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CH2M HILL DOCUMENT RELEASE FORM

(1) Document Number:	RPP-RPT-28966	(2) Revision Number: 0	(3) Effective Date: Issue Date
(4) Document Type:	☐ Digital Image ☐ Hard copy ☒ PDF ☐ Video	(a) Number of pages (including the DRF) or number of digital images 726	
(5) Release Type	☒ New ☐ Cancel	☐ Page Change	☐ Complete Revision
(6) Document Title:	Hanford Double-Shell Tank Thermal and Seismic Project - Seismic Analysis of Hanford Double-Shell Tanks		
(7) Change/Release Description:	The "Double-Shell Tank (DST) Integrity Project – DST Thermal and Seismic Analysis" is in support of Tri-Party Agreement Milestone M-48-14.		
(8) Change Justification:	N/A		

(9) Associated Structure, System, and Component (SSC) and Building Number:		
	(a) Structure Location: 200E/200W	(c) Building Number: 241-AP, AN, AY, AZ, AW, and SY
	(b) System Designator: WST	(d) Equipment ID Number (EIN): All DST tanks

(10) Impacted Documents:	(a) Document Type	(b) Document Number	(c) Document Revision
	N/A	N/A	N/A

(11) Approvals:

(a) Author (Print/Sign): TC Mackey T.C. Mackey	Date: 3/15/06
(b) Responsible Manager (Print/Sign): C. Defigh-Price C Defigh-Price	Date: 3/15/06
(c) Reviewer (Optional, Print/Sign):	Date:
(d) Reviewer (Optional, Print/Sign):	Date:

(12) Distribution:

(a) Name	(b) MSIN	(a) Name	(b) MSIN
HS Berman			
KD Boomer			
C Defigh-Price			
GP Duncan			
JH Huber			
TC Mackey			
DJ Washenfelder			

Release Stamp

DATE: MAR 17 2006
STA: 4
HANFORD RELEASE
ID: 2

(13) Clearance	(a) Cleared for Public Release	(b) Restricted Information?	(c) Restriction Type:
	☒ Yes ☐ No	☐ Yes ☒ No	

(14) Clearance Review (Print/Sign): GE Bratton G.E. Bratton Date: 3/17/06

A-6003-881 (05/05)

Hanford Double-Shell Tank Thermal and Seismic Project - Seismic Analysis of Hanford Double-Shell Tanks

TC Mackey
CH2M Hill, Hanford Group Inc.

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

EDT/ECN: DRF
UC:
Cost Center:
Charge Code:
B&R Code:
Total Pages: 726

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 Analysis" is in support of Tri-Party Agreement Milestone M-48-14.

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RPP-RPT-28966, Rev. 0

PNNL-15720
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Hanford Thermal and Seismic Project—Seismic Analysis of Hanford Double-Shell Tanks

M. W. Rinker
B. G. Carpenter
C. Hendrix
F. G. Abatt

March 2006

Prepared for the U.S. Department of Energy
under Contract DE-AC05-76RL01830

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Richland, Washington.

M&D Professional Services		**Page** ii
		Document No. M&D-2008-004-RPT-01
		Revision No. 0
		Total Pages 739

PROJECT NAME:	PROJECT NUMBER:	CLIENT:
DST Seismic Analysis	2008-004	PNNL

TITLE:

ANSYS® Seismic Analysis of Hanford Double Shell Tank

PROBLEM STATEMENT:

Perform a Soil-Structure Interaction (SSI) Analysis of the Hanford Double Shell Tanks

ANALYTICAL SOFTWARE USED:	PROGRAM/PACKAGE	VERSION	UNVERIFIED ASSUMPTIONS
Yes __X__ No ____	ANSYS®	8.1	Yes __ No _X_

REV.	AFFECTED PAGES	REVISION DESCRIPTION	PREPARER(S)/ DATE	CHECKER(S)/ DATE	APPROVER/ DATE
0	All	Original Issue	Bruce Carpenter 3/13/06 Chad Hendrix 3/10/06	Chad Hendrix 3/13/06 Bruce Carpenter 3/13/06	F.G. Abatt 3/13/06

Executive Summary

M&D Professional Services, Inc. (M&D) is under subcontract to Pacific Northwest National Laboratory (PNNL) to perform seismic analysis of the Hanford Site double-shell tanks (DSTs) in support of a project entitled *Double-Shell Tank (DST) Integrity Project - DST Thermal and Seismic Analyses.* The overall scope of the project is to complete an up-to-date comprehensive analysis of record of the DST system at Hanford in support of Tri-Party Agreement Milestone M-48-14. The work described herein was performed in support of the seismic analysis of the DSTs. The thermal and operating loads analysis of the DSTs is documented in Rinker et al. (2004).

The work statement provided to M&D (PNNL 2003) required that a nonlinear soil-structure interaction (SSI) analysis be performed on the DSTs. The analysis is required to include the effects of sliding interfaces and fluid sloshing (fluid-structure interaction). SSI analysis has traditionally been treated by frequency domain computer codes such as SHAKE (Schnabel et al. 1972) and SASSI (Lysmer et al. 1999a). Such frequency domain programs are limited to the analysis of linear systems. Because of the contact surfaces, the response of the DSTs to a seismic event is inherently nonlinear and consequently outside the range of applicability of the linear frequency domain programs. That is, the nonlinear response of the DSTs to seismic excitation *requires* the use of a time domain code.

The capabilities and limitations of the commercial time domain codes ANSYS®[(a)] and MSC Dytran®[(b)] for performing seismic SSI analysis of the DSTs and the methodology required to perform the detailed seismic analysis of the DSTs have been addressed in Abatt et al. (2006). On the basis of the results reported in Abatt et al. (2006), it is concluded that time domain SSI analysis using ANSYS® is justified for predicting the global response of the DSTs.

The capabilities and limitations of Dytran® and ANSYS® for performing seismically induced Fluid Structure Interaction (FSI) analysis between the contained waste and the DST primary tank are documented separately in Abatt (2006) and Carpenter and Abatt (2006), respectively. The results of those two studies show that both codes have the capability to analyze the fluid-structure interaction behavior of the primary tank and contained waste. As expected, Dytran® appears to have more robust capabilities for FSI analysis. The ANSYS® model used in that study captures much of the FSI behavior, but does have some limitations for predicting the convective response of the waste. While Dytran® appears to have stronger capabilities for the analysis of the FSI behavior in the primary tank; it is more practical for the overall analysis to use ANSYS®. Thus, Dytran® served the purpose of helping to identify limitations in the ANSYS® FSI analysis, so that those limitations can be addressed in the structural evaluation of the primary tank.

The limitations of ANSYS® for predicting the details of the convective (sloshing) response of the waste are not expected to be critical due to the large structural margins that exist in the upper portion of the primary tank. However, the analysis of the lower knuckle of the primary tank will be supplemented by a more refined ANSYS® sub-model to aid in the structural evaluation.

(a) ANSYS® is a registered trademark of ANSYS, Inc.
(b) Dytran® is a registered trademark of MSC.Software Corporation.

This calculation provides the results of the final SSI analysis of the DST using the methodologies developed in Abatt et al. (2006), Carpenter and Abatt (2006), and Abatt (2006) for four separate load cases. Four load cases were analyzed to address uncertainties associated with soil properties and concrete conditions and include: lower bound soil, best estimate soil properties and upper bound soil with a best estimate of the concrete conditions based on a maximum temperature of 250°F, and best estimate soil properties with the concrete fully cracked.

Results from the four load cases have been summarized for gravity load, gravity plus horizontal and vertical seismic excitation, and seismic excitation only. Where forces and moments, stresses, or strains are presented, these results will be combined with non-seismic demands from the thermal and operating loads analysis (Rinker et al. 2004) to determine the structural integrity of the DSTs.

Evaluation of the results for sliding interfaces has shown that for the seismic excitation levels considered, no significant sliding occurs. The interface between the concrete wall and footing showed no sliding for any load case and a maximum elastic displacement of less than 1/1000th of an inch. Localized displacements of up to 0.033 inches occurred between the primary tank and insulating concrete, and up to 0.011 inches between the insulating concrete and the secondary liner. Neither of these displacements is considered to be significant, and sliding interfaces don't need to be carried forward into future analyses unless higher seismic excitation is required or additional information is available in the interface conditions.

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 the technical staff at M&D, including George Abatt, Bruce Carpenter and Chad Hendrix.

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Acronyms and Abbreviations

ACI	American Concrete Institute
ASCE	American Society of Civil Engineers
B	Bulk Modulus
BEC	Best Estimate Concrete
BES	Best Estimate Soil
BNL	Brookhaven National Laboratory
DSA	Documented Safety Analysis
DST	Double-Shell Tank
E	Young's Modulus
FCC	Fully Cracked Concrete
FSI	Fluid Structure Interaction
G	Shear Modulus
g	Acceleration of Gravity
Hz	Hertz (Cycles per second)
LBS	Lower Bound Soil
MCE	Mean Considered Earthquake
M&D	M&D Professional Services, Inc
PC	Performance Category
PGA	Peak Ground Acceleration
PNNL	Pacific Northwest National Laboratory
PSHA	Probabilistic Seismic Hazard Assessment
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
UCC	Uncracked Concrete
USGS	United States Geological Survey
WTP	Waste Treatment Plant
ϕ	Soil Internal Angle of Friction
ρ	Mass Density
ν	Poisson's Ratio
σ	Stress

1.0 Introduction

M&D Professional Services, Inc. (M&D) is under subcontract to Pacific Northwest National Laboratory (PNNL) to perform seismic analysis of the Hanford Site double-shell tanks (DSTs) in support of a project entitled *Double-Shell Tank (DST) Integrity Project - DST Thermal and Seismic Analyses.* The overall scope of the project is to complete an up-to-date comprehensive analysis of record of the DST system at Hanford in support of Tri-Party Agreement Milestone M-48-14. The work described herein was performed in support of the seismic analysis of the DSTs. The thermal and operating loads analysis of the DSTs is documented in Rinker et al. (2004).

The work statement provided to M&D (PNNL 2003) required that the seismic analysis of the DSTs assess the impacts of potentially non-conservative assumptions in previous analyses and account for the additional soil mass due to the as-found soil density increase, the effects of material degradation, additional thermal profiles applied to the full structure including the soil-structure response with the footings, the non-rigid (low frequency) response of the tank roof, the asymmetric seismic-induced soil loading, the structural discontinuity between the concrete tank wall and the support footing and the sloshing of the tank waste.

The seismic analysis considers the interaction of the tank with the surrounding soil and the effects of the primary tank contents. The DSTs and the surrounding soil are modeled as a system of finite elements. The depth and width of the soil incorporated into the analysis model are sufficient to obtain appropriately accurate analytical results. The analyses required to support the work statement differ from previous analysis of the DSTs in that the soil-structure interaction (SSI) model includes several (nonlinear) contact surfaces in the tank structure, and the contained waste must be modeled explicitly in order to capture the fluid-structure interaction behavior between the primary tank and contained waste.

This calculation documents the final stage of the SSI analysis, which adopts the methodologies developed in earlier reports (Abatt et al. [2006], Carpenter and Abatt, [2006], and Abatt [2006]). Four individual load cases were considered in the analysis:

- 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

Also included is a discussion of studies performed to determine certain model parameters to provide the best possible results. These studies address the modeling of the soil near the tank and the interface conditions between the soil and concrete. Gravity, or dead load only, was used for these studies, which are grouped as "Dead Load Study" and "Soil Arching Study."

1.1 Discussion

This analysis uses the baseline liquid level of 422 inches with a specific gravity of 1.7. DST geometry and material properties are based on the configuration of the AY Tank Farm.

Two areas of uncertainty are addressed with the four load cases identified above. These include the uncertainty in the soil properties and the uncertainty in the condition of the concrete tank. How these are addressed is described briefly below.

Soil conditions vary across the various tank farms and need to be accounted for in this SSI analysis. An acceptable method to account for uncertainties in SSI analysis is to vary the low strain soil shear modulus (ASCE 1998). According to ASCE 1998, the low strain shear modulus shall be varied between the best estimate value times $(1+C_v)$ and the best estimate value divided by $(1+C_v)$, where C_v is a factor that accounts for uncertainties in the SSI analysis and soil properties. Because the site response analyses and site specific spectra were developed separately for the AP site, the remaining 200 East sites, and the 200 West site, the site conditions are sufficiently characterized to support a C_v value of 0.5 (Geomatrix [2005]).

The other area of uncertainty addressed in this calculation is the concrete properties and condition in the DSTs. PNNL performed the thermal and operating loads analysis (TOLA) of the DSTs that is documented in Rinker et al. (2004). One result from that analysis is the expected condition of the concrete tank. For the seismic analysis, two potential conditions have been addressed; best estimate concrete and fully cracked concrete.

Best Estimate Concrete uses shell properties to reflect the cracked or uncracked condition of the concrete, along with degradation due to thermal transients. For the seismic analysis, the results from the 250°F case are used. Fully Cracked Concrete uses shell properties based on an assumption that all concrete section have cracked at some point. Fully cracked conditions will result in the "softest" concrete tank.

The purpose of the dead load study was to verify the functionality and determine best analysis methodology for the ANSYS® model. In order to verify the functionality of the detailed ANSYS® model, the dead weight results were compared to the ANSYS® Phase I model (Abatt et al. [2006]) and the model as described in TOLA report (Rinker et al. 2004) from this point referred to as the TOLA model. A simpler ANSYS® model was developed and used in Abatt et al. (2006) to study using ANSYS® for SSI analysis; this simpler model is referred to at the ANSYS® Phase I model. The dead weight results from a variety of analysis methodologies were also compared to the ANSYS® Phase I and TOLA model to confirm the best analytical approach, including reduction in soil arching. The analytical approach chosen will then be used to determine the seismic only results from the ANSYS® detailed transient analyses. The seismic only results were obtained by subtracting the gravity only case from the transient (seismic plus gravity) results.

The dead load study concluded that a combination of friction coefficients resulted in the best match in results between the detailed ANSYS® model and the TOLA model. A friction coefficient of 0.05 over the dome and 0.30 along the walls provided the best result. However, it was also noted that additional effort was required to address potential soil arching over the tank dome and the tension remaining in the soil.

When linear elastic material properties are used to model soils, there is potential for developing artificial tensile zones. As related to the tank and soil model, there is a potential for soil arching behavior over the dome of the tank. Arching in the model can occur in the soil because the model soil elements can carry tension and therefore, support itself over the tank dome, relieving the vertical dome load which does not

actually occur. Excessive arching behavior will result in underestimating the loads on the concrete dome and tank walls. Therefore, a study of arching behavior was performed to minimize the effect on the seismic analysis.

The potential for soil arching over the dome was studied to determine an acceptable method for modeling the soil to prevent arching from occurring. Because the soil is modeled as a linear-elastic material, some features of soil cannot be included such as inability to carry tension loads. If excessive arching occurs over the dome, the vertical loading on the dome may be underestimated.

Creating two "softened" zones in the soil above the DST dome virtually eliminates any soil arching. A cubic region directly over the center of the dome combined with a ring above the haunch results in soil contact pressures and concrete forces that show a good match to the TOLA model and to a theoretical solution based on Coulomb lateral soil pressures. The arching study also provided a basis for using a friction coefficient of 0.6 between the soil and the concrete for the transient analysis.

Detailed results were obtained from the full model and include the following:

- Concrete Forces and Moments
- J-Bolt Forces
- Primary Tank Stresses
- Strains for Concrete Backed Steel
- Waste Behavior
- Contact Data for Interface Surfaces

The transient analysis consists of 2,048 time steps plus an initial static step. For each result items extracted, the full time history and a listing of the minimum and maximum values are extracted. To summarize the results, each item is enveloped around the circumference of the model. Depending on the item, the sign of the result may or may not have been maintained. All data presented in this calculation have been summarized and presented against a 'path' representing the location on the DST. The electronic files from which the results were summarized can be used to determine the specific location and time step at which the result occurred.

Forces and moments are generally highest in the concrete tank for the lower bound soil load case. Due 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 tank is much less stiff and therefore, the load path is retained in the soil.

The highest stresses occur in the primary tank for the Upper Bound Soil load case just above the transition from ¾ inch to ½ inch plate, and are general primary membrane stresses. This transition is located approximately one-third up from the bottom. However, there is little variation in the peak stresses in the primary tank for the upper bound, best estimate, and fully cracked load cases. Primary tank stresses are controlled mainly by the soil response at the bottom of the DST. The soil seismic response at 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 to the behavior. The first is the contact interface between the soil and the concrete tank, which controls how the forces and displacements of the surrounding soil are transferred to the concrete tank. The second is the interface between the primary tank and the inside face of the concrete dome, where the presence and behavior 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 contact and transmit the load between these surfaces. Where separation occurs, the forces are transmitted through the J-Bolt connections only.

Other contact surfaces modeled include the interfaces between the concrete wall and the footing, between the primary tank and the insulating concrete, and between the insulating concrete and the secondary liner. Of specific interest was the potential for the concrete wall sliding relative to the footing.

Steel plates were incorporated into the DST design between the bottom of the wall and the footing to minimize loads due to thermal expansion. The results of the analysis show that this interface does not slip or show significant displacement due to seismic loading. The reason is twofold; the axial load in the wall carries a significant soil load down to the footing, and the lateral load from the soil is not transmitted to the wall perpendicular to direction of excitation, but through friction as the walls become parallel to the direction of excitation.

Neither the interface between the primary tank and insulating concrete nor the interface between the insulating concrete and the secondary liner, show significant displacements. The maximum sliding distance between the primary tank and the insulating concrete is 0.035 inches, of which 0.033 is due to seismic loading. This displacement is insignificant. The maximum displacements occur near the edge of the tank and are centered over a region perpendicular to the direction of excitation. The majority of the tank base moves significantly less. The interface between the insulating concrete and the secondary liner showed even smaller displacements, with a maximum of 0.011 inches. Again, this displacement is insignificant. In future models, these interfaces do not need to be included unless more detailed information is available that would influence local behavior.

It is noted that the displacements of the contacts between the primary tank and insulating concrete and the insulating concrete and the secondary liner are dependent on the level of seismic excitation and the coefficient of friction used. The coefficient of friction used for both these interfaces was 0.4 and was based on Rinker et al. (2004). No additional studies were performed as part of this analysis.

1.2 Conclusions

1.2.1 Force and Stress Results

Results have been obtained from the detailed SSI analysis for four different load cases and have been summarized in this calculation. Results have been included for dead load only, seismic loading only, and combined dead load and two-direction seismic motion. The results are presented graphically in the body of the calculation and numerically in the attachments. These results will be combined with non-seismic demands from the thermal and operating loads analysis (Rinker et al. 2004) to determine the structural integrity of the DSTs.

Specific results included are as follows:

- Concrete Forces and Moments
- J-Bolt Forces
- Primary Tank Stresses (component stresses for shell top, middle, and bottom)
- Concrete Backed Steel Strains (component and principal strains)

1.2.2 Sliding

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

- Concrete Wall/Footing 0.00093 inch
- Primary Tank/Insulating Concrete 0.033 inch
- Insulating Concrete/Secondary Liner 0.011 inch

Including contact surfaces between the soil and the concrete tank and the concrete tank dome and the top of the primary tank are critical features for the performance of the model. Allowing for sliding between the soil and the concrete tank results in the best estimate of the initial conditions. Contact surfaces between the primary tank and inside face of the concrete dome effective capture the behavior by realistically capturing the load path for compressive or tensile loads (i.e., face-to-face contact in compression and tension on the J-Bolts only if separation occurs).

1.2.3 General Seismic Behavior

Based on the comparison of free-field motion and the motions at the edge of the model, the model is both capable of reproducing appropriate motions for the defined seismic event and the model is sufficiently large that the boundary conditions do not adversely affect the interaction between the soil and the DSTs.

The dynamic response of the waste/tank system can be predicted by the response at the bottom of the DSTs. For certain conditions (lower bound soil), the response at the bottom of the tank can exceed the surface free field response for some frequencies. These frequencies can correspond to natural frequency of waste/tank systems. Therefore, under certain conditions, it would be unconservative to use the surface spectra to predict the response of the primary tank and contained waste.

2.0 Methodology

2.1 Model Development

Significant effort has gone into the development of the model used in this analysis. A detailed description of the model is provided in Section 3.0. Where other studies have been performed supporting the development of this model, these will be referenced as appropriate.

Three related studies were conducted in support of the development of this model.

- Methodology Report (Abatt et al. 2006) – The methodology report documents the investigation performed to establish the methodology to perform the required SSI analysis of the DSTs in the time domain. Specifically, the report documents the capabilities and limitations of the commercial time domain codes ANSYS® and Dytran® for performing seismic analysis of the DSTs and establishes much of the methodology required to perform the detailed seismic analysis of the DSTs. The justification for using a time domain code for SSI analysis proceeded in a step-by-step process in which the time domain solutions were benchmarked or calibrated against frequency domain solutions beginning with simpler site response problems and progressing to more complex SSI problems. The methodology report documents the conclusion that time domain SSI analysis using ANSYS® is justified for predicting the global response of the DSTs.

- ANSYS® Benchmarking (Carpenter and Abatt 2006) – The ANSYS® benchmarking study documents the capabilities and limitations of ANSYS® for performing a fluid-structure interaction analysis of the primary tank and contained waste. To this end, the ANSYS® solutions were benchmarked against theoretical solutions appearing in BNL (1995), when such theoretical solutions exist. When theoretical solutions were not available, comparisons were made to theoretical solutions of similar problems and the results from Dytran® simulations (Abatt [2006]. The results of the study demonstrated that the ANSYS® model has the capability to adequately predict global responses such as frequencies and overall reaction forces. It was also documented that while the ANSYS® model is capable of adequately predicting waste pressures and primary tank stresses in a large portion of the waste tank, the model does not completely capture the convective behavior of the waste near the free surface, and it did not give accurate predictions of slosh heights.

- Dytran® Benchmarking (Abatt [2006]) - The benchmarking study documented in Carpenter and Abatt (2006) showed that the ANSYS® model used in that study captured much of the fluid-structure interaction (FSI) behavior, but did have limitations for predicting the convective response of the waste. Dytran® was developed specifically as a fluid-structure interaction code and was used to identify and quantify possible shortcomings of the ANSYS® model for the evaluation of the FSI behavior. Once the limitations of the ANSYS® model were identified, they were addressed in the structural evaluation of the primary tank.

2.2 Seismic Input

The seismic analysis of the DSTs requires appropriate acceleration time-history records representing the required seismic excitation. Time history records must be available for both the horizontal and vertical directions. Typically, the required seismic input is specified in terms of design spectra. If time-histories

are required, such time histories are often synthesized numerically subject to certain requirements related to the proper representation of the design spectra (ASCE 1998, NUREG-0800). Generation of acceptable time-histories is not a trivial task. If time-histories exist that are appropriate for or can be modified appropriately to apply to the analysis of the DSTs, significant budget and schedule savings can be realized for the project. Accordingly, the time-history records used in this analysis of the DSTs were existing time-histories that were used on the Hanford Waste Treatment Project (WTP). The justification for the use of existing time-histories is presented below.

The Hanford Tank Farms Documented Safety Analysis, or DSA (RPP-13033), designates the DSTs as Performance Category 2 (PC-2) structures. DOE-STD-1020-2002, Section 2, states that the ground motions for PC-2 shall be developed following IBC 2000, in which the surface response spectra are specified to be 2/3 of the Maximum Considered Earthquake (MCE) ground motions. The MCE ground motions are defined as the ground motions with a mean annual frequency of exceedance of 4×10^{-4} (2% probability of exceedance in 50 years). The MCE motions may be defined based on either the USGS National Hazard Mapping results, adjusted for the appropriate site classification, or from a site-specific Probabilistic Seismic Hazard Analysis (PSHA). If the MCE response spectrum is to be defined from a site-specific PSHA, it cannot be less that 80% of the spectrum defined from the USGS National Hazard Mapping results. The PC-2 ground motions used in the DST analysis are based on a site-specific PSHA. The detailed development of the PC-2 spectra for the DST Farms is documented in Geomatrix (2005).

Acceleration time-histories for two horizontal components and one vertical component of seismic motion were synthesized for the seismic design and evaluation of the Hanford Site WTP (BNFL 2000). The horizontal design spectrum for the WTP is anchored at 0.257*g* (peak ground acceleration (PGA), and the vertical design spectrum is anchored at 0.175*g* PGA The time-histories generated to match the WTP design spectra were previously used by M&D in the preliminary soil-structure interaction analysis of the WTP high-level waste and pretreatment facilities, and were readily available (M&D 2001a and 2001b).

The Hanford Double-Shell Tank Farms horizontal design spectrum for 5% spectral damping is shown in Figure 2.1. Also shown in Figure 2.1 are the horizontal control motion spectra for the WTP project. All reference or control motions are defined at the soil surface. Similar plots for the vertical direction are shown in Figure 2.2.

The relationships between the design spectra and the control motion response spectra show that it is acceptable to use the acceleration time-histories from the WTP for the analysis of the DSTs.

Acceleration and displacement time histories for horizontal and vertical input are shown in Figures 2.3 and 2.4, respectively.

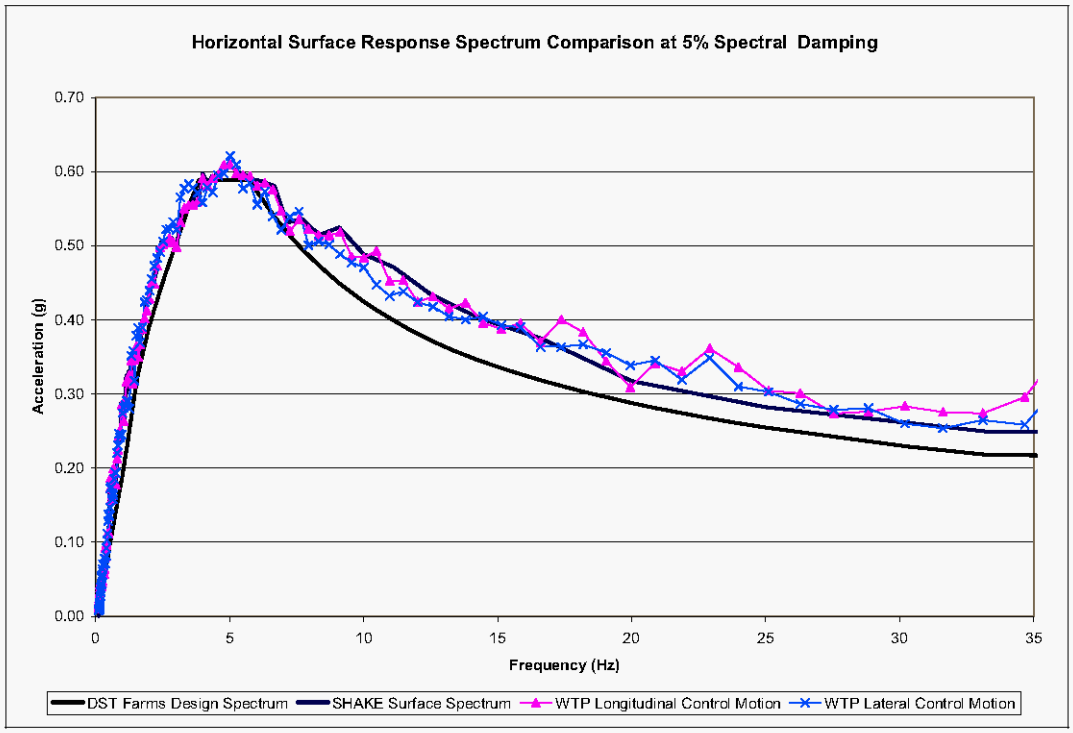


Figure 2.1. Comparison of Horizontal Surface Spectra at 5% Spectral Damping

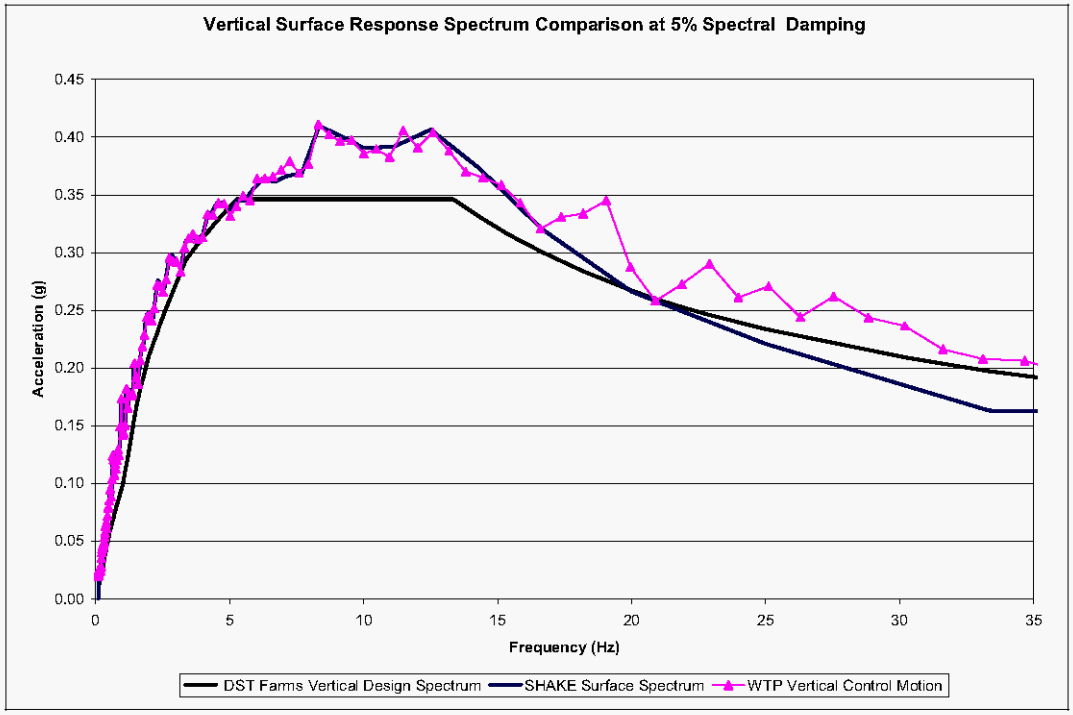


Figure 2.2. Comparison of Vertical Surface Spectra at 5% Spectral Damping

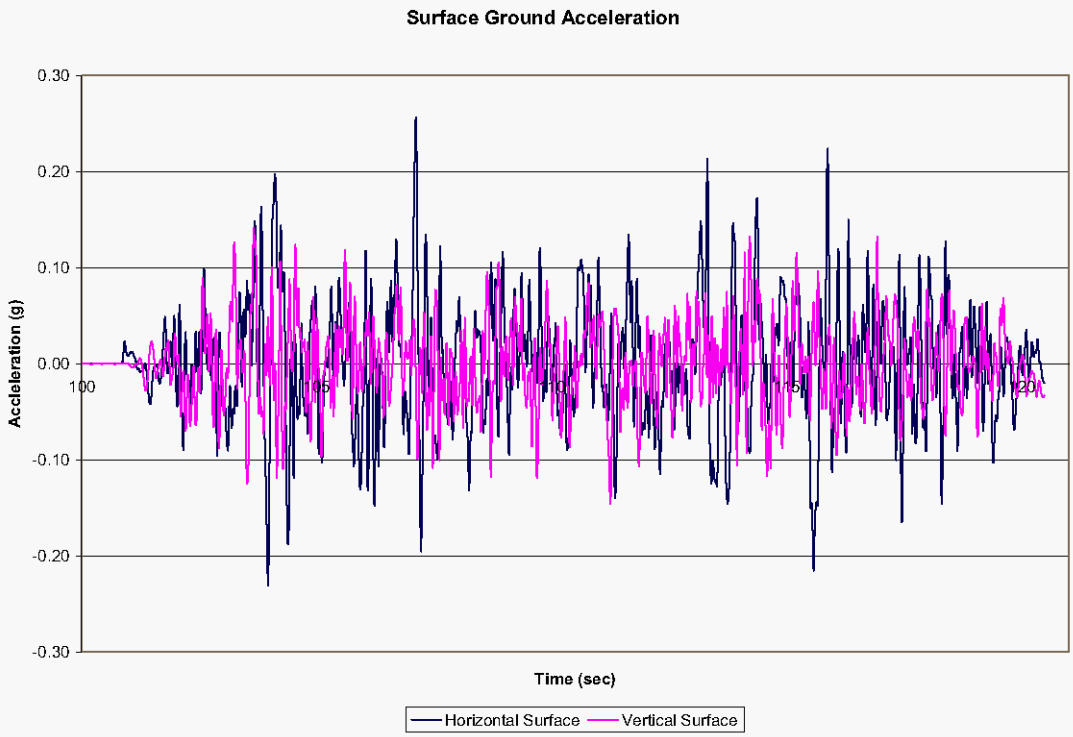


Figure 2.3. Horizontal and Vertical Surface Acceleration Time History

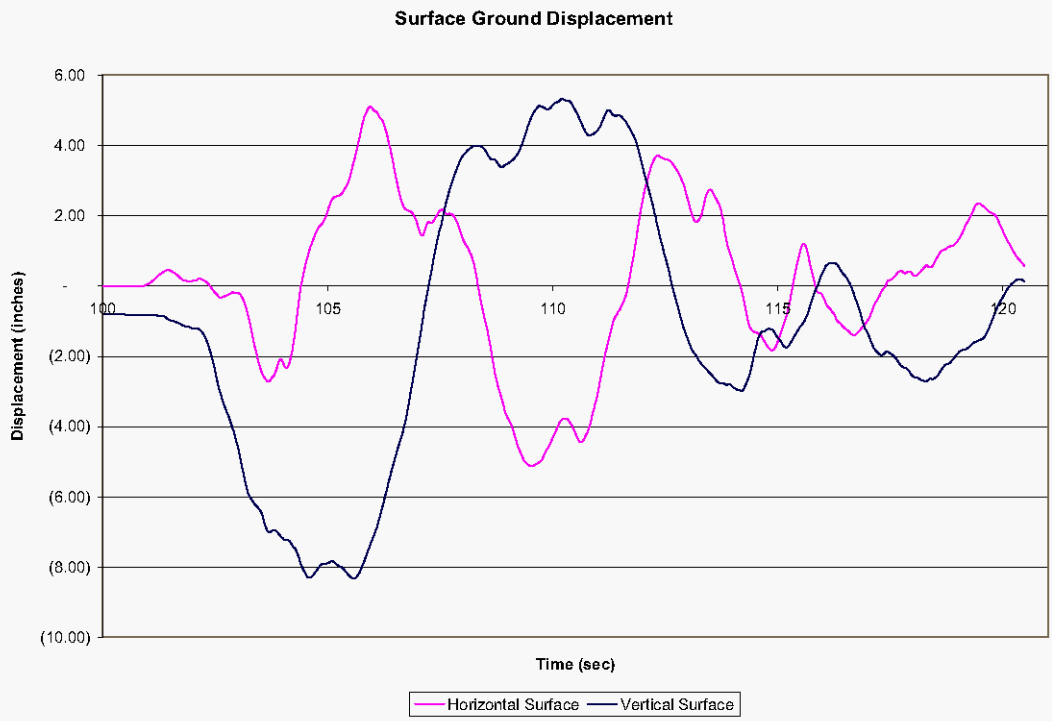


Figure 2.4. Horizontal and Vertical Surface Displacement Time History

2.3 Load Cases

Four separate load cases have been considered in this analysis:

- Lower Bound Soil, Best Estimate Concrete Properties
- Best Estimate Soil, Best Estimate Concrete Properties
- Upper Bound Soil, Best Estimate Concrete Properties
- Best Estimate Soil, Fully Cracked Concrete 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 covers the additional uncertainty of expected 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 2048 time steps. Acceleration time histories were developed for each of the three soil conditions at the -266-ft level (Abatt, et al. [2006]).

2.3.1 Acceptance Criteria for Response Spectra

The following acceptance or screening criteria were applied to the tank foundation-level response spectra generated by the ANSYS® column model:

1. The envelope of the best estimate, lower bound, and upper bound response spectra at the tank foundation level (-57.6 ft) should be at least 60% of the surface control motion. This applies to both horizontal and vertical motion.

2. The envelope of the best estimate, lower bound, and upper bound ANSYS® and Dytran® response spectra at the tank foundation level (-57.6 ft) should be at least 90% of the SHAKE response spectrum.

3. The envelope of the best estimate, lower bound, and upper bound ANSYS® and Dytran® response spectra at the tank foundation level (-57 ft) should be greater than or equal to the SHAKE response spectrum over any ±15% bandwidth.

The above criteria should be met for both horizontal and vertical spectra. Additional criteria were evaluated for these input motions and response spectra. The additional criteria are discussed in Abatt et al. (2006). The first condition is intended to minimize the dip that can occur in deconvolved response spectra at moderate depth at the frequency of the overlying soil column. Such a dip appears in the foundation level SHAKE spectrum shown in Figure 2.5 as well as in other plots.

The tests of the first criterion are shown graphically for both horizontal and vertical input, as shown in Figures 2.5 and 2.6, respectively. The results indicate that the first condition is not met at all frequencies. Modifications to ensure that the condition is met will be discussed in Section 2.3.2.

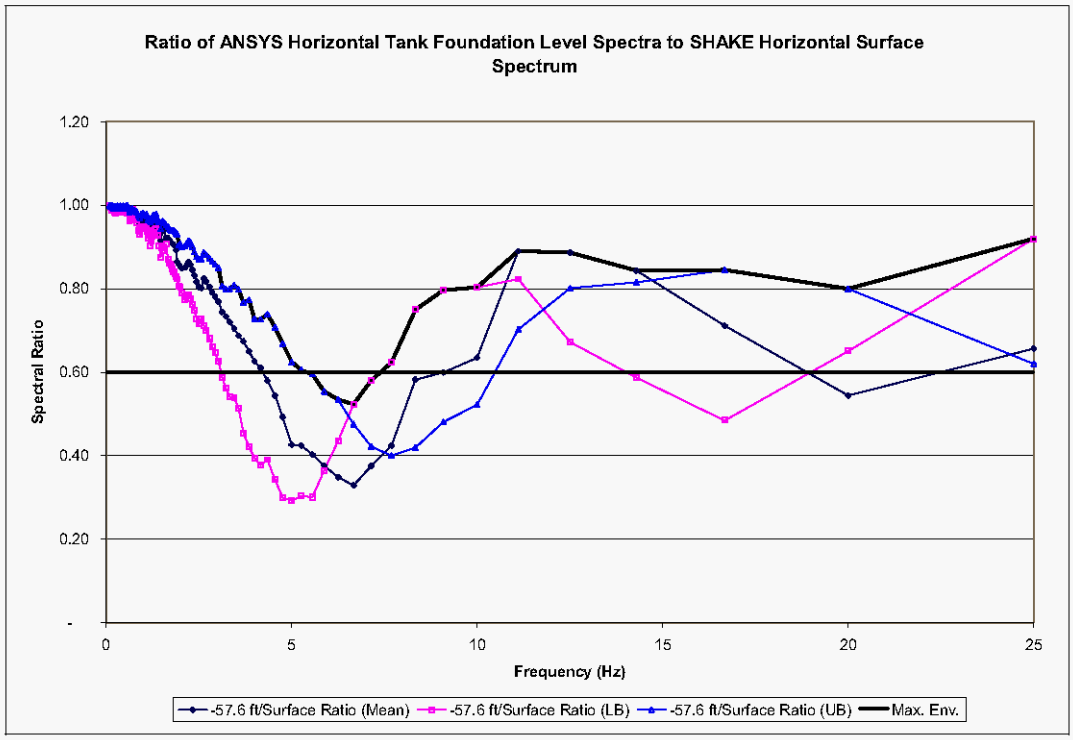


Figure 2.5. Ratio of the ANSYS® Tank Foundation Level Spectra to the SHAKE Surface Spectrum for Horizontal Excitation

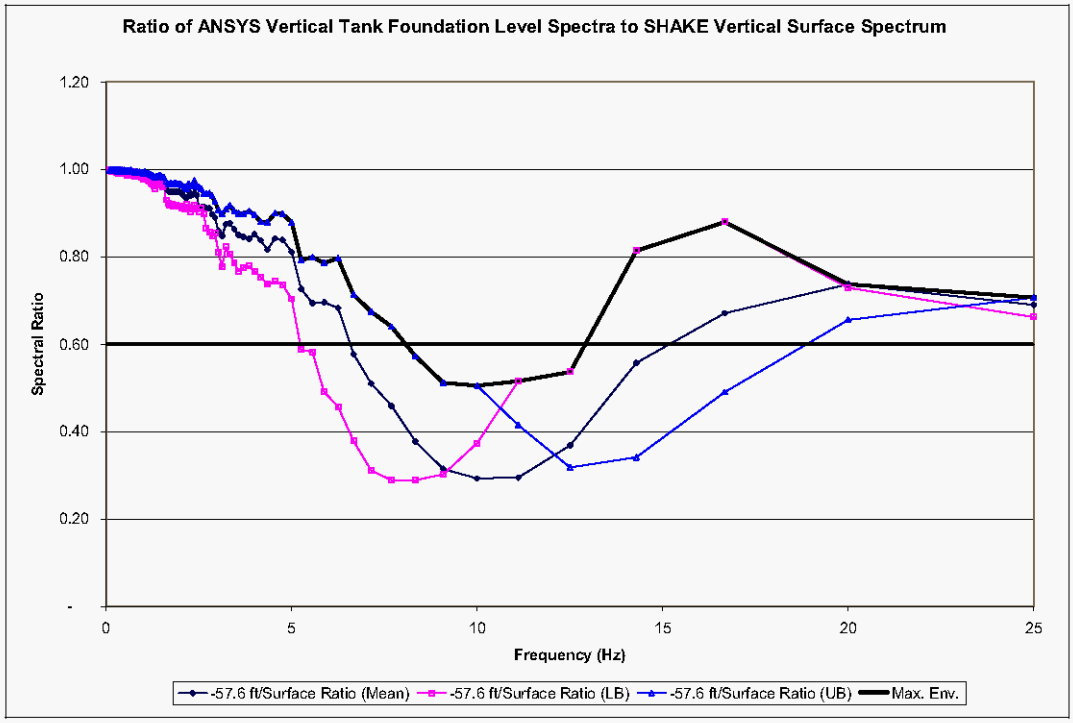


Figure 2.6. Envelope of the Ratio of the ANSYS® Tank Foundation-Level Spectra to the SHAKE Surface Spectrum for Vertical Excitation

2.3.2 Modification to ANSYS® Base Time Histories

Comparison of the ANSYS® soil column spectra at the tank foundation level to the SHAKE surface spectra for horizontal and vertical excitation (Figures 2.5 and 2.6) showed that the tank foundation spectra do not meet the first criterion. The envelope of the best estimate, lower bound, and upper bound response spectra at the tank foundation level (-57.6 ft) should be at least 60% of the surface control motion. This applies to both horizontal and vertical motion. To ensure that the envelope of the tank foundation level spectra is at least 60% of the SHAKE surface spectrum, the horizontal lower and upper bound base time histories used as input to the ANSYS® soil column model were scaled up by factors of 1.175 and 1.12, respectively. The vertical lower and upper bound base time histories were scaled up by factors of 1.12 and 1.19, respectively. Comparisons of the tank foundation-level spectra to the SHAKE surface spectra for the modified base time histories are shown in Figures 2.7 and 2.8. Increasing the base time histories by the above factors results in the ratio of the tank foundation-level spectra to SHAKE surface spectra meeting the 60% criterion.

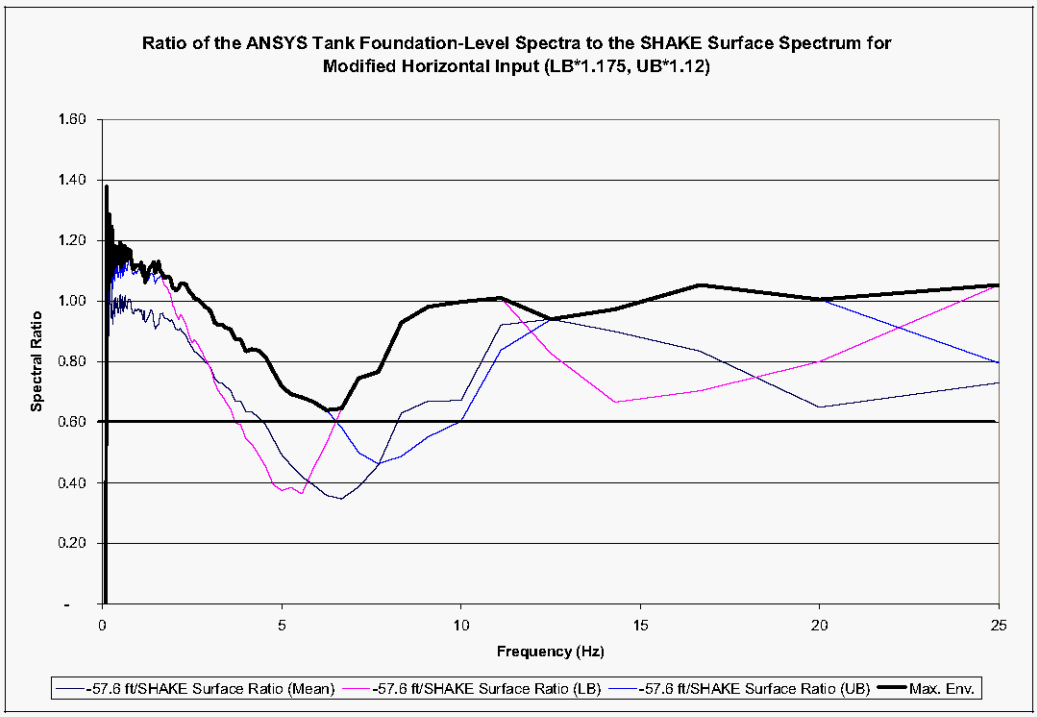


Figure 2.7. Ratio of the ANSYS® Tank Foundation Level Spectra to the SHAKE Surface Spectrum for Modified Horizontal Excitation

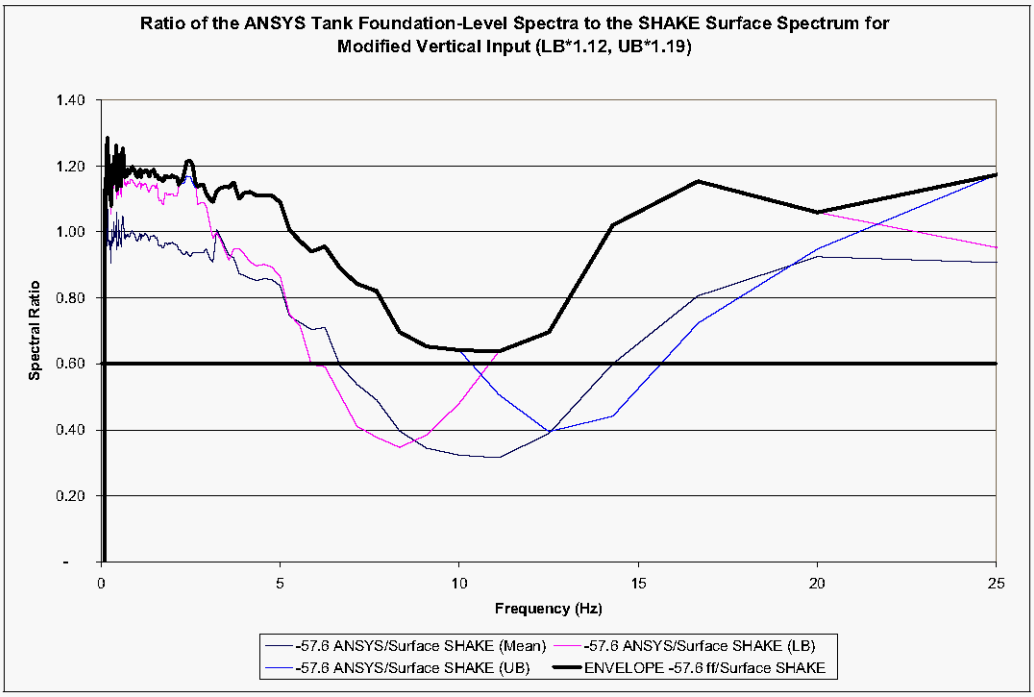


Figure 2.8. Envelope of the Ratio of the Tank Foundation Level Spectra to the Surface Spectra for Modified Vertical Excitation

2.3.3 ANSYS® Base Acceleration Time Histories

Individual time histories are applied for each different soil condition. Lower Bound, Best Estimate, and Upper Bound soil horizontal and vertical acceleration time histories are shown in Figures 2.9, 2.11, and 2.13, respectively. Lower Bound, Best Estimate, and Upper Bound soil horizontal and vertical displacement time histories are shown in Figures 2.10, 2.12, and 2.14, respectively.

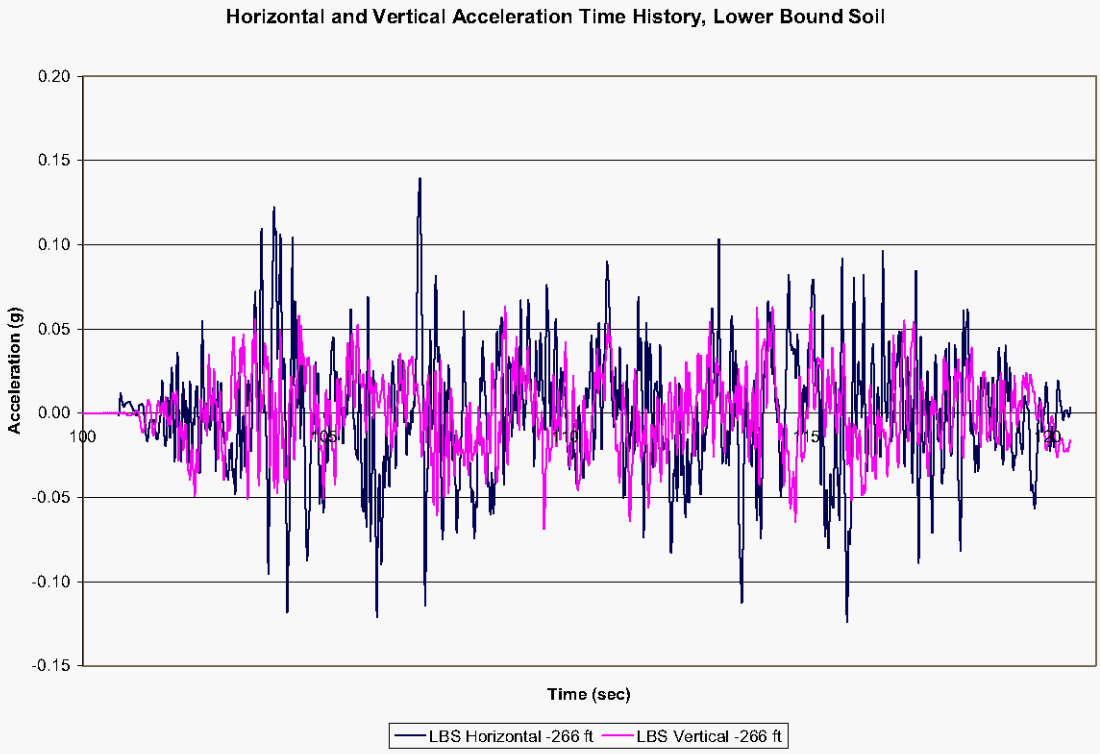


Figure 2.9. Horizontal and Vertical Base Acceleration Time History, -266 ft, Lower Bound Soil

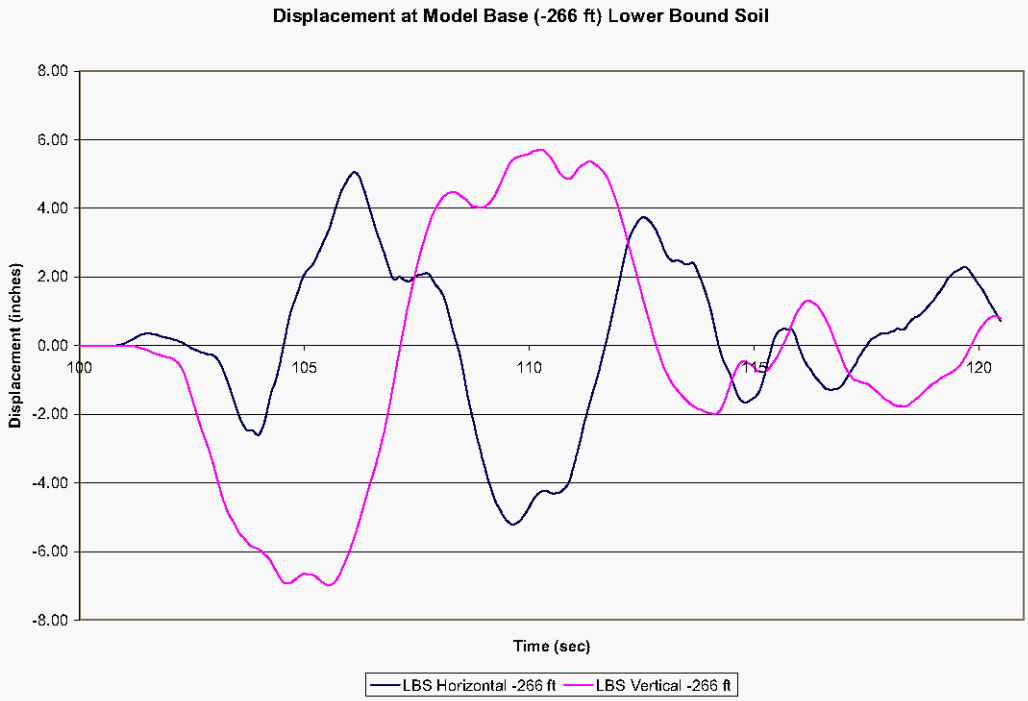


Figure 2.10. Horizontal and Vertical Base Displacement Time History, -266 ft, Lower Bound Soil

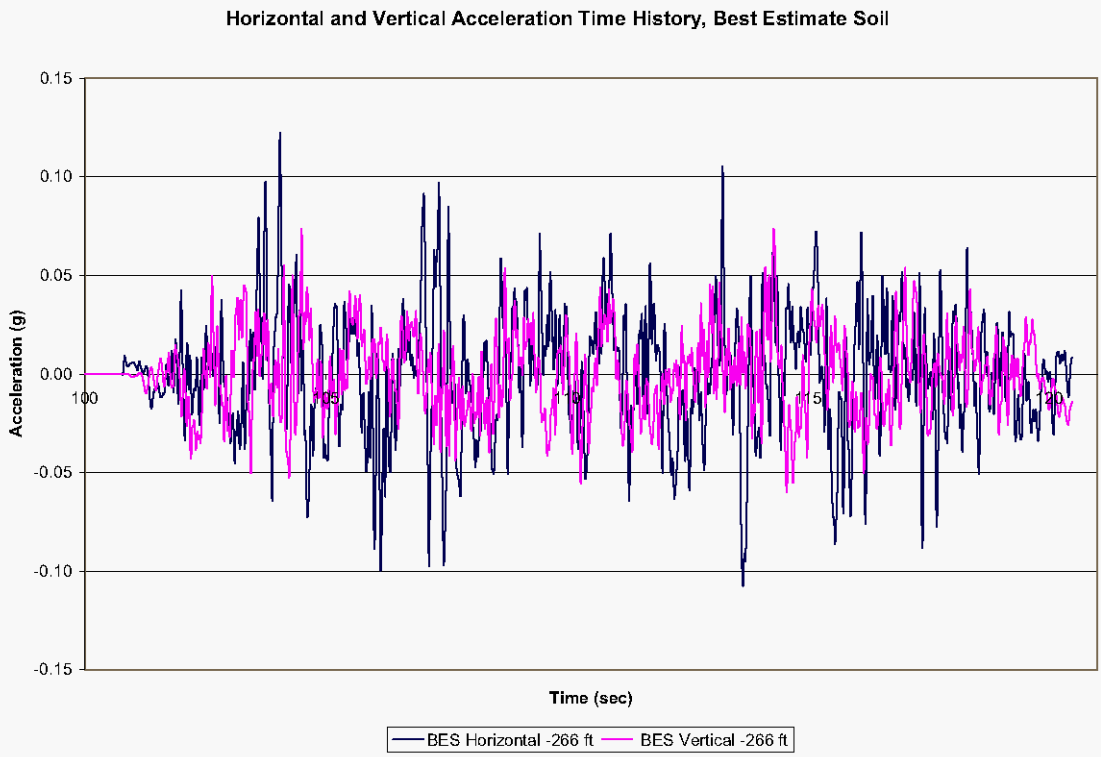


Figure 2.11. Horizontal and Vertical Base Acceleration Time History, -266 ft, Best Estimate Soil

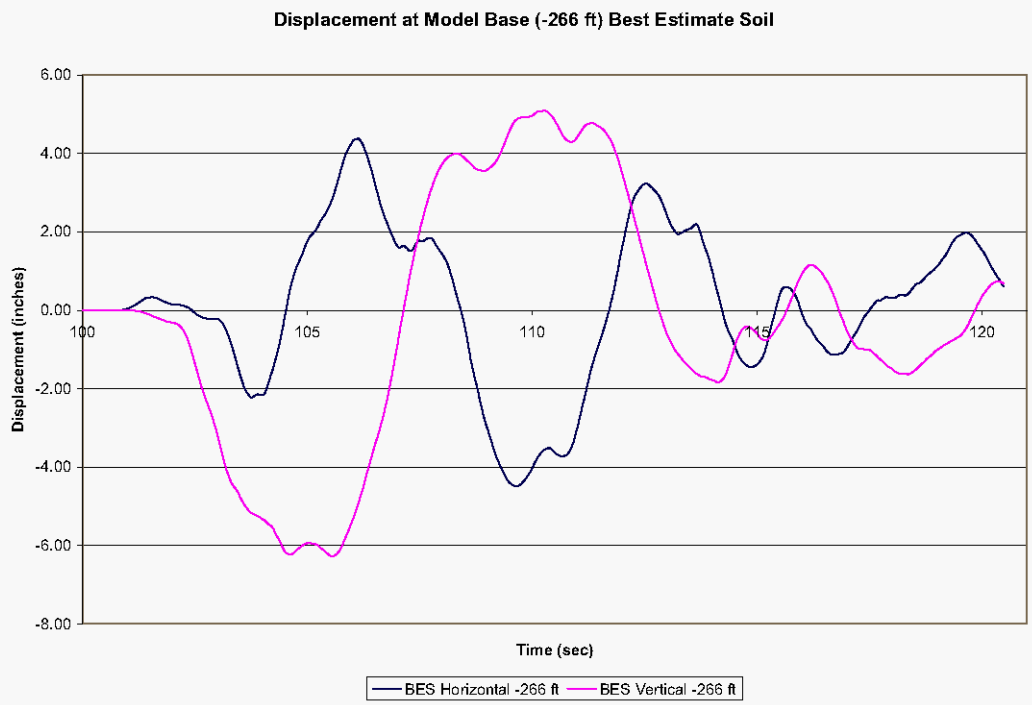


Figure 2.12. Horizontal and Vertical Base Displacement Time History, -266 ft, Best Estimate Soil

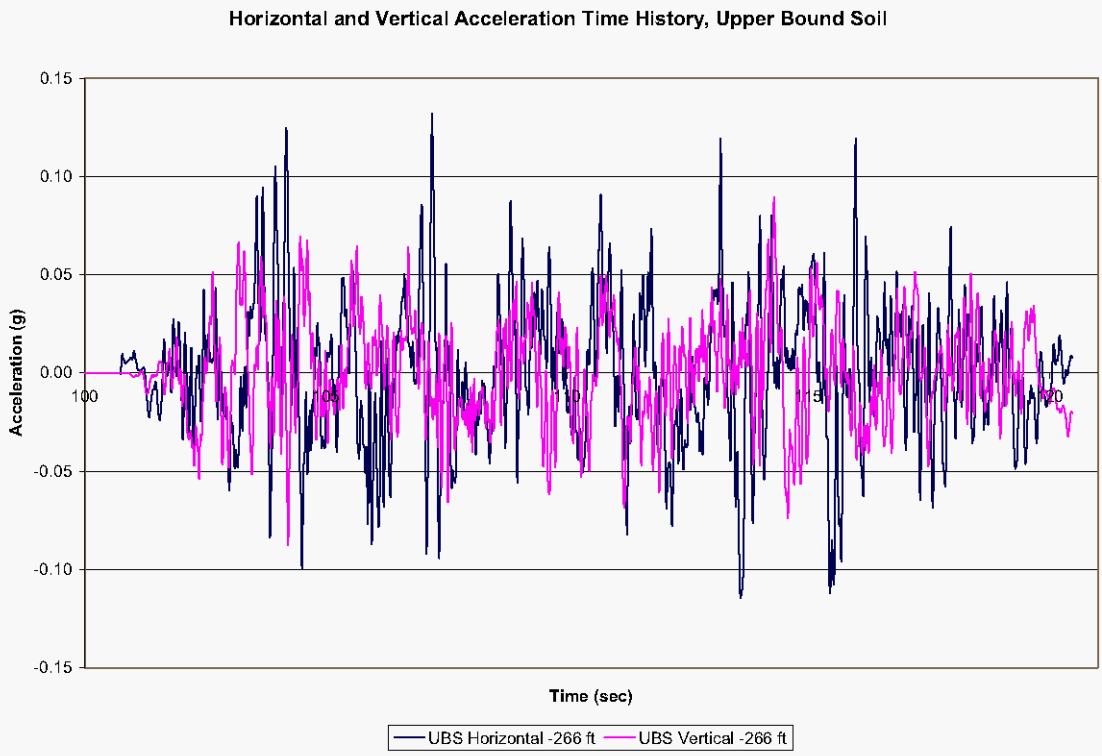


Figure 2.13. Horizontal and Vertical Base Acceleration Time History, -266 ft, Upper Bound Soil

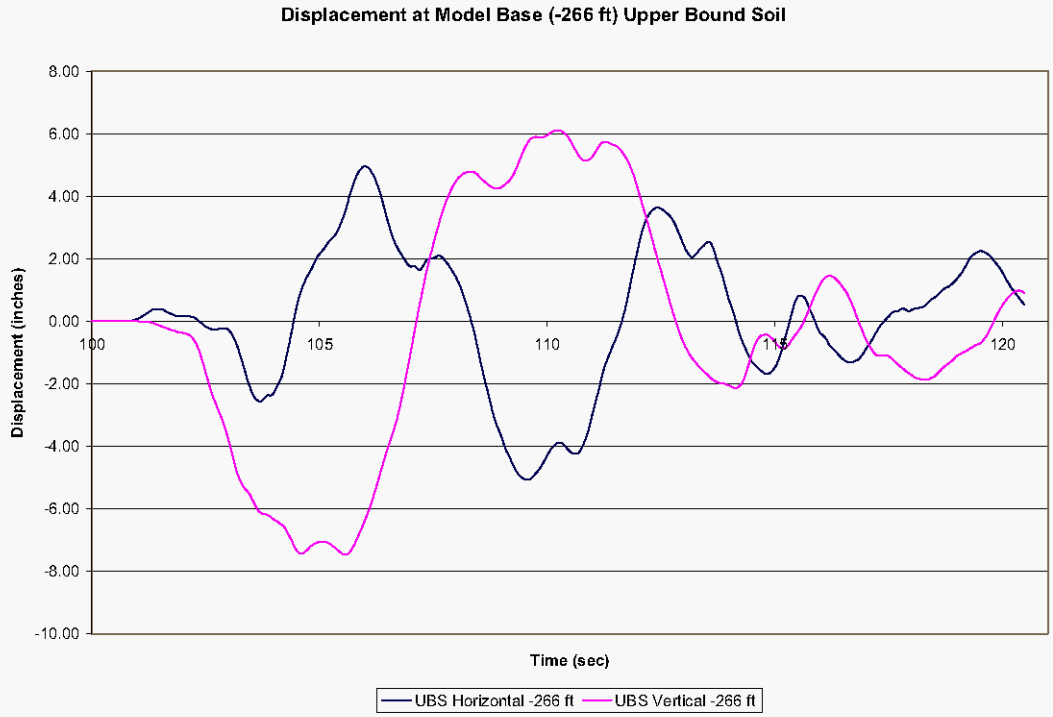


Figure 2.14. Horizontal and Vertical Base Displacement Time History, -266 ft, Upper Bound Soil

2.4 Result Extraction

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

- Nodes — All active degrees of freedom
- Reactions — All reactions
- Concrete Tank — 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 analyses.

- Nodes — Displacements at selected locations
    - Used to generate response spectra for soil, concrete tank, and primary tank
- Reactions — None
- Concrete Tank — Element Forces and Moment and Selected Strains
- Primary Tank — Element stresses (top, middle, bottom)
- Secondary Liner — lement 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 Model Description

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 tank, primary tank, secondary liner, J-Bolts, waste, and surrounding soil, was developed to evaluate the seismic loading on the DST. Details for each part of the model are discussed in detail in the following sections.

The tank model geometry was based on the AY tank configuration shown in Hanford Drawing No. H-2-64449. The primary tank has a 450-inch radius and the height of the vertical wall is 424 inches. The dome apex is 561.5 inches above the bottom of the tank. The models were run using waste depth of 422 inches. An excerpt from Drawing No. H-2-64449 is shown as Figure 3.1. The complete model, including the DST and surrounding soil, is shown in Figure 3.2.

A significant effort was undertaken to determine the best approach for modeling various aspects of the tank and surrounding soil. Abatt et al. (2006), provides a discussion of the development of the soil models, including material properties and boundary conditions. Carpenter and Abatt (2006) and Abatt (2006) document benchmarking studies for the methodology used to model the waste. The reports provide comparisons to theoretical fluid-structure interaction predictions of waste pressures and total hydrodynamic reactions to those obtained from ANSYS® and Dytran® models.

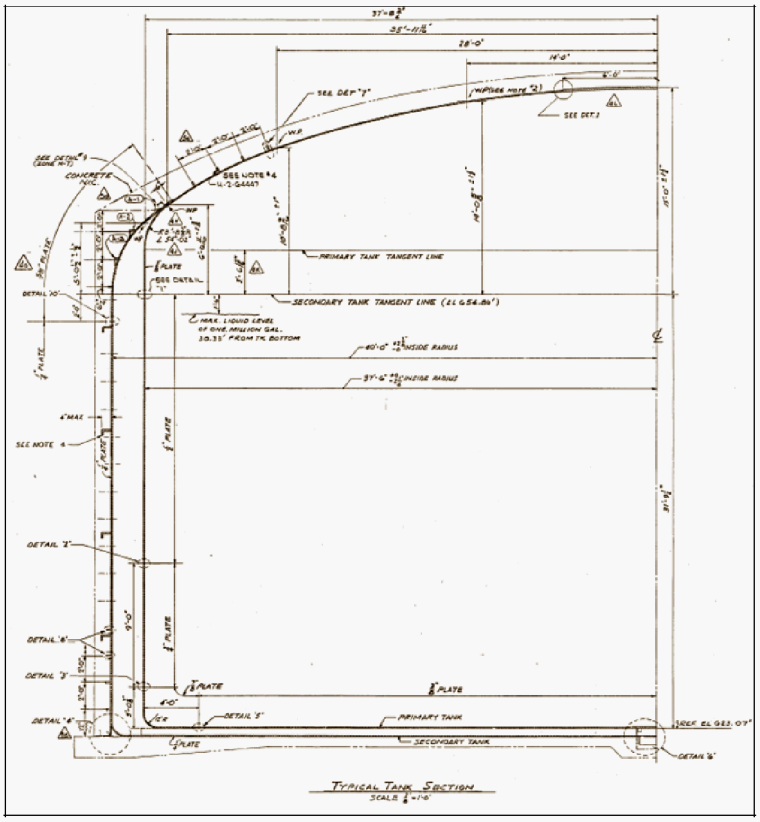


Figure 3.1. AY Primary Tank Dimensions

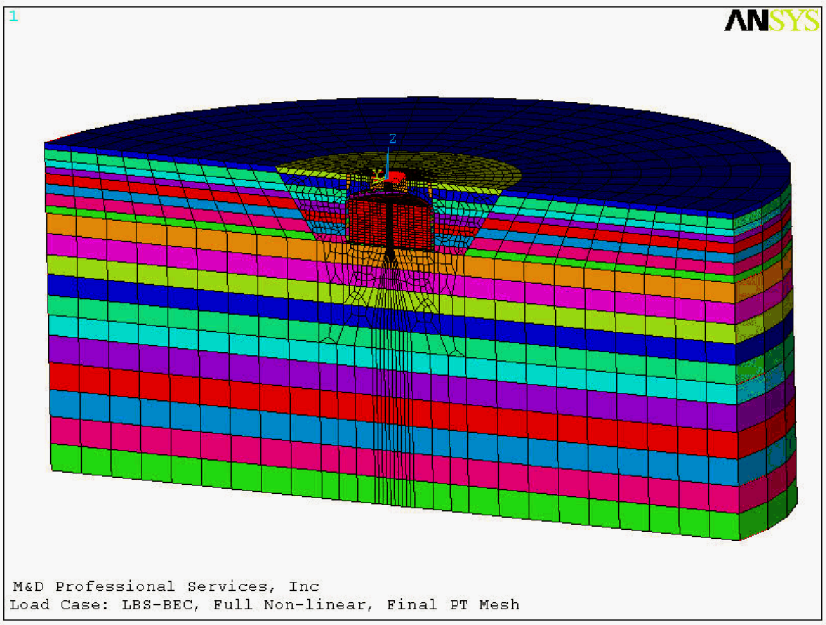


Figure 3.2. Composite Tank Model Detail

The detailed ANSYS® model was developed based on coordinates developed for models used in the static tank analyses. 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 3.1. Files that are common to all load cases are provided in Appendix D. Files that are unique to a specific load case are provided in the appendix for each load case.

All components of the model are based on 9-degree slices over the half model, for a total of twenty slices.

The model description will address the tank components first, then the surrounding soil.

Table 3.1. ANSYS® Model Input File Description

File Name	Description
Run-Tank.txt	Calls each input for development of model
Tank-Coordinates-AY.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 tank mesh. Foundation and wall are separate entities
Primary-Props-AY.txt	Defines primary tank material and real properties.
Primary.txt	Creates primary tank mesh. Primary tank is not connected to concrete tank.
Insulate.txt	Creates insulating concrete mesh. Uses existing geometry from concrete and primary tanks, but is not connected.
Waste-Solid-AY.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 tank 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 tank.
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 tank. 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.

3.1 Tank Model Geometry

3.1.1 Concrete Model

The first component developed in the model is the concrete tank shell and footing. Thirty-three sections are used between the dome and center of the floor for each 9-degree slice. In the detailed TOLA model, 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 3.2). 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 tank is based on a combination in data from drawings and the TOLA model. The basic geometry is based on drawings H-2-64310 and H-2-64307. Nodal locations were selected to

Table 3.2. Concrete Tank 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
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	382.1	14
Wall	26	489	360.8	18			
Wall	27	489	345.6	18			
Wall	28	489	335	18	489	335	15
Wall	29	489	321	18			
Wall	30	489	306	18			
Wall	31	489	300	18			
Wall	32	489	281	18	489	281	16
Wall	33	489	260.5	18			
Wall	34	489	236	18	489	236.5	17
Wall	35	489	210.5	18			
Wall	36	489	201	18			
Wall	37	489	186.8	18	489	186.8	18
Wall	38	489	171	18			
Wall	39	489	150.5	18			
Wall	40	489	145.5	18	489	145.5	19
Wall	41	489	120.5	18			
Wall	42	489	100.5	18			
Wall	43	489	80	18			
Wall	44	489	60	18	489	70.0	20
Wall	45	489	39.9	18			
Wall	46	489	21	18	489	20	21
Wall	47	489	-4.5	18			
					489	-4.0	22
					531	-4.0	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	-4.0	24
Slab	54	485.1	-19.1	22			

Table 3.2. (contd)

		Coordinates			ANSYS		
	Section	R (inch)	H (inch)	t (Inch)	X	Z	Set #
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	-4.0	25
Slab	60	421.4	-17.9	17.05			
Slab	61	390	-15.9	13.12			
					410	-4.0	26
Slab	62	358	-13.9	9.13	358	-4.0	27
Slab	63	338	-13.4	8			
Slab	64	277.7	-13.4	8	277.7	-4.0	28
Slab	65	218.5	-13.4	8	218.5	-4.0	29
Slab	66	180	-13.4	8	180	-4.0	30
Slab	67	129.9	-13.4	8	129.9	-4.0	31
Slab	68	95.7	-13.4	8	95.7	-4.0	32
Slab	69	54	-17.1	15.43			
					36	-4.0	33
Slab	70	20	-20.1	21.5			
					0	-4.0	34
Note: The concrete tank wall is 8 inches short due to modeling error							

correspond reasonably well to the TOLA model. This was done to simplify load combinations. Table 3.2 provides a listing comparison of nodal coordinates for the ANSYS® seismic model and TOLA model.

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

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 tank material properties and real constants (thickness) for the best estimate concrete. Input file "Tank-Props-BEC-Crack.txt" defines the concrete tank material properties and real constants (thickness) for the fully cracked concrete. Table 3.4 provides a complete listing of section properties based on the TOLA model. Table 3.4 provides concrete section properties assuming all sections are cracked.

Table 3.3. Best-Estimate Concrete Properites, 250°F

Cracked	Eshl		Shell Thickness t-shl		Shell Density, Rho-shl		M&D Section	PNNL Section
Y/N	(psi)	(ksf)	(in)	(ft)	(lb/in^3)	(lbf/ft^3)	No.	No.
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

Table 3.3. (contd)

Cracked	Eshl		Shell Thickness t-shl		Shell Density, Rho-shl		M&D Section	PNNL Section
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 3.4. Fully Cracked Concrete Properites

Is Section Cracked?	Eshl		Shell Thickness t-shl		Shell Density, Rho-shl		M&D Section	PNNL Section
	(psi)	(ksf)	(in)	(ft)	(lb/in^3)	(lbf/ft^3)	No.	No.
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

Table 3.4. (contd)

Is Section Cracked?	Eshl		Shell Thickness t-shl		Shell Density, Rho-shl		M&D Section	PNNL Section
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 tank model. Element type SHELL143 is used for the concrete tank to be able to extract through-wall shear forces.

Figures 3.3 and 3.4 show the profile and full concrete tank model, respectively.

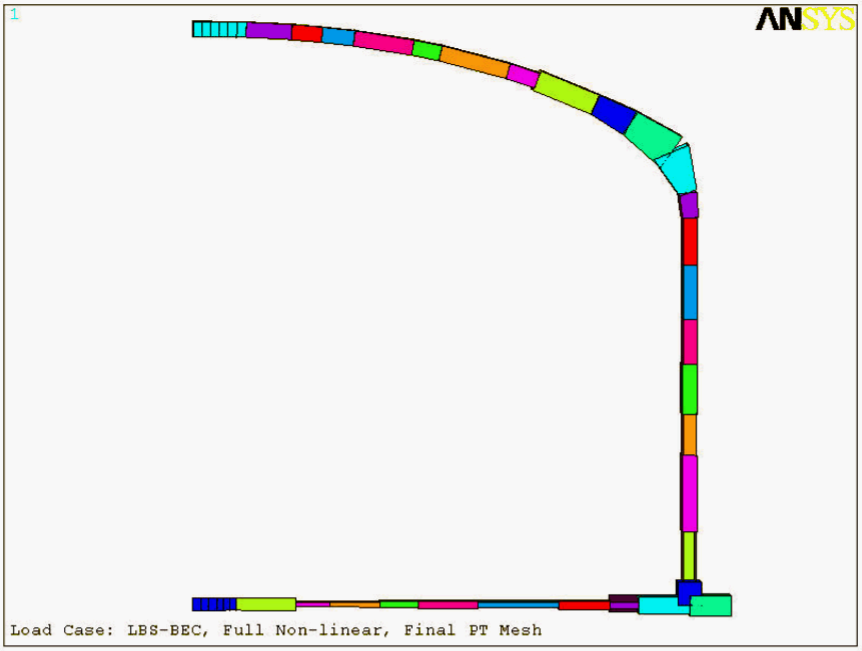


Figure 3.3. Concrete Tank Profile, Inlcuding Shell Thickness

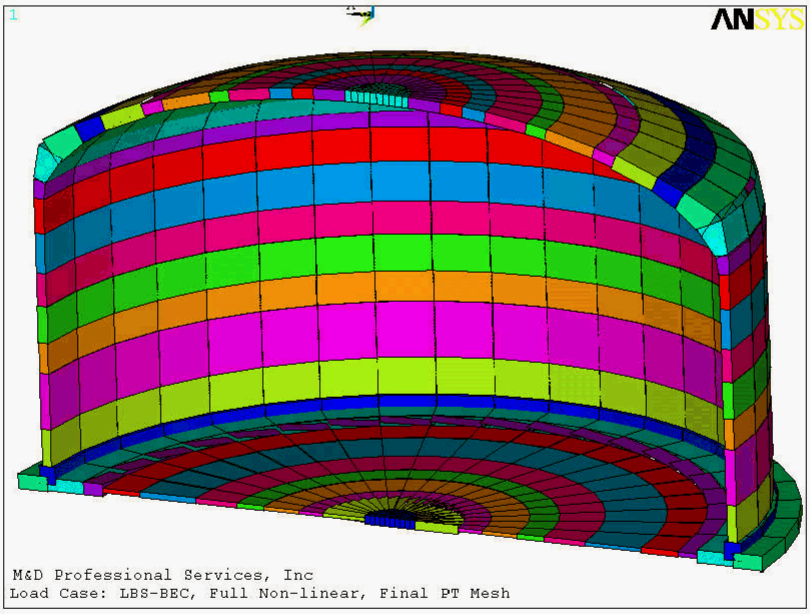


Figure 3.4. Concrete Tank Model Detail

3.1.2 Primary Tank

The geometry of the primary tank is based on drawing H-2-64449. 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 tank coordinate, taking into account the concrete shell thickness, and normal to the primary tank (see Figure 3.5). The concrete shell thickness used is based on the nominal concrete thickness.

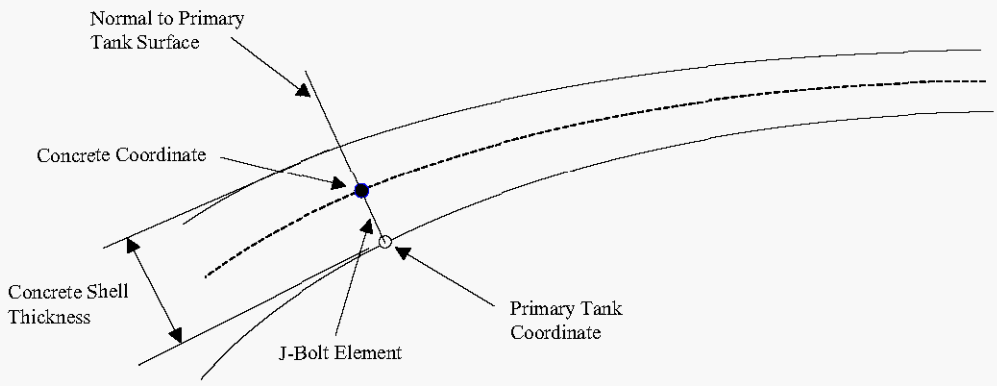


Figure 3.5. Primary/Concrete Tank Node Geometry

The location of the primary tank nodes were iteratively determined a 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 location of y' is as follows:

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

a = Minor Radius = 180 in

b = Major Radius = 480 in

x = Test Location for x

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

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, the slope of the ellipse is –0.048. The corresponding angle is the arctangent of the slope, or in this case, -0.048. 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 (60.4), the x location of the primary tank is 61.0398. y' was determined to be –1.46. Adjusting this to value for the vertical location of the center of the ellipse, add 561.45 (elevation of the primary tank at the apex). For this case, y=559.99. The check is as follows:

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

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

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

Table 3.5. 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	561.45	0.00	0.000	0.000	0.000	7.500	0.000
30.2	568.6	15	0%	30.0238	561.10	-0.35	-0.024	-0.023	-1.346	7.498	-0.176
45	568.2	15	0%	44.7369	560.67	-0.78	-0.035	-0.035	-2.010	7.495	-0.263
61.4	567.5	15	0%	61.0398	559.99	-1.46	-0.048	-0.048	-2.753	7.491	-0.360
120.72	563.21	15	0%	119.9972	555.73	-5.72	-0.097	-0.097	-5.530	7.465	-0.723
152.9	559.7	15	0%	151.9685	552.19	-9.26	-0.125	-0.125	-7.134	7.442	-0.931
211.4	550.7	15	0%	210.0535	543.30	-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	520.62	-40.83	-0.308	-0.298	-17.099	7.169	-2.205
335.6	518.2	15	0%	333.0513	511.07	-50.38	-0.361	-0.347	-19.866	7.054	-2.549
393.7	494.5	15	0%	390.2214	486.27	-75.18	-0.524	-0.482	-27.633	6.645	-3.479
428.7	476.2	22.58	0%	422.2643	467.04	-94.41	-0.694	-0.607	-34.752	9.276	-6.436
				432	459.91	-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										

Element thicknesses are based on the drawing H-2-64449. General steel properties are used and are as follows:

Elastic Modulus (E) = 4,176,000 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-AY.txt." Tank element properties are from input file "Primary-Props-AY." The tank mesh is generated using "Primary.txt" and uses SHELL143 elements.

Figure 3.6 shows the full primary tank model, and Figure 3.7 shows the detail in the knuckle region at the bottom of the tank.

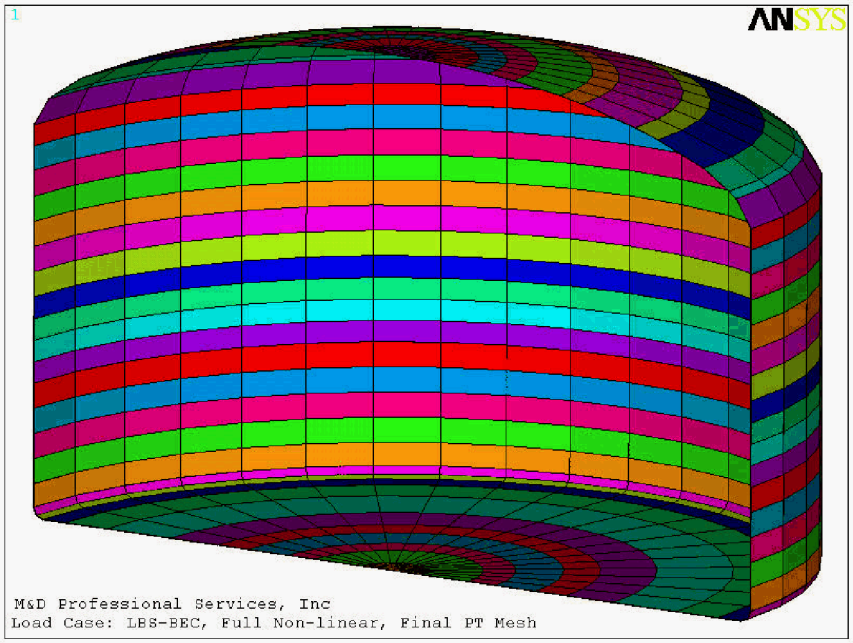


Figure 3.6. Primary Tank Model Detail

It was noted during checking that the overall height of the primary tank is 8 inches short. This does not affect the waste depth modeled (422 inches). Because the difference is small, it does not have a significant affect on the results and is therefore acceptable.

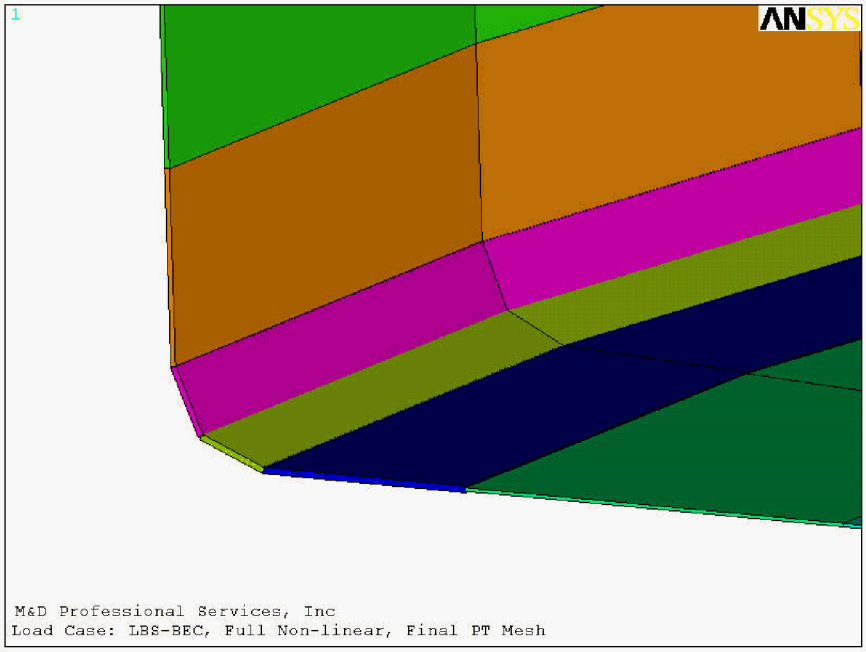


Figure 3.7. Primary Tank Model Detail – Knuckle Region

3.1.3 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 as follows 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 3.8 shows the insulating concrete elements.

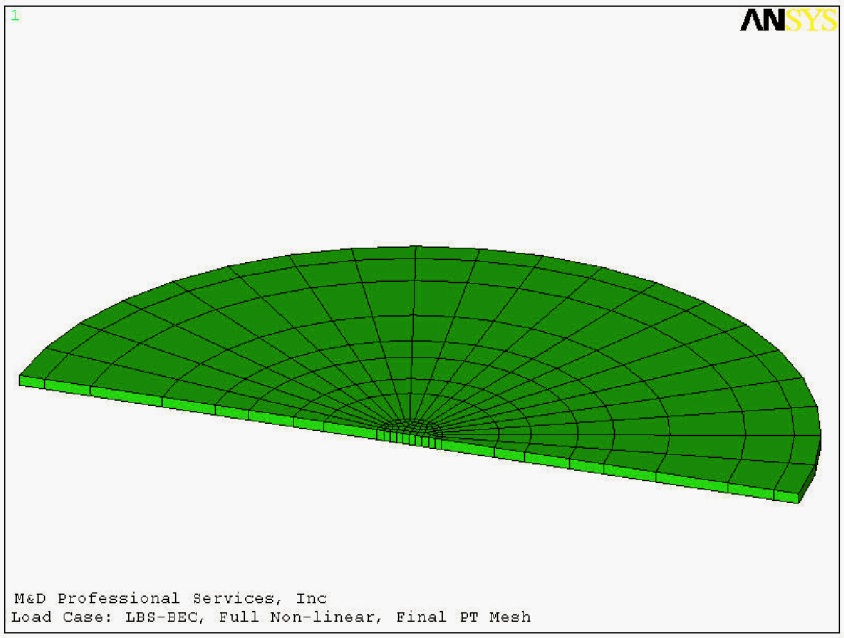


Figure 3.8. Insulating Concrete Model Detail

3.1.4 J-Bolts

The J-Bolts connecting the primary tank to the concrete tank 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.

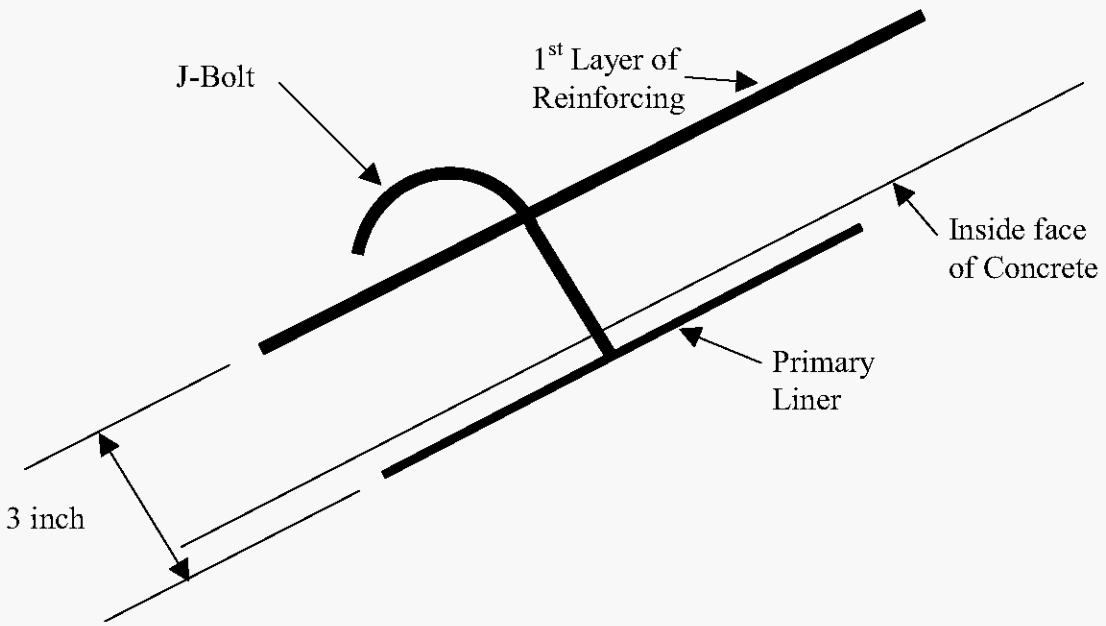


Figure 3.9. J-Bolt Geometry Detail

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:

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

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

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

$$L = 3\,\text{in}$$

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

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 3.6. 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 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 3.10 for the distribution of J-Bolts. Figure 3.11 shows the locations of spring elements connecting the end of each J-Bolt to the primary tank.

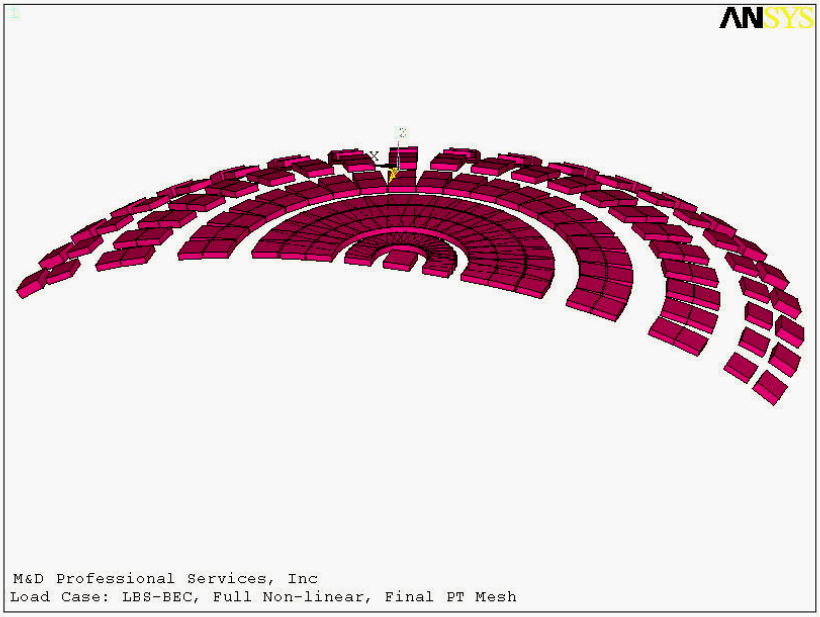


Figure 3.10. J-Bolt Model Detail

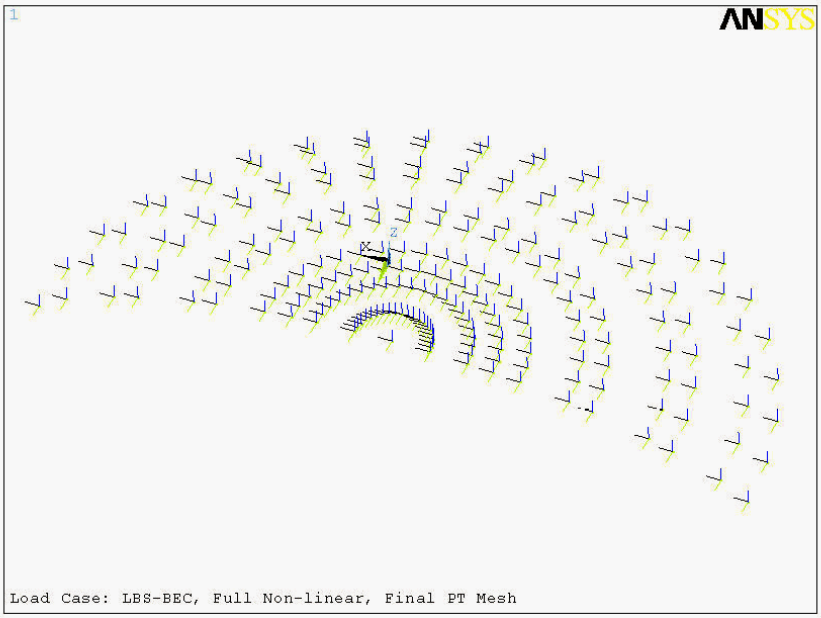


Figure 3.11. Spring Elements – J-Bolts to Primary Tank

3.1.5 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 1st full wall element coincident with the liner.

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

Elastic Modulus (E) =4,176,000 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%

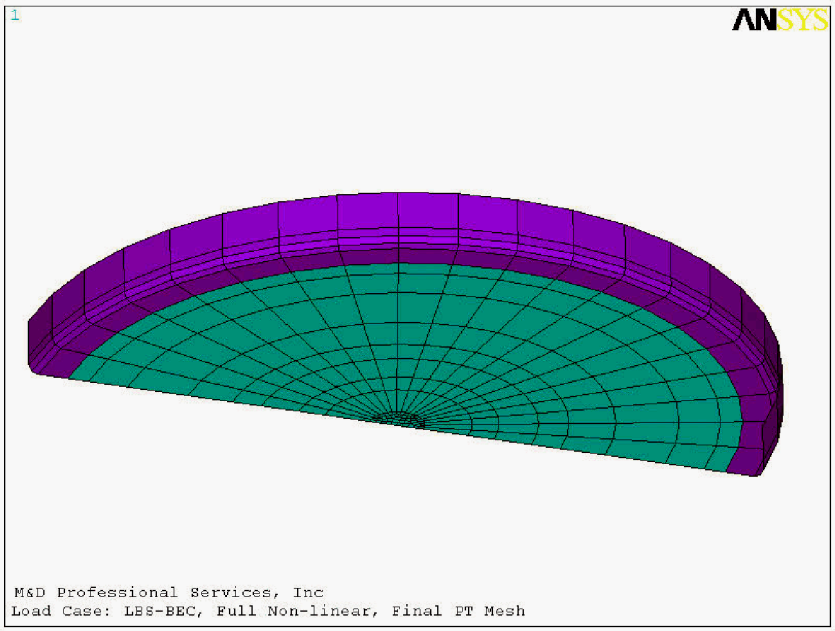


Figure 3.12. Secondary Liner Model Detail

3.1.6 Waste

The waste is modeled using solid elements (SOLID45) with material properties defined to emulate 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) = 0.003294 kip-sec^2/ft^4 = ((1.7*0.0624 kip/ft^3)/(32.2 ft/sec^2))
Damping = 0
Shear Modulus (G) = 0.216 kip/ft^2

E 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.

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

G 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.

Figure 3.13 shows the waste elements.

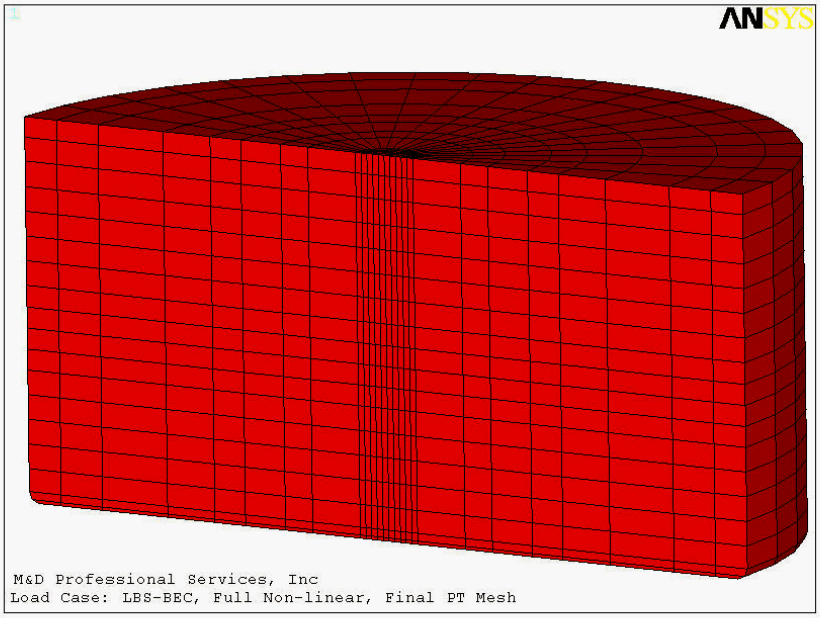


Figure 3.13. Waste Model Detail

Two benchmarking studies were performed to assess the fluid-structure interaction behavior of the primary tank and contained waste under seismic excitation. In the study documented in Carpenter and Abatt (2006), the fluid-structure interaction was simulated in ANSYS®. In the study documented in Abatt (2006), the fluid-structure interaction was simulated using Dytran®. The studies showed that the modeling approach used in ANSYS® adequately predicts the total hydrodynamic reaction force and pressure distribution both vertically and circumferentially, but that the model was deficient in predicting the convective response of the waste. In particular, the maximum slosh height is not well characterized, under-predicting the maximum displacement by a factor of three.

3.1.7 Primary Tank/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 0.4 was used for the contact surface.

The contact surface is developed using input file "bolt-friction.txt." Figure 3.14 shows the contact and target elements comprising the dome contact surface.

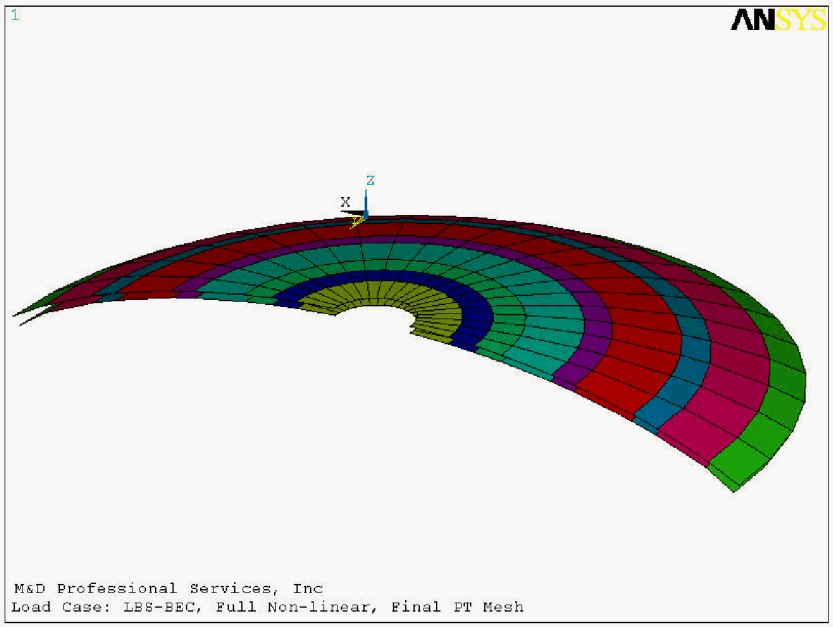


Figure 3.14. Contact Elements – Primary Tank to Concrete Dome

3.1.8 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 3.15 shows the contact elements (Top layer of elements)

3.1.9 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." Figure 3.15 shows the contact elements (bottom layer of elements).

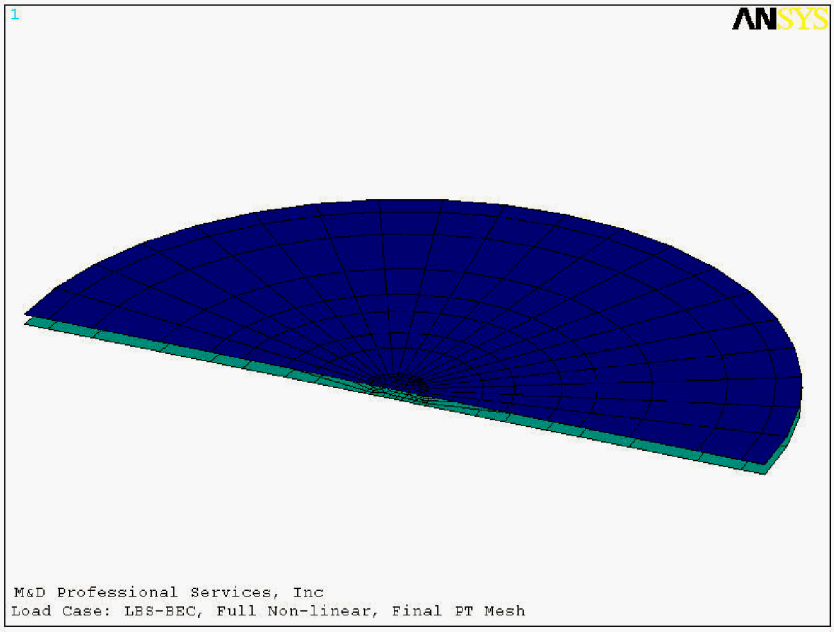


Figure 3.15. Contact Elements –Insulating Concrete Top and Bottom

3.1.10 Soil/Concrete Tank Interface

A combination of TARGE170 and CONTA173 elements are used to model the interface between the soil and the concrete tank, and for the interface plane between the native and excavated soils. A coefficient of friction of 0.2 was used for the contact surface during the gravity solution phase (static case), and then changed to 0.6 for the transient portion of the solution. See Sections 4.1 and 4.2 for a discussion of development of the modeling the soil/concrete interface. See Figure 3.16 for the contact surface model.

For the interface between the bottom of the footing and the native soil, COMBIN14 (spring) elements were used. An arbitrary, high, stiffness values was applied to these springs. See Figure 3.17.

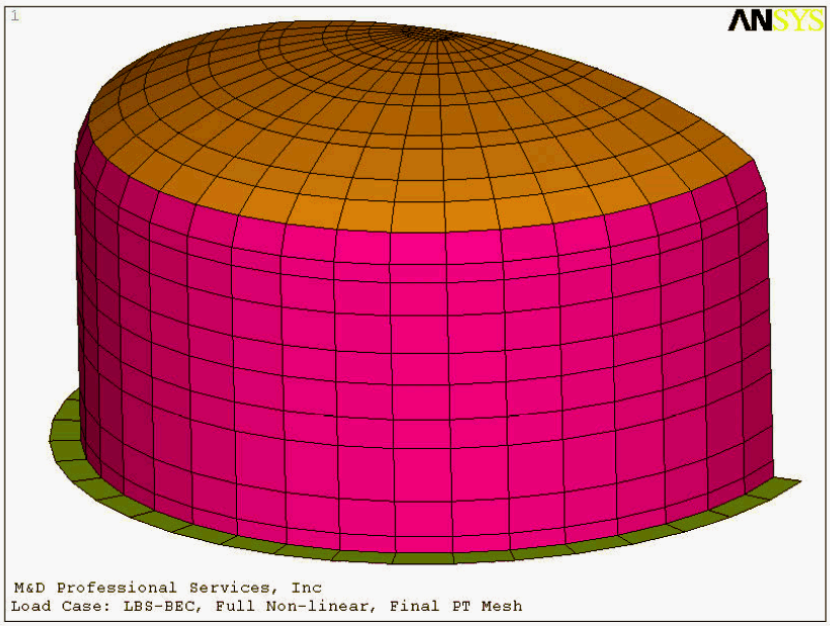


Figure 3.16. Contact Elements – Soil to Concrete Tank

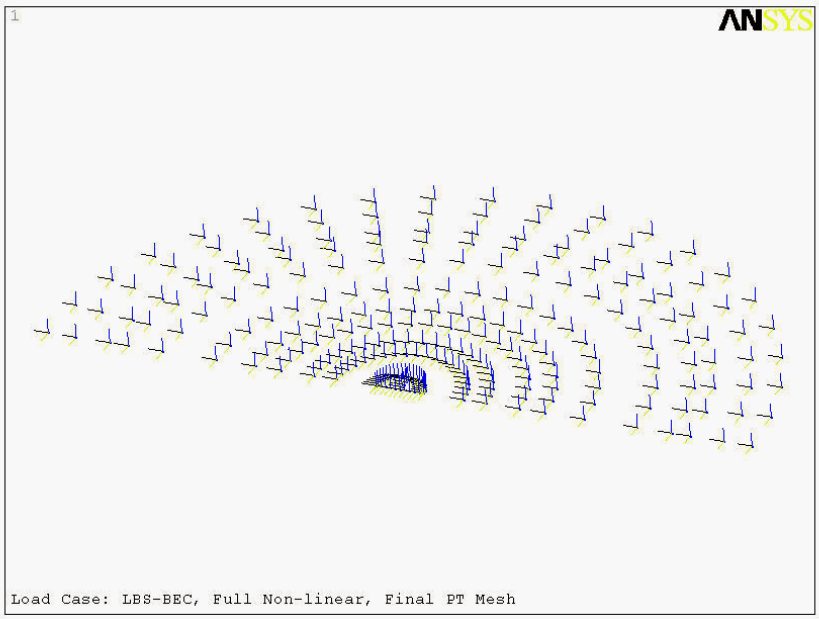


Figure 3.17. Spring Elements – Concrete Footing to Soil

3.1.11 Excavated/Native Soil Interface

A combination of TARGE170 and CONTA173 elements are used to model the interface between the native and excavated soils. An initial coefficient of friction 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.

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

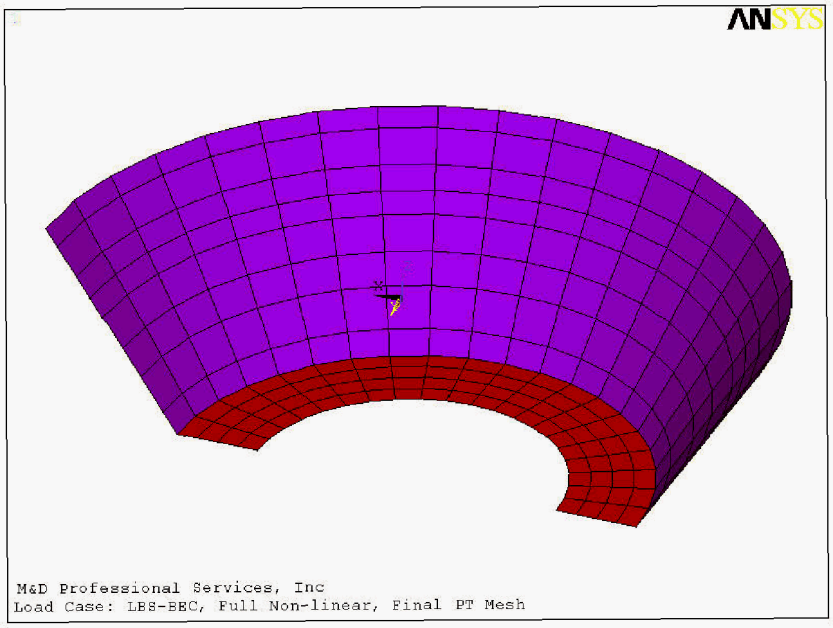


Figure 3.18. Contact Elements – Near Soil to Far Soil

3.1.12 Waste/Primary Tank Interface

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 developed using input file "Waste-Soild-AY.txt."

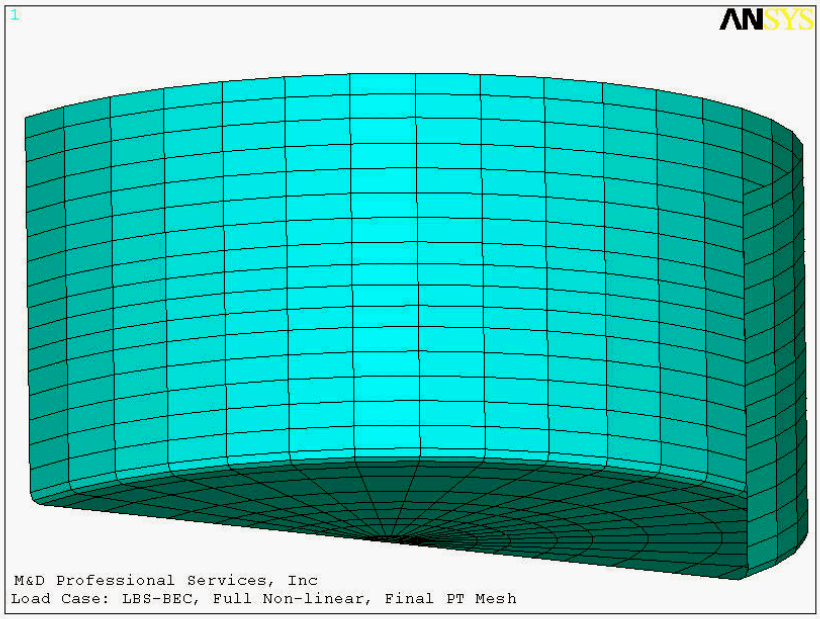


Figure 3.19. Contact Elements – Waste to Primary Tank

3.1.13 Concrete Wall/Footing Interface

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, and allows only normal and shear forces to be transferred to the footing.

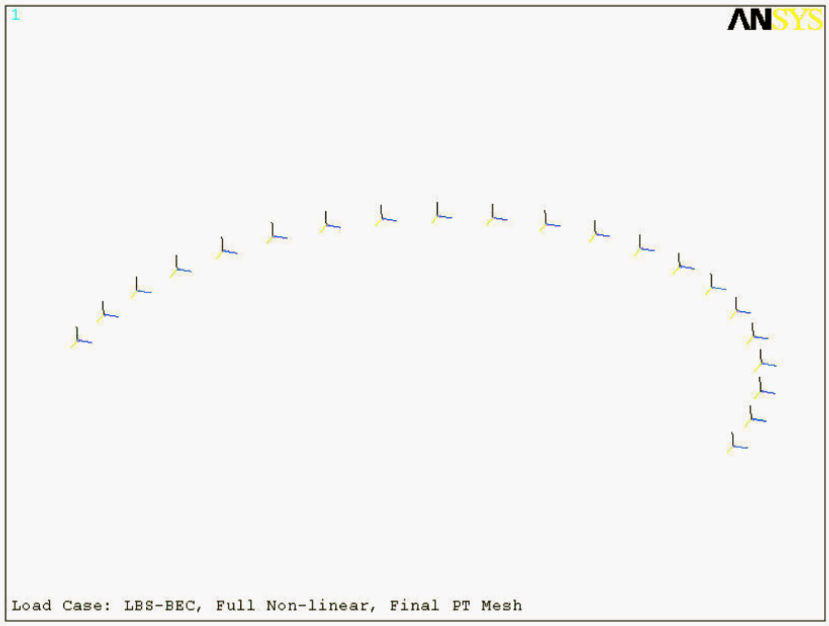


Figure 3.20. Contact Elements – Concrete Wall to Footing

3.1.14 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.

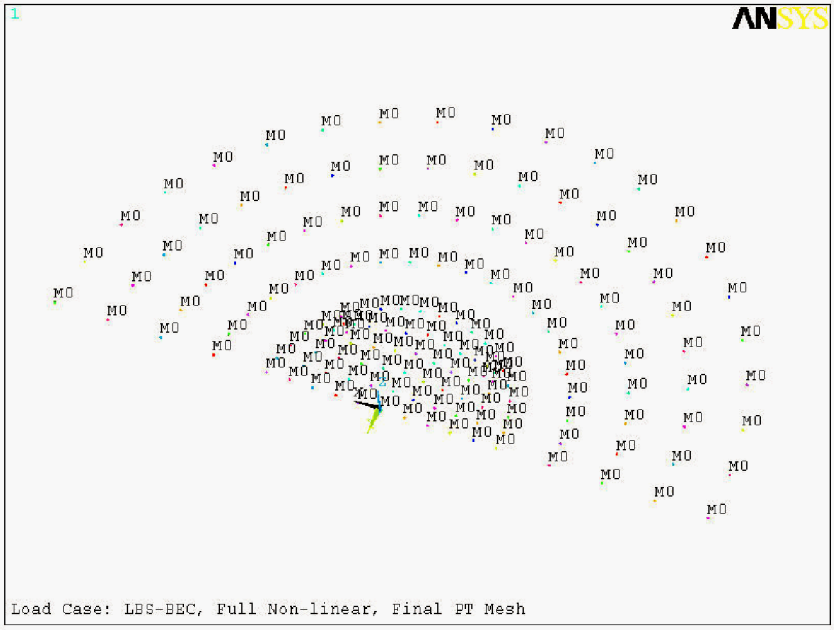


Figure 3.21. Mass Elements – Soil Surface

3.2 Soil Model

3.2.1 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 tank 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, Abatt et al. (2006). 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 3 7. Best Estimate Native Soil Iterated Soil Properties
- Table 3 8. Best Estimate Excavated Soil Iterated Soil Properties
- Table 3 9. Upper Bound Native Soil Iterated Soil Properties
- Table 3 10. Upper Bound Excavated Soil Iterated Soil Properties

- Table 3 11. Lower Bound Native Soil Iterated Soil Properties
- Table 3 12. Lower Bound Excavated Soil Iterated Soil Properties

Table 3.7. 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
255.5	0.024	16209.2	0.28	. 41,496	120	919

Table 3.8. 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 3.9. 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 3.10. 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 3.11. 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 3.12. 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

3.2.2 Excavated Soil

The excavated soil portion of the soil is developed using the input file "Near-Soil-1.txt." Figure 3.22 shows the detail of the excavated region of soil. The development of the softened regions of the soil over the tank dome is discussed in detail in Section 4.2.

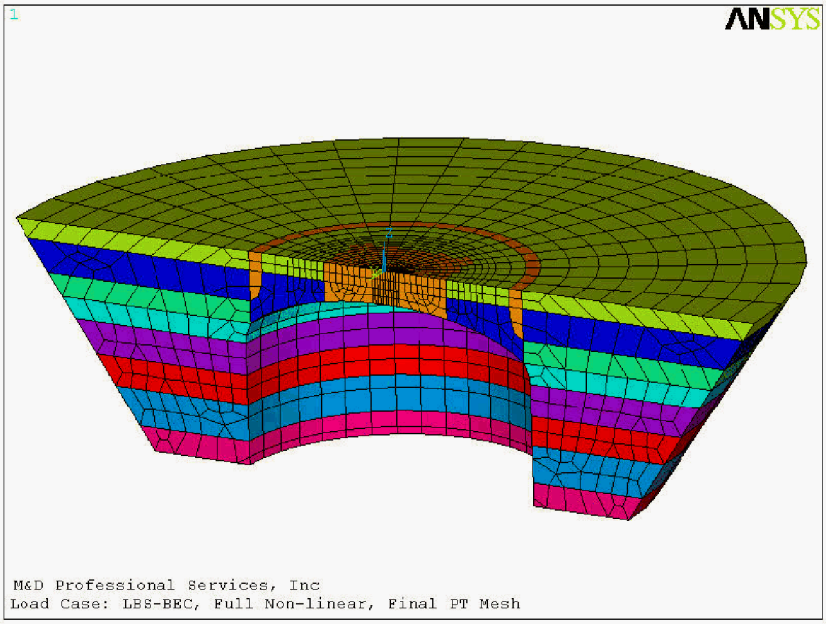


Figure 3.22. Excavated Soil Model Detail

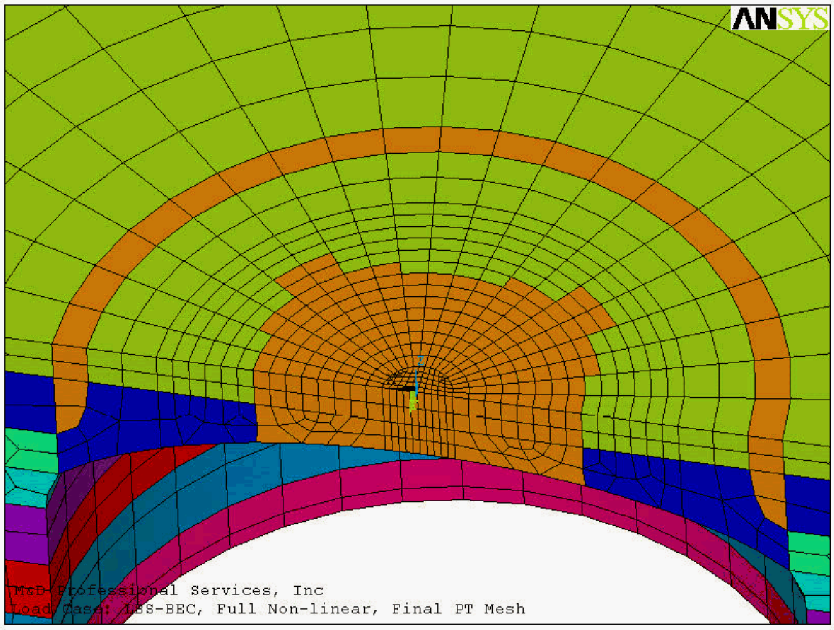


Figure 3.23. Excavated Soil - Softened Soil Zones

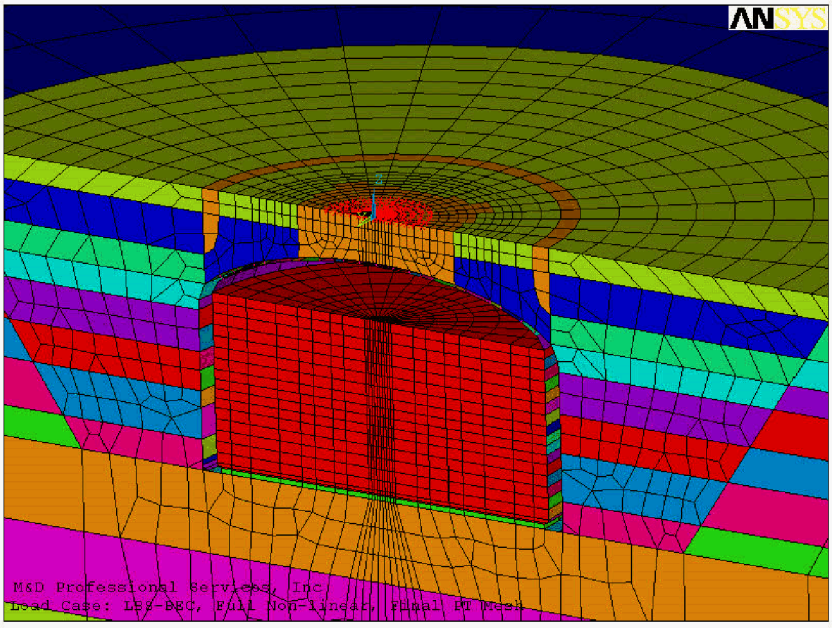


Figure 3.24. Model Detail

3.2.3 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 3.25 shows the native soil portion of the model.

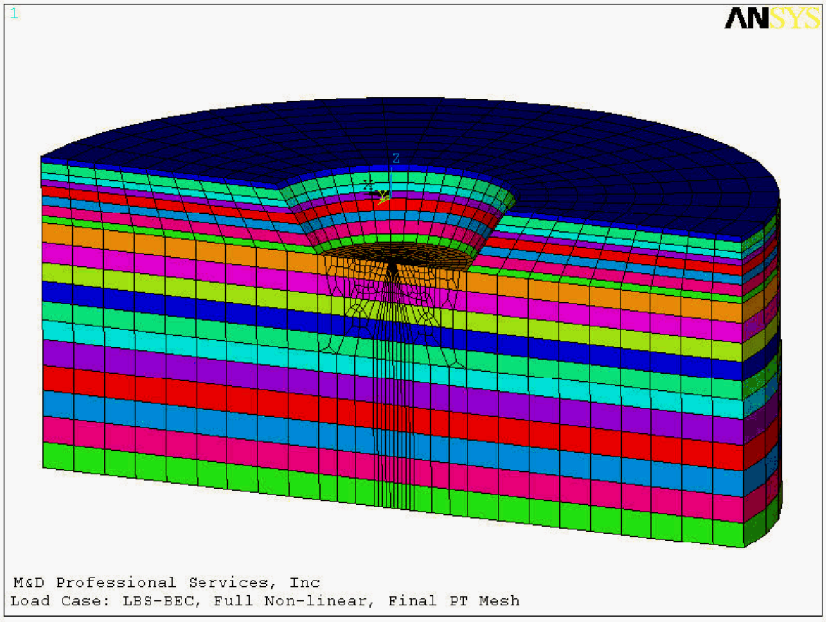


Figure 3.25. Far-Field Soil Model Detail

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 3.26 shows the locations of the link elements. Input file "Outer-Spar.txt" develops these elements.

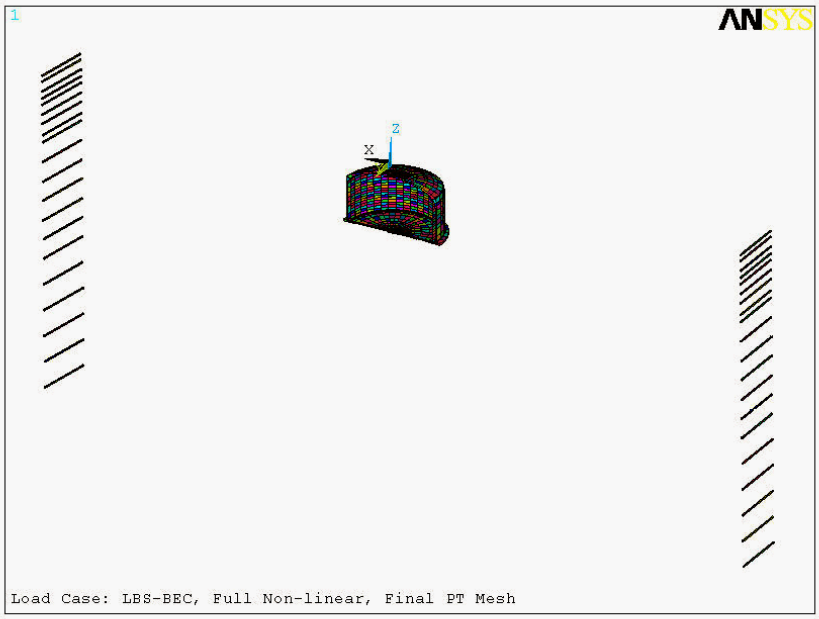


Figure 3.26. Link Elements – Edges of Soil Model

3.3 Boundary Conditions

3.3.1 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. All nodes on the bottom of the model (-266 ft) are coupled together to create a rigid foundation (see Figure 3.27). This approach is used to create the appropriate conditions for vertical and horizontal waves to pass through the model (see Figures 3.28 and 3.29). The effectiveness of this approach is documented in Abatt et al. (2006).

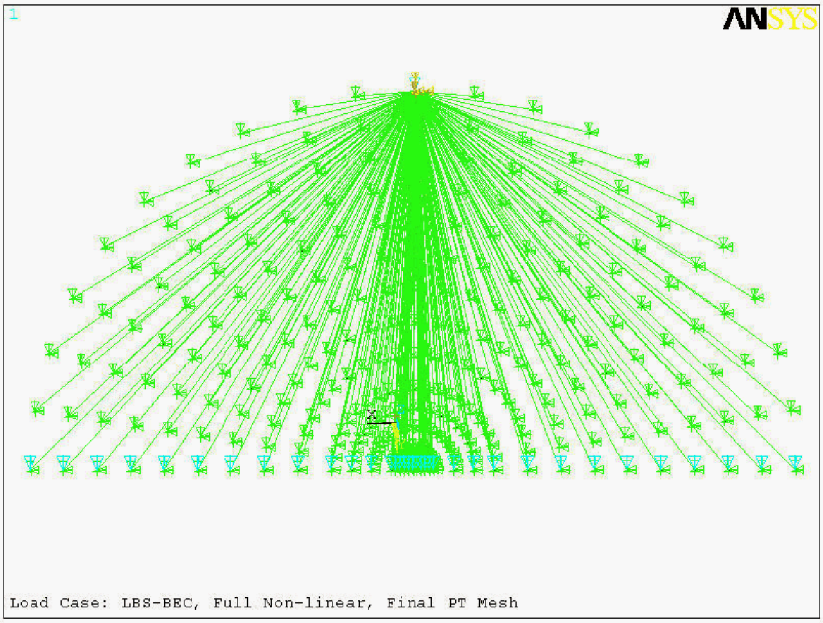


Figure 3.27. Boundary Conditions - Soil Base

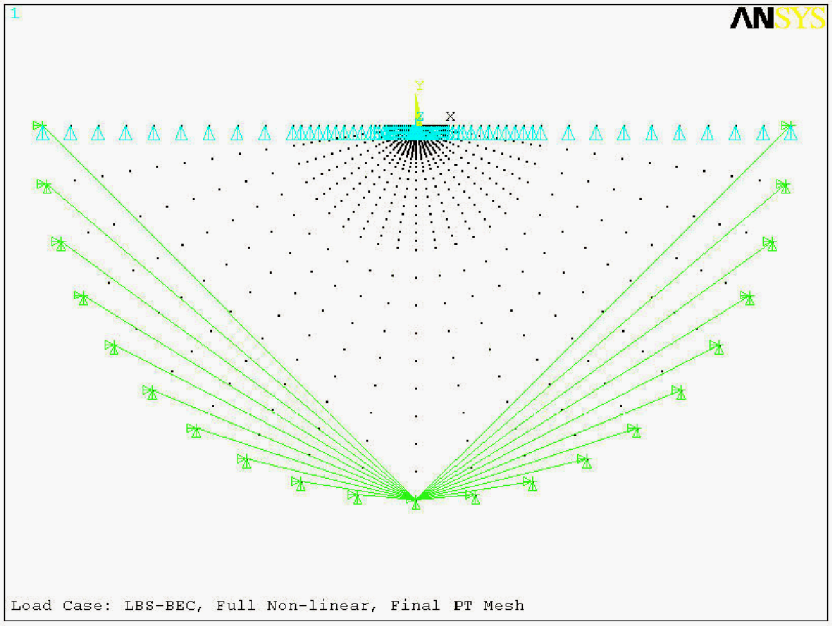


Figure 3.28. Boundary Conditions – Typical Soil Layer

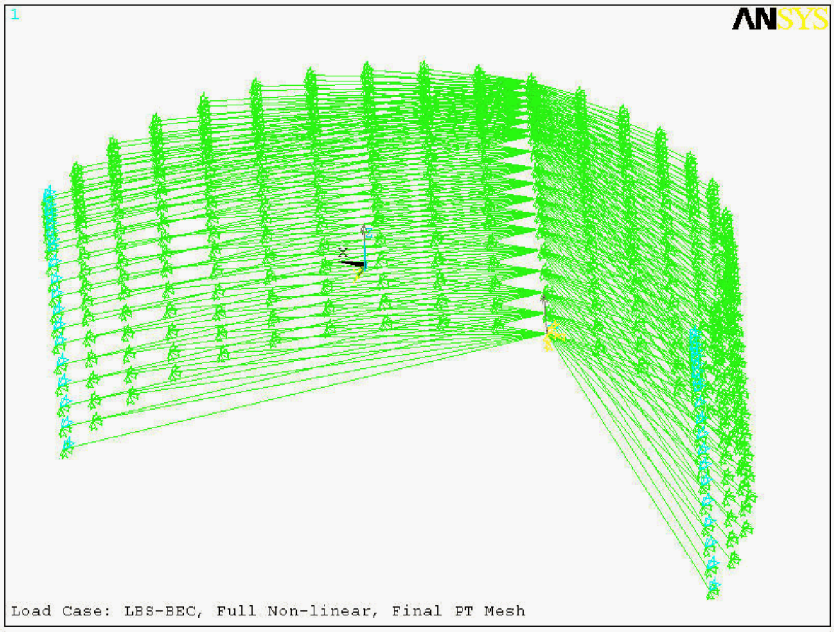


Figure 3.29. Boundary Conditions – Slaved Boundary Conditions

The symmetry plane for the soil has all nodes fixed for Y translation, see Figure 3.30.

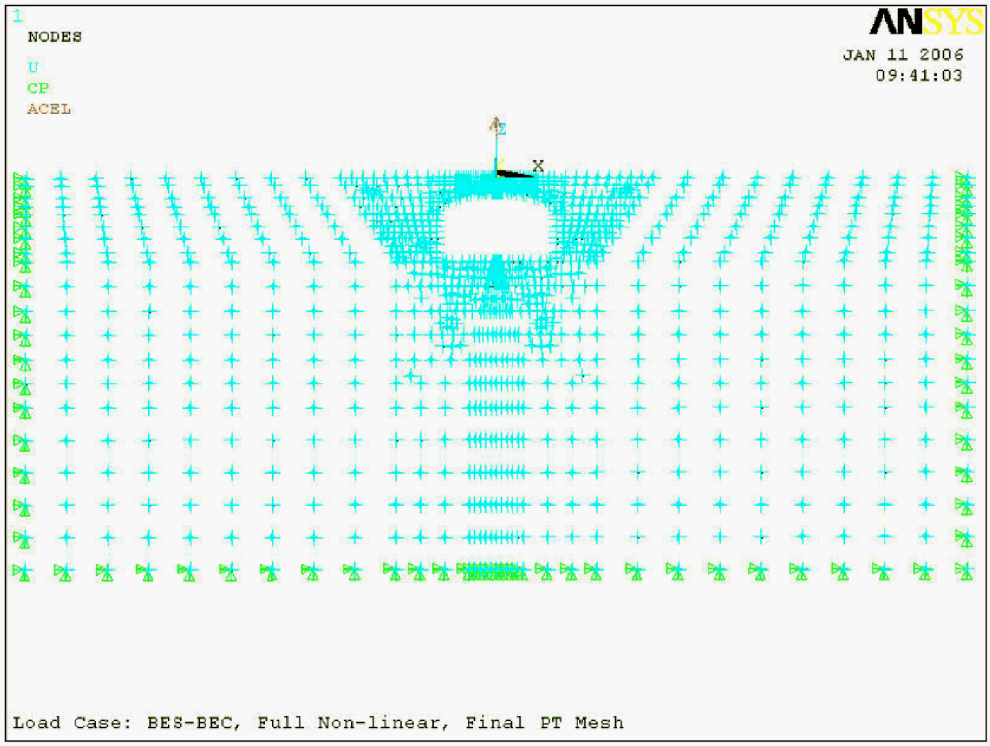


Figure 3.30. Boundary Conditions – Symmetry Plane

3.3.2 Tank Boundary Conditions

The tank model has all nodes on the symmetry plane fixed to the Y translation, X rotation and Z rotation (see Figures 3.31 and 3.32). Couples have been used between some components to ensure compatible displacements occur. Where no common nodes exist between the concrete tank and secondary liner, couples are used to control the deformation of the secondary liner where it is in contact with the concrete tank. This ensures that the secondary liner does not "pass through" the concrete on the footing and on the walls (see Figure 3.33).

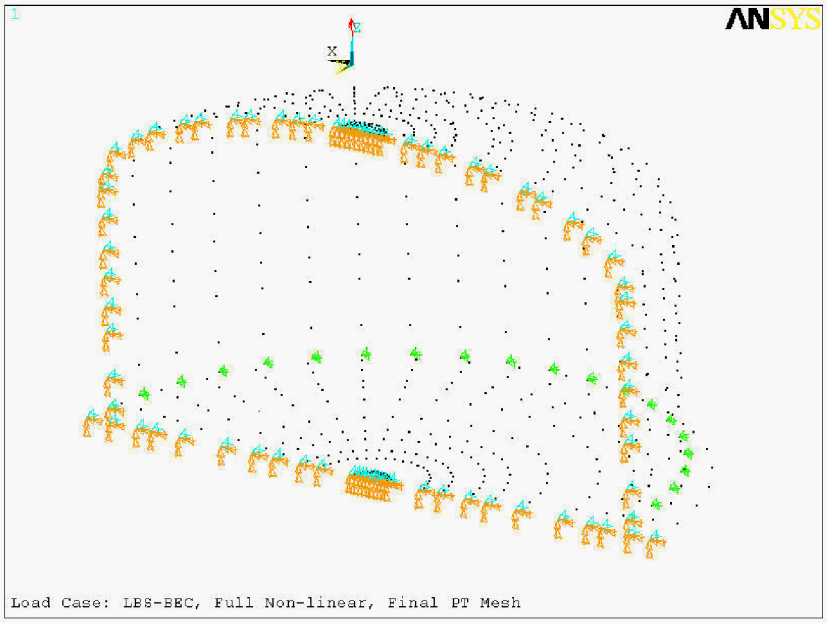


Figure 3.31. Boundary Condition – Concrete Tank

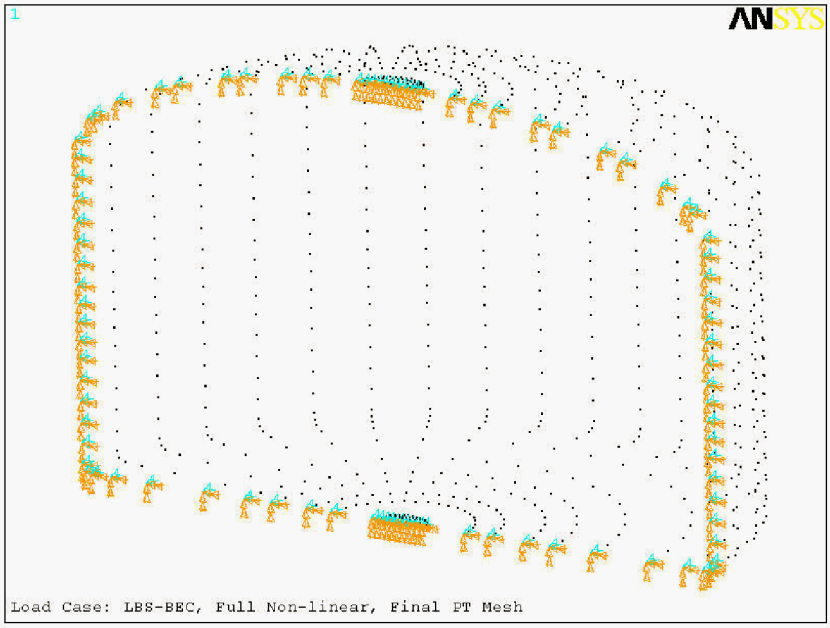


Figure 3.32. Boundary Conditions – Primary Tank

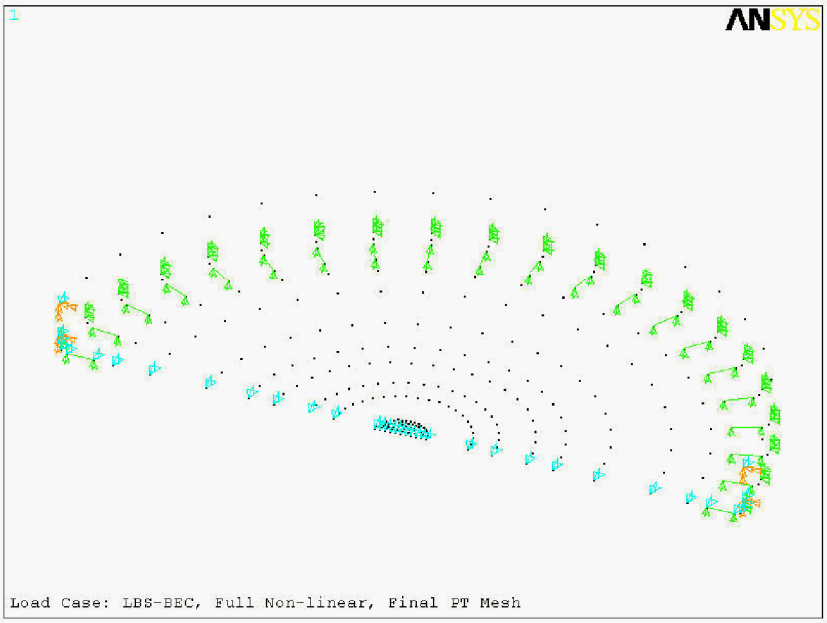


Figure 3.33. Boundary Conditions – Secondary Liner

3.4 Model Excitation

An acceleration time history extracted from SHAKE at the -266 ft level is used for the excitation of the full model. A very 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 model.

4.0 Studies

4.1 Dead Load

The purpose of the dead load study was to verify the functionality and to determine best analysis methodology for the ANSYS® detailed model. In order to verify the functionality of the detailed ANSYS® model, the dead weight results were compared to the ANSYS® Phase I model (Abatt et al. 2006) and the model as described in PNNL report (Rinker et al. 2004) from this point referred to as the TOLA model. A simpler ANSYS® model was developed and used in Abatt et al. (2006) to study using ANSYS® for SSI analysis. This simpler model is referred to at the ANSYS® Phase I model. The dead weight results from a variety of analysis methodologies were also compared to the ANSYS® Phase I and TOLA model to confirm the best analytical approach, including reduction in soil arching. The analytical approach chosen will then be used to determine the seismic only results from the ANSYS® detailed transient analyses. The seismic only results were obtained by subtracting the gravity only case from the transient (seismic plus gravity) results.

4.1.1 Model

The ANSYS® detailed model used for this dead weigh study is essentially the same as described in Section 2.1. The main difference is that, for most analyses, no contact elements are used. Instead of contact elements, stiff springs are used across the interfaces. Some of the dead weight analyses do include contact elements, but only between the concrete tank and the excavated soil. The soil and concrete tank are identical in geometry. Soil properties are the same as discussed above, but the concrete was modeled as nominal concrete which, per ACI 318-02, is 450,000 kip/ft^2 and the TOLA model uses concrete with a modulus of 731,952 kip/ft^2. For comparison, an analysis was done using the ANSYS® detailed model using the same concrete modulus as the TOLA model. The model for the primary tank and waste is less refined in the wall (i.e., fewer elements over the wall height). The ANSYS® Phase I model has the following additional differences: 1) the concrete tank floor is modeled along the centerline of each section thickness and 2) the primary tank knuckle is square and there is less refinement in the wall and floor.

4.1.2 Load Cases

A variety of load cases were examined for effects on the concrete tank forces and moments, J-Bolt forces and the primary tank stresses. Included in these load cases are variations in excavated soil to concrete tank interface properties. The following load cases were considered for this study:

Table 4.1. Dead Weight Load Case Summary

Load Case	Model Description	Excavated Soil Interface					Concrete Modulus (kip/ft2)	J-Bolts	Figure Label
		Merged	Springs	Dome Friction	Haunch Friction	Wall Friction			
1	TOLA Model	-	-	0.3	0.3	0.05	731,952	Beam Links	PNNL
2	ANSYS Phaes I Model	Y	-	-	-	-	450,000	Rigid Links	Old Geom
3	ANSYS Detailed Model	-	Stiff	-	-	-	450,000	Rigid Links	New Geom
3a	ANSYS Detailed Model	-	Stiff	-	-	-	731,952	Rigid Links	New Geom - PNNL Concrete
3b	ANSYS Detailed Model	-	Stiff	-	-	-	450,000	Beam Elements	New Geom - New Jbolts
9	ANSYS Detailed Model	-	-	0	0	0	450,000	Beam Elements	No Friction Soil
10	ANSYS Detailed Model	-	-	0	0	0.05	450,000	Beam Elements	No Dome Friction Soil
11	ANSYS Detailed Model	-	-	0.3	0	0	450,000	Beam Elements	No Wall Friciton Soil
12	ANSYS Detailed Model	-	-	0.3	0.3	0.05	450,000	Beam Elements	Low Soil Friction - Haunch Friciton 0.30
12a	ANSYS Detailed Model	-	-	0.3	0.05	0.05	450,000	Beam Elements	Low Soil Friction - Haunch Friciton 0.05
13	ANSYS Detailed Model	-	-	1	1	1	450,000	Beam Elements	High Friction Soil
14	ANSYS Detailed Model (Element Birtn & Death)	-	Soft	-	-	-	450,000	Rigid Links	B&D Spr Soil

In the table above the column headers are as follows:

- Model – Model used for the analysis
- Excavated Soil Interface – method which the excavated soil/concrete tank interface is connected.
  - Merged – coincident excavated soil and concrete tank nodes are merged
  - Springs – spring elements connect coincident excavated soil and concrete tank nodes in all three component directions.
  - Dome Friction – Friction coefficient used on the concrete tank dome
  - Haunch Friction – Friction coefficient used on the concrete tank haunch
  - Wall Friction – Friction coefficient used on the concrete tank wall
- Concrete Modulus – the elastic modulus of the concrete in kip/ft^2

- J-Bolts – the modeling of the J-Bolts varied in the ANSYS® Phase I and II models to ensure that a shear connection was maintained and moments were not transferred to the primary tank.
    - Rigid links – beam elements with rotational degrees of freedom released on the end attaching to the primary tank
    - Beam Elements – in the locations of the J-Bolts, the primary tank had coincident, duplicate nodes. Beam elements were used to connect the concrete tank to one set of the coincident nodes, and spring elements were used between the coincident nodes.
    - Beam Links – the TOLA model used beam elements to link the concrete tank to the primary tank

- Figure Label – provides the labels used for comparison graphs

The analysis done with element birth and death simulates the construction sequence in a four-step process. The first step includes all the native soil, and an empty double shell tank. The second step adds the excavated soil in contact with the walls only. The vertical spring stiffness for the interface elements between the soil and concrete tank are softened, to 1e4 to allow for "sliding" and to prevent the soil drag from adding load to the walls and basemat footing. The third step was to add the excavated soil over the dome. The horizontal component springs were made soft to allow for sliding. The fourth step was to add the waste elements to the model as well as the live load over the dome apex.

4.1.3 Results

Results from the concrete tank elements, primary tank elements, and J-Bolts were extracted and evaluated. Concrete tank forces and moments, primary tank stresses, and J-Bolt forces are compared against the TOLA model and the ANSYS® Phase I Model. A preliminary evaluation of soil tension was done on each model to determine which methodology provides the best solution.

4.1.3.1 Concrete Tank Results and Conclusions

The concrete tank forces and moments from load cases 1, 2, 3, 3a, 3b, 12a and 14 are compared in Figures 4.1 through 4.4. Friction parameters were varied on the concrete tank dome, haunch and wall in load cases 9, 10, 11, 12,12a and 13 and the concrete tank forces and moments are a compared in Figures 4.5 through 4.8. See Table 4.1 for the description and labels associated with of these load cases.

The concrete tank meridional forces were compared in Figure 4.1, and provide some interesting trends. It can be seen that the use of element birth and death closely emulates the results obtained from the TOLA model. Changing the concrete modulus (from the nominal high strength value of 450,000 kip/ft^2 to the TOLA model value of 731,952 kip/ft^2) has a significant effect of the meridional forces in the dome, haunch. It can also be seen that there is very little difference between the ANSYS® Phase I and detailed model results. Including friction elements between the concrete tank and the excavated soil does not have a significant impact on the meridional forces. The largest impact occurs in the dome, haunch and wall, where it appears to have similar results as TOLA model and element birth and death. The variables considered do appear to have some effect on the concrete tank meridional forces but, other than in the dome, the ANSYS® detailed model predicts higher forces.

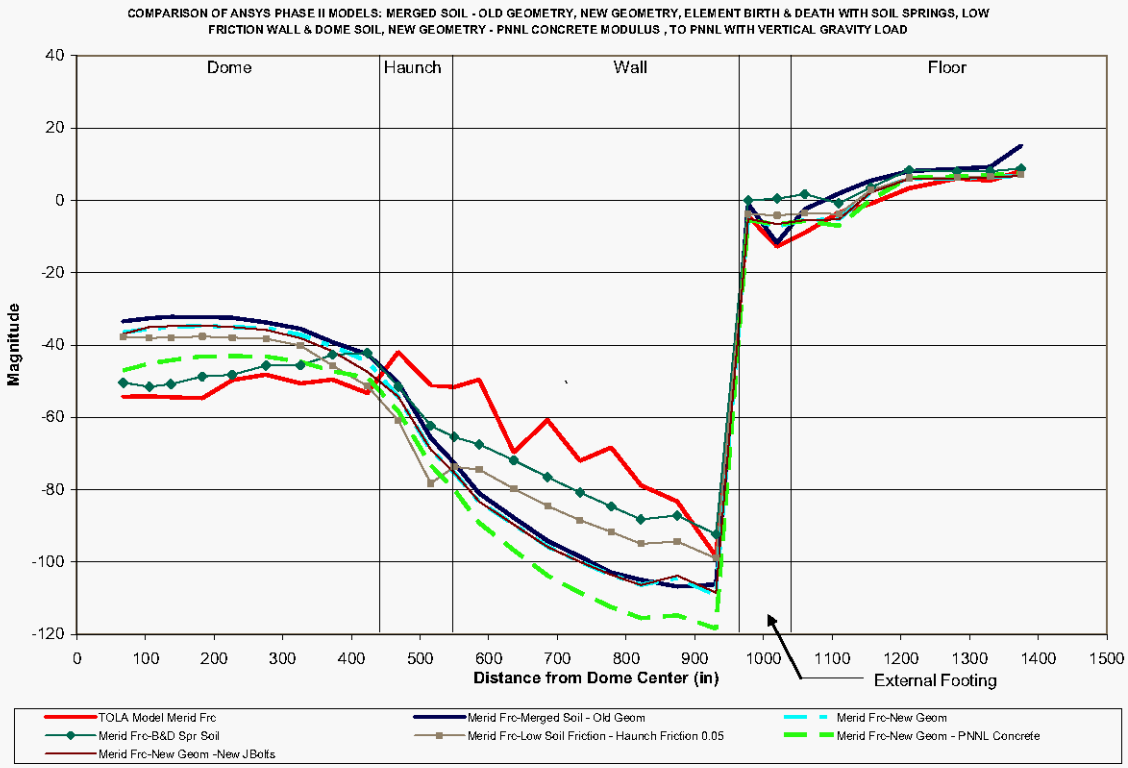


Figure 4.1. Concrete Tank Meridional Force Comparison

Figure 4.2 provides results for the concrete tank hoop forces. The general trends for hoop forces are very similar to those for the meridional forces, with TOLA model results and element birth and death being the most similar. Unlike the meridional forces, there seems to be almost no difference through the entire path between the analyses.

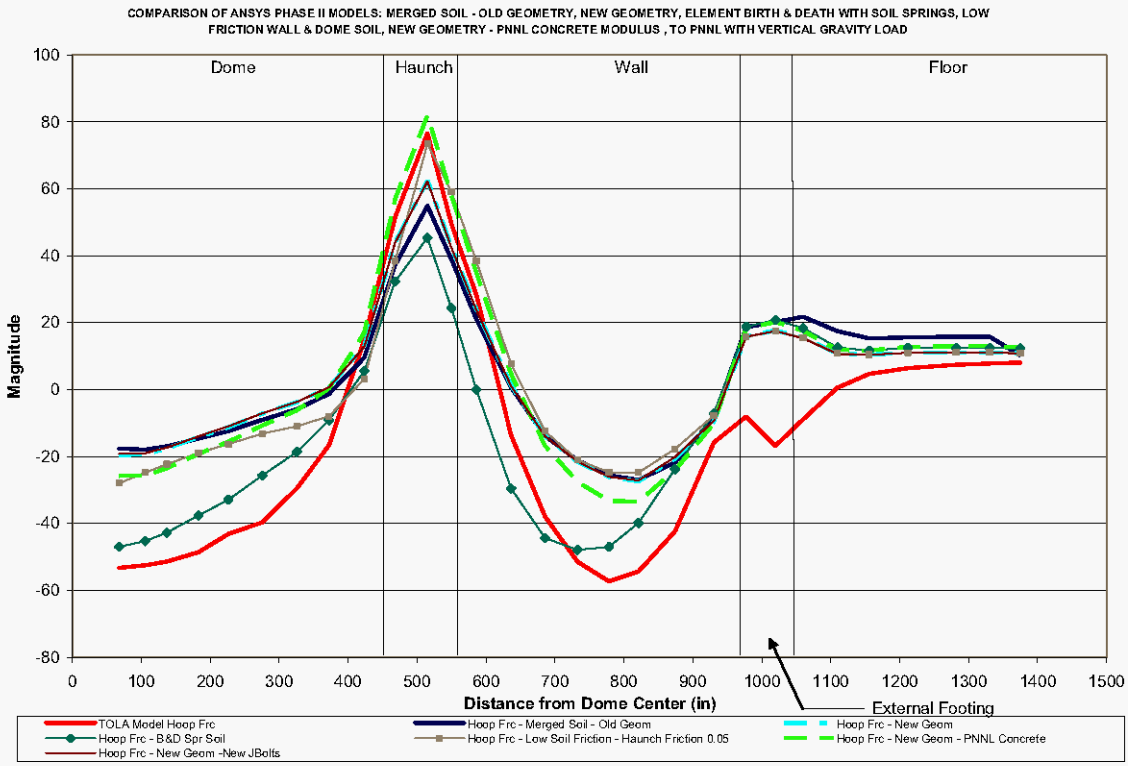


Figure 4.2. Concrete Tank Hoop Force Comparison

The concrete tank meridional and hoop moments were also evaluated and compared for the various analyses. The meridional moments in Figure 4.3 are all very similar, except at the interface between the base of the concrete tank wall and the basemat footing. The TOLA model predicts a higher meridional moment. This is attributed to the fact that the Phase I and detailed models model the concrete tank as shells (SHELL143) instead of solids like the TOLA model. The forces and moments for shells are extracted at the center of the element, and forces and moments for solids are extracted at the nodes. As a result, the M&D Phase I and detailed models are not extracting results at the same location and not capturing the peak directly under the base of the wall. If the trend lines of the ANSYS® Phase I and detailed models are extended as shown in the figure as long dash-dot-dot bright blue lines, the results are more closely matched, with the TOLA model. The hoop moments in Figure 4.4, are also very similar irregardless of solution methodology, except in the haunch. The haunch is different due to the selection of which elements are considered to have the dome coefficient of friction 0.30 and which elements are part of the wall and receive the 0.05 friction coefficient. A more detailed discussion of the effects of varying friction parameters is discussed below.

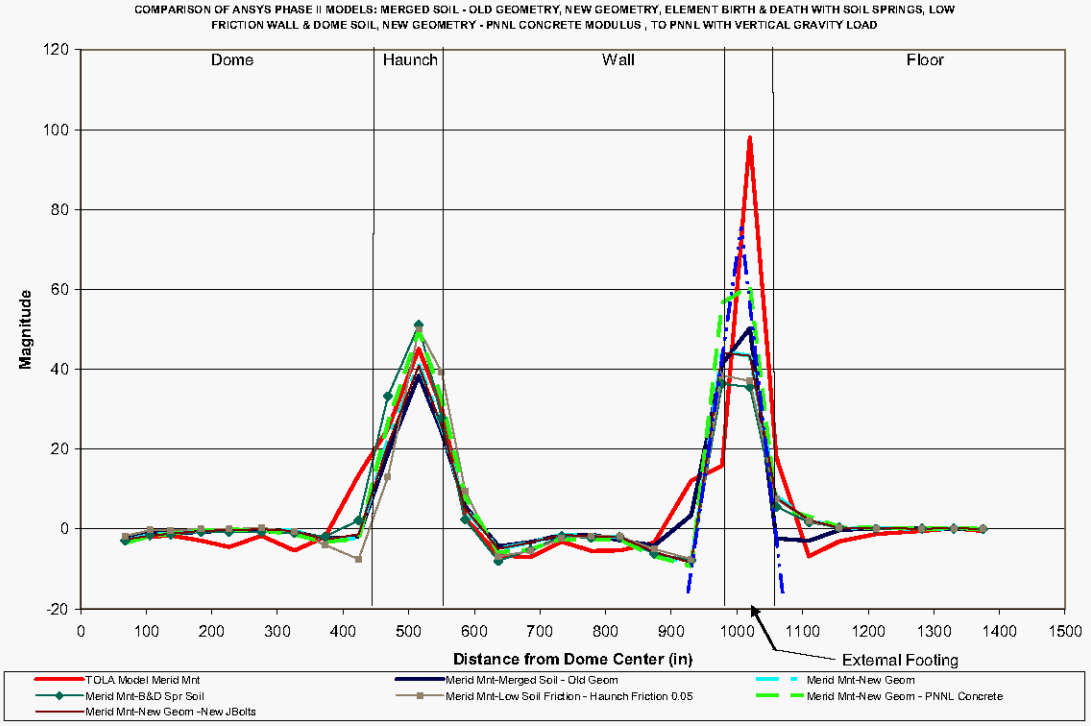


Figure 4.3. Concrete Tank Meridional Force Comparison

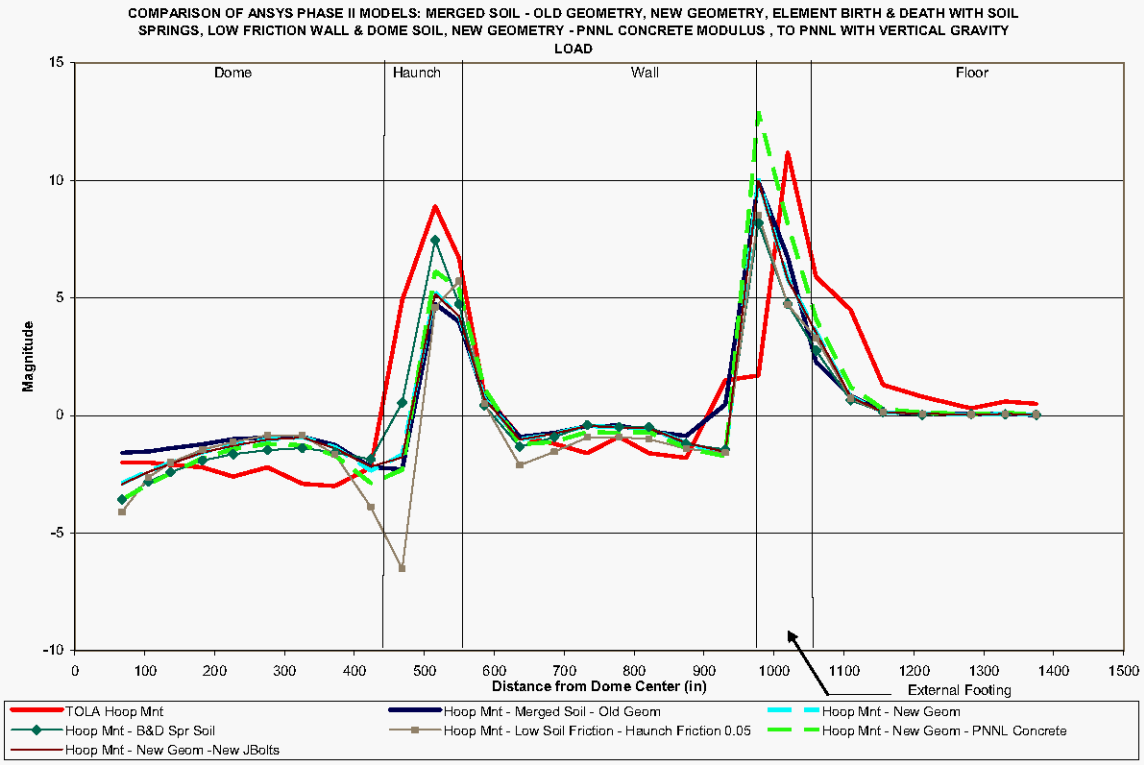


Figure 4.4. Concrete Tank Hoop Moment Comparison

The meridional and hoop forces extracted from analyses done varying the friction coefficients from Figures 4.5 and 4.6, respectively, show several trends. It can be seen that, any dome friction coefficient value other than zero, yields approximately the same meridional and hoop forces. The TOLA model predicts a meridional force that is nearly halfway in-between any friction coefficient and frictionless. Hoop forces also show that any dome friction (between the tried 0.30 and 1.0) appears to yield very consistent results. The hoop force results for a frictionless dome are very similar to the TOLA model results. Changing the wall friction coefficient changes the meridional forces in the wall, with zero friction forces being almost the same from top to bottom of the wall. It is also evident that increasing the wall friction coefficient increases the meridional forces going down the wall. The wall friction coefficient has almost no effect on the wall hoop forces. The variation of wall and dome friction coefficients has little effect on the basemat meridional and hoop forces.

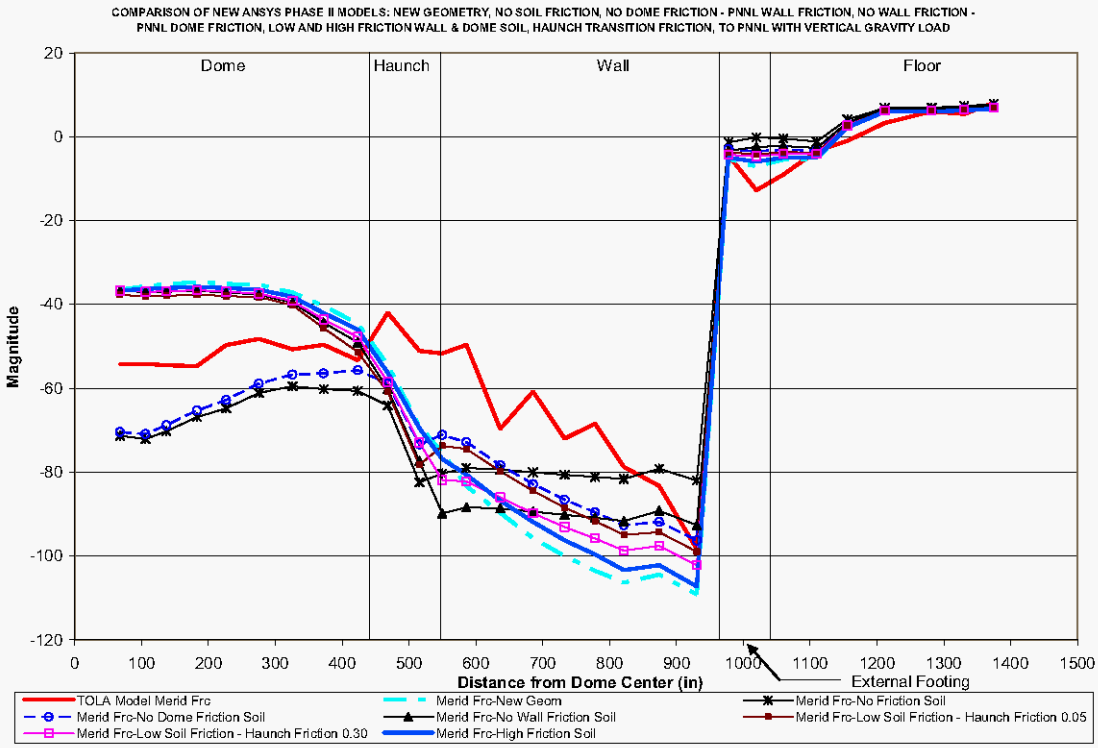


Figure 4.5. Concrete Tank Meridional Force Friction Parameter Comparison

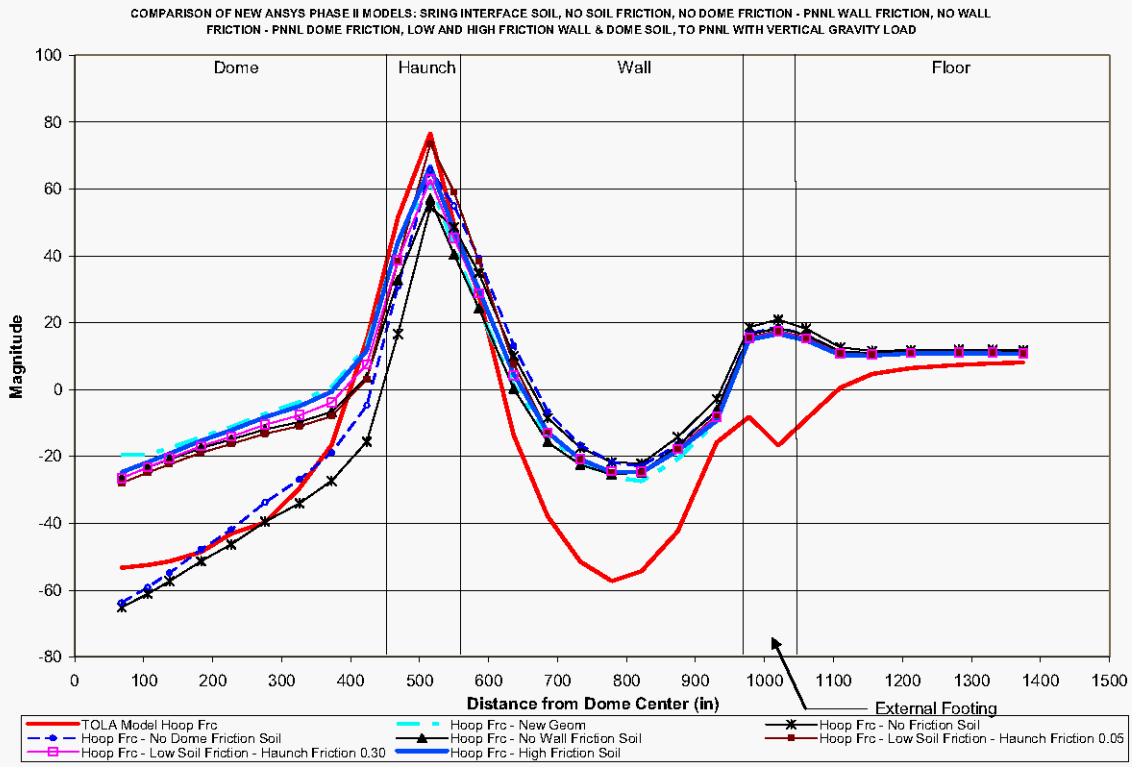


Figure 4.6. Concrete Tank Hoop Force Friction Parameter Comparison

The meridional and hoop moments for the concrete tank are presented in Figures 4.7 and 4.8, respectively. The meridional moments are consistent irregardless of friction coefficient used, except for at the interface between the wall and the external basemat footing. At this location, increasing the friction coefficient increases the meridional moment. There is virtually no difference between frictionless, a 1.0 friction coefficient, and the detailed linear model using stiff springs. Projecting the maximum footing meridional moment due to the previously discuss modeling differences using a green long dash-dot-dot line, there is a nearly 30% increase in meridional moments between the TOLA model and the detailed linear model. Hoop moments are a little more sensitive to changes in friction coefficients, especially at the haunch. There is around a 56% increase in hoop moment in the haunch based on the friction coefficient used for the haunch, with the largest negative hoop moment being -6.5 kip*ft/ft corresponding to using the wall friction coefficient of 0.05. The detailed model predicts a lower positive haunch hoop moment than does the TOLA model.

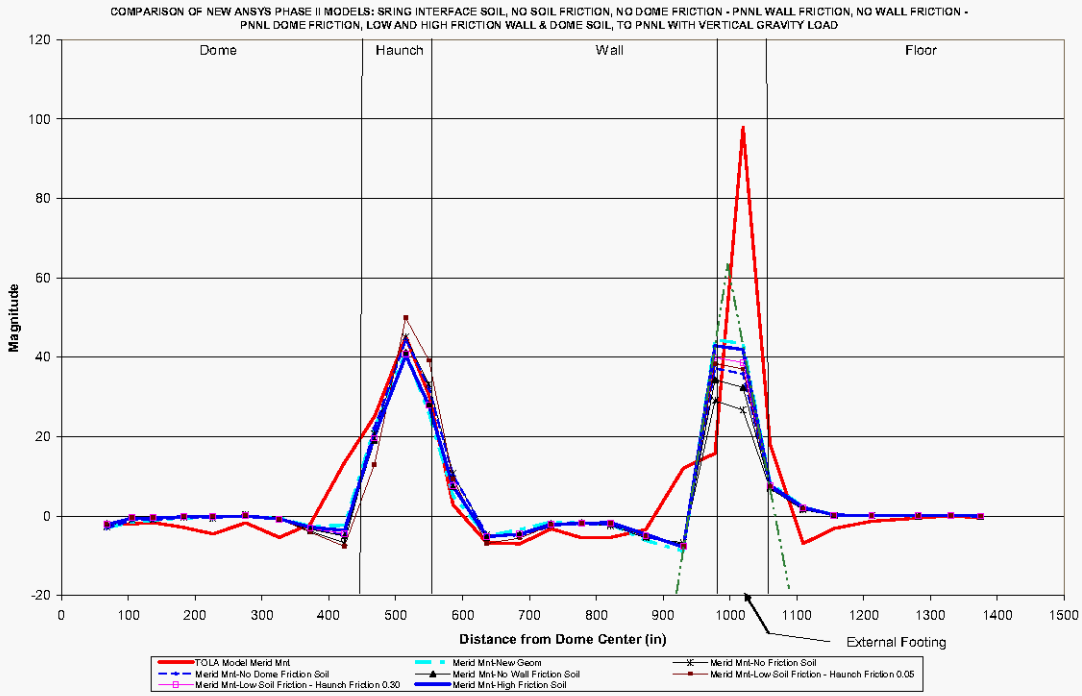


Figure 4.7. Concrete Tank Meridional Moment Friction Parameter Comparison

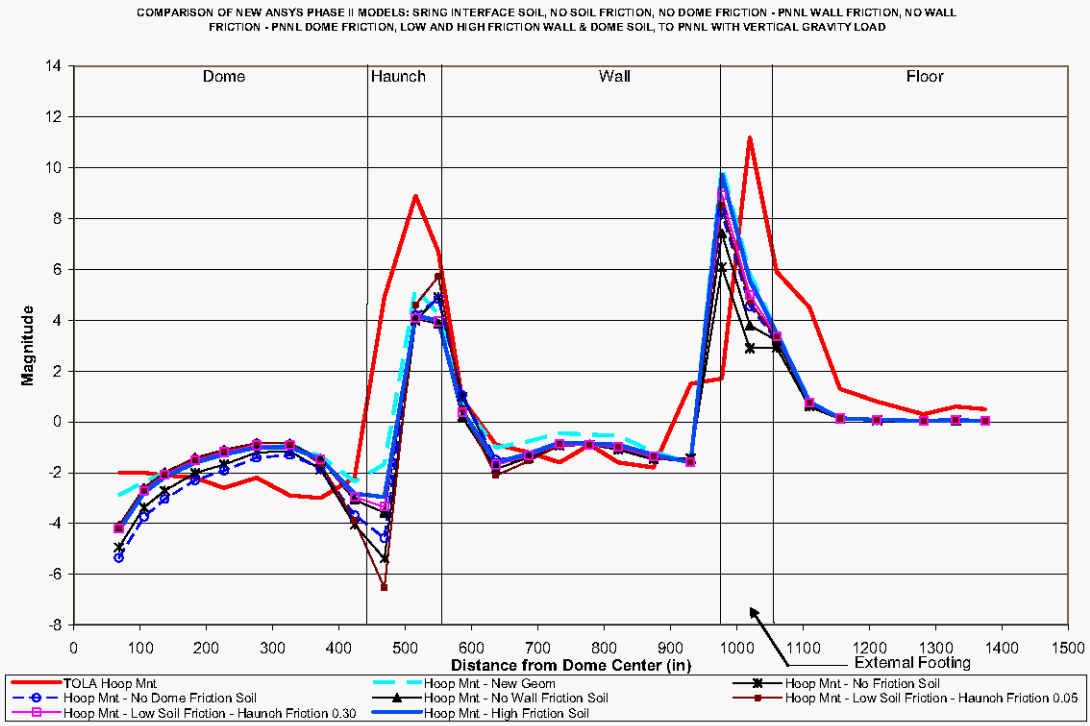


Figure 4.8. Concrete Tank Hoop Moment Friction Parameter Comparison

The concrete tank forces and moments were analyzed using a variety of analysis methods and component parameters, and were presented in Figures 4.1 through 4.8. Based on the results obtained from these analyses, the TOLA model friction coefficients should be used with the transition from the dome coefficient to the wall coefficient before the haunch. The remainder of the analysis methodologies, except element birth and death meridional forces, and parameters had little influence on the forces and moments. Element birth and death did change the meridional forces to more closely match the TOLA model results. Element birth and death is not considered an acceptable analysis alternative at this point due to difficulties in running non-linear seismic analyses. As a result of the review of the concrete tank forces and moments, the best overall methodology is to use the ANSYS® detailed model with the haunch having a 0.05 friction coefficient.

4.1.3.2 Primary Tank Results and Conclusions

The primary tank stresses for the shell top, middle and bottom surfaces from load cases 1, 2, 3, 3a, 3b, 12a and 14 are compared in Figures 4.9 through 4.14. Friction parameters were varied on the concrete tank dome, haunch and wall in load cases 9, 10, 11, 12,12a and 13 and the concrete tank forces and moments are a compared in Figures 4.5 through 4.8. All primary tank stresses presented in these graphs are summarized as absolute values. See Table 4.1 for the description and labels associated with of these load cases.

Comparing the outside, middle and inside surface meridional stresses shown in Figures 4.9, 4.11 and 4.13, there are several trends that become apparent. From these figures, it is apparent that the ANSYS® Phase I linear model does not properly determine the meridional stresses in the primary tank, and therefore will be ignored for this comparison. Considering the remaining models and methodologies, it can be seen that the meridional stresses are nearly identical for the inside and outside surface. The TOLA model predicts a significantly higher meridional stress in the knuckle and a slightly higher stress prior to the haunch and in the middle of the wall than all of the ANSYS® detailed models. All other variables considered here do not have a significant effect of the meridional force.

Results for the primary tank hoop forces on the outside, middle and inside shell surfaces from Figures 4.10, 4.12 and 4.14, respectively. The general trends for hoop forces are very similar to those for the meridional forces, with TOLA model results and all of the ANSYS® detailed models providing very similar results. There seems to be almost no difference in meridional stresses along the path between all of the models considered.

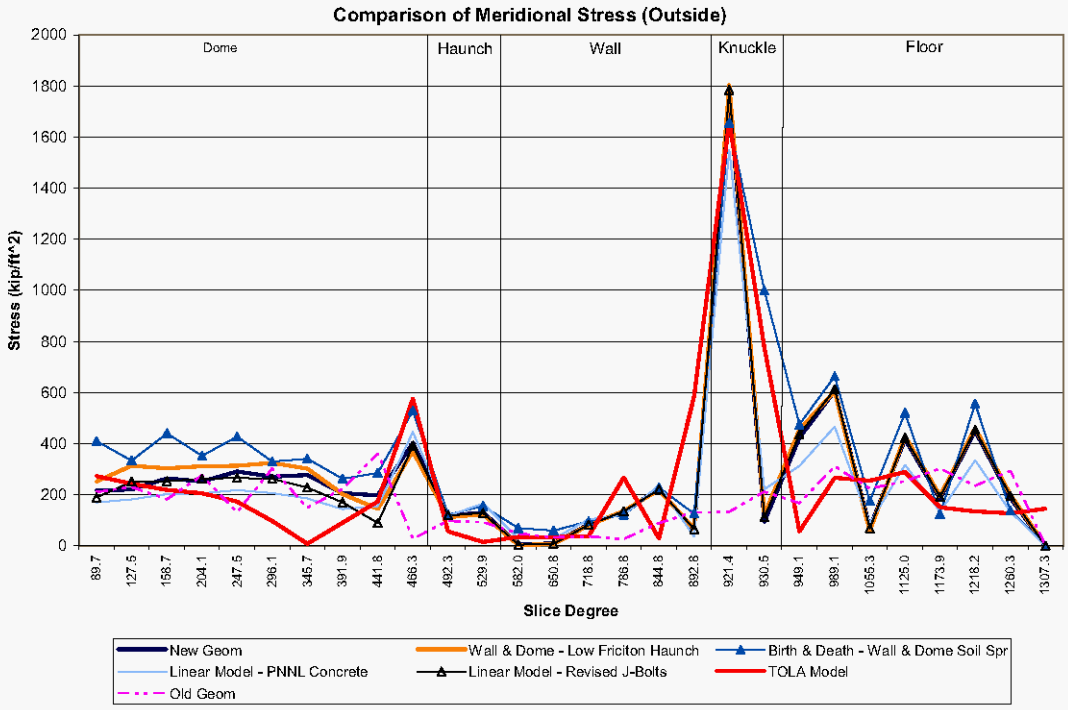


Figure 4.9. Primary Tank Meridional Stress Comparison – Outside Surface (Away from Waste)

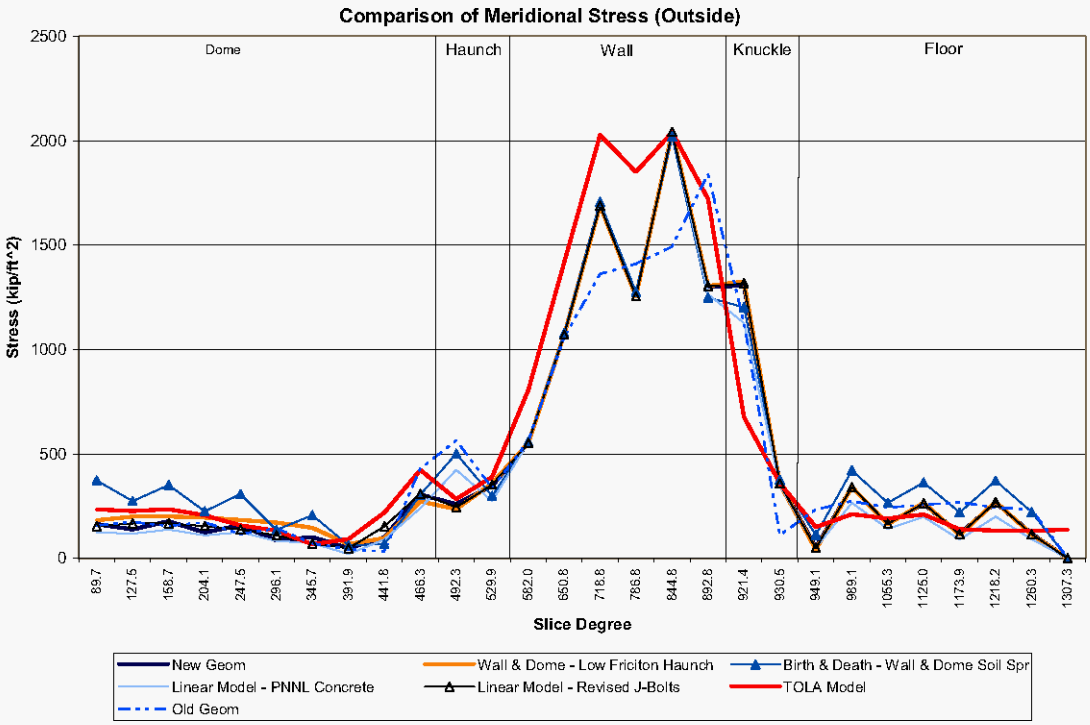


Figure 4.10. Primary Tank Hoop Stress Comparison – Outside Surface (Away from Waste)

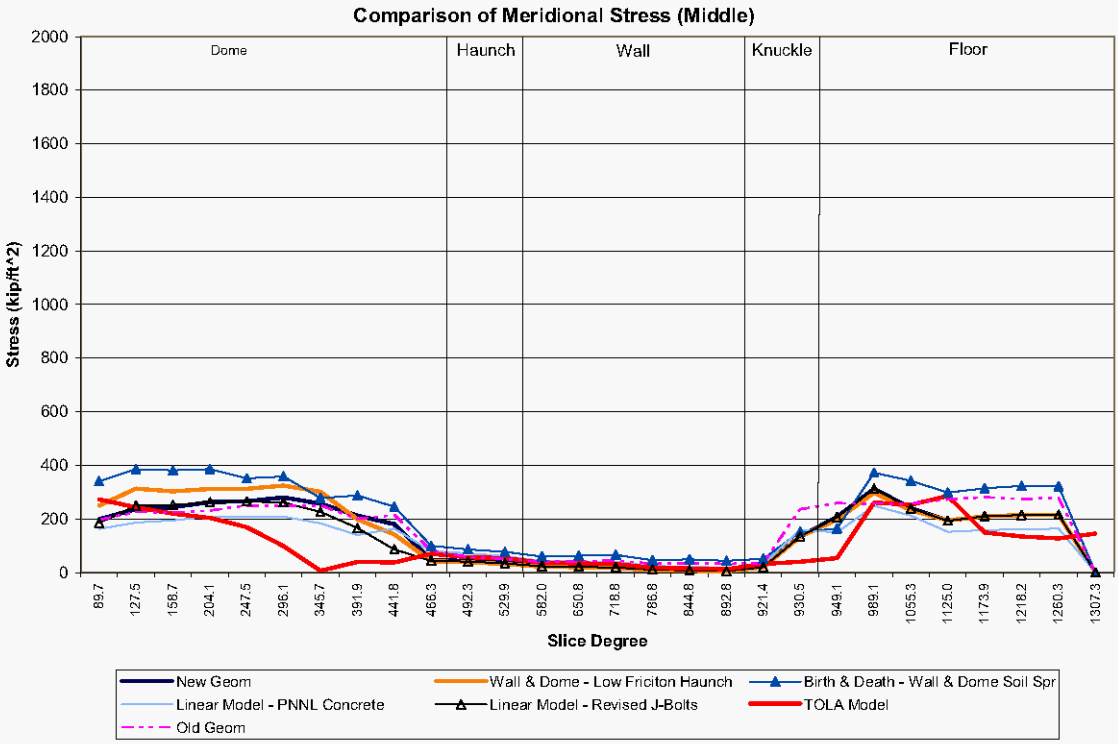


Figure 4.11. Primary Tank Meridional Stress Comparison – Middle Surface

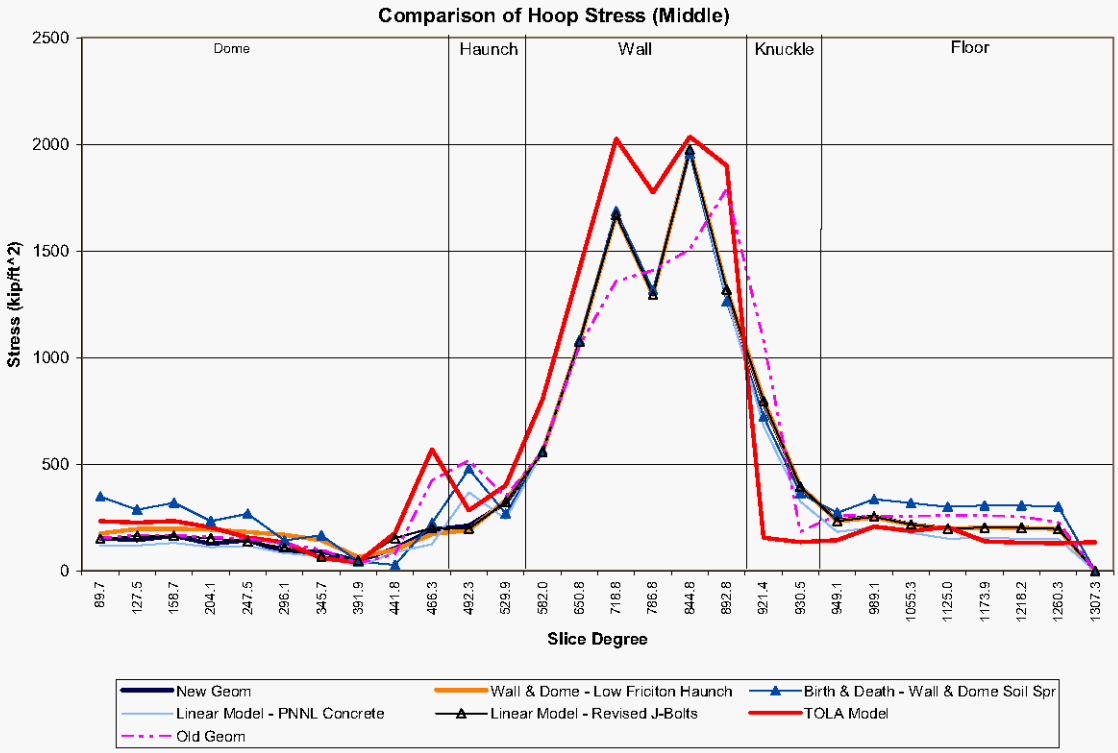


Figure 4.12. Primary Tank Hoop Stress Comparison – Middle Surface

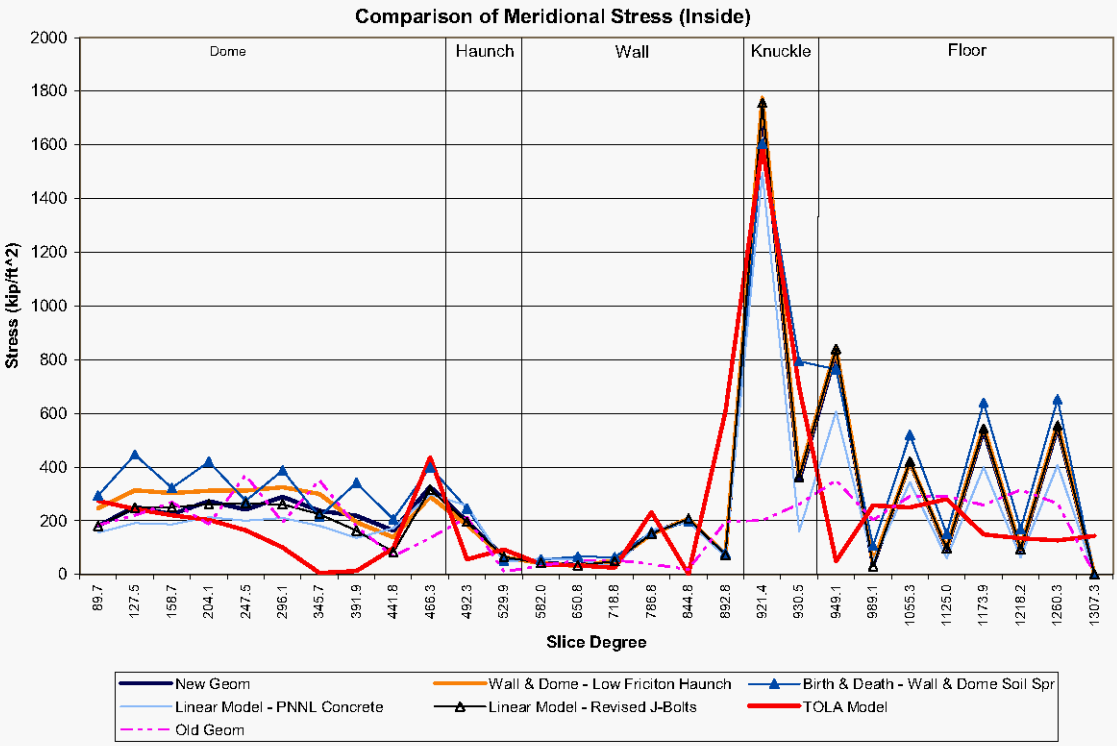


Figure 4.13. Primary Tank Meridional Stress Comparison – Inside Surface (Near Waste)

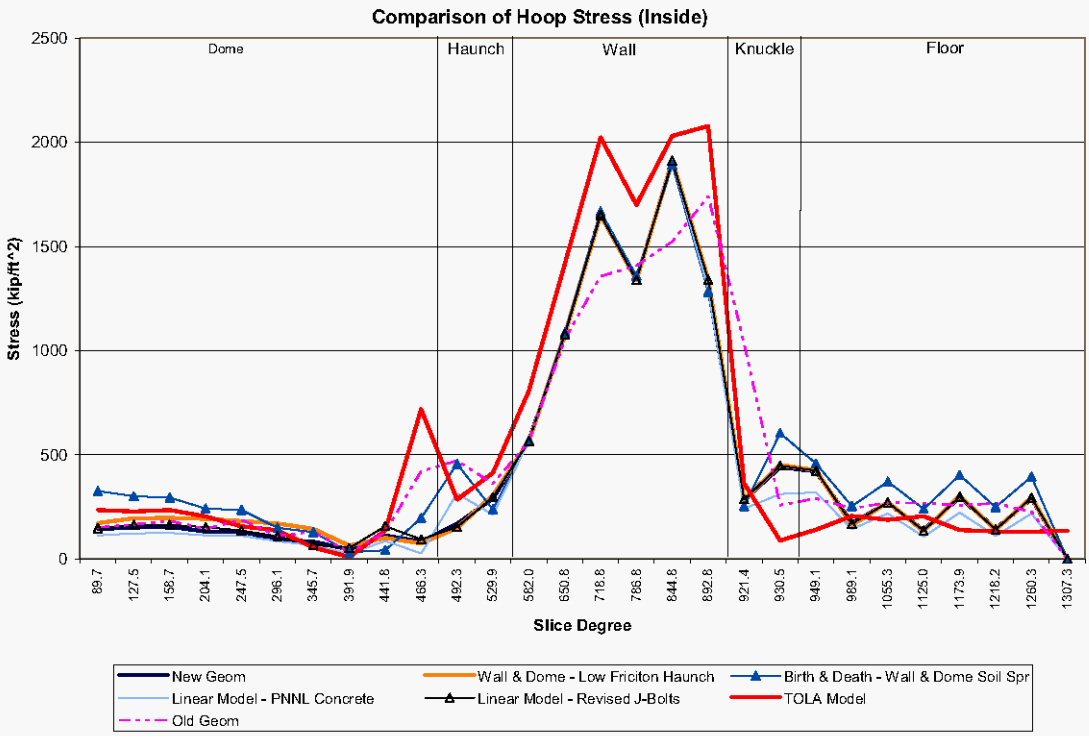


Figure 4.14. Primary Tank Hoop Stress Comparison – Inside Surface (Near Waste)

Several different frictionless gap element studies were done during the dead weight analyses. For a detailed description of the friction coefficient parameters, see Table 4.1 above. Figures 4.15 through 4.20 provide a friction effect comparison for meridional and hoop stresses for the outside, middle and inside shell surfaces. After reviewing the figures below, it is apparent that the variation in friction coefficient and friction coefficient transition location has no apparent impact on meridional and hoop stresses for the primary tank.

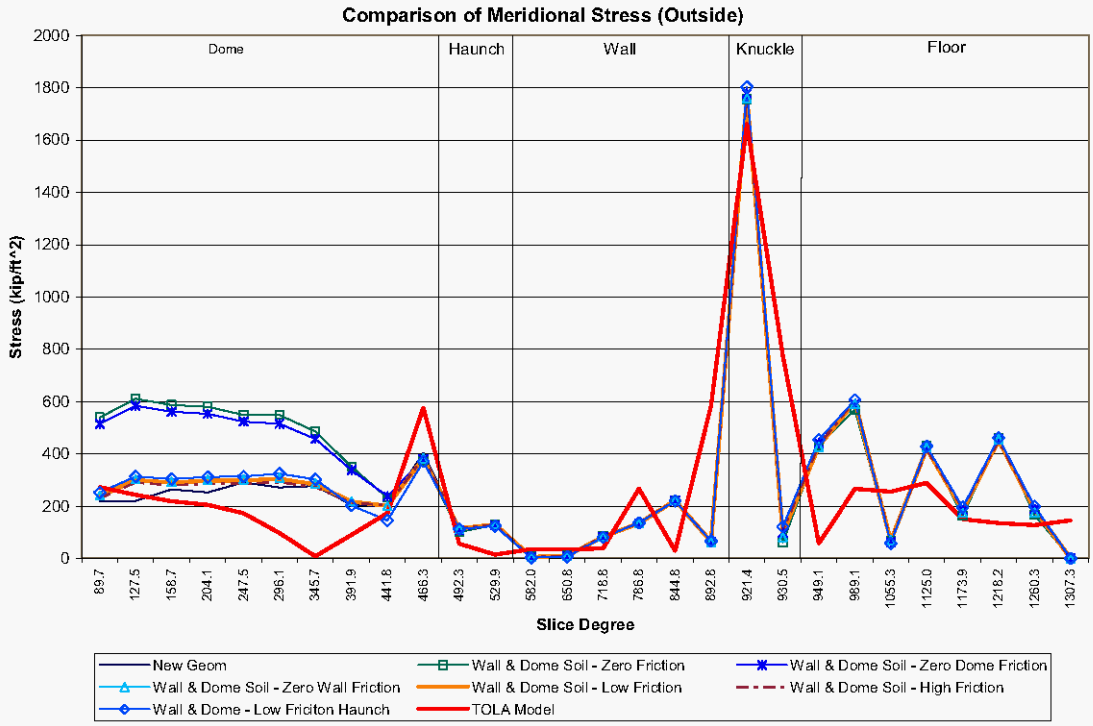


Figure 4.15. Primary Tank Meridional Stress Comparison Friction Variation – Outside Surface (Away from Waste)

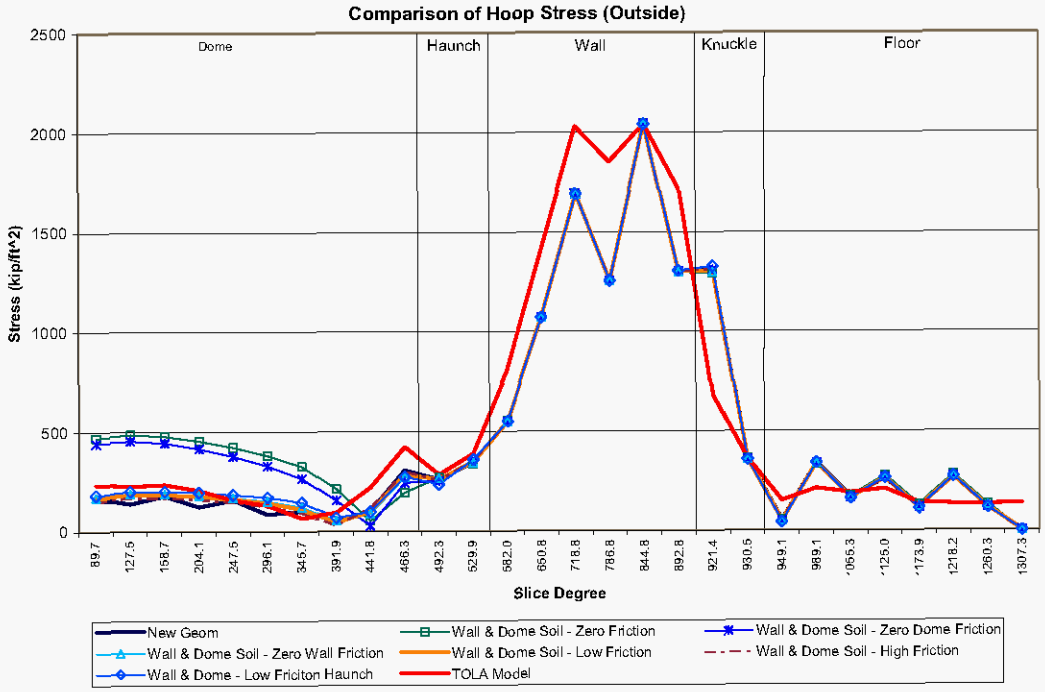


Figure 4.16. Primary Tank Hoop Stress Comparison Friction Variation – Outside Surface (Away from Waste)

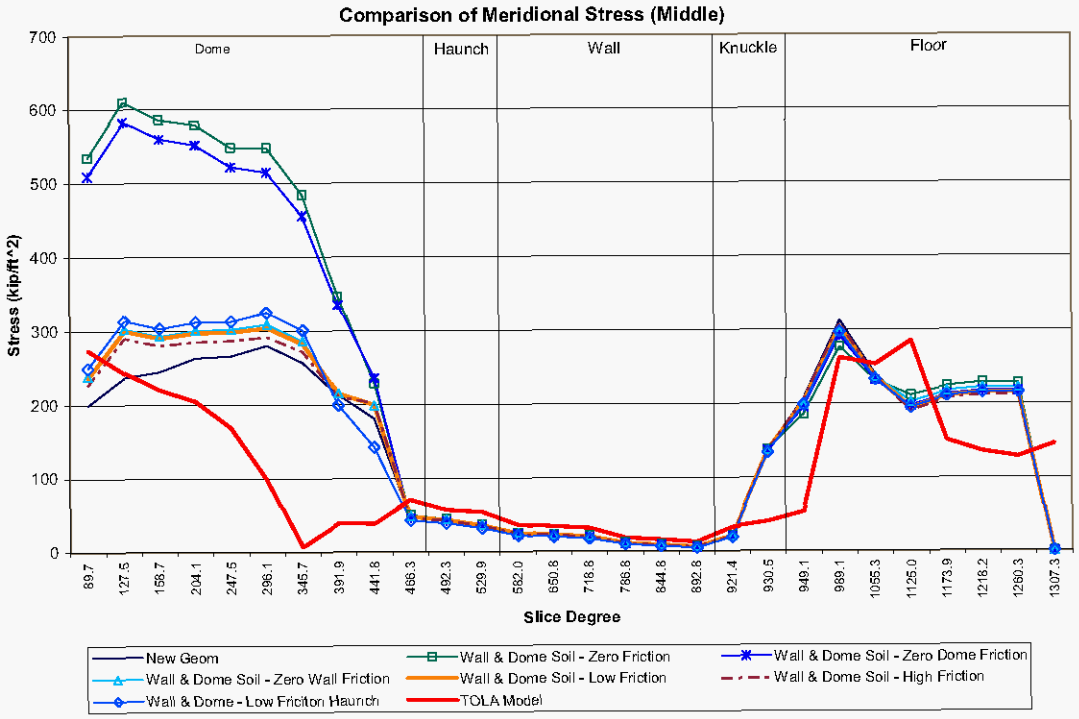


Figure 4.17. Primary Tank Meridional Stress Comparison Friction Variation – Middle Surface

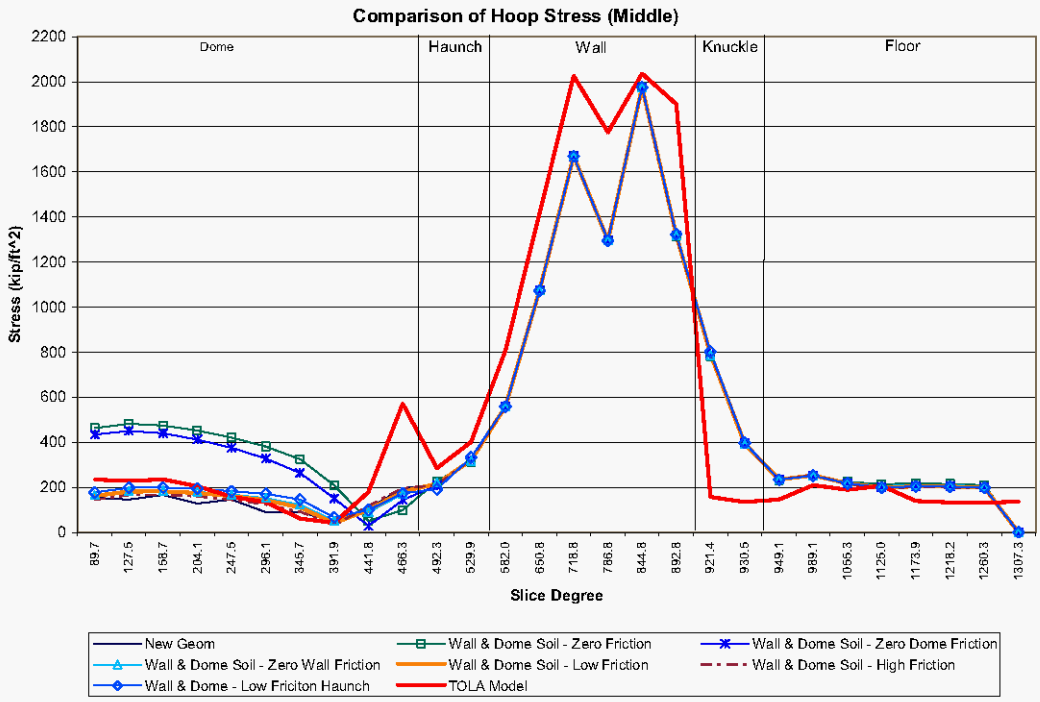


Figure 4.18. Primary Tank Hoop Stress Comparison Friction Variation – Middle Surface

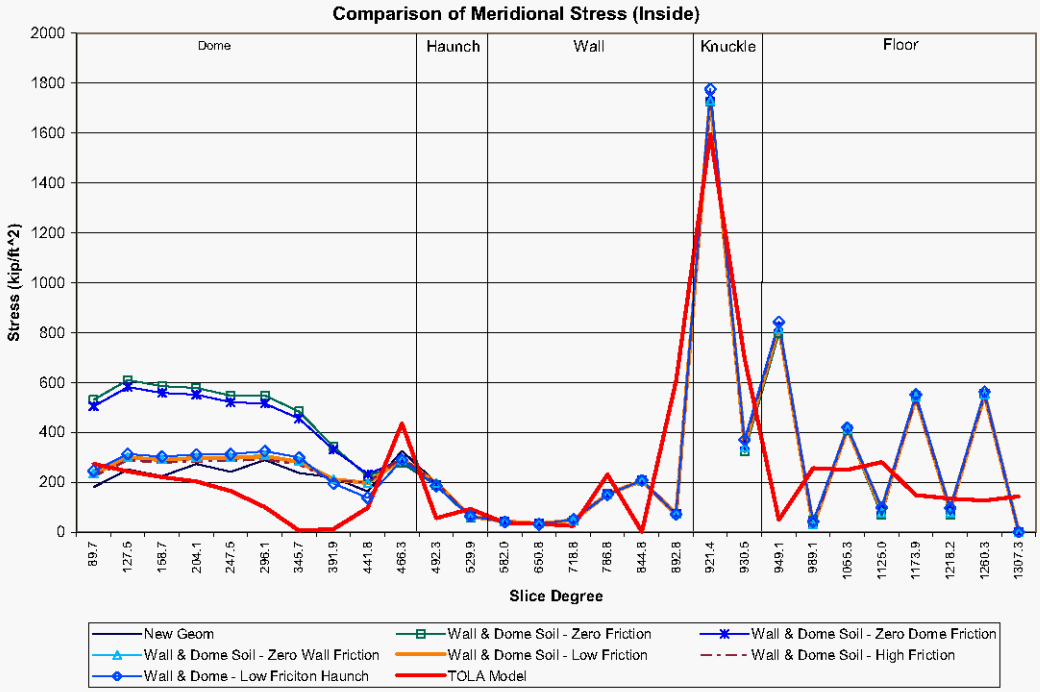


Figure 4.19. Primary Tank Meridional Stress Comparison Friction Variation – Inside Surface (Near Waste)

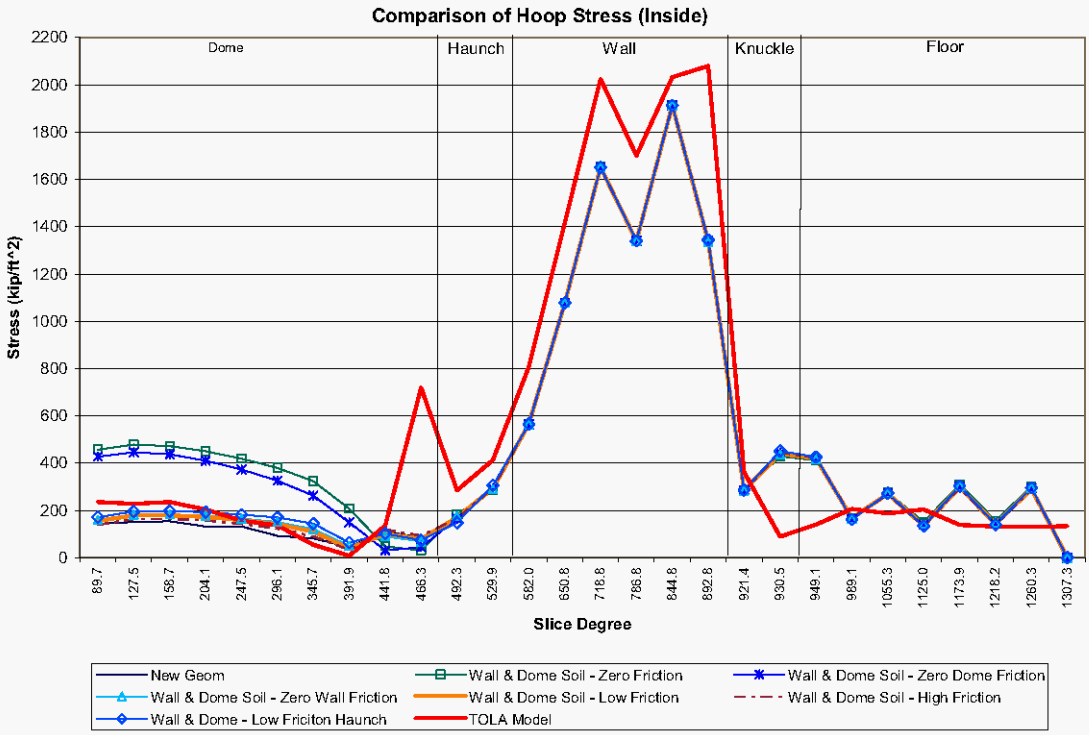


Figure 4.20. Primary Tank Hoop Stress Comparison Friction Variation – Inside Surface (Near Waste)

The primary tank hoop and meridional stresses were analyzed using a variety of analysis methods and component parameters, and were presented in Figures 4.9 through 4.20. Based on the results obtained from these analyses, the TOLA model compares very well to the ANSYS® detailed models for hoop stresses. There is more variation between the TOLA model and the ANSYS® detailed models for meridional stresses, with the greatest discrepancy at the knuckle. As a result of the review of the primary tank stresses, there was no specific ANSYS® detailed methodology that provided significantly better results or closer comparison to the TOLA model results. As a result, it is suggested to use the best methodology as discussed for the concrete tank, the ANSYS® detailed model with the haunch having a 0.05 friction coefficient.

4.1.3.3 J-Bolt Results and Conclusions

The J-Bolt axial and shear forces were extracted from load cases 1, 2, 3, 3a, 3b, 12a and 14 are compared in Figures 4.21 through 4.22. Friction parameters were varied on the concrete tank dome, haunch and wall in load cases 9, 10, 11, 12,12a and 13 and the J-Bolt axial and shear forces are a compared in Figures 4.23 through 4.24. The J-Bolt shear forces are extracted as components, and combined by the square root of the sum of the squares (SRSS). See Table 4.1 for the description and labels associated with of these load cases.

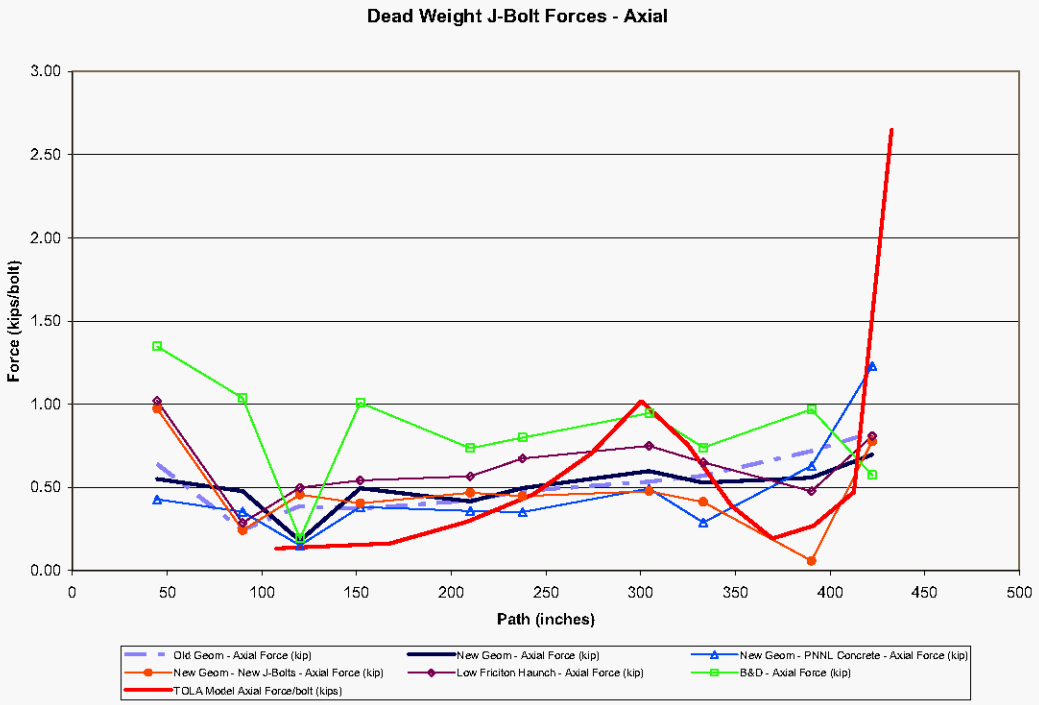


Figure 4.21. J-Bolt Axial Forces

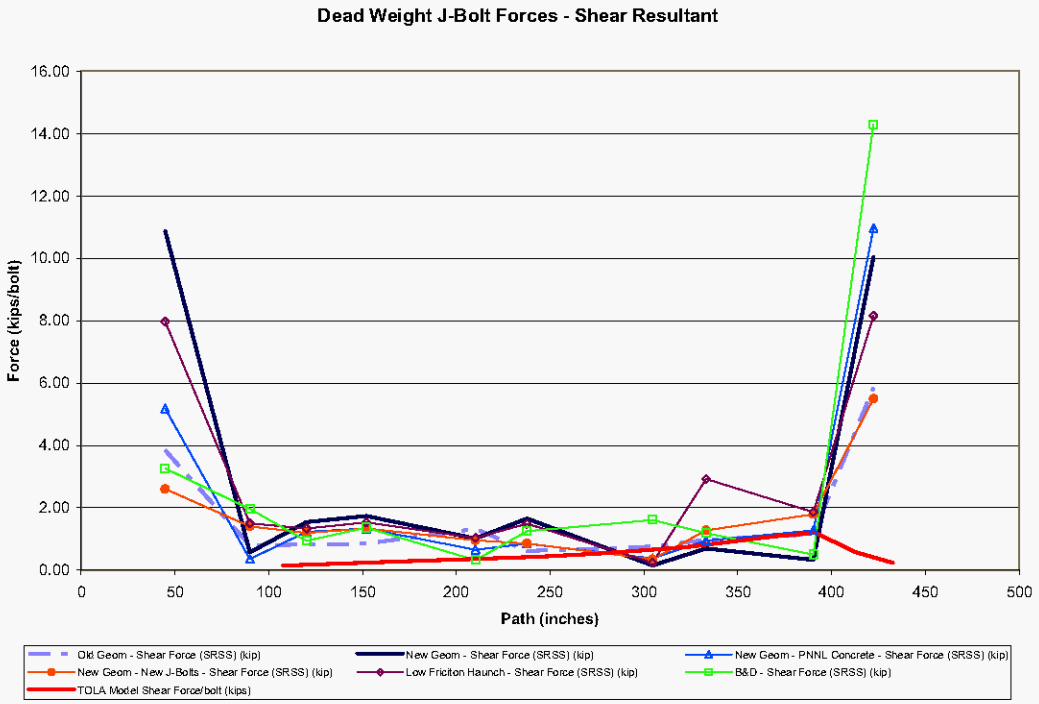


Figure 4.22. J-Bolt Shear Resultant (SRSS) Forces

The axial and resultant shear forces are presented in Figures 4.21 and 4.22 above. The axial forces seen in Figure 4.21 show that the ANSYS® detailed models produce higher results for the first six rings (path length from zero to 210 inches) and the tenth ring (path length 390 inches), whereas the TOLA model is higher for the seventh through the ninth rings (path 211 inches through 389 inches) and for the outer, eleventh ring (path 422 inches). The result SRSS shear forces for the TOLA model are slightly higher for the seventh through the ninth ring ((path 211 inches through 389 inches), while the detailed model is significantly higher at the second and eleventh rings (path 45 inches and 422 inches).

Gap elements across the excavated soil/concrete dome interface had varying friction coefficients applied to study the impact on J-Bolt forces for the dead weight analysis. For a detailed description of the friction coefficient parameters, see Table 4.1 above. Figures 4.23 through 4.24 provides a comparison for the axial and resultant SRSS shear J-Bolt forces based on friction coefficients.

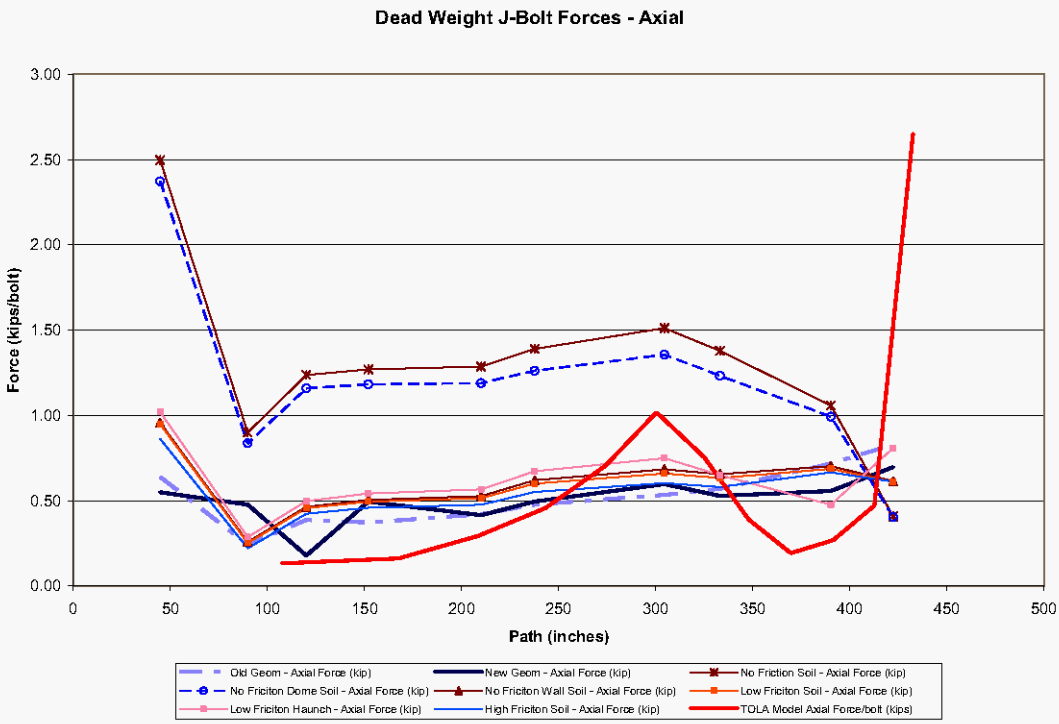


Figure 4.23. J-Bolt Axial Forces – Soil Friction Variation

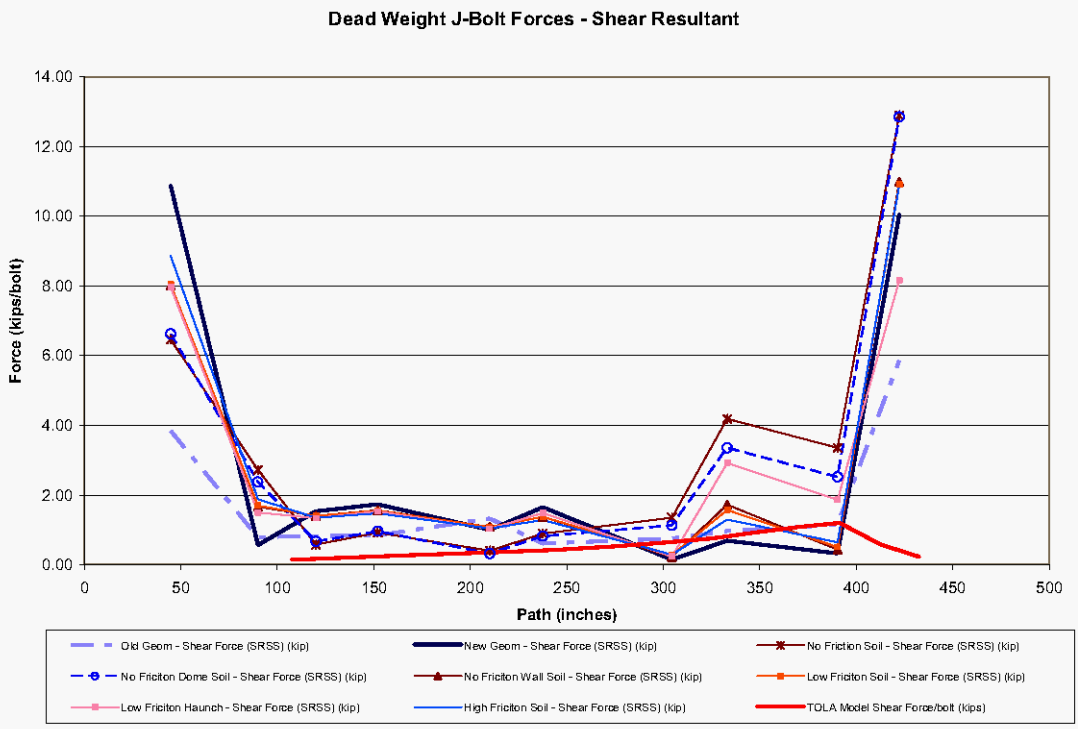
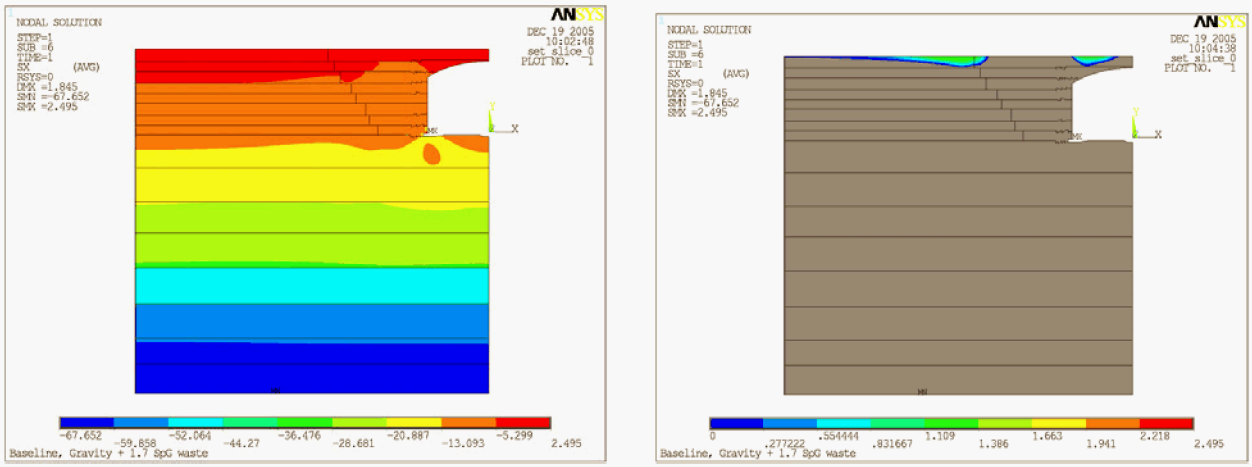


Figure 4.24. J-Bolt Shear Resultant (SRSS) Forces – Soil Friction Variation

It can be seen that soil interface friction coefficients for the dome do affect the axial loading seen by the J-Bolts. Frictionless soil on the dome significantly increases the axial forces seen by all the J-Bolts, except the outer most ring (path 422 inches). This is consistent with expected results due to the effect of the soil on the concrete tank. The resultant SRSS shear forces are not significantly affected by varying the friction coefficient. The effect is most dramatic in the last three rings of J-Bolts (path 333 inches through 422 inches). As a result, it is suggested to use the best methodology as discussed for the concrete tank, the ANSYS® detailed model with the haunch having a 0.05 friction coefficient.

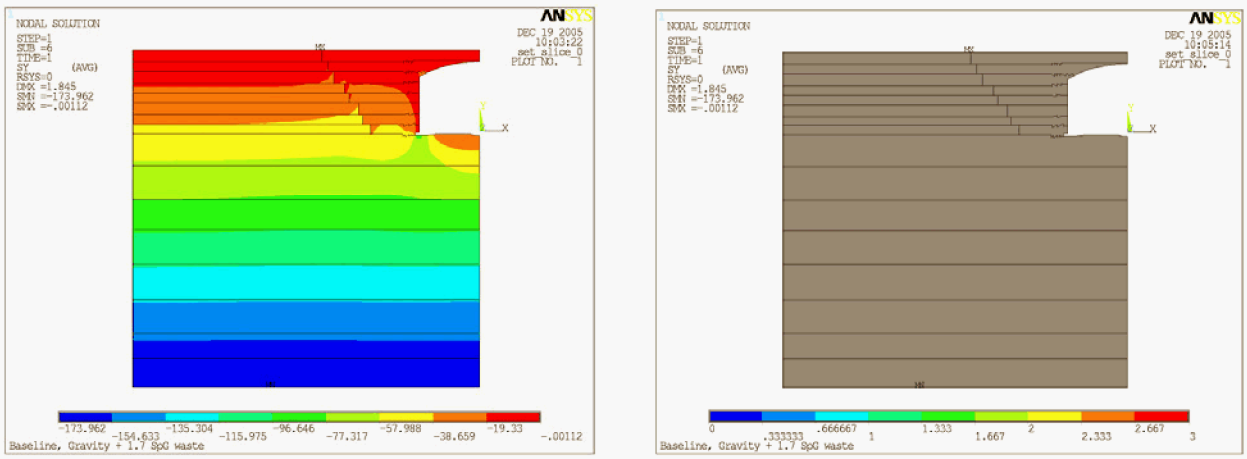
4.1.3.4 Soil Tension Results and Conclusions

Soil tension, as an indication of soil arching over the dome, was investigated for each of the three component directions for load case 1, 2, 3, 12a and 14. Figures 4.25 through 4.39 present the component direction soil tensions for each load case. See Table 4.1 for the description and labels associated with of these load cases.



