect
soil model to symmetry plane
/input,live_load,txt           ! Apply
live load over a 10ft radius over dome
center
/input,fix-soil,txt
/out
ALLSEL

/out,Tank-th,out

save

/input,solve-Slosh-rigid,txt           !
Run solution Phase
/input,contact-waste-ap,txt
/input,waste-reaction,txt
/out
/exit
```

Solve-Slosh-Rigid.txt

```
/prep7
massm_z=148414.59
d,master_node,all
allsel

cmsel,s,excav-soil
nsle
csys,0
nsel,r,loc,x,-ctx(6)-1,ctx(6)+1
nsel,r,loc,y,0,-ctx(6)-1
esln,r,1
mpchg,810,all

cmsel,s,excav-soil
nsle
csys,1
nsel,r,loc,x,ctx(11)-1,ctx(13)+1
nsel,r,loc,z,soilz(1),soilz(3)-1
esln,r,1
mpchg,810,all

*do,i,801,808
esel,s,mat,,i
mpchg,i+10,all
*enddo
allsel

/com - Create Reduced Model
esel,u,type,,8,10
esel,u,type,,21,23
esel,u,type,,30
esel,u,type,,60,63
esel,u,type,,90,91

cm,slosh-model,elem
cmsel,s,conc-tank
nsle
nsel,r,loc,z,ctz(34)
d,all,all
cmsel,s,slosh-model
nsle

/out,AP-460-Slosh-Rigid,out
/solu
antype,trans
TRNOPT,FULL
lumpm,OFF
```

```
!nlgeom,on
NROPT,auto
NTIM=300        !NUMBER OF TIME STEPS
DT=0.05
TIM=1e-06
autots,on
KBC,on
TIMINT,ON,STRU
solcontrol,ON,off,,
ncnv,0,200
LNSRCH,OFF
PRED,on,,on

/COM - Time File

/COM - Dimension Horizontal Input
*DIM,A_1_x,,2048
*DIM,A_1_Z,,2048

*VREAD,A_1_x(1),th-266-Mean-geo,txt
(8(F9.6))
*VREAD,A_1_Z(1),th-266-Mean-geo-v,txt
(8(F9.6))

/Title,Load Case: AP-460-BES-BEC,
Gravity, Dome Friction =0.00,
OUTPR,all,NONE,
OUTRES, ALL,NONE,
OUTRES,RSOL,last
OUTRES,NSOL,last
!OUTRES,ESOL,last,conc-tank
OUTRES,strs,last,Primary-tank
OUTRES,ESOL,last,J_bolts
!OUTRES,Epel,last,liner
!outres,esol,last,wall-int-gap
!outres,esol,last,conc-excav-wall-gap
!outres,esol,last,conc-excav-dome-gap
!outres,strs,last,excav-soil
!outres,strs,last,bottom-soil
outres,esol,last,bolt-friction
outres,esol,last,waste-surf
outres,strs,last,insul-conc
outres,esol,last,primary-int-gap
outres,esol,last,conc-liner-gap
!outres,esol,last,far-soil-contact
!outres,esol,last,soil-contact-foot-elem

alphad,alpha
NSUBST,20,200,10,ON
TIME,100
TIMINT,off
acel,0.08*g,0,g
SOLVE
SAVE
TIMINT,on
ITIM=1
DS=TIM
NSUBST,1,20,1,ON


acel,0,0,g
*DO,ITIM,1,NTIM,1

TIM=DT*ITIM

TIME,TIM+100

!F,master_node,FX,A_1_X(itim)*mass*g
!F,master_node,Fz,(A_1_Z(itim)+1)*(mass+m
assm_z)*g

SOLVE
SAVE
*ENDDO
FINISH
/out
```

TH-Sub-Model-h.txt

```
 0.000000 0.000002 0.000003 0.000004 0.000002-0.000001-0.000003-0.000003
-0.000003-0.000003-0.000004-0.000007-0.000010-0.000009-0.000004 0.000000
 0.000000 0.000000 0.000010 0.000022 0.000023 0.000009-0.000005-0.000012
……..
-0.005195-0.000793 0.003825 0.008090 0.011526 0.013842 0.014969 0.015061
 0.014422 0.013381 0.012179 0.010972 0.009855 0.008877 0.008075 0.007461
 0.006993 0.006573 0.006096 0.005832 0.005568
```

TH-Sub-Model-v.txt

```
 0.000111 0.000169 0.000227 0.000328 0.000419 0.000509 0.000577 0.000610
 0.000607 0.000572 0.000507 0.000424 0.000348 0.000292 0.000230 0.000127
-0.000002-0.000111-0.000210-0.000338-0.000471-0.000555-0.000602-0.000660
…..
 0.024820 0.024673 0.023320 0.020784 0.017191 0.012768 0.007795 0.002554
-0.002696-0.007745-0.012430-0.016604-0.020114-0.022805-0.024576-0.025395
-0.025246-0.024075-0.021803-0.020382-0.018960
```

APPENDIX D

Sub-Model
Best Estimate Soil
Best Estimate Concrete
Results
File Listing

LIST OF TABLES

Table 1 Sub-Model, Primary Tank Stresses, Shell Top, Gravity Plus Seismic Load, Horizontal and Vertical Excitation

AP Primary Tank Sub Model, Best Estimate Soil, Horizontal and Vertical Seismic, Best Estimate Tank Sub Model Concrete, 460 in. Waste Level at 1.83 SpG

M&D Starting M&D Element No.	Path (in.)	Shell Top Surface (inside - waste side)			
		AP-460-Sub-H&V Seismic Hoop Stress (lbs/in^2) Top	AP-460-Sub-H&V Seismic Meridional Stress (lbs/in^2) Top	AP-460-Sub-H&V Seismic Stress Intensity (lbs/in^2) Top	AP-460-Sub-H&V Seismic In-Plane Shear Stress (lbs/in^2) Top
762	**67.33**	172.01	-345.35	736.81	4.80
782	**105.04**	16.38	764.58	773.61	8.23
802	**136.24**	130.63	-324.65	684.03	9.26
822	**181.83**	-202.71	464.38	809.72	18.62
842	**225.10**	197.22	-434.72	909.03	58.49
862	**273.66**	-329.03	647.71	1204.17	179.03
882	**323.27**	661.18	-372.36	1365.28	523.06
902	**369.20**	354.24	1581.25	3368.75	1376.39
922	**419.20**	2385.42	497.29	6017.36	2769.44
942	**444.31**	-2311.81	-5249.31	8291.67	2269.44
962	**458.66**	-3703.47	7250.00	12937.50	2174.31
982	**473.08**	-4763.89	7750.00	14951.39	2160.42
1002	**484.80**	-2981.94	530.97	5456.94	2205.56
1022	**502.48**	3696.53	-648.61	5127.08	2192.36
1042	**526.48**	7965.28	1046.53	7965.28	2064.58
1062	**550.48**	10069.44	1206.94	10076.39	1885.42
1082	**574.60**	12305.56	1463.89	12305.56	1672.92
1102	**598.28**	14944.44	1178.47	14951.39	1440.28
1122	**621.38**	17312.50	1593.06	17312.50	1201.39
1142	**644.48**	19555.56	1427.78	19555.56	932.64
1162	**667.63**	20993.06	1006.94	20993.06	639.10
1182	**690.78**	21305.56	1884.72	21305.56	288.40
1202	**713.88**	22381.94	1505.56	22381.94	156.46
1222	**736.98**	23861.11	870.14	23861.11	417.43
1242	**760.13**	23347.22	381.04	23347.22	730.56
1262	**782.53**	21173.61	2177.78	21173.61	755.56
1282	**804.13**	20298.61	1253.47	20298.61	961.11
1302	**825.73**	21090.28	848.61	21090.28	1163.19
1322	**847.33**	22736.11	1261.11	22736.11	1374.31
1342	**868.87**	21993.06	-1872.92	25590.28	1606.94
1362	**892.10**	14291.67	-1284.72	16222.22	1539.58
1382	**909.20**	4289.58	-813.89	6965.28	1484.03
1402	**918.38**	4629.17	12270.83	12277.78	1496.53
1460	**930.48**	2353.47	7513.89	7576.39	718.75
1442	**949.48**	-755.56	-2779.86	3830.56	605.00
1462	**990.98**	302.64	959.72	965.28	-36.31
1482	**1050.98**	-156.46	-556.81	733.33	47.53
1502	**1110.98**	221.32	729.86	733.33	-29.83
1522	**1170.98**	-137.71	-516.25	708.33	41.53
1542	**1230.98**	199.38	684.72	687.92	-31.23
1562	**1292.98**	-88.06	-450.00	618.89	59.04

Note 1: Meridonal, Hoop, and Shear Stresses are Reversed in Highlighted Sections (Floor)

Table 2 Sub-Model, Primary Tank Stresses, Shell Middle, Gravity Plus Seismic Load, Horizontal and Vertical Excitation

AP Primary Tank Sub Model, Best Estimate Soil, Horizontal and Vertical Seismic, Best Estimate Tank Sub Model Concrete, 460 in. Waste Level at 1.83 SpG

		Shell Mid-Plane			
M&D Starting M&D Element No.	Path (in.)	AP-460-Sub-H&V Seismic Hoop Stress (lbs/in^2) Mid	AP-460-Sub-H&V Seismic Meridional Stress (lbs/in^2) Mid	AP-460-Sub-H&V Seismic Stress Intensity (lbs/in^2) Mid	AP-460-Sub-H&V Seismic In-Plane Shear Stress (lbs/in^2) Mid
762	**67.33**	332.64	45.22	333.33	5.94
782	**105.04**	-120.63	104.31	302.43	8.02
802	**136.24**	326.88	128.47	329.58	9.27
822	**181.83**	-271.46	134.17	542.15	18.58
842	**225.10**	417.71	202.57	426.18	58.26
862	**273.66**	-404.72	327.92	931.94	178.96
882	**323.27**	932.64	550.28	1165.97	523.19
902	**369.20**	-470.07	946.53	3223.61	1375.69
922	**419.20**	2729.86	1300.69	5913.89	2770.83
942	**444.31**	-454.10	1136.81	4988.89	2276.39
962	**458.66**	-4741.67	1056.94	8541.67	2187.50
982	**473.08**	-6043.06	1002.08	10180.56	2154.86
1002	**484.80**	-2661.81	939.58	5865.97	2178.47
1022	**502.48**	4202.78	1001.39	4595.83	2168.06
1042	**526.48**	8006.94	1121.53	8006.94	2053.47
1062	**550.48**	10118.06	1238.89	10125.00	1878.47
1082	**574.60**	12326.39	1339.58	12333.33	1665.97
1102	**598.28**	14965.28	1425.69	14965.28	1433.33
1122	**621.38**	17236.11	1497.22	17236.11	1195.83
1142	**644.48**	19527.78	1547.92	19527.78	927.78
1162	**667.63**	21104.17	1581.25	21104.17	638.75
1182	**690.78**	21083.33	1395.83	21083.33	289.38
1202	**713.88**	22270.83	1386.81	22270.83	150.76
1222	**736.98**	23951.39	1362.50	23951.39	416.60
1242	**760.13**	23590.28	1318.75	23590.28	723.61
1262	**782.53**	20694.44	920.83	20694.44	746.53
1282	**804.13**	20111.11	866.67	20111.11	959.72
1302	**825.73**	21034.72	802.08	21034.72	1164.58
1322	**847.33**	22548.61	727.08	22548.61	1377.08
1342	**868.87**	23236.11	637.99	23236.11	1593.75
1362	**892.10**	14979.17	463.19	14986.11	1501.39
1382	**909.20**	4998.61	430.35	5109.72	1443.06
1402	**918.38**	938.89	535.28	3014.58	1477.78
1460	**930.48**	363.13	621.04	2371.53	1039.58
1442	**949.48**	182.78	333.61	958.33	416.46
1462	**990.98**	62.43	156.74	200.49	72.36
1482	**1050.98**	3.44	6.33	39.64	12.40
1502	**1110.98**	0.86	2.30	39.64	2.10
1522	**1170.98**	0.34	2.35	44.50	0.20
1542	**1230.98**	0.23	2.11	57.35	0.32
1562	**1292.98**	0.07	1.65	95.00	0.27

Note 1: Meridonal, Hoop, and Shear Stresses are Reversed in Highlighted Sections (Floor)

Table 3 Sub-Model, Primary Tank Stresses, Shell Bottom, Gravity Plus Seismic Load, Horizontal and Vertical Excitation

AP Primary Tank Sub Model, Best Estimate Soil, Horizontal and Vertical Seismic, Best Estimate Tank Sub Model Concrete, 460 in. Waste Level at 1.83 SpG

		Shell Bottom Surface (outside - away from waste)			
M&D Starting M&D Element No.	Path (in.)	AP-460-Sub-H&V Seismic Hoop Stress (lbs/in^2) Bot	AP-460-Sub-H&V Seismic Meridional Stress (lbs/in^2) Bot	AP-460-Sub-H&V Seismic Stress Intensity (lbs/in^2) Bot	AP-460-Sub-H&V Seismic In-Plane Shear Stress (lbs/in^2) Bot
762	**67.33**	494.86	653.47	653.61	7.57
782	**105.04**	-242.08	-346.04	582.57	7.88
802	**136.24**	523.68	765.97	766.67	9.28
822	**181.83**	-340.28	-168.06	576.46	18.53
842	**225.10**	683.13	1009.03	1011.81	58.05
862	**273.66**	-480.28	86.74	877.78	178.89
882	**323.27**	1206.25	1542.36	1655.56	523.33
902	**369.20**	-607.01	506.18	3106.94	1375.00
922	**419.20**	3073.61	2749.31	5907.64	2772.22
942	**444.31**	2163.19	10465.28	10472.22	2283.33
962	**458.66**	-5780.56	-3004.17	9263.89	2201.39
982	**473.08**	-7319.44	-3680.56	11375.00	2149.31
1002	**484.80**	-2355.56	2975.00	6375.00	2150.69
1022	**502.48**	4709.03	2770.83	4834.72	2143.75
1042	**526.48**	8048.61	1204.17	8048.61	2043.06
1062	**550.48**	10166.67	1270.83	10166.67	1871.53
1082	**574.60**	12354.17	1253.47	12354.17	1659.03
1102	**598.28**	15041.67	1672.92	15048.61	1426.39
1122	**621.38**	17222.22	1401.39	17229.17	1190.28
1142	**644.48**	19555.56	1668.06	19555.56	923.61
1162	**667.63**	21270.83	2155.56	21270.83	638.40
1182	**690.78**	20937.50	906.94	20937.50	290.35
1202	**713.88**	22243.06	1267.36	22243.06	147.29
1222	**736.98**	24104.17	1854.86	24104.17	415.83
1242	**760.13**	23875.00	2269.44	23875.00	715.97
1262	**782.53**	20298.61	-512.78	20861.11	737.50
1282	**804.13**	19972.22	482.92	19972.22	958.33
1302	**825.73**	20979.17	755.56	20986.11	1166.67
1322	**847.33**	22361.11	211.18	22361.11	1379.17
1342	**868.87**	24479.17	4768.75	24479.17	1579.86
1362	**892.10**	15666.67	2659.03	15666.67	1463.89
1382	**909.20**	5747.22	3965.28	5768.06	1402.78
1402	**918.38**	-1927.78	-7756.94	11270.83	1459.03
1460	**930.48**	-1396.53	-4703.47	6522.22	1359.72
1442	**949.48**	1390.97	4424.31	4451.39	227.99
1462	**990.98**	-137.36	-491.53	671.18	109.17
1482	**1050.98**	233.40	763.89	733.33	-29.88
1502	**1110.98**	-161.32	-534.31	733.33	41.81
1522	**1170.98**	211.25	705.56	708.33	-30.12
1542	**1230.98**	-144.65	-501.04	687.85	43.26
1562	**1292.98**	160.14	615.76	618.96	-40.85

Note 1: Meridonal, Hoop, and Shear Stresses are Reversed in Highlighted Sections (Floor)

Table 4 Sub-Model, Waste Contact Pressure, Gravity Plus Seismic, Horizontal and Vertical Excitation

Tank AY, 460 Inch Waste Level
SpG = 1.83
Sub Model
Horizontal and Vertical Input

Waste Height Ratio	Waste Height	Max Pressure AP Tank, 460 in Waste Level, SpG = 1.83 Time History (PSI)	Min Pressure AP Tank, 460 in Waste Level, SpG = 1.83 Time History (PSI)	Hydrostatic (psi)	Hydro-dyanmic (psi)	Theoretical Min (SRSS)	Theoretical Max (SRSS)
0.99	454.35	8.931	-7.708	0.37	1.65	0.00	2.02
0.96	443.05	11.771	-10.604	1.12	1.69	0.00	2.81
0.94	431.7625	15.521	-10.847	1.87	1.77	0.10	3.64
0.90	414.125	9.882	-4.788	3.03	1.95	1.08	4.98
0.85	390.125	8.174	0.200	4.62	2.25	2.37	6.86
0.80	366.125	9.833	1.484	6.20	2.56	3.64	8.76
0.74	342	12.236	2.042	7.80	2.87	4.93	10.67
0.69	318.325	14.771	2.693	9.36	3.16	6.20	12.52
0.64	295.225	17.410	3.688	10.89	3.42	7.46	14.31
0.59	272.125	19.118	4.612	12.41	3.67	8.75	16.08
0.54	248.975	21.472	5.807	13.94	3.89	10.05	17.84
0.49	225.825	23.438	6.951	15.47	4.10	11.37	19.57
0.44	202.725	24.910	8.250	17.00	4.28	12.71	21.28
0.39	179.625	26.979	9.674	18.53	4.45	14.08	22.98
0.34	156.475	28.549	11.424	20.06	4.60	15.46	24.65
0.29	134.075	29.396	12.750	21.54	4.72	16.82	26.25
0.24	112.475	31.590	13.931	22.96	4.82	18.14	27.78
0.20	90.875	32.028	15.785	24.39	4.90	19.49	29.29
0.15	69.275	34.354	16.910	25.82	4.97	20.85	30.78
0.10	47.738	34.785	19.007	27.24	5.01	22.23	32.25
0.05	24.500	37.458	18.868	28.78	5.05	23.73	33.82
0.02	7.755	42.681	25.306	29.88	5.06	24.82	34.94
0.00	1.755	37.979	25.389	30.28	5.06	25.22	35.34

M&D Professional Services Confidential
12/21/2006

Page 2

AP-460-Sub-Model Both Waste-TH-MAX.xls, FM Max

Table 5 Sub-Model, Primary Tank Stresses, Shell Top, Gravity Plus Seismic Load, Horizontal Excitation

AP Primary Tank Sub Model, Best Estimate Soil, Horizontal Seismic, Best Estimate Tank Sub Model Concrete, 460 in. Waste Level at 1.83 SpG

		Shell Top Surface (inside - waste side)			
M&D Starting M&D Element No.	Path (in.)	AP-460-Sub-Horiz Seismic Hoop Stress (lbs/in^2) Top	AP-460-Sub-Horiz Seismic Meridional Stress (lbs/in^2) Top	AP-460-Sub-Horiz Seismic Stress Intensity (lbs/in^2) Top	AP-460-Sub-Horiz Seismic In-Plane Shear Stress (lbs/in^2) Top
762	**67.33**	158.89	-407.57	679.03	4.77
782	**105.04**	17.44	704.86	711.11	8.25
802	**136.24**	129.17	-383.54	635.00	9.18
822	**181.83**	-239.17	437.57	742.36	18.60
842	**225.10**	196.60	-509.79	845.14	58.50
862	**273.66**	-384.86	632.50	1143.06	179.31
882	**323.27**	660.28	-419.38	1403.47	523.96
902	**369.20**	-379.31	1373.61	3440.28	1379.17
922	**419.20**	2379.17	493.54	6040.28	2776.39
942	**444.31**	-2761.81	-6286.11	7861.11	2275.69
962	**458.66**	-4386.81	6838.19	12048.61	2180.56
982	**473.08**	-5584.03	7770.83	14506.94	2167.36
1002	**484.80**	-3424.31	574.10	5395.83	2213.19
1022	**502.48**	3536.81	-713.19	5273.61	2200.69
1042	**526.48**	7979.17	1040.28	7979.17	2071.53
1062	**550.48**	9979.17	1213.89	9986.11	1887.50
1082	**574.60**	12138.89	1497.22	12138.89	1673.61
1102	**598.28**	14513.89	1184.03	14520.83	1440.28
1122	**621.38**	16611.11	1561.11	16611.11	1201.39
1142	**644.48**	18652.78	1422.92	18652.78	932.64
1162	**667.63**	19930.56	1013.19	19930.56	639.10
1182	**690.78**	20083.33	1897.92	20083.33	287.64
1202	**713.88**	21013.89	1522.22	21013.89	155.49
1222	**736.98**	22458.33	858.33	22458.33	418.40
1242	**760.13**	22013.89	387.64	22020.83	731.94
1262	**782.53**	19986.11	2227.08	19986.11	756.94
1282	**804.13**	19222.22	1279.86	19222.22	961.81
1302	**825.73**	20055.56	878.47	20055.56	1166.67
1322	**847.33**	21736.11	1295.83	21736.11	1377.78
1342	**868.87**	21069.44	-2079.17	24611.11	1607.64
1362	**892.10**	13451.39	-1385.42	14916.67	1538.89
1382	**909.20**	3997.22	-922.92	6783.33	1484.72
1402	**918.38**	4131.25	11493.06	11500.00	1496.53
1460	**930.48**	2144.44	6756.25	6777.78	720.83
1442	**949.48**	-818.75	-3109.72	3440.97	604.44
1462	**990.98**	268.06	846.53	847.22	-37.59
1482	**1050.98**	-176.53	-618.47	650.28	47.80
1502	**1110.98**	196.53	647.15	650.28	-33.24
1522	**1170.98**	-155.21	-572.64	630.21	37.10
1542	**1230.98**	177.22	603.61	606.74	-35.14
1562	**1292.98**	-98.40	-500.21	549.58	51.98

Note 1: Meridonal, Hoop, and Shear Stresses are Reversed in Highlighted Sections (Floor)

Table 6 Sub-Model, Primary Tank Stresses, Shell Middle, Gravity Plus Seismic Load, Horizontal Excitation

AP Primary Tank Sub Model, Best Estimate Soil, Horizontal Seismic, Best Estimate Tank Sub Model Concrete, 460 in. Waste Level at 1.83 SpG

		Shell Mid-Plane			
M&D Starting M&D Element No.	Path (in.)	AP-460-Sub-Horiz Seismic Hoop Stress (lbs/in^2) Mid	AP-460-Sub-Horiz Seismic Meridional Stress (lbs/in^2) Mid	AP-460-Sub-Horiz Seismic Stress Intensity (lbs/in^2) Mid	AP-460-Sub-Horiz Seismic In-Plane Shear Stress (lbs/in^2) Mid
762	**67.33**	306.94	44.99	307.50	5.96
782	**105.04**	-141.67	103.33	277.71	8.06
802	**136.24**	302.92	128.06	305.42	9.19
822	**181.83**	-321.53	134.10	496.32	18.56
842	**225.10**	411.18	202.22	415.00	58.28
862	**273.66**	-475.14	322.01	882.64	179.24
882	**323.27**	929.86	531.88	1175.00	524.10
902	**369.20**	-535.28	879.86	3271.53	1378.47
922	**419.20**	2720.83	1211.11	5918.75	2777.78
942	**444.31**	-530.56	1090.28	5025.00	2283.33
962	**458.66**	-5656.94	1063.89	8319.44	2194.44
982	**473.08**	-7125.00	988.19	9840.28	2161.81
1002	**484.80**	-3047.92	955.56	5886.11	2186.11
1022	**502.48**	4067.36	1029.86	4757.64	2176.39
1042	**526.48**	8013.89	1136.11	8013.89	2060.42
1062	**550.48**	9986.11	1234.72	9993.06	1881.25
1082	**574.60**	12090.28	1322.92	12097.22	1666.67
1102	**598.28**	14590.28	1406.94	14590.28	1433.33
1122	**621.38**	16645.83	1475.69	16645.83	1195.83
1142	**644.48**	18750.00	1525.00	18750.00	928.47
1162	**667.63**	20173.61	1556.94	20173.61	638.75
1182	**690.78**	20000.00	1378.47	20000.00	288.68
1202	**713.88**	21020.83	1372.92	21020.83	149.93
1222	**736.98**	22618.06	1350.00	22618.06	417.50
1242	**760.13**	22305.56	1311.11	22305.56	724.31
1262	**782.53**	19604.17	918.06	19604.17	747.92
1282	**804.13**	19111.11	866.67	19111.11	960.42
1302	**825.73**	20041.67	806.25	20041.67	1167.36
1322	**847.33**	21576.39	737.50	21576.39	1379.86
1342	**868.87**	22333.33	652.57	22333.33	1593.75
1362	**892.10**	14013.89	475.56	14020.83	1501.39
1382	**909.20**	4393.75	444.44	4913.89	1443.75
1402	**918.38**	902.78	547.15	3017.36	1477.78
1460	**930.48**	375.56	618.54	2382.64	1038.89
1442	**949.48**	189.65	329.03	965.28	417.29
1462	**990.98**	63.21	140.76	204.79	72.43
1482	**1050.98**	3.37	6.15	35.10	12.76
1502	**1110.98**	0.88	2.30	35.10	2.12
1522	**1170.98**	0.35	2.35	39.43	0.20
1542	**1230.98**	0.24	2.11	50.93	0.32
1562	**1292.98**	0.07	1.65	84.86	0.27

Note 1: Meridonal, Hoop, and Shear Stresses are Reversed in Highlighted Sections (Floor)

Table 7 Sub-Model, Primary Tank Stresses, Shell Bottom, Gravity Plus Seismic Load, Horizontal Excitation

AP Primary Tank Sub Model, Best Estimate Soil, Horizontal Seismic, Best Estimate Tank Sub Model Concrete, 460 in. Waste Level at 1.83 SpG

M&D Starting M&D Element No.	Path (in.)	Shell Bottom Surface (outside - away from waste) AP-460-Sub-Horiz Seismic Hoop Stress (lbs/in^2) Bot	AP-460-Sub-Horiz Seismic Meridional Stress (lbs/in^2) Bot	AP-460-Sub-Horiz Seismic Stress Intensity (lbs/in^2) Bot	AP-460-Sub-Horiz Seismic In-Plane Shear Stress (lbs/in^2) Bot
762	**67.33**	456.11	602.08	602.15	7.58
782	**105.04**	-285.35	-407.64	547.71	7.91
802	**136.24**	483.82	705.56	706.25	9.26
822	**181.83**	-403.96	-193.54	550.76	18.52
842	**225.10**	632.08	927.78	929.86	58.07
862	**273.66**	-565.49	80.97	859.03	179.10
882	**323.27**	1200.00	1407.64	1658.33	524.24
902	**369.20**	-690.28	517.99	3134.03	1377.78
922	**419.20**	3063.19	2502.78	5910.42	2779.17
942	**444.31**	1963.89	9708.33	9715.28	2290.28
962	**458.66**	-6905.56	-3611.11	8736.11	2207.64
982	**473.08**	-8673.61	-4475.00	10861.11	2156.25
1002	**484.80**	-2664.58	2836.81	6459.72	2158.33
1022	**502.48**	4597.92	2795.83	4989.58	2151.39
1042	**526.48**	8048.61	1245.83	8048.61	2049.31
1062	**550.48**	10000.00	1256.25	10000.00	1874.31
1082	**574.60**	12041.67	1229.17	12048.61	1660.42
1102	**598.28**	14701.39	1637.50	14708.33	1426.39
1122	**621.38**	16680.56	1390.97	16680.56	1190.28
1142	**644.48**	18847.22	1641.67	18847.22	923.61
1162	**667.63**	20409.72	2111.11	20409.72	638.33
1182	**690.78**	19923.61	897.22	19923.61	289.72
1202	**713.88**	21062.50	1250.00	21062.50	147.22
1222	**736.98**	22777.78	1842.36	22777.78	416.60
1242	**760.13**	22597.22	2234.72	22597.22	717.36
1262	**782.53**	19222.22	-573.68	19618.06	738.89
1282	**804.13**	19000.00	473.26	19000.00	959.03
1302	**825.73**	20027.78	742.36	20034.72	1168.06
1322	**847.33**	21416.67	203.40	21416.67	1381.25
1342	**868.87**	23597.22	4843.06	23597.22	1580.56
1362	**892.10**	14583.33	2403.47	14583.33	1463.89
1382	**909.20**	5115.28	3990.97	5611.11	1403.47
1402	**918.38**	-2222.92	-9006.94	10479.17	1459.03
1460	**930.48**	-1565.28	-5239.58	5862.50	1356.25
1442	**949.48**	1240.28	3961.11	3965.28	230.21
1462	**990.98**	-155.83	-540.28	611.04	109.17
1482	**1050.98**	208.75	678.61	653.26	-33.12
1502	**1110.98**	-180.28	-592.92	653.26	37.47
1522	**1170.98**	187.36	623.26	626.18	-33.87
1542	**1230.98**	-163.13	-555.97	610.49	38.66
1562	**1292.98**	143.96	542.78	546.39	-47.18

Note 1: Meridonal, Hoop, and Shear Stresses are Reversed in Highlighted Sections (Floor)

M&D Professional Services Confidential
12/21/2006

AP-460-Sub-Model-Horiz Pri Tank Stress Seismic.xls, Stress Max
Page 3

Table 8 Sub-Model, Waste Contact Pressure, Gravity Plus Seismic, Horizontal Excitation

Tank AY, 460 Inch Waste Level
SpG = 1.83
Best Estimate Soil
Best Estimate Concrete

Waste Height Ratio	Waste Height	Max Pressure AP Tank, 460 in Waste Level, SpG = 1.83 Time History (PSI)	Min Pressure AP Tank, 460 in Waste Level, SpG = 1.83 Time History (PSI)	Hydrostatic (psi)	Hydrodynamic (psi)	Theoretical Min (SRSS)	Theoretical Max (SRSS)
0.99	454.35	8.847	-7.722	0.37	1.65	0.00	2.02
0.96	443.05	11.313	-10.486	1.12	1.68	0.00	2.80
0.94	431.7625	15.090	-10.299	1.87	1.75	0.12	3.61
0.90	414.125	10.326	-4.045	3.03	1.90	1.13	4.93
0.85	390.125	8.035	1.046	4.62	2.14	2.48	6.76
0.80	366.125	9.757	2.586	6.20	2.39	3.81	8.59
0.74	342	12.174	3.535	7.80	2.63	5.16	10.43
0.69	318.325	14.188	4.442	9.36	2.85	6.51	12.21
0.64	295.225	16.479	5.202	10.89	3.05	7.84	13.94
0.59	272.125	18.174	6.298	12.41	3.23	9.19	15.64
0.54	248.975	20.417	7.486	13.94	3.38	10.56	17.33
0.49	225.825	22.444	8.743	15.47	3.52	11.95	19.00
0.44	202.725	23.472	10.507	17.00	3.65	13.35	20.65
0.39	179.625	25.208	11.882	18.53	3.76	14.77	22.28
0.34	156.475	27.014	13.313	20.06	3.85	16.21	23.91
0.29	134.075	28.174	15.014	21.54	3.93	17.61	25.46
0.24	112.475	29.889	16.049	22.96	3.99	18.97	26.95
0.20	90.875	30.764	17.785	24.39	4.04	20.35	28.43
0.15	69.275	32.896	18.854	25.82	4.08	21.74	29.89
0.10	47.738	33.333	21.014	27.24	4.11	23.13	31.35
0.05	24.500	36.389	20.757	28.78	4.12	24.65	32.90
0.02	7.755	41.014	29.222	29.88	4.13	25.75	34.01
0.00	1.755	36.958	29.472	30.28	4.13	26.15	34.41

Table 9 Sub-Model, Primary Tank Stresses, Shell Top, Gravity Plus Seismic Load, Vertical Excitation

AP Primary Tank Sub Model, Best Estimate Soil, Vertical Seismic, Best Estimate Tank Sub Model Concrete, 460 in. Waste Level at 1.83 SpG

		Shell Top Surface (inside - waste side)			
M&D Starting M&D Element No.	Path (in.)	AP-460-Sub-Vert Seismic Hoop Stress (lbs/in^2) Top	AP-460-Sub-Vert Seismic Meridional Stress (lbs/in^2) Top	AP-460-Sub-Vert Seismic Stress Intensity (lbs/in^2) Top	AP-460-Sub-Vert Seismic In-Plane Shear Stress (lbs/in^2) Top
762	**67.33**	168.75	-342.15	676.53	0.71
782	**105.04**	1.10	698.61	700.00	0.23
802	**136.24**	123.40	-322.99	607.01	0.21
822	**181.83**	-202.43	439.17	743.06	0.17
842	**225.10**	145.42	-431.25	793.75	0.26
862	**273.66**	-329.17	627.78	1122.22	0.43
882	**323.27**	428.40	-370.69	989.58	1.05
902	**369.20**	-355.76	1543.06	2078.47	2.57
922	**419.20**	1410.42	-89.51	1575.00	8.15
942	**444.31**	-2302.08	-5234.03	7840.28	8.32
962	**458.66**	-3687.50	6544.44	12020.83	8.83
982	**473.08**	-4757.64	7215.28	14131.94	12.32
1002	**484.80**	-2971.53	-451.11	4197.22	12.44
1022	**502.48**	2567.36	-646.74	3440.97	12.85
1042	**526.48**	6236.81	755.56	6236.81	12.85
1062	**550.48**	8083.33	654.72	8083.33	9.90
1082	**574.60**	10034.72	867.36	10034.72	16.76
1102	**598.28**	12166.67	525.35	12166.67	13.84
1122	**621.38**	14138.89	772.92	14138.89	13.56
1142	**644.48**	16118.06	625.07	16118.06	13.40
1162	**667.63**	17506.94	210.69	17506.94	12.72
1182	**690.78**	17979.17	1061.81	17979.17	9.98
1202	**713.88**	19180.56	731.94	19180.56	11.65
1222	**736.98**	20805.56	147.36	20805.56	10.57
1242	**760.13**	20652.78	-201.53	21000.00	9.51
1262	**782.53**	19006.94	1657.64	19006.94	8.85
1282	**804.13**	18493.06	800.69	18493.06	7.72
1302	**825.73**	19479.17	444.58	19479.17	11.76
1322	**847.33**	21270.83	927.08	21270.83	9.82
1342	**868.87**	20944.44	-2313.19	24388.89	7.99
1362	**892.10**	13881.94	-1487.50	15881.94	9.10
1382	**909.20**	4162.50	-2091.67	6894.44	7.42
1402	**918.38**	4571.53	11979.17	11993.06	7.23
1460	**930.48**	2336.81	7493.06	7548.61	-297.78
1442	**949.48**	-811.11	-2747.22	3827.08	219.72
1462	**990.98**	301.25	959.03	963.89	-40.04
1482	**1050.98**	-160.63	-548.19	735.42	42.97
1502	**1110.98**	221.11	731.94	735.42	-30.06
1522	**1170.98**	-141.11	-508.75	710.42	41.44
1542	**1230.98**	199.24	686.39	689.65	-30.97
1562	**1292.98**	-89.72	-444.10	620.42	58.71

Note 1: Meridonal, Hoop, and Shear Stresses are Reversed in Highlighted Sections (Floor)

M&D Professional Services Confidential
12/21/2006

AP-460-Sub-Model-Vert Pri Tank Stress Seismic.xls, Stress Max
Page 1

Table 10 Sub-Model, Primary Tank Stresses, Shell Middle, Gravity Plus Seismic Load, Vertical Excitation

AP Primary Tank Sub Model, Best Estimate Soil, Vertical Seismic, Best Estimate Tank Sub Model Concrete, 460 in. Waste Level at 1.83 SpG

M&D Starting M&D Element No.	Path (in.)	Shell Mid-Plane			
		AP-460-Sub-Vert Seismic Hoop Stress (lbs/in^2) Mid	AP-460-Sub-Vert Seismic Meridional Stress (lbs/in^2) Mid	AP-460-Sub-Vert Seismic Stress Intensity (lbs/in^2) Mid	AP-460-Sub-Vert Seismic In-Plane Shear Stress (lbs/in^2) Mid
762	**67.33**	312.78	39.80	313.26	0.40
782	**105.04**	-120.00	93.61	275.63	0.17
802	**136.24**	300.14	109.58	302.29	0.16
822	**181.83**	-270.83	95.00	502.43	0.17
842	**225.10**	384.93	147.01	390.97	0.25
862	**273.66**	-404.10	258.75	865.97	0.41
882	**323.27**	738.89	467.57	745.14	1.03
902	**369.20**	-484.79	912.50	1641.67	2.60
922	**419.20**	1835.42	1255.56	1839.58	8.20
942	**444.31**	-451.94	1099.31	1788.89	8.48
962	**458.66**	-4718.75	991.67	8041.67	8.95
982	**473.08**	-6031.25	802.08	9673.61	11.58
1002	**484.80**	-2668.75	732.64	4481.94	11.53
1022	**502.48**	3038.89	718.75	3039.58	11.47
1042	**526.48**	6231.25	711.81	6231.25	11.59
1062	**550.48**	8097.22	704.17	8097.22	8.77
1082	**574.60**	9986.11	696.53	9986.11	14.81
1102	**598.28**	12222.22	689.03	12222.22	12.33
1122	**621.38**	14111.11	681.11	14111.11	11.69
1142	**644.48**	16138.89	673.89	16138.89	11.84
1162	**667.63**	17652.78	666.11	17652.78	11.44
1182	**690.78**	17833.33	576.46	17833.33	8.78
1202	**713.88**	19131.94	568.75	19131.94	9.56
1222	**736.98**	20937.50	561.04	20937.50	8.65
1242	**760.13**	20923.61	553.61	20923.61	7.99
1262	**782.53**	18631.94	397.08	18631.94	6.46
1282	**804.13**	18368.06	389.93	18368.06	6.09
1302	**825.73**	19465.28	382.78	19465.28	9.10
1322	**847.33**	21104.17	375.76	21104.17	8.13
1342	**868.87**	22083.33	368.82	22090.28	6.60
1362	**892.10**	14569.44	305.90	14576.39	6.87
1382	**909.20**	4953.47	311.32	5063.19	5.87
1402	**918.38**	914.58	472.08	1013.89	6.89
1460	**930.48**	199.24	518.96	802.08	-20.92
1442	**949.48**	125.14	320.49	351.39	-17.01
1462	**990.98**	55.91	156.74	160.49	-8.33
1482	**1050.98**	1.29	2.20	39.40	0.23
1502	**1110.98**	0.11	0.21	39.40	0.04
1522	**1170.98**	0.07	0.06	44.22	0.01
1542	**1230.98**	0.04	0.03	56.96	0.00
1562	**1292.98**	0.02	0.02	94.44	0.00

Note 1: Meridonal, Hoop, and Shear Stresses are Reversed in Highlighted Sections (Floor)

M&D Professional Services Confidential
12/21/2006

AP-460-Sub-Model-Vert Pri Tank Stress Seismic.xls, Stress Max
Page 2

Table 11 Sub-Model, Primary Tank Stresses, Shell Bottom, Gravity Plus Seismic Load, Vertical Excitation

AP Primary Tank Sub Model, Best Estimate Soil, Vertical Seismic, Best Estimate Tank Sub Model Concrete, 460 in. Waste Level at 1.83 SpG

M&D Starting M&D Element No.	Path (in.)	Shell Bottom Surface (outside - away from waste)			
		AP-460-Sub-Vert Seismic Hoop Stress (lbs/in^2) Bot	AP-460-Sub-Vert Seismic Meridional Stress (lbs/in^2) Bot	AP-460-Sub-Vert Seismic Stress Intensity (lbs/in^2) Bot	AP-460-Sub-Vert Seismic In-Plane Shear Stress (lbs/in^2) Bot
762	**67.33**	459.31	588.19	588.26	0.57
782	**105.04**	-239.72	-342.71	512.22	0.29
802	**136.24**	477.01	702.08	702.78	0.16
822	**181.83**	-339.24	-166.67	509.31	0.20
842	**225.10**	624.44	940.28	941.67	0.26
862	**273.66**	-479.10	-74.10	722.22	0.40
882	**323.27**	1049.31	1489.58	1493.75	1.00
902	**369.20**	-614.03	281.18	1207.64	2.62
922	**419.20**	2261.11	2645.83	2649.31	8.26
942	**444.31**	2096.53	10027.78	10034.72	8.63
962	**458.66**	-5751.39	-2992.36	8625.00	9.08
982	**473.08**	-7305.56	-3677.78	10805.56	10.84
1002	**484.80**	-2359.72	2282.64	5568.75	10.89
1022	**502.48**	3511.11	2358.33	3511.11	10.16
1042	**526.48**	6225.69	675.90	6225.69	10.59
1062	**550.48**	8111.11	763.19	8111.11	7.76
1082	**574.60**	9951.39	536.18	9951.39	12.86
1102	**598.28**	12270.83	855.56	12270.83	10.81
1122	**621.38**	14083.33	594.79	14083.33	9.83
1142	**644.48**	16152.78	731.25	16152.78	10.34
1162	**667.63**	17798.61	1155.56	17798.61	10.17
1182	**690.78**	17694.44	112.71	17694.44	7.57
1202	**713.88**	19083.33	407.29	19083.33	7.47
1222	**736.98**	21069.44	1002.08	21069.44	6.74
1242	**760.13**	21194.44	1450.69	21194.44	7.15
1262	**782.53**	18256.94	-546.81	19118.06	4.41
1282	**804.13**	18250.00	10.06	18270.83	4.57
1302	**825.73**	19444.44	324.17	19444.44	6.68
1322	**847.33**	20937.50	-136.04	21111.11	6.79
1342	**868.87**	23229.17	4181.25	23229.17	5.83
1362	**892.10**	15263.89	2604.17	15263.89	5.44
1382	**909.20**	5744.44	3346.53	5758.33	5.45
1402	**918.38**	-1943.75	-7798.61	11048.61	6.55
1460	**930.48**	-1403.47	-4665.97	6513.19	364.03
1442	**949.48**	1379.86	4419.44	4440.28	-179.31
1462	**990.98**	-140.69	-483.47	672.15	41.66
1482	**1050.98**	232.78	765.28	735.42	-31.04
1502	**1110.98**	-159.10	-526.53	735.42	41.78
1522	**1170.98**	210.90	706.94	710.42	-29.82
1542	**1230.98**	-143.26	-493.89	689.58	43.05
1562	**1292.98**	160.49	617.22	620.42	-42.18

<u>Note 1</u>: Meridonal, Hoop, and Shear Stresses are Reversed in Highlighted Sections (Floor)

M&D Professional Services Confidential
12/21/2006

AP-460-Sub-Model-Vert Pri Tank Stress Seismic.xls, Stress Max
Page 3

Table 12 Sub-Model, Waste Contact Pressure, Gravity Plus Seismic, Vertical Excitation

Tank AY, 460 Inch Waste Level
SpG = 1.83
Sub-Model Vertical

Waste Height Ratio	Waste Height	Max Pressure AP Tank, 460 in Waste Level, SpG = 1.83 Time History (PSI)	Min Pressure AP Tank, 460 in Waste Level, SpG = 1.83 Time History (PSI)	Hydrostatic (psi)	Hydrodynamic (psi)	Theoretical Min (SRSS)	Theoretical Max (SRSS)
0.99	454.35	0.805	0.191	0.37	0.06	0.32	0.43
0.96	443.05	1.632	-0.566	1.12	0.17	0.95	1.29
0.94	431.7625	4.026	0.599	1.87	0.28	1.58	2.15
0.90	414.125	4.615	1.868	3.03	0.46	2.58	3.49
0.85	390.125	6.233	3.053	4.62	0.69	3.93	5.31
0.80	366.125	7.944	4.492	6.20	0.92	5.28	7.12
0.74	342	10.014	5.637	7.80	1.14	6.65	8.94
0.69	318.325	11.979	6.735	9.36	1.36	8.00	10.72
0.64	295.225	13.938	7.944	10.89	1.56	9.33	12.44
0.59	272.125	15.750	9.181	12.41	1.75	10.67	14.16
0.54	248.975	17.771	10.424	13.94	1.93	12.02	15.87
0.49	225.825	19.701	11.688	15.47	2.09	13.38	17.57
0.44	202.725	21.417	12.938	17.00	2.25	14.75	19.25
0.39	179.625	23.264	14.292	18.53	2.39	16.14	20.91
0.34	156.475	25.153	15.639	20.06	2.51	17.54	22.57
0.29	134.075	26.861	17.056	21.54	2.62	18.92	24.15
0.24	112.475	28.458	18.361	22.96	2.71	20.26	25.67
0.20	90.875	30.083	19.750	24.39	2.78	21.61	27.17
0.15	69.275	31.736	21.007	25.82	2.84	22.98	28.65
0.10	47.738	33.424	22.438	27.24	2.88	24.36	30.12
0.05	24.500	34.701	23.799	28.78	2.91	25.87	31.68
0.02	7.755	36.896	25.417	29.88	2.92	26.96	32.80
0.00	1.755	36.243	25.313	30.28	2.92	27.36	33.20

Sub-Model File Listing, Horizontal and Vertical Excitation

```
 Volume in drive C is 600GB 2xRAID0 (new)
 Volume Serial Number is 8A0A-E4BA

 Directory of C:\Users\Bruce\2008-000 PNNL\2008-005 AP-460\AP-460-Sub-Model-Both

01/02/2007  11:23 AM    <DIR>          .
01/02/2007  11:23 AM    <DIR>          ..
08/21/2006  06:49 AM               101 All-Forces.txt
11/10/2006  03:07 PM               768 AP-460-Slosh-Flex-Dytran.log
11/25/2006  01:37 AM         3,753,733 AP-460-Solve-Sub-HV.out
12/17/2006  12:14 PM           460,800 AP-460-Sub-Model Both Total Reaction.xls
12/21/2006  03:50 PM           934,400 AP-460-Sub-Model Both Waste-TH-MAX.xls
12/17/2006  12:25 PM         9,311,232 AP-460-Sub-Model-Both Pri Tank Stress Seismic.xls
11/20/2006  08:59 AM            76,382 AP-460-Sub-Model-H.log
12/16/2006  07:24 AM             2,998 AP-460-Sub-Model-HV.BCS
12/16/2006  11:16 PM        43,581,440 AP-460-Sub-Model-HV.db
12/17/2006  01:15 PM           723,715 AP-460-Sub-Model-HV.err
12/17/2006  01:33 PM             1,606 AP-460-Sub-Model-HV.log
12/16/2006  07:25 AM           190,159 AP-460-Sub-Model-HV.mntr
12/16/2006  07:24 AM                67 AP-460-Sub-Model-HV.PVTS
11/25/2006  01:33 AM                97 AP-460-Sub-Model-HV.stat
11/17/2006  11:04 AM             6,046 Bolts-Friction.txt
06/09/2005  01:59 PM               262 Boundary.txt
11/19/2006  09:14 AM               227 Contact-AP.txt
08/21/2006  07:59 AM               586 Contact-Footing.txt
08/25/2006  01:28 PM               704 Contact-Insul.txt
08/25/2006  01:27 PM               704 Contact-J-Bolts.txt
08/25/2006  01:28 PM               708 Contact-Primary.txt
08/21/2006  07:59 AM               742 Contact-Soil.txt
08/21/2006  12:44 PM               632 Contact-Waste-AP.txt
01/03/2006  11:17 AM             1,616 Disp-J-Bolts.txt
11/10/2006  02:08 PM             8,620 Far-Soil.txt
11/24/2006  12:40 AM             2,002 file.bat
11/24/2006  12:40 AM                68 file.err
11/24/2006  12:40 AM             6,050 file.log
12/20/2005  04:49 PM            39,925 file.txt
10/13/2005  06:54 AM               562 Fix-Soil.txt
08/21/2006  08:00 AM               894 Force-c.txt
08/21/2006  08:00 AM               661 Force-j_bolt.txt
10/17/2006  01:37 PM             1,668 Insulate.txt
07/20/2006  06:36 AM             4,030 interface-gap1.txt
11/13/2006  01:45 PM             2,445 interface1.txt
08/23/2006  07:47 AM             1,971 Liner.txt
05/02/2005  02:19 PM               667 live_load.txt
07/21/2006  10:03 AM             6,214 Near-Soil-1.txt
04/20/2005  01:14 PM               508 outer-spar.txt
11/10/2006  04:08 PM               125 Post-Tank.txt
11/10/2006  04:05 PM             6,154 Primary-Props-AP.txt
09/27/2005  03:52 PM             1,538 Primary.txt
11/24/2006  12:41 AM           408,638 QA.out
10/31/2005  10:31 AM             1,108 RS_FREQ.txt
11/25/2006  05:12 PM         2,782,383 Run-Tank-Out.out
11/22/2006  06:44 AM             1,919 Run-Tank.txt
12/17/2006  01:01 PM                 0 scratch.hlp
02/11/2005  01:22 PM             1,053 Slave.txt
11/11/2005  10:36 AM             4,989 Soil-Prop-Mean-Geo.txt
11/13/2006  01:57 PM             2,028 Solve-Slosh-flex.txt
12/13/2006  06:48 AM             2,184 Solve-Sub-HV.txt
08/25/2006  08:47 AM             1,918 Solve-TH-BES.txt
09/13/2006  06:12 AM               347 spectra-all.txt
09/13/2006  06:07 AM             3,690 spectra-conc-0.txt
09/13/2006  06:08 AM             3,723 spectra-conc-135.txt
09/13/2006  06:09 AM             3,723 spectra-conc-180.txt
09/13/2006  06:08 AM             3,769 spectra-conc-45.txt
```

```
09/13/2006  06:08 AM             3,649 spectra-conc-90.txt
09/13/2006  06:09 AM             1,590 spectra-conc.txt
08/28/2006  09:38 AM             2,076 spectra-concrete.txt
10/03/2006  02:02 PM             3,624 spectra-primary-0.txt
10/03/2006  02:04 PM             3,777 spectra-primary-135.txt
09/13/2006  06:15 AM             3,777 spectra-primary-180.txt
10/03/2006  02:03 PM             3,703 spectra-primary-45.txt
10/03/2006  02:03 PM             3,703 spectra-primary-90.txt
09/13/2006  06:15 AM             3,801 spectra-soil.txt
06/20/2005  09:04 AM               647 spectra-wall.txt
06/20/2005  08:52 AM               679 spectra-waste.txt
12/17/2006  12:22 PM           279,040 str-comp_0-90b.xls
12/17/2006  12:22 PM           284,160 str-comp_0-90m.xls
12/17/2006  12:22 PM           279,040 str-comp_0-90t.xls
12/17/2006  12:23 PM           279,040 str-comp_99-180b.xls
12/17/2006  12:23 PM           284,160 str-comp_99-180m.xls
12/17/2006  12:23 PM           279,040 str-comp_99-180t.xls
09/05/2006  02:00 PM             2,588 strain-backed.txt
08/21/2006  08:01 AM               566 strain-compb-p.txt
08/16/2006  01:59 PM               621 strain-compb-primary.txt
08/21/2006  08:01 AM               693 strain-compb.txt
08/21/2006  08:02 AM               566 strain-compm-p.txt
08/16/2006  02:00 PM               621 strain-compm-primary.txt
08/21/2006  08:01 AM               705 strain-compm.txt
08/21/2006  08:02 AM               578 strain-compt-p.txt
08/16/2006  02:00 PM               621 strain-compt-primary.txt
08/21/2006  08:02 AM               720 strain-compt.txt
08/21/2006  08:02 AM               730 Strain-Liner-floor.txt
01/05/2006  03:14 PM               550 Strain-Liner-p.txt
08/21/2006  08:02 AM               962 Strain-Liner-wall.txt
08/16/2006  03:01 PM               545 Strain-Liner.txt
08/16/2006  02:01 PM               292 Strain-Primary.txt
08/16/2006  02:19 PM               273 Strain.txt
08/21/2006  08:02 AM               554 stress-compb-p.txt
08/21/2006  08:02 AM               598 stress-compb.txt
08/21/2006  08:03 AM               554 stress-compm-p.txt
08/21/2006  08:03 AM               608 stress-compm.txt
08/21/2006  08:03 AM               554 stress-compt-p.txt
08/24/2006  03:19 PM               598 stress-compt.txt
08/17/2006  11:19 AM               207 Stress-Primary-M.txt
08/24/2006  12:05 PM               224 Stress-Primary.txt
12/16/2006  09:38 PM            13,519 Stress-pt_108max-b.OUT
12/16/2006  05:30 PM            13,519 Stress-pt_108max-m.OUT
12/16/2006  01:22 PM            13,519 Stress-pt_108max-t.OUT
12/16/2006  09:38 PM         6,143,768 Stress-pt_108th-b.OUT
12/16/2006  05:30 PM         6,143,768 Stress-pt_108th-m.OUT
12/16/2006  01:22 PM         6,115,040 Stress-pt_108th-t.OUT
12/16/2006  09:50 PM            13,519 Stress-pt_117max-b.OUT
12/16/2006  05:42 PM            13,519 Stress-pt_117max-m.OUT
12/16/2006  01:34 PM            13,519 Stress-pt_117max-t.OUT
12/16/2006  09:50 PM         6,143,768 Stress-pt_117th-b.OUT
12/16/2006  05:42 PM         6,143,768 Stress-pt_117th-m.OUT
12/16/2006  01:34 PM         6,115,040 Stress-pt_117th-t.OUT
12/16/2006  10:02 PM            13,519 Stress-pt_126max-b.OUT
12/16/2006  05:55 PM            13,519 Stress-pt_126max-m.OUT
12/16/2006  01:47 PM            13,519 Stress-pt_126max-t.OUT
12/16/2006  10:02 PM         6,143,768 Stress-pt_126th-b.OUT
12/16/2006  05:55 PM         6,143,768 Stress-pt_126th-m.OUT
12/16/2006  01:47 PM         6,115,040 Stress-pt_126th-t.OUT
12/16/2006  10:15 PM            13,519 Stress-pt_135max-b.OUT
12/16/2006  06:07 PM            13,519 Stress-pt_135max-m.OUT
12/16/2006  01:59 PM            13,519 Stress-pt_135max-t.OUT
12/16/2006  10:15 PM         6,143,768 Stress-pt_135th-b.OUT
12/16/2006  06:07 PM         6,143,768 Stress-pt_135th-m.OUT
12/16/2006  01:59 PM         6,115,040 Stress-pt_135th-t.OUT
12/16/2006  10:27 PM            13,519 Stress-pt_144max-b.OUT
12/16/2006  06:19 PM            13,519 Stress-pt_144max-m.OUT
12/16/2006  02:12 PM            13,519 Stress-pt_144max-t.OUT
12/16/2006  10:27 PM         6,143,768 Stress-pt_144th-b.OUT
12/16/2006  06:19 PM         6,143,768 Stress-pt_144th-m.OUT
```

```
12/16/2006  02:12 PM         6,115,040 Stress-pt_144th-t.OUT
12/16/2006  10:39 PM            13,519 Stress-pt_153max-b.OUT
12/16/2006  06:32 PM            13,519 Stress-pt_153max-m.OUT
12/16/2006  02:24 PM            13,519 Stress-pt_153max-t.OUT
12/16/2006  10:39 PM         6,143,768 Stress-pt_153th-b.OUT
12/16/2006  06:32 PM         6,143,768 Stress-pt_153th-m.OUT
12/16/2006  02:24 PM         6,115,040 Stress-pt_153th-t.OUT
12/16/2006  10:52 PM            13,519 Stress-pt_162max-b.OUT
12/16/2006  06:44 PM            13,519 Stress-pt_162max-m.OUT
12/16/2006  02:37 PM            13,519 Stress-pt_162max-t.OUT
12/16/2006  10:52 PM         6,143,768 Stress-pt_162th-b.OUT
12/16/2006  06:44 PM         6,143,768 Stress-pt_162th-m.OUT
12/16/2006  02:37 PM         6,115,040 Stress-pt_162th-t.OUT
12/16/2006  11:04 PM            13,521 Stress-pt_171max-b.OUT
12/16/2006  06:57 PM            13,521 Stress-pt_171max-m.OUT
12/16/2006  02:49 PM            13,521 Stress-pt_171max-t.OUT
12/16/2006  11:04 PM         6,143,768 Stress-pt_171th-b.OUT
12/16/2006  06:57 PM         6,143,768 Stress-pt_171th-m.OUT
12/16/2006  02:49 PM         6,115,040 Stress-pt_171th-t.OUT
12/16/2006  11:16 PM            13,521 Stress-pt_180max-b.OUT
12/16/2006  07:09 PM            13,521 Stress-pt_180max-m.OUT
12/16/2006  03:01 PM            13,521 Stress-pt_180max-t.OUT
12/16/2006  11:16 PM         6,143,768 Stress-pt_180th-b.OUT
12/16/2006  07:09 PM         6,143,768 Stress-pt_180th-m.OUT
12/16/2006  03:01 PM         6,115,040 Stress-pt_180th-t.OUT
12/16/2006  07:34 PM            13,519 Stress-pt_18max-b.OUT
12/16/2006  03:26 PM            13,519 Stress-pt_18max-m.OUT
12/16/2006  11:18 AM            13,519 Stress-pt_18max-t.OUT
12/16/2006  07:34 PM         6,143,768 Stress-pt_18th-b.OUT
12/16/2006  03:26 PM         6,143,768 Stress-pt_18th-m.OUT
12/16/2006  11:18 AM         6,115,040 Stress-pt_18th-t.OUT
12/16/2006  07:46 PM            13,519 Stress-pt_27max-b.OUT
12/16/2006  03:38 PM            13,519 Stress-pt_27max-m.OUT
12/16/2006  11:30 AM            13,519 Stress-pt_27max-t.OUT
12/16/2006  07:46 PM         6,143,768 Stress-pt_27th-b.OUT
12/16/2006  03:38 PM         6,143,768 Stress-pt_27th-m.OUT
12/16/2006  11:30 AM         6,115,040 Stress-pt_27th-t.OUT
12/16/2006  07:58 PM            13,519 Stress-pt_36max-b.OUT
12/16/2006  03:50 PM            13,519 Stress-pt_36max-m.OUT
12/16/2006  11:42 AM            13,519 Stress-pt_36max-t.OUT
12/16/2006  07:58 PM         6,143,768 Stress-pt_36th-b.OUT
12/16/2006  03:50 PM         6,143,768 Stress-pt_36th-m.OUT
12/16/2006  11:42 AM         6,115,040 Stress-pt_36th-t.OUT
12/16/2006  08:10 PM            13,519 Stress-pt_45max-b.OUT
12/16/2006  04:02 PM            13,519 Stress-pt_45max-m.OUT
12/16/2006  11:55 AM            13,519 Stress-pt_45max-t.OUT
12/16/2006  08:10 PM         6,143,768 Stress-pt_45th-b.OUT
12/16/2006  04:03 PM         6,143,768 Stress-pt_45th-m.OUT
12/16/2006  11:55 AM         6,115,040 Stress-pt_45th-t.OUT
12/16/2006  08:22 PM            13,519 Stress-pt_54max-b.OUT
12/16/2006  04:15 PM            13,519 Stress-pt_54max-m.OUT
12/16/2006  12:07 PM            13,519 Stress-pt_54max-t.OUT
12/16/2006  08:22 PM         6,143,768 Stress-pt_54th-b.OUT
12/16/2006  04:15 PM         6,143,768 Stress-pt_54th-m.OUT
12/16/2006  12:07 PM         6,115,040 Stress-pt_54th-t.OUT
12/16/2006  08:36 PM            13,519 Stress-pt_63max-b.OUT
12/16/2006  04:28 PM            13,519 Stress-pt_63max-m.OUT
12/16/2006  12:20 PM            13,519 Stress-pt_63max-t.OUT
12/16/2006  08:36 PM         6,143,768 Stress-pt_63th-b.OUT
12/16/2006  04:28 PM         6,143,768 Stress-pt_63th-m.OUT
12/16/2006  12:20 PM         6,115,040 Stress-pt_63th-t.OUT
12/16/2006  08:48 PM            13,519 Stress-pt_72max-b.OUT
12/16/2006  04:40 PM            13,519 Stress-pt_72max-m.OUT
12/16/2006  12:32 PM            13,519 Stress-pt_72max-t.OUT
12/16/2006  08:48 PM         6,143,768 Stress-pt_72th-b.OUT
12/16/2006  04:40 PM         6,143,768 Stress-pt_72th-m.OUT
12/16/2006  12:32 PM         6,115,040 Stress-pt_72th-t.OUT
12/16/2006  09:00 PM            13,519 Stress-pt_81max-b.OUT
12/16/2006  04:52 PM            13,519 Stress-pt_81max-m.OUT
12/16/2006  12:45 PM            13,519 Stress-pt_81max-t.OUT
```

12/16/2006	09:00 PM	6,143,768	Stress-pt_81th-b.OUT
12/16/2006	04:53 PM	6,143,768	Stress-pt_81th-m.OUT
12/16/2006	12:45 PM	6,115,040	Stress-pt_81th-t.OUT
12/16/2006	09:13 PM	13,519	Stress-pt_90max-b.OUT
12/16/2006	05:05 PM	13,519	Stress-pt_90max-m.OUT
12/16/2006	12:57 PM	13,519	Stress-pt_90max-t.OUT
12/16/2006	09:13 PM	6,143,768	Stress-pt_90th-b.OUT
12/16/2006	05:05 PM	6,143,768	Stress-pt_90th-m.OUT
12/16/2006	12:57 PM	6,115,040	Stress-pt_90th-t.OUT
12/16/2006	09:25 PM	13,519	Stress-pt_99max-b.OUT
12/16/2006	05:18 PM	13,519	Stress-pt_99max-m.OUT
12/16/2006	01:10 PM	13,519	Stress-pt_99max-t.OUT
12/16/2006	09:25 PM	6,143,768	Stress-pt_99th-b.OUT
12/16/2006	05:18 PM	6,143,768	Stress-pt_99th-m.OUT
12/16/2006	01:10 PM	6,115,040	Stress-pt_99th-t.OUT
12/16/2006	07:21 PM	13,519	Stress-pt_9max-b.OUT
12/16/2006	03:14 PM	13,519	Stress-pt_9max-m.OUT
12/16/2006	11:05 AM	13,519	Stress-pt_9max-t.OUT
12/16/2006	07:21 PM	6,143,896	Stress-pt_9th-b.OUT
12/16/2006	03:14 PM	6,143,896	Stress-pt_9th-m.OUT
12/16/2006	11:05 AM	6,115,168	Stress-pt_9th-t.OUT
01/02/2007	11:24 AM	0	Sub-Model-Both-Files.txt
08/02/2006	06:15 AM	4,008	Tank-Coordinates-AP.txt
05/25/2005	03:32 PM	2,512	Tank-Mesh1.txt
12/15/2006	07:28 AM	25	tank-out.out
10/17/2006	12:18 PM	5,554	Tank-Props-Rigid.txt
12/15/2006	07:29 AM	7,787	Tank-th.out
11/10/2006	02:17 PM	22,588	TH-Sub-Modal-Column.txt
11/10/2006	02:19 PM	19,879	TH-Sub-Model-h.txt
11/22/2006	08:27 AM	19,879	TH-Sub-Model-v.txt
12/19/2006	03:21 PM	10,996,224	Waste Pressure 0 deg.xls
12/19/2006	03:23 PM	11,942,400	Waste Pressure 45 deg.xls
12/19/2006	03:14 PM	11,920,384	Waste Pressure 90 deg.xls
12/16/2006	09:24 AM	10,180	Waste-Cont_108max.OUT
12/16/2006	09:25 AM	4,643,118	Waste-Cont_108th.OUT
12/16/2006	09:34 AM	10,180	Waste-Cont_117max.OUT
12/16/2006	09:34 AM	4,643,118	Waste-Cont_117th.OUT
12/16/2006	09:44 AM	10,180	Waste-Cont_126max.OUT
12/16/2006	09:44 AM	4,643,118	Waste-Cont_126th.OUT
12/16/2006	09:54 AM	10,180	Waste-Cont_135max.OUT
12/16/2006	09:54 AM	4,643,118	Waste-Cont_135th.OUT
12/16/2006	10:05 AM	10,180	Waste-Cont_144max.OUT
12/16/2006	10:05 AM	4,643,118	Waste-Cont_144th.OUT
12/16/2006	10:14 AM	10,180	Waste-Cont_153max.OUT
12/16/2006	10:14 AM	4,643,118	Waste-Cont_153th.OUT
12/16/2006	10:23 AM	10,180	Waste-Cont_162max.OUT
12/16/2006	10:23 AM	4,643,118	Waste-Cont_162th.OUT
12/16/2006	10:34 AM	10,180	Waste-Cont_171max.OUT
12/16/2006	10:34 AM	4,643,118	Waste-Cont_171th.OUT
12/16/2006	10:44 AM	10,180	Waste-Cont_180max.OUT
12/16/2006	10:44 AM	4,643,118	Waste-Cont_180th.OUT
12/16/2006	07:45 AM	10,180	Waste-Cont_18max.OUT
12/16/2006	07:45 AM	4,643,118	Waste-Cont_18th.OUT
12/16/2006	07:56 AM	10,180	Waste-Cont_27max.OUT
12/16/2006	07:56 AM	4,643,118	Waste-Cont_27th.OUT
12/16/2006	08:06 AM	10,180	Waste-Cont_36max.OUT
12/16/2006	08:06 AM	4,643,118	Waste-Cont_36th.OUT
12/16/2006	08:16 AM	10,180	Waste-Cont_45max.OUT
12/16/2006	08:16 AM	4,643,118	Waste-Cont_45th.OUT
12/16/2006	08:26 AM	10,180	Waste-Cont_54max.OUT
12/16/2006	08:26 AM	4,643,118	Waste-Cont_54th.OUT
12/16/2006	08:35 AM	10,180	Waste-Cont_63max.OUT
12/16/2006	08:35 AM	4,643,118	Waste-Cont_63th.OUT
12/16/2006	08:44 AM	10,180	Waste-Cont_72max.OUT
12/16/2006	08:44 AM	4,643,118	Waste-Cont_72th.OUT
12/16/2006	08:54 AM	10,180	Waste-Cont_81max.OUT
12/16/2006	08:54 AM	4,643,118	Waste-Cont_81th.OUT
12/16/2006	09:04 AM	10,180	Waste-Cont_90max.OUT
12/16/2006	09:04 AM	4,643,118	Waste-Cont_90th.OUT
12/16/2006	09:14 AM	10,180	Waste-Cont_99max.OUT

```
12/16/2006  09:14 AM         4,643,118 Waste-Cont_99th.OUT
12/16/2006  07:34 AM            10,180 Waste-Cont_9max.OUT
12/16/2006  07:34 AM         4,643,246 Waste-Cont_9th.OUT
12/16/2006  10:53 AM            45,117 Waste-Reaction-460-SD3.out
09/25/2006  10:41 AM               340 Waste-Reaction.txt
11/14/2006  07:33 AM            10,553 Waste-solid-AP-S.txt
12/17/2006  01:06 PM               683 Waste-Surface-AP.txt
12/17/2006  01:07 PM             1,027 Waste-Surf_0max.OUT
12/17/2006  01:07 PM           572,693 Waste-Surf_0th.OUT
12/17/2006  01:12 PM             1,027 Waste-Surf_108max.OUT
12/17/2006  01:12 PM           572,693 Waste-Surf_108th.OUT
12/17/2006  01:12 PM             1,027 Waste-Surf_117max.OUT
12/17/2006  01:12 PM           572,693 Waste-Surf_117th.OUT
12/17/2006  01:13 PM             1,027 Waste-Surf_126max.OUT
12/17/2006  01:13 PM           572,693 Waste-Surf_126th.OUT
12/17/2006  01:13 PM             1,027 Waste-Surf_135max.OUT
12/17/2006  01:13 PM           572,693 Waste-Surf_135th.OUT
12/17/2006  01:14 PM             1,027 Waste-Surf_144max.OUT
12/17/2006  01:14 PM           572,693 Waste-Surf_144th.OUT
12/17/2006  01:14 PM             1,027 Waste-Surf_153max.OUT
12/17/2006  01:14 PM           572,693 Waste-Surf_153th.OUT
12/17/2006  01:14 PM             1,027 Waste-Surf_162max.OUT
12/17/2006  01:14 PM           572,693 Waste-Surf_162th.OUT
12/17/2006  01:15 PM             1,027 Waste-Surf_171max.OUT
12/17/2006  01:15 PM           572,693 Waste-Surf_171th.OUT
12/17/2006  01:15 PM             1,027 Waste-Surf_180max.OUT
12/17/2006  01:15 PM           572,693 Waste-Surf_180th.OUT
12/17/2006  01:15 PM             1,027 Waste-Surf_189max.OUT
12/17/2006  01:15 PM           572,693 Waste-Surf_189th.OUT
12/17/2006  01:08 PM             1,027 Waste-Surf_18max.OUT
12/17/2006  01:08 PM           572,693 Waste-Surf_18th.OUT
12/17/2006  01:08 PM             1,027 Waste-Surf_27max.OUT
12/17/2006  01:08 PM           572,693 Waste-Surf_27th.OUT
12/17/2006  01:09 PM             1,027 Waste-Surf_36max.OUT
12/17/2006  01:09 PM           572,693 Waste-Surf_36th.OUT
12/17/2006  01:09 PM             1,027 Waste-Surf_45max.OUT
12/17/2006  01:09 PM           572,693 Waste-Surf_45th.OUT
12/17/2006  01:09 PM             1,027 Waste-Surf_54max.OUT
12/17/2006  01:09 PM           572,693 Waste-Surf_54th.OUT
12/17/2006  01:10 PM             1,027 Waste-Surf_63max.OUT
12/17/2006  01:10 PM           572,693 Waste-Surf_63th.OUT
12/17/2006  01:10 PM             1,027 Waste-Surf_72max.OUT
12/17/2006  01:10 PM           572,693 Waste-Surf_72th.OUT
12/17/2006  01:11 PM             1,027 Waste-Surf_81max.OUT
12/17/2006  01:11 PM           572,693 Waste-Surf_81th.OUT
12/17/2006  01:11 PM             1,027 Waste-Surf_90max.OUT
12/17/2006  01:11 PM           572,693 Waste-Surf_90th.OUT
12/17/2006  01:11 PM             1,027 Waste-Surf_99max.OUT
12/17/2006  01:11 PM           572,693 Waste-Surf_99th.OUT
12/17/2006  01:07 PM             1,027 Waste-Surf_9max.OUT
12/17/2006  01:07 PM           572,693 Waste-Surf_9th.OUT
12/17/2006  12:17 PM           229,888 waste_0-90.xls
12/17/2006  12:17 PM           229,888 waste_99-180.xls
             320 File(s)    574,095,026 bytes
               2 Dir(s)  160,857,333,760 bytes free
```

Sub-Model File Listing, Horizontal Excitation

```
 Volume in drive C is 600GB 2xRAID0 (new)
 Volume Serial Number is 8A0A-E4BA

 Directory of C:\Users\Bruce\2008-000 PNNL\2008-005 AP-460\AP-460-Sub-Model-Horiz

01/02/2007  11:47 AM    <DIR>          .
01/02/2007  11:47 AM    <DIR>          ..
11/19/2006  09:41 AM                 3 Accel-PT-0.out
08/21/2006  06:49 AM               101 All-Forces.txt
11/10/2006  03:07 PM               768 AP-460-Slosh-Flex-Dytran.log
11/18/2006  09:46 AM         4,452,897 AP-460-Solve-Sub-Horiz.out
12/17/2006  12:14 PM           753,664 AP-460-Sub-Model-H Total Reaction.xls
12/21/2006  03:25 PM           958,464 AP-460-Sub-Model-H Waste-TH-MAX.xls
11/18/2006  09:46 AM             2,998 AP-460-Sub-Model-H.BCS
11/18/2006  12:48 PM        43,581,440 AP-460-Sub-Model-H.db
12/18/2006  01:09 PM               602 AP-460-Sub-Model-H.err
12/18/2006  01:47 PM             1,942 AP-460-Sub-Model-H.log
11/18/2006  09:46 AM           190,159 AP-460-Sub-Model-H.mntr
11/18/2006  09:46 AM                67 AP-460-Sub-Model-H.PVTS
11/16/2006  01:10 PM                 0 AP-460-Sub-Model-H.sda
11/27/2006  03:08 PM         9,269,760 AP-460-Sub-Model-Horiz Pri Tank Stress Seismic.xls
11/17/2006  11:04 AM             6,046 Bolts-Friction.txt
06/09/2005  01:59 PM               262 Boundary.txt
11/19/2006  09:14 AM               227 Contact-AP.txt
08/21/2006  07:59 AM               586 Contact-Footing.txt
08/25/2006  01:28 PM               704 Contact-Insul.txt
08/25/2006  01:27 PM               704 Contact-J-Bolts.txt
08/25/2006  01:28 PM               708 Contact-Primary.txt
08/21/2006  07:59 AM               742 Contact-Soil.txt
08/21/2006  12:44 PM               632 Contact-Waste-AP.txt
01/03/2006  11:17 AM             1,616 Disp-J-Bolts.txt
11/19/2006  09:41 AM           535,476 Disp-PT-0.out
11/10/2006  02:08 PM             8,620 Far-Soil.txt
11/17/2006  10:53 AM               287 FILE.err
11/17/2006  10:53 AM             5,822 file.log
12/20/2005  04:49 PM            39,925 file.txt
10/13/2005  06:54 AM               562 Fix-Soil.txt
08/21/2006  08:00 AM               894 Force-c.txt
08/21/2006  08:00 AM               661 Force-j_bolt.txt
01/02/2007  11:07 AM    <DIR>          Freq Test
10/17/2006  01:37 PM             1,668 Insulate.txt
07/20/2006  06:36 AM             4,030 interface-gap1.txt
11/13/2006  01:45 PM             2,445 interface1.txt
08/23/2006  07:47 AM             1,971 Liner.txt
05/02/2005  02:19 PM               667 live_load.txt
07/21/2006  10:03 AM             6,214 Near-Soil-1.txt
04/20/2005  01:14 PM               508 outer-spar.txt
11/10/2006  04:08 PM               125 Post-Tank.txt
11/10/2006  04:05 PM             6,154 Primary-Props-AP.txt
09/27/2005  03:52 PM             1,538 Primary.txt
11/17/2006  11:14 AM           902,478 QA.out
11/19/2006  09:41 AM            47,121 RS-PT-0.out
10/31/2005  10:31 AM             1,108 RS_FREQ.txt
11/14/2006  07:38 AM             1,894 Run-Tank.txt
12/17/2006  01:33 PM                 0 scratch.hlp
02/11/2005  01:22 PM             1,053 Slave.txt
11/11/2005  10:36 AM             4,989 Soil-Prop-Mean-Geo.txt
11/13/2006  01:57 PM             2,028 Solve-Slosh-flex.txt
11/17/2006  11:14 AM             2,177 Solve-Sub-Horiz.txt
08/25/2006  08:47 AM             1,918 Solve-TH-BES.txt
09/13/2006  06:12 AM               347 spectra-all.txt
09/13/2006  06:07 AM             3,690 spectra-conc-0.txt
09/13/2006  06:08 AM             3,723 spectra-conc-135.txt
09/13/2006  06:09 AM             3,723 spectra-conc-180.txt
09/13/2006  06:08 AM             3,769 spectra-conc-45.txt
09/13/2006  06:08 AM             3,649 spectra-conc-90.txt
```

```
09/13/2006  06:09 AM             1,590 spectra-conc.txt
08/28/2006  09:38 AM             2,076 spectra-concrete.txt
10/03/2006  02:02 PM             3,624 spectra-primary-0.txt
10/03/2006  02:04 PM             3,777 spectra-primary-135.txt
09/13/2006  06:15 AM             3,777 spectra-primary-180.txt
10/03/2006  02:03 PM             3,703 spectra-primary-45.txt
10/03/2006  02:03 PM             3,703 spectra-primary-90.txt
09/13/2006  06:15 AM             3,801 spectra-soil.txt
06/20/2005  09:04 AM               647 spectra-wall.txt
06/20/2005  08:52 AM               679 spectra-waste.txt
11/27/2006  09:23 AM           279,040 str-comp_0-90b.xls
11/27/2006  09:23 AM           284,672 str-comp_0-90m.xls
11/27/2006  09:23 AM           279,040 str-comp_0-90t.xls
11/27/2006  09:24 AM           279,552 str-comp_99-180b.xls
11/27/2006  09:24 AM           284,160 str-comp_99-180m.xls
11/27/2006  09:24 AM           279,040 str-comp_99-180t.xls
09/05/2006  02:00 PM             2,588 strain-backed.txt
08/21/2006  08:01 AM               566 strain-compb-p.txt
08/16/2006  01:59 PM               621 strain-compb-primary.txt
08/21/2006  08:01 AM               693 strain-compb.txt
08/21/2006  08:02 AM               566 strain-compm-p.txt
08/16/2006  02:00 PM               621 strain-compm-primary.txt
08/21/2006  08:01 AM               705 strain-compm.txt
08/21/2006  08:02 AM               578 strain-compt-p.txt
08/16/2006  02:00 PM               621 strain-compt-primary.txt
08/21/2006  08:02 AM               720 strain-compt.txt
08/21/2006  08:02 AM               730 Strain-Liner-floor.txt
01/05/2006  03:14 PM               550 Strain-Liner-p.txt
08/21/2006  08:02 AM               962 Strain-Liner-wall.txt
08/16/2006  03:01 PM               545 Strain-Liner.txt
08/16/2006  02:01 PM               292 Strain-Primary.txt
08/16/2006  02:19 PM               273 Strain.txt
08/21/2006  08:02 AM               554 stress-compb-p.txt
08/21/2006  08:02 AM               598 stress-compb.txt
08/21/2006  08:03 AM               554 stress-compm-p.txt
08/21/2006  08:03 AM               608 stress-compm.txt
08/21/2006  08:03 AM               554 stress-compt-p.txt
08/24/2006  03:19 PM               598 stress-compt.txt
08/17/2006  11:19 AM               207 Stress-Primary-M.txt
08/24/2006  12:05 PM               224 Stress-Primary.txt
11/19/2006  07:15 PM            13,519 Stress-pt_108max-b.OUT
11/19/2006  04:00 PM            13,519 Stress-pt_108max-m.OUT
11/19/2006  12:45 PM            13,519 Stress-pt_108max-t.OUT
11/19/2006  07:15 PM         6,143,768 Stress-pt_108th-b.OUT
11/19/2006  04:00 PM         6,143,768 Stress-pt_108th-m.OUT
11/19/2006  12:45 PM         6,115,040 Stress-pt_108th-t.OUT
11/19/2006  07:24 PM            13,519 Stress-pt_117max-b.OUT
11/19/2006  04:10 PM            13,519 Stress-pt_117max-m.OUT
11/19/2006  12:55 PM            13,519 Stress-pt_117max-t.OUT
11/19/2006  07:24 PM         6,143,768 Stress-pt_117th-b.OUT
11/19/2006  04:10 PM         6,143,768 Stress-pt_117th-m.OUT
11/19/2006  12:55 PM         6,115,040 Stress-pt_117th-t.OUT
11/19/2006  07:34 PM            13,519 Stress-pt_126max-b.OUT
11/19/2006  04:19 PM            13,519 Stress-pt_126max-m.OUT
11/19/2006  01:04 PM            13,519 Stress-pt_126max-t.OUT
11/19/2006  07:34 PM         6,143,768 Stress-pt_126th-b.OUT
11/19/2006  04:19 PM         6,143,768 Stress-pt_126th-m.OUT
11/19/2006  01:04 PM         6,115,040 Stress-pt_126th-t.OUT
11/19/2006  07:44 PM            13,519 Stress-pt_135max-b.OUT
11/19/2006  04:29 PM            13,519 Stress-pt_135max-m.OUT
11/19/2006  01:14 PM            13,519 Stress-pt_135max-t.OUT
11/19/2006  07:44 PM         6,143,768 Stress-pt_135th-b.OUT
11/19/2006  04:29 PM         6,143,768 Stress-pt_135th-m.OUT
11/19/2006  01:14 PM         6,115,040 Stress-pt_135th-t.OUT
11/19/2006  07:53 PM            13,519 Stress-pt_144max-b.OUT
11/19/2006  04:39 PM            13,519 Stress-pt_144max-m.OUT
11/19/2006  01:24 PM            13,519 Stress-pt_144max-t.OUT
11/19/2006  07:53 PM         6,143,768 Stress-pt_144th-b.OUT
11/19/2006  04:39 PM         6,143,768 Stress-pt_144th-m.OUT
11/19/2006  01:24 PM         6,115,040 Stress-pt_144th-t.OUT
```

```
11/19/2006  08:03 PM            13,519 Stress-pt_153max-b.OUT
11/19/2006  04:49 PM            13,519 Stress-pt_153max-m.OUT
11/19/2006  01:34 PM            13,519 Stress-pt_153max-t.OUT
11/19/2006  08:03 PM         6,143,768 Stress-pt_153th-b.OUT
11/19/2006  04:49 PM         6,143,768 Stress-pt_153th-m.OUT
11/19/2006  01:34 PM         6,115,040 Stress-pt_153th-t.OUT
11/19/2006  08:13 PM            13,519 Stress-pt_162max-b.OUT
11/19/2006  04:58 PM            13,519 Stress-pt_162max-m.OUT
11/19/2006  01:44 PM            13,519 Stress-pt_162max-t.OUT
11/19/2006  08:13 PM         6,143,768 Stress-pt_162th-b.OUT
11/19/2006  04:59 PM         6,143,768 Stress-pt_162th-m.OUT
11/19/2006  01:44 PM         6,115,040 Stress-pt_162th-t.OUT
11/19/2006  08:22 PM            13,521 Stress-pt_171max-b.OUT
11/19/2006  05:08 PM            13,521 Stress-pt_171max-m.OUT
11/19/2006  01:53 PM            13,521 Stress-pt_171max-t.OUT
11/19/2006  08:22 PM         6,143,768 Stress-pt_171th-b.OUT
11/19/2006  05:08 PM         6,143,768 Stress-pt_171th-m.OUT
11/19/2006  01:53 PM         6,115,040 Stress-pt_171th-t.OUT
11/19/2006  08:32 PM            13,521 Stress-pt_180max-b.OUT
11/19/2006  05:17 PM            13,521 Stress-pt_180max-m.OUT
11/19/2006  02:03 PM            13,521 Stress-pt_180max-t.OUT
11/19/2006  08:32 PM         6,143,768 Stress-pt_180th-b.OUT
11/19/2006  05:17 PM         6,143,768 Stress-pt_180th-m.OUT
11/19/2006  02:03 PM         6,115,040 Stress-pt_180th-t.OUT
11/19/2006  05:37 PM            13,519 Stress-pt_18max-b.OUT
11/19/2006  02:22 PM            13,519 Stress-pt_18max-m.OUT
11/19/2006  11:05 AM            13,519 Stress-pt_18max-t.OUT
11/19/2006  05:37 PM         6,143,768 Stress-pt_18th-b.OUT
11/19/2006  02:22 PM         6,143,768 Stress-pt_18th-m.OUT
11/19/2006  11:05 AM         6,115,040 Stress-pt_18th-t.OUT
11/19/2006  05:46 PM            13,519 Stress-pt_27max-b.OUT
11/19/2006  02:32 PM            13,519 Stress-pt_27max-m.OUT
11/19/2006  11:15 AM            13,519 Stress-pt_27max-t.OUT
11/19/2006  05:46 PM         6,143,768 Stress-pt_27th-b.OUT
11/19/2006  02:32 PM         6,143,768 Stress-pt_27th-m.OUT
11/19/2006  11:15 AM         6,115,040 Stress-pt_27th-t.OUT
11/19/2006  05:56 PM            13,519 Stress-pt_36max-b.OUT
11/19/2006  02:41 PM            13,519 Stress-pt_36max-m.OUT
11/19/2006  11:25 AM            13,519 Stress-pt_36max-t.OUT
11/19/2006  05:56 PM         6,143,768 Stress-pt_36th-b.OUT
11/19/2006  02:41 PM         6,143,768 Stress-pt_36th-m.OUT
11/19/2006  11:25 AM         6,115,040 Stress-pt_36th-t.OUT
11/19/2006  06:06 PM            13,519 Stress-pt_45max-b.OUT
11/19/2006  02:51 PM            13,519 Stress-pt_45max-m.OUT
11/19/2006  11:36 AM            13,519 Stress-pt_45max-t.OUT
11/19/2006  06:06 PM         6,143,768 Stress-pt_45th-b.OUT
11/19/2006  02:51 PM         6,143,768 Stress-pt_45th-m.OUT
11/19/2006  11:36 AM         6,115,040 Stress-pt_45th-t.OUT
11/19/2006  06:15 PM            13,519 Stress-pt_54max-b.OUT
11/19/2006  03:01 PM            13,519 Stress-pt_54max-m.OUT
11/19/2006  11:45 AM            13,519 Stress-pt_54max-t.OUT
11/19/2006  06:15 PM         6,143,768 Stress-pt_54th-b.OUT
11/19/2006  03:01 PM         6,143,768 Stress-pt_54th-m.OUT
11/19/2006  11:45 AM         6,115,040 Stress-pt_54th-t.OUT
11/19/2006  06:25 PM            13,519 Stress-pt_63max-b.OUT
11/19/2006  03:11 PM            13,519 Stress-pt_63max-m.OUT
11/19/2006  11:56 AM            13,519 Stress-pt_63max-t.OUT
11/19/2006  06:25 PM         6,143,768 Stress-pt_63th-b.OUT
11/19/2006  03:11 PM         6,143,768 Stress-pt_63th-m.OUT
11/19/2006  11:56 AM         6,115,040 Stress-pt_63th-t.OUT
11/19/2006  06:35 PM            13,519 Stress-pt_72max-b.OUT
11/19/2006  03:20 PM            13,519 Stress-pt_72max-m.OUT
11/19/2006  12:05 PM            13,519 Stress-pt_72max-t.OUT
11/19/2006  06:35 PM         6,143,768 Stress-pt_72th-b.OUT
11/19/2006  03:20 PM         6,143,768 Stress-pt_72th-m.OUT
11/19/2006  12:05 PM         6,115,040 Stress-pt_72th-t.OUT
11/19/2006  06:45 PM            13,519 Stress-pt_81max-b.OUT
11/19/2006  03:30 PM            13,519 Stress-pt_81max-m.OUT
11/19/2006  12:15 PM            13,519 Stress-pt_81max-t.OUT
11/19/2006  06:45 PM         6,143,768 Stress-pt_81th-b.OUT
```

11/19/2006	03:30 PM	6,143,768	Stress-pt_81th-m.OUT
11/19/2006	12:15 PM	6,115,040	Stress-pt_81th-t.OUT
11/19/2006	06:55 PM	13,519	Stress-pt_90max-b.OUT
11/19/2006	03:40 PM	13,519	Stress-pt_90max-m.OUT
11/19/2006	12:25 PM	13,519	Stress-pt_90max-t.OUT
11/19/2006	06:55 PM	6,143,768	Stress-pt_90th-b.OUT
11/19/2006	03:40 PM	6,143,768	Stress-pt_90th-m.OUT
11/19/2006	12:25 PM	6,115,040	Stress-pt_90th-t.OUT
11/19/2006	07:05 PM	13,519	Stress-pt_99max-b.OUT
11/19/2006	03:50 PM	13,519	Stress-pt_99max-m.OUT
11/19/2006	12:35 PM	13,519	Stress-pt_99max-t.OUT
11/19/2006	07:05 PM	6,143,768	Stress-pt_99th-b.OUT
11/19/2006	03:50 PM	6,143,768	Stress-pt_99th-m.OUT
11/19/2006	12:35 PM	6,115,040	Stress-pt_99th-t.OUT
11/19/2006	05:27 PM	13,519	Stress-pt_9max-b.OUT
11/19/2006	02:13 PM	13,519	Stress-pt_9max-m.OUT
11/19/2006	10:55 AM	13,519	Stress-pt_9max-t.OUT
11/19/2006	05:27 PM	6,143,896	Stress-pt_9th-b.OUT
11/19/2006	02:13 PM	6,143,896	Stress-pt_9th-m.OUT
11/19/2006	10:55 AM	6,115,168	Stress-pt_9th-t.OUT
01/02/2007	11:47 AM	0	Sub-Model-Horiz-files.txt
08/02/2006	06:15 AM	4,008	Tank-Coordinates-AP.txt
05/25/2005	03:32 PM	2,512	Tank-Mesh1.txt
11/17/2006	11:13 AM	25	tank-out.out
10/17/2006	12:18 PM	5,554	Tank-Props-Rigid.txt
11/17/2006	11:14 AM	7,943	Tank-th.out
11/10/2006	02:17 PM	22,588	TH-Sub-Modal-Column.txt
11/10/2006	02:19 PM	19,879	TH-Sub-Model-h.txt
11/27/2006	10:40 AM	6,813,184	Time History - Bot.xls
11/27/2006	09:58 AM	6,813,184	Time History - Mid.xls
11/27/2006	10:40 AM	6,813,184	Time History - Top.xls
11/19/2006	09:41 AM	535,476	Vel-PT-0.out
12/19/2006	02:55 PM	11,706,368	Waste Pressure 0 deg.xls
12/19/2006	03:11 PM	11,939,328	Waste Pressure 45 deg.xls
12/19/2006	03:10 PM	10,744,320	Waste Pressure 90 deg.xls
11/18/2006	11:36 AM	10,180	Waste-Cont_108max.OUT
11/18/2006	11:36 AM	4,643,118	Waste-Cont_108th.OUT
11/18/2006	11:45 AM	10,180	Waste-Cont_117max.OUT
11/18/2006	11:45 AM	4,643,118	Waste-Cont_117th.OUT
11/18/2006	11:53 AM	10,180	Waste-Cont_126max.OUT
11/18/2006	11:53 AM	4,643,118	Waste-Cont_126th.OUT
11/18/2006	12:02 PM	10,180	Waste-Cont_135max.OUT
11/18/2006	12:02 PM	4,643,118	Waste-Cont_135th.OUT
11/18/2006	12:12 PM	10,180	Waste-Cont_144max.OUT
11/18/2006	12:12 PM	4,643,118	Waste-Cont_144th.OUT
11/18/2006	12:20 PM	10,180	Waste-Cont_153max.OUT
11/18/2006	12:20 PM	4,643,118	Waste-Cont_153th.OUT
11/18/2006	12:29 PM	10,180	Waste-Cont_162max.OUT
11/18/2006	12:29 PM	4,643,118	Waste-Cont_162th.OUT
11/18/2006	12:38 PM	10,180	Waste-Cont_171max.OUT
11/18/2006	12:38 PM	4,643,118	Waste-Cont_171th.OUT
11/18/2006	12:48 PM	10,180	Waste-Cont_180max.OUT
11/18/2006	12:48 PM	4,643,118	Waste-Cont_180th.OUT
11/18/2006	10:05 AM	10,180	Waste-Cont_18max.OUT
11/18/2006	10:05 AM	4,643,118	Waste-Cont_18th.OUT
11/18/2006	10:15 AM	10,180	Waste-Cont_27max.OUT
11/18/2006	10:15 AM	4,643,118	Waste-Cont_27th.OUT
11/18/2006	10:24 AM	10,180	Waste-Cont_36max.OUT
11/18/2006	10:24 AM	4,643,118	Waste-Cont_36th.OUT
11/18/2006	10:33 AM	10,180	Waste-Cont_45max.OUT
11/18/2006	10:33 AM	4,643,118	Waste-Cont_45th.OUT
11/18/2006	10:42 AM	10,180	Waste-Cont_54max.OUT
11/18/2006	10:42 AM	4,643,118	Waste-Cont_54th.OUT
11/18/2006	10:50 AM	10,180	Waste-Cont_63max.OUT
11/18/2006	10:50 AM	4,643,118	Waste-Cont_63th.OUT
11/18/2006	10:59 AM	10,180	Waste-Cont_72max.OUT
11/18/2006	10:59 AM	4,643,118	Waste-Cont_72th.OUT
11/18/2006	11:08 AM	10,180	Waste-Cont_81max.OUT
11/18/2006	11:08 AM	4,643,118	Waste-Cont_81th.OUT
11/18/2006	11:17 AM	10,180	Waste-Cont_90max.OUT

```
11/18/2006  11:17 AM         4,643,118 Waste-Cont_90th.OUT
11/18/2006  11:26 AM            10,180 Waste-Cont_99max.OUT
11/18/2006  11:26 AM         4,643,118 Waste-Cont_99th.OUT
11/18/2006  09:55 AM            10,180 Waste-Cont_9max.OUT
11/18/2006  09:55 AM         4,643,246 Waste-Cont_9th.OUT
11/19/2006  09:24 AM            45,117 Waste-Reaction-460-SD3.out
09/25/2006  10:41 AM               340 Waste-Reaction.txt
11/14/2006  07:33 AM            10,553 Waste-solid-AP-S.txt
12/17/2006  01:06 PM               683 Waste-Surface-AP.txt
12/17/2006  01:35 PM               946 Waste-Surf_0max.OUT
12/17/2006  01:35 PM           509,333 Waste-Surf_0th.OUT
12/17/2006  01:40 PM               946 Waste-Surf_108max.OUT
12/17/2006  01:40 PM           509,205 Waste-Surf_108th.OUT
12/17/2006  01:41 PM               946 Waste-Surf_117max.OUT
12/17/2006  01:41 PM           509,205 Waste-Surf_117th.OUT
12/17/2006  01:41 PM               946 Waste-Surf_126max.OUT
12/17/2006  01:41 PM           509,205 Waste-Surf_126th.OUT
12/17/2006  01:41 PM               946 Waste-Surf_135max.OUT
12/17/2006  01:41 PM           509,205 Waste-Surf_135th.OUT
12/17/2006  01:42 PM               946 Waste-Surf_144max.OUT
12/17/2006  01:42 PM           509,205 Waste-Surf_144th.OUT
12/17/2006  01:42 PM               946 Waste-Surf_153max.OUT
12/17/2006  01:42 PM           509,205 Waste-Surf_153th.OUT
12/17/2006  01:43 PM               946 Waste-Surf_162max.OUT
12/17/2006  01:43 PM           509,205 Waste-Surf_162th.OUT
12/17/2006  01:43 PM               946 Waste-Surf_171max.OUT
12/17/2006  01:43 PM           509,205 Waste-Surf_171th.OUT
12/17/2006  01:43 PM               946 Waste-Surf_180max.OUT
12/17/2006  01:43 PM           509,205 Waste-Surf_180th.OUT
12/17/2006  01:43 PM               946 Waste-Surf_189max.OUT
12/17/2006  01:43 PM           509,205 Waste-Surf_189th.OUT
12/17/2006  01:36 PM               946 Waste-Surf_18max.OUT
12/17/2006  01:36 PM           509,205 Waste-Surf_18th.OUT
12/17/2006  01:37 PM               946 Waste-Surf_27max.OUT
12/17/2006  01:37 PM           509,205 Waste-Surf_27th.OUT
12/17/2006  01:37 PM               946 Waste-Surf_36max.OUT
12/17/2006  01:37 PM           509,205 Waste-Surf_36th.OUT
12/17/2006  01:37 PM               946 Waste-Surf_45max.OUT
12/17/2006  01:37 PM           509,205 Waste-Surf_45th.OUT
12/17/2006  01:38 PM               946 Waste-Surf_54max.OUT
12/17/2006  01:38 PM           509,205 Waste-Surf_54th.OUT
12/17/2006  01:38 PM               946 Waste-Surf_63max.OUT
12/17/2006  01:38 PM           509,205 Waste-Surf_63th.OUT
12/17/2006  01:39 PM               946 Waste-Surf_72max.OUT
12/17/2006  01:39 PM           509,205 Waste-Surf_72th.OUT
12/17/2006  01:39 PM               946 Waste-Surf_81max.OUT
12/17/2006  01:39 PM           509,205 Waste-Surf_81th.OUT
12/17/2006  01:39 PM               946 Waste-Surf_90max.OUT
12/17/2006  01:39 PM           509,205 Waste-Surf_90th.OUT
12/17/2006  01:40 PM               946 Waste-Surf_99max.OUT
12/17/2006  01:40 PM           509,205 Waste-Surf_99th.OUT
12/17/2006  01:36 PM               946 Waste-Surf_9max.OUT
12/17/2006  01:36 PM           509,205 Waste-Surf_9th.OUT
11/27/2006  09:21 AM           229,888 waste_0-90.xls
11/27/2006  09:21 AM           229,888 waste_99-180.xls
             323 File(s)    591,651,351 bytes

 Directory of C:\Users\Bruce\2008-000 PNNL\2008-005 AP-460\AP-460-Sub-Model-Horiz\Freq
Test

01/02/2007  11:07 AM    <DIR>          .
01/02/2007  11:07 AM    <DIR>          ..
08/21/2006  06:49 AM               101 All-Forces.txt
11/10/2006  03:07 PM               768 AP-460-Slosh-Flex-Dytran.log
12/19/2006  10:41 AM           309,512 AP-460-Slosh-Flex-V.out
12/19/2006  10:41 AM             2,998 AP-460-Sub-Model-H.BCS
12/19/2006  10:41 AM        43,646,976 AP-460-Sub-Model-H.db
12/19/2006  10:41 AM        53,084,160 AP-460-Sub-Model-H.dbb
12/19/2006  10:41 AM        11,730,944 AP-460-Sub-Model-H.emat
12/19/2006  12:49 PM           200,318 AP-460-Sub-Model-H.err
```

```
12/19/2006  10:41 AM        50,462,720 AP-460-Sub-Model-H.esav
12/19/2006  10:41 AM        12,845,056 AP-460-Sub-Model-H.full
12/19/2006  10:40 AM        15,299,480 AP-460-Sub-Model-H.ldhi
12/19/2006  01:02 PM            96,922 AP-460-Sub-Model-H.log
12/19/2006  10:41 AM            10,943 AP-460-Sub-Model-H.mntr
12/19/2006  10:40 AM        50,462,720 AP-460-Sub-Model-H.osav
12/19/2006  10:41 AM                67 AP-460-Sub-Model-H.PVTS
12/19/2006  10:41 AM        50,987,008 AP-460-Sub-Model-H.r001
12/19/2006  09:41 AM        43,646,976 AP-460-Sub-Model-H.rdb
11/19/2006  09:52 AM                 0 AP-460-Sub-Model-H.sda
12/19/2006  12:48 PM           140,667 AP-460-Sub-Model-H000.jpg
12/19/2006  12:50 PM            37,344 AP-460-Sub-Model-H001.jpg
12/19/2006  12:51 PM            36,448 AP-460-Sub-Model-H002.jpg
12/19/2006  12:53 PM            51,532 AP-460-Sub-Model-H003.jpg
12/19/2006  12:54 PM            51,017 AP-460-Sub-Model-H004.jpg
12/19/2006  01:00 PM            33,346 AP-460-Sub-Model-H005.jpg
12/19/2006  01:02 PM           120,459 AP-460-Sub-Model-H006.jpg
11/17/2006  11:04 AM             6,046 Bolts-Friction.txt
06/09/2005  01:59 PM               262 Boundary.txt
11/19/2006  09:14 AM               227 Contact-AP.txt
08/21/2006  07:59 AM               586 Contact-Footing.txt
08/25/2006  01:28 PM               704 Contact-Insul.txt
08/25/2006  01:27 PM               704 Contact-J-Bolts.txt
08/25/2006  01:28 PM               708 Contact-Primary.txt
08/21/2006  07:59 AM               742 Contact-Soil.txt
08/21/2006  12:44 PM               632 Contact-Waste-AP.txt
01/03/2006  11:17 AM             1,616 Disp-J-Bolts.txt
11/10/2006  02:08 PM             8,620 Far-Soil.txt
11/17/2006  10:53 AM             5,822 file.log
12/20/2005  04:49 PM            39,925 file.txt
10/13/2005  06:54 AM               562 Fix-Soil.txt
08/21/2006  08:00 AM               894 Force-c.txt
08/21/2006  08:00 AM               661 Force-j_bolt.txt
10/17/2006  01:37 PM             1,668 Insulate.txt
07/20/2006  06:36 AM             4,030 interface-gap1.txt
11/13/2006  01:45 PM             2,445 interface1.txt
08/23/2006  07:47 AM             1,971 Liner.txt
05/02/2005  02:19 PM               667 live_load.txt
07/21/2006  10:03 AM             6,214 Near-Soil-1.txt
04/20/2005  01:14 PM               508 outer-spar.txt
11/10/2006  04:08 PM               125 Post-Tank.txt
11/10/2006  04:05 PM             6,154 Primary-Props-AP.txt
09/27/2005  03:52 PM             1,538 Primary.txt
12/19/2006  09:41 AM         1,353,717 QA.out
10/31/2005  10:31 AM             1,108 RS_FREQ.txt
11/19/2006  09:49 AM             1,893 Run-Tank.txt
12/19/2006  09:40 AM                 0 scratch.hlp
02/11/2005  01:22 PM             1,053 Slave.txt
11/11/2005  10:36 AM             4,989 Soil-Prop-Mean-Geo.txt
11/13/2006  01:57 PM             2,028 Solve-Slosh-flex.txt
11/17/2006  11:14 AM             2,177 Solve-Sub-Horiz.txt
08/25/2006  08:47 AM             1,918 Solve-TH-BES.txt
09/13/2006  06:12 AM               347 spectra-all.txt
09/13/2006  06:07 AM             3,690 spectra-conc-0.txt
09/13/2006  06:08 AM             3,723 spectra-conc-135.txt
09/13/2006  06:09 AM             3,723 spectra-conc-180.txt
09/13/2006  06:08 AM             3,769 spectra-conc-45.txt
09/13/2006  06:08 AM             3,649 spectra-conc-90.txt
09/13/2006  06:09 AM             1,590 spectra-conc.txt
08/28/2006  09:38 AM             2,076 spectra-concrete.txt
10/03/2006  02:02 PM             3,624 spectra-primary-0.txt
10/03/2006  02:04 PM             3,777 spectra-primary-135.txt
09/13/2006  06:15 AM             3,777 spectra-primary-180.txt
10/03/2006  02:03 PM             3,703 spectra-primary-45.txt
10/03/2006  02:03 PM             3,703 spectra-primary-90.txt
09/13/2006  06:15 AM             3,801 spectra-soil.txt
06/20/2005  09:04 AM               647 spectra-wall.txt
06/20/2005  08:52 AM               679 spectra-waste.txt
09/05/2006  02:00 PM             2,588 strain-backed.txt
08/21/2006  08:01 AM               566 strain-compb-p.txt
```

```
08/16/2006  01:59 PM               621 strain-compb-primary.txt
08/21/2006  08:01 AM               693 strain-compb.txt
08/21/2006  08:02 AM               566 strain-compm-p.txt
08/16/2006  02:00 PM               621 strain-compm-primary.txt
08/21/2006  08:01 AM               705 strain-compm.txt
08/21/2006  08:02 AM               578 strain-compt-p.txt
08/16/2006  02:00 PM               621 strain-compt-primary.txt
08/21/2006  08:02 AM               720 strain-compt.txt
08/21/2006  08:02 AM               730 Strain-Liner-floor.txt
01/05/2006  03:14 PM               550 Strain-Liner-p.txt
08/21/2006  08:02 AM               962 Strain-Liner-wall.txt
08/16/2006  03:01 PM               545 Strain-Liner.txt
08/16/2006  02:01 PM               292 Strain-Primary.txt
08/16/2006  02:19 PM               273 Strain.txt
08/21/2006  08:02 AM               554 stress-compb-p.txt
08/21/2006  08:02 AM               598 stress-compb.txt
08/21/2006  08:03 AM               554 stress-compm-p.txt
08/21/2006  08:03 AM               608 stress-compm.txt
08/21/2006  08:03 AM               554 stress-compt-p.txt
08/24/2006  03:19 PM               598 stress-compt.txt
08/17/2006  11:19 AM               207 Stress-Primary-M.txt
08/24/2006  12:05 PM               224 Stress-Primary.txt
08/02/2006  06:15 AM             4,008 Tank-Coordinates-AP.txt
05/25/2005  03:32 PM             2,512 Tank-Mesh1.txt
12/19/2006  09:40 AM                25 tank-out.out
10/17/2006  12:18 PM             5,554 Tank-Props-Rigid.txt
12/19/2006  09:41 AM             6,711 Tank-th.out
11/10/2006  02:17 PM            22,588 TH-Sub-Modal-Column.txt
11/10/2006  02:19 PM            19,879 TH-Sub-Model-h.txt
12/19/2006  12:34 PM            45,117 Waste-Reaction-460-SD3.out
12/19/2006  12:33 PM               339 Waste-Reaction.txt
11/14/2006  07:33 AM            10,553 Waste-solid-AP-S.txt
08/21/2006  08:03 AM               776 Waste-Surface-AP.txt
             111 File(s)    334,901,264 bytes

     Total Files Listed:
             434 File(s)    926,552,615 bytes
               5 Dir(s)  160,844,402,688 bytes free
```

Sub-Model File Listing, Vertical Excitation

```
 Volume in drive C is 600GB 2xRAID0 (new)
 Volume Serial Number is 8A0A-E4BA

 Directory of C:\Users\Bruce\2008-000 PNNL\2008-005 AP-460\AP-460-Sub-Model-Vert

01/02/2007  11:56 AM    <DIR>          .
01/02/2007  11:56 AM    <DIR>          ..
08/21/2006  06:49 AM               101 All-Forces.txt
11/10/2006  03:07 PM               768 AP-460-Slosh-Flex-Dytran.log
11/23/2006  09:35 AM         3,753,412 AP-460-Solve-Sub-Vert.out
11/20/2006  08:59 AM            76,382 AP-460-Sub-Model-H.log
12/14/2006  02:38 PM             2,998 AP-460-Sub-Model-V.BCS
12/18/2006  11:39 AM        43,581,440 AP-460-Sub-Model-V.db
12/17/2006  01:55 PM           701,396 AP-460-Sub-Model-V.err
12/18/2006  11:39 AM             1,016 AP-460-Sub-Model-V.log
12/14/2006  02:38 PM           190,159 AP-460-Sub-Model-V.mntr
12/14/2006  02:38 PM                67 AP-460-Sub-Model-V.PVTS
12/13/2006  06:51 AM                 0 AP-460-Sub-Model-V.sda
11/23/2006  09:30 AM                97 AP-460-Sub-Model-V.stat
12/21/2006  03:29 PM         8,952,320 AP-460-Sub-Model-Vert Pri Tank Stress Seismic.xls
12/17/2006  12:15 PM           377,856 AP-460-Sub-Model-Vert Total Reaction.xls
12/21/2006  03:28 PM           937,472 AP-460-Sub-Model-Vert Waste-TH-MAX.xls
11/17/2006  11:04 AM             6,046 Bolts-Friction.txt
06/09/2005  01:59 PM               262 Boundary.txt
11/19/2006  09:14 AM               227 Contact-AP.txt
08/21/2006  07:59 AM               586 Contact-Footing.txt
08/25/2006  01:28 PM               704 Contact-Insul.txt
08/25/2006  01:27 PM               704 Contact-J-Bolts.txt
08/25/2006  01:28 PM               708 Contact-Primary.txt
08/21/2006  07:59 AM               742 Contact-Soil.txt
08/21/2006  12:44 PM               632 Contact-Waste-AP.txt
01/03/2006  11:17 AM             1,616 Disp-J-Bolts.txt
11/10/2006  02:08 PM             8,620 Far-Soil.txt
11/22/2006  08:32 AM             2,002 file.bat
11/22/2006  08:32 AM                68 file.err
11/22/2006  08:32 AM             6,050 file.log
12/20/2005  04:49 PM            39,925 file.txt
10/13/2005  06:54 AM               562 Fix-Soil.txt
08/21/2006  08:00 AM               894 Force-c.txt
08/21/2006  08:00 AM               661 Force-j_bolt.txt
12/20/2006  07:36 AM    <DIR>          Freq Test
10/17/2006  01:37 PM             1,668 Insulate.txt
07/20/2006  06:36 AM             4,030 interface-gap1.txt
11/13/2006  01:45 PM             2,445 interface1.txt
08/23/2006  07:47 AM             1,971 Liner.txt
05/02/2005  02:19 PM               667 live_load.txt
07/21/2006  10:03 AM             6,214 Near-Soil-1.txt
04/20/2005  01:14 PM               508 outer-spar.txt
11/10/2006  04:08 PM               125 Post-Tank.txt
11/10/2006  04:05 PM             6,154 Primary-Props-AP.txt
09/27/2005  03:52 PM             1,538 Primary.txt
11/22/2006  08:32 AM           408,638 QA.out
10/31/2005  10:31 AM             1,108 RS_FREQ.txt
11/24/2006  12:40 AM         2,782,379 Run-Tank-Out.out
11/22/2006  06:42 AM             1,920 Run-Tank.txt
12/17/2006  01:46 PM                 0 scratch.hlp
02/11/2005  01:22 PM             1,053 Slave.txt
11/11/2005  10:36 AM             4,989 Soil-Prop-Mean-Geo.txt
11/13/2006  01:57 PM             2,028 Solve-Slosh-flex.txt
12/13/2006  06:48 AM             2,168 Solve-Sub-Vert.txt
08/25/2006  08:47 AM             1,918 Solve-TH-BES.txt
09/13/2006  06:12 AM               347 spectra-all.txt
09/13/2006  06:07 AM             3,690 spectra-conc-0.txt
09/13/2006  06:08 AM             3,723 spectra-conc-135.txt
09/13/2006  06:09 AM             3,723 spectra-conc-180.txt
09/13/2006  06:08 AM             3,769 spectra-conc-45.txt
```

```
09/13/2006  06:08 AM           3,649 spectra-conc-90.txt
09/13/2006  06:09 AM           1,590 spectra-conc.txt
08/28/2006  09:38 AM           2,076 spectra-concrete.txt
10/03/2006  02:02 PM           3,624 spectra-primary-0.txt
10/03/2006  02:04 PM           3,777 spectra-primary-135.txt
09/13/2006  06:15 AM           3,777 spectra-primary-180.txt
10/03/2006  02:03 PM           3,703 spectra-primary-45.txt
10/03/2006  02:03 PM           3,703 spectra-primary-90.txt
09/13/2006  06:15 AM           3,801 spectra-soil.txt
06/20/2005  09:04 AM             647 spectra-wall.txt
06/20/2005  08:52 AM             679 spectra-waste.txt
12/15/2006  07:10 AM         286,720 str-comp_0-90b.xls
12/15/2006  07:11 AM         291,840 str-comp_0-90m.xls
12/15/2006  07:11 AM         292,864 str-comp_0-90t.xls
12/15/2006  07:11 AM         293,376 str-comp_99-180b.xls
12/15/2006  07:11 AM         298,496 str-comp_99-180m.xls
12/15/2006  07:12 AM         292,864 str-comp_99-180t.xls
09/05/2006  02:00 PM           2,588 strain-backed.txt
08/21/2006  08:01 AM             566 strain-compb-p.txt
08/16/2006  01:59 PM             621 strain-compb-primary.txt
08/21/2006  08:01 AM             693 strain-compb.txt
08/21/2006  08:02 AM             566 strain-compm-p.txt
08/16/2006  02:00 PM             621 strain-compm-primary.txt
08/21/2006  08:01 AM             705 strain-compm.txt
08/21/2006  08:02 AM             578 strain-compt-p.txt
08/16/2006  02:00 PM             621 strain-compt-primary.txt
08/21/2006  08:02 AM             720 strain-compt.txt
08/21/2006  08:02 AM             730 Strain-Liner-floor.txt
01/05/2006  03:14 PM             550 Strain-Liner-p.txt
08/21/2006  08:02 AM             962 Strain-Liner-wall.txt
08/16/2006  03:01 PM             545 Strain-Liner.txt
08/16/2006  02:01 PM             292 Strain-Primary.txt
08/16/2006  02:19 PM             273 Strain.txt
08/21/2006  08:02 AM             554 stress-compb-p.txt
08/21/2006  08:02 AM             598 stress-compb.txt
08/21/2006  08:03 AM             554 stress-compm-p.txt
08/21/2006  08:03 AM             608 stress-compm.txt
08/21/2006  08:03 AM             554 stress-compt-p.txt
08/24/2006  03:19 PM             598 stress-compt.txt
08/17/2006  11:19 AM             207 Stress-Primary-M.txt
08/24/2006  12:05 PM             224 Stress-Primary.txt
12/15/2006  03:27 AM          13,519 Stress-pt_108max-b.OUT
12/14/2006  11:43 PM          13,519 Stress-pt_108max-m.OUT
12/14/2006  07:58 PM          13,519 Stress-pt_108max-t.OUT
12/15/2006  03:27 AM       6,143,768 Stress-pt_108th-b.OUT
12/14/2006  11:43 PM       6,143,768 Stress-pt_108th-m.OUT
12/14/2006  07:58 PM       6,115,040 Stress-pt_108th-t.OUT
12/15/2006  03:38 AM          13,519 Stress-pt_117max-b.OUT
12/14/2006  11:54 PM          13,519 Stress-pt_117max-m.OUT
12/14/2006  08:09 PM          13,519 Stress-pt_117max-t.OUT
12/15/2006  03:38 AM       6,143,768 Stress-pt_117th-b.OUT
12/14/2006  11:54 PM       6,143,768 Stress-pt_117th-m.OUT
12/14/2006  08:09 PM       6,115,040 Stress-pt_117th-t.OUT
12/15/2006  03:49 AM          13,519 Stress-pt_126max-b.OUT
12/15/2006  12:05 AM          13,519 Stress-pt_126max-m.OUT
12/14/2006  08:21 PM          13,519 Stress-pt_126max-t.OUT
12/15/2006  03:49 AM       6,143,768 Stress-pt_126th-b.OUT
12/15/2006  12:05 AM       6,143,768 Stress-pt_126th-m.OUT
12/14/2006  08:21 PM       6,115,040 Stress-pt_126th-t.OUT
12/15/2006  04:00 AM          13,519 Stress-pt_135max-b.OUT
12/15/2006  12:16 AM          13,519 Stress-pt_135max-m.OUT
12/14/2006  08:32 PM          13,519 Stress-pt_135max-t.OUT
12/15/2006  04:01 AM       6,143,768 Stress-pt_135th-b.OUT
12/15/2006  12:16 AM       6,143,768 Stress-pt_135th-m.OUT
12/14/2006  08:32 PM       6,115,040 Stress-pt_135th-t.OUT
12/15/2006  04:12 AM          13,519 Stress-pt_144max-b.OUT
12/15/2006  12:28 AM          13,519 Stress-pt_144max-m.OUT
12/14/2006  08:43 PM          13,519 Stress-pt_144max-t.OUT
12/15/2006  04:12 AM       6,143,768 Stress-pt_144th-b.OUT
12/15/2006  12:28 AM       6,143,768 Stress-pt_144th-m.OUT
```

```
12/14/2006  08:43 PM         6,115,040 Stress-pt_144th-t.OUT
12/15/2006  04:23 AM            13,519 Stress-pt_153max-b.OUT
12/15/2006  12:39 AM            13,519 Stress-pt_153max-m.OUT
12/14/2006  08:54 PM            13,519 Stress-pt_153max-t.OUT
12/15/2006  04:23 AM         6,143,768 Stress-pt_153th-b.OUT
12/15/2006  12:39 AM         6,143,768 Stress-pt_153th-m.OUT
12/14/2006  08:54 PM         6,115,040 Stress-pt_153th-t.OUT
12/15/2006  04:34 AM            13,519 Stress-pt_162max-b.OUT
12/15/2006  12:50 AM            13,519 Stress-pt_162max-m.OUT
12/14/2006  09:06 PM            13,519 Stress-pt_162max-t.OUT
12/15/2006  04:34 AM         6,143,768 Stress-pt_162th-b.OUT
12/15/2006  12:50 AM         6,143,768 Stress-pt_162th-m.OUT
12/14/2006  09:06 PM         6,115,040 Stress-pt_162th-t.OUT
12/15/2006  04:45 AM            13,521 Stress-pt_171max-b.OUT
12/15/2006  01:01 AM            13,521 Stress-pt_171max-m.OUT
12/14/2006  09:17 PM            13,521 Stress-pt_171max-t.OUT
12/15/2006  04:45 AM         6,143,768 Stress-pt_171th-b.OUT
12/15/2006  01:01 AM         6,143,768 Stress-pt_171th-m.OUT
12/14/2006  09:17 PM         6,115,040 Stress-pt_171th-t.OUT
12/15/2006  04:56 AM            13,521 Stress-pt_180max-b.OUT
12/15/2006  01:12 AM            13,521 Stress-pt_180max-m.OUT
12/14/2006  09:28 PM            13,521 Stress-pt_180max-t.OUT
12/15/2006  04:56 AM         6,143,768 Stress-pt_180th-b.OUT
12/15/2006  01:12 AM         6,143,768 Stress-pt_180th-m.OUT
12/14/2006  09:28 PM         6,115,040 Stress-pt_180th-t.OUT
12/15/2006  01:35 AM            13,519 Stress-pt_18max-b.OUT
12/14/2006  09:51 PM            13,519 Stress-pt_18max-m.OUT
12/14/2006  06:06 PM            13,519 Stress-pt_18max-t.OUT
12/15/2006  01:35 AM         6,143,768 Stress-pt_18th-b.OUT
12/14/2006  09:51 PM         6,143,768 Stress-pt_18th-m.OUT
12/14/2006  06:06 PM         6,115,040 Stress-pt_18th-t.OUT
12/15/2006  01:45 AM            13,519 Stress-pt_27max-b.OUT
12/14/2006  10:02 PM            13,519 Stress-pt_27max-m.OUT
12/14/2006  06:17 PM            13,519 Stress-pt_27max-t.OUT
12/15/2006  01:45 AM         6,143,768 Stress-pt_27th-b.OUT
12/14/2006  10:02 PM         6,143,768 Stress-pt_27th-m.OUT
12/14/2006  06:17 PM         6,115,040 Stress-pt_27th-t.OUT
12/15/2006  01:56 AM            13,519 Stress-pt_36max-b.OUT
12/14/2006  10:13 PM            13,519 Stress-pt_36max-m.OUT
12/14/2006  06:28 PM            13,519 Stress-pt_36max-t.OUT
12/15/2006  01:56 AM         6,143,768 Stress-pt_36th-b.OUT
12/14/2006  10:13 PM         6,143,768 Stress-pt_36th-m.OUT
12/14/2006  06:28 PM         6,115,040 Stress-pt_36th-t.OUT
12/15/2006  02:08 AM            13,519 Stress-pt_45max-b.OUT
12/14/2006  10:24 PM            13,519 Stress-pt_45max-m.OUT
12/14/2006  06:40 PM            13,519 Stress-pt_45max-t.OUT
12/15/2006  02:08 AM         6,143,768 Stress-pt_45th-b.OUT
12/14/2006  10:24 PM         6,143,768 Stress-pt_45th-m.OUT
12/14/2006  06:40 PM         6,115,040 Stress-pt_45th-t.OUT
12/15/2006  02:19 AM            13,519 Stress-pt_54max-b.OUT
12/14/2006  10:35 PM            13,519 Stress-pt_54max-m.OUT
12/14/2006  06:50 PM            13,519 Stress-pt_54max-t.OUT
12/15/2006  02:19 AM         6,143,768 Stress-pt_54th-b.OUT
12/14/2006  10:35 PM         6,143,768 Stress-pt_54th-m.OUT
12/14/2006  06:50 PM         6,115,040 Stress-pt_54th-t.OUT
12/15/2006  02:31 AM            13,519 Stress-pt_63max-b.OUT
12/14/2006  10:47 PM            13,519 Stress-pt_63max-m.OUT
12/14/2006  07:02 PM            13,519 Stress-pt_63max-t.OUT
12/15/2006  02:31 AM         6,143,768 Stress-pt_63th-b.OUT
12/14/2006  10:47 PM         6,143,768 Stress-pt_63th-m.OUT
12/14/2006  07:02 PM         6,115,040 Stress-pt_63th-t.OUT
12/15/2006  02:41 AM            13,519 Stress-pt_72max-b.OUT
12/14/2006  10:58 PM            13,519 Stress-pt_72max-m.OUT
12/14/2006  07:13 PM            13,519 Stress-pt_72max-t.OUT
12/15/2006  02:41 AM         6,143,768 Stress-pt_72th-b.OUT
12/14/2006  10:58 PM         6,143,768 Stress-pt_72th-m.OUT
12/14/2006  07:13 PM         6,115,040 Stress-pt_72th-t.OUT
12/15/2006  02:53 AM            13,519 Stress-pt_81max-b.OUT
12/14/2006  11:09 PM            13,519 Stress-pt_81max-m.OUT
12/14/2006  07:24 PM            13,519 Stress-pt_81max-t.OUT
```

```
12/15/2006  02:53 AM         6,143,768 Stress-pt_81th-b.OUT
12/14/2006  11:09 PM         6,143,768 Stress-pt_81th-m.OUT
12/14/2006  07:24 PM         6,115,040 Stress-pt_81th-t.OUT
12/15/2006  03:04 AM            13,519 Stress-pt_90max-b.OUT
12/14/2006  11:20 PM            13,519 Stress-pt_90max-m.OUT
12/14/2006  07:36 PM            13,519 Stress-pt_90max-t.OUT
12/15/2006  03:04 AM         6,143,768 Stress-pt_90th-b.OUT
12/14/2006  11:20 PM         6,143,768 Stress-pt_90th-m.OUT
12/14/2006  07:36 PM         6,115,040 Stress-pt_90th-t.OUT
12/15/2006  03:16 AM            13,519 Stress-pt_99max-b.OUT
12/14/2006  11:32 PM            13,519 Stress-pt_99max-m.OUT
12/14/2006  07:47 PM            13,519 Stress-pt_99max-t.OUT
12/15/2006  03:16 AM         6,143,768 Stress-pt_99th-b.OUT
12/14/2006  11:32 PM         6,143,768 Stress-pt_99th-m.OUT
12/14/2006  07:47 PM         6,115,040 Stress-pt_99th-t.OUT
12/15/2006  01:23 AM            13,519 Stress-pt_9max-b.OUT
12/14/2006  09:39 PM            13,519 Stress-pt_9max-m.OUT
12/14/2006  05:55 PM            13,519 Stress-pt_9max-t.OUT
12/15/2006  01:24 AM         6,143,896 Stress-pt_9th-b.OUT
12/14/2006  09:39 PM         6,143,896 Stress-pt_9th-m.OUT
12/14/2006  05:55 PM         6,115,168 Stress-pt_9th-t.OUT
01/02/2007  11:57 AM                 0 Sub-Model-Vert-Files.txt
08/02/2006  06:15 AM             4,008 Tank-Coordinates-AP.txt
05/25/2005  03:32 PM             2,512 Tank-Mesh1.txt
11/22/2006  08:32 AM                25 tank-out.out
10/17/2006  12:18 PM             5,554 Tank-Props-Rigid.txt
11/22/2006  08:32 AM             7,639 Tank-th.out
11/10/2006  02:17 PM            22,588 TH-Sub-Modal-Column.txt
11/10/2006  02:19 PM            19,879 TH-Sub-Model-h.txt
11/22/2006  08:27 AM            19,879 TH-Sub-Model-v.txt
12/19/2006  03:13 PM        11,696,640 Waste Pressure 0 deg.xls
12/19/2006  03:13 PM        11,919,872 Waste Pressure 45 deg.xls
12/19/2006  03:14 PM        11,920,384 Waste Pressure 90 deg.xls
12/14/2006  04:26 PM            10,180 Waste-Cont_108max.OUT
12/14/2006  04:26 PM         4,643,118 Waste-Cont_108th.OUT
12/14/2006  04:35 PM            10,180 Waste-Cont_117max.OUT
12/14/2006  04:35 PM         4,643,118 Waste-Cont_117th.OUT
12/14/2006  04:44 PM            10,180 Waste-Cont_126max.OUT
12/14/2006  04:44 PM         4,643,118 Waste-Cont_126th.OUT
12/14/2006  04:53 PM            10,180 Waste-Cont_135max.OUT
12/14/2006  04:53 PM         4,643,118 Waste-Cont_135th.OUT
12/14/2006  05:02 PM            10,180 Waste-Cont_144max.OUT
12/14/2006  05:02 PM         4,643,118 Waste-Cont_144th.OUT
12/14/2006  05:10 PM            10,180 Waste-Cont_153max.OUT
12/14/2006  05:10 PM         4,643,118 Waste-Cont_153th.OUT
12/14/2006  05:19 PM            10,180 Waste-Cont_162max.OUT
12/14/2006  05:19 PM         4,643,118 Waste-Cont_162th.OUT
12/14/2006  05:28 PM            10,180 Waste-Cont_171max.OUT
12/14/2006  05:28 PM         4,643,118 Waste-Cont_171th.OUT
12/14/2006  05:37 PM            10,180 Waste-Cont_180max.OUT
12/14/2006  05:37 PM         4,643,118 Waste-Cont_180th.OUT
12/14/2006  02:57 PM            10,180 Waste-Cont_18max.OUT
12/14/2006  02:57 PM         4,643,118 Waste-Cont_18th.OUT
12/14/2006  03:06 PM            10,180 Waste-Cont_27max.OUT
12/14/2006  03:06 PM         4,643,118 Waste-Cont_27th.OUT
12/14/2006  03:16 PM            10,180 Waste-Cont_36max.OUT
12/14/2006  03:16 PM         4,643,118 Waste-Cont_36th.OUT
12/14/2006  03:25 PM            10,180 Waste-Cont_45max.OUT
12/14/2006  03:25 PM         4,643,118 Waste-Cont_45th.OUT
12/14/2006  03:34 PM            10,180 Waste-Cont_54max.OUT
12/14/2006  03:34 PM         4,643,118 Waste-Cont_54th.OUT
12/14/2006  03:42 PM            10,180 Waste-Cont_63max.OUT
12/14/2006  03:42 PM         4,643,118 Waste-Cont_63th.OUT
12/14/2006  03:51 PM            10,180 Waste-Cont_72max.OUT
12/14/2006  03:51 PM         4,643,118 Waste-Cont_72th.OUT
12/14/2006  03:59 PM            10,180 Waste-Cont_81max.OUT
12/14/2006  03:59 PM         4,643,118 Waste-Cont_81th.OUT
12/14/2006  04:08 PM            10,180 Waste-Cont_90max.OUT
12/14/2006  04:08 PM         4,643,118 Waste-Cont_90th.OUT
12/14/2006  04:17 PM            10,180 Waste-Cont_99max.OUT
```

```
12/14/2006  04:17 PM         4,643,118 Waste-Cont_99th.OUT
12/14/2006  02:47 PM            10,180 Waste-Cont_9max.OUT
12/14/2006  02:47 PM         4,643,246 Waste-Cont_9th.OUT
12/14/2006  05:43 PM            45,117 Waste-Reaction-460-SD3.out
09/25/2006  10:41 AM               340 Waste-Reaction.txt
11/14/2006  07:33 AM            10,553 Waste-solid-AP-S.txt
12/17/2006  01:06 PM               683 Waste-Surface-AP.txt
12/17/2006  01:47 PM             1,027 Waste-Surf_0max.OUT
12/17/2006  01:47 PM           572,821 Waste-Surf_0th.OUT
12/17/2006  01:52 PM             1,027 Waste-Surf_108max.OUT
12/17/2006  01:52 PM           572,693 Waste-Surf_108th.OUT
12/17/2006  01:53 PM             1,027 Waste-Surf_117max.OUT
12/17/2006  01:53 PM           572,693 Waste-Surf_117th.OUT
12/17/2006  01:53 PM             1,027 Waste-Surf_126max.OUT
12/17/2006  01:53 PM           572,693 Waste-Surf_126th.OUT
12/17/2006  01:53 PM             1,027 Waste-Surf_135max.OUT
12/17/2006  01:53 PM           572,693 Waste-Surf_135th.OUT
12/17/2006  01:54 PM             1,027 Waste-Surf_144max.OUT
12/17/2006  01:54 PM           572,693 Waste-Surf_144th.OUT
12/17/2006  01:54 PM             1,027 Waste-Surf_153max.OUT
12/17/2006  01:54 PM           572,693 Waste-Surf_153th.OUT
12/17/2006  01:55 PM             1,027 Waste-Surf_162max.OUT
12/17/2006  01:55 PM           572,693 Waste-Surf_162th.OUT
12/17/2006  01:55 PM             1,027 Waste-Surf_171max.OUT
12/17/2006  01:55 PM           572,693 Waste-Surf_171th.OUT
12/17/2006  01:55 PM             1,027 Waste-Surf_180max.OUT
12/17/2006  01:55 PM           572,693 Waste-Surf_180th.OUT
12/17/2006  01:55 PM             1,027 Waste-Surf_189max.OUT
12/17/2006  01:55 PM           572,693 Waste-Surf_189th.OUT
12/17/2006  01:48 PM             1,027 Waste-Surf_18max.OUT
12/17/2006  01:48 PM           572,693 Waste-Surf_18th.OUT
12/17/2006  01:48 PM             1,027 Waste-Surf_27max.OUT
12/17/2006  01:48 PM           572,693 Waste-Surf_27th.OUT
12/17/2006  01:49 PM             1,027 Waste-Surf_36max.OUT
12/17/2006  01:49 PM           572,693 Waste-Surf_36th.OUT
12/17/2006  01:49 PM             1,027 Waste-Surf_45max.OUT
12/17/2006  01:49 PM           572,693 Waste-Surf_45th.OUT
12/17/2006  01:50 PM             1,027 Waste-Surf_54max.OUT
12/17/2006  01:50 PM           572,693 Waste-Surf_54th.OUT
12/17/2006  01:50 PM             1,027 Waste-Surf_63max.OUT
12/17/2006  01:50 PM           572,693 Waste-Surf_63th.OUT
12/17/2006  01:50 PM             1,027 Waste-Surf_72max.OUT
12/17/2006  01:50 PM           572,693 Waste-Surf_72th.OUT
12/17/2006  01:51 PM             1,027 Waste-Surf_81max.OUT
12/17/2006  01:51 PM           572,693 Waste-Surf_81th.OUT
12/17/2006  01:51 PM             1,027 Waste-Surf_90max.OUT
12/17/2006  01:51 PM           572,693 Waste-Surf_90th.OUT
12/17/2006  01:52 PM             1,027 Waste-Surf_99max.OUT
12/17/2006  01:52 PM           572,693 Waste-Surf_99th.OUT
12/17/2006  01:48 PM             1,027 Waste-Surf_9max.OUT
12/17/2006  01:48 PM           572,693 Waste-Surf_9th.OUT
12/15/2006  07:15 AM           229,888 waste_0-90.xls
12/15/2006  07:15 AM           229,888 waste_99-180.xls
             321 File(s)    574,382,541 bytes

 Directory of C:\Users\Bruce\2008-000 PNNL\2008-005 AP-460\AP-460-Sub-Model-Vert\Freq
Test

12/20/2006  07:36 AM    <DIR>          .
12/20/2006  07:36 AM    <DIR>          ..
08/21/2006  06:49 AM               101 All-Forces.txt
11/10/2006  03:07 PM               768 AP-460-Slosh-Flex-Dytran.log
12/19/2006  02:09 PM           323,726 AP-460-Slosh-Flex-V.out
12/19/2006  01:07 PM               136 AP-460-Sub-Model-H.err
12/19/2006  01:07 PM            77,418 AP-460-Sub-Model-H.log
12/19/2006  02:09 PM             2,998 AP-460-Sub-Model-V.BCS
12/19/2006  02:09 PM        43,646,976 AP-460-Sub-Model-V.db
12/19/2006  02:09 PM        53,084,160 AP-460-Sub-Model-V.dbb
12/19/2006  02:09 PM        11,730,944 AP-460-Sub-Model-V.emat
12/20/2006  07:36 AM            48,725 AP-460-Sub-Model-V.err
```

```
12/19/2006  02:09 PM        50,462,720 AP-460-Sub-Model-V.esav
12/19/2006  02:09 PM        12,845,056 AP-460-Sub-Model-V.full
12/19/2006  02:08 PM        15,299,480 AP-460-Sub-Model-V.ldhi
12/20/2006  07:36 AM             2,948 AP-460-Sub-Model-V.log
12/19/2006  02:09 PM            10,943 AP-460-Sub-Model-V.mntr
12/19/2006  02:08 PM        50,462,720 AP-460-Sub-Model-V.osav
12/19/2006  02:09 PM                67 AP-460-Sub-Model-V.PVTS
12/19/2006  02:09 PM        50,987,008 AP-460-Sub-Model-V.r001
12/19/2006  01:08 PM        43,646,976 AP-460-Sub-Model-V.rdb
12/19/2006  02:09 PM       610,467,840 AP-460-Sub-Model-V.rst
11/17/2006  11:04 AM             6,046 Bolts-Friction.txt
06/09/2005  01:59 PM               262 Boundary.txt
11/19/2006  09:14 AM               227 Contact-AP.txt
08/21/2006  07:59 AM               586 Contact-Footing.txt
08/25/2006  01:28 PM               704 Contact-Insul.txt
08/25/2006  01:27 PM               704 Contact-J-Bolts.txt
08/25/2006  01:28 PM               708 Contact-Primary.txt
08/21/2006  07:59 AM               742 Contact-Soil.txt
08/21/2006  12:44 PM               632 Contact-Waste-AP.txt
01/03/2006  11:17 AM             1,616 Disp-J-Bolts.txt
11/10/2006  02:08 PM             8,620 Far-Soil.txt
11/17/2006  10:53 AM             5,822 file.log
12/20/2005  04:49 PM            39,925 file.txt
10/13/2005  06:54 AM               562 Fix-Soil.txt
08/21/2006  08:00 AM               894 Force-c.txt
08/21/2006  08:00 AM               661 Force-j_bolt.txt
10/17/2006  01:37 PM             1,668 Insulate.txt
07/20/2006  06:36 AM             4,030 interface-gap1.txt
11/13/2006  01:45 PM             2,445 interface1.txt
08/23/2006  07:47 AM             1,971 Liner.txt
05/02/2005  02:19 PM               667 live_load.txt
07/21/2006  10:03 AM             6,214 Near-Soil-1.txt
04/20/2005  01:14 PM               508 outer-spar.txt
11/10/2006  04:08 PM               125 Post-Tank.txt
11/10/2006  04:05 PM             6,154 Primary-Props-AP.txt
09/27/2005  03:52 PM             1,538 Primary.txt
12/19/2006  01:08 PM           451,239 QA.out
10/31/2005  10:31 AM             1,108 RS_FREQ.txt
12/19/2006  09:50 AM             1,893 Run-Tank.txt
12/19/2006  01:07 PM                 0 scratch.hlp
02/11/2005  01:22 PM             1,053 Slave.txt
11/11/2005  10:36 AM             4,989 Soil-Prop-Mean-Geo.txt
12/19/2006  09:50 AM             2,028 Solve-Slosh-vert.txt
11/17/2006  11:14 AM             2,177 Solve-Sub-Horiz.txt
08/25/2006  08:47 AM             1,918 Solve-TH-BES.txt
09/13/2006  06:12 AM               347 spectra-all.txt
09/13/2006  06:07 AM             3,690 spectra-conc-0.txt
09/13/2006  06:08 AM             3,723 spectra-conc-135.txt
09/13/2006  06:09 AM             3,723 spectra-conc-180.txt
09/13/2006  06:08 AM             3,769 spectra-conc-45.txt
09/13/2006  06:08 AM             3,649 spectra-conc-90.txt
09/13/2006  06:09 AM             1,590 spectra-conc.txt
08/28/2006  09:38 AM             2,076 spectra-concrete.txt
10/03/2006  02:02 PM             3,624 spectra-primary-0.txt
10/03/2006  02:04 PM             3,777 spectra-primary-135.txt
09/13/2006  06:15 AM             3,777 spectra-primary-180.txt
10/03/2006  02:03 PM             3,703 spectra-primary-45.txt
10/03/2006  02:03 PM             3,703 spectra-primary-90.txt
09/13/2006  06:15 AM             3,801 spectra-soil.txt
06/20/2005  09:04 AM               647 spectra-wall.txt
06/20/2005  08:52 AM               679 spectra-waste.txt
09/05/2006  02:00 PM             2,588 strain-backed.txt
08/21/2006  08:01 AM               566 strain-compb-p.txt
08/16/2006  01:59 PM               621 strain-compb-primary.txt
08/21/2006  08:01 AM               693 strain-compb.txt
08/21/2006  08:02 AM               566 strain-compm-p.txt
08/16/2006  02:00 PM               621 strain-compm-primary.txt
08/21/2006  08:01 AM               705 strain-compm.txt
08/21/2006  08:02 AM               578 strain-compt-p.txt
08/16/2006  02:00 PM               621 strain-compt-primary.txt
```

```
08/21/2006  08:02 AM               720 strain-compt.txt
08/21/2006  08:02 AM               730 Strain-Liner-floor.txt
01/05/2006  03:14 PM               550 Strain-Liner-p.txt
08/21/2006  08:02 AM               962 Strain-Liner-wall.txt
08/16/2006  03:01 PM               545 Strain-Liner.txt
08/16/2006  02:01 PM               292 Strain-Primary.txt
08/16/2006  02:19 PM               273 Strain.txt
08/21/2006  08:02 AM               554 stress-compb-p.txt
08/21/2006  08:02 AM               598 stress-compb.txt
08/21/2006  08:03 AM               554 stress-compm-p.txt
08/21/2006  08:03 AM               608 stress-compm.txt
08/21/2006  08:03 AM               554 stress-compt-p.txt
08/24/2006  03:19 PM               598 stress-compt.txt
08/17/2006  11:19 AM               207 Stress-Primary-M.txt
08/24/2006  12:05 PM               224 Stress-Primary.txt
08/02/2006  06:15 AM             4,008 Tank-Coordinates-AP.txt
05/25/2005  03:32 PM             2,512 Tank-Mesh1.txt
12/19/2006  01:07 PM                25 tank-out.out
10/17/2006  12:18 PM             5,554 Tank-Props-Rigid.txt
12/19/2006  01:08 PM             6,409 Tank-th.out
11/10/2006  02:17 PM            22,588 TH-Sub-Modal-Column.txt
11/10/2006  02:19 PM            19,879 TH-Sub-Model-h.txt
12/19/2006  02:09 PM            45,117 Waste-Reaction-460-SD3.out
12/19/2006  01:45 PM               339 Waste-Reaction.txt
11/14/2006  07:33 AM            10,553 Waste-solid-AP-S.txt
08/21/2006  08:03 AM               776 Waste-Surface-AP.txt
             106 File(s)    943,841,712 bytes

     Total Files Listed:
             427 File(s)  1,518,224,253 bytes
               5 Dir(s)  160,786,079,744 bytes free
```

APPENDIX E

Common ANSYS Files Listing

All-Forces.txt

```
/input,force-c,txt
/input,stress-Primary,txt
/input,Force-J_bolt,txt
/input,strain-liner,txt
```

Bolts-Friction.txt

```
pi=acos(-1)                    ! Define PI

!ET,4,BEAM44           ! Rigid Links
!KEYOPT,4,8,111
et,4,BEAM4
keyopt,4,6,1

et,31,combin14,,1
et,32,combin14,,2
et,33,combin14,,3

et,34,targe170
et,35,conta173
!keyopt,35,2,3
keyopt,35,5,3
keyopt,35,9,1
keyopt,35,11,1
!keyopt,35,12,4
r,701,0,0,0.01
r,702,0,0,0.01
r,703,0,0,0.01
r,704,0,0,0.01
r,705,0,0,0.01
r,706,0,0,0.01
r,707,0,0,0.01
r,708,0,0,0.01
r,709,0,0,0.01
r,710,0,0,0.01
r,711,0,0,0.01

BX=33333/20
BY=33333/20
BZ=22777/10
mp,mu,700,0.01

/COM - Create Rigid Links for J-Bolts
nj_bolt=11

mp,ex,401,4176000
mp,nuxy,401,0.30
mp,dens,401,0
r,401,1,10,10,2.5,2.5
rmore,,1e-3
r,402,1,10,10,2.5,2.5
rmore,,1e-3
r,403,1,10,10,2.5,2.5
rmore,,1e-3
r,404,1,10,10,2.5,2.5
rmore,,1e-3
r,405,1,10,10,2.5,2.5
rmore,,1e-3
r,406,1,10,10,2.5,2.5
rmore,,1e-3
r,407,1,10,10,2.5,2.5
rmore,,1e-3
r,408,1,10,10,2.5,2.5
rmore,,1e-3
r,409,1,10,10,2.5,2.5
rmore,,1e-3
r,410,1,10,10,2.5,2.5
rmore,,1e-3
r,411,1,10,10,2.5,2.5
rmore,,1e-3

r,421,1/2,10,10,2.5,2.5
rmore,,1e-3
r,422,1/2,10,10,2.5,2.5
rmore,,1e-3
r,423,1/2,10,10,2.5,2.5
rmore,,1e-3
r,424,1/2,10,10,2.5,2.5
rmore,,1e-3
r,425,1/2,10,10,2.5,2.5
rmore,,1e-3
r,426,1/2,10,10,2.5,2.5
rmore,,1e-3
r,427,1/2,10,10,2.5,2.5
rmore,,1e-3
r,428,1/2,10,10,2.5,2.5
rmore,,1e-3
r,429,1/2,10,10,2.5,2.5
rmore,,1e-3
r,430,1/2,10,10,2.5,2.5
rmore,,1e-3
r,431,1/2,10,10,2.5,2.5
rmore,,1e-3

r,501,1.364*BX
r,502,0.550*BX
r,503,0.887*BX
r,504,1.027*BX
r,505,1.971*BX
r,506,2.407*BX
r,507,3.301*BX
r,508,4.039*BX
r,509,4.369*BX
r,510,5.362*BX
r,511,3.596*BX

r,521,1.364*BY
r,522,0.550*BY
r,523,0.887*BY
r,524,1.027*BY
r,525,1.971*BY
r,526,2.407*BY
r,527,3.301*BY
r,528,4.039*BY
r,529,4.369*BY
r,530,5.362*BY
r,531,3.596*BY

r,541,1.364*BZ
r,542,0.550*BZ
r,543,0.887*BZ
r,544,1.027*BZ
r,545,1.971*BZ
r,546,2.407*BZ
r,547,3.301*BZ
r,548,4.039*BZ
r,549,4.369*BZ
r,550,5.362*BZ
r,551,3.596*BZ

R,601,1.364*BX/2
R,602,0.550*BX/2
R,603,0.887*BX/2
R,604,1.027*BX/2
```

```
R,605,1.971*BX/2
R,606,2.407*BX/2
R,607,3.301*BX/2
R,608,4.039*BX/2
R,609,4.369*BX/2
R,610,5.362*BX/2
R,611,3.596*BX/2

R,621,1.364*BY/2
R,622,0.550*BY/2
R,623,0.887*BY/2
R,624,1.027*BY/2
R,625,1.971*BY/2
R,626,2.407*BY/2
R,627,3.301*BY/2
R,628,4.039*BY/2
R,629,4.369*BY/2
R,630,5.362*BY/2
R,631,3.596*BY/2

R,641,1.364*BZ/2
R,642,0.550*BZ/2
R,643,0.887*BZ/2
R,644,1.027*BZ/2
R,645,1.971*BZ/2
R,646,2.407*BZ/2
R,647,3.301*BZ/2
R,648,4.039*BZ/2
R,649,4.369*BZ/2
R,650,5.362*BZ/2
R,651,3.596*BZ/2

cmsel,s,primary-tank
nsle
nsel,r,loc,z,ptz(1),ptz(11)
cm,bolt-primary-n,node
nsel,none
n,,0,0,ptz(1)
*do,i,2,nj_bolt
*do,j,0,180/arcsize
angley=-j*arcsize
n,,ptx(i),angley,ptz(i)
*enddo
*enddo
cm,bolt-node,node


/COM - Create link at top center of tanks
type,4
mat,401
real,401

nsel,s,loc,x,0                           !
Select nodes on model origin
nsel,r,loc,z,ptz(1),ctz(1)               !
Reselect nodes on concrete and primary
tanks
!nsel,u,node,,1
cmsel,u,bolt-primary-n
eintf,10                                 !
Place link at dome center

csys,1
/COM - Create links for J-Bolts
*do,i,2,nj_bolt
        ! Cycle by radius
REAL,400+i
*do,j,1,180/arcsize-1                    !
Cycle by model slice
angley=-j*arcsize                        !
Define angle for node selection
nsel,s,loc,x,ctx(i),ptx(i)               !
Select nodes at radius
nsel,r,loc,z,ctz(i),ptz(i)
nsel,r,loc,y,angley                      !
Reselect nodes at angle "anlgey"
cmsel,u,bolt-primary-n
cmsel,u,waste-n
eintf,10                                 !
Create rigid link
*enddo
real,420+i
nsel,s,loc,x,ctx(i),ptx(i)               !
Select nodes at radius
nsel,r,loc,z,ctz(i),ptz(i)
nsel,r,loc,y,0                           !
Reselect nodes at angle 0
cmsel,u,bolt-primary-n
cmsel,u,waste-n
eintf,10                                 !
Create rigid link
nsel,s,loc,x,ctx(i),ptx(i)               !
Select nodes at radius
nsel,r,loc,z,ctz(i),ptz(i)
nsel,r,loc,y,180                         !
Reselect nodes at angle 180
cmsel,u,bolt-primary-n
cmsel,u,waste-n
eintf,10                                 !
Create rigid link

*enddo

esel,s,type,,4
cm,j_bolts,elem
        ! Create component for J-Bolt
rigid links
allsel



/COM - Create link at top center of tanks
nsel,R,loc,x,0                           !
Select nodes on model origin
nsel,r,loc,z,ptz(1),ptz(1)               !
Reselect nodes on concrete and primary
tanks
TYPE,31
REAL,501
eintf                         ! Place
link at dome center
TYPE,32
REAL,521
eintf                         ! Place
link at dome center
TYPE,33
REAL,541
eintf                         ! Place
link at dome center

csys,1
/COM - Create links for J-Bolts
*do,j,0,2
type,31+j
*do,i,2,nj_bolt
        ! Cycle by radius
REAL,500+20*j+i
*do,k,1,180/arcsize-1                    !
Cycle by model slice
```

```
angley=-k*arcsize                        !
Define angle for node selection
nsel,s,loc,x,ptx(i),ptx(i)               !
Select nodes at radius
nsel,r,loc,z,ptz(i),ptz(i)               !
Select nodes at radius
nsel,r,loc,y,angley                      !
Reselect nodes at angle "anlgey"
cmsel,u,waste-n
eintf                           ! Create
rigid link
*enddo
real,600+j*20+i
nsel,s,loc,x,ptx(i),ptx(i)               !
Select nodes at radius
nsel,r,loc,z,ptz(i),ptz(i)               !
Select nodes at radius
nsel,r,loc,y,0                           !
Reselect nodes at angle 0
cmsel,u,waste-n
eintf                           ! Create
rigid link
nsel,s,loc,x,ptx(i),ptx(i)               !
Select nodes at radius
nsel,r,loc,z,ptz(i),ptz(i)               !
Select nodes at radius
nsel,r,loc,y,180                         !
Reselect nodes at angle 180
cmsel,u,waste-n
eintf                           ! Create
rigid link

*enddo
*enddo

esel,s,type,,31,33
cm,bolt-springs,elem

*do,i,1,10
cmsel,s,conc-tank
nsle
nsel,r,loc,x,ctx(i),ctx(i+1)
nsel,r,loc,z,ctz(i),ctz(i+1)
esln,r
real,700+i
type,34
esurf,,bottom
cmsel,s,primary-tank
nsle
nsel,r,loc,x,ptx(i),ptx(i+1)
nsel,r,loc,z,ptz(i),ptz(i+1)
esln,r
type,35
real,700+i
mat,700
esurf,,bottom
*enddo
esel,s,type,,35
cm,bolt-friction,elem

!*do,i,3,nj_bolt
!cmsel,s,primary-tank
!cmsel,a,conc-tank
!nsle
!nsel,r,loc,z,ptz(i),ctz(i)
!nsel,r,loc,x,ptx(i),ctx(i)
!type,35
!mat,700
!real,700
!eintf,1,high
!*enddo

*get,KMAXjb,KP,0,num,max       ! Get
maximum keypoint number
*get,LMAXjb,LINE,0,num,max     ! Get
maximum line number
*get,AMAXjb,AREA,0,num,max     ! Get
maximum area number
*get,VMAXjb,volu,0,num,max     ! Get
maximum volume number
```

Boundary.txt

```
/COM - Fix symmetry face
allsel
csys,0
nsel,s,loc,y,0
d,all,uy
csys,1

cmsel,s,conc-tank
cmsel,a,primary-tank
cmsel,a,liner
nsle
csys,0
nsel,r,loc,y,0
d,all,rotx
d,all,rotz
csys,1

allsel

!esel,s,type,,24
!nsle
!cmsel,u,conc-slab
!ddele,all,uy
!allsel
```

Contact-AP.txt

```
/input,waste-reaction,txt
/input,contact-waste-ap,txt
/input,contact-insul,txt
/input,contact-primary,txt
/input,contact-j-bolts,txt
/input,contact-soil,txt
/input,waste-surface-ap,txt
/input,contact-footing,txt
```

Contact-Footing.txt

```
/post26
numvar,200
*do,z,2,200
VARDEL,z
*enddo

*do,i,1,21
angley=-arcsize*(i-1)
esel,s,type,,24
nsle
nsel,r,loc,y,angley
esln,r,1
*get,emax,elem,,num,max
esol,(2+i),(emax),,smisc,1,pr%(emax)%
esol,(32+i),(emax),,cont,slide,sl%(emax)%
esol,(62+i),(emax),,cont,gap,gp%(emax)%
```

```
esol,(92+i),(emax),,cont,stat,st%(emax)%
esol,(122+i),(emax),,smisc,2,fsy%(emax)%
esol,(152+i),(emax),,smisc,3,fsz%(emax)%
*enddo
LINES,2150
extrem
/OUT,Footing-Cont_max,OUT
extrem,3,200
/OUT

/OUT,Footing-Cont_th,OUT
*do,k,1,20
PRVAR,2+k,32+k,62+k,92+k,122+k,152+k
*enddo
/OUT
```

Contact-Insul.txt

```
/post26
numvar,200
*do,z,2,200
VARDEL,z
*enddo

*do,i,1,20
*do,j,1,8
angley=-arcsize*(i-1)
esel,s,type,,68
nsle
nsel,r,loc,y,angley,angley-arcsize
nsel,r,loc,x,ctx(j+24),ctx(j+25)
nsel,r,loc,z,ctz(j+24),ctz(j+25)
esln,r,1
*get,emax,elem,,num,max
esol,(2+j),(emax),,cont,pres,pr%(emax)%
esol,(32+j),(emax),,cont,slide,sl%(emax)%
esol,(62+j),(emax),,cont,gap,gap%(emax)%
esol,(92+j),(emax),,cont,stat,st%(emax)%
esol,(122+j),(emax),,cont,sfric,sf%(emax)
%
esol,(152+j),(emax),,cont,pene,pn%(emax)%
*enddo

LINES,2150
extrem
/OUT,Insul-Cont_%(9*i)%max,OUT
extrem,3,200
/OUT

/OUT,Insul-Cont_%(9*i)%th,OUT
*do,k,1,20
PRVAR,2+k,32+k,62+k,92+k,122+k,152+k
*enddo
/OUT

*enddo
```

Contact-J-Bolts.txt

```
/post26
numvar,200
*do,z,2,200
VARDEL,z
*enddo

*do,i,1,20
*do,j,1,9
angley=-arcsize*(i-1)
esel,s,type,,35
nsle
nsel,r,loc,y,angley,angley-arcsize
nsel,r,loc,x,ptx(j+1),ptx(j+2)
nsel,r,loc,z,ptz(j+1),ptz(j+2)
esln,r,1
*get,emax,elem,,num,max
esol,(2+j),(emax),,cont,pres,pr%(emax)%
esol,(32+j),(emax),,cont,slide,sl%(emax)%
esol,(62+j),(emax),,cont,gap,gap%(emax)%
esol,(92+j),(emax),,cont,stat,stat%(emax)
%
esol,(122+j),(emax),,cont,sfric,sf%(emax)
%
esol,(152+j),(emax),,cont,pene,pn%(emax)%
*enddo

LINES,2150
extrem
/OUT,J-Bolt-Cont_%(9*i)%max,OUT
extrem,3,200
/OUT

/OUT,J-Bolt-Cont_%(9*i)%th,OUT
*do,k,1,21
PRVAR,2+k,32+k,62+k,92+k.122+k,152+k
*enddo
/OUT

*enddo
```

Contact-Primary.txt

```
/post26
numvar,200
*do,z,2,200
VARDEL,z
*enddo

*do,i,1,20
*do,j,1,8
angley=-arcsize*(i-1)
esel,s,type,,66
nsle
nsel,r,loc,y,angley,angley-arcsize
nsel,r,loc,x,ptx(j+34),ptx(j+35)
nsel,r,loc,z,ptz(j+34),ptz(j+35)
esln,r,1
*get,emax,elem,,num,max
esol,(2+j),(emax),,cont,pres,pr%(emax)%
esol,(32+j),(emax),,cont,slide,sl%(emax)%
esol,(62+j),(emax),,cont,gap,gap%(emax)%
esol,(92+j),(emax),,cont,stat,st%(emax)%
esol,(122+j),(emax),,cont,sfric,sf%(emax)
%
esol,(152+j),(emax),,cont,pene,pn%(emax)%
*enddo

LINES,2150
extrem
/OUT,Primary-Cont_%(9*i)%max,OUT
extrem,3,200
/OUT

/OUT,Primary-Cont_%(9*i)%th,OUT
*do,k,1,20
PRVAR,2+k,32+k,62+k,92+k,122+k,152+k
```

```
*enddo
/OUT

*enddo
```

Contact-Soil.txt

```
/post26
numvar,200
*do,z,2,200
VARDEL,z
*enddo

*do,i,1,20
*do,j,1,20
angley=-arcsize*(i-1)
esel,s,type,,61,63,2
nsle
nsel,r,loc,y,angley,angley-arcsize
nsel,r,loc,x,ctx(j+1),ctx(j+2)
nsel,r,loc,z,ctz(j+1),ctz(j+2)
esln,r,1
*get,emax,elem,,num,max
*get,nmax,node,,num,max
esol,(2+j),(emax),,cont,pres,pr%(emax)%
esol,(32+j),(emax),,cont,slide,pr%(emax)%
esol,(62+j),(emax),,cont,gap,pr%(emax)%
esol,(92+j),(emax),,cont,stat,pr%(emax)%
esol,(122+j),(emax),nmax,smisc,8,taur%(em
ax)%
esol,(152+j),(emax),nmax,smisc,12,taus%(e
max)%
*enddo

LINES,2150
extrem
/OUT,Soil-Contact_%(9*i)%max,OUT
extrem,3,200
/OUT

/OUT,Soil-Contact_%(9*i)%th,OUT
*do,k,1,21
PRVAR,2+k,32+k,62+k,92+k,122+k,152+k
*enddo
/OUT

*enddo
```

Contact-Waste-AP.txt

```
/post26
numvar,200
*do,z,2,200
VARDEL,z
*enddo

*do,i,1,20
*do,j,1,31
angley=-arcsize*(i-1)
cmsel,s,waste-surf
nsle
nsel,r,loc,y,angley,angley-arcsize
nsel,r,loc,x,ptx(j+wastet-
1),ptx(j+wastet)
nsel,r,loc,z,ptz(j+wastet-
1),ptz(j+wastet)
esln,r,1
*get,emax,elem,,num,max
esol,(2+j),(emax),,Cont,pres,pr%(emax)%
esol,(42+j),(emax),,Cont,slide,sl%(emax)%
esol,(82+j),(emax),,Cont,gap,gp%(emax)%
esol,(122+j),(emax),,Cont,stat,st%(emax)%
*enddo

LINES,2050
extrem
/OUT,Waste-Cont_%(9*i)%max,OUT
extrem,3,200
/OUT

/OUT,Waste-Cont_%(9*i)%th,OUT
*do,k,1,31
PRVAR,2+k,42+k,82+k,122+k
*enddo
/OUT

*enddo
```

Far-Soil.txt

```
et,9,solid45          ! Use Elment type
SOLID45 for Far Soil
et,10,mass21
r,1001,mass,mass,mass
type,9

asel,none      ! unselect all reas
vsel,none      ! unselect all volumes
lsel,none
nsel,none
ksel,none
esel,none

/COM - Generate Keypoints at full model
radius
*do,i,1,tanksoil
k,kmaxns+i,soil_radius,0,soilz(i)
*enddo

*do,i,1,9
k,kmaxns+tanksoil+i,Soilx(i),0,soilz(i)
*enddo

/COM - Generate areas outside excavated
soil
*do,i,1,tanksoil-1
kp1=kp(soilx(i),0,soilz(i))
kp2=kp(soil_radius,0,soilz(i))
kp3=kp(soil_radius,0,soilz(i+1))
kp4=kp(soilx(i+1),0,soilz(i+1))
a,kp1,kp2,kp3,kp4
*enddo
ksel,a,kp,,1,ct_kps,ct_kps-1
vrotat,all,,,,,,1,ct_kps,180,2
cm,far-soil-volu,volu
*do,i,1,tanksoil-1
cmsel,s,far-soil-volu
vsel,r,loc,z,soilz(i),soilz(i+1)
vatt,900+i,,9                          !
Assign attributes
aslv
lsla
lsel,r,loc,x,soilx(i)
lesize,all,,arcsize                    !
Match excavated soil meshing
```

```
lsla
lsel,r,loc,x,soilx(i+1)
lesize,all,,arcsize                    !
Match excavated soil meshing
lsla
lsel,r,loc,x,soil_radius
lsel,r,loc,z,soilz(i)
lesize,all,,arcsize                    !
Match excavated soil meshing
lsla
lsel,r,loc,x,soil_radius
lsel,r,loc,z,soilz(i+1)
lesize,all,,arcsize                    !
Match excavated soil meshing
*enddo

/COM - Mesh soil outside excavated soil
cmsel,s,far-soil-volu
esize,30
vmesh,all
csys,1
esel,s,type,,9
nsle
!nrotat,all                             !
Rotate all nodes to cylidrical
coordinates
cm,far-soil-top,elem

!/COM - Connect new soil elements to
excavated soil at interface
!*do,i,1,tanksoil
!nsel,s,loc,x,soilx(i)
!nsel,r,loc,z,soilz(i)
!cmsel,u,excav-wall
!nummrg,node
!*enddo

*get,KMAXtemp,KP,0,num,max
*get,LMAXtemp,LINE,0,num,max
*get,AMAXtemp,AREA,0,num,max
*get,VMAXtemp,VOLU,0,num,max

ksel,u,kp,,all
asel,u,area,,all
vsel,u,volu,,all

/COM - Generate Keypoint below tank for
five layers
*do,i,0,deepsoil-tanksoil-5
k,kmaxtemp+5*i+1,0,0,soilz(i+tanksoil)
                          ! Keypoint on
centerline
k,kmaxtemp+5*i+2,ctx(ct_kps-1-
i),0,soilz(i+tanksoil) ! Keypoint to
flare central area under tank
k,kmaxtemp+5*i+3,ctx(bm_kp+1),0,soilz(i+t
anksoil)        ! Keypoint under edge of
tank
k,kmaxtemp+5*i+4,soilx(tanksoil),0,soilz(
i+tanksoil)     ! Keypoint under edge of
excavated soil
k,kmaxtemp+5*i+5,soil_radius,0,soilz(i+ta
nksoil) ! Keypoint at edge of model
*enddo

/COM - Generate Keypoint below tank to
full depth
*do,i,5,deepsoil-tanksoil
k,kmaxtemp+5*i+1,0,0,soilz(i+tanksoil)
                          ! Keypoint on
centerline
k,kmaxtemp+5*i+2,ctx(ct_kps-
5),0,soilz(i+tanksoil) ! Keypoint for
central soil area
k,kmaxtemp+5*i+3,ctx(bm_kp+1),0,soilz(i+t
anksoil)        ! Keypoint under edge of
tank
k,kmaxtemp+5*i+4,soilx(tanksoil),0,soilz(
i+tanksoil)     ! Keypoint under edge of
excavated soil
k,kmaxtemp+5*i+5,soil_radius,0,soilz(i+ta
nksoil) ! Keypoint at edge of model
*enddo

*do,i,0,3                  ! Area pattern for
1st 4 layers under tank
a,kmaxtemp+5*i+1,kmaxtemp+5*i+2,kmaxtemp+
5*(i+1)+2,kmaxtemp+5*(i+1)+1
a,kmaxtemp+5*i+2,kmaxtemp+5*i+3,kmaxtemp+
5*(i+1)+3,kmaxtemp+5*(i+1)+2
a,kmaxtemp+5*i+3,kmaxtemp+5*i+4,kmaxtemp+
5*(i+1)+4,kmaxtemp+5*(i+1)+3
a,kmaxtemp+5*i+4,kmaxtemp+5*i+5,kmaxtemp+
5*(i+1)+5,kmaxtemp+5*(i+1)+4
*enddo

! Area pattern for transition layer
a,kmaxtemp+5*4+1,kmaxtemp+5*4+2,kmaxtemp+
5*(4+1)+2,kmaxtemp+5*(4+1)+1
a,kmaxtemp+5*4+2,kmaxtemp+5*4+3,kmaxtemp+
5*4+4,kmaxtemp+5*(4+1)+4,kmaxtemp+5*(4+1)
+2
a,kmaxtemp+5*4+4,kmaxtemp+5*4+5,kmaxtemp+
5*(4+1)+5,kmaxtemp+5*(4+1)+4

*do,i,5,10                 ! Area pattern to
bottom of model
a,kmaxtemp+5*i+1,kmaxtemp+5*i+2,kmaxtemp+
5*(i+1)+2,kmaxtemp+5*(i+1)+1
a,kmaxtemp+5*i+2,kmaxtemp+5*i+4,kmaxtemp+
5*(i+1)+4,kmaxtemp+5*(i+1)+2
a,kmaxtemp+5*i+4,kmaxtemp+5*i+5,kmaxtemp+
5*(i+1)+5,kmaxtemp+5*(i+1)+4
*enddo


/COM - divide line interfacing with
bottom of tank to match tank meshing
lsla
lsel,r,loc,z,soilz(tanksoil)
lsel,r,loc,x,ctx(ct_kps-1),ctx(bm_kp+1)
ratio=(ctx(ct_kps-1)-ctx(ct_kps-
2))/(ctx(ct_kps-1)-ctx(bm_kp+1))
ldiv,all,ratio
*get,LMAXtemp,LINE,0,num,max
*do,i,1,8
lsla
lsel,r,loc,z,soilz(tanksoil)
lsel,r,loc,x,ctx(ct_kps-1-i),ctx(bm_kp+1)
ratio=(ctx(ct_kps-1-i)-ctx(ct_kps-2-
i))/(ctx(ct_kps-1-i)-ctx(bm_kp+1))
ldiv,all,ratio
*enddo

!/COM - Move Keypoints to match tank
bottom vertical locations
!lsla
!*do,i,0,ct_kps-bm_kp-1
```

```
!kact=kp(ctx(ct_kps-i),0,soilz(tanksoil))
!kmodif,kact,ctx(ct_kps-i),0,ctz(ct_kps-
i)
!*enddo

ksel,a,kp,,1,ct_kps,ct_kps-1           !
Select Keypoints for rotation axis
vrotat,all,,,,,,1,ct_kps,180,2
        ! Develop volumes
cm,deep-soil-volu,volu
*do,i,tanksoil,deepsoil-1             !
Assign attributes
vsel,s,loc,z,soilz(i),soilz(i+1)
vatt,900+i,,9
*enddo

/COM - Control meshing to match model
slices
cmsel,s,deep-soil-volu
aslv
lsla
lsel,r,loc,x,soil_radius
lesize,all,,arcsize
lsla
lsel,r,loc,x,soilx(tanksoil)
lesize,all,,arcsize
lsla
lsel,r,loc,x,ctx(bm_kp+1)
lesize,all,,arcsize


vsel,u,loc,x,0,soilx(tanksoil)
vmesh,all
        ! Mesh outside volumes
vsel,s,loc,x,ctx(ct_kps-
5),soilx(tanksoil)
vsel,r,loc,z,soilz(tanksoil+5),soilz(deep
soil)
esize,22
vmesh,all
        ! Mesh under excavated soil and
tank except for central area

cmsel,s,deep-soil-volu
vsel,r,loc,x,0,ctx(ct_kps-3)
        ! Select volumes under center of
tank
aslv
asel,r,loc,z,soilz(tanksoil)
        ! Select soil area at bottom of
tank
lsla
lsel,r,loc,x,ctx(ct_kps-1)
        ! Select Lines on outside of
center area
lesize,all,,arcsize
        ! Control mesh for slices
lsla
lsel,u,loc,x,ctx(ct_kps-1)
lesize,all,,,midsize
        ! control mesh on inside of area
aslv
lsla
cmsel,s,deep-soil-volu
vsel,r,loc,x,0,ctx(ct_kps-3)
aslv
lsla
lsel,r,loc,z,soilz(tanksoil),soilz(tankso
il+1)
lsel,u,loc,z,soilz(tanksoil)
lsel,u,loc,z,soilz(tanksoil+1)
lesize,all,,,4
        ! Control meshing under tank
cmsel,s,deep-soil-volu
vsel,r,loc,x,0,ctx(ct_kps-3)
aslv
lsla
lsel,r,loc,z,soilz(tanksoil+1),soilz(tank
soil+2)
lsel,u,loc,z,soilz(tanksoil+1)
lsel,u,loc,z,soilz(tanksoil+2)
lesize,all,,,2
        ! Control meshing under tank
cmsel,s,deep-soil-volu
vsel,r,loc,x,0,ctx(ct_kps-3)
aslv
asel,r,loc,z,soilz(tanksoil)
type,1
amesh,all
        ! mesh area at tank/soil
interface
vsweep,all
        ! Sweep mesh to bottom of model
aclear,all
        ! Clear Pattern

cmsel,s,deep-soil-volu
aslv
lsla
lsel,r,loc,z,soilz(tanksoil+1)
lsel,r,loc,x,ctx(ct_kps-2),ctx(bm_kp+1)
lsel,u,loc,x,ctx(ct_kps-2)
lsel,u,loc,x,ctx(bm_kp+1)
lesize,all,,,8
        ! Control meshing under tank

lsla
lsel,r,loc,z,soilz(tanksoil+2)
lsel,r,loc,x,ctx(ct_kps-3),ctx(bm_kp+1)
lsel,u,loc,x,ctx(ct_kps-3)
lsel,u,loc,x,ctx(bm_kp+1)
lesize,all,,,6
        ! Control meshing under tank

lsla
lsel,r,loc,z,soilz(tanksoil+3)
lsel,r,loc,x,ctx(ct_kps-4),ctx(bm_kp+1)
lsel,u,loc,x,ctx(ct_kps-4)
lsel,u,loc,x,ctx(bm_kp+1)
lesize,all,,,4
        ! Control meshing under tank

lsla
lsel,r,loc,z,soilz(tanksoil+4)
lsel,r,loc,x,ctx(ct_kps-5),ctx(bm_kp+1)
lsel,u,loc,x,ctx(ct_kps-5)
lsel,u,loc,x,ctx(bm_kp+1)
lesize,all,,,2
        ! Control meshing under tank

*do,i,0,2
lsla
lsel,r,loc,z,soilz(tanksoil+i)
lsel,r,loc,x,ctx(bm_kp+1),soilx(tanksoil)
lsel,u,loc,x,ctx(bm_kp+1)
lsel,u,loc,x,soilx(tanksoil)
lesize,all,,,4-i
                ! Control meshing under
tank
*enddo
```

```
cmsel,s,deep-soil-volu
aslv
lsla
lsel,r,loc,x,ctx(bm_kp+1)
lsel,r,loc,z,soilz(tanksoil),soilz(tankso
il+1)
lsel,u,loc,z,soilz(tanksoil)
lsel,u,loc,z,soilz(tanksoil+1)
ldiv,all,2
        ! Control meshing under tank

cmsel,s,deep-soil-volu
aslv
lsla
lsel,r,loc,z,soilz(tanksoil)
lsel,r,loc,x,ctx(ct_kps-2),ctx(bm_kp+1)
lesize,all,,arcsize
                ! Control meshing for
slices

*do,i,0,4
vsel,s,loc,z,soilz(tanksoil+i),soilz(tank
soil+1+i)
vsel,r,loc,x,ctx(ct_kps-1-
i),soilx(tanksoil)
aslv
asel,r,loc,y,0
type,1
amesh,all
        ! Mesh area for sweep pattern
vsweep,all
        ! Mesh volumes
aclear,all
        ! Clear pattern
*enddo

esel,s,type,,9
nsle
nummrg,node                    ! Merge
bottom soil to rest of model

esel,s,type,,9
nsle
nsel,s,loc,x,soilx(1)
nsel,r,loc,z,soilz(1)
cm,far-soil-face-node,node
*do,i,2,9
esel,s,type,,9
nsle
nsel,r,loc,x,soilx(i)
nsel,r,loc,z,soilz(i)
cmsel,a,far-soil-face-node
cm,far-soil-face-node,node
*enddo

esel,s,type,,9
nsle
nsel,r,loc,z,soilz(9)
nsel,r,loc,x,41,68
cm,far-soil-bot-node,node

!nsel,s,loc,x,68,320
!nummrg,node

!esel,s,type,,8,9
!nsle
!nsel,r,loc,z,soilz(9)
!nsel,r,loc,x,41,67
!cpint,uz

type,10
real,1001

csys,0
nsel,s,loc,z,soilz(deepsoil)
csys,1
nsel,r,loc,x,320
csys,0
nsel,r,loc,x,0
*get,master_node,node,,num,max
d,master_node,all
allsel

e,master_node                    ! Large
mass for excitation

csys,1
nsel,s,loc,z,soilz(9),soilz(10)
nsel,r,loc,x,0,soilx(9)
esln,,1
esel,r,type,,9
cm,bottom-soil,elem
```

Fix-Soil.txt

```
!esel,s,type,,8,9
!nsle
!nsel,r,loc,z,soilz(9)
!nsel,r,loc,x,ctx(21)+1,68
!nummrg,node

et,90,targe170
et,91,conta173
keyopt,91,9,1
mp,mu,90,0.3
mp,mu,91,0.7
mp,mu,92,0.7
r,90,,,0.1
r,91,,,0.1

esel,s,type,,9
cmsel,s,far-soil-face-node
esln,r
type,90
real,90
mat,90
esurf
esel,s,type,,8
cmsel,s,near-soil-face-node
esln,r
type,91
esurf

esel,s,type,,9
cmsel,s,far-soil-bot-node
esln,r
type,90
real,91
mat,91
esurf
esel,s,type,,8
cmsel,s,near-soil-bot-node
esln,r
type,91
esurf

esel,s,type,,91
```

```
cm,far-soil-contact,elem
```

Force-c.txt

```
/post26
numvar,200

*do,z,2,199
VARDEL,z
*enddo

*do,i,1,20
*do,j,1,30
esol,(10+j),(36+i+20*j),,smisc,1,s1%(36+i
+20*j)%
esol,(40+j),(36+i+20*j),,smisc,2,s2%(36+i
+20*j)%
esol,(70+j),(36+i+20*j),,smisc,3,s3%(36+i
+20*j)%
esol,(100+j),(36+i+20*j),,smisc,4,s4%(36+
i+20*j)%
esol,(130+j),(36+i+20*j),,smisc,5,s5%(36+
i+20*j)%
esol,(160+j),(36+i+20*j),,smisc,6,s6%(36+
i+20*j)%
*enddo

LINES,2150
extrem
/OUT,Force-c_%(9*i)%max,OUT
extrem,11,198
/OUT

/OUT,Force-c_%(9*i)%th,OUT
*do,k,1,30
PRVAR,10+I,40+I,70+I,100+I,130+I,160+I
*enddo
/OUT

*enddo

*do,z,2,199
VARDEL,z
*enddo

*do,i,1,20
*do,j,1,30
esol,(10+j),(36+i+20*j),,smisc,7,s1%(36+i
+20*j)%
esol,(40+j),(36+i+20*j),,smisc,8,s2%(36+i
+20*j)%
*enddo

LINES,2150
extrem
/OUT,Force-c_%(9*i)%amax,OUT
extrem,5,80
/OUT

/OUT,Force-c_%(9*i)%ath,OUT
*do,k,1,30
PRVAR,10+I,40+I,70+I
*enddo
/OUT

*enddo
```

Force-j_bolt.txt

```
/post26
LINES,2150

*do,z,2,199
VARDEL,z
*enddo

! select j-bolts based on radius
nj_bolt=11


csys,1
*do,i,2,nj_bolt
     ! radius selection
*do,j,1,21                        !
angle selection

angley=-j*arcsize+arcsize

cmsel,s,j_bolts
nsle
nsel,r,loc,x,ctx(i),ptx(i)
nsel,r,loc,y,angley               !
select lines 1-21 (line 1&21 on symetry
plane)

esln,s,1
*get,emax,elem,,num,max
esol,(10+j),emax,,smisc,7,fx%(emax)%
esol,(40+j),emax,,smisc,8,fy%(emax)%
esol,(70+j),emax,,smisc,9,fz%(emax)%
*enddo

LINES,2150
extrem
/OUT,Force-jb_r%i%_max,OUT
extrem,11,180
/OUT


/OUT,Force-jb_r%i%-th,OUT
*do,k,1,21
PRVAR,10+k,40+k,70+k
*enddo
/OUT

*enddo
```

Insulate.txt

```
et,2,solid45   ! SOLID45 elements for
insulating concrete

mp,ex,50,23760
mp,dens,50,0.05/g
mp,prxy,50,0.15
mp,damp,50,0.07/DF

/COM - Key Points for Insulating Concrete
*do,i,0,tw,1
k,kmaxpt+1+i,ptx(pt_kps-i),0,ptz(pt_kps-
i)      ! Match Keypoint to Primary Tank
k,kmaxpt+2+tw+i,ctx(ct_kps-
i),0,ctz(ct_kps-i)     ! Match Keypoint
to Concrete Tank
*enddo
```

```
/COM - Areas for Insulating Concrete
*do,i,1,tw,1
a,kmaxpt+i,kmaxpt+tw+1+i,kmaxpt+tw+2+i,km
axpt+1+i
*enddo

/COM - Assign Material Properties
*do,i,1,tw,1
asel,s,area,,amaxpt+i
aatt,50,i,2
*enddo

asel,s,area,,amaxpt+1,amaxpt+tw
vrotat,all,,,,,,1,ct_kps,180,2

type,2
/COM - Elements in insulating concrete
*do,i,2,tw,1
vsel,s,volu,,i
vsel,a,volu,,tw+i
aslv
lsla
lsel,r,loc,x,ctx(ct_kps-i),ctx(ct_kps-i-
1)
lesize,all,,arcsize
vmesh,all
*enddo

/COM - Mesh center volume to match
primary tank
vsel,s,volu,,1,tw+1,tw
aslv
asel,r,loc,z,ptz(pt_kps)
cm,a2,area
cmsel,a,a1
mshcopy,2,a1,a2
type,2
vsweep,all,,all

allsel
esel,s,type,,2
mpchg,50,all
cm,insul-conc,elem
cmsel,a,primary-tank
nsle
nsel,r,loc,z,ptz(pt_kps)
cm,primary-int,node
allsel
cmsel,s,conc-tank
esel,a,type,,2
nsle
nsel,r,loc,z,ctz(ct_kps)
nsel,r,loc,x,ctx(ct_kps-tw),ctx(ct_kps)

cm,insul-vol,volu
cm,insul-int,node

cmsel,s,a2
aclear,all
allsel
*get,KMAXic,KP,0,num,max        ! Get
maximum Keypoint Number
*get,LMAXic,LINE,0,num,max      ! Get
maximum Line Number
*get,AMAXic,AREA,0,num,max      ! Get
maximum Area Number
*get,VMAXic,VOLU,0,num,max      ! Get
maximum Volume Number
cmsel,s,insul-conc
nsle
nsel,r,loc,z,ptz(pt_kps)
nsel,r,loc,x,ptx(pt_kps-tw)
csys,1
!nrotat,all
allsel
```

interface-gap1.txt

```
/COM, Create components for wall and dome
of concrete tank and excavated soil for
interface coupling
csys,1
cmsel,s,conc-dome_wall-n
nsel,r,loc,x,ctx(12),ctx(14)+.1
esln,s,1
cmsel,u,liner
cm,conc-wall-e,elem
cm,conc-wall-n,node

cmsel,s,conc-dome_wall-e
cmsel,s,conc-dome_wall-n
cmsel,u,conc-wall-e
nsle,s,1
nsel,u,loc,z,ctz(13),ctz(14)
esln,r,1
cm,conc-dome-e,elem
cm,conc-dome-n,node

cmsel,s,excav-soil
nsle,s,1
nsel,r,loc,x,ctx(12),ctx(14)
nsel,r,loc,z,ctz(12),ctz(22)
esln,s
cm,excav-wall-e,elem
cm,excav-wall-n,node

cmsel,s,excav-soil
nsle,s,1
CM,EXCAV-SOIL-N,NODE
!nsel,r,loc,x,0,ctx(14)
!nsel,u,loc,z,0,soilz(3)
!nsel,u,loc,z,ctz(14),ctz(22)
!cm,ntemp,node
!nsel,r,loc,z,-11,-13.4
!nsel,u,loc,x,0,28
!cm,ntemp1,node
!cmsel,s,ntemp
!cmsel,u,ntemp1
CMSEL,S,EXCAV-SOIL-N
NSEL,R,LOC,X,CTX(1),CTX(2)
NSEL,R,LOC,Z,CTZ(1),CTZ(2)
cm,excav-dome-n,node
*DO,I,3,12
CMSEL,S,EXCAV-SOIL-N
NSEL,R,LOC,X,CTX(I)
NSEL,R,LOC,Z,CTZ(I)
CMSEL,A,EXCAV-DOME-N
cm,excav-dome-n,node
*ENDDO
esln,
cm,excav-dome-e,elem
```

```
/COM, Create wall soil to concrete tank
interface elements
cmsel,s,conc-wall-n
cmsel,a,excav-wall-n
cm,conc-excav-wall-int,node

cmsel,s,conc-dome-n
cmsel,a,excav-dome-n
cm,conc-excav-dome-int,node

/COM, Define contact properteis
et,61,conta173                ! Contact
Surface - Concrete Tank
keyopt,61,5,3                 ! Type of
constriant - Shell/Solid contact normal
direction
et,60,targe170        ! Contact Element
- Excavated Soil
!keyopt,60,8,2                !
Asymmetric contact selection (all contact
elements on one surface and all target
elements on the other surface)
keyopt,61,12,4                        !
Behavior of contact surface (no
seperation, sliding permitted)
!keyopt,61,2,3

et,63,conta173
keyopt,63,5,3
et,62,targe170
!keyopt,62,8,2
!keyopt,63,12,4
!keyopt,63,2,3

mp,mu,60,0.2                  !
Coefficient of Friction between excavated
soil and concrete tank wall
MP,damp,60,0.07/DF
r,60,,,0.05

mp,mu,62,0.2                  !
Coefficient of Friction between excavated
soil and concrete tank dome
MP,damp,62,0.07/DF
r,62,,,0.05

r,61,,,0.05
r,63,,,0.025
mp,mu,64,0.6                  !
Coefficient of Friction between excavated
soil and concrete tank dome
MP,damp,64,0.07/DF


! add wall interface elements
! concrete tank surface target
cmsel,s,conc-wall-e
nsle,s,1
type,60
real,60
mat,60
esurf
esel,s,type,,60
nsle
nsel,r,loc,z,ctz(12),ctz(14)
esln,r,1
emodif,all,real,61
esel,s,type,,61
cmsel,u,conc-wall-e
cm,conc-target,elem

type,61
cmsel,s,excav-wall-e
cmsel,a,excav-wall-n
esurf
esel,s,type,,61
nsle
nsel,r,loc,z,ctz(12),ctz(14)
esln,r,1
emodif,all,real,61
esel,s,type,,61
cmsel,u,excav-wall-e
cmsel,u,excav-wall-n
cm,excav-contact,elem

cmsel,s,conc-target
cmsel,a,excav-contact
cm,conc-excav-wall-gap,elem

! add dome interface elements
! concrete tank surface target
cmsel,s,conc-dome-e
nsle,s,1
type,62
real,62
mat,62
esurf
esel,s,type,,62
nsle
nsel,r,loc,z,ctz(12),ctz(14)
esln,r,1
emodif,all,real,62
esel,s,type,,62
cmsel,u,conc-dome-e
cm,conc-dome-target,elem

type,63
cmsel,s,excav-dome-e
esel,u,type,,1
cmsel,s,excav-dome-n
esurf
cmsel,u,excav-dome-e
cm,excav-dome-contact,elem

cmsel,s,conc-dome-target
cmsel,a,excav-dome-contact
cm,conc-excav-dome-gap,elem
allsel

/COM, Create concrete slab to soil
interface elments
! spring constants
! slab
r,307,1e8
r,308,1e8
r,309,1e8
esel,none

esel,s,type,,9
nsle
nsel,r,loc,z,ctz(23)
nsel,r,loc,x,0,ctx(23)
cm,soil-slab,node
allsel
esel,none
cmsel,s,conc-slab
cmsel,a,soil-slab
type,21
real,307
eintf
```

```
type,22
real,308
eintf

type,23
real,309
eintf
cm,conc-soil-slab-spr,elem
esel,none
allsel

/COM - Create contact on top of footing
slab

cmsel,s,conc-tank
nsle
nsel,r,loc,x,ctx(23)
esln,r
nsle
type,60
real,63
mat,64
esurf,top

cmsel,s,excav-soil
nsle
nsel,r,loc,z,soilz(9)
nsel,r,loc,x,ctx(22),ctx(23)
esln,r
type,61
esurf
esel,s,real,,63
esel,r,type,,61
cm,soil-contact-foot-elem,elem
```

interface1.txt

```
et,21,combin14,,1
et,22,combin14,,2
et,23,combin14,,3

r,201,1e8
r,202,1e8
r,203,1e8

et,24,conta178
keyopt,24,2,1

R,204,,,,,,,
RMORE,,1,,,,,

mp,mu,64,0.20                    !
Coefficient of Friction between concrete
tank wall and concrete tank slab
mp,damp,64,0.07/DF