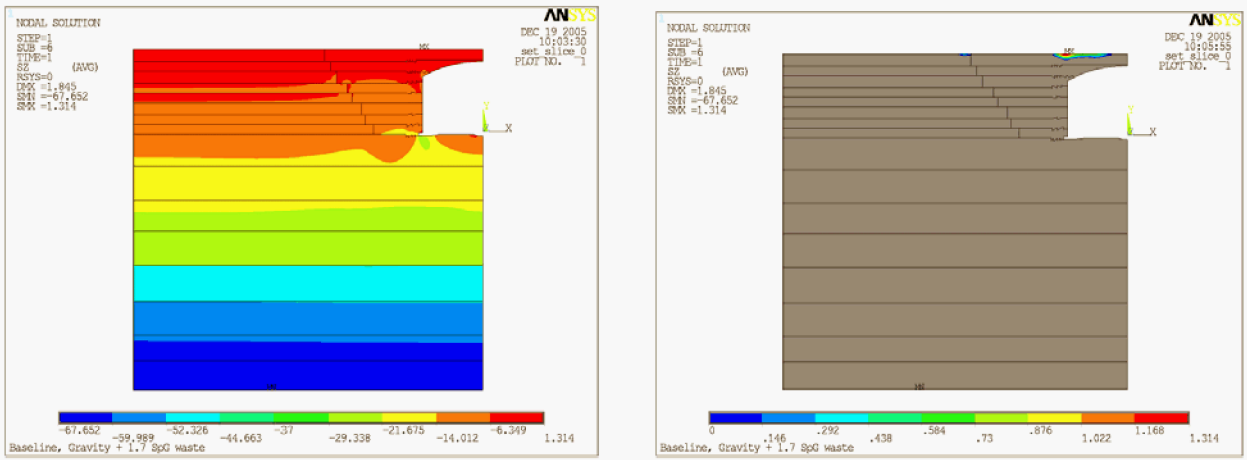
a) All b) Soil Tension

Figure 4.25. PNNL Soil Stresses (psi) - X Component



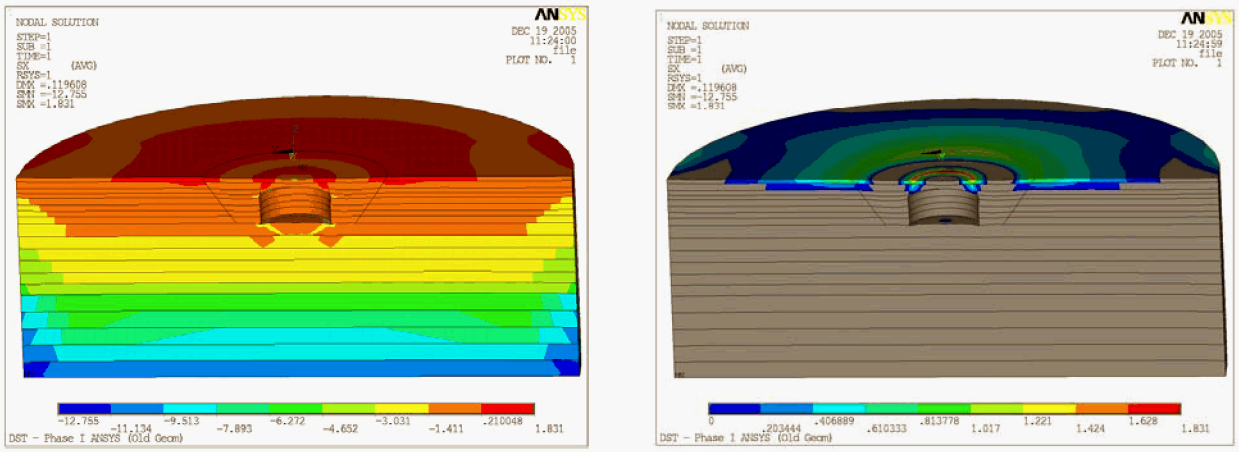
b) Soil Tension a) All

Figure 4.26. TOLA Model Soil Stresses (psi) - Y Component



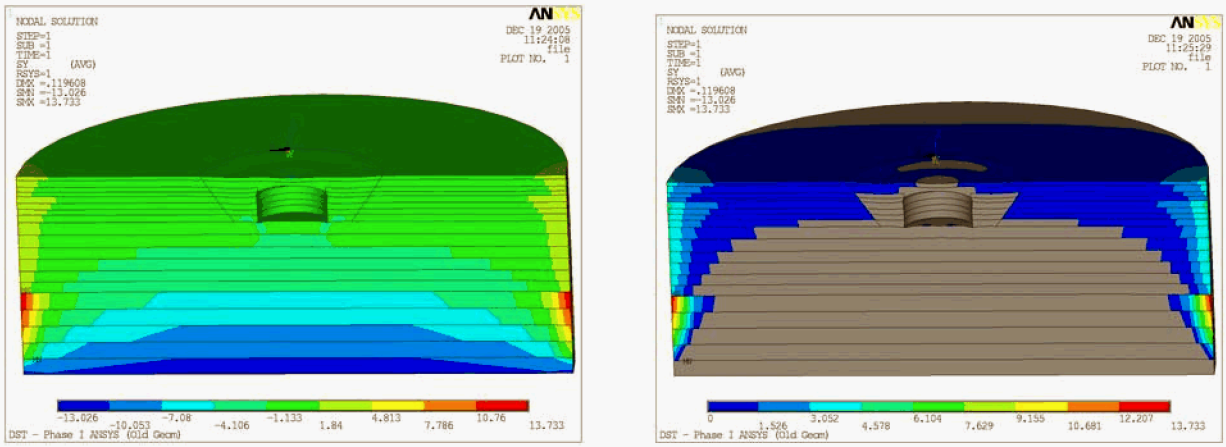
a) All b) Soil Tension

Figure 4.27. TOLA Model Soil Stresses (psi) - Z Component



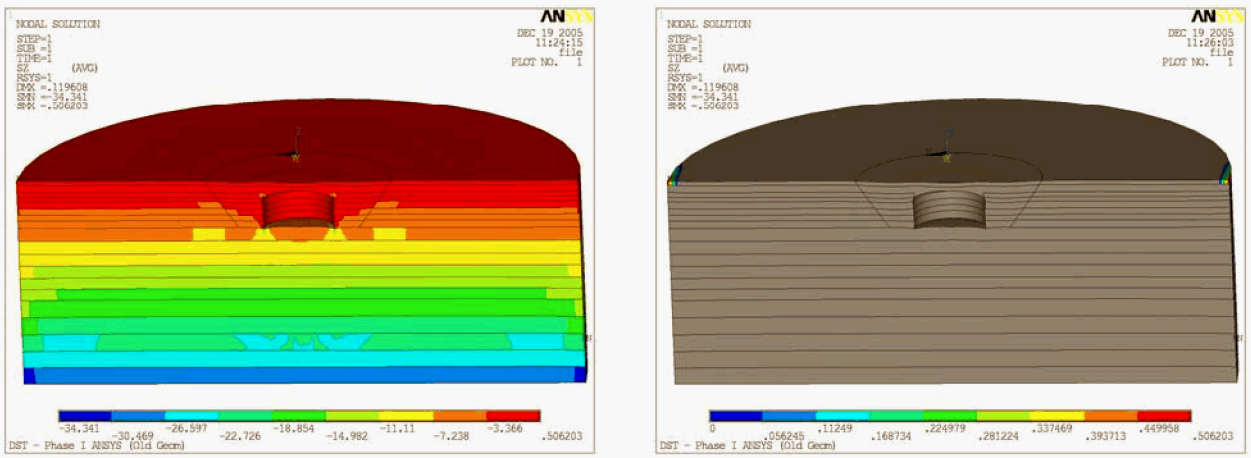
a) All b) Soil Tension

Figure 4.28. ANSYS® (Old Geom.) Soil Stresses (kip/ft^2) - X Component



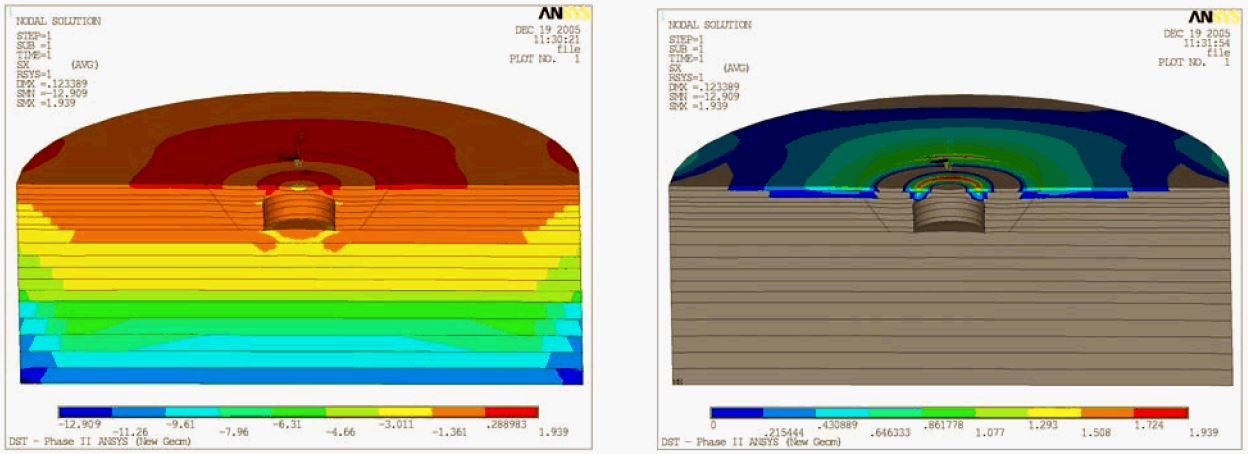
a) All b) Soil Tension

Figure 4.29. ANSYS® (Old Geom.) Soil Stresses (kip/ft^2) - Y Component



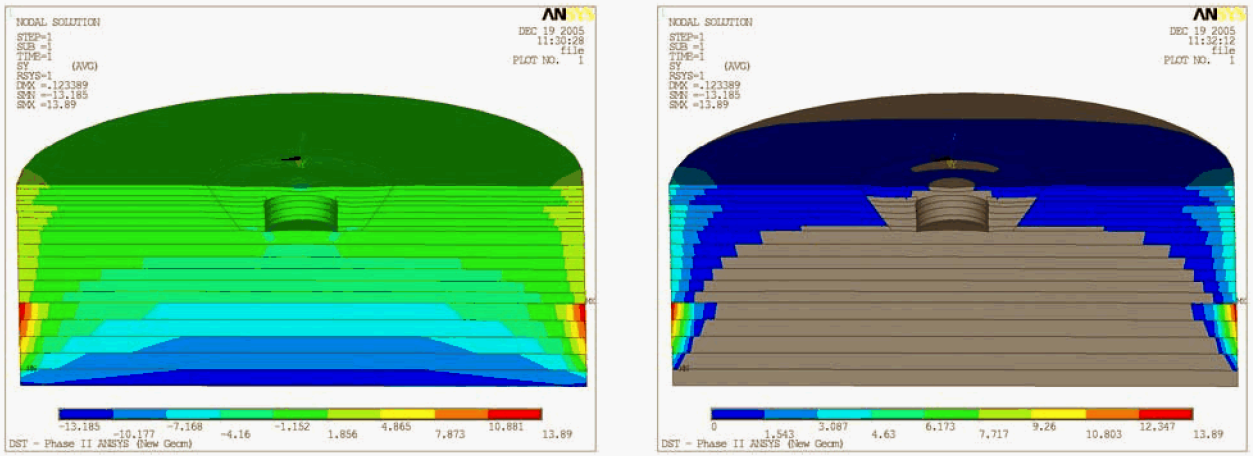
a) All b) Soil Tension

Figure 4.30. Phase I ANSYS® (Old Geom.) Soil Stresses (kip/ft^2) - Z Component



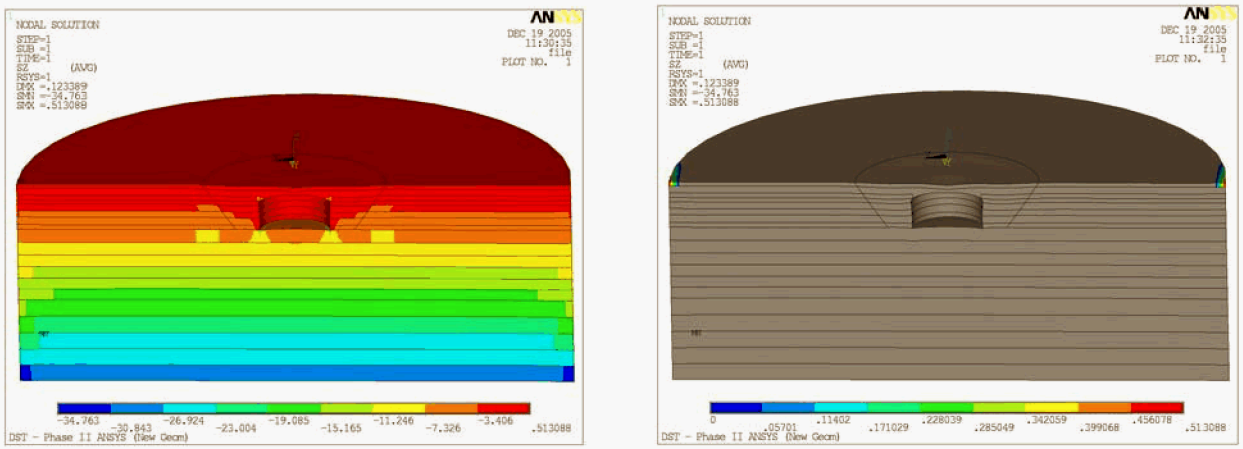
a) All b) Soil Tension

Figure 4.31. Detailed ANSYS® (New Geom.) Soil Stresses (kip/ft^2) - X Component



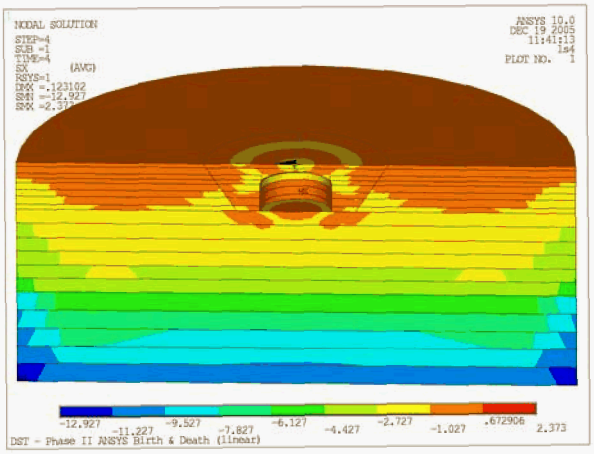
a) All b) Soil Tension

Figure 4.32. Detailed ANSYS® (New Geom.) Soil Stresses (kip/ft^2) - Y Component

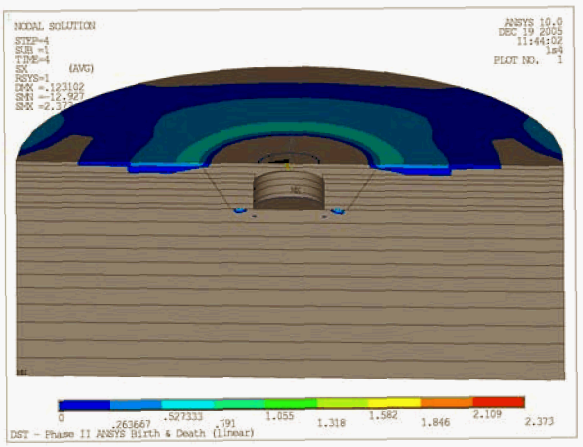


a) All b) Soil Tension

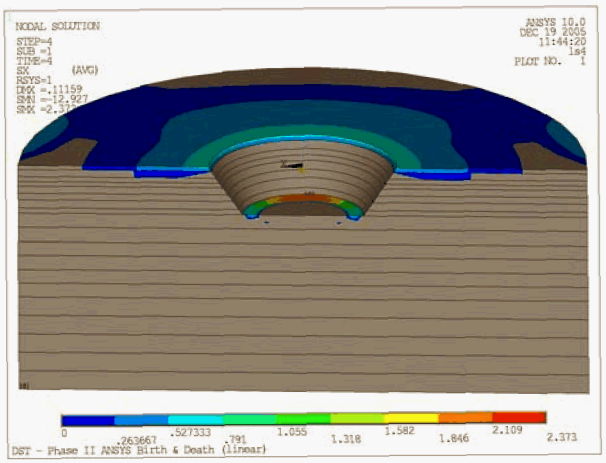
Figure 4.33. Detailed ANSYS® (New Geom.) Soil Stresses (kip/ft^2) - Z Component



a) All

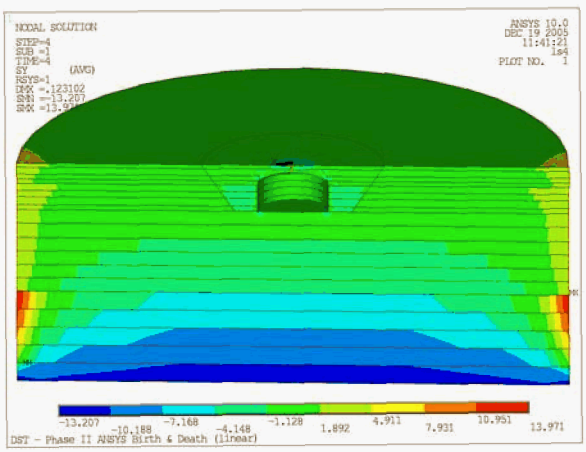


b) Soil Tension

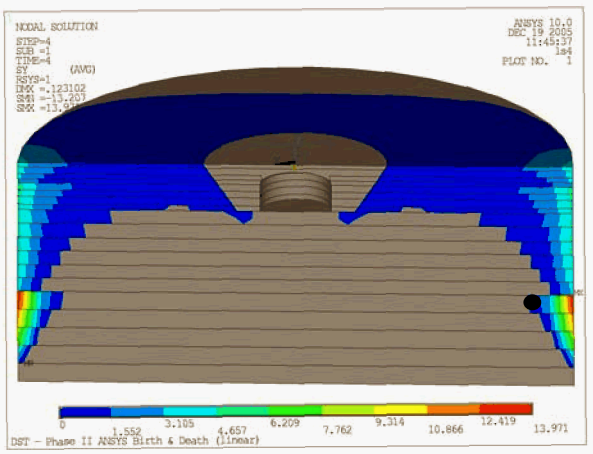


c) Soil Tension – Max (excavated soil removed)

Figure 4.34. Element Birth & Death - Soil Stresses (kip/ft^2) - X Component

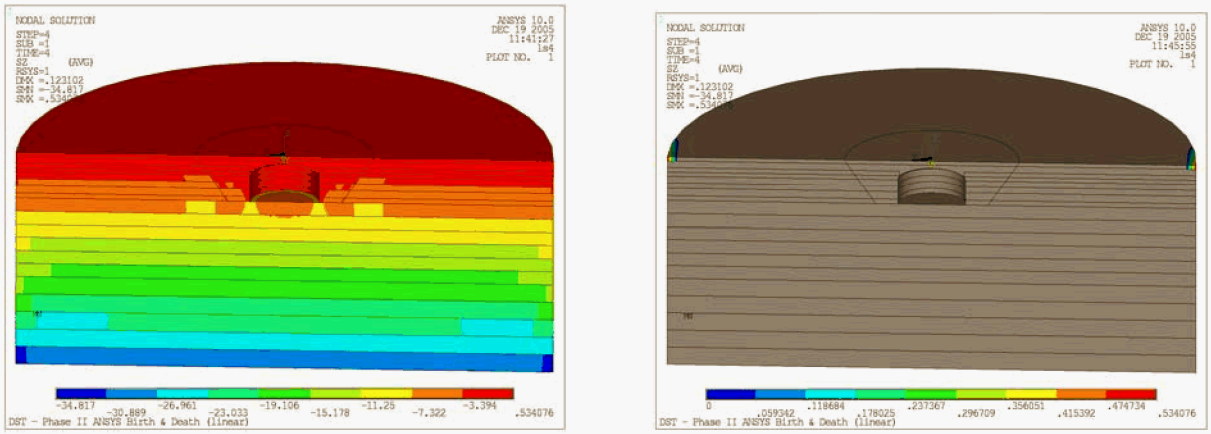


a) All



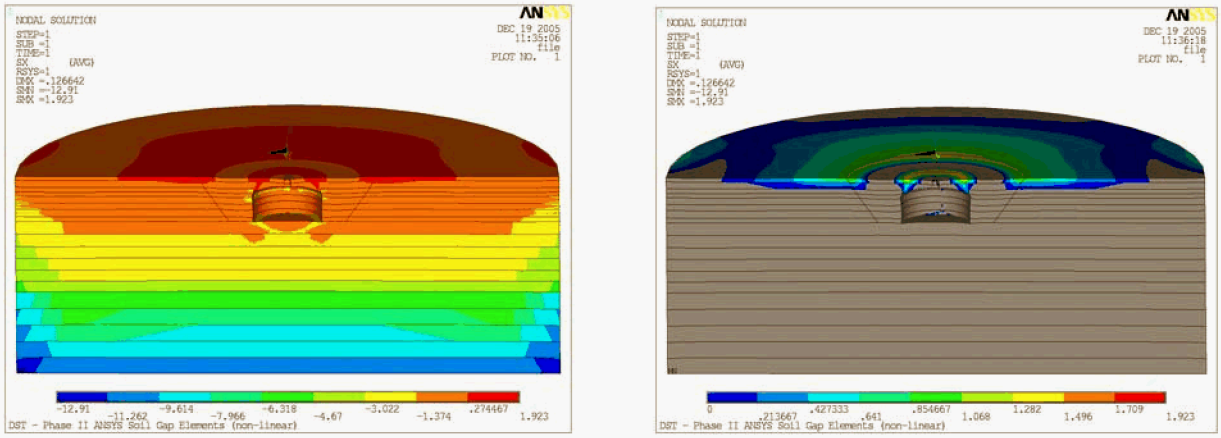
b) Soil Tension

Figure 4.35. Element Birth & Death - Soil Stresses (kip/ft^2) - Y Component



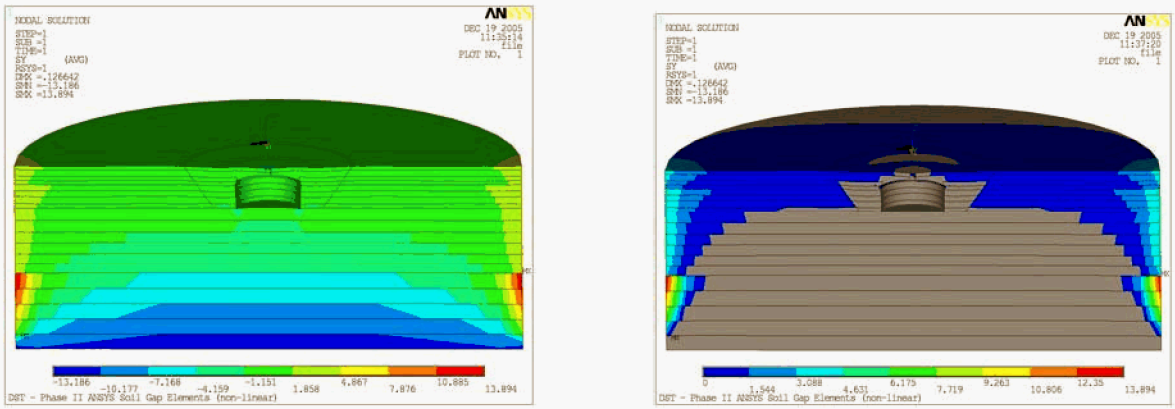
a) All b) Soil Tension

Figure 4.36. Element Birth & Death - Soil Stresses (kip/ft^2) - Z Component



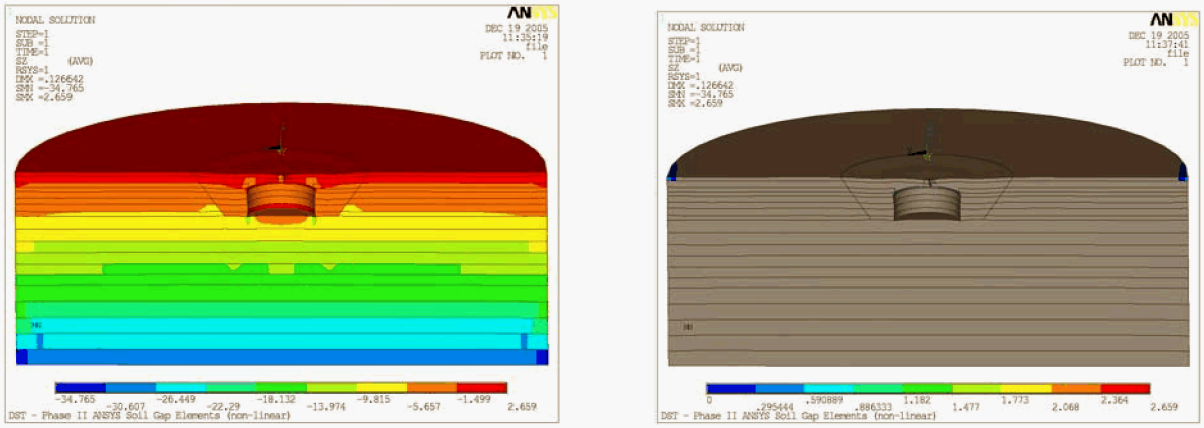
a) All b) Soil Tension

Figure 4.37. Soil Gaps (Low Friction Soil – Haunch 0.05) Soil Stresses (kip/ft^2) – X Component



a) All b) Soil Tension

Figure 4.38. Soil Gaps (Low Friction Soil – Haunch 0.05) Soil Stresses (kip/ft^2) – Y Component



a) All b) Soil Tension

Figure 4.39. Soil Gaps (Low Friction Soil – Haunch 0.05) Soil Stresses (kip/ft^2) – Z Component

From the results presented in Figures 4.25 through 4.39, it can be seen that the best method for reducing soil tension would be the ANSYS® detailed model using element birth and death method. Due to solution convergence issues, the ANSYS® detailed model using element birth and death method cannot be used for the seismic analyses. As a result, the ANSYS® detailed model should be modified to reduce or eliminate any soil tension and potential soil arching around the concrete tank.

4.1.4 Dead Weight Analysis Conclusions

Based on the information and discussions above, the ANSYS® detailed model should use contact elements with friction coefficients of 0.30 on the dome, 0.05 on the haunch and wall. In addition, further study of the ANSYS® detailed model should be done to minimize soil tension and potential soil arching around the concrete tank

4.2 Soil Arching

When linear elastic material properties are used to model soils, there is potential for developing artificial tensile zones. As related to the tank and soil model, there is a potential for soil arching behavior over the dome of the tank. Excessive arching behavior will result in underestimating the loads on the concrete dome and tank walls. Therefore, a study of arching behavior was performed to minimize the effect on the seismic analysis.

The potential for soil arching over the dome was studied to determine an acceptable method for modeling the soil to prevent arching from occurring. Because the soil is modeled as a linear-elastic material, some features of soil cannot be included such as inability to carry tension loads. If excessive arching occurs over the dome, the vertical loading on the dome may be underestimated.

The model features studied include contact friction between the soil and the concrete and soil properties and their distribution.

4.2.1 Model

The model used for this arching study is essentially the same as described in Section 2.1. The soil and concrete tank are identical in geometry. Soil properties are the same as discussed above, but the concrete was modeled as uncracked to match the concrete properties of the TOLA model used for comparison. The model for the primary tank and waste is less refined in the wall (i.e., fewer elements over the wall height).

Two areas of the model were studied to determine the effect of arching. Figure 4.40 shows two soil zones for which Young's Modulus was studied. The intent of softening two soil zones is to create a break in the soil through which only limited tension or compression can be carried. The ring over the tank wall breaks the tension zone changing the soil over the tank from "fixed" and the edges, to "simply supported." A zone over the center of the dome was also softened to break the "beam action" over the dome, essentially preventing a moment being carried over the dome.

The zone over the center of the dome was initially studied by modifying the properties of a cylinder of soil. In reviewing the compressive stresses in the soil, it was determined that a compression ring was formed in the first cylinder of elements outside of the softened center zone. Therefore, an approximately cubic section of soil was then softened (See Figure 4.42). This had the desired affect of removing the compression ring.

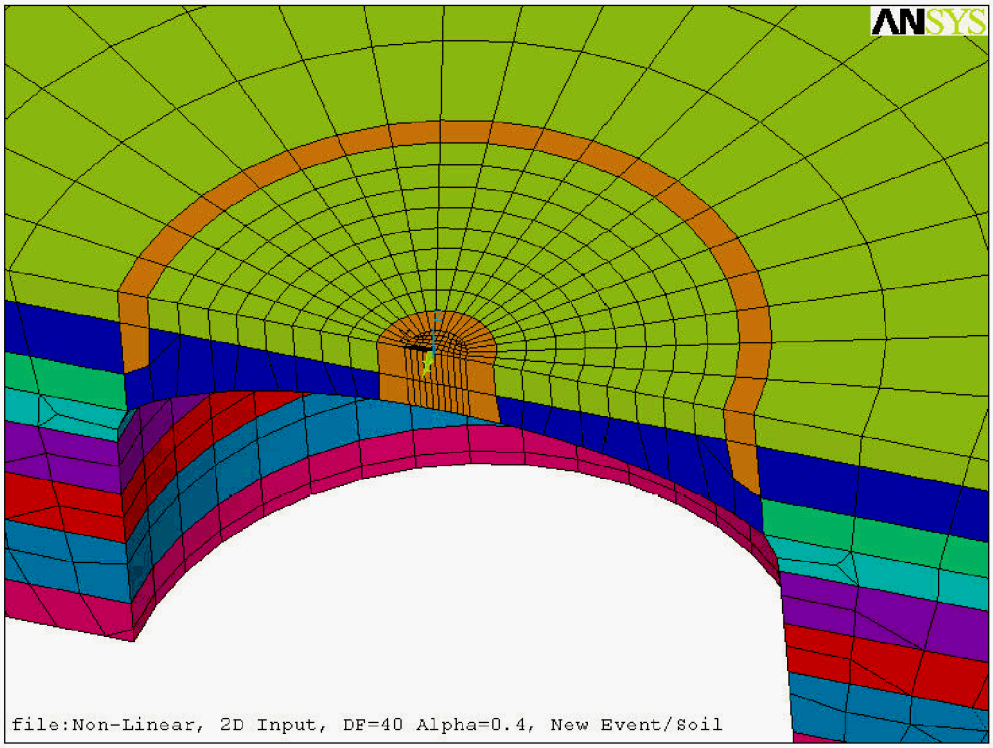


Figure 4.40. Model Detail for Arching Study

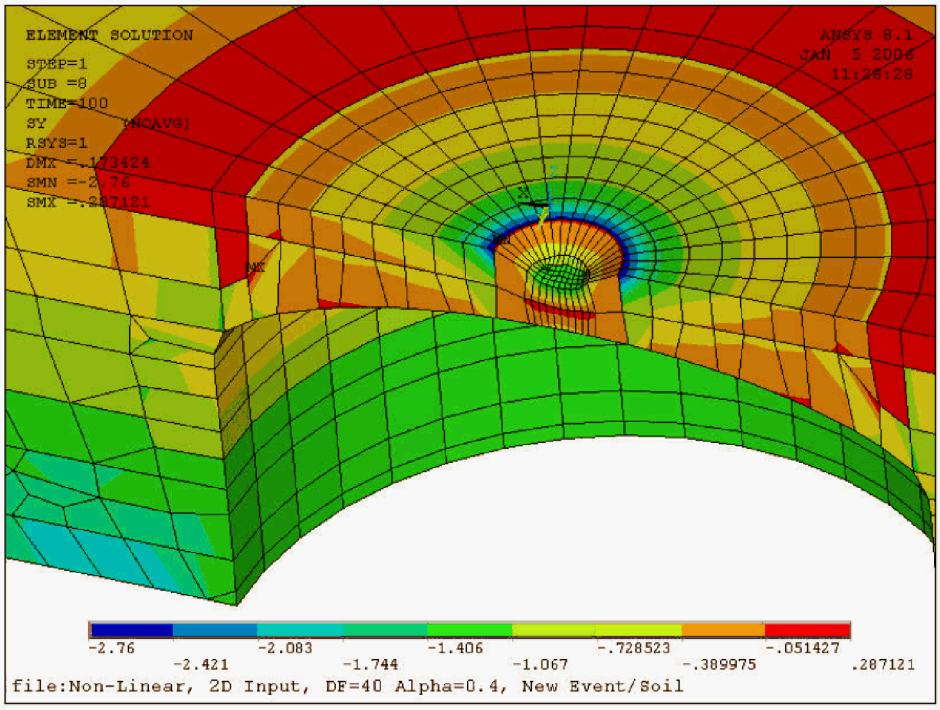


Figure 4.41. Compression Ring over Dome Center

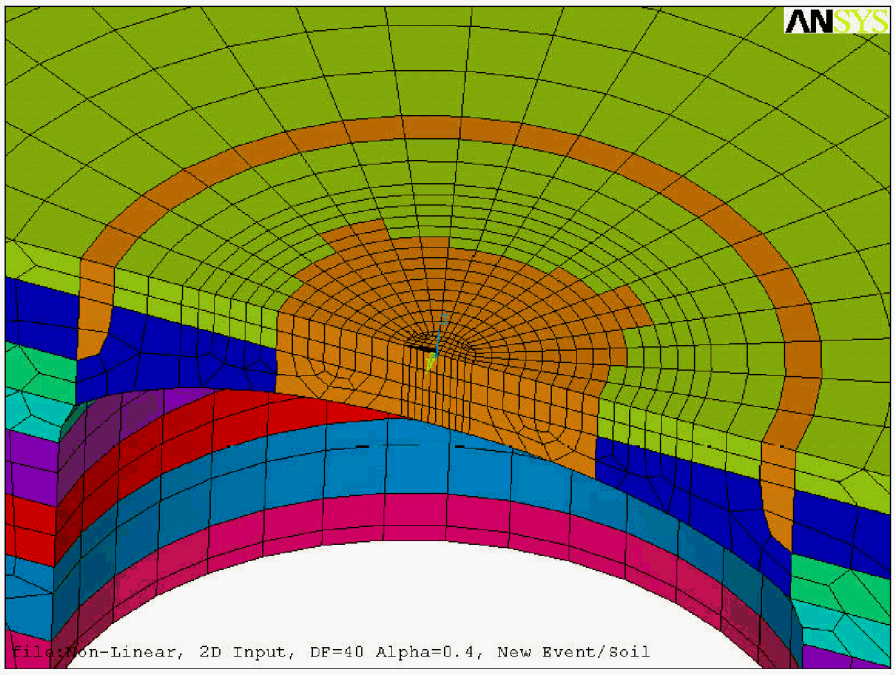


Figure 4.42. Model Detail for Arching Study, Final Configuration

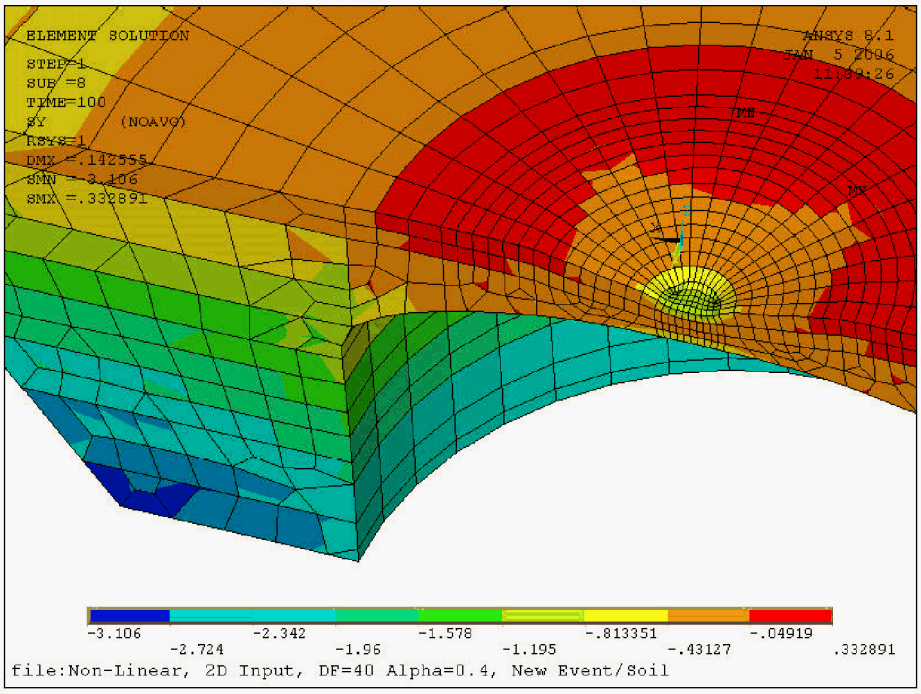


Figure 4.43. Stress Field in Soil over Dome – Final Configuration

The influence of contact friction between the soil and the concrete tank and at the soil/soil interface at the edge of the construction excavation was also studied. Figures 4.44 and 4.45 show the soil/concrete and soil/soil contact surfaces, respectively.

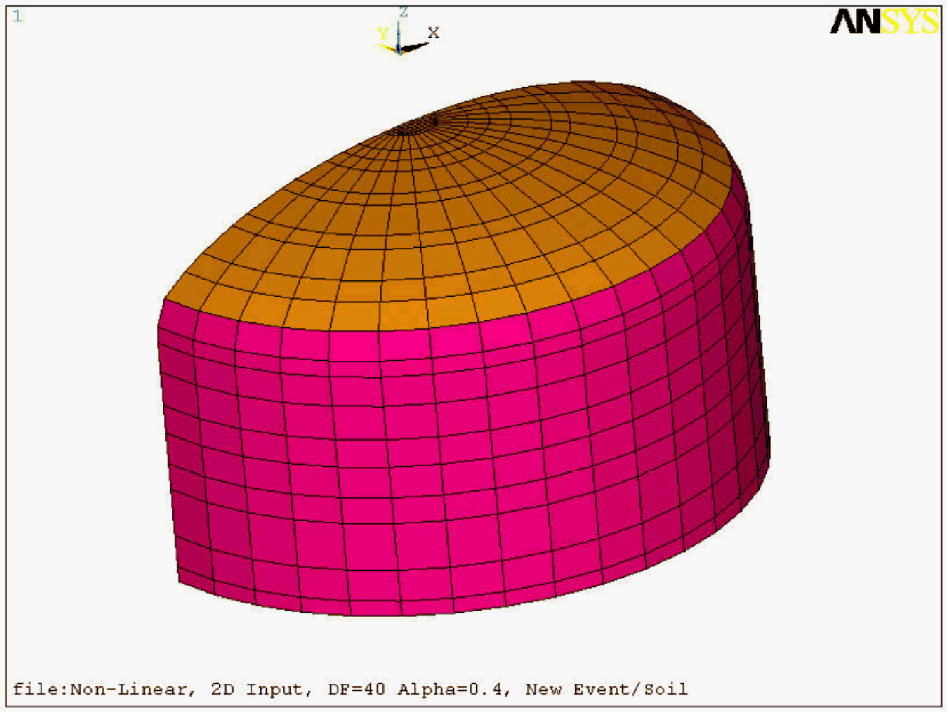


Figure 4.44. Soil/Concrete Contact Surface

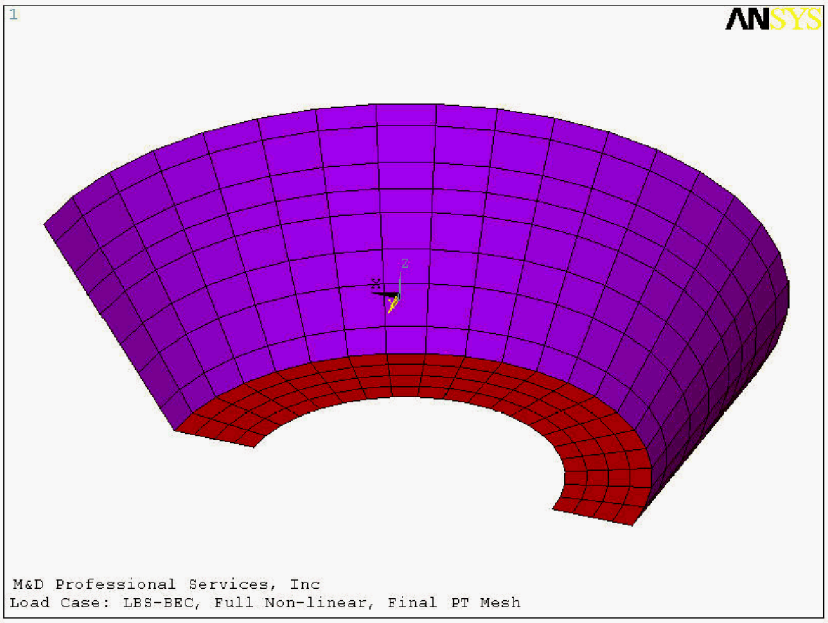


Figure 4.45. Soil/Soil Contact Surface

4.2.2 Soil Friction Properties

Significant efforts were taken and documented in RPP-RPT-23308 to determine soil properties with a view to modeling the soil using a Drucker-Prager formulation for the soil. Included in the referenced report are results showing the effect of soil depth on the internal angle of friction. Figure 4.46 is extracted from this report.

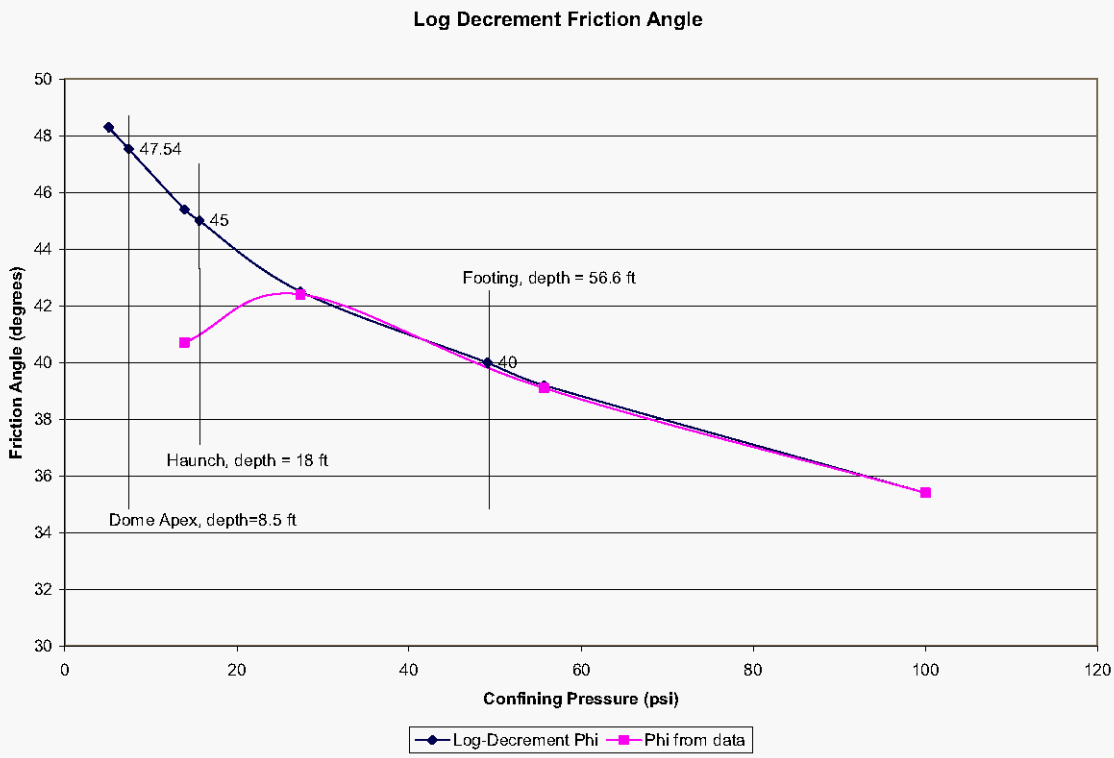


Figure 4.46. Soil Friction Angle vs. Soil Depth

From Bowles (1982), the coefficient of friction between the base of a retaining wall and the soil may be taken as:

$$f = \tan\phi \text{ to } 0.67\tan\phi$$

Table 4.2. Soil Internal Angle of Friction vs. Wall Friction Coefficient

ϕ	$\tan\phi$	$0.67\tan\phi$
47.5	1.09	0.73
45	1.00	0.67
40	0.84	0.56
35	0.70	0.47

Based on the above range of potential wall friction coefficients, values between 0.5 and 0.8 were selected for evaluation. After the initial cases were evaluated, an additional value of 0.2 was also tested. The low value was included to address issues related to construction sequence.

4.2.3 Load Cases

The following Load Cases were considered for the initial study

- Case 1 E=250 kip/ft^2 $\mu = 0.50$
- Case 2 E=250 kip/ft^2 $\mu = 0.60$
- Case 3 E=250 kip/ft^2 $\mu = 0.70$
- Case 4 E=250 kip/ft^2 $\mu = 0.80$
- Case 5 E=9958 kip/ft^2 $\mu = 0.70$
- Case 5a E=1000 kip/ft^2 $\mu = 0.70$

Later cases included

- Case 9 E=250 kip/ft^2 $\mu = 0.20, 0.60$
- Case 10 E=250 kip/ft^2 $\mu = 0.20, 0.60$
- UBS-UCC E=250 kip/ft^2 $\mu = 0.20, 0.60$

Where E is the elastic modulus of the softened soil zones and μ is the coefficient of friction between the soil and the concrete tank.

4.2.4 Results

Results from the soil contact elements, concrete tank elements, and primary tank elements were extracted and evaluated. Soil contact pressure results were compared against both a theoretical solution and results from the TOLA model. Concrete tank forces and moments are compared against the TOLA model. Primary tank stresses are also compared against TOLA model results.

A comparison against active earth pressure was developed to provide a comparison against a theoretical solution. Values for the soil internal angle were taken as 33 degrees and 49 degrees. These values represent the extremes from Figure 4.46. Coulomb lateral earth pressure is determined using the following equation:

$$\sigma_3 = \sigma_1 \tan^2\left(45 - \frac{\phi}{2}\right) - 2c\tan\left(45 - \frac{\phi}{2}\right)$$

For the excavated soil region, the soil is considered to be cohesionless; therefore, the second term can be ignored. For the two friction angles considers, the multiplier for the normal pressure is:

$$\mathrm{Ka} = \tan^2\left(45 - \frac{\phi}{2}\right)$$

The resulting values are 0.295 and 0.140 for internal friction angles of 33 and 49 degrees, respectively. Inherent in the Coulomb formulation for lateral soil pressure is the assumption that the pressure acts against a rigid wall. This assumption is reasonable for the uncracked concrete model, but is not for the best estimate concrete or fully cracked concrete.

The theoretical pressure normal to the shell elements was then calculated using the vertical and lateral soil pressures as follows:

$$P_v = \rho g h$$
$$P_l = K_a P_v$$
$$P_n = \sqrt{(P_v \mathrm{Cos}\theta)^2 + (P_l \mathrm{Sin}\theta)^2}$$

Where θ = shell normal angle from horizontal.

A surcharge pressure due a 200,000 lbf concentrated load over the dome is included as appropriate.

Table 4.3. Theoretical Concrete Shell Normal Pressures Due to Gravity

Depth	Element Normal Angle (rad)	Vertical Pressure	Surcharge Pressure	Active Lateral Pressure, ϕ=33 Deg	Active Lateral Pressure, ϕ=49 Deg	Normal Pressure ϕ = 33 deg	Normal Pressure ϕ = 49 deg
8.500	-0.035	9.84	2.46	2.90	1.38	9.83	9.83
8.683	-0.071	10.00	2.46	2.95	1.40	9.97	9.97
8.899	-0.097	10.18	2.46	3.00	1.43	10.14	10.14
9.192	-0.125	8.32	0.34	2.45	1.16	8.26	8.26
9.942	-0.181	8.97	0.34	2.65	1.26	8.84	8.83
10.400	-0.210	9.03	0	2.66	1.26	8.85	8.83
11.860	-0.298	10.30	0	3.04	1.44	9.88	9.85
12.650	-0.347	10.98	0	3.24	1.54	10.39	10.34
14.625	-0.482	12.70	0	3.75	1.78	11.38	11.28
16.150	-0.607	14.02	0	4.14	1.96	11.76	11.57
18.550	-0.657	16.10	0	4.75	2.25	13.08	12.83
21.908	-1.571	19.02	0	5.61	2.66	5.61	2.66
23.992	-1.571	20.83	0	6.14	2.92	6.14	2.92
27.917	-1.571	24.23	0	7.15	3.39	7.15	3.39
32.417	-1.571	28.14	0	8.30	3.94	8.30	3.94
36.125	-1.571	31.36	0	9.25	4.39	9.25	4.39
40.267	-1.571	34.95	0	10.31	4.89	10.31	4.89
43.708	-1.571	37.94	0	11.19	5.31	11.19	5.31
50.000	-1.571	43.40	0	12.80	6.08	12.80	6.08
53.833	-1.571	46.73	0	13.79	6.54	13.79	6.54

Figure 4.47 shows the theoretical soil pressures normal to the concrete shell elements. The increased pressure near the center of the dome is due to the 200,000 lbf surcharge included on the surface. As the element normal changes past the wall to become vertical, there is a significant drop in pressure because the weight of the soil burden no longer contributes to the soil pressure normal to the concrete.

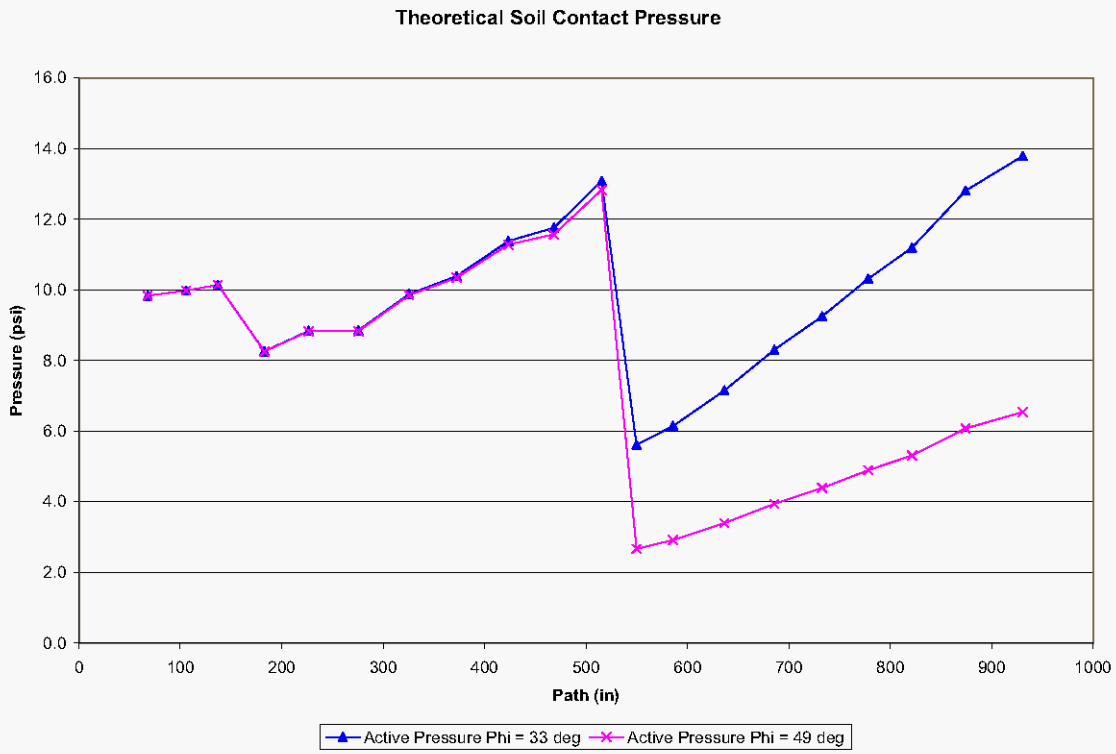


Figure 4.47. Theoretical Soil Pressures Normal to Concrete Elements

Soil contact pressures were extracted from the TOLA model for comparison to the study results. In the dome portion of the model, the contact pressure results varied widely. For this comparison, the pressures were averaged over a number of elements to obtain a smoother pressure distribution. The original soil pressures and averaged pressures are shown in Figure 4.48. The variation in soil pressures is due to the selection of which elements (soil/concrete) to use as the basis for the contact or target element. In the TOLA model, the target was the less refined surface, resulting in the varying soil pressures shown below. However, because the average results show the expected pressure distribution and the pressure variations are highly localized compared to the concrete overall thickness, the variation is unlikely to have a significant affect on the overall results.

Figure 4.49 shows a comparison of the TOLA model results compared to the theoretical solution. The PNNL solution is significantly different from the theoretical solution near the haunch of the concrete tank. Soil pressures near the dome center due to soil overburden show reasonable agreement as does the lateral soil pressure lower on the tank wall. The Drucker-Prager formulation for soil properties in the TOLA model uses a base soil internal angle of friction of 35 degrees. The lateral soil pressures show a good match on the vertical wall region of the model for 35 degrees.

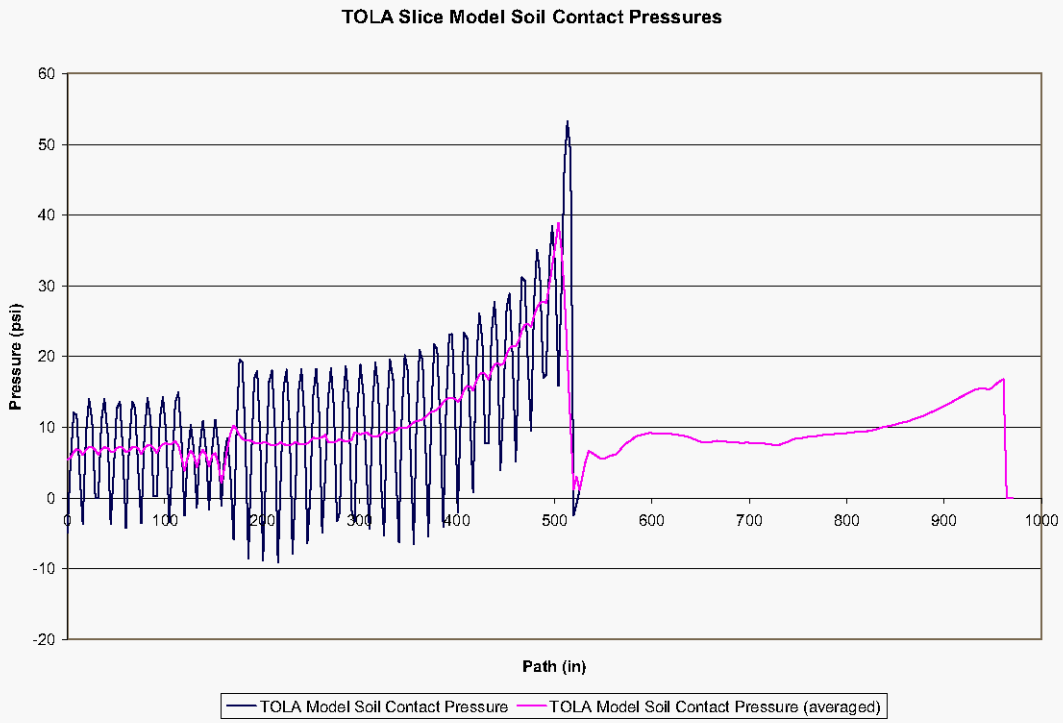


Figure 4.48. Soil Contact Pressures from the TOLA Model

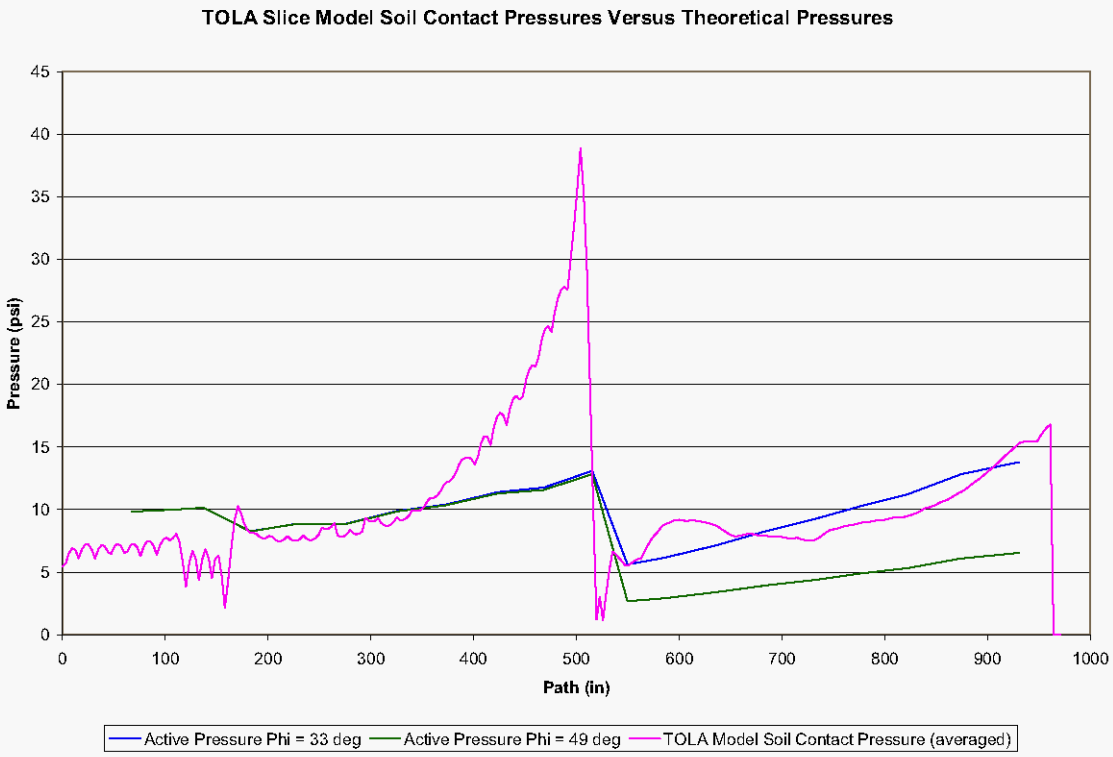


Figure 4.49. TOLA Model Soil Contact Pressures Compared to Theoretical Solution

Figure 4.50 shows a comparison of soil contact pressures based on varying the coefficient of friction between the soil and the concrete tank. The contact pressures are fairly insensitive to the coefficient of friction until significant "sticking" occurs between the soil and tank. This occurs with a coefficient of friction between 0.7 and 0.8. The offset in the path location for the peak pressure is due to the difference in models. The TOLA model follows the exterior surface of the concrete tank whereas the seismic model follows the concrete mid-line. Based on this difference, the slope of the contact elements changes away from horizontal sooner than the detailed TOLA model.

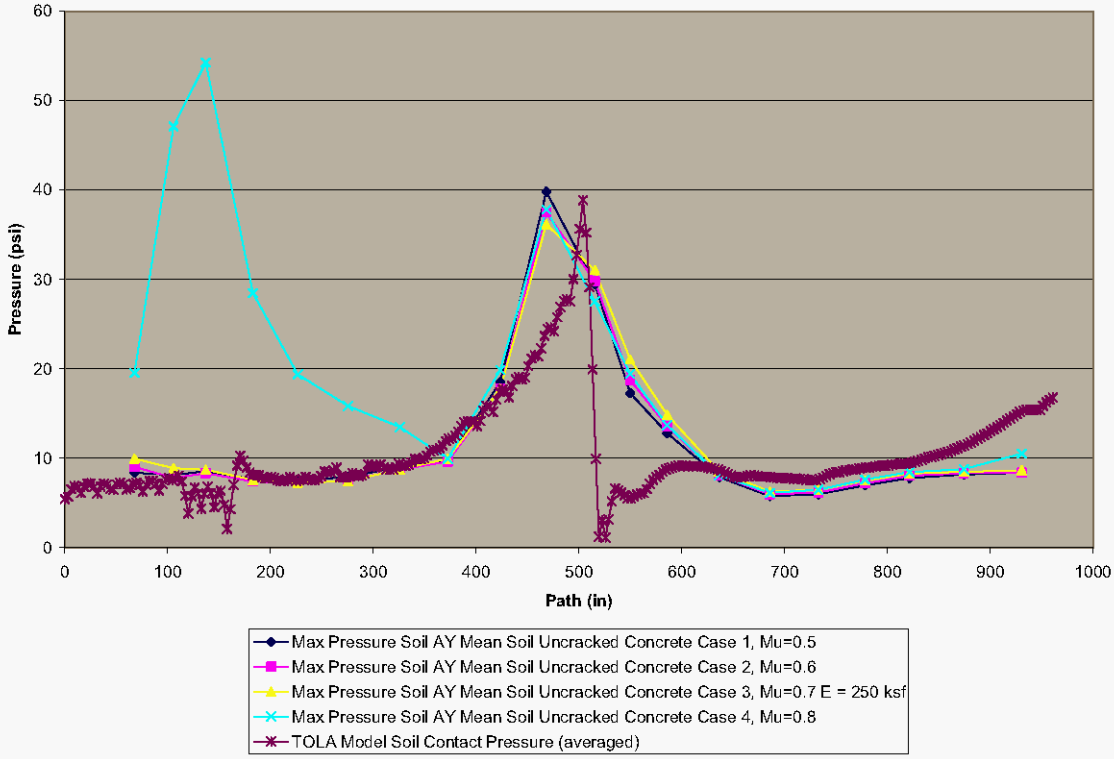


Figure 4.50. Soil Contact Pressures for Varying Coefficients of Friction

Figure 4.51 shows a comparison of soil contact pressures based on varying the elastic modulus of the soil in two zones above the tank. Include in the plot are results for the unmodified elastic modulus, and values that are approximately 1/10 and 1/40 of the original modulus. The results for the original modulus show that the pressures over the dome are underestimated. This is the expected result due to arching behavior of the soil. Both reduced modulus cases show better matches with TOLA model results.

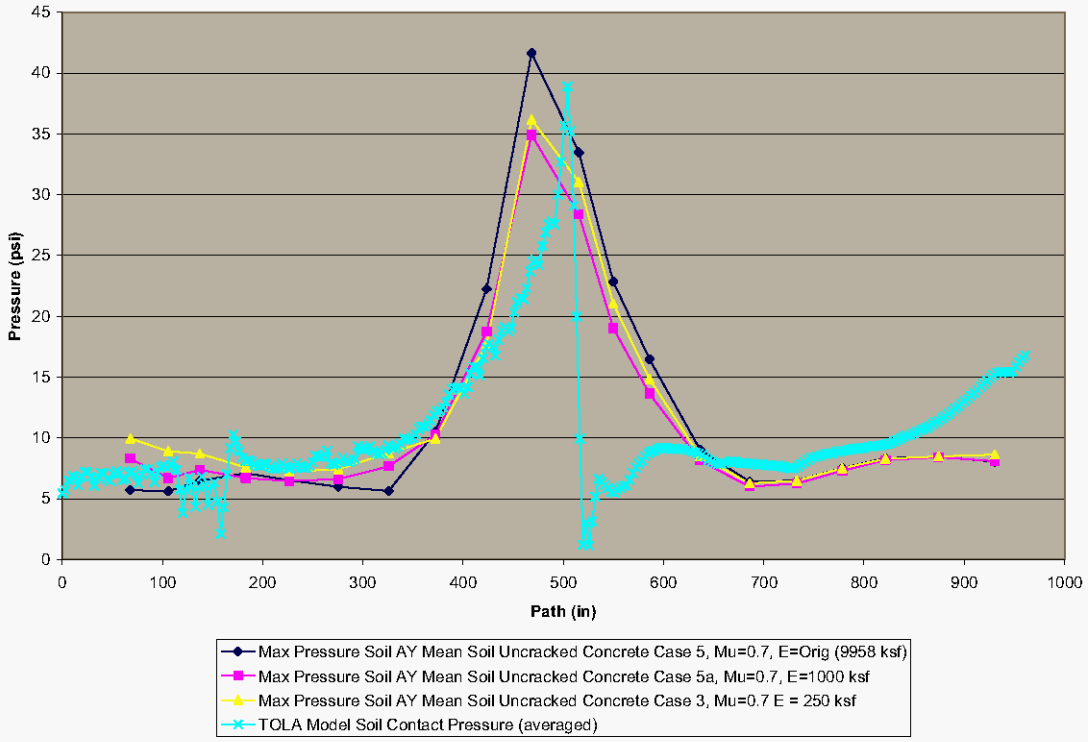


Figure 4.51. Soil Contact Pressures for Varying Soil Elastic Modulus

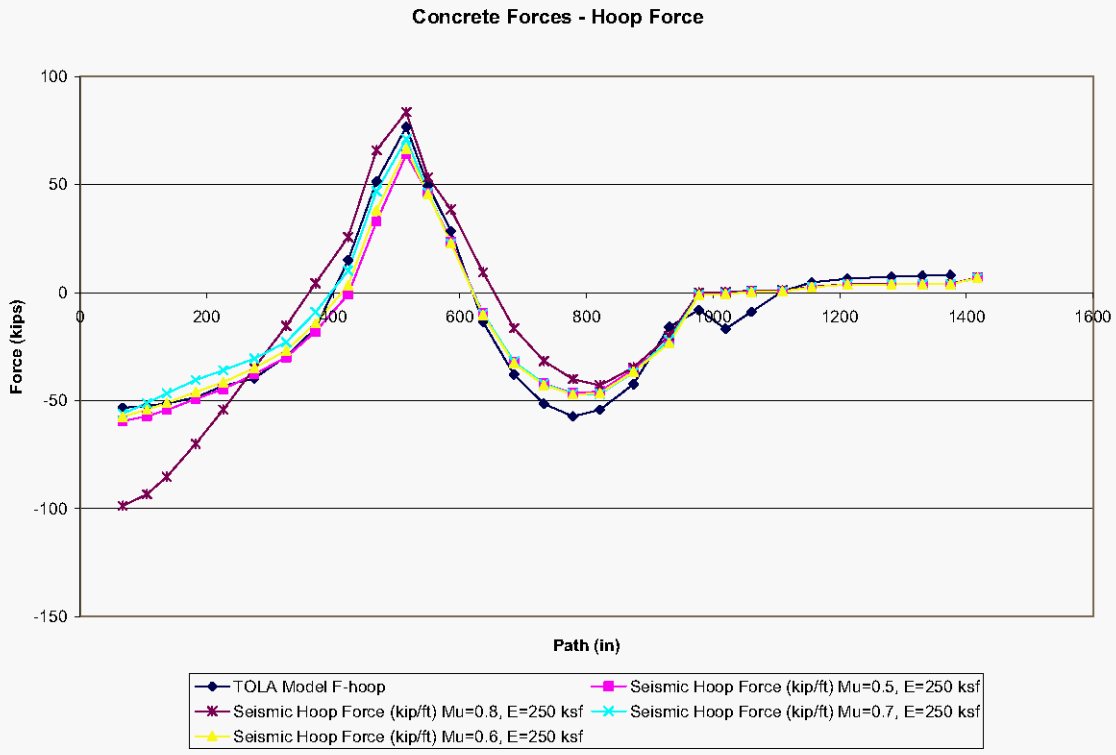


Figure 4.52. Concrete Hoop Forces for Varying Coefficients of Friction

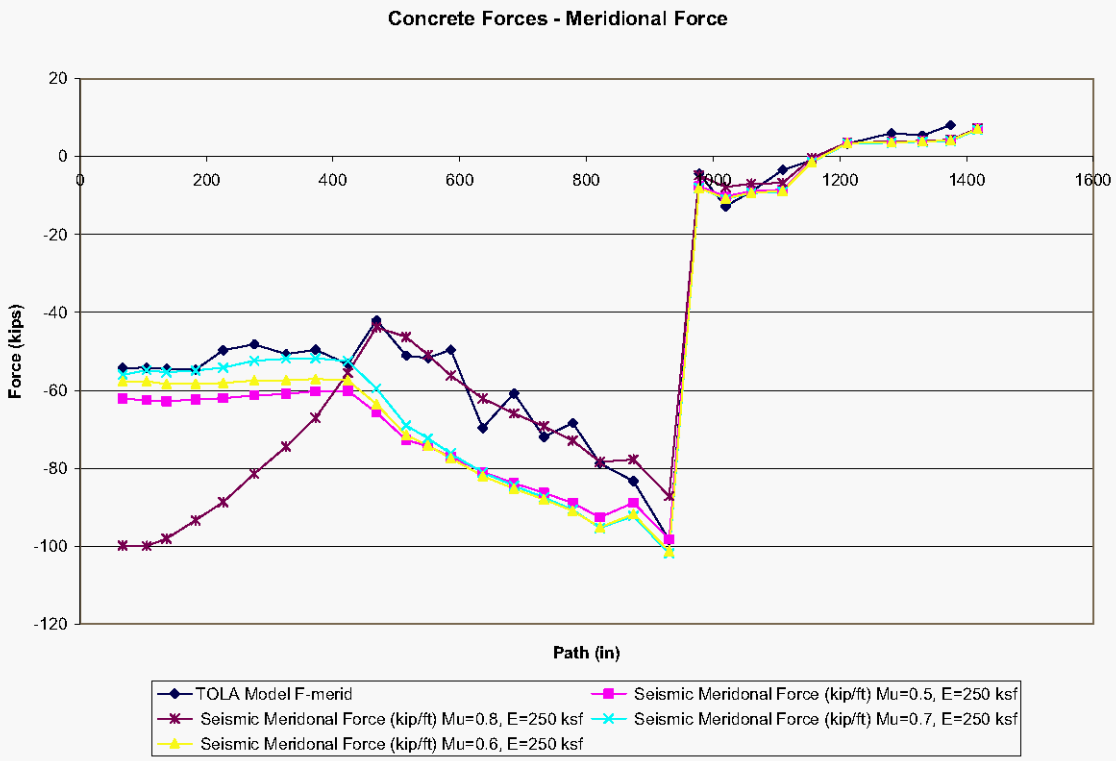


Figure 4.53. Concrete Meridional Forces for Varying Coefficients of Friction

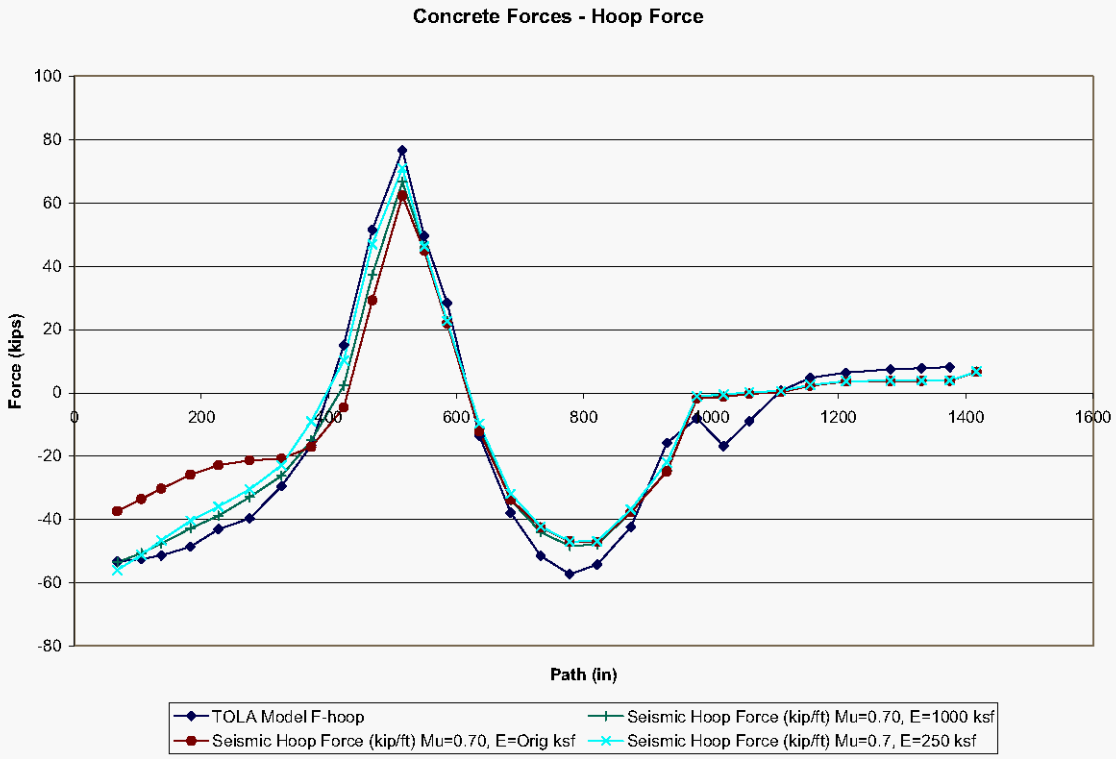


Figure 4.54. Concrete Hoop Forces for Varying Soil Elastic Modulus

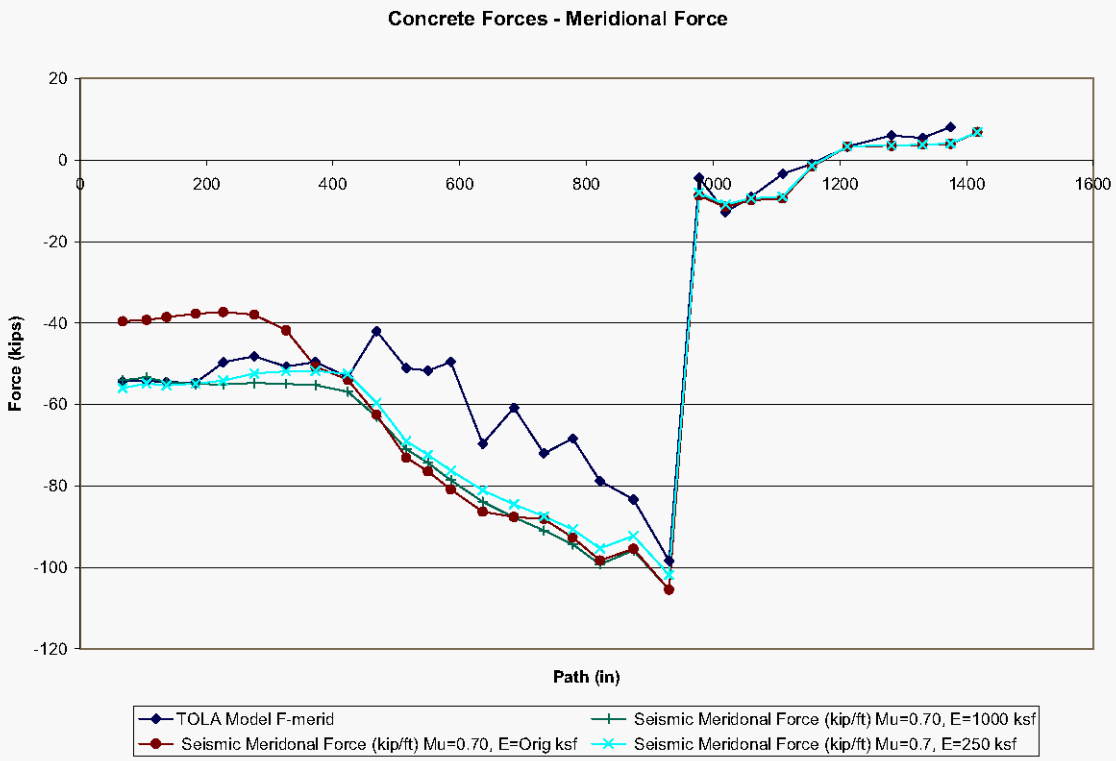


Figure 4.55. Concrete Meridional Forces for Varying Soil Elastic Modulus

For each of the load cases addressed for the arching study, the primary tank stresses were obtained and compared. As can be seen in Figure 4.56, primary tank stresses are insensitive to friction coefficients between the soil and concrete tank or the stiffness of the soil above the concrete tank. Therefore, primary tank stresses were not considered further for this study.

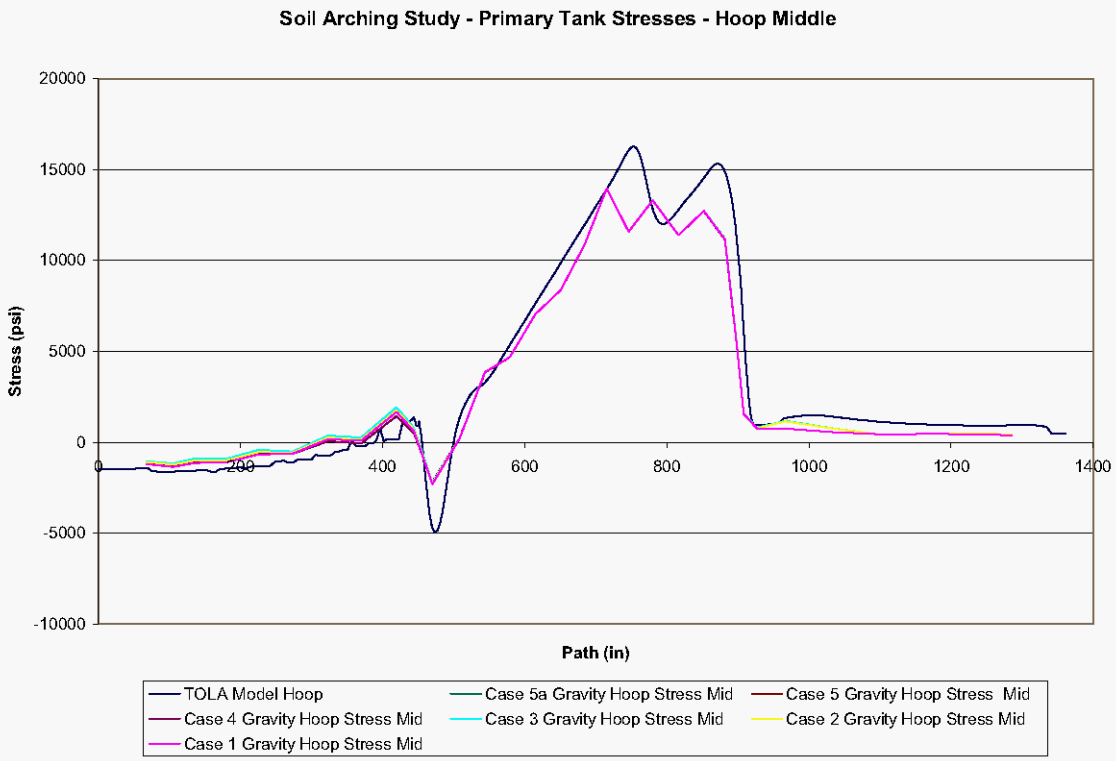


Figure 4.56. Primary Tank Hoop Stress for Varying Coefficients of Friction

Three final cases were run using an initial coefficient of friction of 0.2. A low coefficient of friction was shown in the gravity load study to provide the best estimate for the initial conditions (gravity only). Figure 4.57 shows the results for uncracked and best estimate concrete properties. The difference in concrete properties has a significant impact on the lateral soil pressures on the vertical wall of the concrete tank.

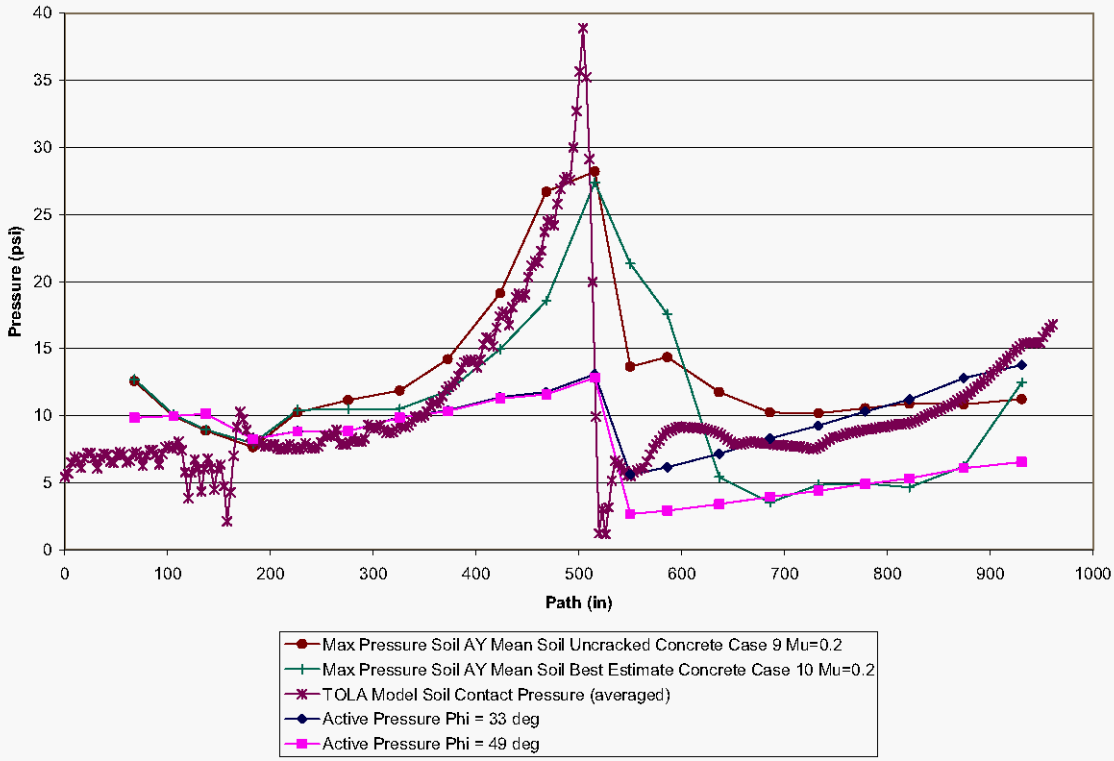


Figure 4.57. Soil Contact Pressures for μ=0.2

One drawback in the application of the soil load in a single step is it does not represent the effect of construction method. During the construction of the tanks, the tank was completed in an excavation then the soil was added. ANSYS® can represent this processing using element birth and death. It is anticipated that using element birth and death will provide the most realistic representation of the initial conditions. Figure 4.58 shows a comparison between the results for element birth and death and a single step loading. The only significant difference occurs over the haunch.

The difference in soil contact pressures results in differences in concrete forces and moments. Again, the primary area affected is the haunch of the tank. Figures 4.59 through 4.62 show concrete forces and moment comparisons. The largest difference occurs in the Meridional moment in the haunch, however, is can be seen that the single step loading general results in higher forces and moments.

Enabling the large displacement feature in ANSYS® is required to perform an analysis with birth and death of element. The modeling of the waste creates solution problems when large geometry is enabled, so can not be used in the transient portion of the solution. Unfortunately, the large displacement feature can not be switched on and off between solution phases (static vs. transient). Therefore, the birth and death feature can not be used for the full transient analysis. However, it is useful for evaluating the initial loading (gravity only) condition of the model.

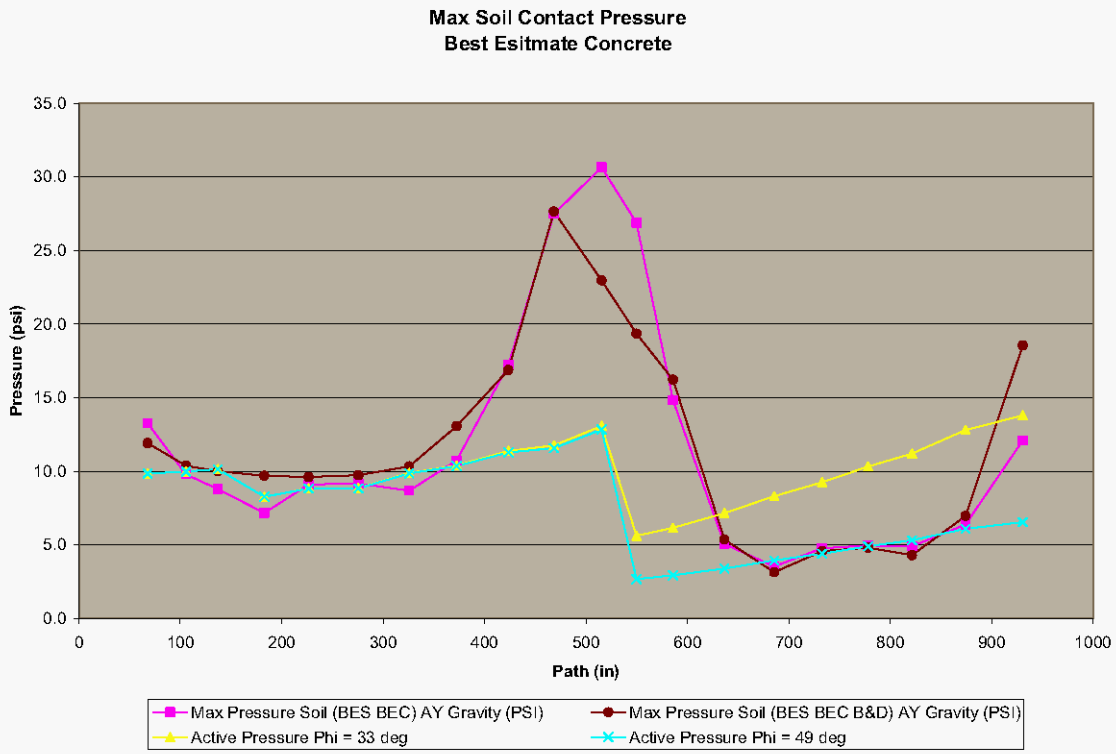


Figure 4.58. Soil Contact Pressures for Single-Step and Multi-Step Loading

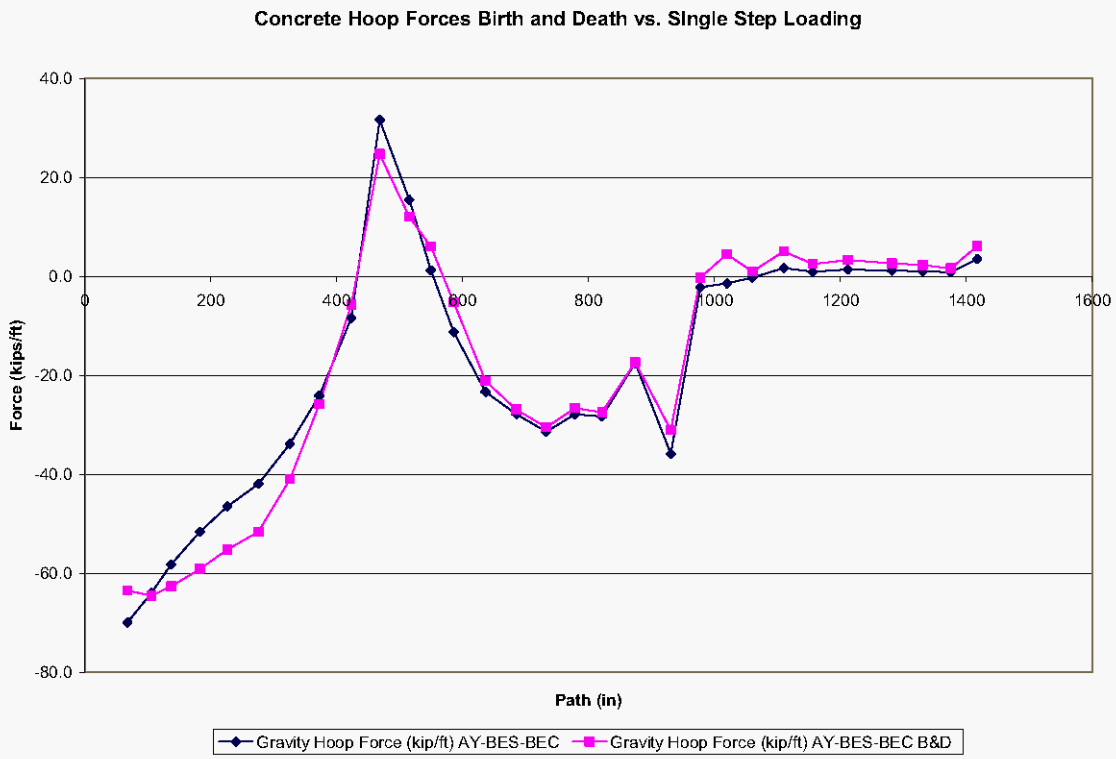


Figure 4.59. Concrete Hoop Forces for Single-Step and Multi-Step Loading

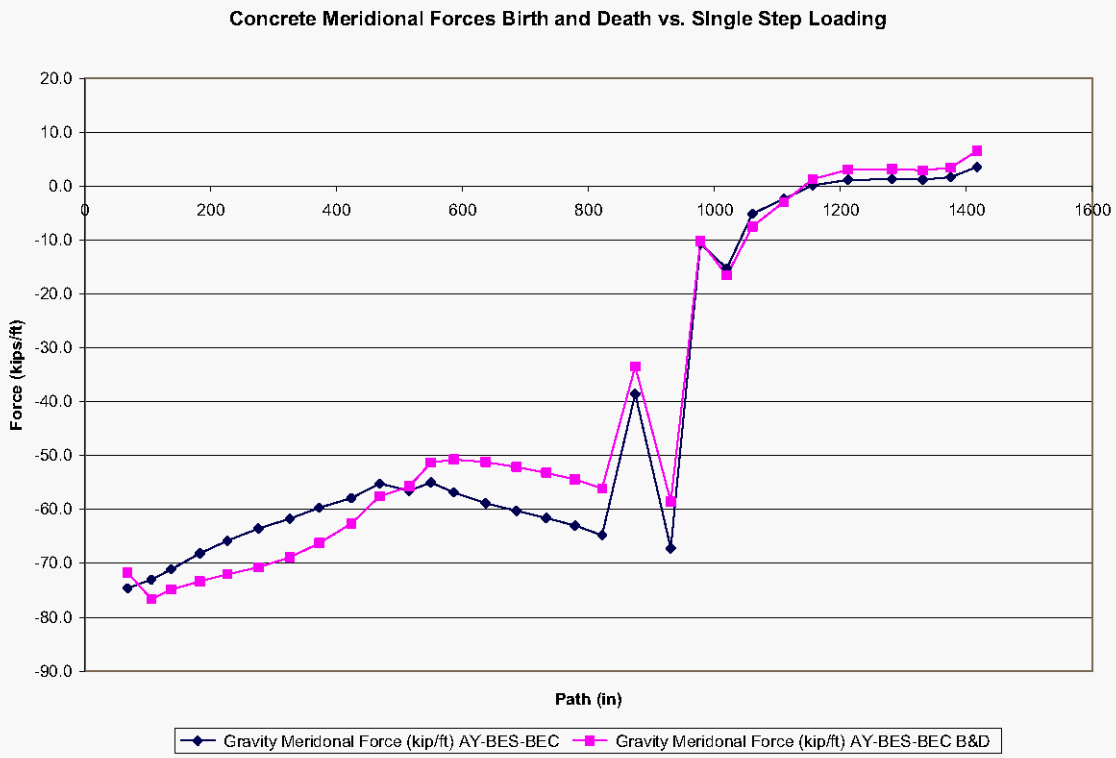


Figure 4.60. Concrete Meridional Forces for Single-Step and Multi-Step Loading

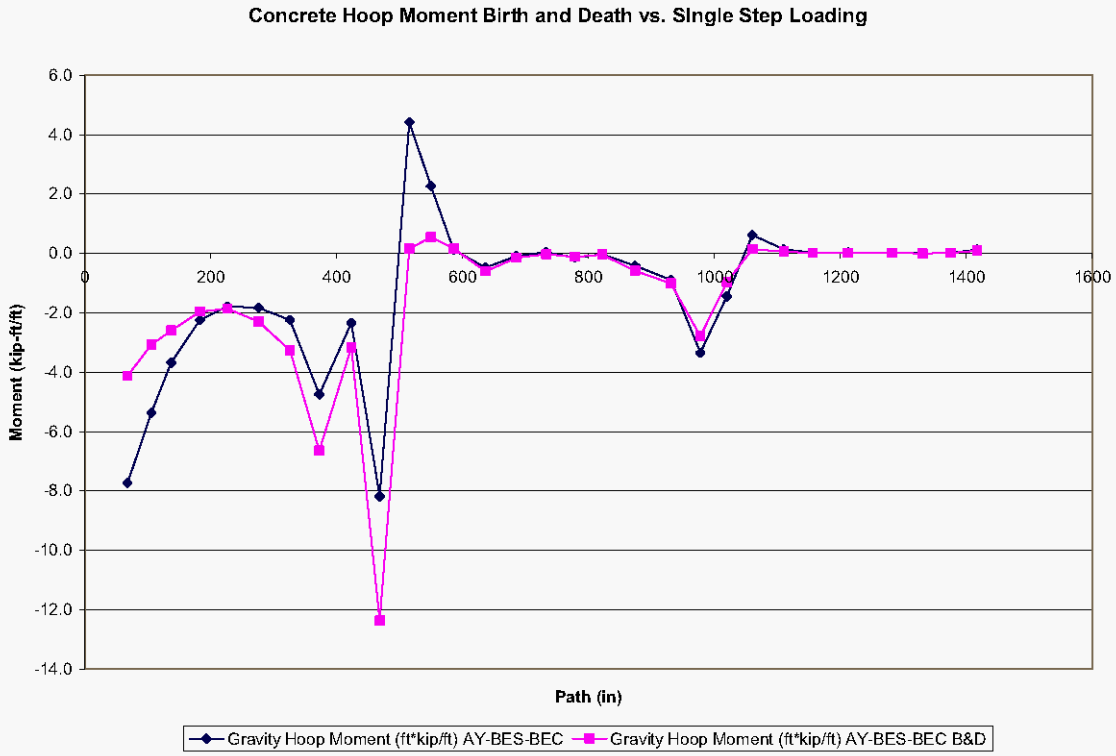


Figure 4.61. Concrete Hoop Moments for Single-Step and Multi-Step Loading

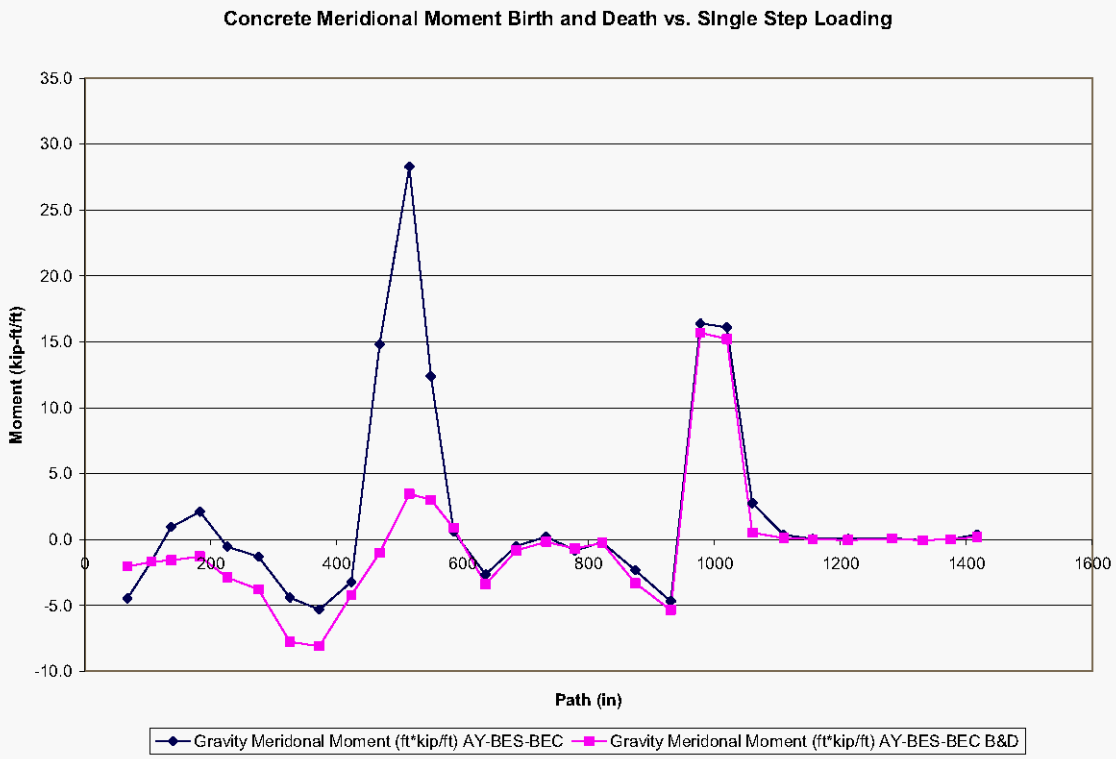


Figure 4.62. Concrete Meridional Moments for Single-Step and Multi-Step Loading

4.2.5 Conclusion

Based in the discussion above, the following model features will be used to minimize the effects of soil arching over the dome.

Initial coefficient of friction = 0.2
Transient coefficient of friction = 0.6
Reduce soil stiffness in two regions over dome to 250 kip/ft^2. This will be done in a cubic zone over the center of the dome and in a ring over the haunch of the tank.

5.0 Global Model Results

This section presents a summary of the results for the global model for the four load conditions considered for this analysis. 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 E
- Best Estimate Soil, Best Estimate Concrete — Appendix F
- Upper Bound Soil, Best Estimate Concrete — Appendix G
- Best Estimate Soil, Fully Cracked Concrete — Appendix H

All data was extracted for the full transient analysis (2049 step) and summarized using ANSYS® to obtain the minimum and maximum values. Both the full time history data and summary data are available electronically.

5.1 Load Cases

As discussed in Section 2.0, 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.

5.1.1 Lower Bound Soil, Best Estimate Concrete

For the lower bound soil case, the spectra are compared against the surface and tank base spectra with the appropriate scale factors applied. For the lower bound soil, scale factors of 1.175 and 1.12 have been applied to the base acceleration time histories for horizontal and vertical accelerations, respectively. As can be seen in Figures 5.1 through 5.4, 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.

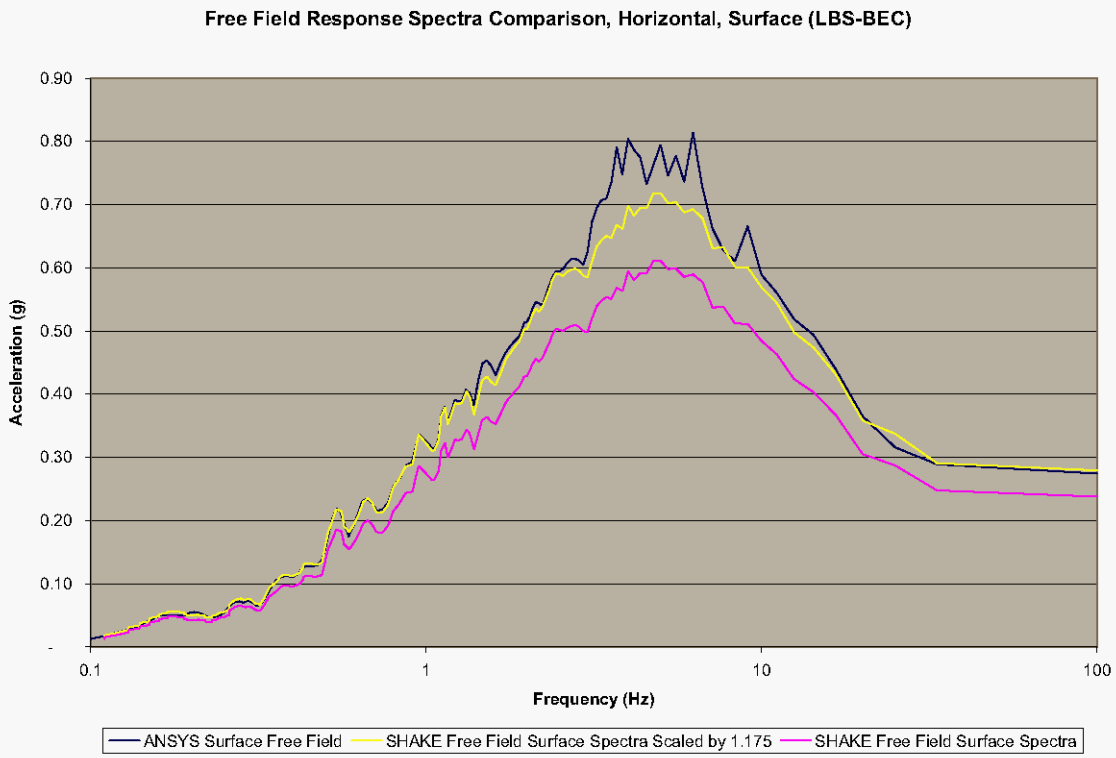


Figure 5.1. Horizontal Response Spectra Comparison, Surface (LBS-BEC)

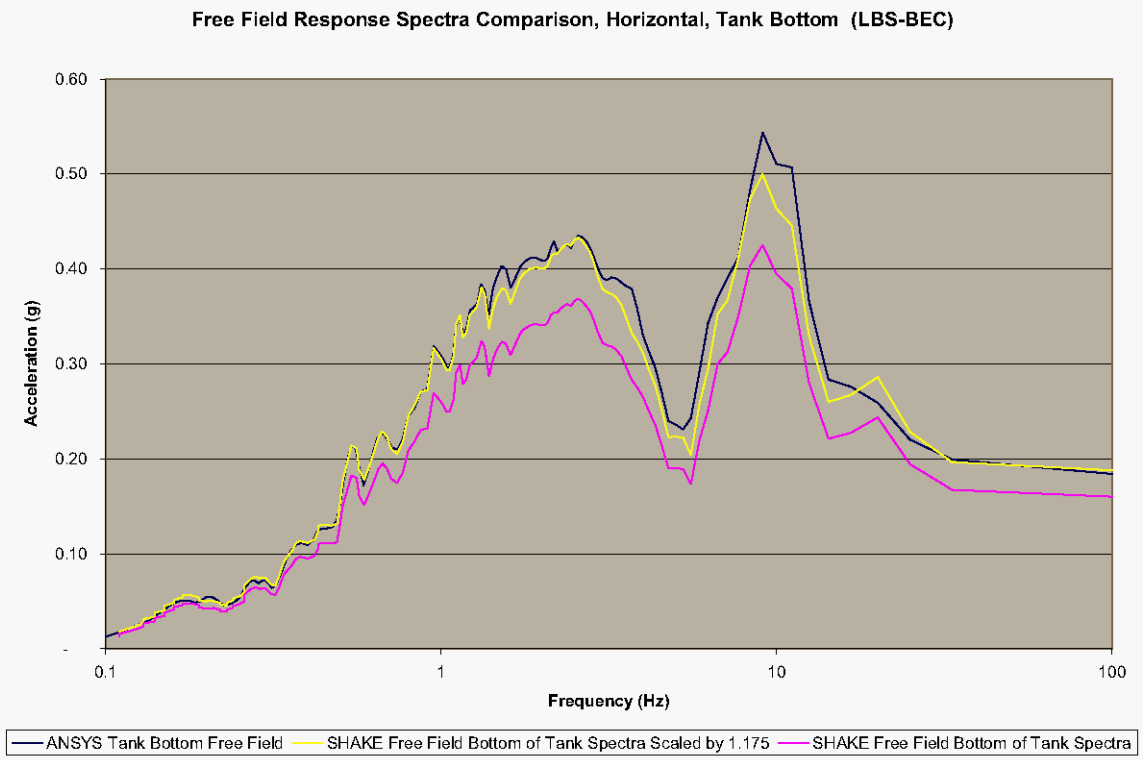


Figure 5.2. Horizontal Response Spectra, Tank Bottom (LBS-BEC)

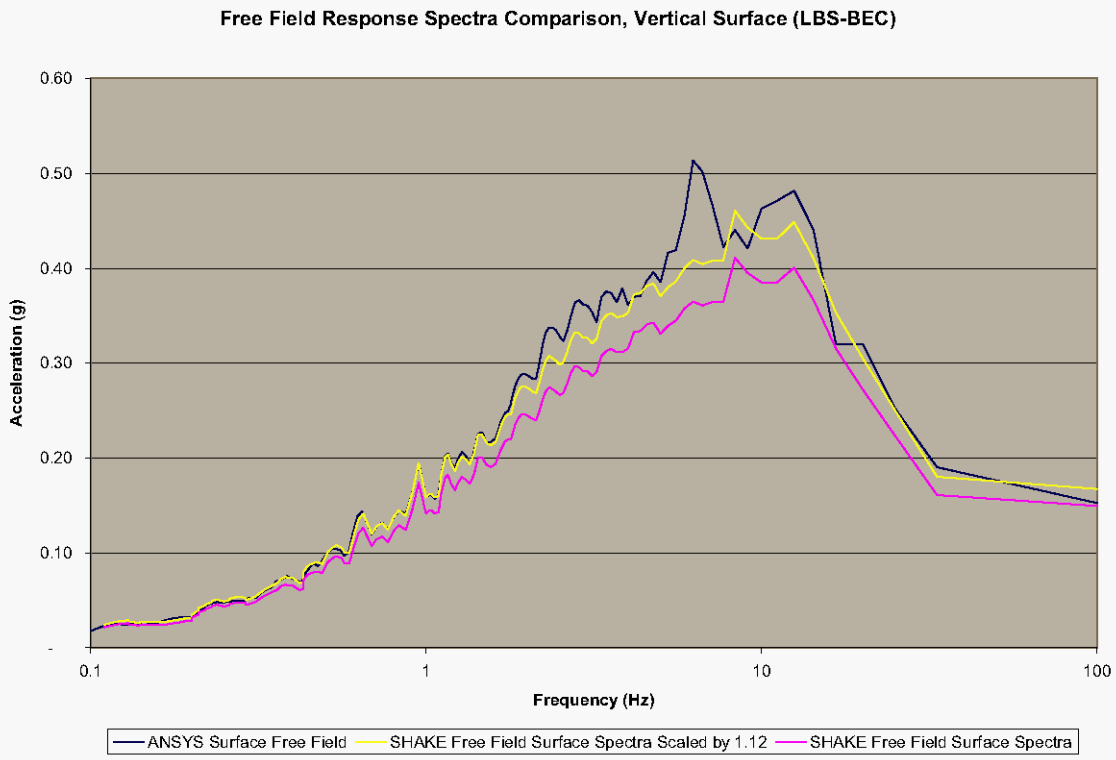


Figure 5.3. Vertical Response Spectra Comparison, Surface (LBS-BEC)

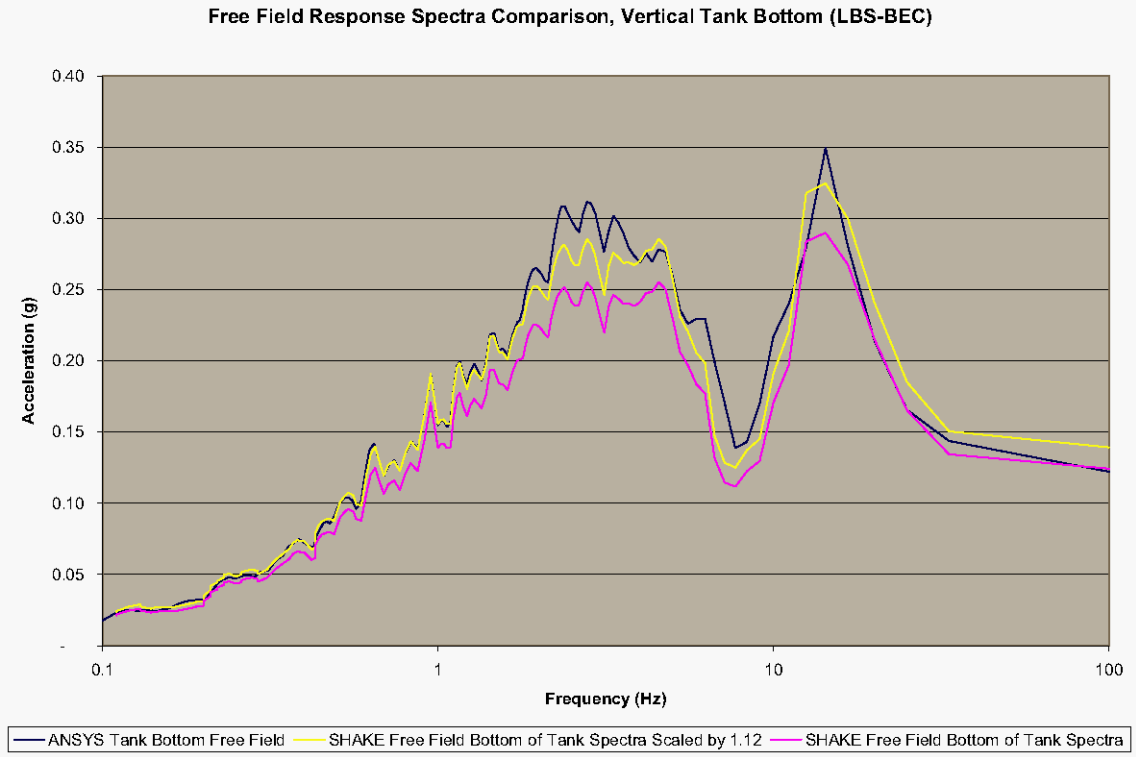


Figure 5.4. Vertical Response Spectra, Tank Bottom (LBS-BEC)

5.1.2 Best Estimate Soil, Best Estimate 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. As can be seen in Figures 5.5 through 5.8, 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.

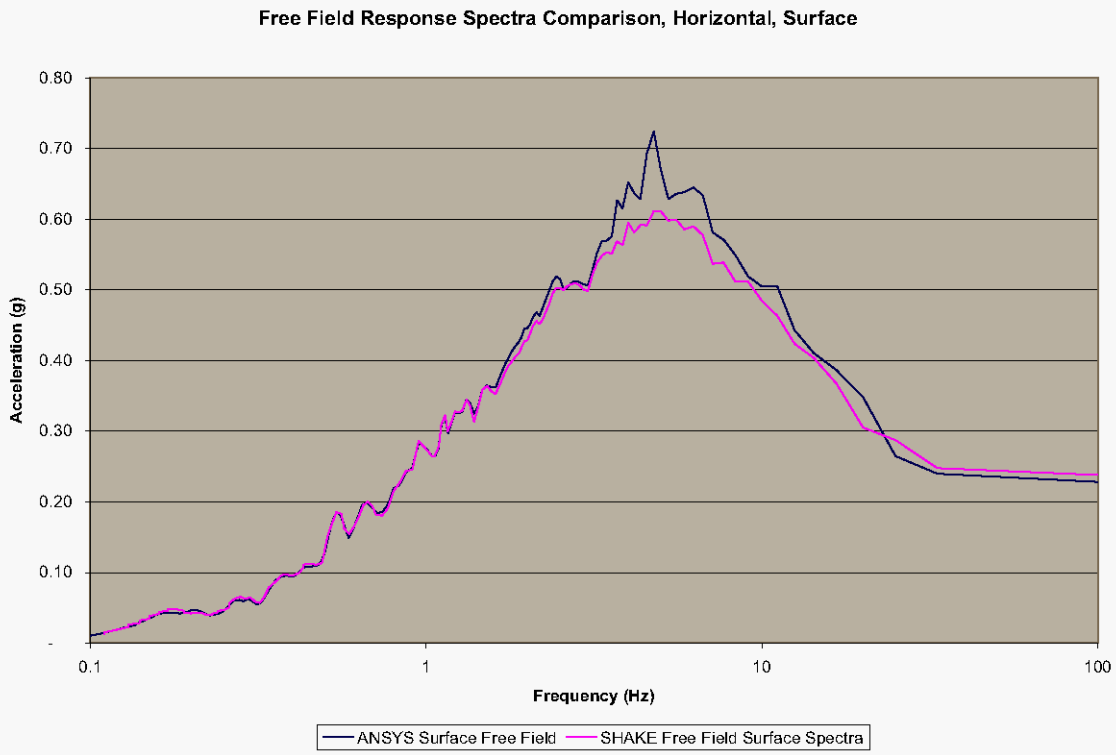


Figure 5.5. Horizontal Response Spectra Comparison, Surface (BES-BEC)

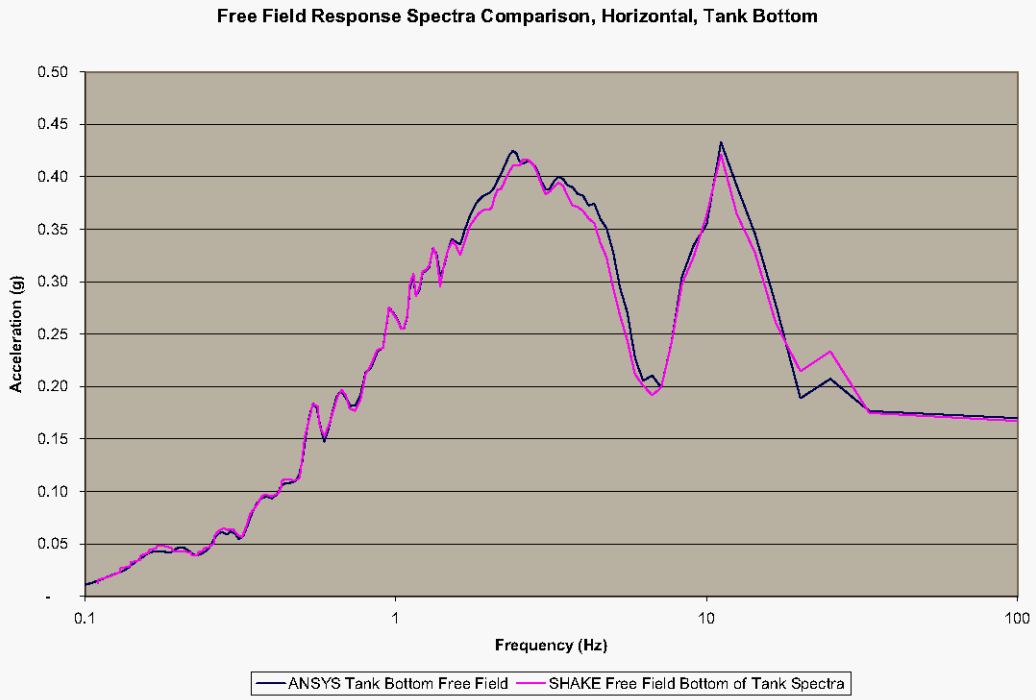


Figure 5.6. Horizontal Response Spectra, Tank Bottom (BES-BEC)

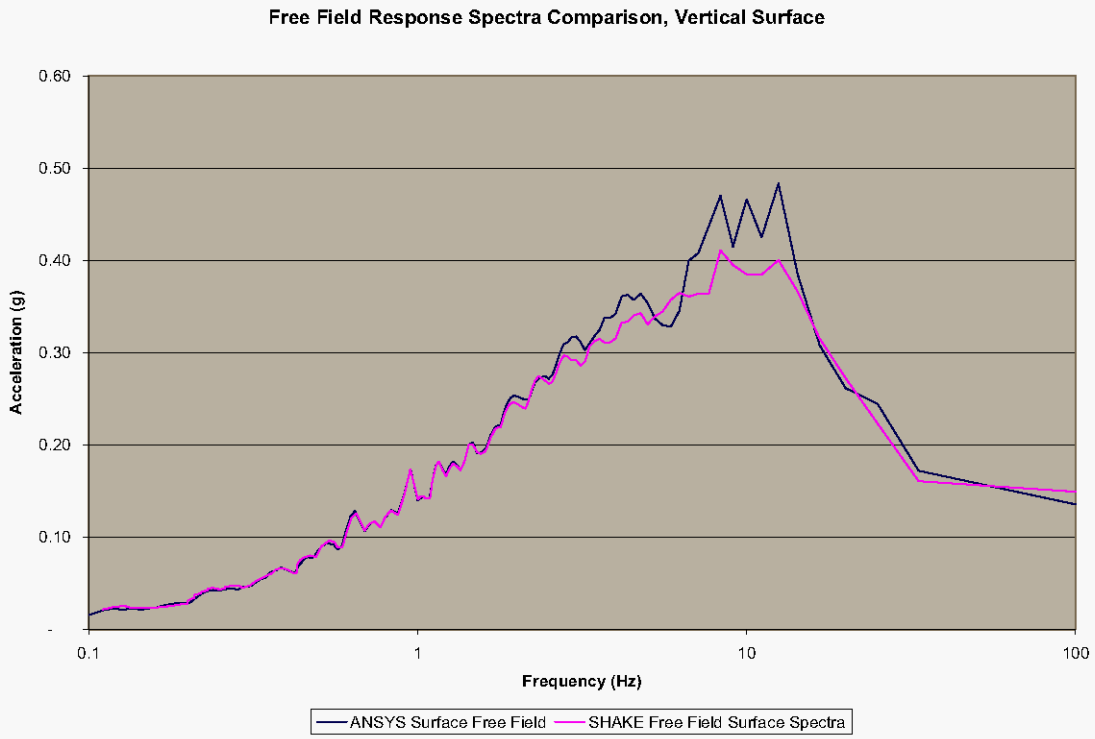


Figure 5.7. Vertical Response Spectra Comparison, Surface (BES-BEC)

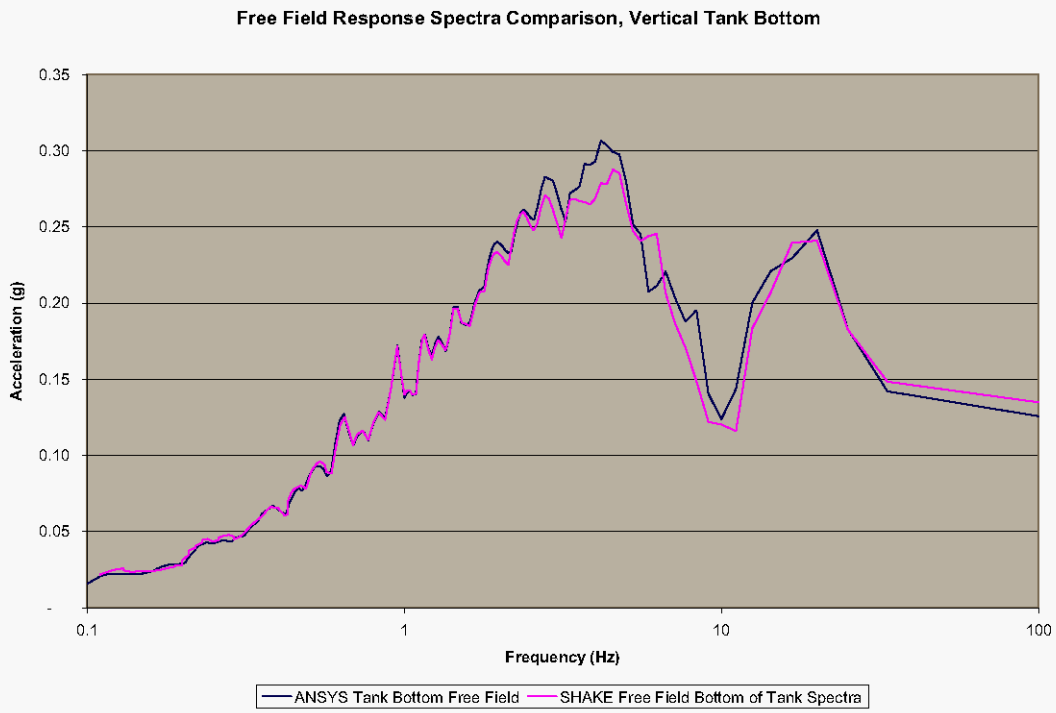


Figure 5.8. Vertical Response Spectra, Tank Bottom (BES-BEC)

5.1.3 Upper Bound Soil, Best Estimate Concrete

For the upper bound soil case, the spectra are compared against the surface and tank base spectra with the appropriate scale factors applied. For the lower bound soil, scale factors of 1.2 and 1.19 have been applied to the base acceleration time histories for horizontal and vertical accelerations, respectively. As can be seen in Figures 5.9 through 5.12, 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.

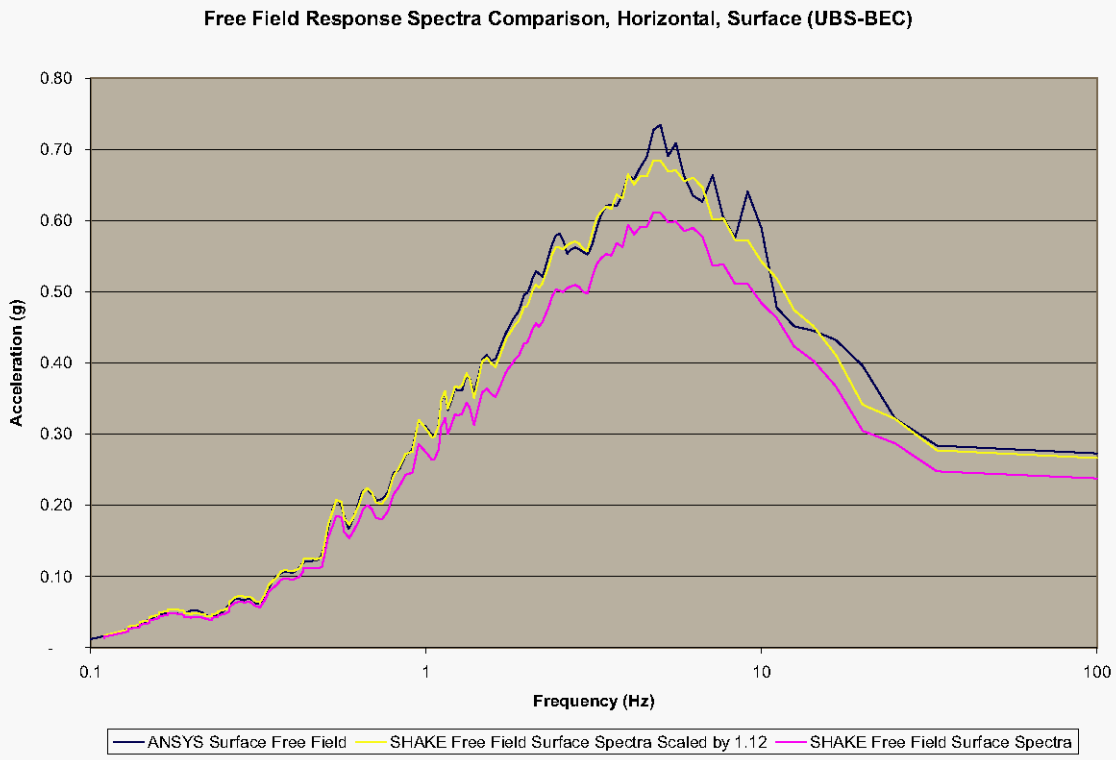


Figure 5.9. Horizontal Response Spectra Comparison, Surface (UBS-BEC)

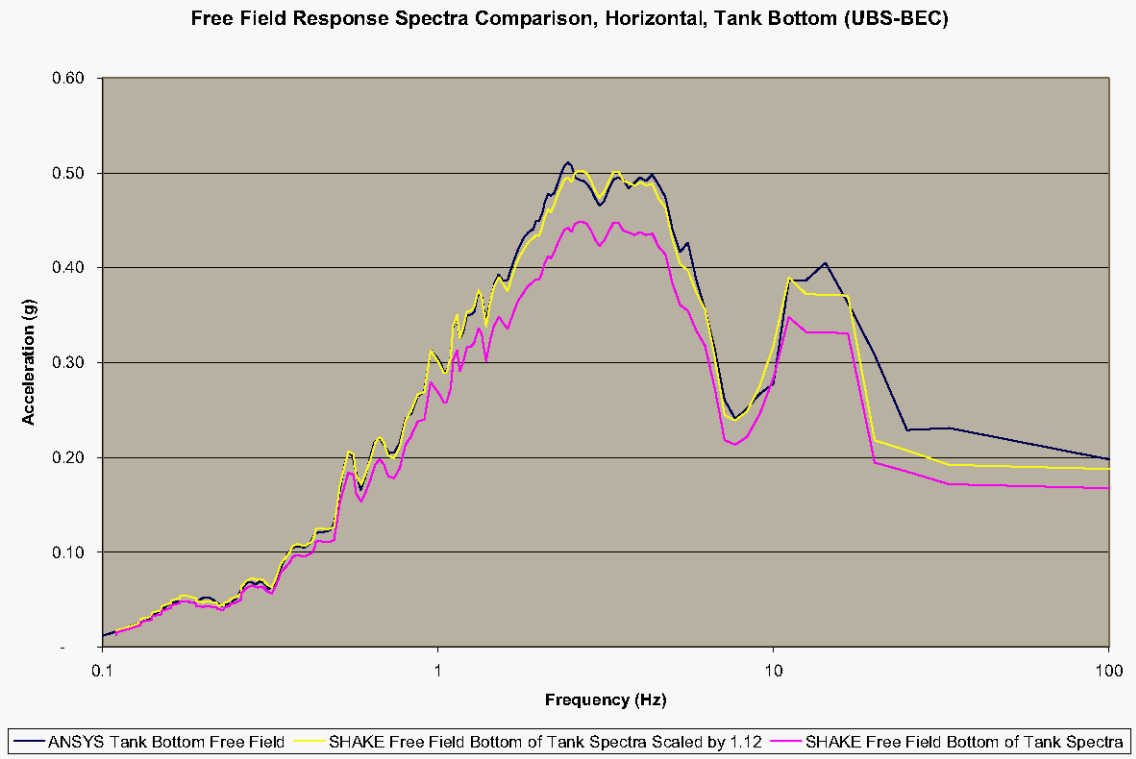


Figure 5.10. Horizontal Response Spectra, Tank Bottom (UBS-BEC)

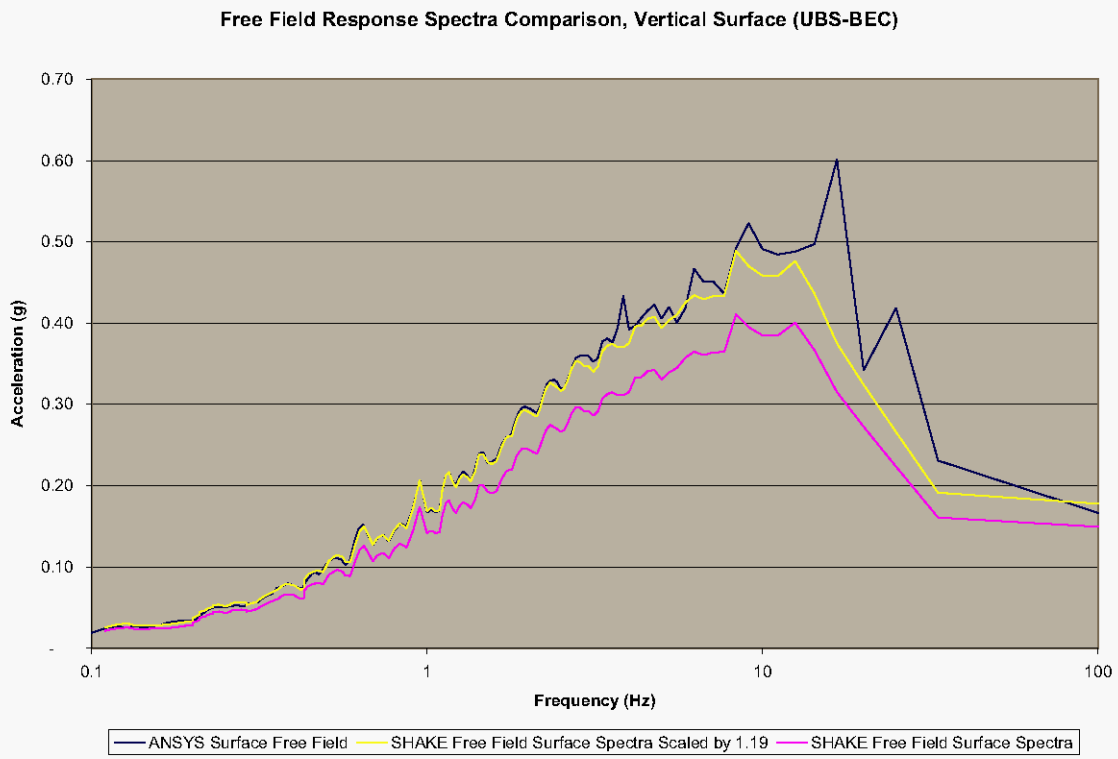


Figure 5.11. Vertical Response Spectra Comparison, Surface (UBS-BEC)

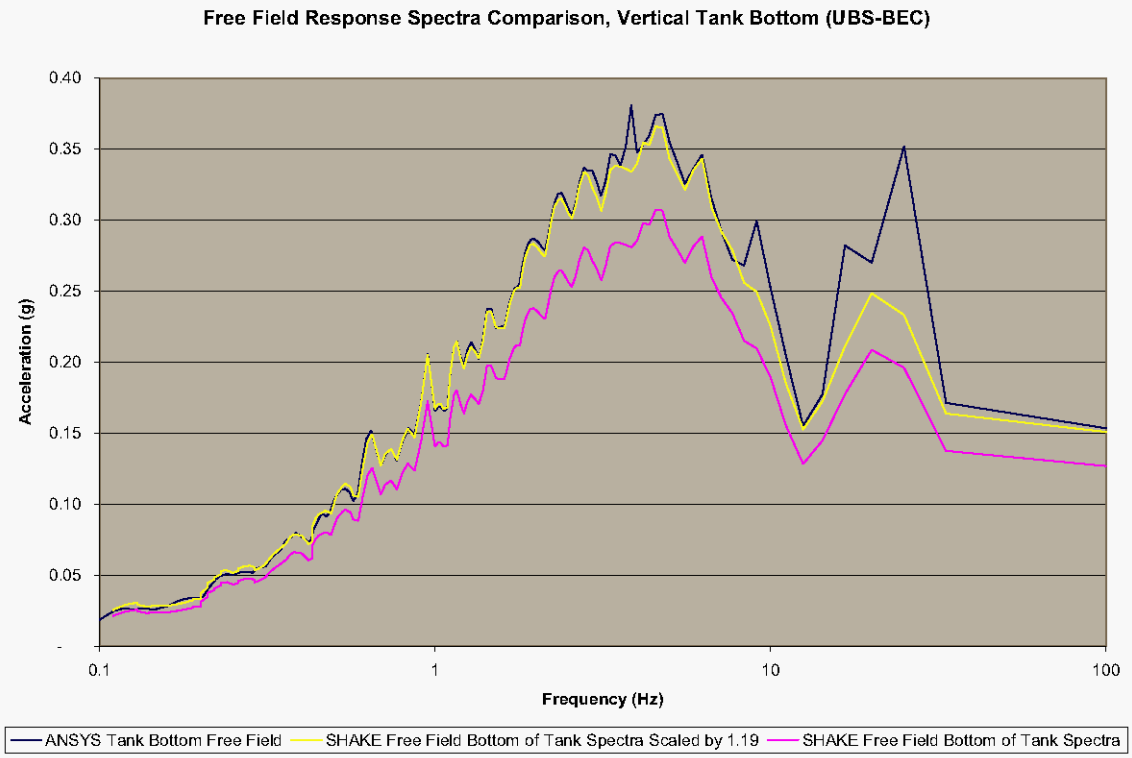


Figure 5.12. Vertical Response Spectra, Tank Bottom (UBS-BEC)

5.1.4 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. As can be seen in Figures 5.13 through 5.16, 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.

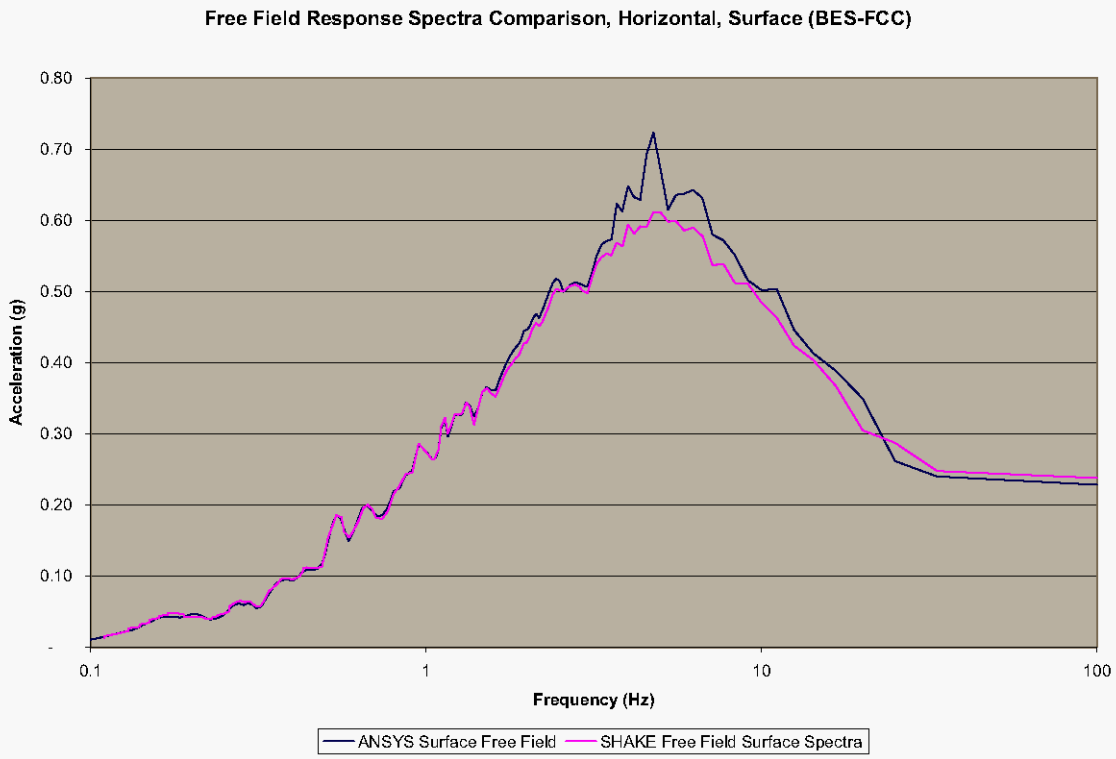


Figure 5.13. Horizontal Response Spectra Comparison, Surface (BES-FCC)

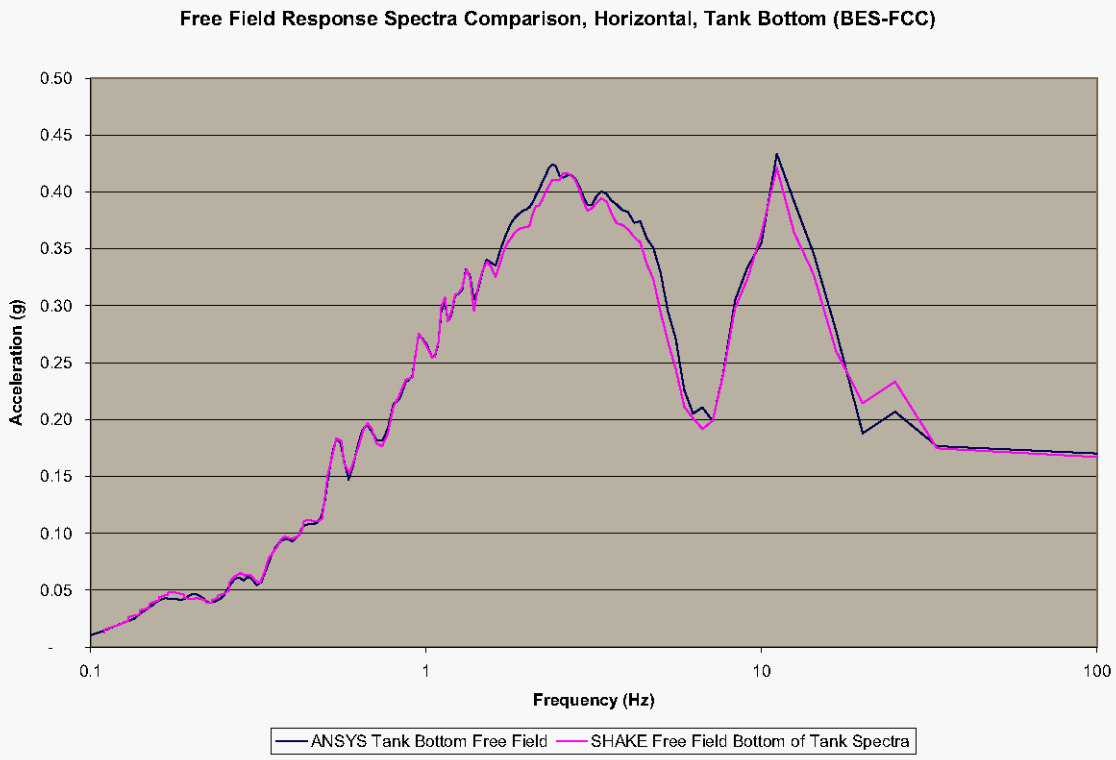


Figure 5.14. Horizontal Response Spectra, Tank Bottom (BES-FCC)

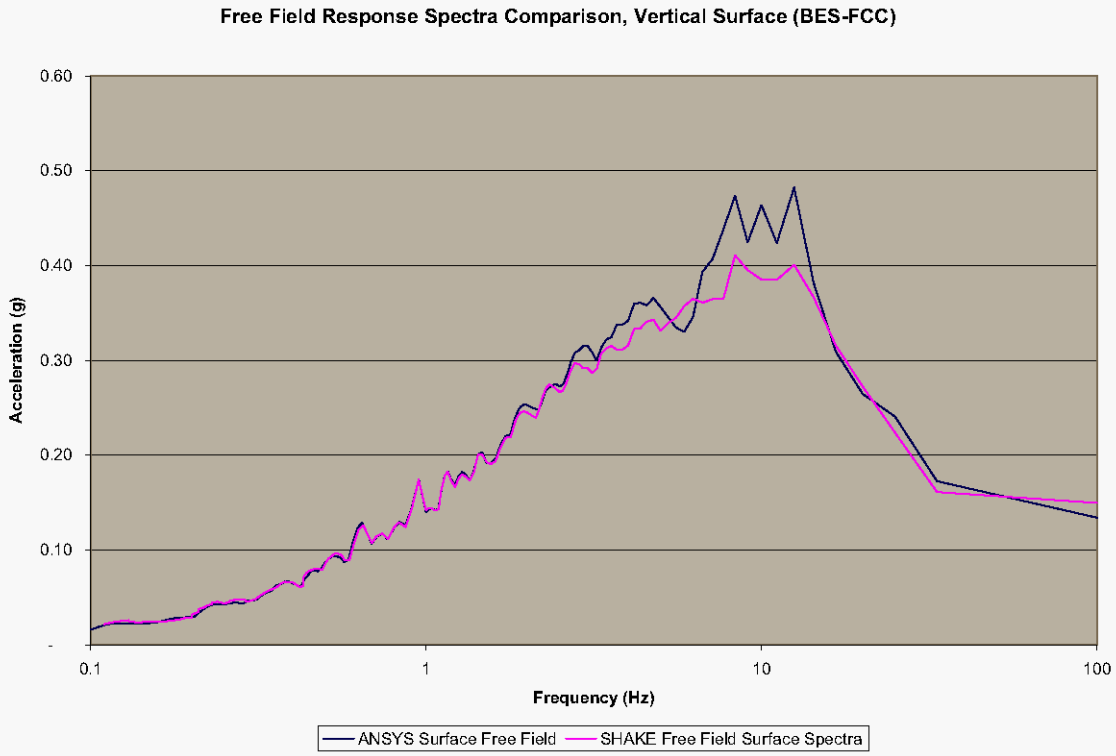


Figure 5.15. Vertical Response Spectra Comparison, Surface (BES-FCC)

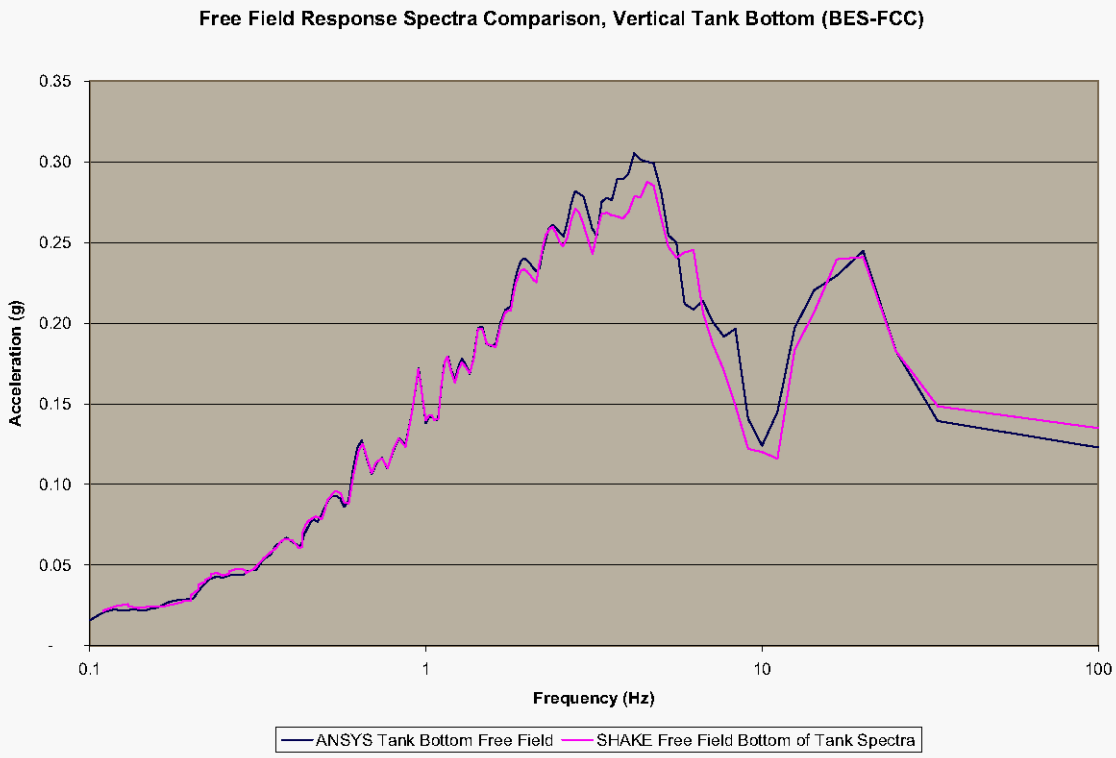


Figure 5.16. Vertical Response Spectra, Tank Bottom (BES-FCC)

6.0 Tank Results

6.1 Concrete Tank

Concrete tank 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 6.1 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 6 2. Concrete Tank Hoop Forces – Gravity Only
- Figure 6 3. Concrete Tank Hoop Forces – Gravity Plus Seismic
- Figure 6 4. Concrete Tank Hoop Forces – Seismic Only
- Figure 6 5. Concrete Tank Meridional Forces – Gravity Only
- Figure 6 6. Concrete Tank Meridional Forces – Gravity Plus Seismic
- Figure 6 7. Concrete Tank Meridional Forces – Seismic Only
- Figure 6 8. Concrete Tank Hoop Moments – Gravity Only
- Figure 6 9. Concrete Tank Hoop Moments – Gravity Plus Seismic
- Figure 6 10. Concrete Tank Hoop Moments – Seismic Only
- Figure 6 11. Concrete Tank Meridional Moments – Gravity Only
- Figure 6 12. Concrete Tank Meridional Moments – Gravity Plus Seismic
- Figure 6 13. Concrete Tank Meridional – Seismic Only
- Figure 6 14. Concrete Tank In-Plane Shear Forces – Gravity Only
- Figure 6 15. Concrete Tank In-Plane Shear Forces – Gravity Plus Seismic
- Figure 6 16. Concrete Tank In-Plane Shear Forces – Seismic Only
- Figure 6 17. Concrete Tank Through-Wall Shear Forces – Gravity Only

- Figure 6 18. Concrete Tank Through-Wall Shear Forces – Gravity Plus Seismic
- Figure 6 19. Concrete Tank 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.

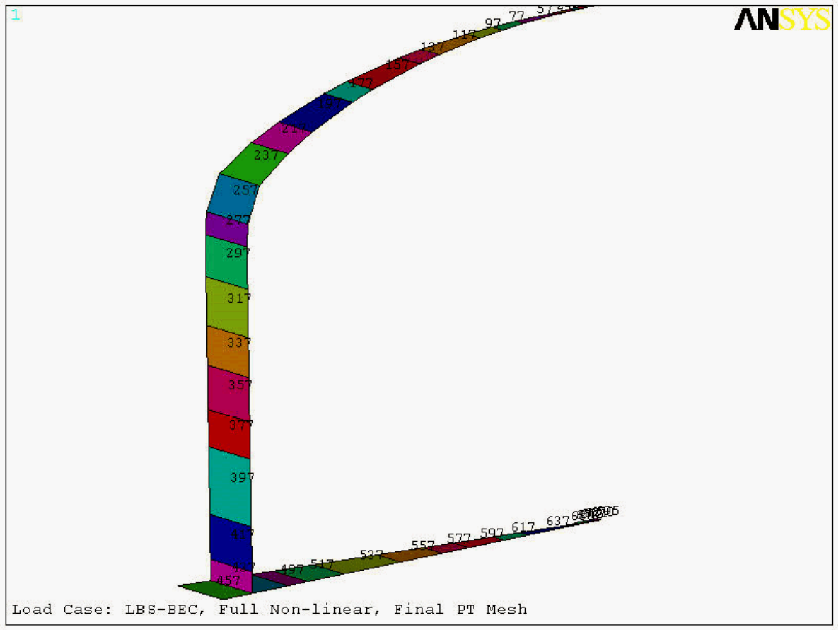


Figure 6.1. Concrete Tank Element Retreival Sequence Starting Numbers

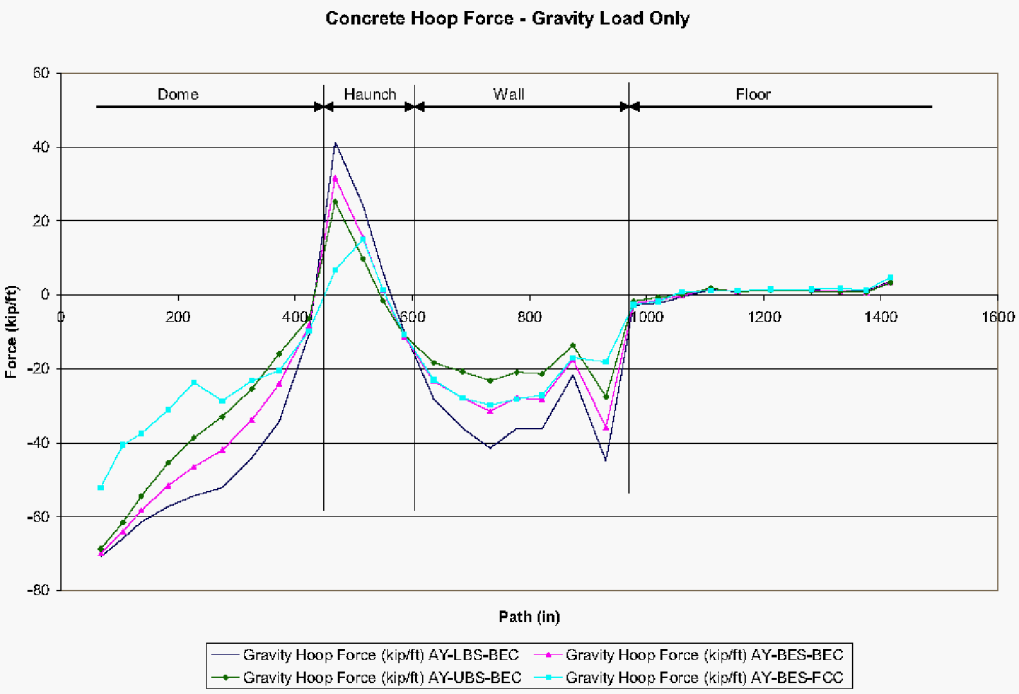


Figure 6.2. Concrete Tank Hoop Forces – Gravity Only

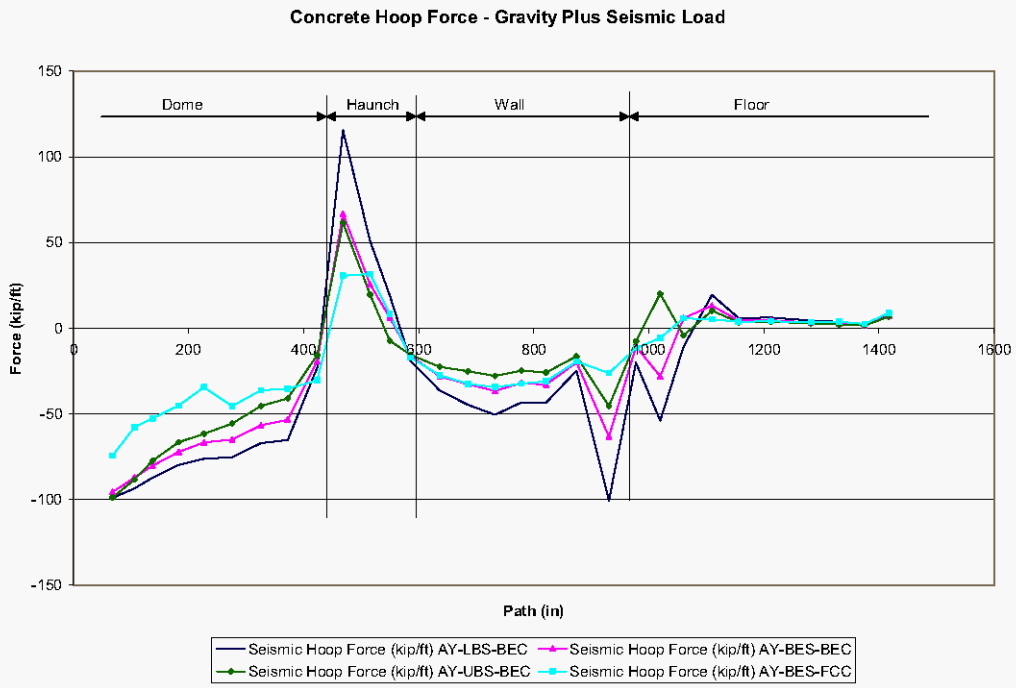


Figure 6.3. Concrete Tank Hoop Forces – Gravity Plus Seismic

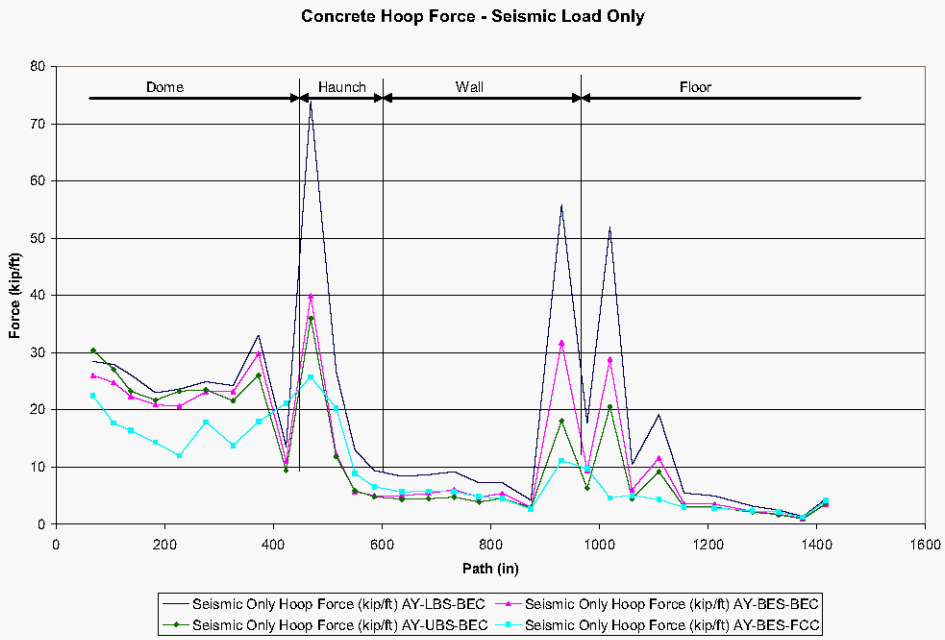


Figure 6.4. Concrete Tank Hoop Forces – Seismic Only

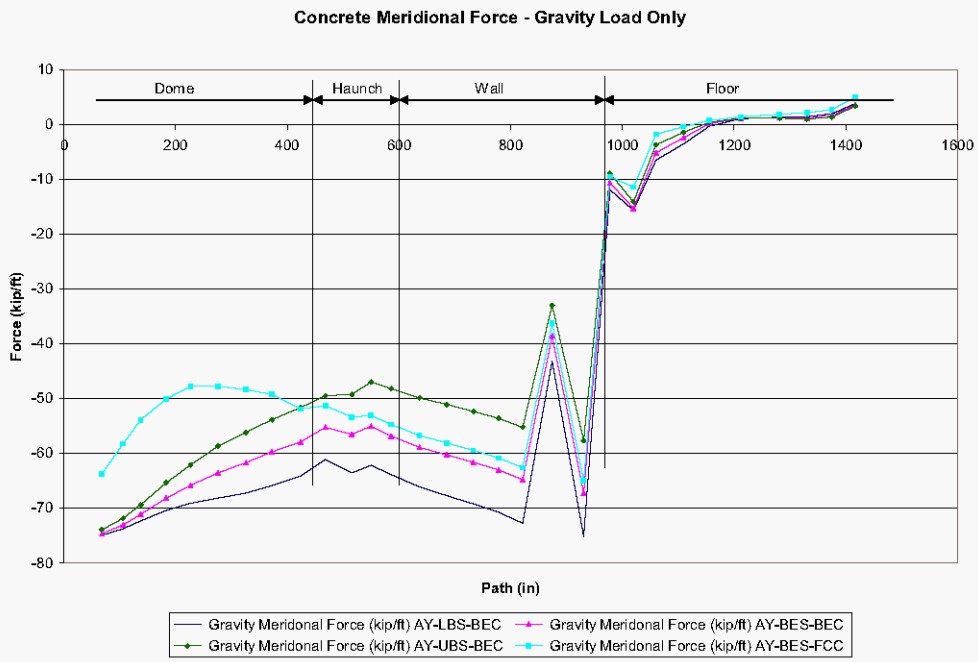


Figure 6.5. Concrete Tank Meridional Forces – Gravity Only

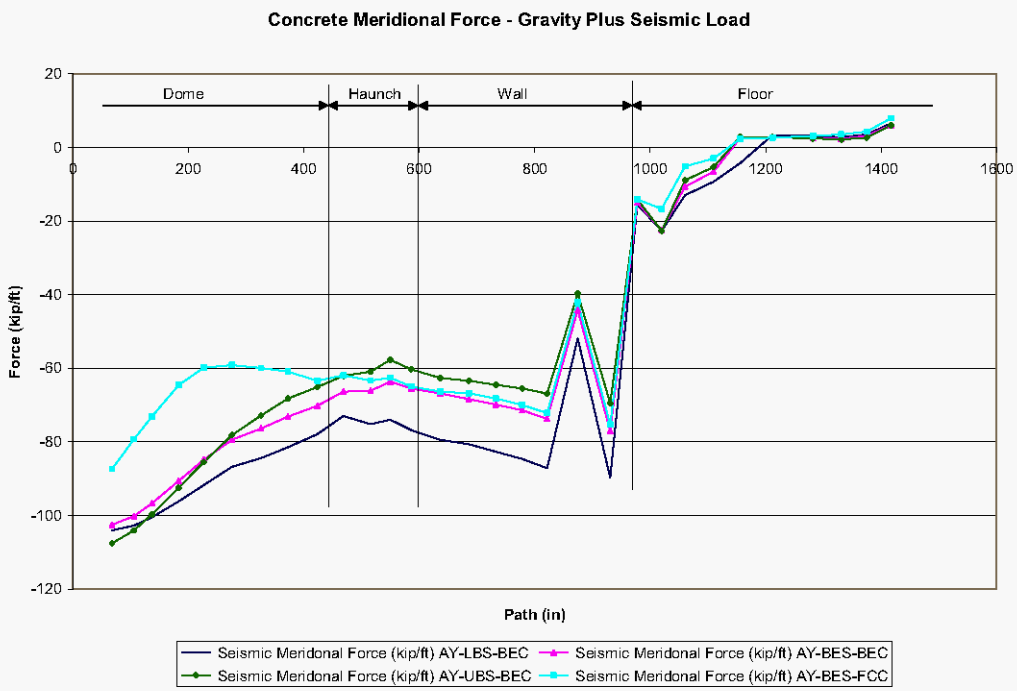


Figure 6.6. Concrete Tank Meridional Forces – Gravity Plus Seismic

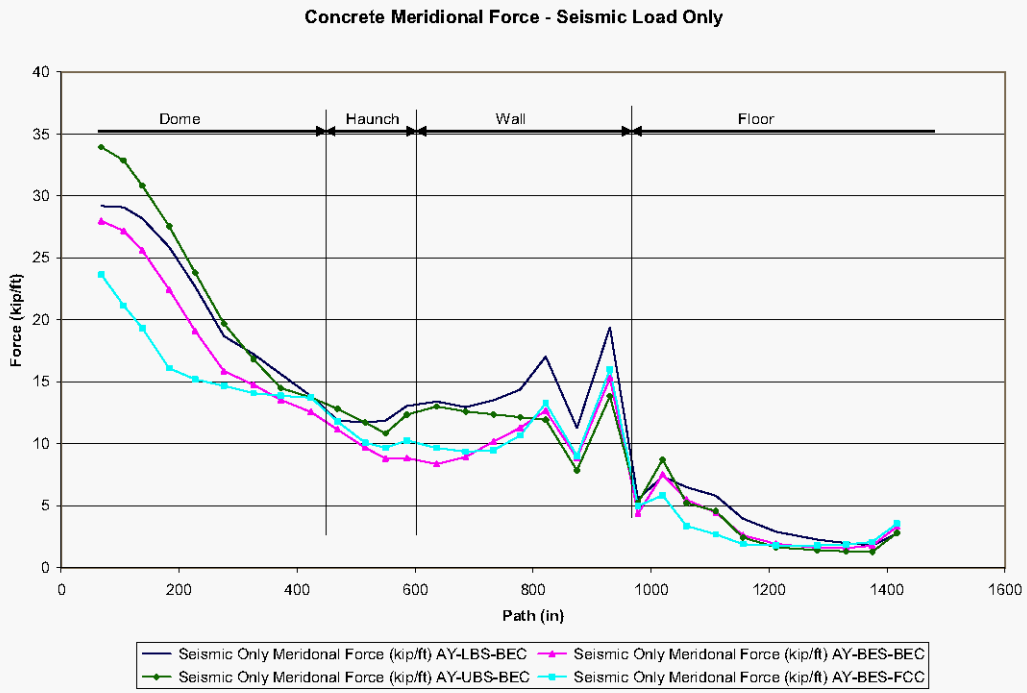


Figure 6.7. Concrete Tank Meridional Forces – Seismic Only

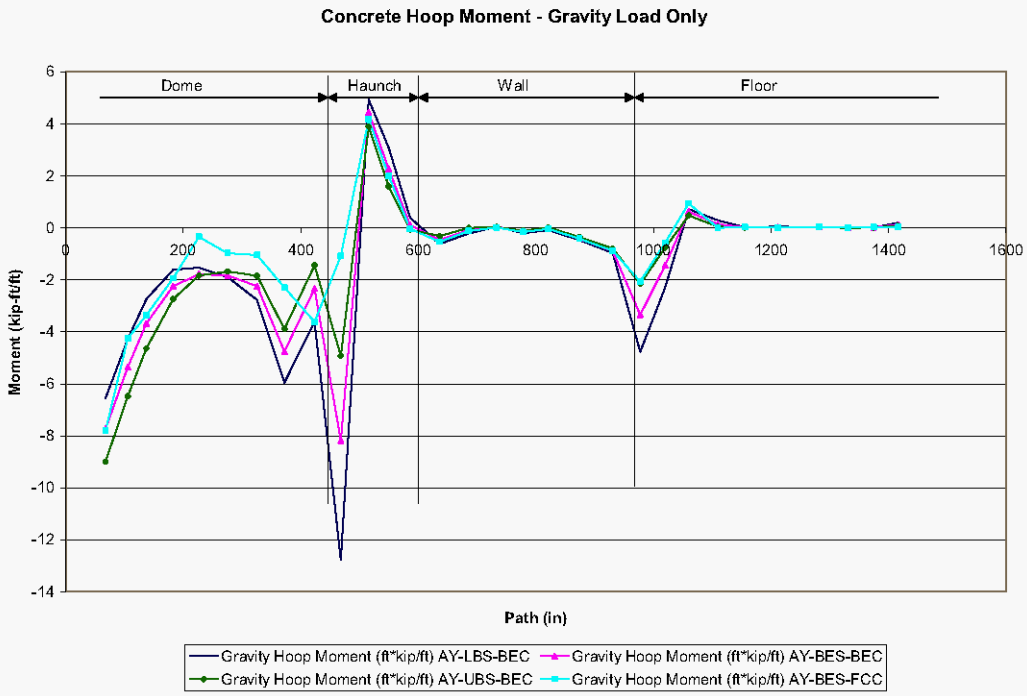


Figure 6.8. Concrete Tank Hoop Moments – Gravity Only

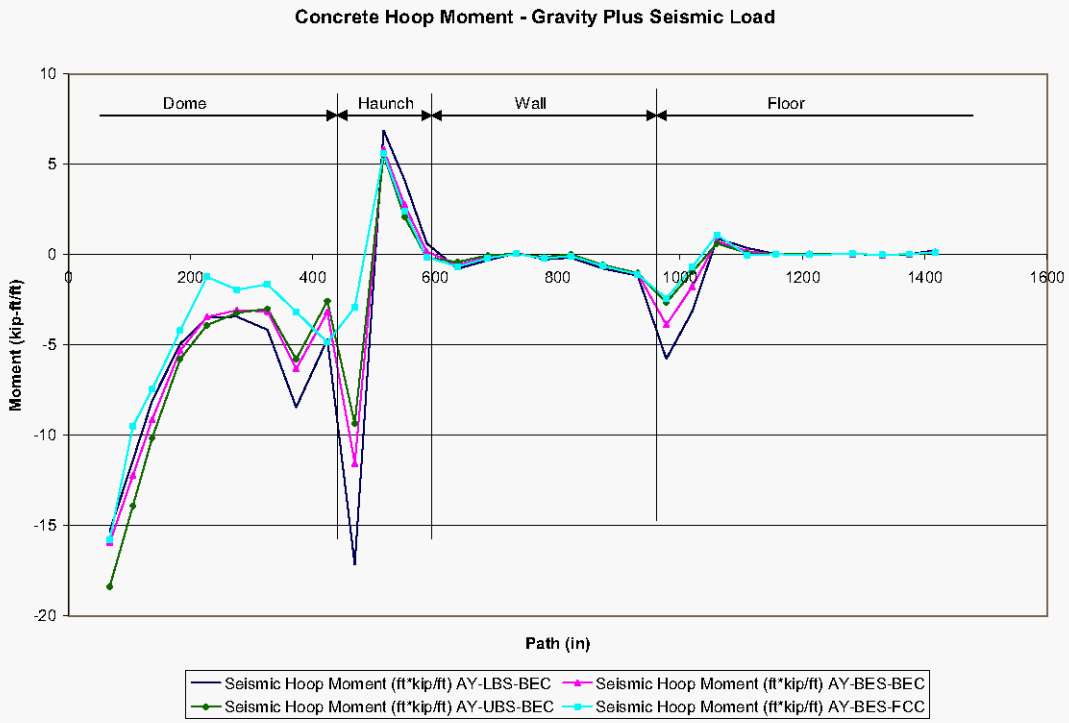


Figure 6.9. Concrete Tank Hoop Moments – Gravity Plus Seismic

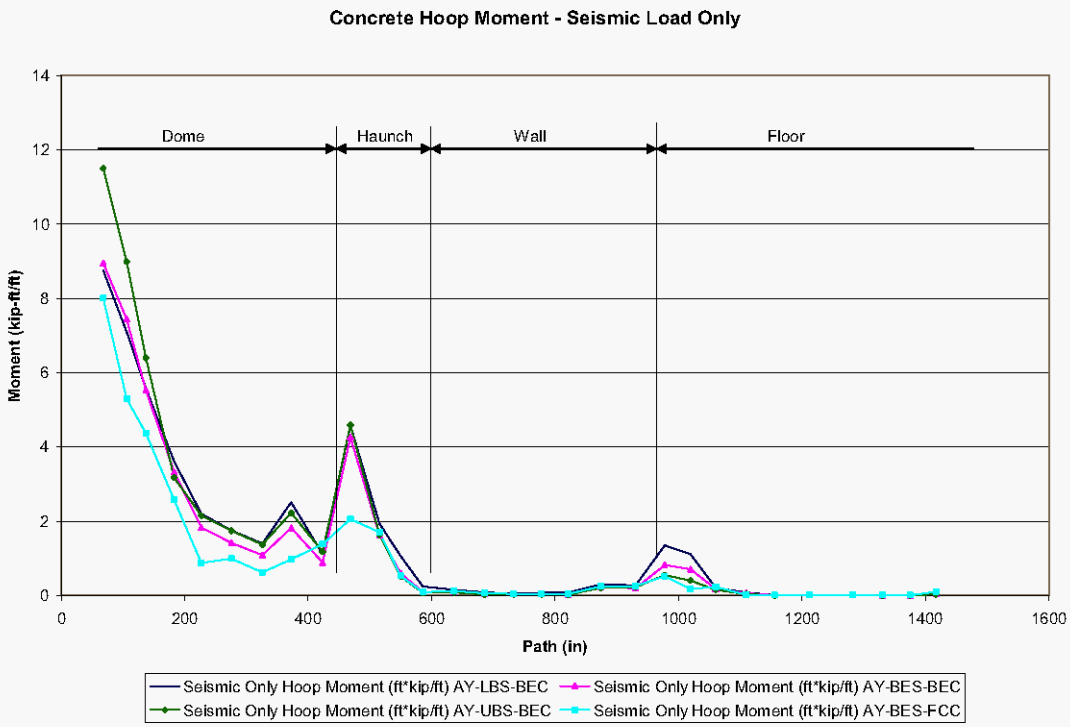


Figure 6.10. Concrete Tank Hoop Moments – Seismic Only

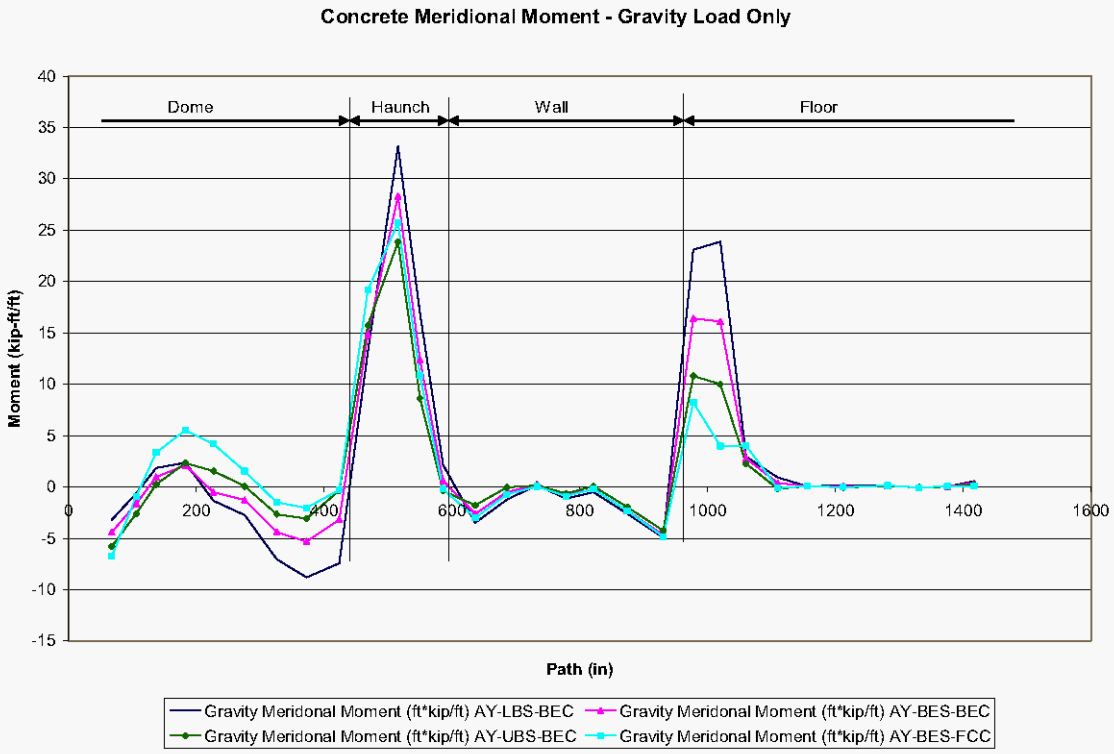


Figure 6.11. Concrete Tank Meridional Moments – Gravity Only

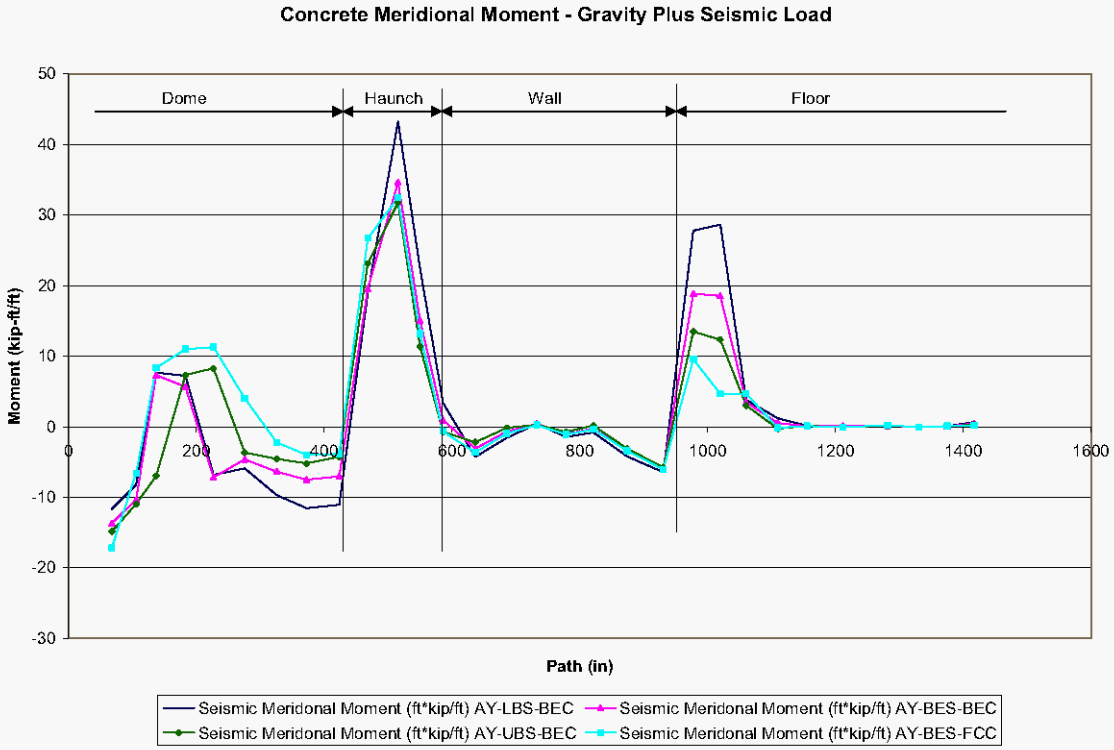


Figure 6.12. Concrete Tank Meridional Moments – Gravity Plus Seismic

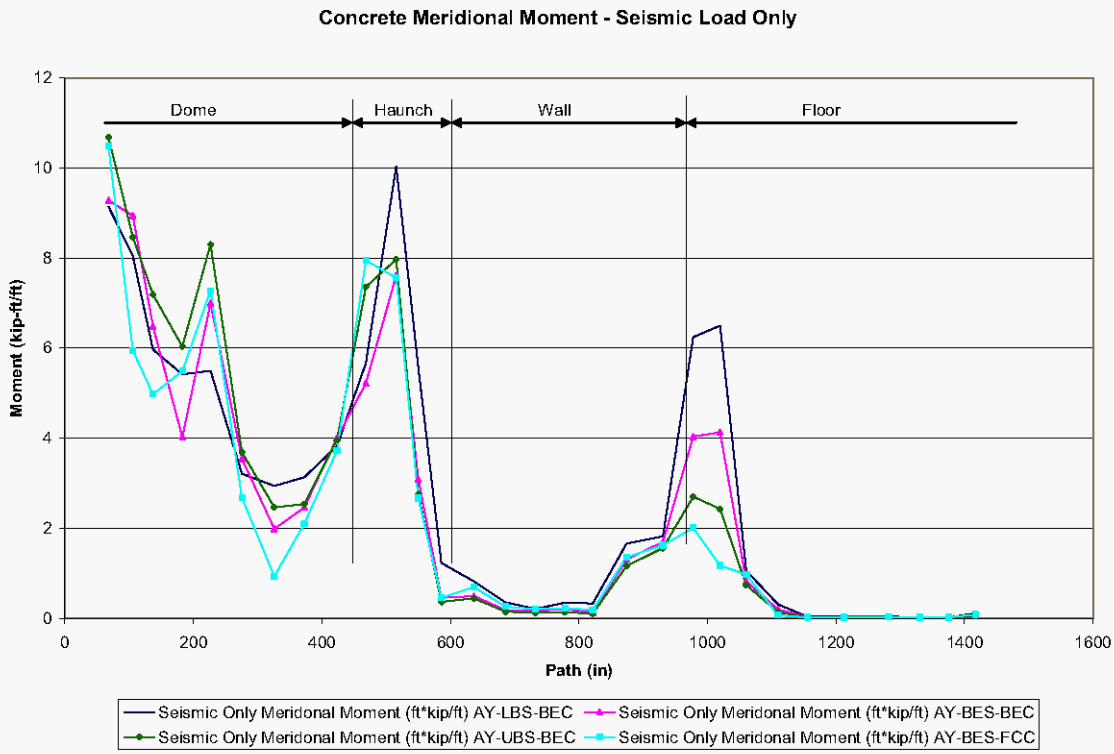


Figure 6.13. Concrete Tank Meridional – Seismic Only

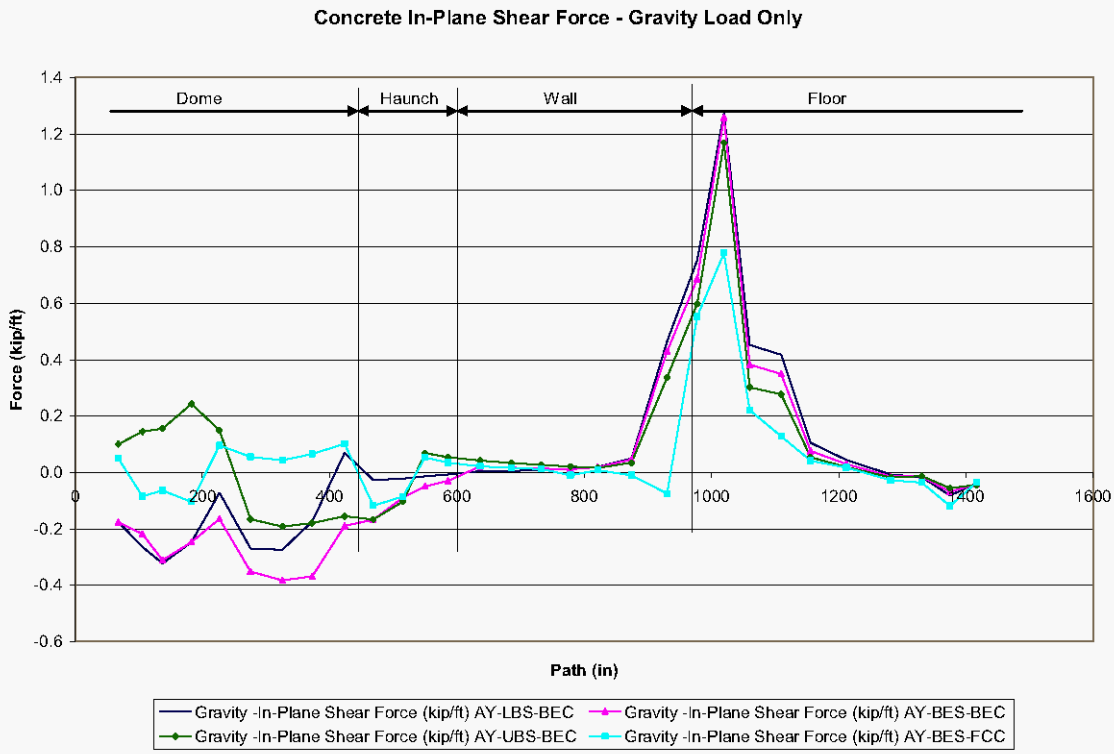


Figure 6.14. Concrete Tank In-Plane Shear Forces – Gravity Only

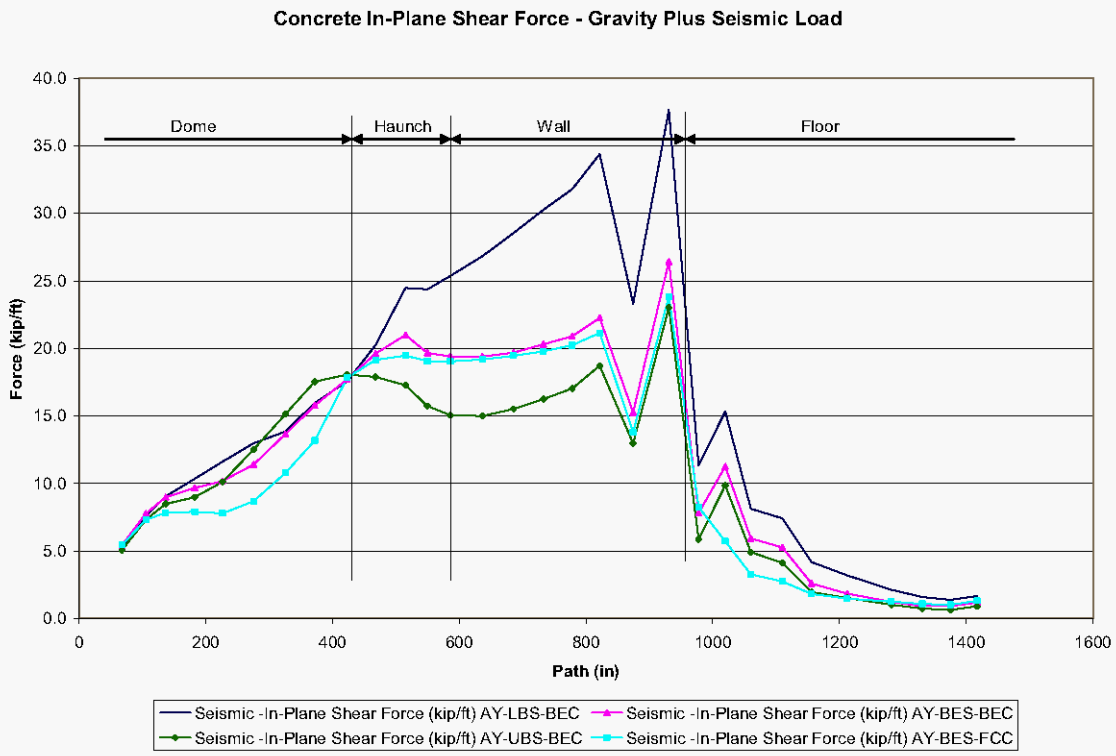


Figure 6.15. Concrete Tank In-Plane Shear Forces – Gravity Plus Seismic

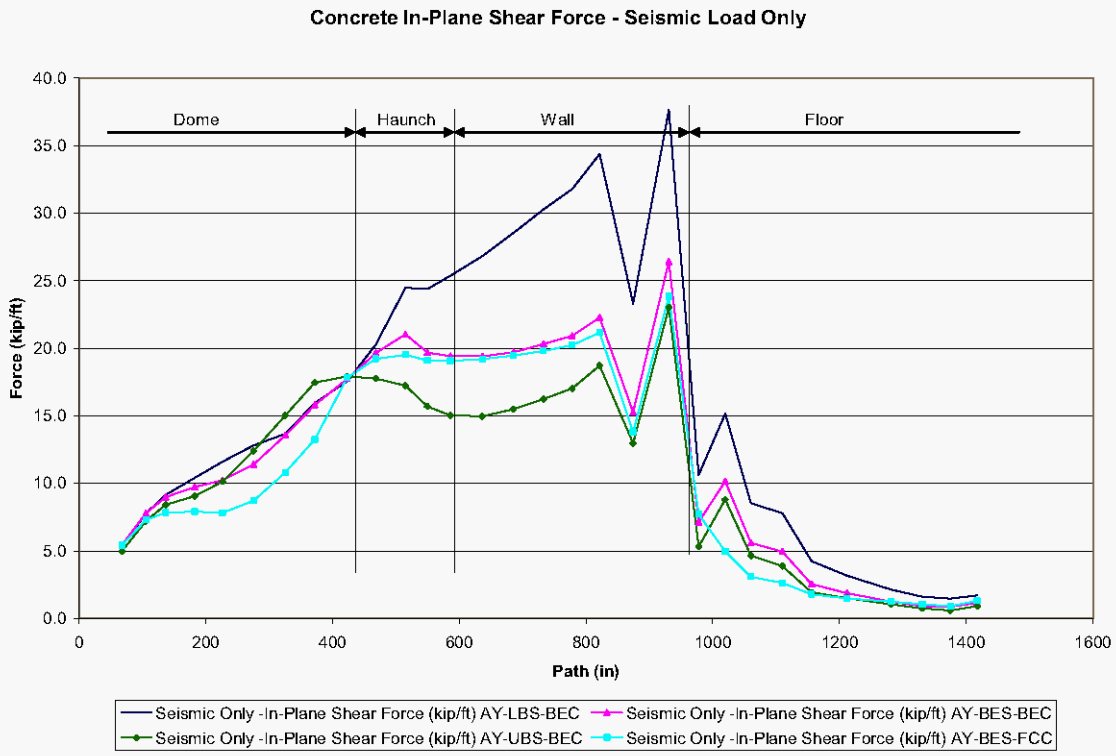


Figure 6.16. Concrete Tank In-Plane Shear Forces – Seismic Only

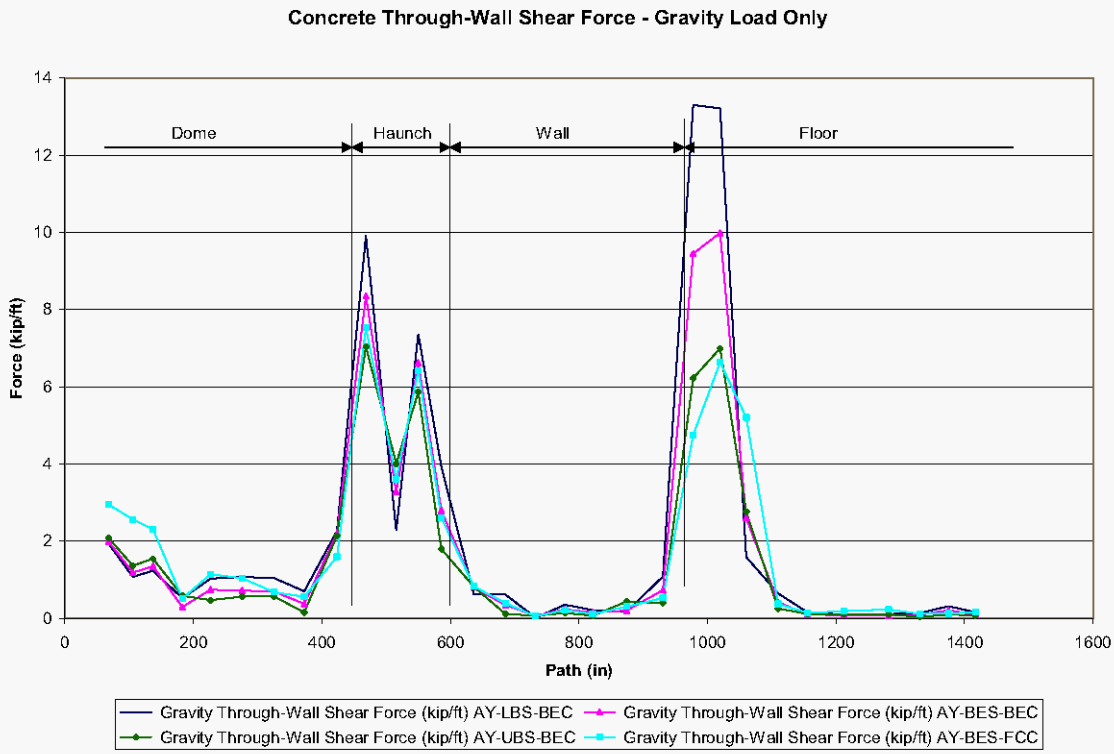


Figure 6.17. Concrete Tank Through-Wall Shear Forces – Gravity Only

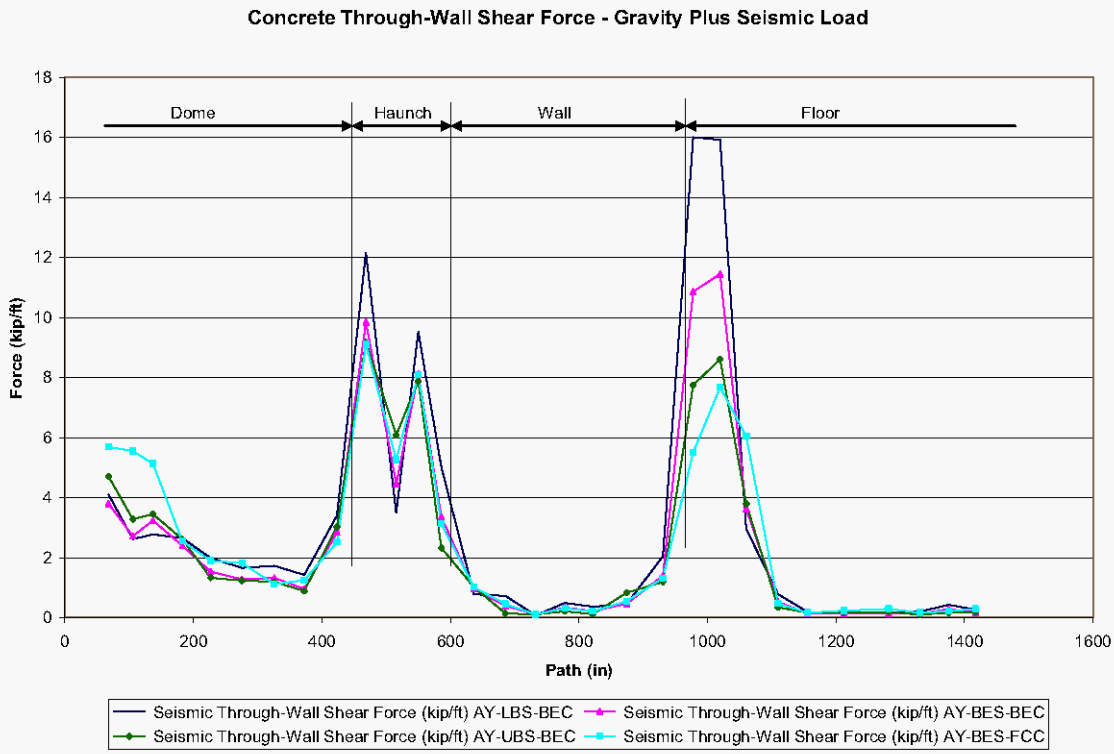


Figure 6.18. Concrete Tank Through-Wall Shear Forces – Gravity Plus Seismic

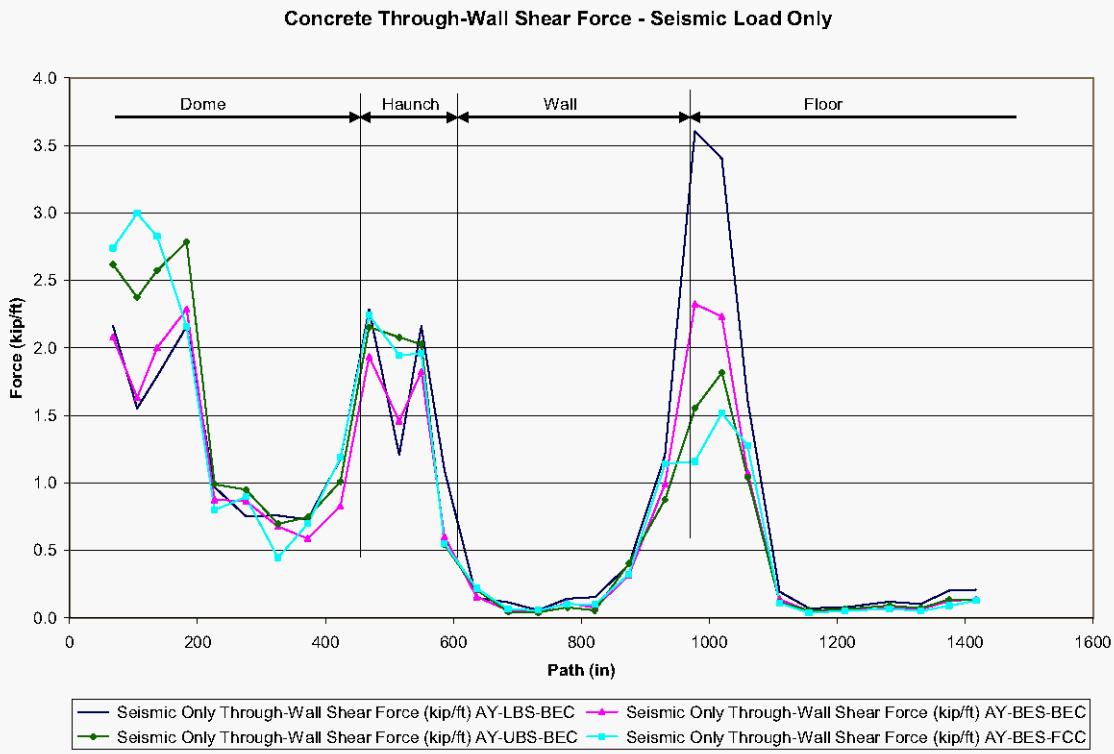


Figure 6.19. Concrete Tank Through-Wall Shear Forces – Seismic Only

6.2 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 6.20 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 6 21. Primary Hoop Stress (Middle) – Gravity Only
- Figure 6 22. Primary Tank Hoop Stress (Middle) – Gravity Plus Seismic
- Figure 6 23. Primary Tank Hoop Stress (Middle) – Seismic Only
- Figure 6 24. Primary Meridional Stress (Inside) – Gravity Only
- Figure 6 25. Primary Tank Meridional Stress (Inside) – Gravity Plus Seismic
- Figure 6 26. Primary Tank Meridional Stress (Inside) – Seismic Only
- Figure 6 27. Primary Meridional Stress (Outside) – Gravity Only
- Figure 6 28. Primary Tank Meridional Stress (Outside) – Gravity Plus Seismic
- Figure 6 29. Primary Tank Meridional Stress (Outside) – Seismic Only
- Figure 6 30. Primary Tank In-Plane Shear Stress (Middle) – Gravity Only
- Figure 6 31. Primary Tank In-Plane Shear Stress (Middle) – Gravity Plus Seismic
- Figure 6 32. Primary Tank In-Plane Shear Stress (Middle) – Seismic Only

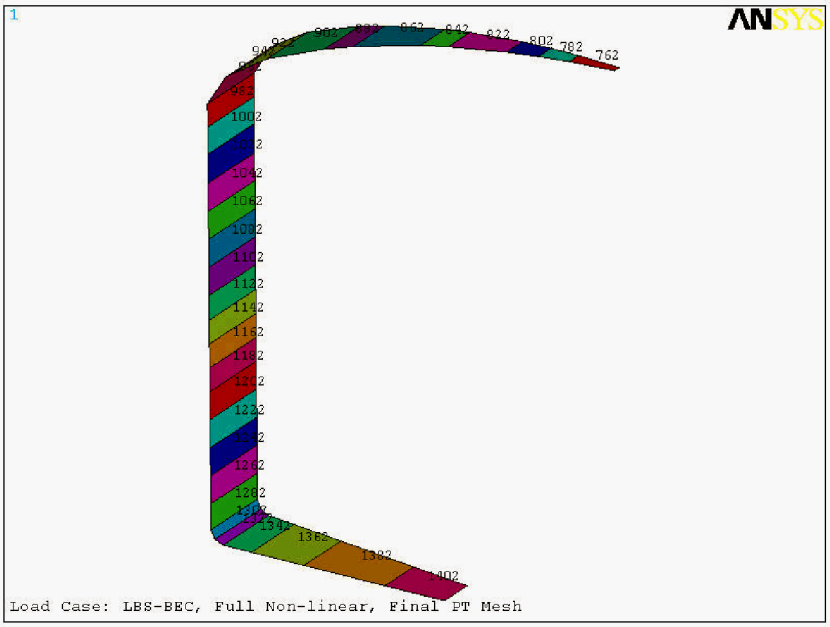


Figure 6.20. Primary Tank Element Retreival Sequence Starting Numbers

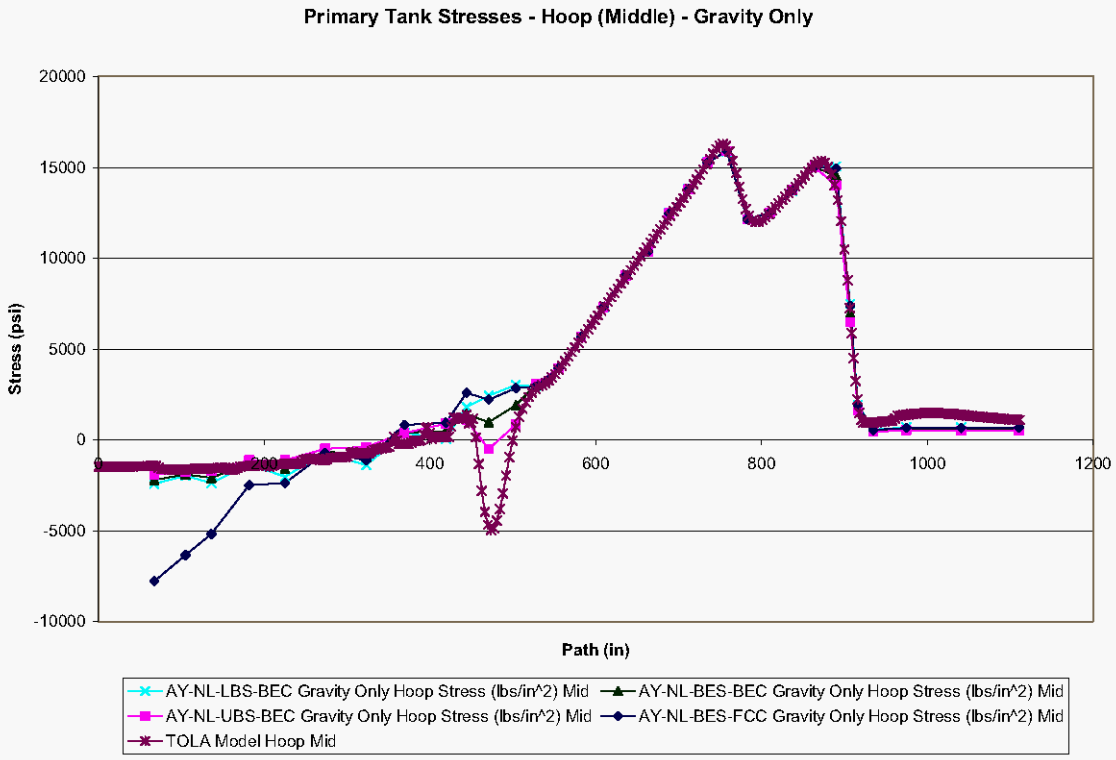


Figure 6.21. Primary Hoop Stress (Middle) – Gravity Only

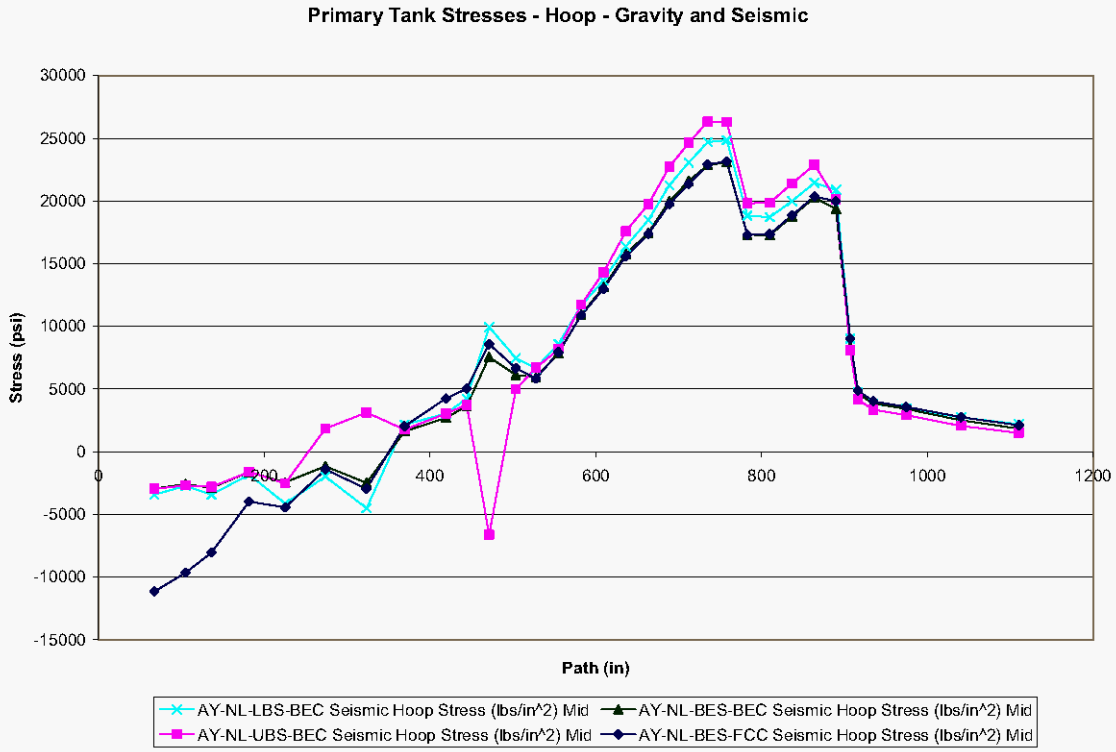


Figure 6.22. Primary Tank Hoop Stress (Middle) – Gravity Plus Seismic

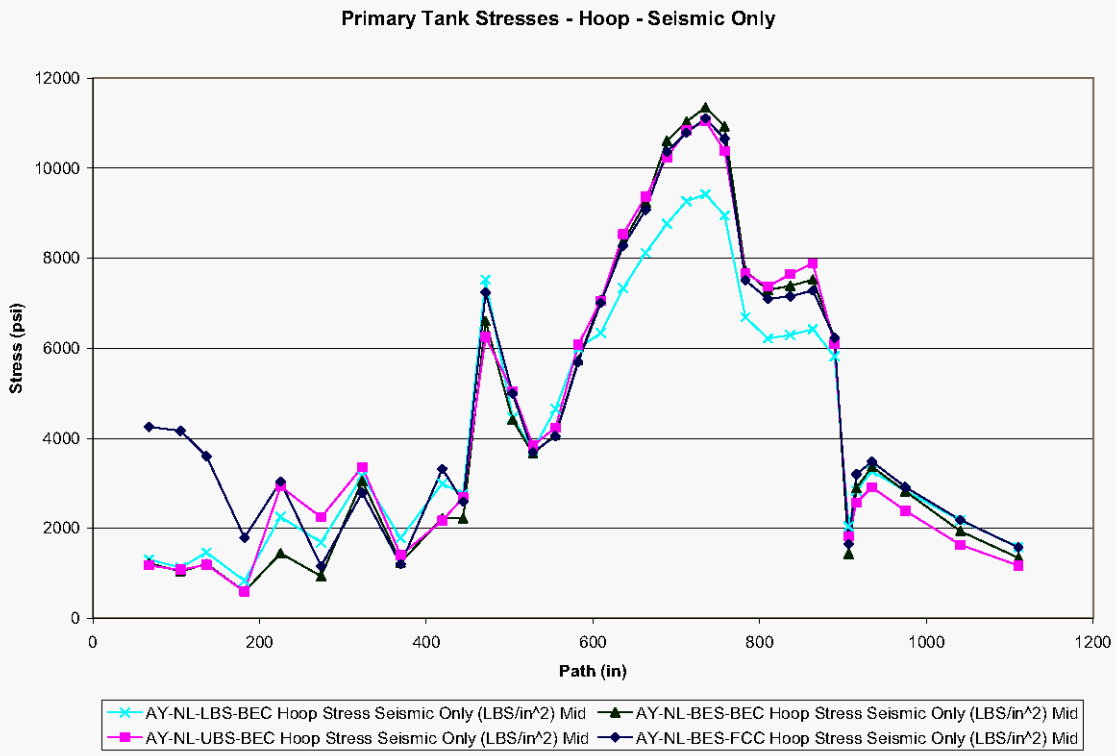


Figure 6.23. Primary Tank Hoop Stress (Middle) – Seismic Only

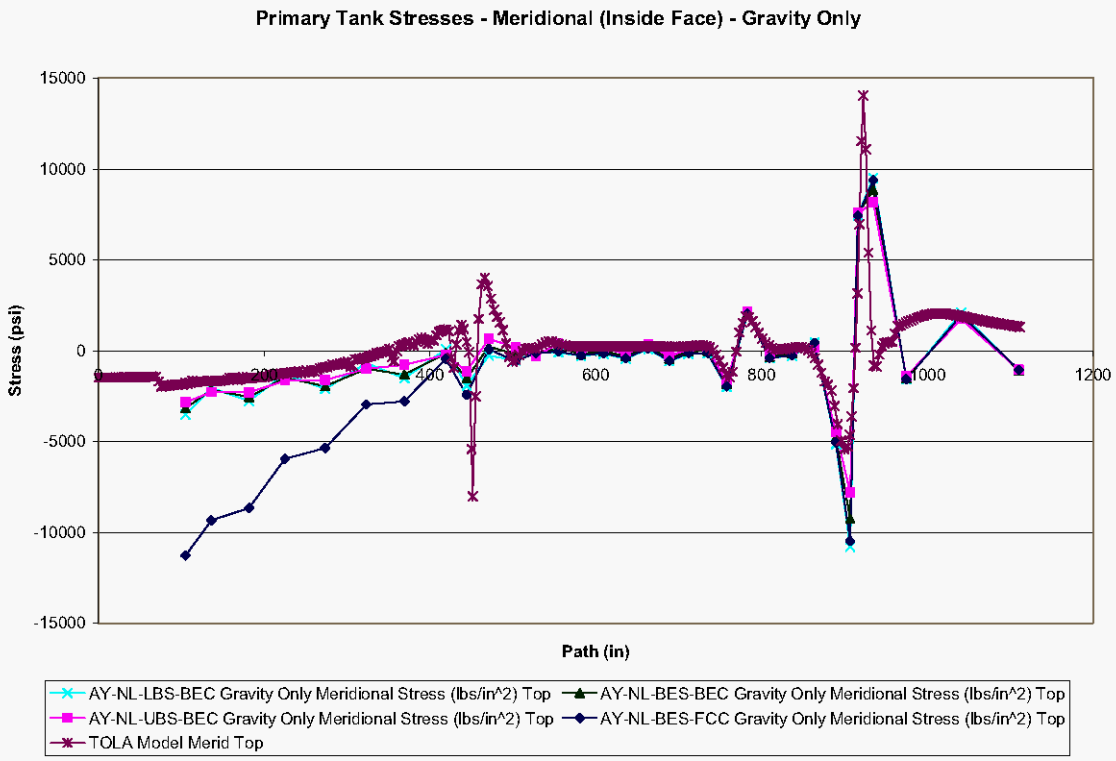


Figure 6.24. Primary Meridional Stress (Inside) – Gravity Only

As shown in Figure 6.24, the peak Meridional stress on the inside face of the knuckle is under-predicted for the gravity only case. The peak stress from the detailed TOLA model is 14,029 lbf/in^2, whereas, a stress of only 8,139 lbf/in^2 is predicted for the upper bound soil case. An enveloping factor of 1.72 should be applied to the inside face, meridional stresses in the knuckle region.

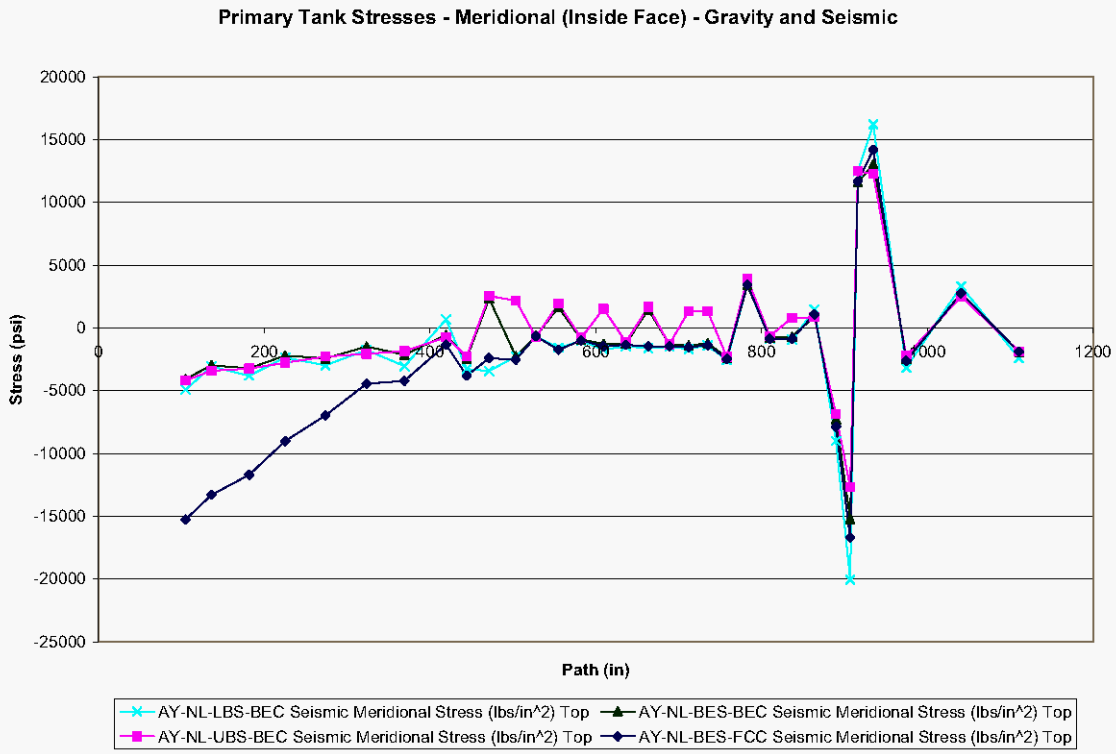


Figure 6.25. Primary Tank Meridional Stress (Inside) – Gravity Plus Seismic

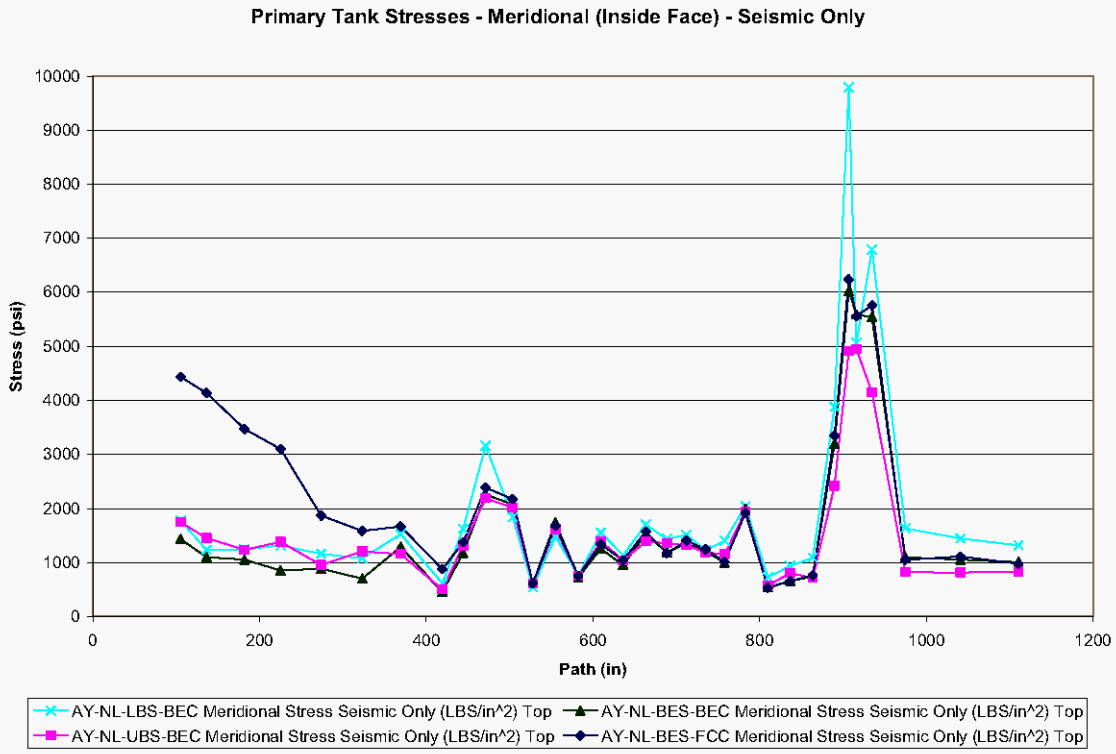


Figure 6.26. Primary Tank Meridional Stress (Inside) – Seismic Only

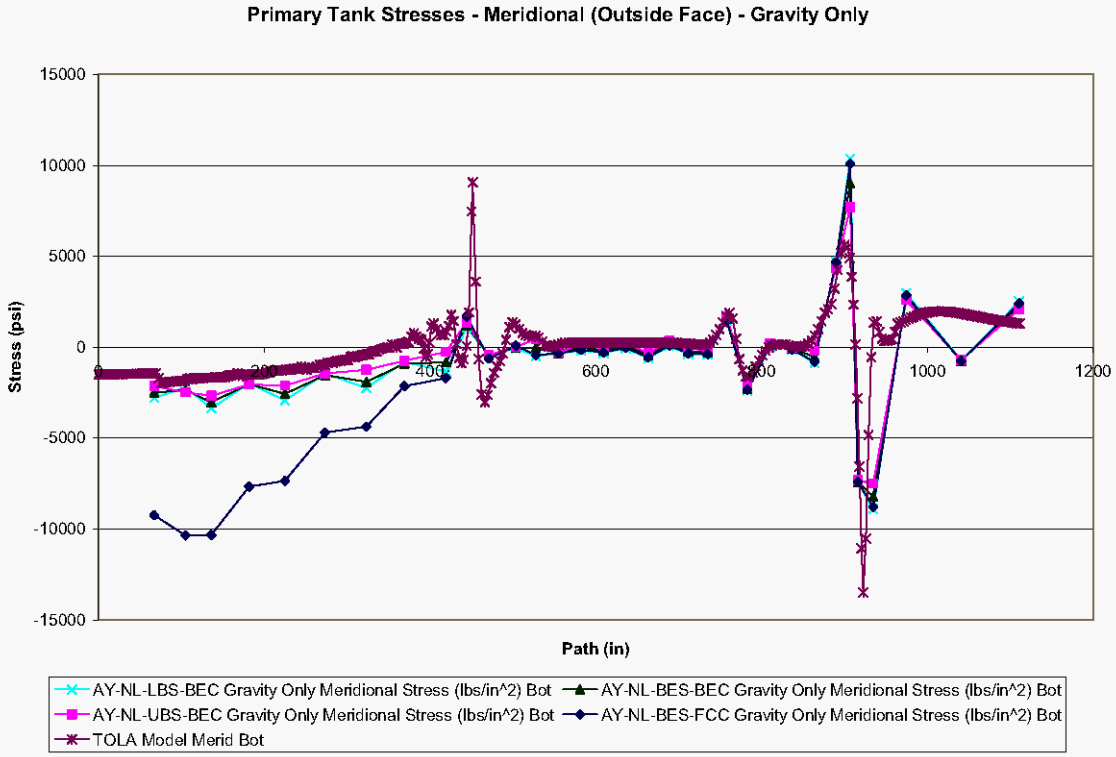


Figure 6.27. Primary Meridional Stress (Outside) – Gravity Only

As shown in Figure 6.27, the peak Meridional stress on the outside face of the knuckle is under-predicted for the gravity only case. The peak stress from the detailed TOLA model is -13,500 lbf/in^2, whereas, a stress of only 7,507 lbf/in^2 is predicted for the upper bound soil case. An enveloping factor of 1.80 should be applied to the outside face, meridional stresses in the knuckle region.

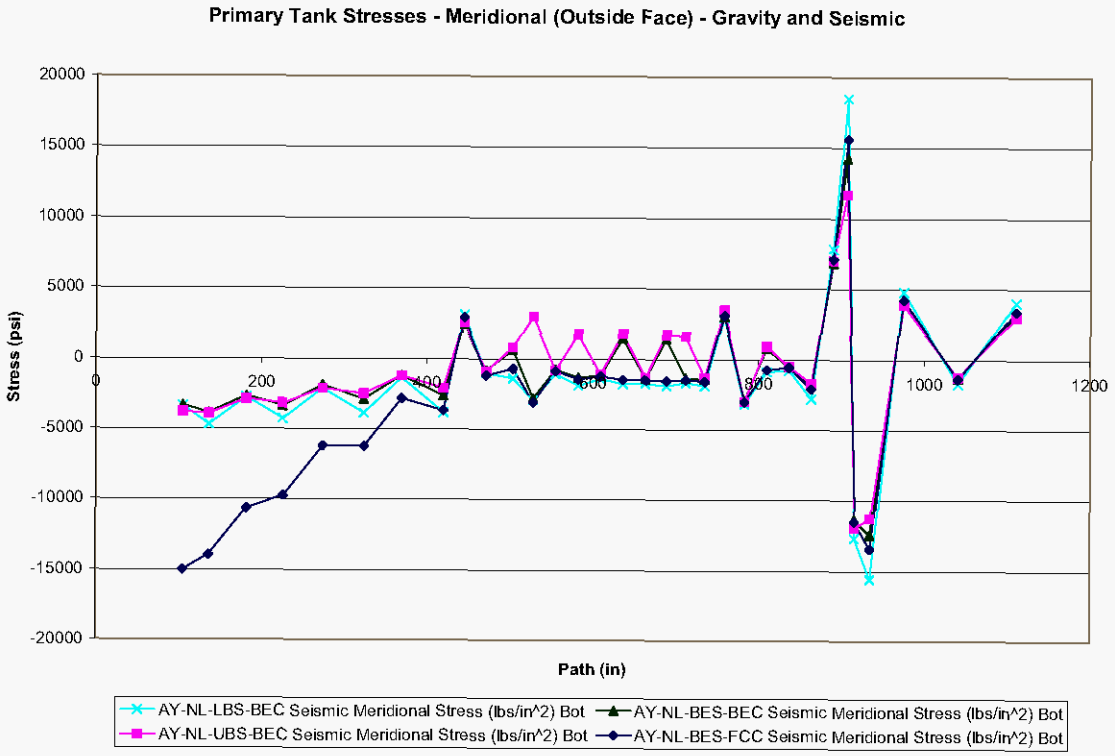


Figure 6.28. Primary Tank Meridional Stress (Outside) – Gravity Plus Seismic

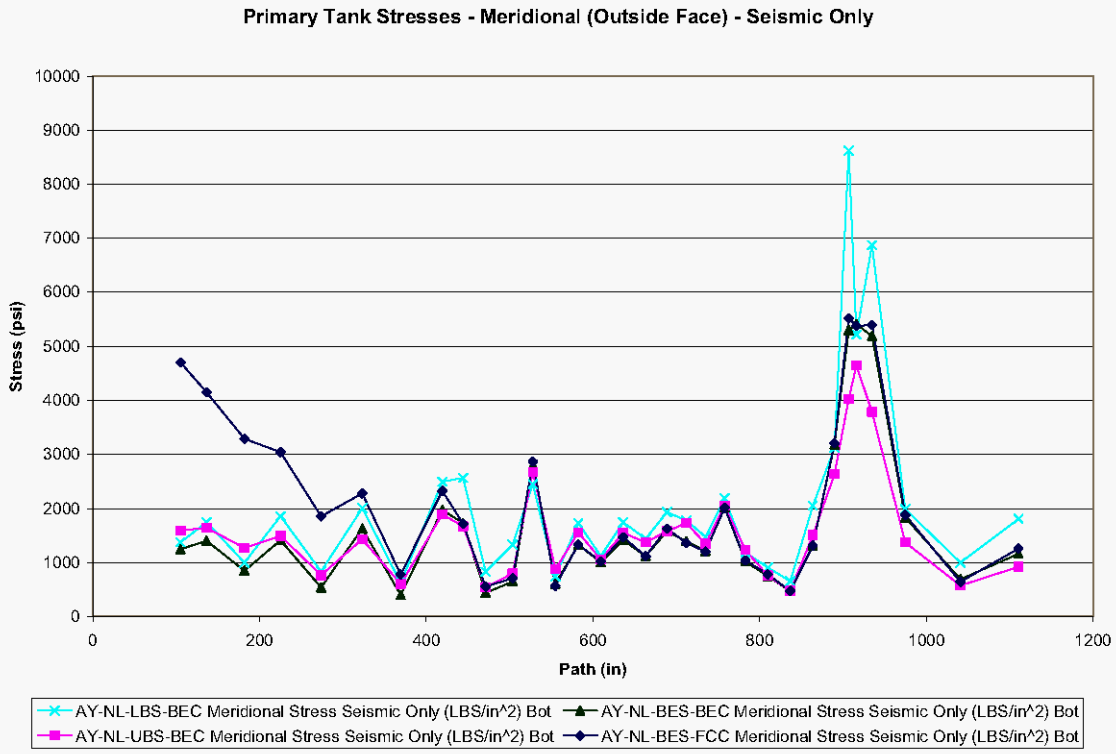


Figure 6.29. Primary Tank Meridional Stress (Outside) – Seismic Only

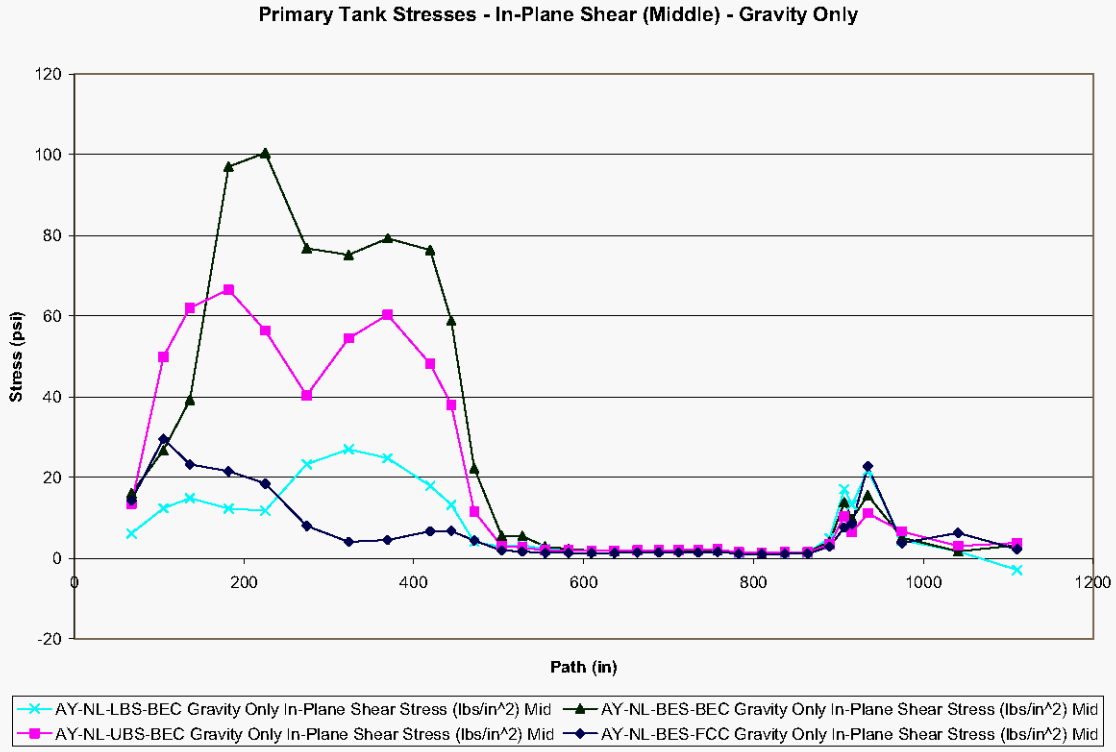


Figure 6.30. Primary Tank In-Plane Shear Stress (Middle) – Gravity Only

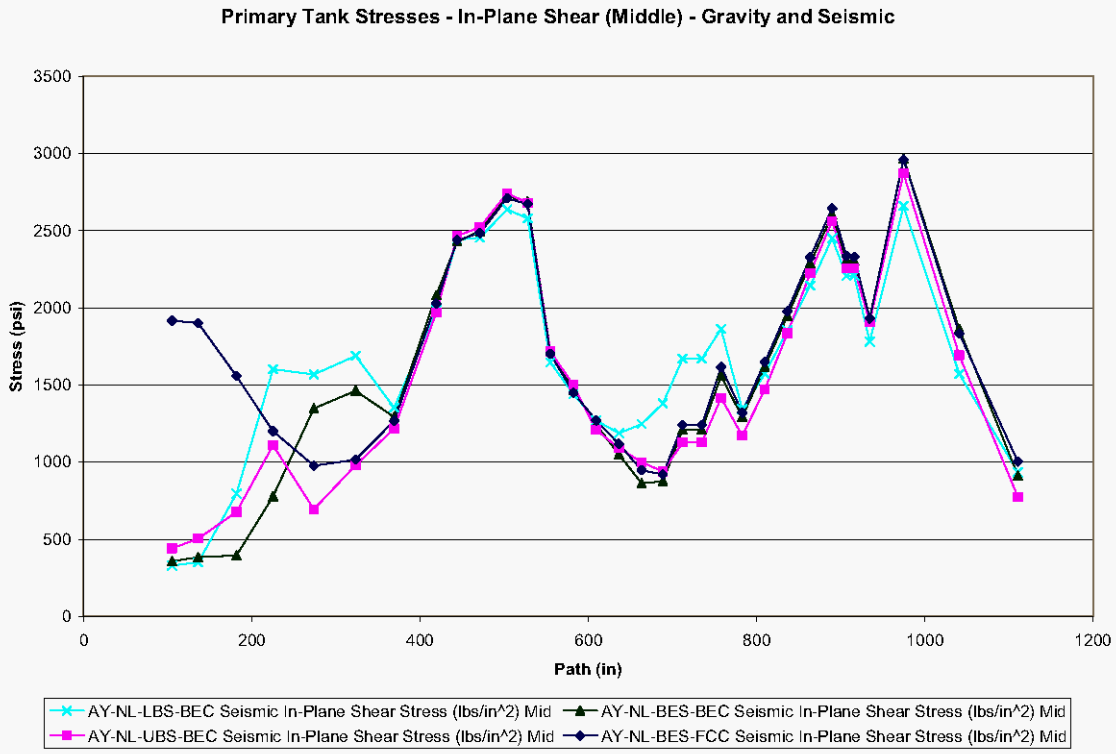


Figure 6.31. Primary Tank In-Plane Shear Stress (Middle) – Gravity Plus Seismic

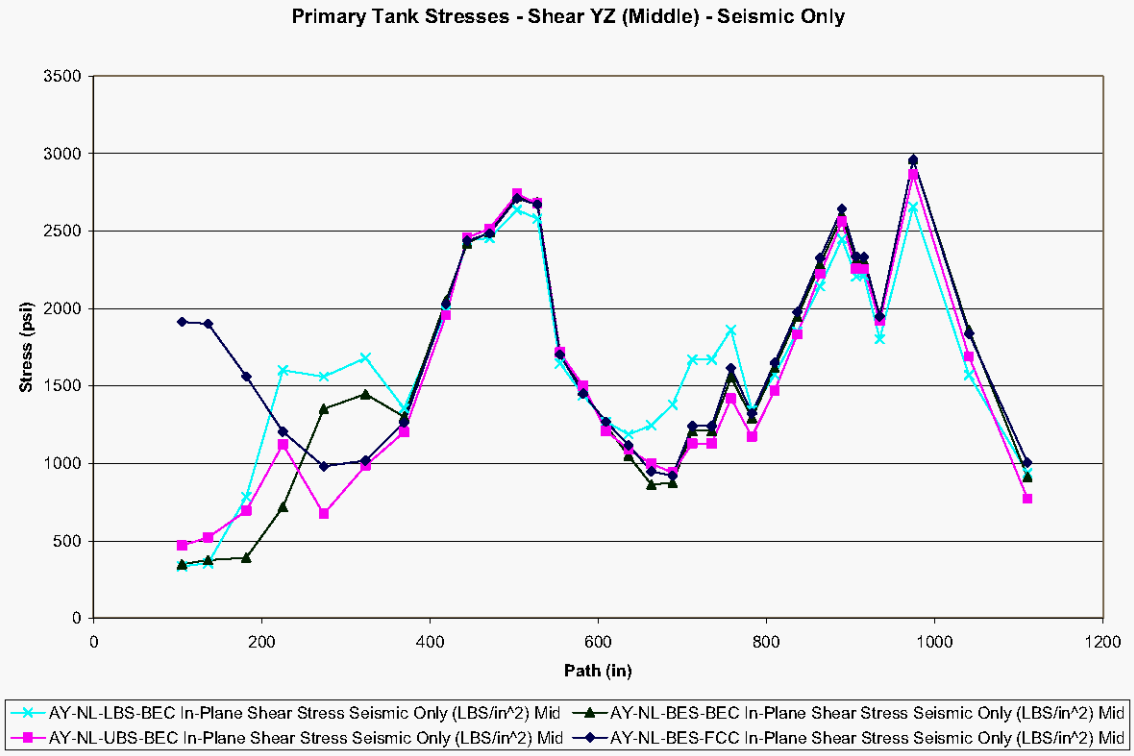


Figure 6.32. Primary Tank In-Plane Shear Stress (Middle) – Seismic Only

6.3 J-Bolts

Axial and shear forces were extracted for the J-Bolt elements. Figure 6.33 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 3.6. 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 6 34. J-Bolts – Maximum Axial Force - Gravity Only
- Figure 6 35. J-Bolts – Minimum Axial Force - Gravity Only
- Figure 6 36. J-Bolts – Maximum Axial Force - Gravity Plus Seismic
- Figure 6 37. J-Bolts – Minimum Axial Force - Gravity Plus Seismic
- Figure 6 38. J-Bolts – Maximum Axial Force - Seismic Only
- Figure 6 39. J-Bolts – Minimum Axial Force - Seismic Only
- Figure 6 40. J-Bolts – Shear Force - Gravity Only
- Figure 6 41. J-Bolts – Shear Force - Gravity Plus Seismic
- Figure 6 42. J-Bolts – Shear Force - Seismic Only

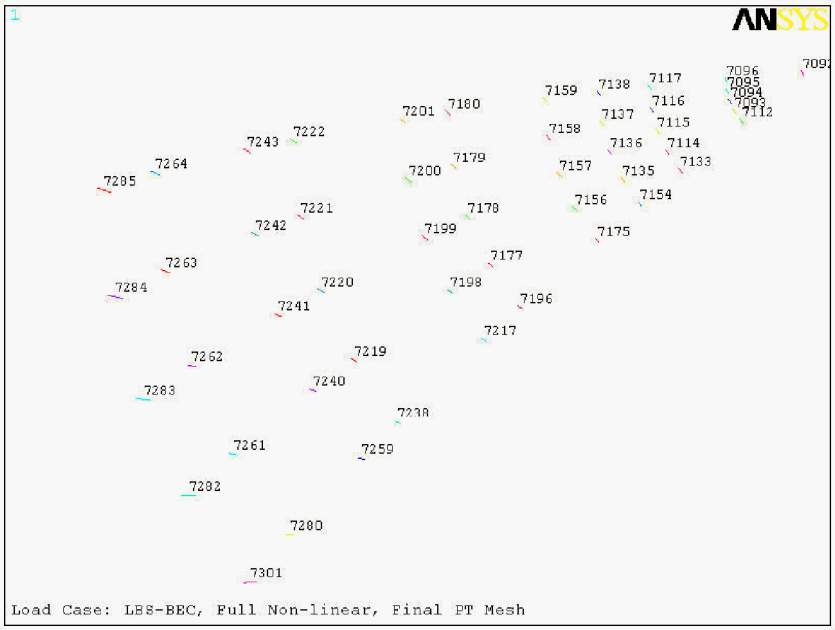


Figure 6.33. J-Bolt Element Retreival Sequence Starting Numbers

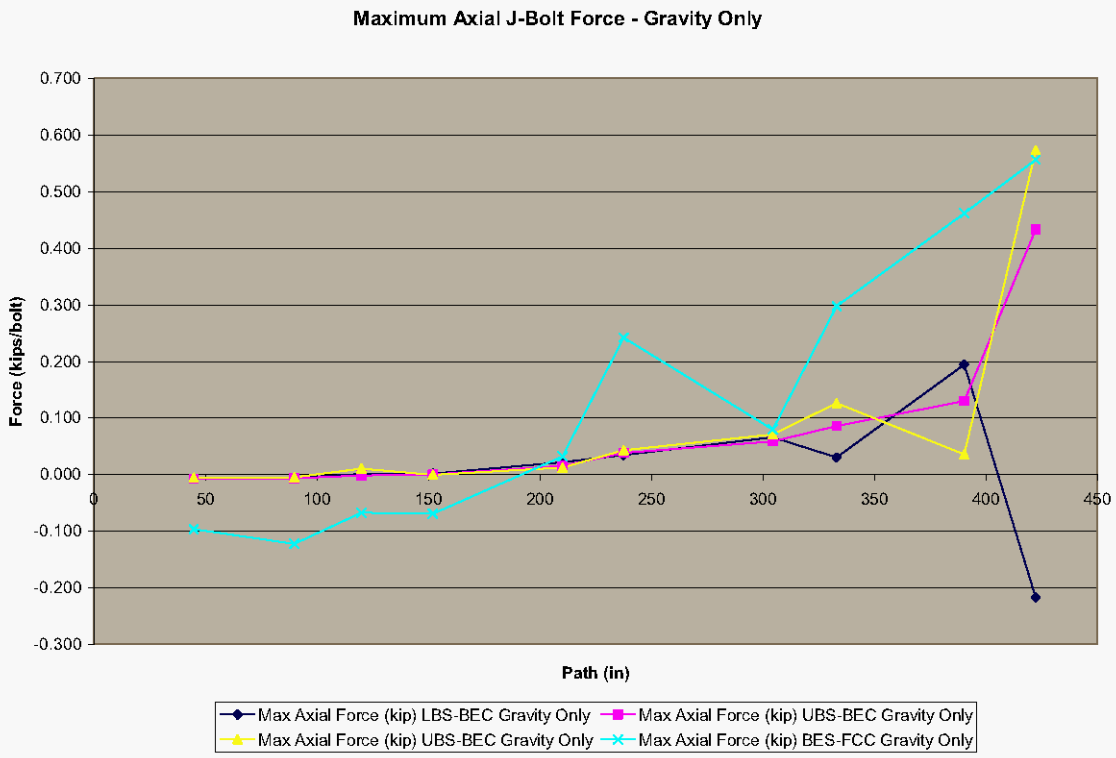


Figure 6.34. J-Bolts – Maximum Axial Force - Gravity Only

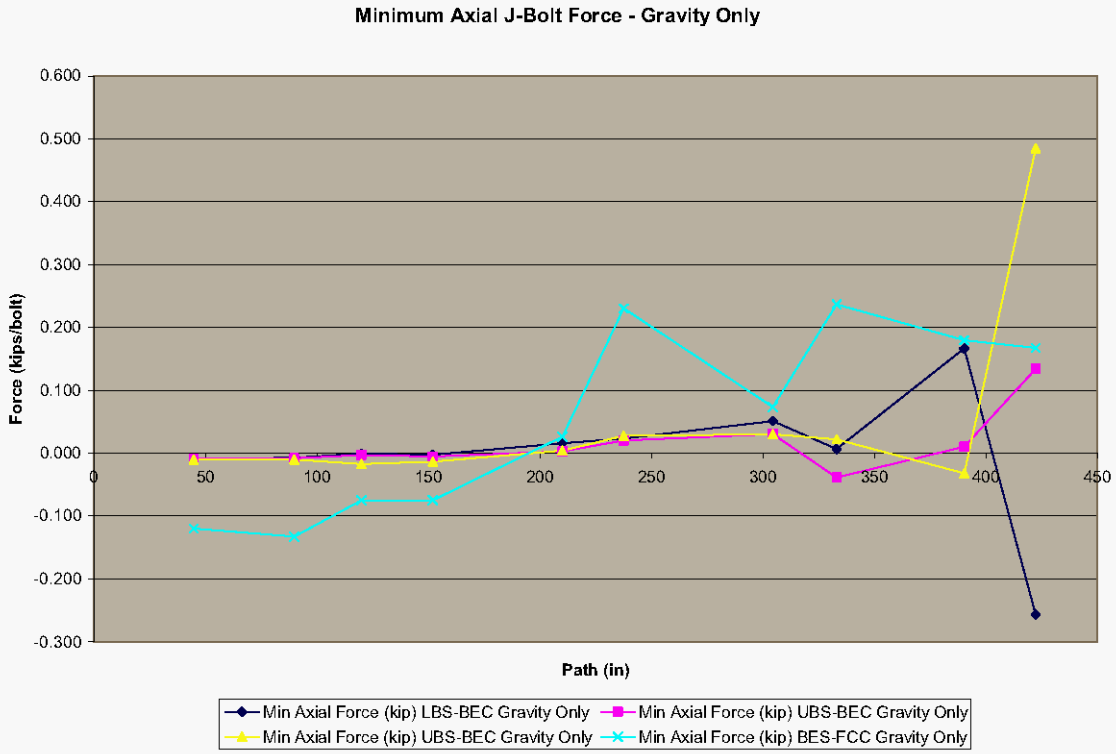


Figure 6.35. J-Bolts – Minimum Axial Force - Gravity Only

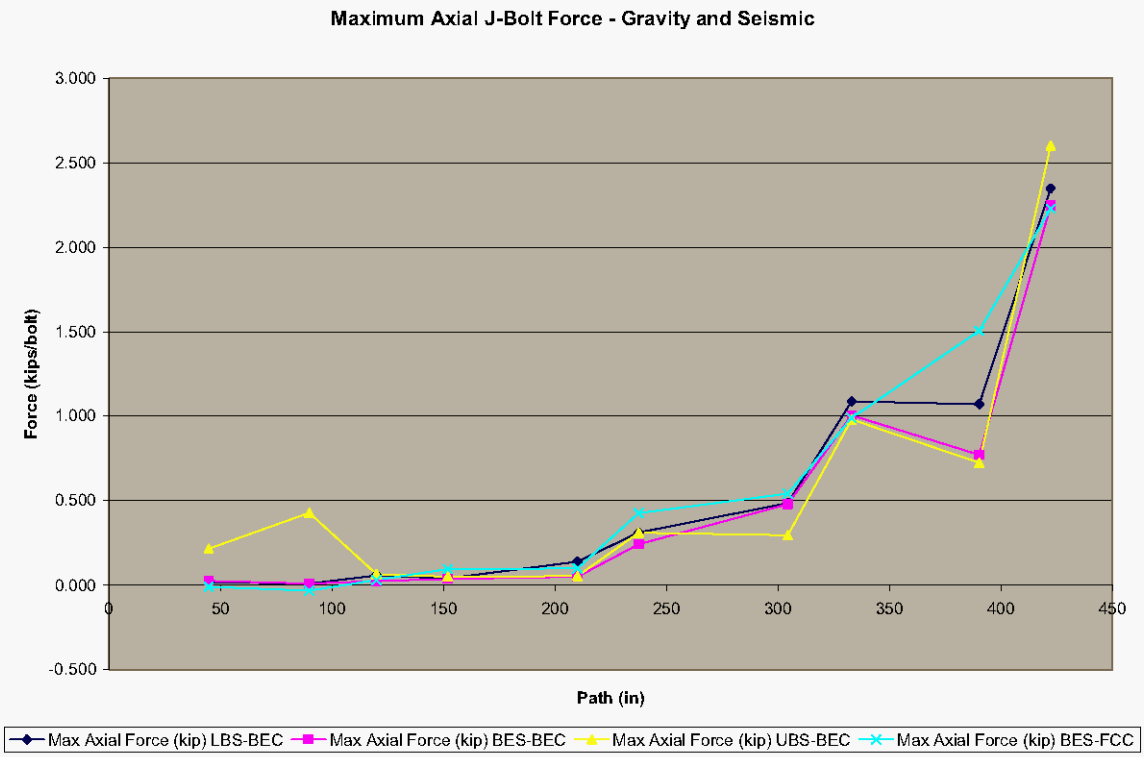


Figure 6.36. J-Bolts – Maximum Axial Force - Gravity Plus Seismic

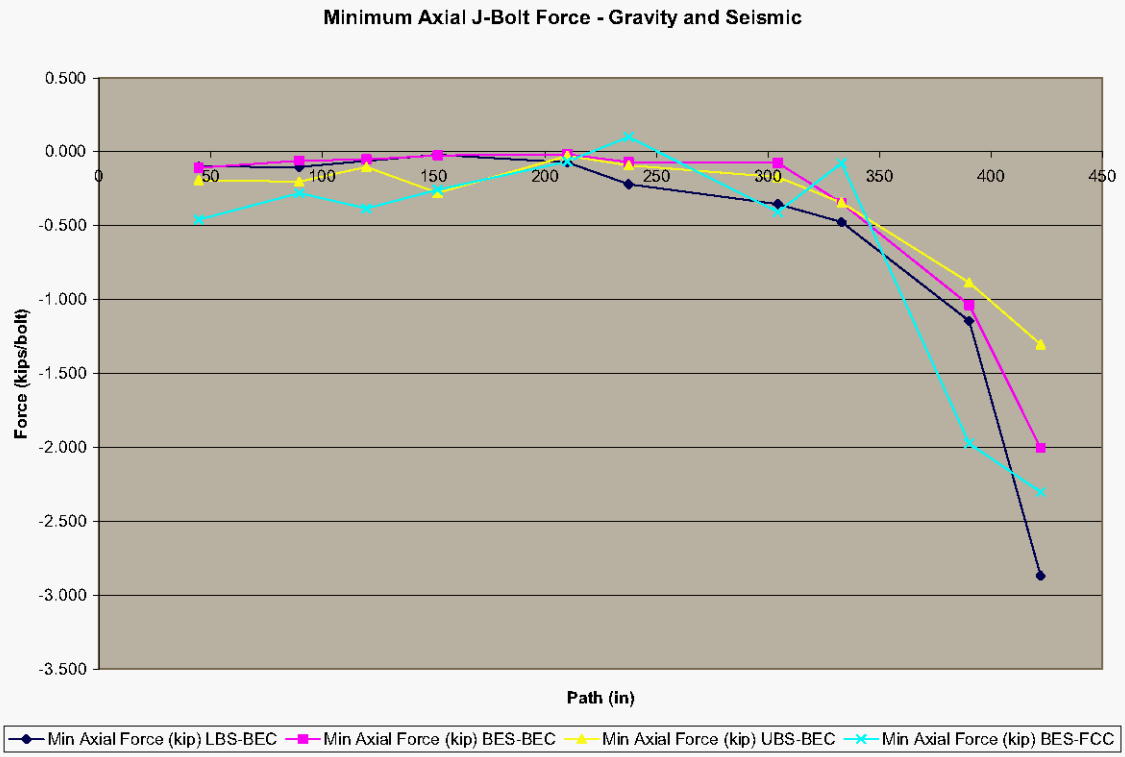


Figure 6.37. J-Bolts – Minimum Axial Force - Gravity Plus Seismic

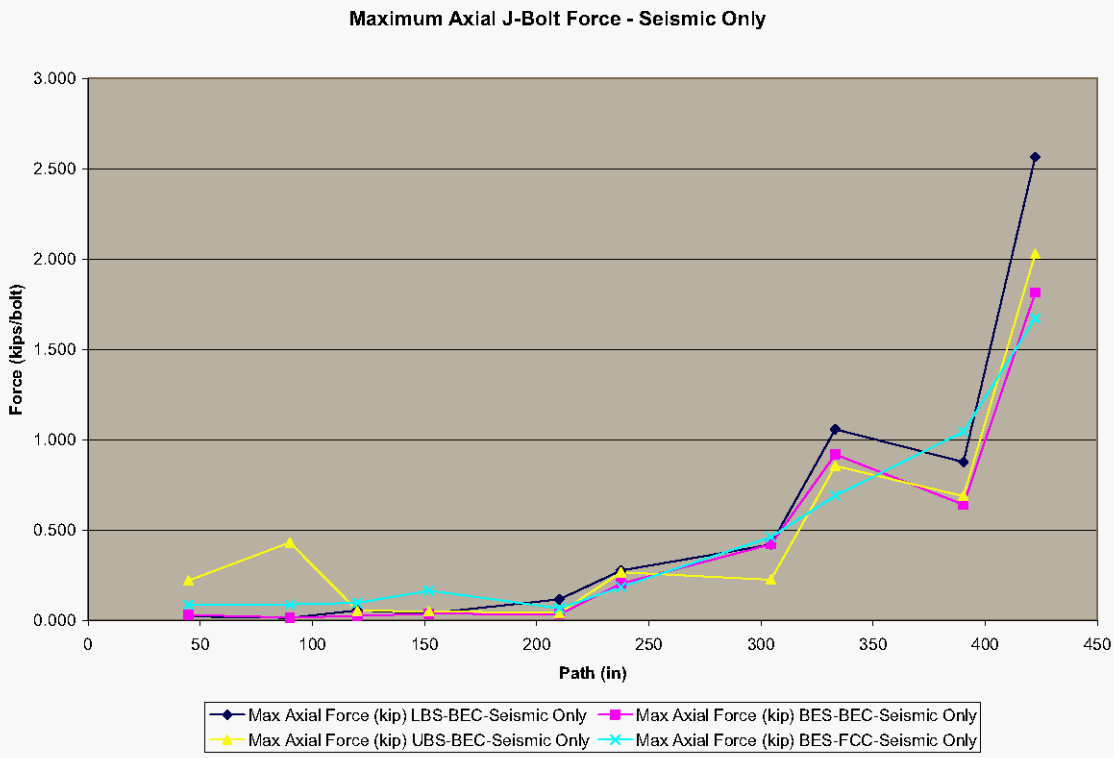


Figure 6.38. J-Bolts – Maximum Axial Force - Seismic Only

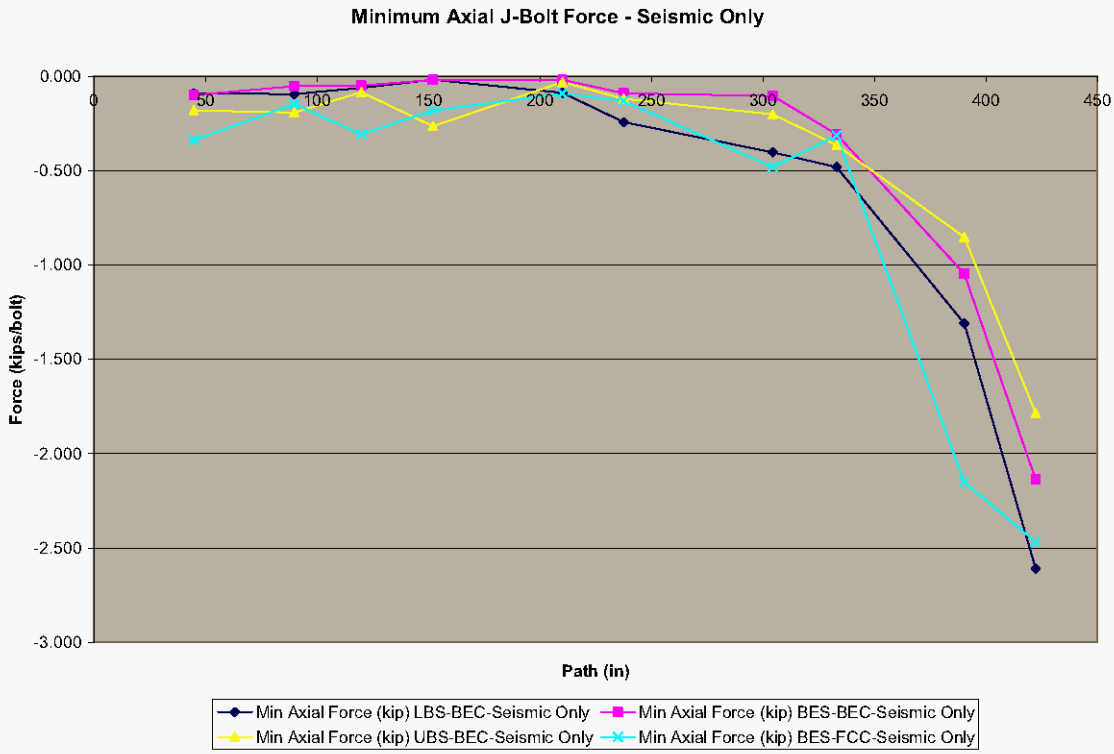


Figure 6.39. J-Bolts – Minimum Axial Force - Seismic Only

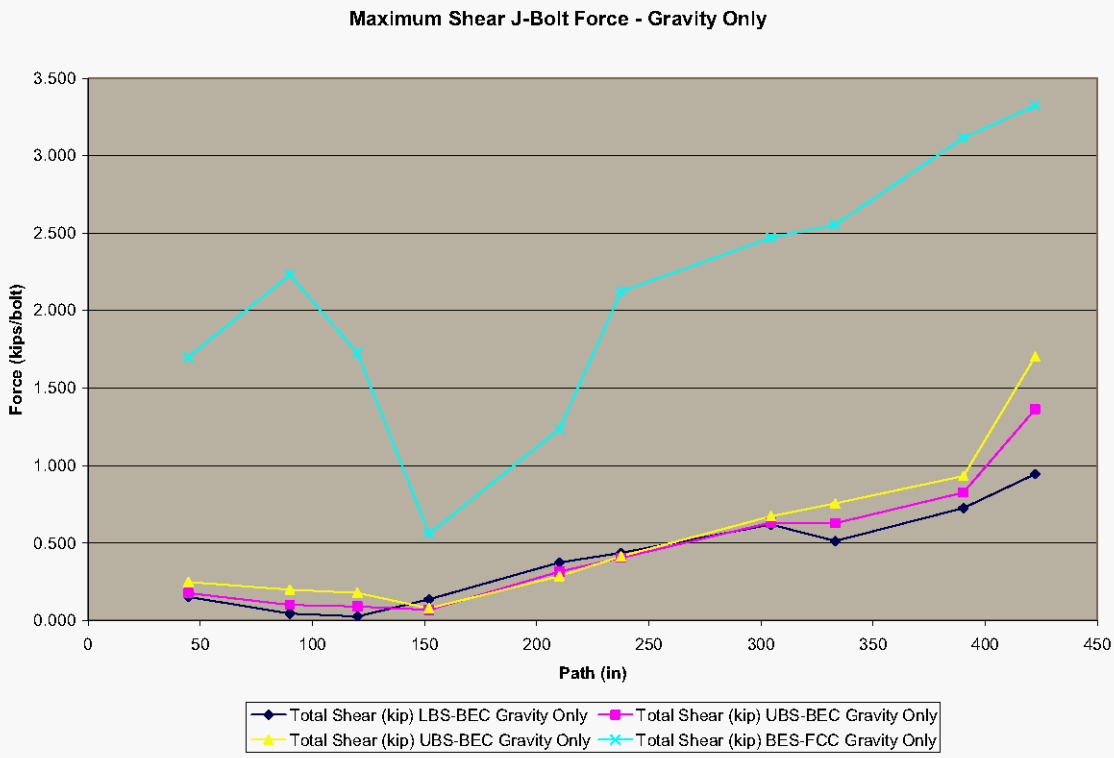


Figure 6.40. J-Bolts – Shear Force - Gravity Only

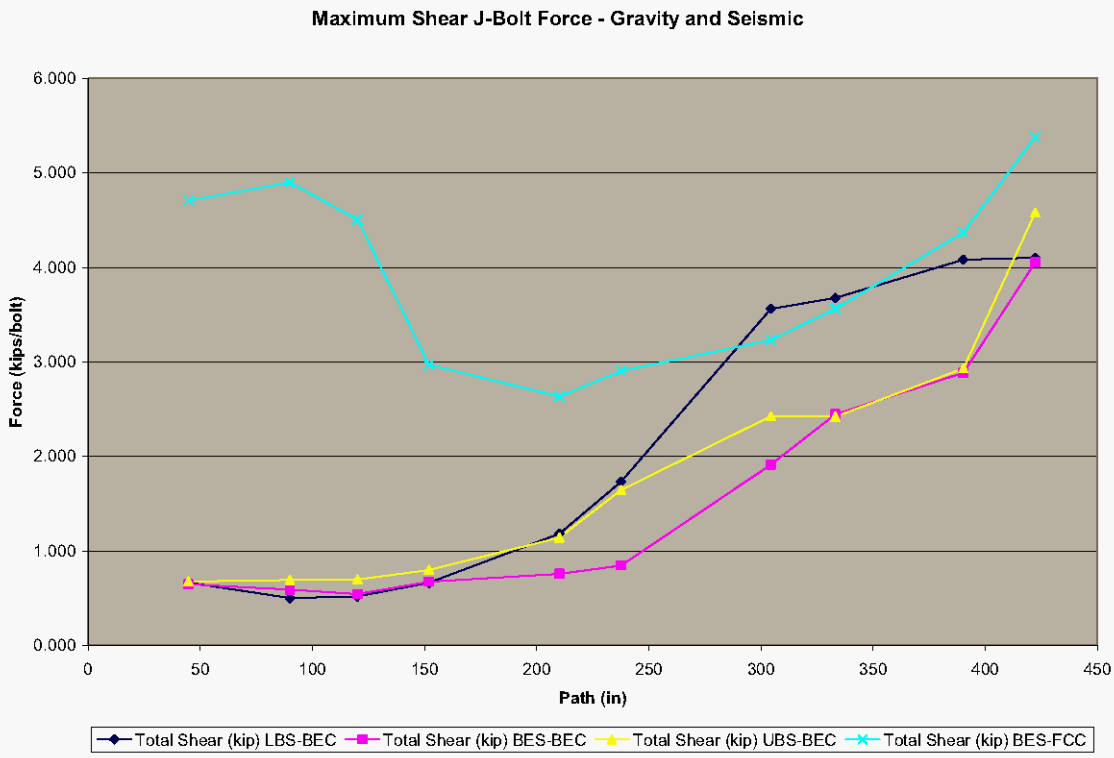


Figure 6.41. J-Bolts – Shear Force - Gravity Plus Seismic

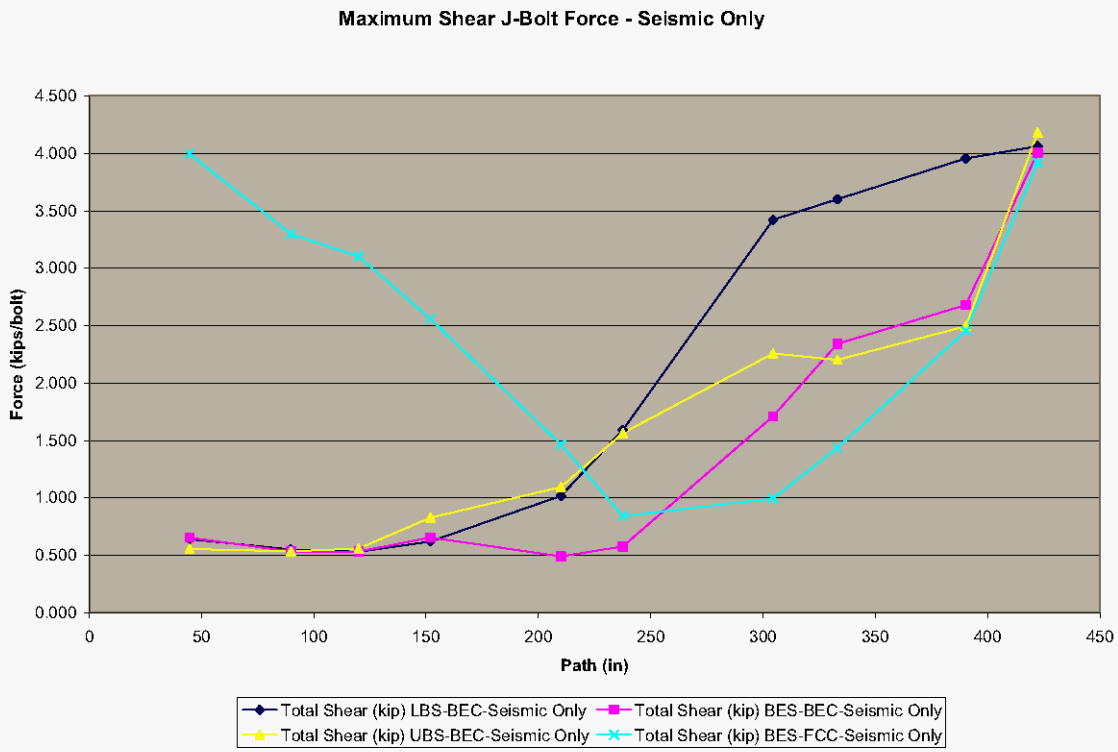


Figure 6.42. J-Bolts – Shear Force - Seismic Only

6.4 Secondary Liner

Secondary liner strains are extracted from the model in 9 degree slices, starting near the top element and moving down the wall and across the footing from the outside to the center of the liner. Strains were extracted for the top, middle, and bottom of each shell element. Figure 6.43 shows the first slice, with element numbers. Each of the subsequent figures shows one component of strain, comparing the results from each load case.

The following strains were extracted for the SHELL143 elements for the top, middle and bottom of each element.

- EPELX Hoop Strain
- EPELY Meridional Strain
- EPELINT Strain Intensity
- EPELXY In-Plane Shear Strain
- EPELYZ Shear Strain (Element YZ)
- EPELXZ Shear Strain (Element XY)

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 secondary liner, hoop strains at the shell middle, meridional strains at the shell top and bottom, and in-plane shear strains at the shell middle are presented in the following figures.

- Figure 6 44. Secondary Liner – Hoop Strain (Middle) Gravity Only
- Figure 6 45. Secondary Liner – Hoop Strain (Middle) Gravity Plus Seismic
- Figure 6 46. Secondary Liner – Hoop Strain (Middle) Seismic Only
- Figure 6 47. Secondary Liner – Meridional Strain (Inside) Gravity Only
- Figure 6 48. Secondary Liner – Meridional Strain (Inside) Gravity Plus Seismic
- Figure 6 49. Secondary Liner – Meridional Strain (Inside) Seismic Only
- Figure 6 50. Secondary Liner – Merdional Strain (Outside) Gravity Only
- Figure 6 51. Secondary Liner – Merdional Strain (Outside) Gravity Plus Seismic
- Figure 6 52. Secondary Liner – Merdional Strain (Outside) Seismic Only
- Figure 6 53. Secondary Liner – Shear Strain (Middle) Gravity Only
- Figure 6 54. Secondary Liner – Shear Strain (Middle) Gravity Plus Seismic
- Figure 6 55. Secondary Liner – Shear Strain (Middle) Seismic Only

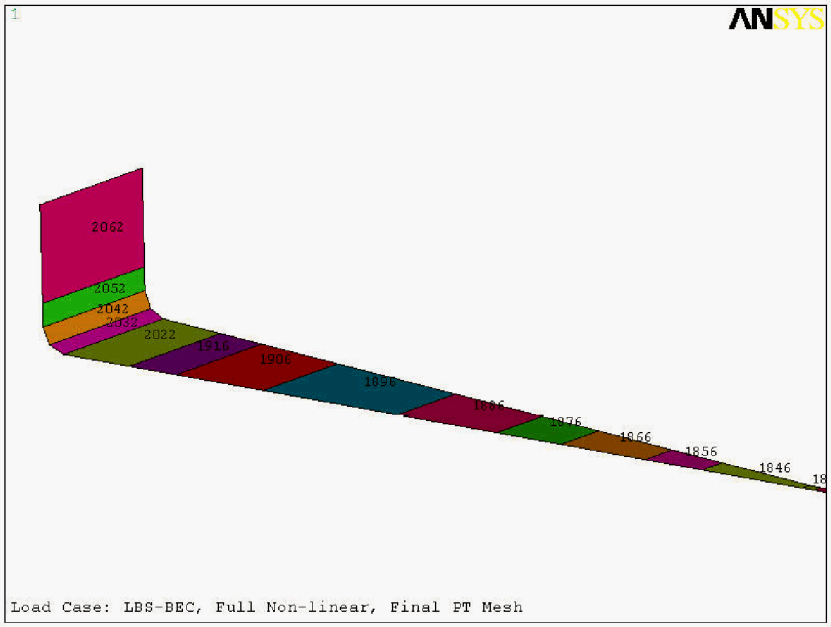


Figure 6.43. Secondary Liner Element Retreival Sequence Starting Numbers

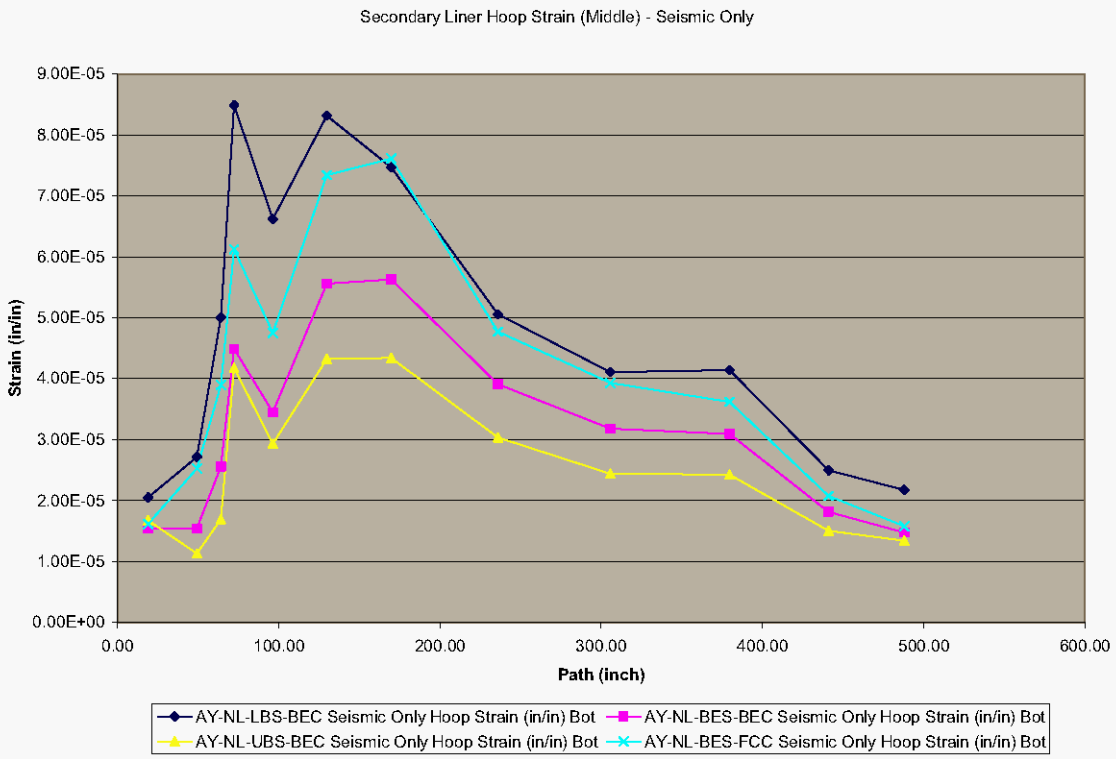


Figure 6.44. Secondary Liner – Hoop Strain (Middle) Gravity Only

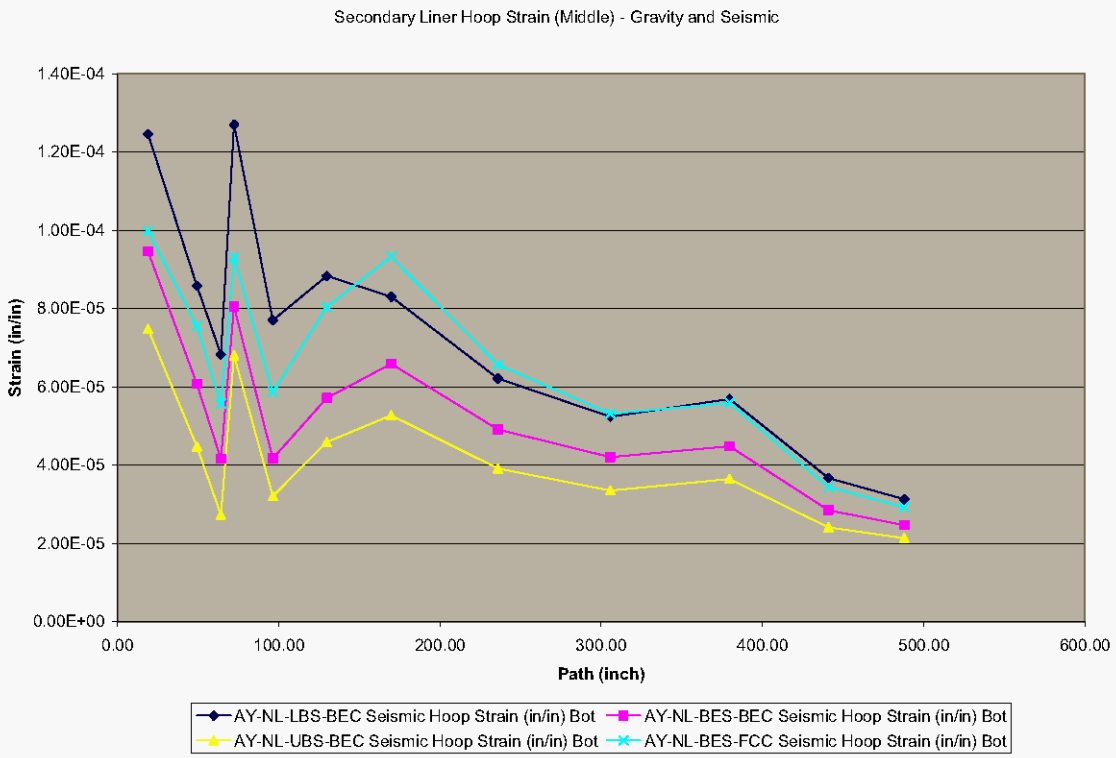


Figure 6.45. Secondary Liner – Hoop Strain (Middle) Gravity Plus Seismic

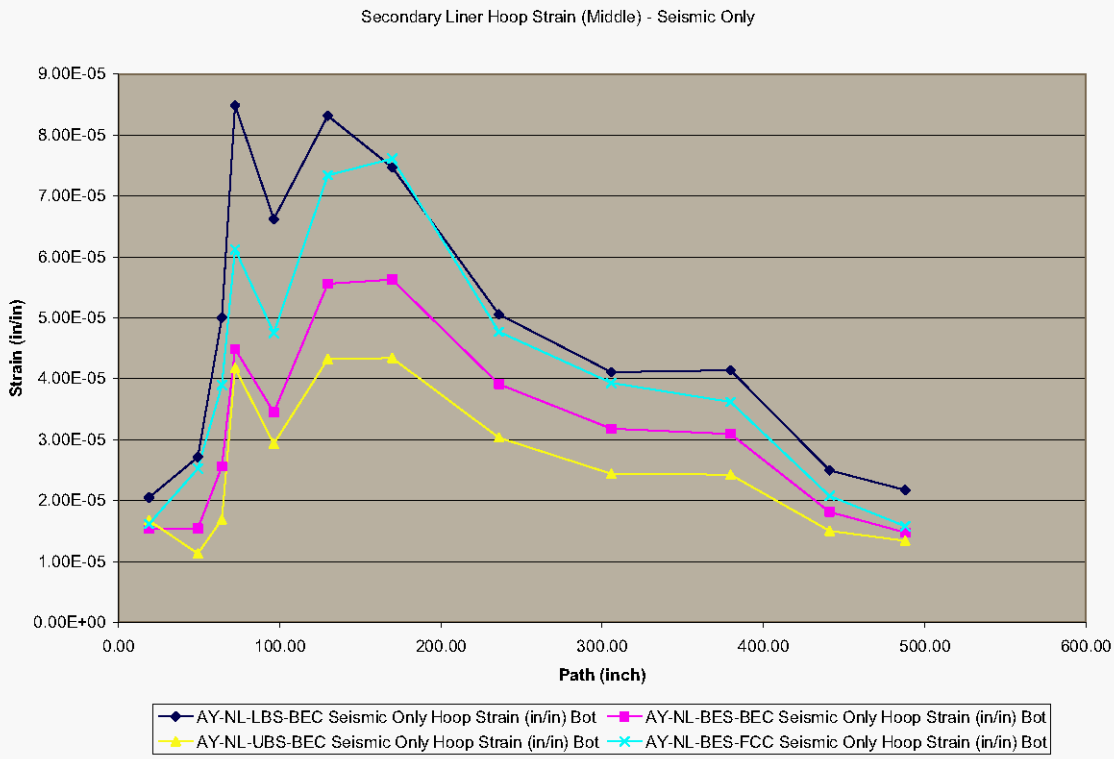


Figure 6.46. Secondary Liner – Hoop Strain (Middle) Seismic Only

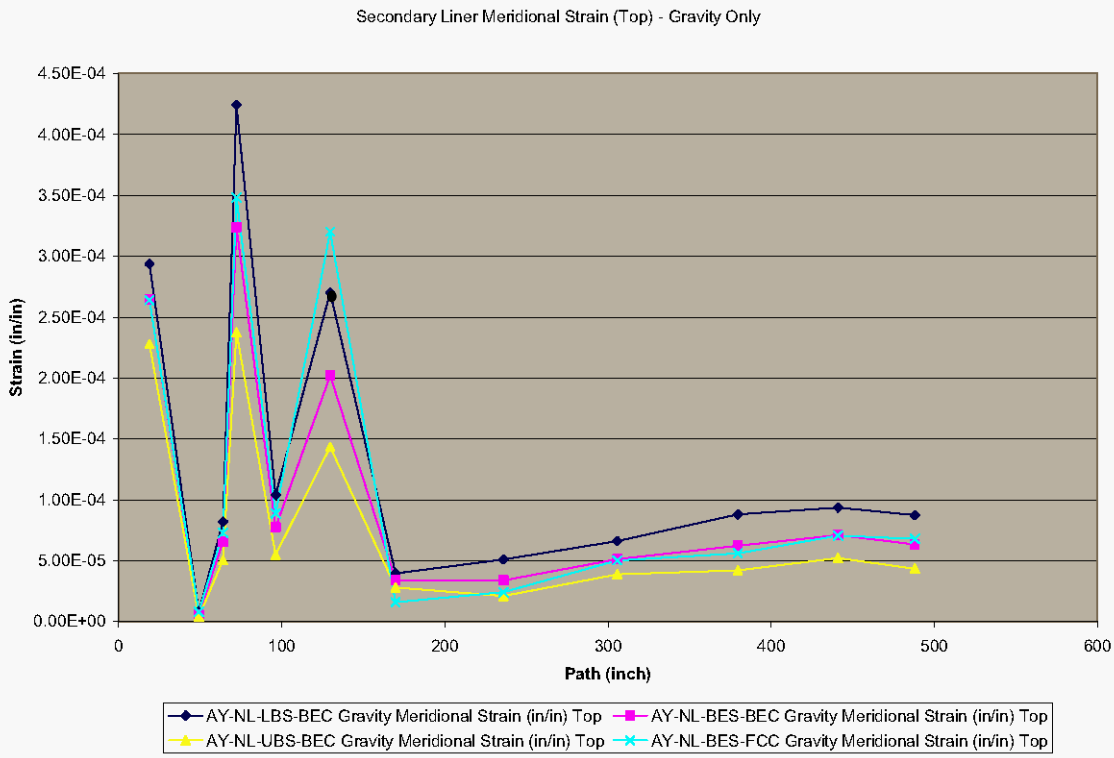


Figure 6.47. Secondary Liner – Meridional Strain (Inside) Gravity Only

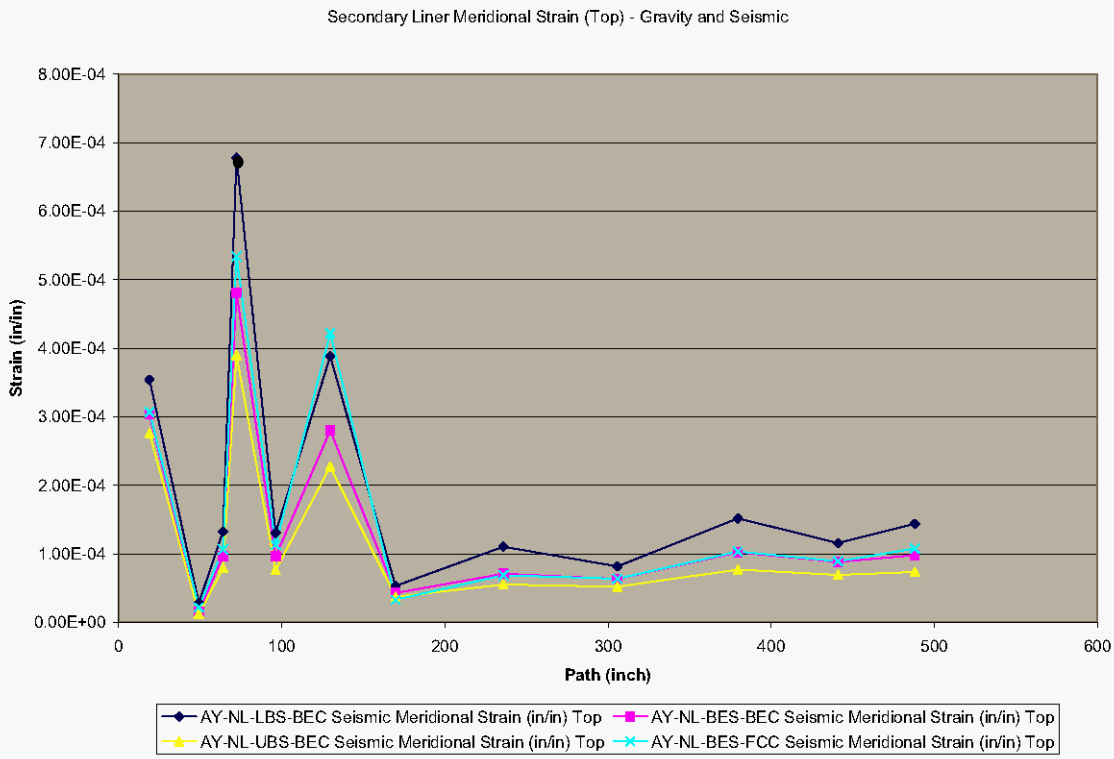


Figure 6.48. Secondary Liner – Meridional Strain (Inside) Gravity Plus Seismic

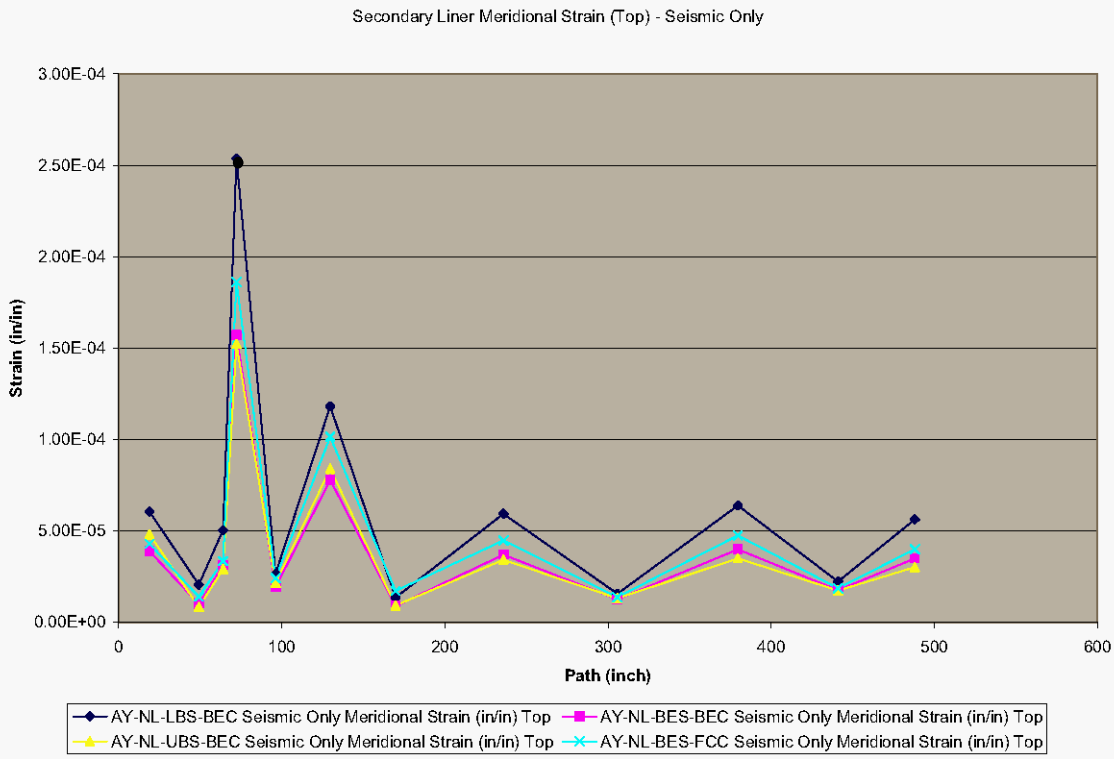


Figure 6.49. Secondary Liner – Meridional Strain (Inside) Seismic Only

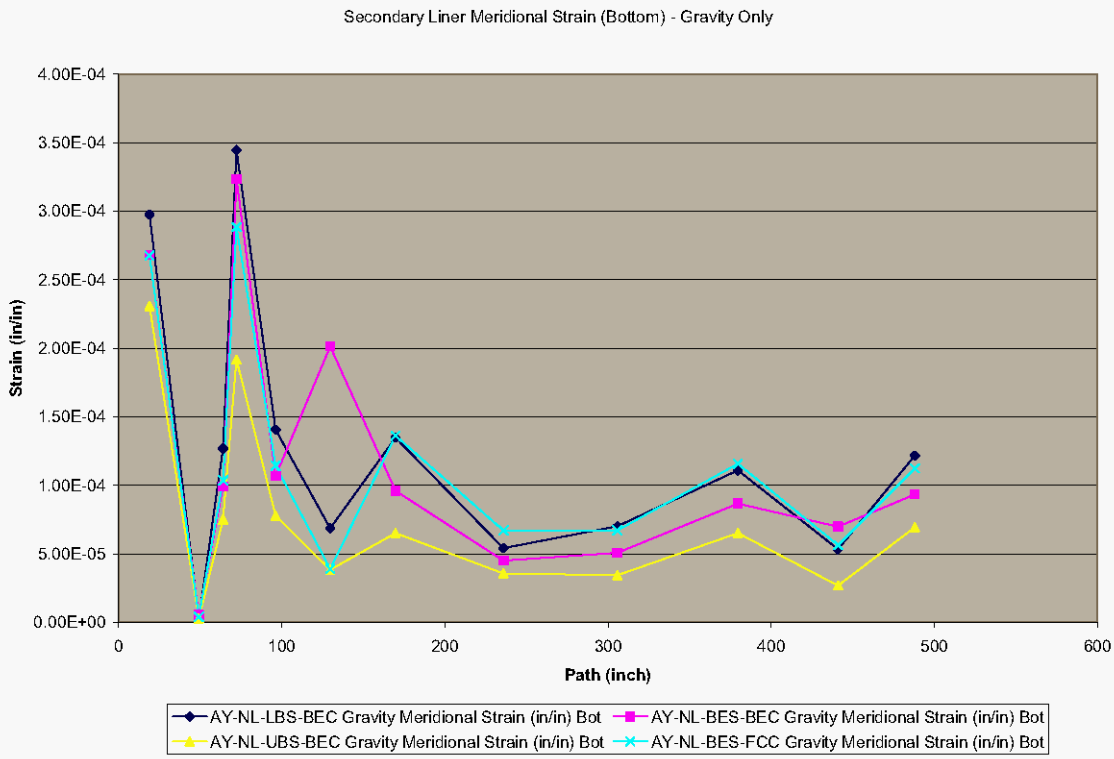


Figure 6.50. Secondary Liner – Merdional Strain (Outside) Gravity Only

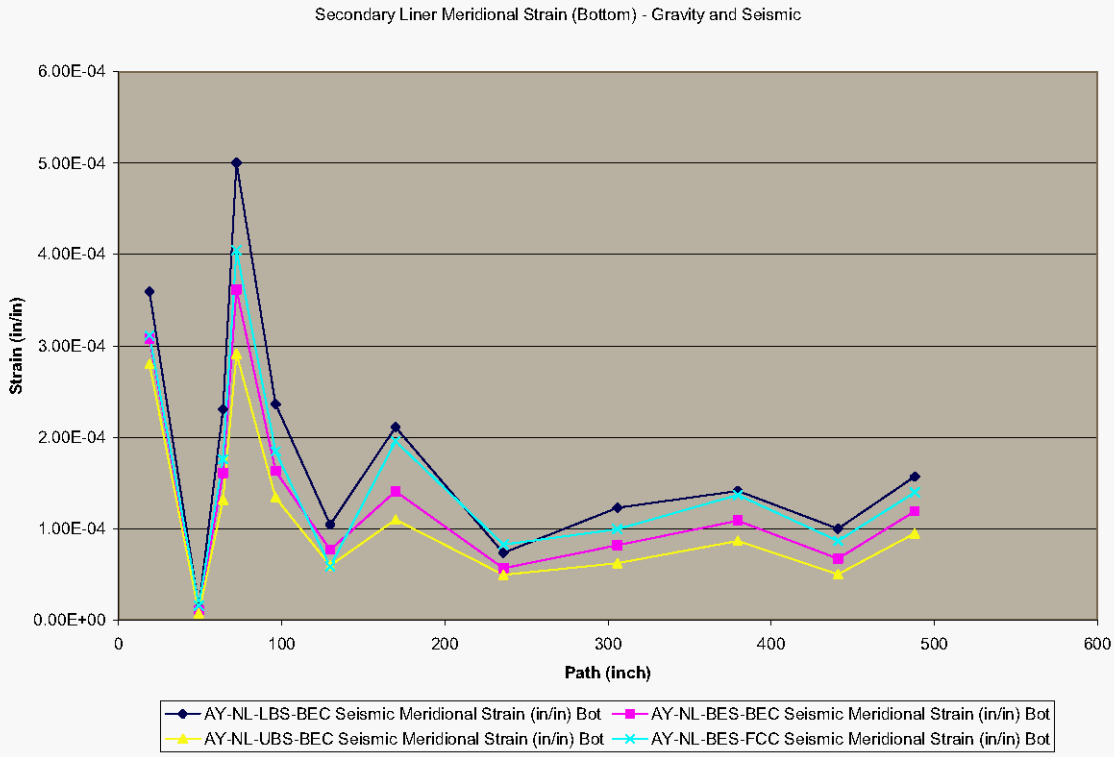


Figure 6.51. Secondary Liner – Merdional Strain (Outside) Gravity Plus Seismic

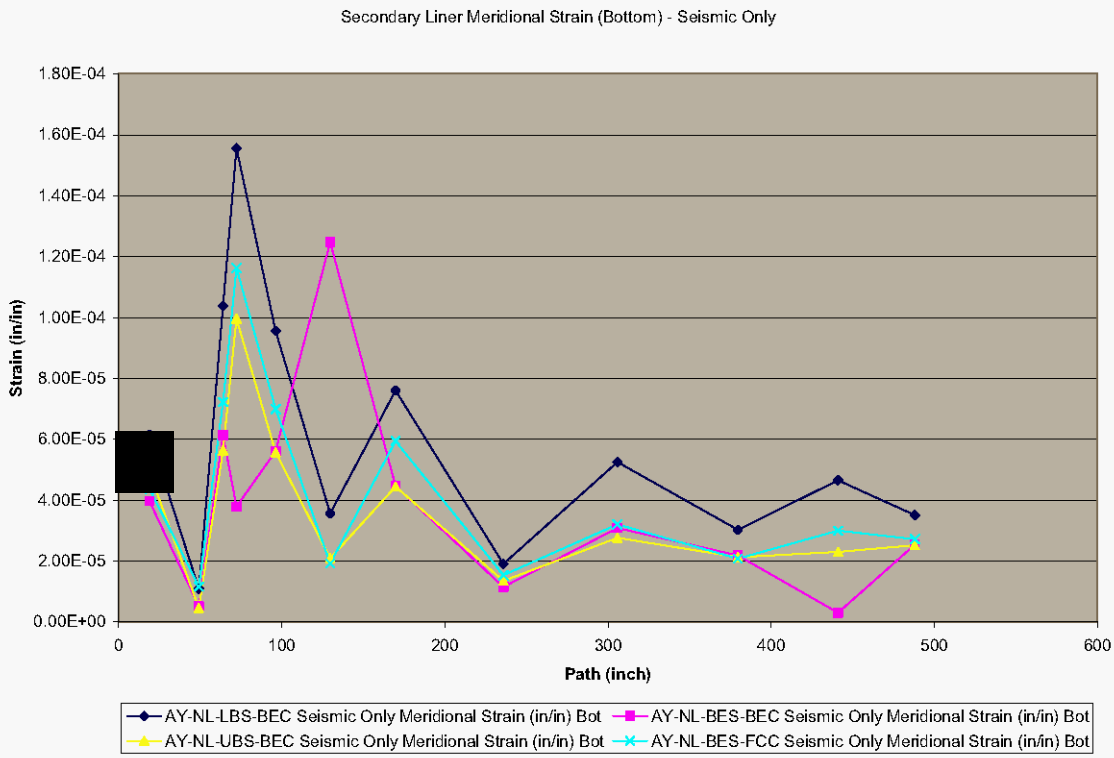


Figure 6.52. Secondary Liner – Merdional Strain (Outside) Seismic Only

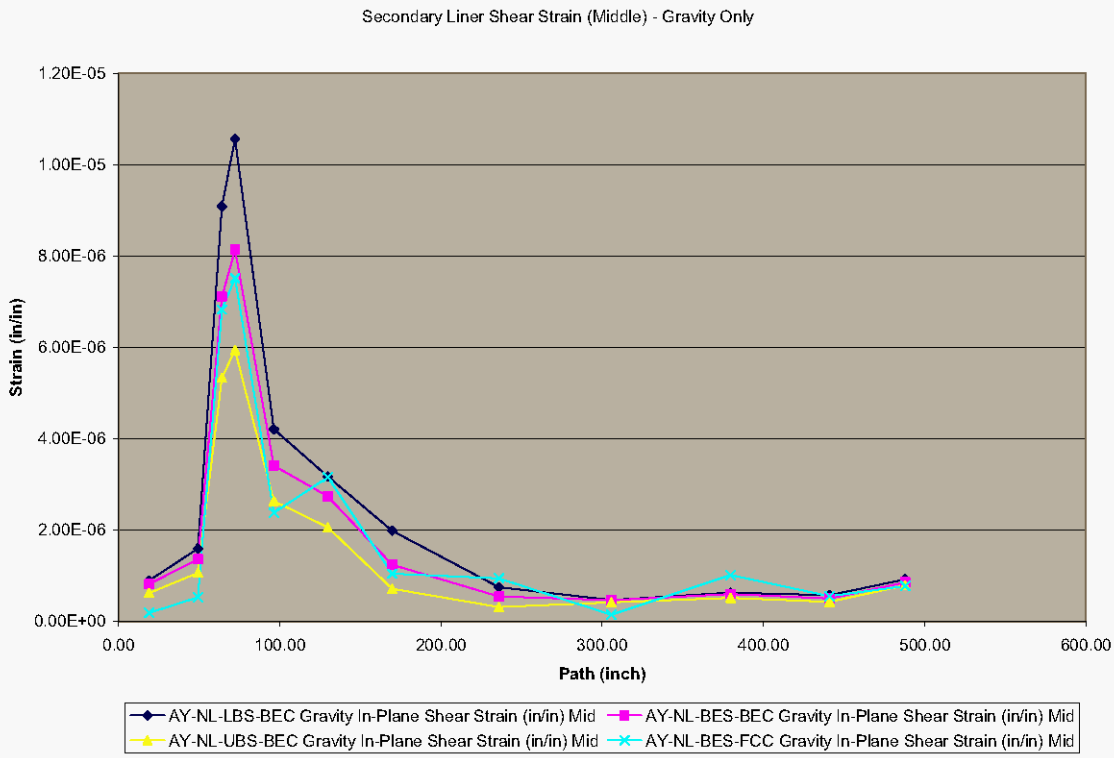


Figure 6.53. Secondary Liner – Shear Strain (Middle) Gravity Only

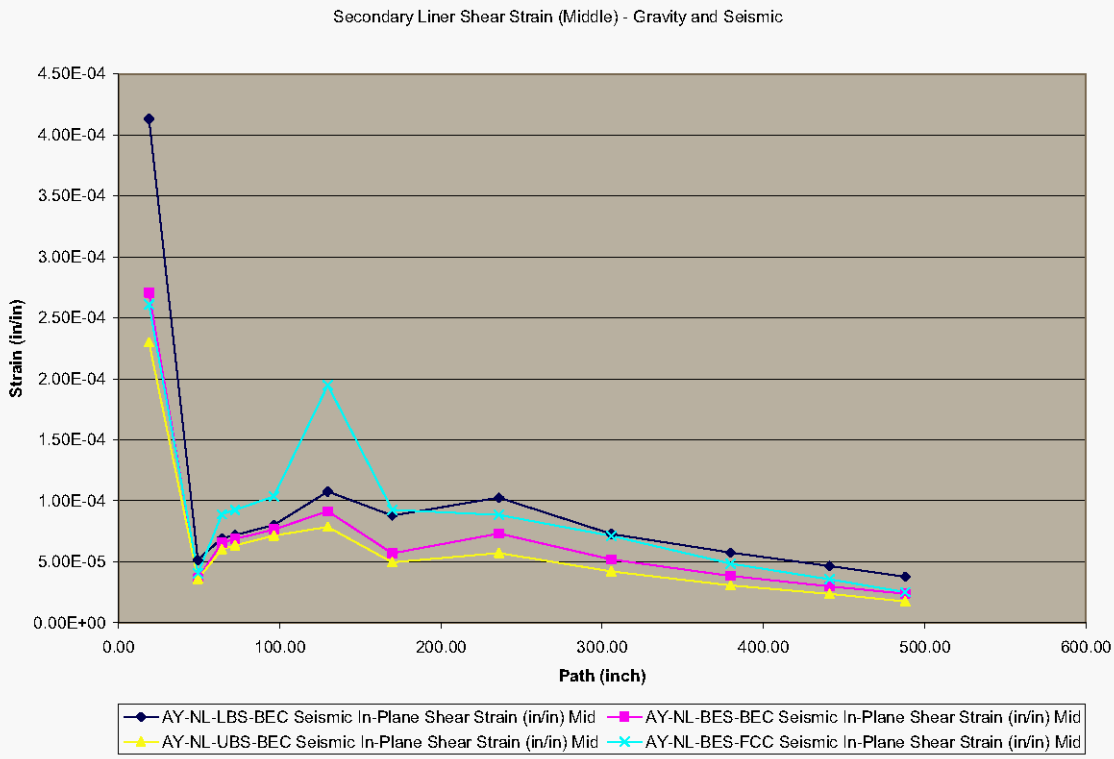


Figure 6.54. Secondary Liner – Shear Strain (Middle) Gravity Plus Seismic

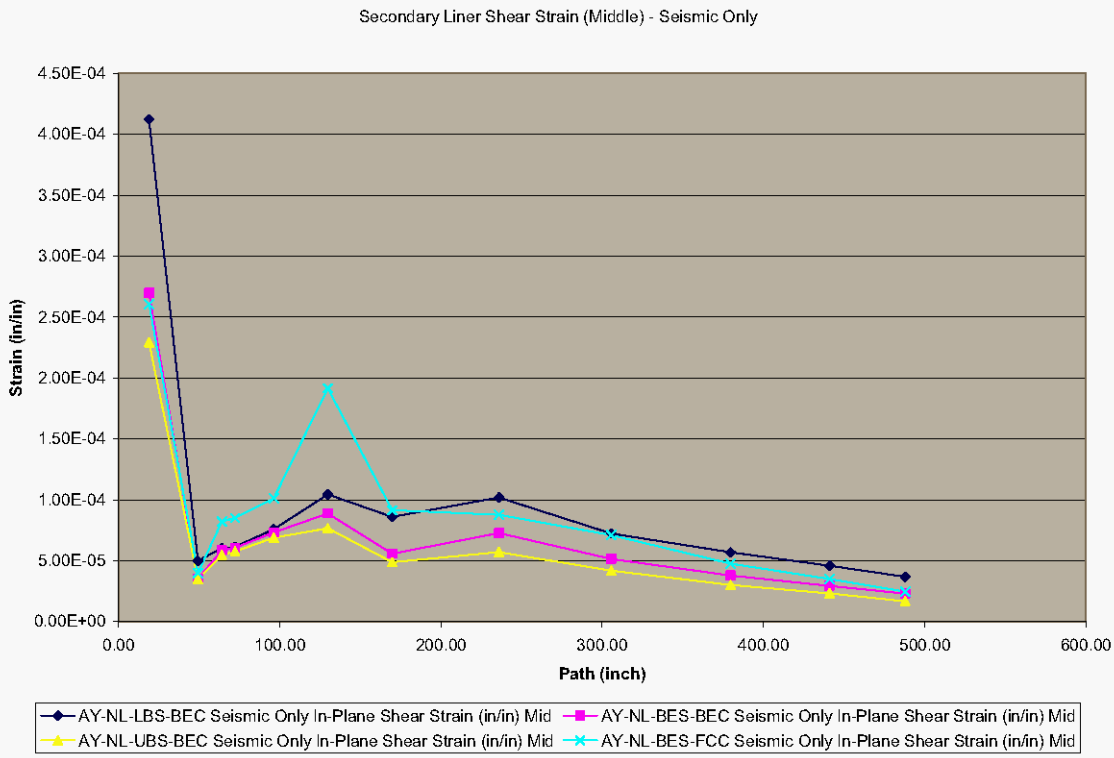


Figure 6.55. Secondary Liner – Shear Strain (Middle) Seismic Only

6.4.1 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 stresses were extracted for the top, middle, and bottom of each shell element representing the primary tank in the dome region. Strains were then calculated. Principal strains were extracted for the inside face of the concrete tank 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. Figures 6.56 and 6.57 show the 1st slice, with element numbers. Each of the subsequent figures shows one component of strain for the Best Estimate Soil, Best Estimate Concrete case only.

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

- S1 1st Principal Stress (Top, Middle, Bottom)
- S2 2nd Principal Stress (Top, Middle, Bottom)
- S3 3rd Principal Stress (Top, Middle, Bottom)

The following strains were extracted for the SHELL143 Concrete tank 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

The following strains were extracted for the SHELL143 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)

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 6 58. Concrete Backed Steel Strain, Principal 1, BES-BEC, Gravity Only
- Figure 6 59. Concrete Backed Steel Strain, Principal 1, BES-BEC, Gravity Plus Seismic
- Figure 6 60. Concrete Backed Steel Strain, Principal 1, BES-BEC, Seismic Only
- Figure 6 61. Concrete Backed Steel Strain, Principal 2, BES-BEC, Gravity Only
- Figure 6 62. Concrete Backed Steel Strain, Principal 2, BES-BEC, Gravity Plus Seismic
- Figure 6 63. Concrete Backed Steel Strain, Principal 2, BES-BEC, Seismic Only
- Figure 6 64. Concrete Backed Steel Strain, Principal 3, BES-BEC, Gravity Only

- Figure 6 65. Concrete Backed Steel Strain, Principal 3, BES-BEC, Gravity Plus Seismic
- Figure 6 66. Concrete Backed Steel Strain, Principal 3, BES-BEC, Seismic Only

Figure 6.56. Element Retrieval Sequence Starting Numbers for Strain

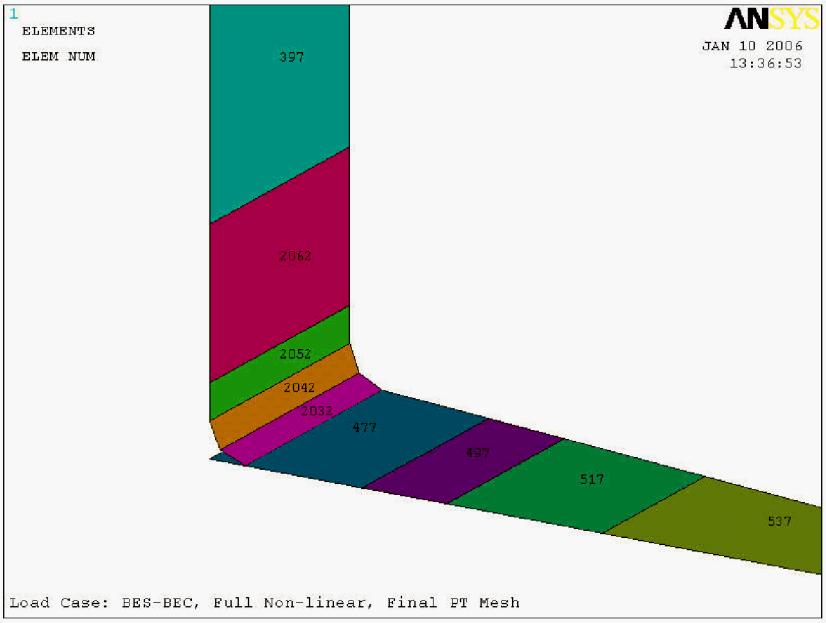


Figure 6.57. Element Retrieval Sequence Starting Numbers for Strain (Detail)

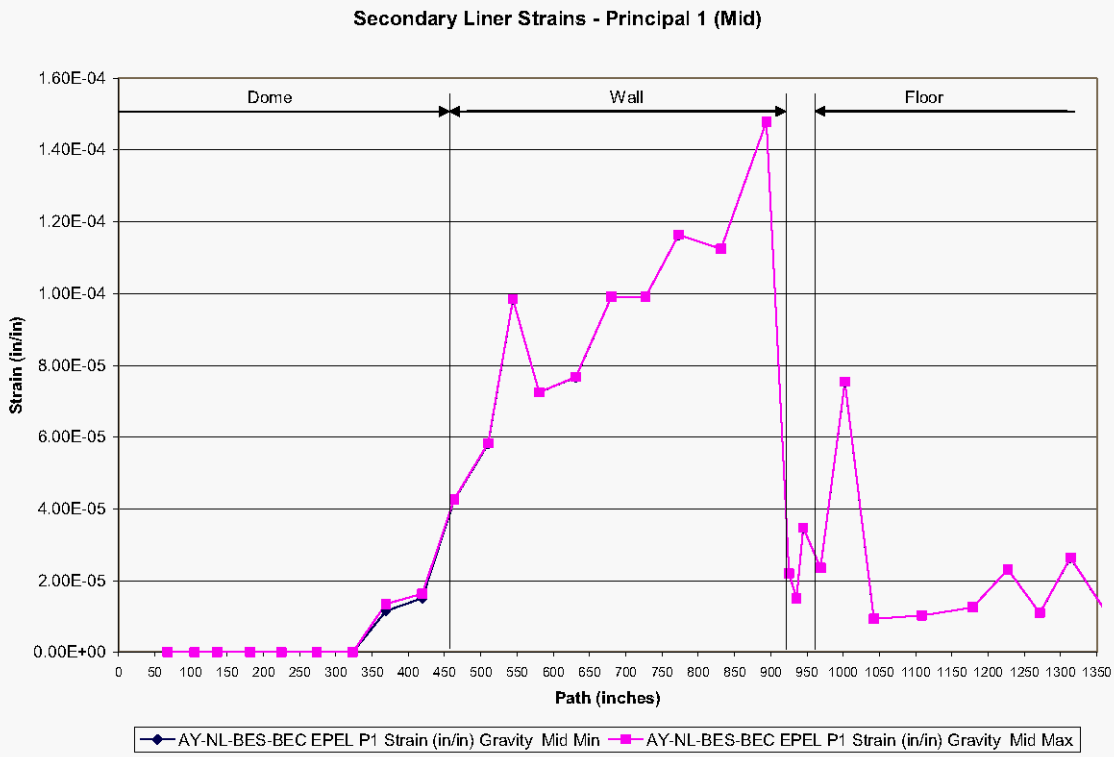


Figure 6.58. Concrete Backed Steel Strain, Principal 1, BES-BEC, Gravity Only

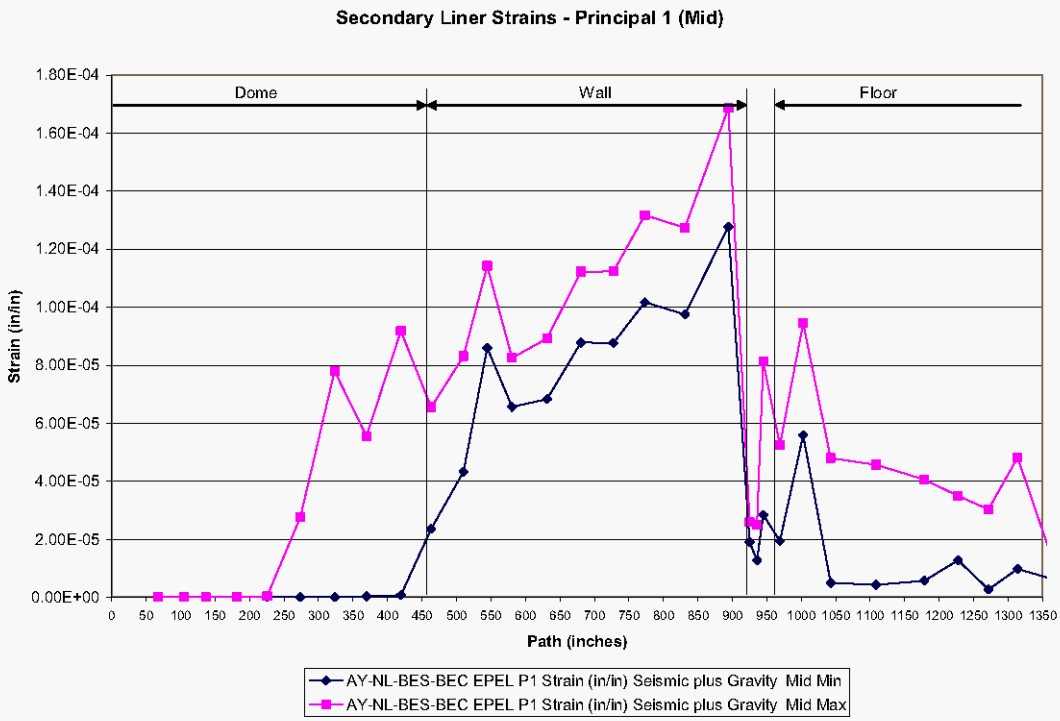


Figure 6.59. Concrete Backed Steel Strain, Principal 1, BES-BEC, Gravity Plus Seismic

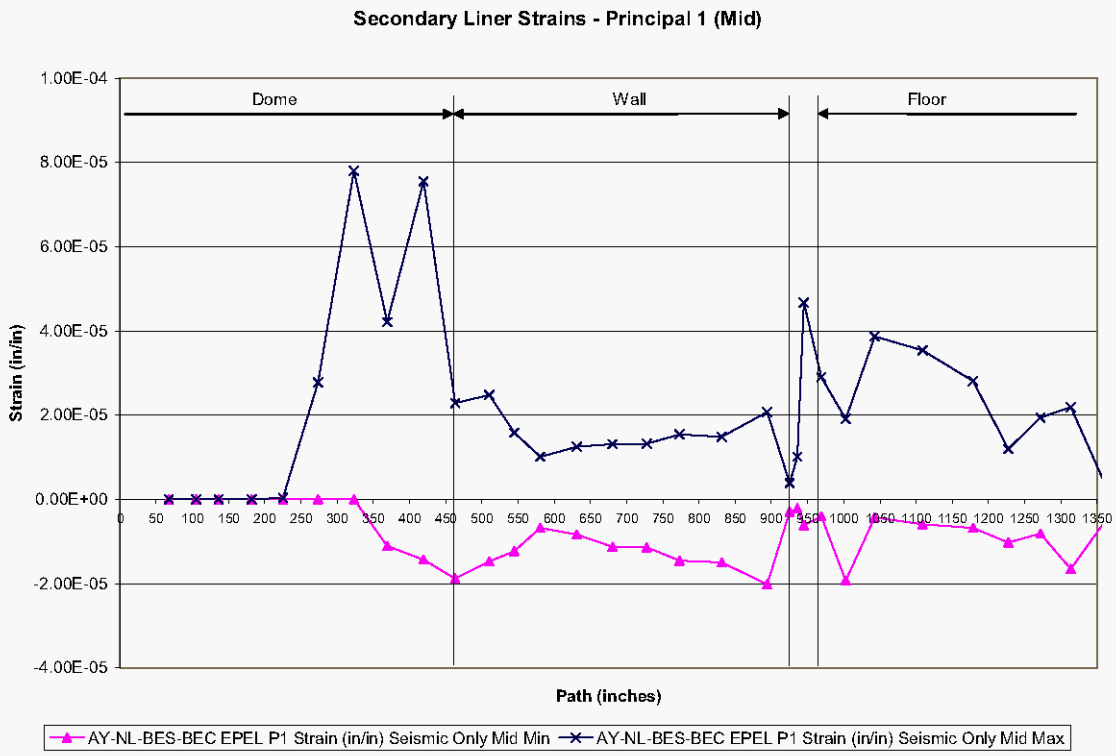


Figure 6.60. Concrete Backed Steel Strain, Principal 1, BES-BEC, Seismic Only

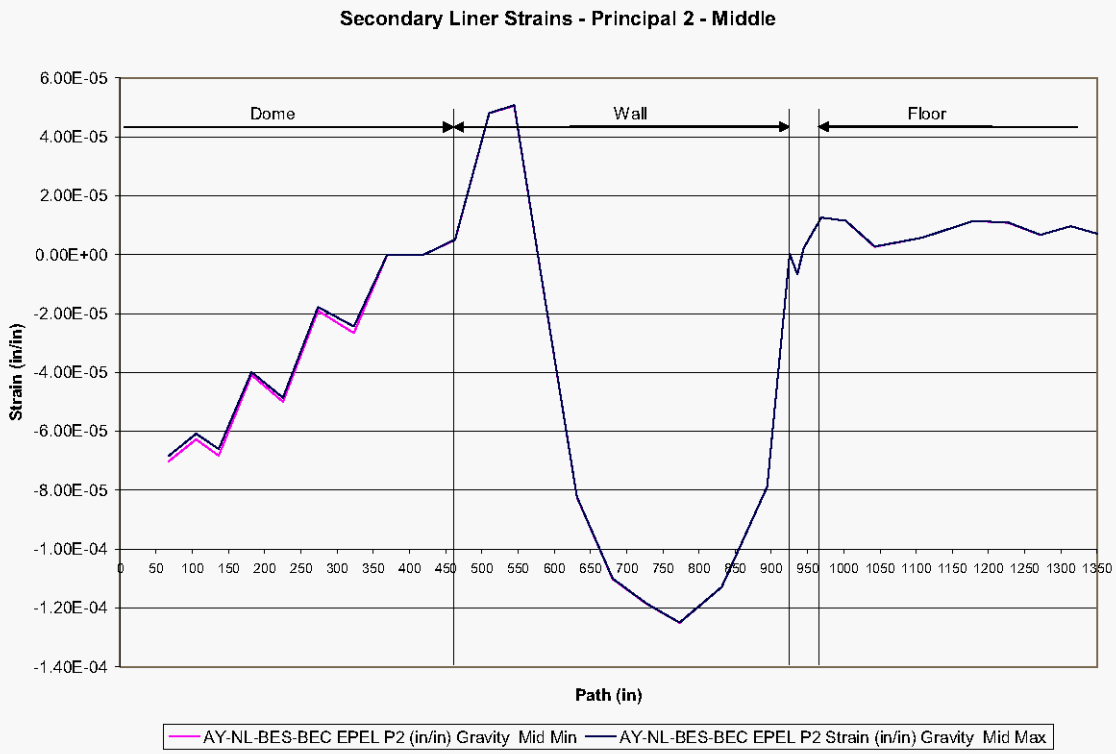


Figure 6.61. Concrete Backed Steel Strain, Principal 2, BES-BEC, Gravity Only

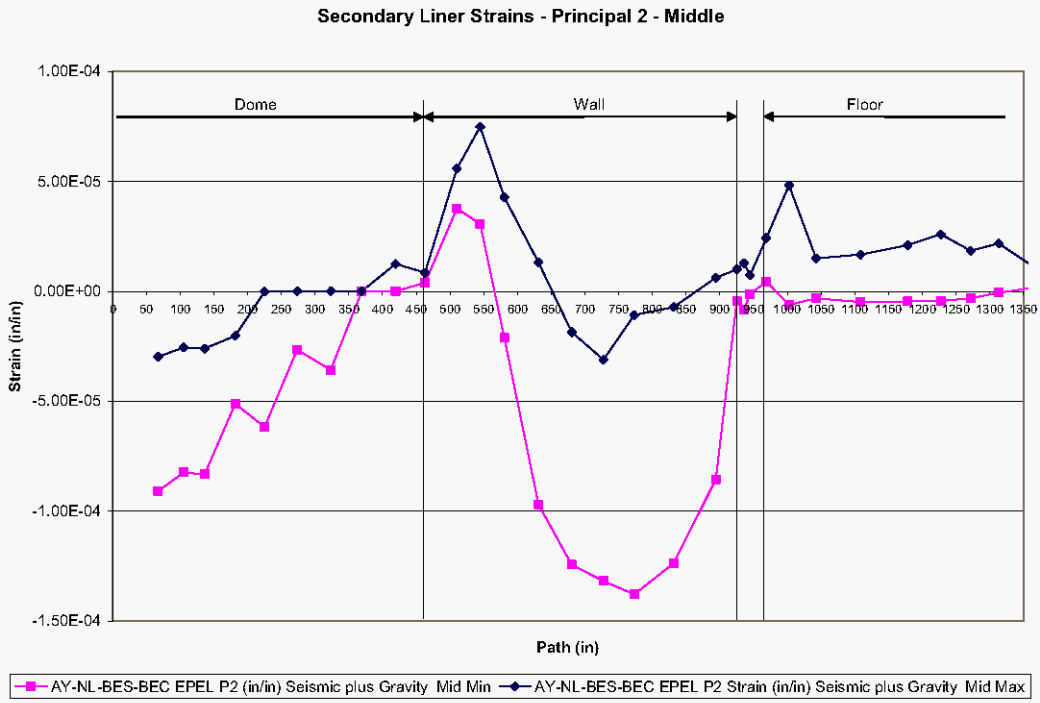


Figure 6.62. Concrete Backed Steel Strain, Principal 2, BES-BEC, Gravity Plus Seismic

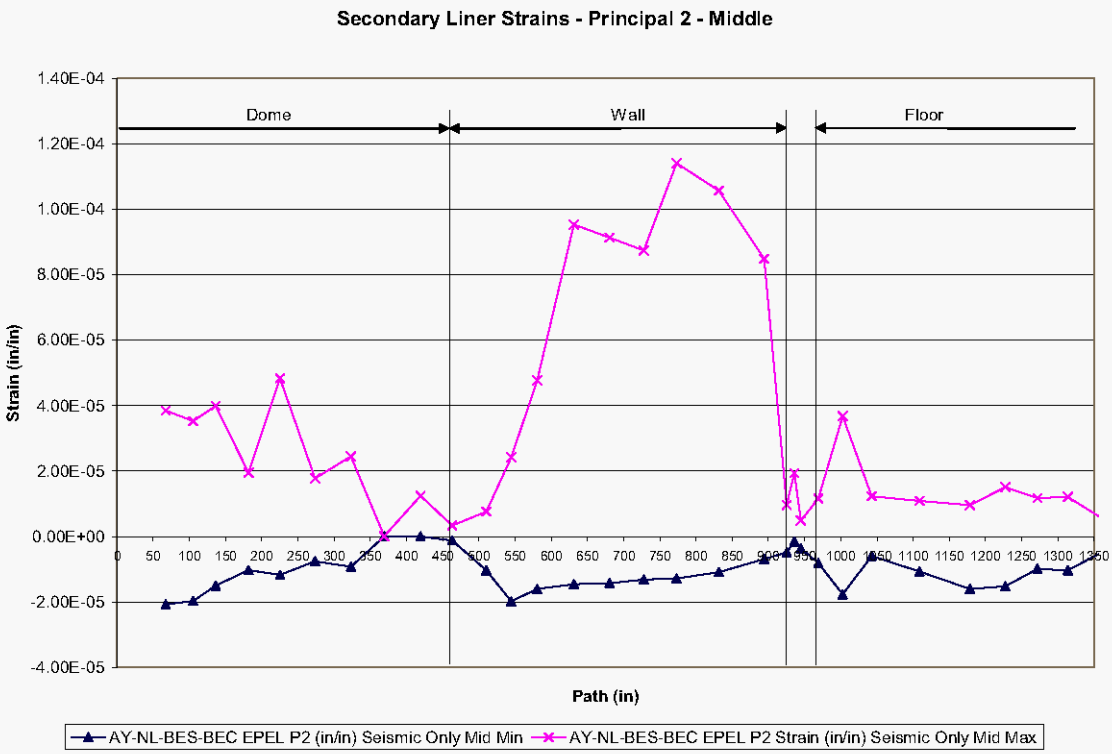


Figure 6.63. Concrete Backed Steel Strain, Principal 2, BES-BEC, Seismic Only

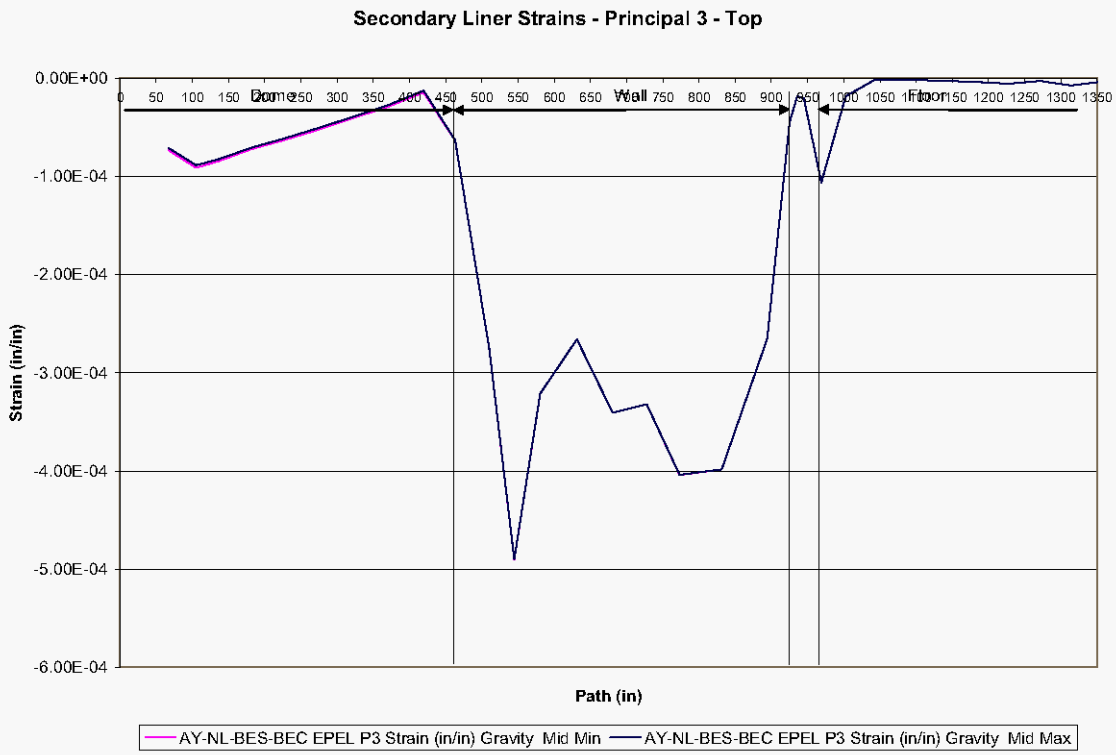


Figure 6.64. Concrete Backed Steel Strain, Principal 3, BES-BEC, Gravity Only

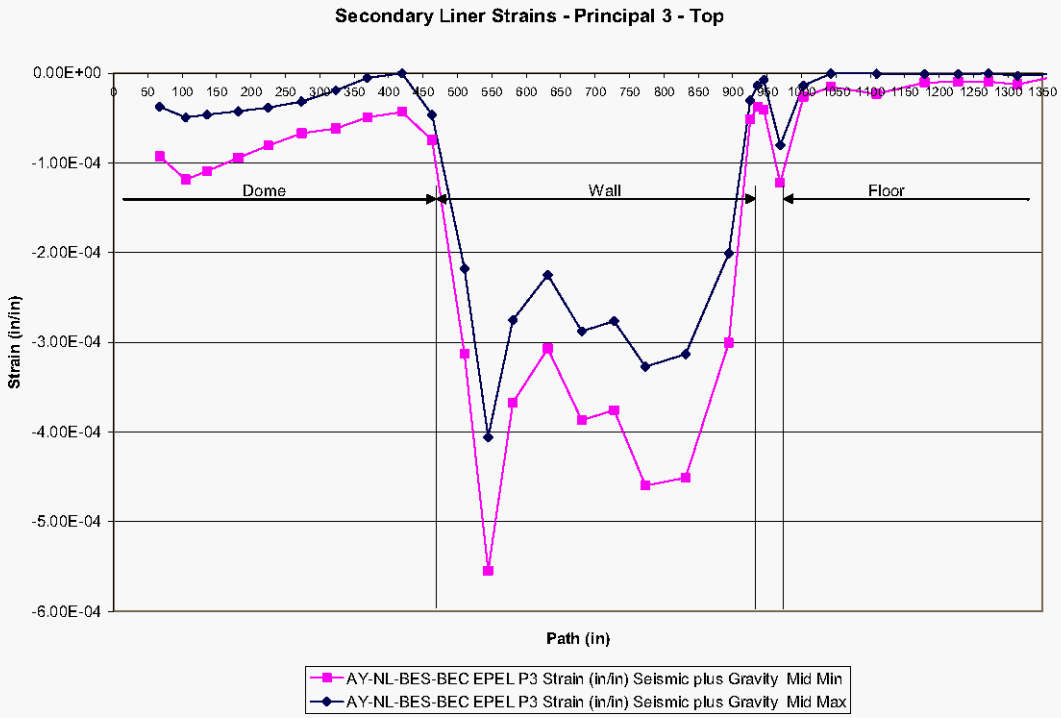


Figure 6.65. Concrete Backed Steel Strain, Principal 3, BES-BEC, Gravity Plus Seismic

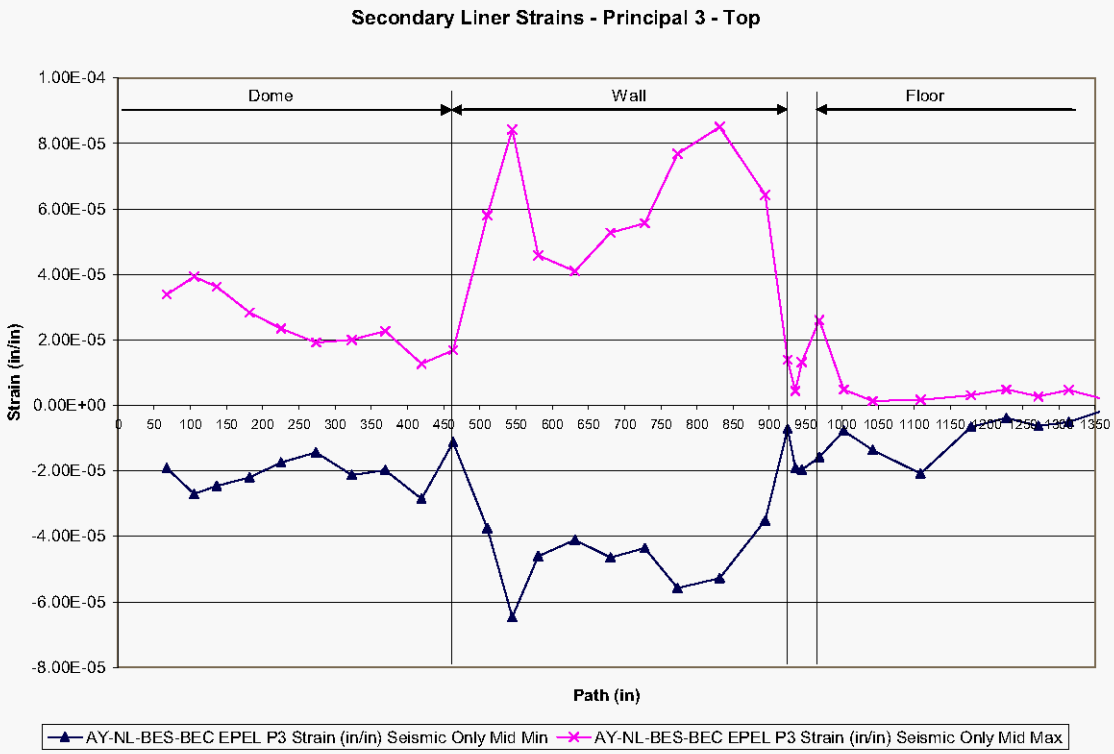


Figure 6.66. Concrete Backed Steel Strain, Principal 3, BES-BEC, Seismic Only

7.0 Contact Element Results

7.1 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 7.1 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 7 2. Concrete Footing Contact Force - Gravity Only
- Figure 7 3. Maximum Concrete Footing Contact Force - Gravity Plus Seismic
- Figure 7 4. Minimum Concrete Footing Contact Force - Gravity Plus Seismic
- Figure 7 5. Maximum Concrete Footing Contact Force - Seismic Only
- Figure 7 6. Minimum Concrete Footing Contact Force - Seismic Only
- Figure 7 7. Concrete Footing Contact Shear - Gravity Only
- Figure 7 8. Concrete Footing Contact Shear - Gravity Plus Seismic
- Figure 7 9. Concrete Footing Contact Shear - Seismic Only

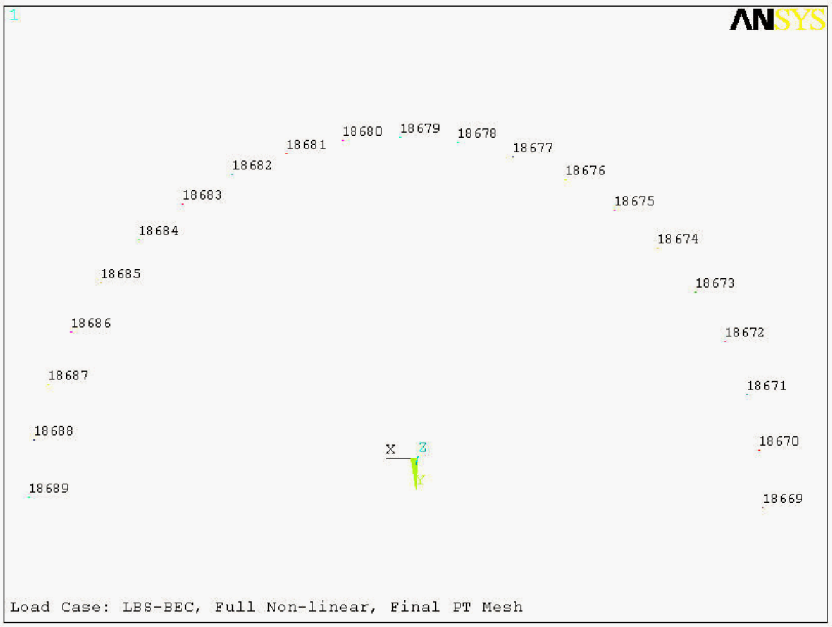


Figure 7.1. Footing Contact Element Retreival Numbers

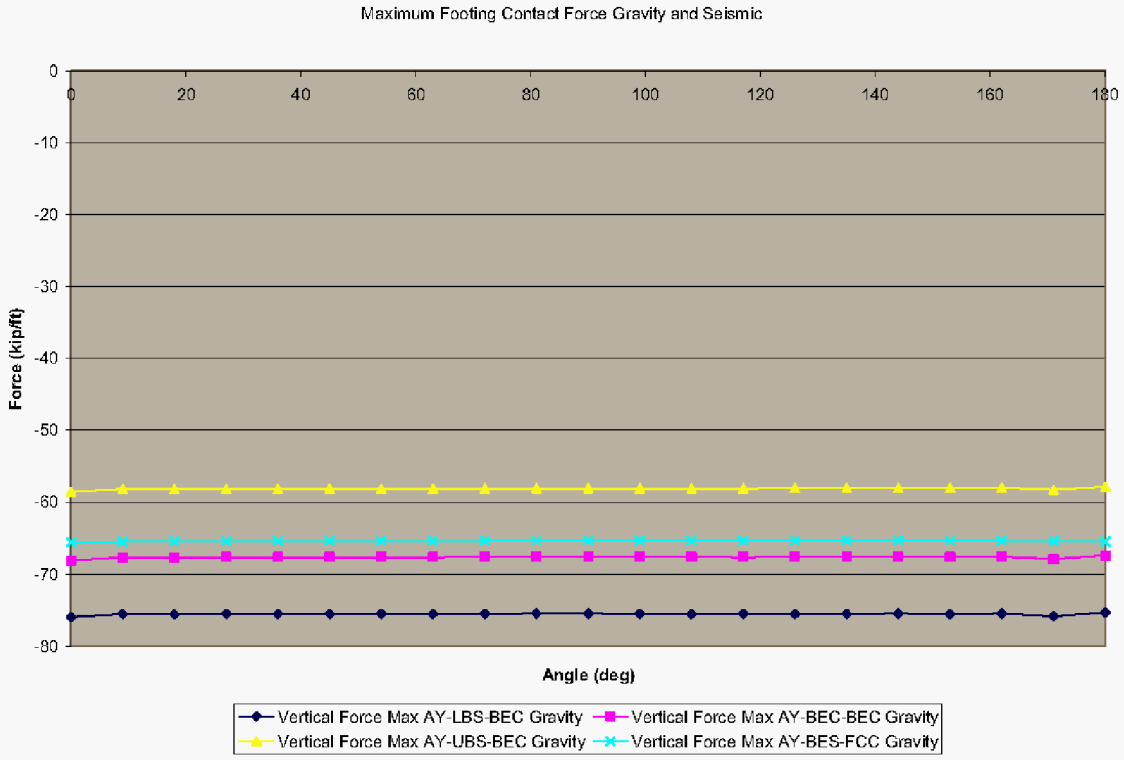


Figure 7.2. Concrete Footing Contact Force - Gravity Only

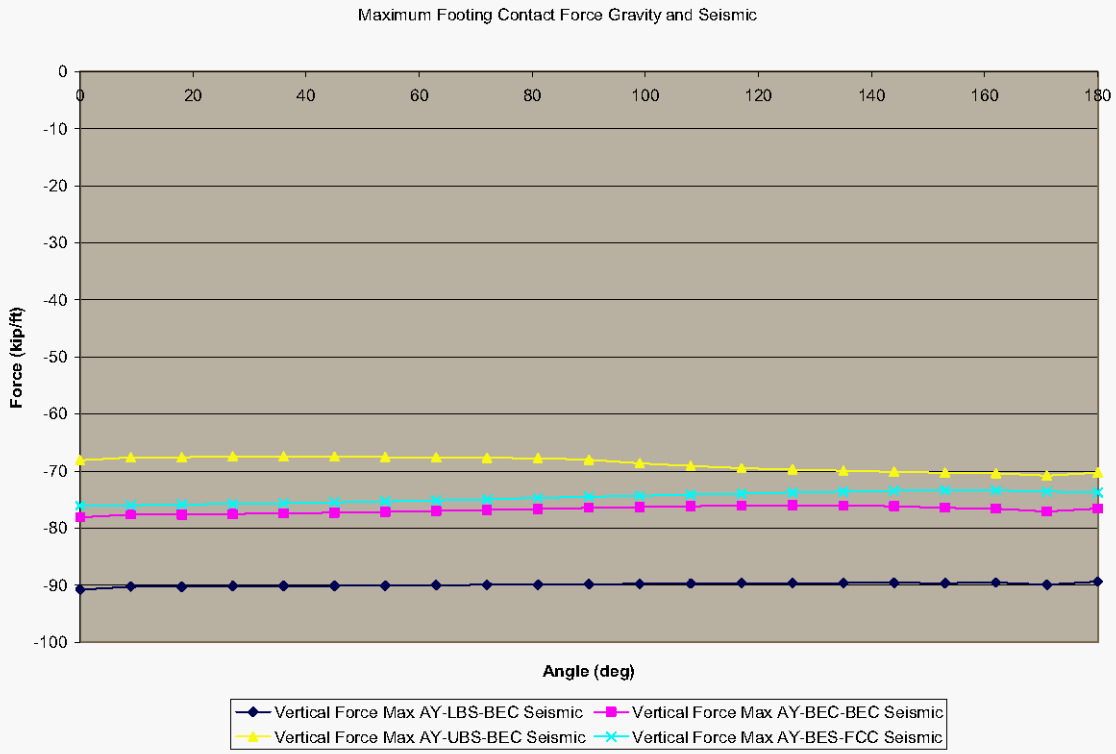


Figure 7.3. Maximum Concrete Footing Contact Force - Gravity Plus Seismic

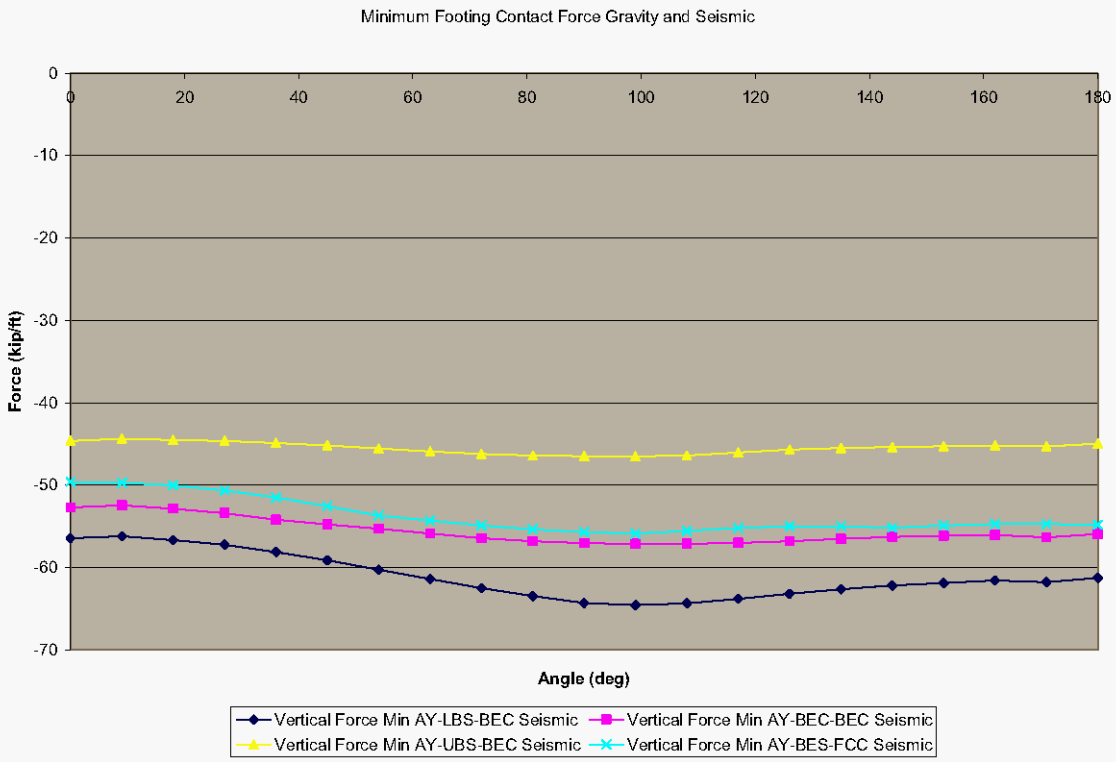


Figure 7.4. Minimum Concrete Footing Contact Force - Gravity Plus Seismic

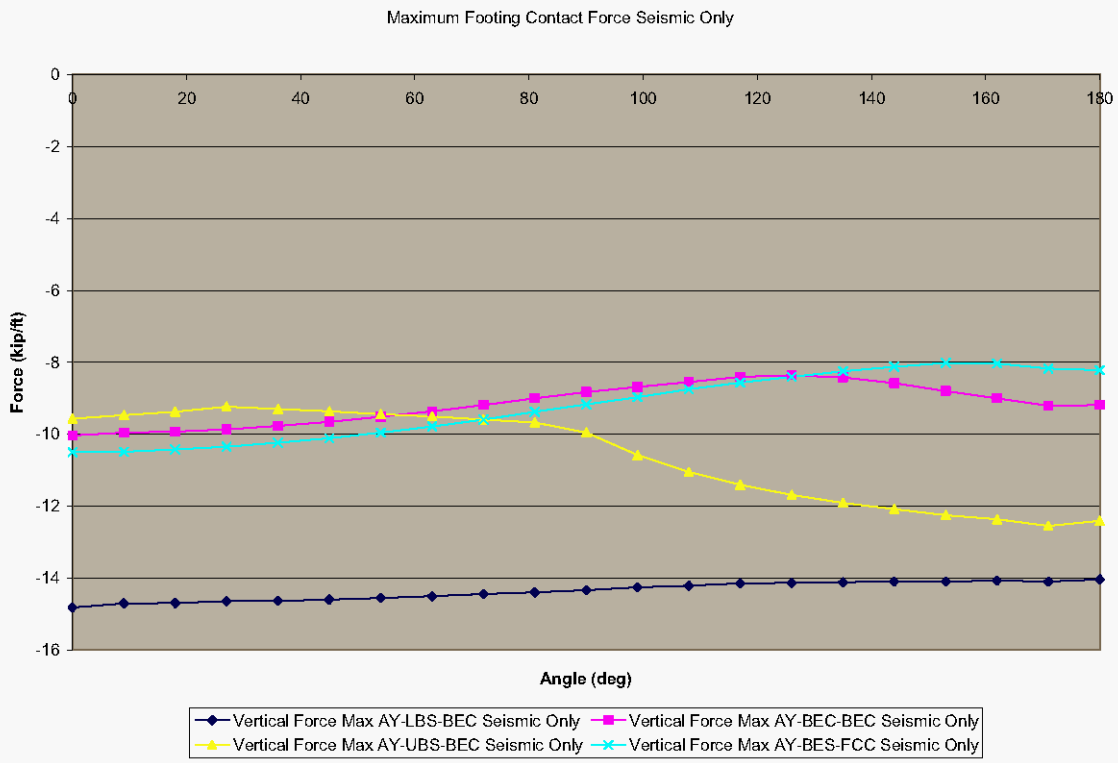


Figure 7.5. Maximum Concrete Footing Contact Force - Seismic Only

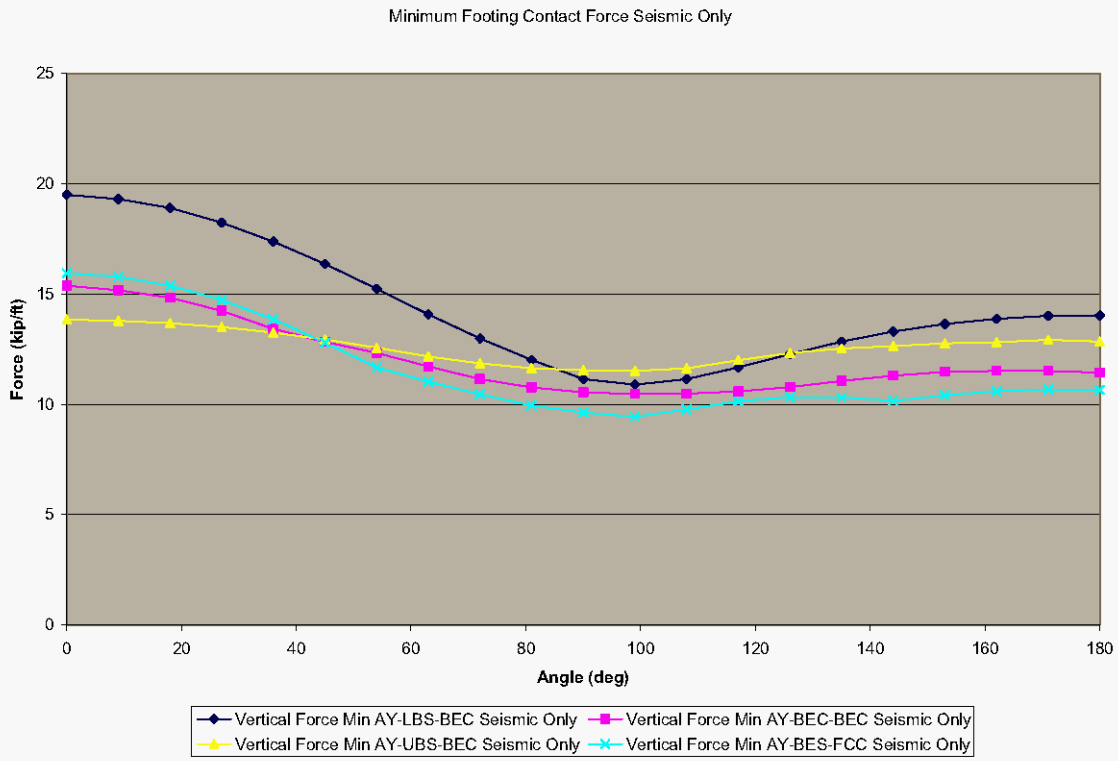


Figure 7.6. Minimum Concrete Footing Contact Force - Seismic Only

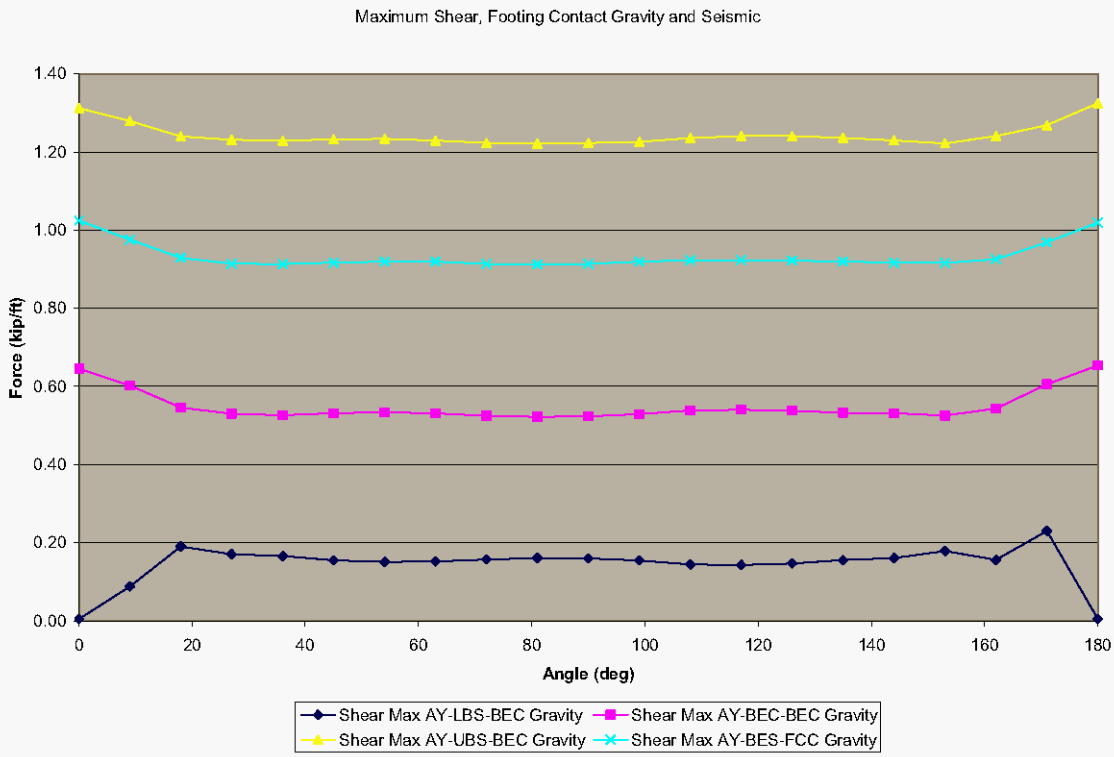


Figure 7.7. Concrete Footing Contact Shear - Gravity Only

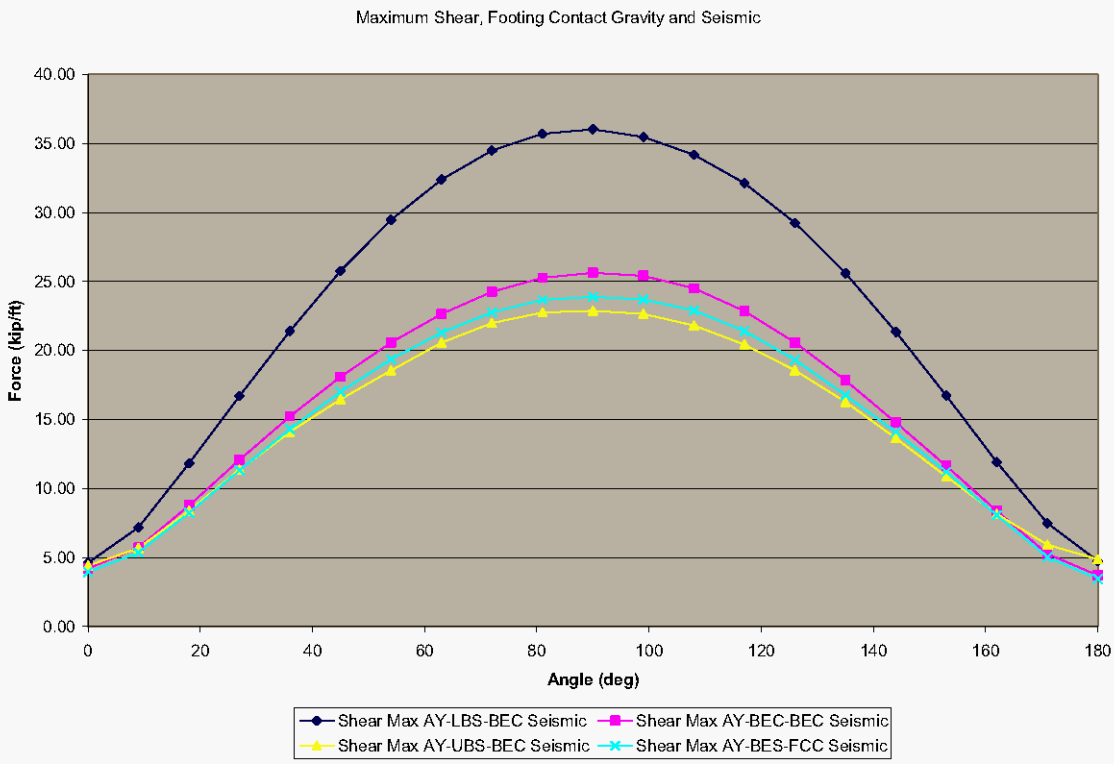


Figure 7.8. Concrete Footing Contact Shear - Gravity Plus Seismic

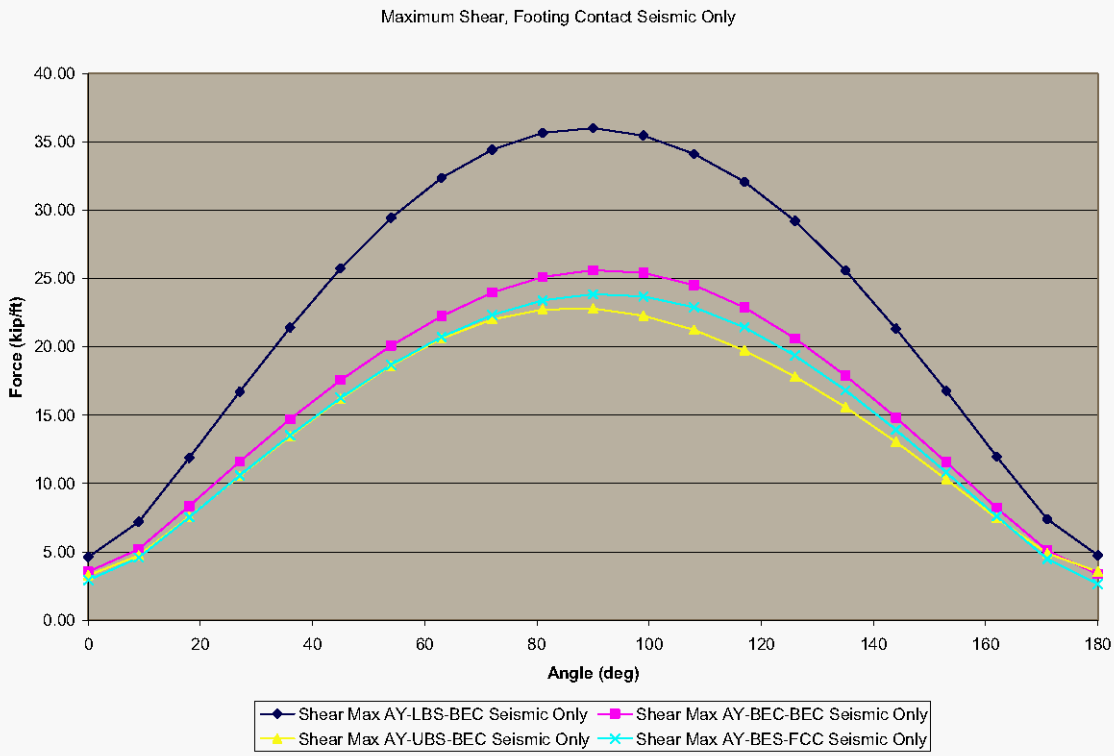


Figure 7.9. Concrete Footing Contact Shear - Seismic Only

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 0.00093 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 7 10. Concrete Footing Time History, =9 Deg– LBS-BEC
- Figure 7 11. Concrete Footing Time History, =90 Deg– LBS-BEC
- Figure 7 12. Concrete Footing Displacment Time History, =90 Deg – BES-FCC
- Figure 7 13. Concrete Footing Time History, =9 Deg – BES-BEC
- Figure 7 14. Concrete Footing Time History, =90 Deg – BES-BEC
- Figure 7 15. Concrete Footing Time History, =9 Deg – UBS-BEC
- Figure 7 16. Concrete Footing Time History, =90 Deg – UBS-BEC
- Figure 7 17. Concrete Footing Time History, =9 Deg – BES-FCC
- Figure 7 18. Concrete Footing Time History, =90 Deg – BES-FCC

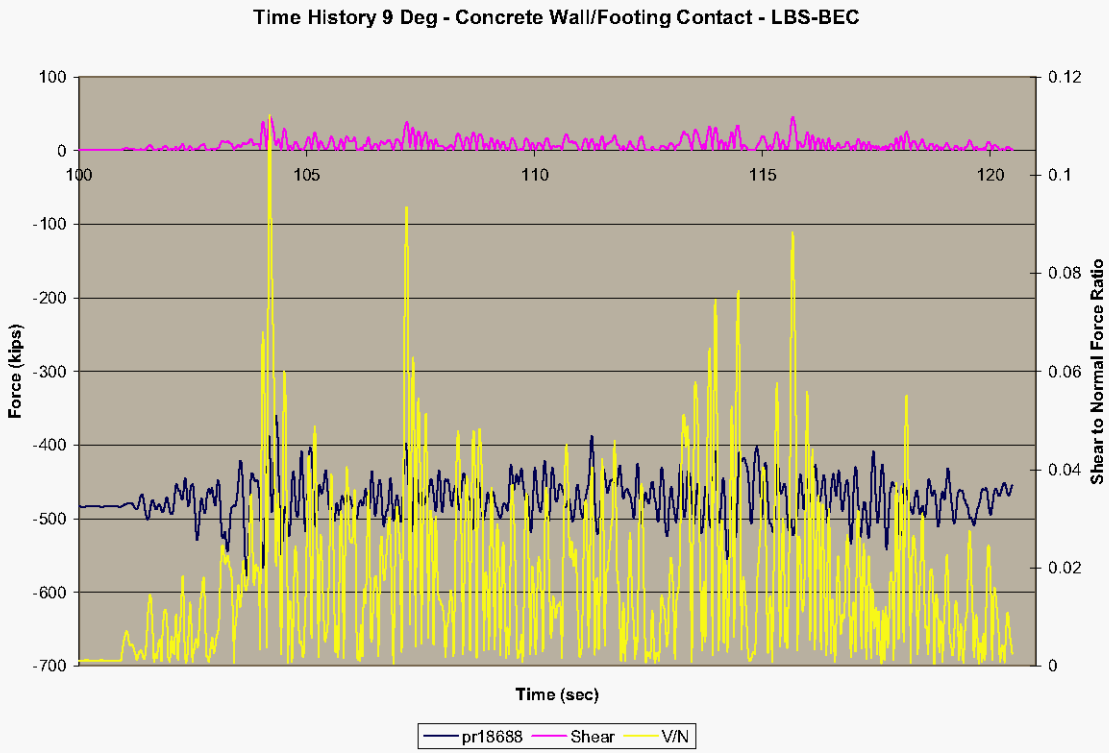


Figure 7.10. Concrete Footing Time History, θ=9 Deg– LBS-BEC

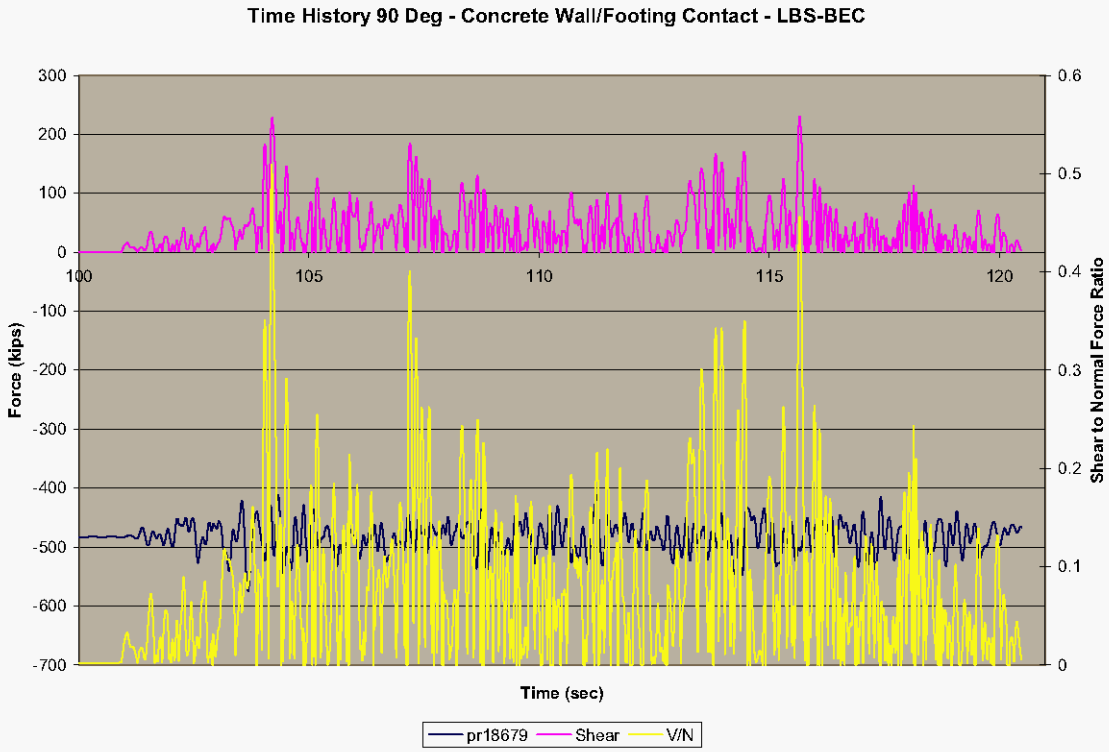


Figure 7.11. Concrete Footing Time History, θ=90 Deg– LBS-BEC

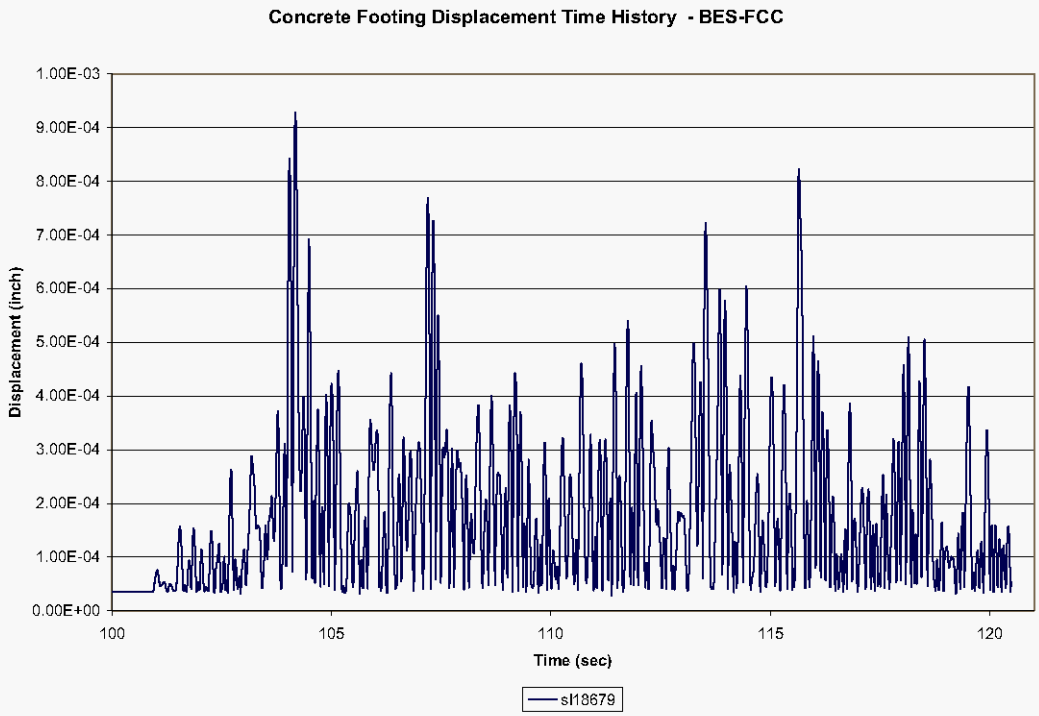


Figure 7.12. Concrete Footing Displacment Time History, θ=90 Deg – BES-FCC

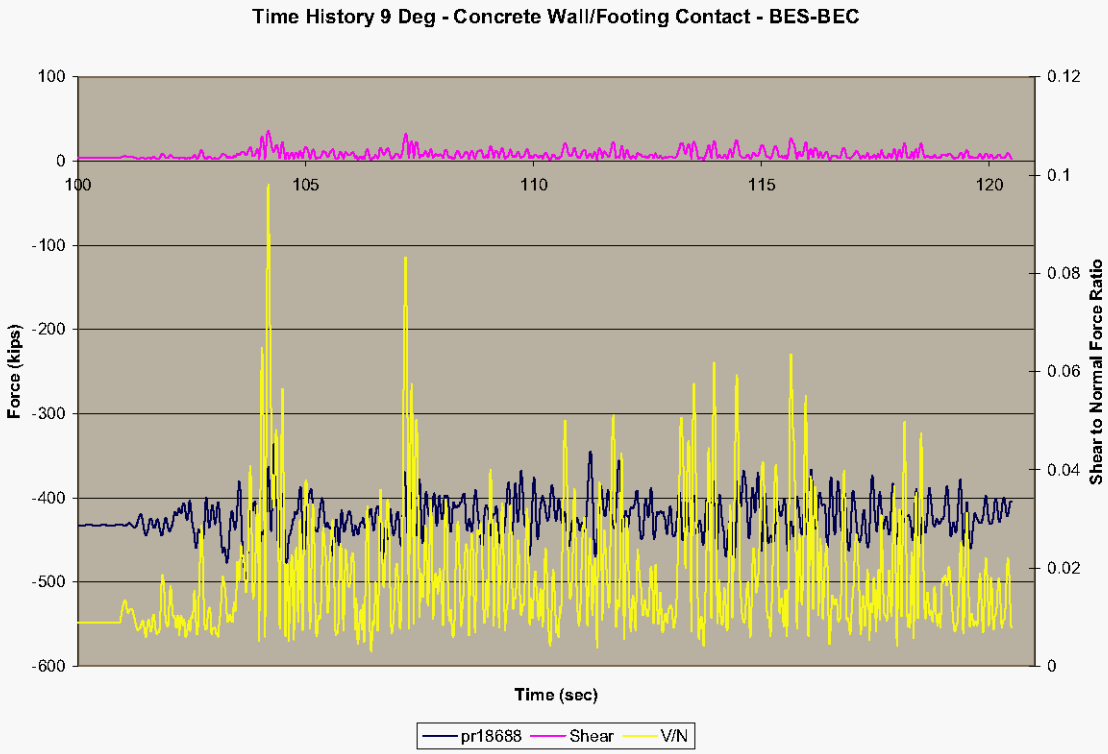


Figure 7.13. Concrete Footing Time History, θ=9 Deg – BES-BEC

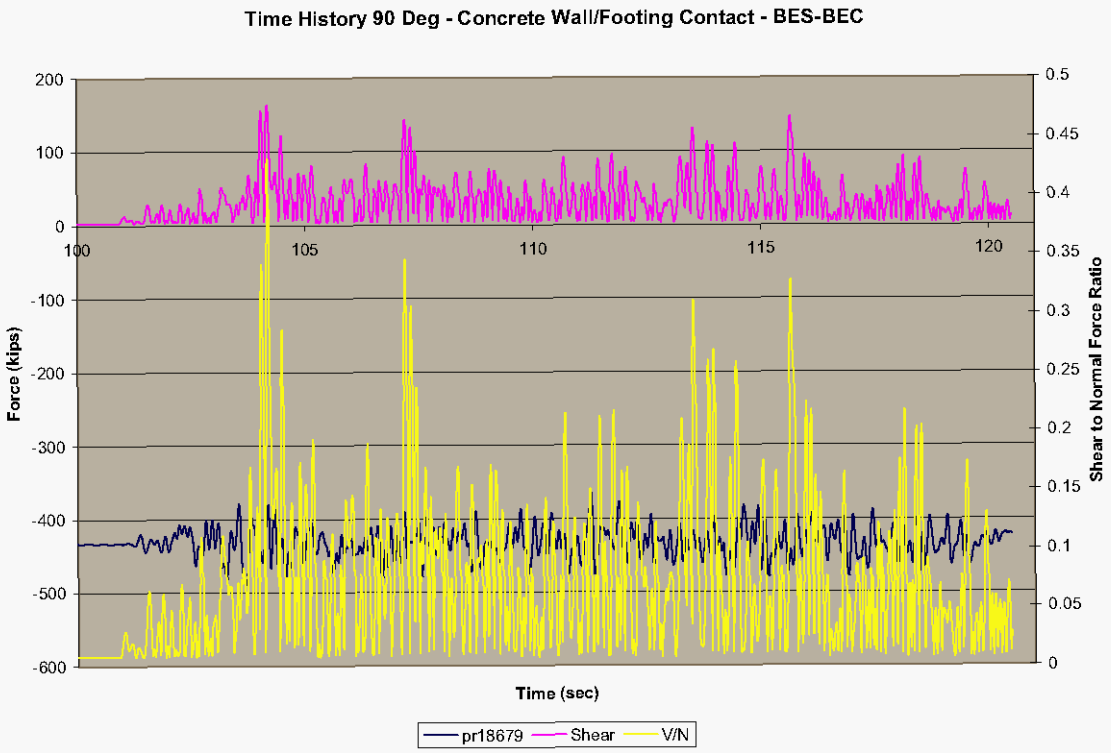


Figure 7.14. Concrete Footing Time History, θ=90 Deg – BES-BEC

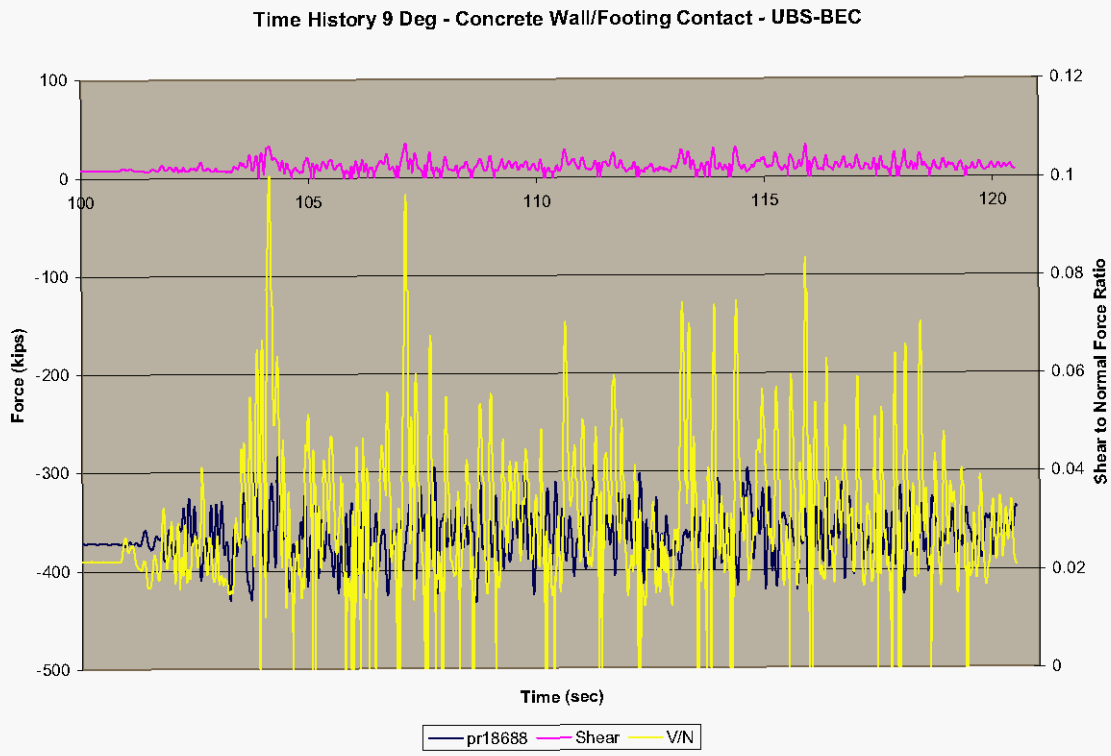


Figure 7.15. Concrete Footing Time History, θ=9 Deg – UBS-BEC

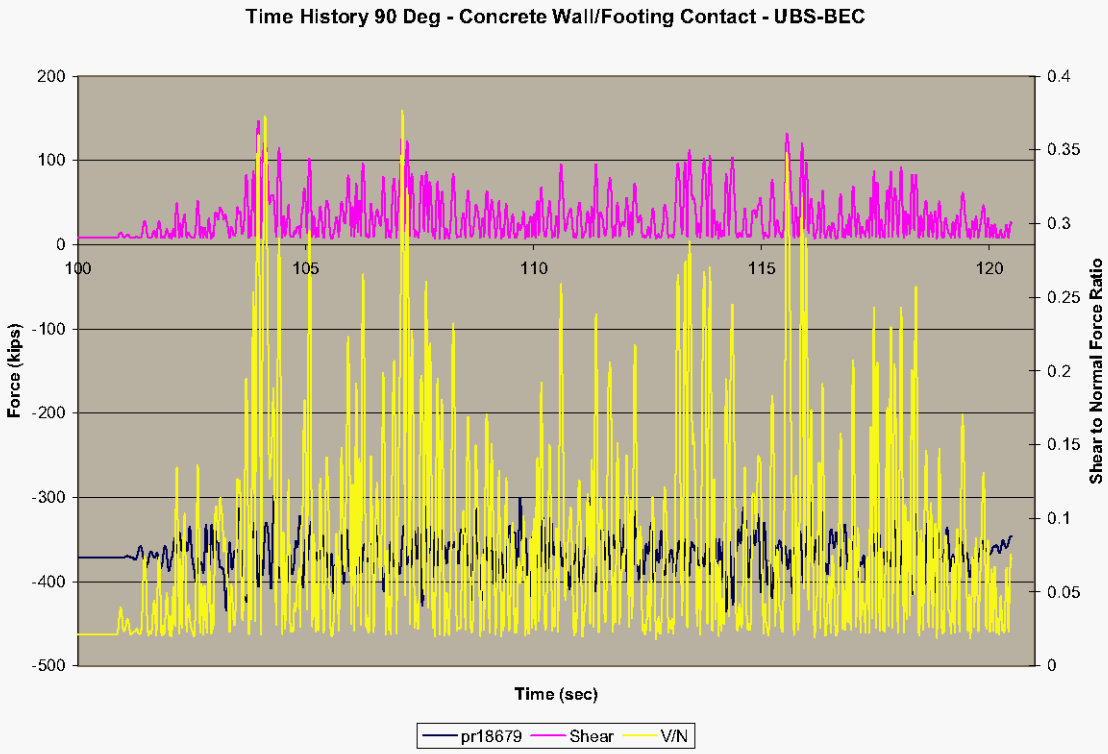


Figure 7.16. Concrete Footing Time History, θ=90 Deg – UBS-BEC

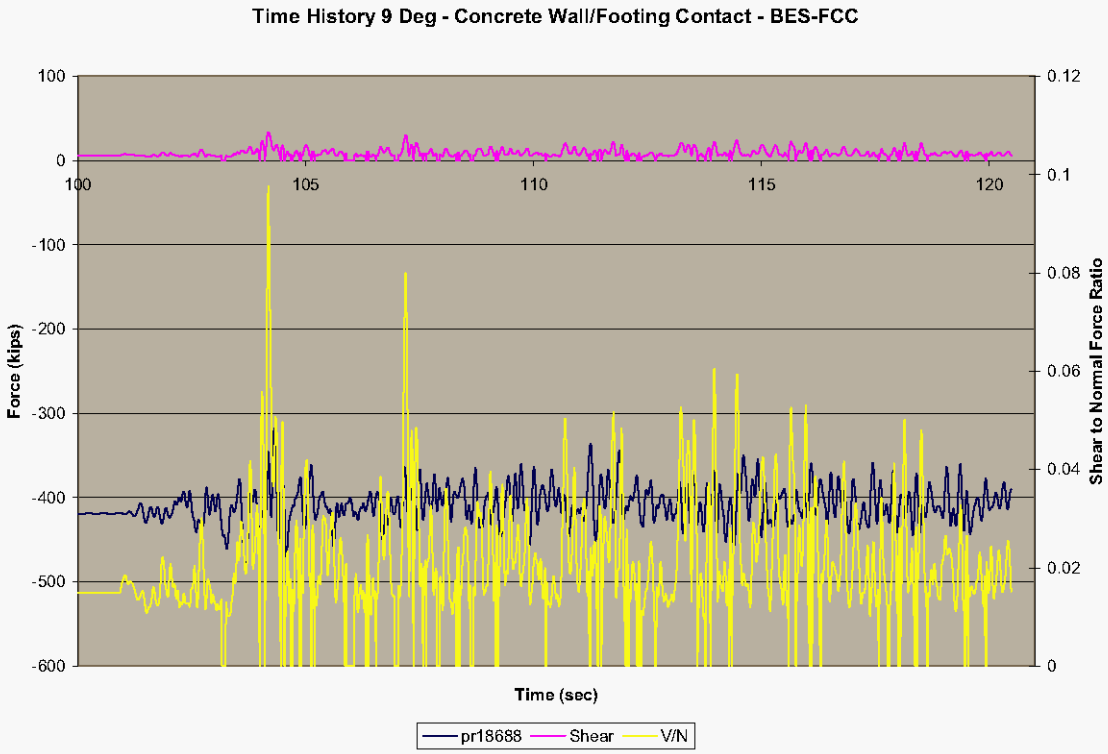


Figure 7.17. Concrete Footing Time History, θ=9 Deg – BES-FCC

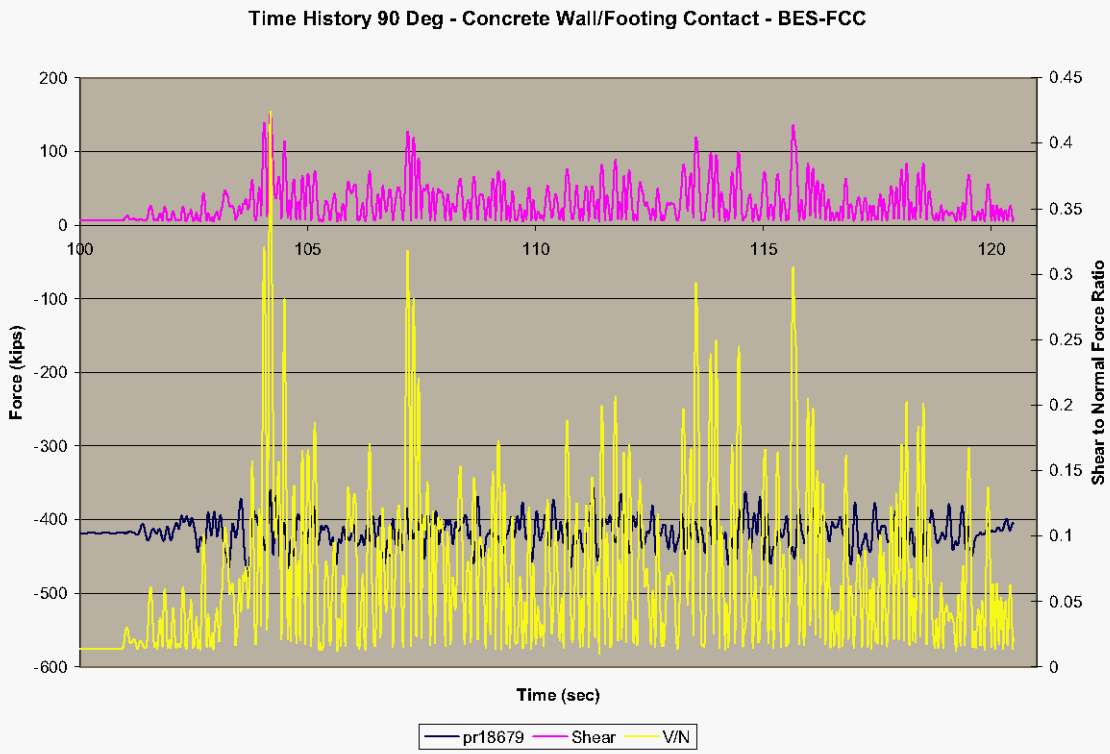


Figure 7.18. Concrete Footing Time History, θ=90 Deg – BES-FCC

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.

7.2 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 tank. Figure 7.19 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 7 20. Soil/Concrete Contact Element Normal Pressure – Gravity Only

- Figure 7 21. Soil/Concrete Contact Element Maximum Normal Pressure – Gravity Plus Seismic Only
- Figure 7 22. Soil/Concrete Contact Element Minimum Normal Pressure – Gravity Plus Seismic Only
- Figure 7 23. Soil/Concrete Contact Element Maximum Normal Pressure – Seismic Only
- Figure 7 24. Soil/Concrete Contact Element Minimum Normal Pressure – Seismic Only
- Figure 7 26. Soil/Concrete Contact Element Meridional Shear – Gravity Plus Seismic
- Figure 7 27. Soil/Concrete Contact Element Meridional Shear – Seismic Only
- Figure 7 29. Soil/Concrete Contact Element Tangential Shear – Gravity Plus Seismic
- Figure 7 30. Soil/Concrete Contact Element Gap Tangential Shear – Seismic Only
- Figure 7 32. Soil/Concrete Contact Element Gap Lateral Displacement (Slide) – Gravity Plus Seismic
- Figure 7 33. Soil/Concrete Contact Element Gap Lateral Displacement (Slide) – Seismic Only

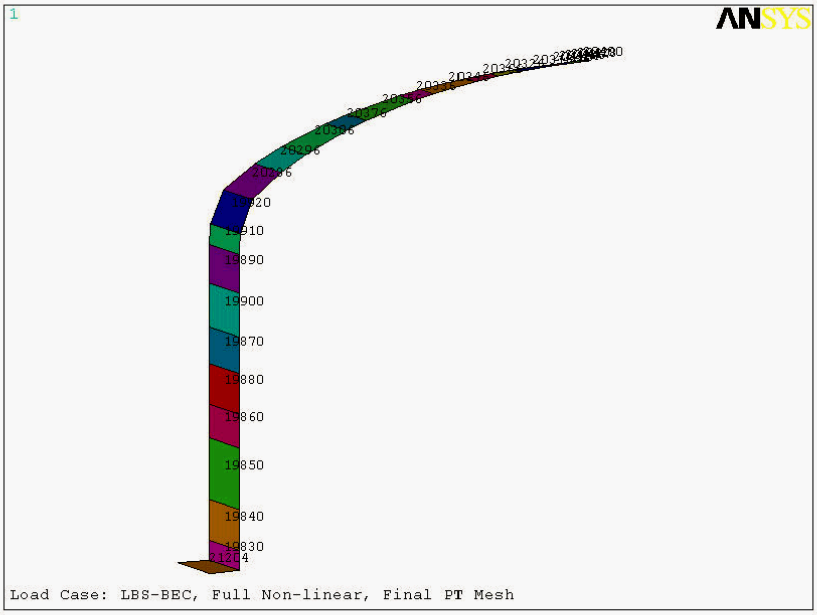


Figure 7.19. Soil/Concrete Contact Element Retreival Sequence Starting Numbers

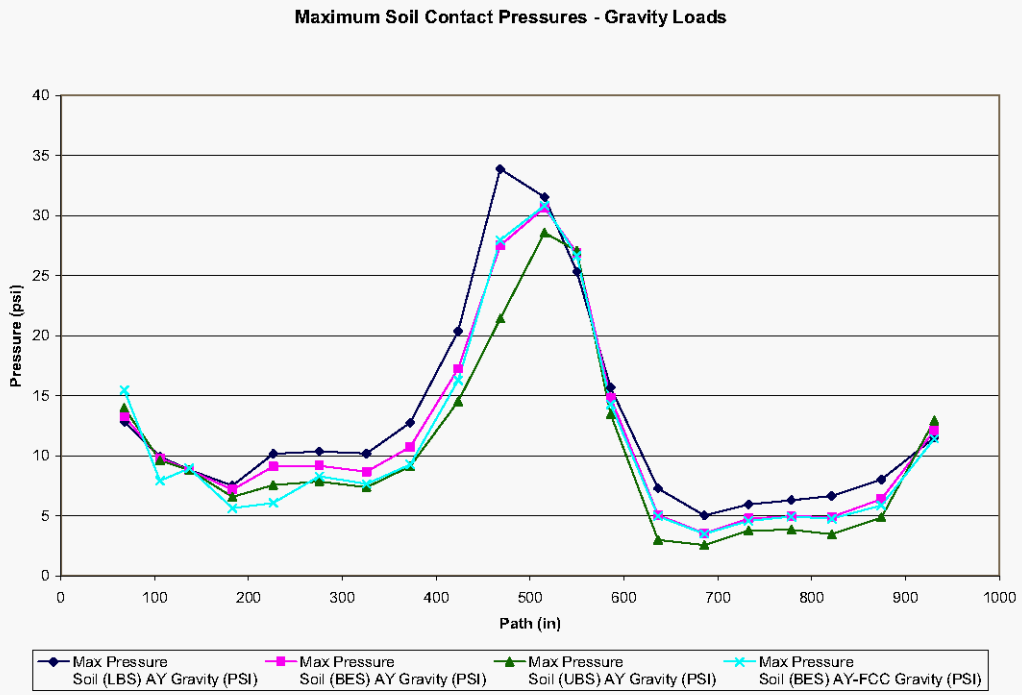


Figure 7.20. Soil/Concrete Contact Element Normal Pressure – Gravity Only

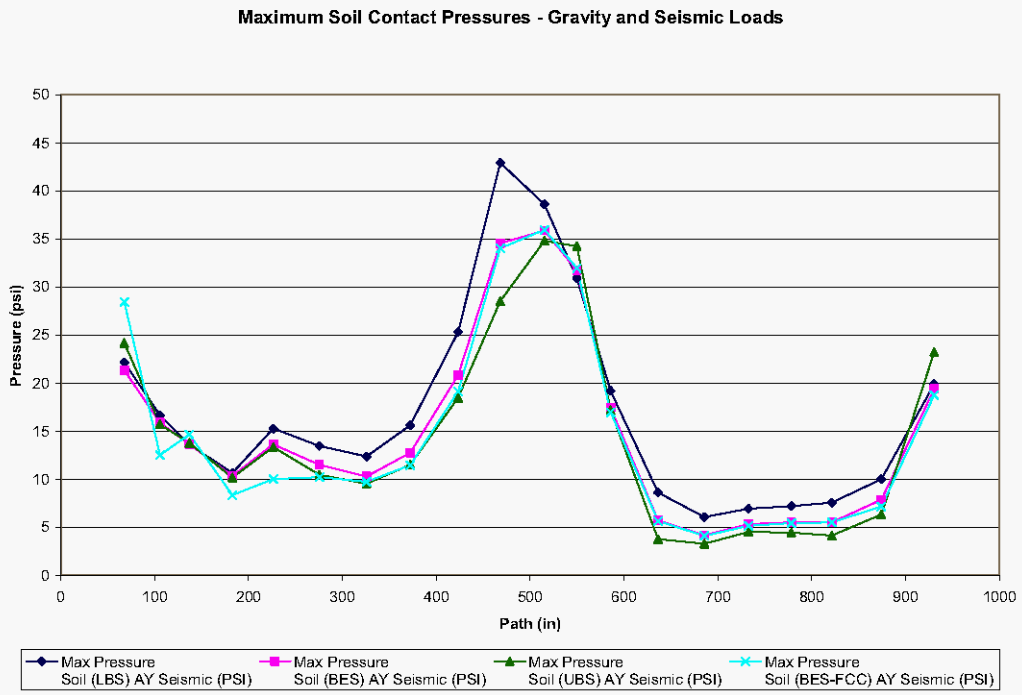


Figure 7.21. Soil/Concrete Contact Element Maximum Normal Pressure – Gravity Plus Seismic Only

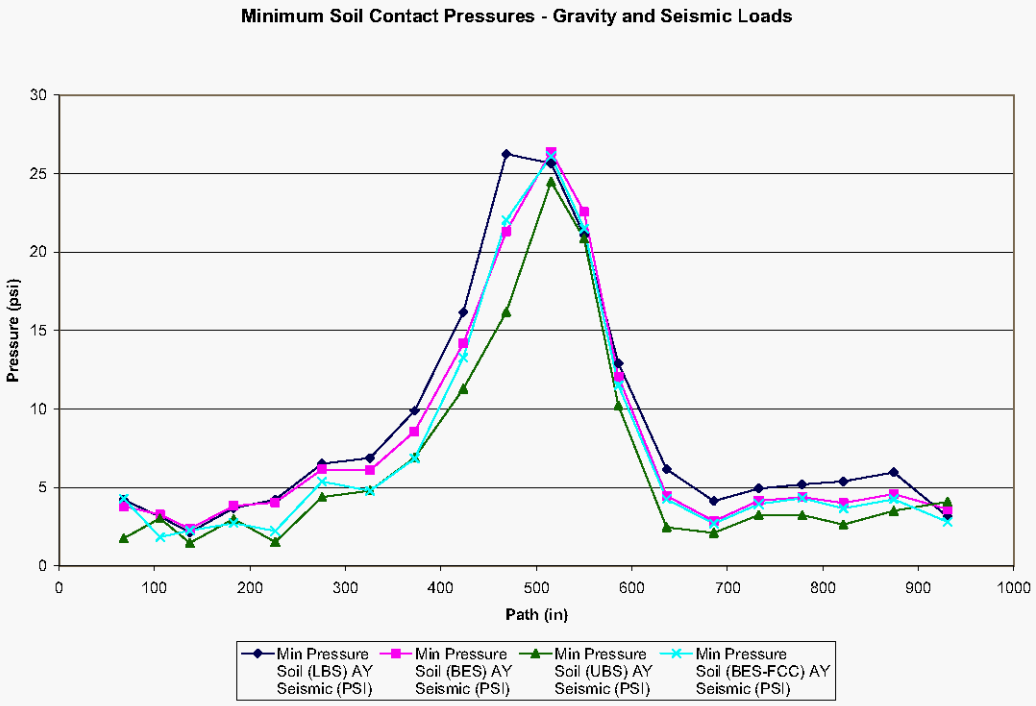


Figure 7.22. Soil/Concrete Contact Element Minimum Normal Pressure – Gravity Plus Seismic Only

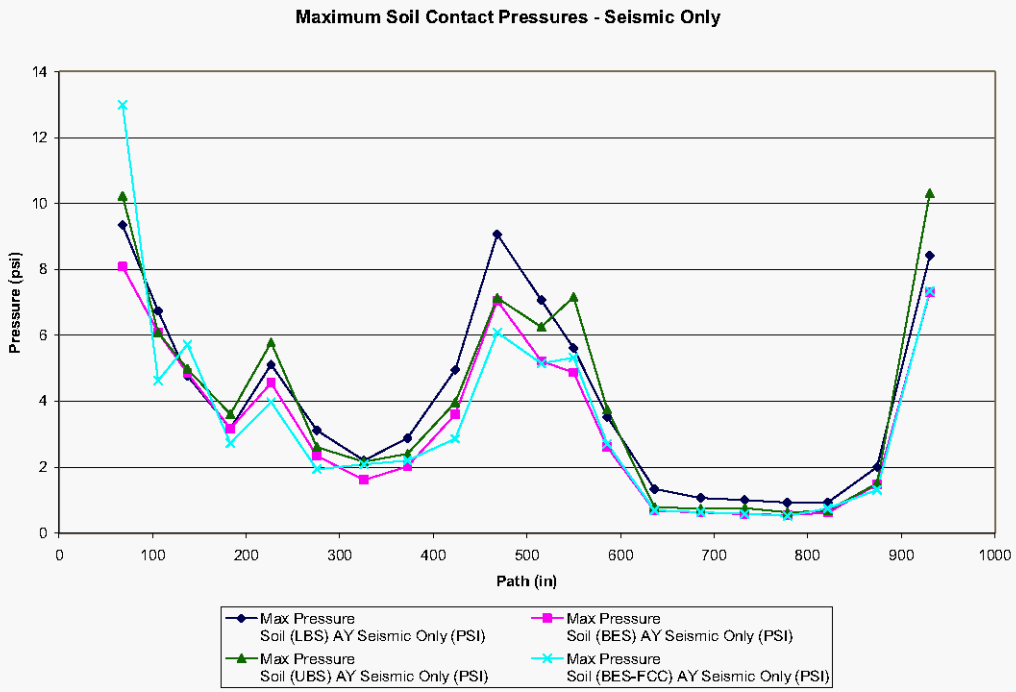


Figure 7.23. Soil/Concrete Contact Element Maximum Normal Pressure – Seismic Only

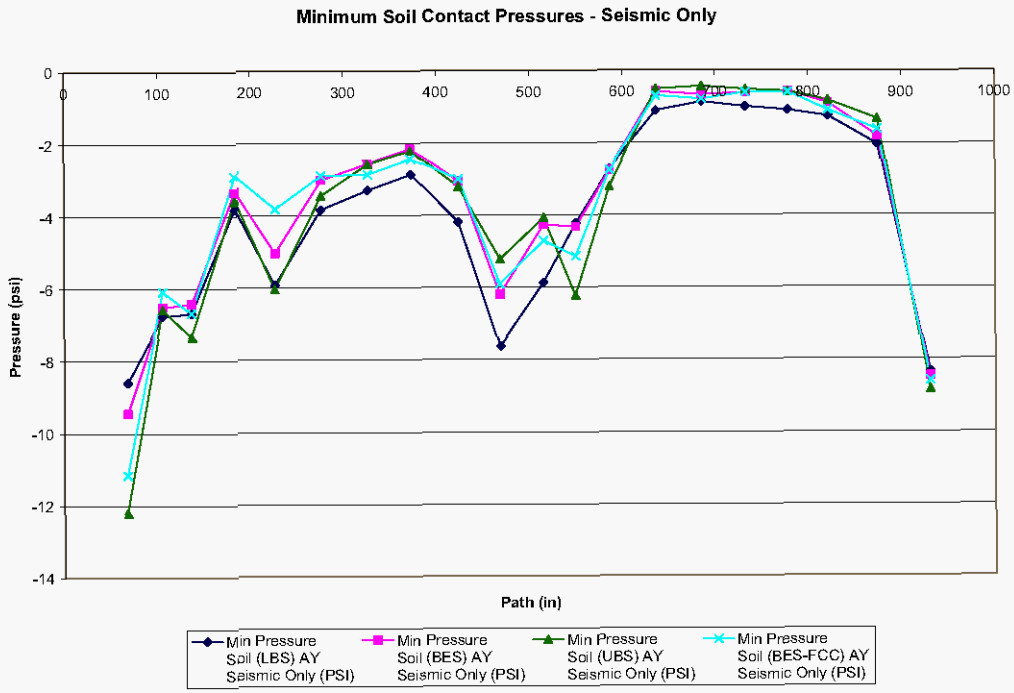


Figure 7.24. Soil/Concrete Contact Element Minimum Normal Pressure – Seismic Only

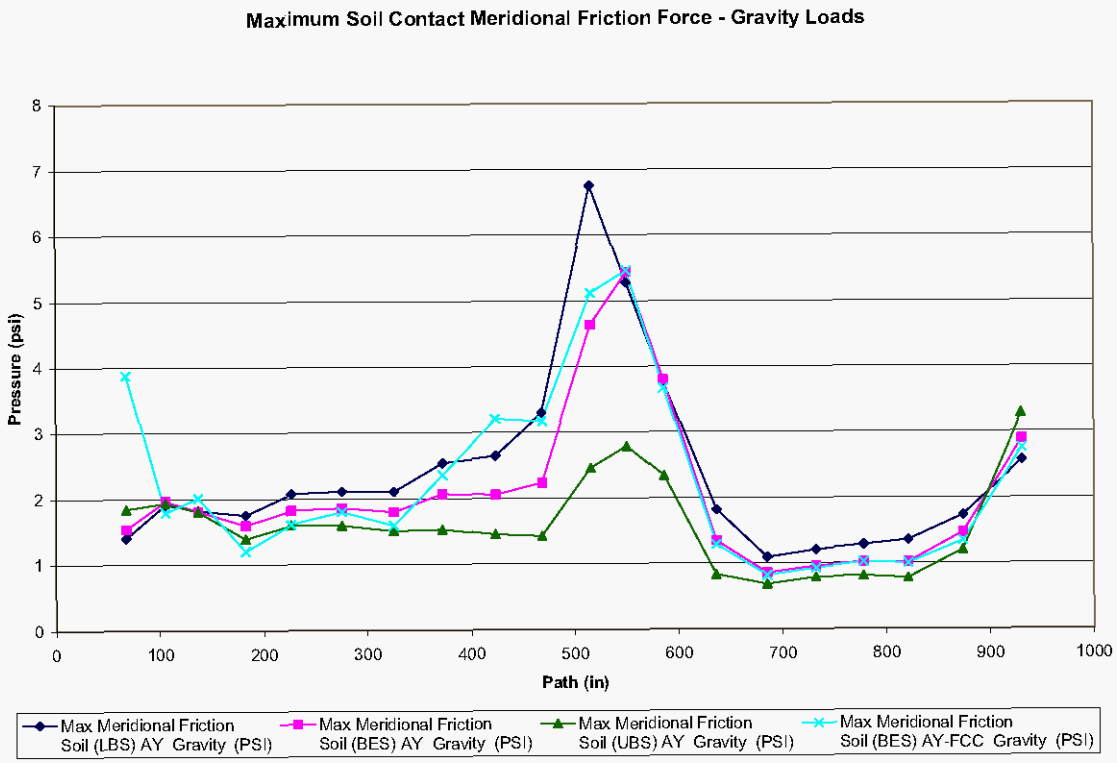


Figure 7.25. Soil/Concrete Contact Element Meridional Shear – Gravity Only

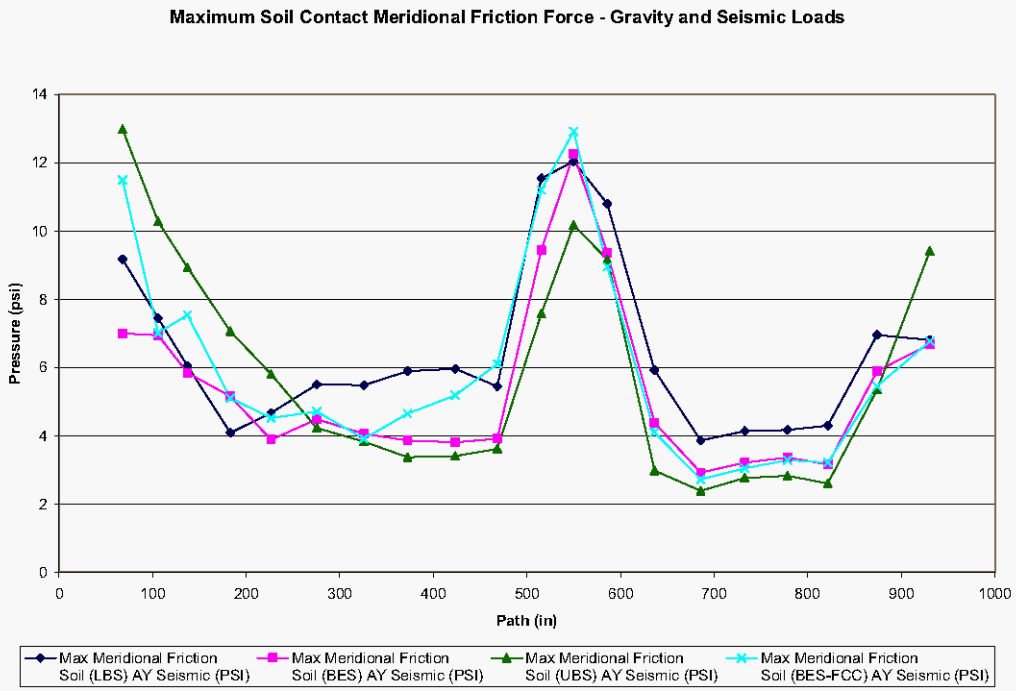


Figure 7.26. Soil/Concrete Contact Element Meridional Shear – Gravity Plus Seismic

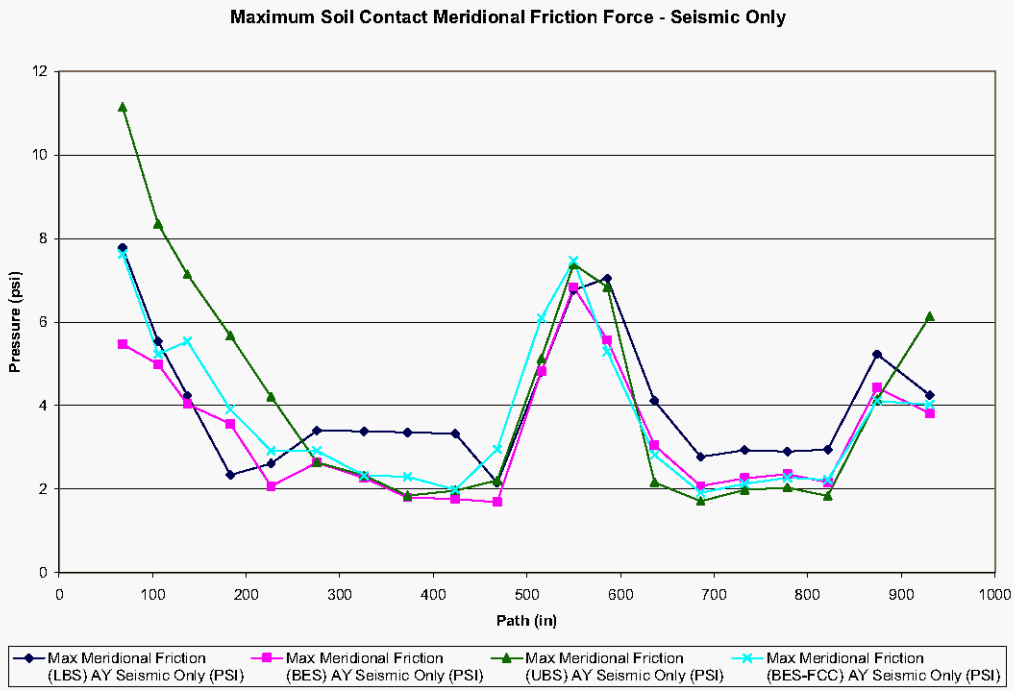


Figure 7.27. Soil/Concrete Contact Element Meridional Shear – Seismic Only

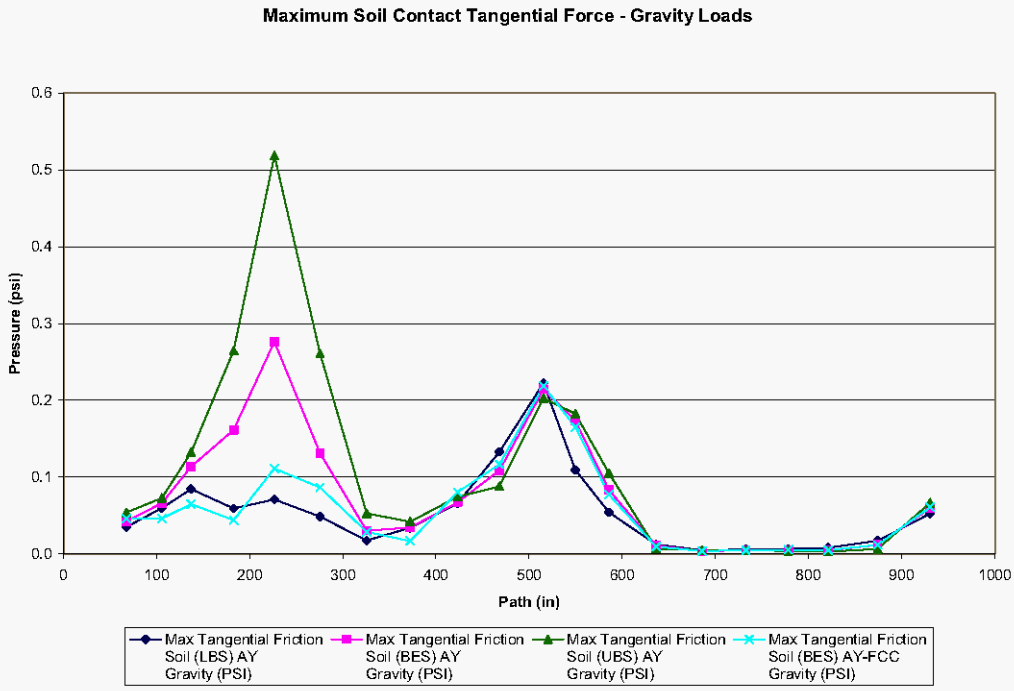


Figure 7.28. Soil/Concrete Contact Element Tangential Shear – Gravity Only

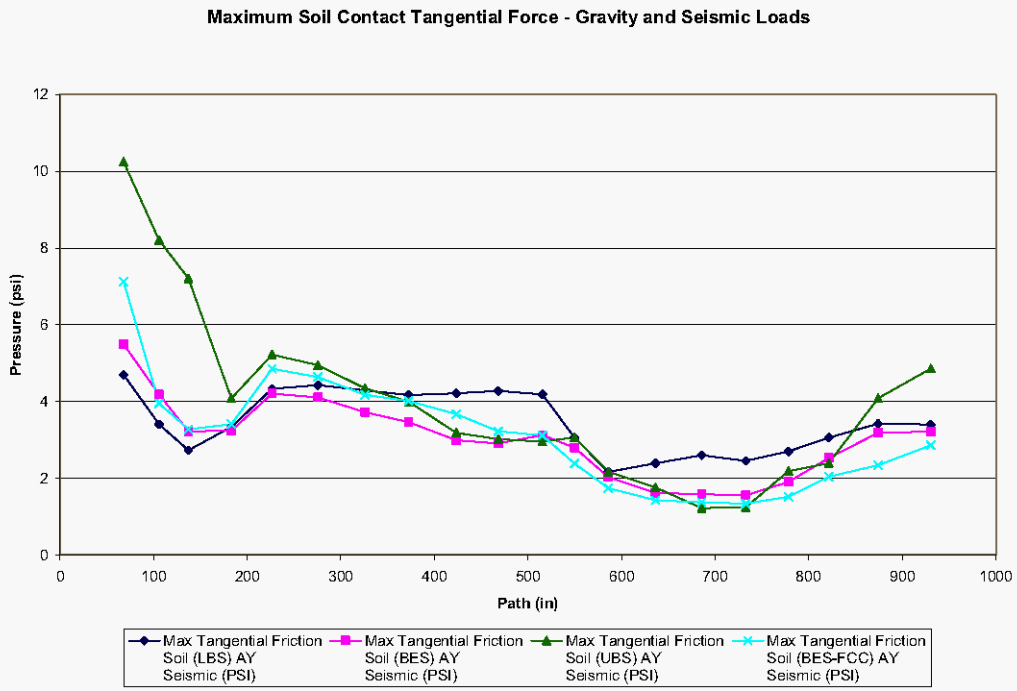


Figure 7.29. Soil/Concrete Contact Element Tangential Shear – Gravity Plus Seismic

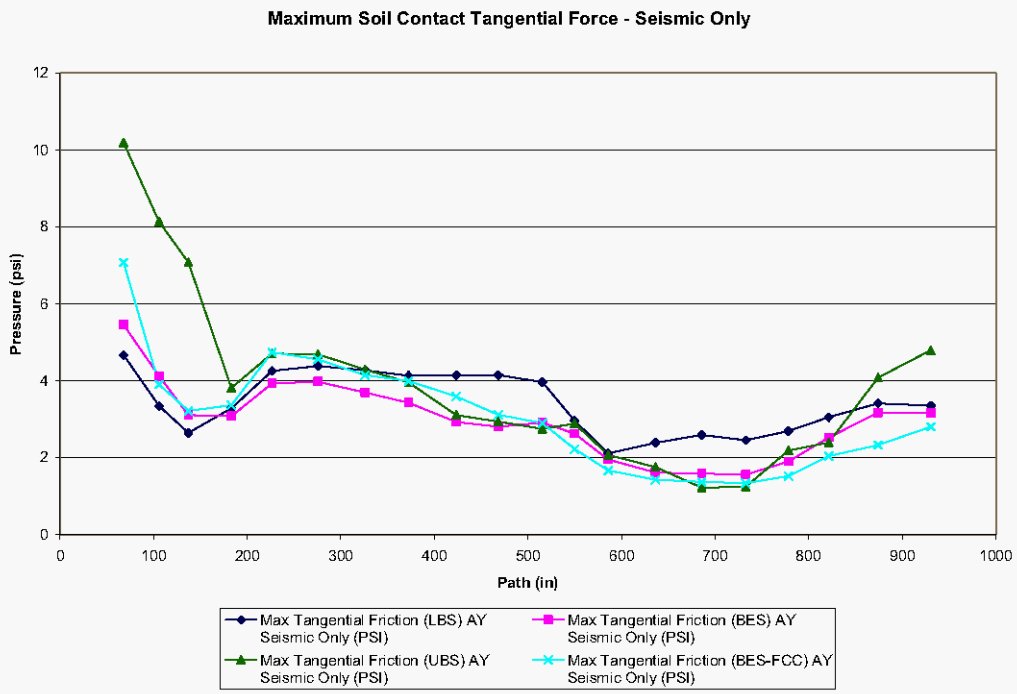


Figure 7.30. Soil/Concrete Contact Element Gap Tangential Shear – Seismic Only

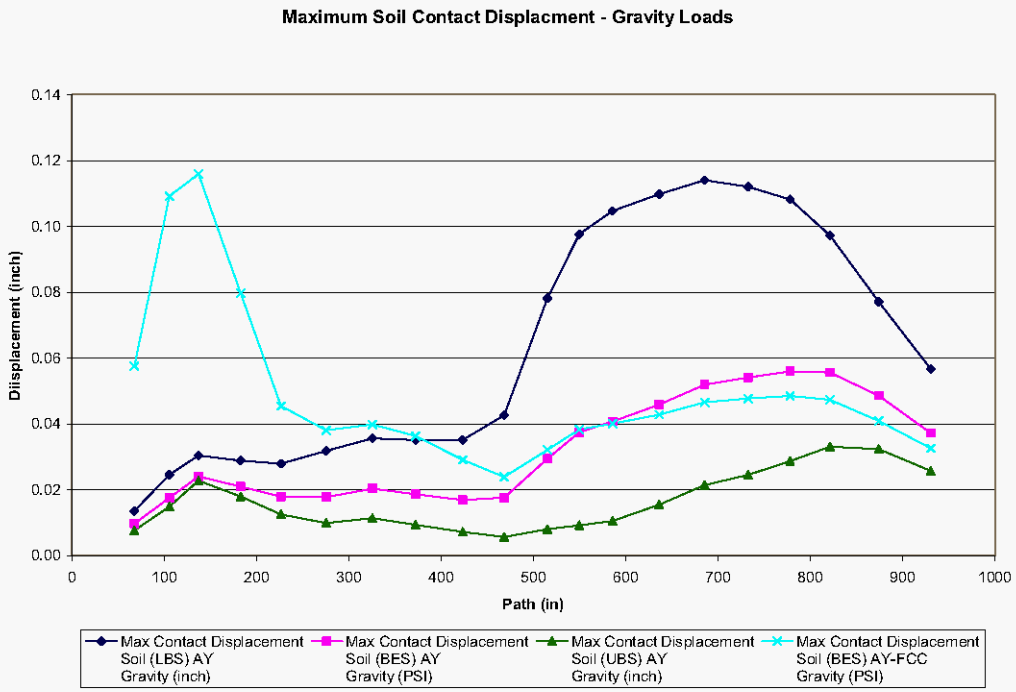


Figure 7.31. Soil/Concrete Contact Element Gap Lateral Displacement (Slide) – Gravity Only

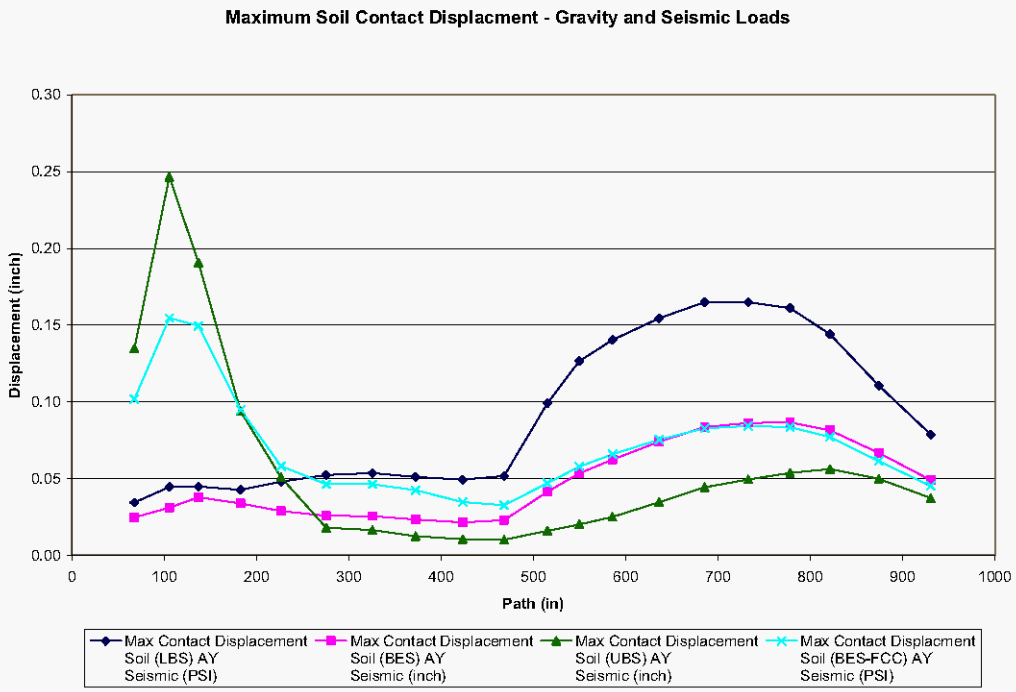


Figure 7.32. Soil/Concrete Contact Element Gap Lateral Displacement (Slide) – Gravity Plus Seismic

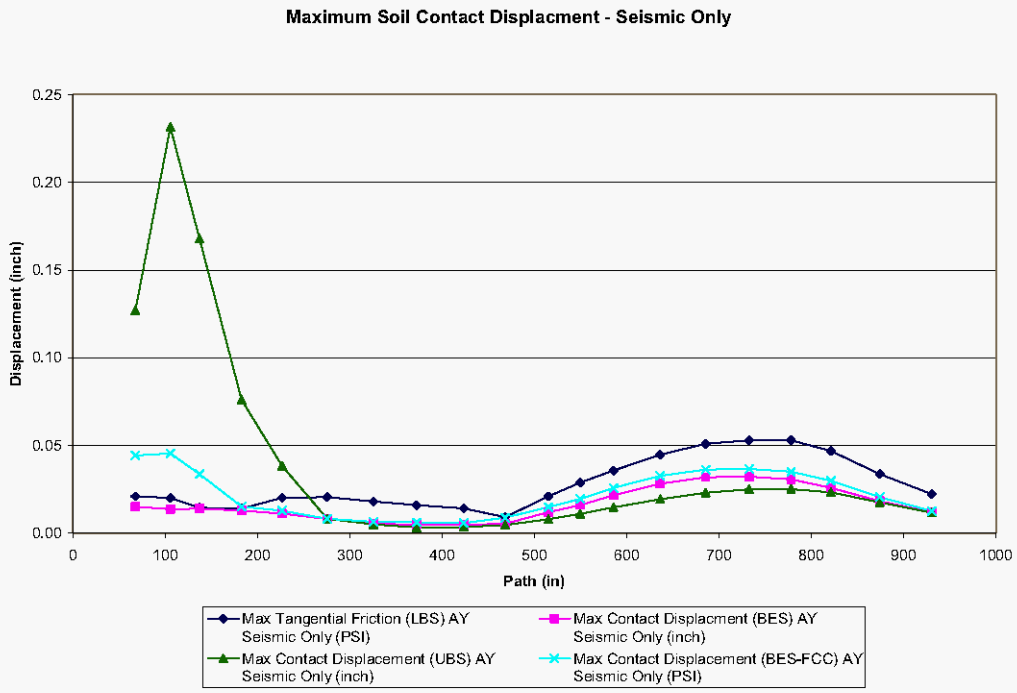


Figure 7.33. Soil/Concrete Contact Element Gap Lateral Displacement (Slide) – Seismic Only

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. Figures 7.34 through 7.37 show this comparison for each load case. These comparisons demonstrate that there is not significant arching is the soil.

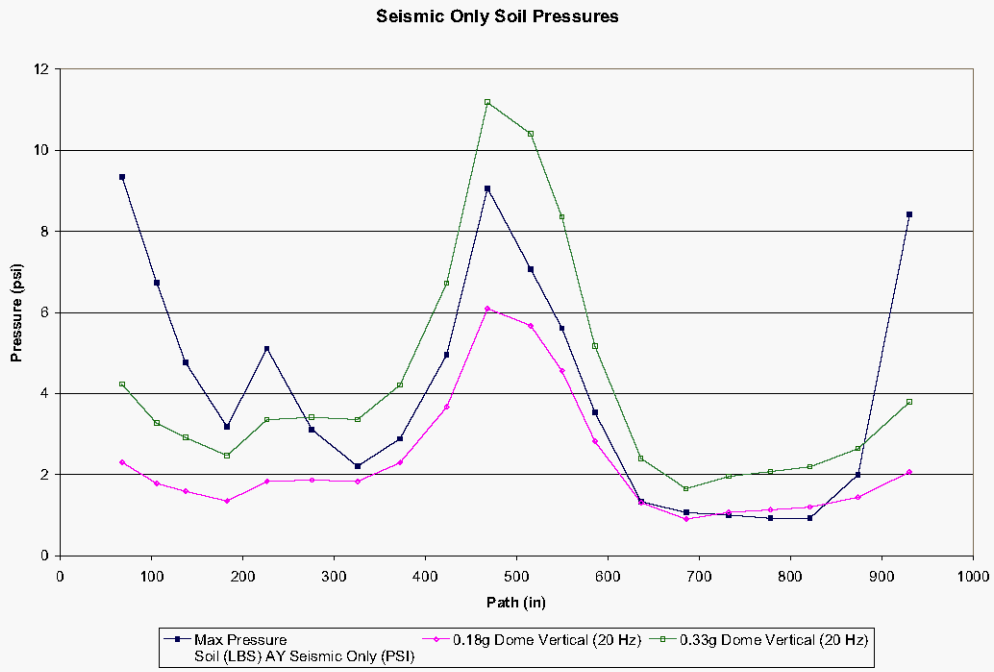


Figure 7.34. Seismic Soil Pressure Comparison to Scaled Gravity Soil Pressures, LBS-BEC

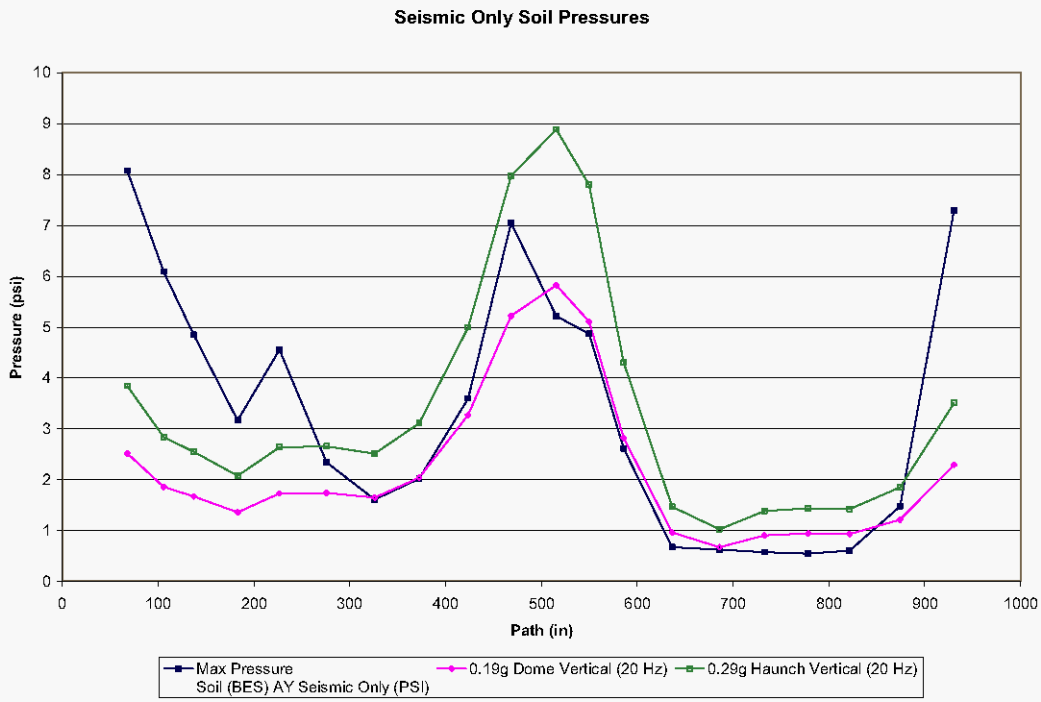


Figure 7.35. Seismic Soil Pressure Comparison to Scaled Gravity Soil Pressures, BES-BEC

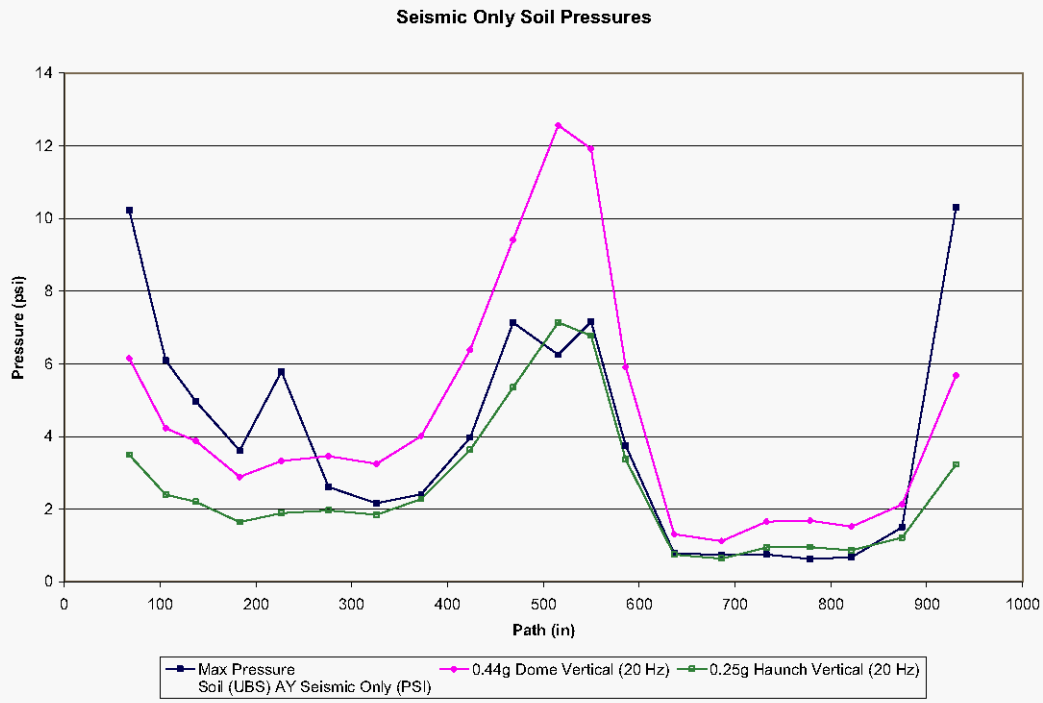


Figure 7.36. Seismic Soil Pressure Comparison to Scaled Gravity Soil Pressures, UBS-BEC

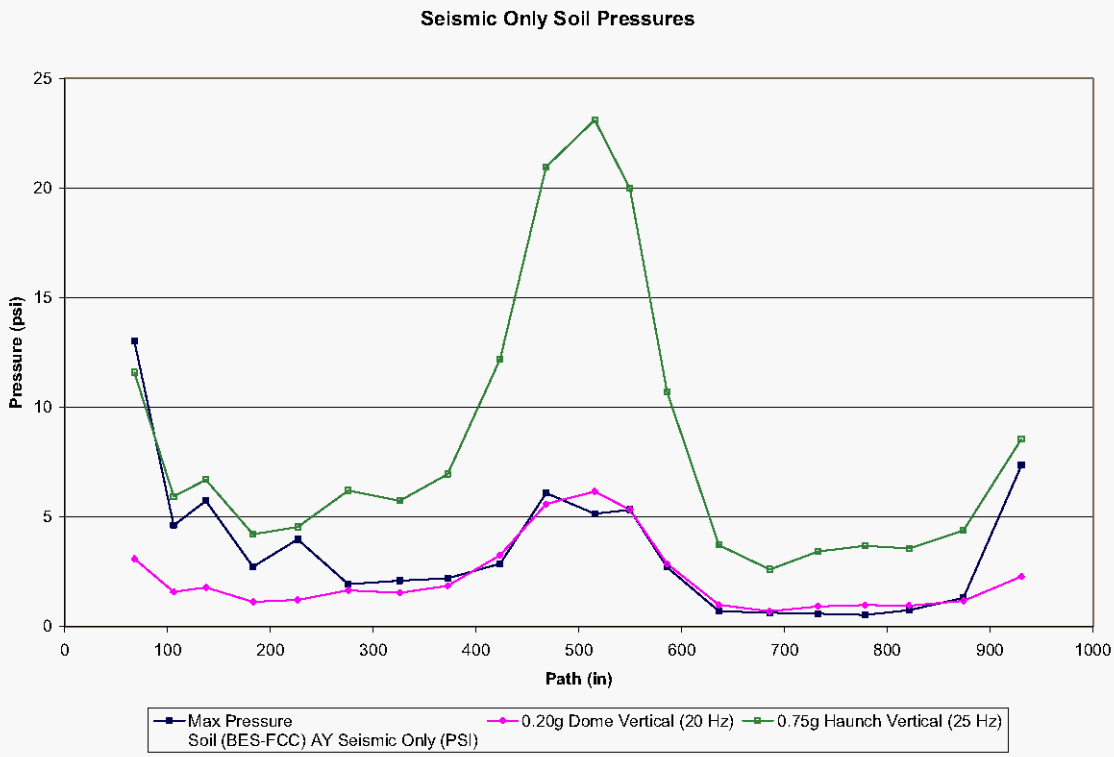


Figure 7.37. Seismic Soil Pressure Comparison to Scaled Gravity Soil Pressures, BES-FCC

7.3 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 7.38 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 7 39. Primary Tank/Concrete Dome Contact Element Contact Pressure – Gravity Only
- Figure 7 40. Primary Tank/Concrete Dome Contact Element Maximum Contact Pressure – Gravity Plus Seismic
- Figure 7 41. Primary Tank/Concrete Dome Contact Element Minimum Contact Pressure – Gravity Plus Seismic
- Figure 7 42. Primary Tank/Concrete Dome Contact Element Maximum Contact Pressure – Seismic Only
- Figure 7 43. Primary Tank/Concrete Dome Contact Element Maximum Contact Pressure Relief – Seismic Only
- Figure 7 44. Primary Tank/Concrete Dome Contact Element Maximum Contact Gap – Gravity Only
- Figure 7 45. Primary Tank/Concrete Dome Contact Element Maximum Contact Gap – Gravity Plus Seismic
- Figure 7 46. Primary Tank/Concrete Dome Contact Element Maximum Contact Gap – Seismic Only
- Figure 7 47. Primary Tank/Concrete Dome Contact Element Maximum Contact Lateral Displacement (Slide) – Gravity Only
- Figure 7 48. Primary Tank/Concrete Dome Contact Element Maximum Contact Lateral Displacement (Slide) – Gravity Plus Seismic
- Figure 7 49. Primary Tank/Concrete Dome Contact Element Maximum Contact Lateral Displacement (Slide) – Seismic Only

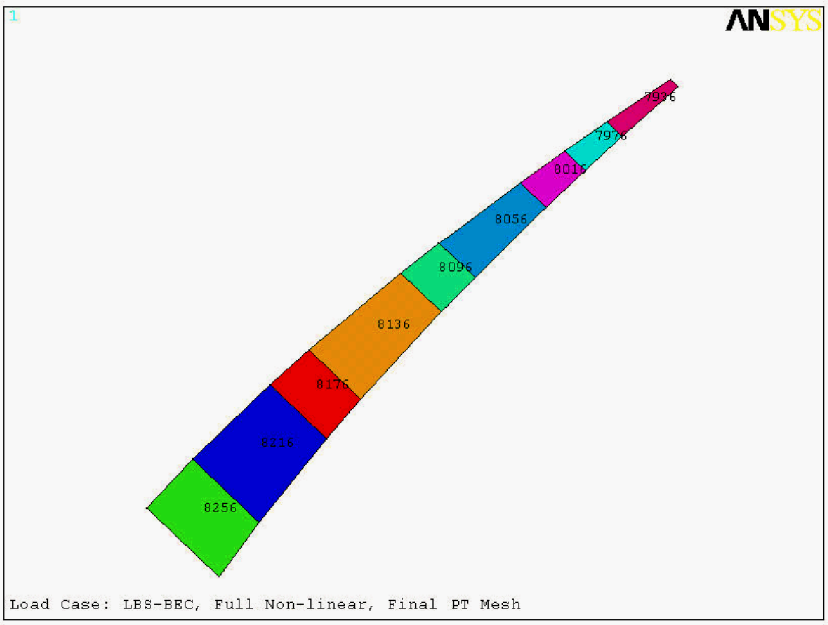


Figure 7.38. Primary Tank Dome Contact Element Retreival Sequence Starting Numbers

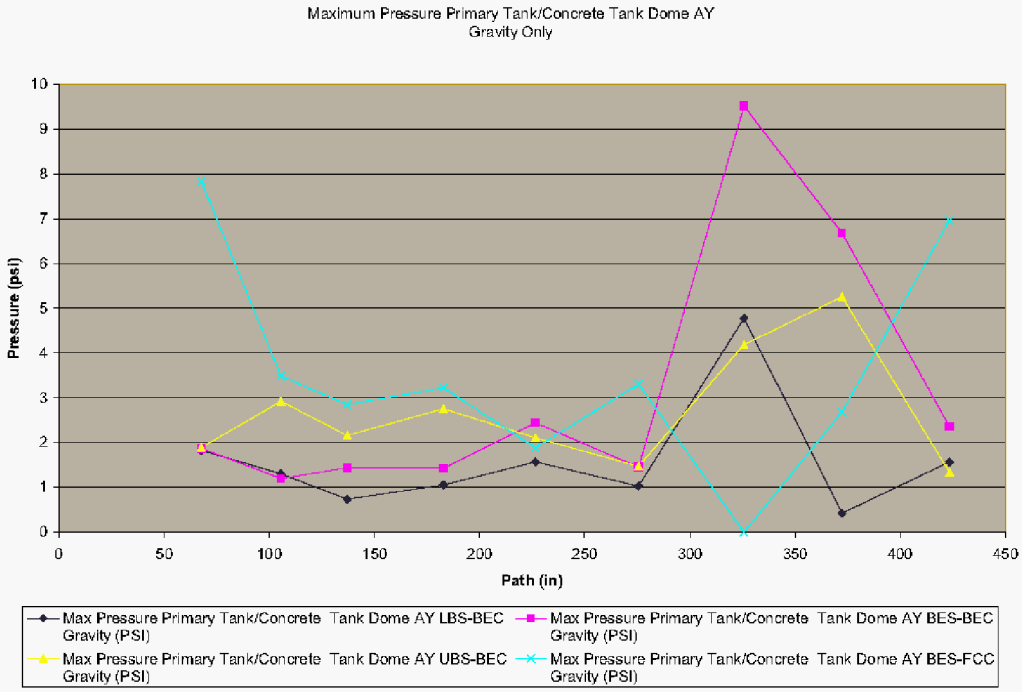


Figure 7.39. Primary Tank/Concrete Dome Contact Element Contact Pressure – Gravity Only

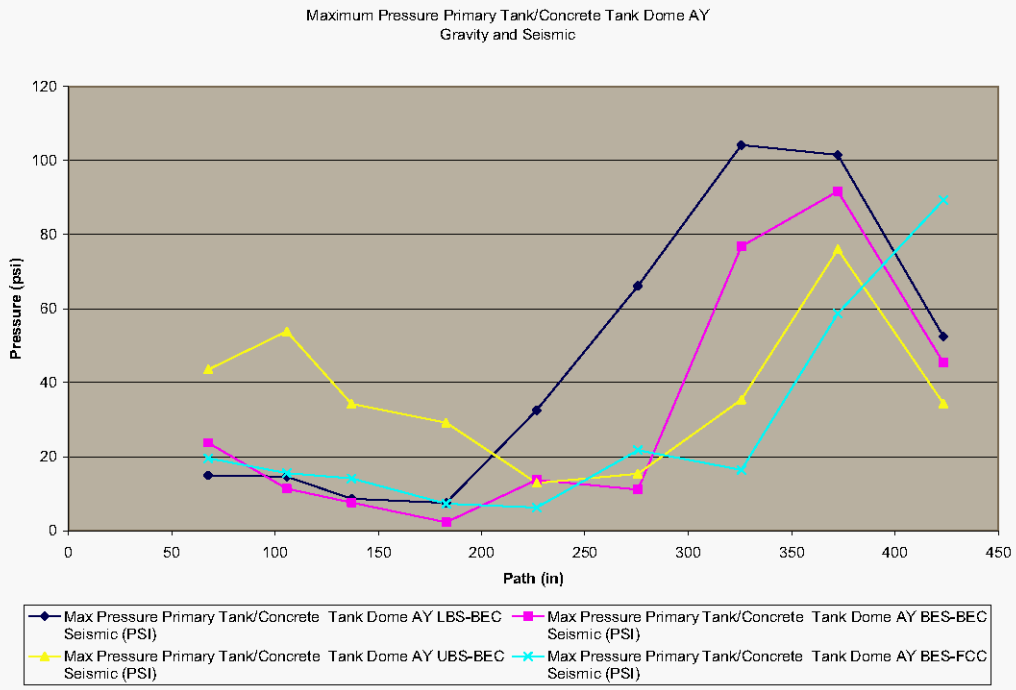


Figure 7.40. Primary Tank/Concrete Dome Contact Element Maximum Contact Pressure – Gravity Plus Seismic

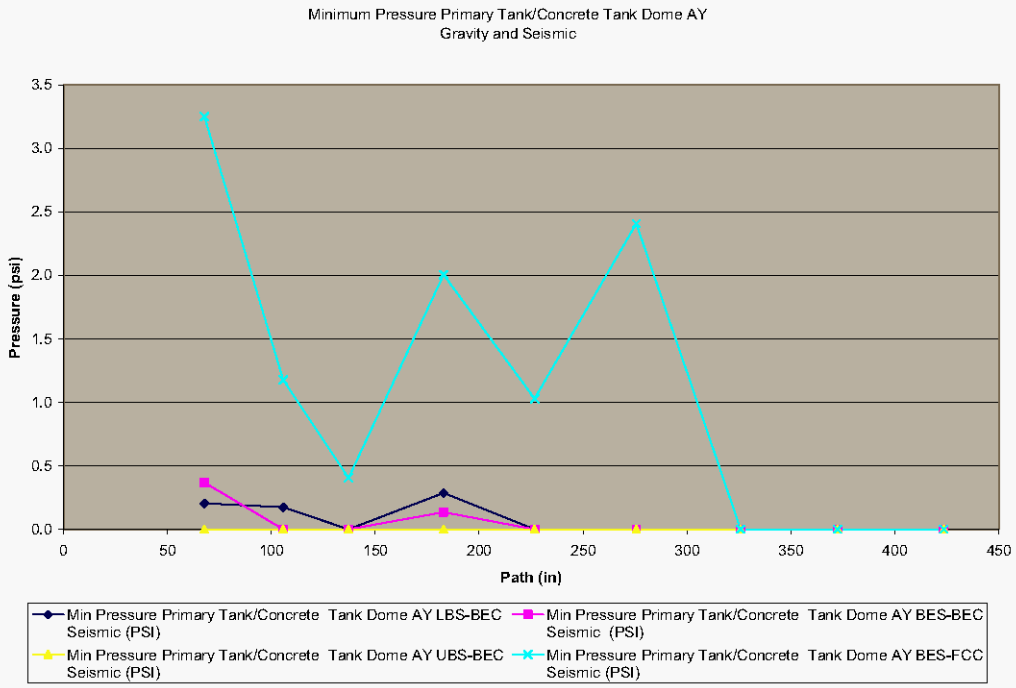


Figure 7.41. Primary Tank/Concrete Dome Contact Element Minimum Contact Pressure – Gravity Plus Seismic

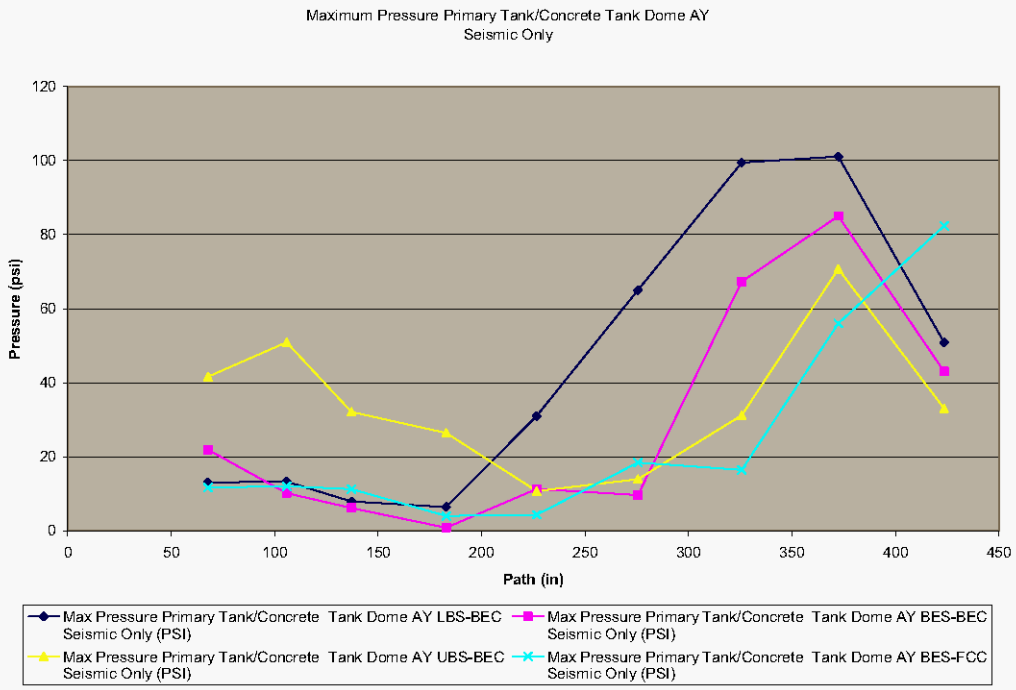


Figure 7.42. Primary Tank/Concrete Dome Contact Element Maximum Contact Pressure – Seismic Only

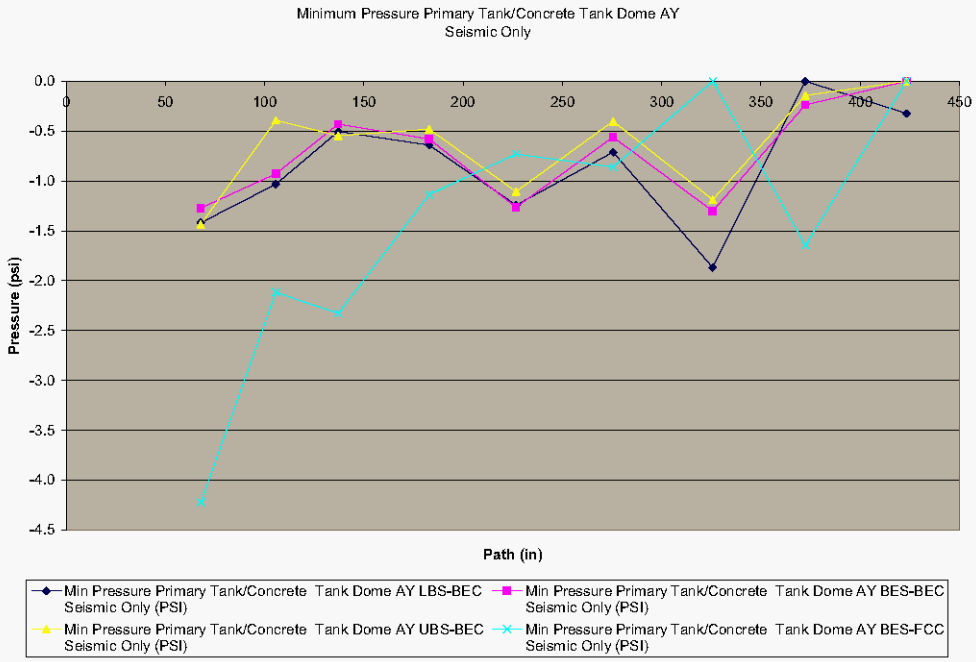


Figure 7.43. Primary Tank/Concrete Dome Contact Element Maximum Contact Pressure Relief – Seismic Only

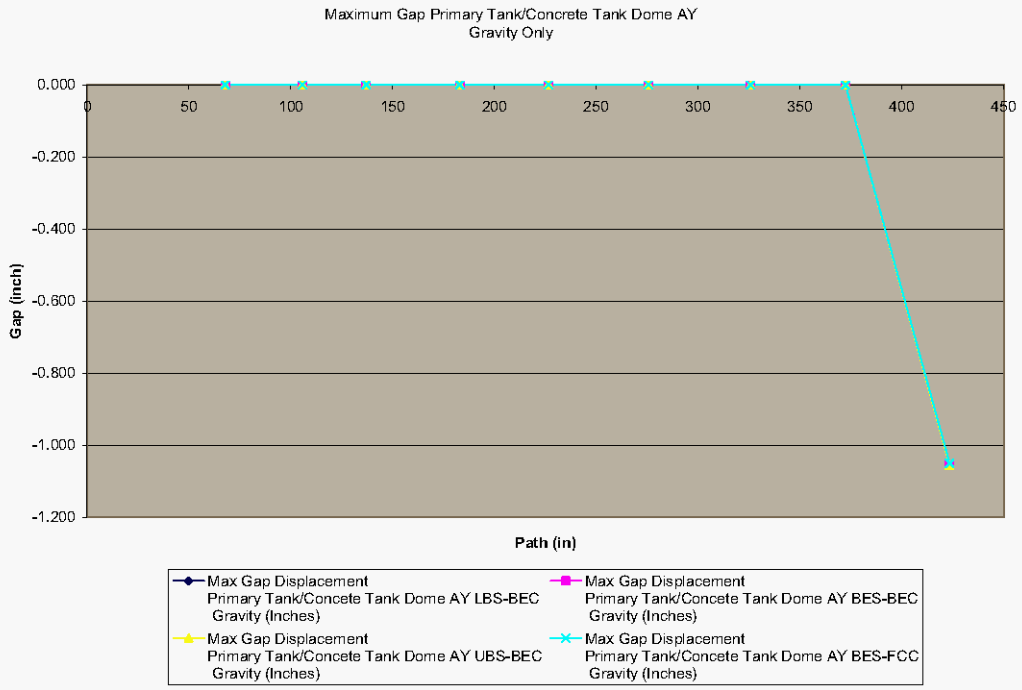


Figure 7.44. Primary Tank/Concrete Dome Contact Element Maximum Contact Gap – Gravity Only

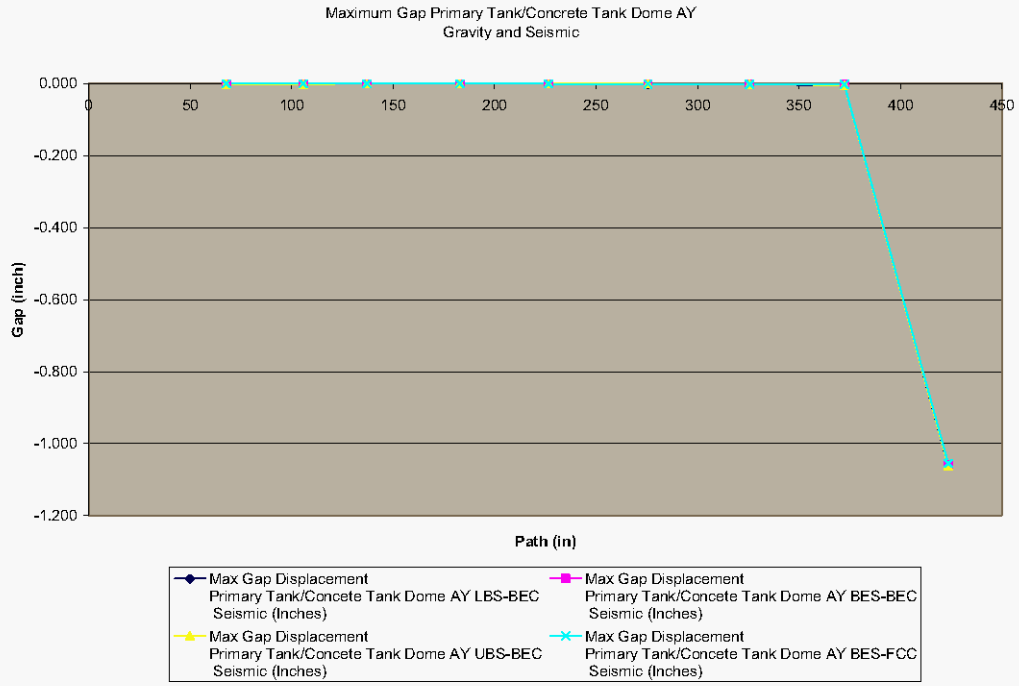


Figure 7.45. Primary Tank/Concrete Dome Contact Element Maximum Contact Gap – Gravity Plus Seismic

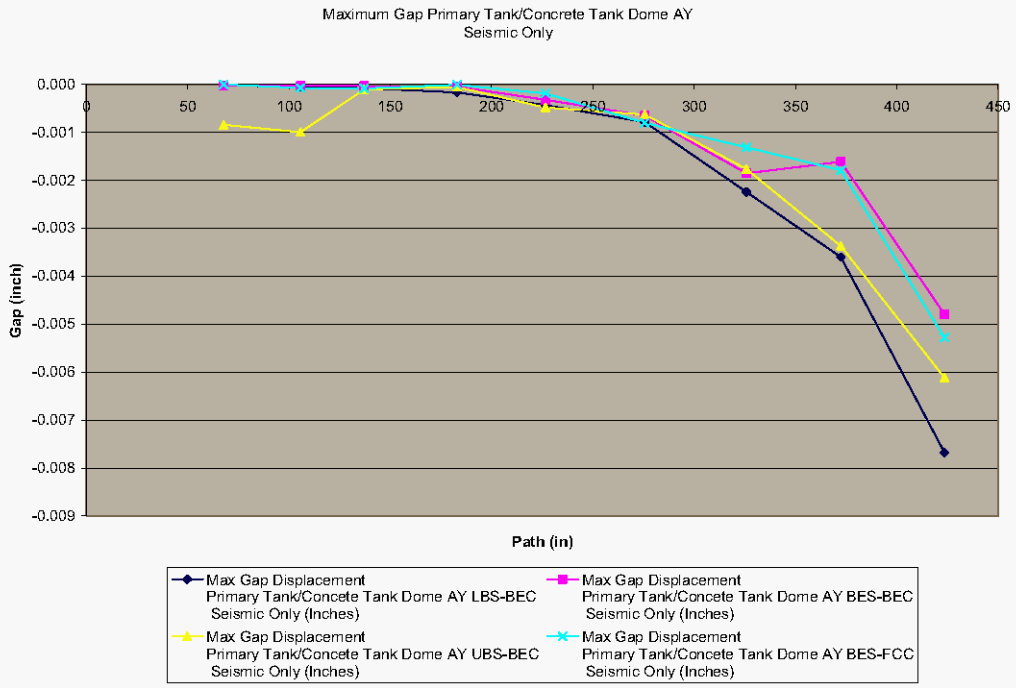


Figure 7.46. Primary Tank/Concrete Dome Contact Element Maximum Contact Gap – Seismic Only

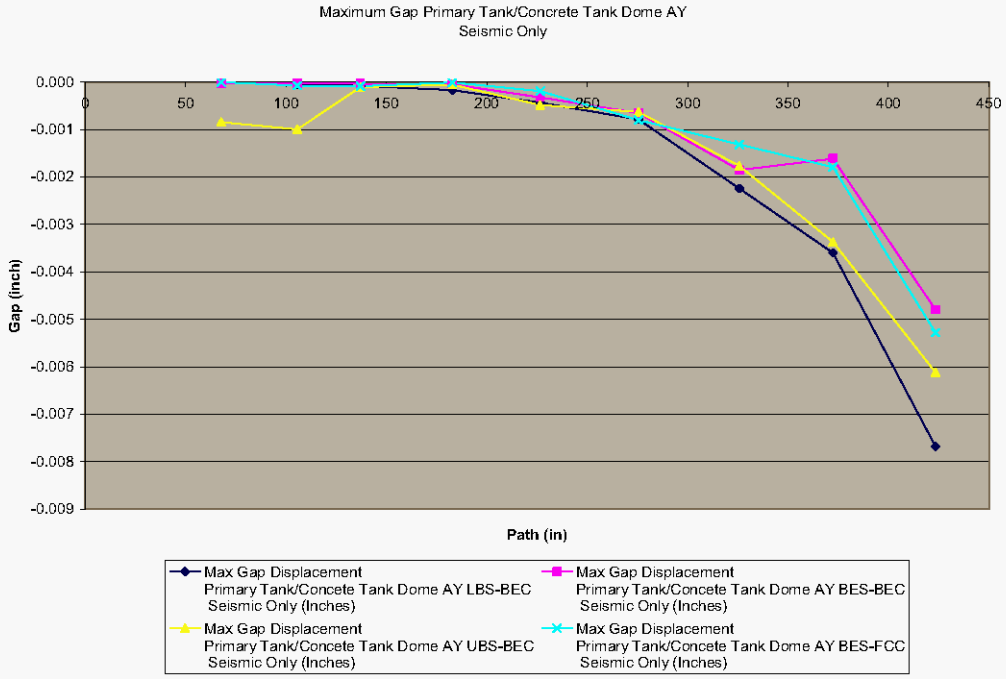


Figure 7.47. Primary Tank/Concrete Dome Contact Element Maximum Contact Lateral Displacement (Slide) – Gravity Only

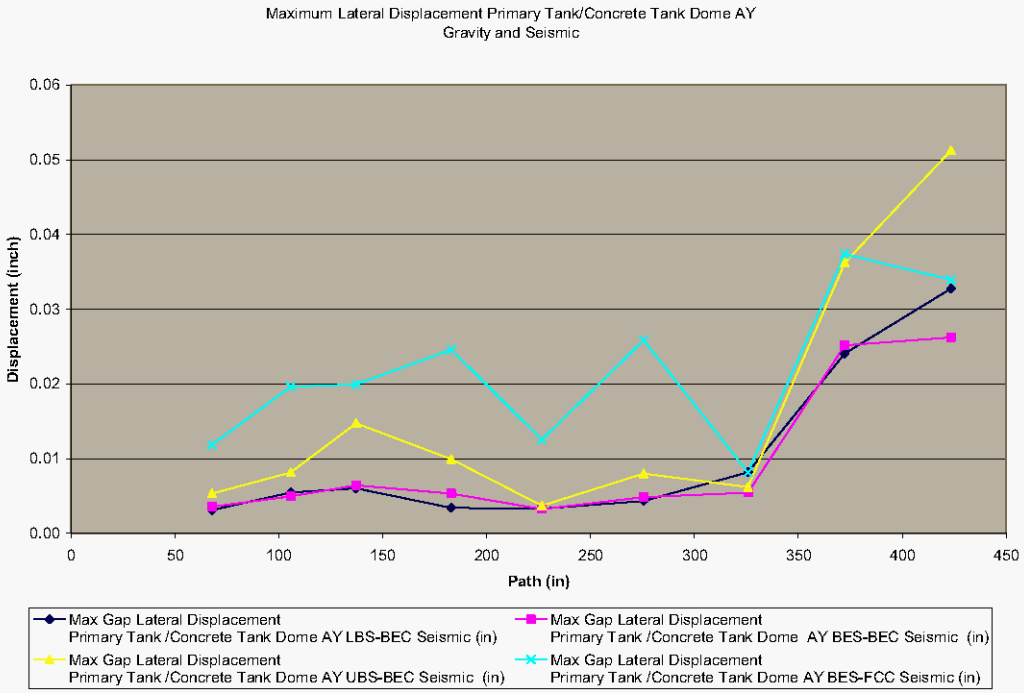


Figure 7.48. Primary Tank/Concrete Dome Contact Element Maximum Contact Lateral Displacement (Slide)– Gravity Plus Seismic

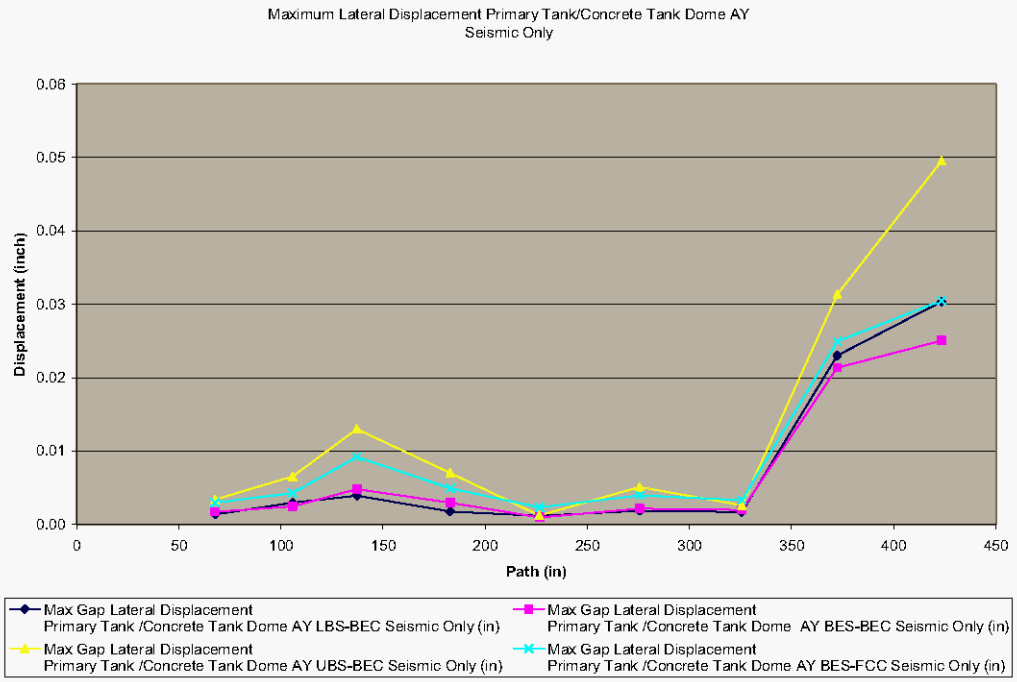


Figure 7.49. Primary Tank/Concrete Dome Contact Element Maximum Contact Lateral Displacement (Slide)– Seismic Only

7.4 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 7.50 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 7 51. Primary Tank/Insulating Concrete Contact Element Contact Pressure – Gravity Only
- Figure 7 52. Primary Tank/Insulating Concrete Contact Element Maximum Contact Pressure – Gravity Plus Seismic
- Figure 7 53. Primary Tank/Insulating Concrete Contact Element Minimum Contact Pressure – Gravity Plus Seismic
- Figure 7 54. Primary Tank/Insulating Concrete Contact Element Maximum Contact Pressure – Seismic Only
- Figure 7 55. Primary Tank/Insulating Concrete Contact Element Minimum Contact Pressure – Seismic Only
- Figure 7 56. Primary Tank/Insulating Concrete Contact Element Maximum Contact Gap – Gravity Only
- Figure 7 57. Primary Tank/Insulating Concrete Contact Element Maximum Contact Gap – Gravity Plus Seismic
- Figure 7 58. Primary Tank/Insulating Concrete Contact Element Maximum Contact Gap – Seismic Only
- Figure 7 59. Primary Tank/Insulating Concrete Contact Element Maximum Contact Lateral Displacement (Slide) – Gravity Only
- Figure 7 60. Primary Tank/Insulating Concrete Contact Element Maximum Contact Lateral Displacement (Slide) – Gravity Plus Seismic
- Figure 7 61. Primary Tank/Insulating Concrete Contact Element Maximum Contact Lateral Displacement (Slide) – Seismic Only

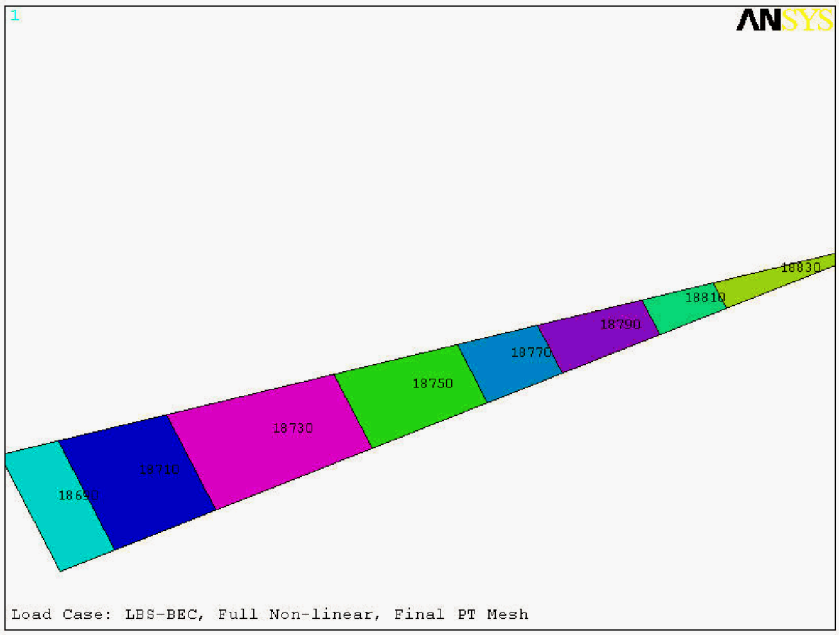


Figure 7.50. Primary Tank Bottom Contact Element Retreival Sequence Starting Numbers

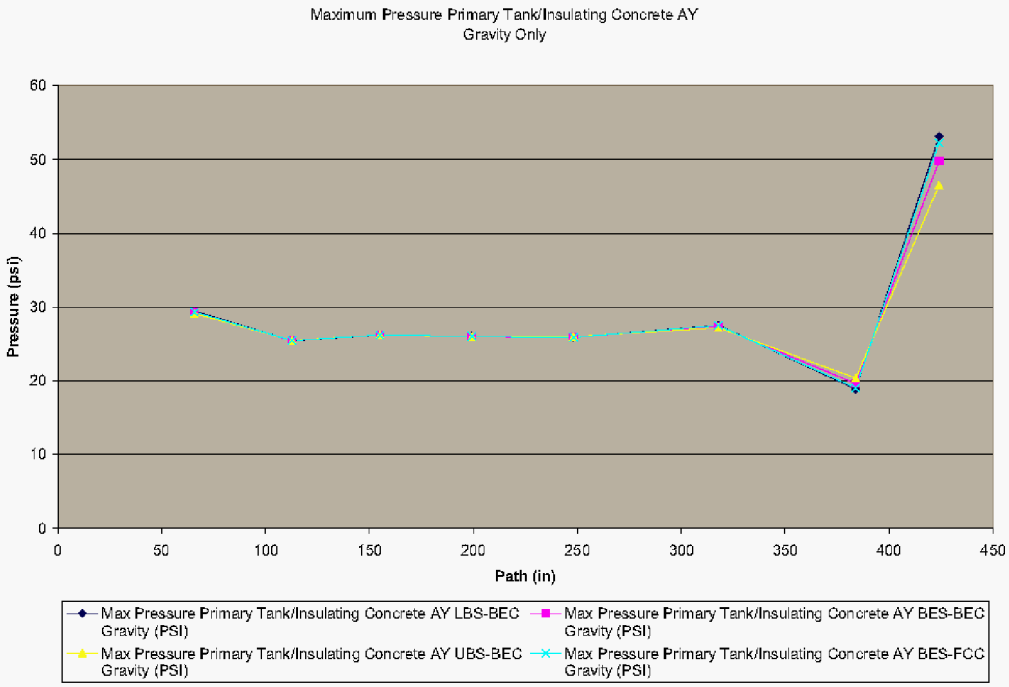


Figure 7.51. Primary Tank/Insulating Concrete Contact Element Contact Pressure – Gravity Only

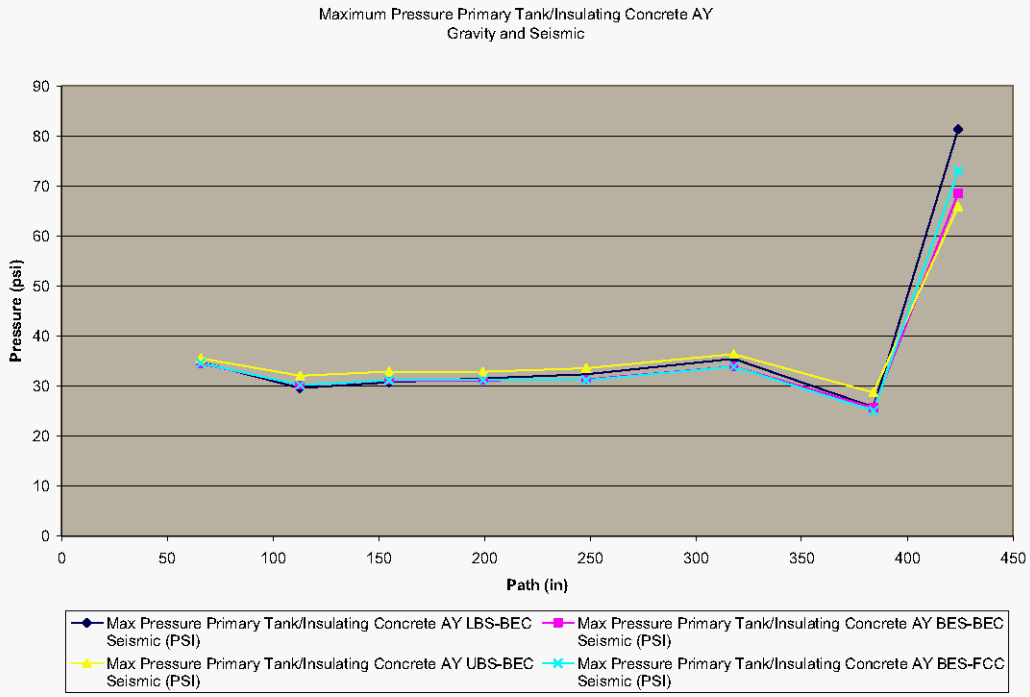


Figure 7.52. Primary Tank/Insulating Concrete Contact Element Maximum Contact Pressure – Gravity Plus Seismic

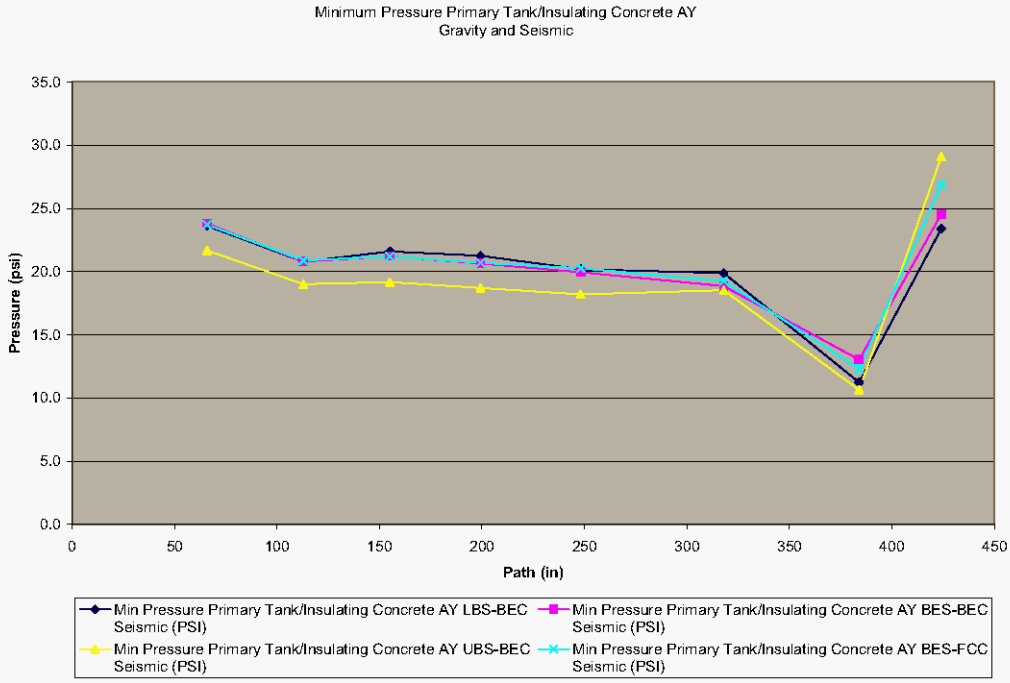


Figure 7.53. Primary Tank/Insulating Concrete Contact Element Minimum Contact Pressure – Gravity Plus Seismic

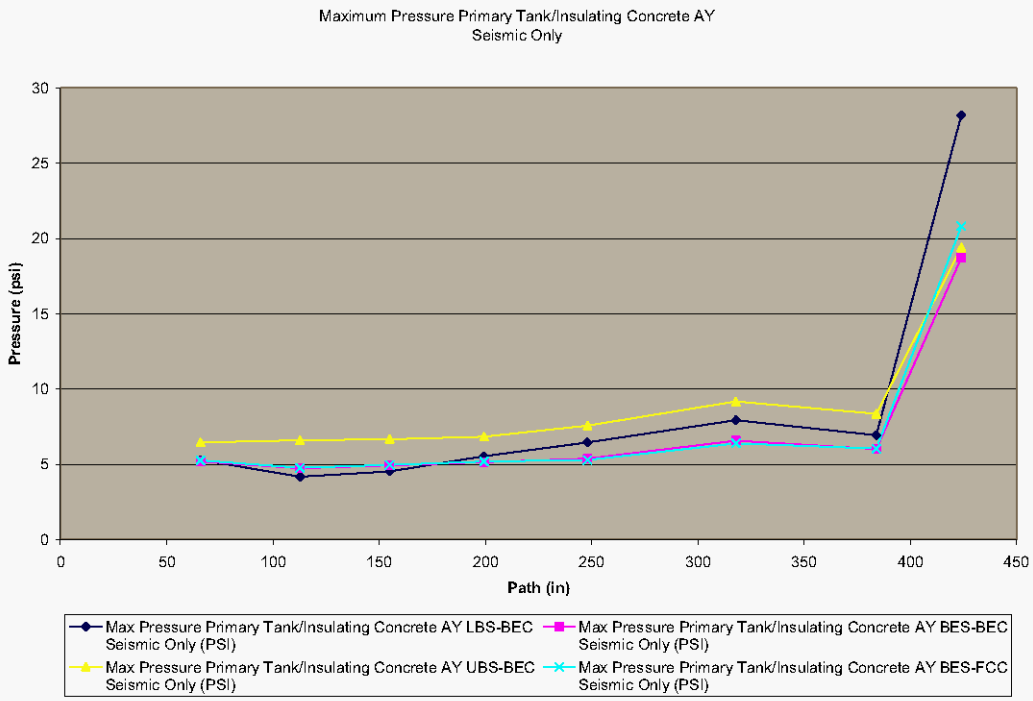


Figure 7.54. Primary Tank/Insulating Concrete Contact Element Maximum Contact Pressure – Seismic Only

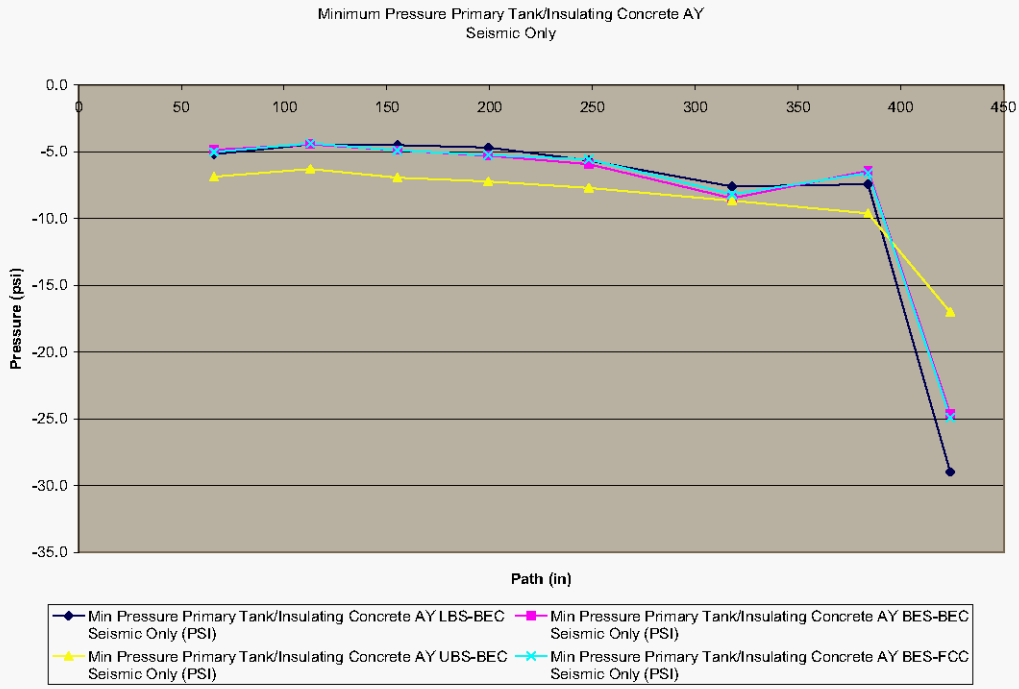


Figure 7.55. Primary Tank/Insulating Concrete Contact Element Minimum Contact Pressure – Seismic Only

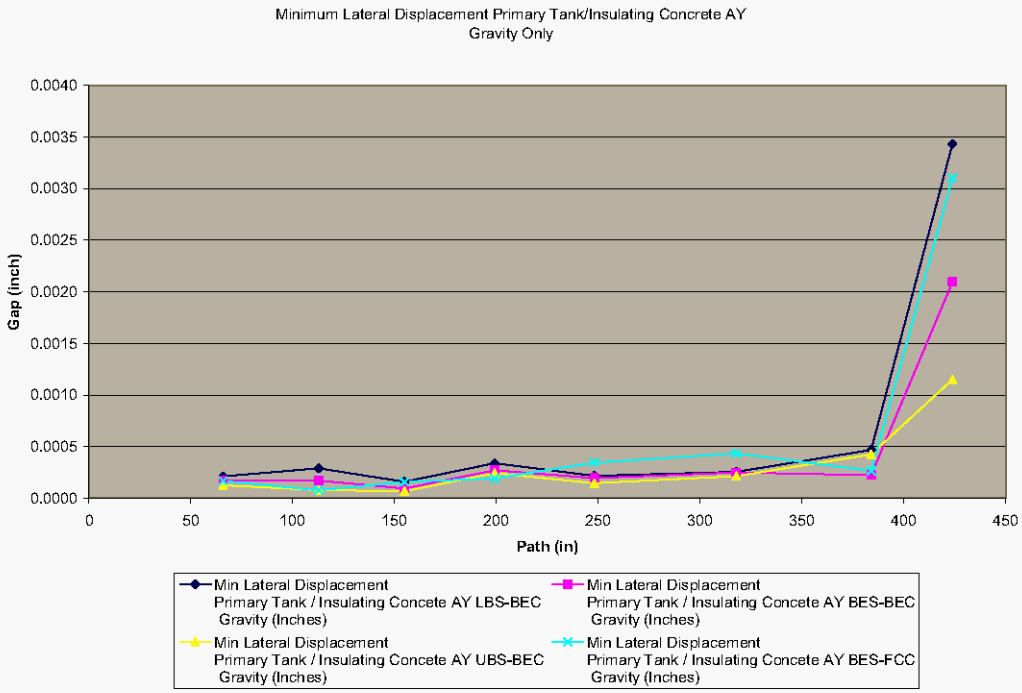


Figure 7.56. Primary Tank/Insulating Concrete Contact Element Maximum Contact Gap – Gravity Only

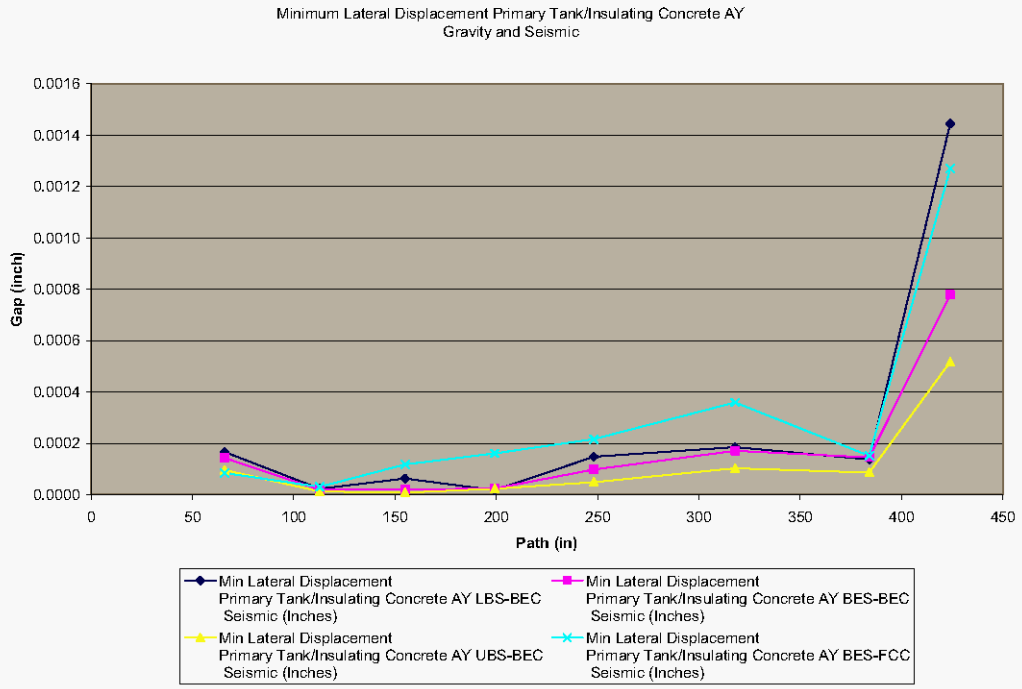


Figure 7.57. Primary Tank/Insulating Concrete Contact Element Maximum Contact Gap – Gravity Plus Seismic

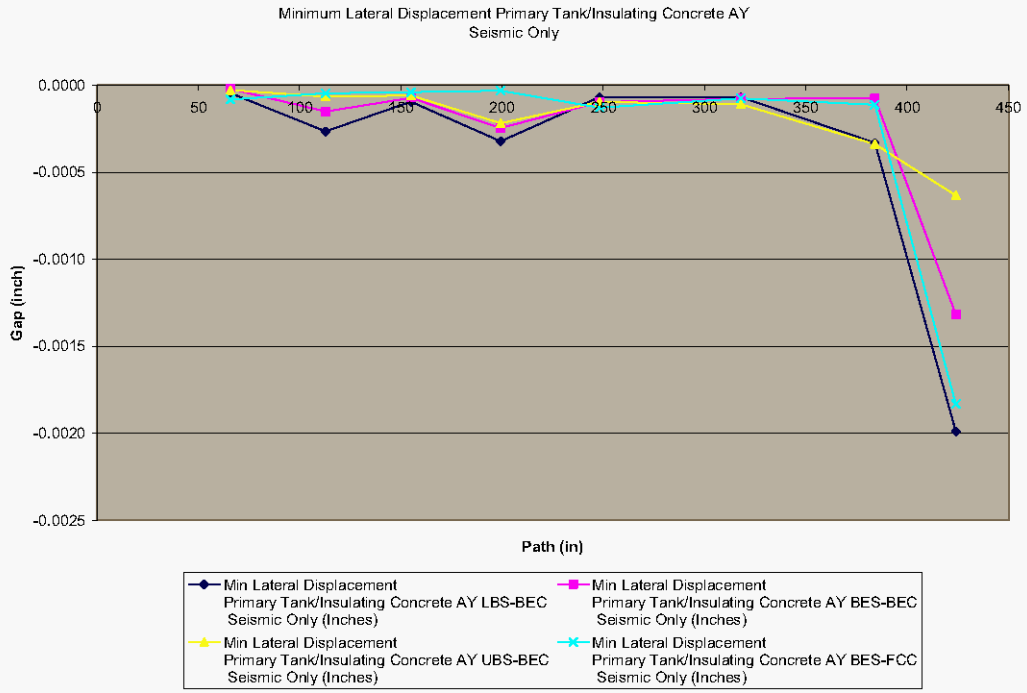


Figure 7.58. Primary Tank/Insulating Concrete Contact Element Maximum Contact Gap – Seismic Only

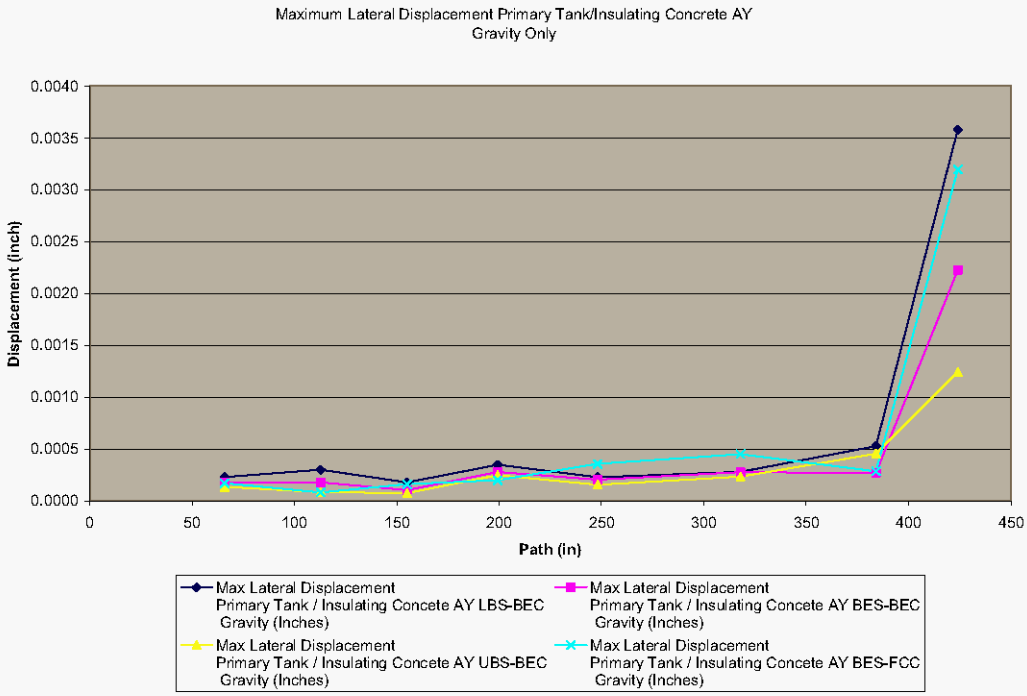


Figure 7.59. Primary Tank/Insulating Concrete Contact Element Maximum Contact Lateral Displacement (Slide) – Gravity Only

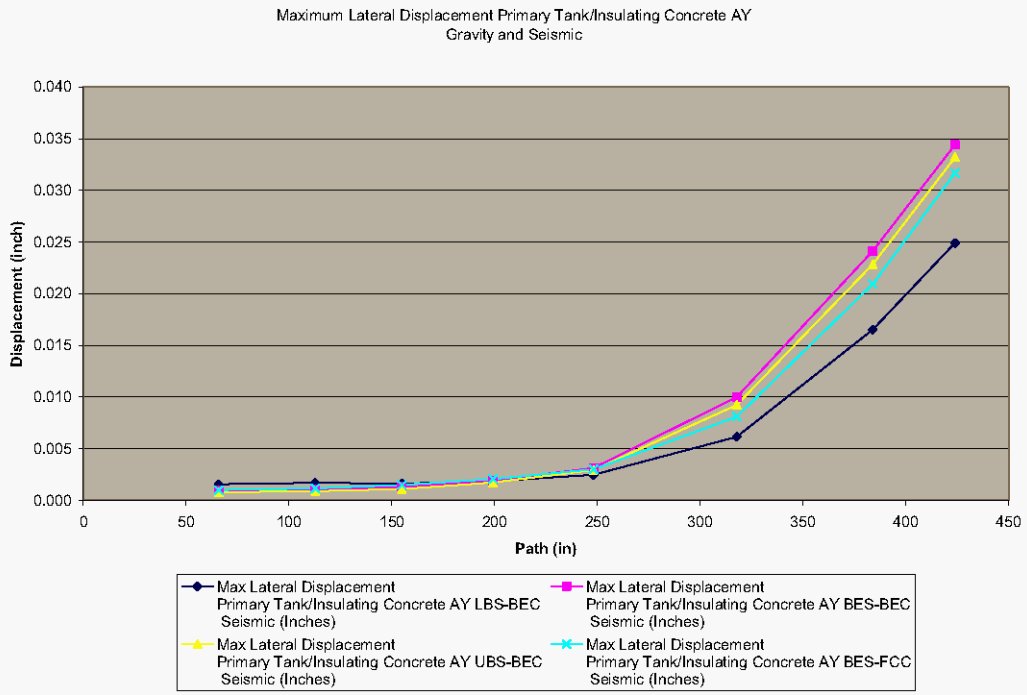


Figure 7.60. Primary Tank/Insulating Concrete Contact Element Maximum Contact Lateral Displacement (Slide)– Gravity Plus Seismic

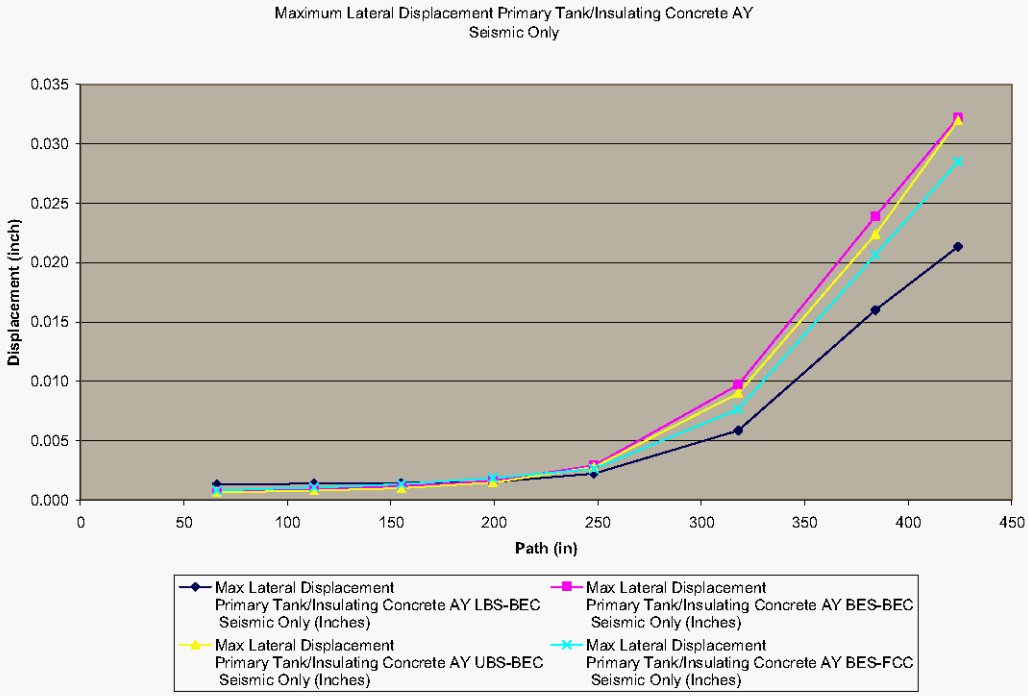


Figure 7.61. Primary Tank/Insulating Concrete Contact Element Maximum Contact Lateral Displacement (Slide)– Seismic Only

The maximum sliding displacement due to a seismic event is approximately 0.033 inches and occurs in both the Upper Bound Soil and Best Estimate Soil load cases. Figures 7.62 and 7.63 show the location and magnitude of the sliding between the primary tank and insulating concrete. The figures show the status and displacement for the Upper Bound Soil case. The displacements are in feet and include both gravity and seismic loads.