/COM, Define contact properteis
et,65,targe170                   ! Target
Surface
keyopt,65,5,3                    ! Type of
constriant - Shell/Solid contact normal
direction
et,66,conta173                   ! Contact
Element
keyopt,66,9,1

r,65,,,0.02
et,67,targe170                   ! Target
Surface - Concrete Tank
keyopt,67,5,3                    ! Type of
constriant - Shell/Solid contact normal
direction
et,68,conta173                   ! Contact
Element - Secondary Line
keyopt,68,9,1
r,67,,,0.01

mp,mu,65,0.40                    !
Coefficient of Friction between primary
tank and insulating concrete (PNNL
values)
MP,damp,65,0.3/DF

mp,mu,67,0.40                    !
Coefficient of Friction between secondary
liner and concrete tank basemat (PNNL
values)
MP,damp,67,0.3/DF

esel,none
/COM - Create Interface Elements at
Bottom of Concrete Wall
cmsel,s,wall-int
type,24
real,204
mat,64
eintf,,,high
cm,wall-int-gap,elem

esel,none
/COM - Create Interface Elements between
primary tank and insulating concrete
cmsel,s,primary-tank
csys,1
nsle
nsel,r,loc,z,ptz(40)
!nsel,r,loc,x,ptx(41),ptx(39)
cm,primary-int-n,node
esln,r,1
cm,primary-int-e,elem

cmsel,s,insul-conc
nsle
nsel,r,loc,z,ptz(40)
!nsel,r,loc,x,ptx(31),ptx(39)
cm,insul-int-n,node

cmsel,s,primary-int-e
cmsel,s,primary-int-n
type,66
real,65
mat,65
esurf,,bottom
cmsel,u,primary-int-e
cm,pri-target,elem

cmsel,s,insul-conc
cmsel,s,insul-int-n
type,65
real,65
esurf
cmsel,u,insul-conc
cm,insul-contact,elem

cmsel,s,pri-target
cmsel,a,insul-contact
```

```
cm,primary-int-gap,elem
esel,none

!nsel,s,loc,z,ptz(34)
!nsel,r,loc,x,ptx(39)-.1,ptx(40)
!cpint,uz

/COM - Create Interface Elements between
concrete tank and insulating concrete
cmsel,s,conc-tank
cmsel,a,liner
cmsel,a,insul-int
esln,r,1
cm,etemp,elem

cmsel,s,etemp
esel,u,real,,51
cm,conc-temp,elem

cmsel,s,etemp
esel,r,real,,51
cm,liner-temp,elem

cmsel,s,conc-temp
nsle
type,67
real,67
mat,67
esurf,,top
cmsel,u,conc-temp
cm,conc-target,elem

cmsel,s,liner-temp
nsle
type,68
real,67
esurf,,bottom
cmsel,u,liner-temp
cm,liner-contact,elem

cmsel,s,conc-target
cmsel,a,liner-contact
cm,conc-liner-gap,elem
```

Liner.txt

```
ksel,u,kp,,all                 ! Clear
active Keypoints
asel,u,area,,all               ! Clear
active Areas
vsel,u,volu,,all               ! Clear
active Volumes
ksel,s,kp,,1,ct_kps,ct_kps-1  ! Activate
Keypoints for axis of rotation
esel,u,elem,,all
lsel,u,line,,all

et,21,combin14,,1
et,22,combin14,,2
et,23,combin14,,3

r,201,1e8
r,202,1e8
r,203,1e8


r,51,0.375/12
r,52,0.5/12
r,53,0.5625/12

cmsel,s,insul-vol
aslv
asel,r,loc,z,ctz(ct_kps)
cm,liner-a,area
aatt,101,51,1
asel,r,loc,x,ptx(pt_kps-tw),ptx(pt_kps-
tw+1)
aatt,101,52,1
cmsel,s,liner-a

asel,none
k,kmaxic+1,ctx(bm_kp+3),0,ctz(bm_kp+3)
k,kmaxic+2,ctx(bm_kp)-1,0,ctz(bm_kp)
k,kmaxic+3,ctx(bm_kp)-
0.2929,0,ctz(bm_kp)+0.2929
k,kmaxic+4,ctx(bm_kp),0,ctz(bm_kp)+1
k,kmaxic+5,ctx(bm_kp-1),0,ctz(bm_kp-1)
k,kmaxic+6,ctx(bm_kp-2),0,ctz(bm_kp-2)

l,kmaxic+1,kmaxic+2
l,kmaxic+2,kmaxic+3
l,kmaxic+3,kmaxic+4
l,kmaxic+4,kmaxic+5
l,kmaxic+5,kmaxic+6

arotat,all,,,,,,1,ct_kps,180,2
aatt,101,52,1
cm,liner-lines,line
cmsel,a,liner-a
cm,liner-a,area
asel,r,loc,x,ctx(bm_kp)-2,ctx(bm_kp)
asel,r,loc,z,ctz(bm_kp-1),ctz(bm_kp)
aatt,101,53,1
cmsel,s,liner-a


lsel,r,loc,x,ctx(bm_kp)
lesize,all,,arcsize
cmsel,s,liner-lines
lsel,r,loc,x,ctx(bm_kp+3)
lesize,all,,arcsize
cmsel,s,liner-lines
lsel,r,loc,x,ctx(bm_kp)-1
lesize,all,,arcsize
cmsel,s,liner-lines
lsel,r,loc,x,ctx(bm_kp)-0.2929
lesize,all,,arcsize


amesh,all
nsle
nummrg,node

cm,liner,elem
nsle
nsel,r,loc,x,ctx(bm_kp+3),ctx(bm_kp)-1
cpint,uz,3.5
cmsel,s,liner
nsle
nsel,r,loc,z,ctz(bm_kp-1),ctz(bm_kp)+1
cpintf,ux,3
cpintf,uy,3

allsel
nsel,s,loc,x,ctx(bm_kp)
nsel,r,loc,z,ctz(bm_kp-2),ctz(bm_kp-1)
cm,liner-wall,node
```

```
esel,none

/COM - Merge liner and concrete wall
nummrg,node


allsel
*get,KMAX1,KP,0,num,max        ! Get
maximum Keypoint Number
*get,LMAX1,LINE,0,num,max      ! Get
maximum Line Number
*get,AMAX1,AREA,0,num,max      ! Get
maximum Area Number
*get,VMAX1,VOLU,0,num,max      ! Get
maximum Volume Number
```

live_load.txt

```
! select nodes to apply concentrated live
load over - 10 ft radius
allsel
nsel,s,loc,z,0
nsel,r,loc,x,0,11
cm,n-live,node
*get,nodes,node,,count         ! count the
number of nodes selected
*get,nstart,node,,num,min      ! get min
node number

live_load=200000      ! live load 100 tons
(lbs)
live_mass=live_load/(2*g*1000*nodes)  !
convert live load to slugs/node selected

R,1002,live_mass,live_mass,live_mass
type,10
real,1002

cmsel,s,n-live
cm,nlive,node                  ! temporary
counter for nodes

*do,i,1,nodes
cmsel,s,nlive
*get,cnode,node,,num,min
e,cnode
nsel,u,node,,cnode
cm,nlive,node
*enddo

esel,s,real,,1002
cm,live-load,elem
allsel
```

outer-spar.txt

```
! deinfe element type, material and real
constants
et,30,link8            ! rigid link to be
place between couping and boundry
conditions

mp,ex,300,10e9         ! high modulus to
create a rigid link
mp,dens,300,0          ! massless rigid
link
r,300,1                ! cross-sectional
area of rigid link

! select elements and define rigid links
nsle
nsel,s,loc,x,soil_radius
nsel,u,loc,y,-10,-170
cm,ntemp,node

type,30
mat,300
real,300

*do,i,1,20
cmsel,s,ntemp
nsel,r,loc,z,soilz(i)
eintf,51
*enddo

allsel
```

Post-Tank.txt

```
/input,spectra-all,txt
/input,contact-ap,txt
/input,force-c,txt
/input,stress-Primary,txt
/input,Force-J_bolt,txt
```

Primary-Props-AP.txt

```
/COM - Material Definitions
/COM - Material 101, Tank Steel
mp,ex,101,4176200
mp,nuxy,101,0.30
mp,dens,101,490/(1000*g)
mp,damp,101,0.001

/COM - Material 102, Tank Steel
mp,ex,102,4176200
mp,nuxy,102,0.30
mp,dens,102,490/(1000*g)
mp,damp,102,0.001

/COM - Material 103, Tank Steel
mp,ex,103,4176200
mp,nuxy,103,0.30
mp,dens,103,490/(1000*g)
mp,damp,103,0.001

/COM - Material 104, Tank Steel
mp,ex,104,4176200
mp,nuxy,104,0.30
mp,dens,104,490/(1000*g)
mp,damp,104,0.001

/COM - Material  105, Tank Steel
mp,ex,105,4176200
mp,nuxy,105,0.30
mp,dens,105,490/(1000*g)
mp,damp,105,0.001

/COM - Material 106, Tank Steel
mp,ex,106,4176200
mp,nuxy,106,0.30
```

```
mp,dens,106,490/(1000*g)
mp,damp,106,0.001

/COM - Material 107, Tank Steel
mp,ex,107,4176200
mp,nuxy,107,0.30
mp,dens,107,490/(1000*g)
mp,damp,107,0.001

/COM - Material 108, Tank Steel
mp,ex,108,4176200
mp,nuxy,108,0.30
mp,dens,108,490/(1000*g)
mp,damp,108,0.001

/COM - Material 109, Tank Steel
mp,ex,109,4176200
mp,nuxy,109,0.30
mp,dens,109,490/(1000*g)
mp,damp,109,0.001

/COM - Material,110, Tank Steel
mp,ex,110,4176200
mp,nuxy,110,0.30
mp,dens,110,490/(1000*g)
mp,damp,110,0.001

/COM - Material,111, Tank Steel
mp,ex,111,4176200
mp,nuxy,111,0.30
mp,dens,111,490/(1000*g)
mp,damp,111,0.001

/COM - Material,112, Tank Steel
mp,ex,112,4176200
mp,nuxy,112,0.30
mp,dens,112,490/(1000*g)
mp,damp,112,0.001

/COM - Material,113, Tank Steel
mp,ex,113,4176200
mp,nuxy,113,0.30
mp,dens,113,490/(1000*g)
mp,damp,113,0.001

/COM - Material,114, Tank Steel
mp,ex,114,4176200
mp,nuxy,114,0.30
mp,dens,114,490/(1000*g)
mp,damp,114,0.001

/COM - Material,115, Tank Steel
mp,ex,115,4176200
mp,nuxy,115,0.30
mp,dens,115,490/(1000*g)
mp,damp,115,0.001

/COM - Material,116, Tank Steel
mp,ex,116,4176200
mp,nuxy,116,0.30
mp,dens,116,490/(1000*g)
mp,damp,116,0.001

/COM - Material,117, Tank Steel
mp,ex,117,4176200
mp,nuxy,117,0.30
mp,dens,117,490/(1000*g)
mp,damp,117,0.001

/COM - Material,118, Tank Steel
mp,ex,118,4176200
mp,nuxy,118,0.30
mp,dens,118,490/(1000*g)
mp,damp,118,0.001

/COM - Material,119, Tank Steel
mp,ex,119,4176200
mp,nuxy,119,0.30
mp,dens,119,490/(1000*g)
mp,damp,119,0.001

/COM - Material,120, Tank Steel
mp,ex,120,4176200
mp,nuxy,120,0.30
mp,dens,120,490/(1000*g)
mp,damp,120,0.001

/COM - Material,121, Tank Steel
mp,ex,121,4176200
mp,nuxy,121,0.30
mp,dens,121,490/(1000*g)
mp,damp,121,0.001

/COM - Material,122, Tank Steel
mp,ex,122,4176200
mp,nuxy,122,0.30
mp,dens,122,490/(1000*g)
mp,damp,122,0.03/df

/COM - Material,123, Tank Steel
mp,ex,123,4176200
mp,nuxy,123,0.30
mp,dens,123,490/(1000*g)
mp,damp,123,0.001

/COM - Material,124, Tank Steel
mp,ex,124,4176200
mp,nuxy,124,0.30
mp,dens,124,490/(1000*g)
mp,damp,124,0.001

/COM - Material,125, Tank Steel
mp,ex,125,4176200
mp,nuxy,125,0.30
mp,dens,125,490/(1000*g)
mp,damp,125,0.001

/COM - Material,126, Tank Steel
mp,ex,126,4176200
mp,nuxy,126,0.30
mp,dens,126,490/(1000*g)
mp,damp,126,0.001

/COM - Material,127, Tank Steel
mp,ex,127,4176200
mp,nuxy,127,0.30
mp,dens,127,490/(1000*g)
mp,damp,127,0.001

/COM - Material,128, Tank Steel
mp,ex,128,4176200
mp,nuxy,128,0.30
mp,dens,128,490/(1000*g)
mp,damp,128,0.001

/COM - Material,129, Tank Steel
mp,ex,129,4176200
mp,nuxy,129,0.30
mp,dens,129,490/(1000*g)
mp,damp,129,0.001
```

```
/COM - Material,130, Tank Steel
mp,ex,130,4176200
mp,nuxy,130,0.30
mp,dens,130,490/(1000*g)
mp,damp,130,0.001

/COM - Material,131, Tank Steel
mp,ex,131,4176200
mp,nuxy,131,0.30
mp,dens,131,490/(1000*g)
mp,damp,131,0.001

/COM - Material,132, Tank Steel
mp,ex,132,4176200
mp,nuxy,132,0.30
mp,dens,132,490/(1000*g)
mp,damp,132,0.001

/COM - Material,133, Tank Steel
mp,ex,133,4176200
mp,nuxy,133,0.30
mp,dens,133,490/(1000*g)
mp,damp,133,0.001

/COM - Material,134, Tank Steel
mp,ex,134,4176200
mp,nuxy,134,0.30
mp,dens,134,490/(1000*g)
mp,damp,134,0.001

/COM - Material,135, Tank Steel
mp,ex,135,4176200
mp,nuxy,135,0.30
mp,dens,135,490/(1000*g)
mp,damp,135,0.001

/COM - Material,136, Tank Steel
mp,ex,136,4176200
mp,nuxy,136,0.30
mp,dens,136,490/(1000*g)
mp,damp,136,0.001

/COM - Material,137, Tank Steel
mp,ex,137,4176200
mp,nuxy,137,0.30
mp,dens,137,490/(1000*g)
mp,damp,137,0.001

/COM - Material,138, Tank Steel
mp,ex,138,4176200
mp,nuxy,138,0.30
mp,dens,138,490/(1000*g)
mp,damp,138,0.001

/COM - Material,139, Tank Steel
mp,ex,139,4176200
mp,nuxy,139,0.30
mp,dens,139,490/(1000*g)
mp,damp,139,0.001

/COM - Material,140, Tank Steel
mp,ex,140,4176200
mp,nuxy,140,0.30
mp,dens,140,490/(1000*g)
mp,damp,140,0.001

/COM - Material,141, Tank Steel
mp,ex,141,4176200
mp,nuxy,141,0.30
mp,dens,141,490/(1000*g)
mp,damp,141,0.001

/COM - Material,142, Tank Steel
mp,ex,142,4176200
mp,nuxy,142,0.30
mp,dens,142,490/(1000*g)
mp,damp,142,0.001

/COM - Material,143, Tank Steel
mp,ex,143,4176200
mp,nuxy,143,0.30
mp,dens,143,490/(1000*g)
mp,damp,143,0.001

r,101,(0.5-0.06)/12
r,102,(0.5-0.06)/12
r,103,(0.375-0.06)/12
r,104,(0.375-0.06)/12
r,105,(0.375-0.06)/12
r,106,(0.375-0.06)/12
r,107,(0.375-0.06)/12
r,108,(0.375-0.06)/12
r,109,(0.375-0.06)/12
r,110,(0.375-0.06)/12
r,111,(0.5-0.06)/12
r,112,(0.5-0.06)/12
r,113,(0.5-0.06)/12
r,114,(0.5-0.06)/12
r,115,(0.5-0.06)/12
r,116,(0.5-0.06)/12
r,117,(0.5-0.06)/12
r,118,(0.5-0.06)/12
r,119,(0.5-0.06)/12
r,120,(0.5-0.06)/12
r,121,(0.5-0.06)/12
r,122,(0.5-0.06)/12
r,123,(0.5625-0.06)/12
r,124,(0.5625-0.06)/12
r,125,(0.5625-0.06)/12
r,126,(0.5625-0.06)/12
r,127,(0.75-0.06)/12
r,128,(0.75-0.06)/12
r,129,(0.75-0.06)/12
r,130,(0.75-0.06)/12
r,131,(0.75-0.06)/12
r,132,(0.875-0.06)/12
r,133,(0.9375-0.06)/12
r,134,(0.9375-0.06)/12
r,135,(0.875-0.06)/12
r,136,(0.875-0.06)/12
r,137,(0.5-0.06)/12
r,138,(0.5-0.06)/12
r,139,(0.5-0.06)/12
r,140,(0.5-0.06)/12
r,141,(0.5-0.06)/12
r,142,(0.5-0.06)/12
r,143,(1-0.06)/12
```

Primary.txt

```
/COM - Create KeyPoints for primarytank
*do,i,1,pt_kps,1
k,kmaxct+i,ptx(i),0,ptz(i)
*enddo

/COM - Create lines for primary tank
*do,i,1,pt_kps-1,1
l,kmaxct+i,kmaxct+i+1
```

```
*enddo

/COM - Create Areas for primary tank
lsel,s,line,,LMAXct+1,LMAXct+pt_kps-1
arotat,all,,,,,,1,ct_kps,180,2

/COM - Assign Material and Real
Properties to primary tank areas
csys,1
*do,i,1,pt_kps-1,1
asel,s,area,,AMAXct+i
asel,a,area,,AMAXct+pt_kps-1+i
aatt,100+i,100+i,1
*enddo
allsel

/COM - Elements at tank Top center
asel,s,loc,x,ptx(1),ptx(2)
asel,r,loc,z,ptz(1),ptz(2)
lsla
lsel,r,loc,x,ptx(2)
lesize,all,,arcsize
lsla
lsel,u,loc,x,ptx(2)
lesize,all,,,midsize
amesh,all

/COM - Elements in primary tank
*do,i,2,pt_kps-2,1
asel,s,area,,AMAXct+i
asel,a,area,,AMAXct+pt_kps-1+i
lsla
lsel,s,loc,x,ptx(i),ptx(i+1)
lsel,r,loc,z,ptz(i),ptz(i+1)
lesize,all,,arcsize
amesh,all
*enddo

/COM - Elements at tank floor center
asel,s,loc,x,ptx(pt_kps-1),ptx(pt_kps)
asel,r,loc,z,ptz(pt_kps)
cm,a1,area
lsla
lsel,r,loc,x,ptx(pt_kps-1)
lesize,all,,arcsize
lsla
lsel,u,loc,x,ptx(pt_kps-1)
lesize,all,,,midsize
amesh,all
asel,r,loc,y,0,-90
cm,a1a,area                    ! Component
for mesh mapping
cmsel,s,a1
cmsel,u,a1a
cm,a1b,area                    ! Compoment
for mesh mapping
allsel
cmsel,u,conc-tank
*get,emax,elem,,num,maxd
enorm,emax
cm,primary-tank,elem

allsel
*get,KMAXpt,KP,0,num,max       ! Get
maximum Keypoint number
*get,LMAXpt,LINE,0,num,max     ! Get
maximum Line Number
*get,AMAXpt,AREA,0,num,max     ! Get
maximum Area Number
```

RS_FREQ.txt

```
data,2,1,152,1,frequency
(f7.3)
0.100
0.105
0.111
0.118
0.125
0.128
0.132
0.135
0.139
0.143
0.147
0.152
0.156
0.161
0.167
0.172
0.179
0.185
0.192
0.196
0.200
0.204
0.208
0.213
0.217
0.222
0.227
0.233
0.238
0.244
0.250
0.256
0.263
0.270
0.278
0.286
0.294
0.303
0.313
0.323
0.333
0.345
0.357
0.370
0.385
0.400
0.417
0.426
0.435
0.444
0.455
0.465
0.476
0.488
0.500
0.513
0.526
0.541
0.556
0.571
0.588
0.606
0.625
0.645
```

```
0.667
0.690
0.714
0.741
0.769
0.800
0.833
0.870
0.909
0.952
1.000
1.020
1.042
1.064
1.087
1.111
1.136
1.163
1.190
1.220
1.250
1.282
1.316
1.351
1.389
1.429
1.471
1.515
1.563
1.613
1.667
1.724
1.754
1.786
1.818
1.852
1.887
1.923
1.961
2.000
2.041
2.083
2.128
2.174
2.222
2.273
2.326
2.381
2.439
2.500
2.564
2.632
2.703
2.778
2.857
2.941
3.030
3.125
3.226
3.333
3.448
3.571
3.704
3.846
4.000
4.167
4.348
4.545
4.762
5.000
5.263
5.556
5.882
6.250
6.667
7.143
7.692
8.333
9.091
10.000
11.111
12.500
14.286
16.667
20.000
25.000
33.333
100.000
```

Slave.txt

```
/COM - Develop Slave Boundarz Conditions
/COM - 20 Layer Model

csys,1                          ! Set
Cylindrical Coordinates
*get,CPMAX,CP,0,num,max              !
Counter for Couple Set Numbers
nsel,s,loc,x,soil_radius        ! Select
soil exterior surface nodes
csys,0                          ! Set
Cartesian Coordinates
nrotat,all                      ! Rotate
into Global Cartesian Coordinates
nsel,s,loc,z,soilz(deepsoil)    ! Select
all Base nodes
nrotat,all                      ! Rotate
into Global Cartesian Coordinates

csys,1                          ! Set
Cylindrical Coordinates
*do,i,1,deepsoil-1,1            ! Cycle
through each soil layer
nsel,s,loc,x,soil_radius        ! Select
all exterior nodes
nsel,r,loc,z,soilz(i)           ! Select
nodes by layer
cp,3*i-2+cpmax,ux,all           ! Couple in
X
cp,3*i+cpmax,uz,all             ! Couple in
Z
nsel,u,loc,y,0                  ! Unselect
nodes on Symmetry Plane
nsel,u,loc,y,180
cp,3*i-1+cpmax,uy,all           ! Couple in
Y
*enddo

nsel,s,loc,z,soilz(deepsoil)    ! Select
base nodes
nsel,u,loc,z,320-.1,320+.1
cp,deepsoil*10+1+cpmax,ux,all ! Couple in
X
cp,deepsoil*10+2+cpmax,uy,all ! Couple in
Y
cp,deepsoil*10+3+cpmax,uz,all ! Couple in
Z

allsel
```

spectra-all.txt

```
/input,spectra-conc,txt
/input,spectra-conc-0,txt
/input,spectra-conc-45,txt
/input,spectra-conc-90,txt
/input,spectra-conc-135,txt
/input,spectra-conc-180,txt
/input,spectra-primary-0,txt
/input,spectra-primary-45,txt
/input,spectra-primary-90,txt
/input,spectra-primary-135,txt
/input,spectra-primary-180,txt
/input,spectra-soil,txt
```

spectra-conc-0.txt

```
fini

/POST26
numvar,200
*do,z,2,200
VARDEL,z
*enddo

cmsel,s,conc-tank
nsle
csys,1
nsel,r,loc,x,ctx(11)
nsel,r,loc,y,0
nsel,r,loc,z,ctz(11)
*get,ct_0_H,node,,num,max

cmsel,s,conc-tank
nsle
nsel,r,loc,x,ctx(14)
nsel,r,loc,y,0
nsel,r,loc,z,ctz(14)
*get,ct_0_382,node,,num,max

cmsel,s,conc-tank
nsle
nsel,r,loc,x,ctx(17)
nsel,r,loc,y,0
nsel,r,loc,z,ctz(17)
*get,ct_0_236,node,,num,max

cmsel,s,conc-tank
nsle
nsel,r,loc,x,ctx(19)
nsel,r,loc,y,0
nsel,r,loc,z,ctz(19)
*get,ct_0_145,node,,num,max

cmsel,s,conc-tank
nsle
nsel,r,loc,x,ctx(22)
nsel,r,loc,y,0
nsel,r,loc,z,ctz(22)
*get,ct_0_0,node,,num,max

nsol,3,ct_0_H,u,x,N_%(ct_0_H)%X
nsol,4,ct_0_382,u,x,N_%(ct_0_382)%X
nsol,5,ct_0_236,u,x,N_%(ct_0_236)%X
nsol,6,ct_0_145,u,x,N_%(ct_0_145)%X
nsol,7,ct_0_0,u,x,N_%(ct_0_0)%X
nsol,13,ct_0_H,u,y,N_%(ct_0_H)%y
nsol,14,ct_0_382,u,y,N_%(ct_0_382)%y
nsol,15,ct_0_236,u,y,N_%(ct_0_236)%y
nsol,16,ct_0_145,u,y,N_%(ct_0_145)%y
nsol,17,ct_0_0,u,y,N_%(ct_0_0)%y

nsol,23,ct_0_H,u,z,N_%(ct_0_H)%z
nsol,24,ct_0_382,u,z,N_%(ct_0_382)%z
nsol,25,ct_0_236,u,z,N_%(ct_0_236)%z
nsol,26,ct_0_145,u,z,N_%(ct_0_145)%z
nsol,27,ct_0_0,u,z,N_%(ct_0_0)%z

/input,rs_freq,txt

resp,31,2,3,3,0.033,0.01,100,120.48
resp,32,2,4,3,0.033,0.01,100,120.48
resp,33,2,5,3,0.033,0.01,100,120.48
resp,34,2,6,3,0.033,0.01,100,120.48
resp,35,2,7,3,0.033,0.01,100,120.48
resp,41,2,13,3,0.033,0.01,100,120.48
resp,42,2,14,3,0.033,0.01,100,120.48
resp,43,2,15,3,0.033,0.01,100,120.48
resp,44,2,16,3,0.033,0.01,100,120.48
resp,45,2,17,3,0.033,0.01,100,120.48
resp,51,2,23,3,0.033,0.01,100,120.48
resp,52,2,24,3,0.033,0.01,100,120.48
resp,53,2,25,3,0.033,0.01,100,120.48
resp,54,2,26,3,0.033,0.01,100,120.48
resp,55,2,27,3,0.033,0.01,100,120.48

prod,61,31,,,rs_%(ct_0_H)%-X,,,1/g
prod,62,32,,,rs_%(ct_0_382)%-X,,,1/g
prod,63,33,,,rs_%(ct_0_236)%-X,,,1/g
prod,64,34,,,rs_%(ct_0_145)%-X,,,1/g
prod,65,35,,,rs_%(ct_0_0)%-X,,,1/g
prod,71,41,,,rs_%(ct_0_H)%-y,,,1/g
prod,72,42,,,rs_%(ct_0_382)%-y,,,1/g
prod,73,43,,,rs_%(ct_0_236)%-y,,,1/g
prod,74,44,,,rs_%(ct_0_145)%-y,,,1/g
prod,75,45,,,rs_%(ct_0_0)%-y,,,1/g
prod,81,51,,,rs_%(ct_0_H)%-z,,,1/g
prod,82,52,,,rs_%(ct_0_382)%-z,,,1/g
prod,83,53,,,rs_%(ct_0_236)%-z,,,1/g
prod,84,54,,,rs_%(ct_0_145)%-z,,,1/g
prod,85,55,,,rs_%(ct_0_0)%-z,,,1/g


lines,200
/out,RS-ct-0,out
prvar,2,61,62,63,64,65
prvar,2,71,72,73,74,75
prvar,2,81,82,83,84,85
/out

deriv,91,3,1,,vx3
deriv,92,4,1,,vx4
deriv,93,5,1,,vx5
deriv,94,6,1,,vx6
deriv,95,7,1,,vx7

deriv,101,13,1,,vy13
deriv,102,14,1,,vy14
deriv,103,15,1,,vy15
deriv,104,16,1,,vy16
deriv,105,71,1,,vy17

deriv,111,23,1,,vz23
deriv,112,24,1,,vz24
deriv,113,25,1,,vz25
```

```
deriv,114,26,1,,vz26
deriv,115,27,1,,vz27

deriv,121,91,1,,a_%(ct_0_H)%-x,,,1/g
deriv,122,92,1,,a_%(ct_0_382)%-x,,,1/g
deriv,123,93,1,,a_%(ct_0_236)%-x,,,1/g
deriv,124,94,1,,a_%(ct_0_145)%-x,,,1/g
deriv,125,95,1,,a_%(ct_0_0)%-x,,,1/g

deriv,131,101,1,,a_%(ct_0_H)%-y,,,1/g
deriv,132,102,1,,a_%(ct_0_382)%-y,,,1/g
deriv,133,103,1,,a_%(ct_0_236)%-y,,,1/g
deriv,134,104,1,,a_%(ct_0_145)%-y,,,1/g
deriv,135,105,1,,a_%(ct_0_0)%-y,,,1/g

deriv,141,111,1,,a_%(ct_0_H)%-z,,,1/g
deriv,142,112,1,,a_%(ct_0_382)%-z,,,1/g
deriv,143,113,1,,a_%(ct_0_236)%-z,,,1/g
deriv,144,114,1,,a_%(ct_0_145)%-z,,,1/g
deriv,145,115,1,,a_%(ct_0_0)%-z,,,1/g

lines,2150
/out,Disp-ct-0,out
prvar,3,4,5,6,7
prvar,13,14,15,16,17
prvar,23,24,25,26,27
/out

/out,Vel-ct-0,out
prvar,91,92,93,94,95
prvar,101,102,103,104,105
prvar,111,112,113,114,115
/out

/out,Accel-ct-0,out
prvar,121,122,123,124,125
prvar,131,132,133,134,135
prvar,141,142,143,144,145
/out
```

spectra-conc-135.txt

```
fini

/POST26
numvar,200
*do,z,2,200
VARDEL,z
*enddo

csys,1
cmsel,s,conc-tank
nsle
nsel,r,loc,x,ctx(11)
nsel,r,loc,y,-135
nsel,r,loc,z,ctz(11)
*get,ct_135_H,node,,num,max

cmsel,s,conc-tank
nsle
nsel,r,loc,x,ctx(14)
nsel,r,loc,y,-135
nsel,r,loc,z,ctz(14)
*get,ct_135_382,node,,num,max

cmsel,s,conc-tank
nsle
nsel,r,loc,x,ctx(17)
nsel,r,loc,y,-135
nsel,r,loc,z,ctz(17)
*get,ct_135_236,node,,num,max

cmsel,s,conc-tank
nsle
nsel,r,loc,x,ctx(19)
nsel,r,loc,y,-135
nsel,r,loc,z,ctz(19)
*get,ct_135_145,node,,num,max

cmsel,s,conc-tank
nsle
nsel,r,loc,x,ctx(22)
nsel,r,loc,y,-135
nsel,r,loc,z,ctz(22)
*get,ct_135_0,node,,num,max

nsol,3,ct_135_H,u,x,N_%(ct_135_H)%X
nsol,4,ct_135_382,u,x,N_%(ct_135_382)%X
nsol,5,ct_135_236,u,x,N_%(ct_135_236)%X
nsol,6,ct_135_145,u,x,N_%(ct_135_145)%X
nsol,7,ct_135_0,u,x,N_%(ct_135_0)%X

nsol,13,ct_135_H,u,y,N_%(ct_135_H)%y
nsol,14,ct_135_382,u,y,N_%(ct_135_382)%y
nsol,15,ct_135_236,u,y,N_%(ct_135_236)%y
nsol,16,ct_135_145,u,y,N_%(ct_135_145)%y
nsol,17,ct_135_0,u,y,N_%(ct_135_0)%y

nsol,23,ct_135_H,u,z,N_%(ct_135_H)%z
nsol,24,ct_135_382,u,z,N_%(ct_135_382)%z
nsol,25,ct_135_236,u,z,N_%(ct_135_236)%z
nsol,26,ct_135_145,u,z,N_%(ct_135_145)%z
nsol,27,ct_135_0,u,z,N_%(ct_135_0)%z

/input,rs_freq,txt

resp,31,2,3,3,0.033,0.01,100,120.48
resp,32,2,4,3,0.033,0.01,100,120.48
resp,33,2,5,3,0.033,0.01,100,120.48
resp,34,2,6,3,0.033,0.01,100,120.48
resp,35,2,7,3,0.033,0.01,100,120.48
resp,41,2,13,3,0.033,0.01,100,120.48
resp,42,2,14,3,0.033,0.01,100,120.48
resp,43,2,15,3,0.033,0.01,100,120.48
resp,44,2,16,3,0.033,0.01,100,120.48
resp,45,2,17,3,0.033,0.01,100,120.48
resp,51,2,23,3,0.033,0.01,100,120.48
resp,52,2,24,3,0.033,0.01,100,120.48
resp,53,2,25,3,0.033,0.01,100,120.48
resp,54,2,26,3,0.033,0.01,100,120.48
resp,55,2,27,3,0.033,0.01,100,120.48

prod,61,31,,,rs_ct_135_H-X,,,1/g
prod,62,32,,,rs_ct_135_382-X,,,1/g
prod,63,33,,,rs_ct_135_236-X,,,1/g
prod,64,34,,,rs_ct_135_145-X,,,1/g
prod,65,35,,,rs_ct_135_0-X,,,1/g
prod,71,41,,,rs_ct_135_H-y,,,1/g
prod,72,42,,,rs_ct_135_382-y,,,1/g
prod,73,43,,,rs_ct_135_236-y,,,1/g
prod,74,44,,,rs_ct_135_145-y,,,1/g
prod,75,45,,,rs_ct_135_0-y,,,1/g
prod,81,51,,,rs_ct_135_H-z,,,1/g
prod,82,52,,,rs_ct_135_382-z,,,1/g
prod,83,53,,,rs_ct_135_236-z,,,1/g
prod,84,54,,,rs_ct_135_145-z,,,1/g
prod,85,55,,,rs_ct_135_0-z,,,1/g
```

```
lines,200
/out,RS-ct-135,out
prvar,2,61,62,63,64,65
prvar,2,71,72,73,74,75
prvar,2,81,82,83,84,85
/out

deriv,91,3,1,,vx3
deriv,92,4,1,,vx4
deriv,93,5,1,,vx5
deriv,94,6,1,,vx6
deriv,95,7,1,,vx7

deriv,101,13,1,,vy13
deriv,102,14,1,,vy14
deriv,103,15,1,,vy15
deriv,104,16,1,,vy16
deriv,105,71,1,,vy17

deriv,111,23,1,,vz23
deriv,112,24,1,,vz24
deriv,113,25,1,,vz25
deriv,114,26,1,,vz26
deriv,115,27,1,,vz27

deriv,121,91,1,,a_ct_135_H-x,,,1/g
deriv,122,92,1,,a_ct_135_382-x,,,1/g
deriv,123,93,1,,a_ct_135_236-x,,,1/g
deriv,124,94,1,,a_ct_135_145-x,,,1/g
deriv,125,95,1,,a_ct_135_0-x,,,1/g

deriv,131,101,1,,a_ct_135_H-y,,,1/g
deriv,132,102,1,,a_ct_135_382-y,,,1/g
deriv,133,103,1,,a_ct_135_236-y,,,1/g
deriv,134,104,1,,a_ct_135_145-y,,,1/g
deriv,135,105,1,,a_ct_135_0-y,,,1/g

deriv,141,111,1,,a_ct_135_H-z,,,1/g
deriv,142,112,1,,a_ct_135_382-z,,,1/g
deriv,143,113,1,,a_ct_135_236-z,,,1/g
deriv,144,114,1,,a_ct_135_145-z,,,1/g
deriv,145,115,1,,a_ct_135_0-z,,,1/g

lines,2150
/out,Disp-ct-135,out
prvar,3,4,5,6,7
prvar,13,14,15,16,17
prvar,23,24,25,26,27
/out

/out,Vel-ct-135,out
prvar,91,92,93,94,95
prvar,101,102,103,104,105
prvar,111,112,113,114,115
/out

/out,Accel-ct-135,out
prvar,121,122,123,124,125
prvar,131,132,133,134,135
prvar,141,142,143,144,145
/out
```

spectra-conc-180.txt

```
fini

/POST26
numvar,200
*do,z,2,200
VARDEL,z
*enddo

csys,1
cmsel,s,conc-tank
nsle
nsel,r,loc,x,ctx(11)
nsel,r,loc,y,-180
nsel,r,loc,z,ctz(11)
*get,ct_180_H,node,,num,max

cmsel,s,conc-tank
nsle
nsel,r,loc,x,ctx(14)
nsel,r,loc,y,-180
nsel,r,loc,z,ctz(14)
*get,ct_180_382,node,,num,max

cmsel,s,conc-tank
nsle
nsel,r,loc,x,ctx(17)
nsel,r,loc,y,-180
nsel,r,loc,z,ctz(17)
*get,ct_180_236,node,,num,max

cmsel,s,conc-tank
nsle
nsel,r,loc,x,ctx(19)
nsel,r,loc,y,-180
nsel,r,loc,z,ctz(19)
*get,ct_180_145,node,,num,max

cmsel,s,conc-tank
nsle
nsel,r,loc,x,ctx(22)
nsel,r,loc,y,-180
nsel,r,loc,z,ctz(22)
*get,ct_180_0,node,,num,max

nsol,3,ct_180_H,u,x,N_%(ct_180_H)%X
nsol,4,ct_180_382,u,x,N_%(ct_180_382)%X
nsol,5,ct_180_236,u,x,N_%(ct_180_236)%X
nsol,6,ct_180_145,u,x,N_%(ct_180_145)%X
nsol,7,ct_180_0,u,x,N_%(ct_180_0)%X

nsol,13,ct_180_H,u,y,N_%(ct_180_H)%y
nsol,14,ct_180_382,u,y,N_%(ct_180_382)%y
nsol,15,ct_180_236,u,y,N_%(ct_180_236)%y
nsol,16,ct_180_145,u,y,N_%(ct_180_145)%y
nsol,17,ct_180_0,u,y,N_%(ct_180_0)%y

nsol,23,ct_180_H,u,z,N_%(ct_180_H)%z
nsol,24,ct_180_382,u,z,N_%(ct_180_382)%z
nsol,25,ct_180_236,u,z,N_%(ct_180_236)%z
nsol,26,ct_180_145,u,z,N_%(ct_180_145)%z
nsol,27,ct_180_0,u,z,N_%(ct_180_0)%z

/input,rs_freq,txt

resp,31,2,3,3,0.033,0.01,100,120.48
resp,32,2,4,3,0.033,0.01,100,120.48
resp,33,2,5,3,0.033,0.01,100,120.48
resp,34,2,6,3,0.033,0.01,100,120.48
resp,35,2,7,3,0.033,0.01,100,120.48
resp,41,2,13,3,0.033,0.01,100,120.48
resp,42,2,14,3,0.033,0.01,100,120.48
resp,43,2,15,3,0.033,0.01,100,120.48
resp,44,2,16,3,0.033,0.01,100,120.48
resp,45,2,17,3,0.033,0.01,100,120.48
resp,51,2,23,3,0.033,0.01,100,120.48
```

```
resp,52,2,24,3,0.033,0.01,100,120.48
resp,53,2,25,3,0.033,0.01,100,120.48
resp,54,2,26,3,0.033,0.01,100,120.48
resp,55,2,27,3,0.033,0.01,100,120.48

prod,61,31,,,rs_ct_180_H-X,,,1/g
prod,62,32,,,rs_ct_180_382-X,,,1/g
prod,63,33,,,rs_ct_180_236-X,,,1/g
prod,64,34,,,rs_ct_180_145-X,,,1/g
prod,65,35,,,rs_ct_180_0-X,,,1/g
prod,71,41,,,rs_ct_180_H-y,,,1/g
prod,72,42,,,rs_ct_180_382-y,,,1/g
prod,73,43,,,rs_ct_180_236-y,,,1/g
prod,74,44,,,rs_ct_180_145-y,,,1/g
prod,75,45,,,rs_ct_180_0-y,,,1/g
prod,81,51,,,rs_ct_180_H-z,,,1/g
prod,82,52,,,rs_ct_180_382-z,,,1/g
prod,83,53,,,rs_ct_180_236-z,,,1/g
prod,84,54,,,rs_ct_180_145-z,,,1/g
prod,85,55,,,rs_ct_180_0-z,,,1/g


lines,200
/out,RS-ct-180,out
prvar,2,61,62,63,64,65
prvar,2,71,72,73,74,75
prvar,2,81,82,83,84,85
/out

deriv,91,3,1,,vx3
deriv,92,4,1,,vx4
deriv,93,5,1,,vx5
deriv,94,6,1,,vx6
deriv,95,7,1,,vx7

deriv,101,13,1,,vy13
deriv,102,14,1,,vy14
deriv,103,15,1,,vy15
deriv,104,16,1,,vy16
deriv,105,71,1,,vy17

deriv,111,23,1,,vz23
deriv,112,24,1,,vz24
deriv,113,25,1,,vz25
deriv,114,26,1,,vz26
deriv,115,27,1,,vz27

deriv,121,91,1,,a_ct_180_H-x,,,1/g
deriv,122,92,1,,a_ct_180_382-x,,,1/g
deriv,123,93,1,,a_ct_180_236-x,,,1/g
deriv,124,94,1,,a_ct_180_145-x,,,1/g
deriv,125,95,1,,a_ct_180_0-x,,,1/g

deriv,131,101,1,,a_ct_180_H-y,,,1/g
deriv,132,102,1,,a_ct_180_382-y,,,1/g
deriv,133,103,1,,a_ct_180_236-y,,,1/g
deriv,134,104,1,,a_ct_180_145-y,,,1/g
deriv,135,105,1,,a_ct_180_0-y,,,1/g

deriv,141,111,1,,a_ct_180_H-z,,,1/g
deriv,142,112,1,,a_ct_180_382-z,,,1/g
deriv,143,113,1,,a_ct_180_236-z,,,1/g
deriv,144,114,1,,a_ct_180_145-z,,,1/g
deriv,145,115,1,,a_ct_180_0-z,,,1/g

lines,2150
/out,Disp-ct-180,out
prvar,3,4,5,6,7
prvar,13,14,15,16,17
prvar,23,24,25,26,27
/out

/out,Vel-ct-180,out
prvar,91,92,93,94,95
prvar,101,102,103,104,105
prvar,111,112,113,114,115
/out

/out,Accel-ct-180,out
prvar,121,122,123,124,125
prvar,131,132,133,134,135
prvar,141,142,143,144,145
/out
```

spectra-conc-45.txt

```
fini

/POST26
numvar,200
*do,z,2,200
VARDEL,z
*enddo

csys,1
cmsel,s,conc-tank
nsle
nsel,r,loc,x,ctx(11)
nsel,r,loc,y,-45
nsel,r,loc,z,ctz(11)
*get,ct_45_H,node,,num,max

cmsel,s,conc-tank
nsle
nsel,r,loc,x,ctx(14)
nsel,r,loc,y,-45
nsel,r,loc,z,ctz(14)
*get,ct_45_382,node,,num,max

cmsel,s,conc-tank
nsle
nsel,r,loc,x,ctx(17)
nsel,r,loc,y,-45
nsel,r,loc,z,ctz(17)
*get,ct_45_236,node,,num,max

cmsel,s,conc-tank
nsle
nsel,r,loc,x,ctx(19)
nsel,r,loc,y,-45
nsel,r,loc,z,ctz(19)
*get,ct_45_145,node,,num,max

cmsel,s,conc-tank
nsle
nsel,r,loc,x,ctx(22)
nsel,r,loc,y,-45
nsel,r,loc,z,ctz(22)
*get,ct_45_0,node,,num,max

nsol,3,ct_45_H,u,x,N_%(ct_45_H)%X
nsol,4,ct_45_382,u,x,N_%(ct_45_382)%X
nsol,5,ct_45_236,u,x,N_%(ct_45_236)%X
nsol,6,ct_45_145,u,x,N_%(ct_45_145)%X
nsol,7,ct_45_0,u,x,N_%(ct_45_0)%X

nsol,13,ct_45_H,u,y,N_%(ct_45_H)%y
nsol,14,ct_45_382,u,y,N_%(ct_45_382)%y
nsol,15,ct_45_236,u,y,N_%(ct_45_236)%y
```

```
nsol,16,ct_45_145,u,y,N_%(ct_45_145)%y
nsol,17,ct_45_0,u,y,N_%(ct_45_0)%y

nsol,23,ct_45_H,u,z,N_%(ct_45_H)%z
nsol,24,ct_45_382,u,z,N_%(ct_45_382)%z
nsol,25,ct_45_236,u,z,N_%(ct_45_236)%z
nsol,26,ct_45_145,u,z,N_%(ct_45_145)%z
nsol,27,ct_45_0,u,z,N_%(ct_45_0)%z

/input,rs_freq,txt

resp,31,2,3,3,0.033,0.01,100,120.48
resp,32,2,4,3,0.033,0.01,100,120.48
resp,33,2,5,3,0.033,0.01,100,120.48
resp,34,2,6,3,0.033,0.01,100,120.48
resp,35,2,7,3,0.033,0.01,100,120.48
resp,41,2,13,3,0.033,0.01,100,120.48
resp,42,2,14,3,0.033,0.01,100,120.48
resp,43,2,15,3,0.033,0.01,100,120.48
resp,44,2,16,3,0.033,0.01,100,120.48
resp,45,2,17,3,0.033,0.01,100,120.48
resp,51,2,23,3,0.033,0.01,100,120.48
resp,52,2,24,3,0.033,0.01,100,120.48
resp,53,2,25,3,0.033,0.01,100,120.48
resp,54,2,26,3,0.033,0.01,100,120.48
resp,55,2,27,3,0.033,0.01,100,120.48

prod,61,31,,,rs_%(ct_45_H)%-X,,,1/g
prod,62,32,,,rs_%(ct_45_382)%-X,,,1/g
prod,63,33,,,rs_%(ct_45_236)%-X,,,1/g
prod,64,34,,,rs_%(ct_45_145)%-X,,,1/g
prod,65,35,,,rs_%(ct_45_0)%-X,,,1/g
prod,71,41,,,rs_%(ct_45_H)%-y,,,1/g
prod,72,42,,,rs_%(ct_45_382)%-y,,,1/g
prod,73,43,,,rs_%(ct_45_236)%-y,,,1/g
prod,74,44,,,rs_%(ct_45_145)%-y,,,1/g
prod,75,45,,,rs_%(ct_45_0)%-y,,,1/g
prod,81,51,,,rs_%(ct_45_H)%-z,,,1/g
prod,82,52,,,rs_%(ct_45_382)%-z,,,1/g
prod,83,53,,,rs_%(ct_45_236)%-z,,,1/g
prod,84,54,,,rs_%(ct_45_145)%-z,,,1/g
prod,85,55,,,rs_%(ct_45_0)%-z,,,1/g


lines,200
/out,RS-ct-45,out
prvar,2,61,62,63,64,65
prvar,2,71,72,73,74,75
prvar,2,81,82,83,84,85
/out

deriv,91,3,1,,vx3
deriv,92,4,1,,vx4
deriv,93,5,1,,vx5
deriv,94,6,1,,vx6
deriv,95,7,1,,vx7

deriv,101,13,1,,vy13
deriv,102,14,1,,vy14
deriv,103,15,1,,vy15
deriv,104,16,1,,vy16
deriv,105,71,1,,vy17

deriv,111,23,1,,vz23
deriv,112,24,1,,vz24
deriv,113,25,1,,vz25
deriv,114,26,1,,vz26
deriv,115,27,1,,vz27

deriv,121,91,1,,a_%(ct_45_H)%-x,,,1/g
deriv,122,92,1,,a_%(ct_45_382)%-x,,,1/g
deriv,123,93,1,,a_%(ct_45_236)%-x,,,1/g
deriv,124,94,1,,a_%(ct_45_145)%-x,,,1/g
deriv,125,95,1,,a_%(ct_45_0)%-x,,,1/g

deriv,131,101,1,,a_%(ct_45_H)%-y,,,1/g
deriv,132,102,1,,a_%(ct_45_382)%-y,,,1/g
deriv,133,103,1,,a_%(ct_45_236)%-y,,,1/g
deriv,134,104,1,,a_%(ct_45_145)%-y,,,1/g
deriv,135,105,1,,a_%(ct_45_0)%-y,,,1/g

deriv,141,111,1,,a_%(ct_45_H)%-z,,,1/g
deriv,142,112,1,,a_%(ct_45_382)%-z,,,1/g
deriv,143,113,1,,a_%(ct_45_236)%-z,,,1/g
deriv,144,114,1,,a_%(ct_45_145)%-z,,,1/g
deriv,145,115,1,,a_%(ct_45_0)%-z,,,1/g

lines,2150
/out,Disp-ct-45,out
prvar,3,4,5,6,7
prvar,13,14,15,16,17
prvar,23,24,25,26,27
/out

/out,Vel-ct-45,out
prvar,91,92,93,94,95
prvar,101,102,103,104,105
prvar,111,112,113,114,115
/out

/out,Accel-ct-45,out
prvar,121,122,123,124,125
prvar,131,132,133,134,135
prvar,141,142,143,144,145
/out
```

spectra-conc-90.txt

```
fini

/POST26
numvar,200
*do,z,2,200
VARDEL,z
*enddo

csys,1
cmsel,s,conc-tank
nsle
nsel,r,loc,x,ctx(11)
nsel,r,loc,y,-90
nsel,r,loc,z,ctz(11)
*get,ct_90_H,node,,num,max

cmsel,s,conc-tank
nsle
nsel,r,loc,x,ctx(14)
nsel,r,loc,y,-90
nsel,r,loc,z,ctz(14)
*get,ct_90_382,node,,num,max

cmsel,s,conc-tank
nsle
nsel,r,loc,x,ctx(17)
nsel,r,loc,y,-90
nsel,r,loc,z,ctz(17)
*get,ct_90_236,node,,num,max

cmsel,s,conc-tank
```

```
nsle
nsel,r,loc,x,ctx(19)
nsel,r,loc,y,-90
nsel,r,loc,z,ctz(19)
*get,ct_90_145,node,,num,max

cmsel,s,conc-tank
nsle
nsel,r,loc,x,ctx(22)
nsel,r,loc,y,-90
nsel,r,loc,z,ctz(22)
*get,ct_90_0,node,,num,max

nsol,3,ct_90_H,u,x,N_%(ct_90_H)%X
nsol,4,ct_90_382,u,x,N_%(ct_90_382)%X
nsol,5,ct_90_236,u,x,N_%(ct_90_236)%X
nsol,6,ct_90_145,u,x,N_%(ct_90_145)%X
nsol,7,ct_90_0,u,x,N_%(ct_90_0)%X

nsol,13,ct_90_H,u,y,N_%(ct_90_H)%y
nsol,14,ct_90_382,u,y,N_%(ct_90_382)%y
nsol,15,ct_90_236,u,y,N_%(ct_90_236)%y
nsol,16,ct_90_145,u,y,N_%(ct_90_145)%y
nsol,17,ct_90_0,u,y,N_%(ct_90_0)%y

nsol,23,ct_90_H,u,z,N_%(ct_90_H)%z
nsol,24,ct_90_382,u,z,N_%(ct_90_382)%z
nsol,25,ct_90_236,u,z,N_%(ct_90_236)%z
nsol,26,ct_90_145,u,z,N_%(ct_90_145)%z
nsol,27,ct_90_0,u,z,N_%(ct_90_0)%z

/input,rs_freq,txt

resp,31,2,3,3,0.033,0.01,100,120.48
resp,32,2,4,3,0.033,0.01,100,120.48
resp,33,2,5,3,0.033,0.01,100,120.48
resp,34,2,6,3,0.033,0.01,100,120.48
resp,35,2,7,3,0.033,0.01,100,120.48
resp,41,2,13,3,0.033,0.01,100,120.48
resp,42,2,14,3,0.033,0.01,100,120.48
resp,43,2,15,3,0.033,0.01,100,120.48
resp,44,2,16,3,0.033,0.01,100,120.48
resp,45,2,17,3,0.033,0.01,100,120.48
resp,51,2,23,3,0.033,0.01,100,120.48
resp,52,2,24,3,0.033,0.01,100,120.48
resp,53,2,25,3,0.033,0.01,100,120.48
resp,54,2,26,3,0.033,0.01,100,120.48
resp,55,2,27,3,0.033,0.01,100,120.48

prod,61,31,,,rs_ct_90_H-X,,,1/g
prod,62,32,,,rs_ct_90_382-X,,,1/g
prod,63,33,,,rs_ct_90_236-X,,,1/g
prod,64,34,,,rs_ct_90_145-X,,,1/g
prod,65,35,,,rs_ct_90_0-X,,,1/g
prod,71,41,,,rs_ct_90_H-y,,,1/g
prod,72,42,,,rs_ct_90_382-y,,,1/g
prod,73,43,,,rs_ct_90_236-y,,,1/g
prod,74,44,,,rs_ct_90_145-y,,,1/g
prod,75,45,,,rs_ct_90_0-y,,,1/g
prod,81,51,,,rs_ct_90_H-z,,,1/g
prod,82,52,,,rs_ct_90_382-z,,,1/g
prod,83,53,,,rs_ct_90_236-z,,,1/g
prod,84,54,,,rs_ct_90_145-z,,,1/g
prod,85,55,,,rs_ct_90_0-z,,,1/g


lines,200
/out,RS-ct-90,out
prvar,2,61,62,63,64,65
prvar,2,71,72,73,74,75
prvar,2,81,82,83,84,85
/out

deriv,91,3,1,,vx3
deriv,92,4,1,,vx4
deriv,93,5,1,,vx5
deriv,94,6,1,,vx6
deriv,95,7,1,,vx7

deriv,101,13,1,,vy13
deriv,102,14,1,,vy14
deriv,103,15,1,,vy15
deriv,104,16,1,,vy16
deriv,105,71,1,,vy17

deriv,111,23,1,,vz23
deriv,112,24,1,,vz24
deriv,113,25,1,,vz25
deriv,114,26,1,,vz26
deriv,115,27,1,,vz27

deriv,121,91,1,,a_ct_90_H-x,,,1/g
deriv,122,92,1,,a_ct_90_382-x,,,1/g
deriv,123,93,1,,a_ct_90_236-x,,,1/g
deriv,124,94,1,,a_ct_90_145-x,,,1/g
deriv,125,95,1,,a_ct_90_0-x,,,1/g

deriv,131,101,1,,a_ct_90_H-y,,,1/g
deriv,132,102,1,,a_ct_90_382-y,,,1/g
deriv,133,103,1,,a_ct_90_236-y,,,1/g
deriv,134,104,1,,a_ct_90_145-y,,,1/g
deriv,135,105,1,,a_ct_90_0-y,,,1/g

deriv,141,111,1,,a_ct_90_H-z,,,1/g
deriv,142,112,1,,a_ct_90_382-z,,,1/g
deriv,143,113,1,,a_ct_90_236-z,,,1/g
deriv,144,114,1,,a_ct_90_145-z,,,1/g
deriv,145,115,1,,a_ct_90_0-z,,,1/g

lines,2150
/out,Disp-ct-90,out
prvar,3,4,5,6,7
prvar,13,14,15,16,17
prvar,23,24,25,26,27
/out

/out,Vel-ct-90,out
prvar,91,92,93,94,95
prvar,101,102,103,104,105
prvar,111,112,113,114,115
/out

/out,Accel-ct-90,out
prvar,121,122,123,124,125
prvar,131,132,133,134,135
prvar,141,142,143,144,145
/out
```

spectra-conc.txt

```
fini

/POST26
numvar,200
*do,z,2,200
VARDEL,z
*enddo

cmsel,s,conc-tank
```

```
nsle
csys,1
nsel,r,loc,x,ctx(1)
nsel,r,loc,z,ctz(1)
*get,ct_Top,node,,num,max

cmsel,s,conc-tank
nsle
nsel,r,loc,x,ctx(34)
nsel,r,loc,z,ctz(34)
*get,ct_Bottom,node,,num,max

nsol,3,ct_Top,u,x,N_%(ct_Top)%X
nsol,4,ct_Bottom,u,x,N_%(ct_Bottom)%X

nsol,13,ct_Top,u,y,N_%(ct_Top)%y
nsol,14,ct_Bottom,u,y,N_%(ct_Bottom)%y

nsol,23,ct_Top,u,z,N_%(ct_Top)%z
nsol,24,ct_Bottom,u,z,N_%(ct_Bottom)%z

/input,rs_freq,txt

resp,31,2,3,3,0.033,0.01,100,120.48
resp,32,2,4,3,0.033,0.01,100,120.48
resp,41,2,13,3,0.033,0.01,100,120.48
resp,42,2,14,3,0.033,0.01,100,120.48
resp,51,2,23,3,0.033,0.01,100,120.48
resp,52,2,24,3,0.033,0.01,100,120.48

prod,61,31,,,rs_ct_Top-X,,,1/g
prod,62,32,,,rs_ct_Bottom-X,,,1/g
prod,71,41,,,rs_ct_Top-y,,,1/g
prod,72,42,,,rs_ct_Bottom-y,,,1/g
prod,81,51,,,rs_ct_Top-z,,,1/g
prod,82,52,,,rs_ct_Bottom-z,,,1/g


lines,200
/out,RS-ct,out
prvar,2,61,62
prvar,2,71,72
prvar,2,81,82
/out

deriv,91,3,1,,vx3
deriv,92,4,1,,vx4

deriv,101,13,1,,vy13
deriv,102,14,1,,vy14

deriv,111,23,1,,vz23
deriv,112,24,1,,vz24

deriv,121,91,1,,a_ct_Top-x,,,1/g
deriv,122,92,1,,a_ct_Bottom-x,,,1/g

deriv,131,101,1,,a_ct_Top-y,,,1/g
deriv,132,102,1,,a_ct_Bottom-y,,,1/g

deriv,141,111,1,,a_ct_Top-z,,,1/g
deriv,142,112,1,,a_ct_Bottom-z,,,1/g

lines,2150
/out,Disp-ct,out
prvar,3,4
prvar,13,14
prvar,23,24
/out

/out,Vel-ct,out
prvar,91,92
prvar,101,102
prvar,111,112
/out

/out,Accel-ct,out
prvar,121,122
prvar,131,132
prvar,141,142
/out
```

spectra-concrete.txt

```
fini

/POST26
numvar,200
*do,z,2,200
VARDEL,z
*enddo

csys,1
cmsel,s,conc-tank
nsle
nsel,r,loc,x,ctx(1)
nsel,r,loc,z,ctz(1)
*get,c_top,node,,num,max

cmsel,s,conc-tank
nsle
nsel,r,loc,x,ctx(14)
nsel,r,loc,y,0
nsel,r,loc,z,ctz(14)
*get,c_bot,node,,num,max

cmsel,s,conc-tank
nsle
nsel,r,loc,x,ctx(16)
nsel,r,loc,y,0
nsel,r,loc,z,ctz(16)
*get,c_h0,node,,num,max

cmsel,s,conc-tank
nsle
nsel,r,loc,x,ctx(18)
nsel,r,loc,y,0
nsel,r,loc,z,ctz(18)
*get,c_h90,node,,num,max

cmsel,s,conc-tank
nsle
nsel,r,loc,x,ctx(20)
nsel,r,loc,y,0
nsel,r,loc,z,ctz(20)
*get,c_h180,node,,num,max

nsol,3,c_top,u,x,N_%(c_top)%X
nsol,4,c_bot,u,x,N_%(c_bot)%X
nsol,5,c_h0,u,x,N_%(c_h0)%X
nsol,6,c_h90,u,x,N_%(c_h90)%X
nsol,7,c_h180,u,x,N_%(c_h180)%X

nsol,13,c_top,u,y,N_%(c_top)%y
nsol,14,c_bot,u,y,N_%(c_bot)%y
nsol,15,c_h0,u,y,N_%(c_h0)%y
nsol,16,c_h90,u,y,N_%(c_h90)%y
nsol,17,c_h180,u,y,N_%(c_h180)%y
```

```
nsol,23,c_top,u,z,N_%(c_top)%z
nsol,24,c_bot,u,z,N_%(c_bot)%z
nsol,25,c_h0,u,z,N_%(c_h0)%z
nsol,26,c_h90,u,z,N_%(c_h90)%z
nsol,27,c_h180,u,z,N_%(c_h180)%z

/input,rs_freq,txt

resp,31,2,3,3,0.033,0.01,100,105
resp,32,2,4,3,0.033,0.01,100,105
resp,33,2,5,3,0.033,0.01,100,105
resp,34,2,6,3,0.033,0.01,100,105
resp,35,2,7,3,0.033,0.01,100,105
resp,41,2,13,3,0.033,0.01,100,105
resp,42,2,14,3,0.033,0.01,100,105
resp,43,2,15,3,0.033,0.01,100,105
resp,44,2,16,3,0.033,0.01,100,105
resp,45,2,17,3,0.033,0.01,100,105
resp,51,2,23,3,0.033,0.01,100,105
resp,52,2,24,3,0.033,0.01,100,105
resp,53,2,25,3,0.033,0.01,100,105
resp,54,2,26,3,0.033,0.01,100,105
resp,55,2,27,3,0.033,0.01,100,105

prod,61,31,,,,,,1/g
prod,62,32,,,,,,1/g
prod,63,33,,,,,,1/g
prod,64,34,,,,,,1/g
prod,65,35,,,,,,1/g
prod,71,41,,,,,,1/g
prod,72,42,,,,,,1/g
prod,73,43,,,,,,1/g
prod,74,44,,,,,,1/g
prod,75,45,,,,,,1/g
prod,81,51,,,,,,1/g
prod,82,52,,,,,,1/g
prod,83,53,,,,,,1/g
prod,84,54,,,,,,1/g
prod,85,55,,,,,,1/g


lines,200
/out,RS-OUT-Concrete,txt
prvar,2,61,62,63,64,65
prvar,2,71,72,73,74,75
prvar,2,81,82,83,84,85
/out
```

spectra-primary-0.txt

```
fini

/POST26
numvar,120
*do,z,2,120
VARDEL,z
*enddo

csys,1
cmsel,s,primary-tank
nsle
nsel,r,loc,x,ptx(12)
nsel,r,loc,y,0
nsel,r,loc,z,ptz(12)
*get,pt_0_460,node,,num,max

cmsel,s,primary-tank
nsle
nsel,r,loc,x,ptx(18)
nsel,r,loc,y,0
nsel,r,loc,z,ptz(18)
*get,pt_0_354,node,,num,max

cmsel,s,primary-tank
nsle
nsel,r,loc,x,ptx(22)
nsel,r,loc,y,0
nsel,r,loc,z,ptz(22)
*get,pt_0_260,node,,num,max

cmsel,s,primary-tank
nsle
nsel,r,loc,x,ptx(28)
nsel,r,loc,y,0
nsel,r,loc,z,ptz(28)
*get,pt_0_123,node,,num,max

cmsel,s,primary-tank
nsle
nsel,r,loc,x,ptx(33)
nsel,r,loc,y,0
nsel,r,loc,z,ptz(33)
*get,pt_0_12,node,,num,max

nsol,3,pt_0_460,u,x,N_%(pt_0_460)%X
nsol,4,pt_0_354,u,x,N_%(pt_0_354)%X
nsol,5,pt_0_260,u,x,N_%(pt_0_260)%X
nsol,6,pt_0_123,u,x,N_%(pt_0_123)%X
nsol,7,pt_0_12,u,x,N_%(pt_0_12)%X

nsol,13,pt_0_460,u,y,N_%(pt_0_460)%y
nsol,14,pt_0_354,u,y,N_%(pt_0_354)%y
nsol,15,pt_0_260,u,y,N_%(pt_0_260)%y
nsol,16,pt_0_123,u,y,N_%(pt_0_123)%y
nsol,17,pt_0_12,u,y,N_%(pt_0_12)%y

nsol,23,pt_0_460,u,z,N_%(pt_0_460)%z
nsol,24,pt_0_354,u,z,N_%(pt_0_354)%z
nsol,25,pt_0_260,u,z,N_%(pt_0_260)%z
nsol,26,pt_0_123,u,z,N_%(pt_0_123)%z
nsol,27,pt_0_12,u,z,N_%(pt_0_12)%z

/input,rs_freq,txt

resp,31,2,3,3,0.033,0.01,100,112.48
resp,32,2,4,3,0.033,0.01,100,112.48
resp,33,2,5,3,0.033,0.01,100,112.48
resp,34,2,6,3,0.033,0.01,100,112.48
resp,35,2,7,3,0.033,0.01,100,112.48
resp,41,2,13,3,0.033,0.01,100,112.48
resp,42,2,14,3,0.033,0.01,100,112.48
resp,43,2,15,3,0.033,0.01,100,112.48
resp,44,2,16,3,0.033,0.01,100,112.48
resp,45,2,17,3,0.033,0.01,100,112.48
resp,51,2,23,3,0.033,0.01,100,112.48
resp,52,2,24,3,0.033,0.01,100,112.48
resp,53,2,25,3,0.033,0.01,100,112.48
resp,54,2,26,3,0.033,0.01,100,112.48
resp,55,2,27,3,0.033,0.01,100,112.48

prod,61,31,,,rs_pt_0_460-X,,,1/g
prod,62,32,,,rs_pt_0_354-X,,,1/g
prod,63,33,,,rs_pt_0_260-X,,,1/g
prod,64,34,,,rs_pt_0_123-X,,,1/g
prod,65,35,,,rs_pt_0_12-X,,,1/g
prod,71,41,,,rs_pt_0_460-y,,,1/g
prod,72,42,,,rs_pt_0_354-y,,,1/g
prod,73,43,,,rs_pt_0_260-y,,,1/g
prod,74,44,,,rs_pt_0_123-y,,,1/g
```

```
prod,75,45,,,rs_pt_0_12-y,,,1/g
prod,81,51,,,rs_pt_0_460-z,,,1/g
prod,82,52,,,rs_pt_0_354-z,,,1/g
prod,83,53,,,rs_pt_0_260-z,,,1/g
prod,84,54,,,rs_pt_0_123-z,,,1/g
prod,85,55,,,rs_pt_0_12-z,,,1/g


lines,200
/out,RS-PT-0,out
prvar,2,61,62,63,64,65
prvar,2,71,72,73,74,75
prvar,2,81,82,83,84,85
/out

deriv,91,3,1,,vx3
deriv,92,4,1,,vx4
deriv,93,5,1,,vx5
deriv,94,6,1,,vx6
deriv,95,7,1,,vx7

deriv,101,13,1,,vy13
deriv,102,14,1,,vy14
deriv,103,15,1,,vy15
deriv,104,16,1,,vy16
deriv,105,71,1,,vy17

deriv,111,23,1,,vz23
deriv,112,24,1,,vz24
deriv,113,25,1,,vz25
deriv,114,26,1,,vz26
deriv,115,27,1,,vz27

deriv,121,91,1,,a_pt_0_460-x,,,1/g
deriv,122,92,1,,a_pt_0_354-x,,,1/g
deriv,123,93,1,,a_pt_0_260-x,,,1/g
deriv,124,94,1,,a_pt_0_123-x,,,1/g
deriv,125,95,1,,a_pt_0_12-x,,,1/g

deriv,131,101,1,,a_pt_0_460-y,,,1/g
deriv,132,102,1,,a_pt_0_354-y,,,1/g
deriv,133,103,1,,a_pt_0_260-y,,,1/g
deriv,134,104,1,,a_pt_0_123-y,,,1/g
deriv,135,105,1,,a_pt_0_12-y,,,1/g

deriv,141,111,1,,a_pt_0_460-z,,,1/g
deriv,142,112,1,,a_pt_0_354-z,,,1/g
deriv,143,113,1,,a_pt_0_260-z,,,1/g
deriv,144,114,1,,a_pt_0_123-z,,,1/g
deriv,145,115,1,,a_pt_0_12-z,,,1/g

lines,2250
/out,Disp-PT-0,out
prvar,3,4,5,6,7
prvar,13,14,15,16,17
prvar,23,24,25,26,27
/out

/out,Vel-PT-0,out
prvar,91,92,93,94,95
prvar,101,102,103,104,105
prvar,111,112,113,114,115
/out

/out,Accel-PT-0,out
prvar,121,122,123,124,125
prvar,131,132,133,134,135
prvar,141,142,143,144,145
/out
```

spectra-primary-135.txt

```
fini

/POST26
numvar,120
*do,z,2,120
VARDEL,z
*enddo

csys,1
cmsel,s,primary-tank
nsle
nsel,r,loc,x,ptx(12)
nsel,r,loc,y,-135
nsel,r,loc,z,ptz(12)
*get,pt_135_460,node,,num,max

cmsel,s,primary-tank
nsle
nsel,r,loc,x,ptx(18)
nsel,r,loc,y,-135
nsel,r,loc,z,ptz(18)
*get,pt_135_354,node,,num,max

cmsel,s,primary-tank
nsle
nsel,r,loc,x,ptx(22)
nsel,r,loc,y,-135
nsel,r,loc,z,ptz(22)
*get,pt_135_260,node,,num,max

cmsel,s,primary-tank
nsle
nsel,r,loc,x,ptx(28)
nsel,r,loc,y,-135
nsel,r,loc,z,ptz(28)
*get,pt_135_123,node,,num,max

cmsel,s,primary-tank
nsle
nsel,r,loc,x,ptx(33)
nsel,r,loc,y,-135
nsel,r,loc,z,ptz(33)
*get,pt_135_12,node,,num,max

nsol,3,pt_135_460,u,x,N_%(pt_135_460)%X
nsol,4,pt_135_354,u,x,N_%(pt_135_354)%X
nsol,5,pt_135_260,u,x,N_%(pt_135_260)%X
nsol,6,pt_135_123,u,x,N_%(pt_135_123)%X
nsol,7,pt_135_12,u,x,N_%(pt_135_12)%X

nsol,13,pt_135_460,u,y,N_%(pt_135_460)%y
nsol,14,pt_135_354,u,y,N_%(pt_135_354)%y
nsol,15,pt_135_260,u,y,N_%(pt_135_260)%y
nsol,16,pt_135_123,u,y,N_%(pt_135_123)%y
nsol,17,pt_135_12,u,y,N_%(pt_135_12)%y

nsol,23,pt_135_460,u,z,N_%(pt_135_460)%z
nsol,24,pt_135_354,u,z,N_%(pt_135_354)%z
nsol,25,pt_135_260,u,z,N_%(pt_135_260)%z
nsol,26,pt_135_123,u,z,N_%(pt_135_123)%z
nsol,27,pt_135_12,u,z,N_%(pt_135_12)%z

/input,rs_freq,txt

resp,31,2,3,3,0.033,0.01,100,112.48
resp,32,2,4,3,0.033,0.01,100,112.48
resp,33,2,5,3,0.033,0.01,100,112.48
```

```
resp,34,2,6,3,0.033,0.01,100,112.48
resp,35,2,7,3,0.033,0.01,100,112.48
resp,41,2,13,3,0.033,0.01,100,112.48
resp,42,2,14,3,0.033,0.01,100,112.48
resp,43,2,15,3,0.033,0.01,100,112.48
resp,44,2,16,3,0.033,0.01,100,112.48
resp,45,2,17,3,0.033,0.01,100,112.48
resp,51,2,23,3,0.033,0.01,100,112.48
resp,52,2,24,3,0.033,0.01,100,112.48
resp,53,2,25,3,0.033,0.01,100,112.48
resp,54,2,26,3,0.033,0.01,100,112.48
resp,55,2,27,3,0.033,0.01,100,112.48

prod,61,31,,,rs_pt_135_460-X,,,1/g
prod,62,32,,,rs_pt_135_354-X,,,1/g
prod,63,33,,,rs_pt_135_260-X,,,1/g
prod,64,34,,,rs_pt_135_123-X,,,1/g
prod,65,35,,,rs_pt_135_12-X,,,1/g
prod,71,41,,,rs_pt_135_460-y,,,1/g
prod,72,42,,,rs_pt_135_354-y,,,1/g
prod,73,43,,,rs_pt_135_260-y,,,1/g
prod,74,44,,,rs_pt_135_123-y,,,1/g
prod,75,45,,,rs_pt_135_12-y,,,1/g
prod,81,51,,,rs_pt_135_460-z,,,1/g
prod,82,52,,,rs_pt_135_354-z,,,1/g
prod,83,53,,,rs_pt_135_260-z,,,1/g
prod,84,54,,,rs_pt_135_123-z,,,1/g
prod,85,55,,,rs_pt_135_12-z,,,1/g


lines,200
/out,RS-PT-135,out
prvar,2,61,62,63,64,65
prvar,2,71,72,73,74,75
prvar,2,81,82,83,84,85
/out

deriv,91,3,1,,vx3
deriv,92,4,1,,vx4
deriv,93,5,1,,vx5
deriv,94,6,1,,vx6
deriv,95,7,1,,vx7

deriv,101,13,1,,vy13
deriv,102,14,1,,vy14
deriv,103,15,1,,vy15
deriv,104,16,1,,vy16
deriv,105,71,1,,vy17

deriv,111,23,1,,vz23
deriv,112,24,1,,vz24
deriv,113,25,1,,vz25
deriv,114,26,1,,vz26
deriv,115,27,1,,vz27

deriv,121,91,1,,a_pt_135_460-x,,,1/g
deriv,122,92,1,,a_pt_135_354-x,,,1/g
deriv,123,93,1,,a_pt_135_260-x,,,1/g
deriv,124,94,1,,a_pt_135_123-x,,,1/g
deriv,125,95,1,,a_pt_135_12-x,,,1/g

deriv,131,101,1,,a_pt_135_460-y,,,1/g
deriv,132,102,1,,a_pt_135_354-y,,,1/g
deriv,133,103,1,,a_pt_135_260-y,,,1/g
deriv,134,104,1,,a_pt_135_123-y,,,1/g
deriv,135,105,1,,a_pt_135_12-y,,,1/g

deriv,141,111,1,,a_pt_135_460-z,,,1/g
deriv,142,112,1,,a_pt_135_354-z,,,1/g
deriv,143,113,1,,a_pt_135_260-z,,,1/g
deriv,144,114,1,,a_pt_135_123-z,,,1/g
deriv,145,115,1,,a_pt_135_12-z,,,1/g

lines,2250
/out,Disp-PT-135,out
prvar,3,4,5,6,7
prvar,13,14,15,16,17
prvar,23,24,25,26,27
/out

/out,Vel-PT-135,out
prvar,91,92,93,94,95
prvar,101,102,103,104,105
prvar,111,112,113,114,115
/out

/out,Accel-PT-135,out
prvar,121,122,123,124,125
prvar,131,132,133,134,135
prvar,141,142,143,144,145
/out
```

spectra-primary-180.txt

```
fini

/POST26
numvar,120
*do,z,2,120
VARDEL,z
*enddo

csys,1
cmsel,s,primary-tank
nsle
nsel,r,loc,x,ptx(12)
nsel,r,loc,y,-180
nsel,r,loc,z,ptz(12)
*get,pt_180_460,node,,num,max

cmsel,s,primary-tank
nsle
nsel,r,loc,x,ptx(18)
nsel,r,loc,y,-180
nsel,r,loc,z,ptz(18)
*get,pt_180_354,node,,num,max

cmsel,s,primary-tank
nsle
nsel,r,loc,x,ptx(22)
nsel,r,loc,y,-180
nsel,r,loc,z,ptz(22)
*get,pt_180_260,node,,num,max

cmsel,s,primary-tank
nsle
nsel,r,loc,x,ptx(28)
nsel,r,loc,y,-180
nsel,r,loc,z,ptz(28)
*get,pt_180_123,node,,num,max

cmsel,s,primary-tank
nsle
nsel,r,loc,x,ptx(33)
nsel,r,loc,y,-180
nsel,r,loc,z,ptz(33)
*get,pt_180_12,node,,num,max

nsol,3,pt_180_460,u,x,N_%(pt_180_460)%X
```

```
nsol,4,pt_180_354,u,x,N_%(pt_180_354)%X
nsol,5,pt_180_260,u,x,N_%(pt_180_260)%X
nsol,6,pt_180_123,u,x,N_%(pt_180_123)%X
nsol,7,pt_180_12,u,x,N_%(pt_180_12)%X

nsol,13,pt_180_460,u,y,N_%(pt_180_460)%y
nsol,14,pt_180_354,u,y,N_%(pt_180_354)%y
nsol,15,pt_180_260,u,y,N_%(pt_180_260)%y
nsol,16,pt_180_123,u,y,N_%(pt_180_123)%y
nsol,17,pt_180_12,u,y,N_%(pt_180_12)%y

nsol,23,pt_180_460,u,z,N_%(pt_180_460)%z
nsol,24,pt_180_354,u,z,N_%(pt_180_354)%z
nsol,25,pt_180_260,u,z,N_%(pt_180_260)%z
nsol,26,pt_180_123,u,z,N_%(pt_180_123)%z
nsol,27,pt_180_12,u,z,N_%(pt_180_12)%z

/input,rs_freq,txt

resp,31,2,3,3,0.033,0.01,100,112.48
resp,32,2,4,3,0.033,0.01,100,112.48
resp,33,2,5,3,0.033,0.01,100,112.48
resp,34,2,6,3,0.033,0.01,100,112.48
resp,35,2,7,3,0.033,0.01,100,112.48
resp,41,2,13,3,0.033,0.01,100,112.48
resp,42,2,14,3,0.033,0.01,100,112.48
resp,43,2,15,3,0.033,0.01,100,112.48
resp,44,2,16,3,0.033,0.01,100,112.48
resp,45,2,17,3,0.033,0.01,100,112.48
resp,51,2,23,3,0.033,0.01,100,112.48
resp,52,2,24,3,0.033,0.01,100,112.48
resp,53,2,25,3,0.033,0.01,100,112.48
resp,54,2,26,3,0.033,0.01,100,112.48
resp,55,2,27,3,0.033,0.01,100,112.48

prod,61,31,,,rs_pt_180_460-X,,,1/g
prod,62,32,,,rs_pt_180_354-X,,,1/g
prod,63,33,,,rs_pt_180_260-X,,,1/g
prod,64,34,,,rs_pt_180_123-X,,,1/g
prod,65,35,,,rs_pt_180_12-X,,,1/g
prod,71,41,,,rs_pt_180_460-y,,,1/g
prod,72,42,,,rs_pt_180_354-y,,,1/g
prod,73,43,,,rs_pt_180_260-y,,,1/g
prod,74,44,,,rs_pt_180_123-y,,,1/g
prod,75,45,,,rs_pt_180_12-y,,,1/g
prod,81,51,,,rs_pt_180_460-z,,,1/g
prod,82,52,,,rs_pt_180_354-z,,,1/g
prod,83,53,,,rs_pt_180_260-z,,,1/g
prod,84,54,,,rs_pt_180_123-z,,,1/g
prod,85,55,,,rs_pt_180_12-z,,,1/g


lines,200
/out,RS-PT-180,out
prvar,2,61,62,63,64,65
prvar,2,71,72,73,74,75
prvar,2,81,82,83,84,85
/out

deriv,91,3,1,,vx3
deriv,92,4,1,,vx4
deriv,93,5,1,,vx5
deriv,94,6,1,,vx6
deriv,95,7,1,,vx7

deriv,101,13,1,,vy13
deriv,102,14,1,,vy14
deriv,103,15,1,,vy15
deriv,104,16,1,,vy16
deriv,105,71,1,,vy17

deriv,111,23,1,,vz23
deriv,112,24,1,,vz24
deriv,113,25,1,,vz25
deriv,114,26,1,,vz26
deriv,115,27,1,,vz27

deriv,121,91,1,,a_pt_180_460-x,,,1/g
deriv,122,92,1,,a_pt_180_354-x,,,1/g
deriv,123,93,1,,a_pt_180_260-x,,,1/g
deriv,124,94,1,,a_pt_180_123-x,,,1/g
deriv,125,95,1,,a_pt_180_12-x,,,1/g

deriv,131,101,1,,a_pt_180_460-y,,,1/g
deriv,132,102,1,,a_pt_180_354-y,,,1/g
deriv,133,103,1,,a_pt_180_260-y,,,1/g
deriv,134,104,1,,a_pt_180_123-y,,,1/g
deriv,135,105,1,,a_pt_180_12-y,,,1/g

deriv,141,111,1,,a_pt_180_460-z,,,1/g
deriv,142,112,1,,a_pt_180_354-z,,,1/g
deriv,143,113,1,,a_pt_180_260-z,,,1/g
deriv,144,114,1,,a_pt_180_123-z,,,1/g
deriv,145,115,1,,a_pt_180_12-z,,,1/g

lines,2250
/out,Disp-PT-180,out
prvar,3,4,5,6,7
prvar,13,14,15,16,17
prvar,23,24,25,26,27
/out

/out,Vel-PT-180,out
prvar,91,92,93,94,95
prvar,101,102,103,104,105
prvar,111,112,113,114,115
/out

/out,Accel-PT-180,out
prvar,121,122,123,124,125
prvar,131,132,133,134,135
prvar,141,142,143,144,145
/out
```

spectra-primary-45.txt

```
fini

/POST26
numvar,120
*do,z,2,120
VARDEL,z
*enddo

csys,1
cmsel,s,primary-tank
nsle
nsel,r,loc,x,ptx(12)
nsel,r,loc,y,-45
nsel,r,loc,z,ptz(12)
*get,pt_45_460,node,,num,max

cmsel,s,primary-tank
nsle
nsel,r,loc,x,ptx(18)
nsel,r,loc,y,-45
nsel,r,loc,z,ptz(18)
*get,pt_45_354,node,,num,max
```

```
cmsel,s,primary-tank
nsle
nsel,r,loc,x,ptx(22)
nsel,r,loc,y,-45
nsel,r,loc,z,ptz(22)
*get,pt_45_260,node,,num,max

cmsel,s,primary-tank
nsle
nsel,r,loc,x,ptx(28)
nsel,r,loc,y,-45
nsel,r,loc,z,ptz(28)
*get,pt_45_123,node,,num,max

cmsel,s,primary-tank
nsle
nsel,r,loc,x,ptx(33)
nsel,r,loc,y,-45
nsel,r,loc,z,ptz(33)
*get,pt_45_12,node,,num,max

nsol,3,pt_45_460,u,x,N_%(pt_45_460)%X
nsol,4,pt_45_354,u,x,N_%(pt_45_354)%X
nsol,5,pt_45_260,u,x,N_%(pt_45_260)%X
nsol,6,pt_45_123,u,x,N_%(pt_45_123)%X
nsol,7,pt_45_12,u,x,N_%(pt_45_12)%X

nsol,13,pt_45_460,u,y,N_%(pt_45_460)%y
nsol,14,pt_45_354,u,y,N_%(pt_45_354)%y
nsol,15,pt_45_260,u,y,N_%(pt_45_260)%y
nsol,16,pt_45_123,u,y,N_%(pt_45_123)%y
nsol,17,pt_45_12,u,y,N_%(pt_45_12)%y

nsol,23,pt_45_460,u,z,N_%(pt_45_460)%z
nsol,24,pt_45_354,u,z,N_%(pt_45_354)%z
nsol,25,pt_45_260,u,z,N_%(pt_45_260)%z
nsol,26,pt_45_123,u,z,N_%(pt_45_123)%z
nsol,27,pt_45_12,u,z,N_%(pt_45_12)%z

/input,rs_freq,txt

resp,31,2,3,3,0.033,0.01,100,112.48
resp,32,2,4,3,0.033,0.01,100,112.48
resp,33,2,5,3,0.033,0.01,100,112.48
resp,34,2,6,3,0.033,0.01,100,112.48
resp,35,2,7,3,0.033,0.01,100,112.48
resp,41,2,13,3,0.033,0.01,100,112.48
resp,42,2,14,3,0.033,0.01,100,112.48
resp,43,2,15,3,0.033,0.01,100,112.48
resp,44,2,16,3,0.033,0.01,100,112.48
resp,45,2,17,3,0.033,0.01,100,112.48
resp,51,2,23,3,0.033,0.01,100,112.48
resp,52,2,24,3,0.033,0.01,100,112.48
resp,53,2,25,3,0.033,0.01,100,112.48
resp,54,2,26,3,0.033,0.01,100,112.48
resp,55,2,27,3,0.033,0.01,100,112.48

prod,61,31,,,rs_pt_45_460-X,,,1/g
prod,62,32,,,rs_pt_45_354-X,,,1/g
prod,63,33,,,rs_pt_45_260-X,,,1/g
prod,64,34,,,rs_pt_45_123-X,,,1/g
prod,65,35,,,rs_pt_45_12-X,,,1/g
prod,71,41,,,rs_pt_45_460-y,,,1/g
prod,72,42,,,rs_pt_45_354-y,,,1/g
prod,73,43,,,rs_pt_45_260-y,,,1/g
prod,74,44,,,rs_pt_45_123-y,,,1/g
prod,75,45,,,rs_pt_45_12-y,,,1/g
prod,81,51,,,rs_pt_45_460-z,,,1/g
prod,82,52,,,rs_pt_45_354-z,,,1/g
prod,83,53,,,rs_pt_45_260-z,,,1/g
prod,84,54,,,rs_pt_45_123-z,,,1/g
prod,85,55,,,rs_pt_45_12-z,,,1/g


lines,200
/out,RS-PT-45,out
prvar,2,61,62,63,64,65
prvar,2,71,72,73,74,75
prvar,2,81,82,83,84,85
/out

deriv,91,3,1,,vx3
deriv,92,4,1,,vx4
deriv,93,5,1,,vx5
deriv,94,6,1,,vx6
deriv,95,7,1,,vx7

deriv,101,13,1,,vy13
deriv,102,14,1,,vy14
deriv,103,15,1,,vy15
deriv,104,16,1,,vy16
deriv,105,71,1,,vy17

deriv,111,23,1,,vz23
deriv,112,24,1,,vz24
deriv,113,25,1,,vz25
deriv,114,26,1,,vz26
deriv,115,27,1,,vz27

deriv,121,91,1,,a_pt_45_460-x,,,1/g
deriv,122,92,1,,a_pt_45_354-x,,,1/g
deriv,123,93,1,,a_pt_45_260-x,,,1/g
deriv,124,94,1,,a_pt_45_123-x,,,1/g
deriv,125,95,1,,a_pt_45_12-x,,,1/g

deriv,131,101,1,,a_pt_45_460-y,,,1/g
deriv,132,102,1,,a_pt_45_354-y,,,1/g
deriv,133,103,1,,a_pt_45_260-y,,,1/g
deriv,134,104,1,,a_pt_45_123-y,,,1/g
deriv,135,105,1,,a_pt_45_12-y,,,1/g

deriv,141,111,1,,a_pt_45_460-z,,,1/g
deriv,142,112,1,,a_pt_45_354-z,,,1/g
deriv,143,113,1,,a_pt_45_260-z,,,1/g
deriv,144,114,1,,a_pt_45_123-z,,,1/g
deriv,145,115,1,,a_pt_45_12-z,,,1/g

lines,2150
/out,Disp-PT-45,out
prvar,3,4,5,6,7
prvar,13,14,15,16,17
prvar,23,24,25,26,27
/out

/out,Vel-PT-45,out
prvar,91,92,93,94,95
prvar,101,102,103,104,105
prvar,111,112,113,114,115
/out

/out,Accel-PT-45,out
prvar,121,122,123,124,125
prvar,131,132,133,134,135
prvar,141,142,143,144,145
/out
```

spectra-primary-90.txt

```
fini
```

```
/POST26
numvar,120
*do,z,2,120
VARDEL,z
*enddo

csys,1
cmsel,s,primary-tank
nsle
nsel,r,loc,x,ptx(12)
nsel,r,loc,y,-90
nsel,r,loc,z,ptz(12)
*get,pt_90_460,node,,num,max

cmsel,s,primary-tank
nsle
nsel,r,loc,x,ptx(18)
nsel,r,loc,y,-90
nsel,r,loc,z,ptz(18)
*get,pt_90_354,node,,num,max

cmsel,s,primary-tank
nsle
nsel,r,loc,x,ptx(22)
nsel,r,loc,y,-90
nsel,r,loc,z,ptz(22)
*get,pt_90_260,node,,num,max

cmsel,s,primary-tank
nsle
nsel,r,loc,x,ptx(28)
nsel,r,loc,y,-90
nsel,r,loc,z,ptz(28)
*get,pt_90_123,node,,num,max

cmsel,s,primary-tank
nsle
nsel,r,loc,x,ptx(33)
nsel,r,loc,y,-90
nsel,r,loc,z,ptz(33)
*get,pt_90_12,node,,num,max

nsol,3,pt_90_460,u,x,N_%(pt_90_460)%X
nsol,4,pt_90_354,u,x,N_%(pt_90_354)%X
nsol,5,pt_90_260,u,x,N_%(pt_90_260)%X
nsol,6,pt_90_123,u,x,N_%(pt_90_123)%X
nsol,7,pt_90_12,u,x,N_%(pt_90_12)%X

nsol,13,pt_90_460,u,y,N_%(pt_90_460)%y
nsol,14,pt_90_354,u,y,N_%(pt_90_354)%y
nsol,15,pt_90_260,u,y,N_%(pt_90_260)%y
nsol,16,pt_90_123,u,y,N_%(pt_90_123)%y
nsol,17,pt_90_12,u,y,N_%(pt_90_12)%y

nsol,23,pt_90_460,u,z,N_%(pt_90_460)%z
nsol,24,pt_90_354,u,z,N_%(pt_90_354)%z
nsol,25,pt_90_260,u,z,N_%(pt_90_260)%z
nsol,26,pt_90_123,u,z,N_%(pt_90_123)%z
nsol,27,pt_90_12,u,z,N_%(pt_90_12)%z

/input,rs_freq,txt

resp,31,2,3,3,0.033,0.01,100,112.48
resp,32,2,4,3,0.033,0.01,100,112.48
resp,33,2,5,3,0.033,0.01,100,112.48
resp,34,2,6,3,0.033,0.01,100,112.48
resp,35,2,7,3,0.033,0.01,100,112.48
resp,41,2,13,3,0.033,0.01,100,112.48
resp,42,2,14,3,0.033,0.01,100,112.48
resp,43,2,15,3,0.033,0.01,100,112.48
resp,44,2,16,3,0.033,0.01,100,112.48
resp,45,2,17,3,0.033,0.01,100,112.48
resp,51,2,23,3,0.033,0.01,100,112.48
resp,52,2,24,3,0.033,0.01,100,112.48
resp,53,2,25,3,0.033,0.01,100,112.48
resp,54,2,26,3,0.033,0.01,100,112.48
resp,55,2,27,3,0.033,0.01,100,112.48

prod,61,31,,,rs_pt_90_460-X,,,1/g
prod,62,32,,,rs_pt_90_354-X,,,1/g
prod,63,33,,,rs_pt_90_260-X,,,1/g
prod,64,34,,,rs_pt_90_123-X,,,1/g
prod,65,35,,,rs_pt_90_12-X,,,1/g
prod,71,41,,,rs_pt_90_460-y,,,1/g
prod,72,42,,,rs_pt_90_354-y,,,1/g
prod,73,43,,,rs_pt_90_260-y,,,1/g
prod,74,44,,,rs_pt_90_123-y,,,1/g
prod,75,45,,,rs_pt_90_12-y,,,1/g
prod,81,51,,,rs_pt_90_460-z,,,1/g
prod,82,52,,,rs_pt_90_354-z,,,1/g
prod,83,53,,,rs_pt_90_260-z,,,1/g
prod,84,54,,,rs_pt_90_123-z,,,1/g
prod,85,55,,,rs_pt_90_12-z,,,1/g


lines,200
/out,RS-PT-90,out
prvar,2,61,62,63,64,65
prvar,2,71,72,73,74,75
prvar,2,81,82,83,84,85
/out

deriv,91,3,1,,vx3
deriv,92,4,1,,vx4
deriv,93,5,1,,vx5
deriv,94,6,1,,vx6
deriv,95,7,1,,vx7

deriv,101,13,1,,vy13
deriv,102,14,1,,vy14
deriv,103,15,1,,vy15
deriv,104,16,1,,vy16
deriv,105,71,1,,vy17

deriv,111,23,1,,vz23
deriv,112,24,1,,vz24
deriv,113,25,1,,vz25
deriv,114,26,1,,vz26
deriv,115,27,1,,vz27

deriv,121,91,1,,a_pt_90_460-x,,,1/g
deriv,122,92,1,,a_pt_90_354-x,,,1/g
deriv,123,93,1,,a_pt_90_260-x,,,1/g
deriv,124,94,1,,a_pt_90_123-x,,,1/g
deriv,125,95,1,,a_pt_90_12-x,,,1/g

deriv,131,101,1,,a_pt_90_460-y,,,1/g
deriv,132,102,1,,a_pt_90_354-y,,,1/g
deriv,133,103,1,,a_pt_90_260-y,,,1/g
deriv,134,104,1,,a_pt_90_123-y,,,1/g
deriv,135,105,1,,a_pt_90_12-y,,,1/g

deriv,141,111,1,,a_pt_90_460-z,,,1/g
deriv,142,112,1,,a_pt_90_354-z,,,1/g
deriv,143,113,1,,a_pt_90_260-z,,,1/g
deriv,144,114,1,,a_pt_90_123-z,,,1/g
deriv,145,115,1,,a_pt_90_12-z,,,1/g

lines,2250
```

```
/out,Disp-PT-90,out
prvar,3,4,5,6,7
prvar,13,14,15,16,17
prvar,23,24,25,26,27
/out

/out,Vel-PT-90,out
prvar,91,92,93,94,95
prvar,101,102,103,104,105
prvar,111,112,113,114,115
/out

/out,Accel-PT-90,out
prvar,121,122,123,124,125
prvar,131,132,133,134,135
prvar,141,142,143,144,145
/out
```

spectra-soil.txt

```
fini

/POST26
numvar,200
*do,z,2,200
VARDEL,z
*enddo

esel,s,type,,9
nsle
csys,1
nsel,r,loc,x,soil_radius
nsel,r,loc,y,0
nsel,r,loc,z,soilz(1)
*get,Soil_Surf,node,,num,max

nsle
nsel,r,loc,x,Soil_radius
nsel,r,loc,y,0
nsel,r,loc,z,soilz(3)
*get,Soil_Tank_top,node,,num,max

nsle
nsel,r,loc,x,Soil_radius
nsel,r,loc,y,0
nsel,r,loc,z,soilz(6)
*get,Soil_Tank_mid,node,,num,max

nsle
nsel,r,loc,x,soil_radius
nsel,r,loc,y,0
nsel,r,loc,z,soilz(9)
*get,Soil_Tank_bot,node,,num,max

nsle
nsel,r,loc,x,Soil_radius
nsel,r,loc,y,0
nsel,r,loc,z,soilz(20)
*get,Soil_Bottom,node,,num,max

nsol,3,Soil_Surf,u,x,N_%(Soil_Surf)%X
nsol,4,Soil_Tank_top,u,x,N_%(Soil_Tank_to
p)%X
nsol,5,Soil_Tank_mid,u,x,N_%(Soil_Tank_mi
d)%X
nsol,6,Soil_Tank_bot,u,x,N_%(Soil_Tank_bo
t)%X
nsol,7,Soil_Bottom,u,x,N_%(Soil_Bottom)%X
nsol,13,Soil_Surf,u,y,N_%(Soil_Surf)%y
nsol,14,Soil_Tank_top,u,y,N_%(Soil_Tank_t
op)%y
nsol,15,Soil_Tank_mid,u,y,N_%(Soil_Tank_m
id)%y
nsol,16,Soil_Tank_bot,u,y,N_%(Soil_Tank_b
ot)%y
nsol,17,Soil_Bottom,u,y,N_%(Soil_Bottom)%
y

nsol,23,Soil_Surf,u,z,N_%(Soil_Surf)%z
nsol,24,Soil_Tank_top,u,z,N_%(Soil_Tank_t
op)%z
nsol,25,Soil_Tank_mid,u,z,N_%(Soil_Tank_m
id)%z
nsol,26,Soil_Tank_bot,u,z,N_%(Soil_Tank_b
ot)%z
nsol,27,Soil_Bottom,u,z,N_%(Soil_Bottom)%
z

/input,rs_freq,txt

resp,31,2,3,3,0.05,0.01,100,120.48
resp,32,2,4,3,0.05,0.01,100,120.48
resp,33,2,5,3,0.05,0.01,100,120.48
resp,34,2,6,3,0.05,0.01,100,120.48
resp,35,2,7,3,0.05,0.01,100,120.48
resp,41,2,13,3,0.05,0.01,100,120.48
resp,42,2,14,3,0.05,0.01,100,120.48
resp,43,2,15,3,0.05,0.01,100,120.48
resp,44,2,16,3,0.05,0.01,100,120.48
resp,45,2,17,3,0.05,0.01,100,120.48
resp,51,2,23,3,0.05,0.01,100,120.48
resp,52,2,24,3,0.05,0.01,100,120.48
resp,53,2,25,3,0.05,0.01,100,120.48
resp,54,2,26,3,0.05,0.01,100,120.48
resp,55,2,27,3,0.05,0.01,100,120.48

prod,61,31,,,rs_Soil_Surf-X,,,1/g
prod,62,32,,,rs_Soil_Tank_top-X,,,1/g
prod,63,33,,,rs_Soil_Tank_mid-X,,,1/g
prod,64,34,,,rs_Soil_Tank_bot-X,,,1/g
prod,65,35,,,rs_Soil_Bottom-X,,,1/g
prod,71,41,,,rs_Soil_Surf-y,,,1/g
prod,72,42,,,rs_Soil_Tank_top-y,,,1/g
prod,73,43,,,rs_Soil_Tank_mid-y,,,1/g
prod,74,44,,,rs_Soil_Tank_bot-y,,,1/g
prod,75,45,,,rs_Soil_Bottom-y,,,1/g
prod,81,51,,,rs_Soil_Surf-z,,,1/g
prod,82,52,,,rs_Soil_Tank_top-z,,,1/g
prod,83,53,,,rs_Soil_Tank_mid-z,,,1/g
prod,84,54,,,rs_Soil_Tank_bot-z,,,1/g
prod,85,55,,,rs_Soil_Bottom-z,,,1/g


lines,200
/out,RS-SOil,out
prvar,2,61,62,63,64,65
prvar,2,71,72,73,74,75
prvar,2,81,82,83,84,85
/out

deriv,91,3,1,,vx3
deriv,92,4,1,,vx4
deriv,93,5,1,,vx5
deriv,94,6,1,,vx6
deriv,95,7,1,,vx7

deriv,101,13,1,,vy13
deriv,102,14,1,,vy14
```

```
deriv,103,15,1,,vy15
deriv,104,16,1,,vy16
deriv,105,71,1,,vy17

deriv,111,23,1,,vz23
deriv,112,24,1,,vz24
deriv,113,25,1,,vz25
deriv,114,26,1,,vz26
deriv,115,27,1,,vz27

deriv,121,91,1,,a_Soil_Surf-x,,,1/g
deriv,122,92,1,,a_Soil_Tank_top-x,,,1/g
deriv,123,93,1,,a_Soil_Tank_mid-x,,,1/g
deriv,124,94,1,,a_Soil_Tank_bot-x,,,1/g
deriv,125,95,1,,a_Soil_Bottom-x,,,1/g

deriv,131,101,1,,a_Soil_Surf-y,,,1/g
deriv,132,102,1,,a_Soil_Tank_top-y,,,1/g
deriv,133,103,1,,a_Soil_Tank_mid-y,,,1/g
deriv,134,104,1,,a_Soil_Tank_bot-y,,,1/g
deriv,135,105,1,,a_Soil_Bottom-y,,,1/g

deriv,141,111,1,,a_Soil_Surf-z,,,1/g
deriv,142,112,1,,a_Soil_Tank_top-z,,,1/g
deriv,143,113,1,,a_Soil_Tank_mid-z,,,1/g
deriv,144,114,1,,a_Soil_Tank_bot-z,,,1/g
deriv,145,115,1,,a_Soil_Bottom-z,,,1/g

lines,2150
/out,Disp-Soil,out
prvar,3,4,5,6,7
prvar,13,14,15,16,17
prvar,23,24,25,26,27
/out

/out,Vel-Soil,out
prvar,91,92,93,94,95
prvar,101,102,103,104,105
prvar,111,112,113,114,115
/out

/out,Accel-SOil,out
prvar,121,122,123,124,125
prvar,131,132,133,134,135
prvar,141,142,143,144,145
/out
```

strain-backed-principle-bot.txt

```
/post26
numvar,200
*do,z,2,200
VARDEL,z
*enddo

csys,1
*do,i,1,20
angley=-arcsize*(i-1)
*do,j,2,10
cmsel,s,strain-1
!shell,bot
nsle
nsel,r,loc,y,angley,angley-arcsize
nsel,r,loc,x,ptx(j),ptx(j+1)
nsel,r,loc,z,ptz(j)+.1,ptz(j+1)-.1
esln,r,1
*get,emax,elem,,num,max
esol,(1+j),(emax),,epel,1,epel1%(emax)%-b
esol,(44+j),(emax),,epel,2,epel2%(emax)%-
b
esol,(87+j),(emax),,epel,int,epelint%(ema
x)%-b
esol,(130+j),(emax),,epel,3,epel3%(emax)%
-b
*enddo

*do,j,11,20
cmsel,s,strain-2
nsle
shell,bot
nsel,r,loc,y,angley,angley-arcsize
nsel,r,loc,x,ctx(j),ctx(j+1)
nsel,r,loc,z,ctz(j)+.1,ctz(j+1)-.1
esln,r,1
*get,emax,elem,,num,max
esol,(1+j),(emax),,epel,1,epel1%(emax)%-b
esol,(44+j),(emax),,epel,2,epel2%(emax)%-
b
esol,(87+j),(emax),,epel,int,epelint%(ema
x)%-b
esol,(130+j),(emax),,epel,3,epel3%(emax)%
-b
*enddo


*do,j,21,23
cmsel,s,strain-3
shell,bot
nsle
nsel,r,loc,y,angley,angley-arcsize
nsel,r,loc,x,linx(j-19),linx(j+1-19)
nsel,r,loc,z,linz(j-19)+.1,linz(j+1-19)-
.1
esln,r,1
*get,emax,elem,,num,max
esol,(1+j),(emax),,epel,1,epel1%(emax)%-b
esol,(44+j),(emax),,epel,2,epel2%(emax)%-
b
esol,(87+j),(emax),,epel,int,epelint%(ema
x)%-b
esol,(130+j),(emax),,epel,3,epel3%(emax)%
-b
*enddo

!*do,j,24,32
!cmsel,s,strain-4
!shell,top
!nsle
!nsel,r,loc,y,angley,angley-arcsize
!nsel,r,loc,x,ctx(j),ctx(j+1)
!nsel,r,loc,z,ctz(j)+.1,ctz(j+1)-.1
!esln,r,1
!*get,emax,elem,,num,max
!esol,(1+j),(emax),,epel,1,epel1%(emax)%-
b
!esol,(44+j),(emax),,epel,2,epel2%(emax)%
-b
!esol,(87+j),(emax),,epel,int,epelint%(em
ax)%-b
!esol,(130+j),(emax),,epel,3,epel3%(emax)
%-b
!*enddo

LINES,2050
extrem
/OUT,Strain-Backed-Princ_%(9*i)%-bot-
max,OUT
extrem,2,200
```

```
/OUT

/OUT,Strain-Backed-Princ_%(9*i)%-bot-
th,OUT
*do,k,2,32
PRVAR,1+k,44+k,87+k,130+k
*enddo
/OUT

*enddo
```

strain-backed-principle-mid.txt

```
/post26
numvar,200
*do,z,2,200
VARDEL,z
*enddo

csys,1
*do,i,1,20
angley=-arcsize*(i-1)
*do,j,2,10
cmsel,s,strain-1
!shell,mid
nsle
nsel,r,loc,y,angley,angley-arcsize
nsel,r,loc,x,ptx(j),ptx(j+1)
nsel,r,loc,z,ptz(j)+.1,ptz(j+1)-.1
esln,r,1
*get,emax,elem,,num,max
esol,(1+j),(emax),,epel,1,epel1%(emax)%-m
esol,(44+j),(emax),,epel,2,epel2%(emax)%-
m
esol,(87+j),(emax),,epel,int,epelint%(ema
x)%-m
esol,(130+j),(emax),,epel,3,epel3%(emax)%
-m
*enddo

!*do,j,11,20
!cmsel,s,strain-2
!nsle
!shell,bot
!nsel,r,loc,y,angley,angley-arcsize
!nsel,r,loc,x,ctx(j),ctx(j+1)
!nsel,r,loc,z,ctz(j)+.1,ctz(j+1)-.1
!esln,r,1
!*get,emax,elem,,num,max
!esol,(1+j),(emax),,epel,1,epel1%(emax)%-
m
!esol,(44+j),(emax),,epel,2,epel2%(emax)%
-m
!esol,(87+j),(emax),,epel,int,epelint%(em
ax)%-m
!esol,(130+j),(emax),,epel,3,epel3%(emax)
%-m
!*enddo


*do,j,21,23
cmsel,s,strain-3
!shell,mid
nsle
nsel,r,loc,y,angley,angley-arcsize
nsel,r,loc,x,linx(j-19),linx(j+1-19)
nsel,r,loc,z,linz(j-19)+.1,linz(j+1-19)-
.1
esln,r,1
*get,emax,elem,,num,max
esol,(1+j),(emax),,epel,1,epel1%(emax)%-m
esol,(44+j),(emax),,epel,2,epel2%(emax)%-
m
esol,(87+j),(emax),,epel,int,epelint%(ema
x)%-m
esol,(130+j),(emax),,epel,3,epel3%(emax)%
-m
*enddo

!*do,j,24,32
!cmsel,s,strain-4
!shell,top
!nsle
!nsel,r,loc,y,angley,angley-arcsize
!nsel,r,loc,x,ctx(j),ctx(j+1)
!nsel,r,loc,z,ctz(j)+.1,ctz(j+1)-.1
!esln,r,1
!*get,emax,elem,,num,max
!esol,(1+j),(emax),,epel,1,epel1%(emax)%-
m
!esol,(44+j),(emax),,epel,2,epel2%(emax)%
-m
!esol,(87+j),(emax),,epel,int,epelint%(em
ax)%-m
!esol,(130+j),(emax),,epel,3,epel3%(emax)
%-m
!*enddo

LINES,2050
extrem
/OUT,Strain-Backed-Princ_%(9*i)%max,OUT
extrem,2,200
/OUT

/OUT,Strain-Backed-Princ_%(9*i)%th,OUT
*do,k,2,32
PRVAR,1+k,44+k,87+k,130+k
*enddo
/OUT

*enddo
```

strain-backed-principle-top.txt

```
/post26
numvar,200
*do,z,2,200
VARDEL,z
*enddo

csys,1
*do,i,1,20
angley=-arcsize*(i-1)
*do,j,2,10
cmsel,s,strain-1
!shell,top
nsle
nsel,r,loc,y,angley,angley-arcsize
nsel,r,loc,x,ptx(j),ptx(j+1)
nsel,r,loc,z,ptz(j)+.1,ptz(j+1)-.1
esln,r,1
*get,emax,elem,,num,max
esol,(1+j),(emax),,epel,1,epel1%(emax)%-t
esol,(44+j),(emax),,epel,2,epel2%(emax)%-
t
esol,(87+j),(emax),,epel,int,epelint%(ema
x)%-t
```

```
esol,(130+j),(emax),,epel,3,epel3%(emax)%
-t
*enddo

!*do,j,11,20
!cmsel,s,strain-2
!nsle
!shell,bot
!nsel,r,loc,y,angley,angley-arcsize
!nsel,r,loc,x,ctx(j),ctx(j+1)
!nsel,r,loc,z,ctz(j)+.1,ctz(j+1)-.1
!esln,r,1
!*get,emax,elem,,num,max
!esol,(1+j),(emax),,epel,1,epel1%(emax)%-
t
!esol,(44+j),(emax),,epel,2,epel2%(emax)%
-t
!esol,(87+j),(emax),,epel,int,epelint%(em
ax)%-t
!esol,(130+j),(emax),,epel,3,epel3%(emax)
%-t
!*enddo


*do,j,21,23
cmsel,s,strain-3
!shell,top
nsle
nsel,r,loc,y,angley,angley-arcsize
nsel,r,loc,x,linx(j-19),linx(j+1-19)
nsel,r,loc,z,linz(j-19)+.1,linz(j+1-19)-
.1
esln,r,1
*get,emax,elem,,num,max
esol,(1+j),(emax),,epel,1,epel1%(emax)%-t
esol,(44+j),(emax),,epel,2,epel2%(emax)%-
t
esol,(87+j),(emax),,epel,int,epelint%(ema
x)%-t
esol,(130+j),(emax),,epel,3,epel3%(emax)%
-t
*enddo

*do,j,24,32
cmsel,s,strain-4
!shell,top
nsle
nsel,r,loc,y,angley,angley-arcsize
nsel,r,loc,x,ctx(j),ctx(j+1)
nsel,r,loc,z,ctz(j)+.1,ctz(j+1)-.1
esln,r,1
*get,emax,elem,,num,max
esol,(1+j),(emax),,epel,1,epel1%(emax)%-t
esol,(44+j),(emax),,epel,2,epel2%(emax)%-
t
esol,(87+j),(emax),,epel,int,epelint%(ema
x)%-t
esol,(130+j),(emax),,epel,3,epel3%(emax)%
-t
*enddo

LINES,2050
extrem
/OUT,Strain-Backed-Princ_%(9*i)%-Top-
max,OUT
extrem,2,200
/OUT

/OUT,Strain-Backed-Princ_%(9*i)%-Top-
th,OUT
*do,k,2,32
PRVAR,1+k,44+k,87+k,130+k
*enddo
/OUT

*enddo
```

strain-backed-principle.txt

```
! Primary Tank in dome
cmsel,s,primary-tank
nsle
nsel,r,loc,x,ptx(2),ptx(11)
nsel,r,loc,z,ptz(2),ptz(11)
esln,r,1
cm,strain-1,elem

cmsel,s,conc-tank
nsle
nsel,r,loc,x,ctx(11),ctx(21)
nsel,r,loc,z,ctz(11),ctz(21)
esln,r,1
cm,strain-2,elem

*dim,linx,,20
*dim,linz,,20

linx(1)=ctx(20),ctx(21),ctx(22),ctx(22)-
0.2929,ctx(22)-
1,ctx(25),ctx(26),ctx(27),ctx(28),ctx(29)
linx(11)=ctx(30),ctx(31),ctx(32),ctx(33),
ctx(34)

linz(1)=ctz(20),ctz(21),-56.643,-
57.350,ctz(24),ctz(25),ctz(26),ctz(27),ct
z(28),ctz(29)
linz(11)=ctz(30),ctz(31),ctz(32),ctz(33),
ctz(34)

cmsel,s,liner
nsle
nsel,r,loc,x,linx(2),linx(5)
nsel,r,loc,z,linz(2),linz(5)
esln,r,1
cm,strain-3,elem

cmsel,s,conc-tank
nsle
nsel,r,loc,x,ctx(24),ctx(33)
nsel,r,loc,z,ctz(24),ctz(33)
esln,r,1
cm,strain-4,elem

/post26
shell,bot
/input,strain-backed-Principle-Bot,txt
shell,mid
/input,strain-backed-Principle-Mid,txt
shell,top
/input,strain-backed-Principle-Top,txt
```

stress-compb.txt

```
/post26

*do,z,2,200
VARDEL,z
```

```
*enddo
csys,1
*do,i,1,20
angley=-arcsize*(i-1)
*do,j,2,42
cmsel,s,primary-tank
nsle
nsel,r,loc,y,angley,angley-arcsize
nsel,r,loc,x,ptx(j),ptx(j+1)
nsel,r,loc,z,ptz(j)+.1,ptz(j+1)-.1
esln,r,1
*get,emax,elem,,num,max
esol,(1+j),(emax),,s,x,sx%(emax)%-b
esol,(44+j),(emax),,s,y,sy%(emax)%-b
esol,(87+j),(emax),,s,int,sint%(emax)%-b
esol,(130+j),(emax),,s,xy,sxy%(emax)%-b
*enddo

LINES,2150
extrem
/OUT,Stress-pt_%(9*i)%max-b,OUT
extrem,2,200
/OUT

/OUT,Stress-pt_%(9*i)%th-b,OUT
*do,k,2,42
PRVAR,1+k,44+k,87+k,130+k
*enddo
/OUT

*enddo
```

stress-compm.txt

```
/post26
numvar,200
*do,z,2,200
VARDEL,z
*enddo
csys,1
*do,i,1,20
angley=-arcsize*(i-1)
*do,j,2,42
cmsel,s,primary-tank
nsle
nsel,r,loc,y,angley,angley-arcsize
nsel,r,loc,x,ptx(j),ptx(j+1)
nsel,r,loc,z,ptz(j)+.1,ptz(j+1)-.1
esln,r,1
*get,emax,elem,,num,max
esol,(1+j),(emax),,s,x,sx%(emax)%-m
esol,(44+j),(emax),,s,y,sy%(emax)%-m
esol,(87+j),(emax),,s,int,sint%(emax)%-m
esol,(130+j),(emax),,s,xy,sxy%(emax)%-m
*enddo

LINES,2150
extrem
/OUT,Stress-pt_%(9*i)%max-m,OUT
extrem,2,200
/OUT

/OUT,Stress-pt_%(9*i)%th-m,OUT
*do,k,2,42
PRVAR,1+k,44+k,87+k,130+k
*enddo
/OUT

*enddo
```

stress-compt.txt

```
/post26

*do,z,2,200
VARDEL,z
*enddo
csys,1
*do,i,1,20
angley=-arcsize*(i-1)
*do,j,2,42
cmsel,s,primary-tank
nsle
nsel,r,loc,y,angley,angley-arcsize
nsel,r,loc,x,ptx(j),ptx(j+1)
nsel,r,loc,z,ptz(j)+.1,ptz(j+1)-.1
esln,r,1
*get,emax,elem,,num,max
esol,(1+j),(emax),,s,x,sx%(emax)%-t
esol,(43+j),(emax),,s,y,sy%(emax)%-t
esol,(87+j),(emax),,s,int,sint%(emax)%-t
esol,(130+j),(emax),,s,xy,sxy%(emax)%-t
*enddo

LINES,2150
extrem
/OUT,Stress-pt_%(9*i)%max-t,OUT
extrem,2,200
/OUT

/OUT,Stress-pt_%(9*i)%th-t,OUT
*do,k,2,42
PRVAR,1+k,44+k,87+k,130+k
*enddo
/OUT

*enddo
```

Stress-Primary.txt

```
! extract primary tank stress components
at the top, middel and bottom surface of
the shell
/post26
numvar,200
shell,top
/input,stress-compt,txt

shell,mid
/input,stress-compm,txt

shell,bot
/input,stress-compb,txt
```

Tank-Coordinates-AP.txt

```
/COM - Definition of KeyPoints for
Primary tank

ct_kps=34      ! Total number of Concrete
tank Coordinate pairs
pt_kps=44      ! Total number of Primary
Tank Coordinate pairs
bm_kp=22       ! Coordinate pair at
bottom on concrete tank wall
```

```
tw=9          ! Rings in commmon for
insulating concrete
arcsize=9     ! Control for meshing,
section angle
Midsize=5     ! Control for meshing,
center areas
z_off=57.31   ! Vertical offset for tank
(bottom of primary tank is Z=0 for
coordinates)
C_Floor=-4


*dim,ctx,,ct_kps      ! Concrete Tank
Keypoint X Coordinates
*dim,ctz,,ct_kps      ! Concrete Tank
Keypoint Z Coordinates
*dim,ptx,,pt_kps      ! Primary Tank
Keypoint X Coordinates
*dim,ptz,,pt_kps      ! Primary Tank
Keypoint Z Coordinates

/COM - Define Horizontal Keypoint
Locations
ctx(1)=0
ctx(2)=45/12
ctx(3)=90.4/12
ctx(4)=120.72/12
ctx(5)=152.9/12
ctx(6)=211.4/12
ctx(7)=239.1/12
ctx(8)=306.63/12
ctx(9)=335.6/12
ctx(10)=393.7/12
ctx(11)=428.7/12
ctx(12)=469.9/12
ctx(13)=486.9/12
ctx(14)=489/12
ctx(15)=489/12
ctx(16)=489/12
ctx(17)=489/12
ctx(18)=489/12
ctx(19)=489/12
ctx(20)=489/12
ctx(21)=489/12
ctx(22)=489/12
ctx(23)=531/12
ctx(24)=489/12
ctx(25)=438/12
ctx(26)=423/12
ctx(27)=400/12
ctx(28)=340/12
ctx(29)=280/12
ctx(30)=220/12
ctx(31)=160/12
ctx(32)=100/12
ctx(33)=36/12
ctx(34)=0

/COM - Define Vertical Keypoint Locations

ctz(1)=576.8/12-z_off
ctz(2)=576/12-z_off
ctz(3)=573.8/12-z_off
ctz(4)=571.21/12-z_off
ctz(5)=567.7/12-z_off
ctz(6)=558.7/12-z_off
ctz(7)=553.2/12-z_off
ctz(8)=535.68/12-z_off
ctz(9)=526.2/12-z_off
ctz(10)=502.5/12-z_off
ctz(11)=484.2/12-z_off
ctz(12)=455.4/12-z_off
ctz(13)=415.1/12-z_off
ctz(14)=382.1/12-z_off
ctz(15)=335/12-z_off
ctz(16)=281/12-z_off
ctz(17)=236.5/12-z_off
ctz(18)=186.8/12-z_off
ctz(19)=145.5/12-z_off
ctz(20)=70/12-z_off
ctz(21)=(c_Floor+24)/12-z_off
ctz(22)=C_Floor/12-z_off
ctz(23)=C_Floor/12-z_off
ctz(24)=C_Floor/12-z_off
ctz(25)=C_Floor/12-z_off
ctz(26)=C_Floor/12-z_off
ctz(27)=C_Floor/12-z_off
ctz(28)=C_Floor/12-z_off
ctz(29)=C_Floor/12-z_off
ctz(30)=C_Floor/12-z_off
ctz(31)=C_Floor/12-z_off
ctz(32)=C_Floor/12-z_off
ctz(33)=C_Floor/12-z_off
ctz(34)=C_Floor/12-z_off

ptx(1)=0
ptx(2)=44.73689/12
ptx(3)=89.86533/12
ptx(4)=119.99721/12
ptx(5)=151.96854/12
ptx(6)=210.05344/12
ptx(7)=237.53366/12
ptx(8)=304.42488/12
ptx(9)=333.05132/12
ptx(10)=390.22141/12
ptx(11)=422.26434/12
ptx(12)=432/12
ptx(13)=444.36/12
ptx(14)=448.66/12
ptx(15)=450/12
ptx(16)=450/12
ptx(17)=450/12
ptx(18)=450/12
ptx(19)=450/12
ptx(20)=450/12
ptx(21)=450/12
ptx(22)=450/12
ptx(23)=450/12
ptx(24)=450/12
ptx(25)=450/12
ptx(26)=450/12
ptx(27)=450/12
ptx(28)=450/12
ptx(29)=450/12
ptx(30)=450/12
ptx(31)=450/12
ptx(32)=450/12
ptx(33)=450/12
ptx(34)=446.49/12
ptx(35)=438/12
ptx(36)=423/12
ptx(37)=400/12
ptx(38)=340/12
ptx(39)=280/12
ptx(40)=220/12
ptx(41)=160/12
ptx(42)=100/12
ptx(43)=36/12
ptx(44)=0
```

```
ptz(1)=569.30000/12-z_off
ptz(2)=568.50462/12-z_off
ptz(3)=566.31908/12-z_off
ptz(4)=563.74491/12-z_off
ptz(5)=560.25807/12-z_off
ptz(6)=551.32187/12-z_off
ptz(7)=545.86539/12-z_off
ptz(8)=528.51150/12-z_off
Ptz(9)=519.14633/12-z_off
ptz(10)=495.85550/12-z_off
ptz(11)=474.92388/12-z_off
ptz(12)=468/12-z_off
ptz(13)=456.7/12-z_off
ptz(14)=445.4/12-z_off
ptz(15)=432.3125/12-z_off
ptz(16)=410.125/12-z_off
ptz(17)=386.125/12-z_off
ptz(18)=362.125/12-z_off
ptz(19)=337.875/12-z_off
ptz(20)=314.775/12-z_off
ptz(21)=291.675/12-z_off
ptz(22)=268.575/12-z_off
ptz(23)=245.375/12-z_off
ptz(24)=222.275/12-z_off
ptz(25)=199.175/12-z_off
ptz(26)=176.075/12-z_off
ptz(27)=152.875/12-z_off
ptz(28)=131.275/12-z_off
ptz(29)=109.675/12-z_off
ptz(30)=88.075/12-z_off
ptz(31)=66.475/12-z_off
ptz(32)=45/12-z_off
ptz(33)=20/12-z_off
ptz(34)=11.51/12-z_off
ptz(35)=8/12-z_off
ptz(36)=8/12-z_off
ptz(37)=8/12-z_off
ptz(38)=8/12-z_off
ptz(39)=8/12-z_off
ptz(40)=8/12-z_off
ptz(41)=8/12-z_off
ptz(42)=8/12-z_off
ptz(43)=8/12-z_off
ptz(44)=8/12-z_off
```

Tank-Mesh1.txt

```
et,1,shell143          ! SHELL143
Elements for Concrete Tank
keyopt,1,3,2
keyopt,1,5,1


csys,1                 ! Cylindrical
Coordinates
/COM - Create KeyPoints for concrete tank
*do,i,1,ct_kps,1
k,i,ctx(i),0,ctz(i)
*enddo

/COM - Create lines from top of tank to
bottom of wall
*do,i,1,bm_kp-1,1
l,i,i+1
*enddo

/COM - Create lines from edge of
foundation to center
/COM - Wall and Foundation do not have
common lines
*do,i,bm_kp+1,ct_kps-1,1
l,i,i+1
*enddo

/COM - Create Areas for tank dome and
walls
lsel,s,line,,1,bm_kp-1
arotat,all,,,,,,1,ct_kps,180,2

/COM - Create areas for tank
foundation/floor
lsel,s,line,,bm_kp,ct_kps-2
arotat,all,,,,,,1,ct_kps,180,2

/COM - Assign Material and Real
Properties to areas
csys,1
*do,i,1,bm_kp-1,1
asel,s,loc,x,ctx(i),ctx(i+1)
asel,r,loc,z,ctz(i),ctz(i+1)
aatt,i,i,1
*enddo

asel,s,area,,1,2*(bm_kp-1)
CM,ctank-u,area

*do,i,bm_kp,ct_kps-2,1
asel,s,area,,bm_kp-1+i
asel,a,area,,ct_kps-2+i
aatt,i,i,1
*enddo

/COM - Create Elements
/COM - Elements at dome apex
esize,7                          ! Define
element maximum size
asel,s,loc,x,ctx(1),ctx(2)       ! Select
area at top
asel,r,loc,z,ctz(1),ctz(2)
lsla                             ! Select
lines from areas
lsel,r,loc,x,ctx(2)              ! Select
line at a radius of CTX(2)
lesize,all,,arcsize              ! Divide
line to match tank slices
lsla
lsel,u,loc,x,ctx(2)              ! Select
only interior lines
lesize,all,,,midsize             ! Define
element resolution
amesh,all                        ! Mesh area

/COM - Elements in dome and wall
*do,i,2,bm_kp-1,1
asel,s,loc,x,ctx(i),ctx(i+1)
asel,r,loc,z,ctz(i),ctz(i+1)
lsla
lsel,s,loc,x,ctx(i),ctx(i+1)
lsel,r,loc,z,ctz(i),ctz(i+1)
lesize,all,,arcsize
amesh,all
*enddo
cm,conc-dome_wall-n,node
cm,conc-dome_wall-e,elem

esel,none
nsel,none
*do,i,bm_kp+1,ct_kps-2,1
```

```
asel,s,area,,bm_kp-2+i
asel,a,area,,ct_kps-3+i
lsla
lsel,s,loc,x,ctx(i),ctx(i+1)
lsel,r,loc,z,ctz(i),ctz(i+1)
lesize,all,,arcsize
amesh,all
*enddo

/COM - Elements at floor center
asel,s,loc,x,ctx(ct_kps-1),ctx(ct_kps)
lsla
lsel,r,loc,x,ctx(ct_kps-1)
lesize,all,,arcsize
lsla
lsel,u,loc,x,ctx(ct_kps-1)
lesize,all,,,midsize
amesh,all
cm,conc-slab,node
cm,conc-floor-e,elem
allsel
cm,conc-tank,elem
cm,conc-tank-a,area

/COM - Create Component for Concrete
Wall/Floor Interface nodes
nsel,s,loc,z,ctz(bm_kp)
nsel,r,loc,x,ctx(bm_kp)
cm,Wall-int,node

allsel
*get,KMAXct,KP,0,num,max       ! Get
Maximum Keypoint Number
*get,LMAXct,LINE,0,num,max     ! Get
Maximum Line Number
*get,AMAXct,AREA,0,num,max     ! Get
Maximum Area Number
```

Waste-Reaction.txt

```
/post1
*dim,REACTX,,2149
*dim,REACTZ,,2149

cmsel,s,waste
cmsel,a,waste-surf
nsle
*do,i,1,2149
set,i
fsum,,cont
*get,REACTX(i),FSUM,0,ITEM,FX
*get,reactz(i),FSUM,0,ITEM,FZ
*enddo
/out,Waste-Reaction-460-SD3,out

*vwrite
('Total Waste Forces')
*vwrite
('     Fx        FZ')
*vwrite,reactx(1),reactz(1)
(f10.1,f10.1)
/out
```

Waste-solid-AP-S.txt

```
et,3,solid45   ! Solid45 Elements
Wastet=12      ! Primary tank coordinate
for top of waste (460 in for AP Tanks)
Wasteb=35      ! Primary tank coordinate
for bottom of waste

mp,ex,201,2.592                  !
Bulk Modulus = 300,000 psi
mp,ey,201,2.592
mp,ez,201,2.592
mp,prxy,201,0.49999
mp,pryz,201,0.49999
mp,prxz,201,0.49999
mp,gxy,201,0.464
mp,gyz,201,0.464
mp,gxz,201,0.464
mp,dens,201,1.83*62.4/(1000*g)       !
Waste Density
mp,damp,201,0.001

ksel,u,kp,,all                ! Clear
active Keypoints
asel,u,area,,all              ! Clear
active Areas
vsel,u,volu,,all              ! Clear
active Volumes
ksel,s,kp,,1,ct_kps,ct_kps-1  ! Activate
Keypoints for center of rotation

/COM - Create KeyPoints for waste in tank
*do,i,0,Wasteb-Wastet,1
                       ! Cycle on
vertical Keypoints
*do,j,0,tw-1
               ! Cycle on horizontal
Keypoints
k,kmaxl+i*(tw+1)+j+1,ptx(pt_kps-
j),0,ptz(i+Wastet)
*enddo
k,kmaxl+i*(tw+1)+j+2,ptx(i+Wastet),0,ptz(
i+Wastet)      !
*enddo


/COM - Create Areas for waste in tank
*do,i,0,Wasteb-Wastet-1,1
*do,j,0,tw-1
a,kmaxl+i*(tw+1)+j+1,kmaxl+i*(tw+1)+j+2,k
maxl+(i+1)*(tw+1)+j+2,kmaxl+(i+1)*(tw+1)+
j+1
*enddo
*enddo



/COM - Create Volumes for Waste
vrotat,all,,,,,,1,ct_kps,180,2

/COM - Assign attributes
vatt,201,,3

wastevols=(tw)*(wasteb-wastet)
/COM - Elements in waste
*do,i,0,Wasteb-Wastet-1,1
*do,j,1,tw-1,1
vsel,s,volu,,vmaxl+i*tw+j+1
vsel,a,volu,,vmaxl+wastevols+i*tw+j+1
aslv
lsla
lsel,r,loc,x,ptx(pt_kps-j),ptx(i+Wastet)
lesize,all,,arcsize
```

```
vmesh,all
*enddo
*enddo

allsel
/COM - Mesh center column to match
primary tank center
asel,s,loc,x,ptx(pt_kps-1),ptx(pt_kps)
asel,r,loc,z,ptz(wastet)
asel,r,loc,y,0,-90
cm,a3a,area
cmsel,s,a3a
cmsel,a,a1a
mshcopy,2,a1a,a3a,,,,ptz(wastet)-
ptz(wasteb)
allsel
asel,s,loc,x,ptx(pt_kps-1),ptx(pt_kps)
asel,r,loc,z,ptz(wastet)
cmsel,u,a3a
cm,a3b,area
cmsel,a,a1b
mshcopy,2,a1b,a3b,,,,ptz(wastet)-
ptz(wasteb)
vsel,s,volu,,vmaxl+1,vmaxl+2*wastevols+1,
tw
vsweep,all,,all
cmsel,u,a1b
cmsel,a,a3a
aclear,all


esel,s,type,,3
cm,waste,elem
nsle
cm,waste-n,node


/COM - Couple waste to primary tank
csys,1
allsel


et,44,targe170
et,45,conta173
et,46,conta173
r,800,,,400/1.5
r,801,,,400/1.5
r,802,,,400/1.5
r,803,,,400/1.5
r,804,,,380/1.5
r,805,,,360/1.5
r,806,,,340/1.5
r,807,,,320/1.5
r,808,,,300/1.5
r,809,,,280/1.5

r,810,,,400/1.5
r,811,,,400/1.5
r,812,,,400/1.5
r,813,,,400/1.5
r,814,,,380/1.5
r,815,,,360/1.5
r,816,,,340/1.5
r,817,,,320/1.5
r,818,,,300/1.5
r,819,,,280/1.5

r,820,,,400/1.5
r,821,,,400/1.5
r,822,,,400/1.5
r,823,,,400/1.5
r,824,,,380/1.5
r,825,,,360/1.5
r,826,,,340/1.5
r,827,,,320/1.5
r,828,,,300/1.5
r,829,,,280/1.5

r,830,,,400/1.5
r,831,,,400/1.5
r,832,,,400/1.5
r,833,,,400/1.5
r,834,,,380/1.5
r,835,,,360/1.5
r,836,,,340/1.5
r,837,,,320/1.5
r,838,,,300/1.5
r,839,,,280/1.5

keyopt,45,12,4
keyopt,46,12,4


! - Third Facet of Haunch
cmsel,s,primary-tank
nsle
nsel,r,loc,z,ptz(8),ptz(16)
nsel,r,loc,x,ptx(8),ptx(16)
esln,r,1
type,44
real,809
esurf
real,819
esurf
real,829
esurf
real,839
esurf
cmsel,s,waste
nsle
nsel,r,loc,z,ptz(12),ptz(13)
nsel,r,loc,x,ptx(12),ptx(13)
nsel,r,loc,y,0,-45
esln,r
real,809
type,46
esurf

cmsel,s,waste
nsle
nsel,r,loc,z,ptz(12),ptz(13)
nsel,r,loc,x,ptx(12),ptx(13)
nsel,r,loc,y,-45,-90
esln,r
real,819
type,46
esurf

cmsel,s,waste
nsle
nsel,r,loc,z,ptz(12),ptz(13)
nsel,r,loc,x,ptx(12),ptx(13)
nsel,r,loc,y,-90,-135
esln,r
real,829
type,46
esurf

cmsel,s,waste
nsle
```

```
nsel,r,loc,z,ptz(12),ptz(13)
nsel,r,loc,x,ptx(12),ptx(13)
nsel,r,loc,y,-135,-180
esln,r
real,839
type,46
esurf

! - Second Facet of Haunch
cmsel,s,primary-tank
nsle
nsel,r,loc,z,ptz(9),ptz(17)
nsel,r,loc,x,ptx(9),ptx(17)
esln,r,1
type,44
real,808
esurf
real,818
esurf
real,828
esurf
real,838
esurf
cmsel,s,waste
nsle
nsel,r,loc,z,ptz(13),ptz(14)
nsel,r,loc,x,ptx(13),ptx(14)
nsel,r,loc,y,0,-45
esln,r
real,808
type,46
esurf

cmsel,s,waste
nsle
nsel,r,loc,z,ptz(13),ptz(14)
nsel,r,loc,x,ptx(13),ptx(14)
nsel,r,loc,y,-45,-90
esln,r
real,818
type,46
esurf

cmsel,s,waste
nsle
nsel,r,loc,z,ptz(13),ptz(14)
nsel,r,loc,x,ptx(13),ptx(14)
nsel,r,loc,y,-90,-135
esln,r
real,828
type,46
esurf

cmsel,s,waste
nsle
nsel,r,loc,z,ptz(13),ptz(14)
nsel,r,loc,x,ptx(13),ptx(14)
nsel,r,loc,y,-135,-180
esln,r
real,838
type,46
esurf

! - First Facet of Haunch
cmsel,s,primary-tank
nsle
nsel,r,loc,z,ptz(10),ptz(18)
nsel,r,loc,x,ptx(10),ptx(18)
esln,r,1
type,44
real,807
esurf
real,817
esurf
real,827
esurf
real,837
esurf
cmsel,s,waste
nsle
nsel,r,loc,z,ptz(14),ptz(15)
nsel,r,loc,x,ptx(14),ptx(15)
nsel,r,loc,y,0,-45
esln,r
real,807
type,46
esurf

cmsel,s,waste
nsle
nsel,r,loc,z,ptz(14),ptz(15)
nsel,r,loc,x,ptx(14),ptx(15)
nsel,r,loc,y,-45,-90
esln,r
real,817
type,46
esurf

cmsel,s,waste
nsle
nsel,r,loc,z,ptz(14),ptz(15)
nsel,r,loc,x,ptx(14),ptx(15)
nsel,r,loc,y,-90,-135
esln,r
real,827
type,46
esurf

cmsel,s,waste
nsle
nsel,r,loc,z,ptz(14),ptz(15)
nsel,r,loc,x,ptx(14),ptx(15)
nsel,r,loc,y,-135,-180
esln,r
real,837
type,46
esurf

! - First Layer below Haunch
cmsel,s,primary-tank
nsle
nsel,r,loc,z,ptz(11),ptz(19)
nsel,r,loc,x,ptx(11),ptx(19)
esln,r,1
type,44
real,806
esurf
real,816
esurf
real,826
esurf
real,836
esurf
cmsel,s,waste
nsle
nsel,r,loc,z,ptz(15),ptz(16)
nsel,r,loc,x,ptx(15),ptx(16)
nsel,r,loc,y,0,-45
esln,r
real,806
```

```
type,46
esurf

cmsel,s,waste
nsle
nsel,r,loc,z,ptz(15),ptz(16)
nsel,r,loc,x,ptx(15),ptx(16)
nsel,r,loc,y,-45,-90
esln,r
real,816
type,46
esurf

cmsel,s,waste
nsle
nsel,r,loc,z,ptz(15),ptz(16)
nsel,r,loc,x,ptx(15),ptx(16)
nsel,r,loc,y,-90,-135
esln,r
real,826
type,46
esurf

cmsel,s,waste
nsle
nsel,r,loc,z,ptz(15),ptz(16)
nsel,r,loc,x,ptx(15),ptx(16)
nsel,r,loc,y,-135,-180
esln,r
real,836
type,46
esurf

! - First Facet of Haunch
cmsel,s,primary-tank
nsle
nsel,r,loc,z,ptz(12),ptz(20)
nsel,r,loc,x,ptx(12),ptx(20)
esln,r,1
type,44
real,805
esurf
real,815
esurf
real,825
esurf
real,835
esurf
cmsel,s,waste
nsle
nsel,r,loc,z,ptz(16),ptz(17)
nsel,r,loc,x,ptx(16),ptx(17)
nsel,r,loc,y,0,-45
esln,r
real,805
type,46
esurf

cmsel,s,waste
nsle
nsel,r,loc,z,ptz(16),ptz(17)
nsel,r,loc,x,ptx(16),ptx(17)
nsel,r,loc,y,-45,-90
esln,r
real,815
type,46
esurf

cmsel,s,waste
nsle
nsel,r,loc,z,ptz(16),ptz(17)
nsel,r,loc,x,ptx(16),ptx(17)
nsel,r,loc,y,-90,-135
esln,r
real,825
type,46
esurf

cmsel,s,waste
nsle
nsel,r,loc,z,ptz(16),ptz(17)
nsel,r,loc,x,ptx(16),ptx(17)
nsel,r,loc,y,-135,-180
esln,r
real,835
type,46
esurf

! - First Facet of Haunch
cmsel,s,primary-tank
nsle
nsel,r,loc,z,ptz(13),ptz(21)
nsel,r,loc,x,ptx(13),ptx(21)
esln,r,1
type,44
real,804
esurf
real,814
esurf
real,824
esurf
real,834
esurf
cmsel,s,waste
nsle
nsel,r,loc,z,ptz(17),ptz(18)
nsel,r,loc,x,ptx(17),ptx(18)
nsel,r,loc,y,0,-45
esln,r
real,804
type,46
esurf

cmsel,s,waste
nsle
nsel,r,loc,z,ptz(17),ptz(18)
nsel,r,loc,x,ptx(17),ptx(18)
nsel,r,loc,y,-45,-90
esln,r
real,814
type,46
esurf

cmsel,s,waste
nsle
nsel,r,loc,z,ptz(17),ptz(18)
nsel,r,loc,x,ptx(17),ptx(18)
nsel,r,loc,y,-90,-135
esln,r
real,824
type,46
esurf

cmsel,s,waste
nsle
nsel,r,loc,z,ptz(17),ptz(18)
nsel,r,loc,x,ptx(17),ptx(18)
nsel,r,loc,y,-135,-180
esln,r
real,834
```

```
type,46
esurf

cmsel,s,primary-tank
nsle
nsel,r,loc,z,ptz(15),ptz(33)
esln,r,1
nsle
type,44
real,803
esurf
real,813
esurf
real,823
esurf
real,833
esurf
cmsel,s,waste
nsle
nsel,r,loc,z,ptz(18),ptz(34)
nsel,r,loc,x,ptx(18)
nsel,r,loc,y,0,-45
esln,r
real,803
type,45
esurf

cmsel,s,waste
nsle
nsel,r,loc,z,ptz(18),ptz(34)
nsel,r,loc,x,ptx(18)
nsel,r,loc,y,-45,-90
esln,r
real,813
type,45
esurf

cmsel,s,waste
nsle
nsel,r,loc,z,ptz(18),ptz(34)
nsel,r,loc,x,ptx(18)
nsel,r,loc,y,-90,-135
esln,r
real,823
type,45
esurf

cmsel,s,waste
nsle
nsel,r,loc,z,ptz(18),ptz(34)
nsel,r,loc,x,ptx(18)
nsel,r,loc,y,-135,-180
esln,r
real,833
type,45
esurf

! - Second Facet of Knuckle
cmsel,s,primary-tank
nsle
nsel,r,loc,z,ptz(32),ptz(36)
nsel,r,loc,x,ptx(32),ptx(36)
esln,r,1
type,44
real,802
esurf
real,812
esurf
real,822
esurf
real,832
esurf
cmsel,s,waste
nsle
nsel,r,loc,z,ptz(33),ptz(34)
nsel,r,loc,x,ptx(33),ptx(34)
nsel,r,loc,y,0,-45
esln,r
real,802
type,46
esurf

cmsel,s,waste
nsle
nsel,r,loc,z,ptz(33),ptz(34)
nsel,r,loc,x,ptx(33),ptx(34)
nsel,r,loc,y,-45,-90
esln,r
real,812
type,46
esurf

cmsel,s,waste
nsle
nsel,r,loc,z,ptz(33),ptz(34)
nsel,r,loc,x,ptx(33),ptx(34)
nsel,r,loc,y,-90,-135
esln,r
real,822
type,46
esurf

cmsel,s,waste
nsle
nsel,r,loc,z,ptz(33),ptz(34)
nsel,r,loc,x,ptx(33),ptx(34)
nsel,r,loc,y,-135,-180
esln,r
real,832
type,46
esurf

! - First Facet of Knuckle
cmsel,s,primary-tank
nsle
nsel,r,loc,z,ptz(32),ptz(37)
nsel,r,loc,x,ptx(32),ptx(37)
esln,r,1
type,44
real,801
esurf
real,811
esurf
real,821
esurf
real,831
esurf
cmsel,s,waste
nsle
nsel,r,loc,z,ptz(34),ptz(35)
nsel,r,loc,x,ptx(34),ptx(35)
nsel,r,loc,y,0,-45
esln,r
real,801
type,46
esurf

cmsel,s,waste
nsle
nsel,r,loc,z,ptz(34),ptz(35)
```

```
nsel,r,loc,x,ptx(34),ptx(35)
nsel,r,loc,y,-45,-90
esln,r
real,811
type,46
esurf

cmsel,s,waste
nsle
nsel,r,loc,z,ptz(34),ptz(35)
nsel,r,loc,x,ptx(34),ptx(35)
nsel,r,loc,y,-90,-135
esln,r
real,821
type,46
esurf

cmsel,s,waste
nsle
nsel,r,loc,z,ptz(34),ptz(35)
nsel,r,loc,x,ptx(34),ptx(35)
nsel,r,loc,y,-135,-180
esln,r
real,831
type,46
esurf

! - Bottom of Waste
cmsel,s,primary-tank
nsle
nsel,r,loc,z,ptz(33),ptz(36)
esln,r,1
type,44
real,800
esurf
cmsel,s,waste
nsle
nsel,r,loc,z,ptz(36)
esln,r
type,45
esurf



esel,s,type,,45,46
cm,waste-surf,elem


!cmsel,s,waste-n
!nsel,r,loc,z,ptz(wastet+2),ptz(wastet)
!nsel,r,loc,x,ptx(36),ptx(21)
!esln,r,1
!emodif,mat,,202



!cmsel,s,waste
!nsle
!nsel,r,loc,z,ptz(wastet)

allsel
*get,KMAXw,KP,0,num,max
        ! Get maximum Keypoint number
*get,LMAXw,LINE,0,num,max            !
Get maximum Line number
*get,AMAXw,AREA,0,num,max            !
Get maximum Area number
*get,VMAXw,VOLU,0,num,max            !
Get maximum Volume number
```

Waste-Surface-AP.txt

```
/post26
numvar,200
*do,z,2,200
VARDEL,z
*enddo

cmsel,s,waste
nsle
nsel,r,loc,x,ptx(pt_kps)
nsel,r,loc,z,ptz(wasteb)
*get,nmax,node,,num,max
nsol,(2),(nmax),u,z,uz%(nmax)%

*do,i,0,21
*do,j,0,9
angley=-arcsize*(i)
cmsel,s,waste
nsle
nsel,r,loc,y,angley
nsel,r,loc,x,ptx(pt_kps-j)
nsel,r,loc,z,ptz(wastet)
*get,nmax,node,,num,max
nsol,(2+j),(nmax),u,z,uz%(nmax)%
add,(2+j),(2+J),2,,uz%(nmax)%,,,1,-1
*enddo

cmsel,s,waste
nsle
nsel,r,loc,y,angley
nsel,r,loc,x,ptx(wastet)
nsel,r,loc,z,ptz(wastet)
*get,nmax,node,,num,max
nsol,(3+j),(nmax),u,z,uz%(nmax)%
add,(3+j),(3+J),2,,uz%(nmax)%,,,1,-1