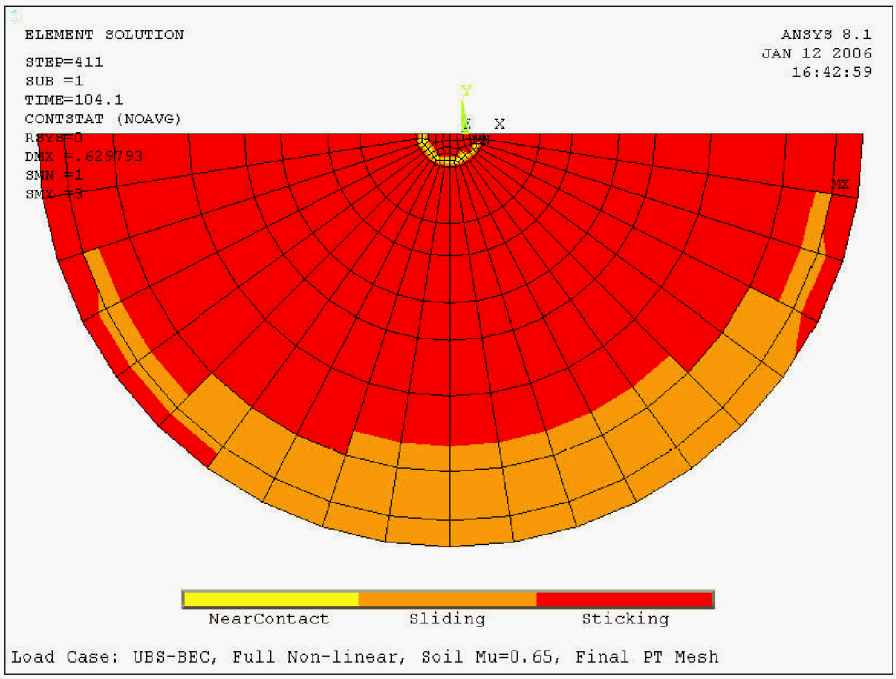


Figure 7.62. Sliding Locations for Primary Tank/Insulating Concrete at Time of Maximum Displacement

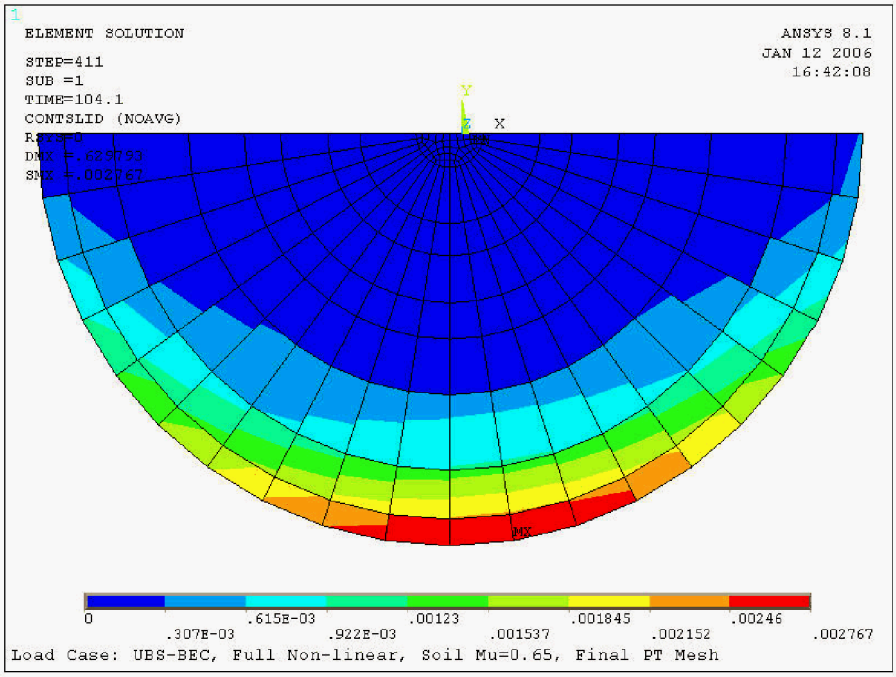


Figure 7.63. Maximum Sliding Displacement Between Primary Tank and Insulating Concrete (ft)

Based on the small displacements between the primary tank and insulating concrete, this contact surface feature could be omitted in future analyses.

7.5 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 7.64 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 7 65. Insulating Concrete/Secondary Liner Contact Element Contact Pressure – Gravity Only
- Figure 7 66. Insulating Concrete/Secondary Liner Contact Element Maximum Contact Pressure – Gravity Plus Seismic
- Figure 7 67. Insulating Concrete/Secondary Liner Contact Element Minimum Contact Pressure – Gravity Plus Seismic

- Figure 7 68. Insulating Concrete/Secondary Liner Contact Element Maximum Contact Pressure – Seismic Only
- Figure 7 69. Insulating Concrete/Secondary Liner Contact Element Minimum Contact Pressure – Seismic Only
- Figure 7 70. Insulating Concrete/Secondary Liner Contact Element Maximum Contact Gap – Gravity Only
- Figure 7 71. Insulating Concrete/Secondary Liner Contact Element Maximum Contact Gap – Gravity Plus Seismic
- Figure 7 72. Insulating Concrete/Secondary Liner Contact Element Maximum Contact Gap – Seismic Only
- Figure 7 73. Insulating Concrete/Secondary Liner Contact Element Maximum Contact Lateral Displacement (Slide) – Gravity Only
- Figure 7 74. Insulating Concrete/Secondary Liner Contact Element Maximum Contact Lateral Displacement (Slide) – Gravity Plus Seismic
- Figure 7 75. Insulating Concrete/Secondary Liner Contact Element Maximum Contact Lateral Displacement (Slide) – Seismic Only

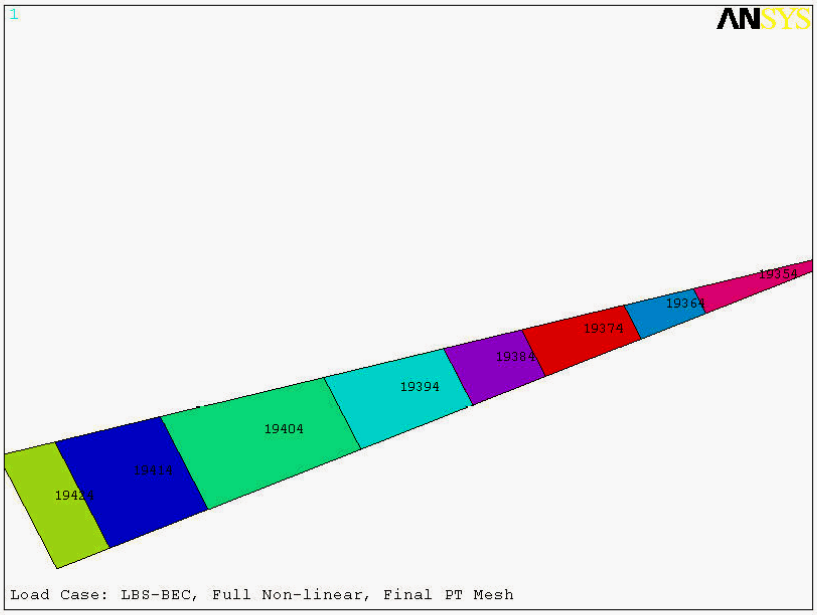


Figure 7.64. Insulating Concrete Contact Element Retreival Sequence Starting Numbers

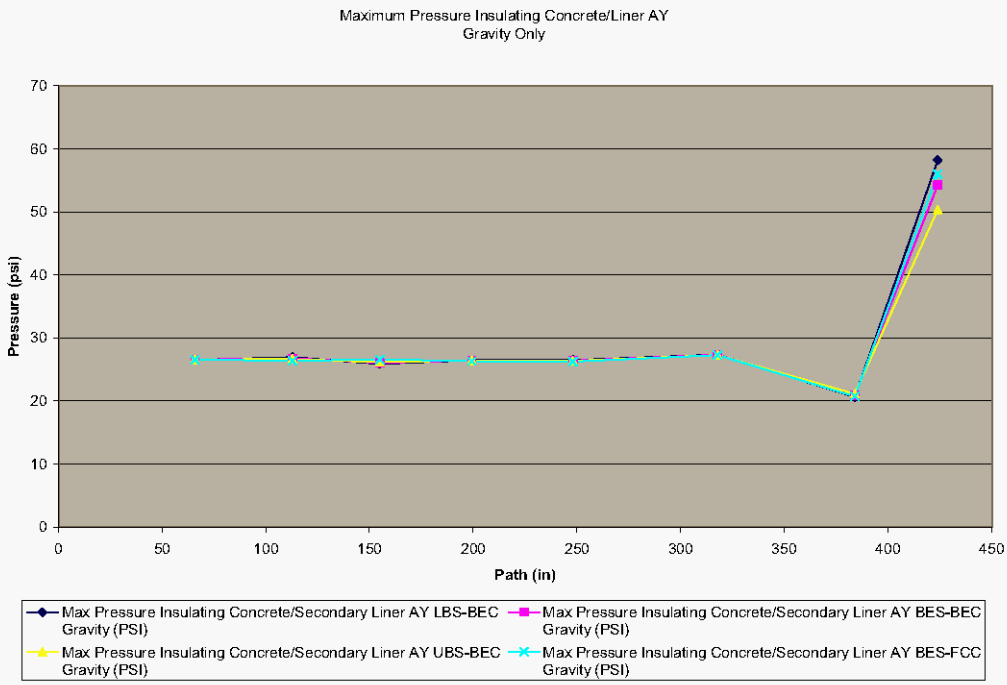


Figure 7.65. Insulating Concrete/Secondary Liner Contact Element Contact Pressure – Gravity Only

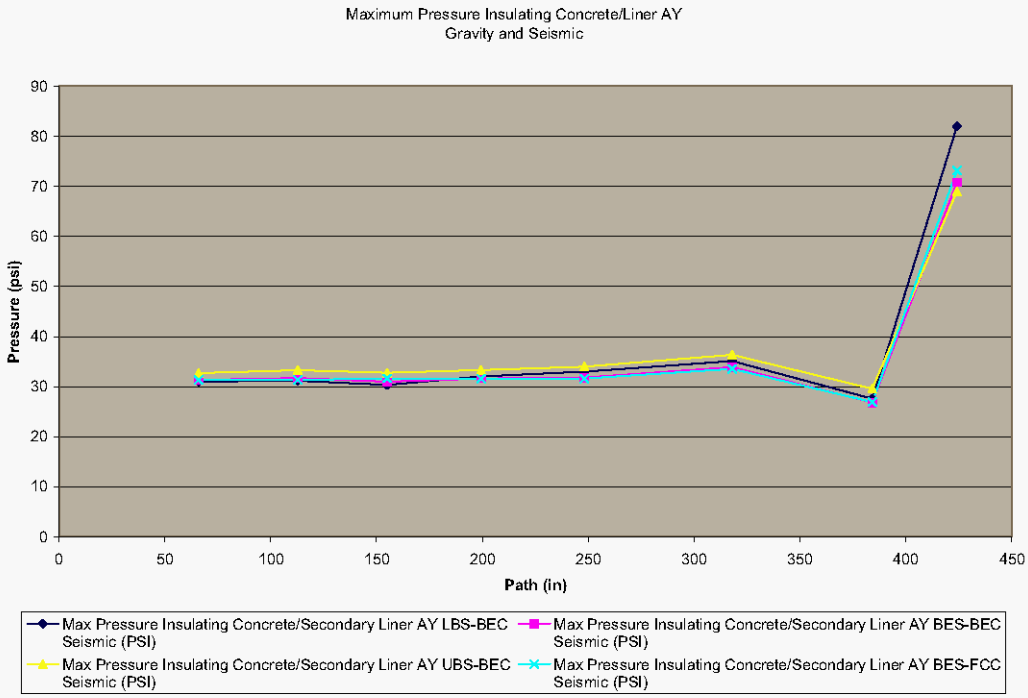


Figure 7.66. Insulating Concrete/Secondary Liner Contact Element Maximum Contact Pressure – Gravity Plus Seismic

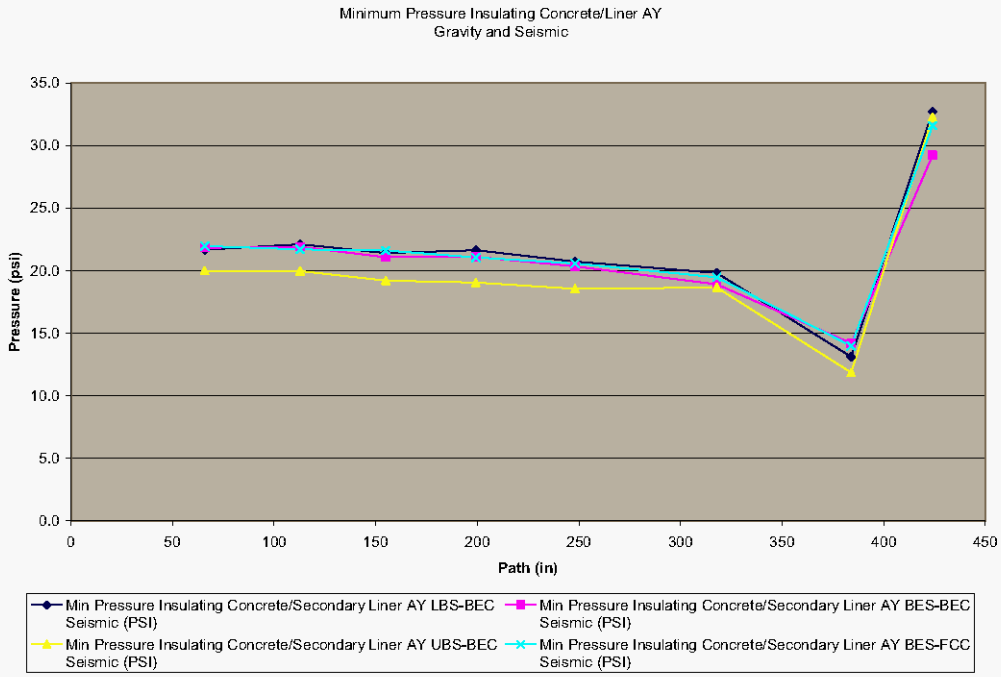


Figure 7.67. Insulating Concrete/Secondary Liner Contact Element Minimum Contact Pressure – Gravity Plus Seismic

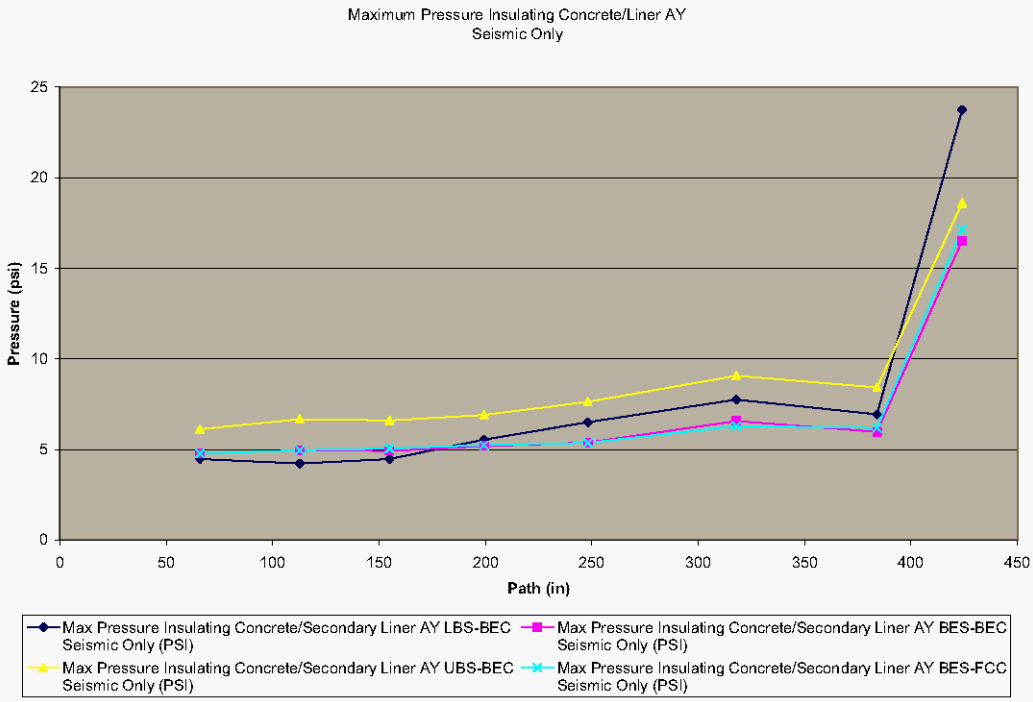


Figure 7.68. Insulating Concrete/Secondary Liner Contact Element Maximum Contact Pressure – Seismic Only

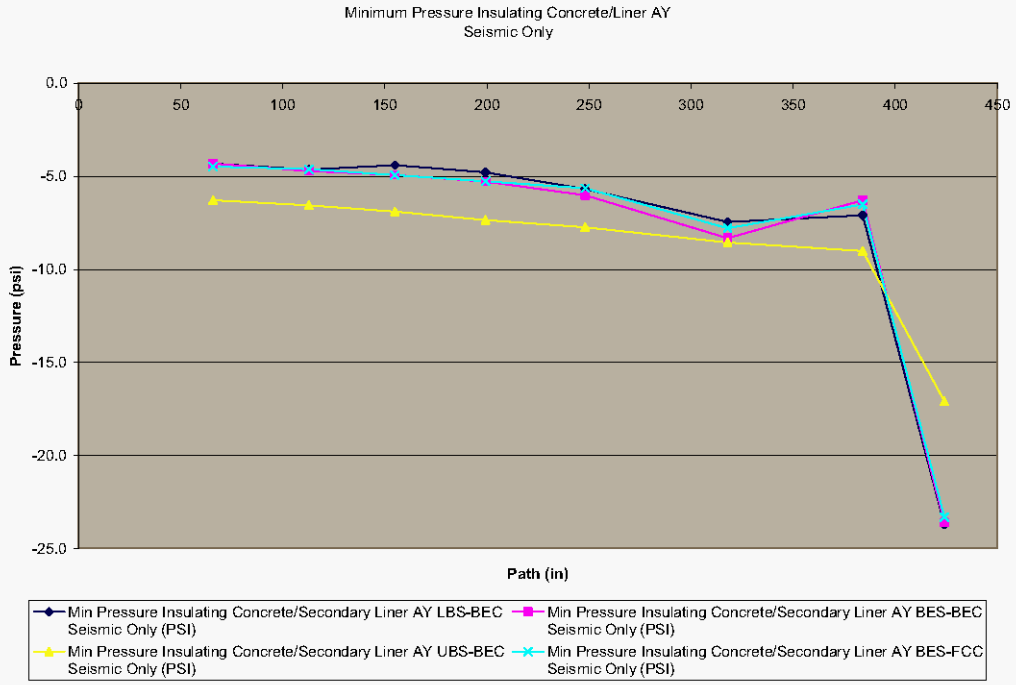


Figure 7.69. Insulating Concrete/Secondary Liner Contact Element Minimum Contact Pressure – Seismic Only

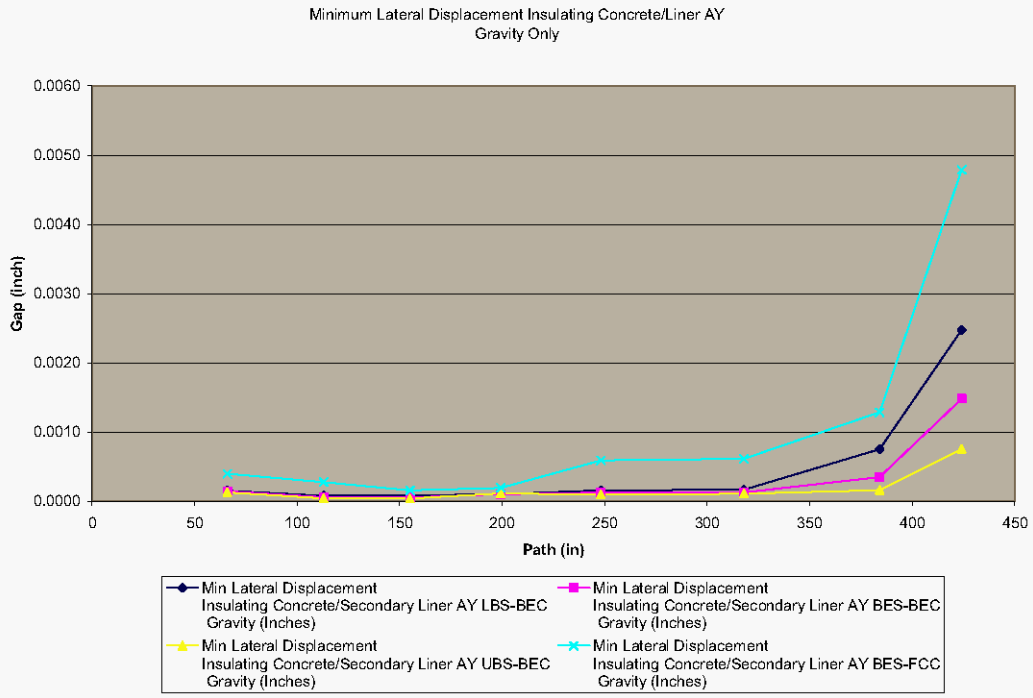


Figure 7.70. Insulating Concrete/Secondary Liner Contact Element Maximum Contact Gap – Gravity Only

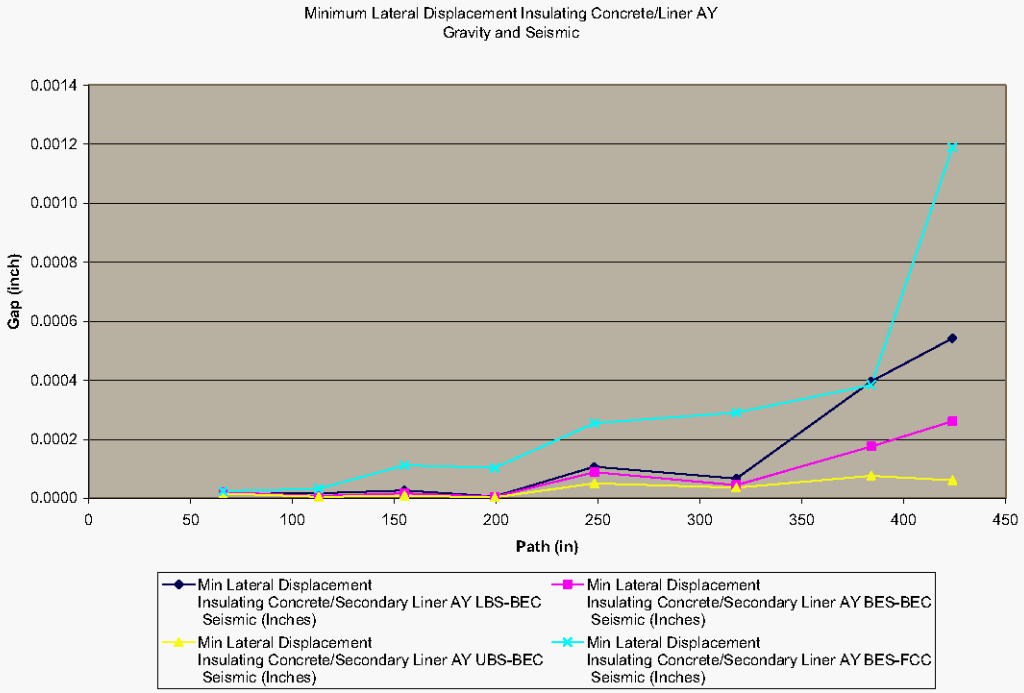


Figure 7.71. Insulating Concrete/Secondary Liner Contact Element Maximum Contact Gap – Gravity Plus Seismic

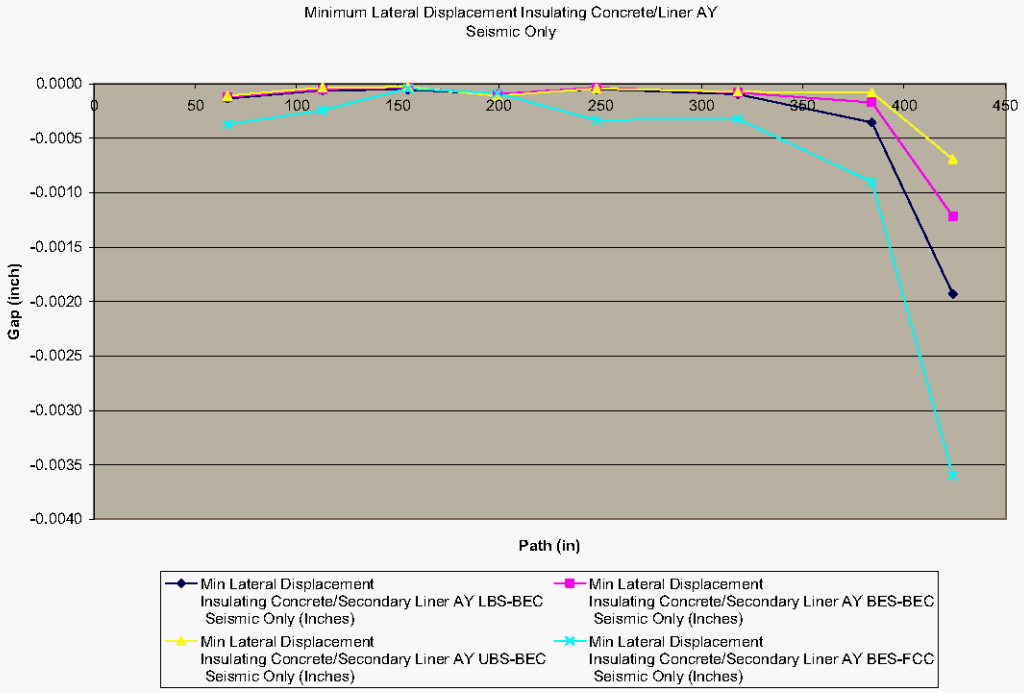


Figure 7.72. Insulating Concrete/Secondary Liner Contact Element Maximum Contact Gap – Seismic Only

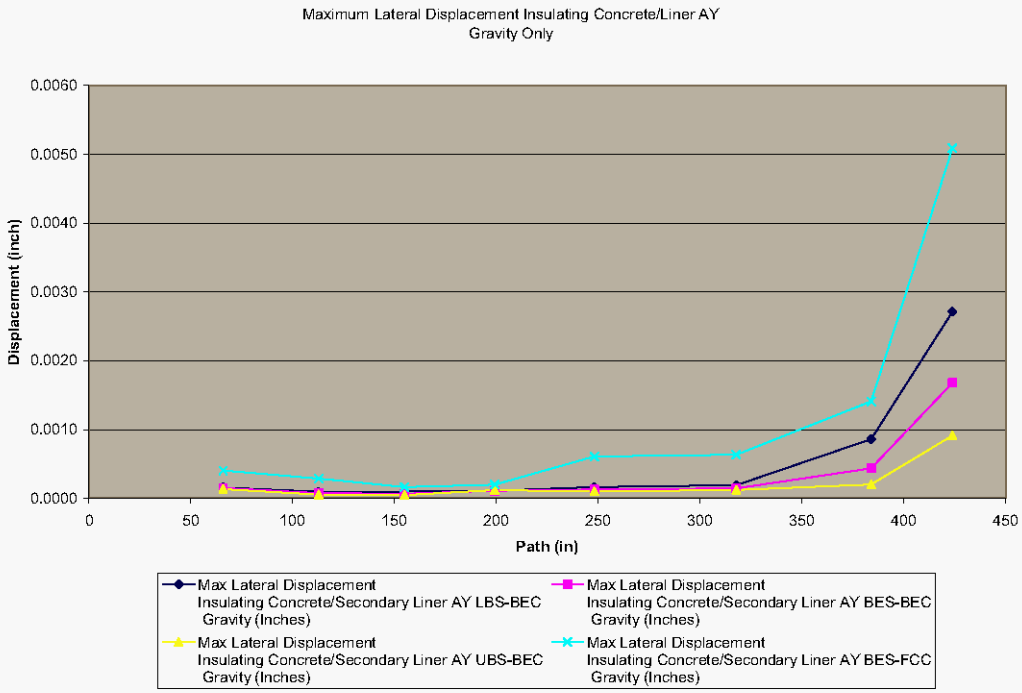


Figure 7.73. Insulating Concrete/Secondary Liner Contact Element Maximum Contact Lateral Displacement (Slide) – Gravity Only

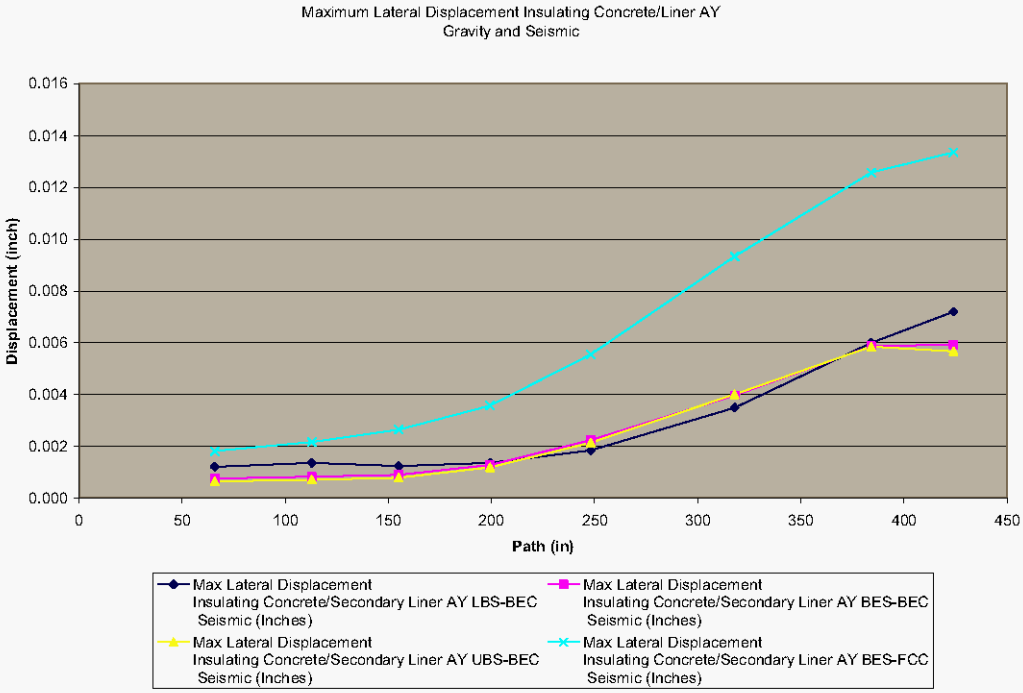


Figure 7.74. Insulating Concrete/Secondary Liner Contact Element Maximum Contact Lateral Displacement (Slide)– Gravity Plus Seismic

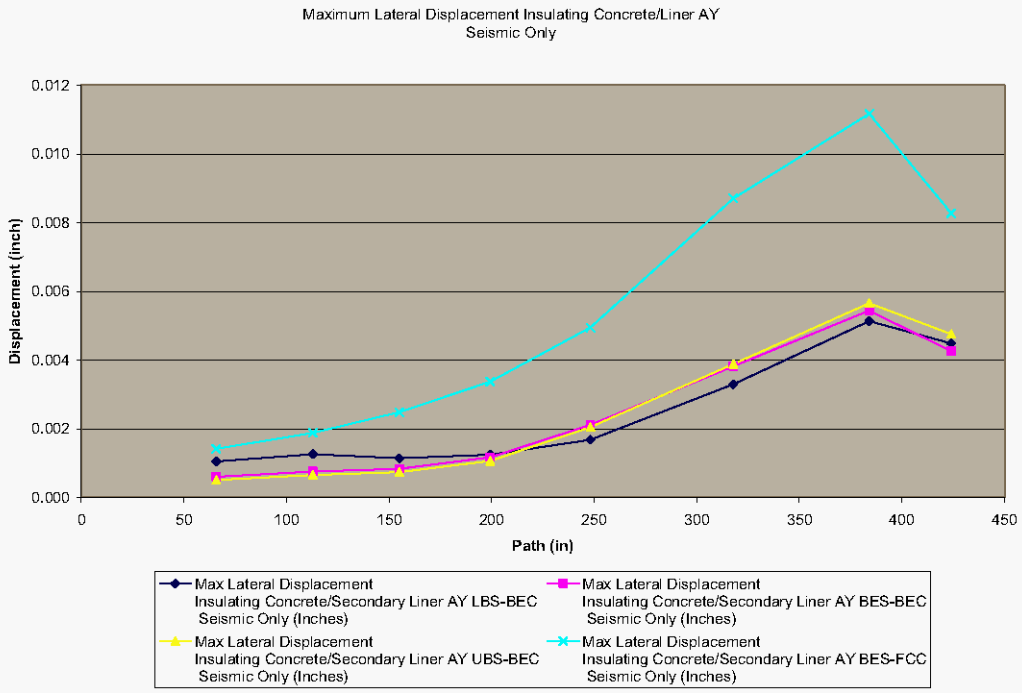


Figure 7.75. Insulating Concrete/Secondary Liner Contact Element Maximum Contact Lateral Displacement (Slide)– Seismic Only

The maximum sliding displacement due to a seismic event is approximately 0.011 inches and occurs in the Best Estimate Soil, Fully Cracked Concrete load case. Figures 7.76 and 7.77 show the location and magnitude of the sliding between the insulating concrete and secondary liner. The figures show the status and displacement for the Best Estimate Soil, Fully Cracked Concrete load case. The displacements are in feet and include both gravity and seismic loads.

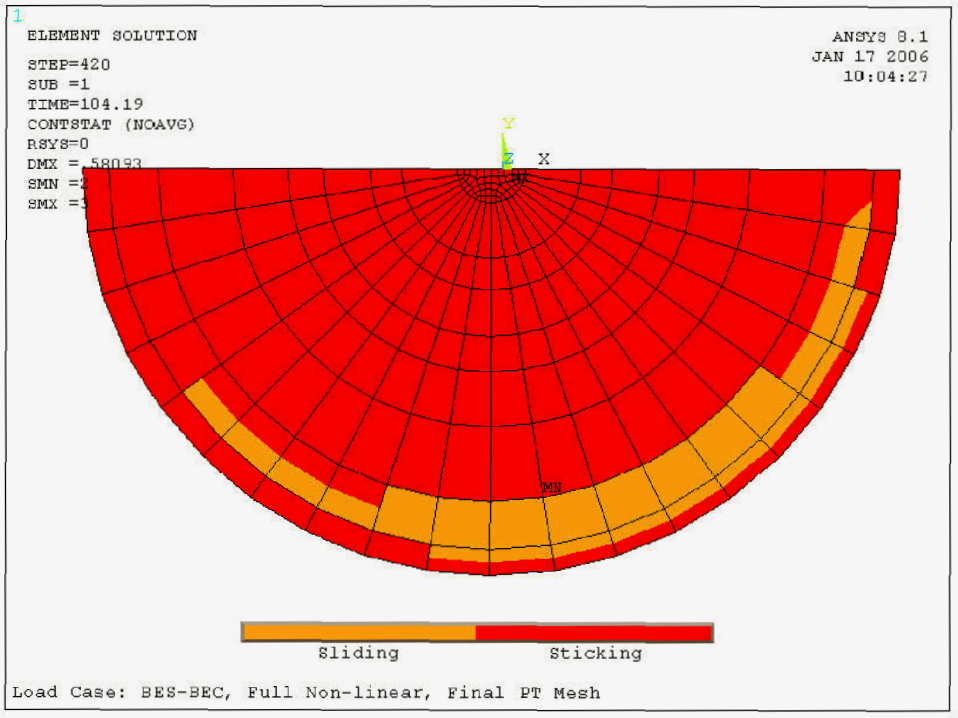


Figure 7.76. Sliding Locations for Insulating Concrete/Secondary Liner Contact at Time of Maximum Displacement

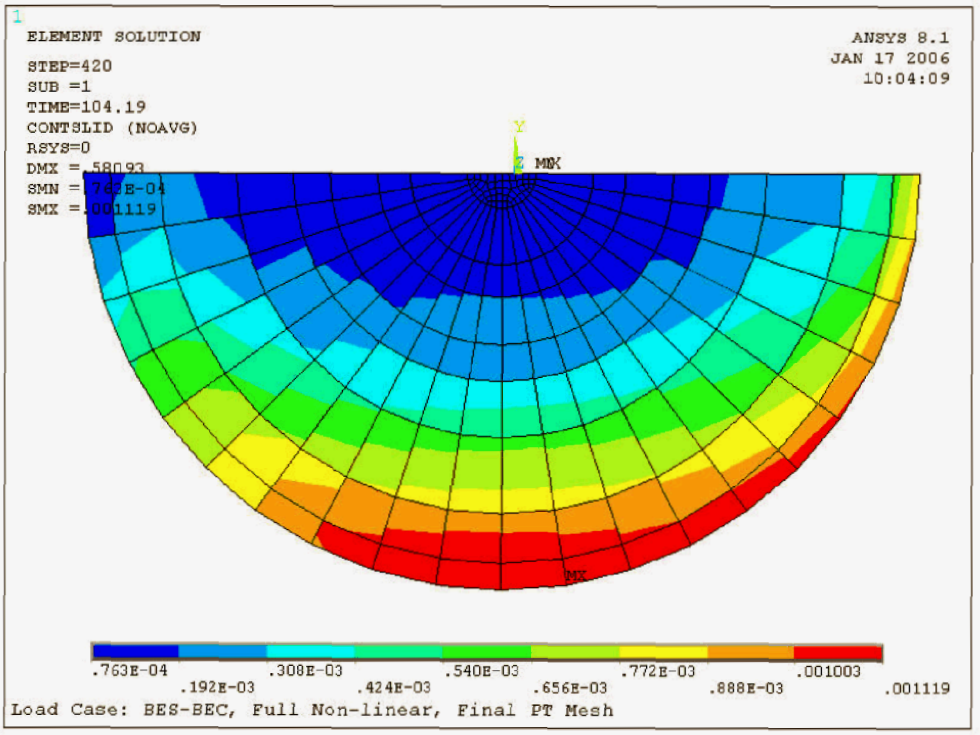


Figure 7.77. Maximum Sliding Displacement Between Insulating Concrete and Secondary Liner at Time of Maximum Displacement (ft)

Based on the small displacements between the insulating concrete and secondary liner, this contact surface feature could be omitted in future analyses.

8.0 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 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 tank wall.

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 8.1 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)

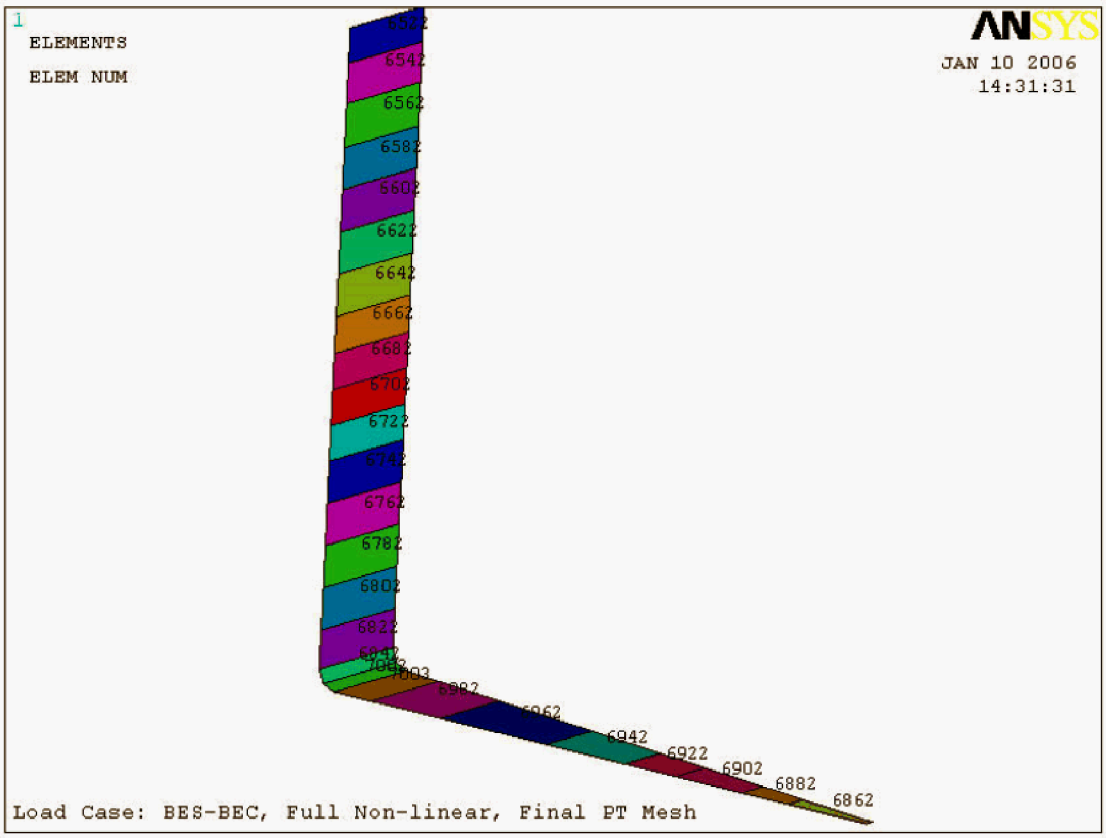


Figure 8.1. Waste Contact Element Retrieval Sequence Starting Element Numbers

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. The theoretical peak hydrodynamic pressures 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 4.55 of BNL 1995. The total pressures are the sum of the hydrostatic pressures and the hydrodynamic pressures. Two methods for combining the impulsive pressures are used in the evaluation, algebraic sum, and square root of the sum of the squares. The hydrostatic, peak hydrodynamic and peak total pressures for the elements located on the plane of excitation. Development of theoretical waste pressures is documented for each load case and is included in the appropriate attachment.

The maximum slosh height over all surface waste elements, regardless of time, is evaluated. According to Equation 4.60 of BNL 1995, the maximum predicted slosh height due to horizontal excitation is 23.7 inches for all load cases.

For each load case, a comparison is also made between the response at the bottom of the DST and the surface free-field response. The purpose of this comparison is to determine if the response at the bottom of the tank exceeds the free-field response. If the bottom response does exceed the surface, the practice of using the surface free-field response to determine the fluid/tank response may be unconservative. Plots of the response spectra at the bottom center and bottom edge of the tank and the surface free-field response are provided for both horizontal and vertical excitation for each load case.

8.1 Lower Bound Soil

S_{ah} = 0.60 g (Horizontal Spectral Acceleration)
S_{av} = 0.21 g (Vertical Spectra Acceleration)

Table 8.1. Theoretical Waste Pressures, LBS-BEC

Waste Height Ratio	Waste Height	Hydrostatic (psi)	Imp (psi)	Conv (psi)	Vert (psi)	Dyn (psi)	Dyn (SRSS) (psi)	Theor Max	Theor Min	Theor Max (SRSS)	Theor Min (SRSS)
0.97	410.75	0.69	1.86	1.39	0.18	2.50	2.33	3.19	-1.81	3.02	-1.64
0.92	386.5	2.18	3.43	1.26	0.57	4.22	3.70	6.40	-2.04	5.88	-1.52
0.85	359.5	3.84	4.9	1.14	1	6.03	5.13	9.87	-2.19	8.97	-1.29
0.79	332	5.53	6.16	1.02	1.43	7.67	6.41	13.20	-2.15	11.93	-0.88
0.72	305	7.18	7.21	0.93	1.84	9.11	7.50	16.29	-1.93	14.68	-0.32
0.66	278	8.84	8.1	0.85	2.22	10.36	8.44	19.20	-1.52	17.28	0.40
0.59	251	10.50	8.87	0.78	2.59	11.49	9.27	21.99	-1.00	19.77	1.22
0.53	225.65	12.05	9.48	0.72	2.91	12.42	9.94	24.47	-0.36	22.00	2.11
0.48	202.3	13.49	9.97	0.67	3.18	13.17	10.49	26.66	0.31	23.97	3.00
0.42	179.3	14.90	10.38	0.63	3.42	13.82	10.95	28.72	1.08	25.85	3.95
0.37	156.35	16.31	10.73	0.6	3.64	14.39	11.35	30.69	1.92	27.65	4.96
0.31	131.45	17.84	11.05	0.57	3.84	14.90	11.71	32.74	2.93	29.55	6.12
0.25	104.5	19.49	11.32	0.54	4.03	15.36	12.03	34.85	4.13	31.52	7.46
0.18	77.5	21.15	11.53	0.52	4.18	15.72	12.28	36.87	5.43	33.42	8.87
0.12	50.5	22.81	11.68	0.51	4.28	15.97	12.45	38.78	6.83	35.26	10.36
0.06	24.5	24.40	11.76	0.5	4.34	16.11	12.55	40.51	8.29	36.95	11.86

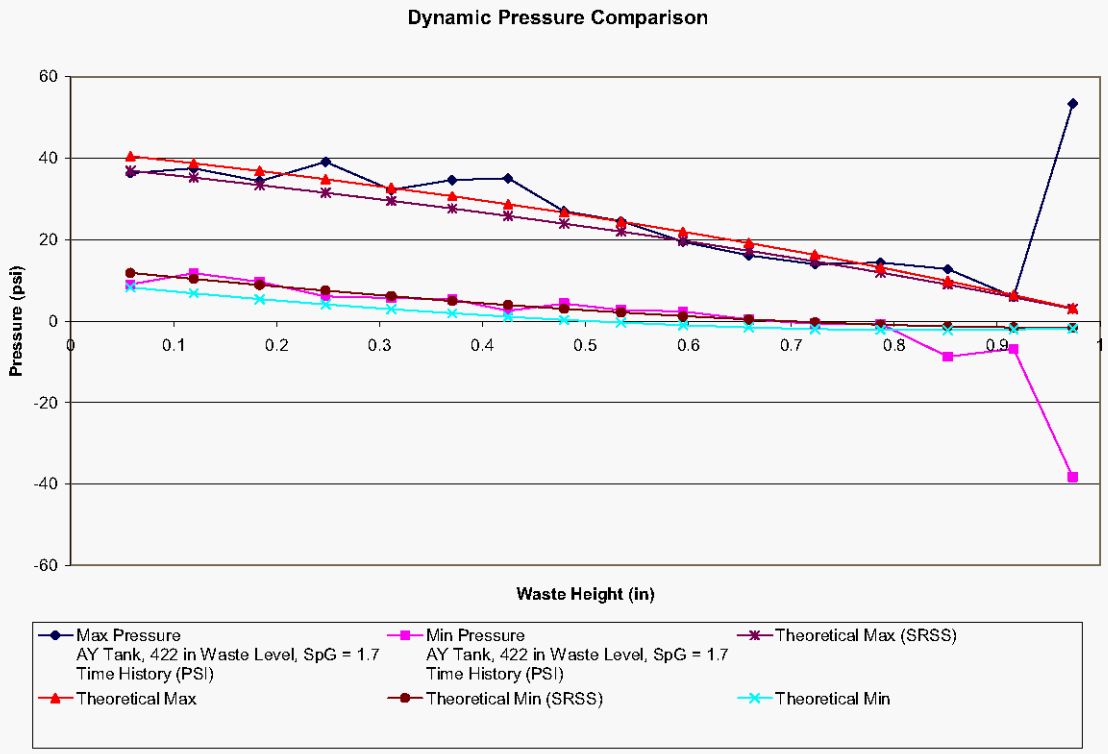


Figure 8.2. Waste Pressure Distribution, LBS-BEC

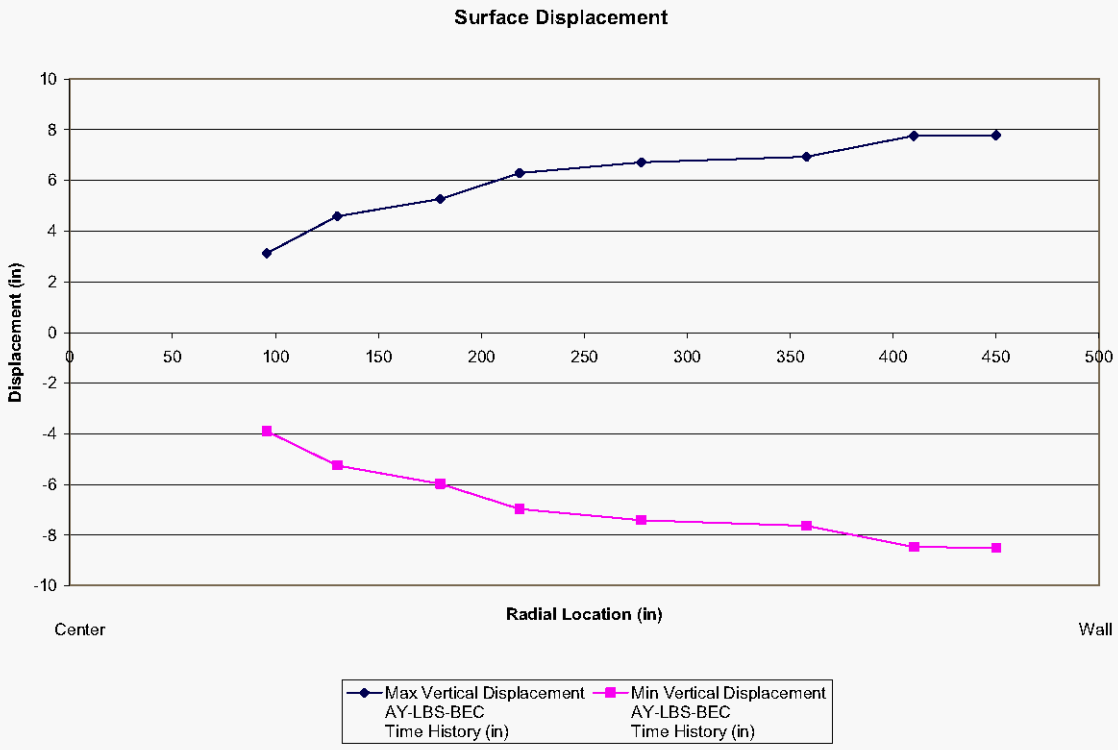


Figure 8.3. Waste Free Surface Displacement, LBS-BEC

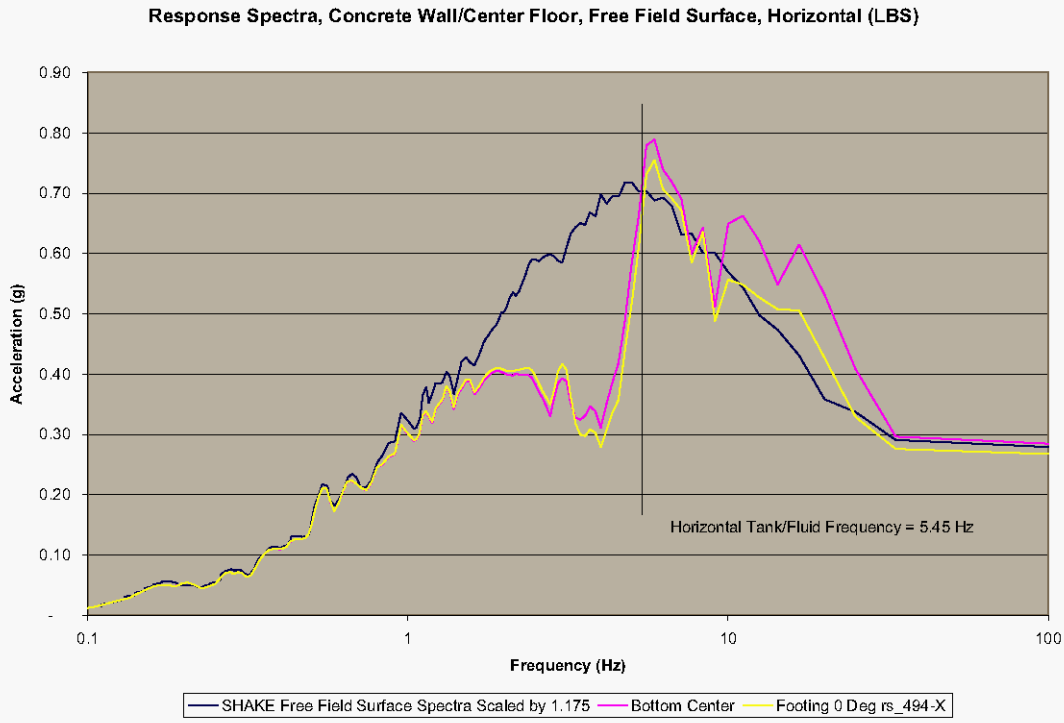


Figure 8.4. Comparison of DST Base and Free Field Surface Response, LBS-BEC, Horizontal

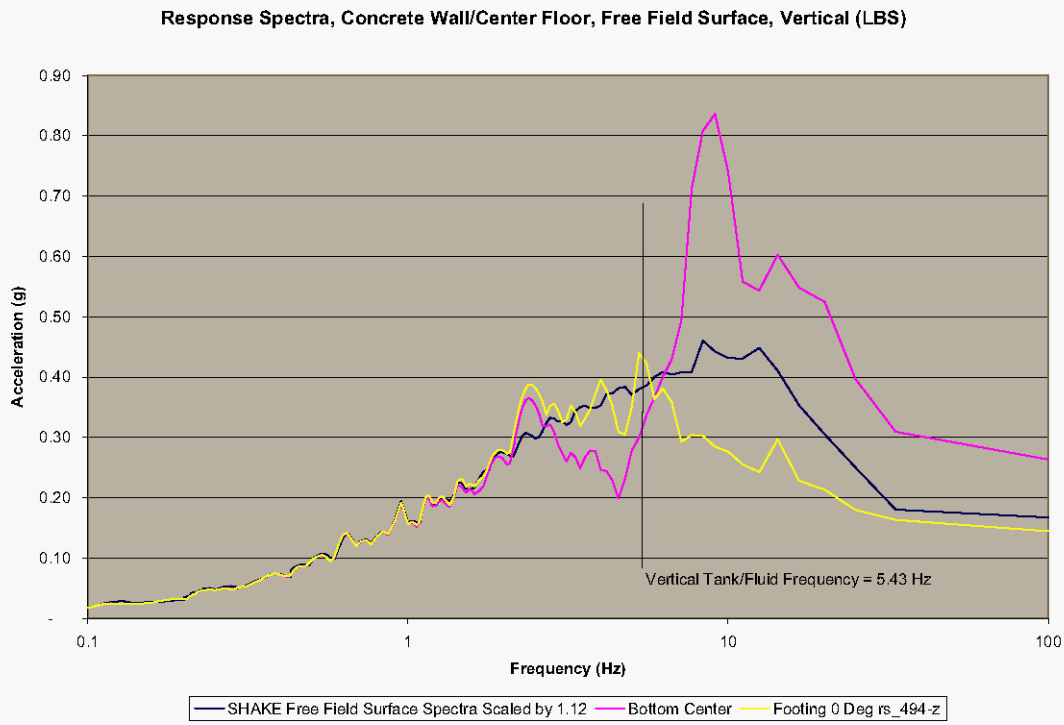


Figure 8.5. Comparison of DST Base and Free Field Surface Response, LBS-BEC, Vertical

8.2 Best Estimate Soil

S_{ah} = 0.35 g
S_{av} = 0.30 g

Table 8.2. Theoretical Waste Pressures, BES-BEC

Waste Height Ratio	Waste Height	Hydro static (psi)	Imp (psi)	Conv (psi)	Vert (psi)	Dyn (psi)	Dyn (SRSS) (psi)	Theor Max	Theor Min	Theor Max (SRSS)	Theor Min (SRSS)
0.97	410.75	0.69	1.08	1.38	0.26	2.01	1.77	2.70	-1.32	2.46	-1.08
0.92	386.5	2.18	2	1.25	0.82	3.18	2.50	5.36	-1.00	4.68	-0.32
0.85	359.5	3.84	2.86	1.13	1.43	4.51	3.39	8.34	-0.67	7.23	0.45
0.79	332	5.53	3.59	1.02	2.05	5.78	4.26	11.31	-0.26	9.78	1.27
0.72	305	7.18	4.2	0.93	2.63	6.93	5.04	14.11	0.25	12.22	2.14
0.66	278	8.84	4.73	0.85	3.18	7.99	5.76	16.83	0.85	14.60	3.08
0.59	251	10.50	5.17	0.77	3.7	8.93	6.40	19.42	1.57	16.90	4.09
0.53	225.65	12.05	5.53	0.72	4.15	9.73	6.95	21.78	2.33	19.01	5.10
0.48	202.3	13.49	5.81	0.67	4.54	10.39	7.40	23.88	3.10	20.89	6.08
0.42	179.3	14.90	6.05	0.63	4.89	10.97	7.80	25.87	3.93	22.70	7.09
0.37	156.35	16.31	6.26	0.6	5.2	11.49	8.16	27.80	4.82	24.47	8.15
0.31	131.45	17.84	6.44	0.56	5.49	11.95	8.48	29.79	5.88	26.32	9.36
0.25	104.5	19.49	6.6	0.54	5.76	12.38	8.78	31.87	7.11	28.27	10.71
0.18	77.5	21.15	6.73	0.52	5.97	12.72	9.01	33.87	8.43	30.16	12.14
0.12	50.5	22.81	6.81	0.5	6.11	12.94	9.16	35.74	9.87	31.97	13.64
0.06	24.5	24.40	6.86	0.49	6.2	13.08	9.26	37.48	11.32	33.66	15.14

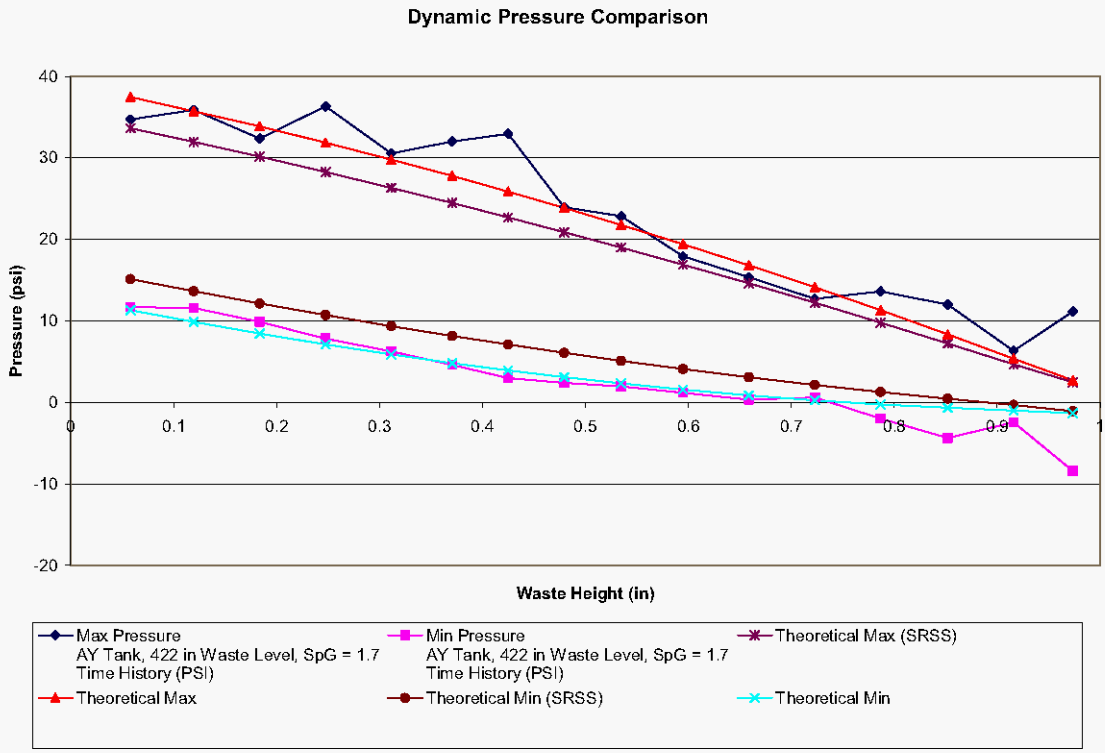


Figure 8.6. Waste Pressure Distribution, BES-BEC

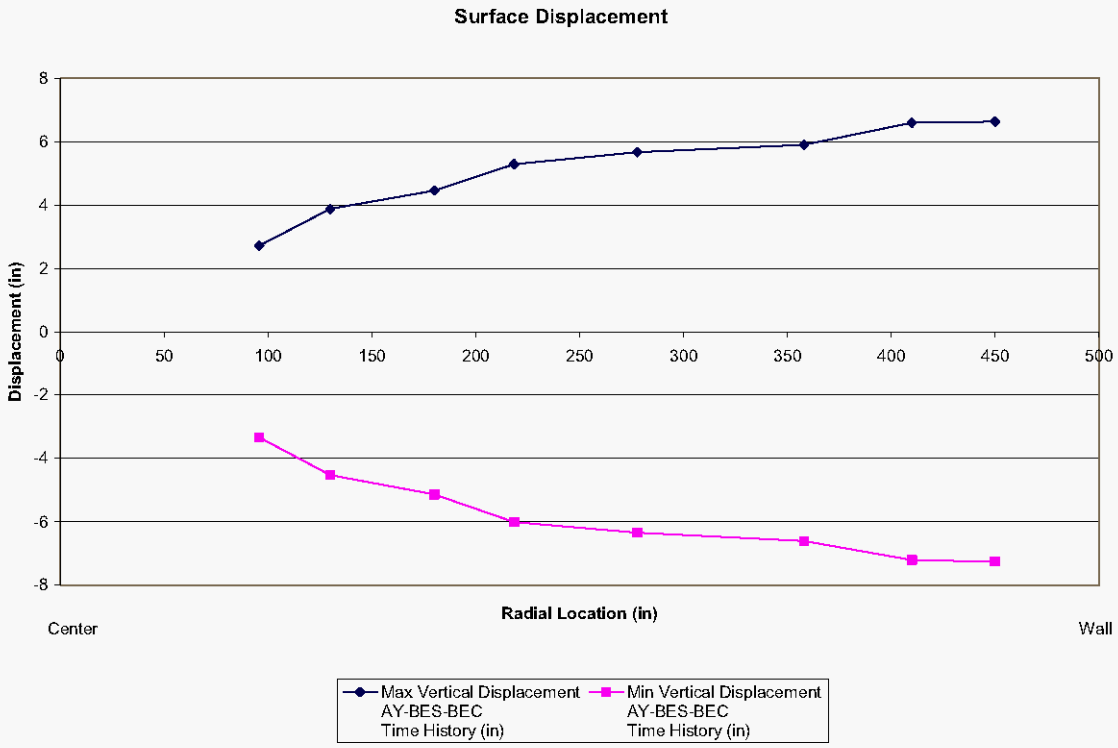


Figure 8.7. Waste Free Surface Displacement, BES-BEC

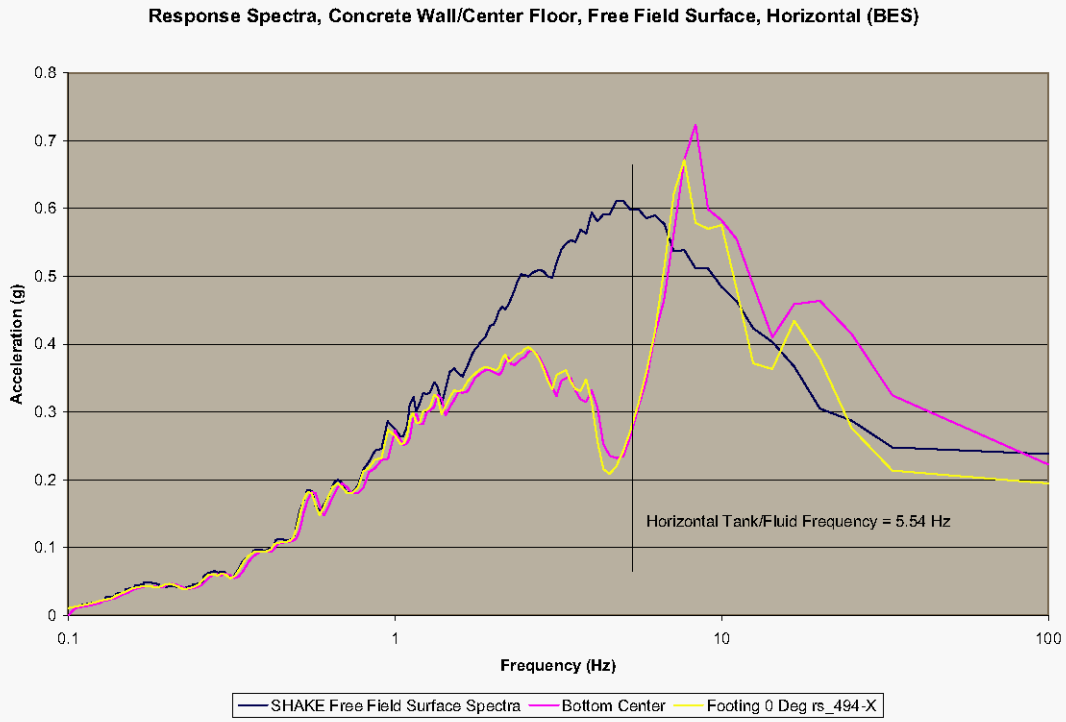


Figure 8.8. Comparison of DST Base and Free Field Surface Response, BES, Horizontal

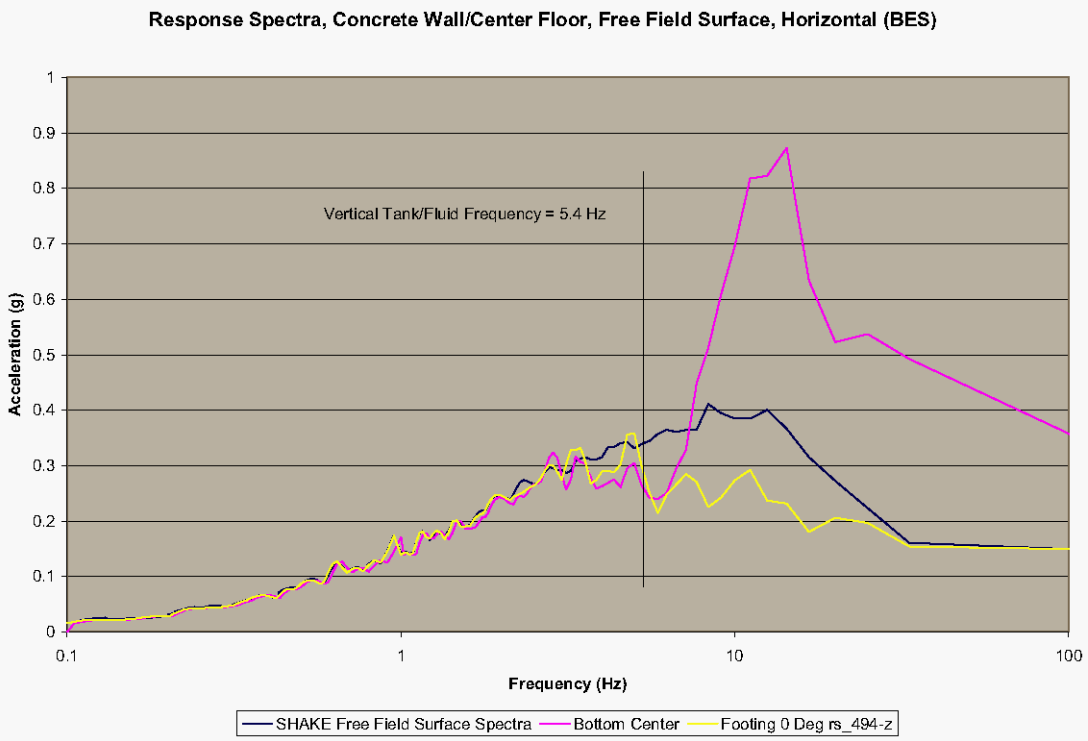


Figure 8.9. Comparison of DST Base and Free Field Surface Response, BES, Vertical

8.3 Upper Bound Soil

$S_{ah} = 0.38$ g
$S_{av} = 0.36$ g

Table 8.3. Theoretical Waste Pressures, UBS-BEC

Waste Height Ratio	Waste Height	Hydro static (psi)	Imp (psi)	Conv (psi)	Vert (psi)	Dyn (psi)	Dyn (SRSS) (psi)	Theor Max	Theor Min	Theor Max (SRSS)	Theor Min (SRSS)
0.97	410.75	0.69	1.18	1.39	0.31	2.13	1.85	2.82	-1.44	2.54	-1.16
0.92	386.5	2.18	2.17	1.26	0.98	3.49	2.69	5.67	-1.31	4.87	-0.51
0.85	359.5	3.84	3.1	1.14	1.72	5.02	3.72	8.86	-1.19	7.56	0.11
0.79	332	5.53	3.9	1.03	2.45	6.48	4.72	12.01	-0.96	10.24	0.81
0.72	305	7.18	4.57	0.93	3.15	7.81	5.63	15.00	-0.63	12.81	1.55
0.66	278	8.84	5.13	0.85	3.81	9.01	6.45	17.85	-0.17	15.29	2.39
0.59	251	10.50	5.62	0.78	4.44	10.11	7.20	20.61	0.38	17.70	3.29
0.53	225.65	12.05	6	0.72	4.98	11.02	7.83	23.08	1.03	19.88	4.22
0.48	202.3	13.49	6.31	0.67	5.45	11.80	8.36	25.28	1.69	21.85	5.12
0.42	179.3	14.90	6.57	0.63	5.86	12.46	8.83	27.36	2.44	23.73	6.07
0.37	156.35	16.31	6.8	0.6	6.24	13.07	9.25	29.37	3.24	25.56	7.06
0.31	131.45	17.84	7	0.57	6.59	13.61	9.63	31.45	4.22	27.47	8.21
0.25	104.5	19.49	7.17	0.54	6.91	14.10	9.97	33.59	5.39	29.46	9.52
0.18	77.5	21.15	7.3	0.52	7.16	14.48	10.24	35.63	6.67	31.39	10.91
0.12	50.5	22.81	7.4	0.51	7.34	14.76	10.44	37.56	8.05	33.24	12.37
0.06	24.5	24.40	7.45	0.5	7.44	14.91	10.54	39.31	9.50	34.94	13.86

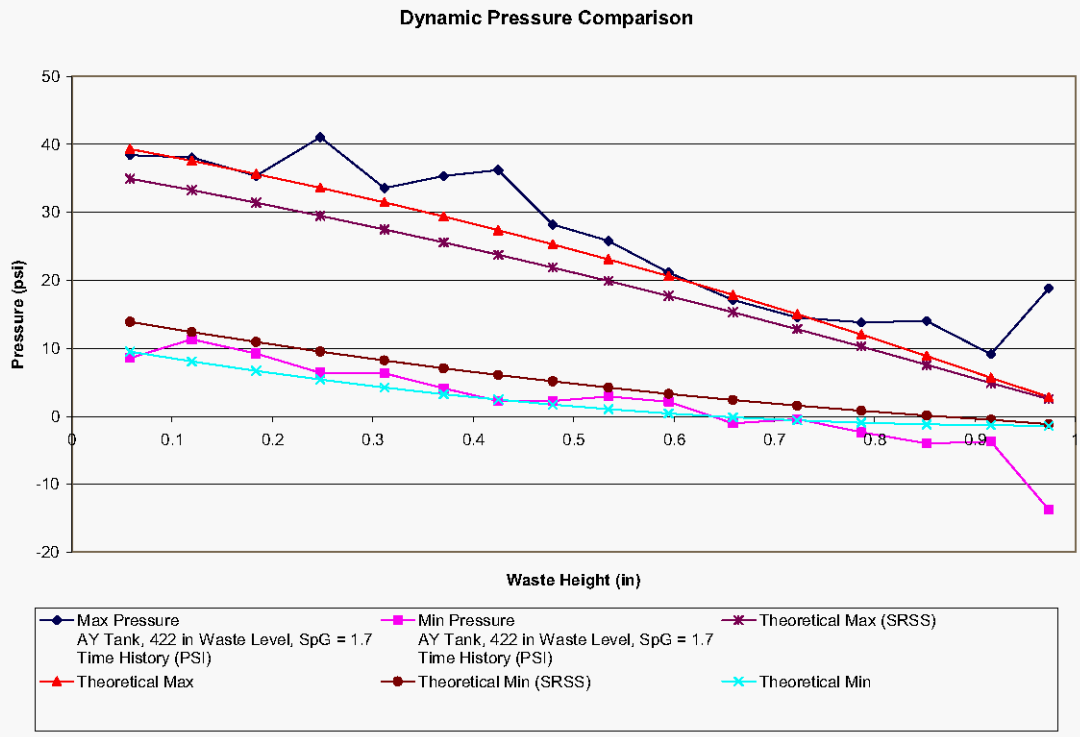


Figure 8.10. Waste Pressure Distribution, UBS-BEC

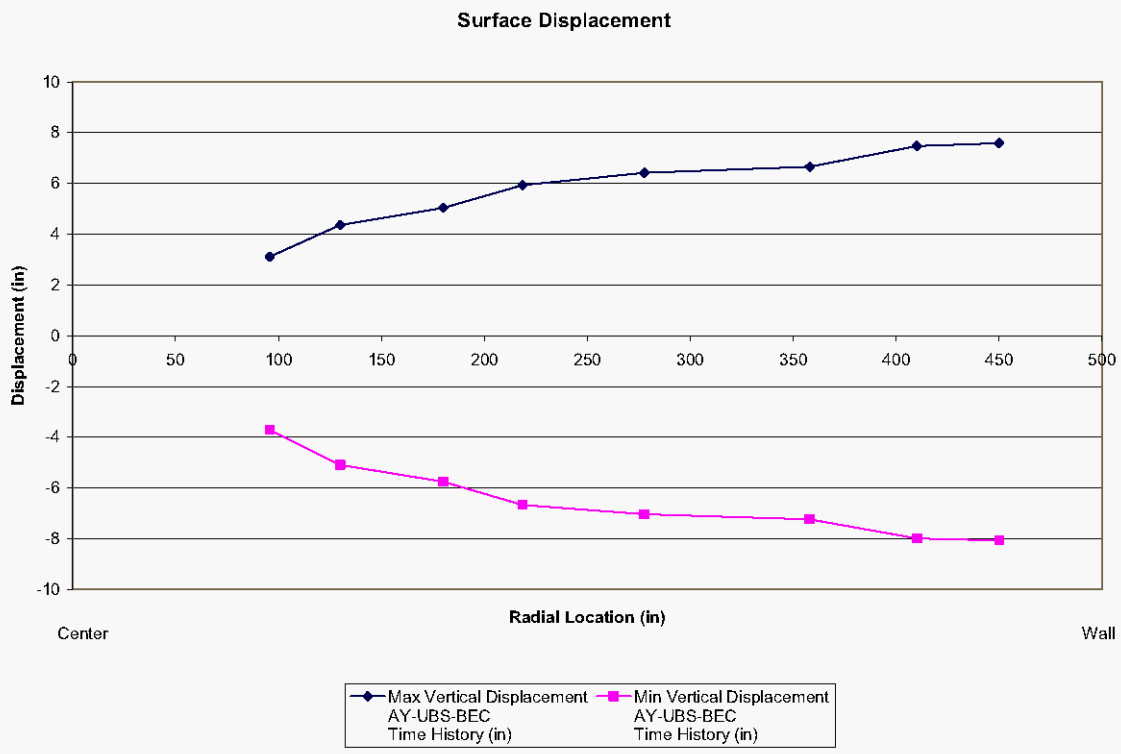


Figure 8.11. Waste Free Surface Displacement, UBS-BEC

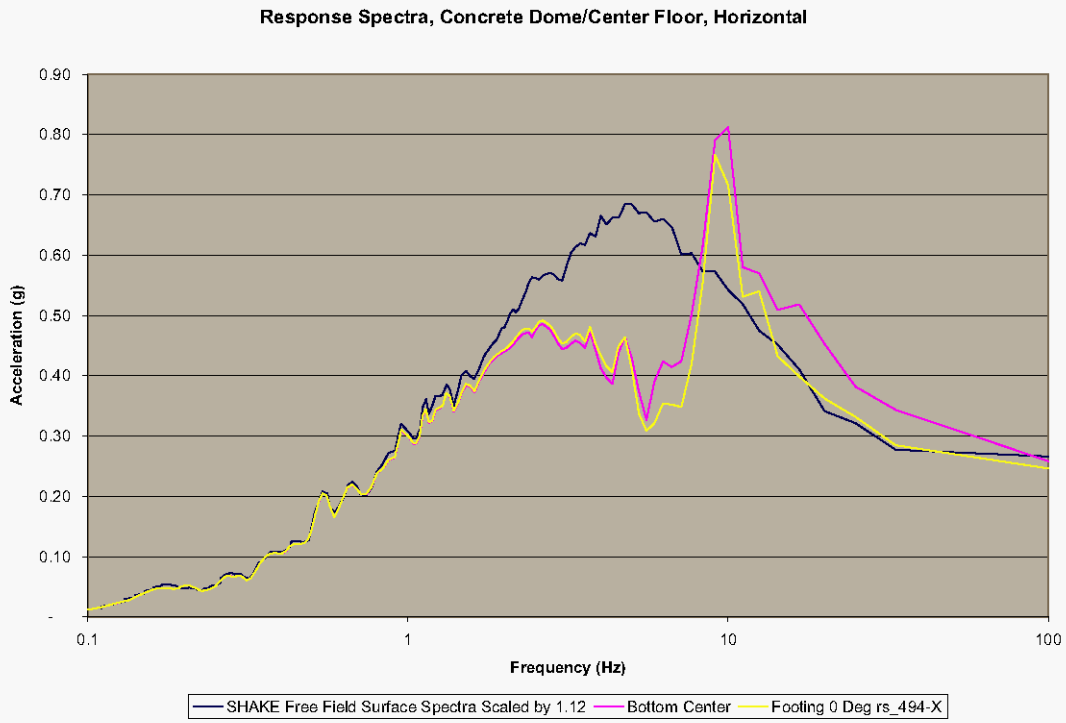


Figure 8.12. Comparison of DST Base and Free Field Surface Response, UBS, Horizontal

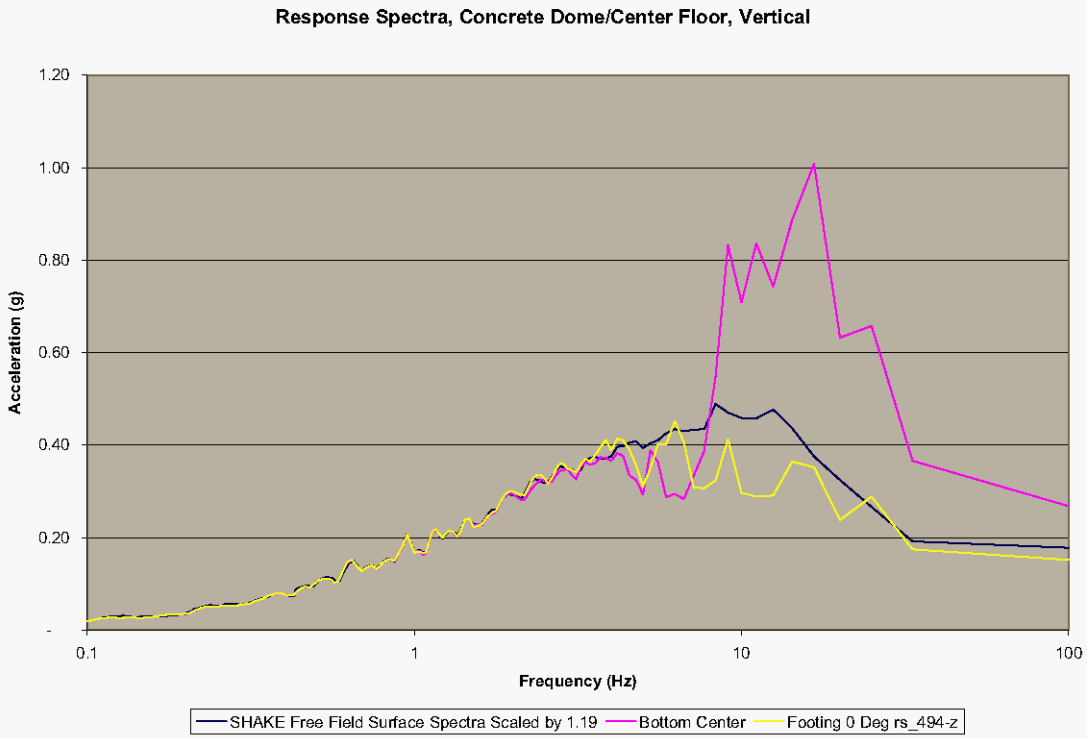


Figure 8.13. Comparison of DST Base and Free Field Surface Response, UBS, Vertical

8.4 Best Estimate Soil, Fully Cracked Concrete

$S_{ah} = 0.39$ g
$S_{av} = 0.30$ g

Table 8.4. Theoretical Waste Pressures, BES-FCC

Waste Height Ratio	Waste Height	Hydro static (psi)	Imp (psi)	Conv. (psi)	Vert. Imp.(psi)	Dyn. (psi)	Dyn (SRSS) (psi)	Theor Max	Theor Min	Theor. Max (SRSS)	Theor Min (SRSS)
0.97	410.75	0.69	1.21	1.38	0.26	2.10	1.85	2.79	-1.40	2.54	-1.16
0.92	386.5	2.18	2.23	1.25	0.82	3.38	2.68	5.56	-1.20	4.86	-0.51
0.85	359.5	3.84	3.18	1.13	1.43	4.80	3.67	8.64	-0.97	7.50	0.17
0.79	332	5.53	4	1.02	2.05	6.18	4.61	11.70	-0.65	10.13	0.92
0.72	305	7.18	4.69	0.93	2.63	7.41	5.46	14.59	-0.23	12.64	1.73
0.66	278	8.84	5.27	0.85	3.18	8.52	6.21	17.36	0.32	15.05	2.63
0.59	251	10.50	5.76	0.77	3.7	9.51	6.89	20.01	0.99	17.39	3.61
0.53	225.65	12.05	6.16	0.72	4.15	10.35	7.46	22.41	1.70	19.52	4.59
0.48	202.3	13.49	6.48	0.67	4.54	11.05	7.94	24.54	2.43	21.43	5.55
0.42	179.3	14.90	6.75	0.63	4.89	11.67	8.36	26.57	3.23	23.26	6.54
0.37	156.35	16.31	6.97	0.6	5.2	12.20	8.72	28.50	4.11	25.02	7.59
0.31	131.45	17.84	7.18	0.56	5.49	12.69	9.06	30.53	5.14	26.89	8.78
0.25	104.5	19.49	7.36	0.54	5.76	13.14	9.36	32.63	6.35	28.85	10.13
0.18	77.5	21.15	7.5	0.52	5.97	13.49	9.60	34.64	7.66	30.75	11.55
0.12	50.5	22.81	7.59	0.5	6.11	13.72	9.76	36.52	9.09	32.56	13.05
0.06	24.5	24.40	7.64	0.49	6.2	13.86	9.85	38.26	10.55	34.25	14.55

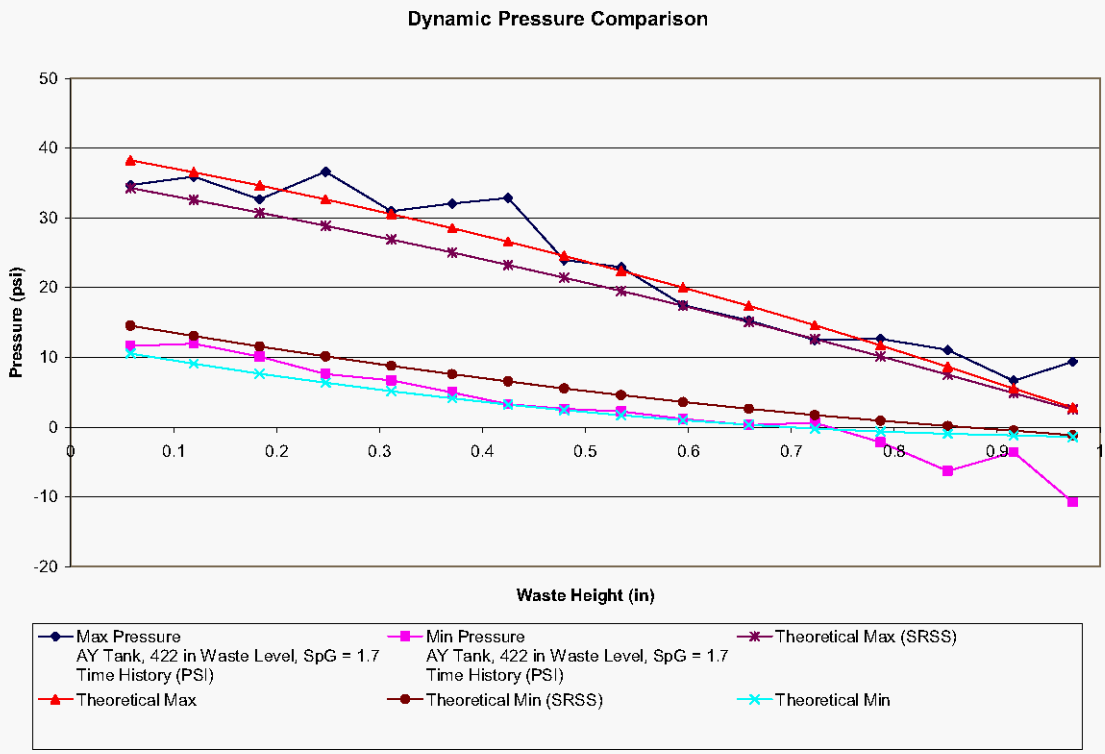


Figure 8.14. Waste Pressure Distribution, BES-FCC

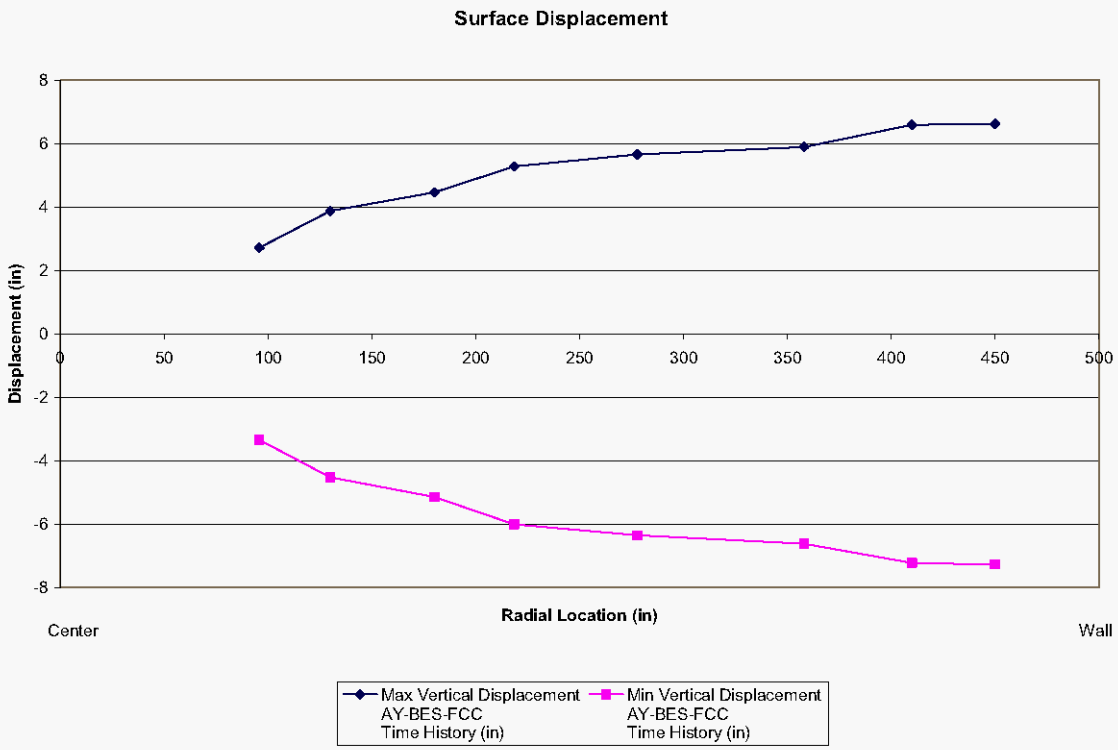


Figure 8.15. Waste Free Surface Displacement, BES-FCC

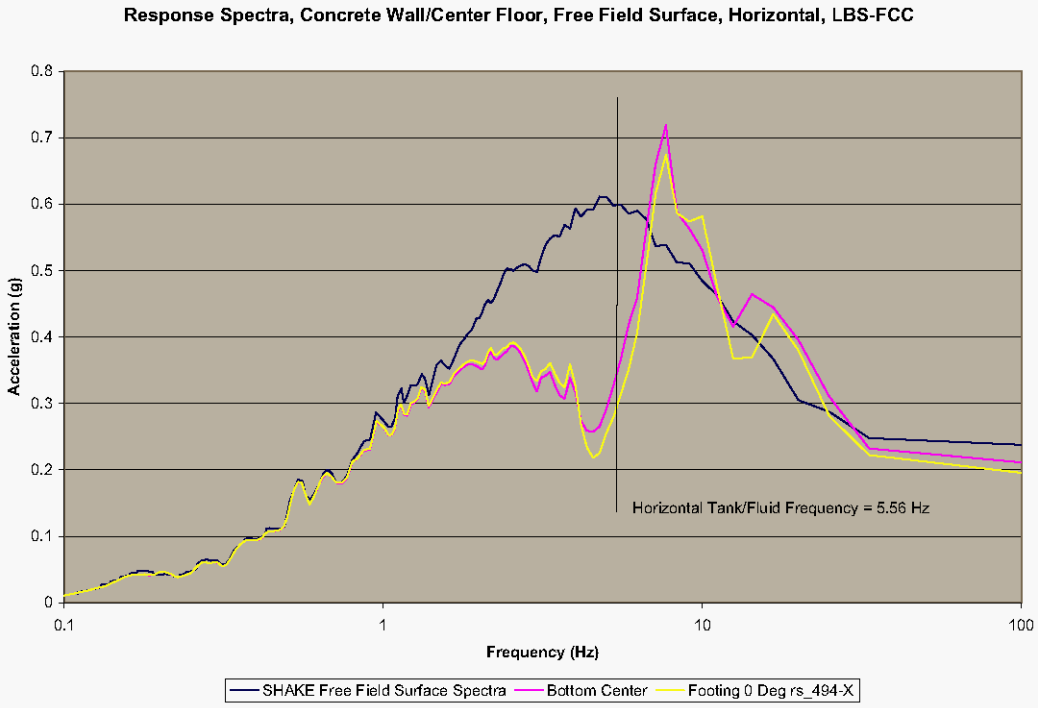


Figure 8.16. Comparison of DST Base and Free Field Surface Response, BES-FCC, Horizontal

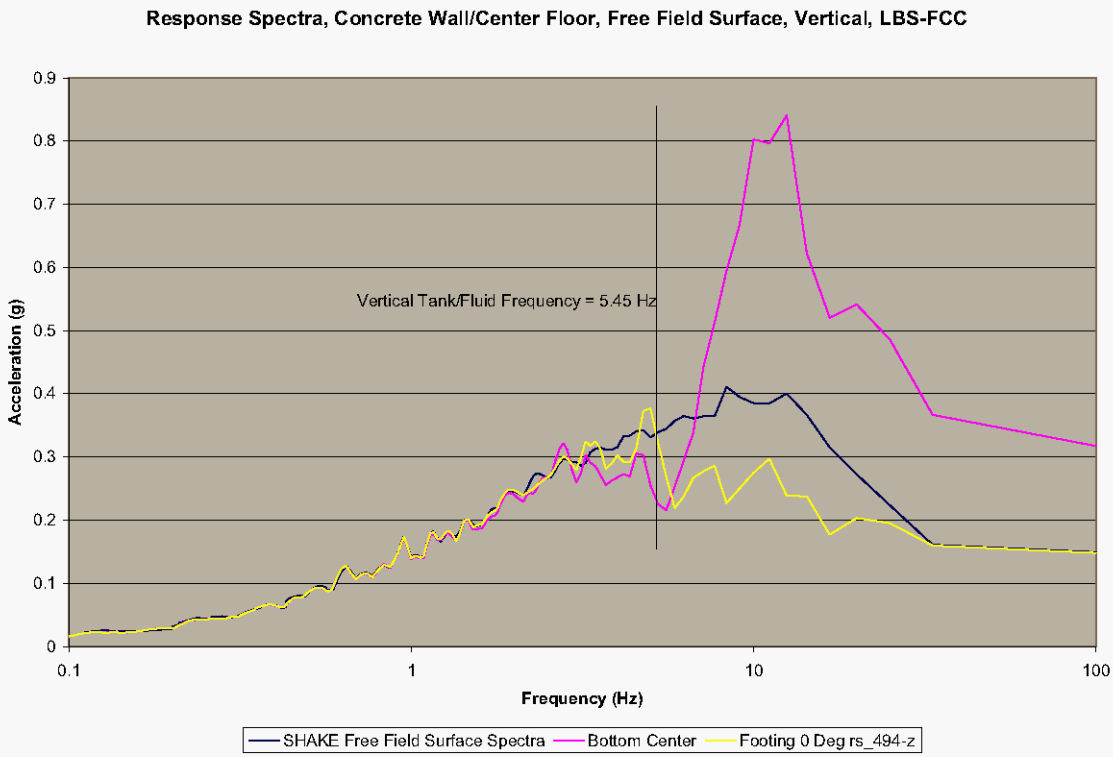


Figure 8.17. Comparison of DST Base and Free Field Surface Response, BES-FCC, Vertical

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10.0 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: Falcon 900, 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 B Soil Arching Study
- Appendix E 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

11.0 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

Dead Load Study

Baseline
Gravity + 1.7 SpG Waste
50F, Full Tank
None None None No ne

ANSYS PII Element	Section	PNNL F-merid PNNL	PNNL F-hoop PNNL	PNNL M-merid PNNL	PNNL M-hoop PNNL
57	2	-54.3	-53.3	-2	-2
77	3	-54.2	-52.5	-2	-2
97	4	-54.5	-51.4	-1.6	-2.1
117	6	-54.7	-48.6	-2.9	-2.2
137	8	-49.7	-43.1	-4.5	-2.6
157	9	-48.2	-39.7	-1.7	-2.2
177	11	-50.7	-29.5	-5.4	-2.9
197	13	-49.6	-16.6	-2	-3
217	17	-53.3	15	13.5	-2.2
237	20	-42	51.5	25.1	4.9
257	22	-51.1	76.6	45.1	8.9
277	24	-51.7	49.5	30.4	6.7
297	26	-49.6	28.4	2.8	0.9
317	30	-69.7	-13.6	-6.7	-0.9
337	33	-60.8	-37.9	-7	-1.2
357	35	-72	-51.5	-3.2	-1.6
377	38	-68.4	-57.3	-5.5	-0.9
397	41	-78.8	-54.3	-5.4	-1.6
417	43	-83.3	-42.4	-3.4	-1.8
437	46	-98.4	-15.8	12.1	1.5
457	48	-4.4	-8.1	15.8	1.7
477	51	-12.8	-16.8	98	11.2
497	53	-9	-8.9	18	5.9
517	55	-3.4	0.6	-6.9	4.5
537	57	-1	4.7	-3.1	1.3
557	58	3.3	6.4	-1.3	0.8
577	59	6	7.4	-0.5	0.3
597	60	5.4	7.8	0.1	0.6
617	61	8.1	8.1	-0.5	0.5

Figure A.1. Concrete Forces and Moments, PNNL Slice Model

	Path Length	Merid Frc-Merged Soil - Old Geom	Hoop Frc - Merged Soil - Old Geom	Shear Frc - Merged Soil - Old Geom	Merid Mnt- Merged Soil - Old Geom	Hoop Mnt - Merged Soil - Old Geom	Shear Mnt - Merged Soil - Old Geom
Dome	67.73	-33.4690	-17.6140	0.6920	-2.1523	-1.5843	0.0037
	105.67	-32.6180	-17.9710	0.6927	-1.0932	-1.5283	0.0011
	137.07	-32.2220	-16.9810	0.6939	-0.9982	-1.3900	-0.0007
	182.85	-32.2900	-14.6670	0.6934	-0.8009	-1.2251	-0.0007
	226.56	-32.5200	-12.3480	0.6837	-0.2924	-1.0079	-0.0007
	275.57	-33.8100	-9.0535	0.6669	-0.5691	-0.9397	-0.0006
	325.69	-35.5450	-5.8113	0.6384	-0.8051	-0.9063	-0.0010
	372.30	-39.2220	-1.2361	0.6045	-2.4018	-1.2528	-0.0018
	423.43	-42.5850	9.6061	0.5694	-1.9223	-2.1903	-0.0090
HAUNCH	468.31	-50.4890	37.2440	0.6646	18.9300	-2.2935	-0.0665
	515.31	-65.7140	54.9220	0.5332	38.4200	4.7606	-0.0943
	549.73	-72.6220	38.9050	0.4187	24.3710	3.9871	-0.0374
	585.82	-81.0380	21.1870	0.2972	5.6889	0.8205	-0.0250
WALL	636.37	-87.7540	0.7338	0.1530	-4.3198	-0.9103	-0.0139
	685.62	-94.1410	-13.8460	0.0151	-3.2385	-0.7420	-0.0058
	732.72	-98.5200	-21.1230	-0.1080	-1.5078	-0.4532	-0.0016
	778.22	-102.9400	-25.6120	-0.2187	-1.3810	-0.4307	0.0029
	821.37	-104.9500	-27.0130	-0.3110	-2.8212	-0.6657	0.0108
	874.17	-106.8000	-21.7740	-0.3866	-4.1945	-0.8689	0.0260
	930.54	-106.2400	-8.6206	-0.3509	3.4481	0.4738	0.0284
FOOTING	977.63	-1.1230	18.7060	-0.5021	41.3220	9.9326	0.0126
FLOOR	1019.65	-11.7940	20.2240	1.6769	50.2430	6.7408	3.5466
	1060.16	-2.4608	21.7880	-0.7447	-2.3837	2.2889	-0.0067
	1109.70	1.8350	17.4910	-0.6014	-2.9719	0.8472	-0.0024
	1155.77	5.3682	15.3220	-0.5433	-0.2624	0.1403	0.0000
	1211.96	8.0807	15.6130	0.0585	0.1015	0.0786	-0.0017
	1281.71	8.6921	15.8490	0.0268	0.0957	0.0739	-0.0016
	1330.56	9.2353	15.7830	-0.0231	0.0921	0.0679	-0.0012
	1374.86	15.0700	10.2430	-0.1892	0.0657	0.0184	0.0097

Figure A.2. Concrete Forces and Moments, Old Geometry

	Path Length	ELEM	Merid Frc-New Geom	Hoop Frc - New Geom	Shear Frc - New Geom	Merid Mnt-New Geom	Hoop Mnt - New Geom	Shear Mnt - New Geom
Dome	67.73	57	-36.5360	-19.5730	0.6651	-2.9357	-2.8811	0.0227
	105.67	77	-35.6150	-19.3980	0.7077	-1.4561	-2.3654	0.0051
	137.07	97	-35.1570	-17.6320	0.6914	-1.1075	-2.0174	-0.0017
	182.85	117	-34.6800	-14.2720	0.6871	-0.4881	-1.5623	-0.0007
	226.56	137	-35.0910	-11.2610	0.6750	-0.2252	-1.2515	-0.0020
	275.57	157	-35.3070	-7.2397	0.6572	-0.1200	-1.0110	-0.0012
	325.69	177	-37.2100	-3.7552	0.6268	-0.4773	-0.9169	-0.0024
	372.30	197	-40.3590	0.7101	0.5932	-2.5839	-1.3586	-0.0027
	423.43	217	-44.6250	13.0000	0.5560	-2.3083	-2.3532	-0.0110
HAUNCH	468.31	237	-54.4520	43.9160	0.6410	22.2070	-1.6688	-0.0831
	515.31	257	-69.0180	62.5330	0.5055	41.2450	5.2284	-0.0941
	549.73	277	-75.3180	42.6140	0.3872	25.8510	4.2481	-0.0471
	585.82	297	-83.3690	23.9410	0.2619	5.0932	0.7197	-0.0241
WALL	636.37	317	-89.6900	1.1138	0.1107	-5.0095	-1.0266	-0.0138
	685.62	337	-95.8090	-13.9240	-0.0365	-3.4081	-0.7698	-0.0056
	732.72	357	-99.9730	-21.5710	-0.1708	-1.4496	-0.4435	-0.0027
	778.22	377	-103.5700	-26.1580	-0.3016	-1.7850	-0.5046	-0.0009
	821.37	397	-106.3500	-27.3860	-0.4759	-2.0180	-0.5358	0.0091
	874.17	417	-104.4400	-20.6910	-0.4958	-6.1379	-1.1903	0.0458
	930.54	437	-109.1700	-9.5779	-0.5190	-8.8517	-1.5992	0.0651
FOOTING	977.63	457	-5.3025	15.9530	1.1391	44.4670	10.0450	2.7120
FLOOR	1019.65	477	-7.1961	17.7170	0.9938	43.3610	5.8139	2.9597
	1060.16	497	-5.4992	15.6670	0.9013	8.1472	3.5488	-0.3513
	1109.70	517	-5.3007	10.7890	0.7762	2.2406	0.7880	-0.1106
	1155.77	537	2.1946	10.4510	0.2675	0.2521	0.1392	-0.0091
	1211.96	557	6.0007	11.0060	0.0333	0.1511	0.0767	-0.0063
	1281.71	577	6.0067	11.0720	0.0210	0.0529	0.0391	0.0077
	1330.56	597	6.3070	11.0990	-0.0027	0.1528	0.0727	-0.0066
	1374.86	617	6.7648	10.8720	-0.0737	0.0418	0.0332	0.0060

Figure A.3. Concrete Forces and Moments, New Geometry

	Path Length	ELEM	Merid Frc-New Geom - PNNL Concrete	Hoop Frc - New Geom - PNNL Concrete	Shear Frc - New Geom - PNNL Concrete	Merid Mnt-New Geom - PNNL Concrete	Hoop Mnt - New Geom - PNNL Concrete	Shear Mnt - New Geom - PNNL Concrete
Dome	67.73	57	-47.0940	-25.8270	0.7689	-3.5264	-3.5836	0.0311
	105.67	77	-45.2080	-25.7480	0.8255	-1.7951	-2.9161	0.0065
	137.07	97	-44.2540	-23.5030	0.8086	-1.2425	-2.4514	-0.0020
	182.85	117	-43.1890	-19.2540	0.8080	-0.3393	-1.8209	-0.0004
	226.56	137	-43.1380	-15.5560	0.7974	-0.1474	-1.4311	-0.0020
	275.57	157	-43.2110	-10.7440	0.7813	-0.2794	-1.2047	-0.0008
	325.69	177	-44.6660	-6.2264	0.7522	-1.4194	-1.2676	-0.0024
	372.30	197	-47.2500	0.3226	0.7184	-3.1958	-1.7054	-0.0037
	423.43	217	-49.0850	17.0360	0.6755	-2.4894	-2.8765	-0.0190
HAUNCH	468.31	237	-58.3380	56.8800	0.7408	26.6260	-2.3175	-0.1107
	515.31	257	-73.2370	81.8970	0.6105	49.5780	6.1319	-0.1276
	549.73	277	-80.0280	57.8360	0.4864	32.7860	5.3791	-0.0641
	585.82	297	-89.1780	34.8640	0.3447	7.9256	1.1564	-0.0354
WALL	636.37	317	-96.7270	4.5497	0.1584	-5.8775	-1.2336	-0.0220
	685.62	337	-103.7800	-16.8100	-0.0353	-5.0930	-1.1252	-0.0099
	732.72	357	-108.5100	-27.5980	-0.2197	-2.5793	-0.7083	-0.0037
	778.22	377	-112.5100	-33.2160	-0.4002	-2.6870	-0.7302	0.0016
	821.37	397	-115.5900	-33.5150	-0.6116	-2.6298	-0.7138	0.0059
	874.17	417	-114.7900	-24.1470	-0.6758	-6.8471	-1.3779	0.0610
	930.54	437	-118.4500	-10.1170	-0.6072	-9.4047	-1.7355	0.1170
FOOTING	977.63	457	-5.4934	18.2610	1.3031	56.6210	12.9050	3.4744
FLOOR	1019.65	477	-6.7041	20.1930	0.9348	60.7390	8.1395	4.1961
	1060.16	497	-5.7152	17.4940	1.0789	5.5105	4.1102	-0.1077
	1109.70	517	-7.0509	11.9290	0.9400	3.0834	1.2094	-0.1498
	1155.77	537	0.0985	11.6370	0.4257	0.5424	0.2669	-0.0219
	1211.96	557	6.2010	12.8420	0.0555	0.2573	0.1275	-0.0106
	1281.71	577	6.5973	13.0200	0.0226	0.0633	0.0650	0.0108
	1330.56	597	6.9643	13.0300	-0.0072	0.2159	0.1126	-0.0083
	1374.86	617	7.3871	12.7130	-0.0809	0.0231	0.0626	0.0070

Figure A.4. Concrete Forces and Moments, New Geometry, PNNL Concrete

	Path Length	ELEM	Merid Frc-New Geom -New JBolts	Hoop Frc - New Geom -New JBolts	Shear Frc - New Geom - New JBolts	Merid Mnt-New Geom -New JBolts	Hoop Mnt - New Geom -New JBolts	Shear Mnt - New Geom -New JBolts
Dome	67.73	57	-36.9770	-19.1550	0.6321	-2.5629	-2.9233	0.0377
	105.67	77	-35.0810	-19.0330	0.6747	-1.6720	-2.3916	0.0105
	137.07	97	-34.8210	-17.3100	0.6870	-1.1884	-2.0558	-0.0033
	182.85	117	-34.6680	-13.9930	0.6907	-0.4540	-1.5773	-0.0008
	226.56	137	-35.1010	-10.9990	0.6856	-0.3081	-1.2824	-0.0048
	275.57	157	-35.8730	-7.0903	0.6612	-0.0903	-1.0208	-0.0012
	325.69	177	-38.1260	-3.7208	0.6316	-0.5216	-0.9346	-0.0015
	372.30	197	-41.7420	0.6838	0.6072	-2.6867	-1.3928	-0.0023
	423.43	217	-47.4550	12.8250	0.5909	-1.3076	-2.1752	-0.0132
HAUNCH	468.31	237	-54.3110	43.9000	0.6380	21.0860	-1.7855	-0.0799
	515.31	257	-68.9740	62.2470	0.5061	40.8560	5.1723	-0.0941
	549.73	277	-75.3030	42.3880	0.3886	25.7320	4.2277	-0.0465
	585.82	297	-83.3590	23.7960	0.2634	5.0825	0.7182	-0.0237
WALL	636.37	317	-89.6910	1.0535	0.1117	-4.9856	-1.0215	-0.0134
	685.62	337	-95.8180	-13.9420	-0.0369	-3.3987	-0.7667	-0.0053
	732.72	357	-99.9890	-21.5700	-0.1747	-1.4616	-0.4432	-0.0019
	778.22	377	-103.5900	-26.1170	-0.3123	-1.8301	-0.5084	0.0011
	821.37	397	-106.4000	-27.1360	-0.4765	-2.0599	-0.5535	-0.0056
	874.17	417	-103.8300	-20.1600	-0.5067	-5.7498	-1.1551	0.0416
	930.54	437	-108.4700	-9.3642	-0.4351	-8.4554	-1.5559	0.1074
FOOTING	977.63	457	-5.1846	15.8600	1.1450	44.0920	9.9861	2.7121
FLOOR	1019.65	477	-6.6549	17.4900	0.9651	43.3300	5.7823	3.0024
	1060.16	497	-5.4977	15.2930	1.0441	7.7901	3.5287	-0.3396
	1109.70	517	-5.3434	10.6190	0.8256	2.2356	0.7957	-0.1166
	1155.77	537	2.0440	10.3800	0.2743	0.2557	0.1399	-0.0092
	1211.96	557	5.9119	10.9740	0.0276	0.1529	0.0767	-0.0064
	1281.71	577	5.9345	11.0400	0.0174	0.0541	0.0387	0.0080
	1330.56	597	6.2432	11.0630	-0.0048	0.1536	0.0729	-0.0067
	1374.86	617	6.7013	10.8310	-0.0737	0.0420	0.0330	0.0062

Figure A.5. Concrete Forces and Moments, New Geometry, New J-Bolts

	Path Length	ELEM	Merid Frc-No Friction Soil	Hoop Frc - No Friction Soil	Shear Frc - No Friction Soil	Merid Mnt-No Friction Soil	Hoop Mnt - No Friction Soil	Shear Mnt - No Friction Soil
Dome	67.73	57	-71.3430	-65.1610	0.4408	-2.6608	-4.9422	-0.0039
	105.67	77	-72.1280	-61.1070	0.4566	-0.7295	-3.3728	-0.0032
	137.07	97	-70.2330	-57.3630	0.4287	-0.8275	-2.7110	-0.0125
	182.85	117	-66.9190	-51.3470	0.3972	-0.2313	-2.0198	-0.0115
	226.56	137	-64.7840	-46.3510	0.3525	-0.5080	-1.6866	-0.0110
	275.57	157	-61.1040	-39.5710	0.3006	0.3742	-1.2031	-0.0032
	325.69	177	-59.5290	-34.0610	0.1930	-0.7374	-1.1530	-0.0148
	372.30	197	-60.2360	-27.3210	0.1047	-3.7657	-1.8657	-0.0443
	423.43	217	-60.6450	-15.6490	-0.2808	-6.7080	-4.0545	0.0150
HAUNCH	468.31	237	-64.1520	16.5820	-1.5525	20.6970	-5.3834	-0.1454
	515.31	257	-82.4530	54.6040	-1.4805	45.1290	3.9886	-0.7880
	549.73	277	-80.3460	48.5700	-0.9531	33.1170	4.9138	-0.8146
	585.82	297	-78.9960	34.8190	-0.9255	10.7630	0.9968	-0.1920
WALL	636.37	317	-79.3990	10.0180	-0.5864	-4.7484	-1.6301	0.2276
	685.62	337	-80.0470	-8.5541	-0.2805	-4.9451	-1.4419	0.1429
	732.72	357	-80.6450	-17.4210	-0.2644	-2.3005	-0.9245	-0.0199
	778.22	377	-81.1350	-21.7260	-0.3283	-1.7706	-0.8907	-0.0950
	821.37	397	-81.6330	-22.1290	-0.3527	-2.4118	-1.0971	-0.0556
	874.17	417	-79.1890	-14.1960	-0.3933	-5.4147	-1.4881	0.2610
	930.54	437	-82.0460	-2.8276	-0.5169	-6.6986	-1.4317	0.4931
FOOTING	977.63	457	-1.3367	18.7410	1.4038	29.0940	6.0820	2.0451
FLOOR	1019.65	477	-0.1775	20.9650	1.1853	26.7460	2.8921	1.9543
	1060.16	497	-0.4298	18.2110	0.9945	6.9892	2.9142	-0.3410
	1109.70	517	-1.1672	12.5860	0.6791	1.6231	0.5951	-0.0821
	1155.77	537	4.1331	11.5580	0.2064	0.2001	0.1132	-0.0066
	1211.96	557	6.8029	11.8300	0.0260	0.1184	0.0648	-0.0045
	1281.71	577	6.9596	11.9430	0.0075	0.0158	0.0393	0.0051
	1330.56	597	7.2629	11.9560	-0.0153	0.1200	0.0602	-0.0049
	1374.86	617	7.8091	11.7010	-0.0923	0.0245	0.0310	0.0047

Figure A.6. Concrete Forces and Moments, No Soil Friction

	Path Length	ELEM	Merid Frc-No Dome Friction Soil	Hoop Frc - No Dome Friction Soil	Shear Frc - No Dome Friction Soil	Merid Mnt-No Dome Friction Soil	Hoop Mnt - No Dome Friction Soil	Shear Mnt - No Dome Friction Soil
Dome	67.73	57	-70.4390	-63.7420	0.4713	-3.0253	-5.3594	-0.0043
	105.67	77	-70.9180	-59.1570	0.4995	-1.0236	-3.7467	-0.0030
	137.07	97	-68.8610	-54.8370	0.4813	-1.0499	-3.0427	-0.0122
	182.85	117	-65.2960	-47.8620	0.4668	-0.4139	-2.3051	-0.0107
	226.56	137	-62.8160	-41.8970	0.4400	-0.5741	-1.9179	-0.0098
	275.57	157	-58.8830	-33.8420	0.4097	0.2353	-1.4192	-0.0033
	325.69	177	-56.7330	-26.9440	0.3297	-0.6368	-1.3012	-0.0149
	372.30	197	-56.4640	-18.8970	0.2686	-3.0779	-1.8293	-0.0407
	423.43	217	-55.7210	-4.7678	-0.0608	-4.8984	-3.6757	0.0287
HAUNCH	468.31	237	-58.9710	30.8550	-1.2360	22.2290	-4.5754	-0.1118
	515.31	257	-73.4050	65.7930	-1.6825	44.4390	4.1882	-0.7019
	549.73	277	-71.1640	54.9240	-1.9053	32.1250	4.8438	-0.6703
	585.82	297	-72.8530	39.2720	-2.7160	10.2770	1.0504	-0.1586
WALL	636.37	317	-78.3470	13.1070	-2.9626	-4.7384	-1.4951	0.1795
	685.62	337	-82.8970	-6.6261	-2.5798	-4.9300	-1.3606	0.1026
	732.72	357	-86.6030	-16.6480	-2.2570	-2.4412	-0.9121	-0.0513
	778.22	377	-89.5990	-21.7750	-1.9928	-1.9757	-0.9142	-0.1025
	821.37	397	-92.6830	-22.9530	-1.6573	-2.1253	-1.0243	-0.0378
	874.17	417	-91.9000	-16.4140	-1.3261	-5.1569	-1.4224	0.2331
	930.54	437	-96.3280	-6.3441	-1.1690	-7.4740	-1.5703	0.4523
FOOTING	977.63	457	-2.9986	16.8480	1.1213	37.2020	8.2406	2.3122
FLOOR	1019.65	477	-3.4963	18.7090	0.9267	35.8040	4.5554	2.5487
	1060.16	497	-3.0713	16.3080	1.0092	7.2934	3.1943	-0.3090
	1109.70	517	-3.3395	11.3090	0.7625	1.9333	0.6971	-0.1004
	1155.77	537	2.9881	10.7360	0.2510	0.2266	0.1261	-0.0080
	1211.96	557	6.2549	11.1800	0.0312	0.1359	0.0703	-0.0055
	1281.71	577	6.3266	11.2610	0.0158	0.0372	0.0382	0.0067
	1330.56	597	6.6236	11.2740	-0.0074	0.1374	0.0662	-0.0060
	1374.86	617	7.1062	11.0330	-0.0794	0.0346	0.0312	0.0056

Figure A.7. Concrete Forces and Moments, No Dome Friction

	Path Length	ELEM	Merid Frc-No Wall Friction Soil	Hoop Frc - No Wall Friction Soil	Shear Frc - No Wall Friction Soil	Merid Mnt-No Wall Friction Soil	Hoop Mnt - No Wall Friction Soil	Shear Mnt - No Wall Friction Soil
Dome	67.73	57	-36.8140	-26.4420	0.5269	-1.8887	-4.0981	-0.0008
	105.67	77	-37.0620	-23.3100	0.5530	-0.3080	-2.6055	0.0045
	137.07	97	-36.9890	-20.8610	0.4885	-0.3556	-1.9904	-0.0072
	182.85	117	-36.7740	-17.5070	0.4350	-0.0004	-1.4211	-0.0085
	226.56	137	-37.1890	-14.9460	0.3886	-0.0128	-1.1017	-0.0084
	275.57	157	-37.6380	-11.9300	0.3058	0.1944	-0.8313	-0.0086
	325.69	177	-39.6120	-9.6911	0.1695	-0.7296	-0.8490	-0.0148
	372.30	197	-44.3300	-6.6319	0.0911	-3.2740	-1.4668	-0.0218
	423.43	217	-49.0420	3.6004	-0.1261	-5.0133	-3.0721	-0.0168
HAUNCH	468.31	237	-60.2370	32.7980	-0.7394	18.9620	-3.5734	-0.2392
	515.31	257	-77.3670	57.0700	-1.3732	41.2790	4.0654	-1.2352
	549.73	277	-89.8510	40.4840	-0.9687	28.2070	3.8664	-1.1556
	585.82	297	-88.4060	24.3490	-1.3745	7.3799	0.1854	-0.1486
WALL	636.37	317	-88.6770	0.2578	-0.7266	-5.2898	-1.8552	0.3508
	685.62	337	-89.4070	-15.7570	-0.1485	-4.4558	-1.4117	0.1407
	732.72	357	-90.1950	-22.5080	-0.0834	-1.8067	-0.8950	-0.0262
	778.22	377	-90.9070	-25.4190	-0.1268	-1.5639	-0.9122	-0.0907
	821.37	397	-91.7070	-24.7560	-0.1574	-1.9553	-1.0520	-0.0318
	874.17	417	-89.2380	-16.8430	-0.2196	-5.0386	-1.4258	0.2757
	930.54	437	-92.6150	-6.1997	-0.3234	-7.0897	-1.4928	0.4802
FOOTING	977.63	457	-3.3508	16.2780	1.3338	34.3350	7.4155	2.3665
FLOOR	1019.65	477	-2.4117	18.5030	1.2531	32.3930	3.7966	2.3317
	1060.16	497	-2.2367	16.3850	1.0502	7.4430	3.2011	-0.3587
	1109.70	517	-2.6820	11.4760	0.7445	1.8607	0.6760	-0.0957
	1155.77	537	3.4162	10.9240	0.2326	0.2229	0.1248	-0.0076
	1211.96	557	6.5265	11.3870	0.0257	0.1318	0.0703	-0.0052
	1281.71	577	6.6365	11.5080	0.0100	0.0285	0.0402	0.0061
	1330.56	597	6.9439	11.5410	-0.0125	0.1329	0.0658	-0.0056
	1374.86	617	7.4658	11.3090	-0.0864	0.0298	0.0327	0.0052

Figure A.8. Concrete Forces and Moments, No Wall Friction

	Path Length	Merid Frc-Low Soil Friction - Haunch Friction 0.30	Hoop Frc - Low Soil Friction - Haunch Friction 0.30	Shear Frc - Low Soil Friction - Haunch Friction 0.30	Merid Mnt-Low Soil Friction - Haunch Friction 0.30	Hoop Mnt - Low Soil Friction - Haunch Friction 0.30	Shear Mnt - Low Soil Friction - Haunch Friction 0.30
Dome	67.73	-36.8010	-26.5000	0.5191	-1.9890	-4.2147	-0.0015
	105.67	-36.9960	-23.2220	0.5481	-0.3982	-2.7146	0.0043
	137.07	-36.8970	-20.6090	0.4865	-0.4405	-2.0932	-0.0074
	182.85	-36.6450	-16.9600	0.4384	-0.0946	-1.5212	-0.0084
	226.56	-37.0000	-14.0700	0.3976	-0.1012	-1.1979	-0.0081
	275.57	-37.4040	-10.5400	0.3242	0.0881	-0.9291	-0.0082
	325.69	-39.2200	-7.6825	0.2031	-0.7464	-0.9263	-0.0136
	372.30	-43.5810	-3.9391	0.1500	-3.0594	-1.4751	-0.0203
	423.43	-47.7860	7.5060	-0.0173	-4.3576	-2.9656	-0.0156
HAUNCH	468.31	-58.5030	38.6710	-0.5146	19.6170	-3.3442	-0.2093
	515.31	-72.9770	62.8650	-1.1704	40.7670	4.0913	-1.0730
	549.73	-81.8790	45.3760	-1.2891	28.0450	3.9511	-0.9727
	585.82	-82.2690	28.7750	-2.3118	7.5840	0.3717	-0.1229
WALL	636.37	-86.0590	4.1012	-2.3334	-5.1107	-1.6884	0.2936
	685.62	-89.8200	-12.8960	-1.9217	-4.4630	-1.3332	0.1074
	732.72	-93.1140	-20.7410	-1.7149	-1.9783	-0.8798	-0.0516
	778.22	-95.8470	-24.4690	-1.5440	-1.7518	-0.9192	-0.0956
	821.37	-98.7130	-24.6110	-1.3132	-1.8021	-0.9929	-0.0204
	874.17	-97.6310	-17.8820	-1.0924	-4.8836	-1.3755	0.2462
	930.54	-102.2300	-8.2345	-0.9713	-7.6428	-1.5917	0.4438
FOOTING	977.63	-4.3292	15.3840	1.1299	39.9580	8.9177	2.5060
FLOOR	1019.65	-4.7354	17.3080	1.0135	38.6970	4.9843	2.7438
	1060.16	-4.0678	15.2980	1.0468	7.6162	3.3740	-0.3266
	1109.70	-4.1766	10.7070	0.7985	2.0693	0.7436	-0.1080
	1155.77	2.6151	10.4090	0.2635	0.2402	0.1331	-0.0086
	1211.96	6.1309	10.9640	0.0298	0.1436	0.0737	-0.0059
	1281.71	6.1816	11.0540	0.0162	0.0435	0.0391	0.0073
	1330.56	6.4837	11.0810	-0.0067	0.1446	0.0696	-0.0063
	1374.86	6.9595	10.8540	-0.0771	0.0368	0.0326	0.0058

Figure A.9. Concrete Forces and Moments, Low Soil Friction, Haunch Friction = 0.30

	Path Length	Merid Frc-Low Soil Friction - Haunch Friction 0.05	Hoop Frc - Low Soil Friction - Haunch Friction 0.05	Shear Frc - Low Soil Friction - Haunch Friction 0.05	Merid Mnt-Low Soil Friction - Haunch Friction 0.05	Hoop Mnt - Low Soil Friction - Haunch Friction 0.05	Shear Mnt - Low Soil Friction - Haunch Friction 0.05
Dome	67.73	-37.7270	-27.9830	0.4935	-1.8302	-4.1104	-0.0059
	105.67	-38.0700	-24.7950	0.5122	-0.2865	-2.6216	0.0012
	137.07	-37.9660	-22.3150	0.4491	-0.3522	-2.0097	-0.0097
	182.85	-37.6800	-18.8920	0.3946	0.0000	-1.4435	-0.0116
	226.56	-38.0210	-16.2800	0.3467	-0.0266	-1.1287	-0.0105
	275.57	-38.2780	-13.1740	0.2590	0.2856	-0.8312	-0.0110
	325.69	-40.2160	-10.9850	0.1169	-0.6941	-0.8501	-0.0198
	372.30	-45.6630	-7.9750	0.0558	-3.9983	-1.6583	-0.0261
	423.43	-51.3880	3.1844	-0.1635	-7.5677	-3.8901	-0.0786
HAUNCH	468.31	-60.9170	38.4650	-0.6371	13.0170	-6.5245	-0.2703
	515.31	-78.3020	73.3990	-1.6631	49.9600	4.6011	-1.0780
	549.73	-73.7290	59.1610	-1.5890	39.2820	5.7153	-1.1771
	585.82	-74.4930	38.4210	-3.0547	9.3805	0.4943	-0.1447
WALL	636.37	-79.7690	7.6516	-2.9743	-6.8536	-2.1171	0.4154
	685.62	-84.5050	-12.4580	-2.2788	-5.5503	-1.5474	0.1582
	732.72	-88.4700	-21.0160	-1.9574	-2.3068	-0.9345	-0.0516
	778.22	-91.6910	-24.7510	-1.7416	-1.7503	-0.9167	-0.0980
	821.37	-95.0030	-24.7800	-1.4488	-1.8598	-1.0081	-0.0287
	874.17	-94.3190	-17.7550	-1.1674	-5.0396	-1.4150	0.2444
	930.54	-98.9910	-7.7067	-1.0267	-7.5666	-1.5898	0.4594
FOOTING	977.63	-3.7437	15.6620	1.0719	38.4030	8.5172	2.4020
FLOOR	1019.65	-4.1933	17.5530	0.9698	37.0900	4.7220	2.6378
	1060.16	-3.6326	15.4840	1.0293	7.4273	3.2861	-0.3165
	1109.70	-3.8128	10.8260	0.7823	2.0008	0.7221	-0.1044
	1155.77	2.7452	10.4570	0.2586	0.2340	0.1303	-0.0083
	1211.96	6.1381	10.9840	0.0310	0.1402	0.0725	-0.0057
	1281.71	6.1998	11.0780	0.0161	0.0405	0.0390	0.0070
	1330.56	6.4982	11.1050	-0.0067	0.1417	0.0684	-0.0062
	1374.86	6.9722	10.8770	-0.0774	0.0363	0.0321	0.0058

Figure A.10. Concrete Forces and Moments, Low Soil Friction, Haunch Friction = 0.05

	Path Length	Merid Frc-High Friction Soil	Hoop Frc - High Friction Soil	Shear Frc - High Friction Soil	Merid Mnt-High Friction Soil	Hoop Mnt - High Friction Soil
Dome	67.73	-36.7350	-24.7170	0.4585	-2.1627	-4.2690
	105.67	-36.2830	21.7240	0.6636	0.4912	2.8017
	137.07	-36.1070	-19.1040	0.6074	-0.5220	-2.1803
	182.85	-35.8010	-15.2960	0.5980	-0.1833	-1.6093
	226.56	-36.1260	-12.1940	0.5869	-0.1646	-1.2808
	275.57	-36.5030	-8.2783	0.5612	-0.0018	-1.0162
	325.69	-38.1980	-4.9695	0.5001	-0.7444	-0.9954
	372.30	-42.0940	-0.6818	0.4714	-2.7942	-1.4697
	423.43	-46.0040	11.6970	0.4507	-3.6138	-2.8210
HAUNCH	468.31	-56.3160	44.1870	0.3233	20.3790	-2.9595
	515.31	-69.4820	66.8350	-0.3579	40.4150	4.1926
	549.73	-76.8280	47.8060	-1.4427	27.7670	3.9714
	585.82	-80.6270	29.9850	-3.0606	7.4109	0.4337
WALL	636.37	-86.7810	4.6309	-3.0289	-5.1779	-1.6013
	685.62	-91.8870	-12.7740	-2.4365	-4.5121	-1.2550
	732.72	-96.2810	-20.8930	-2.0650	-2.0472	-0.8117
	778.22	-99.6560	-24.6490	-1.7653	-1.8190	-0.8617
	821.37	-103.3700	-24.7720	-1.4069	-1.6543	-0.9046
	874.17	-102.2100	-18.2940	-1.1617	-4.6389	-1.2862
	930.54	-107.2900	-9.2451	-1.1661	-7.8300	-1.6015
FOOTING	977.63	-5.0172	14.8780	1.0641	42.8760	9.7328
FLOOR	1019.65	-5.9335	16.6610	0.9694	41.9530	5.5723
	1060.16	-5.0210	14.7340	1.0639	7.7437	3.4887
	1109.70	-4.9748	10.3140	0.8341	2.1856	0.7823
	1155.77	2.2013	10.1580	0.2802	0.2507	0.1380
	1211.96	5.9432	10.7680	0.0315	0.1500	0.0758
	1281.71	5.9653	10.8430	0.0189	0.0512	0.0388
	1330.56	6.2672	10.8680	-0.0042	0.1510	0.0719
	1374.86	6.7240	10.6430	-0.0730	0.0406	0.0327

Figure A.11. Concrete Forces and Moments, High Soil Friction

AY Primary Tank, Best Estimate Soil (Geomatrix), Gravity Only, Best Estimate Concrete, 422 in. Waste Level at 1.7 SpG, Birth & Death

ANSYS MAXIMUMS BY PATH

PNNL Section No.	Path (in.)	Gravity Hoop Force (kip/ft) AY-BES-BEC B&D	Gravity Meridonal Force (kip/ft) AY-BES-BEC B&D	Gravity -In-Plane Shear Force (kip/ft) AY-BES-BEC B&D	Gravity Hoop Moment (ft*kip/ft) AY-BES-BEC B&D	Gravity Meridonal Moment (ft*kip/ft) AY-BES-BEC B&D	Gravity Through-Wall Shear Force (kip/ft) AY-BES-BEC B&D
2	**67.727**	-63.520	-71.700	-0.015	-4.130	-2.046	0.928
3	**105.668**	-64.540	-76.650	-0.049	-3.077	-1.673	1.443
4	**137.069**	-62.670	-74.850	-0.045	-2.606	-1.574	0.531
6	**182.849**	-59.170	-73.380	-0.078	-1.969	-1.278	0.529
8	**226.563**	-55.230	-72.050	-0.120	-1.868	-2.888	0.192
9	**275.566**	-51.620	-70.740	-0.110	-2.298	-3.776	0.902
11	**325.690**	-40.970	-68.890	-0.101	-3.273	-7.767	0.959
13	**372.305**	-25.830	-66.230	-0.102	-6.652	-8.098	0.170
17	**423.427**	-5.701	-62.620	-0.045	-3.166	-4.220	3.038
20	**468.308**	24.760	-57.560	-0.030	-12.370	-1.008	9.014
22	**515.312**	12.030	-55.710	-0.010	0.157	3.468	3.150
24	**549.725**	6.016	-51.300	-0.009	0.536	3.017	7.769
26	**585.819**	-5.220	-50.750	-0.007	0.157	0.871	3.716
30	**636.369**	-21.160	-51.220	-0.004	-0.610	-3.385	0.836
33	**685.619**	-26.960	-52.110	-0.004	-0.149	-0.824	0.452
35	**732.719**	-30.510	-53.200	-0.004	-0.033	-0.179	0.087
38	**778.219**	-26.610	-54.430	-0.004	-0.122	-0.679	0.167
41	**821.369**	-27.470	-56.120	-0.005	-0.046	-0.255	0.236
43	**874.169**	-17.340	-33.460	0.008	-0.596	-3.295	0.572
46	**930.544**	-31.090	-58.570	-0.194	-1.015	-5.338	1.167
48	**977.629**	-0.235	-10.210	0.253	-2.793	15.690	9.035
51	**1019.647**	4.531	-16.580	1.159	-0.973	15.220	9.735
53	**1060.156**	0.996	-7.530	0.172	0.139	0.513	2.812
55	**1109.695**	5.113	-2.956	0.404	0.056	0.116	0.626
57	**1155.770**	2.521	1.296	-0.047	0.012	0.031	0.162
58	**1211.956**	3.354	3.022	-0.048	0.012	-0.036	0.169
59	**1281.707**	2.653	3.172	-0.066	0.012	0.071	0.186
60	**1330.557**	2.299	2.925	-0.096	-0.007	-0.057	0.072
61	**1374.857**	1.634	3.412	-0.281	0.010	0.020	0.186
62	**1417.007**	6.125	6.505	-0.144	0.085	0.191	0.130

Note: Meridonal/Hoop Forces and Meridonal/Hoop Moments are Reversed in Highlighted Sections.

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AY-2D-NL-BES-BEC Conc Tank Demand Gravity-bd.xls, FM Max

Figure A.12. Concrete Forces and Moments, BES-BEC Birth and Death

AY Primary Tank, Best Estimate Soil, Dead Weight Gravity Input, Nominal High Strength (3.125e6 psi) Tank Concrete, 422 in. Waste Level at 1.7 SpG

ANSYS MAXIMUMS BY RADIUS

M&D J-Bolt Radius No.	Mean J-Bolt Radius	Radius of J-Bolts Included		Average Bolts per Element	Old Geom - Axial Force (kip)	Maximum Axial Force Model Angle	Old Geom - Shear Force1 (kip)	Maximum Shear Force1 Model Angle	Old Geom - Shear Force2 (kip)	Maximum Shear Force2 Model Angle	Old Geom - Shear Force (SRSS)
		min	*max*								
Radius 2	44.72	22.36	67.29	0.55	0.64	180.00	0.65	36.00	3.79	171.00	3.84
Radius 3	89.87	67.29	104.93	0.89	0.24	81.00	0.30	126.00	0.73	171.00	0.79
Radius 4	120.00	104.93	135.98	1.03	0.39	171.00	0.03	36.00	0.82	81.00	0.82
Radius 5	151.97	135.98	181.01	1.97	0.37	171.00	0.01	36.00	0.85	81.00	0.85
Radius 6	210.05	181.01	223.79	2.46	0.42	171.00	0.01	126.00	1.32	81.00	1.32
Radius 7	237.53	223.79	270.98	3.30	0.48	171.00	0.04	36.00	0.61	81.00	0.61
Radius 8	304.43	270.98	318.74	4.04	0.53	171.00	0.04	126.00	0.74	81.00	0.75
Radius 9	333.05	318.74	361.64	4.37	0.57	171.00	0.06	36.00	0.97	171.00	0.97
Radius 10	390.22	361.64	406.24	5.36	0.72	171.00	0.18	36.00	1.13	81.00	1.15
Radius 11	422.26	406.24	431.63	3.60	0.83	171.00	1.39	126.00	5.69	171.00	5.85

Comparisons - J Bolts.xls-for report.xls

Figure A.13. J-Bolt Forces, Old Geometry

AY Primary Tank, Best Estimate Soil, Dead Weight Gravity Input, Nominal High Strength (3.125e6 psi) Tank Concrete, 422 in. Waste Level at 1.7 SpG

ANSYS MAXIMUMS BY RADIUS

M&D J-Bolt Radius No.	Mean J-Bolt Radius	Radius of J-Bolts Included		Average Bolts per Element	New Geom - Axial Force (kip)	Maximum Axial Force Model Angle	New Geom - Shear Force1 (kip)	Maximum Shear Force1 Model Angle	New Geom - Shear Force2 (kip)	Maximum Shear Force2 Model Angle	New Geom - Shear Force (SRSS)
		min	*max*								
Radius 2	44.72	22.36	67.29	0.55	0.55	171.00	0.47	45.00	10.86	0.00	10.87
Radius 3	89.87	67.29	104.93	0.89	0.48	81.00	0.37	126.00	0.43	81.00	0.57
Radius 4	120.00	104.93	135.98	1.03	0.18	180.00	0.02	153.00	1.54	81.00	1.54
Radius 5	151.97	135.98	181.01	1.97	0.49	81.00	0.02	117.00	1.73	81.00	1.73
Radius 6	210.05	181.01	223.79	2.46	0.42	180.00	0.02	126.00	1.00	180.00	1.00
Radius 7	237.53	223.79	270.98	3.30	0.50	171.00	0.01	36.00	1.65	81.00	1.65
Radius 8	304.43	270.98	318.74	4.04	0.60	180.00	0.01	36.00	0.14	180.00	0.14
Radius 9	333.05	318.74	361.64	4.37	0.53	171.00	0.06	36.00	0.68	180.00	0.69
Radius 10	390.22	361.64	406.24	5.36	0.56	180.00	0.17	126.00	0.27	171.00	0.32
Radius 11	422.26	406.24	431.63	3.60	0.70	81.00	1.37	126.00	9.95	180.00	10.04

Comparisons - J Bolts.xls-for report.xls

Figure A.14. J-Bolt Forces, New Geometry

AY Primary Tank, Best Estimate Soil, Dead Weight Gravity Input, PNNL Concrete (5.083e6 psi) Tank Concrete, 422 in. Waste Level at 1.7 SpG

ANSYS MAXIMUMS BY RADIUS

M&D J-Bolt Radius No.	Mean J-Bolt Radius	Radius of J-Bolts Included		Average Bolts per Element	New Geom - PNNL Concrete - Axial Force (kip)	Maximum Axial Force Model Angle	New Geom - PNNL Concrete - Shear Force1	Maximum Shear Force1 Model Angle	New Geom - PNNL Concrete - Shear Force2	Maximum Shear Force2 Model Angle	New Geom - PNNL Concrete - Shear
		min	*max*								
Radius 2	44.72	22.36	67.29	0.55	0.43	171.00	0.37	45.00	5.16	180.00	5.18
Radius 3	89.87	67.29	104.93	0.89	0.35	81.00	0.29	27.00	0.19	9.00	0.35
Radius 4	120.00	104.93	135.98	1.03	0.15	171.00	0.02	153.00	1.22	81.00	1.22
Radius 5	151.97	135.98	181.01	1.97	0.38	81.00	0.01	117.00	1.33	81.00	1.33
Radius 6	210.05	181.01	223.79	2.46	0.36	180.00	0.01	126.00	0.65	180.00	0.65
Radius 7	237.53	223.79	270.98	3.30	0.35	171.00	0.00	36.00	0.85	81.00	0.85
Radius 8	304.43	270.98	318.74	4.04	0.49	180.00	0.01	36.00	0.37	81.00	0.38
Radius 9	333.05	318.74	361.64	4.37	0.29	171.00	0.03	36.00	0.94	180.00	0.94
Radius 10	390.22	361.64	406.24	5.36	0.63	180.00	0.11	126.00	1.27	81.00	1.27
Radius 11	422.26	406.24	431.63	3.60	1.23	81.00	1.03	126.00	10.92	180.00	10.97

Comparisons - J Bolts.xls-for report.xls

Figure A.15. J-Bolt Forces, New Geometry, PNNL Concrete

AY Primary Tank, Best Estimate Soil, Dead Weight Gravity Input, Nominal High Strength (3.125e6 psi) Tank Concrete, Updated J-Bolts, 422 in. Waste

ANSYS MAXIMUMS BY RADIUS

M&D J-Bolt Radius No.	Mean J-Bolt Radius	Radius of J-Bolts Included		Average Bolts per Element	New Geom - New J-Bolts - Axial Force (kip)	Maximum Axial Force Model Angle	New Geom - New J-Bolts - Shear Force1	Maximum Shear Force1 Model Angle	New Geom - New J-Bolts - Shear Force2	Maximum Shear Force2 Model Angle	New Geom - New J-Bolts - Shear
		min	*max*								
Radius 2	44.72	22.36	67.29	0.55	0.97	171.00	0.24	45.00	2.59	180.00	2.60
Radius 3	89.87	67.29	104.93	0.89	0.24	81.00	0.16	36.00	1.39	81.00	1.40
Radius 4	120.00	104.93	135.98	1.03	0.46	171.00	0.03	36.00	1.19	81.00	1.19
Radius 5	151.97	135.98	181.01	1.97	0.40	153.00	0.02	36.00	1.33	81.00	1.33
Radius 6	210.05	181.01	223.79	2.46	0.47	0.00	0.02	126.00	0.95	171.00	0.95
Radius 7	237.53	223.79	270.98	3.30	0.45	171.00	0.04	126.00	0.85	81.00	0.85
Radius 8	304.43	270.98	318.74	4.04	0.48	171.00	0.07	126.00	0.33	180.00	0.34
Radius 9	333.05	318.74	361.64	4.37	0.41	171.00	0.15	126.00	1.27	180.00	1.27
Radius 10	390.22	361.64	406.24	5.36	0.06	171.00	0.33	126.00	1.76	180.00	1.79
Radius 11	422.26	406.24	431.63	3.60	0.78	81.00	0.95	126.00	5.41	180.00	5.49

Comparisons - J Bolts.xls-for report.xls

Figure A.16. J-Bolt Forces, New J-Bolts

AY Primary Tank, Best Estimate Soil, Dead Weight Gravity Input, Nominal High Strength (3.125e6 psi) Tank Concrete, 422 in. Waste Level at 1.7 SpG

ANSYS MAXIMUMS BY RADIUS

M&D J-Bolt Radius No.	Mean J-Bolt Radius	Radius of J-Bolts Included		Average Bolts per Element	No Friction Soil - Axial Force (kip)	Maximum Axial Force Model Angle	No Friction Soil - Shear Force1 (kip)	Maximum Shear Force1 Model Angle	No Friction Soil - Shear Force2 (kip)	Maximum Shear Force2 Model Angle	No Friction Soil - Shear Force
		min	*max*								
Radius 2	44.72	22.36	67.29	0.55	2.50	171.00	0.87	90.00	6.40	180.00	6.46
Radius 3	89.87	67.29	104.93	0.89	0.90	81.00	0.40	27.00	2.69	171.00	2.72
Radius 4	120.00	104.93	135.98	1.03	1.24	171.00	0.34	0.00	0.46	90.00	0.57
Radius 5	151.97	135.98	181.01	1.97	1.27	171.00	0.23	0.00	0.89	9.00	0.92
Radius 6	210.05	181.01	223.79	2.46	1.29	171.00	0.28	0.00	0.29	108.00	0.40
Radius 7	237.53	223.79	270.98	3.30	1.39	0.00	0.24	0.00	0.86	90.00	0.89
Radius 8	304.43	270.98	318.74	4.04	1.51	171.00	0.20	0.00	1.34	99.00	1.35
Radius 9	333.05	318.74	361.64	4.37	1.38	0.00	0.20	0.00	4.18	90.00	4.18
Radius 10	390.22	361.64	406.24	5.36	1.06	0.00	0.39	0.00	3.33	108.00	3.36
Radius 11	422.26	406.24	431.63	3.60	0.41	90.00	1.43	99.00	12.81	0.00	12.89

Comparisons - J Bolts.xls-for report.xls

Figure A.17. J-Bolt Forces, No Soil Friction

AY Primary Tank, Best Estimate Soil, Dead Weight Gravity Input, Nominal High Strength (3.125e6 psi) Tank Concrete, 422 in. Waste Level at 1.7 SpG

ANSYS MAXIMUMS BY RADIUS

M&D J-Bolt Radius No.	Mean J-Bolt Radius	Radius of J-Bolts Included		Average Bolts per Element	No Friciton Dome Soil - Axial Force (kip)	Maximum Axial Force Model Angle	No Friciton Dome Soil - Shear Force1 (kip)	Maximum Shear Force1 Model Angle	No Friciton Dome Soil - Shear Force2 (kip)	Maximum Shear Force2 Model Angle	No Friciton Dome Soil - Shear
		min	*max*								
Radius 2	44.72	22.36	67.29	0.55	2.37	171.00	0.95	90.00	6.55	180.00	6.62
Radius 3	89.87	67.29	104.93	0.89	0.84	81.00	0.42	27.00	2.34	171.00	2.37
Radius 4	120.00	104.93	135.98	1.03	1.16	171.00	0.33	0.00	0.58	90.00	0.67
Radius 5	151.97	135.98	181.01	1.97	1.18	171.00	0.22	0.00	0.93	9.00	0.96
Radius 6	210.05	181.01	223.79	2.46	1.19	171.00	0.26	0.00	0.19	108.00	0.32
Radius 7	237.53	223.79	270.98	3.30	1.26	0.00	0.22	0.00	0.79	90.00	0.82
Radius 8	304.43	270.98	318.74	4.04	1.35	171.00	0.18	0.00	1.11	99.00	1.13
Radius 9	333.05	318.74	361.64	4.37	1.23	0.00	0.19	0.00	3.35	90.00	3.35
Radius 10	390.22	361.64	406.24	5.36	0.99	0.00	0.39	0.00	2.49	108.00	2.52
Radius 11	422.26	406.24	431.63	3.60	0.40	90.00	1.32	99.00	12.77	0.00	12.84

Comparisons - J Bolts.xls-for report.xls

Figure A.18. J-Bolt Forces, No Dome Friction

AY Primary Tank, Best Estimate Soil, Dead Weight Gravity Input, Nominal High Strength (3.125e6 psi) Tank Concrete, 422 in. Waste Level at 1.7 SpG

ANSYS MAXIMUMS BY RADIUS

M&D J-Bolt Radius No.	Mean J-Bolt Radius	Radius of J-Bolts Included		Average Bolts per Element	No Friciton Wall Soil - Axial Force (kip)	Maximum Axial Force Model Angle	No Friciton Wall Soil - Shear Force1 (kip)	Maximum Shear Force1 Model Angle	No Friciton Wall Soil - Shear Force2 (kip)	Maximum Shear Force2 Model Angle	No Friciton Wall Soil - Shear Force
		min	*max*								
Radius 2	44.72	22.36	67.29	0.55	0.96	171.00	0.95	90.00	7.96	180.00	8.02
Radius 3	89.87	67.29	104.93	0.89	0.26	81.00	0.56	27.00	1.57	108.00	1.66
Radius 4	120.00	104.93	135.98	1.03	0.46	180.00	0.14	90.00	1.39	171.00	1.40
Radius 5	151.97	135.98	181.01	1.97	0.50	171.00	0.09	0.00	1.56	171.00	1.56
Radius 6	210.05	181.01	223.79	2.46	0.53	0.00	0.11	0.00	1.08	171.00	1.08
Radius 7	237.53	223.79	270.98	3.30	0.62	171.00	0.10	0.00	1.37	81.00	1.37
Radius 8	304.43	270.98	318.74	4.04	0.68	0.00	0.09	0.00	0.20	171.00	0.22
Radius 9	333.05	318.74	361.64	4.37	0.66	171.00	0.11	27.00	1.72	0.00	1.72
Radius 10	390.22	361.64	406.24	5.36	0.70	180.00	0.26	27.00	0.34	81.00	0.43
Radius 11	422.26	406.24	431.63	3.60	0.61	90.00	1.49	126.00	10.88	162.00	10.99

Comparisons - J Bolts.xls-for report.xls

Figure A.19. J-Bolt Forces, No Wall Friction

AY Primary Tank, Best Estimate Soil, Dead Weight Gravity Input, Nominal High Strength (3.125e6 psi) Tank Concrete, 422 in. Waste Level at 1.7 SpG

ANSYS MAXIMUMS BY RADIUS

M&D J-Bolt Radius No.	Mean J-Bolt Radius	Radius of J-Bolts Included		Average Bolts per Element	Low Friciton Soil - Axial Force (kip)	Maximum Axial Force Model Angle	Low Friciton Soil - Shear Force1 (kip)	Maximum Shear Force1 Model Angle	Low Friciton Soil - Shear Force2 (kip)	Maximum Shear Force2 Model Angle	Low Friciton Soil - Shear Force
		min	*max*								
Radius 2	44.72	22.36	67.29	0.55	0.95	171.00	0.97	90.00	7.98	180.00	8.03
Radius 3	89.87	67.29	104.93	0.89	0.25	81.00	0.55	27.00	1.60	108.00	1.69
Radius 4	120.00	104.93	135.98	1.03	0.46	180.00	0.13	90.00	1.40	171.00	1.40
Radius 5	151.97	135.98	181.01	1.97	0.49	171.00	0.09	0.00	1.55	171.00	1.55
Radius 6	210.05	181.01	223.79	2.46	0.51	0.00	0.10	0.00	1.08	171.00	1.08
Radius 7	237.53	223.79	270.98	3.30	0.60	171.00	0.10	0.00	1.37	81.00	1.37
Radius 8	304.43	270.98	318.74	4.04	0.66	0.00	0.09	0.00	0.26	171.00	0.27
Radius 9	333.05	318.74	361.64	4.37	0.63	171.00	0.11	27.00	1.57	0.00	1.57
Radius 10	390.22	361.64	406.24	5.36	0.69	180.00	0.26	27.00	0.43	81.00	0.50
Radius 11	422.26	406.24	431.63	3.60	0.61	90.00	1.47	126.00	10.81	162.00	10.91

Comparisons - J Bolts.xls-for report.xls

Figure A.20. J-Bolt Forces, Low Soil Friction

AY Primary Tank, Best Estimate Soil, Dead Weight Gravity Input, Nominal High Strength (3.125e6 psi) Tank Concrete, 422 in. Waste Level at 1.7 SpG

ANSYS MAXIMUMS BY RADIUS

M&D J-Bolt Radius No.	Mean J-Bolt Radius	Radius of J-Bolts Included		Average Bolts per Element	Low Friciton Haunch - Axial Force (kip)	Maximum Axial Force Model Angle	Low Friciton Haunch - Shear Force1	Maximum Shear Force1 Model Angle	Low Friciton Haunch - Shear Force2	Maximum Shear Force2 Model Angle	Low Friciton Haunch - Shear Force
		min	*max*								
Radius 2	44.72	22.36	67.29	0.55	1.02	171.00	0.95	90.00	7.91	180.00	7.96
Radius 3	89.87	67.29	104.93	0.89	0.29	81.00	0.54	27.00	1.39	180.00	1.49
Radius 4	120.00	104.93	135.98	1.03	0.50	180.00	0.14	90.00	1.33	171.00	1.34
Radius 5	151.97	135.98	181.01	1.97	0.54	171.00	0.10	0.00	1.52	81.00	1.53
Radius 6	210.05	181.01	223.79	2.46	0.57	0.00	0.12	0.00	1.02	171.00	1.03
Radius 7	237.53	223.79	270.98	3.30	0.67	171.00	0.11	0.00	1.48	81.00	1.48
Radius 8	304.43	270.98	318.74	4.04	0.75	0.00	0.09	0.00	0.22	90.00	0.23
Radius 9	333.05	318.74	361.64	4.37	0.65	171.00	0.15	72.00	2.91	0.00	2.92
Radius 10	390.22	361.64	406.24	5.36	0.48	180.00	0.29	81.00	1.84	90.00	1.86
Radius 11	422.26	406.24	431.63	3.60	0.81	90.00	1.63	99.00	7.99	180.00	8.16

Comparisons - J Bolts.xls-for report.xls

Figure A.21. J-Bolt Forces, Low Soil Friction, Haunch

AY Primary Tank, Best Estimate Soil, Dead Weight Gravity Input, Nominal High Strength (3.125e6 psi) Tank Concrete, 422 in. Waste Level at 1.7 SpG

ANSYS MAXIMUMS BY RADIUS

M&D J-Bolt Radius No.	Mean J-Bolt Radius	Radius of J-Bolts Included		Average Bolts per Element	High Friciton Soil - Axial Force (kip)	Maximum Axial Force Model Angle	High Friciton Soil - Shear Force1 (kip)	Maximum Shear Force1 Model Angle	High Friciton Soil - Shear Force2 (kip)	Maximum Shear Force2 Model Angle	High Friciton Soil - Shear Force
		min	*max*								
Radius 2	44.72	22.36	67.29	0.55	0.86	171.00	0.97	90.00	8.80	180.00	8.85
Radius 3	89.87	67.29	104.93	0.89	0.22	81.00	0.55	27.00	1.79	108.00	1.88
Radius 4	120.00	104.93	135.98	1.03	0.42	180.00	0.13	90.00	1.34	171.00	1.35
Radius 5	151.97	135.98	181.01	1.97	0.46	180.00	0.09	0.00	1.47	81.00	1.47
Radius 6	210.05	181.01	223.79	2.46	0.48	171.00	0.10	0.00	1.03	171.00	1.04
Radius 7	237.53	223.79	270.98	3.30	0.55	171.00	0.09	0.00	1.27	81.00	1.28
Radius 8	304.43	270.98	318.74	4.04	0.60	0.00	0.08	0.00	0.27	180.00	0.29
Radius 9	333.05	318.74	361.64	4.37	0.58	171.00	0.11	27.00	1.29	0.00	1.30
Radius 10	390.22	361.64	406.24	5.36	0.67	180.00	0.28	27.00	0.58	81.00	0.64
Radius 11	422.26	406.24	431.63	3.60	0.61	90.00	1.48	126.00	10.79	162.00	10.89

Comparisons - J Bolts.xls-for report.xls

Figure A.22. J-Bolt Forces, High Soil Friction

AY Primary Tank, Best Estimate Soil, Dead Weight Gravity Input, Nominal High Strength (3.125e6 psi) Tank Concrete, 422 in. Waste Level at 1.7 SpG

ANSYS MAXIMUMS BY RADIUS

M&D J-Bolt Radius No.	Mean J-Bolt Radius	Radius of J-Bolts Included		Average Bolts per Element	B&D - Axial Force (kip)	Maximum Axial Force Model Angle	B&D - Shear Force1 (kip)	Maximum Shear Force1 Model Angle	B&D - Shear Force2 (kip)	Maximum Shear Force2 Model Angle	B&D - Shear Force (SRSS) (kip)
		min	*max*								
Radius 2	44.72	22.36	67.29	0.55	1.35	171.00	0.86	0.00	3.14	180.00	3.25
Radius 3	89.87	67.29	104.93	0.89	1.04	81.00	0.05	27.00	1.96	99.00	1.96
Radius 4	120.00	104.93	135.98	1.03	0.19	171.00	0.03	162.00	0.94	171.00	0.94
Radius 5	151.97	135.98	181.01	1.97	1.01	180.00	0.02	162.00	1.36	171.00	1.36
Radius 6	210.05	181.01	223.79	2.46	0.73	162.00	0.02	162.00	0.31	81.00	0.31
Radius 7	237.53	223.79	270.98	3.30	0.80	171.00	0.03	0.00	1.24	171.00	1.24
Radius 8	304.43	270.98	318.74	4.04	0.94	180.00	0.03	0.00	1.60	36.00	1.60
Radius 9	333.05	318.74	361.64	4.37	0.74	171.00	0.01	144.00	1.18	9.00	1.18
Radius 10	390.22	361.64	406.24	5.36	0.97	153.00	0.09	162.00	0.48	171.00	0.49
Radius 11	422.26	406.24	431.63	3.60	0.57	99.00	0.23	162.00	14.29	180.00	14.30

Comparisons - J Bolts.xls-for report.xls

Figure A.23. J-Bolt Forces, Soil Birth and Death

Primary Tank Component Stress Results
Old Geom

ANSYS MAXIMUMS BY PATH

M&D Starting M&D Element No.	Path	Shell Top Surface (outside - away from waste)					
		Phase II 2D HV Seismic Hoop Stress (kip/ft^2)	Phase II 2D HV Seismic Meridional Stress (kip/ft^2)	Phase II 2D HV Seismic Thru-Thickness Stress (kip/ft^2)	Phase II 2D HV Seismic In-Plane Shear Stress (kip/ft^2)	Phase II 2D HV Seismic In-Plane Shear Force Stress (kip/ft^2)	Phase II 2D HV Seismic Thru-Thickness Shear Stress (kip/ft^2)
761	**89.72**	157.90	211.00	0.00	28.90	0.00	0.00
781	**127.48**	173.90	230.00	0.00	29.46	0.00	0.00
801	**158.68**	155.80	181.60	0.00	29.82	0.00	0.00
821	**204.14**	172.90	275.40	0.00	29.78	0.00	0.00
841	**247.52**	116.30	131.50	0.00	29.59	0.00	0.00
861	**296.07**	143.70	303.00	0.00	28.77	0.00	0.00
881	**345.70**	71.96	148.60	0.00	27.86	0.00	0.00
901	**391.94**	43.64	222.90	0.00	26.36	0.00	0.00
921	**441.79**	34.11	361.40	0.00	20.99	0.00	0.00
941	**466.30**	429.80	27.45	0.00	6.39	0.00	0.00
961	**492.29**	564.60	97.65	0.00	3.89	0.00	0.00
981	**529.85**	336.40	92.74	0.00	2.66	0.00	0.00
1001	**582.01**	560.20	48.30	0.00	1.92	0.00	0.00
1021	**650.76**	1058.00	33.00	0.00	1.87	0.00	0.00
1041	**718.76**	1362.00	37.37	0.00	1.79	0.00	0.00
1061	**786.76**	1411.00	26.76	0.00	1.13	0.00	0.00
1081	**844.76**	1492.00	88.96	0.00	1.03	0.00	0.00
1101	**892.76**	1840.00	132.10	0.00	1.07	0.00	0.00
1121	**921.35**	1129.00	133.00	0.00	0.21	0.00	0.00
1141	**930.54**	110.60	211.50	0.00	21.15	0.00	0.00
1161	**949.13**	232.70	167.30	0.00	0.00	35.79	0.00
1181	**989.13**	274.10	310.90	0.00	0.00	42.14	0.00
1201	**1055.28**	243.80	224.10	0.00	0.00	44.82	0.00
1221	**1125.03**	256.70	253.20	0.00	0.00	43.46	0.00
1241	**1173.88**	267.70	303.10	0.00	0.00	44.66	0.00
1261	**1218.18**	243.40	235.00	0.00	0.00	42.66	0.00
1281	**1260.33**	232.90	293.50	0.00	0.00	42.76	0.00
1281	**1307.28**	0.00	0.00	0.00	0.00	0.00	0.00

Note 1: Meridonal, Hoop, and Shear Stresses are Reversed in Highlighted Sections (Floor)
Note 2: Underlined results indicate a reversal of inside (botttom) and outside (top) surfaces in the floor

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Comparisons - Pri Tank-for report.xls, Stress Max-2

Figure A.24. Primary Tank Stresses, Shell Top, Old Geometry

Primary Tank Component Stress Results
Old Geom

ANSYS MAXIMUMS BY PATH

M&D Starting M&D Element No.	Path	Shell Mid-Plane					
		Phase II 2D HV Seismic Hoop Stress (kip/ft^2)	Phase II 2D HV Seismic Meridional Stress (kip/ft^2)	Phase II 2D HV Seismic Thru-Thickness Stress (kip/ft^2)	Phase II 2D HV Seismic In-Plane Shear Stress (kip/ft^2)	Phase II 2D HV Seismic In-Plane Shear Force Stress (kip/ft^2)	Phase II 2D HV Seismic Thru-Thickness Shear Stress (kip/ft^2)
761	**89.72**	154.60	197.30	0.00	28.88	0.00	0.00
781	**127.48**	169.90	225.10	0.00	29.46	0.00	0.00
801	**158.68**	169.40	225.00	0.00	29.82	0.00	0.00
821	**204.14**	159.00	231.30	0.00	29.79	0.00	0.00
841	**247.52**	151.50	250.80	0.00	29.60	0.00	0.00
861	**296.07**	127.10	248.20	0.00	28.77	0.00	0.00
881	**345.70**	101.40	249.70	0.00	27.87	0.00	0.00
901	**391.94**	36.87	200.50	0.00	26.36	0.00	0.00
921	**441.79**	80.31	214.40	0.00	21.01	0.00	0.00
941	**466.30**	425.50	81.33	0.00	6.50	0.00	0.00
961	**492.29**	518.00	57.84	0.00	3.74	0.00	0.00
981	**529.85**	348.90	51.26	0.00	2.64	0.00	0.00
1001	**582.01**	562.80	39.96	0.00	1.90	0.00	0.00
1021	**650.76**	1055.00	42.56	0.00	1.87	0.00	0.00
1041	**718.76**	1359.00	45.37	0.00	1.79	0.00	0.00
1061	**786.76**	1409.00	32.56	0.00	1.11	0.00	0.00
1081	**844.76**	1508.00	35.15	0.00	1.01	0.00	0.00
1101	**892.76**	1790.00	32.48	0.00	1.00	0.00	0.00
1121	**921.35**	1081.00	34.53	0.00	0.87	0.00	0.00
1141	**930.54**	184.80	236.20	0.00	17.55	0.00	0.00
1161	**949.13**	261.40	258.70	0.00	0.00	31.54	0.00
1181	**989.13**	258.40	257.00	0.00	0.00	39.13	0.00
1201	**1055.28**	257.20	257.50	0.00	0.00	42.96	0.00
1221	**1125.03**	262.70	272.80	0.00	0.00	42.97	0.00
1241	**1173.88**	262.30	280.80	0.00	0.00	43.41	0.00
1261	**1218.18**	255.60	274.90	0.00	0.00	42.65	0.00
1281	**1260.33**	228.90	278.90	0.00	0.00	41.94	0.00
1281	**1307.28**	0.00	0.00	0.00	0.00	0.00	0.00

Note 1: Meridonal, Hoop, and Shear Stresses are Reversed in Highlighted Sections (Floor)
Note 2: Underlined results indicate a reversal of inside (botttom) and outside (top) surfaces in the floor

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Comparisons - Pri Tank-for report.xls, Stress Max-2

Figure A.25. Primary Tank Stresses, Shell Middle, Old Geometry

Primary Tank Component Stress Results
Old Geom

ANSYS MAXIMUMS BY PATH

M&D Starting M&D Element No.	Path	Shell Bottom Surface (inside - waste side)					
		Phase II 2D HV Seismic Hoop Stress (kip/ft^2)	Phase II 2D HV Seismic Meridional Stress (kip/ft^2)	Phase II 2D HV Seismic Thru-Thickness Stress (kip/ft^2)	Phase II 2D HV Seismic In-Plane Shear Stress (kip/ft^2)	Phase II 2D HV Seismic In-Plane Shear Force Stress (kip/ft^2)	Phase II 2D HV Seismic Thru-Thickness Shear Stress (kip/ft^2)
761	**89.72**	151.20	183.60	0.00	28.85	0.00	0.00
781	**127.48**	165.90	220.20	0.00	29.45	0.00	0.00
801	**158.68**	183.10	268.50	0.00	29.83	0.00	0.00
821	**204.14**	145.10	187.30	0.00	29.79	0.00	0.00
841	**247.52**	186.70	370.20	0.00	29.60	0.00	0.00
861	**296.07**	110.60	193.40	0.00	28.77	0.00	0.00
881	**345.70**	130.80	350.80	0.00	27.87	0.00	0.00
901	**391.94**	30.11	178.10	0.00	26.37	0.00	0.00
921	**441.79**	126.50	67.37	0.00	21.04	0.00	0.00
941	**466.30**	421.30	135.20	0.00	6.62	0.00	0.00
961	**492.29**	471.30	213.20	0.00	3.59	0.00	0.00
981	**529.85**	361.40	10.27	0.00	2.63	0.00	0.00
1001	**582.01**	565.40	31.62	0.00	1.90	0.00	0.00
1021	**650.76**	1053.00	52.16	0.00	1.88	0.00	0.00
1041	**718.76**	1357.00	53.38	0.00	1.79	0.00	0.00
1061	**786.76**	1408.00	38.57	0.00	1.09	0.00	0.00
1081	**844.76**	1524.00	19.02	0.00	1.00	0.00	0.00
1101	**892.76**	1740.00	196.60	0.00	0.93	0.00	0.00
1121	**921.35**	1033.00	201.80	0.00	1.63	0.00	0.00
1141	**930.54**	259.00	260.80	0.00	16.52	0.00	0.00
1161	**949.13**	290.10	350.20	0.00	0.00	37.04	0.00
1181	**989.13**	242.70	203.00	0.00	0.00	42.01	0.00
1201	**1055.28**	270.60	290.90	0.00	0.00	43.97	0.00
1221	**1125.03**	268.70	292.50	0.00	0.00	44.02	0.00
1241	**1173.88**	256.90	258.50	0.00	0.00	42.86	0.00
1261	**1218.18**	267.90	314.80	0.00	0.00	44.74	0.00
1281	**1260.33**	225.40	264.20	0.00	0.00	41.12	0.00
1281	**1307.28**	0.00	0.00	0.00	0.00	0.00	0.00

Note 1: Meridonal, Hoop, and Shear Stresses are Reversed in Highlighted Sections (Floor)
Note 2: Underlined results indicate a reversal of inside (botttom) and outside (top) surfaces in the floor

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Comparisons - Pri Tank-for report.xls, Stress Max-2

Figure A.26. Primary Tank Stresses, Shell Bottom, Old Geometry

Primary Tank Component Stress Results

Linear Model

ANSYS MAXIMUMS BY PATH

M&D Starting M&D Element No.	Path	Shell Top Surface (outside - away from waste)					
		Phase II 2D HV Seismic Hoop Stress (kip/ft^2)	Phase II 2D HV Seismic Meridional Stress (kip/ft^2)	Phase II 2D HV Seismic Thru-Thickness Stress (kip/ft^2)	Phase II 2D HV Seismic In-Plane Shear Stress (kip/ft^2)	Phase II 2D HV Seismic In-Plane Shear Force Stress (kip/ft^2)	Phase II 2D HV Seismic Thru-Thickness Shear Stress (kip/ft^2)
761	**89.72**	164.00	216.70	0.00	29.03	1.62	0.04
781	**127.48**	139.00	220.60	0.00	29.80	3.42	0.00
801	**158.68**	177.10	264.00	0.00	30.00	2.89	0.02
821	**204.14**	124.10	252.40	0.00	29.81	0.63	0.02
841	**247.52**	158.20	290.40	0.00	29.71	0.21	0.04
861	**296.07**	85.64	270.70	0.00	28.73	0.49	0.03
881	**345.70**	101.50	277.10	0.00	27.85	2.46	0.06
901	**391.94**	47.96	206.00	0.00	26.38	0.70	0.06
921	**441.79**	100.80	197.80	0.00	21.41	1.80	0.07
941	**466.30**	306.10	402.50	0.00	5.49	16.83	0.47
961	**492.29**	260.00	118.00	0.00	3.20	0.18	0.27
981	**529.85**	348.10	130.40	0.00	1.09	7.59	0.11
1001	**582.01**	552.40	6.17	0.00	0.47	8.24	0.02
1021	**650.76**	1070.00	9.73	0.00	0.86	2.40	0.01
1041	**718.76**	1690.00	83.54	0.00	0.70	10.91	0.01
1061	**786.76**	1254.00	134.40	0.00	0.83	4.15	0.02
1081	**844.76**	2042.00	221.80	0.00	0.45	2.83	0.06
1101	**892.76**	1300.00	64.40	0.00	1.42	5.52	0.10
1121	**921.35**	1306.00	1768.00	0.00	4.83	36.09	1.00
1141	**930.54**	359.20	95.04	0.00	9.60	52.04	0.98
1161	**949.13**	52.89	423.60	0.00	1.54	47.26	17.86
1181	**989.13**	339.90	607.10	0.00	0.66	47.84	8.45
1201	**1055.28**	166.80	71.23	0.00	0.46	36.04	5.86
1221	**1125.03**	262.20	417.80	0.00	0.74	43.23	9.36
1241	**1173.88**	116.70	184.90	0.00	1.31	45.62	16.35
1261	**1218.18**	267.60	450.00	0.00	1.26	45.39	14.93
1281	**1260.33**	117.60	187.60	0.00	2.88	45.70	28.46
1281	**1307.28**	0.00	0.00	0.00	0.00	0.00	0.00

Note 1: Meridonal, Hoop, and Shear Stresses are Reversed in Highlighted Sections (Floor)
Note 2: Underlined results indicate a reversal of inside (botttom) and outside (top) surfaces in the floor

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Comparisons - Pri Tank-for report.xls, Stress Max-3

Figure A.27. Primary Tank Stresses, Shell Top, New Geometry

Primary Tank Component Stress Results

Linear Model

ANSYS MAXIMUMS BY PATH

M&D Starting M&D Element No.	Path	Shell Mid-Plane					
		Phase II 2D HV Seismic Hoop Stress (kip/ft^2)	Phase II 2D HV Seismic Meridional Stress (kip/ft^2)	Phase II 2D HV Seismic Thru-Thickness Stress (kip/ft^2)	Phase II 2D HV Seismic In-Plane Shear Stress (kip/ft^2)	Phase II 2D HV Seismic In-Plane Shear Force Stress (kip/ft^2)	Phase II 2D HV Seismic Thru-Thickness Shear Stress (kip/ft^2)
761	**89.72**	154.00	198.60	0.00	28.90	1.62	0.04
781	**127.48**	145.20	236.00	0.00	29.78	3.42	0.00
801	**158.68**	165.80	244.20	0.00	30.02	2.89	0.02
821	**204.14**	128.00	262.80	0.00	29.83	0.63	0.02
841	**247.52**	145.20	265.90	0.00	29.71	0.21	0.04
861	**296.07**	89.09	280.10	0.00	28.77	0.49	0.03
881	**345.70**	91.86	256.90	0.00	27.83	2.46	0.06
901	**391.94**	46.79	212.50	0.00	26.43	0.70	0.06
921	**441.79**	106.90	180.50	0.00	21.46	1.80	0.07
941	**466.30**	194.70	46.77	0.00	5.86	16.83	0.47
961	**492.29**	213.80	43.22	0.00	3.07	0.18	0.27
981	**529.85**	319.90	36.07	0.00	0.96	7.59	0.11
1001	**582.01**	557.90	25.03	0.00	0.54	8.24	0.02
1021	**650.76**	1074.00	22.30	0.00	1.03	2.40	0.01
1041	**718.76**	1670.00	20.14	0.00	0.72	10.91	0.01
1061	**786.76**	1295.00	11.16	0.00	1.23	4.15	0.02
1081	**844.76**	1975.00	8.78	0.00	0.55	2.83	0.06
1101	**892.76**	1318.00	6.16	0.00	2.35	5.52	0.10
1121	**921.35**	791.40	21.20	0.00	6.71	36.09	1.00
1141	**930.54**	393.30	136.20	0.00	10.72	52.04	0.98
1161	**949.13**	235.80	206.60	0.00	1.54	14.55	17.86
1181	**989.13**	255.40	312.40	0.00	0.66	31.33	8.45
1201	**1055.28**	218.60	239.10	0.00	0.46	31.31	5.86
1221	**1125.03**	199.00	193.70	0.00	0.74	31.21	9.36
1241	**1173.88**	204.40	209.90	0.00	1.31	31.05	16.35
1261	**1218.18**	202.90	214.50	0.00	1.26	31.47	14.93
1281	**1260.33**	197.90	215.20	0.00	2.88	31.92	28.46
1281	**1307.28**	0.00	0.00	0.00	0.00	0.00	0.00

Note 1: Meridonal, Hoop, and Shear Stresses are Reversed in Highlighted Sections (Floor)
Note 2: Underlined results indicate a reversal of inside (botttom) and outside (top) surfaces in the floor

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Comparisons - Pri Tank-for report.xls, Stress Max-3

Figure A.28. Primary Tank Stresses, Shell Middle, New Geometry

Primary Tank Component Stress Results

Linear Model

ANSYS MAXIMUMS BY PATH

M&D Starting M&D Element No.	Path	Shell Bottom Surface (inside - waste side)					
		Phase II 2D HV Seismic Hoop Stress (kip/ft^2)	Phase II 2D HV Seismic Meridional Stress (kip/ft^2)	Phase II 2D HV Seismic Thru-Thickness Stress (kip/ft^2)	Phase II 2D HV Seismic In-Plane Shear Stress (kip/ft^2)	Phase II 2D HV Seismic In-Plane Shear Force Stress (kip/ft^2)	Phase II 2D HV Seismic Thru-Thickness Shear Stress (kip/ft^2)
761	**89.72**	143.90	180.60	0.00	28.76	1.62	0.04
781	**127.48**	151.30	251.50	0.00	29.75	3.42	0.00
801	**158.68**	154.50	224.50	0.00	30.04	2.89	0.02
821	**204.14**	131.90	273.30	0.00	29.84	0.63	0.02
841	**247.52**	132.10	241.60	0.00	29.71	0.21	0.04
861	**296.07**	92.54	289.40	0.00	28.81	0.49	0.03
881	**345.70**	82.21	236.80	0.00	27.82	2.46	0.06
901	**391.94**	45.62	219.00	0.00	26.48	0.70	0.06
921	**441.79**	113.00	163.20	0.00	21.51	1.80	0.07
941	**466.30**	83.32	326.30	0.00	6.23	16.83	0.47
961	**492.29**	167.60	198.10	0.00	2.94	0.18	0.27
981	**529.85**	291.70	63.47	0.00	0.84	7.59	0.11
1001	**582.01**	564.30	43.88	0.00	0.60	8.24	0.02
1021	**650.76**	1077.00	35.07	0.00	1.19	2.40	0.01
1041	**718.76**	1652.00	48.09	0.00	0.73	10.91	0.01
1061	**786.76**	1339.00	152.30	0.00	1.62	4.15	0.02
1081	**844.76**	1913.00	206.40	0.00	0.72	2.83	0.06
1101	**892.76**	1338.00	72.47	0.00	3.49	5.52	0.10
1121	**921.35**	285.00	1738.00	0.00	8.59	36.09	1.00
1141	**930.54**	441.00	350.30	0.00	11.84	52.04	0.98
1161	**949.13**	420.90	827.40	0.00	1.54	48.05	17.86
1181	**989.13**	170.80	34.90	0.00	0.66	35.11	8.45
1201	**1055.28**	270.50	417.80	0.00	0.46	41.52	5.86
1221	**1125.03**	136.90	92.09	0.00	0.74	41.85	9.36
1241	**1173.88**	298.30	537.50	0.00	1.31	49.73	16.35
1261	**1218.18**	143.10	89.25	0.00	1.26	41.47	14.93
1281	**1260.33**	291.20	548.30	0.00	2.88	51.56	28.46
1281	**1307.28**	0.00	0.00	0.00	0.00	0.00	0.00

Note 1: Meridonal, Hoop, and Shear Stresses are Reversed in Highlighted Sections (Floor)
Note 2: Underlined results indicate a reversal of inside (botttom) and outside (top) surfaces in the floor

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Comparisons - Pri Tank-for report.xls, Stress Max-3

Figure A.29. Primary Tank Stresses, Shell Bottom, New Geometry

Primary Tank Component Stress Results

Linear Model - PNNL Concrete

ANSYS MAXIMUMS BY PATH

M&D Starting M&D Element No.	Path	Shell Top Surface (outside - away from waste)					
		Phase II 2D HV Seismic Hoop Stress (kip/ft^2)	Phase II 2D HV Seismic Meridional Stress (kip/ft^2)	Phase II 2D HV Seismic Thru-Thickness Stress (kip/ft^2)	Phase II 2D HV Seismic In-Plane Shear Stress (kip/ft^2)	Phase II 2D HV Seismic In-Plane Shear Force Stress (kip/ft^2)	Phase II 2D HV Seismic Thru-Thickness Shear Stress (kip/ft^2)
761	**89.72**	124.60	169.50	0.00	21.00	1.22	0.03
781	**127.48**	118.00	182.30	0.00	21.25	2.50	0.00
801	**158.68**	137.80	202.00	0.00	21.55	2.06	0.01
821	**204.14**	110.20	205.20	0.00	21.51	0.29	0.01
841	**247.52**	124.30	218.20	0.00	21.54	0.70	0.03
861	**296.07**	82.98	205.80	0.00	20.95	0.77	0.02
881	**345.70**	72.21	186.10	0.00	20.48	2.93	0.04
901	**391.94**	21.09	143.60	0.00	19.72	1.27	0.05
921	**441.79**	90.53	155.30	0.00	16.55	3.66	0.05
941	**466.30**	241.10	445.60	0.00	3.76	25.26	0.35
961	**492.29**	424.20	117.30	0.00	2.14	0.23	0.20
981	**529.85**	275.00	165.10	0.00	0.69	9.09	0.08
1001	**582.01**	555.40	28.19	0.00	0.47	8.01	0.01
1021	**650.76**	1067.00	27.72	0.00	0.73	2.50	0.01
1041	**718.76**	1691.00	103.20	0.00	0.63	10.88	0.01
1061	**786.76**	1253.00	121.80	0.00	0.74	4.17	0.02
1081	**844.76**	2046.00	236.80	0.00	0.36	2.66	0.06
1101	**892.76**	1265.00	36.42	0.00	1.13	6.25	0.09
1121	**921.35**	1127.00	1551.00	0.00	3.88	36.40	0.85
1141	**930.54**	348.90	221.30	0.00	7.89	32.45	0.75
1161	**949.13**	49.68	312.80	0.00	1.15	36.06	13.34
1181	**989.13**	266.50	466.30	0.00	0.50	36.37	6.34
1201	**1055.28**	141.20	88.09	0.00	0.34	26.03	4.41
1221	**1125.03**	198.50	316.10	0.00	0.56	33.20	7.07
1241	**1173.88**	90.53	133.70	0.00	0.99	34.59	12.39
1261	**1218.18**	200.30	334.80	0.00	0.96	34.51	11.36
1281	**1260.33**	91.58	133.90	0.00	2.21	34.65	21.73
1281	**1307.28**	0.00	0.00	0.00	0.00	0.00	0.00

Note 1: Meridonal, Hoop, and Shear Stresses are Reversed in Highlighted Sections (Floor)
Note 2: Underlined results indicate a reversal of inside (botttom) and outside (top) surfaces in the floor

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Comparisons - Pri Tank-for report.xls, Stress Max-3a

Figure A.30. Primary Tank Stresses, Shell Top, New Geometry, PNNL Concrete

Primary Tank Component Stress Results

Linear Model - PNNL Concrete

ANSYS MAXIMUMS BY PATH

M&D Starting M&D Element No.	Path	Shell Mid-Plane					
		Phase II 2D HV Seismic Hoop Stress (kip/ft^2)	Phase II 2D HV Seismic Meridional Stress (kip/ft^2)	Phase II 2D HV Seismic Thru-Thickness Stress (kip/ft^2)	Phase II 2D HV Seismic In-Plane Shear Stress (kip/ft^2)	Phase II 2D HV Seismic In-Plane Shear Force Stress (kip/ft^2)	Phase II 2D HV Seismic Thru-Thickness Shear Stress (kip/ft^2)
761	**89.72**	118.80	162.40	0.00	20.89	1.22	0.03
781	**127.48**	120.40	186.50	0.00	21.24	2.50	0.00
801	**158.68**	131.50	194.10	0.00	21.56	2.06	0.01
821	**204.14**	112.00	209.20	0.00	21.52	0.29	0.01
841	**247.52**	117.60	209.20	0.00	21.54	0.70	0.03
861	**296.07**	84.12	208.20	0.00	20.98	0.77	0.02
881	**345.70**	69.00	183.70	0.00	20.47	2.93	0.04
901	**391.94**	22.91	139.80	0.00	19.76	1.27	0.05
921	**441.79**	88.56	163.60	0.00	16.59	3.66	0.05
941	**466.30**	126.20	79.64	0.00	4.02	25.26	0.35
961	**492.29**	369.30	72.03	0.00	2.04	0.23	0.20
981	**529.85**	243.90	61.33	0.00	0.62	9.09	0.08
1001	**582.01**	560.10	44.01	0.00	0.53	8.01	0.01
1021	**650.76**	1071.00	41.41	0.00	0.89	2.50	0.01
1041	**718.76**	1671.00	39.25	0.00	0.60	10.88	0.01
1061	**786.76**	1294.00	23.90	0.00	1.14	4.17	0.02
1081	**844.76**	1979.00	21.67	0.00	0.50	2.66	0.06
1101	**892.76**	1278.00	17.02	0.00	2.04	6.25	0.09
1121	**921.35**	680.60	32.76	0.00	5.29	36.40	0.85
1141	**930.54**	325.00	159.50	0.00	8.76	32.45	0.75
1161	**949.13**	184.00	149.80	0.00	1.15	12.18	13.34
1181	**989.13**	204.90	249.40	0.00	0.50	24.18	6.34
1201	**1055.28**	179.60	211.80	0.00	0.34	25.51	4.41
1221	**1125.03**	152.60	151.40	0.00	0.56	23.85	7.07
1241	**1173.88**	154.40	158.70	0.00	0.99	23.98	12.39
1261	**1218.18**	153.10	161.90	0.00	0.96	24.21	11.36
1281	**1260.33**	149.60	163.50	0.00	2.21	24.75	21.73
1281	**1307.28**	0.00	0.00	0.00	0.00	0.00	0.00

Note 1: Meridonal, Hoop, and Shear Stresses are Reversed in Highlighted Sections (Floor)
Note 2: Underlined results indicate a reversal of inside (botttom) and outside (top) surfaces in the floor

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Comparisons - Pri Tank-for report.xls, Stress Max-3a

Figure A.31. Primary Tank Stresses, Shell Middle, New Geometry, PNNL Concrete

Primary Tank Component Stress Results

Linear Model - PNNL Concrete

ANSYS MAXIMUMS BY PATH

M&D Starting M&D Element No.	Path	Shell Bottom Surface (inside - waste side)					
		Phase II 2D HV Seismic Hoop Stress (kip/ft^2)	Phase II 2D HV Seismic Meridional Stress (kip/ft^2)	Phase II 2D HV Seismic Thru-Thickness Stress (kip/ft^2)	Phase II 2D HV Seismic In-Plane Shear Stress (kip/ft^2)	Phase II 2D HV Seismic In-Plane Shear Force Stress (kip/ft^2)	Phase II 2D HV Seismic Thru-Thickness Shear Stress (kip/ft^2)
761	**89.72**	113.00	155.30	0.00	20.79	1.22	0.03
781	**127.48**	122.70	190.80	0.00	21.22	2.50	0.00
801	**158.68**	125.20	186.30	0.00	21.57	2.06	0.01
821	**204.14**	113.70	213.30	0.00	21.53	0.29	0.01
841	**247.52**	110.80	200.30	0.00	21.54	0.70	0.03
861	**296.07**	85.25	210.70	0.00	21.00	0.77	0.02
881	**345.70**	65.79	181.40	0.00	20.46	2.93	0.04
901	**391.94**	24.72	136.10	0.00	19.80	1.27	0.05
921	**441.79**	86.60	171.80	0.00	16.64	3.66	0.05
941	**466.30**	26.39	298.40	0.00	4.28	25.26	0.35
961	**492.29**	314.40	256.50	0.00	1.94	0.23	0.20
981	**529.85**	212.80	46.25	0.00	0.56	9.09	0.08
1001	**582.01**	565.50	59.83	0.00	0.59	8.01	0.01
1021	**650.76**	1075.00	55.24	0.00	1.06	2.50	0.01
1041	**718.76**	1653.00	28.54	0.00	0.62	10.88	0.01
1061	**786.76**	1339.00	165.90	0.00	1.53	4.17	0.02
1081	**844.76**	1916.00	195.00	0.00	0.64	2.66	0.06
1101	**892.76**	1294.00	66.70	0.00	3.11	6.25	0.09
1121	**921.35**	240.90	1495.00	0.00	6.70	36.40	0.85
1141	**930.54**	311.80	160.30	0.00	9.62	32.45	0.75
1161	**949.13**	320.10	607.20	0.00	1.15	35.16	13.34
1181	**989.13**	143.30	46.37	0.00	0.50	26.21	6.34
1201	**1055.28**	218.00	344.40	0.00	0.34	33.09	4.41
1221	**1125.03**	107.40	60.32	0.00	0.56	31.62	7.07
1241	**1173.88**	223.20	399.80	0.00	0.99	37.79	12.39
1261	**1218.18**	109.90	63.40	0.00	0.96	31.54	11.36
1281	**1260.33**	217.80	408.50	0.00	2.21	39.31	21.73
1281	**1307.28**	0.00	0.00	0.00	0.00	0.00	0.00

Note 1: Meridonal, Hoop, and Shear Stresses are Reversed in Highlighted Sections (Floor)
Note 2: Underlined results indicate a reversal of inside (botttom) and outside (top) surfaces in the floor

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Comparisons - Pri Tank-for report.xls, Stress Max-3a

Figure A.32. Primary Tank Stresses, Shell Bottom, New Geometry, PNNL Concrete

Primary Tank Component Stress Results

Linear Model - Revised J-Bolts

ANSYS MAXIMUMS BY PATH

M&D Starting M&D Element No.	Path	Shell Top Surface (outside - away from waste)					
		Phase II 2D HV Seismic Hoop Stress (kip/ft^2)	Phase II 2D HV Seismic Meridional Stress (kip/ft^2)	Phase II 2D HV Seismic Thru-Thickness Stress (kip/ft^2)	Phase II 2D HV Seismic In-Plane Shear Stress (kip/ft^2)	Phase II 2D HV Seismic In-Plane Shear Force Stress (kip/ft^2)	Phase II 2D HV Seismic Thru-Thickness Shear Stress (kip/ft^2)
761	**89.72**	154.20	189.60	0.00	27.25	3.14	0.16
781	**127.48**	167.30	250.70	0.00	31.09	1.59	0.17
801	**158.68**	167.20	253.20	0.00	29.81	2.30	0.04
821	**204.14**	155.20	262.40	0.00	29.63	1.29	0.03
841	**247.52**	139.20	265.90	0.00	29.20	1.96	0.08
861	**296.07**	110.70	262.10	0.00	28.42	0.26	0.05
881	**345.70**	71.13	228.30	0.00	26.57	0.98	0.19
901	**391.94**	48.22	170.00	0.00	23.25	1.27	0.24
921	**441.79**	153.00	89.77	0.00	14.08	3.77	0.70
941	**466.30**	310.00	392.20	0.00	5.44	16.13	1.28
961	**492.29**	245.60	118.80	0.00	2.27	0.14	0.13
981	**529.85**	352.00	128.20	0.00	0.69	7.45	0.11
1001	**582.01**	552.10	4.25	0.00	0.70	8.25	0.02
1021	**650.76**	1070.00	8.43	0.00	0.89	2.39	0.01
1041	**718.76**	1689.00	82.12	0.00	0.85	10.91	0.01
1061	**786.76**	1254.00	135.20	0.00	0.72	4.14	0.02
1081	**844.76**	2041.00	220.70	0.00	0.49	2.84	0.07
1101	**892.76**	1302.00	65.88	0.00	1.60	5.46	0.10
1121	**921.35**	1317.00	1784.00	0.00	5.07	36.08	1.00
1141	**930.54**	357.80	111.00	0.00	10.24	53.46	0.99
1161	**949.13**	49.04	436.10	0.00	1.56	47.87	18.21
1181	**989.13**	341.50	612.10	0.00	0.67	48.13	8.61
1201	**1055.28**	165.60	68.45	0.00	0.46	36.19	5.97
1221	**1125.03**	263.40	421.70	0.00	0.75	43.47	9.54
1241	**1173.88**	114.90	191.70	0.00	1.33	45.93	16.66
1261	**1218.18**	268.90	454.00	0.00	1.28	45.65	15.21
1281	**1260.33**	116.00	194.50	0.00	2.94	46.03	29.01
1281	**1307.28**	0.00	0.00	0.00	0.00	0.00	0.00

Note 1: Meridonal, Hoop, and Shear Stresses are Reversed in Highlighted Sections (Floor)
Note 2: Underlined results indicate a reversal of inside (botttom) and outside (top) surfaces in the floor

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Comparisons - Pri Tank-for report.xls, Stress Max-3b

Figure A.33. Primary Tank Stresses, Shell Top, New Geometry, New J-Bolts

Primary Tank Component Stress Results

Linear Model - Revised J-Bolts

ANSYS MAXIMUMS BY PATH

M&D Starting M&D Element No.	Path	Shell Mid-Plane					
		Phase II 2D HV Seismic Hoop Stress (kip/ft^2)	Phase II 2D HV Seismic Meridional Stress (kip/ft^2)	Phase II 2D HV Seismic Thru-Thickness Stress (kip/ft^2)	Phase II 2D HV Seismic In-Plane Shear Stress (kip/ft^2)	Phase II 2D HV Seismic In-Plane Shear Force Stress (kip/ft^2)	Phase II 2D HV Seismic Thru-Thickness Shear Stress (kip/ft^2)
761	**89.72**	150.40	185.10	0.00	27.19	3.14	0.16
781	**127.48**	165.10	249.50	0.00	31.11	1.59	0.17
801	**158.68**	165.30	252.10	0.00	29.81	2.30	0.04
821	**204.14**	153.80	261.90	0.00	29.63	1.29	0.03
841	**247.52**	137.80	265.10	0.00	29.20	1.96	0.08
861	**296.07**	109.70	261.60	0.00	28.42	0.26	0.05
881	**345.70**	69.70	226.50	0.00	26.55	0.98	0.19
901	**391.94**	50.23	166.40	0.00	23.19	1.27	0.24
921	**441.79**	155.10	86.40	0.00	14.00	3.77	0.70
941	**466.30**	201.90	43.51	0.00	4.50	16.13	1.28
961	**492.29**	199.50	40.69	0.00	2.28	0.14	0.13
981	**529.85**	323.90	33.92	0.00	0.60	7.45	0.11
1001	**582.01**	557.70	23.48	0.00	0.77	8.25	0.02
1021	**650.76**	1074.00	20.87	0.00	1.00	2.39	0.01
1041	**718.76**	1669.00	18.77	0.00	0.81	10.91	0.01
1061	**786.76**	1295.00	10.29	0.00	1.11	4.14	0.02
1081	**844.76**	1975.00	7.92	0.00	0.67	2.84	0.07
1101	**892.76**	1320.00	5.47	0.00	2.23	5.46	0.10
1121	**921.35**	797.60	20.48	0.00	7.02	36.08	1.00
1141	**930.54**	395.70	134.90	0.00	11.33	53.46	0.99
1161	**949.13**	235.60	206.30	0.00	1.56	14.51	18.21
1181	**989.13**	255.20	312.20	0.00	0.67	31.31	8.61
1201	**1055.28**	218.50	239.10	0.00	0.46	31.31	5.97
1221	**1125.03**	198.90	193.60	0.00	0.75	31.22	9.54
1241	**1173.88**	204.20	209.80	0.00	1.33	31.05	16.66
1261	**1218.18**	202.80	214.40	0.00	1.28	31.48	15.21
1281	**1260.33**	197.80	215.10	0.00	2.94	31.93	29.01
1281	**1307.28**	0.00	0.00	0.00	0.00	0.00	0.00

Note 1: Meridonal, Hoop, and Shear Stresses are Reversed in Highlighted Sections (Floor)
Note 2: Underlined results indicate a reversal of inside (botttom) and outside (top) surfaces in the floor

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Comparisons - Pri Tank-for report.xls, Stress Max-3b

Figure A.34. Primary Tank Stresses, Shell Middle, New Geometry, New J-Bolts

Primary Tank Component Stress Results

Linear Model - Revised J-Bolts

ANSYS MAXIMUMS BY PATH

M&D Starting M&D Element No.	Path	Shell Bottom Surface (inside - waste side)					
		Phase II 2D HV Seismic Hoop Stress (kip/ft^2)	Phase II 2D HV Seismic Meridional Stress (kip/ft^2)	Phase II 2D HV Seismic Thru-Thickness Stress (kip/ft^2)	Phase II 2D HV Seismic In-Plane Shear Stress (kip/ft^2)	Phase II 2D HV Seismic In-Plane Shear Force Stress (kip/ft^2)	Phase II 2D HV Seismic Thru-Thickness Shear Stress (kip/ft^2)
761	**89.72**	146.70	180.60	0.00	27.13	3.14	0.16
781	**127.48**	162.80	248.30	0.00	31.12	1.59	0.17
801	**158.68**	163.40	251.00	0.00	29.82	2.30	0.04
821	**204.14**	152.50	261.40	0.00	29.63	1.29	0.03
841	**247.52**	136.40	264.40	0.00	29.21	1.96	0.08
861	**296.07**	108.70	261.00	0.00	28.42	0.26	0.05
881	**345.70**	68.27	224.70	0.00	26.54	0.98	0.19
901	**391.94**	52.24	162.80	0.00	23.13	1.27	0.24
921	**441.79**	157.10	83.03	0.00	13.93	3.77	0.70
941	**466.30**	94.06	316.30	0.00	3.57	16.13	1.28
961	**492.29**	153.40	195.40	0.00	2.28	0.14	0.13
981	**529.85**	295.70	64.67	0.00	0.77	7.45	0.11
1001	**582.01**	564.20	42.71	0.00	0.84	8.25	0.02
1021	**650.76**	1078.00	33.49	0.00	1.10	2.39	0.01
1041	**718.76**	1651.00	49.27	0.00	0.77	10.91	0.01
1061	**786.76**	1339.00	151.40	0.00	1.53	4.14	0.02
1081	**844.76**	1912.00	207.00	0.00	0.84	2.84	0.07
1101	**892.76**	1341.00	72.41	0.00	3.37	5.46	0.10
1121	**921.35**	286.20	1756.00	0.00	8.97	36.08	1.00
1141	**930.54**	447.50	362.80	0.00	12.42	53.46	0.99
1161	**949.13**	424.40	839.20	0.00	1.56	48.58	18.21
1181	**989.13**	168.90	30.03	0.00	0.67	35.40	8.61
1201	**1055.28**	271.40	420.80	0.00	0.46	41.71	5.97
1221	**1125.03**	135.60	96.79	0.00	0.75	42.08	9.54
1241	**1173.88**	300.20	543.20	0.00	1.33	50.07	16.66
1261	**1218.18**	141.80	94.21	0.00	1.28	41.71	15.21
1281	**1260.33**	293.00	554.00	0.00	2.94	51.93	29.01
1281	**1307.28**	0.00	0.00	0.00	0.00	0.00	0.00

Note 1: Meridonal, Hoop, and Shear Stresses are Reversed in Highlighted Sections (Floor)
Note 2: Underlined results indicate a reversal of inside (botttom) and outside (top) surfaces in the floor

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Comparisons - Pri Tank-for report.xls, Stress Max-3b

Figure A.35. Primary Tank Stresses, Shell Bottom, New Geometry, New J-Bolts

Primary Tank Component Stress Results
Wall & Dome Soil - Zero Friction

ANSYS MAXIMUMS BY PATH

M&D Starting M&D Element No.		Shell Top Surface (outside - away from waste)					
		Phase II 2D HV Seismic Hoop Stress (kip/ft^2)	Phase II 2D HV Seismic Meridional Stress (kip/ft^2)	Phase II 2D HV Seismic Thru-Thickness Stress (kip/ft^2)	Phase II 2D HV Seismic In-Plane Shear Stress (kip/ft^2)	Phase II 2D HV Seismic In-Plane Shear Force Stress (kip/ft^2)	Phase II 2D HV Seismic Thru-Thickness Shear Stress (kip/ft^2)
761	**89.72**	469.30	538.70	0.00	22.13	1.02	0.26
781	**127.48**	484.90	611.00	0.00	21.70	0.15	0.11
801	**158.68**	477.00	587.00	0.00	20.68	0.10	0.09
821	**204.14**	453.30	579.50	0.00	20.19	0.02	0.04
841	**247.52**	421.80	549.10	0.00	20.20	0.19	0.07
861	**296.07**	381.50	547.80	0.00	19.40	0.01	0.02
881	**345.70**	325.80	485.50	0.00	19.29	0.09	0.03
901	**391.94**	211.10	350.00	0.00	18.99	0.20	0.03
921	**441.79**	52.93	231.60	0.00	17.72	0.33	0.05
941	**466.30**	193.70	374.80	0.00	9.39	16.93	0.56
961	**492.29**	268.90	100.90	0.00	5.29	0.39	0.21
981	**529.85**	339.20	128.20	0.00	2.11	7.76	0.08
1001	**582.01**	552.80	7.54	0.00	1.63	8.18	0.01
1021	**650.76**	1069.00	10.35	0.00	1.83	2.42	0.01
1041	**718.76**	1690.00	84.62	0.00	1.75	10.90	0.01
1061	**786.76**	1254.00	133.20	0.00	1.33	4.15	0.02
1081	**844.76**	2042.00	222.70	0.00	1.04	2.81	0.06
1101	**892.76**	1298.00	61.96	0.00	1.96	5.60	0.10
1121	**921.35**	1290.00	1755.00	0.00	5.25	36.13	0.96
1141	**930.54**	362.40	61.47	0.00	10.72	51.03	0.96
1161	**949.13**	51.31	432.80	0.00	1.50	47.75	17.68
1181	**989.13**	333.50	568.30	0.00	0.64	44.37	8.36
1201	**1055.28**	173.20	66.38	0.00	0.45	36.81	5.80
1221	**1125.03**	276.10	431.70	0.00	0.73	42.73	9.27
1241	**1173.88**	130.00	162.80	0.00	1.29	45.02	16.18
1261	**1218.18**	279.30	459.90	0.00	1.25	44.86	14.77
1281	**1260.33**	130.30	166.90	0.00	2.85	45.08	28.17
1281	**1307.28**	0.00	0.00	0.00	0.00	0.00	0.00

Note 1: Meridonal, Hoop, and Shear Stresses are Reversed in Highlighted Sections (Floor)
Note 2: Underlined results indicate a reversal of inside (botttom) and outside (top) surfaces in the floor

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Comparisons - Pri Tank-for report.xls, Stress Max-9

Figure A.36. Primary Tank Stresses, Shell Top, New Geometry, No Soil Friction

Primary Tank Component Stress Results
Wall & Dome Soil - Zero Friction

ANSYS MAXIMUMS BY PATH

M&D Starting M&D Element No.		Shell Mid-Plane					
		Phase II 2D HV Seismic Hoop Stress (kip/ft^2)	Phase II 2D HV Seismic Meridional Stress (kip/ft^2)	Phase II 2D HV Seismic Thru-Thickness Stress (kip/ft^2)	Phase II 2D HV Seismic In-Plane Shear Stress (kip/ft^2)	Phase II 2D HV Seismic In-Plane Shear Force Stress (kip/ft^2)	Phase II 2D HV Seismic Thru-Thickness Shear Stress (kip/ft^2)
761	**89.72**	462.90	534.60	0.00	22.26	1.02	0.26
781	**127.48**	481.80	610.10	0.00	21.74	0.15	0.11
801	**158.68**	474.50	586.10	0.00	20.70	0.10	0.09
821	**204.14**	451.60	579.00	0.00	20.20	0.02	0.04
841	**247.52**	420.40	548.40	0.00	20.22	0.19	0.07
861	**296.07**	380.60	548.00	0.00	19.42	0.01	0.02
881	**345.70**	324.70	484.50	0.00	19.31	0.09	0.03
901	**391.94**	209.00	346.00	0.00	19.02	0.20	0.03
921	**441.79**	50.82	227.90	0.00	17.80	0.33	0.05
941	**466.30**	98.15	49.52	0.00	10.10	16.93	0.56
961	**492.29**	225.90	44.31	0.00	5.30	0.39	0.21
981	**529.85**	312.10	36.93	0.00	2.16	7.76	0.08
1001	**582.01**	558.20	25.80	0.00	1.70	8.18	0.01
1021	**650.76**	1073.00	23.28	0.00	1.99	2.42	0.01
1041	**718.76**	1670.00	21.14	0.00	1.75	10.90	0.01
1061	**786.76**	1295.00	11.92	0.00	1.82	4.15	0.02
1081	**844.76**	1976.00	9.54	0.00	1.24	2.81	0.06
1101	**892.76**	1314.00	6.95	0.00	2.54	5.60	0.10
1121	**921.35**	781.50	21.80	0.00	7.17	36.13	0.96
1141	**930.54**	389.90	137.70	0.00	11.80	51.03	0.96
1161	**949.13**	231.40	185.00	0.00	1.50	15.88	17.68
1181	**989.13**	249.20	276.40	0.00	0.64	27.96	8.36
1201	**1055.28**	224.50	231.30	0.00	0.45	29.52	5.80
1221	**1125.03**	213.40	210.90	0.00	0.73	30.80	9.27
1241	**1173.88**	216.70	223.20	0.00	1.29	30.61	16.18
1261	**1218.18**	214.90	228.00	0.00	1.25	31.10	14.77
1281	**1260.33**	209.40	227.20	0.00	2.85	31.53	28.17
1281	**1307.28**	0.00	0.00	0.00	0.00	0.00	0.00

Note 1: Meridonal, Hoop, and Shear Stresses are Reversed in Highlighted Sections (Floor)
Note 2: Underlined results indicate a reversal of inside (botttom) and outside (top) surfaces in the floor

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Comparisons - Pri Tank-for report.xls, Stress Max-9

Figure A.37. Primary Tank Stresses, Shell Middle, New Geometry, No Soil Friction

Primary Tank Component Stress Results
Wall & Dome Soil - Zero Friction

ANSYS MAXIMUMS BY PATH

M&D Starting M&D Element No.		Shell Bottom Surface (inside - waste side)					
		Phase II 2D HV Seismic Hoop Stress (kip/ft^2)	Phase II 2D HV Seismic Meridional Stress (kip/ft^2)	Phase II 2D HV Seismic Thru-Thickness Stress (kip/ft^2)	Phase II 2D HV Seismic In-Plane Shear Stress (kip/ft^2)	Phase II 2D HV Seismic In-Plane Shear Force Stress (kip/ft^2)	Phase II 2D HV Seismic Thru-Thickness Shear Stress (kip/ft^2)
761	**89.72**	456.60	530.60	0.00	22.39	1.02	0.26
781	**127.48**	478.60	609.30	0.00	21.78	0.15	0.11
801	**158.68**	472.00	585.10	0.00	20.72	0.10	0.09
821	**204.14**	449.80	578.50	0.00	20.21	0.02	0.04
841	**247.52**	419.00	547.70	0.00	20.24	0.19	0.07
861	**296.07**	379.70	548.30	0.00	19.44	0.01	0.02
881	**345.70**	323.70	483.50	0.00	19.33	0.09	0.03
901	**391.94**	206.90	342.10	0.00	19.05	0.20	0.03
921	**441.79**	48.72	224.20	0.00	17.89	0.33	0.05
941	**466.30**	31.28	275.80	0.00	10.82	16.93	0.56
961	**492.29**	182.80	188.00	0.00	5.32	0.39	0.21
981	**529.85**	285.00	57.17	0.00	2.21	7.76	0.08
1001	**582.01**	564.30	44.09	0.00	1.77	8.18	0.01
1021	**650.76**	1077.00	36.26	0.00	2.15	2.42	0.01
1041	**718.76**	1652.00	46.08	0.00	1.76	10.90	0.01
1061	**786.76**	1339.00	153.20	0.00	2.31	4.15	0.02
1081	**844.76**	1913.00	205.20	0.00	1.54	2.81	0.06
1101	**892.76**	1334.00	72.33	0.00	3.65	5.60	0.10
1121	**921.35**	282.70	1724.00	0.00	9.09	36.13	0.96
1141	**930.54**	428.60	321.60	0.00	12.88	51.03	0.96
1161	**949.13**	412.10	796.00	0.00	1.50	45.28	17.68
1181	**989.13**	164.80	46.23	0.00	0.64	37.10	8.36
1201	**1055.28**	275.80	406.90	0.00	0.45	39.59	5.80
1221	**1125.03**	151.50	68.32	0.00	0.73	41.20	9.27
1241	**1173.88**	309.80	545.90	0.00	1.29	49.08	16.18
1261	**1218.18**	155.90	69.34	0.00	1.25	40.88	14.77
1281	**1260.33**	301.30	555.20	0.00	2.85	50.92	28.17
1281	**1307.28**	0.00	0.00	0.00	0.00	0.00	0.00

Note 1: Meridonal, Hoop, and Shear Stresses are Reversed in Highlighted Sections (Floor)
Note 2: Underlined results indicate a reversal of inside (botttom) and outside (top) surfaces in the floor

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Comparisons - Pri Tank-for report.xls, Stress Max-9

Figure A.38. Primary Tank Stresses, Shell Bottom, New Geometry, No Soil Friction

Primary Tank Component Stress Results
Wall & Dome Soil - Zero Dome Friction

ANSYS MAXIMUMS BY PATH

M&D Starting M&D Element No.		Shell Top Surface (outside - away from waste)					
		Phase II 2D HV Seismic Hoop Stress (kip/ft^2)	Phase II 2D HV Seismic Meridional Stress (kip/ft^2)	Phase II 2D HV Seismic Thru-Thickness Stress (kip/ft^2)	Phase II 2D HV Seismic In-Plane Shear Stress (kip/ft^2)	Phase II 2D HV Seismic In-Plane Shear Force Stress (kip/ft^2)	Phase II 2D HV Seismic Thru-Thickness Shear Stress (kip/ft^2)
761	**89.72**	441.30	513.80	0.00	23.22	1.19	0.27
781	**127.48**	453.20	583.80	0.00	22.90	0.19	0.11
801	**158.68**	442.90	561.00	0.00	22.12	0.12	0.08
821	**204.14**	414.00	552.50	0.00	21.86	0.03	0.04
841	**247.52**	376.50	522.90	0.00	21.71	0.19	0.07
861	**296.07**	328.30	514.70	0.00	21.14	0.01	0.02
881	**345.70**	265.10	456.80	0.00	20.71	0.06	0.03
901	**391.94**	153.50	337.30	0.00	19.67	0.17	0.02
921	**441.79**	26.76	238.20	0.00	18.94	0.25	0.05
941	**466.30**	243.00	380.70	0.00	7.97	16.58	0.51
961	**492.29**	253.30	108.30	0.00	4.21	0.31	0.23
981	**529.85**	347.90	126.90	0.00	1.12	7.56	0.09
1001	**582.01**	552.20	5.26	0.00	1.04	8.22	0.01
1021	**650.76**	1070.00	8.76	0.00	1.18	2.40	0.01
1041	**718.76**	1690.00	82.65	0.00	1.07	10.90	0.01
1061	**786.76**	1254.00	134.70	0.00	0.89	4.14	0.02
1081	**844.76**	2042.00	221.10	0.00	0.67	2.84	0.07
1101	**892.76**	1301.00	64.94	0.00	1.74	5.49	0.10
1121	**921.35**	1310.00	1778.00	0.00	5.11	36.11	0.97
1141	**930.54**	358.50	97.95	0.00	10.43	52.93	0.98
1161	**949.13**	47.33	440.70	0.00	1.55	48.52	18.11
1181	**989.13**	338.50	591.70	0.00	0.67	46.58	8.56
1201	**1055.28**	165.80	62.09	0.00	0.46	36.89	5.94
1221	**1125.03**	266.90	424.90	0.00	0.75	42.68	9.49
1241	**1173.88**	117.30	185.30	0.00	1.32	45.41	16.58
1261	**1218.18**	271.20	455.70	0.00	1.28	44.74	15.14
1281	**1260.33**	118.10	188.60	0.00	2.92	45.29	28.86
1281	**1307.28**	0.00	0.00	0.00	0.00	0.00	0.00

Note 1: Meridonal, Hoop, and Shear Stresses are Reversed in Highlighted Sections (Floor)
Note 2: Underlined results indicate a reversal of inside (botttom) and outside (top) surfaces in the floor

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Comparisons - Pri Tank-for report.xls, Stress Max-10

Figure A.39. Primary Tank Stresses, Shell Top, New Geometry, No Dome Soil Friction

Primary Tank Component Stress Results
Wall & Dome Soil - Zero Dome Friction

ANSYS MAXIMUMS BY PATH

M&D Starting M&D Element No.		Shell Mid-Plane					
		Phase II 2D HV Seismic Hoop Stress (kip/ft^2)	Phase II 2D HV Seismic Meridional Stress (kip/ft^2)	Phase II 2D HV Seismic Thru-Thickness Stress (kip/ft^2)	Phase II 2D HV Seismic In-Plane Shear Stress (kip/ft^2)	Phase II 2D HV Seismic In-Plane Shear Force Stress (kip/ft^2)	Phase II 2D HV Seismic Thru-Thickness Shear Stress (kip/ft^2)
761	**89.72**	434.30	509.20	0.00	23.36	1.19	0.27
781	**127.48**	449.70	582.60	0.00	22.94	0.19	0.11
801	**158.68**	440.00	559.60	0.00	22.14	0.12	0.08
821	**204.14**	411.90	551.80	0.00	21.88	0.03	0.04
841	**247.52**	374.70	522.10	0.00	21.72	0.19	0.07
861	**296.07**	327.10	514.80	0.00	21.16	0.01	0.02
881	**345.70**	263.90	455.80	0.00	20.73	0.06	0.03
901	**391.94**	151.50	334.10	0.00	19.69	0.17	0.02
921	**441.79**	28.69	235.50	0.00	19.01	0.25	0.05
941	**466.30**	143.90	45.78	0.00	8.61	16.58	0.51
961	**492.29**	209.10	41.82	0.00	4.20	0.31	0.23
981	**529.85**	320.50	34.52	0.00	1.04	7.56	0.09
1001	**582.01**	557.90	24.08	0.00	1.11	8.22	0.01
1021	**650.76**	1073.00	21.38	0.00	1.28	2.40	0.01
1041	**718.76**	1669.00	19.27	0.00	1.06	10.90	0.01
1061	**786.76**	1295.00	10.64	0.00	1.30	4.14	0.02
1081	**844.76**	1975.00	8.31	0.00	0.76	2.84	0.07
1101	**892.76**	1319.00	5.76	0.00	2.35	5.49	0.10
1121	**921.35**	793.70	20.85	0.00	7.10	36.11	0.97
1141	**930.54**	395.00	136.00	0.00	11.49	52.93	0.98
1161	**949.13**	233.90	194.60	0.00	1.55	15.34	18.11
1181	**989.13**	251.50	291.50	0.00	0.67	29.82	8.56
1201	**1055.28**	218.90	231.30	0.00	0.46	30.17	5.94
1221	**1125.03**	201.90	197.10	0.00	0.75	31.04	9.49
1241	**1173.88**	206.40	211.90	0.00	1.32	30.23	16.58
1261	**1218.18**	204.90	216.60	0.00	1.28	30.65	15.14
1281	**1260.33**	199.70	216.80	0.00	2.92	31.05	28.86
1281	**1307.28**	0.00	0.00	0.00	0.00	0.00	0.00

Note 1: Meridonal, Hoop, and Shear Stresses are Reversed in Highlighted Sections (Floor)
Note 2: Underlined results indicate a reversal of inside (botttom) and outside (top) surfaces in the floor

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Comparisons - Pri Tank-for report.xls, Stress Max-10

Figure A.40. Primary Tank Stresses, Shell Middle, New Geometry, No Dome Soil Friction

Primary Tank Component Stress Results
Wall & Dome Soil - Zero Dome Friction

ANSYS MAXIMUMS BY PATH

M&D Starting M&D Element No.		Shell Bottom Surface (inside - waste side)					
		Phase II 2D HV Seismic Hoop Stress (kip/ft^2)	Phase II 2D HV Seismic Meridional Stress (kip/ft^2)	Phase II 2D HV Seismic Thru-Thickness Stress (kip/ft^2)	Phase II 2D HV Seismic In-Plane Shear Stress (kip/ft^2)	Phase II 2D HV Seismic In-Plane Shear Force Stress (kip/ft^2)	Phase II 2D HV Seismic Thru-Thickness Shear Stress (kip/ft^2)
761	**89.72**	427.40	504.60	0.00	23.51	1.19	0.27
781	**127.48**	446.10	581.40	0.00	22.98	0.19	0.11
801	**158.68**	437.10	558.20	0.00	22.16	0.12	0.08
821	**204.14**	409.80	551.10	0.00	21.89	0.03	0.04
841	**247.52**	372.90	521.30	0.00	21.74	0.19	0.07
861	**296.07**	326.00	514.90	0.00	21.17	0.01	0.02
881	**345.70**	262.60	454.90	0.00	20.75	0.06	0.03
901	**391.94**	149.60	330.90	0.00	19.71	0.17	0.02
921	**441.79**	30.63	232.80	0.00	19.08	0.25	0.05
941	**466.30**	44.86	289.10	0.00	9.25	16.58	0.51
961	**492.29**	164.90	189.70	0.00	4.20	0.31	0.23
981	**529.85**	293.10	60.96	0.00	1.23	7.56	0.09
1001	**582.01**	564.20	42.91	0.00	1.17	8.22	0.01
1021	**650.76**	1077.00	34.16	0.00	1.39	2.40	0.01
1041	**718.76**	1651.00	48.62	0.00	1.06	10.90	0.01
1061	**786.76**	1339.00	151.80	0.00	1.79	4.14	0.02
1081	**844.76**	1912.00	206.50	0.00	1.04	2.84	0.07
1101	**892.76**	1339.00	72.33	0.00	3.49	5.49	0.10
1121	**921.35**	285.20	1749.00	0.00	9.09	36.11	0.97
1141	**930.54**	442.60	351.40	0.00	12.55	52.93	0.98
1161	**949.13**	421.10	824.50	0.00	1.55	47.78	18.11
1181	**989.13**	164.60	39.70	0.00	0.67	36.90	8.56
1201	**1055.28**	272.10	412.80	0.00	0.46	40.50	5.94
1221	**1125.03**	138.60	89.72	0.00	0.75	41.71	9.49
1241	**1173.88**	302.60	544.40	0.00	1.32	49.15	16.58
1261	**1218.18**	144.00	88.59	0.00	1.28	41.07	15.14
1281	**1260.33**	294.60	554.70	0.00	2.92	50.94	28.86
1281	**1307.28**	0.00	0.00	0.00	0.00	0.00	0.00

Note 1: Meridonal, Hoop, and Shear Stresses are Reversed in Highlighted Sections (Floor)
Note 2: Underlined results indicate a reversal of inside (botttom) and outside (top) surfaces in the floor

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Comparisons - Pri Tank-for report.xls, Stress Max-10

Figure A.41. Primary Tank Stresses, Shell Bottom, New Geometry, No Dome Soil Friction

Primary Tank Component Stress Results
Wall & Dome Soil - Zero Wall Friction

ANSYS MAXIMUMS BY PATH

M&D Starting M&D Element No.	`	Shell Top Surface (outside - away from waste)					
		Phase II 2D HV Seismic Hoop Stress (kip/ft^2)	Phase II 2D HV Seismic Meridional Stress (kip/ft^2)	Phase II 2D HV Seismic Thru-Thickness Stress (kip/ft^2)	Phase II 2D HV Seismic In-Plane Shear Stress (kip/ft^2)	Phase II 2D HV Seismic In-Plane Shear Force Stress (kip/ft^2)	Phase II 2D HV Seismic Thru-Thickness Shear Stress (kip/ft^2)
761	**89.72**	169.70	241.20	0.00	32.64	1.84	0.26
781	**127.48**	187.20	302.40	0.00	31.75	0.26	0.05
801	**158.68**	187.50	292.90	0.00	30.96	0.14	0.03
821	**204.14**	181.40	300.60	0.00	30.87	0.06	0.01
841	**247.52**	168.80	302.20	0.00	30.93	0.11	0.03
861	**296.07**	152.40	308.90	0.00	30.07	0.01	0.01
881	**345.70**	122.90	287.10	0.00	28.97	0.11	0.01
901	**391.94**	53.78	217.90	0.00	27.80	0.09	0.01
921	**441.79**	87.38	200.30	0.00	23.33	0.27	0.03
941	**466.30**	271.70	382.80	0.00	8.07	17.36	0.58
961	**492.29**	267.10	113.40	0.00	4.07	0.27	0.26
981	**529.85**	344.90	130.30	0.00	1.11	7.66	0.11
1001	**582.01**	552.40	6.86	0.00	0.55	8.22	0.02
1021	**650.76**	1070.00	10.07	0.00	0.92	2.40	0.01
1041	**718.76**	1690.00	84.00	0.00	0.76	10.91	0.01
1061	**786.76**	1254.00	133.80	0.00	0.88	4.15	0.02
1081	**844.76**	2042.00	222.30	0.00	0.50	2.82	0.06
1101	**892.76**	1298.00	63.15	0.00	1.31	5.54	0.10
1121	**921.35**	1297.00	1760.00	0.00	4.43	36.09	0.96
1141	**930.54**	358.40	81.39	0.00	8.60	51.43	0.94
1161	**949.13**	49.47	426.70	0.00	1.52	46.91	17.74
1181	**989.13**	336.80	591.30	0.00	0.65	44.62	8.39
1201	**1055.28**	168.40	69.61	0.00	0.45	35.20	5.82
1221	**1125.03**	269.20	425.40	0.00	0.73	41.74	9.30
1241	**1173.88**	123.20	173.30	0.00	1.30	44.36	16.24
1261	**1218.18**	273.80	455.70	0.00	1.25	44.16	14.82
1281	**1260.33**	124.20	176.80	0.00	2.86	44.56	28.26
1281	**1307.28**	0.00	0.00	0.00	0.00	0.00	0.00

Note 1: Meridonal, Hoop, and Shear Stresses are Reversed in Highlighted Sections (Floor)
Note 2: Underlined results indicate a reversal of inside (botttom) and outside (top) surfaces in the floor

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Comparisons - Pri Tank-for report.xls, Stress Max-11

Figure A.42. Primary Tank Stresses, Shell Top, New Geometry, No Wall Soil Friction

Primary Tank Component Stress Results
Wall & Dome Soil - Zero Wall Friction

ANSYS MAXIMUMS BY PATH

M&D Starting M&D Element No.	`	Shell Mid-Plane					
		Phase II 2D HV Seismic Hoop Stress (kip/ft^2)	Phase II 2D HV Seismic Meridional Stress (kip/ft^2)	Phase II 2D HV Seismic Thru-Thickness Stress (kip/ft^2)	Phase II 2D HV Seismic In-Plane Shear Stress (kip/ft^2)	Phase II 2D HV Seismic In-Plane Shear Force Stress (kip/ft^2)	Phase II 2D HV Seismic Thru-Thickness Shear Stress (kip/ft^2)
761	**89.72**	164.40	238.10	0.00	32.74	1.84	0.26
781	**127.48**	184.70	302.10	0.00	31.75	0.26	0.05
801	**158.68**	185.50	292.40	0.00	30.95	0.14	0.03
821	**204.14**	179.90	300.30	0.00	30.87	0.06	0.01
841	**247.52**	167.60	302.00	0.00	30.94	0.11	0.03
861	**296.07**	151.60	308.90	0.00	30.08	0.01	0.01
881	**345.70**	121.90	286.10	0.00	28.98	0.11	0.01
901	**391.94**	51.92	214.70	0.00	27.82	0.09	0.01
921	**441.79**	88.96	198.20	0.00	23.39	0.27	0.03
941	**466.30**	170.30	48.49	0.00	8.65	17.36	0.58
961	**492.29**	221.60	44.03	0.00	3.99	0.27	0.26
981	**529.85**	317.00	36.61	0.00	0.99	7.66	0.11
1001	**582.01**	558.00	25.52	0.00	0.59	8.22	0.02
1021	**650.76**	1073.00	22.74	0.00	1.09	2.40	0.01
1041	**718.76**	1670.00	20.57	0.00	0.78	10.91	0.01
1061	**786.76**	1295.00	11.45	0.00	1.27	4.15	0.02
1081	**844.76**	1975.00	9.12	0.00	0.49	2.82	0.06
1101	**892.76**	1316.00	6.43	0.00	2.40	5.54	0.10
1121	**921.35**	786.60	21.43	0.00	6.41	36.09	0.96
1141	**930.54**	391.10	136.50	0.00	9.71	51.43	0.94
1161	**949.13**	232.60	197.70	0.00	1.52	14.54	17.74
1181	**989.13**	251.50	297.20	0.00	0.65	28.17	8.39
1201	**1055.28**	220.60	236.10	0.00	0.45	28.98	5.82
1221	**1125.03**	205.30	202.10	0.00	0.73	29.85	9.30
1241	**1173.88**	209.80	216.50	0.00	1.30	29.76	16.24
1261	**1218.18**	208.60	221.20	0.00	1.25	30.33	14.82
1281	**1260.33**	203.50	221.20	0.00	2.86	30.83	28.26
1281	**1307.28**	0.00	0.00	0.00	0.00	0.00	0.00

Note 1: Meridonal, Hoop, and Shear Stresses are Reversed in Highlighted Sections (Floor)
Note 2: Underlined results indicate a reversal of inside (botttom) and outside (top) surfaces in the floor

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Comparisons - Pri Tank-for report.xls, Stress Max-11

Figure A.43. Primary Tank Stresses, Shell Middle, New Geometry, No Wall Soil Friction

Primary Tank Component Stress Results
Wall & Dome Soil - Zero Wall Friction

ANSYS MAXIMUMS BY PATH

M&D Starting M&D Element No.		Shell Bottom Surface (inside - waste side)					
		Phase II 2D HV Seismic Hoop Stress (kip/ft^2)	Phase II 2D HV Seismic Meridional Stress (kip/ft^2)	Phase II 2D HV Seismic Thru-Thickness Stress (kip/ft^2)	Phase II 2D HV Seismic In-Plane Shear Stress (kip/ft^2)	Phase II 2D HV Seismic In-Plane Shear Force Stress (kip/ft^2)	Phase II 2D HV Seismic Thru-Thickness Shear Stress (kip/ft^2)
761	**89.72**	159.10	235.00	0.00	32.84	1.84	0.26
781	**127.48**	182.20	301.80	0.00	31.75	0.26	0.05
801	**158.68**	183.50	291.90	0.00	30.94	0.14	0.03
821	**204.14**	178.50	300.10	0.00	30.86	0.06	0.01
841	**247.52**	166.50	301.80	0.00	30.94	0.11	0.03
861	**296.07**	150.80	308.80	0.00	30.09	0.01	0.01
881	**345.70**	120.80	285.20	0.00	28.99	0.11	0.01
901	**391.94**	50.19	211.60	0.00	27.84	0.09	0.01
921	**441.79**	90.55	196.10	0.00	23.45	0.27	0.03
941	**466.30**	68.95	290.40	0.00	9.22	17.36	0.58
961	**492.29**	176.00	196.40	0.00	3.91	0.27	0.26
981	**529.85**	289.20	61.50	0.00	0.87	7.66	0.11
1001	**582.01**	564.30	44.18	0.00	0.62	8.22	0.02
1021	**650.76**	1077.00	35.57	0.00	1.26	2.40	0.01
1041	**718.76**	1652.00	47.21	0.00	0.80	10.91	0.01
1061	**786.76**	1339.00	152.70	0.00	1.67	4.15	0.02
1081	**844.76**	1913.00	205.70	0.00	0.66	2.82	0.06
1101	**892.76**	1336.00	72.34	0.00	3.51	5.54	0.10
1121	**921.35**	283.80	1729.00	0.00	8.39	36.09	0.96
1141	**930.54**	435.70	338.60	0.00	10.83	51.43	0.94
1161	**949.13**	416.70	813.40	0.00	1.52	45.98	17.74
1181	**989.13**	166.20	30.45	0.00	0.65	34.89	8.39
1201	**1055.28**	272.80	413.80	0.00	0.45	39.12	5.82
1221	**1125.03**	143.40	79.25	0.00	0.73	40.44	9.30
1241	**1173.88**	304.40	542.80	0.00	1.30	48.34	16.24
1261	**1218.18**	149.50	78.43	0.00	1.25	40.28	14.82
1281	**1260.33**	296.70	552.80	0.00	2.86	50.35	28.26
1281	**1307.28**	0.00	0.00	0.00	0.00	0.00	0.00

Note 1: Meridonal, Hoop, and Shear Stresses are Reversed in Highlighted Sections (Floor)
Note 2: Underlined results indicate a reversal of inside (botttom) and outside (top) surfaces in the floor

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Comparisons - Pri Tank-for report.xls, Stress Max-11

Figure A.44. Primary Tank Stresses, Shell Bottom, New Geometry, No Wall Soil Friction

Primary Tank Component Stress Results
Wall & Dome Soil - Low Friction

ANSYS MAXIMUMS BY PATH

M&D Starting M&D Element No.		Shell Top Surface (outside - away from waste)					
		Phase II 2D HV Seismic Hoop Stress (kip/ft^2)	Phase II 2D HV Seismic Meridional Stress (kip/ft^2)	Phase II 2D HV Seismic Thru-Thickness Stress (kip/ft^2)	Phase II 2D HV Seismic In-Plane Shear Stress (kip/ft^2)	Phase II 2D HV Seismic In-Plane Shear Force Stress (kip/ft^2)	Phase II 2D HV Seismic Thru-Thickness Shear Stress (kip/ft^2)
761	**89.72**	167.10	238.80	0.00	32.29	1.87	0.26
781	**127.48**	183.90	299.80	0.00	31.40	0.26	0.05
801	**158.68**	183.60	290.10	0.00	30.62	0.14	0.03
821	**204.14**	176.20	297.20	0.00	30.57	0.06	0.01
841	**247.52**	162.10	298.30	0.00	30.68	0.11	0.03
861	**296.07**	143.60	304.10	0.00	29.94	0.02	0.01
881	**345.70**	112.20	283.30	0.00	29.00	0.11	0.01
901	**391.94**	42.47	217.60	0.00	27.06	0.08	0.01
921	**441.79**	99.10	200.80	0.00	22.76	0.25	0.03
941	**466.30**	283.20	383.90	0.00	8.03	17.21	0.58
961	**492.29**	261.50	115.00	0.00	4.05	0.25	0.27
981	**529.85**	348.50	129.60	0.00	1.05	7.59	0.11
1001	**582.01**	552.30	6.06	0.00	0.53	8.24	0.02
1021	**650.76**	1070.00	9.51	0.00	0.85	2.40	0.01
1041	**718.76**	1690.00	83.33	0.00	0.70	10.91	0.01
1061	**786.76**	1254.00	134.40	0.00	0.86	4.15	0.02
1081	**844.76**	2042.00	221.70	0.00	0.45	2.83	0.06
1101	**892.76**	1300.00	64.26	0.00	1.44	5.51	0.10
1121	**921.35**	1304.00	1770.00	0.00	4.68	36.09	0.98
1141	**930.54**	357.30	94.86	0.00	9.32	52.25	0.97
1161	**949.13**	49.11	429.30	0.00	1.54	47.47	17.93
1181	**989.13**	338.70	600.10	0.00	0.66	46.32	8.48
1201	**1055.28**	164.60	66.87	0.00	0.46	35.68	5.88
1221	**1125.03**	263.30	419.60	0.00	0.74	41.98	9.40
1241	**1173.88**	116.00	183.90	0.00	1.31	44.71	16.41
1261	**1218.18**	268.30	451.20	0.00	1.27	44.21	14.98
1281	**1260.33**	117.00	186.90	0.00	2.89	44.71	28.57
1281	**1307.28**	0.00	0.00	0.00	0.00	0.00	0.00

Note 1: Meridonal, Hoop, and Shear Stresses are Reversed in Highlighted Sections (Floor)
Note 2: Underlined results indicate a reversal of inside (botttom) and outside (top) surfaces in the floor

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Comparisons - Pri Tank-for report.xls, Stress Max-12

Figure A.45. Primary Tank Stresses, Shell Top, New Geometry, Low Soil Friction

Primary Tank Component Stress Results
Wall & Dome Soil - Low Friction

ANSYS MAXIMUMS BY PATH

M&D Starting M&D Element No.		Shell Mid-Plane					
		Phase II 2D HV Seismic Hoop Stress (kip/ft^2)	Phase II 2D HV Seismic Meridional Stress (kip/ft^2)	Phase II 2D HV Seismic Thru-Thickness Stress (kip/ft^2)	Phase II 2D HV Seismic In-Plane Shear Stress (kip/ft^2)	Phase II 2D HV Seismic In-Plane Shear Force Stress (kip/ft^2)	Phase II 2D HV Seismic Thru-Thickness Shear Stress (kip/ft^2)
761	**89.72**	161.70	235.60	0.00	32.40	1.87	0.26
781	**127.48**	181.40	299.50	0.00	31.40	0.26	0.05
801	**158.68**	181.60	289.50	0.00	30.61	0.14	0.03
821	**204.14**	174.70	296.90	0.00	30.57	0.06	0.01
841	**247.52**	160.90	298.00	0.00	30.69	0.11	0.03
861	**296.07**	142.70	304.00	0.00	29.95	0.02	0.01
881	**345.70**	111.10	282.30	0.00	29.01	0.11	0.01
901	**391.94**	40.76	214.60	0.00	27.07	0.08	0.01
921	**441.79**	100.60	198.90	0.00	22.82	0.25	0.03
941	**466.30**	181.20	47.25	0.00	8.61	17.21	0.58
961	**492.29**	215.70	43.10	0.00	3.97	0.25	0.27
981	**529.85**	320.60	35.76	0.00	0.91	7.59	0.11
1001	**582.01**	557.90	24.90	0.00	0.59	8.24	0.02
1021	**650.76**	1074.00	22.13	0.00	1.02	2.40	0.01
1041	**718.76**	1670.00	19.94	0.00	0.71	10.91	0.01
1061	**786.76**	1295.00	11.03	0.00	1.25	4.15	0.02
1081	**844.76**	1975.00	8.66	0.00	0.53	2.83	0.06
1101	**892.76**	1318.00	6.04	0.00	2.38	5.51	0.10
1121	**921.35**	791.00	21.12	0.00	6.67	36.09	0.98
1141	**930.54**	393.30	136.20	0.00	10.40	52.25	0.97
1161	**949.13**	234.30	201.80	0.00	1.54	14.62	17.93
1181	**989.13**	252.60	303.40	0.00	0.66	29.74	8.48
1201	**1055.28**	217.40	234.80	0.00	0.46	29.79	5.88
1221	**1125.03**	198.80	194.00	0.00	0.74	30.34	9.40
1241	**1173.88**	204.00	209.60	0.00	1.31	29.78	16.41
1261	**1218.18**	202.70	214.30	0.00	1.27	30.25	14.98
1281	**1260.33**	197.70	214.90	0.00	2.89	30.69	28.57
1281	**1307.28**	0.00	0.00	0.00	0.00	0.00	0.00

Note 1: Meridonal, Hoop, and Shear Stresses are Reversed in Highlighted Sections (Floor)
Note 2: Underlined results indicate a reversal of inside (botttom) and outside (top) surfaces in the floor

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Comparisons - Pri Tank-for report.xls, Stress Max-12

Figure A.46. Primary Tank Stresses, Shell Middle, New Geometry, Low Soil Friction

Primary Tank Component Stress Results
Wall & Dome Soil - Low Friction

ANSYS MAXIMUMS BY PATH

M&D Starting M&D Element No.		Shell Bottom Surface (inside - waste side)					
		Phase II 2D HV Seismic Hoop Stress (kip/ft^2)	Phase II 2D HV Seismic Meridional Stress (kip/ft^2)	Phase II 2D HV Seismic Thru-Thickness Stress (kip/ft^2)	Phase II 2D HV Seismic In-Plane Shear Stress (kip/ft^2)	Phase II 2D HV Seismic In-Plane Shear Force Stress (kip/ft^2)	Phase II 2D HV Seismic Thru-Thickness Shear Stress (kip/ft^2)
761	**89.72**	156.30	232.30	0.00	32.51	1.87	0.26
781	**127.48**	178.80	299.10	0.00	31.41	0.26	0.05
801	**158.68**	179.50	289.00	0.00	30.60	0.14	0.03
821	**204.14**	173.20	296.60	0.00	30.56	0.06	0.01
841	**247.52**	159.70	297.70	0.00	30.70	0.11	0.03
861	**296.07**	141.80	303.90	0.00	29.95	0.02	0.01
881	**345.70**	110.00	281.40	0.00	29.02	0.11	0.01
901	**391.94**	39.05	211.50	0.00	27.07	0.08	0.01
921	**441.79**	102.20	196.90	0.00	22.88	0.25	0.03
941	**466.30**	79.19	293.90	0.00	9.19	17.21	0.58
961	**492.29**	170.00	196.20	0.00	3.89	0.25	0.27
981	**529.85**	292.70	62.69	0.00	0.79	7.59	0.11
1001	**582.01**	564.20	43.74	0.00	0.66	8.24	0.02
1021	**650.76**	1077.00	34.90	0.00	1.19	2.40	0.01
1041	**718.76**	1651.00	48.25	0.00	0.73	10.91	0.01
1061	**786.76**	1339.00	152.20	0.00	1.64	4.15	0.02
1081	**844.76**	1912.00	206.20	0.00	0.70	2.83	0.06
1101	**892.76**	1338.00	72.38	0.00	3.52	5.51	0.10
1121	**921.35**	284.80	1740.00	0.00	8.65	36.09	0.98
1141	**930.54**	440.80	349.70	0.00	11.48	52.25	0.97
1161	**949.13**	420.30	825.40	0.00	1.54	47.49	17.93
1181	**989.13**	166.60	26.53	0.00	0.66	35.29	8.48
1201	**1055.28**	270.20	414.60	0.00	0.46	40.03	5.88
1221	**1125.03**	136.50	90.04	0.00	0.74	40.96	9.40
1241	**1173.88**	299.30	539.10	0.00	1.31	48.52	16.41
1261	**1218.18**	142.60	88.00	0.00	1.27	40.49	14.98
1281	**1260.33**	291.70	549.70	0.00	2.89	50.40	28.57
1281	**1307.28**	0.00	0.00	0.00	0.00	0.00	0.00

Note 1: Meridonal, Hoop, and Shear Stresses are Reversed in Highlighted Sections (Floor)
Note 2: Underlined results indicate a reversal of inside (botttom) and outside (top) surfaces in the floor

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Comparisons - Pri Tank-for report.xls, Stress Max-12

Figure A.47. Primary Tank Stresses, Shell Bottom, New Geometry, Low Soil Friction

Primary Tank Component Stress Results
Wall & Dome - Low Friciton Haunch

ANSYS MAXIMUMS BY PATH

M&D Starting M&D Element No.	`	Shell Top Surface (outside - away from waste)					
		Phase II 2D HV Seismic Hoop Stress (kip/ft^2)	Phase II 2D HV Seismic Meridional Stress (kip/ft^2)	Phase II 2D HV Seismic Thru-Thickness Stress (kip/ft^2)	Phase II 2D HV Seismic In-Plane Shear Stress (kip/ft^2)	Phase II 2D HV Seismic In-Plane Shear Force Stress (kip/ft^2)	Phase II 2D HV Seismic Thru-Thickness Shear Stress (kip/ft^2)
761	**89.72**	181.80	252.20	0.00	30.78	1.80	0.26
781	**127.48**	200.20	313.70	0.00	29.85	0.24	0.05
801	**158.68**	200.70	303.30	0.00	29.09	0.13	0.03
821	**204.14**	195.70	312.10	0.00	29.05	0.06	0.02
841	**247.52**	183.90	313.10	0.00	29.14	0.12	0.03
861	**296.07**	171.90	324.60	0.00	28.41	0.02	0.01
881	**345.70**	145.90	301.70	0.00	27.40	0.14	0.01
901	**391.94**	68.33	202.30	0.00	26.38	0.14	0.01
921	**441.79**	97.01	145.30	0.00	25.81	0.31	0.05
941	**466.30**	273.10	370.40	0.00	7.31	15.44	0.64
961	**492.29**	235.80	112.30	0.00	3.50	0.27	0.27
981	**529.85**	359.30	123.80	0.00	0.81	7.39	0.10
1001	**582.01**	551.90	2.90	0.00	0.59	8.26	0.02
1021	**650.76**	1070.00	6.86	0.00	0.78	2.39	0.01
1041	**718.76**	1689.00	80.49	0.00	0.65	10.91	0.01
1061	**786.76**	1254.00	136.20	0.00	0.75	4.14	0.02
1081	**844.76**	2041.00	219.50	0.00	0.34	2.86	0.07
1101	**892.76**	1305.00	66.79	0.00	1.50	5.40	0.10
1121	**921.35**	1326.00	1803.00	0.00	4.81	36.09	0.97
1141	**930.54**	355.40	121.60	0.00	9.69	55.08	0.99
1161	**949.13**	42.07	454.30	0.00	1.59	48.98	18.62
1181	**989.13**	340.40	605.50	0.00	0.68	46.74	8.80
1201	**1055.28**	162.90	58.48	0.00	0.48	36.49	6.11
1221	**1125.03**	266.30	429.00	0.00	0.77	42.59	9.76
1241	**1173.88**	112.50	195.90	0.00	1.36	45.56	17.05
1261	**1218.18**	271.10	460.50	0.00	1.31	44.86	15.56
1281	**1260.33**	113.90	199.40	0.00	3.01	45.53	29.67
1281	**1307.28**	0.00	0.00	0.00	0.00	0.00	0.00

Note 1: Meridonal, Hoop, and Shear Stresses are Reversed in Highlighted Sections (Floor)
Note 2: Underlined results indicate a reversal of inside (botttom) and outside (top) surfaces in the floor

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Comparisons - Pri Tank-for report.xls, Stress Max-12a

Figure A.48. Primary Tank Stresses, Shell Top, New Geometry, Low Soil Friction Haunch

Primary Tank Component Stress Results
Wall & Dome - Low Friciton Haunch

ANSYS MAXIMUMS BY PATH

M&D Starting M&D Element No.		Shell Mid-Plane					
		Phase II 2D HV Seismic Hoop Stress (kip/ft^2)	Phase II 2D HV Seismic Meridional Stress (kip/ft^2)	Phase II 2D HV Seismic Thru-Thickness Stress (kip/ft^2)	Phase II 2D HV Seismic In-Plane Shear Stress (kip/ft^2)	Phase II 2D HV Seismic In-Plane Shear Force Stress (kip/ft^2)	Phase II 2D HV Seismic Thru-Thickness Shear Stress (kip/ft^2)
761	**89.72**	176.60	249.20	0.00	30.89	1.80	0.26
781	**127.48**	197.80	313.50	0.00	29.85	0.24	0.05
801	**158.68**	198.80	302.90	0.00	29.08	0.13	0.03
821	**204.14**	194.40	311.90	0.00	29.05	0.06	0.02
841	**247.52**	182.90	312.90	0.00	29.15	0.12	0.03
861	**296.07**	171.10	324.80	0.00	28.42	0.02	0.01
881	**345.70**	145.00	300.90	0.00	27.41	0.14	0.01
901	**391.94**	66.40	198.60	0.00	26.41	0.14	0.01
921	**441.79**	99.43	141.70	0.00	26.02	0.31	0.05
941	**466.30**	173.50	42.54	0.00	7.74	15.44	0.64
961	**492.29**	192.20	38.59	0.00	3.49	0.27	0.27
981	**529.85**	332.30	31.95	0.00	0.82	7.39	0.10
1001	**582.01**	557.60	22.02	0.00	0.66	8.26	0.02
1021	**650.76**	1074.00	19.46	0.00	0.94	2.39	0.01
1041	**718.76**	1669.00	17.22	0.00	0.65	10.91	0.01
1061	**786.76**	1295.00	9.24	0.00	1.14	4.14	0.02
1081	**844.76**	1975.00	6.96	0.00	0.50	2.86	0.07
1101	**892.76**	1323.00	4.58	0.00	2.31	5.40	0.10
1121	**921.35**	801.40	19.63	0.00	6.93	36.09	0.97
1141	**930.54**	397.40	133.40	0.00	10.75	55.08	0.99
1161	**949.13**	233.40	197.80	0.00	1.59	14.93	18.62
1181	**989.13**	251.40	297.10	0.00	0.68	29.53	8.80
1201	**1055.28**	217.40	232.50	0.00	0.48	29.77	6.11
1221	**1125.03**	199.50	194.60	0.00	0.77	30.65	9.76
1241	**1173.88**	204.10	209.80	0.00	1.36	29.89	17.05
1261	**1218.18**	202.80	214.50	0.00	1.31	30.37	15.56
1281	**1260.33**	197.70	215.00	0.00	3.01	30.81	29.67
1281	**1307.28**	0.00	0.00	0.00	0.00	0.00	0.00

Note 1: Meridonal, Hoop, and Shear Stresses are Reversed in Highlighted Sections (Floor)
Note 2: Underlined results indicate a reversal of inside (botttom) and outside (top) surfaces in the floor

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Comparisons - Pri Tank-for report.xls, Stress Max-12a

Figure A.49. Primary Tank Stresses, Shell Middle, New Geometry, Low Soil Friction Haunch

Primary Tank Component Stress Results
Wall & Dome - Low Friciton Haunch

ANSYS MAXIMUMS BY PATH

M&D Starting M&D Element No.		Shell Bottom Surface (inside - waste side)					
		Phase II 2D HV Seismic Hoop Stress (kip/ft^2)	Phase II 2D HV Seismic Meridional Stress (kip/ft^2)	Phase II 2D HV Seismic Thru-Thickness Stress (kip/ft^2)	Phase II 2D HV Seismic In-Plane Shear Stress (kip/ft^2)	Phase II 2D HV Seismic In-Plane Shear Force Stress (kip/ft^2)	Phase II 2D HV Seismic Thru-Thickness Shear Stress (kip/ft^2)
761	**89.72**	171.40	246.20	0.00	31.00	1.80	0.26
781	**127.48**	195.30	313.20	0.00	29.85	0.24	0.05
801	**158.68**	196.90	302.40	0.00	29.07	0.13	0.03
821	**204.14**	193.00	311.70	0.00	29.04	0.06	0.02
841	**247.52**	181.90	312.70	0.00	29.16	0.12	0.03
861	**296.07**	170.40	325.00	0.00	28.43	0.02	0.01
881	**345.70**	144.10	300.10	0.00	27.43	0.14	0.01
901	**391.94**	64.48	194.90	0.00	26.43	0.14	0.01
921	**441.79**	101.80	138.20	0.00	26.23	0.31	0.05
941	**466.30**	74.61	289.60	0.00	8.16	15.44	0.64
961	**492.29**	148.60	184.80	0.00	3.48	0.27	0.27
981	**529.85**	305.20	64.08	0.00	0.83	7.39	0.10
1001	**582.01**	564.00	41.36	0.00	0.73	8.26	0.02
1021	**650.76**	1078.00	32.05	0.00	1.11	2.39	0.01
1041	**718.76**	1651.00	51.16	0.00	0.66	10.91	0.01
1061	**786.76**	1339.00	150.40	0.00	1.54	4.14	0.02
1081	**844.76**	1912.00	207.50	0.00	0.80	2.86	0.07
1101	**892.76**	1343.00	72.23	0.00	3.45	5.40	0.10
1121	**921.35**	286.70	1776.00	0.00	9.05	36.09	0.97
1141	**930.54**	451.70	370.50	0.00	11.81	55.08	0.99
1161	**949.13**	425.70	843.50	0.00	1.59	48.66	18.62
1181	**989.13**	162.30	42.88	0.00	0.68	36.51	8.80
1201	**1055.28**	271.90	419.10	0.00	0.48	40.39	6.11
1221	**1125.03**	134.20	97.92	0.00	0.77	41.68	9.76
1241	**1173.88**	303.10	551.90	0.00	1.36	49.34	17.05
1261	**1218.18**	140.20	96.79	0.00	1.31	41.17	15.56
1281	**1260.33**	295.30	562.60	0.00	3.01	51.24	29.67
1281	**1307.28**	0.00	0.00	0.00	0.00	0.00	0.00

Note 1: Meridonal, Hoop, and Shear Stresses are Reversed in Highlighted Sections (Floor)
Note 2: Underlined results indicate a reversal of inside (botttom) and outside (top) surfaces in the floor

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Comparisons - Pri Tank-for report.xls, Stress Max-12a

Figure A.50. Primary Tank Stresses, Shell Bottom, New Geometry, Low Soil Friction Haunch

Primary Tank Component Stress Results
Wall & Dome Soil - High Friction

ANSYS MAXIMUMS BY PATH

M&D Starting M&D Element No.		Shell Top Surface (outside - away from waste)					
		Phase II 2D HV Seismic Hoop Stress (kip/ft^2)	Phase II 2D HV Seismic Meridional Stress (kip/ft^2)	Phase II 2D HV Seismic Thru-Thickness Stress (kip/ft^2)	Phase II 2D HV Seismic In-Plane Shear Stress (kip/ft^2)	Phase II 2D HV Seismic In-Plane Shear Force Stress (kip/ft^2)	Phase II 2D HV Seismic Thru-Thickness Shear Stress (kip/ft^2)
761	**89.72**	150.30	229.40	0.00	32.33	1.95	0.26
781	**127.48**	168.90	289.90	0.00	31.29	0.27	0.05
801	**158.68**	169.00	280.30	0.00	30.42	0.14	0.03
821	**204.14**	160.60	285.30	0.00	30.30	0.06	0.01
841	**247.52**	146.00	287.00	0.00	30.32	0.11	0.02
861	**296.07**	125.40	291.60	0.00	29.49	0.02	0.01
881	**345.70**	92.36	272.70	0.00	28.51	0.10	0.01
901	**391.94**	29.47	212.40	0.00	27.06	0.07	0.01
921	**441.79**	116.30	203.20	0.00	22.12	0.23	0.03
941	**466.30**	297.90	385.10	0.00	7.23	16.96	0.59
961	**492.29**	256.20	117.00	0.00	3.81	0.21	0.27
981	**529.85**	351.80	129.20	0.00	1.05	7.53	0.11
1001	**582.01**	552.10	5.32	0.00	0.50	8.25	0.02
1021	**650.76**	1070.00	9.03	0.00	0.84	2.39	0.01
1041	**718.76**	1689.00	82.76	0.00	0.68	10.91	0.01
1061	**786.76**	1254.00	135.00	0.00	0.84	4.14	0.02
1081	**844.76**	2041.00	221.10	0.00	0.44	2.84	0.07
1101	**892.76**	1301.00	65.19	0.00	1.46	5.48	0.10
1121	**921.35**	1312.00	1779.00	0.00	4.83	36.10	1.00
1141	**930.54**	355.90	105.10	0.00	9.73	52.97	0.97
1161	**949.13**	47.15	432.80	0.00	1.55	47.76	18.09
1181	**989.13**	339.70	606.60	0.00	0.67	47.30	8.55
1201	**1055.28**	162.20	65.20	0.00	0.46	35.71	5.93
1221	**1125.03**	260.70	417.40	0.00	0.75	42.21	9.48
1241	**1173.88**	112.20	190.40	0.00	1.32	44.88	16.56
1261	**1218.18**	266.00	449.70	0.00	1.28	44.32	15.12
1281	**1260.33**	113.30	193.20	0.00	2.92	44.81	28.83
1281	**1307.28**	0.00	0.00	0.00	0.00	0.00	0.00

Note 1: Meridonal, Hoop, and Shear Stresses are Reversed in Highlighted Sections (Floor)
Note 2: Underlined results indicate a reversal of inside (botttom) and outside (top) surfaces in the floor

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Comparisons - Pri Tank-for report.xls, Stress Max-13

Figure A.51. Primary Tank Stresses, Shell Top, New Geometry, High Soil Friction

Primary Tank Component Stress Results
Wall & Dome Soil - High Friction

ANSYS MAXIMUMS BY PATH

M&D Starting M&D Element No.	`	Shell Mid-Plane					
		Phase II 2D HV Seismic Hoop Stress (kip/ft^2)	Phase II 2D HV Seismic Meridional Stress (kip/ft^2)	Phase II 2D HV Seismic Thru-Thickness Stress (kip/ft^2)	Phase II 2D HV Seismic In-Plane Shear Stress (kip/ft^2)	Phase II 2D HV Seismic In-Plane Shear Force Stress (kip/ft^2)	Phase II 2D HV Seismic Thru-Thickness Shear Stress (kip/ft^2)
761	**89.72**	144.80	225.90	0.00	32.45	1.95	0.26
781	**127.48**	166.20	289.40	0.00	31.30	0.27	0.05
801	**158.68**	166.80	279.70	0.00	30.42	0.14	0.03
821	**204.14**	159.10	284.90	0.00	30.29	0.06	0.01
841	**247.52**	144.80	286.70	0.00	30.33	0.11	0.02
861	**296.07**	124.40	291.40	0.00	29.50	0.02	0.01
881	**345.70**	91.24	271.70	0.00	28.53	0.10	0.01
901	**391.94**	31.18	209.60	0.00	27.08	0.07	0.01
921	**441.79**	117.80	201.50	0.00	22.18	0.23	0.03
941	**466.30**	195.30	46.36	0.00	7.78	16.96	0.59
961	**492.29**	210.20	42.32	0.00	3.74	0.21	0.27
981	**529.85**	323.90	35.05	0.00	0.92	7.53	0.11
1001	**582.01**	557.80	24.34	0.00	0.57	8.25	0.02
1021	**650.76**	1074.00	21.58	0.00	1.01	2.39	0.01
1041	**718.76**	1669.00	19.39	0.00	0.70	10.91	0.01
1061	**786.76**	1295.00	10.67	0.00	1.23	4.14	0.02
1081	**844.76**	1975.00	8.23	0.00	0.54	2.84	0.07
1101	**892.76**	1319.00	5.73	0.00	2.36	5.48	0.10
1121	**921.35**	794.90	20.77	0.00	6.81	36.10	1.00
1141	**930.54**	394.70	135.50	0.00	10.80	52.97	0.97
1161	**949.13**	234.50	204.80	0.00	1.55	14.63	18.09
1181	**989.13**	252.80	307.70	0.00	0.67	30.59	8.55
1201	**1055.28**	215.60	234.80	0.00	0.46	30.28	5.93
1221	**1125.03**	195.90	190.10	0.00	0.75	30.41	9.48
1241	**1173.88**	201.30	206.40	0.00	1.32	29.83	16.56
1261	**1218.18**	199.80	211.00	0.00	1.28	30.23	15.12
1281	**1260.33**	194.90	211.90	0.00	2.92	30.65	28.83
1281	**1307.28**	0.00	0.00	0.00	0.00	0.00	0.00

Note 1: Meridonal, Hoop, and Shear Stresses are Reversed in Highlighted Sections (Floor)
Note 2: Underlined results indicate a reversal of inside (botttom) and outside (top) surfaces in the floor

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Comparisons - Pri Tank-for report.xls, Stress Max-13

Figure A.52. Primary Tank Stresses, Shell Middle, New Geometry, High Soil Friction

Primary Tank Component Stress Results
Wall & Dome Soil - High Friction

ANSYS MAXIMUMS BY PATH

M&D Starting M&D Element No.		Shell Bottom Surface (inside - waste side)					
		Phase II 2D HV Seismic Hoop Stress (kip/ft^2)	Phase II 2D HV Seismic Meridional Stress (kip/ft^2)	Phase II 2D HV Seismic Thru-Thickness Stress (kip/ft^2)	Phase II 2D HV Seismic In-Plane Shear Stress (kip/ft^2)	Phase II 2D HV Seismic In-Plane Shear Force Stress (kip/ft^2)	Phase II 2D HV Seismic Thru-Thickness Shear Stress (kip/ft^2)
761	**89.72**	139.30	222.50	0.00	32.57	1.95	0.26
781	**127.48**	163.60	288.90	0.00	31.31	0.27	0.05
801	**158.68**	164.70	279.10	0.00	30.41	0.14	0.03
821	**204.14**	157.60	284.50	0.00	30.29	0.06	0.01
841	**247.52**	143.50	286.30	0.00	30.34	0.11	0.02
861	**296.07**	123.40	291.20	0.00	29.51	0.02	0.01
881	**345.70**	90.12	270.80	0.00	28.55	0.10	0.01
901	**391.94**	32.88	206.80	0.00	27.10	0.07	0.01
921	**441.79**	119.30	199.80	0.00	22.24	0.23	0.03
941	**466.30**	93.10	298.10	0.00	8.32	16.96	0.59
961	**492.29**	164.20	196.30	0.00	3.67	0.21	0.27
981	**529.85**	295.90	64.09	0.00	0.79	7.53	0.11
1001	**582.01**	564.20	43.35	0.00	0.63	8.25	0.02
1021	**650.76**	1077.00	34.30	0.00	1.17	2.39	0.01
1041	**718.76**	1651.00	49.07	0.00	0.72	10.91	0.01
1061	**786.76**	1339.00	151.70	0.00	1.63	4.14	0.02
1081	**844.76**	1912.00	206.70	0.00	0.70	2.84	0.07
1101	**892.76**	1340.00	72.37	0.00	3.51	5.48	0.10
1121	**921.35**	285.50	1750.00	0.00	8.79	36.10	1.00
1141	**930.54**	444.90	358.10	0.00	11.86	52.97	0.97
1161	**949.13**	422.60	834.30	0.00	1.55	48.38	18.09
1181	**989.13**	165.80	27.21	0.00	0.67	35.30	8.55
1201	**1055.28**	269.00	416.10	0.00	0.46	40.61	5.93
1221	**1125.03**	132.90	96.12	0.00	0.75	41.19	9.48
1241	**1173.88**	297.30	538.40	0.00	1.32	48.73	16.56
1261	**1218.18**	139.00	93.55	0.00	1.28	40.60	15.12
1281	**1260.33**	289.80	549.30	0.00	2.92	50.52	28.83
1281	**1307.28**	0.00	0.00	0.00	0.00	0.00	0.00

Note 1: Meridonal, Hoop, and Shear Stresses are Reversed in Highlighted Sections (Floor)
Note 2: Underlined results indicate a reversal of inside (botttom) and outside (top) surfaces in the floor

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Comparisons - Pri Tank-for report.xls, Stress Max-13

Figure A.53. Primary Tank Stresses, Shell Bottom, New Geometry, High Soil Friction

Primary Tank Component Stress Results
Birth & Death - Wall & Dome Soil Spr

ANSYS MAXIMUMS BY PATH

M&D Starting M&D Element No.		Shell Top Surface (outside - away from waste)					
		Phase II 2D HV Seismic Hoop Stress (kip/ft^2)	Phase II 2D HV Seismic Meridional Stress (kip/ft^2)	Phase II 2D HV Seismic Thru-Thickness Stress (kip/ft^2)	Phase II 2D HV Seismic In-Plane Shear Stress (kip/ft^2)	Phase II 2D HV Seismic In-Plane Shear Force Stress (kip/ft^2)	Phase II 2D HV Seismic Thru-Thickness Shear Stress (kip/ft^2)
761	**89.72**	373.00	409.60	0.00	1.33	3.56	0.04
781	**127.48**	274.70	333.80	0.00	0.72	8.00	0.00
801	**158.68**	351.20	440.20	0.00	0.72	6.93	0.00
821	**204.14**	225.80	352.30	0.00	0.68	2.17	0.00
841	**247.52**	307.60	427.60	0.00	0.80	2.52	0.01
861	**296.07**	136.00	329.70	0.00	1.14	0.66	0.00
881	**345.70**	206.60	341.40	0.00	2.05	3.19	0.02
901	**391.94**	62.35	262.50	0.00	2.20	2.50	0.03
921	**441.79**	68.76	285.70	0.00	2.16	6.64	0.06
941	**466.30**	304.80	529.50	0.00	1.51	23.73	0.16
961	**492.29**	501.40	122.30	0.00	1.13	0.33	0.04
981	**529.85**	299.20	155.30	0.00	1.47	8.45	0.02
1001	**582.01**	557.70	69.40	0.00	1.18	8.18	0.00
1021	**650.76**	1078.00	59.37	0.00	1.74	2.56	0.01
1041	**718.76**	1707.00	96.05	0.00	1.87	11.03	0.03
1061	**786.76**	1276.00	121.20	0.00	1.26	4.01	0.01
1081	**844.76**	2021.00	228.30	0.00	1.95	4.30	0.05
1101	**892.76**	1249.00	126.30	0.00	1.87	4.95	0.19
1121	**921.35**	1202.00	1655.00	0.00	5.17	38.16	0.85
1141	**930.54**	376.70	999.60	0.00	9.18	77.34	0.89
1161	**949.13**	112.40	475.20	0.00	1.48	51.51	17.72
1181	**989.13**	420.50	663.60	0.00	0.65	40.11	8.38
1201	**1055.28**	266.40	174.80	0.00	0.45	31.99	5.81
1221	**1125.03**	363.70	520.00	0.00	0.73	40.17	9.29
1241	**1173.88**	220.30	124.00	0.00	1.29	43.33	16.22
1261	**1218.18**	371.90	556.10	0.00	1.25	43.62	14.80
1281	**1260.33**	221.60	137.40	0.00	2.86	43.82	28.23
1281	**1307.28**	0.00	0.00	0.00	0.00	0.00	0.00

Note 1: Meridonal, Hoop, and Shear Stresses are Reversed in Highlighted Sections (Floor)
Note 2: Underlined results indicate a reversal of inside (botttom) and outside (top) surfaces in the floor

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Comparisons - Pri Tank-for report.xls, Stress Max-14

Figure A.54. Primary Tank Stresses, Shell Top, New Geometry, Birth and Death

Primary Tank Component Stress Results
Birth & Death - Wall & Dome Soil Spr

ANSYS MAXIMUMS BY PATH

M&D Starting M&D Element No.		Shell Mid-Plane					
		Phase II 2D HV Seismic Hoop Stress (kip/ft^2)	Phase II 2D HV Seismic Meridional Stress (kip/ft^2)	Phase II 2D HV Seismic Thru-Thickness Stress (kip/ft^2)	Phase II 2D HV Seismic In-Plane Shear Stress (kip/ft^2)	Phase II 2D HV Seismic In-Plane Shear Force Stress (kip/ft^2)	Phase II 2D HV Seismic Thru-Thickness Shear Stress (kip/ft^2)
761	**89.72**	349.50	340.60	0.00	1.39	3.56	0.04
781	**127.48**	287.80	384.90	0.00	0.73	8.00	0.00
801	**158.68**	320.60	381.20	0.00	0.71	6.93	0.00
821	**204.14**	234.10	386.10	0.00	0.69	2.17	0.00
841	**247.52**	268.30	350.90	0.00	0.81	2.52	0.01
861	**296.07**	143.20	358.70	0.00	1.16	0.66	0.00
881	**345.70**	167.80	278.00	0.00	2.07	3.19	0.02
901	**391.94**	44.26	287.50	0.00	2.23	2.50	0.03
921	**441.79**	29.03	245.30	0.00	2.17	6.64	0.06
941	**466.30**	224.70	100.00	0.00	1.75	23.73	0.16
961	**492.29**	478.70	86.20	0.00	1.13	0.33	0.04
981	**529.85**	268.20	76.80	0.00	1.53	8.45	0.02
1001	**582.01**	562.80	59.79	0.00	1.23	8.18	0.00
1021	**650.76**	1082.00	62.86	0.00	1.81	2.56	0.01
1041	**718.76**	1687.00	65.89	0.00	1.91	11.03	0.03
1061	**786.76**	1317.00	46.42	0.00	1.87	4.01	0.01
1081	**844.76**	1956.00	49.09	0.00	2.57	4.30	0.05
1101	**892.76**	1265.00	44.05	0.00	1.64	4.95	0.19
1121	**921.35**	723.90	51.61	0.00	6.88	38.16	0.85
1141	**930.54**	363.30	151.60	0.00	10.08	77.34	0.89
1161	**949.13**	273.40	163.50	0.00	1.48	18.67	17.72
1181	**989.13**	337.00	372.20	0.00	0.65	23.85	8.38
1201	**1055.28**	318.50	341.80	0.00	0.45	27.97	5.81
1221	**1125.03**	301.10	298.40	0.00	0.73	28.70	9.29
1241	**1173.88**	307.60	314.30	0.00	1.29	28.70	16.22
1261	**1218.18**	307.60	323.10	0.00	1.25	29.82	14.80
1281	**1260.33**	301.60	321.70	0.00	2.86	30.50	28.23
1281	**1307.28**	0.00	0.00	0.00	0.00	0.00	0.00

Note 1: Meridonal, Hoop, and Shear Stresses are Reversed in Highlighted Sections (Floor)
Note 2: Underlined results indicate a reversal of inside (botttom) and outside (top) surfaces in the floor

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Comparisons - Pri Tank-for report.xls, Stress Max-14

Figure A.55. Primary Tank Stresses, Shell Middle, New Geometry, Birth and Death

Primary Tank Component Stress Results
Birth & Death - Wall & Dome Soil Spr

ANSYS MAXIMUMS BY PATH

M&D Starting M&D Element No.		Shell Bottom Surface (inside - waste side)					
		Phase II 2D HV Seismic Hoop Stress (kip/ft^2)	Phase II 2D HV Seismic Meridional Stress (kip/ft^2)	Phase II 2D HV Seismic Thru-Thickness Stress (kip/ft^2)	Phase II 2D HV Seismic In-Plane Shear Stress (kip/ft^2)	Phase II 2D HV Seismic In-Plane Shear Force Stress (kip/ft^2)	Phase II 2D HV Seismic Thru-Thickness Shear Stress (kip/ft^2)
761	**89.72**	326.00	294.00	0.00	1.45	3.56	0.04
781	**127.48**	300.90	446.00	0.00	0.75	8.00	0.00
801	**158.68**	295.40	322.20	0.00	0.70	6.93	0.00
821	**204.14**	242.40	419.90	0.00	0.70	2.17	0.00
841	**247.52**	235.60	274.40	0.00	0.81	2.52	0.01
861	**296.07**	150.30	387.60	0.00	1.17	0.66	0.00
881	**345.70**	129.00	215.40	0.00	2.10	3.19	0.02
901	**391.94**	31.88	341.60	0.00	2.25	2.50	0.03
921	**441.79**	41.94	205.10	0.00	2.18	6.64	0.06
941	**466.30**	196.50	399.30	0.00	1.98	23.73	0.16
961	**492.29**	456.10	245.00	0.00	1.12	0.33	0.04
981	**529.85**	237.60	51.61	0.00	1.58	8.45	0.02
1001	**582.01**	568.20	55.21	0.00	1.35	8.18	0.00
1021	**650.76**	1086.00	66.35	0.00	1.87	2.56	0.01
1041	**718.76**	1668.00	64.36	0.00	1.94	11.03	0.03
1061	**786.76**	1359.00	158.10	0.00	2.47	4.01	0.01
1081	**844.76**	1893.00	195.70	0.00	3.20	4.30	0.05
1101	**892.76**	1282.00	79.53	0.00	1.61	4.95	0.19
1121	**921.35**	253.00	1604.00	0.00	9.21	38.16	0.85
1141	**930.54**	604.00	793.30	0.00	10.99	77.34	0.89
1161	**949.13**	457.80	764.40	0.00	1.48	35.53	17.72
1181	**989.13**	253.70	106.60	0.00	0.65	31.79	8.38
1201	**1055.28**	370.70	519.90	0.00	0.45	37.22	5.81
1221	**1125.03**	240.00	150.30	0.00	0.73	38.92	9.29
1241	**1173.88**	401.90	639.40	0.00	1.29	47.22	16.22
1261	**1218.18**	248.70	168.00	0.00	1.25	39.32	14.80
1281	**1260.33**	394.80	652.00	0.00	2.86	49.96	28.23
1281	**1307.28**	0.00	0.00	0.00	0.00	0.00	0.00

Note 1: Meridonal, Hoop, and Shear Stresses are Reversed in Highlighted Sections (Floor)
Note 2: Underlined results indicate a reversal of inside (botttom) and outside (top) surfaces in the floor

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Comparisons - Pri Tank-for report.xls, Stress Max-14

Figure A.56. Primary Tank Stresses, Shell Bottom, New Geometry, Birth and Death

Appendix B

Arching Study

Case 1
Tank AY, 422 in Waste Level
SpG=1.7
Mu=0.5, E=250 KSF

Depth	Angle (rad)	Path	Max Pressure Soil AY Mean Soil Uncracked Concrete Case 1, Mu=0.5 (psi)	Min Pressure Soil AY Mean Soil Uncracked Concrete Case 1, Mu=0.5 (psi)	Vertical Pressure (psi)	Horizontal Pressure (psi)	Active Pressure Phi = 33 deg (psi)	Active Pressure Phi = 49 deg (psi)
568	-0.035	**67.727**	8.37	6.75	7.12	0.13	7.11	7.11
565.8	-0.071	**105.668**	8.10	7.72	7.27	0.27	7.26	7.26
563.21	-0.097	**137.069**	8.53	8.42	7.46	0.37	7.43	7.42
559.7	-0.125	**182.849**	7.66	7.56	7.71	0.50	7.65	7.65
550.7	-0.181	**226.563**	7.58	7.51	8.35	0.78	8.23	8.22
545.2	-0.210	**275.566**	7.88	7.82	8.74	0.95	8.57	8.55
527.68	-0.298	**325.690**	9.07	9.01	9.99	1.53	9.59	9.56
518.2	-0.347	**372.305**	9.74	9.72	10.66	1.89	10.09	10.04
494.5	-0.482	**423.427**	18.49	18.35	12.35	2.98	11.07	10.97
476.2	-0.607	**468.308**	39.82	39.61	13.65	4.05	11.45	11.27
447.4	-0.657	**515.312**	29.44	28.99	15.70	4.99	12.75	12.51
407.1	-0.710	**549.725**	17.27	16.92	18.57	6.31	14.53	14.18
382.1	-1.571	**585.819**	12.78	12.57	20.35	10.60	6.00	2.85
335	-1.571	**636.369**	7.89	7.82	23.70	12.35	6.99	3.32
281	-1.571	**685.619**	5.75	5.70	27.55	14.35	8.13	3.86
236.5	-1.571	**732.719**	5.96	5.91	30.71	16.00	9.06	4.30
186.8	-1.571	**778.219**	6.95	6.91	34.25	17.85	10.10	4.80
145.5	-1.571	**821.369**	7.77	7.74	37.19	19.38	10.97	5.21
70	-1.571	**874.169**	8.16	8.15	42.57	22.18	12.56	5.96
24	-1.571	**930.544**	8.36	8.27	45.84	23.88	13.52	6.42

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Arching Study, Case 1, Soil Pressures Gravity.xls, FM Max

Figure B.1. Case 1, Soil Pressures

Case 1
Tank AY, 422 In Waste Level
SpG=1.7
Mu=0.5, E=250 KSF

ANSYS MAXIMUMS BY PATH

PNNL Section No.	Path (in.)	Seismic Hoop Force (kip/ft) Mu=0.5, E=250 ksf	Seismic Meridonal Force (kip/ft) Mu=0.5, E=250 ksf	Seismic -In-Plane Shear Force (kip/ft) Mu=0.5, E=250 ksf	Seismic Hoop Moment (ft*kip/ft) Mu=0.5, E=250 ksf	Seismic Meridonal Moment (ft*kip/ft) Mu=0.5, E=250 ksf	Seismic Through-Thickness Shear Force (kip/ft) Mu=0.5, E=250 ksf
2	**67.727**	-59.490	-62.160	0.216	-3.235	-2.041	0.527
3	**105.668**	-57.150	-62.590	0.164	-2.865	-2.353	0.298
4	**137.069**	-54.370	-62.840	0.159	-2.682	-2.064	0.385
6	**182.849**	-49.260	-62.390	0.187	-1.974	-0.428	0.224
8	**226.563**	-44.650	-62.050	0.216	-1.729	-0.952	0.169
9	**275.566**	-37.830	-61.310	0.220	-1.634	-1.196	0.398
11	**325.690**	-29.930	-60.970	0.203	-2.032	-3.518	0.587
13	**372.305**	-17.950	-60.240	0.188	-1.992	-2.586	0.275
17	**423.427**	-0.848	-60.130	0.171	-1.821	1.075	2.010
20	**468.308**	32.810	-65.750	0.167	-1.160	25.510	12.970
22	**515.312**	63.910	-72.760	0.151	6.939	51.460	1.529
24	**549.725**	45.940	-74.380	0.141	5.810	34.080	10.320
26	**585.819**	23.560	-77.040	0.129	1.501	8.834	7.365
30	**636.369**	-9.643	-80.970	0.113	-1.094	-6.435	0.708
33	**685.619**	-32.140	-83.840	0.099	-1.005	-5.916	1.005
35	**732.719**	-42.220	-86.320	0.089	-0.440	-2.597	0.529
38	**778.219**	-46.520	-88.920	0.080	-0.393	-2.324	0.143
41	**821.369**	-45.750	-92.620	0.067	-0.335	-1.982	0.544
43	**874.169**	-35.610	-88.890	0.050	-1.130	-6.656	0.186
46	**930.544**	-22.750	-98.250	0.041	-1.409	-8.293	0.310
48	**977.629**	-0.858	-7.638	0.559	-9.401	44.040	25.560
51	**1019.647**	-0.376	-10.220	0.832	-5.290	44.420	24.720
53	**1060.156**	0.480	-8.865	0.770	3.860	7.172	1.396
55	**1109.695**	0.710	-8.517	0.749	0.967	2.545	1.379
57	**1155.770**	2.574	-1.141	0.316	0.200	0.381	0.129
58	**1211.956**	3.815	3.520	0.038	0.106	0.207	0.303
59	**1281.707**	3.916	3.729	0.042	0.056	-0.055	0.394
60	**1330.557**	3.987	3.963	0.019	0.098	0.203	0.245
61	**1374.857**	4.015	4.219	0.016	0.050	-0.024	0.301
62	**1417.007**	6.968	7.204	0.067	0.324	0.611	0.176

Note: Meridonal/Hoop Forces and Meridonal/Hoop Moments are Reversed in Highlighted Sections.

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Arching Study, Case 1, Conc Tank Seismic Demand Summary.xls, FM Max

Figure B.2. Case 1, Concrete Forces and Moments

Case 1, Tank AY, 422 In Waste Level, SpG=1.7, Mu=0.5, E=250 KSF

M&D Starting M&D Element No.	Path (in.)	Shell Mid-Plane					
		Phase II 2D HV Seismic Hoop Stress (kip/ft^2)	Phase II 2D HV Seismic Meridional Stress (kip/ft^2)	Phase II 2D HV Seismic Thru-Thickness Stress (kip/ft^2)	Phase II 2D HV Seismic In-Plane Shear Stress (kip/ft^2)	Phase II 2D HV Seismic In-Plane Shear Force Stress (kip/ft^2)	Phase II 2D HV Seismic Thru-Thickness Shear Stress (kip/ft^2)
762	**67.36**	-1202.78	-1286.11	0.00	5.25	2.98	0.02
782	**105.12**	-1356.25	-1589.58	0.00	6.34	-4.94	0.02
802	**136.32**	-1145.14	-1475.69	0.00	6.43	3.11	0.02
822	**181.78**	-1082.64	-1301.39	0.00	6.78	5.78	0.01
842	**225.16**	-677.78	-1093.06	0.00	7.24	-23.94	0.06
862	**273.71**	-622.57	-817.36	0.00	11.55	13.90	0.01
882	**323.34**	163.61	-494.72	0.00	9.10	-41.73	0.04
902	**369.59**	77.29	-208.40	0.00	6.49	19.37	0.04
922	**419.43**	1655.56	184.93	0.00	4.37	-36.74	0.03
942	**443.94**	596.74	591.53	0.00	4.08	199.51	0.07
962	**469.93**	-2308.33	550.28	0.00	3.88	-12.41	0.04
982	**508.49**	206.81	463.26	0.00	5.91	-18.74	0.03
1002	**544.15**	3848.61	339.58	0.00	3.66	-10.51	0.03
1022	**579.15**	4686.81	331.25	0.00	3.58	-18.06	0.01
1042	**614.65**	7034.72	322.29	0.00	3.85	-13.99	0.01
1062	**650.65**	8368.06	313.47	0.00	4.19	-6.11	0.01
1082	**684.35**	10868.06	305.28	0.00	4.57	16.69	0.01
1102	**715.25**	13958.33	297.71	0.00	0.00	-59.77	0.01
1122	**746.15**	11583.33	288.89	0.00	4.19	3.48	0.01
1142	**780.00**	13298.61	185.83	0.00	3.02	15.95	0.02
1162	**816.40**	11395.83	177.64	0.00	3.02	-39.86	0.04
1182	**851.90**	12715.28	167.85	0.00	2.68	19.28	0.13
1202	**881.90**	11159.72	140.49	0.00	8.56	32.53	0.53
1222	**898.99**	5211.11	133.40	0.00	24.52	111.94	0.64
1242	**908.18**	1556.25	218.47	0.00	13.06	189.86	1.78
1262	**926.77**	669.86	763.19	0.00	12.90	-5.82	-134.79
1282	**966.77**	743.75	1128.47	0.00	-4.54	-29.31	75.00
1302	**1032.92**	562.85	747.92	0.00	4.03	-13.58	-36.90
1322	**1102.67**	430.21	415.56	0.00	-4.29	2.37	80.83
1342	**1151.52**	443.68	454.17	0.00	10.72	0.18	-84.72
1362	**1195.82**	440.56	466.18	0.00	-4.96	-0.30	124.24
1382	**1237.97**	431.53	488.06	0.00	20.94	-2.43	-110.56
1402	**1284.92**	381.11	440.00	0.00	6.58	-2.06	220.90

Note 1: Meridonal, Hoop, and Shear Stresses are Reversed in Highlighted Sections (Floor)
Note 2: Underlined results indicate a reversal of inside (botttom) and outside (top) surfaces in the floor

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Arching Study, Case 1 Pri Tank Seismic Stress.xls, Stress Max

Figure B.3. Case 1, Primary Tank Stresses, Mid-Plane

Case 2
Tank AY, 422 in Waste Level
SpG=1.7
Mu=0.06, E=250 KSF

Depth	Angle (rad)	Path	Max Pressure Soil AY Mean Soil Uncracked Concrete Case 2, Mu=0.6 (psi)	Min Pressure Soil AY Mean Soil Uncracked Concrete Case 2, Mu=0.6 (psi)	Vertical Pressure (psi)	Horizontal Pressure (psi)	Active Pressure Phi = 33 deg (psi)	Active Pressure Phi = 49 deg (psi)
568.00	-0.04	**67.73**	9.01	6.37	7.12	0.13	7.11	7.11
565.80	-0.07	**105.67**	7.79	6.95	7.27	0.27	7.26	7.26
563.21	-0.10	**137.07**	8.33	7.43	7.46	0.37	7.43	7.42
559.70	-0.12	**182.85**	7.39	6.89	7.71	0.50	7.65	7.65
550.70	-0.18	**226.56**	7.17	6.89	8.35	0.78	8.23	8.22
545.20	-0.21	**275.57**	7.49	7.16	8.74	0.95	8.57	8.55
527.68	-0.30	**325.69**	8.74	8.40	9.99	1.53	9.59	9.56
518.20	-0.35	**372.30**	9.62	9.26	10.66	1.89	10.09	10.04
494.50	-0.48	**423.43**	17.76	17.72	12.35	2.98	11.07	10.97
476.20	-0.61	**468.31**	37.47	36.60	13.65	4.05	11.45	11.27
447.40	-0.66	**515.31**	29.81	28.54	15.70	4.99	12.75	12.51
407.10	-0.71	**549.73**	18.74	17.44	18.57	6.31	14.53	14.18
382.10	-1.57	**585.82**	13.56	12.77	20.35	10.60	6.00	2.85
335.00	-1.57	**636.37**	8.10	7.83	23.70	12.35	6.99	3.32
281.00	-1.57	**685.62**	5.94	5.76	27.55	14.35	8.13	3.86
236.50	-1.57	**732.72**	6.17	5.99	30.71	16.00	9.06	4.30
186.80	-1.57	**778.22**	7.19	7.01	34.25	17.85	10.10	4.80
145.50	-1.57	**821.37**	8.01	7.88	37.19	19.38	10.97	5.21
70.00	-1.57	**874.17**	8.31	8.29	42.57	22.18	12.56	5.96
24.00	-1.57	**930.54**	8.35	8.05	45.84	23.88	13.52	6.42

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Arching Study, Case 2, Soil Pressures Gravity.xls, FM Max

Figure B.4. Case 2, Soil Pressures

Case 2
Tank AY, 422 In Waste Level
SpG=1.7
Mu=0.6, E=250 KSF

ANSYS MAXIMUMS BY PATH

PNNL Section No.	Path (in.)	Seismic Hoop Force (kip/ft) Mu=0.6, E=250 ksf	Seismic Meridonal Force (kip/ft) Mu=0.6, E=250 ksf	Seismic -In-Plane Shear Force (kip/ft) Mu=0.6, E=250 ksf	Seismic Hoop Moment (ft*kip/ft) Mu=0.6, E=250 ksf	Seismic Meridonal Moment (ft*kip/ft) Mu=0.6, E=250 ksf	Seismic Through-Thickness Shear Force (kip/ft) Mu=0.6, E=250 ksf
2	**67.727**	-57.470	-57.720	0.678	-3.564	-2.248	0.706
3	**105.668**	-54.220	-57.750	0.362	-2.953	-1.929	0.174
4	**137.069**	-51.080	-58.380	0.328	-2.621	-1.533	0.398
6	**182.849**	-45.960	-58.330	0.356	-1.905	-0.169	0.257
8	**226.563**	-41.500	-58.160	0.375	-1.657	-0.793	0.192
9	**275.566**	-34.880	-57.530	0.344	-1.603	-1.211	0.426
11	**325.690**	-26.780	-57.400	0.326	-2.020	-3.544	0.614
13	**372.305**	-14.260	-57.080	0.341	-1.979	-2.348	0.438
17	**423.427**	3.423	-57.490	0.375	-1.599	2.208	2.339
20	**468.308**	38.130	-63.560	0.371	-0.589	26.870	12.720
22	**515.312**	66.470	-71.540	0.422	7.130	51.350	1.830
24	**549.725**	45.640	-74.110	0.421	5.719	33.520	10.480
26	**585.819**	22.760	-77.490	0.395	1.446	8.511	7.280
30	**636.369**	-10.420	-82.010	0.330	-1.096	-6.455	0.651
33	**685.619**	-32.740	-85.240	0.265	-0.990	-5.833	1.057
35	**732.719**	-42.780	-88.020	0.221	-0.425	-2.524	0.536
38	**778.219**	-47.180	-90.970	0.197	-0.388	-2.303	0.151
41	**821.369**	-46.620	-95.200	0.178	-0.330	-1.950	0.554
43	**874.169**	-36.550	-91.780	0.151	-1.146	-6.753	0.196
46	**930.544**	-23.540	-101.400	0.138	-1.445	-8.506	0.271
48	**977.629**	-1.143	-8.051	0.551	-9.818	45.560	26.960
51	**1019.647**	-0.682	-10.740	0.887	-5.609	46.170	25.890
53	**1060.156**	0.232	-9.283	0.808	3.936	7.189	1.233
55	**1109.695**	0.541	-8.892	0.782	1.001	2.644	1.428
57	**1155.770**	2.467	-1.372	0.338	0.206	0.396	0.132
58	**1211.956**	3.743	3.431	0.050	0.108	0.213	0.311
59	**1281.707**	3.838	3.637	0.053	0.055	-0.061	0.404
60	**1330.557**	3.910	3.870	0.028	0.099	0.206	0.252
61	**1374.857**	3.929	4.107	0.026	0.050	-0.026	0.308
62	**1417.007**	6.832	7.045	0.079	0.330	0.618	0.176

Note: Meridonal/Hoop Forces and Meridonal/Hoop Moments are Reversed in Highlighted Sections.

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Arching Study, Case 2, Conc Tank Seismic Demand Summary.xls, FM Max

Figure B.5. Case 2, Concrete Forces and Moments

Case 2, Tank AY, Waste Level = 422 In, SpG=1.7, Mu=0.6, E=250 KSF

M&D Starting M&D Element No.	Path (in.)	Shell Mid-Plane					
		Phase II 2D HV Seismic Hoop Stress (kip/ft^2)	Phase II 2D HV Seismic Meridional Stress (kip/ft^2)	Phase II 2D HV Seismic Thru-Thickness Stress (kip/ft^2)	Phase II 2D HV Seismic In-Plane Shear Stress (kip/ft^2)	Phase II 2D HV Seismic In-Plane Shear Force Stress (kip/ft^2)	Phase II 2D HV Seismic Thru-Thickness Shear Stress (kip/ft^2)
762	**67.36**	-1086.81	-1178.47	0.00	8.53	2.55	0.05
782	**105.12**	-1240.97	-1438.19	0.00	14.62	-3.28	0.01
802	**136.32**	-1000.69	-1320.14	0.00	15.00	1.95	0.01
822	**181.78**	-981.25	-1168.06	0.00	13.92	6.04	0.01
842	**225.16**	-549.38	-979.86	0.00	11.90	-23.38	0.05
862	**273.71**	-564.51	-779.17	0.00	11.02	13.74	0.02
882	**323.34**	258.75	-484.72	0.00	6.18	-40.17	0.04
902	**369.59**	147.92	-195.63	0.00	3.32	18.93	0.03
922	**419.43**	1763.89	190.63	0.00	-0.16	-35.54	0.03
942	**443.94**	674.65	589.79	0.00	0.19	199.17	0.07
962	**469.93**	-2275.69	548.68	0.00	0.16	-12.49	0.10
982	**508.49**	220.76	462.43	0.00	3.00	-18.53	0.06
1002	**544.15**	3847.22	339.51	0.00	1.28	-10.53	0.03
1022	**579.15**	4686.81	331.81	0.00	1.27	-18.04	0.01
1042	**614.65**	7034.72	323.19	0.00	1.31	-13.99	0.01
1062	**650.65**	8368.06	314.31	0.00	1.54	-6.10	0.01
1082	**684.35**	10868.06	306.04	0.00	1.86	16.69	0.01
1102	**715.25**	13958.33	298.54	0.00	0.00	-59.77	0.01
1122	**746.15**	11583.33	289.58	0.00	1.47	3.48	0.01
1142	**780.00**	13298.61	186.25	0.00	1.17	15.96	0.02
1162	**816.40**	11395.83	178.13	0.00	1.17	-39.87	0.04
1182	**851.90**	12715.28	168.26	0.00	0.90	19.37	0.13
1202	**881.90**	11187.50	140.83	0.00	6.82	32.56	0.53
1222	**898.99**	5234.03	133.68	0.00	22.43	111.88	0.63
1242	**908.18**	1564.58	219.10	0.00	10.93	190.21	1.88
1262	**926.77**	675.76	773.61	0.00	12.90	12.90	-135.42
1282	**966.77**	752.08	1152.08	0.00	-4.56	-28.91	75.00
1302	**1032.92**	565.35	758.33	0.00	4.03	-13.31	-37.09
1322	**1102.67**	426.18	410.00	0.00	-4.31	3.12	80.83
1342	**1151.52**	439.72	449.31	0.00	10.72	0.69	-85.14
1362	**1195.82**	436.46	461.32	0.00	-4.98	0.27	124.24
1382	**1237.97**	427.43	483.26	0.00	21.04	-2.12	-111.18
1402	**1284.92**	377.08	434.86	0.00	6.58	-2.01	220.90

Note 1: Meridonal, Hoop, and Shear Stresses are Reversed in Highlighted Sections (Floor)
Note 2: Underlined results indicate a reversal of inside (botttom) and outside (top) surfaces in the floor

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Arching Study, Case 2, Pri Tank Seismic Stress.xls, Stress Max

Figure B.6. Case 2, Primary Tank Stresses, Mid-Plane

Case 3
Tank AY, 422 in Waste Level
SpG=1.7
Mu=0.7, E=250 KSF

Depth	Angle (rad)	Path	Max Pressure Soil AY Mean Soil Uncracked Concrete Case 3, Mu=0.7 (psi)	Min Pressure Soil AY Mean Soil Uncracked Concrete Case 3, Mu=0.7 (psi)	Vertical Pressure (psi)	Horizontal Pressure (psi)	Active Pressure Phi = 33 deg (psi)	Active Pressure Phi = 49 deg (psi)
568	-0.04	**67.73**	9.95	6.37	7.12	0.13	7.11	7.11
565.8	-0.07	**105.67**	8.90	6.12	7.27	0.27	7.26	7.26
563.21	-0.10	**137.07**	8.70	6.54	7.46	0.37	7.43	7.42
559.7	-0.12	**182.85**	7.58	6.08	7.71	0.50	7.65	7.65
550.7	-0.18	**226.56**	7.24	6.10	8.35	0.78	8.23	8.22
545.2	-0.21	**275.57**	7.43	6.14	8.74	0.95	8.57	8.55
527.68	-0.30	**325.69**	8.76	7.36	9.99	1.53	9.59	9.56
518.2	-0.35	**372.30**	9.94	8.05	10.66	1.89	10.09	10.04
494.5	-0.48	**423.43**	17.74	16.70	12.35	2.98	11.07	10.97
476.2	-0.61	**468.31**	36.15	32.93	13.65	4.05	11.45	11.27
447.4	-0.66	**515.31**	31.04	26.72	15.70	4.99	12.75	12.51
407.1	-0.71	**549.73**	21.03	16.63	18.57	6.31	14.53	14.18
382.1	-1.57	**585.82**	14.85	12.18	20.35	10.60	6.00	2.85
335	-1.57	**636.37**	8.49	7.56	23.70	12.35	6.99	3.32
281	-1.57	**685.62**	6.27	5.64	27.55	14.35	8.13	3.86
236.5	-1.57	**732.72**	6.49	5.91	30.71	16.00	9.06	4.30
186.8	-1.57	**778.22**	7.50	6.96	34.25	17.85	10.10	4.80
145.5	-1.57	**821.37**	8.28	7.91	37.19	19.38	10.97	5.21
70	-1.57	**874.17**	8.48	8.40	42.57	22.18	12.56	5.96
24	-1.57	**930.54**	8.63	7.88	45.84	23.88	13.52	6.42

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Arching Study, Case 3, Soil Pressures Gravity.xls, FM Max

Figure B.7. Case 3, Soil Pressures

Case 3
Tank AY, 422 In Waste Level
SpG=1.7
Mu=0.7, E=250 KSF

ANSYS MAXIMUMS BY PATH

PNNL Section No.	Path (in.)	Seismic Hoop Force (kip/ft) Mu=0.7, E=250 ksf	Seismic Meridonal Force (kip/ft) Mu=0.7, E=250 ksf	Seismic -In-Plane Shear Force (kip/ft) Mu=0.7, E=250 ksf	Seismic Hoop Moment (ft*kip/ft) Mu=0.7, E=250 ksf	Seismic Meridonal Moment (ft*kip/ft) Mu=0.7, E=250 ksf	Seismic Through-Thickness Shear Force (kip/ft) Mu=0.7, E=250 ksf
2	**67.727**	-56.030	-56.020	1.258	-3.816	-2.259	0.913
3	**105.668**	-51.180	-54.860	0.668	-2.905	-1.381	0.247
4	**137.069**	-46.590	-55.370	0.423	-2.411	-0.765	0.621
6	**182.849**	-40.390	-54.920	0.620	-1.670	0.486	0.375
8	**226.563**	-35.900	-54.170	0.976	-1.396	-0.101	0.236
9	**275.566**	-30.480	-52.400	1.358	-1.378	-0.788	0.489
11	**325.690**	-22.940	-51.880	1.778	-1.802	-3.111	0.623
13	**372.305**	-9.018	-51.770	2.065	-1.874	-1.841	0.743
17	**423.427**	10.150	-52.520	2.241	-1.214	4.043	2.813
20	**468.308**	46.930	-59.570	2.091	0.364	29.060	12.550
22	**515.312**	71.020	-68.990	1.602	7.501	51.620	2.383
24	**549.725**	46.280	-72.370	1.400	5.648	32.980	10.820
26	**585.819**	22.700	-76.230	1.252	1.464	8.618	7.236
30	**636.369**	-9.736	-81.090	0.988	-1.037	-6.127	0.677
33	**685.619**	-31.910	-84.530	0.746	-0.947	-5.642	1.148
35	**732.719**	-42.190	-87.510	0.620	-0.405	-2.449	0.546
38	**778.219**	-46.960	-90.710	0.530	-0.382	-2.287	0.180
41	**821.369**	-46.840	-95.360	0.445	-0.325	-1.952	0.607
43	**874.169**	-36.900	-92.270	0.338	-1.101	-6.794	0.212
46	**930.544**	-21.980	-101.900	0.277	-1.322	-8.620	0.342
48	**977.629**	-1.025	-8.028	0.543	-9.890	45.800	28.770
51	**1019.647**	-0.609	-10.910	0.909	-5.665	46.470	27.420
53	**1060.156**	0.272	-9.403	0.832	4.037	7.248	1.158
55	**1109.695**	0.553	-8.978	0.804	1.045	2.782	1.502
57	**1155.770**	2.459	-1.467	0.363	0.213	0.415	0.136
58	**1211.956**	3.722	3.362	0.078	0.110	0.221	0.325
59	**1281.707**	3.805	3.562	0.082	0.056	-0.064	0.420
60	**1330.557**	3.871	3.796	0.054	0.101	0.207	0.260
61	**1374.857**	3.883	4.023	0.058	0.050	-0.030	0.319
62	**1417.007**	6.709	6.857	0.121	0.335	0.620	0.175

Note: Meridonal/Hoop Forces and Meridonal/Hoop Moments are Reversed in Highlighted Sections.

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Arching Study, Case 3, Conc Tank Seismic Demand Summary.xls, FM Max

Figure B.8. Case 3, Concrete Forces and Moments

Case 3, Tank AY, 422 In Waste Level, SpG=1.7, Mu=0.7, E=250 KSF

M&D Starting M&D Element No.	Path (in.)	Shell Mid-Plane					
		Phase II 2D HV Seismic Hoop Stress (kip/ft^2)	Phase II 2D HV Seismic Meridional Stress (kip/ft^2)	Phase II 2D HV Seismic Thru-Thickness Stress (kip/ft^2)	Phase II 2D HV Seismic In-Plane Shear Stress (kip/ft^2)	Phase II 2D HV Seismic In-Plane Shear Force Stress (kip/ft^2)	Phase II 2D HV Seismic Thru-Thickness Shear Stress (kip/ft^2)
762	**67.36**	-1038.89	-1161.81	0.00	38.74	2.43	0.07
782	**105.12**	-1171.53	-1411.11	0.00	41.13	-2.46	0.02
802	**136.32**	-888.19	-1288.89	0.00	32.45	1.47	0.03
822	**181.78**	-890.28	-1111.11	0.00	31.17	6.42	0.03
842	**225.16**	-427.22	-917.36	0.00	30.97	-23.25	0.07
862	**273.71**	-507.78	-715.97	0.00	26.57	13.85	0.05
882	**323.34**	368.96	-430.35	0.00	20.10	-38.74	0.08
902	**369.59**	255.49	-152.01	0.00	7.85	18.74	0.12
922	**419.43**	1917.36	211.39	0.00	-1.65	-34.74	0.10
942	**443.94**	784.03	592.85	0.00	-1.02	199.65	0.43
962	**469.93**	-2231.25	549.38	0.00	-1.26	-12.30	0.35
982	**508.49**	232.85	463.26	0.00	-1.30	-18.17	0.11
1002	**544.15**	3844.44	340.14	0.00	-0.90	-10.49	0.04
1022	**579.15**	4686.81	332.64	0.00	-0.06	-18.03	0.01
1042	**614.65**	7034.72	324.38	0.00	-0.43	-13.99	0.01
1062	**650.65**	8368.06	315.90	0.00	-0.66	-6.10	0.01
1082	**684.35**	10868.06	308.06	0.00	-0.77	16.68	0.01
1102	**715.25**	13958.33	300.83	0.00	0.00	-59.77	0.01
1122	**746.15**	11583.33	292.29	0.00	-0.38	3.48	0.01
1142	**780.00**	13305.56	188.33	0.00	-0.56	15.96	0.02
1162	**816.40**	11395.83	180.42	0.00	-0.56	-39.83	0.04
1182	**851.90**	12715.28	170.76	0.00	-0.25	19.52	0.13
1202	**881.90**	11229.17	143.26	0.00	2.72	33.07	0.54
1222	**898.99**	5274.31	136.94	0.00	16.49	111.60	0.62
1242	**908.18**	1572.92	222.99	0.00	4.74	191.81	2.24
1262	**926.77**	676.39	780.11	0.00	12.73	-0.19	-134.79
1282	**966.77**	756.94	1179.17	0.00	-4.56	-25.79	74.17
1302	**1032.92**	563.40	770.14	0.00	3.99	-11.11	-37.20
1322	**1102.67**	424.58	405.28	0.00	-4.37	4.89	80.00
1342	**1151.52**	437.71	445.14	0.00	10.60	2.36	-86.39
1362	**1195.82**	433.96	456.88	0.00	-5.06	2.02	122.92
1382	**1237.97**	424.51	477.01	0.00	21.26	-0.63	-112.92
1402	**1284.92**	373.75	426.74	0.00	6.53	-1.60	218.47

Note 1: Meridonal, Hoop, and Shear Stresses are Reversed in Highlighted Sections (Floor)
Note 2: Underlined results indicate a reversal of inside (botttom) and outside (top) surfaces in the floor

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Arching Study, Case 3, Pri Tank Seismic Stress.xls, Stress Max

Figure B.9. Case 3, Primary Tank Stresses, Mid-Plane

Case 4
Tank AY, 422 in Waste Level
SpG=1.7
Mu=0.8, E=250 KSF

Depth	Angle (rad)	Path	Max Pressure Soil AY Mean Soil Uncracked Concrete Case 4, Mu=0.8 (psi)	Min Pressure Soil AY Mean Soil Uncracked Concrete Case 4, Mu=0.8 (psi)	Vertical Pressure (psi)	Horizontal Pressure (psi)	Active Pressure Phi = 33 deg (psi)	Active Pressure Phi = 49 deg (psi)
568.00	-0.04	**67.73**	19.54	10.24	7.12	0.13	7.11	7.11
565.80	-0.07	**105.67**	47.10	17.32	7.27	0.27	7.26	7.26
563.21	-0.10	**137.07**	54.27	14.99	7.46	0.37	7.43	7.42
559.70	-0.12	**182.85**	28.47	11.65	7.71	0.50	7.65	7.65
550.70	-0.18	**226.56**	19.38	10.86	8.35	0.78	8.23	8.22
545.20	-0.21	**275.57**	15.83	10.58	8.74	0.95	8.57	8.55
527.68	-0.30	**325.69**	13.48	11.70	9.99	1.53	9.59	9.56
518.20	-0.35	**372.30**	9.94	6.59	10.66	1.89	10.09	10.04
494.50	-0.48	**423.43**	19.85	13.21	12.35	2.98	11.07	10.97
476.20	-0.61	**468.31**	37.83	33.07	13.65	4.05	11.45	11.27
447.40	-0.66	**515.31**	27.53	6.19	15.70	4.99	12.75	12.51
407.10	-0.71	**549.73**	19.42	2.81	18.57	6.31	14.53	14.18
382.10	-1.57	**585.82**	13.68	2.38	20.35	10.60	6.00	2.85
335.00	-1.57	**636.37**	8.10	4.53	23.70	12.35	6.99	3.32
281.00	-1.57	**685.62**	6.12	4.04	27.55	14.35	8.13	3.86
236.50	-1.57	**732.72**	6.46	4.50	30.71	16.00	9.06	4.30
186.80	-1.57	**778.22**	7.63	5.73	34.25	17.85	10.10	4.80
145.50	-1.57	**821.37**	8.42	7.13	37.19	19.38	10.97	5.21
70.00	-1.57	**874.17**	8.77	8.17	42.57	22.18	12.56	5.96
24.00	-1.57	**930.54**	10.52	6.83	45.84	23.88	13.52	6.42

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Arching Study, Case 4, Soil Pressures Gravity.xls, FM Max

Figure B.10. Case 4, Soil Pressure

Case 4
Tank AY, 422 In Waste Level
SpG=1.7
Mu=0.8, E=250 KSF

ANSYS MAXIMUMS BY PATH

PNNL Section No.	Path (in.)	Seismic Hoop Force (kip/ft) Mu=0.8, E=250 ksf	Seismic Meridonal Force (kip/ft) Mu=0.8, E=250 ksf	Seismic -In-Plane Shear Force (kip/ft) Mu=0.8, E=250 ksf	Seismic Hoop Moment (ft*kip/ft) Mu=0.8, E=250 ksf	Seismic Meridonal Moment (ft*kip/ft) Mu=0.8, E=250 ksf	Seismic Through-Thickness Shear Force (kip/ft) Mu=0.8, E=250 ksf
2	**67.727**	-98.690	-99.880	11.770	-1.816	-4.833	3.142
3	**105.668**	-93.370	-99.980	9.739	-3.245	-7.554	1.919
4	**137.069**	-85.220	-98.090	6.684	-3.677	-6.093	2.779
6	**182.849**	-69.960	-93.360	2.613	-2.702	-1.305	1.189
8	**226.563**	-54.180	-88.700	-0.272	-2.303	-0.547	1.392
9	**275.566**	-34.890	-81.470	-1.242	-1.943	0.363	0.489
11	**325.690**	-15.400	-74.460	-1.348	-2.081	-0.797	1.137
13	**372.305**	4.324	-67.080	-1.336	-1.135	2.600	1.223
17	**423.427**	25.700	-55.530	-1.193	-0.436	6.581	1.661
20	**468.308**	65.910	-43.840	-0.988	0.986	28.810	12.280
22	**515.312**	83.540	-46.320	-0.765	7.796	50.760	2.523
24	**549.725**	53.390	-50.890	-0.591	5.974	35.770	10.710
26	**585.819**	38.480	-56.200	-0.429	2.423	14.100	7.249
30	**636.369**	9.361	-62.100	-0.259	-0.504	-3.204	1.774
33	**685.619**	-16.470	-65.920	-0.118	-0.816	-5.484	1.161
35	**732.719**	-31.630	-69.240	0.471	-0.406	-2.628	0.571
38	**778.219**	-40.070	-72.910	1.024	-0.372	-2.454	0.145
41	**821.369**	-42.950	-78.390	1.384	-0.316	-1.890	0.642
43	**874.169**	-34.600	-77.760	1.369	-1.118	-6.623	0.175
46	**930.544**	-20.090	-87.180	1.456	-1.243	-8.170	1.005
48	**977.629**	0.048	-4.787	0.985	-8.002	38.400	29.130
51	**1019.647**	0.216	-7.857	2.209	-4.357	38.540	27.660
53	**1060.156**	0.882	-6.962	1.429	4.023	7.140	1.373
55	**1109.695**	0.986	-6.817	1.071	1.052	2.801	1.509
57	**1155.770**	2.685	-0.382	0.473	0.215	0.422	0.142
58	**1211.956**	3.877	3.624	0.141	0.110	0.224	0.337
59	**1281.707**	3.953	3.835	0.112	0.057	-0.043	0.437
60	**1330.557**	4.007	4.039	0.094	0.101	0.217	0.269
61	**1374.857**	4.005	4.328	0.069	0.050	-0.020	0.306
62	**1417.007**	6.917	7.214	0.127	0.316	0.640	0.186

Note: Meridonal/Hoop Forces and Meridonal/Hoop Moments are Reversed in Highlighted Sections.

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Arching Study, Case 4, Conc Tank Seismic Demand Summary.xls, FM Max

Figure B.11. Case 4, Concrete Forces and Moments

Case 4, Tank AY, 422 In Waste Level, SpG=1.7, Mu=0.8, E=250 KSF

M&D Starting M&D Element No.	Path (in.)	Shell Mid-Plane					
		Phase II 2D HV Seismic Hoop Stress (kip/ft^2)	Phase II 2D HV Seismic Meridional Stress (kip/ft^2)	Phase II 2D HV Seismic Thru-Thickness Stress (kip/ft^2)	Phase II 2D HV Seismic In-Plane Shear Stress (kip/ft^2)	Phase II 2D HV Seismic In-Plane Shear Force Stress (kip/ft^2)	Phase II 2D HV Seismic Thru-Thickness Shear Stress (kip/ft^2)
762	**67.36**	-1196.53	-1359.72	0.00	113.82	1.99	0.09
782	**105.12**	-1282.64	-1585.42	0.00	153.89	-4.37	0.13
802	**136.32**	-1056.25	-1300.00	0.00	148.06	1.91	0.14
822	**181.78**	-1012.50	-1134.72	0.00	97.78	6.46	0.08
842	**225.16**	-616.11	-593.96	0.00	76.46	-21.42	0.29
862	**273.71**	-630.00	-447.08	0.00	33.42	13.04	0.11
882	**323.34**	58.92	91.11	0.00	13.34	-40.15	0.36
902	**369.59**	-66.45	182.36	0.00	5.47	19.53	0.17
922	**419.43**	1435.42	330.28	0.00	3.41	-37.26	0.11
942	**443.94**	498.89	604.31	0.00	1.98	196.39	0.11
962	**469.93**	-2188.19	549.93	0.00	-1.12	-10.69	0.05
982	**508.49**	241.39	465.42	0.00	-1.76	-18.39	0.01
1002	**544.15**	3839.58	342.43	0.00	-1.12	-10.52	0.13
1022	**579.15**	4685.42	335.35	0.00	-0.18	-18.11	0.01
1042	**614.65**	7034.72	325.35	0.00	-0.44	-14.01	0.01
1062	**650.65**	8368.06	314.93	0.00	-0.67	-6.08	0.01
1082	**684.35**	10861.11	304.86	0.00	-0.79	16.68	0.01
1102	**715.25**	13958.33	295.56	0.00	0.00	-59.75	0.01
1122	**746.15**	11583.33	287.01	0.00	-0.40	3.48	0.01
1142	**780.00**	13298.61	185.14	0.00	-0.58	15.94	0.02
1162	**816.40**	11388.89	177.50	0.00	-0.58	-39.85	0.04
1182	**851.90**	12708.33	168.54	0.00	-0.30	19.10	0.13
1202	**881.90**	11138.89	141.67	0.00	2.86	32.80	0.50
1222	**898.99**	5177.78	135.21	0.00	18.19	111.67	0.53
1242	**908.18**	1555.56	218.82	0.00	6.59	187.08	1.46
1262	**926.77**	685.90	789.58	0.00	12.81	-3.26	-132.99
1282	**966.77**	765.97	1184.03	0.00	-4.48	-29.55	74.31
1302	**1032.92**	568.82	773.61	0.00	4.00	-14.35	-36.42
1322	**1102.67**	417.92	400.63	0.00	-4.24	1.92	80.14
1342	**1151.52**	431.74	441.74	0.00	10.63	-0.07	-83.61
1362	**1195.82**	429.24	453.26	0.00	-4.89	-1.16	123.19
1382	**1237.97**	420.56	478.54	0.00	20.34	-2.75	-109.03
1402	**1284.92**	370.00	429.17	0.00	6.51	-2.06	218.96

Note 1: Meridonal, Hoop, and Shear Stresses are Reversed in Highlighted Sections (Floor)
Note 2: Underlined results indicate a reversal of inside (botttom) and outside (top) surfaces in the floor

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Arching Study, Case 4, Pri Tank Seismic Stress.xls, Stress Max

Figure B.12. Case 4, Primary Tank Stresses, Mid-Plane

Case 5
Tank AY, 422 in Waste Level
SpG=1.7
Mu=0.7, E=9958 KSF (Original)

Depth	Angle (rad)	Path	Max Pressure Soil AY Mean Soil Uncracked Concrete Case 5, Mu=0.7, E=Orig (psi)	Min Pressure Soil AY Mean Soil Uncracked Concrete Case 5, Mu=0.7, E=Orig (psi)	Vertical Pressure (psi)	Horizontal Pressure (psi)	Active Pressure Phi = 33 deg (psi)	Active Pressure Phi = 49 deg (psi)
568.00	-0.04	**67.73**	5.70	3.61	7.12	0.13	7.11	7.11
565.80	-0.07	**105.67**	5.62	3.44	7.27	0.27	7.26	7.26
563.21	-0.10	**137.07**	6.48	3.22	7.46	0.37	7.43	7.42
559.70	-0.12	**182.85**	7.10	2.65	7.71	0.50	7.65	7.65
550.70	-0.18	**226.56**	6.51	1.88	8.35	0.78	8.23	8.22
545.20	-0.21	**275.57**	5.97	1.84	8.74	0.95	8.57	8.55
527.68	-0.30	**325.69**	5.63	2.07	9.99	1.53	9.59	9.56
518.20	-0.35	**372.30**	10.50	8.95	10.66	1.89	10.09	10.04
494.50	-0.48	**423.43**	22.26	18.99	12.35	2.98	11.07	10.97
476.20	-0.61	**468.31**	41.64	37.96	13.65	4.05	11.45	11.27
447.40	-0.66	**515.31**	33.47	26.24	15.70	4.99	12.75	12.51
407.10	-0.71	**549.73**	22.85	19.41	18.57	6.31	14.53	14.18
382.10	-1.57	**585.82**	16.47	14.08	20.35	10.60	6.00	2.85
335.00	-1.57	**636.37**	9.05	8.30	23.70	12.35	6.99	3.32
281.00	-1.57	**685.62**	6.40	5.64	27.55	14.35	8.13	3.86
236.50	-1.57	**732.72**	6.50	5.63	30.71	16.00	9.06	4.30
186.80	-1.57	**778.22**	7.53	6.80	34.25	17.85	10.10	4.80
145.50	-1.57	**821.37**	8.33	8.03	37.19	19.38	10.97	5.21
70.00	-1.57	**874.17**	8.44	8.30	42.57	22.18	12.56	5.96
24.00	-1.57	**930.54**	8.04	7.44	45.84	23.88	13.52	6.42

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Arching Study, Case 5, Soil Pressures Gravity.xls, FM Max

Figure B.13. Case 5, Soil Pressures

Case 5
Tank AY, 422 In Waste Level
SpG=1.7
Mu=0.7, E=9958 KSF (Original)

ANSYS MAXIMUMS BY PATH

PNNL Section No.	Path (in.)	Seismic Hoop Force (kip/ft) Mu=0.70, E=Orig ksf	Seismic Meridonal Force (kip/ft) Mu=0.70, E=Orig ksf	Seismic -In-Plane Shear Force (kip/ft) Mu=0.70, E=Orig ksf	Seismic Hoop Moment (ft*kip/ft) Mu=0.70, E=Orig ksf	Seismic Meridonal Moment (ft*kip/ft) Mu=0.70, E=Orig ksf	Seismic Through-Thickness Shear Force (kip/ft) Mu=0.70, E=Orig ksf
2	**67.727**	-37.380	-39.570	2.655	-1.935	-1.165	0.863
3	**105.668**	-33.550	-39.260	2.660	-1.167	-0.567	0.486
4	**137.069**	-30.250	-38.580	2.750	-0.682	0.277	0.735
6	**182.849**	-25.880	-37.750	3.162	0.042	1.843	0.613
8	**226.563**	-22.860	-37.320	3.609	0.370	1.920	0.256
9	**275.566**	-21.300	-37.990	3.857	0.240	0.999	0.427
11	**325.690**	-20.810	-41.800	3.476	-0.546	-2.535	1.539
13	**372.305**	-17.100	-50.740	2.671	-1.833	-4.710	0.917
17	**423.427**	-4.628	-53.940	1.723	-2.235	-1.099	3.519
20	**468.308**	29.250	-62.530	1.493	-1.234	27.030	14.660
22	**515.312**	62.220	-73.050	1.285	7.595	55.730	1.838
24	**549.725**	44.860	-76.430	0.865	6.186	36.170	11.890
26	**585.819**	21.940	-80.900	0.615	1.548	9.017	7.960
30	**636.369**	-12.110	-86.340	0.483	-1.131	-6.734	0.672
33	**685.619**	-33.800	-87.660	0.419	-0.930	-5.796	1.207
35	**732.719**	-42.500	-88.130	0.381	-0.266	-1.961	0.594
38	**778.219**	-46.920	-92.670	0.354	-0.245	-1.866	0.210
41	**821.369**	-47.100	-98.300	0.326	-0.264	-1.829	0.600
43	**874.169**	-37.760	-95.440	0.272	-1.130	-6.708	0.223
46	**930.544**	-24.870	-105.500	0.211	1.476	8.749	0.149
48	**977.629**	-1.788	-8.774	0.614	-10.320	47.570	29.000
51	**1019.647**	-1.308	-11.560	0.875	-5.953	48.420	27.710
53	**1060.156**	-0.327	-9.874	0.808	4.064	7.306	1.069
55	**1109.695**	0.167	-9.463	0.799	1.047	2.778	1.507
57	**1155.770**	2.233	-1.699	0.331	0.214	0.415	0.135
58	**1211.956**	3.579	3.291	0.033	0.111	0.221	0.323
59	**1281.707**	3.675	3.471	0.021	0.056	-0.069	0.416
60	**1330.557**	3.748	3.702	0.013	0.102	0.211	0.256
61	**1374.857**	3.784	3.925	0.007	0.051	-0.028	0.310
62	**1417.007**	6.608	6.830	0.054	0.340	0.630	0.176

Note: Meridonal/Hoop Forces and Meridonal/Hoop Moments are Reversed in Highlighted Sections.

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Arching Study, Case 5, Conc Tank Seismic Demand Summary.xls, FM Max

Figure B.14. Case 5, Concrete Forces and Moments

Case 5, Tank AY, 422 In Watse Level, SpG=1.7, Mu=0.7, E=9958 KSF (Original)

M&D Starting M&D Element No.	Path (in.)	Shell Mid-Plane					
		Phase II 2D HV Seismic Hoop Stress (kip/ft^2)	Phase II 2D HV Seismic Meridional Stress (kip/ft^2)	Phase II 2D HV Seismic Thru-Thickness Stress (kip/ft^2)	Phase II 2D HV Seismic In-Plane Shear Stress (kip/ft^2)	Phase II 2D HV Seismic In-Plane Shear Force Stress (kip/ft^2)	Phase II 2D HV Seismic Thru-Thickness Shear Stress (kip/ft^2)
762	**67.36**	-1196.53	-1359.72	0.00	113.82	1.99	0.09
782	**105.12**	-1282.64	-1585.42	0.00	153.89	-4.37	0.13
802	**136.32**	-1056.25	-1300.00	0.00	148.06	1.91	0.14
822	**181.78**	-1012.50	-1134.72	0.00	97.78	6.46	0.08
842	**225.16**	-616.11	-593.96	0.00	76.46	-21.42	0.29
862	**273.71**	-630.00	-447.08	0.00	33.42	13.04	0.11
882	**323.34**	58.92	91.11	0.00	13.34	-40.15	0.36
902	**369.59**	-66.45	182.36	0.00	5.47	19.53	0.17
922	**419.43**	1435.42	330.28	0.00	3.41	-37.26	0.11
942	**443.94**	498.89	604.31	0.00	1.98	196.39	0.11
962	**469.93**	-2188.19	549.93	0.00	-1.12	-10.69	0.05
982	**508.49**	241.39	465.42	0.00	-1.76	-18.39	0.01
1002	**544.15**	3839.58	342.43	0.00	-1.12	-10.52	0.13
1022	**579.15**	4685.42	335.35	0.00	-0.18	-18.11	0.01
1042	**614.65**	7034.72	325.35	0.00	-0.44	-14.01	0.01
1062	**650.65**	8368.06	314.93	0.00	-0.67	-6.08	0.01
1082	**684.35**	10861.11	304.86	0.00	-0.79	16.68	0.01
1102	**715.25**	13958.33	295.56	0.00	0.00	-59.75	0.01
1122	**746.15**	11583.33	287.01	0.00	-0.40	3.48	0.01
1142	**780.00**	13298.61	185.14	0.00	-0.58	15.94	0.02
1162	**816.40**	11388.89	177.50	0.00	-0.58	-39.85	0.04
1182	**851.90**	12708.33	168.54	0.00	-0.30	19.10	0.13
1202	**881.90**	11138.89	141.67	0.00	2.86	32.80	0.50
1222	**898.99**	5177.78	135.21	0.00	18.19	111.67	0.53
1242	**908.18**	1555.56	218.82	0.00	6.59	187.08	1.46
1262	**926.77**	685.90	789.58	0.00	12.81	-3.26	-132.99
1282	**966.77**	765.97	1184.03	0.00	-4.48	-29.55	74.31
1302	**1032.92**	568.82	773.61	0.00	4.00	-14.35	-36.42
1322	**1102.67**	417.92	400.63	0.00	-4.24	1.92	80.14
1342	**1151.52**	431.74	441.74	0.00	10.63	-0.07	-83.61
1362	**1195.82**	429.24	453.26	0.00	-4.89	-1.16	123.19
1382	**1237.97**	420.56	478.54	0.00	20.34	-2.75	-109.03
1402	**1204.92**	370.00	429.17	0.00	6.51	-2.06	210.96

Note 1: Meridonal, Hoop, and Shear Stresses are Reversed in Highlighted Sections (Floor)
Note 2: Underlined results indicate a reversal of inside (botttom) and outside (top) surfaces in the floor

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Arching Study, Case 5, Pri Tank Seismic Stress.xls, Stress Max

Figure B.15. Case 5, Primary Tank Stresses, Mid-Plane

Case 5a
Tank AY, 422 in Waste Level
SpG=1.7
Mu=0.7, E=1000 KSF

Depth	Angle (rad)	Path	Max Pressure Soil AY Mean Soil Uncracked Concrete Case 5a, Mu=0.7, E=1000 (psi)	Min Pressure Soil AY Mean Soil Uncracked Concrete Case 5a, Mu=0.7, E=1000 (psi)	Vertical Pressure (psi)	Horizontal Pressure (psi)	Active Pressure Phi = 33 deg (psi)	Active Pressure Phi = 49 deg (psi)
568.00	-0.04	**67.73**	8.30	6.52	7.12	0.13	7.11	7.11
565.80	-0.07	**105.67**	6.70	5.98	7.27	0.27	7.26	7.26
563.21	-0.10	**137.07**	7.38	6.53	7.46	0.37	7.43	7.42
559.70	-0.12	**182.85**	6.70	6.41	7.71	0.50	7.65	7.65
550.70	-0.18	**226.56**	6.46	6.38	8.35	0.78	8.23	8.22
545.20	-0.21	**275.57**	6.61	6.50	8.74	0.95	8.57	8.55
527.68	-0.30	**325.69**	7.67	7.56	9.99	1.53	9.59	9.56
518.20	-0.35	**372.30**	10.24	10.04	10.66	1.89	10.09	10.04
494.50	-0.48	**423.43**	18.73	18.38	12.35	2.98	11.07	10.97
476.20	-0.61	**468.31**	34.90	34.58	13.65	4.05	11.45	11.27
447.40	-0.66	**515.31**	28.39	27.49	15.70	4.99	12.75	12.51
407.10	-0.71	**549.73**	19.00	18.35	18.57	6.31	14.53	14.18
382.10	-1.57	**585.82**	13.65	13.27	20.35	10.60	6.00	2.85
335.00	-1.57	**636.37**	8.13	8.01	23.70	12.35	6.99	3.32
281.00	-1.57	**685.62**	5.99	5.91	27.55	14.35	8.13	3.86
236.50	-1.57	**732.72**	6.23	6.15	30.71	16.00	9.06	4.30
186.80	-1.57	**778.22**	7.30	7.22	34.25	17.85	10.10	4.80
145.50	-1.57	**821.37**	8.17	8.11	37.19	19.38	10.97	5.21
70.00	-1.57	**874.17**	8.41	8.40	42.57	22.18	12.56	5.96
24.00	-1.57	**930.54**	8.08	7.92	45.84	23.88	13.52	6.42

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Arching Study, Case 5a, Soil Pressures Gravity.xls, FM Max

Figure B.15b. Case 1, Soil Pressures

Case 5a
Tank AY, 422 In Waste Level
SpG=1.7
Mu=0.7, E=1000 KSF

ANSYS MAXIMUMS BY PATH

PNNL Section No.	Path (in.)	Seismic Hoop Force (kip/ft) Mu=0.70, E=1000 ksf	Seismic Meridonal Force (kip/ft) Mu=0.70, E=1000 ksf	Seismic -In-Plane Shear Force (kip/ft) Mu=0.70, E=1000 ksf	Seismic Hoop Moment (ft*kip/ft) Mu=0.70, E=1000 ksf	Seismic Meridonal Moment (ft*kip/ft) Mu=0.70, E=1000 ksf	Seismic Through-Thickness Shear Force (kip/ft) Mu=0.70, E=1000 ksf
2	**67.727**	-53.570	-54.040	1.077	-3.889	-2.177	0.932
3	**105.668**	-50.650	-53.430	0.589	-2.988	-1.514	0.215
4	**137.069**	-47.590	-54.520	0.245	-2.532	-1.065	0.396
6	**182.849**	-42.800	-54.980	0.186	-1.759	0.151	0.253
8	**226.563**	-38.840	-55.090	0.251	-1.459	-0.464	0.187
9	**275.566**	-32.950	-54.770	0.306	-1.433	-1.080	0.483
11	**325.690**	-26.230	-54.930	0.358	-1.948	-3.821	0.893
13	**372.305**	-15.040	-55.280	0.364	-2.091	-3.391	0.221
17	**423.427**	2.274	-56.900	0.311	-1.748	1.590	2.956
20	**468.308**	37.300	-63.030	0.272	-0.654	27.610	12.880
22	**515.312**	66.690	-70.960	0.256	7.200	52.230	1.899
24	**549.725**	46.110	-74.340	0.223	5.791	33.920	10.610
26	**585.819**	22.550	-78.590	0.209	1.441	8.425	7.340
30	**636.369**	-11.320	-83.920	0.213	-1.113	-6.631	0.611
33	**685.619**	-33.890	-87.700	0.211	-0.989	-5.900	1.067
35	**732.719**	-43.950	-90.950	0.200	-0.418	-2.525	0.541
38	**778.219**	-48.370	-94.380	0.186	-0.388	-2.326	0.151
41	**821.369**	-47.850	-99.320	0.169	-0.329	-1.960	0.545
43	**874.169**	-37.730	-95.850	0.137	-1.158	-6.829	0.202
46	**930.544**	-24.670	-105.500	0.129	-1.480	-8.715	0.151
48	**977.629**	-1.698	-8.687	0.553	-10.390	47.610	27.820
51	**1019.647**	-1.237	-11.420	0.902	-6.027	48.590	26.620
53	**1060.156**	-0.205	-9.845	0.816	3.992	7.198	1.054
55	**1109.695**	0.253	-9.399	0.797	1.023	2.705	1.462
57	**1155.770**	2.300	-1.652	0.344	0.210	0.405	0.135
58	**1211.956**	3.639	3.335	0.046	0.109	0.217	0.320
59	**1281.707**	3.737	3.537	0.049	0.056	-0.065	0.413
60	**1330.557**	3.812	3.770	0.025	0.101	0.211	0.255
61	**1374.857**	3.843	3.999	0.023	0.051	-0.027	0.311
62	**1417.007**	6.699	6.907	0.074	0.335	0.628	0.177

Note: Meridonal/Hoop Forces and Meridonal/Hoop Moments are Reversed in Highlighted Sections.

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Arching Study, Case 5a, Conc Tank Seismic Demand Summary.xls, FM Max

Figure B.16. Case 5a, Concrete Forces and Moments

Case 5a, Tank AY, 422 In Waste Level, SpG=1.7, Mu=0.7, E=1000 KSF

M&D Starting M&D Element No.	Path (in.)	Shell Mid-Plane					
		Phase II 2D HV Seismic Hoop Stress (kip/ft^2)	Phase II 2D HV Seismic Meridional Stress (kip/ft^2)	Phase II 2D HV Seismic Thru-Thickness Stress (kip/ft^2)	Phase II 2D HV Seismic In-Plane Shear Stress (kip/ft^2)	Phase II 2D HV Seismic In-Plane Shear Force Stress (kip/ft^2)	Phase II 2D HV Seismic Thru-Thickness Shear Stress (kip/ft^2)
762	**67.36**	-1196.53	-1359.72	0.00	113.82	1.99	0.09
782	**105.12**	-1282.64	-1585.42	0.00	153.89	-4.37	0.13
802	**136.32**	-1056.25	-1300.00	0.00	148.06	1.91	0.14
822	**181.78**	-1012.50	-1134.72	0.00	97.78	6.46	0.08
842	**225.16**	-616.11	-593.96	0.00	76.46	-21.42	0.29
862	**273.71**	-630.00	-447.08	0.00	33.42	13.04	0.11
882	**323.34**	58.92	91.11	0.00	13.34	-40.15	0.36
902	**369.59**	-66.45	182.36	0.00	5.47	19.53	0.17
922	**419.43**	1435.42	330.28	0.00	3.41	-37.26	0.11
942	**443.94**	498.89	604.31	0.00	1.98	196.39	0.11
962	**469.93**	-2188.19	549.93	0.00	-1.12	-10.69	0.05
982	**508.49**	241.39	465.42	0.00	-1.76	-18.39	0.01
1002	**544.15**	3839.58	342.43	0.00	-1.12	-10.52	0.13
1022	**579.15**	4685.42	335.35	0.00	-0.18	-18.11	0.01
1042	**614.65**	7034.72	325.35	0.00	-0.44	-14.01	0.01
1062	**650.65**	8368.06	314.93	0.00	-0.67	-6.08	0.01
1082	**684.35**	10861.11	304.86	0.00	-0.79	16.68	0.01
1102	**715.25**	13958.33	295.56	0.00	0.00	-59.75	0.01
1122	**746.15**	11583.33	287.01	0.00	-0.40	3.48	0.01
1142	**780.00**	13298.61	185.14	0.00	-0.58	15.94	0.02
1162	**816.40**	11388.89	177.50	0.00	-0.58	-39.85	0.04
1182	**851.90**	12708.33	168.54	0.00	-0.30	19.10	0.13
1202	**881.90**	11138.89	141.67	0.00	2.86	32.80	0.50
1222	**898.99**	5177.78	135.21	0.00	18.19	111.67	0.53
1242	**908.18**	1555.56	218.82	0.00	6.59	187.08	1.46
1262	**926.77**	685.90	789.58	0.00	12.81	-3.26	-132.99
1282	**966.77**	765.97	1184.03	0.00	-4.48	-29.55	74.31
1302	**1032.92**	568.82	773.61	0.00	4.00	-14.35	-36.42
1322	**1102.67**	417.92	400.63	0.00	-4.24	1.92	80.14
1342	**1151.52**	431.74	441.74	0.00	10.63	-0.07	-83.61
1362	**1195.82**	429.24	453.26	0.00	-4.89	-1.16	123.19
1382	**1237.97**	420.56	478.54	0.00	20.34	-2.75	-109.03
1402	**1204.92**	370.00	429.17	0.00	6.51	-2.06	210.96

Note 1: Meridonal, Hoop, and Shear Stresses are Reversed in Highlighted Sections (Floor)
Note 2: Underlined results indicate a reversal of inside (botttom) and outside (top) surfaces in the floor

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Arching Study, Case 5a, Pri Tank Seismic Stress.xls, Stress Max

Figure B.17. Case 5a, Primary Tank Stresses, Mid-Plane

Case 9
Tank AY, 422 in Waste Level
SpG=1.7
Mu=0.2, 0.6, E=250 KSF

Depth	Angle (rad)	Path	Max Pressure Soil AY Mean Soil Uncracked Concrete (psi)	Min Pressure Soil AY Mean Soil Uncracked Concrete (psi)	Vertical Pressure (psi)	Horizontal Pressure (psi)	Active Pressure Phi = 33 deg (psi)	Active Pressure Phi = 49 deg (psi)
568.00	-0.04	**67.73**	12.57	11.77	7.12	0.13	7.11	7.11
565.80	-0.07	**105.67**	9.97	9.84	7.27	0.27	7.26	7.26
563.21	-0.10	**137.07**	8.88	7.85	7.46	0.37	7.43	7.42
559.70	-0.12	**182.85**	7.64	6.70	7.71	0.50	7.65	7.65
550.70	-0.18	**226.56**	10.24	7.13	8.35	0.78	8.23	8.22
545.20	-0.21	**275.57**	11.15	10.44	8.74	0.95	8.57	8.55
527.68	-0.30	**325.69**	11.87	11.46	9.99	1.53	9.59	9.56
518.20	-0.35	**372.30**	14.21	14.10	10.66	1.89	10.09	10.04
494.50	-0.48	**423.43**	19.11	19.08	12.35	2.98	11.07	10.97
476.20	-0.61	**468.31**	26.68	26.67	13.65	4.05	11.45	11.27
447.40	-0.66	**515.31**	28.20	28.17	15.70	4.99	12.75	12.51
407.10	-0.71	**549.73**	13.64	13.62	18.57	6.31	14.53	14.18
382.10	-1.57	**585.82**	14.35	14.33	20.35	10.60	6.00	2.85
335.00	-1.57	**636.37**	11.75	11.74	23.70	12.35	6.99	3.32
281.00	-1.57	**685.62**	10.24	10.23	27.55	14.35	8.13	3.86
236.50	-1.57	**732.72**	10.17	10.15	30.71	16.00	9.06	4.30
186.80	-1.57	**778.22**	10.54	10.53	34.25	17.85	10.10	4.80
145.50	-1.57	**821.37**	10.90	10.90	37.19	19.38	10.97	5.21
70.00	-1.57	**874.17**	10.84	10.81	42.57	22.18	12.56	5.96
24.00	-1.57	**930.54**	11.22	11.18	45.84	23.88	13.52	6.42

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Arching Study, Case 9, Soil Pressures Gravity.xls, FM Max

Figure B.18. Case 9, Soil Pressures

Case 9
Tank AY, 422 In Waste Level
SpG=1.7
Mu=0.2, 0.6, E=250 KSF

ANSYS MAXIMUMS BY PATH

PNNL Section No.	Path (in.)	Seismic Hoop Force (kip/ft) Mu=0.2, 0.6, E-250 ksf	Seismic Meridonal Force (kip/ft) Mu=0.2, 0.6, E-250 ksf	Seismic -In-Plane Shear Force (kip/ft) Mu=0.2, 0.6, E-250 ksf	Seismic Hoop Moment (ft*kip/ft) Mu=0.2, 0.6, E-250 ksf	Seismic Meridonal Moment (ft*kip/ft) Mu=0.2, 0.6, E-250 ksf	Seismic Through-Thickness Shear Force (kip/ft) Mu=0.2, 0.6, E-250 ksf
2	**67.727**	-58.010	-60.440	-0.056	-3.764	-2.267	0.645
3	**105.668**	-55.380	-60.190	-0.034	-2.965	-1.908	0.048
4	**137.069**	-52.530	-60.060	0.033	-2.517	-1.410	0.399
6	**182.849**	-47.950	-59.830	0.040	-1.698	0.136	0.195
8	**226.563**	-44.290	-59.860	-0.050	-1.410	-0.518	0.001
9	**275.566**	-39.040	-59.910	-0.059	-1.453	-1.342	-0.001
11	**325.690**	-32.620	-60.420	-0.067	-2.118	-4.653	-0.002
13	**372.305**	-20.550	-60.940	-0.063	-2.530	-5.067	-0.002
17	**423.427**	0.144	-62.030	0.065	-2.679	-1.231	2.701
20	**468.308**	45.190	-64.850	0.068	-2.917	26.570	14.420
22	**515.312**	91.770	-69.210	0.054	7.313	59.070	-0.011
24	**549.725**	72.520	-68.280	0.042	7.294	42.980	0.003
26	**585.819**	47.620	-69.720	0.037	2.416	14.220	0.001
30	**636.369**	6.288	-73.420	0.033	-0.966	-5.666	0.001
33	**685.619**	-26.520	-76.400	0.031	-1.352	-7.936	0.393
35	**732.719**	-43.090	-79.750	0.030	-0.897	-5.254	0.706
38	**778.219**	-49.100	-83.060	0.029	-0.712	-4.165	0.132
41	**821.369**	-46.180	-87.720	0.031	-0.402	-2.308	-0.002
43	**874.169**	-32.880	-85.060	0.030	-0.989	-5.747	-0.011
46	**930.544**	-19.170	-94.390	-0.055	-1.285	-7.516	-0.011
48	**977.629**	1.725	-11.790	1.089	-8.966	42.790	1.944
51	**1019.647**	3.049	-14.180	1.392	-5.167	44.740	23.110
53	**1060.156**	4.524	-7.388	0.975	3.907	6.705	1.016
55	**1109.695**	4.015	-2.821	0.574	1.108	3.356	0.139
57	**1155.770**	4.542	1.739	0.259	0.154	0.215	0.033
58	**1211.956**	5.268	4.326	0.110	0.107	0.158	0.007
59	**1281.707**	5.630	5.474	0.047	0.086	0.085	0.111
60	**1330.557**	5.692	6.156	-0.070	0.087	0.125	0.008
61	**1374.857**	5.506	7.139	-0.162	0.071	0.093	0.142
62	**1417.007**	8.203	9.169	-0.132	0.130	0.490	0.032

Note: Meridonal/Hoop Forces and Meridonal/Hoop Moments are Reversed in Highlighted Sections.

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Arching Study, Case 9, Conc Tank Seismic Demand Summary.xls, FM Max

Figure B.19. Case 9, Concrete Forces and Moments

Case 10
Tank AY, 422 in Waste Level
SpG=1.7
Mu=0.2, 0.6, E=250 KSF, Best Estimate Concrete

Depth	Angle (rad)	Path	Max Pressure Soil AY Mean Soil Uncracked Concrete Case 10 Mu=0.2, 0.6, BEC (psi)	Min Pressure Soil AY Mean Soil Uncracked Concrete Case 10 Mu=0.2, 0.6, BEC (psi)	Vertical Pressure (psi)	Horizontal Pressure (psi)	Active Pressure Phi = 33 deg (psi)	Active Pressure Phi = 49 deg (psi)
568.00	-0.04	**67.73**	12.70	11.86	7.12	0.13	7.11	7.11
565.80	-0.07	**105.67**	10.08	9.94	7.27	0.27	7.26	7.26
563.21	-0.10	**137.07**	8.95	7.90	7.46	0.37	7.43	7.42
559.70	-0.12	**182.85**	7.93	6.89	7.71	0.50	7.65	7.65
550.70	-0.18	**226.56**	10.43	7.45	8.35	0.78	8.23	8.22
545.20	-0.21	**275.57**	10.48	10.00	8.74	0.95	8.57	8.55
527.68	-0.30	**325.69**	10.50	10.07	9.99	1.53	9.59	9.56
518.20	-0.35	**372.30**	11.83	11.72	10.66	1.89	10.09	10.04
494.50	-0.48	**423.43**	14.96	14.92	12.35	2.98	11.07	10.97
476.20	-0.61	**468.31**	18.56	18.53	13.65	4.05	11.45	11.27
447.40	-0.66	**515.31**	27.38	27.31	15.70	4.99	12.75	12.51
407.10	-0.71	**549.73**	21.32	21.27	18.57	6.31	14.53	14.18
382.10	-1.57	**585.82**	17.57	17.54	20.35	10.60	6.00	2.85
335.00	-1.57	**636.37**	5.43	5.42	23.70	12.35	6.99	3.32
281.00	-1.57	**685.62**	3.51	3.51	27.55	14.35	8.13	3.86
236.50	-1.57	**732.72**	4.84	4.83	30.71	16.00	9.06	4.30
186.80	-1.57	**778.22**	4.92	4.90	34.25	17.85	10.10	4.80
145.50	-1.57	**821.37**	4.66	4.64	37.19	19.38	10.97	5.21
70.00	-1.57	**874.17**	6.21	6.12	42.57	22.18	12.56	5.96
24.00	-1.57	**930.54**	12.47	12.40	45.84	23.88	13.52	6.42

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Arching Study, Case 10, Soil Pressures Gravity.xls, FM Max

Figure B.20. Case 10, Soil Pressures

Case 10
Tank AY, 422 In Waste Level
SpG=1.7
Mu=0.2, 0.6, E=250 KSF, Best Estimate Concrete

ANSYS MAXIMUMS BY PATH

PNNL Section No.	Path (in.)	Seismic Hoop Force (kip/ft) Mu=0.2, 0.6, E=250 KSF	Seismic Meridonal Force (kip/ft) Mu=0.2, 0.6, E=250 KSF	Seismic -In-Plane Shear Force (kip/ft) Mu=0.2, 0.6, E=250 KSF	Seismic Hoop Moment (ft*kip/ft) Mu=0.2, 0.6, E=250 KSF	Seismic Meridonal Moment (ft*kip/ft) Mu=0.2, 0.6, E=250 KSF	Seismic Through-Thickness Shear Force (kip/ft) Mu=0.2, 0.6, E=250 KSF
2	**67.727**	-58.010	-60.440	-0.056	-3.764	-2.267	0.645
3	**105.668**	-55.380	-60.190	-0.034	-2.965	-1.908	0.048
4	**137.069**	-52.530	-60.060	0.033	-2.517	-1.410	0.399
6	**182.849**	-47.950	-59.830	0.040	-1.698	0.136	0.195
8	**226.563**	-44.290	-59.860	-0.050	-1.410	-0.518	0.001
9	**275.566**	-39.040	-59.910	-0.059	-1.453	-1.342	-0.001
11	**325.690**	-32.620	-60.420	-0.067	-2.118	-4.653	-0.002
13	**372.305**	-20.550	-60.940	-0.063	-2.530	-5.067	-0.002
17	**423.427**	0.144	-62.030	0.065	-2.679	-1.231	2.701
20	**468.308**	45.190	-64.850	0.068	-2.917	26.570	14.420
22	**515.312**	91.770	-69.210	0.054	7.313	59.070	-0.011
24	**549.725**	72.520	-68.280	0.042	7.294	42.980	0.003
26	**585.819**	47.620	-69.720	0.037	2.416	14.220	0.001
30	**636.369**	6.288	-73.420	0.033	-0.966	-5.666	0.001
33	**685.619**	-26.520	-76.400	0.031	-1.352	-7.936	0.393
35	**732.719**	-43.090	-79.750	0.030	-0.897	-5.254	0.706
38	**778.219**	-49.100	-83.060	0.029	-0.712	-4.165	0.132
41	**821.369**	-46.180	-87.720	0.031	-0.402	-2.308	-0.002
43	**874.169**	-32.880	-85.060	0.030	-0.989	-5.747	-0.011
46	**930.544**	-19.170	-94.390	-0.055	-1.285	-7.516	-0.011
48	**977.629**	1.725	-11.790	1.089	-8.966	42.790	1.944
51	**1019.647**	3.049	-14.180	1.392	-5.167	44.740	23.110
53	**1060.156**	4.524	-7.388	0.975	3.907	6.705	1.016
55	**1109.695**	4.015	-2.821	0.574	1.108	3.356	0.139
57	**1155.770**	4.542	1.739	0.259	0.154	0.215	0.033
58	**1211.956**	5.268	4.326	0.110	0.107	0.158	0.007
59	**1281.707**	5.630	5.474	0.047	0.086	0.085	0.111
60	**1330.557**	5.692	6.156	-0.070	0.087	0.125	0.008
61	**1374.857**	5.506	7.139	-0.162	0.071	0.093	0.142
62	**1417.007**	8.203	9.169	-0.132	0.130	0.490	0.032

Note: Meridonal/Hoop Forces and Meridonal/Hoop Moments are Reversed in Highlighted Sections.

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Arching Study, Case 10, Conc Tank Seismic Demand Summary.xls, FM Max

Figure B.21. Case 10, Concrete Forces and Moments

File Listing

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 Volume Serial Number is 8785-3B22

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03/09/2006  12:15 PM    <DIR>          Case 1
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Summary.xls
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09/06/2005  02:07 PM             7,068 Soil-Contact_9th.OUT
08/24/2005  09:28 AM             4,104 Soil-Prop-Mean-Geo.txt
07/28/2004  10:36 AM             3,911 Soil-Prop-Mean-SW.txt
12/16/2005  01:42 PM           149,504 soil_0-90.xls
12/16/2005  01:43 PM           149,504 soil_99-180.xls
05/03/2005  02:25 PM               217 Solve-g.txt
```

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08/19/2005  01:17 PM             1,684 Solve-Test.txt
08/19/2005  07:42 AM             1,459 Solve-TH-mean.txt
06/20/2005  08:26 AM               651 spectra-soil.txt
06/20/2005  09:04 AM               647 spectra-wall.txt
06/20/2005  08:52 AM               679 spectra-waste.txt
08/24/2005  01:04 PM           350,208 str-comp_0-90b.xls
08/24/2005  01:04 PM           351,744 str-comp_0-90m.xls
08/24/2005  01:04 PM           350,720 str-comp_0-90t.xls
08/24/2005  01:05 PM           350,720 str-comp_99-180b.xls
08/24/2005  01:05 PM           351,744 str-comp_99-180m.xls
08/24/2005  01:05 PM           350,720 str-comp_99-180t.xls
08/23/2005  02:52 PM               566 stress-compb.txt
08/23/2005  02:53 PM               566 stress-compm.txt
08/23/2005  02:53 PM               566 stress-compt.txt
04/13/2005  07:38 AM               205 Stress-Primary.txt
08/24/2005  11:57 AM            16,237 Stress-pt_108max-b.OUT
08/24/2005  11:57 AM            16,237 Stress-pt_108max-m.OUT
08/24/2005  11:56 AM            16,237 Stress-pt_108max-t.OUT
08/24/2005  11:57 AM            17,205 Stress-pt_108th-b.OUT
08/24/2005  11:57 AM            17,205 Stress-pt_108th-m.OUT
08/24/2005  11:56 AM            17,205 Stress-pt_108th-t.OUT
08/24/2005  11:57 AM            16,237 Stress-pt_117max-b.OUT
08/24/2005  11:57 AM            16,237 Stress-pt_117max-m.OUT
08/24/2005  11:56 AM            16,237 Stress-pt_117max-t.OUT
08/24/2005  11:57 AM            17,205 Stress-pt_117th-b.OUT
08/24/2005  11:57 AM            17,205 Stress-pt_117th-m.OUT
08/24/2005  11:56 AM            17,205 Stress-pt_117th-t.OUT
08/24/2005  11:57 AM            16,237 Stress-pt_126max-b.OUT
08/24/2005  11:57 AM            16,237 Stress-pt_126max-m.OUT
08/24/2005  11:56 AM            16,237 Stress-pt_126max-t.OUT
08/24/2005  11:57 AM            17,205 Stress-pt_126th-b.OUT
08/24/2005  11:57 AM            17,205 Stress-pt_126th-m.OUT
08/24/2005  11:56 AM            17,205 Stress-pt_126th-t.OUT
08/24/2005  11:57 AM            16,237 Stress-pt_135max-b.OUT
08/24/2005  11:57 AM            16,237 Stress-pt_135max-m.OUT
08/24/2005  11:56 AM            16,237 Stress-pt_135max-t.OUT
08/24/2005  11:57 AM            17,205 Stress-pt_135th-b.OUT
08/24/2005  11:57 AM            17,205 Stress-pt_135th-m.OUT
08/24/2005  11:56 AM            17,205 Stress-pt_135th-t.OUT
08/24/2005  11:57 AM            16,237 Stress-pt_144max-b.OUT
08/24/2005  11:57 AM            16,237 Stress-pt_144max-m.OUT
08/24/2005  11:56 AM            16,237 Stress-pt_144max-t.OUT
08/24/2005  11:57 AM            17,205 Stress-pt_144th-b.OUT
08/24/2005  11:57 AM            17,205 Stress-pt_144th-m.OUT
08/24/2005  11:56 AM            17,205 Stress-pt_144th-t.OUT
08/24/2005  11:57 AM            16,237 Stress-pt_153max-b.OUT
08/24/2005  11:57 AM            16,237 Stress-pt_153max-m.OUT
08/24/2005  11:56 AM            16,237 Stress-pt_153max-t.OUT
08/24/2005  11:57 AM            17,205 Stress-pt_153th-b.OUT
08/24/2005  11:57 AM            17,205 Stress-pt_153th-m.OUT
08/24/2005  11:56 AM            17,205 Stress-pt_153th-t.OUT
08/24/2005  11:57 AM            16,237 Stress-pt_162max-b.OUT
08/24/2005  11:57 AM            16,237 Stress-pt_162max-m.OUT
08/24/2005  11:56 AM            16,237 Stress-pt_162max-t.OUT
08/24/2005  11:57 AM            17,205 Stress-pt_162th-b.OUT
08/24/2005  11:57 AM            17,205 Stress-pt_162th-m.OUT
08/24/2005  11:56 AM            17,205 Stress-pt_162th-t.OUT
08/24/2005  11:57 AM            16,240 Stress-pt_171max-b.OUT
08/24/2005  11:57 AM            16,240 Stress-pt_171max-m.OUT
08/24/2005  11:56 AM            16,240 Stress-pt_171max-t.OUT
08/24/2005  11:57 AM            17,303 Stress-pt_171th-b.OUT
08/24/2005  11:57 AM            17,303 Stress-pt_171th-m.OUT
08/24/2005  11:56 AM            17,303 Stress-pt_171th-t.OUT
08/24/2005  11:57 AM            16,240 Stress-pt_180max-b.OUT
08/24/2005  11:57 AM            16,240 Stress-pt_180max-m.OUT
08/24/2005  11:56 AM            16,240 Stress-pt_180max-t.OUT
08/24/2005  11:57 AM            17,303 Stress-pt_180th-b.OUT
08/24/2005  11:57 AM            17,303 Stress-pt_180th-m.OUT
08/24/2005  11:56 AM            17,303 Stress-pt_180th-t.OUT
08/24/2005  11:57 AM            16,237 Stress-pt_18max-b.OUT
08/24/2005  11:56 AM            16,237 Stress-pt_18max-m.OUT
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08/24/2005  11:56 AM            16,237 Stress-pt_18max-t.OUT
08/24/2005  11:57 AM            17,205 Stress-pt_18th-b.OUT
08/24/2005  11:56 AM            17,205 Stress-pt_18th-m.OUT
08/24/2005  11:56 AM            17,205 Stress-pt_18th-t.OUT
08/24/2005  11:57 AM            16,237 Stress-pt_27max-b.OUT
08/24/2005  11:56 AM            16,237 Stress-pt_27max-m.OUT
08/24/2005  11:56 AM            16,237 Stress-pt_27max-t.OUT
08/24/2005  11:57 AM            17,205 Stress-pt_27th-b.OUT
08/24/2005  11:56 AM            17,205 Stress-pt_27th-m.OUT
08/24/2005  11:56 AM            17,205 Stress-pt_27th-t.OUT
08/24/2005  11:57 AM            16,237 Stress-pt_36max-b.OUT
08/24/2005  11:56 AM            16,237 Stress-pt_36max-m.OUT
08/24/2005  11:56 AM            16,237 Stress-pt_36max-t.OUT
08/24/2005  11:57 AM            17,205 Stress-pt_36th-b.OUT
08/24/2005  11:56 AM            17,205 Stress-pt_36th-m.OUT
08/24/2005  11:56 AM            17,205 Stress-pt_36th-t.OUT
08/24/2005  11:57 AM            16,237 Stress-pt_45max-b.OUT
08/24/2005  11:56 AM            16,237 Stress-pt_45max-m.OUT
08/24/2005  11:56 AM            16,237 Stress-pt_45max-t.OUT
08/24/2005  11:57 AM            17,205 Stress-pt_45th-b.OUT
08/24/2005  11:56 AM            17,205 Stress-pt_45th-m.OUT
08/24/2005  11:56 AM            17,205 Stress-pt_45th-t.OUT
08/24/2005  11:57 AM            16,237 Stress-pt_54max-b.OUT
08/24/2005  11:56 AM            16,237 Stress-pt_54max-m.OUT
08/24/2005  11:56 AM            16,237 Stress-pt_54max-t.OUT
08/24/2005  11:57 AM            17,205 Stress-pt_54th-b.OUT
08/24/2005  11:56 AM            17,205 Stress-pt_54th-m.OUT
08/24/2005  11:56 AM            17,205 Stress-pt_54th-t.OUT
08/24/2005  11:57 AM            16,237 Stress-pt_63max-b.OUT
08/24/2005  11:56 AM            16,237 Stress-pt_63max-m.OUT
08/24/2005  11:56 AM            16,237 Stress-pt_63max-t.OUT
08/24/2005  11:57 AM            17,205 Stress-pt_63th-b.OUT
08/24/2005  11:56 AM            17,205 Stress-pt_63th-m.OUT
08/24/2005  11:56 AM            17,205 Stress-pt_63th-t.OUT
08/24/2005  11:57 AM            16,237 Stress-pt_72max-b.OUT
08/24/2005  11:56 AM            16,237 Stress-pt_72max-m.OUT
08/24/2005  11:56 AM            16,237 Stress-pt_72max-t.OUT
08/24/2005  11:57 AM            17,205 Stress-pt_72th-b.OUT
08/24/2005  11:56 AM            17,205 Stress-pt_72th-m.OUT
08/24/2005  11:56 AM            17,205 Stress-pt_72th-t.OUT
08/24/2005  11:57 AM            16,237 Stress-pt_81max-b.OUT
08/24/2005  11:56 AM            16,237 Stress-pt_81max-m.OUT
08/24/2005  11:56 AM            16,237 Stress-pt_81max-t.OUT
08/24/2005  11:57 AM            17,205 Stress-pt_81th-b.OUT
08/24/2005  11:57 AM            17,205 Stress-pt_81th-m.OUT
08/24/2005  11:56 AM            17,205 Stress-pt_81th-t.OUT
08/24/2005  11:57 AM            16,237 Stress-pt_90max-b.OUT
08/24/2005  11:57 AM            16,237 Stress-pt_90max-m.OUT
08/24/2005  11:56 AM            16,237 Stress-pt_90max-t.OUT
08/24/2005  11:57 AM            17,205 Stress-pt_90th-b.OUT
08/24/2005  11:57 AM            17,205 Stress-pt_90th-m.OUT
08/24/2005  11:56 AM            17,205 Stress-pt_90th-t.OUT
08/24/2005  11:57 AM            16,237 Stress-pt_99max-b.OUT
08/24/2005  11:57 AM            16,237 Stress-pt_99max-m.OUT
08/24/2005  11:56 AM            16,237 Stress-pt_99max-t.OUT
08/24/2005  11:57 AM            17,205 Stress-pt_99th-b.OUT
08/24/2005  11:57 AM            17,205 Stress-pt_99th-m.OUT
08/24/2005  11:56 AM            17,205 Stress-pt_99th-t.OUT
08/24/2005  11:57 AM            16,237 Stress-pt_9max-b.OUT
08/24/2005  11:56 AM            16,237 Stress-pt_9max-m.OUT
08/24/2005  11:56 AM            16,237 Stress-pt_9max-t.OUT
08/24/2005  11:57 AM            17,333 Stress-pt_9th-b.OUT
08/24/2005  11:56 AM            17,333 Stress-pt_9th-m.OUT
08/24/2005  11:56 AM            17,333 Stress-pt_9th-t.OUT
09/20/2005  09:37 AM               610 Stress-Soil.txt
07/14/2005  12:58 PM             3,667 Tank-Coordinates-AP.txt
08/24/2005  09:21 AM             3,666 Tank-Coordinates-AY.txt
07/18/2005  09:58 AM             3,476 Tank-Coordinates.txt
05/25/2005  03:32 PM             2,512 Tank-Mesh1.txt
08/24/2005  09:30 AM               102 tank-out.out
02/25/2005  02:24 PM             5,406 Tank-Props-BEC-250.txt
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08/19/2005  10:13 AM             5,407 Tank-Props.txt
08/24/2005  09:31 AM             3,007 Tank-th.out
08/24/2005  09:42 AM            63,236 test-th-2d.out
05/16/2005  03:40 PM            41,470 TH-266-Mean-Geo-V.txt
05/13/2005  10:57 AM            41,472 TH-266-Mean-Geo.txt
08/22/2005  08:37 AM             4,252 Waste-solid-AP.txt
08/22/2005  02:11 PM             3,568 Waste-solid-AY.txt
             332 File(s)    451,017,355 bytes

 Directory of C:\Users\Bruce\2008-000 PNNL\2008-004 ANSYS\Soil Arching\Case 10

03/09/2006  12:19 PM    <DIR>          .
03/09/2006  12:19 PM    <DIR>          ..
09/27/2005  03:47 PM                99 All-Forces.txt
12/16/2005  02:56 PM        53,346,304 ansabort.db
03/09/2006  09:38 AM         3,206,656 Arching Study, Case 10, Conc Tank Seismic Demand
Summary.xls
03/09/2006  09:42 AM           819,712 Arching Study, Case 10, Soil Pressures Gravity.xls
09/12/2005  09:13 AM             6,076 Bolts-Friction-Test.txt
09/02/2005  02:01 PM             5,766 Bolts-Friction.txt
06/09/2005  01:59 PM               262 Boundary.txt
06/09/2005  02:28 PM               350 connections.txt
09/27/2005  03:47 PM               162 Contact-AP.txt
09/02/2005  10:03 AM               162 Contact-AY.txt
09/02/2005  10:06 AM               490 Contact-Footing.txt
09/02/2005  09:28 AM               604 Contact-Insul.txt
09/02/2005  09:51 AM               602 Contact-J-Bolts.txt
09/09/2005  09:59 AM               608 Contact-Primary.txt
09/15/2005  11:50 AM               742 Contact-Soil.txt
09/06/2005  11:16 AM               630 Contact-Waste-AP.txt
09/02/2005  09:43 AM               630 Contact-Waste-AY.txt
09/22/2005  04:05 PM             8,608 Far-Soil.txt
12/16/2005  02:52 PM             2,998 file.BCS
12/16/2005  02:52 PM        53,346,304 file.db
12/16/2005  02:41 PM        34,340,864 file.dbb
12/16/2005  02:56 PM        12,255,232 file.emat
01/05/2006  11:31 AM           864,991 file.err
12/16/2005  02:56 PM       101,187,584 file.esav
12/16/2005  02:56 PM        27,459,584 file.full
12/16/2005  02:52 PM           288,402 file.ldhi
12/16/2005  02:56 PM       270,458,880 file.LN09
12/16/2005  02:52 PM        24,032,752 file.LN20
12/16/2005  02:52 PM           792,280 file.LN22
12/16/2005  02:52 PM         8,407,864 file.LN25
01/05/2006  11:36 AM           412,180 file.log
12/16/2005  02:52 PM             1,375 file.mntr
12/16/2005  02:52 PM       101,187,584 file.osav
12/16/2005  02:52 PM               428 file.PCE
12/16/2005  02:52 PM               428 file.PCS
12/16/2005  02:52 PM               739 file.PVTS
12/16/2005  02:52 PM       102,170,624 file.r001
12/16/2005  02:42 PM        34,996,224 file.rdb
12/16/2005  02:56 PM        20,447,232 file.rst
12/16/2005  02:41 PM                 0 file.sda
10/13/2005  09:20 AM                97 file.stat
01/05/2006  11:34 AM           189,944 file000.jpg
10/13/2005  06:54 AM               562 Fix-Soil.txt
09/21/2005  07:10 AM             6,940 Footing-Cont_max.OUT
09/21/2005  07:10 AM             7,068 Footing-Cont_th.OUT
04/06/2005  08:24 AM               894 Force-c.txt
09/21/2005  07:09 AM             4,996 Force-c_108amax.OUT
09/21/2005  07:09 AM             7,050 Force-c_108ath.OUT
09/21/2005  07:09 AM            14,716 Force-c_108max.OUT
09/21/2005  07:09 AM            13,770 Force-c_108th.OUT
09/21/2005  07:09 AM             4,996 Force-c_117amax.OUT
09/21/2005  07:09 AM             7,050 Force-c_117ath.OUT
09/21/2005  07:09 AM            14,716 Force-c_117max.OUT
09/21/2005  07:09 AM            13,770 Force-c_117th.OUT
09/21/2005  07:09 AM             4,996 Force-c_126amax.OUT
09/21/2005  07:09 AM             7,050 Force-c_126ath.OUT
09/21/2005  07:09 AM            14,716 Force-c_126max.OUT
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09/21/2005  07:09 AM            13,770 Force-c_126th.OUT
09/21/2005  07:09 AM             4,996 Force-c_135amax.OUT
09/21/2005  07:09 AM             7,050 Force-c_135ath.OUT
09/21/2005  07:09 AM            14,716 Force-c_135max.OUT
09/21/2005  07:09 AM            13,770 Force-c_135th.OUT
09/21/2005  07:09 AM             4,996 Force-c_144amax.OUT
09/21/2005  07:09 AM             7,050 Force-c_144ath.OUT
09/21/2005  07:09 AM            14,716 Force-c_144max.OUT
09/21/2005  07:09 AM            13,770 Force-c_144th.OUT
09/21/2005  07:09 AM             4,996 Force-c_153amax.OUT
09/21/2005  07:09 AM             7,050 Force-c_153ath.OUT
09/21/2005  07:09 AM            14,716 Force-c_153max.OUT
09/21/2005  07:09 AM            13,770 Force-c_153th.OUT
09/21/2005  07:09 AM             4,996 Force-c_162amax.OUT
09/21/2005  07:09 AM             7,050 Force-c_162ath.OUT
09/21/2005  07:09 AM            14,716 Force-c_162max.OUT
09/21/2005  07:09 AM            13,770 Force-c_162th.OUT
09/21/2005  07:09 AM             4,996 Force-c_171amax.OUT
09/21/2005  07:09 AM             7,050 Force-c_171ath.OUT
09/21/2005  07:09 AM            14,716 Force-c_171max.OUT
09/21/2005  07:09 AM            13,770 Force-c_171th.OUT
09/21/2005  07:09 AM             4,996 Force-c_180amax.OUT
09/21/2005  07:09 AM             7,050 Force-c_180ath.OUT
09/21/2005  07:09 AM            14,716 Force-c_180max.OUT
09/21/2005  07:09 AM            13,770 Force-c_180th.OUT
09/21/2005  07:09 AM             4,996 Force-c_18amax.OUT
09/21/2005  07:09 AM             7,050 Force-c_18ath.OUT
09/21/2005  07:09 AM            14,716 Force-c_18max.OUT
09/21/2005  07:09 AM            13,770 Force-c_18th.OUT
09/21/2005  07:09 AM             4,996 Force-c_27amax.OUT
09/21/2005  07:09 AM             7,050 Force-c_27ath.OUT
09/21/2005  07:09 AM            14,716 Force-c_27max.OUT
09/21/2005  07:09 AM            13,770 Force-c_27th.OUT
09/21/2005  07:09 AM             4,996 Force-c_36amax.OUT
09/21/2005  07:09 AM             7,050 Force-c_36ath.OUT
09/21/2005  07:09 AM            14,716 Force-c_36max.OUT
09/21/2005  07:09 AM            13,770 Force-c_36th.OUT
09/21/2005  07:09 AM             4,996 Force-c_45amax.OUT
09/21/2005  07:09 AM             7,050 Force-c_45ath.OUT
09/21/2005  07:09 AM            14,716 Force-c_45max.OUT
09/21/2005  07:09 AM            13,770 Force-c_45th.OUT
09/21/2005  07:09 AM             4,996 Force-c_54amax.OUT
09/21/2005  07:09 AM             7,050 Force-c_54ath.OUT
09/21/2005  07:09 AM            14,716 Force-c_54max.OUT
09/21/2005  07:09 AM            13,770 Force-c_54th.OUT
09/21/2005  07:09 AM             4,996 Force-c_63amax.OUT
09/21/2005  07:09 AM             7,050 Force-c_63ath.OUT
09/21/2005  07:09 AM            14,716 Force-c_63max.OUT
09/21/2005  07:09 AM            13,770 Force-c_63th.OUT
09/21/2005  07:09 AM             4,996 Force-c_72amax.OUT
09/21/2005  07:09 AM             7,050 Force-c_72ath.OUT
09/21/2005  07:09 AM            14,716 Force-c_72max.OUT
09/21/2005  07:09 AM            13,770 Force-c_72th.OUT
09/21/2005  07:09 AM             4,996 Force-c_81amax.OUT
09/21/2005  07:09 AM             7,050 Force-c_81ath.OUT
09/21/2005  07:09 AM            14,716 Force-c_81max.OUT
09/21/2005  07:09 AM            13,770 Force-c_81th.OUT
09/21/2005  07:09 AM             4,996 Force-c_90amax.OUT
09/21/2005  07:09 AM             7,050 Force-c_90ath.OUT
09/21/2005  07:09 AM            14,716 Force-c_90max.OUT
09/21/2005  07:09 AM            13,770 Force-c_90th.OUT
09/21/2005  07:09 AM             4,996 Force-c_99amax.OUT
09/21/2005  07:09 AM             7,050 Force-c_99ath.OUT
09/21/2005  07:09 AM            14,716 Force-c_99max.OUT
09/21/2005  07:09 AM            13,770 Force-c_99th.OUT
09/21/2005  07:09 AM             4,996 Force-c_9amax.OUT
09/21/2005  07:09 AM             7,178 Force-c_9ath.OUT
09/21/2005  07:09 AM            14,716 Force-c_9max.OUT
09/21/2005  07:09 AM            13,898 Force-c_9th.OUT
06/20/2005  10:53 AM               661 Force-j_bolt.txt
06/07/2005  11:11 AM               516 Forcec1.txt
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09/15/2004  07:37 AM             4,516 Forces-9.txt
05/26/2005  08:18 AM               288 gravity-post.txt
10/13/2005  09:40 AM           440,832 import_0-90.xls
10/13/2005  09:40 AM           441,344 import_99-180.xls
09/01/2005  10:27 AM             1,664 Insulate.txt
07/21/2005  12:20 PM             1,430 interface-gap.txt
10/13/2005  08:28 AM             4,031 interface-gap1.txt
05/02/2005  02:05 PM               689 interface-spr.txt
08/26/2005  08:11 AM               882 interface.txt
09/09/2005  09:34 AM             2,616 interface1.txt
05/13/2005  02:02 PM             1,926 interface2.txt
05/25/2005  03:37 PM             1,793 interface2a.txt
06/01/2005  01:17 PM             1,708 Liner.txt
05/02/2005  02:19 PM               667 live_load.txt
09/28/2005  07:08 AM             6,183 Near-Soil-1.txt
04/20/2005  01:14 PM               508 outer-spar.txt
09/09/2005  07:28 AM             5,557 Primary-Props-AP.txt
09/08/2005  09:30 AM             5,402 Primary-Props-AY.txt
02/17/2005  04:24 PM             4,742 Primary-Props.txt
09/27/2005  03:52 PM             1,538 Primary.txt
12/16/2005  02:41 PM           390,099 QA.out
03/26/2004  01:16 PM             2,689 RS_FREQ.txt
10/13/2005  09:26 AM             9,263 Run-Tank-Out.out
09/09/2005  11:04 AM               145 run-tank.bat
12/16/2005  02:40 PM             1,882 Run-Tank.txt
01/05/2006  11:31 AM                 0 scratch.hlp
05/17/2005  12:15 PM                28 select.txt
02/11/2005  01:22 PM             1,053 Slave.txt
12/16/2005  02:56 PM             9,896 Soil-Contact_108max.OUT
12/16/2005  02:56 PM             9,120 Soil-Contact_108th.OUT
12/16/2005  02:56 PM             9,896 Soil-Contact_117max.OUT
12/16/2005  02:56 PM             9,120 Soil-Contact_117th.OUT
12/16/2005  02:56 PM             9,896 Soil-Contact_126max.OUT
12/16/2005  02:56 PM             9,120 Soil-Contact_126th.OUT
12/16/2005  02:56 PM             9,896 Soil-Contact_135max.OUT
12/16/2005  02:56 PM             9,120 Soil-Contact_135th.OUT
12/16/2005  02:56 PM             9,896 Soil-Contact_144max.OUT
12/16/2005  02:56 PM             9,120 Soil-Contact_144th.OUT
12/16/2005  02:56 PM             9,896 Soil-Contact_153max.OUT
12/16/2005  02:56 PM             9,120 Soil-Contact_153th.OUT
12/16/2005  02:56 PM             9,896 Soil-Contact_162max.OUT
12/16/2005  02:56 PM             9,120 Soil-Contact_162th.OUT
12/16/2005  02:56 PM             9,896 Soil-Contact_171max.OUT
12/16/2005  02:56 PM             9,120 Soil-Contact_171th.OUT
12/16/2005  02:56 PM             9,896 Soil-Contact_180max.OUT
12/16/2005  02:56 PM             9,120 Soil-Contact_180th.OUT
12/16/2005  02:56 PM             9,896 Soil-Contact_18max.OUT
12/16/2005  02:56 PM             9,120 Soil-Contact_18th.OUT
12/16/2005  02:56 PM             9,896 Soil-Contact_27max.OUT
12/16/2005  02:56 PM             9,120 Soil-Contact_27th.OUT
12/16/2005  02:56 PM             9,896 Soil-Contact_36max.OUT
12/16/2005  02:56 PM             9,120 Soil-Contact_36th.OUT
12/16/2005  02:56 PM             9,896 Soil-Contact_45max.OUT
12/16/2005  02:56 PM             9,120 Soil-Contact_45th.OUT
12/16/2005  02:56 PM             9,896 Soil-Contact_54max.OUT
12/16/2005  02:56 PM             9,120 Soil-Contact_54th.OUT
12/16/2005  02:56 PM             9,896 Soil-Contact_63max.OUT
12/16/2005  02:56 PM             9,120 Soil-Contact_63th.OUT
12/16/2005  02:56 PM             9,896 Soil-Contact_72max.OUT
12/16/2005  02:56 PM             9,120 Soil-Contact_72th.OUT
12/16/2005  02:56 PM             9,896 Soil-Contact_81max.OUT
12/16/2005  02:56 PM             9,120 Soil-Contact_81th.OUT
12/16/2005  02:56 PM             9,896 Soil-Contact_90max.OUT
12/16/2005  02:56 PM             9,120 Soil-Contact_90th.OUT
12/16/2005  02:56 PM             9,896 Soil-Contact_99max.OUT
12/16/2005  02:56 PM             9,120 Soil-Contact_99th.OUT
12/16/2005  02:56 PM             9,896 Soil-Contact_9max.OUT
12/16/2005  02:56 PM             9,248 Soil-Contact_9th.OUT
09/07/2005  01:55 PM             4,215 Soil-Prop-Mean-Geo.txt
07/28/2004  10:36 AM             3,911 Soil-Prop-Mean-SW.txt
10/13/2005  08:19 AM             5,016 Soil-Prop-UB-Geo.txt
```

```
12/16/2005  02:57 PM           223,232 soil_0-90.xls
12/16/2005  02:57 PM           223,232 soil_99-180.xls
05/03/2005  02:25 PM               217 Solve-g.txt
09/09/2005  10:02 AM             1,752 Solve-Gravity.txt
09/09/2005  09:32 AM             1,946 Solve-Test.txt
10/13/2005  09:13 AM             1,930 Solve-TH-mean.txt
10/13/2005  08:25 AM             2,471 Solve-TH-UB.txt
09/06/2005  07:03 AM             2,095 spectra-concrete.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
09/02/2005  08:51 AM               707 strain-compb.txt
09/02/2005  08:51 AM               705 strain-compm.txt
09/02/2005  08:50 AM               720 strain-compt.txt
09/02/2005  08:52 AM               544 Strain-Liner.txt
09/08/2005  10:18 AM               692 stress-compb.txt
09/08/2005  10:18 AM               692 stress-compm.txt
09/08/2005  09:20 AM               692 stress-compt.txt
09/09/2005  06:47 AM               803 stress-node-compb.txt
04/13/2005  07:38 AM               205 Stress-Primary.txt
09/09/2005  07:20 AM             3,825 Tank-Coordinates-AP.txt
09/08/2005  09:35 AM             3,773 Tank-Coordinates-AY.txt
07/18/2005  09:58 AM             3,476 Tank-Coordinates.txt
05/25/2005  03:32 PM             2,512 Tank-Mesh1.txt
12/16/2005  02:40 PM               102 tank-out.out
02/25/2005  02:24 PM             5,406 Tank-Props-BEC-250.txt
08/19/2005  10:13 AM             5,407 Tank-Props.txt
12/16/2005  02:41 PM               774 Tank-th.out
12/16/2005  02:56 PM            71,808 test-th-2d.out
05/16/2005  03:40 PM            41,470 TH-266-Mean-Geo-V.txt
05/13/2005  10:57 AM            41,472 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
08/15/2005  06:16 AM               326 Waste-Reaction.txt
09/09/2005  07:53 AM             4,229 Waste-solid-AP.txt
09/08/2005  10:27 AM             3,568 Waste-solid-AY.txt
             355 File(s)    855,611,622 bytes

 Directory of C:\Users\Bruce\2008-000 PNNL\2008-004 ANSYS\Soil Arching\Case 2

03/09/2006  12:15 PM    <DIR>          .
03/09/2006  12:15 PM    <DIR>          ..
07/01/2005  11:43 AM               159 All-Forces.txt
03/09/2006  11:33 AM         8,238,080 Arching Study, Case 2,  Pri Tank Seismic Stress.xls
03/09/2006  08:19 AM         3,181,568 Arching Study, Case 2, Conc Tank Seismic Demand
Summary.xls
03/09/2006  08:13 AM           818,688 Arching Study, Case 2, Soil Pressures Gravity.xls
08/23/2005  03:27 PM             5,766 Bolts-friction.txt
06/09/2005  01:59 PM               262 Boundary.txt
06/09/2005  02:28 PM               350 connections.txt
09/02/2005  10:05 AM               610 Contact-Soil.txt
06/23/2005  01:26 PM             8,149 Far-Soil.txt
08/24/2005  09:54 AM             2,998 file.BCS
08/24/2005  09:55 AM        30,539,776 file.db
08/24/2005  09:54 AM        53,411,840 file.dbb
08/24/2005  09:54 AM        11,993,088 file.emat
09/06/2005  01:50 PM           104,247 file.err
08/24/2005  09:54 AM        82,116,608 file.esav
08/24/2005  09:54 AM        22,085,632 file.full
08/24/2005  09:52 AM           260,462 file.ldhi
09/06/2005  01:53 PM           223,348 file.log
08/24/2005  09:54 AM             1,467 file.mntr
08/24/2005  09:53 AM        82,116,608 file.osav
08/24/2005  09:53 AM               739 file.PVTS
08/24/2005  09:54 AM        82,903,040 file.r001
08/24/2005  09:43 AM        30,474,240 file.rdb
08/24/2005  09:54 AM        31,850,496 file.rst
06/20/2005  08:00 AM             3,484 Footing-Contact.txt
04/06/2005  08:24 AM               894 Force-c.txt
08/24/2005  11:58 AM             4,996 Force-c_108amax.OUT
08/24/2005  11:58 AM             7,050 Force-c_108ath.OUT
```

```
08/24/2005  11:58 AM            14,716 Force-c_108max.OUT
08/24/2005  11:58 AM            13,770 Force-c_108th.OUT
08/24/2005  11:58 AM             4,996 Force-c_117amax.OUT
08/24/2005  11:58 AM             7,050 Force-c_117ath.OUT
08/24/2005  11:58 AM            14,716 Force-c_117max.OUT
08/24/2005  11:58 AM            13,770 Force-c_117th.OUT
08/24/2005  11:58 AM             4,996 Force-c_126amax.OUT
08/24/2005  11:58 AM             7,050 Force-c_126ath.OUT
08/24/2005  11:58 AM            14,716 Force-c_126max.OUT
08/24/2005  11:58 AM            13,770 Force-c_126th.OUT
08/24/2005  11:58 AM             4,996 Force-c_135amax.OUT
08/24/2005  11:58 AM             7,050 Force-c_135ath.OUT
08/24/2005  11:58 AM            14,716 Force-c_135max.OUT
08/24/2005  11:58 AM            13,770 Force-c_135th.OUT
08/24/2005  11:58 AM             4,996 Force-c_144amax.OUT
08/24/2005  11:58 AM             7,050 Force-c_144ath.OUT
08/24/2005  11:58 AM            14,716 Force-c_144max.OUT
08/24/2005  11:58 AM            13,770 Force-c_144th.OUT
08/24/2005  11:58 AM             4,996 Force-c_153amax.OUT
08/24/2005  11:58 AM             7,050 Force-c_153ath.OUT
08/24/2005  11:58 AM            14,716 Force-c_153max.OUT
08/24/2005  11:58 AM            13,770 Force-c_153th.OUT
08/24/2005  11:58 AM             4,996 Force-c_162amax.OUT
08/24/2005  11:58 AM             7,050 Force-c_162ath.OUT
08/24/2005  11:58 AM            14,716 Force-c_162max.OUT
08/24/2005  11:58 AM            13,770 Force-c_162th.OUT
08/24/2005  11:58 AM             4,996 Force-c_171amax.OUT
08/24/2005  11:58 AM             7,050 Force-c_171ath.OUT
08/24/2005  11:58 AM            14,716 Force-c_171max.OUT
08/24/2005  11:58 AM            13,770 Force-c_171th.OUT
08/24/2005  11:58 AM             4,996 Force-c_180amax.OUT
08/24/2005  11:58 AM             7,050 Force-c_180ath.OUT
08/24/2005  11:58 AM            14,716 Force-c_180max.OUT
08/24/2005  11:58 AM            13,770 Force-c_180th.OUT
08/24/2005  11:58 AM             4,996 Force-c_18amax.OUT
08/24/2005  11:58 AM             7,050 Force-c_18ath.OUT
08/24/2005  11:58 AM            14,716 Force-c_18max.OUT
08/24/2005  11:58 AM            13,770 Force-c_18th.OUT
08/24/2005  11:58 AM             4,996 Force-c_27amax.OUT
08/24/2005  11:58 AM             7,050 Force-c_27ath.OUT
08/24/2005  11:58 AM            14,716 Force-c_27max.OUT
08/24/2005  11:58 AM            13,770 Force-c_27th.OUT
08/24/2005  11:58 AM             4,996 Force-c_36amax.OUT
08/24/2005  11:58 AM             7,050 Force-c_36ath.OUT
08/24/2005  11:58 AM            14,716 Force-c_36max.OUT
08/24/2005  11:58 AM            13,770 Force-c_36th.OUT
08/24/2005  11:58 AM             4,996 Force-c_45amax.OUT
08/24/2005  11:58 AM             7,050 Force-c_45ath.OUT
08/24/2005  11:58 AM            14,716 Force-c_45max.OUT
08/24/2005  11:58 AM            13,770 Force-c_45th.OUT
08/24/2005  11:58 AM             4,996 Force-c_54amax.OUT
08/24/2005  11:58 AM             7,050 Force-c_54ath.OUT
08/24/2005  11:58 AM            14,716 Force-c_54max.OUT
08/24/2005  11:58 AM            13,770 Force-c_54th.OUT
08/24/2005  11:58 AM             4,996 Force-c_63amax.OUT
08/24/2005  11:58 AM             7,050 Force-c_63ath.OUT
08/24/2005  11:58 AM            14,716 Force-c_63max.OUT
08/24/2005  11:58 AM            13,770 Force-c_63th.OUT
08/24/2005  11:58 AM             4,996 Force-c_72amax.OUT
08/24/2005  11:58 AM             7,050 Force-c_72ath.OUT
08/24/2005  11:58 AM            14,716 Force-c_72max.OUT
08/24/2005  11:58 AM            13,770 Force-c_72th.OUT
08/24/2005  11:58 AM             4,996 Force-c_81amax.OUT
08/24/2005  11:58 AM             7,050 Force-c_81ath.OUT
08/24/2005  11:58 AM            14,716 Force-c_81max.OUT
08/24/2005  11:58 AM            13,770 Force-c_81th.OUT
08/24/2005  11:58 AM             4,996 Force-c_90amax.OUT
08/24/2005  11:58 AM             7,050 Force-c_90ath.OUT
08/24/2005  11:58 AM            14,716 Force-c_90max.OUT
08/24/2005  11:58 AM            13,770 Force-c_90th.OUT
08/24/2005  11:58 AM             4,996 Force-c_99amax.OUT
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08/24/2005  11:58 AM            7,050 Force-c_99ath.OUT
08/24/2005  11:58 AM           14,716 Force-c_99max.OUT
08/24/2005  11:58 AM           13,770 Force-c_99th.OUT
08/24/2005  11:58 AM            4,996 Force-c_9amax.OUT
08/24/2005  11:58 AM            7,178 Force-c_9ath.OUT
08/24/2005  11:58 AM           14,716 Force-c_9max.OUT
08/24/2005  11:58 AM           13,898 Force-c_9th.OUT
06/20/2005  10:53 AM              661 Force-j_bolt.txt
06/07/2005  11:11 AM              516 Forcec1.txt
09/15/2004  07:37 AM            4,516 Forces-9.txt
05/26/2005  08:18 AM              288 gravity-post.txt
08/24/2005  10:05 AM          441,344 import_0-90.xls
08/24/2005  10:05 AM          440,832 import_99-180.xls
07/15/2005  02:21 PM            1,590 Insulate.txt
07/21/2005  12:20 PM            1,430 interface-gap.txt
08/24/2005  09:29 AM            3,483 interface-gap1.txt
05/02/2005  02:05 PM              689 interface-spr.txt
06/07/2005  01:16 PM              882 interface.txt
05/13/2005  02:02 PM            1,926 interface2.txt
05/25/2005  03:37 PM            1,793 interface2a.txt
06/01/2005  01:17 PM            1,708 Liner.txt
05/02/2005  02:19 PM              667 live_load.txt
06/21/2005  02:15 PM            5,714 Near-Soil-1.txt
04/20/2005  01:14 PM              508 outer-spar.txt
07/01/2005  11:29 AM            4,860 Primary-Props-AP.txt
08/24/2005  09:21 AM            4,715 Primary-Props-AY.txt
02/17/2005  04:24 PM            4,742 Primary-Props.txt
07/26/2005  02:26 PM            1,538 Primary.txt
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02/11/2005  01:22 PM            1,053 Slave.txt
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09/06/2005  01:50 PM            6,940 Soil-Contact_108th.OUT
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09/06/2005  01:50 PM            6,940 Soil-Contact_126th.OUT
09/06/2005  01:50 PM            6,616 Soil-Contact_135max.OUT
09/06/2005  01:50 PM            6,940 Soil-Contact_135th.OUT
09/06/2005  01:50 PM            6,616 Soil-Contact_144max.OUT
09/06/2005  01:50 PM            6,940 Soil-Contact_144th.OUT
09/06/2005  01:50 PM            6,616 Soil-Contact_153max.OUT
09/06/2005  01:50 PM            6,940 Soil-Contact_153th.OUT
09/06/2005  01:50 PM            6,616 Soil-Contact_162max.OUT
09/06/2005  01:50 PM            6,940 Soil-Contact_162th.OUT
09/06/2005  01:50 PM            6,616 Soil-Contact_171max.OUT
09/06/2005  01:50 PM            6,940 Soil-Contact_171th.OUT
09/06/2005  01:50 PM            6,616 Soil-Contact_180max.OUT
09/06/2005  01:50 PM            6,940 Soil-Contact_180th.OUT
09/06/2005  01:50 PM            6,616 Soil-Contact_18max.OUT
09/06/2005  01:50 PM            6,940 Soil-Contact_18th.OUT
09/06/2005  01:50 PM            6,616 Soil-Contact_27max.OUT
09/06/2005  01:50 PM            6,940 Soil-Contact_27th.OUT
09/06/2005  01:50 PM            6,616 Soil-Contact_36max.OUT
09/06/2005  01:50 PM            6,940 Soil-Contact_36th.OUT
09/06/2005  01:50 PM            6,616 Soil-Contact_45max.OUT
09/06/2005  01:50 PM            6,940 Soil-Contact_45th.OUT
09/06/2005  01:50 PM            6,616 Soil-Contact_54max.OUT
09/06/2005  01:50 PM            6,940 Soil-Contact_54th.OUT
09/06/2005  01:50 PM            6,616 Soil-Contact_63max.OUT
09/06/2005  01:50 PM            6,940 Soil-Contact_63th.OUT
09/06/2005  01:50 PM            6,616 Soil-Contact_72max.OUT
09/06/2005  01:50 PM            6,940 Soil-Contact_72th.OUT
09/06/2005  01:50 PM            6,616 Soil-Contact_81max.OUT
09/06/2005  01:50 PM            6,940 Soil-Contact_81th.OUT
09/06/2005  01:50 PM            6,616 Soil-Contact_90max.OUT
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09/06/2005  01:50 PM             6,940 Soil-Contact_90th.OUT
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09/06/2005  01:50 PM             6,940 Soil-Contact_99th.OUT
09/06/2005  01:50 PM             6,616 Soil-Contact_9max.OUT
09/06/2005  01:50 PM             7,068 Soil-Contact_9th.OUT
08/24/2005  09:29 AM             4,104 Soil-Prop-Mean-Geo.txt
07/28/2004  10:36 AM             3,911 Soil-Prop-Mean-SW.txt
12/16/2005  01:46 PM           149,504 soil_0-90.xls
12/16/2005  01:46 PM           149,504 soil_99-180.xls
05/03/2005  02:25 PM               217 Solve-g.txt
08/19/2005  01:17 PM             1,684 Solve-Test.txt
08/19/2005  07:42 AM             1,459 Solve-TH-mean.txt
06/20/2005  08:26 AM               651 spectra-soil.txt
06/20/2005  09:04 AM               647 spectra-wall.txt
06/20/2005  08:52 AM               679 spectra-waste.txt
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08/24/2005  12:38 PM           350,208 str-comp_0-90t.xls
08/24/2005  12:38 PM           350,720 str-comp_99-180b.xls
08/24/2005  12:38 PM           351,744 str-comp_99-180m.xls
08/24/2005  12:39 PM           350,720 str-comp_99-180t.xls
08/23/2005  02:52 PM               566 stress-compb.txt
08/23/2005  02:53 PM               566 stress-compm.txt
08/23/2005  02:53 PM               566 stress-compt.txt
04/13/2005  07:38 AM               205 Stress-Primary.txt
08/24/2005  11:58 AM            16,237 Stress-pt_108max-b.OUT
08/24/2005  11:58 AM            16,237 Stress-pt_108max-m.OUT
08/24/2005  11:58 AM            16,237 Stress-pt_108max-t.OUT
08/24/2005  11:58 AM            17,205 Stress-pt_108th-b.OUT
08/24/2005  11:58 AM            17,205 Stress-pt_108th-m.OUT
08/24/2005  11:58 AM            17,205 Stress-pt_108th-t.OUT
08/24/2005  11:58 AM            16,237 Stress-pt_117max-b.OUT
08/24/2005  11:58 AM            16,237 Stress-pt_117max-m.OUT
08/24/2005  11:58 AM            16,237 Stress-pt_117max-t.OUT
08/24/2005  11:58 AM            17,205 Stress-pt_117th-b.OUT
08/24/2005  11:58 AM            17,205 Stress-pt_117th-m.OUT
08/24/2005  11:58 AM            17,205 Stress-pt_117th-t.OUT
08/24/2005  11:58 AM            16,237 Stress-pt_126max-b.OUT
08/24/2005  11:58 AM            16,237 Stress-pt_126max-m.OUT
08/24/2005  11:58 AM            16,237 Stress-pt_126max-t.OUT
08/24/2005  11:58 AM            17,205 Stress-pt_126th-b.OUT
08/24/2005  11:58 AM            17,205 Stress-pt_126th-m.OUT
08/24/2005  11:58 AM            17,205 Stress-pt_126th-t.OUT
08/24/2005  11:58 AM            16,237 Stress-pt_135max-b.OUT
08/24/2005  11:58 AM            16,237 Stress-pt_135max-m.OUT
08/24/2005  11:58 AM            16,237 Stress-pt_135max-t.OUT
08/24/2005  11:58 AM            17,205 Stress-pt_135th-b.OUT
08/24/2005  11:58 AM            17,205 Stress-pt_135th-m.OUT
08/24/2005  11:58 AM            17,205 Stress-pt_135th-t.OUT
08/24/2005  11:58 AM            16,237 Stress-pt_144max-b.OUT
08/24/2005  11:58 AM            16,237 Stress-pt_144max-m.OUT
08/24/2005  11:58 AM            16,237 Stress-pt_144max-t.OUT
08/24/2005  11:58 AM            17,205 Stress-pt_144th-b.OUT
08/24/2005  11:58 AM            17,205 Stress-pt_144th-m.OUT
08/24/2005  11:58 AM            17,205 Stress-pt_144th-t.OUT
08/24/2005  11:58 AM            16,237 Stress-pt_153max-b.OUT
08/24/2005  11:58 AM            16,237 Stress-pt_153max-m.OUT
08/24/2005  11:58 AM            16,237 Stress-pt_153max-t.OUT
08/24/2005  11:58 AM            17,205 Stress-pt_153th-b.OUT
08/24/2005  11:58 AM            17,205 Stress-pt_153th-m.OUT
08/24/2005  11:58 AM            17,205 Stress-pt_153th-t.OUT
08/24/2005  11:58 AM            16,237 Stress-pt_162max-b.OUT
08/24/2005  11:58 AM            16,237 Stress-pt_162max-m.OUT
08/24/2005  11:58 AM            16,237 Stress-pt_162max-t.OUT
08/24/2005  11:58 AM            17,205 Stress-pt_162th-b.OUT
08/24/2005  11:58 AM            17,205 Stress-pt_162th-m.OUT
08/24/2005  11:58 AM            17,205 Stress-pt_162th-t.OUT
08/24/2005  11:58 AM            16,240 Stress-pt_171max-b.OUT
08/24/2005  11:58 AM            16,240 Stress-pt_171max-m.OUT
08/24/2005  11:58 AM            16,240 Stress-pt_171max-t.OUT
08/24/2005  11:58 AM            17,303 Stress-pt_171th-b.OUT
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08/24/2005  11:58 AM            17,303 Stress-pt_171th-m.OUT
08/24/2005  11:58 AM            17,303 Stress-pt_171th-t.OUT
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08/24/2005  11:58 AM            16,240 Stress-pt_180max-m.OUT
08/24/2005  11:58 AM            16,240 Stress-pt_180max-t.OUT
08/24/2005  11:58 AM            17,303 Stress-pt_180th-b.OUT
08/24/2005  11:58 AM            17,303 Stress-pt_180th-m.OUT
08/24/2005  11:58 AM            17,303 Stress-pt_180th-t.OUT
08/24/2005  11:58 AM            16,237 Stress-pt_18max-b.OUT
08/24/2005  11:58 AM            16,237 Stress-pt_18max-m.OUT
08/24/2005  11:58 AM            16,237 Stress-pt_18max-t.OUT
08/24/2005  11:58 AM            17,205 Stress-pt_18th-b.OUT
08/24/2005  11:58 AM            17,205 Stress-pt_18th-m.OUT
08/24/2005  11:58 AM            17,205 Stress-pt_18th-t.OUT
08/24/2005  11:58 AM            16,237 Stress-pt_27max-b.OUT
08/24/2005  11:58 AM            16,237 Stress-pt_27max-m.OUT
08/24/2005  11:58 AM            16,237 Stress-pt_27max-t.OUT
08/24/2005  11:58 AM            17,205 Stress-pt_27th-b.OUT
08/24/2005  11:58 AM            17,205 Stress-pt_27th-m.OUT
08/24/2005  11:58 AM            17,205 Stress-pt_27th-t.OUT
08/24/2005  11:58 AM            16,237 Stress-pt_36max-b.OUT
08/24/2005  11:58 AM            16,237 Stress-pt_36max-m.OUT
08/24/2005  11:58 AM            16,237 Stress-pt_36max-t.OUT
08/24/2005  11:58 AM            17,205 Stress-pt_36th-b.OUT
08/24/2005  11:58 AM            17,205 Stress-pt_36th-m.OUT
08/24/2005  11:58 AM            17,205 Stress-pt_36th-t.OUT
08/24/2005  11:58 AM            16,237 Stress-pt_45max-b.OUT
08/24/2005  11:58 AM            16,237 Stress-pt_45max-m.OUT
08/24/2005  11:58 AM            16,237 Stress-pt_45max-t.OUT
08/24/2005  11:58 AM            17,205 Stress-pt_45th-b.OUT
08/24/2005  11:58 AM            17,205 Stress-pt_45th-m.OUT
08/24/2005  11:58 AM            17,205 Stress-pt_45th-t.OUT
08/24/2005  11:58 AM            16,237 Stress-pt_54max-b.OUT
08/24/2005  11:58 AM            16,237 Stress-pt_54max-m.OUT
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08/24/2005  11:58 AM            17,205 Stress-pt_54th-t.OUT
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08/24/2005  11:58 AM            16,237 Stress-pt_63max-t.OUT
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08/24/2005  11:58 AM            17,205 Stress-pt_72th-m.OUT
08/24/2005  11:58 AM            17,205 Stress-pt_72th-t.OUT
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08/24/2005  11:58 AM            17,205 Stress-pt_99th-t.OUT
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08/24/2005  11:58 AM            16,237 Stress-pt_9max-t.OUT
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08/24/2005  09:21 AM             3,666 Tank-Coordinates-AY.txt
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Summary.xls
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06/09/2005  02:28 PM               350 connections.txt
09/02/2005  10:05 AM               610 Contact-Soil.txt
06/23/2005  01:26 PM             8,149 Far-Soil.txt
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08/24/2005  10:07 AM        30,539,776 file.db
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08/24/2005  10:06 AM        11,993,088 file.emat
09/21/2005  08:11 AM            94,384 file.err
08/24/2005  10:06 AM        82,116,608 file.esav
08/24/2005  10:06 AM        22,085,632 file.full
08/24/2005  10:05 AM           260,462 file.ldhi
09/21/2005  08:19 AM           232,264 file.log
08/24/2005  10:06 AM             1,467 file.mntr
08/24/2005  10:05 AM        82,116,608 file.osav
08/24/2005  10:06 AM               547 file.PVTS
08/24/2005  10:06 AM        82,903,040 file.r001
08/24/2005  09:55 AM        30,474,240 file.rdb
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08/24/2005  11:59 AM             4,996 Force-c_108amax.OUT
08/24/2005  11:59 AM             7,050 Force-c_108ath.OUT
08/24/2005  11:59 AM            14,716 Force-c_108max.OUT
08/24/2005  11:59 AM            13,770 Force-c_108th.OUT
08/24/2005  11:59 AM             4,996 Force-c_117amax.OUT
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08/24/2005  11:59 AM            14,716 Force-c_117max.OUT
08/24/2005  11:59 AM            13,770 Force-c_117th.OUT
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08/24/2005  11:59 AM             7,050 Force-c_153ath.OUT
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08/24/2005  11:59 AM            13,770 Force-c_153th.OUT
08/24/2005  11:59 AM             4,996 Force-c_162amax.OUT
08/24/2005  11:59 AM             7,050 Force-c_162ath.OUT
08/24/2005  11:59 AM            14,716 Force-c_162max.OUT
08/24/2005  11:59 AM            13,770 Force-c_162th.OUT
08/24/2005  11:59 AM             4,996 Force-c_171amax.OUT
08/24/2005  11:59 AM             7,050 Force-c_171ath.OUT
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08/24/2005  11:59 AM             4,996 Force-c_180amax.OUT
08/24/2005  11:59 AM             7,050 Force-c_180ath.OUT
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08/24/2005  11:59 AM            13,770 Force-c_180th.OUT
08/24/2005  11:59 AM             4,996 Force-c_18amax.OUT
08/24/2005  11:59 AM             7,050 Force-c_18ath.OUT
08/24/2005  11:59 AM            14,716 Force-c_18max.OUT
08/24/2005  11:59 AM            13,770 Force-c_18th.OUT
08/24/2005  11:59 AM             4,996 Force-c_27amax.OUT
08/24/2005  11:59 AM             7,050 Force-c_27ath.OUT
08/24/2005  11:59 AM            14,716 Force-c_27max.OUT
08/24/2005  11:59 AM            13,770 Force-c_27th.OUT
08/24/2005  11:59 AM             4,996 Force-c_36amax.OUT
08/24/2005  11:59 AM             7,050 Force-c_36ath.OUT
08/24/2005  11:59 AM            14,716 Force-c_36max.OUT
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08/24/2005  11:59 AM             7,050 Force-c_45ath.OUT
08/24/2005  11:59 AM            14,716 Force-c_45max.OUT
08/24/2005  11:59 AM            13,770 Force-c_45th.OUT
08/24/2005  11:59 AM             4,996 Force-c_54amax.OUT
08/24/2005  11:59 AM             7,050 Force-c_54ath.OUT
08/24/2005  11:59 AM            14,716 Force-c_54max.OUT
08/24/2005  11:59 AM            13,770 Force-c_54th.OUT
08/24/2005  11:59 AM             4,996 Force-c_63amax.OUT
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07/01/2005  11:29 AM             4,860 Primary-Props-AP.txt
08/24/2005  09:21 AM             4,715 Primary-Props-AY.txt
02/17/2005  04:24 PM             4,742 Primary-Props.txt
07/26/2005  02:26 PM             1,538 Primary.txt
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09/21/2005  08:11 AM             6,616 Soil-Contact_162max.OUT
09/21/2005  08:11 AM             6,940 Soil-Contact_162th.OUT
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02/25/2005  02:24 PM             5,406 Tank-Props-BEC-250.txt
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Summary.xls
03/09/2006  11:50 AM         8,234,496 Arching Study, Case 4, Pri Tank Seismic Stress.xls
08/23/2005  03:27 PM             5,766 Bolts-friction.txt
06/09/2005  01:59 PM               262 Boundary.txt
06/09/2005  02:28 PM               350 connections.txt
09/02/2005  10:05 AM               610 Contact-Soil.txt
06/23/2005  01:26 PM             8,149 Far-Soil.txt
08/24/2005  10:18 AM             2,998 file.BCS
09/23/2005  02:10 PM        30,539,776 file.db
08/24/2005  10:19 AM        30,539,776 file.dbb
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08/24/2005  10:19 AM        22,085,632 file.full
08/24/2005  10:17 AM           260,462 file.ldhi
03/09/2006  09:30 AM                 0 file.lock
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08/24/2005  10:19 AM             1,467 file.mntr
08/24/2005  10:17 AM        82,116,608 file.osav
03/09/2006  09:30 AM                 0 file.page
08/24/2005  10:18 AM               547 file.PVTS
08/24/2005  10:19 AM        82,903,040 file.r001
08/24/2005  10:08 AM        30,474,240 file.rdb
08/24/2005  10:19 AM        31,850,496 file.rst
06/20/2005  08:00 AM             3,484 Footing-Contact.txt
04/06/2005  08:24 AM               894 Force-c.txt
08/24/2005  12:00 PM             4,996 Force-c_108amax.OUT
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08/24/2005  12:00 PM             4,996 Force-c_117amax.OUT
08/24/2005  12:00 PM             7,050 Force-c_117ath.OUT
08/24/2005  12:00 PM            14,716 Force-c_117max.OUT
08/24/2005  12:00 PM            13,770 Force-c_117th.OUT
08/24/2005  12:00 PM             4,996 Force-c_126amax.OUT
08/24/2005  12:00 PM             7,050 Force-c_126ath.OUT
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08/24/2005  12:00 PM            13,770 Force-c_126th.OUT
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08/24/2005  12:00 PM             7,050 Force-c_162ath.OUT
08/24/2005  12:00 PM            14,716 Force-c_162max.OUT
08/24/2005  12:00 PM            13,770 Force-c_162th.OUT
08/24/2005  12:00 PM             4,996 Force-c_171amax.OUT
08/24/2005  12:00 PM             7,050 Force-c_171ath.OUT
08/24/2005  12:00 PM            14,716 Force-c_171max.OUT
08/24/2005  12:00 PM            13,770 Force-c_171th.OUT
08/24/2005  12:00 PM             4,996 Force-c_180amax.OUT
08/24/2005  12:00 PM             7,050 Force-c_180ath.OUT
08/24/2005  12:00 PM            14,716 Force-c_180max.OUT
08/24/2005  12:00 PM            13,770 Force-c_180th.OUT
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08/24/2005  12:00 PM            13,770 Force-c_18th.OUT
08/24/2005  12:00 PM             4,996 Force-c_27amax.OUT
08/24/2005  12:00 PM             7,050 Force-c_27ath.OUT
08/24/2005  12:00 PM            14,716 Force-c_27max.OUT
08/24/2005  12:00 PM            13,770 Force-c_27th.OUT
08/24/2005  12:00 PM             4,996 Force-c_36amax.OUT
08/24/2005  12:00 PM             7,050 Force-c_36ath.OUT
08/24/2005  12:00 PM            14,716 Force-c_36max.OUT
08/24/2005  12:00 PM            13,770 Force-c_36th.OUT
08/24/2005  12:00 PM             4,996 Force-c_45amax.OUT
08/24/2005  12:00 PM             7,050 Force-c_45ath.OUT
08/24/2005  12:00 PM            14,716 Force-c_45max.OUT
08/24/2005  12:00 PM            13,770 Force-c_45th.OUT
Z
```

Appendix C

Model Error Evaluation

Appendix C

Model Error Evaluation

C.1 Error Description

During checking of the ANSYS model, a number of errors were identified. Because the full transient analyses had been performed prior to identifying the errors, a check of the impacts of the errors is performed in lieu of re-running the transient analyses.

The identified errors are as follows:

- Concrete Tank is 8 inches short (Total Height = 580 inches)
- Primary Tank is 8 inches short (Total Height = 570 inches)
- Damping for waste to primary contacts set at 7% instead of 0%
- Liner element under insulating concrete have incorrect material properties (Concrete instead of steel)
- Concrete Material No. 29 has incorrect density (3894 lbs/ft^3 instead of 394 lbs/ft^3)
- Concrete Material Nos. 31 and 32 have incorrect density (150 lbs/ft^3 instead of 411 lbs/ft^3 and 252 lbs/ft^3 for Nos. 31 and 32 respectively)
- Concrete elements in floor have taper rotated 90 degrees
- Primary Tank elements in floor have thickness of 0.44 inches instead of 0.31 inches
- Primary Tank, first row of elements above knuckles have thickness of 0.69 inches instead of 0.815 inches
- Elastic Modulus for soil material properties (No. 901, Upper Bound Soil) are incorrect (approximately 0.04%)

C.2 Corrections

To evaluate the impact of the errors identified above, corrections were made to the appropriate input files. The gravity only case was then re-run for the UBS case. Corrected files are included in this appendix.

C.3 Evaluation

A comparison has been made between the corrected model and the results included in this calculation to evaluate the significance of the errors. The errors affect the concrete tank, primary tank, and secondary liner, therefore, the results for these components have been evaluated.

C.4 Concrete Tank

Figures C.1 through C.6 provide the comparison between the fixed model and the model used for the transient analysis. As can be seen in the figures, there are only small differences between the analysis model and the corrected model. The largest differences appear in the in-plane shear forces, but the magnitudes are small, therefore, even small differences in values appear larger when plotted. Table C.1 provides the values for concrete forces and moments for the corrected model.

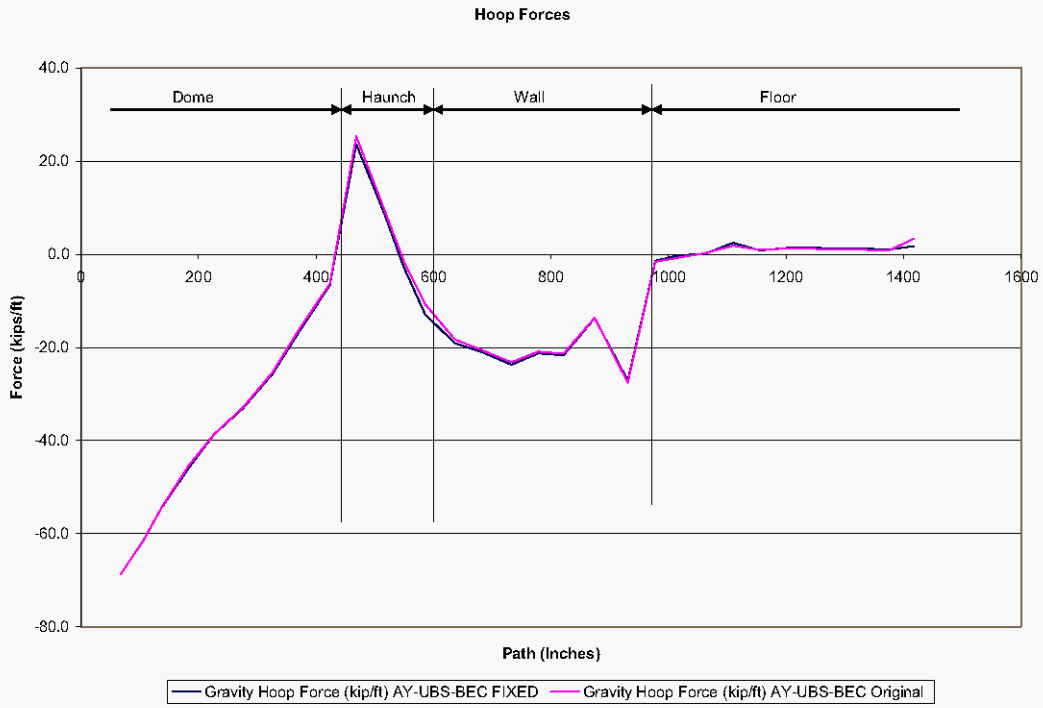

Figure C.1. Comparison of Concrete Hoop Forces, UBS-BEC vs. UBS-BEC-FIXED, Gravity Load Only

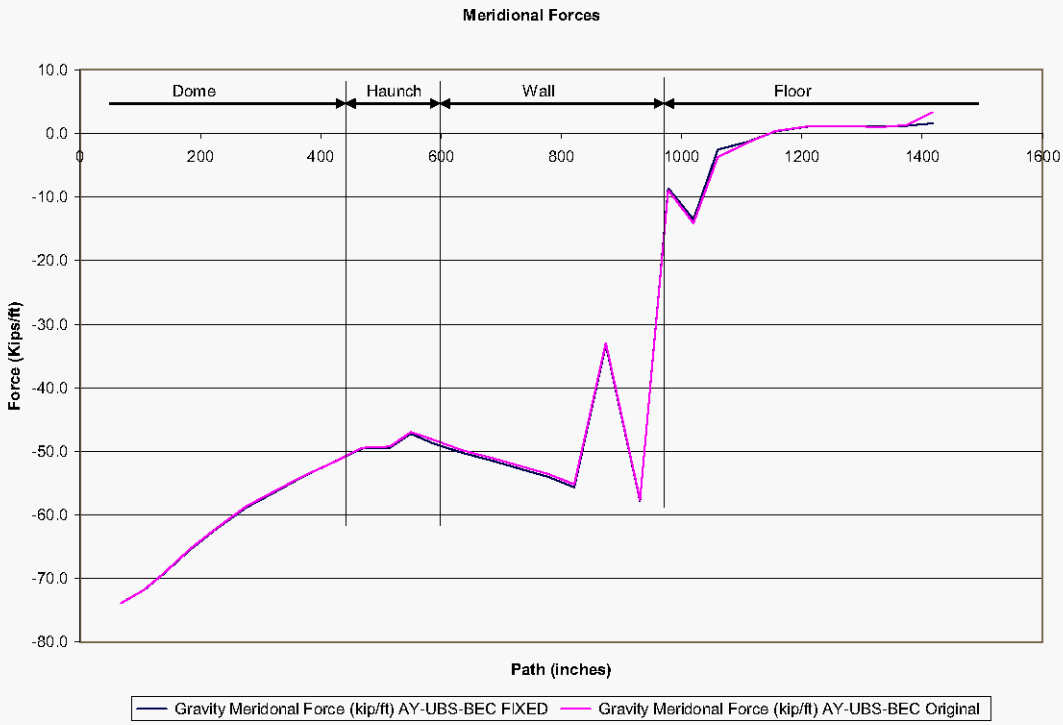

Figure C.2. Comparison of Concrete Meridional Forces, UBS-BEC vs. UBS-BEC-FIXED, Gravity Load Only

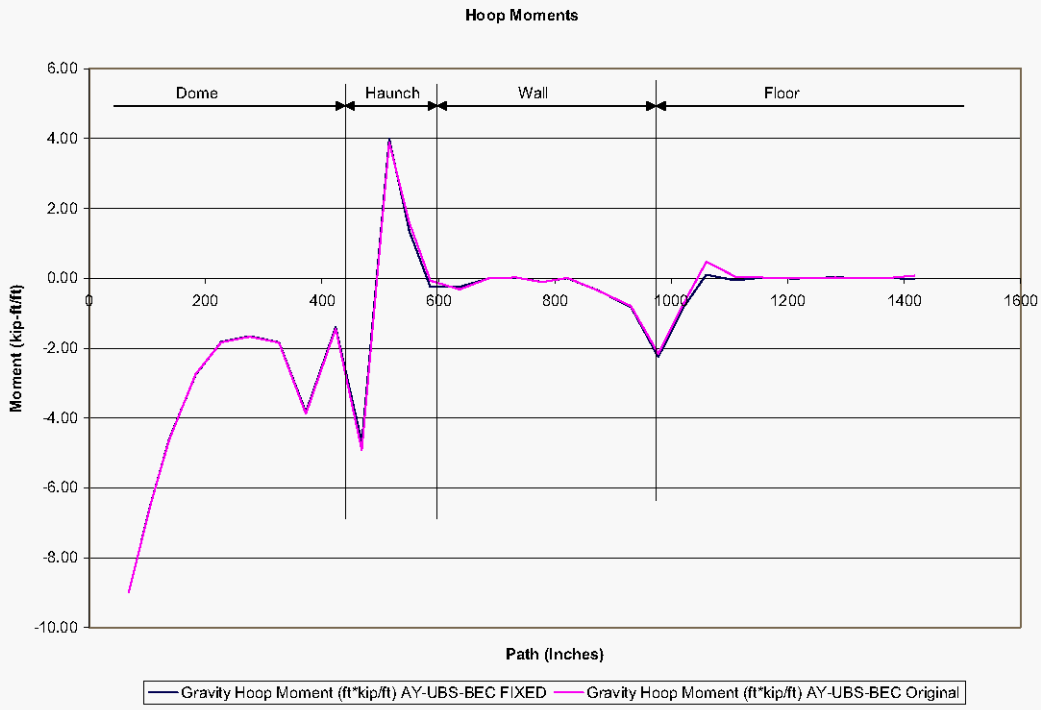

Figure C.3. Comparison of Concrete Hoop Moments, UBS-BEC vs. UBS-BEC-FIXED, Gravity Load Only

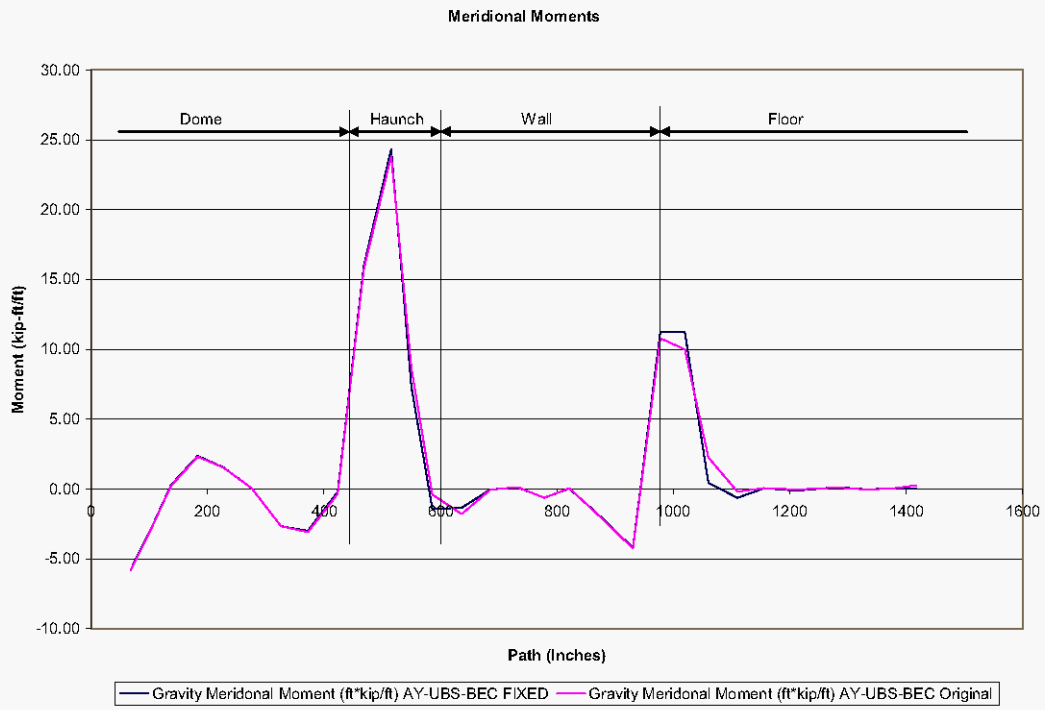

Figure C.4. Comparison of Concrete Meridional Moments, UBS-BEC vs. UBS-BEC-FIXED, Gravity Load Only

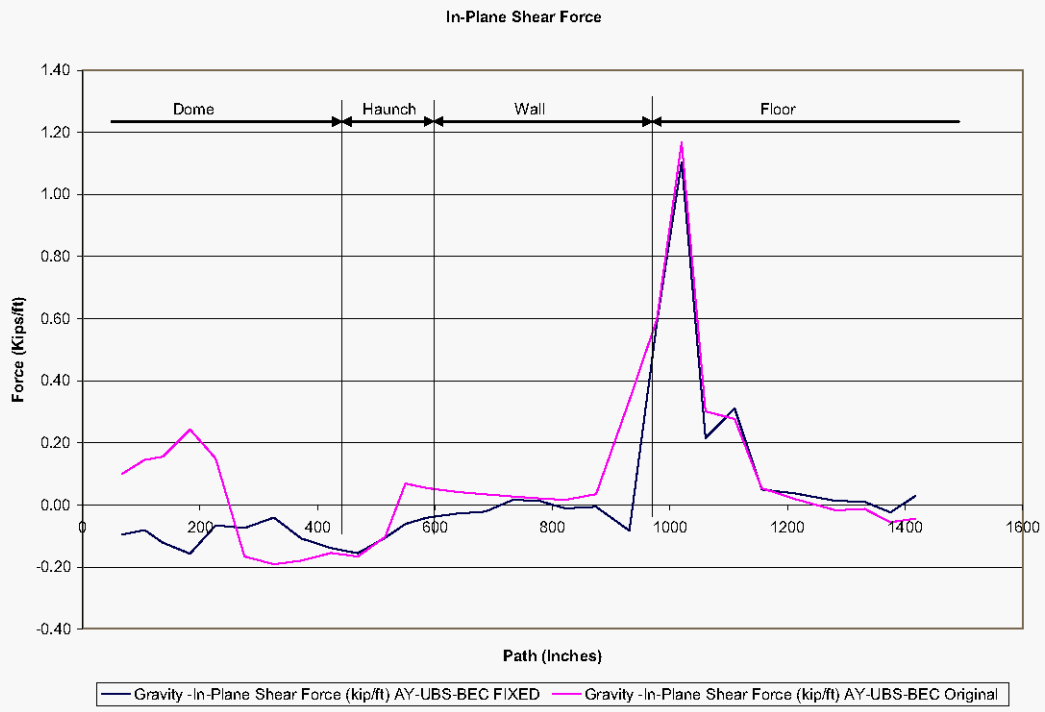

Figure C.5. Comparison of Concrete In-Plane Shear Forces, UBS-BEC vs. UBS-BEC-FIXED, Gravity Load Only

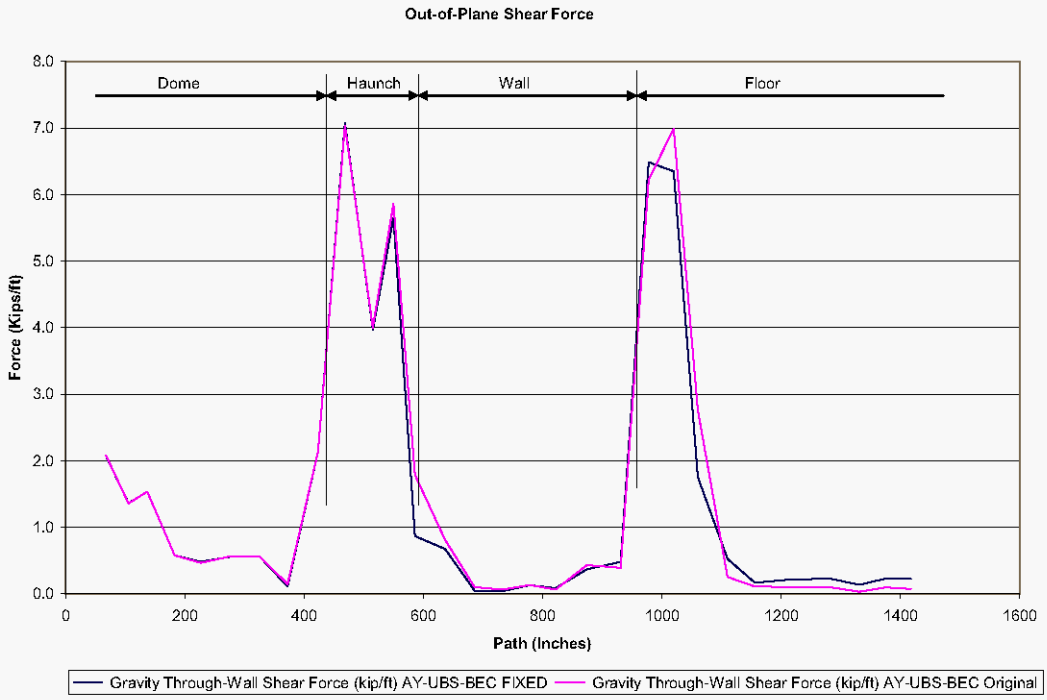

Figure C.6. Comparison of Concrete Through-Wall Shear Forces, UBS-BEC vs. UBS-BEC-FIXED, Gravity Load Only

Table C.1. Concrete Forces and Moments for UBS-BEC-FIXED, Gravity Only

AY Primary Tank, Upper Bound Soil (Geomatrix), Gravity Only, Best Estimate Concrete, 422 in. Waste Level at 1.7 SpG FIXED

ANSYS MAXIMUMS BY PATH

PNNL Section No.	Path (in.)	Gravity Hoop Force (kip/ft) AY-UBS-BEC FIXED	Gravity Meridonal Force (kip/ft) AY-UBS-BEC FIXED	Gravity -In-Plane Shear Force (kip/ft) AY-UBS-BEC FIXED	Gravity Hoop Moment (ft*kip/ft) AY-UBS-BEC FIXED	Gravity Meridonal Moment (ft*kip/ft) AY-UBS-BEC FIXED	Gravity Through-Wall Shear Force (kip/ft) AY-UBS-BEC FIXED
2	**67.727**	-68.650	-73.900	-0.095	-8.993	-5.788	2.074
3	**105.668**	-61.580	-71.840	-0.081	-6.464	-2.598	1.361
4	**137.069**	-54.460	-69.380	-0.122	-4.610	0.277	1.536
6	**182.849**	-45.980	-65.460	-0.158	-2.763	2.359	0.578
8	**226.563**	-38.670	-62.180	-0.066	-1.823	1.553	0.461
9	**275.566**	-33.100	-58.890	-0.075	-1.663	0.053	0.555
11	**325.690**	-25.680	-56.330	-0.041	-1.834	-2.662	0.558
13	**372.305**	-16.450	-53.900	-0.109	-3.837	-3.000	0.110
17	**423.427**	-6.637	-51.620	-0.139	-1.395	-0.215	2.135
20	**468.308**	23.600	-49.560	-0.156	-4.694	15.970	7.080
22	**515.312**	9.008	-49.430	-0.106	3.998	24.330	3.967
24	**549.725**	-2.936	-47.240	-0.062	1.338	7.303	5.649
26	**585.819**	-12.990	-48.730	-0.041	-0.259	-1.431	0.868
30	**636.369**	-19.080	-50.280	-0.029	-0.244	-1.357	0.674
33	**685.619**	-21.210	-51.490	-0.022	-0.008	-0.042	0.049
35	**732.719**	-23.750	-52.800	0.016	0.018	0.100	0.039
38	**778.219**	-21.300	-54.050	0.012	-0.114	-0.630	0.130
41	**821.369**	-21.710	-55.670	-0.011	0.002	0.021	0.085
43	**874.169**	-13.730	-33.250	-0.006	-0.355	-1.960	0.368
46	**930.544**	-27.170	-57.790	-0.083	-0.827	-4.218	0.480
48	**977.629**	-1.437	-8.598	0.587	-2.256	11.250	6.483
51	**1019.647**	-0.216	-13.540	1.104	-0.862	11.220	6.346
53	**1060.156**	0.015	-2.527	0.215	0.097	0.436	1.752
55	**1109.695**	2.431	-1.304	0.310	-0.063	-0.636	0.525
57	**1155.770**	0.810	0.295	0.050	0.014	0.051	0.167
58	**1211.956**	1.476	1.112	0.037	-0.016	-0.127	0.213
59	**1281.707**	1.247	1.164	0.013	0.031	0.126	0.230
60	**1330.557**	1.207	1.150	0.010	-0.003	-0.031	0.137
61	**1374.857**	0.992	1.212	-0.024	0.008	0.025	0.230
62	**1417.007**	1.700	1.614	0.029	-0.031	0.033	0.220

Note: Meridonal/Hoop Forces and Meridonal/Hoop Moments are Reversed in Highlighted Sections.

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AY-2D-NL-UBS-BEC Conc Tank Demand Gravity-FIXED.xls, FM Max FIXED

C.5 Primary tank

Figures C.7, C.8, and C.9 provide the comparison between the fixed model and the model used for the transient analysis. As can be seen in the figures, there are only small differences between the analysis model and the corrected model. Tables C.2, C.3, and C.4 provide the values for primary tank stresses for the corrected model.

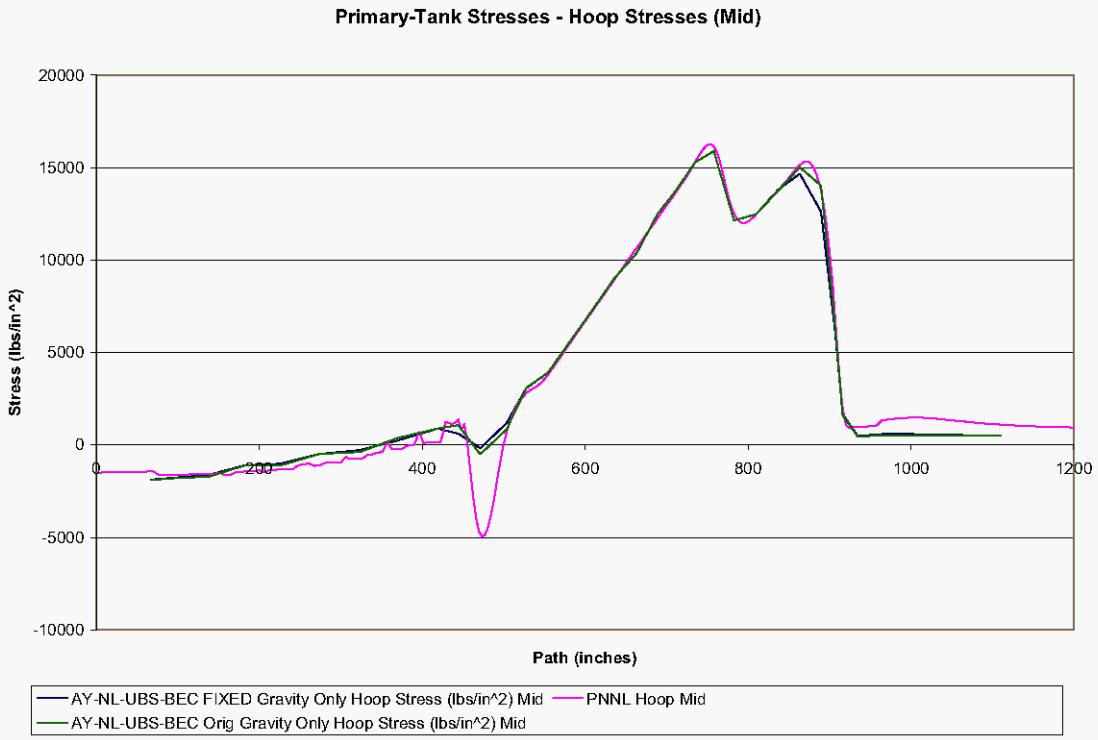

Figure C.7. Comparison of Primary Tank Hoop Stresses, Mid-Plane, UBS-BEC vs. UBS-BEC-FIXED, Gravity Load Only

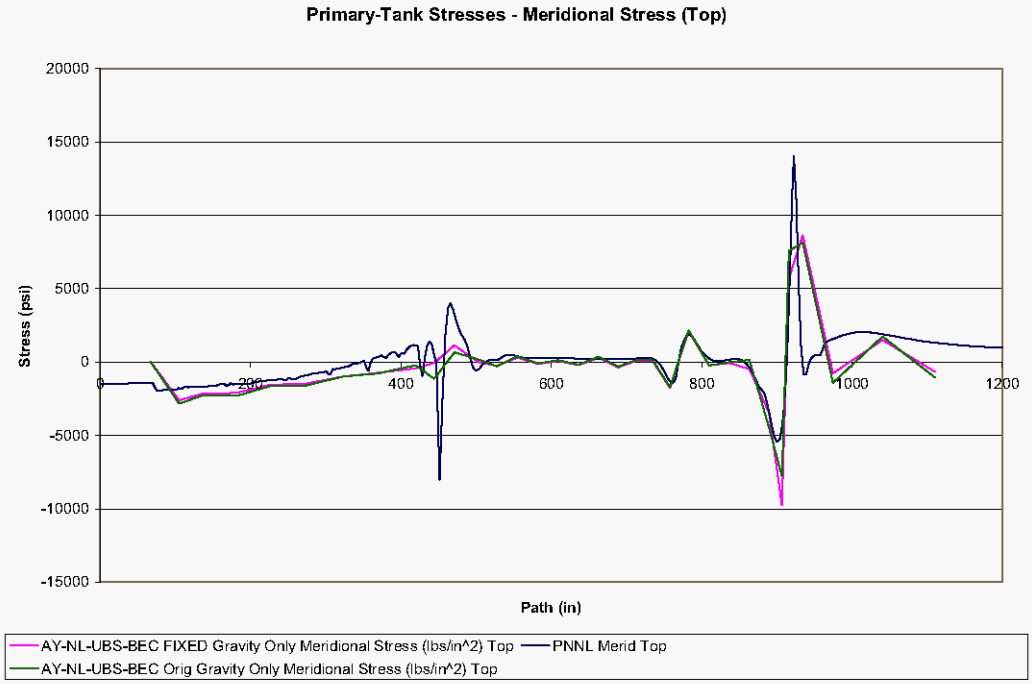

Figure C.8. Comparison of Primary Tank Meridional Stresses, Shell Top, UBS-BEC vs. UBS-BEC-FIXED, Gravity Load Only

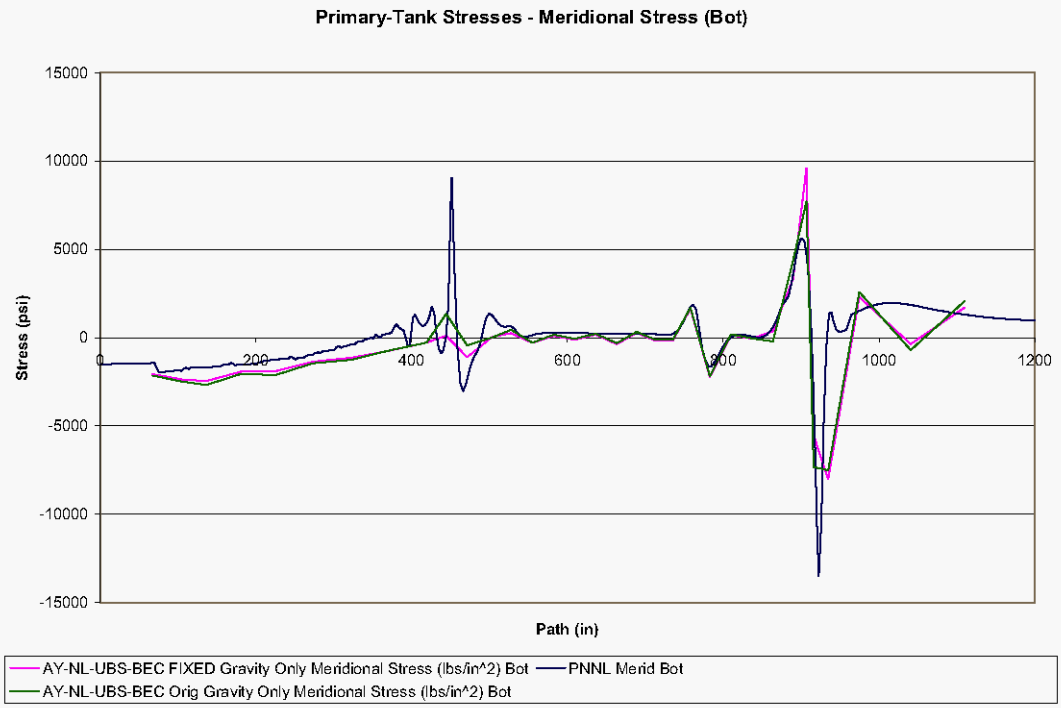

Figure C.9. Comparison of Primary Tank Meridional Stresses, Shell Bottom, UBS-BEC vs. UBS-BEC-FIXED, Gravity Load Only

Table C.2. Primary Tank Stresses, Shell Top, UBS-BEC-FIXED, Gravity Only

AY Primary Tank, Upper Bound Soil, Gravity Input, Best Estimate Tank Concrete, 422 in. Waste Level at 1.7 SpG FIXED

		Shell Top Surface (inside - waste side)					
M&D Starting M&D Element No.	Path (in.)	AY-NL-UBS-BEC FIXED Gravity Only Hoop Stress (lbs/in^2) Top	AY-NL-UBS-BEC FIXED Gravity Only Meridional Stress (lbs/in^2) Top	AY-NL-UBS-BEC FIXED Gravity Only Stress Intensity (lbs/in^2) Top	AY-NL-UBS-BEC FIXED Gravity Only In Plane Shear Stress (lbs/in^2) Top	AY-NL-UBS-BEC FIXED Gravity Only In Plane Shear Force Stress (lbs/in^2) Top	AY-NL-UBS-BEC FIXED Gravity Only Thru-Thickness Shear Stress (lbs/in^2) Top
762	**67.33**	-1798.61	0.00	1798.61	-2.88	7.82	-0.14
782	**105.04**	-1753.47	-2611.11	2611.11	-2.46	-18.97	0.03
802	**136.24**	-1583.33	-2154.86	2155.56	-4.43	15.74	-0.01
822	**181.71**	-1121.53	-2112.50	2112.50	5.41	-1.24	0.02
842	**225.10**	-958.33	-1561.11	1561.11	-2.25	-10.22	-0.10
862	**273.66**	-503.13	-1474.31	1474.31	-5.64	6.47	0.02
882	**323.27**	-255.21	-993.06	993.75	-4.65	-20.74	-0.02
902	**369.20**	228.75	-740.97	956.25	-3.57	6.40	-0.03
922	**419.20**	872.22	-429.65	1299.31	-3.81	-11.06	-0.03
942	**444.11**	585.76	-69.93	657.92	-3.34	12.92	0.05
962	**471.06**	169.44	1131.94	1131.94	-1.52	-15.04	0.11
982	**503.51**	1159.72	-19.55	1178.47	-1.29	-7.58	-0.01
1002	**527.76**	2979.86	-257.78	3238.19	-1.35	-13.18	0.00
1022	**554.76**	4019.44	295.14	4019.44	-0.99	-8.53	0.00
1042	**582.26**	5620.83	-123.33	5744.44	-0.94	-6.97	0.00
1062	**609.26**	7333.33	72.08	7333.33	-0.95	-7.79	0.00
1082	**636.26**	8979.17	-222.64	9201.39	-0.99	-10.22	0.00
1102	**663.26**	10458.33	302.57	10458.33	-1.05	0.23	0.00
1122	**688.61**	12388.89	-361.67	12750.00	-1.13	3.28	0.00
1142	**711.96**	13819.44	55.76	13826.39	-1.16	-5.64	0.01
1162	**734.96**	15319.44	72.50	15319.44	-1.41	-6.64	0.01
1182	**757.91**	15388.89	-1768.75	17152.78	-1.41	-8.86	0.01
1202	**782.81**	12791.67	2127.08	12791.67	-0.97	-17.80	0.01
1222	**809.76**	12423.61	-245.49	12666.67	-0.67	-6.64	0.02
1242	**836.76**	13798.61	-69.51	13868.06	-0.87	-5.18	0.02
1262	**863.76**	14541.67	-489.72	15034.72	-0.93	-7.31	-0.04
1282	**889.76**	11597.22	-3459.72	15055.56	2.08	-10.00	0.14
1302	**906.85**	3431.94	-9770.83	13201.39	7.13	136.04	0.94
1322	**916.04**	3638.89	5704.86	5748.61	-7.73	355.76	2.29
1342	**934.63**	3047.92	8631.94	8666.67	-443.13	7.88	-97.22
1362	**974.63**	154.51	-763.19	925.69	74.38	-1.90	23.98
1382	**1040.78**	822.92	1498.61	1503.47	-55.23	1.20	-15.17
1402	**1110.53**	163.89	-672.22	838.89	67.31	-1.76	22.20

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Table C.3. Primary Tank Stresses, Shell Middle, UBS-BEC-FIXED, Gravity Only

AY Primary Tank, Upper Bound Soil, Gravity Input, Best Estimate Tank Concrete, 422 in. Waste Level at 1.7 SpG FIXED

		Shell Mid-Plane					
M&D Starting M&D Element No.	Path (in.)	AY-NL-UBS-BEC FIXED Gravity Only Hoop Stress (lbs/in^2) Mid	AY-NL-UBS-BEC FIXED Gravity Only Meridional Stress (lbs/in^2) Mid	AY-NL-UBS-BEC FIXED Gravity Only Stress Intensity (lbs/in^2) Mid	AY-NL-UBS-BEC FIXED Gravity Only In Plane Shear Stress (lbs/in^2) Mid	AY-NL-UBS-BEC FIXED Gravity Only In Plane Shear Force Stress (lbs/in^2) Mid	AY-NL-UBS-BEC FIXED Gravity Only Thru-Thickness Shear Stress (lbs/in^2) Mid
762	**67.33**	-1877.78	-1921.53	1921.53	2.47	7.82	-0.14
782	**105.04**	-1740.97	-2488.19	2488.19	-2.18	-18.97	0.03
802	**136.24**	-1646.53	-2306.94	2306.94	-4.11	15.74	-0.01
822	**181.71**	-1104.17	-2015.28	2015.28	-4.88	-1.24	0.02
842	**225.10**	-1016.67	-1732.64	1732.64	-2.06	-10.22	-0.10
862	**273.66**	-493.19	-1419.44	1420.14	-5.23	6.47	0.02
882	**323.27**	-279.72	-1063.19	1063.89	-4.49	-20.74	-0.02
902	**369.20**	220.14	-752.08	957.64	3.56	6.40	-0.03
922	**419.20**	891.67	-356.18	1245.14	-3.76	-11.06	-0.03
942	**444.11**	614.38	20.01	621.32	-3.23	12.92	0.05
962	**471.06**	-183.96	15.86	208.89	-1.64	-15.04	0.11
982	**503.51**	1167.36	10.01	1171.53	-1.20	-7.58	-0.01
1002	**527.76**	3057.64	3.37	3069.44	-1.34	-13.18	0.00
1022	**554.76**	3929.17	-5.72	3940.97	-0.95	-8.53	0.00
1042	**582.26**	5653.47	-13.53	5670.14	-0.95	-6.97	0.00
1062	**609.26**	7305.56	-21.31	7326.39	-0.96	-7.79	0.00
1082	**636.26**	9041.67	-29.21	9069.44	-0.99	-10.22	0.00
1102	**663.26**	10361.11	-37.18	10395.83	-1.07	0.23	0.00
1122	**688.61**	12479.17	-44.72	12527.78	-1.13	3.28	0.00
1142	**711.96**	13791.67	-51.47	13840.28	-1.15	-5.64	0.01
1162	**734.96**	15277.78	-58.42	15340.28	-1.15	-6.64	0.01
1182	**757.91**	15895.83	-65.43	15965.28	-1.35	-8.86	0.01
1202	**782.81**	12138.89	-47.64	12194.44	-0.85	-17.80	0.01
1222	**809.76**	12479.17	-55.63	12534.72	-0.74	-6.64	0.02
1242	**836.76**	13798.61	-63.57	13861.11	-0.84	-5.18	0.02
1262	**863.76**	14666.67	-71.11	14743.06	-0.93	-7.31	-0.04
1282	**889.76**	12618.06	-67.93	12687.50	2.04	-10.00	0.14
1302	**906.85**	6227.08	-89.03	6414.58	5.85	136.04	0.94
1322	**916.04**	1667.36	88.54	1981.25	-6.16	355.76	2.29
1342	**934.63**	482.99	304.03	512.78	16.88	7.88	-97.22
1362	**974.63**	618.40	766.67	768.75	-13.85	-1.90	23.98
1382	**1040.78**	539.24	568.96	569.86	-3.52	1.20	-15.17
1402	**1110.53**	520.35	528.06	529.72	-1.79	-1.76	22.20

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Table C.4. Primary Tank Stresses, Shell Bottom, UBS-BEC-FIXED, Gravity Only

AY Primary Tank, Upper Bound Soil, Gravity Input, Best Estimate Tank Concrete, 422 in. Waste Level at 1.7 SpG FIXED

		Shell Bottom Surface (outside - away from waste)					
M&D Starting M&D Element No.	Path (in.)	AY-NL-UBS-BEC FIXED Gravity Only Hoop Stress (lbs/in^2) Bot	AY-NL-UBS-BEC FIXED Gravity Only Meridional Stress (lbs/in^2) Bot	AY-NL-UBS-BEC FIXED Gravity Only Stress Intensity (lbs/in^2) Bot	AY-NL-UBS-BEC FIXED Gravity Only In Plane Shear Stress (lbs/in^2) Bot	AY-NL-UBS-BEC FIXED Gravity Only In Plane Shear Force Stress (lbs/in^2) Bot	AY-NL-UBS-BEC FIXED Gravity Only Thru-Thickness Shear Stress (lbs/in^2) Bot
762	**67.33**	-1962.50	-2072.92	2072.92	-3.79	7.82	-0.14
782	**105.04**	-1727.78	-2365.97	2366.67	-2.39	-18.97	0.03
802	**136.24**	-1709.72	-2459.03	2459.03	-3.80	15.74	-0.01
822	**181.71**	-1086.11	-1917.36	1917.36	-4.47	-1.24	0.02
842	**225.10**	-1075.00	-1905.56	1905.56	-1.88	-10.22	-0.10
862	**273.66**	-483.75	-1365.28	1365.28	-4.82	6.47	0.02
882	**323.27**	-304.24	-1133.33	1134.03	-4.33	-20.74	-0.02
902	**369.20**	211.53	-763.19	959.72	3.55	6.40	-0.03
922	**419.20**	911.81	-282.99	1191.67	-3.71	-11.06	-0.03
942	**444.11**	642.99	107.15	644.51	-3.12	12.92	0.05
962	**471.06**	-518.75	-1100.00	1100.69	-1.80	-15.04	0.11
982	**503.51**	1175.00	39.32	1176.39	-1.31	-7.58	-0.01
1002	**527.76**	3135.42	262.85	3136.11	-1.32	-13.18	0.00
1022	**554.76**	3839.58	-304.65	4144.44	-0.92	-8.53	0.00
1042	**582.26**	5686.81	97.85	5687.50	-0.96	-6.97	0.00
1062	**609.26**	7277.78	-113.13	7388.89	-0.97	-7.79	0.00
1082	**636.26**	9097.22	166.46	9097.22	-1.00	-10.22	0.00
1102	**663.26**	10256.94	-374.79	10631.94	-1.09	0.23	0.00
1122	**688.61**	12576.39	274.93	12576.39	-1.13	3.28	0.00
1142	**711.96**	13756.94	-156.46	13916.67	-1.21	-5.64	0.01
1162	**734.96**	15243.06	-185.97	15423.61	-1.21	-6.64	0.01
1182	**757.91**	16409.72	1640.97	16409.72	-1.28	-8.86	0.01
1202	**782.81**	11486.11	-2220.14	13708.33	-0.74	-17.80	0.01
1222	**809.76**	12541.67	138.33	12541.67	-0.83	-6.64	0.02
1242	**836.76**	13798.61	-57.61	13861.11	-0.80	-5.18	0.02
1262	**863.76**	14791.67	351.81	14791.67	-1.18	-7.31	-0.04
1282	**889.76**	13631.94	3323.61	13631.94	-2.05	-10.00	0.14
1302	**906.85**	9027.78	9590.28	9597.22	4.56	136.04	0.94
1322	**916.04**	-313.89	-5527.78	5573.61	-4.59	355.76	2.29
1342	**934.63**	-2091.67	-8027.78	8062.50	472.92	7.88	-97.22
1362	**974.63**	1084.03	2290.97	2298.61	-97.43	-1.90	23.98
1382	**1040.78**	256.67	-367.01	628.40	50.90	1.20	-15.17
1402	**1110.53**	881.25	1720.83	1726.39	-68.49	-1.76	22.20

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AY-2D-NL-UBS-BEC Pri Tank Stress Gravity FIXED.xls, Stress Max FIXED

C.6 Secondary Liner

Figures C.10, C.11 and C.12 provide the comparison between the fixed model and the model used for the transient analysis. As can be seen in the figures, there are only small differences between the analysis model and the corrected model. Tables C.5, C.6, and C.7 provide the values for secondary liner strains for the corrected model.

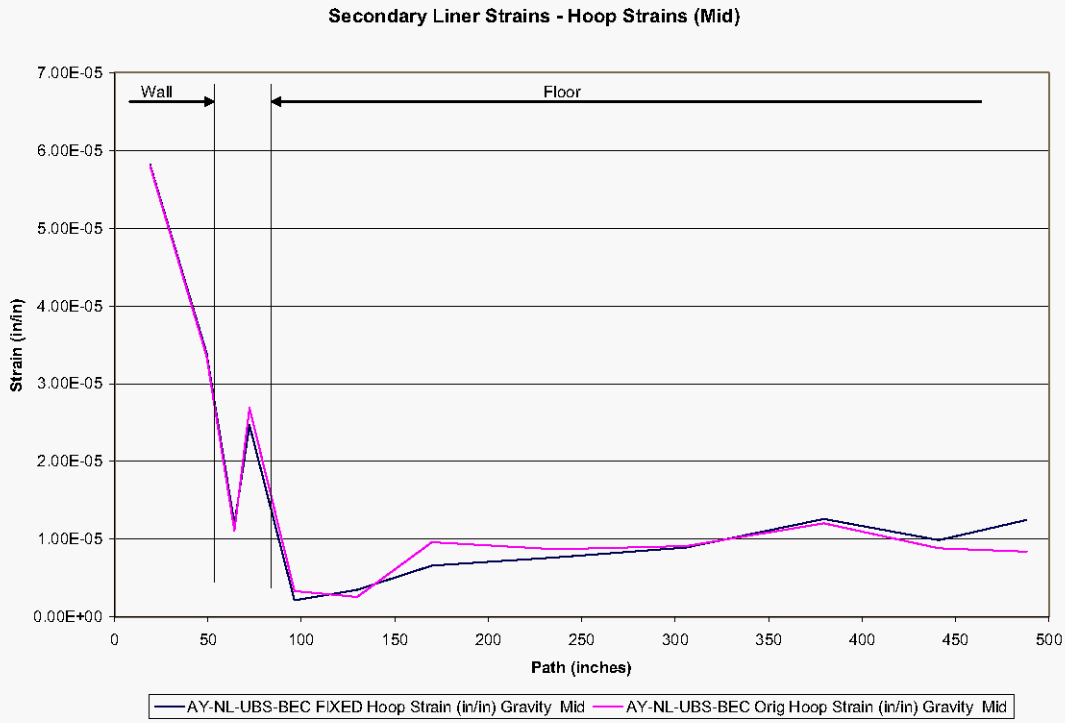

Figure C.10. Comparison of Secondary Liner Hoop Strains, Shell Mid-Plane, UBS-BEC vs. UBS-BEC-FIXED, Gravity Load Only

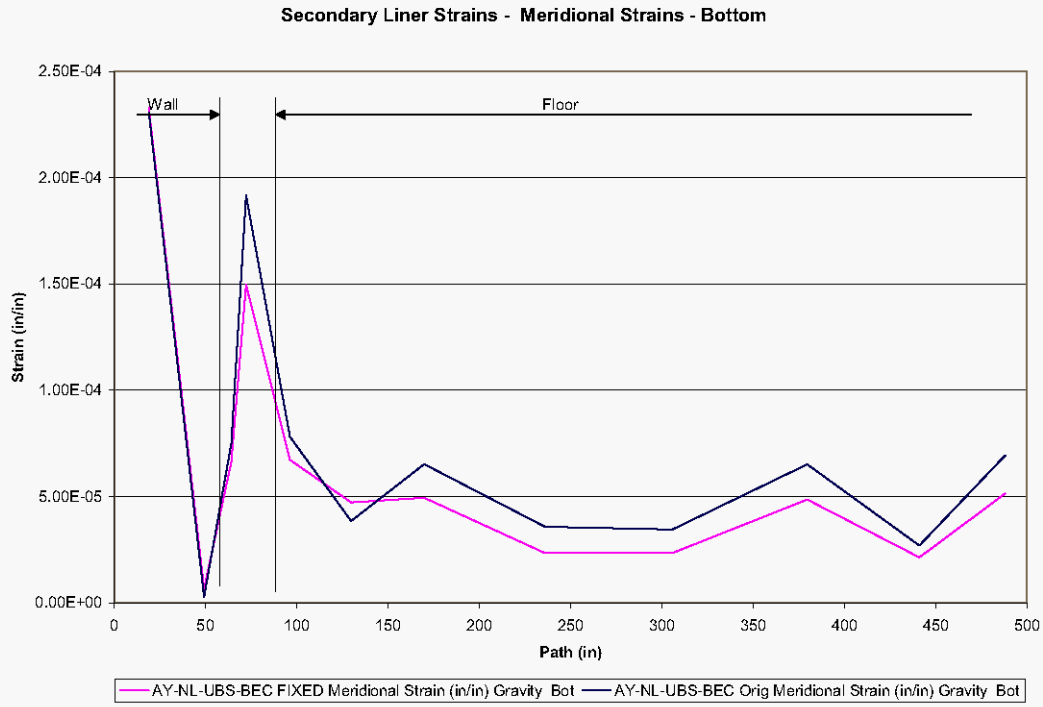

Figure C.11. Comparison of Secondary Liner Merdional Strains, Shell Top, UBS-BEC vs. UBS-BEC-FIXED, Gravity Load Only

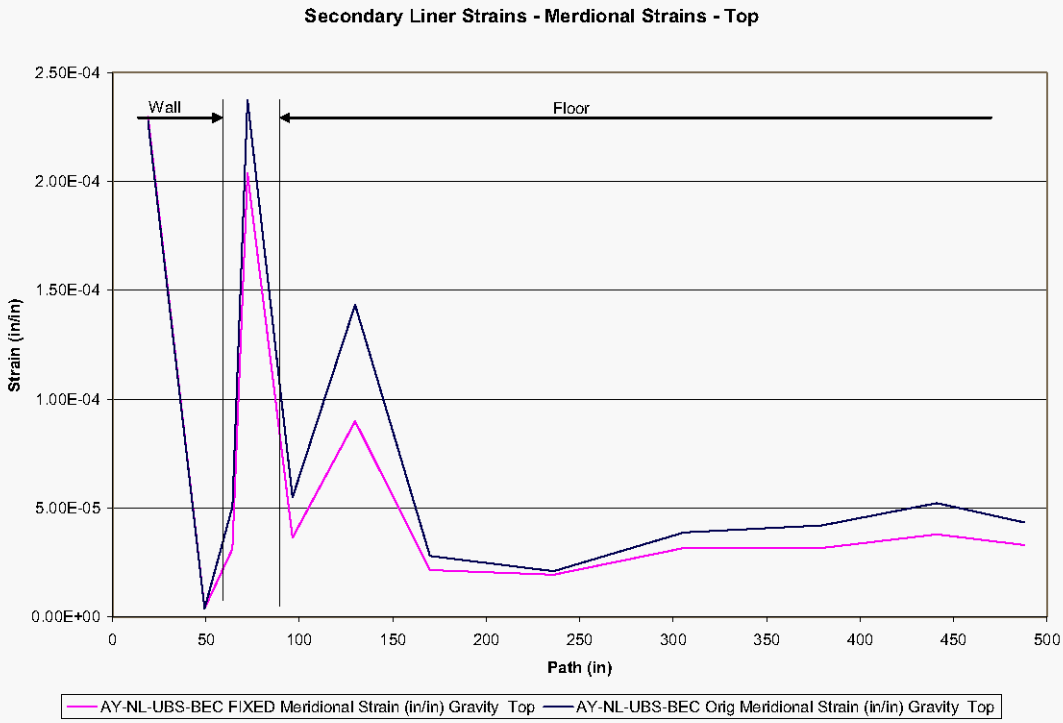

Figure C.12. Comparison of Secondary Liner Meridional Strains, Shell Bottom, UBS-BEC vs. UBS-BEC-FIXED, Gravity Load Only

Table C.5. Secondary Liner Strains, Shell Top, UBS-BEC-FIXED, Gravity Only

AY Secondary Liner, Upper Bound Soil, Gravity Only, Best Estimate Tank Concrete, 422 In Waste Level at 1.7SpG

		Shell Top Surface (inside - towards waste) Gravity					
M&D Starting M&D Element No.	Path (in.)	AY-NL-UBS-BEC FIXED Hoop Strain (in/in) Gravity Top	AY-NL-UBS-BEC FIXED Meridional Strain (in/in) Gravity Top	AY-NL-UBS-BEC FIXED Strain Intensity (in/in) Gravity Top	AY-NL-UBS-BEC FIXED In-Plane Shear Strain (in/in) Gravity Top	AY-NL-UBS-BEC FIXED In-Plane Shear Force Strain (in/in) Gravity Top	AY-NL-UBS-BEC FIXED Thru-Thickness Shear Strain (in/in) Gravity Top
2062	**19.00**	5.82E-05	2.30E-04	3.53E-04	1.07E-07	3.17E-08	8.81E-10
2052	**49.28**	3.42E-05	3.91E-06	5.11E-05	1.41E-06	1.43E-05	7.47E-07
2042	**64.15**	1.28E-05	3.11E-05	5.04E-05	1.40E-05	1.98E-05	8.76E-06
2032	**72.29**	2.52E-05	2.04E-04	2.81E-04	1.24E-05	2.14E-05	8.90E-06
2022	**96.32**	2.09E-06	3.63E-05	5.28E-05	4.15E-06	2.88E-06	2.05E-07
1916	**129.82**	3.54E-06	8.98E-05	1.27E-04	4.30E-07	3.29E-06	7.11E-08
1906	**169.82**	6.74E-06	2.15E-05	3.31E-05	9.92E-07	1.46E-06	1.58E-08
1896	**235.97**	7.68E-06	1.94E-05	2.70E-05	5.08E-07	9.62E-07	5.05E-09
1886	**305.72**	8.94E-06	3.16E-05	4.90E-05	7.30E-07	1.46E-06	1.90E-09
1876	**379.62**	1.26E-05	3.16E-05	4.13E-05	6.31E-07	2.37E-06	4.84E-09
1866	**441.02**	9.80E-06	3.79E-05	5.83E-05	7.11E-07	1.99E-06	8.20E-09
1856	**487.97**	1.27E-05	3.29E-05	4.37E-05	2.84E-06	3.50E-06	6.65E-08

Table C.6. Secondary Liner Strains, Shell Mid-Plane, UBS-BEC-FIXED, Gravity Only

AY Secondary Liner, Upper Bound Soil, Gravity Only, Best Estimate Tank Concrete, 422 In Waste Level at 1.7SpG

		Shell Mid-Plane					
M&D Starting M&D Element No.	Path (in.)	AY-NL-UBS-BEC FIXED Hoop Strain (in/in) Gravity Mid	AY-NL-UBS-BEC FIXED Meridional Strain (in/in) Gravity Mid	AY-NL-UBS-BEC FIXED Strain Intensity (in/in) Gravity Mid	AY-NL-UBS-BEC FIXED In-Plane Shear Strain (in/in) Gravity Mid	AY-NL-UBS-BEC FIXED In-Plane Shear Force Strain (in/in) Gravity Mid	AY-NL-UBS-BEC FIXED Thru-Thickness Shear Strain (in/in) Gravity Mid
2062	**19.00**	5.82E-05	2.31E-04	3.55E-04	1.09E-07	3.17E-08	8.81E-10
2052	**49.28**	3.40E-05	4.47E-06	5.15E-05	1.01E-06	1.43E-05	7.47E-07
2042	**64.15**	1.19E-05	1.84E-05	3.51E-05	5.35E-06	1.98E-05	8.76E-06
2032	**72.29**	2.46E-05	2.89E-05	5.64E-05	4.95E-06	2.14E-05	8.90E-06
2022	**96.32**	2.12E-06	1.56E-05	2.17E-05	3.79E-06	2.88E-06	2.05E-07
1916	**129.82**	3.49E-06	2.15E-05	2.94E-05	3.66E-07	3.29E-06	7.11E-08
1906	**169.82**	6.59E-06	1.41E-05	2.00E-05	9.29E-07	1.46E-06	1.58E-08
1896	**235.97**	7.62E-06	2.31E-06	1.18E-05	6.24E-07	9.62E-07	5.05E-09
1886	**305.72**	8.92E-06	4.29E-06	1.45E-05	6.74E-07	1.46E-06	1.90E-09
1876	**379.62**	1.26E-05	8.50E-06	2.14E-05	5.70E-07	2.37E-06	4.84E-09
1866	**441.02**	9.87E-06	8.86E-06	1.77E-05	5.91E-07	1.99E-06	8.20E-09
1856	**487.97**	1.25E-05	1.06E-05	2.32E-05	2.61E-06	3.50E-06	6.65E-08

Table C.7. Secondary Liner Strains, Shell Bottom, UBS-BEC-FIXED, Gravity Only

AY Secondary Liner, Upper Bound Soil, Gravity Only, Best Estimate Tank Concrete, 422 In Waste Level at 1.7SpG

		Shell Bottom Surface (outside - away from waste) Gravity					
M&D Starting M&D Element No.	Path (in.)	AY-NL-UBS-BEC FIXED Hoop Strain (in/in) Gravity Bot	AY-NL-UBS-BEC FIXED Meridional Strain (in/in) Gravity Bot	AY-NL-UBS-BEC FIXED Strain Intensity (in/in) Gravity Bot	AY-NL-UBS-BEC FIXED In-Plane Shear Strain (in/in) Gravity Bot	AY-NL-UBS-BEC FIXED In-Plane Shear Force Strain (in/in) Gravity Bot	AY-NL-UBS-BEC FIXED Thru-Thickness Shear Strain (in/in) Gravity Bot
2062	**19.00**	5.82E-05	2.33E-04	3.58E-04	1.11E-07	3.17E-08	8.81E-10
2052	**49.28**	3.38E-05	6.61E-06	5.24E-05	1.34E-06	1.43E-05	7.47E-07
2042	**64.15**	1.11E-05	6.62E-05	9.92E-05	3.33E-06	1.98E-05	8.76E-06
2032	**72.29**	2.41E-05	1.50E-04	2.25E-04	3.19E-06	2.14E-05	8.90E-06
2022	**96.32**	2.15E-06	6.72E-05	9.53E-05	3.43E-06	2.88E-06	2.05E-07
1916	**129.82**	3.43E-06	4.72E-05	6.89E-05	3.78E-07	3.29E-06	7.11E-08
1906	**169.82**	6.43E-06	4.94E-05	6.82E-05	8.66E-07	1.46E-06	1.58E-08
1896	**235.97**	7.60E-06	2.34E-05	3.66E-05	7.54E-07	9.62E-07	5.05E-09
1886	**305.72**	8.91E-06	2.33E-05	3.22E-05	7.09E-07	1.46E-06	1.90E-09
1876	**379.62**	1.26E-05	4.85E-05	7.34E-05	6.27E-07	2.37E-06	4.84E-09
1866	**441.02**	1.00E-05	2.13E-05	3.13E-05	8.98E-07	1.99E-06	8.20E-09
1856	**487.97**	1.23E-05	5.14E-05	7.76E-05	2.72E-06	3.50E-06	6.65E-08

C.7 Conclusion

Based on a comparison of the results of the model used for analysis and the corrected model, the differences are insignificant. Therefore, the results presented in this calculation are acceptable for further evaluation of the DST without correction or modification.