LINES,2150
extrem
/OUT,Waste-Surf_%(9*i)%max,OUT
extrem,3,200
/OUT

/OUT,Waste-Surf_%(9*i)%th,OUT
*do,k,2,11
PRVAR,2+k
*enddo
/OUT

*enddo
```

APPENDIX F

Lower Bound Soil
Best Estimate Concrete

Results
Load Case Specific Input Files
File Listing

LIST OF TABLES

Table 1 LBS-BEC Concrete Forces and Moment, Gravity Load Only

AP Primary Tank, Lower Bound Soil (Geomatrix), Gravity Only, Best Estimate Concrete, 460 in. Waste Level at 1.83 SpG

ANSYS MAXIMUMS BY PATH

PNNL Section No.	Path (in.)	Gravity Hoop Force (kip/ft) AP-LBS-BEC	Gravity Meridonal Force (kip/ft) AP-LBS-BEC	Gravity -In-Plane Shear Force (kip/ft) AP-LBS-BEC	Gravity Hoop Moment (ft*kip/ft) AP-LBS-BEC	Gravity Meridonal Moment (ft*kip/ft) AP-LBS-BEC	Gravity Through-Wall Shear Force (kip/ft) AP-LBS-BEC
2	**67.734**	-72.190	-76.220	-0.160	-6.222	-3.128	1.712
3	**105.676**	-67.460	-74.910	-0.257	-4.144	-0.764	1.013
4	**137.076**	-63.000	-73.590	-0.320	-2.707	1.656	1.139
6	**182.856**	-58.820	-71.570	-0.239	-1.631	2.216	-0.527
8	**226.570**	-55.770	-70.340	-0.061	-1.573	-1.478	-1.101
9	**275.574**	-53.430	-69.430	-0.261	-1.939	-2.809	-1.097
11	**325.697**	-45.010	-68.610	-0.268	-2.843	-7.213	-1.192
13	**372.312**	-35.110	-67.460	-0.169	-6.118	-9.082	-0.772
17	**423.434**	-10.880	-65.800	0.065	-3.728	-7.689	2.217
20	**468.315**	42.570	-63.200	0.019	-12.950	14.350	10.470
22	**515.319**	24.640	-65.570	-0.015	5.384	35.730	-2.411
24	**553.722**	4.816	-64.080	-0.012	2.814	15.480	-7.823
26	**593.805**	-13.870	-66.160	-0.007	0.025	0.136	-2.836
30	**644.355**	-30.340	-68.310	-0.004	-0.577	-3.205	0.709
33	**693.605**	-37.280	-69.900	0.003	-0.176	-0.978	0.523
35	**740.705**	-42.540	-71.450	0.003	0.043	0.239	-0.034
38	**786.205**	-37.090	-72.970	0.003	-0.244	-1.357	-0.466
41	**844.605**	-35.910	-75.000	0.004	-0.184	-1.020	-0.224
43	**901.355**	-16.710	-31.660	0.010	-0.131	-0.720	1.196
46	**932.355**	-27.450	-74.280	0.058	-0.700	-3.476	-2.551
48	**1007.355**	-3.424	-11.680	0.674	-5.823	28.450	-16.400
51	**1053.855**	-4.459	-13.040	0.711	-1.921	26.630	15.710
53	**1086.855**	-1.691	-7.447	0.472	1.868	3.811	-1.096
55	**1105.855**	-1.448	-5.416	0.334	3.753	4.877	1.687
57	**1147.355**	-0.396	-3.032	0.220	0.487	1.631	-1.588
58	**1207.355**	0.239	-0.143	0.036	-0.021	-0.149	0.327
59	**1267.355**	0.313	0.230	0.014	0.033	0.163	-0.259
60	**1327.355**	0.486	0.075	0.040	-0.039	-0.244	0.211
61	**1387.355**	0.484	0.674	-0.022	0.033	0.068	-0.121
62	**1449.355**	2.307	2.417	-0.027	0.088	0.085	0.281

Note: Meridonal/Hoop Forces and Meridonal/Hoop Moments are Reversed in Highlighted Sections

Table 2 LBS-BEC Concrete Forces and Moments, Gravity Plus Seismic Load

1/2/2007, 9:03 AM

AP- Primary Tank, Lower Bound Soil (Geomatrix), Best Estimate Concrete,

ANSYS MAXIMUMS BY PATH

PNNL Section No.	Path (in.)	Seismic Hoop Force (kip/ft) AP-LBS-BEC	Seismic Meridonal Force (kip/ft) AP-LBS-BEC	Seismic -In-Plane Shear Force (kip/ft) AP-LBS-BEC	Seismic Hoop Moment (ft*kip/ft) AP-LBS-BEC	Seismic Meridonal Moment (ft*kip/ft) AP-LBS-BEC	Seismic Through-Wall Shear Force (kip/ft) AP-LBS-BEC
2	**67.734**	-98.830	-103.500	4.949	-14.140	-12.350	3.582
3	**105.676**	-94.430	-101.500	7.021	-10.770	-9.063	2.352
4	**137.076**	-88.460	-99.280	8.423	-8.239	7.385	2.735
6	**182.856**	-81.550	-95.050	9.777	-4.853	6.732	2.625
8	**226.570**	-77.210	-91.170	11.130	-3.541	-6.991	2.015
9	**275.574**	-77.340	-87.730	13.380	-3.232	-6.305	1.709
11	**325.697**	-69.820	-85.120	15.590	-4.145	-10.110	1.855
13	**372.312**	-68.710	-82.440	18.180	-8.406	-12.050	1.514
17	**423.434**	-24.530	-79.710	20.680	-4.879	-11.790	3.520
20	**468.315**	115.700	-75.760	24.360	-18.220	21.460	12.540
22	**515.319**	49.410	-77.010	27.690	7.540	46.460	3.792
24	**553.722**	16.710	-75.860	27.090	3.738	20.310	10.040
26	**593.805**	-23.100	-79.150	27.870	0.149	0.739	3.633
30	**644.355**	-38.380	-81.020	29.010	-0.728	-3.947	0.873
33	**693.605**	-45.790	-82.550	30.560	-0.254	-1.280	0.623
35	**740.705**	-51.440	-84.580	32.210	0.082	0.391	0.094
38	**786.205**	-44.090	-86.540	33.700	-0.317	-1.714	0.559
41	**844.605**	-42.540	-89.120	36.260	-0.321	-1.709	0.414
43	**901.355**	-19.560	-37.710	17.950	-0.206	-1.146	2.047
46	**932.355**	-57.260	-89.170	39.730	-0.872	-4.364	3.257
48	**1007.355**	-21.090	-16.390	12.130	-7.356	34.450	19.860
51	**1053.855**	-60.570	-18.680	17.580	-3.392	33.120	18.730
53	**1086.855**	-16.970	-13.830	11.320	2.330	5.081	2.040
55	**1105.855**	-46.410	-11.590	10.520	4.925	6.378	2.403
57	**1147.355**	-9.667	-8.374	6.165	0.642	2.128	2.060
58	**1207.355**	3.810	-3.875	3.206	-0.028	-0.193	0.420
59	**1267.355**	2.999	3.141	2.193	0.045	0.215	0.330
60	**1327.355**	3.613	-2.481	1.831	-0.055	-0.299	0.285
61	**1387.355**	2.108	2.712	1.363	0.044	0.099	0.202
62	**1449.355**	6.171	5.432	1.477	0.190	0.220	0.424

Note: Meridonal/Hoop Forces and Meridonal/Hoop Moments are Reversed in Highlighted Sections

Table 3 LBS-BEC Concrete Forces and Moments, Seismic Only

1/2/2007, 9:04 AM

AP- Primary Tank, Lower Bound Soil (Geomatrix), Best Estimate Concrete, 460 in. Waste Level at 1.83 SpG

ANSYS MAXIMUMS BY PATH

PNNL Section No.	Path (in.)	Seismic Only Hoop Force (kip/ft) AP-LBS-BEC	Seismic Only Meridonal Force (kip/ft) AP-LBS-BEC	Seismic Only - In-Plane Shear Force (kip/ft) AP-LBS-BEC	Seismic Only Hoop Moment (ft*kip/ft) AP-LBS-BEC	Seismic Only Meridonal Moment (ft*kip/ft) AP-LBS-BEC	Seismic Only Through-Wall Shear Force (kip/ft) AP-LBS-BEC
2	**67.734**	28.410	27.280	5.026	8.007	9.328	1.895
3	**105.676**	28.760	26.590	7.202	6.934	8.591	1.441
4	**137.076**	25.730	25.690	8.584	5.602	6.011	1.837
6	**182.856**	25.140	23.480	9.875	3.348	5.084	2.117
8	**226.570**	25.340	20.830	11.102	2.079	5.515	0.917
9	**275.574**	25.430	18.300	13.323	1.444	3.511	0.810
11	**325.697**	25.100	16.510	15.527	1.309	3.293	0.723
13	**372.312**	34.915	14.980	18.140	2.300	3.340	0.774
17	**423.434**	14.181	13.910	20.664	1.185	4.269	1.344
20	**468.315**	73.130	12.560	24.358	5.370	7.110	2.100
22	**515.319**	24.770	11.450	27.695	2.157	10.730	1.381
24	**553.722**	11.912	11.790	27.094	0.926	4.840	2.217
26	**593.805**	9.230	12.990	27.873	0.156	0.741	0.799
30	**644.355**	8.040	12.710	29.012	0.151	0.742	0.164
33	**693.605**	8.510	12.650	30.562	0.078	0.303	0.101
35	**740.705**	8.900	13.130	32.212	0.053	0.152	0.061
38	**786.205**	7.070	15.260	33.702	0.076	0.394	0.097
41	**844.605**	6.870	18.140	36.263	0.137	0.690	0.191
43	**901.355**	3.230	8.220	17.952	0.094	0.530	0.855
46	**932.355**	29.860	18.820	39.720	0.268	1.167	1.021
48	**1007.355**	17.689	5.082	11.488	1.743	7.860	4.540
51	**1053.855**	56.204	6.798	18.290	1.738	7.890	4.170
53	**1086.855**	15.311	6.952	11.777	0.469	1.289	0.945
55	**1105.855**	45.073	6.723	10.840	1.228	1.508	0.722
57	**1147.355**	9.299	5.777	6.374	0.161	0.498	0.473
58	**1207.355**	3.671	3.735	3.235	0.008	0.044	0.094
59	**1267.355**	2.687	3.026	2.186	0.015	0.052	0.072
60	**1327.355**	3.128	2.536	1.796	0.019	0.056	0.076
61	**1387.355**	1.625	2.252	1.378	0.011	0.031	0.082
62	**1449.355**	3.973	3.214	1.463	0.101	0.151	0.149

Note: Meridonal/Hoop Forces and Meridonal/Hoop Moments are Reversed in Highlighted Sections.

Table 4 LBS-BEC Primary Tank Stresses, Shell Top, Gravity Load Only

		AP Primary Tank, Lower Bound Soil, Gravity Only, Best Estimate Tank Concrete, 460 in. Waste Level at 1.83 SpG			
		Shell Top Surface (inside - waste side)			
M&D Starting Element No.	Path (in.)	AP-460-LBS-BEC Gravity Hoop Stress (lbs/in^2) Top	AP-460-LBS-BEC Gravity Meridional Stress (lbs/in^2) Top	AP-460-LBS-BEC Gravity Stress Intensity (lbs/in^2) Top	AP-460-LBS-BEC Gravity In-Plane Shear Stress (lbs/in^2) Top
762	**67.33**	-1781.94	-1527.78	1781.94	6.02
782	**105.04**	-1776.39	-2723.61	2724.31	12.41
802	**136.24**	-1736.81	-1931.94	1932.64	14.94
822	**181.83**	-1300.69	-2182.64	2182.64	11.91
842	**225.10**	-1373.61	-1329.86	1373.61	2.92
862	**273.66**	-797.22	-1549.31	1549.31	11.38
882	**323.27**	-680.90	-796.53	797.92	10.77
902	**369.20**	150.07	-794.44	944.44	7.01
922	**419.20**	934.72	-220.07	1155.56	-3.17
942	**444.31**	745.14	-2059.72	2804.86	-1.32
962	**458.66**	683.40	1363.89	1363.89	-0.90
982	**473.08**	608.68	1151.39	1151.39	-0.88
1002	**484.80**	1454.86	-383.82	1838.89	-0.88
1022	**502.48**	3062.50	-12.06	3079.86	-0.85
1042	**526.48**	4693.75	112.57	4693.75	-0.76
1062	**550.48**	6315.28	-36.29	6352.78	-0.54
1082	**574.60**	7881.94	192.99	7881.94	-0.38
1102	**598.28**	9569.44	-83.82	9652.78	-0.25
1122	**621.38**	11125.00	115.49	11125.00	-0.19
1142	**644.48**	12694.44	-12.06	12708.33	-0.17
1162	**667.63**	13791.67	-360.76	14152.78	-0.22
1182	**690.78**	14201.39	409.86	14201.39	-0.22
1202	**713.88**	15201.39	146.88	15201.39	-0.21
1222	**736.98**	16562.50	-348.06	16909.72	-0.24
1242	**760.13**	16506.94	-729.17	17236.11	-0.28
1262	**782.53**	15270.83	1013.89	15270.83	-0.24
1282	**804.13**	14930.56	327.99	14930.56	0.30
1302	**825.73**	15770.83	-31.66	15805.56	0.38
1322	**847.33**	17138.89	348.54	17138.89	-0.35
1342	**868.87**	17541.67	-1929.17	19472.22	-0.73
1362	**892.10**	13256.94	-3013.19	16277.78	1.10
1382	**909.20**	3752.08	-9562.50	13326.39	1.33
1402	**918.38**	3770.83	5961.81	6009.03	-1.79
1460	**930.48**	3492.36	9909.72	9958.33	-508.47
1442	**949.48**	192.85	-497.22	695.83	54.65
1462	**990.98**	605.28	937.50	939.58	-26.92
1482	**1050.98**	422.78	487.78	583.26	-6.02
1502	**1110.98**	419.65	582.36	583.26	-13.95
1522	**1170.98**	297.64	233.75	298.06	6.37
1542	**1230.98**	351.53	416.60	417.01	-6.35
1562	**1292.98**	286.39	306.60	307.01	-2.99

Note 1: Meridonal, Hoop, and Shear Stresses are Reversed in Highlighted Sections (Floor)

Table 5 LBS-BEC Primary Tank Stresses, Shell Middle, Gravity Load Only

AP Primary Tank, Lower Bound Soil, Gravity Only, Best Estimate Tank Concrete, 460 in. Waste Level at 1.83 SpG

M&D Starting Element No.	Path (in.)	Shell Mid-Plane: AP-460-LBS-BEC Gravity Hoop Stress (lbs/in^2) Mid	AP-460-LBS-BEC Gravity Meridional Stress (lbs/in^2) Mid	AP-460-LBS-BEC Gravity Stress Intensity (lbs/in^2) Mid	AP-460-LBS-BEC Gravity In-Plane Shear Stress (lbs/in^2) Mid
762	**67.33**	-1885.42	-1821.53	1885.42	5.55
782	**105.04**	-1700.69	-2415.28	2415.28	11.76
802	**136.24**	-1842.36	-2250.69	2251.39	13.85
822	**181.83**	-1247.22	-1988.19	1988.19	10.88
842	**225.10**	-1495.83	-1725.69	1725.69	2.48
862	**273.66**	-764.58	-1418.75	1418.75	10.67
882	**323.27**	-765.28	-1068.75	1070.14	10.36
902	**369.20**	161.94	-729.17	891.67	6.85
922	**419.20**	906.25	-298.26	1204.86	-3.20
942	**444.31**	1394.44	65.06	1409.72	-1.35
962	**458.66**	314.31	86.88	314.93	-0.96
982	**473.08**	281.88	80.69	283.68	-0.90
1002	**484.80**	1590.28	76.60	1592.36	-0.86
1022	**502.48**	3087.50	72.43	3088.89	-0.78
1042	**526.48**	4679.17	65.99	4679.86	-0.69
1062	**550.48**	6343.75	59.24	6344.44	-0.50
1082	**574.60**	7840.28	52.47	7840.28	-0.36
1102	**598.28**	9611.11	45.78	9611.11	-0.24
1122	**621.38**	11097.22	39.27	11097.22	-0.19
1142	**644.48**	12701.39	32.75	12708.33	-0.16
1162	**667.63**	13909.72	26.19	13909.72	-0.20
1182	**690.78**	14083.33	16.78	14083.33	-0.19
1202	**713.88**	15159.72	10.22	15159.72	-0.19
1222	**736.98**	16666.67	3.67	16680.56	-0.23
1242	**760.13**	16722.22	-3.90	16729.17	-0.28
1262	**782.53**	14965.28	-8.31	14979.17	-0.21
1282	**804.13**	14826.39	-14.41	14840.28	-0.29
1302	**825.73**	15770.83	-20.58	15791.67	0.36
1322	**847.33**	17027.78	-26.76	17048.61	-0.36
1342	**868.87**	18111.11	-32.76	18159.72	-0.58
1362	**892.10**	14152.78	-33.93	14201.39	0.87
1382	**909.20**	6488.89	-44.09	6660.42	1.05
1402	**918.38**	1690.28	122.43	2010.42	-1.12
1460	**930.48**	448.82	384.86	570.21	5.61
1442	**949.48**	464.79	431.46	465.56	2.98
1462	**990.98**	543.26	755.56	756.94	-17.38
1482	**1050.98**	454.17	597.50	459.58	-12.31
1502	**1110.98**	381.39	459.10	459.58	-7.23
1522	**1170.98**	331.25	349.24	349.38	-2.64
1542	**1230.98**	317.71	324.38	324.58	-1.79
1562	**1292.98**	296.60	358.19	358.82	-6.17

Note 1: Meridonal, Hoop, and Shear Stresses are Reversed in Highlighted Sections (Floor)

Table 6 LBS-BEC Primary Tank Stresses, Shell Bottom, Gravity Load Only

		AP Primary Tank, Lower Bound Soil, Gravity Only, Best Estimate Tank Concrete, 460 in. Waste Level at 1.83 SpG			
		Shell Bottom Surface (outside - away from waste)			
M&D Starting Element No.	Path (in.)	AP-460-LBS-BEC Gravity Hoop Stress (lbs/in^2) Bot	AP-460-LBS-BEC Gravity Meridional Stress (lbs/in^2) Bot	AP-460-LBS-BEC Gravity Stress Intensity (lbs/in^2) Bot	AP-460-LBS-BEC Gravity In-Plane Shear Stress (lbs/in^2) Bot
762	**67.33**	-1996.53	-2115.28	2115.28	5.93
782	**105.04**	-1624.31	-2106.25	2106.94	-11.19
802	**136.24**	-1947.22	-2569.44	2570.14	13.06
822	**181.83**	-1193.75	-1793.75	1793.75	-10.11
842	**225.10**	-1618.75	-2122.22	2122.22	2.20
862	**273.66**	-731.94	-1288.19	1288.19	9.97
882	**323.27**	-850.00	-1340.97	1342.36	9.95
902	**369.20**	173.82	-664.38	838.19	6.69
922	**419.20**	878.47	-376.46	1254.86	-3.23
942	**444.31**	2043.06	2188.19	2188.89	-1.37
962	**458.66**	-62.10	-1190.28	1190.97	-1.02
982	**473.08**	-49.34	-989.58	990.28	-0.93
1002	**484.80**	1726.39	536.18	1726.39	-0.84
1022	**502.48**	3112.50	156.60	3113.19	-0.71
1042	**526.48**	4665.97	19.58	4668.06	-0.62
1062	**550.48**	6372.22	154.03	6372.92	-0.47
1082	**574.60**	7798.61	-89.03	7888.89	-0.34
1102	**598.28**	9645.83	174.44	9645.83	-0.23
1122	**621.38**	11076.39	-38.00	11118.06	-0.19
1142	**644.48**	12715.28	76.46	12715.28	-0.16
1162	**667.63**	14027.78	412.15	14027.78	-0.19
1182	**690.78**	13965.28	-377.36	14340.28	-0.17
1202	**713.88**	15118.06	-127.36	15243.06	-0.19
1222	**736.98**	16777.78	354.72	16777.78	-0.22
1242	**760.13**	16937.50	722.92	16937.50	-0.27
1262	**782.53**	14659.72	-1029.86	15687.50	-0.22
1282	**804.13**	14722.22	-356.32	15076.39	-0.28
1302	**825.73**	15777.78	-8.72	15784.72	0.35
1322	**847.33**	16909.72	-401.25	17312.50	-0.37
1342	**868.87**	18680.56	1867.36	18680.56	-0.43
1362	**892.10**	15048.61	2948.61	15048.61	0.63
1382	**909.20**	9229.17	9479.17	9486.11	0.76
1402	**918.38**	-393.13	-5716.67	5766.67	-0.50
1460	**930.48**	-2600.69	-9138.89	9187.50	518.47
1442	**949.48**	737.50	1358.33	1362.50	-49.54
1462	**990.98**	481.39	574.65	575.28	-7.85
1482	**1050.98**	485.83	708.33	343.40	-18.61
1502	**1110.98**	343.33	337.36	343.40	1.64
1522	**1170.98**	365.14	466.53	467.08	-9.22
1542	**1230.98**	284.58	234.31	284.93	5.36
1562	**1292.98**	308.13	412.15	412.85	-9.89

Note 1: Meridonal, Hoop, and Shear Stresses are Reversed in Highlighted Sections (Floor)

Table 7 LBS-BEC Primary Tank Stresses, Shell Top, Gravity Plus Seismic Load

AP Primary Tank, Lower Bound Soil, Horizontal and Vertical Seismic, Best Estimate Tank Concrete, 460 in. Waste Level at 1.83 SpG

M&D Starting M&D Element No.	Path (in.)	Shell Top Surface (inside - waste side)			
		AP-460-LBS-BEC Seismic Hoop Stress (lbs/in^2) Top	AP-460-LBS-BEC Seismic Meridional Stress (lbs/in^2) Top	AP-460-LBS-BEC Seismic Stress Intensity (lbs/in^2) Top	AP-460-LBS-BEC Seismic In-Plane Shear Stress (lbs/in^2) Top
762	**67.33**	-2589.58	-2490.97	2590.28	-217.99
782	**105.04**	-2638.19	-4195.83	4197.22	-398.89
802	**136.24**	-2787.50	-2940.28	2940.28	-440.56
822	**181.83**	-1931.94	-3304.86	3305.56	-458.40
842	**225.10**	-2497.22	-2348.61	2498.61	528.96
862	**273.66**	-1672.92	-2555.56	2555.56	-741.67
882	**323.27**	-2430.56	-1672.92	2702.78	1228.47
902	**369.20**	2236.81	-2111.81	3995.83	1826.39
922	**419.20**	4151.39	-1132.64	6142.36	2977.08
942	**444.31**	5570.14	-5634.03	6727.08	2870.83
962	**458.66**	6760.42	6794.44	11680.56	2870.14
982	**473.08**	6797.22	6912.50	12368.06	3075.69
1002	**484.80**	5085.42	-2000.00	6875.00	3179.17
1022	**502.48**	5620.14	831.25	7180.56	3113.89
1042	**526.48**	9631.94	1054.17	9638.89	2927.78
1062	**550.48**	12083.33	-1122.92	12083.33	2690.28
1082	**574.60**	14458.33	1574.31	14465.28	2397.92
1102	**598.28**	17083.33	-1417.36	17083.33	2067.36
1122	**621.38**	19479.17	1633.33	19479.17	1693.06
1142	**644.48**	21784.72	1498.61	21784.72	-1311.11
1162	**667.63**	23083.33	-1811.81	23083.33	1018.06
1182	**690.78**	23201.39	2072.92	23201.39	1000.00
1202	**713.88**	24291.67	1713.19	24291.67	1215.28
1222	**736.98**	25881.94	-1696.53	25881.94	1472.92
1242	**760.13**	25256.94	-953.47	25375.00	1765.97
1262	**782.53**	22868.06	2377.08	22868.06	1541.67
1282	**804.13**	21902.78	1436.81	21902.78	1755.56
1302	**825.73**	22756.94	950.69	22756.94	1997.22
1322	**847.33**	24437.50	1340.97	24444.44	2259.03
1342	**868.87**	24465.28	-2303.47	27347.22	2551.39
1362	**892.10**	17284.72	-3600.00	22770.83	2466.67
1382	**909.20**	5804.86	-11416.67	20895.83	2491.67
1402	**918.38**	5911.11	10611.11	10638.89	2483.33
1460	**930.48**	6288.19	17541.67	17625.00	-2960.42
1442	**949.48**	4259.72	-1142.36	4614.58	-2118.75
1462	**990.98**	3768.75	1581.25	6131.94	-3061.11
1482	**1050.98**	2843.06	881.94	2379.86	-1863.19
1502	**1110.98**	2218.06	812.50	2379.86	-1189.58
1522	**1170.98**	1658.33	553.96	1660.42	-768.06
1542	**1230.98**	1253.47	629.93	1254.86	-491.11
1562	**1292.98**	809.03	544.17	809.03	-252.43

Note 1: Meridonal, Hoop, and Shear Stresses are Reversed in Highlighted Sections (Floor)

Table 8 LBS-BEC Primary Tank Stresses, Shell Middle, Gravity Plus Seismic Load

AP Primary Tank, Lower Bound Soil, Horizontal and Vertical Seismic, Best Estimate Tank Concrete, 460 in. Waste Level at 1.83 SpG

		Shell Mid-Plane			
M&D Starting M&D Element No.	Path (in.)	AP-460-LBS-BEC Seismic Hoop Stress (lbs/in^2) Mid	AP-460-LBS-BEC Seismic Meridional Stress (lbs/in^2) Mid	AP-460-LBS-BEC Seismic Stress Intensity (lbs/in^2) Mid	AP-460-LBS-BEC Seismic In-Plane Shear Stress (lbs/in^2) Mid
762	**67.33**	-2887.50	-2473.61	2888.19	-218.47
782	**105.04**	-2431.25	-3298.61	3300.00	-393.82
802	**136.24**	-3097.22	-3110.42	3163.89	-436.18
822	**181.83**	-1827.08	-2778.47	2778.47	-454.44
842	**225.10**	-2872.92	-2459.03	2876.39	-527.78
862	**273.66**	-1611.81	-2142.36	2142.36	-740.97
882	**323.27**	-2690.28	-1870.83	2695.14	1229.86
902	**369.20**	2203.47	-1663.89	3947.22	1825.69
922	**419.20**	4165.28	-1413.19	6178.47	2979.17
942	**444.31**	5346.53	1000.00	6381.25	2913.89
962	**458.66**	7277.78	988.19	7902.78	2899.31
982	**473.08**	7986.11	922.92	8784.72	3024.31
1002	**484.80**	5050.00	865.28	6704.17	3117.36
1022	**502.48**	6075.69	938.89	7076.39	3088.19
1042	**526.48**	9645.83	1052.08	9645.83	2921.53
1062	**550.48**	12118.06	1186.81	12125.00	2684.72
1082	**574.60**	14395.83	1338.89	14402.78	2390.97
1102	**598.28**	17166.67	1475.69	17173.61	2059.03
1122	**621.38**	19472.22	1590.28	19472.22	1686.11
1142	**644.48**	21840.28	1682.64	21840.28	-1306.94
1162	**667.63**	23284.72	1753.47	23284.72	1018.06
1182	**690.78**	23034.72	1572.92	23034.72	996.53
1202	**713.88**	24250.00	1586.81	24256.94	1213.89
1222	**736.98**	26069.44	1576.39	26069.44	1470.83
1242	**760.13**	25611.11	1536.11	25611.11	1747.22
1262	**782.53**	22479.17	1078.47	22479.17	1515.28
1282	**804.13**	21798.61	1015.97	21798.61	1740.97
1302	**825.73**	22798.61	934.03	22798.61	1998.61
1322	**847.33**	24305.56	834.72	24305.56	2263.89
1342	**868.87**	25444.44	-706.25	25451.39	2546.53
1362	**892.10**	18756.94	-514.72	18868.06	2402.08
1382	**909.20**	8715.28	-494.38	9145.83	2320.83
1402	**918.38**	5263.89	517.71	5650.00	2313.19
1460	**930.48**	4431.94	846.53	4701.39	-2305.56
1442	**949.48**	4218.06	861.81	4424.31	-2190.97
1462	**990.98**	3722.22	1319.44	6122.22	-3052.78
1482	**1050.98**	2847.22	902.08	2374.31	-1870.14
1502	**1110.98**	2193.06	654.10	2374.31	-1184.03
1522	**1170.98**	1670.14	519.72	1672.22	-775.69
1542	**1230.98**	1235.42	487.29	1236.81	-485.83
1562	**1292.98**	806.94	533.26	806.94	-255.56

Note 1: Meridonal, Hoop, and Shear Stresses are Reversed in Highlighted Sections (Floor)

Table 9 LBS-BEC Primary Tank Stresses, Shell Bottom, Gravity Plus Seismic Load

AP Primary Tank, Lower Bound Soil, Horizontal and Vertical Seismic, Best Estimate Tank Concrete, 460 in. Waste Level at 1.83 SpG

M&D Starting M&D Element No.	Path (in.)	Shell Bottom Surface (outside - away from waste)			
		AP-460-LBS-BEC Seismic Hoop Stress (lbs/in^2) Bot	AP-460-LBS-BEC Seismic Meridional Stress (lbs/in^2) Bot	AP-460-LBS-BEC Seismic Stress Intensity (lbs/in^2) Bot	AP-460-LBS-BEC Seismic In-Plane Shear Stress (lbs/in^2) Bot
762	**67.33**	-3185.42	-3328.47	3328.47	-219.58
782	**105.04**	-2347.92	-3218.06	3218.75	-388.68
802	**136.24**	-3406.94	-4052.78	4054.86	-431.81
822	**181.83**	-1738.89	-2603.47	2604.17	-450.49
842	**225.10**	-3248.61	-3630.56	3634.03	-526.94
862	**273.66**	-1551.39	-1970.14	1986.11	-740.28
882	**323.27**	-2950.00	-2849.31	2955.56	1230.56
902	**369.20**	2170.14	-1271.53	3902.08	1825.00
922	**419.20**	4179.86	-2270.14	6228.47	2981.94
942	**444.31**	5568.06	7631.94	7631.94	2956.94
962	**458.66**	-8375.00	-4968.75	8375.00	2928.47
982	**473.08**	-9388.89	-5129.17	9395.83	2972.92
1002	**484.80**	5075.00	2765.28	6566.67	3055.56
1022	**502.48**	6531.25	2556.94	7020.83	3062.50
1042	**526.48**	9652.78	1090.97	9659.72	2915.28
1062	**550.48**	12159.72	1359.03	12159.72	2679.86
1082	**574.60**	14333.33	-1239.58	14333.33	2384.03
1102	**598.28**	17256.94	1661.81	17256.94	2050.69
1122	**621.38**	19465.28	1546.53	19472.22	1679.17
1142	**644.48**	21902.78	1865.97	21902.78	-1302.78
1162	**667.63**	23493.06	2309.03	23493.06	1018.06
1182	**690.78**	22861.11	-1718.06	22861.11	993.06
1202	**713.88**	24215.28	-1627.08	24215.28	1212.50
1222	**736.98**	26256.94	2054.17	26256.94	1468.75
1242	**760.13**	25993.06	2539.58	25993.06	1740.97
1262	**782.53**	22090.28	-1786.11	22819.44	1488.19
1282	**804.13**	21694.44	-1235.42	21701.39	1738.89
1302	**825.73**	22840.28	-944.44	22840.28	2000.69
1322	**847.33**	24166.67	-1052.08	24291.67	2268.06
1342	**868.87**	26423.61	4566.67	26423.61	2542.36
1362	**892.10**	20444.44	5553.47	20451.39	2336.81
1382	**909.20**	13333.33	17229.17	17229.17	2152.08
1402	**918.38**	-5414.58	-9993.06	10069.44	2151.39
1460	**930.48**	-8708.33	-16791.67	16875.00	2659.72
1442	**949.48**	4232.64	2478.47	5154.17	-2262.50
1462	**990.98**	3676.39	1100.69	6115.28	-3044.44
1482	**1050.98**	2856.94	1075.69	2377.78	-1877.08
1502	**1110.98**	2170.14	697.22	2377.78	-1178.47
1522	**1170.98**	1681.94	672.99	1684.03	-783.33
1542	**1230.98**	1218.06	523.68	1219.44	-480.56
1562	**1292.98**	806.25	621.81	807.64	-258.75

Note 1: Meridonal, Hoop, and Shear Stresses are Reversed in Highlighted Sections (Floor)

Table 10 LBS-BEC Primary Tank Stresses, Shell Top, Seismic Load Only

AP Primary Tank, Lower Bound Soil, Horizontal and Vertical Seismic, Best Estimate Tank Concrete, 460 in. Waste Level at 1.83 SpG

M&D Starting M&D Element No.	Path (in.)	Shell Top Surface (inside - waste side)			
		AP-460-LBS-BEC Seismic Only Hoop Stress (lbs/in^2) Top	AP-460-LBS-BEC Seismic Only Meridional Stress (lbs/in^2) Top	AP-460-LBS-BEC Seismic Only Stress Intensity (lbs/in^2) Top	AP-460-LBS-BEC Seismic Only In-Plane Shear Stress (lbs/in^2) Top
762	**67.33**	822.22	963.19	822.92	218.67
782	**105.04**	879.17	1472.22	1472.92	402.58
802	**136.24**	1068.06	1034.03	1007.64	444.39
822	**181.83**	739.51	1122.92	1123.61	460.70
842	**225.10**	1267.85	1072.78	1125.00	528.06
862	**273.66**	889.65	1054.10	1048.26	739.03
882	**323.27**	1779.86	963.68	1904.86	1225.99
902	**369.20**	2087.01	1317.36	3061.11	1824.80
922	**419.20**	3272.92	945.42	4988.19	2976.42
942	**444.31**	4825.69	3574.31	3925.00	2870.66
962	**458.66**	6077.43	5431.94	10317.36	2869.99
982	**473.08**	6515.97	5938.19	11217.36	3075.57
1002	**484.80**	3756.25	1617.57	5038.89	3179.05
1022	**502.48**	2558.33	842.42	4100.69	3113.78
1042	**526.48**	4938.89	950.35	4945.14	2927.70
1062	**550.48**	5768.06	1087.33	5730.56	2690.21
1082	**574.60**	6576.39	1381.39	6583.33	2398.00
1102	**598.28**	7513.89	1383.61	7430.56	2067.38
1122	**621.38**	8354.17	1518.13	8354.17	1693.05
1142	**644.48**	9097.22	1509.73	9076.39	1311.14
1162	**667.63**	9291.67	1556.88	8930.56	1018.10
1182	**690.78**	9000.00	1663.26	9000.00	999.97
1202	**713.88**	9113.89	1566.53	9090.28	1215.33
1222	**736.98**	9409.72	1445.83	8972.22	1472.92
1242	**760.13**	8833.33	1270.35	8138.89	1765.86
1262	**782.53**	7597.22	1440.14	7597.22	1541.59
1282	**804.13**	6979.17	1109.03	6979.17	1755.64
1302	**825.73**	6986.11	982.41	6958.33	1997.43
1322	**847.33**	7298.61	992.57	7305.56	2259.05
1342	**868.87**	6923.61	1425.76	7875.00	2550.94
1362	**892.10**	4027.78	3195.00	6701.39	2466.68
1382	**909.20**	2110.42	8826.39	7847.92	2491.65
1402	**918.38**	2142.36	4652.78	4632.64	2483.31
1422	**930.48**	2853.82	7645.83	7680.56	2452.57
1442	**949.48**	4068.61	826.53	3922.08	2173.02
1462	**990.98**	3247.36	857.64	5193.06	3034.79
1482	**1050.98**	2441.04	396.46	1798.06	1858.05
1502	**1110.98**	1849.51	394.24	1798.06	1176.75
1522	**1170.98**	1360.69	322.71	1362.36	773.14
1542	**1230.98**	902.57	397.88	842.50	485.97
1562	**1292.98**	522.64	261.99	505.49	251.26

Note 1: Meridonal, Hoop, and Shear Stresses are Reversed in Highlighted Sections (Floor)

Table 11 LBS-BEC Primary Tank Stresses, Shell Middle, Seismic Load Only

AP Primary Tank, Lower Bound Soil, Horizontal and Vertical Seismic, Best Estimate Tank Concrete, 460 in. Waste Level at 1.83 SpG

M&D Starting M&D Element No.	Path (in.)	Shell Mid-Plane			
		AP-460-LBS-BEC Seismic Only Hoop Stress (lbs/in^2) Mid	AP-460-LBS-BEC Seismic Only Meridional Stress (lbs/in^2) Mid	AP-460-LBS-BEC Seismic Only Stress Intensity (lbs/in^2) Mid	AP-460-LBS-BEC Seismic Only In-Plane Shear Stress (lbs/in^2) Mid
762	**67.33**	1009.72	652.08	1010.42	219.52
782	**105.04**	795.14	883.33	884.72	397.11
802	**136.24**	1270.83	859.72	934.03	439.95
822	**181.83**	662.71	790.28	790.28	456.57
842	**225.10**	1562.86	733.33	1150.69	527.06
862	**273.66**	847.92	723.61	723.61	738.44
882	**323.27**	1925.69	802.08	1625.00	1227.48
902	**369.20**	2041.81	934.72	3065.28	1824.12
922	**419.20**	3361.81	1114.93	4974.31	2978.50
942	**444.31**	3952.78	979.13	4976.39	2913.69
962	**458.66**	7061.11	933.75	7588.40	2899.13
982	**473.08**	7932.15	870.76	8501.04	3024.17
1002	**484.80**	3460.42	818.75	5113.19	3117.24
1022	**502.48**	2988.89	891.04	3988.19	3088.09
1042	**526.48**	4966.67	997.01	4965.97	2921.44
1062	**550.48**	5774.31	1127.72	5780.56	2684.65
1082	**574.60**	6555.56	1286.65	6562.50	2391.04
1102	**598.28**	7555.56	1430.15	7562.50	2059.05
1122	**621.38**	8375.00	1551.24	8375.00	1686.11
1142	**644.48**	9138.89	1650.13	9131.94	1306.96
1162	**667.63**	9375.00	1727.52	9375.00	1018.09
1182	**690.78**	8951.39	1556.32	8951.39	996.52
1202	**713.88**	9090.28	1576.75	9097.22	1213.93
1222	**736.98**	9465.28	1572.93	9388.89	1470.83
1242	**760.13**	8923.61	1539.23	8881.94	1747.14
1262	**782.53**	7513.89	1086.20	7506.94	1515.23
1282	**804.13**	6972.22	1029.85	6958.33	1741.04
1302	**825.73**	7027.78	954.05	7006.94	1998.75
1322	**847.33**	7277.78	860.89	7256.94	2263.88
1342	**868.87**	7333.33	735.28	7291.67	2546.21
1362	**892.10**	4750.00	520.01	4784.72	2402.10
1382	**909.20**	2586.81	480.90	2668.75	2320.86
1402	**918.38**	3575.00	395.49	3640.28	2313.23
1422	**930.48**	4052.43	461.67	4131.32	2310.35
1442	**949.48**	3855.28	501.53	3960.83	2193.64
1462	**990.98**	3234.93	716.50	5365.28	3035.92
1482	**1050.98**	2446.74	423.40	1914.72	1858.76
1502	**1110.98**	1835.76	304.93	1914.72	1177.85
1522	**1170.98**	1338.96	302.61	1325.21	774.26
1542	**1230.98**	917.71	286.72	914.93	485.29
1562	**1292.98**	510.35	263.13	451.32	250.70

Note 1: Meridonal, Hoop, and Shear Stresses are Reversed in Highlighted Sections (Floor)

Table 12 LBS-BEC Primary Tank Stresses, Shell Bottom, Seismic Load Only

AP Primary Tank, Lower Bound Soil, Horizontal and Vertical Seismic, Best Estimate Tank Concrete, 460 in. Waste Level at 1.83 SpG

M&D Starting M&D Element No.	Path (in.)	Shell Bottom Surface (outside - away from waste) AP-460-LBS-BEC Seismic Only Hoop Stress (lbs/in^2) Bot	AP-460-LBS-BEC Seismic Only Meridional Stress (lbs/in^2) Bot	AP-460-LBS-BEC Seismic Only Stress Intensity (lbs/in^2) Bot	AP-460-LBS-BEC Seismic Only In-Plane Shear Stress (lbs/in^2) Bot
762	**67.33**	1197.92	1213.89	1213.19	221.30
782	**105.04**	776.39	1118.75	1116.67	391.57
802	**136.24**	1476.04	1483.33	1485.42	435.51
822	**181.83**	585.21	884.03	810.42	452.44
842	**225.10**	1857.15	1572.29	1511.81	526.39
862	**273.66**	819.44	784.17	704.86	737.84
882	**323.27**	2201.39	1622.85	1613.19	1228.27
902	**369.20**	1996.67	763.06	3069.44	1823.43
922	**419.20**	3472.22	1893.68	4976.39	2981.27
942	**444.31**	3525.00	5444.44	5443.75	2956.72
962	**458.66**	8317.75	3779.17	7184.72	2928.27
982	**473.08**	9341.40	4222.22	8406.25	2972.76
1002	**484.80**	3350.00	2230.49	4841.67	3055.43
1022	**502.48**	3419.44	2544.58	3908.33	3062.39
1042	**526.48**	4987.50	1084.67	4991.67	2915.18
1062	**550.48**	5787.50	1247.36	5787.50	2679.78
1082	**574.60**	6534.72	1224.86	6444.44	2384.08
1102	**598.28**	7611.11	1519.79	7611.11	2050.72
1122	**621.38**	8388.89	1583.63	8361.11	1679.18
1142	**644.48**	9187.50	1789.86	9187.50	1302.78
1162	**667.63**	9465.28	1897.15	9465.28	1018.09
1182	**690.78**	8895.83	1456.04	8520.83	993.06
1202	**713.88**	9097.22	1586.25	8972.22	1212.53
1222	**736.98**	9520.83	1699.72	9486.11	1468.75
1242	**760.13**	9055.56	1838.89	9055.56	1740.92
1262	**782.53**	7430.56	852.99	7131.94	1488.17
1282	**804.13**	6972.22	962.92	6625.00	1739.00
1302	**825.73**	7062.50	936.06	7055.56	2000.84
1322	**847.33**	7256.94	729.86	6979.17	2268.18
1342	**868.87**	7743.06	2747.92	7743.06	2542.49
1362	**892.10**	5541.67	2696.25	5534.72	2336.83
1382	**909.20**	4164.58	7976.39	7750.00	2152.15
1402	**918.38**	5023.40	4653.47	4306.25	2151.49
1422	**930.48**	6111.81	7659.72	7694.44	2214.10
1442	**949.48**	3665.97	1407.90	3795.14	2213.51
1462	**990.98**	3222.43	673.33	5540.00	3037.05
1482	**1050.98**	2451.74	528.61	2036.74	1859.49
1502	**1110.98**	1826.81	362.57	2036.74	1178.94
1522	**1170.98**	1340.83	386.60	1220.90	775.38
1542	**1230.98**	933.47	292.15	934.51	484.61
1562	**1292.98**	523.33	400.88	398.68	250.22

Note 1: Meridonal, Hoop, and Shear Stresses are Reversed in Highlighted Sections (Floor)

Table 13 LBS-BEC J-Bolt Forces, Gravity Load Only

AP Primary Tank, Lower Bound Soil, Gravity Only, Best Estimate Tank Concrete, 460 in. Waste Level at 1.83 SpG

ANSYS MAXIMUMS BY RADIUS

M&D J-Bolt Radius No.	Mean J-Bolt Radius	Radius of J-Bolts Included min	Radius of J-Bolts Included max	Average Bolts per Element	Min Axial Force (kip) LBS-BEC Gravity Only	Max Axial Force (kip) LBS-BEC Gravity Only	Shear Force1 (kip) LBS-BEC Gravity	Maximum Shear Force1 Model Angle	Shear Force2 (kip) LBS-BEC Gravity Only	Maximum Shear Force2 Model Angle	Total Shear (kip) LBS-BEC Gravity
Radius 2	44.72	*22.36*	*67.29*	0.55	-0.015	-0.011	0.002	45	0.075	90	0.075
Radius 3	89.87	*67.29*	*104.93*	0.89	-0.015	-0.014	0.003	27	0.092	0	0.092
Radius 4	120.00	*104.93*	*135.98*	1.03	0.005	0.006	0.007	27	0.170	180	0.170
Radius 5	151.97	*135.98*	*181.01*	1.97	0.001	0.003	0.014	153	0.321	90	0.321
Radius 6	210.05	*181.01*	*223.79*	2.41	0.020	0.021	0.025	153	0.615	81	0.615
Radius 7	237.53	*223.79*	*270.98*	3.30	0.063	0.067	0.022	153	0.734	45	0.734
Radius 8	304.43	*270.98*	*318.74*	4.04	0.049	0.052	0.007	153	0.971	45	0.971
Radius 9	333.05	*318.74*	*361.64*	4.37	0.148	0.149	0.002	153	0.979	45	0.979
Radius 10	390.22	*361.64*	*406.24*	5.36	0.008	0.009	0.001	144	1.134	45	1.134
Radius 11	422.26	*406.24*	*431.63*	3.60	0.640	0.642	0.001	63	1.854	0	1.854

M&D J-Bolt Radius No.	Mean J-Bolt Radius	Radius of J-Bolts Included min	Radius of J-Bolts Included max	Average Bolts per Element	Bolt Angle (Rad)	Shear Stiffness (kip/ft)	Axial Stiffness (kip/ft)	Shear Displacement LBS-BEC-Gravity Only	Axial Min Displacement LBS-BEC-Gravity Only	Axial Max Displacement LBS-BEC-Gravity Only
Radius 2	44.72	*22.36*	*67.29*	0.55	0.0351	1667	2222	0.00054	-0.00008	-0.00006
Radius 3	89.87	*67.29*	*104.93*	0.89	0.0715	1670	2219	0.00066	-0.00008	-0.00007
Radius 4	120.00	*104.93*	*135.98*	1.03	0.0968	1673	2215	0.00122	0.00003	0.00003
Radius 5	151.97	*135.98*	*181.01*	1.97	0.1252	1677	2207	0.00230	0.00000	0.00001
Radius 6	210.05	*181.01*	*223.79*	2.41	0.1825	1688	2192	0.00437	0.00011	0.00011
Radius 7	237.53	*223.79*	*270.98*	3.30	0.2136	1696	2172	0.00520	0.00035	0.00037
Radius 8	304.43	*270.98*	*318.74*	4.04	0.3076	1725	2132	0.00675	0.00028	0.00030
Radius 9	333.05	*318.74*	*361.64*	4.37	0.3613	1746	2086	0.00673	0.00085	0.00086
Radius 10	390.22	*361.64*	*406.24*	5.36	0.5235	1821	2006	0.00747	0.00005	0.00005
Radius 11	460.26	*406.24*	*431.63*	3.60	0.6938	1913	1933	0.01163	0.00397	0.00399

Table 14 LBS-BEC J-Bolt Forces, Gravity Plus Seismic Loads

AP Primary Tank, Lower Bound Soil, Horizontal and Vertical Seismic Input, Best Estimate Tank Concrete, 460 in. Waste Level at 1.83 SpG

ANSYS MAXIMUMS BY RADIUS

M&D J-Bolt Radius No.	Mean J-Bolt Radius	Radius of J-Bolts Included min	Radius of J-Bolts Included max	Average Bolts per Element	Min Axial Force (kip) LBS-BEC	Max Axial Force (kip) LBS-BEC	Shear Force1 (kip) LBS-BEC	Maximum Shear Force1 Model Angle	Shear Force2 (kip) LBS-BEC	Maximum Shear Force2 Model Angle	Total Shear (kip) LBS-BEC
Radius 2	44.72	22.36	67.29	0.55	-0.091	0.001	0.372	90	0.476	0	0.476
Radius 3	89.87	67.29	104.93	0.89	-0.089	-0.009	0.384	90	0.480	180	0.510
Radius 4	120.00	104.93	135.98	1.03	-0.067	0.055	0.446	90	0.617	180	0.623
Radius 5	151.97	135.98	181.01	1.97	-0.081	0.029	0.594	90	0.801	180	0.824
Radius 6	210.05	181.01	223.79	2.41	-0.053	0.037	0.971	90	1.067	180	1.234
Radius 7	237.53	223.79	270.98	3.30	-0.031	0.128	1.273	90	1.248	0	1.515
Radius 8	304.43	270.98	318.74	4.04	-0.024	0.067	2.276	90	1.595	180	2.527
Radius 9	333.05	318.74	361.64	4.37	-0.031	0.375	2.980	90	1.826	180	3.197
Radius 10	390.22	361.64	406.24	5.36	-0.075	0.339	5.008	90	2.219	180	5.181
Radius 11	422.26	406.24	431.63	3.60	-0.579	2.000	7.120	90	3.830	180	7.462

M&D J-Bolt Radius No.	Mean J-Bolt Radius	Radius of J-Bolts Included min	Radius of J-Bolts Included max	Average Bolts per Element	Bolt Angle (Rad)	Shear Stiffness (kip/ft)	Axial Stiffness (kip/ft)	Shear Disp LBS-BEC-Seismic	Axial Min Disp LBS-BEC-Seismic	Axial Max Disp LBS-BEC-Seismic
Radius 2	44.72	22.36	67.29	0.55	0.0351	1667	2222	0.00343	-0.00049	0.00001
Radius 3	89.87	67.29	104.93	0.89	0.0715	1670	2219	0.00367	-0.00048	-0.00005
Radius 4	120.00	104.93	135.98	1.03	0.0968	1673	2215	0.00447	-0.00036	0.00030
Radius 5	151.97	135.98	181.01	1.97	0.1252	1677	2207	0.00590	-0.00044	0.00016
Radius 6	210.05	181.01	223.79	2.41	0.1825	1688	2192	0.00877	-0.00029	0.00020
Radius 7	237.53	223.79	270.98	3.30	0.2136	1696	2172	0.01072	-0.00017	0.00071
Radius 8	304.43	270.98	318.74	4.04	0.3076	1725	2132	0.01758	-0.00014	0.00038
Radius 9	333.05	318.74	361.64	4.37	0.3613	1746	2086	0.02198	-0.00018	0.00216
Radius 10	390.22	361.64	406.24	5.36	0.5235	1821	2006	0.03413	-0.00045	0.00203
Radius 11	460.26	406.24	431.63	3.60	0.6938	1913	1933	0.04680	-0.00359	0.01242

Table 15 LBS-BEC J-Bolt Forces, Seismic Load Only

AP Primary Tank, Lower Bound Soil, Horizontal and Vertical Seismic Input, Best Estimate Tank Concrete, 460 in. Waste Level at 1.83 SpG

ANSYS MAXIMUMS BY RADIUS

M&D J-Bolt Radius No.	Mean J-Bolt Radius	Radius of J-Bolts Included min	Radius of J-Bolts Included max	Average Bolts per Element	Min Axial Force (kip) LBS-BEC-Seismic Only	Max Axial Force (kip) LBS-BEC-Seismic Only	Shear Force1 (kip) LBS-BEC-Seismic Only	Maximum Shear Force1 Model Angle	Shear Force2 (kip) LBS-BEC-Seismic Only	Maximum Shear Force2 Model Angle	Total Shear (kip) LBS-BEC-Seismic Only
Radius 2	44.72	*22.36*	*67.29*	0.55	-0.076	0.013	0.370	108	0.402	0	0.546
Radius 3	89.87	*67.29*	*104.93*	0.89	-0.073	0.005	0.380	108	0.388	0	0.543
Radius 4	120.00	*104.93*	*135.98*	1.03	-0.073	0.049	0.440	108	0.447	0	0.627
Radius 5	151.97	*135.98*	*181.01*	1.97	-0.082	0.026	0.579	108	0.480	0	0.752
Radius 6	210.05	*181.01*	*223.79*	2.41	-0.074	0.016	0.946	108	0.452	144	1.049
Radius 7	237.53	*223.79*	*270.98*	3.30	-0.094	0.061	1.251	90	0.514	135	1.353
Radius 8	304.43	*270.98*	*318.74*	4.04	-0.074	0.015	2.268	117	0.624	117	2.353
Radius 9	333.05	*318.74*	*361.64*	4.37	-0.179	0.226	2.978	117	0.847	117	3.096
Radius 10	390.22	*361.64*	*406.24*	5.36	-0.084	0.330	5.007	108	1.086	0	5.124
Radius 11	460.26	*406.24*	*431.63*	3.60	-1.218	1.358	7.119	108	1.976	0	7.388

M&D J-Bolt Radius No.	Mean J-Bolt Radius	Radius of J-Bolts Included min	Radius of J-Bolts Included max	Average Bolts per Element	Bolt Angle (Rad)	Shear Stiffness (kip/ft)	Axial Stiffness (kip/ft)	Shear Disp LBS-BEC-Seismic Only	Axial Min Disp LBS-BEC-Seismic Only	Axial Max Disp LBS-BEC-Seismic Only
Radius 2	44.72	*22.36*	*67.29*	0.55	0.0351	1667	2222	0.00393	-0.00041	0.00007
Radius 3	89.87	*67.29*	*104.93*	0.89	0.0715	1670	2219	0.00390	-0.00040	0.00003
Radius 4	120.00	*104.93*	*135.98*	1.03	0.0968	1673	2215	0.00450	-0.00039	0.00026
Radius 5	151.97	*135.98*	*181.01*	1.97	0.1252	1677	2207	0.00538	-0.00044	0.00014
Radius 6	210.05	*181.01*	*223.79*	2.41	0.1825	1688	2192	0.00746	-0.00040	0.00009
Radius 7	237.53	*223.79*	*270.98*	3.30	0.2136	1696	2172	0.00957	-0.00052	0.00034
Radius 8	304.43	*270.98*	*318.74*	4.04	0.3076	1725	2132	0.01637	-0.00042	0.00008
Radius 9	333.05	*318.74*	*361.64*	4.37	0.3613	1746	2086	0.02128	-0.00103	0.00130
Radius 10	390.22	*361.64*	*406.24*	5.36	0.5235	1821	2006	0.03375	-0.00050	0.00198
Radius 11	460.26	*406.24*	*431.63*	3.60	0.6938	1913	1933	0.04633	-0.00756	0.00843

Table 16 LBS-BEC Concrete Backed Steel Strain, Shell Top, Gravity Load Only

AP Backed Steel, Lower Bound Soil, Gravity Only, Best Estimate Tank Concrete, 460 In Waste Level at 1.83SpG

M&D Starting M&D Element No.	Path (in)	Shell Top Surface (inside - towards waste) Gravity					
		AP-460-LBS-BEC EPEL P1 Strain (in/in) Gravity Top Min	AP-460-LBS-BEC EPEL P1 Strain (in/in) Gravity Top Max	AP-460-LBS-BEC EPEL P2 (in/in) Gravity Top Min	AP-460-LBS-BEC EPEL P2 Strain (in/in) Gravity Top Max	AP-460-LBS-BEC EPEL P3 Strain (in/in) Gravity Top Min	AP-460-LBS-BEC EPEL P3 Strain (in/in) Gravity Top Max
762	**67.33**	3.42E-05	3.42E-05	-3.40E-05	-3.40E-05	-4.51E-05	-4.51E-05
782	**105.04**	4.63E-05	4.64E-05	-3.25E-05	-3.25E-05	-7.43E-05	-7.42E-05
802	**136.24**	3.78E-05	3.78E-05	-3.93E-05	-3.93E-05	-4.74E-05	-4.74E-05
822	**181.71**	3.59E-05	3.60E-05	-2.21E-05	-2.20E-05	-6.04E-05	-6.03E-05
842	**225.10**	2.79E-05	2.80E-05	-3.07E-05	-3.06E-05	-3.33E-05	-3.33E-05
862	**273.66**	2.43E-05	2.43E-05	-1.14E-05	-1.14E-05	-4.42E-05	-4.41E-05
882	**323.27**	1.53E-05	1.53E-05	-1.52E-05	-1.52E-05	-1.98E-05	-1.98E-05
902	**369.20**	1.34E-05	1.34E-05	6.67E-06	6.67E-06	-2.85E-05	-2.84E-05
922	**419.20**	3.45E-05	3.45E-05	-7.31E-06	-7.30E-06	-1.71E-05	-1.71E-05
237	**463.02**						
257	**510.03**						
277	**544.44**						
297	**580.53**						
317	**631.08**						
337	**680.34**						
357	**727.44**						
377	**772.93**						
397	**831.34**						
417	**894.09**						
2132	**925.08**	3.46E-05	3.47E-05	-3.25E-05	-3.25E-05	-4.24E-05	-4.24E-05
2122	**935.67**	7.56E-05	7.57E-05	-2.12E-05	-2.12E-05	-3.10E-05	-3.10E-05
2112	**944.86**	9.60E-05	9.61E-05	-7.77E-06	-7.76E-06	-2.13E-04	-2.13E-04
477	**968.95**						
497	**1002.45**						
517	**1042.45**						
537	**1108.60**						
557	**1178.35**						
577	**1227.20**						
597	**1271.50**						
617	**1313.65**						
637	**1360.60**						

M&D Professional Services, Inc
1/9/2007

AP-460-LBS-BEC Strain Seismic-Princ.xls
Strain Gravity

Table 17 LBS-BEC Concrete Backed Steel Strain, Shell Middle, Gravity Load Only

AP Backed Steel, Lower Bound Soil, Gravity Only, Best Estimate Tank Concrete, 460 In Waste Level at 1.83SpG

M&D Starting M&D Element No.	Path (in)	Shell Mid-Plane AP-460-LBS-BEC EPEL P1 Strain (in/in) Gravity Mid Min	AP-460-LBS-BEC EPEL P1 Strain (in/in) Gravity Mid Max	AP-460-LBS-BEC EPEL P2 (in/in) Gravity Mid Min	AP-460-LBS-BEC EPEL P2 Strain (in/in) Gravity Mid Max	AP-460-LBS-BEC EPEL P3 Strain (in/in) Gravity Mid Min	AP-460-LBS-BEC EPEL P3 Strain (in/in) Gravity Mid Max
762	**67.33**	3.82E-05	3.83E-05	-4.29E-05	-4.29E-05	-4.59E-05	-4.59E-05
782	**105.04**	4.24E-05	4.24E-05	-3.30E-05	-3.30E-05	-6.47E-05	-6.47E-05
802	**136.24**	4.22E-05	4.22E-05	-3.97E-05	-3.97E-05	-5.73E-05	-5.72E-05
822	**181.71**	3.34E-05	3.34E-05	-2.23E-05	-2.23E-05	-5.42E-05	-5.42E-05
842	**225.10**	3.33E-05	3.33E-05	-3.33E-05	-3.33E-05	-4.28E-05	-4.28E-05
862	**273.66**	2.26E-05	2.26E-05	-1.16E-05	-1.16E-05	-4.01E-05	-4.00E-05
882	**323.27**	1.90E-05	1.90E-05	-1.53E-05	-1.53E-05	-2.83E-05	-2.83E-05
902	**369.20**	1.31E-05	1.31E-05	5.88E-06	5.88E-06	-2.64E-05	-2.64E-05
922	**419.20**	3.43E-05	3.43E-05	-6.23E-06	-6.22E-06	-1.95E-05	-1.95E-05
237	**463.02**	5.70E-05	5.71E-05	3.65E-06	3.66E-06	-7.06E-05	-7.05E-05
257	**510.03**	8.29E-05	8.30E-05	5.61E-05	5.62E-05	-3.38E-04	-3.38E-04
277	**544.44**	1.16E-04	1.16E-04	7.40E-05	7.42E-05	-5.94E-04	-5.94E-04
297	**580.53**	8.16E-05	8.16E-05	-1.08E-05	-1.07E-05	-3.58E-04	-3.58E-04
317	**631.08**	9.16E-05	9.17E-05	-1.17E-04	-1.17E-04	-3.00E-04	-3.00E-04
337	**680.34**	1.18E-04	1.18E-04	-1.60E-04	-1.60E-04	-3.77E-04	-3.76E-04
357	**727.44**	1.21E-04	1.21E-04	-1.73E-04	-1.73E-04	-3.79E-04	-3.79E-04
377	**772.93**	1.38E-04	1.38E-04	-1.82E-04	-1.81E-04	-4.46E-04	-4.46E-04
397	**831.34**	1.28E-04	1.28E-04	-1.52E-04	-1.52E-04	-4.32E-04	-4.31E-04
417	**894.09**	5.96E-05	5.97E-05	-8.25E-05	-8.24E-05	-1.86E-04	-1.86E-04
2132	**925.08**	2.92E-05	2.92E-05	-1.67E-05	-1.67E-05	-4.25E-05	-4.24E-05
2122	**935.67**	3.02E-05	3.02E-05	-2.90E-05	-2.90E-05	-3.07E-05	-3.07E-05
2112	**944.86**	2.20E-05	2.20E-05	-7.73E-06	-7.73E-06	-3.54E-05	-3.54E-05
477	**968.95**	2.44E-05	2.45E-05	8.71E-06	8.72E-06	-1.09E-04	-1.09E-04
497	**1002.45**	2.04E-05	2.04E-05	1.43E-05	1.43E-05	-8.17E-06	-8.16E-06
517	**1042.45**	1.39E-05	1.40E-05	1.32E-05	1.32E-05	-6.15E-06	-6.14E-06
537	**1108.60**	3.74E-05	3.74E-05	7.10E-06	7.12E-06	-1.14E-05	-1.14E-05
557	**1178.35**	4.77E-06	4.77E-06	3.89E-06	3.90E-06	-2.31E-05	-2.30E-05
577	**1227.20**	2.80E-05	2.80E-05	3.92E-06	3.93E-06	-7.30E-06	-7.29E-06
597	**1271.50**	5.03E-06	5.04E-06	4.31E-06	4.31E-06	-2.38E-05	-2.38E-05
617	**1313.65**	1.75E-05	1.75E-05	7.74E-06	7.75E-06	-5.57E-06	-5.56E-06
637	**1360.60**	5.09E-06	5.09E-06	4.74E-06	4.75E-06	-2.02E-06	-2.01E-06

M&D Professional Services, Inc
1/9/2007

AP-460-LBS-BEC Strain Seismic-Princ.xls
Strain Gravity

Table 18 LBS-BEC Concrete Backed Steel Strain, Shell Bottom, Gravity Load Only

AP Backed Steel, Lower Bound Soil, Gravity Only, Best Estimate Tank Concrete, 460 In Waste Level at 1.83SpG

M&D Starting M&D Element No.	Path (in)	Shell Bottom Surface (outside - away from waste) Gravity					
		AP-460-LBS-BEC EPEL P1 Strain (in/in) Gravity Bot Min	AP-460-LBS-BEC EPEL P1 Strain (in/in) Gravity Bot Max	AP-460-LBS-BEC EPEL P2 (in/in) Gravity Bot Min	AP-460-LBS-BEC EPEL P2 Strain (in/in) Gravity Bot Max	AP-460-LBS-BEC EPEL P3 Strain (in/in) Gravity Bot Min	AP-460-LBS-BEC EPEL P3 Strain (in/in) Gravity Bot Max
762	**67.33**	4.24E-05	4.24E-05	-4.66E-05	-4.65E-05	-5.17E-05	-5.16E-05
782	**105.04**	3.84E-05	3.84E-05	-3.35E-05	-3.35E-05	-5.50E-05	-5.50E-05
802	**136.24**	4.66E-05	4.66E-05	-4.01E-05	-4.01E-05	-6.71E-05	-6.70E-05
822	**181.71**	3.09E-05	3.09E-05	-2.26E-05	-2.26E-05	-4.80E-05	-4.80E-05
842	**225.10**	3.87E-05	3.87E-05	-3.33E-05	-3.33E-05	-5.49E-05	-5.48E-05
862	**273.66**	2.09E-05	2.09E-05	-1.19E-05	-1.19E-05	-3.59E-05	-3.59E-05
882	**323.27**	2.27E-05	2.27E-05	-1.54E-05	-1.54E-05	-3.68E-05	-3.68E-05
902	**369.20**	1.28E-05	1.29E-05	5.10E-06	5.10E-06	-2.43E-05	-2.43E-05
922	**419.20**	3.41E-05	3.42E-05	-5.13E-06	-5.13E-06	-2.19E-05	-2.18E-05
237	**463.02**						
257	**510.03**						
277	**544.44**						
297	**580.53**						
317	**631.08**						
337	**680.34**						
357	**727.44**						
377	**772.93**						
397	**831.34**						
417	**894.09**						
2132	**925.08**	2.79E-05	2.80E-05	-4.82E-06	-4.82E-06	-4.25E-05	-4.24E-05
2122	**935.67**	6.42E-05	6.43E-05	-3.03E-05	-3.03E-05	-1.16E-04	-1.16E-04
2112	**944.86**	1.56E-04	1.56E-04	-7.70E-06	-7.70E-06	-6.33E-05	-6.32E-05
477	**968.95**						
497	**1002.45**						
517	**1042.45**						
537	**1108.60**						
557	**1178.35**						
577	**1227.20**						
597	**1271.50**						
617	**1313.65**						
637	**1360.60**						

M&D Professional Services, Inc
1/9/2007

AP-460-LBS-BEC Strain Seismic-Princ.xls
Strain Gravity

Table 19 LBS-BEC Concrete Backed Steel Strain, Shell Top, Gravity Plus Seismic Load

AP Backed Steel, Lower Bound Soil, Seismic Only, Best Estimate Tank Concrete, 460 In Waste Level at 1.83SpG

M&D Starting M&D Element No.	Path (in)	Shell Top Surface (inside - towards waste) Seismic					
		AP-460-LBS-BEC EPEL P1 Strain (in/in) Seismic Top Min	AP-460-LBS-BEC EPEL P1 Strain (in/in) Seismic Top Max	AP-460-LBS-BEC EPEL P2 (in/in) Seismic Top Min	AP-460-LBS-BEC EPEL P2 Strain (in/in) Seismic Top Max	AP-460-LBS-BEC EPEL P3 Strain (in/in) Seismic Top Min	AP-460-LBS-BEC EPEL P3 Strain (in/in) Seismic Top Max
762	67.33	2.28E-05	4.61E-05	-4.91E-05	-5.64E-06	-5.89E-05	-2.77E-05
782	105.04	3.37E-05	7.07E-05	-4.27E-05	-1.31E-05	-9.45E-05	-3.49E-05
802	136.24	2.59E-05	5.13E-05	-4.99E-05	-3.86E-07	-7.37E-05	-3.07E-05
822	181.71	2.70E-05	5.42E-05	-3.06E-05	-3.90E-06	-8.10E-05	-3.13E-05
842	225.10	2.12E-05	3.83E-05	-3.64E-05	2.04E-05	-6.13E-05	-2.42E-05
862	273.66	1.94E-05	3.89E-05	-1.93E-05	1.89E-05	-6.95E-05	-1.43E-05
882	323.27	1.28E-05	5.44E-05	-1.87E-05	2.36E-05	-7.22E-05	-1.16E-05
902	369.20	6.02E-06	8.86E-05	-9.00E-07	2.08E-05	-7.17E-05	-1.50E-06
922	419.20	1.74E-05	1.52E-04	-1.13E-05	1.78E-05	-7.55E-05	-4.46E-07
237	463.02						
257	510.03						
277	544.44						
297	580.53						
317	631.08						
337	680.34						
357	727.44						
377	772.93						
397	831.34						
417	894.09						
2132	925.08	2.90E-05	4.70E-05	-3.72E-05	2.01E-05	-5.92E-05	-3.31E-05
2122	935.67	6.48E-05	1.18E-04	-2.40E-05	1.11E-05	-4.83E-05	-1.97E-05
2112	944.86	7.25E-05	1.60E-04	-1.34E-05	4.54E-05	-2.52E-04	-5.00E-05
477	968.95						
497	1002.45						
517	1042.45						
537	1108.60						
557	1178.35						
577	1227.20						
597	1271.50						
617	1313.65						
637	1360.60						

M&D Professional Services, Inc
1/9/2007

AP-460-LBS-BEC Strain Seismic-Princ.xls
Strain Max

Table 20 LBS-BEC Concrete Backed Steel Strain, Shell Middle, Gravity Plus Seismic Load

AP Backed Steel, Lower Bound Soil, Seismic Only, Best Estimate Tank Concrete, 460 In Waste Level at 1.83SpG

M&D Starting M&D Element No.	Path (in)	Shell Mid-Plane					
		AP-460-LBS-BEC EPEL P1 Strain (in/in) Seismic Mid Min	AP-460-LBS-BEC EPEL P1 Strain (in/in) Seismic Mid Max	AP-460-LBS-BEC EPEL P2 (in/in) Seismic Mid Min	AP-460-LBS-BEC EPEL P2 Strain (in/in) Seismic Mid Max	AP-460-LBS-BEC EPEL P3 Strain (in/in) Seismic Mid Min	AP-460-LBS-BEC EPEL P3 Strain (in/in) Seismic Mid Max
762	**67.33**	2.70E-05	5.52E-05	-5.60E-05	-1.89E-05	-6.11E-05	-3.01E-05
782	**105.04**	2.90E-05	5.89E-05	-4.37E-05	-1.30E-05	-8.58E-05	-4.30E-05
802	**136.24**	3.07E-05	6.42E-05	-5.06E-05	-9.42E-07	-7.96E-05	-3.77E-05
822	**181.71**	2.46E-05	4.70E-05	-3.06E-05	-4.11E-06	-7.54E-05	-3.18E-05
842	**225.10**	2.60E-05	5.46E-05	-4.37E-05	1.77E-05	-6.76E-05	-2.70E-05
862	**273.66**	1.81E-05	3.42E-05	-1.94E-05	1.92E-05	-6.42E-05	-2.09E-05
882	**323.27**	1.51E-05	5.42E-05	-2.42E-05	2.33E-05	-7.27E-05	-1.35E-05
902	**369.20**	5.79E-06	8.91E-05	-1.03E-06	1.92E-05	-6.39E-05	-1.87E-06
922	**419.20**	1.70E-05	1.51E-04	-1.19E-05	2.38E-05	-7.11E-05	-2.13E-06
237	**463.02**	3.09E-05	1.07E-04	1.40E-06	9.62E-06	-8.48E-05	-5.07E-05
257	**510.03**	5.33E-05	1.38E-04	4.97E-05	6.74E-05	-3.93E-04	-2.76E-04
277	**544.44**	1.04E-04	1.37E-04	4.12E-05	1.32E-04	-6.94E-04	-4.85E-04
297	**580.53**	7.35E-05	9.62E-05	-3.62E-05	7.01E-05	-4.24E-04	-2.96E-04
317	**631.08**	8.18E-05	1.08E-04	-1.37E-04	3.83E-05	-3.52E-04	-2.53E-04
337	**680.34**	1.05E-04	1.37E-04	-1.81E-04	1.13E-06	-4.43E-04	-3.13E-04
357	**727.44**	1.08E-04	1.40E-04	-1.93E-04	-1.68E-05	-4.45E-04	-3.07E-04
377	**772.93**	1.21E-04	1.61E-04	-2.01E-04	3.29E-05	-5.34E-04	-3.38E-04
397	**831.34**	1.11E-04	1.50E-04	-1.68E-04	4.88E-05	-5.15E-04	-3.11E-04
417	**894.09**	5.17E-05	6.98E-05	-9.10E-05	4.32E-05	-2.23E-04	-1.15E-04
2132	**925.08**	2.43E-05	3.63E-05	-2.02E-05	1.83E-05	-5.58E-05	-2.28E-05
2122	**935.67**	2.47E-05	3.73E-05	-3.21E-05	1.41E-05	-6.30E-05	-2.42E-05
2112	**944.86**	1.75E-05	4.52E-05	-1.23E-05	2.53E-05	-6.15E-05	-2.01E-05
477	**968.95**	2.01E-05	6.69E-05	-3.01E-07	2.42E-05	-1.29E-04	-7.87E-05
497	**1002.45**	1.39E-05	7.12E-05	-5.04E-06	3.52E-05	-3.57E-05	-3.55E-06
517	**1042.45**	1.18E-05	6.50E-05	-2.38E-06	2.40E-05	-9.20E-06	-1.58E-06
537	**1108.60**	3.11E-05	7.61E-05	-6.99E-06	4.40E-05	-2.58E-05	-5.62E-06
557	**1178.35**	4.04E-06	4.32E-05	-3.10E-06	1.06E-05	-5.45E-05	-3.61E-06
577	**1227.20**	1.76E-05	6.83E-05	-6.63E-06	3.61E-05	-2.38E-05	-2.39E-06
597	**1271.50**	4.40E-06	3.18E-05	-4.37E-06	7.93E-06	-3.93E-05	-6.00E-06
617	**1313.65**	2.46E-06	4.36E-05	-4.13E-06	2.54E-05	-1.32E-05	-8.19E-07
637	**1360.60**	1.59E-06	1.20E-05	-5.59E-07	8.53E-06	-3.67E-06	-3.00E-07

M&D Professional Services, Inc
1/9/2007

AP-460-LBS-BEC Strain Seismic-Princ.xls
Strain Max

Table 21 LBS-BEC Concrete Backed Steel Strain, Shell Bottom, Gravity Plus Seismic Load

AP Backed Steel, Lower Bound Soil, Seismic Only, Best Estimate Tank Concrete, 460 In Waste Level at 1.83SpG

M&D Starting M&D Element No.	Path (in)	Shell Bottom Surface (outside - away from waste) Seismic					
		AP-460-LBS-BEC EPEL P1 Strain (in/in) Seismic Bot Min	AP-460-LBS-BEC EPEL P1 Strain (in/in) Seismic Bot Max	AP-460-LBS-BEC EPEL P2 (in/in) Seismic Bot Min	AP-460-LBS-BEC EPEL P2 Strain (in/in) Seismic Bot Max	AP-460-LBS-BEC EPEL P3 Strain (in/in) Seismic Bot Min	AP-460-LBS-BEC EPEL P3 Strain (in/in) Seismic Bot Max
762	**67.33**	3.10E-05	6.74E-05	-5.95E-05	-1.96E-05	-6.68E-05	-2.42E-05
782	**105.04**	2.43E-05	5.56E-05	-4.45E-05	-1.29E-05	-7.87E-05	-2.40E-05
802	**136.24**	3.53E-05	7.72E-05	-5.09E-05	-1.50E-06	-8.77E-05	-3.43E-05
822	**181.71**	2.14E-05	4.12E-05	-3.08E-05	-4.32E-06	-7.06E-05	-2.70E-05
842	**225.10**	3.02E-05	7.11E-05	-4.93E-05	1.38E-05	-7.90E-05	-2.05E-05
862	**273.66**	1.66E-05	2.99E-05	-1.94E-05	1.99E-05	-6.15E-05	-1.97E-05
882	**323.27**	1.68E-05	5.53E-05	-2.71E-05	2.58E-05	-7.57E-05	-3.65E-06
902	**369.20**	5.53E-06	8.96E-05	-1.14E-06	1.81E-05	-6.05E-05	-6.78E-06
922	**419.20**	1.64E-05	1.51E-04	-1.27E-05	3.03E-05	-7.82E-05	-1.85E-06
237	**463.02**						
257	**510.03**						
277	**544.44**						
297	**580.53**						
317	**631.08**						
337	**680.34**						
357	**727.44**						
377	**772.93**						
397	**831.34**						
417	**894.09**						
2132	**925.08**	2.46E-05	3.43E-05	-8.41E-06	1.60E-05	-5.31E-05	-1.68E-05
2122	**935.67**	5.31E-05	9.24E-05	-3.64E-05	9.63E-06	-1.39E-04	-4.79E-05
2112	**944.86**	1.18E-04	2.73E-04	-1.82E-05	4.49E-05	-7.44E-05	-2.64E-05
477	**968.95**						
497	**1002.45**						
517	**1042.45**						
537	**1108.60**						
557	**1178.35**						
577	**1227.20**						
597	**1271.50**						
617	**1313.65**						
637	**1360.60**						

Table 22 LBS-BEC Concrete Backed Steel Strain, Shell Top, Seismic Load Only

AP Backed Steel, Lower Bound Soil, Seismic Only, Best Estimate Tank Concrete, 460 In Waste Level at 1.83SpG

M&D Starting M&D Element No.	Path (in)	Shell Top Surface (inside - towards waste) Seismic					
		AP-460-LBS-BEC EPEL P1 Strain (in/in) Seismic Only Top Min	AP-460-LBS-BEC EPEL P1 Strain (in/in) Seismic Only Top Max	AP-460-LBS-BEC EPEL P2 (in/in) Seismic Only Top Min	AP-460-LBS-BEC EPEL P2 Strain (in/in) Seismic Only Top Max	AP-460-LBS-BEC EPEL P3 Strain (in/in) Seismic Only Top Min	AP-460-LBS-BEC EPEL P3 Strain (in/in) Seismic Only Top Max
762	**67.33**	-1.14E-05	1.19E-05	-1.51E-05	2.83E-05	-1.37E-05	1.74E-05
782	**105.04**	-1.27E-05	2.43E-05	-1.03E-05	1.94E-05	-2.02E-05	3.93E-05
802	**136.24**	-1.18E-05	1.35E-05	-1.06E-05	3.89E-05	-2.63E-05	1.66E-05
822	**181.71**	-8.90E-06	1.82E-05	-8.51E-06	1.81E-05	-2.07E-05	2.90E-05
842	**225.10**	-6.77E-06	1.04E-05	-5.68E-06	5.11E-05	-2.80E-05	9.04E-06
862	**273.66**	-4.85E-06	1.46E-05	-7.94E-06	3.03E-05	-2.53E-05	2.99E-05
882	**323.27**	-2.47E-06	3.91E-05	-3.54E-06	3.88E-05	-5.24E-05	8.21E-06
902	**369.20**	-7.34E-06	7.52E-05	-7.57E-06	1.41E-05	-4.32E-05	2.69E-05
922	**419.20**	-1.71E-05	1.18E-04	-3.99E-06	2.51E-05	-5.84E-05	1.66E-05
237	**463.02**						
257	**510.03**						
277	**544.44**						
297	**580.53**						
317	**631.08**						
337	**680.34**						
357	**727.44**						
377	**772.93**						
397	**831.34**						
417	**894.09**						
2062	**925.08**	-5.68E-06	1.24E-05	-4.68E-06	5.26E-05	-1.68E-05	9.37E-06
2052	**935.67**	-1.08E-05	4.21E-05	-2.83E-06	3.23E-05	-1.73E-05	1.13E-05
2042	**944.86**	-2.35E-05	6.37E-05	-5.64E-06	5.32E-05	-3.87E-05	1.63E-04
477	**968.95**						
497	**1002.45**						
517	**1042.45**						
537	**1108.60**						
557	**1178.35**						
577	**1227.20**						
597	**1271.50**						
617	**1313.65**						
637	**1360.60**						

Table 23 LBS-BEC Concrete Backed Steel Strain, Shell Middle, Seismic Load Only

AP Backed Steel, Lower Bound Soil, Seismic Only, Best Estimate Tank Concrete, 460 In Waste Level at 1.83SpG

M&D Starting M&D Element No.	Path (in)	Shell Mid-Plane					
		AP-460-LBS-BEC EPEL P1 Strain (in/in) Seismic Only Mid Min	AP-460-LBS-BEC EPEL P1 Strain (in/in) Seismic Only Mid Max	AP-460-LBS-BEC EPEL P2 (in/in) Seismic Only Mid Min	AP-460-LBS-BEC EPEL P2 Strain (in/in) Seismic Only Mid Max	AP-460-LBS-BEC EPEL P3 Strain (in/in) Seismic Only Mid Min	AP-460-LBS-BEC EPEL P3 Strain (in/in) Seismic Only Mid Max
762	**67.33**	-1.12E-05	1.69E-05	-1.31E-05	2.40E-05	-1.52E-05	1.57E-05
782	**105.04**	-1.34E-05	1.65E-05	-1.07E-05	2.00E-05	-2.10E-05	2.17E-05
802	**136.24**	-1.15E-05	2.20E-05	-1.09E-05	3.87E-05	-2.24E-05	1.95E-05
822	**181.71**	-8.82E-06	1.36E-05	-8.28E-06	1.82E-05	-2.12E-05	2.24E-05
842	**225.10**	-7.35E-06	2.12E-05	-1.04E-05	5.10E-05	-2.48E-05	1.58E-05
862	**273.66**	-4.47E-06	1.16E-05	-7.80E-06	3.09E-05	-2.41E-05	1.91E-05
882	**323.27**	-3.86E-06	3.52E-05	-8.91E-06	3.86E-05	-4.44E-05	1.48E-05
902	**369.20**	-7.31E-06	7.59E-05	-6.91E-06	1.33E-05	-3.75E-05	2.45E-05
922	**419.20**	-1.73E-05	1.17E-04	-5.70E-06	3.00E-05	-5.16E-05	1.73E-05
237	**463.02**	-2.61E-05	4.97E-05	-2.25E-06	5.96E-06	-1.42E-05	1.98E-05
257	**510.03**	-2.95E-05	5.53E-05	-6.41E-06	1.12E-05	-5.49E-05	6.24E-05
277	**544.44**	-1.23E-05	2.11E-05	-3.28E-05	5.80E-05	-9.93E-05	1.09E-04
297	**580.53**	-8.07E-06	1.46E-05	-2.54E-05	8.08E-05	-6.58E-05	6.19E-05
317	**631.08**	-9.80E-06	1.59E-05	-2.02E-05	1.55E-04	-5.15E-05	4.67E-05
337	**680.34**	-1.27E-05	1.89E-05	-2.07E-05	1.61E-04	-6.59E-05	6.37E-05
357	**727.44**	-1.36E-05	1.87E-05	-1.95E-05	1.56E-04	-6.56E-05	7.13E-05
377	**772.93**	-1.67E-05	2.29E-05	-1.93E-05	2.14E-04	-8.73E-05	1.08E-04
397	**831.34**	-1.69E-05	2.16E-05	-1.61E-05	2.01E-04	-8.27E-05	1.21E-04
417	**894.09**	-7.86E-06	1.02E-05	-8.54E-06	1.26E-04	-3.67E-05	7.15E-05
2062	**925.08**	-4.95E-06	7.07E-06	-3.54E-06	3.50E-05	-1.33E-05	1.97E-05
2052	**935.67**	-5.49E-06	7.15E-06	-3.09E-06	4.31E-05	-3.22E-05	6.52E-06
2042	**944.86**	-4.48E-06	2.31E-05	-4.55E-06	3.30E-05	-2.62E-05	1.52E-05
477	**968.95**	-4.30E-06	4.24E-05	-9.01E-06	1.55E-05	-2.00E-05	3.05E-05
497	**1002.45**	-6.48E-06	5.07E-05	-1.93E-05	2.10E-05	-2.75E-05	4.61E-06
517	**1042.45**	-2.09E-06	5.10E-05	-1.56E-05	1.08E-05	-3.05E-06	4.56E-06
537	**1108.60**	-6.31E-06	3.87E-05	-1.41E-05	3.68E-05	-1.44E-05	5.76E-06
557	**1178.35**	-7.31E-07	3.84E-05	-6.98E-06	6.67E-06	-3.15E-05	1.94E-05
577	**1227.20**	-1.04E-05	4.03E-05	-1.06E-05	3.22E-05	-1.65E-05	4.90E-06
597	**1271.50**	-6.29E-07	2.68E-05	-8.68E-06	3.62E-06	-1.55E-05	1.78E-05
617	**1313.65**	-1.50E-05	2.61E-05	-1.19E-05	1.76E-05	-7.60E-06	4.74E-06
637	**1360.60**	-3.50E-06	6.88E-06	-5.30E-06	3.79E-06	-1.65E-06	1.71E-06

Table 24 LBS-BEC Concrete Backed Steel Strain, Shell Bottom, Seismic Load Only

AP Backed Steel, Lower Bound Soil, Seismic Only, Best Estimate Tank Concrete, 460 In Waste Level at 1.83SpG

M&D Starting M&D Element No.	Path (in)	Shell Bottom Surface (outside - away from waste) Seismic					
		AP-460-LBS-BEC EPEL P1 Strain (in/in) Seismic Only Bot Min	AP-460-LBS-BEC EPEL P1 Strain (in/in) Seismic Only Bot Max	AP-460-LBS-BEC EPEL P2 (in/in) Seismic Only Bot Min	AP-460-LBS-BEC EPEL P2 Strain (in/in) Seismic Only Bot Max	AP-460-LBS-BEC EPEL P3 Strain (in/in) Seismic Only Bot Min	AP-460-LBS-BEC EPEL P3 Strain (in/in) Seismic Only Bot Max
762	**67.33**	-1.14E-05	2.49E-05	-1.30E-05	2.69E-05	-1.51E-05	2.74E-05
782	**105.04**	-1.41E-05	1.72E-05	-1.10E-05	2.07E-05	-2.36E-05	3.10E-05
802	**136.24**	-1.12E-05	3.06E-05	-1.08E-05	3.86E-05	-2.07E-05	3.27E-05
822	**181.71**	-9.46E-06	1.03E-05	-8.18E-06	1.83E-05	-2.25E-05	2.10E-05
842	**225.10**	-8.46E-06	3.24E-05	-1.60E-05	4.71E-05	-2.41E-05	3.43E-05
862	**273.66**	-4.28E-06	8.97E-06	-7.51E-06	3.17E-05	-2.56E-05	1.62E-05
882	**323.27**	-5.87E-06	3.27E-05	-1.16E-05	4.12E-05	-3.89E-05	3.31E-05
902	**369.20**	-7.31E-06	7.67E-05	-6.24E-06	1.30E-05	-3.62E-05	1.75E-05
922	**419.20**	-1.77E-05	1.17E-04	-7.55E-06	3.54E-05	-5.63E-05	2.00E-05
237	**463.02**						
257	**510.03**						
277	**544.44**						
297	**580.53**						
317	**631.08**						
337	**680.34**						
357	**727.44**						
377	**772.93**						
397	**831.34**						
417	**894.09**						
2062	**925.08**	-3.35E-06	6.36E-06	-3.59E-06	2.08E-05	-1.06E-05	2.56E-05
2052	**935.67**	-1.12E-05	2.82E-05	-6.12E-06	3.99E-05	-2.32E-05	6.81E-05
2042	**944.86**	-3.80E-05	1.17E-04	-1.05E-05	5.26E-05	-1.11E-05	3.68E-05
477	**968.95**						
497	**1002.45**						
517	**1042.45**						
537	**1108.60**						
557	**1178.35**						
577	**1227.20**						
597	**1271.50**						
617	**1313.65**						
637	**1360.60**						

M&D Professional Services, Inc
1/9/2007

AP-460-LBS-BEC Strain Seismic-Princ.xls
Strain Seismic Only

Table 25 LBS-BEC Concrete Wall/Footing Contact Forces, Gravity Only

Tank AY, 460 Inch Waste Level
SpG = 1.83
Lower Bound Soi
Best Estimate Concrete

Angle	Vertical Min AP-LBS-BEC Gravity	Vertical Max AP-LBS-BEC Gravity	Shear Y Min AP-LBS-BEC Gravity	Shear Y Max AP-LBS-BEC Gravity	Shear X Min AP-LBS-BEC Gravity	Shear X Max AP-LBS-BEC Gravity	Shear Y Max AP-LBS-BEC Gravity	Shear X Max AP-LBS-BEC Gravity	Shear Max AP-LBS-BEC Gravity	Vertical Force Max AP-LBS-BEC Gravity	Vertical Force Min AP-LBS-BEC Gravity
0	-239.10	-238.90	0.00	0.00	-4.32	-4.31	0.00	1.35	1.35	-74.72	-74.66
9	-478.40	-477.80	-1.59	-1.58	-8.78	-8.76	0.25	1.37	1.39	-74.75	-74.66
18	-478.30	-477.80	-2.28	-2.28	-8.09	-8.08	0.36	1.26	1.31	-74.73	-74.66
27	-478.30	-477.70	-3.43	-3.43	-7.63	-7.61	0.54	1.19	1.31	-74.73	-74.64
36	-478.30	-477.80	-5.30	-5.29	-7.19	-7.18	0.83	1.12	1.40	-74.73	-74.66
45	-478.20	-477.60	-6.13	-6.12	-6.11	-6.10	0.96	0.95	1.35	-74.72	-74.63
54	-478.20	-477.60	-7.19	-7.18	-5.28	-5.27	1.12	0.83	1.39	-74.72	-74.63
63	-478.20	-477.60	-7.65	-7.64	-3.93	-3.93	1.20	0.61	1.34	-74.72	-74.63
72	-478.30	-477.70	-8.52	-8.51	-2.70	-2.70	1.33	0.42	1.40	-74.73	-74.64
81	-478.10	-477.60	-8.26	-8.25	-1.43	-1.42	1.29	0.22	1.31	-74.70	-74.63
90	-478.20	-477.60	-8.87	-8.86	0.04	0.04	1.39	0.01	1.39	-74.72	-74.63
99	-478.20	-477.70	-8.73	-8.72	1.44	1.44	1.36	0.23	1.38	-74.72	-74.64
108	-478.20	-477.60	-8.02	-8.01	2.43	2.43	1.25	0.38	1.31	-74.72	-74.63
117	-478.30	-477.70	-7.93	-7.92	4.07	4.07	1.24	0.64	1.39	-74.73	-74.64
126	-478.20	-477.70	-6.95	-6.94	5.11	5.12	1.09	0.80	1.35	-74.72	-74.64
135	-478.20	-477.60	-6.18	-6.17	6.31	6.31	0.97	0.99	1.38	-74.72	-74.63
144	-478.10	-477.60	-5.13	-5.12	7.11	7.12	0.80	1.11	1.37	-74.70	-74.63
153	-478.20	-477.60	-4.01	-4.00	7.81	7.82	0.63	1.22	1.37	-74.72	-74.63
162	-478.20	-477.70	-2.67	-2.66	8.29	8.31	0.42	1.30	1.36	-74.72	-74.64
171	-478.20	-477.70	-1.33	-1.32	8.66	8.68	0.21	1.36	1.37	-74.72	-74.64
180	-239.10	-238.90	0.00	0.00	4.39	4.39	0.00	1.37	1.37	-74.72	-74.66

M&D Professional Services, Inc
12/21/2006

AP-460-LBS-BEC Footing Seismic.xls

Table 26 LBS-BEC Concrete Wall/Footing Contact Forces, Gravity Plus Seismic

Tank AY, 460 Inch Waste Level
SpG = 1.83
Lower Bound Soi
Best Estimate Concrete

Angle	Vertical Min AP-LBS-BEC Seismic	Vertical Max AP-LBS-BEC Seismic	Shear Y Min AP-LBS-BEC Seismic	Shear Y Max AP-LBS-BEC Seismic	Shear X Min AP-LBS-BEC Seismic	Shear X Max AP-LBS-BEC Seismic	Shear Y Max AP-LBS-BEC Seismic	Shear X Max AP-LBS-BEC Seismic	Shear Max AP-LBS-BEC Seismic	Vertical Force Max AP-LBS-BEC Seismic	Vertical Force Min AP-LBS-BEC Seismic
0	-288.20	-178.10	0.00	0.00	-11.14	3.35	0.00	3.48	3.48	-90.06	-55.66
9	-575.80	-357.20	-37.54	31.55	-27.58	12.08	5.87	4.31	7.28	-89.97	-55.81
18	-573.50	-359.70	-70.60	60.67	-42.10	29.07	11.03	6.58	12.84	-89.61	-56.20
27	-569.70	-363.80	-97.45	83.30	-65.49	55.16	15.23	10.23	18.35	-89.02	-56.84
36	-565.60	-369.40	-115.90	97.00	-95.37	87.95	18.11	14.90	23.45	-88.38	-57.72
45	-565.70	-375.80	-122.60	101.80	-128.00	125.00	19.16	20.00	27.69	-88.39	-58.72
54	-566.10	-382.90	-118.20	95.58	-160.90	162.10	18.47	25.33	31.35	-88.45	-59.83
63	-566.50	-390.10	-102.30	79.59	-189.80	196.40	15.98	30.69	34.60	-88.52	-60.95
72	-567.00	-397.10	-77.36	54.57	-212.30	224.20	12.09	35.03	37.06	-88.59	-62.05
81	-567.20	-402.90	-44.57	24.57	-226.00	242.60	6.96	37.91	38.54	-88.63	-62.95
90	-567.60	-402.80	-10.98	-7.05	-229.60	250.00	1.72	39.06	39.10	-88.69	-62.94
99	-568.10	-402.50	-42.65	28.14	-222.70	245.80	6.66	38.41	38.98	-88.77	-62.89
108	-568.40	-401.50	-71.95	61.89	-206.10	230.20	11.24	35.97	37.68	-88.81	-62.73
117	-568.90	-400.20	-95.63	88.24	-180.50	205.70	14.94	32.14	35.44	-88.89	-62.53
126	-569.20	-398.30	-109.80	106.10	-149.30	173.70	17.16	27.14	32.11	-88.94	-62.23
135	-569.50	-396.10	-114.20	112.50	-114.90	138.20	17.84	21.59	28.01	-88.98	-61.89
144	-569.70	-393.70	-107.90	107.60	-80.92	102.70	16.86	16.05	23.28	-89.02	-61.52
153	-569.90	-391.60	-91.48	91.67	-50.30	70.57	14.32	11.03	18.08	-89.05	-61.19
162	-570.10	-390.10	-66.29	66.72	-26.06	45.05	10.43	7.04	12.58	-89.08	-60.95
171	-570.20	-388.90	-34.81	35.14	-10.36	28.76	5.49	4.49	7.10	-89.09	-60.77
180	-285.10	-194.20	0.00	0.00	-2.51	11.68	0.00	3.65	3.65	-89.09	-60.69

Table 27 LBS-BEC Concrete Wall/Footing Contact Forces, Seismic Only

Tank AY, 460 Inch Waste Level
SpG = 1.83
Lower Bound Soi
Best Estimate Concrete

Angle	Vertical Min AP-LBS-BEC Seismic Only	Vertical Max AP-LBS-BEC Seismic Only	Shear Y Min AP-LBS-BEC Seismic Only	Shear Y Max AP-LBS-BEC Seismic Only	Shear X Min AP-LBS-BEC Seismic Only	Shear X Max AP-LBS-BEC Seismic Only	Shear Y Max AP-LBS-BEC Seismic Only	Shear X Max AP-LBS-BEC Seismic Only	Shear Max AP-LBS-BEC Seismic Only	Vertical Force Max AP-LBS-BEC Seismic Only	Vertical Force Min AP-LBS-BEC Seismic Only
0	-49.10	60.80	0.00	0.00	-6.82	7.66	0.00	2.39	2.39	-15.34	19.00
9	-97.40	120.60	-35.95	33.13	-18.81	20.84	5.62	3.26	6.49	-15.22	18.84
18	-95.20	118.10	-68.32	62.95	-34.01	37.15	10.68	5.80	12.15	-14.88	18.45
27	-91.40	113.90	-94.02	86.73	-57.86	62.77	14.69	9.81	17.66	-14.28	17.80
36	-87.30	108.40	-110.60	102.29	-88.18	95.13	17.28	14.86	22.79	-13.64	16.94
45	-87.50	101.80	-116.47	107.92	-121.89	131.10	18.20	20.48	27.40	-13.67	15.91
54	-87.90	94.70	-111.01	102.76	-155.62	167.37	17.35	26.15	31.38	-13.73	14.80
63	-88.30	87.50	-94.65	87.23	-185.87	200.33	14.79	31.30	34.62	-13.80	13.67
72	-88.70	80.60	-68.84	63.08	-209.60	226.90	10.76	35.45	37.05	-13.86	12.59
81	-89.10	74.70	-36.31	32.82	-224.58	244.02	5.67	38.13	38.55	-13.92	11.67
90	-89.40	74.80	-2.11	1.81	-229.64	249.96	0.33	39.06	39.06	-13.97	11.69
99	-89.90	75.20	-33.92	36.86	-224.14	244.36	5.76	38.18	38.61	-14.05	11.75
108	-90.20	76.10	-63.93	69.90	-208.53	227.77	10.92	35.59	37.23	-14.09	11.89
117	-90.60	77.50	-87.70	96.16	-184.57	201.63	15.03	31.50	34.90	-14.16	12.11
126	-91.00	79.40	-102.85	113.04	-154.41	168.58	17.66	26.34	31.71	-14.22	12.41
135	-91.30	81.50	-108.02	118.67	-121.21	131.89	18.54	20.61	27.72	-14.27	12.73
144	-91.60	83.90	-102.77	112.72	-88.03	95.58	17.61	14.93	23.09	-14.31	13.11
153	-91.70	86.00	-87.47	95.67	-58.11	62.75	14.95	9.80	17.88	-14.33	13.44
162	-91.90	87.60	-63.62	69.38	-34.35	36.74	10.84	5.74	12.27	-14.36	13.69
171	-92.00	88.80	-33.49	36.46	-19.02	20.08	5.70	3.14	6.50	-14.38	13.88
180	-46.00	44.70	0.00	0.00	-6.90	7.29	0.00	2.28	2.28	-14.38	13.97

M&D Professional Services, Inc
12/21/2006

AP-460-LBS-BEC Footing Seismic.xls

Table 28 LBS-BEC Soil/Concrete Tank Contact Forces, Gravity Only

Tank AP, 460 Inch Waste Level
SpG = 1.83
Lower Bound Soil
Best Estimate Concrete

								1.24	1.19	
	Angle (rad)	Path	Max Pressure Soil (LBS) AP Gravity (PSI)	Min Pressure Soil (LBS) AP Gravity (PSI)	Max Meridional Friction Soil (LBS) AP Gravity (PSI)	Max Tangential Friction Soil (LBS) AP Gravity (PSI)	Max Contact Displacement Soil (LBS) AP Gravity (PSI)	0.24g Dome Vertical	0.19g Haunch Vertical	Active Pressure Phi = 49 deg
568	-0.035089	**67.727**	11.67	11.53	1.51	0.03	0.02	14.48	13.89	7.11
565.8	-0.07135	**105.668**	10.10	9.90	1.91	0.06	0.02	12.53	12.02	7.26
563.21	-0.096521	**137.069**	8.85	7.73	1.83	0.09	0.03	10.97	10.53	7.42
559.7	-0.124516	**182.849**	7.56	6.49	1.76	0.06	0.03	9.37	8.99	7.65
550.7	-0.180521	**226.563**	10.22	7.01	2.05	0.08	0.03	12.67	12.16	8.22
545.2	-0.210395	**275.566**	10.38	9.84	2.11	0.06	0.03	12.87	12.35	8.55
527.68	-0.298426	**325.690**	10.16	9.72	2.09	0.02	0.04	12.60	12.09	9.56
518.2	-0.34673	**372.305**	12.84	12.73	2.52	0.03	0.04	15.92	15.28	10.04
494.5	-0.482293	**423.427**	20.64	20.58	2.64	0.07	0.04	25.59	24.56	10.97
476.2	-0.606571	**468.308**	33.99	33.94	3.33	0.13	0.04	42.14	40.44	11.27
447.4	-0.656685	**515.312**	33.02	32.97	6.65	0.22	0.08	40.95	39.29	12.51
407.1	-0.710341	**549.725**	24.42	24.38	5.03	0.09	0.10	30.29	29.06	14.18
382.1	-1.570796	**585.819**	14.29	14.27	3.48	0.05	0.11	17.72	17.01	2.85
335	-1.570796	**636.369**	6.71	6.71	1.60	0.01	0.11	8.33	7.99	3.32
281	-1.570796	**685.619**	5.33	5.32	1.16	0.01	0.12	6.60	6.34	3.86
236.5	-1.570796	**732.719**	6.11	6.10	1.23	0.01	0.12	7.58	7.27	4.30
186.8	-1.570796	**778.219**	6.07	6.06	1.22	0.01	0.11	7.53	7.22	4.80
145.5	-1.570796	**821.369**	7.60	7.58	1.70	0.01	0.10	9.42	9.04	5.21
70	-1.570796	**874.169**	10.10	10.08	2.13	0.03	0.08	12.53	12.02	5.96
24	-1.570796	**930.544**	11.90	11.81	2.47	0.05	0.06	14.76	14.16	6.42

Table 29 LBS-BEC Soil/Concrete Tank Contact Forces, Gravity Plus Seismic

Tank AP, 460 Inch Waste Level
SpG = 1.83
Lower Bound Soil
Best Estimate Concrete

	Angle (rad)	Path	Max Pressure Soil (LBS) AP Seismic (PSI)	Min Pressure Soil (LBS) AP Seismic (PSI)	Max Meridional Friction Soil (LBS) AP Seismic (PSI)	Max Tangential Friction Soil (LBS) AP Seismic (PSI)	Max Contact Displacement Soil (LBS) AP Seismic (inch)	Vertical Pressure	Active Pressure Phi = 33 deg	Active Pressure Phi = 49 deg
568	-0.035089	**67.727**	19.68	3.13	9.48	4.45	0.08	7.12	7.11	7.11
565.8	-0.07135	**105.668**	17.76	3.00	7.32	3.37	0.06	7.27	7.26	7.26
563.21	-0.096521	**137.069**	13.73	1.77	6.40	2.64	0.05	7.46	7.43	7.42
559.7	-0.124516	**182.849**	10.70	3.63	4.17	3.36	0.04	7.71	7.65	7.65
550.7	-0.180521	**226.563**	14.90	4.14	4.73	4.34	0.05	8.35	8.23	8.22
545.2	-0.210395	**275.566**	13.59	6.43	5.44	4.44	0.05	8.74	8.57	8.55
527.68	-0.298426	**325.690**	12.41	6.83	5.42	4.14	0.05	9.99	9.59	9.56
518.2	-0.34673	**372.305**	15.56	10.06	5.52	3.95	0.05	10.66	10.09	10.04
494.5	-0.482293	**423.427**	25.44	16.64	5.51	3.87	0.05	12.35	11.07	10.97
476.2	-0.606571	**468.308**	42.53	26.42	5.80	4.01	0.05	13.65	11.45	11.27
447.4	-0.656685	**515.312**	40.03	27.19	11.78	4.14	0.10	15.70	12.75	12.51
407.1	-0.710341	**549.725**	30.04	20.35	12.51	3.11	0.13	18.57	14.53	14.18
382.1	-1.570796	**585.819**	17.26	11.94	10.56	2.36	0.15	20.35	6.00	2.85
335	-1.570796	**636.369**	8.03	5.59	5.30	2.48	0.16	23.70	6.99	3.32
281	-1.570796	**685.619**	6.43	4.34	4.06	2.56	0.17	27.55	8.13	3.86
236.5	-1.570796	**732.719**	7.17	5.01	4.15	2.48	0.17	30.71	9.06	4.30
186.8	-1.570796	**778.219**	6.91	4.98	4.04	2.70	0.16	34.25	10.10	4.80
145.5	-1.570796	**821.369**	8.85	6.08	5.86	3.26	0.14	37.19	10.97	5.21
70	-1.570796	**874.169**	13.75	6.49	6.89	3.33	0.11	42.57	12.56	5.96
24	-1.570796	**930.544**	19.95	3.60	6.55	3.01	0.07	45.84	13.52	6.42

Table 30 LBS-BEC Soil/Concrete Tank Contact Forces, Seismic Only

Tank AP, 460 Inch Waste Level
SpG = 1.83
Lower Bound Soil
Best Estimate Concrete

	Angle (rad)	Path	Max Pressure Soil (LBS) AP Seismic Only (PSI)	Min Pressure Soil (LBS) AP Seismic Only (PSI)	Max Meridional Friction (LBS) AP Seismic Only (PSI)	Max Tangential Friction (LBS) AP Seismic Only (PSI)	Max Contact Displacment (LBS) AP Seismic Only (inch)
568	-0.035089	**67.727**	8.01	-8.55	7.97	4.42	0.07
565.8	-0.07135	**105.668**	7.66	-7.10	5.41	3.31	0.03
563.21	-0.096521	**137.069**	4.88	-7.08	4.57	2.55	0.02
559.7	-0.124516	**182.849**	3.15	-3.92	2.40	3.30	0.01
550.7	-0.180521	**226.563**	4.68	-6.07	2.68	4.26	0.02
545.2	-0.210395	**275.566**	3.21	-3.96	3.34	4.38	0.02
527.68	-0.298426	**325.690**	2.25	-3.33	3.33	4.12	0.02
518.2	-0.34673	**372.305**	2.72	-2.78	3.00	3.91	0.01
494.5	-0.482293	**423.427**	4.81	-4.00	2.87	3.81	0.01
476.2	-0.606571	**468.308**	8.54	-7.56	2.46	3.88	0.01
447.4	-0.656685	**515.312**	7.01	-5.83	5.12	3.92	0.02
407.1	-0.710341	**549.725**	5.62	-4.07	7.48	3.02	0.03
382.1	-1.570796	**585.819**	2.97	-2.35	7.08	2.32	0.04
335	-1.570796	**636.369**	1.32	-1.13	3.69	2.47	0.05
281	-1.570796	**685.619**	1.10	-0.99	2.90	2.56	0.06
236.5	-1.570796	**732.719**	1.06	-1.10	2.92	2.47	0.06
186.8	-1.570796	**778.219**	0.84	-1.09	2.82	2.70	0.05
145.5	-1.570796	**821.369**	1.25	-1.52	4.15	3.25	0.04
70	-1.570796	**874.169**	3.65	-3.62	4.76	3.30	0.03
24	-1.570796	**930.544**	8.05	-8.31	4.08	2.96	0.02

Table 31 LBS-BEC Primary Tank/Concrete Dome Contact Data, Gravity Only

Tank AP, 460 Inch Waste Level
SpG = 1.83
Lower Bound Soil
Best Estimate Concrete

Radius	Max Pressure Primary Tank/Concrete Tank Dome AP Gravity (PSI)	Min Pressure Primary Tank/Concrete Tank Dome AP Gravity (PSI)	Max Gap Lateral Displacement Primary Tank /Concrete Tank Dome Gravity (in)	Max Gap Displacement Primary Tank/Concete Tank Dome AP Gravity (Inches)
67.727	1.347	1.288	0.002288	0.000000
105.668	1.147	1.129	0.003391	0.000000
137.069	0.541	0.530	0.003883	0.000000
182.849	0.918	0.895	0.005051	0.000000
226.563	1.147	1.102	0.002984	-0.000039
275.566	0.586	0.572	0.003776	-0.000020
325.690	1.587	1.572	0.004664	-0.000140
372.305	0.429	0.424	0.011254	0.000000
423.427	0.300	0.295	0.007034	-1.055520

Table 32 LBS-BEC Primary Tank/Concrete Dome Contact Data, Gravity Plus Seismic

Tank AP, 460 Inch Waste Level
SpG = 1.83
Lower Bound Soil
Best Estimate Concrete

Radius	Max Pressure Primary Tank/Concrete Tank Dome AP Seismic (PSI)	Min Pressure Primary Tank/Concrete Tank Dome AP Seismic (PSI)	Max Gap Lateral Displacement Primary Tank /Concrete Tank Dome Seismic (in)	Max Gap Displacement Primary Tank/Concete Tank Dome AP Seismic (Inches)
67.727	2.543	0.771	0.003485	0.000000
105.668	2.439	0.626	0.005024	-0.000070
137.069	1.842	0.244	0.005804	-0.000064
182.849	1.817	0.497	0.007754	0.000000
226.563	2.515	0.468	0.018504	-0.000105
275.566	1.280	0.239	0.011701	-0.000032
325.690	1.840	0.042	0.012960	-0.000503
372.305	1.643	0.000	0.017064	-0.001145
423.427	1.391	0.000	0.034980	-1.059480

Table 33 LBS-BEC Primary Tank/Concrete Dome Contact Data, Seismic Only

Tank AP, 460 Inch Waste Level
SpG = 1.83
Lower Bound Soil
Best Estimate Concrete

Radius	Max Pressure Primary Tank/Concrete Tank Dome AP Seismic Only (PSI)	Min Pressure Primary Tank/Concrete Tank Dome AP Seismic Only (PSI)	Max Gap Lateral Displacement Primary Tank /Concrete Tank Dome Seismic Only (in)	Max Gap Displacement Primary Tank/Concete Tank Dome AP Seismic Only (Inches)
67.727	1.197	-0.517	0.001196	0.000000
105.668	1.292	-0.503	0.001633	-0.000070
137.069	1.302	-0.286	0.001921	-0.000064
182.849	0.899	-0.398	0.002704	0.000000
226.563	1.367	-0.634	0.015520	-0.000065
275.566	0.694	-0.333	0.007925	-0.000012
325.690	0.253	-1.530	0.008296	-0.000363
372.305	1.214	-0.424	0.005810	-0.001145
423.427	1.091	-0.295	0.027946	-0.003960

Table 34 LBS-BEC Primary Tank/Insulating Concrete Contact Forces, Gravity Only

Tank AP, 460 Inch Waste Level
SpG = 1.83
Lower Bound Soil
Best Estimate Concrete

Radius	Max Pressure Primary Tank/Insulating Concrete AP Gravity (PSI)	Min Pressure Primary Tank/Insulating Concrete AP Gravity (PSI)	Max Lateral Displacement Primary Tank / Insulating Concete AP Gravity (Inches)	Min Lateral Displacement Primary Tank / Insulating Concete AP Gravity (Inches)
424.00	75.486	75.347	0.011330	0.011302
384.00	13.069	13.049	0.000375	0.000368
317.85	33.403	33.368	0.002321	0.002309
248.10	29.701	29.674	0.002796	0.002785
199.25	30.764	30.736	0.002148	0.002140
154.95	30.479	30.444	0.001122	0.001116
112.80	30.479	30.438	0.000217	0.000208
65.85	30.896	30.799	0.000469	0.000452

Table 35 LBS-BEC Primary Tank/ Insulating Concrete Contact Data, Gravity Plus Seismic

Tank AP, 460 Inch Waste Level
SpG = 1.83
Lower Bound Soil
Best Estimate Concrete

Radius	Max Pressure Primary Tank/Insulaiting Concrete AP Seismic (PSI)	Min Pressure Primary Tank/Insulaiting Concrete AP Seismic (PSI)	Max Lateral Displacement Primary Tank/Insulaiting Concrete AP Seismic (Inches)	Min Lateral Displacement Primary Tank/Insulaiting Concrete AP Seismic (Inches)
424.00	110.764	26.257	0.055104	0.006257
384.00	25.903	3.496	0.200160	0.000102
317.85	43.215	24.319	0.032280	0.000832
248.10	37.646	22.299	0.016752	0.000552
199.25	38.375	24.549	0.009676	0.000295
154.95	36.111	25.063	0.006120	0.000376
112.80	35.181	25.014	0.004398	0.000069
65.85	35.819	25.451	0.003653	0.000314

Table 36 LBS-BEC Primary Tank/ Insulating Concrete Contact Forces, Seismic Only

Tank AP, 460 Inch Waste Level
SpG = 1.83
Lower Bound Soil
Best Estimate Concrete

Radius	Max Pressure Primary Tank/Insulaiting Concrete AP Seismic Only (PSI)	Min Pressure Primary Tank/Insulaiting Concrete AP Seismic Only (PSI)	Max Lateral Displacement Primary Tank/Insulaiting Concrete AP Seismic Only (Inches)	Min Lateral Displacement Primary Tank/Insulaiting Concrete AP Seismic Only (Inches)
424.00	35.278	-49.090	0.044	-0.005
384.00	12.833	-9.553	0.200	0.000
317.85	9.813	-9.049	0.030	-0.001
248.10	7.944	-7.375	0.014	-0.002
199.25	7.611	-6.188	0.008	-0.002
154.95	5.632	-5.382	0.005	-0.001
112.80	4.701	-5.424	0.004	0.000
65.85	4.924	-5.347	0.003	0.000

Table 37 LBS-BEC Insulating Concrete/Concrete Backed Steel Contact Data, Gravity Only

Tank AP, 460 Inch Waste Level
SpG = 1.83
Lower Bound Soil
Best Estimate Concrete

Radius	Max Pressure Insulating Concrete/Secondary Liner AP Gravity (PSI)	Min Pressure Insulating Concrete/Secondary Liner AP Gravity (PSI)	Max Lateral Displacement Insulating Concrete/Secondary Liner AP Gravity (Inches)	Min Lateral Displacement Insulating Concrete/Secondary Liner AP Gravity (Inches)
424.00	96.944	96.597	0.005172	0.005129
384.00	34.653	34.563	0.004285	0.004247
317.85	27.389	27.354	0.003188	0.003155
248.10	31.625	31.597	0.002322	0.002297
199.25	30.882	30.840	0.001525	0.001510
154.95	30.486	30.438	0.001106	0.001097
112.80	31.313	31.222	0.000803	0.000800
65.85	30.424	30.188	0.000313	0.000307

Table 38 LBS-BEC Insulating Concrete/Concrete Backed Steel Contact Data, Gravity Plus Seismic

Tank AP, 460 Inch Waste Level
SpG = 1.83
Lower Bound Soil
Best Estimate Concrete

Radius	Max Pressure Insulating Concrete/Secondary Liner AP Seismic (PSI)	Min Pressure Insulating Concrete/Secondary Liner AP Seismic (PSI)	Max Lateral Displacement Insulating Concrete/Secondary Liner AP Seismic (Inches)	Min Lateral Displacement Insulating Concrete/Secondary Liner AP Seismic (Inches)
424.00	113.194	80.278	0.021720	0.000214
384.00	43.944	25.917	0.020244	0.000346
317.85	36.146	18.813	0.017892	0.000140
248.10	39.986	24.208	0.015684	0.000072
199.25	38.438	24.618	0.013416	0.000090
154.95	36.194	25.181	0.011056	0.000060
112.80	35.944	25.806	0.009767	0.000050
65.85	35.417	25.542	0.008903	0.000099

Table 39 LBS-BEC Insulating Concrete/Concrete Backed Steel Contact Data, Seismic Only

Tank AP, 460 Inch Waste Level
SpG = 1.83
Lower Bound Soil
Best Estimate Concrete

Radius	Max Pressure Insulating Concrete/Secondary Liner AP Seismic Only (PSI)	Min Pressure Insulating Concrete/Secondary Liner AP Seismic Only (PSI)	Max Lateral Displacement Insulating Concrete/Secondary Liner AP Seismic Only (Inches)	Min Lateral Displacement Insulating Concrete/Secondary Liner AP Seismic Only (Inches)
424.00	16.250	-16.319	0.017	-0.005
384.00	9.292	-8.646	0.016	-0.004
317.85	8.757	-8.542	0.015	-0.003
248.10	8.361	-7.389	0.013	-0.002
199.25	7.556	-6.222	0.012	-0.001
154.95	5.708	-5.257	0.010	-0.001
112.80	4.632	-5.417	0.009	-0.001
65.85	4.993	-4.646	0.009	0.000

Table 40 LBS-BEC Waste Contact Pressure, Gravity Plus Seismic

Tank AP, 460 Inch Waste Level
SpG = 1.83
Lower Bound Soil
Best Estimate Concrete

Waste Height Ratio	Waste Height	Max Pressure AP Tank, 460 in Waste Level, SpG = 1.83 Time History (PSI)	Min Pressure AP Tank, 460 in Waste Level, SpG = 1.83 Time History (PSI)	Hydrostatic (psi)	Hydrodynamic (psi)	Theoretical Min (SRSS)	Theoretical Max (SRSS)
0.99	454.35	11.153	-10.382	0.37	1.79	0.00	2.16
0.96	443.05	15.646	-13.264	1.12	2.03	0.00	3.15
0.94	431.7625	16.660	-13.042	1.87	2.35	0.00	4.21
0.90	414.125	14.694	-8.833	3.03	2.91	0.13	5.94
0.85	390.125	10.396	-1.240	4.62	3.69	0.93	8.30
0.80	366.125	12.222	0.239	6.20	4.44	1.77	10.64
0.74	342	14.486	1.451	7.80	5.15	2.65	12.94
0.69	318.325	16.799	2.137	9.36	5.80	3.57	15.16
0.64	295.225	19.319	3.182	10.89	6.38	4.50	17.27
0.59	272.125	21.528	3.831	12.41	6.93	5.49	19.34
0.54	248.975	23.458	4.776	13.94	7.43	6.52	21.37
0.49	225.825	25.646	5.795	15.47	7.89	7.59	23.36
0.44	202.725	28.215	6.840	17.00	8.30	8.70	25.30
0.39	179.625	30.361	7.819	18.53	8.67	9.85	27.20
0.34	156.475	31.104	9.500	20.06	9.00	11.06	29.05
0.29	134.075	32.458	10.944	21.54	9.28	12.26	30.81
0.24	112.475	34.750	12.153	22.96	9.50	13.46	32.46
0.20	90.875	34.965	13.736	24.39	9.69	14.70	34.08
0.15	69.275	38.563	15.389	25.82	9.84	15.98	35.66
0.10	47.738	38.250	17.097	27.24	9.95	17.29	37.19
0.05	24.500	43.639	15.104	28.78	10.02	18.76	38.79
0.02	7.755	45.778	24.743	29.88	10.04	19.84	39.92
0.00	1.755	42.493	24.465	30.28	10.04	20.23	40.32

Table 41 LBS-BEC Waste Contact Pressure, Theoretical Pressures

Tank Radius, Hr	450	Hl/Hr	1.022222222		Waste Dens	1.71E-04					
Waste Depth, Hl	460	Conv 1st	Conv 2nd	Conv 3rd	Impul H	Pressure					
		Conv 1st	Conv 2nd	Conv 3rd		Conv 1st	Conv 2nd	Conv 3rd	Impul H	Impul V	
Centroid	Lamda	1.841	5.331	8.536	Sa=	0.064	0.108	0.163	0.32	0.29	
Height	nu	con0(n)	con1(n)	con2(n)	ci(n)	24.7296	41.7312	62.9832	123.65	112.06	SRSS
454.35	0.99	0.82	0.07	0.03	0.09	1.56	0.22	0.12	0.84	0.14	1.79
443.05	0.96	0.78	0.06	0.02	0.14	1.49	0.19	0.10	1.30	0.41	2.03
431.7625	0.94	0.75	0.05	0.02	0.18	1.43	0.17	0.08	1.73	0.68	2.35
414.125	0.90	0.70	0.04	0.01	0.24	1.33	0.14	0.06	2.33	1.10	2.91
390.125	0.85	0.64	0.03	0.01	0.32	1.22	0.10	0.04	3.05	1.67	3.69
366.125	0.80	0.59	0.02	0.00	0.39	1.11	0.08	0.02	3.68	2.22	4.44
342	0.74	0.54	0.02	0.00	0.44	1.02	0.06	0.01	4.22	2.77	5.15
318.325	0.69	0.49	0.01	0.00	0.49	0.94	0.04	0.01	4.68	3.28	5.80
295.225	0.64	0.45	0.01	0.00	0.53	0.86	0.03	0.01	5.08	3.76	6.38
272.125	0.59	0.42	0.01	0.00	0.57	0.80	0.03	0.00	5.43	4.22	6.93
248.975	0.54	0.39	0.01	0.00	0.60	0.74	0.02	0.00	5.74	4.65	7.43
225.825	0.49	0.36	0.00	0.00	0.63	0.69	0.01	0.00	6.01	5.06	7.89
202.725	0.44	0.34	0.00	0.00	0.66	0.65	0.01	0.00	6.25	5.43	8.30
179.625	0.39	0.32	0.00	0.00	0.68	0.61	0.01	0.00	6.45	5.77	8.67
156.475	0.34	0.30	0.00	0.00	0.70	0.57	0.01	0.00	6.62	6.07	9.00
134.075	0.29	0.29	0.00	0.00	0.71	0.55	0.01	0.00	6.76	6.33	9.28
112.475	0.24	0.28	0.00	0.00	0.72	0.53	0.00	0.00	6.88	6.54	9.50
90.875	0.20	0.27	0.00	0.00	0.73	0.51	0.00	0.00	6.97	6.71	9.69
69.275	0.15	0.26	0.00	0.00	0.74	0.49	0.00	0.00	7.04	6.86	9.84
47.7375	0.10	0.25	0.00	0.00	0.75	0.48	0.00	0.00	7.09	6.96	9.95
24.5	0.05	0.25	0.00	0.00	0.75	0.48	0.00	0.00	7.13	7.03	10.02
7.755	0.02	0.25	0.00	0.00	0.75	0.47	0.00	0.00	7.14	7.05	10.04
1.755	0.00	0.25	0.00	0.00	0.75	0.47	0.00	0.00	7.14	7.05	10.04

Table 42 LBS-BEC Waste Surface Displacement, Gravity Plus Seismic

Tank AP, 460 Inch Waste Level
SpG = 1.83
Lower Bound Soil
Best Estimate Concrete

Waste Radius	Max Vertical Displacement AP-460-BES-BEC Time History (in)	Min Vertical Displacement AP-460-BES-BEC Time History (in)
95.7	7.30	-13.81
129.9	8.22	-12.68
180	8.92	-14.41
218.5	7.96	-15.54
277.7	8.88	-15.61
358	9.27	-15.74
410	7.69	-14.93
450	5.10	-11.27

Near-Soil-1.txt

```
et,8,solid45                              !
Use Element SOLID45 for Near Soil
Elements
/input,soil-prop-LB-geo,txt               !
Read Soil Properties

ksel,u,kp,,1,kmaxjb                       !
Unselect existing Keypoints
asel,u,area,,1,amaxjb                     !
Unselect existing Area
lsel,u,line,,1,lmaxjb                     !
Unselect existing Lines
vsel,u,volu,,1,vmaxw                      !
Unselect existing Volumes

/COM - Create Keypoints to match concrete
tank profile
*do,i,1,bm_kp
k,kmaxjb+i,ctx(i),0,ctz(i)
*enddo

/COM - Create Keypoints above top of tank
k,kmaxjb+bm_kp+1,0,0,0          ! Keypoint
at origin (surface)
k,kmaxjb+bm_kp+2,0,0,soilz(2) ! Keypoint
at to divide soil above tank
*get,KMAXtemp1,KP,0,num,max   ! Get
maximum keypoint number for counter

/COM - Create Keypoints at outside of
excavated soil
*do,i,1,tanksoil
k,kmaxtemp1+i,soilx(i),0,soilz(i)
*enddo
*get,KMAXtemp2,KP,0,num,max
        ! Get maximum keypoint number for
counter

/COM - Create additional keypoint in soil
above tank
k,kmaxtemp2+1,ctx(2),0,soilz(1)
k,kmaxtemp2+2,ctx(9),0,soilz(1)
k,kmaxtemp2+3,ctx(12),0,soilz(1)
k,kmaxtemp2+4,ctx(2),0,soilz(2)
k,kmaxtemp2+5,ctx(9),0,soilz(2)
k,kmaxtemp2+6,ctx(12),0,soilz(2)
k,kmaxtemp2+7,ctx(12),0,soilz(3)
k,kmaxtemp2+8,ctx(bm_kp+1),0,ctz(bm_kp+1)

a,kmaxtemp2+1,kmaxtemp2+2,kmaxtemp2+5,kma
xtemp2+4
a,kmaxtemp2+2,kmaxtemp2+3,kmaxtemp2+6,kma
xtemp2+5
a,kmaxtemp2+3,kmaxtemp1+1,kmaxtemp1+2,kma
xtemp2+6
a,kmaxtemp2+4,kmaxtemp2+5,kmaxjb+9,kmaxjb
+8,kmaxjb+7,kmaxjb+6,kmaxjb+5,kmaxjb+4,km
axjb+3,kmaxjb+2!a,740,741,712,711,710,709
,708,707,706,705
a,kmaxtemp2+5,kmaxtemp2+6,kmaxtemp2+7,kma
xjb+12,kmaxjb+11,kmaxjb+10,kmaxjb+9
a,kmaxtemp2+6,kmaxtemp1+2,kmaxtemp1+3,kma
xtemp2+7
a,kmaxtemp2+7,kmaxtemp1+3,kmaxtemp1+4,kma
xjb+12
a,kmaxjb+12,kmaxtemp1+4,kmaxtemp1+5,kmaxj
b+14,kmaxjb+13
a,kmaxjb+14,kmaxtemp1+5,kmaxtemp1+6,kmaxj
b+16,kmaxjb+15
a,kmaxjb+16,kmaxtemp1+6,kmaxtemp1+7,kmaxj
b+18,kmaxjb+17
a,kmaxjb+18,kmaxtemp1+7,kmaxtemp1+8,kmaxj
b+20,kmaxjb+19
a,kmaxjb+20,kmaxtemp1+8,kmaxtemp1+9,kmaxt
emp2+8,kmaxjb+22,kmaxjb+21

cm,top-soil-area,area
lsla
cm,top-soil,line
type,1
real,1


/COM - Define line divisions to control
meshing
lsel,s,loc,z,soilz(1),soilz(2)
lsel,r,loc,x,ctx(3),ctx(8)
lesize,all,,,14                          !
soil above tank top, match tank meshing
lsel,s,loc,z,soilz(1),soilz(2)
lsel,r,loc,x,ctx(10),ctx(11)
lesize,all,,,3                  ! soil
above tank top, match tank meshing
cmsel,s,top-soil                ! Reselect
lines in near soil
lsel,r,loc,x,ctx(2)
lesize,all,,,2                  ! Control
vertical element size, above tank
cmsel,s,top-soil
lsel,s,loc,x,ctx(9)
lesize,all,,,2                  ! Control
vertical element size, above tank
cmsel,s,top-soil
lsel,r,loc,x,ctx(12)
lesize,all,,,2                  ! Control
vertical element size, above tank
cmsel,s,top-soil
lsel,r,loc,z,ctz(2),ctz(12)
lsel,r,loc,x,ctx(2),ctx(12)
lesize,all,,,1                  ! Control
vertical element size, outside excavation
mesh
lsel,s,line,,lmaxjb+8,lmaxjb+10,2
lsel,a,line,,lmaxjb+26,lmaxjb+28,2
lsel,a,line,,lmaxjb+30,lmaxjb+38,4
lesize,all,,,9
lsel,s,line,,lmaxjb+42,lmaxjb+42,4
lesize,all,,,7                  ! Control
horizontal meshing in soil
lsel,s,line,,lmaxjb+9
lsel,a,line,,lmaxjb+25,lmaxjb+27,2
lsel,a,line,,lmaxjb+29,lmaxjb+45,4
lesize,all,,,1                  ! Control
horizontal meshing in soil
lsel,s,line,,lmaxjb+6
lsel,a,line,,lmaxjb+20,lmaxjb+21
lsel,a,line,,lmaxjb+32,lmaxjb+44,4
lsel,a,line,,lmaxjb+31,lmaxjb+43,4
lsel,a,line,,lmaxjb+47,lmaxjb+49
lesize,all,,,1                  ! Control
meshing to match tank
lsel,s,line,,lmaxjb+46
```

```
lesize,all,,,4                 ! Control
mesh size at bottom of excavated soil

cmsel,s,top-soil-area

amesh,all                      ! Mesh area
to develop pattern for volume meshing

type,8
ksel,a,kp,,1                   ! Select
Keypoint for rotation axis
ksel,a,kp,,ct_kps              ! Select
Keypoint for rotation axis
vrotat,all,,,,,,1,ct_kps,180,2        !
Generate Volumes for excavated soil
lsla
lsel,r,loc,x,ctx(2)
lesize,all,,arcsize            ! Define
meshing for slices
lsla
lsel,r,loc,x,ctx(9)
lesize,all,,arcsize            ! Define
meshing for slices
lsla
lsel,r,loc,x,ctx(12)
lesize,all,,arcsize            ! Define
meshing for slices
vsweep,all                     ! Sweep
pattern into volume
aclear,all                     ! Delete
elements used for sweep
cm,top-soil-vol,volu

*get,VMAXtemp,VOLU,0,num,max
/COM - Generate element above top center
of tank
asel,u,area,,all
vsel,u,volu,,all
a,kmaxjb+bm_kp+1,kmaxtemp2+1,kmaxtemp2+4,
kmaxjb+bm_kp+2
a,kmaxjb+bm_kp+2,kmaxtemp2+4,kmaxjb+2,kma
xjb+1
vrotat,all,,,,,,1,ct_kps,180,2
vsel,s,volu,,vmaxtemp+1,vmaxtemp+3,2
vatt,801,,8                           !
Assign material properties
vsel,s,volu,,vmaxtemp+2,vmaxtemp+4,2
vatt,802,,8                           !
Assign material properties
vsel,s,volu,,vmaxtemp+1,vmaxtemp+4
allsel
asel,s,loc,z,ctz(1),ctz(2)
type,1
asel,r,loc,x,0,4
asel,r,loc,z,ctz(1),ctz(2)
cmsel,u,conc-tank-a
*get,atemp,area,,num,max
*get,atemp1,area,,num,min
asel,a,area,,1,22,21
mshcopy,2,1,atemp1             ! copy mesh
top match top of concrete tank
mshcopy,2,22,atemp             ! copy mesh
top match top of concrete tank
asel,u,area,,1,22,21
vsel,s,volu,,vmaxtemp+1,vmaxtemp+4
vsweep,all                            !
Generate elements by sweeping area
aclear,atemp
aclear,atemp1
```

```
/COM - Assign soil properties by layer
*do,i,1,tanksoil-1
cmsel,s,top-soil-vol
vsel,r,loc,z,soilz(i),soilz(i+1)
eslv
emodif,all,mat,800+i
esys,0
*enddo

cmsel,s,top-soil-vol
vsel,a,loc,z,soilz(1),ctz(2)
eslv
cm,excav-soil,elem
nsle
nummrg,node

/COM - Define component for excavated
soil - tank walls only
cmsel,s,excav-soil
nsle,s,1
nsel,r,loc,z,soilz(5),soilz(9)
esln,r,1
cm,excav-wall,elem


/COM - Define component for excavated
soil - tank dome only
cmsel,s,excav-soil
cmsel,u,excav-wall
cm,excav-dome,elem

csys,1
cmsel,s,excav-wall
nsle
nsel,r,loc,x,ctx(14)
cm,excav-wall-n,node

esel,s,type,,8
nsle
nsel,s,loc,x,soilx(1)
nsel,r,loc,z,soilz(1)
cm,near-soil-face-node,node
*do,i,2,9
esel,s,type,,8
nsle
nsel,r,loc,x,soilx(i)
nsel,r,loc,z,soilz(i)
cmsel,a,near-soil-face-node
cm,near-soil-face-node,node
*enddo

esel,s,type,,8
nsle
nsel,r,loc,z,soilz(9)
nsel,r,loc,x,41,68
cm,near-soil-bot-node,node


allsel
*get,KMAXns,KP,0,num,max       ! Get
maximum Keypoint number
*get,LMAXns,LINE,0,num,max     ! Get
maximum line number
*get,AMAXns,AREA,0,num,max     ! Get
maximum Area number
*get,VMAXns,volu,0,num,max     ! Get
maximum Volume number
```

Run-Tank.txt

```
!/batch
! PNNL DST Seismic Analysis, Gravity
Inputs, Lower Bound Soil, Best Est
Concrete Properties, AP Primary Tank
Geometry, Dome Friction=0.0
!
fini
/clear
/filname,AP-460-LBS-BEC-Seismic,1
/config,nres,3000             ! Increase
allowable number of results to 3000
/config,nproc,2                         !
Activate 2 processers for solution
/config,fsplit,1024           ! Split
binary file at 4.2GB
/prep7
g=32.2                        ! Gravity
(ft/sec)

DF=40                         ! Factor
for beta (stiffness) damping
ALPHA=0.4                     ! Alpha
damping

/out,tank-out,out
/sys,"X:\07.00 - Quality Assurance\ANSYS
QA\usrcfg.bat" > QA.out
/out,QA,out,,append
/input,tank-coordinates-AP,txt       !
Run file defining tank coordinates
(concrete and primary)
/input,tank-props-bec-250,txt ! Run file
defining fully cracked concrete
properties (PNNL Concrete Properties)
/input,tank-mesh1,txt         ! Develop
concrete tank
/input,primary-props-AP,txt   ! Run file
defining AP Primary tank properties
/input,primary,txt            ! Develop
Primary tank
/input,insulate,txt           ! Develop
insulating concrete model
/input,liner,txt              ! Develop
Liner model
/input,waste-solid-AP-s,txt   ! Develop
waste model
/input,bolts-friction,txt     ! Develop
J-Bolt model
/input,near-soil-1,txt        ! Develop
excavated soil model
/input,far-soil,txt           ! Develop
Far-Field soil model
/input,interface1,txt         ! Develop
Soil and Concrete Interfaces
/input,interface-gap1,txt     ! Develop
Primary Tank Interfaces
/input,slave,txt              ! Develop
slaved boundary conditions
/input,boundary,txt           ! Place
base and symmetry boundary conditions
/input,outer-spar,txt         ! Connect
soil model to symmetry plane
/input,live_load,txt          ! Apply
live load over a 10ft radius over dome
center
/input,fix-soil,txt
/out
ALLSEL

/out,Tank-th,out

save

/input,solve-TH-LBS,txt                !
Run solution Phase

/input,post-tank,txt

/out
/exit
```

Soil-Prop-LB-Geo.txt

```
Tanksoil=9
deepsoil=20
soil_radius=320
mass=1e8

*dim,soilx,,30
*dim,soilz,,30


soilz(1)=0
soilz(2)=-5
soilz(3)=ctz(9)
soilz(4)=ctz(12)
soilz(5)=ctz(14)
soilz(6)=ctz(16)
soilz(7)=ctz(18)
soilz(8)=ctz(20)
soilz(9)=ctz(23)
soilz(10)=-73.5
soilz(11)=-90.5
soilz(12)=-106.5
soilz(13)=-123.5
soilz(14)=-139.5
soilz(15)=-156
soilz(16)=-178
soilz(17)=-200
soilz(18)=-222
soilz(19)=-244
soilz(20)=-266

soilx(9)=68
soilx(8)=soilx(9)-(soilz(9)-soilz(8))/1.5
soilx(7)=soilx(9)-(soilz(9)-soilz(7))/1.5
soilx(6)=soilx(9)-(soilz(9)-soilz(6))/1.5
soilx(5)=soilx(9)-(soilz(9)-soilz(5))/1.5
soilx(4)=soilx(9)-(soilz(9)-soilz(4))/1.5
soilx(3)=soilx(9)-(soilz(9)-soilz(3))/1.5
soilx(2)=soilx(9)-(soilz(9)-soilz(2))/1.5
soilx(1)=soilx(9)-(soilz(9)-soilz(1))/1.5


/COM Excavated Soil Properties

/COM - Material Definitions
/COM - Material 801, Soil     (Top Layer)
mp,ex,801,6470
mp,nuxy,801,0.27
mp,dens,801,125/(1000*g)
mp,damp,801,0.023/df

/COM - Material 802, Soil
mp,ex,802,5402
mp,nuxy,802,0.27
```

```
mp,dens,802,125/(1000*g)
mp,damp,802,0.044/df

/COM - Material 803, Soil
mp,ex,803,4527
mp,nuxy,803,0.27
mp,dens,803,125/(1000*g)
mp,damp,803,0.066/df

/COM - Material 804, Soil
mp,ex,804,4854
mp,nuxy,804,0.27
mp,dens,804,125/(1000*g)
mp,damp,804,0.053/df

/COM - Material 805, Soil
mp,ex,805,4514
mp,nuxy,805,0.27
mp,dens,805,125/(1000*g)
mp,damp,805,0.061/df

/COM - Material 806, Soil
mp,ex,806,4291
mp,nuxy,806,0.27
mp,dens,806,125/(1000*g)
mp,damp,806,0.067/df

/COM - Material 807, Soil
mp,ex,807,4136
mp,nuxy,807,0.27
mp,dens,807,125/(1000*g)
mp,damp,807,0.070/df

/COM - Material 808, Soil
mp,ex,808,4612
mp,nuxy,808,0.27
mp,dens,808,125/(1000*g)
mp,damp,808,0.056/df

/COM - Material 810, Soil
mp,ex,810,250
mp,nuxy,810,0.27
mp,dens,810,125/(1000*g)
mp,damp,810,0.056/df



/COM - Lower Bound Soil Properties
Geomatrix Soil Data
/COM - 19 Layer Mode
/COM - Material Definitions

/COM - Material 901, Soil     (Top Layer)
mp,ex,901,10870
mp,nuxy,901,0.24
mp,dens,901,110/(1000*g)
mp,damp,901,0.018/df

/COM - Material 902, Soil
mp,ex,902,9930
mp,nuxy,902,0.24
mp,dens,902,110/(1000*g)
mp,damp,902,0.030/df

/COM - Material 903, Soil
mp,ex,903,8904
mp,nuxy,903,0.24
mp,dens,903,110/(1000*g)
mp,damp,903,0.043/df

/COM - Material 904, Soil
mp,ex,904,9274
mp,nuxy,904,0.24
mp,dens,904,110/(1000*g)
mp,damp,904,0.034/df

/COM - Material 905, Soil
mp,ex,905,8452
mp,nuxy,905,0.19
mp,dens,905,110/(1000*g)
mp,damp,905,0.040/df

/COM - Material 906, Soil
mp,ex,906,9530
mp,nuxy,906,0.19
mp,dens,906,110/(1000*g)
mp,damp,906,0.042/df

/COM - Material 907, Soil
mp,ex,907,10856
mp,nuxy,907,0.19
mp,dens,907,110/(1000*g)
mp,damp,907,0.042/df

/COM - Material 908, Soil
mp,ex,908,13399
mp,nuxy,908,0.19
mp,dens,908,110/(1000*g)
mp,damp,908,0.030/df

/COM - Material 909, Soil
mp,ex,909,15068
mp,nuxy,909,0.19
mp,dens,909,110/(1000*g)
mp,damp,909,0.030/df

/COM - Material 910, Soil
mp,ex,910,14438
mp,nuxy,910,0.19
mp,dens,910,110/(1000*g)
mp,damp,910,0.035/df

/COM - Material 911, Soil
mp,ex,911,13879
mp,nuxy,911,0.19
mp,dens,911,110/(1000*g)
mp,damp,911,0.039/df

/COM - Material 912, Soil
mp,ex,912,13408
mp,nuxy,912,0.19
mp,dens,912,110/(1000*g)
mp,damp,912,0.043/df

/COM - Material 913, Soil
mp,ex,913,16152
mp,nuxy,913,0.19
mp,dens,913,110/(1000*g)
mp,damp,913,0.032/df

/COM - Material 914, Soil
mp,ex,914,16097
mp,nuxy,914,0.19
mp,dens,914,110/(1000*g)
mp,damp,914,0.032/df

/COM - Material 915, Soil
mp,ex,915,22066
mp,nuxy,915,0.28
mp,dens,915,120/(1000*g)
```

```
mp,damp,915,0.028/df

/COM - Material 916, Soil
mp,ex,916,24180
mp,nuxy,916,0.28
mp,dens,916,120/(1000*g)
mp,damp,916,0.028/df

/COM - Material 917, Soil
mp,ex,917,23846
mp,nuxy,917,0.28
mp,dens,917,120/(1000*g)
mp,damp,917,0.029/df

/COM - Material 918, Soil
mp,ex,918,23861
mp,nuxy,918,0.28
mp,dens,918,120/(1000*g)
mp,damp,918,0.029/df

/COM - Material 919, Soil
mp,ex,919,27106
mp,nuxy,919,0.28
mp,dens,919,120/(1000*g)
mp,damp,919,0.026/df
```

Solve-Gravity-LBS.txt

```
/prep7
massm_z=148414.59
d,master_node,all
allsel

cmsel,s,excav-soil
nsle
csys,0
nsel,r,loc,x,-ctx(6)-1,ctx(6)+1
nsel,r,loc,y,0,-ctx(6)-1
esln,r,1
mpchg,810,all

cmsel,s,excav-soil
nsle
csys,1
nsel,r,loc,x,ctx(11)-1,ctx(13)+1
nsel,r,loc,z,soilz(1),soilz(3)-1
esln,r,1
mpchg,810,all

*do,i,801,808
esel,s,mat,,i
mpchg,i+10,all
*enddo
allsel

/out,AP-460-BEC-LBS-Gravity,out
/solu
antype,trans
TRNOPT,FULL
lumpm,OFF
!nlgeom,on
NROPT,auto
NTIM=10 !NUMBER OF TIME STEPS
DT=0.01
TIM=1e-06
autots,on
KBC,on
TIMINT,ON,STRU
solcontrol,ON,off,,
ncnv,0,200
LNSRCH,OFF
PRED,on,,on

/COM - Time File

/COM - Dimension Horizontal Input
*DIM,A_1_x,,2148
*DIM,A_1_Z,,2148

*VREAD,A_1_x(1),th-266-LB-geo,txt
(8(F9.6))
*VREAD,A_1_Z(1),th-266-LB-geo-v,txt
(8(F9.6))

/Title,Load Case: AP-460-LBS-BEC, Full
Non-linear, Dome Contact Friction = 0.0,
Gravity
OUTPR,all,NONE,
OUTRES, ALL,NONE,
OUTRES,RSOL,last
OUTRES,NSOL,last
OUTRES,ESOL,last,conc-tank
OUTRES,esol,last,Primary-tank
OUTRES,ESOL,last,J_bolts
OUTRES,Epel,last,liner
outres,esol,last,wall-int-gap
outres,esol,last,conc-excav-wall-gap
outres,esol,last,conc-excav-dome-gap
!outres,strs,last,excav-soil
!outres,strs,last,bottom-soil
outres,esol,last,bolt-friction
outres,esol,last,waste-surf
outres,strs,last,insul-conc
outres,esol,last,primary-int-gap
outres,esol,last,conc-liner-gap
outres,esol,last,far-soil-contact
!outres,esol,last,soil-contact-foot-elem

alphad,alpha
NSUBST,20,200,5,ON
TIME,100
TIMINT,off
acel,0,0,g
SOLVE
SAVE
TIMINT,on
ITIM=1
DS=TIM
NSUBST,1,20,1,ON

!ddele,master_node,ux
!ddele,master_node,uz

esel,s,type,,61,63,2
mpchg,64,all

esel,s,type,,91,93,2
mpchg,92,all

allsel

*DO,ITIM,1,NTIM,1

TIM=DT*ITIM

TIME,TIM+100

!F,master_node,FX,A_1_X(itim)*mass*g
```

```
!F,master_node,Fz,(A_1_Z(itim)+1)*(mass+m
assm_z)*g

SOLVE
SAVE
*ENDDO
FINISH
/out
```

Solve-TH-LBS

```
/prep7
massm_z=148414.59
d,master_node,all
allsel

cmsel,s,excav-soil
nsle
csys,0
nsel,r,loc,x,-ctx(6)-1,ctx(6)+1
nsel,r,loc,y,0,-ctx(6)-1
esln,r,1
mpchg,810,all

cmsel,s,excav-soil
nsle
csys,1
nsel,r,loc,x,ctx(11)-1,ctx(13)+1
nsel,r,loc,z,soilz(1),soilz(3)-1
esln,r,1
mpchg,810,all

*do,i,801,808
esel,s,mat,,i
mpchg,i+10,all
*enddo
allsel

/out,AP-460-BEC-LBS-Seismic,out
/solu
antype,trans
TRNOPT,FULL
lumpm,OFF
!nlgeom,on
NROPT,auto
NTIM=2148      !NUMBER OF TIME STEPS
DT=0.01
TIM=1e-06
autots,on
KBC,on
TIMINT,ON,STRU
solcontrol,ON,off,,
ncnv,0,200
LNSRCH,OFF
PRED,on,,on

/COM - Time File

/COM - Dimension Horizontal Input
*DIM,A_1_x,,2148
*DIM,A_1_Z,,2148

*VREAD,A_1_x(1),th-266-LB-geo,txt
(8(F9.6))
*VREAD,A_1_Z(1),th-266-LB-geo-v,txt
(8(F9.6))

/Title,Load Case: AP-460-LBS-BEC, Full
Non-linear, Dome Contact Friction = 0.0
OUTPR,all,NONE,
OUTRES, ALL,NONE,
OUTRES,RSOL,last
OUTRES,NSOL,last
OUTRES,ESOL,last,conc-tank
OUTRES,esol,last,Primary-tank
OUTRES,ESOL,last,J_bolts
OUTRES,Epel,last,liner
outres,esol,last,wall-int-gap
outres,esol,last,conc-excav-wall-gap
outres,esol,last,conc-excav-dome-gap
!outres,strs,last,excav-soil
!outres,strs,last,bottom-soil
outres,esol,last,bolt-friction
outres,esol,last,waste-surf
outres,strs,last,insul-conc
outres,esol,last,primary-int-gap
outres,esol,last,conc-liner-gap
outres,esol,last,far-soil-contact
!outres,esol,last,soil-contact-foot-elem

alphad,alpha
NSUBST,20,200,5,ON
TIME,100
TIMINT,off
acel,0,0,g
SOLVE
SAVE
TIMINT,on
ITIM=1
DS=TIM
NSUBST,1,20,1,ON

ddele,master_node,ux
ddele,master_node,uz

esel,s,type,,61,63,2
mpchg,64,all

esel,s,type,,91,93,2
mpchg,92,all

allsel

*DO,ITIM,1,NTIM,1

TIM=DT*ITIM

TIME,TIM+100

F,master_node,FX,1.175*A_1_X(itim)*mass*g
F,master_node,Fz,(1.12*A_1_Z(itim)+1)*(ma
ss+massm_z)*g

SOLVE
SAVE
*ENDDO
FINISH
/out
```

Tank-Props-BEC-250

```
/COM - Tank Concrete Properties

/COM - Material Definitions
```

```
! EX - Youngs Modulus, (k/ft2)
! NUXY - Poisons ratio
! DENS - Density (1000*slugs/ft3)
! DAMP - Beta (Stiffness) Damping

/COM - Material 1, Tank Concrete
mp,ex,1,626754
mp,nuxy,1,0.18
mp,dens,1,148/(1000*g)
mp,damp,1,0.07/df

/COM - Material 2, Tank Concrete
mp,ex,2,620114
mp,nuxy,2,0.18
mp,dens,2,149/(1000*g)
mp,damp,2,0.07/df

/COM - Material 3, Tank Concrete
mp,ex,3,616594
mp,nuxy,3,0.18
mp,dens,3,149/(1000*g)
mp,damp,3,0.07/df

/COM - Material 4, Tank Concrete
mp,ex,4,610922
mp,nuxy,4,0.18
mp,dens,4,149/(1000*g)
mp,damp,4,0.07/df

/COM - Material  5, Tank Concrete
mp,ex, 5,612305
mp,nuxy, 5,0.18
mp,dens, 5,148/(1000*g)
mp,damp,5,0.07/df

/COM - Material 6, Tank Concrete
mp,ex,6,607093
mp,nuxy,6,0.18
mp,dens,6,148/(1000*g)
mp,damp,6,0.07/df

/COM - Material 7, Tank Concrete
mp,ex,7,639237
mp,nuxy,7,0.18
mp,dens,7,146/(1000*g)
mp,damp,7,0.07/df

/COM - Material 8, Tank Concrete
mp,ex,8,634338
mp,nuxy,8,0.18
mp,dens,8,147/(1000*g)
mp,damp,8,0.07/df

/COM - Material 9, Tank Concrete
mp,ex,9,628756
mp,nuxy,9,0.18
mp,dens,9,147/(1000*g)
mp,damp,9,0.07/df

/COM - Material,10, Tank Concrete
mp,ex,10,193677
mp,nuxy,10,0.18
mp,dens,10,165/(1000*g)
mp,damp,10,0.07/df

/COM - Material,11, Tank Concrete
mp,ex,11,575959
mp,nuxy,11,0.18
mp,dens,11,144/(1000*g)
mp,damp,11,0.07/df

/COM - Material,12, Tank Concrete
mp,ex,12,202953
mp,nuxy,12,0.18
mp,dens,12,159/(1000*g)
mp,damp,12,0.07/df

/COM - Material,13, Tank Concrete
mp,ex,13,157426
mp,nuxy,13,0.18
mp,dens,13,176/(1000*g)
mp,damp,13,0.07/df

/COM - Material,14, Tank Concrete
mp,ex,14,153784
mp,nuxy,14,0.18
mp,dens,14,193/(1000*g)
mp,damp,14,0.07/df

/COM - Material,15, Tank Concrete
mp,ex,15,136651
mp,nuxy,15,0.18
mp,dens,15,200/(1000*g)
mp,damp,15,0.07/df

/COM - Material,16, Tank Concrete
mp,ex,16,136651
mp,nuxy,16,0.18
mp,dens,16,200/(1000*g)
mp,damp,16,0.07/df

/COM - Material,17, Tank Concrete
mp,ex,17,138084
mp,nuxy,17,0.18
mp,dens,17,181/(1000*g)
mp,damp,17,0.07/df

/COM - Material,18, Tank Concrete
mp,ex,18,123378
mp,nuxy,18,0.18
mp,dens,18,209/(1000*g)
mp,damp,18,0.07/df

/COM - Material,19, Tank Concrete
mp,ex,19,124633
mp,nuxy,19,0.18
mp,dens,19,190/(1000*g)
mp,damp,19,0.07/df

/COM - Material,20, Tank Concrete
mp,ex,20,124388
mp,nuxy,20,0.18
mp,dens,20,210/(1000*g)
mp,damp,20,0.07/df

/COM - Material,21, Tank Concrete
mp,ex,21,548683
mp,nuxy,21,0.18
mp,dens,21,166/(1000*g)
mp,damp,21,0.07/df

/COM - Material,22, Tank Concrete
mp,ex,22,154870
mp,nuxy,22,0.18
mp,dens,22,184/(1000*g)
mp,damp,22,0.07/df

/COM - Material,23, Tank Concrete
mp,ex,23,514287
mp,nuxy,23,0.18
```

```
mp,dens,23,172/(1000*g)
mp,damp,23,0.060/df

/COM - Material,24, Tank Concrete
mp,ex,24,164113
mp,nuxy,24,0.18
mp,dens,24,288/(1000*g)
mp,damp,24,0.07/df

/COM - Material,25, Tank Concrete
mp,ex,25,522946
mp,nuxy,25,0.18
mp,dens,25,201/(1000*g)
mp,damp,25,0.07/df

/COM - Material,26, Tank Concrete
mp,ex,26,194254
mp,nuxy,26,0.18
mp,dens,26,322/(1000*g)
mp,damp,26,0.07/df

/COM - Material,27, Tank Concrete
mp,ex,27,199783
mp,nuxy,27,0.18
mp,dens,27,281/(1000*g)
mp,damp,27,0.07/df

/COM - Material,28, Tank Concrete
mp,ex,28,162553
mp,nuxy,28,0.18
mp,dens,28,299/(1000*g)
mp,damp,28,0.07/df

/COM - Material,29, Tank Concrete
mp,ex,29,200531
mp,nuxy,29,0.18
mp,dens,29,3894/(1000*g)
mp,damp,29,0.07/df

/COM - Material,30, Tank Concrete
mp,ex,30,167538
mp,nuxy,30,0.18
mp,dens,30,411/(1000*g)
mp,damp,30,0.07/df

/COM - Material,31, Tank Concrete
mp,ex,31,731952
mp,nuxy,31,0.18
mp,dens,31,150/(1000*g)
mp,damp,31,0.07/df

/COM - Material,32, Tank Concrete
mp,ex,32,731952
mp,nuxy,32,0.18
mp,dens,32,150/(1000*g)
mp,damp,32,0.07/df

!/COM - Material,33, Tank Concrete
!mp,ex,33,731952
!mp,nuxy,33,0.18
!mp,dens,33,150/(1000*g)
!mp,damp,33,0.07/df

!/COM - Material,34, Tank Concrete
!mp,ex,34,731952
!mp,nuxy,34,0.18
!mp,dens,34,150/(1000*g)
!mp,damp,34,0.07/df

!/COM - Material,35, Tank Concrete
!mp,ex,35,731952
!mp,nuxy,35,0.18
!mp,dens,35,150/(1000*g)
!mp,damp,35,0.07/df

!/COM - Material,36, Tank Concrete
!mp,ex,36,731952
!mp,nuxy,36,0.18
!mp,dens,36,150/(1000*g)
!mp,damp,36,0.07/df

!/COM - Material,37, Tank Concrete
!mp,ex,37,731952
!mp,nuxy,37,0.18
!mp,dens,37,150/(1000*g)
!mp,damp,37,0.07/df

/COM - Concrete Real Values, t in ft
r,1,1.26                        ! 15 in
r,2,1.26                        ! 15 in
r,3,1.26                        ! 15 in
r,4,1.26                        ! 15 in
r,5,1.27                        ! 15 in
r,6,1.26                        ! 15 in
r,7,1.28                        ! 15 in
r,8,1.28                        ! 15 in
r,9,1.73                        ! 15 in
r,10,1.73,1.73,2.23,2.23        ! 15 in to
r,11,2.23,2.22,3.15,3.15        !
r,12,3.15,3.15,1.50,1.50        !
r,13,1.50,1.50,1.28,1.28        !
r,14,1.17                       ! 18 in
r,15,1.13                       ! 18 in
r,16,1.13                       ! 18 in
r,17,1.24                       ! 18 in
r,18,1.07                       ! 18 in
r,19,1.18                       ! 18 in
r,20,1.07                       ! 18 in
r,21,1.07                       ! 18 in
r,22,1.97                       ! 18 in
r,23,1.97,1.67,1.67,1.97        ! 18 in
r,24,1.67                       !
r,25,1.68,1.43,1.43,1.68        !
r,26,1.43,0.51,0.51,1.43        ! 8 in
r,27,0.51,0.41,0.41,0.51        ! 8 in
r,28,0.41,0.55,0.55,0.41        ! 8 in
r,29,0.55                       ! 8 in
r,30,0.55,0.40,0.40,0.55        ! 8 in
r,31,0.40,1.02,1.02,0.40        ! 8 in to
r,32,1.02                       !
!r,34,1
!r,35,1
!r,36,1
!r,37,1
!r,39,1


/COM - Material,50, Insulating Concrete
mp,ex,50,23760
mp,nuxy,50,0.15
mp,dens,50,50/(1000*g)
mp,damp,50,0.07/df
```

TH-266-LB-Geo-V.txt

```
-0.000173-0.000255 0.000174 0.000257-0.000174-0.000258 0.000176 0.000261     1
-0.000176-0.000262 0.000178 0.000264-0.000178-0.000265 0.000180 0.000268     2
-0.000180-0.000269 0.000182 0.000272-0.000182-0.000273 0.000184 0.000277     3
. . . . . . . . .
-0.000163-0.000237 0.000164 0.000238-0.000164-0.000239 0.000165 0.000241   510
-0.000166-0.000242 0.000167 0.000244-0.000167-0.000245 0.000169 0.000247   511
-0.000169-0.000248 0.000171 0.000250-0.000171-0.000251 0.000172 0.000254   512
```

TH-266-LB-Geo.txt

```
-0.000061 0.000024 0.000058-0.000026-0.000058 0.000024 0.000054-0.000026     1
-0.000054 0.000024 0.000050-0.000026-0.000051 0.000024 0.000045-0.000027     2
-0.000046 0.000023 0.000040-0.000027-0.000041 0.000023 0.000034-0.000028     3
. . . . . . . .
-0.000073 0.000023 0.000072-0.000024-0.000072 0.000023 0.000070-0.000024   510
-0.000070 0.000023 0.000068-0.000024-0.000068 0.000023 0.000066-0.000025   511
-0.000066 0.000024 0.000063-0.000025-0.000064 0.000024 0.000061-0.000025   512
```

LBS-BEC Seismic File Listing

```
  Volume in drive C is 600GB 2xRAID0 (new)
 Volume Serial Number is 8A0A-E4BA

 Directory of C:\Users\Bruce\2008-000 PNNL\2008-005 AP-460\AP-460-LBS-BEC-Seismic Run

01/09/2007  06:41 AM    <DIR>          .
01/09/2007  06:41 AM    <DIR>          ..
10/14/2006  09:45 PM           561,576 Accel-ct-0.out
10/14/2006  09:45 PM           561,828 Accel-ct-135.out
10/14/2006  09:46 PM           561,828 Accel-ct-180.out
10/14/2006  09:45 PM           561,576 Accel-ct-45.out
10/14/2006  09:45 PM           561,828 Accel-ct-90.out
10/14/2006  09:45 PM           290,676 Accel-ct.out
10/14/2006  09:46 PM           561,828 Accel-PT-0.out
10/14/2006  09:46 PM           561,828 Accel-PT-135.out
10/14/2006  09:46 PM           561,828 Accel-PT-180.out
10/14/2006  09:46 PM           561,828 Accel-PT-45.out
10/14/2006  09:46 PM           561,828 Accel-PT-90.out
10/14/2006  09:46 PM           561,828 Accel-SOil.out
08/21/2006  06:49 AM               101 All-Forces.txt
11/19/2006  06:54 AM         4,748,249 AP-460-BEC-LBS-Seismic.out
01/02/2007  09:04 AM         3,549,184 AP-460-LBS-BEC Conc Tank Demand Seismic Only.xls
01/02/2007  09:03 AM         3,328,512 AP-460-LBS-BEC Conc Tank Demand Seismic.xls
10/18/2006  07:47 AM         1,426,944 AP-460-LBS-BEC Conc-Tank Spectra.xls
12/21/2006  01:06 PM         1,435,136 AP-460-LBS-BEC Footing Seismic.xls
10/18/2006  07:26 AM           306,176 AP-460-LBS-BEC Free Field RS Comparision.xls
01/02/2007  09:08 AM           730,112 AP-460-LBS-BEC J Bolt Forces Seismic.xls
10/17/2006  01:39 PM           789,504 AP-460-LBS-BEC J-Bolt-Contact-Seismic.xls
10/17/2006  01:46 PM           698,880 AP-460-LBS-BEC Liner-Contact-Seismic.xls
01/05/2007  01:28 PM         7,511,040 AP-460-LBS-BEC Pri Tank Stress Seismic Only.xls
10/17/2006  10:24 AM         7,328,768 AP-460-LBS-BEC Pri Tank Stress Seismic.xls
10/17/2006  01:44 PM           699,392 AP-460-LBS-BEC Primary-Contact-Seismic.xls
10/18/2006  07:52 AM         1,156,608 AP-460-LBS-BEC Primary-Tank Spectra.xls
12/18/2006  09:23 AM         2,071,552 AP-460-LBS-BEC Soil Pressures Seismic.xls
01/09/2007  04:33 AM         3,834,880 AP-460-LBS-BEC Strain Seismic-Princ.xls
10/18/2006  06:52 AM           611,328 AP-460-LBS-BEC Total Reaction.xls
12/21/2006  01:12 PM           391,168 AP-460-LBS-BEC Waste-Disp-TH-MAX.xls
12/21/2006  03:21 PM           920,576 AP-460-LBS-BEC Waste-TH-MAX.xls
01/08/2007  10:47 AM    <DIR>          AP-460-LBS-BEC-Gravity
11/19/2006  06:54 AM             2,998 AP-460-LBS-BEC-Seismic.BCS
11/19/2006  08:23 AM        43,843,584 AP-460-LBS-BEC-Seismic.db
11/19/2006  06:54 AM        63,897,600 AP-460-LBS-BEC-Seismic.dbb
11/19/2006  06:54 AM        12,713,984 AP-460-LBS-BEC-Seismic.emat
01/04/2007  06:51 PM           630,251 AP-460-LBS-BEC-Seismic.err
11/19/2006  06:54 AM       111,607,808 AP-460-LBS-BEC-Seismic.esav
11/19/2006  06:54 AM        30,081,024 AP-460-LBS-BEC-Seismic.full
11/19/2006  06:53 AM       340,804,299 AP-460-LBS-BEC-Seismic.ldhi
01/05/2007  09:39 AM             4,160 AP-460-LBS-BEC-Seismic.log
11/19/2006  06:54 AM           198,991 AP-460-LBS-BEC-Seismic.mntr
11/19/2006  06:53 AM       111,607,808 AP-460-LBS-BEC-Seismic.osav
11/19/2006  06:54 AM             1,795 AP-460-LBS-BEC-Seismic.PVTS
11/19/2006  06:54 AM       112,656,384 AP-460-LBS-BEC-Seismic.r001
11/17/2006  12:56 PM        43,974,656 AP-460-LBS-BEC-Seismic.rdb
11/19/2006  06:54 AM     4,294,967,296 AP-460-LBS-BEC-Seismic.rst
11/17/2006  10:24 PM     4,294,967,296 AP-460-LBS-BEC-Seismic.rst02
11/18/2006  03:13 AM     4,294,967,296 AP-460-LBS-BEC-Seismic.rst03
11/18/2006  08:08 AM     4,294,967,296 AP-460-LBS-BEC-Seismic.rst04
11/18/2006  01:13 PM     4,294,967,296 AP-460-LBS-BEC-Seismic.rst05
11/18/2006  06:25 PM     4,294,967,296 AP-460-LBS-BEC-Seismic.rst06
11/18/2006  11:43 PM     4,294,967,296 AP-460-LBS-BEC-Seismic.rst07
11/19/2006  05:09 AM     4,294,967,296 AP-460-LBS-BEC-Seismic.rst08
11/19/2006  06:54 AM     1,388,445,696 AP-460-LBS-BEC-Seismic.rst09
08/25/2006  01:26 PM             6,031 Bolts-Friction.txt
09/08/2006  02:54 PM               277 Boundary.txt
08/25/2006  08:48 AM               220 Contact-AP.txt
08/21/2006  07:59 AM               586 Contact-Footing.txt
08/25/2006  01:28 PM               704 Contact-Insul.txt
```

```
08/25/2006  01:27 PM               704 Contact-J-Bolts.txt
08/25/2006  01:28 PM               708 Contact-Primary.txt
08/21/2006  07:59 AM               742 Contact-Soil.txt
08/21/2006  12:44 PM               632 Contact-Waste-AP.txt
10/14/2006  09:45 PM           561,576 Disp-ct-0.out
10/14/2006  09:45 PM           561,576 Disp-ct-135.out
10/14/2006  09:46 PM           561,576 Disp-ct-180.out
10/14/2006  09:45 PM           561,576 Disp-ct-45.out
10/14/2006  09:45 PM           561,576 Disp-ct-90.out
10/14/2006  09:45 PM           290,550 Disp-ct.out
01/03/2006  11:17 AM             1,616 Disp-J-Bolts.txt
10/14/2006  09:46 PM           561,576 Disp-PT-0.out
10/14/2006  09:46 PM           561,576 Disp-PT-135.out
10/14/2006  09:46 PM           561,576 Disp-PT-180.out
10/14/2006  09:46 PM           561,576 Disp-PT-45.out
10/14/2006  09:46 PM           561,576 Disp-PT-90.out
10/14/2006  09:46 PM           561,576 Disp-Soil.out
10/18/2006  07:04 AM            40,960 disp_0-90.xls
10/18/2006  07:04 AM            38,400 disp_99-180.xls
05/08/2006  01:31 PM             8,616 Far-Soil.txt
01/09/2007  06:41 AM                 0 file-list.txt
10/12/2006  04:06 PM                68 file.err
09/11/2006  09:47 AM                 0 file.lock
10/12/2006  04:06 PM               480 file.log
10/13/2005  06:54 AM               562 Fix-Soil.txt
10/14/2006  09:43 PM            10,342 Footing-Cont_max.OUT
10/14/2006  09:43 PM         4,346,248 Footing-Cont_th.OUT
08/21/2006  08:00 AM               894 Force-c.txt
10/15/2006  01:59 AM             4,996 Force-c_108amax.OUT
10/15/2006  01:59 AM         2,905,500 Force-c_108ath.OUT
10/14/2006  11:22 PM            14,716 Force-c_108max.OUT
10/14/2006  11:22 PM         6,519,180 Force-c_108th.OUT
10/15/2006  02:06 AM             4,996 Force-c_117amax.OUT
10/15/2006  02:06 AM         2,905,500 Force-c_117ath.OUT
10/14/2006  11:29 PM            14,716 Force-c_117max.OUT
10/14/2006  11:29 PM         6,519,180 Force-c_117th.OUT
10/15/2006  02:14 AM             4,996 Force-c_126amax.OUT
10/15/2006  02:14 AM         2,905,500 Force-c_126ath.OUT
10/14/2006  11:37 PM            14,716 Force-c_126max.OUT
10/14/2006  11:37 PM         6,519,180 Force-c_126th.OUT
10/15/2006  02:22 AM             4,996 Force-c_135amax.OUT
10/15/2006  02:22 AM         2,905,500 Force-c_135ath.OUT
10/14/2006  11:45 PM            14,716 Force-c_135max.OUT
10/14/2006  11:45 PM         6,519,180 Force-c_135th.OUT
10/15/2006  02:29 AM             4,996 Force-c_144amax.OUT
10/15/2006  02:29 AM         2,905,500 Force-c_144ath.OUT
10/14/2006  11:53 PM            14,716 Force-c_144max.OUT
10/14/2006  11:53 PM         6,519,180 Force-c_144th.OUT
10/15/2006  02:38 AM             4,996 Force-c_153amax.OUT
10/15/2006  02:38 AM         2,905,500 Force-c_153ath.OUT
10/15/2006  12:01 AM            14,716 Force-c_153max.OUT
10/15/2006  12:01 AM         6,519,180 Force-c_153th.OUT
10/15/2006  02:45 AM             4,996 Force-c_162amax.OUT
10/15/2006  02:45 AM         2,905,500 Force-c_162ath.OUT
10/15/2006  12:09 AM            14,716 Force-c_162max.OUT
10/15/2006  12:09 AM         6,519,180 Force-c_162th.OUT
10/15/2006  02:53 AM             4,996 Force-c_171amax.OUT
10/15/2006  02:53 AM         2,905,500 Force-c_171ath.OUT
10/15/2006  12:17 AM            14,716 Force-c_171max.OUT
10/15/2006  12:17 AM         6,519,180 Force-c_171th.OUT
10/15/2006  03:01 AM             4,996 Force-c_180amax.OUT
10/15/2006  03:01 AM         2,905,500 Force-c_180ath.OUT
10/15/2006  12:25 AM            14,716 Force-c_180max.OUT
10/15/2006  12:25 AM         6,519,180 Force-c_180th.OUT
10/15/2006  12:42 AM             4,996 Force-c_18amax.OUT
10/15/2006  12:42 AM         2,905,500 Force-c_18ath.OUT
10/14/2006  10:03 PM            14,716 Force-c_18max.OUT
10/14/2006  10:03 PM         6,519,180 Force-c_18th.OUT
10/15/2006  12:49 AM             4,996 Force-c_27amax.OUT
10/15/2006  12:49 AM         2,905,500 Force-c_27ath.OUT
```

10/14/2006	10:11 PM	14,716	Force-c_27max.OUT
10/14/2006	10:11 PM	6,519,180	Force-c_27th.OUT
10/15/2006	12:57 AM	4,996	Force-c_36amax.OUT
10/15/2006	12:57 AM	2,905,500	Force-c_36ath.OUT
10/14/2006	10:19 PM	14,716	Force-c_36max.OUT
10/14/2006	10:19 PM	6,519,180	Force-c_36th.OUT
10/15/2006	01:05 AM	4,996	Force-c_45amax.OUT
10/15/2006	01:05 AM	2,905,500	Force-c_45ath.OUT
10/14/2006	10:27 PM	14,716	Force-c_45max.OUT
10/14/2006	10:27 PM	6,519,180	Force-c_45th.OUT
10/15/2006	01:12 AM	4,996	Force-c_54amax.OUT
10/15/2006	01:12 AM	2,905,500	Force-c_54ath.OUT
10/14/2006	10:34 PM	14,716	Force-c_54max.OUT
10/14/2006	10:34 PM	6,519,180	Force-c_54th.OUT
10/15/2006	01:20 AM	4,996	Force-c_63amax.OUT
10/15/2006	01:20 AM	2,905,500	Force-c_63ath.OUT
10/14/2006	10:42 PM	14,716	Force-c_63max.OUT
10/14/2006	10:42 PM	6,519,180	Force-c_63th.OUT
10/15/2006	01:27 AM	4,996	Force-c_72amax.OUT
10/15/2006	01:27 AM	2,905,500	Force-c_72ath.OUT
10/14/2006	10:49 PM	14,716	Force-c_72max.OUT
10/14/2006	10:49 PM	6,519,180	Force-c_72th.OUT
10/15/2006	01:35 AM	4,996	Force-c_81amax.OUT
10/15/2006	01:35 AM	2,905,500	Force-c_81ath.OUT
10/14/2006	10:57 PM	14,716	Force-c_81max.OUT
10/14/2006	10:57 PM	6,519,180	Force-c_81th.OUT
10/15/2006	01:43 AM	4,996	Force-c_90amax.OUT
10/15/2006	01:43 AM	2,905,500	Force-c_90ath.OUT
10/14/2006	11:05 PM	14,716	Force-c_90max.OUT
10/14/2006	11:05 PM	6,519,180	Force-c_90th.OUT
10/15/2006	01:51 AM	4,996	Force-c_99amax.OUT
10/15/2006	01:51 AM	2,905,500	Force-c_99ath.OUT
10/14/2006	11:14 PM	14,716	Force-c_99max.OUT
10/14/2006	11:14 PM	6,519,180	Force-c_99th.OUT
10/15/2006	12:33 AM	4,996	Force-c_9amax.OUT
10/15/2006	12:33 AM	2,905,628	Force-c_9ath.OUT
10/14/2006	09:54 PM	14,716	Force-c_9max.OUT
10/14/2006	09:54 PM	6,519,308	Force-c_9th.OUT
10/17/2006	09:55 AM	135,168	force-jb.xls
10/15/2006	01:53 PM	2,666,244	Force-jb_r10-th.OUT
10/15/2006	01:53 PM	5,239	Force-jb_r10_max.OUT
10/15/2006	01:54 PM	2,666,244	Force-jb_r11-th.OUT
10/15/2006	01:54 PM	5,239	Force-jb_r11_max.OUT
10/15/2006	01:49 PM	2,666,372	Force-jb_r2-th.OUT
10/15/2006	01:49 PM	5,239	Force-jb_r2_max.OUT
10/15/2006	01:49 PM	2,666,244	Force-jb_r3-th.OUT
10/15/2006	01:49 PM	5,239	Force-jb_r3_max.OUT
10/15/2006	01:50 PM	2,666,244	Force-jb_r4-th.OUT
10/15/2006	01:50 PM	5,239	Force-jb_r4_max.OUT
10/15/2006	01:51 PM	2,666,244	Force-jb_r5-th.OUT
10/15/2006	01:51 PM	5,239	Force-jb_r5_max.OUT
10/15/2006	01:51 PM	2,666,244	Force-jb_r6-th.OUT
10/15/2006	01:51 PM	5,239	Force-jb_r6_max.OUT
10/15/2006	01:52 PM	2,666,244	Force-jb_r7-th.OUT
10/15/2006	01:52 PM	5,239	Force-jb_r7_max.OUT
10/15/2006	01:52 PM	2,666,244	Force-jb_r8-th.OUT
10/15/2006	01:52 PM	5,239	Force-jb_r8_max.OUT
10/15/2006	01:53 PM	2,666,244	Force-jb_r9-th.OUT
10/15/2006	01:53 PM	5,239	Force-jb_r9_max.OUT
08/21/2006	08:00 AM	661	Force-j_bolt.txt
10/17/2006	09:38 AM	437,248	import_0-90.xls
10/17/2006	09:38 AM	437,760	import_99-180.xls
10/17/2006	01:45 PM	105,472	Insul-Contact_0-90.xls
10/17/2006	01:45 PM	105,472	Insul-Contact_99-180.xls
10/14/2006	06:03 PM	4,024	Insul-Cont_108max.OUT
10/14/2006	06:03 PM	1,738,448	Insul-Cont_108th.OUT
10/14/2006	06:04 PM	4,024	Insul-Cont_117max.OUT
10/14/2006	06:04 PM	1,738,448	Insul-Cont_117th.OUT
10/14/2006	06:05 PM	4,024	Insul-Cont_126max.OUT
10/14/2006	06:05 PM	1,738,448	Insul-Cont_126th.OUT

```
10/14/2006  06:06 PM             4,024 Insul-Cont_135max.OUT
10/14/2006  06:06 PM         1,738,448 Insul-Cont_135th.OUT
10/14/2006  06:08 PM             4,024 Insul-Cont_144max.OUT
10/14/2006  06:08 PM         1,738,448 Insul-Cont_144th.OUT
10/14/2006  06:10 PM             4,024 Insul-Cont_153max.OUT
10/14/2006  06:10 PM         1,738,448 Insul-Cont_153th.OUT
10/14/2006  06:11 PM             4,024 Insul-Cont_162max.OUT
10/14/2006  06:11 PM         1,738,448 Insul-Cont_162th.OUT
10/14/2006  06:13 PM             4,024 Insul-Cont_171max.OUT
10/14/2006  06:13 PM         1,738,448 Insul-Cont_171th.OUT
10/14/2006  06:14 PM             4,024 Insul-Cont_180max.OUT
10/14/2006  06:14 PM         1,738,448 Insul-Cont_180th.OUT
10/14/2006  05:50 PM             4,024 Insul-Cont_18max.OUT
10/14/2006  05:51 PM         1,738,448 Insul-Cont_18th.OUT
10/14/2006  05:51 PM             4,024 Insul-Cont_27max.OUT
10/14/2006  05:51 PM         1,738,448 Insul-Cont_27th.OUT
10/14/2006  05:52 PM             4,024 Insul-Cont_36max.OUT
10/14/2006  05:52 PM         1,738,448 Insul-Cont_36th.OUT
10/14/2006  05:54 PM             4,024 Insul-Cont_45max.OUT
10/14/2006  05:54 PM         1,738,448 Insul-Cont_45th.OUT
10/14/2006  05:55 PM             4,024 Insul-Cont_54max.OUT
10/14/2006  05:55 PM         1,738,448 Insul-Cont_54th.OUT
10/14/2006  05:57 PM             4,024 Insul-Cont_63max.OUT
10/14/2006  05:57 PM         1,738,448 Insul-Cont_63th.OUT
10/14/2006  05:58 PM             4,024 Insul-Cont_72max.OUT
10/14/2006  05:58 PM         1,738,448 Insul-Cont_72th.OUT
10/14/2006  05:59 PM             4,024 Insul-Cont_81max.OUT
10/14/2006  05:59 PM         1,738,448 Insul-Cont_81th.OUT
10/14/2006  06:01 PM             4,024 Insul-Cont_90max.OUT
10/14/2006  06:01 PM         1,738,448 Insul-Cont_90th.OUT
10/14/2006  06:02 PM             4,024 Insul-Cont_99max.OUT
10/14/2006  06:02 PM         1,738,448 Insul-Cont_99th.OUT
10/14/2006  05:49 PM             4,024 Insul-Cont_9max.OUT
10/14/2006  05:49 PM         1,738,576 Insul-Cont_9th.OUT
09/01/2005  10:27 AM             1,664 Insulate.txt
07/20/2006  06:36 AM             4,030 interface-gap1.txt
08/23/2006  07:55 AM             2,411 interface1.txt
10/17/2006  01:38 PM           117,248 J-Bolt-Contact_0-90.xls
10/17/2006  01:38 PM           117,248 J-Bolt-Contact_99-180.xls
10/14/2006  07:07 PM             4,519 J-Bolt-Cont_108max.OUT
10/14/2006  07:07 PM         1,685,484 J-Bolt-Cont_108th.OUT
10/14/2006  07:09 PM             4,519 J-Bolt-Cont_117max.OUT
10/14/2006  07:09 PM         1,685,484 J-Bolt-Cont_117th.OUT
10/14/2006  07:10 PM             4,519 J-Bolt-Cont_126max.OUT
10/14/2006  07:10 PM         1,685,484 J-Bolt-Cont_126th.OUT
10/14/2006  07:12 PM             4,519 J-Bolt-Cont_135max.OUT
10/14/2006  07:12 PM         1,685,484 J-Bolt-Cont_135th.OUT
10/14/2006  07:14 PM             4,519 J-Bolt-Cont_144max.OUT
10/14/2006  07:14 PM         1,685,484 J-Bolt-Cont_144th.OUT
10/14/2006  07:16 PM             4,519 J-Bolt-Cont_153max.OUT
10/14/2006  07:16 PM         1,685,484 J-Bolt-Cont_153th.OUT
10/14/2006  07:17 PM             4,519 J-Bolt-Cont_162max.OUT
10/14/2006  07:17 PM         1,685,484 J-Bolt-Cont_162th.OUT
10/14/2006  07:19 PM             4,519 J-Bolt-Cont_171max.OUT
10/14/2006  07:19 PM         1,685,484 J-Bolt-Cont_171th.OUT
10/14/2006  07:20 PM             4,519 J-Bolt-Cont_180max.OUT
10/14/2006  07:20 PM         1,685,484 J-Bolt-Cont_180th.OUT
10/14/2006  06:50 PM             4,519 J-Bolt-Cont_18max.OUT
10/14/2006  06:50 PM         1,685,484 J-Bolt-Cont_18th.OUT
10/14/2006  06:52 PM             4,519 J-Bolt-Cont_27max.OUT
10/14/2006  06:52 PM         1,685,484 J-Bolt-Cont_27th.OUT
10/14/2006  06:53 PM             4,519 J-Bolt-Cont_36max.OUT
10/14/2006  06:53 PM         1,685,484 J-Bolt-Cont_36th.OUT
10/14/2006  06:56 PM             4,519 J-Bolt-Cont_45max.OUT
10/14/2006  06:56 PM         1,685,484 J-Bolt-Cont_45th.OUT
10/14/2006  06:58 PM             4,519 J-Bolt-Cont_54max.OUT
10/14/2006  06:58 PM         1,685,484 J-Bolt-Cont_54th.OUT
10/14/2006  07:00 PM             4,519 J-Bolt-Cont_63max.OUT
10/14/2006  07:00 PM         1,685,484 J-Bolt-Cont_63th.OUT
10/14/2006  07:01 PM             4,519 J-Bolt-Cont_72max.OUT
```

```
10/14/2006  07:01 PM        1,685,484 J-Bolt-Cont_72th.OUT
10/14/2006  07:03 PM            4,519 J-Bolt-Cont_81max.OUT
10/14/2006  07:03 PM        1,685,484 J-Bolt-Cont_81th.OUT
10/14/2006  07:04 PM            4,519 J-Bolt-Cont_90max.OUT
10/14/2006  07:04 PM        1,685,484 J-Bolt-Cont_90th.OUT
10/14/2006  07:06 PM            4,519 J-Bolt-Cont_99max.OUT
10/14/2006  07:06 PM        1,685,484 J-Bolt-Cont_99th.OUT
10/14/2006  06:49 PM            4,519 J-Bolt-Cont_9max.OUT
10/14/2006  06:49 PM        1,685,612 J-Bolt-Cont_9th.OUT
12/22/2006  08:33 AM           52,949 LBS-BEC-Seismic-File-List.txt
08/23/2006  07:47 AM            1,971 Liner.txt
05/02/2005  02:19 PM              667 live_load.txt
09/01/2006  06:03 AM            6,212 Near-Soil-1.txt
04/20/2005  01:14 PM              508 outer-spar.txt
11/17/2006  12:54 PM              162 Post-Tank.txt
10/17/2006  01:42 PM          105,984 Primary-Contact_0-90.xls
10/17/2006  01:43 PM          105,984 Primary-Contact_99-180.xls
10/14/2006  06:34 PM            4,024 Primary-Cont_108max.OUT
10/14/2006  06:34 PM        1,738,448 Primary-Cont_108th.OUT
10/14/2006  06:35 PM            4,024 Primary-Cont_117max.OUT
10/14/2006  06:35 PM        1,738,448 Primary-Cont_117th.OUT
10/14/2006  06:37 PM            4,024 Primary-Cont_126max.OUT
10/14/2006  06:37 PM        1,738,448 Primary-Cont_126th.OUT
10/14/2006  06:38 PM            4,024 Primary-Cont_135max.OUT
10/14/2006  06:38 PM        1,738,448 Primary-Cont_135th.OUT
10/14/2006  06:40 PM            4,024 Primary-Cont_144max.OUT
10/14/2006  06:40 PM        1,738,448 Primary-Cont_144th.OUT
10/14/2006  06:41 PM            4,024 Primary-Cont_153max.OUT
10/14/2006  06:41 PM        1,738,448 Primary-Cont_153th.OUT
10/14/2006  06:42 PM            4,024 Primary-Cont_162max.OUT
10/14/2006  06:42 PM        1,738,448 Primary-Cont_162th.OUT
10/14/2006  06:44 PM            4,024 Primary-Cont_171max.OUT
10/14/2006  06:44 PM        1,738,448 Primary-Cont_171th.OUT
10/14/2006  06:46 PM            4,024 Primary-Cont_180max.OUT
10/14/2006  06:46 PM        1,738,448 Primary-Cont_180th.OUT
10/14/2006  06:18 PM            4,024 Primary-Cont_18max.OUT
10/14/2006  06:18 PM        1,738,448 Primary-Cont_18th.OUT
10/14/2006  06:20 PM            4,024 Primary-Cont_27max.OUT
10/14/2006  06:20 PM        1,738,448 Primary-Cont_27th.OUT
10/14/2006  06:20 PM            4,024 Primary-Cont_36max.OUT
10/14/2006  06:20 PM        1,738,448 Primary-Cont_36th.OUT
10/14/2006  06:22 PM            4,024 Primary-Cont_45max.OUT
10/14/2006  06:22 PM        1,738,448 Primary-Cont_45th.OUT
10/14/2006  06:24 PM            4,024 Primary-Cont_54max.OUT
10/14/2006  06:24 PM        1,738,448 Primary-Cont_54th.OUT
10/14/2006  06:26 PM            4,024 Primary-Cont_63max.OUT
10/14/2006  06:26 PM        1,738,448 Primary-Cont_63th.OUT
10/14/2006  06:27 PM            4,024 Primary-Cont_72max.OUT
10/14/2006  06:27 PM        1,738,448 Primary-Cont_72th.OUT
10/14/2006  06:29 PM            4,024 Primary-Cont_81max.OUT
10/14/2006  06:29 PM        1,738,448 Primary-Cont_81th.OUT
10/14/2006  06:30 PM            4,024 Primary-Cont_90max.OUT
10/14/2006  06:30 PM        1,738,448 Primary-Cont_90th.OUT
10/14/2006  06:32 PM            4,024 Primary-Cont_99max.OUT
10/14/2006  06:32 PM        1,738,448 Primary-Cont_99th.OUT
10/14/2006  06:16 PM            4,024 Primary-Cont_9max.OUT
10/14/2006  06:16 PM        1,738,576 Primary-Cont_9th.OUT
10/12/2006  02:28 PM            6,028 Primary-Props-AP.txt
09/27/2005  03:52 PM            1,538 Primary.txt
11/17/2006  12:56 PM          448,180 QA.out
10/14/2006  09:45 PM           47,121 RS-ct-0.out
10/14/2006  09:45 PM           47,121 RS-ct-135.out
10/14/2006  09:46 PM           47,121 RS-ct-180.out
10/14/2006  09:45 PM           47,121 RS-ct-45.out
10/14/2006  09:45 PM           47,121 RS-ct-90.out
10/14/2006  09:45 PM           27,591 RS-ct.out
10/14/2006  09:46 PM           47,121 RS-PT-0.out
10/14/2006  09:46 PM           47,121 RS-PT-135.out
10/14/2006  09:46 PM           47,121 RS-PT-180.out
10/14/2006  09:46 PM           47,121 RS-PT-45.out
```

```
10/14/2006  09:46 PM            47,121 RS-PT-90.out
10/14/2006  09:46 PM            47,121 RS-SOil.out
10/31/2005  10:31 AM             1,108 RS_FREQ.txt
09/01/2006  06:03 AM             1,819 Run-Tank.txt
01/04/2007  02:57 PM                 0 scratch.hlp
02/11/2005  01:22 PM             1,053 Slave.txt
10/14/2006  08:35 PM             9,896 Soil-Contact_108max.OUT
10/14/2006  08:35 PM         4,348,080 Soil-Contact_108th.OUT
10/14/2006  08:41 PM             9,896 Soil-Contact_117max.OUT
10/14/2006  08:41 PM         4,348,080 Soil-Contact_117th.OUT
10/14/2006  08:47 PM             9,896 Soil-Contact_126max.OUT
10/14/2006  08:47 PM         4,348,080 Soil-Contact_126th.OUT
10/14/2006  08:53 PM             9,896 Soil-Contact_135max.OUT
10/14/2006  08:53 PM         4,348,080 Soil-Contact_135th.OUT
10/14/2006  09:00 PM             9,896 Soil-Contact_144max.OUT
10/14/2006  09:00 PM         4,348,080 Soil-Contact_144th.OUT
10/14/2006  09:06 PM             9,896 Soil-Contact_153max.OUT
10/14/2006  09:06 PM         4,348,080 Soil-Contact_153th.OUT
10/14/2006  09:12 PM             9,896 Soil-Contact_162max.OUT
10/14/2006  09:12 PM         4,348,080 Soil-Contact_162th.OUT
10/14/2006  09:18 PM             9,896 Soil-Contact_171max.OUT
10/14/2006  09:18 PM         4,348,080 Soil-Contact_171th.OUT
10/14/2006  09:24 PM             9,896 Soil-Contact_180max.OUT
10/14/2006  09:24 PM         4,348,080 Soil-Contact_180th.OUT
10/14/2006  07:33 PM             9,896 Soil-Contact_18max.OUT
10/14/2006  07:33 PM         4,348,080 Soil-Contact_18th.OUT
10/14/2006  07:39 PM             9,896 Soil-Contact_27max.OUT
10/14/2006  07:39 PM         4,348,080 Soil-Contact_27th.OUT
10/14/2006  07:45 PM             9,896 Soil-Contact_36max.OUT
10/14/2006  07:45 PM         4,348,080 Soil-Contact_36th.OUT
10/14/2006  07:51 PM             9,896 Soil-Contact_45max.OUT
10/14/2006  07:51 PM         4,348,080 Soil-Contact_45th.OUT
10/14/2006  07:57 PM             9,896 Soil-Contact_54max.OUT
10/14/2006  07:57 PM         4,348,080 Soil-Contact_54th.OUT
10/14/2006  08:04 PM             9,896 Soil-Contact_63max.OUT
10/14/2006  08:04 PM         4,348,080 Soil-Contact_63th.OUT
10/14/2006  08:10 PM             9,896 Soil-Contact_72max.OUT
10/14/2006  08:10 PM         4,348,080 Soil-Contact_72th.OUT
10/14/2006  08:16 PM             9,896 Soil-Contact_81max.OUT
10/14/2006  08:16 PM         4,348,080 Soil-Contact_81th.OUT
10/14/2006  08:22 PM             9,896 Soil-Contact_90max.OUT
10/14/2006  08:22 PM         4,348,080 Soil-Contact_90th.OUT
10/14/2006  08:29 PM             9,896 Soil-Contact_99max.OUT
10/14/2006  08:29 PM         4,348,080 Soil-Contact_99th.OUT
10/14/2006  07:26 PM             9,896 Soil-Contact_9max.OUT
10/14/2006  07:26 PM         4,348,208 Soil-Contact_9th.OUT
09/20/2005  02:46 PM             4,106 Soil-Prop-LB-Geo.txt
10/17/2006  12:34 PM           223,744 soil_0-90.xls
10/17/2006  12:34 PM           223,744 soil_99-180.xls
09/11/2006  09:46 AM             1,925 Solve-TH-LBS.txt
09/13/2006  06:12 AM               347 spectra-all.txt
09/13/2006  06:07 AM             3,690 spectra-conc-0.txt
09/13/2006  06:08 AM             3,723 spectra-conc-135.txt
09/13/2006  06:09 AM             3,723 spectra-conc-180.txt
09/13/2006  06:08 AM             3,769 spectra-conc-45.txt
09/13/2006  06:08 AM             3,649 spectra-conc-90.txt
09/13/2006  06:09 AM             1,590 spectra-conc.txt
08/28/2006  09:38 AM             2,076 spectra-concrete.txt
09/13/2006  06:13 AM             3,609 spectra-primary-0.txt
09/13/2006  06:14 AM             3,762 spectra-primary-135.txt
09/13/2006  06:15 AM             3,777 spectra-primary-180.txt
09/13/2006  06:13 AM             3,688 spectra-primary-45.txt
09/13/2006  06:14 AM             3,688 spectra-primary-90.txt
09/13/2006  06:15 AM             3,801 spectra-soil.txt
06/20/2005  09:04 AM               647 spectra-wall.txt
06/20/2005  08:52 AM               679 spectra-waste.txt
10/17/2006  10:14 AM           276,992 str-comp_0-90b.xls
10/17/2006  10:14 AM           276,992 str-comp_0-90m.xls
10/17/2006  10:14 AM           276,480 str-comp_0-90t.xls
10/17/2006  10:14 AM           276,480 str-comp_99-180b.xls
```

```
10/17/2006  10:15 AM           276,480 str-comp_99-180m.xls
10/17/2006  10:15 AM           276,480 str-comp_99-180t.xls
01/03/2007  03:40 PM             1,823 strain-backed-principle-bot.txt
01/03/2007  03:40 PM             1,828 strain-backed-principle-mid.txt
01/03/2007  03:41 PM             1,825 strain-backed-principle-top.txt
01/03/2007  04:02 PM               966 strain-backed-principle.txt
01/04/2007  04:31 PM             7,496 Strain-Backed-Princ_108-bot-max.OUT
01/04/2007  04:31 PM         3,463,218 Strain-Backed-Princ_108-bot-th.OUT
01/04/2007  07:59 PM             7,162 Strain-Backed-Princ_108-Top-max.OUT
01/04/2007  07:59 PM         3,305,799 Strain-Backed-Princ_108-Top-th.OUT
01/04/2007  06:18 PM             4,156 Strain-Backed-Princ_108max.OUT
01/04/2007  06:18 PM         1,889,028 Strain-Backed-Princ_108th.OUT
01/04/2007  04:38 PM             7,496 Strain-Backed-Princ_117-bot-max.OUT
01/04/2007  04:38 PM         3,463,218 Strain-Backed-Princ_117-bot-th.OUT
01/04/2007  08:05 PM             7,162 Strain-Backed-Princ_117-Top-max.OUT
01/04/2007  08:05 PM         3,305,799 Strain-Backed-Princ_117-Top-th.OUT
01/04/2007  06:22 PM             4,156 Strain-Backed-Princ_117max.OUT
01/04/2007  06:22 PM         1,889,028 Strain-Backed-Princ_117th.OUT
01/04/2007  04:45 PM             7,496 Strain-Backed-Princ_126-bot-max.OUT
01/04/2007  04:45 PM         3,463,218 Strain-Backed-Princ_126-bot-th.OUT
01/04/2007  08:10 PM             7,162 Strain-Backed-Princ_126-Top-max.OUT
01/04/2007  08:10 PM         3,305,799 Strain-Backed-Princ_126-Top-th.OUT
01/04/2007  06:26 PM             4,156 Strain-Backed-Princ_126max.OUT
01/04/2007  06:26 PM         1,889,028 Strain-Backed-Princ_126th.OUT
01/04/2007  04:53 PM             7,496 Strain-Backed-Princ_135-bot-max.OUT
01/04/2007  04:53 PM         3,463,218 Strain-Backed-Princ_135-bot-th.OUT
01/04/2007  08:16 PM             7,162 Strain-Backed-Princ_135-Top-max.OUT
01/04/2007  08:16 PM         3,305,799 Strain-Backed-Princ_135-Top-th.OUT
01/04/2007  06:30 PM             4,156 Strain-Backed-Princ_135max.OUT
01/04/2007  06:30 PM         1,889,028 Strain-Backed-Princ_135th.OUT
01/04/2007  05:00 PM             7,496 Strain-Backed-Princ_144-bot-max.OUT
01/04/2007  05:00 PM         3,463,218 Strain-Backed-Princ_144-bot-th.OUT
01/04/2007  08:22 PM             7,162 Strain-Backed-Princ_144-Top-max.OUT
01/04/2007  08:22 PM         3,305,799 Strain-Backed-Princ_144-Top-th.OUT
01/04/2007  06:35 PM             4,156 Strain-Backed-Princ_144max.OUT
01/04/2007  06:35 PM         1,889,028 Strain-Backed-Princ_144th.OUT
01/04/2007  05:07 PM             7,496 Strain-Backed-Princ_153-bot-max.OUT
01/04/2007  05:07 PM         3,463,218 Strain-Backed-Princ_153-bot-th.OUT
01/04/2007  08:27 PM             7,162 Strain-Backed-Princ_153-Top-max.OUT
01/04/2007  08:28 PM         3,305,799 Strain-Backed-Princ_153-Top-th.OUT
01/04/2007  06:39 PM             4,156 Strain-Backed-Princ_153max.OUT
01/04/2007  06:39 PM         1,889,028 Strain-Backed-Princ_153th.OUT
01/04/2007  05:14 PM             7,496 Strain-Backed-Princ_162-bot-max.OUT
01/04/2007  05:14 PM         3,463,218 Strain-Backed-Princ_162-bot-th.OUT
01/04/2007  08:33 PM             7,162 Strain-Backed-Princ_162-Top-max.OUT
01/04/2007  08:33 PM         3,305,799 Strain-Backed-Princ_162-Top-th.OUT
01/04/2007  06:43 PM             4,156 Strain-Backed-Princ_162max.OUT
01/04/2007  06:43 PM         1,889,028 Strain-Backed-Princ_162th.OUT
01/04/2007  05:21 PM             7,496 Strain-Backed-Princ_171-bot-max.OUT
01/04/2007  05:21 PM         3,463,218 Strain-Backed-Princ_171-bot-th.OUT
01/04/2007  08:39 PM             7,162 Strain-Backed-Princ_171-Top-max.OUT
01/04/2007  08:39 PM         3,305,799 Strain-Backed-Princ_171-Top-th.OUT
01/04/2007  06:47 PM             4,156 Strain-Backed-Princ_171max.OUT
01/04/2007  06:47 PM         1,889,028 Strain-Backed-Princ_171th.OUT
01/04/2007  03:12 PM             7,496 Strain-Backed-Princ_18-bot-max.OUT
01/04/2007  03:12 PM         3,463,218 Strain-Backed-Princ_18-bot-th.OUT
01/04/2007  07:03 PM             7,162 Strain-Backed-Princ_18-Top-max.OUT
01/04/2007  07:03 PM         3,305,799 Strain-Backed-Princ_18-Top-th.OUT
01/04/2007  05:28 PM             7,496 Strain-Backed-Princ_180-bot-max.OUT
01/04/2007  05:28 PM         3,463,218 Strain-Backed-Princ_180-bot-th.OUT
01/04/2007  08:45 PM             7,162 Strain-Backed-Princ_180-Top-max.OUT
01/04/2007  08:45 PM         3,305,799 Strain-Backed-Princ_180-Top-th.OUT
01/04/2007  06:51 PM             4,156 Strain-Backed-Princ_180max.OUT
01/04/2007  06:51 PM         1,889,028 Strain-Backed-Princ_180th.OUT
01/04/2007  05:36 PM             4,156 Strain-Backed-Princ_18max.OUT
01/04/2007  05:36 PM         1,889,028 Strain-Backed-Princ_18th.OUT
01/04/2007  03:20 PM             7,496 Strain-Backed-Princ_27-bot-max.OUT
01/04/2007  03:20 PM         3,463,218 Strain-Backed-Princ_27-bot-th.OUT
01/04/2007  07:09 PM             7,162 Strain-Backed-Princ_27-Top-max.OUT
01/04/2007  07:09 PM         3,305,799 Strain-Backed-Princ_27-Top-th.OUT
```

```
01/04/2007  05:41 PM             4,156 Strain-Backed-Princ_27max.OUT
01/04/2007  05:41 PM         1,889,028 Strain-Backed-Princ_27th.OUT
01/04/2007  03:29 PM             7,496 Strain-Backed-Princ_36-bot-max.OUT
01/04/2007  03:29 PM         3,463,218 Strain-Backed-Princ_36-bot-th.OUT
01/04/2007  07:15 PM             7,162 Strain-Backed-Princ_36-Top-max.OUT
01/04/2007  07:15 PM         3,305,799 Strain-Backed-Princ_36-Top-th.OUT
01/04/2007  05:45 PM             4,156 Strain-Backed-Princ_36max.OUT
01/04/2007  05:45 PM         1,889,028 Strain-Backed-Princ_36th.OUT
01/04/2007  03:36 PM             7,496 Strain-Backed-Princ_45-bot-max.OUT
01/04/2007  03:36 PM         3,463,218 Strain-Backed-Princ_45-bot-th.OUT
01/04/2007  07:20 PM             7,162 Strain-Backed-Princ_45-Top-max.OUT
01/04/2007  07:20 PM         3,305,799 Strain-Backed-Princ_45-Top-th.OUT
01/04/2007  05:49 PM             4,156 Strain-Backed-Princ_45max.OUT
01/04/2007  05:49 PM         1,889,028 Strain-Backed-Princ_45th.OUT
01/04/2007  03:45 PM             7,496 Strain-Backed-Princ_54-bot-max.OUT
01/04/2007  03:45 PM         3,463,218 Strain-Backed-Princ_54-bot-th.OUT
01/04/2007  07:25 PM             7,162 Strain-Backed-Princ_54-Top-max.OUT
01/04/2007  07:25 PM         3,305,799 Strain-Backed-Princ_54-Top-th.OUT
01/04/2007  05:53 PM             4,156 Strain-Backed-Princ_54max.OUT
01/04/2007  05:53 PM         1,889,028 Strain-Backed-Princ_54th.OUT
01/04/2007  03:53 PM             7,496 Strain-Backed-Princ_63-bot-max.OUT
01/04/2007  03:53 PM         3,463,218 Strain-Backed-Princ_63-bot-th.OUT
01/04/2007  07:31 PM             7,162 Strain-Backed-Princ_63-Top-max.OUT
01/04/2007  07:31 PM         3,305,799 Strain-Backed-Princ_63-Top-th.OUT
01/04/2007  05:57 PM             4,156 Strain-Backed-Princ_63max.OUT
01/04/2007  05:57 PM         1,889,028 Strain-Backed-Princ_63th.OUT
01/04/2007  04:01 PM             7,496 Strain-Backed-Princ_72-bot-max.OUT
01/04/2007  04:01 PM         3,463,218 Strain-Backed-Princ_72-bot-th.OUT
01/04/2007  07:36 PM             7,162 Strain-Backed-Princ_72-Top-max.OUT
01/04/2007  07:36 PM         3,305,799 Strain-Backed-Princ_72-Top-th.OUT
01/04/2007  06:01 PM             4,156 Strain-Backed-Princ_72max.OUT
01/04/2007  06:01 PM         1,889,028 Strain-Backed-Princ_72th.OUT
01/04/2007  04:09 PM             7,496 Strain-Backed-Princ_81-bot-max.OUT
01/04/2007  04:09 PM         3,463,218 Strain-Backed-Princ_81-bot-th.OUT
01/04/2007  07:41 PM             7,162 Strain-Backed-Princ_81-Top-max.OUT
01/04/2007  07:41 PM         3,305,799 Strain-Backed-Princ_81-Top-th.OUT
01/04/2007  06:05 PM             4,156 Strain-Backed-Princ_81max.OUT
01/04/2007  06:05 PM         1,889,028 Strain-Backed-Princ_81th.OUT
01/04/2007  03:05 PM             7,496 Strain-Backed-Princ_9-bot-max.OUT
01/04/2007  03:05 PM         3,463,346 Strain-Backed-Princ_9-bot-th.OUT
01/04/2007  06:57 PM             7,162 Strain-Backed-Princ_9-Top-max.OUT
01/04/2007  06:57 PM         3,305,927 Strain-Backed-Princ_9-Top-th.OUT
01/04/2007  04:17 PM             7,496 Strain-Backed-Princ_90-bot-max.OUT
01/04/2007  04:17 PM         3,463,218 Strain-Backed-Princ_90-bot-th.OUT
01/04/2007  07:47 PM             7,162 Strain-Backed-Princ_90-Top-max.OUT
01/04/2007  07:47 PM         3,305,799 Strain-Backed-Princ_90-Top-th.OUT
01/04/2007  06:10 PM             4,156 Strain-Backed-Princ_90max.OUT
01/04/2007  06:10 PM         1,889,028 Strain-Backed-Princ_90th.OUT
01/04/2007  04:24 PM             7,496 Strain-Backed-Princ_99-bot-max.OUT
01/04/2007  04:24 PM         3,463,218 Strain-Backed-Princ_99-bot-th.OUT
01/04/2007  07:54 PM             7,162 Strain-Backed-Princ_99-Top-max.OUT
01/04/2007  07:54 PM         3,305,799 Strain-Backed-Princ_99-Top-th.OUT
01/04/2007  06:14 PM             4,156 Strain-Backed-Princ_99max.OUT
01/04/2007  06:14 PM         1,889,028 Strain-Backed-Princ_99th.OUT
01/04/2007  05:32 PM             4,156 Strain-Backed-Princ_9max.OUT
01/04/2007  05:32 PM         1,889,156 Strain-Backed-Princ_9th.OUT
09/05/2006  02:00 PM             2,588 strain-backed.txt
08/21/2006  08:01 AM               566 strain-compb-p.txt
08/16/2006  01:59 PM               621 strain-compb-primary.txt
08/21/2006  08:01 AM               693 strain-compb.txt
08/21/2006  08:02 AM               566 strain-compm-p.txt
08/16/2006  02:00 PM               621 strain-compm-primary.txt
08/21/2006  08:01 AM               705 strain-compm.txt
08/21/2006  08:02 AM               578 strain-compt-p.txt
08/16/2006  02:00 PM               621 strain-compt-primary.txt
08/21/2006  08:02 AM               720 strain-compt.txt
08/21/2006  08:02 AM               730 Strain-Liner-floor.txt
01/05/2006  03:14 PM               550 Strain-Liner-p.txt
08/21/2006  08:02 AM               962 Strain-Liner-wall.txt
08/16/2006  03:01 PM               545 Strain-Liner.txt
```

```
08/16/2006  02:01 PM             292 Strain-Primary.txt
01/05/2007  07:48 AM         113,152 Strain-Princ_0-90.xls
01/05/2007  07:48 AM         187,392 Strain-Princ_0-90b.xls
01/05/2007  07:48 AM         180,224 Strain-Princ_0-90t.xls
01/05/2007  07:49 AM         113,152 Strain-Princ_99-180.xls
01/05/2007  07:49 AM         187,904 Strain-Princ_99-180b.xls
01/05/2007  07:49 AM         180,224 Strain-Princ_99-180t.xls
08/16/2006  02:19 PM             273 Strain.txt
10/17/2006  10:27 AM         254,464 Strain_0-90.xls
10/17/2006  10:27 AM         254,464 Strain_99-180.xls
08/21/2006  08:02 AM             554 stress-compb-p.txt
08/21/2006  08:02 AM             598 stress-compb.txt
08/21/2006  08:03 AM             554 stress-compm-p.txt
08/21/2006  08:03 AM             608 stress-compm.txt
08/21/2006  08:03 AM             554 stress-compt-p.txt
08/24/2006  03:19 PM             598 stress-compt.txt
08/17/2006  11:19 AM             207 Stress-Primary-M.txt
08/24/2006  12:05 PM             224 Stress-Primary.txt
10/15/2006  12:22 PM          13,519 Stress-pt_108max-b.OUT
10/15/2006  08:46 AM          13,519 Stress-pt_108max-m.OUT
10/15/2006  05:11 AM          13,519 Stress-pt_108max-t.OUT
10/15/2006  12:22 PM       6,443,068 Stress-pt_108th-b.OUT
10/15/2006  08:46 AM       6,443,068 Stress-pt_108th-m.OUT
10/15/2006  05:11 AM       6,412,940 Stress-pt_108th-t.OUT
10/15/2006  12:32 PM          13,519 Stress-pt_117max-b.OUT
10/15/2006  08:57 AM          13,519 Stress-pt_117max-m.OUT
10/15/2006  05:22 AM          13,519 Stress-pt_117max-t.OUT
10/15/2006  12:32 PM       6,443,068 Stress-pt_117th-b.OUT
10/15/2006  08:57 AM       6,443,068 Stress-pt_117th-m.OUT
10/15/2006  05:22 AM       6,412,940 Stress-pt_117th-t.OUT
10/15/2006  12:43 PM          13,519 Stress-pt_126max-b.OUT
10/15/2006  09:07 AM          13,519 Stress-pt_126max-m.OUT
10/15/2006  05:32 AM          13,519 Stress-pt_126max-t.OUT
10/15/2006  12:43 PM       6,443,068 Stress-pt_126th-b.OUT
10/15/2006  09:07 AM       6,443,068 Stress-pt_126th-m.OUT
10/15/2006  05:32 AM       6,412,940 Stress-pt_126th-t.OUT
10/15/2006  12:53 PM          13,519 Stress-pt_135max-b.OUT
10/15/2006  09:18 AM          13,519 Stress-pt_135max-m.OUT
10/15/2006  05:42 AM          13,519 Stress-pt_135max-t.OUT
10/15/2006  12:53 PM       6,443,068 Stress-pt_135th-b.OUT
10/15/2006  09:18 AM       6,443,068 Stress-pt_135th-m.OUT
10/15/2006  05:42 AM       6,412,940 Stress-pt_135th-t.OUT
10/15/2006  01:04 PM          13,519 Stress-pt_144max-b.OUT
10/15/2006  09:29 AM          13,519 Stress-pt_144max-m.OUT
10/15/2006  05:53 AM          13,519 Stress-pt_144max-t.OUT
10/15/2006  01:04 PM       6,443,068 Stress-pt_144th-b.OUT
10/15/2006  09:29 AM       6,443,068 Stress-pt_144th-m.OUT
10/15/2006  05:53 AM       6,412,940 Stress-pt_144th-t.OUT
10/15/2006  01:15 PM          13,519 Stress-pt_153max-b.OUT
10/15/2006  09:40 AM          13,519 Stress-pt_153max-m.OUT
10/15/2006  06:04 AM          13,519 Stress-pt_153max-t.OUT
10/15/2006  01:15 PM       6,443,068 Stress-pt_153th-b.OUT
10/15/2006  09:40 AM       6,443,068 Stress-pt_153th-m.OUT
10/15/2006  06:04 AM       6,412,940 Stress-pt_153th-t.OUT
10/15/2006  01:26 PM          13,519 Stress-pt_162max-b.OUT
10/15/2006  09:50 AM          13,519 Stress-pt_162max-m.OUT
10/15/2006  06:15 AM          13,519 Stress-pt_162max-t.OUT
10/15/2006  01:26 PM       6,443,068 Stress-pt_162th-b.OUT
10/15/2006  09:50 AM       6,443,068 Stress-pt_162th-m.OUT
10/15/2006  06:15 AM       6,412,940 Stress-pt_162th-t.OUT
10/15/2006  01:37 PM          13,521 Stress-pt_171max-b.OUT
10/15/2006  10:01 AM          13,521 Stress-pt_171max-m.OUT
10/15/2006  06:26 AM          13,521 Stress-pt_171max-t.OUT
10/15/2006  01:37 PM       6,443,068 Stress-pt_171th-b.OUT
10/15/2006  10:02 AM       6,443,068 Stress-pt_171th-m.OUT
10/15/2006  06:26 AM       6,412,940 Stress-pt_171th-t.OUT
10/15/2006  01:48 PM          13,521 Stress-pt_180max-b.OUT
10/15/2006  10:12 AM          13,521 Stress-pt_180max-m.OUT
10/15/2006  06:37 AM          13,521 Stress-pt_180max-t.OUT
10/15/2006  01:48 PM       6,443,068 Stress-pt_180th-b.OUT
```

```
10/15/2006  10:13 AM        6,443,068 Stress-pt_180th-m.OUT
10/15/2006  06:37 AM        6,412,940 Stress-pt_180th-t.OUT
10/15/2006  10:34 AM           13,519 Stress-pt_18max-b.OUT
10/15/2006  06:59 AM           13,519 Stress-pt_18max-m.OUT
10/15/2006  03:23 AM           13,519 Stress-pt_18max-t.OUT
10/15/2006  10:34 AM        6,443,068 Stress-pt_18th-b.OUT
10/15/2006  06:59 AM        6,443,068 Stress-pt_18th-m.OUT
10/15/2006  03:23 AM        6,412,940 Stress-pt_18th-t.OUT
10/15/2006  10:45 AM           13,519 Stress-pt_27max-b.OUT
10/15/2006  07:10 AM           13,519 Stress-pt_27max-m.OUT
10/15/2006  03:34 AM           13,519 Stress-pt_27max-t.OUT
10/15/2006  10:45 AM        6,443,068 Stress-pt_27th-b.OUT
10/15/2006  07:10 AM        6,443,068 Stress-pt_27th-m.OUT
10/15/2006  03:34 AM        6,412,940 Stress-pt_27th-t.OUT
10/15/2006  10:56 AM           13,519 Stress-pt_36max-b.OUT
10/15/2006  07:21 AM           13,519 Stress-pt_36max-m.OUT
10/15/2006  03:45 AM           13,519 Stress-pt_36max-t.OUT
10/15/2006  10:56 AM        6,443,068 Stress-pt_36th-b.OUT
10/15/2006  07:21 AM        6,443,068 Stress-pt_36th-m.OUT
10/15/2006  03:45 AM        6,412,940 Stress-pt_36th-t.OUT
10/15/2006  11:07 AM           13,519 Stress-pt_45max-b.OUT
10/15/2006  07:31 AM           13,519 Stress-pt_45max-m.OUT
10/15/2006  03:56 AM           13,519 Stress-pt_45max-t.OUT
10/15/2006  11:07 AM        6,443,068 Stress-pt_45th-b.OUT
10/15/2006  07:31 AM        6,443,068 Stress-pt_45th-m.OUT
10/15/2006  03:56 AM        6,412,940 Stress-pt_45th-t.OUT
10/15/2006  11:17 AM           13,519 Stress-pt_54max-b.OUT
10/15/2006  07:42 AM           13,519 Stress-pt_54max-m.OUT
10/15/2006  04:06 AM           13,519 Stress-pt_54max-t.OUT
10/15/2006  11:17 AM        6,443,068 Stress-pt_54th-b.OUT
10/15/2006  07:42 AM        6,443,068 Stress-pt_54th-m.OUT
10/15/2006  04:06 AM        6,412,940 Stress-pt_54th-t.OUT
10/15/2006  11:28 AM           13,519 Stress-pt_63max-b.OUT
10/15/2006  07:52 AM           13,519 Stress-pt_63max-m.OUT
10/15/2006  04:17 AM           13,519 Stress-pt_63max-t.OUT
10/15/2006  11:28 AM        6,443,068 Stress-pt_63th-b.OUT
10/15/2006  07:53 AM        6,443,068 Stress-pt_63th-m.OUT
10/15/2006  04:17 AM        6,412,940 Stress-pt_63th-t.OUT
10/15/2006  11:38 AM           13,519 Stress-pt_72max-b.OUT
10/15/2006  08:03 AM           13,519 Stress-pt_72max-m.OUT
10/15/2006  04:27 AM           13,519 Stress-pt_72max-t.OUT
10/15/2006  11:38 AM        6,443,068 Stress-pt_72th-b.OUT
10/15/2006  08:03 AM        6,443,068 Stress-pt_72th-m.OUT
10/15/2006  04:27 AM        6,412,940 Stress-pt_72th-t.OUT
10/15/2006  11:49 AM           13,519 Stress-pt_81max-b.OUT
10/15/2006  08:13 AM           13,519 Stress-pt_81max-m.OUT
10/15/2006  04:38 AM           13,519 Stress-pt_81max-t.OUT
10/15/2006  11:49 AM        6,443,068 Stress-pt_81th-b.OUT
10/15/2006  08:13 AM        6,443,068 Stress-pt_81th-m.OUT
10/15/2006  04:38 AM        6,412,940 Stress-pt_81th-t.OUT
10/15/2006  12:00 PM           13,519 Stress-pt_90max-b.OUT
10/15/2006  08:24 AM           13,519 Stress-pt_90max-m.OUT
10/15/2006  04:49 AM           13,519 Stress-pt_90max-t.OUT
10/15/2006  12:00 PM        6,443,068 Stress-pt_90th-b.OUT
10/15/2006  08:24 AM        6,443,068 Stress-pt_90th-m.OUT
10/15/2006  04:49 AM        6,412,940 Stress-pt_90th-t.OUT
10/15/2006  12:11 PM           13,519 Stress-pt_99max-b.OUT
10/15/2006  08:35 AM           13,519 Stress-pt_99max-m.OUT
10/15/2006  05:00 AM           13,519 Stress-pt_99max-t.OUT
10/15/2006  12:11 PM        6,443,068 Stress-pt_99th-b.OUT
10/15/2006  08:36 AM        6,443,068 Stress-pt_99th-m.OUT
10/15/2006  05:00 AM        6,412,940 Stress-pt_99th-t.OUT
10/15/2006  10:23 AM           13,519 Stress-pt_9max-b.OUT
10/15/2006  06:48 AM           13,519 Stress-pt_9max-m.OUT
10/15/2006  03:13 AM           13,519 Stress-pt_9max-t.OUT
10/15/2006  10:23 AM        6,443,196 Stress-pt_9th-b.OUT
10/15/2006  06:48 AM        6,443,196 Stress-pt_9th-m.OUT
10/15/2006  03:13 AM        6,413,068 Stress-pt_9th-t.OUT
10/12/2006  02:29 PM            4,009 Tank-Coordinates-AP.txt
05/25/2005  03:32 PM            2,512 Tank-Mesh1.txt
```

11/17/2006	12:55 PM	102	tank-out.out
08/25/2006	07:52 AM	5,450	Tank-Props-BEC-250.txt
11/17/2006	12:56 PM	6,797	Tank-th.out
12/22/2005	12:43 PM	10,035	temp.log
05/16/2005	03:41 PM	41,470	TH-266-LB-Geo-V.txt
05/16/2005	08:44 AM	41,472	TH-266-LB-Geo.txt
10/14/2006	09:45 PM	561,576	Vel-ct-0.out
10/14/2006	09:45 PM	561,576	Vel-ct-135.out
10/14/2006	09:46 PM	561,576	Vel-ct-180.out
10/14/2006	09:45 PM	561,576	Vel-ct-45.out
10/14/2006	09:45 PM	561,576	Vel-ct-90.out
10/14/2006	09:45 PM	290,550	Vel-ct.out
10/14/2006	09:46 PM	561,576	Vel-PT-0.out
10/14/2006	09:46 PM	561,576	Vel-PT-135.out
10/14/2006	09:46 PM	561,576	Vel-PT-180.out
10/14/2006	09:46 PM	561,576	Vel-PT-45.out
10/14/2006	09:46 PM	561,576	Vel-PT-90.out
10/14/2006	09:46 PM	561,576	Vel-Soil.out
10/14/2006	04:40 PM	10,180	Waste-Cont_108max.OUT
10/14/2006	04:40 PM	4,875,649	Waste-Cont_108th.OUT
10/14/2006	04:48 PM	10,180	Waste-Cont_117max.OUT
10/14/2006	04:48 PM	4,875,649	Waste-Cont_117th.OUT
10/14/2006	04:56 PM	10,180	Waste-Cont_126max.OUT
10/14/2006	04:56 PM	4,875,649	Waste-Cont_126th.OUT
10/14/2006	05:05 PM	10,180	Waste-Cont_135max.OUT
10/14/2006	05:05 PM	4,875,649	Waste-Cont_135th.OUT
10/14/2006	05:13 PM	10,180	Waste-Cont_144max.OUT
10/14/2006	05:13 PM	4,875,649	Waste-Cont_144th.OUT
10/14/2006	05:21 PM	10,180	Waste-Cont_153max.OUT
10/14/2006	05:21 PM	4,875,649	Waste-Cont_153th.OUT
10/14/2006	05:30 PM	10,180	Waste-Cont_162max.OUT
10/14/2006	05:30 PM	4,875,649	Waste-Cont_162th.OUT
10/14/2006	05:38 PM	10,180	Waste-Cont_171max.OUT
10/14/2006	05:38 PM	4,875,649	Waste-Cont_171th.OUT
10/14/2006	05:47 PM	10,180	Waste-Cont_180max.OUT
10/14/2006	05:47 PM	4,875,649	Waste-Cont_180th.OUT
10/14/2006	03:16 PM	10,180	Waste-Cont_18max.OUT
10/14/2006	03:16 PM	4,875,649	Waste-Cont_18th.OUT
10/14/2006	03:24 PM	10,180	Waste-Cont_27max.OUT
10/14/2006	03:24 PM	4,875,649	Waste-Cont_27th.OUT
10/14/2006	03:33 PM	10,180	Waste-Cont_36max.OUT
10/14/2006	03:33 PM	4,875,649	Waste-Cont_36th.OUT
10/14/2006	03:41 PM	10,180	Waste-Cont_45max.OUT
10/14/2006	03:41 PM	4,875,649	Waste-Cont_45th.OUT
10/14/2006	03:49 PM	10,180	Waste-Cont_54max.OUT
10/14/2006	03:49 PM	4,875,649	Waste-Cont_54th.OUT
10/14/2006	03:57 PM	10,180	Waste-Cont_63max.OUT
10/14/2006	03:57 PM	4,875,649	Waste-Cont_63th.OUT
10/14/2006	04:05 PM	10,180	Waste-Cont_72max.OUT
10/14/2006	04:05 PM	4,875,649	Waste-Cont_72th.OUT
10/14/2006	04:14 PM	10,180	Waste-Cont_81max.OUT
10/14/2006	04:14 PM	4,875,649	Waste-Cont_81th.OUT
10/14/2006	04:22 PM	10,180	Waste-Cont_90max.OUT
10/14/2006	04:22 PM	4,875,649	Waste-Cont_90th.OUT
10/14/2006	04:31 PM	10,180	Waste-Cont_99max.OUT
10/14/2006	04:31 PM	4,875,649	Waste-Cont_99th.OUT
10/14/2006	03:07 PM	10,180	Waste-Cont_9max.OUT
10/14/2006	03:07 PM	4,875,777	Waste-Cont_9th.OUT
10/14/2006	02:59 PM	47,317	Waste-Reaction-460-SD3.out
08/25/2006	08:47 AM	340	Waste-Reaction.txt
10/12/2006	02:27 PM	10,266	Waste-solid-AP-S.txt
08/21/2006	08:03 AM	776	Waste-Surface-AP.txt
10/14/2006	09:27 PM	865	Waste-Surf_0max.OUT
10/14/2006	09:27 PM	534,133	Waste-Surf_0th.OUT
10/14/2006	09:36 PM	865	Waste-Surf_108max.OUT
10/14/2006	09:36 PM	534,005	Waste-Surf_108th.OUT
10/14/2006	09:37 PM	865	Waste-Surf_117max.OUT
10/14/2006	09:37 PM	534,005	Waste-Surf_117th.OUT
10/14/2006	09:37 PM	865	Waste-Surf_126max.OUT
10/14/2006	09:37 PM	534,005	Waste-Surf_126th.OUT

```
10/14/2006  09:38 PM               865 Waste-Surf_135max.OUT
10/14/2006  09:38 PM           534,005 Waste-Surf_135th.OUT
10/14/2006  09:39 PM               865 Waste-Surf_144max.OUT
10/14/2006  09:39 PM           534,005 Waste-Surf_144th.OUT
10/14/2006  09:40 PM               865 Waste-Surf_153max.OUT
10/14/2006  09:40 PM           534,005 Waste-Surf_153th.OUT
10/14/2006  09:41 PM               865 Waste-Surf_162max.OUT
10/14/2006  09:41 PM           534,005 Waste-Surf_162th.OUT
10/14/2006  09:41 PM               865 Waste-Surf_171max.OUT
10/14/2006  09:41 PM           534,005 Waste-Surf_171th.OUT
10/14/2006  09:42 PM               865 Waste-Surf_180max.OUT
10/14/2006  09:42 PM           534,005 Waste-Surf_180th.OUT
10/14/2006  09:42 PM               865 Waste-Surf_189max.OUT
10/14/2006  09:42 PM           534,005 Waste-Surf_189th.OUT
10/14/2006  09:28 PM               865 Waste-Surf_18max.OUT
10/14/2006  09:28 PM           534,005 Waste-Surf_18th.OUT
10/14/2006  09:29 PM               865 Waste-Surf_27max.OUT
10/14/2006  09:29 PM           534,005 Waste-Surf_27th.OUT
10/14/2006  09:30 PM               865 Waste-Surf_36max.OUT
10/14/2006  09:30 PM           534,005 Waste-Surf_36th.OUT
10/14/2006  09:31 PM               865 Waste-Surf_45max.OUT
10/14/2006  09:31 PM           534,005 Waste-Surf_45th.OUT
10/14/2006  09:31 PM               865 Waste-Surf_54max.OUT
10/14/2006  09:31 PM           534,005 Waste-Surf_54th.OUT
10/14/2006  09:32 PM               865 Waste-Surf_63max.OUT
10/14/2006  09:32 PM           534,005 Waste-Surf_63th.OUT
10/14/2006  09:33 PM               865 Waste-Surf_72max.OUT
10/14/2006  09:33 PM           534,005 Waste-Surf_72th.OUT
10/14/2006  09:34 PM               865 Waste-Surf_81max.OUT
10/14/2006  09:34 PM           534,005 Waste-Surf_81th.OUT
10/14/2006  09:34 PM               865 Waste-Surf_90max.OUT
10/14/2006  09:34 PM           534,005 Waste-Surf_90th.OUT
10/14/2006  09:35 PM               865 Waste-Surf_99max.OUT
10/14/2006  09:35 PM           534,005 Waste-Surf_99th.OUT
10/14/2006  09:28 PM               865 Waste-Surf_9max.OUT
10/14/2006  09:28 PM           534,005 Waste-Surf_9th.OUT
10/17/2006  01:49 PM           230,400 waste_0-90.xls
10/17/2006  01:49 PM           229,888 waste_99-180.xls
             797 File(s) 37,768,716,868 bytes
               3 Dir(s)  248,221,745,152 bytes free
```

LBS-BEC Gravity File Listing

```
 Volume in drive C is 600GB 2xRAID0 (new)
 Volume Serial Number is 8A0A-E4BA

 Directory of C:\Users\Bruce\2008-000 PNNL\2008-005 AP-460\AP-460-LBS-BEC-Seismic Run\AP-
460-LBS-BEC-Gravity

01/09/2007  06:41 AM    <DIR>          .
01/09/2007  06:41 AM    <DIR>          ..
10/13/2006  09:09 AM           768,512 460-AP-LBS-BEC J-Bolt-Contact-Gravity.xls
10/13/2006  09:21 AM           692,736 460-AP-LBS-BEC-Primary-Contact-Gravity.xls
08/21/2006  06:49 AM               101 All-Forces.txt
10/13/2006  07:26 AM           120,990 AP-460-BEC-LBS-Gravity.out
08/25/2006  08:39 AM         1,707,761 AP-460-BES-BEC-Gravity.ldhi
01/02/2007  09:05 AM         3,178,496 AP-460-LBS-BEC Conc Tank Demand Gravity.xls
10/13/2006  08:54 AM           688,640 AP-460-LBS-BEC J Bolt Forces Gravity.xls
10/13/2006  09:15 AM         7,301,632 AP-460-LBS-BEC Pri Tank Stress Gravity.xls
10/13/2006  08:46 AM         2,041,344 AP-460-LBS-BEC Soil Pressures Gravity.xls
01/08/2007  10:47 AM         3,755,520 AP-460-LBS-BEC Strain Gravity-Princ.xls
10/13/2006  09:26 AM           952,320 AP-460-LBS-BEC Waste-TH-MAX Gravity.xls
10/13/2006  07:26 AM             2,998 AP-460-LBS-BEC-Gravity.BCS
10/13/2006  07:28 AM        43,909,120 AP-460-LBS-BEC-Gravity.db
09/01/2006  06:56 AM        63,897,600 AP-460-LBS-BEC-Gravity.dbb
01/04/2007  07:55 AM             1,713 AP-460-LBS-BEC-Gravity.DO2
10/13/2006  07:26 AM        12,713,984 AP-460-LBS-BEC-Gravity.emat
01/04/2007  07:57 AM           297,509 AP-460-LBS-BEC-Gravity.err
```

```
10/13/2006  07:26 AM       111,607,808 AP-460-LBS-BEC-Gravity.esav
10/13/2006  07:26 AM        30,015,488 AP-460-LBS-BEC-Gravity.full
10/13/2006  07:25 AM         1,744,061 AP-460-LBS-BEC-Gravity.ldhi
01/04/2007  07:57 AM             7,246 AP-460-LBS-BEC-Gravity.log
10/13/2006  07:26 AM             2,295 AP-460-LBS-BEC-Gravity.mntr
10/13/2006  07:25 AM       111,607,808 AP-460-LBS-BEC-Gravity.osav
10/13/2006  07:26 AM             1,507 AP-460-LBS-BEC-Gravity.PVTS
10/13/2006  07:26 AM       112,656,384 AP-460-LBS-BEC-Gravity.r001
10/13/2006  07:06 AM        43,974,656 AP-460-LBS-BEC-Gravity.rdb
10/13/2006  07:26 AM       186,580,992 AP-460-LBS-BEC-Gravity.rst
09/01/2006  06:19 AM                 0 AP-460-LBS-BEC-Gravity.sda
10/13/2006  07:24 AM                97 AP-460-LBS-BEC-Gravity.stat
10/13/2006  09:33 AM           684,032 AP-460-LBS-BEC-Insul-Contact-Gravity.xls
08/21/2006  01:22 PM             6,042 Bolts-Friction.txt
09/08/2006  07:09 AM               277 Boundary.txt
08/25/2006  08:42 AM               221 Contact-AP.txt
08/21/2006  07:59 AM               586 Contact-Footing.txt
08/24/2006  08:01 AM               654 Contact-Insul.txt
08/21/2006  07:59 AM               655 Contact-J-Bolts.txt
08/24/2006  08:01 AM               658 Contact-Primary.txt
08/21/2006  07:59 AM               742 Contact-Soil.txt
08/21/2006  12:44 PM               632 Contact-Waste-AP.txt
01/03/2006  11:17 AM             1,616 Disp-J-Bolts.txt
05/08/2006  01:31 PM             8,616 Far-Soil.txt
01/09/2007  06:41 AM                 0 file-list.txt
10/13/2006  07:06 AM             1,904 file.bat
10/13/2006  07:06 AM                68 file.err
10/13/2006  07:06 AM               228 file.log
10/13/2005  06:54 AM               562 Fix-Soil.txt
10/13/2006  07:27 AM            10,342 Footing-Cont_max.OUT
10/13/2006  07:27 AM            33,288 Footing-Cont_th.OUT
08/21/2006  08:00 AM               894 Force-c.txt
10/13/2006  07:27 AM             4,996 Force-c_108amax.OUT
10/13/2006  07:27 AM            27,900 Force-c_108ath.OUT
10/13/2006  07:27 AM            14,716 Force-c_108max.OUT
10/13/2006  07:27 AM            49,740 Force-c_108th.OUT
10/13/2006  07:27 AM             4,996 Force-c_117amax.OUT
10/13/2006  07:27 AM            27,900 Force-c_117ath.OUT
10/13/2006  07:27 AM            14,716 Force-c_117max.OUT
10/13/2006  07:27 AM            49,740 Force-c_117th.OUT
10/13/2006  07:27 AM             4,996 Force-c_126amax.OUT
10/13/2006  07:27 AM            27,900 Force-c_126ath.OUT
10/13/2006  07:27 AM            14,716 Force-c_126max.OUT
10/13/2006  07:27 AM            49,740 Force-c_126th.OUT
10/13/2006  07:27 AM             4,996 Force-c_135amax.OUT
10/13/2006  07:27 AM            27,900 Force-c_135ath.OUT
10/13/2006  07:27 AM            14,716 Force-c_135max.OUT
10/13/2006  07:27 AM            49,740 Force-c_135th.OUT
10/13/2006  07:27 AM             4,996 Force-c_144amax.OUT
10/13/2006  07:27 AM            27,900 Force-c_144ath.OUT
10/13/2006  07:27 AM            14,716 Force-c_144max.OUT
10/13/2006  07:27 AM            49,740 Force-c_144th.OUT
10/13/2006  07:27 AM             4,996 Force-c_153amax.OUT
10/13/2006  07:27 AM            27,900 Force-c_153ath.OUT
10/13/2006  07:27 AM            14,716 Force-c_153max.OUT
10/13/2006  07:27 AM            49,740 Force-c_153th.OUT
10/13/2006  07:27 AM             4,996 Force-c_162amax.OUT
10/13/2006  07:27 AM            27,900 Force-c_162ath.OUT
10/13/2006  07:27 AM            14,716 Force-c_162max.OUT
10/13/2006  07:27 AM            49,740 Force-c_162th.OUT
10/13/2006  07:27 AM             4,996 Force-c_171amax.OUT
10/13/2006  07:27 AM            27,900 Force-c_171ath.OUT
10/13/2006  07:27 AM            14,716 Force-c_171max.OUT
10/13/2006  07:27 AM            49,740 Force-c_171th.OUT
10/13/2006  07:27 AM             4,996 Force-c_180amax.OUT
10/13/2006  07:27 AM            27,900 Force-c_180ath.OUT
10/13/2006  07:27 AM            14,716 Force-c_180max.OUT
10/13/2006  07:27 AM            49,740 Force-c_180th.OUT
10/13/2006  07:27 AM             4,996 Force-c_18amax.OUT
10/13/2006  07:27 AM            27,900 Force-c_18ath.OUT
```

```
10/13/2006  07:27 AM            14,716 Force-c_18max.OUT
10/13/2006  07:27 AM            49,740 Force-c_18th.OUT
10/13/2006  07:27 AM             4,996 Force-c_27amax.OUT
10/13/2006  07:27 AM            27,900 Force-c_27ath.OUT
10/13/2006  07:27 AM            14,716 Force-c_27max.OUT
10/13/2006  07:27 AM            49,740 Force-c_27th.OUT
10/13/2006  07:27 AM             4,996 Force-c_36amax.OUT
10/13/2006  07:27 AM            27,900 Force-c_36ath.OUT
10/13/2006  07:27 AM            14,716 Force-c_36max.OUT
10/13/2006  07:27 AM            49,740 Force-c_36th.OUT
10/13/2006  07:27 AM             4,996 Force-c_45amax.OUT
10/13/2006  07:27 AM            27,900 Force-c_45ath.OUT
10/13/2006  07:27 AM            14,716 Force-c_45max.OUT
10/13/2006  07:27 AM            49,740 Force-c_45th.OUT
10/13/2006  07:27 AM             4,996 Force-c_54amax.OUT
10/13/2006  07:27 AM            27,900 Force-c_54ath.OUT
10/13/2006  07:27 AM            14,716 Force-c_54max.OUT
10/13/2006  07:27 AM            49,740 Force-c_54th.OUT
10/13/2006  07:27 AM             4,996 Force-c_63amax.OUT
10/13/2006  07:27 AM            27,900 Force-c_63ath.OUT
10/13/2006  07:27 AM            14,716 Force-c_63max.OUT
10/13/2006  07:27 AM            49,740 Force-c_63th.OUT
10/13/2006  07:27 AM             4,996 Force-c_72amax.OUT
10/13/2006  07:27 AM            27,900 Force-c_72ath.OUT
10/13/2006  07:27 AM            14,716 Force-c_72max.OUT
10/13/2006  07:27 AM            49,740 Force-c_72th.OUT
10/13/2006  07:27 AM             4,996 Force-c_81amax.OUT
10/13/2006  07:27 AM            27,900 Force-c_81ath.OUT
10/13/2006  07:27 AM            14,716 Force-c_81max.OUT
10/13/2006  07:27 AM            49,740 Force-c_81th.OUT
10/13/2006  07:27 AM             4,996 Force-c_90amax.OUT
10/13/2006  07:27 AM            27,900 Force-c_90ath.OUT
10/13/2006  07:27 AM            14,716 Force-c_90max.OUT
10/13/2006  07:27 AM            49,740 Force-c_90th.OUT
10/13/2006  07:27 AM             4,996 Force-c_99amax.OUT
10/13/2006  07:27 AM            27,900 Force-c_99ath.OUT
10/13/2006  07:27 AM            14,716 Force-c_99max.OUT
10/13/2006  07:27 AM            49,740 Force-c_99th.OUT
10/13/2006  07:27 AM             4,996 Force-c_9amax.OUT
10/13/2006  07:27 AM            28,028 Force-c_9ath.OUT
10/13/2006  07:27 AM            14,716 Force-c_9max.OUT
10/13/2006  07:27 AM            49,868 Force-c_9th.OUT
10/13/2006  08:47 AM           137,216 force-jb.xls
10/13/2006  07:28 AM            23,352 Force-jb_r10-th.OUT
10/13/2006  07:28 AM             5,239 Force-jb_r10_max.OUT
10/13/2006  07:28 AM            23,352 Force-jb_r11-th.OUT
10/13/2006  07:28 AM             5,239 Force-jb_r11_max.OUT
10/13/2006  07:27 AM            23,480 Force-jb_r2-th.OUT
10/13/2006  07:27 AM             5,239 Force-jb_r2_max.OUT
10/13/2006  07:28 AM            23,352 Force-jb_r3-th.OUT
10/13/2006  07:28 AM             5,239 Force-jb_r3_max.OUT
10/13/2006  07:28 AM            23,352 Force-jb_r4-th.OUT
10/13/2006  07:28 AM             5,239 Force-jb_r4_max.OUT
10/13/2006  07:28 AM            23,352 Force-jb_r5-th.OUT
10/13/2006  07:28 AM             5,239 Force-jb_r5_max.OUT
10/13/2006  07:28 AM            23,352 Force-jb_r6-th.OUT
10/13/2006  07:28 AM             5,239 Force-jb_r6_max.OUT
10/13/2006  07:28 AM            23,352 Force-jb_r7-th.OUT
10/13/2006  07:28 AM             5,239 Force-jb_r7_max.OUT
10/13/2006  07:28 AM            23,352 Force-jb_r8-th.OUT
10/13/2006  07:28 AM             5,239 Force-jb_r8_max.OUT
10/13/2006  07:28 AM            23,352 Force-jb_r9-th.OUT
10/13/2006  07:28 AM             5,239 Force-jb_r9_max.OUT
08/21/2006  08:00 AM               661 Force-j_bolt.txt
10/13/2006  08:56 AM           442,880 import_0-90.xls
10/13/2006  08:56 AM           442,880 import_99-180.xls
10/13/2006  09:32 AM            91,648 Insul-Contact_0-90.xls
10/13/2006  09:32 AM            91,136 Insul-Contact_99-180.xls
10/13/2006  07:26 AM             3,376 Insul-Cont_108max.OUT
10/13/2006  07:26 AM            11,808 Insul-Cont_108th.OUT
```

```
10/13/2006  07:26 AM             3,376 Insul-Cont_117max.OUT
10/13/2006  07:26 AM            11,808 Insul-Cont_117th.OUT
10/13/2006  07:26 AM             3,376 Insul-Cont_126max.OUT
10/13/2006  07:26 AM            11,808 Insul-Cont_126th.OUT
10/13/2006  07:26 AM             3,376 Insul-Cont_135max.OUT
10/13/2006  07:26 AM            11,808 Insul-Cont_135th.OUT
10/13/2006  07:26 AM             3,376 Insul-Cont_144max.OUT
10/13/2006  07:26 AM            11,808 Insul-Cont_144th.OUT
10/13/2006  07:26 AM             3,376 Insul-Cont_153max.OUT
10/13/2006  07:26 AM            11,808 Insul-Cont_153th.OUT
10/13/2006  07:26 AM             3,376 Insul-Cont_162max.OUT
10/13/2006  07:26 AM            11,808 Insul-Cont_162th.OUT
10/13/2006  07:26 AM             3,376 Insul-Cont_171max.OUT
10/13/2006  07:26 AM            11,808 Insul-Cont_171th.OUT
10/13/2006  07:26 AM             3,376 Insul-Cont_180max.OUT
10/13/2006  07:26 AM            11,808 Insul-Cont_180th.OUT
10/13/2006  07:26 AM             3,376 Insul-Cont_18max.OUT
10/13/2006  07:26 AM            11,808 Insul-Cont_18th.OUT
10/13/2006  07:26 AM             3,376 Insul-Cont_27max.OUT
10/13/2006  07:26 AM            11,808 Insul-Cont_27th.OUT
10/13/2006  07:26 AM             3,376 Insul-Cont_36max.OUT
10/13/2006  07:26 AM            11,808 Insul-Cont_36th.OUT
10/13/2006  07:26 AM             3,376 Insul-Cont_45max.OUT
10/13/2006  07:26 AM            11,808 Insul-Cont_45th.OUT
10/13/2006  07:26 AM             3,376 Insul-Cont_54max.OUT
10/13/2006  07:26 AM            11,808 Insul-Cont_54th.OUT
10/13/2006  07:26 AM             3,376 Insul-Cont_63max.OUT
10/13/2006  07:26 AM            11,808 Insul-Cont_63th.OUT
10/13/2006  07:26 AM             3,376 Insul-Cont_72max.OUT
10/13/2006  07:26 AM            11,808 Insul-Cont_72th.OUT
10/13/2006  07:26 AM             3,376 Insul-Cont_81max.OUT
10/13/2006  07:26 AM            11,808 Insul-Cont_81th.OUT
10/13/2006  07:26 AM             3,376 Insul-Cont_90max.OUT
10/13/2006  07:26 AM            11,808 Insul-Cont_90th.OUT
10/13/2006  07:26 AM             3,376 Insul-Cont_99max.OUT
10/13/2006  07:26 AM            11,808 Insul-Cont_99th.OUT
10/13/2006  07:26 AM             3,376 Insul-Cont_9max.OUT
10/13/2006  07:26 AM            11,936 Insul-Cont_9th.OUT
09/01/2005  10:27 AM             1,664 Insulate.txt
07/20/2006  06:36 AM             4,030 interface-gap1.txt
08/23/2006  07:55 AM             2,411 interface1.txt
10/13/2006  09:00 AM           101,888 J-Bolt-Contact_0-90.xls
10/13/2006  09:00 AM           101,888 J-Bolt-Contact_99-180.xls
10/13/2006  07:27 AM             3,790 J-Bolt-Cont_108max.OUT
10/13/2006  07:27 AM            12,276 J-Bolt-Cont_108th.OUT
10/13/2006  07:27 AM             3,790 J-Bolt-Cont_117max.OUT
10/13/2006  07:27 AM            12,276 J-Bolt-Cont_117th.OUT
10/13/2006  07:27 AM             3,790 J-Bolt-Cont_126max.OUT
10/13/2006  07:27 AM            12,276 J-Bolt-Cont_126th.OUT
10/13/2006  07:27 AM             3,790 J-Bolt-Cont_135max.OUT
10/13/2006  07:27 AM            12,276 J-Bolt-Cont_135th.OUT
10/13/2006  07:27 AM             3,790 J-Bolt-Cont_144max.OUT
10/13/2006  07:27 AM            12,276 J-Bolt-Cont_144th.OUT
10/13/2006  07:27 AM             3,790 J-Bolt-Cont_153max.OUT
10/13/2006  07:27 AM            12,276 J-Bolt-Cont_153th.OUT
10/13/2006  07:27 AM             3,790 J-Bolt-Cont_162max.OUT
10/13/2006  07:27 AM            12,276 J-Bolt-Cont_162th.OUT
10/13/2006  07:27 AM             3,790 J-Bolt-Cont_171max.OUT
10/13/2006  07:27 AM            12,276 J-Bolt-Cont_171th.OUT
10/13/2006  07:27 AM             3,790 J-Bolt-Cont_180max.OUT
10/13/2006  07:27 AM            12,276 J-Bolt-Cont_180th.OUT
10/13/2006  07:27 AM             3,790 J-Bolt-Cont_18max.OUT
10/13/2006  07:27 AM            12,276 J-Bolt-Cont_18th.OUT
10/13/2006  07:27 AM             3,790 J-Bolt-Cont_27max.OUT
10/13/2006  07:27 AM            12,276 J-Bolt-Cont_27th.OUT
10/13/2006  07:27 AM             3,790 J-Bolt-Cont_36max.OUT
10/13/2006  07:27 AM            12,276 J-Bolt-Cont_36th.OUT
10/13/2006  07:27 AM             3,790 J-Bolt-Cont_45max.OUT
10/13/2006  07:27 AM            12,276 J-Bolt-Cont_45th.OUT
10/13/2006  07:27 AM             3,790 J-Bolt-Cont_54max.OUT
```

```
10/13/2006  07:27 AM            12,276 J-Bolt-Cont_54th.OUT
10/13/2006  07:27 AM             3,790 J-Bolt-Cont_63max.OUT
10/13/2006  07:27 AM            12,276 J-Bolt-Cont_63th.OUT
10/13/2006  07:27 AM             3,790 J-Bolt-Cont_72max.OUT
10/13/2006  07:27 AM            12,276 J-Bolt-Cont_72th.OUT
10/13/2006  07:27 AM             3,790 J-Bolt-Cont_81max.OUT
10/13/2006  07:27 AM            12,276 J-Bolt-Cont_81th.OUT
10/13/2006  07:27 AM             3,790 J-Bolt-Cont_90max.OUT
10/13/2006  07:27 AM            12,276 J-Bolt-Cont_90th.OUT
10/13/2006  07:27 AM             3,790 J-Bolt-Cont_99max.OUT
10/13/2006  07:27 AM            12,276 J-Bolt-Cont_99th.OUT
10/13/2006  07:27 AM             3,790 J-Bolt-Cont_9max.OUT
10/13/2006  07:27 AM            12,404 J-Bolt-Cont_9th.OUT
12/22/2006  08:33 AM            48,651 LBS-BEC-Gravity-File-List.txt
08/23/2006  07:47 AM             1,971 Liner.txt
05/02/2005  02:19 PM               667 live_load.txt
09/01/2006  06:01 AM             6,212 Near-Soil-1.txt
04/20/2005  01:14 PM               508 outer-spar.txt
10/13/2006  07:46 AM               123 Post-Tank.txt
10/13/2006  09:21 AM            91,648 Primary-Contact_0-90.xls
10/13/2006  09:21 AM            91,648 Primary-Contact_99-180.xls
10/13/2006  07:27 AM             3,376 Primary-Cont_108max.OUT
10/13/2006  07:27 AM            11,808 Primary-Cont_108th.OUT
10/13/2006  07:27 AM             3,376 Primary-Cont_117max.OUT
10/13/2006  07:27 AM            11,808 Primary-Cont_117th.OUT
10/13/2006  07:27 AM             3,376 Primary-Cont_126max.OUT
10/13/2006  07:27 AM            11,808 Primary-Cont_126th.OUT
10/13/2006  07:27 AM             3,376 Primary-Cont_135max.OUT
10/13/2006  07:27 AM            11,808 Primary-Cont_135th.OUT
10/13/2006  07:27 AM             3,376 Primary-Cont_144max.OUT
10/13/2006  07:27 AM            11,808 Primary-Cont_144th.OUT
10/13/2006  07:27 AM             3,376 Primary-Cont_153max.OUT
10/13/2006  07:27 AM            11,808 Primary-Cont_153th.OUT
10/13/2006  07:27 AM             3,376 Primary-Cont_162max.OUT
10/13/2006  07:27 AM            11,808 Primary-Cont_162th.OUT
10/13/2006  07:27 AM             3,376 Primary-Cont_171max.OUT
10/13/2006  07:27 AM            11,808 Primary-Cont_171th.OUT
10/13/2006  07:27 AM             3,376 Primary-Cont_180max.OUT
10/13/2006  07:27 AM            11,808 Primary-Cont_180th.OUT
10/13/2006  07:26 AM             3,376 Primary-Cont_18max.OUT
10/13/2006  07:26 AM            11,808 Primary-Cont_18th.OUT
10/13/2006  07:26 AM             3,376 Primary-Cont_27max.OUT
10/13/2006  07:26 AM            11,808 Primary-Cont_27th.OUT
10/13/2006  07:26 AM             3,376 Primary-Cont_36max.OUT
10/13/2006  07:26 AM            11,808 Primary-Cont_36th.OUT
10/13/2006  07:26 AM             3,376 Primary-Cont_45max.OUT
10/13/2006  07:26 AM            11,808 Primary-Cont_45th.OUT
10/13/2006  07:26 AM             3,376 Primary-Cont_54max.OUT
10/13/2006  07:26 AM            11,808 Primary-Cont_54th.OUT
10/13/2006  07:26 AM             3,376 Primary-Cont_63max.OUT
10/13/2006  07:26 AM            11,808 Primary-Cont_63th.OUT
10/13/2006  07:26 AM             3,376 Primary-Cont_72max.OUT
10/13/2006  07:26 AM            11,808 Primary-Cont_72th.OUT
10/13/2006  07:26 AM             3,376 Primary-Cont_81max.OUT
10/13/2006  07:26 AM            11,808 Primary-Cont_81th.OUT
10/13/2006  07:26 AM             3,376 Primary-Cont_90max.OUT
10/13/2006  07:26 AM            11,808 Primary-Cont_90th.OUT
10/13/2006  07:26 AM             3,376 Primary-Cont_99max.OUT
10/13/2006  07:26 AM            11,808 Primary-Cont_99th.OUT
10/13/2006  07:26 AM             3,376 Primary-Cont_9max.OUT
10/13/2006  07:26 AM            11,936 Primary-Cont_9th.OUT
10/12/2006  02:28 PM             6,028 Primary-Props-AP.txt
09/27/2005  03:52 PM             1,538 Primary.txt
10/13/2006  07:06 AM           405,579 QA.out
10/31/2005  10:31 AM             1,108 RS_FREQ.txt
10/13/2006  07:28 AM         4,960,128 Run-Tank-Out.out
10/12/2006  03:02 PM             1,823 Run-Tank.txt
01/04/2007  07:56 AM                 0 scratch.hlp
02/11/2005  01:22 PM             1,053 Slave.txt
10/13/2006  07:27 AM             9,896 Soil-Contact_108max.OUT
```

```
10/13/2006  07:27 AM            35,120 Soil-Contact_108th.OUT
10/13/2006  07:27 AM             9,896 Soil-Contact_117max.OUT
10/13/2006  07:27 AM            35,120 Soil-Contact_117th.OUT
10/13/2006  07:27 AM             9,896 Soil-Contact_126max.OUT
10/13/2006  07:27 AM            35,120 Soil-Contact_126th.OUT
10/13/2006  07:27 AM             9,896 Soil-Contact_135max.OUT
10/13/2006  07:27 AM            35,120 Soil-Contact_135th.OUT
10/13/2006  07:27 AM             9,896 Soil-Contact_144max.OUT
10/13/2006  07:27 AM            35,120 Soil-Contact_144th.OUT
10/13/2006  07:27 AM             9,896 Soil-Contact_153max.OUT
10/13/2006  07:27 AM            35,120 Soil-Contact_153th.OUT
10/13/2006  07:27 AM             9,896 Soil-Contact_162max.OUT
10/13/2006  07:27 AM            35,120 Soil-Contact_162th.OUT
10/13/2006  07:27 AM             9,896 Soil-Contact_171max.OUT
10/13/2006  07:27 AM            35,120 Soil-Contact_171th.OUT
10/13/2006  07:27 AM             9,896 Soil-Contact_180max.OUT
10/13/2006  07:27 AM            35,120 Soil-Contact_180th.OUT
10/13/2006  07:27 AM             9,896 Soil-Contact_18max.OUT
10/13/2006  07:27 AM            35,120 Soil-Contact_18th.OUT
10/13/2006  07:27 AM             9,896 Soil-Contact_27max.OUT
10/13/2006  07:27 AM            35,120 Soil-Contact_27th.OUT
10/13/2006  07:27 AM             9,896 Soil-Contact_36max.OUT
10/13/2006  07:27 AM            35,120 Soil-Contact_36th.OUT
10/13/2006  07:27 AM             9,896 Soil-Contact_45max.OUT
10/13/2006  07:27 AM            35,120 Soil-Contact_45th.OUT
10/13/2006  07:27 AM             9,896 Soil-Contact_54max.OUT
10/13/2006  07:27 AM            35,120 Soil-Contact_54th.OUT
10/13/2006  07:27 AM             9,896 Soil-Contact_63max.OUT
10/13/2006  07:27 AM            35,120 Soil-Contact_63th.OUT
10/13/2006  07:27 AM             9,896 Soil-Contact_72max.OUT
10/13/2006  07:27 AM            35,120 Soil-Contact_72th.OUT
10/13/2006  07:27 AM             9,896 Soil-Contact_81max.OUT
10/13/2006  07:27 AM            35,120 Soil-Contact_81th.OUT
10/13/2006  07:27 AM             9,896 Soil-Contact_90max.OUT
10/13/2006  07:27 AM            35,120 Soil-Contact_90th.OUT
10/13/2006  07:27 AM             9,896 Soil-Contact_99max.OUT
10/13/2006  07:27 AM            35,120 Soil-Contact_99th.OUT
10/13/2006  07:27 AM             9,896 Soil-Contact_9max.OUT
10/13/2006  07:27 AM            35,248 Soil-Contact_9th.OUT
09/20/2005  02:46 PM             4,106 Soil-Prop-LB-Geo.txt
10/13/2006  08:43 AM           224,256 soil_0-90.xls
10/13/2006  08:43 AM           224,256 soil_99-180.xls
09/01/2006  06:01 AM             1,925 Solve-Gravity-LBS.txt
08/21/2006  08:00 AM             3,363 spectra-conc-0.txt
10/31/2005  11:41 AM             1,459 spectra-conc.txt
10/14/2005  11:18 AM             2,061 spectra-concrete.txt
10/31/2005  10:16 AM             3,402 spectra-primary-0.txt
08/21/2006  08:01 AM             3,551 spectra-primary-180.txt
09/06/2005  06:49 AM             1,287 spectra-soil.txt
06/20/2005  09:04 AM               647 spectra-wall.txt
06/20/2005  08:52 AM               679 spectra-waste.txt
10/13/2006  09:12 AM           288,768 str-comp_0-90b.xls
10/13/2006  09:12 AM           292,352 str-comp_0-90m.xls
10/13/2006  09:12 AM           288,256 str-comp_0-90t.xls
10/13/2006  09:13 AM           288,256 str-comp_99-180b.xls
10/13/2006  09:13 AM           292,352 str-comp_99-180m.xls
10/13/2006  09:13 AM           288,256 str-comp_99-180t.xls
01/03/2007  03:40 PM             1,823 strain-backed-principle-bot.txt
01/03/2007  03:40 PM             1,828 strain-backed-principle-mid.txt
01/03/2007  03:41 PM             1,825 strain-backed-principle-top.txt
01/03/2007  04:02 PM               966 strain-backed-principle.txt
01/04/2007  07:56 AM             7,496 Strain-Backed-Princ_108-bot-max.OUT
01/04/2007  07:56 AM            23,628 Strain-Backed-Princ_108-bot-th.OUT
01/04/2007  07:57 AM             7,162 Strain-Backed-Princ_108-Top-max.OUT
01/04/2007  07:57 AM            22,554 Strain-Backed-Princ_108-Top-th.OUT
01/04/2007  07:57 AM             4,156 Strain-Backed-Princ_108max.OUT
01/04/2007  07:57 AM            12,888 Strain-Backed-Princ_108th.OUT
01/04/2007  07:56 AM             7,496 Strain-Backed-Princ_117-bot-max.OUT
01/04/2007  07:56 AM            23,628 Strain-Backed-Princ_117-bot-th.OUT
01/04/2007  07:57 AM             7,162 Strain-Backed-Princ_117-Top-max.OUT
```

```
01/04/2007  07:57 AM            22,554 Strain-Backed-Princ_117-Top-th.OUT
01/04/2007  07:57 AM             4,156 Strain-Backed-Princ_117max.OUT
01/04/2007  07:57 AM            12,888 Strain-Backed-Princ_117th.OUT
01/04/2007  07:57 AM             7,496 Strain-Backed-Princ_126-bot-max.OUT
01/04/2007  07:57 AM            23,628 Strain-Backed-Princ_126-bot-th.OUT
01/04/2007  07:57 AM             7,162 Strain-Backed-Princ_126-Top-max.OUT
01/04/2007  07:57 AM            22,554 Strain-Backed-Princ_126-Top-th.OUT
01/04/2007  07:57 AM             4,156 Strain-Backed-Princ_126max.OUT
01/04/2007  07:57 AM            12,888 Strain-Backed-Princ_126th.OUT
01/04/2007  07:57 AM             7,496 Strain-Backed-Princ_135-bot-max.OUT
01/04/2007  07:57 AM            23,628 Strain-Backed-Princ_135-bot-th.OUT
01/04/2007  07:57 AM             7,162 Strain-Backed-Princ_135-Top-max.OUT
01/04/2007  07:57 AM            22,554 Strain-Backed-Princ_135-Top-th.OUT
01/04/2007  07:57 AM             4,156 Strain-Backed-Princ_135max.OUT
01/04/2007  07:57 AM            12,888 Strain-Backed-Princ_135th.OUT
01/04/2007  07:57 AM             7,496 Strain-Backed-Princ_144-bot-max.OUT
01/04/2007  07:57 AM            23,628 Strain-Backed-Princ_144-bot-th.OUT
01/04/2007  07:57 AM             7,162 Strain-Backed-Princ_144-Top-max.OUT
01/04/2007  07:57 AM            22,554 Strain-Backed-Princ_144-Top-th.OUT
01/04/2007  07:57 AM             4,156 Strain-Backed-Princ_144max.OUT
01/04/2007  07:57 AM            12,888 Strain-Backed-Princ_144th.OUT
01/04/2007  07:57 AM             7,496 Strain-Backed-Princ_153-bot-max.OUT
01/04/2007  07:57 AM            23,628 Strain-Backed-Princ_153-bot-th.OUT
01/04/2007  07:57 AM             7,162 Strain-Backed-Princ_153-Top-max.OUT
01/04/2007  07:57 AM            22,554 Strain-Backed-Princ_153-Top-th.OUT
01/04/2007  07:57 AM             4,156 Strain-Backed-Princ_153max.OUT
01/04/2007  07:57 AM            12,888 Strain-Backed-Princ_153th.OUT
01/04/2007  07:57 AM             7,496 Strain-Backed-Princ_162-bot-max.OUT
01/04/2007  07:57 AM            23,628 Strain-Backed-Princ_162-bot-th.OUT
01/04/2007  07:57 AM             7,162 Strain-Backed-Princ_162-Top-max.OUT
01/04/2007  07:57 AM            22,554 Strain-Backed-Princ_162-Top-th.OUT
01/04/2007  07:57 AM             4,156 Strain-Backed-Princ_162max.OUT
01/04/2007  07:57 AM            12,888 Strain-Backed-Princ_162th.OUT
01/04/2007  07:57 AM             7,496 Strain-Backed-Princ_171-bot-max.OUT
01/04/2007  07:57 AM            23,628 Strain-Backed-Princ_171-bot-th.OUT
01/04/2007  07:57 AM             7,162 Strain-Backed-Princ_171-Top-max.OUT
01/04/2007  07:57 AM            22,554 Strain-Backed-Princ_171-Top-th.OUT
01/04/2007  07:57 AM             4,156 Strain-Backed-Princ_171max.OUT
01/04/2007  07:57 AM            12,888 Strain-Backed-Princ_171th.OUT
01/04/2007  07:56 AM             7,496 Strain-Backed-Princ_18-bot-max.OUT
01/04/2007  07:56 AM            23,628 Strain-Backed-Princ_18-bot-th.OUT
01/04/2007  07:57 AM             7,162 Strain-Backed-Princ_18-Top-max.OUT
01/04/2007  07:57 AM            22,554 Strain-Backed-Princ_18-Top-th.OUT
01/04/2007  07:57 AM             7,496 Strain-Backed-Princ_180-bot-max.OUT
01/04/2007  07:57 AM            23,628 Strain-Backed-Princ_180-bot-th.OUT
01/04/2007  07:57 AM             7,162 Strain-Backed-Princ_180-Top-max.OUT
01/04/2007  07:57 AM            22,554 Strain-Backed-Princ_180-Top-th.OUT
01/04/2007  07:57 AM             4,156 Strain-Backed-Princ_180max.OUT
01/04/2007  07:57 AM            12,888 Strain-Backed-Princ_180th.OUT
01/04/2007  07:57 AM             4,156 Strain-Backed-Princ_18max.OUT
01/04/2007  07:57 AM            12,888 Strain-Backed-Princ_18th.OUT
01/04/2007  07:56 AM             7,496 Strain-Backed-Princ_27-bot-max.OUT
01/04/2007  07:56 AM            23,628 Strain-Backed-Princ_27-bot-th.OUT
01/04/2007  07:57 AM             7,162 Strain-Backed-Princ_27-Top-max.OUT
01/04/2007  07:57 AM            22,554 Strain-Backed-Princ_27-Top-th.OUT
01/04/2007  07:57 AM             4,156 Strain-Backed-Princ_27max.OUT
01/04/2007  07:57 AM            12,888 Strain-Backed-Princ_27th.OUT
01/04/2007  07:56 AM             7,496 Strain-Backed-Princ_36-bot-max.OUT
01/04/2007  07:56 AM            23,628 Strain-Backed-Princ_36-bot-th.OUT
01/04/2007  07:57 AM             7,162 Strain-Backed-Princ_36-Top-max.OUT
01/04/2007  07:57 AM            22,554 Strain-Backed-Princ_36-Top-th.OUT
01/04/2007  07:57 AM             4,156 Strain-Backed-Princ_36max.OUT
01/04/2007  07:57 AM            12,888 Strain-Backed-Princ_36th.OUT
01/04/2007  07:56 AM             7,496 Strain-Backed-Princ_45-bot-max.OUT
01/04/2007  07:56 AM            23,628 Strain-Backed-Princ_45-bot-th.OUT
01/04/2007  07:57 AM             7,162 Strain-Backed-Princ_45-Top-max.OUT
01/04/2007  07:57 AM            22,554 Strain-Backed-Princ_45-Top-th.OUT
01/04/2007  07:57 AM             4,156 Strain-Backed-Princ_45max.OUT
01/04/2007  07:57 AM            12,888 Strain-Backed-Princ_45th.OUT
01/04/2007  07:56 AM             7,496 Strain-Backed-Princ_54-bot-max.OUT
```

```
01/04/2007  07:56 AM            23,628 Strain-Backed-Princ_54-bot-th.OUT
01/04/2007  07:57 AM             7,162 Strain-Backed-Princ_54-Top-max.OUT
01/04/2007  07:57 AM            22,554 Strain-Backed-Princ_54-Top-th.OUT
01/04/2007  07:57 AM             4,156 Strain-Backed-Princ_54max.OUT
01/04/2007  07:57 AM            12,888 Strain-Backed-Princ_54th.OUT
01/04/2007  07:56 AM             7,496 Strain-Backed-Princ_63-bot-max.OUT
01/04/2007  07:56 AM            23,628 Strain-Backed-Princ_63-bot-th.OUT
01/04/2007  07:57 AM             7,162 Strain-Backed-Princ_63-Top-max.OUT
01/04/2007  07:57 AM            22,554 Strain-Backed-Princ_63-Top-th.OUT
01/04/2007  07:57 AM             4,156 Strain-Backed-Princ_63max.OUT
01/04/2007  07:57 AM            12,888 Strain-Backed-Princ_63th.OUT
01/04/2007  07:56 AM             7,496 Strain-Backed-Princ_72-bot-max.OUT
01/04/2007  07:56 AM            23,628 Strain-Backed-Princ_72-bot-th.OUT
01/04/2007  07:57 AM             7,162 Strain-Backed-Princ_72-Top-max.OUT
01/04/2007  07:57 AM            22,554 Strain-Backed-Princ_72-Top-th.OUT
01/04/2007  07:57 AM             4,156 Strain-Backed-Princ_72max.OUT
01/04/2007  07:57 AM            12,888 Strain-Backed-Princ_72th.OUT
01/04/2007  07:56 AM             7,496 Strain-Backed-Princ_81-bot-max.OUT
01/04/2007  07:56 AM            23,628 Strain-Backed-Princ_81-bot-th.OUT
01/04/2007  07:57 AM             7,162 Strain-Backed-Princ_81-Top-max.OUT
01/04/2007  07:57 AM            22,554 Strain-Backed-Princ_81-Top-th.OUT
01/04/2007  07:57 AM             4,156 Strain-Backed-Princ_81max.OUT
01/04/2007  07:57 AM            12,888 Strain-Backed-Princ_81th.OUT
01/04/2007  07:56 AM             7,496 Strain-Backed-Princ_9-bot-max.OUT
01/04/2007  07:56 AM            23,756 Strain-Backed-Princ_9-bot-th.OUT
01/04/2007  07:57 AM             7,162 Strain-Backed-Princ_9-Top-max.OUT
01/04/2007  07:57 AM            22,682 Strain-Backed-Princ_9-Top-th.OUT
01/04/2007  07:56 AM             7,496 Strain-Backed-Princ_90-bot-max.OUT
01/04/2007  07:56 AM            23,628 Strain-Backed-Princ_90-bot-th.OUT
01/04/2007  07:57 AM             7,162 Strain-Backed-Princ_90-Top-max.OUT
01/04/2007  07:57 AM            22,554 Strain-Backed-Princ_90-Top-th.OUT
01/04/2007  07:57 AM             4,156 Strain-Backed-Princ_90max.OUT
01/04/2007  07:57 AM            12,888 Strain-Backed-Princ_90th.OUT
01/04/2007  07:56 AM             7,496 Strain-Backed-Princ_99-bot-max.OUT
01/04/2007  07:56 AM            23,628 Strain-Backed-Princ_99-bot-th.OUT
01/04/2007  07:57 AM             7,162 Strain-Backed-Princ_99-Top-max.OUT
01/04/2007  07:57 AM            22,554 Strain-Backed-Princ_99-Top-th.OUT
01/04/2007  07:57 AM             4,156 Strain-Backed-Princ_99max.OUT
01/04/2007  07:57 AM            12,888 Strain-Backed-Princ_99th.OUT
01/04/2007  07:57 AM             4,156 Strain-Backed-Princ_9max.OUT
01/04/2007  07:57 AM            13,016 Strain-Backed-Princ_9th.OUT
09/05/2006  02:00 PM             2,588 strain-backed.txt
01/04/2007  07:55 AM               800 Strain-Backed_18max.OUT
01/04/2007  07:55 AM             3,888 Strain-Backed_18th.OUT
01/04/2007  07:55 AM               800 Strain-Backed_27max.OUT
01/04/2007  07:55 AM             3,888 Strain-Backed_27th.OUT
01/04/2007  07:55 AM               800 Strain-Backed_36max.OUT
01/04/2007  07:55 AM             3,888 Strain-Backed_36th.OUT
01/04/2007  07:55 AM               800 Strain-Backed_9max.OUT
01/04/2007  07:55 AM             4,016 Strain-Backed_9th.OUT
08/30/2006  09:47 AM               621 strain-compb-primary.txt
08/21/2006  08:01 AM               693 strain-compb.txt
08/30/2006  09:47 AM               621 strain-compm-primary.txt
08/21/2006  08:01 AM               705 strain-compm.txt
08/30/2006  09:47 AM               621 strain-compt-primary.txt
08/21/2006  08:02 AM               720 strain-compt.txt
08/21/2006  08:02 AM               730 Strain-Liner-floor.txt
08/21/2006  08:02 AM               962 Strain-Liner-wall.txt
08/16/2006  03:01 PM               545 Strain-Liner.txt
08/16/2006  02:01 PM               292 Strain-Primary.txt
01/08/2007  10:45 AM           113,152 Strain-Princ_0-90.xls
01/08/2007  10:44 AM           187,904 Strain-Princ_0-90b.xls
01/08/2007  10:46 AM           180,224 Strain-Princ_0-90t.xls
01/08/2007  10:46 AM           113,152 Strain-Princ_99-180.xls
01/08/2007  10:46 AM           188,416 Strain-Princ_99-180b.xls
01/08/2007  10:46 AM           180,736 Strain-Princ_99-180t.xls
08/30/2006  09:38 AM               274 Strain.txt
08/21/2006  08:02 AM               554 stress-compb-primary.txt
08/21/2006  08:02 AM               598 stress-compb.txt
08/21/2006  08:03 AM               554 stress-compm-primary.txt
```

```
08/21/2006  08:03 AM              608 stress-compm.txt
08/21/2006  08:03 AM              554 stress-compt-primary.txt
08/24/2006  03:19 PM              598 stress-compt.txt
08/17/2006  11:19 AM              207 Stress-Primary-M.txt
08/24/2006  12:05 PM              224 Stress-Primary.txt
10/13/2006  07:27 AM           13,519 Stress-pt_108max-b.OUT
10/13/2006  07:27 AM           13,519 Stress-pt_108max-m.OUT
10/13/2006  07:27 AM           13,519 Stress-pt_108max-t.OUT
10/13/2006  07:27 AM           55,924 Stress-pt_108th-b.OUT
10/13/2006  07:27 AM           55,924 Stress-pt_108th-m.OUT
10/13/2006  07:27 AM           55,728 Stress-pt_108th-t.OUT
10/13/2006  07:27 AM           13,519 Stress-pt_117max-b.OUT
10/13/2006  07:27 AM           13,519 Stress-pt_117max-m.OUT
10/13/2006  07:27 AM           13,519 Stress-pt_117max-t.OUT
10/13/2006  07:27 AM           55,924 Stress-pt_117th-b.OUT
10/13/2006  07:27 AM           55,924 Stress-pt_117th-m.OUT
10/13/2006  07:27 AM           55,728 Stress-pt_117th-t.OUT
10/13/2006  07:27 AM           13,519 Stress-pt_126max-b.OUT
10/13/2006  07:27 AM           13,519 Stress-pt_126max-m.OUT
10/13/2006  07:27 AM           13,519 Stress-pt_126max-t.OUT
10/13/2006  07:27 AM           55,924 Stress-pt_126th-b.OUT
10/13/2006  07:27 AM           55,924 Stress-pt_126th-m.OUT
10/13/2006  07:27 AM           55,728 Stress-pt_126th-t.OUT
10/13/2006  07:27 AM           13,519 Stress-pt_135max-b.OUT
10/13/2006  07:27 AM           13,519 Stress-pt_135max-m.OUT
10/13/2006  07:27 AM           13,519 Stress-pt_135max-t.OUT
10/13/2006  07:27 AM           55,924 Stress-pt_135th-b.OUT
10/13/2006  07:27 AM           55,924 Stress-pt_135th-m.OUT
10/13/2006  07:27 AM           55,728 Stress-pt_135th-t.OUT
10/13/2006  07:27 AM           13,519 Stress-pt_144max-b.OUT
10/13/2006  07:27 AM           13,519 Stress-pt_144max-m.OUT
10/13/2006  07:27 AM           13,519 Stress-pt_144max-t.OUT
10/13/2006  07:27 AM           55,924 Stress-pt_144th-b.OUT
10/13/2006  07:27 AM           55,924 Stress-pt_144th-m.OUT
10/13/2006  07:27 AM           55,728 Stress-pt_144th-t.OUT
10/13/2006  07:27 AM           13,519 Stress-pt_153max-b.OUT
10/13/2006  07:27 AM           13,519 Stress-pt_153max-m.OUT
10/13/2006  07:27 AM           13,519 Stress-pt_153max-t.OUT
10/13/2006  07:27 AM           55,924 Stress-pt_153th-b.OUT
10/13/2006  07:27 AM           55,924 Stress-pt_153th-m.OUT
10/13/2006  07:27 AM           55,728 Stress-pt_153th-t.OUT
10/13/2006  07:27 AM           13,519 Stress-pt_162max-b.OUT
10/13/2006  07:27 AM           13,519 Stress-pt_162max-m.OUT
10/13/2006  07:27 AM           13,519 Stress-pt_162max-t.OUT
10/13/2006  07:27 AM           55,924 Stress-pt_162th-b.OUT
10/13/2006  07:27 AM           55,924 Stress-pt_162th-m.OUT
10/13/2006  07:27 AM           55,728 Stress-pt_162th-t.OUT
10/13/2006  07:27 AM           13,521 Stress-pt_171max-b.OUT
10/13/2006  07:27 AM           13,521 Stress-pt_171max-m.OUT
10/13/2006  07:27 AM           13,521 Stress-pt_171max-t.OUT
10/13/2006  07:27 AM           55,924 Stress-pt_171th-b.OUT
10/13/2006  07:27 AM           55,924 Stress-pt_171th-m.OUT
10/13/2006  07:27 AM           55,728 Stress-pt_171th-t.OUT
10/13/2006  07:27 AM           13,521 Stress-pt_180max-b.OUT
10/13/2006  07:27 AM           13,521 Stress-pt_180max-m.OUT
10/13/2006  07:27 AM           13,521 Stress-pt_180max-t.OUT
10/13/2006  07:27 AM           55,924 Stress-pt_180th-b.OUT
10/13/2006  07:27 AM           55,924 Stress-pt_180th-m.OUT
10/13/2006  07:27 AM           55,728 Stress-pt_180th-t.OUT
10/13/2006  07:27 AM           13,519 Stress-pt_18max-b.OUT
10/13/2006  07:27 AM           13,519 Stress-pt_18max-m.OUT
10/13/2006  07:27 AM           13,519 Stress-pt_18max-t.OUT
10/13/2006  07:27 AM           55,924 Stress-pt_18th-b.OUT
10/13/2006  07:27 AM           55,924 Stress-pt_18th-m.OUT
10/13/2006  07:27 AM           55,728 Stress-pt_18th-t.OUT
10/13/2006  07:27 AM           13,519 Stress-pt_27max-b.OUT
10/13/2006  07:27 AM           13,519 Stress-pt_27max-m.OUT
10/13/2006  07:27 AM           13,519 Stress-pt_27max-t.OUT
10/13/2006  07:27 AM           55,924 Stress-pt_27th-b.OUT
10/13/2006  07:27 AM           55,924 Stress-pt_27th-m.OUT
```

```
10/13/2006  07:27 AM            55,728 Stress-pt_27th-t.OUT
10/13/2006  07:27 AM            13,519 Stress-pt_36max-b.OUT
10/13/2006  07:27 AM            13,519 Stress-pt_36max-m.OUT
10/13/2006  07:27 AM            13,519 Stress-pt_36max-t.OUT
10/13/2006  07:27 AM            55,924 Stress-pt_36th-b.OUT
10/13/2006  07:27 AM            55,924 Stress-pt_36th-m.OUT
10/13/2006  07:27 AM            55,728 Stress-pt_36th-t.OUT
10/13/2006  07:27 AM            13,519 Stress-pt_45max-b.OUT
10/13/2006  07:27 AM            13,519 Stress-pt_45max-m.OUT
10/13/2006  07:27 AM            13,519 Stress-pt_45max-t.OUT
10/13/2006  07:27 AM            55,924 Stress-pt_45th-b.OUT
10/13/2006  07:27 AM            55,924 Stress-pt_45th-m.OUT
10/13/2006  07:27 AM            55,728 Stress-pt_45th-t.OUT
10/13/2006  07:27 AM            13,519 Stress-pt_54max-b.OUT
10/13/2006  07:27 AM            13,519 Stress-pt_54max-m.OUT
10/13/2006  07:27 AM            13,519 Stress-pt_54max-t.OUT
10/13/2006  07:27 AM            55,924 Stress-pt_54th-b.OUT
10/13/2006  07:27 AM            55,924 Stress-pt_54th-m.OUT
10/13/2006  07:27 AM            55,728 Stress-pt_54th-t.OUT
10/13/2006  07:27 AM            13,519 Stress-pt_63max-b.OUT
10/13/2006  07:27 AM            13,519 Stress-pt_63max-m.OUT
10/13/2006  07:27 AM            13,519 Stress-pt_63max-t.OUT
10/13/2006  07:27 AM            55,924 Stress-pt_63th-b.OUT
10/13/2006  07:27 AM            55,924 Stress-pt_63th-m.OUT
10/13/2006  07:27 AM            55,728 Stress-pt_63th-t.OUT
10/13/2006  07:27 AM            13,519 Stress-pt_72max-b.OUT
10/13/2006  07:27 AM            13,519 Stress-pt_72max-m.OUT
10/13/2006  07:27 AM            13,519 Stress-pt_72max-t.OUT
10/13/2006  07:27 AM            55,924 Stress-pt_72th-b.OUT
10/13/2006  07:27 AM            55,924 Stress-pt_72th-m.OUT
10/13/2006  07:27 AM            55,728 Stress-pt_72th-t.OUT
10/13/2006  07:27 AM            13,519 Stress-pt_81max-b.OUT
10/13/2006  07:27 AM            13,519 Stress-pt_81max-m.OUT
10/13/2006  07:27 AM            13,519 Stress-pt_81max-t.OUT
10/13/2006  07:27 AM            55,924 Stress-pt_81th-b.OUT
10/13/2006  07:27 AM            55,924 Stress-pt_81th-m.OUT
10/13/2006  07:27 AM            55,728 Stress-pt_81th-t.OUT
10/13/2006  07:27 AM            13,519 Stress-pt_90max-b.OUT
10/13/2006  07:27 AM            13,519 Stress-pt_90max-m.OUT
10/13/2006  07:27 AM            13,519 Stress-pt_90max-t.OUT
10/13/2006  07:27 AM            55,924 Stress-pt_90th-b.OUT
10/13/2006  07:27 AM            55,924 Stress-pt_90th-m.OUT
10/13/2006  07:27 AM            55,728 Stress-pt_90th-t.OUT
10/13/2006  07:27 AM            13,519 Stress-pt_99max-b.OUT
10/13/2006  07:27 AM            13,519 Stress-pt_99max-m.OUT
10/13/2006  07:27 AM            13,519 Stress-pt_99max-t.OUT
10/13/2006  07:27 AM            55,924 Stress-pt_99th-b.OUT
10/13/2006  07:27 AM            55,924 Stress-pt_99th-m.OUT
10/13/2006  07:27 AM            55,728 Stress-pt_99th-t.OUT
10/13/2006  07:27 AM            13,519 Stress-pt_9max-b.OUT
10/13/2006  07:27 AM            13,519 Stress-pt_9max-m.OUT
10/13/2006  07:27 AM            13,519 Stress-pt_9max-t.OUT
10/13/2006  07:27 AM            56,052 Stress-pt_9th-b.OUT
10/13/2006  07:27 AM            56,052 Stress-pt_9th-m.OUT
10/13/2006  07:27 AM            55,856 Stress-pt_9th-t.OUT
10/12/2006  02:29 PM             4,009 Tank-Coordinates-AP.txt
05/25/2005  03:32 PM             2,512 Tank-Mesh1.txt
10/13/2006  07:06 AM               102 tank-out.out
08/25/2006  07:52 AM             5,450 Tank-Props-BEC-250.txt
10/13/2006  07:06 AM             6,500 Tank-th.out
12/22/2005  12:43 PM            10,035 temp.log
05/16/2005  03:41 PM            41,470 TH-266-LB-Geo-V.txt
05/16/2005  08:44 AM            41,472 TH-266-LB-Geo.txt
10/13/2006  07:26 AM            10,180 Waste-Cont_108max.OUT
10/13/2006  07:26 AM            40,114 Waste-Cont_108th.OUT
10/13/2006  07:26 AM            10,180 Waste-Cont_117max.OUT
10/13/2006  07:26 AM            40,114 Waste-Cont_117th.OUT
10/13/2006  07:26 AM            10,180 Waste-Cont_126max.OUT
10/13/2006  07:26 AM            40,114 Waste-Cont_126th.OUT
10/13/2006  07:26 AM            10,180 Waste-Cont_135max.OUT
```

```
10/13/2006  07:26 AM            40,114 Waste-Cont_135th.OUT
10/13/2006  07:26 AM            10,180 Waste-Cont_144max.OUT
10/13/2006  07:26 AM            40,114 Waste-Cont_144th.OUT
10/13/2006  07:26 AM            10,180 Waste-Cont_153max.OUT
10/13/2006  07:26 AM            40,114 Waste-Cont_153th.OUT
10/13/2006  07:26 AM            10,180 Waste-Cont_162max.OUT
10/13/2006  07:26 AM            40,114 Waste-Cont_162th.OUT
10/13/2006  07:26 AM            10,180 Waste-Cont_171max.OUT
10/13/2006  07:26 AM            40,114 Waste-Cont_171th.OUT
10/13/2006  07:26 AM            10,180 Waste-Cont_180max.OUT
10/13/2006  07:26 AM            40,114 Waste-Cont_180th.OUT
10/13/2006  07:26 AM            10,180 Waste-Cont_18max.OUT
10/13/2006  07:26 AM            40,114 Waste-Cont_18th.OUT
10/13/2006  07:26 AM            10,180 Waste-Cont_27max.OUT
10/13/2006  07:26 AM            40,114 Waste-Cont_27th.OUT
10/13/2006  07:26 AM            10,180 Waste-Cont_36max.OUT
10/13/2006  07:26 AM            40,114 Waste-Cont_36th.OUT
10/13/2006  07:26 AM            10,180 Waste-Cont_45max.OUT
10/13/2006  07:26 AM            40,114 Waste-Cont_45th.OUT
10/13/2006  07:26 AM            10,180 Waste-Cont_54max.OUT
10/13/2006  07:26 AM            40,114 Waste-Cont_54th.OUT
10/13/2006  07:26 AM            10,180 Waste-Cont_63max.OUT
10/13/2006  07:26 AM            40,114 Waste-Cont_63th.OUT
10/13/2006  07:26 AM            10,180 Waste-Cont_72max.OUT
10/13/2006  07:26 AM            40,114 Waste-Cont_72th.OUT
10/13/2006  07:26 AM            10,180 Waste-Cont_81max.OUT
10/13/2006  07:26 AM            40,114 Waste-Cont_81th.OUT
10/13/2006  07:26 AM            10,180 Waste-Cont_90max.OUT
10/13/2006  07:26 AM            40,114 Waste-Cont_90th.OUT
10/13/2006  07:26 AM            10,180 Waste-Cont_99max.OUT
10/13/2006  07:26 AM            40,114 Waste-Cont_99th.OUT
10/13/2006  07:26 AM            10,180 Waste-Cont_9max.OUT
10/13/2006  07:26 AM            40,242 Waste-Cont_9th.OUT
08/21/2006  01:31 PM               339 Waste-Reaction.txt
10/12/2006  02:27 PM            10,266 Waste-solid-AP-S.txt
08/21/2006  08:03 AM               776 Waste-Surface-AP.txt
10/13/2006  07:27 AM               865 Waste-Surf_0max.OUT
10/13/2006  07:27 AM             6,519 Waste-Surf_0th.OUT
10/13/2006  07:27 AM               865 Waste-Surf_108max.OUT
10/13/2006  07:27 AM             6,391 Waste-Surf_108th.OUT
10/13/2006  07:27 AM               865 Waste-Surf_117max.OUT
10/13/2006  07:27 AM             6,391 Waste-Surf_117th.OUT
10/13/2006  07:27 AM               865 Waste-Surf_126max.OUT
10/13/2006  07:27 AM             6,391 Waste-Surf_126th.OUT
10/13/2006  07:27 AM               865 Waste-Surf_135max.OUT
10/13/2006  07:27 AM             6,391 Waste-Surf_135th.OUT
10/13/2006  07:27 AM               865 Waste-Surf_144max.OUT
10/13/2006  07:27 AM             6,391 Waste-Surf_144th.OUT
10/13/2006  07:27 AM               865 Waste-Surf_153max.OUT
10/13/2006  07:27 AM             6,391 Waste-Surf_153th.OUT
10/13/2006  07:27 AM               865 Waste-Surf_162max.OUT
10/13/2006  07:27 AM             6,391 Waste-Surf_162th.OUT
10/13/2006  07:27 AM               865 Waste-Surf_171max.OUT
10/13/2006  07:27 AM             6,391 Waste-Surf_171th.OUT
10/13/2006  07:27 AM               865 Waste-Surf_180max.OUT
10/13/2006  07:27 AM             6,391 Waste-Surf_180th.OUT
10/13/2006  07:27 AM               865 Waste-Surf_189max.OUT
10/13/2006  07:27 AM             6,391 Waste-Surf_189th.OUT
10/13/2006  07:27 AM               865 Waste-Surf_18max.OUT
10/13/2006  07:27 AM             6,391 Waste-Surf_18th.OUT
10/13/2006  07:27 AM               865 Waste-Surf_27max.OUT
10/13/2006  07:27 AM             6,391 Waste-Surf_27th.OUT
10/13/2006  07:27 AM               865 Waste-Surf_36max.OUT
10/13/2006  07:27 AM             6,391 Waste-Surf_36th.OUT
10/13/2006  07:27 AM               865 Waste-Surf_45max.OUT
10/13/2006  07:27 AM             6,391 Waste-Surf_45th.OUT
10/13/2006  07:27 AM               865 Waste-Surf_54max.OUT
10/13/2006  07:27 AM             6,391 Waste-Surf_54th.OUT
10/13/2006  07:27 AM               865 Waste-Surf_63max.OUT
10/13/2006  07:27 AM             6,391 Waste-Surf_63th.OUT
```

```
10/13/2006  07:27 AM               865 Waste-Surf_72max.OUT
10/13/2006  07:27 AM             6,391 Waste-Surf_72th.OUT
10/13/2006  07:27 AM               865 Waste-Surf_81max.OUT
10/13/2006  07:27 AM             6,391 Waste-Surf_81th.OUT
10/13/2006  07:27 AM               865 Waste-Surf_90max.OUT
10/13/2006  07:27 AM             6,391 Waste-Surf_90th.OUT
10/13/2006  07:27 AM               865 Waste-Surf_99max.OUT
10/13/2006  07:27 AM             6,391 Waste-Surf_99th.OUT
10/13/2006  07:27 AM               865 Waste-Surf_9max.OUT
10/13/2006  07:27 AM             6,391 Waste-Surf_9th.OUT
10/13/2006  09:25 AM           259,584 waste_0-90.xls
10/13/2006  09:25 AM           260,096 waste_99-180.xls
             729 File(s)    762,822,074 bytes
               2 Dir(s)  248,221,691,904 bytes free
```

APPENDIX G

Best Estimate Soil
Best Estimate Concrete

Results
Load Case Specific Input Files
File Listing

LIST OF TABLES

Table 1 BES-BEC Concrete Forces and Moment, Gravity Load Only

AP Primary Tank, Best Estimate Soil (Geomatrix), Gravity Only, Best Estimate Concrete, 460 in. Waste Level at 1.83 SpG

ANSYS MAXIMUMS BY PATH

PNNL Section No.	Path (in.)	Gravity Hoop Force (kip/ft) AP-BES-BEC	Gravity Meridonal Force (kip/ft) AP-BES-BEC	Gravity -In-Plane Shear Force (kip/ft) AP-BES-BEC	Gravity Hoop Moment (ft*kip/ft) AP-BES-BEC	Gravity Meridonal Moment (ft*kip/ft) AP-BES-BEC	Gravity Through-Wall Shear Force (kip/ft) AP-BES-BEC
2	**67.734**	-71.110	-75.640	-0.115	-7.359	-4.269	1.725
3	**105.676**	-65.280	-73.940	-0.172	-5.205	-1.763	1.115
4	**137.076**	-59.520	-72.100	-0.224	-3.637	0.778	1.262
6	**182.856**	-52.840	-69.090	-0.184	-2.253	1.984	0.273
8	**226.570**	-47.630	-66.820	-0.049	-1.825	-0.616	-0.795
9	**275.574**	-42.980	-64.660	-0.178	-1.864	-1.317	-0.734
11	**325.697**	-34.650	-62.850	0.141	-2.292	-4.489	-0.803
13	**372.312**	-24.800	-61.000	-0.056	-4.864	-5.474	-0.438
17	**423.434**	-8.647	-59.050	-0.024	-2.396	-3.279	2.161
20	**468.315**	31.900	-56.900	-0.055	-8.195	15.940	8.741
22	**515.319**	15.520	-58.080	-0.044	4.760	30.140	-3.421
24	**553.722**	-0.166	-56.480	-0.026	2.016	11.050	-6.813
26	**593.805**	-14.320	-58.640	-0.014	-0.170	-0.937	-1.767
30	**644.355**	-24.810	-60.520	-0.006	-0.405	-2.248	0.770
33	**693.605**	-28.700	-61.900	0.004	-0.065	-0.362	0.261
35	**740.705**	-32.290	-63.310	0.003	0.045	0.247	-0.041
38	**786.205**	-28.640	-64.690	0.003	-0.161	-0.893	-0.290
41	**844.605**	-28.470	-66.490	-0.004	-0.114	-0.629	-0.222
43	**901.355**	-14.020	-28.120	0.004	-0.187	-1.035	0.678
46	**932.355**	-23.880	-66.640	0.039	-0.678	-3.632	-1.768
48	**1007.355**	-2.856	-10.330	0.617	-4.280	21.190	-12.210
51	**1053.855**	-3.510	-12.650	0.753	-0.938	17.440	12.750
53	**1086.855**	-1.228	-6.325	0.425	1.922	6.127	-3.114
55	**1105.855**	-0.545	-4.383	0.329	2.571	4.504	0.226
57	**1147.355**	-0.136	-2.277	0.184	0.305	1.091	-1.199
58	**1207.355**	0.292	0.039	0.030	-0.019	-0.127	0.285
59	**1267.355**	0.328	0.294	0.011	0.026	0.131	-0.233
60	**1327.355**	0.480	0.107	0.038	-0.033	-0.194	0.208
61	**1387.355**	0.468	0.635	-0.021	0.024	0.059	-0.146
62	**1449.355**	2.289	2.414	-0.032	0.034	-0.044	0.279

Note: Meridonal/Hoop Forces and Meridonal/Hoop Moments are Reversed in Highlighted Sections.

Table 2 BES-BEC Concrete Forces and Moments, Gravity Plus Seismic Load

12/20/2006, 3:54 PM

AP- Primary Tank, Best Estimate Soil (Geomatrix), Best Estimate Concrete, 460 in. Waste Level at 1.83 SpG

ANSYS MAXIMUMS BY PATH

PNNL Section No.	Path (in.)	Seismic Hoop Force (kip/ft) AP-BES-BEC	Seismic Meridonal Force (kip/ft) AP-BES-BEC	Seismic -In-Plane Shear Force (kip/ft) AP-BES-BEC	Seismic Hoop Moment (ft*kip/ft) AP-BES-BEC	Seismic Meridonal Moment (ft*kip/ft) AP-BES-BEC	Seismic Through-Wall Shear Force (kip/ft) AP-BES-BEC
2	**67.734**	-96.440	-103.800	5.353	-15.350	-14.470	3.477
3	**105.676**	-88.430	-101.100	7.498	-12.520	-10.690	2.686
4	**137.076**	-81.280	-97.610	8.596	-9.537	7.415	3.311
6	**182.856**	-73.450	-91.730	9.255	-5.238	5.605	2.666
8	**226.570**	-66.750	-86.140	9.807	-3.423	-7.668	1.606
9	**275.574**	-64.820	-80.840	11.780	-3.009	-5.030	1.250
11	**325.697**	-56.930	-76.780	13.720	-3.158	-6.840	1.503
13	**372.312**	-54.220	-73.110	15.940	-6.309	-7.928	1.026
17	**423.434**	-19.820	-70.070	18.480	-3.318	-7.832	2.956
20	**468.315**	68.280	-66.760	21.530	-11.860	20.960	10.290
22	**515.319**	27.650	-66.500	22.230	6.166	36.750	4.649
24	**553.722**	-6.263	-65.470	20.600	2.479	13.540	8.250
26	**593.805**	-19.360	-68.740	20.190	-0.251	-1.344	2.151
30	**644.355**	-29.250	-70.050	20.030	-0.478	-2.618	0.898
33	**693.605**	-33.400	-70.790	20.250	-0.106	-0.535	0.310
35	**740.705**	-37.390	-72.550	21.040	0.070	0.368	0.099
38	**786.205**	-33.060	-74.480	21.730	-0.203	-1.100	0.365
41	**844.605**	-33.070	-76.790	23.470	-0.200	-1.063	0.385
43	**901.355**	-15.980	-32.500	11.900	-0.287	-1.585	1.237
46	**932.355**	-40.250	-76.550	28.440	-0.781	-4.292	2.501
48	**1007.355**	-12.370	-14.460	8.134	-4.936	24.690	14.220
51	**1053.855**	-35.450	-17.660	13.060	-1.602	20.540	14.760
53	**1086.855**	-10.000	-11.080	8.448	2.280	7.062	3.796
55	**1105.855**	-26.420	-9.378	7.597	3.577	5.514	0.832
57	**1147.355**	-5.582	-6.731	4.422	0.435	1.458	1.559
58	**1207.355**	2.624	-2.730	1.997	-0.024	-0.160	0.361
59	**1267.355**	2.340	2.360	1.257	0.038	0.165	0.297
60	**1327.355**	3.044	2.318	1.060	-0.043	-0.230	0.289
61	**1387.355**	1.962	2.510	0.875	0.031	0.081	0.242
62	**1449.355**	6.335	5.830	1.007	0.104	-0.200	0.408

Note: Meridonal/Hoop Forces and Meridonal/Hoop Moments are Reversed in Highlighted Sections.

Table 3 BES-BEC Concrete Forces and Moments, Seismic Only

12/20/2006, 3:53 PM

AP- Primary Tank, Best Estimate Soil (Geomatrix), Best Estimate Concrete, 460 in. Waste Level at 1.83 SpG

ANSYS MAXIMUMS BY PATH

PNNL Section No.	Path (in.)	Seismic Only Hoop Force (kip/ft) AP-BES-BEC	Seismic Only Meridonal Force (kip/ft) AP-BES-BEC	Seismic Only - In-Plane Shear Force (kip/ft) AP-BES-BEC	Seismic Only Hoop Moment (ft*kip/ft) AP-BES-BEC	Seismic Only Meridonal Moment (ft*kip/ft) AP-BES-BEC	Seismic Only Through-Wall Shear Force (kip/ft) AP-BES-BEC
2	**67.734**	28.810	28.160	5.365	9.065	10.250	2.132
3	**105.676**	26.430	27.160	7.538	7.611	9.112	1.623
4	**137.076**	21.960	25.510	8.651	5.900	6.716	2.083
6	**182.856**	21.650	22.640	9.292	3.215	4.025	2.489
8	**226.570**	20.710	19.320	9.799	1.812	7.157	0.906
9	**275.574**	21.860	16.180	11.746	1.416	3.930	0.805
11	**325.697**	22.450	13.930	13.690	1.138	2.360	0.737
13	**372.312**	29.740	12.110	15.931	1.990	2.713	0.719
17	**423.434**	11.282	11.020	18.487	1.005	4.676	0.983
20	**468.315**	41.840	9.860	21.545	4.720	6.110	1.582
22	**515.319**	12.220	8.450	22.241	1.639	7.290	1.502
24	**553.722**	6.097	9.000	20.607	0.478	2.510	1.608
26	**593.805**	5.040	10.110	20.194	0.081	0.408	0.388
30	**644.355**	4.750	9.530	20.032	0.073	0.372	0.132
33	**693.605**	5.190	9.110	20.250	0.040	0.175	0.058
35	**740.705**	5.810	10.040	21.040	0.028	0.120	0.058
38	**786.205**	4.960	11.370	21.730	0.042	0.207	0.078
41	**844.605**	5.570	13.690	23.470	0.092	0.468	0.163
43	**901.355**	2.220	6.420	11.901	0.102	0.557	0.617
46	**932.355**	18.039	15.610	28.432	0.161	0.848	0.735
48	**1007.355**	9.539	4.496	7.551	1.107	5.600	3.231
51	**1053.855**	32.038	5.710	12.672	0.877	5.260	3.087
53	**1086.855**	8.802	4.756	8.043	0.449	1.190	0.688
55	**1105.855**	25.990	4.995	7.421	1.010	1.244	0.614
57	**1147.355**	5.478	4.454	4.300	0.130	0.367	0.361
58	**1207.355**	2.431	2.744	2.017	0.005	0.034	0.077
59	**1267.355**	2.012	2.087	1.254	0.012	0.034	0.065
60	**1327.355**	2.564	2.234	1.066	0.012	0.036	0.083
61	**1387.355**	1.495	2.144	0.862	0.007	0.023	0.098
62	**1449.355**	4.050	3.459	0.992	0.070	0.163	0.135

Note: Meridonal/Hoop Forces and Meridonal/Hoop Moments are Reversed in Highlighted Sections.

Table 4 BES-BEC Primary Tank Stresses, Shell Top, Gravity Load Only

		AP Primary Tank, Best Estimate Soil, Gravity Only, Best Estimate Tank Concrete, 460 in. Waste Level at 1.83 SpG			
		Shell Top Surface (inside - waste side)			
M&D Starting Element No.	Path (in.)	AP-460-BES-BEC Gravity Hoop Stress (lbs/in^2) Top	AP-460-BES-BEC Gravity Meridional Stress (lbs/in^2) Top	AP-460-BES-BEC Gravity Stress Intensity (lbs/in^2) Top	AP-460-BES-BEC Gravity In-Plane Shear Stress (lbs/in^2) Top
762	**67.33**	-1649.31	-1606.25	1649.31	4.26
782	**105.04**	-1647.92	-2436.11	2436.81	7.97
802	**136.24**	-1529.17	-1981.94	1981.94	9.44
822	**181.83**	-1143.75	-1978.47	1978.47	8.06
842	**225.10**	-1035.42	-1436.81	1436.81	2.90
862	**273.66**	-588.61	-1352.78	1352.78	8.39
882	**323.27**	-293.54	-886.81	888.19	6.33
902	**369.20**	255.49	-550.63	806.25	3.03
922	**419.20**	1122.92	-254.03	1377.08	-0.34
942	**444.31**	292.01	-2337.50	2629.86	-0.96
962	**458.66**	-222.64	2077.78	2299.31	-0.84
982	**473.08**	-460.97	1906.25	2366.67	-0.53
1002	**484.80**	709.03	-460.49	1170.14	-0.91
1022	**502.48**	2906.25	-142.57	3048.61	-0.98
1042	**526.48**	4710.42	206.32	4711.11	-0.76
1062	**550.48**	6312.50	51.05	6313.89	-0.50
1082	**574.60**	7881.94	275.14	7881.94	-0.35
1102	**598.28**	9569.44	1.00	9576.39	0.21
1122	**621.38**	11118.06	198.75	11118.06	-0.17
1142	**644.48**	12687.50	72.43	12687.50	-0.17
1162	**667.63**	13791.67	-277.01	14069.44	-0.23
1182	**690.78**	14194.44	482.08	14194.44	-0.24
1202	**713.88**	15194.44	219.79	15201.39	-0.23
1222	**736.98**	16562.50	-275.07	16833.33	-0.26
1242	**760.13**	16506.94	-654.79	17159.72	0.33
1262	**782.53**	15270.83	1065.28	15270.83	-0.28
1282	**804.13**	14923.61	379.44	14923.61	0.37
1302	**825.73**	15770.83	31.42	15770.83	0.45
1322	**847.33**	17159.72	412.29	17159.72	-0.38
1342	**868.87**	17479.17	-2054.17	19534.72	-0.75
1362	**892.10**	13000.00	-2792.36	15791.67	1.16
1382	**909.20**	3732.64	-8527.78	12270.83	1.26
1402	**918.38**	3756.25	6333.33	6371.53	-1.44
1460	**930.48**	3329.86	9451.39	9500.00	-485.42
1442	**949.48**	137.29	-631.67	776.39	60.94
1462	**990.98**	588.75	913.19	915.28	-26.36
1482	**1050.98**	399.93	422.64	594.51	-2.81
1502	**1110.98**	424.93	593.61	594.51	-14.61
1522	**1170.98**	297.36	224.17	297.92	7.27
1542	**1230.98**	359.86	448.06	448.54	-8.47
1562	**1292.98**	277.64	278.54	279.24	2.11

Note 1: Meridonal, Hoop, and Shear Stresses are Reversed in Highlighted Sections (Floor)

Table 5 BES-BEC Primary Tank Stresses, Shell Middle, Gravity Load Only

AP Primary Tank, Best Estimate Soil, Gravity Only, Best Estimate Tank Concrete, 460 in. Waste Level at 1.83 SpG

		Shell Mid-Plane			
M&D Starting Element No.	**Path (in.)**	**AP-460-BES-BEC Gravity Hoop Stress (lbs/in^2) Mid**	**AP-460-BES-BEC Gravity Meridional Stress (lbs/in^2) Mid**	**AP-460-BES-BEC Gravity Stress Intensity (lbs/in^2) Mid**	**AP-460-BES-BEC Gravity In-Plane Shear Stress (lbs/in^2) Mid**
762	**67.33**	-1719.44	-1751.39	1751.39	3.69
782	**105.04**	-1627.08	-2303.47	2303.47	7.53
802	**136.24**	-1589.58	-2136.11	2136.81	8.90
822	**181.83**	-1122.22	-1881.25	1881.25	7.20
842	**225.10**	-1094.44	-1616.67	1616.67	2.56
862	**273.66**	-581.46	-1306.25	1306.25	7.71
882	**323.27**	-313.47	-943.06	943.75	6.08
902	**369.20**	239.17	-582.99	822.22	2.96
922	**419.20**	1153.47	-140.35	1295.14	-0.29
942	**444.31**	1081.94	204.10	1090.97	-0.76
962	**458.66**	-760.42	206.32	967.36	-0.67
982	**473.08**	-988.19	174.44	1165.28	-0.43
1002	**484.80**	891.67	160.83	893.06	-0.78
1022	**502.48**	2995.14	155.83	2995.83	-0.86
1042	**526.48**	4693.06	149.31	4693.75	-0.69
1062	**550.48**	6340.28	142.64	6340.28	-0.48
1082	**574.60**	7840.28	135.90	7840.28	-0.33
1102	**598.28**	9604.17	129.17	9604.17	0.21
1122	**621.38**	11097.22	122.64	11097.22	-0.16
1142	**644.48**	12701.39	116.04	12701.39	-0.15
1162	**667.63**	13909.72	109.44	13909.72	-0.20
1182	**690.78**	14076.39	89.72	14076.39	-0.21
1202	**713.88**	15159.72	83.13	15159.72	-0.21
1222	**736.98**	16666.67	76.53	16666.67	-0.25
1242	**760.13**	16722.22	69.93	16722.22	-0.31
1262	**782.53**	14965.28	45.44	14965.28	-0.25
1282	**804.13**	14819.44	39.31	14826.39	0.35
1302	**825.73**	15770.83	33.26	15770.83	0.43
1322	**847.33**	17048.61	27.18	17048.61	-0.39
1342	**868.87**	18104.17	21.13	18125.00	-0.61
1362	**892.10**	13840.28	11.57	13854.17	0.89
1382	**909.20**	6176.39	3.54	6325.00	0.98
1402	**918.38**	1596.53	160.90	1872.22	-0.94
1460	**930.48**	446.39	399.65	576.81	4.18
1442	**949.48**	457.92	433.61	458.82	2.22
1462	**990.98**	527.71	725.69	727.08	-16.29
1482	**1050.98**	441.81	563.61	449.31	-10.72
1502	**1110.98**	380.49	448.82	449.31	-6.69
1522	**1170.98**	337.22	358.26	358.47	-3.09
1542	**1230.98**	321.74	333.26	333.54	-2.40
1562	**1292.98**	296.04	356.67	357.43	-6.31

Note 1: Meridonal, Hoop, and Shear Stresses are Reversed in Highlighted Sections (Floor)

Table 6 BES-BEC Primary Tank Stresses, Shell Bottom, Gravity Load Only

AP Primary Tank, Best Estimate Soil, Gravity Only, Best Estimate Tank Concrete, 460 in. Waste Level at 1.83 SpG

		Shell Bottom Surface (outside - away from waste)			
M&D Starting Element No.	Path (in.)	AP-460-BES-BEC Gravity Hoop Stress (lbs/in^2) Bot	AP-460-BES-BEC Gravity Meridional Stress (lbs/in^2) Bot	AP-460-BES-BEC Gravity Stress Intensity (lbs/in^2) Bot	AP-460-BES-BEC Gravity In-Plane Shear Stress (lbs/in^2) Bot
762	**67.33**	-1795.83	-1897.92	1897.92	4.24
782	**105.04**	-1606.25	-2170.83	2170.83	7.17
802	**136.24**	-1648.61	-2290.97	2291.67	8.47
822	**181.83**	-1102.08	-1784.03	1784.03	-6.60
842	**225.10**	-1154.17	-1797.22	1797.22	-2.14
862	**273.66**	-574.38	-1259.03	1259.03	-6.97
882	**323.27**	-333.19	-1000.00	1000.69	-5.77
902	**369.20**	223.40	-615.69	838.89	-2.88
922	**419.20**	1184.72	-28.35	1217.36	0.40
942	**444.31**	1871.53	2745.83	2747.22	0.75
962	**458.66**	-1297.22	-1664.58	1664.58	0.87
982	**473.08**	-1515.28	-1556.94	1557.64	0.92
1002	**484.80**	1076.39	781.25	1077.08	0.91
1022	**502.48**	3084.72	453.96	3084.72	0.84
1042	**526.48**	4676.39	92.64	4677.08	0.97
1062	**550.48**	6368.06	234.44	6368.06	0.93
1082	**574.60**	7798.61	-5.69	7805.56	1.04
1102	**598.28**	9645.83	257.57	9645.83	1.17
1122	**621.38**	11076.39	46.69	11076.39	1.26
1142	**644.48**	12715.28	159.86	12715.28	1.34
1162	**667.63**	14020.83	494.93	14020.83	1.41
1182	**690.78**	13958.33	-305.83	14263.89	1.27
1202	**713.88**	15118.06	-56.91	15173.61	1.31
1222	**736.98**	16770.83	427.50	16770.83	1.37
1242	**760.13**	16937.50	795.14	16937.50	1.43
1262	**782.53**	14659.72	-977.08	15631.94	1.10
1282	**804.13**	14722.22	-304.03	15020.83	1.17
1302	**825.73**	15770.83	35.60	15770.83	1.16
1322	**847.33**	16930.56	-362.50	17291.67	1.23
1342	**868.87**	18722.22	2098.61	18722.22	1.87
1362	**892.10**	14715.28	2826.39	14715.28	4.73
1382	**909.20**	8659.72	8597.22	8666.67	10.53
1402	**918.38**	-575.63	-6020.14	6059.72	5.50
1460	**930.48**	-2489.58	-8736.11	8784.72	495.35
1442	**949.48**	786.11	1499.31	1505.56	-63.13
1462	**990.98**	473.06	541.74	542.57	-10.22
1482	**1050.98**	489.24	711.81	340.83	-22.02
1502	**1110.98**	340.83	317.15	340.83	3.69
1522	**1170.98**	381.39	498.54	499.79	-12.24
1542	**1230.98**	287.43	228.89	287.92	6.65
1562	**1292.98**	318.82	440.83	442.15	-12.00

Note 1: Meridonal, Hoop, and Shear Stresses are Reversed in Highlighted Sections (Floor)

Table 7 BES-BEC Primary Tank Stresses, Shell Top, Gravity Plus Seismic Load

AP Primary Tank, Best Estimate Soil, Horizontal and Vertical Seismic, Best Estimate Tank Concrete, 460 in. Waste Level at 1.83 SpG

M&D Starting M&D Element No.	Path (in.)	Shell Top Surface (inside - waste side)			
		AP-460-BES-BEC Seismic Hoop Stress (lbs/in^2) Top	AP-460-BES-BEC Seismic Meridional Stress (lbs/in^2) Top	AP-460-BES-BEC Seismic Stress Intensity (lbs/in^2) Top	AP-460-BES-BEC Seismic In-Plane Shear Stress (lbs/in^2) Top
762	**67.33**	-2263.89	-2423.61	2423.61	-227.43
782	**105.04**	-2291.67	-3468.06	3468.06	-390.83
802	**136.24**	-2239.58	-2911.11	2911.81	-419.24
822	**181.83**	-1756.94	-2768.75	2768.75	-428.33
842	**225.10**	-2061.11	-2285.42	2285.42	-478.75
862	**273.66**	-1225.69	-2078.47	2079.17	-608.06
882	**323.27**	-1556.94	-1602.78	2334.72	-1050.69
902	**369.20**	1550.69	-1497.92	3377.78	-1577.08
922	**419.20**	2965.97	-913.89	5404.17	-2611.11
942	**444.31**	4426.39	-5330.56	5734.03	-2552.08
962	**458.66**	-5900.69	6747.22	12131.94	-2540.28
982	**473.08**	-6422.22	7409.72	13833.33	-2759.72
1002	**484.80**	4259.03	-1788.89	6046.53	-2911.11
1022	**502.48**	5075.00	-813.19	6516.67	-2850.69
1042	**526.48**	9020.83	1173.61	9027.78	-2627.78
1062	**550.48**	11465.28	1179.86	11465.28	-2363.19
1082	**574.60**	13888.89	1604.17	13888.89	-2054.17
1102	**598.28**	16479.17	-1302.78	16479.17	-1700.00
1122	**621.38**	18701.39	1679.86	18701.39	-1321.53
1142	**644.48**	20798.61	1534.72	20798.61	-1036.81
1162	**667.63**	22138.89	-1643.06	22138.89	-970.14
1182	**690.78**	22562.50	2023.61	22562.50	-767.36
1202	**713.88**	23729.17	1597.92	23729.17	851.39
1222	**736.98**	25333.33	-1443.06	25333.33	1144.44
1242	**760.13**	24902.78	-834.03	25361.11	1528.47
1262	**782.53**	22701.39	2302.08	22701.39	1427.78
1282	**804.13**	21784.72	1256.94	21784.72	1732.64
1302	**825.73**	22638.89	702.08	22638.89	2036.11
1322	**847.33**	24284.72	1176.39	24284.72	2348.61
1342	**868.87**	24402.78	-2593.06	27173.61	2700.69
1362	**892.10**	17215.28	-3254.17	21868.06	2609.72
1382	**909.20**	5371.53	-9798.61	17097.22	2568.75
1402	**918.38**	5913.89	10916.67	10951.39	2527.08
1460	**930.48**	6409.72	14659.72	14729.17	-2920.83
1442	**949.48**	4160.42	-1177.08	4765.97	-2171.53
1462	**990.98**	3669.44	1409.72	6463.89	-3229.86
1482	**1050.98**	2706.94	696.53	2464.58	-2015.97
1502	**1110.98**	2069.44	843.75	2464.58	-1231.25
1522	**1170.98**	1518.75	396.18	1527.08	-747.22
1542	**1230.98**	1125.00	650.49	1126.39	-459.65
1562	**1292.98**	753.47	479.79	753.47	-227.78

Note 1: Meridonal, Hoop, and Shear Stresses are Reversed in Highlighted Sections (Floor)

Table 8 BES-BEC Primary Tank Stresses, Shell Middle, Gravity Plus Seismic Load

AP Primary Tank, Best Estimate Soil, Horizontal and Vertical Seismic, Best Estimate Tank Concrete, 460 in. Waste Level at 1.83 SpG

M&D Starting M&D Element No.	Path (in.)	Shell Mid-Plane			
		AP-460-BES-BEC Seismic Hoop Stress (lbs/in^2) Mid	AP-460-BES-BEC Seismic Meridional Stress (lbs/in^2) Mid	AP-460-BES-BEC Seismic Stress Intensity (lbs/in^2) Mid	AP-460-BES-BEC Seismic In-Plane Shear Stress (lbs/in^2) Mid
762	**67.33**	-2375.69	-2404.86	2405.56	-218.26
782	**105.04**	-2290.97	-3152.78	3153.47	-381.67
802	**136.24**	-2414.58	-2917.36	2917.36	-410.69
822	**181.83**	-1709.72	-2557.64	2558.33	-421.81
842	**225.10**	-2320.14	-2206.94	2321.53	-475.42
862	**273.66**	-1157.64	-1831.94	1832.64	-607.92
882	**323.27**	-1763.19	-1432.64	2238.89	-1052.08
902	**369.20**	1567.36	-1247.22	3367.36	-1577.08
922	**419.20**	3058.33	-1128.47	5406.94	-2612.50
942	**444.31**	3986.81	1102.08	5406.94	-2595.83
962	**458.66**	-7361.11	1068.06	8444.44	-2584.72
982	**473.08**	-8388.89	959.72	9354.17	-2718.06
1002	**484.80**	4171.53	927.78	5837.50	-2840.28
1022	**502.48**	5460.42	1025.00	6262.50	-2817.36
1042	**526.48**	9013.89	1161.81	9013.89	-2622.22
1062	**550.48**	11500.00	1287.50	11500.00	-2357.64
1082	**574.60**	13812.50	1404.86	13812.50	-2047.22
1102	**598.28**	16541.67	1502.78	16541.67	-1693.75
1122	**621.38**	18659.72	1581.25	18659.72	-1315.97
1142	**644.48**	20798.61	1636.11	20798.61	-1022.92
1162	**667.63**	22256.94	1663.19	22256.94	-959.03
1182	**690.78**	22319.44	1461.81	22319.44	-758.33
1202	**713.88**	23590.28	1436.11	23590.28	850.69
1222	**736.98**	25388.89	1385.42	25388.89	1143.06
1242	**760.13**	25138.89	1311.11	25138.89	1520.14
1262	**782.53**	22145.83	890.28	22145.83	1415.97
1282	**804.13**	21534.72	804.86	21534.72	1731.94
1302	**825.73**	22562.50	-721.53	22562.50	2038.89
1322	**847.33**	24062.50	-630.90	24062.50	2353.47
1342	**868.87**	25256.94	-517.36	25263.89	2684.72
1362	**892.10**	18604.17	384.65	18625.00	2527.78
1382	**909.20**	8194.44	378.40	8618.06	2411.81
1402	**918.38**	5354.86	443.06	5845.14	2398.61
1460	**930.48**	4439.58	775.69	4856.25	-2377.78
1442	**949.48**	4213.19	774.31	4625.00	-2246.53
1462	**990.98**	3638.89	1165.28	6450.69	-3220.14
1482	**1050.98**	2715.97	857.64	2465.28	-2024.31
1502	**1110.98**	2052.78	670.97	2465.28	-1223.61
1522	**1170.98**	1530.56	543.26	1531.94	-754.86
1542	**1230.98**	1118.75	494.72	1119.44	-453.54
1562	**1292.98**	743.75	502.50	743.75	-232.99

Note 1: Meridonal, Hoop, and Shear Stresses are Reversed in Highlighted Sections (Floor)

Table 9 BES-BEC Primary Tank Stresses, Shell Bottom, Gravity Plus Seismic Load

AP Primary Tank, Best Estimate Soil, Horizontal and Vertical Seismic, Best Estimate Tank Concrete, 460 in. Waste Level at 1.83 SpG

M&D Starting M&D Element No.	Path (in.)	Shell Bottom Surface (outside - away from waste)			
		AP-460-BES-BEC Seismic Hoop Stress (lbs/in^2) Bot	AP-460-BES-BEC Seismic Meridional Stress (lbs/in^2) Bot	AP-460-BES-BEC Seismic Stress Intensity (lbs/in^2) Bot	AP-460-BES-BEC Seismic In-Plane Shear Stress (lbs/in^2) Bot
762	**67.33**	-2535.42	-2721.53	2721.53	-209.10
782	**105.04**	-2297.92	-3179.17	3179.86	-372.43
802	**136.24**	-2590.28	-3295.83	3296.53	-402.15
822	**181.83**	-1662.50	-2486.11	2486.81	-415.28
842	**225.10**	-2579.17	-2935.42	2936.81	-472.15
862	**273.66**	-1090.28	-1797.92	1813.89	-607.78
882	**323.27**	-2014.58	-2224.31	2279.17	-1052.78
902	**369.20**	1583.33	-1189.58	3357.64	-1577.78
922	**419.20**	3254.17	1572.92	5410.42	-2614.58
942	**444.31**	3650.69	7375.00	7375.00	-2641.67
962	**458.66**	-8847.22	-4927.08	8854.17	-2635.42
982	**473.08**	-10354.17	-5494.44	10354.17	-2676.39
1002	**484.80**	4083.33	2677.78	5634.03	-2770.14
1022	**502.48**	5907.64	2834.03	6104.86	-2783.33
1042	**526.48**	9006.94	1162.50	9006.94	-2616.67
1062	**550.48**	11534.72	1404.86	11534.72	-2352.08
1082	**574.60**	13736.11	-1280.56	13736.11	-2040.28
1102	**598.28**	16604.17	1720.14	16604.17	-1686.81
1122	**621.38**	18618.06	-1497.92	18618.06	-1311.11
1142	**644.48**	20798.61	1737.50	20798.61	-1009.03
1162	**667.63**	22409.72	2245.14	22409.72	-947.92
1182	**690.78**	22152.78	-1507.64	22152.78	-749.31
1202	**713.88**	23562.50	-1444.44	23562.50	849.31
1222	**736.98**	25597.22	1929.86	25604.17	1141.67
1242	**760.13**	25534.72	2312.50	25534.72	1511.11
1262	**782.53**	21784.72	-1532.64	22722.22	1403.47
1282	**804.13**	21444.44	-990.28	21493.06	1731.25
1302	**825.73**	22604.17	710.42	22611.11	2041.67
1322	**847.33**	23868.06	-797.22	24166.67	2359.03
1342	**868.87**	26111.11	4045.14	26111.11	2671.53
1362	**892.10**	19993.06	4713.19	19993.06	2447.92
1382	**909.20**	11458.33	13847.22	13854.17	2255.56
1402	**918.38**	-5756.25	-10104.17	10138.89	2276.39
1460	**930.48**	-7527.78	-13569.44	13645.83	2216.67
1442	**949.48**	4265.97	2476.39	5394.44	-2321.53
1462	**990.98**	3608.33	939.58	6439.58	-3210.42
1482	**1050.98**	2725.00	1027.78	2468.75	-2032.64
1502	**1110.98**	2036.11	510.90	2468.75	-1215.97
1522	**1170.98**	1542.36	711.11	1543.75	-762.50
1542	**1230.98**	1111.81	402.15	1112.50	-447.36
1562	**1292.98**	738.89	622.29	740.28	-238.26

Note 1: Meridonal, Hoop, and Shear Stresses are Reversed in Highlighted Sections (Floor)

Table 10 BES-BEC Primary Tank Stresses, Shell Top, Seismic Load Only

AP Primary Tank, Best Estimate Soil, Horizontal and Vertical Seismic, Best Estimate Tank Concrete, 460 in. Waste Level at 1.83 SpG

M&D Starting M&D Element No.	Path (in.)	Shell Top Surface (inside - waste side)			
		AP-460-BES-BEC Seismic Only Hoop Stress (lbs/in^2) Top	AP-460-BES-BEC Seismic Only Meridional Stress (lbs/in^2) Top	AP-460-BES-BEC Seismic Only Stress Intensity (lbs/in^2) Top	AP-460-BES-BEC Seismic Only In-Plane Shear Stress (lbs/in^2) Top
762	**67.33**	688.19	818.75	784.72	227.19
782	**105.04**	729.86	1132.64	1131.25	393.11
802	**136.24**	845.83	929.17	929.86	421.48
822	**181.83**	616.67	843.75	842.36	429.55
842	**225.10**	1025.69	848.61	848.61	477.90
862	**273.66**	742.85	810.76	807.85	606.34
882	**323.27**	1268.82	715.97	1446.53	1049.32
902	**369.20**	1385.21	1066.18	2575.00	1577.61
922	**419.20**	1938.89	659.93	4027.78	2610.95
942	**444.31**	4134.38	3150.00	3105.56	2551.75
962	**458.66**	5981.46	4670.83	9834.72	2540.12
982	**473.08**	6396.18	5835.42	11469.44	2759.76
1002	**484.80**	3554.17	1374.58	4880.56	2911.24
1022	**502.48**	2526.32	684.10	3468.06	2850.84
1042	**526.48**	5195.90	1079.44	4317.36	2627.88
1062	**550.48**	6229.65	1215.51	5151.39	2363.27
1082	**574.60**	7291.39	1449.93	6103.47	2054.21
1102	**598.28**	8531.94	1303.61	7213.89	1700.02
1122	**621.38**	9491.67	1526.39	8157.64	1321.52
1142	**644.48**	10229.86	1510.56	8796.53	1036.78
1162	**667.63**	10492.36	1367.15	9159.03	970.10
1182	**690.78**	10115.28	1651.11	8947.92	767.31
1202	**713.88**	10090.28	1450.21	8858.33	851.47
1222	**736.98**	10236.11	1168.61	9076.39	1144.54
1242	**760.13**	9581.94	983.19	8743.06	1528.57
1262	**782.53**	8263.89	1421.25	7972.22	1427.85
1282	**804.13**	7541.67	989.86	7020.83	1732.73
1302	**825.73**	7451.39	786.24	6868.06	2036.28
1322	**847.33**	7680.56	918.54	7298.61	2348.61
1342	**868.87**	7201.39	1316.67	8173.61	2700.23
1362	**892.10**	4215.28	2246.81	6076.39	2609.75
1382	**909.20**	1958.33	5937.50	5111.11	2568.77
1402	**918.38**	2373.61	5262.50	4582.64	2527.10
1422	**930.48**	3081.25	5575.69	5236.11	2436.25
1442	**949.48**	4024.58	597.22	3994.44	2231.95
1462	**990.98**	3085.07	974.83	5550.00	3204.18
1482	**1050.98**	2320.97	449.69	1871.25	2014.15
1502	**1110.98**	1688.06	351.74	1871.25	1217.97
1522	**1170.98**	1248.19	248.69	1232.50	753.02
1542	**1230.98**	804.03	221.67	683.54	452.73
1562	**1292.98**	475.83	254.79	475.56	228.10

Note 1: Meridonal, Hoop, and Shear Stresses are Reversed in Highlighted Sections (Floor)

Table 11 BES-BEC Primary Tank Stresses, Shell Middle, Seismic Load Only

AP Primary Tank, Best Estimate Soil, Horizontal and Vertical Seismic, Best Estimate Tank Concrete, 460 in. Waste Level at 1.83 SpG

M&D Starting M&D Element No.	Path (in.)	Shell Mid-Plane			
		AP-460-BES-BEC Seismic Only Hoop Stress (lbs/in^2) Mid	AP-460-BES-BEC Seismic Only Meridional Stress (lbs/in^2) Mid	AP-460-BES-BEC Seismic Only Stress Intensity (lbs/in^2) Mid	AP-460-BES-BEC Seismic Only In-Plane Shear Stress (lbs/in^2) Mid
762	**67.33**	764.58	653.47	656.25	218.73
782	**105.04**	689.58	849.31	850.00	383.61
802	**136.24**	953.33	792.36	791.67	412.95
822	**181.83**	588.19	723.61	722.22	422.88
842	**225.10**	1225.69	647.92	704.86	474.69
862	**273.66**	689.24	568.75	568.06	606.25
882	**323.27**	1455.35	607.85	1297.22	1050.76
902	**369.20**	1407.78	724.86	2548.61	1577.62
922	**419.20**	2013.19	988.19	4112.50	2612.35
942	**444.31**	2936.81	937.78	4317.36	2595.57
962	**458.66**	6935.42	907.36	7478.47	2584.60
982	**473.08**	7918.06	863.19	8191.67	2718.07
1002	**484.80**	3284.72	846.46	4947.92	2840.38
1022	**502.48**	2963.34	953.47	3267.36	2817.49
1042	**526.48**	5215.56	1106.11	4320.14	2622.33
1062	**550.48**	6247.92	1239.72	5159.72	2357.73
1082	**574.60**	7280.83	1362.15	6032.64	2047.28
1102	**598.28**	8588.89	1461.04	7242.36	1693.78
1122	**621.38**	9504.17	1535.76	8084.72	1315.98
1142	**644.48**	10269.44	1592.43	8790.97	1022.90
1162	**667.63**	10594.44	1623.33	9080.56	958.99
1182	**690.78**	10062.50	1427.15	8725.00	758.28
1202	**713.88**	10098.61	1413.68	8768.75	850.77
1222	**736.98**	10313.89	1379.24	9020.83	1143.15
1242	**760.13**	9715.28	1319.86	8548.61	1520.24
1262	**782.53**	8119.44	910.69	7340.28	1416.06
1282	**804.13**	7506.94	839.94	6805.56	1732.05
1302	**825.73**	7472.22	754.60	6854.17	2039.02
1322	**847.33**	7618.06	657.78	7097.22	2353.43
1342	**868.87**	7618.06	537.87	7243.06	2684.84
1362	**892.10**	4763.89	373.15	4770.83	2527.81
1382	**909.20**	2020.14	374.86	2293.75	2411.85
1402	**918.38**	3783.33	341.94	3973.61	2398.67
1422	**930.48**	3994.93	510.63	4279.79	2381.31
1442	**949.48**	3776.32	564.24	4167.78	2248.47
1462	**990.98**	3111.32	875.00	5723.61	3204.44
1482	**1050.98**	2298.96	517.75	2015.97	2014.63
1502	**1110.98**	1705.07	291.04	2015.97	1218.16
1522	**1170.98**	1229.86	214.65	1176.32	753.18
1542	**1230.98**	820.21	221.18	789.10	452.61
1562	**1292.98**	447.71	226.18	390.07	228.21

Note 1: Meridonal, Hoop, and Shear Stresses are Reversed in Highlighted Sections (Floor)

Table 12 BES-BEC Primary Tank Stresses, Shell Bottom, Seismic Load Only

AP Primary Tank, Best Estimate Soil, Horizontal and Vertical Seismic, Best Estimate Tank Concrete, 460 in. Waste Level at 1.83 SpG

M&D Starting M&D Element No.	Path (in.)	Shell Bottom Surface (outside - away from waste)			
		AP-460-BES-BEC Seismic Only Hoop Stress (lbs/in^2) Bot	AP-460-BES-BEC Seismic Only Meridional Stress (lbs/in^2) Bot	AP-460-BES-BEC Seismic Only Stress Intensity (lbs/in^2) Bot	AP-460-BES-BEC Seismic Only In-Plane Shear Stress (lbs/in^2) Bot
762	**67.33**	890.28	925.69	923.61	211.43
782	**105.04**	705.56	1008.33	1009.03	374.09
802	**136.24**	1117.71	1121.53	1121.53	404.57
822	**181.83**	561.11	702.08	710.42	415.97
842	**225.10**	1425.00	1211.67	1144.58	471.47
862	**273.66**	636.26	580.28	559.03	606.01
882	**323.27**	1686.32	1250.56	1279.86	1051.51
902	**369.20**	1431.11	575.42	2520.83	1577.66
922	**419.20**	2154.17	1600.92	4193.75	2614.47
942	**444.31**	1957.99	5002.08	4634.72	2641.51
962	**458.66**	7890.97	3262.50	7193.06	2635.37
982	**473.08**	9438.89	4166.67	8801.39	2676.43
1002	**484.80**	3014.58	1897.22	4562.50	2770.26
1022	**502.48**	3401.04	2553.13	3020.83	2783.50
1042	**526.48**	5235.14	1141.94	4330.56	2616.84
1062	**550.48**	6266.11	1264.86	5179.86	2352.23
1082	**574.60**	7270.35	1277.30	5968.75	2040.40
1102	**598.28**	8653.47	1618.54	7277.78	1686.91
1122	**621.38**	9522.92	1544.58	8018.75	1311.18
1142	**644.48**	10308.33	1682.64	8792.36	1009.08
1162	**667.63**	10696.53	1911.81	9279.17	947.95
1182	**690.78**	10010.42	1205.00	8807.64	749.31
1202	**713.88**	10100.69	1390.94	8720.14	849.33
1222	**736.98**	10391.67	1590.90	9236.11	1141.72
1242	**760.13**	9840.28	1688.89	9013.89	1511.17
1262	**782.53**	7977.78	596.46	7680.56	1403.54
1282	**804.13**	7479.17	689.38	6888.89	1731.34
1302	**825.73**	7493.06	723.31	6847.22	2041.78
1322	**847.33**	7555.56	469.10	7250.00	2359.13
1342	**868.87**	8048.61	2380.21	8041.67	2671.62
1362	**892.10**	5312.50	2193.26	5312.50	2447.95
1382	**909.20**	2909.03	5312.50	5236.11	2255.58
1402	**918.38**	5359.93	4687.50	4089.58	2276.55
1422	**930.48**	5259.72	5319.44	4951.39	2341.46
1442	**949.48**	3534.03	1435.84	3896.53	2265.31
1462	**990.98**	3143.33	803.68	5899.86	3204.93
1482	**1050.98**	2270.76	597.36	2132.22	2015.42
1502	**1110.98**	1721.04	253.31	2132.22	1218.62
1522	**1170.98**	1207.78	244.58	1050.63	753.52
1542	**1230.98**	837.50	251.03	830.69	452.46
1562	**1292.98**	427.22	231.81	303.13	228.38

Note 1: Meridonal, Hoop, and Shear Stresses are Reversed in Highlighted Sections (Floor)

Table 13 BES-BEC J-Bolt Forces, Gravity Load Only

AP Primary Tank, Best Estimate Soil, Gravity Only, Best Estimate Tank Concrete, 460 in. Waste Level at 1.83 SpG

ANSYS MAXIMUMS BY RADIUS

M&D J-Bolt Radius No.	Mean J-Bolt Radius	Radius of J-Bolts Included *min*	Radius of J-Bolts Included *max*	Average Bolts per Element	Min Axial Force (kip) BES-BEC Gravity Only	Max Axial Force (kip) BES-BEC Gravity Only	Shear Force1 (kip) BES-BEC Gravity	Maximum Shear Force1 Model Angle	Shear Force2 (kip) BES-BEC Gravity Only	Maximum Shear Force2 Model Angle	Total Shear (kip) BES-BEC Gravity
Radius 2	44.72	*22.36*	*67.29*	0.55	-0.017	-0.013	0.002	45	0.103	90	0.103
Radius 3	89.87	*67.29*	*104.93*	0.89	-0.015	-0.013	0.002	36	0.028	0	0.028
Radius 4	120.00	*104.93*	*135.98*	1.03	0.001	0.002	0.004	27	0.090	180	0.090
Radius 5	151.97	*135.98*	*181.01*	1.97	-0.002	0.000	0.010	27	0.226	90	0.226
Radius 6	210.05	*181.01*	*223.79*	2.41	0.015	0.015	0.018	144	0.519	81	0.519
Radius 7	237.53	*223.79*	*270.98*	3.30	0.060	0.063	0.016	144	0.657	45	0.657
Radius 8	304.43	*270.98*	*318.74*	4.04	0.049	0.051	0.004	153	0.931	45	0.931
Radius 9	333.05	*318.74*	*361.64*	4.37	0.161	0.161	0.001	144	1.019	45	1.019
Radius 10	390.22	*361.64*	*406.24*	5.36	0.014	0.014	0.001	117	1.197	180	1.197
Radius 11	422.26	*406.24*	*431.63*	3.60	0.733	0.736	0.001	54	2.099	0	2.099

M&D J-Bolt Radius No.	Mean J-Bolt Radius	Radius of J-Bolts Included *min*	Radius of J-Bolts Included *max*	Average Bolts per Element	Bolt Angle (Rad)	Shear Stiffness (kip/ft)	Axial Stiffness (kip/ft)	Shear Displacement BES-BEC-Gravity Only	Axial Min Displacement BES-BEC-Gravity Only	Axial Max Displacement BES-BEC-Gravity Only
Radius 2	44.72	*22.36*	*67.29*	0.55	0.0351	1667	2222	0.00074	-0.00009	-0.00007
Radius 3	89.87	*67.29*	*104.93*	0.89	0.0715	1670	2219	0.00020	-0.00008	-0.00007
Radius 4	120.00	*104.93*	*135.98*	1.03	0.0968	1673	2215	0.00064	0.00001	0.00001
Radius 5	151.97	*135.98*	*181.01*	1.97	0.1252	1677	2207	0.00162	-0.00001	0.00000
Radius 6	210.05	*181.01*	*223.79*	2.41	0.1825	1688	2192	0.00369	0.00008	0.00008
Radius 7	237.53	*223.79*	*270.98*	3.30	0.2136	1696	2172	0.00465	0.00033	0.00035
Radius 8	304.43	*270.98*	*318.74*	4.04	0.3076	1725	2132	0.00648	0.00028	0.00029
Radius 9	333.05	*318.74*	*361.64*	4.37	0.3613	1746	2086	0.00700	0.00093	0.00093
Radius 10	390.22	*361.64*	*406.24*	5.36	0.5235	1821	2006	0.00789	0.00008	0.00009
Radius 11	460.26	*406.24*	*431.63*	3.60	0.6938	1913	1933	0.01317	0.00455	0.00457

Table 14 BES-BEC J-Bolt Forces, Gravity Plus Seismic Loads

AP Primary Tank, Best Estimate Soil, Horizontal and Vertical Seismic Input, Best Estimate Tank Concrete, 460 in. Waste Level at 1.83 SpG

ANSYS MAXIMUMS BY RADIUS

M&D J-Bolt Radius No.	Mean J-Bolt Radius	Radius of J-Bolts Included min	Radius of J-Bolts Included max	Average Bolts per Element	Min Axial Force (kip) BES-BEC	Max Axial Force (kip) BES-BEC	Shear Force1 (kip) BES-BEC	Maximum Shear Force1 Model Angle	Shear Force2 (kip) BES-BEC	Maximum Shear Force2 Model Angle	Total Shear (kip) BES-BEC
Radius 2	44.72	*22.36*	*67.29*	0.55	-0.096	0.005	0.377	90	0.474	180	0.515
Radius 3	89.87	*67.29*	*104.93*	0.89	-0.091	-0.009	0.323	90	0.389	0	0.454
Radius 4	120.00	*104.93*	*135.98*	1.03	-0.070	0.030	0.413	90	0.579	180	0.579
Radius 5	151.97	*135.98*	*181.01*	1.97	-0.077	0.024	0.547	90	0.777	180	0.777
Radius 6	210.05	*181.01*	*223.79*	2.41	-0.046	0.036	0.892	90	0.966	0	1.125
Radius 7	237.53	*223.79*	*270.98*	3.30	-0.018	0.126	1.180	90	1.153	0	1.412
Radius 8	304.43	*270.98*	*318.74*	4.04	-0.019	0.071	2.159	90	1.560	180	2.405
Radius 9	333.05	*318.74*	*361.64*	4.37	-0.003	0.446	2.829	90	1.816	180	3.071
Radius 10	390.22	*361.64*	*406.24*	5.36	-0.070	0.366	4.702	90	2.275	180	4.901
Radius 11	422.26	*406.24*	*431.63*	3.60	-0.260	1.764	6.820	90	3.814	180	7.257

M&D J-Bolt Radius No.	Mean J-Bolt Radius	Radius of J-Bolts Included min	Radius of J-Bolts Included max	Average Bolts per Element	Bolt Angle (Rad)	Shear Stiffness (kip/ft)	Axial Stiffness (kip/ft)	Shear Disp BES-BEC-Seismic	Axial Min Disp BES-BEC-Seismic	Axial Max Disp BES-BEC-Seismic
Radius 2	44.72	*22.36*	*67.29*	0.55	0.0351	1667	2222	0.00371	-0.00052	0.00003
Radius 3	89.87	*67.29*	*104.93*	0.89	0.0715	1670	2219	0.00327	-0.00049	-0.00005
Radius 4	120.00	*104.93*	*135.98*	1.03	0.0968	1673	2215	0.00415	-0.00038	0.00016
Radius 5	151.97	*135.98*	*181.01*	1.97	0.1252	1677	2207	0.00556	-0.00042	0.00013
Radius 6	210.05	*181.01*	*223.79*	2.41	0.1825	1688	2192	0.00800	-0.00025	0.00020
Radius 7	237.53	*223.79*	*270.98*	3.30	0.2136	1696	2172	0.00999	-0.00010	0.00069
Radius 8	304.43	*270.98*	*318.74*	4.04	0.3076	1725	2132	0.01673	-0.00011	0.00040
Radius 9	333.05	*318.74*	*361.64*	4.37	0.3613	1746	2086	0.02111	-0.00002	0.00257
Radius 10	390.22	*361.64*	*406.24*	5.36	0.5235	1821	2006	0.03229	-0.00042	0.00219
Radius 11	460.26	*406.24*	*431.63*	3.60	0.6938	1913	1933	0.04551	-0.00161	0.01095

Table 15 BES-BEC J-Bolt Forces, Seismic Load Only

AP Primary Tank, Best Estimate Soil, Horizontal and Vertical Seismic Input, Best Estimate Tank Concrete, 460 in. Waste Level at 1.83 SpG Seismic Only

ANSYS MAXIMUMS BY RADIUS

M&D J-Bolt Radius No.	Mean J-Bolt Radius	Radius of J-Bolts Included min	max	Average Bolts per Element	Min Axial Force (kip) BES-BEC-Seismic Only	Max Axial Force (kip) BES-BEC-Seismic Only	Shear Force1 (kip) BES-BEC-Seismic Only	Maximum Shear Force1 Model Angle	Shear Force2 (kip) BES-BEC-Seismic Only	Maximum Shear Force2 Model Angle	Total Shear (kip) BES-BEC-Seismic Only
Radius 2	44.72	22.36	67.29	0.55	-0.080	0.018	0.375	108	0.370	0	0.527
Radius 3	89.87	67.29	104.93	0.89	-0.076	0.004	0.321	108	0.361	0	0.483
Radius 4	120.00	104.93	135.98	1.03	-0.072	0.027	0.409	108	0.489	0	0.638
Radius 5	151.97	135.98	181.01	1.97	-0.075	0.025	0.537	108	0.550	0	0.769
Radius 6	210.05	181.01	223.79	2.41	-0.061	0.021	0.874	108	0.446	144	0.981
Radius 7	237.53	223.79	270.98	3.30	-0.078	0.063	1.164	90	0.496	135	1.265
Radius 8	304.43	270.98	318.74	4.04	-0.068	0.020	2.155	117	0.629	117	2.245
Radius 9	333.05	318.74	361.64	4.37	-0.164	0.285	2.828	117	0.797	117	2.939
Radius 10	390.22	361.64	406.24	5.36	-0.084	0.351	4.700	108	1.078	0	4.823
Radius 11	460.26	406.24	431.63	3.60	-0.993	1.028	6.819	108	1.715	0	7.031

M&D J-Bolt Radius No.	Mean J-Bolt Radius	Radius of J-Bolts Included min	max	Average Bolts per Element	Bolt Angle (Rad)	Shear Stiffness (kip/ft)	Axial Stiffness (kip/ft)	Shear Disp BES-BEC-Seismic Only	Axial Min Disp BES-BEC-Seismic Only	Axial Max Disp BES-BEC-Seismic Only
Radius 2	44.72	22.36	67.29	0.55	0.0351	1667	2222	0.00379	-0.00043	0.00010
Radius 3	89.87	67.29	104.93	0.89	0.0715	1670	2219	0.00347	-0.00041	0.00002
Radius 4	120.00	104.93	135.98	1.03	0.0968	1673	2215	0.00457	-0.00039	0.00015
Radius 5	151.97	135.98	181.01	1.97	0.1252	1677	2207	0.00550	-0.00041	0.00013
Radius 6	210.05	181.01	223.79	2.41	0.1825	1688	2192	0.00698	-0.00034	0.00011
Radius 7	237.53	223.79	270.98	3.30	0.2136	1696	2172	0.00896	-0.00043	0.00035
Radius 8	304.43	270.98	318.74	4.04	0.3076	1725	2132	0.01561	-0.00039	0.00011
Radius 9	333.05	318.74	361.64	4.37	0.3613	1746	2086	0.02020	-0.00094	0.00164
Radius 10	390.22	361.64	406.24	5.36	0.5235	1821	2006	0.03177	-0.00050	0.00210
Radius 11	460.26	406.24	431.63	3.60	0.6938	1913	1933	0.04409	-0.00617	0.00638

M&D Professional Services Confidential
12/20/2006

AP-460-BES-BEC J Bolt Forces Seismic.xls
Page 1

Table 16 BES-BEC Concrete Backed Steel Strain, Shell Top, Gravity Load Only

AP Backed Steel, Best Estimate Soil, Gravity Only, Best Estimate Tank Concrete, 460 In Waste Level at 1.83SpG

M&D Starting M&D Element No.	Path (in)	Shell Top Surface (inside - towards waste) Gravity AP-460-BES-BEC EPEL P1 Strain (in/in) Gravity Top Min	AP-460-BES-BEC EPEL P1 Strain (in/in) Gravity Top Max	AP-460-BES-BEC EPEL P2 (in/in) Gravity Top Min	AP-460-BES-BEC EPEL P2 Strain (in/in) Gravity Top Max	AP-460-BES-BEC EPEL P3 Strain (in/in) Gravity Top Min	AP-460-BES-BEC EPEL P3 Strain (in/in) Gravity Top Max
762	**67.33**	3.36E-05	3.37E-05	-3.81E-05	-3.81E-05	-3.99E-05	-3.99E-05
782	**105.04**	4.21E-05	4.21E-05	-3.12E-05	-3.12E-05	-6.62E-05	-6.61E-05
802	**136.24**	3.62E-05	3.62E-05	-3.18E-05	-3.18E-05	-5.17E-05	-5.17E-05
822	**181.71**	3.22E-05	3.23E-05	-1.89E-05	-1.88E-05	-5.55E-05	-5.54E-05
842	**225.10**	2.56E-05	2.56E-05	-2.06E-05	-2.06E-05	-3.82E-05	-3.82E-05
862	**273.66**	2.01E-05	2.01E-05	-6.25E-06	-6.25E-06	-4.00E-05	-3.99E-05
882	**323.27**	1.22E-05	1.22E-05	-7.65E-07	-7.54E-07	-2.72E-05	-2.72E-05
902	**369.20**	1.45E-05	1.45E-05	3.10E-06	3.10E-06	-2.14E-05	-2.14E-05
922	**419.20**	4.13E-05	4.13E-05	-8.89E-06	-8.88E-06	-2.03E-05	-2.03E-05
237	**463.02**						
257	**510.03**						
277	**544.44**						
297	**580.53**						
317	**631.08**						
337	**680.34**						
357	**727.44**						
377	**772.93**						
397	**831.34**						
417	**894.09**						
2132	**925.08**	2.84E-05	2.84E-05	-2.59E-05	-2.59E-05	-3.60E-05	-3.60E-05
2122	**935.67**	7.02E-05	7.02E-05	-1.99E-05	-1.99E-05	-2.67E-05	-2.67E-05
2112	**944.86**	7.35E-05	7.36E-05	-5.93E-06	-5.93E-06	-1.63E-04	-1.63E-04
477	**968.95**						
497	**1002.45**						
517	**1042.45**						
537	**1108.60**						
557	**1178.35**						
577	**1227.20**						
597	**1271.50**						
617	**1313.65**						
637	**1360.60**						

M&D Professional Services, Inc
1/9/2007

AP-460-BES-BEC Strain Seismic-Princ.xls
Strain Gravity

Table 17 BES-BEC Concrete Backed Steel Strain, Shell Middle, Gravity Load Only

AP Backed Steel, Best Estimate Soil, Gravity Only, Best Estimate Tank Concrete, 460 In Waste Level at 1.83SpG

M&D Starting M&D Element No.	Path (in)	Shell Mid-Plane					
		AP-460-BES-BEC EPEL P1 Strain (in/in) Gravity Mid Min	AP-460-BES-BEC EPEL P1 Strain (in/in) Gravity Mid Max	AP-460-BES-BEC EPEL P2 (in/in) Gravity Mid Min	AP-460-BES-BEC EPEL P2 Strain (in/in) Gravity Mid Max	AP-460-BES-BEC EPEL P3 Strain (in/in) Gravity Mid Min	AP-460-BES-BEC EPEL P3 Strain (in/in) Gravity Mid Max
762	**67.33**	3.58E-05	3.59E-05	-4.10E-05	-4.10E-05	-4.23E-05	-4.23E-05
782	**105.04**	4.05E-05	4.05E-05	-3.19E-05	-3.18E-05	-6.20E-05	-6.19E-05
802	**136.24**	3.84E-05	3.84E-05	-3.24E-05	-3.23E-05	-5.64E-05	-5.64E-05
822	**181.71**	3.10E-05	3.11E-05	-1.92E-05	-1.92E-05	-5.24E-05	-5.23E-05
842	**225.10**	2.80E-05	2.81E-05	-2.07E-05	-2.07E-05	-4.37E-05	-4.36E-05
862	**273.66**	1.95E-05	1.95E-05	-6.50E-06	-6.49E-06	-3.85E-05	-3.84E-05
882	**323.27**	1.30E-05	1.30E-05	-8.69E-07	-8.58E-07	-2.90E-05	-2.89E-05
902	**369.20**	1.43E-05	1.43E-05	3.61E-06	3.61E-06	-2.24E-05	-2.23E-05
922	**419.20**	4.12E-05	4.12E-05	-1.04E-05	-1.03E-05	-1.67E-05	-1.67E-05
237	**463.02**	4.30E-05	4.31E-05	5.58E-06	5.58E-06	-6.61E-05	-6.60E-05
257	**510.03**	5.86E-05	5.87E-05	5.08E-05	5.08E-05	-2.89E-04	-2.89E-04
277	**544.44**	9.53E-05	9.53E-05	4.55E-05	4.56E-05	-4.71E-04	-4.70E-04
297	**580.53**	6.77E-05	6.77E-05	-2.07E-05	-2.07E-05	-2.86E-04	-2.86E-04
317	**631.08**	8.31E-05	8.32E-05	-9.00E-05	-9.00E-05	-2.88E-04	-2.88E-04
337	**680.34**	1.03E-04	1.03E-04	-1.14E-04	-1.14E-04	-3.55E-04	-3.55E-04
357	**727.44**	1.02E-04	1.02E-04	-1.22E-04	-1.22E-04	-3.42E-04	-3.42E-04
377	**772.93**	1.19E-04	1.19E-04	-1.29E-04	-1.29E-04	-4.14E-04	-4.14E-04
397	**831.34**	1.12E-04	1.12E-04	-1.12E-04	-1.12E-04	-3.96E-04	-3.96E-04
417	**894.09**	4.79E-05	4.80E-05	-6.72E-05	-6.72E-05	-1.50E-04	-1.50E-04
2132	**925.08**	2.35E-05	2.35E-05	-1.16E-05	-1.16E-05	-3.60E-05	-3.60E-05
2122	**935.67**	2.38E-05	2.39E-05	-2.10E-05	-2.10E-05	-2.64E-05	-2.64E-05
2112	**944.86**	1.64E-05	1.64E-05	-5.73E-06	-5.73E-06	-2.66E-05	-2.66E-05
477	**968.95**	1.76E-05	1.76E-05	7.07E-06	7.08E-06	-7.69E-05	-7.69E-05
497	**1002.45**	5.64E-05	5.65E-05	1.03E-05	1.03E-05	-1.66E-05	-1.66E-05
517	**1042.45**	1.40E-05	1.40E-05	8.75E-06	8.77E-06	-4.96E-06	-4.96E-06
537	**1108.60**	2.42E-05	2.42E-05	5.07E-06	5.08E-06	-7.85E-06	-7.84E-06
557	**1178.35**	3.77E-06	3.78E-06	3.74E-06	3.74E-06	-1.83E-05	-1.83E-05
577	**1227.20**	2.37E-05	2.37E-05	3.79E-06	3.80E-06	-6.31E-06	-6.30E-06
597	**1271.50**	4.61E-06	4.62E-06	3.33E-06	3.33E-06	-1.87E-05	-1.87E-05
617	**1313.65**	1.59E-05	1.59E-05	6.58E-06	6.59E-06	-5.03E-06	-5.02E-06
637	**1360.60**	4.24E-06	4.24E-06	3.26E-06	3.27E-06	-1.52E-06	-1.52E-06

M&D Professional Services, Inc
1/9/2007

AP-460-BES-BEC Strain Seismic-Princ.xls
Strain Gravity

Table 18 BES-BEC Concrete Backed Steel Strain, Shell Bottom, Gravity Load Only

AP Backed Steel, Best Estimate Soil, Gravity Only, Best Estimate Tank Concrete, 460 In Waste Level at 1.83SpG

M&D Starting M&D Element No.	Path (in)	Shell Bottom Surface (outside - away from waste) Gravity					
		AP-460-BES-BEC EPEL P1 Strain (in/in) Gravity Bot Min	AP-460-BES-BEC EPEL P1 Strain (in/in) Gravity Bot Max	AP-460-BES-BEC EPEL P2 (in/in) Gravity Bot Min	AP-460-BES-BEC EPEL P2 Strain (in/in) Gravity Bot Max	AP-460-BES-BEC EPEL P3 Strain (in/in) Gravity Bot Min	AP-460-BES-BEC EPEL P3 Strain (in/in) Gravity Bot Max
762	**67.33**	3.81E-05	3.82E-05	-4.20E-05	-4.20E-05	-4.64E-05	-4.63E-05
782	**105.04**	3.90E-05	3.90E-05	-3.25E-05	-3.24E-05	-5.77E-05	-5.77E-05
802	**136.24**	4.06E-05	4.07E-05	-3.29E-05	-3.28E-05	-6.10E-05	-6.10E-05
822	**181.71**	2.98E-05	2.99E-05	-1.95E-05	-1.95E-05	-4.92E-05	-4.91E-05
842	**225.10**	3.05E-05	3.05E-05	-2.08E-05	-2.08E-05	-4.90E-05	-4.90E-05
862	**273.66**	1.89E-05	1.90E-05	-6.74E-06	-6.74E-06	-3.69E-05	-3.69E-05
882	**323.27**	1.37E-05	1.38E-05	-9.72E-07	-9.62E-07	-3.07E-05	-3.07E-05
902	**369.20**	1.40E-05	1.41E-05	4.12E-06	4.13E-06	-2.33E-05	-2.33E-05
922	**419.20**	4.11E-05	4.11E-05	-1.17E-05	-1.16E-05	-1.33E-05	-1.33E-05
237	**463.02**						
257	**510.03**						
277	**544.44**						
297	**580.53**						
317	**631.08**						
337	**680.34**						
357	**727.44**						
377	**772.93**						
397	**831.34**						
417	**894.09**						
2132	**925.08**	2.34E-05	2.34E-05	-1.89E-06	-1.89E-06	-3.60E-05	-3.60E-05
2122	**935.67**	5.46E-05	5.46E-05	-2.61E-05	-2.61E-05	-9.89E-05	-9.88E-05
2112	**944.86**	1.20E-04	1.20E-04	-5.54E-06	-5.54E-06	-4.89E-05	-4.89E-05
477	**968.95**						
497	**1002.45**						
517	**1042.45**						
537	**1108.60**						
557	**1178.35**						
577	**1227.20**						
597	**1271.50**						
617	**1313.65**						
637	**1360.60**						

M&D Professional Services, Inc
1/9/2007

AP-460-BES-BEC Strain Seismic-Princ.xls
Strain Gravity

Table 19 BES-BEC Concrete Backed Steel Strain, Shell Top, Gravity Plus Seismic Load

AP Backed Steel, Best Estimate Soil, Seismic Only, Best Estimate Tank Concrete, 460 In Waste Level at 1.83SpG

M&D Starting M&D Element No.	Path (in)	Shell Top Surface (inside - towards waste) Seismic					
		AP-460-BES-BEC EPEL P1 Strain (in/in) Seismic Top Min	AP-460-BES-BEC EPEL P1 Strain (in/in) Seismic Top Max	AP-460-BES-BEC EPEL P2 (in/in) Seismic Top Min	AP-460-BES-BEC EPEL P2 Strain (in/in) Seismic Top Max	AP-460-BES-BEC EPEL P3 Strain (in/in) Seismic Top Min	AP-460-BES-BEC EPEL P3 Strain (in/in) Seismic Top Max
762	**67.33**	2.37E-05	4.65E-05	-5.00E-05	-1.42E-05	-5.76E-05	-2.65E-05
782	**105.04**	3.16E-05	5.71E-05	-3.97E-05	-1.16E-05	-8.53E-05	-3.43E-05
802	**136.24**	2.67E-05	4.97E-05	-4.15E-05	-2.67E-06	-7.72E-05	-3.12E-05
822	**181.71**	2.56E-05	4.39E-05	-2.74E-05	-1.04E-06	-7.52E-05	-3.18E-05
842	**225.10**	2.05E-05	3.39E-05	-3.08E-05	1.95E-05	-6.46E-05	-2.27E-05
862	**273.66**	1.67E-05	3.21E-05	-1.50E-05	1.68E-05	-5.78E-05	-1.46E-05
882	**323.27**	1.03E-05	4.60E-05	-1.26E-05	1.61E-05	-5.70E-05	-1.25E-05
902	**369.20**	4.61E-06	7.34E-05	4.30E-07	1.35E-05	-5.01E-05	-1.05E-06
922	**419.20**	2.68E-05	1.32E-04	-1.26E-05	7.35E-06	-5.54E-05	-1.16E-06
237	**463.02**						
257	**510.03**						
277	**544.44**						
297	**580.53**						
317	**631.08**						
337	**680.34**						
357	**727.44**						
377	**772.93**						
397	**831.34**						
417	**894.09**						
2132	**925.08**	2.51E-05	3.78E-05	-2.99E-05	1.03E-05	-4.95E-05	-2.79E-05
2122	**935.67**	5.90E-05	1.06E-04	-2.28E-05	5.30E-07	-3.75E-05	-1.90E-05
2112	**944.86**	6.05E-05	1.26E-04	-9.28E-06	2.69E-05	-1.98E-04	-3.32E-05
477	**968.95**						
497	**1002.45**						
517	**1042.45**						
537	**1108.60**						
557	**1178.35**						
577	**1227.20**						
597	**1271.50**						
617	**1313.65**						
637	**1360.60**						

M&D Professional Services, Inc
1/9/2007

AP-460-BES-BEC Strain Seismic-Princ.xls
Strain Max

Table 20 BES-BEC Concrete Backed Steel Strain, Shell Middle, Gravity Plus Seismic Load

AP Backed Steel, Best Estimate Soil, Seismic Only, Best Estimate Tank Concrete, 460 In Waste Level at 1.83SpG

M&D Starting M&D Element No.	Path (in)	Shell Mid-Plane					
		AP-460-BES-BEC EPEL P1 Strain (in/in) Seismic Mid Min	AP-460-BES-BEC EPEL P1 Strain (in/in) Seismic Mid Max	AP-460-BES-BEC EPEL P2 (in/in) Seismic Mid Min	AP-460-BES-BEC EPEL P2 Strain (in/in) Seismic Mid Max	AP-460-BES-BEC EPEL P3 Strain (in/in) Seismic Mid Min	AP-460-BES-BEC EPEL P3 Strain (in/in) Seismic Mid Max
762	**67.33**	2.62E-05	4.94E-05	-5.20E-05	-1.91E-05	-5.86E-05	-2.94E-05
782	**105.04**	2.95E-05	5.63E-05	-4.06E-05	-1.17E-05	-8.41E-05	-4.12E-05
802	**136.24**	2.94E-05	5.24E-05	-4.26E-05	-2.82E-06	-7.84E-05	-3.64E-05
822	**181.71**	2.42E-05	4.16E-05	-2.76E-05	-1.43E-06	-7.29E-05	-3.06E-05
842	**225.10**	2.32E-05	4.41E-05	-3.41E-05	1.73E-05	-6.37E-05	-2.37E-05
862	**273.66**	1.66E-05	2.75E-05	-1.51E-05	1.74E-05	-5.74E-05	-1.84E-05
882	**323.27**	8.94E-06	4.59E-05	-1.29E-05	1.79E-05	-5.21E-05	-1.18E-05
902	**369.20**	4.75E-06	7.36E-05	1.66E-06	1.26E-05	-4.83E-05	-1.47E-06
922	**419.20**	2.69E-05	1.31E-04	-1.60E-05	1.48E-05	-5.03E-05	-1.53E-06
237	**463.02**	2.56E-05	6.90E-05	4.25E-06	8.71E-06	-7.68E-05	-4.87E-05
257	**510.03**	4.64E-05	8.64E-05	3.96E-05	5.86E-05	-3.23E-04	-2.34E-04
277	**544.44**	8.49E-05	1.10E-04	2.57E-05	7.37E-05	-5.25E-04	-3.97E-04
297	**580.53**	6.15E-05	7.89E-05	-3.55E-05	4.04E-05	-3.29E-04	-2.48E-04
317	**631.08**	7.42E-05	9.58E-05	-1.03E-04	7.00E-06	-3.33E-04	-2.45E-04
337	**680.34**	9.15E-05	1.17E-04	-1.27E-04	-2.04E-05	-4.05E-04	-3.01E-04
357	**727.44**	9.03E-05	1.16E-04	-1.36E-04	-3.21E-05	-3.87E-04	-2.87E-04
377	**772.93**	1.04E-04	1.36E-04	-1.43E-04	-1.06E-05	-4.69E-04	-3.33E-04
397	**831.34**	9.70E-05	1.27E-04	-1.24E-04	-5.43E-07	-4.48E-04	-3.02E-04
417	**894.09**	4.16E-05	5.83E-05	-7.40E-05	1.75E-05	-1.74E-04	-1.07E-04
2132	**925.08**	2.03E-05	2.97E-05	-1.55E-05	1.35E-05	-4.57E-05	-2.28E-05
2122	**935.67**	2.06E-05	3.04E-05	-2.53E-05	1.18E-05	-4.80E-05	-2.14E-05
2112	**944.86**	1.38E-05	2.75E-05	-8.58E-06	2.02E-05	-4.91E-05	-1.44E-05
477	**968.95**	1.52E-05	4.10E-05	-9.57E-07	1.82E-05	-8.74E-05	-5.82E-05
497	**1002.45**	4.73E-05	7.53E-05	-5.91E-06	4.15E-05	-1.96E-05	-1.11E-05
517	**1042.45**	1.19E-05	3.91E-05	-2.27E-06	1.84E-05	-7.40E-06	-1.77E-06
537	**1108.60**	1.85E-05	4.88E-05	-4.62E-06	3.13E-05	-1.93E-05	-4.15E-06
557	**1178.35**	3.48E-06	2.73E-05	-1.97E-06	7.18E-06	-3.72E-05	-2.74E-06
577	**1227.20**	1.42E-05	4.92E-05	-4.52E-06	2.59E-05	-1.24E-05	-2.31E-06
597	**1271.50**	3.55E-06	2.51E-05	-4.04E-06	5.75E-06	-2.90E-05	-6.14E-06
617	**1313.65**	4.07E-06	4.12E-05	-2.43E-06	2.14E-05	-1.10E-05	-1.21E-06
637	**1360.60**	6.81E-07	1.16E-05	-1.33E-07	7.33E-06	-3.33E-06	-3.34E-07

M&D Professional Services, Inc
1/9/2007

AP-460-BES-BEC Strain Seismic-Princ.xls
Strain Max

Table 21 BES-BEC Concrete Backed Steel Strain, Shell Bottom, Gravity Plus Seismic Load

AP Backed Steel, Best Estimate Soil, Seismic Only, Best Estimate Tank Concrete, 460 In Waste Level at 1.83SpG

M&D Starting M&D Element No.	Path (in)	Shell Bottom Surface (outside - away from waste) Seismic					
		AP-460-BES-BEC EPEL P1 Strain (in/in) Seismic Bot Min	AP-460-BES-BEC EPEL P1 Strain (in/in) Seismic Bot Max	AP-460-BES-BEC EPEL P2 (in/in) Seismic Bot Min	AP-460-BES-BEC EPEL P2 Strain (in/in) Seismic Bot Max	AP-460-BES-BEC EPEL P3 Strain (in/in) Seismic Bot Min	AP-460-BES-BEC EPEL P3 Strain (in/in) Seismic Bot Max
762	**67.33**	2.82E-05	5.41E-05	-5.40E-05	-2.01E-05	-6.05E-05	-2.43E-05
782	**105.04**	2.66E-05	5.54E-05	-4.16E-05	-1.19E-05	-8.29E-05	-3.24E-05
802	**136.24**	3.20E-05	6.06E-05	-4.29E-05	-2.97E-06	-8.06E-05	-3.49E-05
822	**181.71**	2.27E-05	4.05E-05	-2.78E-05	-1.82E-06	-7.03E-05	-2.78E-05
842	**225.10**	2.38E-05	5.65E-05	-3.47E-05	1.49E-05	-6.68E-05	-2.16E-05
862	**273.66**	1.59E-05	2.62E-05	-1.52E-05	1.80E-05	-5.63E-05	-1.72E-05
882	**323.27**	7.95E-06	4.58E-05	-1.31E-05	1.93E-05	-5.70E-05	-2.69E-06
902	**369.20**	5.13E-06	7.37E-05	1.78E-06	1.31E-05	-4.77E-05	-4.69E-06
922	**419.20**	2.71E-05	1.31E-04	-1.94E-05	3.38E-05	-5.13E-05	-2.29E-06
237	**463.02**						
257	**510.03**						
277	**544.44**						
297	**580.53**						
317	**631.08**						
337	**680.34**						
357	**727.44**						
377	**772.93**						
397	**831.34**						
417	**894.09**						
2132	**925.08**	2.05E-05	2.91E-05	-4.99E-06	1.35E-05	-4.41E-05	-1.61E-05
2122	**935.67**	4.71E-05	7.77E-05	-2.96E-05	-3.28E-06	-1.19E-04	-4.22E-05
2112	**944.86**	9.89E-05	2.12E-04	-1.31E-05	2.72E-05	-5.87E-05	-1.85E-05
477	**968.95**						
497	**1002.45**						
517	**1042.45**						
537	**1108.60**						
557	**1178.35**						
577	**1227.20**						
597	**1271.50**						
617	**1313.65**						
637	**1360.60**						

M&D Professional Services, Inc
1/9/2007

AP-460-BES-BEC Strain Seismic-Princ.xls
Strain Max

Table 22 BES-BEC Concrete Backed Steel Strain, Shell Top, Seismic Load Only

AP Backed Steel, Best Estimate Soil, Seismic Only, Best Estimate Tank Concrete, 460 In Waste Level at 1.83SpG

M&D Starting M&D Element No.	Path (in)	Shell Top Surface (inside - towards waste) Seismic					
		AP-460-BES-BEC EPEL P1 Strain (in/in) Seismic Only Top Min	AP-460-BES-BEC EPEL P1 Strain (in/in) Seismic Only Top Max	AP-460-BES-BEC EPEL P2 (in/in) Seismic Only Top Min	AP-460-BES-BEC EPEL P2 Strain (in/in) Seismic Only Top Max	AP-460-BES-BEC EPEL P3 Strain (in/in) Seismic Only Top Min	AP-460-BES-BEC EPEL P3 Strain (in/in) Seismic Only Top Max
762	**67.33**	-9.92E-06	1.28E-05	-1.19E-05	2.39E-05	-1.77E-05	1.34E-05
782	**105.04**	-1.05E-05	1.50E-05	-8.51E-06	1.96E-05	-1.92E-05	3.18E-05
802	**136.24**	-9.45E-06	1.35E-05	-9.68E-06	2.91E-05	-2.55E-05	2.05E-05
822	**181.71**	-6.68E-06	1.17E-05	-8.55E-06	1.78E-05	-1.97E-05	2.37E-05
842	**225.10**	-5.01E-06	8.30E-06	-1.02E-05	4.01E-05	-2.64E-05	1.55E-05
862	**273.66**	-3.34E-06	1.21E-05	-8.78E-06	2.31E-05	-1.78E-05	2.53E-05
882	**323.27**	-1.85E-06	3.38E-05	-1.19E-05	1.68E-05	-2.98E-05	1.47E-05
902	**369.20**	-9.87E-06	5.89E-05	-2.67E-06	1.03E-05	-2.87E-05	2.03E-05
922	**419.20**	-1.45E-05	9.06E-05	-3.73E-06	1.62E-05	-3.51E-05	1.91E-05
237	**463.02**						
257	**510.03**						
277	**544.44**						
297	**580.53**						
317	**631.08**						
337	**680.34**						
357	**727.44**						
377	**772.93**						
397	**831.34**						
417	**894.09**						
2062	**925.08**	-3.31E-06	9.35E-06	-4.02E-06	3.62E-05	-1.34E-05	8.11E-06
2052	**935.67**	-1.13E-05	3.55E-05	-2.87E-06	2.04E-05	-1.08E-05	7.71E-06
2042	**944.86**	-1.31E-05	5.21E-05	-3.35E-06	3.28E-05	-3.44E-05	1.30E-04
477	**968.95**						
497	**1002.45**						
517	**1042.45**						
537	**1108.60**						
557	**1178.35**						
577	**1227.20**						
597	**1271.50**						
617	**1313.65**						
637	**1360.60**						

M&D Professional Services, Inc
1/9/2007

AP-460-BES-BEC Strain Seismic-Princ.xls
Strain Seismic Only

Table 23 BES-BEC Concrete Backed Steel Strain, Shell Middle, Seismic Load Only

AP Backed Steel, Best Estimate Soil, Seismic Only, Best Estimate Tank Concrete, 460 In Waste Level at 1.83SpG

M&D Starting M&D Element No.	Path (in)	Shell Mid-Plane					
		AP-460-BES-BEC EPEL P1 Strain (in/in) Seismic Only Mid Min	AP-460-BES-BEC EPEL P1 Strain (in/in) Seismic Only Mid Max	AP-460-BES-BEC EPEL P2 (in/in) Seismic Only Mid Min	AP-460-BES-BEC EPEL P2 Strain (in/in) Seismic Only Mid Max	AP-460-BES-BEC EPEL P3 Strain (in/in) Seismic Only Mid Min	AP-460-BES-BEC EPEL P3 Strain (in/in) Seismic Only Mid Max
762	**67.33**	-9.67E-06	1.36E-05	-1.10E-05	2.19E-05	-1.63E-05	1.29E-05
782	**105.04**	-1.10E-05	1.57E-05	-8.76E-06	2.01E-05	-2.21E-05	2.07E-05
802	**136.24**	-9.01E-06	1.39E-05	-1.02E-05	2.95E-05	-2.20E-05	2.00E-05
822	**181.71**	-6.85E-06	1.06E-05	-8.40E-06	1.77E-05	-2.06E-05	2.18E-05
842	**225.10**	-4.85E-06	1.61E-05	-1.34E-05	3.80E-05	-2.01E-05	1.99E-05
862	**273.66**	-2.95E-06	7.98E-06	-8.62E-06	2.39E-05	-1.90E-05	2.01E-05
882	**323.27**	-4.02E-06	3.29E-05	-1.20E-05	1.87E-05	-2.32E-05	1.71E-05
902	**369.20**	-9.50E-06	5.93E-05	-1.95E-06	9.00E-06	-2.60E-05	2.09E-05
922	**419.20**	-1.43E-05	9.02E-05	-5.64E-06	2.52E-05	-3.35E-05	1.52E-05
237	**463.02**	-1.74E-05	2.59E-05	-1.33E-06	3.14E-06	-1.07E-05	1.74E-05
257	**510.03**	-1.22E-05	2.77E-05	-1.12E-05	7.82E-06	-3.38E-05	5.52E-05
277	**544.44**	-1.03E-05	1.47E-05	-1.98E-05	2.81E-05	-5.42E-05	7.34E-05
297	**580.53**	-6.16E-06	1.12E-05	-1.48E-05	6.10E-05	-4.33E-05	3.76E-05
317	**631.08**	-8.90E-06	1.26E-05	-1.32E-05	9.70E-05	-4.46E-05	4.28E-05
337	**680.34**	-1.14E-05	1.35E-05	-1.35E-05	9.32E-05	-5.00E-05	5.38E-05
357	**727.44**	-1.16E-05	1.37E-05	-1.36E-05	8.99E-05	-4.46E-05	5.53E-05
377	**772.93**	-1.47E-05	1.66E-05	-1.41E-05	1.18E-04	-5.53E-05	8.08E-05
397	**831.34**	-1.45E-05	1.54E-05	-1.19E-05	1.12E-04	-5.14E-05	9.42E-05
417	**894.09**	-6.37E-06	1.03E-05	-6.74E-06	8.47E-05	-2.38E-05	4.35E-05
2062	**925.08**	-3.20E-06	6.19E-06	-3.89E-06	2.50E-05	-9.65E-06	1.32E-05
2052	**935.67**	-3.27E-06	6.59E-06	-4.31E-06	3.28E-05	-2.16E-05	5.03E-06
2042	**944.86**	-2.58E-06	1.11E-05	-2.85E-06	2.59E-05	-2.25E-05	1.22E-05
477	**968.95**	-2.36E-06	2.34E-05	-8.03E-06	1.11E-05	-1.05E-05	1.87E-05
497	**1002.45**	-9.10E-06	1.88E-05	-1.62E-05	3.12E-05	-3.02E-06	5.48E-06
517	**1042.45**	-2.07E-06	2.51E-05	-1.10E-05	9.62E-06	-2.44E-06	3.19E-06
537	**1108.60**	-5.73E-06	2.46E-05	-9.69E-06	2.62E-05	-1.15E-05	3.69E-06
557	**1178.35**	-2.96E-07	2.35E-05	-5.71E-06	3.43E-06	-1.89E-05	1.56E-05
577	**1227.20**	-9.52E-06	2.55E-05	-8.31E-06	2.21E-05	-6.05E-06	3.99E-06
597	**1271.50**	-1.06E-06	2.05E-05	-7.37E-06	2.43E-06	-1.03E-05	1.26E-05
617	**1313.65**	-1.18E-05	2.53E-05	-9.01E-06	1.48E-05	-6.01E-06	3.81E-06
637	**1360.60**	-3.56E-06	7.31E-06	-3.40E-06	4.07E-06	-1.81E-06	1.19E-06

M&D Professional Services, Inc
1/9/2007

AP-460-BES-BEC Strain Seismic-Princ.xls
Strain Seismic Only

Table 24 BES-BEC Concrete Backed Steel Strain, Shell Bottom, Seismic Load Only

AP Backed Steel, Best Estimate Soil, Seismic Only, Best Estimate Tank Concrete, 460 In Waste Level at 1.83SpG

M&D Starting M&D Element No.	Path (in)	Shell Bottom Surface (outside - away from waste) Seismic					
		AP-460-BES-BEC EPEL P1 Strain (in/in) Seismic Only Bot Min	AP-460-BES-BEC EPEL P1 Strain (in/in) Seismic Only Bot Max	AP-460-BES-BEC EPEL P2 (in/in) Seismic Only Bot Min	AP-460-BES-BEC EPEL P2 Strain (in/in) Seismic Only Bot Max	AP-460-BES-BEC EPEL P3 Strain (in/in) Seismic Only Bot Min	AP-460-BES-BEC EPEL P3 Strain (in/in) Seismic Only Bot Max
762	**67.33**	-9.96E-06	1.59E-05	-1.19E-05	2.19E-05	-1.42E-05	2.21E-05
782	**105.04**	-1.23E-05	1.64E-05	-9.10E-06	2.06E-05	-2.52E-05	2.53E-05
802	**136.24**	-8.68E-06	1.99E-05	-9.99E-06	2.99E-05	-1.96E-05	2.61E-05
822	**181.71**	-7.11E-06	1.07E-05	-8.22E-06	1.77E-05	-2.12E-05	2.14E-05
842	**225.10**	-6.67E-06	2.60E-05	-1.39E-05	3.57E-05	-1.78E-05	2.73E-05
862	**273.66**	-3.01E-06	7.24E-06	-8.41E-06	2.47E-05	-1.94E-05	1.97E-05
882	**323.27**	-5.79E-06	3.21E-05	-1.21E-05	2.03E-05	-2.63E-05	2.80E-05
902	**369.20**	-8.89E-06	5.97E-05	-2.35E-06	8.94E-06	-2.44E-05	1.86E-05
922	**419.20**	-1.40E-05	8.99E-05	-7.71E-06	4.54E-05	-3.80E-05	1.10E-05
237	**463.02**						
257	**510.03**						
277	**544.44**						
297	**580.53**						
317	**631.08**						
337	**680.34**						
357	**727.44**						
377	**772.93**						
397	**831.34**						
417	**894.09**						
2062	**925.08**	-2.83E-06	5.72E-06	-3.09E-06	1.54E-05	-8.07E-06	1.99E-05
2052	**935.67**	-7.48E-06	2.31E-05	-3.46E-06	2.28E-05	-2.05E-05	5.66E-05
2042	**944.86**	-2.10E-05	9.19E-05	-7.55E-06	3.27E-05	-9.80E-06	3.04E-05
477	**968.95**						
497	**1002.45**						
517	**1042.45**						
537	**1108.60**						
557	**1178.35**						
577	**1227.20**						
597	**1271.50**						
617	**1313.65**						
637	**1360.60**						

M&D Professional Services, Inc
1/9/2007

AP-460-BES-BEC Strain Seismic-Princ.xls
Strain Seismic Only

Table 25 BES-BEC Concrete Wall/Footing Contact Forces, Gravity Only

Tank AY, 460 Inch Waste Level
SpG = 1.83
Best Estimate Soil
Best Estimate Concrete

Angle	Vertical Min AP-BES-BEC Gravity	Vertical Max AP-BES-BEC Gravity	Shear Y Min AP-BES-BEC Gravity	Shear Y Max AP-BES-BEC Gravity	Shear X Min AP-BES-BEC Gravity	Shear X Max AP-BES-BEC Gravity	Shear Y Max AP-BES-BEC Gravity	Shear X Max AP-BES-BEC Gravity	Shear Max AP-BES-BEC Gravity	Vertical Force Max AP-BES-BEC Gravity	Vertical Force Min AP-BES-BEC Gravity
0	-214.80	-214.60	0.00	0.00	-1.16	-1.16	0.00	0.36	0.36	-67.13	-67.06
9	-429.60	-429.20	-0.44	-0.43	-2.34	-2.33	0.07	0.37	0.37	-67.13	-67.06
18	-429.60	-429.20	-0.48	-0.48	-2.19	-2.19	0.07	0.34	0.35	-67.13	-67.06
27	-429.60	-429.20	-0.75	-0.74	-2.09	-2.08	0.12	0.33	0.35	-67.13	-67.06
36	-429.60	-429.20	-1.45	-1.45	-1.91	-1.90	0.23	0.30	0.37	-67.13	-67.06
45	-429.60	-429.20	-1.64	-1.64	-1.64	-1.64	0.26	0.26	0.36	-67.13	-67.06
54	-429.50	-429.10	-1.93	-1.92	-1.46	-1.46	0.30	0.23	0.38	-67.11	-67.05
63	-429.50	-429.10	-2.03	-2.02	-1.08	-1.08	0.32	0.17	0.36	-67.11	-67.05
72	-429.60	-429.20	-2.29	-2.29	-0.72	-0.72	0.36	0.11	0.38	-67.13	-67.06
81	-429.50	-429.10	-2.17	-2.16	-0.44	-0.44	0.34	0.07	0.35	-67.11	-67.05
90	-429.50	-429.10	-2.39	-2.39	0.04	0.04	0.37	0.01	0.37	-67.11	-67.05
99	-429.60	-429.10	-2.34	-2.33	0.42	0.42	0.37	0.07	0.37	-67.13	-67.05
108	-429.50	-429.10	-2.14	-2.13	0.57	0.58	0.33	0.09	0.35	-67.11	-67.05
117	-429.60	-429.20	-2.10	-2.10	1.14	1.14	0.33	0.18	0.37	-67.13	-67.06
126	-429.60	-429.20	-1.82	-1.82	1.41	1.42	0.28	0.22	0.36	-67.13	-67.06
135	-429.60	-429.20	-1.62	-1.61	1.74	1.75	0.25	0.27	0.37	-67.13	-67.06
144	-429.50	-429.10	-1.35	-1.35	1.95	1.95	0.21	0.30	0.37	-67.11	-67.05
153	-429.60	-429.20	-1.06	-1.06	2.10	2.11	0.17	0.33	0.37	-67.13	-67.06
162	-429.60	-429.20	-0.68	-0.68	2.22	2.23	0.11	0.35	0.36	-67.13	-67.06
171	-429.60	-429.20	-0.32	-0.32	2.33	2.34	0.05	0.37	0.37	-67.13	-67.06
180	-214.80	-214.60	0.00	0.00	1.18	1.18	0.00	0.37	0.37	-67.13	-67.06

Table 26 BES-BEC Concrete Wall/Footing Contact Forces, Gravity Plus Seismic

Tank AY, 460 Inch Waste Level
SpG = 1.83
Best Estimate Soil
Best Estimate Concrete

Angle	Vertical Min AP-BES-BEC Seismic	Vertical Max AP-BES-BEC Seismic	Shear Y Min AP-BES-BEC Seismic	Shear Y Max AP-BES-BEC Seismic	Shear X Min AP-BES-BEC Seismic	Shear X Max AP-BES-BEC Seismic	Shear Y Max AP-BES-BEC Seismic	Shear X Max AP-BES-BEC Seismic	Shear Max AP-BES-BEC Seismic	Vertical Force Max AP-BES-BEC Seismic	Vertical Force Min AP-BES-BEC Seismic
0	-244.40	-164.40	0.00	0.00	-6.50	5.80	0.00	2.03	2.03	-76.38	-51.38
9	-488.80	-329.60	-25.61	23.57	-16.79	15.49	4.00	2.62	4.78	-76.38	-51.50
18	-488.60	-331.90	-48.32	45.24	-27.71	27.18	7.55	4.33	8.70	-76.34	-51.86
27	-488.20	-335.60	-66.59	62.29	-44.87	45.22	10.40	7.07	12.58	-76.28	-52.44
36	-487.70	-340.70	-78.90	72.74	-66.53	68.06	12.33	10.63	16.28	-76.20	-53.23
45	-487.00	-346.60	-83.23	76.43	-90.52	93.61	13.00	14.63	19.57	-76.09	-54.16
54	-486.20	-353.10	-79.77	72.33	-114.60	119.40	12.46	18.66	22.44	-75.97	-55.17
63	-485.40	-357.20	-68.48	61.10	-136.10	143.30	10.70	22.39	24.82	-75.84	-55.81
72	-484.50	-359.80	-50.62	43.44	-153.10	162.60	7.91	25.41	26.61	-75.70	-56.22
81	-483.50	-361.60	-27.53	21.66	-163.80	175.30	4.30	27.39	27.73	-75.55	-56.50
90	-482.50	-362.80	-3.27	-1.25	-166.70	180.30	0.51	28.17	28.18	-75.39	-56.69
99	-481.60	-363.10	-26.79	24.34	-161.70	176.80	4.19	27.63	27.94	-75.25	-56.73
108	-483.40	-362.70	-47.87	47.96	-149.50	164.90	7.49	25.77	26.83	-75.53	-56.67
117	-485.20	-362.00	-64.34	66.27	-130.80	146.20	10.35	22.84	25.08	-75.81	-56.56
126	-486.70	-360.80	-74.32	77.74	-108.40	122.30	12.15	19.11	22.64	-76.05	-56.38
135	-487.90	-359.30	-77.31	81.09	-84.14	96.11	12.67	15.02	19.65	-76.23	-56.14
144	-489.20	-358.00	-72.96	76.45	-60.40	70.34	11.95	10.99	16.23	-76.44	-55.94
153	-490.60	-357.10	-61.73	64.46	-39.34	47.51	10.07	7.42	12.51	-76.66	-55.80
162	-492.10	-356.80	-44.60	46.51	-23.11	29.80	7.27	4.66	8.63	-76.89	-55.75
171	-493.20	-356.70	-23.36	24.35	-12.65	18.59	3.80	2.90	4.79	-77.06	-55.73
180	-246.80	-178.40	0.00	0.00	-4.55	7.40	0.00	2.31	2.31	-77.13	-55.75

M&D Professional Services, Inc
12/20/2006

AP-460-BES-BEC Footing Seismic.xls

Table 27 BES-BEC Concrete Wall/Footing Contact Forces, Seismic Only

Tank AY, 460 Inch Waste Level
SpG = 1.83
Best Estimate Soil
Best Estimate Concrete

Angle	Vertical Min AP-BES-BEC Seismic Only	Vertical Max AP-BES-BEC Seismic Only	Shear Y Min AP-BES-BEC Seismic Only	Shear Y Max AP-BES-BEC Seismic Only	Shear X Min AP-BES-BEC Seismic Only	Shear X Max AP-BES-BEC Seismic Only	Shear Y Max AP-BES-BEC Seismic Only	Shear X Max AP-BES-BEC Seismic Only	Shear Max AP-BES-BEC Seismic Only	Vertical Force Max AP-BES-BEC Seismic Only	Vertical Force Min AP-BES-BEC Seismic Only
0	-29.60	50.20	0.00	0.00	-5.34	6.96	0.00	2.17	2.17	-9.25	15.69
9	-59.20	99.60	-25.17	24.00	-14.45	17.82	3.93	2.79	4.82	-9.25	15.56
18	-59.00	97.30	-47.84	45.72	-25.52	29.37	7.48	4.59	8.77	-9.22	15.20
27	-58.60	93.60	-65.84	63.03	-42.78	47.30	10.29	7.39	12.67	-9.16	14.63
36	-58.10	88.50	-77.45	74.19	-64.62	69.96	12.10	10.93	16.31	-9.08	13.83
45	-57.40	82.60	-81.59	78.07	-88.88	95.25	12.75	14.88	19.60	-8.97	12.91
54	-56.70	76.00	-77.85	74.25	-113.14	120.86	12.16	18.88	22.46	-8.86	11.88
63	-55.90	71.90	-66.46	63.12	-135.02	144.38	10.38	22.56	24.83	-8.73	11.23
72	-54.90	69.40	-48.33	45.73	-152.38	163.32	7.55	25.52	26.61	-8.58	10.84
81	-54.00	67.50	-25.37	23.82	-163.36	175.74	3.96	27.46	27.74	-8.44	10.55
90	-53.00	66.30	-0.88	1.14	-166.74	180.26	0.18	28.17	28.17	-8.28	10.36
99	-52.00	66.00	-24.45	26.67	-162.12	176.38	4.17	27.56	27.87	-8.13	10.31
108	-53.90	66.40	-45.73	50.09	-150.07	164.32	7.83	25.68	26.84	-8.42	10.38
117	-55.60	67.20	-62.24	68.37	-131.94	145.06	10.68	22.67	25.06	-8.69	10.50
126	-57.10	68.40	-72.50	79.56	-109.81	120.88	12.43	18.89	22.61	-8.92	10.69
135	-58.30	69.90	-75.70	82.70	-85.88	94.36	12.92	14.74	19.61	-9.11	10.92
144	-59.70	71.10	-71.61	77.80	-62.35	68.39	12.16	10.69	16.18	-9.33	11.11
153	-61.00	72.10	-60.67	65.52	-41.44	45.40	10.24	7.09	12.46	-9.53	11.27
162	-62.50	72.40	-43.92	47.19	-25.33	27.58	7.37	4.31	8.54	-9.77	11.31
171	-63.60	72.50	-23.04	24.67	-14.98	16.25	3.85	2.54	4.62	-9.94	11.33
180	-32.00	36.20	0.00	0.00	-5.73	6.22	0.00	1.94	1.94	-10.00	11.31

M&D Professional Services, Inc
12/20/2006

AP-460-BES-BEC Footing Seismic.xls

Table 28 BES-BEC Soil/Concrete Tank Contact Forces, Gravity Only

Tank AP, 460 Inch Waste Level
SpG = 1.83
Best Estimate Soil
Best Estimate Concrete

											1.22	1.17
	Angle (rad)	Path	Max Pressure Soil (BES) AP Gravity (PSI)	Min Pressure Soil (BES) AP Gravity (PSI)	Max Meridional Friction Soil (BES) AP Gravity (PSI)	Max Tangential Friction Soil (BES) AP Gravity (PSI)	Max Contact Displacement Soil (BES) AP Gravity (PSI)	Vertical Pressure	Active Pressure Phi = 33 deg	Active Pressure Phi = 49 deg	0.22g Dome Vertical	0.17g Haunch Vertical
568	-0.035089	**67.727**	11.63	11.48	1.60	0.04	0.01	7.12	7.11	7.11	14.19	13.61
565.8	-0.07135	**105.668**	10.01	9.83	1.98	0.07	0.02	7.27	7.26	7.26	12.22	11.72
563.21	-0.096521	**137.069**	8.80	7.76	1.82	0.11	0.02	7.46	7.43	7.42	10.73	10.29
559.7	-0.124516	**182.849**	7.22	6.28	1.60	0.17	0.02	7.71	7.65	7.65	8.80	8.44
550.7	-0.180521	**226.563**	9.13	6.44	1.81	0.28	0.02	8.35	8.23	8.22	11.13	10.68
545.2	-0.210395	**275.566**	9.17	8.77	1.85	0.14	0.02	8.74	8.57	8.55	11.18	10.73
527.68	-0.298426	**325.690**	8.64	8.24	1.77	0.03	0.02	9.99	9.59	9.56	10.54	10.11
518.2	-0.34673	**372.305**	10.81	10.72	2.04	0.03	0.02	10.66	10.09	10.04	13.19	12.65
494.5	-0.482293	**423.427**	17.48	17.40	2.06	0.06	0.02	12.35	11.07	10.97	21.32	20.45
476.2	-0.606571	**468.308**	27.65	27.60	2.21	0.11	0.02	13.65	11.45	11.27	33.73	32.35
447.4	-0.656685	**515.312**	31.96	31.86	4.44	0.21	0.03	15.70	12.75	12.51	38.99	37.39
407.1	-0.710341	**549.725**	25.83	25.77	5.35	0.16	0.04	18.57	14.53	14.18	31.51	30.22
382.1	-1.570796	**585.819**	12.88	12.86	3.35	0.07	0.04	20.35	6.00	2.85	15.72	15.07
335	-1.570796	**636.369**	4.50	4.50	1.10	0.01	0.05	23.70	6.99	3.32	5.49	5.27
281	-1.570796	**685.619**	3.96	3.96	0.93	0.00	0.05	27.55	8.13	3.86	4.83	4.64
236.5	-1.570796	**732.719**	4.95	4.94	1.01	0.00	0.06	30.71	9.06	4.30	6.03	5.79
186.8	-1.570796	**778.219**	4.66	4.65	0.95	0.00	0.06	34.25	10.10	4.80	5.68	5.45
145.5	-1.570796	**821.369**	5.71	5.71	1.28	0.01	0.06	37.19	10.97	5.21	6.97	6.68
70	-1.570796	**874.169**	8.43	8.42	1.87	0.02	0.05	42.57	12.56	5.96	10.29	9.86
24	-1.570796	**930.544**	12.40	12.35	2.76	0.06	0.04	45.84	13.52	6.42	15.12	14.50

Table 29 BES-BEC Soil/Concrete Tank Contact Forces, Gravity Plus Seismic

Tank AP, 460 Inch Waste Level
SpG = 1.83
Best Estiamte Soil
Best Estimate Concrete

	Angle (rad)	Path	Max Pressure Soil (BES) AP Seismic (PSI)	Min Pressure Soil (BES) AP Seismic (PSI)	Max Meridional Friction Soil (BES) AP Seismic (PSI)	Max Tangential Friction Soil (BES) AP Seismic (PSI)	Max Contact Displacement Soil (BES) AP Seismic (inch)	Vertical Pressure	Active Pressure Phi = 33 deg	Active Pressure Phi = 49 deg
568	-0.035089	**67.727**	19.56	2.90	7.42	5.24	0.03	7.12	7.11	7.11
565.8	-0.07135	**105.668**	16.92	3.56	6.97	3.94	0.03	7.27	7.26	7.26
563.21	-0.096521	**137.069**	13.97	2.25	5.64	3.20	0.03	7.46	7.43	7.42
559.7	-0.124516	**182.849**	10.26	3.75	4.55	3.54	0.03	7.71	7.65	7.65
550.7	-0.180521	**226.563**	14.65	3.75	3.97	4.55	0.03	8.35	8.23	8.22
545.2	-0.210395	**275.566**	11.66	5.97	4.65	4.41	0.03	8.74	8.57	8.55
527.68	-0.298426	**325.690**	10.22	6.15	4.23	3.76	0.03	9.99	9.59	9.56
518.2	-0.34673	**372.305**	12.73	8.69	3.81	3.45	0.02	10.66	10.09	10.04
494.5	-0.482293	**423.427**	20.78	14.57	3.96	2.86	0.02	12.35	11.07	10.97
476.2	-0.606571	**468.308**	34.52	21.40	4.71	2.88	0.02	13.65	11.45	11.27
447.4	-0.656685	**515.312**	37.42	27.36	9.98	2.80	0.04	15.70	12.75	12.51
407.1	-0.710341	**549.725**	30.17	21.50	12.74	2.23	0.06	18.57	14.53	14.18
382.1	-1.570796	**585.819**	14.94	10.65	8.51	1.54	0.06	20.35	6.00	2.85
335	-1.570796	**636.369**	5.22	3.96	3.65	1.39	0.08	23.70	6.99	3.32
281	-1.570796	**685.619**	4.60	3.34	3.13	1.56	0.09	27.55	8.13	3.86
236.5	-1.570796	**732.719**	5.58	4.37	3.25	1.54	0.09	30.71	9.06	4.30
186.8	-1.570796	**778.219**	5.18	4.04	2.99	2.02	0.09	34.25	10.10	4.80
145.5	-1.570796	**821.369**	6.51	4.98	4.40	2.92	0.08	37.19	10.97	5.21
70	-1.570796	**874.169**	11.69	4.74	7.17	3.15	0.07	42.57	12.56	5.96
24	-1.570796	**930.544**	20.17	3.45	6.35	3.00	0.05	45.84	13.52	6.42

Table 30 BES-BEC Soil/Concrete Tank Contact Forces, Seismic Only

Tank AP, 460 Inch Waste Level
SpG = 1.83
Best Estiamte Soil
Best Estimate Concrete

	Angle (rad)	Path	Max Pressure Soil (BES) AP Seismic Only (PSI)	Min Pressure Soil (BES) AP Seismic Only (PSI)	Max Meridional Friction (BES) AP Seismic Only (PSI)	Max Tangential Friction (BES) AP Seismic Only (PSI)	Max Contact Displacment (BES) AP Seismic Only (inch)
568	-0.035089	**67.727**	7.92	-8.74	5.82	5.20	0.01
565.8	-0.07135	**105.668**	6.91	-6.45	4.99	3.88	0.01
563.21	-0.096521	**137.069**	5.17	-6.55	3.82	3.09	0.01
559.7	-0.124516	**182.849**	3.04	-3.46	2.94	3.37	0.01
550.7	-0.180521	**226.563**	5.53	-5.37	2.16	4.27	0.01
545.2	-0.210395	**275.566**	2.49	-3.20	2.80	4.27	0.01
527.68	-0.298426	**325.690**	1.58	-2.49	2.46	3.73	0.01
518.2	-0.34673	**372.305**	1.92	-2.13	1.77	3.42	0.01
494.5	-0.482293	**423.427**	3.30	-2.91	1.90	2.79	0.00
476.2	-0.606571	**468.308**	6.88	-6.25	2.51	2.77	0.01
447.4	-0.656685	**515.312**	5.47	-4.60	5.54	2.60	0.01
407.1	-0.710341	**549.725**	4.34	-4.33	7.40	2.07	0.02
382.1	-1.570796	**585.819**	2.06	-2.24	5.16	1.47	0.02
335	-1.570796	**636.369**	0.72	-0.54	2.55	1.38	0.03
281	-1.570796	**685.619**	0.64	-0.63	2.20	1.56	0.03
236.5	-1.570796	**732.719**	0.64	-0.58	2.24	1.53	0.03
186.8	-1.570796	**778.219**	0.52	-0.62	2.04	2.02	0.03
145.5	-1.570796	**821.369**	0.80	-0.73	3.12	2.91	0.03
70	-1.570796	**874.169**	3.26	-3.69	5.30	3.13	0.02
24	-1.570796	**930.544**	7.78	-8.95	3.60	2.95	0.01

Table 31 BES-BEC Primary Tank/Concrete Dome Contact Data, Gravity Only

Tank AP, 460 Inch Waste Level
SpG = 1.83
Best Estimate Soil
Best Estimate Concrete

Radius	Max Pressure Primary Tank/Concrete Tank Dome AP Gravity (PSI)	Min Pressure Primary Tank/Concrete Tank Dome AP Gravity (PSI)	Max Gap Lateral Displacement Primary Tank /Concrete Tank Dome Gravity (in)	Max Gap Displacement Primary Tank/Concete Tank Dome AP Gravity (Inches)
67.727	1.309	1.253	0.002350	0.000000
105.668	1.053	1.033	0.003487	0.000000
137.069	0.546	0.536	0.004021	0.000000
182.849	0.824	0.808	0.005198	0.000000
226.563	1.008	0.974	0.003052	-0.000042
275.566	0.473	0.465	0.003610	-0.000019
325.690	1.389	1.381	0.004608	-0.000159
372.305	0.334	0.332	0.011040	0.000000
423.427	0.006	0.001	0.005921	-1.055640

Table 32 BES-BEC Primary Tank/Concrete Dome Contact Data, Gravity Plus Seismic

Tank AP, 460 Inch Waste Level
SpG = 1.83
Best Estimate Soil
Best Estimate Concrete

Radius	Max Pressure Primary Tank/Concrete Tank Dome AP Seismic (PSI)	Min Pressure Primary Tank/Concrete Tank Dome AP Seismic (PSI)	Max Gap Lateral Displacement Primary Tank /Concrete Tank Dome Seismic (in)	Max Gap Displacement Primary Tank/Concete Tank Dome AP Seismic (Inches)
67.727	2.401	0.688	0.003448	0.000000
105.668	2.177	0.617	0.004670	-0.000005
137.069	1.891	0.210	0.005370	-0.000002
182.849	1.418	0.539	0.007001	0.000000
226.563	1.813	0.505	0.018036	-0.000094
275.566	1.035	0.233	0.011106	-0.000023
325.690	1.615	0.099	0.007702	-0.000628
372.305	1.688	0.000	0.013464	-0.001411
423.427	0.915	0.000	0.062760	-1.059000

Table 33 BES-BEC Primary Tank/Concrete Dome Contact Data, Seismic Only

Tank AP, 460 Inch Waste Level
SpG = 1.83
Best Estimate Soil
Best Estimate Concrete

Radius	Max Pressure Primary Tank/Concrete Tank Dome AP Seismic Only (PSI)	Min Pressure Primary Tank/Concrete Tank Dome AP Seismic Only (PSI)	Max Gap Lateral Displacement Primary Tank /Concrete Tank Dome Seismic Only (in)	Max Gap Displacement Primary Tank/Concete Tank Dome AP Seismic Only (Inches)
67.727	1.092	-0.565	0.001098	0.000000
105.668	1.124	-0.416	0.001183	-0.000005
137.069	1.345	-0.327	0.001349	-0.000002
182.849	0.594	-0.270	0.001802	0.000000
226.563	0.806	-0.470	0.014984	-0.000052
275.566	0.562	-0.232	0.007496	-0.000004
325.690	0.226	-1.282	0.003094	-0.000469
372.305	1.353	-0.332	0.002424	-0.001411
423.427	0.909	-0.001	0.056839	-0.003360

Table 34 BES-BEC Primary Tank/Insulating Concrete Contact Forces, Gravity Only

Tank AP, 460 Inch Waste Level
SpG = 1.83
Best Esitmate Soil
Best Estimate Concrete

Radius	Max Pressure Primary Tank/Insulating Concrete AP Gravity (PSI)	Min Pressure Primary Tank/Insulating Concrete AP Gravity (PSI)	Max Lateral Displacement Primary Tank / Insulating Concete AP Gravity (Inches)	Min Lateral Displacement Primary Tank / Insulating Concete AP Gravity (Inches)
424.00	72.708	72.639	0.008764	0.008744
384.00	13.465	13.451	0.000326	0.000267
317.85	33.285	33.250	0.002755	0.002741
248.10	29.729	29.701	0.002479	0.002467
199.25	30.750	30.722	0.001744	0.001735
154.95	30.479	30.451	0.000997	0.000990
112.80	30.444	30.417	0.000156	0.000150
65.85	30.979	30.917	0.000304	0.000291

Table 35 BES-BEC Primary Tank/ Insulating Concrete Contact Data, Gravity Plus Seismic

Tank AP, 460 Inch Waste Level
SpG = 1.83
Best Estimate Soil
Best Estimate Concrete

Radius	Max Pressure Primary Tank/Insulaiting Concrete AP Seismic (PSI)	Min Pressure Primary Tank/Insulaiting Concrete AP Seismic (PSI)	Max Lateral Displacement Primary Tank/Insulaiting Concrete AP Seismic (Inches)	Min Lateral Displacement Primary Tank/Insulaiting Concrete AP Seismic (Inches)
424.00	98.681	39.125	0.062712	0.004598
384.00	24.521	7.299	0.306360	0.000106
317.85	43.042	23.340	0.038640	0.000744
248.10	37.042	21.035	0.020028	0.000514
199.25	38.014	22.083	0.010837	0.000289
154.95	36.465	22.764	0.006524	0.000288
112.80	36.056	24.014	0.004350	0.000037
65.85	36.465	24.431	0.003374	0.000234

Table 36 BES-BEC Primary Tank/ Insulating Concrete Contact Forces, Seismic Only

Tank AP, 460 Inch Waste Level
SpG = 1.83
Best Estimate Soil
Best Estimate Concrete

Radius	Max Pressure Primary Tank/Insulaiting Concrete AP Seismic Only (PSI)	Min Pressure Primary Tank/Insulaiting Concrete AP Seismic Only (PSI)	Max Lateral Displacement Primary Tank/Insulaiting Concrete AP Seismic Only (Inches)	Min Lateral Displacement Primary Tank/Insulaiting Concrete AP Seismic Only (Inches)
424.00	25.972	-33.514	0.054	-0.004
384.00	11.056	-6.153	0.306	0.000
317.85	9.757	-9.910	0.036	-0.002
248.10	7.313	-8.667	0.018	-0.002
199.25	7.264	-8.639	0.009	-0.001
154.95	5.986	-7.688	0.006	-0.001
112.80	5.611	-6.403	0.004	0.000
65.85	5.486	-6.486	0.003	0.000

Table 37 BES-BEC Insulating Concrete/Concrete Backed Steel Contact Data, Gravity Only

Tank AP, 460 Inch Waste Level
SpG = 1.83
Best Esitmate Soil
Best Estimate Concrete

Radius	Max Pressure Insulating Concrete/Secondary Liner AP Gravity (PSI)	Min Pressure Insulating Concrete/Secondary Liner AP Gravity (PSI)	Max Lateral Displacement Insulating Concrete/Secondary Liner AP Gravity (Inches)	Min Lateral Displacement Insulating Concrete/Secondary Liner AP Gravity (Inches)
424.00	86.458	86.250	0.003563	0.003527
384.00	33.854	33.785	0.002846	0.002810
317.85	27.736	27.701	0.002029	0.001997
248.10	31.500	31.472	0.001470	0.001445
199.25	30.931	30.896	0.000920	0.000905
154.95	30.576	30.542	0.000659	0.000651
112.80	31.215	31.146	0.000489	0.000487
65.85	30.597	30.410	0.000165	0.000160

Table 38 BES-BEC Insulating Concrete/Concrete Backed Steel Contact Data, Gravity Plus Seismic

Tank AP, 460 Inch Waste Level
SpG = 1.83
Best Estimate Soil
Best Estimate Concrete

Radius	Max Pressure Insulating Concrete/Secondary Liner AP Seismic (PSI)	Min Pressure Insulating Concrete/Secondary Liner AP Seismic (PSI)	Max Lateral Displacement Insulating Concrete/Secondary Liner AP Seismic (Inches)	Min Lateral Displacement Insulating Concrete/Secondary Liner AP Seismic (Inches)
424.00	99.444	71.944	0.017964	0.000158
384.00	42.083	24.590	0.016872	0.000273
317.85	35.910	17.715	0.015096	0.000084
248.10	39.340	22.556	0.014532	0.000060
199.25	38.076	22.181	0.012588	0.000027
154.95	36.625	22.806	0.010172	0.000031
112.80	36.896	24.556	0.008530	0.000037
65.85	35.951	24.250	0.007418	0.000060

Table 39 BES-BEC Insulating Concrete/Concrete Backed Steel Contact Data, Seismic Only

Tank AP, 460 Inch Waste Level
SpG = 1.83
Best Estimate Soil
Best Estimate Concrete

Radius	Max Pressure Insulating Concrete/Secondary Liner AP Seismic Only (PSI)	Min Pressure Insulating Concrete/Secondary Liner AP Seismic Only (PSI)	Max Lateral Displacement Insulating Concrete/Secondary Liner AP Seismic Only (Inches)	Min Lateral Displacement Insulating Concrete/Secondary Liner AP Seismic Only (Inches)
424.00	12.986	-14.306	0.014	-0.003
384.00	8.229	-9.194	0.014	-0.003
317.85	8.174	-9.986	0.013	-0.002
246.10	7.840	-8.917	0.013	-0.001
199.25	7.146	-8.715	0.012	-0.001
154.95	6.049	-7.736	0.010	-0.001
112.80	5.681	-6.590	0.008	0.000
65.85	5.354	-6.160	0.007	0.000

Table 40 BES-BEC Waste Contact Pressure, Gravity Plus Seismic

Tank AY, 460 Inch Waste Level
SpG = 1.83
Best Estimate Soil
Best Estimate Concrete

Waste Height Ratio	Waste Height	Max Pressure AP Tank, 460 in Waste Level, SpG = 1.83 Time History (PSI)	Min Pressure AP Tank, 460 in Waste Level, SpG = 1.83 Time History (PSI)	Hydrostatic (psi)	Hydrodynamic (psi)	Theoretical Min (SRSS)	Theoretical Max (SRSS)
0.99	454.35	9.264	-8.222	0.37	1.74	0.00	2.12
0.96	443.05	13.104	-11.611	1.12	1.92	0.00	3.04
0.94	431.7625	14.535	-10.382	1.87	2.17	0.00	4.04
0.90	414.125	12.028	-7.035	3.03	2.63	0.40	5.66
0.85	390.125	9.514	-0.906	4.62	3.30	1.32	7.91
0.80	366.125	11.271	0.116	6.20	3.94	2.26	10.15
0.74	342	13.979	0.463	7.80	4.56	3.23	12.36
0.69	318.325	16.167	1.108	9.36	5.13	4.23	14.49
0.64	295.225	18.438	1.572	10.89	5.65	5.24	16.54
0.59	272.125	20.757	2.526	12.41	6.13	6.29	18.54
0.54	248.975	22.771	3.436	13.94	6.57	7.37	20.52
0.49	225.825	25.306	4.401	15.47	6.98	8.49	22.45
0.44	202.725	26.910	5.671	17.00	7.35	9.65	24.35
0.39	179.625	28.771	7.035	18.53	7.68	10.85	26.20
0.34	156.475	31.257	8.424	20.06	7.97	12.09	28.02
0.29	134.075	32.653	9.958	21.54	8.21	13.32	29.75
0.24	112.475	33.715	11.424	22.96	8.42	14.55	31.38
0.20	90.875	34.958	12.993	24.39	8.58	15.81	32.97
0.15	69.275	37.014	14.299	25.82	8.72	17.10	34.53
0.10	47.738	37.903	16.264	27.24	8.81	18.43	36.05
0.05	24.500	41.528	16.674	28.78	8.88	19.90	37.65
0.02	7.755	46.472	24.743	29.88	8.90	20.98	38.78
0.00	1.755	40.597	25.056	30.28	8.90	21.38	39.18

Table 41 BES-BEC Waste Contact Pressure, Theoretical Pressures

Tank Radius, Hr	450	Hl/Hr	1.022222222		Waste Dens	1.71E-04				
Waste Depth, Hl	460	Conv 1st	Conv 2nd	Conv 3rd	Impul H	Pressure				
		Conv 1st	Conv 2nd	Conv 3rd		Conv 1st	Conv 2nd	Conv 3rd	Impul H	Impul V
Centroid	Lamda	1.841	5.331	8.536	Sa=	0.064	0.108	0.163	0.28	0.26

Height	nu	con0(n)	con1(n)	con2(n)	ci(n)	24.7296	41.7312	62.9832	108.19	100.46	SRSS
454.35	0.99	0.82	0.07	0.03	0.09	1.56	0.22	0.12	0.73	0.12	1.74
443.05	0.96	0.78	0.06	0.02	0.14	1.49	0.19	0.10	1.14	0.37	1.92
431.7625	0.94	0.75	0.05	0.02	0.18	1.43	0.17	0.08	1.51	0.61	2.17
414.125	0.90	0.70	0.04	0.01	0.24	1.33	0.14	0.06	2.04	0.99	2.63
390.125	0.85	0.64	0.03	0.01	0.32	1.22	0.10	0.04	2.67	1.49	3.30
366.125	0.80	0.59	0.02	0.00	0.39	1.11	0.08	0.02	3.22	1.99	3.94
342	0.74	0.54	0.02	0.00	0.44	1.02	0.06	0.01	3.69	2.48	4.56
318.325	0.69	0.49	0.01	0.00	0.49	0.94	0.04	0.01	4.10	2.94	5.13
295.225	0.64	0.45	0.01	0.00	0.53	0.86	0.03	0.01	4.45	3.37	5.65
272.125	0.59	0.42	0.01	0.00	0.57	0.80	0.03	0.00	4.75	3.78	6.13
248.975	0.54	0.39	0.01	0.00	0.60	0.74	0.02	0.00	5.02	4.17	6.57
225.825	0.49	0.36	0.00	0.00	0.63	0.69	0.01	0.00	5.26	4.53	6.98
202.725	0.44	0.34	0.00	0.00	0.66	0.65	0.01	0.00	5.46	4.87	7.35
179.625	0.39	0.32	0.00	0.00	0.68	0.61	0.01	0.00	5.64	5.17	7.68
156.475	0.34	0.30	0.00	0.00	0.70	0.57	0.01	0.00	5.79	5.44	7.97
134.075	0.29	0.29	0.00	0.00	0.71	0.55	0.01	0.00	5.92	5.67	8.21
112.475	0.24	0.28	0.00	0.00	0.72	0.53	0.00	0.00	6.02	5.86	8.42
90.875	0.20	0.27	0.00	0.00	0.73	0.51	0.00	0.00	6.10	6.02	8.58
69.275	0.15	0.26	0.00	0.00	0.74	0.49	0.00	0.00	6.16	6.15	8.72
47.7375	0.10	0.25	0.00	0.00	0.75	0.48	0.00	0.00	6.20	6.24	8.81
24.5	0.05	0.25	0.00	0.00	0.75	0.48	0.00	0.00	6.23	6.30	8.88
7.755	0.02	0.25	0.00	0.00	0.75	0.47	0.00	0.00	6.24	6.32	8.90
1.755	0.00	0.25	0.00	0.00	0.75	0.47	0.00	0.00	6.25	6.32	8.90

Table 42 BES-BEC Waste Surface Displacement, Gravity Plus Seismic

Tank AP, 460 Inch Waste Level
SpG = 1.83
Best Estimate Soil
Best Estimate Concrete

Waste Radius	Max Vertical Displacement AP-460-BES-BEC Time History (in)	Min Vertical Displacement AP-460-BES-BEC Time History (in)
95.7	6.60	-11.66
129.9	7.52	-10.69
180	8.07	-12.12
218.5	7.39	-13.09
277.7	8.11	-13.20
358	8.58	-13.24
410	7.09	-12.43
450	5.02	-9.41

Near-Soil-1.txt

```
et,8,solid45                              !
Use Element SOLID45 for Near Soil
Elements
/input,soil-prop-Mean-geo,txt             !
Read Soil Properties

ksel,u,kp,,1,kmaxjb                       !
Unselect existing Keypoints
asel,u,area,,1,amaxjb                     !
Unselect existing Area
lsel,u,line,,1,lmaxjb                     !
Unselect existing Lines
vsel,u,volu,,1,vmaxw                      !
Unselect existing Volumes

/COM - Create Keypoints to match concrete
tank profile
*do,i,1,bm_kp
k,kmaxjb+i,ctx(i),0,ctz(i)
*enddo

/COM - Create Keypoints above top of tank
k,kmaxjb+bm_kp+1,0,0,0          ! Keypoint
at origin (surface)
k,kmaxjb+bm_kp+2,0,0,soilz(2) ! Keypoint
at to divide soil above tank
*get,KMAXtemp1,KP,0,num,max   ! Get
maximum keypoint number for counter

/COM - Create Keypoints at outside of
excavated soil
*do,i,1,tanksoil
k,kmaxtemp1+i,soilx(i),0,soilz(i)
*enddo
*get,KMAXtemp2,KP,0,num,max
        ! Get maximum keypoint number for
counter

/COM - Create additional keypoint in soil
above tank
k,kmaxtemp2+1,ctx(2),0,soilz(1)
k,kmaxtemp2+2,ctx(9),0,soilz(1)
k,kmaxtemp2+3,ctx(12),0,soilz(1)
k,kmaxtemp2+4,ctx(2),0,soilz(2)
k,kmaxtemp2+5,ctx(9),0,soilz(2)
k,kmaxtemp2+6,ctx(12),0,soilz(2)
k,kmaxtemp2+7,ctx(12),0,soilz(3)
k,kmaxtemp2+8,ctx(bm_kp+1),0,ctz(bm_kp+1)

a,kmaxtemp2+1,kmaxtemp2+2,kmaxtemp2+5,kma
xtemp2+4
a,kmaxtemp2+2,kmaxtemp2+3,kmaxtemp2+6,kma
xtemp2+5
a,kmaxtemp2+3,kmaxtemp1+1,kmaxtemp1+2,kma
xtemp2+6
a,kmaxtemp2+4,kmaxtemp2+5,kmaxjb+9,kmaxjb
+8,kmaxjb+7,kmaxjb+6,kmaxjb+5,kmaxjb+4,km
axjb+3,kmaxjb+2!a,740,741,712,711,710,709
,708,707,706,705
a,kmaxtemp2+5,kmaxtemp2+6,kmaxtemp2+7,kma
xjb+12,kmaxjb+11,kmaxjb+10,kmaxjb+9
a,kmaxtemp2+6,kmaxtemp1+2,kmaxtemp1+3,kma
xtemp2+7
a,kmaxtemp2+7,kmaxtemp1+3,kmaxtemp1+4,kma
xjb+12
a,kmaxjb+12,kmaxtemp1+4,kmaxtemp1+5,kmaxj
b+14,kmaxjb+13
a,kmaxjb+14,kmaxtemp1+5,kmaxtemp1+6,kmaxj
b+16,kmaxjb+15
a,kmaxjb+16,kmaxtemp1+6,kmaxtemp1+7,kmaxj
b+18,kmaxjb+17
a,kmaxjb+18,kmaxtemp1+7,kmaxtemp1+8,kmaxj
b+20,kmaxjb+19
a,kmaxjb+20,kmaxtemp1+8,kmaxtemp1+9,kmaxt
emp2+8,kmaxjb+22,kmaxjb+21

cm,top-soil-area,area
lsla
cm,top-soil,line
type,1
real,1


/COM - Define line divisions to control
meshing
lsel,s,loc,z,soilz(1),soilz(2)
lsel,r,loc,x,ctx(3),ctx(8)
lesize,all,,,14                          !
soil above tank top, match tank meshing
lsel,s,loc,z,soilz(1),soilz(2)
lsel,r,loc,x,ctx(10),ctx(11)
lesize,all,,,3                     ! soil
above tank top, match tank meshing
cmsel,s,top-soil                   ! Reselect
lines in near soil
lsel,r,loc,x,ctx(2)
lesize,all,,,2                     ! Control
vertical element size, above tank
cmsel,s,top-soil
lsel,s,loc,x,ctx(9)
lesize,all,,,2                     ! Control
vertical element size, above tank
cmsel,s,top-soil
lsel,r,loc,x,ctx(12)
lesize,all,,,2                     ! Control
vertical element size, above tank
cmsel,s,top-soil
lsel,r,loc,z,ctz(2),ctz(12)
lsel,r,loc,x,ctx(2),ctx(12)
lesize,all,,,1                     ! Control
vertical element size, outside excavation
mesh
lsel,s,line,,lmaxjb+8,lmaxjb+10,2
lsel,a,line,,lmaxjb+26,lmaxjb+28,2
lsel,a,line,,lmaxjb+30,lmaxjb+38,4
lesize,all,,,9
lsel,s,line,,lmaxjb+42,lmaxjb+42,4
lesize,all,,,7                     ! Control
horizontal meshing in soil
lsel,s,line,,lmaxjb+9
lsel,a,line,,lmaxjb+25,lmaxjb+27,2
lsel,a,line,,lmaxjb+29,lmaxjb+45,4
lesize,all,,,1                     ! Control
horizontal meshing in soil
lsel,s,line,,lmaxjb+6
lsel,a,line,,lmaxjb+20,lmaxjb+21
lsel,a,line,,lmaxjb+32,lmaxjb+44,4
lsel,a,line,,lmaxjb+31,lmaxjb+43,4
lsel,a,line,,lmaxjb+47,lmaxjb+49
lesize,all,,,1                     ! Control
meshing to match tank
lsel,s,line,,lmaxjb+46
```

```
lesize,all,,,4                    ! Control
mesh size at bottom of excavated soil

cmsel,s,top-soil-area

amesh,all                         ! Mesh area
to develop pattern for volume meshing

type,8
ksel,a,kp,,1                      ! Select
Keypoint for rotation axis
ksel,a,kp,,ct_kps                 ! Select
Keypoint for rotation axis
vrotat,all,,,,,,1,ct_kps,180,2        !
Generate Volumes for excavated soil
lsla
lsel,r,loc,x,ctx(2)
lesize,all,,arcsize               ! Define
meshing for slices
lsla
lsel,r,loc,x,ctx(9)
lesize,all,,arcsize               ! Define
meshing for slices
lsla
lsel,r,loc,x,ctx(12)
lesize,all,,arcsize               ! Define
meshing for slices
vsweep,all                        ! Sweep
pattern into volume
aclear,all                        ! Delete
elements used for sweep
cm,top-soil-vol,volu