C.8 Corrected Files

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,51,0.25/12

cmsel,s,insul-vol
aslv
asel,r,loc,z,ctz(ct_kps)

mat,101
type,1
real,51
amesh,all

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
cm,liner-lines,line
aatt,101,51,1


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,KMAXl,KP,0,num,max       ! Get maximum
Keypoint Number
*get,LMAXl,LINE,0,num,max     ! Get maximum
Line Number
*get,AMAXl,AREA,0,num,max     ! Get maximum
Area Number
*get,VMAXl,VOLU,0,num,max     ! Get maximum
Volume Number
```

Soil-Props-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,901,24811
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,903,22986
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
```

Tank-Coordinates-AY.txt

```
/COM - Definition of KeyPoints for Primary
tank

ct_kps-34      ! Total number of Concrete
tank Coordinate pairs
pt_kps-40      ! 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)=410/12
ctx(27)=358/12
ctx(28)=277.7/12
ctx(29)=218.5/12
ctx(30)=180/12
ctx(31)=129.9/12
ctx(32)=95.7/12
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)=450/12
ptx(13)=450/12
ptx(14)=450/12
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)=446.49/12
ptx(31)=438/12
ptx(32)=410/12
ptx(33)=358/12
ptx(34)=277.7/12
ptx(35)=218.5/12
ptx(36)=180/12
ptx(37)=129.9/12
ptx(38)=95.7/12
ptx(39)=36/12
ptx(40)=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)=440.3125/12-z_off
ptz(13)=430.0/12-z_off
ptz(14)=407.5/12-z_off
ptz(15)=381.5/12-z_off
ptz(16)=353.5/12-z_off
ptz(17)=326.5/12-z_off
ptz(18)=299.5/12-z_off
ptz(19)=272.5/12-z_off
ptz(20)=245.5/12-z_off
ptz(21)=221.8/12-z_off
ptz(22)=198.8/12-z_off
ptz(23)=175.8/12-z_off
ptz(24)=152.9/12-z_off
ptz(25)=126/12-z_off
ptz(26)=99/12-z_off
ptz(27)=72/12-z_off
ptz(28)=45/12-z_off
ptz(29)=20/12-z_off
ptz(30)=11.51/12-z_off
ptz(31)=8/12-z_off
ptz(32)=8/12-z_off
ptz(33)=8/12-z_off
ptz(34)=8/12-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
```

Tank-Props-BEC-250.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
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, 5,621305
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,29,394/(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,31,125560
mp,nuxy,31,0.18
mp,dens,31,242/(1000*g)
mp,damp,31,0.07/df

/COM - Material,32, Tank Concrete
mp,ex,32,125560
mp,nuxy,32,0.18
mp,dens,32,252/(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,21,1.97                       ! 18 in
r,22,1.68                       ! 18 in
r,23,1.43                       ! 18 in
r,24,0.51      !
r,25,0.66      !
r,26,0.41      !
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,31,1.02      ! 8 in to
r,32,1.02                       !
!r,34,1
!r,35,1
!r,36,1
!r,37,1
!r,39,1
```

Waste-Soild-AY.txt

```
et,3,solid45   ! FLUID80 (3-D Non-Flowing
Fluid elements)
Wastet-13      ! Primary tank coordinate for
top of waste (422 in for AY Tanks)
Wasteb-31      ! 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,201,1.7*62.4/(1000*g) ! Waste
Density

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+W
astet)  !
*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,kmax
l+(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

!cmsel,s,waste
!cmsel,s,primary-tank                !
Select Primary tank elements
!cmsel,a,waste                       !
Select Waste elements
!nsle
!nsel,r,loc,x,ptx(wasteb-2),ptx(wastet)
        ! Select nodes at vertical interface
!nsel,r,loc,z,ptz(wasteb),ptz(wastet)
!cpintf,ux                           !
Couple nodes radially
```

```
!cpintf,uy
!nsle
!nsel,r,loc,x,ptx(36),ptx(34)         !
Select node at bottom interface
!nsel,a,loc,z,ptz(21)
!cpintf,uz                            !
Couple nodes vertically
!allsel

mp,damp,45,0
mp,mu,45,0

et,44,targe170
et,45,conta173
r,800,,,1000
!keyopt,45,2,3
!keyopt,45,5,3
!keyopt,45,9,1
keyopt,45,12,4
cmsel,s,primary-tank
nsle
nsel,r,loc,z,ptz(14),ptz(36)
!nsel,u,loc,x,ptx(36),ptx(33)
esln,r
nsle
mat,45
type,44
real,800
esurf
*get,emax,elem,,num,maxd
enorm,emax
cmsel,s,waste
nsle
nsel,r,loc,x,ptx(11),ptx(15)
nsel,a,loc,z,ptz(36)
!nsel,u,loc,x,ptx(36),ptx(34)
esln,r
type,45
esurf
esel,s,type,,45
cm,waste-surf,elem


!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
```

Appendix D

Common ANSYS Input File Listing

Appendix D

Common ANSYS Input File 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,.1
r,702,0,0,.1
r,703,0,0,.1
r,704,0,0,.1
r,705,0,0,.1
r,706,0,0,.1
r,707,0,0,.1
r,708,0,0,.1
r,709,0,0,.1
r,710,0,0,.1
r,711,0,0,.1

BX=33333/20
BY=33333/20
BZ=22777/10
mp,mu,700,0.4

/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,100                           ! 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,y,angley                 !
Reselect nodes at angle "anlgey"
cmsel,u,bolt-primary-n
cmsel,u,waste-n
eintf,100                           !
Create rigid link
*enddo
real,420+i
nsel,s,loc,x,ctx(i),ptx(i)          !
Select nodes at radius
nsel,r,loc,y,0                      !
Reselect nodes at angle 0
cmsel,u,bolt-primary-n
cmsel,u,waste-n
eintf,100                           !
Create rigid link
nsel,s,loc,x,ctx(i),ptx(i)          !
Select nodes at radius
nsel,r,loc,y,180                    !
Reselect nodes at angle 180
cmsel,u,bolt-primary-n
cmsel,u,waste-n
eintf,100                           !
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,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,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,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,2,10
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
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-AY.txt

```
/input,contact-footing,txt
/input,contact-insul,txt
/input,contact-j-bolts,txt
/input,contact-primary,txt
/input,contact-soil,txt
/input,contact-waste-ay,txt
/input,waste-reaction,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,2050
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,pr%(emax)%
esol,(62+j),(emax),,cont,gap,pr%(emax)%
esol,(92+j),(emax),,cont,stat,pr%(emax)%
*enddo

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

/OUT,Insul-Cont_%(9*i)%th,OUT
*do,k,1,21
PRVAR,2+k,32+k,62+k,92+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,pr%(emax)%
esol,(62+j),(emax),,cont,gap,pr%(emax)%
esol,(92+j),(emax),,cont,stat,pr%(emax)%
*enddo

LINES,2050
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
*enddo
/OUT

*enddo
```

Contact-Primaary.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+30),ptx(j+31)
nsel,r,loc,z,ptz(j+30),ptz(j+31)
esln,r,1
*get,emax,elem,,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)%
*enddo

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

/OUT,Primary-Cont_%(9*i)%th,OUT
*do,k,1,21
PRVAR,2+k,32+k,62+k,92+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%(emax)
%
esol,(152+j),(emax),nmax,smisc,12,taus%(emax
)%
*enddo

LINES,2050
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-AY.txt

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

*do,i,1,20
*do,j,1,25
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,(32+j),(emax),,Cont,slide,pr%(emax)%
esol,(62+j),(emax),,Cont,gap,pr%(emax)%
esol,(92+j),(emax),,Cont,stat,pr%(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,1,21
PRVAR,2+k,32+k,62+k,92+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+tank
soil)   ! Keypoint under edge of tank
k,kmaxtemp+5*i+4,soilx(tanksoil),0,soilz(i+t
anksoil)       ! Keypoint under edge of
excavated soil
k,kmaxtemp+5*i+5,soil_radius,0,soilz(i+tanks
oil)    ! 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+tank
soil)   ! Keypoint under edge of tank
k,kmaxtemp+5*i+4,soilx(tanksoil),0,soilz(i+t
anksoil)       ! Keypoint under edge of
excavated soil
k,kmaxtemp+5*i+5,soil_radius,0,soilz(i+tanks
oil)    ! 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(deepsoi
l)
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-5)
        ! 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-5)
aslv
lsla
lsel,r,loc,z,soilz(tanksoil),soilz(tanksoil+
1)
lsel,u,loc,z,soilz(tanksoil)
lsel,u,loc,z,soilz(tanksoil+1)
lesize,all,,,3
        ! Control meshing under tank
cmsel,s,deep-soil-volu
vsel,r,loc,x,0,ctx(ct_kps-5)
aslv
lsla
lsel,r,loc,z,soilz(tanksoil+1),soilz(tanksoi
l+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-5)
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(tanksoil+
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(tanksoi
l+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+2
0*j)%
esol,(130+j),(36+i+20*j),,smisc,5,s5%(36+i+2
0*j)%
esol,(160+j),(36+i+20*j),,smisc,6,s6%(36+i+2
0*j)%
*enddo

LINES,2050
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,2050
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,2050

*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,2050
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,kmaxp
t+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,66,12,4                       !
Behavior of contact surface (no seperation,
sliding permitted)
keyopt,66,9,1
!keyopt,66,10,1

r,65,,,0.05

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,68,12,4                       !
Behavior of contact surface (no seperation,
sliding permitted
keyopt,68,9,1
!keyopt,68,10,1
r,67,,,0.05

mp,mu,65,0.40                  ! Coefficient
of Friction between primary tank and
insulating concrete (PNNL values)
MP,damp,65,0.03/DF

mp,mu,67,0.40                  ! Coefficient
of Friction between secondary liner and
concrete tank basemat (PNNL values)
MP,damp,67,0.03/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(34)
!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(34)
!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,51,0.25/12

cmsel,s,insul-vol
aslv
asel,r,loc,z,ctz(ct_kps)

type,1
real,51
amesh,all

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
cm,liner-lines,line
aatt,101,51,1


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,KMAXl,KP,0,num,max       ! Get maximum
Keypoint Number
*get,LMAXl,LINE,0,num,max     ! Get maximum
Line Number
*get,AMAXl,AREA,0,num,max     ! Get maximum
Area Number
*get,VMAXl,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
```

Primary-Props-AY.txt

```
/COM - Material Definitions
/COM - Material 101, Tank Steel
mp,ex,101,4248000
mp,nuxy,101,0.30
mp,dens,101,490/(1000*g)
mp,damp,101,0.04/df

/COM - Material 102, Tank Steel
mp,ex,102,4248000
mp,nuxy,102,0.30
mp,dens,102,490/(1000*g)
mp,damp,102,0.04/df

/COM - Material 103, Tank Steel
mp,ex,103,4248000
mp,nuxy,103,0.30
mp,dens,103,490/(1000*g)
mp,damp,103,0.04/df

/COM - Material 104, Tank Steel
mp,ex,104,4248000
mp,nuxy,104,0.30
mp,dens,104,490/(1000*g)
mp,damp,104,0.04/df

/COM - Material  105, Tank Steel
mp,ex,105,4248000
mp,nuxy,105,0.30
mp,dens,105,490/(1000*g)
mp,damp,105,0.04/df

/COM - Material 106, Tank Steel
mp,ex,106,4248000
mp,nuxy,106,0.30
mp,dens,106,490/(1000*g)
mp,damp,106,0.04/df

/COM - Material 107, Tank Steel
mp,ex,107,4248000
mp,nuxy,107,0.30
mp,dens,107,490/(1000*g)
mp,damp,107,0.04/df

/COM - Material 108, Tank Steel
mp,ex,108,4248000
mp,nuxy,108,0.30
mp,dens,108,490/(1000*g)
mp,damp,108,0.04/df

/COM - Material 109, Tank Steel
mp,ex,109,4248000
mp,nuxy,109,0.30
mp,dens,109,490/(1000*g)
mp,damp,109,0.04/df

/COM - Material,110, Tank Steel
mp,ex,110,4248000
mp,nuxy,110,0.30
mp,dens,110,490/(1000*g)
mp,damp,110,0.04/df

/COM - Material,111, Tank Steel
mp,ex,111,4248000
mp,nuxy,111,0.30
mp,dens,111,490/(1000*g)
mp,damp,111,0.04/df

/COM - Material,112, Tank Steel
mp,ex,112,4248000
mp,nuxy,112,0.30
mp,dens,112,490/(1000*g)
mp,damp,112,0.04/df

/COM - Material,113, Tank Steel
mp,ex,113,4248000
mp,nuxy,113,0.30
mp,dens,113,490/(1000*g)
mp,damp,113,0.04/df

/COM - Material,114, Tank Steel
mp,ex,114,4248000
mp,nuxy,114,0.30
mp,dens,114,490/(1000*g)
mp,damp,114,0.04/df

/COM - Material,115, Tank Steel
```

```
mp,ex,115,4248000
mp,nuxy,115,0.30
mp,dens,115,490/(1000*g)
mp,damp,115,0.04/df

/COM - Material,116, Tank Steel
mp,ex,116,4248000
mp,nuxy,116,0.30
mp,dens,116,490/(1000*g)
mp,damp,116,0.04/df

/COM - Material,117, Tank Steel
mp,ex,117,4248000
mp,nuxy,117,0.30
mp,dens,117,490/(1000*g)
mp,damp,117,0.04/df

/COM - Material,118, Tank Steel
mp,ex,118,4248000
mp,nuxy,118,0.30
mp,dens,118,490/(1000*g)
mp,damp,118,0.04/df

/COM - Material,119, Tank Steel
mp,ex,119,4248000
mp,nuxy,119,0.30
mp,dens,119,490/(1000*g)
mp,damp,119,0.04/df

/COM - Material,120, Tank Steel
mp,ex,120,4248000
mp,nuxy,120,0.30
mp,dens,120,490/(1000*g)
mp,damp,120,0.04/df

/COM - Material,121, Tank Steel
mp,ex,121,4248000
mp,nuxy,121,0.30
mp,dens,121,490/(1000*g)
mp,damp,121,0.04/df

/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,123,0.04/df

/COM - Material,124, Tank Steel
mp,ex,124,4248000
mp,nuxy,124,0.30
mp,dens,124,490/(1000*g)
mp,damp,124,0.04/df

/COM - Material,125, Tank Steel
mp,ex,125,4248000
mp,nuxy,125,0.30
mp,dens,125,490/(1000*g)
mp,damp,125,0.04/df

/COM - Material,126, Tank Steel
mp,ex,126,4248000
mp,nuxy,126,0.30
mp,dens,126,490/(1000*g)
mp,damp,126,0.04/df

/COM - Material,127, Tank Steel
mp,ex,127,4248000
mp,nuxy,127,0.30
mp,dens,127,490/(1000*g)
mp,damp,127,0.04/df

/COM - Material,128, Tank Steel
mp,ex,128,4248000
mp,nuxy,128,0.30
mp,dens,128,490/(1000*g)
mp,damp,128,0.04/df

/COM - Material,129, Tank Steel
mp,ex,129,4248000
mp,nuxy,129,0.30
mp,dens,129,490/(1000*g)
mp,damp,129,0.04/df

/COM - Material,130, Tank Steel
mp,ex,130,4248000
mp,nuxy,130,0.30
mp,dens,130,490/(1000*g)
mp,damp,130,0.04/df

/COM - Material,131, Tank Steel
mp,ex,131,4248000
mp,nuxy,131,0.30
mp,dens,131,490/(1000*g)
mp,damp,131,0.04/df

/COM - Material,132, Tank Steel
mp,ex,132,4248000
mp,nuxy,132,0.30
mp,dens,132,490/(1000*g)
mp,damp,132,0.04/df

/COM - Material,133, Tank Steel
mp,ex,133,4248000
mp,nuxy,133,0.30
mp,dens,133,490/(1000*g)
mp,damp,133,0.04/df

/COM - Material,134, Tank Steel
mp,ex,134,4248000
mp,nuxy,134,0.30
mp,dens,134,490/(1000*g)
mp,damp,134,0.04/df

/COM - Material,135, Tank Steel
mp,ex,135,4248000
mp,nuxy,135,0.30
mp,dens,135,490/(1000*g)
mp,damp,135,0.04 /df

/COM - Material,136, Tank Steel
mp,ex,136,4248000
mp,nuxy,136,0.30
mp,dens,136,490/(1000*g)
mp,damp,136,0.04 /df

/COM - Material,137, Tank Steel
mp,ex,137,4248000
mp,nuxy,137,0.30
mp,dens,137,490/(1000*g)
mp,damp,137,0.04 /df

/COM - Material,138, Tank Steel
mp,ex,138,4248000
mp,nuxy,138,0.30
mp,dens,138,490/(1000*g)
mp,damp,138,0.04 /df
```

```
/COM - Material,139, Tank Steel
mp,ex,139,4248000
mp,nuxy,139,0.30
mp,dens,139,490/(1000*g)
mp,damp,139,0.04 /df

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,(0.375-0.06)/12
r,112,(0.375-0.06)/12
r,113,(0.375-0.06)/12
r,114,(0.375-0.06)/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,(0.5-0.06)/12
r,124,(0.75-0.06)/12
r,125,(0.75-0.06)/12
r,126,(0.75-0.06)/12
r,127,(0.75-0.06)/12
r,128,(0.75-0.06)/12
r,129,(0.875-0.06)/12
r,130,(0.875-0.06)/12
r,131,(0.875-0.06)/12
r,132,(0.5-0.06)/12
r,133,(0.5-0.06)/12
r,134,(0.5-0.06)/12
r,135,(0.5-0.06)/12
r,136,(0.5-0.06)/12
r,137,(0.5-0.06)/12
r,138,(0.5-0.06)/12
r,139,(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
```

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	1.064
0.135	1.087
0.139	1.111
0.143	1.136
0.147	1.163
0.152	1.190
0.156	1.220
0.161	1.250
0.167	1.282
0.172	1.316
0.179	1.351
0.185	1.389
0.192	1.429
0.196	1.471
0.200	1.515
0.204	1.563
0.208	1.613
0.213	1.667
0.217	1.724
0.222	1.754
0.227	1.786
0.233	1.818
0.238	1.852
0.244	1.887
0.250	1.923
0.256	1.961
0.263	2.000
0.270	2.041
0.278	2.083
0.286	2.128
0.294	2.174
0.303	2.222
0.313	2.273
0.323	2.326
0.333	2.381
0.345	2.439
0.357	2.500
0.370	2.564
0.385	2.632
0.400	2.703
0.417	2.778
0.426	2.857
0.435	2.941
0.444	3.030
0.455	3.125
0.465	3.226
0.476	3.333
0.488	3.448
0.500	3.571
0.513	3.704
0.526	3.846
0.541	4.000
0.556	4.167
0.571	4.348
0.588	4.545
0.606	4.762
0.625	5.000
0.645	5.263
0.667	5.556
0.690	5.882
0.714	6.250
0.741	6.667
0.769	7.143
0.800	7.692
0.833	8.333
0.870	9.091
0.909	10.000
0.952	11.111
1.000	12.500
1.020	14.286
1.042	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-0,txt
/input,spectra-conc-45,txt
/input,spectra-conc-90,txt
/input,spectra-conc-135,txt
/input,spectra-conc-180,txt
/input,spectra-conc,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,31,2,3,3,0.05,0.01,100,120.48
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_%(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,2050
/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,31,2,3,3,0.05,0.01,100,120.48
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_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-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_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,2050
/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,31,2,3,3,0.05,0.01,100,120.48
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_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-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_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,2050
/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,31,2,3,3,0.05,0.01,100,120.48
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_%(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,2050
/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,31,2,3,3,0.05,0.01,100,120.48
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_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-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_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,2050
/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,31,2,3,3,0.05,0.01,100,120.48
resp,32,2,4,3,0.05,0.01,100,120.48
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,51,2,23,3,0.05,0.01,100,120.48
resp,52,2,24,3,0.05,0.01,100,120.48

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,2050
/out,Accel-ct,out
prvar,121,122
prvar,131,132
prvar,141,142
/out
```

Spectra-primary-0.txt

```
fini

/POST26
numvar,200
*do,z,2,200
VARDEL,z
*enddo

csys,1
cmsel,s,primary-tank
nsle
nsel,r,loc,x,ptx(11)
nsel,r,loc,y,0
nsel,r,loc,z,ptz(11)
*get,pt_0_460,node,,num,max

cmsel,s,primary-tank
nsle
nsel,r,loc,x,ptx(16)
nsel,r,loc,y,0
nsel,r,loc,z,ptz(16)
*get,pt_0_353,node,,num,max

cmsel,s,primary-tank
nsle
nsel,r,loc,x,ptx(20)
nsel,r,loc,y,0
nsel,r,loc,z,ptz(20)
*get,pt_0_245,node,,num,max

cmsel,s,primary-tank
nsle
nsel,r,loc,x,ptx(25)
nsel,r,loc,y,0
nsel,r,loc,z,ptz(25)
*get,pt_0_126,node,,num,max

cmsel,s,primary-tank
nsle
nsel,r,loc,x,ptx(29)
nsel,r,loc,y,0
nsel,r,loc,z,ptz(29)
*get,pt_0_20,node,,num,max

nsol,3,pt_0_460,u,x,N_%(pt_0_460)%X
nsol,4,pt_0_353,u,x,N_%(pt_0_353)%X
nsol,5,pt_0_245,u,x,N_%(pt_0_245)%X
nsol,6,pt_0_126,u,x,N_%(pt_0_126)%X
nsol,7,pt_0_20,u,x,N_%(pt_0_20)%X

nsol,13,pt_0_460,u,y,N_%(pt_0_460)%y
nsol,14,pt_0_353,u,y,N_%(pt_0_353)%y
nsol,15,pt_0_245,u,y,N_%(pt_0_245)%y
nsol,16,pt_0_126,u,y,N_%(pt_0_126)%y
nsol,17,pt_0_20,u,y,N_%(pt_0_20)%y

nsol,23,pt_0_460,u,z,N_%(pt_0_460)%z
nsol,24,pt_0_353,u,z,N_%(pt_0_353)%z
nsol,25,pt_0_245,u,z,N_%(pt_0_245)%z
nsol,26,pt_0_126,u,z,N_%(pt_0_126)%z
nsol,27,pt_0_20,u,z,N_%(pt_0_20)%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_pt_0_460-X,,,1/g
prod,62,32,,,rs_pt_0_353-X,,,1/g
prod,63,33,,,rs_pt_0_245-X,,,1/g
```

```
prod,64,34,,,rs_pt_0_126-X,,,1/g
prod,65,35,,,rs_pt_0_20-X,,,1/g
prod,71,41,,,rs_pt_0_460-y,,,1/g
prod,72,42,,,rs_pt_0_353-y,,,1/g
prod,73,43,,,rs_pt_0_245-y,,,1/g
prod,74,44,,,rs_pt_0_126-y,,,1/g
prod,75,45,,,rs_pt_0_20-y,,,1/g
prod,81,51,,,rs_pt_0_460-z,,,1/g
prod,82,52,,,rs_pt_0_353-z,,,1/g
prod,83,53,,,rs_pt_0_245-z,,,1/g
prod,84,54,,,rs_pt_0_126-z,,,1/g
prod,85,55,,,rs_pt_0_20-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_353-x,,1/g
deriv,123,93,1,,a_pt_0_245-x,,1/g
deriv,124,94,1,,a_pt_0_126-x,,1/g
deriv,125,95,1,,a_pt_0_20-x,,1/g

deriv,131,101,1,,a_pt_0_460-y,,1/g
deriv,132,102,1,,a_pt_0_353-y,,1/g
deriv,133,103,1,,a_pt_0_245-y,,1/g
deriv,134,104,1,,a_pt_0_126-y,,1/g
deriv,135,105,1,,a_pt_0_20-y,,1/g

deriv,141,111,1,,a_pt_0_460-z,,1/g
deriv,142,112,1,,a_pt_0_353-z,,1/g
deriv,143,113,1,,a_pt_0_245-z,,1/g
deriv,144,114,1,,a_pt_0_126-z,,1/g
deriv,145,115,1,,a_pt_0_20-z,,1/g

lines,2050
/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,200
*do,z,2,200
VARDEL,z
*enddo

csys,1
cmsel,s,primary-tank
nsle
nsel,r,loc,x,ptx(11)
nsel,r,loc,y,-135
nsel,r,loc,z,ptz(11)
*get,pt_135_460,node,,num,max

cmsel,s,primary-tank
nsle
nsel,r,loc,x,ptx(16)
nsel,r,loc,y,-135
nsel,r,loc,z,ptz(16)
*get,pt_135_353,node,,num,max

cmsel,s,primary-tank
nsle
nsel,r,loc,x,ptx(20)
nsel,r,loc,y,-135
nsel,r,loc,z,ptz(20)
*get,pt_135_245,node,,num,max

cmsel,s,primary-tank
nsle
nsel,r,loc,x,ptx(25)
nsel,r,loc,y,-135
nsel,r,loc,z,ptz(25)
*get,pt_135_126,node,,num,max

cmsel,s,primary-tank
nsle
nsel,r,loc,x,ptx(29)
nsel,r,loc,y,-135
nsel,r,loc,z,ptz(29)
*get,pt_135_20,node,,num,max

nsol,3,pt_135_460,u,x,N_%(pt_135_460)%X
nsol,4,pt_135_353,u,x,N_%(pt_135_353)%X
nsol,5,pt_135_245,u,x,N_%(pt_135_245)%X
nsol,6,pt_135_126,u,x,N_%(pt_135_126)%X
nsol,7,pt_135_20,u,x,N_%(pt_135_20)%X

nsol,13,pt_135_460,u,y,N_%(pt_135_460)%y
nsol,14,pt_135_353,u,y,N_%(pt_135_353)%y
nsol,15,pt_135_245,u,y,N_%(pt_135_245)%y
nsol,16,pt_135_126,u,y,N_%(pt_135_126)%y
nsol,17,pt_135_20,u,y,N_%(pt_135_20)%y

nsol,23,pt_135_460,u,z,N_%(pt_135_460)%z
nsol,24,pt_135_353,u,z,N_%(pt_135_353)%z
nsol,25,pt_135_245,u,z,N_%(pt_135_245)%z
nsol,26,pt_135_126,u,z,N_%(pt_135_126)%z
nsol,27,pt_135_20,u,z,N_%(pt_135_20)%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_pt_135_460-X,,,1/g
prod,62,32,,,rs_pt_135_353-X,,,1/g
prod,63,33,,,rs_pt_135_245-X,,,1/g
prod,64,34,,,rs_pt_135_126-X,,,1/g
prod,65,35,,,rs_pt_135_20-X,,,1/g
prod,71,41,,,rs_pt_135_460-y,,,1/g
prod,72,42,,,rs_pt_135_353-y,,,1/g
prod,73,43,,,rs_pt_135_245-y,,,1/g
prod,74,44,,,rs_pt_135_126-y,,,1/g
prod,75,45,,,rs_pt_135_20-y,,,1/g
prod,81,51,,,rs_pt_135_460-z,,,1/g
prod,82,52,,,rs_pt_135_353-z,,,1/g
prod,83,53,,,rs_pt_135_245-z,,,1/g
prod,84,54,,,rs_pt_135_126-z,,,1/g
prod,85,55,,,rs_pt_135_20-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_353-x,,1/g
deriv,123,93,1,,a_pt_135_245-x,,1/g
deriv,124,94,1,,a_pt_135_126-x,,1/g
deriv,125,95,1,,a_pt_135_20-x,,1/g

deriv,131,101,1,,a_pt_135_460-y,,1/g
deriv,132,102,1,,a_pt_135_353-y,,1/g
deriv,133,103,1,,a_pt_135_245-y,,1/g
deriv,134,104,1,,a_pt_135_126-y,,1/g
deriv,135,105,1,,a_pt_135_20-y,,1/g

deriv,141,111,1,,a_pt_135_460-z,,1/g
deriv,142,112,1,,a_pt_135_353-z,,1/g
deriv,143,113,1,,a_pt_135_245-z,,1/g
deriv,144,114,1,,a_pt_135_126-z,,1/g
deriv,145,115,1,,a_pt_135_20-z,,1/g

lines,2050
/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,200
*do,z,2,200
VARDEL,z
*enddo

csys,1
cmsel,s,primary-tank
nsle
nsel,r,loc,x,ptx(11)
nsel,r,loc,y,-180
nsel,r,loc,z,ptz(11)
*get,pt_180_460,node,,num,max

cmsel,s,primary-tank
nsle
nsel,r,loc,x,ptx(16)
nsel,r,loc,y,-180
nsel,r,loc,z,ptz(16)
*get,pt_180_353,node,,num,max

cmsel,s,primary-tank
nsle
nsel,r,loc,x,ptx(20)
nsel,r,loc,y,-180
nsel,r,loc,z,ptz(20)
*get,pt_180_245,node,,num,max

cmsel,s,primary-tank
nsle
nsel,r,loc,x,ptx(25)
nsel,r,loc,y,-180
nsel,r,loc,z,ptz(25)
*get,pt_180_126,node,,num,max

cmsel,s,primary-tank
nsle
nsel,r,loc,x,ptx(29)
nsel,r,loc,y,-180
nsel,r,loc,z,ptz(29)
*get,pt_180_20,node,,num,max

nsol,3,pt_180_460,u,x,N_%(pt_180_460)%X
nsol,4,pt_180_353,u,x,N_%(pt_180_353)%X
nsol,5,pt_180_245,u,x,N_%(pt_180_245)%X
nsol,6,pt_180_126,u,x,N_%(pt_180_126)%X
nsol,7,pt_180_20,u,x,N_%(pt_180_20)%X

nsol,13,pt_180_460,u,y,N_%(pt_180_460)%y
nsol,14,pt_180_353,u,y,N_%(pt_180_353)%y
nsol,15,pt_180_245,u,y,N_%(pt_180_245)%y
nsol,16,pt_180_126,u,y,N_%(pt_180_126)%y
nsol,17,pt_180_20,u,y,N_%(pt_180_20)%y

nsol,23,pt_180_460,u,z,N_%(pt_180_460)%z
nsol,24,pt_180_353,u,z,N_%(pt_180_353)%z
nsol,25,pt_180_245,u,z,N_%(pt_180_245)%z
nsol,26,pt_180_126,u,z,N_%(pt_180_126)%z
nsol,27,pt_180_20,u,z,N_%(pt_180_20)%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_pt_180_460-X,,,1/g
prod,62,32,,,rs_pt_180_353-X,,,1/g
prod,63,33,,,rs_pt_180_245-X,,,1/g
prod,64,34,,,rs_pt_180_126-X,,,1/g
prod,65,35,,,rs_pt_180_20-X,,,1/g
prod,71,41,,,rs_pt_180_460-y,,,1/g
prod,72,42,,,rs_pt_180_353-y,,,1/g
prod,73,43,,,rs_pt_180_245-y,,,1/g
prod,74,44,,,rs_pt_180_126-y,,,1/g
prod,75,45,,,rs_pt_180_20-y,,,1/g
prod,81,51,,,rs_pt_180_460-z,,,1/g
prod,82,52,,,rs_pt_180_353-z,,,1/g
prod,83,53,,,rs_pt_180_245-z,,,1/g
prod,84,54,,,rs_pt_180_126-z,,,1/g
prod,85,55,,,rs_pt_180_20-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_353-x,,,1/g
deriv,123,93,1,,a_pt_180_245-x,,,1/g
deriv,124,94,1,,a_pt_180_126-x,,,1/g
deriv,125,95,1,,a_pt_180_20-x,,,1/g

deriv,131,101,1,,a_pt_180_460-y,,,1/g
deriv,132,102,1,,a_pt_180_353-y,,,1/g
deriv,133,103,1,,a_pt_180_245-y,,,1/g
deriv,134,104,1,,a_pt_180_126-y,,,1/g
deriv,135,105,1,,a_pt_180_20-y,,,1/g

deriv,141,111,1,,a_pt_180_460-z,,,1/g
deriv,142,112,1,,a_pt_180_353-z,,,1/g
deriv,143,113,1,,a_pt_180_245-z,,,1/g
deriv,144,114,1,,a_pt_180_126-z,,,1/g
deriv,145,115,1,,a_pt_180_20-z,,,1/g

lines,2050
/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,200
*do,z,2,200
VARDEL,z
*enddo

csys,1
cmsel,s,primary-tank
nsle
nsel,r,loc,x,ptx(11)
nsel,r,loc,y,-45
nsel,r,loc,z,ptz(11)
*get,pt_45_460,node,,num,max

cmsel,s,primary-tank
nsle
nsel,r,loc,x,ptx(16)
nsel,r,loc,y,-45
nsel,r,loc,z,ptz(16)
*get,pt_45_353,node,,num,max

cmsel,s,primary-tank
nsle
nsel,r,loc,x,ptx(20)
nsel,r,loc,y,-45
nsel,r,loc,z,ptz(20)
*get,pt_45_245,node,,num,max

cmsel,s,primary-tank
nsle
nsel,r,loc,x,ptx(25)
nsel,r,loc,y,-45
nsel,r,loc,z,ptz(25)
*get,pt_45_126,node,,num,max

cmsel,s,primary-tank
nsle
nsel,r,loc,x,ptx(29)
nsel,r,loc,y,-45
nsel,r,loc,z,ptz(29)
*get,pt_45_20,node,,num,max

nsol,3,pt_45_460,u,x,N_%(pt_45_460)%X
nsol,4,pt_45_353,u,x,N_%(pt_45_353)%X
nsol,5,pt_45_245,u,x,N_%(pt_45_245)%X
nsol,6,pt_45_126,u,x,N_%(pt_45_126)%X
nsol,7,pt_45_20,u,x,N_%(pt_45_20)%X

nsol,13,pt_45_460,u,y,N_%(pt_45_460)%y
nsol,14,pt_45_353,u,y,N_%(pt_45_353)%y
nsol,15,pt_45_245,u,y,N_%(pt_45_245)%y
nsol,16,pt_45_126,u,y,N_%(pt_45_126)%y
nsol,17,pt_45_20,u,y,N_%(pt_45_20)%y
```

```
nsol,23,pt_45_460,u,z,N_%(pt_45_460)%z
nsol,24,pt_45_353,u,z,N_%(pt_45_353)%z
nsol,25,pt_45_245,u,z,N_%(pt_45_245)%z
nsol,26,pt_45_126,u,z,N_%(pt_45_126)%z
nsol,27,pt_45_20,u,z,N_%(pt_45_20)%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_pt_45_460-X,,,1/g
prod,62,32,,,rs_pt_45_353-X,,,1/g
prod,63,33,,,rs_pt_45_245-X,,,1/g
prod,64,34,,,rs_pt_45_126-X,,,1/g
prod,65,35,,,rs_pt_45_20-X,,,1/g
prod,71,41,,,rs_pt_45_460-y,,,1/g
prod,72,42,,,rs_pt_45_353-y,,,1/g
prod,73,43,,,rs_pt_45_245-y,,,1/g
prod,74,44,,,rs_pt_45_126-y,,,1/g
prod,75,45,,,rs_pt_45_20-y,,,1/g
prod,81,51,,,rs_pt_45_460-z,,,1/g
prod,82,52,,,rs_pt_45_353-z,,,1/g
prod,83,53,,,rs_pt_45_245-z,,,1/g
prod,84,54,,,rs_pt_45_126-z,,,1/g
prod,85,55,,,rs_pt_45_20-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_353-x,,1/g
deriv,123,93,1,,a_pt_45_245-x,,1/g
deriv,124,94,1,,a_pt_45_126-x,,1/g
deriv,125,95,1,,a_pt_45_20-x,,1/g

deriv,131,101,1,,a_pt_45_460-y,,1/g
deriv,132,102,1,,a_pt_45_353-y,,1/g
deriv,133,103,1,,a_pt_45_245-y,,1/g
deriv,134,104,1,,a_pt_45_126-y,,1/g
deriv,135,105,1,,a_pt_45_20-y,,1/g

deriv,141,111,1,,a_pt_45_460-z,,1/g
deriv,142,112,1,,a_pt_45_353-z,,1/g
deriv,143,113,1,,a_pt_45_245-z,,1/g
deriv,144,114,1,,a_pt_45_126-z,,1/g
deriv,145,115,1,,a_pt_45_20-z,,1/g

lines,2050
/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,200
*do,z,2,200
VARDEL,z
*enddo

csys,1
cmsel,s,primary-tank
nsle
nsel,r,loc,x,ptx(11)
nsel,r,loc,y,-90
nsel,r,loc,z,ptz(11)
*get,pt_90_460,node,,num,max

cmsel,s,primary-tank
nsle
nsel,r,loc,x,ptx(16)
nsel,r,loc,y,-90
nsel,r,loc,z,ptz(16)
*get,pt_90_353,node,,num,max

cmsel,s,primary-tank
nsle
nsel,r,loc,x,ptx(20)
nsel,r,loc,y,-90
nsel,r,loc,z,ptz(20)
*get,pt_90_245,node,,num,max

cmsel,s,primary-tank
nsle
nsel,r,loc,x,ptx(25)
nsel,r,loc,y,-90
nsel,r,loc,z,ptz(25)
*get,pt_90_126,node,,num,max

cmsel,s,primary-tank
nsle
nsel,r,loc,x,ptx(29)
nsel,r,loc,y,-90
nsel,r,loc,z,ptz(29)
*get,pt_90_20,node,,num,max

nsol,3,pt_90_460,u,x,N_%(pt_90_460)%X
nsol,4,pt_90_353,u,x,N_%(pt_90_353)%X
nsol,5,pt_90_245,u,x,N_%(pt_90_245)%X
```

```
nsol,6,pt_90_126,u,x,N_%(pt_90_126)%X
nsol,7,pt_90_20,u,x,N_%(pt_90_20)%X

nsol,13,pt_90_460,u,y,N_%(pt_90_460)%y
nsol,14,pt_90_353,u,y,N_%(pt_90_353)%y
nsol,15,pt_90_245,u,y,N_%(pt_90_245)%y
nsol,16,pt_90_126,u,y,N_%(pt_90_126)%y
nsol,17,pt_90_20,u,y,N_%(pt_90_20)%y

nsol,23,pt_90_460,u,z,N_%(pt_90_460)%z
nsol,24,pt_90_353,u,z,N_%(pt_90_353)%z
nsol,25,pt_90_245,u,z,N_%(pt_90_245)%z
nsol,26,pt_90_126,u,z,N_%(pt_90_126)%z
nsol,27,pt_90_20,u,z,N_%(pt_90_20)%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_pt_90_460-X,,,1/g
prod,62,32,,,rs_pt_90_353-X,,,1/g
prod,63,33,,,rs_pt_90_245-X,,,1/g
prod,64,34,,,rs_pt_90_126-X,,,1/g
prod,65,35,,,rs_pt_90_20-X,,,1/g
prod,71,41,,,rs_pt_90_460-y,,,1/g
prod,72,42,,,rs_pt_90_353-y,,,1/g
prod,73,43,,,rs_pt_90_245-y,,,1/g
prod,74,44,,,rs_pt_90_126-y,,,1/g
prod,75,45,,,rs_pt_90_20-y,,,1/g
prod,81,51,,,rs_pt_90_460-z,,,1/g
prod,82,52,,,rs_pt_90_353-z,,,1/g
prod,83,53,,,rs_pt_90_245-z,,,1/g
prod,84,54,,,rs_pt_90_126-z,,,1/g
prod,85,55,,,rs_pt_90_20-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_353-x,,1/g
deriv,123,93,1,,a_pt_90_245-x,,1/g
deriv,124,94,1,,a_pt_90_126-x,,1/g
deriv,125,95,1,,a_pt_90_20-x,,1/g

deriv,131,101,1,,a_pt_90_460-y,,1/g
deriv,132,102,1,,a_pt_90_353-y,,1/g
deriv,133,103,1,,a_pt_90_245-y,,1/g
deriv,134,104,1,,a_pt_90_126-y,,1/g
deriv,135,105,1,,a_pt_90_20-y,,1/g

deriv,141,111,1,,a_pt_90_460-z,,1/g
deriv,142,112,1,,a_pt_90_353-z,,1/g
deriv,143,113,1,,a_pt_90_245-z,,1/g
deriv,144,114,1,,a_pt_90_126-z,,1/g
deriv,145,115,1,,a_pt_90_20-z,,1/g

lines,2050
/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,oil_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_top)%
X
nsol,5,Soil_Tank_mid,u,x,N_%(Soil_Tank_mid)%
X
nsol,6,Soil_Tank_bot,u,x,N_%(Soil_Tank_bot)%
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_top)
%y
nsol,15,Soil_Tank_mid,u,y,N_%(Soil_Tank_mid)
%y
nsol,16,Soil_Tank_bot,u,y,N_%(Soil_Tank_bot)
%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_top)
%z
nsol,25,Soil_Tank_mid,u,z,N_%(Soil_Tank_mid)
%z
nsol,26,Soil_Tank_bot,u,z,N_%(Soil_Tank_bot)
%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,2050
/out,Accel-SOil,out
prvar,121,122,123,124,125
prvar,131,132,133,134,135
prvar,141,142,143,144,145
/out
```

Strain-compb.txt

```
/post26

*do,z,2,199
VARDEL,z
*enddo
csys,1
*do,i,1,20
angley--arcsize*(i-1)
*do,j,1,12
cmsel,s,liner
nsle
nsel,r,loc,y,angley,angley-arcsize
nsel,r,loc,x,linx(j),linx(j+1)
nsel,r,loc,z,linz(j)+.1,linz(j+1)-.1
esln,r,1
*get,emax,elem,,num,max
esol,(2+j),(emax),,epel,x,ex%(emax)%-b
esol,(35+j),(emax),,epel,y,ey%(emax)%-b
esol,(68+j),(emax),,epel,int,eint%(emax)%-b
esol,(101+j),(emax),,epel,xy,exy%(emax)%-b
esol,(134+j),(emax),,epel,yz,eyz%(emax)%-b
esol,(167+j),(emax),,epel,xz,exz%(emax)%-b
*enddo
```

```
LINES,2050
extrem
/OUT,Strain-lb_%(9*i)%max-b,OUT
extrem,2,200
/OUT

/OUT,Strain-lb_%(9*i)%th-b,OUT
*do,k,1,33
PRVAR,2+k,35+k,68+k,101+k,134+k,167+k
*enddo
/OUT

*enddo
```

Strain-compm.txt

```
/post26
*do,z,2,199
VARDEL,z
*enddo
csys,1
*do,i,1,20
angley--arcsize*(i-1)
*do,j,1,12
cmsel,s,liner
nsle
nsel,r,loc,y,angley,angley-arcsize
nsel,r,loc,x,linx(j),linx(j+1)
nsel,r,loc,z,linz(j)+.1,linz(j+1)-.1
esln,r,1
*get,emax,elem,,num,max
esol,(2+j),(emax),,epel,x,ex%(emax)%-m
esol,(35+j),(emax),,epel,y,ey%(emax)%-m
esol,(68+j),(emax),,epel,int,eint%(emax)%-m
esol,(101+j),(emax),,epel,xy,exy%(emax)%-m
esol,(134+j),(emax),,epel,yz,eyz%(emax)%-m
esol,(167+j),(emax),,epel,xz,exz%(emax)%-m
*enddo

LINES,2050
extrem
/OUT,Strain-lm_%(9*i)%max-m,OUT
extrem,2,200
/OUT

/OUT,Strain-lm_%(9*i)%th-m,OUT
*do,k,1,33
PRVAR,2+k,35+k,68+k,101+k,134+k,167+k
*enddo
/OUT

*enddo
```

Strain-compt.txt

```
/post26
cmsel,s,liner
*do,z,2,199
VARDEL,z
*enddo
csys,1
*do,i,1,20
angley--arcsize*(i-1)
*do,j,1,12
cmsel,s,liner
nsle
nsel,r,loc,y,angley,angley-arcsize
nsel,r,loc,x,linx(j),linx(j+1)
nsel,r,loc,z,linz(j)+.1,linz(j+1)-.1
esln,r,1
*get,emax,elem,,num,max
esol,(2+j),(emax),,epel,x,ex%(emax)%-t
esol,(35+j),(emax),,epel,y,ey%(emax)%-t
esol,(68+j),(emax),,epel,int,eint%(emax)%-t
esol,(101+j),(emax),,epel,xy,exy%(emax)%-t
esol,(134+j),(emax),,epel,yz,eyz%(emax)%-t
esol,(167+j),(emax),,epel,xz,exz%(emax)%-t
*enddo

LINES,2050
extrem
/OUT,Strain-lt_%(9*i)%max-t,OUT
extrem,2,200
/OUT

/OUT,Strain-lt_%(9*i)%th-t,OUT
*do,k,1,33
PRVAR,2+k,35+k,68+k,101+k,134+k,167+k
*enddo
/OUT

*enddo
```

Strain-Liner.txt

```
! extract liner tank strain components at
the top, middle and bottom surface of the
shell
/post26
numvar,200
*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),-55.893,-
56.60,ctz(24),ctz(25),ctz(26),ctz(27),ctz(28
),ctz(29)
linz(11)=ctz(30),ctz(31),ctz(32),ctz(33),ctz
(34)

shell,top
/input,strain-compt,txt

shell,mid
/input,strain-compm,txt

shell,bot
/input,strain-compb,txt
```

Stress-compb.txt

```
/post26

*do,z,2,200
VARDEL,z
*enddo
csys,1
*do,i,1,20
angley--arcsize*(i-1)
*do,j,2,34
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,(34+j),(emax),,s,y,sy%(emax)%-b
esol,(67+j),(emax),,s,int,sint%(emax)%-b
esol,(100+j),(emax),,s,xy,sxy%(emax)%-b
esol,(133+j),(emax),,s,yz,syz%(emax)%-b
esol,(166+j),(emax),,s,xz,sxz%(emax)%-b
*enddo

LINES,2050
extrem
/OUT,Stress-pt_%(9*i)%max-b,OUT
extrem,2,200
/OUT

/OUT,Stress-pt_%(9*i)%th-b,OUT
*do,k,2,34
PRVAR,1+k,34+k,67+k,100+k,133+k,166+k
*enddo
/OUT

*enddo
```

Stress-compm.txt

```
/post26

*do,z,2,200
VARDEL,z
*enddo
csys,1
*do,i,1,20
angley--arcsize*(i-1)
*do,j,2,34
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,(34+j),(emax),,s,y,sy%(emax)%-m
esol,(67+j),(emax),,s,int,sint%(emax)%-m
esol,(100+j),(emax),,s,xy,sxy%(emax)%-m
esol,(133+j),(emax),,s,yz,syz%(emax)%-m
esol,(166+j),(emax),,s,xz,sxz%(emax)%-m
*enddo

LINES,2050
extrem
/OUT,Stress-pt_%(9*i)%max-m,OUT
extrem,2,200
/OUT

/OUT,Stress-pt_%(9*i)%th-m,OUT
*do,k,2,34
PRVAR,1+k,34+k,67+k,100+k,133+k,166+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,2,34
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,(33+j),(emax),,s,y,sy%(emax)%-t
esol,(67+j),(emax),,s,int,sint%(emax)%-t
esol,(100+j),(emax),,s,xy,sxy%(emax)%-t
esol,(133+j),(emax),,s,yz,syz%(emax)%-t
esol,(166+j),(emax),,s,xz,sxz%(emax)%-t
*enddo

LINES,2050
extrem
/OUT,Stress-pt_%(9*i)%max-t,OUT
extrem,2,200
/OUT

/OUT,Stress-pt_%(9*i)%th-t,OUT
*do,k,2,34
PRVAR,1+k,34+k,67+k,100+k,133+k,166+k
*enddo
/OUT

*enddo
```

Stress-Primary.txt

```
! extract primary tank stress components at
the top, middel and bottom surface of the
shell

shell,top
/input,stress-compt,txt

shell,mid
/input,stress-compm,txt

shell,bot
/input,stress-compb,txt
```

Tank-Coordinates-AY.txt

```
/COM - Definition of KeyPoints for Primary
tank

ct_kps-34      ! Total number of Concrete
tank Coordinate pairs
pt_kps-40      ! 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=56.56    ! 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)=410/12
ctx(27)=358/12
ctx(28)=277.7/12
ctx(29)=218.5/12
ctx(30)=180/12
ctx(31)=129.9/12
ctx(32)=95.7/12
ctx(33)=36/12
ctx(34)=0

/COM - Define Vertical Keypoint Locations

ctz(1)=568.8/12-z_off
ctz(2)=568/12-z_off
ctz(3)=565.8/12-z_off
ctz(4)=563.21/12-z_off
ctz(5)=559.7/12-z_off
ctz(6)=550.7/12-z_off
ctz(7)=545.2/12-z_off
ctz(8)=527.68/12-z_off
ctz(9)=518.2/12-z_off
ctz(10)=494.5/12-z_off
ctz(11)=476.2/12-z_off
ctz(12)=447.4/12-z_off
ctz(13)=407.1/12-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)=431.63/12
ptx(13)=450/12
ptx(14)=450/12
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)=446.49/12
ptx(31)=438/12
ptx(32)=410/12
ptx(33)=358/12
ptx(34)=277.7/12
ptx(35)=218.5/12
ptx(36)=180/12
ptx(37)=129.9/12
ptx(38)=95.7/12
ptx(39)=36/12
ptx(40)=0

ptz(1)=561.30000/12-z_off
ptz(2)=560.50462/12-z_off
ptz(3)=558.31908/12-z_off
ptz(4)=555.74491/12-z_off
ptz(5)=552.25807/12-z_off
ptz(6)=543.32187/12-z_off
ptz(7)=537.86539/12-z_off
ptz(8)=520.51150/12-z_off
Ptz(9)=511.14633/12-z_off
```

```
ptz(10)=487.85550/12-z_off
ptz(11)=466.92388/12-z_off
ptz(12)=460.19602/12-z_off
ptz(13)=430.0/12-z_off
ptz(14)=407.5/12-z_off
ptz(15)=381.5/12-z_off
ptz(16)=353.5/12-z_off
ptz(17)=326.5/12-z_off
ptz(18)=299.5/12-z_off
ptz(19)=272.5/12-z_off
ptz(20)=245.5/12-z_off
ptz(21)=221.8/12-z_off
ptz(22)=198.8/12-z_off
ptz(23)=175.8/12-z_off
ptz(24)=152.9/12-z_off
ptz(25)=126/12-z_off
ptz(26)=99/12-z_off
ptz(27)=72/12-z_off
ptz(28)=45/12-z_off
ptz(29)=20/12-z_off
ptz(30)=11.51/12-z_off
ptz(31)=8/12-z_off
ptz(32)=8/12-z_off
ptz(33)=8/12-z_off
ptz(34)=8/12-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
```

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,,2049
*dim,REACTZ,,2049

cmsel,s,waste
cmsel,a,waste-surf
nsle
*do,i,1,2049
set,i
fsum,,cont
*get,REACTX(i),FSUM,0,ITEM,FX
*get,reactz(i),FSUM,0,ITEM,FZ
*enddo
/out,Waste-Reaction,out

*vwrite
('Total Waste Forces')
*vwrite
('     Fx        FZ')
*vwrite,reactx(1),reactz(1)
(f10.1,f10.1)
/out
```

Waste-Solid-AY.txt

```
et,3,solid45   ! FLUID80 (3-D Non-Flowing
Fluid elements)
Wastet-13      ! Primary tank coordinate for
top of waste (422 in for AY Tanks)
Wasteb-31      ! 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,201,1.7*62.4/(1000*g) ! Waste
Density

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+W
astet)  !
*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,kmax
l+(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

!cmsel,s,waste
!cmsel,s,primary-tank                !
Select Primary tank elements
!cmsel,a,waste                       !
Select Waste elements
!nsle
!nsel,r,loc,x,ptx(wasteb-2),ptx(wastet)
        ! Select nodes at vertical interface
!nsel,r,loc,z,ptz(wasteb),ptz(wastet)
!cpintf,ux                           !
Couple nodes radially
!cpintf,uy
!nsle
!nsel,r,loc,x,ptx(36),ptx(34)        !
Select node at bottom interface
!nsel,a,loc,z,ptz(21)
!cpintf,uz                           !
Couple nodes vertically
!allsel

et,44,targe170
et,45,conta173
r,800,,,1000
!keyopt,45,2,3
!keyopt,45,5,3
!keyopt,45,9,1
keyopt,45,12,4
cmsel,s,primary-tank
nsle
nsel,r,loc,z,ptz(14),ptz(36)
!nsel,u,loc,x,ptx(36),ptx(33)
esln,r
nsle
type,44
real,800
esurf
*get,emax,elem,,num,maxd
enorm,emax
cmsel,s,waste
nsle
nsel,r,loc,x,ptx(11),ptx(15)
nsel,a,loc,z,ptz(36)
!nsel,u,loc,x,ptx(36),ptx(34)
esln,r
type,45
esurf
esel,s,type,,45
cm,waste-surf,elem


!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-AY.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,0,20
*do,j,2,8
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,2050
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 E

Lower Bound Soil
Best Estimate Concrete

Results
Load Case Specific Input Files
File Listing
Theoretical Waste Pressure Calculation

Appendix E

Lower Bound Soil
Best Estimate Concrete

Results
Load Case Specific Input Files
File Listing
Theoretical Waste Pressure Calculation

AY Primary Tank, Lower Bound Soil (Geomatrix), Gravity Only, Best Estimate Concrete, 422 in. Waste Level at 1.7 SpG

ANSYS MAXIMUMS BY PATH

PNNL Section No.	Path (in.)	Gravity Hoop Force (kip/ft) AY-LBS-BEC	Gravity Meridonal Force (kip/ft) AY-LBS-BEC	Gravity -In-Plane Shear Force (kip/ft) AY-LBS-BEC	Gravity Hoop Moment (ft*kip/ft) AY-LBS-BEC	Gravity Meridonal Moment (ft*kip/ft) AY-LBS-BEC	Gravity Through-Wall Shear Force (kip/ft) AY-LBS-BEC
2	**67.727**	-70.790	-74.920	-0.175	-6.564	-3.218	1.936
3	**105.668**	-65.940	-73.730	-0.264	-4.287	-0.643	1.068
4	**137.069**	-61.410	-72.320	-0.322	-2.747	1.835	1.232
6	**182.849**	-57.270	-70.360	-0.247	-1.619	2.341	0.516
8	**226.563**	-54.340	-69.050	-0.072	-1.533	-1.373	1.023
9	**275.566**	-52.140	-68.110	-0.269	-1.897	-2.752	1.067
11	**325.690**	-43.980	-67.220	-0.274	-2.775	-7.053	1.037
13	**372.305**	-34.310	-65.860	-0.174	-5.956	-8.816	0.694
17	**423.427**	-10.630	-64.100	0.070	-3.617	-7.446	2.255
20	**468.308**	41.440	-61.120	-0.027	-12.780	13.080	9.904
22	**515.312**	24.190	-63.550	-0.022	4.928	33.180	2.276
24	**549.725**	6.159	-62.140	-0.014	3.072	16.910	7.356
26	**585.819**	-9.882	-63.830	-0.007	0.387	2.147	3.918
30	**636.369**	-28.120	-66.100	0.004	-0.630	-3.495	0.622
33	**685.619**	-36.110	-67.690	0.005	-0.226	-1.250	0.606
35	**732.719**	-41.430	-69.200	0.009	0.031	0.172	0.008
38	**778.219**	-36.150	-70.720	0.012	-0.207	-1.149	0.347
41	**821.369**	-36.270	-72.720	0.020	-0.093	-0.516	0.211
43	**874.169**	-21.620	-43.220	0.050	-0.474	-2.609	0.168
46	**930.544**	-44.930	-75.140	0.465	-0.970	-4.950	1.079
48	**977.629**	-2.730	-11.910	0.753	-4.773	23.080	13.300
51	**1019.647**	-2.231	-15.670	1.273	-2.311	23.860	13.210
53	**1060.156**	-0.589	-6.515	0.452	0.712	2.921	1.583
55	**1109.695**	1.381	-3.532	0.417	0.283	0.905	0.641
57	**1155.770**	0.894	-0.326	0.105	0.023	0.056	0.146
58	**1211.956**	1.511	1.043	0.045	0.043	0.127	0.095
59	**1281.707**	1.318	1.341	-0.007	0.023	0.096	0.103
60	**1330.557**	1.237	1.390	-0.016	-0.007	-0.057	0.130
61	**1374.857**	0.953	1.943	-0.082	0.016	0.023	0.310
62	**1417.007**	3.726	3.772	-0.037	0.191	0.544	0.153

Note: Meridonal/Hoop Forces and Meridonal/Hoop Moments are Reversed in Highlighted Sections.

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AY-2D-NL-LBS-BEC Conc Tank Demand Gravity.xls, FM Max

Figure E.1. LBS-BEC Concrete Forces and Moment, Gravity Load Only

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AY- Primary Tank, Lower Bound Soil (Geomatrix), Best Estimate Concrete, 422 in. Waste Level at 1.7 SpG

ANSYS MAXIMUMS BY PATH

PNNL Section No.	Path (in.)	Seismic Hoop Force (kip/ft) AY-LBS-BEC	Seismic Meridonal Force (kip/ft) AY-LBS-BEC	Seismic -In-Plane Shear Force (kip/ft) AY-LBS-BEC	Seismic Hoop Moment (ft*kip/ft) AY-LBS-BEC	Seismic Meridonal Moment (ft*kip/ft) AY-LBS-BEC	Seismic Through-Wall Shear Force (kip/ft) AY-LBS-BEC
2	**67.727**	-99.000	-104.100	5.264	-15.310	-11.730	4.101
3	**105.668**	-93.510	-102.800	7.615	-11.380	-8.268	2.619
4	**137.069**	-87.280	-100.500	9.059	-8.104	7.641	2.773
6	**182.849**	-79.870	-96.230	10.350	-4.948	7.194	2.649
8	**226.563**	-76.300	-91.750	11.620	-3.483	-6.852	1.987
9	**275.566**	-75.350	-86.810	12.970	-3.436	-5.938	1.656
11	**325.690**	-67.110	-84.450	13.840	-4.160	-9.722	1.719
13	**372.305**	-65.340	-81.470	15.970	-8.451	-11.570	1.417
17	**423.427**	-23.120	-77.930	17.570	-4.687	-11.090	3.396
20	**468.308**	115.600	-73.000	20.260	-17.170	18.820	12.160
22	**515.312**	50.910	-75.230	24.470	6.865	43.240	3.481
24	**549.725**	19.090	-74.000	24.370	4.129	22.470	9.517
26	**585.819**	-19.230	-76.860	25.360	0.625	3.363	5.013
30	**636.369**	-36.450	-79.510	26.820	-0.788	-4.307	0.771
33	**685.619**	-44.730	-80.630	28.530	-0.308	-1.600	0.721
35	**732.719**	-50.570	-82.700	30.260	0.082	0.375	0.066
38	**778.219**	-43.330	-84.670	31.780	-0.274	-1.478	0.485
41	**821.369**	-43.450	-87.200	34.360	-0.172	-0.831	0.362
43	**874.169**	-24.930	-51.880	23.310	-0.775	-4.255	0.436
46	**930.544**	-100.600	-89.870	37.640	-1.156	-6.471	2.052
48	**977.629**	-20.200	-15.560	11.330	-5.774	27.760	16.010
51	**1019.647**	-54.010	-22.630	15.330	-3.132	28.620	15.920
53	**1060.156**	-10.850	-13.000	8.132	0.885	3.768	2.953
55	**1109.695**	19.330	-9.345	7.411	0.363	1.191	0.772
57	**1155.770**	5.938	-4.290	4.178	0.034	0.087	0.184
58	**1211.956**	6.197	3.384	3.199	0.056	0.151	0.142
59	**1281.707**	4.427	3.102	2.140	0.033	0.131	0.172
60	**1330.557**	3.651	2.755	1.602	-0.013	-0.077	0.192
61	**1374.857**	2.269	3.524	1.397	0.020	0.032	0.421
62	**1417.007**	8.059	6.519	1.681	0.239	0.631	0.270

Note: Meridonal/Hoop Forces and Meridonal/Hoop Moments are Reversed in Highlighted Sections.

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Figure E.2. LBS-BEC Concrete Forces and Moments, Gravity Plus Seismic Load

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AY- Primary Tank, Lower Bound Soil (Geomatrix), Best Estimate Concrete, 422 in. Waste Level at 1.7 SpG

ANSYS MAXIMUMS BY PATH

PNNL Section No.	Path (in.)	Seismic Only Hoop Force (kip/ft) AY-LBS-BEC	Seismic Only Meridonal Force (kip/ft) AY-LBS-BEC	Seismic Only - In-Plane Shear Force (kip/ft) AY-LBS-BEC	Seismic Only Hoop Moment (ft*kip/ft) AY-LBS-BEC	Seismic Only Meridonal Moment (ft*kip/ft) AY-LBS-BEC	Seismic Only Through-Wall Shear Force (kip/ft) AY-LBS-BEC
2	**67.727**	28.420	29.180	5.332	8.750	9.145	2.165
3	**105.668**	27.910	29.070	7.765	7.097	8.041	1.553
4	**137.069**	26.130	28.180	9.153	5.577	5.962	1.791
6	**182.849**	22.950	25.870	10.400	3.615	5.417	2.158
8	**226.563**	23.590	22.700	11.603	2.200	5.492	0.968
9	**275.566**	24.900	18.700	12.807	1.751	3.207	0.756
11	**325.690**	24.220	17.230	13.661	1.396	2.938	0.758
13	**372.305**	33.003	15.610	15.934	2.511	3.132	0.729
17	**423.427**	13.515	13.840	17.556	1.112	3.819	1.178
20	**468.308**	73.900	11.880	20.259	4.580	5.670	2.284
22	**515.312**	26.670	11.710	24.475	1.934	10.040	1.206
24	**549.725**	12.934	11.870	24.374	1.059	5.570	2.161
26	**585.819**	9.348	13.040	25.363	0.240	1.222	1.097
30	**636.369**	8.340	13.410	26.823	0.159	0.814	0.149
33	**685.619**	8.620	12.950	28.532	0.083	0.350	0.115
35	**732.719**	9.140	13.510	30.262	0.057	0.206	0.057
38	**778.219**	7.190	14.370	31.781	0.071	0.347	0.142
41	**821.369**	7.190	17.030	34.360	0.080	0.328	0.153
43	**874.169**	4.170	11.260	23.309	0.303	1.656	0.394
46	**930.544**	55.740	19.380	37.633	0.271	1.818	1.204
48	**977.629**	17.564	5.533	10.610	1.352	6.240	3.606
51	**1019.647**	51.992	7.372	15.161	1.115	6.500	3.402
53	**1060.156**	10.365	6.485	8.541	0.207	1.054	1.609
55	**1109.695**	19.095	5.813	7.786	0.083	0.303	0.194
57	**1155.770**	5.402	3.966	4.247	0.011	0.032	0.071
58	**1211.956**	4.926	2.905	3.162	0.017	0.043	0.078
59	**1281.707**	3.127	2.276	2.142	0.010	0.035	0.119
60	**1330.557**	2.413	1.968	1.614	0.008	0.023	0.103
61	**1374.857**	1.320	1.812	1.471	0.005	0.014	0.202
62	**1417.007**	4.391	2.744	1.711	0.062	0.107	0.209

Note: Meridonal/Hoop Forces and Meridonal/Hoop Moments are Reversed in Highlighted Sections.

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Figure E.3. LBS-BEC Concrete Forces and Moments, Seismic Only

AY Primary Tank, Lower Bound Soil, Horizontal and Vertical Seismic Input, Best Estimate Tank Concrete, 422 in. Waste Level at 1.7 SpG

		Shell Top Surface (inside - waste side)					
M&D Starting M&D Element No.	Path (in.)	AY-NL-LBS-BEC Gravity Only Hoop Stress (lbs/in^2) Top	AY-NL-LBS-BEC Gravity Only Meridional Stress (lbs/in^2) Top	AY-NL-LBS-BEC Gravity Only Stress Intensity (lbs/in^2) Top	AY-NL-LBS-BEC Gravity Only In-Plane Shear Stress (lbs/in^2) Top	AY-NL-LBS-BEC Gravity Only In-Plane Shear Force Stress (lbs/in^2) Top	AY-NL-LBS-BEC Gravity Only Thru-Thickness Shear Stress (lbs/in^2) Top
762	**67.33**	-2230.56	0.00	2231.25	6.75	13.77	-0.17
782	**105.04**	-2143.75	-3527.08	3527.78	12.95	-34.02	0.04
802	**136.24**	-2172.22	-2057.64	2172.92	16.10	31.97	-0.04
822	**181.71**	-1470.83	-2765.28	2765.28	13.44	-8.26	-0.03
842	**225.10**	-1779.17	-1272.22	1779.17	-12.25	5.89	-0.15
862	**273.66**	-832.64	-2112.50	2112.50	-23.92	1.38	-0.05
882	**323.27**	-1153.47	-687.01	1153.47	-27.50	-8.29	-0.09
902	**369.20**	282.50	-1526.39	1712.50	-24.85	-5.28	-0.07
922	**419.20**	267.64	67.03	271.53	-18.10	15.56	0.07
942	**444.11**	1381.94	-1930.56	3300.69	-14.06	-63.03	-0.28
962	**471.06**	2453.47	-269.44	2721.53	-3.69	-4.51	-0.11
982	**503.51**	2943.06	-545.14	3488.89	3.04	18.50	-0.06
1002	**527.76**	2986.11	-121.04	3109.72	3.44	-20.26	0.01
1022	**554.76**	3985.42	-107.36	4089.58	2.29	-6.67	0.00
1042	**582.26**	5634.72	-288.26	5920.83	2.12	-7.60	0.00
1062	**609.26**	7333.33	-169.24	7500.00	1.99	-7.65	0.00
1082	**636.26**	8986.11	-440.07	9423.61	1.88	-10.26	0.00
1102	**663.26**	10465.28	87.29	10465.28	1.93	0.25	0.00
1122	**688.61**	12388.89	-583.82	12972.22	1.90	3.28	0.00
1142	**711.96**	13819.44	-169.51	13993.06	1.86	-5.64	0.01
1162	**734.96**	15319.44	-155.00	15472.22	1.90	-6.66	0.01
1182	**757.91**	15375.00	-1995.83	17368.06	1.90	-8.83	0.01
1202	**782.81**	12798.61	2003.47	12798.61	1.28	-17.75	0.01
1222	**809.76**	12423.61	-409.51	12833.33	1.20	-7.03	-0.02
1242	**836.76**	13680.56	-284.58	13965.28	1.15	-4.30	-0.03
1262	**863.76**	15208.33	456.60	15208.33	1.05	-3.02	0.10
1282	**889.76**	13569.44	-5146.53	18715.28	4.12	-25.94	-0.31
1302	**906.85**	4441.67	-10791.67	15229.17	20.38	147.43	-2.44
1322	**916.04**	4501.39	7437.50	7493.06	19.54	446.53	-5.11
1342	**934.63**	3402.08	9500.00	9541.67	11.21	-485.07	-135.00
1362	**974.63**	-12.90	-1592.36	1604.86	-3.58	128.68	45.22
1382	**1040.78**	1111.81	2088.19	2095.14	2.20	-78.89	-27.83
1402	**1110.53**	148.06	-1096.53	1253.47	-3.13	99.31	39.51

Note 1: Meridonal, Hoop, and Shear Stresses are Reversed in Highlighted Sections (Floor)

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AY-2D-NL-LBS-BEC Pri Tank Stress Gravity.xls, Stress Max

Figure E.4. LBS-BEC Primary Tank Stresses, Shell Top, Gravity Load Only

AY Primary Tank, Lower Bound Soil, Horizontal and Vertical Seismic Input, Best Estimate Tank Concrete, 422 in. Waste Level at 1.7 SpG

		Shell Mid-Plane					
M&D Starting M&D Element No.	Path (in.)	AY-NL-LBS-BEC Gravity Only Hoop Stress (lbs/in^2) Mid	AY-NL-LBS-BEC Gravity Only Meridional Stress (lbs/in^2) Mid	AY-NL-LBS-BEC Gravity Only Stress Intensity (lbs/in^2) Mid	AY-NL-LBS-BEC Gravity Only In-Plane Shear Stress (lbs/in^2) Mid	AY-NL-LBS-BEC Gravity Only In-Plane Shear Force Stress (lbs/in^2) Mid	AY-NL-LBS-BEC Gravity Only Thru-Thickness Shear Stress (lbs/in^2) Mid
762	**67.33**	-2418.06	-2187.50	2418.06	6.10	13.77	-0.17
782	**105.04**	-1968.06	-2877.78	2878.47	12.33	-34.02	0.04
802	**136.24**	-2377.08	-2711.11	2711.81	14.87	31.97	-0.04
822	**181.71**	-1359.72	-2376.39	2376.39	12.31	-8.26	-0.03
842	**225.10**	-2033.33	-2105.56	2105.56	-11.72	5.89	-0.15
862	**273.66**	-741.67	-1788.19	1788.19	-23.26	1.38	-0.05
882	**323.27**	-1390.28	-1465.28	1465.28	-26.99	-8.29	-0.09
902	**369.20**	381.04	-1168.75	1456.25	-24.78	-5.28	-0.07
922	**419.20**	53.76	-642.01	685.63	-17.92	15.56	0.07
942	**444.11**	1813.19	-426.25	2248.61	-13.24	-63.03	-0.28
962	**471.06**	2428.47	-345.00	2773.61	-3.97	-4.51	-0.11
982	**503.51**	3018.06	-300.00	3313.89	2.81	18.50	-0.06
1002	**527.76**	2933.33	-307.08	3233.33	3.28	-20.26	0.01
1022	**554.76**	3947.92	-227.29	4173.61	2.20	-6.67	0.00
1042	**582.26**	5650.69	-235.63	5882.64	2.02	-7.60	0.00
1062	**609.26**	7305.56	-243.68	7548.61	1.90	-7.65	0.00
1082	**636.26**	9041.67	-251.81	9291.67	1.82	-10.26	0.00
1102	**663.26**	10361.11	-259.86	10618.06	1.89	0.25	0.00
1122	**688.61**	12479.17	-267.50	12750.00	1.88	3.28	0.00
1142	**711.96**	13791.67	-274.38	14062.50	1.93	-5.64	0.01
1162	**734.96**	15277.78	-281.60	15555.56	1.93	-6.66	0.01
1182	**757.91**	15888.89	-288.40	16173.61	1.88	-8.83	0.01
1202	**782.81**	12138.89	-189.86	12333.33	1.24	-17.75	0.01
1222	**809.76**	12486.11	-197.85	12680.56	1.21	-7.03	-0.02
1242	**836.76**	13701.39	-205.42	13909.72	1.13	-4.30	-0.03
1262	**863.76**	15013.89	-211.94	15222.22	1.32	-3.02	0.10
1282	**889.76**	15048.61	-222.99	15277.78	4.95	-25.94	-0.31
1302	**906.85**	7479.17	-218.26	7770.83	17.10	147.43	-2.44
1322	**916.04**	1933.33	-8.15	2376.39	13.17	446.53	-5.11
1342	**934.63**	560.90	301.88	612.64	11.21	21.70	-135.00
1362	**974.63**	689.24	709.72	715.28	-3.58	-4.44	45.22
1382	**1040.78**	679.44	682.57	684.79	2.20	1.69	-27.83
1402	**1110.53**	684.17	704.86	709.03	-3.13	-2.95	39.51

Note 1: Meridonal, Hoop, and Shear Stresses are Reversed in Highlighted Sections (Floor)

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AY-2D-NL-LBS-BEC Pri Tank Stress Gravity.xls, Stress Max

Figure E.5. LBS-BEC Primary Tank Stresses, Shell Middle, Gravity Load Only

AY Primary Tank, Lower Bound Soil, Horizontal and Vertical Seismic Input, Best Estimate Tank Concrete, 422 in. Waste Level at 1.7 SpG

		Shell Bottom Surface (outside - away from waste)					
M&D Starting M&D Element No.	Path (in.)	AY-NL-LBS-BEC Gravity Only Hoop Stress (lbs/in^2) Bot	AY-NL-LBS-BEC Gravity Only Meridional Stress (lbs/in^2) Bot	AY-NL-LBS-BEC Gravity Only Stress Intensity (lbs/in^2) Bot	AY-NL-LBS-BEC Gravity Only In-Plane Shear Stress (lbs/in^2) Bot	AY-NL-LBS-BEC Gravity Only In-Plane Shear Force Stress (lbs/in^2) Bot	AY-NL-LBS-BEC Gravity Only Thru-Thickness Shear Stress (lbs/in^2) Bot
762	**67.33**	-2611.11	-2790.28	2790.28	6.79	13.77	-0.17
782	**105.04**	-1791.67	-2227.78	2229.17	11.69	-34.02	0.04
802	**136.24**	-2582.64	-3363.89	3364.58	13.63	31.97	-0.04
822	**181.71**	-1248.61	-1986.81	1986.81	-11.22	-8.26	-0.03
842	**225.10**	-2288.19	-2939.58	2939.58	-11.20	5.89	-0.15
862	**273.66**	-651.04	-1463.19	1463.19	-22.60	1.38	-0.05
882	**323.27**	-1628.47	-2243.06	2243.06	-26.47	-8.29	-0.09
902	**369.20**	479.65	-813.19	1200.00	-24.73	-5.28	-0.07
922	**419.20**	-251.74	-1340.97	1341.67	-17.74	15.56	0.07
942	**444.11**	2244.44	1088.19	2247.92	-12.42	-63.03	-0.28
962	**471.06**	2403.47	-424.24	2825.69	-4.31	-4.51	-0.11
982	**503.51**	3093.75	-68.07	3143.75	2.68	18.50	-0.06
1002	**527.76**	2880.56	-495.14	3364.58	3.14	-20.26	0.01
1022	**554.76**	3911.81	-347.22	4256.94	2.10	-6.67	0.00
1042	**582.26**	5667.36	-182.92	5845.14	1.92	-7.60	0.00
1062	**609.26**	7284.72	-318.19	7604.17	1.85	-7.65	0.00
1082	**636.26**	9097.22	-63.47	9159.72	1.79	-10.26	0.00
1102	**663.26**	10263.89	-596.04	10854.17	1.85	0.25	0.00
1122	**688.61**	12576.39	60.51	12576.39	1.85	3.28	0.00
1142	**711.96**	13756.94	-379.31	14138.89	2.01	-5.64	0.01
1162	**734.96**	15243.06	-408.19	15645.83	2.01	-6.66	0.01
1182	**757.91**	16402.78	1431.94	16402.78	1.86	-8.83	0.01
1202	**782.81**	11486.11	-2375.69	13861.11	1.20	-17.75	0.01
1222	**809.76**	12548.61	23.15	12548.61	1.42	-7.03	-0.02
1242	**836.76**	13729.17	-126.32	13854.17	1.15	-4.30	-0.03
1262	**863.76**	14819.44	-880.56	15687.50	1.63	-3.02	0.10
1282	**889.76**	16527.78	4700.69	16527.78	5.77	-25.94	-0.31
1302	**906.85**	10520.83	10361.11	10527.78	13.83	147.43	-2.44
1322	**916.04**	-664.58	-7444.44	7500.00	6.81	446.53	-5.11
1342	**934.63**	-2316.67	-8916.67	8965.28	11.21	522.01	-135.00
1362	**974.63**	1377.08	2970.83	2981.94	-3.58	-129.24	45.22
1382	**1040.78**	249.65	-739.58	997.22	2.20	79.10	-27.83
1402	**1110.53**	1227.08	2502.08	2511.11	-3.13	-102.71	39.51

Note 1: Meridonal, Hoop, and Shear Stresses are Reversed in Highlighted Sections (Floor)

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AY-2D-NL-LBS-BEC Pri Tank Stress Gravity.xls, Stress Max

Figure E.6. LBS-BEC Primary Tank Stresses, Shell Bottom, Gravity Load Only

AY Primary Tank, Lower Bound Soil, Horizontal and Vertical Seismic Input, Best Estimate Tank Concrete, 422 in. Waste Level at 1.7 SpG

		Shell Top Surface (inside - waste side)					
M&D Starting M&D Element No.	Path (in.)	AY-NL-LBS-BEC Seismic Hoop Stress (lbs/in^2) Top	AY-NL-LBS-BEC Seismic Meridional Stress (lbs/in^2) Top	AY-NL-LBS-BEC Seismic Stress Intensity (lbs/in^2) Top	AY-NL-LBS-BEC Seismic In-Plane Shear Stress (lbs/in^2) Top	AY-NL-LBS-BEC Seismic In-Plane Shear Force Stress (lbs/in^2) Top	AY-NL-LBS-BEC Seismic Thru-Thickness Shear Stress (lbs/in^2) Top
762	**67.33**	-3117.36	0.00	3118.06	-212.57	22.76	-3.62
782	**105.04**	-2987.50	-4912.50	4913.89	-336.04	-55.24	1.94
802	**136.24**	-2981.25	-3081.25	3084.72	-356.88	56.28	3.10
822	**181.71**	-2084.03	-3805.56	3805.56	-800.00	-20.46	-2.62
842	**225.10**	-3580.56	-2379.17	3832.64	-1593.06	35.78	23.32
862	**273.66**	-2230.56	-2990.28	3671.53	-1565.28	-14.69	10.80
882	**323.27**	-4010.42	-1755.56	4606.25	-1675.00	-41.37	18.12
902	**369.20**	2113.19	-3049.31	3903.47	1352.78	-37.01	10.11
922	**419.20**	2913.89	672.78	3961.11	-1980.56	80.28	10.57
942	**444.11**	3754.86	-3271.53	7027.78	-2425.00	-372.64	14.74
962	**471.06**	9395.83	-3427.78	12736.11	-2447.92	-28.70	-11.38
982	**503.51**	7145.83	-2252.08	9402.78	-2700.69	145.00	12.24
1002	**527.76**	6328.47	-659.79	6979.17	-2613.19	-97.15	3.89
1022	**554.76**	8736.11	-1584.03	8756.94	-1668.06	43.18	-3.23
1042	**582.26**	11527.78	-1020.14	11534.72	1449.31	-38.67	-2.59
1062	**609.26**	13847.22	-1723.61	13854.17	1281.94	-24.60	-2.11
1082	**636.26**	16291.67	-1461.81	16291.67	-1185.42	-23.52	-2.19
1102	**663.26**	18562.50	-1628.47	18562.50	-1250.69	-15.45	-2.47
1122	**688.61**	21111.11	-1505.56	21111.11	1381.94	35.76	-2.23
1142	**711.96**	23027.78	-1681.94	23034.72	1506.25	-45.34	1.68
1162	**734.96**	24708.33	-1384.72	24708.33	1867.36	40.04	1.69
1182	**757.91**	24104.17	-2557.64	25902.78	1867.36	-46.87	1.76
1202	**782.81**	19729.17	3404.17	19729.17	1349.31	-28.28	-2.74
1222	**809.76**	18597.22	-865.28	18638.89	1566.67	12.67	2.18
1242	**836.76**	19979.17	-932.64	19979.17	1847.92	-21.39	2.10
1262	**863.76**	21541.67	1459.72	21541.67	2129.17	-14.65	1.68
1282	**889.76**	18375.00	-9006.94	27138.89	2486.81	-101.18	4.73
1302	**906.85**	5887.50	-20062.50	23486.11	2381.94	240.07	31.43
1322	**916.04**	5930.56	12493.06	12583.33	2390.28	829.86	36.41
1342	**934.63**	5372.92	16222.22	16298.61	-2386.81	19.46	-236.60
1362	**974.63**	-3363.89	-3181.94	5684.72	2648.61	-6.36	81.04
1382	**1040.78**	2962.50	3322.22	3977.08	-1654.17	3.96	-50.12
1402	**1110.53**	1927.78	-2413.19	2490.97	1033.33	-5.61	71.53

Note 1: Meridonal, Hoop, and Shear Stresses are Reversed in Highlighted Sections (Floor)

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AY-2D-NL-LBS-BEC Pri Tank Stress Seismic.xls, Stress Max

Figure E.7. LBS-BEC Primary Tank Stresses, Shell Top, Gravity Plus Seismic Load

AY Primary Tank, Lower Bound Soil, Horizontal and Vertical Seismic Input, Best Estimate Tank Concrete, 422 in. Waste Level at 1.7 SpG

		Shell Mid-Plane					
M&D Starting M&D Element No.	Path (in.)	AY-NL-LBS-BEC Seismic Hoop Stress (lbs/in^2) Mid	AY-NL-LBS-BEC Seismic Meridional Stress (lbs/in^2) Mid	AY-NL-LBS-BEC Seismic Stress Intensity (lbs/in^2) Mid	AY-NL-LBS-BEC Seismic In-Plane Shear Stress (lbs/in^2) Mid	AY-NL-LBS-BEC Seismic In-Plane Shear Force Stress (lbs/in^2) Mid	AY-NL-LBS-BEC Seismic Thru-Thickness Shear Stress (lbs/in^2) Mid
762	**67.33**	-3434.03	-3013.89	3434.03	-209.51	22.76	-3.62
782	**105.04**	-2734.03	-3946.53	3947.22	-330.49	-55.24	1.94
802	**136.24**	-3434.72	-3695.14	3696.53	-351.60	56.28	3.10
822	**181.71**	-1839.58	-3215.97	3215.97	-795.83	-20.46	-2.62
842	**225.10**	-4143.06	-2839.58	4532.64	-1602.08	35.78	23.32
862	**273.66**	-1981.25	-2397.22	3497.92	-1568.06	-14.69	10.80
882	**323.27**	-4504.86	-2028.47	4670.83	-1688.89	-41.37	18.12
902	**369.20**	2156.25	-2022.92	3555.56	1352.08	-37.01	10.11
922	**419.20**	3046.53	-1722.92	4008.33	-1984.03	80.28	10.57
942	**444.11**	4239.58	-1790.97	5934.72	-2440.97	-372.64	14.74
962	**471.06**	9937.50	-1545.83	11451.39	-2453.47	-28.70	-11.38
982	**503.51**	7465.28	-1400.00	8680.56	-2636.81	145.00	12.24
1002	**527.76**	6668.75	-1588.19	6672.22	-2579.17	-97.15	3.89
1022	**554.76**	8597.22	-1331.25	8597.22	-1646.53	43.18	-3.23
1042	**582.26**	11652.78	-1467.36	11659.72	1440.28	-38.67	-2.59
1062	**609.26**	13645.83	-1578.47	13645.83	1270.14	-24.60	-2.11
1082	**636.26**	16375.00	-1634.72	16375.00	-1187.50	-23.52	-2.19
1102	**663.26**	18479.17	-1684.72	18479.17	-1245.83	-15.45	-2.47
1122	**688.61**	21243.06	-1693.75	21243.06	1379.86	35.76	-2.23
1142	**711.96**	23055.56	-1681.25	23055.56	1670.83	-45.34	1.68
1162	**734.96**	24694.44	-1634.72	24694.44	1670.83	40.04	1.69
1182	**757.91**	24833.33	-1542.36	24833.33	1862.50	-46.87	1.76
1202	**782.81**	18826.39	-931.94	18826.39	1343.75	-28.28	-2.74
1222	**809.76**	18701.39	-880.56	18701.39	1572.22	12.67	2.18
1242	**836.76**	19993.06	-818.06	19993.06	1851.39	-21.39	2.10
1262	**863.76**	21437.50	-729.17	21437.50	2143.06	-14.65	1.68
1282	**889.76**	20868.06	-772.92	21347.22	2450.00	-101.18	4.73
1302	**906.85**	9013.89	-770.14	9833.33	2206.94	240.07	31.43
1322	**916.04**	4760.42	-325.69	5342.36	2209.72	829.86	36.41
1342	**934.63**	3815.97	613.33	3900.00	-1781.94	19.46	-236.60
1362	**974.63**	3450.69	1097.22	5356.25	-2659.03	-6.36	81.04
1382	**1040.78**	2739.58	968.75	3179.86	-1570.83	3.96	-50.12
1402	**1110.53**	2188.89	1043.06	2190.97	935.42	-5.61	71.53

Note 1: Meridonal, Hoop, and Shear Stresses are Reversed in Highlighted Sections (Floor)

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AY-2D-NL-LBS-BEC Pri Tank Stress Seismic.xls, Stress Max

Figure E.8. LBS-BEC Primary Tank Stresses, Shell Middle, Gravity Plus Seismic Load

AY Primary Tank, Lower Bound Soil, Horizontal and Vertical Seismic Input, Best Estimate Tank Concrete, 422 in. Waste Level at 1.7 SpG

		Shell Bottom Surface (outside - away from waste)					
M&D Starting M&D Element No.	Path (in.)	AY-NL-LBS-BEC Seismic Hoop Stress (lbs/in^2) Bot	AY-NL-LBS-BEC Seismic Meridional Stress (lbs/in^2) Bot	AY-NL-LBS-BEC Seismic Stress Intensity (lbs/in^2) Bot	AY-NL-LBS-BEC Seismic In-Plane Shear Stress (lbs/in^2) Bot	AY-NL-LBS-BEC Seismic In-Plane Shear Force Stress (lbs/in^2) Bot	AY-NL-LBS-BEC Seismic Thru-Thickness Shear Stress (lbs/in^2) Bot
762	**67.33**	-3750.69	-3965.97	3966.67	-206.74	22.76	-3.62
782	**105.04**	-2589.58	-3377.08	3379.17	-324.93	-55.24	1.94
802	**136.24**	-3888.89	-4709.72	4710.42	-346.32	56.28	3.10
822	**181.71**	-1709.03	-2781.94	2781.94	-791.67	-20.46	-2.62
842	**225.10**	-4715.97	-4297.92	5440.97	-1610.42	35.78	23.32
862	**273.66**	-1731.25	-2117.36	3356.25	-1570.83	-14.69	10.80
882	**323.27**	-4998.61	-3879.86	5225.69	-1702.78	-41.37	18.12
902	**369.20**	2199.31	-1368.75	3369.44	1351.39	-37.01	10.11
922	**419.20**	-3281.94	-3831.25	4172.22	-1988.19	80.28	10.57
942	**444.11**	4786.11	3074.31	5272.92	-2457.64	-372.64	14.74
962	**471.06**	10479.17	-1023.61	10479.17	-2458.33	-28.70	-11.38
982	**503.51**	7777.78	-1399.31	7993.06	-2573.61	145.00	12.24
1002	**527.76**	7006.94	-2939.58	7020.83	-2545.83	-97.15	3.89
1022	**554.76**	8541.67	-1090.28	8548.61	-1625.00	43.18	-3.23
1042	**582.26**	11937.50	-1914.58	11937.50	1432.64	-38.67	-2.59
1062	**609.26**	13722.22	-1433.33	13722.22	1259.03	-24.60	-2.11
1082	**636.26**	16527.78	-1807.64	16527.78	-1189.58	-23.52	-2.19
1102	**663.26**	18395.83	-1740.97	18395.83	-1240.28	-15.45	-2.47
1122	**688.61**	21375.00	-1882.64	21375.00	1377.78	35.76	-2.23
1142	**711.96**	23083.33	-1679.86	23083.33	1672.22	-45.34	1.68
1162	**734.96**	24687.50	-1884.03	24687.50	1672.22	40.04	1.69
1182	**757.91**	25562.50	2961.11	25562.50	1857.64	-46.87	1.76
1202	**782.81**	18000.00	-3168.06	20694.44	1338.89	-28.28	-2.74
1222	**809.76**	18805.56	-895.14	18805.56	1577.78	12.67	2.18
1242	**836.76**	20006.94	-778.47	20006.94	1854.86	-21.39	2.10
1262	**863.76**	21333.33	-2813.89	21916.67	2156.94	-14.65	1.68
1282	**889.76**	23354.17	7819.44	23354.17	2413.89	-101.18	4.73
1302	**906.85**	14604.17	18520.83	18527.78	2031.94	240.07	31.43
1322	**916.04**	-4924.31	-12659.72	12750.00	2029.17	829.86	36.41
1342	**934.63**	-7604.17	-15569.44	15652.78	2202.78	19.46	-236.60
1362	**974.63**	3793.75	4813.19	5940.28	-2797.92	-6.36	81.04
1382	**1040.78**	2520.83	-1732.64	3438.89	1525.00	3.96	-50.12
1402	**1110.53**	2458.33	4038.89	4054.86	-976.39	-5.61	71.53

Note 1: Meridonal, Hoop, and Shear Stresses are Reversed in Highlighted Sections (Floor)

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AY-2D-NL-LBS-BEC Pri Tank Stress Seismic.xls, Stress Max

Figure E.9. LBS-BEC Primary Tank Stresses, Shell Bottom, Gravity Plus Seismic Load

AY Primary Tank, Lower Bound Soil, Horizontal and Vertical Seismic Input, Best Estimate Tank Concrete, 422 in. Waste Level at 1.7 SpG

		Shell Top Surface (inside - waste side)					
M&D Starting M&D Element No.	Path (in.)	AY-NL-LBS-BEC Hoop Stress Seismic Only (LBS/in^2) Top	AY-NL-LBS-BEC Meridional Stress Seismic Only (LBS/in^2) Top	AY-NL-LBS-BEC Stress Seismic Only Intensity (LBS/in^2) Top	AY-NL-LBS-BEC In-Plane Shear Stress Seismic Only (LBS/in^2) Top	AY-NL-LBS-BEC In-Plane Shear Force Stress Seismic Only (LBS/in^2) Top	AY-NL-LBS-BEC Thru-Thickness Shear Stress Seismic Only (LBS/in^2) Top
762	**67.33**	1191.67	0.00	1190.97	212.85	11.06	3.70
782	**105.04**	1178.47	1773.61	1773.61	340.44	27.94	1.95
802	**136.24**	1289.58	1234.72	984.03	361.32	30.10	3.11
822	**181.71**	893.61	1245.83	1244.44	787.23	14.06	2.63
842	**225.10**	1984.17	1314.51	2069.44	1591.78	33.62	23.44
862	**273.66**	1874.31	1162.50	1581.25	1555.93	15.62	10.82
882	**323.27**	2988.89	1080.14	3453.47	1665.20	43.46	18.18
902	**369.20**	1841.18	1523.61	2190.97	1357.18	31.78	10.15
922	**419.20**	2646.25	616.35	3690.83	1981.04	64.75	10.59
942	**444.11**	2583.33	1626.18	3744.44	2425.17	309.71	14.76
962	**471.06**	6952.78	3159.93	10025.00	2448.07	24.19	11.39
982	**503.51**	4229.17	1837.71	5920.14	2700.95	126.65	12.23
1002	**527.76**	3342.36	540.14	3870.14	2613.44	76.90	3.88
1022	**554.76**	4751.39	1478.96	4668.06	1668.21	49.67	3.23
1042	**582.26**	5894.44	759.58	5617.36	1448.88	31.07	2.59
1062	**609.26**	6513.89	1554.38	6361.11	1281.57	23.94	2.11
1082	**636.26**	7312.50	1134.79	6875.00	1185.53	13.26	2.19
1102	**663.26**	8104.17	1704.79	8104.17	1250.81	15.67	2.47
1122	**688.61**	8722.22	1436.81	8145.83	1381.54	32.49	2.23
1142	**711.96**	9208.33	1512.43	9048.61	1505.85	39.73	1.69
1162	**734.96**	9388.89	1229.72	9243.06	1866.92	46.67	1.68
1182	**757.91**	8729.17	1403.82	8756.94	1866.92	38.08	1.74
1202	**782.81**	6930.56	2039.24	6930.56	1348.98	10.58	2.74
1222	**809.76**	6180.56	727.36	5812.50	1566.41	19.67	2.19
1242	**836.76**	6298.61	939.65	6020.83	1847.95	17.19	2.11
1262	**863.76**	6333.33	1091.39	6333.33	2128.68	17.06	1.71
1282	**889.76**	4805.56	3883.33	8423.61	2485.12	78.10	4.72
1302	**906.85**	1602.08	9790.97	8928.47	2380.37	94.88	31.62
1322	**916.04**	1436.11	5062.50	5104.17	2391.65	407.26	36.09
1342	**934.63**	1978.47	6790.97	6805.56	1905.00	8.76	102.43
1362	**974.63**	3366.53	1633.33	4101.39	2642.78	2.84	36.50
1382	**1040.78**	1856.25	1444.79	1885.42	1576.94	1.81	22.83
1402	**1110.53**	1991.25	1319.44	1237.50	936.32	2.60	33.01

Note 1: Meridonal, Hoop, and Shear Stresses are Reversed in Highlighted Sections (Floor)

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AY-2D-NL-LBS-BEC Pri Tank Stress Seismic Only.xls, Stress Max

Figure E.10. LBS-BEC Primary Tank Stresses, Shell Top, Seismic Load Only

AY Primary Tank, Lower Bound Soil, Horizontal and Vertical Seismic Input, Best Estimate Tank Concrete, 422 in. Waste Level at 1.7 SpG

		Shell Mid-Plane					
M&D Starting M&D Element No.	Path (in.)	AY-NL-LBS-BEC Hoop Stress Seismic Only (LBS/in^2) Mid	AY-NL-LBS-BEC Meridional Stress Seismic Only (LBS/in^2) Mid	AY-NL-LBS-BEC Stress Seismic Only Intensity (LBS/in^2) Mid	AY-NL-LBS-BEC In-Plane Shear Stress Seismic Only (LBS/in^2) Mid	AY-NL-LBS-BEC In-Plane Shear Force Stress Seismic Only (LBS/in^2) Mid	AY-NL-LBS-BEC Thru-Thickness Shear Stress Seismic Only (LBS/in^2) Mid
762	**67.33**	1311.11	1093.06	1265.97	210.51	11.06	3.70
782	**105.04**	1127.08	1332.64	1321.53	334.43	27.94	1.95
802	**136.24**	1461.11	1220.14	1209.03	355.99	30.10	3.11
822	**181.71**	832.64	993.06	992.36	783.83	14.06	2.63
842	**225.10**	2256.11	877.78	2433.33	1601.09	33.62	23.44
862	**273.66**	1687.08	753.47	1731.94	1559.42	15.62	10.82
882	**323.27**	3159.72	784.03	3206.94	1679.47	43.46	18.18
902	**369.20**	1786.04	854.86	2119.44	1356.38	31.78	10.15
922	**419.20**	2996.05	1081.04	3325.21	1984.52	64.75	10.59
942	**444.11**	2763.19	1365.00	3702.08	2441.16	309.71	14.76
962	**471.06**	7519.44	1201.18	8688.89	2453.66	24.19	11.39
982	**503.51**	4450.69	1100.00	5373.61	2637.07	126.65	12.23
1002	**527.76**	3736.81	1281.11	3439.58	2579.41	76.90	3.88
1022	**554.76**	4650.00	1103.96	4425.00	1646.69	49.67	3.23
1042	**582.26**	6002.08	1231.74	5779.17	1439.92	31.07	2.59
1062	**609.26**	6340.28	1334.79	6097.22	1269.76	23.94	2.11
1082	**636.26**	7333.33	1382.92	7090.28	1187.61	13.26	2.19
1102	**663.26**	8118.06	1424.86	7868.06	1245.94	15.67	2.47
1122	**688.61**	8763.89	1426.25	8500.00	1379.46	32.49	2.23
1142	**711.96**	9263.89	1406.88	9000.00	1670.43	39.73	1.69
1162	**734.96**	9416.67	1353.13	9138.89	1670.43	46.67	1.68
1182	**757.91**	8944.44	1253.96	8659.72	1862.07	38.08	1.74
1202	**782.81**	6687.50	772.29	6500.00	1343.43	10.58	2.74
1222	**809.76**	6215.28	724.86	6027.78	1571.87	19.67	2.19
1242	**836.76**	6291.67	640.21	6090.28	1851.18	17.19	2.11
1262	**863.76**	6423.61	517.22	6222.22	2142.43	17.06	1.71
1282	**889.76**	5819.44	574.10	6069.44	2448.59	78.10	4.72
1302	**906.85**	2041.67	586.81	2299.31	2206.02	94.88	31.62
1322	**916.04**	2845.14	323.50	2973.61	2210.28	407.26	36.09
1342	**934.63**	3264.03	316.78	3292.85	1801.78	8.76	102.43
1362	**974.63**	2835.49	580.83	4652.78	2657.32	2.84	36.50
1382	**1040.78**	2174.65	437.99	2501.39	1570.79	1.81	22.83
1402	**1110.53**	1584.58	493.75	1481.94	937.04	2.60	52.70

Note 1: Meridonal, Hoop, and Shear Stresses are Reversed in Highlighted Sections (Floor)

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AY-2D-NL-LBS-BEC Pri Tank Stress Seismic Only.xls, Stress Max

Figure E.11. LBS-BEC Primary Tank Stresses, Shell Middle, Seismic Load Only

AY Primary Tank, Lower Bound Soil, Horizontal and Vertical Seismic Input, Best Estimate Tank Concrete, 422 in. Waste Level at 1.7 SpG

		Shell Bottom Surface (outside - away from waste)					
M&D Starting M&D Element No.	Path (in.)	AY-NL-LBS-BEC Hoop Stress Seismic Only (LBS/in^2) Bot	AY-NL-LBS-BEC Meridional Stress Seismic Only (LBS/in^2) Bot	AY-NL-LBS-BEC Stress Seismic Only Intensity (LBS/in^2) Bot	AY-NL-LBS-BEC In-Plane Shear Stress Seismic Only (LBS/in^2) Bot	AY-NL-LBS-BEC In-Plane Shear Force Stress Seismic Only (LBS/in^2) Bot	AY-NL-LBS-BEC Thru-Thickness Shear Stress Seismic Only (LBS/in^2) Bot
762	**67.33**	1486.11	1500.69	1499.31	208.17	11.06	3.70
782	**105.04**	1080.14	1375.69	1332.64	328.42	27.94	1.95
802	**136.24**	1684.03	1743.75	1743.06	350.59	30.10	3.11
822	**181.71**	776.94	1002.78	950.00	780.44	14.06	2.63
842	**225.10**	2540.28	1856.94	2509.03	1609.71	33.62	23.44
862	**273.66**	1607.57	837.78	1914.58	1562.90	15.62	10.82
882	**323.27**	3370.83	2005.56	2984.72	1693.75	43.46	18.18
902	**369.20**	1730.90	624.78	2188.19	1355.58	31.78	10.15
922	**419.20**	3412.29	2497.22	2838.89	1988.69	64.75	10.59
942	**444.11**	2943.06	2566.67	3032.64	2457.84	309.71	14.76
962	**471.06**	8086.11	828.61	7664.58	2458.54	24.19	11.39
982	**503.51**	4687.50	1331.72	4855.56	2573.89	126.65	12.23
1002	**527.76**	4129.86	2448.54	3656.94	2546.08	76.90	3.88
1022	**554.76**	4630.56	743.06	4292.36	1625.16	49.67	3.23
1042	**582.26**	6270.83	1731.67	6093.75	1432.27	31.07	2.59
1062	**609.26**	6437.50	1120.56	6125.00	1258.65	23.94	2.11
1082	**636.26**	7430.56	1744.17	7375.00	1189.70	13.26	2.19
1102	**663.26**	8138.89	1439.86	7548.61	1240.39	15.67	2.47
1122	**688.61**	8798.61	1931.44	8798.61	1377.38	32.49	2.23
1142	**711.96**	9326.39	1777.64	8951.39	1671.82	39.73	1.69
1162	**734.96**	9444.44	1475.83	9048.61	1671.82	46.67	1.68
1182	**757.91**	9222.22	2190.28	9159.72	1857.21	38.08	1.74
1202	**782.81**	6513.89	1189.58	6840.28	1338.59	10.58	2.74
1222	**809.76**	6256.94	908.51	6256.94	1577.33	19.67	2.19
1242	**836.76**	6277.78	652.15	6159.72	1854.41	17.19	2.11
1262	**863.76**	6513.89	2052.08	6229.17	2156.19	17.06	1.71
1282	**889.76**	6826.39	3118.75	6826.39	2412.77	78.10	4.72
1302	**906.85**	4625.00	8616.67	8041.67	2031.67	94.88	31.62
1322	**916.04**	4341.25	5215.28	5250.00	2028.73	407.26	36.09
1342	**934.63**	5325.69	6873.61	6756.94	1737.71	8.76	102.43
1362	**974.63**	2418.75	1987.50	2961.81	2671.53	2.84	36.50
1382	**1040.78**	2492.78	997.22	2449.31	1563.75	1.81	22.83
1402	**1110.53**	1236.81	1810.42	1558.33	944.72	2.60	52.70

Note 1: Meridonal, Hoop, and Shear Stresses are Reversed in Highlighted Sections (Floor)

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AY-2D-NL-LBS-BEC Pri Tank Stress Seismic Only.xls, Stress Max

Figure E.12. LBS-BEC Primary Tank Stresses, Shell Bottom, Seismic Load Only

AY Primary Tank, Lower Bound Soil, Gravity Only, Best Estimate Tank Concrete, 422 in. Waste Level at 1.7 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) 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
		min	*max*								
Radius 2	44.72	*22.36*	*67.29*	0.55	-0.008	-0.006	0.007	135	0.152	81	0.152
Radius 3	89.87	*67.29*	*104.93*	0.89	-0.007	-0.006	0.007	144	0.044	45	0.044
Radius 4	120.00	*104.93*	*135.98*	1.03	0.000	0.001	0.010	153	0.026	180	0.026
Radius 5	151.97	*135.98*	*181.01*	1.97	-0.002	0.002	0.017	153	0.136	90	0.136
Radius 6	210.05	*181.01*	*223.79*	2.41	0.016	0.022	0.028	153	0.374	90	0.374
Radius 7	237.53	*223.79*	*270.98*	3.30	0.023	0.035	0.027	153	0.436	135	0.436
Radius 8	304.43	*270.98*	*318.74*	4.04	0.051	0.066	0.013	153	0.619	45	0.619
Radius 9	333.05	*318.74*	*361.64*	4.37	0.007	0.030	0.010	162	0.512	45	0.512
Radius 10	390.22	*361.64*	*406.24*	5.36	0.166	0.194	0.005	162	0.726	45	0.726
Radius 11	422.26	*406.24*	*431.63*	3.60	-0.257	-0.217	0.003	63	0.946	0	0.946

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	0.00109	-0.00005	-0.00003
Radius 3	89.87	*67.29*	*104.93*	0.89	0.0715	1670	2219	0.00032	-0.00004	-0.00003
Radius 4	120.00	*104.93*	*135.98*	1.03	0.0968	1673	2215	0.00018	0.00000	0.00001
Radius 5	151.97	*135.98*	*181.01*	1.97	0.1252	1677	2207	0.00097	-0.00001	0.00001
Radius 6	210.05	*181.01*	*223.79*	2.41	0.1825	1688	2192	0.00266	0.00009	0.00012
Radius 7	237.53	*223.79*	*270.98*	3.30	0.2136	1696	2172	0.00309	0.00013	0.00019
Radius 8	304.43	*270.98*	*318.74*	4.04	0.3076	1725	2132	0.00431	0.00029	0.00037
Radius 9	333.05	*318.74*	*361.64*	4.37	0.3613	1746	2086	0.00352	0.00004	0.00018
Radius 10	390.22	*361.64*	*406.24*	5.36	0.5235	1821	2006	0.00478	0.00100	0.00116
Radius 11	422.26	*406.24*	*431.63*	3.60	0.6938	1913	1933	0.00593	-0.00159	-0.00134

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AY-2D-NL-LBS-BEC J Bolt Forces Gravity.xls, Forces

Figure E.13. LBS-BEC J-Bolt Forces, Gravity Load Only

AY Primary Tank, Lower Bound Soil, Horizontal and Vertical Seismic Input, Best Estimate Tank Concrete, 422 in. Waste Level at 1.7 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) 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
		min	*max*								
Radius 2	44.72	*22.36*	*67.29*	0.55	-0.100	0.016	0.397	90	0.664	0	0.664
Radius 3	89.87	*67.29*	*104.93*	0.89	-0.102	0.009	0.322	81	0.497	0	0.500
Radius 4	120.00	*104.93*	*135.98*	1.03	-0.061	0.058	0.278	90	0.485	180	0.517
Radius 5	151.97	*135.98*	*181.01*	1.97	-0.020	0.041	0.349	63	0.662	180	0.662
Radius 6	210.05	*181.01*	*223.79*	2.41	-0.072	0.138	0.925	54	0.858	180	1.180
Radius 7	237.53	*223.79*	*270.98*	3.30	-0.220	0.311	1.547	54	0.907	162	1.731
Radius 8	304.43	*270.98*	*318.74*	4.04	-0.353	0.486	3.394	63	1.148	72	3.560
Radius 9	333.05	*318.74*	*361.64*	4.37	-0.475	1.088	3.541	63	1.215	180	3.675
Radius 10	390.22	*361.64*	*406.24*	5.36	-1.144	1.071	3.868	63	1.579	90	4.080
Radius 11	422.26	*406.24*	*431.63*	3.60	-2.867	2.348	3.691	90	2.647	180	4.101

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)	Displacement LBS-BEC-Gravity Plus	Displacement LBS-BEC-Gravity Plus	Displacement LBS-BEC-Gravity Plus
		min	*max*							
Radius 2	44.72	*22.36*	*67.29*	0.55	0.0351	1667	2222	0.00478	-0.00054	0.00009
Radius 3	89.87	*67.29*	*104.93*	0.89	0.0715	1670	2219	0.00359	-0.00055	0.00005
Radius 4	120.00	*104.93*	*135.98*	1.03	0.0968	1673	2215	0.00371	-0.00033	0.00031
Radius 5	151.97	*135.98*	*181.01*	1.97	0.1252	1677	2207	0.00474	-0.00011	0.00022
Radius 6	210.05	*181.01*	*223.79*	2.41	0.1825	1688	2192	0.00839	-0.00039	0.00076
Radius 7	237.53	*223.79*	*270.98*	3.30	0.2136	1696	2172	0.01225	-0.00121	0.00172
Radius 8	304.43	*270.98*	*318.74*	4.04	0.3076	1725	2132	0.02476	-0.00199	0.00273
Radius 9	333.05	*318.74*	*361.64*	4.37	0.3613	1746	2086	0.02526	-0.00273	0.00626
Radius 10	390.22	*361.64*	*406.24*	5.36	0.5235	1821	2006	0.02688	-0.00684	0.00641
Radius 11	422.26	*406.24*	*431.63*	3.60	0.6938	1913	1933	0.02572	-0.01780	0.01458

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Figure E.14. LBS-BEC J-Bolt Forces, Gravity Plus Seismic Loads

AY Primary Tank, Lower Bound Soil, Horizontal and Vertical Seismic Input, Best Estimate Tank Concrete, 422 in. Waste Level at 1.7 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) 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	-0.091	0.023	0.389	108	0.512	0	0.643
Radius 3	89.87	*67.29*	*104.93*	0.89	-0.095	0.015	0.315	108	0.453	0	0.552
Radius 4	120.00	*104.93*	*135.98*	1.03	-0.061	0.056	0.268	108	0.460	0	0.532
Radius 5	151.97	*135.98*	*181.01*	1.97	-0.018	0.039	0.332	108	0.527	0	0.622
Radius 6	210.05	*181.01*	*223.79*	2.41	-0.088	0.116	0.896	108	0.485	144	1.019
Radius 7	237.53	*223.79*	*270.98*	3.30	-0.243	0.277	1.521	90	0.471	135	1.592
Radius 8	304.43	*270.98*	*318.74*	4.04	-0.404	0.420	3.381	117	0.529	117	3.422
Radius 9	333.05	*318.74*	*361.64*	4.37	-0.482	1.058	3.531	117	0.703	117	3.600
Radius 10	390.22	*361.64*	*406.24*	5.36	-1.311	0.877	3.863	108	0.853	0	3.956
Radius 11	422.26	*406.24*	*431.63*	3.60	-2.611	2.565	3.688	108	1.701	0	4.061

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)	Displacement LBS-BEC-Seismic Only	Displacement LBS-BEC-Seismic Only	Displacement LBS-BEC-Seismic Only
Radius 2	44.72	*22.36*	*67.29*	0.55	0.0351	1667	2222	0.00463	-0.00049	0.00012
Radius 3	89.87	*67.29*	*104.93*	0.89	0.0715	1670	2219	0.00396	-0.00051	0.00008
Radius 4	120.00	*104.93*	*135.98*	1.03	0.0968	1673	2215	0.00382	-0.00033	0.00031
Radius 5	151.97	*135.98*	*181.01*	1.97	0.1252	1677	2207	0.00445	-0.00010	0.00021
Radius 6	210.05	*181.01*	*223.79*	2.41	0.1825	1688	2192	0.00724	-0.00048	0.00064
Radius 7	237.53	*223.79*	*270.98*	3.30	0.2136	1696	2172	0.01127	-0.00134	0.00153
Radius 8	304.43	*270.98*	*318.74*	4.04	0.3076	1725	2132	0.02380	-0.00227	0.00236
Radius 9	333.05	*318.74*	*361.64*	4.37	0.3613	1746	2086	0.02475	-0.00277	0.00608
Radius 10	390.22	*361.64*	*406.24*	5.36	0.5235	1821	2006	0.02606	-0.00784	0.00524
Radius 11	422.26	*406.24*	*431.63*	3.60	0.6938	1913	1933	0.02547	-0.01621	0.01592

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Figure E.15. LBS-BEC J-Bolt Forces, Seismic Load Only

AY Secondary Liner, Lower Bound Soil, Gravity Only, Best Estimate Tank Concrete, 422 In Waste Level at 1.7SpG

		Shell Top Surface (inside - towards waste) Gravity					
M&D Starting M&D Element No.	Path (in.)	AY-NL-LBS-BEC Hoop Strain (in/in) Gravity Top	AY-NL-LBS-BEC Meridional Strain (in/in) Gravity Top	AY-NL-LBS-BEC Strain Intensity (in/in) Gravity Top	AY-NL-LBS-BEC In-Plane Shear Strain (in/in) Gravity Top	AY-NL-LBS-BEC In-Plane Shear Force Strain (in/in) Gravity Top	AY-NL-LBS-BEC Thru Thickness Shear Strain (in/in) Gravity Top
2062	**19.00**	1.04E-04	2.94E-04	4.64E-04	8.98E-07	1.45E-08	1.70E-09
2052	**49.28**	5.91E-05	7.85E-06	8.69E-05	1.50E-06	2.17E-05	7.82E-07
2042	**64.15**	2.08E-05	8.21E-05	1.16E-04	2.29E-05	2.84E-05	1.23E-05
2032	**72.29**	4.47E-05	4.24E-04	5.88E-04	2.34E-05	2.53E-05	1.20E-05
2022	**96.32**	1.28E-05	1.04E-04	1.46E-04	4.17E-06	1.71E-06	2.52E-07
1916	**129.82**	5.79E-06	2.70E-04	3.30E-04	2.89E-06	7.96E-06	2.10E-07
1906	**169.82**	9.44E-06	3.96E-05	4.92E-05	2.02E-06	3.78E-06	4.58E-08
1896	**235.97**	1.13E-05	5.11E-05	6.05E-05	7.91E-07	2.62E-06	1.25E-08
1886	**305.72**	1.13E-05	6.61E-05	8.30E-05	1.06E-06	4.17E-06	4.04E-09
1876	**379.62**	1.51E-05	8.80E-05	1.05E-04	1.13E-06	7.22E-06	9.37E-09
1866	**441.02**	1.12E-05	9.35E-05	1.16E-04	2.39E-06	6.53E-06	3.31E-08
1856	**487.97**	1.12E-05	8.74E-05	1.05E-04	3.43E-06	1.23E-05	2.76E-07

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AY-NL-LBS-BEC Liner Strain Gravity.xls, Strain Max

Figure E.16. LBS-BEC Secondary Liner Strain, Shell Top, Gravity Load Only

AY Secondary Liner, Lower Bound Soil, Gravity Only, Best Estimate Tank Concrete, 422 In Waste Level at 1.7SpG

		Shell Mid-Plane					
M&D Starting M&D Element No.	Path (in.)	AY-NL-LBS-BEC Hoop Strain (in/in) Gravity Mid	AY-NL-LBS-BEC Meridional Strain (in/in) Gravity Mid	AY-NL-LBS-BEC Strain Intensity (in/in) Gravity Mid	AY-NL-LBS-BEC In-Plane Shear Strain (in/in) Gravity Mid	AY-NL-LBS-BEC In-Plane Shear Force Strain (in/in) Gravity Mid	AY-NL-LBS-BEC Thru Thickness Shear Strain (in/in) Gravity Mid
2062	**19.00**	1.04E-04	2.96E-04	4.67E-04	8.97E-07	1.45E-08	1.70E-09
2052	**49.28**	5.89E-05	5.13E-06	8.70E-05	1.60E-06	2.17E-05	7.82E-07
2042	**64.15**	1.95E-05	2.33E-05	4.77E-05	9.09E-06	2.84E-05	1.23E-05
2032	**72.29**	4.34E-05	4.26E-05	8.86E-05	1.06E-05	2.53E-05	1.20E-05
2022	**96.32**	1.18E-05	1.86E-05	2.95E-05	4.21E-06	1.71E-06	2.52E-07
1916	**129.82**	5.37E-06	1.02E-04	1.25E-04	3.17E-06	7.96E-06	2.10E-07
1906	**169.82**	8.89E-06	5.26E-05	6.25E-05	1.98E-06	3.78E-06	4.58E-08
1896	**235.97**	1.14E-05	1.59E-06	1.45E-05	7.50E-07	2.62E-06	1.25E-08
1886	**305.72**	1.13E-05	2.79E-06	1.55E-05	4.71E-07	4.17E-06	4.04E-09
1876	**379.62**	1.53E-05	1.15E-05	2.17E-05	6.30E-07	7.22E-06	9.37E-09
1866	**441.02**	1.13E-05	2.02E-05	2.76E-05	5.76E-07	6.53E-06	3.31E-08
1856	**487.97**	1.02E-05	1.77E-05	2.68E-05	9.23E-07	1.23E-05	2.76E-07

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Figure E.17. LBS-BEC Secondary Liner Strain, Shell Middle, Gravity Load Only

AY Secondary Liner, Lower Bound Soil, Gravity Only, Best Estimate Tank Concrete, 422 In Waste Level at 1.7SpG

		Shell Bottom Surface (outside - away from waste) Gravity					
M&D Starting M&D Element No.	Path (in.)	AY-NL-LBS-BEC Hoop Strain (in/in) Gravity Bot	AY-NL-LBS-BEC Meridional Strain (in/in) Gravity Bot	AY-NL-LBS-BEC Strain Intensity (in/in) Gravity Bot	AY-NL-LBS-BEC In-Plane Shear Strain (in/in) Gravity Bot	AY-NL-LBS-BEC In-Plane Shear Force Strain (in/in) Gravity Bot	AY-NL-LBS-BEC Thru Thickness Shear Strain (in/in) Gravity Bot
2062	**19.00**	1.04E-04	2.98E-04	4.70E-04	8.96E-07	1.45E-08	1.70E-09
2052	**49.28**	5.87E-05	2.72E-06	8.73E-05	1.70E-06	2.17E-05	7.82E-07
2042	**64.15**	1.83E-05	1.27E-04	1.88E-04	5.39E-06	2.84E-05	1.23E-05
2032	**72.29**	4.21E-05	3.45E-04	5.11E-04	4.73E-06	2.53E-05	1.20E-05
2022	**96.32**	1.08E-05	1.41E-04	2.04E-04	4.24E-06	1.71E-06	2.52E-07
1916	**129.82**	5.16E-06	6.86E-05	8.31E-05	3.45E-06	7.96E-06	2.10E-07
1906	**169.82**	8.34E-06	1.35E-04	1.64E-04	1.95E-06	3.78E-06	4.58E-08
1896	**235.97**	1.15E-05	5.42E-05	6.78E-05	9.48E-07	2.62E-06	1.25E-08
1886	**305.72**	1.13E-05	7.01E-05	8.32E-05	1.06E-06	4.17E-06	4.04E-09
1876	**379.62**	1.55E-05	1.11E-04	1.38E-04	1.46E-06	7.22E-06	9.37E-09
1866	**441.02**	1.18E-05	5.32E-05	6.49E-05	2.01E-06	6.53E-06	3.31E-08
1856	**487.97**	9.52E-06	1.22E-04	1.50E-04	2.99E-06	1.23E-05	2.76E-07

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Figure E.18. LBS-BEC Secondary Liner Strain, Shell Bottom, Gravity Load Only

AY Secondary Liner, Lower Bound Soil, Horizontal and Vertical Input, Best Estimate Tank Concrete, 422 In Waste Level at 1.7SpG

		Shell Top Surface (inside - towards waste)					
M&D Starting M&D Element No.	Path (in.)	AY-NL-LBS-BEC Hoop Strain (in/in) Top	AY-NL-LBS-BEC Meridional Strain (in/in) Top	AY-NL-LBS-BEC Strain Intensity (in/in) Top	AY-NL-LBS-BEC In-Plane Shear Strain (in/in) Top	AY-NL-LBS-BEC In-Plane Shear Force Strain (in/in) Top	AY-NL-LBS-BEC Thru Thickness Shear Strain (in/in) Top
2062	**19.00**	1.25E-04	3.54E-04	6.16E-04	4.14E-04	3.76E-08	3.40E-08
2052	**49.28**	8.59E-05	2.84E-05	1.18E-04	5.13E-05	3.57E-05	1.49E-06
2042	**64.15**	6.93E-05	1.32E-04	2.07E-04	6.86E-05	4.47E-05	1.92E-05
2032	**72.29**	1.30E-04	6.78E-04	9.14E-04	7.19E-05	4.07E-05	2.07E-05
2022	**96.32**	7.69E-05	1.31E-04	2.06E-04	8.01E-05	2.44E-06	4.75E-07
1916	**129.82**	8.83E-05	3.88E-04	4.65E-04	1.08E-04	1.14E-05	3.26E-07
1906	**169.82**	8.45E-05	5.31E-05	1.08E-04	8.77E-05	5.34E-06	7.12E-08
1896	**235.97**	6.26E-05	1.10E-04	1.76E-04	1.02E-04	3.67E-06	1.96E-08
1886	**305.72**	5.25E-05	8.18E-05	1.14E-04	7.30E-05	5.81E-06	7.66E-09
1876	**379.62**	5.64E-05	1.52E-04	1.97E-04	5.72E-05	9.99E-06	1.53E-08
1866	**441.02**	3.54E-05	1.16E-04	1.49E-04	4.74E-05	8.96E-06	4.08E-08
1856	**487.97**	3.30E-05	1.44E-04	1.71E-04	3.83E-05	1.68E-05	3.85E-07

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Figure E.19. LBS-BEC Secondary Liner Strain, Shell Top, Gravity Plus Seismic Load

AY Secondary Liner, Lower Bound Soil, Horizontal and Vertical Input, Best Estimate Tank Concrete, 422 In Waste Level at 1.7SpG

		Shell Mid-Plane					
M&D Starting M&D Element No.	Path (in.)	AY-NL-LBS-BEC Hoop Strain (in/in) Mid	AY-NL-LBS-BEC Meridional Strain (in/in) Mid	AY-NL-LBS-BEC Strain Intensity (in/in) Mid	AY-NL-LBS-BEC In-Plane Shear Strain (in/in) Mid	AY-NL-LBS-BEC In-Plane Shear Force Strain (in/in) Mid	AY-NL-LBS-BEC Thru Thickness Shear Strain (in/in) Mid
2062	**19.00**	1.25E-04	3.57E-04	6.18E-04	4.13E-04	3.76E-08	3.40E-08
2052	**49.28**	8.59E-05	1.98E-05	1.16E-04	5.14E-05	3.57E-05	1.49E-06
2042	**64.15**	6.88E-05	5.21E-05	9.57E-05	6.92E-05	4.47E-05	1.92E-05
2032	**72.29**	1.29E-04	8.91E-05	2.23E-04	7.18E-05	4.07E-05	2.07E-05
2022	**96.32**	7.69E-05	6.01E-05	1.19E-04	8.00E-05	2.44E-06	4.75E-07
1916	**129.82**	8.83E-05	1.59E-04	2.39E-04	1.08E-04	1.14E-05	3.26E-07
1906	**169.82**	8.37E-05	9.28E-05	1.77E-04	8.78E-05	5.34E-06	7.12E-08
1896	**235.97**	6.24E-05	3.70E-05	1.04E-04	1.03E-04	3.67E-06	1.96E-08
1886	**305.72**	5.24E-05	2.94E-05	8.12E-05	7.27E-05	5.81E-06	7.66E-09
1876	**379.62**	5.66E-05	3.65E-05	7.40E-05	5.74E-05	9.99E-06	1.53E-08
1866	**441.02**	3.60E-05	3.60E-05	5.08E-05	4.65E-05	8.96E-06	4.08E-08
1856	**487.97**	3.21E-05	3.25E-05	4.53E-05	3.77E-05	1.68E-05	3.85E-07

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Figure E.20. LBS-BEC Secondary Liner Strain, Shell Middle, Gravity Plus Seismic Load

AY Secondary Liner, Lower Bound Soil, Horizontal and Vertical Input, Best Estimate Tank Concrete, 422 In Waste Level at 1.7SpG

		Shell Bottom Surface (outside - away from waste)					
M&D Starting M&D Element No.	Path (in.)	AY-NL-LBS-BEC Hoop Strain (in/in) Bot	AY-NL-LBS-BEC Meridional Strain (in/in) Bot	AY-NL-LBS-BEC Strain Intensity (in/in) Bot	AY-NL-LBS-BEC In-Plane Shear Strain (in/in) Bot	AY-NL-LBS-BEC In-Plane Shear Force Strain (in/in) Bot	AY-NL-LBS-BEC Thru Thickness Shear Strain (in/in) Bot
2062	**19.00**	1.25E-04	3.59E-04	6.20E-04	4.13E-04	3.76E-08	3.40E-08
2052	**49.28**	8.58E-05	1.36E-05	1.19E-04	5.14E-05	3.57E-05	1.49E-06
2042	**64.15**	6.83E-05	2.31E-04	3.19E-04	7.00E-05	4.47E-05	1.92E-05
2032	**72.29**	1.27E-04	5.00E-04	7.69E-04	7.17E-05	4.07E-05	2.07E-05
2022	**96.32**	7.70E-05	2.36E-04	3.13E-04	7.99E-05	2.44E-06	4.75E-07
1916	**129.82**	8.83E-05	1.04E-04	1.69E-04	1.07E-04	1.14E-05	3.26E-07
1906	**169.82**	8.30E-05	2.11E-04	2.89E-04	8.79E-05	5.34E-06	7.12E-08
1896	**235.97**	6.21E-05	7.33E-05	1.23E-04	1.03E-04	3.67E-06	1.96E-08
1886	**305.72**	5.23E-05	1.23E-04	1.75E-04	7.25E-05	5.81E-06	7.66E-09
1876	**379.62**	5.69E-05	1.41E-04	1.83E-04	5.79E-05	9.99E-06	1.53E-08
1866	**441.02**	3.67E-05	9.97E-05	1.35E-04	4.67E-05	8.96E-06	4.08E-08
1856	**487.97**	3.13E-05	1.57E-04	1.97E-04	3.91E-05	1.68E-05	3.85E-07

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Figure E.21. LBS-BEC Secondary Liner Strain, Shell Bottom, Gravity Plus Seismic Load

AY Secondary Liner, Lower Bound Soil, Horizontal and Vertical Input, Best Estimate Tank Concrete, 422 In Waste Level at 1.7SpG Seismic Only

		Shell Top Surface (inside - towards waste)					
M&D Starting M&D Element No.	Path (in.)	AY-NL-LBS-BEC Seismic Only Hoop Strain (in/in) Top	AY-NL-LBS-BEC Seismic Only Meridional Strain (in/in) Top	AY-NL-LBS-BEC Seismic Only Strain Intensity (in/in) Top	AY-NL-LBS-BEC Seismic Only In-Plane Shear Strain (in/in) Top	AY-NL-LBS-BEC Seismic Only In-Plane Shear Force Strain (in/in) Top	AY-NL-LBS-BEC Seismic Only Thru-Thickness Shear Strain (in/in) Top
2062	**19.00**	2.05E-05	6.05E-05	1.52E-04	4.13E-04	2.31E-08	3.23E-08
2052	**49.28**	2.69E-05	2.06E-05	3.07E-05	4.98E-05	1.40E-05	7.09E-07
2042	**64.15**	4.85E-05	5.03E-05	9.13E-05	4.57E-05	1.63E-05	6.86E-06
2032	**72.29**	8.52E-05	2.54E-04	3.26E-04	4.85E-05	1.54E-05	8.70E-06
2022	**96.32**	6.40E-05	2.65E-05	6.02E-05	7.60E-05	7.38E-07	2.23E-07
1916	**129.82**	8.25E-05	1.18E-04	1.35E-04	1.05E-04	3.42E-06	1.16E-07
1906	**169.82**	7.50E-05	1.35E-05	5.86E-05	8.56E-05	1.56E-06	2.54E-08
1896	**235.97**	5.13E-05	5.93E-05	1.15E-04	1.02E-04	1.05E-06	7.02E-09
1886	**305.72**	4.12E-05	1.57E-05	3.11E-05	7.20E-05	1.65E-06	3.61E-09
1876	**379.62**	4.13E-05	6.39E-05	9.22E-05	5.60E-05	2.77E-06	5.94E-09
1866	**441.02**	2.42E-05	2.22E-05	3.29E-05	4.50E-05	2.43E-06	7.70E-09
1856	**487.97**	2.18E-05	5.63E-05	6.57E-05	3.49E-05	4.45E-06	1.09E-07

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Figure E.22. LBS-BEC Secondary Liner Strain, Shell Top, Seismic Load Only

AY Secondary Liner, Lower Bound Soil, Horizontal and Vertical Input, Best Estimate Tank Concrete, 422 In Waste Level at 1.7SpG Seismic Only

		Shell Mid-Plane					
M&D Starting M&D Element No.	Path (in.)	AY-NL-LBS-BEC Seismic Only Hoop Strain (in/in) Mid	AY-NL-LBS-BEC Seismic Only Meridional Strain (in/in) Mid	AY-NL-LBS-BEC Seismic Only Strain Intensity (in/in) Mid	AY-NL-LBS-BEC Seismic Only In-Plane Shear Strain (in/in) Mid	AY-NL-LBS-BEC Seismic Only In-Plane Shear Force Strain (in/in) Mid	AY-NL-LBS-BEC Seismic Only Thru-Thickness Shear Strain (in/in) Mid
2062	**19.00**	2.05E-05	6.09E-05	1.51E-04	4.12E-04	2.31E-08	3.23E-08
2052	**49.28**	2.70E-05	1.46E-05	2.93E-05	4.98E-05	1.40E-05	7.09E-07
2042	**64.15**	4.93E-05	2.88E-05	4.81E-05	6.02E-05	1.63E-05	6.86E-06
2032	**72.29**	8.51E-05	4.65E-05	1.35E-04	6.13E-05	1.54E-05	8.70E-06
2022	**96.32**	6.51E-05	4.15E-05	8.96E-05	7.58E-05	7.38E-07	2.23E-07
1916	**129.82**	8.29E-05	5.72E-05	1.14E-04	1.04E-04	3.42E-06	1.16E-07
1906	**169.82**	7.49E-05	4.02E-05	1.14E-04	8.58E-05	1.56E-06	2.54E-08
1896	**235.97**	5.10E-05	3.54E-05	8.96E-05	1.02E-04	1.05E-06	7.02E-09
1886	**305.72**	4.11E-05	2.67E-05	6.57E-05	7.22E-05	1.65E-06	3.61E-09
1876	**379.62**	4.13E-05	2.50E-05	5.23E-05	5.68E-05	2.77E-06	5.94E-09
1866	**441.02**	2.47E-05	1.58E-05	2.31E-05	4.59E-05	2.43E-06	7.70E-09
1856	**487.97**	2.19E-05	1.48E-05	1.85E-05	3.68E-05	4.45E-06	1.09E-07

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Figure E.23. LBS-BEC Secondary Liner Strain, Shell Middle, Seismic Load Only

AY Secondary Liner, Upper Bound Soil, Gravity Only, Best Estimate Tank Concrete, 422 In Waste Level at 1.7SpG

		Shell Bottom Surface (outside - away from waste) Gravity					
M&D Starting M&D Element No.	Path (in.)	AY-NL-LBS-BEC Hoop Strain (in/in) Gravity Bot	AY-NL-LBS-BEC Meridional Strain (in/in) Gravity Bot	AY-NL-LBS-BEC Strain Intensity (in/in) Gravity Bot	AY-NL-LBS-BEC In-Plane Shear Strain (in/in) Gravity Bot	AY-NL-LBS-BEC In-Plane Shear Force Strain (in/in) Gravity Bot	AY-NL-LBS-BEC Thru Thickness Shear Strain (in/in) Gravity Bot
2063	**19.00**	1.04E-04	2.98E-04	4.70E-04	8.96E-07	1.45E-08	1.70E-09
2053	**49.28**	5.87E-05	2.72E-06	8.73E-05	1.70E-06	2.17E-05	7.82E-07
2043	**64.15**	1.83E-05	1.27E-04	1.88E-04	5.39E-06	2.84E-05	1.23E-05
2033	**72.29**	4.21E-05	3.45E-04	5.11E-04	4.73E-06	2.53E-05	1.20E-05
2023	**96.32**	1.08E-05	1.41E-04	2.04E-04	4.24E-06	1.71E-06	2.52E-07
1915	**129.82**	5.16E-06	6.86E-05	8.31E-05	3.45E-06	7.96E-06	2.10E-07
1905	**169.82**	8.34E-06	1.35E-04	1.64E-04	1.95E-06	3.78E-06	4.58E-08
1895	**235.97**	1.15E-05	5.42E-05	6.78E-05	9.48E-07	2.62E-06	1.25E-08
1885	**305.72**	1.13E-05	7.01E-05	8.32E-05	1.06E-06	4.17E-06	4.04E-09
1875	**379.62**	1.55E-05	1.11E-04	1.38E-04	1.46E-06	7.22E-06	9.37E-09
1865	**441.02**	1.18E-05	5.32E-05	6.49E-05	2.01E-06	6.53E-06	3.31E-08
1855	**487.97**	9.52E-06	1.22E-04	1.50E-04	2.99E-06	1.23E-05	2.76E-07

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Figure E.24. LBS-BEC Secondary Liner Strain, Shell Bottom, Seismic Load Only

Tank AY, 422 Inch Waste Level
SpG = 1.7
Lower Bound Soil
Best Estimate Concrete

Angle	Vertical Min AY-LBS-BEC Gravity	Vertical Max AY-LBS-BEC Gravity	Shear Y Min AY-LBS-BEC Gravity	Shear Y Max AY-LBS-BEC Gravity	Shear X Min AY-LBS-BEC Gravity	Shear X Max AY-LBS-BEC Gravity	Shear Y Max AY-LBS-BEC Gravity	Shear X Max AY-LBS-BEC Gravity	Shear Max AY-LBS-BEC Gravity	Vertical Force Max AY-LBS-BEC Gravity	Vertical Force Min AY-LBS-BEC Gravity
0	-243.10	-243.10	0.00	0.00	0.01	0.02	0.00	0.00	0.00	-75.97	-75.97
9	-483.40	-483.30	-0.48	-0.48	-0.29	-0.29	0.07	0.05	0.09	-75.53	-75.52
18	-483.80	-483.80	-1.04	-1.03	-0.64	-0.64	0.16	0.10	0.19	-75.59	-75.59
27	-483.20	-483.10	-0.80	-0.80	-0.74	-0.74	0.13	0.12	0.17	-75.50	-75.48
36	-483.30	-483.20	-0.76	-0.76	-0.74	-0.73	0.12	0.12	0.17	-75.52	-75.50
45	-483.20	-483.20	-0.74	-0.73	-0.66	-0.66	0.12	0.10	0.15	-75.50	-75.50
54	-483.20	-483.20	-0.79	-0.79	-0.55	-0.55	0.12	0.09	0.15	-75.50	-75.50
63	-483.20	-483.20	-0.87	-0.87	-0.43	-0.43	0.14	0.07	0.15	-75.50	-75.50
72	-483.20	-483.20	-0.96	-0.96	-0.29	-0.29	0.15	0.05	0.16	-75.50	-75.50
81	-483.10	-483.10	-1.02	-1.01	-0.17	-0.17	0.16	0.03	0.16	-75.48	-75.48
90	-483.10	-483.10	-1.02	-1.02	-0.04	-0.04	0.16	0.01	0.16	-75.48	-75.48
99	-483.20	-483.10	-0.98	-0.98	0.11	0.11	0.15	0.02	0.15	-75.50	-75.48
108	-483.20	-483.20	-0.89	-0.88	0.25	0.26	0.14	0.04	0.14	-75.50	-75.50
117	-483.30	-483.20	-0.83	-0.82	0.39	0.39	0.13	0.06	0.14	-75.52	-75.50
126	-483.20	-483.20	-0.78	-0.78	0.52	0.53	0.12	0.08	0.15	-75.50	-75.50
135	-483.20	-483.20	-0.76	-0.75	0.64	0.65	0.12	0.10	0.16	-75.50	-75.50
144	-483.10	-483.10	-0.71	-0.71	0.73	0.74	0.11	0.12	0.16	-75.48	-75.48
153	-483.40	-483.40	-0.85	-0.85	0.76	0.77	0.13	0.12	0.18	-75.53	-75.53
162	-483.00	-483.00	-0.68	-0.68	0.72	0.73	0.11	0.11	0.16	-75.47	-75.47
171	-485.30	-485.30	-1.44	-1.44	0.28	0.28	0.23	0.04	0.23	-75.83	-75.83
180	-241.00	-241.00	0.00	0.00	-0.02	-0.01	0.00	0.01	0.01	-75.31	-75.31

Figure E.25. LBS-BEC Concrete Wall/Footing Contact Forces. Gravity Only

Tank AY, 422 Inch Waste Level
SpG = 1.7
Lower Bound Soil
Best Estimate Concrete

Angle	Vertical Min AY-LBS-BEC Seismic	Vertical Max AY-LBS-BEC Seismic	Shear Y Min AY-LBS-BEC Seismic	Shear Y Max AY-LBS-BEC Seismic	Shear X Min AY-LBS-BEC Seismic	Shear X Max AY-LBS-BEC Seismic	Shear Y Max AY-LBS-BEC Seismic	Shear X Max AY-LBS-BEC Seismic	Shear Max AY-LBS-BEC Seismic	Vertical Force Max AY-LBS-BEC Seismic	Vertical Force Min AY-LBS-BEC Seismic
0	-290.50	-180.70	0.00	0.00	-14.76	14.79	0.00	4.62	4.62	-90.78	-56.47
9	-577.50	-359.80	-30.62	30.79	-34.06	33.29	4.81	5.32	7.17	-90.23	-56.22
18	-577.80	-362.80	-58.19	58.19	-48.28	46.25	9.09	7.54	11.81	-90.28	-56.69
27	-576.90	-366.40	-79.08	80.36	-70.48	67.24	12.56	11.01	16.70	-90.14	-57.25
36	-576.90	-372.00	-92.91	94.90	-98.90	94.24	14.83	15.45	21.42	-90.14	-58.13
45	-576.60	-378.50	-98.17	100.40	-130.70	124.60	15.69	20.42	25.75	-90.09	-59.14
54	-576.30	-385.70	-94.15	95.74	-162.40	155.50	14.96	25.38	29.46	-90.05	-60.27
63	-576.00	-393.10	-80.91	81.23	-190.60	183.90	12.69	29.78	32.37	-90.00	-61.42
72	-575.60	-400.10	-59.53	58.51	-212.50	207.20	9.30	33.20	34.48	-89.94	-62.52
81	-575.20	-406.20	-32.00	30.11	-226.20	222.60	5.00	35.34	35.70	-89.88	-63.47
90	-574.80	-411.80	-2.60	0.88	-230.50	228.30	0.41	36.02	36.02	-89.81	-64.34
99	-574.40	-413.40	-32.07	30.26	-224.70	224.10	5.01	35.11	35.47	-89.75	-64.59
108	-574.10	-411.90	-59.68	58.37	-209.30	210.40	9.33	32.88	34.17	-89.70	-64.36
117	-573.80	-408.50	-81.40	81.02	-186.30	188.70	12.72	29.48	32.11	-89.66	-63.83
126	-573.60	-404.60	-95.19	95.62	-158.00	160.80	14.94	25.13	29.23	-89.63	-63.22
135	-573.50	-401.00	-99.82	100.50	-127.10	129.40	15.70	20.22	25.60	-89.61	-62.66
144	-573.30	-398.00	-94.85	95.22	-96.45	97.89	14.88	15.30	21.34	-89.58	-62.19
153	-573.60	-396.10	-81.20	80.72	-69.04	69.80	12.69	10.91	16.73	-89.63	-61.89
162	-573.00	-394.20	-59.43	58.77	-47.51	47.79	9.29	7.47	11.92	-89.53	-61.59
171	-575.50	-395.60	-33.18	30.60	-34.46	33.65	5.18	5.38	7.47	-89.92	-61.81
180	-285.90	-196.10	0.00	0.00	-15.17	14.46	0.00	4.74	4.74	-89.34	-61.28

Figure E.26. LBS-BEC Concrete Wall/Footing Contact Forces. Gravity Plus Seismic

Tank AY, 422 Inch Waste Level
SpG = 1.7
Lower Bound Soil
Best Estimate Concrete

Angle	Vertical Min AY-LBS-BEC Seismic Only	Vertical Max AY-LBS-BEC Seismic Only	Shear Y Min AY-LBS-BEC Seismic Only	Shear Y Max AY-LBS-BEC Seismic Only	Shear X Min AY-LBS-BEC Seismic Only	Shear X Max AY-LBS-BEC Seismic Only	Shear Y Max AY-LBS-BEC Seismic Only	Shear X Max AY-LBS-BEC Seismic Only	Shear Max AY-LBS-BEC Seismic Only	Vertical Force Max AY-LBS-BEC Seismic Only	Vertical Force Min AY-LBS-BEC Seismic Only
0	-47.40	62.40	0.00	0.00	-14.77	14.77	0.00	4.62	4.62	-14.81	19.50
9	-94.10	123.50	-30.14	31.27	-33.77	33.58	4.89	5.28	7.19	-14.70	19.30
18	-94.00	121.00	-57.16	59.22	-47.64	46.89	9.25	7.44	11.88	-14.69	18.91
27	-93.70	116.70	-78.28	81.16	-69.74	67.98	12.68	10.90	16.72	-14.64	18.23
36	-93.60	111.20	-92.15	95.66	-98.16	94.97	14.95	15.34	21.42	-14.63	17.38
45	-93.40	104.70	-97.43	101.13	-130.04	125.26	15.80	20.32	25.74	-14.59	16.36
54	-93.10	97.50	-93.36	96.53	-161.85	156.05	15.08	25.29	29.45	-14.55	15.23
63	-92.80	90.10	-80.04	82.10	-190.17	184.33	12.83	29.71	32.37	-14.50	14.08
72	-92.40	83.10	-58.57	59.47	-212.21	207.49	9.29	33.16	34.44	-14.44	12.98
81	-92.10	76.90	-30.98	31.12	-226.03	222.77	4.86	35.32	35.65	-14.39	12.02
90	-91.70	71.30	-1.58	1.90	-230.46	228.34	0.30	36.01	36.01	-14.33	11.14
99	-91.20	69.70	-31.09	31.24	-224.81	223.99	4.88	35.13	35.46	-14.25	10.89
108	-90.90	71.30	-58.79	59.25	-209.55	210.14	9.26	32.84	34.12	-14.20	11.14
117	-90.50	74.70	-80.57	81.84	-186.69	188.31	12.79	29.42	32.08	-14.14	11.67
126	-90.40	78.60	-94.41	96.40	-158.52	160.27	15.06	25.04	29.22	-14.13	12.28
135	-90.30	82.20	-99.06	101.25	-127.74	128.75	15.82	20.12	25.59	-14.11	12.84
144	-90.20	85.10	-94.14	95.93	-97.18	97.15	14.99	15.19	21.34	-14.09	13.30
153	-90.20	87.30	-80.35	81.57	-69.80	69.03	12.74	10.91	16.77	-14.09	13.64
162	-90.00	88.80	-58.75	59.45	-48.23	47.06	9.29	7.54	11.96	-14.06	13.88
171	-90.20	89.70	-31.74	32.04	-34.74	33.37	5.01	5.43	7.38	-14.09	14.02
180	-44.90	44.90	0.00	0.00	-15.15	14.47	0.00	4.74	4.74	-14.03	14.03

Figure E.27. LBS-BEC Concrete Wall/Footing Contact Forces. Seismic Only

Tank AY, 422 Inch Waste Level
SpG = 1.7
Lower Bound Soil
Best Estimate Concrete

	Angle (rad)	Path	Max Pressure Soil (LBS) AY Gravity (PSI)	Min Pressure Soil (LBS) AY Gravity (PSI)	Max Meridional Friction Soil (LBS) AY Gravity (PSI)	Max Tangential Friction Soil (LBS) AY Gravity (PSI)	Max Contact Displacement Soil (LBS) AY Gravity (Inch)	Vertical Pressure	Active Pressure Phi = 33 deg	Active Pressure Phi = 49 deg
568	-0.035089	**67.727**	12.813	11.729	1.400	0.035	0.014	7.12	7.11	7.11
565.8	-0.07135	**105.668**	9.903	9.715	1.912	0.059	0.025	7.27	7.26	7.26
563.21	-0.096521	**137.069**	8.819	7.694	1.817	0.084	0.030	7.46	7.43	7.42
559.7	-0.124516	**182.849**	7.486	6.449	1.755	0.059	0.029	7.71	7.65	7.65
550.7	-0.180521	**226.563**	10.160	6.958	2.069	0.071	0.028	8.35	8.23	8.22
545.2	-0.210395	**275.566**	10.347	9.792	2.108	0.048	0.032	8.74	8.57	8.55
527.68	-0.298426	**325.690**	10.167	9.715	2.103	0.017	0.036	9.99	9.59	9.56
518.2	-0.34673	**372.305**	12.743	12.632	2.540	0.034	0.035	10.66	10.09	10.04
494.5	-0.482293	**423.427**	20.361	20.319	2.642	0.066	0.035	12.35	11.07	10.97
476.2	-0.606571	**468.308**	33.875	33.840	3.299	0.133	0.043	13.65	11.45	11.27
447.4	-0.656685	**515.312**	31.528	31.479	6.749	0.222	0.078	15.70	12.75	12.51
407.1	-0.710341	**549.725**	25.313	25.278	5.277	0.109	0.098	18.57	14.53	14.18
382.1	-1.570796	**585.819**	15.653	15.632	3.755	0.054	0.105	20.35	6.00	2.85
335	-1.570796	**636.369**	7.271	7.264	1.815	0.012	0.110	23.70	6.99	3.32
281	-1.570796	**685.619**	5.001	4.998	1.092	0.004	0.114	27.55	8.13	3.86
236.5	-1.570796	**732.719**	5.927	5.923	1.208	0.005	0.112	30.71	9.06	4.30
186.8	-1.570796	**778.219**	6.282	6.266	1.280	0.006	0.108	34.25	10.10	4.80
145.5	-1.570796	**821.369**	6.642	6.610	1.353	0.008	0.097	37.19	10.97	5.21
70	-1.570796	**874.169**	7.993	7.896	1.731	0.017	0.077	42.57	12.56	5.96
24	-1.570796	**930.544**	11.486	11.431	2.567	0.052	0.057	45.84	13.52	6.42

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Figure E.28. LBS-BEC Soil/Concrete Tank Contact Forces. Gravity Only

Tank AY, 422 Inch Waste Level
SpG = 1.7
Lower Bound Soil
Best Estimate Concrete

	Angle (rad)	Path	Max Pressure Soil (LBS) AY Seismic (PSI)	Min Pressure Soil (LBS) AY Seismic (PSI)	Max Meridional Friction Soil (LBS) AY Seismic (PSI)	Max Tangential Friction Soil (LBS) AY Seismic (PSI)	Max Contact Displacement Soil (LBS) AY Seismic (PSI)	Vertical Pressure	Active Pressure Phi = 33 deg	Active Pressure Phi = 49 deg
568	-0.035089	**67.727**	22.16	4.21	9.17	4.70	0.03	7.12	7.11	7.11
565.8	-0.07135	**105.668**	16.64	3.14	7.44	3.40	0.04	7.27	7.26	7.26
563.21	-0.096521	**137.069**	13.59	2.14	6.05	2.73	0.04	7.46	7.43	7.42
559.7	-0.124516	**182.849**	10.66	3.68	4.09	3.34	0.04	7.71	7.65	7.65
550.7	-0.180521	**226.563**	15.27	4.22	4.68	4.33	0.05	8.35	8.23	8.22
545.2	-0.210395	**275.566**	13.46	6.51	5.51	4.43	0.05	8.74	8.57	8.55
527.68	-0.298426	**325.690**	12.37	6.87	5.48	4.29	0.05	9.99	9.59	9.56
518.2	-0.34673	**372.305**	15.63	9.88	5.89	4.17	0.05	10.66	10.09	10.04
494.5	-0.482293	**423.427**	25.31	16.17	5.96	4.21	0.05	12.35	11.07	10.97
476.2	-0.606571	**468.308**	42.94	26.24	5.45	4.28	0.05	13.65	11.45	11.27
447.4	-0.656685	**515.312**	38.60	25.66	11.55	4.19	0.10	15.70	12.75	12.51
407.1	-0.710341	**549.725**	30.92	21.08	12.04	3.06	0.13	18.57	14.53	14.18
382.1	-1.570796	**585.819**	19.18	12.92	10.80	2.17	0.14	20.35	6.00	2.85
335	-1.570796	**636.369**	8.60	6.15	5.92	2.39	0.15	23.70	6.99	3.32
281	-1.570796	**685.619**	6.06	4.13	3.86	2.60	0.16	27.55	8.13	3.86
236.5	-1.570796	**732.719**	6.93	4.92	4.14	2.46	0.16	30.71	9.06	4.30
186.8	-1.570796	**778.219**	7.20	5.19	4.17	2.70	0.16	34.25	10.10	4.80
145.5	-1.570796	**821.369**	7.57	5.39	4.30	3.06	0.14	37.19	10.97	5.21
70	-1.570796	**874.169**	9.99	5.96	6.96	3.42	0.11	42.57	12.56	5.96
24	-1.570796	**930.544**	19.90	3.15	6.81	3.40	0.08	45.84	13.52	6.42

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Figure E.29. LBS-BEC Soil/Concrete Tank Contact Forces. Gravity Plus Seismic

Tank AY, 422 Inch Waste Level
SpG = 1.7
Lower Bound Soil
Best Estimate Concrete

	Angle (rad)	Path	Max Pressure Soil (LBS) AY Seismic Only (PSI)	Min Pressure Soil (LBS) AY Seismic Only (PSI)	Max Meridional Friction (LBS) AY Seismic Only (PSI)	Max Tangential Friction (LBS) AY Seismic Only (PSI)	Max Tangential Friction (LBS) AY Seismic Only (PSI)
568	-0.035089	**67.727**	9.35	-8.60	7.77	4.67	0.02
565.8	-0.07135	**105.668**	6.74	-6.76	5.53	3.34	0.02
563.21	-0.096521	**137.069**	4.77	-6.68	4.23	2.64	0.01
559.7	-0.124516	**182.849**	3.17	-3.81	2.33	3.28	0.01
550.7	-0.180521	**226.563**	5.11	-5.94	2.61	4.26	0.02
545.2	-0.210395	**275.566**	3.11	-3.84	3.40	4.38	0.02
527.68	-0.298426	**325.690**	2.20	-3.30	3.38	4.27	0.02
518.2	-0.34673	**372.305**	2.88	-2.86	3.35	4.13	0.02
494.5	-0.482293	**423.427**	4.95	-4.19	3.32	4.15	0.01
476.2	-0.606571	**468.308**	9.06	-7.63	2.15	4.15	0.01
447.4	-0.656685	**515.312**	7.07	-5.87	4.80	3.97	0.02
407.1	-0.710341	**549.725**	5.61	-4.23	6.76	2.95	0.03
382.1	-1.570796	**585.819**	3.53	-2.74	7.04	2.11	0.04
335	-1.570796	**636.369**	1.33	-1.12	4.11	2.38	0.04
281	-1.570796	**685.619**	1.06	-0.87	2.77	2.59	0.05
236.5	-1.570796	**732.719**	1.00	-1.00	2.93	2.45	0.05
186.8	-1.570796	**778.219**	0.92	-1.09	2.89	2.69	0.05
145.5	-1.570796	**821.369**	0.93	-1.25	2.95	3.05	0.05
70	-1.570796	**874.169**	2.00	-2.03	5.23	3.41	0.03
24	-1.570796	**930.544**	8.42	-8.34	4.24	3.35	0.02

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Figure E.30. LBS-BEC Soil/Concrete Tank Contact Forces. Seismic Only

Tank AY, 422 Inch Waste Level
SpG = 1.7
Lower Bound Soil
Best Estimate Concrete

Radius	Max Pressure Primary Tank/Concrete Tank Dome AY Gravity (PSI)	Min Pressure Primary Tank/Concrete Tank Dome AY Gravity (PSI)	Max Gap Lateral Displacement Primary Tank /Concrete Tank Dome Gravity (in)	Max Gap Displacement Primary Tank/Concete Tank Dome AY Gravity (Inches)
67.727	1.826	1.624	0.001745	0.000000
105.668	1.302	1.207	0.002490	0.000000
137.069	0.736	0.506	0.002071	0.000000
182.849	1.055	0.930	0.001628	-0.000016
226.563	1.567	1.243	0.002122	-0.000018
275.566	1.031	0.713	0.002468	-0.000084
325.690	4.783	1.871	0.006485	0.000000
372.305	0.422	0.000	0.001067	-0.000383
423.427	1.566	0.324	0.002368	-1.053720

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Figure E.31. LBS-BEC Primary Tank/Concrete Dome Contact Data, Gravity Only

Tank AY, 422 Inch Waste Level
SpG = 1.7
Lower Bound Soil
Best Estimate Concrete

Radius	Max Pressure Primary Tank/Concrete Tank Dome AY Seismic (PSI)	Min Pressure Primary Tank/Concrete Tank Dome AY Seismic (PSI)	Max Gap Lateral Displacement Primary Tank /Concrete Tank Dome Seismic (in)	Max Gap Displacement Primary Tank/Concete Tank Dome AY Seismic (Inches)
67.727	14.944	0.204	0.003107	-0.000019
105.668	14.583	0.174	0.005449	-0.000049
137.069	8.653	0.000	0.006001	-0.000076
182.849	7.493	0.287	0.003395	-0.000185
226.563	32.576	0.000	0.003299	-0.000452
275.566	66.063	0.000	0.004324	-0.000870
325.690	104.167	0.000	0.008165	-0.002239
372.305	101.458	0.000	0.024060	-0.003983
423.427	52.417	0.000	0.032748	-1.061400

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Figure E.32. LBS-BEC Primary Tank/Concrete Dome Contact Data, Gravity Plus Seismic

Tank AY, 422 Inch Waste Level
SpG = 1.7
Lower Bound Soil
Best Estimate Concrete

Radius	Max Pressure Primary Tank/Concrete Tank Dome AY Seismic Only (PSI)	Min Pressure Primary Tank/Concrete Tank Dome AY Seismic Only (PSI)	Max Gap Lateral Displacement Primary Tank /Concrete Tank Dome Seismic Only (in)	Max Gap Displacement Primary Tank/Concete Tank Dome AY Seismic Only (Inches)
67.727	13.118	-1.420	0.001362	-0.000019
105.668	13.281	-1.033	0.002959	-0.000049
137.069	7.917	-0.506	0.003930	-0.000075
182.849	6.438	-0.643	0.001766	-0.000169
226.563	31.009	-1.243	0.001177	-0.000434
275.566	65.032	-0.713	0.001855	-0.000787
325.690	99.384	-1.871	0.001680	-0.002239
372.305	101.036	0.000	0.022993	-0.003600
423.427	50.851	-0.324	0.030380	-0.007680

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Figure E.33. LBS-BEC Primary Tank/Concrete Dome Contact Data, Seismic Only

Tank AY, 422 Inch Waste Level
SpG = 1.7
Lower Bound Soil
Best Estimate Concrete

Radius	Max Pressure Primary Tank/Insulating Concrete AY Gravity (PSI)	Min Pressure Primary Tank/Insulating Concrete AY Gravity (PSI)	Max Lateral Displacement Primary Tank / Insulating Concete AY Gravity (Inches)	Min Lateral Displacement Primary Tank / Insulating Concete AY Gravity (Inches)
424.00	53.125	52.361	0.003580	0.003433
384.00	18.854	18.653	0.000527	0.000469
317.85	27.528	27.486	0.000280	0.000254
248.10	25.896	25.840	0.000228	0.000217
199.25	26.007	25.931	0.000348	0.000340
154.95	26.215	26.104	0.000177	0.000159
112.80	25.424	25.222	0.000299	0.000289
65.85	29.444	28.806	0.000229	0.000212

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Figure E.34. LBS-BEC Primary Tank/Insulating Concrete Contact Forces. Gravity Only

Tank AY, 422 Inch Waste Level
SpG = 1.7
Lower Bound Soil
Best Estimate Concrete

Radius	Max Pressure Primary Tank/Insulaiting Concrete AY Seismic (PSI)	Min Pressure Primary Tank/Insulaiting Concrete AY Seismic (PSI)	Max Lateral Displacement Primary Tank/Insulaiting Concrete AY Seismic (Inches)	Min Lateral Displacement Primary Tank/Insulaiting Concrete AY Seismic (Inches)
424.00	81.319	23.382	0.024912	0.001445
384.00	25.778	11.222	0.016524	0.000137
317.85	35.458	19.882	0.006144	0.000185
248.10	32.354	20.188	0.002460	0.000148
199.25	31.542	21.236	0.001853	0.000017
154.95	30.750	21.597	0.001622	0.000063
112.80	29.597	20.778	0.001685	0.000023
65.85	34.736	23.618	0.001549	0.000166

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Figure E.35. LBS-BEC Primary Tank/ Insulating Concrete Contact Data, Gravity Plus Seismic

Tank AY, 422 Inch Waste Level
SpG = 1.7
Lower Bound Soil
Best Estimate Concrete

Radius	Max Pressure Primary Tank/Insulaiting Concrete AY Seismic Only (PSI)	Min Pressure Primary Tank/Insulaiting Concrete AY Seismic Only (PSI)	Max Lateral Displacement Primary Tank/Insulaiting Concrete AY Seismic Only (Inches)	Min Lateral Displacement Primary Tank/Insulaiting Concrete AY Seismic Only (Inches)
424.00	28.194	-28.979	0.021	-0.002
384.00	6.924	-7.431	0.016	0.000
317.85	7.931	-7.604	0.006	0.000
248.10	6.458	-5.653	0.002	0.000
199.25	5.535	-4.694	0.002	0.000
154.95	4.535	-4.507	0.001	0.000
112.80	4.174	-4.444	0.001	0.000
65.85	5.292	-5.188	0.001	0.000

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Figure E.36. LBS-BEC Primary Tank/ Insulating Concrete Contact Forces. Seismic Only

Tank AY, 422 Inch Waste Level
SpG = 1.7
Lower Bound Soil
Best Estimate Concrete

Radius	Max Pressure Insulating Concrete/Secondary Liner AY Gravity (PSI)	Min Pressure Insulating Concrete/Secondary Liner AY Gravity (PSI)	Max Lateral Displacement Insulating Concrete/Secondary Liner AY Gravity (Inches)	Min Lateral Displacement Insulating Concrete/Secondary Liner AY Gravity (Inches)
424.00	58.201	56.403	0.002711	0.002472
384.00	20.653	20.194	0.000859	0.000751
317.85	27.382	27.264	0.000192	0.000163
248.10	26.507	26.417	0.000163	0.000157
199.25	26.472	26.424	0.000108	0.000101
154.95	25.882	25.813	0.000096	0.000080
112.80	26.965	26.750	0.000095	0.000077
65.85	26.535	25.986	0.000157	0.000151

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Figure E.37. LBS-BEC Insulating Concrete/Secondary Liner Contact Data, Gravity Only

Tank AY, 422 Inch Waste Level
SpG = 1.7
Lower Bound Soil
Best Estimate Concrete

Radius	Max Pressure Insulating Concrete/Secondary Liner AY Seismic (PSI)	Min Pressure Insulating Concrete/Secondary Liner AY Seismic (PSI)	Max Lateral Displacement Insulating Concrete/Secondary Liner AY Seismic (Inches)	Min Lateral Displacement Insulating Concrete/Secondary Liner AY Seismic (Inches)
424.00	81.944	32.701	0.007196	0.000542
384.00	27.583	13.104	0.005992	0.000396
317.85	35.132	19.806	0.003486	0.000066
248.10	33.007	20.729	0.001844	0.000107
199.25	32.007	21.639	0.001354	0.000006
154.95	30.347	21.410	0.001236	0.000026
112.80	31.181	22.104	0.001354	0.000017
65.85	31.000	21.667	0.001206	0.000014

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Figure E.38. LBS-BEC Insulating Concrete/Secondary Liner Contact Data, Gravity Plus Seismic

Tank AY, 422 Inch Waste Level
SpG = 1.7
Lower Bound Soil
Best Estimate Concrete

Radius	Max Pressure Insulating Concrete/Secondary Liner AY Seismic Only (PSI)	Min Pressure Insulating Concrete/Secondary Liner AY Seismic Only (PSI)	Max Lateral Displacement Insulating Concrete/Secondary Liner AY Seismic Only (Inches)	Min Lateral Displacement Insulating Concrete/Secondary Liner AY Seismic Only (Inches)
424.00	23.743	-23.701	0.004	-0.002
384.00	6.931	-7.090	0.005	0.000
317.85	7.750	-7.458	0.003	0.000
248.10	6.500	-5.688	0.002	0.000
199.25	5.535	-4.785	0.001	0.000
154.95	4.465	-4.403	0.001	0.000
112.80	4.215	-4.646	0.001	0.000
65.85	4.465	-4.319	0.001	-0.0001

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Figure E.39. LBS-BEC Insulating Concrete/Secondary Liner Contact Data, Seismic Only

Tank AY, 422 Inch Waste Level
SpG = 1.7
Lower Bound Soil
Best Estimate Concrete

Waste Height	Max Pressure AY Tank, 422 in Waste Level, SpG = 1.7 Time History (PSI)	Min Pressure AY Tank, 422 in Waste Level, SpG = 1.7 Time History (PSI)	Hydrostatic (psi)	Impulsive (psi)	Convective (psi)	Breathing (psi)	Dynamic (psi)	Dynamic (SRSS) (psi)	Theoretical Max	Theoretical Min	Theoretical Max (SRSS)	Theoretical Min (SRSS)
410.75	53.382	-38.347	0.69	1.86	1.39	0.18	2.50	2.33	3.19	-1.81	3.02	-1.64
386.5	5.944	-6.781	2.18	3.43	1.26	0.57	4.22	3.70	6.40	-2.04	5.88	-1.52
359.5	12.806	-8.736	3.84	4.9	1.14	1	6.03	5.13	9.87	-2.19	8.97	-1.29
332	14.396	-0.717	5.53	6.16	1.02	1.43	7.67	6.41	13.20	-2.15	11.93	-0.88
305	13.972	-0.657	7.18	7.21	0.93	1.84	9.11	7.50	16.29	-1.93	14.68	-0.32
278	16.153	0.418	8.84	8.1	0.85	2.22	10.36	8.44	19.20	-1.52	17.28	0.40
251	19.479	2.390	10.50	8.87	0.78	2.59	11.49	9.27	21.99	-1.00	19.77	1.22
225.65	24.597	2.748	12.05	9.48	0.72	2.91	12.42	9.94	24.47	-0.36	22.00	2.11
202.3	26.965	4.295	13.49	9.97	0.67	3.18	13.17	10.49	26.66	0.31	23.97	3.00
179.3	35.083	2.542	14.90	10.38	0.63	3.42	13.82	10.95	28.72	1.08	25.85	3.95
156.35	34.660	5.355	16.31	10.73	0.6	3.64	14.39	11.35	30.69	1.92	27.65	4.96
131.45	32.222	5.716	17.84	11.05	0.57	3.84	14.90	11.71	32.74	2.93	29.55	6.12
104.5	39.111	6.122	19.49	11.32	0.54	4.03	15.36	12.03	34.85	4.13	31.52	7.46
77.5	34.340	9.674	21.15	11.53	0.52	4.18	15.72	12.28	36.87	5.43	33.42	8.87
50.5	37.528	11.819	22.81	11.68	0.51	4.28	15.97	12.45	38.78	6.83	35.26	10.36
24.5	36.326	9.035	24.40	11.76	0.5	4.34	16.11	12.55	40.51	8.29	36.95	11.86

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AY-2D-NL-LBS-BEC Waste-TH-MAX.xls, FM Max

Figure E.40. LBS-BEC LBS Waste Contact Pressure, Gravity Plus Seismic

Tank AY, 422 Inch Waste Level
SpG = 1.7
Lower Bound Soil
Best Estimate Concrete

Waste Radius	Max Vertical Displacement AY-LBS-BEC Time History (in)	Min Vertical Displacement AY-LBS-BEC Time History (in)
95.7	3.12	-3.90
129.9	4.59	-5.25
180	5.27	-5.98
218.5	6.29	-6.97
277.7	6.71	-7.41
358	6.93	-7.63
410	7.76	-8.47
450	7.78	-8.50

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Figure E.41. LBS-BEC LBS Waste Surface Displacement, Gravity Plus Seismic

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,kmaxte
mp2+4
a,kmaxtemp2+2,kmaxtemp2+3,kmaxtemp2+6,kmaxte
mp2+5
a,kmaxtemp2+3,kmaxtemp1+1,kmaxtemp1+2,kmaxte
mp2+6
a,kmaxtemp2+4,kmaxtemp2+5,kmaxjb+9,kmaxjb+8,
kmaxjb+7,kmaxjb+6,kmaxjb+5,kmaxjb+4,kmaxjb+3
,kmaxjb+2!a,740,741,712,711,710,709,708,707,
706,705
a,kmaxtemp2+5,kmaxtemp2+6,kmaxtemp2+7,kmaxjb
+12,kmaxjb+11,kmaxjb+10,kmaxjb+9
a,kmaxtemp2+6,kmaxtemp1+2,kmaxtemp1+3,kmaxte
mp2+7
a,kmaxtemp2+7,kmaxtemp1+3,kmaxtemp1+4,kmaxjb
+12
a,kmaxjb+12,kmaxtemp1+4,kmaxtemp1+5,kmaxjb+1
4,kmaxjb+13
a,kmaxjb+14,kmaxtemp1+5,kmaxtemp1+6,kmaxjb+1
6,kmaxjb+15
a,kmaxjb+16,kmaxtemp1+6,kmaxtemp1+7,kmaxjb+1
8,kmaxjb+17
a,kmaxjb+18,kmaxtemp1+7,kmaxtemp1+8,kmaxjb+2
0,kmaxjb+19
a,kmaxjb+20,kmaxtemp1+8,kmaxtemp1+9,kmaxtemp
2+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,kma
xjb+bm_kp+2
a,kmaxjb+bm_kp+2,kmaxtemp2+4,kmaxjb+2,kmaxjb
+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

/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, Horizontal and
Vertical Seismic Inputs, Best Estimate Soil,
Best Estimate Concrete Properties, AP
Primary Tank Geometry
```

```
!
fini
/clear
/filname,PNNL-2D-LBS-BEC,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-AY,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-AY,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-AY,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-LB,txt        ! Run solution
Phase
/input,contact-AY,txt         ! Extract
Contact data
/input,all-forces,txt         ! Extract
component forces/strains
/input,spectra-all,txt        ! Extract
Response Spectra
/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-LB.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,PNNL-AY-2D-NL-BEC-LBS,out
/solu
antype,trans
TRNOPT,FULL
lumpm,OFF
!nlgeom,on
NROPT,auto
NTIM=2  !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-LB-geo,txt
(8(F9.6))
*VREAD,A_1_Z(1),th-266-LB-geo-v,txt
(8(F9.6))

/Title,Load Case: LBS-BEC, Full Non-linear,
Final PT Mesh
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,20,200,5,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*1.175
F,master_node,Fz,(A_1_Z(itim)*1.12+1)*(mass+
massm_z)*g

SOLVE
SAVE
*ENDDO
FINISH
/out
```

Solve-TH-LB

```
/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,PNNL-AY-2D-NL-BEC-LBS,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-266-LB-geo,txt
(8(F9.6))
*VREAD,A_1_Z(1),th-266-LB-geo-v,txt
(8(F9.6))

/Title,Load Case: LBS-BEC, Full Non-linear,
Final PT Mesh
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,20,200,5,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*1.175
F,master_node,Fz,(A_1_Z(itim)*1.12+1)*(mass+
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,21,1.97                       ! 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
```

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 D is 300GB Maxtor
 Volume Serial Number is 5851-C3F2

 Directory of D:\Bruce\PNNL\PNNL-2D-NL-AY-LBS-BEC-Siesmic

12/21/2005  07:56 AM    <DIR>          .
12/21/2005  07:56 AM    <DIR>          ..
12/10/2005  12:00 PM           535,476 Accel-ct-0.out
12/10/2005  12:06 PM           535,728 Accel-ct-135.out
12/10/2005  12:08 PM           535,728 Accel-ct-180.out
12/10/2005  12:02 PM           535,476 Accel-ct-45.out
12/10/2005  12:04 PM           535,728 Accel-ct-90.out
12/10/2005  12:09 PM           277,176 Accel-ct.out
12/10/2005  12:11 PM           535,728 Accel-PT-0.out
12/10/2005  12:17 PM           535,728 Accel-PT-135.out
12/10/2005  12:19 PM           535,728 Accel-PT-180.out
12/10/2005  12:13 PM           535,728 Accel-PT-45.out
12/10/2005  12:15 PM           535,728 Accel-PT-90.out
12/10/2005  12:21 PM           535,728 Accel-SOil.out
09/27/2005  03:47 PM                99 All-Forces.txt
09/02/2005  02:01 PM             5,766 Bolts-Friction.txt
06/09/2005  01:59 PM               262 Boundary.txt
10/31/2005  12:24 PM               189 Contact-AY.txt
12/01/2005  09:11 AM               586 Contact-Footing.txt
09/02/2005  09:28 AM               604 Contact-Insul.txt
09/02/2005  09:51 AM               602 Contact-J-Bolts.txt
09/09/2005  09:59 AM               608 Contact-Primary.txt
09/15/2005  11:50 AM               742 Contact-Soil.txt
09/06/2005  11:16 AM               630 Contact-Waste-AY.txt
09/22/2005  04:05 PM             8,608 Far-Soil.txt
11/03/2005  10:01 AM             2,046 file.bat
11/03/2005  10:01 AM                68 file.err
11/03/2005  10:01 AM               456 file.log
12/21/2005  07:56 AM                 0 files.txt
10/13/2005  06:54 AM               562 Fix-Soil.txt
12/14/2005  10:59 AM            10,342 Footing-Cont_max.OUT
12/14/2005  10:59 AM         4,144,248 Footing-Cont_th.OUT
04/06/2005  08:24 AM               894 Force-c.txt
11/07/2005  03:40 PM             4,996 Force-c_108amax.OUT
11/07/2005  03:40 PM         2,770,500 Force-c_108ath.OUT
11/07/2005  12:45 PM            14,716 Force-c_108max.OUT
11/07/2005  12:45 PM         6,216,180 Force-c_108th.OUT
11/07/2005  03:48 PM             4,996 Force-c_117amax.OUT
11/07/2005  03:48 PM         2,770,500 Force-c_117ath.OUT
11/07/2005  12:54 PM            14,716 Force-c_117max.OUT
11/07/2005  12:54 PM         6,216,180 Force-c_117th.OUT
11/07/2005  03:57 PM             4,996 Force-c_126amax.OUT
11/07/2005  03:57 PM         2,770,500 Force-c_126ath.OUT
11/07/2005  01:02 PM            14,716 Force-c_126max.OUT
11/07/2005  01:02 PM         6,216,180 Force-c_126th.OUT
11/07/2005  04:05 PM             4,996 Force-c_135amax.OUT
11/07/2005  04:05 PM         2,770,500 Force-c_135ath.OUT
11/07/2005  01:11 PM            14,716 Force-c_135max.OUT
11/07/2005  01:11 PM         6,216,180 Force-c_135th.OUT
11/07/2005  04:14 PM             4,996 Force-c_144amax.OUT
11/07/2005  04:14 PM         2,770,500 Force-c_144ath.OUT
11/07/2005  01:20 PM            14,716 Force-c_144max.OUT
11/07/2005  01:20 PM         6,216,180 Force-c_144th.OUT
11/07/2005  04:22 PM             4,996 Force-c_153amax.OUT
11/07/2005  04:23 PM         2,770,500 Force-c_153ath.OUT
11/07/2005  01:29 PM            14,716 Force-c_153max.OUT
11/07/2005  01:29 PM         6,216,180 Force-c_153th.OUT
11/07/2005  04:32 PM             4,996 Force-c_162amax.OUT
11/07/2005  04:32 PM         2,770,500 Force-c_162ath.OUT
11/07/2005  01:38 PM            14,716 Force-c_162max.OUT
11/07/2005  01:38 PM         6,216,180 Force-c_162th.OUT
11/07/2005  04:40 PM             4,996 Force-c_171amax.OUT
11/07/2005  04:40 PM         2,770,500 Force-c_171ath.OUT
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11/07/2005  01:47 PM            14,716 Force-c_171max.OUT
11/07/2005  01:47 PM         6,216,180 Force-c_171th.OUT
11/07/2005  04:49 PM             4,996 Force-c_180amax.OUT
11/07/2005  04:49 PM         2,770,500 Force-c_180ath.OUT
11/07/2005  01:56 PM            14,716 Force-c_180max.OUT
11/07/2005  01:56 PM         6,216,180 Force-c_180th.OUT
11/07/2005  02:14 PM             4,996 Force-c_18amax.OUT
11/07/2005  02:14 PM         2,770,500 Force-c_18ath.OUT
11/07/2005  11:17 AM            14,716 Force-c_18max.OUT
11/07/2005  11:17 AM         6,216,180 Force-c_18th.OUT
11/07/2005  02:22 PM             4,996 Force-c_27amax.OUT
11/07/2005  02:22 PM         2,770,500 Force-c_27ath.OUT
11/07/2005  11:25 AM            14,716 Force-c_27max.OUT
11/07/2005  11:25 AM         6,216,180 Force-c_27th.OUT
11/07/2005  02:30 PM             4,996 Force-c_36amax.OUT
11/07/2005  02:30 PM         2,770,500 Force-c_36ath.OUT
11/07/2005  11:34 AM            14,716 Force-c_36max.OUT
11/07/2005  11:34 AM         6,216,180 Force-c_36th.OUT
11/07/2005  02:39 PM             4,996 Force-c_45amax.OUT
11/07/2005  02:39 PM         2,770,500 Force-c_45ath.OUT
11/07/2005  11:43 AM            14,716 Force-c_45max.OUT
11/07/2005  11:43 AM         6,216,180 Force-c_45th.OUT
11/07/2005  02:48 PM             4,996 Force-c_54amax.OUT
11/07/2005  02:48 PM         2,770,500 Force-c_54ath.OUT
11/07/2005  11:52 AM            14,716 Force-c_54max.OUT
11/07/2005  11:52 AM         6,216,180 Force-c_54th.OUT
11/07/2005  02:56 PM             4,996 Force-c_63amax.OUT
11/07/2005  02:56 PM         2,770,500 Force-c_63ath.OUT
11/07/2005  12:01 PM            14,716 Force-c_63max.OUT
11/07/2005  12:01 PM         6,216,180 Force-c_63th.OUT
11/07/2005  03:05 PM             4,996 Force-c_72amax.OUT
11/07/2005  03:05 PM         2,770,500 Force-c_72ath.OUT
11/07/2005  12:10 PM            14,716 Force-c_72max.OUT
11/07/2005  12:10 PM         6,216,180 Force-c_72th.OUT
11/07/2005  03:14 PM             4,996 Force-c_81amax.OUT
11/07/2005  03:14 PM         2,770,500 Force-c_81ath.OUT
11/07/2005  12:18 PM            14,716 Force-c_81max.OUT
11/07/2005  12:18 PM         6,216,180 Force-c_81th.OUT
11/07/2005  03:22 PM             4,996 Force-c_90amax.OUT
11/07/2005  03:22 PM         2,770,500 Force-c_90ath.OUT
11/07/2005  12:27 PM            14,716 Force-c_90max.OUT
11/07/2005  12:27 PM         6,216,180 Force-c_90th.OUT
11/07/2005  03:31 PM             4,996 Force-c_99amax.OUT
11/07/2005  03:31 PM         2,770,500 Force-c_99ath.OUT
11/07/2005  12:36 PM            14,716 Force-c_99max.OUT
11/07/2005  12:36 PM         6,216,180 Force-c_99th.OUT
11/07/2005  02:05 PM             4,996 Force-c_9amax.OUT
11/07/2005  02:05 PM         2,770,628 Force-c_9ath.OUT
11/07/2005  11:08 AM            14,716 Force-c_9max.OUT
11/07/2005  11:08 AM         6,216,308 Force-c_9th.OUT
11/08/2005  02:36 AM         2,542,344 Force-jb_r10-th.OUT
11/08/2005  02:36 AM             5,239 Force-jb_r10_max.OUT
11/08/2005  02:36 AM         2,542,344 Force-jb_r11-th.OUT
11/08/2005  02:36 AM             5,239 Force-jb_r11_max.OUT
11/08/2005  02:31 AM         2,542,472 Force-jb_r2-th.OUT
11/08/2005  02:31 AM             5,239 Force-jb_r2_max.OUT
11/08/2005  02:31 AM         2,542,344 Force-jb_r3-th.OUT
11/08/2005  02:31 AM             5,239 Force-jb_r3_max.OUT
11/08/2005  02:32 AM         2,542,344 Force-jb_r4-th.OUT
11/08/2005  02:32 AM             5,239 Force-jb_r4_max.OUT
11/08/2005  02:32 AM         2,542,344 Force-jb_r5-th.OUT
11/08/2005  02:32 AM             5,239 Force-jb_r5_max.OUT
11/08/2005  02:33 AM         2,542,344 Force-jb_r6-th.OUT
11/08/2005  02:33 AM             5,239 Force-jb_r6_max.OUT
11/08/2005  02:34 AM         2,542,344 Force-jb_r7-th.OUT
11/08/2005  02:34 AM             5,239 Force-jb_r7_max.OUT
11/08/2005  02:34 AM         2,542,344 Force-jb_r8-th.OUT
11/08/2005  02:34 AM             5,239 Force-jb_r8_max.OUT
11/08/2005  02:35 AM         2,542,344 Force-jb_r9-th.OUT
11/08/2005  02:35 AM             5,239 Force-jb_r9_max.OUT
06/20/2005  10:53 AM               661 Force-j_bolt.txt
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11/05/2005  01:53 PM             2,728 Insul-Cont_108max.OUT
11/05/2005  01:53 PM         1,200,544 Insul-Cont_108th.OUT
11/05/2005  01:56 PM             2,728 Insul-Cont_117max.OUT
11/05/2005  01:56 PM         1,200,544 Insul-Cont_117th.OUT
11/05/2005  01:58 PM             2,728 Insul-Cont_126max.OUT
11/05/2005  01:58 PM         1,200,544 Insul-Cont_126th.OUT
11/05/2005  02:01 PM             2,728 Insul-Cont_135max.OUT
11/05/2005  02:01 PM         1,200,544 Insul-Cont_135th.OUT
11/05/2005  02:04 PM             2,728 Insul-Cont_144max.OUT
11/05/2005  02:04 PM         1,200,544 Insul-Cont_144th.OUT
11/05/2005  02:06 PM             2,728 Insul-Cont_153max.OUT
11/05/2005  02:06 PM         1,200,544 Insul-Cont_153th.OUT
11/05/2005  02:10 PM             2,728 Insul-Cont_162max.OUT
11/05/2005  02:10 PM         1,200,544 Insul-Cont_162th.OUT
11/05/2005  02:12 PM             2,728 Insul-Cont_171max.OUT
11/05/2005  02:12 PM         1,200,544 Insul-Cont_171th.OUT
11/05/2005  02:15 PM             2,728 Insul-Cont_180max.OUT
11/05/2005  02:15 PM         1,200,544 Insul-Cont_180th.OUT
11/05/2005  01:25 PM             2,728 Insul-Cont_18max.OUT
11/05/2005  01:25 PM         1,200,544 Insul-Cont_18th.OUT
11/05/2005  01:27 PM             2,728 Insul-Cont_27max.OUT
11/05/2005  01:27 PM         1,200,544 Insul-Cont_27th.OUT
11/05/2005  01:30 PM             2,728 Insul-Cont_36max.OUT
11/05/2005  01:30 PM         1,200,544 Insul-Cont_36th.OUT
11/05/2005  01:33 PM             2,728 Insul-Cont_45max.OUT
11/05/2005  01:33 PM         1,200,544 Insul-Cont_45th.OUT
11/05/2005  01:36 PM             2,728 Insul-Cont_54max.OUT
11/05/2005  01:36 PM         1,200,544 Insul-Cont_54th.OUT
11/05/2005  01:39 PM             2,728 Insul-Cont_63max.OUT
11/05/2005  01:39 PM         1,200,544 Insul-Cont_63th.OUT
11/05/2005  01:42 PM             2,728 Insul-Cont_72max.OUT
11/05/2005  01:42 PM         1,200,544 Insul-Cont_72th.OUT
11/05/2005  01:44 PM             2,728 Insul-Cont_81max.OUT
11/05/2005  01:44 PM         1,200,544 Insul-Cont_81th.OUT
11/05/2005  01:47 PM             2,728 Insul-Cont_90max.OUT
11/05/2005  01:47 PM         1,200,544 Insul-Cont_90th.OUT
11/05/2005  01:50 PM             2,728 Insul-Cont_99max.OUT
11/05/2005  01:50 PM         1,200,544 Insul-Cont_99th.OUT
11/05/2005  01:22 PM             2,728 Insul-Cont_9max.OUT
11/05/2005  01:22 PM         1,200,672 Insul-Cont_9th.OUT
09/01/2005  10:27 AM             1,664 Insulate.txt
10/13/2005  08:28 AM             4,031 interface-gap1.txt
09/09/2005  09:34 AM             2,616 interface1.txt
11/05/2005  02:59 PM             3,052 J-Bolt-Cont_108max.OUT
11/05/2005  02:59 PM         1,350,612 J-Bolt-Cont_108th.OUT
11/05/2005  03:02 PM             3,052 J-Bolt-Cont_117max.OUT
11/05/2005  03:02 PM         1,350,612 J-Bolt-Cont_117th.OUT
11/05/2005  03:06 PM             3,052 J-Bolt-Cont_126max.OUT
11/05/2005  03:06 PM         1,350,612 J-Bolt-Cont_126th.OUT
11/05/2005  03:10 PM             3,052 J-Bolt-Cont_135max.OUT
11/05/2005  03:10 PM         1,350,612 J-Bolt-Cont_135th.OUT
11/05/2005  03:13 PM             3,052 J-Bolt-Cont_144max.OUT
11/05/2005  03:13 PM         1,350,612 J-Bolt-Cont_144th.OUT
11/05/2005  03:17 PM             3,052 J-Bolt-Cont_153max.OUT
11/05/2005  03:17 PM         1,350,612 J-Bolt-Cont_153th.OUT
11/05/2005  03:21 PM             3,052 J-Bolt-Cont_162max.OUT
11/05/2005  03:21 PM         1,350,612 J-Bolt-Cont_162th.OUT
11/05/2005  03:25 PM             3,052 J-Bolt-Cont_171max.OUT
11/05/2005  03:25 PM         1,350,612 J-Bolt-Cont_171th.OUT
11/05/2005  03:28 PM             3,052 J-Bolt-Cont_180max.OUT
11/05/2005  03:28 PM         1,350,612 J-Bolt-Cont_180th.OUT
11/05/2005  02:22 PM             3,052 J-Bolt-Cont_18max.OUT
11/05/2005  02:22 PM         1,350,612 J-Bolt-Cont_18th.OUT
11/05/2005  02:26 PM             3,052 J-Bolt-Cont_27max.OUT
11/05/2005  02:26 PM         1,350,612 J-Bolt-Cont_27th.OUT
11/05/2005  02:30 PM             3,052 J-Bolt-Cont_36max.OUT
11/05/2005  02:30 PM         1,350,612 J-Bolt-Cont_36th.OUT
11/05/2005  02:33 PM             3,052 J-Bolt-Cont_45max.OUT
11/05/2005  02:33 PM         1,350,612 J-Bolt-Cont_45th.OUT
11/05/2005  02:37 PM             3,052 J-Bolt-Cont_54max.OUT
11/05/2005  02:37 PM         1,350,612 J-Bolt-Cont_54th.OUT
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11/05/2005  02:40 PM             3,052 J-Bolt-Cont_63max.OUT
11/05/2005  02:40 PM         1,350,612 J-Bolt-Cont_63th.OUT
11/05/2005  02:44 PM             3,052 J-Bolt-Cont_72max.OUT
11/05/2005  02:44 PM         1,350,612 J-Bolt-Cont_72th.OUT
11/05/2005  02:48 PM             3,052 J-Bolt-Cont_81max.OUT
11/05/2005  02:48 PM         1,350,612 J-Bolt-Cont_81th.OUT
11/05/2005  02:51 PM             3,052 J-Bolt-Cont_90max.OUT
11/05/2005  02:52 PM         1,350,612 J-Bolt-Cont_90th.OUT
11/05/2005  02:55 PM             3,052 J-Bolt-Cont_99max.OUT
11/05/2005  02:55 PM         1,350,612 J-Bolt-Cont_99th.OUT
11/05/2005  02:19 PM             3,052 J-Bolt-Cont_9max.OUT
11/05/2005  02:19 PM         1,350,740 J-Bolt-Cont_9th.OUT
06/01/2005  01:17 PM             1,708 Liner.txt
05/02/2005  02:19 PM               667 live_load.txt
11/02/2005  09:25 AM             6,183 Near-Soil-1.txt
04/20/2005  01:14 PM               508 outer-spar.txt
11/05/2005  01:17 PM             2,998 PNNL-2D-LBS-BEC.BCS
11/05/2005  01:17 PM        55,574,528 PNNL-2D-LBS-BEC.db
11/05/2005  01:17 PM        12,386,304 PNNL-2D-LBS-BEC.emat
12/14/2005  10:57 AM            52,007 PNNL-2D-LBS-BEC.err
11/05/2005  01:17 PM       102,563,840 PNNL-2D-LBS-BEC.esav
11/05/2005  01:17 PM        27,918,336 PNNL-2D-LBS-BEC.full
11/05/2005  01:16 PM       298,920,099 PNNL-2D-LBS-BEC.ldhi
12/14/2005  02:47 PM             2,524 PNNL-2D-LBS-BEC.log
11/05/2005  01:17 PM           189,791 PNNL-2D-LBS-BEC.mntr
11/05/2005  01:16 PM       102,563,840 PNNL-2D-LBS-BEC.osav
11/05/2005  01:17 PM             1,507 PNNL-2D-LBS-BEC.PVTS
11/05/2005  01:17 PM       103,546,880 PNNL-2D-LBS-BEC.r001
11/03/2005  10:02 AM        35,782,656 PNNL-2D-LBS-BEC.rdb
11/05/2005  01:17 PM     4,294,967,296 PNNL-2D-LBS-BEC.rst
11/03/2005  08:56 PM     4,294,967,296 PNNL-2D-LBS-BEC.rst02
11/04/2005  02:31 AM     4,294,967,296 PNNL-2D-LBS-BEC.rst03
11/04/2005  08:06 AM     4,294,967,296 PNNL-2D-LBS-BEC.rst04
11/04/2005  01:47 PM     4,294,967,296 PNNL-2D-LBS-BEC.rst05
11/04/2005  07:36 PM     4,294,967,296 PNNL-2D-LBS-BEC.rst06
11/05/2005  01:29 AM     4,294,967,296 PNNL-2D-LBS-BEC.rst07
11/05/2005  07:34 AM     4,294,967,296 PNNL-2D-LBS-BEC.rst08
11/05/2005  01:17 PM     4,002,217,984 PNNL-2D-LBS-BEC.rst09
11/05/2005  01:15 PM                97 PNNL-2D-LBS-BEC.stat
11/05/2005  01:17 PM         3,139,708 PNNL-AY-2D-NL-BEC-LBS.out
12/10/2005  11:41 AM                80 post-waste.txt
11/05/2005  04:02 PM             2,728 Primary-Cont_108max.OUT
11/05/2005  04:02 PM         1,200,544 Primary-Cont_108th.OUT
11/05/2005  04:05 PM             2,728 Primary-Cont_117max.OUT
11/05/2005  04:05 PM         1,200,544 Primary-Cont_117th.OUT
11/05/2005  04:08 PM             2,728 Primary-Cont_126max.OUT
11/05/2005  04:08 PM         1,200,544 Primary-Cont_126th.OUT
11/05/2005  04:11 PM             2,728 Primary-Cont_135max.OUT
11/05/2005  04:11 PM         1,200,544 Primary-Cont_135th.OUT
11/05/2005  04:14 PM             2,728 Primary-Cont_144max.OUT
11/05/2005  04:14 PM         1,200,544 Primary-Cont_144th.OUT
11/05/2005  04:17 PM             2,728 Primary-Cont_153max.OUT
11/05/2005  04:17 PM         1,200,544 Primary-Cont_153th.OUT
11/05/2005  04:20 PM             2,728 Primary-Cont_162max.OUT
11/05/2005  04:20 PM         1,200,544 Primary-Cont_162th.OUT
11/05/2005  04:23 PM             2,728 Primary-Cont_171max.OUT
11/05/2005  04:23 PM         1,200,544 Primary-Cont_171th.OUT
11/05/2005  04:25 PM             2,728 Primary-Cont_180max.OUT
11/05/2005  04:25 PM         1,200,544 Primary-Cont_180th.OUT
11/05/2005  03:33 PM             2,728 Primary-Cont_18max.OUT
11/05/2005  03:33 PM         1,200,544 Primary-Cont_18th.OUT
11/05/2005  03:36 PM             2,728 Primary-Cont_27max.OUT
11/05/2005  03:36 PM         1,200,544 Primary-Cont_27th.OUT
11/05/2005  03:39 PM             2,728 Primary-Cont_36max.OUT
11/05/2005  03:39 PM         1,200,544 Primary-Cont_36th.OUT
11/05/2005  03:41 PM             2,728 Primary-Cont_45max.OUT
11/05/2005  03:41 PM         1,200,544 Primary-Cont_45th.OUT
11/05/2005  03:44 PM             2,728 Primary-Cont_54max.OUT
11/05/2005  03:44 PM         1,200,544 Primary-Cont_54th.OUT
11/05/2005  03:47 PM             2,728 Primary-Cont_63max.OUT
11/05/2005  03:47 PM         1,200,544 Primary-Cont_63th.OUT
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11/05/2005  03:51 PM             2,728 Primary-Cont_72max.OUT
11/05/2005  03:51 PM         1,200,544 Primary-Cont_72th.OUT
11/05/2005  03:53 PM             2,728 Primary-Cont_81max.OUT
11/05/2005  03:53 PM         1,200,544 Primary-Cont_81th.OUT
11/05/2005  03:56 PM             2,728 Primary-Cont_90max.OUT
11/05/2005  03:56 PM         1,200,544 Primary-Cont_90th.OUT
11/05/2005  03:59 PM             2,728 Primary-Cont_99max.OUT
11/05/2005  03:59 PM         1,200,544 Primary-Cont_99th.OUT
11/05/2005  03:31 PM             2,728 Primary-Cont_9max.OUT
11/05/2005  03:31 PM         1,200,672 Primary-Cont_9th.OUT
10/31/2005  12:18 PM             5,549 Primary-Props-AY.txt
09/27/2005  03:52 PM             1,538 Primary.txt
11/03/2005  10:01 AM           341,370 QA.out
12/10/2005  12:00 PM            47,121 RS-ct-0.out
12/10/2005  12:06 PM            47,121 RS-ct-135.out
12/10/2005  12:08 PM            47,121 RS-ct-180.out
12/10/2005  12:02 PM            47,121 RS-ct-45.out
12/10/2005  12:04 PM            47,121 RS-ct-90.out
12/10/2005  12:09 PM            27,591 RS-ct.out
12/10/2005  12:11 PM            47,121 RS-PT-0.out
12/10/2005  12:17 PM            47,121 RS-PT-135.out
12/10/2005  12:19 PM            47,121 RS-PT-180.out
12/10/2005  12:13 PM            47,121 RS-PT-45.out
12/10/2005  12:15 PM            47,121 RS-PT-90.out
12/10/2005  12:21 PM            47,121 RS-SOil.out
10/31/2005  10:31 AM             1,108 RS_FREQ.txt
11/05/2005  09:00 PM         1,146,825 Run-Tank-Out.out
09/19/2005  09:37 AM               145 run-tank.bat
11/02/2005  12:28 PM             1,958 Run-Tank.txt
12/14/2005  10:57 AM                 0 scratch.hlp
02/11/2005  01:22 PM             1,053 Slave.txt
11/05/2005  05:46 PM             9,896 Soil-Contact_108max.OUT
11/05/2005  05:46 PM         4,151,880 Soil-Contact_108th.OUT
11/05/2005  05:53 PM             9,896 Soil-Contact_117max.OUT
11/05/2005  05:53 PM         4,151,880 Soil-Contact_117th.OUT
11/05/2005  05:59 PM             9,896 Soil-Contact_126max.OUT
11/05/2005  05:59 PM         4,151,880 Soil-Contact_126th.OUT
11/05/2005  06:06 PM             9,896 Soil-Contact_135max.OUT
11/05/2005  06:06 PM         4,151,880 Soil-Contact_135th.OUT
11/05/2005  06:13 PM             9,896 Soil-Contact_144max.OUT
11/05/2005  06:13 PM         4,151,880 Soil-Contact_144th.OUT
11/05/2005  06:20 PM             9,896 Soil-Contact_153max.OUT
11/05/2005  06:20 PM         4,151,880 Soil-Contact_153th.OUT
11/05/2005  06:27 PM             9,896 Soil-Contact_162max.OUT
11/05/2005  06:27 PM         4,151,880 Soil-Contact_162th.OUT
11/05/2005  06:33 PM             9,896 Soil-Contact_171max.OUT
11/05/2005  06:33 PM         4,151,880 Soil-Contact_171th.OUT
11/05/2005  06:40 PM             9,896 Soil-Contact_180max.OUT
11/05/2005  06:40 PM         4,151,880 Soil-Contact_180th.OUT
11/05/2005  04:39 PM             9,896 Soil-Contact_18max.OUT
11/05/2005  04:39 PM         4,151,880 Soil-Contact_18th.OUT
11/05/2005  04:45 PM             9,896 Soil-Contact_27max.OUT
11/05/2005  04:45 PM         4,151,880 Soil-Contact_27th.OUT
11/05/2005  04:52 PM             9,896 Soil-Contact_36max.OUT
11/05/2005  04:52 PM         4,151,880 Soil-Contact_36th.OUT
11/05/2005  04:59 PM             9,896 Soil-Contact_45max.OUT
11/05/2005  04:59 PM         4,151,880 Soil-Contact_45th.OUT
11/05/2005  05:05 PM             9,896 Soil-Contact_54max.OUT
11/05/2005  05:05 PM         4,151,880 Soil-Contact_54th.OUT
11/05/2005  05:12 PM             9,896 Soil-Contact_63max.OUT
11/05/2005  05:12 PM         4,151,880 Soil-Contact_63th.OUT
11/05/2005  05:19 PM             9,896 Soil-Contact_72max.OUT
11/05/2005  05:19 PM         4,151,880 Soil-Contact_72th.OUT
11/05/2005  05:26 PM             9,896 Soil-Contact_81max.OUT
11/05/2005  05:26 PM         4,151,880 Soil-Contact_81th.OUT
11/05/2005  05:33 PM             9,896 Soil-Contact_90max.OUT
11/05/2005  05:33 PM         4,151,880 Soil-Contact_90th.OUT
11/05/2005  05:39 PM             9,896 Soil-Contact_99max.OUT
11/05/2005  05:39 PM         4,151,880 Soil-Contact_99th.OUT
11/05/2005  04:32 PM             9,896 Soil-Contact_9max.OUT
11/05/2005  04:32 PM         4,152,008 Soil-Contact_9th.OUT
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09/20/2005  02:46 PM            4,106 Soil-Prop-LB-Geo.txt
11/02/2005  09:26 AM            1,900 Solve-TH-LB.txt
11/28/2005  02:23 PM              347 spectra-all.txt
11/28/2005  02:16 PM            3,483 spectra-conc-0.txt
12/09/2005  07:53 AM            3,512 spectra-conc-135.txt
12/09/2005  07:53 AM            3,512 spectra-conc-180.txt
11/28/2005  02:18 PM            3,560 spectra-conc-45.txt
12/09/2005  07:53 AM            3,440 spectra-conc-90.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
10/31/2005  10:17 AM            3,551 spectra-primary-135.txt
10/31/2005  11:02 AM            3,566 spectra-primary-180.txt
10/31/2005  10:16 AM            3,479 spectra-primary-45.txt
10/31/2005  10:16 AM            3,479 spectra-primary-90.txt
10/31/2005  11:37 AM            3,608 spectra-soil.txt
06/20/2005  09:04 AM              647 spectra-wall.txt
06/20/2005  08:52 AM              679 spectra-waste.txt
09/02/2005  08:51 AM              707 strain-compb.txt
09/02/2005  08:51 AM              705 strain-compm.txt
09/02/2005  08:50 AM              720 strain-compt.txt
11/08/2005  05:53 AM            6,110 Strain-lb_108max-b.OUT
11/08/2005  05:53 AM        2,551,312 Strain-lb_108th-b.OUT
11/08/2005  05:56 AM            6,110 Strain-lb_117max-b.OUT
11/08/2005  05:56 AM        2,551,312 Strain-lb_117th-b.OUT
11/08/2005  05:59 AM            6,110 Strain-lb_126max-b.OUT
11/08/2005  05:59 AM        2,551,312 Strain-lb_126th-b.OUT
11/08/2005  06:03 AM            6,110 Strain-lb_135max-b.OUT
11/08/2005  06:03 AM        2,551,312 Strain-lb_135th-b.OUT
11/08/2005  06:07 AM            6,110 Strain-lb_144max-b.OUT
11/08/2005  06:07 AM        2,551,312 Strain-lb_144th-b.OUT
11/08/2005  06:11 AM            6,110 Strain-lb_153max-b.OUT
11/08/2005  06:11 AM        2,551,312 Strain-lb_153th-b.OUT
11/08/2005  06:15 AM            6,110 Strain-lb_162max-b.OUT
11/08/2005  06:15 AM        2,551,312 Strain-lb_162th-b.OUT
11/08/2005  06:19 AM            6,110 Strain-lb_171max-b.OUT
11/08/2005  06:19 AM        2,551,312 Strain-lb_171th-b.OUT
11/08/2005  06:23 AM            6,110 Strain-lb_180max-b.OUT
11/08/2005  06:23 AM        2,551,312 Strain-lb_180th-b.OUT
11/08/2005  05:15 AM            6,110 Strain-lb_18max-b.OUT
11/08/2005  05:15 AM        2,551,312 Strain-lb_18th-b.OUT
11/08/2005  05:18 AM            6,110 Strain-lb_27max-b.OUT
11/08/2005  05:18 AM        2,551,312 Strain-lb_27th-b.OUT
11/08/2005  05:21 AM            6,110 Strain-lb_36max-b.OUT
11/08/2005  05:21 AM        2,551,312 Strain-lb_36th-b.OUT
11/08/2005  05:26 AM            6,110 Strain-lb_45max-b.OUT
11/08/2005  05:26 AM        2,551,312 Strain-lb_45th-b.OUT
11/08/2005  05:30 AM            6,110 Strain-lb_54max-b.OUT
11/08/2005  05:30 AM        2,551,312 Strain-lb_54th-b.OUT
11/08/2005  05:34 AM            6,110 Strain-lb_63max-b.OUT
11/08/2005  05:34 AM        2,551,312 Strain-lb_63th-b.OUT
11/08/2005  05:37 AM            6,110 Strain-lb_72max-b.OUT
11/08/2005  05:37 AM        2,551,312 Strain-lb_72th-b.OUT
11/08/2005  05:42 AM            6,110 Strain-lb_81max-b.OUT
11/08/2005  05:42 AM        2,551,312 Strain-lb_81th-b.OUT
11/08/2005  05:45 AM            6,110 Strain-lb_90max-b.OUT
11/08/2005  05:45 AM        2,551,312 Strain-lb_90th-b.OUT
11/08/2005  05:49 AM            6,110 Strain-lb_99max-b.OUT
11/08/2005  05:49 AM        2,551,312 Strain-lb_99th-b.OUT
11/08/2005  05:11 AM            6,110 Strain-lb_9max-b.OUT
11/08/2005  05:11 AM        2,551,440 Strain-lb_9th-b.OUT
09/02/2005  08:52 AM              544 Strain-Liner.txt
11/08/2005  04:37 AM            6,110 Strain-lm_108max-m.OUT
11/08/2005  04:37 AM        2,551,312 Strain-lm_108th-m.OUT
11/08/2005  04:40 AM            6,110 Strain-lm_117max-m.OUT
11/08/2005  04:40 AM        2,551,312 Strain-lm_117th-m.OUT
11/08/2005  04:44 AM            6,110 Strain-lm_126max-m.OUT
11/08/2005  04:44 AM        2,551,312 Strain-lm_126th-m.OUT
11/08/2005  04:48 AM            6,110 Strain-lm_135max-m.OUT
11/08/2005  04:48 AM        2,551,312 Strain-lm_135th-m.OUT
11/08/2005  04:52 AM            6,110 Strain-lm_144max-m.OUT
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11/08/2005  04:52 AM         2,551,312 Strain-lm_144th-m.OUT
11/08/2005  04:56 AM             6,110 Strain-lm_153max-m.OUT
11/08/2005  04:56 AM         2,551,312 Strain-lm_153th-m.OUT
11/08/2005  05:00 AM             6,110 Strain-lm_162max-m.OUT
11/08/2005  05:00 AM         2,551,312 Strain-lm_162th-m.OUT
11/08/2005  05:03 AM             6,110 Strain-lm_171max-m.OUT
11/08/2005  05:03 AM         2,551,312 Strain-lm_171th-m.OUT
11/08/2005  05:07 AM             6,110 Strain-lm_180max-m.OUT
11/08/2005  05:07 AM         2,551,312 Strain-lm_180th-m.OUT
11/08/2005  03:59 AM             6,110 Strain-lm_18max-m.OUT
11/08/2005  03:59 AM         2,551,312 Strain-lm_18th-m.OUT
11/08/2005  04:02 AM             6,110 Strain-lm_27max-m.OUT
11/08/2005  04:02 AM         2,551,312 Strain-lm_27th-m.OUT
11/08/2005  04:06 AM             6,110 Strain-lm_36max-m.OUT
11/08/2005  04:06 AM         2,551,312 Strain-lm_36th-m.OUT
11/08/2005  04:10 AM             6,110 Strain-lm_45max-m.OUT
11/08/2005  04:10 AM         2,551,312 Strain-lm_45th-m.OUT
11/08/2005  04:14 AM             6,110 Strain-lm_54max-m.OUT
11/08/2005  04:14 AM         2,551,312 Strain-lm_54th-m.OUT
11/08/2005  04:18 AM             6,110 Strain-lm_63max-m.OUT
11/08/2005  04:18 AM         2,551,312 Strain-lm_63th-m.OUT
11/08/2005  04:22 AM             6,110 Strain-lm_72max-m.OUT
11/08/2005  04:22 AM         2,551,312 Strain-lm_72th-m.OUT
11/08/2005  04:26 AM             6,110 Strain-lm_81max-m.OUT
11/08/2005  04:26 AM         2,551,312 Strain-lm_81th-m.OUT
11/08/2005  04:30 AM             6,110 Strain-lm_90max-m.OUT
11/08/2005  04:30 AM         2,551,312 Strain-lm_90th-m.OUT
11/08/2005  04:33 AM             6,110 Strain-lm_99max-m.OUT
11/08/2005  04:33 AM         2,551,312 Strain-lm_99th-m.OUT
11/08/2005  03:55 AM             6,110 Strain-lm_9max-m.OUT
11/08/2005  03:55 AM         2,551,440 Strain-lm_9th-m.OUT
11/08/2005  03:21 AM             6,110 Strain-lt_108max-t.OUT
11/08/2005  03:21 AM         2,551,312 Strain-lt_108th-t.OUT
11/08/2005  03:25 AM             6,110 Strain-lt_117max-t.OUT
11/08/2005  03:25 AM         2,551,312 Strain-lt_117th-t.OUT
11/08/2005  03:28 AM             6,110 Strain-lt_126max-t.OUT
11/08/2005  03:28 AM         2,551,312 Strain-lt_126th-t.OUT
11/08/2005  03:32 AM             6,110 Strain-lt_135max-t.OUT
11/08/2005  03:32 AM         2,551,312 Strain-lt_135th-t.OUT
11/08/2005  03:36 AM             6,110 Strain-lt_144max-t.OUT
11/08/2005  03:36 AM         2,551,312 Strain-lt_144th-t.OUT
11/08/2005  03:40 AM             6,110 Strain-lt_153max-t.OUT
11/08/2005  03:40 AM         2,551,312 Strain-lt_153th-t.OUT
11/08/2005  03:44 AM             6,110 Strain-lt_162max-t.OUT
11/08/2005  03:44 AM         2,551,312 Strain-lt_162th-t.OUT
11/08/2005  03:48 AM             6,110 Strain-lt_171max-t.OUT
11/08/2005  03:48 AM         2,551,312 Strain-lt_171th-t.OUT
11/08/2005  03:52 AM             6,110 Strain-lt_180max-t.OUT
11/08/2005  03:52 AM         2,551,312 Strain-lt_180th-t.OUT
11/08/2005  02:43 AM             6,110 Strain-lt_18max-t.OUT
11/08/2005  02:44 AM         2,551,312 Strain-lt_18th-t.OUT
11/08/2005  02:47 AM             6,110 Strain-lt_27max-t.OUT
11/08/2005  02:47 AM         2,551,312 Strain-lt_27th-t.OUT
11/08/2005  02:50 AM             6,110 Strain-lt_36max-t.OUT
11/08/2005  02:50 AM         2,551,312 Strain-lt_36th-t.OUT
11/08/2005  02:54 AM             6,110 Strain-lt_45max-t.OUT
11/08/2005  02:55 AM         2,551,312 Strain-lt_45th-t.OUT
11/08/2005  02:59 AM             6,110 Strain-lt_54max-t.OUT
11/08/2005  02:59 AM         2,551,312 Strain-lt_54th-t.OUT
11/08/2005  03:02 AM             6,110 Strain-lt_63max-t.OUT
11/08/2005  03:02 AM         2,551,312 Strain-lt_63th-t.OUT
11/08/2005  03:06 AM             6,110 Strain-lt_72max-t.OUT
11/08/2005  03:06 AM         2,551,312 Strain-lt_72th-t.OUT
11/08/2005  03:10 AM             6,110 Strain-lt_81max-t.OUT
11/08/2005  03:10 AM         2,551,312 Strain-lt_81th-t.OUT
11/08/2005  03:14 AM             6,110 Strain-lt_90max-t.OUT
11/08/2005  03:14 AM         2,551,312 Strain-lt_90th-t.OUT
11/08/2005  03:17 AM             6,110 Strain-lt_99max-t.OUT
11/08/2005  03:17 AM         2,551,312 Strain-lt_99th-t.OUT
11/08/2005  02:40 AM             6,110 Strain-lt_9max-t.OUT
11/08/2005  02:40 AM         2,551,440 Strain-lt_9th-t.OUT
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09/08/2005  10:18 AM               692 stress-compb.txt
11/01/2005  10:46 AM               702 stress-compm.txt
09/08/2005  09:20 AM               692 stress-compt.txt
04/13/2005  07:38 AM               205 Stress-Primary.txt
11/08/2005  01:12 AM            16,291 Stress-pt_108max-b.OUT
11/07/2005  09:59 PM            16,291 Stress-pt_108max-m.OUT
11/07/2005  06:45 PM            16,210 Stress-pt_108max-t.OUT
11/08/2005  01:12 AM         6,841,032 Stress-pt_108th-b.OUT
11/07/2005  09:59 PM         6,841,032 Stress-pt_108th-m.OUT
11/07/2005  06:45 PM         6,812,304 Stress-pt_108th-t.OUT
11/08/2005  01:22 AM            16,291 Stress-pt_117max-b.OUT
11/07/2005  10:08 PM            16,291 Stress-pt_117max-m.OUT
11/07/2005  06:55 PM            16,210 Stress-pt_117max-t.OUT
11/08/2005  01:22 AM         6,841,032 Stress-pt_117th-b.OUT
11/07/2005  10:08 PM         6,841,032 Stress-pt_117th-m.OUT
11/07/2005  06:55 PM         6,812,304 Stress-pt_117th-t.OUT
11/08/2005  01:31 AM            16,291 Stress-pt_126max-b.OUT
11/07/2005  10:18 PM            16,291 Stress-pt_126max-m.OUT
11/07/2005  07:04 PM            16,210 Stress-pt_126max-t.OUT
11/08/2005  01:31 AM         6,841,032 Stress-pt_126th-b.OUT
11/07/2005  10:18 PM         6,841,032 Stress-pt_126th-m.OUT
11/07/2005  07:04 PM         6,812,304 Stress-pt_126th-t.OUT
11/08/2005  01:41 AM            16,291 Stress-pt_135max-b.OUT
11/07/2005  10:27 PM            16,291 Stress-pt_135max-m.OUT
11/07/2005  07:14 PM            16,210 Stress-pt_135max-t.OUT
11/08/2005  01:41 AM         6,841,032 Stress-pt_135th-b.OUT
11/07/2005  10:27 PM         6,841,032 Stress-pt_135th-m.OUT
11/07/2005  07:14 PM         6,812,304 Stress-pt_135th-t.OUT
11/08/2005  01:50 AM            16,291 Stress-pt_144max-b.OUT
11/07/2005  10:37 PM            16,291 Stress-pt_144max-m.OUT
11/07/2005  07:23 PM            16,210 Stress-pt_144max-t.OUT
11/08/2005  01:50 AM         6,841,032 Stress-pt_144th-b.OUT
11/07/2005  10:37 PM         6,841,032 Stress-pt_144th-m.OUT
11/07/2005  07:23 PM         6,812,304 Stress-pt_144th-t.OUT
11/08/2005  02:00 AM            16,291 Stress-pt_153max-b.OUT
11/07/2005  10:46 PM            16,291 Stress-pt_153max-m.OUT
11/07/2005  07:33 PM            16,210 Stress-pt_153max-t.OUT
11/08/2005  02:00 AM         6,841,032 Stress-pt_153th-b.OUT
11/07/2005  10:46 PM         6,841,032 Stress-pt_153th-m.OUT
11/07/2005  07:33 PM         6,812,304 Stress-pt_153th-t.OUT
11/08/2005  02:09 AM            16,291 Stress-pt_162max-b.OUT
11/07/2005  10:56 PM            16,291 Stress-pt_162max-m.OUT
11/07/2005  07:42 PM            16,210 Stress-pt_162max-t.OUT
11/08/2005  02:10 AM         6,841,032 Stress-pt_162th-b.OUT
11/07/2005  10:56 PM         6,841,032 Stress-pt_162th-m.OUT
11/07/2005  07:42 PM         6,812,304 Stress-pt_162th-t.OUT
11/08/2005  02:19 AM            16,295 Stress-pt_171max-b.OUT
11/07/2005  11:05 PM            16,295 Stress-pt_171max-m.OUT
11/07/2005  07:52 PM            16,214 Stress-pt_171max-t.OUT
11/08/2005  02:19 AM         6,841,032 Stress-pt_171th-b.OUT
11/07/2005  11:05 PM         6,841,032 Stress-pt_171th-m.OUT
11/07/2005  07:52 PM         6,812,304 Stress-pt_171th-t.OUT
11/08/2005  02:29 AM            16,295 Stress-pt_180max-b.OUT
11/07/2005  11:15 PM            16,295 Stress-pt_180max-m.OUT
11/07/2005  08:02 PM            16,214 Stress-pt_180max-t.OUT
11/08/2005  02:29 AM         6,841,032 Stress-pt_180th-b.OUT
11/07/2005  11:15 PM         6,841,032 Stress-pt_180th-m.OUT
11/07/2005  08:02 PM         6,812,304 Stress-pt_180th-t.OUT
11/07/2005  11:35 PM            16,291 Stress-pt_18max-b.OUT
11/07/2005  08:21 PM            16,291 Stress-pt_18max-m.OUT
11/07/2005  05:08 PM            16,210 Stress-pt_18max-t.OUT
11/07/2005  11:35 PM         6,841,032 Stress-pt_18th-b.OUT
11/07/2005  08:21 PM         6,841,032 Stress-pt_18th-m.OUT
11/07/2005  05:08 PM         6,812,304 Stress-pt_18th-t.OUT
11/07/2005  11:44 PM            16,291 Stress-pt_27max-b.OUT
11/07/2005  08:31 PM            16,291 Stress-pt_27max-m.OUT
11/07/2005  05:18 PM            16,210 Stress-pt_27max-t.OUT
11/07/2005  11:44 PM         6,841,032 Stress-pt_27th-b.OUT
11/07/2005  08:31 PM         6,841,032 Stress-pt_27th-m.OUT
11/07/2005  05:18 PM         6,812,304 Stress-pt_27th-t.OUT
11/07/2005  11:54 PM            16,291 Stress-pt_36max-b.OUT
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11/07/2005  08:40 PM            16,291 Stress-pt_36max-m.OUT
11/07/2005  05:27 PM            16,210 Stress-pt_36max-t.OUT
11/07/2005  11:54 PM         6,841,032 Stress-pt_36th-b.OUT
11/07/2005  08:41 PM         6,841,032 Stress-pt_36th-m.OUT
11/07/2005  05:27 PM         6,812,304 Stress-pt_36th-t.OUT
11/08/2005  12:03 AM            16,291 Stress-pt_45max-b.OUT
11/07/2005  08:50 PM            16,291 Stress-pt_45max-m.OUT
11/07/2005  05:36 PM            16,210 Stress-pt_45max-t.OUT
11/08/2005  12:03 AM         6,841,032 Stress-pt_45th-b.OUT
11/07/2005  08:50 PM         6,841,032 Stress-pt_45th-m.OUT
11/07/2005  05:36 PM         6,812,304 Stress-pt_45th-t.OUT
11/08/2005  12:13 AM            16,291 Stress-pt_54max-b.OUT
11/07/2005  08:59 PM            16,291 Stress-pt_54max-m.OUT
11/07/2005  05:46 PM            16,210 Stress-pt_54max-t.OUT
11/08/2005  12:13 AM         6,841,032 Stress-pt_54th-b.OUT
11/07/2005  08:59 PM         6,841,032 Stress-pt_54th-m.OUT
11/07/2005  05:46 PM         6,812,304 Stress-pt_54th-t.OUT
11/08/2005  12:23 AM            16,291 Stress-pt_63max-b.OUT
11/07/2005  09:09 PM            16,291 Stress-pt_63max-m.OUT
11/07/2005  05:56 PM            16,210 Stress-pt_63max-t.OUT
11/08/2005  12:23 AM         6,841,032 Stress-pt_63th-b.OUT
11/07/2005  09:09 PM         6,841,032 Stress-pt_63th-m.OUT
11/07/2005  05:56 PM         6,812,304 Stress-pt_63th-t.OUT
11/08/2005  12:32 AM            16,291 Stress-pt_72max-b.OUT
11/07/2005  09:18 PM            16,291 Stress-pt_72max-m.OUT
11/07/2005  06:05 PM            16,210 Stress-pt_72max-t.OUT
11/08/2005  12:32 AM         6,841,032 Stress-pt_72th-b.OUT
11/07/2005  09:18 PM         6,841,032 Stress-pt_72th-m.OUT
11/07/2005  06:05 PM         6,812,304 Stress-pt_72th-t.OUT
11/08/2005  12:42 AM            16,291 Stress-pt_81max-b.OUT
11/07/2005  09:28 PM            16,291 Stress-pt_81max-m.OUT
11/07/2005  06:15 PM            16,210 Stress-pt_81max-t.OUT
11/08/2005  12:42 AM         6,841,032 Stress-pt_81th-b.OUT
11/07/2005  09:28 PM         6,841,032 Stress-pt_81th-m.OUT
11/07/2005  06:15 PM         6,812,304 Stress-pt_81th-t.OUT
11/08/2005  12:52 AM            16,291 Stress-pt_90max-b.OUT
11/07/2005  09:39 PM            16,291 Stress-pt_90max-m.OUT
11/07/2005  06:25 PM            16,210 Stress-pt_90max-t.OUT
11/08/2005  12:52 AM         6,841,032 Stress-pt_90th-b.OUT
11/07/2005  09:39 PM         6,841,032 Stress-pt_90th-m.OUT
11/07/2005  06:25 PM         6,812,304 Stress-pt_90th-t.OUT
11/08/2005  01:02 AM            16,291 Stress-pt_99max-b.OUT
11/07/2005  09:49 PM            16,291 Stress-pt_99max-m.OUT
11/07/2005  06:35 PM            16,210 Stress-pt_99max-t.OUT
11/08/2005  01:02 AM         6,841,032 Stress-pt_99th-b.OUT
11/07/2005  09:49 PM         6,841,032 Stress-pt_99th-m.OUT
11/07/2005  06:35 PM         6,812,304 Stress-pt_99th-t.OUT
11/07/2005  11:25 PM            16,291 Stress-pt_9max-b.OUT
11/07/2005  08:12 PM            16,291 Stress-pt_9max-m.OUT
11/07/2005  04:58 PM            16,210 Stress-pt_9max-t.OUT
11/07/2005  11:25 PM         6,841,160 Stress-pt_9th-b.OUT
11/07/2005  08:12 PM         6,841,160 Stress-pt_9th-m.OUT
11/07/2005  04:59 PM         6,812,432 Stress-pt_9th-t.OUT
10/31/2005  12:13 PM             3,825 Tank-Coordinates-AY.txt
05/25/2005  03:32 PM             2,512 Tank-Mesh1.txt
11/03/2005  10:01 AM               102 tank-out.out
02/25/2005  02:24 PM             5,406 Tank-Props-BEC-250.txt
11/03/2005  10:01 AM             6,486 Tank-th.out
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
11/05/2005  08:05 PM             8,236 Waste-Cont_108max.OUT
11/05/2005  08:05 PM         3,151,428 Waste-Cont_108th.OUT
11/05/2005  08:11 PM             8,236 Waste-Cont_117max.OUT
11/05/2005  08:11 PM         3,151,428 Waste-Cont_117th.OUT
11/05/2005  08:18 PM             8,236 Waste-Cont_126max.OUT
11/05/2005  08:18 PM         3,151,428 Waste-Cont_126th.OUT
11/05/2005  08:25 PM             8,236 Waste-Cont_135max.OUT
11/05/2005  08:25 PM         3,151,428 Waste-Cont_135th.OUT
11/05/2005  08:32 PM             8,236 Waste-Cont_144max.OUT
11/05/2005  08:32 PM         3,151,428 Waste-Cont_144th.OUT
11/05/2005  08:39 PM             8,236 Waste-Cont_153max.OUT
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11/05/2005  08:39 PM         3,151,428 Waste-Cont_153th.OUT
11/05/2005  08:46 PM             8,236 Waste-Cont_162max.OUT
11/05/2005  08:46 PM         3,151,428 Waste-Cont_162th.OUT
11/05/2005  08:53 PM             8,236 Waste-Cont_171max.OUT
11/05/2005  08:53 PM         3,151,428 Waste-Cont_171th.OUT
11/05/2005  09:00 PM             8,236 Waste-Cont_180max.OUT
11/05/2005  09:00 PM         3,151,428 Waste-Cont_180th.OUT
11/05/2005  06:55 PM             8,236 Waste-Cont_18max.OUT
11/05/2005  06:55 PM         3,151,428 Waste-Cont_18th.OUT
11/05/2005  07:01 PM             8,236 Waste-Cont_27max.OUT
11/05/2005  07:01 PM         3,151,428 Waste-Cont_27th.OUT
11/05/2005  07:08 PM             8,236 Waste-Cont_36max.OUT
11/05/2005  07:08 PM         3,151,428 Waste-Cont_36th.OUT
11/05/2005  07:15 PM             8,236 Waste-Cont_45max.OUT
11/05/2005  07:15 PM         3,151,428 Waste-Cont_45th.OUT
11/05/2005  07:22 PM             8,236 Waste-Cont_54max.OUT
11/05/2005  07:22 PM         3,151,428 Waste-Cont_54th.OUT
11/05/2005  07:30 PM             8,236 Waste-Cont_63max.OUT
11/05/2005  07:30 PM         3,151,428 Waste-Cont_63th.OUT
11/05/2005  07:37 PM             8,236 Waste-Cont_72max.OUT
11/05/2005  07:37 PM         3,151,428 Waste-Cont_72th.OUT
11/05/2005  07:44 PM             8,236 Waste-Cont_81max.OUT
11/05/2005  07:44 PM         3,151,428 Waste-Cont_81th.OUT
11/05/2005  07:51 PM             8,236 Waste-Cont_90max.OUT
11/05/2005  07:51 PM         3,151,428 Waste-Cont_90th.OUT
11/05/2005  07:58 PM             8,236 Waste-Cont_99max.OUT
11/05/2005  07:58 PM         3,151,428 Waste-Cont_99th.OUT
11/05/2005  06:47 PM             8,236 Waste-Cont_9max.OUT
11/05/2005  06:47 PM         3,151,556 Waste-Cont_9th.OUT
12/10/2005  11:58 AM            45,117 Waste-Reaction.out
11/08/2005  08:42 AM               332 Waste-Reaction.txt
10/31/2005  12:01 PM             3,265 Waste-solid-AY.txt
11/29/2005  08:46 AM               776 Waste-Surface-ay.txt
12/10/2005  12:35 PM               784 Waste-Surf_0max.OUT
12/10/2005  12:35 PM           509,216 Waste-Surf_0th.OUT
12/10/2005  03:32 PM               784 Waste-Surf_108max.OUT
12/10/2005  03:32 PM           509,088 Waste-Surf_108th.OUT
12/10/2005  03:47 PM               784 Waste-Surf_117max.OUT
12/10/2005  03:47 PM           509,088 Waste-Surf_117th.OUT
12/10/2005  04:02 PM               784 Waste-Surf_126max.OUT
12/10/2005  04:02 PM           509,088 Waste-Surf_126th.OUT
12/10/2005  04:17 PM               784 Waste-Surf_135max.OUT
12/10/2005  04:17 PM           509,088 Waste-Surf_135th.OUT
12/10/2005  04:32 PM               784 Waste-Surf_144max.OUT
12/10/2005  04:32 PM           509,088 Waste-Surf_144th.OUT
12/10/2005  04:47 PM               784 Waste-Surf_153max.OUT
12/10/2005  04:47 PM           509,088 Waste-Surf_153th.OUT
12/10/2005  05:02 PM               784 Waste-Surf_162max.OUT
12/10/2005  05:02 PM           509,088 Waste-Surf_162th.OUT
12/10/2005  05:17 PM               784 Waste-Surf_171max.OUT
12/10/2005  05:17 PM           509,088 Waste-Surf_171th.OUT
12/10/2005  05:32 PM               784 Waste-Surf_180max.OUT
12/10/2005  05:32 PM           509,088 Waste-Surf_180th.OUT
12/10/2005  01:05 PM               784 Waste-Surf_18max.OUT
12/10/2005  01:05 PM           509,088 Waste-Surf_18th.OUT
12/10/2005  01:19 PM               784 Waste-Surf_27max.OUT
12/10/2005  01:19 PM           509,088 Waste-Surf_27th.OUT
12/10/2005  01:34 PM               784 Waste-Surf_36max.OUT
12/10/2005  01:34 PM           509,088 Waste-Surf_36th.OUT
12/10/2005  01:49 PM               784 Waste-Surf_45max.OUT
12/10/2005  01:49 PM           509,088 Waste-Surf_45th.OUT
12/10/2005  02:03 PM               784 Waste-Surf_54max.OUT
12/10/2005  02:03 PM           509,088 Waste-Surf_54th.OUT
12/10/2005  02:18 PM               784 Waste-Surf_63max.OUT
12/10/2005  02:18 PM           509,088 Waste-Surf_63th.OUT
12/10/2005  02:33 PM               784 Waste-Surf_72max.OUT
12/10/2005  02:33 PM           509,088 Waste-Surf_72th.OUT
12/10/2005  02:48 PM               784 Waste-Surf_81max.OUT
12/10/2005  02:48 PM           509,088 Waste-Surf_81th.OUT
12/10/2005  03:02 PM               784 Waste-Surf_90max.OUT
12/10/2005  03:02 PM           509,088 Waste-Surf_90th.OUT
```

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12/10/2005  03:17 PM               784 Waste-Surf_99max.OUT
12/10/2005  03:17 PM           509,088 Waste-Surf_99th.OUT
12/10/2005  12:50 PM               784 Waste-Surf_9max.OUT
12/10/2005  12:50 PM           509,088 Waste-Surf_9th.OUT
             704 File(s) 40,119,471,972 bytes
               2 Dir(s)  176,165,568,512 bytes free
```

LBS-BEC Gravity File Listing

```
 Volume in drive E is 250GB HITAC
 Volume Serial Number is B4FB-DB23

 Directory of E:\PNNL-2D-NL-AY-LBS-BEC-Siesmic\PNNL-2D-NL-AY-LBS-BEC-Gravity

12/20/2005  04:49 PM    <DIR>          .
12/20/2005  04:49 PM    <DIR>          ..
09/27/2005  03:47 PM                99 All-Forces.txt
12/08/2005  09:28 AM         3,365,888 AY-2D-NL-LBS-BEC Conc Tank Demand Gravity.xls
12/08/2005  09:30 AM           676,864 AY-2D-NL-LBS-BEC J Bolt Forces Gravity.xls
12/14/2005  01:39 PM         8,519,680 AY-2D-NL-LBS-BEC Pri Tank Stress Gravity.xls
12/13/2005  03:35 PM         2,107,392 AY-2D-NL-LBS-BEC Soil Pressures Gravity.xls
12/08/2005  09:40 AM           681,984 AY-2D-NL-LBS-BEC-Insul-Contact-Gravity.xls
12/08/2005  09:31 AM           721,408 AY-2D-NL-LBS-BEC-J-Bolt-Contact-Gravity.xls
12/08/2005  09:34 AM           764,416 AY-2D-NL-LBS-BEC-Primary-Contact-Gravity.xls
12/08/2005  09:47 AM         3,471,872 AY-NL-LBS-BEC Liner Strain Gravity.xls
09/02/2005  02:01 PM             5,766 Bolts-Friction.txt
06/09/2005  01:59 PM               262 Boundary.txt
10/31/2005  12:24 PM               189 Contact-AY.txt
12/01/2005  09:11 AM               586 Contact-Footing.txt
09/02/2005  09:28 AM               604 Contact-Insul.txt
09/02/2005  09:51 AM               602 Contact-J-Bolts.txt
09/09/2005  09:59 AM               608 Contact-Primary.txt
09/15/2005  11:50 AM               742 Contact-Soil.txt
09/06/2005  11:16 AM               630 Contact-Waste-AY.txt
09/22/2005  04:05 PM             8,608 Far-Soil.txt
11/04/2005  08:44 AM             2,054 file.bat
11/04/2005  08:44 AM               204 file.err
11/04/2005  08:44 AM               684 file.log
12/20/2005  04:49 PM                 0 file.txt
10/13/2005  06:54 AM               562 Fix-Soil.txt
12/14/2005  04:31 PM            10,342 Footing-Cont_max.OUT
12/14/2005  04:31 PM            11,328 Footing-Cont_th.OUT
04/06/2005  08:24 AM               894 Force-c.txt
11/02/2005  12:30 PM             4,996 Force-c_108amax.OUT
11/02/2005  12:30 PM             8,400 Force-c_108ath.OUT
11/02/2005  12:30 PM            14,716 Force-c_108max.OUT
11/02/2005  12:30 PM            16,800 Force-c_108th.OUT
11/02/2005  12:30 PM             4,996 Force-c_117amax.OUT
11/02/2005  12:30 PM             8,400 Force-c_117ath.OUT
11/02/2005  12:30 PM            14,716 Force-c_117max.OUT
11/02/2005  12:30 PM            16,800 Force-c_117th.OUT
11/02/2005  12:30 PM             4,996 Force-c_126amax.OUT
11/02/2005  12:30 PM             8,400 Force-c_126ath.OUT
11/02/2005  12:30 PM            14,716 Force-c_126max.OUT
11/02/2005  12:30 PM            16,800 Force-c_126th.OUT
11/02/2005  12:30 PM             4,996 Force-c_135amax.OUT
11/02/2005  12:30 PM             8,400 Force-c_135ath.OUT
11/02/2005  12:30 PM            14,716 Force-c_135max.OUT
11/02/2005  12:30 PM            16,800 Force-c_135th.OUT
11/02/2005  12:30 PM             4,996 Force-c_144amax.OUT
11/02/2005  12:30 PM             8,400 Force-c_144ath.OUT
11/02/2005  12:30 PM            14,716 Force-c_144max.OUT
11/02/2005  12:30 PM            16,800 Force-c_144th.OUT
11/02/2005  12:30 PM             4,996 Force-c_153amax.OUT
11/02/2005  12:30 PM             8,400 Force-c_153ath.OUT
11/02/2005  12:30 PM            14,716 Force-c_153max.OUT
11/02/2005  12:30 PM            16,800 Force-c_153th.OUT
11/02/2005  12:30 PM             4,996 Force-c_162amax.OUT
11/02/2005  12:30 PM             8,400 Force-c_162ath.OUT
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11/02/2005  12:30 PM            14,716 Force-c_162max.OUT
11/02/2005  12:30 PM            16,800 Force-c_162th.OUT
11/02/2005  12:30 PM             4,996 Force-c_171amax.OUT
11/02/2005  12:30 PM             8,400 Force-c_171ath.OUT
11/02/2005  12:30 PM            14,716 Force-c_171max.OUT
11/02/2005  12:30 PM            16,800 Force-c_171th.OUT
11/02/2005  12:30 PM             4,996 Force-c_180amax.OUT
11/02/2005  12:30 PM             8,400 Force-c_180ath.OUT
11/02/2005  12:30 PM            14,716 Force-c_180max.OUT
11/02/2005  12:30 PM            16,800 Force-c_180th.OUT
11/02/2005  12:30 PM             4,996 Force-c_18amax.OUT
11/02/2005  12:30 PM             8,400 Force-c_18ath.OUT
11/02/2005  12:30 PM            14,716 Force-c_18max.OUT
11/02/2005  12:30 PM            16,800 Force-c_18th.OUT
11/02/2005  12:30 PM             4,996 Force-c_27amax.OUT
11/02/2005  12:30 PM             8,400 Force-c_27ath.OUT
11/02/2005  12:30 PM            14,716 Force-c_27max.OUT
11/02/2005  12:30 PM            16,800 Force-c_27th.OUT
11/02/2005  12:30 PM             4,996 Force-c_36amax.OUT
11/02/2005  12:30 PM             8,400 Force-c_36ath.OUT
11/02/2005  12:30 PM            14,716 Force-c_36max.OUT
11/02/2005  12:30 PM            16,800 Force-c_36th.OUT
11/02/2005  12:30 PM             4,996 Force-c_45amax.OUT
11/02/2005  12:30 PM             8,400 Force-c_45ath.OUT
11/02/2005  12:30 PM            14,716 Force-c_45max.OUT
11/02/2005  12:30 PM            16,800 Force-c_45th.OUT
11/02/2005  12:30 PM             4,996 Force-c_54amax.OUT
11/02/2005  12:30 PM             8,400 Force-c_54ath.OUT
11/02/2005  12:30 PM            14,716 Force-c_54max.OUT
11/02/2005  12:30 PM            16,800 Force-c_54th.OUT
11/02/2005  12:30 PM             4,996 Force-c_63amax.OUT
11/02/2005  12:30 PM             8,400 Force-c_63ath.OUT
11/02/2005  12:30 PM            14,716 Force-c_63max.OUT
11/02/2005  12:30 PM            16,800 Force-c_63th.OUT
11/02/2005  12:30 PM             4,996 Force-c_72amax.OUT
11/02/2005  12:30 PM             8,400 Force-c_72ath.OUT
11/02/2005  12:30 PM            14,716 Force-c_72max.OUT
11/02/2005  12:30 PM            16,800 Force-c_72th.OUT
11/02/2005  12:30 PM             4,996 Force-c_81amax.OUT
11/02/2005  12:30 PM             8,400 Force-c_81ath.OUT
11/02/2005  12:30 PM            14,716 Force-c_81max.OUT
11/02/2005  12:30 PM            16,800 Force-c_81th.OUT
11/02/2005  12:30 PM             4,996 Force-c_90amax.OUT
11/02/2005  12:30 PM             8,400 Force-c_90ath.OUT
11/02/2005  12:30 PM            14,716 Force-c_90max.OUT
11/02/2005  12:30 PM            16,800 Force-c_90th.OUT
11/02/2005  12:30 PM             4,996 Force-c_99amax.OUT
11/02/2005  12:30 PM             8,400 Force-c_99ath.OUT
11/02/2005  12:30 PM            14,716 Force-c_99max.OUT
11/02/2005  12:30 PM            16,800 Force-c_99th.OUT
11/02/2005  12:30 PM             4,996 Force-c_9amax.OUT
11/02/2005  12:30 PM             8,528 Force-c_9ath.OUT
11/02/2005  12:30 PM            14,716 Force-c_9max.OUT
11/02/2005  12:30 PM            16,928 Force-c_9th.OUT
12/08/2005  09:30 AM           136,704 force-jb.xls
11/02/2005  12:31 PM             7,350 Force-jb_r10-th.OUT
11/02/2005  12:31 PM             5,239 Force-jb_r10_max.OUT
11/02/2005  12:31 PM             7,350 Force-jb_r11-th.OUT
11/02/2005  12:31 PM             5,239 Force-jb_r11_max.OUT
11/02/2005  12:31 PM             7,478 Force-jb_r2-th.OUT
11/02/2005  12:31 PM             5,239 Force-jb_r2_max.OUT
11/02/2005  12:31 PM             7,350 Force-jb_r3-th.OUT
11/02/2005  12:31 PM             5,239 Force-jb_r3_max.OUT
11/02/2005  12:31 PM             7,350 Force-jb_r4-th.OUT
11/02/2005  12:31 PM             5,239 Force-jb_r4_max.OUT
11/02/2005  12:31 PM             7,350 Force-jb_r5-th.OUT
11/02/2005  12:31 PM             5,239 Force-jb_r5_max.OUT
11/02/2005  12:31 PM             7,350 Force-jb_r6-th.OUT
11/02/2005  12:31 PM             5,239 Force-jb_r6_max.OUT
11/02/2005  12:31 PM             7,350 Force-jb_r7-th.OUT
11/02/2005  12:31 PM             5,239 Force-jb_r7_max.OUT
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11/02/2005  12:31 PM            7,350 Force-jb_r8-th.OUT
11/02/2005  12:31 PM            5,239 Force-jb_r8_max.OUT
11/02/2005  12:31 PM            7,350 Force-jb_r9-th.OUT
11/02/2005  12:31 PM            5,239 Force-jb_r9_max.OUT
06/20/2005  10:53 AM              661 Force-j_bolt.txt
12/08/2005  09:28 AM          442,880 import_0-90.xls
12/08/2005  09:28 AM          442,880 import_99-180.xls
12/08/2005  09:39 AM           79,872 Insul-Contact_0-90.xls
12/08/2005  09:40 AM           80,384 Insul-Contact_99-180.xls
11/04/2005  08:59 AM            2,728 Insul-Cont_108max.OUT
11/04/2005  08:59 AM            5,680 Insul-Cont_108th.OUT
11/04/2005  08:59 AM            2,728 Insul-Cont_117max.OUT
11/04/2005  08:59 AM            5,680 Insul-Cont_117th.OUT
11/04/2005  08:59 AM            2,728 Insul-Cont_126max.OUT
11/04/2005  08:59 AM            5,680 Insul-Cont_126th.OUT
11/04/2005  08:59 AM            2,728 Insul-Cont_135max.OUT
11/04/2005  08:59 AM            5,680 Insul-Cont_135th.OUT
11/04/2005  08:59 AM            2,728 Insul-Cont_144max.OUT
11/04/2005  08:59 AM            5,680 Insul-Cont_144th.OUT
11/04/2005  08:59 AM            2,728 Insul-Cont_153max.OUT
11/04/2005  08:59 AM            5,680 Insul-Cont_153th.OUT
11/04/2005  08:59 AM            2,728 Insul-Cont_162max.OUT
11/04/2005  08:59 AM            5,680 Insul-Cont_162th.OUT
11/04/2005  08:59 AM            2,728 Insul-Cont_171max.OUT
11/04/2005  08:59 AM            5,680 Insul-Cont_171th.OUT
11/04/2005  08:59 AM            2,728 Insul-Cont_180max.OUT
11/04/2005  08:59 AM            5,680 Insul-Cont_180th.OUT
11/04/2005  08:59 AM            2,728 Insul-Cont_18max.OUT
11/04/2005  08:59 AM            5,680 Insul-Cont_18th.OUT
11/04/2005  08:59 AM            2,728 Insul-Cont_27max.OUT
11/04/2005  08:59 AM            5,680 Insul-Cont_27th.OUT
11/04/2005  08:59 AM            2,728 Insul-Cont_36max.OUT
11/04/2005  08:59 AM            5,680 Insul-Cont_36th.OUT
11/04/2005  08:59 AM            2,728 Insul-Cont_45max.OUT
11/04/2005  08:59 AM            5,680 Insul-Cont_45th.OUT
11/04/2005  08:59 AM            2,728 Insul-Cont_54max.OUT
11/04/2005  08:59 AM            5,680 Insul-Cont_54th.OUT
11/04/2005  08:59 AM            2,728 Insul-Cont_63max.OUT
11/04/2005  08:59 AM            5,680 Insul-Cont_63th.OUT
11/04/2005  08:59 AM            2,728 Insul-Cont_72max.OUT
11/04/2005  08:59 AM            5,680 Insul-Cont_72th.OUT
11/04/2005  08:59 AM            2,728 Insul-Cont_81max.OUT
11/04/2005  08:59 AM            5,680 Insul-Cont_81th.OUT
11/04/2005  08:59 AM            2,728 Insul-Cont_90max.OUT
11/04/2005  08:59 AM            5,680 Insul-Cont_90th.OUT
11/04/2005  08:59 AM            2,728 Insul-Cont_99max.OUT
11/04/2005  08:59 AM            5,680 Insul-Cont_99th.OUT
11/04/2005  08:59 AM            2,728 Insul-Cont_9max.OUT
11/04/2005  08:59 AM            5,808 Insul-Cont_9th.OUT
09/01/2005  10:27 AM            1,664 Insulate.txt
10/13/2005  08:28 AM            4,031 interface-gap1.txt
09/09/2005  09:34 AM            2,616 interface1.txt
12/08/2005  09:30 AM           82,432 J-Bolt-Contact_0-90.xls
12/08/2005  09:31 AM           82,432 J-Bolt-Contact_99-180.xls
11/04/2005  08:59 AM            3,052 J-Bolt-Cont_108max.OUT
11/04/2005  08:59 AM            6,390 J-Bolt-Cont_108th.OUT
11/04/2005  08:59 AM            3,052 J-Bolt-Cont_117max.OUT
11/04/2005  08:59 AM            6,390 J-Bolt-Cont_117th.OUT
11/04/2005  08:59 AM            3,052 J-Bolt-Cont_126max.OUT
11/04/2005  08:59 AM            6,390 J-Bolt-Cont_126th.OUT
11/04/2005  08:59 AM            3,052 J-Bolt-Cont_135max.OUT
11/04/2005  08:59 AM            6,390 J-Bolt-Cont_135th.OUT
11/04/2005  08:59 AM            3,052 J-Bolt-Cont_144max.OUT
11/04/2005  08:59 AM            6,390 J-Bolt-Cont_144th.OUT
11/04/2005  08:59 AM            3,052 J-Bolt-Cont_153max.OUT
11/04/2005  08:59 AM            6,390 J-Bolt-Cont_153th.OUT
11/04/2005  08:59 AM            3,052 J-Bolt-Cont_162max.OUT
11/04/2005  08:59 AM            6,390 J-Bolt-Cont_162th.OUT
11/04/2005  08:59 AM            3,052 J-Bolt-Cont_171max.OUT
11/04/2005  08:59 AM            6,390 J-Bolt-Cont_171th.OUT
11/04/2005  08:59 AM            3,052 J-Bolt-Cont_180max.OUT
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11/04/2005  08:59 AM             6,390 J-Bolt-Cont_180th.OUT
11/04/2005  08:59 AM             3,052 J-Bolt-Cont_18max.OUT
11/04/2005  08:59 AM             6,390 J-Bolt-Cont_18th.OUT
11/04/2005  08:59 AM             3,052 J-Bolt-Cont_27max.OUT
11/04/2005  08:59 AM             6,390 J-Bolt-Cont_27th.OUT
11/04/2005  08:59 AM             3,052 J-Bolt-Cont_36max.OUT
11/04/2005  08:59 AM             6,390 J-Bolt-Cont_36th.OUT
11/04/2005  08:59 AM             3,052 J-Bolt-Cont_45max.OUT
11/04/2005  08:59 AM             6,390 J-Bolt-Cont_45th.OUT
11/04/2005  08:59 AM             3,052 J-Bolt-Cont_54max.OUT
11/04/2005  08:59 AM             6,390 J-Bolt-Cont_54th.OUT
11/04/2005  08:59 AM             3,052 J-Bolt-Cont_63max.OUT
11/04/2005  08:59 AM             6,390 J-Bolt-Cont_63th.OUT
11/04/2005  08:59 AM             3,052 J-Bolt-Cont_72max.OUT
11/04/2005  08:59 AM             6,390 J-Bolt-Cont_72th.OUT
11/04/2005  08:59 AM             3,052 J-Bolt-Cont_81max.OUT
11/04/2005  08:59 AM             6,390 J-Bolt-Cont_81th.OUT
11/04/2005  08:59 AM             3,052 J-Bolt-Cont_90max.OUT
11/04/2005  08:59 AM             6,390 J-Bolt-Cont_90th.OUT
11/04/2005  08:59 AM             3,052 J-Bolt-Cont_99max.OUT
11/04/2005  08:59 AM             6,390 J-Bolt-Cont_99th.OUT
11/04/2005  08:59 AM             3,052 J-Bolt-Cont_9max.OUT
11/04/2005  08:59 AM             6,518 J-Bolt-Cont_9th.OUT
12/08/2005  09:41 AM           158,208 liner-strain-comp_0-90b.xls
12/08/2005  09:41 AM           158,208 liner-strain-comp_0-90m.xls
12/08/2005  09:42 AM           158,208 liner-strain-comp_0-90t.xls
12/08/2005  09:42 AM           158,208 liner-strain-comp_99-180b.xls
12/08/2005  09:42 AM           158,208 liner-strain-comp_99-180m.xls
12/08/2005  09:42 AM           158,208 liner-strain-comp_99-180t.xls
06/01/2005  01:17 PM             1,708 Liner.txt
05/02/2005  02:19 PM               667 live_load.txt
11/02/2005  09:25 AM             6,183 Near-Soil-1.txt
04/20/2005  01:14 PM               508 outer-spar.txt
12/07/2005  04:09 PM           169,074 PNNL-2D-LBS-BEC-Full.jpg
11/04/2005  08:59 AM             2,998 PNNL-2D-LBS-BEC.BCS
11/04/2005  08:59 AM        55,574,528 PNNL-2D-LBS-BEC.db
11/04/2005  08:59 AM        12,386,304 PNNL-2D-LBS-BEC.emat
12/15/2005  12:30 PM            45,603 PNNL-2D-LBS-BEC.err
11/04/2005  08:59 AM       102,563,840 PNNL-2D-LBS-BEC.esav
11/04/2005  08:59 AM        27,852,800 PNNL-2D-LBS-BEC.full
11/04/2005  08:58 AM           437,553 PNNL-2D-LBS-BEC.ldhi
12/15/2005  01:05 PM            39,690 PNNL-2D-LBS-BEC.log
11/04/2005  08:59 AM             1,559 PNNL-2D-LBS-BEC.mntr
11/04/2005  08:58 AM       102,563,840 PNNL-2D-LBS-BEC.osav
11/04/2005  08:59 AM             1,699 PNNL-2D-LBS-BEC.PVTS
11/04/2005  08:59 AM       103,546,880 PNNL-2D-LBS-BEC.r001
11/04/2005  08:45 AM        35,782,656 PNNL-2D-LBS-BEC.rdb
11/04/2005  08:59 AM        57,671,680 PNNL-2D-LBS-BEC.rst
11/04/2005  08:57 AM                97 PNNL-2D-LBS-BEC.stat
12/07/2005  04:26 PM           162,974 PNNL-2D-LBS-BEC000.jpg
12/07/2005  04:26 PM           237,020 PNNL-2D-LBS-BEC001.jpg
12/07/2005  04:27 PM           163,272 PNNL-2D-LBS-BEC002.jpg
12/07/2005  04:27 PM           144,955 PNNL-2D-LBS-BEC003.jpg
12/07/2005  04:27 PM           189,713 PNNL-2D-LBS-BEC004.jpg
12/07/2005  04:29 PM           159,776 PNNL-2D-LBS-BEC005.jpg
12/07/2005  04:29 PM           165,711 PNNL-2D-LBS-BEC006.jpg
12/07/2005  04:29 PM            59,242 PNNL-2D-LBS-BEC007.jpg
12/07/2005  04:30 PM            87,600 PNNL-2D-LBS-BEC008.jpg
12/07/2005  04:33 PM            97,411 PNNL-2D-LBS-BEC009.jpg
12/07/2005  04:34 PM            91,255 PNNL-2D-LBS-BEC010.jpg
12/07/2005  04:35 PM           145,490 PNNL-2D-LBS-BEC011.jpg
12/07/2005  04:35 PM           153,912 PNNL-2D-LBS-BEC012.jpg
12/07/2005  04:35 PM           137,646 PNNL-2D-LBS-BEC013.jpg
12/07/2005  04:36 PM           103,632 PNNL-2D-LBS-BEC014.jpg
12/07/2005  04:37 PM            72,197 PNNL-2D-LBS-BEC015.jpg
12/07/2005  04:39 PM            67,433 PNNL-2D-LBS-BEC016.jpg
11/04/2005  08:59 AM            60,478 PNNL-AY-2D-NL-BEC-LBS.out
12/08/2005  09:34 AM            73,728 Primary-Contact_0-90.xls
12/08/2005  09:34 AM            74,240 Primary-Contact_99-180.xls
11/04/2005  08:59 AM             2,728 Primary-Cont_108max.OUT
11/04/2005  08:59 AM             5,680 Primary-Cont_108th.OUT
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11/04/2005  08:59 AM            2,728 Primary-Cont_117max.OUT
11/04/2005  08:59 AM            5,680 Primary-Cont_117th.OUT
11/04/2005  08:59 AM            2,728 Primary-Cont_126max.OUT
11/04/2005  08:59 AM            5,680 Primary-Cont_126th.OUT
11/04/2005  08:59 AM            2,728 Primary-Cont_135max.OUT
11/04/2005  08:59 AM            5,680 Primary-Cont_135th.OUT
11/04/2005  08:59 AM            2,728 Primary-Cont_144max.OUT
11/04/2005  08:59 AM            5,680 Primary-Cont_144th.OUT
11/04/2005  08:59 AM            2,728 Primary-Cont_153max.OUT
11/04/2005  08:59 AM            5,680 Primary-Cont_153th.OUT
11/04/2005  08:59 AM            2,728 Primary-Cont_162max.OUT
11/04/2005  08:59 AM            5,680 Primary-Cont_162th.OUT
11/04/2005  08:59 AM            2,728 Primary-Cont_171max.OUT
11/04/2005  08:59 AM            5,680 Primary-Cont_171th.OUT
11/04/2005  08:59 AM            2,728 Primary-Cont_180max.OUT
11/04/2005  08:59 AM            5,680 Primary-Cont_180th.OUT
11/04/2005  08:59 AM            2,728 Primary-Cont_18max.OUT
11/04/2005  08:59 AM            5,680 Primary-Cont_18th.OUT
11/04/2005  08:59 AM            2,728 Primary-Cont_27max.OUT
11/04/2005  08:59 AM            5,680 Primary-Cont_27th.OUT
11/04/2005  08:59 AM            2,728 Primary-Cont_36max.OUT
11/04/2005  08:59 AM            5,680 Primary-Cont_36th.OUT
11/04/2005  08:59 AM            2,728 Primary-Cont_45max.OUT
11/04/2005  08:59 AM            5,680 Primary-Cont_45th.OUT
11/04/2005  08:59 AM            2,728 Primary-Cont_54max.OUT
11/04/2005  08:59 AM            5,680 Primary-Cont_54th.OUT
11/04/2005  08:59 AM            2,728 Primary-Cont_63max.OUT
11/04/2005  08:59 AM            5,680 Primary-Cont_63th.OUT
11/04/2005  08:59 AM            2,728 Primary-Cont_72max.OUT
11/04/2005  08:59 AM            5,680 Primary-Cont_72th.OUT
11/04/2005  08:59 AM            2,728 Primary-Cont_81max.OUT
11/04/2005  08:59 AM            5,680 Primary-Cont_81th.OUT
11/04/2005  08:59 AM            2,728 Primary-Cont_90max.OUT
11/04/2005  08:59 AM            5,680 Primary-Cont_90th.OUT
11/04/2005  08:59 AM            2,728 Primary-Cont_99max.OUT
11/04/2005  08:59 AM            5,680 Primary-Cont_99th.OUT
11/04/2005  08:59 AM            2,728 Primary-Cont_9max.OUT
11/04/2005  08:59 AM            5,808 Primary-Cont_9th.OUT
10/31/2005  12:18 PM            5,549 Primary-Props-AY.txt
09/27/2005  03:52 PM            1,538 Primary.txt
11/04/2005  08:45 AM          341,312 QA.out
10/31/2005  10:31 AM            1,108 RS_FREQ.txt
11/04/2005  09:00 AM        1,146,995 Run-Tank-Out.out
11/02/2005  09:29 AM              146 run-tank.bat
11/02/2005  12:27 PM            1,963 Run-Tank.txt
12/15/2005  12:30 PM                0 scratch.hlp
02/11/2005  01:22 PM            1,053 Slave.txt
11/04/2005  08:59 AM            9,896 Soil-Contact_108max.OUT
11/04/2005  08:59 AM           18,960 Soil-Contact_108th.OUT
11/04/2005  08:59 AM            9,896 Soil-Contact_117max.OUT
11/04/2005  08:59 AM           18,960 Soil-Contact_117th.OUT
11/04/2005  08:59 AM            9,896 Soil-Contact_126max.OUT
11/04/2005  08:59 AM           18,960 Soil-Contact_126th.OUT
11/04/2005  08:59 AM            9,896 Soil-Contact_135max.OUT
11/04/2005  08:59 AM           18,960 Soil-Contact_135th.OUT
11/04/2005  08:59 AM            9,896 Soil-Contact_144max.OUT
11/04/2005  09:00 AM           18,960 Soil-Contact_144th.OUT
11/04/2005  09:00 AM            9,896 Soil-Contact_153max.OUT
11/04/2005  09:00 AM           18,960 Soil-Contact_153th.OUT
11/04/2005  09:00 AM            9,896 Soil-Contact_162max.OUT
11/04/2005  09:00 AM           18,960 Soil-Contact_162th.OUT
11/04/2005  09:00 AM            9,896 Soil-Contact_171max.OUT
11/04/2005  09:00 AM           18,960 Soil-Contact_171th.OUT
11/04/2005  09:00 AM            9,896 Soil-Contact_180max.OUT
11/04/2005  09:00 AM           18,960 Soil-Contact_180th.OUT
11/04/2005  08:59 AM            9,896 Soil-Contact_18max.OUT
11/04/2005  08:59 AM           18,960 Soil-Contact_18th.OUT
11/04/2005  08:59 AM            9,896 Soil-Contact_27max.OUT
11/04/2005  08:59 AM           18,960 Soil-Contact_27th.OUT
11/04/2005  08:59 AM            9,896 Soil-Contact_36max.OUT
11/04/2005  08:59 AM           18,960 Soil-Contact_36th.OUT
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11/04/2005  08:59 AM            9,896 Soil-Contact_45max.OUT
11/04/2005  08:59 AM           18,960 Soil-Contact_45th.OUT
11/04/2005  08:59 AM            9,896 Soil-Contact_54max.OUT
11/04/2005  08:59 AM           18,960 Soil-Contact_54th.OUT
11/04/2005  08:59 AM            9,896 Soil-Contact_63max.OUT
11/04/2005  08:59 AM           18,960 Soil-Contact_63th.OUT
11/04/2005  08:59 AM            9,896 Soil-Contact_72max.OUT
11/04/2005  08:59 AM           18,960 Soil-Contact_72th.OUT
11/04/2005  08:59 AM            9,896 Soil-Contact_81max.OUT
11/04/2005  08:59 AM           18,960 Soil-Contact_81th.OUT
11/04/2005  08:59 AM            9,896 Soil-Contact_90max.OUT
11/04/2005  08:59 AM           18,960 Soil-Contact_90th.OUT
11/04/2005  08:59 AM            9,896 Soil-Contact_99max.OUT
11/04/2005  08:59 AM           18,960 Soil-Contact_99th.OUT
11/04/2005  08:59 AM            9,896 Soil-Contact_9max.OUT
11/04/2005  08:59 AM           19,088 Soil-Contact_9th.OUT
09/20/2005  02:46 PM            4,106 Soil-Prop-LB-Geo.txt
12/08/2005  09:29 AM          223,744 soil_0-90.xls
12/08/2005  09:29 AM          223,744 soil_99-180.xls
11/02/2005  09:27 AM            1,897 Solve-Gravity-LB.txt
10/31/2005  11:02 AM            3,363 spectra-conc-0.txt
10/14/2005  11:18 AM            2,061 spectra-concrete.txt
10/31/2005  10:17 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
12/08/2005  04:33 PM          354,816 str-comp_0-90b.xls
12/08/2005  04:34 PM          355,328 str-comp_0-90m.xls
12/08/2005  04:34 PM          352,768 str-comp_0-90t.xls
12/08/2005  04:34 PM          354,816 str-comp_99-180b.xls
12/08/2005  04:35 PM          355,328 str-comp_99-180m.xls
12/08/2005  04:35 PM          352,768 str-comp_99-180t.xls
09/02/2005  08:51 AM              707 strain-compb.txt
09/02/2005  08:51 AM              705 strain-compm.txt
09/02/2005  08:50 AM              720 strain-compt.txt
11/02/2005  12:31 PM            6,110 Strain-lb_108max-b.OUT
11/02/2005  12:31 PM            8,134 Strain-lb_108th-b.OUT
11/02/2005  12:31 PM            6,110 Strain-lb_117max-b.OUT
11/02/2005  12:31 PM            8,134 Strain-lb_117th-b.OUT
11/02/2005  12:31 PM            6,110 Strain-lb_126max-b.OUT
11/02/2005  12:31 PM            8,134 Strain-lb_126th-b.OUT
11/02/2005  12:31 PM            6,110 Strain-lb_135max-b.OUT
11/02/2005  12:31 PM            8,134 Strain-lb_135th-b.OUT
11/02/2005  12:31 PM            6,110 Strain-lb_144max-b.OUT
11/02/2005  12:31 PM            8,134 Strain-lb_144th-b.OUT
11/02/2005  12:31 PM            6,110 Strain-lb_153max-b.OUT
11/02/2005  12:31 PM            8,134 Strain-lb_153th-b.OUT
11/02/2005  12:31 PM            6,110 Strain-lb_162max-b.OUT
11/02/2005  12:31 PM            8,134 Strain-lb_162th-b.OUT
11/02/2005  12:31 PM            6,110 Strain-lb_171max-b.OUT
11/02/2005  12:31 PM            8,134 Strain-lb_171th-b.OUT
11/02/2005  12:31 PM            6,110 Strain-lb_180max-b.OUT
11/02/2005  12:31 PM            8,134 Strain-lb_180th-b.OUT
11/02/2005  12:31 PM            6,110 Strain-lb_18max-b.OUT
11/02/2005  12:31 PM            8,134 Strain-lb_18th-b.OUT
11/02/2005  12:31 PM            6,110 Strain-lb_27max-b.OUT
11/02/2005  12:31 PM            8,134 Strain-lb_27th-b.OUT
11/02/2005  12:31 PM            6,110 Strain-lb_36max-b.OUT
11/02/2005  12:31 PM            8,134 Strain-lb_36th-b.OUT
11/02/2005  12:31 PM            6,110 Strain-lb_45max-b.OUT
11/02/2005  12:31 PM            8,134 Strain-lb_45th-b.OUT
11/02/2005  12:31 PM            6,110 Strain-lb_54max-b.OUT
11/02/2005  12:31 PM            8,134 Strain-lb_54th-b.OUT
11/02/2005  12:31 PM            6,110 Strain-lb_63max-b.OUT
11/02/2005  12:31 PM            8,134 Strain-lb_63th-b.OUT
11/02/2005  12:31 PM            6,110 Strain-lb_72max-b.OUT
11/02/2005  12:31 PM            8,134 Strain-lb_72th-b.OUT
11/02/2005  12:31 PM            6,110 Strain-lb_81max-b.OUT
11/02/2005  12:31 PM            8,134 Strain-lb_81th-b.OUT
11/02/2005  12:31 PM            6,110 Strain-lb_90max-b.OUT
11/02/2005  12:31 PM            8,134 Strain-lb_90th-b.OUT
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11/02/2005  12:31 PM             6,110 Strain-lb_99max-b.OUT
11/02/2005  12:31 PM             8,134 Strain-lb_99th-b.OUT
11/02/2005  12:31 PM             6,110 Strain-lb_9max-b.OUT
11/02/2005  12:31 PM             8,262 Strain-lb_9th-b.OUT
09/02/2005  08:52 AM               544 Strain-Liner.txt
11/02/2005  12:31 PM             6,110 Strain-lm_108max-m.OUT
11/02/2005  12:31 PM             8,134 Strain-lm_108th-m.OUT
11/02/2005  12:31 PM             6,110 Strain-lm_117max-m.OUT
11/02/2005  12:31 PM             8,134 Strain-lm_117th-m.OUT
11/02/2005  12:31 PM             6,110 Strain-lm_126max-m.OUT
11/02/2005  12:31 PM             8,134 Strain-lm_126th-m.OUT
11/02/2005  12:31 PM             6,110 Strain-lm_135max-m.OUT
11/02/2005  12:31 PM             8,134 Strain-lm_135th-m.OUT
11/02/2005  12:31 PM             6,110 Strain-lm_144max-m.OUT
11/02/2005  12:31 PM             8,134 Strain-lm_144th-m.OUT
11/02/2005  12:31 PM             6,110 Strain-lm_153max-m.OUT
11/02/2005  12:31 PM             8,134 Strain-lm_153th-m.OUT
11/02/2005  12:31 PM             6,110 Strain-lm_162max-m.OUT
11/02/2005  12:31 PM             8,134 Strain-lm_162th-m.OUT
11/02/2005  12:31 PM             6,110 Strain-lm_171max-m.OUT
11/02/2005  12:31 PM             8,134 Strain-lm_171th-m.OUT
11/02/2005  12:31 PM             6,110 Strain-lm_180max-m.OUT
11/02/2005  12:31 PM             8,134 Strain-lm_180th-m.OUT
11/02/2005  12:31 PM             6,110 Strain-lm_18max-m.OUT
11/02/2005  12:31 PM             8,134 Strain-lm_18th-m.OUT
11/02/2005  12:31 PM             6,110 Strain-lm_27max-m.OUT
11/02/2005  12:31 PM             8,134 Strain-lm_27th-m.OUT
11/02/2005  12:31 PM             6,110 Strain-lm_36max-m.OUT
11/02/2005  12:31 PM             8,134 Strain-lm_36th-m.OUT
11/02/2005  12:31 PM             6,110 Strain-lm_45max-m.OUT
11/02/2005  12:31 PM             8,134 Strain-lm_45th-m.OUT
11/02/2005  12:31 PM             6,110 Strain-lm_54max-m.OUT
11/02/2005  12:31 PM             8,134 Strain-lm_54th-m.OUT
11/02/2005  12:31 PM             6,110 Strain-lm_63max-m.OUT
11/02/2005  12:31 PM             8,134 Strain-lm_63th-m.OUT
11/02/2005  12:31 PM             6,110 Strain-lm_72max-m.OUT
11/02/2005  12:31 PM             8,134 Strain-lm_72th-m.OUT
11/02/2005  12:31 PM             6,110 Strain-lm_81max-m.OUT
11/02/2005  12:31 PM             8,134 Strain-lm_81th-m.OUT
11/02/2005  12:31 PM             6,110 Strain-lm_90max-m.OUT
11/02/2005  12:31 PM             8,134 Strain-lm_90th-m.OUT
11/02/2005  12:31 PM             6,110 Strain-lm_99max-m.OUT
11/02/2005  12:31 PM             8,134 Strain-lm_99th-m.OUT
11/02/2005  12:31 PM             6,110 Strain-lm_9max-m.OUT
11/02/2005  12:31 PM             8,262 Strain-lm_9th-m.OUT
11/02/2005  12:31 PM             6,110 Strain-lt_108max-t.OUT
11/02/2005  12:31 PM             8,134 Strain-lt_108th-t.OUT
11/02/2005  12:31 PM             6,110 Strain-lt_117max-t.OUT
11/02/2005  12:31 PM             8,134 Strain-lt_117th-t.OUT
11/02/2005  12:31 PM             6,110 Strain-lt_126max-t.OUT
11/02/2005  12:31 PM             8,134 Strain-lt_126th-t.OUT
11/02/2005  12:31 PM             6,110 Strain-lt_135max-t.OUT
11/02/2005  12:31 PM             8,134 Strain-lt_135th-t.OUT
11/02/2005  12:31 PM             6,110 Strain-lt_144max-t.OUT
11/02/2005  12:31 PM             8,134 Strain-lt_144th-t.OUT
11/02/2005  12:31 PM             6,110 Strain-lt_153max-t.OUT
11/02/2005  12:31 PM             8,134 Strain-lt_153th-t.OUT
11/02/2005  12:31 PM             6,110 Strain-lt_162max-t.OUT
11/02/2005  12:31 PM             8,134 Strain-lt_162th-t.OUT
11/02/2005  12:31 PM             6,110 Strain-lt_171max-t.OUT
11/02/2005  12:31 PM             8,134 Strain-lt_171th-t.OUT
11/02/2005  12:31 PM             6,110 Strain-lt_180max-t.OUT
11/02/2005  12:31 PM             8,134 Strain-lt_180th-t.OUT
11/02/2005  12:31 PM             6,110 Strain-lt_18max-t.OUT
11/02/2005  12:31 PM             8,134 Strain-lt_18th-t.OUT
11/02/2005  12:31 PM             6,110 Strain-lt_27max-t.OUT
11/02/2005  12:31 PM             8,134 Strain-lt_27th-t.OUT
11/02/2005  12:31 PM             6,110 Strain-lt_36max-t.OUT
11/02/2005  12:31 PM             8,134 Strain-lt_36th-t.OUT
11/02/2005  12:31 PM             6,110 Strain-lt_45max-t.OUT
11/02/2005  12:31 PM             8,134 Strain-lt_45th-t.OUT
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11/02/2005  12:31 PM             6,110 Strain-lt_54max-t.OUT
11/02/2005  12:31 PM             8,134 Strain-lt_54th-t.OUT
11/02/2005  12:31 PM             6,110 Strain-lt_63max-t.OUT
11/02/2005  12:31 PM             8,134 Strain-lt_63th-t.OUT
11/02/2005  12:31 PM             6,110 Strain-lt_72max-t.OUT
11/02/2005  12:31 PM             8,134 Strain-lt_72th-t.OUT
11/02/2005  12:31 PM             6,110 Strain-lt_81max-t.OUT
11/02/2005  12:31 PM             8,134 Strain-lt_81th-t.OUT
11/02/2005  12:31 PM             6,110 Strain-lt_90max-t.OUT
11/02/2005  12:31 PM             8,134 Strain-lt_90th-t.OUT
11/02/2005  12:31 PM             6,110 Strain-lt_99max-t.OUT
11/02/2005  12:31 PM             8,134 Strain-lt_99th-t.OUT
11/02/2005  12:31 PM             6,110 Strain-lt_9max-t.OUT
11/02/2005  12:31 PM             8,262 Strain-lt_9th-t.OUT
09/08/2005  10:18 AM               692 stress-compb.txt
11/01/2005  10:46 AM               702 stress-compm.txt
09/08/2005  09:20 AM               692 stress-compt.txt
04/13/2005  07:38 AM               205 Stress-Primary.txt
11/02/2005  12:31 PM            16,291 Stress-pt_108max-b.OUT
11/02/2005  12:30 PM            16,291 Stress-pt_108max-m.OUT
11/02/2005  12:30 PM            16,210 Stress-pt_108max-t.OUT
11/02/2005  12:31 PM            21,714 Stress-pt_108th-b.OUT
11/02/2005  12:30 PM            21,714 Stress-pt_108th-m.OUT
11/02/2005  12:30 PM            21,630 Stress-pt_108th-t.OUT
11/02/2005  12:31 PM            16,291 Stress-pt_117max-b.OUT
11/02/2005  12:30 PM            16,291 Stress-pt_117max-m.OUT
11/02/2005  12:30 PM            16,210 Stress-pt_117max-t.OUT
11/02/2005  12:31 PM            21,714 Stress-pt_117th-b.OUT
11/02/2005  12:30 PM            21,714 Stress-pt_117th-m.OUT
11/02/2005  12:30 PM            21,630 Stress-pt_117th-t.OUT
11/02/2005  12:31 PM            16,291 Stress-pt_126max-b.OUT
11/02/2005  12:30 PM            16,291 Stress-pt_126max-m.OUT
11/02/2005  12:30 PM            16,210 Stress-pt_126max-t.OUT
11/02/2005  12:31 PM            21,714 Stress-pt_126th-b.OUT
11/02/2005  12:30 PM            21,714 Stress-pt_126th-m.OUT
11/02/2005  12:30 PM            21,630 Stress-pt_126th-t.OUT
11/02/2005  12:31 PM            16,291 Stress-pt_135max-b.OUT
11/02/2005  12:30 PM            16,291 Stress-pt_135max-m.OUT
11/02/2005  12:30 PM            16,210 Stress-pt_135max-t.OUT
11/02/2005  12:31 PM            21,714 Stress-pt_135th-b.OUT
11/02/2005  12:30 PM            21,714 Stress-pt_135th-m.OUT
11/02/2005  12:30 PM            21,630 Stress-pt_135th-t.OUT
11/02/2005  12:31 PM            16,291 Stress-pt_144max-b.OUT
11/02/2005  12:30 PM            16,291 Stress-pt_144max-m.OUT
11/02/2005  12:30 PM            16,210 Stress-pt_144max-t.OUT
11/02/2005  12:31 PM            21,714 Stress-pt_144th-b.OUT
11/02/2005  12:30 PM            21,714 Stress-pt_144th-m.OUT
11/02/2005  12:30 PM            21,630 Stress-pt_144th-t.OUT
11/02/2005  12:31 PM            16,291 Stress-pt_153max-b.OUT
11/02/2005  12:30 PM            16,291 Stress-pt_153max-m.OUT
11/02/2005  12:30 PM            16,210 Stress-pt_153max-t.OUT
11/02/2005  12:31 PM            21,714 Stress-pt_153th-b.OUT
11/02/2005  12:30 PM            21,714 Stress-pt_153th-m.OUT
11/02/2005  12:30 PM            21,630 Stress-pt_153th-t.OUT
11/02/2005  12:31 PM            16,291 Stress-pt_162max-b.OUT
11/02/2005  12:30 PM            16,291 Stress-pt_162max-m.OUT
11/02/2005  12:30 PM            16,210 Stress-pt_162max-t.OUT
11/02/2005  12:31 PM            21,714 Stress-pt_162th-b.OUT
11/02/2005  12:30 PM            21,714 Stress-pt_162th-m.OUT
11/02/2005  12:30 PM            21,630 Stress-pt_162th-t.OUT
11/02/2005  12:31 PM            16,295 Stress-pt_171max-b.OUT
11/02/2005  12:30 PM            16,295 Stress-pt_171max-m.OUT
11/02/2005  12:30 PM            16,214 Stress-pt_171max-t.OUT
11/02/2005  12:31 PM            21,714 Stress-pt_171th-b.OUT
11/02/2005  12:30 PM            21,714 Stress-pt_171th-m.OUT
11/02/2005  12:30 PM            21,630 Stress-pt_171th-t.OUT
11/02/2005  12:31 PM            16,295 Stress-pt_180max-b.OUT
11/02/2005  12:30 PM            16,295 Stress-pt_180max-m.OUT
11/02/2005  12:30 PM            16,214 Stress-pt_180max-t.OUT
11/02/2005  12:31 PM            21,714 Stress-pt_180th-b.OUT
11/02/2005  12:30 PM            21,714 Stress-pt_180th-m.OUT
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11/02/2005  12:30 PM            21,630 Stress-pt_180th-t.OUT
11/02/2005  12:30 PM            16,291 Stress-pt_18max-b.OUT
11/02/2005  12:30 PM            16,291 Stress-pt_18max-m.OUT
11/02/2005  12:30 PM            16,210 Stress-pt_18max-t.OUT
11/02/2005  12:30 PM            21,714 Stress-pt_18th-b.OUT
11/02/2005  12:30 PM            21,714 Stress-pt_18th-m.OUT
11/02/2005  12:30 PM            21,630 Stress-pt_18th-t.OUT
11/02/2005  12:30 PM            16,291 Stress-pt_27max-b.OUT
11/02/2005  12:30 PM            16,291 Stress-pt_27max-m.OUT
11/02/2005  12:30 PM            16,210 Stress-pt_27max-t.OUT
11/02/2005  12:30 PM            21,714 Stress-pt_27th-b.OUT
11/02/2005  12:30 PM            21,714 Stress-pt_27th-m.OUT
11/02/2005  12:30 PM            21,630 Stress-pt_27th-t.OUT
11/02/2005  12:30 PM            16,291 Stress-pt_36max-b.OUT
11/02/2005  12:30 PM            16,291 Stress-pt_36max-m.OUT
11/02/2005  12:30 PM            16,210 Stress-pt_36max-t.OUT
11/02/2005  12:30 PM            21,714 Stress-pt_36th-b.OUT
11/02/2005  12:30 PM            21,714 Stress-pt_36th-m.OUT
11/02/2005  12:30 PM            21,630 Stress-pt_36th-t.OUT
11/02/2005  12:30 PM            16,291 Stress-pt_45max-b.OUT
11/02/2005  12:30 PM            16,291 Stress-pt_45max-m.OUT
11/02/2005  12:30 PM            16,210 Stress-pt_45max-t.OUT
11/02/2005  12:30 PM            21,714 Stress-pt_45th-b.OUT
11/02/2005  12:30 PM            21,714 Stress-pt_45th-m.OUT
11/02/2005  12:30 PM            21,630 Stress-pt_45th-t.OUT
11/02/2005  12:31 PM            16,291 Stress-pt_54max-b.OUT
11/02/2005  12:30 PM            16,291 Stress-pt_54max-m.OUT
11/02/2005  12:30 PM            16,210 Stress-pt_54max-t.OUT
11/02/2005  12:31 PM            21,714 Stress-pt_54th-b.OUT
11/02/2005  12:30 PM            21,714 Stress-pt_54th-m.OUT
11/02/2005  12:30 PM            21,630 Stress-pt_54th-t.OUT
11/02/2005  12:31 PM            16,291 Stress-pt_63max-b.OUT
11/02/2005  12:30 PM            16,291 Stress-pt_63max-m.OUT
11/02/2005  12:30 PM            16,210 Stress-pt_63max-t.OUT
11/02/2005  12:31 PM            21,714 Stress-pt_63th-b.OUT
11/02/2005  12:30 PM            21,714 Stress-pt_63th-m.OUT
11/02/2005  12:30 PM            21,630 Stress-pt_63th-t.OUT
11/02/2005  12:31 PM            16,291 Stress-pt_72max-b.OUT
11/02/2005  12:30 PM            16,291 Stress-pt_72max-m.OUT
11/02/2005  12:30 PM            16,210 Stress-pt_72max-t.OUT
11/02/2005  12:31 PM            21,714 Stress-pt_72th-b.OUT
11/02/2005  12:30 PM            21,714 Stress-pt_72th-m.OUT
11/02/2005  12:30 PM            21,630 Stress-pt_72th-t.OUT
11/02/2005  12:31 PM            16,291 Stress-pt_81max-b.OUT
11/02/2005  12:30 PM            16,291 Stress-pt_81max-m.OUT
11/02/2005  12:30 PM            16,210 Stress-pt_81max-t.OUT
11/02/2005  12:31 PM            21,714 Stress-pt_81th-b.OUT
11/02/2005  12:30 PM            21,714 Stress-pt_81th-m.OUT
11/02/2005  12:30 PM            21,630 Stress-pt_81th-t.OUT
11/02/2005  12:31 PM            16,291 Stress-pt_90max-b.OUT
11/02/2005  12:30 PM            16,291 Stress-pt_90max-m.OUT
11/02/2005  12:30 PM            16,210 Stress-pt_90max-t.OUT
11/02/2005  12:31 PM            21,714 Stress-pt_90th-b.OUT
11/02/2005  12:30 PM            21,714 Stress-pt_90th-m.OUT
11/02/2005  12:30 PM            21,630 Stress-pt_90th-t.OUT
11/02/2005  12:31 PM            16,291 Stress-pt_99max-b.OUT
11/02/2005  12:30 PM            16,291 Stress-pt_99max-m.OUT
11/02/2005  12:30 PM            16,210 Stress-pt_99max-t.OUT
11/02/2005  12:31 PM            21,714 Stress-pt_99th-b.OUT
11/02/2005  12:30 PM            21,714 Stress-pt_99th-m.OUT
11/02/2005  12:30 PM            21,630 Stress-pt_99th-t.OUT
11/02/2005  12:30 PM            16,291 Stress-pt_9max-b.OUT
11/02/2005  12:30 PM            16,291 Stress-pt_9max-m.OUT
11/02/2005  12:30 PM            16,210 Stress-pt_9max-t.OUT
11/02/2005  12:30 PM            21,842 Stress-pt_9th-b.OUT
11/02/2005  12:30 PM            21,842 Stress-pt_9th-m.OUT
11/02/2005  12:30 PM            21,758 Stress-pt_9th-t.OUT
10/31/2005  12:13 PM             3,825 Tank-Coordinates-AY.txt
05/25/2005  03:32 PM             2,512 Tank-Mesh1.txt
11/04/2005  08:44 AM               102 tank-out.out
02/25/2005  02:24 PM             5,406 Tank-Props-BEC-250.txt
```

```
11/04/2005  08:45 AM            6,491 Tank-th.out
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
11/04/2005  09:00 AM            8,236 Waste-Cont_108max.OUT
11/04/2005  09:00 AM           14,910 Waste-Cont_108th.OUT
11/04/2005  09:00 AM            8,236 Waste-Cont_117max.OUT
11/04/2005  09:00 AM           14,910 Waste-Cont_117th.OUT
11/04/2005  09:00 AM            8,236 Waste-Cont_126max.OUT
11/04/2005  09:00 AM           14,910 Waste-Cont_126th.OUT
11/04/2005  09:00 AM            8,236 Waste-Cont_135max.OUT
11/04/2005  09:00 AM           14,910 Waste-Cont_135th.OUT
11/04/2005  09:00 AM            8,236 Waste-Cont_144max.OUT
11/04/2005  09:00 AM           14,910 Waste-Cont_144th.OUT
11/04/2005  09:00 AM            8,236 Waste-Cont_153max.OUT
11/04/2005  09:00 AM           14,910 Waste-Cont_153th.OUT
11/04/2005  09:00 AM            8,236 Waste-Cont_162max.OUT
11/04/2005  09:00 AM           14,910 Waste-Cont_162th.OUT
11/04/2005  09:00 AM            8,236 Waste-Cont_171max.OUT
11/04/2005  09:00 AM           14,910 Waste-Cont_171th.OUT
11/04/2005  09:00 AM            8,236 Waste-Cont_180max.OUT
11/04/2005  09:00 AM           14,910 Waste-Cont_180th.OUT
11/04/2005  09:00 AM            8,236 Waste-Cont_18max.OUT
11/04/2005  09:00 AM           14,910 Waste-Cont_18th.OUT
11/04/2005  09:00 AM            8,236 Waste-Cont_27max.OUT
11/04/2005  09:00 AM           14,910 Waste-Cont_27th.OUT
11/04/2005  09:00 AM            8,236 Waste-Cont_36max.OUT
11/04/2005  09:00 AM           14,910 Waste-Cont_36th.OUT
11/04/2005  09:00 AM            8,236 Waste-Cont_45max.OUT
11/04/2005  09:00 AM           14,910 Waste-Cont_45th.OUT
11/04/2005  09:00 AM            8,236 Waste-Cont_54max.OUT
11/04/2005  09:00 AM           14,910 Waste-Cont_54th.OUT
11/04/2005  09:00 AM            8,236 Waste-Cont_63max.OUT
11/04/2005  09:00 AM           14,910 Waste-Cont_63th.OUT
11/04/2005  09:00 AM            8,236 Waste-Cont_72max.OUT
11/04/2005  09:00 AM           14,910 Waste-Cont_72th.OUT
11/04/2005  09:00 AM            8,236 Waste-Cont_81max.OUT
11/04/2005  09:00 AM           14,910 Waste-Cont_81th.OUT
11/04/2005  09:00 AM            8,236 Waste-Cont_90max.OUT
11/04/2005  09:00 AM           14,910 Waste-Cont_90th.OUT
11/04/2005  09:00 AM            8,236 Waste-Cont_99max.OUT
11/04/2005  09:00 AM           14,910 Waste-Cont_99th.OUT
11/04/2005  09:00 AM            8,236 Waste-Cont_9max.OUT
11/04/2005  09:00 AM           15,038 Waste-Cont_9th.OUT
11/04/2005  09:00 AM            1,378 Waste-Reaction.out
11/01/2005  12:19 PM              342 Waste-Reaction.txt
10/31/2005  12:01 PM            3,265 Waste-solid-AY.txt
             667 File(s)    533,682,207 bytes
               2 Dir(s)  78,397,083,648 bytes free
```

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$H_l := 422 \cdot in$ Baseline waste level as modeled in ANSYS

$H_t := 460 \cdot in$ Height to primary tank tangent line

$\frac{H_l}{H_t} = 0.92$ Ratio of waste height to tank height

$g := 386.4 \cdot \frac{in}{sec^2}$

$R := 450 \cdot in$ Tank radius

$\frac{H_l}{R} = 0.94$ Ratio of waste height to tank radius

$i := 0..2$

$\lambda := \begin{pmatrix} 1.841 \\ 5.331 \\ 8.536 \end{pmatrix}$ Bessel function roots

$\theta := \begin{pmatrix} 0 \cdot deg \\ 45 \cdot deg \\ 90 \cdot deg \end{pmatrix}$ Circumferential location of waste elements for which pressures are reported

Convective Frequencies

$fcon_i := \frac{1}{2 \cdot \pi} \cdot \left[\sqrt{\left[\lambda_i \cdot \left[\frac{g}{R} \cdot \tanh\left[\lambda_i \cdot \left(\frac{H_l}{R} \right) \right] \right] \right]} \right]$ Eqn. 4.14 BNL 1995

$fcon = \begin{pmatrix} 0.19 \\ 0.34 \\ 0.43 \end{pmatrix} Hz$ First three convective frequencies

$\rho_l := 1.59 \cdot 10^{-4} \cdot \frac{lbf \cdot sec^2}{in^4}$ waste density - specific gravity = 1.7

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Calculation of Impulsive Frequency:

$\rho_t := 7.35 \cdot 10^{-4} \cdot \frac{lbf \cdot sec^2}{in^4}$ Steel density

$t_{tw} := 0.65 \cdot in$ Average thickness of AY over lower 2/3.

$E_t := 29 \cdot 10^6 \cdot \frac{lbf}{in^2}$ Elastic modulus for steel

$C_{iref} := 0.102$ Table 4.4 of BNL 1995. Hinged top support condition - estimated for H_l/H_t=0.92

$C_i := C_{iref} \cdot \sqrt{127 \cdot \frac{\left(\frac{t_{tw}}{R}\right)}{\left(\frac{\rho_l}{\rho_t}\right)}}$ Eqn. 4.18 BNL 1995

$C_i = 0.09$ Impulsive coefficient for frequency calculation

$f_i := 5.54$ ANSYS Results

Determine Convective Pressures on the Tank Wall:

$$z := \begin{pmatrix} 24.5 \cdot in \\ 50.5 \cdot in \\ 77.5 \cdot in \\ 104.5 \cdot in \\ 131.45 \cdot in \\ 156.35 \cdot in \\ 179.3 \cdot in \\ 202.3 \cdot in \\ 225.65 \cdot in \\ 251 \cdot in \\ 278 \cdot in \\ 305 \cdot in \\ 332 \cdot in \\ 359.5 \cdot in \\ 386.5 \cdot in \\ 410.75 \cdot in \end{pmatrix}$$

Vertical location of element centroids at which pressures are reported.

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$\eta_l := \frac{z}{H_l}$ Ratio of tank wall vertical location to waste height for waste element centroids.

$\eta_l =$

	0
0	0.06
1	0.12
2	0.18
3	0.25
4	0.31
5	0.37
6	0.42
7	0.48
8	0.53
9	0.59
10	0.66
11	0.72
12	0.79
13	0.85
14	0.92
15	0.97

Determine convective coefficients as a function of dimensionless height per BNL 1995 Eqn. 4.4

$$con_0(\eta_l) := \left[\frac{2}{(\lambda_0)^2 - 1} \cdot \frac{\cosh\left[\lambda_0 \cdot \left(\frac{H_l}{R}\right) \cdot \eta_l\right]}{\cosh\left[\lambda_0 \cdot \left(\frac{H_l}{R}\right)\right]}\right]$$

$$con_1(\eta_l) := \left[\frac{2}{(\lambda_1)^2 - 1} \cdot \frac{\cosh\left[\lambda_1 \cdot \left(\frac{H_l}{R}\right) \cdot \eta_l\right]}{\cosh\left[\lambda_1 \cdot \left(\frac{H_l}{R}\right)\right]}\right]$$

$$con_2(\eta_l) := \left[\frac{2}{(\lambda_2)^2 - 1} \cdot \frac{\cosh\left[\lambda_2 \cdot \left(\frac{H_l}{R}\right) \cdot \eta_l\right]}{\cosh\left[\lambda_2 \cdot \left(\frac{H_l}{R}\right)\right]}\right]$$

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$con_0(\eta_1) =$

	0
0	0.29
1	0.29
2	0.3
3	0.32
4	0.33
5	0.35
6	0.37
7	0.39
8	0.42
9	0.45
10	0.5
11	0.54
12	0.6
13	0.66
14	0.73
15	0.8

$con_1(\eta_1) =$

	0
0	$1.03 \cdot 10^{-3}$
1	$1.16 \cdot 10^{-3}$
2	$1.43 \cdot 10^{-3}$
3	$1.84 \cdot 10^{-3}$
4	$2.44 \cdot 10^{-3}$
5	$3.21 \cdot 10^{-3}$
6	$4.17 \cdot 10^{-3}$
7	$5.45 \cdot 10^{-3}$
8	$7.16 \cdot 10^{-3}$
9	$9.64 \cdot 10^{-3}$
10	0.01
11	0.02
12	0.03
13	0.03
14	0.05
15	0.06

$con_2(\eta_1) =$

	0
0	$2.06 \cdot 10^{-5}$
1	$2.78 \cdot 10^{-5}$
2	$4.25 \cdot 10^{-5}$
3	$6.87 \cdot 10^{-5}$
4	$1.13 \cdot 10^{-4}$
5	$1.81 \cdot 10^{-4}$
6	$2.79 \cdot 10^{-4}$
7	$4.31 \cdot 10^{-4}$
8	$6.72 \cdot 10^{-4}$
9	$1.09 \cdot 10^{-3}$
10	$1.81 \cdot 10^{-3}$
11	$3.02 \cdot 10^{-3}$
12	$5.05 \cdot 10^{-3}$
13	$8.5 \cdot 10^{-3}$
14	0.01
15	0.02

Impulsive pressure coefficient as a function of dimensionless wall height

$$c_i(\eta_1) := 1 - con_0(\eta_1) - con_1(\eta_1) - con_2(\eta_1)$$

BNL 1995 Eqn. 4.7

$c_i(\eta_1) =$

	0
0	0.71
1	0.7
2	0.7
3	0.68
4	0.67
5	0.65
6	0.63
7	0.6
8	0.57
9	0.53
10	0.49
11	0.43
12	0.37
13	0.3
14	0.21
15	0.11

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Calculate maximum values of dynamic wall pressures

Consider the first three convective modes

$SA_{c0} := 0.062 \cdot g$ $\quad SA_{c0} = 23.96 \frac{in}{sec^2}$

$SA_{c1} := 0.108 \cdot g$ $\quad SA_{c1} = 41.73 \frac{in}{sec^2}$ $\quad$ 0.5% Dome RS from Spectr

$SA_{c2} := 0.163 \cdot g$ $\quad SA_{c2} = 62.98 \frac{in}{sec^2}$

Determine the spectral acceleration for the impulsive mode.

$SA_i := 0.60 \cdot g$ $\quad SA_i = 231.84 \frac{in}{sec^2}$

$$p_{maxconv}(\eta_1, \theta) := \left[\sqrt{(con_0(\eta_1) \cdot SA_{c0})^2 + (con_1(\eta_1) \cdot SA_{c1})^2 + (con_2(\eta_1) \cdot SA_{c2})^2}\right] \cdot (\rho_l \cdot R \cdot \cos(\theta \cdot deg))$$

$$p_{maximpulsive}(\eta_1, \theta) := \left[\sqrt{[c_i(\eta_1) \cdot (SA_i)]^2}\right] \cdot (\rho_l \cdot R \cdot \cos(\theta \cdot deg))$$

$$p_{max}(\eta_1, \theta) := \left[\sqrt{[(c_i(\eta_1)) \cdot (SA_i)]^2 + (con_0(\eta_1) \cdot SA_{c0})^2 + (con_1(\eta_1) \cdot SA_{c1})^2 + (con_2(\eta_1) \cdot SA_{c2})^2}\right] \cdot (\rho_l \cdot R \cdot \cos(\theta \cdot deg))$$

Previous equation is Eqn. 4.24 from BNL 1995

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$p_{maximpulsive}(\eta_1, 0) =$

	0
0	11.76
1	11.68
2	11.53
3	11.32
4	11.05
5	10.73
6	10.38
7	9.97
8	9.48
9	8.87
10	8.1
11	7.21
12	6.16
13	4.9
14	3.43
15	1.86

$\frac{lbf}{in^2}$

Maximum impulsive dynamic pressures at theta = 0.

$p_{maxconv}(\eta_1, 0) =$

	0
0	0.5
1	0.51
2	0.52
3	0.54
4	0.57
5	0.6
6	0.63
7	0.67
8	0.72
9	0.78
10	0.85
11	0.93
12	1.03
13	1.14
14	1.26
15	1.39

$\frac{lbf}{in^2}$

Maximum convective dynamic pressures at theta = 0.

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$p_{max}(\eta_1, 0) =$

	0
0	11.77
1	11.69
2	11.54
3	11.34
4	11.06
5	10.75
6	10.4
7	9.99
8	9.51
9	8.9
10	8.15
11	7.27
12	6.24
13	5.03
14	3.65
15	2.32

$\frac{lbf}{in^2}$

Maximum total dynamic pressure at theta = 0.

$p_{max}(\eta_1, 45) =$

	0
0	8.32
1	8.26
2	8.16
3	8.02
4	7.82
5	7.6
6	7.35
7	7.06
8	6.72
9	6.29
10	5.76
11	5.14
12	4.41
13	3.56
14	2.58
15	1.64

$\frac{lbf}{in^2}$

Maximum total dynamic pressure at theta = 45 degrees.

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$p_{max}(\eta_l, 90) =$

	0
0	0
1	0
2	0
3	0
4	0
5	0
6	0
7	0
8	0
9	0
10	0
11	0
12	0
13	0
14	0
15	0

$\frac{lbf}{in^2}$

Maximum total dynamic pressure at theta = 90 degrees.

Calculate Maximum Slosh Height:

$$conmax := \begin{pmatrix} 0.837 \\ 0.073 \\ 0.028 \end{pmatrix}$$

Maximum value of convective coefficients at η_l=1

$$h_{maxslosh} := R \cdot \sqrt{\left(conmax_0 \cdot \frac{SA_{c0}}{g}\right)^2 + \left(conmax_1 \cdot \frac{SA_{c1}}{g}\right)^2 + \left(conmax_2 \cdot \frac{SA_{c2}}{g}\right)^2}$$

$h_{maxslosh} = 23.71\,in$

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Calculate Maximum Total Hydrodynamic Force:

The maximum hydrodynamic force induced on the tank wall is given by Eqn. 4.31 of BNL 1995 with the instantaneous accelerations replaced by the maximum spectral accelerations. First determine the effective impulsive and convective masses.

$m_{lapprox} := \pi \cdot R^2 \cdot H_l \cdot \rho_l$ $\quad m_{lapprox} = 4.27 \times 10^4 \frac{lbf \cdot sec^2}{in}$ Total waste mass base on circular cylinder approximation.

$m_l := 4.27 \times 10^4 \cdot \frac{lbf \cdot sec^2}{in}$ *Actual waste mass reported by ANSYS model.*

$$m_{c0} := \left[\frac{2}{\lambda_0 \cdot \left[\left(\lambda_0\right)^2 - 1\right] \cdot \left(\frac{H_l}{R}\right)}\right] \cdot \tanh\left[\lambda_0 \cdot \left(\frac{H_l}{R}\right)\right] \cdot m_l$$

First mode convective mass

$$m_{c0} = 1.94 \times 10^4 \frac{lbf \cdot sec^2}{in}$$

$$m_{c1} := \left[\frac{2}{\lambda_1 \cdot \left[\left(\lambda_1\right)^2 - 1\right] \cdot \left(\frac{H_l}{R}\right)}\right] \cdot \tanh\left[\lambda_1 \cdot \left(\frac{H_l}{R}\right)\right] \cdot m_l$$

Second mode convective mass

$$m_{c1} = 622.94 \frac{lbf \cdot sec^2}{in}$$

$$m_{c2} := \left[\frac{2}{\lambda_2 \cdot \left[\left(\lambda_2\right)^2 - 1\right] \cdot \left(\frac{H_l}{R}\right)}\right] \cdot \tanh\left[\lambda_2 \cdot \left(\frac{H_l}{R}\right)\right] \cdot m_l$$

Third mode convective mass

$$m_{c2} = 148.46 \frac{lbf \cdot sec^2}{in}$$

$m_i := m_l - \left(m_{c0} + m_{c1} + m_{c2}\right)$ Impulsive mass

$$m_i = 2.25 \times 10^4 \frac{lbf \cdot sec^2}{in}$$

$F_{max} := m_i \cdot SA_i + m_{c0} \cdot SA_{c0} + m_{c1} \cdot SA_{c1} + m_{c2} \cdot SA_{c2}$

$F_{max} = 5.72 \times 10^6 \, lbf$ Conservative estimate of maximum hydrodynamic force

The above expression is a conservative estimate because it assumes that the peak impulsive and convective forces occur simultaneously. A less conservative estimate can be made via a square-root-sum-of-the-squares (SRSS) combination.

$F_{srss} := \sqrt{(m_i \cdot SA_i)^2 + (m_{c0} \cdot SA_{c0})^2 + (m_{c1} \cdot SA_{c1})^2 + (m_{c2} \cdot SA_{c2})^2}$

$F_{srss} = 5.24 \times 10^6 \, lbf$ SRSS estimate of peak hydrodynamic force

$F_{con} := \sqrt{(m_{c0} \cdot SA_{c0})^2 + (m_{c1} \cdot SA_{c1})^2 + (m_{c2} \cdot SA_{c2})^2}$

$F_{con} = 4.66 \times 10^5 \, lbf$ Peak hydrodynamic force due to convective effects only

<u>Consider Vertical Excitation</u>:

Calculate the axisymmetric breathing mode frequency for the tank

$C_{vref} := 0.088$ Table 4.17 BNL 1995

$C_v := C_{vref} \cdot \sqrt{127 \cdot \frac{\left(\frac{t_{tw}}{R}\right)}{\left(\frac{\rho_l}{\rho_t}\right)}}$ $C_v = 0.081$

$f_v := 5.4$

$s_{Av} := 0.21 \cdot g$ $s_{Av} = 81.14 \frac{in}{sec^2}$ Vert. Haunch 4 % RS from Spectr

The maximum dynamic wall pressure as a function of the dimensionless vertical distance is given by

$$p_{maxv}(\eta_1) := (0.8)\cdot\left(\cos\left(\frac{\pi}{2}\cdot\eta_1\right)\right)\cdot(\rho_1\cdot H_1\cdot S_{Av})$$ Eqn. 4.52 BNL 1995

$p_{maxv}(\eta_1) =$

	0
0	4.34
1	4.28
2	4.18
3	4.03
4	3.84
5	3.64
6	3.42
7	3.18
8	2.91
9	2.59
10	2.22
11	1.84
12	1.43
13	1
14	0.57
15	0.18

$\frac{lbf}{in^2}$

$c_{oprimeouter} := 0.28$ $c_{oprimecenter} := 0.54$ Estimated from Figure 4.7 BNL 1995

$c_{vprimeouter} := 0.72$ $c_{vprimecenter} := 0.46$

$PGA_{vert} := 0.12\cdot g$

The maximum base pressures at the outer and center elements are given by

$$p_{maxbasevertouter} := c_{oprimeouter}\cdot\rho_1\cdot H_1\cdot PGA_{vert} + c_{vprimeouter}\cdot(\rho_1\cdot H_1)\cdot S_{Av}$$ Eqn. 4.55 BNL 1995

$$p_{maxbasevertcenter} := c_{oprimecenter}\cdot\rho_1\cdot H_1\cdot PGA_{vert} + c_{vprimecenter}\cdot(\rho_1\cdot H_1)\cdot S_{Av}$$

$$p_{maxbasevertouter} = 4.79\,\frac{lbf}{in^2}$$

$$p_{maxbasevertcenter} = 4.18\,\frac{lbf}{in^2}$$

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Determine the maximum vertical force on the base

$m_0 := 0.402 \cdot m_1$ Component of waste mass particpating in the motion of the tank base

$m_v := 0.598 \cdot m_1$ Component of waste mass particpating in the motion of the tank wall

BNL Table 4.17

$F_{maxbasevert} := \sqrt{(m_0 \cdot PGA_{vert})^2 + (m_v \cdot S_{Av})^2}$ Eqn. 4.57 BNL 1995 modified for maximum response per p. 4-34

$F_{maxbasevert} = 2.22 \times 10^6 \, lbf$

$m_0 = 1.72 \times 10^4 \, lbf \cdot \frac{sec^2}{in}$

$m_v = 2.55 \times 10^4 \, lbf \cdot \frac{sec^2}{in}$

Appendix F

Best Estimate Soil
Best Estimate Concrete

Results
Load Case Specific Input Files
File Listing
Theoretical Waste Pressure Calculation

Appendix E

Best Estimate Soil
Best Estimate Concrete

Results
Load Case Specific Input Files
File Listing
Theoretical Waste Pressure Calculation

AY Primary Tank, Best Estimate Soil (Geomatrix), Gravity Only, Best Estimate Concrete, 422 in. Waste Level at 1.7 SpG

ANSYS MAXIMUMS BY PATH

PNNL Section No.	Path (in.)	Gravity Hoop Force (kip/ft) AY-BES-BEC	Gravity Meridonal Force (kip/ft) AY-BES-BEC	Gravity -In-Plane Shear Force (kip/ft) AY-BES-BEC	Gravity Hoop Moment (ft*kip/ft) AY-BES-BEC	Gravity Meridonal Moment (ft*kip/ft) AY-BES-BEC	Gravity Through-Wall Shear Force (kip/ft) AY-BES-BEC
2	**67.727**	-69.960	-74.640	-0.176	-7.742	-4.446	1.987
3	**105.668**	-64.030	-73.020	-0.218	-5.366	-1.648	1.182
4	**137.069**	-58.220	-71.110	0.332	-3.687	0.964	1.347
6	**182.849**	-51.620	-68.160	0.505	-2.244	2.106	0.286
8	**226.563**	-46.520	-65.810	0.365	-1.790	-0.551	-0.737
9	**275.566**	-41.930	-63.560	-0.351	-1.834	-1.298	-0.715
11	**325.690**	-33.820	-61.700	-0.382	-2.250	-4.409	-0.684
13	**372.305**	-24.110	-59.700	-0.369	-4.758	-5.315	-0.370
17	**423.427**	-8.359	-57.880	-0.190	-2.344	-3.204	2.191
20	**468.308**	32.060	-55.220	-0.168	-8.191	14.910	8.348
22	**515.312**	15.610	-56.510	-0.088	4.432	28.300	-3.268
24	**549.725**	1.313	-55.010	-0.049	2.260	12.390	-6.618
26	**585.819**	-11.240	-56.830	0.032	0.109	0.600	-2.788
30	**636.369**	-23.350	-58.880	0.024	-0.475	-2.637	0.802
33	**685.619**	-27.860	-60.240	0.020	-0.089	-0.495	0.341
35	**732.719**	-31.410	-61.610	0.017	0.040	0.221	-0.061
38	**778.219**	-27.840	-62.990	0.014	-0.150	-0.835	-0.224
41	**821.369**	-28.290	-64.780	0.019	-0.038	-0.211	-0.146
43	**874.169**	-17.470	-38.560	0.046	-0.422	-2.326	-0.195
46	**930.544**	-35.850	-67.210	0.429	-0.893	-4.688	-0.725
48	**977.629**	-2.195	-10.650	0.686	-3.351	16.390	-9.446
51	**1019.647**	-1.392	-15.290	1.258	-1.452	16.100	9.981
53	**1060.156**	-0.204	-5.149	0.383	0.614	2.773	-2.595
55	**1109.695**	1.702	-2.392	0.349	0.133	0.363	0.416
57	**1155.770**	0.948	0.137	0.076	0.018	0.058	-0.092
58	**1211.956**	1.406	1.146	0.029	0.023	0.059	0.078
59	**1281.707**	1.177	1.272	-0.014	0.020	0.094	-0.065
60	**1330.557**	1.078	1.189	-0.014	-0.007	-0.048	-0.085
61	**1374.857**	0.838	1.643	-0.069	0.012	0.020	0.203
62	**1417.007**	3.527	3.559	-0.041	0.119	0.381	-0.087

Note: Meridonal/Hoop Forces and Meridonal/Hoop Moments are Reversed in Highlighted Sections.

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AY-2D-NL-BES-BEC Conc Tank Demand Gravity.xls, FM Max

Figure F.1. BES-BEC Concrete Forces and Moments, Gravity Load Only

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AY- Primary Tank, Best Estimate Soil (Geomatrix), Best Estimate Concrete, 422 in. Waste Level at 1.7 SpG

ANSYS MAXIMUMS BY PATH

PNNL Section No.	Path (in.)	Seismic Hoop Force (kip/ft) AY-BES-BEC	Seismic Meridonal Force (kip/ft) AY-BES-BEC	Seismic -In-Plane Shear Force (kip/ft) AY-BES-BEC	Seismic Hoop Moment (ft*kip/ft) AY-BES-BEC	Seismic Meridonal Moment (ft*kip/ft) AY-BES-BEC	Seismic Through-Wall Shear Force (kip/ft) AY-BES-BEC
2	**67.727**	-95.710	-102.600	5.433	-15.950	-13.680	3.795
3	**105.668**	-87.260	-100.200	7.779	-12.230	-10.410	2.717
4	**137.069**	-80.310	-96.710	8.980	-9.129	7.289	3.228
6	**182.849**	-72.230	-90.610	9.665	-5.316	5.612	2.396
8	**226.563**	-66.740	-84.920	10.180	-3.454	-7.202	1.527
9	**275.566**	-65.050	-79.420	11.410	-3.075	-4.638	1.277
11	**325.690**	-56.750	-76.370	13.640	-3.154	-6.392	1.318
13	**372.305**	-53.490	-73.200	15.770	-6.335	-7.545	0.953
17	**423.427**	-19.200	-70.240	17.730	-3.182	-7.064	2.838
20	**468.308**	66.720	-66.350	19.610	-11.560	19.540	9.840
22	**515.312**	25.610	-66.130	20.990	5.811	34.630	4.457
24	**549.725**	6.270	-63.690	19.650	2.762	15.100	8.122
26	**585.819**	-16.150	-65.560	19.400	0.175	0.920	3.342
30	**636.369**	-28.110	-66.890	19.380	-0.567	-3.123	0.956
33	**685.619**	-32.830	-68.360	19.680	-0.133	-0.673	0.391
35	**732.719**	-36.620	-69.920	20.300	0.073	0.380	0.108
38	**778.219**	-32.090	-71.410	20.900	-0.191	-1.035	0.333
41	**821.369**	-32.980	-73.800	22.260	-0.069	-0.328	0.218
43	**874.169**	-19.980	-44.190	15.260	-0.618	-3.399	0.459
46	**930.544**	-63.350	-77.130	26.410	-1.049	-5.926	1.394
48	**977.629**	-10.720	-15.000	7.811	-3.879	18.830	10.860
51	**1019.647**	-28.140	-22.460	11.250	-1.775	18.540	11.450
53	**1060.156**	5.836	-10.630	5.931	0.749	3.450	3.625
55	**1109.695**	13.130	-6.614	5.269	0.182	0.506	0.522
57	**1155.770**	4.456	2.576	2.599	0.027	0.080	0.128
58	**1211.956**	4.645	2.762	1.855	0.034	0.076	0.130
59	**1281.707**	3.333	2.473	1.245	0.028	0.119	0.136
60	**1330.557**	2.776	2.314	0.927	-0.011	-0.059	0.125
61	**1374.857**	1.820	3.133	0.933	0.014	0.025	0.278
62	**1417.007**	7.014	6.088	1.182	0.154	0.446	0.171

Note: Meridonal/Hoop Forces and Meridonal/Hoop Moments are Reversed in Highlighted Sections.

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Figure F.2. BES-BEC Concrete Forces and Moments, Gravity and Seismic Load

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AY- Primary Tank, Best Estimate Soil (Geomatrix), Best Estimate Concrete, 422 in. Waste Level at 1.7 SpG

ANSYS MAXIMUMS BY PATH

PNNL Section No.	Path (in.)	Seismic Only Hoop Force (kip/ft) AY-BES-BEC	Seismic Only Meridonal Force (kip/ft) AY-BES-BEC	Seismic Only - In-Plane Shear Force (kip/ft) AY-BES-BEC	Seismic Only Hoop Moment (ft*kip/ft) AY-BES-BEC	Seismic Only Meridonal Moment (ft*kip/ft) AY-BES-BEC	Seismic Only Through-Wall Shear Force (kip/ft) AY-BES-BEC
2	**67.727**	26.020	27.960	5.436	8.953	9.277	2.079
3	**105.668**	24.730	27.180	7.793	7.442	8.937	1.631
4	**137.069**	22.320	25.600	8.984	5.526	6.480	2.001
6	**182.849**	20.870	22.450	9.728	3.329	4.017	2.288
8	**226.563**	20.590	19.110	10.236	1.833	6.994	0.874
9	**275.566**	23.150	15.860	11.405	1.413	3.537	0.865
11	**325.690**	23.160	14.770	13.550	1.090	1.983	0.677
13	**372.305**	29.800	13.540	15.796	1.819	2.459	0.588
17	**423.427**	10.954	12.550	17.750	0.889	4.001	0.828
20	**468.308**	39.925	11.150	19.640	4.258	5.221	1.936
22	**515.312**	12.176	9.680	21.028	1.625	7.610	1.458
24	**549.725**	5.681	8.800	19.677	0.595	3.084	1.823
26	**585.819**	4.950	8.850	19.422	0.091	0.451	0.603
30	**636.369**	4.950	8.350	19.398	0.093	0.490	0.156
33	**685.619**	5.390	8.930	19.695	0.043	0.179	0.056
35	**732.719**	6.000	10.170	20.312	0.036	0.161	0.047
38	**778.219**	4.670	11.280	20.910	0.041	0.201	0.110
41	**821.369**	5.370	12.670	22.268	0.033	0.127	0.076
43	**874.169**	2.830	8.830	15.265	0.237	1.303	0.316
46	**930.544**	31.734	15.290	26.419	0.192	1.690	0.991
48	**977.629**	9.391	4.370	7.150	0.820	4.030	2.326
51	**1019.647**	28.777	7.521	10.148	0.707	4.130	2.231
53	**1060.156**	5.969	5.481	5.585	0.173	0.812	1.071
55	**1109.695**	11.557	4.434	4.954	0.062	0.194	0.138
57	**1155.770**	3.521	2.621	2.534	0.009	0.028	0.051
58	**1211.956**	3.454	1.915	1.875	0.013	0.025	0.054
59	**1281.707**	2.244	1.619	1.240	0.009	0.028	0.071
60	**1330.557**	1.698	1.591	0.919	0.007	0.016	0.063
61	**1374.857**	0.983	1.777	0.871	0.003	0.009	0.126
62	**1417.007**	3.541	3.316	1.154	0.040	0.065	0.136

Note: Meridonal/Hoop Forces and Meridonal/Hoop Moments are Reversed in Highlighted Sections.

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Figure F.3. BES-BEC Concrete Forces and Moments, Seismic Load Only

AY Primary Tank, Best Estimate Soil, Gravity Input, Best Estimate Tank Concrete, 422 in. Waste Level at 1.7 SpG

		Shell Top Surface (inside - waste side)					
M&D Starting M&D Element No.	Path (in.)	AY-NL-BES-BEC Gravity Only Hoop Stress (lbs/in^2) Top	AY-NL-BES-BEC Gravity Only Meridional Stress (lbs/in^2) Top	AY-NL-BES-BEC Gravity Only Stress Intensity (lbs/in^2) Top	AY-NL-BES-BEC Gravity Only In-Plane Shear Stress (lbs/in^2) Top	AY-NL-BES-BEC Gravity Only In-Plane Shear Force Stress (lbs/in^2) Top	AY-NL-BES-BEC Gravity Only Thru-Thickness Shear Stress (lbs/in^2) Top
762	**67.33**	-2065.97	0.00	2065.97	-16.26	11.15	-0.22
782	**105.04**	-2012.50	-3173.61	3174.31	-26.53	-27.35	0.08
802	**136.24**	-1956.94	-2162.50	2164.58	38.78	24.65	0.13
822	**181.71**	-1336.11	-2549.31	2549.31	97.01	-5.20	0.10
842	**225.10**	-1418.75	-1484.72	1488.89	100.49	-2.30	-0.36
862	**273.66**	-665.35	-1957.64	1957.64	77.29	3.52	0.20
882	**323.27**	-790.28	-997.92	1006.25	-75.63	-14.01	0.96
902	**369.20**	346.39	-1315.97	1536.81	-78.96	1.64	0.45
922	**419.20**	586.11	-143.61	689.17	-76.25	7.19	0.34
942	**444.11**	1025.00	-1528.47	2540.28	-63.37	-9.69	-1.62
962	**471.06**	1066.67	217.08	1066.67	-21.24	-4.04	-0.51
982	**503.51**	1886.11	-194.51	2079.86	5.80	2.75	-0.16
1002	**527.76**	2981.25	-210.49	3188.89	5.63	-16.02	0.04
1022	**554.76**	4010.42	158.40	4011.11	2.81	-7.89	-0.01
1042	**582.26**	5629.86	-187.78	5809.72	2.39	-7.24	0.00
1062	**609.26**	7333.33	-23.73	7354.17	1.88	-7.76	0.00
1082	**636.26**	8986.11	-307.78	9284.72	-1.87	-10.24	0.00
1102	**663.26**	10465.28	225.49	10465.28	-1.91	0.24	0.00
1122	**688.61**	12388.89	-448.33	12833.33	-1.98	3.28	0.00
1142	**711.96**	13819.44	-33.69	13854.17	-2.01	-5.64	0.01
1162	**734.96**	15319.44	-18.30	15333.33	-2.06	-6.66	0.01
1182	**757.91**	15381.94	-1856.25	17236.11	-2.06	-8.85	0.01
1202	**782.81**	12798.61	2085.42	12798.61	-1.46	-17.76	0.01
1222	**809.76**	12416.67	-324.51	12743.06	-1.36	-6.98	-0.02
1242	**836.76**	13715.28	-149.93	13861.11	-1.45	-4.13	-0.03
1262	**863.76**	15131.94	294.44	15131.94	-1.62	-5.40	0.08
1282	**889.76**	13118.06	-4804.86	17923.61	3.45	-13.99	-0.24
1302	**906.85**	4351.39	-9263.89	13611.11	16.53	147.71	-1.97
1322	**916.04**	4309.03	7548.61	7583.33	14.33	392.78	-3.87
1342	**934.63**	3116.67	8826.39	8868.06	-453.40	10.21	-125.56
1362	**974.63**	-74.03	-1536.81	1548.61	118.40	-3.35	42.41
1382	**1040.78**	968.75	1883.33	1889.58	-74.03	2.06	-26.09
1402	**1110.53**	65.10	-1099.31	1172.92	93.33	-2.93	37.07

Note 1: Meridonal, Hoop, and Shear Stresses are Reversed in Highlighted Sections (Floor)

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AY-2D-NL-BES-BEC Pri Tank Stress Gravity.xls, Stress Max

Figure F.4. BES-BEC Primary Tank Stresses, Shell Top, Gravity Load Only

AY Primary Tank, Best Estimate Soil, Gravity Input, Best Estimate Tank Concrete, 422 in. Waste Level at 1.7 SpG

		Shell Mid-Plane					
M&D Starting M&D Element No.	Path (in.)	AY-NL-BES-BEC Gravity Only Hoop Stress (lbs/in^2) Mid	AY-NL-BES-BEC Gravity Only Meridional Stress (lbs/in^2) Mid	AY-NL-BES-BEC Gravity Only Stress Intensity (lbs/in^2) Mid	AY-NL-BES-BEC Gravity Only In-Plane Shear Stress (lbs/in^2) Mid	AY-NL-BES-BEC Gravity Only In-Plane Shear Force Stress (lbs/in^2) Mid	AY-NL-BES-BEC Gravity Only Thru-Thickness Shear Stress (lbs/in^2) Mid
762	**67.33**	-2209.72	-2102.08	2209.72	-15.99	11.15	-0.22
782	**105.04**	-1906.94	-2756.94	2757.64	-26.72	-27.35	0.08
802	**136.24**	-2101.39	-2591.67	2591.67	39.19	24.65	0.13
822	**181.71**	-1268.75	-2289.58	2289.58	97.01	-5.20	0.10
842	**225.10**	-1588.89	-2029.86	2030.56	100.42	-2.30	-0.36
862	**273.66**	-610.21	-1749.31	1749.31	76.81	3.52	0.20
882	**323.27**	-936.11	-1448.61	1452.78	-75.14	-14.01	0.96
902	**369.20**	396.53	-1115.28	1390.97	-79.24	1.64	0.45
922	**419.20**	480.56	-495.49	918.75	-76.32	7.19	0.34
942	**444.11**	1420.83	-166.39	1583.33	-58.88	-9.69	-1.62
962	**471.06**	975.00	-121.04	1095.14	-22.24	-4.04	-0.51
982	**503.51**	1911.81	-110.28	2017.36	5.47	2.75	-0.16
1002	**527.76**	3010.42	-118.06	3122.92	5.48	-16.02	0.04
1022	**554.76**	3941.67	-92.22	4029.86	2.83	-7.89	-0.01
1042	**582.26**	5656.25	-100.49	5748.61	2.28	-7.24	0.00
1062	**609.26**	7312.50	-108.54	7409.72	-1.82	-7.76	0.00
1082	**636.26**	9041.67	-116.53	9152.78	-1.83	-10.24	0.00
1102	**663.26**	10361.11	-124.38	10479.17	-1.88	0.24	0.00
1122	**688.61**	12486.11	-131.81	12611.11	-1.93	3.28	0.00
1142	**711.96**	13791.67	-138.47	13923.61	-1.94	-5.64	0.01
1162	**734.96**	15277.78	-145.42	15423.61	-1.94	-6.66	0.01
1182	**757.91**	15895.83	-151.94	16041.67	-2.02	-8.85	0.01
1202	**782.81**	12138.89	-102.64	12243.06	-1.40	-17.76	0.01
1222	**809.76**	12479.17	-110.42	12590.28	-1.33	-6.98	-0.02
1242	**836.76**	13722.22	-117.85	13840.28	-1.42	-4.13	-0.03
1262	**863.76**	15013.89	-124.58	15131.94	-1.53	-5.40	0.08
1282	**889.76**	14520.83	-134.58	14659.72	4.02	-13.99	-0.24
1302	**906.85**	6958.33	-135.00	7187.50	13.78	147.71	-1.97
1322	**916.04**	1754.17	63.18	2113.89	9.71	392.78	-3.87
1342	**934.63**	490.76	309.17	535.28	15.53	10.21	-125.56
1362	**974.63**	587.71	629.31	634.79	-5.09	-3.35	42.41
1382	**1040.78**	566.11	571.81	574.10	-1.61	2.06	-26.09
1402	**1110.53**	568.33	587.64	592.15	-3.16	-2.93	37.07

Note 1: Meridonal, Hoop, and Shear Stresses are Reversed in Highlighted Sections (Floor)

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AY-2D-NL-BES-BEC Pri Tank Stress Gravity.xls, Stress Max

Figure F.5. BES-BEC Primary Tank Stresses, Shell Middle, Gravity Load Only

AY Primary Tank, Best Estimate Soil, Gravity Input, Best Estimate Tank Concrete, 422 in. Waste Level at 1.7 SpG

		Shell Bottom Surface (outside - away from waste)					
M&D Starting M&D Element No.	Path (in.)	AY-NL-BES-BEC Gravity Only Hoop Stress (lbs/in^2) Bot	AY-NL-BES-BEC Gravity Only Meridional Stress (lbs/in^2) Bot	AY-NL-BES-BEC Gravity Only Stress Intensity (lbs/in^2) Bot	AY-NL-BES-BEC Gravity Only In-Plane Shear Stress (lbs/in^2) Bot	AY-NL-BES-BEC Gravity Only In-Plane Shear Force Stress (lbs/in^2) Bot	AY-NL-BES-BEC Gravity Only Thru-Thickness Shear Stress (lbs/in^2) Bot
762	**67.33**	-2355.56	-2506.94	2506.94	-15.82	11.15	-0.22
782	**105.04**	-1809.72	-2360.42	2361.81	-26.91	-27.35	0.08
802	**136.24**	-2245.83	-3025.00	3025.69	39.86	24.65	0.13
822	**181.71**	-1201.39	-2029.17	2029.17	97.01	-5.20	0.10
842	**225.10**	-1758.33	-2575.00	2575.69	100.42	-2.30	-0.36
862	**273.66**	-555.00	-1541.67	1541.67	76.25	3.52	0.20
882	**323.27**	-1081.25	-1910.42	1914.58	-74.72	-14.01	0.96
902	**369.20**	446.67	-915.28	1245.83	-79.44	1.64	0.45
922	**419.20**	374.93	-847.22	1153.47	-76.46	7.19	0.34
942	**444.11**	1823.61	1198.61	1824.31	-54.40	-9.69	-1.62
962	**471.06**	884.03	-425.14	1309.03	-23.23	-4.04	-0.51
982	**503.51**	1938.19	-43.95	1956.94	5.14	2.75	-0.16
1002	**527.76**	3042.36	-29.91	3063.19	5.34	-16.02	0.04
1022	**554.76**	3872.92	-321.74	4190.28	2.86	-7.89	-0.01
1042	**582.26**	5683.33	-13.22	5691.67	2.18	-7.24	0.00
1062	**609.26**	7284.72	-193.40	7472.22	-1.80	-7.76	0.00
1082	**636.26**	9097.22	88.26	9097.22	-1.80	-10.24	0.00
1102	**663.26**	10263.89	-461.32	10715.28	-1.86	0.24	0.00
1122	**688.61**	12576.39	197.78	12576.39	-1.88	3.28	0.00
1142	**711.96**	13756.94	-243.26	14000.00	-1.93	-5.64	0.01
1162	**734.96**	15243.06	-272.57	15506.94	-1.93	-6.66	0.01
1182	**757.91**	16402.78	1565.28	16402.78	-1.98	-8.85	0.01
1202	**782.81**	11486.11	-2283.33	13770.83	-1.33	-17.76	0.01
1222	**809.76**	12548.61	111.81	12548.61	-1.30	-6.98	-0.02
1242	**836.76**	13736.11	-85.83	13812.50	-1.40	-4.13	-0.03
1262	**863.76**	14888.89	-543.54	15423.61	-1.43	-5.40	0.08
1282	**889.76**	15923.61	4535.42	15923.61	4.59	-13.99	-0.24
1302	**906.85**	9576.39	8993.06	9576.39	11.05	147.71	-1.97
1322	**916.04**	-825.69	-7423.61	7465.28	5.09	392.78	-3.87
1342	**934.63**	-2160.42	-8222.22	8263.89	480.49	10.21	-125.56
1362	**974.63**	1239.58	2762.50	2773.61	-122.50	-3.35	42.41
1382	**1040.78**	166.81	-751.39	926.39	73.89	2.06	-26.09
1402	**1110.53**	1077.78	2270.14	2279.17	-96.25	-2.93	37.07

Note 1: Meridonal, Hoop, and Shear Stresses are Reversed in Highlighted Sections (Floor)

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AY-2D-NL-BES-BEC Pri Tank Stress Gravity.xls, Stress Max

Figure F.6. BES-BEC Primary Tank Stresses, Shell Bottom, Gravity Load Only

AY Primary Tank, Best Estimate Soil, Horizontal and Vertical Seismic Input, Best Estimate Tank Concrete, 422 in. Waste Level at 1.7 SpG

		Shell Top Surface (inside - waste side)					
M&D Starting M&D Element No.	Path (in.)	AY-NL-BES-BEC Seismic Hoop Stress (lbs/in^2) Top	AY-NL-BES-BEC Seismic Meridional Stress (lbs/in^2) Top	AY-NL-BES-BEC Seismic Stress Intensity (lbs/in^2) Top	AY-NL-BES-BEC Seismic In-Plane Shear Stress (lbs/in^2) Top	AY-NL-BES-BEC Seismic In-Plane Shear Force Stress (lbs/in^2) Top	AY-NL-BES-BEC Seismic Thru-Thickness Shear Stress (lbs/in^2) Top
762	**67.33**	-2751.39	0.00	2751.39	222.71	16.56	3.45
782	**105.04**	-2664.58	-4080.56	4081.25	366.67	-40.78	1.38
802	**136.24**	-2620.14	-2975.00	3001.39	392.22	39.54	-1.30
822	**181.71**	-1697.92	-3217.36	3218.06	402.36	-13.92	-1.68
842	**225.10**	-2053.47	-2192.36	2193.06	779.86	-24.80	-7.34
862	**273.66**	-1263.19	-2439.58	2942.36	-1347.92	14.03	-5.77
882	**323.27**	-2229.86	-1479.17	3502.08	-1454.17	-40.40	-15.59
902	**369.20**	1588.19	-2122.22	3220.14	-1295.14	-28.77	-7.42
922	**419.20**	2565.28	-556.88	4152.08	-2073.61	59.53	6.90
942	**444.11**	3240.97	-2440.97	5768.75	2409.72	-244.44	9.59
962	**471.06**	7312.50	2345.83	9326.39	2488.89	-21.16	9.27
982	**503.51**	5770.14	-2259.72	8041.67	2767.36	91.88	8.63
1002	**527.76**	5602.08	-648.96	6794.44	2704.86	-54.13	2.38
1022	**554.76**	8062.50	1656.94	8062.50	1718.06	-41.35	-1.71
1042	**582.26**	10868.06	-906.94	10868.06	1488.89	-19.96	1.30
1062	**609.26**	13180.56	-1279.86	13187.50	-1257.64	-26.94	1.49
1082	**636.26**	15666.67	-1254.17	15666.67	-1052.08	-15.31	1.45
1102	**663.26**	17604.17	1470.83	17604.17	-870.14	-16.24	-1.48
1122	**688.61**	19881.94	-1324.31	19881.94	-876.39	35.96	-1.44
1142	**711.96**	21562.50	-1385.42	21562.50	-952.08	-44.68	-1.44
1162	**734.96**	22868.06	-1225.00	22868.06	1565.97	38.69	-1.38
1182	**757.91**	22361.11	-2354.86	24208.33	1565.97	-47.23	-1.37
1202	**782.81**	18125.00	3386.11	18125.00	1304.17	-25.75	-2.64
1222	**809.76**	17201.39	-759.03	17395.83	1612.50	-9.84	-1.96
1242	**836.76**	18798.61	-698.61	18798.61	1943.06	-16.83	-1.78
1262	**863.76**	20347.22	936.11	20347.22	2278.47	-14.71	0.98
1282	**889.76**	17222.22	-7298.61	24527.78	2651.39	-64.73	4.12
1302	**906.85**	5454.17	-15229.17	18861.11	2477.08	223.89	23.76
1322	**916.04**	5643.06	11604.17	11652.78	2459.72	636.81	27.13
1342	**934.63**	5279.86	13041.67	13097.22	-2413.89	15.03	-188.61
1362	**974.63**	3104.86	-2498.61	6115.28	-2852.78	-5.10	64.64
1382	**1040.78**	2693.75	2625.69	3895.14	-1923.61	3.13	-39.88
1402	**1110.53**	1617.36	-1906.25	2217.36	-829.86	-4.49	56.84

Note 1: Meridonal, Hoop, and Shear Stresses are Reversed in Highlighted Sections (Floor)

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AY-2D-NL-BES-BEC Pri Tank Stress Seismic.xls, Stress Max

Figure F.7. BES-BEC Primary Tank Stresses, Shell Top, Gravity Plus Seismic Load

AY Primary Tank, Best Estimate Soil, Horizontal and Vertical Seismic Input, Best Estimate Tank Concrete, 422 in. Waste Level at 1.7 SpG

		Shell Mid-Plane					
M&D Starting M&D Element No.	Path (in.)	AY-NL-BES-BEC Seismic Hoop Stress (lbs/in^2) Mid	AY-NL-BES-BEC Seismic Meridional Stress (lbs/in^2) Mid	AY-NL-BES-BEC Seismic Stress Intensity (lbs/in^2) Mid	AY-NL-BES-BEC Seismic In-Plane Shear Stress (lbs/in^2) Mid	AY-NL-BES-BEC Seismic In-Plane Shear Force Stress (lbs/in^2) Mid	AY-NL-BES-BEC Seismic Thru-Thickness Shear Stress (lbs/in^2) Mid
762	**67.33**	-2945.14	-2830.56	2945.14	221.32	16.56	3.45
782	**105.04**	-2597.22	-3639.58	3640.28	358.54	-40.78	1.38
802	**136.24**	-2878.47	-3367.36	3368.06	385.07	39.54	-1.30
822	**181.71**	-1628.47	-2927.78	2927.78	395.83	-13.92	-1.68
842	**225.10**	-2439.58	-2516.67	2585.42	778.47	-24.80	-7.34
862	**273.66**	-1159.72	-2082.64	2913.89	-1347.92	14.03	-5.77
882	**323.27**	-2493.06	-1729.86	3522.92	-1461.81	-40.40	-15.59
902	**369.20**	1622.92	-1491.67	3034.03	-1292.36	-28.77	-7.42
922	**419.20**	2704.17	-1238.19	4161.81	-2080.56	59.53	6.90
942	**444.11**	3639.58	-1288.19	5220.14	2428.47	-244.44	9.59
962	**471.06**	7555.56	-1179.86	8722.22	2496.53	-21.16	9.27
982	**503.51**	6120.14	-1138.19	7236.11	2722.92	91.88	8.63
1002	**527.76**	5933.33	-1261.11	6577.08	2688.19	-54.13	2.38
1022	**554.76**	7847.22	-1028.47	7847.22	1720.14	-41.35	-1.71
1042	**582.26**	10916.67	-1120.14	10916.67	1468.75	-19.96	1.30
1062	**609.26**	13111.11	-1204.86	13111.11	-1244.44	-26.94	1.49
1082	**636.26**	15777.78	-1278.47	15777.78	-1050.69	-15.31	1.45
1102	**663.26**	17465.28	-1340.28	17465.28	-863.19	-16.24	-1.48
1122	**688.61**	19979.17	-1358.33	19979.17	-875.69	35.96	-1.44
1142	**711.96**	21597.22	-1359.03	21597.22	-1209.72	-44.68	-1.44
1162	**734.96**	22861.11	-1325.69	22861.11	-1209.72	38.69	-1.38
1182	**757.91**	23076.39	-1279.17	23076.39	1557.64	-47.23	-1.37
1202	**782.81**	17305.56	-778.47	17312.50	1292.36	-25.75	-2.64
1222	**809.76**	17263.89	-702.78	17263.89	1618.06	-9.84	-1.96
1242	**836.76**	18770.83	-614.72	18770.83	1946.53	-16.83	-1.78
1262	**863.76**	20263.89	-532.85	20263.89	2284.72	-14.71	0.98
1282	**889.76**	19340.28	-508.82	19590.28	2601.39	-64.73	4.12
1302	**906.85**	8375.00	-490.42	8743.06	2308.33	223.89	23.76
1322	**916.04**	4599.31	300.42	5297.92	2304.17	636.81	27.13
1342	**934.63**	3848.61	538.54	4101.39	-1931.94	15.03	-188.61
1362	**974.63**	3404.17	894.44	5945.83	-2965.97	-5.10	64.64
1382	**1040.78**	2501.39	754.86	3775.00	-1861.11	3.13	-39.88
1402	**1110.53**	1833.33	834.72	1850.00	-912.50	-4.49	56.84

Note 1: Meridonal, Hoop, and Shear Stresses are Reversed in Highlighted Sections (Floor)

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Figure F.8. BES-BEC Primary Tank Stresses, Shell Middle, Gravity Plus Seismic Load

AY Primary Tank, Best Estimate Soil, Horizontal and Vertical Seismic Input, Best Estimate Tank Concrete, 422 in. Waste Level at 1.7 SpG

M&D Starting M&D Element No.	Path (in.)	Shell Bottom Surface (outside - away from waste)					
		AY-NL-BES-BEC Seismic Hoop Stress (lbs/in^2) Bot	AY-NL-BES-BEC Seismic Meridional Stress (lbs/in^2) Bot	AY-NL-BES-BEC Seismic Stress Intensity (lbs/in^2) Bot	AY-NL-BES-BEC Seismic In-Plane Shear Stress (lbs/in^2) Bot	AY-NL-BES-BEC Seismic In-Plane Shear Force Stress (lbs/in^2) Bot	AY-NL-BES-BEC Seismic Thru-Thickness Shear Stress (lbs/in^2) Bot
762	**67.33**	-3184.72	-3261.11	3261.11	219.93	16.56	3.45
782	**105.04**	-2529.86	-3320.83	3325.00	350.49	-40.78	1.38
802	**136.24**	-3136.11	-3881.25	3882.64	377.85	39.54	-1.30
822	**181.71**	-1559.03	-2680.56	2680.56	389.65	-13.92	-1.68
842	**225.10**	-2827.78	-3382.64	3382.64	777.08	-24.80	-7.34
862	**273.66**	-1056.25	-1872.92	2886.11	-1347.22	14.03	-5.77
882	**323.27**	-2786.11	-2894.44	3636.81	-1469.44	-40.40	-15.59
902	**369.20**	1657.64	-1212.50	2859.72	-1290.28	-28.77	-7.42
922	**419.20**	2843.06	-2661.81	4190.97	-2087.50	59.53	6.90
942	**444.11**	4038.89	2418.06	4972.22	2447.22	-244.44	9.59
962	**471.06**	7798.61	-824.31	8131.94	2504.17	-21.16	9.27
982	**503.51**	6470.14	634.65	6543.06	2679.17	91.88	8.63
1002	**527.76**	6264.58	-2820.83	6442.36	2670.83	-54.13	2.38
1022	**554.76**	7770.83	-791.67	7784.72	1722.22	-41.35	-1.71
1042	**582.26**	11159.72	-1333.33	11166.67	1461.81	-19.96	1.30
1062	**609.26**	13041.67	-1196.53	13041.67	-1231.25	-26.94	1.49
1082	**636.26**	15895.83	1427.78	15895.83	-1048.61	-15.31	1.45
1102	**663.26**	17340.28	-1394.44	17340.28	-855.56	-16.24	-1.48
1122	**688.61**	20076.39	1421.53	20076.39	-875.00	35.96	-1.44
1142	**711.96**	21625.00	-1345.83	21625.00	-1204.17	-44.68	-1.44
1162	**734.96**	22861.11	-1426.39	22861.11	-1204.17	38.69	-1.38
1182	**757.91**	23791.67	3031.94	23791.67	1548.61	-47.23	-1.37
1202	**782.81**	16555.56	-2947.22	19145.83	1281.25	-25.75	-2.64
1222	**809.76**	17319.44	749.31	17319.44	1623.61	-9.84	-1.96
1242	**836.76**	18743.06	-553.47	18743.06	1950.00	-16.83	-1.78
1262	**863.76**	20180.56	-1831.94	20625.00	2290.97	-14.71	0.98
1282	**889.76**	21458.33	6854.86	21458.33	2551.39	-64.73	4.12
1302	**906.85**	12166.67	14250.00	14250.00	2138.89	223.89	23.76
1322	**916.04**	-5007.64	-11340.28	11388.89	2149.31	636.81	27.13
1342	**934.63**	-6385.42	-12430.56	12493.06	1791.67	15.03	-188.61
1362	**974.63**	3704.17	3975.00	6339.58	-3079.17	-5.10	64.64
1382	**1040.78**	2317.36	-1332.64	3925.69	-1799.31	3.13	-39.88
1402	**1110.53**	2061.11	3185.42	3198.61	-1000.00	-4.49	56.84

Note 1: Meridonal, Hoop, and Shear Stresses are Reversed in Highlighted Sections (Floor)

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Figure F.9. BES-BEC Primary Tank Stresses, Shell Bottom, Gravity Plus Seismic Load

AY Primary Tank, Best Estimate Soil, Horizontal and Vertical Seismic Input, Best Estimate Tank Concrete, 422 in. Waste Level at 1.7 SpG

		Shell Top Surface (inside - waste side)					
M&D Starting M&D Element No.	Path (in.)	AY-NL-BES-BEC Hoop Stress Seismic Only (LBS/in^2) Top	AY-NL-BES-BEC Meridional Stress Seismic Only (LBS/in^2) Top	AY-NL-BES-BEC Stress Seismic Only Intensity (LBS/in^2) Top	AY-NL-BES-BEC In-Plane Shear Stress Seismic Only (LBS/in^2) Top	AY-NL-BES-BEC In-Plane Shear Force Stress Seismic Only (LBS/in^2) Top	AY-NL-BES-BEC Thru-Thickness Shear Stress Seismic Only (LBS/in^2) Top
762	**67.33**	1104.17	0.00	941.67	220.34	9.25	3.37
782	**105.04**	1095.83	1436.81	1436.81	356.97	23.37	1.31
802	**136.24**	1041.67	1097.92	915.97	382.92	24.67	1.24
822	**181.71**	666.25	1054.17	1053.47	397.41	10.71	1.65
842	**225.10**	1152.01	851.81	793.75	718.78	23.82	6.98
862	**273.66**	1053.61	886.11	1126.39	1352.06	13.10	5.76
882	**323.27**	2835.00	701.14	2665.28	1439.44	35.88	15.65
902	**369.20**	1257.36	1287.71	1825.00	1303.78	27.58	7.41
922	**419.20**	1981.74	454.86	3485.97	2042.87	52.86	6.84
942	**444.11**	2226.39	1176.53	3266.67	2401.94	246.65	9.29
962	**471.06**	6264.58	2255.63	8278.47	2487.29	17.59	9.02
982	**503.51**	4223.61	2077.29	5975.00	2767.08	89.49	8.53
1002	**527.76**	3163.06	614.72	3607.64	2704.49	38.11	2.34
1022	**554.76**	4317.99	1739.65	4051.39	1717.83	33.47	1.71
1042	**582.26**	5635.81	725.42	5058.33	1488.45	23.09	1.30
1062	**609.26**	7089.65	1256.13	5884.03	1257.02	19.18	1.48
1082	**636.26**	8294.38	953.13	7384.72	1051.86	12.02	1.45
1102	**663.26**	9300.00	1529.24	8137.50	870.08	16.45	1.48
1122	**688.61**	10493.06	1192.29	9710.42	876.01	32.68	1.44
1142	**711.96**	11038.19	1351.72	9897.22	951.78	39.08	1.45
1162	**734.96**	11347.22	1206.70	10288.89	1565.30	45.33	1.39
1182	**757.91**	10622.92	1000.69	10665.97	1565.30	38.42	1.38
1202	**782.81**	8144.44	1992.29	8141.67	1303.57	9.16	2.64
1222	**809.76**	7236.11	543.61	6959.72	1612.32	14.38	1.95
1242	**836.76**	7400.69	660.56	6986.81	1942.74	12.78	1.77
1262	**863.76**	7520.83	739.93	7513.89	2278.14	15.30	0.98
1282	**889.76**	5270.83	3195.83	8444.44	2650.83	51.31	4.04
1302	**906.85**	1495.83	6020.83	5305.56	2476.69	101.47	23.08
1322	**916.04**	1622.92	5591.67	4076.39	2460.35	247.36	27.75
1342	**934.63**	2168.06	5537.50	4927.78	1963.61	6.13	79.01
1362	**974.63**	3169.40	1094.58	4584.72	2966.67	2.08	26.33
1382	**1040.78**	1737.50	1054.17	2013.89	1850.69	1.26	16.00
1402	**1110.53**	1557.76	1007.61	1048.61	919.86	1.78	22.43

Note 1: Meridonal, Hoop, and Shear Stresses are Reversed in Highlighted Sections (Floor)

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Figure F.10. BES-BEC Primary Tank Stresses, Shell Top, Seismic Load Only

AY Primary Tank, Best Estimate Soil, Horizontal and Vertical Seismic Input, Best Estimate Tank Concrete, 422 in. Waste Level at 1.7 SpG

		Shell Mid-Plane					
M&D Starting M&D Element No.	Path (in.)	AY-NL-BES-BEC Hoop Stress Seismic Only (LBS/in^2) Mid	AY-NL-BES-BEC Meridional Stress Seismic Only (LBS/in^2) Mid	AY-NL-BES-BEC Stress Seismic Only Intensity (LBS/in^2) Mid	AY-NL-BES-BEC In-Plane Shear Stress Seismic Only (LBS/in^2) Mid	AY-NL-BES-BEC In-Plane Shear Force Stress Seismic Only (LBS/in^2) Mid	AY-NL-BES-BEC Thru-Thickness Shear Stress Seismic Only (LBS/in^2) Mid
762	**67.33**	1224.31	915.97	997.22	218.67	9.25	3.37
782	**105.04**	1040.28	1175.69	1175.00	348.89	23.37	1.31
802	**136.24**	1211.11	1095.14	1095.14	375.65	24.67	1.24
822	**181.71**	596.04	880.56	879.86	390.99	10.71	1.65
842	**225.10**	1445.86	727.08	726.39	717.47	23.82	6.98
862	**273.66**	935.35	597.22	1302.78	1351.97	13.10	5.76
882	**323.27**	3048.61	610.14	2202.08	1447.12	35.88	15.65
902	**369.20**	1241.25	712.71	1767.36	1300.60	27.58	7.41
922	**419.20**	2225.56	800.42	3261.81	2050.77	52.86	6.84
942	**444.11**	2221.53	1127.78	3668.06	2421.17	246.65	9.29
962	**471.06**	6600.00	1061.32	7650.69	2494.70	17.59	9.02
982	**503.51**	4409.03	1030.14	5227.78	2722.70	89.49	8.53
1002	**527.76**	3657.57	1146.11	3457.64	2687.82	38.11	2.34
1022	**554.76**	4079.38	940.90	3818.75	1719.90	33.47	1.71
1042	**582.26**	5729.03	1025.35	5168.75	1468.34	23.09	1.30
1062	**609.26**	7062.29	1102.57	5961.11	1243.81	19.18	1.48
1082	**636.26**	8358.13	1161.94	7243.75	1050.47	12.02	1.45
1102	**663.26**	9233.33	1215.90	8095.14	863.15	16.45	1.48
1122	**688.61**	10603.47	1226.53	9472.92	875.32	32.68	1.44
1142	**711.96**	11027.78	1220.56	9929.17	1209.83	39.08	1.45
1162	**734.96**	11351.39	1180.28	10289.58	1209.83	45.33	1.39
1182	**757.91**	10928.47	1128.89	9950.69	1557.05	38.42	1.38
1202	**782.81**	7717.36	675.83	7147.92	1292.15	9.16	2.64
1222	**809.76**	7291.67	592.36	6818.06	1617.87	14.38	1.95
1242	**836.76**	7387.50	499.24	7022.22	1946.19	12.78	1.77
1262	**863.76**	7520.83	411.60	7284.72	2284.41	15.30	0.98
1282	**889.76**	6222.22	379.58	6208.33	2600.81	51.31	4.04
1302	**906.85**	1430.56	363.82	1569.44	2307.98	101.47	23.08
1322	**916.04**	2888.89	242.49	3189.58	2304.57	247.36	27.75
1342	**934.63**	3367.01	415.35	3572.92	1945.74	6.13	79.01
1362	**974.63**	2818.82	773.54	5320.07	2962.60	2.08	26.33
1382	**1040.78**	1935.56	482.08	3204.93	1860.22	1.26	16.00
1402	**1110.53**	1340.14	422.92	1257.99	910.97	1.78	52.70

Note 1: Meridonal, Hoop, and Shear Stresses are Reversed in Highlighted Sections (Floor)

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Figure F.11. BES-BEC Primary Tank Stresses, Shell Middle, Seismic Load Only

AY Primary Tank, Best Estimate Soil, Horizontal and Vertical Seismic Input, Best Estimate Tank Concrete, 422 in. Waste Level at 1.7 SpG

		Shell Bottom Surface (outside - away from waste)					
M&D Starting M&D Element No.	Path (in.)	AY-NL-BES-BEC Hoop Stress Seismic Only (LBS/in^2) Bot	AY-NL-BES-BEC Meridional Stress Seismic Only (LBS/in^2) Bot	AY-NL-BES-BEC Stress Seismic Only Intensity (LBS/in^2) Bot	AY-NL-BES-BEC In-Plane Shear Stress Seismic Only (LBS/in^2) Bot	AY-NL-BES-BEC In-Plane Shear Force Stress Seismic Only (LBS/in^2) Bot	AY-NL-BES-BEC Thru-Thickness Shear Stress Seismic Only (LBS/in^2) Bot
762	**67.33**	1343.75	1224.31	1223.61	217.00	9.25	3.37
782	**105.04**	983.33	1247.92	1247.22	340.73	23.37	1.31
802	**136.24**	1437.50	1404.17	1403.47	368.37	24.67	1.24
822	**181.71**	525.90	847.92	847.92	384.92	10.71	1.65
842	**225.10**	1739.03	1413.89	1332.64	716.16	23.82	6.98
862	**273.66**	877.92	536.81	1466.67	1351.18	13.10	5.76
882	**323.27**	3262.50	1631.00	1849.31	1454.68	35.88	15.65
902	**369.20**	1225.14	398.61	1735.42	1298.13	27.58	7.41
922	**419.20**	2469.31	1972.22	3056.94	2058.67	52.86	6.84
942	**444.11**	2215.28	1726.88	3226.39	2440.87	246.65	9.29
962	**471.06**	6934.72	438.72	6845.83	2502.12	17.59	9.02
982	**503.51**	4593.75	651.08	4592.36	2679.01	89.49	8.53
1002	**527.76**	4152.78	2799.92	3381.25	2670.47	38.11	2.34
1022	**554.76**	3900.00	607.36	3632.99	1721.97	33.47	1.71
1042	**582.26**	5822.29	1325.28	5475.69	1461.66	23.09	1.30
1062	**609.26**	7034.93	1010.07	6038.19	1230.61	19.18	1.48
1082	**636.26**	8428.75	1410.90	7200.69	1048.38	12.02	1.45
1102	**663.26**	9160.42	1122.01	8275.00	855.52	16.45	1.48
1122	**688.61**	10713.89	1577.08	9436.11	874.64	32.68	1.44
1142	**711.96**	11024.31	1394.86	9954.17	1204.33	39.08	1.45
1162	**734.96**	11348.61	1212.71	10297.22	1204.33	45.33	1.39
1182	**757.91**	11240.97	2017.01	10790.28	1548.11	38.42	1.38
1202	**782.81**	7289.58	1020.83	8143.06	1281.04	9.16	2.64
1222	**809.76**	7347.92	748.96	6786.81	1623.41	14.38	1.95
1242	**836.76**	7368.06	471.53	7058.33	1949.65	12.78	1.77
1262	**863.76**	7520.83	1318.40	7375.00	2290.67	15.30	0.98
1282	**889.76**	7180.56	3185.42	7173.61	2550.79	51.31	4.04
1302	**906.85**	2706.25	5298.61	4701.39	2138.57	101.47	23.08
1322	**916.04**	4638.89	5412.50	3923.61	2149.49	247.36	27.75
1342	**934.63**	4754.17	5189.58	4277.78	1961.81	6.13	79.01
1362	**974.63**	2466.67	1831.94	3573.61	2958.40	2.08	26.33
1382	**1040.78**	2151.74	691.78	3006.94	1870.35	1.26	16.00
1402	**1110.53**	1121.63	1161.81	935.42	906.18	1.78	52.70

Note 1: Meridonal, Hoop, and Shear Stresses are Reversed in Highlighted Sections (Floor)

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Figure F.12. BES-BEC Primary Tank Stresses, Shell Bottom, Seismic Load Only

AY Primary Tank, Best Estimate Soil, Gravity Only, Best Estimate Tank Concrete, 422 in. Waste Level at 1.7 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) 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
Radius 2	44.72	*22.36*	*67.29*	0.55	-0.009	-0.007	0.014	126	0.177	90	0.177
Radius 3	89.87	*67.29*	*104.93*	0.89	-0.008	-0.007	0.015	135	0.101	0	0.101
Radius 4	120.00	*104.93*	*135.98*	1.03	-0.003	-0.001	0.023	72	0.089	117	0.090
Radius 5	151.97	*135.98*	*181.01*	1.97	-0.005	0.000	0.046	72	0.067	180	0.069
Radius 6	210.05	*181.01*	*223.79*	2.41	0.003	0.015	0.061	63	0.315	162	0.316
Radius 7	237.53	*223.79*	*270.98*	3.30	0.020	0.038	0.053	63	0.404	135	0.404
Radius 8	304.43	*270.98*	*318.74*	4.04	0.031	0.059	0.032	117	0.632	45	0.632
Radius 9	333.05	*318.74*	*361.64*	4.37	-0.039	0.086	0.029	117	0.628	45	0.628
Radius 10	390.22	*361.64*	*406.24*	5.36	0.010	0.130	0.017	108	0.827	45	0.827
Radius 11	422.26	*406.24*	*431.63*	3.60	0.134	0.433	0.012	27	1.364	0	1.364

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 UBS-BEC-Gravity Only	Axial Min Displacement UBS-BEC-Gravity Only	Axial Max Displacement UBS-BEC-Gravity Only
Radius 2	44.72	*22.36*	*67.29*	0.55	0.0351	1667	2222	0.00127	-0.00005	-0.00004
Radius 3	89.87	*67.29*	*104.93*	0.89	0.0715	1670	2219	0.00073	-0.00004	-0.00004
Radius 4	120.00	*104.93*	*135.98*	1.03	0.0968	1673	2215	0.00064	-0.00002	-0.00001
Radius 5	151.97	*135.98*	*181.01*	1.97	0.1252	1677	2207	0.00049	-0.00003	0.00000
Radius 6	210.05	*181.01*	*223.79*	2.41	0.1825	1688	2192	0.00224	0.00002	0.00008
Radius 7	237.53	*223.79*	*270.98*	3.30	0.2136	1696	2172	0.00286	0.00011	0.00021
Radius 8	304.43	*270.98*	*318.74*	4.04	0.3076	1725	2132	0.00439	0.00017	0.00033
Radius 9	333.05	*318.74*	*361.64*	4.37	0.3613	1746	2086	0.00431	-0.00022	0.00049
Radius 10	390.22	*361.64*	*406.24*	5.36	0.5235	1821	2006	0.00545	0.00006	0.00078
Radius 11	422.26	*406.24*	*431.63*	3.60	0.6938	1913	1933	0.00855	0.00083	0.00269

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Figure F.13. BES-BEC J-Bolt Forces, Gravity Load Only

AY Primary Tank, Best Estimate Soil, Horizontal and Vertical Seismic Input, Best Estimate Tank Concrete, 422 in. Waste Level at 1.7 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	-0.109	0.024	0.492	90	0.625	0	0.645
Radius 3	89.87	*67.29*	*104.93*	0.89	-0.061	0.009	0.405	90	0.469	180	0.588
Radius 4	120.00	*104.93*	*135.98*	1.03	-0.052	0.023	0.348	90	0.513	0	0.543
Radius 5	151.97	*135.98*	*181.01*	1.97	-0.024	0.037	0.303	90	0.673	0	0.673
Radius 6	210.05	*181.01*	*223.79*	2.41	-0.016	0.050	0.280	99	0.755	9	0.756
Radius 7	237.53	*223.79*	*270.98*	3.30	-0.070	0.242	0.508	108	0.761	9	0.843
Radius 8	304.43	*270.98*	*318.74*	4.04	-0.075	0.479	1.699	90	1.014	18	1.911
Radius 9	333.05	*318.74*	*361.64*	4.37	-0.347	1.005	2.282	90	1.264	0	2.444
Radius 10	390.22	*361.64*	*406.24*	5.36	-1.037	0.771	2.620	108	1.460	9	2.883
Radius 11	422.26	*406.24*	*431.63*	3.60	-2.004	2.246	3.641	90	3.058	0	4.052

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 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	0.00464	-0.00059	0.00013
Radius 3	89.87	*67.29*	*104.93*	0.89	0.0715	1670	2219	0.00423	-0.00033	0.00005
Radius 4	120.00	*104.93*	*135.98*	1.03	0.0968	1673	2215	0.00389	-0.00028	0.00013
Radius 5	151.97	*135.98*	*181.01*	1.97	0.1252	1677	2207	0.00482	-0.00013	0.00020
Radius 6	210.05	*181.01*	*223.79*	2.41	0.1825	1688	2192	0.00537	-0.00009	0.00028
Radius 7	237.53	*223.79*	*270.98*	3.30	0.2136	1696	2172	0.00597	-0.00038	0.00134
Radius 8	304.43	*270.98*	*318.74*	4.04	0.3076	1725	2132	0.01329	-0.00042	0.00270
Radius 9	333.05	*318.74*	*361.64*	4.37	0.3613	1746	2086	0.01680	-0.00199	0.00578
Radius 10	390.22	*361.64*	*406.24*	5.36	0.5235	1821	2006	0.01899	-0.00620	0.00461
Radius 11	422.26	*406.24*	*431.63*	3.60	0.6938	1913	1933	0.02541	-0.01244	0.01395

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Figure F.14. BES-BEC J-Bolt Forces, Gravity Plus Seismic Load

AY Primary Tank, Best Estimate Soil, Horizontal and Vertical Seismic Input, Best Estimate Tank Concrete, 422 in. Waste Level at 1.7 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) 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
		min	*max*								
Radius 2	44.72	*22.36*	*67.29*	0.55	-0.100	0.031	0.478	108	0.449	0	0.656
Radius 3	89.87	*67.29*	*104.93*	0.89	-0.053	0.015	0.389	108	0.368	0	0.536
Radius 4	120.00	*104.93*	*135.98*	1.03	-0.049	0.024	0.325	108	0.425	0	0.535
Radius 5	151.97	*135.98*	*181.01*	1.97	-0.019	0.037	0.256	108	0.606	0	0.658
Radius 6	210.05	*181.01*	*223.79*	2.41	-0.019	0.035	0.219	108	0.440	144	0.491
Radius 7	237.53	*223.79*	*270.98*	3.30	-0.090	0.204	0.454	90	0.357	135	0.578
Radius 8	304.43	*270.98*	*318.74*	4.04	-0.105	0.421	1.667	117	0.382	117	1.710
Radius 9	333.05	*318.74*	*361.64*	4.37	-0.308	0.919	2.253	117	0.637	117	2.341
Radius 10	390.22	*361.64*	*406.24*	5.36	-1.047	0.641	2.604	108	0.633	0	2.680
Radius 11	422.26	*406.24*	*431.63*	3.60	-2.138	1.814	3.629	108	1.694	0	4.005

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-BEC-Seismic Only	Axial Min Disp BES-BEC-Seismic Only	Axial Max Disp BES-BEC-Seismic Only
		min	*max*							
Radius 2	44.72	*22.36*	*67.29*	0.55	0.0351	1667	2222	0.00472	-0.00054	0.00017
Radius 3	89.87	*67.29*	*104.93*	0.89	0.0715	1670	2219	0.00385	-0.00028	0.00008
Radius 4	120.00	*104.93*	*135.98*	1.03	0.0968	1673	2215	0.00384	-0.00027	0.00013
Radius 5	151.97	*135.98*	*181.01*	1.97	0.1252	1677	2207	0.00471	-0.00010	0.00020
Radius 6	210.05	*181.01*	*223.79*	2.41	0.1825	1688	2192	0.00349	-0.00010	0.00019
Radius 7	237.53	*223.79*	*270.98*	3.30	0.2136	1696	2172	0.00409	-0.00050	0.00113
Radius 8	304.43	*270.98*	*318.74*	4.04	0.3076	1725	2132	0.01190	-0.00059	0.00237
Radius 9	333.05	*318.74*	*361.64*	4.37	0.3613	1746	2086	0.01609	-0.00177	0.00529
Radius 10	390.22	*361.64*	*406.24*	5.36	0.5235	1821	2006	0.01765	-0.00626	0.00384
Radius 11	422.26	*406.24*	*431.63*	3.60	0.6938	1913	1933	0.02512	-0.01327	0.01126

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Figure F.15. BES-BEC J-Bolt Forces, Seismic Load Only

AY Secondary Liner, Best Estiamte Soil, Gravity Only, Best Estimate Tank Concrete, 422 In Waste Level at 1.7SpG

M&D Starting M&D Element No.	Path (in.)	Shell Top Surface (inside - towards waste) Gravity					
		AY-NL-BES-BEC Hoop Strain (in/in) Gravity Top	AY-NL-BES-BEC Meridional Strain (in/in) Gravity Top	AY-NL-BES-BEC Strain Intensity (in/in) Gravity Top	AY-NL-BES-BEC In-Plane Shear Strain (in/in) Gravity Top	AY-NL-BES-BEC In-Plane Shear Force Strain (in/in) Gravity Top	AY-NL-BES-BEC Thru-Thickness Shear Strain (in/in) Gravity Top
2062	**19.00**	7.92E-05	2.64E-04	4.11E-04	8.14E-07	1.68E-08	1.25E-09
2052	**49.28**	4.55E-05	5.63E-06	6.69E-05	1.24E-06	1.66E-05	6.00E-07
2042	**64.15**	1.60E-05	6.54E-05	9.24E-05	1.76E-05	2.16E-05	9.27E-06
2032	**72.29**	3.56E-05	3.24E-04	4.48E-04	1.79E-05	1.92E-05	9.05E-06
2022	**96.32**	7.76E-06	7.72E-05	1.09E-04	3.39E-06	1.28E-06	1.95E-07
1916	**129.82**	1.56E-06	2.02E-04	2.46E-04	2.50E-06	5.93E-06	1.60E-07
1906	**169.82**	1.02E-05	3.41E-05	4.28E-05	1.28E-06	2.82E-06	3.48E-08
1896	**235.97**	1.00E-05	3.38E-05	4.25E-05	5.78E-07	1.95E-06	9.38E-09
1886	**305.72**	1.02E-05	5.11E-05	6.45E-05	7.23E-07	3.11E-06	3.10E-09
1876	**379.62**	1.36E-05	6.23E-05	7.37E-05	8.55E-07	5.38E-06	6.91E-09
1866	**441.02**	9.91E-06	7.09E-05	8.86E-05	1.82E-06	4.86E-06	2.47E-08
1856	**487.97**	1.01E-05	6.32E-05	7.54E-05	2.55E-06	9.16E-06	2.06E-07

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Figure F.16. BES-BEC Secondary Liner Strain, Shell Top, Gravity Load Only

AY Secondary Liner, Best Estiamte Soil, Gravity Only, Best Estimate Tank Concrete, 422 In Waste Level at 1.7SpG

M&D Starting M&D Element No.	Path (in.)	Shell Mid-Plane					
		AY-NL-BES-BEC Hoop Strain (in/in) Gravity Mid	AY-NL-BES-BEC Meridional Strain (in/in) Gravity Mid	AY-NL-BES-BEC Strain Intensity (in/in) Gravity Mid	AY-NL-BES-BEC In-Plane Shear Strain (in/in) Gravity Mid	AY-NL-BES-BEC In-Plane Shear Force Strain (in/in) Gravity Mid	AY-NL-BES-BEC Thru-Thickness Shear Strain (in/in) Gravity Mid
2062	**19.00**	7.93E-05	2.66E-04	4.14E-04	8.14E-07	1.68E-08	1.25E-09
2052	**49.28**	4.53E-05	4.11E-06	6.69E-05	1.36E-06	1.66E-05	6.00E-07
2042	**64.15**	1.51E-05	1.77E-05	3.62E-05	7.11E-06	2.16E-05	9.27E-06
2032	**72.29**	3.47E-05	3.29E-05	6.96E-05	8.13E-06	1.92E-05	9.05E-06
2022	**96.32**	6.99E-06	1.51E-05	2.28E-05	3.41E-06	1.28E-06	1.95E-07
1916	**129.82**	1.24E-06	7.61E-05	9.29E-05	2.74E-06	5.93E-06	1.60E-07
1906	**169.82**	9.84E-06	3.54E-05	4.47E-05	1.24E-06	2.82E-06	3.48E-08
1896	**235.97**	1.01E-05	5.72E-06	1.33E-05	5.43E-07	1.95E-06	9.38E-09
1886	**305.72**	1.02E-05	4.87E-07	1.31E-05	4.63E-07	3.11E-06	3.10E-09
1876	**379.62**	1.37E-05	1.22E-05	1.95E-05	5.98E-07	5.38E-06	6.91E-09
1866	**441.02**	1.00E-05	1.60E-05	2.21E-05	5.01E-07	4.86E-06	2.47E-08
1856	**487.97**	9.33E-06	1.55E-05	2.29E-05	8.55E-07	9.16E-06	2.06E-07

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AY-2D-NL-BES-BEC Liner Strain Gravity.xls, Strain Max

Figure F.17. BES-BEC Secondary Liner Strain, Shell Middle, Gravity Load Only

AY Secondary Liner, Best Estiamte Soil, Gravity Only, Best Estimate Tank Concrete, 422 In Waste Level at 1.7SpG

M&D Starting M&D Element No.	Path (in.)	Shell Bottom Surface (outside - away from waste) Gravity					
		AY-NL-BES-BEC Hoop Strain (in/in) Gravity Bot	AY-NL-BES-BEC Meridional Strain (in/in) Gravity Bot	AY-NL-BES-BEC Strain Intensity (in/in) Gravity Bot	AY-NL-BES-BEC In-Plane Shear Strain (in/in) Gravity Bot	AY-NL-BES-BEC In-Plane Shear Force Strain (in/in) Gravity Bot	AY-NL-BES-BEC Thru-Thickness Shear Strain (in/in) Gravity Bot
2062	**19.00**	7.93E-05	2.68E-04	4.16E-04	8.14E-07	1.68E-08	1.25E-09
2052	**49.28**	4.53E-05	5.37E-06	6.70E-05	1.24E-06	1.66E-05	6.00E-07
2042	**64.15**	1.60E-05	9.92E-05	1.47E-04	1.72E-05	2.16E-05	9.27E-06
2032	**72.29**	3.56E-05	3.23E-04	4.47E-04	1.79E-05	1.92E-05	9.05E-06
2022	**96.32**	7.16E-06	1.07E-04	1.54E-04	3.39E-06	1.28E-06	1.95E-07
1916	**129.82**	1.56E-06	2.01E-04	2.46E-04	2.97E-06	5.93E-06	1.60E-07
1906	**169.82**	9.64E-06	9.59E-05	1.16E-04	1.20E-06	2.82E-06	3.48E-08
1896	**235.97**	1.00E-05	4.51E-05	5.68E-05	5.08E-07	1.95E-06	9.38E-09
1886	**305.72**	1.02E-05	5.08E-05	6.30E-05	6.62E-07	3.11E-06	3.10E-09
1876	**379.62**	1.39E-05	8.66E-05	1.08E-04	8.55E-07	5.38E-06	6.91E-09
1866	**441.02**	1.04E-05	6.98E-05	8.72E-05	1.82E-06	4.86E-06	2.47E-08
1856	**487.97**	9.86E-06	9.34E-05	1.16E-04	2.55E-06	9.16E-06	2.06E-07

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AY-2D-NL-BES-BEC Liner Strain Gravity.xls, Strain Max

Figure F.18. BES-BEC Secondary Liner Strain, Shell Bottom, Gravity Load Only

AY Secondary Liner, Best Estimate Soil, Horizontal and Vertical Input, Best Estimate Tank Concrete, 422 In Waste Level at 1.7SpG

M&D Starting M&D Element No.	Path (in.)	Shell Top Surface (inside - towards waste)					
		AY-NL-BES-BEC Hoop Strain (in/in) Top	AY-NL-BES-BEC Meridional Strain (in/in) Top	AY-NL-BES-BEC Strain Intensity (in/in) Top	AY-NL-BES-BEC In-Plane Shear Strain (in/in) Top	AY-NL-BES-BEC In-Plane Shear Force Strain (in/in) Top	AY-NL-BES-BEC Thru-Thickness Shear Strain (in/in) Top
2062	**19.00**	9.46E-05	3.03E-04	5.02E-04	2.71E-04	3.97E-08	2.15E-08
2052	**49.28**	6.09E-05	1.56E-05	8.37E-05	3.62E-05	2.52E-05	1.02E-06
2042	**64.15**	4.28E-05	9.65E-05	1.46E-04	6.46E-05	3.18E-05	1.36E-05
2032	**72.29**	8.23E-05	4.81E-04	6.52E-04	6.89E-05	2.88E-05	1.43E-05
2022	**96.32**	4.16E-05	9.64E-05	1.49E-04	7.65E-05	1.74E-06	3.22E-07
1916	**129.82**	5.67E-05	2.80E-04	3.35E-04	9.14E-05	8.13E-06	2.29E-07
1906	**169.82**	6.68E-05	4.29E-05	7.58E-05	5.69E-05	3.82E-06	5.02E-08
1896	**235.97**	4.95E-05	7.07E-05	1.16E-04	7.33E-05	2.63E-06	1.36E-08
1886	**305.72**	4.21E-05	6.36E-05	8.62E-05	5.18E-05	4.15E-06	5.19E-09
1876	**379.62**	4.45E-05	1.02E-04	1.28E-04	3.87E-05	7.13E-06	1.02E-08
1866	**441.02**	2.74E-05	8.84E-05	1.13E-04	2.98E-05	6.38E-06	2.96E-08
1856	**487.97**	2.60E-05	9.81E-05	1.17E-04	2.45E-05	1.19E-05	2.76E-07

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AY-2D-NL-BES-BEC Liner Strain Seismic.xls, Strain Max

Figure F.19. BES-BEC Secondary Liner Strain, Shell Top, Gravity Plus Seismic Load

AY Secondary Liner, Best Estimate Soil, Horizontal and Vertical Input, Best Estimate Tank Concrete, 422 In Waste Level at 1.7SpG

M&D Starting M&D Element No.	Path (in.)	Shell Mid-Plane					
		AY-NL-BES-BEC Hoop Strain (in/in) Mid	AY-NL-BES-BEC Meridional Strain (in/in) Mid	AY-NL-BES-BEC Strain Intensity (in/in) Mid	AY-NL-BES-BEC In-Plane Shear Strain (in/in) Mid	AY-NL-BES-BEC In-Plane Shear Force Strain (in/in) Mid	AY-NL-BES-BEC Thru-Thickness Shear Strain (in/in) Mid
2062	**19.00**	9.46E-05	3.05E-04	5.04E-04	2.71E-04	3.97E-08	2.15E-08
2052	**49.28**	6.08E-05	1.23E-05	8.35E-05	3.63E-05	2.52E-05	1.02E-06
2042	**64.15**	4.22E-05	3.38E-05	7.04E-05	6.55E-05	3.18E-05	1.36E-05
2032	**72.29**	8.14E-05	5.97E-05	1.45E-04	6.86E-05	2.88E-05	1.43E-05
2022	**96.32**	4.16E-05	3.96E-05	7.73E-05	7.65E-05	1.74E-06	3.22E-07
1916	**129.82**	5.67E-05	1.14E-04	1.53E-04	9.14E-05	8.13E-06	2.29E-07
1906	**169.82**	6.64E-05	6.37E-05	1.13E-04	5.68E-05	3.82E-06	5.02E-08
1896	**235.97**	4.93E-05	2.87E-05	7.39E-05	7.31E-05	2.63E-06	1.36E-08
1886	**305.72**	4.20E-05	1.68E-05	5.67E-05	5.19E-05	4.15E-06	5.19E-09
1876	**379.62**	4.47E-05	2.83E-05	4.77E-05	3.83E-05	7.13E-06	1.02E-08
1866	**441.02**	2.80E-05	2.67E-05	3.93E-05	2.98E-05	6.38E-06	2.96E-08
1856	**487.97**	2.53E-05	2.87E-05	3.74E-05	2.38E-05	1.19E-05	2.76E-07

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AY-2D-NL-BES-BEC Liner Strain Seismic.xls, Strain Max

Figure F.20. BES-BEC Secondary Liner Strain, Shell Middle, Gravity Plus Seismic Load

AY Secondary Liner, Best Estimate Soil, Horizontal and Vertical Input, Best Estimate Tank Concrete, 422 In Waste Level at 1.7SpG

M&D Starting M&D Element No.	Path (in.)	Shell Bottom Surface (outside - away from waste)					
		AY-NL-BES-BEC Hoop Strain (in/in) Bot	AY-NL-BES-BEC Meridional Strain (in/in) Bot	AY-NL-BES-BEC Strain Intensity (in/in) Bot	AY-NL-BES-BEC In-Plane Shear Strain (in/in) Bot	AY-NL-BES-BEC In-Plane Shear Force Strain (in/in) Bot	AY-NL-BES-BEC Thru-Thickness Shear Strain (in/in) Bot
2062	**19.00**	9.46E-05	3.08E-04	5.07E-04	2.70E-04	3.97E-08	2.15E-08
2052	**49.28**	6.07E-05	1.05E-05	8.33E-05	3.64E-05	2.52E-05	1.02E-06
2042	**64.15**	4.16E-05	1.61E-04	2.26E-04	6.64E-05	3.18E-05	1.36E-05
2032	**72.29**	8.04E-05	3.61E-04	5.51E-04	6.84E-05	2.88E-05	1.43E-05
2022	**96.32**	4.16E-05	1.63E-04	2.20E-04	7.64E-05	1.74E-06	3.22E-07
1916	**129.82**	5.71E-05	7.66E-05	1.17E-04	9.14E-05	8.13E-06	2.29E-07
1906	**169.82**	6.59E-05	1.41E-04	1.92E-04	5.68E-05	3.82E-06	5.02E-08
1896	**235.97**	4.91E-05	5.66E-05	9.01E-05	7.29E-05	2.63E-06	1.36E-08
1886	**305.72**	4.20E-05	8.17E-05	1.18E-04	5.21E-05	4.15E-06	5.19E-09
1876	**379.62**	4.48E-05	1.09E-04	1.39E-04	3.81E-05	7.13E-06	1.02E-08
1866	**441.02**	2.85E-05	6.68E-05	8.84E-05	3.03E-05	6.38E-06	2.96E-08
1856	**487.97**	2.46E-05	1.19E-04	1.49E-04	2.42E-05	1.19E-05	2.76E-07

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AY-2D-NL-BES-BEC Liner Strain Seismic.xls, Strain Max

Figure F.21. BES-BEC Secondary Liner Strain, Shell Bottom, Gravity Plus Seismic Load

AY Secondary Liner, Best Estimate Soil, Horizontal and Vertical Input, Best Estimate Tank Concrete, 422 In Waste Level at 1.7SpG Seismic Only

M&D Starting M&D Element No.	Path (in.)	Shell Top Surface (inside - towards waste)					
		AY-NL-BES-BEC Seismic Only Hoop Strain (in/in) Top	AY-NL-BES-BEC Seismic Only Meridional Strain (in/in) Top	AY-NL-BES-BEC Seismic Only Strain Intensity (in/in) Top	AY-NL-BES-BEC Seismic Only In-Plane Shear Strain (in/in) Top	AY-NL-BES-BEC Seismic Only In-Plane Shear Force Strain (in/in) Top	AY-NL-BES-BEC Seismic Only Thru-Thickness Shear Strain (in/in) Top
2062	**19.00**	1.54E-05	3.89E-05	9.05E-05	2.70E-04	2.28E-08	2.02E-08
2052	**49.28**	1.54E-05	1.00E-05	1.67E-05	3.50E-05	8.66E-06	4.20E-07
2042	**64.15**	2.67E-05	3.11E-05	5.33E-05	4.70E-05	1.02E-05	4.32E-06
2032	**72.29**	4.67E-05	1.57E-04	2.05E-04	5.09E-05	9.60E-06	5.22E-06
2022	**96.32**	3.38E-05	1.92E-05	3.93E-05	7.32E-05	4.64E-07	1.27E-07
1916	**129.82**	5.52E-05	7.79E-05	8.85E-05	8.89E-05	2.20E-06	6.95E-08
1906	**169.82**	5.66E-05	8.81E-06	3.30E-05	5.56E-05	1.00E-06	1.54E-08
1896	**235.97**	3.95E-05	3.70E-05	7.36E-05	7.27E-05	6.75E-07	4.26E-09
1886	**305.72**	3.19E-05	1.25E-05	2.17E-05	5.11E-05	1.05E-06	2.08E-09
1876	**379.62**	3.09E-05	3.99E-05	5.46E-05	3.78E-05	1.75E-06	3.24E-09
1866	**441.02**	1.75E-05	1.75E-05	2.45E-05	2.80E-05	1.52E-06	4.91E-09
1856	**487.97**	1.59E-05	3.48E-05	4.11E-05	2.19E-05	2.76E-06	6.98E-08

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Figure F.22. BES-BEC Secondary Liner Strain, Shell Top, Seismic Load Only

AY Secondary Liner, Best Estimate Soil, Horizontal and Vertical Input, Best Estimate Tank Concrete, 422 In Waste Level at 1.7SpG Seismic Only

M&D Starting M&D Element No.	Path (in.)	Shell Mid-Plane					
		AY-NL-BES-BEC Seismic Only Hoop Strain (in/in) Mid	AY-NL-BES-BEC Seismic Only Meridional Strain (in/in) Mid	AY-NL-BES-BEC Seismic Only Strain Intensity (in/in) Mid	AY-NL-BES-BEC Seismic Only In-Plane Shear Strain (in/in) Mid	AY-NL-BES-BEC Seismic Only In-Plane Shear Force Strain (in/in) Mid	AY-NL-BES-BEC Seismic Only Thru-Thickness Shear Strain (in/in) Mid
2062	**19.00**	1.54E-05	3.92E-05	9.01E-05	2.70E-04	2.28E-08	2.02E-08
2052	**49.28**	1.55E-05	8.15E-06	1.66E-05	3.49E-05	8.66E-06	4.20E-07
2042	**64.15**	2.71E-05	1.61E-05	3.42E-05	5.84E-05	1.02E-05	4.32E-06
2032	**72.29**	4.67E-05	2.68E-05	7.50E-05	6.05E-05	9.60E-06	5.22E-06
2022	**96.32**	3.46E-05	2.45E-05	5.44E-05	7.31E-05	4.64E-07	1.27E-07
1916	**129.82**	5.54E-05	3.79E-05	5.96E-05	8.87E-05	2.20E-06	6.95E-08
1906	**169.82**	5.65E-05	2.84E-05	6.87E-05	5.56E-05	1.00E-06	1.54E-08
1896	**235.97**	3.92E-05	2.30E-05	6.05E-05	7.25E-05	6.75E-07	4.26E-09
1886	**305.72**	3.18E-05	1.64E-05	4.36E-05	5.14E-05	1.05E-06	2.08E-09
1876	**379.62**	3.09E-05	1.62E-05	2.82E-05	3.77E-05	1.75E-06	3.24E-09
1866	**441.02**	1.79E-05	1.06E-05	1.73E-05	2.93E-05	1.52E-06	4.91E-09
1856	**487.97**	1.60E-05	1.31E-05	1.45E-05	2.30E-05	2.76E-06	6.98E-08

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Figure F.23. BES-BEC Secondary Liner Strain, Shell Middle, Seismic Load Only

AY Secondary Liner, Best Estimate Soil, Horizontal and Vertical Input, Best Estimate Tank Concrete, 422 In Waste Level at 1.7SpG Seismic Only

		Shell Bottom Surface (outside - away from waste)					
M&D Starting M&D Element No.	Path (in.)	AY-NL-BES-BEC Seismic Only Hoop Strain (in/in) Bot	AY-NL-BES-BEC Seismic Only Meridional Strain (in/in) Bot	AY-NL-BES-BEC Seismic Only Strain Intensity (in/in) Bot	AY-NL-BES-BEC Seismic Only In-Plane Shear Strain (in/in) Bot	AY-NL-BES-BEC Seismic Only In-Plane Shear Force Strain (in/in) Bot	AY-NL-BES-BEC Seismic Only Thru-Thickness Shear Strain (in/in) Bot
2062	**19.00**	1.54E-05	3.97E-05	9.01E-05	2.70E-04	2.28E-08	2.02E-08
2052	**49.28**	1.54E-05	5.13E-06	1.63E-05	3.51E-05	8.66E-06	4.20E-07
2042	**64.15**	2.56E-05	6.14E-05	7.89E-05	4.92E-05	1.02E-05	4.32E-06
2032	**72.29**	4.49E-05	3.79E-05	1.04E-04	5.04E-05	9.60E-06	5.22E-06
2022	**96.32**	3.45E-05	5.60E-05	6.65E-05	7.30E-05	4.64E-07	1.27E-07
1916	**129.82**	5.56E-05	-1.25E-04	-1.29E-04	8.84E-05	2.20E-06	6.95E-08
1906	**169.82**	5.63E-05	4.47E-05	7.57E-05	5.56E-05	1.00E-06	1.54E-08
1896	**235.97**	3.91E-05	1.15E-05	3.33E-05	7.23E-05	6.75E-07	4.26E-09
1886	**305.72**	3.18E-05	3.09E-05	5.51E-05	5.14E-05	1.05E-06	2.08E-09
1876	**379.62**	3.09E-05	2.19E-05	3.13E-05	3.73E-05	1.75E-06	3.24E-09
1866	**441.02**	1.81E-05	-2.99E-06	1.22E-06	2.84E-05	1.52E-06	4.91E-09
1856	**487.97**	1.48E-05	2.54E-05	3.33E-05	2.16E-05	2.76E-06	6.98E-08

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Figure F.24. BES-BEC Secondary Liner Strain, Shell Bottom, Seismic Load Only

Tank AY, 422 Inch Waste Level
SpG = 1.7
Best Estimate Soil
Best Estimate Concrete

Angle	Vertical Min AY-BES-BEC Gravity	Vertical Max AY-BES-BEC Gravity	Shear Y Min AY-BES-BEC Gravity	Shear Y Max AY-BES-BEC Gravity	Shear X Min AY-BES-BEC Gravity	Shear X Max AY-BES-BEC Gravity	Shear Y Max AY-BES-BEC Gravity	Shear X Max AY-BES-BEC Gravity	Shear Max AY-BES-BEC Gravity	Vertical Force Max AY-BES-BEC Gravity	Vertical Force Min AY-BES-BEC Gravity
0	-217.90	-217.90	0.00	0.00	2.06	2.06	0.00	0.65	0.65	-68.09	-68.09
9	-433.00	-432.90	0.39	0.39	3.83	3.84	0.06	0.60	0.60	-67.66	-67.64
18	-433.40	-433.30	0.49	0.50	3.46	3.46	0.08	0.54	0.55	-67.72	-67.70
27	-432.90	-432.90	1.28	1.30	3.13	3.13	0.20	0.49	0.53	-67.64	-67.64
36	-432.90	-432.90	1.87	1.88	2.79	2.79	0.29	0.44	0.53	-67.64	-67.64
45	-432.80	-432.80	2.37	2.39	2.42	2.42	0.37	0.38	0.53	-67.63	-67.63
54	-432.80	-432.80	2.75	2.76	2.01	2.01	0.43	0.31	0.53	-67.63	-67.63
63	-432.80	-432.80	3.02	3.03	1.54	1.54	0.47	0.24	0.53	-67.63	-67.63
72	-432.70	-432.70	3.19	3.20	1.04	1.04	0.50	0.16	0.52	-67.61	-67.61
81	-432.70	-432.70	3.30	3.30	0.49	0.50	0.52	0.08	0.52	-67.61	-67.61
90	-432.70	-432.60	3.35	3.35	-0.06	-0.05	0.52	0.01	0.52	-67.61	-67.59
99	-432.70	-432.70	3.33	3.33	-0.59	-0.58	0.52	0.09	0.53	-67.61	-67.61
108	-432.70	-432.70	3.26	3.27	-1.10	-1.09	0.51	0.17	0.54	-67.61	-67.61
117	-432.80	-432.70	3.07	3.07	-1.58	-1.58	0.48	0.25	0.54	-67.63	-67.61
126	-432.70	-432.70	2.78	2.78	-2.02	-2.02	0.44	0.32	0.54	-67.61	-67.61
135	-432.70	-432.70	2.40	2.40	-2.43	-2.42	0.37	0.38	0.53	-67.61	-67.61
144	-432.60	-432.60	1.96	1.96	-2.78	-2.77	0.31	0.43	0.53	-67.59	-67.59
153	-432.90	-432.80	1.30	1.31	-3.10	-3.09	0.20	0.48	0.53	-67.64	-67.63
162	-432.50	-432.50	0.85	0.85	-3.37	-3.36	0.13	0.53	0.54	-67.58	-67.58
171	-434.50	-434.50	-0.54	-0.54	-3.84	-3.83	0.08	0.60	0.61	-67.89	-67.89
180	-215.60	-215.60	0.00	0.00	-2.09	-2.09	0.00	0.65	0.65	-67.38	-67.38

Figure F.25. BES-BEC Concrete Wall/Footing Contact Forces, Gravity Load Only

Tank AY, 422 Inch Waste Level
SpG = 1.7
Best Estimate Soil
Best Estimate Concrete

Angle	Vertical Min AY-BES-BEC Seismic	Vertical Max AY-BES-BEC Seismic	Shear Y Min AY-BES-BEC Seismic	Shear Y Max AY-BES-BEC Seismic	Shear X Min AY-BES-BEC Seismic	Shear X Max AY-BES-BEC Seismic	Shear Y Max AY-BES-BEC Seismic	Shear X Max AY-BES-BEC Seismic	Shear Max AY-BES-BEC Seismic	Vertical Force Max AY-BES-BEC Seismic	Vertical Force Min AY-BES-BEC Seismic
0	-250.00	-168.70	0.00	0.00	-7.94	13.43	0.00	4.20	4.20	-78.13	-52.72
9	-496.70	-335.80	-20.21	21.77	-18.74	29.37	3.40	4.59	5.71	-77.61	-52.47
18	-496.90	-338.40	-38.57	41.08	-28.48	38.17	6.42	5.96	8.76	-77.64	-52.88
27	-496.00	-341.80	-52.40	56.82	-43.87	52.40	8.88	8.19	12.08	-77.50	-53.41
36	-495.40	-347.00	-61.52	67.00	-63.33	70.80	10.47	11.06	15.23	-77.41	-54.22
45	-494.60	-350.70	-64.85	70.83	-84.93	91.62	11.07	14.32	18.09	-77.28	-54.80
54	-493.70	-353.90	-61.81	67.83	-106.60	112.90	10.60	17.64	20.58	-77.14	-55.30
63	-492.70	-357.80	-52.45	58.32	-126.10	132.70	9.11	20.73	22.65	-76.98	-55.91
72	-491.50	-361.40	-37.43	43.25	-141.70	149.00	6.76	23.28	24.24	-76.80	-56.47
81	-490.30	-363.80	-18.01	24.19	-151.70	159.80	3.78	24.97	25.25	-76.61	-56.84
90	-489.20	-365.10	1.34	5.11	-155.10	163.90	0.80	25.61	25.62	-76.44	-57.05
99	-488.30	-365.70	-17.82	26.05	-151.40	160.50	4.07	25.08	25.41	-76.30	-57.14
108	-487.40	-365.60	-36.36	45.98	-141.10	149.90	7.18	23.42	24.50	-76.16	-57.13
117	-486.60	-365.00	-50.81	61.31	-125.50	132.80	9.58	20.75	22.85	-76.03	-57.03
126	-486.20	-363.70	-59.89	70.39	-106.60	111.30	11.00	17.39	20.58	-75.97	-56.83
135	-486.60	-361.90	-62.92	72.48	-86.07	88.12	11.33	13.77	17.83	-76.03	-56.55
144	-487.50	-360.30	-59.70	67.73	-65.96	65.60	10.58	10.31	14.77	-76.17	-56.30
153	-489.20	-359.40	-50.98	56.76	-48.14	45.79	8.87	7.52	11.63	-76.44	-56.16
162	-490.10	-358.80	-37.14	41.06	-34.35	30.42	6.42	5.37	8.36	-76.58	-56.06
171	-493.40	-360.80	-21.01	21.12	-26.21	20.61	3.30	4.10	5.26	-77.09	-56.38
180	-245.00	-179.00	0.00	0.00	-11.85	8.64	0.00	3.70	3.70	-76.56	-55.94

Figure F.26. BES-BEC Concrete Wall/Footing Contact Forces, Gravity Plus Seismic Load

Tank AY, 422 Inch Waste Level
SpG = 1.7
Best Estimate Soil
Best Estimate Concrete

Angle	Vertical Min AY-BES-BEC Seismic Only	Vertical Max AY-BES-BEC Seismic Only	Shear Y Min AY-BES-BEC Seismic Only	Shear Y Max AY-BES-BEC Seismic Only	Shear X Min AY-BES-BEC Seismic Only	Shear X Max AY-BES-BEC Seismic Only	Shear Y Max AY-BES-BEC Seismic Only	Shear X Max AY-BES-BEC Seismic Only	Shear Max AY-BES-BEC Seismic Only	Vertical Force Max AY-BES-BEC Seismic Only	Vertical Force Min AY-BES-BEC Seismic Only
0	-32.10	49.20	0.00	0.00	-10.00	11.37	0.00	3.55	3.55	-10.03	15.38
9	-63.70	97.10	-20.60	21.38	-22.57	25.54	3.34	3.99	5.20	-9.95	15.17
18	-63.50	94.90	-39.06	40.58	-31.94	34.71	6.34	5.42	8.34	-9.92	14.83
27	-63.10	91.10	-53.68	55.52	-47.00	49.27	8.67	7.70	11.60	-9.86	14.23
36	-62.50	85.90	-63.39	65.12	-66.12	68.01	10.17	10.63	14.71	-9.77	13.42
45	-61.80	82.10	-67.22	68.44	-87.35	89.20	10.69	13.94	17.57	-9.66	12.83
54	-60.90	78.90	-64.56	65.07	-108.61	110.89	10.17	17.33	20.09	-9.52	12.33
63	-59.90	75.00	-55.47	55.29	-127.64	131.16	8.67	20.49	22.25	-9.36	11.72
72	-58.80	71.30	-40.62	40.06	-142.74	147.96	6.35	23.12	23.97	-9.19	11.14
81	-57.60	68.90	-21.31	20.89	-152.19	159.30	3.33	24.89	25.11	-9.00	10.77
90	-56.50	67.50	-2.00	1.76	-155.04	163.95	0.31	25.62	25.62	-8.83	10.55
99	-55.60	67.00	-21.15	22.72	-150.81	161.08	3.55	25.17	25.42	-8.69	10.47
108	-54.70	67.10	-39.62	42.71	-140.00	150.99	6.67	23.59	24.52	-8.55	10.48
117	-53.80	67.70	-53.88	58.24	-123.92	134.38	9.10	21.00	22.88	-8.41	10.58
126	-53.50	69.00	-62.67	67.61	-104.58	113.32	10.56	17.71	20.62	-8.36	10.78
135	-53.90	70.80	-65.32	70.08	-83.65	90.54	10.95	14.15	17.89	-8.42	11.06
144	-54.90	72.30	-61.66	65.77	-63.18	68.37	10.28	10.68	14.82	-8.58	11.30
153	-56.30	73.40	-52.28	55.45	-45.04	48.88	8.66	7.64	11.55	-8.80	11.47
162	-57.60	73.70	-37.99	40.21	-30.98	33.78	6.28	5.28	8.21	-9.00	11.52
171	-58.90	73.70	-20.47	21.66	-22.37	24.44	3.38	3.82	5.10	-9.20	11.52
180	-29.40	36.60	0.00	0.00	-9.76	10.72	0.00	3.35	3.35	-9.19	11.44

Figure F.27. BES-BEC Concrete Wall/Footing Contact Forces, Seismic Load Only

Tank AY, 422 Inch Waste Level
SpG = 1.7
Best Estimate Soil
Best Estimate Concrete

	Angle (rad)	Path	Max Pressure Soil (BES) AY Gravity (PSI)	Min Pressure Soil (BES) AY Gravity (PSI)	Max Meridional Friction Soil (BES) AY Gravity (PSI)	Max Tangential Friction Soil (BES) AY Gravity (PSI)	Max Contact Displacement Soil (BES) AY Gravity (PSI)	Vertical Pressure	Active Pressure Phi = 33 deg	Active Pressure Phi = 49 deg
568	-0.035089	**67.727**	13.25	11.72	1.53	0.04	0.01	7.12	7.11	7.11
565.8	-0.07135	**105.668**	9.78	9.50	1.96	0.07	0.02	7.27	7.26	7.26
563.21	-0.096521	**137.069**	8.78	7.72	1.81	0.11	0.02	7.46	7.43	7.42
559.7	-0.124516	**182.849**	7.16	6.24	1.60	0.16	0.02	7.71	7.65	7.65
550.7	-0.180521	**226.563**	9.09	6.40	1.82	0.28	0.02	8.35	8.23	8.22
545.2	-0.210395	**275.566**	9.16	8.74	1.86	0.13	0.02	8.74	8.57	8.55
527.68	-0.298426	**325.690**	8.67	8.24	1.80	0.03	0.02	9.99	9.59	9.56
518.2	-0.34673	**372.305**	10.73	10.65	2.07	0.03	0.02	10.66	10.09	10.04
494.5	-0.482293	**423.427**	17.22	17.14	2.05	0.07	0.02	12.35	11.07	10.97
476.2	-0.606571	**468.308**	27.50	27.40	2.23	0.11	0.02	13.65	11.45	11.27
447.4	-0.656685	**515.312**	30.65	30.53	4.63	0.21	0.03	15.70	12.75	12.51
407.1	-0.710341	**549.725**	26.88	26.79	5.43	0.17	0.04	18.57	14.53	14.18
382.1	-1.570796	**585.819**	14.83	14.79	3.79	0.08	0.04	20.35	6.00	2.85
335	-1.570796	**636.369**	5.05	5.05	1.34	0.01	0.05	23.70	6.99	3.32
281	-1.570796	**685.619**	3.53	3.52	0.85	0.00	0.05	27.55	8.13	3.86
236.5	-1.570796	**732.719**	4.76	4.75	0.96	0.00	0.05	30.71	9.06	4.30
186.8	-1.570796	**778.219**	4.95	4.93	1.01	0.00	0.06	34.25	10.10	4.80
145.5	-1.570796	**821.369**	4.90	4.88	1.01	0.00	0.06	37.19	10.97	5.21
70	-1.570796	**874.169**	6.38	6.28	1.47	0.01	0.05	42.57	12.56	5.96
24	-1.570796	**930.544**	12.08	12.02	2.88	0.06	0.04	45.84	13.52	6.42

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Figure F.28. BES-BEC Soil/Concrete Tank Contact Forces, Gravity Load Only

Tank AY, 422 Inch Waste Level
SpG = 1.7
Best Estiamte Soil
Best Estimate Concrete

	Angle (rad)	Path	Max Pressure Soil (BES) AY Seismic (PSI)	Min Pressure Soil (BES) AY Seismic (PSI)	Max Meridional Friction Soil (BES) AY Seismic (PSI)	Max Tangential Friction Soil (BES) AY Seismic (PSI)	Max Contact Displacement Soil (BES) AY Seismic (inch)	Vertical Pressure	Active Pressure Phi = 33 deg	Active Pressure Phi = 49 deg
568	-0.035089	**67.727**	21.33	3.79	7.00	5.50	0.02	7.12	7.11	7.11
565.8	-0.07135	**105.668**	15.88	3.27	6.94	4.18	0.03	7.27	7.26	7.26
563.21	-0.096521	**137.069**	13.63	2.36	5.84	3.22	0.04	7.46	7.43	7.42
559.7	-0.124516	**182.849**	10.33	3.83	5.15	3.24	0.03	7.71	7.65	7.65
550.7	-0.180521	**226.563**	13.65	4.04	3.89	4.21	0.03	8.35	8.23	8.22
545.2	-0.210395	**275.566**	11.50	6.14	4.48	4.10	0.03	8.74	8.57	8.55
527.68	-0.298426	**325.690**	10.28	6.10	4.06	3.72	0.03	9.99	9.59	9.56
518.2	-0.34673	**372.305**	12.75	8.57	3.86	3.46	0.02	10.66	10.09	10.04
494.5	-0.482293	**423.427**	20.82	14.17	3.81	2.99	0.02	12.35	11.07	10.97
476.2	-0.606571	**468.308**	34.55	21.31	3.91	2.91	0.02	13.65	11.45	11.27
447.4	-0.656685	**515.312**	35.87	26.40	9.44	3.13	0.04	15.70	12.75	12.51
407.1	-0.710341	**549.725**	31.75	22.56	12.26	2.80	0.05	18.57	14.53	14.18
382.1	-1.570796	**585.819**	17.44	12.06	9.35	2.03	0.06	20.35	6.00	2.85
335	-1.570796	**636.369**	5.72	4.46	4.38	1.62	0.07	23.70	6.99	3.32
281	-1.570796	**685.619**	4.15	2.85	2.92	1.59	0.08	27.55	8.13	3.86
236.5	-1.570796	**732.719**	5.33	4.15	3.21	1.56	0.09	30.71	9.06	4.30
186.8	-1.570796	**778.219**	5.50	4.38	3.37	1.90	0.09	34.25	10.10	4.80
145.5	-1.570796	**821.369**	5.51	4.01	3.17	2.53	0.08	37.19	10.97	5.21
70	-1.570796	**874.169**	7.85	4.58	5.90	3.18	0.07	42.57	12.56	5.96
24	-1.570796	**930.544**	19.38	3.61	6.69	3.22	0.05	45.84	13.52	6.42

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Figure F.29. BES-BEC Soil/Concrete Tank Contact Forces, Gravity Plus Seismic Load

Tank AY, 422 Inch Waste Level
SpG = 1.7
Best Estiamte Soil
Best Estimate Concrete

	Angle (rad)	Path	Max Pressure Soil (BES) AY Seismic Only (PSI)	Min Pressure Soil (BES) AY Seismic Only (PSI)	Max Meridional Friction (BES) AY Seismic Only (PSI)	Max Tangential Friction (BES) AY Seismic Only (PSI)	Max Contact Displacment (BES) AY Seismic Only (inch)
568	-0.035089	**67.727**	8.08	-9.46	5.47	5.45	0.01
565.8	-0.07135	**105.668**	6.09	-6.51	4.98	4.12	0.01
563.21	-0.096521	**137.069**	4.85	-6.42	4.03	3.11	0.01
559.7	-0.124516	**182.849**	3.17	-3.33	3.56	3.08	0.01
550.7	-0.180521	**226.563**	4.56	-5.05	2.07	3.93	0.01
545.2	-0.210395	**275.566**	2.34	-3.02	2.63	3.97	0.01
527.68	-0.298426	**325.690**	1.61	-2.57	2.27	3.69	0.01
518.2	-0.34673	**372.305**	2.02	-2.16	1.79	3.43	0.00
494.5	-0.482293	**423.427**	3.60	-3.06	1.76	2.92	0.00
476.2	-0.606571	**468.308**	7.05	-6.19	1.68	2.80	0.01
447.4	-0.656685	**515.312**	5.22	-4.26	4.81	2.91	0.01
407.1	-0.710341	**549.725**	4.87	-4.33	6.83	2.62	0.02
382.1	-1.570796	**585.819**	2.61	-2.77	5.57	1.95	0.02
335	-1.570796	**636.369**	0.67	-0.59	3.04	1.61	0.03
281	-1.570796	**685.619**	0.63	-0.68	2.07	1.58	0.03
236.5	-1.570796	**732.719**	0.57	-0.61	2.25	1.56	0.03
186.8	-1.570796	**778.219**	0.55	-0.57	2.35	1.90	0.03
145.5	-1.570796	**821.369**	0.61	-0.89	2.16	2.52	0.03
70	-1.570796	**874.169**	1.47	-1.80	4.42	3.17	0.02
24	-1.570796	**930.544**	7.30	-8.47	3.81	3.16	0.01

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Figure F.30. BES-BEC Soil/Concrete Tank Contact Forces, Seismic Load Only

Tank AY, 422 Inch Waste Level
SpG = 1.7
Best Estimate Soil
Best Estimate Concrete

Radius	Max Pressure Primary Tank/Concrete Tank Dome AY Gravity (PSI)	Min Pressure Primary Tank/Concrete Tank Dome AY Gravity (PSI)	Max Gap Lateral Displacement Primary Tank /Concrete Tank Dome Gravity (in)	Max Gap Displacement Primary Tank/Concete Tank Dome AY Gravity (Inches)
67.727	1.869	1.640	0.001836	0.000000
105.668	1.199	0.929	0.002484	0.000000
137.069	1.437	0.431	0.001600	-0.000002
182.849	1.428	0.714	0.002346	-0.000007
226.563	2.442	1.265	0.002278	-0.000028
275.566	1.452	0.560	0.002677	-0.000066
325.690	9.514	1.303	0.003445	-0.000084
372.305	6.683	0.237	0.003802	-0.000236
423.427	2.358	0.000	0.001149	-1.055160

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Figure F.31. BES-BEC Primary Tank/Concrete Dome Contact Forces, Gravity Load Only

Tank AY, 422 Inch Waste Level
SpG = 1.7
Best Estimate Soil
Best Estimate Concrete

Radius	Max Pressure Primary Tank/Concrete Tank Dome AY Seismic (PSI)	Min Pressure Primary Tank/Concrete Tank Dome AY Seismic (PSI)	Max Gap Lateral Displacement Primary Tank /Concrete Tank Dome Seismic (in)	Max Gap Displacement Primary Tank/Concete Tank Dome AY Seismic (Inches)
67.727	23.743	0.367	0.003557	-0.000023
105.668	11.382	0.000	0.004936	-0.000030
137.069	7.604	0.000	0.006421	-0.000038
182.849	2.271	0.135	0.005311	-0.000055
226.563	13.750	0.000	0.003216	-0.000351
275.566	11.125	0.000	0.004837	-0.000717
325.690	76.806	0.000	0.005440	-0.001936
372.305	91.667	0.000	0.025152	-0.001847
423.427	45.396	0.000	0.026196	-1.059960

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Figure F.32. BES-BEC Primary Tank/Concrete Dome Contact Forces, Gravity Plus Seismic Load

Tank AY, 422 Inch Waste Level
SpG = 1.7
Best Estimate Soil
Best Estimate Concrete

Radius	Max Pressure Primary Tank/Concrete Tank Dome AY Seismic Only (PSI)	Min Pressure Primary Tank/Concrete Tank Dome AY Seismic Only (PSI)	Max Gap Lateral Displacement Primary Tank /Concrete Tank Dome Seismic Only (in)	Max Gap Displacement Primary Tank/Concete Tank Dome AY Seismic Only (Inches)
67.727	21.874	-1.273	0.001721	-0.000023
105.668	10.183	-0.929	0.002452	-0.000030
137.069	6.167	-0.431	0.004822	-0.000036
182.849	0.842	-0.579	0.002965	-0.000047
226.563	11.308	-1.265	0.000938	-0.000322
275.566	9.673	-0.560	0.002160	-0.000652
325.690	67.292	-1.303	0.001994	-0.001852
372.305	84.983	-0.237	0.021350	-0.001611
423.427	43.038	0.000	0.025047	-0.004800

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Figure F.33. BES-BEC Primary Tank/Concrete Dome Contact Forces, Seismic Load Only

Tank AY, 422 Inch Waste Level
SpG = 1.7
Best Esitmate Soil
Best Estimate Concrete

Radius	Max Pressure Primary Tank/Insulating Concrete AY Gravity (PSI)	Min Pressure Primary Tank/Insulating Concrete AY Gravity (PSI)	Max Lateral Dispiacement Primary Tank / Insulating Concete AY Gravity (Inches)	Min Lateral Dispiacement Primary Tank / Insulating Concete AY Gravity (Inches)
424.00	49.785	49.153	0.002226	0.002094
384.00	19.618	19.451	0.000267	0.000222
317.85	27.361	27.333	0.000276	0.000250
248.10	25.924	25.875	0.000204	0.000195
199.25	26.000	25.924	0.000278	0.000271
154.95	26.208	26.104	0.000104	0.000094
112.80	25.451	25.257	0.000178	0.000170
65.85	29.271	28.667	0.000180	0.000166

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Figure F.34. BES-BEC Primary Tank/Insulating Concrete Contact Forces, Gravity Load Only

Tank AY, 422 Inch Waste Level
SpG = 1.7
Best Estimate Soil
Best Estimate Concrete

Radius	Max Pressure Primary Tank/Insulaiting Concrete AY Seismic (PSI)	Min Pressure Primary Tank/Insulaiting Concrete AY Seismic (PSI)	Max Lateral Displacement Primary Tank/Insulaiting Concrete AY Seismic (Inches)	Min Lateral Displacement Primary Tank/Insulaiting Concrete AY Seismic (Inches)
424.00	68.514	24.528	0.034416	0.000778
384.00	25.639	13.014	0.024144	0.000145
317.85	33.924	18.847	0.009985	0.000171
248.10	31.299	19.944	0.003124	0.000097
199.25	31.139	20.632	0.001885	0.000024
154.95	31.139	21.208	0.001270	0.000020
112.80	30.194	20.799	0.001054	0.000018
65.85	34.465	23.813	0.000933	0.000144

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Figure F.35. BES-BEC Primary Tank/Insulating Concrete Contact Forces, Gravity Plus Seismic Load

Tank AY, 422 Inch Waste Level
SpG = 1.7
Best Estimate Soil
Best Estimate Concrete

Radius	Max Pressure Primary Tank/Insulaiting Concrete AY Seismic Only (PSI)	Min Pressure Primary Tank/Insulaiting Concrete AY Seismic Only (PSI)	Max Lateral Displacement Primary Tank/Insulaiting Concrete AY Seismic Only (Inches)	Min Lateral Displacement Primary Tank/Insulaiting Concrete AY Seismic Only (Inches)
424.00	18.729	-24.625	0.032	-0.001
384.00	6.021	-6.438	0.024	0.000
317.85	6.563	-8.486	0.010	0.000
248.10	5.375	-5.931	0.003	0.000
199.25	5.139	-5.292	0.002	0.000
154.95	4.931	-4.896	0.001	0.000
112.80	4.743	-4.458	0.001	0.000
65.85	5.194	-4.854	0.001	0.000

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AY-2D-NL-BES-BEC Primary-Contact-Seismic.xls
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Figure F.36. BES-BEC Primary Tank/Insulating Concrete Contact Forces, Seismic Load Only

Tank AY, 422 Inch Waste Level
SpG = 1.7
Best Esitmate Soil
Best Estimate Concrete

Radius	Max Pressure Insulating Concrete/Secondary Liner AY Gravity (PSI)	Min Pressure Insulating Concrete/Secondary Liner AY Gravity (PSI)	Max Lateral Displacement Insulating Concrete/Secondary Liner AY Gravity (Inches)	Min Lateral Displacement Insulating Concrete/Secondary Liner AY Gravity (Inches)
424.00	54.250	52.833	0.001678	0.001478
384.00	20.840	20.465	0.000433	0.000348
317.85	27.333	27.229	0.000142	0.000127
248.10	26.424	26.347	0.000128	0.000124
199.25	26.451	26.396	0.000107	0.000100
154.95	26.056	25.993	0.000065	0.000052
112.80	26.771	26.618	0.000073	0.000058
65.85	26.563	26.146	0.000149	0.000143

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Figure F.37. BES-BEC Insulating Concrete/Secondary Liner Contact Forces, Gravity Load Only

Tank AY, 422 Inch Waste Level
SpG = 1.7
Best Estimate Soil
Best Estimate Concrete

Radius	Max Pressure Insulating Concrete/Secondary Liner AY Seismic (PSI)	Min Pressure Insulating Concrete/Secondary Liner AY Seismic (PSI)	Max Lateral Displacement Insulating Concrete/Secondary Liner AY Seismic (Inches)	Min Lateral Displacement Insulating Concrete/Secondary Liner AY Seismic (Inches)
424.00	70.764	29.222	0.005928	0.000260
384.00	26.806	14.181	0.005868	0.000175
317.85	33.896	18.903	0.003961	0.000045
248.10	31.799	20.326	0.002237	0.000089
199.25	31.632	21.104	0.001274	0.000005
154.95	30.972	21.069	0.000897	0.000017
112.80	31.722	21.896	0.000829	0.000007
65.85	31.326	21.826	0.000750	0.000021

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Figure F.38. BES-BEC Insulating Concrete/Secondary Liner Contact Forces, Gravity Plus Seismic Load

Tank AY, 422 Inch Waste Level
SpG = 1.7
Best Estimate Soil
Best Estimate Concrete

Radius	Max Pressure Insulating Concrete/Secondary Liner AY Seismic Only (PSI)	Min Pressure Insulating Concrete/Secondary Liner AY Seismic Only (PSI)	Max Lateral Displacement Insulating Concrete/Secondary Liner AY Seismic Only (Inches)	Min Lateral Displacement Insulating Concrete/Secondary Liner AY Seismic Only (Inches)
424.00	16.514	-23.611	0.004	-0.001
384.00	5.965	-6.285	0.005	0.000
317.85	6.563	-8.326	0.004	0.000
248.10	5.375	-6.021	0.002	0.000
199.25	5.181	-5.292	0.001	0.000
154.95	4.917	-4.924	0.001	0.000
112.80	4.951	-4.722	0.001	0.000
65.85	4.764	-4.319	0.001	0.000

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AY-2D-NL-BES-BEC Liner-Contact-

Figure F.39. BES-BEC Insulating Concrete/Secondary Liner Contact Forces, Seismic Load Only

Tank AY, 422 Inch Waste Level
SpG = 1.7
Best Estimate Soil
Best Estimate Concrete

Waste Height	Max Pressure AY Tank, 422 in Waste Level, SpG = 1.7 Time History (PSI)	Min Pressure AY Tank, 422 in Waste Level, SpG = 1.7 Time History (PSI)	Hydrostatic (psi)	Impulsive (psi)	Convective (psi)	Breathing (psi)	Dynamic (psi)	Dynamic (SRSS) (psi)	Theoretical Max	Theoretical Min	Theoretical Max (SRSS)	Theoretical Min (SRSS)
410.75	11.153	-8.417	0.69	1.08	1.38	0.26	2.01	1.77	2.70	-1.32	2.46	-1.08
386.5	6.321	-2.458	2.18	2	1.25	0.82	3.18	2.50	5.36	-1.00	4.68	-0.32
359.5	12.007	-4.372	3.84	2.86	1.13	1.43	4.51	3.39	8.34	-0.67	7.23	0.45
332	13.625	-1.998	5.53	3.59	1.02	2.05	5.78	4.26	11.31	-0.26	9.78	1.27
305	12.701	0.609	7.18	4.2	0.93	2.63	6.93	5.04	14.11	0.25	12.22	2.14
278	15.361	0.332	8.84	4.73	0.85	3.18	7.99	5.76	16.83	0.85	14.60	3.08
251	17.931	1.163	10.50	5.17	0.77	3.7	8.93	6.40	19.42	1.57	16.90	4.09
225.65	22.833	1.968	12.05	5.53	0.72	4.15	9.73	6.95	21.78	2.33	19.01	5.10
202.3	23.958	2.387	13.49	5.81	0.67	4.54	10.39	7.40	23.88	3.10	20.89	6.08
179.3	32.958	2.989	14.90	6.05	0.63	4.89	10.97	7.80	25.87	3.93	22.70	7.09
156.35	32.014	4.589	16.31	6.26	0.6	5.2	11.49	8.16	27.80	4.82	24.47	8.15
131.45	30.556	6.265	17.84	6.44	0.56	5.49	11.95	8.48	29.79	5.88	26.32	9.36
104.5	36.319	7.813	19.49	6.6	0.54	5.76	12.38	8.78	31.87	7.11	28.27	10.71
77.5	32.389	9.868	21.15	6.73	0.52	5.97	12.72	9.01	33.87	8.43	30.16	12.14
50.5	35.882	11.590	22.81	6.81	0.5	6.11	12.94	9.16	35.74	9.87	31.97	13.64
24.5	34.729	11.694	24.40	6.86	0.49	6.2	13.08	9.26	37.48	11.32	33.66	15.14

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Figure F.40. BES-BEC Waste Contact Pressure, Gravity Plus Seismic Load

Tank AY, 422 Inch Waste Level
SpG = 1.7
Best Estimate Soil
Best Estimate Concrete

Waste Radius	Max Vertical Displacement AY-BES-BEC Time History (in)	Min Vertical Displacement AY-BES-BEC Time History (in)
95.7	2.72	-3.33
129.9	3.88	-4.53
180	4.46	-5.14
218.5	5.29	-6.01
277.7	5.67	-6.35
358	5.90	-6.61
410	6.60	-7.21
450	6.64	-7.26

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Figure F.41. BES-BEC Waste Surface Displacement, Gravity Plus Seismic Load

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,kmaxte
mp2+4
a,kmaxtemp2+2,kmaxtemp2+3,kmaxtemp2+6,kmaxte
mp2+5
a,kmaxtemp2+3,kmaxtemp1+1,kmaxtemp1+2,kmaxte
mp2+6
a,kmaxtemp2+4,kmaxtemp2+5,kmaxjb+9,kmaxjb+8,
kmaxjb+7,kmaxjb+6,kmaxjb+5,kmaxjb+4,kmaxjb+3
,kmaxjb+2!a,740,741,712,711,710,709,708,707,
706,705
a,kmaxtemp2+5,kmaxtemp2+6,kmaxtemp2+7,kmaxjb
+12,kmaxjb+11,kmaxjb+10,kmaxjb+9
a,kmaxtemp2+6,kmaxtemp1+2,kmaxtemp1+3,kmaxte
mp2+7
a,kmaxtemp2+7,kmaxtemp1+3,kmaxtemp1+4,kmaxjb
+12
a,kmaxjb+12,kmaxtemp1+4,kmaxtemp1+5,kmaxjb+1
4,kmaxjb+13
a,kmaxjb+14,kmaxtemp1+5,kmaxtemp1+6,kmaxjb+1
6,kmaxjb+15
a,kmaxjb+16,kmaxtemp1+6,kmaxtemp1+7,kmaxjb+1
8,kmaxjb+17
a,kmaxjb+18,kmaxtemp1+7,kmaxtemp1+8,kmaxjb+2
0,kmaxjb+19
a,kmaxjb+20,kmaxtemp1+8,kmaxtemp1+9,kmaxtemp
2+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,kma
xjb+bm_kp+2
a,kmaxjb+bm_kp+2,kmaxtemp2+4,kmaxjb+2,kmaxjb
+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

/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, Horizontal and
Vertical Seismic Inputs, Best Estimate Soil,
Best Estimate Concrete Properties, AP
Primary Tank Geometry
```

```
!
fini
/clear
/filname,PNNL-2D-BES-BEC,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-AY,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-AY,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-AY,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,contact-AY,txt         ! Extract
Contact data
/input,all-forces,txt         ! Extract
component forces/strains
/input,spectra-all,txt        ! Extract
Response Spectra
/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-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,PNNL-AY-2D-NL-BEC-BES-Gravity,out
/solu
antype,trans
TRNOPT,FULL
lumpm,OFF
!nlgeom,on
NROPT,auto
NTIM-2 !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: BES-BEC, Full Non-linear,
Final PT Mesh
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,20,200,5,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+massm
_z)*g

SOLVE
SAVE
*ENDDO
FINISH
/out
```

Solve-TH-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,PNNL-AY-2D-NL-BEC-BES,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-266-Mean-geo,txt
(8(F9.6))
*VREAD,A_1_Z(1),th-266-Mean-geo-v,txt
(8(F9.6))

/Title,Load Case: BES-BEC, Full Non-linear,
Final PT Mesh
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,20,200,5,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+massm
_z)*g

SOLVE
SAVE
*ENDDO
FINISH
/out
```

Tank-Props-BEC-250.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
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,32,1.02                    !
r,20,1.07                    ! 18 in              !r,34,1
r,21,1.97                    ! 18 in              !r,35,1
r,22,1.68                    ! 18 in              !r,36,1
r,23,1.43                    ! 18 in              !r,37,1
r,24,1.43,1.43,0.51,0.51     !                    !r,39,1
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               /COM - Material,50, Insulating Concrete
r,28,0.55                    ! 8 in               mp,ex,50,23760
r,29,0.42                    ! 8 in               mp,nuxy,50,0.15
r,30,0.40                    ! 8 in               mp,dens,50,50/(1000*g)
r,31,0.40,0.40,1.02,1.02     ! 8 in to            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 D is 300GB Maxtor
 Volume Serial Number is 5851-C3F2

 Directory of D:\Bruce\PNNL\PNNL-2D-NL-AY-BES-BEC-Seismic

12/21/2005  07:53 AM    <DIR>          .
12/21/2005  07:53 AM    <DIR>          ..
12/12/2005  09:57 AM           535,476 Accel-ct-0.out
12/12/2005  10:05 AM           535,728 Accel-ct-135.out
12/12/2005  10:08 AM           535,728 Accel-ct-180.out
12/12/2005  10:00 AM           535,476 Accel-ct-45.out
12/12/2005  10:02 AM           535,728 Accel-ct-90.out
12/12/2005  10:10 AM           277,176 Accel-ct.out
12/12/2005  10:13 AM           535,728 Accel-PT-0.out
12/12/2005  10:21 AM           535,728 Accel-PT-135.out
12/12/2005  10:24 AM           535,728 Accel-PT-180.out
12/12/2005  10:16 AM           535,728 Accel-PT-45.out
12/12/2005  10:18 AM           535,728 Accel-PT-90.out
12/12/2005  10:26 AM           535,728 Accel-SOil.out
09/27/2005  03:47 PM                99 All-Forces.txt
09/02/2005  02:01 PM             5,766 Bolts-Friction.txt
06/09/2005  01:59 PM               262 Boundary.txt
10/31/2005  12:24 PM               189 Contact-AY.txt
12/01/2005  09:11 AM               586 Contact-Footing.txt
09/02/2005  09:28 AM               604 Contact-Insul.txt
09/02/2005  09:51 AM               602 Contact-J-Bolts.txt
09/09/2005  09:59 AM               608 Contact-Primary.txt
09/15/2005  11:50 AM               742 Contact-Soil.txt
09/06/2005  11:16 AM               630 Contact-Waste-AY.txt
09/22/2005  04:05 PM             8,608 Far-Soil.txt
11/11/2005  12:08 PM             2,050 file.bat
11/11/2005  12:08 PM                68 file.err
11/11/2005  12:08 PM               456 file.log
12/21/2005  07:53 AM                 0 files.txt
10/13/2005  06:54 AM               562 Fix-Soil.txt
12/14/2005  09:52 AM            10,342 Footing-Cont_max.OUT
12/14/2005  09:52 AM         4,144,248 Footing-Cont_th.OUT
04/06/2005  08:24 AM               894 Force-c.txt
11/14/2005  04:09 PM             4,996 Force-c_108amax.OUT
11/14/2005  04:09 PM         2,770,500 Force-c_108ath.OUT
11/14/2005  12:39 PM            14,716 Force-c_108max.OUT
11/14/2005  12:39 PM         6,216,180 Force-c_108th.OUT
11/14/2005  04:18 PM             4,996 Force-c_117amax.OUT
11/14/2005  04:19 PM         2,770,500 Force-c_117ath.OUT
11/14/2005  12:50 PM            14,716 Force-c_117max.OUT
11/14/2005  12:50 PM         6,216,180 Force-c_117th.OUT
11/14/2005  04:28 PM             4,996 Force-c_126amax.OUT
11/14/2005  04:29 PM         2,770,500 Force-c_126ath.OUT
11/14/2005  01:00 PM            14,716 Force-c_126max.OUT
11/14/2005  01:00 PM         6,216,180 Force-c_126th.OUT
11/14/2005  04:39 PM             4,996 Force-c_135amax.OUT
11/14/2005  04:39 PM         2,770,500 Force-c_135ath.OUT
11/14/2005  01:11 PM            14,716 Force-c_135max.OUT
11/14/2005  01:11 PM         6,216,180 Force-c_135th.OUT
11/14/2005  04:49 PM             4,996 Force-c_144amax.OUT
11/14/2005  04:49 PM         2,770,500 Force-c_144ath.OUT
11/14/2005  01:21 PM            14,716 Force-c_144max.OUT
11/14/2005  01:21 PM         6,216,180 Force-c_144th.OUT
11/14/2005  05:00 PM             4,996 Force-c_153amax.OUT
11/14/2005  05:00 PM         2,770,500 Force-c_153ath.OUT
11/14/2005  01:32 PM            14,716 Force-c_153max.OUT
11/14/2005  01:32 PM         6,216,180 Force-c_153th.OUT
11/14/2005  05:11 PM             4,996 Force-c_162amax.OUT
11/14/2005  05:11 PM         2,770,500 Force-c_162ath.OUT
11/14/2005  01:43 PM            14,716 Force-c_162max.OUT
11/14/2005  01:43 PM         6,216,180 Force-c_162th.OUT
11/14/2005  05:21 PM             4,996 Force-c_171amax.OUT
11/14/2005  05:21 PM         2,770,500 Force-c_171ath.OUT
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11/14/2005  01:54 PM            14,716 Force-c_171max.OUT
11/14/2005  01:54 PM         6,216,180 Force-c_171th.OUT
11/14/2005  05:31 PM             4,996 Force-c_180amax.OUT
11/14/2005  05:31 PM         2,770,500 Force-c_180ath.OUT
11/14/2005  02:04 PM            14,716 Force-c_180max.OUT
11/14/2005  02:04 PM         6,216,180 Force-c_180th.OUT
11/14/2005  02:26 PM             4,996 Force-c_18amax.OUT
11/14/2005  02:26 PM         2,770,500 Force-c_18ath.OUT
11/14/2005  10:54 AM            14,716 Force-c_18max.OUT
11/14/2005  10:54 AM         6,216,180 Force-c_18th.OUT
11/14/2005  02:35 PM             4,996 Force-c_27amax.OUT
11/14/2005  02:35 PM         2,770,500 Force-c_27ath.OUT
11/14/2005  11:03 AM            14,716 Force-c_27max.OUT
11/14/2005  11:04 AM         6,216,180 Force-c_27th.OUT
11/14/2005  02:45 PM             4,996 Force-c_36amax.OUT
11/14/2005  02:45 PM         2,770,500 Force-c_36ath.OUT
11/14/2005  11:14 AM            14,716 Force-c_36max.OUT
11/14/2005  11:14 AM         6,216,180 Force-c_36th.OUT
11/14/2005  02:56 PM             4,996 Force-c_45amax.OUT
11/14/2005  02:56 PM         2,770,500 Force-c_45ath.OUT
11/14/2005  11:25 AM            14,716 Force-c_45max.OUT
11/14/2005  11:25 AM         6,216,180 Force-c_45th.OUT
11/14/2005  03:06 PM             4,996 Force-c_54amax.OUT
11/14/2005  03:06 PM         2,770,500 Force-c_54ath.OUT
11/14/2005  11:35 AM            14,716 Force-c_54max.OUT
11/14/2005  11:35 AM         6,216,180 Force-c_54th.OUT
11/14/2005  03:17 PM             4,996 Force-c_63amax.OUT
11/14/2005  03:17 PM         2,770,500 Force-c_63ath.OUT
11/14/2005  11:46 AM            14,716 Force-c_63max.OUT
11/14/2005  11:46 AM         6,216,180 Force-c_63th.OUT
11/14/2005  03:28 PM             4,996 Force-c_72amax.OUT
11/14/2005  03:28 PM         2,770,500 Force-c_72ath.OUT
11/14/2005  11:57 AM            14,716 Force-c_72max.OUT
11/14/2005  11:57 AM         6,216,180 Force-c_72th.OUT
11/14/2005  03:38 PM             4,996 Force-c_81amax.OUT
11/14/2005  03:38 PM         2,770,500 Force-c_81ath.OUT
11/14/2005  12:07 PM            14,716 Force-c_81max.OUT
11/14/2005  12:07 PM         6,216,180 Force-c_81th.OUT
11/14/2005  03:48 PM             4,996 Force-c_90amax.OUT
11/14/2005  03:48 PM         2,770,500 Force-c_90ath.OUT
11/14/2005  12:18 PM            14,716 Force-c_90max.OUT
11/14/2005  12:18 PM         6,216,180 Force-c_90th.OUT
11/14/2005  03:58 PM             4,996 Force-c_99amax.OUT
11/14/2005  03:58 PM         2,770,500 Force-c_99ath.OUT
11/14/2005  12:28 PM            14,716 Force-c_99max.OUT
11/14/2005  12:28 PM         6,216,180 Force-c_99th.OUT
11/14/2005  02:15 PM             4,996 Force-c_9amax.OUT
11/14/2005  02:15 PM         2,770,628 Force-c_9ath.OUT
11/14/2005  10:43 AM            14,716 Force-c_9max.OUT
11/14/2005  10:43 AM         6,216,308 Force-c_9th.OUT
11/15/2005  04:40 AM         2,542,344 Force-jb_r10-th.OUT
11/15/2005  04:40 AM             5,239 Force-jb_r10_max.OUT
11/15/2005  04:41 AM         2,542,344 Force-jb_r11-th.OUT
11/15/2005  04:41 AM             5,239 Force-jb_r11_max.OUT
11/15/2005  04:33 AM         2,542,472 Force-jb_r2-th.OUT
11/15/2005  04:33 AM             5,239 Force-jb_r2_max.OUT
11/15/2005  04:34 AM         2,542,344 Force-jb_r3-th.OUT
11/15/2005  04:34 AM             5,239 Force-jb_r3_max.OUT
11/15/2005  04:35 AM         2,542,344 Force-jb_r4-th.OUT
11/15/2005  04:35 AM             5,239 Force-jb_r4_max.OUT
11/15/2005  04:36 AM         2,542,344 Force-jb_r5-th.OUT
11/15/2005  04:36 AM             5,239 Force-jb_r5_max.OUT
11/15/2005  04:37 AM         2,542,344 Force-jb_r6-th.OUT
11/15/2005  04:37 AM             5,239 Force-jb_r6_max.OUT
11/15/2005  04:37 AM         2,542,344 Force-jb_r7-th.OUT
11/15/2005  04:37 AM             5,239 Force-jb_r7_max.OUT
11/15/2005  04:38 AM         2,542,344 Force-jb_r8-th.OUT
11/15/2005  04:38 AM             5,239 Force-jb_r8_max.OUT
11/15/2005  04:39 AM         2,542,344 Force-jb_r9-th.OUT
11/15/2005  04:39 AM             5,239 Force-jb_r9_max.OUT
06/20/2005  10:53 AM               661 Force-j_bolt.txt
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11/13/2005  04:39 PM             2,728 Insul-Cont_108max.OUT
11/13/2005  04:39 PM         1,200,544 Insul-Cont_108th.OUT
11/13/2005  04:43 PM             2,728 Insul-Cont_117max.OUT
11/13/2005  04:43 PM         1,200,544 Insul-Cont_117th.OUT
11/13/2005  04:46 PM             2,728 Insul-Cont_126max.OUT
11/13/2005  04:46 PM         1,200,544 Insul-Cont_126th.OUT
11/13/2005  04:50 PM             2,728 Insul-Cont_135max.OUT
11/13/2005  04:50 PM         1,200,544 Insul-Cont_135th.OUT
11/13/2005  04:54 PM             2,728 Insul-Cont_144max.OUT
11/13/2005  04:54 PM         1,200,544 Insul-Cont_144th.OUT
11/13/2005  04:57 PM             2,728 Insul-Cont_153max.OUT
11/13/2005  04:57 PM         1,200,544 Insul-Cont_153th.OUT
11/13/2005  05:02 PM             2,728 Insul-Cont_162max.OUT
11/13/2005  05:02 PM         1,200,544 Insul-Cont_162th.OUT
11/13/2005  05:05 PM             2,728 Insul-Cont_171max.OUT
11/13/2005  05:05 PM         1,200,544 Insul-Cont_171th.OUT
11/13/2005  05:09 PM             2,728 Insul-Cont_180max.OUT
11/13/2005  05:09 PM         1,200,544 Insul-Cont_180th.OUT
11/13/2005  04:02 PM             2,728 Insul-Cont_18max.OUT
11/13/2005  04:02 PM         1,200,544 Insul-Cont_18th.OUT
11/13/2005  04:05 PM             2,728 Insul-Cont_27max.OUT
11/13/2005  04:05 PM         1,200,544 Insul-Cont_27th.OUT
11/13/2005  04:09 PM             2,728 Insul-Cont_36max.OUT
11/13/2005  04:09 PM         1,200,544 Insul-Cont_36th.OUT
11/13/2005  04:13 PM             2,728 Insul-Cont_45max.OUT
11/13/2005  04:13 PM         1,200,544 Insul-Cont_45th.OUT
11/13/2005  04:16 PM             2,728 Insul-Cont_54max.OUT
11/13/2005  04:16 PM         1,200,544 Insul-Cont_54th.OUT
11/13/2005  04:20 PM             2,728 Insul-Cont_63max.OUT
11/13/2005  04:20 PM         1,200,544 Insul-Cont_63th.OUT
11/13/2005  04:24 PM             2,728 Insul-Cont_72max.OUT
11/13/2005  04:24 PM         1,200,544 Insul-Cont_72th.OUT
11/13/2005  04:28 PM             2,728 Insul-Cont_81max.OUT
11/13/2005  04:28 PM         1,200,544 Insul-Cont_81th.OUT
11/13/2005  04:32 PM             2,728 Insul-Cont_90max.OUT
11/13/2005  04:32 PM         1,200,544 Insul-Cont_90th.OUT
11/13/2005  04:35 PM             2,728 Insul-Cont_99max.OUT
11/13/2005  04:35 PM         1,200,544 Insul-Cont_99th.OUT
11/13/2005  03:58 PM             2,728 Insul-Cont_9max.OUT
11/13/2005  03:58 PM         1,200,672 Insul-Cont_9th.OUT
09/01/2005  10:27 AM             1,664 Insulate.txt
10/13/2005  08:28 AM             4,031 interface-gap1.txt
09/09/2005  09:34 AM             2,616 interface1.txt
11/13/2005  06:02 PM             3,052 J-Bolt-Cont_108max.OUT
11/13/2005  06:02 PM         1,350,612 J-Bolt-Cont_108th.OUT
11/13/2005  06:07 PM             3,052 J-Bolt-Cont_117max.OUT
11/13/2005  06:07 PM         1,350,612 J-Bolt-Cont_117th.OUT
11/13/2005  06:11 PM             3,052 J-Bolt-Cont_126max.OUT
11/13/2005  06:11 PM         1,350,612 J-Bolt-Cont_126th.OUT
11/13/2005  06:16 PM             3,052 J-Bolt-Cont_135max.OUT
11/13/2005  06:16 PM         1,350,612 J-Bolt-Cont_135th.OUT
11/13/2005  06:20 PM             3,052 J-Bolt-Cont_144max.OUT
11/13/2005  06:20 PM         1,350,612 J-Bolt-Cont_144th.OUT
11/13/2005  06:25 PM             3,052 J-Bolt-Cont_153max.OUT
11/13/2005  06:25 PM         1,350,612 J-Bolt-Cont_153th.OUT
11/13/2005  06:29 PM             3,052 J-Bolt-Cont_162max.OUT
11/13/2005  06:29 PM         1,350,612 J-Bolt-Cont_162th.OUT
11/13/2005  06:34 PM             3,052 J-Bolt-Cont_171max.OUT
11/13/2005  06:34 PM         1,350,612 J-Bolt-Cont_171th.OUT
11/13/2005  06:38 PM             3,052 J-Bolt-Cont_180max.OUT
11/13/2005  06:38 PM         1,350,612 J-Bolt-Cont_180th.OUT
11/13/2005  05:18 PM             3,052 J-Bolt-Cont_18max.OUT
11/13/2005  05:18 PM         1,350,612 J-Bolt-Cont_18th.OUT
11/13/2005  05:22 PM             3,052 J-Bolt-Cont_27max.OUT
11/13/2005  05:22 PM         1,350,612 J-Bolt-Cont_27th.OUT
11/13/2005  05:27 PM             3,052 J-Bolt-Cont_36max.OUT
11/13/2005  05:27 PM         1,350,612 J-Bolt-Cont_36th.OUT
11/13/2005  05:31 PM             3,052 J-Bolt-Cont_45max.OUT
11/13/2005  05:31 PM         1,350,612 J-Bolt-Cont_45th.OUT
11/13/2005  05:36 PM             3,052 J-Bolt-Cont_54max.OUT
11/13/2005  05:36 PM         1,350,612 J-Bolt-Cont_54th.OUT
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11/13/2005  05:40 PM             3,052 J-Bolt-Cont_63max.OUT
11/13/2005  05:40 PM         1,350,612 J-Bolt-Cont_63th.OUT
11/13/2005  05:45 PM             3,052 J-Bolt-Cont_72max.OUT
11/13/2005  05:45 PM         1,350,612 J-Bolt-Cont_72th.OUT
11/13/2005  05:49 PM             3,052 J-Bolt-Cont_81max.OUT
11/13/2005  05:49 PM         1,350,612 J-Bolt-Cont_81th.OUT
11/13/2005  05:53 PM             3,052 J-Bolt-Cont_90max.OUT
11/13/2005  05:53 PM         1,350,612 J-Bolt-Cont_90th.OUT
11/13/2005  05:58 PM             3,052 J-Bolt-Cont_99max.OUT
11/13/2005  05:58 PM         1,350,612 J-Bolt-Cont_99th.OUT
11/13/2005  05:13 PM             3,052 J-Bolt-Cont_9max.OUT
11/13/2005  05:14 PM         1,350,740 J-Bolt-Cont_9th.OUT
06/01/2005  01:17 PM             1,708 Liner.txt
05/02/2005  02:19 PM               667 live_load.txt
11/11/2005  10:38 AM             6,185 Near-Soil-1.txt
04/20/2005  01:14 PM               508 outer-spar.txt
11/13/2005  03:51 PM             2,998 PNNL-2D-BES-BEC.BCS
11/13/2005  03:51 PM        55,574,528 PNNL-2D-BES-BEC.db
11/13/2005  03:51 PM        12,386,304 PNNL-2D-BES-BEC.emat
12/14/2005  09:49 AM            48,994 PNNL-2D-BES-BEC.err
11/13/2005  03:51 PM       102,563,840 PNNL-2D-BES-BEC.esav
11/13/2005  03:51 PM        27,918,336 PNNL-2D-BES-BEC.full
11/13/2005  03:50 PM       298,920,099 PNNL-2D-BES-BEC.ldhi
12/14/2005  10:21 AM             3,582 PNNL-2D-BES-BEC.log
11/13/2005  03:51 PM           189,791 PNNL-2D-BES-BEC.mntr
11/13/2005  03:50 PM       102,563,840 PNNL-2D-BES-BEC.osav
11/13/2005  03:51 PM             1,699 PNNL-2D-BES-BEC.PVTS
11/13/2005  03:51 PM       103,546,880 PNNL-2D-BES-BEC.r001
11/11/2005  12:09 PM        35,782,656 PNNL-2D-BES-BEC.rdb
11/13/2005  03:51 PM     4,294,967,296 PNNL-2D-BES-BEC.rst
11/11/2005  11:10 PM     4,294,967,296 PNNL-2D-BES-BEC.rst02
11/12/2005  04:45 AM     4,294,967,296 PNNL-2D-BES-BEC.rst03
11/12/2005  10:23 AM     4,294,967,296 PNNL-2D-BES-BEC.rst04
11/12/2005  04:06 PM     4,294,967,296 PNNL-2D-BES-BEC.rst05
11/12/2005  09:56 PM     4,294,967,296 PNNL-2D-BES-BEC.rst06
11/13/2005  03:50 AM     4,294,967,296 PNNL-2D-BES-BEC.rst07
11/13/2005  09:54 AM     4,294,967,296 PNNL-2D-BES-BEC.rst08
11/13/2005  03:51 PM     4,002,217,984 PNNL-2D-BES-BEC.rst09
11/13/2005  03:51 PM               289 PNNL-2D-BES-BEC.stat
11/13/2005  03:51 PM         3,139,712 PNNL-AY-2D-NL-BEC-BES.out
11/13/2005  07:24 PM             2,728 Primary-Cont_108max.OUT
11/13/2005  07:24 PM         1,200,544 Primary-Cont_108th.OUT
11/13/2005  07:27 PM             2,728 Primary-Cont_117max.OUT
11/13/2005  07:27 PM         1,200,544 Primary-Cont_117th.OUT
11/13/2005  07:31 PM             2,728 Primary-Cont_126max.OUT
11/13/2005  07:31 PM         1,200,544 Primary-Cont_126th.OUT
11/13/2005  07:35 PM             2,728 Primary-Cont_135max.OUT
11/13/2005  07:35 PM         1,200,544 Primary-Cont_135th.OUT
11/13/2005  07:39 PM             2,728 Primary-Cont_144max.OUT
11/13/2005  07:39 PM         1,200,544 Primary-Cont_144th.OUT
11/13/2005  07:43 PM             2,728 Primary-Cont_153max.OUT
11/13/2005  07:43 PM         1,200,544 Primary-Cont_153th.OUT
11/13/2005  07:47 PM             2,728 Primary-Cont_162max.OUT
11/13/2005  07:47 PM         1,200,544 Primary-Cont_162th.OUT
11/13/2005  07:51 PM             2,728 Primary-Cont_171max.OUT
11/13/2005  07:51 PM         1,200,544 Primary-Cont_171th.OUT
11/13/2005  07:54 PM             2,728 Primary-Cont_180max.OUT
11/13/2005  07:54 PM         1,200,544 Primary-Cont_180th.OUT
11/13/2005  06:45 PM             2,728 Primary-Cont_18max.OUT
11/13/2005  06:45 PM         1,200,544 Primary-Cont_18th.OUT
11/13/2005  06:49 PM             2,728 Primary-Cont_27max.OUT
11/13/2005  06:49 PM         1,200,544 Primary-Cont_27th.OUT
11/13/2005  06:53 PM             2,728 Primary-Cont_36max.OUT
11/13/2005  06:53 PM         1,200,544 Primary-Cont_36th.OUT
11/13/2005  06:56 PM             2,728 Primary-Cont_45max.OUT
11/13/2005  06:56 PM         1,200,544 Primary-Cont_45th.OUT
11/13/2005  07:00 PM             2,728 Primary-Cont_54max.OUT
11/13/2005  07:00 PM         1,200,544 Primary-Cont_54th.OUT
11/13/2005  07:04 PM             2,728 Primary-Cont_63max.OUT
11/13/2005  07:04 PM         1,200,544 Primary-Cont_63th.OUT
11/13/2005  07:08 PM             2,728 Primary-Cont_72max.OUT
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11/13/2005  07:08 PM         1,200,544 Primary-Cont_72th.OUT
11/13/2005  07:12 PM             2,728 Primary-Cont_81max.OUT
11/13/2005  07:12 PM         1,200,544 Primary-Cont_81th.OUT
11/13/2005  07:16 PM             2,728 Primary-Cont_90max.OUT
11/13/2005  07:16 PM         1,200,544 Primary-Cont_90th.OUT
11/13/2005  07:20 PM             2,728 Primary-Cont_99max.OUT
11/13/2005  07:20 PM         1,200,544 Primary-Cont_99th.OUT
11/13/2005  06:42 PM             2,728 Primary-Cont_9max.OUT
11/13/2005  06:42 PM         1,200,672 Primary-Cont_9th.OUT
10/31/2005  12:18 PM             5,549 Primary-Props-AY.txt
09/27/2005  03:52 PM             1,538 Primary.txt
11/11/2005  12:09 PM           343,286 QA.out
12/12/2005  09:57 AM            47,121 RS-ct-0.out
12/12/2005  10:05 AM            47,121 RS-ct-135.out
12/12/2005  10:08 AM            47,121 RS-ct-180.out
12/12/2005  10:00 AM            47,121 RS-ct-45.out
12/12/2005  10:02 AM            47,121 RS-ct-90.out
12/12/2005  10:10 AM            27,591 RS-ct.out
11/15/2005  11:38 AM            34,101 RS-OUT-Soil.txt
12/12/2005  10:13 AM            47,121 RS-PT-0.out
12/12/2005  10:21 AM            47,121 RS-PT-135.out
12/12/2005  10:24 AM            47,121 RS-PT-180.out
12/12/2005  10:16 AM            47,121 RS-PT-45.out
12/12/2005  10:18 AM            47,121 RS-PT-90.out
12/12/2005  10:26 AM            47,121 RS-SOil.out
10/31/2005  10:31 AM             1,108 RS_FREQ.txt
11/14/2005  01:20 AM         1,146,825 Run-Tank-Out.out
09/19/2005  09:37 AM               145 run-tank.bat
11/11/2005  10:37 AM             1,959 Run-Tank.txt
12/14/2005  09:49 AM                 0 scratch.hlp
02/11/2005  01:22 PM             1,053 Slave.txt
11/13/2005  09:31 PM             9,896 Soil-Contact_108max.OUT
11/13/2005  09:31 PM         4,151,880 Soil-Contact_108th.OUT
11/13/2005  09:38 PM             9,896 Soil-Contact_117max.OUT
11/13/2005  09:38 PM         4,151,880 Soil-Contact_117th.OUT
11/13/2005  09:46 PM             9,896 Soil-Contact_126max.OUT
11/13/2005  09:46 PM         4,151,880 Soil-Contact_126th.OUT
11/13/2005  09:54 PM             9,896 Soil-Contact_135max.OUT
11/13/2005  09:54 PM         4,151,880 Soil-Contact_135th.OUT
11/13/2005  10:02 PM             9,896 Soil-Contact_144max.OUT
11/13/2005  10:02 PM         4,151,880 Soil-Contact_144th.OUT
11/13/2005  10:11 PM             9,896 Soil-Contact_153max.OUT
11/13/2005  10:11 PM         4,151,880 Soil-Contact_153th.OUT
11/13/2005  10:19 PM             9,896 Soil-Contact_162max.OUT
11/13/2005  10:19 PM         4,151,880 Soil-Contact_162th.OUT
11/13/2005  10:27 PM             9,896 Soil-Contact_171max.OUT
11/13/2005  10:27 PM         4,151,880 Soil-Contact_171th.OUT
11/13/2005  10:35 PM             9,896 Soil-Contact_180max.OUT
11/13/2005  10:35 PM         4,151,880 Soil-Contact_180th.OUT
11/13/2005  08:10 PM             9,896 Soil-Contact_18max.OUT
11/13/2005  08:10 PM         4,151,880 Soil-Contact_18th.OUT
11/13/2005  08:18 PM             9,896 Soil-Contact_27max.OUT
11/13/2005  08:18 PM         4,151,880 Soil-Contact_27th.OUT
11/13/2005  08:26 PM             9,896 Soil-Contact_36max.OUT
11/13/2005  08:26 PM         4,151,880 Soil-Contact_36th.OUT
11/13/2005  08:34 PM             9,896 Soil-Contact_45max.OUT
11/13/2005  08:34 PM         4,151,880 Soil-Contact_45th.OUT
11/13/2005  08:42 PM             9,896 Soil-Contact_54max.OUT
11/13/2005  08:42 PM         4,151,880 Soil-Contact_54th.OUT
11/13/2005  08:50 PM             9,896 Soil-Contact_63max.OUT
11/13/2005  08:50 PM         4,151,880 Soil-Contact_63th.OUT
11/13/2005  08:58 PM             9,896 Soil-Contact_72max.OUT
11/13/2005  08:58 PM         4,151,880 Soil-Contact_72th.OUT
11/13/2005  09:06 PM             9,896 Soil-Contact_81max.OUT
11/13/2005  09:06 PM         4,151,880 Soil-Contact_81th.OUT
11/13/2005  09:14 PM             9,896 Soil-Contact_90max.OUT
11/13/2005  09:14 PM         4,151,880 Soil-Contact_90th.OUT
11/13/2005  09:23 PM             9,896 Soil-Contact_99max.OUT
11/13/2005  09:23 PM         4,151,880 Soil-Contact_99th.OUT
11/13/2005  08:02 PM             9,896 Soil-Contact_9max.OUT
11/13/2005  08:02 PM         4,152,008 Soil-Contact_9th.OUT
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11/11/2005  10:36 AM             4,989 Soil-Prop-Mean-Geo.txt
11/11/2005  10:33 AM             1,893 Solve-TH-BES.txt
11/28/2005  02:23 PM               347 spectra-all.txt
11/28/2005  02:16 PM             3,483 spectra-conc-0.txt
12/09/2005  07:53 AM             3,512 spectra-conc-135.txt
12/09/2005  07:53 AM             3,512 spectra-conc-180.txt
11/28/2005  02:18 PM             3,560 spectra-conc-45.txt
12/09/2005  07:53 AM             3,440 spectra-conc-90.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
10/31/2005  10:17 AM             3,551 spectra-primary-135.txt
10/31/2005  11:02 AM             3,566 spectra-primary-180.txt
10/31/2005  10:16 AM             3,479 spectra-primary-45.txt
10/31/2005  10:16 AM             3,479 spectra-primary-90.txt
10/31/2005  11:37 AM             3,608 spectra-soil.txt
06/20/2005  09:04 AM               647 spectra-wall.txt
06/20/2005  08:52 AM               679 spectra-waste.txt
09/02/2005  08:51 AM               707 strain-compb.txt
09/02/2005  08:51 AM               705 strain-compm.txt
09/02/2005  08:50 AM               720 strain-compt.txt
11/15/2005  08:56 AM             6,110 Strain-lb_108max-b.OUT
11/15/2005  08:56 AM         2,551,312 Strain-lb_108th-b.OUT
11/15/2005  09:00 AM             6,110 Strain-lb_117max-b.OUT
11/15/2005  09:00 AM         2,551,312 Strain-lb_117th-b.OUT
11/15/2005  09:05 AM             6,110 Strain-lb_126max-b.OUT
11/15/2005  09:05 AM         2,551,312 Strain-lb_126th-b.OUT
11/15/2005  09:10 AM             6,110 Strain-lb_135max-b.OUT
11/15/2005  09:10 AM         2,551,312 Strain-lb_135th-b.OUT
11/15/2005  09:15 AM             6,110 Strain-lb_144max-b.OUT
11/15/2005  09:15 AM         2,551,312 Strain-lb_144th-b.OUT
11/15/2005  09:20 AM             6,110 Strain-lb_153max-b.OUT
11/15/2005  09:20 AM         2,551,312 Strain-lb_153th-b.OUT
11/15/2005  09:25 AM             6,110 Strain-lb_162max-b.OUT
11/15/2005  09:25 AM         2,551,312 Strain-lb_162th-b.OUT
11/15/2005  09:30 AM             6,110 Strain-lb_171max-b.OUT
11/15/2005  09:30 AM         2,551,312 Strain-lb_171th-b.OUT
11/15/2005  09:35 AM             6,110 Strain-lb_180max-b.OUT
11/15/2005  09:35 AM         2,551,312 Strain-lb_180th-b.OUT
11/15/2005  08:07 AM             6,110 Strain-lb_18max-b.OUT
11/15/2005  08:07 AM         2,551,312 Strain-lb_18th-b.OUT
11/15/2005  08:11 AM             6,110 Strain-lb_27max-b.OUT
11/15/2005  08:11 AM         2,551,312 Strain-lb_27th-b.OUT
11/15/2005  08:16 AM             6,110 Strain-lb_36max-b.OUT
11/15/2005  08:16 AM         2,551,312 Strain-lb_36th-b.OUT
11/15/2005  08:21 AM             6,110 Strain-lb_45max-b.OUT
11/15/2005  08:21 AM         2,551,312 Strain-lb_45th-b.OUT
11/15/2005  08:26 AM             6,110 Strain-lb_54max-b.OUT
11/15/2005  08:26 AM         2,551,312 Strain-lb_54th-b.OUT
11/15/2005  08:31 AM             6,110 Strain-lb_63max-b.OUT
11/15/2005  08:31 AM         2,551,312 Strain-lb_63th-b.OUT
11/15/2005  08:36 AM             6,110 Strain-lb_72max-b.OUT
11/15/2005  08:36 AM         2,551,312 Strain-lb_72th-b.OUT
11/15/2005  08:42 AM             6,110 Strain-lb_81max-b.OUT
11/15/2005  08:42 AM         2,551,312 Strain-lb_81th-b.OUT
11/15/2005  08:47 AM             6,110 Strain-lb_90max-b.OUT
11/15/2005  08:47 AM         2,551,312 Strain-lb_90th-b.OUT
11/15/2005  08:51 AM             6,110 Strain-lb_99max-b.OUT
11/15/2005  08:51 AM         2,551,312 Strain-lb_99th-b.OUT
11/15/2005  08:02 AM             6,110 Strain-lb_9max-b.OUT
11/15/2005  08:02 AM         2,551,440 Strain-lb_9th-b.OUT
09/02/2005  08:52 AM               544 Strain-Liner.txt
11/15/2005  07:18 AM             6,110 Strain-lm_108max-m.OUT
11/15/2005  07:18 AM         2,551,312 Strain-lm_108th-m.OUT
11/15/2005  07:22 AM             6,110 Strain-lm_117max-m.OUT
11/15/2005  07:22 AM         2,551,312 Strain-lm_117th-m.OUT
11/15/2005  07:27 AM             6,110 Strain-lm_126max-m.OUT
11/15/2005  07:27 AM         2,551,312 Strain-lm_126th-m.OUT
11/15/2005  07:32 AM             6,110 Strain-lm_135max-m.OUT
11/15/2005  07:32 AM         2,551,312 Strain-lm_135th-m.OUT
11/15/2005  07:37 AM             6,110 Strain-lm_144max-m.OUT
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11/15/2005  07:37 AM         2,551,312 Strain-lm_144th-m.OUT
11/15/2005  07:42 AM             6,110 Strain-lm_153max-m.OUT
11/15/2005  07:42 AM         2,551,312 Strain-lm_153th-m.OUT
11/15/2005  07:47 AM             6,110 Strain-lm_162max-m.OUT
11/15/2005  07:47 AM         2,551,312 Strain-lm_162th-m.OUT
11/15/2005  07:52 AM             6,110 Strain-lm_171max-m.OUT
11/15/2005  07:52 AM         2,551,312 Strain-lm_171th-m.OUT
11/15/2005  07:57 AM             6,110 Strain-lm_180max-m.OUT
11/15/2005  07:57 AM         2,551,312 Strain-lm_180th-m.OUT
11/15/2005  06:29 AM             6,110 Strain-lm_18max-m.OUT
11/15/2005  06:29 AM         2,551,312 Strain-lm_18th-m.OUT
11/15/2005  06:33 AM             6,110 Strain-lm_27max-m.OUT
11/15/2005  06:33 AM         2,551,312 Strain-lm_27th-m.OUT
11/15/2005  06:38 AM             6,110 Strain-lm_36max-m.OUT
11/15/2005  06:38 AM         2,551,312 Strain-lm_36th-m.OUT
11/15/2005  06:43 AM             6,110 Strain-lm_45max-m.OUT
11/15/2005  06:43 AM         2,551,312 Strain-lm_45th-m.OUT
11/15/2005  06:48 AM             6,110 Strain-lm_54max-m.OUT
11/15/2005  06:48 AM         2,551,312 Strain-lm_54th-m.OUT
11/15/2005  06:53 AM             6,110 Strain-lm_63max-m.OUT
11/15/2005  06:53 AM         2,551,312 Strain-lm_63th-m.OUT
11/15/2005  06:58 AM             6,110 Strain-lm_72max-m.OUT
11/15/2005  06:58 AM         2,551,312 Strain-lm_72th-m.OUT
11/15/2005  07:04 AM             6,110 Strain-lm_81max-m.OUT
11/15/2005  07:04 AM         2,551,312 Strain-lm_81th-m.OUT
11/15/2005  07:09 AM             6,110 Strain-lm_90max-m.OUT
11/15/2005  07:09 AM         2,551,312 Strain-lm_90th-m.OUT
11/15/2005  07:13 AM             6,110 Strain-lm_99max-m.OUT
11/15/2005  07:13 AM         2,551,312 Strain-lm_99th-m.OUT
11/15/2005  06:24 AM             6,110 Strain-lm_9max-m.OUT
11/15/2005  06:24 AM         2,551,440 Strain-lm_9th-m.OUT
11/15/2005  05:40 AM             6,110 Strain-lt_108max-t.OUT
11/15/2005  05:40 AM         2,551,312 Strain-lt_108th-t.OUT
11/15/2005  05:44 AM             6,110 Strain-lt_117max-t.OUT
11/15/2005  05:44 AM         2,551,312 Strain-lt_117th-t.OUT
11/15/2005  05:49 AM             6,110 Strain-lt_126max-t.OUT
11/15/2005  05:49 AM         2,551,312 Strain-lt_126th-t.OUT
11/15/2005  05:54 AM             6,110 Strain-lt_135max-t.OUT
11/15/2005  05:54 AM         2,551,312 Strain-lt_135th-t.OUT
11/15/2005  05:59 AM             6,110 Strain-lt_144max-t.OUT
11/15/2005  05:59 AM         2,551,312 Strain-lt_144th-t.OUT
11/15/2005  06:04 AM             6,110 Strain-lt_153max-t.OUT
11/15/2005  06:04 AM         2,551,312 Strain-lt_153th-t.OUT
11/15/2005  06:09 AM             6,110 Strain-lt_162max-t.OUT
11/15/2005  06:09 AM         2,551,312 Strain-lt_162th-t.OUT
11/15/2005  06:14 AM             6,110 Strain-lt_171max-t.OUT
11/15/2005  06:14 AM         2,551,312 Strain-lt_171th-t.OUT
11/15/2005  06:19 AM             6,110 Strain-lt_180max-t.OUT
11/15/2005  06:19 AM         2,551,312 Strain-lt_180th-t.OUT
11/15/2005  04:51 AM             6,110 Strain-lt_18max-t.OUT
11/15/2005  04:51 AM         2,551,312 Strain-lt_18th-t.OUT
11/15/2005  04:55 AM             6,110 Strain-lt_27max-t.OUT
11/15/2005  04:55 AM         2,551,312 Strain-lt_27th-t.OUT
11/15/2005  05:00 AM             6,110 Strain-lt_36max-t.OUT
11/15/2005  05:00 AM         2,551,312 Strain-lt_36th-t.OUT
11/15/2005  05:05 AM             6,110 Strain-lt_45max-t.OUT
11/15/2005  05:05 AM         2,551,312 Strain-lt_45th-t.OUT
11/15/2005  05:10 AM             6,110 Strain-lt_54max-t.OUT
11/15/2005  05:10 AM         2,551,312 Strain-lt_54th-t.OUT
11/15/2005  05:15 AM             6,110 Strain-lt_63max-t.OUT
11/15/2005  05:15 AM         2,551,312 Strain-lt_63th-t.OUT
11/15/2005  05:20 AM             6,110 Strain-lt_72max-t.OUT
11/15/2005  05:20 AM         2,551,312 Strain-lt_72th-t.OUT
11/15/2005  05:25 AM             6,110 Strain-lt_81max-t.OUT
11/15/2005  05:25 AM         2,551,312 Strain-lt_81th-t.OUT
11/15/2005  05:30 AM             6,110 Strain-lt_90max-t.OUT
11/15/2005  05:30 AM         2,551,312 Strain-lt_90th-t.OUT
11/15/2005  05:35 AM             6,110 Strain-lt_99max-t.OUT
11/15/2005  05:35 AM         2,551,312 Strain-lt_99th-t.OUT
11/15/2005  04:46 AM             6,110 Strain-lt_9max-t.OUT
11/15/2005  04:46 AM         2,551,440 Strain-lt_9th-t.OUT
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09/08/2005  10:18 AM               692 stress-compb.txt
11/01/2005  10:46 AM               702 stress-compm.txt
09/08/2005  09:20 AM               692 stress-compt.txt
04/13/2005  07:38 AM               205 Stress-Primary.txt
11/15/2005  03:04 AM            16,291 Stress-pt_108max-b.OUT
11/14/2005  11:24 PM            16,291 Stress-pt_108max-m.OUT
11/14/2005  07:45 PM            16,210 Stress-pt_108max-t.OUT
11/15/2005  03:04 AM         6,841,032 Stress-pt_108th-b.OUT
11/14/2005  11:24 PM         6,841,032 Stress-pt_108th-m.OUT
11/14/2005  07:45 PM         6,812,304 Stress-pt_108th-t.OUT
11/15/2005  03:14 AM            16,291 Stress-pt_117max-b.OUT
11/14/2005  11:35 PM            16,291 Stress-pt_117max-m.OUT
11/14/2005  07:55 PM            16,210 Stress-pt_117max-t.OUT
11/15/2005  03:14 AM         6,841,032 Stress-pt_117th-b.OUT
11/14/2005  11:35 PM         6,841,032 Stress-pt_117th-m.OUT
11/14/2005  07:55 PM         6,812,304 Stress-pt_117th-t.OUT
11/15/2005  03:25 AM            16,291 Stress-pt_126max-b.OUT
11/14/2005  11:46 PM            16,291 Stress-pt_126max-m.OUT
11/14/2005  08:06 PM            16,210 Stress-pt_126max-t.OUT
11/15/2005  03:25 AM         6,841,032 Stress-pt_126th-b.OUT
11/14/2005  11:46 PM         6,841,032 Stress-pt_126th-m.OUT
11/14/2005  08:06 PM         6,812,304 Stress-pt_126th-t.OUT
11/15/2005  03:36 AM            16,291 Stress-pt_135max-b.OUT
11/14/2005  11:57 PM            16,291 Stress-pt_135max-m.OUT
11/14/2005  08:17 PM            16,210 Stress-pt_135max-t.OUT
11/15/2005  03:36 AM         6,841,032 Stress-pt_135th-b.OUT
11/14/2005  11:57 PM         6,841,032 Stress-pt_135th-m.OUT
11/14/2005  08:17 PM         6,812,304 Stress-pt_135th-t.OUT
11/15/2005  03:47 AM            16,291 Stress-pt_144max-b.OUT
11/15/2005  12:07 AM            16,291 Stress-pt_144max-m.OUT
11/14/2005  08:28 PM            16,210 Stress-pt_144max-t.OUT
11/15/2005  03:47 AM         6,841,032 Stress-pt_144th-b.OUT
11/15/2005  12:07 AM         6,841,032 Stress-pt_144th-m.OUT
11/14/2005  08:28 PM         6,812,304 Stress-pt_144th-t.OUT
11/15/2005  03:58 AM            16,291 Stress-pt_153max-b.OUT
11/15/2005  12:18 AM            16,291 Stress-pt_153max-m.OUT
11/14/2005  08:39 PM            16,210 Stress-pt_153max-t.OUT
11/15/2005  03:58 AM         6,841,032 Stress-pt_153th-b.OUT
11/15/2005  12:18 AM         6,841,032 Stress-pt_153th-m.OUT
11/14/2005  08:39 PM         6,812,304 Stress-pt_153th-t.OUT
11/15/2005  04:09 AM            16,291 Stress-pt_162max-b.OUT
11/15/2005  12:29 AM            16,291 Stress-pt_162max-m.OUT
11/14/2005  08:50 PM            16,210 Stress-pt_162max-t.OUT
11/15/2005  04:09 AM         6,841,032 Stress-pt_162th-b.OUT
11/15/2005  12:29 AM         6,841,032 Stress-pt_162th-m.OUT
11/14/2005  08:50 PM         6,812,304 Stress-pt_162th-t.OUT
11/15/2005  04:20 AM            16,295 Stress-pt_171max-b.OUT
11/15/2005  12:40 AM            16,295 Stress-pt_171max-m.OUT
11/14/2005  09:01 PM            16,214 Stress-pt_171max-t.OUT
11/15/2005  04:20 AM         6,841,032 Stress-pt_171th-b.OUT
11/15/2005  12:40 AM         6,841,032 Stress-pt_171th-m.OUT
11/14/2005  09:01 PM         6,812,304 Stress-pt_171th-t.OUT
11/15/2005  04:31 AM            16,295 Stress-pt_180max-b.OUT
11/15/2005  12:51 AM            16,295 Stress-pt_180max-m.OUT
11/14/2005  09:12 PM            16,214 Stress-pt_180max-t.OUT
11/15/2005  04:31 AM         6,841,032 Stress-pt_180th-b.OUT
11/15/2005  12:51 AM         6,841,032 Stress-pt_180th-m.OUT
11/14/2005  09:12 PM         6,812,304 Stress-pt_180th-t.OUT
11/15/2005  01:13 AM            16,291 Stress-pt_18max-b.OUT
11/14/2005  09:34 PM            16,291 Stress-pt_18max-m.OUT
11/14/2005  05:53 PM            16,210 Stress-pt_18max-t.OUT
11/15/2005  01:13 AM         6,841,032 Stress-pt_18th-b.OUT
11/14/2005  09:34 PM         6,841,032 Stress-pt_18th-m.OUT
11/14/2005  05:53 PM         6,812,304 Stress-pt_18th-t.OUT
11/15/2005  01:24 AM            16,291 Stress-pt_27max-b.OUT
11/14/2005  09:45 PM            16,291 Stress-pt_27max-m.OUT
11/14/2005  06:04 PM            16,210 Stress-pt_27max-t.OUT
11/15/2005  01:24 AM         6,841,032 Stress-pt_27th-b.OUT
11/14/2005  09:45 PM         6,841,032 Stress-pt_27th-m.OUT
11/14/2005  06:04 PM         6,812,304 Stress-pt_27th-t.OUT
11/15/2005  01:35 AM            16,291 Stress-pt_36max-b.OUT
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11/14/2005  09:56 PM            16,291 Stress-pt_36max-m.OUT
11/14/2005  06:15 PM            16,210 Stress-pt_36max-t.OUT
11/15/2005  01:35 AM         6,841,032 Stress-pt_36th-b.OUT
11/14/2005  09:56 PM         6,841,032 Stress-pt_36th-m.OUT
11/14/2005  06:15 PM         6,812,304 Stress-pt_36th-t.OUT
11/15/2005  01:45 AM            16,291 Stress-pt_45max-b.OUT
11/14/2005  10:06 PM            16,291 Stress-pt_45max-m.OUT
11/14/2005  06:26 PM            16,210 Stress-pt_45max-t.OUT
11/15/2005  01:45 AM         6,841,032 Stress-pt_45th-b.OUT
11/14/2005  10:06 PM         6,841,032 Stress-pt_45th-m.OUT
11/14/2005  06:26 PM         6,812,304 Stress-pt_45th-t.OUT
11/15/2005  01:56 AM            16,291 Stress-pt_54max-b.OUT
11/14/2005  10:17 PM            16,291 Stress-pt_54max-m.OUT
11/14/2005  06:37 PM            16,210 Stress-pt_54max-t.OUT
11/15/2005  01:56 AM         6,841,032 Stress-pt_54th-b.OUT
11/14/2005  10:17 PM         6,841,032 Stress-pt_54th-m.OUT
11/14/2005  06:37 PM         6,812,304 Stress-pt_54th-t.OUT
11/15/2005  02:07 AM            16,291 Stress-pt_63max-b.OUT
11/14/2005  10:28 PM            16,291 Stress-pt_63max-m.OUT
11/14/2005  06:48 PM            16,210 Stress-pt_63max-t.OUT
11/15/2005  02:07 AM         6,841,032 Stress-pt_63th-b.OUT
11/14/2005  10:28 PM         6,841,032 Stress-pt_63th-m.OUT
11/14/2005  06:48 PM         6,812,304 Stress-pt_63th-t.OUT
11/15/2005  02:18 AM            16,291 Stress-pt_72max-b.OUT
11/14/2005  10:39 PM            16,291 Stress-pt_72max-m.OUT
11/14/2005  06:59 PM            16,210 Stress-pt_72max-t.OUT
11/15/2005  02:18 AM         6,841,032 Stress-pt_72th-b.OUT
11/14/2005  10:39 PM         6,841,032 Stress-pt_72th-m.OUT
11/14/2005  06:59 PM         6,812,304 Stress-pt_72th-t.OUT
11/15/2005  02:29 AM            16,291 Stress-pt_81max-b.OUT
11/14/2005  10:50 PM            16,291 Stress-pt_81max-m.OUT
11/14/2005  07:10 PM            16,210 Stress-pt_81max-t.OUT
11/15/2005  02:29 AM         6,841,032 Stress-pt_81th-b.OUT
11/14/2005  10:50 PM         6,841,032 Stress-pt_81th-m.OUT
11/14/2005  07:10 PM         6,812,304 Stress-pt_81th-t.OUT
11/15/2005  02:41 AM            16,291 Stress-pt_90max-b.OUT
11/14/2005  11:02 PM            16,291 Stress-pt_90max-m.OUT
11/14/2005  07:22 PM            16,210 Stress-pt_90max-t.OUT
11/15/2005  02:41 AM         6,841,032 Stress-pt_90th-b.OUT
11/14/2005  11:02 PM         6,841,032 Stress-pt_90th-m.OUT
11/14/2005  07:22 PM         6,812,304 Stress-pt_90th-t.OUT
11/15/2005  02:52 AM            16,291 Stress-pt_99max-b.OUT
11/14/2005  11:13 PM            16,291 Stress-pt_99max-m.OUT
11/14/2005  07:33 PM            16,210 Stress-pt_99max-t.OUT
11/15/2005  02:52 AM         6,841,032 Stress-pt_99th-b.OUT
11/14/2005  11:13 PM         6,841,032 Stress-pt_99th-m.OUT
11/14/2005  07:33 PM         6,812,304 Stress-pt_99th-t.OUT
11/15/2005  01:02 AM            16,291 Stress-pt_9max-b.OUT
11/14/2005  09:23 PM            16,291 Stress-pt_9max-m.OUT
11/14/2005  05:42 PM            16,210 Stress-pt_9max-t.OUT
11/15/2005  01:02 AM         6,841,160 Stress-pt_9th-b.OUT
11/14/2005  09:23 PM         6,841,160 Stress-pt_9th-m.OUT
11/14/2005  05:42 PM         6,812,432 Stress-pt_9th-t.OUT
10/31/2005  12:13 PM             3,825 Tank-Coordinates-AY.txt
05/25/2005  03:32 PM             2,512 Tank-Mesh1.txt
11/11/2005  12:08 PM               102 tank-out.out
02/25/2005  02:24 PM             5,406 Tank-Props-BEC-250.txt
11/11/2005  12:09 PM             4,679 Tank-th.out
05/16/2005  03:40 PM            41,470 TH-266-Mean-Geo-V.txt
05/13/2005  10:57 AM            41,472 TH-266-Mean-Geo.txt
11/14/2005  12:14 AM             8,236 Waste-Cont_108max.OUT
11/14/2005  12:14 AM         3,151,428 Waste-Cont_108th.OUT
11/14/2005  12:22 AM             8,236 Waste-Cont_117max.OUT
11/14/2005  12:22 AM         3,151,428 Waste-Cont_117th.OUT
11/14/2005  12:30 AM             8,236 Waste-Cont_126max.OUT
11/14/2005  12:30 AM         3,151,428 Waste-Cont_126th.OUT
11/14/2005  12:38 AM             8,236 Waste-Cont_135max.OUT
11/14/2005  12:38 AM         3,151,428 Waste-Cont_135th.OUT
11/14/2005  12:47 AM             8,236 Waste-Cont_144max.OUT
11/14/2005  12:47 AM         3,151,428 Waste-Cont_144th.OUT
11/14/2005  12:55 AM             8,236 Waste-Cont_153max.OUT
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11/14/2005  12:55 AM         3,151,428 Waste-Cont_153th.OUT
11/14/2005  01:03 AM             8,236 Waste-Cont_162max.OUT
11/14/2005  01:03 AM         3,151,428 Waste-Cont_162th.OUT
11/14/2005  01:11 AM             8,236 Waste-Cont_171max.OUT
11/14/2005  01:11 AM         3,151,428 Waste-Cont_171th.OUT
11/14/2005  01:20 AM             8,236 Waste-Cont_180max.OUT
11/14/2005  01:20 AM         3,151,428 Waste-Cont_180th.OUT
11/13/2005  10:52 PM             8,236 Waste-Cont_18max.OUT
11/13/2005  10:52 PM         3,151,428 Waste-Cont_18th.OUT
11/13/2005  10:59 PM             8,236 Waste-Cont_27max.OUT
11/13/2005  10:59 PM         3,151,428 Waste-Cont_27th.OUT
11/13/2005  11:08 PM             8,236 Waste-Cont_36max.OUT
11/13/2005  11:08 PM         3,151,428 Waste-Cont_36th.OUT
11/13/2005  11:16 PM             8,236 Waste-Cont_45max.OUT
11/13/2005  11:16 PM         3,151,428 Waste-Cont_45th.OUT
11/13/2005  11:24 PM             8,236 Waste-Cont_54max.OUT
11/13/2005  11:24 PM         3,151,428 Waste-Cont_54th.OUT
11/13/2005  11:33 PM             8,236 Waste-Cont_63max.OUT
11/13/2005  11:33 PM         3,151,428 Waste-Cont_63th.OUT
11/13/2005  11:41 PM             8,236 Waste-Cont_72max.OUT
11/13/2005  11:42 PM         3,151,428 Waste-Cont_72th.OUT
11/13/2005  11:49 PM             8,236 Waste-Cont_81max.OUT
11/13/2005  11:50 PM         3,151,428 Waste-Cont_81th.OUT
11/13/2005  11:58 PM             8,236 Waste-Cont_90max.OUT
11/13/2005  11:58 PM         3,151,428 Waste-Cont_90th.OUT
11/14/2005  12:06 AM             8,236 Waste-Cont_99max.OUT
11/14/2005  12:06 AM         3,151,428 Waste-Cont_99th.OUT
11/13/2005  10:43 PM             8,236 Waste-Cont_9max.OUT
11/13/2005  10:43 PM         3,151,556 Waste-Cont_9th.OUT
12/12/2005  11:04 AM            45,117 Waste-Reaction.out
12/09/2005  08:42 AM               332 Waste-Reaction.txt
10/31/2005  12:01 PM             3,265 Waste-solid-AY.txt
11/29/2005  08:46 AM               776 Waste-Surface-ay.txt
12/09/2005  09:20 AM               784 Waste-Surf_0max.OUT
12/09/2005  09:20 AM           509,216 Waste-Surf_0th.OUT
12/09/2005  01:43 PM               784 Waste-Surf_108max.OUT
12/09/2005  01:43 PM           509,088 Waste-Surf_108th.OUT
12/09/2005  02:05 PM               784 Waste-Surf_117max.OUT
12/09/2005  02:05 PM           509,088 Waste-Surf_117th.OUT
12/09/2005  02:27 PM               784 Waste-Surf_126max.OUT
12/09/2005  02:27 PM           509,088 Waste-Surf_126th.OUT
12/09/2005  02:48 PM               784 Waste-Surf_135max.OUT
12/09/2005  02:48 PM           509,088 Waste-Surf_135th.OUT
12/09/2005  03:10 PM               784 Waste-Surf_144max.OUT
12/09/2005  03:10 PM           509,088 Waste-Surf_144th.OUT
12/09/2005  03:32 PM               784 Waste-Surf_153max.OUT
12/09/2005  03:32 PM           509,088 Waste-Surf_153th.OUT
12/09/2005  03:53 PM               784 Waste-Surf_162max.OUT
12/09/2005  03:53 PM           509,088 Waste-Surf_162th.OUT
12/09/2005  04:15 PM               784 Waste-Surf_171max.OUT
12/09/2005  04:15 PM           509,088 Waste-Surf_171th.OUT
12/09/2005  04:37 PM               784 Waste-Surf_180max.OUT
12/09/2005  04:37 PM           509,088 Waste-Surf_180th.OUT
12/09/2005  10:03 AM               784 Waste-Surf_18max.OUT
12/09/2005  10:03 AM           509,088 Waste-Surf_18th.OUT
12/09/2005  10:25 AM               784 Waste-Surf_27max.OUT
12/09/2005  10:25 AM           509,088 Waste-Surf_27th.OUT
12/09/2005  10:47 AM               784 Waste-Surf_36max.OUT
12/09/2005  10:47 AM           509,088 Waste-Surf_36th.OUT
12/09/2005  11:09 AM               784 Waste-Surf_45max.OUT
12/09/2005  11:09 AM           509,088 Waste-Surf_45th.OUT
12/09/2005  11:30 AM               784 Waste-Surf_54max.OUT
12/09/2005  11:30 AM           509,088 Waste-Surf_54th.OUT
12/09/2005  11:54 AM               784 Waste-Surf_63max.OUT
12/09/2005  11:54 AM           509,088 Waste-Surf_63th.OUT
12/09/2005  12:16 PM               784 Waste-Surf_72max.OUT
12/09/2005  12:16 PM           509,088 Waste-Surf_72th.OUT
12/09/2005  12:38 PM               784 Waste-Surf_81max.OUT
12/09/2005  12:38 PM           509,088 Waste-Surf_81th.OUT
12/09/2005  01:00 PM               784 Waste-Surf_90max.OUT
12/09/2005  01:00 PM           509,088 Waste-Surf_90th.OUT
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12/09/2005  01:21 PM               784 Waste-Surf_99max.OUT
12/09/2005  01:21 PM           509,088 Waste-Surf_99th.OUT
12/09/2005  09:42 AM               784 Waste-Surf_9max.OUT
12/09/2005  09:42 AM           509,088 Waste-Surf_9th.OUT
             704 File(s) 40,119,505,418 bytes
               2 Dir(s)  176,165,658,624 bytes free
```

BES-BEC Gravity File Listing