*get,VMAXtemp,VOLU,0,num,max
/COM - Generate element above top center
of tank
asel,u,area,,all
vsel,u,volu,,all
a,kmaxjb+bm_kp+1,kmaxtemp2+1,kmaxtemp2+4,
kmaxjb+bm_kp+2
a,kmaxjb+bm_kp+2,kmaxtemp2+4,kmaxjb+2,kma
xjb+1
vrotat,all,,,,,,1,ct_kps,180,2
vsel,s,volu,,vmaxtemp+1,vmaxtemp+3,2
vatt,801,,8                           !
Assign material properties
vsel,s,volu,,vmaxtemp+2,vmaxtemp+4,2
vatt,802,,8                           !
Assign material properties
vsel,s,volu,,vmaxtemp+1,vmaxtemp+4
allsel
asel,s,loc,z,ctz(1),ctz(2)
type,1
asel,r,loc,x,0,4
asel,r,loc,z,ctz(1),ctz(2)
cmsel,u,conc-tank-a
*get,atemp,area,,num,max
*get,atemp1,area,,num,min
asel,a,area,,1,22,21
mshcopy,2,1,atemp1                ! copy mesh
top match top of concrete tank
mshcopy,2,22,atemp                ! copy mesh
top match top of concrete tank
asel,u,area,,1,22,21
vsel,s,volu,,vmaxtemp+1,vmaxtemp+4
vsweep,all                            !
Generate elements by sweeping area
aclear,atemp
aclear,atemp1
```

```
/COM - Assign soil properties by layer
*do,i,1,tanksoil-1
cmsel,s,top-soil-vol
vsel,r,loc,z,soilz(i),soilz(i+1)
eslv
emodif,all,mat,800+i
esys,0
*enddo

cmsel,s,top-soil-vol
vsel,a,loc,z,soilz(1),ctz(2)
eslv
cm,excav-soil,elem
nsle
nummrg,node

/COM - Define component for excavated
soil - tank walls only
cmsel,s,excav-soil
nsle,s,1
nsel,r,loc,z,soilz(5),soilz(9)
esln,r,1
cm,excav-wall,elem


/COM - Define component for excavated
soil - tank dome only
cmsel,s,excav-soil
cmsel,u,excav-wall
cm,excav-dome,elem

csys,1
cmsel,s,excav-wall
nsle
nsel,r,loc,x,ctx(14)
cm,excav-wall-n,node

esel,s,type,,8
nsle
nsel,s,loc,x,soilx(1)
nsel,r,loc,z,soilz(1)
cm,near-soil-face-node,node
*do,i,2,9
esel,s,type,,8
nsle
nsel,r,loc,x,soilx(i)
nsel,r,loc,z,soilz(i)
cmsel,a,near-soil-face-node
cm,near-soil-face-node,node
*enddo

esel,s,type,,8
nsle
nsel,r,loc,z,soilz(9)
nsel,r,loc,x,41,68
cm,near-soil-bot-node,node


allsel
*get,KMAXns,KP,0,num,max        ! Get
maximum Keypoint number
*get,LMAXns,LINE,0,num,max      ! Get
maximum line number
*get,AMAXns,AREA,0,num,max      ! Get
maximum Area number
*get,VMAXns,volu,0,num,max      ! Get
maximum Volume number
```

Run-Tank.txt

```
!/batch
! PNNL DST Seismic Analysis, Gravity
Inputs, Best Est Soil, Best Est Concrete
Properties, AP Primary Tank Geometry,
Dome Friction=0.0
!
fini
/clear
/filname,AP-460-BES-BEC-Seismic,1
/config,nres,3000              ! Increase
allowable number of results to 3000
/config,nproc,2                          !
Activate 2 processers for solution
/config,fsplit,1024            ! Split
binary file at 4.2GB
/prep7
g=32.2                         ! Gravity
(ft/sec)

DF=40                          ! Factor
for beta (stiffness) damping
ALPHA=0.4                      ! Alpha
damping

/out,tank-out,out
/sys,"X:\07.00 - Quality Assurance\ANSYS
QA\usrcfg.bat" > QA.out
/out,QA,out,,append
/input,tank-coordinates-AP,txt         !
Run file defining tank coordinates
(concrete and primary)
/input,tank-props-bec-250,txt ! Run file
defining fully cracked concrete
properties (PNNL Concrete Properties)
/input,tank-mesh1,txt          ! Develop
concrete tank
/input,primary-props-AP,txt    ! Run file
defining AP Primary tank properties
/input,primary,txt             ! Develop
Primary tank
/input,insulate,txt            ! Develop
insulating concrete model
/input,liner,txt               ! Develop
Liner model
/input,waste-solid-AP-s,txt    ! Develop
waste model
/input,bolts-friction,txt      ! Develop
J-Bolt model
/input,near-soil-1,txt         ! Develop
excavated soil model
/input,far-soil,txt            ! Develop
Far-Field soil model
/input,interface1,txt          ! Develop
Soil and Concrete Interfaces
/input,interface-gap1,txt      ! Develop
Primary Tank Interfaces
/input,slave,txt               ! Develop
slaved boundary conditions
/input,boundary,txt            ! Place
base and symmetry boundary conditions
/input,outer-spar,txt          ! Connect
soil model to symmetry plane
/input,live_load,txt           ! Apply
live load over a 10ft radius over dome
center
/input,fix-soil,txt
/out
ALLSEL

/out,Tank-th,out

save

/input,solve-TH-BES,txt              !
Run solution Phase

/input,post-tank,txt

/out
/exit
```

Soil-Prop-Mean-Geo.txt

```
Tanksoil=9
deepsoil=20
soil_radius=320
mass=1e8

*dim,soilx,,30
*dim,soilz,,30


soilz(1)=0
soilz(2)=-5
soilz(3)=ctz(9)
soilz(4)=ctz(12)
soilz(5)=ctz(14)
soilz(6)=ctz(16)
soilz(7)=ctz(18)
soilz(8)=ctz(20)
soilz(9)=ctz(23)
soilz(10)=-73.5
soilz(11)=-90.5
soilz(12)=-106.5
soilz(13)=-123.5
soilz(14)=-139.5
soilz(15)=-156
soilz(16)=-178
soilz(17)=-200
soilz(18)=-222
soilz(19)=-244
soilz(20)=-266

soilx(9)=68
soilx(8)=soilx(9)-(soilz(9)-soilz(8))/1.5
soilx(7)=soilx(9)-(soilz(9)-soilz(7))/1.5
soilx(6)=soilx(9)-(soilz(9)-soilz(6))/1.5
soilx(5)=soilx(9)-(soilz(9)-soilz(5))/1.5
soilx(4)=soilx(9)-(soilz(9)-soilz(4))/1.5
soilx(3)=soilx(9)-(soilz(9)-soilz(3))/1.5
soilx(2)=soilx(9)-(soilz(9)-soilz(2))/1.5
soilx(1)=soilx(9)-(soilz(9)-soilz(1))/1.5


/COM Excavated Soil Properties
mp,ex,801,18*144
mp,nuxy,801,0.27
mp,dens,801,125/(1000*g)
mp,damp,801,0.017/df

/COM - Material 802, Soil
mp,ex,802,22.5*144
mp,nuxy,802,0.27
mp,dens,802,125/(1000*g)
mp,damp,802,0.027/df
```

```
/COM - Material 803, Soil
mp,ex,803,29.25*144
mp,nuxy,803,0.27
mp,dens,803,125/(1000*g)
mp,damp,803,0.039/df

/COM - Material 804, Soil
mp,ex,804,36*144
mp,nuxy,804,0.27
mp,dens,804,125/(1000*g)
mp,damp,804,0.031/df

/COM - Material 805, Soil
mp,ex,805,42*144
mp,nuxy,805,0.27
mp,dens,805,125/(1000*g)
mp,damp,805,0.035/df

/COM - Material 806, Soil
mp,ex,806,48.75*144
mp,nuxy,806,0.27
mp,dens,806,125/(1000*g)
mp,damp,806,0.042/df

/COM - Material 807, Soil
mp,ex,807,55.5*144
mp,nuxy,807,0.27
mp,dens,807,125/(1000*g)
mp,damp,807,0.047/df

/COM - Material 808, Soil
mp,ex,808,60*144
mp,nuxy,808,0.27
mp,dens,808,125/(1000*g)
mp,damp,808,0.037/df

/COM - Material 810, Soil
mp,ex,810,250
mp,nuxy,810,0.27
mp,dens,810,125/(1000*g)
mp,damp,810,0.037/df


/COM - Material Definitions
/COM - Material 811, Soil     (Top Layer)
mp,ex,811,9958
mp,nuxy,811,0.27
mp,dens,811,125/(1000*g)
mp,damp,811,0.019/df

/COM - Material 812, Soil
mp,ex,812,8797
mp,nuxy,812,0.27
mp,dens,812,125/(1000*g)
mp,damp,812,0.035/df

/COM - Material 813, Soil
mp,ex,813,7845
mp,nuxy,813,0.27
mp,dens,813,125/(1000*g)
mp,damp,813,0.048/df

/COM - Material 814, Soil
mp,ex,814,8209
mp,nuxy,814,0.27
mp,dens,814,125/(1000*g)
mp,damp,814,0.039/df

/COM - Material 815, Soil
mp,ex,815,7634
mp,nuxy,815,0.27
mp,dens,815,125/(1000*g)
mp,damp,815,0.048/df

/COM - Material 816, Soil
mp,ex,816,7188
mp,nuxy,816,0.27
mp,dens,816,125/(1000*g)
mp,damp,816,0.055/df

/COM - Material 817, Soil
mp,ex,817,6933
mp,nuxy,817,0.27
mp,dens,817,125/(1000*g)
mp,damp,817,0.059/df

/COM - Material 818, Soil
mp,ex,818,7667
mp,nuxy,818,0.27
mp,dens,818,125/(1000*g)
mp,damp,818,0.045/df


/COM - Mean Soil Properties Geomatrix
Soil Data
/COM - 19 Layer Mode
/COM - Material Definitions

/COM - Material 901, Soil     (Top Layer)
mp,ex,901,16423
mp,nuxy,901,0.24
mp,dens,901,110/(1000*g)
mp,damp,901,0.017/df

/COM - Material 902, Soil
mp,ex,902,15479
mp,nuxy,902,0.24
mp,dens,902,110/(1000*g)
mp,damp,902,0.025/df

/COM - Material 903, Soil
mp,ex,903,14481
mp,nuxy,903,0.24
mp,dens,903,110/(1000*g)
mp,damp,903,0.034/df

/COM - Material 904, Soil
mp,ex,904,14707
mp,nuxy,904,0.24
mp,dens,904,110/(1000*g)
mp,damp,904,0.028/df

/COM - Material 905, Soil
mp,ex,905,13625
mp,nuxy,905,0.19
mp,dens,905,110/(1000*g)
mp,damp,905,0.032/df

/COM - Material 906, Soil
mp,ex,906,15456
mp,nuxy,906,0.19
mp,dens,906,110/(1000*g)
mp,damp,906,0.033/df

/COM - Material 907, Soil
mp,ex,907,17532
mp,nuxy,907,0.19
mp,dens,907,110/(1000*g)
mp,damp,907,0.033/df
```

```
/COM - Material 908, Soil
mp,ex,908,20972
mp,nuxy,908,0.19
mp,dens,908,110/(1000*g)
mp,damp,908,0.025/df

/COM - Material 909, Soil
mp,ex,909,23447
mp,nuxy,909,0.19
mp,dens,909,110/(1000*g)
mp,damp,909,0.026/df

/COM - Material 910, Soil
mp,ex,910,23138
mp,nuxy,910,0.19
mp,dens,910,110/(1000*g)
mp,damp,910,0.027/df

/COM - Material 911, Soil
mp,ex,911,22753
mp,nuxy,911,0.19
mp,dens,911,110/(1000*g)
mp,damp,911,0.029/df

/COM - Material 912, Soil
mp,ex,912,22069
mp,nuxy,912,0.19
mp,dens,912,110/(1000*g)
mp,damp,912,0.033/df

/COM - Material 913, Soil
mp,ex,913,25780
mp,nuxy,913,0.19
mp,dens,913,110/(1000*g)
mp,damp,913,0.025/df

/COM - Material 914, Soil
mp,ex,914,25333
mp,nuxy,914,0.19
mp,dens,914,110/(1000*g)
mp,damp,914,0.027/df

/COM - Material 915, Soil
mp,ex,915,35501
mp,nuxy,915,0.28
mp,dens,915,120/(1000*g)
mp,damp,915,0.022/df

/COM - Material 916, Soil
mp,ex,916,39465
mp,nuxy,916,0.28
mp,dens,916,120/(1000*g)
mp,damp,916,0.021/df

/COM - Material 917, Soil
mp,ex,917,38565
mp,nuxy,917,0.28
mp,dens,917,120/(1000*g)
mp,damp,917,0.023/df

/COM - Material 918, Soil
mp,ex,918,37715
mp,nuxy,918,0.28
mp,dens,918,120/(1000*g)
mp,damp,918,0.025/df

/COM - Material 919, Soil
mp,ex,919,41496
mp,nuxy,919,0.28
mp,dens,919,120/(1000*g)
mp,damp,919,0.024/df
```

Solve-Gravity-LBS.txt

```
/prep7
massm_z=148414.59
d,master_node,all
allsel

cmsel,s,excav-soil
nsle
csys,0
nsel,r,loc,x,-ctx(6)-1,ctx(6)+1
nsel,r,loc,y,0,-ctx(6)-1
esln,r,1
mpchg,810,all

cmsel,s,excav-soil
nsle
csys,1
nsel,r,loc,x,ctx(11)-1,ctx(13)+1
nsel,r,loc,z,soilz(1),soilz(3)-1
esln,r,1
mpchg,810,all

*do,i,801,808
esel,s,mat,,i
mpchg,i+10,all
*enddo
allsel

/out,AP-460-BEC-BES-Gravity,out
/solu
antype,trans
TRNOPT,FULL
lumpm,OFF
!nlgeom,on
NROPT,auto
NTIM=10 !NUMBER OF TIME STEPS
DT=0.01
TIM=1e-06
autots,on
KBC,on
TIMINT,ON,STRU
solcontrol,ON,off,,
ncnv,0,200
LNSRCH,OFF
PRED,on,,on

/COM - Time File

/COM - Dimension Horizontal Input
*DIM,A_1_x,,2148
*DIM,A_1_Z,,2148

*VREAD,A_1_x(1),th-266-Mean-geo,txt
(8(F9.6))
*VREAD,A_1_Z(1),th-266-Mean-geo-v,txt
(8(F9.6))

/Title,Load Case: AP-460-BES-BEC, Full
Non-linear, Dome Contact Friction = 0.0,
Gravity
OUTPR,all,NONE,
OUTRES, ALL,NONE,
OUTRES,RSOL,last
OUTRES,NSOL,last
OUTRES,ESOL,last,conc-tank
OUTRES,esol,last,Primary-tank
```

```
OUTRES,ESOL,last,J_bolts
OUTRES,Epel,last,liner
outres,esol,last,wall-int-gap
outres,esol,last,conc-excav-wall-gap
outres,esol,last,conc-excav-dome-gap
!outres,strs,last,excav-soil
!outres,strs,last,bottom-soil
outres,esol,last,bolt-friction
outres,esol,last,waste-surf
outres,strs,last,insul-conc
outres,esol,last,primary-int-gap
outres,esol,last,conc-liner-gap
outres,esol,last,far-soil-contact
!outres,esol,last,soil-contact-foot-elem

alphad,alpha
NSUBST,20,200,5,ON
TIME,100
TIMINT,off
acel,0,0,g
SOLVE
SAVE
TIMINT,on
ITIM=1
DS=TIM
NSUBST,1,20,1,ON

!ddele,master_node,ux
!ddele,master_node,uz

esel,s,type,,61,63,2
mpchg,64,all

esel,s,type,,91,93,2
mpchg,92,all

allsel

*DO,ITIM,1,NTIM,1

TIM=DT*ITIM

TIME,TIM+100

!F,master_node,FX,A_1_X(itim)*mass*g
!F,master_node,Fz,(A_1_Z(itim)+1)*(mass+m
assm_z)*g

SOLVE
SAVE
*ENDDO
FINISH
/out
```

Solve-TH-BES

```
/prep7
massm_z=148414.59
d,master_node,all
allsel

cmsel,s,excav-soil
nsle
csys,0
nsel,r,loc,x,-ctx(6)-1,ctx(6)+1
nsel,r,loc,y,0,-ctx(6)-1
esln,r,1
mpchg,810,all

cmsel,s,excav-soil
nsle
csys,1
nsel,r,loc,x,ctx(11)-1,ctx(13)+1
nsel,r,loc,z,soilz(1),soilz(3)-1
esln,r,1
mpchg,810,all

*do,i,801,808
esel,s,mat,,i
mpchg,i+10,all
*enddo
allsel

/out,AP-460-BEC-BES-Seismic,out
/solu
antype,trans
TRNOPT,FULL
lumpm,OFF
!nlgeom,on
NROPT,auto
NTIM=2148      !NUMBER OF TIME STEPS
DT=0.01
TIM=1e-06
autots,on
KBC,on
TIMINT,ON,STRU
solcontrol,ON,off,,
ncnv,0,200
LNSRCH,OFF
PRED,on,,on

/COM - Time File

/COM - Dimension Horizontal Input
*DIM,A_1_x,,2148
*DIM,A_1_Z,,2148

*VREAD,A_1_x(1),th-266-Mean-geo,txt
(8(F9.6))
*VREAD,A_1_Z(1),th-266-Mean-geo-v,txt
(8(F9.6))

/Title,Load Case: AP-460-BES-BEC, Full
Non-linear, Dome Contact Friction = 0.0
OUTPR,all,NONE,
OUTRES, ALL,NONE,
OUTRES,RSOL,last
OUTRES,NSOL,last
OUTRES,ESOL,last,conc-tank
OUTRES,esol,last,Primary-tank
OUTRES,ESOL,last,J_bolts
OUTRES,Epel,last,liner
outres,esol,last,wall-int-gap
outres,esol,last,conc-excav-wall-gap
outres,esol,last,conc-excav-dome-gap
!outres,strs,last,excav-soil
!outres,strs,last,bottom-soil
outres,esol,last,bolt-friction
outres,esol,last,waste-surf
outres,strs,last,insul-conc
outres,esol,last,primary-int-gap
outres,esol,last,conc-liner-gap
outres,esol,last,far-soil-contact
!outres,esol,last,soil-contact-foot-elem

alphad,alpha
NSUBST,20,200,5,ON
```

```
TIME,100
TIMINT,off
acel,0,0,g
SOLVE
SAVE
TIMINT,on
ITIM=1
DS=TIM
NSUBST,1,20,1,ON

ddele,master_node,ux
ddele,master_node,uz

esel,s,type,,61,63,2
mpchg,64,all

esel,s,type,,91,93,2
mpchg,92,all

allsel

*DO,ITIM,1,NTIM,1

TIM=DT*ITIM

TIME,TIM+100

F,master_node,FX,A_1_X(itim)*mass*g
F,master_node,Fz,(A_1_Z(itim)+1)*(mass+ma
ssm_z)*g

SOLVE
SAVE
*ENDDO
FINISH
/out
```

Tank-Props-BEC-250

```
/COM - Tank Concrete Properties

/COM - Material Definitions
! EX - Youngs Modulus, (k/ft2)
! NUXY - Poisons ratio
! DENS - Density (1000*slugs/ft3)
! DAMP - Beta (Stiffness) Damping

/COM - Material 1, Tank Concrete
mp,ex,1,626754
mp,nuxy,1,0.18
mp,dens,1,148/(1000*g)
mp,damp,1,0.07/df

/COM - Material 2, Tank Concrete
mp,ex,2,620114
mp,nuxy,2,0.18
mp,dens,2,149/(1000*g)
mp,damp,2,0.07/df

/COM - Material 3, Tank Concrete
mp,ex,3,616594
mp,nuxy,3,0.18
mp,dens,3,149/(1000*g)
mp,damp,3,0.07/df

/COM - Material 4, Tank Concrete
mp,ex,4,610922
mp,nuxy,4,0.18
mp,dens,4,149/(1000*g)
mp,damp,4,0.07/df

/COM - Material  5, Tank Concrete
mp,ex, 5,612305
mp,nuxy, 5,0.18
mp,dens, 5,148/(1000*g)
mp,damp,5,0.07/df

/COM - Material 6, Tank Concrete
mp,ex,6,607093
mp,nuxy,6,0.18
mp,dens,6,148/(1000*g)
mp,damp,6,0.07/df

/COM - Material 7, Tank Concrete
mp,ex,7,639237
mp,nuxy,7,0.18
mp,dens,7,146/(1000*g)
mp,damp,7,0.07/df

/COM - Material 8, Tank Concrete
mp,ex,8,634338
mp,nuxy,8,0.18
mp,dens,8,147/(1000*g)
mp,damp,8,0.07/df

/COM - Material 9, Tank Concrete
mp,ex,9,628756
mp,nuxy,9,0.18
mp,dens,9,147/(1000*g)
mp,damp,9,0.07/df

/COM - Material,10, Tank Concrete
mp,ex,10,193677
mp,nuxy,10,0.18
mp,dens,10,165/(1000*g)
mp,damp,10,0.07/df

/COM - Material,11, Tank Concrete
mp,ex,11,575959
mp,nuxy,11,0.18
mp,dens,11,144/(1000*g)
mp,damp,11,0.07/df

/COM - Material,12, Tank Concrete
mp,ex,12,202953
mp,nuxy,12,0.18
mp,dens,12,159/(1000*g)
mp,damp,12,0.07/df

/COM - Material,13, Tank Concrete
mp,ex,13,157426
mp,nuxy,13,0.18
mp,dens,13,176/(1000*g)
mp,damp,13,0.07/df

/COM - Material,14, Tank Concrete
mp,ex,14,153784
mp,nuxy,14,0.18
mp,dens,14,193/(1000*g)
mp,damp,14,0.07/df

/COM - Material,15, Tank Concrete
mp,ex,15,136651
mp,nuxy,15,0.18
mp,dens,15,200/(1000*g)
mp,damp,15,0.07/df
```

```
/COM - Material,16, Tank Concrete
mp,ex,16,136651
mp,nuxy,16,0.18
mp,dens,16,200/(1000*g)
mp,damp,16,0.07/df

/COM - Material,17, Tank Concrete
mp,ex,17,138084
mp,nuxy,17,0.18
mp,dens,17,181/(1000*g)
mp,damp,17,0.07/df

/COM - Material,18, Tank Concrete
mp,ex,18,123378
mp,nuxy,18,0.18
mp,dens,18,209/(1000*g)
mp,damp,18,0.07/df

/COM - Material,19, Tank Concrete
mp,ex,19,124633
mp,nuxy,19,0.18
mp,dens,19,190/(1000*g)
mp,damp,19,0.07/df

/COM - Material,20, Tank Concrete
mp,ex,20,124388
mp,nuxy,20,0.18
mp,dens,20,210/(1000*g)
mp,damp,20,0.07/df

/COM - Material,21, Tank Concrete
mp,ex,21,548683
mp,nuxy,21,0.18
mp,dens,21,166/(1000*g)
mp,damp,21,0.07/df

/COM - Material,22, Tank Concrete
mp,ex,22,154870
mp,nuxy,22,0.18
mp,dens,22,184/(1000*g)
mp,damp,22,0.07/df

/COM - Material,23, Tank Concrete
mp,ex,23,514287
mp,nuxy,23,0.18
mp,dens,23,172/(1000*g)
mp,damp,23,0.060/df

/COM - Material,24, Tank Concrete
mp,ex,24,164113
mp,nuxy,24,0.18
mp,dens,24,288/(1000*g)
mp,damp,24,0.07/df

/COM - Material,25, Tank Concrete
mp,ex,25,522946
mp,nuxy,25,0.18
mp,dens,25,201/(1000*g)
mp,damp,25,0.07/df

/COM - Material,26, Tank Concrete
mp,ex,26,194254
mp,nuxy,26,0.18
mp,dens,26,322/(1000*g)
mp,damp,26,0.07/df

/COM - Material,27, Tank Concrete
mp,ex,27,199783
mp,nuxy,27,0.18
mp,dens,27,281/(1000*g)
mp,damp,27,0.07/df

/COM - Material,28, Tank Concrete
mp,ex,28,162553
mp,nuxy,28,0.18
mp,dens,28,299/(1000*g)
mp,damp,28,0.07/df

/COM - Material,29, Tank Concrete
mp,ex,29,200531
mp,nuxy,29,0.18
mp,dens,29,3894/(1000*g)
mp,damp,29,0.07/df

/COM - Material,30, Tank Concrete
mp,ex,30,167538
mp,nuxy,30,0.18
mp,dens,30,411/(1000*g)
mp,damp,30,0.07/df

/COM - Material,31, Tank Concrete
mp,ex,31,731952
mp,nuxy,31,0.18
mp,dens,31,150/(1000*g)
mp,damp,31,0.07/df

/COM - Material,32, Tank Concrete
mp,ex,32,731952
mp,nuxy,32,0.18
mp,dens,32,150/(1000*g)
mp,damp,32,0.07/df

!/COM - Material,33, Tank Concrete
!mp,ex,33,731952
!mp,nuxy,33,0.18
!mp,dens,33,150/(1000*g)
!mp,damp,33,0.07/df

!/COM - Material,34, Tank Concrete
!mp,ex,34,731952
!mp,nuxy,34,0.18
!mp,dens,34,150/(1000*g)
!mp,damp,34,0.07/df

!/COM - Material,35, Tank Concrete
!mp,ex,35,731952
!mp,nuxy,35,0.18
!mp,dens,35,150/(1000*g)
!mp,damp,35,0.07/df

!/COM - Material,36, Tank Concrete
!mp,ex,36,731952
!mp,nuxy,36,0.18
!mp,dens,36,150/(1000*g)
!mp,damp,36,0.07/df

!/COM - Material,37, Tank Concrete
!mp,ex,37,731952
!mp,nuxy,37,0.18
!mp,dens,37,150/(1000*g)
!mp,damp,37,0.07/df

/COM - Concrete Real Values, t in ft
r,1,1.26                     ! 15 in
r,2,1.26                     ! 15 in
r,3,1.26                     ! 15 in
r,4,1.26                     ! 15 in
r,5,1.27                     ! 15 in
r,6,1.26                     ! 15 in
r,7,1.28                     ! 15 in
```

```
r,8,1.28                          ! 15 in
r,9,1.73                          ! 15 in
r,10,1.73,1.73,2.23,2.23          ! 15 in to
r,11,2.23,2.22,3.15,3.15          !
r,12,3.15,3.15,1.50,1.50          !
r,13,1.50,1.50,1.28,1.28          !
r,14,1.17                         ! 18 in
r,15,1.13                         ! 18 in
r,16,1.13                         ! 18 in
r,17,1.24                         ! 18 in
r,18,1.07                         ! 18 in
r,19,1.18                         ! 18 in
r,20,1.07                         ! 18 in
r,21,1.07                         ! 18 in
r,22,1.97                         ! 18 in
r,23,1.97,1.67,1.67,1.97          ! 18 in
r,24,1.67                         !
r,25,1.68,1.43,1.43,1.68          !
r,26,1.43,0.51,0.51,1.43          ! 8 in
r,27,0.51,0.41,0.41,0.51          ! 8 in
r,28,0.41,0.55,0.55,0.41          ! 8 in
r,29,0.55                         ! 8 in
r,30,0.55,0.40,0.40,0.55          ! 8 in
r,31,0.40,1.02,1.02,0.40          ! 8 in to
r,32,1.02                         !
!r,34,1
!r,35,1
!r,36,1
!r,37,1
!r,39,1


/COM - Material,50, Insulating Concrete
mp,ex,50,23760
mp,nuxy,50,0.15
mp,dens,50,50/(1000*g)
mp,damp,50,0.07/df
```

TH-266-Mean-Geo.txt

```
-0.000046 0.000024 0.000044-0.000025-0.000044 0.000024 0.000042-0.000025     1
-0.000042 0.000024 0.000040-0.000025-0.000040 0.000024 0.000037-0.000025     2
-0.000037 0.000024 0.000033-0.000025-0.000033 0.000023 0.000030-0.000026     3
. . . . . .
-0.000054 0.000023 0.000053-0.000023-0.000053 0.000023 0.000052-0.000023   510
-0.000052 0.000023 0.000051-0.000024-0.000051 0.000023 0.000050-0.000024   511
-0.000049 0.000023 0.000048-0.000024-0.000048 0.000023 0.000046-0.000024   512
```

TH-266-Mean-Geo-V.txt

```
-0.000029 0.000124 0.000029-0.000125-0.000029 0.000126 0.000030-0.000127     1
-0.000030 0.000128 0.000030-0.000128-0.000030 0.000130 0.000031-0.000130     2
-0.000031 0.000131 0.000032-0.000132-0.000032 0.000133 0.000033-0.000134     3
. . . . . .
-0.000026 0.000116 0.000026-0.000116-0.000026 0.000117 0.000027-0.000118   510
-0.000027 0.000118 0.000027-0.000119-0.000027 0.000120 0.000028-0.000120   511
-0.000028 0.000121 0.000028-0.000122-0.000028 0.000123 0.000029-0.000123   512
```

BES-BEC Seismic File Listing

```
 Volume in drive C is 600GB 2xRAID0 (new)
 Volume Serial Number is 8A0A-E4BA

 Directory of C:\Users\Bruce\2008-000 PNNL\2008-005 AP-460\AP-460-BES-BEC-Seismic Run

01/09/2007  06:21 AM    <DIR>          .
01/09/2007  06:21 AM    <DIR>          ..
10/30/2006  04:00 PM           561,828 Accel-BASE.out
10/15/2006  09:29 AM           561,576 Accel-ct-0.out
10/15/2006  09:32 AM           561,828 Accel-ct-135.out
10/15/2006  09:33 AM           561,828 Accel-ct-180.out
10/15/2006  09:30 AM           561,576 Accel-ct-45.out
10/15/2006  09:31 AM           561,828 Accel-ct-90.out
10/17/2006  05:45 AM           290,676 Accel-ct.out
10/15/2006  09:34 AM           561,828 Accel-PT-0.out
10/15/2006  09:38 AM           561,828 Accel-PT-135.out
10/15/2006  09:39 AM           561,828 Accel-PT-180.out
10/15/2006  09:36 AM           561,828 Accel-PT-45.out
10/15/2006  09:37 AM           561,828 Accel-PT-90.out
10/15/2006  09:40 AM           561,828 Accel-SOil.out
10/12/2006  02:42 PM                99 All-Forces.txt
10/15/2006  09:27 AM         4,770,993 AP-460-BEC-BES-Seismic.out
01/02/2007  09:45 AM         3,548,672 AP-460-BES-BEC Conc Tank Demand Seismic Only.xls
01/02/2007  09:45 AM         3,319,808 AP-460-BES-BEC Conc Tank Demand Seismic.xls
10/17/2006  08:42 AM         1,426,944 AP-460-BES-BEC Conc-Tank Spectra.xls
12/17/2006  03:02 PM         1,372,160 AP-460-BES-BEC Footing Seismic.xls
10/17/2006  08:30 AM           317,952 AP-460-BES-BEC Free Field RS Comparision.xls
01/02/2007  10:11 AM           728,064 AP-460-BES-BEC J Bolt Forces Seismic.xls
10/17/2006  07:53 AM           790,016 AP-460-BES-BEC J-Bolt-Contact-Seismic.xls
12/18/2006  10:44 AM           692,224 AP-460-BES-BEC Liner-Contact-Seismic.xls
01/05/2007  11:24 AM         7,510,528 AP-460-BES-BEC Pri Tank Stress Seismic Only.xls
01/05/2007  11:30 AM         7,235,072 AP-460-BES-BEC Pri Tank Stress Seismic.xls
01/05/2007  08:07 AM           675,840 AP-460-BES-BEC Primary-Contact-Seismic.xls
10/17/2006  09:24 AM         1,156,608 AP-460-BES-BEC Primary-Tank Spectra.xls
12/20/2006  04:03 PM         2,024,448 AP-460-BES-BEC Soil Pressures Seismic.xls
01/09/2007  04:26 AM         3,801,088 AP-460-BES-BEC Strain Seismic-Princ.xls
01/09/2007  05:40 AM           632,832 AP-460-BES-BEC Total Reaction.xls
10/17/2006  06:47 AM           403,456 AP-460-BES-BEC Waste-Disp-TH-MAX.xls
01/09/2007  05:39 AM           919,040 AP-460-BES-BEC Waste-TH-MAX.xls
01/08/2007  10:24 AM    <DIR>          AP-460-BES-BEC-Gravity
10/15/2006  09:26 AM             2,998 AP-460-BES-BEC-Seismic.BCS
10/16/2006  06:49 PM        43,909,120 AP-460-BES-BEC-Seismic.db
10/15/2006  09:27 AM        63,897,600 AP-460-BES-BEC-Seismic.dbb
10/15/2006  09:27 AM        12,713,984 AP-460-BES-BEC-Seismic.emat
01/03/2007  07:49 PM           190,449 AP-460-BES-BEC-Seismic.err
10/15/2006  09:27 AM       111,607,808 AP-460-BES-BEC-Seismic.esav
10/15/2006  09:27 AM        30,081,024 AP-460-BES-BEC-Seismic.full
10/15/2006  09:25 AM       340,804,299 AP-460-BES-BEC-Seismic.ldhi
01/04/2007  07:50 AM           168,572 AP-460-BES-BEC-Seismic.log
10/15/2006  09:26 AM           198,991 AP-460-BES-BEC-Seismic.mntr
10/15/2006  09:26 AM       111,607,808 AP-460-BES-BEC-Seismic.osav
10/15/2006  09:26 AM             1,315 AP-460-BES-BEC-Seismic.PVTS
10/15/2006  09:27 AM       112,656,384 AP-460-BES-BEC-Seismic.r001
10/13/2006  02:24 PM        43,974,656 AP-460-BES-BEC-Seismic.rdb
10/15/2006  09:27 AM     4,294,967,296 AP-460-BES-BEC-Seismic.rst
10/14/2006  12:03 AM     4,294,967,296 AP-460-BES-BEC-Seismic.rst02
10/14/2006  04:58 AM     4,294,967,296 AP-460-BES-BEC-Seismic.rst03
10/14/2006  10:01 AM     4,294,967,296 AP-460-BES-BEC-Seismic.rst04
10/14/2006  03:14 PM     4,294,967,296 AP-460-BES-BEC-Seismic.rst05
10/14/2006  08:35 PM     4,294,967,296 AP-460-BES-BEC-Seismic.rst06
10/15/2006  02:02 AM     4,294,967,296 AP-460-BES-BEC-Seismic.rst07
10/15/2006  07:38 AM     4,294,967,296 AP-460-BES-BEC-Seismic.rst08
10/15/2006  09:27 AM     1,388,445,696 AP-460-BES-BEC-Seismic.rst09
12/22/2006  09:40 AM            61,025 BES-BEC-Seismic-File-List.txt
08/25/2006  01:26 PM             6,031 Bolts-Friction.txt
09/08/2006  07:10 AM               277 Boundary.txt
08/25/2006  08:48 AM               220 Contact-AP.txt
```

```
08/21/2006  07:59 AM               586 Contact-Footing.txt
08/25/2006  01:28 PM               704 Contact-Insul.txt
08/25/2006  01:27 PM               704 Contact-J-Bolts.txt
08/25/2006  01:28 PM               708 Contact-Primary.txt
08/21/2006  07:59 AM               742 Contact-Soil.txt
08/21/2006  12:44 PM               632 Contact-Waste-AP.txt
10/30/2006  04:00 PM           561,576 Disp-BASE.out
10/15/2006  09:29 AM           561,576 Disp-ct-0.out
10/15/2006  09:32 AM           561,576 Disp-ct-135.out
10/15/2006  09:33 AM           561,576 Disp-ct-180.out
10/15/2006  09:30 AM           561,576 Disp-ct-45.out
10/15/2006  09:31 AM           561,576 Disp-ct-90.out
10/17/2006  05:45 AM           290,550 Disp-ct.out
01/03/2006  11:17 AM             1,616 Disp-J-Bolts.txt
10/15/2006  09:34 AM           561,576 Disp-PT-0.out
10/15/2006  09:38 AM           561,576 Disp-PT-135.out
10/15/2006  09:39 AM           561,576 Disp-PT-180.out
10/15/2006  09:36 AM           561,576 Disp-PT-45.out
10/15/2006  09:37 AM           561,576 Disp-PT-90.out
10/15/2006  09:40 AM           561,576 Disp-Soil.out
10/17/2006  06:46 AM            40,960 disp_0-90.xls
10/17/2006  06:46 AM            38,400 disp_99-180.xls
05/08/2006  01:31 PM             8,616 Far-Soil.txt
01/09/2007  06:21 AM                 0 File-List.txt
08/10/2006  05:47 AM             2,334 file.log
12/20/2005  04:49 PM            39,925 file.txt
10/13/2005  06:54 AM               562 Fix-Soil.txt
10/15/2006  09:54 PM            10,342 Footing-Cont_max.OUT
10/15/2006  09:54 PM         4,346,248 Footing-Cont_th.OUT
08/21/2006  08:00 AM               894 Force-c.txt
10/16/2006  02:39 AM             4,996 Force-c_108amax.OUT
10/16/2006  02:39 AM         2,905,500 Force-c_108ath.OUT
10/15/2006  11:42 PM            14,716 Force-c_108max.OUT
10/15/2006  11:42 PM         6,519,180 Force-c_108th.OUT
10/16/2006  02:47 AM             4,996 Force-c_117amax.OUT
10/16/2006  02:47 AM         2,905,500 Force-c_117ath.OUT
10/15/2006  11:50 PM            14,716 Force-c_117max.OUT
10/15/2006  11:50 PM         6,519,180 Force-c_117th.OUT
10/16/2006  02:55 AM             4,996 Force-c_126amax.OUT
10/16/2006  02:55 AM         2,905,500 Force-c_126ath.OUT
10/15/2006  11:59 PM            14,716 Force-c_126max.OUT
10/15/2006  11:59 PM         6,519,180 Force-c_126th.OUT
10/16/2006  03:04 AM             4,996 Force-c_135amax.OUT
10/16/2006  03:04 AM         2,905,500 Force-c_135ath.OUT
10/16/2006  12:08 AM            14,716 Force-c_135max.OUT
10/16/2006  12:08 AM         6,519,180 Force-c_135th.OUT
10/16/2006  03:13 AM             4,996 Force-c_144amax.OUT
10/16/2006  03:13 AM         2,905,500 Force-c_144ath.OUT
10/16/2006  12:17 AM            14,716 Force-c_144max.OUT
10/16/2006  12:17 AM         6,519,180 Force-c_144th.OUT
10/16/2006  03:22 AM             4,996 Force-c_153amax.OUT
10/16/2006  03:22 AM         2,905,500 Force-c_153ath.OUT
10/16/2006  12:26 AM            14,716 Force-c_153max.OUT
10/16/2006  12:26 AM         6,519,180 Force-c_153th.OUT
10/16/2006  03:30 AM             4,996 Force-c_162amax.OUT
10/16/2006  03:30 AM         2,905,500 Force-c_162ath.OUT
10/16/2006  12:35 AM            14,716 Force-c_162max.OUT
10/16/2006  12:35 AM         6,519,180 Force-c_162th.OUT
10/16/2006  03:39 AM             4,996 Force-c_171amax.OUT
10/16/2006  03:39 AM         2,905,500 Force-c_171ath.OUT
10/16/2006  12:44 AM            14,716 Force-c_171max.OUT
10/16/2006  12:44 AM         6,519,180 Force-c_171th.OUT
10/16/2006  03:48 AM             4,996 Force-c_180amax.OUT
10/16/2006  03:48 AM         2,905,500 Force-c_180ath.OUT
10/16/2006  12:54 AM            14,716 Force-c_180max.OUT
10/16/2006  12:54 AM         6,519,180 Force-c_180th.OUT
10/16/2006  01:12 AM             4,996 Force-c_18amax.OUT
10/16/2006  01:12 AM         2,905,500 Force-c_18ath.OUT
10/15/2006  10:12 PM            14,716 Force-c_18max.OUT
10/15/2006  10:12 PM         6,519,180 Force-c_18th.OUT
```

```
10/16/2006  01:21 AM           4,996 Force-c_27amax.OUT
10/16/2006  01:21 AM       2,905,500 Force-c_27ath.OUT
10/15/2006  10:21 PM          14,716 Force-c_27max.OUT
10/15/2006  10:21 PM       6,519,180 Force-c_27th.OUT
10/16/2006  01:30 AM           4,996 Force-c_36amax.OUT
10/16/2006  01:30 AM       2,905,500 Force-c_36ath.OUT
10/15/2006  10:31 PM          14,716 Force-c_36max.OUT
10/15/2006  10:31 PM       6,519,180 Force-c_36th.OUT
10/16/2006  01:38 AM           4,996 Force-c_45amax.OUT
10/16/2006  01:38 AM       2,905,500 Force-c_45ath.OUT
10/15/2006  10:39 PM          14,716 Force-c_45max.OUT
10/15/2006  10:39 PM       6,519,180 Force-c_45th.OUT
10/16/2006  01:46 AM           4,996 Force-c_54amax.OUT
10/16/2006  01:46 AM       2,905,500 Force-c_54ath.OUT
10/15/2006  10:48 PM          14,716 Force-c_54max.OUT
10/15/2006  10:48 PM       6,519,180 Force-c_54th.OUT
10/16/2006  01:55 AM           4,996 Force-c_63amax.OUT
10/16/2006  01:55 AM       2,905,500 Force-c_63ath.OUT
10/15/2006  10:57 PM          14,716 Force-c_63max.OUT
10/15/2006  10:57 PM       6,519,180 Force-c_63th.OUT
10/16/2006  02:03 AM           4,996 Force-c_72amax.OUT
10/16/2006  02:03 AM       2,905,500 Force-c_72ath.OUT
10/15/2006  11:05 PM          14,716 Force-c_72max.OUT
10/15/2006  11:05 PM       6,519,180 Force-c_72th.OUT
10/16/2006  02:12 AM           4,996 Force-c_81amax.OUT
10/16/2006  02:12 AM       2,905,500 Force-c_81ath.OUT
10/15/2006  11:14 PM          14,716 Force-c_81max.OUT
10/15/2006  11:14 PM       6,519,180 Force-c_81th.OUT
10/16/2006  02:21 AM           4,996 Force-c_90amax.OUT
10/16/2006  02:21 AM       2,905,500 Force-c_90ath.OUT
10/15/2006  11:23 PM          14,716 Force-c_90max.OUT
10/15/2006  11:23 PM       6,519,180 Force-c_90th.OUT
10/16/2006  02:30 AM           4,996 Force-c_99amax.OUT
10/16/2006  02:30 AM       2,905,500 Force-c_99ath.OUT
10/15/2006  11:33 PM          14,716 Force-c_99max.OUT
10/15/2006  11:33 PM       6,519,180 Force-c_99th.OUT
10/16/2006  01:03 AM           4,996 Force-c_9amax.OUT
10/16/2006  01:03 AM       2,905,628 Force-c_9ath.OUT
10/15/2006  10:03 PM          14,716 Force-c_9max.OUT
10/15/2006  10:03 PM       6,519,308 Force-c_9th.OUT
10/17/2006  07:36 AM         135,680 force-jb.xls
10/16/2006  03:44 PM       2,666,244 Force-jb_r10-th.OUT
10/16/2006  03:44 PM           5,239 Force-jb_r10_max.OUT
10/16/2006  03:45 PM       2,666,244 Force-jb_r11-th.OUT
10/16/2006  03:45 PM           5,239 Force-jb_r11_max.OUT
10/16/2006  03:39 PM       2,666,372 Force-jb_r2-th.OUT
10/16/2006  03:39 PM           5,239 Force-jb_r2_max.OUT
10/16/2006  03:40 PM       2,666,244 Force-jb_r3-th.OUT
10/16/2006  03:40 PM           5,239 Force-jb_r3_max.OUT
10/16/2006  03:40 PM       2,666,244 Force-jb_r4-th.OUT
10/16/2006  03:40 PM           5,239 Force-jb_r4_max.OUT
10/16/2006  03:41 PM       2,666,244 Force-jb_r5-th.OUT
10/16/2006  03:41 PM           5,239 Force-jb_r5_max.OUT
10/16/2006  03:42 PM       2,666,244 Force-jb_r6-th.OUT
10/16/2006  03:42 PM           5,239 Force-jb_r6_max.OUT
10/16/2006  03:42 PM       2,666,244 Force-jb_r7-th.OUT
10/16/2006  03:42 PM           5,239 Force-jb_r7_max.OUT
10/16/2006  03:43 PM       2,666,244 Force-jb_r8-th.OUT
10/16/2006  03:43 PM           5,239 Force-jb_r8_max.OUT
10/16/2006  03:44 PM       2,666,244 Force-jb_r9-th.OUT
10/16/2006  03:44 PM           5,239 Force-jb_r9_max.OUT
08/21/2006  08:00 AM             661 Force-j_bolt.txt
10/17/2006  07:15 AM         438,784 import_0-90.xls
10/17/2006  07:16 AM         439,296 import_99-180.xls
12/18/2006  10:41 AM         105,984 Insul-Contact_0-90.xls
12/18/2006  10:42 AM         105,472 Insul-Contact_99-180.xls
10/15/2006  01:30 PM           4,024 Insul-Cont_108max.OUT
10/15/2006  01:30 PM       1,738,448 Insul-Cont_108th.OUT
10/15/2006  01:32 PM           4,024 Insul-Cont_117max.OUT
10/15/2006  01:32 PM       1,738,448 Insul-Cont_117th.OUT
```

```
10/15/2006  01:35 PM           4,024 Insul-Cont_126max.OUT
10/15/2006  01:35 PM       1,738,448 Insul-Cont_126th.OUT
10/15/2006  01:37 PM           4,024 Insul-Cont_135max.OUT
10/15/2006  01:37 PM       1,738,448 Insul-Cont_135th.OUT
10/15/2006  01:40 PM           4,024 Insul-Cont_144max.OUT
10/15/2006  01:40 PM       1,738,448 Insul-Cont_144th.OUT
10/15/2006  01:42 PM           4,024 Insul-Cont_153max.OUT
10/15/2006  01:42 PM       1,738,448 Insul-Cont_153th.OUT
10/15/2006  01:45 PM           4,024 Insul-Cont_162max.OUT
10/15/2006  01:45 PM       1,738,448 Insul-Cont_162th.OUT
10/15/2006  01:47 PM           4,024 Insul-Cont_171max.OUT
10/15/2006  01:47 PM       1,738,448 Insul-Cont_171th.OUT
10/15/2006  01:50 PM           4,024 Insul-Cont_180max.OUT
10/15/2006  01:50 PM       1,738,448 Insul-Cont_180th.OUT
10/15/2006  01:06 PM           4,024 Insul-Cont_18max.OUT
10/15/2006  01:06 PM       1,738,448 Insul-Cont_18th.OUT
10/15/2006  01:09 PM           4,024 Insul-Cont_27max.OUT
10/15/2006  01:09 PM       1,738,448 Insul-Cont_27th.OUT
10/15/2006  01:11 PM           4,024 Insul-Cont_36max.OUT
10/15/2006  01:11 PM       1,738,448 Insul-Cont_36th.OUT
10/15/2006  01:13 PM           4,024 Insul-Cont_45max.OUT
10/15/2006  01:13 PM       1,738,448 Insul-Cont_45th.OUT
10/15/2006  01:16 PM           4,024 Insul-Cont_54max.OUT
10/15/2006  01:16 PM       1,738,448 Insul-Cont_54th.OUT
10/15/2006  01:18 PM           4,024 Insul-Cont_63max.OUT
10/15/2006  01:18 PM       1,738,448 Insul-Cont_63th.OUT
10/15/2006  01:20 PM           4,024 Insul-Cont_72max.OUT
10/15/2006  01:20 PM       1,738,448 Insul-Cont_72th.OUT
10/15/2006  01:22 PM           4,024 Insul-Cont_81max.OUT
10/15/2006  01:22 PM       1,738,448 Insul-Cont_81th.OUT
10/15/2006  01:25 PM           4,024 Insul-Cont_90max.OUT
10/15/2006  01:25 PM       1,738,448 Insul-Cont_90th.OUT
10/15/2006  01:28 PM           4,024 Insul-Cont_99max.OUT
10/15/2006  01:28 PM       1,738,448 Insul-Cont_99th.OUT
10/15/2006  01:04 PM           4,024 Insul-Cont_9max.OUT
10/15/2006  01:04 PM       1,738,576 Insul-Cont_9th.OUT
09/01/2005  10:27 AM           1,664 Insulate.txt
07/20/2006  06:36 AM           4,030 interface-gap1.txt
08/23/2006  07:55 AM           2,411 interface1.txt
10/17/2006  07:52 AM         117,248 J-Bolt-Contact_0-90.xls
10/17/2006  07:52 AM         117,248 J-Bolt-Contact_99-180.xls
10/15/2006  03:33 PM           4,519 J-Bolt-Cont_108max.OUT
10/15/2006  03:33 PM       1,685,484 J-Bolt-Cont_108th.OUT
10/15/2006  03:37 PM           4,519 J-Bolt-Cont_117max.OUT
10/15/2006  03:37 PM       1,685,484 J-Bolt-Cont_117th.OUT
10/15/2006  03:40 PM           4,519 J-Bolt-Cont_126max.OUT
10/15/2006  03:40 PM       1,685,484 J-Bolt-Cont_126th.OUT
10/15/2006  03:44 PM           4,519 J-Bolt-Cont_135max.OUT
10/15/2006  03:44 PM       1,685,484 J-Bolt-Cont_135th.OUT
10/15/2006  03:47 PM           4,519 J-Bolt-Cont_144max.OUT
10/15/2006  03:47 PM       1,685,484 J-Bolt-Cont_144th.OUT
10/15/2006  03:51 PM           4,519 J-Bolt-Cont_153max.OUT
10/15/2006  03:51 PM       1,685,484 J-Bolt-Cont_153th.OUT
10/15/2006  03:55 PM           4,519 J-Bolt-Cont_162max.OUT
10/15/2006  03:55 PM       1,685,484 J-Bolt-Cont_162th.OUT
10/15/2006  03:58 PM           4,519 J-Bolt-Cont_171max.OUT
10/15/2006  03:58 PM       1,685,484 J-Bolt-Cont_171th.OUT
10/15/2006  04:02 PM           4,519 J-Bolt-Cont_180max.OUT
10/15/2006  04:02 PM       1,685,484 J-Bolt-Cont_180th.OUT
10/15/2006  02:57 PM           4,519 J-Bolt-Cont_18max.OUT
10/15/2006  02:57 PM       1,685,484 J-Bolt-Cont_18th.OUT
10/15/2006  03:01 PM           4,519 J-Bolt-Cont_27max.OUT
10/15/2006  03:01 PM       1,685,484 J-Bolt-Cont_27th.OUT
10/15/2006  03:04 PM           4,519 J-Bolt-Cont_36max.OUT
10/15/2006  03:04 PM       1,685,484 J-Bolt-Cont_36th.OUT
10/15/2006  03:08 PM           4,519 J-Bolt-Cont_45max.OUT
10/15/2006  03:08 PM       1,685,484 J-Bolt-Cont_45th.OUT
10/15/2006  03:12 PM           4,519 J-Bolt-Cont_54max.OUT
10/15/2006  03:12 PM       1,685,484 J-Bolt-Cont_54th.OUT
10/15/2006  03:15 PM           4,519 J-Bolt-Cont_63max.OUT
```

```
10/15/2006  03:15 PM         1,685,484 J-Bolt-Cont_63th.OUT
10/15/2006  03:19 PM             4,519 J-Bolt-Cont_72max.OUT
10/15/2006  03:19 PM         1,685,484 J-Bolt-Cont_72th.OUT
10/15/2006  03:22 PM             4,519 J-Bolt-Cont_81max.OUT
10/15/2006  03:22 PM         1,685,484 J-Bolt-Cont_81th.OUT
10/15/2006  03:26 PM             4,519 J-Bolt-Cont_90max.OUT
10/15/2006  03:26 PM         1,685,484 J-Bolt-Cont_90th.OUT
10/15/2006  03:30 PM             4,519 J-Bolt-Cont_99max.OUT
10/15/2006  03:30 PM         1,685,484 J-Bolt-Cont_99th.OUT
10/15/2006  02:54 PM             4,519 J-Bolt-Cont_9max.OUT
10/15/2006  02:54 PM         1,685,612 J-Bolt-Cont_9th.OUT
08/23/2006  07:47 AM             1,971 Liner.txt
05/02/2005  02:19 PM               667 live_load.txt
07/21/2006  10:03 AM             6,214 Near-Soil-1.txt
04/20/2005  01:14 PM               508 outer-spar.txt
10/13/2006  01:29 PM               147 Post-Tank.txt
01/04/2007  11:20 AM           105,984 Primary-Contact_0-90.xls
01/04/2007  11:20 AM           105,984 Primary-Contact_99-180.xls
10/15/2006  02:26 PM             4,024 Primary-Cont_108max.OUT
10/15/2006  02:26 PM         1,738,448 Primary-Cont_108th.OUT
10/15/2006  02:29 PM             4,024 Primary-Cont_117max.OUT
10/15/2006  02:29 PM         1,738,448 Primary-Cont_117th.OUT
10/15/2006  02:32 PM             4,024 Primary-Cont_126max.OUT
10/15/2006  02:32 PM         1,738,448 Primary-Cont_126th.OUT
10/15/2006  02:35 PM             4,024 Primary-Cont_135max.OUT
10/15/2006  02:35 PM         1,738,448 Primary-Cont_135th.OUT
10/15/2006  02:38 PM             4,024 Primary-Cont_144max.OUT
10/15/2006  02:38 PM         1,738,448 Primary-Cont_144th.OUT
10/15/2006  02:41 PM             4,024 Primary-Cont_153max.OUT
10/15/2006  02:41 PM         1,738,448 Primary-Cont_153th.OUT
10/15/2006  02:44 PM             4,024 Primary-Cont_162max.OUT
10/15/2006  02:44 PM         1,738,448 Primary-Cont_162th.OUT
10/15/2006  02:47 PM             4,024 Primary-Cont_171max.OUT
10/15/2006  02:47 PM         1,738,448 Primary-Cont_171th.OUT
10/15/2006  02:50 PM             4,024 Primary-Cont_180max.OUT
10/15/2006  02:50 PM         1,738,448 Primary-Cont_180th.OUT
10/15/2006  01:56 PM             4,024 Primary-Cont_18max.OUT
10/15/2006  01:56 PM         1,738,448 Primary-Cont_18th.OUT
10/15/2006  01:59 PM             4,024 Primary-Cont_27max.OUT
10/15/2006  01:59 PM         1,738,448 Primary-Cont_27th.OUT
10/15/2006  02:02 PM             4,024 Primary-Cont_36max.OUT
10/15/2006  02:02 PM         1,738,448 Primary-Cont_36th.OUT
10/15/2006  02:05 PM             4,024 Primary-Cont_45max.OUT
10/15/2006  02:05 PM         1,738,448 Primary-Cont_45th.OUT
10/15/2006  02:08 PM             4,024 Primary-Cont_54max.OUT
10/15/2006  02:08 PM         1,738,448 Primary-Cont_54th.OUT
10/15/2006  02:11 PM             4,024 Primary-Cont_63max.OUT
10/15/2006  02:11 PM         1,738,448 Primary-Cont_63th.OUT
10/15/2006  02:14 PM             4,024 Primary-Cont_72max.OUT
10/15/2006  02:14 PM         1,738,448 Primary-Cont_72th.OUT
10/15/2006  02:17 PM             4,024 Primary-Cont_81max.OUT
10/15/2006  02:17 PM         1,738,448 Primary-Cont_81th.OUT
10/15/2006  02:20 PM             4,024 Primary-Cont_90max.OUT
10/15/2006  02:20 PM         1,738,448 Primary-Cont_90th.OUT
10/15/2006  02:23 PM             4,024 Primary-Cont_99max.OUT
10/15/2006  02:23 PM         1,738,448 Primary-Cont_99th.OUT
10/15/2006  01:53 PM             4,024 Primary-Cont_9max.OUT
10/15/2006  01:53 PM         1,738,576 Primary-Cont_9th.OUT
10/12/2006  02:28 PM             6,028 Primary-Props-AP.txt
09/27/2005  03:52 PM             1,538 Primary.txt
10/13/2006  02:23 PM           450,096 QA.out
10/17/2006  05:53 AM            47,121 RS-BASE-old.out
10/30/2006  04:00 PM            47,121 RS-BASE.out
10/15/2006  09:29 AM            47,121 RS-ct-0.out
10/15/2006  09:32 AM            47,121 RS-ct-135.out
10/15/2006  09:33 AM            47,121 RS-ct-180.out
10/15/2006  09:30 AM            47,121 RS-ct-45.out
10/15/2006  09:31 AM            47,121 RS-ct-90.out
10/17/2006  05:45 AM            27,591 RS-ct.out
08/28/2006  10:32 AM            47,121 RS-OUT-Concrete.txt
```

```
08/28/2006  08:24 AM            34,101 RS-OUT-Soil.txt
10/15/2006  09:34 AM            47,121 RS-PT-0.out
10/15/2006  09:38 AM            47,121 RS-PT-135.out
10/15/2006  09:39 AM            47,121 RS-PT-180.out
10/15/2006  09:36 AM            47,121 RS-PT-45.out
10/15/2006  09:37 AM            47,121 RS-PT-90.out
10/15/2006  09:40 AM            47,121 RS-SOil.out
05/22/2006  02:21 PM             1,285 RS_FREQ-d.txt
10/31/2005  10:31 AM             1,108 RS_FREQ.txt
08/23/2006  09:01 AM             1,816 Run-Tank.txt
01/03/2007  04:02 PM                 0 scratch.hlp
02/11/2005  01:22 PM             1,053 Slave.txt
10/15/2006  05:27 PM             9,896 Soil-Contact_108max.OUT
10/15/2006  05:27 PM         4,348,080 Soil-Contact_108th.OUT
10/15/2006  05:34 PM             9,896 Soil-Contact_117max.OUT
10/15/2006  05:34 PM         4,348,080 Soil-Contact_117th.OUT
10/15/2006  05:42 PM             9,896 Soil-Contact_126max.OUT
10/15/2006  05:42 PM         4,348,080 Soil-Contact_126th.OUT
10/15/2006  05:49 PM             9,896 Soil-Contact_135max.OUT
10/15/2006  05:49 PM         4,348,080 Soil-Contact_135th.OUT
10/15/2006  05:56 PM             9,896 Soil-Contact_144max.OUT
10/15/2006  05:56 PM         4,348,080 Soil-Contact_144th.OUT
10/15/2006  06:03 PM             9,896 Soil-Contact_153max.OUT
10/15/2006  06:03 PM         4,348,080 Soil-Contact_153th.OUT
10/15/2006  06:10 PM             9,896 Soil-Contact_162max.OUT
10/15/2006  06:10 PM         4,348,080 Soil-Contact_162th.OUT
10/15/2006  06:17 PM             9,896 Soil-Contact_171max.OUT
10/15/2006  06:17 PM         4,348,080 Soil-Contact_171th.OUT
10/15/2006  06:24 PM             9,896 Soil-Contact_180max.OUT
10/15/2006  06:24 PM         4,348,080 Soil-Contact_180th.OUT
10/15/2006  04:16 PM             9,896 Soil-Contact_18max.OUT
10/15/2006  04:16 PM         4,348,080 Soil-Contact_18th.OUT
10/15/2006  04:23 PM             9,896 Soil-Contact_27max.OUT
10/15/2006  04:23 PM         4,348,080 Soil-Contact_27th.OUT
10/15/2006  04:30 PM             9,896 Soil-Contact_36max.OUT
10/15/2006  04:30 PM         4,348,080 Soil-Contact_36th.OUT
10/15/2006  04:37 PM             9,896 Soil-Contact_45max.OUT
10/15/2006  04:37 PM         4,348,080 Soil-Contact_45th.OUT
10/15/2006  04:45 PM             9,896 Soil-Contact_54max.OUT
10/15/2006  04:45 PM         4,348,080 Soil-Contact_54th.OUT
10/15/2006  04:52 PM             9,896 Soil-Contact_63max.OUT
10/15/2006  04:52 PM         4,348,080 Soil-Contact_63th.OUT
10/15/2006  04:59 PM             9,896 Soil-Contact_72max.OUT
10/15/2006  04:59 PM         4,348,080 Soil-Contact_72th.OUT
10/15/2006  05:06 PM             9,896 Soil-Contact_81max.OUT
10/15/2006  05:06 PM         4,348,080 Soil-Contact_81th.OUT
10/15/2006  05:13 PM             9,896 Soil-Contact_90max.OUT
10/15/2006  05:13 PM         4,348,080 Soil-Contact_90th.OUT
10/15/2006  05:20 PM             9,896 Soil-Contact_99max.OUT
10/15/2006  05:20 PM         4,348,080 Soil-Contact_99th.OUT
10/15/2006  04:09 PM             9,896 Soil-Contact_9max.OUT
10/15/2006  04:09 PM         4,348,208 Soil-Contact_9th.OUT
11/11/2005  10:36 AM             4,989 Soil-Prop-Mean-Geo.txt
10/17/2006  06:56 AM           223,744 soil_0-90.xls
10/17/2006  06:56 AM           223,744 soil_99-180.xls
08/25/2006  08:47 AM             1,918 Solve-TH-BES.txt
09/13/2006  06:12 AM               347 spectra-all.txt
10/30/2006  03:57 PM             3,074 spectra-base.txt
09/13/2006  06:07 AM             3,690 spectra-conc-0.txt
09/13/2006  06:08 AM             3,723 spectra-conc-135.txt
09/13/2006  06:09 AM             3,723 spectra-conc-180.txt
09/13/2006  06:08 AM             3,769 spectra-conc-45.txt
09/13/2006  06:08 AM             3,649 spectra-conc-90.txt
10/16/2006  02:18 PM             1,596 spectra-conc.txt
08/28/2006  09:38 AM             2,076 spectra-concrete.txt
10/03/2006  02:02 PM             3,624 spectra-primary-0.txt
10/03/2006  02:04 PM             3,777 spectra-primary-135.txt
09/13/2006  06:15 AM             3,777 spectra-primary-180.txt
10/03/2006  02:03 PM             3,703 spectra-primary-45.txt
10/03/2006  02:03 PM             3,703 spectra-primary-90.txt
```

```
09/13/2006  06:15 AM            3,801 spectra-soil.txt
06/20/2005  09:04 AM              647 spectra-wall.txt
06/20/2005  08:52 AM              679 spectra-waste.txt
10/17/2006  07:54 AM          276,992 str-comp_0-90b.xls
10/17/2006  07:54 AM          276,992 str-comp_0-90m.xls
10/17/2006  07:54 AM          276,992 str-comp_0-90t.xls
10/17/2006  07:55 AM          276,480 str-comp_99-180b.xls
10/17/2006  07:55 AM          276,480 str-comp_99-180m.xls
10/17/2006  07:55 AM          276,480 str-comp_99-180t.xls
01/03/2007  03:40 PM            1,823 strain-backed-principle-bot.txt
01/03/2007  03:40 PM            1,828 strain-backed-principle-mid.txt
01/03/2007  03:41 PM            1,825 strain-backed-principle-top.txt
01/03/2007  04:02 PM              966 strain-backed-principle.txt
01/03/2007  05:28 PM            7,496 Strain-Backed-Princ_108-bot-max.OUT
01/03/2007  05:28 PM        3,463,218 Strain-Backed-Princ_108-bot-th.OUT
01/03/2007  08:57 PM            7,162 Strain-Backed-Princ_108-Top-max.OUT
01/03/2007  08:57 PM        3,305,799 Strain-Backed-Princ_108-Top-th.OUT
01/03/2007  07:16 PM            4,156 Strain-Backed-Princ_108max.OUT
01/03/2007  07:16 PM        1,889,028 Strain-Backed-Princ_108th.OUT
01/03/2007  05:35 PM            7,496 Strain-Backed-Princ_117-bot-max.OUT
01/03/2007  05:35 PM        3,463,218 Strain-Backed-Princ_117-bot-th.OUT
01/03/2007  09:03 PM            7,162 Strain-Backed-Princ_117-Top-max.OUT
01/03/2007  09:03 PM        3,305,799 Strain-Backed-Princ_117-Top-th.OUT
01/03/2007  07:20 PM            4,156 Strain-Backed-Princ_117max.OUT
01/03/2007  07:20 PM        1,889,028 Strain-Backed-Princ_117th.OUT
01/03/2007  05:42 PM            7,496 Strain-Backed-Princ_126-bot-max.OUT
01/03/2007  05:42 PM        3,463,218 Strain-Backed-Princ_126-bot-th.OUT
01/03/2007  09:08 PM            7,162 Strain-Backed-Princ_126-Top-max.OUT
01/03/2007  09:08 PM        3,305,799 Strain-Backed-Princ_126-Top-th.OUT
01/03/2007  07:24 PM            4,156 Strain-Backed-Princ_126max.OUT
01/03/2007  07:24 PM        1,889,028 Strain-Backed-Princ_126th.OUT
01/03/2007  05:49 PM            7,496 Strain-Backed-Princ_135-bot-max.OUT
01/03/2007  05:49 PM        3,463,218 Strain-Backed-Princ_135-bot-th.OUT
01/03/2007  09:13 PM            7,162 Strain-Backed-Princ_135-Top-max.OUT
01/03/2007  09:14 PM        3,305,799 Strain-Backed-Princ_135-Top-th.OUT
01/03/2007  07:28 PM            4,156 Strain-Backed-Princ_135max.OUT
01/03/2007  07:28 PM        1,889,028 Strain-Backed-Princ_135th.OUT
01/03/2007  05:56 PM            7,496 Strain-Backed-Princ_144-bot-max.OUT
01/03/2007  05:56 PM        3,463,218 Strain-Backed-Princ_144-bot-th.OUT
01/03/2007  09:19 PM            7,162 Strain-Backed-Princ_144-Top-max.OUT
01/03/2007  09:19 PM        3,305,799 Strain-Backed-Princ_144-Top-th.OUT
01/03/2007  07:32 PM            4,156 Strain-Backed-Princ_144max.OUT
01/03/2007  07:32 PM        1,889,028 Strain-Backed-Princ_144th.OUT
01/03/2007  06:03 PM            7,496 Strain-Backed-Princ_153-bot-max.OUT
01/03/2007  06:03 PM        3,463,218 Strain-Backed-Princ_153-bot-th.OUT
01/03/2007  09:25 PM            7,162 Strain-Backed-Princ_153-Top-max.OUT
01/03/2007  09:25 PM        3,305,799 Strain-Backed-Princ_153-Top-th.OUT
01/03/2007  07:37 PM            4,156 Strain-Backed-Princ_153max.OUT
01/03/2007  07:37 PM        1,889,028 Strain-Backed-Princ_153th.OUT
01/03/2007  06:10 PM            7,496 Strain-Backed-Princ_162-bot-max.OUT
01/03/2007  06:10 PM        3,463,218 Strain-Backed-Princ_162-bot-th.OUT
01/03/2007  09:31 PM            7,162 Strain-Backed-Princ_162-Top-max.OUT
01/03/2007  09:31 PM        3,305,799 Strain-Backed-Princ_162-Top-th.OUT
01/03/2007  07:41 PM            4,156 Strain-Backed-Princ_162max.OUT
01/03/2007  07:41 PM        1,889,028 Strain-Backed-Princ_162th.OUT
01/03/2007  06:17 PM            7,496 Strain-Backed-Princ_171-bot-max.OUT
01/03/2007  06:17 PM        3,463,218 Strain-Backed-Princ_171-bot-th.OUT
01/03/2007  09:37 PM            7,162 Strain-Backed-Princ_171-Top-max.OUT
01/03/2007  09:37 PM        3,305,799 Strain-Backed-Princ_171-Top-th.OUT
01/03/2007  07:45 PM            4,156 Strain-Backed-Princ_171max.OUT
01/03/2007  07:45 PM        1,889,028 Strain-Backed-Princ_171th.OUT
01/03/2007  04:17 PM            7,496 Strain-Backed-Princ_18-bot-max.OUT
01/03/2007  04:17 PM        3,463,218 Strain-Backed-Princ_18-bot-th.OUT
01/03/2007  08:01 PM            7,162 Strain-Backed-Princ_18-Top-max.OUT
01/03/2007  08:01 PM        3,305,799 Strain-Backed-Princ_18-Top-th.OUT
01/03/2007  06:25 PM            7,496 Strain-Backed-Princ_180-bot-max.OUT
01/03/2007  06:25 PM        3,463,218 Strain-Backed-Princ_180-bot-th.OUT
01/03/2007  09:43 PM            7,162 Strain-Backed-Princ_180-Top-max.OUT
01/03/2007  09:43 PM        3,305,799 Strain-Backed-Princ_180-Top-th.OUT
01/03/2007  07:49 PM            4,156 Strain-Backed-Princ_180max.OUT
```

```
01/03/2007  07:49 PM         1,889,028 Strain-Backed-Princ_180th.OUT
01/03/2007  06:33 PM             4,156 Strain-Backed-Princ_18max.OUT
01/03/2007  06:33 PM         1,889,028 Strain-Backed-Princ_18th.OUT
01/03/2007  04:24 PM             7,496 Strain-Backed-Princ_27-bot-max.OUT
01/03/2007  04:24 PM         3,463,218 Strain-Backed-Princ_27-bot-th.OUT
01/03/2007  08:07 PM             7,162 Strain-Backed-Princ_27-Top-max.OUT
01/03/2007  08:07 PM         3,305,799 Strain-Backed-Princ_27-Top-th.OUT
01/03/2007  06:38 PM             4,156 Strain-Backed-Princ_27max.OUT
01/03/2007  06:38 PM         1,889,028 Strain-Backed-Princ_27th.OUT
01/03/2007  04:31 PM             7,496 Strain-Backed-Princ_36-bot-max.OUT
01/03/2007  04:31 PM         3,463,218 Strain-Backed-Princ_36-bot-th.OUT
01/03/2007  08:12 PM             7,162 Strain-Backed-Princ_36-Top-max.OUT
01/03/2007  08:12 PM         3,305,799 Strain-Backed-Princ_36-Top-th.OUT
01/03/2007  06:42 PM             4,156 Strain-Backed-Princ_36max.OUT
01/03/2007  06:42 PM         1,889,028 Strain-Backed-Princ_36th.OUT
01/03/2007  04:38 PM             7,496 Strain-Backed-Princ_45-bot-max.OUT
01/03/2007  04:38 PM         3,463,218 Strain-Backed-Princ_45-bot-th.OUT
01/03/2007  08:18 PM             7,162 Strain-Backed-Princ_45-Top-max.OUT
01/03/2007  08:18 PM         3,305,799 Strain-Backed-Princ_45-Top-th.OUT
01/03/2007  06:46 PM             4,156 Strain-Backed-Princ_45max.OUT
01/03/2007  06:46 PM         1,889,028 Strain-Backed-Princ_45th.OUT
01/03/2007  04:45 PM             7,496 Strain-Backed-Princ_54-bot-max.OUT
01/03/2007  04:45 PM         3,463,218 Strain-Backed-Princ_54-bot-th.OUT
01/03/2007  08:23 PM             7,162 Strain-Backed-Princ_54-Top-max.OUT
01/03/2007  08:23 PM         3,305,799 Strain-Backed-Princ_54-Top-th.OUT
01/03/2007  06:50 PM             4,156 Strain-Backed-Princ_54max.OUT
01/03/2007  06:50 PM         1,889,028 Strain-Backed-Princ_54th.OUT
01/03/2007  04:52 PM             7,496 Strain-Backed-Princ_63-bot-max.OUT
01/03/2007  04:52 PM         3,463,218 Strain-Backed-Princ_63-bot-th.OUT
01/03/2007  08:29 PM             7,162 Strain-Backed-Princ_63-Top-max.OUT
01/03/2007  08:29 PM         3,305,799 Strain-Backed-Princ_63-Top-th.OUT
01/03/2007  06:54 PM             4,156 Strain-Backed-Princ_63max.OUT
01/03/2007  06:54 PM         1,889,028 Strain-Backed-Princ_63th.OUT
01/03/2007  04:59 PM             7,496 Strain-Backed-Princ_72-bot-max.OUT
01/03/2007  04:59 PM         3,463,218 Strain-Backed-Princ_72-bot-th.OUT
01/03/2007  08:34 PM             7,162 Strain-Backed-Princ_72-Top-max.OUT
01/03/2007  08:34 PM         3,305,799 Strain-Backed-Princ_72-Top-th.OUT
01/03/2007  06:59 PM             4,156 Strain-Backed-Princ_72max.OUT
01/03/2007  06:59 PM         1,889,028 Strain-Backed-Princ_72th.OUT
01/03/2007  05:06 PM             7,496 Strain-Backed-Princ_81-bot-max.OUT
01/03/2007  05:06 PM         3,463,218 Strain-Backed-Princ_81-bot-th.OUT
01/03/2007  08:39 PM             7,162 Strain-Backed-Princ_81-Top-max.OUT
01/03/2007  08:39 PM         3,305,799 Strain-Backed-Princ_81-Top-th.OUT
01/03/2007  07:03 PM             4,156 Strain-Backed-Princ_81max.OUT
01/03/2007  07:03 PM         1,889,028 Strain-Backed-Princ_81th.OUT
01/03/2007  04:10 PM             7,496 Strain-Backed-Princ_9-bot-max.OUT
01/03/2007  04:10 PM         3,463,346 Strain-Backed-Princ_9-bot-th.OUT
01/03/2007  07:55 PM             7,162 Strain-Backed-Princ_9-Top-max.OUT
01/03/2007  07:55 PM         3,305,927 Strain-Backed-Princ_9-Top-th.OUT
01/03/2007  05:13 PM             7,496 Strain-Backed-Princ_90-bot-max.OUT
01/03/2007  05:13 PM         3,463,218 Strain-Backed-Princ_90-bot-th.OUT
01/03/2007  08:45 PM             7,162 Strain-Backed-Princ_90-Top-max.OUT
01/03/2007  08:45 PM         3,305,799 Strain-Backed-Princ_90-Top-th.OUT
01/03/2007  07:07 PM             4,156 Strain-Backed-Princ_90max.OUT
01/03/2007  07:07 PM         1,889,028 Strain-Backed-Princ_90th.OUT
01/03/2007  05:21 PM             7,496 Strain-Backed-Princ_99-bot-max.OUT
01/03/2007  05:21 PM         3,463,218 Strain-Backed-Princ_99-bot-th.OUT
01/03/2007  08:51 PM             7,162 Strain-Backed-Princ_99-Top-max.OUT
01/03/2007  08:51 PM         3,305,799 Strain-Backed-Princ_99-Top-th.OUT
01/03/2007  07:11 PM             4,156 Strain-Backed-Princ_99max.OUT
01/03/2007  07:11 PM         1,889,028 Strain-Backed-Princ_99th.OUT
01/03/2007  06:29 PM             4,156 Strain-Backed-Princ_9max.OUT
01/03/2007  06:29 PM         1,889,156 Strain-Backed-Princ_9th.OUT
09/05/2006  02:00 PM             2,588 strain-backed.txt
08/21/2006  08:01 AM               566 strain-compb-p.txt
08/16/2006  01:59 PM               621 strain-compb-primary.txt
08/21/2006  08:01 AM               693 strain-compb.txt
08/21/2006  08:02 AM               566 strain-compm-p.txt
08/16/2006  02:00 PM               621 strain-compm-primary.txt
08/21/2006  08:01 AM               705 strain-compm.txt
```

```
08/21/2006  08:02 AM             578 strain-compt-p.txt
08/16/2006  02:00 PM             621 strain-compt-primary.txt
08/21/2006  08:02 AM             720 strain-compt.txt
08/21/2006  08:02 AM             730 Strain-Liner-floor.txt
01/05/2006  03:14 PM             550 Strain-Liner-p.txt
08/21/2006  08:02 AM             962 Strain-Liner-wall.txt
08/16/2006  03:01 PM             545 Strain-Liner.txt
08/16/2006  02:01 PM             292 Strain-Primary.txt
01/04/2007  09:34 AM         113,152 Strain-Princ_0-90.xls
01/04/2007  09:34 AM         187,392 Strain-Princ_0-90b.xls
01/04/2007  09:34 AM         180,224 Strain-Princ_0-90t.xls
01/04/2007  09:35 AM         113,152 Strain-Princ_99-180.xls
01/04/2007  09:34 AM         187,904 Strain-Princ_99-180b.xls
01/04/2007  09:35 AM         180,224 Strain-Princ_99-180t.xls
08/16/2006  02:19 PM             273 Strain.txt
08/21/2006  08:02 AM             554 stress-compb-p.txt
08/21/2006  08:02 AM             598 stress-compb.txt
08/21/2006  08:03 AM             554 stress-compm-p.txt
08/21/2006  08:03 AM             608 stress-compm.txt
08/21/2006  08:03 AM             554 stress-compt-p.txt
08/24/2006  03:19 PM             598 stress-compt.txt
08/17/2006  11:19 AM             207 Stress-Primary-M.txt
08/24/2006  12:05 PM             224 Stress-Primary.txt
10/16/2006  02:05 PM          13,519 Stress-pt_108max-b.OUT
10/16/2006  10:02 AM          13,519 Stress-pt_108max-m.OUT
10/16/2006  06:06 AM          13,519 Stress-pt_108max-t.OUT
10/16/2006  02:05 PM       6,443,068 Stress-pt_108th-b.OUT
10/16/2006  10:02 AM       6,443,068 Stress-pt_108th-m.OUT
10/16/2006  06:06 AM       6,412,940 Stress-pt_108th-t.OUT
10/16/2006  02:17 PM          13,519 Stress-pt_117max-b.OUT
10/16/2006  10:15 AM          13,519 Stress-pt_117max-m.OUT
10/16/2006  06:17 AM          13,519 Stress-pt_117max-t.OUT
10/16/2006  02:17 PM       6,443,068 Stress-pt_117th-b.OUT
10/16/2006  10:15 AM       6,443,068 Stress-pt_117th-m.OUT
10/16/2006  06:17 AM       6,412,940 Stress-pt_117th-t.OUT
10/16/2006  02:28 PM          13,519 Stress-pt_126max-b.OUT
10/16/2006  10:27 AM          13,519 Stress-pt_126max-m.OUT
10/16/2006  06:28 AM          13,519 Stress-pt_126max-t.OUT
10/16/2006  02:28 PM       6,443,068 Stress-pt_126th-b.OUT
10/16/2006  10:27 AM       6,443,068 Stress-pt_126th-m.OUT
10/16/2006  06:28 AM       6,412,940 Stress-pt_126th-t.OUT
10/16/2006  02:39 PM          13,519 Stress-pt_135max-b.OUT
10/16/2006  10:38 AM          13,519 Stress-pt_135max-m.OUT
10/16/2006  06:40 AM          13,519 Stress-pt_135max-t.OUT
10/16/2006  02:39 PM       6,443,068 Stress-pt_135th-b.OUT
10/16/2006  10:38 AM       6,443,068 Stress-pt_135th-m.OUT
10/16/2006  06:40 AM       6,412,940 Stress-pt_135th-t.OUT
10/16/2006  02:51 PM          13,519 Stress-pt_144max-b.OUT
10/16/2006  10:50 AM          13,519 Stress-pt_144max-m.OUT
10/16/2006  06:51 AM          13,519 Stress-pt_144max-t.OUT
10/16/2006  02:51 PM       6,443,068 Stress-pt_144th-b.OUT
10/16/2006  10:50 AM       6,443,068 Stress-pt_144th-m.OUT
10/16/2006  06:51 AM       6,412,940 Stress-pt_144th-t.OUT
10/16/2006  03:03 PM          13,519 Stress-pt_153max-b.OUT
10/16/2006  11:02 AM          13,519 Stress-pt_153max-m.OUT
10/16/2006  07:03 AM          13,519 Stress-pt_153max-t.OUT
10/16/2006  03:03 PM       6,443,068 Stress-pt_153th-b.OUT
10/16/2006  11:02 AM       6,443,068 Stress-pt_153th-m.OUT
10/16/2006  07:03 AM       6,412,940 Stress-pt_153th-t.OUT
10/16/2006  03:15 PM          13,519 Stress-pt_162max-b.OUT
10/16/2006  11:14 AM          13,519 Stress-pt_162max-m.OUT
10/16/2006  07:14 AM          13,519 Stress-pt_162max-t.OUT
10/16/2006  03:15 PM       6,443,068 Stress-pt_162th-b.OUT
10/16/2006  11:14 AM       6,443,068 Stress-pt_162th-m.OUT
10/16/2006  07:14 AM       6,412,940 Stress-pt_162th-t.OUT
10/16/2006  03:26 PM          13,521 Stress-pt_171max-b.OUT
10/16/2006  11:26 AM          13,521 Stress-pt_171max-m.OUT
10/16/2006  07:26 AM          13,521 Stress-pt_171max-t.OUT
10/16/2006  03:26 PM       6,443,068 Stress-pt_171th-b.OUT
10/16/2006  11:26 AM       6,443,068 Stress-pt_171th-m.OUT
```

```
10/16/2006  07:26 AM         6,412,940 Stress-pt_171th-t.OUT
10/16/2006  03:38 PM            13,521 Stress-pt_180max-b.OUT
10/16/2006  11:39 AM            13,521 Stress-pt_180max-m.OUT
10/16/2006  07:37 AM            13,521 Stress-pt_180max-t.OUT
10/16/2006  03:38 PM         6,443,068 Stress-pt_180th-b.OUT
10/16/2006  11:39 AM         6,443,068 Stress-pt_180th-m.OUT
10/16/2006  07:37 AM         6,412,940 Stress-pt_180th-t.OUT
10/16/2006  12:04 PM            13,519 Stress-pt_18max-b.OUT
10/16/2006  08:01 AM            13,519 Stress-pt_18max-m.OUT
10/16/2006  04:12 AM            13,519 Stress-pt_18max-t.OUT
10/16/2006  12:04 PM         6,443,068 Stress-pt_18th-b.OUT
10/16/2006  08:01 AM         6,443,068 Stress-pt_18th-m.OUT
10/16/2006  04:12 AM         6,412,940 Stress-pt_18th-t.OUT
10/16/2006  12:16 PM            13,519 Stress-pt_27max-b.OUT
10/16/2006  08:13 AM            13,519 Stress-pt_27max-m.OUT
10/16/2006  04:23 AM            13,519 Stress-pt_27max-t.OUT
10/16/2006  12:16 PM         6,443,068 Stress-pt_27th-b.OUT
10/16/2006  08:13 AM         6,443,068 Stress-pt_27th-m.OUT
10/16/2006  04:23 AM         6,412,940 Stress-pt_27th-t.OUT
10/16/2006  12:28 PM            13,519 Stress-pt_36max-b.OUT
10/16/2006  08:25 AM            13,519 Stress-pt_36max-m.OUT
10/16/2006  04:35 AM            13,519 Stress-pt_36max-t.OUT
10/16/2006  12:28 PM         6,443,068 Stress-pt_36th-b.OUT
10/16/2006  08:25 AM         6,443,068 Stress-pt_36th-m.OUT
10/16/2006  04:35 AM         6,412,940 Stress-pt_36th-t.OUT
10/16/2006  12:41 PM            13,519 Stress-pt_45max-b.OUT
10/16/2006  08:38 AM            13,519 Stress-pt_45max-m.OUT
10/16/2006  04:46 AM            13,519 Stress-pt_45max-t.OUT
10/16/2006  12:41 PM         6,443,068 Stress-pt_45th-b.OUT
10/16/2006  08:38 AM         6,443,068 Stress-pt_45th-m.OUT
10/16/2006  04:46 AM         6,412,940 Stress-pt_45th-t.OUT
10/16/2006  12:52 PM            13,519 Stress-pt_54max-b.OUT
10/16/2006  08:50 AM            13,519 Stress-pt_54max-m.OUT
10/16/2006  04:58 AM            13,519 Stress-pt_54max-t.OUT
10/16/2006  12:52 PM         6,443,068 Stress-pt_54th-b.OUT
10/16/2006  08:50 AM         6,443,068 Stress-pt_54th-m.OUT
10/16/2006  04:58 AM         6,412,940 Stress-pt_54th-t.OUT
10/16/2006  01:05 PM            13,519 Stress-pt_63max-b.OUT
10/16/2006  09:02 AM            13,519 Stress-pt_63max-m.OUT
10/16/2006  05:09 AM            13,519 Stress-pt_63max-t.OUT
10/16/2006  01:05 PM         6,443,068 Stress-pt_63th-b.OUT
10/16/2006  09:02 AM         6,443,068 Stress-pt_63th-m.OUT
10/16/2006  05:09 AM         6,412,940 Stress-pt_63th-t.OUT
10/16/2006  01:16 PM            13,519 Stress-pt_72max-b.OUT
10/16/2006  09:14 AM            13,519 Stress-pt_72max-m.OUT
10/16/2006  05:20 AM            13,519 Stress-pt_72max-t.OUT
10/16/2006  01:16 PM         6,443,068 Stress-pt_72th-b.OUT
10/16/2006  09:14 AM         6,443,068 Stress-pt_72th-m.OUT
10/16/2006  05:20 AM         6,412,940 Stress-pt_72th-t.OUT
10/16/2006  01:28 PM            13,519 Stress-pt_81max-b.OUT
10/16/2006  09:27 AM            13,519 Stress-pt_81max-m.OUT
10/16/2006  05:31 AM            13,519 Stress-pt_81max-t.OUT
10/16/2006  01:28 PM         6,443,068 Stress-pt_81th-b.OUT
10/16/2006  09:27 AM         6,443,068 Stress-pt_81th-m.OUT
10/16/2006  05:31 AM         6,412,940 Stress-pt_81th-t.OUT
10/16/2006  01:41 PM            13,519 Stress-pt_90max-b.OUT
10/16/2006  09:39 AM            13,519 Stress-pt_90max-m.OUT
10/16/2006  05:43 AM            13,519 Stress-pt_90max-t.OUT
10/16/2006  01:41 PM         6,443,068 Stress-pt_90th-b.OUT
10/16/2006  09:39 AM         6,443,068 Stress-pt_90th-m.OUT
10/16/2006  05:43 AM         6,412,940 Stress-pt_90th-t.OUT
10/16/2006  01:53 PM            13,519 Stress-pt_99max-b.OUT
10/16/2006  09:51 AM            13,519 Stress-pt_99max-m.OUT
10/16/2006  05:55 AM            13,519 Stress-pt_99max-t.OUT
10/16/2006  01:54 PM         6,443,068 Stress-pt_99th-b.OUT
10/16/2006  09:51 AM         6,443,068 Stress-pt_99th-m.OUT
10/16/2006  05:55 AM         6,412,940 Stress-pt_99th-t.OUT
10/16/2006  11:52 AM            13,519 Stress-pt_9max-b.OUT
10/16/2006  07:49 AM            13,519 Stress-pt_9max-m.OUT
10/16/2006  04:00 AM            13,519 Stress-pt_9max-t.OUT
```

```
10/16/2006  11:52 AM         6,443,196 Stress-pt_9th-b.OUT
10/16/2006  07:49 AM         6,443,196 Stress-pt_9th-m.OUT
10/16/2006  04:00 AM         6,413,068 Stress-pt_9th-t.OUT
10/12/2006  02:29 PM             4,009 Tank-Coordinates-AP.txt
05/25/2005  03:32 PM             2,512 Tank-Mesh1.txt
10/13/2006  02:22 PM               102 tank-out.out
08/25/2006  07:52 AM             5,450 Tank-Props-BEC-250.txt
07/21/2006  09:41 AM             5,591 Tank-Props-Rigid.txt
10/13/2006  02:23 PM             4,989 Tank-th.out
12/22/2005  12:43 PM            10,035 temp.log
12/17/2006  02:02 PM             1,631 Text-File.lis
08/09/2006  07:43 AM            23,166 TH-266-Mean-Geo-V.txt
08/09/2006  07:31 AM            23,166 TH-266-Mean-Geo.txt
10/30/2006  04:00 PM           561,576 Vel-BASE.out
10/15/2006  09:29 AM           561,576 Vel-ct-0.out
10/15/2006  09:32 AM           561,576 Vel-ct-135.out
10/15/2006  09:33 AM           561,576 Vel-ct-180.out
10/15/2006  09:30 AM           561,576 Vel-ct-45.out
10/15/2006  09:31 AM           561,576 Vel-ct-90.out
10/17/2006  05:45 AM           290,550 Vel-ct.out
10/15/2006  09:34 AM           561,576 Vel-PT-0.out
10/15/2006  09:38 AM           561,576 Vel-PT-135.out
10/15/2006  09:39 AM           561,576 Vel-PT-180.out
10/15/2006  09:36 AM           561,576 Vel-PT-45.out
10/15/2006  09:37 AM           561,576 Vel-PT-90.out
10/15/2006  09:40 AM           561,576 Vel-Soil.out
10/15/2006  11:46 AM            10,180 Waste-Cont_108max.OUT
10/15/2006  11:46 AM         4,875,649 Waste-Cont_108th.OUT
10/15/2006  11:55 AM            10,180 Waste-Cont_117max.OUT
10/15/2006  11:55 AM         4,875,649 Waste-Cont_117th.OUT
10/15/2006  12:05 PM            10,180 Waste-Cont_126max.OUT
10/15/2006  12:05 PM         4,875,649 Waste-Cont_126th.OUT
10/15/2006  12:14 PM            10,180 Waste-Cont_135max.OUT
10/15/2006  12:14 PM         4,875,649 Waste-Cont_135th.OUT
10/15/2006  12:24 PM            10,180 Waste-Cont_144max.OUT
10/15/2006  12:24 PM         4,875,649 Waste-Cont_144th.OUT
10/15/2006  12:32 PM            10,180 Waste-Cont_153max.OUT
10/15/2006  12:33 PM         4,875,649 Waste-Cont_153th.OUT
10/15/2006  12:42 PM            10,180 Waste-Cont_162max.OUT
10/15/2006  12:42 PM         4,875,649 Waste-Cont_162th.OUT
10/15/2006  12:51 PM            10,180 Waste-Cont_171max.OUT
10/15/2006  12:51 PM         4,875,649 Waste-Cont_171th.OUT
10/15/2006  01:01 PM            10,180 Waste-Cont_180max.OUT
10/15/2006  01:01 PM         4,875,649 Waste-Cont_180th.OUT
10/15/2006  10:11 AM            10,180 Waste-Cont_18max.OUT
10/15/2006  10:11 AM         4,875,649 Waste-Cont_18th.OUT
10/15/2006  10:21 AM            10,180 Waste-Cont_27max.OUT
10/15/2006  10:21 AM         4,875,649 Waste-Cont_27th.OUT
10/15/2006  10:30 AM            10,180 Waste-Cont_36max.OUT
10/15/2006  10:30 AM         4,875,649 Waste-Cont_36th.OUT
10/15/2006  10:39 AM            10,180 Waste-Cont_45max.OUT
10/15/2006  10:39 AM         4,875,649 Waste-Cont_45th.OUT
10/15/2006  10:49 AM            10,180 Waste-Cont_54max.OUT
10/15/2006  10:49 AM         4,875,649 Waste-Cont_54th.OUT
10/15/2006  10:58 AM            10,180 Waste-Cont_63max.OUT
10/15/2006  10:58 AM         4,875,649 Waste-Cont_63th.OUT
10/15/2006  11:08 AM            10,180 Waste-Cont_72max.OUT
10/15/2006  11:08 AM         4,875,649 Waste-Cont_72th.OUT
10/15/2006  11:17 AM            10,180 Waste-Cont_81max.OUT
10/15/2006  11:17 AM         4,875,649 Waste-Cont_81th.OUT
10/15/2006  11:27 AM            10,180 Waste-Cont_90max.OUT
10/15/2006  11:27 AM         4,875,649 Waste-Cont_90th.OUT
10/15/2006  11:36 AM            10,180 Waste-Cont_99max.OUT
10/15/2006  11:36 AM         4,875,649 Waste-Cont_99th.OUT
10/15/2006  10:01 AM            10,180 Waste-Cont_9max.OUT
10/15/2006  10:01 AM         4,875,777 Waste-Cont_9th.OUT
10/15/2006  09:51 AM            47,317 Waste-Reaction-460-SD3.out
08/25/2006  08:47 AM               340 Waste-Reaction.txt
10/12/2006  02:27 PM            10,266 Waste-solid-AP-S.txt
08/21/2006  08:03 AM               776 Waste-Surface-AP.txt
```

```
10/15/2006  06:35 PM               865 Waste-Surf_0max.OUT
10/15/2006  06:35 PM           534,133 Waste-Surf_0th.OUT
10/15/2006  08:33 PM               865 Waste-Surf_108max.OUT
10/15/2006  08:33 PM           534,005 Waste-Surf_108th.OUT
10/15/2006  08:43 PM               865 Waste-Surf_117max.OUT
10/15/2006  08:43 PM           534,005 Waste-Surf_117th.OUT
10/15/2006  08:53 PM               865 Waste-Surf_126max.OUT
10/15/2006  08:53 PM           534,005 Waste-Surf_126th.OUT
10/15/2006  09:03 PM               865 Waste-Surf_135max.OUT
10/15/2006  09:03 PM           534,005 Waste-Surf_135th.OUT
10/15/2006  09:13 PM               865 Waste-Surf_144max.OUT
10/15/2006  09:13 PM           534,005 Waste-Surf_144th.OUT
10/15/2006  09:22 PM               865 Waste-Surf_153max.OUT
10/15/2006  09:22 PM           534,005 Waste-Surf_153th.OUT
10/15/2006  09:32 PM               865 Waste-Surf_162max.OUT
10/15/2006  09:32 PM           534,005 Waste-Surf_162th.OUT
10/15/2006  09:42 PM               865 Waste-Surf_171max.OUT
10/15/2006  09:42 PM           534,005 Waste-Surf_171th.OUT
10/15/2006  09:52 PM               865 Waste-Surf_180max.OUT
10/15/2006  09:52 PM           534,005 Waste-Surf_180th.OUT
10/15/2006  09:52 PM               865 Waste-Surf_189max.OUT
10/15/2006  09:52 PM           534,005 Waste-Surf_189th.OUT
10/15/2006  06:55 PM               865 Waste-Surf_18max.OUT
10/15/2006  06:55 PM           534,005 Waste-Surf_18th.OUT
10/15/2006  07:05 PM               865 Waste-Surf_27max.OUT
10/15/2006  07:05 PM           534,005 Waste-Surf_27th.OUT
10/15/2006  07:15 PM               865 Waste-Surf_36max.OUT
10/15/2006  07:15 PM           534,005 Waste-Surf_36th.OUT
10/15/2006  07:25 PM               865 Waste-Surf_45max.OUT
10/15/2006  07:25 PM           534,005 Waste-Surf_45th.OUT
10/15/2006  07:34 PM               865 Waste-Surf_54max.OUT
10/15/2006  07:34 PM           534,005 Waste-Surf_54th.OUT
10/15/2006  07:44 PM               865 Waste-Surf_63max.OUT
10/15/2006  07:44 PM           534,005 Waste-Surf_63th.OUT
10/15/2006  07:54 PM               865 Waste-Surf_72max.OUT
10/15/2006  07:54 PM           534,005 Waste-Surf_72th.OUT
10/15/2006  08:04 PM               865 Waste-Surf_81max.OUT
10/15/2006  08:04 PM           534,005 Waste-Surf_81th.OUT
10/15/2006  08:14 PM               865 Waste-Surf_90max.OUT
10/15/2006  08:14 PM           534,005 Waste-Surf_90th.OUT
10/15/2006  08:23 PM               865 Waste-Surf_99max.OUT
10/15/2006  08:23 PM           534,005 Waste-Surf_99th.OUT
10/15/2006  06:45 PM               865 Waste-Surf_9max.OUT
10/15/2006  06:45 PM           534,005 Waste-Surf_9th.OUT
10/16/2006  11:30 AM           229,888 waste_0-90.xls
10/16/2006  11:30 AM           229,888 waste_99-180.xls
             805 File(s) 37,769,675,672 bytes
               3 Dir(s)  248,222,982,144 bytes free
```

BES-BEC Gravity File Listing

```
 Volume in drive C is 600GB 2xRAID0 (new)
 Volume Serial Number is 8A0A-E4BA

 Directory of C:\Users\Bruce\2008-000 PNNL\2008-005 AP-460\AP-460-BES-BEC-Seismic Run\AP-
460-BES-BEC-Gravity

01/09/2007  06:21 AM    <DIR>          .
01/09/2007  06:21 AM    <DIR>          ..
10/13/2006  09:42 AM           768,512 460-AP-BES-BEC J-Bolt-Contact-Gravity.xls
10/13/2006  10:10 AM           692,736 460-AP-BES-BEC-Primary-Contact-Gravity.xls
08/21/2006  06:49 AM               101 All-Forces.txt
10/13/2006  08:56 AM           132,631 AP-460-BEC-BES-Gravity.out
01/02/2007  09:46 AM         3,178,496 AP-460-BES-BEC Conc Tank Demand Gravity.xls
10/13/2006  09:39 AM           688,640 AP-460-BES-BEC J Bolt Forces Gravity.xls
10/13/2006  09:48 AM         7,319,552 AP-460-BES-BEC Pri Tank Stress Gravity.xls
11/20/2006  09:26 AM         2,207,232 AP-460-BES-BEC Principal Strain Gravity.xls
10/13/2006  09:37 AM         2,041,344 AP-460-BES-BEC Soil Pressures Gravity.xls
01/08/2007  10:24 AM         3,737,600 AP-460-BES-BEC Strain Gravity-Princ.xls
```

```
10/13/2006  10:08 AM           952,320 AP-460-BES-BEC Waste-TH-MAX Gravity.xls
10/13/2006  08:56 AM             2,998 AP-460-BES-BEC-Gravity.BCS
10/13/2006  08:58 AM        43,843,584 AP-460-BES-BEC-Gravity.db
10/13/2006  08:56 AM        63,897,600 AP-460-BES-BEC-Gravity.dbb
10/13/2006  08:56 AM        12,713,984 AP-460-BES-BEC-Gravity.emat
01/04/2007  02:18 PM         2,054,959 AP-460-BES-BEC-Gravity.err
10/13/2006  08:56 AM       111,607,808 AP-460-BES-BEC-Gravity.esav
10/13/2006  08:56 AM        30,015,488 AP-460-BES-BEC-Gravity.full
10/13/2006  08:55 AM         1,744,061 AP-460-BES-BEC-Gravity.ldhi
01/04/2007  02:57 PM            92,726 AP-460-BES-BEC-Gravity.log
10/13/2006  08:56 AM             2,295 AP-460-BES-BEC-Gravity.mntr
10/13/2006  08:55 AM       111,607,808 AP-460-BES-BEC-Gravity.osav
10/13/2006  08:56 AM             1,795 AP-460-BES-BEC-Gravity.PVTS
10/13/2006  08:56 AM       112,656,384 AP-460-BES-BEC-Gravity.r001
10/13/2006  08:37 AM        43,974,656 AP-460-BES-BEC-Gravity.rdb
10/13/2006  08:56 AM       186,580,992 AP-460-BES-BEC-Gravity.rst
08/25/2006  08:03 AM                 0 AP-460-BES-BEC-Gravity.sda
10/12/2006  03:22 PM                97 AP-460-BES-BEC-Gravity.stat
10/13/2006  10:16 AM           684,032 AP-460-BES-BEC-Insul-Contact-Gravity.xls
08/25/2006  07:19 AM               524 AP-460-BES-BEC-Seismic.err
08/25/2006  07:19 AM            28,752 AP-460-BES-BEC-Seismic.log
11/30/2006  03:12 PM               219 AP-460-UBS-BEC-Gravity.err
11/30/2006  03:12 PM               324 AP-460-UBS-BEC-Gravity.log
12/22/2006  09:40 AM            48,967 BES-BEC-Gravity-File-List.txt
08/21/2006  01:22 PM             6,042 Bolts-Friction.txt
10/13/2006  08:34 AM               277 Boundary.txt
10/12/2006  02:44 PM               221 Contact-AP.txt
08/21/2006  07:59 AM               586 Contact-Footing.txt
08/24/2006  08:01 AM               654 Contact-Insul.txt
08/21/2006  07:59 AM               655 Contact-J-Bolts.txt
08/24/2006  08:01 AM               658 Contact-Primary.txt
08/21/2006  07:59 AM               742 Contact-Soil.txt
08/21/2006  12:44 PM               632 Contact-Waste-AP.txt
01/03/2006  11:17 AM             1,616 Disp-J-Bolts.txt
05/08/2006  01:31 PM             8,616 Far-Soil.txt
01/09/2007  06:21 AM                 0 file-list.txt
10/12/2006  03:03 PM             1,904 file.bat
10/12/2006  03:03 PM                68 file.err
10/12/2006  03:03 PM             2,562 file.log
12/20/2005  04:49 PM            39,925 file.txt
10/13/2005  06:54 AM               562 Fix-Soil.txt
10/13/2006  08:57 AM            10,342 Footing-Cont_max.OUT
10/13/2006  08:57 AM            27,488 Footing-Cont_th.OUT
08/21/2006  08:00 AM               894 Force-c.txt
10/13/2006  08:57 AM             4,996 Force-c_108amax.OUT
10/13/2006  08:57 AM            19,200 Force-c_108ath.OUT
10/13/2006  08:57 AM            14,716 Force-c_108max.OUT
10/13/2006  08:57 AM            41,040 Force-c_108th.OUT
10/13/2006  08:57 AM             4,996 Force-c_117amax.OUT
10/13/2006  08:57 AM            19,200 Force-c_117ath.OUT
10/13/2006  08:57 AM            14,716 Force-c_117max.OUT
10/13/2006  08:57 AM            41,040 Force-c_117th.OUT
10/13/2006  08:57 AM             4,996 Force-c_126amax.OUT
10/13/2006  08:57 AM            19,200 Force-c_126ath.OUT
10/13/2006  08:57 AM            14,716 Force-c_126max.OUT
10/13/2006  08:57 AM            41,040 Force-c_126th.OUT
10/13/2006  08:57 AM             4,996 Force-c_135amax.OUT
10/13/2006  08:57 AM            19,200 Force-c_135ath.OUT
10/13/2006  08:57 AM            14,716 Force-c_135max.OUT
10/13/2006  08:57 AM            41,040 Force-c_135th.OUT
10/13/2006  08:57 AM             4,996 Force-c_144amax.OUT
10/13/2006  08:57 AM            19,200 Force-c_144ath.OUT
10/13/2006  08:57 AM            14,716 Force-c_144max.OUT
10/13/2006  08:57 AM            41,040 Force-c_144th.OUT
10/13/2006  08:57 AM             4,996 Force-c_153amax.OUT
10/13/2006  08:57 AM            19,200 Force-c_153ath.OUT
10/13/2006  08:57 AM            14,716 Force-c_153max.OUT
10/13/2006  08:57 AM            41,040 Force-c_153th.OUT
10/13/2006  08:57 AM             4,996 Force-c_162amax.OUT
10/13/2006  08:57 AM            19,200 Force-c_162ath.OUT
```

```
10/13/2006  08:57 AM            14,716 Force-c_162max.OUT
10/13/2006  08:57 AM            41,040 Force-c_162th.OUT
10/13/2006  08:57 AM             4,996 Force-c_171amax.OUT
10/13/2006  08:57 AM            19,200 Force-c_171ath.OUT
10/13/2006  08:57 AM            14,716 Force-c_171max.OUT
10/13/2006  08:57 AM            41,040 Force-c_171th.OUT
10/13/2006  08:57 AM             4,996 Force-c_180amax.OUT
10/13/2006  08:57 AM            19,200 Force-c_180ath.OUT
10/13/2006  08:57 AM            14,716 Force-c_180max.OUT
10/13/2006  08:57 AM            41,040 Force-c_180th.OUT
10/13/2006  08:57 AM             4,996 Force-c_18amax.OUT
10/13/2006  08:57 AM            19,200 Force-c_18ath.OUT
10/13/2006  08:57 AM            14,716 Force-c_18max.OUT
10/13/2006  08:57 AM            41,040 Force-c_18th.OUT
10/13/2006  08:57 AM             4,996 Force-c_27amax.OUT
10/13/2006  08:57 AM            19,200 Force-c_27ath.OUT
10/13/2006  08:57 AM            14,716 Force-c_27max.OUT
10/13/2006  08:57 AM            41,040 Force-c_27th.OUT
10/13/2006  08:57 AM             4,996 Force-c_36amax.OUT
10/13/2006  08:57 AM            19,200 Force-c_36ath.OUT
10/13/2006  08:57 AM            14,716 Force-c_36max.OUT
10/13/2006  08:57 AM            41,040 Force-c_36th.OUT
10/13/2006  08:57 AM             4,996 Force-c_45amax.OUT
10/13/2006  08:57 AM            19,200 Force-c_45ath.OUT
10/13/2006  08:57 AM            14,716 Force-c_45max.OUT
10/13/2006  08:57 AM            41,040 Force-c_45th.OUT
10/13/2006  08:57 AM             4,996 Force-c_54amax.OUT
10/13/2006  08:57 AM            19,200 Force-c_54ath.OUT
10/13/2006  08:57 AM            14,716 Force-c_54max.OUT
10/13/2006  08:57 AM            41,040 Force-c_54th.OUT
10/13/2006  08:57 AM             4,996 Force-c_63amax.OUT
10/13/2006  08:57 AM            19,200 Force-c_63ath.OUT
10/13/2006  08:57 AM            14,716 Force-c_63max.OUT
10/13/2006  08:57 AM            41,040 Force-c_63th.OUT
10/13/2006  08:57 AM             4,996 Force-c_72amax.OUT
10/13/2006  08:57 AM            19,200 Force-c_72ath.OUT
10/13/2006  08:57 AM            14,716 Force-c_72max.OUT
10/13/2006  08:57 AM            41,040 Force-c_72th.OUT
10/13/2006  08:57 AM             4,996 Force-c_81amax.OUT
10/13/2006  08:57 AM            19,200 Force-c_81ath.OUT
10/13/2006  08:57 AM            14,716 Force-c_81max.OUT
10/13/2006  08:57 AM            41,040 Force-c_81th.OUT
10/13/2006  08:57 AM             4,996 Force-c_90amax.OUT
10/13/2006  08:57 AM            19,200 Force-c_90ath.OUT
10/13/2006  08:57 AM            14,716 Force-c_90max.OUT
10/13/2006  08:57 AM            41,040 Force-c_90th.OUT
10/13/2006  08:57 AM             4,996 Force-c_99amax.OUT
10/13/2006  08:57 AM            19,200 Force-c_99ath.OUT
10/13/2006  08:57 AM            14,716 Force-c_99max.OUT
10/13/2006  08:57 AM            41,040 Force-c_99th.OUT
10/13/2006  08:57 AM             4,996 Force-c_9amax.OUT
10/13/2006  08:57 AM            19,328 Force-c_9ath.OUT
10/13/2006  08:57 AM            14,716 Force-c_9max.OUT
10/13/2006  08:57 AM            41,168 Force-c_9th.OUT
10/13/2006  09:39 AM           137,728 force-jb.xls
10/13/2006  08:58 AM            17,262 Force-jb_r10-th.OUT
10/13/2006  08:58 AM             5,239 Force-jb_r10_max.OUT
10/13/2006  08:58 AM            17,262 Force-jb_r11-th.OUT
10/13/2006  08:58 AM             5,239 Force-jb_r11_max.OUT
10/13/2006  08:58 AM            17,390 Force-jb_r2-th.OUT
10/13/2006  08:58 AM             5,239 Force-jb_r2_max.OUT
10/13/2006  08:58 AM            17,262 Force-jb_r3-th.OUT
10/13/2006  08:58 AM             5,239 Force-jb_r3_max.OUT
10/13/2006  08:58 AM            17,262 Force-jb_r4-th.OUT
10/13/2006  08:58 AM             5,239 Force-jb_r4_max.OUT
10/13/2006  08:58 AM            17,262 Force-jb_r5-th.OUT
10/13/2006  08:58 AM             5,239 Force-jb_r5_max.OUT
10/13/2006  08:58 AM            17,262 Force-jb_r6-th.OUT
10/13/2006  08:58 AM             5,239 Force-jb_r6_max.OUT
10/13/2006  08:58 AM            17,262 Force-jb_r7-th.OUT
```

```
10/13/2006  08:58 AM             5,239 Force-jb_r7_max.OUT
10/13/2006  08:58 AM            17,262 Force-jb_r8-th.OUT
10/13/2006  08:58 AM             5,239 Force-jb_r8_max.OUT
10/13/2006  08:58 AM            17,262 Force-jb_r9-th.OUT
10/13/2006  08:58 AM             5,239 Force-jb_r9_max.OUT
08/21/2006  08:00 AM               661 Force-j_bolt.txt
10/13/2006  09:38 AM           443,904 import_0-90.xls
10/13/2006  09:38 AM           444,416 import_99-180.xls
10/17/2006  08:09 AM           105,984 Insul-Contact_0-90.xls
10/17/2006  08:10 AM           105,472 Insul-Contact_99-180.xls
10/13/2006  08:57 AM             3,376 Insul-Cont_108max.OUT
10/13/2006  08:57 AM             9,488 Insul-Cont_108th.OUT
10/13/2006  08:57 AM             3,376 Insul-Cont_117max.OUT
10/13/2006  08:57 AM             9,488 Insul-Cont_117th.OUT
10/13/2006  08:57 AM             3,376 Insul-Cont_126max.OUT
10/13/2006  08:57 AM             9,488 Insul-Cont_126th.OUT
10/13/2006  08:57 AM             3,376 Insul-Cont_135max.OUT
10/13/2006  08:57 AM             9,488 Insul-Cont_135th.OUT
10/13/2006  08:57 AM             3,376 Insul-Cont_144max.OUT
10/13/2006  08:57 AM             9,488 Insul-Cont_144th.OUT
10/13/2006  08:57 AM             3,376 Insul-Cont_153max.OUT
10/13/2006  08:57 AM             9,488 Insul-Cont_153th.OUT
10/13/2006  08:57 AM             3,376 Insul-Cont_162max.OUT
10/13/2006  08:57 AM             9,488 Insul-Cont_162th.OUT
10/13/2006  08:57 AM             3,376 Insul-Cont_171max.OUT
10/13/2006  08:57 AM             9,488 Insul-Cont_171th.OUT
10/13/2006  08:57 AM             3,376 Insul-Cont_180max.OUT
10/13/2006  08:57 AM             9,488 Insul-Cont_180th.OUT
10/13/2006  08:57 AM             3,376 Insul-Cont_18max.OUT
10/13/2006  08:57 AM             9,488 Insul-Cont_18th.OUT
10/13/2006  08:57 AM             3,376 Insul-Cont_27max.OUT
10/13/2006  08:57 AM             9,488 Insul-Cont_27th.OUT
10/13/2006  08:57 AM             3,376 Insul-Cont_36max.OUT
10/13/2006  08:57 AM             9,488 Insul-Cont_36th.OUT
10/13/2006  08:57 AM             3,376 Insul-Cont_45max.OUT
10/13/2006  08:57 AM             9,488 Insul-Cont_45th.OUT
10/13/2006  08:57 AM             3,376 Insul-Cont_54max.OUT
10/13/2006  08:57 AM             9,488 Insul-Cont_54th.OUT
10/13/2006  08:57 AM             3,376 Insul-Cont_63max.OUT
10/13/2006  08:57 AM             9,488 Insul-Cont_63th.OUT
10/13/2006  08:57 AM             3,376 Insul-Cont_72max.OUT
10/13/2006  08:57 AM             9,488 Insul-Cont_72th.OUT
10/13/2006  08:57 AM             3,376 Insul-Cont_81max.OUT
10/13/2006  08:57 AM             9,488 Insul-Cont_81th.OUT
10/13/2006  08:57 AM             3,376 Insul-Cont_90max.OUT
10/13/2006  08:57 AM             9,488 Insul-Cont_90th.OUT
10/13/2006  08:57 AM             3,376 Insul-Cont_99max.OUT
10/13/2006  08:57 AM             9,488 Insul-Cont_99th.OUT
10/13/2006  08:57 AM             3,376 Insul-Cont_9max.OUT
10/13/2006  08:57 AM             9,616 Insul-Cont_9th.OUT
09/01/2005  10:27 AM             1,664 Insulate.txt
07/20/2006  06:36 AM             4,030 interface-gap1.txt
08/23/2006  07:55 AM             2,411 interface1.txt
10/13/2006  09:41 AM           101,888 J-Bolt-Contact_0-90.xls
10/13/2006  09:41 AM           101,888 J-Bolt-Contact_99-180.xls
10/13/2006  08:57 AM             3,790 J-Bolt-Cont_108max.OUT
10/13/2006  08:57 AM             9,666 J-Bolt-Cont_108th.OUT
10/13/2006  08:57 AM             3,790 J-Bolt-Cont_117max.OUT
10/13/2006  08:57 AM             9,666 J-Bolt-Cont_117th.OUT
10/13/2006  08:57 AM             3,790 J-Bolt-Cont_126max.OUT
10/13/2006  08:57 AM             9,666 J-Bolt-Cont_126th.OUT
10/13/2006  08:57 AM             3,790 J-Bolt-Cont_135max.OUT
10/13/2006  08:57 AM             9,666 J-Bolt-Cont_135th.OUT
10/13/2006  08:57 AM             3,790 J-Bolt-Cont_144max.OUT
10/13/2006  08:57 AM             9,666 J-Bolt-Cont_144th.OUT
10/13/2006  08:57 AM             3,790 J-Bolt-Cont_153max.OUT
10/13/2006  08:57 AM             9,666 J-Bolt-Cont_153th.OUT
10/13/2006  08:57 AM             3,790 J-Bolt-Cont_162max.OUT
10/13/2006  08:57 AM             9,666 J-Bolt-Cont_162th.OUT
10/13/2006  08:57 AM             3,790 J-Bolt-Cont_171max.OUT
```

```
10/13/2006  08:57 AM             9,666 J-Bolt-Cont_171th.OUT
10/13/2006  08:57 AM             3,790 J-Bolt-Cont_180max.OUT
10/13/2006  08:57 AM             9,666 J-Bolt-Cont_180th.OUT
10/13/2006  08:57 AM             3,790 J-Bolt-Cont_18max.OUT
10/13/2006  08:57 AM             9,666 J-Bolt-Cont_18th.OUT
10/13/2006  08:57 AM             3,790 J-Bolt-Cont_27max.OUT
10/13/2006  08:57 AM             9,666 J-Bolt-Cont_27th.OUT
10/13/2006  08:57 AM             3,790 J-Bolt-Cont_36max.OUT
10/13/2006  08:57 AM             9,666 J-Bolt-Cont_36th.OUT
10/13/2006  08:57 AM             3,790 J-Bolt-Cont_45max.OUT
10/13/2006  08:57 AM             9,666 J-Bolt-Cont_45th.OUT
10/13/2006  08:57 AM             3,790 J-Bolt-Cont_54max.OUT
10/13/2006  08:57 AM             9,666 J-Bolt-Cont_54th.OUT
10/13/2006  08:57 AM             3,790 J-Bolt-Cont_63max.OUT
10/13/2006  08:57 AM             9,666 J-Bolt-Cont_63th.OUT
10/13/2006  08:57 AM             3,790 J-Bolt-Cont_72max.OUT
10/13/2006  08:57 AM             9,666 J-Bolt-Cont_72th.OUT
10/13/2006  08:57 AM             3,790 J-Bolt-Cont_81max.OUT
10/13/2006  08:57 AM             9,666 J-Bolt-Cont_81th.OUT
10/13/2006  08:57 AM             3,790 J-Bolt-Cont_90max.OUT
10/13/2006  08:57 AM             9,666 J-Bolt-Cont_90th.OUT
10/13/2006  08:57 AM             3,790 J-Bolt-Cont_99max.OUT
10/13/2006  08:57 AM             9,666 J-Bolt-Cont_99th.OUT
10/13/2006  08:57 AM             3,790 J-Bolt-Cont_9max.OUT
10/13/2006  08:57 AM             9,794 J-Bolt-Cont_9th.OUT
08/23/2006  07:47 AM             1,971 Liner.txt
05/02/2005  02:19 PM               667 live_load.txt
07/21/2006  10:03 AM             6,214 Near-Soil-1.txt
04/20/2005  01:14 PM               508 outer-spar.txt
10/13/2006  07:46 AM               123 Post-Tank.txt
10/17/2006  08:07 AM           105,984 Primary-Contact_0-90.xls
10/17/2006  08:08 AM           105,984 Primary-Contact_99-180.xls
10/13/2006  08:57 AM             3,376 Primary-Cont_108max.OUT
10/13/2006  08:57 AM             9,488 Primary-Cont_108th.OUT
10/13/2006  08:57 AM             3,376 Primary-Cont_117max.OUT
10/13/2006  08:57 AM             9,488 Primary-Cont_117th.OUT
10/13/2006  08:57 AM             3,376 Primary-Cont_126max.OUT
10/13/2006  08:57 AM             9,488 Primary-Cont_126th.OUT
10/13/2006  08:57 AM             3,376 Primary-Cont_135max.OUT
10/13/2006  08:57 AM             9,488 Primary-Cont_135th.OUT
10/13/2006  08:57 AM             3,376 Primary-Cont_144max.OUT
10/13/2006  08:57 AM             9,488 Primary-Cont_144th.OUT
10/13/2006  08:57 AM             3,376 Primary-Cont_153max.OUT
10/13/2006  08:57 AM             9,488 Primary-Cont_153th.OUT
10/13/2006  08:57 AM             3,376 Primary-Cont_162max.OUT
10/13/2006  08:57 AM             9,488 Primary-Cont_162th.OUT
10/13/2006  08:57 AM             3,376 Primary-Cont_171max.OUT
10/13/2006  08:57 AM             9,488 Primary-Cont_171th.OUT
10/13/2006  08:57 AM             3,376 Primary-Cont_180max.OUT
10/13/2006  08:57 AM             9,488 Primary-Cont_180th.OUT
10/13/2006  08:57 AM             3,376 Primary-Cont_18max.OUT
10/13/2006  08:57 AM             9,488 Primary-Cont_18th.OUT
10/13/2006  08:57 AM             3,376 Primary-Cont_27max.OUT
10/13/2006  08:57 AM             9,488 Primary-Cont_27th.OUT
10/13/2006  08:57 AM             3,376 Primary-Cont_36max.OUT
10/13/2006  08:57 AM             9,488 Primary-Cont_36th.OUT
10/13/2006  08:57 AM             3,376 Primary-Cont_45max.OUT
10/13/2006  08:57 AM             9,488 Primary-Cont_45th.OUT
10/13/2006  08:57 AM             3,376 Primary-Cont_54max.OUT
10/13/2006  08:57 AM             9,488 Primary-Cont_54th.OUT
10/13/2006  08:57 AM             3,376 Primary-Cont_63max.OUT
10/13/2006  08:57 AM             9,488 Primary-Cont_63th.OUT
10/13/2006  08:57 AM             3,376 Primary-Cont_72max.OUT
10/13/2006  08:57 AM             9,488 Primary-Cont_72th.OUT
10/13/2006  08:57 AM             3,376 Primary-Cont_81max.OUT
10/13/2006  08:57 AM             9,488 Primary-Cont_81th.OUT
10/13/2006  08:57 AM             3,376 Primary-Cont_90max.OUT
10/13/2006  08:57 AM             9,488 Primary-Cont_90th.OUT
10/13/2006  08:57 AM             3,376 Primary-Cont_99max.OUT
10/13/2006  08:57 AM             9,488 Primary-Cont_99th.OUT
```

```
10/13/2006  08:57 AM             3,376 Primary-Cont_9max.OUT
10/13/2006  08:57 AM             9,616 Primary-Cont_9th.OUT
10/12/2006  02:28 PM             6,028 Primary-Props-AP.txt
09/27/2005  03:52 PM             1,538 Primary.txt
10/13/2006  08:37 AM           450,096 QA.out
10/31/2005  10:31 AM             1,108 RS_FREQ.txt
10/12/2006  03:25 PM         4,960,128 Run-Tank-Out.out
10/12/2006  03:03 PM             1,820 Run-Tank.txt
01/04/2007  01:57 PM                 0 scratch.hlp
02/11/2005  01:22 PM             1,053 Slave.txt
10/13/2006  08:57 AM             9,896 Soil-Contact_108max.OUT
10/13/2006  08:57 AM            29,320 Soil-Contact_108th.OUT
10/13/2006  08:57 AM             9,896 Soil-Contact_117max.OUT
10/13/2006  08:57 AM            29,320 Soil-Contact_117th.OUT
10/13/2006  08:57 AM             9,896 Soil-Contact_126max.OUT
10/13/2006  08:57 AM            29,320 Soil-Contact_126th.OUT
10/13/2006  08:57 AM             9,896 Soil-Contact_135max.OUT
10/13/2006  08:57 AM            29,320 Soil-Contact_135th.OUT
10/13/2006  08:57 AM             9,896 Soil-Contact_144max.OUT
10/13/2006  08:57 AM            29,320 Soil-Contact_144th.OUT
10/13/2006  08:57 AM             9,896 Soil-Contact_153max.OUT
10/13/2006  08:57 AM            29,320 Soil-Contact_153th.OUT
10/13/2006  08:57 AM             9,896 Soil-Contact_162max.OUT
10/13/2006  08:57 AM            29,320 Soil-Contact_162th.OUT
10/13/2006  08:57 AM             9,896 Soil-Contact_171max.OUT
10/13/2006  08:57 AM            29,320 Soil-Contact_171th.OUT
10/13/2006  08:57 AM             9,896 Soil-Contact_180max.OUT
10/13/2006  08:57 AM            29,320 Soil-Contact_180th.OUT
10/13/2006  08:57 AM             9,896 Soil-Contact_18max.OUT
10/13/2006  08:57 AM            29,320 Soil-Contact_18th.OUT
10/13/2006  08:57 AM             9,896 Soil-Contact_27max.OUT
10/13/2006  08:57 AM            29,320 Soil-Contact_27th.OUT
10/13/2006  08:57 AM             9,896 Soil-Contact_36max.OUT
10/13/2006  08:57 AM            29,320 Soil-Contact_36th.OUT
10/13/2006  08:57 AM             9,896 Soil-Contact_45max.OUT
10/13/2006  08:57 AM            29,320 Soil-Contact_45th.OUT
10/13/2006  08:57 AM             9,896 Soil-Contact_54max.OUT
10/13/2006  08:57 AM            29,320 Soil-Contact_54th.OUT
10/13/2006  08:57 AM             9,896 Soil-Contact_63max.OUT
10/13/2006  08:57 AM            29,320 Soil-Contact_63th.OUT
10/13/2006  08:57 AM             9,896 Soil-Contact_72max.OUT
10/13/2006  08:57 AM            29,320 Soil-Contact_72th.OUT
10/13/2006  08:57 AM             9,896 Soil-Contact_81max.OUT
10/13/2006  08:57 AM            29,320 Soil-Contact_81th.OUT
10/13/2006  08:57 AM             9,896 Soil-Contact_90max.OUT
10/13/2006  08:57 AM            29,320 Soil-Contact_90th.OUT
10/13/2006  08:57 AM             9,896 Soil-Contact_99max.OUT
10/13/2006  08:57 AM            29,320 Soil-Contact_99th.OUT
10/13/2006  08:57 AM             9,896 Soil-Contact_9max.OUT
10/13/2006  08:57 AM            29,448 Soil-Contact_9th.OUT
11/11/2005  10:36 AM             4,989 Soil-Prop-Mean-Geo.txt
10/13/2006  09:36 AM           224,256 soil_0-90.xls
10/13/2006  09:37 AM           224,256 soil_99-180.xls
08/25/2006  08:18 AM             1,929 Solve-Gravity-BES.txt
08/21/2006  08:00 AM             3,363 spectra-conc-0.txt
10/31/2005  11:41 AM             1,459 spectra-conc.txt
10/14/2005  11:18 AM             2,061 spectra-concrete.txt
10/31/2005  10:16 AM             3,402 spectra-primary-0.txt
08/21/2006  08:01 AM             3,551 spectra-primary-180.txt
09/06/2005  06:49 AM             1,287 spectra-soil.txt
06/20/2005  09:04 AM               647 spectra-wall.txt
06/20/2005  08:52 AM               679 spectra-waste.txt
10/13/2006  09:47 AM           288,768 str-comp_0-90b.xls
10/13/2006  09:46 AM           289,792 str-comp_0-90m.xls
10/13/2006  09:47 AM           288,256 str-comp_0-90t.xls
10/13/2006  08:24 AM           288,768 str-comp_99-180b.xls
10/13/2006  09:47 AM           289,792 str-comp_99-180m.xls
10/13/2006  09:47 AM           288,256 str-comp_99-180t.xls
01/04/2007  12:38 PM             1,825 strain-backed-principle-bot.txt
01/03/2007  03:40 PM             1,828 strain-backed-principle-mid.txt
```

```
01/03/2007  03:41 PM             1,825 strain-backed-principle-top.txt
01/03/2007  04:02 PM               966 Strain-Backed-Principle.txt
01/04/2007  07:51 AM             7,496 Strain-Backed-Princ_108-bot-max.OUT
01/04/2007  07:51 AM            23,628 Strain-Backed-Princ_108-bot-th.OUT
01/04/2007  07:52 AM             7,162 Strain-Backed-Princ_108-Top-max.OUT
01/04/2007  07:52 AM            22,554 Strain-Backed-Princ_108-Top-th.OUT
01/04/2007  07:52 AM             4,156 Strain-Backed-Princ_108max.OUT
01/04/2007  07:52 AM            12,888 Strain-Backed-Princ_108th.OUT
01/04/2007  07:51 AM             7,496 Strain-Backed-Princ_117-bot-max.OUT
01/04/2007  07:51 AM            23,628 Strain-Backed-Princ_117-bot-th.OUT
01/04/2007  07:52 AM             7,162 Strain-Backed-Princ_117-Top-max.OUT
01/04/2007  07:52 AM            22,554 Strain-Backed-Princ_117-Top-th.OUT
01/04/2007  07:52 AM             4,156 Strain-Backed-Princ_117max.OUT
01/04/2007  07:52 AM            12,888 Strain-Backed-Princ_117th.OUT
01/04/2007  07:51 AM             7,496 Strain-Backed-Princ_126-bot-max.OUT
01/04/2007  07:51 AM            23,628 Strain-Backed-Princ_126-bot-th.OUT
01/04/2007  07:52 AM             7,162 Strain-Backed-Princ_126-Top-max.OUT
01/04/2007  07:52 AM            22,554 Strain-Backed-Princ_126-Top-th.OUT
01/04/2007  07:52 AM             4,156 Strain-Backed-Princ_126max.OUT
01/04/2007  07:52 AM            12,888 Strain-Backed-Princ_126th.OUT
01/04/2007  07:51 AM             7,496 Strain-Backed-Princ_135-bot-max.OUT
01/04/2007  07:51 AM            23,628 Strain-Backed-Princ_135-bot-th.OUT
01/04/2007  07:52 AM             7,162 Strain-Backed-Princ_135-Top-max.OUT
01/04/2007  07:52 AM            22,554 Strain-Backed-Princ_135-Top-th.OUT
01/04/2007  07:52 AM             4,156 Strain-Backed-Princ_135max.OUT
01/04/2007  07:52 AM            12,888 Strain-Backed-Princ_135th.OUT
01/04/2007  07:52 AM             7,496 Strain-Backed-Princ_144-bot-max.OUT
01/04/2007  07:52 AM            23,628 Strain-Backed-Princ_144-bot-th.OUT
01/04/2007  07:52 AM             7,162 Strain-Backed-Princ_144-Top-max.OUT
01/04/2007  07:52 AM            22,554 Strain-Backed-Princ_144-Top-th.OUT
01/04/2007  07:52 AM             4,156 Strain-Backed-Princ_144max.OUT
01/04/2007  07:52 AM            12,888 Strain-Backed-Princ_144th.OUT
01/04/2007  07:52 AM             7,496 Strain-Backed-Princ_153-bot-max.OUT
01/04/2007  07:52 AM            23,628 Strain-Backed-Princ_153-bot-th.OUT
01/04/2007  07:52 AM             7,162 Strain-Backed-Princ_153-Top-max.OUT
01/04/2007  07:52 AM            22,554 Strain-Backed-Princ_153-Top-th.OUT
01/04/2007  07:52 AM             4,156 Strain-Backed-Princ_153max.OUT
01/04/2007  07:52 AM            12,888 Strain-Backed-Princ_153th.OUT
01/04/2007  07:52 AM             7,496 Strain-Backed-Princ_162-bot-max.OUT
01/04/2007  07:52 AM            23,628 Strain-Backed-Princ_162-bot-th.OUT
01/04/2007  07:52 AM             7,162 Strain-Backed-Princ_162-Top-max.OUT
01/04/2007  07:52 AM            22,554 Strain-Backed-Princ_162-Top-th.OUT
01/04/2007  07:52 AM             4,156 Strain-Backed-Princ_162max.OUT
01/04/2007  07:52 AM            12,888 Strain-Backed-Princ_162th.OUT
01/04/2007  07:52 AM             7,496 Strain-Backed-Princ_171-bot-max.OUT
01/04/2007  07:52 AM            23,628 Strain-Backed-Princ_171-bot-th.OUT
01/04/2007  07:52 AM             7,162 Strain-Backed-Princ_171-Top-max.OUT
01/04/2007  07:52 AM            22,554 Strain-Backed-Princ_171-Top-th.OUT
01/04/2007  07:52 AM             4,156 Strain-Backed-Princ_171max.OUT
01/04/2007  07:52 AM            12,888 Strain-Backed-Princ_171th.OUT
01/04/2007  07:51 AM             7,496 Strain-Backed-Princ_18-bot-max.OUT
01/04/2007  07:51 AM            23,628 Strain-Backed-Princ_18-bot-th.OUT
01/04/2007  07:52 AM             7,162 Strain-Backed-Princ_18-Top-max.OUT
01/04/2007  07:52 AM            22,554 Strain-Backed-Princ_18-Top-th.OUT
01/04/2007  07:52 AM             7,496 Strain-Backed-Princ_180-bot-max.OUT
01/04/2007  07:52 AM            23,628 Strain-Backed-Princ_180-bot-th.OUT
01/04/2007  07:52 AM             7,162 Strain-Backed-Princ_180-Top-max.OUT
01/04/2007  07:52 AM            22,554 Strain-Backed-Princ_180-Top-th.OUT
01/04/2007  07:52 AM             4,156 Strain-Backed-Princ_180max.OUT
01/04/2007  07:52 AM            12,888 Strain-Backed-Princ_180th.OUT
01/04/2007  07:52 AM             4,156 Strain-Backed-Princ_18max.OUT
01/04/2007  07:52 AM            12,888 Strain-Backed-Princ_18th.OUT
01/04/2007  07:51 AM             7,496 Strain-Backed-Princ_27-bot-max.OUT
01/04/2007  07:51 AM            23,628 Strain-Backed-Princ_27-bot-th.OUT
01/04/2007  07:52 AM             7,162 Strain-Backed-Princ_27-Top-max.OUT
01/04/2007  07:52 AM            22,554 Strain-Backed-Princ_27-Top-th.OUT
01/04/2007  07:52 AM             4,156 Strain-Backed-Princ_27max.OUT
01/04/2007  07:52 AM            12,888 Strain-Backed-Princ_27th.OUT
01/04/2007  07:51 AM             7,496 Strain-Backed-Princ_36-bot-max.OUT
01/04/2007  07:51 AM            23,628 Strain-Backed-Princ_36-bot-th.OUT
```

```
01/04/2007  07:52 AM             7,162 Strain-Backed-Princ_36-Top-max.OUT
01/04/2007  07:52 AM            22,554 Strain-Backed-Princ_36-Top-th.OUT
01/04/2007  07:52 AM             4,156 Strain-Backed-Princ_36max.OUT
01/04/2007  07:52 AM            12,888 Strain-Backed-Princ_36th.OUT
01/04/2007  07:51 AM             7,496 Strain-Backed-Princ_45-bot-max.OUT
01/04/2007  07:51 AM            23,628 Strain-Backed-Princ_45-bot-th.OUT
01/04/2007  07:52 AM             7,162 Strain-Backed-Princ_45-Top-max.OUT
01/04/2007  07:52 AM            22,554 Strain-Backed-Princ_45-Top-th.OUT
01/04/2007  07:52 AM             4,156 Strain-Backed-Princ_45max.OUT
01/04/2007  07:52 AM            12,888 Strain-Backed-Princ_45th.OUT
01/04/2007  07:51 AM             7,496 Strain-Backed-Princ_54-bot-max.OUT
01/04/2007  07:51 AM            23,628 Strain-Backed-Princ_54-bot-th.OUT
01/04/2007  07:52 AM             7,162 Strain-Backed-Princ_54-Top-max.OUT
01/04/2007  07:52 AM            22,554 Strain-Backed-Princ_54-Top-th.OUT
01/04/2007  07:52 AM             4,156 Strain-Backed-Princ_54max.OUT
01/04/2007  07:52 AM            12,888 Strain-Backed-Princ_54th.OUT
01/04/2007  07:51 AM             7,496 Strain-Backed-Princ_63-bot-max.OUT
01/04/2007  07:51 AM            23,628 Strain-Backed-Princ_63-bot-th.OUT
01/04/2007  07:52 AM             7,162 Strain-Backed-Princ_63-Top-max.OUT
01/04/2007  07:52 AM            22,554 Strain-Backed-Princ_63-Top-th.OUT
01/04/2007  07:52 AM             4,156 Strain-Backed-Princ_63max.OUT
01/04/2007  07:52 AM            12,888 Strain-Backed-Princ_63th.OUT
01/04/2007  07:51 AM             7,496 Strain-Backed-Princ_72-bot-max.OUT
01/04/2007  07:51 AM            23,628 Strain-Backed-Princ_72-bot-th.OUT
01/04/2007  07:52 AM             7,162 Strain-Backed-Princ_72-Top-max.OUT
01/04/2007  07:52 AM            22,554 Strain-Backed-Princ_72-Top-th.OUT
01/04/2007  07:52 AM             4,156 Strain-Backed-Princ_72max.OUT
01/04/2007  07:52 AM            12,888 Strain-Backed-Princ_72th.OUT
01/04/2007  07:51 AM             7,496 Strain-Backed-Princ_81-bot-max.OUT
01/04/2007  07:51 AM            23,628 Strain-Backed-Princ_81-bot-th.OUT
01/04/2007  07:52 AM             7,162 Strain-Backed-Princ_81-Top-max.OUT
01/04/2007  07:52 AM            22,554 Strain-Backed-Princ_81-Top-th.OUT
01/04/2007  07:52 AM             4,156 Strain-Backed-Princ_81max.OUT
01/04/2007  07:52 AM            12,888 Strain-Backed-Princ_81th.OUT
01/04/2007  07:51 AM             7,496 Strain-Backed-Princ_9-bot-max.OUT
01/04/2007  07:51 AM            23,756 Strain-Backed-Princ_9-bot-th.OUT
01/04/2007  07:52 AM             7,162 Strain-Backed-Princ_9-Top-max.OUT
01/04/2007  07:52 AM            22,682 Strain-Backed-Princ_9-Top-th.OUT
01/04/2007  07:51 AM             7,496 Strain-Backed-Princ_90-bot-max.OUT
01/04/2007  07:51 AM            23,628 Strain-Backed-Princ_90-bot-th.OUT
01/04/2007  07:52 AM             7,162 Strain-Backed-Princ_90-Top-max.OUT
01/04/2007  07:52 AM            22,554 Strain-Backed-Princ_90-Top-th.OUT
01/04/2007  07:52 AM             4,156 Strain-Backed-Princ_90max.OUT
01/04/2007  07:52 AM            12,888 Strain-Backed-Princ_90th.OUT
01/04/2007  07:51 AM             7,496 Strain-Backed-Princ_99-bot-max.OUT
01/04/2007  07:51 AM            23,628 Strain-Backed-Princ_99-bot-th.OUT
01/04/2007  07:52 AM             7,162 Strain-Backed-Princ_99-Top-max.OUT
01/04/2007  07:52 AM            22,554 Strain-Backed-Princ_99-Top-th.OUT
01/04/2007  07:52 AM             4,156 Strain-Backed-Princ_99max.OUT
01/04/2007  07:52 AM            12,888 Strain-Backed-Princ_99th.OUT
01/04/2007  07:52 AM             4,156 Strain-Backed-Princ_9max.OUT
01/04/2007  07:52 AM            13,016 Strain-Backed-Princ_9th.OUT
09/05/2006  02:00 PM             2,588 strain-backed.txt
08/30/2006  09:47 AM               621 strain-compb-primary.txt
08/21/2006  08:01 AM               693 strain-compb.txt
08/30/2006  09:47 AM               621 strain-compm-primary.txt
08/21/2006  08:01 AM               705 strain-compm.txt
08/30/2006  09:47 AM               621 strain-compt-primary.txt
08/21/2006  08:02 AM               720 strain-compt.txt
01/04/2007  02:18 PM             6,519 Strain-lb-p_108max-b.OUT
01/04/2007  02:18 PM            11,414 Strain-lb-p_108th-b.OUT
01/04/2007  02:18 PM             6,519 Strain-lb-p_117max-b.OUT
01/04/2007  02:18 PM            11,414 Strain-lb-p_117th-b.OUT
01/04/2007  02:18 PM             6,519 Strain-lb-p_126max-b.OUT
01/04/2007  02:18 PM            11,414 Strain-lb-p_126th-b.OUT
01/04/2007  02:18 PM             6,519 Strain-lb-p_135max-b.OUT
01/04/2007  02:18 PM            11,414 Strain-lb-p_135th-b.OUT
01/04/2007  02:18 PM             6,519 Strain-lb-p_144max-b.OUT
01/04/2007  02:18 PM            11,414 Strain-lb-p_144th-b.OUT
01/04/2007  02:18 PM             6,519 Strain-lb-p_153max-b.OUT
```

```
01/04/2007  02:18 PM          11,414 Strain-lb-p_153th-b.OUT
01/04/2007  02:18 PM           6,519 Strain-lb-p_162max-b.OUT
01/04/2007  02:18 PM          11,414 Strain-lb-p_162th-b.OUT
01/04/2007  02:18 PM           6,519 Strain-lb-p_171max-b.OUT
01/04/2007  02:18 PM          11,414 Strain-lb-p_171th-b.OUT
01/04/2007  02:18 PM           6,519 Strain-lb-p_180max-b.OUT
01/04/2007  02:18 PM          11,414 Strain-lb-p_180th-b.OUT
01/04/2007  02:18 PM           6,519 Strain-lb-p_18max-b.OUT
01/04/2007  02:18 PM          11,414 Strain-lb-p_18th-b.OUT
01/04/2007  02:18 PM           6,519 Strain-lb-p_27max-b.OUT
01/04/2007  02:18 PM          11,414 Strain-lb-p_27th-b.OUT
01/04/2007  02:18 PM           6,519 Strain-lb-p_36max-b.OUT
01/04/2007  02:18 PM          11,414 Strain-lb-p_36th-b.OUT
01/04/2007  02:18 PM           6,519 Strain-lb-p_45max-b.OUT
01/04/2007  02:18 PM          11,414 Strain-lb-p_45th-b.OUT
01/04/2007  02:18 PM           6,519 Strain-lb-p_54max-b.OUT
01/04/2007  02:18 PM          11,414 Strain-lb-p_54th-b.OUT
01/04/2007  02:18 PM           6,519 Strain-lb-p_63max-b.OUT
01/04/2007  02:18 PM          11,414 Strain-lb-p_63th-b.OUT
01/04/2007  02:18 PM           6,519 Strain-lb-p_72max-b.OUT
01/04/2007  02:18 PM          11,414 Strain-lb-p_72th-b.OUT
01/04/2007  02:18 PM           6,519 Strain-lb-p_81max-b.OUT
01/04/2007  02:18 PM          11,414 Strain-lb-p_81th-b.OUT
01/04/2007  02:18 PM           6,519 Strain-lb-p_90max-b.OUT
01/04/2007  02:18 PM          11,414 Strain-lb-p_90th-b.OUT
01/04/2007  02:18 PM           6,519 Strain-lb-p_99max-b.OUT
01/04/2007  02:18 PM          11,414 Strain-lb-p_99th-b.OUT
01/04/2007  02:18 PM           6,519 Strain-lb-p_9max-b.OUT
01/04/2007  02:18 PM          11,542 Strain-lb-p_9th-b.OUT
08/21/2006  08:02 AM             730 Strain-Liner-floor.txt
08/21/2006  08:02 AM             962 Strain-Liner-wall.txt
08/16/2006  03:01 PM             545 Strain-Liner.txt
01/04/2007  02:18 PM           6,028 Strain-lm_108max-m.OUT
01/04/2007  02:18 PM          17,592 Strain-lm_108th-m.OUT
01/04/2007  02:18 PM           6,028 Strain-lm_117max-m.OUT
01/04/2007  02:18 PM          17,592 Strain-lm_117th-m.OUT
01/04/2007  02:18 PM           6,028 Strain-lm_126max-m.OUT
01/04/2007  02:18 PM          17,592 Strain-lm_126th-m.OUT
01/04/2007  02:18 PM           6,028 Strain-lm_135max-m.OUT
01/04/2007  02:18 PM          17,592 Strain-lm_135th-m.OUT
01/04/2007  02:18 PM           6,028 Strain-lm_144max-m.OUT
01/04/2007  02:18 PM          17,592 Strain-lm_144th-m.OUT
01/04/2007  02:18 PM           6,028 Strain-lm_153max-m.OUT
01/04/2007  02:18 PM          17,592 Strain-lm_153th-m.OUT
01/04/2007  02:18 PM           6,028 Strain-lm_162max-m.OUT
01/04/2007  02:18 PM          17,592 Strain-lm_162th-m.OUT
01/04/2007  02:18 PM           6,028 Strain-lm_171max-m.OUT
01/04/2007  02:18 PM          17,592 Strain-lm_171th-m.OUT
01/04/2007  02:18 PM           6,028 Strain-lm_180max-m.OUT
01/04/2007  02:18 PM          17,592 Strain-lm_180th-m.OUT
01/04/2007  02:18 PM           6,028 Strain-lm_18max-m.OUT
01/04/2007  02:18 PM          17,592 Strain-lm_18th-m.OUT
01/04/2007  02:18 PM           6,028 Strain-lm_27max-m.OUT
01/04/2007  02:18 PM          17,592 Strain-lm_27th-m.OUT
01/04/2007  02:18 PM           6,028 Strain-lm_36max-m.OUT
01/04/2007  02:18 PM          17,592 Strain-lm_36th-m.OUT
01/04/2007  02:18 PM           6,028 Strain-lm_45max-m.OUT
01/04/2007  02:18 PM          17,592 Strain-lm_45th-m.OUT
01/04/2007  02:18 PM           6,028 Strain-lm_54max-m.OUT
01/04/2007  02:18 PM          17,592 Strain-lm_54th-m.OUT
01/04/2007  02:18 PM           6,028 Strain-lm_63max-m.OUT
01/04/2007  02:18 PM          17,592 Strain-lm_63th-m.OUT
01/04/2007  02:18 PM           6,028 Strain-lm_72max-m.OUT
01/04/2007  02:18 PM          17,592 Strain-lm_72th-m.OUT
01/04/2007  02:18 PM           6,028 Strain-lm_81max-m.OUT
01/04/2007  02:18 PM          17,592 Strain-lm_81th-m.OUT
01/04/2007  02:18 PM           6,028 Strain-lm_90max-m.OUT
01/04/2007  02:18 PM          17,592 Strain-lm_90th-m.OUT
01/04/2007  02:18 PM           6,028 Strain-lm_99max-m.OUT
01/04/2007  02:18 PM          17,592 Strain-lm_99th-m.OUT
```

```
01/04/2007  02:18 PM           6,028 Strain-lm_9max-m.OUT
01/04/2007  02:18 PM          17,720 Strain-lm_9th-m.OUT
01/04/2007  02:18 PM           6,028 Strain-lt_108max-t.OUT
01/04/2007  02:18 PM          17,592 Strain-lt_108th-t.OUT
01/04/2007  02:18 PM           6,028 Strain-lt_117max-t.OUT
01/04/2007  02:18 PM          17,592 Strain-lt_117th-t.OUT
01/04/2007  02:18 PM           6,028 Strain-lt_126max-t.OUT
01/04/2007  02:18 PM          17,592 Strain-lt_126th-t.OUT
01/04/2007  02:18 PM           6,028 Strain-lt_135max-t.OUT
01/04/2007  02:18 PM          17,592 Strain-lt_135th-t.OUT
01/04/2007  02:18 PM           6,028 Strain-lt_144max-t.OUT
01/04/2007  02:18 PM          17,592 Strain-lt_144th-t.OUT
01/04/2007  02:18 PM           6,028 Strain-lt_153max-t.OUT
01/04/2007  02:18 PM          17,592 Strain-lt_153th-t.OUT
01/04/2007  02:18 PM           6,028 Strain-lt_162max-t.OUT
01/04/2007  02:18 PM          17,592 Strain-lt_162th-t.OUT
01/04/2007  02:18 PM           6,028 Strain-lt_171max-t.OUT
01/04/2007  02:18 PM          17,592 Strain-lt_171th-t.OUT
01/04/2007  02:18 PM           6,028 Strain-lt_180max-t.OUT
01/04/2007  02:18 PM          17,592 Strain-lt_180th-t.OUT
01/04/2007  02:18 PM           6,028 Strain-lt_18max-t.OUT
01/04/2007  02:18 PM          17,592 Strain-lt_18th-t.OUT
01/04/2007  02:18 PM           6,028 Strain-lt_27max-t.OUT
01/04/2007  02:18 PM          17,592 Strain-lt_27th-t.OUT
01/04/2007  02:18 PM           6,028 Strain-lt_36max-t.OUT
01/04/2007  02:18 PM          17,592 Strain-lt_36th-t.OUT
01/04/2007  02:18 PM           6,028 Strain-lt_45max-t.OUT
01/04/2007  02:18 PM          17,592 Strain-lt_45th-t.OUT
01/04/2007  02:18 PM           6,028 Strain-lt_54max-t.OUT
01/04/2007  02:18 PM          17,592 Strain-lt_54th-t.OUT
01/04/2007  02:18 PM           6,028 Strain-lt_63max-t.OUT
01/04/2007  02:18 PM          17,592 Strain-lt_63th-t.OUT
01/04/2007  02:18 PM           6,028 Strain-lt_72max-t.OUT
01/04/2007  02:18 PM          17,592 Strain-lt_72th-t.OUT
01/04/2007  02:18 PM           6,028 Strain-lt_81max-t.OUT
01/04/2007  02:18 PM          17,592 Strain-lt_81th-t.OUT
01/04/2007  02:18 PM           6,028 Strain-lt_90max-t.OUT
01/04/2007  02:18 PM          17,592 Strain-lt_90th-t.OUT
01/04/2007  02:18 PM           6,028 Strain-lt_99max-t.OUT
01/04/2007  02:18 PM          17,592 Strain-lt_99th-t.OUT
01/04/2007  02:18 PM           6,028 Strain-lt_9max-t.OUT
01/04/2007  02:18 PM          17,720 Strain-lt_9th-t.OUT
08/16/2006  02:01 PM             292 Strain-Primary.txt
01/04/2007  07:59 AM         113,152 Strain-Princ_0-90.xls
01/04/2007  07:59 AM         187,904 Strain-Princ_0-90b.xls
01/04/2007  07:59 AM         180,224 Strain-Princ_0-90t.xls
01/04/2007  08:00 AM         113,152 Strain-Princ_99-180.xls
01/04/2007  08:00 AM         188,416 Strain-Princ_99-180b.xls
01/04/2007  08:00 AM         180,736 Strain-Princ_99-180t.xls
08/30/2006  09:38 AM             274 Strain.txt
08/21/2006  08:02 AM             554 stress-compb-primary.txt
08/21/2006  08:02 AM             598 stress-compb.txt
08/21/2006  08:03 AM             554 stress-compm-primary.txt
08/21/2006  08:03 AM             608 stress-compm.txt
08/21/2006  08:03 AM             554 stress-compt-primary.txt
08/24/2006  03:19 PM             598 stress-compt.txt
08/17/2006  11:19 AM             207 Stress-Primary-M.txt
08/24/2006  12:05 PM             224 Stress-Primary.txt
10/13/2006  08:58 AM          13,519 Stress-pt_108max-b.OUT
10/13/2006  08:58 AM          13,519 Stress-pt_108max-m.OUT
10/13/2006  08:57 AM          13,519 Stress-pt_108max-t.OUT
10/13/2006  08:58 AM          44,034 Stress-pt_108th-b.OUT
10/13/2006  08:58 AM          44,034 Stress-pt_108th-m.OUT
10/13/2006  08:57 AM          43,838 Stress-pt_108th-t.OUT
10/13/2006  08:58 AM          13,519 Stress-pt_117max-b.OUT
10/13/2006  08:58 AM          13,519 Stress-pt_117max-m.OUT
10/13/2006  08:58 AM          13,519 Stress-pt_117max-t.OUT
10/13/2006  08:58 AM          44,034 Stress-pt_117th-b.OUT
10/13/2006  08:58 AM          44,034 Stress-pt_117th-m.OUT
10/13/2006  08:58 AM          43,838 Stress-pt_117th-t.OUT
```

```
10/13/2006  08:58 AM            13,519 Stress-pt_126max-b.OUT
10/13/2006  08:58 AM            13,519 Stress-pt_126max-m.OUT
10/13/2006  08:58 AM            13,519 Stress-pt_126max-t.OUT
10/13/2006  08:58 AM            44,034 Stress-pt_126th-b.OUT
10/13/2006  08:58 AM            44,034 Stress-pt_126th-m.OUT
10/13/2006  08:58 AM            43,838 Stress-pt_126th-t.OUT
10/13/2006  08:58 AM            13,519 Stress-pt_135max-b.OUT
10/13/2006  08:58 AM            13,519 Stress-pt_135max-m.OUT
10/13/2006  08:58 AM            13,519 Stress-pt_135max-t.OUT
10/13/2006  08:58 AM            44,034 Stress-pt_135th-b.OUT
10/13/2006  08:58 AM            44,034 Stress-pt_135th-m.OUT
10/13/2006  08:58 AM            43,838 Stress-pt_135th-t.OUT
10/13/2006  08:58 AM            13,519 Stress-pt_144max-b.OUT
10/13/2006  08:58 AM            13,519 Stress-pt_144max-m.OUT
10/13/2006  08:58 AM            13,519 Stress-pt_144max-t.OUT
10/13/2006  08:58 AM            44,034 Stress-pt_144th-b.OUT
10/13/2006  08:58 AM            44,034 Stress-pt_144th-m.OUT
10/13/2006  08:58 AM            43,838 Stress-pt_144th-t.OUT
10/13/2006  08:58 AM            13,519 Stress-pt_153max-b.OUT
10/13/2006  08:58 AM            13,519 Stress-pt_153max-m.OUT
10/13/2006  08:58 AM            13,519 Stress-pt_153max-t.OUT
10/13/2006  08:58 AM            44,034 Stress-pt_153th-b.OUT
10/13/2006  08:58 AM            44,034 Stress-pt_153th-m.OUT
10/13/2006  08:58 AM            43,838 Stress-pt_153th-t.OUT
10/13/2006  08:58 AM            13,519 Stress-pt_162max-b.OUT
10/13/2006  08:58 AM            13,519 Stress-pt_162max-m.OUT
10/13/2006  08:58 AM            13,519 Stress-pt_162max-t.OUT
10/13/2006  08:58 AM            44,034 Stress-pt_162th-b.OUT
10/13/2006  08:58 AM            44,034 Stress-pt_162th-m.OUT
10/13/2006  08:58 AM            43,838 Stress-pt_162th-t.OUT
10/13/2006  08:58 AM            13,521 Stress-pt_171max-b.OUT
10/13/2006  08:58 AM            13,521 Stress-pt_171max-m.OUT
10/13/2006  08:58 AM            13,521 Stress-pt_171max-t.OUT
10/13/2006  08:58 AM            44,034 Stress-pt_171th-b.OUT
10/13/2006  08:58 AM            44,034 Stress-pt_171th-m.OUT
10/13/2006  08:58 AM            43,838 Stress-pt_171th-t.OUT
10/13/2006  08:58 AM            13,521 Stress-pt_180max-b.OUT
10/13/2006  08:58 AM            13,521 Stress-pt_180max-m.OUT
10/13/2006  08:58 AM            13,521 Stress-pt_180max-t.OUT
10/13/2006  08:58 AM            44,034 Stress-pt_180th-b.OUT
10/13/2006  08:58 AM            44,034 Stress-pt_180th-m.OUT
10/13/2006  08:58 AM            43,838 Stress-pt_180th-t.OUT
10/13/2006  08:58 AM            13,519 Stress-pt_18max-b.OUT
10/13/2006  08:58 AM            13,519 Stress-pt_18max-m.OUT
10/13/2006  08:57 AM            13,519 Stress-pt_18max-t.OUT
10/13/2006  08:58 AM            44,034 Stress-pt_18th-b.OUT
10/13/2006  08:58 AM            44,034 Stress-pt_18th-m.OUT
10/13/2006  08:57 AM            43,838 Stress-pt_18th-t.OUT
10/13/2006  08:58 AM            13,519 Stress-pt_27max-b.OUT
10/13/2006  08:58 AM            13,519 Stress-pt_27max-m.OUT
10/13/2006  08:57 AM            13,519 Stress-pt_27max-t.OUT
10/13/2006  08:58 AM            44,034 Stress-pt_27th-b.OUT
10/13/2006  08:58 AM            44,034 Stress-pt_27th-m.OUT
10/13/2006  08:57 AM            43,838 Stress-pt_27th-t.OUT
10/13/2006  08:58 AM            13,519 Stress-pt_36max-b.OUT
10/13/2006  08:58 AM            13,519 Stress-pt_36max-m.OUT
10/13/2006  08:57 AM            13,519 Stress-pt_36max-t.OUT
10/13/2006  08:58 AM            44,034 Stress-pt_36th-b.OUT
10/13/2006  08:58 AM            44,034 Stress-pt_36th-m.OUT
10/13/2006  08:57 AM            43,838 Stress-pt_36th-t.OUT
10/13/2006  08:58 AM            13,519 Stress-pt_45max-b.OUT
10/13/2006  08:58 AM            13,519 Stress-pt_45max-m.OUT
10/13/2006  08:57 AM            13,519 Stress-pt_45max-t.OUT
10/13/2006  08:58 AM            44,034 Stress-pt_45th-b.OUT
10/13/2006  08:58 AM            44,034 Stress-pt_45th-m.OUT
10/13/2006  08:57 AM            43,838 Stress-pt_45th-t.OUT
10/13/2006  08:58 AM            13,519 Stress-pt_54max-b.OUT
10/13/2006  08:58 AM            13,519 Stress-pt_54max-m.OUT
10/13/2006  08:57 AM            13,519 Stress-pt_54max-t.OUT
10/13/2006  08:58 AM            44,034 Stress-pt_54th-b.OUT
```

```
10/13/2006  08:58 AM            44,034 Stress-pt_54th-m.OUT
10/13/2006  08:57 AM            43,838 Stress-pt_54th-t.OUT
10/13/2006  08:58 AM            13,519 Stress-pt_63max-b.OUT
10/13/2006  08:58 AM            13,519 Stress-pt_63max-m.OUT
10/13/2006  08:57 AM            13,519 Stress-pt_63max-t.OUT
10/13/2006  08:58 AM            44,034 Stress-pt_63th-b.OUT
10/13/2006  08:58 AM            44,034 Stress-pt_63th-m.OUT
10/13/2006  08:57 AM            43,838 Stress-pt_63th-t.OUT
10/13/2006  08:58 AM            13,519 Stress-pt_72max-b.OUT
10/13/2006  08:58 AM            13,519 Stress-pt_72max-m.OUT
10/13/2006  08:57 AM            13,519 Stress-pt_72max-t.OUT
10/13/2006  08:58 AM            44,034 Stress-pt_72th-b.OUT
10/13/2006  08:58 AM            44,034 Stress-pt_72th-m.OUT
10/13/2006  08:57 AM            43,838 Stress-pt_72th-t.OUT
10/13/2006  08:58 AM            13,519 Stress-pt_81max-b.OUT
10/13/2006  08:58 AM            13,519 Stress-pt_81max-m.OUT
10/13/2006  08:57 AM            13,519 Stress-pt_81max-t.OUT
10/13/2006  08:58 AM            44,034 Stress-pt_81th-b.OUT
10/13/2006  08:58 AM            44,034 Stress-pt_81th-m.OUT
10/13/2006  08:57 AM            43,838 Stress-pt_81th-t.OUT
10/13/2006  08:58 AM            13,519 Stress-pt_90max-b.OUT
10/13/2006  08:58 AM            13,519 Stress-pt_90max-m.OUT
10/13/2006  08:57 AM            13,519 Stress-pt_90max-t.OUT
10/13/2006  08:58 AM            44,034 Stress-pt_90th-b.OUT
10/13/2006  08:58 AM            44,034 Stress-pt_90th-m.OUT
10/13/2006  08:57 AM            43,838 Stress-pt_90th-t.OUT
10/13/2006  08:58 AM            13,519 Stress-pt_99max-b.OUT
10/13/2006  08:58 AM            13,519 Stress-pt_99max-m.OUT
10/13/2006  08:57 AM            13,519 Stress-pt_99max-t.OUT
10/13/2006  08:58 AM            44,034 Stress-pt_99th-b.OUT
10/13/2006  08:58 AM            44,034 Stress-pt_99th-m.OUT
10/13/2006  08:57 AM            43,838 Stress-pt_99th-t.OUT
10/13/2006  08:58 AM            13,519 Stress-pt_9max-b.OUT
10/13/2006  08:58 AM            13,519 Stress-pt_9max-m.OUT
10/13/2006  08:57 AM            13,519 Stress-pt_9max-t.OUT
10/13/2006  08:58 AM            44,162 Stress-pt_9th-b.OUT
10/13/2006  08:58 AM            44,162 Stress-pt_9th-m.OUT
10/13/2006  08:57 AM            43,966 Stress-pt_9th-t.OUT
10/12/2006  02:29 PM             4,009 Tank-Coordinates-AP.txt
05/25/2005  03:32 PM             2,512 Tank-Mesh1.txt
10/13/2006  08:36 AM               102 tank-out.out
08/25/2006  07:52 AM             5,450 Tank-Props-BEC-250.txt
07/21/2006  09:41 AM             5,591 Tank-Props-Rigid.txt
10/13/2006  08:37 AM             4,994 Tank-th.out
12/22/2005  12:43 PM            10,035 temp.log
08/09/2006  07:43 AM            23,166 TH-266-Mean-Geo-V.txt
08/09/2006  07:31 AM            23,166 TH-266-Mean-Geo.txt
10/13/2006  08:57 AM            10,180 Waste-Cont_108max.OUT
10/13/2006  08:57 AM            31,124 Waste-Cont_108th.OUT
10/13/2006  08:57 AM            10,180 Waste-Cont_117max.OUT
10/13/2006  08:57 AM            31,124 Waste-Cont_117th.OUT
10/13/2006  08:57 AM            10,180 Waste-Cont_126max.OUT
10/13/2006  08:57 AM            31,124 Waste-Cont_126th.OUT
10/13/2006  08:57 AM            10,180 Waste-Cont_135max.OUT
10/13/2006  08:57 AM            31,124 Waste-Cont_135th.OUT
10/13/2006  08:57 AM            10,180 Waste-Cont_144max.OUT
10/13/2006  08:57 AM            31,124 Waste-Cont_144th.OUT
10/13/2006  08:57 AM            10,180 Waste-Cont_153max.OUT
10/13/2006  08:57 AM            31,124 Waste-Cont_153th.OUT
10/13/2006  08:57 AM            10,180 Waste-Cont_162max.OUT
10/13/2006  08:57 AM            31,124 Waste-Cont_162th.OUT
10/13/2006  08:57 AM            10,180 Waste-Cont_171max.OUT
10/13/2006  08:57 AM            31,124 Waste-Cont_171th.OUT
10/13/2006  08:57 AM            10,180 Waste-Cont_180max.OUT
10/13/2006  08:57 AM            31,124 Waste-Cont_180th.OUT
10/13/2006  08:57 AM            10,180 Waste-Cont_18max.OUT
10/13/2006  08:57 AM            31,124 Waste-Cont_18th.OUT
10/13/2006  08:57 AM            10,180 Waste-Cont_27max.OUT
10/13/2006  08:57 AM            31,124 Waste-Cont_27th.OUT
10/13/2006  08:57 AM            10,180 Waste-Cont_36max.OUT
```

```
10/13/2006  08:57 AM            31,124 Waste-Cont_36th.OUT
10/13/2006  08:57 AM            10,180 Waste-Cont_45max.OUT
10/13/2006  08:57 AM            31,124 Waste-Cont_45th.OUT
10/13/2006  08:57 AM            10,180 Waste-Cont_54max.OUT
10/13/2006  08:57 AM            31,124 Waste-Cont_54th.OUT
10/13/2006  08:57 AM            10,180 Waste-Cont_63max.OUT
10/13/2006  08:57 AM            31,124 Waste-Cont_63th.OUT
10/13/2006  08:57 AM            10,180 Waste-Cont_72max.OUT
10/13/2006  08:57 AM            31,124 Waste-Cont_72th.OUT
10/13/2006  08:57 AM            10,180 Waste-Cont_81max.OUT
10/13/2006  08:57 AM            31,124 Waste-Cont_81th.OUT
10/13/2006  08:57 AM            10,180 Waste-Cont_90max.OUT
10/13/2006  08:57 AM            31,124 Waste-Cont_90th.OUT
10/13/2006  08:57 AM            10,180 Waste-Cont_99max.OUT
10/13/2006  08:57 AM            31,124 Waste-Cont_99th.OUT
10/13/2006  08:57 AM            10,180 Waste-Cont_9max.OUT
10/13/2006  08:57 AM            31,252 Waste-Cont_9th.OUT
08/21/2006  01:31 PM               339 Waste-Reaction.txt
10/12/2006  02:27 PM            10,266 Waste-solid-AP-S.txt
08/21/2006  08:03 AM               776 Waste-Surface-AP.txt
10/13/2006  08:57 AM               865 Waste-Surf_0max.OUT
10/13/2006  08:57 AM             3,909 Waste-Surf_0th.OUT
10/13/2006  08:57 AM               865 Waste-Surf_108max.OUT
10/13/2006  08:57 AM             3,781 Waste-Surf_108th.OUT
10/13/2006  08:57 AM               865 Waste-Surf_117max.OUT
10/13/2006  08:57 AM             3,781 Waste-Surf_117th.OUT
10/13/2006  08:57 AM               865 Waste-Surf_126max.OUT
10/13/2006  08:57 AM             3,781 Waste-Surf_126th.OUT
10/13/2006  08:57 AM               865 Waste-Surf_135max.OUT
10/13/2006  08:57 AM             3,781 Waste-Surf_135th.OUT
10/13/2006  08:57 AM               865 Waste-Surf_144max.OUT
10/13/2006  08:57 AM             3,781 Waste-Surf_144th.OUT
10/13/2006  08:57 AM               865 Waste-Surf_153max.OUT
10/13/2006  08:57 AM             3,781 Waste-Surf_153th.OUT
10/13/2006  08:57 AM               865 Waste-Surf_162max.OUT
10/13/2006  08:57 AM             3,781 Waste-Surf_162th.OUT
10/13/2006  08:57 AM               865 Waste-Surf_171max.OUT
10/13/2006  08:57 AM             3,781 Waste-Surf_171th.OUT
10/13/2006  08:57 AM               865 Waste-Surf_180max.OUT
10/13/2006  08:57 AM             3,781 Waste-Surf_180th.OUT
10/13/2006  08:57 AM               865 Waste-Surf_189max.OUT
10/13/2006  08:57 AM             3,781 Waste-Surf_189th.OUT
10/13/2006  08:57 AM               865 Waste-Surf_18max.OUT
10/13/2006  08:57 AM             3,781 Waste-Surf_18th.OUT
10/13/2006  08:57 AM               865 Waste-Surf_27max.OUT
10/13/2006  08:57 AM             3,781 Waste-Surf_27th.OUT
10/13/2006  08:57 AM               865 Waste-Surf_36max.OUT
10/13/2006  08:57 AM             3,781 Waste-Surf_36th.OUT
10/13/2006  08:57 AM               865 Waste-Surf_45max.OUT
10/13/2006  08:57 AM             3,781 Waste-Surf_45th.OUT
10/13/2006  08:57 AM               865 Waste-Surf_54max.OUT
10/13/2006  08:57 AM             3,781 Waste-Surf_54th.OUT
10/13/2006  08:57 AM               865 Waste-Surf_63max.OUT
10/13/2006  08:57 AM             3,781 Waste-Surf_63th.OUT
10/13/2006  08:57 AM               865 Waste-Surf_72max.OUT
10/13/2006  08:57 AM             3,781 Waste-Surf_72th.OUT
10/13/2006  08:57 AM               865 Waste-Surf_81max.OUT
10/13/2006  08:57 AM             3,781 Waste-Surf_81th.OUT
10/13/2006  08:57 AM               865 Waste-Surf_90max.OUT
10/13/2006  08:57 AM             3,781 Waste-Surf_90th.OUT
10/13/2006  08:57 AM               865 Waste-Surf_99max.OUT
10/13/2006  08:57 AM             3,781 Waste-Surf_99th.OUT
10/13/2006  08:57 AM               865 Waste-Surf_9max.OUT
10/13/2006  08:57 AM             3,781 Waste-Surf_9th.OUT
10/13/2006  10:07 AM           229,376 waste_0-90.xls
10/13/2006  10:08 AM           229,376 waste_99-180.xls
             846 File(s)    764,847,953 bytes
               2 Dir(s)  248,222,928,896 bytes free
```

APPENDIX H

Upper Bound Soil
Best Estimate Concrete

Results
Load Case Specific Input Files
File Listing

LIST OF TABLES

Table 1 UBS-BEC Concrete Forces and Moment, Gravity Load Only

AP Primary Tank, Upper Bound Soil (Geomatrix), Gravity Only, Best Estimate Concrete, 460 in. Waste Level at 1.83 SpG

ANSYS MAXIMUMS BY PATH

PNNL Section No.	Path (in.)	Gravity Hoop Force (kip/ft) AP-UBS-BEC	Gravity Meridonal Force (kip/ft) AP-UBS-BEC	Gravity -In-Plane Shear Force (kip/ft) AP-UBS-BEC	Gravity Hoop Moment (ft*kip/ft) AP-UBS-BEC	Gravity Meridonal Moment (ft*kip/ft) AP-UBS-BEC	Gravity Through-Wall Shear Force (kip/ft) AP-UBS-BEC
2	**67.734**	-69.410	-74.460	-0.072	-8.576	-5.449	1.759
3	**105.676**	-62.430	-72.330	-0.076	-6.342	-2.705	1.264
4	**137.076**	-55.370	-69.950	-0.118	-4.600	-0.353	1.449
6	**182.856**	-46.480	-65.970	-0.151	-2.740	2.189	0.566
8	**226.570**	-39.590	-62.720	-0.045	-1.858	1.464	-0.500
9	**275.574**	-33.840	-59.530	-0.072	-1.692	-0.047	-0.579
11	**325.697**	-26.210	-57.030	-0.033	-1.871	-2.710	-0.650
13	**372.312**	-16.800	-54.780	0.072	-3.958	-3.227	-0.209
17	**423.434**	-6.761	-52.680	0.104	-1.474	-0.406	2.161
20	**468.315**	24.610	-50.820	0.119	-4.868	16.550	7.303
22	**515.319**	9.539	-50.480	0.072	4.106	25.040	-4.144
24	**553.722**	-2.727	-47.960	0.040	1.371	7.485	-5.798
26	**593.805**	-12.990	-49.340	-0.022	-0.264	-1.462	-0.886
30	**644.355**	-19.210	-50.880	0.011	-0.250	-1.389	0.687
33	**693.605**	-21.350	-52.100	0.008	-0.008	-0.044	0.049
35	**740.705**	-23.900	-53.400	0.006	0.024	0.132	-0.021
38	**786.205**	-21.500	-54.650	0.005	-0.109	-0.604	-0.155
41	**844.605**	-21.740	-56.270	0.004	-0.048	-0.268	-0.160
43	**901.355**	-11.290	-23.860	0.002	-0.212	-1.174	0.202
46	**932.355**	-19.870	-57.220	0.029	-0.653	-3.582	-1.056
48	**1007.355**	-2.220	-8.751	0.547	-2.896	14.650	-8.440
51	**1053.855**	-2.412	-11.600	0.762	-0.224	10.270	9.595
53	**1086.855**	-0.718	-4.912	0.358	1.698	6.434	-4.284
55	**1105.855**	0.478	-3.251	0.314	1.607	3.343	-0.508
57	**1147.355**	0.146	-1.541	0.147	0.172	0.624	-0.750
58	**1207.355**	0.338	0.172	0.024	-0.012	-0.081	0.196
59	**1267.355**	0.341	0.345	-0.009	0.017	0.085	-0.166
60	**1327.355**	0.475	0.146	0.036	-0.022	-0.129	0.155
61	**1387.355**	0.450	0.597	-0.020	0.016	0.039	-0.119
62	**1449.355**	2.264	2.390	-0.036	0.025	-0.029	0.240

Note: Meridonal/Hoop Forces and Meridonal/Hoop Moments are Reversed in Highlighted Sections.

Table 2 UBS-BEC Concrete Forces and Moments, Gravity Plus Seismic Load

1/2/2007, 10:20 AM

AP- Primary Tank, Upper Bound Soil (Geomatrix), Best Estimate Concrete, 460 in. Waste Level at 1.83 SpG

ANSYS MAXIMUMS BY PATH

PNNL Section No.	Path (in.)	Seismic Hoop Force (kip/ft) AP-UBS-BEC	Seismic Meridonal Force (kip/ft) AP-UBS-BEC	Seismic -In-Plane Shear Force (kip/ft) AP-UBS-BEC	Seismic Hoop Moment (ft*kip/ft) AP-UBS-BEC	Seismic Meridonal Moment (ft*kip/ft) AP-UBS-BEC	Seismic Through-Wall Shear Force (kip/ft) AP-UBS-BEC
2	**67.734**	-103.900	-113.000	4.856	-19.810	-15.180	4.528
3	**105.676**	-92.840	-108.400	6.714	-15.150	-12.180	3.446
4	**137.076**	-81.560	-103.300	7.732	-11.100	-7.493	3.735
6	**182.856**	-67.230	-95.150	8.727	-6.310	7.211	2.769
8	**226.570**	-62.250	-86.830	10.470	-3.880	8.797	1.401
9	**275.574**	-56.500	-79.710	12.550	-3.306	3.917	1.263
11	**325.697**	-47.570	-74.290	14.780	-3.064	-4.724	1.311
13	**372.312**	-45.490	-70.310	16.800	-5.947	-5.676	0.900
17	**423.434**	-17.450	-67.590	19.100	-2.814	-4.724	3.235
20	**468.315**	63.220	-65.180	21.520	-10.030	24.920	9.534
22	**515.319**	19.210	-64.410	20.710	5.829	33.590	6.383
24	**553.722**	-8.599	-60.400	18.360	1.795	9.814	7.800
26	**593.805**	-18.510	-62.570	17.200	-0.383	-2.051	1.142
30	**644.355**	-24.670	-64.490	16.320	-0.322	-1.752	0.887
33	**693.605**	-26.560	-65.320	15.940	-0.045	-0.200	0.086
35	**740.705**	-29.160	-66.550	16.540	0.044	0.223	0.068
38	**786.205**	-25.710	-67.690	17.410	-0.136	-0.723	0.237
41	**844.605**	-26.280	-69.090	19.260	-0.127	-0.658	0.336
43	**901.355**	-13.420	-29.420	10.010	-0.304	-1.680	0.695
46	**932.355**	-31.060	-69.910	25.870	-0.827	-4.653	1.580
48	**1007.355**	-8.971	-15.030	6.888	-3.586	18.730	10.790
51	**1053.855**	-25.790	-19.290	12.370	-0.737	13.430	12.170
53	**1086.855**	-7.688	-11.170	7.282	2.289	8.229	5.182
55	**1105.855**	19.890	-9.631	6.783	2.503	4.929	0.828
57	**1147.355**	-4.624	-6.422	3.789	0.274	0.964	1.138
58	**1207.355**	2.394	2.794	1.617	-0.018	-0.121	0.292
59	**1267.355**	1.958	2.346	0.950	0.026	0.125	0.248
60	**1327.355**	2.465	2.060	0.840	-0.032	-0.170	0.244
61	**1387.355**	1.632	2.479	0.604	0.022	0.061	0.205
62	**1449.355**	5.977	5.532	0.774	0.082	-0.156	0.368

Note: Meridonal/Hoop Forces and Meridonal/Hoop Moments are Reversed in Highlighted Sections.

Table 3 UBS-BEC Concrete Forces and Moments, Seismic Only

1/2/2007, 10:19 AM

AP- Primary Tank, Upper Bound Soil (Geomatrix), Best Estimate Concrete, 460 in. Waste Level at 1.83 SpG

ANSYS MAXIMUMS BY PATH

PNNL Section No.	Path (in.)	Seismic Only Hoop Force (kip/ft) AP-UBS-BEC	Seismic Only Meridonal Force (kip/ft) AP-UBS-BEC	Seismic Only - In-Plane Shear Force (kip/ft) AP-UBS-BEC	Seismic Only Hoop Moment (ft*kip/ft) AP-UBS-BEC	Seismic Only Meridonal Moment (ft*kip/ft) AP-UBS-BEC	Seismic Only Through-Wall Shear Force (kip/ft) AP-UBS BEC
2	**67.734**	34.600	38.540	4.833	11.325	10.425	2.780
3	**105.676**	30.510	36.090	6.735	8.886	9.536	2.460
4	**137.076**	26.330	33.350	7.776	6.528	7.482	2.596
6	**182.856**	22.860	29.180	8.815	3.706	5.916	2.776
8	**226.570**	24.180	24.130	10.491	2.109	8.946	1.086
9	**275.574**	25.245	20.190	12.549	1.832	3.927	1.022
11	**325.697**	23.465	17.260	14.785	1.485	2.367	0.729
13	**372.312**	28.990	15.530	16.821	2.446	2.769	0.875
17	**423.434**	10.780	14.930	19.127	1.395	4.407	1.112
20	**468.315**	39.180	14.380	21.549	5.322	8.390	2.274
22	**515.319**	11.178	13.970	20.727	1.732	8.590	2.240
24	**553.722**	5.872	12.470	18.369	0.447	2.360	2.011
26	**593.805**	5.530	13.250	17.205	0.118	0.589	0.280
30	**644.355**	5.460	13.620	16.322	0.072	0.367	0.200
33	**693.605**	5.210	13.230	15.943	0.037	0.156	0.042
35	**740.705**	5.270	13.150	16.540	0.028	0.096	0.047
38	**786.205**	4.660	13.040	17.410	0.027	0.138	0.081
41	**844.605**	5.220	12.820	19.259	0.078	0.390	0.176
43	**901.355**	2.493	5.940	10.010	0.122	0.676	0.494
46	**932.355**	11.260	14.380	25.869	0.182	1.073	0.897
48	**1007.355**	6.779	6.282	6.378	0.792	4.080	2.353
51	**1053.855**	23.498	7.690	11.631	0.566	3.590	2.578
53	**1086.855**	7.008	6.259	6.949	0.593	1.803	1.005
55	**1105.855**	20.194	6.382	6.491	0.899	1.589	0.474
57	**1147.355**	4.768	4.882	3.654	0.103	0.340	0.389
58	**1207.355**	2.314	2.809	1.603	0.006	0.040	0.097
59	**1267.355**	1.843	2.083	0.950	0.010	0.040	0.083
60	**1327.355**	2.206	2.127	0.811	0.010	0.040	0.090
61	**1387.355**	1.186	1.910	0.615	0.007	0.022	0.088
62	**1449.355**	3.718	3.144	0.766	0.057	0.134	0.134

Note: Meridonal/Hoop Forces and Meridonal/Hoop Moments are Reversed in Highlighted Sections.

Table 4 UBS-BEC Primary Tank Stresses, Shell Top, Gravity Load Only

AP Primary Tank, Upper Bound Soil, Gravity Only, Best Estimate Tank Concrete, 460 in. Waste Level at 1.83 SpG

M&D Starting Element No.	Path (in.)	Shell Top Surface (inside - waste side) AP-460-UBS-BEC Gravity Hoop Stress (lbs/in^2) Top	AP-460-UBS-BEC Gravity Meridional Stress (lbs/in^2) Top	AP-460-UBS-BEC Gravity Stress Intensity (lbs/in^2) Top	AP-460-UBS-BEC Gravity In-Plane Shear Stress (lbs/in^2) Top
762	**67.33**	-1502.08	-1661.81	1661.81	-2.88
782	**105.04**	-1497.92	-2139.58	2139.58	2.76
802	**136.24**	-1302.08	-2003.47	2003.47	3.59
822	**181.83**	-969.44	-1763.19	1763.19	4.02
842	**225.10**	-704.17	-1513.19	1513.89	1.37
862	**273.66**	-410.21	-1140.28	1140.28	4.02
882	**323.27**	38.32	-941.67	979.86	2.04
902	**369.20**	314.44	-302.08	615.28	-0.79
922	**419.20**	1289.58	-270.49	1559.72	-2.83
942	**444.31**	-152.15	-2658.33	2660.42	-2.49
962	**458.66**	-1099.31	2782.64	3881.94	1.76
982	**473.08**	-1508.33	2658.33	4166.67	-0.66
1002	**484.80**	-35.86	-534.38	535.76	-0.95
1022	**502.48**	2752.08	-272.15	3022.92	-1.11
1042	**526.48**	4727.78	298.89	4727.78	-0.77
1062	**550.48**	6309.72	136.32	6310.42	-0.50
1082	**574.60**	7881.94	356.18	7881.94	-0.33
1102	**598.28**	9569.44	83.54	9569.44	0.21
1122	**621.38**	11118.06	280.97	11118.06	-0.17
1142	**644.48**	12687.50	154.79	12687.50	-0.20
1162	**667.63**	13791.67	-194.38	13986.11	-0.26
1182	**690.78**	14194.44	553.26	14194.44	-0.27
1202	**713.88**	15194.44	291.67	15194.44	-0.27
1222	**736.98**	16555.56	-202.99	16763.89	-0.31
1242	**760.13**	16500.00	-581.53	17083.33	0.40
1262	**782.53**	15263.89	1115.28	15263.89	-0.33
1282	**804.13**	14923.61	430.28	14923.61	-0.41
1302	**825.73**	15770.83	93.40	15770.83	0.50
1322	**847.33**	17180.56	474.44	17180.56	-0.43
1342	**868.87**	17416.67	-2172.92	19590.28	-0.80
1362	**892.10**	12756.94	-2569.44	15326.39	1.22
1382	**909.20**	3725.00	-7534.72	11263.89	1.19
1402	**918.38**	3745.14	6644.44	6674.31	-1.23
1460	**930.48**	3176.39	8972.22	9013.89	-459.24
1442	**949.48**	102.92	-761.11	872.92	68.54
1462	**990.98**	599.03	913.19	914.58	-25.53
1482	**1050.98**	408.75	401.18	629.03	1.75
1502	**1110.98**	454.03	628.06	629.03	-15.15
1522	**1170.98**	321.67	240.63	322.22	8.08
1542	**1230.98**	391.39	498.68	499.31	-10.18
1562	**1292.98**	294.65	283.19	295.21	3.42

Note 1: Meridonal, Hoop, and Shear Stresses are Reversed in Highlighted Sections (Floor)

Table 5 UBS-BEC Primary Tank Stresses, Shell Middle, Gravity Load Only

AP Primary Tank, Upper Bound Soil, Gravity Only, Best Estimate Tank Concrete, 460 in. Waste Level at 1.83 SpG

M&D Starting Element No.	Path (in.)	Shell Mid-Plane			
		AP-460-UBS-BEC Gravity Hoop Stress (lbs/in^2) Mid	AP-460-UBS-BEC Gravity Meridional Stress (lbs/in^2) Mid	AP-460-UBS-BEC Gravity Stress Intensity (lbs/in^2) Mid	AP-460-UBS-BEC Gravity In-Plane Shear Stress (lbs/in^2) Mid
762	**67.33**	-1543.06	-1666.67	1666.67	2.08
782	**105.04**	-1529.86	-2172.22	2172.22	-2.60
802	**136.24**	-1320.14	-2002.78	2002.78	3.31
822	**181.83**	-977.78	-1754.86	1754.86	3.41
842	**225.10**	-702.78	-1486.81	1486.81	1.23
862	**273.66**	-425.83	-1171.53	1171.53	3.62
882	**323.27**	78.61	-798.61	877.78	1.90
902	**369.20**	271.04	-427.22	697.22	-0.79
922	**419.20**	1375.69	25.11	1383.33	-2.78
942	**444.31**	794.44	341.32	802.08	-2.15
962	**458.66**	-1803.47	324.03	2128.47	1.52
982	**473.08**	-2235.42	267.01	2505.56	-0.75
1002	**484.80**	202.01	244.03	247.08	-0.73
1022	**502.48**	2904.17	238.06	2904.86	-0.95
1042	**526.48**	4706.94	231.67	4707.64	-0.70
1062	**550.48**	6336.11	225.00	6336.81	-0.48
1082	**574.60**	7840.28	218.19	7840.28	-0.32
1102	**598.28**	9604.17	211.53	9604.17	-0.21
1122	**621.38**	11097.22	204.93	11097.22	-0.15
1142	**644.48**	12701.39	198.40	12701.39	-0.17
1162	**667.63**	13902.78	191.74	13902.78	-0.23
1182	**690.78**	14076.39	161.74	14076.39	-0.24
1202	**713.88**	15152.78	155.21	15152.78	-0.26
1222	**736.98**	16659.72	148.54	16666.67	-0.29
1242	**760.13**	16722.22	141.94	16722.22	0.36
1262	**782.53**	14958.33	97.85	14958.33	-0.31
1282	**804.13**	14819.44	91.67	14819.44	0.40
1302	**825.73**	15770.83	85.63	15770.83	0.48
1322	**847.33**	17062.50	79.51	17062.50	-0.43
1342	**868.87**	18090.28	73.47	18097.22	-0.66
1362	**892.10**	13541.67	55.90	13541.67	0.91
1382	**909.20**	5888.19	49.03	6018.06	0.92
1402	**918.38**	1523.61	197.85	1756.94	-0.84
1460	**930.48**	460.49	414.51	582.57	4.07
1442	**949.48**	469.03	437.71	470.14	2.78
1462	**990.98**	536.94	716.67	718.06	-14.92
1482	**1050.98**	457.85	564.38	466.94	-9.58
1502	**1110.98**	404.72	466.46	466.94	-6.28
1522	**1170.98**	366.46	389.86	390.14	-3.42
1542	**1230.98**	349.31	365.21	365.56	-2.89
1562	**1292.98**	318.61	382.57	383.47	-6.71

Note 1: Meridonal, Hoop, and Shear Stresses are Reversed in Highlighted Sections (Floor)

Table 6 UBS-BEC Primary Tank Stresses, Shell Bottom, Gravity Load Only

		AP Primary Tank, Upper Bound Soil, Gravity Only, Best Estimate Tank Concrete, 460 in. Waste Level at 1.83 SpG			
		Shell Bottom Surface (outside - away from waste)			
M&D Starting Element No.	Path (in.)	AP-460-UBS-BEC Gravity Hoop Stress (lbs/in^2) Bot	AP-460-UBS-BEC Gravity Meridional Stress (lbs/in^2) Bot	AP-460-UBS-BEC Gravity Stress Intensity (lbs/in^2) Bot	AP-460-UBS-BEC Gravity In-Plane Shear Stress (lbs/in^2) Bot
762	**67.33**	-1588.19	-1675.00	1675.00	-2.97
782	**105.04**	-1561.11	-2205.56	2205.56	2.79
802	**136.24**	-1338.89	-2002.08	2002.08	3.18
822	**181.83**	-986.11	-1747.22	1747.22	3.05
842	**225.10**	-700.69	-1461.11	1461.81	1.15
862	**273.66**	-442.01	-1203.47	1203.47	3.23
882	**323.27**	118.89	-656.60	775.00	1.76
902	**369.20**	227.57	-552.57	779.17	-0.79
922	**419.20**	1462.50	319.17	1463.19	-2.73
942	**444.31**	1735.42	3340.97	3343.06	-1.81
962	**458.66**	-2507.64	-2134.03	2507.64	1.28
982	**473.08**	-2962.50	-2124.31	2962.50	-0.83
1002	**484.80**	430.35	1021.53	1022.22	-0.51
1022	**502.48**	3056.94	747.92	3056.94	-0.78
1042	**526.48**	4687.50	164.79	4687.50	-0.66
1062	**550.48**	6363.89	313.82	6363.89	-0.45
1082	**574.60**	7798.61	80.35	7798.61	-0.30
1102	**598.28**	9645.83	339.65	9645.83	-0.21
1122	**621.38**	11069.44	129.10	11069.44	-0.15
1142	**644.48**	12715.28	242.15	12715.28	-0.14
1162	**667.63**	14020.83	576.46	14020.83	-0.20
1182	**690.78**	13958.33	-231.25	14187.50	-0.21
1202	**713.88**	15111.11	18.72	15118.06	-0.28
1222	**736.98**	16770.83	499.17	16770.83	-0.31
1242	**760.13**	16937.50	865.28	16937.50	-0.34
1262	**782.53**	14652.78	-920.14	15576.39	-0.30
1282	**804.13**	14715.28	-247.78	14965.28	0.38
1302	**825.73**	15770.83	78.19	15770.83	0.46
1322	**847.33**	16944.44	-316.04	17263.89	-0.43
1342	**868.87**	18763.89	2321.53	18763.89	0.54
1362	**892.10**	14333.33	2683.33	14333.33	0.64
1382	**909.20**	8055.56	7638.89	8055.56	0.65
1402	**918.38**	-700.69	-6249.31	6281.25	-0.56
1460	**930.48**	-2259.72	-8145.83	8187.50	466.46
1442	**949.48**	836.11	1636.11	1640.97	-63.61
1462	**990.98**	475.14	521.74	522.08	-4.35
1482	**1050.98**	507.50	729.17	356.25	-18.74
1502	**1110.98**	355.90	307.29	356.25	5.27
1522	**1170.98**	411.81	541.88	542.57	-11.86
1542	**1230.98**	307.92	235.00	308.54	7.65
1562	**1292.98**	344.51	485.35	486.39	-13.51

Note 1: Meridonal, Hoop, and Shear Stresses are Reversed in Highlighted Sections (Floor)

M&D Professional Services Confidential
12/21/2006

AP-460-UBS-BEC Pri Tank Stress Gravity.xls, Stress Max
Page 3

Table 7 UBS-BEC Primary Tank Stresses, Shell Top, Gravity Plus Seismic Load

AP Primary Tank, Upper Bound Soil, Horiizontal and Vertical Seismic, Best Estimate Tank Concrete, 460 in. Waste Level at 1.83 SpG

M&D Starting M&D Element No.	Path (in.)	Shell Top Surface (inside - waste side)			
		AP-460-UBS-BEC Seismic Hoop Stress (lbs/in^2) Top	AP-460-UBS-BEC Seismic Meridional Stress (lbs/in^2) Top	AP-460-UBS-BEC Seismic Stress Intensity (lbs/in^2) Top	AP-460-UBS-BEC Seismic In-Plane Shear Stress (lbs/in^2) Top
762	**67.33**	-2245.14	-2742.36	2742.36	-201.11
782	**105.04**	-2256.94	-3507.64	3508.33	-348.82
802	**136.24**	-2132.64	-3238.89	3238.89	-386.18
822	**181.83**	-1668.75	-2829.86	2829.86	-418.40
842	**225.10**	-1895.14	-2602.08	3173.61	-559.03
862	**273.66**	-1345.14	-2063.19	2063.89	-770.83
882	**323.27**	2020.83	-1820.14	3844.44	-1286.81
902	**369.20**	2405.56	-1342.36	3922.22	-1927.08
922	**419.20**	4272.92	-1131.25	6597.22	-3168.75
942	**444.31**	-5152.78	-5706.94	6786.11	-3086.11
962	**458.66**	-7756.94	7854.17	15576.39	-3050.69
982	**473.08**	-8354.17	8847.22	17201.39	-3215.97
1002	**484.80**	-3935.42	-2038.19	6749.31	-3363.19
1022	**502.48**	5833.33	-976.39	7750.00	-3288.19
1042	**526.48**	10590.28	1439.58	10604.17	-3028.47
1062	**550.48**	13673.61	1465.97	13680.56	-2744.44
1082	**574.60**	16437.50	1953.47	16437.50	-2420.83
1102	**598.28**	19298.61	1600.00	19305.56	2075.00
1122	**621.38**	21868.06	2027.78	21875.00	1718.75
1142	**644.48**	24263.89	1914.58	24270.83	1396.53
1162	**667.63**	25701.39	-1625.00	25701.39	-1136.11
1182	**690.78**	25854.17	2385.42	25854.17	-977.78
1202	**713.88**	27097.22	1981.25	27097.22	-927.08
1222	**736.98**	28965.28	-1486.81	28972.22	-1095.83
1242	**760.13**	28437.50	-815.28	28437.50	1452.78
1262	**782.53**	25715.28	2821.53	25715.28	1406.94
1282	**804.13**	24597.22	1657.64	24597.22	1766.67
1302	**825.73**	25604.17	1055.56	25604.17	2127.08
1322	**847.33**	27638.89	1551.39	27638.89	2491.67
1342	**868.87**	26895.83	-2937.50	31006.94	2922.22
1362	**892.10**	17354.17	-3022.92	21263.89	2857.64
1382	**909.20**	5661.11	-8923.61	17250.00	2781.94
1402	**918.38**	6266.67	12805.56	12826.39	2710.42
1460	**930.48**	6727.78	13368.06	13437.50	-3097.92
1442	**949.48**	4522.92	-1597.22	5188.19	-2340.97
1462	**990.98**	3940.28	1666.67	7062.50	-3529.86
1482	**1050.98**	2915.28	765.97	2761.11	-2287.50
1502	**1110.98**	2204.17	938.19	2761.11	-1371.53
1522	**1170.98**	1642.36	474.72	1673.61	-813.19
1542	**1230.98**	1189.58	734.72	1190.97	-493.19
1562	**1292.98**	755.56	495.83	756.25	-239.65

Note 1: Meridonal, Hoop, and Shear Stresses are Reversed in Highlighted Sections (Floor)

M&D Professional Services Confidential
12/21/2006
AP-460-UBS-BEC Pri Tank Stress Seismic.xls, Stress Max
Page 1

Table 8 UBS-BEC Primary Tank Stresses, Shell Middle, Gravity Plus Seismic Load

AP Primary Tank, Upper Bound Soil, Horiizontal and Vertical Seismic, Best Estimate Tank Concrete, 460 in. Waste Level at 1.83 SpG

M&D Starting M&D Element No.	Path (in.)	Shell Mid-Plane			
		AP-460-UBS-BEC Seismic Hoop Stress (lbs/in^2) Mid	AP-460-UBS-BEC Seismic Meridional Stress (lbs/in^2) Mid	AP-460-UBS-BEC Seismic Stress Intensity (lbs/in^2) Mid	AP-460-UBS-BEC Seismic In-Plane Shear Stress (lbs/in^2) Mid
762	**67.33**	-2385.42	-2530.56	2530.56	-193.61
782	**105.04**	-2297.22	-3287.50	3287.50	-341.94
802	**136.24**	-2281.25	-3027.78	3028.47	-379.58
822	**181.83**	-1618.06	-2666.67	2667.36	-414.72
842	**225.10**	-2095.83	-2272.92	2548.61	-558.40
862	**273.66**	-1306.94	-1866.67	2118.06	-770.14
882	**323.27**	2300.69	-1506.25	3187.50	-1287.50
902	**369.20**	2339.58	-1193.06	3946.53	-1927.78
922	**419.20**	4418.06	1083.33	6533.33	-3170.83
942	**444.31**	4818.06	1334.03	6265.97	-3115.28
962	**458.66**	-9659.72	1285.42	10805.56	-3078.47
982	**473.08**	-10673.61	1189.58	11881.94	-3170.83
1002	**484.80**	-3440.97	1153.47	6676.39	-3287.50
1022	**502.48**	6311.11	1277.08	7319.44	-3250.69
1042	**526.48**	10590.28	1445.83	10597.22	-3021.53
1062	**550.48**	13777.78	1593.06	13784.72	-2736.81
1082	**574.60**	16395.83	1727.78	16402.78	-2412.50
1102	**598.28**	19409.72	1838.19	19409.72	2067.36
1122	**621.38**	21888.89	1926.39	21888.89	1711.81
1142	**644.48**	24347.22	1988.89	24347.22	1390.97
1162	**667.63**	25944.44	2026.39	25944.44	-1118.06
1182	**690.78**	25708.33	1790.28	25708.33	-961.11
1202	**713.88**	27076.39	1777.78	27076.39	-911.81
1222	**736.98**	29194.44	1736.81	29194.44	-1091.67
1242	**760.13**	28854.17	1668.75	28854.17	1443.75
1262	**782.53**	25256.94	1161.81	25256.94	1395.14
1282	**804.13**	24472.22	1093.06	24472.22	1764.58
1302	**825.73**	25625.00	1009.03	25625.00	2128.47
1322	**847.33**	27479.17	905.56	27486.11	2499.31
1342	**868.87**	28388.89	779.86	28388.89	2905.56
1362	**892.10**	18548.61	556.88	18555.56	2761.11
1382	**909.20**	8597.22	489.72	8875.00	2622.22
1402	**918.38**	5717.36	637.43	6207.64	2606.25
1460	**930.48**	4837.50	952.78	5327.78	-2586.11
1442	**949.48**	4585.42	940.97	5043.75	-2431.25
1462	**990.98**	3925.69	1391.67	7041.67	-3518.75
1482	**1050.98**	2916.67	960.42	2759.03	-2297.22
1502	**1110.98**	2197.92	734.72	2759.03	-1363.19
1522	**1170.98**	1643.75	610.42	1658.33	-822.92
1542	**1230.98**	1186.81	562.85	1188.19	-485.14
1562	**1292.98**	751.39	577.78	751.39	-245.28

Note 1: Meridonal, Hoop, and Shear Stresses are Reversed in Highlighted Sections (Floor)

Table 9 UBS-BEC Primary Tank Stresses, Shell Bottom, Gravity Plus Seismic Load

AP Primary Tank, Upper Bound Soil, Horiizontal and Vertical Seismic, Best Estimate Tank Concrete, 460 in. Waste Level at 1.83 SpG

M&D Starting M&D Element No.	Path (in.)	Shell Bottom Surface (outside - away from waste) AP-460-UBS-BEC Seismic Hoop Stress (lbs/in^2) Bot	AP-460-UBS-BEC Seismic Meridional Stress (lbs/in^2) Bot	AP-460-UBS-BEC Seismic Stress Intensity (lbs/in^2) Bot	AP-460-UBS-BEC Seismic In-Plane Shear Stress (lbs/in^2) Bot
762	**67.33**	-2561.11	-2770.83	2770.83	-186.94
782	**105.04**	-2372.22	-3586.81	3586.81	-335.07
802	**136.24**	-2429.86	-3338.89	3339.58	-373.06
822	**181.83**	-1567.36	-2730.56	2730.56	-410.97
842	**225.10**	-2295.83	-2763.19	2763.89	-557.78
862	**273.66**	-1268.75	-1897.22	2204.17	-769.44
882	**323.27**	2579.86	-1876.39	2833.33	-1288.19
902	**369.20**	2294.44	-1256.25	3975.00	-1927.78
922	**419.20**	4662.50	1831.94	6484.03	-3172.92
942	**444.31**	5178.47	8368.06	8923.61	-3144.44
962	**458.66**	-11604.17	-5586.81	11611.11	-3106.25
982	**473.08**	-13006.94	-6466.67	13013.89	-3125.69
1002	**484.80**	3309.72	3699.31	6729.17	-3212.50
1022	**502.48**	6836.11	3530.56	7083.33	-3213.19
1042	**526.48**	10583.33	1451.39	10590.28	-3013.89
1062	**550.48**	13881.94	1720.14	13881.94	-2729.86
1082	**574.60**	16361.11	1502.78	16361.11	-2404.86
1102	**598.28**	19513.89	2076.39	19513.89	2060.42
1122	**621.38**	21909.72	1825.00	21909.72	1704.86
1142	**644.48**	24423.61	2063.19	24423.61	1385.42
1162	**667.63**	26180.56	2627.78	26180.56	-1100.69
1182	**690.78**	25555.56	-1560.42	25555.56	-944.44
1202	**713.88**	27048.61	1575.00	27048.61	-897.22
1222	**736.98**	29416.67	2315.97	29416.67	-1088.89
1242	**760.13**	29270.83	2925.69	29270.83	1434.72
1262	**782.53**	24805.56	-1659.03	25305.56	1383.33
1282	**804.13**	24340.28	-1076.39	24340.28	1764.58
1302	**825.73**	25645.83	982.64	25652.78	2130.56
1322	**847.33**	27326.39	-925.69	27326.39	2508.33
1342	**868.87**	29875.00	5667.36	29875.00	2888.19
1362	**892.10**	19743.06	4586.11	19743.06	2664.58
1382	**909.20**	11729.17	12472.22	12479.17	2463.19
1402	**918.38**	-6575.69	-11659.72	11680.56	2501.39
1460	**930.48**	-7326.39	-12277.78	12354.17	2584.72
1442	**949.48**	4648.61	3089.58	6072.22	-2520.83
1462	**990.98**	3911.81	1125.69	7027.78	-3506.94
1482	**1050.98**	2918.06	1175.69	2762.50	-2306.94
1502	**1110.98**	2192.36	569.72	2762.50	-1354.86
1522	**1170.98**	1645.14	804.17	1665.97	-831.94
1542	**1230.98**	1184.03	452.64	1185.42	-477.08
1562	**1292.98**	748.61	705.56	750.00	-251.53

Note 1: Meridonal, Hoop, and Shear Stresses are Reversed in Highlighted Sections (Floor)

Table 10 UBS-BEC Primary Tank Stresses, Shell Top, Seismic Load Only

AP Primary Tank, Upper Bound Soil, Horizontal and Vertical Seismic, Best Estimate Tank Concrete, 460 in. Waste Level at 1.83 SpG

		Shell Top Surface (inside - waste side)			
M&D Starting M&D Element No.	Path (in.)	AP-460-UBS-BEC Seismic Only Hoop Stress (lbs/in^2) Top	AP-460-UBS-BEC Seismic Only Meridional Stress (lbs/in^2) Top	AP-460-UBS-BEC Seismic Only Stress Intensity (lbs/in^2) Top	AP-460-UBS-BEC Seismic Only In-Plane Shear Stress (lbs/in^2) Top
762	**67.33**	768.06	1093.68	1084.72	200.17
782	**105.04**	762.50	1368.06	1368.75	349.46
802	**136.24**	834.03	1248.61	1235.42	386.72
822	**181.83**	700.69	1066.67	1066.67	418.78
842	**225.10**	1333.89	1222.99	1661.81	558.66
862	**273.66**	1003.33	923.61	924.31	770.36
882	**323.27**	1982.51	1044.17	2864.58	1286.68
902	**369.20**	2091.32	1041.81	3309.51	1927.42
922	**419.20**	2984.03	990.35	5038.89	3168.13
942	**444.31**	5001.94	3237.78	4125.69	3085.34
962	**458.66**	6659.03	5073.61	11697.22	3050.26
982	**473.08**	6847.92	6190.28	13038.19	3215.90
1002	**484.80**	3901.01	1504.86	6214.93	3363.30
1022	**502.48**	3291.67	715.21	4727.08	3288.34
1042	**526.48**	5924.31	1141.11	5877.08	3028.56
1062	**550.48**	7363.89	1329.86	7370.14	2744.27
1082	**574.60**	8555.56	1597.50	8555.56	2420.79
1102	**598.28**	9729.17	1516.74	9736.11	2074.96
1122	**621.38**	10750.00	1747.08	10756.94	1718.69
1142	**644.48**	11576.39	1760.07	11583.33	1396.44
1162	**667.63**	11909.72	1617.85	11715.28	1136.05
1182	**690.78**	11659.72	1832.36	11659.72	977.70
1202	**713.88**	11902.78	1689.79	11902.78	926.97
1222	**736.98**	12409.72	1360.28	12215.28	1095.58
1242	**760.13**	11937.50	1142.57	11354.17	1452.90
1262	**782.53**	10451.39	1706.25	10451.39	1407.04
1282	**804.13**	9680.56	1227.36	9680.56	1766.71
1302	**825.73**	9833.33	962.15	9833.33	2127.24
1322	**847.33**	10458.33	1077.08	10458.33	2491.65
1342	**868.87**	9479.17	1931.94	11416.67	2922.35
1362	**892.10**	4604.17	1607.64	5937.50	2857.70
1382	**909.20**	1936.81	5631.94	5993.06	2782.01
1402	**918.38**	2524.31	6163.89	6154.86	2710.47
1422	**930.48**	3552.78	4402.78	4430.56	2639.51
1442	**949.48**	4421.32	837.50	4318.06	2408.89
1462	**990.98**	3341.32	1110.35	6149.31	3505.07
1482	**1050.98**	2506.88	513.13	2133.68	2287.72
1502	**1110.98**	1750.42	448.61	2133.68	1357.86
1522	**1170.98**	1320.69	236.88	1355.07	819.62
1542	**1230.98**	798.89	300.21	698.19	484.82
1562	**1292.98**	474.24	213.47	461.81	240.60

Note 1: Meridonal, Hoop, and Shear Stresses are Reversed in Highlighted Sections (Floor)

Table 11 UBS-BEC Primary Tank Stresses, Shell Middle, Seismic Load Only

AP Primary Tank, Upper Bound Soil, Horizontal and Vertical Seismic, Best Estimate Tank Concrete, 460 in. Waste Level at 1.83 SpG

		Shell Mid-Plane			
M&D Starting M&D Element No.	Path (in.)	AP-460-UBS-BEC Seismic Only Hoop Stress (lbs/in^2) Mid	AP-460-UBS-BEC Seismic Only Meridional Stress (lbs/in^2) Mid	AP-460-UBS-BEC Seismic Only Stress Intensity (lbs/in^2) Mid	AP-460-UBS-BEC Seismic Only In-Plane Shear Stress (lbs/in^2) Mid
762	**67.33**	859.65	864.58	863.89	193.40
782	**105.04**	772.92	1115.28	1115.28	342.35
802	**136.24**	965.28	1025.69	1026.39	380.21
822	**181.83**	641.67	912.50	913.19	414.98
842	**225.10**	1587.50	786.81	1062.50	558.10
862	**273.66**	940.42	695.83	947.22	769.65
882	**323.27**	2222.08	708.33	2309.72	1287.39
902	**369.20**	2068.82	767.01	3252.08	1928.09
922	**419.20**	3051.39	1059.11	5151.39	3170.21
942	**444.31**	4026.39	992.92	5467.36	3114.62
962	**458.66**	7858.33	961.60	8679.17	3078.09
982	**473.08**	8440.97	922.85	9379.17	3170.72
1002	**484.80**	3634.79	909.65	6429.31	3287.56
1022	**502.48**	3699.31	1039.24	4415.97	3250.81
1042	**526.48**	5954.86	1214.44	5889.58	3021.62
1062	**550.48**	7441.67	1368.33	7447.92	2736.67
1082	**574.60**	8555.56	1509.86	8562.50	2412.47
1102	**598.28**	9805.56	1627.01	9805.56	2067.33
1122	**621.38**	10791.67	1721.74	10791.67	1711.76
1142	**644.48**	11645.83	1790.76	11645.83	1390.90
1162	**667.63**	12041.67	1834.86	12041.67	1118.00
1182	**690.78**	11631.94	1628.68	11631.94	961.04
1202	**713.88**	11923.61	1622.78	11923.61	911.70
1222	**736.98**	12534.72	1588.40	12527.78	1091.42
1242	**760.13**	12131.94	1526.94	12131.94	1443.88
1262	**782.53**	10298.61	1063.96	10298.61	1395.25
1282	**804.13**	9652.78	1001.39	9652.78	1764.60
1302	**825.73**	9854.17	923.54	9854.17	2128.58
1322	**847.33**	10416.67	826.25	10423.61	2499.26
1342	**868.87**	10298.61	706.94	10291.67	2905.69
1362	**892.10**	5006.94	501.06	5013.89	2761.18
1382	**909.20**	2710.42	440.75	2859.03	2622.30
1402	**918.38**	4195.83	439.72	4451.39	2606.33
1422	**930.48**	4378.68	547.01	4745.56	2589.66
1442	**949.48**	4117.15	611.32	4575.07	2433.77
1462	**990.98**	3388.96	985.14	6323.61	3504.51
1482	**1050.98**	2458.82	611.23	2292.15	2288.35
1502	**1110.98**	1793.26	349.72	2292.15	1357.86
1522	**1170.98**	1277.29	232.29	1268.19	821.05
1542	**1230.98**	837.50	197.71	826.18	483.87
1562	**1292.98**	454.58	195.28	372.01	240.25

Note 1: Meridonal, Hoop, and Shear Stresses are Reversed in Highlighted Sections (Floor)

Table 12 UBS-BEC Primary Tank Stresses, Shell Bottom, Seismic Load Only

AP Primary Tank, Upper Bound Soil, Horizontal and Vertical Seismic, Best Estimate Tank Concrete, 460 in. Waste Level at 1.83 SpG

		Shell Bottom Surface (outside - away from waste)			
M&D Starting M&D Element No.	**Path (in.)**	**AP-460-UBS-BEC Seismic Only Hoop Stress (lbs/in^2) Bot**	**AP-460-UBS-BEC Seismic Only Meridional Stress (lbs/in^2) Bot**	**AP-460-UBS-BEC Seismic Only Stress Intensity (lbs/in^2) Bot**	**AP-460-UBS-BEC Seismic Only In-Plane Shear Stress (lbs/in^2) Bot**
762	**67.33**	976.39	1095.83	1095.83	186.63
782	**105.04**	817.36	1382.64	1382.64	335.23
802	**136.24**	1095.83	1337.50	1337.50	373.78
822	**181.83**	581.94	984.03	984.03	411.12
842	**225.10**	1842.36	1302.78	1303.47	557.54
862	**273.66**	877.50	760.83	1001.39	768.94
882	**323.27**	2460.97	1221.18	2064.58	1288.11
902	**369.20**	2067.08	751.25	3198.61	1928.07
922	**419.20**	3200.00	1633.89	5020.83	3172.08
942	**444.31**	3444.44	5075.69	5581.94	3143.90
962	**458.66**	9099.31	3502.78	9105.56	3105.91
982	**473.08**	10047.22	4645.83	10053.47	3125.54
1002	**484.80**	3723.47	2678.47	5707.64	3212.51
1022	**502.48**	4125.69	2782.64	4026.39	3213.29
1042	**526.48**	5984.72	1287.08	5902.78	3013.99
1062	**550.48**	7518.75	1406.81	7518.75	2729.76
1082	**574.60**	8562.50	1422.99	8562.50	2404.84
1102	**598.28**	9868.06	1737.29	9868.06	2060.40
1122	**621.38**	10840.28	1696.32	10840.28	1704.83
1142	**644.48**	11708.33	1821.46	11708.33	1385.37
1162	**667.63**	12159.72	2051.74	12159.72	1100.64
1182	**690.78**	11597.22	1425.56	11368.06	944.38
1202	**713.88**	11937.50	1556.47	11937.50	897.12
1222	**736.98**	12645.83	1817.15	12645.83	1088.76
1242	**760.13**	12333.33	2060.42	12333.33	1434.85
1262	**782.53**	10152.78	739.58	9729.17	1383.46
1282	**804.13**	9625.00	841.18	9375.00	1764.72
1302	**825.73**	9881.94	905.00	9888.89	2130.73
1322	**847.33**	10381.94	641.81	10062.50	2508.49
1342	**868.87**	11111.11	3345.83	11111.11	2888.34
1362	**892.10**	5416.67	1911.11	5416.67	2664.65
1382	**909.20**	3829.17	4840.28	4430.56	2463.28
1402	**918.38**	5877.08	5413.89	5402.78	2501.49
1422	**930.48**	5202.78	4145.83	4173.61	2539.44
1442	**949.48**	3813.89	1528.26	4437.50	2457.90
1462	**990.98**	3437.22	862.85	6505.69	3503.26
1482	**1050.98**	2410.83	713.57	2409.58	2288.99
1502	**1110.98**	1836.46	279.60	2409.58	1358.33
1522	**1170.98**	1233.96	319.10	1125.97	821.78
1542	**1230.98**	876.11	220.90	876.88	482.91
1562	**1292.98**	434.93	283.96	269.51	240.24

Note 1: Meridonal, Hoop, and Shear Stresses are Reversed in Highlighted Sections (Floor)

Table 13 UBS-BEC J-Bolt Forces, Gravity Load Only

AP Primary Tank, Upper Bound Soil, Gravity Only, Best Estimate Tank Concrete, 460 in. Waste Level at 1.83 SpG

ANSYS MAXIMUMS BY RADIUS

M&D J-Bolt Radius No.	Mean J-Bolt Radius	Radius of J-Bolts Included		Average Bolts per Element	Min Axial Force (kip) UBS-BEC Gravity Only	Max Axial Force (kip) UBS-BEC Gravity Only	Shear Force1 (kip) UBS-BEC Gravity	Maximum Shear Force1 Model Angle	Shear Force2 (kip) UBS-BEC Gravity Only	Maximum Shear Force2 Model Angle	Total Shear (kip) UBS-BEC Gravity
		min	*max*								
Radius 2	44.72	*22.36*	*67.29*	0.55	-0.018	-0.014	0.002	45	0.136	90	0.136
Radius 3	89.87	*67.29*	*104.93*	0.89	-0.014	-0.013	0.003	63	0.045	90	0.045
Radius 4	120.00	*104.93*	*135.98*	1.03	-0.003	-0.002	0.003	63	0.003	180	0.003
Radius 5	151.97	*135.98*	*181.01*	1.97	-0.004	-0.003	0.003	27	0.129	90	0.129
Radius 6	210.05	*181.01*	*223.79*	2.41	0.011	0.011	0.010	144	0.444	81	0.444
Radius 7	237.53	*223.79*	*270.98*	3.30	0.061	0.062	0.010	144	0.610	45	0.610
Radius 8	304.43	*270.98*	*318.74*	4.04	0.053	0.053	0.002	144	0.916	45	0.916
Radius 9	333.05	*318.74*	*361.64*	4.37	0.169	0.170	0.001	117	1.066	0	1.066
Radius 10	390.22	*361.64*	*406.24*	5.36	0.025	0.025	0.002	117	1.247	0	1.247
Radius 11	422.26	*406.24*	*431.63*	3.60	0.874	0.878	0.002	27	2.288	0	2.288

M&D J-Bolt Radius No.	Mean J-Bolt Radius	Radius of J-Bolts Included		Average Bolts per Element	Bolt Angle (Rad)	Shear Stiffness (kip/ft)	Axial Stiffness (kip/ft)	Shear Displacement UBS-BEC-Gravity Only	Axial Min Displacement UBS-BEC-Gravity Only	Axial Max Displacement UBS-BEC-Gravity Only
		min	*max*							
Radius 2	44.72	*22.36*	*67.29*	0.55	0.0351	1667	2222	0.00098	-0.00009	-0.00008
Radius 3	89.87	*67.29*	*104.93*	0.89	0.0715	1670	2219	0.00033	-0.00008	-0.00007
Radius 4	120.00	*104.93*	*135.98*	1.03	0.0968	1673	2215	0.00002	-0.00001	-0.00001
Radius 5	151.97	*135.98*	*181.01*	1.97	0.1252	1677	2207	0.00092	-0.00002	-0.00002
Radius 6	210.05	*181.01*	*223.79*	2.41	0.1825	1688	2192	0.00316	0.00006	0.00006
Radius 7	237.53	*223.79*	*270.98*	3.30	0.2136	1696	2172	0.00432	0.00034	0.00034
Radius 8	304.43	*270.98*	*318.74*	4.04	0.3076	1725	2132	0.00637	0.00030	0.00030
Radius 9	333.05	*318.74*	*361.64*	4.37	0.3613	1746	2086	0.00733	0.00097	0.00098
Radius 10	390.22	*361.64*	*406.24*	5.36	0.5235	1821	2006	0.00821	0.00015	0.00015
Radius 11	460.26	*406.24*	*431.63*	3.60	0.6938	1913	1933	0.01435	0.00543	0.00545

Table 14 UBS-BEC J-Bolt Forces, Gravity Plus Seismic Loads

AP Primary Tank, Upper Bound Soil, Horizontal and Vertical Seismic Input, Best Estimate Tank Concrete, 460 in. Waste Level at 1.83 SpG

ANSYS MAXIMUMS BY RADIUS

M&D J-Bolt Radius No.	Mean J-Bolt Radius	Radius of J-Bolts Included *min*	*max*	Average Bolts per Element	Min Axial Force (kip) UBS-BEC	Max Axial Force (kip) UBS-BEC	Shear Force1 (kip) UBS-BEC	Maximum Shear Force1 Model Angle	Shear Force2 (kip) UBS-BEC	Maximum Shear Force2 Model Angle	Total Shear (kip) UBS-BEC
Radius 2	44.72	*22.36*	*67.29*	0.55	-0.106	0.005	0.339	90	0.594	180	0.594
Radius 3	89.87	*67.29*	*104.93*	0.89	-0.081	-0.005	0.337	90	0.501	180	0.586
Radius 4	120.00	*104.93*	*135.98*	1.03	-0.091	0.032	0.444	90	0.579	180	0.638
Radius 5	151.97	*135.98*	*181.01*	1.97	-0.071	0.021	0.603	90	0.703	0	0.789
Radius 6	210.05	*181.01*	*223.79*	2.41	-0.055	0.028	1.014	90	0.970	180	1.191
Radius 7	237.53	*223.79*	*270.98*	3.30	-0.015	0.118	1.359	90	1.136	0	1.566
Radius 8	304.43	*270.98*	*318.74*	4.04	-0.034	0.083	2.513	90	1.730	0	2.772
Radius 9	333.05	*318.74*	*361.64*	4.37	-0.008	0.554	3.303	90	2.091	0	3.580
Radius 10	390.22	*361.64*	*406.24*	5.36	-0.086	0.545	5.509	90	2.565	0	5.735
Radius 11	422.26	*406.24*	*431.63*	3.60	-0.187	1.836	7.963	90	4.445	0	8.478

M&D J-Bolt Radius No.	Mean J-Bolt Radius	Radius of J-Bolts Included *min*	*max*	Average Bolts per Element	Bolt Angle (Rad)	Shear Stiffness (kip/ft)	Axial Stiffness (kip/ft)	Shear Disp UBS-BEC-Seismic	Axial Min Disp UBS-BEC-Seismic	Axial Max Disp UBS-BEC-Seismic
Radius 2	44.72	*22.36*	*67.29*	0.55	0.0351	1667	2222	0.00428	-0.00057	0.00003
Radius 3	89.87	*67.29*	*104.93*	0.89	0.0715	1670	2219	0.00421	-0.00044	-0.00003
Radius 4	120.00	*104.93*	*135.98*	1.03	0.0968	1673	2215	0.00458	-0.00050	0.00017
Radius 5	151.97	*135.98*	*181.01*	1.97	0.1252	1677	2207	0.00564	-0.00039	0.00011
Radius 6	210.05	*181.01*	*223.79*	2.41	0.1825	1688	2192	0.00847	-0.00030	0.00015
Radius 7	237.53	*223.79*	*270.98*	3.30	0.2136	1696	2172	0.01108	-0.00008	0.00065
Radius 8	304.43	*270.98*	*318.74*	4.04	0.3076	1725	2132	0.01928	-0.00019	0.00047
Radius 9	333.05	*318.74*	*361.64*	4.37	0.3613	1746	2086	0.02461	-0.00005	0.00319
Radius 10	390.22	*361.64*	*406.24*	5.36	0.5235	1821	2006	0.03778	-0.00051	0.00326
Radius 11	460.26	*406.24*	*431.63*	3.60	0.6938	1913	1933	0.05317	-0.00116	0.01141

M&D Professional Services Confidential
1/2/2007

AP-460-UBS-BEC J Bolt Forces Seismic.xls
Page 3

Table 15 UBS-BEC J-Bolt Forces, Seismic Load Only

AP Primary Tank, Upper Bound Soil, Horizontal and Vertical Seismic Input, Best Estimate Tank Concrete, 460 in. Waste Level at 1.83 SpG Seismic Only

ANSYS MAXIMUMS BY RADIUS

M&D J-Bolt Radius No.	Mean J-Bolt Radius	Radius of J-Bolts Included		Average Bolts per Element	Min Axial Force (kip) UBS-BEC-Seismic Only	Max Axial Force (kip) UBS-BEC-Seismic Only	Shear Force1 (kip) UBS-BEC-Seismic Only	Maximum Shear Force1 Model Angle	Shear Force2 (kip) UBS-BEC-Seismic Only	Maximum Shear Force2 Model Angle	Total Shear (kip) UBS-BEC-Seismic Only
		min	*max*								
Radius 2	44.72	*22.36*	*67.29*	0.55	-0.088	0.019	0.338	108	0.458	0	0.569
Radius 3	89.87	*67.29*	*104.93*	0.89	-0.066	0.007	0.333	108	0.456	0	0.565
Radius 4	120.00	*104.93*	*135.98*	1.03	-0.089	0.034	0.441	108	0.576	0	0.726
Radius 5	151.97	*135.98*	*181.01*	1.97	-0.067	0.024	0.600	108	0.574	0	0.831
Radius 6	210.05	*181.01*	*223.79*	2.41	-0.066	0.016	1.004	108	0.527	144	1.134
Radius 7	237.53	*223.79*	*270.98*	3.30	-0.076	0.056	1.350	90	0.526	135	1.449
Radius 8	304.43	*270.98*	*318.74*	4.04	-0.087	0.030	2.511	117	0.814	117	2.639
Radius 9	333.05	*318.74*	*361.64*	4.37	-0.177	0.384	3.302	117	1.025	117	3.457
Radius 10	390.22	*361.64*	*406.24*	5.36	-0.111	0.520	5.507	108	1.318	0	5.663
Radius 11	460.26	*406.24*	*431.63*	3.60	-1.061	0.960	7.961	108	2.157	0	8.248

M&D J-Bolt Radius No.	Mean J-Bolt Radius	Radius of J-Bolts Included		Average Bolts per Element	Bolt Angle (Rad)	Shear Stiffness (kip/ft)	Axial Stiffness (kip/ft)	Shear Disp UBS-BEC-Seismic Only	Axial Min Disp UBS-BEC-Seismic Only	Axial Max Disp UBS-BEC-Seismic Only
		min	*max*							
Radius 2	44.72	*22.36*	*67.29*	0.55	0.0351	1667	2222	0.00410	-0.00048	0.00010
Radius 3	89.87	*67.29*	*104.93*	0.89	0.0715	1670	2219	0.00406	-0.00036	0.00004
Radius 4	120.00	*104.93*	*135.98*	1.03	0.0968	1673	2215	0.00521	-0.00048	0.00018
Radius 5	151.97	*135.98*	*181.01*	1.97	0.1252	1677	2207	0.00594	-0.00037	0.00013
Radius 6	210.05	*181.01*	*223.79*	2.41	0.1825	1688	2192	0.00806	-0.00036	0.00009
Radius 7	237.53	*223.79*	*270.98*	3.30	0.2136	1696	2172	0.01025	-0.00042	0.00031
Radius 8	304.43	*270.98*	*318.74*	4.04	0.3076	1725	2132	0.01836	-0.00049	0.00017
Radius 9	333.05	*318.74*	*361.64*	4.37	0.3613	1746	2086	0.02376	-0.00102	0.00221
Radius 10	390.22	*361.64*	*406.24*	5.36	0.5235	1821	2006	0.03731	-0.00066	0.00311
Radius 11	460.26	*406.24*	*431.63*	3.60	0.6938	1913	1933	0.05173	-0.00659	0.00596

M&D Professional Services Confidential
12/21/2006

AP-460-UBS-BEC J Bolt Forces Seismic.xls
Page 1

Table 16 UBS-BEC Concrete Backed Steel Strain, Shell Top, Gravity Load Only

AP Backed Steel, Upper Bound Soil, Gravity Only, Best Estimate Tank Concrete, 460 In Waste Level at 1.83SpG

M&D Starting M&D Element No.	Path (in)	Shell Top Surface (inside - towards waste) Gravity					
		AP-460-UBS-BEC EPEL P1 Strain (in/in) Gravity Top Min	AP-460-UBS-BEC EPEL P1 Strain (in/in) Gravity Top Max	AP-460-UBS-BEC EPEL P2 (in/in) Gravity Top Min	AP-460-UBS-BEC EPEL P2 Strain (in/in) Gravity Top Max	AP-460-UBS-BEC EPEL P3 Strain (in/in) Gravity Top Min	AP-460-UBS-BEC EPEL P3 Strain (in/in) Gravity Top Max
762	**67.33**	3.27E-05	3.27E-05	-3.44E-05	-3.43E-05	-4.15E-05	-4.15E-05
782	**105.04**	3.76E-05	3.76E-05	-2.94E-05	-2.94E-05	-5.79E-05	-5.79E-05
802	**136.24**	3.41E-05	3.42E-05	-2.41E-05	-2.40E-05	-5.53E-05	-5.53E-05
822	**181.71**	2.82E-05	2.83E-05	-1.51E-05	-1.51E-05	-5.05E-05	-5.04E-05
842	**225.10**	2.29E-05	2.29E-05	-8.47E-06	-8.46E-06	-4.46E-05	-4.46E-05
862	**273.66**	1.60E-05	1.60E-05	-2.29E-06	-2.29E-06	-3.49E-05	-3.49E-05
882	**323.27**	1.10E-05	1.11E-05	9.41E-06	9.41E-06	-3.27E-05	-3.26E-05
902	**369.20**	1.39E-05	1.40E-05	-4.62E-08	-4.19E-08	-1.36E-05	-1.36E-05
922	**419.20**	4.72E-05	4.73E-05	-1.04E-05	-1.04E-05	-2.26E-05	-2.26E-05
237	**463.02**						
257	**510.03**						
277	**544.44**						
297	**580.53**						
317	**631.08**						
337	**680.34**						
357	**727.44**						
377	**772.93**						
397	**831.34**						
417	**894.09**						
2132	**925.08**	2.22E-05	2.22E-05	-1.96E-05	-1.96E-05	-2.93E-05	-2.92E-05
2122	**935.67**	6.32E-05	6.32E-05	-1.82E-05	-1.82E-05	-2.21E-05	-2.21E-05
2112	**944.86**	5.15E-05	5.15E-05	-4.28E-06	-4.28E-06	-1.14E-04	-1.14E-04
477	**968.95**						
497	**1002.45**						
517	**1042.45**						
537	**1108.60**						
557	**1178.35**						
577	**1227.20**						
597	**1271.50**						
617	**1313.65**						
637	**1360.60**						

M&D Professional Services, Inc
1/9/2007

AP-460-UBS-BEC Strain Seismic-Princ.xls
Strain Gravity

Table 17 UBS-BEC Concrete Backed Steel Strain, Shell Middle, Gravity Load Only

AP Backed Steel, Upper Bound Soil, Gravity Only, Best Estimate Tank Concrete, 460 In Waste Level at 1.83SpG

M&D Starting M&D Element No.	Path (in)	Shell Mid-Plane					
		AP-460-UBS-BEC EPEL P1 Strain (in/in) Gravity Mid Min	AP-460-UBS-BEC EPEL P1 Strain (in/in) Gravity Mid Max	AP-460-UBS-BEC EPEL P2 (in/in) Gravity Mid Min	AP-460-UBS-BEC EPEL P2 Strain (in/in) Gravity Mid Max	AP-460-UBS-BEC EPEL P3 Strain (in/in) Gravity Mid Min	AP-460-UBS-BEC EPEL P3 Strain (in/in) Gravity Mid Max
762	**67.33**	3.32E-05	3.32E-05	-3.59E-05	-3.58E-05	-4.13E-05	-4.13E-05
782	**105.04**	3.82E-05	3.83E-05	-3.01E-05	-3.01E-05	-5.89E-05	-5.88E-05
802	**136.24**	3.43E-05	3.43E-05	-2.47E-05	-2.47E-05	-5.51E-05	-5.51E-05
822	**181.71**	2.82E-05	2.83E-05	-1.55E-05	-1.55E-05	-5.01E-05	-5.01E-05
842	**225.10**	2.26E-05	2.26E-05	-8.69E-06	-8.68E-06	-4.37E-05	-4.37E-05
862	**273.66**	1.65E-05	1.65E-05	-2.53E-06	-2.52E-06	-3.58E-05	-3.58E-05
882	**323.27**	1.09E-05	1.10E-05	7.55E-06	7.55E-06	-2.82E-05	-2.82E-05
902	**369.20**	1.37E-05	1.38E-05	1.69E-06	1.70E-06	-1.74E-05	-1.74E-05
922	**419.20**	4.71E-05	4.72E-05	-1.30E-05	-1.30E-05	-1.48E-05	-1.47E-05
237	**463.02**	3.31E-05	3.31E-05	6.58E-06	6.58E-06	-6.11E-05	-6.11E-05
257	**510.03**	4.47E-05	4.47E-05	4.16E-05	4.17E-05	-2.43E-04	-2.43E-04
277	**544.44**	7.53E-05	7.53E-05	2.70E-05	2.71E-05	-3.61E-04	-3.61E-04
297	**580.53**	5.36E-05	5.36E-05	-2.25E-05	-2.25E-05	-2.21E-04	-2.21E-04
317	**631.08**	7.16E-05	7.17E-05	-6.50E-05	-6.49E-05	-2.61E-04	-2.61E-04
337	**680.34**	8.52E-05	8.53E-05	-7.75E-05	-7.75E-05	-3.11E-04	-3.11E-04
357	**727.44**	8.20E-05	8.21E-05	-8.34E-05	-8.34E-05	-2.90E-04	-2.90E-04
377	**772.93**	9.83E-05	9.84E-05	-8.83E-05	-8.83E-05	-3.60E-04	-3.60E-04
397	**831.34**	9.35E-05	9.35E-05	-7.89E-05	-7.89E-05	-3.47E-04	-3.47E-04
417	**894.09**	3.70E-05	3.71E-05	-5.25E-05	-5.25E-05	-1.16E-04	-1.16E-04
2132	**925.08**	1.79E-05	1.79E-05	-6.80E-06	-6.79E-06	-2.93E-05	-2.92E-05
2122	**935.67**	1.76E-05	1.76E-05	-1.33E-05	-1.33E-05	-2.19E-05	-2.19E-05
2112	**944.86**	1.11E-05	1.11E-05	-3.95E-06	-3.95E-06	-1.81E-05	-1.81E-05
477	**968.95**	1.18E-05	1.18E-05	5.86E-06	5.86E-06	-5.07E-05	-5.06E-05
497	**1002.45**	6.75E-05	6.75E-05	7.48E-06	7.48E-06	-1.96E-05	-1.96E-05
517	**1042.45**	1.05E-05	1.06E-05	6.04E-06	6.05E-06	-3.63E-06	-3.63E-06
537	**1108.60**	1.28E-05	1.28E-05	4.14E-06	4.14E-06	-4.74E-06	-4.73E-06
557	**1178.35**	3.79E-06	3.80E-06	1.94E-06	1.94E-06	-1.05E-05	-1.05E-05
577	**1227.20**	1.72E-05	1.72E-05	3.72E-06	3.73E-06	-4.75E-06	-4.75E-06
597	**1271.50**	4.36E-06	4.36E-06	1.91E-06	1.92E-06	-1.21E-05	-1.21E-05
617	**1313.65**	1.25E-05	1.25E-05	5.73E-06	5.74E-06	-4.06E-06	-4.05E-06
637	**1360.60**	4.01E-06	4.01E-06	3.43E-06	3.43E-06	-1.51E-06	-1.51E-06

M&D Professional Services, Inc
1/9/2007

AP-460-UBS-BEC Strain Seismic-Princ.xls
Strain Gravity

Table 18 UBS-BEC Concrete Backed Steel Strain, Shell Bottom, Gravity Load Only

AP Backed Steel, Upper Bound Soil, Gravity Only, Best Estimate Tank Concrete, 460 In Waste Level at 1.83SpG

M&D Starting M&D Element No.	Path (in)	Shell Bottom Surface (outside - away from waste) Gravity AP-460-UBS-BEC EPEL P1 Strain (in/in) Gravity Bot Min	AP-460-UBS-BEC EPEL P1 Strain (in/in) Gravity Bot Max	AP-460-UBS-BEC EPEL P2 (in/in) Gravity Bot Min	AP-460-UBS-BEC EPEL P2 Strain (in/in) Gravity Bot Max	AP-460-UBS-BEC EPEL P3 Strain (in/in) Gravity Bot Min	AP-460-UBS-BEC EPEL P3 Strain (in/in) Gravity Bot Max
762	**67.33**	3.37E-05	3.37E-05	-3.72E-05	-3.72E-05	-4.11E-05	-4.10E-05
782	**105.04**	3.89E-05	3.90E-05	-3.08E-05	-3.08E-05	-5.97E-05	-5.96E-05
802	**136.24**	3.45E-05	3.45E-05	-2.53E-05	-2.53E-05	-5.49E-05	-5.48E-05
822	**181.71**	2.82E-05	2.83E-05	-1.59E-05	-1.59E-05	-4.97E-05	-4.97E-05
842	**225.10**	2.24E-05	2.24E-05	-8.86E-06	-8.85E-06	-4.27E-05	-4.27E-05
862	**273.66**	1.70E-05	1.70E-05	-2.77E-06	-2.76E-06	-3.67E-05	-3.67E-05
882	**323.27**	1.09E-05	1.09E-05	5.69E-06	5.70E-06	-2.38E-05	-2.38E-05
902	**369.20**	1.35E-05	1.36E-05	3.44E-06	3.44E-06	-2.13E-05	-2.13E-05
922	**419.20**	4.71E-05	4.71E-05	-4.09E-06	-4.08E-06	-1.84E-05	-1.83E-05
237	**463.02**						
257	**510.03**						
277	**544.44**						
297	**580.53**						
317	**631.08**						
337	**680.34**						
357	**727.44**						
377	**772.93**						
397	**831.34**						
417	**894.09**						
2132	**925.08**	1.92E-05	1.92E-05	2.55E-07	2.57E-07	-2.93E-05	-2.92E-05
2122	**935.67**	4.45E-05	4.45E-05	-2.17E-05	-2.17E-05	-8.05E-05	-8.05E-05
2112	**944.86**	8.44E-05	8.45E-05	-3.62E-06	-3.62E-06	-3.45E-05	-3.44E-05
477	**968.95**						
497	**1002.45**						
517	**1042.45**						
537	**1108.60**						
557	**1178.35**						
577	**1227.20**						
597	**1271.50**						
617	**1313.65**						
637	**1360.60**						

M&D Professional Services, Inc
1/9/2007

AP-460-UBS-BEC Strain Seismic-Princ.xls
Strain Gravity

Table 19 UBS-BEC Concrete Backed Steel Strain, Shell Top, Gravity Plus Seismic Load

AP Backed Steel, Upper Bound Soil, Seismic Only, Best Estimate Tank Concrete, 460 In Waste Level at 1.83SpG

M&D Starting M&D Element No.	Path (in)	Shell Top Surface (inside - towards waste) Seismic					
		AP-460-UBS-BEC EPEL P1 Strain (in/in) Seismic Top Min	AP-460-UBS-BEC EPEL P1 Strain (in/in) Seismic Top Max	AP-460-UBS-BEC EPEL P2 (in/in) Seismic Top Min	AP-460-UBS-BEC EPEL P2 Strain (in/in) Seismic Top Max	AP-460-UBS-BEC EPEL P3 Strain (in/in) Seismic Top Min	AP-460-UBS-BEC EPEL P3 Strain (in/in) Seismic Top Max
762	**67.33**	1.98E-05	4.96E-05	-4.67E-05	-5.69E-06	-6.59E-05	-2.34E-05
782	**105.04**	2.33E-05	5.90E-05	-3.95E-05	-1.17E-05	-8.19E-05	-2.64E-05
802	**136.24**	2.26E-05	5.05E-05	-3.73E-05	5.22E-06	-8.91E-05	-2.66E-05
822	**181.71**	1.97E-05	4.41E-05	-2.68E-05	5.38E-06	-7.47E-05	-2.35E-05
842	**225.10**	1.70E-05	4.78E-05	-2.37E-05	2.49E-05	-7.60E-05	-1.97E-05
862	**273.66**	1.17E-05	3.36E-05	-1.33E-05	1.91E-05	-5.81E-05	-9.51E-06
882	**323.27**	7.55E-06	8.86E-05	-6.78E-06	1.71E-05	-7.30E-05	-1.10E-05
902	**369.20**	2.17E-06	9.39E-05	-3.49E-06	1.54E-05	-5.63E-05	-7.98E-07
922	**419.20**	2.48E-05	1.70E-04	-1.52E-05	1.11E-05	-7.03E-05	-1.51E-06
237	**463.02**						
257	**510.03**						
277	**544.44**						
297	**580.53**						
317	**631.08**						
337	**680.34**						
357	**727.44**						
377	**772.93**						
397	**831.34**						
417	**894.09**						
2132	**925.08**	1.90E-05	3.28E-05	-2.30E-05	6.56E-06	-4.18E-05	-2.16E-05
2122	**935.67**	4.94E-05	9.48E-05	-2.14E-05	-2.19E-06	-3.63E-05	-1.44E-05
2112	**944.86**	3.60E-05	1.02E-04	-7.88E-06	1.91E-05	-1.43E-04	-1.84E-05
477	**968.95**						
497	**1002.45**						
517	**1042.45**						
537	**1108.60**						
557	**1178.35**						
577	**1227.20**						
597	**1271.50**						
617	**1313.65**						
637	**1360.60**						

M&D Professional Services, Inc
1/9/2007

AP-460-UBS-BEC Strain Seismic-Princ.xls
Strain Max

Table 20 UBS-BEC Concrete Backed Steel Strain, Shell Middle, Gravity Plus Seismic Load

AP Backed Steel, Upper Bound Soil, Seismic Only, Best Estimate Tank Concrete, 460 In Waste Level at 1.83SpG

M&D Starting M&D Element No.	Path (in)	Shell Mid-Plane					
		AP-460-UBS-BEC EPEL P1 Strain (in/in) Seismic Mid Min	AP-460-UBS-BEC EPEL P1 Strain (in/in) Seismic Mid Max	AP-460-UBS-BEC EPEL P2 (in/in) Seismic Mid Min	AP-460-UBS-BEC EPEL P2 Strain (in/in) Seismic Mid Max	AP-460-UBS-BEC EPEL P3 Strain (in/in) Seismic Mid Min	AP-460-UBS-BEC EPEL P3 Strain (in/in) Seismic Mid Max
762	**67.33**	1.99E-05	5.00E-05	-4.93E-05	-1.32E-05	-6.21E-05	-2.33E-05
782	**105.04**	2.41E-05	5.76E-05	-4.03E-05	-1.21E-05	-8.74E-05	-3.12E-05
802	**136.24**	2.22E-05	5.33E-05	-3.80E-05	4.45E-06	-8.41E-05	-2.80E-05
822	**181.71**	2.01E-05	4.11E-05	-2.67E-05	4.88E-06	-7.62E-05	-2.38E-05
842	**225.10**	1.63E-05	4.76E-05	-2.73E-05	2.20E-05	-6.85E-05	-2.05E-05
862	**273.66**	1.27E-05	3.33E-05	-1.40E-05	1.92E-05	-5.92E-05	-1.40E-05
882	**323.27**	5.27E-06	8.85E-05	-6.84E-06	1.92E-05	-5.76E-05	-7.64E-06
902	**369.20**	2.52E-06	9.21E-05	-3.87E-07	1.55E-05	-5.60E-05	-8.82E-07
922	**419.20**	2.48E-05	1.74E-04	-2.18E-05	1.73E-05	-6.49E-05	-1.64E-06
237	**463.02**	1.46E-05	5.85E-05	5.26E-06	1.04E-05	-7.62E-05	-4.08E-05
257	**510.03**	3.93E-05	6.67E-05	2.15E-05	5.75E-05	-2.93E-04	-1.79E-04
277	**544.44**	6.55E-05	9.63E-05	7.42E-06	5.17E-05	-4.33E-04	-2.75E-04
297	**580.53**	4.77E-05	6.77E-05	-4.16E-05	2.61E-05	-2.73E-04	-1.73E-04
317	**631.08**	6.34E-05	8.82E-05	-8.37E-05	-5.93E-06	-3.15E-04	-2.09E-04
337	**680.34**	7.43E-05	1.03E-04	-9.54E-05	-2.36E-05	-3.70E-04	-2.53E-04
357	**727.44**	7.06E-05	9.82E-05	-9.97E-05	-3.13E-05	-3.42E-04	-2.34E-04
377	**772.93**	8.30E-05	1.19E-04	-1.02E-04	-1.71E-05	-4.24E-04	-2.82E-04
397	**831.34**	7.80E-05	1.12E-04	-9.02E-05	-8.00E-06	-4.04E-04	-2.64E-04
417	**894.09**	3.01E-05	4.46E-05	-5.98E-05	1.29E-05	-1.42E-04	-6.47E-05
2132	**925.08**	1.47E-05	2.60E-05	-1.04E-05	1.01E-05	-3.98E-05	-1.55E-05
2122	**935.67**	1.44E-05	3.15E-05	-1.78E-05	1.08E-05	-3.70E-05	-1.55E-05
2112	**944.86**	8.41E-06	3.58E-05	-6.94E-06	1.61E-05	-4.26E-05	-9.28E-06
477	**968.95**	9.72E-06	3.35E-05	-1.25E-06	1.32E-05	-6.15E-05	-3.42E-05
497	**1002.45**	5.60E-05	9.09E-05	-5.22E-06	3.41E-05	-2.46E-05	-1.27E-05
517	**1042.45**	8.13E-06	3.20E-05	-2.44E-06	1.68E-05	-6.55E-06	-5.41E-07
537	**1108.60**	7.45E-06	4.04E-05	-3.54E-06	2.41E-05	-1.65E-05	-2.27E-06
557	**1178.35**	2.05E-06	2.48E-05	-3.51E-06	1.15E-05	-2.77E-05	-1.55E-06
577	**1227.20**	8.54E-06	4.61E-05	-3.54E-06	2.24E-05	-1.04E-05	-1.41E-06
597	**1271.50**	2.41E-06	2.11E-05	-3.65E-06	5.29E-06	-2.13E-05	-1.32E-06
617	**1313.65**	1.13E-06	3.57E-05	-1.45E-06	1.81E-05	-9.55E-06	-5.16E-07
637	**1360.60**	7.40E-07	1.08E-05	-2.01E-07	7.59E-06	-3.21E-06	-2.97E-07

M&D Professional Services, Inc
1/9/2007

AP-460-UBS-BEC Strain Seismic-Princ.xls
Strain Max

Table 21 UBS-BEC Concrete Backed Steel Strain, Shell Bottom, Gravity Plus Seismic Load

AP Backed Steel, Upper Bound Soil, Seismic Only, Best Estimate Tank Concrete, 460 In Waste Level at 1.83SpG

M&D Starting M&D Element No.	Path (in)	Shell Bottom Surface (outside - away from waste) Seismic					
		AP-460-UBS-BEC EPEL P1 Strain (in/in) Seismic Bot Min	AP-460-UBS-BEC EPEL P1 Strain (in/in) Seismic Bot Max	AP-460-UBS-BEC EPEL P2 (in/in) Seismic Bot Min	AP-460-UBS-BEC EPEL P2 Strain (in/in) Seismic Bot Max	AP-460-UBS-BEC EPEL P3 Strain (in/in) Seismic Bot Min	AP-460-UBS-BEC EPEL P3 Strain (in/in) Seismic Bot Max
762	**67.33**	1.94E-05	5.52E-05	-5.18E-05	-1.38E-05	-5.91E-05	-1.92E-05
782	**105.04**	2.30E-05	6.08E-05	-4.16E-05	-1.24E-05	-9.33E-05	-2.15E-05
802	**136.24**	2.20E-05	5.92E-05	-3.85E-05	3.72E-06	-7.92E-05	-2.67E-05
822	**181.71**	1.96E-05	4.04E-05	-2.67E-05	4.38E-06	-7.79E-05	-2.22E-05
842	**225.10**	1.39E-05	4.91E-05	-2.90E-05	1.84E-05	-6.54E-05	-1.50E-05
862	**273.66**	1.29E-05	3.31E-05	-1.49E-05	1.96E-05	-6.19E-05	-1.61E-05
882	**323.27**	3.03E-06	8.85E-05	-7.27E-06	2.06E-05	-5.49E-05	-1.80E-06
902	**369.20**	3.65E-06	9.08E-05	7.64E-07	1.78E-05	-5.76E-05	-4.03E-06
922	**419.20**	2.47E-05	1.78E-04	-2.82E-05	3.43E-05	-6.13E-05	-1.62E-06
237	**463.02**						
257	**510.03**						
277	**544.44**						
297	**580.53**						
317	**631.08**						
337	**680.34**						
357	**727.44**						
377	**772.93**						
397	**831.34**						
417	**894.09**						
2132	**925.08**	1.65E-05	2.89E-05	-2.10E-06	9.30E-06	-3.89E-05	-1.55E-05
2122	**935.67**	3.73E-05	6.96E-05	-2.68E-05	2.34E-06	-1.07E-04	-2.60E-05
2112	**944.86**	6.11E-05	1.74E-04	-1.59E-05	1.95E-05	-4.35E-05	-1.07E-05
477	**968.95**						
497	**1002.45**						
517	**1042.45**						
537	**1108.60**						
557	**1178.35**						
577	**1227.20**						
597	**1271.50**						
617	**1313.65**						
637	**1360.60**						

M&D Professional Services, Inc
1/9/2007

AP-460-UBS-BEC Strain Seismic-Princ.xls
Strain Max

Table 22 UBS-BEC Concrete Backed Steel Strain, Shell Top, Seismic Load Only

AP Backed Steel, Upper Bound Soil, Seismic Only, Best Estimate Tank Concrete, 460 In Waste Level at 1.83SpG

M&D Starting M&D Element No.	Path (in)	Shell Top Surface (inside - towards waste) Seismic					
		AP-460-UBS-BEC EPEL P1 Strain (in/in) Seismic Only Top Min	AP-460-UBS-BEC EPEL P1 Strain (in/in) Seismic Only Top Max	AP-460-UBS-BEC EPEL P2 (in/in) Seismic Only Top Min	AP-460-UBS-BEC EPEL P2 Strain (in/in) Seismic Only Top Max	AP-460-UBS-BEC EPEL P3 Strain (in/in) Seismic Only Top Min	AP-460-UBS-BEC EPEL P3 Strain (in/in) Seismic Only Top Max
762	**67.33**	-1.29E-05	1.68E-05	-1.24E-05	2.86E-05	-2.45E-05	1.81E-05
782	**105.04**	-1.43E-05	2.14E-05	-1.01E-05	1.77E-05	-2.40E-05	3.15E-05
802	**136.24**	-1.16E-05	1.63E-05	-1.33E-05	2.92E-05	-3.38E-05	2.87E-05
822	**181.71**	-8.49E-06	1.59E-05	-1.17E-05	2.05E-05	-2.42E-05	2.69E-05
842	**225.10**	-5.95E-06	2.49E-05	-1.53E-05	3.34E-05	-3.13E-05	2.49E-05
862	**273.66**	-4.28E-06	1.76E-05	-1.10E-05	2.14E-05	-2.33E-05	2.53E-05
882	**323.27**	-3.48E-06	7.75E-05	-1.62E-05	7.71E-06	-4.03E-05	2.17E-05
902	**369.20**	-1.18E-05	7.99E-05	-3.45E-06	1.54E-05	-4.27E-05	1.28E-05
922	**419.20**	-2.24E-05	1.23E-04	-4.72E-06	2.15E-05	-4.77E-05	2.11E-05
237	**463.02**						
257	**510.03**						
277	**544.44**						
297	**580.53**						
317	**631.08**						
337	**680.34**						
357	**727.44**						
377	**772.93**						
397	**831.34**						
417	**894.09**						
2062	**925.08**	-3.24E-06	1.06E-05	-3.45E-06	2.61E-05	-1.26E-05	7.68E-06
2052	**935.67**	-1.37E-05	3.16E-05	-3.22E-06	1.60E-05	-1.41E-05	7.70E-06
2042	**944.86**	-1.55E-05	5.08E-05	-3.60E-06	2.33E-05	-2.89E-05	9.55E-05
477	**968.95**						
497	**1002.45**						
517	**1042.45**						
537	**1108.60**						
557	**1178.35**						
577	**1227.20**						
597	**1271.50**						
617	**1313.65**						
637	**1360.60**						

M&D Professional Services, Inc
1/9/2007

AP-460-UBS-BEC Strain Seismic-Princ.xls
Strain Seismic Only

Table 23 UBS-BEC Concrete Backed Steel Strain, Shell Middle, Seismic Load Only

AP Backed Steel, Upper Bound Soil, Seismic Only, Best Estimate Tank Concrete, 460 In Waste Level at 1.83SpG

M&D Starting M&D Element No.	Path (in)	Shell Mid-Plane					
		AP-460-UBS-BEC EPEL P1 Strain (in/in) Seismic Only Mid Min	AP-460-UBS-BEC EPEL P1 Strain (in/in) Seismic Only Mid Max	AP-460-UBS-BEC EPEL P2 (in/in) Seismic Only Mid Min	AP-460-UBS-BEC EPEL P2 Strain (in/in) Seismic Only Mid Max	AP-460-UBS-BEC EPEL P3 Strain (in/in) Seismic Only Mid Min	AP-460-UBS-BEC EPEL P3 Strain (in/in) Seismic Only Mid Max
762	**67.33**	-1.33E-05	1.68E-05	-1.34E-05	2.27E-05	-2.08E-05	1.80E-05
782	**105.04**	-1.41E-05	1.94E-05	-1.02E-05	1.80E-05	-2.85E-05	2.77E-05
802	**136.24**	-1.21E-05	1.90E-05	-1.33E-05	2.91E-05	-2.90E-05	2.71E-05
822	**181.71**	-8.14E-06	1.29E-05	-1.12E-05	2.04E-05	-2.61E-05	2.62E-05
842	**225.10**	-6.38E-06	2.49E-05	-1.86E-05	3.07E-05	-2.47E-05	2.32E-05
862	**273.66**	-3.80E-06	1.68E-05	-1.15E-05	2.17E-05	-2.34E-05	2.18E-05
882	**323.27**	-5.67E-06	7.76E-05	-1.44E-05	1.17E-05	-2.94E-05	2.06E-05
902	**369.20**	-1.12E-05	7.84E-05	-2.08E-06	1.38E-05	-3.86E-05	1.65E-05
922	**419.20**	-2.24E-05	1.27E-04	-8.77E-06	3.03E-05	-5.01E-05	1.31E-05
237	**463.02**	-1.85E-05	2.54E-05	-1.32E-06	3.85E-06	-1.50E-05	2.03E-05
257	**510.03**	-5.41E-06	2.20E-05	-2.01E-05	1.59E-05	-4.97E-05	6.45E-05
277	**544.44**	-9.79E-06	2.10E-05	-1.96E-05	2.47E-05	-7.15E-05	8.63E-05
297	**580.53**	-5.92E-06	1.41E-05	-1.91E-05	4.85E-05	-5.19E-05	4.79E-05
317	**631.08**	-8.20E-06	1.66E-05	-1.88E-05	5.90E-05	-5.37E-05	5.15E-05
337	**680.34**	-1.09E-05	1.79E-05	-1.80E-05	5.38E-05	-5.92E-05	5.78E-05
357	**727.44**	-1.14E-05	1.61E-05	-1.64E-05	5.21E-05	-5.22E-05	5.65E-05
377	**772.93**	-1.54E-05	2.08E-05	-1.41E-05	7.12E-05	-6.40E-05	7.80E-05
397	**831.34**	-1.55E-05	1.88E-05	-1.13E-05	7.09E-05	-5.73E-05	8.24E-05
417	**894.09**	-6.95E-06	7.51E-06	-7.31E-06	6.54E-05	-2.58E-05	5.13E-05
2062	**925.08**	-3.19E-06	8.12E-06	-3.56E-06	1.69E-05	-1.06E-05	1.37E-05
2052	**935.67**	-3.26E-06	1.39E-05	-4.49E-06	2.41E-05	-1.51E-05	6.36E-06
2042	**944.86**	-2.70E-06	2.47E-05	-2.99E-06	2.00E-05	-2.45E-05	8.81E-06
477	**968.95**	-2.05E-06	2.17E-05	-7.10E-06	7.29E-06	-1.08E-05	1.65E-05
497	**1002.45**	-1.15E-05	2.34E-05	-1.27E-05	2.67E-05	-4.99E-06	6.87E-06
517	**1042.45**	-2.41E-06	2.14E-05	-8.48E-06	1.07E-05	-2.92E-06	3.08E-06
537	**1108.60**	-5.36E-06	2.76E-05	-7.67E-06	2.00E-05	-1.17E-05	2.46E-06
557	**1178.35**	-1.74E-06	2.10E-05	-5.46E-06	9.51E-06	-1.72E-05	8.94E-06
577	**1227.20**	-8.66E-06	2.89E-05	-7.26E-06	1.87E-05	-5.61E-06	3.34E-06
597	**1271.50**	-1.95E-06	1.68E-05	-5.57E-06	3.38E-06	-9.19E-06	1.08E-05
617	**1313.65**	-1.13E-05	2.32E-05	-7.18E-06	1.24E-05	-5.49E-06	3.54E-06
637	**1360.60**	-3.27E-06	6.76E-06	-3.63E-06	4.16E-06	-1.70E-06	1.21E-06

M&D Professional Services, Inc
1/9/2007

AP-460-UBS-BEC Strain Seismic-Pirrc.xls
Strain Seismic Only

Table 24 UBS-BEC Concrete Backed Steel Strain, Shell Bottom, Seismic Load Only

AP Backed Steel, Upper Bound Soil, Seismic Only, Best Estimate Tank Concrete, 460 In Waste Level at 1.83SpG

M&D Starting M&D Element No.	Path (in)	Shell Bottom Surface (outside - away from waste) Seismic					
		AP-460-UBS-BEC EPEL P1 Strain (in/in) Seismic Only Bot Min	AP-460-UBS-BEC EPEL P1 Strain (in/in) Seismic Only Bot Max	AP-460-UBS-BEC EPEL P2 (in/in) Seismic Only Bot Min	AP-460-UBS-BEC EPEL P2 Strain (in/in) Seismic Only Bot Max	AP-460-UBS-BEC EPEL P3 Strain (in/in) Seismic Only Bot Min	AP-460-UBS-BEC EPEL P3 Strain (in/in) Seismic Only Bot Max
762	**67.33**	-1.43E-05	2.14E-05	-1.45E-05	2.34E-05	-1.80E-05	2.18E-05
782	**105.04**	-1.59E-05	2.19E-05	-1.08E-05	1.84E-05	-3.37E-05	3.81E-05
802	**136.24**	-1.25E-05	2.47E-05	-1.32E-05	2.90E-05	-2.43E-05	2.82E-05
822	**181.71**	-8.60E-06	1.21E-05	-1.08E-05	2.03E-05	-2.82E-05	2.74E-05
842	**225.10**	-8.42E-06	2.68E-05	-2.01E-05	2.72E-05	-2.26E-05	2.78E-05
862	**273.66**	-4.16E-06	1.60E-05	-1.21E-05	2.23E-05	-2.52E-05	2.06E-05
882	**323.27**	-7.82E-06	7.76E-05	-1.30E-05	1.49E-05	-3.11E-05	2.20E-05
902	**369.20**	-9.88E-06	7.73E-05	-2.67E-06	1.43E-05	-3.63E-05	1.73E-05
922	**419.20**	-2.24E-05	1.30E-04	-2.41E-05	3.84E-05	-4.30E-05	1.67E-05
237	**463.02**						
257	**510.03**						
277	**544.44**						
297	**580.53**						
317	**631.08**						
337	**680.34**						
357	**727.44**						
377	**772.93**						
397	**831.34**						
417	**894.09**						
2062	**925.08**	-2.75E-06	9.61E-06	-2.35E-06	9.04E-06	-9.69E-06	1.37E-05
2052	**935.67**	-7.13E-06	2.51E-05	-5.16E-06	2.40E-05	-2.63E-05	5.45E-05
2042	**944.86**	-2.33E-05	8.94E-05	-1.23E-05	2.31E-05	-9.09E-06	2.38E-05
477	**968.95**						
497	**1002.45**						
517	**1042.45**						
537	**1108.60**						
557	**1178.35**						
577	**1227.20**						
597	**1271.50**						
617	**1313.65**						
637	**1360.60**						

M&D Professional Services, Inc
1/9/2007

AP-460-UBS-BEC Strain Seismic-Princ.xls
Strain Seismic Only

Table 25 UBS-BEC Concrete Wall/Footing Contact Forces, Gravity Only

Tank AY, 460 Inch Waste Level
SpG = 1.83
Upper Bound Soil
Best Estimate Concrete

Angle	Vertical Min AP-UBS-BEC Gravity	Vertical Max AP-UBS-BEC Gravity	Shear Y Min AP-UBS-BEC Gravity	Shear Y Max AP-UBS-BEC Gravity	Shear X Min AP-UBS-BEC Gravity	Shear X Max AP-UBS-BEC Gravity	Shear Y Max AP-UBS-BEC Gravity	Shear X Max AP-UBS-BEC Gravity	Shear Max AP-UBS-BEC Gravity	Vertical Force Max AP-UBS-BEC Gravity	Vertical Force Min AP-UBS-BEC Gravity
0	-184.90	-184.70	0.00	0.00	2.01	2.01	0.00	0.63	0.63	-57.78	-57.72
9	-369.60	-369.40	0.65	0.65	4.00	4.00	0.10	0.63	0.63	-57.75	-57.72
18	-369.70	-369.40	1.39	1.39	3.72	3.72	0.22	0.58	0.62	-57.77	-57.72
27	-369.70	-369.40	2.00	2.00	3.46	3.46	0.31	0.54	0.62	-57.77	-57.72
36	-369.60	-369.40	2.37	2.37	3.26	3.26	0.37	0.51	0.63	-57.75	-57.72
45	-369.60	-369.30	2.87	2.87	2.80	2.80	0.45	0.44	0.63	-57.75	-57.70
54	-369.60	-369.30	3.29	3.29	2.29	2.29	0.51	0.36	0.63	-57.75	-57.70
63	-369.60	-369.30	3.62	3.62	1.75	1.75	0.57	0.27	0.63	-57.75	-57.70
72	-369.60	-369.30	3.85	3.85	1.20	1.20	0.60	0.19	0.63	-57.75	-57.70
81	-369.60	-369.30	3.97	3.97	0.61	0.61	0.62	0.10	0.63	-57.75	-57.70
90	-369.50	-369.30	4.02	4.02	-0.01	-0.01	0.63	0.00	0.63	-57.73	-57.70
99	-369.60	-369.30	3.97	3.98	-0.62	-0.62	0.62	0.10	0.63	-57.75	-57.70
108	-369.60	-369.30	3.82	3.82	-1.24	-1.24	0.60	0.19	0.63	-57.75	-57.70
117	-369.60	-369.30	3.62	3.62	-1.78	-1.78	0.57	0.28	0.63	-57.75	-57.70
126	-369.60	-369.30	3.31	3.31	-2.30	-2.30	0.52	0.36	0.63	-57.75	-57.70
135	-369.60	-369.30	2.92	2.92	-2.77	-2.77	0.46	0.43	0.63	-57.75	-57.70
144	-369.60	-369.30	2.42	2.42	-3.19	-3.19	0.38	0.50	0.63	-57.75	-57.70
153	-369.60	-369.40	1.87	1.87	-3.57	-3.57	0.29	0.56	0.63	-57.75	-57.72
162	-369.60	-369.40	1.31	1.31	-3.83	-3.83	0.20	0.60	0.63	-57.75	-57.72
171	-369.60	-369.40	0.69	0.69	-3.97	-3.97	0.11	0.62	0.63	-57.75	-57.72
180	-184.90	-184.70	0.00	0.00	-2.02	-2.02	0.00	0.63	0.63	-57.78	-57.72

M&D Professional Services, Inc
12/21/2006

AP-460-UBS-BEC Footing Seismic.xls

Table 26 UBS-BEC Concrete Wall/Footing Contact Forces, Gravity Plus Seismic

Tank AY, 460 Inch Waste Level
SpG = 1.83
Upper Bound Soil
Best Estimate Concrete

Angle	Vertical Min AP-UBS-BEC Seismic	Vertical Max AP-UBS-BEC Seismic	Shear Y Min AP-UBS-BEC Seismic	Shear Y Max AP-UBS-BEC Seismic	Shear X Min AP-UBS-BEC Seismic	Shear X Max AP-UBS-BEC Seismic	Shear Y Max AP-UBS-BEC Seismic	Shear X Max AP-UBS-BEC Seismic	Shear Max AP-UBS-BEC Seismic	Vertical Force Max AP-UBS-BEC Seismic	Vertical Force Min AP-UBS-BEC Seismic
0	-215.60	-138.50	0.00	0.00	-5.23	10.13	0.00	3.17	3.17	-67.38	-43.28
9	-431.20	-277.20	-22.41	21.83	-13.78	23.72	3.50	3.71	5.10	-67.38	-43.31
18	-431.30	-278.10	-42.46	41.88	-23.89	33.85	6.63	5.29	8.48	-67.39	-43.45
27	-431.30	-279.40	-58.29	58.22	-39.64	49.85	9.11	7.79	11.98	-67.39	-43.66
36	-431.40	-281.30	-68.40	69.21	-59.79	70.13	10.81	10.96	15.40	-67.41	-43.95
45	-431.50	-283.70	-71.50	74.04	-82.93	92.39	11.57	14.44	18.50	-67.42	-44.33
54	-431.70	-286.50	-67.47	71.79	-106.70	114.80	11.22	17.94	21.16	-67.45	-44.77
63	-431.80	-289.20	-56.75	62.36	-128.50	135.30	9.74	21.14	23.28	-67.47	-45.19
72	-432.00	-291.60	-40.22	46.53	-145.60	151.90	7.27	23.73	24.82	-67.50	-45.56
81	-437.20	-293.50	-19.30	26.11	-156.20	162.70	4.08	25.42	25.75	-68.31	-45.86
90	-442.10	-295.00	2.70	6.17	-159.40	166.10	0.96	25.95	25.97	-69.08	-46.09
99	-445.70	-296.10	-18.82	27.55	-155.30	161.50	4.30	25.23	25.60	-69.64	-46.27
108	-448.20	-296.10	-38.66	48.25	-144.40	149.30	7.54	23.33	24.52	-70.03	-46.27
117	-450.00	-293.70	-54.13	63.96	-128.20	130.70	9.99	20.42	22.74	-70.31	-45.89
126	-451.10	-291.80	-63.99	73.24	-108.40	108.10	11.44	16.94	20.44	-70.48	-45.59
135	-451.50	-290.20	-67.40	75.60	-86.81	84.04	11.81	13.56	17.99	-70.55	-45.34
144	-451.70	-288.50	-64.20	70.90	-65.50	60.80	11.08	10.23	15.08	-70.58	-45.08
153	-452.00	-287.20	-54.68	59.59	-46.44	40.20	9.31	7.26	11.80	-70.63	-44.88
162	-452.30	-286.50	-39.73	42.85	-31.34	24.05	6.70	4.90	8.29	-70.67	-44.77
171	-452.50	-286.00	-20.89	22.39	-21.59	14.18	3.50	3.37	4.86	-70.70	-44.69
180	-226.30	-143.00	0.00	0.00	-9.16	5.51	0.00	2.86	2.86	-70.72	-44.69

M&D Professional Services, Inc
12/21/2006

AP-460-UBS-BEC Footing Seismic.xls

Table 27 UBS-BEC Concrete Wall/Footing Contact Forces, Seismic Only

Tank AY, 460 Inch Waste Level
SpG = 1.83
Upper Bound Soil
Best Estimate Concrete

Angle	Vertical Min AP-UBS-BEC Seismic Only	Vertical Max AP-UBS-BEC Seismic Only	Shear Y Min AP-UBS-BEC Seismic Only	Shear Y Max AP-UBS-BEC Seismic Only	Shear X Min AP-UBS-BEC Seismic Only	Shear X Max AP-UBS-BEC Seismic Only	Shear Y Max AP-UBS-BEC Seismic Only	Shear X Max AP-UBS-BEC Seismic Only	Shear Max AP-UBS-BEC Seismic Only	Vertical Force Max AP-UBS-BEC Seismic Only	Vertical Force Min AP-UBS-BEC Seismic Only
0	-30.70	46.20	0.00	0.00	-7.24	8.12	0.00	2.54	2.54	-9.59	14.44
9	-61.60	92.20	-23.06	21.18	-17.78	19.72	3.60	3.08	4.74	-9.62	14.41
18	-61.60	91.30	-43.85	40.49	-27.61	30.13	6.85	4.71	8.31	-9.63	14.27
27	-61.60	90.00	-60.29	56.22	-43.10	46.39	9.42	7.25	11.89	-9.63	14.06
36	-61.80	88.10	-70.77	66.84	-63.05	66.87	11.06	10.45	15.21	-9.66	13.77
45	-61.90	85.60	-74.37	71.17	-85.73	89.59	11.62	14.00	18.19	-9.67	13.38
54	-62.10	82.80	-70.76	68.50	-108.99	112.51	11.06	17.58	20.77	-9.70	12.94
63	-62.20	80.10	-60.37	58.74	-130.25	133.55	9.43	20.87	22.90	-9.72	12.52
72	-62.40	77.70	-44.07	42.68	-146.80	150.70	6.89	23.55	24.53	-9.75	12.14
81	-67.60	75.80	-23.27	22.14	-156.81	162.09	3.64	25.33	25.59	-10.56	11.84
90	-72.60	74.30	-1.31	2.15	-159.39	166.11	0.34	25.95	25.96	-11.34	11.61
99	-76.10	73.20	-22.79	23.58	-154.68	162.12	3.68	25.33	25.60	-11.89	11.44
108	-78.60	73.20	-42.48	44.43	-143.16	150.54	6.94	23.52	24.52	-12.28	11.44
117	-80.40	75.60	-57.75	60.34	-126.42	132.48	9.43	20.70	22.75	-12.56	11.81
126	-81.50	77.50	-67.30	69.93	-106.10	110.40	10.93	17.25	20.42	-12.73	12.11
135	-81.90	79.10	-70.32	72.68	-84.04	86.81	11.36	13.56	17.69	-12.80	12.36
144	-82.10	80.80	-66.62	68.48	-62.31	63.99	10.70	10.00	14.64	-12.83	12.63
153	-82.40	82.20	-56.55	57.72	-42.87	43.77	9.02	6.84	11.32	-12.88	12.84
162	-82.70	82.90	-41.04	41.54	-27.51	27.88	6.49	4.36	7.82	-12.92	12.95
171	-82.90	83.40	-21.58	21.70	-17.62	18.15	3.39	2.84	4.42	-12.95	13.03
180	-41.40	41.70	0.00	0.00	-7.14	7.53	0.00	2.35	2.35	-12.94	13.03

M&D Professional Services, Inc
12/21/2006

AP-460-UBS-BEC Footing Seismic.xls

Table 28 UBS-BEC Soil/Concrete Tank Contact Forces, Gravity Only

Tank AP, 460 Inch Waste Level
SpG = 1.83
Best Estimate Soil
Best Estimate Concrete

											1.22	1.17
	Angle (rad)	Path	Max Pressure Soil (BES) AP Gravity (PSI)	Min Pressure Soil (BES) AP Gravity (PSI)	Max Meridional Friction Soil (BES) AP Gravity (PSI)	Max Tangential Friction Soil (BES) AP Gravity (PSI)	Max Contact Displacement Soil (BES) AP Gravity (PSI)	Vertical Pressure	Active Pressure Phi = 33 deg	Active Pressure Phi = 49 deg	0.22g Dome Vertical	0.17g Haunch Vertical
568	-0.035089	**67.727**	11.63	11.48	1.60	0.04	0.01	7.12	7.11	7.11	14.19	13.61
565.8	-0.07135	**105.668**	10.01	9.83	1.98	0.07	0.02	7.27	7.26	7.26	12.22	11.72
563.21	-0.096521	**137.069**	8.80	7.76	1.82	0.11	0.02	7.46	7.43	7.42	10.73	10.29
559.7	-0.124516	**182.849**	7.22	6.28	1.60	0.17	0.02	7.71	7.65	7.65	8.80	8.44
550.7	-0.180521	**226.563**	9.13	6.44	1.81	0.28	0.02	8.35	8.23	8.22	11.13	10.68
545.2	-0.210395	**275.566**	9.17	8.77	1.85	0.14	0.02	8.74	8.57	8.55	11.18	10.73
527.68	-0.298426	**325.690**	8.64	8.24	1.77	0.03	0.02	9.99	9.59	9.56	10.54	10.11
518.2	-0.34673	**372.305**	10.81	10.72	2.04	0.03	0.02	10.66	10.09	10.04	13.19	12.65
494.5	-0.482293	**423.427**	17.48	17.40	2.06	0.06	0.02	12.35	11.07	10.97	21.32	20.45
476.2	-0.606571	**468.308**	27.65	27.60	2.21	0.11	0.02	13.65	11.45	11.27	33.73	32.35
447.4	-0.656685	**515.312**	31.96	31.86	4.44	0.21	0.03	15.70	12.75	12.51	38.99	37.39
407.1	-0.710341	**549.725**	25.83	25.77	5.35	0.16	0.04	18.57	14.53	14.18	31.51	30.22
382.1	-1.570796	**585.819**	12.88	12.86	3.35	0.07	0.04	20.35	6.00	2.85	15.72	15.07
335	-1.570796	**636.369**	4.50	4.50	1.10	0.01	0.05	23.70	6.99	3.32	5.49	5.27
281	-1.570796	**685.619**	3.96	3.96	0.93	0.00	0.05	27.55	8.13	3.86	4.83	4.64
236.5	-1.570796	**732.719**	4.95	4.94	1.01	0.00	0.06	30.71	9.06	4.30	6.03	5.79
186.8	-1.570796	**778.219**	4.66	4.65	0.95	0.00	0.06	34.25	10.10	4.80	5.68	5.45
145.5	-1.570796	**821.369**	5.71	5.71	1.28	0.01	0.06	37.19	10.97	5.21	6.97	6.68
70	-1.570796	**874.169**	8.43	8.42	1.87	0.02	0.05	42.57	12.56	5.96	10.29	9.86
24	-1.570796	**930.544**	12.40	12.35	2.76	0.06	0.04	45.84	13.52	6.42	15.12	14.50

Table 29 UBS-BEC Soil/Concrete Tank Contact Forces, Gravity Plus Seismic

Tank AP, 460 Inch Waste Level
SpG = 1.83
Upper Bound Soil
Best Estimate Concrete

	Angle (rad)	Path	Max Pressure Soil (UBS) AP Seismic (PSI)	Min Pressure Soil (UBS) AP Seismic (PSI)	Max Meridional Friction Soil (UBS) AP Seismic (PSI)	Max Tangential Friction Soil (UBS) AP Seismic (PSI)	Max Contact Displacement Soil (UBS) AP Seismic (inch)	Vertical Pressure	Active Pressure Phi = 33 deg	Active Pressure Phi = 49 deg
568	-0.035089	**67.727**	23.73	1.88	16.69	6.25	0.53	7.12	7.11	7.11
565.8	-0.07135	**105.668**	17.42	3.35	9.89	3.58	0.45	7.27	7.26	7.26
563.21	-0.096521	**137.069**	14.32	1.29	8.73	2.83	0.23	7.46	7.43	7.42
559.7	-0.124516	**182.849**	10.13	2.64	6.62	3.93	0.09	7.71	7.65	7.65
550.7	-0.180521	**226.563**	13.75	1.50	5.60	5.24	0.02	8.35	8.23	8.22
545.2	-0.210395	**275.566**	10.64	4.31	4.26	5.00	0.02	8.74	8.57	8.55
527.68	-0.298426	**325.690**	9.57	4.56	4.19	4.24	0.02	9.99	9.59	9.56
518.2	-0.34673	**372.305**	11.60	6.76	4.27	3.91	0.01	10.66	10.09	10.04
494.5	-0.482293	**423.427**	19.40	10.76	4.15	3.38	0.01	12.35	11.07	10.97
476.2	-0.606571	**468.308**	28.60	16.65	4.25	3.37	0.01	13.65	11.45	11.27
447.4	-0.656685	**515.312**	37.79	24.35	8.47	4.37	0.02	15.70	12.75	12.51
407.1	-0.710341	**549.725**	34.44	19.14	11.48	3.93	0.02	18.57	14.53	14.18
382.1	-1.570796	**585.819**	14.55	8.26	8.28	2.82	0.03	20.35	6.00	2.85
335	-1.570796	**636.369**	3.38	1.98	2.33	2.09	0.04	23.70	6.99	3.32
281	-1.570796	**685.619**	3.85	2.37	2.70	1.54	0.05	27.55	8.13	3.86
236.5	-1.570796	**732.719**	4.71	3.18	2.92	1.67	0.05	30.71	9.06	4.30
186.8	-1.570796	**778.219**	4.23	3.01	2.50	2.11	0.05	34.25	10.10	4.80
145.5	-1.570796	**821.369**	4.79	3.17	3.24	3.00	0.06	37.19	10.97	5.21
70	-1.570796	**874.169**	10.04	3.57	7.57	4.55	0.05	42.57	12.56	5.96
24	-1.570796	**930.544**	23.45	3.91	8.48	4.35	0.04	45.84	13.52	6.42

Table 30 UBS-BEC Soil/Concrete Tank Contact Forces, Seismic Only

Tank AP, 460 Inch Waste Level
SpG = 1.83
Upper Bound Soil
Best Estimate Concrete

	Angle (rad)	Path	Max Pressure Soil (UBS) AP Seismic Only (PSI)	Min Pressure Soil (UBS) AP Seismic Only (PSI)	Max Meridional Friction (UBS) AP Seismic Only (PSI)	Max Tangential Friction (UBS) AP Seismic Only (PSI)	Max Contact Displacment (UBS) AP Seismic Only (inch)
568	-0.035089	**67.727**	12.15	-9.70	14.93	6.20	0.52
565.8	-0.07135	**105.668**	7.56	-6.52	7.88	3.51	0.44
563.21	-0.096521	**137.069**	5.53	-7.50	6.92	2.70	0.21
559.7	-0.124516	**182.849**	3.51	-3.98	5.22	3.65	0.08
550.7	-0.180521	**226.563**	6.18	-6.07	3.99	4.74	0.01
545.2	-0.210395	**275.566**	2.79	-3.54	2.68	4.75	0.01
527.68	-0.298426	**325.690**	2.23	-2.78	2.69	4.18	0.01
518.2	-0.34673	**372.305**	2.42	-2.42	2.74	3.88	0.00
494.5	-0.482293	**423.427**	4.59	-4.05	2.70	3.32	0.00
476.2	-0.606571	**468.308**	6.94	-5.01	2.97	3.28	0.01
447.4	-0.656685	**515.312**	8.06	-5.39	6.53	4.19	0.01
407.1	-0.710341	**549.725**	8.58	-6.73	9.17	3.75	0.01
382.1	-1.570796	**585.819**	3.55	-2.74	6.20	2.73	0.02
335	-1.570796	**636.369**	0.82	-0.57	1.72	2.08	0.02
281	-1.570796	**685.619**	0.84	-0.64	1.95	1.53	0.02
236.5	-1.570796	**732.719**	0.80	-0.73	2.09	1.66	0.02
186.8	-1.570796	**778.219**	0.70	-0.52	1.79	2.11	0.02
145.5	-1.570796	**821.369**	0.73	-0.89	2.37	2.99	0.02
70	-1.570796	**874.169**	3.51	-2.95	6.04	4.54	0.02
24	-1.570796	**930.544**	10.40	-9.14	5.34	4.29	0.01

M&D Professional Services Confidential
12/21/2006

AP-460-UBS-BEC Soil Pressures Seismic.xls
Page 1

Table 31 UBS-BEC Primary Tank/Concrete Dome Contact Data, Gravity Only

Tank AP, 460 Inch Waste Level
SpG = 1.83
Upper Bound Soil
Best Estimate Concrete

Radius	Max Pressure Primary Tank/Concrete Tank Dome AP Gravity (PSI)	Min Pressure Primary Tank/Concrete Tank Dome AP Gravity (PSI)	Max Gap Lateral Displacement Primary Tank /Concrete Tank Dome Gravity (in)	Max Gap Displacement Primary Tank/Concete Tank Dome AP Gravity (Inches)
67.727	1.262	1.208	0.002394	0.000000
105.668	0.944	0.923	0.003558	0.000000
137.069	0.536	0.528	0.004129	0.000000
182.849	0.716	0.710	0.005299	0.000000
226.563	0.871	0.850	0.003090	-0.000047
275.566	0.368	0.364	0.003628	-0.000023
325.690	1.215	1.210	0.004542	-0.000170
372.305	0.115	0.107	0.010844	0.000000
423.427	0.000	0.000	0.000000	-1.056120

Table 32 UBS-BEC Primary Tank/Concrete Dome Contact Data, Gravity Plus Seismic

Tank AP, 460 Inch Waste Level
SpG = 1.83
Upper Bound Soil
Best Estimate Concrete

Radius	Max Pressure Primary Tank/Concrete Tank Dome AP Seismic (PSI)	Min Pressure Primary Tank/Concrete Tank Dome AP Seismic (PSI)	Max Gap Lateral Displacement Primary Tank /Concrete Tank Dome Seismic (in)	Max Gap Displacement Primary Tank/Concete Tank Dome AP Seismic (Inches)
67.727	2.523	0.543	0.003826	0.000000
105.668	2.214	0.543	0.005365	-0.000020
137.069	1.963	0.193	0.006271	-0.000007
182.849	1.394	0.409	0.008242	0.000000
226.563	1.764	0.410	0.014856	-0.000104
275.566	1.020	0.094	0.011158	-0.000060
325.690	1.629	0.000	0.008800	-0.000964
372.305	1.953	0.000	0.029052	-0.002122
423.427	0.967	0.000	0.048300	-1.059840

Table 33 UBS-BEC Primary Tank/Concrete Dome Contact Data, Seismic Only

Tank AP, 460 Inch Waste Level
SpG = 1.83
Upper Bound Soil
Best Estimate Concrete

Radius	Max Pressure Primary Tank/Concrete Tank Dome AP Seismic Only (PSI)	Min Pressure Primary Tank/Concrete Tank Dome AP Seismic Only (PSI)	Max Gap Lateral Displacement Primary Tank /Concrete Tank Dome Seismic Only (in)	Max Gap Displacement Primary Tank/Concete Tank Dome AP Seismic Only (Inches)
67.727	1.261	-0.665	0.001432	0.000000
105.668	1.269	-0.380	0.001807	-0.000020
137.069	1.427	-0.335	0.002142	-0.000007
182.849	0.678	-0.301	0.002942	0.000000
226.563	0.893	-0.440	0.011766	-0.000057
275.566	0.653	-0.269	0.007530	-0.000037
325.690	0.415	-1.210	0.004258	-0.000794
372.305	1.838	-0.107	0.018208	-0.002122
423.427	0.967	0.000	0.048300	-0.003720

Table 34 UBS-BEC Primary Tank/Insulating Concrete Contact Forces, Gravity Only

Tank AP, 460 Inch Waste Level
SpG = 1.83
Upper Bound Soil
Best Estimate Concrete

Radius	Max Pressure Primary Tank/Insulating Concrete AP Gravity (PSI)	Min Pressure Primary Tank/Insulating Concrete AP Gravity (PSI)	Max Lateral Displacement Primary Tank / Insulating Concete AP Gravity (Inches)	Min Lateral Displacement Primary Tank / Insulating Concete AP Gravity (Inches)
424.00	69.931	69.861	0.006617	0.006601
384.00	13.882	13.868	0.000730	0.000654
317.85	33.153	33.132	0.002825	0.002809
248.10	29.764	29.743	0.002167	0.002156
199.25	30.729	30.708	0.001478	0.001471
154.95	30.486	30.465	0.000894	0.000888
112.80	30.424	30.396	0.000110	0.000107
65.85	31.056	31.014	0.000205	0.000198

Table 35 UBS-BEC Primary Tank/ Insulating Concrete Contact Data, Gravity Plus Seismic

Tank AP, 460 Inch Waste Level
SpG = 1.83
Upper Bound Soil
Best Estimate Concrete

Radius	Max Pressure Primary Tank/Insulaiting Concrete AP Seismic (PSI)	Min Pressure Primary Tank/Insulaiting Concrete AP Seismic (PSI)	Max Lateral Displacement Primary Tank/Insulaiting Concrete AP Seismic (Inches)	Min Lateral Displacement Primary Tank/Insulaiting Concrete AP Seismic (Inches)
424.00	95.556	43.160	0.071064	0.002243
384.00	27.160	6.400	0.369000	0.000574
317.85	46.319	22.889	0.045408	0.000556
248.10	40.931	20.604	0.024048	0.000414
199.25	41.340	22.229	0.012828	0.000174
154.95	38.618	23.271	0.007506	0.000200
112.80	38.021	24.014	0.004883	0.000015
65.85	38.486	24.563	0.003655	0.000092

Table 36 UBS-BEC Primary Tank/ Insulating Concrete Contact Forces, Seismic Only

Tank AP, 460 Inch Waste Level
SpG = 1.83
Upper Bound Soil
Best Estimate Concrete

Radius	Max Pressure Insulating Concrete/Secondary Liner AP Gravity (PSI)	Min Pressure Insulating Concrete/Secondary Liner AP Gravity (PSI)	Max Lateral Displacement Insulating Concrete/Secondary Liner AP Gravity (Inches)	Min Lateral Displacement Insulating Concrete/Secondary Liner AP Gravity (Inches)
424.00	76.458	76.250	0.002165	0.002129
384.00	32.896	32.847	0.001609	0.001573
317.85	28.125	28.097	0.001042	0.001010
248.10	31.438	31.417	0.000724	0.000700
199.25	30.917	30.889	0.000378	0.000363
154.95	30.667	30.639	0.000262	0.000253
112.80	31.118	31.069	0.000212	0.000211
65.85	30.771	30.639	0.000041	0.000040

Table 37 UBS-BEC Insulating Concrete/Concrete Backed Steel Contact Data, Gravity Only

Tank AP, 460 Inch Waste Level
SpG = 1.83
Best Esitmate Soil
Best Estimate Concrete

Radius	Max Pressure Insulating Concrete/Secondary Liner AP Gravity (PSI)	Min Pressure Insulating Concrete/Secondary Liner AP Gravity (PSI)	Max Lateral Displacement Insulating Concrete/Secondary Liner AP Gravity (Inches)	Min Lateral Displacement Insulating Concrete/Secondary Liner AP Gravity (Inches)
424.00	86.458	86.250	0.003563	0.003527
384.00	33.854	33.785	0.002846	0.002810
317.85	27.736	27.701	0.002029	0.001997
248.10	31.500	31.472	0.001470	0.001445
199.25	30.931	30.896	0.000920	0.000905
154.95	30.576	30.542	0.000659	0.000651
112.80	31.215	31.146	0.000489	0.000487
65.85	30.597	30.410	0.000165	0.000160

Table 38 UBS-BEC Insulating Concrete/Concrete Backed Steel Contact Data, Gravity Plus Seismic

Tank AP, 460 Inch Waste Level
SpG = 1.83
Upper Bound Soil
Best Estimate Concrete

Radius	Max Pressure Insulating Concrete/Secondary Liner AP Seismic (PSI)	Min Pressure Insulating Concrete/Secondary Liner AP Seismic (PSI)	Max Lateral Displacement Insulating Concrete/Secondary Liner AP Seismic (Inches)	Min Lateral Displacement Insulating Concrete/Secondary Liner AP Seismic (Inches)
424.00	91.667	58.111	0.014472	0.000072
384.00	45.764	22.153	0.013884	0.000181
317.85	40.826	18.181	0.015360	0.000021
248.10	42.938	22.174	0.015672	0.000029
199.25	41.424	22.444	0.013560	0.000036
154.95	38.924	23.410	0.010792	0.000017
112.80	38.750	24.764	0.008864	0.000011
65.85	38.194	24.222	0.007630	0.000014

Table 39 UBS-BEC Insulating Concrete/Concrete Backed Steel Contact Data, Seismic Only

Tank AP, 460 Inch Waste Level
SpG = 1.83
Upper Bound Soil
Best Estimate Concrete

Radius	Max Pressure Insulating Concrete/Secondary Liner AP Seismic Only (PSI)	Min Pressure Insulating Concrete/Secondary Liner AP Seismic Only (PSI)	Max Lateral Displacement Insulating Concrete/Secondary Liner AP Seismic Only (Inches)	Min Lateral Displacement Insulating Concrete/Secondary Liner AP Seismic Only (Inches)
424.00	15.208	-18.139	0.012	-0.002
384.00	12.868	-10.694	0.012	-0.001
317.85	12.701	-9.917	0.014	-0.001
246.10	11.500	-9.243	0.015	-0.001
199.25	10.507	-8.444	0.013	0.000
154.95	8.257	-7.229	0.011	0.000
112.80	7.632	-6.306	0.009	0.000
65.85	7.424	-6.417	0.008	0.000

Table 40 UBS-BEC Waste Contact Pressure, Gravity Plus Seismic

Tank AY, 460 Inch Waste Level
SpG = 1.83
Upper Bound Soil
Best Estimate Concrete

Waste Height Ratio	Waste Height	Max Pressure AP Tank, 460 in Waste Level, SpG = 1.83 Time History (PSI)	Min Pressure AP Tank, 460 in Waste Level, SpG = 1.83 Time History (PSI)	Hydrostatic (psi)	Hydrodynamic (psi)	Theoretical Min (SRSS)	Theoretical Max (SRSS)
0.99	454.35	10.694	-9.875	0.37	1.84	0.00	2.22
0.96	443.05	14.229	-13.764	1.12	2.15	0.00	3.27
0.94	431.7625	17.111	-13.556	1.87	2.53	0.00	4.40
0.90	414.125	16.431	-10.236	3.03	3.19	0.00	6.22
0.85	390.125	10.375	-2.190	4.62	4.08	0.53	8.70
0.80	366.125	14.229	-0.505	6.20	4.93	1.27	11.14
0.74	342	16.729	0.006	7.80	5.73	2.06	13.53
0.69	318.325	18.889	0.908	9.36	6.46	2.90	15.82
0.64	295.225	22.257	1.893	10.89	7.12	3.77	18.01
0.59	272.125	22.833	2.556	12.41	7.73	4.69	20.14
0.54	248.975	26.625	3.820	13.94	8.28	5.66	22.23
0.49	225.825	28.882	4.864	15.47	8.79	6.68	24.27
0.44	202.725	29.236	5.892	17.00	9.26	7.74	26.25
0.39	179.625	31.549	7.188	18.53	9.67	8.86	28.19
0.34	156.475	35.306	8.819	20.06	10.03	10.02	30.09
0.29	134.075	36.264	10.250	21.54	10.34	11.20	31.87
0.24	112.475	36.938	11.396	22.96	10.59	12.37	33.55
0.20	90.875	39.639	12.507	24.39	10.80	13.59	35.19
0.15	69.275	40.958	13.632	25.82	10.96	14.85	36.78
0.10	47.738	42.993	15.139	27.24	11.08	16.16	38.32
0.05	24.500	43.382	12.514	28.78	11.16	17.61	39.94
0.02	7.755	47.694	23.021	29.88	11.19	18.69	41.07
0.00	1.755	44.396	23.486	30.28	11.19	19.09	41.47

M&D Professional Services Confidential
12/21/2006
Page 2
AP-460-UBS-BEC Waste-TH-MAX.xls, FM Max

Table 41 UBS-BEC Waste Contact Pressure, Theoretical Pressures

Tank Radius, Hr	450	Hl/Hr	1.022222222		Waste Dens	1.71E-04					
Waste Depth, Hl	460	Conv 1st	Conv 2nd	Conv 3rd	Impul H	Pressure					
		Conv 1st	Conv 2nd	Conv 3rd		Conv 1st	Conv 2nd	Conv 3rd	Impul H	Impul V	
Centroid	**Hydrodynamic**	1.841	5.331	8.536	Sa=	0.064	0.108	0.163	0.36	0.32	
Height	nu	con0(n)	con1(n)	con2(n)	ci(n)	24.7296	41.7312	62.9832	139.1	123.65	SRSS
454.35	0.987717391	0.82	0.07	0.03	0.09	1.56	0.22	0.12	0.94	0.15	1.84
443.05	0.963152174	0.78	0.06	0.02	0.14	1.49	0.19	0.10	1.46	0.45	2.15
431.7625	0.93861413	0.75	0.05	0.02	0.18	1.43	0.17	0.08	1.94	0.75	2.53
414.125	0.900271739	0.70	0.04	0.01	0.24	1.33	0.14	0.06	2.62	1.21	3.19
390.125	0.848097826	0.64	0.03	0.01	0.32	1.22	0.10	0.04	3.43	1.84	4.08
366.125	0.795923913	0.59	0.02	0.00	0.39	1.11	0.08	0.02	4.13	2.45	4.93
342	0.743478261	0.54	0.02	0.00	0.44	1.02	0.06	0.01	4.75	3.05	5.73
318.325	0.69201087	0.49	0.01	0.00	0.49	0.94	0.04	0.01	5.27	3.62	6.46
295.225	0.641793478	0.45	0.01	0.00	0.53	0.86	0.03	0.01	5.72	4.15	7.12
272.125	0.591576087	0.42	0.01	0.00	0.57	0.80	0.03	0.00	6.11	4.66	7.73
248.975	0.54125	0.39	0.01	0.00	0.60	0.74	0.02	0.00	6.46	5.13	8.28
225.825	0.490923913	0.36	0.00	0.00	0.63	0.69	0.01	0.00	6.76	5.58	8.79
202.725	0.440706522	0.34	0.00	0.00	0.66	0.65	0.01	0.00	7.03	5.99	9.26
179.625	0.39048913	0.32	0.00	0.00	0.68	0.61	0.01	0.00	7.25	6.36	9.67
156.475	0.340163043	0.30	0.00	0.00	0.70	0.57	0.01	0.00	7.45	6.70	10.03
134.075	0.291467391	0.29	0.00	0.00	0.71	0.55	0.01	0.00	7.61	6.98	10.34
112.475	0.24451087	0.28	0.00	0.00	0.72	0.53	0.00	0.00	7.74	7.21	10.59
90.875	0.197554348	0.27	0.00	0.00	0.73	0.51	0.00	0.00	7.84	7.41	10.80
69.275	0.150597826	0.26	0.00	0.00	0.74	0.49	0.00	0.00	7.92	7.56	10.96
47.7375	0.103777174	0.25	0.00	0.00	0.75	0.48	0.00	0.00	7.98	7.68	11.08
24.5	0.05326087	0.25	0.00	0.00	0.75	0.48	0.00	0.00	8.02	7.75	11.16
7.755	0.016858696	0.25	0.00	0.00	0.75	0.47	0.00	0.00	8.03	7.78	11.19
1.755	0.003815217	0.25	0.00	0.00	0.75	0.47	0.00	0.00	8.03	7.78	11.19

Table 42 UBS-BEC Waste Surface Displacement, Gravity Plus Seismic

Tank AP, 460 Inch Waste Level
SpG = 1.83
Upper Bound Soil
Best Estimate Concrete

Waste Radius	Max Vertical Displacement AP-460-UBS-BEC Time History (in)	Min Vertical Displacement AP-460-UBS-BEC Time History (in)
95.7	8.49	-13.15
129.9	9.27	-11.94
180	9.83	-13.40
218.5	9.54	-14.71
277.7	10.19	-14.76
358	10.51	-14.93
410	9.13	-13.92
450	6.72	-10.55

Near-Soil-1.txt

```
et,8,solid45                              !
Use Element SOLID45 for Near Soil
Elements
/input,soil-prop-UB-geo,txt               !
Read Soil Properties

ksel,u,kp,,1,kmaxjb                       !
Unselect existing Keypoints
asel,u,area,,1,amaxjb                     !
Unselect existing Area
lsel,u,line,,1,lmaxjb                     !
Unselect existing Lines
vsel,u,volu,,1,vmaxw                      !
Unselect existing Volumes

/COM - Create Keypoints to match concrete
tank profile
*do,i,1,bm_kp
k,kmaxjb+i,ctx(i),0,ctz(i)
*enddo

/COM - Create Keypoints above top of tank
k,kmaxjb+bm_kp+1,0,0,0          ! Keypoint
at origin (surface)
k,kmaxjb+bm_kp+2,0,0,soilz(2) ! Keypoint
at to divide soil above tank
*get,KMAXtemp1,KP,0,num,max   ! Get
maximum keypoint number for counter

/COM - Create Keypoints at outside of
excavated soil
*do,i,1,tanksoil
k,kmaxtemp1+i,soilx(i),0,soilz(i)
*enddo
*get,KMAXtemp2,KP,0,num,max
        ! Get maximum keypoint number for
counter

/COM - Create additional keypoint in soil
above tank
k,kmaxtemp2+1,ctx(2),0,soilz(1)
k,kmaxtemp2+2,ctx(9),0,soilz(1)
k,kmaxtemp2+3,ctx(12),0,soilz(1)
k,kmaxtemp2+4,ctx(2),0,soilz(2)
k,kmaxtemp2+5,ctx(9),0,soilz(2)
k,kmaxtemp2+6,ctx(12),0,soilz(2)
k,kmaxtemp2+7,ctx(12),0,soilz(3)
k,kmaxtemp2+8,ctx(bm_kp+1),0,ctz(bm_kp+1)

a,kmaxtemp2+1,kmaxtemp2+2,kmaxtemp2+5,kma
xtemp2+4
a,kmaxtemp2+2,kmaxtemp2+3,kmaxtemp2+6,kma
xtemp2+5
a,kmaxtemp2+3,kmaxtemp1+1,kmaxtemp1+2,kma
xtemp2+6
a,kmaxtemp2+4,kmaxtemp2+5,kmaxjb+9,kmaxjb
+8,kmaxjb+7,kmaxjb+6,kmaxjb+5,kmaxjb+4,km
axjb+3,kmaxjb+2!a,740,741,712,711,710,709
,708,707,706,705
a,kmaxtemp2+5,kmaxtemp2+6,kmaxtemp2+7,kma
xjb+12,kmaxjb+11,kmaxjb+10,kmaxjb+9
a,kmaxtemp2+6,kmaxtemp1+2,kmaxtemp1+3,kma
xtemp2+7
a,kmaxtemp2+7,kmaxtemp1+3,kmaxtemp1+4,kma
xjb+12
a,kmaxjb+12,kmaxtemp1+4,kmaxtemp1+5,kmaxj
b+14,kmaxjb+13
a,kmaxjb+14,kmaxtemp1+5,kmaxtemp1+6,kmaxj
b+16,kmaxjb+15
a,kmaxjb+16,kmaxtemp1+6,kmaxtemp1+7,kmaxj
b+18,kmaxjb+17
a,kmaxjb+18,kmaxtemp1+7,kmaxtemp1+8,kmaxj
b+20,kmaxjb+19
a,kmaxjb+20,kmaxtemp1+8,kmaxtemp1+9,kmaxt
emp2+8,kmaxjb+22,kmaxjb+21

cm,top-soil-area,area
lsla
cm,top-soil,line
type,1
real,1


/COM - Define line divisions to control
meshing
lsel,s,loc,z,soilz(1),soilz(2)
lsel,r,loc,x,ctx(3),ctx(8)
lesize,all,,,14                           !
soil above tank top, match tank meshing
lsel,s,loc,z,soilz(1),soilz(2)
lsel,r,loc,x,ctx(10),ctx(11)
lesize,all,,,3                    ! soil
above tank top, match tank meshing
cmsel,s,top-soil                 ! Reselect
lines in near soil
lsel,r,loc,x,ctx(2)
lesize,all,,,2                   ! Control
vertical element size, above tank
cmsel,s,top-soil
lsel,s,loc,x,ctx(9)
lesize,all,,,2                   ! Control
vertical element size, above tank
cmsel,s,top-soil
lsel,r,loc,x,ctx(12)
lesize,all,,,2                   ! Control
vertical element size, above tank
cmsel,s,top-soil
lsel,r,loc,z,ctz(2),ctz(12)
lsel,r,loc,x,ctx(2),ctx(12)
lesize,all,,,1                   ! Control
vertical element size, outside excavation
mesh
lsel,s,line,,lmaxjb+8,lmaxjb+10,2
lsel,a,line,,lmaxjb+26,lmaxjb+28,2
lsel,a,line,,lmaxjb+30,lmaxjb+38,4
lesize,all,,,9
lsel,s,line,,lmaxjb+42,lmaxjb+42,4
lesize,all,,,7                   ! Control
horizontal meshing in soil
lsel,s,line,,lmaxjb+9
lsel,a,line,,lmaxjb+25,lmaxjb+27,2
lsel,a,line,,lmaxjb+29,lmaxjb+45,4
lesize,all,,,1                   ! Control
horizontal meshing in soil
lsel,s,line,,lmaxjb+6
lsel,a,line,,lmaxjb+20,lmaxjb+21
lsel,a,line,,lmaxjb+32,lmaxjb+44,4
lsel,a,line,,lmaxjb+31,lmaxjb+43,4
lsel,a,line,,lmaxjb+47,lmaxjb+49
lesize,all,,,1                   ! Control
meshing to match tank
lsel,s,line,,lmaxjb+46
```

```
lesize,all,,,4                ! Control
mesh size at bottom of excavated soil

cmsel,s,top-soil-area

amesh,all                     ! Mesh area
to develop pattern for volume meshing

type,8
ksel,a,kp,,1                  ! Select
Keypoint for rotation axis
ksel,a,kp,,ct_kps             ! Select
Keypoint for rotation axis
vrotat,all,,,,,,1,ct_kps,180,2        !
Generate Volumes for excavated soil
lsla
lsel,r,loc,x,ctx(2)
lesize,all,,arcsize           ! Define
meshing for slices
lsla
lsel,r,loc,x,ctx(9)
lesize,all,,arcsize           ! Define
meshing for slices
lsla
lsel,r,loc,x,ctx(12)
lesize,all,,arcsize           ! Define
meshing for slices
vsweep,all                    ! Sweep
pattern into volume
aclear,all                    ! Delete
elements used for sweep
cm,top-soil-vol,volu

*get,VMAXtemp,VOLU,0,num,max
/COM - Generate element above top center
of tank
asel,u,area,,all
vsel,u,volu,,all
a,kmaxjb+bm_kp+1,kmaxtemp2+1,kmaxtemp2+4,
kmaxjb+bm_kp+2
a,kmaxjb+bm_kp+2,kmaxtemp2+4,kmaxjb+2,kma
xjb+1
vrotat,all,,,,,,1,ct_kps,180,2
vsel,s,volu,,vmaxtemp+1,vmaxtemp+3,2
vatt,801,,8                           !
Assign material properties
vsel,s,volu,,vmaxtemp+2,vmaxtemp+4,2
vatt,802,,8                           !
Assign material properties
vsel,s,volu,,vmaxtemp+1,vmaxtemp+4
allsel
asel,s,loc,z,ctz(1),ctz(2)
type,1
asel,r,loc,x,0,4
asel,r,loc,z,ctz(1),ctz(2)
cmsel,u,conc-tank-a
*get,atemp,area,,num,max
*get,atemp1,area,,num,min
asel,a,area,,1,22,21
mshcopy,2,1,atemp1            ! copy mesh
top match top of concrete tank
mshcopy,2,22,atemp            ! copy mesh
top match top of concrete tank
asel,u,area,,1,22,21
vsel,s,volu,,vmaxtemp+1,vmaxtemp+4
vsweep,all                            !
Generate elements by sweeping area
aclear,atemp
aclear,atemp1
```

```
/COM - Assign soil properties by layer
*do,i,1,tanksoil-1
cmsel,s,top-soil-vol
vsel,r,loc,z,soilz(i),soilz(i+1)
eslv
emodif,all,mat,800+i
esys,0
*enddo

cmsel,s,top-soil-vol
vsel,a,loc,z,soilz(1),ctz(2)
eslv
cm,excav-soil,elem
nsle
nummrg,node

/COM - Define component for excavated
soil - tank walls only
cmsel,s,excav-soil
nsle,s,1
nsel,r,loc,z,soilz(5),soilz(9)
esln,r,1
cm,excav-wall,elem


/COM - Define component for excavated
soil - tank dome only
cmsel,s,excav-soil
cmsel,u,excav-wall
cm,excav-dome,elem

csys,1
cmsel,s,excav-wall
nsle
nsel,r,loc,x,ctx(14)
cm,excav-wall-n,node

esel,s,type,,8
nsle
nsel,s,loc,x,soilx(1)
nsel,r,loc,z,soilz(1)
cm,near-soil-face-node,node
*do,i,2,9
esel,s,type,,8
nsle
nsel,r,loc,x,soilx(i)
nsel,r,loc,z,soilz(i)
cmsel,a,near-soil-face-node
cm,near-soil-face-node,node
*enddo

esel,s,type,,8
nsle
nsel,r,loc,z,soilz(9)
nsel,r,loc,x,41,68
cm,near-soil-bot-node,node


allsel
*get,KMAXns,KP,0,num,max      ! Get
maximum Keypoint number
*get,LMAXns,LINE,0,num,max    ! Get
maximum line number
*get,AMAXns,AREA,0,num,max    ! Get
maximum Area number
*get,VMAXns,volu,0,num,max    ! Get
maximum Volume number
```

Run-Tank.txt

```
!/batch
! PNNL DST Seismic Analysis, Gravity
Inputs, Upper Bound Soil, Best Est
Concrete Properties, AP Primary Tank
Geometry, Dome Friction=0.0
!
fini
/clear
/filname,AP-460-UBS-BEC-Seismic,1
/config,nres,3000             ! Increase
allowable number of results to 3000
/config,nproc,2                        !
Activate 2 processers for solution
/config,fsplit,1024           ! Split
binary file at 4.2GB
/prep7
g=32.2                        ! Gravity
(ft/sec)

DF=40                         ! Factor
for beta (stiffness) damping
ALPHA=0.4                     ! Alpha
damping

/out,tank-out,out
/sys,"X:\07.00 - Quality Assurance\ANSYS
QA\usrcfg.bat" > QA.out
/out,QA,out,,append
/input,tank-coordinates-AP,txt        !
Run file defining tank coordinates
(concrete and primary)
/input,tank-props-bec-250,txt ! Run file
defining fully cracked concrete
properties (PNNL Concrete Properties)
/input,tank-mesh1,txt         ! Develop
concrete tank
/input,primary-props-AP,txt   ! Run file
defining AP Primary tank properties
/input,primary,txt            ! Develop
Primary tank
/input,insulate,txt           ! Develop
insulating concrete model
/input,liner,txt              ! Develop
Liner model
/input,waste-solid-AP-s,txt   ! Develop
waste model
/input,bolts-friction,txt     ! Develop
J-Bolt model
/input,near-soil-1,txt        ! Develop
excavated soil model
/input,far-soil,txt           ! Develop
Far-Field soil model
/input,interface1,txt         ! Develop
Soil and Concrete Interfaces
/input,interface-gap1,txt     ! Develop
Primary Tank Interfaces
/input,slave,txt              ! Develop
slaved boundary conditions
/input,boundary,txt           ! Place
base and symmetry boundary conditions
/input,outer-spar,txt         ! Connect
soil model to symmetry plane
/input,live_load,txt          ! Apply
live load over a 10ft radius over dome
center
/input,fix-soil,txt
/out
ALLSEL

/out,Tank-th,out

save

/input,solve-TH-UBS,txt                  !
Run solution Phase

/input,post-tank,txt

/out
/exit
```

Soil-Prop-UB-Geo.txt

```
Tanksoil=9
deepsoil=20
soil_radius=320
mass=1e8

*dim,soilx,,30
*dim,soilz,,30


soilz(1)=0
soilz(2)=-5
soilz(3)=ctz(9)
soilz(4)=ctz(12)
soilz(5)=ctz(14)
soilz(6)=ctz(16)
soilz(7)=ctz(18)
soilz(8)=ctz(20)
soilz(9)=ctz(23)
soilz(10)=-73.5
soilz(11)=-90.5
soilz(12)=-106.5
soilz(13)=-123.5
soilz(14)=-139.5
soilz(15)=-156
soilz(16)=-178
soilz(17)=-200
soilz(18)=-222
soilz(19)=-244
soilz(20)=-266

soilx(9)=68
soilx(8)=soilx(9)-(soilz(9)-soilz(8))/1.5
soilx(7)=soilx(9)-(soilz(9)-soilz(7))/1.5
soilx(6)=soilx(9)-(soilz(9)-soilz(6))/1.5
soilx(5)=soilx(9)-(soilz(9)-soilz(5))/1.5
soilx(4)=soilx(9)-(soilz(9)-soilz(4))/1.5
soilx(3)=soilx(9)-(soilz(9)-soilz(3))/1.5
soilx(2)=soilx(9)-(soilz(9)-soilz(2))/1.5
soilx(1)=soilx(9)-(soilz(9)-soilz(1))/1.5


/COM Excavated Soil Properties


/COM - Material 801, Soil      (Top Layer)
mp,ex,801,18*144
mp,nuxy,801,0.27
mp,dens,801,125/(1000*g)
mp,damp,801,0.017/df

/COM - Material 802, Soil
mp,ex,802,22.5*144
mp,nuxy,802,0.27
mp,dens,802,125/(1000*g)
```

```
mp,damp,802,0.027/df

/COM - Material 803, Soil
mp,ex,803,29.25*144
mp,nuxy,803,0.27
mp,dens,803,125/(1000*g)
mp,damp,803,0.039/df

/COM - Material 804, Soil
mp,ex,804,36*144
mp,nuxy,804,0.27
mp,dens,804,125/(1000*g)
mp,damp,804,0.031/df

/COM - Material 805, Soil
mp,ex,805,42*144
mp,nuxy,805,0.27
mp,dens,805,125/(1000*g)
mp,damp,805,0.035/df

/COM - Material 806, Soil
mp,ex,806,48.75*144
mp,nuxy,806,0.27
mp,dens,806,125/(1000*g)
mp,damp,806,0.042/df

/COM - Material 807, Soil
mp,ex,807,55.5*144
mp,nuxy,807,0.27
mp,dens,807,125/(1000*g)
mp,damp,807,0.047/df

/COM - Material 808, Soil
mp,ex,808,60*144
mp,nuxy,808,0.27
mp,dens,808,125/(1000*g)
mp,damp,808,0.037/df

/COM - Material 810, Soil
mp,ex,810,250
mp,nuxy,810,0.27
mp,dens,810,125/(1000*g)
mp,damp,810,0.037/df

/COM - Material 811, Soil     (Top Layer)
mp,ex,811,15131
mp,nuxy,811,0.27
mp,dens,811,125/(1000*g)
mp,damp,811,0.017/df

/COM - Material 812, Soil
mp,ex,812,14108
mp,nuxy,812,0.27
mp,dens,812,125/(1000*g)
mp,damp,812,0.027/df

/COM - Material 813, Soil
mp,ex,813,12816
mp,nuxy,813,0.27
mp,dens,813,125/(1000*g)
mp,damp,813,0.039/df

/COM - Material 814, Soil
mp,ex,814,13186
mp,nuxy,814,0.27
mp,dens,814,125/(1000*g)
mp,damp,814,0.031/df

/COM - Material 815, Soil
mp,ex,815,12714
mp,nuxy,815,0.27
mp,dens,815,125/(1000*g)
mp,damp,815,0.035/df

/COM - Material 816, Soil
mp,ex,816,12059
mp,nuxy,816,0.27
mp,dens,816,125/(1000*g)
mp,damp,816,0.042/df

/COM - Material 817, Soil
mp,ex,817,11562
mp,nuxy,817,0.27
mp,dens,817,125/(1000*g)
mp,damp,817,0.047/df

/COM - Material 818, Soil
mp,ex,818,12357
mp,nuxy,818,0.27
mp,dens,818,125/(1000*g)
mp,damp,818,0.037/df


/COM - Upper Bound Soil Properties
Geomatrix Soil Data
/COM - 19 Layer Mode
/COM - Material Definitions

/COM - Material 901, Soil     (Top Layer)
mp,ex,901,24801
mp,nuxy,901,0.24
mp,dens,901,110/(1000*g)
mp,damp,901,0.016/df

/COM - Material 902, Soil
mp,ex,902,23826
mp,nuxy,902,0.24
mp,dens,902,110/(1000*g)
mp,damp,902,0.022/df

/COM - Material 903, Soil
mp,ex,903,22996
mp,nuxy,903,0.24
mp,dens,903,110/(1000*g)
mp,damp,903,0.027/df

/COM - Material 904, Soil
mp,ex,904,23271
mp,nuxy,904,0.24
mp,dens,904,110/(1000*g)
mp,damp,904,0.022/df

/COM - Material 905, Soil
mp,ex,905,21584
mp,nuxy,905,0.19
mp,dens,905,110/(1000*g)
mp,damp,905,0.026/df

/COM - Material 906, Soil
mp,ex,906,24488
mp,nuxy,906,0.19
mp,dens,906,110/(1000*g)
mp,damp,906,0.027/df

/COM - Material 907, Soil
mp,ex,907,27725
mp,nuxy,907,0.19
mp,dens,907,110/(1000*g)
mp,damp,907,0.028/df
```

```
/COM - Material 908, Soil
mp,ex,908,32629
mp,nuxy,908,0.19
mp,dens,908,110/(1000*g)
mp,damp,908,0.022/df

/COM - Material 909, Soil
mp,ex,909,36376
mp,nuxy,909,0.19
mp,dens,909,110/(1000*g)
mp,damp,909,0.022/df

/COM - Material 910, Soil
mp,ex,910,35784
mp,nuxy,910,0.19
mp,dens,910,110/(1000*g)
mp,damp,910,0.024/df

/COM - Material 911, Soil
mp,ex,911,35374
mp,nuxy,911,0.19
mp,dens,911,110/(1000*g)
mp,damp,911,0.025/df

/COM - Material 912, Soil
mp,ex,912,35096
mp,nuxy,912,0.19
mp,dens,912,110/(1000*g)
mp,damp,912,0.026/df

/COM - Material 913, Soil
mp,ex,913,40418
mp,nuxy,913,0.19
mp,dens,913,110/(1000*g)
mp,damp,913,0.020/df

/COM - Material 914, Soil
mp,ex,914,40076
mp,nuxy,914,0.19
mp,dens,914,110/(1000*g)
mp,damp,914,0.021/df

/COM - Material 915, Soil
mp,ex,915,55863
mp,nuxy,915,0.28
mp,dens,915,120/(1000*g)
mp,damp,915,0.019/df

/COM - Material 916, Soil
mp,ex,916,61211
mp,nuxy,916,0.28
mp,dens,916,120/(1000*g)
mp,damp,916,0.019/df

/COM - Material 917, Soil
mp,ex,917,60604
mp,nuxy,917,0.28
mp,dens,917,120/(1000*g)
mp,damp,917,0.020/df

/COM - Material 918, Soil
mp,ex,918,60224
mp,nuxy,918,0.28
mp,dens,918,120/(1000*g)
mp,damp,918,0.020/df

/COM - Material 919, Soil
mp,ex,919,66350
mp,nuxy,919,0.28
mp,dens,919,120/(1000*g)
mp,damp,919,0.019/df
```

Solve-Gravity-UBS.txt

```
/prep7
massm_z=148414.59
d,master_node,all
allsel

cmsel,s,excav-soil
nsle
csys,0
nsel,r,loc,x,-ctx(6)-1,ctx(6)+1
nsel,r,loc,y,0,-ctx(6)-1
esln,r,1
mpchg,810,all

cmsel,s,excav-soil
nsle
csys,1
nsel,r,loc,x,ctx(11)-1,ctx(13)+1
nsel,r,loc,z,soilz(1),soilz(3)-1
esln,r,1
mpchg,810,all

*do,i,801,808
esel,s,mat,,i
mpchg,i+10,all
*enddo
allsel

/out,AP-460-BEC-UBS-Gravity,out
/solu
antype,trans
TRNOPT,FULL
lumpm,OFF
!nlgeom,on
NROPT,auto
NTIM=10 !NUMBER OF TIME STEPS
DT=0.01
TIM=1e-06
autots,on
KBC,on
TIMINT,ON,STRU
solcontrol,ON,off,,
ncnv,0,200
LNSRCH,OFF
PRED,on,,on

/COM - Time File

/COM - Dimension Horizontal Input
*DIM,A_1_x,,2148
*DIM,A_1_Z,,2148

*VREAD,A_1_x(1),th-266-UB-geo,txt
(8(F9.6))
*VREAD,A_1_Z(1),th-266-UB-geo-v,txt
(8(F9.6))

/Title,Load Case: AP-460-UBS-BEC, Full
Non-linear, Dome Contact Friction = 0.0,
Gravity
OUTPR,all,NONE,
OUTRES, ALL,NONE,
OUTRES,RSOL,last
OUTRES,NSOL,last
OUTRES,ESOL,last,conc-tank
OUTRES,esol,last,Primary-tank
```

```
OUTRES,ESOL,last,J_bolts
OUTRES,Epel,last,liner
outres,esol,last,wall-int-gap
outres,esol,last,conc-excav-wall-gap
outres,esol,last,conc-excav-dome-gap
!outres,strs,last,excav-soil
!outres,strs,last,bottom-soil
outres,esol,last,bolt-friction
outres,esol,last,waste-surf
outres,strs,last,insul-conc
outres,esol,last,primary-int-gap
outres,esol,last,conc-liner-gap
outres,esol,last,far-soil-contact
!outres,esol,last,soil-contact-foot-elem

alphad,alpha
NSUBST,20,200,5,ON
TIME,100
TIMINT,off
acel,0,0,g
SOLVE
SAVE
TIMINT,on
ITIM=1
DS=TIM
NSUBST,1,20,1,ON

!ddele,master_node,ux
!ddele,master_node,uz

esel,s,type,,61,63,2
mpchg,64,all

esel,s,type,,91,93,2
mpchg,92,all

allsel

*DO,ITIM,1,NTIM,1

TIM=DT*ITIM

TIME,TIM+100

!F,master_node,FX,A_1_X(itim)*mass*g
!F,master_node,Fz,(A_1_Z(itim)+1)*(mass+m
assm_z)*g

SOLVE
SAVE
*ENDDO
FINISH
/out
```

Solve-TH-UBS

```
/prep7
massm_z=148414.59
d,master_node,all
allsel

cmsel,s,excav-soil
nsle
csys,0
nsel,r,loc,x,-ctx(6)-1,ctx(6)+1
nsel,r,loc,y,0,-ctx(6)-1
esln,r,1
mpchg,810,all

cmsel,s,excav-soil
nsle
csys,1
nsel,r,loc,x,ctx(11)-1,ctx(13)+1
nsel,r,loc,z,soilz(1),soilz(3)-1
esln,r,1
mpchg,810,all

*do,i,801,808
esel,s,mat,,i
mpchg,i+10,all
*enddo
allsel

/out,AP-460-BEC-UBS-Seismic,out
/solu
antype,trans
TRNOPT,FULL
lumpm,OFF
!nlgeom,on
NROPT,auto
NTIM=2148      !NUMBER OF TIME STEPS
DT=0.01
TIM=1e-06
autots,on
KBC,on
TIMINT,ON,STRU
solcontrol,ON,off,,
ncnv,0,200
LNSRCH,OFF
PRED,on,,on

/COM - Time File

/COM - Dimension Horizontal Input
*DIM,A_1_x,,2148
*DIM,A_1_Z,,2148

*VREAD,A_1_x(1),th-266-UB-geo,txt
(8(F9.6))
*VREAD,A_1_Z(1),th-266-UB-geo-v,txt
(8(F9.6))

/Title,Load Case: AP-460-UBS-BEC, Full
Non-linear, Dome Contact Friction = 0.0
OUTPR,all,NONE,
OUTRES, ALL,NONE,
OUTRES,RSOL,last
OUTRES,NSOL,last
OUTRES,ESOL,last,conc-tank
OUTRES,esol,last,Primary-tank
OUTRES,ESOL,last,J_bolts
OUTRES,Epel,last,liner
outres,esol,last,wall-int-gap
outres,esol,last,conc-excav-wall-gap
outres,esol,last,conc-excav-dome-gap
!outres,strs,last,excav-soil
!outres,strs,last,bottom-soil
outres,esol,last,bolt-friction
outres,esol,last,waste-surf
outres,strs,last,insul-conc
outres,esol,last,primary-int-gap
outres,esol,last,conc-liner-gap
outres,esol,last,far-soil-contact
!outres,esol,last,soil-contact-foot-elem

alphad,alpha
NSUBST,20,200,5,ON
```

```
TIME,100
TIMINT,off
acel,0,0,g
SOLVE
SAVE
TIMINT,on
ITIM=1
DS=TIM
NSUBST,1,20,1,ON

ddele,master_node,ux
ddele,master_node,uz

esel,s,type,,61,63,2
mpchg,64,all

esel,s,type,,91,93,2
mpchg,92,all

allsel

*DO,ITIM,1,NTIM,1

TIM=DT*ITIM

TIME,TIM+100

F,master_node,FX,1.12*A_1_X(itim)*mass*g
F,master_node,Fz,(1.19*A_1_Z(itim)+1)*(ma
ss+massm_z)*g

SOLVE
SAVE
*ENDDO
FINISH
/out
```

Tank-Props-BEC-250

```
/COM - Tank Concrete Properties

/COM - Material Definitions
! EX - Youngs Modulus, (k/ft2)
! NUXY - Poisons ratio
! DENS - Density (1000*slugs/ft3)
! DAMP - Beta (Stiffness) Damping

/COM - Material 1, Tank Concrete
mp,ex,1,626754
mp,nuxy,1,0.18
mp,dens,1,148/(1000*g)
mp,damp,1,0.07/df

/COM - Material 2, Tank Concrete
mp,ex,2,620114
mp,nuxy,2,0.18
mp,dens,2,149/(1000*g)
mp,damp,2,0.07/df

/COM - Material 3, Tank Concrete
mp,ex,3,616594
mp,nuxy,3,0.18
mp,dens,3,149/(1000*g)
mp,damp,3,0.07/df

/COM - Material 4, Tank Concrete
mp,ex,4,610922
mp,nuxy,4,0.18
mp,dens,4,149/(1000*g)
mp,damp,4,0.07/df

/COM - Material  5, Tank Concrete
mp,ex, 5,612305
mp,nuxy, 5,0.18
mp,dens, 5,148/(1000*g)
mp,damp,5,0.07/df

/COM - Material 6, Tank Concrete
mp,ex,6,607093
mp,nuxy,6,0.18
mp,dens,6,148/(1000*g)
mp,damp,6,0.07/df

/COM - Material 7, Tank Concrete
mp,ex,7,639237
mp,nuxy,7,0.18
mp,dens,7,146/(1000*g)
mp,damp,7,0.07/df

/COM - Material 8, Tank Concrete
mp,ex,8,634338
mp,nuxy,8,0.18
mp,dens,8,147/(1000*g)
mp,damp,8,0.07/df

/COM - Material 9, Tank Concrete
mp,ex,9,628756
mp,nuxy,9,0.18
mp,dens,9,147/(1000*g)
mp,damp,9,0.07/df

/COM - Material,10, Tank Concrete
mp,ex,10,193677
mp,nuxy,10,0.18
mp,dens,10,165/(1000*g)
mp,damp,10,0.07/df

/COM - Material,11, Tank Concrete
mp,ex,11,575959
mp,nuxy,11,0.18
mp,dens,11,144/(1000*g)
mp,damp,11,0.07/df

/COM - Material,12, Tank Concrete
mp,ex,12,202953
mp,nuxy,12,0.18
mp,dens,12,159/(1000*g)
mp,damp,12,0.07/df

/COM - Material,13, Tank Concrete
mp,ex,13,157426
mp,nuxy,13,0.18
mp,dens,13,176/(1000*g)
mp,damp,13,0.07/df

/COM - Material,14, Tank Concrete
mp,ex,14,153784
mp,nuxy,14,0.18
mp,dens,14,193/(1000*g)
mp,damp,14,0.07/df

/COM - Material,15, Tank Concrete
mp,ex,15,136651
mp,nuxy,15,0.18
mp,dens,15,200/(1000*g)
mp,damp,15,0.07/df
```

```
/COM - Material,16, Tank Concrete
mp,ex,16,136651
mp,nuxy,16,0.18
mp,dens,16,200/(1000*g)
mp,damp,16,0.07/df

/COM - Material,17, Tank Concrete
mp,ex,17,138084
mp,nuxy,17,0.18
mp,dens,17,181/(1000*g)
mp,damp,17,0.07/df

/COM - Material,18, Tank Concrete
mp,ex,18,123378
mp,nuxy,18,0.18
mp,dens,18,209/(1000*g)
mp,damp,18,0.07/df

/COM - Material,19, Tank Concrete
mp,ex,19,124633
mp,nuxy,19,0.18
mp,dens,19,190/(1000*g)
mp,damp,19,0.07/df

/COM - Material,20, Tank Concrete
mp,ex,20,124388
mp,nuxy,20,0.18
mp,dens,20,210/(1000*g)
mp,damp,20,0.07/df

/COM - Material,21, Tank Concrete
mp,ex,21,548683
mp,nuxy,21,0.18
mp,dens,21,166/(1000*g)
mp,damp,21,0.07/df

/COM - Material,22, Tank Concrete
mp,ex,22,154870
mp,nuxy,22,0.18
mp,dens,22,184/(1000*g)
mp,damp,22,0.07/df

/COM - Material,23, Tank Concrete
mp,ex,23,514287
mp,nuxy,23,0.18
mp,dens,23,172/(1000*g)
mp,damp,23,0.060/df

/COM - Material,24, Tank Concrete
mp,ex,24,164113
mp,nuxy,24,0.18
mp,dens,24,288/(1000*g)
mp,damp,24,0.07/df

/COM - Material,25, Tank Concrete
mp,ex,25,522946
mp,nuxy,25,0.18
mp,dens,25,201/(1000*g)
mp,damp,25,0.07/df

/COM - Material,26, Tank Concrete
mp,ex,26,194254
mp,nuxy,26,0.18
mp,dens,26,322/(1000*g)
mp,damp,26,0.07/df

/COM - Material,27, Tank Concrete
mp,ex,27,199783
mp,nuxy,27,0.18
mp,dens,27,281/(1000*g)
mp,damp,27,0.07/df

/COM - Material,28, Tank Concrete
mp,ex,28,162553
mp,nuxy,28,0.18
mp,dens,28,299/(1000*g)
mp,damp,28,0.07/df

/COM - Material,29, Tank Concrete
mp,ex,29,200531
mp,nuxy,29,0.18
mp,dens,29,3894/(1000*g)
mp,damp,29,0.07/df

/COM - Material,30, Tank Concrete
mp,ex,30,167538
mp,nuxy,30,0.18
mp,dens,30,411/(1000*g)
mp,damp,30,0.07/df

/COM - Material,31, Tank Concrete
mp,ex,31,731952
mp,nuxy,31,0.18
mp,dens,31,150/(1000*g)
mp,damp,31,0.07/df

/COM - Material,32, Tank Concrete
mp,ex,32,731952
mp,nuxy,32,0.18
mp,dens,32,150/(1000*g)
mp,damp,32,0.07/df

!/COM - Material,33, Tank Concrete
!mp,ex,33,731952
!mp,nuxy,33,0.18
!mp,dens,33,150/(1000*g)
!mp,damp,33,0.07/df

!/COM - Material,34, Tank Concrete
!mp,ex,34,731952
!mp,nuxy,34,0.18
!mp,dens,34,150/(1000*g)
!mp,damp,34,0.07/df

!/COM - Material,35, Tank Concrete
!mp,ex,35,731952
!mp,nuxy,35,0.18
!mp,dens,35,150/(1000*g)
!mp,damp,35,0.07/df

!/COM - Material,36, Tank Concrete
!mp,ex,36,731952
!mp,nuxy,36,0.18
!mp,dens,36,150/(1000*g)
!mp,damp,36,0.07/df

!/COM - Material,37, Tank Concrete
!mp,ex,37,731952
!mp,nuxy,37,0.18
!mp,dens,37,150/(1000*g)
!mp,damp,37,0.07/df

/COM - Concrete Real Values, t in ft
r,1,1.26                      ! 15 in
r,2,1.26                      ! 15 in
r,3,1.26                      ! 15 in
r,4,1.26                      ! 15 in
r,5,1.27                      ! 15 in
r,6,1.26                      ! 15 in
r,7,1.28                      ! 15 in
```

```
r,8,1.28                          ! 15 in
r,9,1.73                          ! 15 in
r,10,1.73,1.73,2.23,2.23          ! 15 in to
r,11,2.23,2.22,3.15,3.15          !
r,12,3.15,3.15,1.50,1.50          !
r,13,1.50,1.50,1.28,1.28          !
r,14,1.17                         ! 18 in
r,15,1.13                         ! 18 in
r,16,1.13                         ! 18 in
r,17,1.24                         ! 18 in
r,18,1.07                         ! 18 in
r,19,1.18                         ! 18 in
r,20,1.07                         ! 18 in
r,21,1.07                         ! 18 in
r,22,1.97                         ! 18 in
r,23,1.97,1.67,1.67,1.97          ! 18 in
r,24,1.67                         !
r,25,1.68,1.43,1.43,1.68          !
r,26,1.43,0.51,0.51,1.43          ! 8 in
r,27,0.51,0.41,0.41,0.51          ! 8 in
r,28,0.41,0.55,0.55,0.41          ! 8 in
r,29,0.55                         ! 8 in
r,30,0.55,0.40,0.40,0.55          ! 8 in
r,31,0.40,1.02,1.02,0.40          ! 8 in to
r,32,1.02                         !
!r,34,1
!r,35,1
!r,36,1
!r,37,1
!r,39,1


/COM - Material,50, Insulating Concrete
mp,ex,50,23760
mp,nuxy,50,0.15
mp,dens,50,50/(1000*g)
mp,damp,50,0.07/df
```

TH-266-UB-Geo-V.txt

```
-0.000079-0.000134 0.000080 0.000135-0.000080-0.000136 0.000081 0.000137    1
-0.000081-0.000138 0.000081 0.000139-0.000081-0.000140 0.000082 0.000141    2
-0.000082-0.000142 0.000083 0.000143-0.000083-0.000144 0.000084 0.000145    3
. . . . . . ..
-0.000075-0.000125 0.000075 0.000125-0.000076-0.000126 0.000076 0.000127  510
-0.000076-0.000127 0.000077 0.000128-0.000077-0.000129 0.000078 0.000130  511
-0.000078-0.000131 0.000078 0.000132-0.000078-0.000132 0.000079 0.000133  512
```

TH-266-UB-Geo.txt

```
-0.000021 0.000047 0.000020-0.000047-0.000020 0.000045 0.000019-0.000045    2
-0.000019 0.000043 0.000017-0.000043-0.000017 0.000041 0.000016-0.000040    3
-0.000016 0.000038 0.000014-0.000037-0.000014 0.000034 0.000012-0.000034    4
. . . . . .
-0.000028 0.000056 0.000027-0.000056-0.000027 0.000055 0.000026-0.000055  510
-0.000026 0.000054 0.000026-0.000054-0.000026 0.000054 0.000025-0.000053  511
-0.000025 0.000053 0.000024-0.000052-0.000024 0.000052 0.000023-0.000051  512
```

UBS-BEC Seismic File Listing

```
 Volume in drive C is 600GB 2xRAID0 (new)
 Volume Serial Number is 8A0A-E4BA

 Directory of C:\Users\Bruce\2008-000 PNNL\2008-005 AP-460\AP-460-UBS-BEC-Seismic Run

01/09/2007  06:53 AM    <DIR>          .
01/09/2007  06:53 AM    <DIR>          ..
10/17/2006  09:29 AM           561,576 Accel-ct-0.out
10/17/2006  09:32 AM           561,828 Accel-ct-135.out
10/17/2006  09:33 AM           561,828 Accel-ct-180.out
10/17/2006  09:30 AM           561,576 Accel-ct-45.out
10/17/2006  09:31 AM           561,828 Accel-ct-90.out
10/17/2006  09:28 AM           290,676 Accel-ct.out
10/17/2006  09:34 AM           561,828 Accel-PT-0.out
10/17/2006  09:38 AM           561,828 Accel-PT-135.out
10/17/2006  09:38 AM           561,828 Accel-PT-180.out
10/17/2006  09:35 AM           561,828 Accel-PT-45.out
10/17/2006  09:36 AM           561,828 Accel-PT-90.out
10/17/2006  09:39 AM           561,828 Accel-SOil.out
09/11/2006  03:21 PM                99 All-Forces.txt
10/16/2006  04:02 PM         5,709,088 AP-460-BEC-UBS-Seismic.out
10/17/2006  09:26 AM               219 AP-460-BES-BEC-Seismic.err
10/17/2006  09:26 AM               324 AP-460-BES-BEC-Seismic.log
01/02/2007  10:20 AM         3,549,696 AP-460-UBS-BEC Conc Tank Demand Seismic Only.xls
01/02/2007  10:20 AM         3,329,024 AP-460-UBS-BEC Conc Tank Demand Seismic.xls
10/18/2006  09:32 AM         1,440,768 AP-460-UBS-BEC Conc-Tank Spectra.xls
10/18/2006  10:27 AM         1,369,088 AP-460-UBS-BEC Footing Seismic.xls
10/18/2006  09:09 AM           308,736 AP-460-UBS-BEC Free Field RS Comparision.xls
01/02/2007  10:22 AM           730,112 AP-460-UBS-BEC J Bolt Forces Seismic.xls
10/18/2006  09:51 AM           794,112 AP-460-UBS-BEC J-Bolt-Contact-Seismic.xls
10/18/2006  10:24 AM           698,880 AP-460-UBS-BEC Liner-Contact-Seismic.xls
01/08/2007  08:45 AM         7,511,040 AP-460-UBS-BEC Pri Tank Stress Seismic Only.xls
10/20/2006  09:55 AM         7,328,768 AP-460-UBS-BEC Pri Tank Stress Seismic.xls
12/18/2006  09:47 AM           699,392 AP-460-UBS-BEC Primary-Contact-Seismic.xls
10/18/2006  09:45 AM         1,156,608 AP-460-UBS-BEC Primary-Tank Spectra.xls
12/18/2006  09:27 AM         2,071,552 AP-460-UBS-BEC Soil Pressures Seismic.xls
01/09/2007  04:44 AM         3,817,472 AP-460-UBS-BEC Strain Seismic-Princ.xls
10/17/2006  02:13 PM           547,328 AP-460-UBS-BEC Total Reaction.xls
10/18/2006  09:47 AM           407,552 AP-460-UBS-BEC Waste-Disp-TH-MAX.xls
12/21/2006  03:26 PM           924,160 AP-460-UBS-BEC Waste-TH-MAX.xls
01/09/2007  04:47 AM    <DIR>          AP-460-UBS-BEC-Gravity
10/16/2006  04:02 PM             2,998 AP-460-UBS-BEC-Seismic.BCS
10/16/2006  04:02 PM        63,897,600 AP-460-UBS-BEC-Seismic.db
10/16/2006  03:59 PM        63,897,600 AP-460-UBS-BEC-Seismic.dbb
10/17/2006  05:16 AM               577 AP-460-UBS-BEC-Seismic.DO5
10/17/2006  05:16 AM               227 AP-460-UBS-BEC-Seismic.DO6
10/16/2006  04:02 PM        12,713,984 AP-460-UBS-BEC-Seismic.emat
01/08/2007  03:47 PM            69,250 AP-460-UBS-BEC-Seismic.err
10/16/2006  04:02 PM       111,607,808 AP-460-UBS-BEC-Seismic.esav
10/16/2006  04:02 PM        30,081,024 AP-460-UBS-BEC-Seismic.full
10/16/2006  04:01 PM       340,804,299 AP-460-UBS-BEC-Seismic.ldhi
01/08/2007  01:47 PM                 0 AP-460-UBS-BEC-Seismic.lock
01/08/2007  04:02 PM           110,214 AP-460-UBS-BEC-Seismic.log
10/16/2006  04:02 PM           198,991 AP-460-UBS-BEC-Seismic.mntr
10/16/2006  04:01 PM       111,607,808 AP-460-UBS-BEC-Seismic.osav
01/08/2007  01:47 PM                 0 AP-460-UBS-BEC-Seismic.page
10/16/2006  04:02 PM             1,507 AP-460-UBS-BEC-Seismic.PVTS
10/16/2006  04:02 PM       112,656,384 AP-460-UBS-BEC-Seismic.r001
10/12/2006  02:52 PM        43,974,656 AP-460-UBS-BEC-Seismic.rdb
10/16/2006  04:02 PM     4,294,967,296 AP-460-UBS-BEC-Seismic.rst
10/13/2006  07:25 AM     4,294,967,296 AP-460-UBS-BEC-Seismic.rst02
10/13/2006  05:31 PM     4,294,967,296 AP-460-UBS-BEC-Seismic.rst03
10/14/2006  05:02 AM     4,294,967,296 AP-460-UBS-BEC-Seismic.rst04
10/14/2006  06:06 PM     4,294,967,296 AP-460-UBS-BEC-Seismic.rst05
10/15/2006  08:17 AM     4,294,967,296 AP-460-UBS-BEC-Seismic.rst06
10/15/2006  09:07 PM     4,294,967,296 AP-460-UBS-BEC-Seismic.rst07
10/16/2006  11:16 AM     4,294,967,296 AP-460-UBS-BEC-Seismic.rst08
```

```
10/16/2006  04:02 PM     1,388,445,696 AP-460-UBS-BEC-Seismic.rst09
12/18/2006  10:57 AM            40,532 AP-460-UBS-BEC-Seismic000.jpg
12/18/2006  10:59 AM            50,901 AP-460-UBS-BEC-Seismic001.jpg
12/18/2006  11:07 AM            38,955 AP-460-UBS-BEC-Seismic002.jpg
12/18/2006  11:07 AM            39,205 AP-460-UBS-BEC-Seismic003.jpg
12/18/2006  11:21 AM            29,728 AP-460-UBS-BEC-Seismic004.jpg
12/18/2006  11:23 AM            35,850 AP-460-UBS-BEC-Seismic005.jpg
12/18/2006  11:24 AM            36,413 AP-460-UBS-BEC-Seismic006.jpg
12/18/2006  11:26 AM            36,312 AP-460-UBS-BEC-Seismic007.jpg
12/18/2006  11:27 AM            36,182 AP-460-UBS-BEC-Seismic008.jpg
12/18/2006  11:49 AM           129,237 AP-460-UBS-BEC-Seismic009.jpg
12/18/2006  11:50 AM            40,876 AP-460-UBS-BEC-Seismic010.jpg
12/18/2006  11:59 AM           121,808 AP-460-UBS-BEC-Seismic011.jpg
12/18/2006  12:01 PM            33,460 AP-460-UBS-BEC-Seismic012.jpg
12/18/2006  12:02 PM            99,338 AP-460-UBS-BEC-Seismic013.jpg
12/18/2006  12:06 PM           111,964 AP-460-UBS-BEC-Seismic014.jpg
12/18/2006  12:09 PM           117,185 AP-460-UBS-BEC-Seismic015.jpg
12/18/2006  12:13 PM            51,531 AP-460-UBS-BEC-Seismic016.jpg
12/18/2006  12:58 PM            66,028 AP-460-UBS-BEC-Seismic017.jpg
08/25/2006  01:26 PM             6,031 Bolts-Friction.txt
09/08/2006  07:08 AM               277 Boundary.txt
08/25/2006  08:48 AM               220 Contact-AP.txt
08/21/2006  07:59 AM               586 Contact-Footing.txt
08/25/2006  01:28 PM               704 Contact-Insul.txt
08/25/2006  01:27 PM               704 Contact-J-Bolts.txt
08/25/2006  01:28 PM               708 Contact-Primary.txt
08/21/2006  07:59 AM               742 Contact-Soil.txt
08/21/2006  12:44 PM               632 Contact-Waste-AP.txt
10/17/2006  09:29 AM           561,576 Disp-ct-0.out
10/17/2006  09:32 AM           561,576 Disp-ct-135.out
10/17/2006  09:33 AM           561,576 Disp-ct-180.out
10/17/2006  09:30 AM           561,576 Disp-ct-45.out
10/17/2006  09:31 AM           561,576 Disp-ct-90.out
10/17/2006  09:28 AM           290,550 Disp-ct.out
01/03/2006  11:17 AM             1,616 Disp-J-Bolts.txt
10/17/2006  09:34 AM           561,576 Disp-PT-0.out
10/17/2006  09:38 AM           561,576 Disp-PT-135.out
10/17/2006  09:38 AM           561,576 Disp-PT-180.out
10/17/2006  09:35 AM           561,576 Disp-PT-45.out
10/17/2006  09:36 AM           561,576 Disp-PT-90.out
10/17/2006  09:39 AM           561,576 Disp-Soil.out
10/18/2006  09:46 AM            40,960 disp_0-90.xls
10/18/2006  09:47 AM            38,400 disp_99-180.xls
05/08/2006  01:31 PM             8,616 Far-Soil.txt
01/09/2007  06:53 AM                 0 File-List.txt
01/03/2007  03:08 PM               136 file.err
10/12/2006  02:51 PM               240 file.log
10/12/2006  02:51 PM                 0 file.page
10/13/2005  06:54 AM               562 Fix-Soil.txt
10/18/2006  09:04 AM            10,342 Footing-Cont_max.OUT
10/18/2006  09:04 AM         4,346,248 Footing-Cont_th.OUT
08/21/2006  08:00 AM               894 Force-c.txt
10/18/2006  01:59 PM             4,996 Force-c_108amax.OUT
10/18/2006  01:59 PM         2,905,500 Force-c_108ath.OUT
10/18/2006  11:13 AM            14,716 Force-c_108max.OUT
10/18/2006  11:13 AM         6,519,180 Force-c_108th.OUT
10/18/2006  02:07 PM             4,996 Force-c_117amax.OUT
10/18/2006  02:07 PM         2,905,500 Force-c_117ath.OUT
10/18/2006  11:21 AM            14,716 Force-c_117max.OUT
10/18/2006  11:21 AM         6,519,180 Force-c_117th.OUT
10/18/2006  02:15 PM             4,996 Force-c_126amax.OUT
10/18/2006  02:15 PM         2,905,500 Force-c_126ath.OUT
10/18/2006  11:29 AM            14,716 Force-c_126max.OUT
10/18/2006  11:29 AM         6,519,180 Force-c_126th.OUT
10/18/2006  02:23 PM             4,996 Force-c_135amax.OUT
10/18/2006  02:23 PM         2,905,500 Force-c_135ath.OUT
10/18/2006  11:37 AM            14,716 Force-c_135max.OUT
10/18/2006  11:37 AM         6,519,180 Force-c_135th.OUT
10/18/2006  02:31 PM             4,996 Force-c_144amax.OUT
10/18/2006  02:31 PM         2,905,500 Force-c_144ath.OUT
```

```
10/18/2006  11:45 AM            14,716 Force-c_144max.OUT
10/18/2006  11:45 AM         6,519,180 Force-c_144th.OUT
10/18/2006  02:39 PM             4,996 Force-c_153amax.OUT
10/18/2006  02:39 PM         2,905,500 Force-c_153ath.OUT
10/18/2006  11:54 AM            14,716 Force-c_153max.OUT
10/18/2006  11:54 AM         6,519,180 Force-c_153th.OUT
10/18/2006  02:47 PM             4,996 Force-c_162amax.OUT
10/18/2006  02:47 PM         2,905,500 Force-c_162ath.OUT
10/18/2006  12:02 PM            14,716 Force-c_162max.OUT
10/18/2006  12:02 PM         6,519,180 Force-c_162th.OUT
10/18/2006  02:55 PM             4,996 Force-c_171amax.OUT
10/18/2006  02:55 PM         2,905,500 Force-c_171ath.OUT
10/18/2006  12:11 PM            14,716 Force-c_171max.OUT
10/18/2006  12:11 PM         6,519,180 Force-c_171th.OUT
10/18/2006  03:04 PM             4,996 Force-c_180amax.OUT
10/18/2006  03:04 PM         2,905,500 Force-c_180ath.OUT
10/18/2006  12:20 PM            14,716 Force-c_180max.OUT
10/18/2006  12:20 PM         6,519,180 Force-c_180th.OUT
10/18/2006  12:38 PM             4,996 Force-c_18amax.OUT
10/18/2006  12:38 PM         2,905,500 Force-c_18ath.OUT
10/18/2006  09:49 AM            14,716 Force-c_18max.OUT
10/18/2006  09:49 AM         6,519,180 Force-c_18th.OUT
10/18/2006  12:46 PM             4,996 Force-c_27amax.OUT
10/18/2006  12:46 PM         2,905,500 Force-c_27ath.OUT
10/18/2006  09:58 AM            14,716 Force-c_27max.OUT
10/18/2006  09:58 AM         6,519,180 Force-c_27th.OUT
10/18/2006  12:55 PM             4,996 Force-c_36amax.OUT
10/18/2006  12:55 PM         2,905,500 Force-c_36ath.OUT
10/18/2006  10:07 AM            14,716 Force-c_36max.OUT
10/18/2006  10:07 AM         6,519,180 Force-c_36th.OUT
10/18/2006  01:03 PM             4,996 Force-c_45amax.OUT
10/18/2006  01:03 PM         2,905,500 Force-c_45ath.OUT
10/18/2006  10:15 AM            14,716 Force-c_45max.OUT
10/18/2006  10:15 AM         6,519,180 Force-c_45th.OUT
10/18/2006  01:10 PM             4,996 Force-c_54amax.OUT
10/18/2006  01:10 PM         2,905,500 Force-c_54ath.OUT
10/18/2006  10:23 AM            14,716 Force-c_54max.OUT
10/18/2006  10:23 AM         6,519,180 Force-c_54th.OUT
10/18/2006  01:18 PM             4,996 Force-c_63amax.OUT
10/18/2006  01:18 PM         2,905,500 Force-c_63ath.OUT
10/18/2006  10:32 AM            14,716 Force-c_63max.OUT
10/18/2006  10:32 AM         6,519,180 Force-c_63th.OUT
10/18/2006  01:25 PM             4,996 Force-c_72amax.OUT
10/18/2006  01:25 PM         2,905,500 Force-c_72ath.OUT
10/18/2006  10:39 AM            14,716 Force-c_72max.OUT
10/18/2006  10:39 AM         6,519,180 Force-c_72th.OUT
10/18/2006  01:34 PM             4,996 Force-c_81amax.OUT
10/18/2006  01:34 PM         2,905,500 Force-c_81ath.OUT
10/18/2006  10:47 AM            14,716 Force-c_81max.OUT
10/18/2006  10:47 AM         6,519,180 Force-c_81th.OUT
10/18/2006  01:42 PM             4,996 Force-c_90amax.OUT
10/18/2006  01:42 PM         2,905,500 Force-c_90ath.OUT
10/18/2006  10:56 AM            14,716 Force-c_90max.OUT
10/18/2006  10:56 AM         6,519,180 Force-c_90th.OUT
10/18/2006  01:51 PM             4,996 Force-c_99amax.OUT
10/18/2006  01:51 PM         2,905,500 Force-c_99ath.OUT
10/18/2006  11:05 AM            14,716 Force-c_99max.OUT
10/18/2006  11:05 AM         6,519,180 Force-c_99th.OUT
10/18/2006  12:30 PM             4,996 Force-c_9amax.OUT
10/18/2006  12:30 PM         2,905,628 Force-c_9ath.OUT
10/18/2006  09:40 AM            14,716 Force-c_9max.OUT
10/18/2006  09:40 AM         6,519,308 Force-c_9th.OUT
10/18/2006  09:47 AM           135,168 force-jb.xls
10/18/2006  09:12 AM         2,666,244 Force-jb_r10-th.OUT
10/18/2006  09:12 AM             5,239 Force-jb_r10_max.OUT
10/18/2006  09:13 AM         2,666,244 Force-jb_r11-th.OUT
10/18/2006  09:13 AM             5,239 Force-jb_r11_max.OUT
10/18/2006  09:07 AM         2,666,372 Force-jb_r2-th.OUT
10/18/2006  09:07 AM             5,239 Force-jb_r2_max.OUT
10/18/2006  09:08 AM         2,666,244 Force-jb_r3-th.OUT
```

```
10/18/2006  09:08 AM             5,239 Force-jb_r3_max.OUT
10/18/2006  09:09 AM         2,666,244 Force-jb_r4-th.OUT
10/18/2006  09:09 AM             5,239 Force-jb_r4_max.OUT
10/18/2006  09:09 AM         2,666,244 Force-jb_r5-th.OUT
10/18/2006  09:09 AM             5,239 Force-jb_r5_max.OUT
10/18/2006  09:10 AM         2,666,244 Force-jb_r6-th.OUT
10/18/2006  09:10 AM             5,239 Force-jb_r6_max.OUT
10/18/2006  09:10 AM         2,666,244 Force-jb_r7-th.OUT
10/18/2006  09:10 AM             5,239 Force-jb_r7_max.OUT
10/18/2006  09:11 AM         2,666,244 Force-jb_r8-th.OUT
10/18/2006  09:11 AM             5,239 Force-jb_r8_max.OUT
10/18/2006  09:11 AM         2,666,244 Force-jb_r9-th.OUT
10/18/2006  09:11 AM             5,239 Force-jb_r9_max.OUT
08/21/2006  08:00 AM               661 Force-j_bolt.txt
10/20/2006  09:48 AM           440,832 import_0-90.xls
10/20/2006  09:48 AM           440,832 import_99-180.xls
10/18/2006  10:23 AM           105,984 Insul-Contact_0-90.xls
10/18/2006  10:23 AM           105,984 Insul-Contact_99-180.xls
10/16/2006  09:27 PM             4,024 Insul-Cont_108max.OUT
10/16/2006  09:27 PM         1,738,448 Insul-Cont_108th.OUT
10/16/2006  09:31 PM             4,024 Insul-Cont_117max.OUT
10/16/2006  09:31 PM         1,738,448 Insul-Cont_117th.OUT
10/16/2006  09:35 PM             4,024 Insul-Cont_126max.OUT
10/16/2006  09:35 PM         1,738,448 Insul-Cont_126th.OUT
10/16/2006  09:39 PM             4,024 Insul-Cont_135max.OUT
10/16/2006  09:39 PM         1,738,448 Insul-Cont_135th.OUT
10/16/2006  09:43 PM             4,024 Insul-Cont_144max.OUT
10/16/2006  09:43 PM         1,738,448 Insul-Cont_144th.OUT
10/16/2006  09:48 PM             4,024 Insul-Cont_153max.OUT
10/16/2006  09:48 PM         1,738,448 Insul-Cont_153th.OUT
10/16/2006  09:51 PM             4,024 Insul-Cont_162max.OUT
10/16/2006  09:51 PM         1,738,448 Insul-Cont_162th.OUT
10/16/2006  09:56 PM             4,024 Insul-Cont_171max.OUT
10/16/2006  09:56 PM         1,738,448 Insul-Cont_171th.OUT
10/16/2006  10:00 PM             4,024 Insul-Cont_180max.OUT
10/16/2006  10:00 PM         1,738,448 Insul-Cont_180th.OUT
10/16/2006  08:46 PM             4,024 Insul-Cont_18max.OUT
10/16/2006  08:46 PM         1,738,448 Insul-Cont_18th.OUT
10/16/2006  08:50 PM             4,024 Insul-Cont_27max.OUT
10/16/2006  08:50 PM         1,738,448 Insul-Cont_27th.OUT
10/16/2006  08:54 PM             4,024 Insul-Cont_36max.OUT
10/16/2006  08:54 PM         1,738,448 Insul-Cont_36th.OUT
10/16/2006  08:58 PM             4,024 Insul-Cont_45max.OUT
10/16/2006  08:58 PM         1,738,448 Insul-Cont_45th.OUT
10/16/2006  09:02 PM             4,024 Insul-Cont_54max.OUT
10/16/2006  09:02 PM         1,738,448 Insul-Cont_54th.OUT
10/16/2006  09:06 PM             4,024 Insul-Cont_63max.OUT
10/16/2006  09:06 PM         1,738,448 Insul-Cont_63th.OUT
10/16/2006  09:10 PM             4,024 Insul-Cont_72max.OUT
10/16/2006  09:10 PM         1,738,448 Insul-Cont_72th.OUT
10/16/2006  09:14 PM             4,024 Insul-Cont_81max.OUT
10/16/2006  09:14 PM         1,738,448 Insul-Cont_81th.OUT
10/16/2006  09:18 PM             4,024 Insul-Cont_90max.OUT
10/16/2006  09:19 PM         1,738,448 Insul-Cont_90th.OUT
10/16/2006  09:23 PM             4,024 Insul-Cont_99max.OUT
10/16/2006  09:23 PM         1,738,448 Insul-Cont_99th.OUT
10/16/2006  08:42 PM             4,024 Insul-Cont_9max.OUT
10/16/2006  08:42 PM         1,738,576 Insul-Cont_9th.OUT
09/01/2005  10:27 AM             1,664 Insulate.txt
07/20/2006  06:36 AM             4,030 interface-gap1.txt
08/23/2006  07:55 AM             2,411 interface1.txt
10/18/2006  09:50 AM           116,736 J-Bolt-Contact_0-90.xls
10/18/2006  09:50 AM           117,248 J-Bolt-Contact_99-180.xls
10/17/2006  12:39 AM             4,519 J-Bolt-Cont_108max.OUT
10/17/2006  12:39 AM         1,685,484 J-Bolt-Cont_108th.OUT
10/17/2006  12:44 AM             4,519 J-Bolt-Cont_117max.OUT
10/17/2006  12:44 AM         1,685,484 J-Bolt-Cont_117th.OUT
10/17/2006  12:49 AM             4,519 J-Bolt-Cont_126max.OUT
10/17/2006  12:49 AM         1,685,484 J-Bolt-Cont_126th.OUT
10/17/2006  12:54 AM             4,519 J-Bolt-Cont_135max.OUT
```

```
10/17/2006  12:54 AM         1,685,484 J-Bolt-Cont_135th.OUT
10/17/2006  01:00 AM             4,519 J-Bolt-Cont_144max.OUT
10/17/2006  01:00 AM         1,685,484 J-Bolt-Cont_144th.OUT
10/17/2006  01:05 AM             4,519 J-Bolt-Cont_153max.OUT
10/17/2006  01:05 AM         1,685,484 J-Bolt-Cont_153th.OUT
10/17/2006  01:10 AM             4,519 J-Bolt-Cont_162max.OUT
10/17/2006  01:10 AM         1,685,484 J-Bolt-Cont_162th.OUT
10/17/2006  01:16 AM             4,519 J-Bolt-Cont_171max.OUT
10/17/2006  01:16 AM         1,685,484 J-Bolt-Cont_171th.OUT
10/17/2006  01:21 AM             4,519 J-Bolt-Cont_180max.OUT
10/17/2006  01:21 AM         1,685,484 J-Bolt-Cont_180th.OUT
10/16/2006  11:45 PM             4,519 J-Bolt-Cont_18max.OUT
10/16/2006  11:45 PM         1,685,484 J-Bolt-Cont_18th.OUT
10/16/2006  11:50 PM             4,519 J-Bolt-Cont_27max.OUT
10/16/2006  11:51 PM         1,685,484 J-Bolt-Cont_27th.OUT
10/16/2006  11:56 PM             4,519 J-Bolt-Cont_36max.OUT
10/16/2006  11:56 PM         1,685,484 J-Bolt-Cont_36th.OUT
10/17/2006  12:01 AM             4,519 J-Bolt-Cont_45max.OUT
10/17/2006  12:01 AM         1,685,484 J-Bolt-Cont_45th.OUT
10/17/2006  12:06 AM             4,519 J-Bolt-Cont_54max.OUT
10/17/2006  12:06 AM         1,685,484 J-Bolt-Cont_54th.OUT
10/17/2006  12:12 AM             4,519 J-Bolt-Cont_63max.OUT
10/17/2006  12:12 AM         1,685,484 J-Bolt-Cont_63th.OUT
10/17/2006  12:17 AM             4,519 J-Bolt-Cont_72max.OUT
10/17/2006  12:17 AM         1,685,484 J-Bolt-Cont_72th.OUT
10/17/2006  12:23 AM             4,519 J-Bolt-Cont_81max.OUT
10/17/2006  12:23 AM         1,685,484 J-Bolt-Cont_81th.OUT
10/17/2006  12:28 AM             4,519 J-Bolt-Cont_90max.OUT
10/17/2006  12:28 AM         1,685,484 J-Bolt-Cont_90th.OUT
10/17/2006  12:33 AM             4,519 J-Bolt-Cont_99max.OUT
10/17/2006  12:33 AM         1,685,484 J-Bolt-Cont_99th.OUT
10/16/2006  11:40 PM             4,519 J-Bolt-Cont_9max.OUT
10/16/2006  11:40 PM         1,685,612 J-Bolt-Cont_9th.OUT
01/03/2007  03:08 PM               876 LicAlert.msg
08/23/2006  07:47 AM             1,971 Liner.txt
05/02/2005  02:19 PM               667 live_load.txt
01/08/2007  01:47 PM                73 menust.tmp
08/31/2006  03:05 PM             6,212 Near-Soil-1.txt
04/20/2005  01:14 PM               508 outer-spar.txt
10/13/2006  07:45 AM               147 Post-Tank.txt
10/18/2006  10:21 AM           105,472 Primary-Contact_0-90.xls
10/18/2006  10:21 AM           105,472 Primary-Contact_99-180.xls
10/16/2006  10:56 PM             4,024 Primary-Cont_108max.OUT
10/16/2006  10:56 PM         1,738,448 Primary-Cont_108th.OUT
10/16/2006  11:01 PM             4,024 Primary-Cont_117max.OUT
10/16/2006  11:01 PM         1,738,448 Primary-Cont_117th.OUT
10/16/2006  11:06 PM             4,024 Primary-Cont_126max.OUT
10/16/2006  11:06 PM         1,738,448 Primary-Cont_126th.OUT
10/16/2006  11:11 PM             4,024 Primary-Cont_135max.OUT
10/16/2006  11:11 PM         1,738,448 Primary-Cont_135th.OUT
10/16/2006  11:16 PM             4,024 Primary-Cont_144max.OUT
10/16/2006  11:16 PM         1,738,448 Primary-Cont_144th.OUT
10/16/2006  11:20 PM             4,024 Primary-Cont_153max.OUT
10/16/2006  11:20 PM         1,738,448 Primary-Cont_153th.OUT
10/16/2006  11:25 PM             4,024 Primary-Cont_162max.OUT
10/16/2006  11:25 PM         1,738,448 Primary-Cont_162th.OUT
10/16/2006  11:30 PM             4,024 Primary-Cont_171max.OUT
10/16/2006  11:30 PM         1,738,448 Primary-Cont_171th.OUT
10/16/2006  11:35 PM             4,024 Primary-Cont_180max.OUT
10/16/2006  11:35 PM         1,738,448 Primary-Cont_180th.OUT
10/16/2006  10:09 PM             4,024 Primary-Cont_18max.OUT
10/16/2006  10:09 PM         1,738,448 Primary-Cont_18th.OUT
10/16/2006  10:13 PM             4,024 Primary-Cont_27max.OUT
10/16/2006  10:13 PM         1,738,448 Primary-Cont_27th.OUT
10/16/2006  10:18 PM             4,024 Primary-Cont_36max.OUT
10/16/2006  10:18 PM         1,738,448 Primary-Cont_36th.OUT
10/16/2006  10:23 PM             4,024 Primary-Cont_45max.OUT
10/16/2006  10:23 PM         1,738,448 Primary-Cont_45th.OUT
10/16/2006  10:27 PM             4,024 Primary-Cont_54max.OUT
10/16/2006  10:27 PM         1,738,448 Primary-Cont_54th.OUT
```

```
10/16/2006  10:33 PM             4,024 Primary-Cont_63max.OUT
10/16/2006  10:33 PM         1,738,448 Primary-Cont_63th.OUT
10/16/2006  10:37 PM             4,024 Primary-Cont_72max.OUT
10/16/2006  10:37 PM         1,738,448 Primary-Cont_72th.OUT
10/16/2006  10:42 PM             4,024 Primary-Cont_81max.OUT
10/16/2006  10:42 PM         1,738,448 Primary-Cont_81th.OUT
10/16/2006  10:46 PM             4,024 Primary-Cont_90max.OUT
10/16/2006  10:46 PM         1,738,448 Primary-Cont_90th.OUT
10/16/2006  10:51 PM             4,024 Primary-Cont_99max.OUT
10/16/2006  10:51 PM         1,738,448 Primary-Cont_99th.OUT
10/16/2006  10:04 PM             4,024 Primary-Cont_9max.OUT
10/16/2006  10:04 PM         1,738,576 Primary-Cont_9th.OUT
10/12/2006  02:28 PM             6,028 Primary-Props-AP.txt
09/27/2005  03:52 PM             1,538 Primary.txt
10/12/2006  02:52 PM           450,111 QA.out
10/17/2006  09:29 AM            47,121 RS-ct-0.out
10/17/2006  09:32 AM            47,121 RS-ct-135.out
10/17/2006  09:33 AM            47,121 RS-ct-180.out
10/17/2006  09:30 AM            47,121 RS-ct-45.out
10/17/2006  09:31 AM            47,121 RS-ct-90.out
10/17/2006  09:28 AM            27,591 RS-ct.out
09/11/2006  02:59 PM            47,121 RS-OUT-Concrete.txt
10/17/2006  09:34 AM            47,121 RS-PT-0.out
10/17/2006  09:38 AM            47,121 RS-PT-135.out
10/17/2006  09:38 AM            47,121 RS-PT-180.out
10/17/2006  09:35 AM            47,121 RS-PT-45.out
10/17/2006  09:36 AM            47,121 RS-PT-90.out
10/17/2006  09:39 AM            47,121 RS-SOil.out
10/31/2005  10:31 AM             1,108 RS_FREQ.txt
08/31/2006  02:56 PM             1,819 Run-Tank.txt
01/08/2007  01:47 PM                 0 scratch.hlp
12/29/2006  11:03 AM            54,765 Seismic-File-List.txt
02/11/2005  01:22 PM             1,053 Slave.txt
10/17/2006  03:20 AM             9,896 Soil-Contact_108max.OUT
10/17/2006  03:20 AM         4,348,080 Soil-Contact_108th.OUT
10/17/2006  03:31 AM             9,896 Soil-Contact_117max.OUT
10/17/2006  03:31 AM         4,348,080 Soil-Contact_117th.OUT
10/17/2006  03:41 AM             9,896 Soil-Contact_126max.OUT
10/17/2006  03:41 AM         4,348,080 Soil-Contact_126th.OUT
10/17/2006  03:51 AM             9,896 Soil-Contact_135max.OUT
10/17/2006  03:51 AM         4,348,080 Soil-Contact_135th.OUT
10/17/2006  04:01 AM             9,896 Soil-Contact_144max.OUT
10/17/2006  04:01 AM         4,348,080 Soil-Contact_144th.OUT
10/17/2006  04:11 AM             9,896 Soil-Contact_153max.OUT
10/17/2006  04:11 AM         4,348,080 Soil-Contact_153th.OUT
10/17/2006  04:21 AM             9,896 Soil-Contact_162max.OUT
10/17/2006  04:21 AM         4,348,080 Soil-Contact_162th.OUT
10/17/2006  04:31 AM             9,896 Soil-Contact_171max.OUT
10/17/2006  04:31 AM         4,348,080 Soil-Contact_171th.OUT
10/17/2006  04:40 AM             9,896 Soil-Contact_180max.OUT
10/17/2006  04:41 AM         4,348,080 Soil-Contact_180th.OUT
10/17/2006  01:41 AM             9,896 Soil-Contact_18max.OUT
10/17/2006  01:41 AM         4,348,080 Soil-Contact_18th.OUT
10/17/2006  01:51 AM             9,896 Soil-Contact_27max.OUT
10/17/2006  01:51 AM         4,348,080 Soil-Contact_27th.OUT
10/17/2006  02:01 AM             9,896 Soil-Contact_36max.OUT
10/17/2006  02:01 AM         4,348,080 Soil-Contact_36th.OUT
10/17/2006  02:11 AM             9,896 Soil-Contact_45max.OUT
10/17/2006  02:11 AM         4,348,080 Soil-Contact_45th.OUT
10/17/2006  02:21 AM             9,896 Soil-Contact_54max.OUT
10/17/2006  02:21 AM         4,348,080 Soil-Contact_54th.OUT
10/17/2006  02:31 AM             9,896 Soil-Contact_63max.OUT
10/17/2006  02:31 AM         4,348,080 Soil-Contact_63th.OUT
10/17/2006  02:41 AM             9,896 Soil-Contact_72max.OUT
10/17/2006  02:41 AM         4,348,080 Soil-Contact_72th.OUT
10/17/2006  02:51 AM             9,896 Soil-Contact_81max.OUT
10/17/2006  02:51 AM         4,348,080 Soil-Contact_81th.OUT
10/17/2006  03:01 AM             9,896 Soil-Contact_90max.OUT
10/17/2006  03:01 AM         4,348,080 Soil-Contact_90th.OUT
10/17/2006  03:11 AM             9,896 Soil-Contact_99max.OUT
```

```
10/17/2006  03:11 AM         4,348,080 Soil-Contact_99th.OUT
10/17/2006  01:31 AM             9,896 Soil-Contact_9max.OUT
10/17/2006  01:31 AM         4,348,208 Soil-Contact_9th.OUT
11/11/2005  10:36 AM             4,989 Soil-Prop-Mean-Geo.txt
10/13/2005  08:19 AM             5,016 Soil-Prop-UB-Geo.txt
10/18/2006  10:07 AM           224,256 soil_0-90.xls
10/18/2006  10:07 AM           223,744 soil_99-180.xls
09/07/2006  01:13 PM             1,924 Solve-TH-UBS.txt
09/13/2006  06:12 AM               347 spectra-all.txt
09/13/2006  06:07 AM             3,690 spectra-conc-0.txt
09/13/2006  06:08 AM             3,723 spectra-conc-135.txt
09/13/2006  06:09 AM             3,723 spectra-conc-180.txt
09/13/2006  06:08 AM             3,769 spectra-conc-45.txt
09/13/2006  06:08 AM             3,649 spectra-conc-90.txt
10/17/2006  09:27 AM             1,596 spectra-conc.txt
09/13/2006  06:11 AM             2,076 spectra-concrete.txt
09/13/2006  06:13 AM             3,609 spectra-primary-0.txt
09/13/2006  06:14 AM             3,762 spectra-primary-135.txt
09/13/2006  06:15 AM             3,777 spectra-primary-180.txt
09/13/2006  06:13 AM             3,688 spectra-primary-45.txt
09/13/2006  06:14 AM             3,688 spectra-primary-90.txt
09/13/2006  06:15 AM             3,801 spectra-soil.txt
06/20/2005  09:04 AM               647 spectra-wall.txt
06/20/2005  08:52 AM               679 spectra-waste.txt
10/20/2006  09:53 AM           276,480 str-comp_0-90b.xls
10/20/2006  09:54 AM           276,992 str-comp_0-90m.xls
10/20/2006  09:54 AM           276,480 str-comp_0-90t.xls
10/20/2006  09:54 AM           276,480 str-comp_99-180b.xls
10/20/2006  09:54 AM           276,480 str-comp_99-180m.xls
10/20/2006  09:55 AM           276,480 str-comp_99-180t.xls
01/03/2007  03:40 PM             1,823 strain-backed-principle-bot.txt
01/03/2007  03:40 PM             1,828 strain-backed-principle-mid.txt
01/03/2007  03:41 PM             1,825 strain-backed-principle-top.txt
01/03/2007  04:02 PM               966 strain-backed-principle.txt
01/05/2007  03:21 PM             7,496 Strain-Backed-Princ_108-bot-max.OUT
01/05/2007  03:21 PM         3,463,218 Strain-Backed-Princ_108-bot-th.OUT
01/05/2007  06:44 PM             7,162 Strain-Backed-Princ_108-Top-max.OUT
01/05/2007  06:44 PM         3,305,799 Strain-Backed-Princ_108-Top-th.OUT
01/05/2007  05:05 PM             4,156 Strain-Backed-Princ_108max.OUT
01/05/2007  05:05 PM         1,889,028 Strain-Backed-Princ_108th.OUT
01/05/2007  03:28 PM             7,496 Strain-Backed-Princ_117-bot-max.OUT
01/05/2007  03:28 PM         3,463,218 Strain-Backed-Princ_117-bot-th.OUT
01/05/2007  06:49 PM             7,162 Strain-Backed-Princ_117-Top-max.OUT
01/05/2007  06:49 PM         3,305,799 Strain-Backed-Princ_117-Top-th.OUT
01/05/2007  05:09 PM             4,156 Strain-Backed-Princ_117max.OUT
01/05/2007  05:09 PM         1,889,028 Strain-Backed-Princ_117th.OUT
01/05/2007  03:35 PM             7,496 Strain-Backed-Princ_126-bot-max.OUT
01/05/2007  03:35 PM         3,463,218 Strain-Backed-Princ_126-bot-th.OUT
01/05/2007  06:55 PM             7,162 Strain-Backed-Princ_126-Top-max.OUT
01/05/2007  06:55 PM         3,305,799 Strain-Backed-Princ_126-Top-th.OUT
01/05/2007  05:13 PM             4,156 Strain-Backed-Princ_126max.OUT
01/05/2007  05:13 PM         1,889,028 Strain-Backed-Princ_126th.OUT
01/05/2007  03:41 PM             7,496 Strain-Backed-Princ_135-bot-max.OUT
01/05/2007  03:42 PM         3,463,218 Strain-Backed-Princ_135-bot-th.OUT
01/05/2007  07:00 PM             7,162 Strain-Backed-Princ_135-Top-max.OUT
01/05/2007  07:00 PM         3,305,799 Strain-Backed-Princ_135-Top-th.OUT
01/05/2007  05:17 PM             4,156 Strain-Backed-Princ_135max.OUT
01/05/2007  05:17 PM         1,889,028 Strain-Backed-Princ_135th.OUT
01/05/2007  03:48 PM             7,496 Strain-Backed-Princ_144-bot-max.OUT
01/05/2007  03:48 PM         3,463,218 Strain-Backed-Princ_144-bot-th.OUT
01/05/2007  07:06 PM             7,162 Strain-Backed-Princ_144-Top-max.OUT
01/05/2007  07:06 PM         3,305,799 Strain-Backed-Princ_144-Top-th.OUT
01/05/2007  05:21 PM             4,156 Strain-Backed-Princ_144max.OUT
01/05/2007  05:21 PM         1,889,028 Strain-Backed-Princ_144th.OUT
01/05/2007  03:55 PM             7,496 Strain-Backed-Princ_153-bot-max.OUT
01/05/2007  03:55 PM         3,463,218 Strain-Backed-Princ_153-bot-th.OUT
01/05/2007  07:12 PM             7,162 Strain-Backed-Princ_153-Top-max.OUT
01/05/2007  07:12 PM         3,305,799 Strain-Backed-Princ_153-Top-th.OUT
01/05/2007  05:25 PM             4,156 Strain-Backed-Princ_153max.OUT
01/05/2007  05:25 PM         1,889,028 Strain-Backed-Princ_153th.OUT
```

```
01/05/2007  04:02 PM           7,496 Strain-Backed-Princ_162-bot-max.OUT
01/05/2007  04:02 PM       3,463,218 Strain-Backed-Princ_162-bot-th.OUT
01/05/2007  07:17 PM           7,162 Strain-Backed-Princ_162-Top-max.OUT
01/05/2007  07:17 PM       3,305,799 Strain-Backed-Princ_162-Top-th.OUT
01/05/2007  05:29 PM           4,156 Strain-Backed-Princ_162max.OUT
01/05/2007  05:29 PM       1,889,028 Strain-Backed-Princ_162th.OUT
01/05/2007  04:09 PM           7,496 Strain-Backed-Princ_171-bot-max.OUT
01/05/2007  04:09 PM       3,463,218 Strain-Backed-Princ_171-bot-th.OUT
01/05/2007  07:23 PM           7,162 Strain-Backed-Princ_171-Top-max.OUT
01/05/2007  07:23 PM       3,305,799 Strain-Backed-Princ_171-Top-th.OUT
01/05/2007  05:33 PM           4,156 Strain-Backed-Princ_171max.OUT
01/05/2007  05:33 PM       1,889,028 Strain-Backed-Princ_171th.OUT
01/05/2007  01:55 PM           7,496 Strain-Backed-Princ_18-bot-max.OUT
01/05/2007  01:55 PM       3,463,218 Strain-Backed-Princ_18-bot-th.OUT
01/05/2007  05:49 PM           7,162 Strain-Backed-Princ_18-Top-max.OUT
01/05/2007  05:49 PM       3,305,799 Strain-Backed-Princ_18-Top-th.OUT
01/05/2007  04:16 PM           7,496 Strain-Backed-Princ_180-bot-max.OUT
01/05/2007  04:16 PM       3,463,218 Strain-Backed-Princ_180-bot-th.OUT
01/05/2007  07:29 PM           7,162 Strain-Backed-Princ_180-Top-max.OUT
01/05/2007  07:29 PM       3,305,799 Strain-Backed-Princ_180-Top-th.OUT
01/05/2007  05:37 PM           4,156 Strain-Backed-Princ_180max.OUT
01/05/2007  05:37 PM       1,889,028 Strain-Backed-Princ_180th.OUT
01/05/2007  04:24 PM           4,156 Strain-Backed-Princ_18max.OUT
01/05/2007  04:24 PM       1,889,028 Strain-Backed-Princ_18th.OUT
01/05/2007  02:06 PM           7,496 Strain-Backed-Princ_27-bot-max.OUT
01/05/2007  02:06 PM       3,463,218 Strain-Backed-Princ_27-bot-th.OUT
01/05/2007  05:54 PM           7,162 Strain-Backed-Princ_27-Top-max.OUT
01/05/2007  05:54 PM       3,305,799 Strain-Backed-Princ_27-Top-th.OUT
01/05/2007  04:28 PM           4,156 Strain-Backed-Princ_27max.OUT
01/05/2007  04:28 PM       1,889,028 Strain-Backed-Princ_27th.OUT
01/05/2007  02:18 PM           7,496 Strain-Backed-Princ_36-bot-max.OUT
01/05/2007  02:18 PM       3,463,218 Strain-Backed-Princ_36-bot-th.OUT
01/05/2007  06:00 PM           7,162 Strain-Backed-Princ_36-Top-max.OUT
01/05/2007  06:00 PM       3,305,799 Strain-Backed-Princ_36-Top-th.OUT
01/05/2007  04:32 PM           4,156 Strain-Backed-Princ_36max.OUT
01/05/2007  04:32 PM       1,889,028 Strain-Backed-Princ_36th.OUT
01/05/2007  02:28 PM           7,496 Strain-Backed-Princ_45-bot-max.OUT
01/05/2007  02:28 PM       3,463,218 Strain-Backed-Princ_45-bot-th.OUT
01/05/2007  06:06 PM           7,162 Strain-Backed-Princ_45-Top-max.OUT
01/05/2007  06:06 PM       3,305,799 Strain-Backed-Princ_45-Top-th.OUT
01/05/2007  04:36 PM           4,156 Strain-Backed-Princ_45max.OUT
01/05/2007  04:36 PM       1,889,028 Strain-Backed-Princ_45th.OUT
01/05/2007  02:35 PM           7,496 Strain-Backed-Princ_54-bot-max.OUT
01/05/2007  02:35 PM       3,463,218 Strain-Backed-Princ_54-bot-th.OUT
01/05/2007  06:11 PM           7,162 Strain-Backed-Princ_54-Top-max.OUT
01/05/2007  06:11 PM       3,305,799 Strain-Backed-Princ_54-Top-th.OUT
01/05/2007  04:40 PM           4,156 Strain-Backed-Princ_54max.OUT
01/05/2007  04:40 PM       1,889,028 Strain-Backed-Princ_54th.OUT
01/05/2007  02:41 PM           7,496 Strain-Backed-Princ_63-bot-max.OUT
01/05/2007  02:41 PM       3,463,218 Strain-Backed-Princ_63-bot-th.OUT
01/05/2007  06:16 PM           7,162 Strain-Backed-Princ_63-Top-max.OUT
01/05/2007  06:16 PM       3,305,799 Strain-Backed-Princ_63-Top-th.OUT
01/05/2007  04:44 PM           4,156 Strain-Backed-Princ_63max.OUT
01/05/2007  04:44 PM       1,889,028 Strain-Backed-Princ_63th.OUT
01/05/2007  02:48 PM           7,496 Strain-Backed-Princ_72-bot-max.OUT
01/05/2007  02:48 PM       3,463,218 Strain-Backed-Princ_72-bot-th.OUT
01/05/2007  06:21 PM           7,162 Strain-Backed-Princ_72-Top-max.OUT
01/05/2007  06:21 PM       3,305,799 Strain-Backed-Princ_72-Top-th.OUT
01/05/2007  04:48 PM           4,156 Strain-Backed-Princ_72max.OUT
01/05/2007  04:48 PM       1,889,028 Strain-Backed-Princ_72th.OUT
01/05/2007  02:55 PM           7,496 Strain-Backed-Princ_81-bot-max.OUT
01/05/2007  02:55 PM       3,463,218 Strain-Backed-Princ_81-bot-th.OUT
01/05/2007  06:27 PM           7,162 Strain-Backed-Princ_81-Top-max.OUT
01/05/2007  06:27 PM       3,305,799 Strain-Backed-Princ_81-Top-th.OUT
01/05/2007  04:53 PM           4,156 Strain-Backed-Princ_81max.OUT
01/05/2007  04:53 PM       1,889,028 Strain-Backed-Princ_81th.OUT
01/05/2007  01:43 PM           7,496 Strain-Backed-Princ_9-bot-max.OUT
01/05/2007  01:43 PM       3,463,346 Strain-Backed-Princ_9-bot-th.OUT
01/05/2007  05:43 PM           7,162 Strain-Backed-Princ_9-Top-max.OUT
01/05/2007  05:43 PM       3,305,927 Strain-Backed-Princ_9-Top-th.OUT
```

```
01/05/2007  03:02 PM           7,496 Strain-Backed-Princ_90-bot-max.OUT
01/05/2007  03:02 PM       3,463,218 Strain-Backed-Princ_90-bot-th.OUT
01/05/2007  06:33 PM           7,162 Strain-Backed-Princ_90-Top-max.OUT
01/05/2007  06:33 PM       3,305,799 Strain-Backed-Princ_90-Top-th.OUT
01/05/2007  04:57 PM           4,156 Strain-Backed-Princ_90max.OUT
01/05/2007  04:57 PM       1,889,028 Strain-Backed-Princ_90th.OUT
01/05/2007  03:10 PM           7,496 Strain-Backed-Princ_99-bot-max.OUT
01/05/2007  03:10 PM       3,463,218 Strain-Backed-Princ_99-bot-th.OUT
01/05/2007  06:38 PM           7,162 Strain-Backed-Princ_99-Top-max.OUT
01/05/2007  06:38 PM       3,305,799 Strain-Backed-Princ_99-Top-th.OUT
01/05/2007  05:01 PM           4,156 Strain-Backed-Princ_99max.OUT
01/05/2007  05:01 PM       1,889,028 Strain-Backed-Princ_99th.OUT
01/05/2007  04:20 PM           4,156 Strain-Backed-Princ_9max.OUT
01/05/2007  04:20 PM       1,889,156 Strain-Backed-Princ_9th.OUT
09/12/2006  10:38 AM           2,598 strain-backed.txt
08/21/2006  08:01 AM             566 strain-compb-p.txt
08/16/2006  01:59 PM             621 strain-compb-primary.txt
08/21/2006  08:01 AM             693 strain-compb.txt
08/21/2006  08:02 AM             566 strain-compm-p.txt
08/16/2006  02:00 PM             621 strain-compm-primary.txt
08/21/2006  08:01 AM             705 strain-compm.txt
08/21/2006  08:02 AM             578 strain-compt-p.txt
08/16/2006  02:00 PM             621 strain-compt-primary.txt
08/21/2006  08:02 AM             720 strain-compt.txt
08/21/2006  08:02 AM             730 Strain-Liner-floor.txt
01/05/2006  03:14 PM             550 Strain-Liner-p.txt
08/21/2006  08:02 AM             962 Strain-Liner-wall.txt
08/16/2006  03:01 PM             545 Strain-Liner.txt
08/16/2006  02:01 PM             292 Strain-Primary.txt
01/08/2007  08:08 AM         113,152 Strain-Princ_0-90.xls
01/08/2007  08:08 AM         187,392 Strain-Princ_0-90b.xls
01/08/2007  08:08 AM         180,224 Strain-Princ_0-90t.xls
01/08/2007  08:09 AM         113,152 Strain-Princ_99-180.xls
01/08/2007  08:08 AM         187,904 Strain-Princ_99-180b.xls
01/08/2007  08:09 AM         180,224 Strain-Princ_99-180t.xls
08/16/2006  02:19 PM             273 Strain.txt
08/21/2006  08:02 AM             554 stress-compb-p.txt
08/21/2006  08:02 AM             598 stress-compb.txt
08/21/2006  08:03 AM             554 stress-compm-p.txt
08/21/2006  08:03 AM             608 stress-compm.txt
08/21/2006  08:03 AM             554 stress-compt-p.txt
08/24/2006  03:19 PM             598 stress-compt.txt
08/17/2006  11:19 AM             207 Stress-Primary-M.txt
08/24/2006  12:05 PM             224 Stress-Primary.txt
10/19/2006  01:40 AM          13,519 Stress-pt_108max-b.OUT
10/18/2006  09:54 PM          13,519 Stress-pt_108max-m.OUT
10/18/2006  06:08 PM          13,519 Stress-pt_108max-t.OUT
10/19/2006  01:40 AM       6,443,068 Stress-pt_108th-b.OUT
10/18/2006  09:54 PM       6,443,068 Stress-pt_108th-m.OUT
10/18/2006  06:08 PM       6,412,940 Stress-pt_108th-t.OUT
10/19/2006  01:51 AM          13,519 Stress-pt_117max-b.OUT
10/18/2006  10:05 PM          13,519 Stress-pt_117max-m.OUT
10/18/2006  06:19 PM          13,519 Stress-pt_117max-t.OUT
10/19/2006  01:52 AM       6,443,068 Stress-pt_117th-b.OUT
10/18/2006  10:05 PM       6,443,068 Stress-pt_117th-m.OUT
10/18/2006  06:19 PM       6,412,940 Stress-pt_117th-t.OUT
10/19/2006  02:02 AM          13,519 Stress-pt_126max-b.OUT
10/18/2006  10:16 PM          13,519 Stress-pt_126max-m.OUT
10/18/2006  06:30 PM          13,519 Stress-pt_126max-t.OUT
10/19/2006  02:02 AM       6,443,068 Stress-pt_126th-b.OUT
10/18/2006  10:16 PM       6,443,068 Stress-pt_126th-m.OUT
10/18/2006  06:30 PM       6,412,940 Stress-pt_126th-t.OUT
10/19/2006  02:13 AM          13,519 Stress-pt_135max-b.OUT
10/18/2006  10:27 PM          13,519 Stress-pt_135max-m.OUT
10/18/2006  06:41 PM          13,519 Stress-pt_135max-t.OUT
10/19/2006  02:13 AM       6,443,068 Stress-pt_135th-b.OUT
10/18/2006  10:27 PM       6,443,068 Stress-pt_135th-m.OUT
10/18/2006  06:41 PM       6,412,940 Stress-pt_135th-t.OUT
10/19/2006  02:24 AM          13,519 Stress-pt_144max-b.OUT
10/18/2006  10:38 PM          13,519 Stress-pt_144max-m.OUT
```

```
10/18/2006  06:52 PM            13,519 Stress-pt_144max-t.OUT
10/19/2006  02:25 AM         6,443,068 Stress-pt_144th-b.OUT
10/18/2006  10:38 PM         6,443,068 Stress-pt_144th-m.OUT
10/18/2006  06:52 PM         6,412,940 Stress-pt_144th-t.OUT
10/19/2006  02:36 AM            13,519 Stress-pt_153max-b.OUT
10/18/2006  10:50 PM            13,519 Stress-pt_153max-m.OUT
10/18/2006  07:04 PM            13,519 Stress-pt_153max-t.OUT
10/19/2006  02:36 AM         6,443,068 Stress-pt_153th-b.OUT
10/18/2006  10:50 PM         6,443,068 Stress-pt_153th-m.OUT
10/18/2006  07:04 PM         6,412,940 Stress-pt_153th-t.OUT
10/19/2006  02:47 AM            13,519 Stress-pt_162max-b.OUT
10/18/2006  11:01 PM            13,519 Stress-pt_162max-m.OUT
10/18/2006  07:15 PM            13,519 Stress-pt_162max-t.OUT
10/19/2006  02:47 AM         6,443,068 Stress-pt_162th-b.OUT
10/18/2006  11:01 PM         6,443,068 Stress-pt_162th-m.OUT
10/18/2006  07:15 PM         6,412,940 Stress-pt_162th-t.OUT
10/19/2006  02:59 AM            13,521 Stress-pt_171max-b.OUT
10/18/2006  11:12 PM            13,521 Stress-pt_171max-m.OUT
10/18/2006  07:26 PM            13,521 Stress-pt_171max-t.OUT
10/19/2006  02:59 AM         6,443,068 Stress-pt_171th-b.OUT
10/18/2006  11:12 PM         6,443,068 Stress-pt_171th-m.OUT
10/18/2006  07:26 PM         6,412,940 Stress-pt_171th-t.OUT
10/19/2006  03:10 AM            13,521 Stress-pt_180max-b.OUT
10/18/2006  11:24 PM            13,521 Stress-pt_180max-m.OUT
10/18/2006  07:38 PM            13,521 Stress-pt_180max-t.OUT
10/19/2006  03:10 AM         6,443,068 Stress-pt_180th-b.OUT
10/18/2006  11:24 PM         6,443,068 Stress-pt_180th-m.OUT
10/18/2006  07:38 PM         6,412,940 Stress-pt_180th-t.OUT
10/18/2006  11:47 PM            13,519 Stress-pt_18max-b.OUT
10/18/2006  08:01 PM            13,519 Stress-pt_18max-m.OUT
10/18/2006  04:14 PM            13,519 Stress-pt_18max-t.OUT
10/18/2006  11:47 PM         6,443,068 Stress-pt_18th-b.OUT
10/18/2006  08:01 PM         6,443,068 Stress-pt_18th-m.OUT
10/18/2006  04:14 PM         6,412,940 Stress-pt_18th-t.OUT
10/18/2006  11:59 PM            13,519 Stress-pt_27max-b.OUT
10/18/2006  08:12 PM            13,519 Stress-pt_27max-m.OUT
10/18/2006  04:26 PM            13,519 Stress-pt_27max-t.OUT
10/18/2006  11:59 PM         6,443,068 Stress-pt_27th-b.OUT
10/18/2006  08:12 PM         6,443,068 Stress-pt_27th-m.OUT
10/18/2006  04:26 PM         6,412,940 Stress-pt_27th-t.OUT
10/19/2006  12:10 AM            13,519 Stress-pt_36max-b.OUT
10/18/2006  08:24 PM            13,519 Stress-pt_36max-m.OUT
10/18/2006  04:38 PM            13,519 Stress-pt_36max-t.OUT
10/19/2006  12:10 AM         6,443,068 Stress-pt_36th-b.OUT
10/18/2006  08:24 PM         6,443,068 Stress-pt_36th-m.OUT
10/18/2006  04:38 PM         6,412,940 Stress-pt_36th-t.OUT
10/19/2006  12:21 AM            13,519 Stress-pt_45max-b.OUT
10/18/2006  08:35 PM            13,519 Stress-pt_45max-m.OUT
10/18/2006  04:49 PM            13,519 Stress-pt_45max-t.OUT
10/19/2006  12:21 AM         6,443,068 Stress-pt_45th-b.OUT
10/18/2006  08:35 PM         6,443,068 Stress-pt_45th-m.OUT
10/18/2006  04:49 PM         6,412,940 Stress-pt_45th-t.OUT
10/19/2006  12:33 AM            13,519 Stress-pt_54max-b.OUT
10/18/2006  08:46 PM            13,519 Stress-pt_54max-m.OUT
10/18/2006  05:00 PM            13,519 Stress-pt_54max-t.OUT
10/19/2006  12:33 AM         6,443,068 Stress-pt_54th-b.OUT
10/18/2006  08:46 PM         6,443,068 Stress-pt_54th-m.OUT
10/18/2006  05:00 PM         6,412,940 Stress-pt_54th-t.OUT
10/19/2006  12:44 AM            13,519 Stress-pt_63max-b.OUT
10/18/2006  08:57 PM            13,519 Stress-pt_63max-m.OUT
10/18/2006  05:11 PM            13,519 Stress-pt_63max-t.OUT
10/19/2006  12:44 AM         6,443,068 Stress-pt_63th-b.OUT
10/18/2006  08:57 PM         6,443,068 Stress-pt_63th-m.OUT
10/18/2006  05:11 PM         6,412,940 Stress-pt_63th-t.OUT
10/19/2006  12:54 AM            13,519 Stress-pt_72max-b.OUT
10/18/2006  09:08 PM            13,519 Stress-pt_72max-m.OUT
10/18/2006  05:22 PM            13,519 Stress-pt_72max-t.OUT
10/19/2006  12:54 AM         6,443,068 Stress-pt_72th-b.OUT
10/18/2006  09:08 PM         6,443,068 Stress-pt_72th-m.OUT
10/18/2006  05:22 PM         6,412,940 Stress-pt_72th-t.OUT
```

```
10/19/2006  01:06 AM            13,519 Stress-pt_81max-b.OUT
10/18/2006  09:19 PM            13,519 Stress-pt_81max-m.OUT
10/18/2006  05:33 PM            13,519 Stress-pt_81max-t.OUT
10/19/2006  01:06 AM         6,443,068 Stress-pt_81th-b.OUT
10/18/2006  09:19 PM         6,443,068 Stress-pt_81th-m.OUT
10/18/2006  05:33 PM         6,412,940 Stress-pt_81th-t.OUT
10/19/2006  01:17 AM            13,519 Stress-pt_90max-b.OUT
10/18/2006  09:31 PM            13,519 Stress-pt_90max-m.OUT
10/18/2006  05:45 PM            13,519 Stress-pt_90max-t.OUT
10/19/2006  01:17 AM         6,443,068 Stress-pt_90th-b.OUT
10/18/2006  09:31 PM         6,443,068 Stress-pt_90th-m.OUT
10/18/2006  05:45 PM         6,412,940 Stress-pt_90th-t.OUT
10/19/2006  01:29 AM            13,519 Stress-pt_99max-b.OUT
10/18/2006  09:43 PM            13,519 Stress-pt_99max-m.OUT
10/18/2006  05:57 PM            13,519 Stress-pt_99max-t.OUT
10/19/2006  01:29 AM         6,443,068 Stress-pt_99th-b.OUT
10/18/2006  09:43 PM         6,443,068 Stress-pt_99th-m.OUT
10/18/2006  05:57 PM         6,412,940 Stress-pt_99th-t.OUT
10/18/2006  11:36 PM            13,519 Stress-pt_9max-b.OUT
10/18/2006  07:50 PM            13,519 Stress-pt_9max-m.OUT
10/18/2006  04:03 PM            13,519 Stress-pt_9max-t.OUT
10/18/2006  11:36 PM         6,443,196 Stress-pt_9th-b.OUT
10/18/2006  07:50 PM         6,443,196 Stress-pt_9th-m.OUT
10/18/2006  04:03 PM         6,413,068 Stress-pt_9th-t.OUT
10/12/2006  02:29 PM             4,009 Tank-Coordinates-AP.txt
05/25/2005  03:32 PM             2,512 Tank-Mesh1.txt
10/12/2006  02:51 PM               102 tank-out.out
08/25/2006  07:52 AM             5,450 Tank-Props-BEC-250.txt
10/12/2006  02:52 PM             4,687 Tank-th.out
12/22/2005  12:43 PM            10,035 temp.log
08/09/2006  07:43 AM            23,166 TH-266-Mean-Geo-V.txt
08/09/2006  07:31 AM            23,166 TH-266-Mean-Geo.txt
05/16/2005  03:42 PM            41,472 TH-266-UB-Geo-V.txt
05/16/2005  08:45 AM            41,391 TH-266-UB-Geo.txt
10/17/2006  09:29 AM           561,576 Vel-ct-0.out
10/17/2006  09:32 AM           561,576 Vel-ct-135.out
10/17/2006  09:33 AM           561,576 Vel-ct-180.out
10/17/2006  09:30 AM           561,576 Vel-ct-45.out
10/17/2006  09:31 AM           561,576 Vel-ct-90.out
10/17/2006  09:28 AM           290,550 Vel-ct.out
10/17/2006  09:34 AM           561,576 Vel-PT-0.out
10/17/2006  09:38 AM           561,576 Vel-PT-135.out
10/17/2006  09:38 AM           561,576 Vel-PT-180.out
10/17/2006  09:35 AM           561,576 Vel-PT-45.out
10/17/2006  09:36 AM           561,576 Vel-PT-90.out
10/17/2006  09:39 AM           561,576 Vel-Soil.out
10/16/2006  07:01 PM            10,180 Waste-Cont_108max.OUT
10/16/2006  07:01 PM         4,875,649 Waste-Cont_108th.OUT
10/16/2006  07:13 PM            10,180 Waste-Cont_117max.OUT
10/16/2006  07:13 PM         4,875,649 Waste-Cont_117th.OUT
10/16/2006  07:25 PM            10,180 Waste-Cont_126max.OUT
10/16/2006  07:25 PM         4,875,649 Waste-Cont_126th.OUT
10/16/2006  07:37 PM            10,180 Waste-Cont_135max.OUT
10/16/2006  07:37 PM         4,875,649 Waste-Cont_135th.OUT
10/16/2006  07:50 PM            10,180 Waste-Cont_144max.OUT
10/16/2006  07:50 PM         4,875,649 Waste-Cont_144th.OUT
10/16/2006  08:01 PM            10,180 Waste-Cont_153max.OUT
10/16/2006  08:02 PM         4,875,649 Waste-Cont_153th.OUT
10/16/2006  08:14 PM            10,180 Waste-Cont_162max.OUT
10/16/2006  08:14 PM         4,875,649 Waste-Cont_162th.OUT
10/16/2006  08:26 PM            10,180 Waste-Cont_171max.OUT
10/16/2006  08:26 PM         4,875,649 Waste-Cont_171th.OUT
10/16/2006  08:38 PM            10,180 Waste-Cont_180max.OUT
10/16/2006  08:38 PM         4,875,649 Waste-Cont_180th.OUT
10/16/2006  04:59 PM            10,180 Waste-Cont_18max.OUT
10/16/2006  04:59 PM         4,875,649 Waste-Cont_18th.OUT
10/16/2006  05:13 PM            10,180 Waste-Cont_27max.OUT
10/16/2006  05:13 PM         4,875,649 Waste-Cont_27th.OUT
10/16/2006  05:25 PM            10,180 Waste-Cont_36max.OUT
10/16/2006  05:25 PM         4,875,649 Waste-Cont_36th.OUT
```

```
10/16/2006  05:37 PM            10,180 Waste-Cont_45max.OUT
10/16/2006  05:37 PM         4,875,649 Waste-Cont_45th.OUT
10/16/2006  05:49 PM            10,180 Waste-Cont_54max.OUT
10/16/2006  05:49 PM         4,875,649 Waste-Cont_54th.OUT
10/16/2006  06:01 PM            10,180 Waste-Cont_63max.OUT
10/16/2006  06:01 PM         4,875,649 Waste-Cont_63th.OUT
10/16/2006  06:13 PM            10,180 Waste-Cont_72max.OUT
10/16/2006  06:13 PM         4,875,649 Waste-Cont_72th.OUT
10/16/2006  06:25 PM            10,180 Waste-Cont_81max.OUT
10/16/2006  06:25 PM         4,875,649 Waste-Cont_81th.OUT
10/16/2006  06:37 PM            10,180 Waste-Cont_90max.OUT
10/16/2006  06:37 PM         4,875,649 Waste-Cont_90th.OUT
10/16/2006  06:49 PM            10,180 Waste-Cont_99max.OUT
10/16/2006  06:49 PM         4,875,649 Waste-Cont_99th.OUT
10/16/2006  04:45 PM            10,180 Waste-Cont_9max.OUT
10/16/2006  04:46 PM         4,875,777 Waste-Cont_9th.OUT
10/16/2006  04:27 PM            47,317 Waste-Reaction-460-SD3.out
08/25/2006  08:47 AM               340 Waste-Reaction.txt
10/12/2006  02:27 PM            10,266 Waste-solid-AP-S.txt
08/21/2006  08:03 AM               776 Waste-Surface-AP.txt
10/17/2006  10:04 AM               865 Waste-Surf_0max.OUT
10/17/2006  10:04 AM           534,133 Waste-Surf_0th.OUT
10/17/2006  11:47 AM               865 Waste-Surf_108max.OUT
10/17/2006  11:47 AM           534,005 Waste-Surf_108th.OUT
10/17/2006  11:56 AM               865 Waste-Surf_117max.OUT
10/17/2006  11:56 AM           534,005 Waste-Surf_117th.OUT
10/17/2006  12:04 PM               865 Waste-Surf_126max.OUT
10/17/2006  12:04 PM           534,005 Waste-Surf_126th.OUT
10/17/2006  12:13 PM               865 Waste-Surf_135max.OUT
10/17/2006  12:13 PM           534,005 Waste-Surf_135th.OUT
10/17/2006  12:21 PM               865 Waste-Surf_144max.OUT
10/17/2006  12:21 PM           534,005 Waste-Surf_144th.OUT
10/17/2006  12:30 PM               865 Waste-Surf_153max.OUT
10/17/2006  12:30 PM           534,005 Waste-Surf_153th.OUT
10/17/2006  12:39 PM               865 Waste-Surf_162max.OUT
10/17/2006  12:39 PM           534,005 Waste-Surf_162th.OUT
10/17/2006  12:47 PM               865 Waste-Surf_171max.OUT
10/17/2006  12:47 PM           534,005 Waste-Surf_171th.OUT
10/17/2006  12:55 PM               865 Waste-Surf_180max.OUT
10/17/2006  12:55 PM           534,005 Waste-Surf_180th.OUT
10/17/2006  12:55 PM               865 Waste-Surf_189max.OUT
10/17/2006  12:55 PM           534,005 Waste-Surf_189th.OUT
10/17/2006  10:21 AM               865 Waste-Surf_18max.OUT
10/17/2006  10:21 AM           534,005 Waste-Surf_18th.OUT
10/17/2006  10:31 AM               865 Waste-Surf_27max.OUT
10/17/2006  10:31 AM           534,005 Waste-Surf_27th.OUT
10/17/2006  10:39 AM               865 Waste-Surf_36max.OUT
10/17/2006  10:39 AM           534,005 Waste-Surf_36th.OUT
10/17/2006  10:48 AM               865 Waste-Surf_45max.OUT
10/17/2006  10:48 AM           534,005 Waste-Surf_45th.OUT
10/17/2006  10:57 AM               865 Waste-Surf_54max.OUT
10/17/2006  10:57 AM           534,005 Waste-Surf_54th.OUT
10/17/2006  11:07 AM               865 Waste-Surf_63max.OUT
10/17/2006  11:07 AM           534,005 Waste-Surf_63th.OUT
10/17/2006  11:15 AM               865 Waste-Surf_72max.OUT
10/17/2006  11:15 AM           534,005 Waste-Surf_72th.OUT
10/17/2006  11:23 AM               865 Waste-Surf_81max.OUT
10/17/2006  11:23 AM           534,005 Waste-Surf_81th.OUT
10/17/2006  11:31 AM               865 Waste-Surf_90max.OUT
10/17/2006  11:31 AM           534,005 Waste-Surf_90th.OUT
10/17/2006  11:39 AM               865 Waste-Surf_99max.OUT
10/17/2006  11:39 AM           534,005 Waste-Surf_99th.OUT
10/17/2006  10:12 AM               865 Waste-Surf_9max.OUT
10/17/2006  10:12 AM           534,005 Waste-Surf_9th.OUT
10/17/2006  02:10 PM           230,400 waste_0-90.xls
10/17/2006  02:11 PM           230,400 waste_99-180.xls
             825 File(s) 37,789,887,281 bytes
               3 Dir(s)  248,220,430,336 bytes free
```

UBS-BEC Gravity File Listing

```
 Volume in drive C is 600GB 2xRAID0 (new)
 Volume Serial Number is 8A0A-E4BA

 Directory of C:\Users\Bruce\2008-000 PNNL\2008-005 AP-460\AP-460-UBS-BEC-Seismic Run\AP-
460-UBS-BEC-Gravity

01/09/2007  06:53 AM    <DIR>          .
01/09/2007  06:53 AM    <DIR>          ..
08/21/2006  06:49 AM               101 All-Forces.txt
10/13/2006  07:48 AM           120,990 AP-460-BEC-UBS-Gravity.out
08/25/2006  08:39 AM         1,707,761 AP-460-BES-BEC-Gravity.ldhi
01/02/2007  10:21 AM         3,178,496 AP-460-UBS-BEC Conc Tank Demand Gravity.xls
10/13/2006  10:21 AM           702,464 AP-460-UBS-BEC J Bolt Forces Gravity.xls
10/13/2006  10:22 AM           768,512 AP-460-UBS-BEC J-Bolt-Contact-Gravity.xls
10/13/2006  10:24 AM         7,301,632 AP-460-UBS-BEC Pri Tank Stress Gravity.xls
10/13/2006  10:19 AM         2,046,976 AP-460-UBS-BEC Soil Pressures Gravity.xls
01/09/2007  04:47 AM         3,772,416 AP-460-UBS-BEC Strain Gravity-Princ.xls
10/13/2006  11:11 AM           952,320 AP-460-UBS-BEC Waste-TH-MAX Gravity.xls
10/13/2006  07:48 AM             2,998 AP-460-UBS-BEC-Gravity.BCS
10/13/2006  07:50 AM        43,909,120 AP-460-UBS-BEC-Gravity.db
09/08/2006  06:55 AM        63,897,600 AP-460-UBS-BEC-Gravity.dbb
10/13/2006  07:48 AM        12,713,984 AP-460-UBS-BEC-Gravity.emat
01/04/2007  01:56 PM           190,477 AP-460-UBS-BEC-Gravity.err
10/13/2006  07:48 AM       111,607,808 AP-460-UBS-BEC-Gravity.esav
10/13/2006  07:48 AM        30,015,488 AP-460-UBS-BEC-Gravity.full
10/13/2006  07:47 AM         1,744,061 AP-460-UBS-BEC-Gravity.ldhi
01/04/2007  01:57 PM            43,662 AP-460-UBS-BEC-Gravity.log
10/13/2006  07:48 AM             2,295 AP-460-UBS-BEC-Gravity.mntr
10/13/2006  07:47 AM       111,607,808 AP-460-UBS-BEC-Gravity.osav
10/13/2006  07:48 AM             1,795 AP-460-UBS-BEC-Gravity.PVTS
10/13/2006  07:48 AM       112,656,384 AP-460-UBS-BEC-Gravity.r001
10/13/2006  07:29 AM        43,974,656 AP-460-UBS-BEC-Gravity.rdb
10/13/2006  07:48 AM       186,580,992 AP-460-UBS-BEC-Gravity.rst
09/08/2006  06:33 AM                 0 AP-460-UBS-BEC-Gravity.sda
10/13/2006  07:47 AM                97 AP-460-UBS-BEC-Gravity.stat
10/13/2006  11:08 AM           684,032 AP-460-UBS-BEC-Insul-Contact-Gravity.xls
10/13/2006  11:05 AM           692,736 AP-460-UBS-BEC-Primary-Contact-Gravity.xls
08/21/2006  01:22 PM             6,042 Bolts-Friction.txt
09/08/2006  06:31 AM               277 Boundary.txt
08/25/2006  08:42 AM               221 Contact-AP.txt
08/21/2006  07:59 AM               586 Contact-Footing.txt
08/24/2006  08:01 AM               654 Contact-Insul.txt
08/21/2006  07:59 AM               655 Contact-J-Bolts.txt
08/24/2006  08:01 AM               658 Contact-Primary.txt
08/21/2006  07:59 AM               742 Contact-Soil.txt
08/21/2006  12:44 PM               632 Contact-Waste-AP.txt
01/03/2006  11:17 AM             1,616 Disp-J-Bolts.txt
05/08/2006  01:31 PM             8,616 Far-Soil.txt
01/09/2007  06:53 AM                 0 File-List.txt
10/13/2006  07:28 AM             1,904 file.bat
10/13/2006  07:28 AM                68 file.err
10/13/2006  07:28 AM               228 file.log
10/13/2005  06:54 AM               562 Fix-Soil.txt
10/13/2006  07:49 AM            10,342 Footing-Cont_max.OUT
10/13/2006  07:49 AM            33,288 Footing-Cont_th.OUT
08/21/2006  08:00 AM               894 Force-c.txt
10/13/2006  07:49 AM             4,996 Force-c_108amax.OUT
10/13/2006  07:49 AM            27,900 Force-c_108ath.OUT
10/13/2006  07:49 AM            14,716 Force-c_108max.OUT
10/13/2006  07:49 AM            49,740 Force-c_108th.OUT
10/13/2006  07:49 AM             4,996 Force-c_117amax.OUT
10/13/2006  07:49 AM            27,900 Force-c_117ath.OUT
10/13/2006  07:49 AM            14,716 Force-c_117max.OUT
10/13/2006  07:49 AM            49,740 Force-c_117th.OUT
10/13/2006  07:49 AM             4,996 Force-c_126amax.OUT
10/13/2006  07:49 AM            27,900 Force-c_126ath.OUT
10/13/2006  07:49 AM            14,716 Force-c_126max.OUT
```

```
10/13/2006  07:49 AM            49,740 Force-c_126th.OUT
10/13/2006  07:49 AM             4,996 Force-c_135amax.OUT
10/13/2006  07:49 AM            27,900 Force-c_135ath.OUT
10/13/2006  07:49 AM            14,716 Force-c_135max.OUT
10/13/2006  07:49 AM            49,740 Force-c_135th.OUT
10/13/2006  07:49 AM             4,996 Force-c_144amax.OUT
10/13/2006  07:49 AM            27,900 Force-c_144ath.OUT
10/13/2006  07:49 AM            14,716 Force-c_144max.OUT
10/13/2006  07:49 AM            49,740 Force-c_144th.OUT
10/13/2006  07:49 AM             4,996 Force-c_153amax.OUT
10/13/2006  07:49 AM            27,900 Force-c_153ath.OUT
10/13/2006  07:49 AM            14,716 Force-c_153max.OUT
10/13/2006  07:49 AM            49,740 Force-c_153th.OUT
10/13/2006  07:49 AM             4,996 Force-c_162amax.OUT
10/13/2006  07:49 AM            27,900 Force-c_162ath.OUT
10/13/2006  07:49 AM            14,716 Force-c_162max.OUT
10/13/2006  07:49 AM            49,740 Force-c_162th.OUT
10/13/2006  07:49 AM             4,996 Force-c_171amax.OUT
10/13/2006  07:49 AM            27,900 Force-c_171ath.OUT
10/13/2006  07:49 AM            14,716 Force-c_171max.OUT
10/13/2006  07:49 AM            49,740 Force-c_171th.OUT
10/13/2006  07:49 AM             4,996 Force-c_180amax.OUT
10/13/2006  07:49 AM            27,900 Force-c_180ath.OUT
10/13/2006  07:49 AM            14,716 Force-c_180max.OUT
10/13/2006  07:49 AM            49,740 Force-c_180th.OUT
10/13/2006  07:49 AM             4,996 Force-c_18amax.OUT
10/13/2006  07:49 AM            27,900 Force-c_18ath.OUT
10/13/2006  07:49 AM            14,716 Force-c_18max.OUT
10/13/2006  07:49 AM            49,740 Force-c_18th.OUT
10/13/2006  07:49 AM             4,996 Force-c_27amax.OUT
10/13/2006  07:49 AM            27,900 Force-c_27ath.OUT
10/13/2006  07:49 AM            14,716 Force-c_27max.OUT
10/13/2006  07:49 AM            49,740 Force-c_27th.OUT
10/13/2006  07:49 AM             4,996 Force-c_36amax.OUT
10/13/2006  07:49 AM            27,900 Force-c_36ath.OUT
10/13/2006  07:49 AM            14,716 Force-c_36max.OUT
10/13/2006  07:49 AM            49,740 Force-c_36th.OUT
10/13/2006  07:49 AM             4,996 Force-c_45amax.OUT
10/13/2006  07:49 AM            27,900 Force-c_45ath.OUT
10/13/2006  07:49 AM            14,716 Force-c_45max.OUT
10/13/2006  07:49 AM            49,740 Force-c_45th.OUT
10/13/2006  07:49 AM             4,996 Force-c_54amax.OUT
10/13/2006  07:49 AM            27,900 Force-c_54ath.OUT
10/13/2006  07:49 AM            14,716 Force-c_54max.OUT
10/13/2006  07:49 AM            49,740 Force-c_54th.OUT
10/13/2006  07:49 AM             4,996 Force-c_63amax.OUT
10/13/2006  07:49 AM            27,900 Force-c_63ath.OUT
10/13/2006  07:49 AM            14,716 Force-c_63max.OUT
10/13/2006  07:49 AM            49,740 Force-c_63th.OUT
10/13/2006  07:49 AM             4,996 Force-c_72amax.OUT
10/13/2006  07:49 AM            27,900 Force-c_72ath.OUT
10/13/2006  07:49 AM            14,716 Force-c_72max.OUT
10/13/2006  07:49 AM            49,740 Force-c_72th.OUT
10/13/2006  07:49 AM             4,996 Force-c_81amax.OUT
10/13/2006  07:49 AM            27,900 Force-c_81ath.OUT
10/13/2006  07:49 AM            14,716 Force-c_81max.OUT
10/13/2006  07:49 AM            49,740 Force-c_81th.OUT
10/13/2006  07:49 AM             4,996 Force-c_90amax.OUT
10/13/2006  07:49 AM            27,900 Force-c_90ath.OUT
10/13/2006  07:49 AM            14,716 Force-c_90max.OUT
10/13/2006  07:49 AM            49,740 Force-c_90th.OUT
10/13/2006  07:49 AM             4,996 Force-c_99amax.OUT
10/13/2006  07:49 AM            27,900 Force-c_99ath.OUT
10/13/2006  07:49 AM            14,716 Force-c_99max.OUT
10/13/2006  07:49 AM            49,740 Force-c_99th.OUT
10/13/2006  07:49 AM             4,996 Force-c_9amax.OUT
10/13/2006  07:49 AM            28,028 Force-c_9ath.OUT
10/13/2006  07:49 AM            14,716 Force-c_9max.OUT
10/13/2006  07:49 AM            49,868 Force-c_9th.OUT
10/13/2006  10:21 AM           137,728 force-jb.xls
```

```
10/13/2006  07:50 AM            23,352 Force-jb_r10-th.OUT
10/13/2006  07:50 AM             5,239 Force-jb_r10_max.OUT
10/13/2006  07:50 AM            23,352 Force-jb_r11-th.OUT
10/13/2006  07:50 AM             5,239 Force-jb_r11_max.OUT
10/13/2006  07:49 AM            23,480 Force-jb_r2-th.OUT
10/13/2006  07:49 AM             5,239 Force-jb_r2_max.OUT
10/13/2006  07:49 AM            23,352 Force-jb_r3-th.OUT
10/13/2006  07:49 AM             5,239 Force-jb_r3_max.OUT
10/13/2006  07:49 AM            23,352 Force-jb_r4-th.OUT
10/13/2006  07:49 AM             5,239 Force-jb_r4_max.OUT
10/13/2006  07:49 AM            23,352 Force-jb_r5-th.OUT
10/13/2006  07:49 AM             5,239 Force-jb_r5_max.OUT
10/13/2006  07:50 AM            23,352 Force-jb_r6-th.OUT
10/13/2006  07:50 AM             5,239 Force-jb_r6_max.OUT
10/13/2006  07:50 AM            23,352 Force-jb_r7-th.OUT
10/13/2006  07:50 AM             5,239 Force-jb_r7_max.OUT
10/13/2006  07:50 AM            23,352 Force-jb_r8-th.OUT
10/13/2006  07:50 AM             5,239 Force-jb_r8_max.OUT
10/13/2006  07:50 AM            23,352 Force-jb_r9-th.OUT
10/13/2006  07:50 AM             5,239 Force-jb_r9_max.OUT
08/21/2006  08:00 AM               661 Force-j_bolt.txt
12/29/2006  11:04 AM            48,644 Gravity-File-List.txt
10/13/2006  10:19 AM           446,464 import_0-90.xls
10/13/2006  10:20 AM           445,952 import_99-180.xls
10/13/2006  11:05 AM            91,648 Insul-Contact_0-90.xls
10/13/2006  11:06 AM            91,648 Insul-Contact_99-180.xls
10/13/2006  07:48 AM             3,376 Insul-Cont_108max.OUT
10/13/2006  07:48 AM            11,808 Insul-Cont_108th.OUT
10/13/2006  07:48 AM             3,376 Insul-Cont_117max.OUT
10/13/2006  07:48 AM            11,808 Insul-Cont_117th.OUT
10/13/2006  07:48 AM             3,376 Insul-Cont_126max.OUT
10/13/2006  07:48 AM            11,808 Insul-Cont_126th.OUT
10/13/2006  07:48 AM             3,376 Insul-Cont_135max.OUT
10/13/2006  07:48 AM            11,808 Insul-Cont_135th.OUT
10/13/2006  07:48 AM             3,376 Insul-Cont_144max.OUT
10/13/2006  07:48 AM            11,808 Insul-Cont_144th.OUT
10/13/2006  07:48 AM             3,376 Insul-Cont_153max.OUT
10/13/2006  07:48 AM            11,808 Insul-Cont_153th.OUT
10/13/2006  07:48 AM             3,376 Insul-Cont_162max.OUT
10/13/2006  07:48 AM            11,808 Insul-Cont_162th.OUT
10/13/2006  07:48 AM             3,376 Insul-Cont_171max.OUT
10/13/2006  07:48 AM            11,808 Insul-Cont_171th.OUT
10/13/2006  07:48 AM             3,376 Insul-Cont_180max.OUT
10/13/2006  07:48 AM            11,808 Insul-Cont_180th.OUT
10/13/2006  07:48 AM             3,376 Insul-Cont_18max.OUT
10/13/2006  07:48 AM            11,808 Insul-Cont_18th.OUT
10/13/2006  07:48 AM             3,376 Insul-Cont_27max.OUT
10/13/2006  07:48 AM            11,808 Insul-Cont_27th.OUT
10/13/2006  07:48 AM             3,376 Insul-Cont_36max.OUT
10/13/2006  07:48 AM            11,808 Insul-Cont_36th.OUT
10/13/2006  07:48 AM             3,376 Insul-Cont_45max.OUT
10/13/2006  07:48 AM            11,808 Insul-Cont_45th.OUT
10/13/2006  07:48 AM             3,376 Insul-Cont_54max.OUT
10/13/2006  07:48 AM            11,808 Insul-Cont_54th.OUT
10/13/2006  07:48 AM             3,376 Insul-Cont_63max.OUT
10/13/2006  07:48 AM            11,808 Insul-Cont_63th.OUT
10/13/2006  07:48 AM             3,376 Insul-Cont_72max.OUT
10/13/2006  07:48 AM            11,808 Insul-Cont_72th.OUT
10/13/2006  07:48 AM             3,376 Insul-Cont_81max.OUT
10/13/2006  07:48 AM            11,808 Insul-Cont_81th.OUT
10/13/2006  07:48 AM             3,376 Insul-Cont_90max.OUT
10/13/2006  07:48 AM            11,808 Insul-Cont_90th.OUT
10/13/2006  07:48 AM             3,376 Insul-Cont_99max.OUT
10/13/2006  07:48 AM            11,808 Insul-Cont_99th.OUT
10/13/2006  07:48 AM             3,376 Insul-Cont_9max.OUT
10/13/2006  07:48 AM            11,936 Insul-Cont_9th.OUT
09/01/2005  10:27 AM             1,664 Insulate.txt
07/20/2006  06:36 AM             4,030 interface-gap1.txt
08/23/2006  07:55 AM             2,411 interface1.txt
10/13/2006  10:21 AM           100,864 J-Bolt-Contact_0-90.xls
```

```
10/13/2006  10:21 AM           100,864 J-Bolt-Contact_99-180.xls
10/13/2006  07:49 AM             3,790 J-Bolt-Cont_108max.OUT
10/13/2006  07:49 AM            12,276 J-Bolt-Cont_108th.OUT
10/13/2006  07:49 AM             3,790 J-Bolt-Cont_117max.OUT
10/13/2006  07:49 AM            12,276 J-Bolt-Cont_117th.OUT
10/13/2006  07:49 AM             3,790 J-Bolt-Cont_126max.OUT
10/13/2006  07:49 AM            12,276 J-Bolt-Cont_126th.OUT
10/13/2006  07:49 AM             3,790 J-Bolt-Cont_135max.OUT
10/13/2006  07:49 AM            12,276 J-Bolt-Cont_135th.OUT
10/13/2006  07:49 AM             3,790 J-Bolt-Cont_144max.OUT
10/13/2006  07:49 AM            12,276 J-Bolt-Cont_144th.OUT
10/13/2006  07:49 AM             3,790 J-Bolt-Cont_153max.OUT
10/13/2006  07:49 AM            12,276 J-Bolt-Cont_153th.OUT
10/13/2006  07:49 AM             3,790 J-Bolt-Cont_162max.OUT
10/13/2006  07:49 AM            12,276 J-Bolt-Cont_162th.OUT
10/13/2006  07:49 AM             3,790 J-Bolt-Cont_171max.OUT
10/13/2006  07:49 AM            12,276 J-Bolt-Cont_171th.OUT
10/13/2006  07:49 AM             3,790 J-Bolt-Cont_180max.OUT
10/13/2006  07:49 AM            12,276 J-Bolt-Cont_180th.OUT
10/13/2006  07:49 AM             3,790 J-Bolt-Cont_18max.OUT
10/13/2006  07:49 AM            12,276 J-Bolt-Cont_18th.OUT
10/13/2006  07:49 AM             3,790 J-Bolt-Cont_27max.OUT
10/13/2006  07:49 AM            12,276 J-Bolt-Cont_27th.OUT
10/13/2006  07:49 AM             3,790 J-Bolt-Cont_36max.OUT
10/13/2006  07:49 AM            12,276 J-Bolt-Cont_36th.OUT
10/13/2006  07:49 AM             3,790 J-Bolt-Cont_45max.OUT
10/13/2006  07:49 AM            12,276 J-Bolt-Cont_45th.OUT
10/13/2006  07:49 AM             3,790 J-Bolt-Cont_54max.OUT
10/13/2006  07:49 AM            12,276 J-Bolt-Cont_54th.OUT
10/13/2006  07:49 AM             3,790 J-Bolt-Cont_63max.OUT
10/13/2006  07:49 AM            12,276 J-Bolt-Cont_63th.OUT
10/13/2006  07:49 AM             3,790 J-Bolt-Cont_72max.OUT
10/13/2006  07:49 AM            12,276 J-Bolt-Cont_72th.OUT
10/13/2006  07:49 AM             3,790 J-Bolt-Cont_81max.OUT
10/13/2006  07:49 AM            12,276 J-Bolt-Cont_81th.OUT
10/13/2006  07:49 AM             3,790 J-Bolt-Cont_90max.OUT
10/13/2006  07:49 AM            12,276 J-Bolt-Cont_90th.OUT
10/13/2006  07:49 AM             3,790 J-Bolt-Cont_99max.OUT
10/13/2006  07:49 AM            12,276 J-Bolt-Cont_99th.OUT
10/13/2006  07:48 AM             3,790 J-Bolt-Cont_9max.OUT
10/13/2006  07:48 AM            12,404 J-Bolt-Cont_9th.OUT
08/23/2006  07:47 AM             1,971 Liner.txt
05/02/2005  02:19 PM               667 live_load.txt
08/31/2006  03:05 PM             6,212 Near-Soil-1.txt
04/20/2005  01:14 PM               508 outer-spar.txt
10/13/2006  07:46 AM               123 Post-Tank.txt
10/13/2006  11:04 AM            91,648 Primary-Contact_0-90.xls
10/13/2006  11:05 AM            91,648 Primary-Contact_99-180.xls
10/13/2006  07:48 AM             3,376 Primary-Cont_108max.OUT
10/13/2006  07:48 AM            11,808 Primary-Cont_108th.OUT
10/13/2006  07:48 AM             3,376 Primary-Cont_117max.OUT
10/13/2006  07:48 AM            11,808 Primary-Cont_117th.OUT
10/13/2006  07:48 AM             3,376 Primary-Cont_126max.OUT
10/13/2006  07:48 AM            11,808 Primary-Cont_126th.OUT
10/13/2006  07:48 AM             3,376 Primary-Cont_135max.OUT
10/13/2006  07:48 AM            11,808 Primary-Cont_135th.OUT
10/13/2006  07:48 AM             3,376 Primary-Cont_144max.OUT
10/13/2006  07:48 AM            11,808 Primary-Cont_144th.OUT
10/13/2006  07:48 AM             3,376 Primary-Cont_153max.OUT
10/13/2006  07:48 AM            11,808 Primary-Cont_153th.OUT
10/13/2006  07:48 AM             3,376 Primary-Cont_162max.OUT
10/13/2006  07:48 AM            11,808 Primary-Cont_162th.OUT
10/13/2006  07:48 AM             3,376 Primary-Cont_171max.OUT
10/13/2006  07:48 AM            11,808 Primary-Cont_171th.OUT
10/13/2006  07:48 AM             3,376 Primary-Cont_180max.OUT
10/13/2006  07:48 AM            11,808 Primary-Cont_180th.OUT
10/13/2006  07:48 AM             3,376 Primary-Cont_18max.OUT
10/13/2006  07:48 AM            11,808 Primary-Cont_18th.OUT
10/13/2006  07:48 AM             3,376 Primary-Cont_27max.OUT
10/13/2006  07:48 AM            11,808 Primary-Cont_27th.OUT
```

```
10/13/2006  07:48 AM             3,376 Primary-Cont_36max.OUT
10/13/2006  07:48 AM            11,808 Primary-Cont_36th.OUT
10/13/2006  07:48 AM             3,376 Primary-Cont_45max.OUT
10/13/2006  07:48 AM            11,808 Primary-Cont_45th.OUT
10/13/2006  07:48 AM             3,376 Primary-Cont_54max.OUT
10/13/2006  07:48 AM            11,808 Primary-Cont_54th.OUT
10/13/2006  07:48 AM             3,376 Primary-Cont_63max.OUT
10/13/2006  07:48 AM            11,808 Primary-Cont_63th.OUT
10/13/2006  07:48 AM             3,376 Primary-Cont_72max.OUT
10/13/2006  07:48 AM            11,808 Primary-Cont_72th.OUT
10/13/2006  07:48 AM             3,376 Primary-Cont_81max.OUT
10/13/2006  07:48 AM            11,808 Primary-Cont_81th.OUT
10/13/2006  07:48 AM             3,376 Primary-Cont_90max.OUT
10/13/2006  07:48 AM            11,808 Primary-Cont_90th.OUT
10/13/2006  07:48 AM             3,376 Primary-Cont_99max.OUT
10/13/2006  07:48 AM            11,808 Primary-Cont_99th.OUT
10/13/2006  07:48 AM             3,376 Primary-Cont_9max.OUT
10/13/2006  07:48 AM            11,936 Primary-Cont_9th.OUT
10/12/2006  02:28 PM             6,028 Primary-Props-AP.txt
09/27/2005  03:52 PM             1,538 Primary.txt
10/13/2006  07:28 AM           407,510 QA.out
10/31/2005  10:31 AM             1,108 RS_FREQ.txt
10/13/2006  07:50 AM         4,615,384 Run-Tank-Out.out
10/12/2006  03:03 PM             1,823 Run-Tank.txt
01/04/2007  12:29 PM                 0 scratch.hlp
02/11/2005  01:22 PM             1,053 Slave.txt
10/13/2006  07:49 AM             9,896 Soil-Contact_108max.OUT
10/13/2006  07:49 AM            35,120 Soil-Contact_108th.OUT
10/13/2006  07:49 AM             9,896 Soil-Contact_117max.OUT
10/13/2006  07:49 AM            35,120 Soil-Contact_117th.OUT
10/13/2006  07:49 AM             9,896 Soil-Contact_126max.OUT
10/13/2006  07:49 AM            35,120 Soil-Contact_126th.OUT
10/13/2006  07:49 AM             9,896 Soil-Contact_135max.OUT
10/13/2006  07:49 AM            35,120 Soil-Contact_135th.OUT
10/13/2006  07:49 AM             9,896 Soil-Contact_144max.OUT
10/13/2006  07:49 AM            35,120 Soil-Contact_144th.OUT
10/13/2006  07:49 AM             9,896 Soil-Contact_153max.OUT
10/13/2006  07:49 AM            35,120 Soil-Contact_153th.OUT
10/13/2006  07:49 AM             9,896 Soil-Contact_162max.OUT
10/13/2006  07:49 AM            35,120 Soil-Contact_162th.OUT
10/13/2006  07:49 AM             9,896 Soil-Contact_171max.OUT
10/13/2006  07:49 AM            35,120 Soil-Contact_171th.OUT
10/13/2006  07:49 AM             9,896 Soil-Contact_180max.OUT
10/13/2006  07:49 AM            35,120 Soil-Contact_180th.OUT
10/13/2006  07:49 AM             9,896 Soil-Contact_18max.OUT
10/13/2006  07:49 AM            35,120 Soil-Contact_18th.OUT
10/13/2006  07:49 AM             9,896 Soil-Contact_27max.OUT
10/13/2006  07:49 AM            35,120 Soil-Contact_27th.OUT
10/13/2006  07:49 AM             9,896 Soil-Contact_36max.OUT
10/13/2006  07:49 AM            35,120 Soil-Contact_36th.OUT
10/13/2006  07:49 AM             9,896 Soil-Contact_45max.OUT
10/13/2006  07:49 AM            35,120 Soil-Contact_45th.OUT
10/13/2006  07:49 AM             9,896 Soil-Contact_54max.OUT
10/13/2006  07:49 AM            35,120 Soil-Contact_54th.OUT
10/13/2006  07:49 AM             9,896 Soil-Contact_63max.OUT
10/13/2006  07:49 AM            35,120 Soil-Contact_63th.OUT
10/13/2006  07:49 AM             9,896 Soil-Contact_72max.OUT
10/13/2006  07:49 AM            35,120 Soil-Contact_72th.OUT
10/13/2006  07:49 AM             9,896 Soil-Contact_81max.OUT
10/13/2006  07:49 AM            35,120 Soil-Contact_81th.OUT
10/13/2006  07:49 AM             9,896 Soil-Contact_90max.OUT
10/13/2006  07:49 AM            35,120 Soil-Contact_90th.OUT
10/13/2006  07:49 AM             9,896 Soil-Contact_99max.OUT
10/13/2006  07:49 AM            35,120 Soil-Contact_99th.OUT
10/13/2006  07:49 AM             9,896 Soil-Contact_9max.OUT
10/13/2006  07:49 AM            35,248 Soil-Contact_9th.OUT
10/13/2005  08:19 AM             5,016 Soil-Prop-UB-Geo.txt
10/13/2006  10:18 AM           230,400 soil_0-90.xls
10/13/2006  10:19 AM           230,400 soil_99-180.xls
09/01/2006  05:52 AM             1,925 Solve-Gravity-UBS.txt
```

```
08/21/2006  08:00 AM             3,363 spectra-conc-0.txt
10/31/2005  11:41 AM             1,459 spectra-conc.txt
10/14/2005  11:18 AM             2,061 spectra-concrete.txt
10/31/2005  10:16 AM             3,402 spectra-primary-0.txt
08/21/2006  08:01 AM             3,551 spectra-primary-180.txt
09/06/2005  06:49 AM             1,287 spectra-soil.txt
06/20/2005  09:04 AM               647 spectra-wall.txt
06/20/2005  08:52 AM               679 spectra-waste.txt
10/13/2006  10:22 AM           287,744 str-comp_0-90b.xls
10/13/2006  10:22 AM           288,768 str-comp_0-90m.xls
10/13/2006  10:23 AM           287,744 str-comp_0-90t.xls
10/13/2006  10:23 AM           287,744 str-comp_99-180b.xls
10/13/2006  10:23 AM           288,768 str-comp_99-180m.xls
10/13/2006  10:23 AM           287,744 str-comp_99-180t.xls
01/04/2007  12:45 PM             1,825 strain-backed-principle-bot.txt
01/03/2007  03:40 PM             1,828 strain-backed-principle-mid.txt
01/03/2007  03:41 PM             1,825 strain-backed-principle-top.txt
01/03/2007  04:02 PM               966 strain-backed-principle.txt
01/04/2007  12:46 PM             7,496 Strain-Backed-Princ_108-bot-max.OUT
01/04/2007  12:46 PM            23,628 Strain-Backed-Princ_108-bot-th.OUT
01/04/2007  12:46 PM             7,162 Strain-Backed-Princ_108-Top-max.OUT
01/04/2007  12:46 PM            22,554 Strain-Backed-Princ_108-Top-th.OUT
01/04/2007  12:46 PM             4,156 Strain-Backed-Princ_108max.OUT
01/04/2007  12:46 PM            12,888 Strain-Backed-Princ_108th.OUT
01/04/2007  12:46 PM             7,496 Strain-Backed-Princ_117-bot-max.OUT
01/04/2007  12:46 PM            23,628 Strain-Backed-Princ_117-bot-th.OUT
01/04/2007  12:46 PM             7,162 Strain-Backed-Princ_117-Top-max.OUT
01/04/2007  12:46 PM            22,554 Strain-Backed-Princ_117-Top-th.OUT
01/04/2007  12:46 PM             4,156 Strain-Backed-Princ_117max.OUT
01/04/2007  12:46 PM            12,888 Strain-Backed-Princ_117th.OUT
01/04/2007  12:46 PM             7,496 Strain-Backed-Princ_126-bot-max.OUT
01/04/2007  12:46 PM            23,628 Strain-Backed-Princ_126-bot-th.OUT
01/04/2007  12:46 PM             7,162 Strain-Backed-Princ_126-Top-max.OUT
01/04/2007  12:46 PM            22,554 Strain-Backed-Princ_126-Top-th.OUT
01/04/2007  12:46 PM             4,156 Strain-Backed-Princ_126max.OUT
01/04/2007  12:46 PM            12,888 Strain-Backed-Princ_126th.OUT
01/04/2007  12:46 PM             7,496 Strain-Backed-Princ_135-bot-max.OUT
01/04/2007  12:46 PM            23,628 Strain-Backed-Princ_135-bot-th.OUT
01/04/2007  12:46 PM             7,162 Strain-Backed-Princ_135-Top-max.OUT
01/04/2007  12:46 PM            22,554 Strain-Backed-Princ_135-Top-th.OUT
01/04/2007  12:46 PM             4,156 Strain-Backed-Princ_135max.OUT
01/04/2007  12:46 PM            12,888 Strain-Backed-Princ_135th.OUT
01/04/2007  12:46 PM             7,496 Strain-Backed-Princ_144-bot-max.OUT
01/04/2007  12:46 PM            23,628 Strain-Backed-Princ_144-bot-th.OUT
01/04/2007  12:46 PM             7,162 Strain-Backed-Princ_144-Top-max.OUT
01/04/2007  12:46 PM            22,554 Strain-Backed-Princ_144-Top-th.OUT
01/04/2007  12:46 PM             4,156 Strain-Backed-Princ_144max.OUT
01/04/2007  12:46 PM            12,888 Strain-Backed-Princ_144th.OUT
01/04/2007  12:46 PM             7,496 Strain-Backed-Princ_153-bot-max.OUT
01/04/2007  12:46 PM            23,628 Strain-Backed-Princ_153-bot-th.OUT
01/04/2007  12:46 PM             7,162 Strain-Backed-Princ_153-Top-max.OUT
01/04/2007  12:46 PM            22,554 Strain-Backed-Princ_153-Top-th.OUT
01/04/2007  12:46 PM             4,156 Strain-Backed-Princ_153max.OUT
01/04/2007  12:46 PM            12,888 Strain-Backed-Princ_153th.OUT
01/04/2007  12:46 PM             7,496 Strain-Backed-Princ_162-bot-max.OUT
01/04/2007  12:46 PM            23,628 Strain-Backed-Princ_162-bot-th.OUT
01/04/2007  12:46 PM             7,162 Strain-Backed-Princ_162-Top-max.OUT
01/04/2007  12:46 PM            22,554 Strain-Backed-Princ_162-Top-th.OUT
01/04/2007  12:46 PM             4,156 Strain-Backed-Princ_162max.OUT
01/04/2007  12:46 PM            12,888 Strain-Backed-Princ_162th.OUT
01/04/2007  12:46 PM             7,496 Strain-Backed-Princ_171-bot-max.OUT
01/04/2007  12:46 PM            23,628 Strain-Backed-Princ_171-bot-th.OUT
01/04/2007  12:46 PM             7,162 Strain-Backed-Princ_171-Top-max.OUT
01/04/2007  12:46 PM            22,554 Strain-Backed-Princ_171-Top-th.OUT
01/04/2007  12:46 PM             4,156 Strain-Backed-Princ_171max.OUT
01/04/2007  12:46 PM            12,888 Strain-Backed-Princ_171th.OUT
01/04/2007  12:45 PM             7,496 Strain-Backed-Princ_18-bot-max.OUT
01/04/2007  12:45 PM            23,628 Strain-Backed-Princ_18-bot-th.OUT
01/04/2007  12:46 PM             7,162 Strain-Backed-Princ_18-Top-max.OUT
01/04/2007  12:46 PM            22,554 Strain-Backed-Princ_18-Top-th.OUT
```

```
01/04/2007  12:46 PM             7,496 Strain-Backed-Princ_180-bot-max.OUT
01/04/2007  12:46 PM            23,628 Strain-Backed-Princ_180-bot-th.OUT
01/04/2007  12:46 PM             7,162 Strain-Backed-Princ_180-Top-max.OUT
01/04/2007  12:46 PM            22,554 Strain-Backed-Princ_180-Top-th.OUT
01/04/2007  12:46 PM             4,156 Strain-Backed-Princ_180max.OUT
01/04/2007  12:46 PM            12,888 Strain-Backed-Princ_180th.OUT
01/04/2007  12:46 PM             4,156 Strain-Backed-Princ_18max.OUT
01/04/2007  12:46 PM            12,888 Strain-Backed-Princ_18th.OUT
01/04/2007  12:45 PM             7,496 Strain-Backed-Princ_27-bot-max.OUT
01/04/2007  12:45 PM            23,628 Strain-Backed-Princ_27-bot-th.OUT
01/04/2007  12:46 PM             7,162 Strain-Backed-Princ_27-Top-max.OUT
01/04/2007  12:46 PM            22,554 Strain-Backed-Princ_27-Top-th.OUT
01/04/2007  12:46 PM             4,156 Strain-Backed-Princ_27max.OUT
01/04/2007  12:46 PM            12,888 Strain-Backed-Princ_27th.OUT
01/04/2007  12:46 PM             7,496 Strain-Backed-Princ_36-bot-max.OUT
01/04/2007  12:46 PM            23,628 Strain-Backed-Princ_36-bot-th.OUT
01/04/2007  12:46 PM             7,162 Strain-Backed-Princ_36-Top-max.OUT
01/04/2007  12:46 PM            22,554 Strain-Backed-Princ_36-Top-th.OUT
01/04/2007  12:46 PM             4,156 Strain-Backed-Princ_36max.OUT
01/04/2007  12:46 PM            12,888 Strain-Backed-Princ_36th.OUT
01/04/2007  12:46 PM             7,496 Strain-Backed-Princ_45-bot-max.OUT
01/04/2007  12:46 PM            23,628 Strain-Backed-Princ_45-bot-th.OUT
01/04/2007  12:46 PM             7,162 Strain-Backed-Princ_45-Top-max.OUT
01/04/2007  12:46 PM            22,554 Strain-Backed-Princ_45-Top-th.OUT
01/04/2007  12:46 PM             4,156 Strain-Backed-Princ_45max.OUT
01/04/2007  12:46 PM            12,888 Strain-Backed-Princ_45th.OUT
01/04/2007  12:46 PM             7,496 Strain-Backed-Princ_54-bot-max.OUT
01/04/2007  12:46 PM            23,628 Strain-Backed-Princ_54-bot-th.OUT
01/04/2007  12:46 PM             7,162 Strain-Backed-Princ_54-Top-max.OUT
01/04/2007  12:46 PM            22,554 Strain-Backed-Princ_54-Top-th.OUT
01/04/2007  12:46 PM             4,156 Strain-Backed-Princ_54max.OUT
01/04/2007  12:46 PM            12,888 Strain-Backed-Princ_54th.OUT
01/04/2007  12:46 PM             7,496 Strain-Backed-Princ_63-bot-max.OUT
01/04/2007  12:46 PM            23,628 Strain-Backed-Princ_63-bot-th.OUT
01/04/2007  12:46 PM             7,162 Strain-Backed-Princ_63-Top-max.OUT
01/04/2007  12:46 PM            22,554 Strain-Backed-Princ_63-Top-th.OUT
01/04/2007  12:46 PM             4,156 Strain-Backed-Princ_63max.OUT
01/04/2007  12:46 PM            12,888 Strain-Backed-Princ_63th.OUT
01/04/2007  12:46 PM             7,496 Strain-Backed-Princ_72-bot-max.OUT
01/04/2007  12:46 PM            23,628 Strain-Backed-Princ_72-bot-th.OUT
01/04/2007  12:46 PM             7,162 Strain-Backed-Princ_72-Top-max.OUT
01/04/2007  12:46 PM            22,554 Strain-Backed-Princ_72-Top-th.OUT
01/04/2007  12:46 PM             4,156 Strain-Backed-Princ_72max.OUT
01/04/2007  12:46 PM            12,888 Strain-Backed-Princ_72th.OUT
01/04/2007  12:46 PM             7,496 Strain-Backed-Princ_81-bot-max.OUT
01/04/2007  12:46 PM            23,628 Strain-Backed-Princ_81-bot-th.OUT
01/04/2007  12:46 PM             7,162 Strain-Backed-Princ_81-Top-max.OUT
01/04/2007  12:46 PM            22,554 Strain-Backed-Princ_81-Top-th.OUT
01/04/2007  12:46 PM             4,156 Strain-Backed-Princ_81max.OUT
01/04/2007  12:46 PM            12,888 Strain-Backed-Princ_81th.OUT
01/04/2007  12:45 PM             7,496 Strain-Backed-Princ_9-bot-max.OUT
01/04/2007  12:45 PM            23,756 Strain-Backed-Princ_9-bot-th.OUT
01/04/2007  12:46 PM             7,162 Strain-Backed-Princ_9-Top-max.OUT
01/04/2007  12:46 PM            22,682 Strain-Backed-Princ_9-Top-th.OUT
01/04/2007  12:46 PM             7,496 Strain-Backed-Princ_90-bot-max.OUT
01/04/2007  12:46 PM            23,628 Strain-Backed-Princ_90-bot-th.OUT
01/04/2007  12:46 PM             7,162 Strain-Backed-Princ_90-Top-max.OUT
01/04/2007  12:46 PM            22,554 Strain-Backed-Princ_90-Top-th.OUT
01/04/2007  12:46 PM             4,156 Strain-Backed-Princ_90max.OUT
01/04/2007  12:46 PM            12,888 Strain-Backed-Princ_90th.OUT
01/04/2007  12:46 PM             7,496 Strain-Backed-Princ_99-bot-max.OUT
01/04/2007  12:46 PM            23,628 Strain-Backed-Princ_99-bot-th.OUT
01/04/2007  12:46 PM             7,162 Strain-Backed-Princ_99-Top-max.OUT
01/04/2007  12:46 PM            22,554 Strain-Backed-Princ_99-Top-th.OUT
01/04/2007  12:46 PM             4,156 Strain-Backed-Princ_99max.OUT
01/04/2007  12:46 PM            12,888 Strain-Backed-Princ_99th.OUT
01/04/2007  12:46 PM             4,156 Strain-Backed-Princ_9max.OUT
01/04/2007  12:46 PM            13,016 Strain-Backed-Princ_9th.OUT
09/05/2006  02:00 PM             2,588 strain-backed.txt
08/30/2006  09:47 AM               621 strain-compb-primary.txt
```

```
08/21/2006  08:01 AM               693 strain-compb.txt
08/30/2006  09:47 AM               621 strain-compm-primary.txt
08/21/2006  08:01 AM               705 strain-compm.txt
08/30/2006  09:47 AM               621 strain-compt-primary.txt
08/21/2006  08:02 AM               720 strain-compt.txt
08/21/2006  08:02 AM               730 Strain-Liner-floor.txt
08/21/2006  08:02 AM               962 Strain-Liner-wall.txt
08/16/2006  03:01 PM               545 Strain-Liner.txt
08/16/2006  02:01 PM               292 Strain-Primary.txt
01/09/2007  04:42 AM           113,152 Strain-Princ_0-90.xls
01/09/2007  04:41 AM           187,904 Strain-Princ_0-90b.xls
01/09/2007  04:42 AM           180,224 Strain-Princ_0-90t.xls
01/09/2007  04:42 AM           113,152 Strain-Princ_99-180.xls
01/09/2007  04:42 AM           188,416 Strain-Princ_99-180b.xls
01/09/2007  04:42 AM           180,736 Strain-Princ_99-180t.xls
08/30/2006  09:38 AM               274 Strain.txt
10/20/2006  10:07 AM           254,976 Strain_0-90.xls
10/20/2006  10:08 AM           254,976 Strain_99-180.xls
08/21/2006  08:02 AM               554 stress-compb-primary.txt
08/21/2006  08:02 AM               598 stress-compb.txt
08/21/2006  08:03 AM               554 stress-compm-primary.txt
08/21/2006  08:03 AM               608 stress-compm.txt
08/21/2006  08:03 AM               554 stress-compt-primary.txt
08/24/2006  03:19 PM               598 stress-compt.txt
08/17/2006  11:19 AM               207 Stress-Primary-M.txt
08/24/2006  12:05 PM               224 Stress-Primary.txt
10/13/2006  07:49 AM            13,519 Stress-pt_108max-b.OUT
10/13/2006  07:49 AM            13,519 Stress-pt_108max-m.OUT
10/13/2006  07:49 AM            13,519 Stress-pt_108max-t.OUT
10/13/2006  07:49 AM            55,924 Stress-pt_108th-b.OUT
10/13/2006  07:49 AM            55,924 Stress-pt_108th-m.OUT
10/13/2006  07:49 AM            55,728 Stress-pt_108th-t.OUT
10/13/2006  07:49 AM            13,519 Stress-pt_117max-b.OUT
10/13/2006  07:49 AM            13,519 Stress-pt_117max-m.OUT
10/13/2006  07:49 AM            13,519 Stress-pt_117max-t.OUT
10/13/2006  07:49 AM            55,924 Stress-pt_117th-b.OUT
10/13/2006  07:49 AM            55,924 Stress-pt_117th-m.OUT
10/13/2006  07:49 AM            55,728 Stress-pt_117th-t.OUT
10/13/2006  07:49 AM            13,519 Stress-pt_126max-b.OUT
10/13/2006  07:49 AM            13,519 Stress-pt_126max-m.OUT
10/13/2006  07:49 AM            13,519 Stress-pt_126max-t.OUT
10/13/2006  07:49 AM            55,924 Stress-pt_126th-b.OUT
10/13/2006  07:49 AM            55,924 Stress-pt_126th-m.OUT
10/13/2006  07:49 AM            55,728 Stress-pt_126th-t.OUT
10/13/2006  07:49 AM            13,519 Stress-pt_135max-b.OUT
10/13/2006  07:49 AM            13,519 Stress-pt_135max-m.OUT
10/13/2006  07:49 AM            13,519 Stress-pt_135max-t.OUT
10/13/2006  07:49 AM            55,924 Stress-pt_135th-b.OUT
10/13/2006  07:49 AM            55,924 Stress-pt_135th-m.OUT
10/13/2006  07:49 AM            55,728 Stress-pt_135th-t.OUT
10/13/2006  07:49 AM            13,519 Stress-pt_144max-b.OUT
10/13/2006  07:49 AM            13,519 Stress-pt_144max-m.OUT
10/13/2006  07:49 AM            13,519 Stress-pt_144max-t.OUT
10/13/2006  07:49 AM            55,924 Stress-pt_144th-b.OUT
10/13/2006  07:49 AM            55,924 Stress-pt_144th-m.OUT
10/13/2006  07:49 AM            55,728 Stress-pt_144th-t.OUT
10/13/2006  07:49 AM            13,519 Stress-pt_153max-b.OUT
10/13/2006  07:49 AM            13,519 Stress-pt_153max-m.OUT
10/13/2006  07:49 AM            13,519 Stress-pt_153max-t.OUT
10/13/2006  07:49 AM            55,924 Stress-pt_153th-b.OUT
10/13/2006  07:49 AM            55,924 Stress-pt_153th-m.OUT
10/13/2006  07:49 AM            55,728 Stress-pt_153th-t.OUT
10/13/2006  07:49 AM            13,519 Stress-pt_162max-b.OUT
10/13/2006  07:49 AM            13,519 Stress-pt_162max-m.OUT
10/13/2006  07:49 AM            13,519 Stress-pt_162max-t.OUT
10/13/2006  07:49 AM            55,924 Stress-pt_162th-b.OUT
10/13/2006  07:49 AM            55,924 Stress-pt_162th-m.OUT
10/13/2006  07:49 AM            55,728 Stress-pt_162th-t.OUT
10/13/2006  07:49 AM            13,521 Stress-pt_171max-b.OUT
10/13/2006  07:49 AM            13,521 Stress-pt_171max-m.OUT
```

```
10/13/2006  07:49 AM              13,521 Stress-pt_171max-t.OUT
10/13/2006  07:49 AM              55,924 Stress-pt_171th-b.OUT
10/13/2006  07:49 AM              55,924 Stress-pt_171th-m.OUT
10/13/2006  07:49 AM              55,728 Stress-pt_171th-t.OUT
10/13/2006  07:49 AM              13,521 Stress-pt_180max-b.OUT
10/13/2006  07:49 AM              13,521 Stress-pt_180max-m.OUT
10/13/2006  07:49 AM              13,521 Stress-pt_180max-t.OUT
10/13/2006  07:49 AM              55,924 Stress-pt_180th-b.OUT
10/13/2006  07:49 AM              55,924 Stress-pt_180th-m.OUT
10/13/2006  07:49 AM              55,728 Stress-pt_180th-t.OUT
10/13/2006  07:49 AM              13,519 Stress-pt_18max-b.OUT
10/13/2006  07:49 AM              13,519 Stress-pt_18max-m.OUT
10/13/2006  07:49 AM              13,519 Stress-pt_18max-t.OUT
10/13/2006  07:49 AM              55,924 Stress-pt_18th-b.OUT
10/13/2006  07:49 AM              55,924 Stress-pt_18th-m.OUT
10/13/2006  07:49 AM              55,728 Stress-pt_18th-t.OUT
10/13/2006  07:49 AM              13,519 Stress-pt_27max-b.OUT
10/13/2006  07:49 AM              13,519 Stress-pt_27max-m.OUT
10/13/2006  07:49 AM              13,519 Stress-pt_27max-t.OUT
10/13/2006  07:49 AM              55,924 Stress-pt_27th-b.OUT
10/13/2006  07:49 AM              55,924 Stress-pt_27th-m.OUT
10/13/2006  07:49 AM              55,728 Stress-pt_27th-t.OUT
10/13/2006  07:49 AM              13,519 Stress-pt_36max-b.OUT
10/13/2006  07:49 AM              13,519 Stress-pt_36max-m.OUT
10/13/2006  07:49 AM              13,519 Stress-pt_36max-t.OUT
10/13/2006  07:49 AM              55,924 Stress-pt_36th-b.OUT
10/13/2006  07:49 AM              55,924 Stress-pt_36th-m.OUT
10/13/2006  07:49 AM              55,728 Stress-pt_36th-t.OUT
10/13/2006  07:49 AM              13,519 Stress-pt_45max-b.OUT
10/13/2006  07:49 AM              13,519 Stress-pt_45max-m.OUT
10/13/2006  07:49 AM              13,519 Stress-pt_45max-t.OUT
10/13/2006  07:49 AM              55,924 Stress-pt_45th-b.OUT
10/13/2006  07:49 AM              55,924 Stress-pt_45th-m.OUT
10/13/2006  07:49 AM              55,728 Stress-pt_45th-t.OUT
10/13/2006  07:49 AM              13,519 Stress-pt_54max-b.OUT
10/13/2006  07:49 AM              13,519 Stress-pt_54max-m.OUT
10/13/2006  07:49 AM              13,519 Stress-pt_54max-t.OUT
10/13/2006  07:49 AM              55,924 Stress-pt_54th-b.OUT
10/13/2006  07:49 AM              55,924 Stress-pt_54th-m.OUT
10/13/2006  07:49 AM              55,728 Stress-pt_54th-t.OUT
10/13/2006  07:49 AM              13,519 Stress-pt_63max-b.OUT
10/13/2006  07:49 AM              13,519 Stress-pt_63max-m.OUT
10/13/2006  07:49 AM              13,519 Stress-pt_63max-t.OUT
10/13/2006  07:49 AM              55,924 Stress-pt_63th-b.OUT
10/13/2006  07:49 AM              55,924 Stress-pt_63th-m.OUT
10/13/2006  07:49 AM              55,728 Stress-pt_63th-t.OUT
10/13/2006  07:49 AM              13,519 Stress-pt_72max-b.OUT
10/13/2006  07:49 AM              13,519 Stress-pt_72max-m.OUT
10/13/2006  07:49 AM              13,519 Stress-pt_72max-t.OUT
10/13/2006  07:49 AM              55,924 Stress-pt_72th-b.OUT
10/13/2006  07:49 AM              55,924 Stress-pt_72th-m.OUT
10/13/2006  07:49 AM              55,728 Stress-pt_72th-t.OUT
10/13/2006  07:49 AM              13,519 Stress-pt_81max-b.OUT
10/13/2006  07:49 AM              13,519 Stress-pt_81max-m.OUT
10/13/2006  07:49 AM              13,519 Stress-pt_81max-t.OUT
10/13/2006  07:49 AM              55,924 Stress-pt_81th-b.OUT
10/13/2006  07:49 AM              55,924 Stress-pt_81th-m.OUT
10/13/2006  07:49 AM              55,728 Stress-pt_81th-t.OUT
10/13/2006  07:49 AM              13,519 Stress-pt_90max-b.OUT
10/13/2006  07:49 AM              13,519 Stress-pt_90max-m.OUT
10/13/2006  07:49 AM              13,519 Stress-pt_90max-t.OUT
10/13/2006  07:49 AM              55,924 Stress-pt_90th-b.OUT
10/13/2006  07:49 AM              55,924 Stress-pt_90th-m.OUT
10/13/2006  07:49 AM              55,728 Stress-pt_90th-t.OUT
10/13/2006  07:49 AM              13,519 Stress-pt_99max-b.OUT
10/13/2006  07:49 AM              13,519 Stress-pt_99max-m.OUT
10/13/2006  07:49 AM              13,519 Stress-pt_99max-t.OUT
10/13/2006  07:49 AM              55,924 Stress-pt_99th-b.OUT
10/13/2006  07:49 AM              55,924 Stress-pt_99th-m.OUT
10/13/2006  07:49 AM              55,728 Stress-pt_99th-t.OUT
```

```
10/13/2006  07:49 AM           13,519 Stress-pt_9max-b.OUT
10/13/2006  07:49 AM           13,519 Stress-pt_9max-m.OUT
10/13/2006  07:49 AM           13,519 Stress-pt_9max-t.OUT
10/13/2006  07:49 AM           56,052 Stress-pt_9th-b.OUT
10/13/2006  07:49 AM           56,052 Stress-pt_9th-m.OUT
10/13/2006  07:49 AM           55,856 Stress-pt_9th-t.OUT
10/12/2006  02:29 PM            4,009 Tank-Coordinates-AP.txt
05/25/2005  03:32 PM            2,512 Tank-Mesh1.txt
10/13/2006  07:28 AM              102 tank-out.out
08/25/2006  07:52 AM            5,450 Tank-Props-BEC-250.txt
10/13/2006  07:28 AM            4,692 Tank-th.out
12/22/2005  12:43 PM           10,035 temp.log
05/16/2005  03:42 PM           41,472 TH-266-UB-Geo-V.txt
05/16/2005  08:45 AM           41,391 TH-266-UB-Geo.txt
10/13/2006  07:48 AM           10,180 Waste-Cont_108max.OUT
10/13/2006  07:48 AM           40,114 Waste-Cont_108th.OUT
10/13/2006  07:48 AM           10,180 Waste-Cont_117max.OUT
10/13/2006  07:48 AM           40,114 Waste-Cont_117th.OUT
10/13/2006  07:48 AM           10,180 Waste-Cont_126max.OUT
10/13/2006  07:48 AM           40,114 Waste-Cont_126th.OUT
10/13/2006  07:48 AM           10,180 Waste-Cont_135max.OUT
10/13/2006  07:48 AM           40,114 Waste-Cont_135th.OUT
10/13/2006  07:48 AM           10,180 Waste-Cont_144max.OUT
10/13/2006  07:48 AM           40,114 Waste-Cont_144th.OUT
10/13/2006  07:48 AM           10,180 Waste-Cont_153max.OUT
10/13/2006  07:48 AM           40,114 Waste-Cont_153th.OUT
10/13/2006  07:48 AM           10,180 Waste-Cont_162max.OUT
10/13/2006  07:48 AM           40,114 Waste-Cont_162th.OUT
10/13/2006  07:48 AM           10,180 Waste-Cont_171max.OUT
10/13/2006  07:48 AM           40,114 Waste-Cont_171th.OUT
10/13/2006  07:48 AM           10,180 Waste-Cont_180max.OUT
10/13/2006  07:48 AM           40,114 Waste-Cont_180th.OUT
10/13/2006  07:48 AM           10,180 Waste-Cont_18max.OUT
10/13/2006  07:48 AM           40,114 Waste-Cont_18th.OUT
10/13/2006  07:48 AM           10,180 Waste-Cont_27max.OUT
10/13/2006  07:48 AM           40,114 Waste-Cont_27th.OUT
10/13/2006  07:48 AM           10,180 Waste-Cont_36max.OUT
10/13/2006  07:48 AM           40,114 Waste-Cont_36th.OUT
10/13/2006  07:48 AM           10,180 Waste-Cont_45max.OUT
10/13/2006  07:48 AM           40,114 Waste-Cont_45th.OUT
10/13/2006  07:48 AM           10,180 Waste-Cont_54max.OUT
10/13/2006  07:48 AM           40,114 Waste-Cont_54th.OUT
10/13/2006  07:48 AM           10,180 Waste-Cont_63max.OUT
10/13/2006  07:48 AM           40,114 Waste-Cont_63th.OUT
10/13/2006  07:48 AM           10,180 Waste-Cont_72max.OUT
10/13/2006  07:48 AM           40,114 Waste-Cont_72th.OUT
10/13/2006  07:48 AM           10,180 Waste-Cont_81max.OUT
10/13/2006  07:48 AM           40,114 Waste-Cont_81th.OUT
10/13/2006  07:48 AM           10,180 Waste-Cont_90max.OUT
10/13/2006  07:48 AM           40,114 Waste-Cont_90th.OUT
10/13/2006  07:48 AM           10,180 Waste-Cont_99max.OUT
10/13/2006  07:48 AM           40,114 Waste-Cont_99th.OUT
10/13/2006  07:48 AM           10,180 Waste-Cont_9max.OUT
10/13/2006  07:48 AM           40,242 Waste-Cont_9th.OUT
08/21/2006  01:31 PM              339 Waste-Reaction.txt
10/12/2006  02:27 PM           10,266 Waste-solid-AP-S.txt
08/21/2006  08:03 AM              776 Waste-Surface-AP.txt
10/13/2006  07:49 AM              865 Waste-Surf_0max.OUT
10/13/2006  07:49 AM            6,519 Waste-Surf_0th.OUT
10/13/2006  07:49 AM              865 Waste-Surf_108max.OUT
10/13/2006  07:49 AM            6,391 Waste-Surf_108th.OUT
10/13/2006  07:49 AM              865 Waste-Surf_117max.OUT
10/13/2006  07:49 AM            6,391 Waste-Surf_117th.OUT
10/13/2006  07:49 AM              865 Waste-Surf_126max.OUT
10/13/2006  07:49 AM            6,391 Waste-Surf_126th.OUT
10/13/2006  07:49 AM              865 Waste-Surf_135max.OUT
10/13/2006  07:49 AM            6,391 Waste-Surf_135th.OUT
10/13/2006  07:49 AM              865 Waste-Surf_144max.OUT
10/13/2006  07:49 AM            6,391 Waste-Surf_144th.OUT
10/13/2006  07:49 AM              865 Waste-Surf_153max.OUT
```

```
10/13/2006  07:49 AM             6,391 Waste-Surf_153th.OUT
10/13/2006  07:49 AM               865 Waste-Surf_162max.OUT
10/13/2006  07:49 AM             6,391 Waste-Surf_162th.OUT
10/13/2006  07:49 AM               865 Waste-Surf_171max.OUT
10/13/2006  07:49 AM             6,391 Waste-Surf_171th.OUT
10/13/2006  07:49 AM               865 Waste-Surf_180max.OUT
10/13/2006  07:49 AM             6,391 Waste-Surf_180th.OUT
10/13/2006  07:49 AM               865 Waste-Surf_189max.OUT
10/13/2006  07:49 AM             6,391 Waste-Surf_189th.OUT
10/13/2006  07:49 AM               865 Waste-Surf_18max.OUT
10/13/2006  07:49 AM             6,391 Waste-Surf_18th.OUT
10/13/2006  07:49 AM               865 Waste-Surf_27max.OUT
10/13/2006  07:49 AM             6,391 Waste-Surf_27th.OUT
10/13/2006  07:49 AM               865 Waste-Surf_36max.OUT
10/13/2006  07:49 AM             6,391 Waste-Surf_36th.OUT
10/13/2006  07:49 AM               865 Waste-Surf_45max.OUT
10/13/2006  07:49 AM             6,391 Waste-Surf_45th.OUT
10/13/2006  07:49 AM               865 Waste-Surf_54max.OUT
10/13/2006  07:49 AM             6,391 Waste-Surf_54th.OUT
10/13/2006  07:49 AM               865 Waste-Surf_63max.OUT
10/13/2006  07:49 AM             6,391 Waste-Surf_63th.OUT
10/13/2006  07:49 AM               865 Waste-Surf_72max.OUT
10/13/2006  07:49 AM             6,391 Waste-Surf_72th.OUT
10/13/2006  07:49 AM               865 Waste-Surf_81max.OUT
10/13/2006  07:49 AM             6,391 Waste-Surf_81th.OUT
10/13/2006  07:49 AM               865 Waste-Surf_90max.OUT
10/13/2006  07:49 AM             6,391 Waste-Surf_90th.OUT
10/13/2006  07:49 AM               865 Waste-Surf_99max.OUT
10/13/2006  07:49 AM             6,391 Waste-Surf_99th.OUT
10/13/2006  07:49 AM               865 Waste-Surf_9max.OUT
10/13/2006  07:49 AM             6,391 Waste-Surf_9th.OUT
10/13/2006  11:10 AM           229,888 waste_0-90.xls
10/13/2006  11:10 AM           229,888 waste_99-180.xls
             722 File(s)    762,881,950 bytes
               2 Dir(s)  248,220,377,088 bytes free
```

APPENDIX I

Best Estimate Soil
Fully Cracked Concrete

Results
Load Case Specific Input Files
File Listing

LIST OF TABLES

Table 1 BES-FCC Concrete Forces and Moment, Gravity Load Only

AP Primary Tank, Best Estimate Soil (Geomatrix), Gravity Only, Fully Cracked Concrete, 460 in. Waste Level at 1.83 SpG

ANSYS MAXIMUMS BY PATH

PNNL Section No.	Path (in.)	Gravity Hoop Force (kip/ft) AP-BES-FCC	Gravity Meridonal Force (kip/ft) AP-BES-FCC	Gravity -In-Plane Shear Force (kip/ft) AP-BES-FCC	Gravity Hoop Moment (ft*kip/ft) AP-BES-FCC	Gravity Meridonal Moment (ft*kip/ft) AP-BES-FCC	Gravity Through-Wall Shear Force (kip/ft) AP-BES-FCC
2	**67.734**	-54.230	-65.850	-0.060	-7.563	-6.218	2.491
3	**105.676**	-42.100	-59.650	-0.060	-4.301	-1.047	2.463
4	**137.076**	-39.130	-55.280	-0.021	-3.426	3.290	2.192
6	**182.856**	-32.560	-51.110	-0.063	-2.003	5.501	0.494
8	**226.570**	-24.750	-48.630	-0.070	-0.368	4.274	-1.235
9	**275.574**	-29.800	-48.550	-0.032	-1.001	1.605	-1.101
11	**325.697**	-24.140	-49.250	-0.020	-1.073	-1.526	-0.824
13	**372.312**	-21.430	-50.160	-0.046	-2.361	-2.161	-0.671
17	**423.434**	-10.500	-52.830	-0.088	-3.770	-0.557	1.411
20	**468.315**	6.412	-52.740	-0.103	-1.054	20.020	7.914
22	**515.319**	15.140	-54.730	-0.076	4.426	27.140	-3.729
24	**553.722**	0.176	-54.420	-0.043	1.691	9.244	-6.579
26	**593.805**	-13.620	-56.390	-0.021	-0.328	-1.804	-1.594
30	**644.355**	-24.390	-58.230	0.008	-0.478	-2.651	0.820
33	**693.605**	-28.650	-59.600	0.004	-0.101	-0.557	0.304
35	**740.705**	-30.420	-60.990	0.003	0.019	0.101	-0.026
38	**786.205**	-28.840	-62.360	-0.003	-0.168	-0.928	-0.285
41	**844.605**	-27.080	-64.140	-0.004	-0.164	-0.907	-0.265
43	**901.355**	-12.730	-26.190	0.005	-0.119	-0.661	1.029
46	**932.355**	-16.040	-63.150	0.026	-0.582	-3.062	-2.114
48	**1007.355**	-2.505	-7.697	0.430	-2.083	8.061	-4.653
51	**1053.855**	-1.606	-9.120	0.603	-0.577	3.855	6.516
53	**1086.855**	0.393	-1.623	0.167	1.094	4.759	-8.257
55	**1105.855**	0.533	-0.701	0.105	0.077	0.239	-0.217
57	**1147.355**	0.539	-0.301	0.073	0.012	0.033	-0.021
58	**1207.355**	0.930	0.628	0.032	0.006	0.003	0.011
59	**1267.355**	1.014	0.969	0.011	0.012	0.019	-0.007
60	**1327.355**	1.235	1.336	-0.016	0.012	0.015	0.007
61	**1387.355**	0.891	1.683	-0.070	0.008	0.008	-0.014
62	**1449.355**	3.007	3.077	-0.028	0.045	0.222	0.144

Note: Meridonal/Hoop Forces and Meridonal/Hoop Moments are Reversed in Highlighted Sections.

Table 2 BES-FCC Concrete Forces and Moments, Gravity Plus Seismic Load

1/2/2007, 10:41 AM

AP- Primary Tank, Best Estimate Soil (Geomatrix), Fully Cracked Concrete, 460 in. Waste Level at 1.83 SpG

ANSYS MAXIMUMS BY PATH

PNNL Section No.	Path (in.)	Seismic Hoop Force (kip/ft) AP-BES-FCC	Seismic Meridonal Force (kip/ft) AP-BES-FCC	Seismic -In-Plane Shear Force (kip/ft) AP-BES-FCC	Seismic Hoop Moment (ft*kip/ft) AP-BES-FCC	Seismic Meridonal Moment (ft*kip/ft) AP-BES-FCC	Seismic Through-Wall Shear Force (kip/ft) AP-BES FCC
2	**67.734**	-77.070	-90.430	5.360	-14.710	-15.710	4.795
3	**105.676**	-60.690	-82.590	6.896	-9.053	-6.865	5.197
4	**137.076**	-55.760	-76.170	7.419	-7.270	7.907	4.812
6	**182.856**	-45.760	-68.750	7.470	-4.220	10.620	2.477
8	**226.570**	-36.850	-63.210	7.575	-1.334	11.150	1.968
9	**275.574**	-48.820	-61.770	8.908	-1.971	4.159	1.873
11	**325.697**	-38.750	-62.480	11.360	-1.587	-2.370	1.224
13	**372.312**	-37.400	-63.270	13.710	-3.203	-4.080	1.305
17	**423.434**	-30.800	-65.750	18.080	-5.077	-4.595	2.320
20	**468.315**	31.200	-64.790	20.810	-3.356	27.690	9.604
22	**515.319**	31.480	-65.430	20.700	5.888	33.940	5.434
24	**553.722**	-7.690	-66.180	20.080	2.047	11.140	8.166
26	**593.805**	-19.030	-69.070	19.950	-0.484	-2.626	1.913
30	**644.355**	-29.280	-70.050	20.020	-0.589	-3.212	1.009
33	**693.605**	-33.380	-70.050	20.250	-0.156	-0.787	0.354
35	**740.705**	-35.330	-70.100	20.730	0.048	0.253	0.100
38	**786.205**	-33.280	-71.650	21.270	-0.217	-1.152	0.366
41	**844.605**	-31.020	-73.680	22.490	-0.258	-1.405	0.450
43	**901.355**	-14.410	-30.180	10.860	-0.240	-1.331	1.632
46	**932.355**	-25.230	-72.870	23.900	-0.666	-3.660	3.103
48	**1007.355**	-11.360	-12.120	8.330	-2.435	9.298	5.368
51	**1053.855**	-5.454	-12.900	5.970	-0.674	4.451	7.514
53	**1086.855**	4.081	-5.382	3.233	1.263	5.493	9.506
55	**1105.855**	3.547	-4.501	2.844	0.109	0.321	0.349
57	**1147.355**	2.644	-2.742	1.916	0.021	0.057	0.055
58	**1207.355**	3.226	2.724	1.564	0.010	0.012	0.041
59	**1267.355**	3.116	2.927	1.260	0.024	0.042	0.033
60	**1327.355**	3.459	3.362	1.054	0.021	0.035	0.037
61	**1387.355**	2.317	3.863	0.809	0.015	0.023	0.054
62	**1449.355**	7.296	6.898	0.958	0.139	0.314	0.263

Note: Meridonal/Hoop Forces and Meridonal/Hoop Moments are Reversed in Highlighted Sections.

Table 3 BES-FCC Concrete Forces and Moments, Seismic Only

1/2/2007, 10:40 AM

AP- Primary Tank, Best Estimate Soil (Geomatrix), Fully Cracked Concrete, 460 in. Waste Level at 1.83 SpG

ANSYS MAXIMUMS BY PATH

PNNL Section No.	Path (in.)	Seismic Only Hoop Force (kip/ft) AP-BES-FCC	Seismic Only Meridonal Force (kip/ft) AP-BES-FCC	Seismic Only - In-Plane Shear Force (kip/ft) AP-BES-FCC	Seismic Only Hoop Moment (ft*kip/ft) AP-BES-FCC	Seismic Only Meridonal Moment (ft*kip/ft) AP-BES-FCC	Seismic Only Through-Wall Shear Force (kip/ft) AP-BES FCC
2	**67.734**	24.120	24.670	5.344	7.237	9.492	2.328
3	**105.676**	21.600	23.110	6.878	4.916	6.361	2.734
4	**137.076**	19.820	21.140	7.413	4.390	4.769	2.620
6	**182.856**	13.370	17.900	7.480	2.785	5.119	2.353
8	**226.570**	12.500	14.800	7.591	0.966	7.077	0.930
9	**275.574**	19.080	13.790	8.918	1.137	2.738	0.885
11	**325.697**	14.735	13.270	11.368	0.681	0.906	0.408
13	**372.312**	19.347	13.150	13.725	0.912	2.052	0.646
17	**423.434**	22.590	12.930	18.105	1.536	4.168	1.065
20	**468.315**	24.788	12.080	20.838	2.423	7.710	1.743
22	**515.319**	18.530	10.760	20.721	1.678	7.040	1.922
24	**553.722**	7.717	11.790	20.092	0.379	1.943	1.691
26	**593.805**	5.521	12.690	19.956	0.156	0.822	0.327
30	**644.355**	5.000	11.820	20.023	0.111	0.566	0.189
33	**693.605**	5.270	10.450	20.252	0.055	0.233	0.062
35	**740.705**	5.300	9.810	20.730	0.034	0.153	0.074
38	**786.205**	4.550	11.740	21.272	0.049	0.224	0.083
41	**844.605**	4.610	14.120	22.492	0.104	0.550	0.187
43	**901.355**	2.320	6.300	10.861	0.134	0.769	0.669
46	**932.355**	10.839	15.300	23.893	0.149	0.743	0.990
48	**1007.355**	8.890	4.931	7.930	0.532	2.006	1.159
51	**1053.855**	3.950	4.507	5.621	0.170	1.129	1.543
53	**1086.855**	4.182	3.761	3.236	0.287	1.195	1.600
55	**1105.855**	3.456	3.801	2.901	0.033	0.121	0.258
57	**1147.355**	2.340	2.441	1.981	0.009	0.024	0.035
58	**1207.355**	2.453	2.293	1.588	0.004	0.015	0.031
59	**1267.355**	2.102	2.066	1.264	0.012	0.024	0.028
60	**1327.355**	2.224	2.047	1.046	0.009	0.021	0.031
61	**1387.355**	1.426	2.206	0.747	0.007	0.015	0.043
62	**1449.355**	4.294	3.861	0.947	0.104	0.098	0.120

Note: Meridonal/Hoop Forces and Meridonal/Hoop Moments are Reversed in Highlighted Sections.

Table 4 BES-FCC Primary Tank Stresses, Shell Top, Gravity Load Only

AP Primary Tank, Best Estimate Soil, Gravity Only, Fully Cracked Tank Concrete, 460 in. Waste Level at 1.83 SpG

		Shell Top Surface (inside - waste side)			
M&D Starting Element No.	Path (in.)	AP-460-BES-FCC Gravity Hoop Stress (lbs/in^2) Top	AP-460-BES-FCC Gravity Meridional Stress (lbs/in^2) Top	AP-460-BES-FCC Gravity Stress Intensity (lbs/in^2) Top	AP-460-BES-FCC Gravity In-Plane Shear Stress (lbs/in^2) Top
762	**67.33**	-6575.00	-7423.61	7423.61	-24.06
782	**105.04**	-5793.06	-10395.83	10395.83	-21.16
802	**136.24**	-4358.33	-9152.78	9152.78	-9.87
822	**181.83**	-2337.50	-8104.17	8104.17	14.08
842	**225.10**	-1695.14	-6069.44	6069.44	-15.12
862	**273.66**	-756.25	-4906.94	4906.94	-5.95
882	**323.27**	-446.74	-3163.89	3163.89	-2.66
902	**369.20**	610.14	-2231.25	2836.81	-3.28
922	**419.20**	1733.33	-811.81	2539.58	-5.73
942	**444.31**	1458.33	-2512.50	3965.28	-4.51
962	**458.66**	1252.78	1542.36	1542.36	3.46
982	**473.08**	897.92	1145.14	1145.14	-1.39
1002	**484.80**	1605.56	-359.86	1964.58	-0.65
1022	**502.48**	3093.06	6.49	3100.69	-0.90
1042	**526.48**	4690.28	92.64	4690.28	-0.67
1062	**550.48**	6314.58	-57.52	6372.22	-0.43
1082	**574.60**	7881.94	173.96	7881.94	-0.27
1102	**598.28**	9569.44	-104.10	9673.61	-0.23
1122	**621.38**	11118.06	96.11	11118.06	-0.29
1142	**644.48**	12687.50	-32.22	12722.22	-0.34
1162	**667.63**	13791.67	-381.04	14173.61	-0.39
1182	**690.78**	14201.39	392.99	14201.39	-0.38
1202	**713.88**	15201.39	129.86	15201.39	-0.37
1222	**736.98**	16562.50	-365.63	16930.56	-0.40
1242	**760.13**	16500.00	-746.53	17250.00	0.46
1262	**782.53**	15270.83	1002.08	15270.83	-0.36
1282	**804.13**	14923.61	315.69	14923.61	-0.45
1302	**825.73**	15770.83	-45.97	15812.50	0.51
1322	**847.33**	17131.94	334.79	17131.94	-0.49
1342	**868.87**	17555.56	-1911.11	19465.28	-0.83
1362	**892.10**	13298.61	-3065.28	16368.06	1.25
1382	**909.20**	3745.14	-9722.22	13479.17	1.54
1402	**918.38**	3794.44	6022.22	6071.53	-1.76
1460	**930.48**	3545.83	10111.11	10159.72	-520.56
1442	**949.48**	193.68	-448.89	647.92	50.92
1462	**990.98**	575.35	866.67	868.75	-23.83
1482	**1050.98**	398.61	392.99	572.64	1.64
1502	**1110.98**	434.24	571.88	572.64	-12.16
1522	**1170.98**	331.94	282.29	332.29	5.38
1542	**1230.98**	376.74	475.00	475.63	-9.16
1562	**1292.98**	285.28	284.72	286.32	1.95

<u>Note 1</u>: Meridonal, Hoop, and Shear Stresses are Reversed in Highlighted Sections (Floor)

Table 5 BES-FCC Primary Tank Stresses, Shell Middle, Gravity Load Only

AP Primary Tank, Best Estimate Soil, Gravity Only, Fully Cracked Tank Concrete, 460 in. Waste Level at 1.83 SpG

		Shell Mid-Plane			
M&D Starting Element No.	Path (in.)	AP-460-BES-FCC Gravity Hoop Stress (lbs/in^2) Mid	AP-460-BES-FCC Gravity Meridional Stress (lbs/in^2) Mid	AP-460-BES-FCC Gravity Stress Intensity (lbs/in^2) Mid	AP-460-BES-FCC Gravity In-Plane Shear Stress (lbs/in^2) Mid
762	**67.33**	-7006.94	-7875.00	7875.00	16.08
782	**105.04**	-5915.28	-10270.83	10270.83	-17.90
802	**136.24**	-4535.42	-9319.44	9319.44	9.00
822	**181.83**	-2312.50	-7805.56	7805.56	11.40
842	**225.10**	-1802.78	-6336.81	6336.81	13.49
862	**273.66**	-726.39	-4761.11	4761.11	5.82
882	**323.27**	-521.88	-3386.11	3386.11	2.60
902	**369.20**	614.38	-2184.72	2793.06	-3.25
922	**419.20**	1716.67	-845.83	2556.94	-5.67
942	**444.31**	2230.56	18.58	2267.36	-4.02
962	**458.66**	829.86	59.85	830.56	3.06
982	**473.08**	570.14	60.53	572.36	-1.58
1002	**484.80**	1727.78	57.15	1729.86	-0.43
1022	**502.48**	3106.94	53.15	3109.03	-0.72
1042	**526.48**	4676.39	46.79	4677.08	-0.61
1062	**550.48**	6343.06	40.08	6344.44	-0.39
1082	**574.60**	7840.28	33.26	7840.28	-0.24
1102	**598.28**	9611.11	26.54	9611.11	-0.20
1122	**621.38**	11097.22	19.97	11097.22	-0.26
1142	**644.48**	12701.39	13.35	12708.33	-0.31
1162	**667.63**	13909.72	6.75	13909.72	-0.36
1182	**690.78**	14076.39	-1.88	14083.33	-0.35
1202	**713.88**	15159.72	-8.40	15166.67	-0.35
1222	**736.98**	16666.67	-14.88	16687.50	-0.39
1242	**760.13**	16722.22	-21.40	16743.06	-0.44
1262	**782.53**	14965.28	-21.03	14986.11	-0.34
1282	**804.13**	14826.39	-27.11	14854.17	-0.42
1302	**825.73**	15770.83	-33.25	15805.56	0.49
1322	**847.33**	17020.83	-39.41	17055.56	-0.49
1342	**868.87**	18111.11	-45.38	18173.61	-0.68
1362	**892.10**	14208.33	-44.51	14263.89	1.00
1382	**909.20**	6527.08	-54.41	6704.86	1.18
1402	**918.38**	1690.97	115.21	2022.22	-1.12
1460	**930.48**	439.72	380.69	571.25	5.28
1442	**949.48**	454.72	425.21	455.49	2.70
1462	**990.98**	522.01	702.78	704.17	-15.01
1482	**1050.98**	437.15	525.14	443.82	-8.13
1502	**1110.98**	393.06	443.47	443.82	-5.27
1522	**1170.98**	363.13	390.90	391.11	-3.59
1542	**1230.98**	343.06	366.18	366.46	-3.25
1562	**1292.98**	305.90	368.06	368.82	-6.35

Note 1: Meridonal, Hoop, and Shear Stresses are Reversed in Highlighted Sections (Floor)

Table 6 BES-FCC Primary Tank Stresses, Shell Bottom, Gravity Load Only

		AP Primary Tank, Best Estimate Soil, Gravity Only, Fully Cracked Tank Concrete, 460 in. Waste Level at 1.83 SpG			
		Shell Bottom Surface (outside - away from waste)			
M&D Starting Element No.	Path (in.)	AP-460-BES-FCC Gravity Hoop Stress (lbs/in^2) Bot	AP-460-BES-FCC Gravity Meridional Stress (lbs/in^2) Bot	AP-460-BES-FCC Gravity Stress Intensity (lbs/in^2) Bot	AP-460-BES-FCC Gravity In-Plane Shear Stress (lbs/in^2) Bot
762	**67.33**	-7458.33	-8361.11	8361.11	-16.56
782	**105.04**	-6052.08	-10166.67	10166.67	16.44
802	**136.24**	-4713.89	-9506.94	9506.94	8.33
822	**181.83**	-2287.50	-7513.89	7513.89	-9.94
842	**225.10**	-1910.42	-6614.58	6614.58	12.10
862	**273.66**	-697.22	-4617.36	4617.36	5.73
882	**323.27**	-597.22	-3612.50	3613.19	2.56
902	**369.20**	618.68	-2139.58	2750.00	-3.23
922	**419.20**	1700.00	-880.56	2575.00	-5.60
942	**444.31**	3002.78	2549.31	3003.47	-3.53
962	**458.66**	407.43	-1422.92	1822.22	2.66
982	**473.08**	242.57	-1024.31	1260.42	-1.77
1002	**484.80**	1850.00	473.40	1850.00	-0.71
1022	**502.48**	3120.83	102.29	3121.53	-0.54
1042	**526.48**	4662.50	-1.36	4669.44	-0.55
1062	**550.48**	6372.22	135.63	6372.92	-0.35
1082	**574.60**	7798.61	-109.65	7909.72	-0.22
1102	**598.28**	9645.83	155.28	9645.83	-0.19
1122	**621.38**	11076.39	-58.25	11131.94	-0.22
1142	**644.48**	12715.28	57.15	12715.28	-0.28
1162	**667.63**	14027.78	392.92	14027.78	-0.33
1182	**690.78**	13965.28	-395.07	14354.17	-0.31
1202	**713.88**	15118.06	-145.00	15263.89	-0.36
1222	**736.98**	16770.83	337.71	16770.83	-0.38
1242	**760.13**	16937.50	706.25	16937.50	-0.42
1262	**782.53**	14659.72	-1043.06	15701.39	-0.33
1282	**804.13**	14722.22	-369.24	15090.28	-0.40
1302	**825.73**	15777.78	-19.61	15798.61	0.46
1322	**847.33**	16909.72	-412.57	17319.44	-0.48
1342	**868.87**	18673.61	1823.61	18673.61	0.57
1362	**892.10**	15111.11	2979.17	15111.11	0.76
1382	**909.20**	9312.50	9625.00	9625.00	0.88
1402	**918.38**	-415.90	-5792.36	5843.06	-0.56
1460	**930.48**	-2672.22	-9354.17	9402.78	529.65
1442	**949.48**	716.67	1297.92	1301.39	-46.47
1462	**990.98**	468.89	539.58	540.07	-6.23
1482	**1050.98**	476.04	658.75	352.50	-15.65
1502	**1110.98**	352.22	317.01	352.50	4.11
1522	**1170.98**	394.86	501.67	502.22	-9.83
1542	**1230.98**	310.14	259.93	310.56	5.51
1562	**1292.98**	328.47	454.31	455.21	-11.86

Note 1: Meridonal, Hoop, and Shear Stresses are Reversed in Highlighted Sections (Floor)

Table 7 BES-FCC Primary Tank Stresses, Shell Top, Gravity Plus Seismic Load

AP Primary Tank, Best Estimate Soil, Horizontal and Vertical Seismic, Fully Cracked Tank Concrete, 460 in. Waste Level at 1.83 SpG

M&D Starting M&D Element No.	Path (in.)	Shell Top Surface (inside - waste side) AP-460-BES-FCC Seismic Hoop Stress (lbs/in^2) Top	AP-460-BES-FCC Seismic Meridional Stress (lbs/in^2) Top	AP-460-BES-FCC Seismic Stress Intensity (lbs/in^2) Top	AP-460-BES-FCC Seismic In-Plane Shear Stress (lbs/in^2) Top
762	**67.33**	-9194.44	-10750.00	10756.94	-1229.17
782	**105.04**	-8534.72	-13909.72	13916.67	-2013.89
802	**136.24**	-6736.81	-12965.28	12965.28	-1964.58
822	**181.83**	-3820.83	-10840.28	10840.28	-1596.53
842	**225.10**	-4153.47	-9041.67	9451.39	-1178.47
862	**273.66**	-2150.69	-6397.92	6397.92	-907.64
882	**323.27**	-2352.78	-4977.08	6880.56	-1013.89
902	**369.20**	2184.72	-3354.17	4807.64	-1493.75
922	**419.20**	4926.39	-1785.42	6716.67	-2691.67
942	**444.31**	4811.81	-5994.44	6659.03	-2688.89
962	**458.66**	6188.89	7062.50	12854.17	-2684.03
982	**473.08**	-6897.92	7930.56	14833.33	-2895.14
1002	**484.80**	4293.75	-1782.64	6194.44	-3040.28
1022	**502.48**	5191.67	-895.83	6703.47	-2981.94
1042	**526.48**	9041.67	1228.47	9048.61	-2763.89
1062	**550.48**	11465.28	1237.50	11472.22	-2502.78
1082	**574.60**	13895.83	1667.36	13895.83	-2198.61
1102	**598.28**	16465.28	-1360.42	16465.28	-1847.22
1122	**621.38**	18784.72	1751.39	18784.72	-1456.94
1142	**644.48**	21138.89	1609.03	21138.89	1083.33
1162	**667.63**	22736.11	-1730.56	22736.11	-909.03
1182	**690.78**	23131.94	2106.94	23131.94	-725.00
1202	**713.88**	24298.61	1677.08	24298.61	810.42
1222	**736.98**	25930.56	-1536.81	25930.56	1062.50
1242	**760.13**	25437.50	-853.47	25750.00	1432.64
1262	**782.53**	23138.89	2392.36	23138.89	1365.28
1282	**804.13**	22173.61	1331.94	22173.61	1670.83
1302	**825.73**	23020.83	775.00	23020.83	1987.50
1322	**847.33**	24701.39	1259.72	24701.39	2313.19
1342	**868.87**	24791.67	-2411.81	27590.28	2678.47
1362	**892.10**	17451.39	-3443.06	22326.39	2589.58
1382	**909.20**	5800.69	-11597.22	19548.61	2513.89
1402	**918.38**	6074.31	9166.67	9194.44	2449.31
1460	**930.48**	7187.50	15576.39	15652.78	-2946.53
1442	**949.48**	5072.92	1648.61	5079.17	-2232.64
1462	**990.98**	4087.50	1193.75	6394.44	-3174.31
1482	**1050.98**	3297.92	1097.22	2863.19	-2131.25
1502	**1110.98**	2479.17	684.03	2863.19	-1418.06
1522	**1170.98**	1974.31	809.72	1975.69	-946.53
1542	**1230.98**	1347.92	521.39	1350.00	-579.17
1562	**1292.98**	929.86	700.69	938.19	-308.54

Note 1: Meridonal, Hoop, and Shear Stresses are Reversed in Highlighted Sections (Floor)

Table 8 BES-FCC Primary Tank Stresses, Shell Middle, Gravity Plus Seismic Load

AP Primary Tank, Best Estimate Soil, Horizontal and Vertical Seismic, Fully Cracked Tank Concrete, 460 in. Waste Level at 1.83 SpG

M&D Starting M&D Element No.	Path (in.)	Shell Mid-Plane			
		AP-460-BES-FCC Seismic Hoop Stress (lbs/in^2) Mid	AP-460-BES-FCC Seismic Meridional Stress (lbs/in^2) Mid	AP-460-BES-FCC Seismic Stress Intensity (lbs/in^2) Mid	AP-460-BES-FCC Seismic In-Plane Shear Stress (lbs/in^2) Mid
762	**67.33**	-9812.50	-10750.00	10750.00	-1147.92
782	**105.04**	-8847.22	-13923.61	13930.56	-1940.97
802	**136.24**	-7104.17	-12590.28	12597.22	-1890.28
822	**181.83**	-3754.86	-10479.17	10479.17	-1554.86
842	**225.10**	-4612.50	-8381.94	8680.56	-1163.19
862	**273.66**	-2011.11	-6186.81	6260.42	-903.47
882	**323.27**	-2672.22	-4445.14	6202.78	-1013.89
902	**369.20**	2097.22	-3044.44	4691.67	-1495.14
922	**419.20**	5170.14	-1575.00	6131.25	-2693.75
942	**444.31**	4815.97	1153.47	5930.56	-2737.50
962	**458.66**	-7666.67	1120.14	8791.67	-2731.25
982	**473.08**	-9006.94	1011.81	10013.89	-2854.17
1002	**484.80**	4197.92	973.61	6013.19	-2971.53
1022	**502.48**	5625.00	1070.14	6427.08	-2948.61
1042	**526.48**	9034.72	1213.19	9041.67	-2758.33
1062	**550.48**	11493.06	1345.14	11493.06	-2497.22
1082	**574.60**	13812.50	1466.67	13812.50	-2191.67
1102	**598.28**	16493.06	1568.75	16500.00	-1840.28
1122	**621.38**	18715.28	1651.39	18715.28	-1451.39
1142	**644.48**	21111.11	1710.42	21111.11	1072.92
1162	**667.63**	22847.22	1743.75	22847.22	-896.53
1182	**690.78**	22881.94	1535.42	22881.94	-715.28
1202	**713.88**	24159.72	1515.28	24159.72	809.72
1222	**736.98**	25986.11	1468.75	25986.11	1061.11
1242	**760.13**	25673.61	1398.61	25673.61	1424.31
1262	**782.53**	22569.44	956.94	22569.44	1353.47
1282	**804.13**	21916.67	874.31	21916.67	1669.44
1302	**825.73**	22944.44	-792.36	22944.44	1989.58
1322	**847.33**	24472.22	-700.69	24472.22	2319.44
1342	**868.87**	25659.72	-593.26	25666.67	2661.11
1362	**892.10**	18909.72	-401.46	18930.56	2502.78
1382	**909.20**	9166.67	-370.97	9520.83	2366.67
1402	**918.38**	6032.64	455.56	6497.22	2345.83
1460	**930.48**	4924.31	746.53	5038.89	-2390.28
1442	**949.48**	4726.39	756.94	4807.64	-2222.92
1462	**990.98**	4134.72	1234.72	6393.06	-3181.25
1482	**1050.98**	3238.89	950.69	2859.03	-2125.69
1502	**1110.98**	2525.00	779.86	2859.03	-1425.00
1522	**1170.98**	1921.53	663.06	1923.61	-940.28
1542	**1230.98**	1390.28	587.36	1391.67	-584.79
1562	**1292.98**	885.42	557.99	886.11	-303.47

Note 1: Meridonal, Hoop, and Shear Stresses are Reversed in Highlighted Sections (Floor)

Table 9 BES-FCC Primary Tank Stresses, Shell Bottom, Gravity Plus Seismic Load

AP Primary Tank, Best Estimate Soil, Horizontal and Vertical Seismic, Fully Cracked Tank Concrete, 460 in. Waste Level at 1.83 SpG

M&D Starting M&D Element No.	Path (in.)	Shell Bottom Surface (outside - away from waste)			
		AP-460-BES-FCC Seismic Hoop Stress (lbs/in^2) Bot	AP-460-BES-FCC Seismic Meridional Stress (lbs/in^2) Bot	AP-460-BES-FCC Seismic Stress Intensity (lbs/in^2) Bot	AP-460-BES-FCC Seismic In-Plane Shear Stress (lbs/in^2) Bot
762	**67.33**	-10444.44	-11430.56	11430.56	-1067.36
782	**105.04**	-9284.72	-14368.06	14368.06	-1867.36
802	**136.24**	-7486.11	-12687.50	12687.50	-1816.67
822	**181.83**	-3688.89	-10277.78	10277.78	-1513.19
842	**225.10**	-5071.53	-8631.94	8631.94	-1148.61
862	**273.66**	-1871.53	-6234.72	6400.00	-899.31
882	**323.27**	-3005.56	-5159.03	5545.83	-1013.89
902	**369.20**	2045.83	-3018.75	4856.94	-1496.53
922	**419.20**	5413.19	-2303.47	5765.28	-2695.83
942	**444.31**	5428.47	8270.83	8270.83	-2785.42
962	**458.66**	-9263.89	-5260.42	9270.83	-2778.47
982	**473.08**	-11118.06	-5947.22	11125.00	-2813.89
1002	**484.80**	4102.08	2731.94	5839.58	-2902.78
1022	**502.48**	6057.64	3014.58	6247.92	-2914.58
1042	**526.48**	9027.78	1209.03	9034.72	-2752.08
1062	**550.48**	11520.83	1452.08	11520.83	-2491.67
1082	**574.60**	13729.17	-1339.58	13729.17	-2184.72
1102	**598.28**	16527.78	1790.28	16527.78	-1834.03
1122	**621.38**	18638.89	-1564.58	18645.83	-1445.83
1142	**644.48**	21076.39	1812.50	21076.39	1062.50
1162	**667.63**	22965.28	2334.03	22965.28	-884.03
1182	**690.78**	22680.56	-1590.97	22680.56	-705.56
1202	**713.88**	24111.11	-1527.08	24111.11	808.33
1222	**736.98**	26187.50	2019.44	26187.50	1060.42
1242	**760.13**	26055.56	2418.06	26062.50	1415.97
1262	**782.53**	22180.56	-1588.19	23041.67	1341.67
1282	**804.13**	21805.56	-1063.89	21812.50	1668.75
1302	**825.73**	22965.28	796.53	22972.22	1992.36
1322	**847.33**	24256.94	-856.94	24472.22	2325.00
1342	**868.87**	26569.44	4100.00	26569.44	2644.44
1362	**892.10**	20375.00	4975.69	20375.00	2417.36
1382	**909.20**	12958.33	15159.72	15166.67	2220.14
1402	**918.38**	5990.97	-8263.89	8305.56	2242.36
1460	**930.48**	-8006.94	-14625.00	14701.39	2381.94
1442	**949.48**	4381.25	-1634.72	5572.92	-2213.89
1462	**990.98**	4181.94	1375.69	6393.06	-3187.50
1482	**1050.98**	3180.56	859.03	2865.28	-2119.44
1502	**1110.98**	2571.53	920.83	2865.28	-1431.25
1522	**1170.98**	1869.44	571.46	1894.44	-934.72
1542	**1230.98**	1440.97	732.64	1441.67	-590.42
1562	**1292.98**	845.83	491.60	847.22	-298.40

Note 1: Meridonal, Hoop, and Shear Stresses are Reversed in Highlighted Sections (Floor)

Table 10 BES-FCC Primary Tank Stresses, Shell Top, Seismic Load Only

AP Primary Tank, Best Estimate Soil, Horizontal and Vertical Seismic, Fully Cracked Tank Concrete, 460 in. Waste Level at 1.83 SpG

M&D Starting M&D Element No.	Path (in.)	Shell Top Surface (inside - waste side) AP-460-BES-FCC Seismic Only Hoop Stress (lbs/in^2) Top	AP-460-BES-FCC Seismic Only Meridional Stress (lbs/in^2) Top	AP-460-BES-FCC Seismic Only Stress Intensity (lbs/in^2) Top	AP-460-BES-FCC Seismic Only In-Plane Shear Stress (lbs/in^2) Top
762	**67.33**	3352.78	3381.94	3381.94	1219.64
782	**105.04**	3484.72	3686.11	3678.47	2010.26
802	**136.24**	2675.00	3881.94	3881.94	1961.98
822	**181.83**	1639.79	2956.25	2950.00	1599.81
842	**225.10**	2656.25	3020.14	3429.86	1181.72
862	**273.66**	1612.50	1830.56	1829.86	909.85
882	**323.27**	2345.07	1827.08	3730.56	1015.04
902	**369.20**	1914.93	1737.36	2341.11	1495.04
922	**419.20**	3193.06	979.86	4177.78	2690.08
942	**444.31**	5153.47	3482.64	2695.83	2687.42
962	**458.66**	7381.94	5522.22	11313.19	2683.31
982	**473.08**	7774.31	6786.81	13689.58	2894.91
1002	**484.80**	4479.86	1423.40	4243.75	3040.32
1022	**502.48**	2760.28	900.00	3604.86	2982.06
1042	**526.48**	5182.43	1136.04	4358.33	2763.93
1062	**550.48**	6232.71	1293.01	5101.39	2502.80
1082	**574.60**	7299.31	1493.61	6050.00	2198.60
1102	**598.28**	8420.83	1448.75	7140.97	1847.19
1122	**621.38**	9265.97	1655.49	7902.08	1456.89
1142	**644.48**	9982.64	1639.51	8527.78	1083.41
1162	**667.63**	10235.42	1532.64	8957.64	908.94
1182	**690.78**	9881.25	1714.17	8937.50	724.91
1202	**713.88**	9862.50	1547.43	9097.22	810.40
1222	**736.98**	10004.17	1282.43	9000.00	1062.64
1242	**760.13**	9375.00	1129.03	8500.00	1432.77
1262	**782.53**	8062.50	1406.67	7868.06	1365.38
1282	**804.13**	7326.39	1016.39	7250.00	1670.95
1302	**825.73**	7250.00	821.03	7208.33	1987.65
1322	**847.33**	7569.44	943.26	7569.44	2313.16
1342	**868.87**	7236.11	1528.75	8187.50	2677.98
1362	**892.10**	4152.78	2436.18	5965.28	2589.26
1382	**909.20**	2141.67	6054.86	6076.39	2513.89
1402	**918.38**	3242.85	7231.94	3376.39	2449.30
1422	**930.48**	3643.75	5661.81	5500.00	2426.94
1442	**949.48**	4879.58	2092.43	4436.11	2283.08
1462	**990.98**	3614.79	1355.28	5526.39	3151.20
1482	**1050.98**	2899.31	706.53	2291.67	2131.65
1502	**1110.98**	2095.42	678.54	2291.67	1407.20
1522	**1170.98**	1642.36	532.29	1643.40	950.46
1542	**1230.98**	1012.43	465.85	879.72	571.41
1562	**1292.98**	644.58	420.69	654.10	309.06

Note 1: Meridonal, Hoop, and Shear Stresses are Reversed in Highlighted Sections (Floor)

Table 11 BES-FCC Primary Tank Stresses, Shell Middle, Seismic Load Only

AP Primary Tank, Best Estimate Soil, Horizontal and Vertical Seismic, Fully Cracked Tank Concrete, 460 in. Waste Level at 1.83 SpG

M&D Starting M&D Element No.	Path (in.)	Shell Mid-Plane			
		AP-460-BES-FCC Seismic Only Hoop Stress (lbs/in^2) Mid	AP-460-BES-FCC Seismic Only Meridional Stress (lbs/in^2) Mid	AP-460-BES-FCC Seismic Only Stress Intensity (lbs/in^2) Mid	AP-460-BES-FCC Seismic Only In-Plane Shear Stress (lbs/in^2) Mid
762	**67.33**	3700.00	2993.75	2945.14	1143.22
782	**105.04**	3686.81	3919.44	3877.78	1936.58
802	**136.24**	2862.50	3566.67	3528.47	1888.40
822	**181.83**	1538.89	2990.28	2970.14	1557.22
842	**225.10**	3047.92	2383.33	2372.22	1166.35
862	**273.66**	1484.03	1739.58	1738.19	905.41
882	**323.27**	2699.86	1350.69	2824.31	1015.11
902	**369.20**	1921.25	1313.19	1907.64	1496.36
922	**419.20**	3453.47	1370.76	3574.31	2692.14
942	**444.31**	3852.78	1135.35	3664.58	2736.24
962	**458.66**	8477.08	1060.56	7978.47	2730.59
982	**473.08**	9553.68	951.58	9462.99	2853.88
1002	**484.80**	4127.78	916.72	4297.22	2971.50
1022	**502.48**	3142.57	1017.22	3320.83	2948.70
1042	**526.48**	5210.97	1166.64	4364.58	2758.39
1062	**550.48**	6251.81	1305.33	5148.61	2497.25
1082	**574.60**	7288.89	1433.70	5978.47	2191.67
1102	**598.28**	8478.47	1542.50	7071.53	1840.26
1122	**621.38**	9284.72	1631.67	7835.42	1451.34
1142	**644.48**	10012.50	1697.27	8505.56	1072.98
1162	**667.63**	10335.42	1737.19	8937.50	896.45
1182	**690.78**	9831.25	1535.83	8798.61	715.19
1202	**713.88**	9864.58	1522.26	8993.06	809.69
1222	**736.98**	10080.56	1482.35	9298.61	1061.25
1242	**760.13**	9506.94	1418.82	8930.56	1424.44
1262	**782.53**	7923.61	977.15	7583.33	1353.59
1282	**804.13**	7298.61	900.68	7062.50	1669.57
1302	**825.73**	7229.17	813.09	7138.89	1989.74
1322	**847.33**	7451.39	713.56	7416.67	2319.38
1342	**868.87**	7548.61	588.26	7493.06	2660.75
1362	**892.10**	4708.33	408.29	4673.61	2502.82
1382	**909.20**	2641.67	404.91	2818.75	2366.70
1402	**918.38**	4343.06	385.83	4476.39	2345.89
1422	**930.48**	4486.04	567.43	4468.06	2394.72
1442	**949.48**	4272.22	628.06	4353.47	2225.27
1462	**990.98**	3612.78	979.86	5689.58	3166.88
1482	**1050.98**	2801.81	582.74	2415.21	2118.67
1502	**1110.98**	2131.94	337.78	2415.21	1420.95
1522	**1170.98**	1558.40	273.89	1535.14	938.05
1542	**1230.98**	1047.22	223.13	1028.19	582.94
1562	**1292.98**	579.51	191.67	520.83	298.58

Note 1: Meridonal, Hoop, and Shear Stresses are Reversed in Highlighted Sections (Floor)

M&D Professional Services Confidential
1/5/2007

AP-460-BES-FCC Pri Tank Stress Seismic Only.xls, Stress Max
Page 2

Table 12 BES-FCC Primary Tank Stresses, Shell Bottom, Seismic Load Only

AP Primary Tank, Best Estimate Soil, Horizontal and Vertical Seismic, Fully Cracked Tank Concrete, 460 in. Waste Level at 1.83 SpG

M&D Starting M&D Element No.	Path (in.)	Shell Bottom Surface (outside - away from waste) AP-460-BES-FCC Seismic Only Hoop Stress (lbs/in^2) Bot	AP-460-BES-FCC Seismic Only Meridional Stress (lbs/in^2) Bot	AP-460-BES-FCC Seismic Only Stress Intensity (lbs/in^2) Bot	AP-460-BES-FCC Seismic Only In-Plane Shear Stress (lbs/in^2) Bot
762	**67.33**	4042.36	3132.64	3129.17	1067.49
782	**105.04**	3890.28	4319.44	4284.03	1862.20
802	**136.24**	3054.86	3406.25	3393.75	1815.51
822	**181.83**	1438.89	3069.44	3056.94	1514.63
842	**225.10**	3439.58	2552.78	2552.08	1151.66
862	**273.66**	1355.14	1829.17	1825.00	900.96
882	**323.27**	3054.65	2182.64	1938.89	1015.19
902	**369.20**	1927.57	1030.56	2106.94	1497.68
922	**419.20**	3713.19	2225.69	3193.75	2694.20
942	**444.31**	2609.03	5722.92	5268.06	2784.37
962	**458.66**	9649.03	3838.89	7461.81	2777.88
982	**473.08**	11334.86	4924.31	9883.33	2813.54
1002	**484.80**	3784.03	2258.96	4003.47	2902.67
1022	**502.48**	3524.86	2912.92	3127.78	2914.64
1042	**526.48**	5240.14	1208.32	4365.28	2752.15
1062	**550.48**	6270.21	1316.88	5148.61	2491.71
1082	**574.60**	7278.54	1373.68	6017.36	2184.74
1102	**598.28**	8543.06	1635.49	7106.25	1834.02
1122	**621.38**	9296.53	1607.82	7823.61	1445.80
1142	**644.48**	10049.31	1755.72	8511.11	1062.55
1162	**667.63**	10435.42	1941.39	8983.33	883.95
1182	**690.78**	9781.94	1357.92	8613.89	705.47
1202	**713.88**	9867.36	1496.39	8847.22	808.30
1222	**736.98**	10156.94	1682.01	9416.67	1060.34
1242	**760.13**	9631.94	1711.81	9125.00	1416.11
1262	**782.53**	7790.97	673.68	7423.61	1341.79
1282	**804.13**	7270.83	788.47	6722.22	1668.89
1302	**825.73**	7243.06	815.57	7173.61	1992.53
1322	**847.33**	7361.11	529.24	7152.78	2324.90
1342	**868.87**	7972.22	2602.08	7895.83	2644.60
1362	**892.10**	5263.89	2331.88	5263.89	2417.40
1382	**909.20**	3652.78	5541.67	5548.61	2220.21
1402	**918.38**	6404.10	6460.28	2893.06	2242.47
1422	**930.48**	5704.17	5372.22	5305.56	2371.74
1442	**949.48**	4430.56	2927.08	4278.47	2168.10
1462	**990.98**	3713.06	839.24	5853.75	3181.86
1482	**1050.98**	2767.71	948.82	2515.56	2104.99
1502	**1110.98**	2219.31	608.06	2515.56	1434.00
1522	**1170.98**	1519.86	512.26	1392.29	926.33
1542	**1230.98**	1130.83	476.81	1131.11	594.46
1562	**1292.98**	527.71	403.05	396.53	288.10

Note 1: Meridonal, Hoop, and Shear Stresses are Reversed in Highlighted Sections (Floor)

Table 13 BES-FCC J-Bolt Forces, Gravity Load Only

AP Primary Tank, Best Estimate Soil, Gravity Only, Fully Cracked Tank Concrete, 460 in. Waste Level at 1.83 SpG

ANSYS MAXIMUMS BY RADIUS

M&D J-Bolt Radius No.	Mean J-Bolt Radius	Radius of J-Bolts Included		Average Bolts per Element	Min Axial Force (kip) BES-FCC Gravity Only	Max Axial Force (kip) BES-FCC Gravity Only	Shear Force1 (kip) BES-FCC Gravity	Maximum Shear Force1 Model Angle	Shear Force2 (kip) BES-FCC Gravity Only	Maximum Shear Force2 Model Angle	Total Shear (kip) BES-FCC Gravity
		min	*max*								
Radius 2	44.72	*22.36*	*67.29*	0.55	-0.298	-0.252	0.009	45	1.611	90	1.611
Radius 3	89.87	*67.29*	*104.93*	0.89	-0.305	-0.284	0.030	63	1.939	90	1.939
Radius 4	120.00	*104.93*	*135.98*	1.03	-0.087	-0.073	0.044	63	1.367	0	1.367
Radius 5	151.97	*135.98*	*181.01*	1.97	-0.178	-0.171	0.045	63	0.157	9	0.160
Radius 6	210.05	*181.01*	*223.79*	2.41	-0.036	-0.030	0.016	72	1.645	90	1.645
Radius 7	237.53	*223.79*	*270.98*	3.30	0.200	0.204	0.013	144	2.603	90	2.603
Radius 8	304.43	*270.98*	*318.74*	4.04	0.027	0.029	0.005	144	2.983	45	2.983
Radius 9	333.05	*318.74*	*361.64*	4.37	0.335	0.337	0.001	126	3.166	36	3.166
Radius 10	390.22	*361.64*	*406.24*	5.36	0.131	0.132	0.002	63	3.621	0	3.621
Radius 11	422.26	*406.24*	*431.63*	3.60	0.972	0.978	0.002	126	4.263	0	4.263

M&D J-Bolt Radius No.	Mean J-Bolt Radius	Radius of J-Bolts Included		Average Bolts per Element	Bolt Angle (Rad)	Shear Stiffness (kip/ft)	Axial Stiffness (kip/ft)	Shear Displacement BES-FCC-Gravity Only	Axial Min Displacement BES-FCC-Gravity Only	Axial Max Displacement BES-FCC-Gravity Only
		min	*max*							
Radius 2	44.72	*22.36*	*67.29*	0.55	0.0351	1667	2222	0.01160	-0.00161	-0.00136
Radius 3	89.87	*67.29*	*104.93*	0.89	0.0715	1670	2219	0.01393	-0.00165	-0.00153
Radius 4	120.00	*104.93*	*135.98*	1.03	0.0968	1673	2215	0.00980	-0.00047	-0.00040
Radius 5	151.97	*135.98*	*181.01*	1.97	0.1252	1677	2207	0.00115	-0.00097	-0.00093
Radius 6	210.05	*181.01*	*223.79*	2.41	0.1825	1688	2192	0.01170	-0.00020	-0.00017
Radius 7	237.53	*223.79*	*270.98*	3.30	0.2136	1696	2172	0.01843	0.00110	0.00113
Radius 8	304.43	*270.98*	*318.74*	4.04	0.3076	1725	2132	0.02075	0.00015	0.00017
Radius 9	333.05	*318.74*	*361.64*	4.37	0.3613	1746	2086	0.02176	0.00193	0.00194
Radius 10	390.22	*361.64*	*406.24*	5.36	0.5235	1821	2006	0.02386	0.00078	0.00079
Radius 11	460.26	*406.24*	*431.63*	3.60	0.6938	1913	1933	0.02673	0.00604	0.00607

Table 14 BES-FCC J-Bolt Forces, Gravity Plus Seismic Loads

AP Primary Tank, Best Estimate Soil, Horizontal and Vertical Seismic Input, Fully Cracked Tank Concrete, 460 in. Waste Level at 1.83 SpG Seismic

ANSYS MAXIMUMS BY RADIUS

M&D J-Bolt Radius No.	Mean J-Bolt Radius	Radius of J-Bolts Included		Average Bolts per Element	Min Axial Force (kip) BES-FCC	Max Axial Force (kip) BES-FCC	Shear Force1 (kip) BES-FCC	Maximum Shear Force1 Model Angle	Shear Force2 (kip) BES-FCC	Maximum Shear Force2 Model Angle	Total Shear (kip) BES-FCC
		min	*max*								
Radius 2	44.72	*22.36*	*67.29*	0.55	-0.841	-0.300	2.537	90	4.321	180	4.323
Radius 3	89.87	*67.29*	*104.93*	0.89	-0.823	-0.315	1.767	90	4.430	0	4.487
Radius 4	120.00	*104.93*	*135.98*	1.03	-0.292	0.014	1.118	99	4.097	0	4.097
Radius 5	151.97	*135.98*	*181.01*	1.97	-0.575	-0.116	0.648	108	2.550	0	2.550
Radius 6	210.05	*181.01*	*223.79*	2.41	-0.255	-0.065	0.806	99	2.744	0	2.744
Radius 7	237.53	*223.79*	*270.98*	3.30	0.000	0.182	1.186	99	3.543	0	3.545
Radius 8	304.43	*270.98*	*318.74*	4.04	-0.142	0.027	2.242	90	3.978	0	4.310
Radius 9	333.05	*318.74*	*361.64*	4.37	0.136	0.438	3.049	90	4.346	0	4.999
Radius 10	390.22	*361.64*	*406.24*	5.36	-0.064	0.172	5.286	90	4.928	0	6.869
Radius 11	422.26	*406.24*	*431.63*	3.60	0.042	2.086	7.418	90	6.486	0	9.124

M&D J-Bolt Radius No.	Mean J-Bolt Radius	Radius of J-Bolts Included		Average Bolts per Element	Bolt Angle (Rad)	Shear Stiffness (kip/ft)	Axial Stiffness (kip/ft)	Shear Disp BES-FCC-Seismic	Axial Min Disp BES-FCC-Seismic	Axial Max Disp BES-FCC-Seismic
		min	*max*							
Radius 2	44.72	*22.36*	*67.29*	0.55	0.0351	1667	2222	0.03111	-0.00454	-0.00162
Radius 3	89.87	*67.29*	*104.93*	0.89	0.0715	1670	2219	0.03224	-0.00445	-0.00170
Radius 4	120.00	*104.93*	*135.98*	1.03	0.0968	1673	2215	0.02939	-0.00158	0.00007
Radius 5	151.97	*135.98*	*181.01*	1.97	0.1252	1677	2207	0.01825	-0.00313	-0.00063
Radius 6	210.05	*181.01*	*223.79*	2.41	0.1825	1688	2192	0.01951	-0.00140	-0.00036
Radius 7	237.53	*223.79*	*270.98*	3.30	0.2136	1696	2172	0.02509	0.00000	0.00101
Radius 8	304.43	*270.98*	*318.74*	4.04	0.3076	1725	2132	0.02998	-0.00080	0.00015
Radius 9	333.05	*318.74*	*361.64*	4.37	0.3613	1746	2086	0.03436	0.00078	0.00252
Radius 10	390.22	*361.64*	*406.24*	5.36	0.5235	1821	2006	0.04525	-0.00038	0.00103
Radius 11	460.26	*406.24*	*431.63*	3.60	0.6938	1913	1933	0.05722	0.00026	0.01295

Table 15 BES-FCC J-Bolt Forces, Seismic Load Only

AP Primary Tank, Best Estimate Soil, Horizontal and Vertical Seismic Input, Fully Cracked Tank Concrete, 460 in. Waste Level at 1.83 SpG Seismic Only

ANSYS MAXIMUMS BY RADIUS

M&D J-Bolt Radius No.	Mean J-Bolt Radius	Radius of J-Bolts Included min	Radius of J-Bolts Included max	Average Bolts per Element	Min Axial Force (kip) BES-FCC-Seismic Only	Max Axial Force (kip) BES-FCC-Seismic Only	Shear Force1 (kip) BES-FCC-Seismic Only	Maximum Shear Force1 Model Angle	Shear Force2 (kip) BES-FCC-Seismic Only	Maximum Shear Force2 Model Angle	Total Shear (kip) BES-FCC-Seismic Only
Radius 2	44.72	22.36	67.29	0.55	-0.544	-0.047	2.528	108	2.709	0	3.706
Radius 3	89.87	67.29	104.93	0.89	-0.518	-0.031	1.738	108	2.491	0	3.037
Radius 4	120.00	104.93	135.98	1.03	-0.204	0.087	1.074	108	2.730	0	2.934
Radius 5	151.97	135.98	181.01	1.97	-0.397	0.055	0.603	108	2.393	0	2.467
Radius 6	210.05	181.01	223.79	2.41	-0.219	-0.035	0.790	108	1.098	144	1.353
Radius 7	237.53	223.79	270.98	3.30	-0.200	-0.022	1.173	90	0.940	135	1.503
Radius 8	304.43	270.98	318.74	4.04	-0.169	-0.002	2.237	117	0.995	117	2.449
Radius 9	333.05	318.74	361.64	4.37	-0.199	0.101	3.048	117	1.181	117	3.268
Radius 10	390.22	361.64	406.24	5.36	-0.195	0.040	5.283	108	1.306	0	5.442
Radius 11	460.26	406.24	431.63	3.60	-0.930	1.108	7.416	108	2.223	0	7.742

M&D J-Bolt Radius No.	Mean J-Bolt Radius	Radius of J-Bolts Included min	Radius of J-Bolts Included max	Average Bolts per Element	Bolt Angle (Rad)	Shear Stiffness (kip/ft)	Axial Stiffness (kip/ft)	Shear Disp BES-FCC-Seismic Only	Axial Min Disp BES-FCC-Seismic Only	Axial Max Disp BES-FCC-Seismic Only
Radius 2	44.72	22.36	67.29	0.55	0.0351	1667	2222	0.02667	-0.00294	-0.00026
Radius 3	89.87	67.29	104.93	0.89	0.0715	1670	2219	0.02183	-0.00280	-0.00017
Radius 4	120.00	104.93	135.98	1.03	0.0968	1673	2215	0.02105	-0.00111	0.00047
Radius 5	151.97	135.98	181.01	1.97	0.1252	1677	2207	0.01766	-0.00216	0.00030
Radius 6	210.05	181.01	223.79	2.41	0.1825	1688	2192	0.00962	-0.00120	-0.00019
Radius 7	237.53	223.79	270.98	3.30	0.2136	1696	2172	0.01064	-0.00111	-0.00012
Radius 8	304.43	270.98	318.74	4.04	0.3076	1725	2132	0.01703	-0.00095	-0.00001
Radius 9	333.05	318.74	361.64	4.37	0.3613	1746	2086	0.02247	-0.00114	0.00058
Radius 10	390.22	361.64	406.24	5.36	0.5235	1821	2006	0.03586	-0.00117	0.00024
Radius 11	460.26	406.24	431.63	3.60	0.6938	1913	1933	0.04855	-0.00578	0.00688

M&D Professional Services Confidential
12/21/2006

AP-460-BES-FCC J Bolt Forces Seismic.xls
Page 1

Table 16 BES-FCC Concrete Backed Steel Strain, Shell Top, Gravity Load Only

AP Backed Steel, Best Estimate Soil, Gravity Only, Fully Cracked Tank Concrete, 460 In Waste Level at 1.83SpG

M&D Starting M&D Element No.	Path (in)	Shell Top Surface (inside - towards waste) Gravity					
		AP-460-BES-FCC EPEL P1 Strain (in/in) Gravity Top Min	AP-460-BES-FCC EPEL P1 Strain (in/in) Gravity Top Max	AP-460-BES-FCC EPEL P2 (in/in) Gravity Top Min	AP-460-BES-FCC EPEL P2 Strain (in/in) Gravity Top Max	AP-460-BES-FCC EPEL P3 Strain (in/in) Gravity Top Min	AP-460-BES-FCC EPEL P3 Strain (in/in) Gravity Top Max
762	**67.33**	1.45E-04	1.45E-04	-1.48E-04	-1.48E-04	-1.86E-04	-1.85E-04
782	**105.04**	1.67E-04	1.67E-04	-9.13E-05	-9.12E-05	-2.97E-04	-2.96E-04
802	**136.24**	1.40E-04	1.40E-04	-5.50E-05	-5.50E-05	-2.68E-04	-2.68E-04
822	**181.71**	1.08E-04	1.08E-04	3.43E-06	3.44E-06	-2.54E-04	-2.54E-04
842	**225.10**	8.01E-05	8.02E-05	4.74E-06	4.76E-06	-1.90E-04	-1.90E-04
862	**273.66**	5.84E-05	5.85E-05	2.50E-05	2.50E-05	-1.61E-04	-1.61E-04
882	**323.27**	3.73E-05	3.73E-05	1.75E-05	1.75E-05	-1.04E-04	-1.04E-04
902	**369.20**	4.40E-05	4.41E-05	1.69E-05	1.69E-05	-8.30E-05	-8.29E-05
922	**419.20**	6.80E-05	6.81E-05	-9.46E-06	-9.45E-06	-4.57E-05	-4.56E-05
237	**463.02**						
257	**510.03**						
277	**544.44**						
297	**580.53**						
317	**631.08**						
337	**680.34**						
357	**727.44**						
377	**772.93**						
397	**831.34**						
417	**894.09**						
2132	**925.08**	2.93E-05	2.93E-05	-2.84E-05	-2.84E-05	-3.37E-05	-3.37E-05
2122	**935.67**	5.42E-05	5.42E-05	-1.68E-05	-1.67E-05	-2.23E-05	-2.23E-05
2112	**944.86**	9.37E-05	9.37E-05	-3.39E-06	-3.39E-06	-2.12E-04	-2.12E-04
477	**968.95**						
497	**1002.45**						
517	**1042.45**						
537	**1108.60**						
557	**1178.35**						
577	**1227.20**						
597	**1271.50**						
617	**1313.65**						
637	**1360.60**						

Table 17 BES-FCC Concrete Backed Steel Strain, Shell Middle, Gravity Load Only

AP Backed Steel, Best Estimate Soil, Gravity Only, Fully Cracked Tank Concrete, 460 In Waste Level at 1.83SpG

M&D Starting M&D Element No.	Path (in)	Shell Mid-Plane					
		AP-460-BES-FCC EPEL P1 Strain (in/in) Gravity Mid Min	AP-460-BES-FCC EPEL P1 Strain (in/in) Gravity Mid Max	AP-460-BES-FCC EPEL P2 (in/in) Gravity Mid Min	AP-460-BES-FCC EPEL P2 Strain (in/in) Gravity Mid Max	AP-460-BES-FCC EPEL P3 Strain (in/in) Gravity Mid Min	AP-460-BES-FCC EPEL P3 Strain (in/in) Gravity Mid Max
762	**67.33**	1.54E-04	1.54E-04	-4.34E-05	-4.33E-05	-4.59E-05	-4.59E-05
782	**105.04**	1.67E-04	1.67E-04	-3.30E-05	-3.30E-05	-6.59E-05	-6.58E-05
802	**136.24**	1.43E-04	1.43E-04	-3.97E-05	-3.97E-05	-5.87E-05	-5.87E-05
822	**181.71**	1.05E-04	1.05E-04	1.36E-06	1.37E-06	-5.57E-05	-5.56E-05
842	**225.10**	8.40E-05	8.41E-05	3.93E-06	3.95E-06	-4.40E-05	-4.40E-05
862	**273.66**	5.67E-05	5.67E-05	2.45E-05	2.45E-05	-4.10E-05	-4.10E-05
882	**323.27**	4.04E-05	4.04E-05	1.72E-05	1.73E-05	-2.90E-05	-2.89E-05
902	**369.20**	4.37E-05	4.37E-05	1.64E-05	1.64E-05	-2.68E-05	-2.68E-05
922	**419.20**	6.78E-05	6.79E-05	-6.27E-06	-6.26E-06	-1.97E-05	-1.97E-05
237	**463.02**	5.70E-05	5.71E-05	3.43E-05	3.44E-05	-7.06E-05	-7.06E-05
257	**510.03**	8.28E-05	8.29E-05	5.91E-05	5.92E-05	-3.34E-04	-3.34E-04
277	**544.44**	1.16E-04	1.16E-04	7.39E-05	7.41E-05	-4.83E-04	-4.82E-04
297	**580.53**	8.16E-05	8.16E-05	-1.09E-05	-1.08E-05	-2.47E-04	-2.46E-04
317	**631.08**	9.16E-05	9.16E-05	-8.64E-05	-8.64E-05	-2.60E-04	-2.60E-04
337	**680.34**	1.18E-04	1.18E-04	-1.12E-04	-1.12E-04	-3.23E-04	-3.23E-04
357	**727.44**	1.21E-04	1.21E-04	-1.21E-04	-1.21E-04	-3.48E-04	-3.48E-04
377	**772.93**	1.38E-04	1.38E-04	-1.28E-04	-1.28E-04	-3.82E-04	-3.82E-04
397	**831.34**	1.28E-04	1.28E-04	-1.13E-04	-1.13E-04	-3.98E-04	-3.98E-04
417	**894.09**	5.95E-05	5.96E-05	-6.40E-05	-6.40E-05	-1.64E-04	-1.64E-04
2132	**925.08**	2.92E-05	2.92E-05	-1.68E-05	-1.68E-05	-3.37E-05	-3.37E-05
2122	**935.67**	3.01E-05	3.01E-05	-2.20E-05	-2.20E-05	-3.08E-05	-3.08E-05
2112	**944.86**	2.19E-05	2.20E-05	-3.62E-06	-3.61E-06	-3.56E-05	-3.56E-05
477	**968.95**	6.75E-05	6.75E-05	7.27E-06	7.29E-06	-2.61E-04	-2.61E-04
497	**1002.45**	2.39E-04	2.40E-04	1.64E-05	1.64E-05	-7.43E-05	-7.42E-05
517	**1042.45**	1.47E-05	1.47E-05	9.76E-06	9.77E-06	-5.55E-06	-5.54E-06
537	**1108.60**	9.24E-06	9.25E-06	9.30E-07	9.37E-07	-2.20E-06	-2.19E-06
557	**1178.35**	1.04E-05	1.05E-05	5.65E-06	5.66E-06	-3.48E-06	-3.47E-06
577	**1227.20**	1.15E-05	1.15E-05	1.12E-05	1.12E-05	-4.93E-06	-4.92E-06
597	**1271.50**	1.25E-05	1.25E-05	1.10E-05	1.10E-05	-5.09E-06	-5.08E-06
617	**1313.65**	2.02E-05	2.02E-05	8.21E-06	8.22E-06	-6.16E-06	-6.15E-06
637	**1360.60**	6.78E-06	6.79E-06	3.99E-06	4.00E-06	-2.21E-06	-2.21E-06

M&D Professional Services, Inc
1/9/2007

AP-460-BES-FCC Strain Seismic-Princ.xls
Strain Gravity

Table 18 BES-FCC Concrete Backed Steel Strain, Shell Bottom, Gravity Load Only

AP Backed Steel, Best Estimate Soil, Gravity Only, Fully Cracked Tank Concrete, 460 In Waste Level at 1.83SpG

M&D Starting M&D Element No.	Path (in)	Shell Bottom Surface (outside - away from waste) Gravity					
		AP-460-BES-FCC EPEL P1 Strain (in/in) Gravity Bot Min	AP-460-BES-FCC EPEL P1 Strain (in/in) Gravity Bot Max	AP-460-BES-FCC EPEL P2 (in/in) Gravity Bot Min	AP-460-BES-FCC EPEL P2 Strain (in/in) Gravity Bot Max	AP-460-BES-FCC EPEL P3 Strain (in/in) Gravity Bot Min	AP-460-BES-FCC EPEL P3 Strain (in/in) Gravity Bot Max
762	67.33	1.64E-04	1.64E-04	-4.67E-05	-4.67E-05	-5.21E-05	-5.21E-05
782	105.04	1.68E-04	1.68E-04	-3.36E-05	-3.36E-05	-5.59E-05	-5.58E-05
802	136.24	1.47E-04	1.47E-04	-4.01E-05	-4.01E-05	-6.84E-05	-6.83E-05
822	181.71	1.01E-04	1.01E-04	-6.38E-07	-6.27E-07	-4.94E-05	-4.93E-05
842	225.10	8.81E-05	8.82E-05	3.12E-06	3.15E-06	-5.63E-05	-5.63E-05
862	273.66	5.49E-05	5.49E-05	2.40E-05	2.40E-05	-3.68E-05	-3.67E-05
882	323.27	4.35E-05	4.36E-05	1.70E-05	1.70E-05	-3.74E-05	-3.74E-05
902	369.20	4.33E-05	4.34E-05	1.59E-05	1.59E-05	-2.47E-05	-2.46E-05
922	419.20	6.76E-05	6.77E-05	-5.18E-06	-5.17E-06	-2.21E-05	-2.20E-05
237	463.02						
257	510.03						
277	544.44						
297	580.53						
317	631.08						
337	680.34						
357	727.44						
377	772.93						
397	831.34						
417	894.09						
2132	925.08	2.79E-05	2.79E-05	-4.91E-06	-4.91E-06	-3.37E-05	-3.37E-05
2122	935.67	6.41E-05	6.41E-05	-2.17E-05	-2.17E-05	-9.95E-05	-9.95E-05
2112	944.86	1.54E-04	1.54E-04	-3.84E-06	-3.84E-06	-6.32E-05	-6.31E-05
477	968.95						
497	1002.45						
517	1042.45						
537	1108.60						
557	1178.35						
577	1227.20						
597	1271.50						
617	1313.65						
637	1360.60						

M&D Professional Services, Inc
1/9/2007

AP-460-BES-FCC Strain Seismic-Princ.xls
Strain Gravity

Table 19 BES-FCC Concrete Backed Steel Strain, Shell Top, Gravity Plus Seismic Load

AP Backed Steel, Best Estimate Soil, Seismic Only, Fully Cracked Tank Concrete, 460 In Waste Level at 1.83SpG

M&D Starting M&D Element No.	Path (in)	Shell Top Surface (inside - towards waste) Seismic					
		AP-460-BES-FCC EPEL P1 Strain (in/in) Seismic Top Min	AP-460-BES-FCC EPEL P1 Strain (in/in) Seismic Top Max	AP-460-BES-FCC EPEL P2 (in/in) Seismic Top Min	AP-460-BES-FCC EPEL P2 Strain (in/in) Seismic Top Max	AP-460-BES-FCC EPEL P3 Strain (in/in) Seismic Top Min	AP-460-BES-FCC EPEL P3 Strain (in/in) Seismic Top Max
762	**67.33**	9.44E-05	1.98E-04	-1.79E-04	-5.00E-05	-2.72E-04	-1.09E-04
782	**105.04**	1.16E-04	2.23E-04	-1.22E-04	-3.62E-07	-3.83E-04	-1.89E-04
802	**136.24**	9.56E-05	1.88E-04	-9.48E-05	3.55E-05	-3.89E-04	-1.46E-04
822	**181.71**	7.96E-05	1.39E-04	-3.88E-05	7.10E-05	-3.34E-04	-1.56E-04
842	**225.10**	5.91E-05	1.20E-04	-5.57E-05	9.11E-05	-2.84E-04	-7.70E-05
862	**273.66**	4.61E-05	8.22E-05	-6.33E-06	6.09E-05	-2.00E-04	-9.79E-05
882	**323.27**	2.94E-05	1.17E-04	-1.58E-05	4.47E-05	-1.54E-04	-4.05E-05
902	**369.20**	1.77E-05	9.83E-05	1.19E-05	3.37E-05	-1.07E-04	-1.60E-05
922	**419.20**	4.05E-05	1.88E-04	-1.71E-05	8.04E-06	-9.05E-05	-4.41E-06
237	**463.02**						
257	**510.03**						
277	**544.44**						
297	**580.53**						
317	**631.08**						
337	**680.34**						
357	**727.44**						
377	**772.93**						
397	**831.34**						
417	**894.09**						
2132	**925.08**	2.57E-05	3.66E-05	-3.24E-05	1.38E-05	-5.21E-05	-2.75E-05
2122	**935.67**	4.16E-05	9.45E-05	-1.85E-05	1.09E-05	-3.87E-05	-1.51E-05
2112	**944.86**	8.11E-05	1.47E-04	-7.06E-06	4.22E-05	-2.58E-04	-4.86E-05
477	**968.95**						
497	**1002.45**						
517	**1042.45**						
537	**1108.60**						
557	**1178.35**						
577	**1227.20**						
597	**1271.50**						
617	**1313.65**						
637	**1360.60**						

M&D Professional Services, Inc
1/9/2007

AP-460-BES-FCC Strain Seismic-Princ.xls
Strain Max

Table 20 BES-FCC Concrete Backed Steel Strain, Shell Middle, Gravity Plus Seismic Load

AP Backed Steel, Best Estimate Soil, Seismic Only, Fully Cracked Tank Concrete, 460 In Waste Level at 1.83SpG

M&D Starting M&D Element No.	Path (in)	Shell Mid-Plane					
		AP-460-BES-FCC EPEL P1 Strain (in/in) Seismic Mid Min	AP-460-BES-FCC EPEL P1 Strain (in/in) Seismic Mid Max	AP-460-BES-FCC EPEL P2 (in/in) Seismic Mid Min	AP-460-BES-FCC EPEL P2 Strain (in/in) Seismic Mid Max	AP-460-BES-FCC EPEL P3 Strain (in/in) Seismic Mid Min	AP-460-BES-FCC EPEL P3 Strain (in/in) Seismic Mid Max
762	67.33	1.02E-04	2.11E-04	-1.93E-04	-5.38E-05	-2.74E-04	-1.24E-04
782	105.04	1.12E-04	2.28E-04	-1.27E-04	-1.16E-06	-3.95E-04	-1.81E-04
802	136.24	1.02E-04	1.89E-04	-9.76E-05	3.09E-05	-3.76E-04	-1.65E-04
822	181.71	7.60E-05	1.36E-04	-4.03E-05	6.84E-05	-3.30E-04	-1.45E-04
842	225.10	6.61E-05	1.19E-04	-5.64E-05	8.45E-05	-2.71E-04	-1.09E-04
862	273.66	4.36E-05	8.19E-05	-6.89E-06	6.13E-05	-2.01E-04	-9.10E-05
882	323.27	3.21E-05	1.17E-04	-1.64E-05	4.44E-05	-1.48E-04	-5.50E-05
902	369.20	1.74E-05	9.80E-05	1.30E-05	2.79E-05	-1.08E-04	-2.38E-05
922	419.20	4.03E-05	1.88E-04	-2.09E-05	1.52E-05	-8.21E-05	-5.19E-06
237	463.02	3.19E-05	1.01E-04	2.74E-05	4.11E-05	-2.42E-04	-1.41E-04
257	510.03	5.32E-05	1.09E-04	4.06E-05	6.97E-05	-3.87E-04	-2.57E-04
277	544.44	8.74E-05	1.16E-04	2.68E-05	8.86E-05	-5.54E-04	-4.03E-04
297	580.53	5.34E-05	7.07E-05	-3.60E-05	4.00E-05	-2.89E-04	-2.06E-04
317	631.08	6.86E-05	8.94E-05	-1.02E-04	9.41E-06	-3.06E-04	-2.15E-04
337	680.34	8.51E-05	1.09E-04	-1.26E-04	-1.80E-05	-3.75E-04	-2.73E-04
357	727.44	9.12E-05	1.17E-04	-1.35E-04	-2.60E-05	-4.01E-04	-2.87E-04
377	772.93	9.86E-05	1.28E-04	-1.40E-04	-1.19E-05	-4.40E-04	-3.02E-04
397	831.34	9.82E-05	1.28E-04	-1.23E-04	4.95E-06	-4.52E-04	-2.96E-04
417	894.09	4.46E-05	6.33E-05	-6.92E-05	1.36E-05	-1.92E-04	-1.14E-04
2132	925.08	2.24E-05	3.34E-05	-2.48E-05	1.12E-05	-4.88E-05	-2.21E-05
2122	935.67	2.37E-05	3.43E-05	-2.62E-05	1.11E-05	-5.63E-05	-2.41E-05
2112	944.86	1.85E-05	4.21E-05	-6.55E-06	2.31E-05	-5.57E-05	-2.06E-05
477	968.95	5.86E-05	7.69E-05	-9.78E-08	4.36E-05	-2.96E-04	-1.90E-04
497	1002.45	2.06E-04	2.85E-04	4.07E-06	4.82E-05	-8.47E-05	-5.53E-05
517	1042.45	7.44E-06	4.57E-05	-5.72E-06	3.50E-05	-2.73E-05	-9.66E-07
537	1108.60	3.11E-06	3.55E-05	-4.13E-06	2.62E-05	-2.53E-05	-3.70E-07
557	1178.35	4.05E-06	3.39E-05	-4.06E-06	2.55E-05	-1.70E-05	-2.54E-07
577	1227.20	5.07E-06	3.31E-05	-4.16E-06	3.28E-05	-1.12E-05	-3.20E-07
597	1271.50	5.48E-06	3.04E-05	-3.04E-06	2.93E-05	-8.84E-06	-3.05E-07
617	1313.65	6.31E-06	4.59E-05	-2.61E-06	2.17E-05	-1.08E-05	-1.13E-06
637	1360.60	2.93E-06	1.18E-05	-1.13E-07	1.08E-05	-4.17E-06	-3.64E-07

M&D Professional Services, Inc
1/9/2007

AP-460-BES-FCC Strain Seismic-Princ.xls
Strain Max

Table 21 BES-FCC Concrete Backed Steel Strain, Shell Bottom, Gravity Plus Seismic Load

AP Backed Steel, Best Estimate Soil, Seismic Only, Fully Cracked Tank Concrete, 460 In Waste Level at 1.83SpG

M&D Starting M&D Element No.	Path (in)	Shell Bottom Surface (outside - away from waste) Seismic					
		AP-460-BES-FCC EPEL P1 Strain (in/in) Seismic Bot Min	AP-460-BES-FCC EPEL P1 Strain (in/in) Seismic Bot Max	AP-460-BES-FCC EPEL P2 (in/in) Seismic Bot Min	AP-460-BES-FCC EPEL P2 Strain (in/in) Seismic Bot Max	AP-460-BES-FCC EPEL P3 Strain (in/in) Seismic Bot Min	AP-460-BES-FCC EPEL P3 Strain (in/in) Seismic Bot Max
762	**67.33**	1.11E-04	2.25E-04	-2.10E-04	-5.76E-05	-2.75E-04	-1.34E-04
782	**105.04**	1.07E-04	2.43E-04	-1.33E-04	-1.95E-06	-4.04E-04	-1.65E-04
802	**136.24**	1.07E-04	1.95E-04	-1.01E-04	2.63E-05	-3.61E-04	-1.76E-04
822	**181.71**	7.15E-05	1.34E-04	-4.16E-05	6.58E-05	-3.25E-04	-1.32E-04
842	**225.10**	7.06E-05	1.24E-04	-5.70E-05	7.69E-05	-2.61E-04	-1.30E-04
862	**273.66**	4.11E-05	8.16E-05	-7.45E-06	6.39E-05	-2.02E-04	-8.10E-05
882	**323.27**	3.13E-05	1.17E-04	-1.69E-05	4.73E-05	-1.44E-04	-5.57E-05
902	**369.20**	1.71E-05	9.76E-05	1.25E-05	2.60E-05	-1.11E-04	-3.05E-05
922	**419.20**	4.02E-05	1.88E-04	-2.61E-05	2.50E-05	-8.82E-05	-6.37E-06
237	**463.02**						
257	**510.03**						
277	**544.44**						
297	**580.53**						
317	**631.08**						
337	**680.34**						
357	**727.44**						
377	**772.93**						
397	**831.34**						
417	**894.09**						
2132	**925.08**	2.12E-05	3.52E-05	-1.71E-05	1.07E-05	-4.62E-05	-1.55E-05
2122	**935.67**	4.53E-05	7.69E-05	-2.66E-05	1.16E-05	-1.16E-04	-4.05E-05
2112	**944.86**	1.31E-04	2.47E-04	-1.05E-05	4.18E-05	-7.68E-05	-2.71E-05
477	**968.95**						
497	**1002.45**						
517	**1042.45**						
537	**1108.60**						
557	**1178.35**						
577	**1227.20**						
597	**1271.50**						
617	**1313.65**						
637	**1360.60**						

M&D Professional Services, Inc
1/9/2007

AP-460-BES-FCC Strain Seismic-Princ.xls
Strain Max

Table 22 BES-FCC Concrete Backed Steel Strain, Shell Top, Seismic Load Only

AP Backed Steel, Best Estimate Soil, Seismic Only, Fully Cracked Tank Concrete, 460 In Waste Level at 1.83SpG

M&D Starting M&D Element No.	Path (in)	Shell Top Surface (inside - towards waste) Seismic					
		AP-460-BES-FCC EPEL P1 Strain (in/in) Seismic Only Top Min	AP-460-BES-FCC EPEL P1 Strain (in/in) Seismic Only Top Max	AP-460-BES-FCC EPEL P2 (in/in) Seismic Only Top Min	AP-460-BES-FCC EPEL P2 Strain (in/in) Seismic Only Top Max	AP-460-BES-FCC EPEL P3 Strain (in/in) Seismic Only Top Min	AP-460-BES-FCC EPEL P3 Strain (in/in) Seismic Only Top Max
762	**67.33**	-5.02E-05	5.32E-05	-3.08E-05	9.77E-05	-8.63E-05	7.69E-05
782	**105.04**	-5.08E-05	5.61E-05	-3.08E-05	9.09E-05	-8.64E-05	1.08E-04
802	**136.24**	-4.39E-05	4.87E-05	-3.98E-05	9.04E-05	-1.21E-04	1.21E-04
822	**181.71**	-2.83E-05	3.09E-05	-4.22E-05	6.75E-05	-7.94E-05	9.79E-05
842	**225.10**	-2.11E-05	4.02E-05	-6.04E-05	8.63E-05	-9.39E-05	1.13E-04
862	**273.66**	-1.23E-05	2.37E-05	-3.13E-05	3.59E-05	-3.94E-05	6.26E-05
882	**323.27**	-7.84E-06	7.98E-05	-3.32E-05	2.72E-05	-5.00E-05	6.33E-05
902	**369.20**	-2.63E-05	5.42E-05	-4.96E-06	1.68E-05	-2.43E-05	6.69E-05
922	**419.20**	-2.75E-05	1.20E-04	-7.63E-06	1.75E-05	-4.48E-05	4.12E-05
237	**463.02**						
257	**510.03**						
277	**544.44**						
297	**580.53**						
317	**631.08**						
337	**680.34**						
357	**727.44**						
377	**772.93**						
397	**831.34**						
417	**894.09**						
2062	**925.08**	-3.55E-06	7.34E-06	-4.01E-06	4.22E-05	-1.84E-05	6.15E-06
2052	**935.67**	-1.27E-05	4.03E-05	-1.73E-06	2.76E-05	-1.64E-05	7.22E-06
2042	**944.86**	-1.26E-05	5.29E-05	-3.67E-06	4.56E-05	-4.63E-05	1.63E-04
477	**968.95**						
497	**1002.45**						
517	**1042.45**						
537	**1108.60**						
557	**1178.35**						
577	**1227.20**						
597	**1271.50**						
617	**1313.65**						
637	**1360.60**						

M&D Professional Services, Inc
1/9/2007

AP-460-BES-FCC Strain Seismic-Princ.xls
Strain Seismic Only

Table 23 BES-FCC Concrete Backed Steel Strain, Shell Middle, Seismic Load Only

AP Backed Steel, Best Estimate Soil, Seismic Only, Fully Cracked Tank Concrete, 460 In Waste Level at 1.83SpG

M&D Starting M&D Element No.	Path (in)	Shell Mid-Plane					
		AP-460-BES-FCC EPEL P1 Strain (in/in) Seismic Only Mid Min	AP-460-BES-FCC EPEL P1 Strain (in/in) Seismic Only Mid Max	AP-460-BES-FCC EPEL P2 (in/in) Seismic Only Mid Min	AP-460-BES-FCC EPEL P2 Strain (in/in) Seismic Only Mid Max	AP-460-BES-FCC EPEL P3 Strain (in/in) Seismic Only Mid Min	AP-460-BES-FCC EPEL P3 Strain (in/in) Seismic Only Mid Max
762	**67.33**	-5.15E-05	5.67E-05	-1.50E-04	-1.04E-05	-2.28E-04	-7.84E-05
782	**105.04**	-5.50E-05	6.08E-05	-9.44E-05	3.18E-05	-3.29E-04	-1.15E-04
802	**136.24**	-4.15E-05	4.57E-05	-5.79E-05	7.05E-05	-3.18E-04	-1.06E-04
822	**181.71**	-2.86E-05	3.14E-05	-4.17E-05	6.70E-05	-2.74E-04	-8.94E-05
842	**225.10**	-1.79E-05	3.52E-05	-6.03E-05	8.06E-05	-2.27E-04	-6.52E-05
862	**273.66**	-1.31E-05	2.52E-05	-3.13E-05	3.68E-05	-1.60E-04	-5.00E-05
882	**323.27**	-8.31E-06	7.64E-05	-3.36E-05	2.71E-05	-1.19E-04	-2.61E-05
902	**369.20**	-2.63E-05	5.42E-05	-3.41E-06	1.15E-05	-8.07E-05	3.02E-06
922	**419.20**	-2.74E-05	1.20E-04	-1.46E-05	2.15E-05	-6.24E-05	1.45E-05
237	**463.02**	-2.51E-05	4.39E-05	-6.90E-06	6.72E-06	-1.71E-04	-7.03E-05
257	**510.03**	-2.96E-05	2.65E-05	-1.86E-05	1.05E-05	-5.27E-05	7.67E-05
277	**544.44**	-2.88E-05	-5.00E-07	-4.72E-05	1.46E-05	-7.07E-05	7.94E-05
297	**580.53**	-2.82E-05	-1.10E-05	-2.51E-05	5.08E-05	-4.26E-05	4.06E-05
317	**631.08**	-2.30E-05	-2.27E-06	-1.55E-05	9.58E-05	-4.59E-05	4.46E-05
337	**680.34**	-3.26E-05	-8.40E-06	-1.49E-05	9.35E-05	-5.16E-05	4.95E-05
357	**727.44**	-2.99E-05	-3.90E-06	-1.36E-05	9.50E-05	-5.26E-05	6.09E-05
377	**772.93**	-3.92E-05	-1.00E-05	-1.25E-05	1.16E-04	-5.79E-05	8.00E-05
397	**831.34**	-3.00E-05	-4.00E-07	-1.04E-05	1.18E-04	-5.40E-05	1.02E-04
417	**894.09**	-1.50E-05	3.68E-06	-5.20E-06	7.76E-05	-2.87E-05	4.96E-05
2062	**925.08**	-6.80E-06	4.12E-06	-7.99E-06	2.80E-05	-1.52E-05	1.16E-05
2052	**935.67**	-6.41E-06	4.14E-06	-4.21E-06	3.31E-05	-2.55E-05	6.71E-06
2042	**944.86**	-3.45E-06	2.01E-05	-2.94E-06	2.67E-05	-2.01E-05	1.49E-05
477	**968.95**	-8.87E-06	9.31E-06	-7.37E-06	3.63E-05	-3.45E-05	7.10E-05
497	**1002.45**	-3.34E-05	4.54E-05	-1.24E-05	3.18E-05	-1.04E-05	1.89E-05
517	**1042.45**	-7.28E-06	3.10E-05	-1.55E-05	2.52E-05	-2.18E-05	4.57E-06
537	**1108.60**	-6.13E-06	2.62E-05	-5.05E-06	2.52E-05	-2.31E-05	1.82E-06
557	**1178.35**	-6.38E-06	2.35E-05	-9.70E-06	1.99E-05	-1.36E-05	3.22E-06
577	**1227.20**	-6.45E-06	2.15E-05	-1.53E-05	2.17E-05	-6.25E-06	4.60E-06
597	**1271.50**	-7.00E-06	1.79E-05	-1.40E-05	1.83E-05	-3.75E-06	4.77E-06
617	**1313.65**	-1.39E-05	2.57E-05	-1.08E-05	1.35E-05	-4.65E-06	5.02E-06
637	**1360.60**	-3.85E-06	5.02E-06	-4.10E-06	6.78E-06	-1.96E-06	1.84E-06

Table 24 BES-FCC Concrete Backed Steel Strain, Shell Bottom, Seismic Load Only

AP Backed Steel, Best Estimate Soil, Seismic Only, Fully Cracked Tank Concrete, 460 In Waste Level at 1.83SpG

M&D Starting M&D Element No.	Path (in)	Shell Bottom Surface (outside - away from waste) Seismic					
		AP-460-BES-FCC EPEL P1 Strain (in/in) Seismic Only Bot Min	AP-460-BES-FCC EPEL P1 Strain (in/in) Seismic Only Bot Max	AP-460-BES-FCC EPEL P2 (in/in) Seismic Only Bot Min	AP-460-BES-FCC EPEL P2 Strain (in/in) Seismic Only Bot Max	AP-460-BES-FCC EPEL P3 Strain (in/in) Seismic Only Bot Min	AP-460-BES-FCC EPEL P3 Strain (in/in) Seismic Only Bot Max
762	**67.33**	-5.30E-05	6.11E-05	-1.63E-04	-1.09E-05	-2.23E-04	-8.20E-05
782	**105.04**	-6.05E-05	7.53E-05	-9.92E-05	3.16E-05	-3.48E-04	-1.10E-04
802	**136.24**	-3.97E-05	4.80E-05	-6.11E-05	6.63E-05	-2.92E-04	-1.08E-04
822	**181.71**	-2.98E-05	3.24E-05	-4.10E-05	6.64E-05	-2.75E-04	-8.24E-05
842	**225.10**	-1.75E-05	3.60E-05	-6.01E-05	7.37E-05	-2.05E-04	-7.33E-05
862	**273.66**	-1.38E-05	2.66E-05	-3.14E-05	3.99E-05	-1.65E-04	-4.43E-05
882	**323.27**	-1.22E-05	7.31E-05	-3.39E-05	3.02E-05	-1.06E-04	-1.83E-05
902	**369.20**	-2.62E-05	5.43E-05	-3.41E-06	1.02E-05	-8.61E-05	-5.81E-06
922	**419.20**	-2.74E-05	1.20E-04	-2.09E-05	3.01E-05	-6.62E-05	1.56E-05
237	**463.02**						
257	**510.03**						
277	**544.44**						
297	**580.53**						
317	**631.08**						
337	**680.34**						
357	**727.44**						
377	**772.93**						
397	**831.34**						
417	**894.09**						
2062	**925.08**	-6.71E-06	7.33E-06	-1.22E-05	1.56E-05	-1.25E-05	1.82E-05
2052	**935.67**	-1.88E-05	1.28E-05	-4.90E-06	3.33E-05	-1.62E-05	5.90E-05
2042	**944.86**	-2.32E-05	9.24E-05	-6.69E-06	4.57E-05	-1.36E-05	3.60E-05
477	**968.95**						
497	**1002.45**						
517	**1042.45**						
537	**1108.60**						
557	**1178.35**						
577	**1227.20**						
597	**1271.50**						
617	**1313.65**						
637	**1360.60**						

M&D Professional Services, Inc
1/9/2007

AP-460-BES-FCC Strain Seismic-Princ xls
Strain Seismic Only

Table 25 BES-FCC Concrete Wall/Footing Contact Forces, Gravity Only

Tank AY, 460 Inch Waste Level
SpG = 1.83
Best Estimate Soil
Fully Cracked Concrete

Angle	Vertical Min AP-BES-FCC Gravity	Vertical Max AP-BES-FCC Gravity	Shear Y Min AP-BES-FCC Gravity	Shear Y Max AP-BES-FCC Gravity	Shear X Min AP-BES-FCC Gravity	Shear X Max AP-BES-FCC Gravity	Shear Y Max AP-BES-FCC Gravity	Shear X Max AP-BES-FCC Gravity	Shear Max AP-BES-FCC Gravity	Vertical Force Max AP-BES-FCC Gravity	Vertical Force Min AP-BES-FCC Gravity
0	-204.10	-203.90	0.00	0.00	-2.24	-2.24	0.00	0.70	0.70	-63.78	-63.72
9	-408.10	-407.70	-0.69	-0.69	-4.48	-4.47	0.11	0.70	0.71	-63.77	-63.70
18	-408.10	-407.70	-1.20	-1.20	-4.15	-4.14	0.19	0.65	0.67	-63.77	-63.70
27	-408.10	-407.80	-1.78	-1.77	-3.89	-3.88	0.28	0.61	0.67	-63.77	-63.72
36	-408.10	-407.70	-2.63	-2.62	-3.69	-3.69	0.41	0.58	0.71	-63.77	-63.70
45	-408.00	-407.70	-3.12	-3.12	-3.21	-3.20	0.49	0.50	0.70	-63.75	-63.70
54	-408.00	-407.70	-3.63	-3.62	-2.74	-2.73	0.57	0.43	0.71	-63.75	-63.70
63	-408.00	-407.70	-3.93	-3.92	-2.08	-2.08	0.61	0.33	0.69	-63.75	-63.70
72	-408.10	-407.70	-4.30	-4.29	-1.41	-1.41	0.67	0.22	0.71	-63.77	-63.70
81	-408.00	-407.60	-4.23	-4.22	-0.79	-0.79	0.66	0.12	0.67	-63.75	-63.69
90	-408.00	-407.60	-4.53	-4.52	0.02	0.02	0.71	0.00	0.71	-63.75	-63.69
99	-408.00	-407.70	-4.46	-4.45	0.75	0.75	0.70	0.12	0.71	-63.75	-63.70
108	-408.00	-407.70	-4.11	-4.10	1.27	1.28	0.64	0.20	0.67	-63.75	-63.70
117	-408.10	-407.70	-3.99	-3.99	2.12	2.12	0.62	0.33	0.71	-63.77	-63.70
126	-408.10	-407.70	-3.53	-3.53	2.69	2.70	0.55	0.42	0.69	-63.77	-63.70
135	-408.00	-407.70	-3.11	-3.10	3.27	3.27	0.49	0.51	0.70	-63.75	-63.70
144	-408.00	-407.60	-2.59	-2.58	3.71	3.71	0.40	0.58	0.71	-63.75	-63.69
153	-408.00	-407.70	-2.00	-1.99	4.02	4.03	0.31	0.63	0.70	-63.75	-63.70
162	-408.10	-407.70	-1.32	-1.32	4.26	4.27	0.21	0.67	0.70	-63.77	-63.70
171	-408.00	-407.70	-0.65	-0.65	4.43	4.44	0.10	0.69	0.70	-63.75	-63.70
180	-204.10	-203.90	0.00	0.00	2.26	2.26	0.00	0.71	0.71	-63.78	-63.72

M&D Professional Services, Inc
12/21/2006

AP-460-BES-FCC Footing Seismic.xls

Table 26 BES-FCC Concrete Wall/Footing Contact Forces, Gravity Plus Seismic

Tank AY, 460 Inch Waste Level
SpG = 1.83
Best Estimate Soil
Fully Cracked Concrete

Angle	Vertical Min AP-BES-FCC Seismic	Vertical Max AP-BES-FCC Seismic	Shear Y Min AP-BES-FCC Seismic	Shear Y Max AP-BES-FCC Seismic	Shear X Min AP-BES-FCC Seismic	Shear X Max AP-BES-FCC Seismic	Shear Y Max AP-BES-FCC Seismic	Shear X Max AP-BES-FCC Seismic	Shear Max AP-BES-FCC Seismic	Vertical Force Max AP-BES-FCC Seismic	Vertical Force Min AP-BES-FCC Seismic
0	-235.40	-154.90	0.00	0.00	-7.76	4.78	0.00	2.43	2.43	-73.56	-48.41
9	-470.70	-310.60	-21.35	19.11	-18.37	12.72	3.34	2.87	4.40	-73.55	-48.53
18	-470.50	-313.00	-40.49	36.57	-26.61	22.57	6.33	4.16	7.57	-73.52	-48.91
27	-470.20	-316.90	-55.95	50.39	-40.36	37.59	8.74	6.31	10.78	-73.47	-49.52
36	-469.70	-322.10	-66.49	58.87	-58.35	56.52	10.39	9.12	13.82	-73.39	-50.33
45	-469.00	-328.20	-70.52	61.66	-78.08	78.00	11.02	12.20	16.44	-73.28	-51.28
54	-468.30	-335.10	-68.02	57.97	-97.86	99.79	10.63	15.59	18.87	-73.17	-52.36
63	-467.50	-341.90	-59.06	48.34	-115.40	120.10	9.23	18.77	20.91	-73.05	-53.42
72	-466.60	-347.50	-44.55	33.40	-129.20	136.70	6.96	21.36	22.47	-72.91	-54.30
81	-465.70	-349.50	-25.20	15.17	-137.60	148.00	3.94	23.13	23.46	-72.77	-54.61
90	-464.70	-350.80	-6.46	-3.33	-139.70	152.80	1.01	23.88	23.90	-72.61	-54.81
99	-463.80	-351.30	-25.49	18.36	-135.20	150.30	3.98	23.48	23.82	-72.47	-54.89
108	-463.00	-351.40	-43.03	38.39	-124.70	140.80	6.72	22.00	23.00	-72.34	-54.91
117	-462.20	-351.10	-56.79	53.91	-108.70	125.60	8.87	19.63	21.54	-72.22	-54.86
126	-461.40	-350.50	-64.85	63.92	-89.54	105.80	10.13	16.53	19.39	-72.09	-54.77
135	-460.80	-349.60	-66.94	67.09	-68.80	84.11	10.48	13.14	16.81	-72.00	-54.63
144	-460.30	-348.80	-62.84	63.50	-48.59	62.61	9.92	9.78	13.93	-71.92	-54.50
153	-460.40	-348.30	-52.94	53.67	-31.01	43.51	8.39	6.80	10.80	-71.94	-54.42
162	-461.30	-346.80	-38.17	38.74	-17.40	28.61	6.05	4.47	7.52	-72.08	-54.19
171	-461.90	-345.80	-19.97	20.28	-8.59	19.15	3.17	2.99	4.36	-72.17	-54.03
180	-231.10	-172.80	0.00	0.00	-2.80	8.06	0.00	2.52	2.52	-72.22	-54.00

M&D Professional Services, Inc
12/21/2006

AP-460-BES-FCC Footing Seismic.xls

Table 27 BES-FCC Concrete Wall/Footing Contact Forces, Seismic Only

Tank AY, 460 Inch Waste Level
SpG = 1.83
Best Estimate Soil
Fully Cracked Concrete

Angle	Vertical Min AP-BES-FCC Seismic Only	Vertical Max AP-BES-FCC Seismic Only	Shear Y Min AP-BES-FCC Seismic Only	Shear Y Max AP-BES-FCC Seismic Only	Shear X Min AP-BES-FCC Seismic Only	Shear X Max AP-BES-FCC Seismic Only	Shear Y Max AP-BES-FCC Seismic Only	Shear X Max AP-BES-FCC Seismic Only	Shear Max AP-BES-FCC Seismic Only	Vertical Force Max AP-BES-FCC Seismic Only	Vertical Force Min AP-BES-FCC Seismic Only
0	-31.30	49.00	0.00	0.00	-5.52	7.02	0.00	2.19	2.19	-9.78	15.31
9	-62.60	97.10	-20.66	19.80	-13.90	17.19	3.23	2.69	4.20	-9.78	15.17
18	-62.40	94.70	-39.29	37.77	-22.46	26.71	6.14	4.17	7.42	-9.75	14.80
27	-62.10	90.90	-54.17	52.16	-36.47	41.47	8.46	6.48	10.66	-9.70	14.20
36	-61.60	85.60	-63.86	61.49	-54.66	60.21	9.98	9.41	13.71	-9.62	13.38
45	-61.00	79.50	-67.40	64.78	-74.88	81.20	10.53	12.69	16.49	-9.53	12.42
54	-60.30	72.60	-64.39	61.59	-95.12	102.52	10.06	16.02	18.92	-9.42	11.34
63	-59.50	65.80	-55.13	52.26	-113.32	122.18	8.61	19.09	20.94	-9.30	10.28
72	-58.50	60.20	-40.25	37.69	-127.79	138.11	6.29	21.58	22.48	-9.14	9.41
81	-57.70	58.10	-20.97	19.39	-136.81	148.79	3.28	23.25	23.48	-9.02	9.08
90	-56.70	56.80	-1.93	1.20	-139.72	152.78	0.30	23.87	23.87	-8.86	8.88
99	-55.80	56.40	-21.04	22.81	-135.95	149.55	3.56	23.37	23.64	-8.72	8.81
108	-55.00	56.30	-38.92	42.49	-125.97	139.53	6.64	21.80	22.79	-8.59	8.80
117	-54.10	56.60	-52.80	57.90	-110.82	123.48	9.05	19.29	21.31	-8.45	8.84
126	-53.30	57.20	-61.32	67.45	-92.23	103.10	10.54	16.11	19.25	-8.33	8.94
135	-52.80	58.10	-63.84	70.19	-72.07	80.84	10.97	12.63	16.73	-8.25	9.08
144	-52.30	58.80	-60.25	66.08	-52.30	58.90	10.33	9.20	13.83	-8.17	9.19
153	-52.40	59.40	-50.95	55.66	-35.03	39.48	8.70	6.17	10.66	-8.19	9.28
162	-53.20	60.90	-36.85	40.06	-21.66	24.34	6.26	3.80	7.32	-8.31	9.52
171	-53.90	61.90	-19.32	20.93	-13.02	14.71	3.27	2.30	4.00	-8.42	9.67
180	-27.00	31.10	0.00	0.00	-5.06	5.79	0.00	1.81	1.81	-8.44	9.72

M&D Professional Services, Inc
12/21/2006

AP-460-BES-FCC Footing Seismic.xls

Table 28 BES-FCC Soil/Concrete Tank Contact Forces, Gravity Only

Tank AP, 460 Inch Waste Level
SpG = 1.83
Best Estimate Soil
Fully Cracked Concrete

								1.7	1.19	
	Angle (rad)	**Path**	**Max Pressure Soil (BES-FCC) AP Gravity (PSI)**	**Min Pressure Soil (BES-FCC) AP Gravity (PSI)**	**Max Meridional Friction Soil (BES-FCC) AP Gravity (PSI)**	**Max Tangential Friction Soil (BES-FCC) AP Gravity (PSI)**	**Max Contact Displacement Soil (BES-FCC) AP Gravity (PSI)**	**0.70g Dome Vertical**	**0.19g Haunch Vertical**	**Active Pressure Phi = 49 deg**
568	-0.035089	**67.727**	9.85	9.67	2.05	0.04	0.08	16.75	11.73	7.11
565.8	-0.07135	**105.668**	8.26	8.03	1.80	0.04	0.12	14.05	9.83	7.26
563.21	-0.096521	**137.069**	8.87	8.44	2.03	0.06	0.12	15.08	10.55	7.42
559.7	-0.124516	**182.849**	5.62	4.42	1.20	0.04	0.08	9.56	6.69	7.65
550.7	-0.180521	**226.563**	5.94	5.04	1.58	0.11	0.05	10.10	7.07	8.22
545.2	-0.210395	**275.566**	8.26	7.65	1.78	0.08	0.04	14.04	9.83	8.55
527.68	-0.298426	**325.690**	7.61	7.27	1.56	0.03	0.04	12.94	9.06	9.56
518.2	-0.34673	**372.305**	9.25	9.16	2.34	0.02	0.04	15.73	11.01	10.04
494.5	-0.482293	**423.427**	16.41	16.26	3.30	0.08	0.03	27.90	19.53	10.97
476.2	-0.606571	**468.308**	28.08	27.99	3.18	0.12	0.02	47.74	33.42	11.27
447.4	-0.656685	**515.312**	31.94	31.77	5.02	0.21	0.03	54.29	38.01	12.51
407.1	-0.710341	**549.725**	25.44	25.38	5.31	0.16	0.04	43.26	30.28	14.18
382.1	-1.570796	**585.819**	12.38	12.36	3.23	0.06	0.04	21.04	14.73	2.85
335	-1.570796	**636.369**	4.39	4.38	1.06	0.01	0.04	7.46	5.22	3.32
281	-1.570796	**685.619**	3.84	3.83	0.88	0.00	0.05	6.53	4.57	3.86
236.5	-1.570796	**732.719**	4.74	4.74	0.96	0.00	0.05	8.06	5.64	4.30
186.8	-1.570796	**778.219**	4.41	4.40	0.92	0.00	0.05	7.50	5.25	4.80
145.5	-1.570796	**821.369**	5.67	5.66	1.31	0.01	0.05	9.64	6.75	5.21
70	-1.570796	**874.169**	9.10	9.08	2.04	0.03	0.04	15.47	10.83	5.96
24	-1.570796	**930.544**	12.02	11.95	2.51	0.05	0.03	20.44	14.30	6.42

Table 29 BES-FCC Soil/Concrete Tank Contact Forces, Gravity Plus Seismic

Tank AP, 460 Inch Waste Level
SpG = 1.83
Best Estiamte Soil
Fully Cracked Concrete

	Angle (rad)	Path	Max Pressure Soil (BES-FCC) AP Seismic (PSI)	Min Pressure Soil (BES-FCC) AP Seismic (PSI)	Max Meridional Friction Soil (BES-FCC) AP Seismic (PSI)	Max Tangential Friction Soil (BES-FCC) AP Seismic (PSI)	Max Contact Displacement Soil (BES-FCC) AP Seismic (inch)	Vertical Pressure	Active Pressure Phi = 33 deg	Active Pressure Phi = 49 deg
568	-0.035089	**67.727**	17.85	2.42	8.94	5.75	0.13	7.12	7.11	7.11
565.8	-0.07135	**105.668**	13.85	2.14	8.13	3.97	0.15	7.27	7.26	7.26
563.21	-0.096521	**137.069**	15.17	1.43	8.35	3.53	0.15	7.46	7.43	7.42
559.7	-0.124516	**182.849**	8.58	2.71	5.33	3.61	0.10	7.71	7.65	7.65
550.7	-0.180521	**226.563**	10.62	1.81	4.50	5.17	0.06	8.35	8.23	8.22
545.2	-0.210395	**275.566**	10.22	5.46	4.54	4.74	0.05	8.74	8.57	8.55
527.68	-0.298426	**325.690**	9.78	4.55	4.06	4.28	0.05	9.99	9.59	9.56
518.2	-0.34673	**372.305**	11.45	6.91	4.52	4.03	0.04	10.66	10.09	10.04
494.5	-0.482293	**423.427**	19.74	13.06	5.90	3.54	0.04	12.35	11.07	10.97
476.2	-0.606571	**468.308**	34.19	22.11	7.01	3.01	0.03	13.65	11.45	11.27
447.4	-0.656685	**515.312**	38.73	26.94	11.67	3.07	0.05	15.70	12.75	12.51
407.1	-0.710341	**549.725**	31.28	20.55	12.78	2.56	0.06	18.57	14.53	14.18
382.1	-1.570796	**585.819**	14.84	10.34	8.19	1.80	0.07	20.35	6.00	2.85
335	-1.570796	**636.369**	5.12	3.74	3.33	1.42	0.08	23.70	6.99	3.32
281	-1.570796	**685.619**	4.52	3.17	2.89	1.36	0.08	27.55	8.13	3.86
236.5	-1.570796	**732.719**	5.41	4.17	3.09	1.39	0.08	30.71	9.06	4.30
186.8	-1.570796	**778.219**	4.93	3.75	2.92	1.61	0.08	34.25	10.10	4.80
145.5	-1.570796	**821.369**	6.65	4.78	4.36	2.57	0.08	37.19	10.97	5.21
70	-1.570796	**874.169**	12.31	5.41	7.36	2.75	0.06	42.57	12.56	5.96
24	-1.570796	**930.544**	20.06	2.62	6.52	2.84	0.04	45.84	13.52	6.42

Table 30 BES-FCC Soil/Concrete Tank Contact Forces, Seismic Only

Tank AP, 460 Inch Waste Level
SpG = 1.83
Best Estiamte Soil
Fully Cracked Concrete

	Angle (rad)	Path	Max Pressure Soil (BES-FCC) AP Seismic Only (PSI)	Min Pressure Soil (BES-FCC) AP Seismic Only (PSI)	Max Meridional Friction (BES-FCC) AP Seismic Only (PSI)	Max Tangential Friction (BES-FCC) AP Seismic Only (PSI)	Max Contact Displacment (BES-FCC) AP Seismic Only (inch)
568	-0.035089	**67.727**	7.99	-7.43	6.89	5.72	0.05
565.8	-0.07135	**105.668**	5.58	-6.12	6.33	3.93	0.03
563.21	-0.096521	**137.069**	6.30	-7.44	6.33	3.47	0.03
559.7	-0.124516	**182.849**	2.96	-2.91	4.13	3.57	0.01
550.7	-0.180521	**226.563**	4.68	-4.14	2.93	5.06	0.01
545.2	-0.210395	**275.566**	1.96	-2.80	2.76	4.65	0.01
527.68	-0.298426	**325.690**	2.17	-3.06	2.50	4.25	0.01
518.2	-0.34673	**372.305**	2.20	-2.34	2.18	4.01	0.01
494.5	-0.482293	**423.427**	3.33	-3.35	2.60	3.46	0.01
476.2	-0.606571	**468.308**	6.11	-5.97	3.83	2.89	0.01
447.4	-0.656685	**515.312**	6.79	-5.00	6.65	2.86	0.02
407.1	-0.710341	**549.725**	5.84	-4.90	7.48	2.40	0.02
382.1	-1.570796	**585.819**	2.47	-2.03	4.97	1.74	0.03
335	-1.570796	**636.369**	0.73	-0.65	2.27	1.42	0.03
281	-1.570796	**685.619**	0.68	-0.67	2.01	1.36	0.03
236.5	-1.570796	**732.719**	0.66	-0.57	2.13	1.39	0.03
186.8	-1.570796	**778.219**	0.52	-0.66	2.01	1.60	0.03
145.5	-1.570796	**821.369**	0.98	-0.89	3.04	2.56	0.03
70	-1.570796	**874.169**	3.21	-3.69	5.32	2.72	0.02
24	-1.570796	**930.544**	8.03	-9.40	4.00	2.79	0.01

Table 31 BES-FCC Primary Tank/Concrete Dome Contact Data, Gravity Only

Tank AP, 460 Inch Waste Level
SpG = 1.83
Best Estimate Soil
Fully Cracked Concrete

Radius	Max Pressure Primary Tank/Concrete Tank Dome AP Gravity (PSI)	Min Pressure Primary Tank/Concrete Tank Dome AP Gravity (PSI)	Max Gap Lateral Displacement Primary Tank /Concrete Tank Dome Gravity (in)	Max Gap Displacement Primary Tank/Concete Tank Dome AP Gravity (Inches)
67.727	6.210	6.014	0.010516	0.000000
105.668	3.776	3.697	0.017640	0.000000
137.069	2.708	2.668	0.021168	0.000000
182.849	2.951	2.917	0.022872	0.000000
226.563	1.797	1.760	0.011905	-0.000034
275.566	2.883	2.867	0.025560	0.000000
325.690	0.436	0.426	0.004495	-0.000047
372.305	1.424	1.409	0.014832	-0.000013
423.427	1.965	1.951	0.015984	-1.050960

Table 32 BES-FCC Primary Tank/Concrete Dome Contact Data, Gravity Plus Seismic

Tank AP, 460 Inch Waste Level
SpG = 1.83
Best Estimate Soil
Fully Cracked Concrete

Radius	Max Pressure Primary Tank/Concrete Tank Dome AP Seismic (PSI)	Min Pressure Primary Tank/Concrete Tank Dome AP Seismic (PSI)	Max Gap Lateral Displacement Primary Tank /Concrete Tank Dome Seismic (in)	Max Gap Displacement Primary Tank/Concete Tank Dome AP Seismic (Inches)
67.727	7.361	3.192	0.014124	0.000000
105.668	4.847	2.086	0.023376	0.000000
137.069	3.496	1.575	0.027816	0.000000
182.849	3.274	1.764	0.029508	0.000000
226.563	2.758	1.469	0.030804	0.000000
275.566	2.805	1.631	0.031572	0.000000
325.690	1.806	0.527	0.026736	-0.000051
372.305	2.001	0.653	0.036036	-0.000054
423.427	2.282	0.000	0.019500	-1.053240

Table 33 BES-FCC Primary Tank/Concrete Dome Contact Data, Seismic Only

Tank AP, 460 Inch Waste Level
SpG = 1.83
Best Estimate Soil
Fully Cracked Concrete

Radius	Max Pressure Primary Tank/Concrete Tank Dome AP Seismic Only (PSI)	Min Pressure Primary Tank/Concrete Tank Dome AP Seismic Only (PSI)	Max Gap Lateral Displacement Primary Tank /Concrete Tank Dome Seismic Only (in)	Max Gap Displacement Primary Tank/Concete Tank Dome AP Seismic Only (Inches)
67.727	1.151	-2.822	0.003608	0.000000
105.668	1.072	-1.611	0.005736	0.000000
137.069	0.788	-1.093	0.006648	0.000000
182.849	0.323	-1.153	0.006636	0.000000
226.563	0.962	-0.292	0.018899	0.000034
275.566	-0.078	-1.235	0.006012	0.000000
325.690	1.369	0.101	0.022241	-0.000004
372.305	0.577	-0.756	0.021204	-0.000041
423.427	0.317	-1.951	0.003516	-0.002280

Table 34 BES-FCC Primary Tank/Insulating Concrete Contact Forces, Gravity Only

Tank AP, 460 Inch Waste Level
SpG = 1.83
Best Esitmate Soil
Fully Cracked Concrete

Radius	Max Pressure Primary Tank/Insulating Concrete AP Gravity (PSI)	Min Pressure Primary Tank/Insulating Concrete AP Gravity (PSI)	Max Lateral Displacement Primary Tank / Insulating Concete AP Gravity (Inches)	Min Lateral Displacement Primary Tank / Insulating Concete AP Gravity (Inches)
424.00	76.111	75.972	0.011204	0.011182
384.00	12.931	12.917	0.000215	0.000138
317.85	33.451	33.417	0.003043	0.003030
248.10	29.681	29.660	0.002262	0.002251
199.25	30.764	30.736	0.000995	0.000988
154.95	30.479	30.451	0.000732	0.000726
112.80	30.451	30.417	0.000337	0.000330
65.85	30.972	30.882	0.000346	0.000334

Table 35 BES-FCC Primary Tank/ Insulating Concrete Contact Data, Gravity Plus Seismic

Tank AP, 460 Inch Waste Level
SpG = 1.83
Best Estimate Soil
Fully Cracked Concrete

Radius	Max Pressure Primary Tank/Insulaiting Concrete AP Seismic (PSI)	Min Pressure Primary Tank/Insulaiting Concrete AP Seismic (PSI)	Max Lateral Displacement Primary Tank/Insulaiting Concrete AP Seismic (Inches)	Min Lateral Displacement Primary Tank/Insulaiting Concrete AP Seismic (Inches)
424.00	100.208	42.028	0.076152	0.002960
384.00	25.951	8.104	0.162840	0.001160
317.85	42.319	22.201	0.051528	0.000932
248.10	37.611	20.722	0.032700	0.000779
199.25	37.479	21.618	0.021708	0.000160
154.95	36.361	22.431	0.015156	0.000171
112.80	36.326	23.951	0.011286	0.000027
65.85	35.500	23.681	0.009168	0.000037

Table 36 BES-FCC Primary Tank/ Insulating Concrete Contact Forces, Seismic Only

Tank AP, 460 Inch Waste Level
SpG = 1.83
Best Estimate Soil
Fully Cracked Concrete

Radius	Max Pressure Primary Tank/Insulaiting Concrete AP Seismic Only (PSI)	Min Pressure Primary Tank/Insulaiting Concrete AP Seismic Only (PSI)	Max Lateral Displacement Primary Tank/Insulaiting Concrete AP Seismic Only (Inches)	Min Lateral Displacement Primary Tank/Insulaiting Concrete AP Seismic Only (Inches)
424.00	24.097	-33.944	0.065	-0.008
384.00	13.021	-4.813	0.163	0.001
317.85	8.868	-11.215	0.048	-0.002
248.10	7.931	-8.938	0.030	-0.001
199.25	6.715	-9.118	0.021	-0.001
154.95	5.882	-8.021	0.014	-0.001
112.80	5.875	-6.465	0.011	0.000
65.85	4.528	-7.201	0.009	0.000

Table 37 BES-FCC Insulating Concrete/Concrete Backed Steel Contact Data, Gravity Only

Tank AP, 460 Inch Waste Level
SpG = 1.83
Best Esitmate Soil
Fully Cracked Concrete

Radius	Max Pressure Insulating Concrete/Secondary Liner AP Gravity (PSI)	Min Pressure Insulating Concrete/Secondary Liner AP Gravity (PSI)	Max Lateral Displacement Insulating Concrete/Secondary Liner AP Gravity (Inches)	Min Lateral Displacement Insulating Concrete/Secondary Liner AP Gravity (Inches)
424.00	97.222	96.944	0.006835	0.006791
384.00	36.493	36.410	0.005813	0.005773
317.85	26.840	26.806	0.004486	0.004454
248.10	31.514	31.486	0.003389	0.003366
199.25	30.944	30.910	0.002450	0.002435
154.95	30.806	30.764	0.001607	0.001598
112.80	31.153	31.063	0.000703	0.000700
65.85	30.542	30.306	0.000090	0.000084

Table 38 BES-FCC Insulating Concrete/Concrete Backed Steel Contact Data, Gravity Plus Seismic

Tank AP, 460 Inch Waste Level
SpG = 1.83
Best Estimate Soil
Fully Cracked Concrete

Radius	Max Pressure Insulating Concrete/Secondary Liner AP Seismic (PSI)	Min Pressure Insulating Concrete/Secondary Liner AP Seismic (PSI)	Max Lateral Displacement Insulating Concrete/Secondary Liner AP Seismic (Inches)	Min Lateral Displacement Insulating Concrete/Secondary Liner AP Seismic (Inches)
424.00	109.931	81.319	0.024732	0.000354
384.00	45.451	27.924	0.023232	0.000384
317.85	35.563	16.368	0.020484	0.000331
248.10	39.674	22.056	0.017304	0.000288
199.25	37.660	21.903	0.014628	0.000226
154.95	36.722	22.618	0.012288	0.000156
112.80	36.931	24.375	0.010303	0.000174
65.85	35.653	23.924	0.009026	0.000040

Table 39 BES-FCC Insulating Concrete/Concrete Backed Steel Contact Data, Seismic Only

Tank AP, 460 Inch Waste Level
SpG = 1.83
Best Estimate Soil
Fully Cracked Concrete

Radius	Max Pressure Insulating Concrete/Secondary Liner AP Seismic Only (PSI)	Min Pressure Insulating Concrete/Secondary Liner AP Seismic Only (PSI)	Max Lateral Displacement Insulating Concrete/Secondary Liner AP Seismic Only (Inches)	Min Lateral Displacement Insulating Concrete/Secondary Liner AP Seismic Only (Inches)
424.00	12.708	-15.625	0.018	-0.006
384.00	8.958	-8.486	0.017	-0.005
317.85	8.722	-10.438	0.016	-0.004
248.10	8.160	-9.431	0.014	-0.003
199.25	6.715	-9.007	0.012	-0.002
154.95	5.917	-8.146	0.011	-0.001
112.80	5.778	-6.688	0.010	-0.001
65.85	5.111	-6.382	0.009	0.000

M&D Professional Services Confidential
12/21/2006

AP-460-BES-FCC Liner-Contact-Seismic.xls
Page 1

Table 40 BES-FCC Waste Contact Pressure, Gravity Plus Seismic

Tank AY, 460 Inch Waste Level
SpG = 1.83
Best Estimate Soil
Fully Cracked Concrete

Waste Height Ratio	Waste Height	Max Pressure AP Tank, 460 in Waste Level, SpG = 1.83 Time History (PSI)	Min Pressure AP Tank, 460 in Waste Level, SpG = 1.83 Time History (PSI)	Hydrostatic (psi)	Hydrodynamic (psi)	Theoretical Min (SRSS)	Theoretical Max (SRSS)
0.99	454.35	9.194	-8.375	0.37	1.75	0.00	2.13
0.96	443.05	13.444	-12.167	1.12	1.94	0.00	3.06
0.94	431.7625	14.528	-10.340	1.87	2.20	0.00	4.07
0.90	414.125	11.938	-6.713	3.03	2.68	0.35	5.71
0.85	390.125	9.083	-0.898	4.62	3.35	1.27	7.97
0.80	366.125	11.708	0.095	6.20	4.00	2.20	10.20
0.74	342	13.840	0.489	7.80	4.62	3.18	12.42
0.69	318.325	16.056	1.160	9.36	5.19	4.17	14.55
0.64	295.225	18.736	1.796	10.89	5.70	5.19	16.59
0.59	272.125	20.646	2.802	12.41	6.17	6.24	18.59
0.54	248.975	23.271	3.713	13.94	6.61	7.33	20.56
0.49	225.825	25.979	4.672	15.47	7.01	8.46	22.48
0.44	202.725	26.688	5.980	17.00	7.37	9.63	24.37
0.39	179.625	28.417	7.313	18.53	7.70	10.83	26.22
0.34	156.475	31.889	8.653	20.06	7.98	12.07	28.04
0.29	134.075	33.340	10.208	21.54	8.22	13.31	29.76
0.24	112.475	33.208	11.694	22.96	8.42	14.54	31.38
0.20	90.875	35.590	13.319	24.39	8.58	15.81	32.97
0.15	69.275	36.382	14.660	25.82	8.71	17.11	34.53
0.10	47.738	38.521	16.493	27.24	8.80	18.44	36.04
0.05	24.500	41.014	16.910	28.78	8.87	19.91	37.64
0.02	7.755	46.979	24.917	29.88	8.89	20.99	38.77
0.00	1.755	40.417	24.736	30.28	8.89	21.39	39.17

Table 41 BES-FCC Waste Contact Pressure, Theoretical Pressures

Tank Radius, Hr	450	HI/Hr	1.02222222		Waste Dens	1.71E-04					
Waste Depth, HI	460	Conv 1st	Conv 2nd	Conv 3rd	Impul H	Pressure					
		Conv 1st	Conv 2nd	Conv 3rd		Conv 1st	Conv 2nd	Conv 3rd	Impul H	Impul V	
Centroid	Lamda	1.841	5.331	8.536	Sa=	0.064	0.108	0.163	0.29	0.25	
Height	nu	con0(n)	con1(n)	con2(n)	ci(n)	24.7296	41.7312	62.9832	112.06	96.6	SRSS
454.35	0.98771739	0.82	0.07	0.03	0.09	1.56	0.22	0.12	0.76	0.12	1.75
443.05	0.96315217	0.78	0.06	0.02	0.14	1.49	0.19	0.10	1.18	0.35	1.94
431.7625	0.93861413	0.75	0.05	0.02	0.18	1.43	0.17	0.08	1.56	0.59	2.20
414.125	0.90027174	0.70	0.04	0.01	0.24	1.33	0.14	0.06	2.11	0.95	2.68
390.125	0.84809783	0.64	0.03	0.01	0.32	1.22	0.10	0.04	2.77	1.44	3.35
366.125	0.79592391	0.59	0.02	0.00	0.39	1.11	0.08	0.02	3.33	1.92	4.00
342	0.74347826	0.54	0.02	0.00	0.44	1.02	0.06	0.01	3.82	2.38	4.62
318.325	0.69201087	0.49	0.01	0.00	0.49	0.94	0.04	0.01	4.25	2.83	5.19
295.225	0.64179348	0.45	0.01	0.00	0.53	0.86	0.03	0.01	4.61	3.24	5.70
272.125	0.59157609	0.42	0.01	0.00	0.57	0.80	0.03	0.00	4.92	3.64	6.17
248.975	0.54125	0.39	0.01	0.00	0.60	0.74	0.02	0.00	5.20	4.01	6.61
225.825	0.49092391	0.36	0.00	0.00	0.63	0.69	0.01	0.00	5.45	4.36	7.01
202.725	0.44070652	0.34	0.00	0.00	0.66	0.65	0.01	0.00	5.66	4.68	7.37
179.625	0.39048913	0.32	0.00	0.00	0.68	0.61	0.01	0.00	5.84	4.97	7.70
156.475	0.34016304	0.30	0.00	0.00	0.70	0.57	0.01	0.00	6.00	5.23	7.98
134.075	0.29146739	0.29	0.00	0.00	0.71	0.55	0.01	0.00	6.13	5.45	8.22
112.475	0.24451087	0.28	0.00	0.00	0.72	0.53	0.00	0.00	6.23	5.64	8.42
90.875	0.19755435	0.27	0.00	0.00	0.73	0.51	0.00	0.00	6.31	5.79	8.58
69.275	0.15059783	0.26	0.00	0.00	0.74	0.49	0.00	0.00	6.38	5.91	8.71
47.7375	0.10377717	0.25	0.00	0.00	0.75	0.48	0.00	0.00	6.43	6.00	8.80
24.5	0.05326087	0.25	0.00	0.00	0.75	0.48	0.00	0.00	6.46	6.06	8.87
7.755	0.0168587	0.25	0.00	0.00	0.75	0.47	0.00	0.00	6.47	6.08	8.89
1.755	0.00381522	0.25	0.00	0.00	0.75	0.47	0.00	0.00	6.47	6.08	8.89

Table 42 BES-FCC Waste Surface Displacement, Gravity Plus Seismic

Tank AP, 460 Inch Waste Level
SpG = 1.83
Best Estimate Soil
Fully Cracked Concrete

Waste Radius	Max Vertical Displacement AP-460-BES-FCC Time History (in)	Min Vertical Displacement AP-460-BES-FCC Time History (in)
95.7	6.59	-11.64
129.9	7.53	-10.70
180	8.10	-12.12
218.5	7.40	-13.10
277.7	8.12	-13.19
358	8.60	-13.21
410	7.10	-12.44
450	5.04	-9.38

Near-Soil-1.txt

```
et,8,solid45                          !
Use Element SOLID45 for Near Soil
Elements
/input,soil-prop-Mean-geo,txt         !
Read Soil Properties

ksel,u,kp,,1,kmaxjb                   !
Unselect existing Keypoints
asel,u,area,,1,amaxjb                 !
Unselect existing Area
lsel,u,line,,1,lmaxjb                 !
Unselect existing Lines
vsel,u,volu,,1,vmaxw                  !
Unselect existing Volumes

/COM - Create Keypoints to match concrete
tank profile
*do,i,1,bm_kp
k,kmaxjb+i,ctx(i),0,ctz(i)
*enddo

/COM - Create Keypoints above top of tank
k,kmaxjb+bm_kp+1,0,0,0        ! Keypoint
at origin (surface)
k,kmaxjb+bm_kp+2,0,0,soilz(2) ! Keypoint
at to divide soil above tank
*get,KMAXtemp1,KP,0,num,max   ! Get
maximum keypoint number for counter

/COM - Create Keypoints at outside of
excavated soil
*do,i,1,tanksoil
k,kmaxtemp1+i,soilx(i),0,soilz(i)
*enddo
*get,KMAXtemp2,KP,0,num,max
       ! Get maximum keypoint number for
counter

/COM - Create additional keypoint in soil
above tank
k,kmaxtemp2+1,ctx(2),0,soilz(1)
k,kmaxtemp2+2,ctx(9),0,soilz(1)
k,kmaxtemp2+3,ctx(12),0,soilz(1)
k,kmaxtemp2+4,ctx(2),0,soilz(2)
k,kmaxtemp2+5,ctx(9),0,soilz(2)
k,kmaxtemp2+6,ctx(12),0,soilz(2)
k,kmaxtemp2+7,ctx(12),0,soilz(3)
k,kmaxtemp2+8,ctx(bm_kp+1),0,ctz(bm_kp+1)

a,kmaxtemp2+1,kmaxtemp2+2,kmaxtemp2+5,kma
xtemp2+4
a,kmaxtemp2+2,kmaxtemp2+3,kmaxtemp2+6,kma
xtemp2+5
a,kmaxtemp2+3,kmaxtemp1+1,kmaxtemp1+2,kma
xtemp2+6
a,kmaxtemp2+4,kmaxtemp2+5,kmaxjb+9,kmaxjb
+8,kmaxjb+7,kmaxjb+6,kmaxjb+5,kmaxjb+4,km
axjb+3,kmaxjb+2!a,740,741,712,711,710,709
,708,707,706,705
a,kmaxtemp2+5,kmaxtemp2+6,kmaxtemp2+7,kma
xjb+12,kmaxjb+11,kmaxjb+10,kmaxjb+9
a,kmaxtemp2+6,kmaxtemp1+2,kmaxtemp1+3,kma
xtemp2+7
a,kmaxtemp2+7,kmaxtemp1+3,kmaxtemp1+4,kma
xjb+12
a,kmaxjb+12,kmaxtemp1+4,kmaxtemp1+5,kmaxj
b+14,kmaxjb+13
a,kmaxjb+14,kmaxtemp1+5,kmaxtemp1+6,kmaxj
b+16,kmaxjb+15
a,kmaxjb+16,kmaxtemp1+6,kmaxtemp1+7,kmaxj
b+18,kmaxjb+17
a,kmaxjb+18,kmaxtemp1+7,kmaxtemp1+8,kmaxj
b+20,kmaxjb+19
a,kmaxjb+20,kmaxtemp1+8,kmaxtemp1+9,kmaxt
emp2+8,kmaxjb+22,kmaxjb+21

cm,top-soil-area,area
lsla
cm,top-soil,line
type,1
real,1


/COM - Define line divisions to control
meshing
lsel,s,loc,z,soilz(1),soilz(2)
lsel,r,loc,x,ctx(3),ctx(8)
lesize,all,,,14                          !
soil above tank top, match tank meshing
lsel,s,loc,z,soilz(1),soilz(2)
lsel,r,loc,x,ctx(10),ctx(11)
lesize,all,,,3                     ! soil
above tank top, match tank meshing
cmsel,s,top-soil                   ! Reselect
lines in near soil
lsel,r,loc,x,ctx(2)
lesize,all,,,2                     ! Control
vertical element size, above tank
cmsel,s,top-soil
lsel,s,loc,x,ctx(9)
lesize,all,,,2                     ! Control
vertical element size, above tank
cmsel,s,top-soil
lsel,r,loc,x,ctx(12)
lesize,all,,,2                     ! Control
vertical element size, above tank
cmsel,s,top-soil
lsel,r,loc,z,ctz(2),ctz(12)
lsel,r,loc,x,ctx(2),ctx(12)
lesize,all,,,1                     ! Control
vertical element size, outside excavation
mesh
lsel,s,line,,lmaxjb+8,lmaxjb+10,2
lsel,a,line,,lmaxjb+26,lmaxjb+28,2
lsel,a,line,,lmaxjb+30,lmaxjb+38,4
lesize,all,,,9
lsel,s,line,,lmaxjb+42,lmaxjb+42,4
lesize,all,,,7                     ! Control
horizontal meshing in soil
lsel,s,line,,lmaxjb+9
lsel,a,line,,lmaxjb+25,lmaxjb+27,2
lsel,a,line,,lmaxjb+29,lmaxjb+45,4
lesize,all,,,1                     ! Control
horizontal meshing in soil
lsel,s,line,,lmaxjb+6
lsel,a,line,,lmaxjb+20,lmaxjb+21
lsel,a,line,,lmaxjb+32,lmaxjb+44,4
lsel,a,line,,lmaxjb+31,lmaxjb+43,4
lsel,a,line,,lmaxjb+47,lmaxjb+49
lesize,all,,,1                     ! Control
meshing to match tank
lsel,s,line,,lmaxjb+46
```

```
lesize,all,,,4                  ! Control
mesh size at bottom of excavated soil

cmsel,s,top-soil-area

amesh,all                       ! Mesh area
to develop pattern for volume meshing

type,8
ksel,a,kp,,1                    ! Select
Keypoint for rotation axis
ksel,a,kp,,ct_kps               ! Select
Keypoint for rotation axis
vrotat,all,,,,,,1,ct_kps,180,2        !
Generate Volumes for excavated soil
lsla
lsel,r,loc,x,ctx(2)
lesize,all,,arcsize             ! Define
meshing for slices
lsla
lsel,r,loc,x,ctx(9)
lesize,all,,arcsize             ! Define
meshing for slices
lsla
lsel,r,loc,x,ctx(12)
lesize,all,,arcsize             ! Define
meshing for slices
vsweep,all                      ! Sweep
pattern into volume
aclear,all                      ! Delete
elements used for sweep
cm,top-soil-vol,volu

*get,VMAXtemp,VOLU,0,num,max
/COM - Generate element above top center
of tank
asel,u,area,,all
vsel,u,volu,,all
a,kmaxjb+bm_kp+1,kmaxtemp2+1,kmaxtemp2+4,
kmaxjb+bm_kp+2
a,kmaxjb+bm_kp+2,kmaxtemp2+4,kmaxjb+2,kma
xjb+1
vrotat,all,,,,,,1,ct_kps,180,2
vsel,s,volu,,vmaxtemp+1,vmaxtemp+3,2
vatt,801,,8                           !
Assign material properties
vsel,s,volu,,vmaxtemp+2,vmaxtemp+4,2
vatt,802,,8                           !
Assign material properties
vsel,s,volu,,vmaxtemp+1,vmaxtemp+4
allsel
asel,s,loc,z,ctz(1),ctz(2)
type,1
asel,r,loc,x,0,4
asel,r,loc,z,ctz(1),ctz(2)
cmsel,u,conc-tank-a
*get,atemp,area,,num,max
*get,atemp1,area,,num,min
asel,a,area,,1,22,21
mshcopy,2,1,atemp1              ! copy mesh
top match top of concrete tank
mshcopy,2,22,atemp              ! copy mesh
top match top of concrete tank
asel,u,area,,1,22,21
vsel,s,volu,,vmaxtemp+1,vmaxtemp+4
vsweep,all                            !
Generate elements by sweeping area
aclear,atemp
aclear,atemp1
```

```
/COM - Assign soil properties by layer
*do,i,1,tanksoil-1
cmsel,s,top-soil-vol
vsel,r,loc,z,soilz(i),soilz(i+1)
eslv
emodif,all,mat,800+i
esys,0
*enddo

cmsel,s,top-soil-vol
vsel,a,loc,z,soilz(1),ctz(2)
eslv
cm,excav-soil,elem
nsle
nummrg,node

/COM - Define component for excavated
soil - tank walls only
cmsel,s,excav-soil
nsle,s,1
nsel,r,loc,z,soilz(5),soilz(9)
esln,r,1
cm,excav-wall,elem


/COM - Define component for excavated
soil - tank dome only
cmsel,s,excav-soil
cmsel,u,excav-wall
cm,excav-dome,elem

csys,1
cmsel,s,excav-wall
nsle
nsel,r,loc,x,ctx(14)
cm,excav-wall-n,node

esel,s,type,,8
nsle
nsel,s,loc,x,soilx(1)
nsel,r,loc,z,soilz(1)
cm,near-soil-face-node,node
*do,i,2,9
esel,s,type,,8
nsle
nsel,r,loc,x,soilx(i)
nsel,r,loc,z,soilz(i)
cmsel,a,near-soil-face-node
cm,near-soil-face-node,node
*enddo

esel,s,type,,8
nsle
nsel,r,loc,z,soilz(9)
nsel,r,loc,x,41,68
cm,near-soil-bot-node,node


allsel
*get,KMAXns,KP,0,num,max       ! Get
maximum Keypoint number
*get,LMAXns,LINE,0,num,max     ! Get
maximum line number
*get,AMAXns,AREA,0,num,max     ! Get
maximum Area number
*get,VMAXns,volu,0,num,max     ! Get
maximum Volume number
```

Run-Tank.txt

```
!/batch
! PNNL DST Seismic Analysis, Gravity
Inputs, Best Est Soil, Fully Cracked
Concrete Properties, AP Primary Tank
Geometry, Dome Friction=0.0
!
fini
/clear
/filname,AP-460-BES-FCC-Seismic,1
/config,nres,3000              ! Increase
allowable number of results to 3000
/config,nproc,2                       !
Activate 2 processers for solution
/config,fsplit,1024            ! Split
binary file at 4.2GB
/prep7
g=32.2                         ! Gravity
(ft/sec)

DF=40                          ! Factor
for beta (stiffness) damping
ALPHA=0.4                      ! Alpha
damping

/out,tank-out,out
/sys,"X:\07.00 - Quality Assurance\ANSYS
QA\usrcfg.bat" > QA.out
/out,QA,out,,append
/input,tank-coordinates-AP,txt        !
Run file defining tank coordinates
(concrete and primary)
/input,tank-props-crack.txt    ! Run file
defining fully cracked concrete
properties (PNNL Concrete Properties)
/input,tank-mesh1,txt          ! Develop
concrete tank
/input,primary-props-AP,txt    ! Run file
defining AP Primary tank properties
/input,primary,txt             ! Develop
Primary tank
/input,insulate,txt            ! Develop
insulating concrete model
/input,liner,txt               ! Develop
Liner model
/input,waste-solid-AP-s,txt    ! Develop
waste model
/input,bolts-friction,txt      ! Develop
J-Bolt model
/input,near-soil-1,txt         ! Develop
excavated soil model
/input,far-soil,txt            ! Develop
Far-Field soil model
/input,interface1,txt          ! Develop
Soil and Concrete Interfaces
/input,interface-gap1,txt      ! Develop
Primary Tank Interfaces
/input,slave,txt               ! Develop
slaved boundary conditions
/input,boundary,txt            ! Place
base and symmetry boundary conditions
/input,outer-spar,txt          ! Connect
soil model to symmetry plane
/input,live_load,txt           ! Apply
live load over a 10ft radius over dome
center
/input,fix-soil,txt
/out
ALLSEL

/out,Tank-th,out

save

/input,solve-TH-BES,txt             !
Run solution Phase

/input,post-tank,txt

/out
/exit
```

Soil-Prop-BES-Geo.txt

```
Tanksoil=9
deepsoil=20
soil_radius=320
mass=1e8

*dim,soilx,,30
*dim,soilz,,30


soilz(1)=0
soilz(2)=-5
soilz(3)=ctz(9)
soilz(4)=ctz(12)
soilz(5)=ctz(14)
soilz(6)=ctz(16)
soilz(7)=ctz(18)
soilz(8)=ctz(20)
soilz(9)=ctz(23)
soilz(10)=-73.5
soilz(11)=-90.5
soilz(12)=-106.5
soilz(13)=-123.5
soilz(14)=-139.5
soilz(15)=-156
soilz(16)=-178
soilz(17)=-200
soilz(18)=-222
soilz(19)=-244
soilz(20)=-266

soilx(9)=68
soilx(8)=soilx(9)-(soilz(9)-soilz(8))/1.5
soilx(7)=soilx(9)-(soilz(9)-soilz(7))/1.5
soilx(6)=soilx(9)-(soilz(9)-soilz(6))/1.5
soilx(5)=soilx(9)-(soilz(9)-soilz(5))/1.5
soilx(4)=soilx(9)-(soilz(9)-soilz(4))/1.5
soilx(3)=soilx(9)-(soilz(9)-soilz(3))/1.5
soilx(2)=soilx(9)-(soilz(9)-soilz(2))/1.5
soilx(1)=soilx(9)-(soilz(9)-soilz(1))/1.5


/COM Excavated Soil Properties
mp,ex,801,18*144
mp,nuxy,801,0.27
mp,dens,801,125/(1000*g)
mp,damp,801,0.017/df

/COM - Material 802, Soil
mp,ex,802,22.5*144
mp,nuxy,802,0.27
mp,dens,802,125/(1000*g)
mp,damp,802,0.027/df
```

```
/COM - Material 803, Soil
mp,ex,803,29.25*144
mp,nuxy,803,0.27
mp,dens,803,125/(1000*g)
mp,damp,803,0.039/df

/COM - Material 804, Soil
mp,ex,804,36*144
mp,nuxy,804,0.27
mp,dens,804,125/(1000*g)
mp,damp,804,0.031/df

/COM - Material 805, Soil
mp,ex,805,42*144
mp,nuxy,805,0.27
mp,dens,805,125/(1000*g)
mp,damp,805,0.035/df

/COM - Material 806, Soil
mp,ex,806,48.75*144
mp,nuxy,806,0.27
mp,dens,806,125/(1000*g)
mp,damp,806,0.042/df

/COM - Material 807, Soil
mp,ex,807,55.5*144
mp,nuxy,807,0.27
mp,dens,807,125/(1000*g)
mp,damp,807,0.047/df

/COM - Material 808, Soil
mp,ex,808,60*144
mp,nuxy,808,0.27
mp,dens,808,125/(1000*g)
mp,damp,808,0.037/df

/COM - Material 810, Soil
mp,ex,810,250
mp,nuxy,810,0.27
mp,dens,810,125/(1000*g)
mp,damp,810,0.037/df


/COM - Material Definitions
/COM - Material 811, Soil     (Top Layer)
mp,ex,811,9958
mp,nuxy,811,0.27
mp,dens,811,125/(1000*g)
mp,damp,811,0.019/df

/COM - Material 812, Soil
mp,ex,812,8797
mp,nuxy,812,0.27
mp,dens,812,125/(1000*g)
mp,damp,812,0.035/df

/COM - Material 813, Soil
mp,ex,813,7845
mp,nuxy,813,0.27
mp,dens,813,125/(1000*g)
mp,damp,813,0.048/df

/COM - Material 814, Soil
mp,ex,814,8209
mp,nuxy,814,0.27
mp,dens,814,125/(1000*g)
mp,damp,814,0.039/df

/COM - Material 815, Soil
mp,ex,815,7634
mp,nuxy,815,0.27
mp,dens,815,125/(1000*g)
mp,damp,815,0.048/df

/COM - Material 816, Soil
mp,ex,816,7188
mp,nuxy,816,0.27
mp,dens,816,125/(1000*g)
mp,damp,816,0.055/df

/COM - Material 817, Soil
mp,ex,817,6933
mp,nuxy,817,0.27
mp,dens,817,125/(1000*g)
mp,damp,817,0.059/df

/COM - Material 818, Soil
mp,ex,818,7667
mp,nuxy,818,0.27
mp,dens,818,125/(1000*g)
mp,damp,818,0.045/df


/COM - Mean Soil Properties Geomatrix
Soil Data
/COM - 19 Layer Mode
/COM - Material Definitions

/COM - Material 901, Soil     (Top Layer)
mp,ex,901,16423
mp,nuxy,901,0.24
mp,dens,901,110/(1000*g)
mp,damp,901,0.017/df

/COM - Material 902, Soil
mp,ex,902,15479
mp,nuxy,902,0.24
mp,dens,902,110/(1000*g)
mp,damp,902,0.025/df

/COM - Material 903, Soil
mp,ex,903,14481
mp,nuxy,903,0.24
mp,dens,903,110/(1000*g)
mp,damp,903,0.034/df

/COM - Material 904, Soil
mp,ex,904,14707
mp,nuxy,904,0.24
mp,dens,904,110/(1000*g)
mp,damp,904,0.028/df

/COM - Material 905, Soil
mp,ex,905,13625
mp,nuxy,905,0.19
mp,dens,905,110/(1000*g)
mp,damp,905,0.032/df

/COM - Material 906, Soil
mp,ex,906,15456
mp,nuxy,906,0.19
mp,dens,906,110/(1000*g)
mp,damp,906,0.033/df

/COM - Material 907, Soil
mp,ex,907,17532
mp,nuxy,907,0.19
mp,dens,907,110/(1000*g)
mp,damp,907,0.033/df
```

```
/COM - Material 908, Soil
mp,ex,908,20972
mp,nuxy,908,0.19
mp,dens,908,110/(1000*g)
mp,damp,908,0.025/df

/COM - Material 909, Soil
mp,ex,909,23447
mp,nuxy,909,0.19
mp,dens,909,110/(1000*g)
mp,damp,909,0.026/df

/COM - Material 910, Soil
mp,ex,910,23138
mp,nuxy,910,0.19
mp,dens,910,110/(1000*g)
mp,damp,910,0.027/df

/COM - Material 911, Soil
mp,ex,911,22753
mp,nuxy,911,0.19
mp,dens,911,110/(1000*g)
mp,damp,911,0.029/df

/COM - Material 912, Soil
mp,ex,912,22069
mp,nuxy,912,0.19
mp,dens,912,110/(1000*g)
mp,damp,912,0.033/df

/COM - Material 913, Soil
mp,ex,913,25780
mp,nuxy,913,0.19
mp,dens,913,110/(1000*g)
mp,damp,913,0.025/df

/COM - Material 914, Soil
mp,ex,914,25333
mp,nuxy,914,0.19
mp,dens,914,110/(1000*g)
mp,damp,914,0.027/df

/COM - Material 915, Soil
mp,ex,915,35501
mp,nuxy,915,0.28
mp,dens,915,120/(1000*g)
mp,damp,915,0.022/df

/COM - Material 916, Soil
mp,ex,916,39465
mp,nuxy,916,0.28
mp,dens,916,120/(1000*g)
mp,damp,916,0.021/df

/COM - Material 917, Soil
mp,ex,917,38565
mp,nuxy,917,0.28
mp,dens,917,120/(1000*g)
mp,damp,917,0.023/df

/COM - Material 918, Soil
mp,ex,918,37715
mp,nuxy,918,0.28
mp,dens,918,120/(1000*g)
mp,damp,918,0.025/df

/COM - Material 919, Soil
mp,ex,919,41496
mp,nuxy,919,0.28
mp,dens,919,120/(1000*g)
mp,damp,919,0.024/df
```

Solve-Gravity-BES.txt

```
/prep7
massm_z=148414.59
d,master_node,all
allsel

cmsel,s,excav-soil
nsle
csys,0
nsel,r,loc,x,-ctx(6)-1,ctx(6)+1
nsel,r,loc,y,0,-ctx(6)-1
esln,r,1
mpchg,810,all

cmsel,s,excav-soil
nsle
csys,1
nsel,r,loc,x,ctx(11)-1,ctx(13)+1
nsel,r,loc,z,soilz(1),soilz(3)-1
esln,r,1
mpchg,810,all

*do,i,801,808
esel,s,mat,,i
mpchg,i+10,all
*enddo
allsel

/out,AP-460-FCC-BES-Gravity,out
/solu
antype,trans
TRNOPT,FULL
lumpm,OFF
!nlgeom,on
NROPT,auto
NTIM=10 !NUMBER OF TIME STEPS
DT=0.01
TIM=1e-06
autots,on
KBC,on
TIMINT,ON,STRU
solcontrol,ON,off,,
ncnv,0,200
LNSRCH,OFF
PRED,on,,on

/COM - Time File

/COM - Dimension Horizontal Input
*DIM,A_1_x,,2148
*DIM,A_1_Z,,2148

*VREAD,A_1_x(1),th-266-Mean-geo,txt
(8(F9.6))
*VREAD,A_1_Z(1),th-266-Mean-geo-v,txt
(8(F9.6))

/Title,Load Case: AP-460-BES-FCC, Full
Non-linear, Dome Contact Friction = 0.0,
Gravity
OUTPR,all,NONE,
OUTRES, ALL,NONE,
OUTRES,RSOL,last
OUTRES,NSOL,last
OUTRES,ESOL,last,conc-tank
OUTRES,esol,last,Primary-tank
```

```
OUTRES,ESOL,last,J_bolts
OUTRES,Epel,last,liner
outres,esol,last,wall-int-gap
outres,esol,last,conc-excav-wall-gap
outres,esol,last,conc-excav-dome-gap
!outres,strs,last,excav-soil
!outres,strs,last,bottom-soil
outres,esol,last,bolt-friction
outres,esol,last,waste-surf
outres,strs,last,insul-conc
outres,esol,last,primary-int-gap
outres,esol,last,conc-liner-gap
outres,esol,last,far-soil-contact
!outres,esol,last,soil-contact-foot-elem

alphad,alpha
NSUBST,20,200,5,ON
TIME,100
TIMINT,off
acel,0,0,g
SOLVE
SAVE
TIMINT,on
ITIM=1
DS=TIM
NSUBST,1,20,1,ON

!ddele,master_node,ux
!ddele,master_node,uz

esel,s,type,,61,63,2
mpchg,64,all

esel,s,type,,91,93,2
mpchg,92,all

allsel

*DO,ITIM,1,NTIM,1

TIM=DT*ITIM

TIME,TIM+100

!F,master_node,FX,A_1_X(itim)*mass*g
!F,master_node,Fz,(A_1_Z(itim)+1)*(mass+m
assm_z)*g

SOLVE
SAVE
*ENDDO
FINISH
/out
```

Solve-TH-BES

```
/prep7
massm_z=148414.59
d,master_node,all
allsel

cmsel,s,excav-soil
nsle
csys,0
nsel,r,loc,x,-ctx(6)-1,ctx(6)+1
nsel,r,loc,y,0,-ctx(6)-1
esln,r,1
mpchg,810,all

cmsel,s,excav-soil
nsle
csys,1
nsel,r,loc,x,ctx(11)-1,ctx(13)+1
nsel,r,loc,z,soilz(1),soilz(3)-1
esln,r,1
mpchg,810,all

*do,i,801,808
esel,s,mat,,i
mpchg,i+10,all
*enddo
allsel

/out,AP-460-FCC-BES-Seismic,out
/solu
antype,trans
TRNOPT,FULL
lumpm,OFF
!nlgeom,on
NROPT,auto
NTIM=2148      !NUMBER OF TIME STEPS
DT=0.01
TIM=1e-06
autots,on
KBC,on
TIMINT,ON,STRU
solcontrol,ON,off,,
ncnv,0,200
LNSRCH,OFF
PRED,on,,on

/COM - Time File

/COM - Dimension Horizontal Input
*DIM,A_1_x,,2148
*DIM,A_1_Z,,2148

*VREAD,A_1_x(1),th-266-Mean-geo,txt
(8(F9.6))
*VREAD,A_1_Z(1),th-266-Mean-geo-v,txt
(8(F9.6))

/Title,Load Case: AP-460-BES-FCC, Full
Non-linear, Dome Contact Friction = 0.0
OUTPR,all,NONE,
OUTRES, ALL,NONE,
OUTRES,RSOL,last
OUTRES,NSOL,last
OUTRES,ESOL,last,conc-tank
OUTRES,esol,last,Primary-tank
OUTRES,ESOL,last,J_bolts
OUTRES,Epel,last,liner
outres,esol,last,wall-int-gap
outres,esol,last,conc-excav-wall-gap
outres,esol,last,conc-excav-dome-gap
!outres,strs,last,excav-soil
!outres,strs,last,bottom-soil
outres,esol,last,bolt-friction
outres,esol,last,waste-surf
outres,strs,last,insul-conc
outres,esol,last,primary-int-gap
outres,esol,last,conc-liner-gap
outres,esol,last,far-soil-contact
!outres,esol,last,soil-contact-foot-elem

alphad,alpha
NSUBST,20,200,5,ON
```

```
TIME,100
TIMINT,off
acel,0,0,g
SOLVE
SAVE
TIMINT,on
ITIM=1
DS=TIM
NSUBST,1,20,1,ON

ddele,master_node,ux
ddele,master_node,uz

esel,s,type,,61,63,2
mpchg,64,all

esel,s,type,,91,93,2
mpchg,92,all

allsel

*DO,ITIM,1,NTIM,1

TIM=DT*ITIM

TIME,TIM+100

F,master_node,FX,A_1_X(itim)*mass*g
F,master_node,Fz,(A_1_Z(itim)+1)*(mass+ma
ssm_z)*g

SOLVE
SAVE
*ENDDO
FINISH
/out
```

Tank-Props-Crack

```
/COM - Tank Concrete Properties

/COM - Material Definitions
! EX - Youngs Modulus, (k/ft2)
! NUXY - Poisons ratio
! DENS - Density (1000*slugs/ft3)
! DAMP - Beta (Stiffness) Damping

/COM - Material 1, Tank Concrete - Dome
Center
mp,ex,1,156131
mp,nuxy,1,0.18
mp,dens,1,170/(1000*g)
mp,damp,1,0.07/df

/COM - Material 2, Tank Concrete
mp,ex,2,134843
mp,nuxy,2,0.18
mp,dens,2,1864/(1000*g)
mp,damp,2,0.07/df

/COM - Material 3, Tank Concrete
mp,ex,3,122210
mp,nuxy,3,0.18
mp,dens,3,196/(1000*g)
mp,damp,3,0.07/df

/COM - Material 4, Tank Concrete
mp,ex,4,134181
mp,nuxy,4,0.18
mp,dens,4,181/(1000*g)
mp,damp,4,0.07/df

/COM - Material  5, Tank Concrete
mp,ex, 5,156781
mp,nuxy, 5,0.18
mp,dens, 5,169/(1000*g)
mp,damp,5,0.07/df

/COM - Material 6, Tank Concrete
mp,ex,6,148115
mp,nuxy,6,0.18
mp,dens,6,172/(1000*g)
mp,damp,6,0.07/df

/COM - Material 7, Tank Concrete
mp,ex,7,219124
mp,nuxy,7,0.18
mp,dens,7,151/(1000*g)
mp,damp,7,0.07/df

/COM - Material 8, Tank Concrete
mp,ex,8,209367
mp,nuxy,8,0.18
mp,dens,8,154/(1000*g)
mp,damp,8,0.07/df

/COM - Material 9, Tank Concrete
mp,ex,9,212206
mp,nuxy,9,0.18
mp,dens,9,155/(1000*g)
mp,damp,9,0.07/df

/COM - Material,10, Tank Concrete
mp,ex,10,195944
mp,nuxy,10,0.18
mp,dens,10,139/(1000*g)
mp,damp,10,0.07/df

/COM - Material,11, Tank Concrete
mp,ex,11,182924
mp,nuxy,11,0.18
mp,dens,11,138/(1000*g)
mp,damp,11,0.07/df

/COM - Material,12, Tank Concrete
mp,ex,12,187438
mp,nuxy,12,0.18
mp,dens,12,156/(1000*g)
mp,damp,12,0.07/df

/COM - Material,13, Tank Concrete
mp,ex,13,143402
mp,nuxy,13,0.18
mp,dens,13,190/(1000*g)
mp,damp,13,0.07/df

/COM - Material,14, Tank Concrete
mp,ex,14,142377
mp,nuxy,14,0.18
mp,dens,14,172/(1000*g)
mp,damp,14,0.07/df

/COM - Material,15, Tank Concrete
mp,ex,15,126463
mp,nuxy,15,0.18
mp,dens,15,178/(1000*g)
mp,damp,15,0.07/df
```

```
/COM - Material,16, Tank Concrete
mp,ex,16,126463
mp,nuxy,16,0.18
mp,dens,16,178/(1000*g)
mp,damp,16,0.07/df

/COM - Material,17, Tank Concrete
mp,ex,17,126463
mp,nuxy,17,0.18
mp,dens,17,178/(1000*g)
mp,damp,17,0.07/df

/COM - Material,18, Tank Concrete
mp,ex,18,113881
mp,nuxy,18,0.18
mp,dens,18,186/(1000*g)
mp,damp,18,0.07/df

/COM - Material,19, Tank Concrete
mp,ex,19,113881
mp,nuxy,19,0.18
mp,dens,19,186/(1000*g)
mp,damp,19,0.07/df

/COM - Material,20, Tank Concrete
mp,ex,20,113629
mp,nuxy,20,0.18
mp,dens,20,205/(1000*g)
mp,damp,20,0.07/df

/COM - Material,21, Tank Concrete
mp,ex,21,134235
mp,nuxy,21,0.18
mp,dens,21,182/(1000*g)
mp,damp,21,0.07/df

/COM - Material,22, Tank Concrete
mp,ex,22,139096
mp,nuxy,22,0.18
mp,dens,22,181/(1000*g)
mp,damp,22,0.07/df

/COM - Material,23, Tank Concrete
mp,ex,23,93743
mp,nuxy,23,0.18
mp,dens,23,229/(1000*g)
mp,damp,23,0.060/df

/COM - Material,24, Tank Concrete
mp,ex,24,118250
mp,nuxy,24,0.18
mp,dens,24,244/(1000*g)
mp,damp,24,0.07/df

/COM - Material,25, Tank Concrete
mp,ex,25,165097
mp,nuxy,25,0.18
mp,dens,25,342/(1000*g)
mp,damp,25,0.07/df

/COM - Material,26, Tank Concrete
mp,ex,26,179441
mp,nuxy,26,0.18
mp,dens,26,317/(1000*g)
mp,damp,26,0.07/df

/COM - Material,27, Tank Concrete
mp,ex,27,199781
mp,nuxy,27,0.18
mp,dens,27,381/(1000*g)
mp,damp,27,0.07/df

/COM - Material,28, Tank Concrete
mp,ex,28,149439
mp,nuxy,28,0.18
mp,dens,28,293/(1000*g)
mp,damp,28,0.07/df

/COM - Material,29, Tank Concrete
mp,ex,29,171940
mp,nuxy,29,0.18
mp,dens,29,282/(1000*g)
mp,damp,29,0.07/df

/COM - Material,30, Tank Concrete
mp,ex,30,144316
mp,nuxy,30,0.18
mp,dens,30,301/(1000*g)
mp,damp,30,0.07/df

/COM - Material,31, Tank Concrete
mp,ex,31,790720
mp,nuxy,31,0.18
mp,dens,31,150/(1000*g)
mp,damp,31,0.07/df

/COM - Material,32, Tank Concrete
mp,ex,32,790720
mp,nuxy,32,0.18
mp,dens,32,150/(1000*g)
mp,damp,32,0.07/df

!/COM - Material,33, Tank Concrete
!mp,ex,33,731952
!mp,nuxy,33,0.18
!mp,dens,33,150/(1000*g)
!mp,damp,33,0.07/df

!/COM - Material,34, Tank Concrete
!mp,ex,34,731952
!mp,nuxy,34,0.18
!mp,dens,34,150/(1000*g)
!mp,damp,34,0.07/df

!/COM - Material,35, Tank Concrete
!mp,ex,35,731952
!mp,nuxy,35,0.18
!mp,dens,35,150/(1000*g)
!mp,damp,35,0.07/df

!/COM - Material,36, Tank Concrete
!mp,ex,36,731952
!mp,nuxy,36,0.18
!mp,dens,36,150/(1000*g)
!mp,damp,36,0.07/df

!/COM - Material,37, Tank Concrete
!mp,ex,37,731952
!mp,nuxy,37,0.18
!mp,dens,37,150/(1000*g)
!mp,damp,37,0.07/df

/COM - Concrete Real Values, t in ft
r,1,1.10                      ! 13.21 in
r,2,1.01                      ! 12.10 in
r,3,.96                       ! 11.49 in
r,4,1.03                      ! 12.41 in
r,5,1.11                      ! 13.32 in
r,6,1.09                      ! 13.08 in
```

```
r,7,1.24                        ! 14.86 in
r,8,1.22                        ! 14.59 in
r,9,1.64                        ! 19.67 in
r,10,1.64,1.64,2.65,2.65        ! 31.78 in
to
r,11,2.65,2.65,2.69,2.69        !
r,12,2.69,2.69,1.53,1.53        !
r,13,1.53,1.53,1.19,1.19
r,14,1.31                       ! 15.72 in
r,15,1.27                       ! 15.21 in
r,16,1.27                       ! 15.21 in
r,17,1.27                       ! 15.21 in
r,18,1.21                       ! 14.54 in
r,19,1.21                       ! 14.54 in
r,20,1.10                       ! 13.17 in
r,21,1.79                       ! 21.54 in
r,22,1.71                       ! 20.46 in
r,23,1.20                       ! 14.43 in
r,24,1.20,0.81,0.81,1.20        !
r,25,0.81,0.41,0.41,0.81        !
r,26,0.41,0.42,0.42,0.41        !
r,27,0.43                       ! 5.18 in
r,28,0.56                       ! 6.73 in
r,29,0.58                       ! 6.99 in
r,30,0.55                       ! 6.57 in
r,31,0.55,1.02,1.02,0.55        ! 12.18 in
to
r,32,1.02                       !
!r,34,1
!r,35,1
!r,36,1
!r,37,1
!r,39,1


/COM - Material,50, Insulating Concrete
mp,ex,50,23760
mp,nuxy,50,0.15
mp,dens,50,50/(1000*g)
mp,damp,50,0.07/df
```

TH-266-Mean-Geo.txt

```
-0.000046 0.000024 0.000044-0.000025-0.000044 0.000024 0.000042-0.000025     1
-0.000042 0.000024 0.000040-0.000025-0.000040 0.000024 0.000037-0.000025     2
-0.000037 0.000024 0.000033-0.000025-0.000033 0.000023 0.000030-0.000026     3
. . . . . .
-0.000054 0.000023 0.000053-0.000023-0.000053 0.000023 0.000052-0.000023   510
-0.000052 0.000023 0.000051-0.000024-0.000051 0.000023 0.000050-0.000024   511
-0.000049 0.000023 0.000048-0.000024-0.000048 0.000023 0.000046-0.000024   512
```

TH-266-Mean-Geo-V.txt

```
-0.000029 0.000124 0.000029-0.000125-0.000029 0.000126 0.000030-0.000127     1
-0.000030 0.000128 0.000030-0.000128-0.000030 0.000130 0.000031-0.000130     2
-0.000031 0.000131 0.000032-0.000132-0.000032 0.000133 0.000033-0.000134     3
. . . . . .
-0.000026 0.000116 0.000026-0.000116-0.000026 0.000117 0.000027-0.000118   510
-0.000027 0.000118 0.000027-0.000119-0.000027 0.000120 0.000028-0.000120   511
-0.000028 0.000121 0.000028-0.000122-0.000028 0.000123 0.000029-0.000123   512
```

BES-FCC Seismic File Listing

```
 Volume in drive C is P52 Mustang 300GB
 Volume Serial Number is CDB0-3951

 Directory of C:\Users\Bruce\AP\AP-460-BES-FCC-Seismic Run

01/09/2007  07:02 AM    <DIR>          .
01/09/2007  07:02 AM    <DIR>          ..
10/22/2006  08:30 PM           561,576 Accel-ct-0.out
10/22/2006  08:36 PM           561,828 Accel-ct-135.out
10/22/2006  08:38 PM           561,828 Accel-ct-180.out
10/22/2006  08:32 PM           561,576 Accel-ct-45.out
10/22/2006  08:34 PM           561,828 Accel-ct-90.out
10/22/2006  08:28 PM           290,676 Accel-ct.out
10/22/2006  08:40 PM           561,828 Accel-PT-0.out
10/22/2006  08:45 PM           561,828 Accel-PT-135.out
10/22/2006  08:47 PM           561,828 Accel-PT-180.out
10/22/2006  08:41 PM           561,828 Accel-PT-45.out
10/22/2006  08:43 PM           561,828 Accel-PT-90.out
10/22/2006  08:49 PM           561,828 Accel-SOil.out
09/22/2006  01:00 PM                74 All-Forces.txt
01/02/2007  10:40 AM         3,548,672 AP-460-BES-FCC Conc Tank Demand Seismic Only.xls
01/02/2007  10:41 AM         3,328,512 AP-460-BES-FCC Conc Tank Demand Seismic.xls
10/24/2006  07:39 AM         1,426,944 AP-460-BES-FCC Conc-Tank Spectra.xls
12/21/2006  01:08 PM         1,440,768 AP-460-BES-FCC Footing Seismic.xls
10/24/2006  07:34 AM           320,512 AP-460-BES-FCC Free Field RS Comparision.xls
01/02/2007  10:51 AM           730,112 AP-460-BES-FCC J Bolt Forces Seismic.xls
10/24/2006  08:27 AM           794,112 AP-460-BES-FCC J-Bolt-Contact-Seismic.xls
10/24/2006  09:00 AM           699,904 AP-460-BES-FCC Liner-Contact-Seismic.xls
01/04/2007  11:19 AM         7,512,576 AP-460-BES-FCC Pri Tank Stress Seismic Only.xls
10/24/2006  08:34 AM         7,328,768 AP-460-BES-FCC Pri Tank Stress Seismic.xls
10/24/2006  08:57 AM           700,928 AP-460-BES-FCC Primary-Contact-Seismic.xls
10/24/2006  07:45 AM         1,156,608 AP-460-BES-FCC Primary-Tank Spectra.xls
12/18/2006  09:29 AM         2,072,576 AP-460-BES-FCC Soil Pressures Seismic.xls
01/08/2007  10:31 AM         3,755,008 AP-460-BES-FCC Strain Gravity-Princ.xls
01/05/2007  08:03 AM         3,844,096 AP-460-BES-FCC Strain Seismic-Princ.xls
10/24/2006  06:58 AM           545,792 AP-460-BES-FCC Total Reaction.xls
10/24/2006  10:22 AM           407,552 AP-460-BES-FCC Waste-Disp-TH-MAX.xls
12/21/2006  03:23 PM           924,160 AP-460-BES-FCC Waste-TH-MAX.xls
10/22/2006  04:13 AM             2,998 AP-460-BES-FCC-Seismic.BCS
12/06/2006  03:55 PM        63,963,136 AP-460-BES-FCC-Seismic.db
10/22/2006  04:13 AM        63,897,600 AP-460-BES-FCC-Seismic.dbb
10/22/2006  04:13 AM        12,713,984 AP-460-BES-FCC-Seismic.emat
01/03/2007  07:55 PM           254,025 AP-460-BES-FCC-Seismic.err
10/22/2006  04:13 AM       111,607,808 AP-460-BES-FCC-Seismic.esav
10/22/2006  04:13 AM        30,081,024 AP-460-BES-FCC-Seismic.full
10/22/2006  04:11 AM       340,804,299 AP-460-BES-FCC-Seismic.ldhi
01/04/2007  08:06 AM             2,600 AP-460-BES-FCC-Seismic.log
10/22/2006  04:13 AM           198,991 AP-460-BES-FCC-Seismic.mntr
10/22/2006  04:11 AM       111,607,808 AP-460-BES-FCC-Seismic.osav
10/22/2006  04:12 AM             1,699 AP-460-BES-FCC-Seismic.PVTS
10/22/2006  04:13 AM       112,656,384 AP-460-BES-FCC-Seismic.r001
10/19/2006  02:05 PM        43,974,656 AP-460-BES-FCC-Seismic.rdb
10/22/2006  04:13 AM     4,294,967,296 AP-460-BES-FCC-Seismic.rst
10/20/2006  03:41 AM     4,294,967,296 AP-460-BES-FCC-Seismic.rst02
10/20/2006  10:26 AM     4,294,967,296 AP-460-BES-FCC-Seismic.rst03
10/20/2006  05:13 PM     4,294,967,296 AP-460-BES-FCC-Seismic.rst04
10/21/2006  12:19 AM     4,294,967,296 AP-460-BES-FCC-Seismic.rst05
10/21/2006  07:43 AM     4,294,967,296 AP-460-BES-FCC-Seismic.rst06
10/21/2006  03:37 PM     4,294,967,296 AP-460-BES-FCC-Seismic.rst07
10/22/2006  12:58 AM     4,294,967,296 AP-460-BES-FCC-Seismic.rst08
10/22/2006  04:13 AM     1,388,445,696 AP-460-BES-FCC-Seismic.rst09
10/22/2006  04:13 AM         5,371,187 AP-460-FCC-BES-Seismic.out
08/25/2006  01:26 PM             6,031 Bolts-Friction.txt
09/08/2006  07:10 AM               277 Boundary.txt
08/25/2006  08:48 AM               220 Contact-AP.txt
08/21/2006  07:59 AM               586 Contact-Footing.txt
08/25/2006  01:28 PM               704 Contact-Insul.txt
```

```
08/25/2006  01:27 PM            704 Contact-J-Bolts.txt
08/25/2006  01:28 PM            708 Contact-Primary.txt
08/21/2006  07:59 AM            742 Contact-Soil.txt
08/21/2006  12:44 PM            632 Contact-Waste-AP.txt
10/22/2006  08:30 PM        561,576 Disp-ct-0.out
10/22/2006  08:36 PM        561,576 Disp-ct-135.out
10/22/2006  08:38 PM        561,576 Disp-ct-180.out
10/22/2006  08:32 PM        561,576 Disp-ct-45.out
10/22/2006  08:34 PM        561,576 Disp-ct-90.out
10/22/2006  08:28 PM        290,550 Disp-ct.out
01/03/2006  11:17 AM          1,616 Disp-J-Bolts.txt
10/22/2006  08:40 PM        561,576 Disp-PT-0.out
10/22/2006  08:45 PM        561,576 Disp-PT-135.out
10/22/2006  08:47 PM        561,576 Disp-PT-180.out
10/22/2006  08:41 PM        561,576 Disp-PT-45.out
10/22/2006  08:43 PM        561,576 Disp-PT-90.out
10/22/2006  08:49 PM        561,576 Disp-Soil.out
10/24/2006  10:21 AM         40,960 disp_0-90.xls
10/24/2006  10:21 AM         38,400 disp_99-180.xls
05/08/2006  01:31 PM          8,616 Far-Soil.txt
01/09/2007  07:02 AM              0 file-list.txt
10/23/2006  09:04 AM            576 file.err
10/23/2006  09:04 AM          1,128 file.log
10/13/2005  06:54 AM            562 Fix-Soil.txt
10/22/2006  08:26 PM         10,342 Footing-Cont_max.OUT
10/22/2006  08:26 PM      4,346,248 Footing-Cont_th.OUT
08/21/2006  08:00 AM            894 Force-c.txt
10/23/2006  02:00 AM          4,996 Force-c_108amax.OUT
10/23/2006  02:00 AM      2,905,500 Force-c_108ath.OUT
10/22/2006  10:47 PM         14,716 Force-c_108max.OUT
10/22/2006  10:47 PM      6,519,180 Force-c_108th.OUT
10/23/2006  02:09 AM          4,996 Force-c_117amax.OUT
10/23/2006  02:09 AM      2,905,500 Force-c_117ath.OUT
10/22/2006  10:56 PM         14,716 Force-c_117max.OUT
10/22/2006  10:56 PM      6,519,180 Force-c_117th.OUT
10/23/2006  02:18 AM          4,996 Force-c_126amax.OUT
10/23/2006  02:18 AM      2,905,500 Force-c_126ath.OUT
10/22/2006  11:06 PM         14,716 Force-c_126max.OUT
10/22/2006  11:06 PM      6,519,180 Force-c_126th.OUT
10/23/2006  02:28 AM          4,996 Force-c_135amax.OUT
10/23/2006  02:28 AM      2,905,500 Force-c_135ath.OUT
10/22/2006  11:16 PM         14,716 Force-c_135max.OUT
10/22/2006  11:16 PM      6,519,180 Force-c_135th.OUT
10/23/2006  02:37 AM          4,996 Force-c_144amax.OUT
10/23/2006  02:37 AM      2,905,500 Force-c_144ath.OUT
10/22/2006  11:25 PM         14,716 Force-c_144max.OUT
10/22/2006  11:25 PM      6,519,180 Force-c_144th.OUT
10/23/2006  02:47 AM          4,996 Force-c_153amax.OUT
10/23/2006  02:47 AM      2,905,500 Force-c_153ath.OUT
10/22/2006  11:36 PM         14,716 Force-c_153max.OUT
10/22/2006  11:36 PM      6,519,180 Force-c_153th.OUT
10/23/2006  02:56 AM          4,996 Force-c_162amax.OUT
10/23/2006  02:56 AM      2,905,500 Force-c_162ath.OUT
10/22/2006  11:44 PM         14,716 Force-c_162max.OUT
10/22/2006  11:44 PM      6,519,180 Force-c_162th.OUT
10/23/2006  03:06 AM          4,996 Force-c_171amax.OUT
10/23/2006  03:06 AM      2,905,500 Force-c_171ath.OUT
10/22/2006  11:55 PM         14,716 Force-c_171max.OUT
10/22/2006  11:55 PM      6,519,180 Force-c_171th.OUT
10/23/2006  03:15 AM          4,996 Force-c_180amax.OUT
10/23/2006  03:15 AM      2,905,500 Force-c_180ath.OUT
10/23/2006  12:04 AM         14,716 Force-c_180max.OUT
10/23/2006  12:05 AM      6,519,180 Force-c_180th.OUT
10/23/2006  12:25 AM          4,996 Force-c_18amax.OUT
10/23/2006  12:25 AM      2,905,500 Force-c_18ath.OUT
10/22/2006  09:09 PM         14,716 Force-c_18max.OUT
10/22/2006  09:09 PM      6,519,180 Force-c_18th.OUT
10/23/2006  12:34 AM          4,996 Force-c_27amax.OUT
10/23/2006  12:34 AM      2,905,500 Force-c_27ath.OUT
10/22/2006  09:19 PM         14,716 Force-c_27max.OUT
```

```
10/22/2006  09:19 PM         6,519,180 Force-c_27th.OUT
10/23/2006  12:45 AM             4,996 Force-c_36amax.OUT
10/23/2006  12:45 AM         2,905,500 Force-c_36ath.OUT
10/22/2006  09:30 PM            14,716 Force-c_36max.OUT
10/22/2006  09:30 PM         6,519,180 Force-c_36th.OUT
10/23/2006  12:54 AM             4,996 Force-c_45amax.OUT
10/23/2006  12:54 AM         2,905,500 Force-c_45ath.OUT
10/22/2006  09:39 PM            14,716 Force-c_45max.OUT
10/22/2006  09:39 PM         6,519,180 Force-c_45th.OUT
10/23/2006  01:03 AM             4,996 Force-c_54amax.OUT
10/23/2006  01:03 AM         2,905,500 Force-c_54ath.OUT
10/22/2006  09:48 PM            14,716 Force-c_54max.OUT
10/22/2006  09:48 PM         6,519,180 Force-c_54th.OUT
10/23/2006  01:12 AM             4,996 Force-c_63amax.OUT
10/23/2006  01:12 AM         2,905,500 Force-c_63ath.OUT
10/22/2006  09:58 PM            14,716 Force-c_63max.OUT
10/22/2006  09:58 PM         6,519,180 Force-c_63th.OUT
10/23/2006  01:21 AM             4,996 Force-c_72amax.OUT
10/23/2006  01:21 AM         2,905,500 Force-c_72ath.OUT
10/22/2006  10:07 PM            14,716 Force-c_72max.OUT
10/22/2006  10:07 PM         6,519,180 Force-c_72th.OUT
10/23/2006  01:30 AM             4,996 Force-c_81amax.OUT
10/23/2006  01:30 AM         2,905,500 Force-c_81ath.OUT
10/22/2006  10:17 PM            14,716 Force-c_81max.OUT
10/22/2006  10:17 PM         6,519,180 Force-c_81th.OUT
10/23/2006  01:40 AM             4,996 Force-c_90amax.OUT
10/23/2006  01:40 AM         2,905,500 Force-c_90ath.OUT
10/22/2006  10:27 PM            14,716 Force-c_90max.OUT
10/22/2006  10:27 PM         6,519,180 Force-c_90th.OUT
10/23/2006  01:50 AM             4,996 Force-c_99amax.OUT
10/23/2006  01:50 AM         2,905,500 Force-c_99ath.OUT
10/22/2006  10:37 PM            14,716 Force-c_99max.OUT
10/22/2006  10:37 PM         6,519,180 Force-c_99th.OUT
10/23/2006  12:14 AM             4,996 Force-c_9amax.OUT
10/23/2006  12:14 AM         2,905,628 Force-c_9ath.OUT
10/22/2006  08:59 PM            14,716 Force-c_9max.OUT
10/22/2006  08:59 PM         6,519,308 Force-c_9th.OUT
10/24/2006  08:20 AM           133,632 force-jb.xls
10/23/2006  06:09 PM         2,666,244 Force-jb_r10-th.OUT
10/23/2006  06:09 PM             5,239 Force-jb_r10_max.OUT
10/23/2006  06:10 PM         2,666,244 Force-jb_r11-th.OUT
10/23/2006  06:10 PM             5,239 Force-jb_r11_max.OUT
10/23/2006  06:05 PM         2,666,372 Force-jb_r2-th.OUT
10/23/2006  06:05 PM             5,239 Force-jb_r2_max.OUT
10/23/2006  06:05 PM         2,666,244 Force-jb_r3-th.OUT
10/23/2006  06:05 PM             5,239 Force-jb_r3_max.OUT
10/23/2006  06:06 PM         2,666,244 Force-jb_r4-th.OUT
10/23/2006  06:06 PM             5,239 Force-jb_r4_max.OUT
10/23/2006  06:06 PM         2,666,244 Force-jb_r5-th.OUT
10/23/2006  06:06 PM             5,239 Force-jb_r5_max.OUT
10/23/2006  06:07 PM         2,666,244 Force-jb_r6-th.OUT
10/23/2006  06:07 PM             5,239 Force-jb_r6_max.OUT
10/23/2006  06:07 PM         2,666,244 Force-jb_r7-th.OUT
10/23/2006  06:07 PM             5,239 Force-jb_r7_max.OUT
10/23/2006  06:08 PM         2,666,244 Force-jb_r8-th.OUT
10/23/2006  06:08 PM             5,239 Force-jb_r8_max.OUT
10/23/2006  06:09 PM         2,666,244 Force-jb_r9-th.OUT
10/23/2006  06:09 PM             5,239 Force-jb_r9_max.OUT
08/21/2006  08:00 AM               661 Force-j_bolt.txt
10/24/2006  08:08 AM           441,856 import_0-90.xls
10/24/2006  08:08 AM           441,856 import_99-180.xls
10/24/2006  08:59 AM           105,472 Insul-Contact_0-90.xls
10/24/2006  08:59 AM           105,984 Insul-Contact_99-180.xls
10/22/2006  09:16 AM             4,024 Insul-Cont_108max.OUT
10/22/2006  09:16 AM         1,738,448 Insul-Cont_108th.OUT
10/22/2006  09:19 AM             4,024 Insul-Cont_117max.OUT
10/22/2006  09:19 AM         1,738,448 Insul-Cont_117th.OUT
10/22/2006  09:22 AM             4,024 Insul-Cont_126max.OUT
10/22/2006  09:22 AM         1,738,448 Insul-Cont_126th.OUT
10/22/2006  09:25 AM             4,024 Insul-Cont_135max.OUT
```

```
10/22/2006  09:25 AM         1,738,448 Insul-Cont_135th.OUT
10/22/2006  09:28 AM             4,024 Insul-Cont_144max.OUT
10/22/2006  09:28 AM         1,738,448 Insul-Cont_144th.OUT
10/22/2006  09:31 AM             4,024 Insul-Cont_153max.OUT
10/22/2006  09:31 AM         1,738,448 Insul-Cont_153th.OUT
10/22/2006  09:34 AM             4,024 Insul-Cont_162max.OUT
10/22/2006  09:34 AM         1,738,448 Insul-Cont_162th.OUT
10/22/2006  09:37 AM             4,024 Insul-Cont_171max.OUT
10/22/2006  09:37 AM         1,738,448 Insul-Cont_171th.OUT
10/22/2006  09:41 AM             4,024 Insul-Cont_180max.OUT
10/22/2006  09:41 AM         1,738,448 Insul-Cont_180th.OUT
10/22/2006  08:47 AM             4,024 Insul-Cont_18max.OUT
10/22/2006  08:47 AM         1,738,448 Insul-Cont_18th.OUT
10/22/2006  08:51 AM             4,024 Insul-Cont_27max.OUT
10/22/2006  08:51 AM         1,738,448 Insul-Cont_27th.OUT
10/22/2006  08:54 AM             4,024 Insul-Cont_36max.OUT
10/22/2006  08:54 AM         1,738,448 Insul-Cont_36th.OUT
10/22/2006  08:56 AM             4,024 Insul-Cont_45max.OUT
10/22/2006  08:56 AM         1,738,448 Insul-Cont_45th.OUT
10/22/2006  08:59 AM             4,024 Insul-Cont_54max.OUT
10/22/2006  08:59 AM         1,738,448 Insul-Cont_54th.OUT
10/22/2006  09:02 AM             4,024 Insul-Cont_63max.OUT
10/22/2006  09:02 AM         1,738,448 Insul-Cont_63th.OUT
10/22/2006  09:04 AM             4,024 Insul-Cont_72max.OUT
10/22/2006  09:04 AM         1,738,448 Insul-Cont_72th.OUT
10/22/2006  09:07 AM             4,024 Insul-Cont_81max.OUT
10/22/2006  09:07 AM         1,738,448 Insul-Cont_81th.OUT
10/22/2006  09:10 AM             4,024 Insul-Cont_90max.OUT
10/22/2006  09:10 AM         1,738,448 Insul-Cont_90th.OUT
10/22/2006  09:13 AM             4,024 Insul-Cont_99max.OUT
10/22/2006  09:13 AM         1,738,448 Insul-Cont_99th.OUT
10/22/2006  08:44 AM             4,024 Insul-Cont_9max.OUT
10/22/2006  08:44 AM         1,738,576 Insul-Cont_9th.OUT
09/22/2006  03:37 PM             1,672 Insulate.txt
07/20/2006  06:36 AM             4,030 interface-gap1.txt
09/22/2006  04:02 PM             2,411 interface1.txt
10/24/2006  08:24 AM           117,248 J-Bolt-Contact_0-90.xls
10/24/2006  08:24 AM           117,248 J-Bolt-Contact_99-180.xls
10/22/2006  11:35 AM             4,519 J-Bolt-Cont_108max.OUT
10/22/2006  11:35 AM         1,685,484 J-Bolt-Cont_108th.OUT
10/22/2006  11:39 AM             4,519 J-Bolt-Cont_117max.OUT
10/22/2006  11:39 AM         1,685,484 J-Bolt-Cont_117th.OUT
10/22/2006  11:43 AM             4,519 J-Bolt-Cont_126max.OUT
10/22/2006  11:43 AM         1,685,484 J-Bolt-Cont_126th.OUT
10/22/2006  11:47 AM             4,519 J-Bolt-Cont_135max.OUT
10/22/2006  11:47 AM         1,685,484 J-Bolt-Cont_135th.OUT
10/22/2006  11:51 AM             4,519 J-Bolt-Cont_144max.OUT
10/22/2006  11:51 AM         1,685,484 J-Bolt-Cont_144th.OUT
10/22/2006  11:55 AM             4,519 J-Bolt-Cont_153max.OUT
10/22/2006  11:55 AM         1,685,484 J-Bolt-Cont_153th.OUT
10/22/2006  11:59 AM             4,519 J-Bolt-Cont_162max.OUT
10/22/2006  11:59 AM         1,685,484 J-Bolt-Cont_162th.OUT
10/22/2006  12:04 PM             4,519 J-Bolt-Cont_171max.OUT
10/22/2006  12:04 PM         1,685,484 J-Bolt-Cont_171th.OUT
10/22/2006  12:08 PM             4,519 J-Bolt-Cont_180max.OUT
10/22/2006  12:08 PM         1,685,484 J-Bolt-Cont_180th.OUT
10/22/2006  10:54 AM             4,519 J-Bolt-Cont_18max.OUT
10/22/2006  10:54 AM         1,685,484 J-Bolt-Cont_18th.OUT
10/22/2006  10:58 AM             4,519 J-Bolt-Cont_27max.OUT
10/22/2006  10:58 AM         1,685,484 J-Bolt-Cont_27th.OUT
10/22/2006  11:02 AM             4,519 J-Bolt-Cont_36max.OUT
10/22/2006  11:02 AM         1,685,484 J-Bolt-Cont_36th.OUT
10/22/2006  11:06 AM             4,519 J-Bolt-Cont_45max.OUT
10/22/2006  11:06 AM         1,685,484 J-Bolt-Cont_45th.OUT
10/22/2006  11:10 AM             4,519 J-Bolt-Cont_54max.OUT
10/22/2006  11:10 AM         1,685,484 J-Bolt-Cont_54th.OUT
10/22/2006  11:14 AM             4,519 J-Bolt-Cont_63max.OUT
10/22/2006  11:14 AM         1,685,484 J-Bolt-Cont_63th.OUT
10/22/2006  11:18 AM             4,519 J-Bolt-Cont_72max.OUT
10/22/2006  11:18 AM         1,685,484 J-Bolt-Cont_72th.OUT
```

```
10/22/2006  11:22 AM              4,519 J-Bolt-Cont_81max.OUT
10/22/2006  11:22 AM          1,685,484 J-Bolt-Cont_81th.OUT
10/22/2006  11:26 AM              4,519 J-Bolt-Cont_90max.OUT
10/22/2006  11:26 AM          1,685,484 J-Bolt-Cont_90th.OUT
10/22/2006  11:31 AM              4,519 J-Bolt-Cont_99max.OUT
10/22/2006  11:31 AM          1,685,484 J-Bolt-Cont_99th.OUT
10/22/2006  10:50 AM              4,519 J-Bolt-Cont_9max.OUT
10/22/2006  10:50 AM          1,685,612 J-Bolt-Cont_9th.OUT
08/23/2006  07:47 AM              1,971 Liner.txt
05/02/2005  02:19 PM                667 live_load.txt
07/21/2006  10:03 AM              6,214 Near-Soil-1.txt
04/20/2005  01:14 PM                508 outer-spar.txt
10/23/2006  09:03 AM                150 Post-Tank.txt
10/24/2006  08:56 AM            105,984 Primary-Contact_0-90.xls
10/24/2006  08:56 AM            105,984 Primary-Contact_99-180.xls
10/22/2006  10:20 AM              4,024 Primary-Cont_108max.OUT
10/22/2006  10:20 AM          1,738,448 Primary-Cont_108th.OUT
10/22/2006  10:23 AM              4,024 Primary-Cont_117max.OUT
10/22/2006  10:23 AM          1,738,448 Primary-Cont_117th.OUT
10/22/2006  10:26 AM              4,024 Primary-Cont_126max.OUT
10/22/2006  10:26 AM          1,738,448 Primary-Cont_126th.OUT
10/22/2006  10:30 AM              4,024 Primary-Cont_135max.OUT
10/22/2006  10:30 AM          1,738,448 Primary-Cont_135th.OUT
10/22/2006  10:33 AM              4,024 Primary-Cont_144max.OUT
10/22/2006  10:33 AM          1,738,448 Primary-Cont_144th.OUT
10/22/2006  10:36 AM              4,024 Primary-Cont_153max.OUT
10/22/2006  10:36 AM          1,738,448 Primary-Cont_153th.OUT
10/22/2006  10:39 AM              4,024 Primary-Cont_162max.OUT
10/22/2006  10:39 AM          1,738,448 Primary-Cont_162th.OUT
10/22/2006  10:42 AM              4,024 Primary-Cont_171max.OUT
10/22/2006  10:42 AM          1,738,448 Primary-Cont_171th.OUT
10/22/2006  10:46 AM              4,024 Primary-Cont_180max.OUT
10/22/2006  10:46 AM          1,738,448 Primary-Cont_180th.OUT
10/22/2006  09:47 AM              4,024 Primary-Cont_18max.OUT
10/22/2006  09:47 AM          1,738,448 Primary-Cont_18th.OUT
10/22/2006  09:50 AM              4,024 Primary-Cont_27max.OUT
10/22/2006  09:50 AM          1,738,448 Primary-Cont_27th.OUT
10/22/2006  09:54 AM              4,024 Primary-Cont_36max.OUT
10/22/2006  09:54 AM          1,738,448 Primary-Cont_36th.OUT
10/22/2006  09:57 AM              4,024 Primary-Cont_45max.OUT
10/22/2006  09:57 AM          1,738,448 Primary-Cont_45th.OUT
10/22/2006  10:00 AM              4,024 Primary-Cont_54max.OUT
10/22/2006  10:00 AM          1,738,448 Primary-Cont_54th.OUT
10/22/2006  10:04 AM              4,024 Primary-Cont_63max.OUT
10/22/2006  10:04 AM          1,738,448 Primary-Cont_63th.OUT
10/22/2006  10:07 AM              4,024 Primary-Cont_72max.OUT
10/22/2006  10:07 AM          1,738,448 Primary-Cont_72th.OUT
10/22/2006  10:10 AM              4,024 Primary-Cont_81max.OUT
10/22/2006  10:10 AM          1,738,448 Primary-Cont_81th.OUT
10/22/2006  10:13 AM              4,024 Primary-Cont_90max.OUT
10/22/2006  10:13 AM          1,738,448 Primary-Cont_90th.OUT
10/22/2006  10:16 AM              4,024 Primary-Cont_99max.OUT
10/22/2006  10:16 AM          1,738,448 Primary-Cont_99th.OUT
10/22/2006  09:44 AM              4,024 Primary-Cont_9max.OUT
10/22/2006  09:44 AM          1,738,576 Primary-Cont_9th.OUT
10/12/2006  02:28 PM              6,028 Primary-Props-AP.txt
09/27/2005  03:52 PM              1,538 Primary.txt
10/19/2006  02:04 PM            450,409 QA.out
10/22/2006  08:30 PM             47,121 RS-ct-0.out
10/22/2006  08:36 PM             47,121 RS-ct-135.out
10/22/2006  08:38 PM             47,121 RS-ct-180.out
10/22/2006  08:32 PM             47,121 RS-ct-45.out
10/22/2006  08:34 PM             47,121 RS-ct-90.out
10/22/2006  08:28 PM             27,591 RS-ct.out
10/22/2006  08:40 PM             47,121 RS-PT-0.out
10/22/2006  08:45 PM             47,121 RS-PT-135.out
10/22/2006  08:47 PM             47,121 RS-PT-180.out
10/22/2006  08:41 PM             47,121 RS-PT-45.out
10/22/2006  08:43 PM             47,121 RS-PT-90.out
10/22/2006  08:49 PM             47,121 RS-SOil.out
```

```
10/31/2005  10:31 AM              1,108 RS_FREQ.txt
09/22/2006  02:33 PM              1,819 Run-Tank.txt
01/03/2007  04:10 PM                  0 scratch.hlp
02/11/2005  01:22 PM              1,053 Slave.txt
10/22/2006  01:37 PM              9,896 Soil-Contact_108max.OUT
10/22/2006  01:37 PM          4,348,080 Soil-Contact_108th.OUT
10/22/2006  01:44 PM              9,896 Soil-Contact_117max.OUT
10/22/2006  01:44 PM          4,348,080 Soil-Contact_117th.OUT
10/22/2006  01:52 PM              9,896 Soil-Contact_126max.OUT
10/22/2006  01:52 PM          4,348,080 Soil-Contact_126th.OUT
10/22/2006  02:00 PM              9,896 Soil-Contact_135max.OUT
10/22/2006  02:00 PM          4,348,080 Soil-Contact_135th.OUT
10/22/2006  02:07 PM              9,896 Soil-Contact_144max.OUT
10/22/2006  02:07 PM          4,348,080 Soil-Contact_144th.OUT
10/22/2006  02:14 PM              9,896 Soil-Contact_153max.OUT
10/22/2006  02:14 PM          4,348,080 Soil-Contact_153th.OUT
10/22/2006  02:22 PM              9,896 Soil-Contact_162max.OUT
10/22/2006  02:22 PM          4,348,080 Soil-Contact_162th.OUT
10/22/2006  02:29 PM              9,896 Soil-Contact_171max.OUT
10/22/2006  02:29 PM          4,348,080 Soil-Contact_171th.OUT
10/22/2006  02:36 PM              9,896 Soil-Contact_180max.OUT
10/22/2006  02:36 PM          4,348,080 Soil-Contact_180th.OUT
10/22/2006  12:23 PM              9,896 Soil-Contact_18max.OUT
10/22/2006  12:23 PM          4,348,080 Soil-Contact_18th.OUT
10/22/2006  12:30 PM              9,896 Soil-Contact_27max.OUT
10/22/2006  12:30 PM          4,348,080 Soil-Contact_27th.OUT
10/22/2006  12:38 PM              9,896 Soil-Contact_36max.OUT
10/22/2006  12:38 PM          4,348,080 Soil-Contact_36th.OUT
10/22/2006  12:45 PM              9,896 Soil-Contact_45max.OUT
10/22/2006  12:45 PM          4,348,080 Soil-Contact_45th.OUT
10/22/2006  12:52 PM              9,896 Soil-Contact_54max.OUT
10/22/2006  12:52 PM          4,348,080 Soil-Contact_54th.OUT
10/22/2006  01:00 PM              9,896 Soil-Contact_63max.OUT
10/22/2006  01:00 PM          4,348,080 Soil-Contact_63th.OUT
10/22/2006  01:07 PM              9,896 Soil-Contact_72max.OUT
10/22/2006  01:07 PM          4,348,080 Soil-Contact_72th.OUT
10/22/2006  01:15 PM              9,896 Soil-Contact_81max.OUT
10/22/2006  01:15 PM          4,348,080 Soil-Contact_81th.OUT
10/22/2006  01:22 PM              9,896 Soil-Contact_90max.OUT
10/22/2006  01:22 PM          4,348,080 Soil-Contact_90th.OUT
10/22/2006  01:29 PM              9,896 Soil-Contact_99max.OUT
10/22/2006  01:29 PM          4,348,080 Soil-Contact_99th.OUT
10/22/2006  12:15 PM              9,896 Soil-Contact_9max.OUT
10/22/2006  12:15 PM          4,348,208 Soil-Contact_9th.OUT
11/11/2005  10:36 AM              4,989 Soil-Prop-Mean-Geo.txt
10/24/2006  08:00 AM            223,744 soil_0-90.xls
10/24/2006  08:00 AM            223,744 soil_99-180.xls
09/22/2006  04:04 PM              1,918 Solve-TH-BES.txt
09/13/2006  06:12 AM                347 spectra-all.txt
09/13/2006  06:07 AM              3,690 spectra-conc-0.txt
09/13/2006  06:08 AM              3,723 spectra-conc-135.txt
09/13/2006  06:09 AM              3,723 spectra-conc-180.txt
09/13/2006  06:08 AM              3,769 spectra-conc-45.txt
09/13/2006  06:08 AM              3,649 spectra-conc-90.txt
09/13/2006  06:09 AM              1,590 spectra-conc.txt
08/28/2006  09:38 AM              2,076 spectra-concrete.txt
09/13/2006  06:13 AM              3,609 spectra-primary-0.txt
09/13/2006  06:14 AM              3,762 spectra-primary-135.txt
09/13/2006  06:15 AM              3,777 spectra-primary-180.txt
09/13/2006  06:13 AM              3,688 spectra-primary-45.txt
09/13/2006  06:14 AM              3,688 spectra-primary-90.txt
09/13/2006  06:15 AM              3,801 spectra-soil.txt
06/20/2005  09:04 AM                647 spectra-wall.txt
06/20/2005  08:52 AM                679 spectra-waste.txt
10/24/2006  08:30 AM            276,480 str-comp_0-90b.xls
10/24/2006  08:31 AM            276,480 str-comp_0-90m.xls
10/24/2006  08:31 AM            275,968 str-comp_0-90t.xls
10/24/2006  08:31 AM            275,968 str-comp_99-180b.xls
10/24/2006  08:31 AM            275,968 str-comp_99-180m.xls
10/24/2006  08:32 AM            275,968 str-comp_99-180t.xls
```

```
01/03/2007  03:40 PM          1,823 strain-backed-principle-bot.txt
01/03/2007  03:40 PM          1,828 strain-backed-principle-mid.txt
01/03/2007  03:41 PM          1,825 strain-backed-principle-top.txt
01/03/2007  04:02 PM            966 strain-backed-principle.txt
01/03/2007  05:37 PM          7,496 Strain-Backed-Princ_108-bot-max.OUT
01/03/2007  05:37 PM      3,463,218 Strain-Backed-Princ_108-bot-th.OUT
01/03/2007  09:04 PM          7,162 Strain-Backed-Princ_108-Top-max.OUT
01/03/2007  09:04 PM      3,305,799 Strain-Backed-Princ_108-Top-th.OUT
01/03/2007  07:23 PM          4,156 Strain-Backed-Princ_108max.OUT
01/03/2007  07:23 PM      1,889,028 Strain-Backed-Princ_108th.OUT
01/03/2007  05:45 PM          7,496 Strain-Backed-Princ_117-bot-max.OUT
01/03/2007  05:45 PM      3,463,218 Strain-Backed-Princ_117-bot-th.OUT
01/03/2007  09:09 PM          7,162 Strain-Backed-Princ_117-Top-max.OUT
01/03/2007  09:09 PM      3,305,799 Strain-Backed-Princ_117-Top-th.OUT
01/03/2007  07:27 PM          4,156 Strain-Backed-Princ_117max.OUT
01/03/2007  07:27 PM      1,889,028 Strain-Backed-Princ_117th.OUT
01/03/2007  05:52 PM          7,496 Strain-Backed-Princ_126-bot-max.OUT
01/03/2007  05:52 PM      3,463,218 Strain-Backed-Princ_126-bot-th.OUT
01/03/2007  09:14 PM          7,162 Strain-Backed-Princ_126-Top-max.OUT
01/03/2007  09:14 PM      3,305,799 Strain-Backed-Princ_126-Top-th.OUT
01/03/2007  07:31 PM          4,156 Strain-Backed-Princ_126max.OUT
01/03/2007  07:31 PM      1,889,028 Strain-Backed-Princ_126th.OUT
01/03/2007  05:59 PM          7,496 Strain-Backed-Princ_135-bot-max.OUT
01/03/2007  05:59 PM      3,463,218 Strain-Backed-Princ_135-bot-th.OUT
01/03/2007  09:20 PM          7,162 Strain-Backed-Princ_135-Top-max.OUT
01/03/2007  09:20 PM      3,305,799 Strain-Backed-Princ_135-Top-th.OUT
01/03/2007  07:35 PM          4,156 Strain-Backed-Princ_135max.OUT
01/03/2007  07:35 PM      1,889,028 Strain-Backed-Princ_135th.OUT
01/03/2007  06:06 PM          7,496 Strain-Backed-Princ_144-bot-max.OUT
01/03/2007  06:06 PM      3,463,218 Strain-Backed-Princ_144-bot-th.OUT
01/03/2007  09:26 PM          7,162 Strain-Backed-Princ_144-Top-max.OUT
01/03/2007  09:26 PM      3,305,799 Strain-Backed-Princ_144-Top-th.OUT
01/03/2007  07:39 PM          4,156 Strain-Backed-Princ_144max.OUT
01/03/2007  07:39 PM      1,889,028 Strain-Backed-Princ_144th.OUT
01/03/2007  06:13 PM          7,496 Strain-Backed-Princ_153-bot-max.OUT
01/03/2007  06:13 PM      3,463,218 Strain-Backed-Princ_153-bot-th.OUT
01/03/2007  09:32 PM          7,162 Strain-Backed-Princ_153-Top-max.OUT
01/03/2007  09:32 PM      3,305,799 Strain-Backed-Princ_153-Top-th.OUT
01/03/2007  07:43 PM          4,156 Strain-Backed-Princ_153max.OUT
01/03/2007  07:43 PM      1,889,028 Strain-Backed-Princ_153th.OUT
01/03/2007  06:20 PM          7,496 Strain-Backed-Princ_162-bot-max.OUT
01/03/2007  06:20 PM      3,463,218 Strain-Backed-Princ_162-bot-th.OUT
01/03/2007  09:37 PM          7,162 Strain-Backed-Princ_162-Top-max.OUT
01/03/2007  09:37 PM      3,305,799 Strain-Backed-Princ_162-Top-th.OUT
01/03/2007  07:47 PM          4,156 Strain-Backed-Princ_162max.OUT
01/03/2007  07:47 PM      1,889,028 Strain-Backed-Princ_162th.OUT
01/03/2007  06:27 PM          7,496 Strain-Backed-Princ_171-bot-max.OUT
01/03/2007  06:27 PM      3,463,218 Strain-Backed-Princ_171-bot-th.OUT
01/03/2007  09:43 PM          7,162 Strain-Backed-Princ_171-Top-max.OUT
01/03/2007  09:43 PM      3,305,799 Strain-Backed-Princ_171-Top-th.OUT
01/03/2007  07:51 PM          4,156 Strain-Backed-Princ_171max.OUT
01/03/2007  07:51 PM      1,889,028 Strain-Backed-Princ_171th.OUT
01/03/2007  04:26 PM          7,496 Strain-Backed-Princ_18-bot-max.OUT
01/03/2007  04:26 PM      3,463,218 Strain-Backed-Princ_18-bot-th.OUT
01/03/2007  08:07 PM          7,162 Strain-Backed-Princ_18-Top-max.OUT
01/03/2007  08:07 PM      3,305,799 Strain-Backed-Princ_18-Top-th.OUT
01/03/2007  06:34 PM          7,496 Strain-Backed-Princ_180-bot-max.OUT
01/03/2007  06:34 PM      3,463,218 Strain-Backed-Princ_180-bot-th.OUT
01/03/2007  09:49 PM          7,162 Strain-Backed-Princ_180-Top-max.OUT
01/03/2007  09:49 PM      3,305,799 Strain-Backed-Princ_180-Top-th.OUT
01/03/2007  07:55 PM          4,156 Strain-Backed-Princ_180max.OUT
01/03/2007  07:55 PM      1,889,028 Strain-Backed-Princ_180th.OUT
01/03/2007  06:42 PM          4,156 Strain-Backed-Princ_18max.OUT
01/03/2007  06:42 PM      1,889,028 Strain-Backed-Princ_18th.OUT
01/03/2007  04:33 PM          7,496 Strain-Backed-Princ_27-bot-max.OUT
01/03/2007  04:33 PM      3,463,218 Strain-Backed-Princ_27-bot-th.OUT
01/03/2007  08:13 PM          7,162 Strain-Backed-Princ_27-Top-max.OUT
01/03/2007  08:13 PM      3,305,799 Strain-Backed-Princ_27-Top-th.OUT
01/03/2007  06:46 PM          4,156 Strain-Backed-Princ_27max.OUT
01/03/2007  06:46 PM      1,889,028 Strain-Backed-Princ_27th.OUT
```

```
01/03/2007  04:40 PM           7,496 Strain-Backed-Princ_36-bot-max.OUT
01/03/2007  04:41 PM       3,463,218 Strain-Backed-Princ_36-bot-th.OUT
01/03/2007  08:19 PM           7,162 Strain-Backed-Princ_36-Top-max.OUT
01/03/2007  08:19 PM       3,305,799 Strain-Backed-Princ_36-Top-th.OUT
01/03/2007  06:50 PM           4,156 Strain-Backed-Princ_36max.OUT
01/03/2007  06:50 PM       1,889,028 Strain-Backed-Princ_36th.OUT
01/03/2007  04:48 PM           7,496 Strain-Backed-Princ_45-bot-max.OUT
01/03/2007  04:48 PM       3,463,218 Strain-Backed-Princ_45-bot-th.OUT
01/03/2007  08:24 PM           7,162 Strain-Backed-Princ_45-Top-max.OUT
01/03/2007  08:24 PM       3,305,799 Strain-Backed-Princ_45-Top-th.OUT
01/03/2007  06:54 PM           4,156 Strain-Backed-Princ_45max.OUT
01/03/2007  06:54 PM       1,889,028 Strain-Backed-Princ_45th.OUT
01/03/2007  04:55 PM           7,496 Strain-Backed-Princ_54-bot-max.OUT
01/03/2007  04:55 PM       3,463,218 Strain-Backed-Princ_54-bot-th.OUT
01/03/2007  08:30 PM           7,162 Strain-Backed-Princ_54-Top-max.OUT
01/03/2007  08:30 PM       3,305,799 Strain-Backed-Princ_54-Top-th.OUT
01/03/2007  06:58 PM           4,156 Strain-Backed-Princ_54max.OUT
01/03/2007  06:58 PM       1,889,028 Strain-Backed-Princ_54th.OUT
01/03/2007  05:02 PM           7,496 Strain-Backed-Princ_63-bot-max.OUT
01/03/2007  05:02 PM       3,463,218 Strain-Backed-Princ_63-bot-th.OUT
01/03/2007  08:35 PM           7,162 Strain-Backed-Princ_63-Top-max.OUT
01/03/2007  08:35 PM       3,305,799 Strain-Backed-Princ_63-Top-th.OUT
01/03/2007  07:02 PM           4,156 Strain-Backed-Princ_63max.OUT
01/03/2007  07:02 PM       1,889,028 Strain-Backed-Princ_63th.OUT
01/03/2007  05:09 PM           7,496 Strain-Backed-Princ_72-bot-max.OUT
01/03/2007  05:09 PM       3,463,218 Strain-Backed-Princ_72-bot-th.OUT
01/03/2007  08:40 PM           7,162 Strain-Backed-Princ_72-Top-max.OUT
01/03/2007  08:40 PM       3,305,799 Strain-Backed-Princ_72-Top-th.OUT
01/03/2007  07:06 PM           4,156 Strain-Backed-Princ_72max.OUT
01/03/2007  07:06 PM       1,889,028 Strain-Backed-Princ_72th.OUT
01/03/2007  05:16 PM           7,496 Strain-Backed-Princ_81-bot-max.OUT
01/03/2007  05:16 PM       3,463,218 Strain-Backed-Princ_81-bot-th.OUT
01/03/2007  08:46 PM           7,162 Strain-Backed-Princ_81-Top-max.OUT
01/03/2007  08:46 PM       3,305,799 Strain-Backed-Princ_81-Top-th.OUT
01/03/2007  07:10 PM           4,156 Strain-Backed-Princ_81max.OUT
01/03/2007  07:11 PM       1,889,028 Strain-Backed-Princ_81th.OUT
01/03/2007  04:19 PM           7,496 Strain-Backed-Princ_9-bot-max.OUT
01/03/2007  04:19 PM       3,463,346 Strain-Backed-Princ_9-bot-th.OUT
01/03/2007  08:01 PM           7,162 Strain-Backed-Princ_9-Top-max.OUT
01/03/2007  08:01 PM       3,305,927 Strain-Backed-Princ_9-Top-th.OUT
01/03/2007  05:23 PM           7,496 Strain-Backed-Princ_90-bot-max.OUT
01/03/2007  05:23 PM       3,463,218 Strain-Backed-Princ_90-bot-th.OUT
01/03/2007  08:52 PM           7,162 Strain-Backed-Princ_90-Top-max.OUT
01/03/2007  08:52 PM       3,305,799 Strain-Backed-Princ_90-Top-th.OUT
01/03/2007  07:15 PM           4,156 Strain-Backed-Princ_90max.OUT
01/03/2007  07:15 PM       1,889,028 Strain-Backed-Princ_90th.OUT
01/03/2007  05:30 PM           7,496 Strain-Backed-Princ_99-bot-max.OUT
01/03/2007  05:30 PM       3,463,218 Strain-Backed-Princ_99-bot-th.OUT
01/03/2007  08:58 PM           7,162 Strain-Backed-Princ_99-Top-max.OUT
01/03/2007  08:58 PM       3,305,799 Strain-Backed-Princ_99-Top-th.OUT
01/03/2007  07:19 PM           4,156 Strain-Backed-Princ_99max.OUT
01/03/2007  07:19 PM       1,889,028 Strain-Backed-Princ_99th.OUT
01/03/2007  06:38 PM           4,156 Strain-Backed-Princ_9max.OUT
01/03/2007  06:38 PM       1,889,156 Strain-Backed-Princ_9th.OUT
09/05/2006  02:00 PM           2,588 strain-backed.txt
10/23/2006  06:20 PM          10,533 Strain-Backed_9max.OUT
08/21/2006  08:01 AM             566 strain-compb-p.txt
08/16/2006  01:59 PM             621 strain-compb-primary.txt
08/21/2006  08:01 AM             693 strain-compb.txt
08/21/2006  08:02 AM             566 strain-compm-p.txt
08/16/2006  02:00 PM             621 strain-compm-primary.txt
08/21/2006  08:01 AM             705 strain-compm.txt
08/21/2006  08:02 AM             578 strain-compt-p.txt
08/16/2006  02:00 PM             621 strain-compt-primary.txt
08/21/2006  08:02 AM             720 strain-compt.txt
08/21/2006  08:02 AM             730 Strain-Liner-floor.txt
01/05/2006  03:14 PM             550 Strain-Liner-p.txt
08/21/2006  08:02 AM             962 Strain-Liner-wall.txt
08/16/2006  03:01 PM             545 Strain-Liner.txt
08/16/2006  02:01 PM             292 Strain-Primary.txt
```

```
01/04/2007  03:48 PM           113,152 Strain-Princ_0-90.xls
01/04/2007  03:48 PM           187,904 Strain-Princ_0-90b.xls
01/04/2007  03:49 PM           180,224 Strain-Princ_0-90t.xls
01/04/2007  03:49 PM           113,152 Strain-Princ_99-180.xls
01/04/2007  03:49 PM           188,416 Strain-Princ_99-180b.xls
01/04/2007  03:49 PM           180,736 Strain-Princ_99-180t.xls
08/16/2006  02:19 PM               273 Strain.txt
08/21/2006  08:02 AM               554 stress-compb-p.txt
08/21/2006  08:02 AM               598 stress-compb.txt
08/21/2006  08:03 AM               554 stress-compm-p.txt
08/21/2006  08:03 AM               608 stress-compm.txt
08/21/2006  08:03 AM               554 stress-compt-p.txt
08/24/2006  03:19 PM               598 stress-compt.txt
08/17/2006  11:19 AM               207 Stress-Primary-M.txt
10/23/2006  09:03 AM               225 Stress-Primary.txt
10/23/2006  04:15 PM            13,519 Stress-pt_108max-b.OUT
10/23/2006  11:45 AM            13,519 Stress-pt_108max-m.OUT
10/23/2006  05:57 AM            13,519 Stress-pt_108max-t.OUT
10/23/2006  04:15 PM         6,443,068 Stress-pt_108th-b.OUT
10/23/2006  11:45 AM         6,443,068 Stress-pt_108th-m.OUT
10/23/2006  05:57 AM         6,412,940 Stress-pt_108th-t.OUT
10/23/2006  04:28 PM            13,519 Stress-pt_117max-b.OUT
10/23/2006  11:59 AM            13,519 Stress-pt_117max-m.OUT
10/23/2006  06:10 AM            13,519 Stress-pt_117max-t.OUT
10/23/2006  04:28 PM         6,443,068 Stress-pt_117th-b.OUT
10/23/2006  11:59 AM         6,443,068 Stress-pt_117th-m.OUT
10/23/2006  06:10 AM         6,412,940 Stress-pt_117th-t.OUT
10/23/2006  04:41 PM            13,519 Stress-pt_126max-b.OUT
10/23/2006  12:12 PM            13,519 Stress-pt_126max-m.OUT
10/23/2006  06:23 AM            13,519 Stress-pt_126max-t.OUT
10/23/2006  04:41 PM         6,443,068 Stress-pt_126th-b.OUT
10/23/2006  12:12 PM         6,443,068 Stress-pt_126th-m.OUT
10/23/2006  06:23 AM         6,412,940 Stress-pt_126th-t.OUT
10/23/2006  04:55 PM            13,519 Stress-pt_135max-b.OUT
10/23/2006  12:26 PM            13,519 Stress-pt_135max-m.OUT
10/23/2006  06:37 AM            13,519 Stress-pt_135max-t.OUT
10/23/2006  04:55 PM         6,443,068 Stress-pt_135th-b.OUT
10/23/2006  12:26 PM         6,443,068 Stress-pt_135th-m.OUT
10/23/2006  06:37 AM         6,412,940 Stress-pt_135th-t.OUT
10/23/2006  05:08 PM            13,519 Stress-pt_144max-b.OUT
10/23/2006  12:39 PM            13,519 Stress-pt_144max-m.OUT
10/23/2006  06:50 AM            13,519 Stress-pt_144max-t.OUT
10/23/2006  05:08 PM         6,443,068 Stress-pt_144th-b.OUT
10/23/2006  12:39 PM         6,443,068 Stress-pt_144th-m.OUT
10/23/2006  06:50 AM         6,412,940 Stress-pt_144th-t.OUT
10/23/2006  05:22 PM            13,519 Stress-pt_153max-b.OUT
10/23/2006  12:53 PM            13,519 Stress-pt_153max-m.OUT
10/23/2006  07:04 AM            13,519 Stress-pt_153max-t.OUT
10/23/2006  05:22 PM         6,443,068 Stress-pt_153th-b.OUT
10/23/2006  12:53 PM         6,443,068 Stress-pt_153th-m.OUT
10/23/2006  07:04 AM         6,412,940 Stress-pt_153th-t.OUT
10/23/2006  05:36 PM            13,519 Stress-pt_162max-b.OUT
10/23/2006  01:07 PM            13,519 Stress-pt_162max-m.OUT
10/23/2006  07:18 AM            13,519 Stress-pt_162max-t.OUT
10/23/2006  05:36 PM         6,443,068 Stress-pt_162th-b.OUT
10/23/2006  01:07 PM         6,443,068 Stress-pt_162th-m.OUT
10/23/2006  07:18 AM         6,412,940 Stress-pt_162th-t.OUT
10/23/2006  05:50 PM            13,521 Stress-pt_171max-b.OUT
10/23/2006  01:21 PM            13,521 Stress-pt_171max-m.OUT
10/23/2006  07:32 AM            13,521 Stress-pt_171max-t.OUT
10/23/2006  05:50 PM         6,443,068 Stress-pt_171th-b.OUT
10/23/2006  01:21 PM         6,443,068 Stress-pt_171th-m.OUT
10/23/2006  07:32 AM         6,412,940 Stress-pt_171th-t.OUT
10/23/2006  06:03 PM            13,521 Stress-pt_180max-b.OUT
10/23/2006  01:34 PM            13,521 Stress-pt_180max-m.OUT
10/23/2006  07:45 AM            13,521 Stress-pt_180max-t.OUT
10/23/2006  06:03 PM         6,443,068 Stress-pt_180th-b.OUT
10/23/2006  01:34 PM         6,443,068 Stress-pt_180th-m.OUT
10/23/2006  07:45 AM         6,412,940 Stress-pt_180th-t.OUT
10/23/2006  02:01 PM            13,519 Stress-pt_18max-b.OUT
```

```
10/23/2006  09:32 AM          13,519 Stress-pt_18max-m.OUT
10/23/2006  03:42 AM          13,519 Stress-pt_18max-t.OUT
10/23/2006  02:01 PM       6,443,068 Stress-pt_18th-b.OUT
10/23/2006  09:32 AM       6,443,068 Stress-pt_18th-m.OUT
10/23/2006  03:42 AM       6,412,940 Stress-pt_18th-t.OUT
10/23/2006  02:15 PM          13,519 Stress-pt_27max-b.OUT
10/23/2006  09:45 AM          13,519 Stress-pt_27max-m.OUT
10/23/2006  03:56 AM          13,519 Stress-pt_27max-t.OUT
10/23/2006  02:15 PM       6,443,068 Stress-pt_27th-b.OUT
10/23/2006  09:45 AM       6,443,068 Stress-pt_27th-m.OUT
10/23/2006  03:56 AM       6,412,940 Stress-pt_27th-t.OUT
10/23/2006  02:28 PM          13,519 Stress-pt_36max-b.OUT
10/23/2006  09:59 AM          13,519 Stress-pt_36max-m.OUT
10/23/2006  04:09 AM          13,519 Stress-pt_36max-t.OUT
10/23/2006  02:28 PM       6,443,068 Stress-pt_36th-b.OUT
10/23/2006  09:59 AM       6,443,068 Stress-pt_36th-m.OUT
10/23/2006  04:09 AM       6,412,940 Stress-pt_36th-t.OUT
10/23/2006  02:42 PM          13,519 Stress-pt_45max-b.OUT
10/23/2006  10:13 AM          13,519 Stress-pt_45max-m.OUT
10/23/2006  04:23 AM          13,519 Stress-pt_45max-t.OUT
10/23/2006  02:42 PM       6,443,068 Stress-pt_45th-b.OUT
10/23/2006  10:13 AM       6,443,068 Stress-pt_45th-m.OUT
10/23/2006  04:23 AM       6,412,940 Stress-pt_45th-t.OUT
10/23/2006  02:55 PM          13,519 Stress-pt_54max-b.OUT
10/23/2006  10:25 AM          13,519 Stress-pt_54max-m.OUT
10/23/2006  04:35 AM          13,519 Stress-pt_54max-t.OUT
10/23/2006  02:55 PM       6,443,068 Stress-pt_54th-b.OUT
10/23/2006  10:26 AM       6,443,068 Stress-pt_54th-m.OUT
10/23/2006  04:36 AM       6,412,940 Stress-pt_54th-t.OUT
10/23/2006  03:08 PM          13,519 Stress-pt_63max-b.OUT
10/23/2006  10:39 AM          13,519 Stress-pt_63max-m.OUT
10/23/2006  04:49 AM          13,519 Stress-pt_63max-t.OUT
10/23/2006  03:08 PM       6,443,068 Stress-pt_63th-b.OUT
10/23/2006  10:39 AM       6,443,068 Stress-pt_63th-m.OUT
10/23/2006  04:49 AM       6,412,940 Stress-pt_63th-t.OUT
10/23/2006  03:20 PM          13,519 Stress-pt_72max-b.OUT
10/23/2006  10:51 AM          13,519 Stress-pt_72max-m.OUT
10/23/2006  05:02 AM          13,519 Stress-pt_72max-t.OUT
10/23/2006  03:20 PM       6,443,068 Stress-pt_72th-b.OUT
10/23/2006  10:51 AM       6,443,068 Stress-pt_72th-m.OUT
10/23/2006  05:02 AM       6,412,940 Stress-pt_72th-t.OUT
10/23/2006  03:34 PM          13,519 Stress-pt_81max-b.OUT
10/23/2006  11:04 AM          13,519 Stress-pt_81max-m.OUT
10/23/2006  05:15 AM          13,519 Stress-pt_81max-t.OUT
10/23/2006  03:34 PM       6,443,068 Stress-pt_81th-b.OUT
10/23/2006  11:05 AM       6,443,068 Stress-pt_81th-m.OUT
10/23/2006  05:15 AM       6,412,940 Stress-pt_81th-t.OUT
10/23/2006  03:47 PM          13,519 Stress-pt_90max-b.OUT
10/23/2006  11:18 AM          13,519 Stress-pt_90max-m.OUT
10/23/2006  05:28 AM          13,519 Stress-pt_90max-t.OUT
10/23/2006  03:47 PM       6,443,068 Stress-pt_90th-b.OUT
10/23/2006  11:18 AM       6,443,068 Stress-pt_90th-m.OUT
10/23/2006  05:28 AM       6,412,940 Stress-pt_90th-t.OUT
10/23/2006  04:01 PM          13,519 Stress-pt_99max-b.OUT
10/23/2006  11:32 AM          13,519 Stress-pt_99max-m.OUT
10/23/2006  05:42 AM          13,519 Stress-pt_99max-t.OUT
10/23/2006  04:01 PM       6,443,068 Stress-pt_99th-b.OUT
10/23/2006  11:32 AM       6,443,068 Stress-pt_99th-m.OUT
10/23/2006  05:42 AM       6,412,940 Stress-pt_99th-t.OUT
10/23/2006  01:48 PM          13,519 Stress-pt_9max-b.OUT
10/23/2006  09:18 AM          13,519 Stress-pt_9max-m.OUT
10/23/2006  03:29 AM          13,519 Stress-pt_9max-t.OUT
10/23/2006  01:48 PM       6,443,196 Stress-pt_9th-b.OUT
10/23/2006  09:18 AM       6,443,196 Stress-pt_9th-m.OUT
10/23/2006  03:29 AM       6,413,068 Stress-pt_9th-t.OUT
10/12/2006  02:29 PM           4,009 Tank-Coordinates-AP.txt
05/25/2005  03:32 PM           2,512 Tank-Mesh1.txt
10/19/2006  02:03 PM             102 tank-out.out
12/05/2005  10:51 AM           5,495 Tank-Props-Crack.txt
07/21/2006  09:41 AM           5,591 Tank-Props-Rigid.txt
```

```
10/19/2006  02:04 PM             4,687 Tank-th.out
12/22/2005  12:43 PM            10,035 temp.log
08/09/2006  07:43 AM            23,166 TH-266-Mean-Geo-V.txt
08/09/2006  07:31 AM            23,166 TH-266-Mean-Geo.txt
10/22/2006  08:30 PM           561,576 Vel-ct-0.out
10/22/2006  08:36 PM           561,576 Vel-ct-135.out
10/22/2006  08:38 PM           561,576 Vel-ct-180.out
10/22/2006  08:32 PM           561,576 Vel-ct-45.out
10/22/2006  08:34 PM           561,576 Vel-ct-90.out
10/22/2006  08:28 PM           290,550 Vel-ct.out
10/22/2006  08:40 PM           561,576 Vel-PT-0.out
10/22/2006  08:45 PM           561,576 Vel-PT-135.out
10/22/2006  08:47 PM           561,576 Vel-PT-180.out
10/22/2006  08:41 PM           561,576 Vel-PT-45.out
10/22/2006  08:43 PM           561,576 Vel-PT-90.out
10/22/2006  08:49 PM           561,576 Vel-Soil.out
10/22/2006  07:19 AM            10,180 Waste-Cont_108max.OUT
10/22/2006  07:19 AM         4,875,649 Waste-Cont_108th.OUT
10/22/2006  07:29 AM            10,180 Waste-Cont_117max.OUT
10/22/2006  07:29 AM         4,875,649 Waste-Cont_117th.OUT
10/22/2006  07:40 AM            10,180 Waste-Cont_126max.OUT
10/22/2006  07:40 AM         4,875,649 Waste-Cont_126th.OUT
10/22/2006  07:50 AM            10,180 Waste-Cont_135max.OUT
10/22/2006  07:50 AM         4,875,649 Waste-Cont_135th.OUT
10/22/2006  08:01 AM            10,180 Waste-Cont_144max.OUT
10/22/2006  08:01 AM         4,875,649 Waste-Cont_144th.OUT
10/22/2006  08:11 AM            10,180 Waste-Cont_153max.OUT
10/22/2006  08:11 AM         4,875,649 Waste-Cont_153th.OUT
10/22/2006  08:21 AM            10,180 Waste-Cont_162max.OUT
10/22/2006  08:21 AM         4,875,649 Waste-Cont_162th.OUT
10/22/2006  08:31 AM            10,180 Waste-Cont_171max.OUT
10/22/2006  08:31 AM         4,875,649 Waste-Cont_171th.OUT
10/22/2006  08:41 AM            10,180 Waste-Cont_180max.OUT
10/22/2006  08:41 AM         4,875,649 Waste-Cont_180th.OUT
10/22/2006  05:14 AM            10,180 Waste-Cont_18max.OUT
10/22/2006  05:14 AM         4,875,649 Waste-Cont_18th.OUT
10/22/2006  05:48 AM            10,180 Waste-Cont_27max.OUT
10/22/2006  05:48 AM         4,875,649 Waste-Cont_27th.OUT
10/22/2006  05:58 AM            10,180 Waste-Cont_36max.OUT
10/22/2006  05:58 AM         4,875,649 Waste-Cont_36th.OUT
10/22/2006  06:09 AM            10,180 Waste-Cont_45max.OUT
10/22/2006  06:09 AM         4,875,649 Waste-Cont_45th.OUT
10/22/2006  06:19 AM            10,180 Waste-Cont_54max.OUT
10/22/2006  06:19 AM         4,875,649 Waste-Cont_54th.OUT
10/22/2006  06:29 AM            10,180 Waste-Cont_63max.OUT
10/22/2006  06:29 AM         4,875,649 Waste-Cont_63th.OUT
10/22/2006  06:39 AM            10,180 Waste-Cont_72max.OUT
10/22/2006  06:39 AM         4,875,649 Waste-Cont_72th.OUT
10/22/2006  06:49 AM            10,180 Waste-Cont_81max.OUT
10/22/2006  06:49 AM         4,875,649 Waste-Cont_81th.OUT
10/22/2006  06:59 AM            10,180 Waste-Cont_90max.OUT
10/22/2006  06:59 AM         4,875,649 Waste-Cont_90th.OUT
10/22/2006  07:09 AM            10,180 Waste-Cont_99max.OUT
10/22/2006  07:09 AM         4,875,649 Waste-Cont_99th.OUT
10/22/2006  04:41 AM            10,180 Waste-Cont_9max.OUT
10/22/2006  04:41 AM         4,875,777 Waste-Cont_9th.OUT
10/22/2006  04:31 AM            45,117 Waste-Reaction-460-SD3.out
09/25/2006  10:41 AM               340 Waste-Reaction.txt
10/12/2006  02:27 PM            10,266 Waste-solid-AP-S.txt
08/21/2006  08:03 AM               776 Waste-Surface-AP.txt
10/22/2006  02:55 PM               865 Waste-Surf_0max.OUT
10/22/2006  02:55 PM           534,133 Waste-Surf_0th.OUT
10/22/2006  06:13 PM               865 Waste-Surf_108max.OUT
10/22/2006  06:13 PM           534,005 Waste-Surf_108th.OUT
10/22/2006  06:29 PM               865 Waste-Surf_117max.OUT
10/22/2006  06:29 PM           534,005 Waste-Surf_117th.OUT
10/22/2006  06:45 PM               865 Waste-Surf_126max.OUT
10/22/2006  06:45 PM           534,005 Waste-Surf_126th.OUT
10/22/2006  07:02 PM               865 Waste-Surf_135max.OUT
10/22/2006  07:02 PM           534,005 Waste-Surf_135th.OUT
```

```
10/22/2006  07:18 PM               865 Waste-Surf_144max.OUT
10/22/2006  07:18 PM           534,005 Waste-Surf_144th.OUT
10/22/2006  07:35 PM               865 Waste-Surf_153max.OUT
10/22/2006  07:35 PM           534,005 Waste-Surf_153th.OUT
10/22/2006  07:51 PM               865 Waste-Surf_162max.OUT
10/22/2006  07:51 PM           534,005 Waste-Surf_162th.OUT
10/22/2006  08:08 PM               865 Waste-Surf_171max.OUT
10/22/2006  08:08 PM           534,005 Waste-Surf_171th.OUT
10/22/2006  08:24 PM               865 Waste-Surf_180max.OUT
10/22/2006  08:24 PM           534,005 Waste-Surf_180th.OUT
10/22/2006  08:24 PM               865 Waste-Surf_189max.OUT
10/22/2006  08:24 PM           534,005 Waste-Surf_189th.OUT
10/22/2006  03:28 PM               865 Waste-Surf_18max.OUT
10/22/2006  03:28 PM           534,005 Waste-Surf_18th.OUT
10/22/2006  03:44 PM               865 Waste-Surf_27max.OUT
10/22/2006  03:44 PM           534,005 Waste-Surf_27th.OUT
10/22/2006  04:01 PM               865 Waste-Surf_36max.OUT
10/22/2006  04:01 PM           534,005 Waste-Surf_36th.OUT
10/22/2006  04:17 PM               865 Waste-Surf_45max.OUT
10/22/2006  04:17 PM           534,005 Waste-Surf_45th.OUT
10/22/2006  04:34 PM               865 Waste-Surf_54max.OUT
10/22/2006  04:34 PM           534,005 Waste-Surf_54th.OUT
10/22/2006  04:50 PM               865 Waste-Surf_63max.OUT
10/22/2006  04:50 PM           534,005 Waste-Surf_63th.OUT
10/22/2006  05:07 PM               865 Waste-Surf_72max.OUT
10/22/2006  05:07 PM           534,005 Waste-Surf_72th.OUT
10/22/2006  05:23 PM               865 Waste-Surf_81max.OUT
10/22/2006  05:23 PM           534,005 Waste-Surf_81th.OUT
10/22/2006  05:39 PM               865 Waste-Surf_90max.OUT
10/22/2006  05:39 PM           534,005 Waste-Surf_90th.OUT
10/22/2006  05:56 PM               865 Waste-Surf_99max.OUT
10/22/2006  05:56 PM           534,005 Waste-Surf_99th.OUT
10/22/2006  03:11 PM               865 Waste-Surf_9max.OUT
10/22/2006  03:11 PM           534,005 Waste-Surf_9th.OUT
10/24/2006  06:47 AM           236,544 waste_0-90.xls
10/24/2006  06:47 AM           236,544 waste_99-180.xls
             796 File(s) 37,792,265,865 bytes
               2 Dir(s)  185,365,233,664 bytes free
```

BES-FCC Gravity File Listing

```
 Volume in drive C is 600GB 2xRAID0 (new)
 Volume Serial Number is 8A0A-E4BA

 Directory of C:\Users\Bruce\2008-000 PNNL\2008-005 AP-460\AP-460-BES-FCC-Seismic Run\AP-
460-BES-FCC-Gravity

01/09/2007  06:55 AM    <DIR>          .
01/09/2007  06:55 AM    <DIR>          ..
10/13/2006  02:28 PM           768,512 460-AP-BES-FCC J-Bolt-Contact-Gravity.xls
10/13/2006  02:43 PM           692,736 460-AP-BES-FCC-Primary-Contact-Gravity.xls
08/21/2006  06:49 AM               101 All-Forces.txt
01/02/2007  10:41 AM         3,178,496 AP-460-BES-FCC Conc Tank Demand Gravity.xls
10/13/2006  02:27 PM           688,640 AP-460-BES-FCC J Bolt Forces Gravity.xls
10/13/2006  02:35 PM         7,301,632 AP-460-BES-FCC Pri Tank Stress Gravity.xls
10/24/2006  07:57 AM         2,041,344 AP-460-BES-FCC Soil Pressures Gravity.xls
01/08/2007  10:31 AM         3,755,008 AP-460-BES-FCC Strain Gravity-Princ.xls
10/13/2006  02:50 PM           952,320 AP-460-BES-FCC Waste-TH-MAX Gravity.xls
10/13/2006  07:04 AM             2,998 AP-460-BES-FCC-Gravity.BCS
10/13/2006  07:06 AM        43,909,120 AP-460-BES-FCC-Gravity.db
09/01/2006  07:24 AM        63,897,600 AP-460-BES-FCC-Gravity.dbb
10/13/2006  07:04 AM        12,713,984 AP-460-BES-FCC-Gravity.emat
01/04/2007  07:53 AM           654,310 AP-460-BES-FCC-Gravity.err
10/13/2006  07:04 AM       111,607,808 AP-460-BES-FCC-Gravity.esav
10/13/2006  07:04 AM        30,015,488 AP-460-BES-FCC-Gravity.full
10/13/2006  07:03 AM         1,744,061 AP-460-BES-FCC-Gravity.ldhi
01/04/2007  07:54 AM             7,872 AP-460-BES-FCC-Gravity.log
10/13/2006  07:04 AM             2,295 AP-460-BES-FCC-Gravity.mntr
10/13/2006  07:03 AM       111,607,808 AP-460-BES-FCC-Gravity.osav
```

```
10/13/2006  07:04 AM             1,795 AP-460-BES-FCC-Gravity.PVTS
10/13/2006  07:04 AM       112,656,384 AP-460-BES-FCC-Gravity.r001
10/13/2006  06:44 AM        43,974,656 AP-460-BES-FCC-Gravity.rdb
10/13/2006  07:04 AM       186,580,992 AP-460-BES-FCC-Gravity.rst
10/13/2006  07:02 AM                97 AP-460-BES-FCC-Gravity.stat
10/13/2006  02:45 PM           684,032 AP-460-BES-FCC-Insul-Contact-Gravity.xls
10/13/2006  07:04 AM           120,544 AP-460-FCC-BES-Gravity.out
01/02/2007  08:44 AM            48,447 BES-FCC-Gravity-Files.txt
08/21/2006  01:22 PM             6,042 Bolts-Friction.txt
09/08/2006  07:11 AM               277 Boundary.txt
08/25/2006  08:42 AM               221 Contact-AP.txt
08/21/2006  07:59 AM               586 Contact-Footing.txt
08/24/2006  08:01 AM               654 Contact-Insul.txt
08/21/2006  07:59 AM               655 Contact-J-Bolts.txt
08/24/2006  08:01 AM               658 Contact-Primary.txt
08/21/2006  07:59 AM               742 Contact-Soil.txt
08/21/2006  12:44 PM               632 Contact-Waste-AP.txt
01/03/2006  11:17 AM             1,616 Disp-J-Bolts.txt
05/08/2006  01:31 PM             8,616 Far-Soil.txt
01/09/2007  06:55 AM                 0 file-list.txt
10/13/2006  06:43 AM             1,904 file.bat
10/13/2006  06:43 AM                68 file.err
10/13/2006  06:43 AM               228 file.log
10/13/2005  06:54 AM               562 Fix-Soil.txt
10/13/2006  07:05 AM            10,342 Footing-Cont_max.OUT
10/13/2006  07:05 AM            33,288 Footing-Cont_th.OUT
08/21/2006  08:00 AM               894 Force-c.txt
10/13/2006  07:05 AM             4,996 Force-c_108amax.OUT
10/13/2006  07:05 AM            27,900 Force-c_108ath.OUT
10/13/2006  07:05 AM            14,716 Force-c_108max.OUT
10/13/2006  07:05 AM            49,740 Force-c_108th.OUT
10/13/2006  07:05 AM             4,996 Force-c_117amax.OUT
10/13/2006  07:05 AM            27,900 Force-c_117ath.OUT
10/13/2006  07:05 AM            14,716 Force-c_117max.OUT
10/13/2006  07:05 AM            49,740 Force-c_117th.OUT
10/13/2006  07:05 AM             4,996 Force-c_126amax.OUT
10/13/2006  07:05 AM            27,900 Force-c_126ath.OUT
10/13/2006  07:05 AM            14,716 Force-c_126max.OUT
10/13/2006  07:05 AM            49,740 Force-c_126th.OUT
10/13/2006  07:05 AM             4,996 Force-c_135amax.OUT
10/13/2006  07:05 AM            27,900 Force-c_135ath.OUT
10/13/2006  07:05 AM            14,716 Force-c_135max.OUT
10/13/2006  07:05 AM            49,740 Force-c_135th.OUT
10/13/2006  07:05 AM             4,996 Force-c_144amax.OUT
10/13/2006  07:05 AM            27,900 Force-c_144ath.OUT
10/13/2006  07:05 AM            14,716 Force-c_144max.OUT
10/13/2006  07:05 AM            49,740 Force-c_144th.OUT
10/13/2006  07:05 AM             4,996 Force-c_153amax.OUT
10/13/2006  07:05 AM            27,900 Force-c_153ath.OUT
10/13/2006  07:05 AM            14,716 Force-c_153max.OUT
10/13/2006  07:05 AM            49,740 Force-c_153th.OUT
10/13/2006  07:05 AM             4,996 Force-c_162amax.OUT
10/13/2006  07:05 AM            27,900 Force-c_162ath.OUT
10/13/2006  07:05 AM            14,716 Force-c_162max.OUT
10/13/2006  07:05 AM            49,740 Force-c_162th.OUT
10/13/2006  07:05 AM             4,996 Force-c_171amax.OUT
10/13/2006  07:05 AM            27,900 Force-c_171ath.OUT
10/13/2006  07:05 AM            14,716 Force-c_171max.OUT
10/13/2006  07:05 AM            49,740 Force-c_171th.OUT
10/13/2006  07:05 AM             4,996 Force-c_180amax.OUT
10/13/2006  07:05 AM            27,900 Force-c_180ath.OUT
10/13/2006  07:05 AM            14,716 Force-c_180max.OUT
10/13/2006  07:05 AM            49,740 Force-c_180th.OUT
10/13/2006  07:05 AM             4,996 Force-c_18amax.OUT
10/13/2006  07:05 AM            27,900 Force-c_18ath.OUT
10/13/2006  07:05 AM            14,716 Force-c_18max.OUT
10/13/2006  07:05 AM            49,740 Force-c_18th.OUT
10/13/2006  07:05 AM             4,996 Force-c_27amax.OUT
10/13/2006  07:05 AM            27,900 Force-c_27ath.OUT
10/13/2006  07:05 AM            14,716 Force-c_27max.OUT
```

```
10/13/2006  07:05 AM            49,740 Force-c_27th.OUT
10/13/2006  07:05 AM             4,996 Force-c_36amax.OUT
10/13/2006  07:05 AM            27,900 Force-c_36ath.OUT
10/13/2006  07:05 AM            14,716 Force-c_36max.OUT
10/13/2006  07:05 AM            49,740 Force-c_36th.OUT
10/13/2006  07:05 AM             4,996 Force-c_45amax.OUT
10/13/2006  07:05 AM            27,900 Force-c_45ath.OUT
10/13/2006  07:05 AM            14,716 Force-c_45max.OUT
10/13/2006  07:05 AM            49,740 Force-c_45th.OUT
10/13/2006  07:05 AM             4,996 Force-c_54amax.OUT
10/13/2006  07:05 AM            27,900 Force-c_54ath.OUT
10/13/2006  07:05 AM            14,716 Force-c_54max.OUT
10/13/2006  07:05 AM            49,740 Force-c_54th.OUT
10/13/2006  07:05 AM             4,996 Force-c_63amax.OUT
10/13/2006  07:05 AM            27,900 Force-c_63ath.OUT
10/13/2006  07:05 AM            14,716 Force-c_63max.OUT
10/13/2006  07:05 AM            49,740 Force-c_63th.OUT
10/13/2006  07:05 AM             4,996 Force-c_72amax.OUT
10/13/2006  07:05 AM            27,900 Force-c_72ath.OUT
10/13/2006  07:05 AM            14,716 Force-c_72max.OUT
10/13/2006  07:05 AM            49,740 Force-c_72th.OUT
10/13/2006  07:05 AM             4,996 Force-c_81amax.OUT
10/13/2006  07:05 AM            27,900 Force-c_81ath.OUT
10/13/2006  07:05 AM            14,716 Force-c_81max.OUT
10/13/2006  07:05 AM            49,740 Force-c_81th.OUT
10/13/2006  07:05 AM             4,996 Force-c_90amax.OUT
10/13/2006  07:05 AM            27,900 Force-c_90ath.OUT
10/13/2006  07:05 AM            14,716 Force-c_90max.OUT
10/13/2006  07:05 AM            49,740 Force-c_90th.OUT
10/13/2006  07:05 AM             4,996 Force-c_99amax.OUT
10/13/2006  07:05 AM            27,900 Force-c_99ath.OUT
10/13/2006  07:05 AM            14,716 Force-c_99max.OUT
10/13/2006  07:05 AM            49,740 Force-c_99th.OUT
10/13/2006  07:05 AM             4,996 Force-c_9amax.OUT
10/13/2006  07:05 AM            28,028 Force-c_9ath.OUT
10/13/2006  07:05 AM            14,716 Force-c_9max.OUT
10/13/2006  07:05 AM            49,868 Force-c_9th.OUT
10/13/2006  02:26 PM           135,680 force-jb.xls
10/13/2006  07:05 AM            23,352 Force-jb_r10-th.OUT
10/13/2006  07:05 AM             5,239 Force-jb_r10_max.OUT
10/13/2006  07:05 AM            23,352 Force-jb_r11-th.OUT
10/13/2006  07:05 AM             5,239 Force-jb_r11_max.OUT
10/13/2006  07:05 AM            23,480 Force-jb_r2-th.OUT
10/13/2006  07:05 AM             5,239 Force-jb_r2_max.OUT
10/13/2006  07:05 AM            23,352 Force-jb_r3-th.OUT
10/13/2006  07:05 AM             5,239 Force-jb_r3_max.OUT
10/13/2006  07:05 AM            23,352 Force-jb_r4-th.OUT
10/13/2006  07:05 AM             5,239 Force-jb_r4_max.OUT
10/13/2006  07:05 AM            23,352 Force-jb_r5-th.OUT
10/13/2006  07:05 AM             5,239 Force-jb_r5_max.OUT
10/13/2006  07:05 AM            23,352 Force-jb_r6-th.OUT
10/13/2006  07:05 AM             5,239 Force-jb_r6_max.OUT
10/13/2006  07:05 AM            23,352 Force-jb_r7-th.OUT
10/13/2006  07:05 AM             5,239 Force-jb_r7_max.OUT
10/13/2006  07:05 AM            23,352 Force-jb_r8-th.OUT
10/13/2006  07:05 AM             5,239 Force-jb_r8_max.OUT
10/13/2006  07:05 AM            23,352 Force-jb_r9-th.OUT
10/13/2006  07:05 AM             5,239 Force-jb_r9_max.OUT
08/21/2006  08:00 AM               661 Force-j_bolt.txt
10/13/2006  02:24 PM           446,464 import_0-90.xls
10/13/2006  02:24 PM           446,976 import_99-180.xls
10/13/2006  02:45 PM            91,648 Insul-Contact_0-90.xls
10/13/2006  02:45 PM            91,136 Insul-Contact_99-180.xls
10/13/2006  07:04 AM             3,376 Insul-Cont_108max.OUT
10/13/2006  07:04 AM            11,808 Insul-Cont_108th.OUT
10/13/2006  07:04 AM             3,376 Insul-Cont_117max.OUT
10/13/2006  07:04 AM            11,808 Insul-Cont_117th.OUT
10/13/2006  07:04 AM             3,376 Insul-Cont_126max.OUT
10/13/2006  07:04 AM            11,808 Insul-Cont_126th.OUT
10/13/2006  07:04 AM             3,376 Insul-Cont_135max.OUT
```

```
10/13/2006  07:04 AM            11,808 Insul-Cont_135th.OUT
10/13/2006  07:04 AM             3,376 Insul-Cont_144max.OUT
10/13/2006  07:04 AM            11,808 Insul-Cont_144th.OUT
10/13/2006  07:04 AM             3,376 Insul-Cont_153max.OUT
10/13/2006  07:04 AM            11,808 Insul-Cont_153th.OUT
10/13/2006  07:04 AM             3,376 Insul-Cont_162max.OUT
10/13/2006  07:04 AM            11,808 Insul-Cont_162th.OUT
10/13/2006  07:04 AM             3,376 Insul-Cont_171max.OUT
10/13/2006  07:04 AM            11,808 Insul-Cont_171th.OUT
10/13/2006  07:04 AM             3,376 Insul-Cont_180max.OUT
10/13/2006  07:04 AM            11,808 Insul-Cont_180th.OUT
10/13/2006  07:04 AM             3,376 Insul-Cont_18max.OUT
10/13/2006  07:04 AM            11,808 Insul-Cont_18th.OUT
10/13/2006  07:04 AM             3,376 Insul-Cont_27max.OUT
10/13/2006  07:04 AM            11,808 Insul-Cont_27th.OUT
10/13/2006  07:04 AM             3,376 Insul-Cont_36max.OUT
10/13/2006  07:04 AM            11,808 Insul-Cont_36th.OUT
10/13/2006  07:04 AM             3,376 Insul-Cont_45max.OUT
10/13/2006  07:04 AM            11,808 Insul-Cont_45th.OUT
10/13/2006  07:04 AM             3,376 Insul-Cont_54max.OUT
10/13/2006  07:04 AM            11,808 Insul-Cont_54th.OUT
10/13/2006  07:04 AM             3,376 Insul-Cont_63max.OUT
10/13/2006  07:04 AM            11,808 Insul-Cont_63th.OUT
10/13/2006  07:04 AM             3,376 Insul-Cont_72max.OUT
10/13/2006  07:04 AM            11,808 Insul-Cont_72th.OUT
10/13/2006  07:04 AM             3,376 Insul-Cont_81max.OUT
10/13/2006  07:04 AM            11,808 Insul-Cont_81th.OUT
10/13/2006  07:04 AM             3,376 Insul-Cont_90max.OUT
10/13/2006  07:04 AM            11,808 Insul-Cont_90th.OUT
10/13/2006  07:04 AM             3,376 Insul-Cont_99max.OUT
10/13/2006  07:04 AM            11,808 Insul-Cont_99th.OUT
10/13/2006  07:04 AM             3,376 Insul-Cont_9max.OUT
10/13/2006  07:04 AM            11,936 Insul-Cont_9th.OUT
09/01/2005  10:27 AM             1,664 Insulate.txt
07/20/2006  06:36 AM             4,030 interface-gap1.txt
08/23/2006  07:55 AM             2,411 interface1.txt
10/13/2006  02:28 PM           101,888 J-Bolt-Contact_0-90.xls
10/13/2006  02:28 PM           101,888 J-Bolt-Contact_99-180.xls
10/13/2006  07:04 AM             3,790 J-Bolt-Cont_108max.OUT
10/13/2006  07:04 AM            12,276 J-Bolt-Cont_108th.OUT
10/13/2006  07:04 AM             3,790 J-Bolt-Cont_117max.OUT
10/13/2006  07:04 AM            12,276 J-Bolt-Cont_117th.OUT
10/13/2006  07:04 AM             3,790 J-Bolt-Cont_126max.OUT
10/13/2006  07:04 AM            12,276 J-Bolt-Cont_126th.OUT
10/13/2006  07:04 AM             3,790 J-Bolt-Cont_135max.OUT
10/13/2006  07:04 AM            12,276 J-Bolt-Cont_135th.OUT
10/13/2006  07:04 AM             3,790 J-Bolt-Cont_144max.OUT
10/13/2006  07:04 AM            12,276 J-Bolt-Cont_144th.OUT
10/13/2006  07:04 AM             3,790 J-Bolt-Cont_153max.OUT
10/13/2006  07:04 AM            12,276 J-Bolt-Cont_153th.OUT
10/13/2006  07:04 AM             3,790 J-Bolt-Cont_162max.OUT
10/13/2006  07:04 AM            12,276 J-Bolt-Cont_162th.OUT
10/13/2006  07:04 AM             3,790 J-Bolt-Cont_171max.OUT
10/13/2006  07:04 AM            12,276 J-Bolt-Cont_171th.OUT
10/13/2006  07:04 AM             3,790 J-Bolt-Cont_180max.OUT
10/13/2006  07:04 AM            12,276 J-Bolt-Cont_180th.OUT
10/13/2006  07:04 AM             3,790 J-Bolt-Cont_18max.OUT
10/13/2006  07:04 AM            12,276 J-Bolt-Cont_18th.OUT
10/13/2006  07:04 AM             3,790 J-Bolt-Cont_27max.OUT
10/13/2006  07:04 AM            12,276 J-Bolt-Cont_27th.OUT
10/13/2006  07:04 AM             3,790 J-Bolt-Cont_36max.OUT
10/13/2006  07:04 AM            12,276 J-Bolt-Cont_36th.OUT
10/13/2006  07:04 AM             3,790 J-Bolt-Cont_45max.OUT
10/13/2006  07:04 AM            12,276 J-Bolt-Cont_45th.OUT
10/13/2006  07:04 AM             3,790 J-Bolt-Cont_54max.OUT
10/13/2006  07:04 AM            12,276 J-Bolt-Cont_54th.OUT
10/13/2006  07:04 AM             3,790 J-Bolt-Cont_63max.OUT
10/13/2006  07:04 AM            12,276 J-Bolt-Cont_63th.OUT
10/13/2006  07:04 AM             3,790 J-Bolt-Cont_72max.OUT
10/13/2006  07:04 AM            12,276 J-Bolt-Cont_72th.OUT
```

```
10/13/2006  07:04 AM             3,790 J-Bolt-Cont_81max.OUT
10/13/2006  07:04 AM            12,276 J-Bolt-Cont_81th.OUT
10/13/2006  07:04 AM             3,790 J-Bolt-Cont_90max.OUT
10/13/2006  07:04 AM            12,276 J-Bolt-Cont_90th.OUT
10/13/2006  07:04 AM             3,790 J-Bolt-Cont_99max.OUT
10/13/2006  07:04 AM            12,276 J-Bolt-Cont_99th.OUT
10/13/2006  07:04 AM             3,790 J-Bolt-Cont_9max.OUT
10/13/2006  07:04 AM            12,404 J-Bolt-Cont_9th.OUT
08/23/2006  07:47 AM             1,971 Liner.txt
05/02/2005  02:19 PM               667 live_load.txt
07/21/2006  10:03 AM             6,214 Near-Soil-1.txt
04/20/2005  01:14 PM               508 outer-spar.txt
10/13/2006  07:46 AM               123 Post-Tank.txt
10/13/2006  02:43 PM            91,648 Primary-Contact_0-90.xls
10/13/2006  02:43 PM            91,648 Primary-Contact_99-180.xls
10/13/2006  07:04 AM             3,376 Primary-Cont_108max.OUT
10/13/2006  07:04 AM            11,808 Primary-Cont_108th.OUT
10/13/2006  07:04 AM             3,376 Primary-Cont_117max.OUT
10/13/2006  07:04 AM            11,808 Primary-Cont_117th.OUT
10/13/2006  07:04 AM             3,376 Primary-Cont_126max.OUT
10/13/2006  07:04 AM            11,808 Primary-Cont_126th.OUT
10/13/2006  07:04 AM             3,376 Primary-Cont_135max.OUT
10/13/2006  07:04 AM            11,808 Primary-Cont_135th.OUT
10/13/2006  07:04 AM             3,376 Primary-Cont_144max.OUT
10/13/2006  07:04 AM            11,808 Primary-Cont_144th.OUT
10/13/2006  07:04 AM             3,376 Primary-Cont_153max.OUT
10/13/2006  07:04 AM            11,808 Primary-Cont_153th.OUT
10/13/2006  07:04 AM             3,376 Primary-Cont_162max.OUT
10/13/2006  07:04 AM            11,808 Primary-Cont_162th.OUT
10/13/2006  07:04 AM             3,376 Primary-Cont_171max.OUT
10/13/2006  07:04 AM            11,808 Primary-Cont_171th.OUT
10/13/2006  07:04 AM             3,376 Primary-Cont_180max.OUT
10/13/2006  07:04 AM            11,808 Primary-Cont_180th.OUT
10/13/2006  07:04 AM             3,376 Primary-Cont_18max.OUT
10/13/2006  07:04 AM            11,808 Primary-Cont_18th.OUT
10/13/2006  07:04 AM             3,376 Primary-Cont_27max.OUT
10/13/2006  07:04 AM            11,808 Primary-Cont_27th.OUT
10/13/2006  07:04 AM             3,376 Primary-Cont_36max.OUT
10/13/2006  07:04 AM            11,808 Primary-Cont_36th.OUT
10/13/2006  07:04 AM             3,376 Primary-Cont_45max.OUT
10/13/2006  07:04 AM            11,808 Primary-Cont_45th.OUT
10/13/2006  07:04 AM             3,376 Primary-Cont_54max.OUT
10/13/2006  07:04 AM            11,808 Primary-Cont_54th.OUT
10/13/2006  07:04 AM             3,376 Primary-Cont_63max.OUT
10/13/2006  07:04 AM            11,808 Primary-Cont_63th.OUT
10/13/2006  07:04 AM             3,376 Primary-Cont_72max.OUT
10/13/2006  07:04 AM            11,808 Primary-Cont_72th.OUT
10/13/2006  07:04 AM             3,376 Primary-Cont_81max.OUT
10/13/2006  07:04 AM            11,808 Primary-Cont_81th.OUT
10/13/2006  07:04 AM             3,376 Primary-Cont_90max.OUT
10/13/2006  07:04 AM            11,808 Primary-Cont_90th.OUT
10/13/2006  07:04 AM             3,376 Primary-Cont_99max.OUT
10/13/2006  07:04 AM            11,808 Primary-Cont_99th.OUT
10/13/2006  07:04 AM             3,376 Primary-Cont_9max.OUT
10/13/2006  07:04 AM            11,936 Primary-Cont_9th.OUT
10/12/2006  02:28 PM             6,028 Primary-Props-AP.txt
09/27/2005  03:52 PM             1,538 Primary.txt
10/13/2006  06:44 AM           407,507 QA.out
10/31/2005  10:31 AM             1,108 RS_FREQ.txt
10/13/2006  07:06 AM         4,960,128 Run-Tank-Out.out
10/12/2006  03:03 PM             1,823 Run-Tank.txt
01/04/2007  07:52 AM                 0 scratch.hlp
02/11/2005  01:22 PM             1,053 Slave.txt
10/13/2006  07:05 AM             9,896 Soil-Contact_108max.OUT
10/13/2006  07:05 AM            35,120 Soil-Contact_108th.OUT
10/13/2006  07:05 AM             9,896 Soil-Contact_117max.OUT
10/13/2006  07:05 AM            35,120 Soil-Contact_117th.OUT
10/13/2006  07:05 AM             9,896 Soil-Contact_126max.OUT
10/13/2006  07:05 AM            35,120 Soil-Contact_126th.OUT
10/13/2006  07:05 AM             9,896 Soil-Contact_135max.OUT
```

```
10/13/2006  07:05 AM            35,120 Soil-Contact_135th.OUT
10/13/2006  07:05 AM             9,896 Soil-Contact_144max.OUT
10/13/2006  07:05 AM            35,120 Soil-Contact_144th.OUT
10/13/2006  07:05 AM             9,896 Soil-Contact_153max.OUT
10/13/2006  07:05 AM            35,120 Soil-Contact_153th.OUT
10/13/2006  07:05 AM             9,896 Soil-Contact_162max.OUT
10/13/2006  07:05 AM            35,120 Soil-Contact_162th.OUT
10/13/2006  07:05 AM             9,896 Soil-Contact_171max.OUT
10/13/2006  07:05 AM            35,120 Soil-Contact_171th.OUT
10/13/2006  07:05 AM             9,896 Soil-Contact_180max.OUT
10/13/2006  07:05 AM            35,120 Soil-Contact_180th.OUT
10/13/2006  07:04 AM             9,896 Soil-Contact_18max.OUT
10/13/2006  07:04 AM            35,120 Soil-Contact_18th.OUT
10/13/2006  07:04 AM             9,896 Soil-Contact_27max.OUT
10/13/2006  07:04 AM            35,120 Soil-Contact_27th.OUT
10/13/2006  07:04 AM             9,896 Soil-Contact_36max.OUT
10/13/2006  07:04 AM            35,120 Soil-Contact_36th.OUT
10/13/2006  07:04 AM             9,896 Soil-Contact_45max.OUT
10/13/2006  07:04 AM            35,120 Soil-Contact_45th.OUT
10/13/2006  07:04 AM             9,896 Soil-Contact_54max.OUT
10/13/2006  07:04 AM            35,120 Soil-Contact_54th.OUT
10/13/2006  07:04 AM             9,896 Soil-Contact_63max.OUT
10/13/2006  07:04 AM            35,120 Soil-Contact_63th.OUT
10/13/2006  07:04 AM             9,896 Soil-Contact_72max.OUT
10/13/2006  07:04 AM            35,120 Soil-Contact_72th.OUT
10/13/2006  07:04 AM             9,896 Soil-Contact_81max.OUT
10/13/2006  07:04 AM            35,120 Soil-Contact_81th.OUT
10/13/2006  07:04 AM             9,896 Soil-Contact_90max.OUT
10/13/2006  07:04 AM            35,120 Soil-Contact_90th.OUT
10/13/2006  07:05 AM             9,896 Soil-Contact_99max.OUT
10/13/2006  07:05 AM            35,120 Soil-Contact_99th.OUT
10/13/2006  07:04 AM             9,896 Soil-Contact_9max.OUT
10/13/2006  07:04 AM            35,248 Soil-Contact_9th.OUT
11/11/2005  10:36 AM             4,989 Soil-Prop-Mean-Geo.txt
10/13/2006  02:21 PM           224,256 soil_0-90.xls
10/13/2006  02:21 PM           224,256 soil_99-180.xls
09/01/2006  06:09 AM             1,929 Solve-Gravity-BES.txt
08/21/2006  08:00 AM             3,363 spectra-conc-0.txt
10/31/2005  11:41 AM             1,459 spectra-conc.txt
10/14/2005  11:18 AM             2,061 spectra-concrete.txt
10/31/2005  10:16 AM             3,402 spectra-primary-0.txt
08/21/2006  08:01 AM             3,551 spectra-primary-180.txt
09/06/2005  06:49 AM             1,287 spectra-soil.txt
06/20/2005  09:04 AM               647 spectra-wall.txt
06/20/2005  08:52 AM               679 spectra-waste.txt
10/13/2006  02:32 PM           288,256 str-comp_0-90b.xls
10/13/2006  02:32 PM           293,376 str-comp_0-90m.xls
10/13/2006  02:32 PM           288,256 str-comp_0-90t.xls
10/13/2006  02:32 PM           288,256 str-comp_99-180b.xls
10/13/2006  02:33 PM           293,888 str-comp_99-180m.xls
10/13/2006  02:33 PM           288,256 str-comp_99-180t.xls
01/03/2007  03:40 PM             1,823 strain-backed-principle-bot.txt
01/03/2007  03:40 PM             1,828 strain-backed-principle-mid.txt
01/03/2007  03:41 PM             1,825 strain-backed-principle-top.txt
01/03/2007  04:02 PM               966 strain-backed-principle.txt
01/04/2007  07:53 AM             7,496 Strain-Backed-Princ_108-bot-max.OUT
01/04/2007  07:53 AM            23,628 Strain-Backed-Princ_108-bot-th.OUT
01/04/2007  07:53 AM             7,162 Strain-Backed-Princ_108-Top-max.OUT
01/04/2007  07:53 AM            22,554 Strain-Backed-Princ_108-Top-th.OUT
01/04/2007  07:53 AM             4,156 Strain-Backed-Princ_108max.OUT
01/04/2007  07:53 AM            12,888 Strain-Backed-Princ_108th.OUT
01/04/2007  07:53 AM             7,496 Strain-Backed-Princ_117-bot-max.OUT
01/04/2007  07:53 AM            23,628 Strain-Backed-Princ_117-bot-th.OUT
01/04/2007  07:53 AM             7,162 Strain-Backed-Princ_117-Top-max.OUT
01/04/2007  07:53 AM            22,554 Strain-Backed-Princ_117-Top-th.OUT
01/04/2007  07:53 AM             4,156 Strain-Backed-Princ_117max.OUT
01/04/2007  07:53 AM            12,888 Strain-Backed-Princ_117th.OUT
01/04/2007  07:53 AM             7,496 Strain-Backed-Princ_126-bot-max.OUT
01/04/2007  07:53 AM            23,628 Strain-Backed-Princ_126-bot-th.OUT
01/04/2007  07:53 AM             7,162 Strain-Backed-Princ_126-Top-max.OUT
```

```
01/04/2007  07:53 AM            22,554 Strain-Backed-Princ_126-Top-th.OUT
01/04/2007  07:53 AM             4,156 Strain-Backed-Princ_126max.OUT
01/04/2007  07:53 AM            12,888 Strain-Backed-Princ_126th.OUT
01/04/2007  07:53 AM             7,496 Strain-Backed-Princ_135-bot-max.OUT
01/04/2007  07:53 AM            23,628 Strain-Backed-Princ_135-bot-th.OUT
01/04/2007  07:53 AM             7,162 Strain-Backed-Princ_135-Top-max.OUT
01/04/2007  07:53 AM            22,554 Strain-Backed-Princ_135-Top-th.OUT
01/04/2007  07:53 AM             4,156 Strain-Backed-Princ_135max.OUT
01/04/2007  07:53 AM            12,888 Strain-Backed-Princ_135th.OUT
01/04/2007  07:53 AM             7,496 Strain-Backed-Princ_144-bot-max.OUT
01/04/2007  07:53 AM            23,628 Strain-Backed-Princ_144-bot-th.OUT
01/04/2007  07:53 AM             7,162 Strain-Backed-Princ_144-Top-max.OUT
01/04/2007  07:53 AM            22,554 Strain-Backed-Princ_144-Top-th.OUT
01/04/2007  07:53 AM             4,156 Strain-Backed-Princ_144max.OUT
01/04/2007  07:53 AM            12,888 Strain-Backed-Princ_144th.OUT
01/04/2007  07:53 AM             7,496 Strain-Backed-Princ_153-bot-max.OUT
01/04/2007  07:53 AM            23,628 Strain-Backed-Princ_153-bot-th.OUT
01/04/2007  07:53 AM             7,162 Strain-Backed-Princ_153-Top-max.OUT
01/04/2007  07:53 AM            22,554 Strain-Backed-Princ_153-Top-th.OUT
01/04/2007  07:53 AM             4,156 Strain-Backed-Princ_153max.OUT
01/04/2007  07:53 AM            12,888 Strain-Backed-Princ_153th.OUT
01/04/2007  07:53 AM             7,496 Strain-Backed-Princ_162-bot-max.OUT
01/04/2007  07:53 AM            23,628 Strain-Backed-Princ_162-bot-th.OUT
01/04/2007  07:53 AM             7,162 Strain-Backed-Princ_162-Top-max.OUT
01/04/2007  07:53 AM            22,554 Strain-Backed-Princ_162-Top-th.OUT
01/04/2007  07:53 AM             4,156 Strain-Backed-Princ_162max.OUT
01/04/2007  07:53 AM            12,888 Strain-Backed-Princ_162th.OUT
01/04/2007  07:53 AM             7,496 Strain-Backed-Princ_171-bot-max.OUT
01/04/2007  07:53 AM            23,628 Strain-Backed-Princ_171-bot-th.OUT
01/04/2007  07:53 AM             7,162 Strain-Backed-Princ_171-Top-max.OUT
01/04/2007  07:53 AM            22,554 Strain-Backed-Princ_171-Top-th.OUT
01/04/2007  07:53 AM             4,156 Strain-Backed-Princ_171max.OUT
01/04/2007  07:53 AM            12,888 Strain-Backed-Princ_171th.OUT
01/04/2007  07:53 AM             7,496 Strain-Backed-Princ_18-bot-max.OUT
01/04/2007  07:53 AM            23,628 Strain-Backed-Princ_18-bot-th.OUT
01/04/2007  07:53 AM             7,162 Strain-Backed-Princ_18-Top-max.OUT
01/04/2007  07:53 AM            22,554 Strain-Backed-Princ_18-Top-th.OUT
01/04/2007  07:53 AM             7,496 Strain-Backed-Princ_180-bot-max.OUT
01/04/2007  07:53 AM            23,628 Strain-Backed-Princ_180-bot-th.OUT
01/04/2007  07:53 AM             7,162 Strain-Backed-Princ_180-Top-max.OUT
01/04/2007  07:53 AM            22,554 Strain-Backed-Princ_180-Top-th.OUT
01/04/2007  07:53 AM             4,156 Strain-Backed-Princ_180max.OUT
01/04/2007  07:53 AM            12,888 Strain-Backed-Princ_180th.OUT
01/04/2007  07:53 AM             4,156 Strain-Backed-Princ_18max.OUT
01/04/2007  07:53 AM            12,888 Strain-Backed-Princ_18th.OUT
01/04/2007  07:53 AM             7,496 Strain-Backed-Princ_27-bot-max.OUT
01/04/2007  07:53 AM            23,628 Strain-Backed-Princ_27-bot-th.OUT
01/04/2007  07:53 AM             7,162 Strain-Backed-Princ_27-Top-max.OUT
01/04/2007  07:53 AM            22,554 Strain-Backed-Princ_27-Top-th.OUT
01/04/2007  07:53 AM             4,156 Strain-Backed-Princ_27max.OUT
01/04/2007  07:53 AM            12,888 Strain-Backed-Princ_27th.OUT
01/04/2007  07:53 AM             7,496 Strain-Backed-Princ_36-bot-max.OUT
01/04/2007  07:53 AM            23,628 Strain-Backed-Princ_36-bot-th.OUT
01/04/2007  07:53 AM             7,162 Strain-Backed-Princ_36-Top-max.OUT
01/04/2007  07:53 AM            22,554 Strain-Backed-Princ_36-Top-th.OUT
01/04/2007  07:53 AM             4,156 Strain-Backed-Princ_36max.OUT
01/04/2007  07:53 AM            12,888 Strain-Backed-Princ_36th.OUT
01/04/2007  07:53 AM             7,496 Strain-Backed-Princ_45-bot-max.OUT
01/04/2007  07:53 AM            23,628 Strain-Backed-Princ_45-bot-th.OUT
01/04/2007  07:53 AM             7,162 Strain-Backed-Princ_45-Top-max.OUT
01/04/2007  07:53 AM            22,554 Strain-Backed-Princ_45-Top-th.OUT
01/04/2007  07:53 AM             4,156 Strain-Backed-Princ_45max.OUT
01/04/2007  07:53 AM            12,888 Strain-Backed-Princ_45th.OUT
01/04/2007  07:53 AM             7,496 Strain-Backed-Princ_54-bot-max.OUT
01/04/2007  07:53 AM            23,628 Strain-Backed-Princ_54-bot-th.OUT
01/04/2007  07:53 AM             7,162 Strain-Backed-Princ_54-Top-max.OUT
01/04/2007  07:53 AM            22,554 Strain-Backed-Princ_54-Top-th.OUT
01/04/2007  07:53 AM             4,156 Strain-Backed-Princ_54max.OUT
01/04/2007  07:53 AM            12,888 Strain-Backed-Princ_54th.OUT
01/04/2007  07:53 AM             7,496 Strain-Backed-Princ_63-bot-max.OUT
```

01/04/2007	07:53 AM	23,628	Strain-Backed-Princ_63-bot-th.OUT
01/04/2007	07:53 AM	7,162	Strain-Backed-Princ_63-Top-max.OUT
01/04/2007	07:53 AM	22,554	Strain-Backed-Princ_63-Top-th.OUT
01/04/2007	07:53 AM	4,156	Strain-Backed-Princ_63max.OUT
01/04/2007	07:53 AM	12,888	Strain-Backed-Princ_63th.OUT
01/04/2007	07:53 AM	7,496	Strain-Backed-Princ_72-bot-max.OUT
01/04/2007	07:53 AM	23,628	Strain-Backed-Princ_72-bot-th.OUT
01/04/2007	07:53 AM	7,162	Strain-Backed-Princ_72-Top-max.OUT
01/04/2007	07:53 AM	22,554	Strain-Backed-Princ_72-Top-th.OUT
01/04/2007	07:53 AM	4,156	Strain-Backed-Princ_72max.OUT
01/04/2007	07:53 AM	12,888	Strain-Backed-Princ_72th.OUT
01/04/2007	07:53 AM	7,496	Strain-Backed-Princ_81-bot-max.OUT
01/04/2007	07:53 AM	23,628	Strain-Backed-Princ_81-bot-th.OUT
01/04/2007	07:53 AM	7,162	Strain-Backed-Princ_81-Top-max.OUT
01/04/2007	07:53 AM	22,554	Strain-Backed-Princ_81-Top-th.OUT
01/04/2007	07:53 AM	4,156	Strain-Backed-Princ_81max.OUT
01/04/2007	07:53 AM	12,888	Strain-Backed-Princ_81th.OUT
01/04/2007	07:53 AM	7,496	Strain-Backed-Princ_9-bot-max.OUT
01/04/2007	07:53 AM	23,756	Strain-Backed-Princ_9-bot-th.OUT
01/04/2007	07:53 AM	7,162	Strain-Backed-Princ_9-Top-max.OUT
01/04/2007	07:53 AM	22,682	Strain-Backed-Princ_9-Top-th.OUT
01/04/2007	07:53 AM	7,496	Strain-Backed-Princ_90-bot-max.OUT
01/04/2007	07:53 AM	23,628	Strain-Backed-Princ_90-bot-th.OUT
01/04/2007	07:53 AM	7,162	Strain-Backed-Princ_90-Top-max.OUT
01/04/2007	07:53 AM	22,554	Strain-Backed-Princ_90-Top-th.OUT
01/04/2007	07:53 AM	4,156	Strain-Backed-Princ_90max.OUT
01/04/2007	07:53 AM	12,888	Strain-Backed-Princ_90th.OUT
01/04/2007	07:53 AM	7,496	Strain-Backed-Princ_99-bot-max.OUT
01/04/2007	07:53 AM	23,628	Strain-Backed-Princ_99-bot-th.OUT
01/04/2007	07:53 AM	7,162	Strain-Backed-Princ_99-Top-max.OUT
01/04/2007	07:53 AM	22,554	Strain-Backed-Princ_99-Top-th.OUT
01/04/2007	07:53 AM	4,156	Strain-Backed-Princ_99max.OUT
01/04/2007	07:53 AM	12,888	Strain-Backed-Princ_99th.OUT
01/04/2007	07:53 AM	4,156	Strain-Backed-Princ_9max.OUT
01/04/2007	07:53 AM	13,016	Strain-Backed-Princ_9th.OUT
09/05/2006	02:00 PM	2,588	strain-backed.txt
08/30/2006	09:47 AM	621	strain-compb-primary.txt
08/21/2006	08:01 AM	693	strain-compb.txt
08/30/2006	09:47 AM	621	strain-compm-primary.txt
08/21/2006	08:01 AM	705	strain-compm.txt
08/30/2006	09:47 AM	621	strain-compt-primary.txt
08/21/2006	08:02 AM	720	strain-compt.txt
08/21/2006	08:02 AM	730	Strain-Liner-floor.txt
08/21/2006	08:02 AM	962	Strain-Liner-wall.txt
08/16/2006	03:01 PM	545	Strain-Liner.txt
08/16/2006	02:01 PM	292	Strain-Primary.txt
01/04/2007	03:48 PM	113,152	Strain-Princ_0-90.xls
01/04/2007	03:48 PM	187,904	Strain-Princ_0-90b.xls
01/04/2007	03:49 PM	180,224	Strain-Princ_0-90t.xls
01/04/2007	03:49 PM	113,152	Strain-Princ_99-180.xls
01/04/2007	03:49 PM	188,416	Strain-Princ_99-180b.xls
01/04/2007	03:49 PM	180,736	Strain-Princ_99-180t.xls
08/30/2006	09:38 AM	274	Strain.txt
08/21/2006	08:02 AM	554	stress-compb-primary.txt
08/21/2006	08:02 AM	598	stress-compb.txt
08/21/2006	08:03 AM	554	stress-compm-primary.txt
08/21/2006	08:03 AM	608	stress-compm.txt
08/21/2006	08:03 AM	554	stress-compt-primary.txt
08/24/2006	03:19 PM	598	stress-compt.txt
08/17/2006	11:19 AM	207	Stress-Primary-M.txt
08/24/2006	12:05 PM	224	Stress-Primary.txt
10/13/2006	07:05 AM	13,519	Stress-pt_108max-b.OUT
10/13/2006	07:05 AM	13,519	Stress-pt_108max-m.OUT
10/13/2006	07:05 AM	13,519	Stress-pt_108max-t.OUT
10/13/2006	07:05 AM	55,924	Stress-pt_108th-b.OUT
10/13/2006	07:05 AM	55,924	Stress-pt_108th-m.OUT
10/13/2006	07:05 AM	55,728	Stress-pt_108th-t.OUT
10/13/2006	07:05 AM	13,519	Stress-pt_117max-b.OUT
10/13/2006	07:05 AM	13,519	Stress-pt_117max-m.OUT
10/13/2006	07:05 AM	13,519	Stress-pt_117max-t.OUT

```
10/13/2006  07:05 AM            55,924 Stress-pt_117th-b.OUT
10/13/2006  07:05 AM            55,924 Stress-pt_117th-m.OUT
10/13/2006  07:05 AM            55,728 Stress-pt_117th-t.OUT
10/13/2006  07:05 AM            13,519 Stress-pt_126max-b.OUT
10/13/2006  07:05 AM            13,519 Stress-pt_126max-m.OUT
10/13/2006  07:05 AM            13,519 Stress-pt_126max-t.OUT
10/13/2006  07:05 AM            55,924 Stress-pt_126th-b.OUT
10/13/2006  07:05 AM            55,924 Stress-pt_126th-m.OUT
10/13/2006  07:05 AM            55,728 Stress-pt_126th-t.OUT
10/13/2006  07:05 AM            13,519 Stress-pt_135max-b.OUT
10/13/2006  07:05 AM            13,519 Stress-pt_135max-m.OUT
10/13/2006  07:05 AM            13,519 Stress-pt_135max-t.OUT
10/13/2006  07:05 AM            55,924 Stress-pt_135th-b.OUT
10/13/2006  07:05 AM            55,924 Stress-pt_135th-m.OUT
10/13/2006  07:05 AM            55,728 Stress-pt_135th-t.OUT
10/13/2006  07:05 AM            13,519 Stress-pt_144max-b.OUT
10/13/2006  07:05 AM            13,519 Stress-pt_144max-m.OUT
10/13/2006  07:05 AM            13,519 Stress-pt_144max-t.OUT
10/13/2006  07:05 AM            55,924 Stress-pt_144th-b.OUT
10/13/2006  07:05 AM            55,924 Stress-pt_144th-m.OUT
10/13/2006  07:05 AM            55,728 Stress-pt_144th-t.OUT
10/13/2006  07:05 AM            13,519 Stress-pt_153max-b.OUT
10/13/2006  07:05 AM            13,519 Stress-pt_153max-m.OUT
10/13/2006  07:05 AM            13,519 Stress-pt_153max-t.OUT
10/13/2006  07:05 AM            55,924 Stress-pt_153th-b.OUT
10/13/2006  07:05 AM            55,924 Stress-pt_153th-m.OUT
10/13/2006  07:05 AM            55,728 Stress-pt_153th-t.OUT
10/13/2006  07:05 AM            13,519 Stress-pt_162max-b.OUT
10/13/2006  07:05 AM            13,519 Stress-pt_162max-m.OUT
10/13/2006  07:05 AM            13,519 Stress-pt_162max-t.OUT
10/13/2006  07:05 AM            55,924 Stress-pt_162th-b.OUT
10/13/2006  07:05 AM            55,924 Stress-pt_162th-m.OUT
10/13/2006  07:05 AM            55,728 Stress-pt_162th-t.OUT
10/13/2006  07:05 AM            13,521 Stress-pt_171max-b.OUT
10/13/2006  07:05 AM            13,521 Stress-pt_171max-m.OUT
10/13/2006  07:05 AM            13,521 Stress-pt_171max-t.OUT
10/13/2006  07:05 AM            55,924 Stress-pt_171th-b.OUT
10/13/2006  07:05 AM            55,924 Stress-pt_171th-m.OUT
10/13/2006  07:05 AM            55,728 Stress-pt_171th-t.OUT
10/13/2006  07:05 AM            13,521 Stress-pt_180max-b.OUT
10/13/2006  07:05 AM            13,521 Stress-pt_180max-m.OUT
10/13/2006  07:05 AM            13,521 Stress-pt_180max-t.OUT
10/13/2006  07:05 AM            55,924 Stress-pt_180th-b.OUT
10/13/2006  07:05 AM            55,924 Stress-pt_180th-m.OUT
10/13/2006  07:05 AM            55,728 Stress-pt_180th-t.OUT
10/13/2006  07:05 AM            13,519 Stress-pt_18max-b.OUT
10/13/2006  07:05 AM            13,519 Stress-pt_18max-m.OUT
10/13/2006  07:05 AM            13,519 Stress-pt_18max-t.OUT
10/13/2006  07:05 AM            55,924 Stress-pt_18th-b.OUT
10/13/2006  07:05 AM            55,924 Stress-pt_18th-m.OUT
10/13/2006  07:05 AM            55,728 Stress-pt_18th-t.OUT
10/13/2006  07:05 AM            13,519 Stress-pt_27max-b.OUT
10/13/2006  07:05 AM            13,519 Stress-pt_27max-m.OUT
10/13/2006  07:05 AM            13,519 Stress-pt_27max-t.OUT
10/13/2006  07:05 AM            55,924 Stress-pt_27th-b.OUT
10/13/2006  07:05 AM            55,924 Stress-pt_27th-m.OUT
10/13/2006  07:05 AM            55,728 Stress-pt_27th-t.OUT
10/13/2006  07:05 AM            13,519 Stress-pt_36max-b.OUT
10/13/2006  07:05 AM            13,519 Stress-pt_36max-m.OUT
10/13/2006  07:05 AM            13,519 Stress-pt_36max-t.OUT
10/13/2006  07:05 AM            55,924 Stress-pt_36th-b.OUT
10/13/2006  07:05 AM            55,924 Stress-pt_36th-m.OUT
10/13/2006  07:05 AM            55,728 Stress-pt_36th-t.OUT
10/13/2006  07:05 AM            13,519 Stress-pt_45max-b.OUT
10/13/2006  07:05 AM            13,519 Stress-pt_45max-m.OUT
10/13/2006  07:05 AM            13,519 Stress-pt_45max-t.OUT
10/13/2006  07:05 AM            55,924 Stress-pt_45th-b.OUT
10/13/2006  07:05 AM            55,924 Stress-pt_45th-m.OUT
10/13/2006  07:05 AM            55,728 Stress-pt_45th-t.OUT
10/13/2006  07:05 AM            13,519 Stress-pt_54max-b.OUT
```

```
10/13/2006  07:05 AM            13,519 Stress-pt_54max-m.OUT
10/13/2006  07:05 AM            13,519 Stress-pt_54max-t.OUT
10/13/2006  07:05 AM            55,924 Stress-pt_54th-b.OUT
10/13/2006  07:05 AM            55,924 Stress-pt_54th-m.OUT
10/13/2006  07:05 AM            55,728 Stress-pt_54th-t.OUT
10/13/2006  07:05 AM            13,519 Stress-pt_63max-b.OUT
10/13/2006  07:05 AM            13,519 Stress-pt_63max-m.OUT
10/13/2006  07:05 AM            13,519 Stress-pt_63max-t.OUT
10/13/2006  07:05 AM            55,924 Stress-pt_63th-b.OUT
10/13/2006  07:05 AM            55,924 Stress-pt_63th-m.OUT
10/13/2006  07:05 AM            55,728 Stress-pt_63th-t.OUT
10/13/2006  07:05 AM            13,519 Stress-pt_72max-b.OUT
10/13/2006  07:05 AM            13,519 Stress-pt_72max-m.OUT
10/13/2006  07:05 AM            13,519 Stress-pt_72max-t.OUT
10/13/2006  07:05 AM            55,924 Stress-pt_72th-b.OUT
10/13/2006  07:05 AM            55,924 Stress-pt_72th-m.OUT
10/13/2006  07:05 AM            55,728 Stress-pt_72th-t.OUT
10/13/2006  07:05 AM            13,519 Stress-pt_81max-b.OUT
10/13/2006  07:05 AM            13,519 Stress-pt_81max-m.OUT
10/13/2006  07:05 AM            13,519 Stress-pt_81max-t.OUT
10/13/2006  07:05 AM            55,924 Stress-pt_81th-b.OUT
10/13/2006  07:05 AM            55,924 Stress-pt_81th-m.OUT
10/13/2006  07:05 AM            55,728 Stress-pt_81th-t.OUT
10/13/2006  07:05 AM            13,519 Stress-pt_90max-b.OUT
10/13/2006  07:05 AM            13,519 Stress-pt_90max-m.OUT
10/13/2006  07:05 AM            13,519 Stress-pt_90max-t.OUT
10/13/2006  07:05 AM            55,924 Stress-pt_90th-b.OUT
10/13/2006  07:05 AM            55,924 Stress-pt_90th-m.OUT
10/13/2006  07:05 AM            55,728 Stress-pt_90th-t.OUT
10/13/2006  07:05 AM            13,519 Stress-pt_99max-b.OUT
10/13/2006  07:05 AM            13,519 Stress-pt_99max-m.OUT
10/13/2006  07:05 AM            13,519 Stress-pt_99max-t.OUT
10/13/2006  07:05 AM            55,924 Stress-pt_99th-b.OUT
10/13/2006  07:05 AM            55,924 Stress-pt_99th-m.OUT
10/13/2006  07:05 AM            55,728 Stress-pt_99th-t.OUT
10/13/2006  07:05 AM            13,519 Stress-pt_9max-b.OUT
10/13/2006  07:05 AM            13,519 Stress-pt_9max-m.OUT
10/13/2006  07:05 AM            13,519 Stress-pt_9max-t.OUT
10/13/2006  07:05 AM            56,052 Stress-pt_9th-b.OUT
10/13/2006  07:05 AM            56,052 Stress-pt_9th-m.OUT
10/13/2006  07:05 AM            55,856 Stress-pt_9th-t.OUT
10/12/2006  02:29 PM             4,009 Tank-Coordinates-AP.txt
05/25/2005  03:32 PM             2,512 Tank-Mesh1.txt
10/13/2006  06:43 AM               102 tank-out.out
08/25/2006  07:52 AM             5,450 Tank-Props-BEC-250.txt
12/05/2005  10:51 AM             5,495 Tank-Props-Crack.txt
10/13/2006  06:44 AM             4,692 Tank-th.out
08/09/2006  07:43 AM            23,166 TH-266-Mean-Geo-V.txt
08/09/2006  07:31 AM            23,166 TH-266-Mean-Geo.txt
10/13/2006  07:04 AM            10,180 Waste-Cont_108max.OUT
10/13/2006  07:04 AM            40,114 Waste-Cont_108th.OUT
10/13/2006  07:04 AM            10,180 Waste-Cont_117max.OUT
10/13/2006  07:04 AM            40,114 Waste-Cont_117th.OUT
10/13/2006  07:04 AM            10,180 Waste-Cont_126max.OUT
10/13/2006  07:04 AM            40,114 Waste-Cont_126th.OUT
10/13/2006  07:04 AM            10,180 Waste-Cont_135max.OUT
10/13/2006  07:04 AM            40,114 Waste-Cont_135th.OUT
10/13/2006  07:04 AM            10,180 Waste-Cont_144max.OUT
10/13/2006  07:04 AM            40,114 Waste-Cont_144th.OUT
10/13/2006  07:04 AM            10,180 Waste-Cont_153max.OUT
10/13/2006  07:04 AM            40,114 Waste-Cont_153th.OUT
10/13/2006  07:04 AM            10,180 Waste-Cont_162max.OUT
10/13/2006  07:04 AM            40,114 Waste-Cont_162th.OUT
10/13/2006  07:04 AM            10,180 Waste-Cont_171max.OUT
10/13/2006  07:04 AM            40,114 Waste-Cont_171th.OUT
10/13/2006  07:04 AM            10,180 Waste-Cont_180max.OUT
10/13/2006  07:04 AM            40,114 Waste-Cont_180th.OUT
10/13/2006  07:04 AM            10,180 Waste-Cont_18max.OUT
10/13/2006  07:04 AM            40,114 Waste-Cont_18th.OUT
10/13/2006  07:04 AM            10,180 Waste-Cont_27max.OUT
```

```
10/13/2006  07:04 AM            40,114 Waste-Cont_27th.OUT
10/13/2006  07:04 AM            10,180 Waste-Cont_36max.OUT
10/13/2006  07:04 AM            40,114 Waste-Cont_36th.OUT
10/13/2006  07:04 AM            10,180 Waste-Cont_45max.OUT
10/13/2006  07:04 AM            40,114 Waste-Cont_45th.OUT
10/13/2006  07:04 AM            10,180 Waste-Cont_54max.OUT
10/13/2006  07:04 AM            40,114 Waste-Cont_54th.OUT
10/13/2006  07:04 AM            10,180 Waste-Cont_63max.OUT
10/13/2006  07:04 AM            40,114 Waste-Cont_63th.OUT
10/13/2006  07:04 AM            10,180 Waste-Cont_72max.OUT
10/13/2006  07:04 AM            40,114 Waste-Cont_72th.OUT
10/13/2006  07:04 AM            10,180 Waste-Cont_81max.OUT
10/13/2006  07:04 AM            40,114 Waste-Cont_81th.OUT
10/13/2006  07:04 AM            10,180 Waste-Cont_90max.OUT
10/13/2006  07:04 AM            40,114 Waste-Cont_90th.OUT
10/13/2006  07:04 AM            10,180 Waste-Cont_99max.OUT
10/13/2006  07:04 AM            40,114 Waste-Cont_99th.OUT
10/13/2006  07:04 AM            10,180 Waste-Cont_9max.OUT
10/13/2006  07:04 AM            40,242 Waste-Cont_9th.OUT
08/21/2006  01:31 PM               339 Waste-Reaction.txt
10/12/2006  02:27 PM            10,266 Waste-solid-AP-S.txt
08/21/2006  08:03 AM               776 Waste-Surface-AP.txt
10/13/2006  07:05 AM               865 Waste-Surf_0max.OUT
10/13/2006  07:05 AM             6,519 Waste-Surf_0th.OUT
10/13/2006  07:05 AM               865 Waste-Surf_108max.OUT
10/13/2006  07:05 AM             6,391 Waste-Surf_108th.OUT
10/13/2006  07:05 AM               865 Waste-Surf_117max.OUT
10/13/2006  07:05 AM             6,391 Waste-Surf_117th.OUT
10/13/2006  07:05 AM               865 Waste-Surf_126max.OUT
10/13/2006  07:05 AM             6,391 Waste-Surf_126th.OUT
10/13/2006  07:05 AM               865 Waste-Surf_135max.OUT
10/13/2006  07:05 AM             6,391 Waste-Surf_135th.OUT
10/13/2006  07:05 AM               865 Waste-Surf_144max.OUT
10/13/2006  07:05 AM             6,391 Waste-Surf_144th.OUT
10/13/2006  07:05 AM               865 Waste-Surf_153max.OUT
10/13/2006  07:05 AM             6,391 Waste-Surf_153th.OUT
10/13/2006  07:05 AM               865 Waste-Surf_162max.OUT
10/13/2006  07:05 AM             6,391 Waste-Surf_162th.OUT
10/13/2006  07:05 AM               865 Waste-Surf_171max.OUT
10/13/2006  07:05 AM             6,391 Waste-Surf_171th.OUT
10/13/2006  07:05 AM               865 Waste-Surf_180max.OUT
10/13/2006  07:05 AM             6,391 Waste-Surf_180th.OUT
10/13/2006  07:05 AM               865 Waste-Surf_189max.OUT
10/13/2006  07:05 AM             6,391 Waste-Surf_189th.OUT
10/13/2006  07:05 AM               865 Waste-Surf_18max.OUT
10/13/2006  07:05 AM             6,391 Waste-Surf_18th.OUT
10/13/2006  07:05 AM               865 Waste-Surf_27max.OUT
10/13/2006  07:05 AM             6,391 Waste-Surf_27th.OUT
10/13/2006  07:05 AM               865 Waste-Surf_36max.OUT
10/13/2006  07:05 AM             6,391 Waste-Surf_36th.OUT
10/13/2006  07:05 AM               865 Waste-Surf_45max.OUT
10/13/2006  07:05 AM             6,391 Waste-Surf_45th.OUT
10/13/2006  07:05 AM               865 Waste-Surf_54max.OUT
10/13/2006  07:05 AM             6,391 Waste-Surf_54th.OUT
10/13/2006  07:05 AM               865 Waste-Surf_63max.OUT
10/13/2006  07:05 AM             6,391 Waste-Surf_63th.OUT
10/13/2006  07:05 AM               865 Waste-Surf_72max.OUT
10/13/2006  07:05 AM             6,391 Waste-Surf_72th.OUT
10/13/2006  07:05 AM               865 Waste-Surf_81max.OUT
10/13/2006  07:05 AM             6,391 Waste-Surf_81th.OUT
10/13/2006  07:05 AM               865 Waste-Surf_90max.OUT
10/13/2006  07:05 AM             6,391 Waste-Surf_90th.OUT
10/13/2006  07:05 AM               865 Waste-Surf_99max.OUT
10/13/2006  07:05 AM             6,391 Waste-Surf_99th.OUT
10/13/2006  07:05 AM               865 Waste-Surf_9max.OUT
10/13/2006  07:05 AM             6,391 Waste-Surf_9th.OUT
10/13/2006  02:49 PM           229,888 waste_0-90.xls
10/13/2006  02:50 PM           229,888 waste_99-180.xls
             718 File(s)    761,358,420 bytes
               2 Dir(s)  248,220,327,936 bytes free
```