```
 Volume in drive E is 250GB HITAC
 Volume Serial Number is B4FB-DB23

 Directory of E:\PNNL-2D-NL-AY-BES-BEC-Seismic\PNNL-2D-NL-AY-BES-BEC-Gravity

12/20/2005  04:49 PM    <DIR>          .
12/20/2005  04:49 PM    <DIR>          ..
09/27/2005  03:47 PM                99 All-Forces.txt
12/08/2005  10:37 AM         3,372,032 AY-2D-NL-BES-BEC Conc Tank Demand Gravity.xls
12/08/2005  10:51 AM           680,448 AY-2D-NL-BES-BEC J Bolt Forces Gravity.xls
12/08/2005  01:29 PM         3,471,872 AY-2D-NL-BES-BEC Liner Strain Gravity.xls
12/14/2005  04:12 PM         8,528,896 AY-2D-NL-BES-BEC Pri Tank Stress Gravity.xls
12/13/2005  04:10 PM         2,107,904 AY-2D-NL-BES-BEC Soil Pressures Gravity.xls
12/08/2005  01:04 PM           685,568 AY-2D-NL-BES-BEC-Insul-Contact-Gravity.xls
12/08/2005  10:50 AM           726,016 AY-2D-NL-BES-BEC-J-Bolt-Contact-Gravity.xls
12/08/2005  01:01 PM           768,000 AY-2D-NL-BES-BEC-Primary-Contact-Gravity.xls
09/02/2005  02:01 PM             5,766 Bolts-Friction.txt
06/09/2005  01:59 PM               262 Boundary.txt
10/31/2005  12:24 PM               189 Contact-AY.txt
12/01/2005  09:11 AM               586 Contact-Footing.txt
09/02/2005  09:28 AM               604 Contact-Insul.txt
09/02/2005  09:51 AM               602 Contact-J-Bolts.txt
09/09/2005  09:59 AM               608 Contact-Primary.txt
09/15/2005  11:50 AM               742 Contact-Soil.txt
09/06/2005  11:16 AM               630 Contact-Waste-AY.txt
09/22/2005  04:05 PM             8,608 Far-Soil.txt
12/08/2005  03:05 PM             1,108 file.err
12/08/2005  05:02 PM             2,468 file.log
12/20/2005  04:49 PM                 0 file.txt
10/13/2005  06:54 AM               562 Fix-Soil.txt
12/14/2005  04:30 PM            10,342 Footing-Cont_max.OUT
12/14/2005  04:30 PM            11,328 Footing-Cont_th.OUT
04/06/2005  08:24 AM               894 Force-c.txt
12/08/2005  09:23 AM             4,996 Force-c_108amax.OUT
12/08/2005  09:23 AM             8,400 Force-c_108ath.OUT
12/08/2005  09:23 AM            14,716 Force-c_108max.OUT
12/08/2005  09:23 AM            16,800 Force-c_108th.OUT
12/08/2005  09:23 AM             4,996 Force-c_117amax.OUT
12/08/2005  09:23 AM             8,400 Force-c_117ath.OUT
12/08/2005  09:23 AM            14,716 Force-c_117max.OUT
12/08/2005  09:23 AM            16,800 Force-c_117th.OUT
12/08/2005  09:23 AM             4,996 Force-c_126amax.OUT
12/08/2005  09:23 AM             8,400 Force-c_126ath.OUT
12/08/2005  09:23 AM            14,716 Force-c_126max.OUT
12/08/2005  09:23 AM            16,800 Force-c_126th.OUT
12/08/2005  09:23 AM             4,996 Force-c_135amax.OUT
12/08/2005  09:23 AM             8,400 Force-c_135ath.OUT
12/08/2005  09:23 AM            14,716 Force-c_135max.OUT
12/08/2005  09:23 AM            16,800 Force-c_135th.OUT
12/08/2005  09:23 AM             4,996 Force-c_144amax.OUT
12/08/2005  09:23 AM             8,400 Force-c_144ath.OUT
12/08/2005  09:23 AM            14,716 Force-c_144max.OUT
12/08/2005  09:23 AM            16,800 Force-c_144th.OUT
12/08/2005  09:23 AM             4,996 Force-c_153amax.OUT
12/08/2005  09:23 AM             8,400 Force-c_153ath.OUT
12/08/2005  09:23 AM            14,716 Force-c_153max.OUT
12/08/2005  09:23 AM            16,800 Force-c_153th.OUT
12/08/2005  09:23 AM             4,996 Force-c_162amax.OUT
12/08/2005  09:23 AM             8,400 Force-c_162ath.OUT
12/08/2005  09:23 AM            14,716 Force-c_162max.OUT
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12/08/2005  09:23 AM            16,800 Force-c_162th.OUT
12/08/2005  09:23 AM             4,996 Force-c_171amax.OUT
12/08/2005  09:23 AM             8,400 Force-c_171ath.OUT
12/08/2005  09:23 AM            14,716 Force-c_171max.OUT
12/08/2005  09:23 AM            16,800 Force-c_171th.OUT
12/08/2005  09:23 AM             4,996 Force-c_180amax.OUT
12/08/2005  09:23 AM             8,400 Force-c_180ath.OUT
12/08/2005  09:23 AM            14,716 Force-c_180max.OUT
12/08/2005  09:23 AM            16,800 Force-c_180th.OUT
12/08/2005  09:23 AM             4,996 Force-c_18amax.OUT
12/08/2005  09:23 AM             8,400 Force-c_18ath.OUT
12/08/2005  09:23 AM            14,716 Force-c_18max.OUT
12/08/2005  09:23 AM            16,800 Force-c_18th.OUT
12/08/2005  09:23 AM             4,996 Force-c_27amax.OUT
12/08/2005  09:23 AM             8,400 Force-c_27ath.OUT
12/08/2005  09:23 AM            14,716 Force-c_27max.OUT
12/08/2005  09:23 AM            16,800 Force-c_27th.OUT
12/08/2005  09:23 AM             4,996 Force-c_36amax.OUT
12/08/2005  09:23 AM             8,400 Force-c_36ath.OUT
12/08/2005  09:23 AM            14,716 Force-c_36max.OUT
12/08/2005  09:23 AM            16,800 Force-c_36th.OUT
12/08/2005  09:23 AM             4,996 Force-c_45amax.OUT
12/08/2005  09:23 AM             8,400 Force-c_45ath.OUT
12/08/2005  09:23 AM            14,716 Force-c_45max.OUT
12/08/2005  09:23 AM            16,800 Force-c_45th.OUT
12/08/2005  09:23 AM             4,996 Force-c_54amax.OUT
12/08/2005  09:23 AM             8,400 Force-c_54ath.OUT
12/08/2005  09:23 AM            14,716 Force-c_54max.OUT
12/08/2005  09:23 AM            16,800 Force-c_54th.OUT
12/08/2005  09:23 AM             4,996 Force-c_63amax.OUT
12/08/2005  09:23 AM             8,400 Force-c_63ath.OUT
12/08/2005  09:23 AM            14,716 Force-c_63max.OUT
12/08/2005  09:23 AM            16,800 Force-c_63th.OUT
12/08/2005  09:23 AM             4,996 Force-c_72amax.OUT
12/08/2005  09:23 AM             8,400 Force-c_72ath.OUT
12/08/2005  09:23 AM            14,716 Force-c_72max.OUT
12/08/2005  09:23 AM            16,800 Force-c_72th.OUT
12/08/2005  09:23 AM             4,996 Force-c_81amax.OUT
12/08/2005  09:23 AM             8,400 Force-c_81ath.OUT
12/08/2005  09:23 AM            14,716 Force-c_81max.OUT
12/08/2005  09:23 AM            16,800 Force-c_81th.OUT
12/08/2005  09:23 AM             4,996 Force-c_90amax.OUT
12/08/2005  09:23 AM             8,400 Force-c_90ath.OUT
12/08/2005  09:23 AM            14,716 Force-c_90max.OUT
12/08/2005  09:23 AM            16,800 Force-c_90th.OUT
12/08/2005  09:23 AM             4,996 Force-c_99amax.OUT
12/08/2005  09:23 AM             8,400 Force-c_99ath.OUT
12/08/2005  09:23 AM            14,716 Force-c_99max.OUT
12/08/2005  09:23 AM            16,800 Force-c_99th.OUT
12/08/2005  09:23 AM             4,996 Force-c_9amax.OUT
12/08/2005  09:23 AM             8,528 Force-c_9ath.OUT
12/08/2005  09:23 AM            14,716 Force-c_9max.OUT
12/08/2005  09:23 AM            16,928 Force-c_9th.OUT
12/08/2005  10:50 AM           136,704 force-jb.xls
12/08/2005  09:24 AM             7,350 Force-jb_r10-th.OUT
12/08/2005  09:24 AM             5,239 Force-jb_r10_max.OUT
12/08/2005  09:24 AM             7,350 Force-jb_r11-th.OUT
12/08/2005  09:24 AM             5,239 Force-jb_r11_max.OUT
12/08/2005  09:24 AM             7,478 Force-jb_r2-th.OUT
12/08/2005  09:24 AM             5,239 Force-jb_r2_max.OUT
12/08/2005  09:24 AM             7,350 Force-jb_r3-th.OUT
12/08/2005  09:24 AM             5,239 Force-jb_r3_max.OUT
12/08/2005  09:24 AM             7,350 Force-jb_r4-th.OUT
12/08/2005  09:24 AM             5,239 Force-jb_r4_max.OUT
12/08/2005  09:24 AM             7,350 Force-jb_r5-th.OUT
12/08/2005  09:24 AM             5,239 Force-jb_r5_max.OUT
12/08/2005  09:24 AM             7,350 Force-jb_r6-th.OUT
12/08/2005  09:24 AM             5,239 Force-jb_r6_max.OUT
12/08/2005  09:24 AM             7,350 Force-jb_r7-th.OUT
12/08/2005  09:24 AM             5,239 Force-jb_r7_max.OUT
12/08/2005  09:24 AM             7,350 Force-jb_r8-th.OUT
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12/08/2005  09:24 AM            5,239 Force-jb_r8_max.OUT
12/08/2005  09:24 AM            7,350 Force-jb_r9-th.OUT
12/08/2005  09:24 AM            5,239 Force-jb_r9_max.OUT
06/20/2005  10:53 AM              661 Force-j_bolt.txt
12/08/2005  10:34 AM          444,416 import_0-90.xls
12/08/2005  10:35 AM          443,904 import_99-180.xls
12/08/2005  01:02 PM           74,240 Insul-Contact_0-90.xls
12/08/2005  01:02 PM           74,240 Insul-Contact_99-180.xls
12/08/2005  09:20 AM            2,728 Insul-Cont_108max.OUT
12/08/2005  09:20 AM            3,360 Insul-Cont_108th.OUT
12/08/2005  09:20 AM            2,728 Insul-Cont_117max.OUT
12/08/2005  09:20 AM            3,360 Insul-Cont_117th.OUT
12/08/2005  09:20 AM            2,728 Insul-Cont_126max.OUT
12/08/2005  09:20 AM            3,360 Insul-Cont_126th.OUT
12/08/2005  09:20 AM            2,728 Insul-Cont_135max.OUT
12/08/2005  09:20 AM            3,360 Insul-Cont_135th.OUT
12/08/2005  09:20 AM            2,728 Insul-Cont_144max.OUT
12/08/2005  09:20 AM            3,360 Insul-Cont_144th.OUT
12/08/2005  09:20 AM            2,728 Insul-Cont_153max.OUT
12/08/2005  09:20 AM            3,360 Insul-Cont_153th.OUT
12/08/2005  09:20 AM            2,728 Insul-Cont_162max.OUT
12/08/2005  09:20 AM            3,360 Insul-Cont_162th.OUT
12/08/2005  09:20 AM            2,728 Insul-Cont_171max.OUT
12/08/2005  09:20 AM            3,360 Insul-Cont_171th.OUT
12/08/2005  09:20 AM            2,728 Insul-Cont_180max.OUT
12/08/2005  09:20 AM            3,360 Insul-Cont_180th.OUT
12/08/2005  09:20 AM            2,728 Insul-Cont_18max.OUT
12/08/2005  09:20 AM            3,360 Insul-Cont_18th.OUT
12/08/2005  09:20 AM            2,728 Insul-Cont_27max.OUT
12/08/2005  09:20 AM            3,360 Insul-Cont_27th.OUT
12/08/2005  09:20 AM            2,728 Insul-Cont_36max.OUT
12/08/2005  09:20 AM            3,360 Insul-Cont_36th.OUT
12/08/2005  09:20 AM            2,728 Insul-Cont_45max.OUT
12/08/2005  09:20 AM            3,360 Insul-Cont_45th.OUT
12/08/2005  09:20 AM            2,728 Insul-Cont_54max.OUT
12/08/2005  09:20 AM            3,360 Insul-Cont_54th.OUT
12/08/2005  09:20 AM            2,728 Insul-Cont_63max.OUT
12/08/2005  09:20 AM            3,360 Insul-Cont_63th.OUT
12/08/2005  09:20 AM            2,728 Insul-Cont_72max.OUT
12/08/2005  09:20 AM            3,360 Insul-Cont_72th.OUT
12/08/2005  09:20 AM            2,728 Insul-Cont_81max.OUT
12/08/2005  09:20 AM            3,360 Insul-Cont_81th.OUT
12/08/2005  09:20 AM            2,728 Insul-Cont_90max.OUT
12/08/2005  09:20 AM            3,360 Insul-Cont_90th.OUT
12/08/2005  09:20 AM            2,728 Insul-Cont_99max.OUT
12/08/2005  09:20 AM            3,360 Insul-Cont_99th.OUT
12/08/2005  09:20 AM            2,728 Insul-Cont_9max.OUT
12/08/2005  09:20 AM            3,488 Insul-Cont_9th.OUT
09/01/2005  10:27 AM            1,664 Insulate.txt
10/13/2005  08:28 AM            4,031 interface-gap1.txt
09/09/2005  09:34 AM            2,616 interface1.txt
12/08/2005  10:46 AM           82,944 J-Bolt-Contact_0-90.xls
12/08/2005  10:46 AM           82,944 J-Bolt-Contact_99-180.xls
12/08/2005  09:20 AM            3,052 J-Bolt-Cont_108max.OUT
12/08/2005  09:20 AM            3,780 J-Bolt-Cont_108th.OUT
12/08/2005  09:20 AM            3,052 J-Bolt-Cont_117max.OUT
12/08/2005  09:20 AM            3,780 J-Bolt-Cont_117th.OUT
12/08/2005  09:20 AM            3,052 J-Bolt-Cont_126max.OUT
12/08/2005  09:20 AM            3,780 J-Bolt-Cont_126th.OUT
12/08/2005  09:20 AM            3,052 J-Bolt-Cont_135max.OUT
12/08/2005  09:20 AM            3,780 J-Bolt-Cont_135th.OUT
12/08/2005  09:20 AM            3,052 J-Bolt-Cont_144max.OUT
12/08/2005  09:20 AM            3,780 J-Bolt-Cont_144th.OUT
12/08/2005  09:20 AM            3,052 J-Bolt-Cont_153max.OUT
12/08/2005  09:20 AM            3,780 J-Bolt-Cont_153th.OUT
12/08/2005  09:20 AM            3,052 J-Bolt-Cont_162max.OUT
12/08/2005  09:20 AM            3,780 J-Bolt-Cont_162th.OUT
12/08/2005  09:20 AM            3,052 J-Bolt-Cont_171max.OUT
12/08/2005  09:20 AM            3,780 J-Bolt-Cont_171th.OUT
12/08/2005  09:20 AM            3,052 J-Bolt-Cont_180max.OUT
12/08/2005  09:20 AM            3,780 J-Bolt-Cont_180th.OUT
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12/08/2005  09:20 AM             3,052 J-Bolt-Cont_18max.OUT
12/08/2005  09:20 AM             3,780 J-Bolt-Cont_18th.OUT
12/08/2005  09:20 AM             3,052 J-Bolt-Cont_27max.OUT
12/08/2005  09:20 AM             3,780 J-Bolt-Cont_27th.OUT
12/08/2005  09:20 AM             3,052 J-Bolt-Cont_36max.OUT
12/08/2005  09:20 AM             3,780 J-Bolt-Cont_36th.OUT
12/08/2005  09:20 AM             3,052 J-Bolt-Cont_45max.OUT
12/08/2005  09:20 AM             3,780 J-Bolt-Cont_45th.OUT
12/08/2005  09:20 AM             3,052 J-Bolt-Cont_54max.OUT
12/08/2005  09:20 AM             3,780 J-Bolt-Cont_54th.OUT
12/08/2005  09:20 AM             3,052 J-Bolt-Cont_63max.OUT
12/08/2005  09:20 AM             3,780 J-Bolt-Cont_63th.OUT
12/08/2005  09:20 AM             3,052 J-Bolt-Cont_72max.OUT
12/08/2005  09:20 AM             3,780 J-Bolt-Cont_72th.OUT
12/08/2005  09:20 AM             3,052 J-Bolt-Cont_81max.OUT
12/08/2005  09:20 AM             3,780 J-Bolt-Cont_81th.OUT
12/08/2005  09:20 AM             3,052 J-Bolt-Cont_90max.OUT
12/08/2005  09:20 AM             3,780 J-Bolt-Cont_90th.OUT
12/08/2005  09:20 AM             3,052 J-Bolt-Cont_99max.OUT
12/08/2005  09:20 AM             3,780 J-Bolt-Cont_99th.OUT
12/08/2005  09:20 AM             3,052 J-Bolt-Cont_9max.OUT
12/08/2005  09:20 AM             3,908 J-Bolt-Cont_9th.OUT
12/08/2005  01:25 PM           158,208 liner-strain-comp_0-90b.xls
12/08/2005  01:07 PM           158,208 liner-strain-comp_0-90m.xls
12/08/2005  01:28 PM           158,208 liner-strain-comp_0-90t.xls
12/08/2005  01:10 PM           164,352 liner-strain-comp_99-180b.xls
12/08/2005  01:10 PM           164,352 liner-strain-comp_99-180m.xls
12/08/2005  01:11 PM           164,352 liner-strain-comp_99-180t.xls
06/01/2005  01:17 PM             1,708 Liner.txt
05/02/2005  02:19 PM               667 live_load.txt
11/11/2005  10:38 AM             6,185 Near-Soil-1.txt
04/20/2005  01:14 PM               508 outer-spar.txt
12/08/2005  09:20 AM             2,998 PNNL-2D-BES-BEC.BCS
12/08/2005  09:20 AM        55,508,992 PNNL-2D-BES-BEC.db
12/08/2005  09:19 AM        55,508,992 PNNL-2D-BES-BEC.dbb
12/08/2005  09:20 AM        12,386,304 PNNL-2D-BES-BEC.emat
12/16/2005  03:01 PM            44,254 PNNL-2D-BES-BEC.err
12/08/2005  09:20 AM       102,563,840 PNNL-2D-BES-BEC.esav
12/08/2005  09:20 AM        27,852,800 PNNL-2D-BES-BEC.full
12/08/2005  09:19 AM           437,553 PNNL-2D-BES-BEC.ldhi
12/16/2005  03:08 PM             3,662 PNNL-2D-BES-BEC.log
12/08/2005  09:20 AM             1,559 PNNL-2D-BES-BEC.mntr
12/08/2005  09:19 AM       102,563,840 PNNL-2D-BES-BEC.osav
12/08/2005  09:20 AM             1,027 PNNL-2D-BES-BEC.PVTS
12/08/2005  09:20 AM       103,546,880 PNNL-2D-BES-BEC.r001
12/08/2005  09:06 AM        35,782,656 PNNL-2D-BES-BEC.rdb
12/08/2005  09:20 AM        57,671,680 PNNL-2D-BES-BEC.rst
12/08/2005  09:20 AM            70,389 PNNL-AY-2D-NL-BEC-BES-Gravity.out
12/08/2005  01:00 PM            74,240 Primary-Contact_0-90.xls
12/08/2005  01:01 PM            80,384 Primary-Contact_99-180.xls
12/08/2005  09:20 AM             2,728 Primary-Cont_108max.OUT
12/08/2005  09:20 AM             3,360 Primary-Cont_108th.OUT
12/08/2005  09:20 AM             2,728 Primary-Cont_117max.OUT
12/08/2005  09:20 AM             3,360 Primary-Cont_117th.OUT
12/08/2005  09:20 AM             2,728 Primary-Cont_126max.OUT
12/08/2005  09:20 AM             3,360 Primary-Cont_126th.OUT
12/08/2005  09:20 AM             2,728 Primary-Cont_135max.OUT
12/08/2005  09:20 AM             3,360 Primary-Cont_135th.OUT
12/08/2005  09:20 AM             2,728 Primary-Cont_144max.OUT
12/08/2005  09:20 AM             3,360 Primary-Cont_144th.OUT
12/08/2005  09:20 AM             2,728 Primary-Cont_153max.OUT
12/08/2005  09:20 AM             3,360 Primary-Cont_153th.OUT
12/08/2005  09:20 AM             2,728 Primary-Cont_162max.OUT
12/08/2005  09:20 AM             3,360 Primary-Cont_162th.OUT
12/08/2005  09:20 AM             2,728 Primary-Cont_171max.OUT
12/08/2005  09:20 AM             3,360 Primary-Cont_171th.OUT
12/08/2005  09:20 AM             2,728 Primary-Cont_180max.OUT
12/08/2005  09:20 AM             3,360 Primary-Cont_180th.OUT
12/08/2005  09:20 AM             2,728 Primary-Cont_18max.OUT
12/08/2005  09:20 AM             3,360 Primary-Cont_18th.OUT
12/08/2005  09:20 AM             2,728 Primary-Cont_27max.OUT
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12/08/2005  09:20 AM            3,360 Primary-Cont_27th.OUT
12/08/2005  09:20 AM            2,728 Primary-Cont_36max.OUT
12/08/2005  09:20 AM            3,360 Primary-Cont_36th.OUT
12/08/2005  09:20 AM            2,728 Primary-Cont_45max.OUT
12/08/2005  09:20 AM            3,360 Primary-Cont_45th.OUT
12/08/2005  09:20 AM            2,728 Primary-Cont_54max.OUT
12/08/2005  09:20 AM            3,360 Primary-Cont_54th.OUT
12/08/2005  09:20 AM            2,728 Primary-Cont_63max.OUT
12/08/2005  09:20 AM            3,360 Primary-Cont_63th.OUT
12/08/2005  09:20 AM            2,728 Primary-Cont_72max.OUT
12/08/2005  09:20 AM            3,360 Primary-Cont_72th.OUT
12/08/2005  09:20 AM            2,728 Primary-Cont_81max.OUT
12/08/2005  09:20 AM            3,360 Primary-Cont_81th.OUT
12/08/2005  09:20 AM            2,728 Primary-Cont_90max.OUT
12/08/2005  09:20 AM            3,360 Primary-Cont_90th.OUT
12/08/2005  09:20 AM            2,728 Primary-Cont_99max.OUT
12/08/2005  09:20 AM            3,360 Primary-Cont_99th.OUT
12/08/2005  09:20 AM            2,728 Primary-Cont_9max.OUT
12/08/2005  09:20 AM            3,488 Primary-Cont_9th.OUT
10/31/2005  12:18 PM            5,549 Primary-Props-AY.txt
09/27/2005  03:52 PM            1,538 Primary.txt
12/08/2005  09:06 AM          385,189 QA.out
10/31/2005  10:31 AM            1,108 RS_FREQ.txt
11/11/2005  11:16 AM        1,146,885 Run-Tank-Out.out
12/08/2005  09:04 AM            1,942 Run-Tank.txt
12/16/2005  03:01 PM                0 scratch.hlp
02/11/2005  01:22 PM            1,053 Slave.txt
12/08/2005  09:21 AM            9,896 Soil-Contact_108max.OUT
12/08/2005  09:21 AM           13,160 Soil-Contact_108th.OUT
12/08/2005  09:21 AM            9,896 Soil-Contact_117max.OUT
12/08/2005  09:21 AM           13,160 Soil-Contact_117th.OUT
12/08/2005  09:21 AM            9,896 Soil-Contact_126max.OUT
12/08/2005  09:21 AM           13,160 Soil-Contact_126th.OUT
12/08/2005  09:21 AM            9,896 Soil-Contact_135max.OUT
12/08/2005  09:21 AM           13,160 Soil-Contact_135th.OUT
12/08/2005  09:21 AM            9,896 Soil-Contact_144max.OUT
12/08/2005  09:21 AM           13,160 Soil-Contact_144th.OUT
12/08/2005  09:21 AM            9,896 Soil-Contact_153max.OUT
12/08/2005  09:21 AM           13,160 Soil-Contact_153th.OUT
12/08/2005  09:21 AM            9,896 Soil-Contact_162max.OUT
12/08/2005  09:21 AM           13,160 Soil-Contact_162th.OUT
12/08/2005  09:21 AM            9,896 Soil-Contact_171max.OUT
12/08/2005  09:21 AM           13,160 Soil-Contact_171th.OUT
12/08/2005  09:21 AM            9,896 Soil-Contact_180max.OUT
12/08/2005  09:21 AM           13,160 Soil-Contact_180th.OUT
12/08/2005  09:21 AM            9,896 Soil-Contact_18max.OUT
12/08/2005  09:21 AM           13,160 Soil-Contact_18th.OUT
12/08/2005  09:21 AM            9,896 Soil-Contact_27max.OUT
12/08/2005  09:21 AM           13,160 Soil-Contact_27th.OUT
12/08/2005  09:21 AM            9,896 Soil-Contact_36max.OUT
12/08/2005  09:21 AM           13,160 Soil-Contact_36th.OUT
12/08/2005  09:21 AM            9,896 Soil-Contact_45max.OUT
12/08/2005  09:21 AM           13,160 Soil-Contact_45th.OUT
12/08/2005  09:21 AM            9,896 Soil-Contact_54max.OUT
12/08/2005  09:21 AM           13,160 Soil-Contact_54th.OUT
12/08/2005  09:21 AM            9,896 Soil-Contact_63max.OUT
12/08/2005  09:21 AM           13,160 Soil-Contact_63th.OUT
12/08/2005  09:21 AM            9,896 Soil-Contact_72max.OUT
12/08/2005  09:21 AM           13,160 Soil-Contact_72th.OUT
12/08/2005  09:21 AM            9,896 Soil-Contact_81max.OUT
12/08/2005  09:21 AM           13,160 Soil-Contact_81th.OUT
12/08/2005  09:21 AM            9,896 Soil-Contact_90max.OUT
12/08/2005  09:21 AM           13,160 Soil-Contact_90th.OUT
12/08/2005  09:21 AM            9,896 Soil-Contact_99max.OUT
12/08/2005  09:21 AM           13,160 Soil-Contact_99th.OUT
12/08/2005  09:20 AM            9,896 Soil-Contact_9max.OUT
12/08/2005  09:20 AM           13,288 Soil-Contact_9th.OUT
11/11/2005  10:36 AM            4,989 Soil-Prop-Mean-Geo.txt
12/08/2005  10:37 AM          223,744 soil_0-90.xls
12/08/2005  10:38 AM          223,232 soil_99-180.xls
11/11/2005  10:54 AM            1,898 Solve-Gravity-BES.txt
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10/31/2005  11:02 AM             3,363 spectra-conc-0.txt
10/14/2005  11:18 AM             2,061 spectra-concrete.txt
10/31/2005  10:17 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
12/09/2005  07:45 AM           354,304 str-comp_0-90b.xls
12/09/2005  07:45 AM           355,328 str-comp_0-90m.xls
12/09/2005  07:45 AM           353,280 str-comp_0-90t.xls
12/09/2005  07:45 AM           354,304 str-comp_99-180b.xls
12/09/2005  07:46 AM           354,816 str-comp_99-180m.xls
12/09/2005  07:46 AM           353,280 str-comp_99-180t.xls
09/02/2005  08:51 AM               707 strain-compb.txt
09/02/2005  08:51 AM               705 strain-compm.txt
09/02/2005  08:50 AM               720 strain-compt.txt
12/08/2005  09:24 AM             6,110 Strain-lb_108max-b.OUT
12/08/2005  09:24 AM             8,134 Strain-lb_108th-b.OUT
12/08/2005  09:24 AM             6,110 Strain-lb_117max-b.OUT
12/08/2005  09:24 AM             8,134 Strain-lb_117th-b.OUT
12/08/2005  09:24 AM             6,110 Strain-lb_126max-b.OUT
12/08/2005  09:24 AM             8,134 Strain-lb_126th-b.OUT
12/08/2005  09:24 AM             6,110 Strain-lb_135max-b.OUT
12/08/2005  09:24 AM             8,134 Strain-lb_135th-b.OUT
12/08/2005  09:24 AM             6,110 Strain-lb_144max-b.OUT
12/08/2005  09:24 AM             8,134 Strain-lb_144th-b.OUT
12/08/2005  09:24 AM             6,110 Strain-lb_153max-b.OUT
12/08/2005  09:24 AM             8,134 Strain-lb_153th-b.OUT
12/08/2005  09:24 AM             6,110 Strain-lb_162max-b.OUT
12/08/2005  09:24 AM             8,134 Strain-lb_162th-b.OUT
12/08/2005  09:24 AM             6,110 Strain-lb_171max-b.OUT
12/08/2005  09:24 AM             8,134 Strain-lb_171th-b.OUT
12/08/2005  09:24 AM             6,110 Strain-lb_180max-b.OUT
12/08/2005  09:24 AM             8,134 Strain-lb_180th-b.OUT
12/08/2005  09:24 AM             6,110 Strain-lb_18max-b.OUT
12/08/2005  09:24 AM             8,134 Strain-lb_18th-b.OUT
12/08/2005  09:24 AM             6,110 Strain-lb_27max-b.OUT
12/08/2005  09:24 AM             8,134 Strain-lb_27th-b.OUT
12/08/2005  09:24 AM             6,110 Strain-lb_36max-b.OUT
12/08/2005  09:24 AM             8,134 Strain-lb_36th-b.OUT
12/08/2005  09:24 AM             6,110 Strain-lb_45max-b.OUT
12/08/2005  09:24 AM             8,134 Strain-lb_45th-b.OUT
12/08/2005  09:24 AM             6,110 Strain-lb_54max-b.OUT
12/08/2005  09:24 AM             8,134 Strain-lb_54th-b.OUT
12/08/2005  09:24 AM             6,110 Strain-lb_63max-b.OUT
12/08/2005  09:24 AM             8,134 Strain-lb_63th-b.OUT
12/08/2005  09:24 AM             6,110 Strain-lb_72max-b.OUT
12/08/2005  09:24 AM             8,134 Strain-lb_72th-b.OUT
12/08/2005  09:24 AM             6,110 Strain-lb_81max-b.OUT
12/08/2005  09:24 AM             8,134 Strain-lb_81th-b.OUT
12/08/2005  09:24 AM             6,110 Strain-lb_90max-b.OUT
12/08/2005  09:24 AM             8,134 Strain-lb_90th-b.OUT
12/08/2005  09:24 AM             6,110 Strain-lb_99max-b.OUT
12/08/2005  09:24 AM             8,134 Strain-lb_99th-b.OUT
12/08/2005  09:24 AM             6,110 Strain-lb_9max-b.OUT
12/08/2005  09:24 AM             8,262 Strain-lb_9th-b.OUT
09/02/2005  08:52 AM               544 Strain-Liner.txt
12/08/2005  09:24 AM             6,110 Strain-lm_108max-m.OUT
12/08/2005  09:24 AM             8,134 Strain-lm_108th-m.OUT
12/08/2005  09:24 AM             6,110 Strain-lm_117max-m.OUT
12/08/2005  09:24 AM             8,134 Strain-lm_117th-m.OUT
12/08/2005  09:24 AM             6,110 Strain-lm_126max-m.OUT
12/08/2005  09:24 AM             8,134 Strain-lm_126th-m.OUT
12/08/2005  09:24 AM             6,110 Strain-lm_135max-m.OUT
12/08/2005  09:24 AM             8,134 Strain-lm_135th-m.OUT
12/08/2005  09:24 AM             6,110 Strain-lm_144max-m.OUT
12/08/2005  09:24 AM             8,134 Strain-lm_144th-m.OUT
12/08/2005  09:24 AM             6,110 Strain-lm_153max-m.OUT
12/08/2005  09:24 AM             8,134 Strain-lm_153th-m.OUT
12/08/2005  09:24 AM             6,110 Strain-lm_162max-m.OUT
12/08/2005  09:24 AM             8,134 Strain-lm_162th-m.OUT
12/08/2005  09:24 AM             6,110 Strain-lm_171max-m.OUT
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12/08/2005  09:24 AM             8,134 Strain-lm_171th-m.OUT
12/08/2005  09:24 AM             6,110 Strain-lm_180max-m.OUT
12/08/2005  09:24 AM             8,134 Strain-lm_180th-m.OUT
12/08/2005  09:24 AM             6,110 Strain-lm_18max-m.OUT
12/08/2005  09:24 AM             8,134 Strain-lm_18th-m.OUT
12/08/2005  09:24 AM             6,110 Strain-lm_27max-m.OUT
12/08/2005  09:24 AM             8,134 Strain-lm_27th-m.OUT
12/08/2005  09:24 AM             6,110 Strain-lm_36max-m.OUT
12/08/2005  09:24 AM             8,134 Strain-lm_36th-m.OUT
12/08/2005  09:24 AM             6,110 Strain-lm_45max-m.OUT
12/08/2005  09:24 AM             8,134 Strain-lm_45th-m.OUT
12/08/2005  09:24 AM             6,110 Strain-lm_54max-m.OUT
12/08/2005  09:24 AM             8,134 Strain-lm_54th-m.OUT
12/08/2005  09:24 AM             6,110 Strain-lm_63max-m.OUT
12/08/2005  09:24 AM             8,134 Strain-lm_63th-m.OUT
12/08/2005  09:24 AM             6,110 Strain-lm_72max-m.OUT
12/08/2005  09:24 AM             8,134 Strain-lm_72th-m.OUT
12/08/2005  09:24 AM             6,110 Strain-lm_81max-m.OUT
12/08/2005  09:24 AM             8,134 Strain-lm_81th-m.OUT
12/08/2005  09:24 AM             6,110 Strain-lm_90max-m.OUT
12/08/2005  09:24 AM             8,134 Strain-lm_90th-m.OUT
12/08/2005  09:24 AM             6,110 Strain-lm_99max-m.OUT
12/08/2005  09:24 AM             8,134 Strain-lm_99th-m.OUT
12/08/2005  09:24 AM             6,110 Strain-lm_9max-m.OUT
12/08/2005  09:24 AM             8,262 Strain-lm_9th-m.OUT
12/08/2005  09:24 AM             6,110 Strain-lt_108max-t.OUT
12/08/2005  09:24 AM             8,134 Strain-lt_108th-t.OUT
12/08/2005  09:24 AM             6,110 Strain-lt_117max-t.OUT
12/08/2005  09:24 AM             8,134 Strain-lt_117th-t.OUT
12/08/2005  09:24 AM             6,110 Strain-lt_126max-t.OUT
12/08/2005  09:24 AM             8,134 Strain-lt_126th-t.OUT
12/08/2005  09:24 AM             6,110 Strain-lt_135max-t.OUT
12/08/2005  09:24 AM             8,134 Strain-lt_135th-t.OUT
12/08/2005  09:24 AM             6,110 Strain-lt_144max-t.OUT
12/08/2005  09:24 AM             8,134 Strain-lt_144th-t.OUT
12/08/2005  09:24 AM             6,110 Strain-lt_153max-t.OUT
12/08/2005  09:24 AM             8,134 Strain-lt_153th-t.OUT
12/08/2005  09:24 AM             6,110 Strain-lt_162max-t.OUT
12/08/2005  09:24 AM             8,134 Strain-lt_162th-t.OUT
12/08/2005  09:24 AM             6,110 Strain-lt_171max-t.OUT
12/08/2005  09:24 AM             8,134 Strain-lt_171th-t.OUT
12/08/2005  09:24 AM             6,110 Strain-lt_180max-t.OUT
12/08/2005  09:24 AM             8,134 Strain-lt_180th-t.OUT
12/08/2005  09:24 AM             6,110 Strain-lt_18max-t.OUT
12/08/2005  09:24 AM             8,134 Strain-lt_18th-t.OUT
12/08/2005  09:24 AM             6,110 Strain-lt_27max-t.OUT
12/08/2005  09:24 AM             8,134 Strain-lt_27th-t.OUT
12/08/2005  09:24 AM             6,110 Strain-lt_36max-t.OUT
12/08/2005  09:24 AM             8,134 Strain-lt_36th-t.OUT
12/08/2005  09:24 AM             6,110 Strain-lt_45max-t.OUT
12/08/2005  09:24 AM             8,134 Strain-lt_45th-t.OUT
12/08/2005  09:24 AM             6,110 Strain-lt_54max-t.OUT
12/08/2005  09:24 AM             8,134 Strain-lt_54th-t.OUT
12/08/2005  09:24 AM             6,110 Strain-lt_63max-t.OUT
12/08/2005  09:24 AM             8,134 Strain-lt_63th-t.OUT
12/08/2005  09:24 AM             6,110 Strain-lt_72max-t.OUT
12/08/2005  09:24 AM             8,134 Strain-lt_72th-t.OUT
12/08/2005  09:24 AM             6,110 Strain-lt_81max-t.OUT
12/08/2005  09:24 AM             8,134 Strain-lt_81th-t.OUT
12/08/2005  09:24 AM             6,110 Strain-lt_90max-t.OUT
12/08/2005  09:24 AM             8,134 Strain-lt_90th-t.OUT
12/08/2005  09:24 AM             6,110 Strain-lt_99max-t.OUT
12/08/2005  09:24 AM             8,134 Strain-lt_99th-t.OUT
12/08/2005  09:24 AM             6,110 Strain-lt_9max-t.OUT
12/08/2005  09:24 AM             8,262 Strain-lt_9th-t.OUT
09/08/2005  10:18 AM               692 stress-compb.txt
11/01/2005  10:46 AM               702 stress-compm.txt
09/08/2005  09:20 AM               692 stress-compt.txt
04/13/2005  07:38 AM               205 Stress-Primary.txt
12/08/2005  09:24 AM            16,291 Stress-pt_108max-b.OUT
12/08/2005  09:23 AM            16,291 Stress-pt_108max-m.OUT
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12/08/2005  09:23 AM            16,210 Stress-pt_108max-t.OUT
12/08/2005  09:24 AM            21,714 Stress-pt_108th-b.OUT
12/08/2005  09:23 AM            21,714 Stress-pt_108th-m.OUT
12/08/2005  09:23 AM            21,630 Stress-pt_108th-t.OUT
12/08/2005  09:24 AM            16,291 Stress-pt_117max-b.OUT
12/08/2005  09:24 AM            16,291 Stress-pt_117max-m.OUT
12/08/2005  09:23 AM            16,210 Stress-pt_117max-t.OUT
12/08/2005  09:24 AM            21,714 Stress-pt_117th-b.OUT
12/08/2005  09:24 AM            21,714 Stress-pt_117th-m.OUT
12/08/2005  09:23 AM            21,630 Stress-pt_117th-t.OUT
12/08/2005  09:24 AM            16,291 Stress-pt_126max-b.OUT
12/08/2005  09:24 AM            16,291 Stress-pt_126max-m.OUT
12/08/2005  09:23 AM            16,210 Stress-pt_126max-t.OUT
12/08/2005  09:24 AM            21,714 Stress-pt_126th-b.OUT
12/08/2005  09:24 AM            21,714 Stress-pt_126th-m.OUT
12/08/2005  09:23 AM            21,630 Stress-pt_126th-t.OUT
12/08/2005  09:24 AM            16,291 Stress-pt_135max-b.OUT
12/08/2005  09:24 AM            16,291 Stress-pt_135max-m.OUT
12/08/2005  09:23 AM            16,210 Stress-pt_135max-t.OUT
12/08/2005  09:24 AM            21,714 Stress-pt_135th-b.OUT
12/08/2005  09:24 AM            21,714 Stress-pt_135th-m.OUT
12/08/2005  09:23 AM            21,630 Stress-pt_135th-t.OUT
12/08/2005  09:24 AM            16,291 Stress-pt_144max-b.OUT
12/08/2005  09:24 AM            16,291 Stress-pt_144max-m.OUT
12/08/2005  09:23 AM            16,210 Stress-pt_144max-t.OUT
12/08/2005  09:24 AM            21,714 Stress-pt_144th-b.OUT
12/08/2005  09:24 AM            21,714 Stress-pt_144th-m.OUT
12/08/2005  09:23 AM            21,630 Stress-pt_144th-t.OUT
12/08/2005  09:24 AM            16,291 Stress-pt_153max-b.OUT
12/08/2005  09:24 AM            16,291 Stress-pt_153max-m.OUT
12/08/2005  09:23 AM            16,210 Stress-pt_153max-t.OUT
12/08/2005  09:24 AM            21,714 Stress-pt_153th-b.OUT
12/08/2005  09:24 AM            21,714 Stress-pt_153th-m.OUT
12/08/2005  09:23 AM            21,630 Stress-pt_153th-t.OUT
12/08/2005  09:24 AM            16,291 Stress-pt_162max-b.OUT
12/08/2005  09:24 AM            16,291 Stress-pt_162max-m.OUT
12/08/2005  09:23 AM            16,210 Stress-pt_162max-t.OUT
12/08/2005  09:24 AM            21,714 Stress-pt_162th-b.OUT
12/08/2005  09:24 AM            21,714 Stress-pt_162th-m.OUT
12/08/2005  09:23 AM            21,630 Stress-pt_162th-t.OUT
12/08/2005  09:24 AM            16,295 Stress-pt_171max-b.OUT
12/08/2005  09:24 AM            16,295 Stress-pt_171max-m.OUT
12/08/2005  09:23 AM            16,214 Stress-pt_171max-t.OUT
12/08/2005  09:24 AM            21,714 Stress-pt_171th-b.OUT
12/08/2005  09:24 AM            21,714 Stress-pt_171th-m.OUT
12/08/2005  09:23 AM            21,630 Stress-pt_171th-t.OUT
12/08/2005  09:24 AM            16,295 Stress-pt_180max-b.OUT
12/08/2005  09:24 AM            16,295 Stress-pt_180max-m.OUT
12/08/2005  09:23 AM            16,214 Stress-pt_180max-t.OUT
12/08/2005  09:24 AM            21,714 Stress-pt_180th-b.OUT
12/08/2005  09:24 AM            21,714 Stress-pt_180th-m.OUT
12/08/2005  09:23 AM            21,630 Stress-pt_180th-t.OUT
12/08/2005  09:24 AM            16,291 Stress-pt_18max-b.OUT
12/08/2005  09:23 AM            16,291 Stress-pt_18max-m.OUT
12/08/2005  09:23 AM            16,210 Stress-pt_18max-t.OUT
12/08/2005  09:24 AM            21,714 Stress-pt_18th-b.OUT
12/08/2005  09:23 AM            21,714 Stress-pt_18th-m.OUT
12/08/2005  09:23 AM            21,630 Stress-pt_18th-t.OUT
12/08/2005  09:24 AM            16,291 Stress-pt_27max-b.OUT
12/08/2005  09:23 AM            16,291 Stress-pt_27max-m.OUT
12/08/2005  09:23 AM            16,210 Stress-pt_27max-t.OUT
12/08/2005  09:24 AM            21,714 Stress-pt_27th-b.OUT
12/08/2005  09:23 AM            21,714 Stress-pt_27th-m.OUT
12/08/2005  09:23 AM            21,630 Stress-pt_27th-t.OUT
12/08/2005  09:24 AM            16,291 Stress-pt_36max-b.OUT
12/08/2005  09:23 AM            16,291 Stress-pt_36max-m.OUT
12/08/2005  09:23 AM            16,210 Stress-pt_36max-t.OUT
12/08/2005  09:24 AM            21,714 Stress-pt_36th-b.OUT
12/08/2005  09:23 AM            21,714 Stress-pt_36th-m.OUT
12/08/2005  09:23 AM            21,630 Stress-pt_36th-t.OUT
12/08/2005  09:24 AM            16,291 Stress-pt_45max-b.OUT
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12/08/2005  09:23 AM            16,291 Stress-pt_45max-m.OUT
12/08/2005  09:23 AM            16,210 Stress-pt_45max-t.OUT
12/08/2005  09:24 AM            21,714 Stress-pt_45th-b.OUT
12/08/2005  09:23 AM            21,714 Stress-pt_45th-m.OUT
12/08/2005  09:23 AM            21,630 Stress-pt_45th-t.OUT
12/08/2005  09:24 AM            16,291 Stress-pt_54max-b.OUT
12/08/2005  09:23 AM            16,291 Stress-pt_54max-m.OUT
12/08/2005  09:23 AM            16,210 Stress-pt_54max-t.OUT
12/08/2005  09:24 AM            21,714 Stress-pt_54th-b.OUT
12/08/2005  09:23 AM            21,714 Stress-pt_54th-m.OUT
12/08/2005  09:23 AM            21,630 Stress-pt_54th-t.OUT
12/08/2005  09:24 AM            16,291 Stress-pt_63max-b.OUT
12/08/2005  09:23 AM            16,291 Stress-pt_63max-m.OUT
12/08/2005  09:23 AM            16,210 Stress-pt_63max-t.OUT
12/08/2005  09:24 AM            21,714 Stress-pt_63th-b.OUT
12/08/2005  09:23 AM            21,714 Stress-pt_63th-m.OUT
12/08/2005  09:23 AM            21,630 Stress-pt_63th-t.OUT
12/08/2005  09:24 AM            16,291 Stress-pt_72max-b.OUT
12/08/2005  09:23 AM            16,291 Stress-pt_72max-m.OUT
12/08/2005  09:23 AM            16,210 Stress-pt_72max-t.OUT
12/08/2005  09:24 AM            21,714 Stress-pt_72th-b.OUT
12/08/2005  09:23 AM            21,714 Stress-pt_72th-m.OUT
12/08/2005  09:23 AM            21,630 Stress-pt_72th-t.OUT
12/08/2005  09:24 AM            16,291 Stress-pt_81max-b.OUT
12/08/2005  09:23 AM            16,291 Stress-pt_81max-m.OUT
12/08/2005  09:23 AM            16,210 Stress-pt_81max-t.OUT
12/08/2005  09:24 AM            21,714 Stress-pt_81th-b.OUT
12/08/2005  09:23 AM            21,714 Stress-pt_81th-m.OUT
12/08/2005  09:23 AM            21,630 Stress-pt_81th-t.OUT
12/08/2005  09:24 AM            16,291 Stress-pt_90max-b.OUT
12/08/2005  09:23 AM            16,291 Stress-pt_90max-m.OUT
12/08/2005  09:23 AM            16,210 Stress-pt_90max-t.OUT
12/08/2005  09:24 AM            21,714 Stress-pt_90th-b.OUT
12/08/2005  09:23 AM            21,714 Stress-pt_90th-m.OUT
12/08/2005  09:23 AM            21,630 Stress-pt_90th-t.OUT
12/08/2005  09:24 AM            16,291 Stress-pt_99max-b.OUT
12/08/2005  09:23 AM            16,291 Stress-pt_99max-m.OUT
12/08/2005  09:23 AM            16,210 Stress-pt_99max-t.OUT
12/08/2005  09:24 AM            21,714 Stress-pt_99th-b.OUT
12/08/2005  09:23 AM            21,714 Stress-pt_99th-m.OUT
12/08/2005  09:23 AM            21,630 Stress-pt_99th-t.OUT
12/08/2005  09:24 AM            16,291 Stress-pt_9max-b.OUT
12/08/2005  09:23 AM            16,291 Stress-pt_9max-m.OUT
12/08/2005  09:23 AM            16,210 Stress-pt_9max-t.OUT
12/08/2005  09:24 AM            21,842 Stress-pt_9th-b.OUT
12/08/2005  09:23 AM            21,842 Stress-pt_9th-m.OUT
12/08/2005  09:23 AM            21,758 Stress-pt_9th-t.OUT
10/31/2005  12:13 PM             3,825 Tank-Coordinates-AY.txt
05/25/2005  03:32 PM             2,512 Tank-Mesh1.txt
12/08/2005  09:05 AM               102 tank-out.out
02/25/2005  02:24 PM             5,406 Tank-Props-BEC-250.txt
12/08/2005  09:06 AM             4,692 Tank-th.out
05/16/2005  03:40 PM            41,470 TH-266-Mean-Geo-V.txt
05/13/2005  10:57 AM            41,472 TH-266-Mean-Geo.txt
12/08/2005  09:21 AM             8,236 Waste-Cont_108max.OUT
12/08/2005  09:21 AM             8,820 Waste-Cont_108th.OUT
12/08/2005  09:21 AM             8,236 Waste-Cont_117max.OUT
12/08/2005  09:21 AM             8,820 Waste-Cont_117th.OUT
12/08/2005  09:21 AM             8,236 Waste-Cont_126max.OUT
12/08/2005  09:21 AM             8,820 Waste-Cont_126th.OUT
12/08/2005  09:21 AM             8,236 Waste-Cont_135max.OUT
12/08/2005  09:21 AM             8,820 Waste-Cont_135th.OUT
12/08/2005  09:21 AM             8,236 Waste-Cont_144max.OUT
12/08/2005  09:21 AM             8,820 Waste-Cont_144th.OUT
12/08/2005  09:21 AM             8,236 Waste-Cont_153max.OUT
12/08/2005  09:21 AM             8,820 Waste-Cont_153th.OUT
12/08/2005  09:21 AM             8,236 Waste-Cont_162max.OUT
12/08/2005  09:21 AM             8,820 Waste-Cont_162th.OUT
12/08/2005  09:21 AM             8,236 Waste-Cont_171max.OUT
12/08/2005  09:21 AM             8,820 Waste-Cont_171th.OUT
12/08/2005  09:21 AM             8,236 Waste-Cont_180max.OUT
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12/08/2005  09:21 AM             8,820 Waste-Cont_180th.OUT
12/08/2005  09:21 AM             8,236 Waste-Cont_18max.OUT
12/08/2005  09:21 AM             8,820 Waste-Cont_18th.OUT
12/08/2005  09:21 AM             8,236 Waste-Cont_27max.OUT
12/08/2005  09:21 AM             8,820 Waste-Cont_27th.OUT
12/08/2005  09:21 AM             8,236 Waste-Cont_36max.OUT
12/08/2005  09:21 AM             8,820 Waste-Cont_36th.OUT
12/08/2005  09:21 AM             8,236 Waste-Cont_45max.OUT
12/08/2005  09:21 AM             8,820 Waste-Cont_45th.OUT
12/08/2005  09:21 AM             8,236 Waste-Cont_54max.OUT
12/08/2005  09:21 AM             8,820 Waste-Cont_54th.OUT
12/08/2005  09:21 AM             8,236 Waste-Cont_63max.OUT
12/08/2005  09:21 AM             8,820 Waste-Cont_63th.OUT
12/08/2005  09:21 AM             8,236 Waste-Cont_72max.OUT
12/08/2005  09:21 AM             8,820 Waste-Cont_72th.OUT
12/08/2005  09:21 AM             8,236 Waste-Cont_81max.OUT
12/08/2005  09:21 AM             8,820 Waste-Cont_81th.OUT
12/08/2005  09:21 AM             8,236 Waste-Cont_90max.OUT
12/08/2005  09:21 AM             8,820 Waste-Cont_90th.OUT
12/08/2005  09:21 AM             8,236 Waste-Cont_99max.OUT
12/08/2005  09:21 AM             8,820 Waste-Cont_99th.OUT
12/08/2005  09:21 AM             8,236 Waste-Cont_9max.OUT
12/08/2005  09:21 AM             8,948 Waste-Cont_9th.OUT
12/08/2005  09:23 AM            33,299 Waste-Reaction.out
11/01/2005  12:19 PM               342 Waste-Reaction.txt
10/31/2005  12:01 PM             3,265 Waste-solid-AY.txt
             647 File(s)    586,428,661 bytes
               2 Dir(s)  78,397,038,592 bytes free
```

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$H_l := 422 \cdot in$ Baseline waste level as modeled in ANSYS

$H_t := 460 \cdot in$ Height to primary tank tangent line

$\frac{H_l}{H_t} = 0.92$ Ratio of waste height to tank height

$g := 386.4 \cdot \frac{in}{sec^2}$

$R := 450 \cdot in$ Tank radius

$\frac{H_l}{R} = 0.94$ Ratio of waste height to tank radius

$i := 0 .. 2$

$\lambda := \begin{pmatrix} 1.841 \\ 5.331 \\ 8.536 \end{pmatrix}$ Bessel function roots

$\theta := \begin{pmatrix} 0 \cdot deg \\ 45 \cdot deg \\ 90 \cdot deg \end{pmatrix}$ Circumferential location of waste elements for which pressures are reported

Convective Frequencies

$fcon_i := \frac{1}{2 \cdot \pi} \cdot \left[\sqrt{\left[\lambda_i \cdot \left[\frac{g}{R} \cdot \tanh\left[\lambda_i \cdot \left(\frac{H_l}{R} \right) \right] \right] \right]} \right]$ Eqn. 4.14 BNL 1995

$fcon = \begin{pmatrix} 0.19 \\ 0.34 \\ 0.43 \end{pmatrix} Hz$ First three convective frequencies

$\rho_l := 1.59 \cdot 10^{-4} \cdot \frac{lbf \cdot sec^2}{in^4}$ waste density - specific gravity = 1.7

Calculation of Impulsive Frequency:

$\rho_t := 7.35 \cdot 10^{-4} \cdot \frac{lbf \cdot sec^2}{in^4}$ Steel density

$t_{tw} := 0.65 \cdot in$ Average thickness of AY over lower 2/3.

$E_t := 29 \cdot 10^6 \cdot \frac{lbf}{in^2}$ Elastic modulus for steel

$C_{iref} := 0.102$ Table 4.4 of BNL 1995. Hinged top support condition - estimated for H_l/H_t=0.92

$C_i := C_{iref} \cdot \sqrt{127 \cdot \frac{\left(\frac{t_{tw}}{R}\right)}{\left(\frac{\rho_l}{\rho_t}\right)}}$ Eqn. 4.18 BNL 1995

$C_i = 0.09$ Impulsive coefficient for frequency calculation

$f_i := 5.54$ ANSYS Results

Determine Convective Pressures on the Tank Wall:

$$z := \begin{pmatrix} 24.5 \cdot in \\ 50.5 \cdot in \\ 77.5 \cdot in \\ 104.5 \cdot in \\ 131.45 \cdot in \\ 156.35 \cdot in \\ 179.3 \cdot in \\ 202.3 \cdot in \\ 225.65 \cdot in \\ 251 \cdot in \\ 278 \cdot in \\ 305 \cdot in \\ 332 \cdot in \\ 359.5 \cdot in \\ 386.5 \cdot in \\ 410.75 \cdot in \end{pmatrix}$$

Vertical location of element centroids at which pressures are reported.

$\eta_l := \frac{z}{H_l}$ Ratio of tank wall vertical location to waste height for waste element centroids.

$\eta_l =$

	0
0	0.06
1	0.12
2	0.18
3	0.25
4	0.31
5	0.37
6	0.42
7	0.48
8	0.53
9	0.59
10	0.66
11	0.72
12	0.79
13	0.85
14	0.92
15	0.97

Determine convective coefficients as a function of dimensionless height per BNL 1995 Eqn. 4.4

$$con_0(\eta_l) := \left[\frac{2}{(\lambda_0)^2 - 1} \cdot \frac{\cosh\left[\lambda_0 \cdot \left(\frac{H_l}{R}\right) \cdot \eta_l\right]}{\cosh\left[\lambda_0 \cdot \left(\frac{H_l}{R}\right)\right]}\right]$$

$$con_1(\eta_l) := \left[\frac{2}{(\lambda_1)^2 - 1} \cdot \frac{\cosh\left[\lambda_1 \cdot \left(\frac{H_l}{R}\right) \cdot \eta_l\right]}{\cosh\left[\lambda_1 \cdot \left(\frac{H_l}{R}\right)\right]}\right]$$

$$con_2(\eta_l) := \left[\frac{2}{(\lambda_2)^2 - 1} \cdot \frac{\cosh\left[\lambda_2 \cdot \left(\frac{H_l}{R}\right) \cdot \eta_l\right]}{\cosh\left[\lambda_2 \cdot \left(\frac{H_l}{R}\right)\right]}\right]$$

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$con_0(\eta_1) =$

	0
0	0.29
1	0.29
2	0.3
3	0.32
4	0.33
5	0.35
6	0.37
7	0.39
8	0.42
9	0.45
10	0.5
11	0.54
12	0.6
13	0.66
14	0.73
15	0.8

$con_1(\eta_1) =$

	0
0	$1.03 \cdot 10^{-3}$
1	$1.16 \cdot 10^{-3}$
2	$1.43 \cdot 10^{-3}$
3	$1.84 \cdot 10^{-3}$
4	$2.44 \cdot 10^{-3}$
5	$3.21 \cdot 10^{-3}$
6	$4.17 \cdot 10^{-3}$
7	$5.45 \cdot 10^{-3}$
8	$7.16 \cdot 10^{-3}$
9	$9.64 \cdot 10^{-3}$
10	0.01
11	0.02
12	0.03
13	0.03
14	0.05
15	0.06

$con_2(\eta_1) =$

	0
0	$2.06 \cdot 10^{-5}$
1	$2.78 \cdot 10^{-5}$
2	$4.25 \cdot 10^{-5}$
3	$6.87 \cdot 10^{-5}$
4	$1.13 \cdot 10^{-4}$
5	$1.81 \cdot 10^{-4}$
6	$2.79 \cdot 10^{-4}$
7	$4.31 \cdot 10^{-4}$
8	$6.72 \cdot 10^{-4}$
9	$1.09 \cdot 10^{-3}$
10	$1.81 \cdot 10^{-3}$
11	$3.02 \cdot 10^{-3}$
12	$5.05 \cdot 10^{-3}$
13	$8.5 \cdot 10^{-3}$
14	0.01
15	0.02

Impulsive pressure coefficient as a function of dimensionless wall height

$$c_i(\eta_1) := 1 - con_0(\eta_1) - con_1(\eta_1) - con_2(\eta_1)$$

BNL 1995 Eqn. 4.7

$c_i(\eta_1) =$

	0
0	0.71
1	0.7
2	0.7
3	0.68
4	0.67
5	0.65
6	0.63
7	0.6
8	0.57
9	0.53
10	0.49
11	0.43
12	0.37
13	0.3
14	0.21
15	0.11

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Calculate maximum values of dynamic wall pressures

Consider the first three convective modes

$SA_{c0} := 0.062 \cdot g$ $\quad SA_{c0} = 23.96 \frac{in}{sec^2}$

$SA_{c1} := 0.108 \cdot g$ $\quad SA_{c1} = 41.73 \frac{in}{sec^2}$ $\quad$ 0.5% Dome RS from Spectr

$SA_{c2} := 0.163 \cdot g$ $\quad SA_{c2} = 62.98 \frac{in}{sec^2}$

Determine the spectral acceleration for the impulsive mode.

$SA_i := 0.35 \cdot g$ $\quad SA_i = 135.24 \frac{in}{sec^2}$

$$p_{maxconv}(\eta_1, \theta) := \left[\sqrt{(con_0(\eta_1) \cdot SA_{c0})^2 + (con_1(\eta_1) \cdot SA_{c1})^2 + (con_2(\eta_1) \cdot SA_{c2})^2}\right] \cdot (\rho_l \cdot R \cdot \cos(\theta \cdot deg))$$

$$p_{maximpulsive}(\eta_1, \theta) := \left[\sqrt{[c_i(\eta_1) \cdot (SA_i)]^2}\right] \cdot (\rho_l \cdot R \cdot \cos(\theta \cdot deg))$$

$$p_{max}(\eta_1, \theta) := \left[\sqrt{[(c_i(\eta_1)) \cdot (SA_i)]^2 + (con_0(\eta_1) \cdot SA_{c0})^2 + (con_1(\eta_1) \cdot SA_{c1})^2 + (con_2(\eta_1) \cdot SA_{c2})^2}\right] \cdot (\rho_l \cdot R \cdot \cos(\theta \cdot deg))$$

Previous equation is Eqn. 4.24 from BNL 1995

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$p_{maximpulsive}(\eta_1, 0) =$

	0
0	6.86
1	6.81
2	6.73
3	6.6
4	6.44
5	6.26
6	6.05
7	5.81
8	5.53
9	5.17
10	4.73
11	4.2
12	3.59
13	2.86
14	2
15	1.08

$\frac{lbf}{in^2}$

Maximum impulsive dynamic pressures at theta = 0.

$p_{maxconv}(\eta_1, 0) =$

	0
0	0.5
1	0.51
2	0.52
3	0.54
4	0.57
5	0.6
6	0.63
7	0.67
8	0.72
9	0.78
10	0.85
11	0.93
12	1.03
13	1.14
14	1.26
15	1.39

$\frac{lbf}{in^2}$

Maximum convective dynamic pressures at theta = 0.

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$p_{max}(\eta_1, 0) =$

	0
0	6.88
1	6.83
2	6.75
3	6.63
4	6.47
5	6.29
6	6.09
7	5.85
8	5.58
9	5.23
10	4.8
11	4.31
12	3.74
13	3.08
14	2.36
15	1.76

$\frac{lbf}{in^2}$

Maximum total dynamic pressure at theta = 0.

$p_{max}(\eta_1, 45) =$

	0
0	4.86
1	4.83
2	4.77
3	4.69
4	4.57
5	4.45
6	4.3
7	4.14
8	3.94
9	3.7
10	3.4
11	3.05
12	2.64
13	2.17
14	1.67
15	1.25

$\frac{lbf}{in^2}$

Maximum total dynamic pressure at theta = 45 degrees.

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$p_{max}(\eta_l, 90) =$

	0
0	0
1	0
2	0
3	0
4	0
5	0
6	0
7	0
8	0
9	0
10	0
11	0
12	0
13	0
14	0
15	0

$\frac{lbf}{in^2}$

Maximum total dynamic pressure at theta = 90 degrees.

Calculate Maximum Slosh Height:

$$conmax := \begin{pmatrix} 0.837 \\ 0.073 \\ 0.028 \end{pmatrix}$$

Maximum value of convective coefficients at η_l=1

$$h_{maxslosh} := R \cdot \sqrt{\left(conmax_0 \cdot \frac{SA_{c0}}{g}\right)^2 + \left(conmax_1 \cdot \frac{SA_{c1}}{g}\right)^2 + \left(conmax_2 \cdot \frac{SA_{c2}}{g}\right)^2}$$

$h_{maxslosh} = 23.71\,in$

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Calculate Maximum Total Hydrodynamic Force:

The maximum hydrodynamic force induced on the tank wall is given by Eqn. 4.31 of BNL 1995 with the instantaneous accelerations replaced by the maximum spectral accelerations. First determine the effective impulsive and convective masses.

$m_{lapprox} := \pi \cdot R^2 \cdot H_l \cdot \rho_l$ $\quad m_{lapprox} = 4.27 \times 10^4 \frac{lbf \cdot sec^2}{in}$ Total waste mass base on circular cylinder approximation.

$m_l := 4.27 \times 10^4 \cdot \frac{lbf \cdot sec^2}{in}$ Actual waste mass reported by ANSYS model.

$$m_{c0} := \left[\frac{2}{\lambda_0 \cdot \left[\left(\lambda_0\right)^2 - 1\right] \cdot \left(\frac{H_l}{R}\right)}\right] \cdot \tanh\left[\lambda_0 \cdot \left(\frac{H_l}{R}\right)\right] \cdot m_l$$ First mode convective mass

$m_{c0} = 1.94 \times 10^4 \frac{lbf \cdot sec^2}{in}$

$$m_{c1} := \left[\frac{2}{\lambda_1 \cdot \left[\left(\lambda_1\right)^2 - 1\right] \cdot \left(\frac{H_l}{R}\right)}\right] \cdot \tanh\left[\lambda_1 \cdot \left(\frac{H_l}{R}\right)\right] \cdot m_l$$ Second mode convective mass

$m_{c1} = 622.94 \frac{lbf \cdot sec^2}{in}$

$$m_{c2} := \left[\frac{2}{\lambda_2 \cdot \left[\left(\lambda_2\right)^2 - 1\right] \cdot \left(\frac{H_l}{R}\right)}\right] \cdot \tanh\left[\lambda_2 \cdot \left(\frac{H_l}{R}\right)\right] \cdot m_l$$ Third mode convective mass

$m_{c2} = 148.46 \frac{lbf \cdot sec^2}{in}$

$m_i := m_l - \left(m_{c0} + m_{c1} + m_{c2}\right)$ Impulsive mass

$m_i = 2.25 \times 10^4 \frac{lbf \cdot sec^2}{in}$

$F_{max} := m_i \cdot SA_i + m_{c0} \cdot SA_{c0} + m_{c1} \cdot SA_{c1} + m_{c2} \cdot SA_{c2}$

$F_{max} = 3.54 \times 10^6 \, lbf$ Conservative estimate of maximum hydrodynamic force

The above expression is a conservative estimate because it assumes that the peak impulsive and convective forces occur simultaneously. A less conservative estimate can be made via a square-root-sum-of-the-squares (SRSS) combination.

$F_{srss} := \sqrt{(m_i \cdot SA_i)^2 + (m_{c0} \cdot SA_{c0})^2 + (m_{c1} \cdot SA_{c1})^2 + (m_{c2} \cdot SA_{c2})^2}$

$F_{srss} = 3.08 \times 10^6 \, lbf$ SRSS estimate of peak hydrodynamic force

$F_{con} := \sqrt{(m_{c0} \cdot SA_{c0})^2 + (m_{c1} \cdot SA_{c1})^2 + (m_{c2} \cdot SA_{c2})^2}$

$F_{con} = 4.66 \times 10^5 \, lbf$ Peak hydrodynamic force due to convective effects only

Consider Vertical Excitation:

Calculate the axisymmetric breathing mode frequency for the tank

$C_{vref} := 0.088$ Table 4.17 BNL 1995

$C_v := C_{vref} \cdot \sqrt{127 \cdot \frac{\left(\frac{t_{tw}}{R}\right)}{\left(\frac{\rho_l}{\rho_t}\right)}}$ $C_v = 0.081$

$f_v := 4.9$

$S_{Av} := 0.30 \cdot g$ $S_{Av} = 115.92 \frac{in}{sec^2}$ Vert. Haunch 4 % RS from Spectr

The maximum dynamic wall pressure as a function of the dimensionless vertical distance is given by

$p_{maxv}(\eta_l) := (0.8)\cdot\left(\cos\left(\frac{\pi}{2}\cdot\eta_l\right)\right)\cdot(\rho_l\cdot H_l\cdot S_{Av})$ Eqn. 4.52 BNL 1995

$p_{maxv}(\eta_l) =$

	0
0	6.2
1	6.11
2	5.97
3	5.76
4	5.49
5	5.2
6	4.89
7	4.54
8	4.15
9	3.7
10	3.18
11	2.63
12	2.05
13	1.43
14	0.82
15	0.26

$\frac{lbf}{in^2}$

$c_{oprimeouter} := 0.28$ $c_{oprimecenter} := 0.54$ Estimated from Figure 4.7 BNL 1995

$c_{vprimeouter} := 0.72$ $c_{vprimecenter} := 0.46$

$PGA_{vert} := 0.12\cdot g$

The maximum base pressures at the outer and center elements are given by

$p_{maxbasevertouter} := c_{oprimeouter}\cdot\rho_l\cdot H_l\cdot PGA_{vert} + c_{vprimeouter}\cdot(\rho_l\cdot H_l)\cdot S_{Av}$ Eqn. 4.55 BNL 1995

$p_{maxbasevertcenter} := c_{oprimecenter}\cdot\rho_l\cdot H_l\cdot PGA_{vert} + c_{vprimecenter}\cdot(\rho_l\cdot H_l)\cdot S_{Av}$

$p_{maxbasevertouter} = 6.47\frac{lbf}{in^2}$

$p_{maxbasevertcenter} = 5.26\frac{lbf}{in^2}$

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Determine the maximum vertical force on the base

$m_0 := 0.402 \cdot m_l$ Component of waste mass participating in the motion of the tank base

$m_v := 0.598 \cdot m_l$ Component of waste mass participating in the motion of the tank wall

BNL Table 4.17

$F_{maxbasevert} := \sqrt{(m_0 \cdot PGA_{vert})^2 + (m_v \cdot S_{Av})^2}$ Eqn. 4.57 BNL 1995 modified for maximum response per p. 4-34

$F_{maxbasevert} = 3.07 \times 10^6 \, lbf$

$m_0 = 1.72 \times 10^4 \, lbf \cdot \frac{sec^2}{in}$

$m_v = 2.55 \times 10^4 \, lbf \cdot \frac{sec^2}{in}$

Appendix G

Upper Bound Soil
Best Estimate Concrete

Results
Load Case Specific Input Files
File Listing
Theoretical Waste Pressure Calculations

Appendix E

Upper Bound Soil
Best Estimate Concrete

Results
Load Case Specific Input Files
File Listing
Theoretical Waste Pressure Calculations

AY Primary Tank, Upper Bound Soil (Geomatrix), Gravity Only, Best Estimate Concrete, 422 in. Waste Level at 1.7 SpG

ANSYS MAXIMUMS BY PATH

PNNL Section No.	Path (in.)	Gravity Hoop Force (kip/ft) AY-UBS-BEC	Gravity Meridonal Force (kip/ft) AY-UBS-BEC	Gravity -In-Plane Shear Force (kip/ft) AY-UBS-BEC	Gravity Hoop Moment (ft*kip/ft) AY-UBS-BEC	Gravity Meridonal Moment (ft*kip/ft) AY-UBS-BEC	Gravity Through-Wall Shear Force (kip/ft) AY-UBS-BEC
2	**67.727**	-68.660	-73.920	0.100	-9.001	-5.812	2.080
3	**105.668**	-61.560	-71.820	0.145	-6.481	-2.635	1.359
4	**137.069**	-54.410	-69.350	0.155	-4.642	0.226	1.537
6	**182.849**	-45.470	-65.360	0.243	-2.750	2.301	0.579
8	**226.563**	-38.650	-62.090	0.150	-1.842	1.534	0.465
9	**275.566**	-32.910	-58.680	-0.166	-1.679	0.046	0.561
11	**325.690**	-25.400	-56.140	-0.192	-1.847	-2.660	0.560
13	**372.305**	-15.930	-53.830	-0.180	-3.890	-3.102	0.144
17	**423.427**	-6.373	-51.650	-0.155	-1.445	-0.367	2.135
20	**468.308**	25.270	-49.440	-0.167	-4.933	15.720	7.034
22	**515.312**	9.852	-49.230	-0.103	3.882	23.830	4.001
24	**549.725**	-1.579	-46.980	0.069	1.584	8.653	5.860
26	**585.819**	-10.790	-48.160	0.054	-0.075	-0.406	1.788
30	**636.369**	-18.340	-49.870	0.042	-0.324	-1.797	0.812
33	**685.619**	-20.750	-51.060	0.034	-0.010	-0.054	0.102
35	**732.719**	-23.220	-52.340	0.027	0.025	0.137	0.061
38	**778.219**	-20.910	-53.590	0.021	-0.114	-0.634	0.132
41	**821.369**	-21.370	-55.210	0.016	0.008	0.051	0.064
43	**874.169**	-13.640	-32.960	0.035	-0.359	-1.984	0.431
46	**930.544**	-27.590	-57.630	0.337	-0.798	-4.265	0.391
48	**977.629**	-1.629	-8.915	0.598	-2.164	10.780	6.218
51	**1019.647**	-0.684	-14.100	1.169	-0.772	9.993	6.990
53	**1060.156**	0.155	-3.718	0.301	0.474	2.247	2.756
55	**1109.695**	1.819	-1.436	0.277	0.042	-0.193	0.252
57	**1155.770**	0.923	0.401	0.054	0.016	0.062	0.107
58	**1211.956**	1.260	1.144	0.019	0.007	-0.049	0.106
59	**1281.707**	1.022	1.145	-0.018	0.019	0.093	0.100
60	**1330.557**	0.921	0.990	-0.013	-0.007	-0.042	0.032
61	**1374.857**	0.723	1.347	-0.056	0.009	0.018	0.097
62	**1417.007**	3.315	3.333	-0.044	0.075	0.253	0.072

Note: Meridonal/Hoop Forces and Meridonal/Hoop Moments are Reversed in Highlighted Sections.

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AY-2D-NL-UBS-BEC Conc Tank Demand Gravity.xls, FM Max

Figure G.1. UBS-BEC Concrete Forces and Moments, Gravity Load Only

1/16/2006, 11:02 AM

AY- Primary Tank, Upper Bound Soil (Geomatrix), Best Estimate Concrete, 422 in. Waste Level at 1.7 SpG

ANSYS MAXIMUMS BY PATH

PNNL Section No.	Path (in.)	Seismic Hoop Force (kip/ft) AY-UBS-BEC	Seismic Meridonal Force (kip/ft) AY-UBS-BEC	Seismic -In-Plane Shear Force (kip/ft) AY-UBS-BEC	Seismic Hoop Moment (ft*kip/ft) AY-UBS-BEC	Seismic Meridonal Moment (ft*kip/ft) AY-UBS-BEC	Seismic Through-Wall Shear Force (kip/ft) AY-UBS-BEC
2	**67.727**	-98.820	-107.600	5.068	-18.390	-14.900	4.699
3	**105.668**	-88.370	-104.100	7.324	-13.910	-10.960	3.273
4	**137.069**	-77.370	-99.660	8.492	-10.160	-7.026	3.444
6	**182.849**	-66.550	-92.500	8.985	-5.788	7.305	2.609
8	**226.563**	-61.660	-85.500	10.120	-3.907	8.261	1.322
9	**275.566**	-55.670	-78.200	12.510	-3.233	-3.680	1.234
11	**325.690**	-45.410	-72.890	15.130	-2.996	-4.578	1.192
13	**372.305**	-41.030	-68.300	17.530	-5.789	-5.226	0.889
17	**423.427**	-15.660	-65.140	18.060	-2.574	-4.276	3.021
20	**468.308**	61.430	-62.060	17.880	-9.343	23.110	9.172
22	**515.312**	19.650	-60.950	17.270	5.516	31.780	6.078
24	**549.725**	-7.421	-57.700	15.730	2.087	11.380	7.883
26	**585.819**	-15.570	-60.290	15.050	-0.146	-0.770	2.323
30	**636.369**	-22.590	-62.660	14.990	-0.405	-2.229	1.016
33	**685.619**	-25.130	-63.440	15.510	-0.043	-0.198	0.141
35	**732.719**	-27.880	-64.500	16.250	0.049	0.251	0.101
38	**778.219**	-24.740	-65.520	17.030	-0.143	-0.761	0.210
41	**821.369**	-25.820	-66.930	18.720	0.025	0.139	0.115
43	**874.169**	-16.400	-39.730	12.960	-0.569	-3.133	0.828
46	**930.544**	-45.510	-69.510	23.020	-1.020	-5.804	1.185
48	**977.629**	-7.574	-14.130	5.868	-2.659	13.460	7.752
51	**1019.647**	20.060	-22.670	9.870	-0.970	12.330	8.604
53	**1060.156**	-4.282	-8.947	4.922	0.627	2.984	3.796
55	**1109.695**	10.220	-5.345	4.119	0.078	-0.310	0.344
57	**1155.770**	3.453	2.809	1.967	0.023	0.086	0.163
58	**1211.956**	3.766	2.766	1.527	0.014	-0.079	0.170
59	**1281.707**	2.735	2.431	1.034	0.027	0.123	0.191
60	**1330.557**	2.291	2.195	0.744	-0.010	-0.052	0.091
61	**1374.857**	1.547	2.601	0.641	0.011	0.023	0.163
62	**1417.007**	6.633	6.035	0.912	0.095	0.307	0.186

Note: Meridonal/Hoop Forces and Meridonal/Hoop Moments are Reversed in Highlighted Sections.

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Figure G.2. UBS-BEC Concrete Forces and Moments, Gravity Plus Seismic Load

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AY- Primary Tank, Upper Bound Soil (Geomatrix), Best Estimate Concrete, 422 in. Waste Level at 1.7 SpG

ANSYS MAXIMUMS BY PATH

PNNL Section No.	Path (in.)	Seismic Only Hoop Force (kip/ft) AY-UBS-BEC	Seismic Only Meridonal Force (kip/ft) AY-UBS-BEC	Seismic Only - In-Plane Shear Force (kip/ft) AY-UBS-BEC	Seismic Only Hoop Moment (ft*kip/ft) AY-UBS-BEC	Seismic Only Meridonal Moment (ft*kip/ft) AY-UBS-BEC	Seismic Only Through-Wall Shear Force (kip/ft) AY-UBS-BEC
2	**67.727**	30.340	33.930	4.985	11.504	10.680	2.619
3	**105.668**	27.050	32.850	7.200	8.988	8.464	2.373
4	**137.069**	23.240	30.820	8.419	6.399	7.189	2.572
6	**182.849**	21.680	27.560	9.052	3.175	6.031	2.785
8	**226.563**	23.230	23.800	10.130	2.149	8.298	0.990
9	**275.566**	23.506	19.700	12.404	1.744	3.685	0.951
11	**325.690**	21.543	16.810	15.021	1.373	2.461	0.697
13	**372.305**	25.980	14.490	17.461	2.224	2.533	0.745
17	**423.427**	9.357	13.730	17.922	1.177	3.955	1.011
20	**468.308**	36.000	12.820	17.753	4.590	7.360	2.154
22	**515.312**	11.778	11.720	17.232	1.638	7.970	2.077
24	**549.725**	5.842	10.830	15.699	0.510	2.754	2.027
26	**585.819**	4.780	12.340	15.023	0.071	0.364	0.541
30	**636.369**	4.320	13.000	14.967	0.082	0.438	0.208
33	**685.619**	4.420	12.590	15.492	0.033	0.144	0.044
35	**732.719**	4.690	12.370	16.236	0.030	0.118	0.040
38	**778.219**	3.860	12.130	17.019	0.029	0.132	0.078
41	**821.369**	4.470	11.930	18.712	0.022	0.103	0.055
43	**874.169**	2.840	7.840	12.956	0.212	1.156	0.403
46	**930.544**	18.020	13.840	23.012	0.225	1.558	0.876
48	**977.629**	6.242	5.251	5.300	0.548	2.700	1.552
51	**1019.647**	20.496	8.710	8.810	0.403	2.426	1.817
53	**1060.156**	4.394	5.229	4.647	0.153	0.736	1.040
55	**1109.695**	9.150	4.579	3.872	0.037	0.135	0.117
57	**1155.770**	2.954	2.432	1.925	0.007	0.024	0.056
58	**1211.956**	2.962	1.642	1.515	0.008	0.030	0.064
59	**1281.707**	2.050	1.415	1.041	0.008	0.029	0.091
60	**1330.557**	1.634	1.309	0.747	0.004	0.013	0.072
61	**1374.857**	0.941	1.281	0.593	0.003	0.008	0.137
62	**1417.007**	3.601	2.792	0.906	0.031	0.053	0.129

Note: Meridonal/Hoop Forces and Meridonal/Hoop Moments are Reversed in Highlighted Sections.

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Figure G.3. UBS-BEC Concrete Forces and Moments, Seismic Load Only

AY Primary Tank, Upper Bound Soil, Gravity Input, Best Estimate Tank Concrete, 422 in. Waste Level at 1.7 SpG

		Shell Top Surface (inside - waste side)					
M&D Starting M&D Element No.	Path (in.)	AY-NL-UBS-BEC Gravity Only Hoop Stress (lbs/in^2) Top	AY-NL-UBS-BEC Gravity Only Meridional Stress (lbs/in^2) Top	AY-NL-UBS-BEC Gravity Only Stress Intensity (lbs/in^2) Top	AY-NL-UBS-BEC Gravity Only In-Plane Shear Stress (lbs/in^2) Top	AY-NL-UBS-BEC Gravity Only In-Plane Shear Force Stress (lbs/in^2) Top	AY-NL-UBS-BEC Gravity Only Thru-Thickness Shear Stress (lbs/in^2) Top
762	**67.33**	-1811.11	0.00	1811.11	13.95	8.38	-0.17
782	**105.04**	-1797.92	-2837.50	2837.50	50.48	-20.48	-0.36
802	**136.24**	-1654.86	-2276.39	2277.08	61.59	17.50	-0.36
822	**181.71**	-1156.94	-2306.94	2306.94	66.81	-2.26	-0.12
842	**225.10**	-1047.92	-1652.78	1656.94	56.34	-8.99	-0.33
862	**273.66**	-515.42	-1608.33	1609.72	40.47	5.77	0.23
882	**323.27**	-337.85	-993.06	993.75	54.40	-18.24	0.75
902	**369.20**	364.79	-782.64	1070.14	-60.14	4.64	-0.22
922	**419.20**	895.83	-232.43	1126.39	-48.26	-4.15	-0.28
942	**444.11**	697.22	-1143.06	1836.11	-41.02	48.18	-0.97
962	**471.06**	-341.04	656.81	987.50	-10.66	-2.90	-0.35
982	**503.51**	856.94	168.89	857.64	3.08	-13.49	-0.10
1002	**527.76**	2975.00	-290.14	3263.89	2.61	-11.74	0.02
1022	**554.76**	4027.78	388.26	4027.78	1.95	-9.01	-0.01
1042	**582.26**	5620.14	-87.29	5705.56	1.90	-6.85	0.01
1062	**609.26**	7333.33	127.78	7333.33	1.89	-7.85	0.00
1082	**636.26**	8979.17	-175.63	9152.78	1.86	-10.22	0.00
1102	**663.26**	10458.33	354.58	10458.33	1.95	0.23	0.00
1122	**688.61**	12388.89	-312.43	12694.44	1.93	3.29	0.00
1142	**711.96**	13819.44	107.29	13819.44	1.98	-5.64	0.01
1162	**734.96**	15319.44	124.17	15319.44	2.18	-6.64	0.01
1182	**757.91**	15388.89	-1718.06	17104.17	2.18	-8.86	0.01
1202	**782.81**	12791.67	2162.50	12791.67	1.58	-17.76	0.01
1222	**809.76**	12416.67	-240.28	12659.72	1.42	-6.92	-0.02
1242	**836.76**	13743.06	-19.12	13763.89	1.61	-3.97	0.02
1262	**863.76**	15062.50	141.11	15062.50	1.45	-7.64	0.06
1282	**889.76**	12694.44	-4465.28	17159.72	3.08	-2.51	-0.15
1302	**906.85**	4284.03	-7805.56	12090.28	12.31	147.22	-1.39
1322	**916.04**	4129.17	7569.44	7604.17	9.15	340.07	-2.46
1342	**934.63**	2855.56	8138.89	8173.61	-419.58	9.30	-115.76
1362	**974.63**	-87.71	-1421.53	1431.94	106.94	-3.11	39.53
1382	**1040.78**	870.14	1732.64	1738.89	-70.07	1.92	-24.33
1402	**1110.53**	21.80	-1055.56	1085.42	86.53	-2.74	34.60

Note 1: Meridonal, Hoop, and Shear Stresses are Reversed in Highlighted Sections (Floor)

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AY-2D-NL-UBS-BEC Pri Tank Stress Gravity.xls, Stress Max

Figure G.4. UBS-BEC Primary Tank Stresses, Shell Top, Gravity Load Only

AY Primary Tank, Upper Bound Soil, Gravity Input, Best Estimate Tank Concrete, 422 in. Waste Level at 1.7 SpG

		Shell Mid-Plane					
M&D Starting M&D Element No.	Path (in.)	AY-NL-UBS-BEC Gravity Only Hoop Stress (lbs/in^2) Mid	AY-NL-UBS-BEC Gravity Only Meridional Stress (lbs/in^2) Mid	AY-NL-UBS-BEC Gravity Only Stress Intensity (lbs/in^2) Mid	AY-NL-UBS-BEC Gravity Only In-Plane Shear Stress (lbs/in^2) Mid	AY-NL-UBS-BEC Gravity Only In-Plane Shear Force Stress (lbs/in^2) Mid	AY-NL-UBS-BEC Gravity Only Thru-Thickness Shear Stress (lbs/in^2) Mid
762	**67.33**	-1904.17	-1950.00	1950.69	13.38	8.38	-0.17
782	**105.04**	-1765.97	-2663.89	2663.89	49.84	-20.48	-0.36
802	**136.24**	-1733.33	-2479.86	2480.56	62.01	17.50	-0.36
822	**181.71**	-1130.56	-2179.86	2179.86	66.54	-2.26	-0.12
842	**225.10**	-1127.78	-1884.03	1885.42	56.38	-8.99	-0.33
862	**273.66**	-495.83	-1526.39	1527.78	40.27	5.77	0.23
882	**323.27**	-390.83	-1111.81	1112.50	54.47	-18.24	0.75
902	**369.20**	369.24	-764.58	1052.08	-60.32	4.64	-0.22
922	**419.20**	889.58	-252.57	1131.94	-48.14	-4.15	-0.28
942	**444.11**	1075.00	117.43	1093.75	-38.01	48.18	-0.97
962	**471.06**	-500.69	112.57	608.33	-11.53	-2.90	-0.35
982	**503.51**	834.72	83.40	836.81	2.92	-13.49	-0.10
1002	**527.76**	3083.33	76.04	3084.72	2.63	-11.74	0.02
1022	**554.76**	3927.08	47.99	3928.47	1.90	-9.01	-0.01
1042	**582.26**	5656.25	40.17	5657.64	1.86	-6.85	0.01
1062	**609.26**	7305.56	32.52	7305.56	1.85	-7.85	0.00
1082	**636.26**	9041.67	24.87	9041.67	1.83	-10.22	0.00
1102	**663.26**	10361.11	17.23	10361.11	1.92	0.23	0.00
1122	**688.61**	12479.17	10.10	12486.11	1.90	3.29	0.00
1142	**711.96**	13791.67	3.52	13798.61	1.97	-5.64	0.01
1162	**734.96**	15277.78	-9.40	15291.67	1.97	-6.64	0.01
1182	**757.91**	15895.83	-16.22	15916.67	2.12	-8.86	0.01
1202	**782.81**	12138.89	-16.26	12166.67	1.41	-17.76	0.01
1222	**809.76**	12479.17	-24.19	12506.94	1.39	-6.92	-0.02
1242	**836.76**	13743.06	-31.89	13770.83	1.53	-3.97	0.02
1262	**863.76**	15006.94	-39.19	15048.61	1.45	-7.64	0.06
1282	**889.76**	14020.83	-48.37	14069.44	3.36	-2.51	-0.15
1302	**906.85**	6486.81	-54.28	6663.19	10.23	147.22	-1.39
1322	**916.04**	1606.94	121.60	1889.58	6.32	340.07	-2.46
1342	**934.63**	448.33	320.90	485.83	11.07	9.30	-115.76
1362	**974.63**	527.71	590.28	595.56	-6.61	-3.11	39.53
1382	**1040.78**	497.71	515.00	517.22	-3.00	1.92	-24.33
1402	**1110.53**	491.04	513.96	518.47	-3.77	-2.74	34.60

Note 1: Meridonal, Hoop, and Shear Stresses are Reversed in Highlighted Sections (Floor)

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AY-2D-NL-UBS-BEC Pri Tank Stress Gravity.xls, Stress Max

Figure G.5. UBS-BEC Primary Tank Stresses, Shell Middle, Gravity Load Only

AY Primary Tank, Upper Bound Soil, Gravity Input, Best Estimate Tank Concrete, 422 in. Waste Level at 1.7 SpG

		Shell Bottom Surface (outside - away from waste)					
M&D Starting M&D Element No.	Path (in.)	AY-NL-UBS-BEC Gravity Only Hoop Stress (lbs/in^2) Bot	AY-NL-UBS-BEC Gravity Only Meridional Stress (lbs/in^2) Bot	AY-NL-UBS-BEC Gravity Only Stress Intensity (lbs/in^2) Bot	AY-NL-UBS-BEC Gravity Only In-Plane Shear Stress (lbs/in^2) Bot	AY-NL-UBS-BEC Gravity Only In-Plane Shear Force Stress (lbs/in^2) Bot	AY-NL-UBS-BEC Gravity Only Thru-Thickness Shear Stress (lbs/in^2) Bot
762	**67.33**	-2000.00	-2146.53	2147.22	13.08	8.38	-0.17
782	**105.04**	-1734.72	-2490.28	2490.97	49.19	-20.48	-0.36
802	**136.24**	-1819.44	-2683.33	2684.03	62.44	17.50	-0.36
822	**181.71**	-1104.86	-2052.08	2052.08	66.28	-2.26	-0.12
842	**225.10**	-1206.94	-2124.31	2124.31	56.41	-8.99	-0.33
862	**273.66**	-476.25	-1443.75	1445.83	40.34	5.77	0.23
882	**323.27**	-443.82	-1251.39	1252.08	54.53	-18.24	0.75
902	**369.20**	373.61	-747.22	1034.72	-60.50	4.64	-0.22
922	**419.20**	883.33	-275.83	1143.75	-48.02	-4.15	-0.28
942	**444.11**	1453.47	1345.14	1456.94	-35.00	48.18	-0.97
962	**471.06**	-660.42	-436.81	660.49	-12.40	-2.90	-0.35
982	**503.51**	813.19	7.17	823.61	3.07	-13.49	-0.10
1002	**527.76**	3193.06	441.32	3193.06	2.67	-11.74	0.02
1022	**554.76**	3825.69	-294.17	4118.75	1.84	-9.01	-0.01
1042	**582.26**	5693.06	163.13	5693.75	1.83	-6.85	0.01
1062	**609.26**	7277.78	-68.85	7347.22	1.82	-7.85	0.00
1082	**636.26**	9097.22	219.86	9097.22	1.82	-10.22	0.00
1102	**663.26**	10256.94	-326.53	10583.33	1.88	0.23	0.00
1122	**688.61**	12576.39	327.08	12576.39	1.87	3.29	0.00
1142	**711.96**	13756.94	-107.01	13868.06	1.95	-5.64	0.01
1162	**734.96**	15243.06	-137.01	15375.00	1.95	-6.64	0.01
1182	**757.91**	16409.72	1692.36	16409.72	2.09	-8.86	0.01
1202	**782.81**	11486.11	-2192.36	13680.56	1.34	-17.76	0.01
1222	**809.76**	12548.61	196.81	12548.61	1.36	-6.92	-0.02
1242	**836.76**	13736.11	-44.67	13777.78	1.45	-3.97	0.02
1262	**863.76**	14958.33	-218.06	15173.61	1.58	-7.64	0.06
1282	**889.76**	15347.22	4368.06	15347.22	3.64	-2.51	-0.15
1302	**906.85**	8694.44	7701.39	8701.39	8.15	147.22	-1.39
1322	**916.04**	-930.56	-7326.39	7361.11	3.49	340.07	-2.46
1342	**934.63**	-1973.61	-7506.94	7541.67	438.82	9.30	-115.76
1362	**974.63**	1137.50	2581.94	2591.67	-116.04	-3.11	39.53
1382	**1040.78**	127.57	-710.42	845.83	67.40	1.92	-24.33
1402	**1110.53**	965.28	2078.47	2086.81	-90.07	-2.74	34.60

Note 1: Meridonal, Hoop, and Shear Stresses are Reversed in Highlighted Sections (Floor)

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AY-2D-NL-UBS-BEC Pri Tank Stress Gravity.xls, Stress Max

Figure G.6. UBS-BEC Primary Tank Stresses, Shell Bottom, Gravity Load Only

AY Primary Tank, Upper Bound Soil, Horizontal and Vertical Seismic Input, Best Estimate Tank Concrete, 422 in. Waste Level at 1.7 SpG

		Shell Top Surface (inside - waste side)					
M&D Starting M&D Element No.	Path (in.)	AY-NL-UBS-BEC Seismic Hoop Stress (lbs/in^2) Top	AY-NL-UBS-BEC Seismic Meridional Stress (lbs/in^2) Top	AY-NL-UBS-BEC Seismic Stress Intensity (lbs/in^2) Top	AY-NL-UBS-BEC Seismic In-Plane Shear Stress (lbs/in^2) Top	AY-NL-UBS-BEC Seismic In-Plane Shear Force Stress (lbs/in^2) Top	AY-NL-UBS-BEC Seismic Thru-Thickness Shear Stress (lbs/in^2) Top
762	**67.33**	-2796.53	0.00	2918.06	-258.96	14.94	4.20
782	**105.04**	-2728.47	-4192.36	4192.36	-452.01	-37.60	1.85
802	**136.24**	-2575.69	-3419.44	3419.44	-512.85	35.43	-3.10
822	**181.71**	-1689.58	-3238.19	3238.19	-682.43	-11.76	4.47
842	**225.10**	-2237.50	-2780.56	4433.33	-1109.72	-31.24	12.90
862	**273.66**	1840.97	-2290.28	2961.81	694.44	16.72	9.11
882	**323.27**	2937.50	-2060.42	4826.39	-981.25	-48.20	-11.72
902	**369.20**	1705.56	-1851.39	3238.19	1215.28	30.60	7.67
922	**419.20**	2852.08	-731.94	4203.47	1968.06	-56.22	6.22
942	**444.11**	3347.22	-2254.17	5579.86	2434.72	290.14	-9.38
962	**471.06**	-6240.97	2555.56	8694.44	2511.11	-23.23	-8.69
982	**503.51**	4747.22	2188.19	6432.64	2787.50	-101.25	-8.76
1002	**527.76**	6378.47	-720.14	6907.64	2695.83	-52.00	4.01
1022	**554.76**	8354.17	1918.75	8361.11	1719.44	-53.06	3.46
1042	**582.26**	11555.56	-790.28	11555.56	-1506.94	-23.73	2.81
1062	**609.26**	14368.06	1520.14	14368.06	-1214.58	-29.76	2.14
1082	**636.26**	17395.83	-1138.89	17395.83	1102.08	-15.83	2.21
1102	**663.26**	19833.33	1680.56	19833.33	1005.56	-16.56	-2.06
1122	**688.61**	22562.50	-1301.39	22562.50	-951.39	38.28	2.36
1142	**711.96**	24611.11	1328.47	24611.11	-913.19	-46.66	1.92
1162	**734.96**	26319.44	1310.42	26319.44	-1439.58	39.99	1.76
1182	**757.91**	25513.89	-2319.44	27034.72	-1439.58	-49.88	1.65
1202	**782.81**	20784.72	3934.72	20784.72	-1193.75	-29.01	-2.88
1222	**809.76**	19722.22	-655.21	19722.22	-1467.36	-10.26	-1.95
1242	**836.76**	21375.00	792.36	21375.00	1825.00	-18.94	-2.13
1262	**863.76**	22861.11	853.47	22861.11	2220.14	-17.24	-1.93
1282	**889.76**	18027.78	-6875.00	24812.50	2616.67	-64.05	-4.33
1302	**906.85**	5773.61	-12687.50	16229.17	2404.86	237.85	26.92
1322	**916.04**	5577.78	12500.00	12541.67	2371.53	525.49	25.07
1342	**934.63**	4894.44	12256.94	12305.56	-2361.81	14.02	-173.89
1362	**974.63**	-2551.39	-2220.14	5881.94	-2757.64	-4.70	59.65
1382	**1040.78**	2295.14	2510.42	3568.06	-1754.17	2.89	-36.88
1402	**1110.53**	-1336.81	-1878.47	1956.94	743.75	-4.15	52.70

Note 1: Meridonal, Hoop, and Shear Stresses are Reversed in Highlighted Sections (Floor)

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AY-2D-NL-UBS-BEC Pri Tank Stress Seismic.xls, Stress Max

Figure G.7. UBS-BEC Primary Tank Stresses, Shell Top, Gravity Plus Seismic Load

AY Primary Tank, Upper Bound Soil, Horizontal and Vertical Seismic Input, Best Estimate Tank Concrete, 422 in. Waste Level at 1.7 SpG

		Shell Mid-Plane					
M&D Starting M&D Element No.	Path (in.)	AY-NL-UBS-BEC Seismic Hoop Stress (lbs/in^2) Mid	AY-NL-UBS-BEC Seismic Meridional Stress (lbs/in^2) Mid	AY-NL-UBS-BEC Seismic Stress Intensity (lbs/in^2) Mid	AY-NL-UBS-BEC Seismic In-Plane Shear Stress (lbs/in^2) Mid	AY-NL-UBS-BEC Seismic In-Plane Shear Force Stress (lbs/in^2) Mid	AY-NL-UBS-BEC Seismic Thru-Thickness Shear Stress (lbs/in^2) Mid
762	**67.33**	-2971.53	-2924.31	2972.22	-260.07	14.94	4.20
782	**105.04**	-2686.11	-3759.03	3759.03	-442.71	-37.60	1.85
802	**136.24**	-2809.72	-3450.69	3450.69	-505.00	35.43	-3.10
822	**181.71**	-1615.28	-3006.94	3007.64	-677.92	-11.76	4.47
842	**225.10**	-2534.72	-2581.25	4193.06	-1109.72	-31.24	12.90
862	**273.66**	1840.28	-2087.50	3190.28	695.14	16.72	9.11
882	**323.27**	3120.14	-1714.58	4472.92	-981.25	-48.20	-11.72
902	**369.20**	1752.78	-1363.89	3111.81	1217.36	30.60	7.67
922	**419.20**	3048.61	-1045.83	4223.61	1968.75	-56.22	6.22
942	**444.11**	3736.81	1239.58	5164.58	2465.97	290.14	-9.38
962	**471.06**	-6644.44	1174.31	7722.22	2520.14	-23.23	-8.69
982	**503.51**	4986.11	1090.28	5820.83	2741.67	-101.25	-8.76
1002	**527.76**	6674.31	1227.78	6675.00	2678.47	-52.00	4.01
1022	**554.76**	8159.72	1004.86	8159.72	1716.67	-53.06	3.46
1042	**582.26**	11736.11	1144.44	11736.11	-1500.00	-23.73	2.81
1062	**609.26**	14284.72	1245.83	14284.72	-1209.03	-29.76	2.14
1082	**636.26**	17569.44	1290.97	17569.44	1091.67	-15.83	2.21
1102	**663.26**	19729.17	1311.81	19729.17	999.31	-16.56	-2.06
1122	**688.61**	22715.28	1300.00	22715.28	-939.58	38.28	2.36
1142	**711.96**	24625.00	1279.17	24625.00	-1127.78	-46.66	1.92
1162	**734.96**	26326.39	1246.53	26333.33	-1127.78	39.99	1.76
1182	**757.91**	26277.78	1191.67	26277.78	-1416.67	-49.88	1.65
1202	**782.81**	19805.56	695.83	19805.56	-1172.22	-29.01	-2.88
1222	**809.76**	19847.22	610.35	19847.22	1470.14	-10.26	-1.95
1242	**836.76**	21381.94	-519.72	21381.94	1834.03	-18.94	-2.13
1262	**863.76**	22888.89	-450.28	22888.89	2222.92	-17.24	-1.93
1282	**889.76**	20104.17	-444.17	20104.17	2560.42	-64.05	-4.33
1302	**906.85**	8076.39	-492.29	8423.61	2256.25	237.85	26.92
1322	**916.04**	4171.53	387.57	5023.61	2254.17	525.49	25.07
1342	**934.63**	3354.86	658.89	3856.25	-1908.33	14.02	-173.89
1362	**974.63**	2918.75	1045.83	5745.14	-2869.44	-4.70	59.65
1382	**1040.78**	2064.58	786.11	3415.28	-1690.97	2.89	-36.88
1402	**1110.53**	1495.83	781.94	1565.28	-774.31	-4.15	52.70

Note 1: Meridonal, Hoop, and Shear Stresses are Reversed in Highlighted Sections (Floor)

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AY-2D-NL-UBS-BEC Pri Tank Stress Seismic.xls, Stress Max

Figure G.8. UBS-BEC Primary Tank Stresses, Shell Middle, Gravity Plus Seismic Load

AY Primary Tank, Upper Bound Soil, Horizontal and Vertical Seismic Input, Best Estimate Tank Concrete, 422 in. Waste Level at 1.7 SpG

		Shell Bottom Surface (outside - away from waste)					
M&D Starting M&D Element No.	Path (in.)	AY-NL-UBS-BEC Seismic Hoop Stress (lbs/in^2) Bot	AY-NL-UBS-BEC Seismic Meridional Stress (lbs/in^2) Bot	AY-NL-UBS-BEC Seismic Stress Intensity (lbs/in^2) Bot	AY-NL-UBS-BEC Seismic In-Plane Shear Stress (lbs/in^2) Bot	AY-NL-UBS-BEC Seismic In-Plane Shear Force Stress (lbs/in^2) Bot	AY-NL-UBS-BEC Seismic Thru-Thickness Shear Stress (lbs/in^2) Bot
762	**67.33**	-3159.72	-3387.50	3387.50	-261.94	14.94	4.20
782	**105.04**	-2655.56	-3794.44	3795.14	-433.47	-37.60	1.85
802	**136.24**	-3043.75	-3945.14	3945.83	-503.33	35.43	-3.10
822	**181.71**	-1602.08	-2897.92	2904.86	-673.47	-11.76	4.47
842	**225.10**	-2831.94	-3197.22	3956.25	-1109.72	-31.24	12.90
862	**273.66**	1838.89	-2123.61	3419.44	695.83	16.72	9.11
882	**323.27**	3302.08	-2500.69	4119.44	-981.25	-48.20	-11.72
902	**369.20**	1807.64	-1231.94	2991.67	1222.22	30.60	7.67
922	**419.20**	3282.64	-2118.06	4260.42	1970.14	-56.22	6.22
942	**444.11**	4125.69	2547.92	5003.47	2496.53	290.14	-9.38
962	**471.06**	-7048.61	-880.56	7055.56	2529.86	-23.23	-8.69
982	**503.51**	5225.00	805.56	5480.56	2695.14	-101.25	-8.76
1002	**527.76**	6972.22	2985.42	6972.22	2661.11	-52.00	4.01
1022	**554.76**	8180.56	-841.67	8194.44	-1718.06	-53.06	3.46
1042	**582.26**	11923.61	1720.83	11923.61	-1492.36	-23.73	2.81
1062	**609.26**	14201.39	-1114.58	14201.39	-1203.47	-29.76	2.14
1082	**636.26**	17743.06	1768.06	17743.06	1081.25	-15.83	2.21
1102	**663.26**	19625.00	-1315.97	19625.00	993.06	-16.56	-2.06
1122	**688.61**	22868.06	1725.69	22868.06	-927.08	38.28	2.36
1142	**711.96**	24645.83	1628.47	24645.83	-1114.58	-46.66	1.92
1162	**734.96**	26340.28	-1317.36	26340.28	-1114.58	39.99	1.76
1182	**757.91**	27048.61	3493.06	27048.61	-1394.44	-49.88	1.65
1202	**782.81**	18861.11	-3023.61	21611.11	-1150.69	-29.01	-2.88
1222	**809.76**	19972.22	911.11	19979.17	1477.08	-10.26	-1.95
1242	**836.76**	21381.94	-517.43	21381.94	1842.36	-18.94	-2.13
1262	**863.76**	22909.72	-1721.53	22909.72	2226.39	-17.24	-1.93
1282	**889.76**	22180.56	7000.00	22180.56	2504.17	-64.05	-4.33
1302	**906.85**	11152.78	11708.33	11708.33	2107.64	237.85	26.92
1322	**916.04**	-4856.94	-11951.39	11986.11	2136.81	525.49	25.07
1342	**934.63**	-5581.94	-11256.94	11326.39	2083.33	14.02	-173.89
1362	**974.63**	3299.31	3866.67	6134.03	-2981.25	-4.70	59.65
1382	**1040.78**	1840.28	-1271.53	3550.00	-1628.47	2.89	-36.88
1402	**1110.53**	1773.61	2989.58	2997.22	-859.03	-4.15	52.70

Note 1: Meridonal, Hoop, and Shear Stresses are Reversed in Highlighted Sections (Floor)

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AY-2D-NL-UBS-BEC Pri Tank Stress Seismic.xls, Stress Max

Figure G.9. UBS-BEC Primary Tank Stresses, Shell Bottom, Gravity Plus Seismic Load

AY Primary Tank, Upper Bound Soil, Horizontal and Vertical Seismic Input, Best Estimate Tank Concrete, 422 in. Waste Level at 1.7 SpG

		Shell Top Surface (inside - waste side)					
M&D Starting M&D Element No.	Path (in.)	AY-NL-UBS-BEC Hoop Stress Seismic Only (LBS/in^2) Top	AY-NL-UBS-BEC Meridional Stress Seismic Only (LBS/in^2) Top	AY-NL-UBS-BEC Stress Seismic Only Intensity (LBS/in^2) Top	AY-NL-UBS-BEC In-Plane Shear Stress Seismic Only (LBS/in^2) Top	AY-NL-UBS-BEC In-Plane Shear Force Stress Seismic Only (LBS/in^2) Top	AY-NL-UBS-BEC Thru-Thickness Shear Stress Seismic Only (LBS/in^2) Top
762	**67.33**	1040.28	0.00	1146.53	267.43	9.59	4.07
782	**105.04**	1078.89	1746.53	1745.14	478.73	20.12	1.78
802	**136.24**	1054.58	1454.86	1327.78	530.26	21.48	2.97
822	**181.71**	663.96	1236.11	1231.94	698.87	10.13	4.46
842	**225.10**	2733.33	1383.19	2959.03	1123.15	23.26	12.87
862	**273.66**	2257.78	952.15	1526.39	672.76	11.50	9.11
882	**323.27**	3134.58	1208.33	3972.22	986.45	39.34	11.66
902	**369.20**	1352.85	1157.43	2204.17	1199.26	27.16	7.68
922	**419.20**	1963.89	501.11	3084.03	1955.29	52.20	6.20
942	**444.11**	2670.56	1311.53	3777.08	2426.15	242.37	9.03
962	**471.06**	5975.97	2189.17	7710.42	2506.41	20.50	8.59
982	**503.51**	4843.75	2019.31	5579.86	2785.58	93.00	8.70
1002	**527.76**	3404.17	608.06	3643.75	2694.58	45.00	3.99
1022	**554.76**	4327.08	1616.94	4334.03	1718.25	44.10	3.45
1042	**582.26**	5949.93	751.25	5851.39	1507.08	26.33	2.80
1062	**609.26**	7082.50	1393.47	7034.72	1214.99	21.94	2.14
1082	**636.26**	8416.67	1037.15	8243.06	1100.79	12.34	2.21
1102	**663.26**	9375.00	1391.04	9375.00	1004.32	16.77	2.06
1122	**688.61**	10173.61	1357.36	9868.06	952.21	35.00	2.36
1142	**711.96**	10791.67	1320.07	10791.67	914.14	41.06	1.92
1162	**734.96**	11000.00	1189.86	11000.00	1441.13	46.60	1.75
1182	**757.91**	10125.00	1152.64	9930.56	1441.13	41.03	1.64
1202	**782.81**	7993.06	1944.86	7993.06	1194.89	11.31	2.87
1222	**809.76**	7305.56	574.65	7069.44	1467.97	16.69	1.94
1242	**836.76**	7631.94	808.36	7611.11	1824.08	15.04	2.15
1262	**863.76**	7798.61	714.24	7798.61	2219.23	13.97	1.95
1282	**889.76**	5340.28	2418.75	7666.67	2615.60	61.86	4.40
1302	**906.85**	1491.67	4909.72	4909.72	2404.07	91.25	27.20
1322	**916.04**	1450.69	4951.39	4965.28	2371.69	187.43	25.64
1342	**934.63**	2040.28	4145.83	4159.72	1944.58	4.72	58.61
1362	**974.63**	2622.22	821.53	4459.72	2861.53	1.64	20.81
1382	**1040.78**	1494.86	813.89	1837.50	1685.28	1.02	13.10
1402	**1110.53**	1354.95	838.89	877.08	776.25	1.51	19.09

Note 1: Meridonal, Hoop, and Shear Stresses are Reversed in Highlighted Sections (Floor)

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AY-2D-NL-UBS-BEC Pri Tank Stress Seismic Only.xls, Stress Max

Figure G.10. UBS-BEC Primary Tank Stresses, Shell Top, Seismic Load Only

AY Primary Tank, Upper Bound Soil, Horizontal and Vertical Seismic Input, Best Estimate Tank Concrete, 422 in. Waste Level at 1.7 SpG

		Shell Mid-Plane					
M&D Starting M&D Element No.	Path (in.)	AY-NL-UBS-BEC Hoop Stress Seismic Only (LBS/in^2) Mid	AY-NL-UBS-BEC Meridional Stress Seismic Only (LBS/in^2) Mid	AY-NL-UBS-BEC Stress Seismic Only Intensity (LBS/in^2) Mid	AY-NL-UBS-BEC In-Plane Shear Stress Seismic Only (LBS/in^2) Mid	AY-NL-UBS-BEC In-Plane Shear Force Stress Seismic Only (LBS/in^2) Mid	AY-NL-UBS-BEC Thru-Thickness Shear Stress Seismic Only (LBS/in^2) Mid
762	**67.33**	1176.32	1057.64	1021.53	267.70	9.59	4.07
782	**105.04**	1074.44	1353.47	1354.17	469.10	20.12	1.78
802	**136.24**	1193.47	1205.56	1204.86	522.13	21.48	2.97
822	**181.71**	597.01	997.22	997.22	694.21	10.13	4.46
842	**225.10**	2929.17	831.94	2508.33	1123.03	23.26	12.87
862	**273.66**	2242.92	739.03	1829.17	673.44	11.50	9.11
882	**323.27**	3357.08	729.17	3486.81	986.40	39.34	11.66
902	**369.20**	1403.82	693.47	2096.53	1201.26	27.16	7.68
922	**419.20**	2170.14	813.19	3100.69	1956.22	52.20	6.20
942	**444.11**	2681.25	1130.49	4088.19	2457.43	242.37	9.03
962	**471.06**	6248.40	1061.74	7119.93	2515.45	20.50	8.59
982	**503.51**	5038.89	1007.57	5006.25	2739.67	93.00	8.70
1002	**527.76**	3838.19	1152.50	3590.28	2677.09	45.00	3.99
1022	**554.76**	4232.64	957.54	4231.94	1715.50	44.10	3.45
1042	**582.26**	6079.86	1105.44	6078.47	1500.15	26.33	2.80
1062	**609.26**	7047.92	1214.97	6979.17	1209.44	21.94	2.14
1082	**636.26**	8527.78	1268.19	8527.78	1090.40	12.34	2.21
1102	**663.26**	9368.06	1297.16	9368.06	998.08	16.77	2.06
1122	**688.61**	10236.11	1293.04	10236.11	940.39	35.00	2.36
1142	**711.96**	10833.33	1277.47	10833.33	1128.91	41.06	1.92
1162	**734.96**	11048.61	1251.41	11041.67	1128.91	46.60	1.75
1182	**757.91**	10381.94	1203.14	10361.11	1418.10	41.03	1.64
1202	**782.81**	7666.67	709.05	7638.89	1173.20	11.31	2.87
1222	**809.76**	7368.06	631.24	7347.22	1469.39	16.69	1.94
1242	**836.76**	7645.83	524.24	7611.11	1833.15	15.04	2.15
1262	**863.76**	7881.94	438.44	7840.28	2222.08	13.97	1.95
1282	**889.76**	6090.28	410.65	6048.61	2559.39	61.86	4.40
1302	**906.85**	1825.69	442.86	1852.78	2255.55	91.25	27.20
1322	**916.04**	2570.14	321.81	3138.89	2254.15	187.43	25.64
1342	**934.63**	2909.72	401.32	3375.42	1917.64	4.72	58.61
1362	**974.63**	2391.81	706.04	5154.10	2864.09	1.64	20.81
1382	**1040.78**	1633.96	454.61	2899.65	1688.90	1.02	13.10
1402	**1110.53**	1170.83	285.00	1046.88	771.78	1.51	52.70

Note 1: Meridonal, Hoop, and Shear Stresses are Reversed in Highlighted Sections (Floor)

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AY-2D-NL-UBS-BEC Pri Tank Stress Seismic Only.xls, Stress Max

Figure G.11. UBS-BEC Primary Tank Stresses, Shell Middle, Seismic Load Only

AY Primary Tank, Upper Bound Soil, Horizontal and Vertical Seismic Input, Best Estimate Tank Concrete, 422 in. Waste Level at 1.7 SpG

		Shell Bottom Surface (outside - away from waste)					
M&D Starting M&D Element No.	Path (in.)	AY-NL-UBS-BEC Hoop Stress Seismic Only (LBS/in^2) Bot	AY-NL-UBS-BEC Meridional Stress Seismic Only (LBS/in^2) Bot	AY-NL-UBS-BEC Stress Seismic Only Intensity (LBS/in^2) Bot	AY-NL-UBS-BEC In-Plane Shear Stress Seismic Only (LBS/in^2) Bot	AY-NL-UBS-BEC In-Plane Shear Force Stress Seismic Only (LBS/in^2) Bot	AY-NL-UBS-BEC Thru-Thickness Shear Stress Seismic Only (LBS/in^2) Bot
762	**67.33**	1316.67	1390.97	1384.72	270.36	9.59	4.07
782	**105.04**	1078.96	1591.67	1579.86	459.55	20.12	1.78
802	**136.24**	1349.86	1645.83	1641.67	519.70	21.48	2.97
822	**181.71**	583.68	1265.56	1211.81	689.62	10.13	4.46
842	**225.10**	3125.00	1495.21	2060.42	1122.91	23.26	12.87
862	**273.66**	2227.36	765.97	2132.64	674.13	11.50	9.11
882	**323.27**	3578.96	1430.90	3000.69	986.34	39.34	11.66
902	**369.20**	1454.72	605.14	2003.47	1206.05	27.16	7.68
922	**419.20**	2413.89	1889.03	3129.86	1957.83	52.20	6.20
942	**444.11**	2690.28	1671.53	3565.97	2488.01	242.37	9.03
962	**471.06**	6520.83	538.06	6405.21	2525.18	20.50	8.59
982	**503.51**	5234.03	800.37	4669.44	2693.06	93.00	8.70
1002	**527.76**	4302.08	2675.83	3779.17	2659.60	45.00	3.99
1022	**554.76**	4354.86	878.19	4076.39	1717.85	44.10	3.45
1042	**582.26**	6231.25	1559.38	6230.56	1492.52	26.33	2.80
1062	**609.26**	7013.40	1057.67	6861.11	1203.89	21.94	2.14
1082	**636.26**	8645.83	1550.69	8645.83	1080.01	12.34	2.21
1102	**663.26**	9368.06	1375.28	9041.67	991.83	16.77	2.06
1122	**688.61**	10291.67	1581.46	10291.67	927.88	35.00	2.36
1142	**711.96**	10888.89	1731.11	10784.72	1115.74	41.06	1.92
1162	**734.96**	11097.22	1344.79	10965.28	1115.74	46.60	1.75
1182	**757.91**	10638.89	2047.64	10638.89	1395.78	41.03	1.64
1202	**782.81**	7375.00	1230.56	7937.50	1151.51	11.31	2.87
1222	**809.76**	7430.56	757.92	7437.50	1476.25	16.69	1.94
1242	**836.76**	7645.83	474.38	7604.17	1841.52	15.04	2.15
1262	**863.76**	7951.39	1507.08	7743.06	2225.63	13.97	1.95
1282	**889.76**	6847.22	2635.42	6847.22	2503.19	61.86	4.40
1302	**906.85**	2897.92	4027.78	3020.83	2107.03	91.25	27.20
1322	**916.04**	4022.22	4645.83	4645.83	2136.60	187.43	25.64
1342	**934.63**	3815.28	3784.72	3819.44	1911.67	4.72	58.61
1362	**974.63**	2161.81	1370.83	3547.92	2866.53	1.64	20.81
1382	**1040.78**	1772.08	574.31	2711.81	1693.13	1.02	13.10
1402	**1110.53**	988.86	923.61	927.08	771.46	1.51	52.70

Note 1: Meridonal, Hoop, and Shear Stresses are Reversed in Highlighted Sections (Floor)

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AY-2D-NL-UBS-BEC Pri Tank Stress Seismic Only.xls, Stress Max

Figure G.12. UBS-BEC Primary Tank Stresses, Shell Bottom, Seismic Load Only

AY Primary Tank, Upper Bound Soil, Gravity Only, Best Estimate Tank Concrete, 422 in. Waste Level at 1.7 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) 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	Maximum Shear Force2 Model Angle	Total Shear (kip) UBS-BEC Gravity
Radius 2	44.72	*22.36*	*67.29*	0.55	-0.010	-0.005	0.080	108	0.249	0	0.249
Radius 3	89.87	*67.29*	*104.93*	0.89	-0.010	-0.005	0.078	108	0.198	0	0.198
Radius 4	120.00	*104.93*	*135.98*	1.03	-0.017	0.011	0.067	108	0.178	0	0.178
Radius 5	151.97	*135.98*	*181.01*	1.97	-0.013	0.000	0.059	108	0.079	0	0.079
Radius 6	210.05	*181.01*	*223.79*	2.41	0.004	0.012	0.039	108	0.285	144	0.286
Radius 7	237.53	*223.79*	*270.98*	3.30	0.028	0.043	0.036	63	0.412	135	0.413
Radius 8	304.43	*270.98*	*318.74*	4.04	0.030	0.071	0.037	117	0.673	117	0.674
Radius 9	333.05	*318.74*	*361.64*	4.37	0.022	0.126	0.040	117	0.754	117	0.755
Radius 10	390.22	*361.64*	*406.24*	5.36	-0.032	0.036	0.026	108	0.933	0	0.933
Radius 11	422.26	*406.24*	*431.63*	3.60	0.485	0.573	0.019	108	1.704	0	1.704

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 UBS-BEC-Gravity Only	Axial Min Disp UBS-BEC-Gravity Only	Axial Max Disp UBS-BEC-Gravity Only
Radius 2	44.72	*22.36*	*67.29*	0.55	0.0351	1667	2222	0.00179	-0.00006	-0.00003
Radius 3	89.87	*67.29*	*104.93*	0.89	0.0715	1670	2219	0.00143	-0.00005	-0.00002
Radius 4	120.00	*104.93*	*135.98*	1.03	0.0968	1673	2215	0.00128	-0.00009	0.00006
Radius 5	151.97	*135.98*	*181.01*	1.97	0.1252	1677	2207	0.00056	-0.00007	0.00000
Radius 6	210.05	*181.01*	*223.79*	2.41	0.1825	1688	2192	0.00204	0.00002	0.00007
Radius 7	237.53	*223.79*	*270.98*	3.30	0.2136	1696	2172	0.00292	0.00015	0.00024
Radius 8	304.43	*270.98*	*318.74*	4.04	0.3076	1725	2132	0.00469	0.00017	0.00040
Radius 9	333.05	*318.74*	*361.64*	4.37	0.3613	1746	2086	0.00519	0.00013	0.00073
Radius 10	390.22	*361.64*	*406.24*	5.36	0.5235	1821	2006	0.00614	-0.00019	0.00021
Radius 11	422.26	*406.24*	*431.63*	3.60	0.6938	1913	1933	0.01069	0.00301	0.00356

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Figure G.13. UBS-BEC J-Bolt Forces, Gravity Load Only

AY Primary Tank, Upper Bound Soil, Horizontal and Vertical Seismic Input, Best Estimate Tank Concrete, 422 in. Waste Level at 1.7 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) 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	-0.191	0.215	0.467	90	0.648	180	0.674
Radius 3	89.87	*67.29*	*104.93*	0.89	-0.202	0.427	0.417	90	0.616	180	0.692
Radius 4	120.00	*104.93*	*135.98*	1.03	-0.102	0.064	0.403	81	0.626	180	0.697
Radius 5	151.97	*135.98*	*181.01*	1.97	-0.278	0.050	0.590	81	0.716	180	0.797
Radius 6	210.05	*181.01*	*223.79*	2.41	-0.027	0.054	0.944	81	0.905	180	1.140
Radius 7	237.53	*223.79*	*270.98*	3.30	-0.092	0.310	1.507	72	0.944	171	1.644
Radius 8	304.43	*270.98*	*318.74*	4.04	-0.171	0.296	2.237	72	1.178	117	2.423
Radius 9	333.05	*318.74*	*361.64*	4.37	-0.344	0.981	2.166	81	1.327	117	2.419
Radius 10	390.22	*361.64*	*406.24*	5.36	-0.885	0.724	2.410	99	1.669	99	2.931
Radius 11	422.26	*406.24*	*431.63*	3.60	-1.302	2.602	3.841	90	3.394	0	4.577

M&D J-Bolt Radius No.	Mean J-Bolt Radius	Radius of J-Bolts min	Radius of J-Bolts max	Average Bolts per Element	Bolt Angle (Rad)	Shear Stiffness (kip/ft)	Axial Stiffness (kip/ft)	Shear Displacement UBS-BEC-Gravity Plus Seismic	Axial Min Displacement UBS-BEC-Gravity Plus Seismic	Axial Max Displacement UBS-BEC-Gravity Plus Seismic
Radius 2	44.72	*22.36*	*67.29*	0.55	0.0351	1667	2222	0.00485	-0.00103	0.00116
Radius 3	89.87	*67.29*	*104.93*	0.89	0.0715	1670	2219	0.00498	-0.00109	0.00231
Radius 4	120.00	*104.93*	*135.98*	1.03	0.0968	1673	2215	0.00500	-0.00055	0.00035
Radius 5	151.97	*135.98*	*181.01*	1.97	0.1252	1677	2207	0.00570	-0.00151	0.00027
Radius 6	210.05	*181.01*	*223.79*	2.41	0.1825	1688	2192	0.00810	-0.00015	0.00030
Radius 7	237.53	*223.79*	*270.98*	3.30	0.2136	1696	2172	0.01163	-0.00051	0.00171
Radius 8	304.43	*270.98*	*318.74*	4.04	0.3076	1725	2132	0.01686	-0.00096	0.00166
Radius 9	333.05	*318.74*	*361.64*	4.37	0.3613	1746	2086	0.01662	-0.00198	0.00565
Radius 10	390.22	*361.64*	*406.24*	5.36	0.5235	1821	2006	0.01931	-0.00529	0.00433
Radius 11	422.26	*406.24*	*431.63*	3.60	0.6938	1913	1933	0.02871	-0.00808	0.01615

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Figure G.14. UBS-BEC J-Bolt Forces, Gravity Plus Seismic Load

AY Primary Tank, Upper Bound Soil, Horizontal and Vertical Seismic Input, Best Estimate Tank Concrete, 422 in. Waste Level at 1.7 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) 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
Radius 2	44.72	*22.36*	*67.29*	0.55	-0.181	0.220	0.387	108	0.400	0	0.556
Radius 3	89.87	*67.29*	*104.93*	0.89	-0.192	0.432	0.339	108	0.418	0	0.538
Radius 4	120.00	*104.93*	*135.98*	1.03	-0.085	0.053	0.336	108	0.448	0	0.560
Radius 5	151.97	*135.98*	*181.01*	1.97	-0.265	0.050	0.531	108	0.637	0	0.829
Radius 6	210.05	*181.01*	*223.79*	2.41	-0.031	0.041	0.905	108	0.620	144	1.096
Radius 7	237.53	*223.79*	*270.98*	3.30	-0.119	0.267	1.471	90	0.532	135	1.564
Radius 8	304.43	*270.98*	*318.74*	4.04	-0.201	0.225	2.200	117	0.506	117	2.257
Radius 9	333.05	*318.74*	*361.64*	4.37	-0.366	0.855	2.126	117	0.573	117	2.202
Radius 10	390.22	*361.64*	*406.24*	5.36	-0.853	0.688	2.383	108	0.736	0	2.494
Radius 11	422.26	*406.24*	*431.63*	3.60	-1.786	2.029	3.822	108	1.690	0	4.179

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 UBS-BEC-Seismic Only	Axial Min Displacement UBS-BEC-Seismic Only	Axial Max Displacement UBS-BEC-Seismic Only
Radius 2	44.72	*22.36*	*67.29*	0.55	0.0351	1667	2222	0.00400	-0.00098	0.00119
Radius 3	89.87	*67.29*	*104.93*	0.89	0.0715	1670	2219	0.00387	-0.00104	0.00233
Radius 4	120.00	*104.93*	*135.98*	1.03	0.0968	1673	2215	0.00402	-0.00046	0.00029
Radius 5	151.97	*135.98*	*181.01*	1.97	0.1252	1677	2207	0.00594	-0.00144	0.00027
Radius 6	210.05	*181.01*	*223.79*	2.41	0.1825	1688	2192	0.00780	-0.00017	0.00023
Radius 7	237.53	*223.79*	*270.98*	3.30	0.2136	1696	2172	0.01107	-0.00066	0.00148
Radius 8	304.43	*270.98*	*318.74*	4.04	0.3076	1725	2132	0.01570	-0.00113	0.00126
Radius 9	333.05	*318.74*	*361.64*	4.37	0.3613	1746	2086	0.01513	-0.00210	0.00492
Radius 10	390.22	*361.64*	*406.24*	5.36	0.5235	1821	2006	0.01643	-0.00510	0.00412
Radius 11	422.26	*406.24*	*431.63*	3.60	0.6938	1913	1933	0.02621	-0.01109	0.01260

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Figure G.15. UBS-BEC J-Bolt Forces, Seismic Load Only

AY Secondary Liner, Upper Bound Soil, Gravity Only, Best Estimate Tank Concrete, 422 In Waste Level at 1.7SpG

M&D Starting M&D Element No.	Path (in.)	Shell Top Surface (inside - towards waste) Gravity					
		AY-NL-UBS-BEC Hoop Strain (in/in) Gravity Top	AY-NL-UBS-BEC Meridional Strain (in/in) Gravity Top	AY-NL-UBS-BEC Strain Intensity (in/in) Gravity Top	AY-NL-UBS-BEC In-Plane Shear Strain (in/in) Gravity Top	AY-NL-UBS-BEC In-Plane Shear Force Strain (in/in) Gravity Top	AY-NL-UBS-BEC Thru-Thickness Shear Strain (in/in) Gravity Top
2062	**19.00**	5.80E-05	2.28E-04	3.50E-04	6.18E-07	3.72E-08	8.81E-10
2052	**49.28**	3.37E-05	3.77E-06	4.97E-05	9.37E-07	1.22E-05	4.41E-07
2042	**64.15**	1.18E-05	5.05E-05	7.12E-05	1.30E-05	1.59E-05	6.69E-06
2032	**72.29**	2.76E-05	2.38E-04	3.28E-04	1.31E-05	1.40E-05	6.58E-06
2022	**96.32**	3.86E-06	5.49E-05	7.85E-05	2.62E-06	9.20E-07	1.46E-07
1916	**129.82**	2.70E-06	1.43E-04	1.74E-04	1.89E-06	4.23E-06	1.17E-07
1906	**169.82**	9.86E-06	2.80E-05	3.55E-05	7.48E-07	2.01E-06	2.54E-08
1896	**235.97**	8.66E-06	2.10E-05	2.92E-05	3.43E-07	1.39E-06	6.77E-09
1886	**305.72**	9.09E-06	3.88E-05	4.92E-05	4.48E-07	2.22E-06	2.29E-09
1876	**379.62**	1.19E-05	4.20E-05	5.18E-05	6.27E-07	3.84E-06	4.91E-09
1866	**441.02**	8.72E-06	5.22E-05	6.55E-05	1.34E-06	3.47E-06	1.77E-08
1856	**487.97**	8.92E-06	4.33E-05	5.17E-05	1.83E-06	6.53E-06	1.47E-07

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AY-2D-NL-UBS-BEC Liner Strain Gravity.xls, Strain Max

Figure G.16. UBS-BEC Secondary Liner Strains, Shell Top, Gravity Load Only

AY Secondary Liner, Upper Bound Soil, Gravity Only, Best Estimate Tank Concrete, 422 In Waste Level at 1.7SpG

M&D Starting M&D Element No.	Path (in.)	Shell Mid-Plane					
		AY-NL-UBS-BEC Hoop Strain (in/in) Gravity Mid	AY-NL-UBS-BEC Meridional Strain (in/in) Gravity Mid	AY-NL-UBS-BEC Strain Intensity (in/in) Gravity Mid	AY-NL-UBS-BEC In-Plane Shear Strain (in/in) Gravity Mid	AY-NL-UBS-BEC In-Plane Shear Force Strain (in/in) Gravity Mid	AY-NL-UBS-BEC Thru-Thickness Shear Strain (in/in) Gravity Mid
2062	**19.00**	5.80E-05	2.29E-04	3.52E-04	6.18E-07	3.72E-08	8.81E-10
2052	**49.28**	3.36E-05	3.17E-06	4.95E-05	1.06E-06	1.22E-05	4.41E-07
2042	**64.15**	1.11E-05	1.28E-05	2.64E-05	5.33E-06	1.59E-05	6.69E-06
2032	**72.29**	2.69E-05	2.45E-05	5.29E-05	5.94E-06	1.40E-05	6.58E-06
2022	**96.32**	3.30E-06	1.19E-05	1.71E-05	2.64E-06	9.20E-07	1.46E-07
1916	**129.82**	2.56E-06	5.29E-05	6.41E-05	2.06E-06	4.23E-06	1.17E-07
1906	**169.82**	9.59E-06	2.22E-05	3.15E-05	7.13E-07	2.01E-06	2.54E-08
1896	**235.97**	8.71E-06	7.46E-06	1.21E-05	3.15E-07	1.39E-06	6.77E-09
1886	**305.72**	9.09E-06	2.23E-06	1.17E-05	4.18E-07	2.22E-06	2.29E-09
1876	**379.62**	1.20E-05	1.16E-05	1.72E-05	5.13E-07	3.84E-06	4.91E-09
1866	**441.02**	8.82E-06	1.28E-05	1.77E-05	4.26E-07	3.47E-06	1.77E-08
1856	**487.97**	8.38E-06	1.33E-05	1.93E-05	7.88E-07	6.53E-06	1.47E-07

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AY-2D-NL-UBS-BEC Liner Strain Gravity.xls, Strain Max

Figure G.17. UBS-BEC Secondary Liner Strains, Shell Middle, Gravity Load Only

AY Secondary Liner, Upper Bound Soil, Gravity Only, Best Estimate Tank Concrete, 422 In Waste Level at 1.7SpG

M&D Starting M&D Element No.	Path (in.)	Shell Bottom Surface (outside - away from waste) Gravity					
		AY-NL-UBS-BEC Hoop Strain (in/in) Gravity Bot	AY-NL-UBS-BEC Meridional Strain (in/in) Gravity Bot	AY-NL-UBS-BEC Strain Intensity (in/in) Gravity Bot	AY-NL-UBS-BEC In-Plane Shear Strain (in/in) Gravity Bot	AY-NL-UBS-BEC In-Plane Shear Force Strain (in/in) Gravity Bot	AY-NL-UBS-BEC Thru-Thickness Shear Strain (in/in) Gravity Bot
2062	**19.00**	5.80E-05	2.31E-04	3.55E-04	6.18E-07	3.72E-08	8.81E-10
2052	**49.28**	3.35E-05	2.74E-06	4.95E-05	1.19E-06	1.22E-05	4.41E-07
2042	**64.15**	1.04E-05	7.51E-05	1.11E-04	2.77E-06	1.59E-05	6.69E-06
2032	**72.29**	2.63E-05	1.92E-04	2.85E-04	2.74E-06	1.40E-05	6.58E-06
2022	**96.32**	2.74E-06	7.80E-05	1.11E-04	2.65E-06	9.20E-07	1.46E-07
1916	**129.82**	2.68E-06	3.84E-05	4.74E-05	2.24E-06	4.23E-06	1.17E-07
1906	**169.82**	9.33E-06	6.52E-05	7.82E-05	6.78E-07	2.01E-06	2.54E-08
1896	**235.97**	8.78E-06	3.57E-05	4.53E-05	5.20E-07	1.39E-06	6.77E-09
1886	**305.72**	9.12E-06	3.44E-05	4.35E-05	6.29E-07	2.22E-06	2.29E-09
1876	**379.62**	1.22E-05	6.51E-05	8.15E-05	7.49E-07	3.84E-06	4.91E-09
1866	**441.02**	9.04E-06	2.69E-05	3.58E-05	1.01E-06	3.47E-06	1.77E-08
1856	**487.97**	7.95E-06	6.94E-05	8.61E-05	1.59E-06	6.53E-06	1.47E-07

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Figure G.18. UBS-BEC Secondary Liner Strains, Shell Bottom, Gravity Load Only

AY Secondary Liner, Upper Bound Soil, Horizontal and Vertical Input, Best Estimate Tank Concrete, 422 In Waste Level at 1.7SpG

		Shell Top Surface (inside - towards waste)					
M&D Starting M&D Element No.	Path (in.)	AY-NL-UBS-BEC Hoop Strain Seismic (in/in) Top	AY-NL-UBS-BEC Meridional Strain Seismic (in/in) Top	AY-NL-UBS-BEC Strain Intensity Seismic (in/in) Top	AY-NL-UBS-BEC In-Plane Shear Strain Seismic (in/in) Top	AY-NL-UBS-BEC In-Plane Shear Force Strain Seismic (in/in) Top	AY-NL-UBS-BEC Thru-Thickness Shear Strain Seismic (in/in) Top
2062	**19.00**	7.48E-05	2.76E-04	4.36E-04	2.30E-04	7.15E-08	1.84E-08
2052	**49.28**	4.50E-05	1.21E-05	6.42E-05	3.59E-05	2.05E-05	8.40E-07
2042	**64.15**	2.82E-05	7.96E-05	1.21E-04	5.88E-05	2.59E-05	1.09E-05
2032	**72.29**	6.97E-05	3.90E-04	5.28E-04	6.35E-05	2.33E-05	1.16E-05
2022	**96.32**	3.16E-05	7.63E-05	1.18E-04	7.14E-05	1.40E-06	2.67E-07
1916	**129.82**	4.49E-05	2.27E-04	2.70E-04	7.86E-05	6.47E-06	1.87E-07
1906	**169.82**	5.35E-05	3.71E-05	6.85E-05	4.93E-05	3.03E-06	4.09E-08
1896	**235.97**	3.94E-05	5.52E-05	9.60E-05	5.74E-05	2.08E-06	1.11E-08
1886	**305.72**	3.35E-05	5.19E-05	7.02E-05	4.22E-05	3.29E-06	4.06E-09
1876	**379.62**	3.62E-05	7.70E-05	1.06E-04	3.05E-05	5.63E-06	7.71E-09
1866	**441.02**	2.33E-05	6.95E-05	8.95E-05	2.41E-05	5.03E-06	2.30E-08
1856	**487.97**	2.23E-05	7.35E-05	9.24E-05	1.76E-05	9.36E-06	2.18E-07

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Figure G.19. UBS-BEC Secondary Liner Strains, Shell Top, Gravity Plus Seismic Load

AY Secondary Liner, Upper Bound Soil, Horizontal and Vertical Input, Best Estimate Tank Concrete, 422 In Waste Level at 1.7SpG

		Shell Mid-Plane					
M&D Starting M&D Element No.	Path (in.)	AY-NL-UBS-BEC Hoop Strain Seismic (in/in) Mid	AY-NL-UBS-BEC Meridional Strain Seismic (in/in) Mid	AY-NL-UBS-BEC Strain Intensity Seismic (in/in) Mid	AY-NL-UBS-BEC In-Plane Shear Strain Seismic (in/in) Mid	AY-NL-UBS-BEC In-Plane Shear Force Strain Seismic (in/in) Mid	AY-NL-UBS-BEC Thru-Thickness Shear Strain Seismic (in/in) Mid
2062	**19.00**	7.48E-05	2.78E-04	4.38E-04	2.30E-04	7.15E-08	1.84E-08
2052	**49.28**	4.49E-05	8.12E-06	6.41E-05	3.60E-05	2.05E-05	8.40E-07
2042	**64.15**	2.77E-05	2.78E-05	6.25E-05	6.01E-05	2.59E-05	1.09E-05
2032	**72.29**	6.88E-05	4.94E-05	1.21E-04	6.35E-05	2.33E-05	1.16E-05
2022	**96.32**	3.13E-05	3.35E-05	7.15E-05	7.14E-05	1.40E-06	2.67E-07
1916	**129.82**	4.54E-05	9.43E-05	1.40E-04	7.86E-05	6.47E-06	1.87E-07
1906	**169.82**	5.31E-05	4.71E-05	1.00E-04	4.95E-05	3.03E-06	4.09E-08
1896	**235.97**	3.93E-05	3.10E-05	5.80E-05	5.72E-05	2.08E-06	1.11E-08
1886	**305.72**	3.35E-05	1.69E-05	4.49E-05	4.21E-05	3.29E-06	4.06E-09
1876	**379.62**	3.63E-05	2.70E-05	4.58E-05	3.06E-05	5.63E-06	7.71E-09
1866	**441.02**	2.37E-05	2.40E-05	3.30E-05	2.36E-05	5.03E-06	2.30E-08
1856	**487.97**	2.18E-05	2.60E-05	3.33E-05	1.75E-05	9.36E-06	2.18E-07

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Figure G.20. UBS-BEC Secondary Liner Strains, Shell Middle, Gravity Plus Seismic Load

AY Secondary Liner, Upper Bound Soil, Horizontal and Vertical Input, Best Estimate Tank Concrete, 422 In Waste Level at 1.7SpG

		Shell Bottom Surface (outside - away from waste)					
M&D Starting M&D Element No.	Path (in.)	AY-NL-UBS-BEC Hoop Strain Seismic (in/in) Bot	AY-NL-UBS-BEC Meridional Strain Seismic (in/in) Bot	AY-NL-UBS-BEC Strain Intensity Seismic (in/in) Bot	AY-NL-UBS-BEC In-Plane Shear Strain Seismic (in/in) Bot	AY-NL-UBS-BEC In-Plane Shear Force Strain Seismic (in/in) Bot	AY-NL-UBS-BEC Thru-Thickness Shear Strain Seismic (in/in) Bot
2062	**19.00**	7.48E-05	2.80E-04	4.40E-04	2.30E-04	7.15E-08	1.84E-08
2052	**49.28**	4.48E-05	7.28E-06	6.42E-05	3.60E-05	2.05E-05	8.40E-07
2042	**64.15**	2.73E-05	1.31E-04	1.85E-04	6.13E-05	2.59E-05	1.09E-05
2032	**72.29**	6.80E-05	2.91E-04	4.45E-04	6.34E-05	2.33E-05	1.16E-05
2022	**96.32**	3.21E-05	1.34E-04	1.79E-04	7.14E-05	1.40E-06	2.67E-07
1916	**129.82**	4.59E-05	5.93E-05	8.97E-05	7.86E-05	6.47E-06	1.87E-07
1906	**169.82**	5.27E-05	1.10E-04	1.61E-04	4.96E-05	3.03E-06	4.09E-08
1896	**235.97**	3.91E-05	4.92E-05	7.06E-05	5.72E-05	2.08E-06	1.11E-08
1886	**305.72**	3.35E-05	6.21E-05	9.56E-05	4.20E-05	3.29E-06	4.06E-09
1876	**379.62**	3.64E-05	8.63E-05	1.10E-04	3.07E-05	5.63E-06	7.71E-09
1866	**441.02**	2.41E-05	4.99E-05	7.37E-05	2.34E-05	5.03E-06	2.30E-08
1856	**487.97**	2.14E-05	9.45E-05	1.19E-04	1.84E-05	9.36E-06	2.18E-07

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Figure G.21. UBS-BEC Secondary Liner Strains, Shell Bottom, Gravity Plus Seismic Load

AY Secondary Liner, Upper Bound Soil, Horizontal and Vertical Input, Best Estimate Tank Concrete, 422 In Waste Level at 1.7SpG Seismic Only

		Shell Top Surface (inside - towards waste)					
M&D Starting M&D Element No.	Path (in.)	AY-NL-UBS-BEC Seismic Only Hoop Strain (in/in) Top	AY-NL-UBS-BEC Seismic Only Meridional Strain (in/in) Top	AY-NL-UBS-BEC Seismic Only Strain Intensity (in/in) Top	AY-NL-UBS-BEC Seismic Only In-Plane Shear Strain (in/in) Top	AY-NL-UBS-BEC Seismic Only In-Plane Shear Force Strain (in/in) Top	AY-NL-UBS-BEC Seismic Only Thru-Thickness Shear Strain (in/in) Top
2062	**19.00**	1.67E-05	4.81E-05	8.55E-05	2.29E-04	3.43E-08	1.75E-08
2052	**49.28**	1.13E-05	8.35E-06	1.45E-05	3.50E-05	8.33E-06	3.99E-07
2042	**64.15**	1.64E-05	2.91E-05	4.94E-05	4.58E-05	9.99E-06	4.19E-06
2032	**72.29**	4.21E-05	1.52E-04	2.00E-04	5.04E-05	9.38E-06	5.03E-06
2022	**96.32**	2.78E-05	2.14E-05	3.97E-05	6.88E-05	4.80E-07	1.21E-07
1916	**129.82**	4.22E-05	8.39E-05	9.52E-05	7.67E-05	2.24E-06	7.02E-08
1906	**169.82**	4.36E-05	9.18E-06	3.30E-05	4.86E-05	1.02E-06	1.55E-08
1896	**235.97**	3.07E-05	3.42E-05	6.68E-05	5.70E-05	6.89E-07	4.32E-09
1886	**305.72**	2.44E-05	1.31E-05	2.10E-05	4.17E-05	1.07E-06	1.77E-09
1876	**379.62**	2.42E-05	3.50E-05	5.40E-05	2.99E-05	1.80E-06	2.81E-09
1866	**441.02**	1.46E-05	1.73E-05	2.40E-05	2.28E-05	1.56E-06	5.35E-09
1856	**487.97**	1.33E-05	3.02E-05	4.07E-05	1.58E-05	2.83E-06	7.14E-08

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Figure G.22. UBS-BEC Secondary Liner Strains, Shell Top, Seismic Load Only

AY Secondary Liner, Upper Bound Soil, Horizontal and Vertical Input, Best Estimate Tank Concrete, 422 In Waste Level at 1.7SpG Seismic Only

		Shell Mid-Plane					
M&D Starting M&D Element No.	Path (in.)	AY-NL-UBS-BEC Seismic Only Hoop Strain (in/in) Mid	AY-NL-UBS-BEC Seismic Only Meridional Strain (in/in) Mid	AY-NL-UBS-BEC Seismic Only Strain Intensity (in/in) Mid	AY-NL-UBS-BEC Seismic Only In-Plane Shear Strain (in/in) Mid	AY-NL-UBS-BEC Seismic Only In-Plane Shear Force Strain (in/in) Mid	AY-NL-UBS-BEC Seismic Only Thru-Thickness Shear Strain (in/in) Mid
2062	**19.00**	1.67E-05	4.87E-05	8.53E-05	2.29E-04	3.43E-08	1.75E-08
2052	**49.28**	1.13E-05	4.95E-06	1.46E-05	3.49E-05	8.33E-06	3.99E-07
2042	**64.15**	1.66E-05	1.50E-05	3.61E-05	5.47E-05	9.99E-06	4.19E-06
2032	**72.29**	4.19E-05	2.49E-05	6.84E-05	5.75E-05	9.38E-06	5.03E-06
2022	**96.32**	2.80E-05	2.15E-05	5.44E-05	6.88E-05	4.80E-07	1.21E-07
1916	**129.82**	4.28E-05	4.14E-05	7.59E-05	7.65E-05	2.24E-06	7.02E-08
1906	**169.82**	4.35E-05	2.50E-05	6.88E-05	4.87E-05	1.02E-06	1.55E-08
1896	**235.97**	3.06E-05	2.36E-05	4.60E-05	5.69E-05	6.89E-07	4.32E-09
1886	**305.72**	2.44E-05	1.46E-05	3.32E-05	4.17E-05	1.07E-06	1.77E-09
1876	**379.62**	2.42E-05	1.54E-05	2.86E-05	3.01E-05	1.80E-06	2.81E-09
1866	**441.02**	1.49E-05	1.13E-05	1.53E-05	2.32E-05	1.56E-06	5.35E-09
1856	**487.97**	1.34E-05	1.27E-05	1.41E-05	1.67E-05	2.83E-06	7.14E-08

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Figure G.23. UBS-BEC Secondary Liner Strains, Shell Middle, Seismic Load Only

AY Secondary Liner, Upper Bound Soil, Horizontal and Vertical Input, Best Estimate Tank Concrete, 422 In Waste Level at 1.7SpG Seismic Only

		Shell Bottom Surface (outside - away from waste)					
M&D Starting M&D Element No.	Path (in.)	AY-NL-UBS-BEC Seismic Only Hoop Strain (in/in) Bot	AY-NL-UBS-BEC Seismic Only Meridional Strain (in/in) Bot	AY-NL-UBS-BEC Seismic Only Strain Intensity (in/in) Bot	AY-NL-UBS-BEC Seismic Only In-Plane Shear Strain (in/in) Bot	AY-NL-UBS-BEC Seismic Only In-Plane Shear Force Strain (in/in) Bot	AY-NL-UBS-BEC Seismic Only Thru-Thickness Shear Strain (in/in) Bot
2062	**19.00**	1.67E-05	4.92E-05	8.51E-05	2.29E-04	3.43E-08	1.75E-08
2052	**49.28**	1.13E-05	4.54E-06	1.47E-05	3.48E-05	8.33E-06	3.99E-07
2042	**64.15**	1.69E-05	5.64E-05	7.35E-05	5.85E-05	9.99E-06	4.19E-06
2032	**72.29**	4.18E-05	9.96E-05	1.60E-04	6.06E-05	9.38E-06	5.03E-06
2022	**96.32**	2.93E-05	5.58E-05	6.77E-05	6.87E-05	4.80E-07	1.21E-07
1916	**129.82**	4.32E-05	2.08E-05	4.22E-05	7.63E-05	2.24E-06	7.02E-08
1906	**169.82**	4.34E-05	4.44E-05	8.31E-05	4.89E-05	1.02E-06	1.55E-08
1896	**235.97**	3.03E-05	1.35E-05	2.54E-05	5.67E-05	6.89E-07	4.32E-09
1886	**305.72**	2.44E-05	2.76E-05	5.21E-05	4.14E-05	1.07E-06	1.77E-09
1876	**379.62**	2.42E-05	2.13E-05	2.85E-05	3.00E-05	1.80E-06	2.81E-09
1866	**441.02**	1.50E-05	2.30E-05	3.79E-05	2.24E-05	1.56E-06	5.35E-09
1856	**487.97**	1.34E-05	2.52E-05	3.27E-05	1.68E-05	2.83E-06	7.14E-08

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Figure G.24. UBS-BEC Secondary Liner Strains, Shell Bottom, Gravity Load Only

Tank AY, 422 Inch Waste Level
SpG = 1.7
Upper Bound Soil
Best Estimate Concrete

Angle	Vertical Min AY-UBS-BEC Gravity	Vertical Max AY-UBS-BEC Gravity	Shear Y Min AY-UBS-BEC Gravity	Shear Y Max AY-UBS-BEC Gravity	Shear X Min AY-UBS-BEC Gravity	Shear X Max AY-UBS-BEC Gravity	Shear Y Max AY-UBS-BEC Gravity	Shear X Max AY-UBS-BEC Gravity	Shear Max AY-UBS-BEC Gravity	Vertical Force Max AY-UBS-BEC Gravity	Vertical Force Min AY-UBS-BEC Gravity
0	-187.30	-187.20	0.00	0.00	4.20	4.20	0.00	1.31	1.31	-58.53	-58.50
9	-372.20	-372.20	1.19	1.19	8.10	8.10	0.19	1.27	1.28	-58.16	-58.16
18	-372.50	-372.40	2.03	2.03	7.67	7.67	0.32	1.20	1.24	-58.20	-58.19
27	-372.20	-372.10	3.39	3.40	7.10	7.10	0.53	1.11	1.23	-58.16	-58.14
36	-372.10	-372.10	4.54	4.55	6.41	6.41	0.71	1.00	1.23	-58.14	-58.14
45	-372.00	-372.00	5.55	5.55	5.60	5.60	0.87	0.87	1.23	-58.13	-58.13
54	-371.90	-371.90	6.37	6.37	4.65	4.66	1.00	0.73	1.23	-58.11	-58.11
63	-371.90	-371.80	7.00	7.00	3.59	3.59	1.09	0.56	1.23	-58.11	-58.09
72	-371.70	-371.70	7.44	7.44	2.43	2.43	1.16	0.38	1.22	-58.08	-58.08
81	-371.70	-371.60	7.72	7.72	1.20	1.21	1.21	0.19	1.22	-58.08	-58.06
90	-371.60	-371.50	7.82	7.82	-0.05	-0.04	1.22	0.01	1.22	-58.06	-58.05
99	-371.60	-371.50	7.74	7.74	-1.28	-1.28	1.21	0.20	1.23	-58.06	-58.05
108	-371.60	-371.50	7.51	7.51	-2.48	-2.47	1.17	0.39	1.24	-58.06	-58.05
117	-371.60	-371.50	7.07	7.07	-3.61	-3.61	1.10	0.56	1.24	-58.06	-58.05
126	-371.50	-371.50	6.43	6.43	-4.65	-4.65	1.01	0.73	1.24	-58.05	-58.05
135	-371.50	-371.40	5.61	5.61	-5.57	-5.57	0.88	0.87	1.24	-58.05	-58.03
144	-371.40	-371.30	4.65	4.66	-6.34	-6.34	0.73	0.99	1.23	-58.03	-58.02
153	-371.50	-371.50	3.46	3.47	-7.01	-7.01	0.54	1.10	1.22	-58.05	-58.05
162	-371.20	-371.20	2.35	2.36	-7.58	-7.58	0.37	1.18	1.24	-58.00	-58.00
171	-372.70	-372.70	0.43	0.43	-8.11	-8.10	0.07	1.27	1.27	-58.23	-58.23
180	-185.10	-185.00	0.00	0.00	-4.24	-4.24	0.00	1.32	1.32	-57.84	-57.81

Figure G.25. UBS-BEC Concrete Wall/Footing Contact Forces, Gravity Load Only

Tank AY, 422 Inch Waste Level
SpG = 1.7
Upper Bound Soil
Best Estimate Concrete

Angle	Vertical Min AY-UBS-BEC Seismic	Vertical Max AY-UBS-BEC Seismic	Shear Y Min AY-UBS-BEC Seismic	Shear Y Max AY-UBS-BEC Seismic	Shear X Min AY-UBS-BEC Seismic	Shear X Max AY-UBS-BEC Seismic	Shear Y Max AY-UBS-BEC Seismic	Shear X Max AY-UBS-BEC Seismic	Shear Max AY-UBS-BEC Seismic	Vertical Force Max AY-UBS-BEC Seismic	Vertical Force Min AY-UBS-BEC Seismic
0	-217.90	-142.90	0.00	0.00	-6.28	14.09	0.00	4.40	4.40	-68.09	-44.66
9	-432.80	-284.00	-16.25	20.27	-15.36	30.21	3.17	4.72	5.68	-67.63	-44.38
18	-432.50	-284.90	-31.08	38.41	-24.20	37.54	6.00	5.87	8.39	-67.58	-44.52
27	-431.30	-285.70	-41.95	53.52	-38.09	49.07	8.36	7.67	11.35	-67.39	-44.64
36	-431.60	-287.30	-48.68	63.90	-56.04	63.73	9.98	9.96	14.10	-67.44	-44.89
45	-431.90	-289.20	-50.44	68.70	-76.58	79.93	10.73	12.49	16.47	-67.48	-45.19
54	-432.30	-291.50	-46.95	67.17	-97.84	96.08	10.50	15.29	18.54	-67.55	-45.55
63	-432.70	-293.90	-38.54	59.23	-117.50	110.70	9.25	18.36	20.56	-67.61	-45.92
72	-433.10	-295.80	-25.91	45.67	-133.10	122.30	7.14	20.80	21.99	-67.67	-46.22
81	-433.60	-297.10	-10.19	28.21	-142.80	129.60	4.41	22.31	22.74	-67.75	-46.42
90	-435.30	-297.60	5.48	10.69	-146.00	131.60	1.67	22.81	22.87	-68.02	-46.50
99	-439.30	-297.80	-10.96	25.67	-142.60	127.40	4.01	22.28	22.64	-68.64	-46.53
108	-442.30	-297.10	-27.91	40.16	-133.70	117.30	6.28	20.89	21.81	-69.11	-46.42
117	-444.60	-294.70	-41.24	51.26	-120.30	102.50	8.01	18.80	20.43	-69.47	-46.05
126	-446.30	-292.60	-49.88	57.56	-103.90	84.80	8.99	16.23	18.56	-69.73	-45.72
135	-447.70	-291.20	-53.20	58.45	-86.13	66.17	9.13	13.46	16.26	-69.95	-45.50
144	-448.70	-290.40	-51.00	54.12	-68.54	48.38	8.46	10.71	13.65	-70.11	-45.38
153	-449.90	-289.80	-43.82	45.14	-52.86	32.91	7.05	8.26	10.86	-70.30	-45.28
162	-450.30	-289.20	-32.04	32.52	-40.73	21.13	5.08	6.36	8.14	-70.36	-45.19
171	-453.00	-290.00	-18.10	16.62	-33.32	13.93	2.83	5.21	5.92	-70.78	-45.31
180	-224.80	-143.90	0.00	0.00	-15.57	5.74	0.00	4.87	4.87	-70.25	-44.97

Figure G.26. UBS-BEC Concrete Wall/Footing Contact Forces, Gravity Plus Seismic Load

Tank AY, 422 Inch Waste Level
SpG = 1.7
Upper Bound Soil
Best Estimate Concrete

Angle	Vertical Min AY-UBS-BEC Seismic Only	Vertical Max AY-UBS-BEC Seismic Only	Shear Y Min AY-UBS-BEC Seismic Only	Shear Y Max AY-UBS-BEC Seismic Only	Shear X Min AY-UBS-BEC Seismic Only	Shear X Max AY-UBS-BEC Seismic Only	Shear Y Max AY-UBS-BEC Seismic Only	Shear X Max AY-UBS-BEC Seismic Only	Shear Max AY-UBS-BEC Seismic Only	Vertical Force Max AY-UBS-BEC Seismic Only	Vertical Force Min AY-UBS-BEC Seismic Only
0	-30.60	44.30	0.00	0.00	-10.48	9.89	0.00	3.27	3.27	-9.56	13.84
9	-60.60	88.20	-17.44	19.08	-23.46	22.11	2.98	3.67	4.72	-9.47	13.78
18	-60.00	87.50	-33.11	36.38	-31.87	29.87	5.68	4.98	7.56	-9.38	13.67
27	-59.10	86.40	-45.34	50.12	-45.19	41.97	7.83	7.06	10.54	-9.23	13.50
36	-59.50	84.80	-53.22	59.35	-62.45	57.32	9.27	9.76	13.46	-9.30	13.25
45	-59.90	82.80	-55.99	63.15	-82.18	74.33	9.87	12.84	16.19	-9.36	12.94
54	-60.40	80.40	-53.32	60.80	-102.49	91.42	9.50	16.01	18.62	-9.44	12.56
63	-60.80	77.90	-45.54	52.23	-121.09	107.11	8.16	18.92	20.60	-9.50	12.17
72	-61.40	75.90	-33.35	38.23	-135.53	119.87	5.97	21.18	22.00	-9.59	11.86
81	-61.90	74.50	-17.91	20.49	-144.00	128.39	3.20	22.50	22.73	-9.67	11.64
90	-63.70	73.90	-2.34	2.87	-145.95	131.64	0.45	22.80	22.81	-9.95	11.55
99	-67.70	73.70	-18.70	17.93	-141.32	128.68	2.92	22.08	22.27	-10.58	11.52
108	-70.70	74.40	-35.42	32.65	-131.22	119.77	5.53	20.50	21.24	-11.05	11.63
117	-73.00	76.80	-48.31	44.19	-116.69	106.11	7.55	18.23	19.73	-11.41	12.00
126	-74.80	78.90	-56.31	51.13	-99.25	89.45	8.80	15.51	17.83	-11.69	12.33
135	-76.20	80.20	-58.81	52.84	-80.56	71.74	9.19	12.59	15.58	-11.91	12.53
144	-77.30	80.90	-55.65	49.46	-62.20	54.72	8.70	9.72	13.04	-12.08	12.64
153	-78.40	81.70	-47.28	41.67	-45.85	39.92	7.39	7.16	10.29	-12.25	12.77
162	-79.10	82.00	-34.39	30.16	-33.15	28.71	5.37	5.18	7.46	-12.36	12.81
171	-80.30	82.70	-18.53	16.19	-25.21	22.03	2.90	3.94	4.89	-12.55	12.92
180	-39.70	41.10	0.00	0.00	-11.33	9.98	0.00	3.54	3.54	-12.41	12.84

Figure G.27. UBS-BEC Concrete Wall/Footing Contact Forces, Seismic Load Only

Tank AY, 422 Inch Waste Level
SpG = 1.7
Upper Bound Soil
Best Estimate Concrete

	Angle (rad)	Path	Max Pressure Soil (UBS) AY Gravity (PSI)	Min Pressure Soil (UBS) AY Gravity (PSI)	Max Meridional Friction Soil (UBS) AY Gravity (PSI)	Max Tangential Friction Soil (UBS) AY Gravity (PSI)	Max Contact Displacement Soil (UBS) AY Gravity (inch)	Vertical Pressure	Active Pressure Phi = 33 deg	Active Pressure Phi = 49 deg
568	-0.035089	**67.727**	13.96	11.78	1.84	0.05	0.01	7.12	7.11	7.11
565.8	-0.07135	**105.668**	9.60	9.16	1.93	0.07	0.01	7.27	7.26	7.26
563.21	-0.096521	**137.069**	8.80	7.97	1.80	0.13	0.02	7.46	7.43	7.42
559.7	-0.124516	**182.849**	6.56	6.04	1.39	0.26	0.02	7.71	7.65	7.65
550.7	-0.180521	**226.563**	7.56	5.55	1.60	0.52	0.01	8.35	8.23	8.22
545.2	-0.210395	**275.566**	7.85	7.50	1.59	0.26	0.01	8.74	8.57	8.55
527.68	-0.298426	**325.690**	7.37	7.04	1.51	0.05	0.01	9.99	9.59	9.56
518.2	-0.34673	**372.305**	9.11	9.05	1.53	0.04	0.01	10.66	10.09	10.04
494.5	-0.482293	**423.427**	14.51	14.38	1.45	0.07	0.01	12.35	11.07	10.97
476.2	-0.606571	**468.308**	21.40	21.15	1.42	0.09	0.01	13.65	11.45	11.27
447.4	-0.656685	**515.312**	28.56	28.37	2.46	0.20	0.01	15.70	12.75	12.51
407.1	-0.710341	**549.725**	27.08	26.92	2.79	0.18	0.01	18.57	14.53	14.18
382.1	-1.570796	**585.819**	13.44	13.38	2.34	0.11	0.01	20.35	6.00	2.85
335	-1.570796	**636.369**	2.97	2.97	0.83	0.01	0.02	23.70	6.99	3.32
281	-1.570796	**685.619**	2.54	2.52	0.68	0.00	0.02	27.55	8.13	3.86
236.5	-1.570796	**732.719**	3.76	3.75	0.79	0.00	0.02	30.71	9.06	4.30
186.8	-1.570796	**778.219**	3.81	3.79	0.80	0.00	0.03	34.25	10.10	4.80
145.5	-1.570796	**821.369**	3.45	3.43	0.77	0.00	0.03	37.19	10.97	5.21
70	-1.570796	**874.169**	4.83	4.74	1.20	0.01	0.03	42.57	12.56	5.96
24	-1.570796	**930.544**	12.92	12.85	3.28	0.07	0.03	45.84	13.52	6.42

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Figure G.28. UBS-BEC Soil/Concrete Tank Contact Forces, Gravity Load Only

Tank AY, 422 Inch Waste Level
SpG = 1.7
Upper Bound Soil
Best Estimate Concrete

	Angle (rad)	Path	Max Pressure Soil (UBS) AY Seismic (PSI)	Min Pressure Soil (UBS) AY Seismic (PSI)	Max Meridional Friction Soil (UBS) AY Seismic (PSI)	Max Tangential Friction Soil (UBS) AY Seismic (PSI)	Max Contact Displacement Soil (UBS) AY Seismic (inch)
568	-0.035089	**67.727**	24.181	1.747	12.986	10.243	0.135
565.8	-0.07135	**105.668**	15.694	3.022	10.278	8.208	0.246
563.21	-0.096521	**137.069**	13.771	1.466	8.938	7.208	0.191
559.7	-0.124516	**182.849**	10.174	2.985	7.063	4.080	0.094
550.7	-0.180521	**226.563**	13.340	1.509	5.806	5.225	0.051
545.2	-0.210395	**275.566**	10.451	4.393	4.231	4.949	0.018
527.68	-0.298426	**325.690**	9.528	4.790	3.831	4.344	0.016
518.2	-0.34673	**372.305**	11.514	6.893	3.374	3.999	0.012
494.5	-0.482293	**423.427**	18.472	11.285	3.407	3.183	0.011
476.2	-0.606571	**468.308**	28.528	16.174	3.621	3.023	0.010
447.4	-0.656685	**515.312**	34.806	24.479	7.576	2.952	0.016
407.1	-0.710341	**549.725**	34.236	20.847	10.174	3.069	0.020
382.1	-1.570796	**585.819**	17.181	10.215	9.167	2.174	0.025
335	-1.570796	**636.369**	3.755	2.453	2.985	1.758	0.035
281	-1.570796	**685.619**	3.276	2.094	2.390	1.224	0.044
236.5	-1.570796	**732.719**	4.516	3.238	2.769	1.243	0.049
186.8	-1.570796	**778.219**	4.440	3.239	2.833	2.189	0.054
145.5	-1.570796	**821.369**	4.119	2.627	2.606	2.392	0.056
70	-1.570796	**874.169**	6.333	3.500	5.349	4.086	0.050
24	-1.570796	**930.544**	23.222	4.090	9.417	4.860	0.037

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Figure G.29. UBS-BEC Soil/Concrete Tank Contact Forces, Gravity Plus Seismic Load

Tank AY, 422 Inch Waste Level
SpG = 1.7
Upper Bound Soil
Best Estimate Concrete

	Angle (rad)	Path	Max Pressure Soil (UBS) AY Seismic Only (PSI)	Min Pressure Soil (UBS) AY Seismic Only (PSI)	Max Meridional Friction (UBS) AY Seismic Only (PSI)	Max Tangential Friction (UBS) AY Seismic Only (PSI)	Max Contact Displacement (UBS) AY Seismic Only (inch)
568	-0.035089	**67.727**	10.222	-12.211	11.145	10.189	0.127
565.8	-0.07135	**105.668**	6.090	-6.583	8.344	8.136	0.232
563.21	-0.096521	**137.069**	4.972	-7.333	7.133	7.076	0.168
559.7	-0.124516	**182.849**	3.611	-3.577	5.668	3.815	0.076
550.7	-0.180521	**226.563**	5.785	-6.047	4.210	4.706	0.038
545.2	-0.210395	**275.566**	2.604	-3.454	2.639	4.688	0.008
527.68	-0.298426	**325.690**	2.160	-2.578	2.324	4.291	0.005
518.2	-0.34673	**372.305**	2.403	-2.218	1.842	3.958	0.003
494.5	-0.482293	**423.427**	3.965	-3.222	1.960	3.108	0.003
476.2	-0.606571	**468.308**	7.132	-5.222	2.201	2.935	0.004
447.4	-0.656685	**515.312**	6.250	-4.076	5.121	2.750	0.008
407.1	-0.710341	**549.725**	7.160	-6.229	7.385	2.887	0.011
382.1	-1.570796	**585.819**	3.743	-3.222	6.830	2.069	0.015
335	-1.570796	**636.369**	0.781	-0.521	2.157	1.752	0.019
281	-1.570796	**685.619**	0.740	-0.441	1.706	1.219	0.023
236.5	-1.570796	**732.719**	0.752	-0.526	1.978	1.239	0.025
186.8	-1.570796	**778.219**	0.626	-0.576	2.030	2.185	0.025
145.5	-1.570796	**821.369**	0.674	-0.818	1.834	2.389	0.023
70	-1.570796	**874.169**	1.502	-1.331	4.144	4.080	0.017
24	-1.570796	**930.544**	10.306	-8.827	6.139	4.794	0.012

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Figure G.30. UBS-BEC Soil/Concrete Tank Contact Forces, Seismic Load Only

Tank AY, 422 Inch Waste Level
SpG = 1.7
Upper Bound Soil
Best Estimate Concrete

Radius	Max Pressure Primary Tank/Concrete Tank Dome AY Gravity (PSI)	Min Pressure Primary Tank/Concrete Tank Dome AY Gravity (PSI)	Max Gap Lateral Displacement Primary Tank /Concrete Tank Dome Gravity (in)	Max Gap Displacement Primary Tank/Concete Tank Dome AY Gravity (Inches)
67.727	1.890	1.437	0.001908	0.000000
105.668	2.919	0.392	0.001612	-0.000010
137.069	2.160	0.548	0.001720	-0.000010
182.849	2.753	0.481	0.002896	-0.000002
226.563	2.108	1.107	0.002468	-0.000038
275.566	1.467	0.403	0.002904	-0.000077
325.690	4.185	1.190	0.003571	-0.000134
372.305	5.258	0.143	0.004902	-0.000006
423.427	1.340	0.000	0.001699	-1.055400

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Figure G.31. UBS-BEC Primary Tank/Concrete Dome Contact Forces, Gravity Load Only

Tank AY, 422 Inch Waste Level
SpG = 1.7
Upper Bound Soil
Best Estimate Concrete

Radius	Max Pressure Primary Tank/Concrete Tank Dome AY Seismic (PSI)	Min Pressure Primary Tank/Concrete Tank Dome AY Seismic (PSI)	Max Gap Lateral Displacement Primary Tank /Concrete Tank Dome Seismic (in)	Max Gap Displacement Primary Tank/Concete Tank Dome AY Seismic (Inches)
67.727	43.549	0.000	0.005315	-0.000843
105.668	53.840	0.000	0.008142	-0.001006
137.069	34.257	0.000	0.014712	-0.000113
182.849	29.201	0.000	0.009923	-0.000057
226.563	12.861	0.000	0.003691	-0.000520
275.566	15.410	0.000	0.007994	-0.000704
325.690	35.396	0.000	0.006169	-0.001901
372.305	75.972	0.000	0.036228	-0.003378
423.427	34.368	0.000	0.051240	-1.061520

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Figure G.32. UBS-BEC Primary Tank/Concrete Dome Contact Forces, Gravity Plus Seismic Load

Tank AY, 422 Inch Waste Level
SpG = 1.7
Upper Bound Soil
Best Estimate Concrete

Radius	Max Pressure Primary Tank/Concrete Tank Dome AY Seismic Only (PSI)	Min Pressure Primary Tank/Concrete Tank Dome AY Seismic Only (PSI)	Max Gap Lateral Displacement Primary Tank /Concrete Tank Dome Seismic Only (in)	Max Gap Displacement Primary Tank/Concete Tank Dome AY Seismic Only (Inches)
67.727	41.659	-1.437	0.003407	-0.000843
105.668	50.922	-0.392	0.006530	-0.000996
137.069	32.097	-0.548	0.012992	-0.000103
182.849	26.449	-0.481	0.007027	-0.000055
226.563	10.753	-1.107	0.001223	-0.000482
275.566	13.942	-0.403	0.005090	-0.000628
325.690	31.210	-1.190	0.002598	-0.001767
372.305	70.715	-0.143	0.031326	-0.003372
423.427	33.028	0.000	0.049541	-0.006120

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Figure G.33. UBS-BEC Primary Tank/Concrete Dome Contact Forces, Seismic Load Only

Tank AY, 422 Inch Waste Level
SpG = 1.7
Upper Bound Soil
Best Estimate Concrete

Radius	Max Pressure Primary Tank/Insulating Concrete AY Gravity (PSI)	Min Pressure Primary Tank/Insulating Concrete AY Gravity (PSI)	Max Lateral Displacement Primary Tank / Insulating Concete AY Gravity (Inches)	Min Lateral Displacement Primary Tank / Insulating Concete AY Gravity (Inches)
424.00	46.507	46.083	0.001244	0.001151
384.00	20.354	20.243	0.000453	0.000425
317.85	27.208	27.181	0.000234	0.000213
248.10	25.958	25.903	0.000155	0.000145
199.25	25.993	25.917	0.000248	0.000243
154.95	26.208	26.104	0.000075	0.000068
112.80	25.472	25.292	0.000085	0.000079
65.85	29.097	28.528	0.000135	0.000125

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Figure G.34. UBS-BEC Primary Tank/Insulating Concrete Contact Forces, Gravity Load Only

Tank AY, 422 Inch Waste Level
SpG = 1.7
Upper Bound Soil
Best Estimate Concrete

Radius	Max Pressure Primary Tank/Insulaiting Concrete AY Seismic (PSI)	Min Pressure Primary Tank/Insulaiting Concrete AY Seismic (PSI)	Max Lateral Displacement Primary Tank/Insulaiting Concrete AY Seismic (Inches)	Min Lateral Displacement Primary Tank/Insulaiting Concrete AY Seismic (Inches)
424.00	65.903	29.076	0.033192	0.000517
384.00	28.701	10.625	0.022848	0.000086
317.85	36.382	18.521	0.009216	0.000102
248.10	33.535	18.194	0.002930	0.000049
199.25	32.833	18.694	0.001729	0.000023
154.95	32.875	19.167	0.001075	0.000008
112.80	32.076	19.000	0.000888	0.000012
65.85	35.556	21.660	0.000778	0.000096

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Figure G.35. UBS-BEC Primary Tank/Insulating Concrete Contact Forces, Gravity Plus Seismic Load

Tank AY, 422 Inch Waste Level
SpG = 1.7
Upper Bound Soil
Best Estimate Concrete

Radius	Max Pressure Primary Tank/Concrete Tank Dome AY Seismic Only (PSI)	Min Pressure Primary Tank/Concrete Tank Dome AY Seismic Only (PSI)	Max Gap Lateral Displacement Primary Tank /Concrete Tank Dome Seismic Only (in)	Max Gap Displacement Primary Tank/Concete Tank Dome AY Seismic Only (Inches)
67.727	41.659	-1.437	0.003407	-0.000843
105.668	50.922	-0.392	0.006530	-0.000996
137.069	32.097	-0.548	0.012992	-0.000103
182.849	26.449	-0.481	0.007027	-0.000055
226.563	10.753	-1.107	0.001223	-0.000482
275.566	13.942	-0.403	0.005090	-0.000628
325.690	31.210	-1.190	0.002598	-0.001767
372.305	70.715	-0.143	0.031326	-0.003372
423.427	33.028	0.000	0.049541	-0.006120

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Figure G.36. UBS-BEC Primary Tank/Insulating Concrete Contact Forces, Seismic Load Only

Tank AY, 422 Inch Waste Level
SpG = 1.7
Upper Bound Soil
Best Estimate Concrete

Radius	Max Pressure Insulating Concrete/Secondary Liner AY Gravity (PSI)	Min Pressure Insulating Concrete/Secondary Liner AY Gravity (PSI)	Max Lateral Displacement Insulating Concrete/Secondary Liner AY Gravity (Inches)	Min Lateral Displacement Insulating Concrete/Secondary Liner AY Gravity (Inches)
424.00	50.347	49.333	0.000912	0.000754
384.00	21.139	20.868	0.000199	0.000159
317.85	27.285	27.208	0.000122	0.000109
248.10	26.354	26.299	0.000097	0.000094
199.25	26.438	26.396	0.000120	0.000114
154.95	26.160	26.104	0.000047	0.000037
112.80	26.639	26.528	0.000053	0.000040
65.85	26.576	26.264	0.000132	0.000127

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Figure G.37. UBS-BEC Insulating Concrete/Secondary Liner Contact Forces, Gravity Load Only

Tank AY, 422 Inch Waste Level
SpG = 1.7
Upper Bound Soil
Best Estimate Concrete

Radius	Max Pressure Insulating Concrete/Secondary Liner AY Seismic (PSI)	Min Pressure Insulating Concrete/Secondary Liner AY Seismic (PSI)	Max Lateral Displacement Insulating Concrete/Secondary Liner AY Seismic (Inches)	Min Lateral Displacement Insulating Concrete/Secondary Liner AY Seismic (Inches)
424.00	68.944	32.243	0.005665	0.000061
384.00	29.556	11.847	0.005851	0.000076
317.85	36.347	18.646	0.004004	0.000036
248.10	33.979	18.549	0.002142	0.000050
199.25	33.340	19.049	0.001182	0.000003
154.95	32.764	19.201	0.000783	0.000009
112.80	33.306	19.965	0.000704	0.000005
65.85	32.688	19.979	0.000639	0.000016

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Figure G.38. UBS-BEC Insulating Concrete/Secondary Liner Contact Forces, Gravity Plus Seismic Load

Tank AY, 422 Inch Waste Level
SpG = 1.7
Upper Bound Soil
Best Estimate Concrete

Radius	Max Pressure Insulating Concrete/Secondary Liner AY Seismic Only (PSI)	Min Pressure Insulating Concrete/Secondary Liner AY Seismic Only (PSI)	Max Lateral Displacement Insulating Concrete/Secondary Liner AY Seismic Only (Inches)	Min Lateral Displacement Insulating Concrete/Secondary Liner AY Seismic Only (Inches)
424.00	18.597	-17.090	0.005	-0.001
384.00	8.417	-9.021	0.006	0.000
317.85	9.063	-8.563	0.004	0.000
248.10	7.625	-7.750	0.002	0.000
199.25	6.903	-7.347	0.001	0.000
154.95	6.604	-6.903	0.001	0.000
112.80	6.667	-6.563	0.001	0.000
65.85	6.111	-6.285	0.001	0.000

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Page 1

Figure G.39. UBS-BEC Insulating Concrete/Secondary Liner Contact Forces, Seismic Load Only

Tank AY, 422 Inch Waste Level
SpG = 1.7
Upper Bound Soil
Best Estimate Concrete

Waste Height	Max Pressure AY Tank, 422 in Waste Level, SpG = 1.7 Time History (PSI)	Min Pressure AY Tank, 422 in Waste Level, SpG = 1.7 Time History (PSI)	Hydrostatic (psi)	Impulsive (psi)	Convective (psi)	Breathing (psi)	Dynamic (psi)	Dynamic (SRSS) (psi)	Theoretical Max	Theoretical Min	Theoretical Max (SRSS)	Theoretical Min (SRSS)
410.75	18.785	-13.715	0.69	1.18	1.39	0.31	2.13	1.85	2.82	-1.44	2.54	-1.16
386.5	9.132	-3.740	2.18	2.17	1.26	0.98	3.49	2.69	5.67	-1.31	4.87	-0.51
359.5	13.986	-4.013	3.84	3.1	1.14	1.72	5.02	3.72	8.86	-1.19	7.56	0.11
332	13.813	-2.351	5.53	3.9	1.03	2.45	6.48	4.72	12.01	-0.96	10.24	0.81
305	14.514	-0.414	7.18	4.57	0.93	3.15	7.81	5.63	15.00	-0.63	12.81	1.55
278	17.104	-1.053	8.84	5.13	0.85	3.81	9.01	6.45	17.85	-0.17	15.29	2.39
251	21.146	2.137	10.50	5.62	0.78	4.44	10.11	7.20	20.61	0.38	17.70	3.29
225.65	25.778	2.914	12.05	6	0.72	4.98	11.02	7.83	23.08	1.03	19.88	4.22
202.3	28.194	2.242	13.49	6.31	0.67	5.45	11.80	8.36	25.28	1.69	21.85	5.12
179.3	36.201	2.247	14.90	6.57	0.63	5.86	12.46	8.83	27.36	2.44	23.73	6.07
156.35	35.340	4.097	16.31	6.8	0.6	6.24	13.07	9.25	29.37	3.24	25.56	7.06
131.45	33.556	6.322	17.84	7	0.57	6.59	13.61	9.63	31.45	4.22	27.47	8.21
104.5	41.021	6.372	19.49	7.17	0.54	6.91	14.10	9.97	33.59	5.39	29.46	9.52
77.5	35.375	9.222	21.15	7.3	0.52	7.16	14.48	10.24	35.63	6.67	31.39	10.91
50.5	38.063	11.292	22.81	7.4	0.51	7.34	14.76	10.44	37.56	8.05	33.24	12.37
24.5	38.403	8.542	24.40	7.45	0.5	7.44	14.91	10.54	39.31	9.50	34.94	13.86

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Figure G.40. UBS-BEC Waste Contact Pressures, Gravity Plus Seismic Load

Tank AY, 422 Inch Waste Level
SpG = 1.7
Upper Bound Soil
Best Estimate Concrete

Waste Radius	Max Vertical Displacement AY-UBS-BEC Time History (in)	Min Vertical Displacement AY-UBS-BEC Time History (in)
95.7	3.11	-3.73
129.9	4.36	-5.10
180	5.04	-5.76
218.5	5.93	-6.68
277.7	6.42	-7.05
358	6.65	-7.25
410	7.47	-8.00
450	7.59	-8.08

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Figure G.41. UBS-BEC Waste Surface Displacement, Gravity Plus Seismic Load

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,kmaxte
mp2+4
a,kmaxtemp2+2,kmaxtemp2+3,kmaxtemp2+6,kmaxte
mp2+5
a,kmaxtemp2+3,kmaxtemp1+1,kmaxtemp1+2,kmaxte
mp2+6
a,kmaxtemp2+4,kmaxtemp2+5,kmaxjb+9,kmaxjb+8,
kmaxjb+7,kmaxjb+6,kmaxjb+5,kmaxjb+4,kmaxjb+3
,kmaxjb+2!a,740,741,712,711,710,709,708,707,
706,705
a,kmaxtemp2+5,kmaxtemp2+6,kmaxtemp2+7,kmaxjb
+12,kmaxjb+11,kmaxjb+10,kmaxjb+9
a,kmaxtemp2+6,kmaxtemp1+2,kmaxtemp1+3,kmaxte
mp2+7
a,kmaxtemp2+7,kmaxtemp1+3,kmaxtemp1+4,kmaxjb
+12
a,kmaxjb+12,kmaxtemp1+4,kmaxtemp1+5,kmaxjb+1
4,kmaxjb+13
a,kmaxjb+14,kmaxtemp1+5,kmaxtemp1+6,kmaxjb+1
6,kmaxjb+15
a,kmaxjb+16,kmaxtemp1+6,kmaxtemp1+7,kmaxjb+1
8,kmaxjb+17
a,kmaxjb+18,kmaxtemp1+7,kmaxtemp1+8,kmaxjb+2
0,kmaxjb+19
a,kmaxjb+20,kmaxtemp1+8,kmaxtemp1+9,kmaxtemp
2+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,kma
xjb+bm_kp+2
a,kmaxjb+bm_kp+2,kmaxtemp2+4,kmaxjb+2,kmaxjb
+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

/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, Horizontal and
Vertical Seismic Inputs, Best Estimate Soil,
Best Estimate Concrete Properties, AP
Primary Tank Geometry
```

```
!
fini
/clear
/filname,PNNL-2D-UBS-BEC,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-AY,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-AY,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-AY,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-UB,txt        ! Run solution
Phase
/input,all-forces,txt         ! Extract
component forces/strains
/input,contact-AY,txt         ! Extract
Contact data
/input,spectra-all,txt        ! Extract
Response Spectra
/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-UB.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,PNNL-AY-2D-NL-BEC-UBS-Gravity,out
/solu
antype,trans
TRNOPT,FULL
lumpm,OFF
!nlgeom,on
NROPT,auto
NTIM-2  !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

!/input,atm-ay,txt

/COM - Time File

/COM - Dimension Horizontal Input
*DIM,A_1_x,,2048
*DIM,A_1_Z,,2048

*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: AY Tank, 422 In Waste,
UBS-BEC
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,20,200,5,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*1.12
F,master_node,Fz,(A_1_Z(itim)*1.19+1)*(mass+
massm_z)*g

SOLVE
SAVE
*ENDDO
FINISH
/out
```

Solve-TH-UB

```
/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,PNNL-AY-2D-NL-BEC-UBS,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-266-UB-geo,txt
(8(F9.6))
*VREAD,A_1_Z(1),th-266-UB-geo-v,txt
(8(F9.6))

/Title,Load Case: UBS-BEC, Full Non-linear,
Soil Mu=0.65, Final PT Mesh
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,20,200,5,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*1.12
F,master_node,Fz,(A_1_Z(itim)*1.19+1)*(mass+
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,21,1.97                    ! 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
```

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 E is 250GB HITAC
 Volume Serial Number is B4FB-DB23

 Directory of E:\PNNL-2D-NL-AY-UBS-BEC-Seismic

12/20/2005  04:40 PM    <DIR>          .
12/20/2005  04:40 PM    <DIR>          ..
11/28/2005  02:26 PM           535,476 Accel-ct-0.out
11/28/2005  02:34 PM           535,476 Accel-ct-45.out
11/28/2005  02:35 PM           277,176 Accel-ct.out
11/28/2005  02:37 PM           535,728 Accel-PT-0.out
11/28/2005  02:43 PM           535,728 Accel-PT-135.out
11/28/2005  02:44 PM           535,728 Accel-PT-180.out
11/28/2005  02:39 PM           535,728 Accel-PT-45.out
11/28/2005  02:41 PM           535,728 Accel-PT-90.out
11/28/2005  02:46 PM           535,728 Accel-SOil.out
09/27/2005  03:47 PM                99 All-Forces.txt
12/05/2005  11:33 AM         3,641,344 AY-2D-NL-UBS-BEC Conc Tank Demand Seismic Only.xls
12/02/2005  12:43 PM         3,126,272 AY-2D-NL-UBS-BEC Conc Tank Demand Seismic.xls
12/02/2005  04:07 PM         1,104,896 AY-2D-NL-UBS-BEC Conc-Tank Spectra.xls
12/16/2005  10:21 AM         1,369,600 AY-2D-NL-UBS-BEC Footing Seismic.xls
12/15/2005  02:04 PM           296,960 AY-2D-NL-UBS-BEC Free Field RS Comparision.xls
12/06/2005  09:56 AM           701,952 AY-2D-NL-UBS-BEC J Bolt Forces Seismic.xls
12/02/2005  01:07 PM           737,280 AY-2D-NL-UBS-BEC J-Bolt-Contact-Seismic.xls
11/29/2005  04:48 PM         3,489,792 AY-2D-NL-UBS-BEC Liner Strain Seismic.xls
12/08/2005  10:24 AM           699,904 AY-2D-NL-UBS-BEC Liner-Contact-Seismic.xls
12/20/2005  01:24 PM         8,423,424 AY-2D-NL-UBS-BEC Pri Tank Stress Seismic Only.xls
12/14/2005  12:46 PM         8,418,816 AY-2D-NL-UBS-BEC Pri Tank Stress Seismic.xls
12/02/2005  08:05 AM           766,976 AY-2D-NL-UBS-BEC Primary-Contact-Seismic.xls
12/02/2005  04:46 PM         1,156,608 AY-2D-NL-UBS-BEC Primary-Tank Spectra.xls
12/13/2005  04:01 PM         2,094,080 AY-2D-NL-UBS-BEC Soil Pressures Seismic.xls
12/12/2005  12:44 PM           526,336 AY-2D-NL-UBS-BEC Total Reaction.xls
12/01/2005  09:25 AM           408,576 AY-2D-NL-UBS-BEC Waste-Disp-TH-MAX.xls
12/12/2005  12:47 PM           829,952 AY-2D-NL-UBS-BEC Waste-TH-MAX.xls
12/02/2005  02:06 PM            73,728 AY-2D-UBS-BEC Excel File List.doc
09/02/2005  02:01 PM             5,766 Bolts-Friction.txt
06/09/2005  01:59 PM               262 Boundary.txt
10/31/2005  12:24 PM               189 Contact-AY.txt
12/01/2005  09:11 AM               586 Contact-Footing.txt
09/02/2005  09:28 AM               604 Contact-Insul.txt
09/02/2005  09:51 AM               602 Contact-J-Bolts.txt
09/09/2005  09:59 AM               608 Contact-Primary.txt
09/15/2005  11:50 AM               742 Contact-Soil.txt
09/06/2005  11:16 AM               630 Contact-Waste-AY.txt
12/01/2005  09:14 AM            36,352 disp_0-90.xls
12/01/2005  09:15 AM            36,352 disp_99-180.xls
09/22/2005  04:05 PM             8,608 Far-Soil.txt
11/04/2005  09:21 AM             2,046 file.bat
11/04/2005  09:20 AM                68 file.err
12/20/2005  04:40 PM                 0 file.lis
11/04/2005  09:21 AM               228 file.log
10/13/2005  06:54 AM               562 Fix-Soil.txt
12/01/2005  09:12 AM            10,342 Footing-Cont_max.OUT
12/01/2005  09:12 AM         4,144,248 Footing-Cont_th.OUT
04/06/2005  08:24 AM               894 Force-c.txt
11/06/2005  10:19 PM             4,996 Force-c_108amax.OUT
11/06/2005  10:19 PM         2,779,200 Force-c_108ath.OUT
11/06/2005  07:54 PM            14,716 Force-c_108max.OUT
11/06/2005  07:54 PM         6,224,880 Force-c_108th.OUT
11/06/2005  10:26 PM             4,996 Force-c_117amax.OUT
11/06/2005  10:26 PM         2,779,200 Force-c_117ath.OUT
11/06/2005  08:01 PM            14,716 Force-c_117max.OUT
11/06/2005  08:01 PM         6,224,880 Force-c_117th.OUT
11/06/2005  10:33 PM             4,996 Force-c_126amax.OUT
11/06/2005  10:33 PM         2,779,200 Force-c_126ath.OUT
11/06/2005  08:08 PM            14,716 Force-c_126max.OUT
11/06/2005  08:08 PM         6,224,880 Force-c_126th.OUT
11/06/2005  10:41 PM             4,996 Force-c_135amax.OUT
11/06/2005  10:41 PM         2,779,200 Force-c_135ath.OUT
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11/06/2005  08:16 PM            14,716 Force-c_135max.OUT
11/06/2005  08:16 PM         6,224,880 Force-c_135th.OUT
11/06/2005  10:48 PM             4,996 Force-c_144amax.OUT
11/06/2005  10:48 PM         2,779,200 Force-c_144ath.OUT
11/06/2005  08:23 PM            14,716 Force-c_144max.OUT
11/06/2005  08:23 PM         6,224,880 Force-c_144th.OUT
11/06/2005  10:55 PM             4,996 Force-c_153amax.OUT
11/06/2005  10:55 PM         2,779,200 Force-c_153ath.OUT
11/06/2005  08:31 PM            14,716 Force-c_153max.OUT
11/06/2005  08:31 PM         6,224,880 Force-c_153th.OUT
11/06/2005  11:02 PM             4,996 Force-c_162amax.OUT
11/06/2005  11:02 PM         2,779,200 Force-c_162ath.OUT
11/06/2005  08:38 PM            14,716 Force-c_162max.OUT
11/06/2005  08:38 PM         6,224,880 Force-c_162th.OUT
11/06/2005  11:09 PM             4,996 Force-c_171amax.OUT
11/06/2005  11:09 PM         2,779,200 Force-c_171ath.OUT
11/06/2005  08:46 PM            14,716 Force-c_171max.OUT
11/06/2005  08:46 PM         6,224,880 Force-c_171th.OUT
11/06/2005  11:16 PM             4,996 Force-c_180amax.OUT
11/06/2005  11:16 PM         2,779,200 Force-c_180ath.OUT
11/06/2005  08:53 PM            14,716 Force-c_180max.OUT
11/06/2005  08:53 PM         6,224,880 Force-c_180th.OUT
11/06/2005  09:07 PM             4,996 Force-c_18amax.OUT
11/06/2005  09:07 PM         2,779,200 Force-c_18ath.OUT
11/06/2005  06:40 PM            14,716 Force-c_18max.OUT
11/06/2005  06:40 PM         6,224,880 Force-c_18th.OUT
11/06/2005  09:14 PM             4,996 Force-c_27amax.OUT
11/06/2005  09:14 PM         2,779,200 Force-c_27ath.OUT
11/06/2005  06:47 PM            14,716 Force-c_27max.OUT
11/06/2005  06:47 PM         6,224,880 Force-c_27th.OUT
11/06/2005  09:21 PM             4,996 Force-c_36amax.OUT
11/06/2005  09:21 PM         2,779,200 Force-c_36ath.OUT
11/06/2005  06:54 PM            14,716 Force-c_36max.OUT
11/06/2005  06:54 PM         6,224,880 Force-c_36th.OUT
11/06/2005  09:29 PM             4,996 Force-c_45amax.OUT
11/06/2005  09:29 PM         2,779,200 Force-c_45ath.OUT
11/06/2005  07:02 PM            14,716 Force-c_45max.OUT
11/06/2005  07:02 PM         6,224,880 Force-c_45th.OUT
11/06/2005  09:36 PM             4,996 Force-c_54amax.OUT
11/06/2005  09:36 PM         2,779,200 Force-c_54ath.OUT
11/06/2005  07:09 PM            14,716 Force-c_54max.OUT
11/06/2005  07:09 PM         6,224,880 Force-c_54th.OUT
11/06/2005  09:43 PM             4,996 Force-c_63amax.OUT
11/06/2005  09:43 PM         2,779,200 Force-c_63ath.OUT
11/06/2005  07:17 PM            14,716 Force-c_63max.OUT
11/06/2005  07:17 PM         6,224,880 Force-c_63th.OUT
11/06/2005  09:51 PM             4,996 Force-c_72amax.OUT
11/06/2005  09:51 PM         2,779,200 Force-c_72ath.OUT
11/06/2005  07:24 PM            14,716 Force-c_72max.OUT
11/06/2005  07:24 PM         6,224,880 Force-c_72th.OUT
11/06/2005  09:58 PM             4,996 Force-c_81amax.OUT
11/06/2005  09:58 PM         2,779,200 Force-c_81ath.OUT
11/06/2005  07:32 PM            14,716 Force-c_81max.OUT
11/06/2005  07:32 PM         6,224,880 Force-c_81th.OUT
11/06/2005  10:05 PM             4,996 Force-c_90amax.OUT
11/06/2005  10:05 PM         2,779,200 Force-c_90ath.OUT
11/06/2005  07:39 PM            14,716 Force-c_90max.OUT
11/06/2005  07:39 PM         6,224,880 Force-c_90th.OUT
11/06/2005  10:12 PM             4,996 Force-c_99amax.OUT
11/06/2005  10:12 PM         2,779,200 Force-c_99ath.OUT
11/06/2005  07:46 PM            14,716 Force-c_99max.OUT
11/06/2005  07:46 PM         6,224,880 Force-c_99th.OUT
11/06/2005  09:00 PM             4,996 Force-c_9amax.OUT
11/06/2005  09:00 PM         2,779,328 Force-c_9ath.OUT
11/06/2005  06:32 PM            14,716 Force-c_9max.OUT
11/06/2005  06:32 PM         6,225,008 Force-c_9th.OUT
11/22/2005  11:59 AM           135,168 force-jb.xls
11/07/2005  06:52 AM         2,548,434 Force-jb_r10-th.OUT
11/07/2005  06:52 AM             5,239 Force-jb_r10_max.OUT
11/07/2005  06:53 AM         2,548,434 Force-jb_r11-th.OUT
11/07/2005  06:53 AM             5,239 Force-jb_r11_max.OUT
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11/07/2005  06:49 AM         2,548,562 Force-jb_r2-th.OUT
11/07/2005  06:49 AM             5,239 Force-jb_r2_max.OUT
11/07/2005  06:49 AM         2,548,434 Force-jb_r3-th.OUT
11/07/2005  06:49 AM             5,239 Force-jb_r3_max.OUT
11/07/2005  06:49 AM         2,548,434 Force-jb_r4-th.OUT
11/07/2005  06:49 AM             5,239 Force-jb_r4_max.OUT
11/07/2005  06:50 AM         2,548,434 Force-jb_r5-th.OUT
11/07/2005  06:50 AM             5,239 Force-jb_r5_max.OUT
11/07/2005  06:50 AM         2,548,434 Force-jb_r6-th.OUT
11/07/2005  06:50 AM             5,239 Force-jb_r6_max.OUT
11/07/2005  06:51 AM         2,548,434 Force-jb_r7-th.OUT
11/07/2005  06:51 AM             5,239 Force-jb_r7_max.OUT
11/07/2005  06:51 AM         2,548,434 Force-jb_r8-th.OUT
11/07/2005  06:51 AM             5,239 Force-jb_r8_max.OUT
11/07/2005  06:52 AM         2,548,434 Force-jb_r9-th.OUT
11/07/2005  06:52 AM             5,239 Force-jb_r9_max.OUT
06/20/2005  10:53 AM               661 Force-j_bolt.txt
11/07/2005  01:01 PM           439,808 import_0-90.xls
11/07/2005  01:02 PM           440,832 import_99-180.xls
12/20/2005  03:57 PM             3,742 input.lis
12/08/2005  10:23 AM            73,728 Insul-Contact_0-90.xls
12/08/2005  10:23 AM            73,728 Insul-Contact_99-180.xls
11/07/2005  10:13 AM             2,728 Insul-Cont_108max.OUT
11/07/2005  10:13 AM         1,200,544 Insul-Cont_108th.OUT
11/07/2005  10:15 AM             2,728 Insul-Cont_117max.OUT
11/07/2005  10:15 AM         1,200,544 Insul-Cont_117th.OUT
11/07/2005  10:17 AM             2,728 Insul-Cont_126max.OUT
11/07/2005  10:17 AM         1,200,544 Insul-Cont_126th.OUT
11/07/2005  10:20 AM             2,728 Insul-Cont_135max.OUT
11/07/2005  10:20 AM         1,200,544 Insul-Cont_135th.OUT
11/07/2005  10:22 AM             2,728 Insul-Cont_144max.OUT
11/07/2005  10:22 AM         1,200,544 Insul-Cont_144th.OUT
11/07/2005  10:24 AM             2,728 Insul-Cont_153max.OUT
11/07/2005  10:24 AM         1,200,544 Insul-Cont_153th.OUT
11/07/2005  10:26 AM             2,728 Insul-Cont_162max.OUT
11/07/2005  10:26 AM         1,200,544 Insul-Cont_162th.OUT
11/07/2005  10:28 AM             2,728 Insul-Cont_171max.OUT
11/07/2005  10:28 AM         1,200,544 Insul-Cont_171th.OUT
11/07/2005  10:30 AM             2,728 Insul-Cont_180max.OUT
11/07/2005  10:30 AM         1,200,544 Insul-Cont_180th.OUT
11/07/2005  09:53 AM             2,728 Insul-Cont_18max.OUT
11/07/2005  09:53 AM         1,200,544 Insul-Cont_18th.OUT
11/07/2005  09:55 AM             2,728 Insul-Cont_27max.OUT
11/07/2005  09:55 AM         1,200,544 Insul-Cont_27th.OUT
11/07/2005  09:56 AM             2,728 Insul-Cont_36max.OUT
11/07/2005  09:56 AM         1,200,544 Insul-Cont_36th.OUT
11/07/2005  09:59 AM             2,728 Insul-Cont_45max.OUT
11/07/2005  09:59 AM         1,200,544 Insul-Cont_45th.OUT
11/07/2005  10:01 AM             2,728 Insul-Cont_54max.OUT
11/07/2005  10:01 AM         1,200,544 Insul-Cont_54th.OUT
11/07/2005  10:03 AM             2,728 Insul-Cont_63max.OUT
11/07/2005  10:03 AM         1,200,544 Insul-Cont_63th.OUT
11/07/2005  10:05 AM             2,728 Insul-Cont_72max.OUT
11/07/2005  10:05 AM         1,200,544 Insul-Cont_72th.OUT
11/07/2005  10:07 AM             2,728 Insul-Cont_81max.OUT
11/07/2005  10:07 AM         1,200,544 Insul-Cont_81th.OUT
11/07/2005  10:09 AM             2,728 Insul-Cont_90max.OUT
11/07/2005  10:09 AM         1,200,544 Insul-Cont_90th.OUT
11/07/2005  10:11 AM             2,728 Insul-Cont_99max.OUT
11/07/2005  10:11 AM         1,200,544 Insul-Cont_99th.OUT
11/07/2005  09:51 AM             2,728 Insul-Cont_9max.OUT
11/07/2005  09:51 AM         1,200,672 Insul-Cont_9th.OUT
09/01/2005  10:27 AM             1,664 Insulate.txt
10/13/2005  08:28 AM             4,031 interface-gap1.txt
09/09/2005  09:34 AM             2,616 interface1.txt
11/29/2005  02:00 PM            80,896 J-Bolt-Contact_0-90.xls
11/29/2005  02:00 PM            80,896 J-Bolt-Contact_99-180.xls
11/07/2005  11:06 AM             3,052 J-Bolt-Cont_108max.OUT
11/07/2005  11:06 AM         1,350,612 J-Bolt-Cont_108th.OUT
11/07/2005  11:09 AM             3,052 J-Bolt-Cont_117max.OUT
11/07/2005  11:09 AM         1,350,612 J-Bolt-Cont_117th.OUT
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11/07/2005  11:12 AM            3,052 J-Bolt-Cont_126max.OUT
11/07/2005  11:12 AM        1,350,612 J-Bolt-Cont_126th.OUT
11/07/2005  11:15 AM            3,052 J-Bolt-Cont_135max.OUT
11/07/2005  11:15 AM        1,350,612 J-Bolt-Cont_135th.OUT
11/07/2005  11:18 AM            3,052 J-Bolt-Cont_144max.OUT
11/07/2005  11:18 AM        1,350,612 J-Bolt-Cont_144th.OUT
11/07/2005  11:23 AM            3,052 J-Bolt-Cont_153max.OUT
11/07/2005  11:23 AM        1,350,612 J-Bolt-Cont_153th.OUT
11/07/2005  11:26 AM            3,052 J-Bolt-Cont_162max.OUT
11/07/2005  11:26 AM        1,350,612 J-Bolt-Cont_162th.OUT
11/07/2005  11:29 AM            3,052 J-Bolt-Cont_171max.OUT
11/07/2005  11:29 AM        1,350,612 J-Bolt-Cont_171th.OUT
11/07/2005  11:32 AM            3,052 J-Bolt-Cont_180max.OUT
11/07/2005  11:32 AM        1,350,612 J-Bolt-Cont_180th.OUT
11/07/2005  10:36 AM            3,052 J-Bolt-Cont_18max.OUT
11/07/2005  10:36 AM        1,350,612 J-Bolt-Cont_18th.OUT
11/07/2005  10:39 AM            3,052 J-Bolt-Cont_27max.OUT
11/07/2005  10:39 AM        1,350,612 J-Bolt-Cont_27th.OUT
11/07/2005  10:42 AM            3,052 J-Bolt-Cont_36max.OUT
11/07/2005  10:42 AM        1,350,612 J-Bolt-Cont_36th.OUT
11/07/2005  10:45 AM            3,052 J-Bolt-Cont_45max.OUT
11/07/2005  10:45 AM        1,350,612 J-Bolt-Cont_45th.OUT
11/07/2005  10:48 AM            3,052 J-Bolt-Cont_54max.OUT
11/07/2005  10:48 AM        1,350,612 J-Bolt-Cont_54th.OUT
11/07/2005  10:51 AM            3,052 J-Bolt-Cont_63max.OUT
11/07/2005  10:51 AM        1,350,612 J-Bolt-Cont_63th.OUT
11/07/2005  10:54 AM            3,052 J-Bolt-Cont_72max.OUT
11/07/2005  10:54 AM        1,350,612 J-Bolt-Cont_72th.OUT
11/07/2005  10:58 AM            3,052 J-Bolt-Cont_81max.OUT
11/07/2005  10:58 AM        1,350,612 J-Bolt-Cont_81th.OUT
11/07/2005  11:00 AM            3,052 J-Bolt-Cont_90max.OUT
11/07/2005  11:00 AM        1,350,612 J-Bolt-Cont_90th.OUT
11/07/2005  11:03 AM            3,052 J-Bolt-Cont_99max.OUT
11/07/2005  11:03 AM        1,350,612 J-Bolt-Cont_99th.OUT
11/07/2005  10:33 AM            3,052 J-Bolt-Cont_9max.OUT
11/07/2005  10:33 AM        1,350,740 J-Bolt-Cont_9th.OUT
11/23/2005  11:48 AM          134,656 Knuckle Study.doc
11/23/2005  12:01 PM        3,209,728 Kunckle Study.xls
11/08/2005  11:45 AM          157,696 liner-strain-comp_0-90b.xls
11/08/2005  11:45 AM          157,696 liner-strain-comp_0-90m.xls
11/08/2005  11:46 AM          157,696 liner-strain-comp_0-90t.xls
11/08/2005  11:46 AM          157,696 liner-strain-comp_99-180b.xls
11/08/2005  11:46 AM          157,696 liner-strain-comp_99-180m.xls
11/08/2005  11:46 AM          157,696 liner-strain-comp_99-180t.xls
06/01/2005  01:17 PM            1,708 Liner.txt
05/02/2005  02:19 PM              667 live_load.txt
12/02/2005  08:14 AM    <DIR>         Miscellaneous Post Processing
09/28/2005  07:08 AM            6,183 Near-Soil-1.txt
04/20/2005  01:14 PM              508 outer-spar.txt
12/16/2005  01:25 PM    <DIR>         PNNL-2D-NL-AY-UBS-BEC-Gravity
12/15/2005  02:06 PM    <DIR>         PNNL-2D-NL-AY-UBS-Gravity-FIXED
12/16/2005  04:05 PM    <DIR>         PNNL-2D-NL-AY-UBS-NC-Gravity
11/09/2005  04:27 PM       26,246,656 PNNL-2D-UBS-BEC.avi
11/06/2005  06:25 PM            2,998 PNNL-2D-UBS-BEC.BCS
11/07/2005  04:14 PM       35,782,656 PNNL-2D-UBS-BEC.db
11/06/2005  06:25 PM       12,386,304 PNNL-2D-UBS-BEC.emat
12/16/2005  11:13 AM           57,577 PNNL-2D-UBS-BEC.err
11/06/2005  06:25 PM      102,563,840 PNNL-2D-UBS-BEC.esav
11/06/2005  06:25 PM       27,918,336 PNNL-2D-UBS-BEC.full
11/06/2005  06:23 PM      298,920,099 PNNL-2D-UBS-BEC.ldhi
12/16/2005  01:05 PM          105,284 PNNL-2D-UBS-BEC.log
11/06/2005  06:25 PM          189,791 PNNL-2D-UBS-BEC.mntr
11/06/2005  06:23 PM      102,563,840 PNNL-2D-UBS-BEC.osav
11/06/2005  06:24 PM            1,315 PNNL-2D-UBS-BEC.PVTS
11/06/2005  06:25 PM      103,546,880 PNNL-2D-UBS-BEC.r001
11/04/2005  09:21 AM       35,782,656 PNNL-2D-UBS-BEC.rdb
11/06/2005  06:25 PM    4,294,967,296 PNNL-2D-UBS-BEC.rst
11/04/2005  09:36 PM    4,294,967,296 PNNL-2D-UBS-BEC.rst02
11/05/2005  03:47 AM    4,294,967,296 PNNL-2D-UBS-BEC.rst03
11/05/2005  10:02 AM    4,294,967,296 PNNL-2D-UBS-BEC.rst04
11/05/2005  04:23 PM    4,294,967,296 PNNL-2D-UBS-BEC.rst05
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11/05/2005  10:51 PM     4,294,967,296 PNNL-2D-UBS-BEC.rst06
11/06/2005  05:25 AM     4,294,967,296 PNNL-2D-UBS-BEC.rst07
11/06/2005  12:09 PM     4,294,967,296 PNNL-2D-UBS-BEC.rst08
11/06/2005  06:25 PM     4,002,217,984 PNNL-2D-UBS-BEC.rst09
11/06/2005  06:25 PM               289 PNNL-2D-UBS-BEC.stat
12/07/2005  04:51 PM         1,729,206 PNNL-2D-UBS-BEC000.bmp
12/07/2005  04:54 PM         1,729,206 PNNL-2D-UBS-BEC001.bmp
11/06/2005  06:25 PM         3,139,708 PNNL-AY-2D-NL-BEC-UBS.out
11/29/2005  03:30 PM            73,728 Primary-Contact_0-90.xls
11/29/2005  03:30 PM            73,728 Primary-Contact_99-180.xls
11/07/2005  11:55 AM             2,728 Primary-Cont_108max.OUT
11/07/2005  11:55 AM         1,200,544 Primary-Cont_108th.OUT
11/07/2005  11:57 AM             2,728 Primary-Cont_117max.OUT
11/07/2005  11:57 AM         1,200,544 Primary-Cont_117th.OUT
11/07/2005  11:59 AM             2,728 Primary-Cont_126max.OUT
11/07/2005  11:59 AM         1,200,544 Primary-Cont_126th.OUT
11/07/2005  12:02 PM             2,728 Primary-Cont_135max.OUT
11/07/2005  12:02 PM         1,200,544 Primary-Cont_135th.OUT
11/07/2005  12:04 PM             2,728 Primary-Cont_144max.OUT
11/07/2005  12:04 PM         1,200,544 Primary-Cont_144th.OUT
11/07/2005  12:06 PM             2,728 Primary-Cont_153max.OUT
11/07/2005  12:06 PM         1,200,544 Primary-Cont_153th.OUT
11/07/2005  12:08 PM             2,728 Primary-Cont_162max.OUT
11/07/2005  12:08 PM         1,200,544 Primary-Cont_162th.OUT
11/07/2005  12:10 PM             2,728 Primary-Cont_171max.OUT
11/07/2005  12:10 PM         1,200,544 Primary-Cont_171th.OUT
11/07/2005  12:12 PM             2,728 Primary-Cont_180max.OUT
11/07/2005  12:12 PM         1,200,544 Primary-Cont_180th.OUT
11/07/2005  11:35 AM             2,728 Primary-Cont_18max.OUT
11/07/2005  11:35 AM         1,200,544 Primary-Cont_18th.OUT
11/07/2005  11:36 AM             2,728 Primary-Cont_27max.OUT
11/07/2005  11:36 AM         1,200,544 Primary-Cont_27th.OUT
11/07/2005  11:38 AM             2,728 Primary-Cont_36max.OUT
11/07/2005  11:38 AM         1,200,544 Primary-Cont_36th.OUT
11/07/2005  11:40 AM             2,728 Primary-Cont_45max.OUT
11/07/2005  11:40 AM         1,200,544 Primary-Cont_45th.OUT
11/07/2005  11:42 AM             2,728 Primary-Cont_54max.OUT
11/07/2005  11:42 AM         1,200,544 Primary-Cont_54th.OUT
11/07/2005  11:44 AM             2,728 Primary-Cont_63max.OUT
11/07/2005  11:44 AM         1,200,544 Primary-Cont_63th.OUT
11/07/2005  11:47 AM             2,728 Primary-Cont_72max.OUT
11/07/2005  11:47 AM         1,200,544 Primary-Cont_72th.OUT
11/07/2005  11:49 AM             2,728 Primary-Cont_81max.OUT
11/07/2005  11:49 AM         1,200,544 Primary-Cont_81th.OUT
11/07/2005  11:51 AM             2,728 Primary-Cont_90max.OUT
11/07/2005  11:51 AM         1,200,544 Primary-Cont_90th.OUT
11/07/2005  11:53 AM             2,728 Primary-Cont_99max.OUT
11/07/2005  11:53 AM         1,200,544 Primary-Cont_99th.OUT
11/07/2005  11:34 AM             2,728 Primary-Cont_9max.OUT
11/07/2005  11:34 AM         1,200,672 Primary-Cont_9th.OUT
10/31/2005  12:18 PM             5,549 Primary-Props-AY.txt
09/27/2005  03:52 PM             1,538 Primary.txt
11/04/2005  09:21 AM           343,243 QA.out
11/28/2005  02:26 PM            47,121 RS-ct-0.out
11/28/2005  02:32 PM            47,121 RS-ct-135.out
11/28/2005  02:34 PM            47,121 RS-ct-180.out
11/28/2005  02:28 PM            47,121 RS-ct-45.out
11/28/2005  02:30 PM            47,121 RS-ct-90.out
11/28/2005  02:35 PM            27,591 RS-ct.out
10/14/2005  11:18 AM            40,851 RS-OUT-Concrete.txt
11/28/2005  02:37 PM            47,121 RS-PT-0.out
11/28/2005  02:43 PM            47,121 RS-PT-135.out
11/28/2005  02:44 PM            47,121 RS-PT-180.out
11/28/2005  02:39 PM            47,121 RS-PT-45.out
11/28/2005  02:41 PM            47,121 RS-PT-90.out
11/28/2005  02:46 PM            47,121 RS-SOil.out
10/31/2005  10:31 AM             1,108 RS_FREQ.txt
11/07/2005  04:14 PM         5,641,770 Run-Tank-Out.out
11/02/2005  09:29 AM               146 run-tank.bat
10/31/2005  12:22 PM             1,958 Run-Tank.txt
12/16/2005  11:13 AM                 0 scratch.hlp
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02/11/2005  01:22 PM             1,053 Slave.txt
11/07/2005  01:23 PM             9,896 Soil-Contact_108max.OUT
11/07/2005  01:23 PM         4,151,880 Soil-Contact_108th.OUT
11/07/2005  01:28 PM             9,896 Soil-Contact_117max.OUT
11/07/2005  01:28 PM         4,151,880 Soil-Contact_117th.OUT
11/07/2005  01:34 PM             9,896 Soil-Contact_126max.OUT
11/07/2005  01:34 PM         4,151,880 Soil-Contact_126th.OUT
11/07/2005  01:40 PM             9,896 Soil-Contact_135max.OUT
11/07/2005  01:40 PM         4,151,880 Soil-Contact_135th.OUT
11/07/2005  01:46 PM             9,896 Soil-Contact_144max.OUT
11/07/2005  01:46 PM         4,151,880 Soil-Contact_144th.OUT
11/07/2005  01:52 PM             9,896 Soil-Contact_153max.OUT
11/07/2005  01:52 PM         4,151,880 Soil-Contact_153th.OUT
11/07/2005  01:58 PM             9,896 Soil-Contact_162max.OUT
11/07/2005  01:58 PM         4,151,880 Soil-Contact_162th.OUT
11/07/2005  02:04 PM             9,896 Soil-Contact_171max.OUT
11/07/2005  02:04 PM         4,151,880 Soil-Contact_171th.OUT
11/07/2005  02:10 PM             9,896 Soil-Contact_180max.OUT
11/07/2005  02:10 PM         4,151,880 Soil-Contact_180th.OUT
11/07/2005  12:24 PM             9,896 Soil-Contact_18max.OUT
11/07/2005  12:24 PM         4,151,880 Soil-Contact_18th.OUT
11/07/2005  12:30 PM             9,896 Soil-Contact_27max.OUT
11/07/2005  12:30 PM         4,151,880 Soil-Contact_27th.OUT
11/07/2005  12:36 PM             9,896 Soil-Contact_36max.OUT
11/07/2005  12:36 PM         4,151,880 Soil-Contact_36th.OUT
11/07/2005  12:42 PM             9,896 Soil-Contact_45max.OUT
11/07/2005  12:42 PM         4,151,880 Soil-Contact_45th.OUT
11/07/2005  12:47 PM             9,896 Soil-Contact_54max.OUT
11/07/2005  12:48 PM         4,151,880 Soil-Contact_54th.OUT
11/07/2005  12:53 PM             9,896 Soil-Contact_63max.OUT
11/07/2005  12:53 PM         4,151,880 Soil-Contact_63th.OUT
11/07/2005  12:59 PM             9,896 Soil-Contact_72max.OUT
11/07/2005  12:59 PM         4,151,880 Soil-Contact_72th.OUT
11/07/2005  01:05 PM             9,896 Soil-Contact_81max.OUT
11/07/2005  01:05 PM         4,151,880 Soil-Contact_81th.OUT
11/07/2005  01:11 PM             9,896 Soil-Contact_90max.OUT
11/07/2005  01:11 PM         4,151,880 Soil-Contact_90th.OUT
11/07/2005  01:17 PM             9,896 Soil-Contact_99max.OUT
11/07/2005  01:17 PM         4,151,880 Soil-Contact_99th.OUT
11/07/2005  12:18 PM             9,896 Soil-Contact_9max.OUT
11/07/2005  12:18 PM         4,152,008 Soil-Contact_9th.OUT
10/13/2005  08:19 AM             5,016 Soil-Prop-UB-Geo.txt
11/22/2005  01:24 PM           223,232 soil_0-90.xls
11/22/2005  01:24 PM           223,232 soil_99-180.xls
10/31/2005  01:58 PM             1,913 Solve-TH-UB.txt
11/28/2005  02:23 PM               347 spectra-all.txt
11/28/2005  02:16 PM             3,483 spectra-conc-0.txt
12/05/2005  10:59 AM             3,511 spectra-conc-135.txt
12/05/2005  10:59 AM             3,511 spectra-conc-180.txt
11/28/2005  02:18 PM             3,560 spectra-conc-45.txt
12/05/2005  10:59 AM             3,440 spectra-conc-90.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
10/31/2005  10:17 AM             3,551 spectra-primary-135.txt
10/31/2005  11:02 AM             3,566 spectra-primary-180.txt
10/31/2005  10:16 AM             3,479 spectra-primary-45.txt
10/31/2005  10:16 AM             3,479 spectra-primary-90.txt
10/31/2005  11:37 AM             3,608 spectra-soil.txt
06/20/2005  09:04 AM               647 spectra-wall.txt
06/20/2005  08:52 AM               679 spectra-waste.txt
12/07/2005  09:19 AM           344,576 str-comp_0-90b.xls
12/07/2005  09:19 AM           344,576 str-comp_0-90m.xls
12/07/2005  09:20 AM           343,040 str-comp_0-90t.xls
12/07/2005  09:20 AM           345,088 str-comp_99-180b.xls
12/07/2005  09:20 AM           345,088 str-comp_99-180m.xls
12/07/2005  09:21 AM           343,040 str-comp_99-180t.xls
09/02/2005  08:51 AM               707 strain-compb.txt
09/02/2005  08:51 AM               705 strain-compm.txt
09/02/2005  08:50 AM               720 strain-compt.txt
11/07/2005  09:25 AM             6,110 Strain-lb_108max-b.OUT
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11/07/2005  09:25 AM         2,555,082 Strain-lb_108th-b.OUT
11/07/2005  09:27 AM             6,110 Strain-lb_117max-b.OUT
11/07/2005  09:27 AM         2,555,082 Strain-lb_117th-b.OUT
11/07/2005  09:30 AM             6,110 Strain-lb_126max-b.OUT
11/07/2005  09:30 AM         2,555,082 Strain-lb_126th-b.OUT
11/07/2005  09:33 AM             6,110 Strain-lb_135max-b.OUT
11/07/2005  09:33 AM         2,555,082 Strain-lb_135th-b.OUT
11/07/2005  09:36 AM             6,110 Strain-lb_144max-b.OUT
11/07/2005  09:36 AM         2,555,082 Strain-lb_144th-b.OUT
11/07/2005  09:39 AM             6,110 Strain-lb_153max-b.OUT
11/07/2005  09:39 AM         2,555,082 Strain-lb_153th-b.OUT
11/07/2005  09:43 AM             6,110 Strain-lb_162max-b.OUT
11/07/2005  09:43 AM         2,555,082 Strain-lb_162th-b.OUT
11/07/2005  09:46 AM             6,110 Strain-lb_171max-b.OUT
11/07/2005  09:46 AM         2,555,082 Strain-lb_171th-b.OUT
11/07/2005  09:48 AM             6,110 Strain-lb_180max-b.OUT
11/07/2005  09:48 AM         2,555,082 Strain-lb_180th-b.OUT
11/07/2005  08:56 AM             6,110 Strain-lb_18max-b.OUT
11/07/2005  08:56 AM         2,555,082 Strain-lb_18th-b.OUT
11/07/2005  08:58 AM             6,110 Strain-lb_27max-b.OUT
11/07/2005  08:58 AM         2,555,082 Strain-lb_27th-b.OUT
11/07/2005  09:01 AM             6,110 Strain-lb_36max-b.OUT
11/07/2005  09:01 AM         2,555,082 Strain-lb_36th-b.OUT
11/07/2005  09:04 AM             6,110 Strain-lb_45max-b.OUT
11/07/2005  09:04 AM         2,555,082 Strain-lb_45th-b.OUT
11/07/2005  09:07 AM             6,110 Strain-lb_54max-b.OUT
11/07/2005  09:07 AM         2,555,082 Strain-lb_54th-b.OUT
11/07/2005  09:10 AM             6,110 Strain-lb_63max-b.OUT
11/07/2005  09:10 AM         2,555,082 Strain-lb_63th-b.OUT
11/07/2005  09:13 AM             6,110 Strain-lb_72max-b.OUT
11/07/2005  09:13 AM         2,555,082 Strain-lb_72th-b.OUT
11/07/2005  09:16 AM             6,110 Strain-lb_81max-b.OUT
11/07/2005  09:16 AM         2,555,082 Strain-lb_81th-b.OUT
11/07/2005  09:19 AM             6,110 Strain-lb_90max-b.OUT
11/07/2005  09:19 AM         2,555,082 Strain-lb_90th-b.OUT
11/07/2005  09:22 AM             6,110 Strain-lb_99max-b.OUT
11/07/2005  09:22 AM         2,555,082 Strain-lb_99th-b.OUT
11/07/2005  08:53 AM             6,110 Strain-lb_9max-b.OUT
11/07/2005  08:53 AM         2,555,210 Strain-lb_9th-b.OUT
09/02/2005  08:52 AM               544 Strain-Liner.txt
11/07/2005  08:26 AM             6,110 Strain-lm_108max-m.OUT
11/07/2005  08:26 AM         2,555,082 Strain-lm_108th-m.OUT
11/07/2005  08:29 AM             6,110 Strain-lm_117max-m.OUT
11/07/2005  08:29 AM         2,555,082 Strain-lm_117th-m.OUT
11/07/2005  08:32 AM             6,110 Strain-lm_126max-m.OUT
11/07/2005  08:32 AM         2,555,082 Strain-lm_126th-m.OUT
11/07/2005  08:35 AM             6,110 Strain-lm_135max-m.OUT
11/07/2005  08:35 AM         2,555,082 Strain-lm_135th-m.OUT
11/07/2005  08:38 AM             6,110 Strain-lm_144max-m.OUT
11/07/2005  08:38 AM         2,555,082 Strain-lm_144th-m.OUT
11/07/2005  08:41 AM             6,110 Strain-lm_153max-m.OUT
11/07/2005  08:41 AM         2,555,082 Strain-lm_153th-m.OUT
11/07/2005  08:44 AM             6,110 Strain-lm_162max-m.OUT
11/07/2005  08:44 AM         2,555,082 Strain-lm_162th-m.OUT
11/07/2005  08:47 AM             6,110 Strain-lm_171max-m.OUT
11/07/2005  08:47 AM         2,555,082 Strain-lm_171th-m.OUT
11/07/2005  08:50 AM             6,110 Strain-lm_180max-m.OUT
11/07/2005  08:50 AM         2,555,082 Strain-lm_180th-m.OUT
11/07/2005  07:57 AM             6,110 Strain-lm_18max-m.OUT
11/07/2005  07:57 AM         2,555,082 Strain-lm_18th-m.OUT
11/07/2005  07:59 AM             6,110 Strain-lm_27max-m.OUT
11/07/2005  07:59 AM         2,555,082 Strain-lm_27th-m.OUT
11/07/2005  08:02 AM             6,110 Strain-lm_36max-m.OUT
11/07/2005  08:02 AM         2,555,082 Strain-lm_36th-m.OUT
11/07/2005  08:05 AM             6,110 Strain-lm_45max-m.OUT
11/07/2005  08:05 AM         2,555,082 Strain-lm_45th-m.OUT
11/07/2005  08:08 AM             6,110 Strain-lm_54max-m.OUT
11/07/2005  08:08 AM         2,555,082 Strain-lm_54th-m.OUT
11/07/2005  08:11 AM             6,110 Strain-lm_63max-m.OUT
11/07/2005  08:11 AM         2,555,082 Strain-lm_63th-m.OUT
11/07/2005  08:14 AM             6,110 Strain-lm_72max-m.OUT
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11/07/2005  08:14 AM         2,555,082 Strain-lm_72th-m.OUT
11/07/2005  08:18 AM             6,110 Strain-lm_81max-m.OUT
11/07/2005  08:18 AM         2,555,082 Strain-lm_81th-m.OUT
11/07/2005  08:21 AM             6,110 Strain-lm_90max-m.OUT
11/07/2005  08:21 AM         2,555,082 Strain-lm_90th-m.OUT
11/07/2005  08:23 AM             6,110 Strain-lm_99max-m.OUT
11/07/2005  08:23 AM         2,555,082 Strain-lm_99th-m.OUT
11/07/2005  07:54 AM             6,110 Strain-lm_9max-m.OUT
11/07/2005  07:54 AM         2,555,210 Strain-lm_9th-m.OUT
11/07/2005  07:28 AM             6,110 Strain-lt_108max-t.OUT
11/07/2005  07:28 AM         2,555,082 Strain-lt_108th-t.OUT
11/07/2005  07:30 AM             6,110 Strain-lt_117max-t.OUT
11/07/2005  07:30 AM         2,555,082 Strain-lt_117th-t.OUT
11/07/2005  07:33 AM             6,110 Strain-lt_126max-t.OUT
11/07/2005  07:33 AM         2,555,082 Strain-lt_126th-t.OUT
11/07/2005  07:36 AM             6,110 Strain-lt_135max-t.OUT
11/07/2005  07:36 AM         2,555,082 Strain-lt_135th-t.OUT
11/07/2005  07:39 AM             6,110 Strain-lt_144max-t.OUT
11/07/2005  07:39 AM         2,555,082 Strain-lt_144th-t.OUT
11/07/2005  07:42 AM             6,110 Strain-lt_153max-t.OUT
11/07/2005  07:42 AM         2,555,082 Strain-lt_153th-t.OUT
11/07/2005  07:45 AM             6,110 Strain-lt_162max-t.OUT
11/07/2005  07:45 AM         2,555,082 Strain-lt_162th-t.OUT
11/07/2005  07:48 AM             6,110 Strain-lt_171max-t.OUT
11/07/2005  07:48 AM         2,555,082 Strain-lt_171th-t.OUT
11/07/2005  07:51 AM             6,110 Strain-lt_180max-t.OUT
11/07/2005  07:51 AM         2,555,082 Strain-lt_180th-t.OUT
11/07/2005  06:58 AM             6,110 Strain-lt_18max-t.OUT
11/07/2005  06:58 AM         2,555,082 Strain-lt_18th-t.OUT
11/07/2005  07:01 AM             6,110 Strain-lt_27max-t.OUT
11/07/2005  07:01 AM         2,555,082 Strain-lt_27th-t.OUT
11/07/2005  07:03 AM             6,110 Strain-lt_36max-t.OUT
11/07/2005  07:03 AM         2,555,082 Strain-lt_36th-t.OUT
11/07/2005  07:06 AM             6,110 Strain-lt_45max-t.OUT
11/07/2005  07:06 AM         2,555,082 Strain-lt_45th-t.OUT
11/07/2005  07:10 AM             6,110 Strain-lt_54max-t.OUT
11/07/2005  07:10 AM         2,555,082 Strain-lt_54th-t.OUT
11/07/2005  07:13 AM             6,110 Strain-lt_63max-t.OUT
11/07/2005  07:13 AM         2,555,082 Strain-lt_63th-t.OUT
11/07/2005  07:16 AM             6,110 Strain-lt_72max-t.OUT
11/07/2005  07:16 AM         2,555,082 Strain-lt_72th-t.OUT
11/07/2005  07:19 AM             6,110 Strain-lt_81max-t.OUT
11/07/2005  07:19 AM         2,555,082 Strain-lt_81th-t.OUT
11/07/2005  07:22 AM             6,110 Strain-lt_90max-t.OUT
11/07/2005  07:22 AM         2,555,082 Strain-lt_90th-t.OUT
11/07/2005  07:24 AM             6,110 Strain-lt_99max-t.OUT
11/07/2005  07:24 AM         2,555,082 Strain-lt_99th-t.OUT
11/07/2005  06:55 AM             6,110 Strain-lt_9max-t.OUT
11/07/2005  06:55 AM         2,555,210 Strain-lt_9th-t.OUT
09/08/2005  10:18 AM               692 stress-compb.txt
09/08/2005  10:18 AM               692 stress-compm.txt
09/08/2005  09:20 AM               692 stress-compt.txt
04/13/2005  07:38 AM               205 Stress-Primary.txt
11/07/2005  05:47 AM            16,291 Stress-pt_108max-b.OUT
11/07/2005  03:17 AM            16,291 Stress-pt_108max-m.OUT
11/07/2005  12:46 AM            16,210 Stress-pt_108max-t.OUT
11/07/2005  05:47 AM         6,850,602 Stress-pt_108th-b.OUT
11/07/2005  03:17 AM         6,850,602 Stress-pt_108th-m.OUT
11/07/2005  12:46 AM         6,821,874 Stress-pt_108th-t.OUT
11/07/2005  05:55 AM            16,291 Stress-pt_117max-b.OUT
11/07/2005  03:24 AM            16,291 Stress-pt_117max-m.OUT
11/07/2005  12:54 AM            16,210 Stress-pt_117max-t.OUT
11/07/2005  05:55 AM         6,850,602 Stress-pt_117th-b.OUT
11/07/2005  03:24 AM         6,850,602 Stress-pt_117th-m.OUT
11/07/2005  12:54 AM         6,821,874 Stress-pt_117th-t.OUT
11/07/2005  06:02 AM            16,291 Stress-pt_126max-b.OUT
11/07/2005  03:32 AM            16,291 Stress-pt_126max-m.OUT
11/07/2005  01:01 AM            16,210 Stress-pt_126max-t.OUT
11/07/2005  06:02 AM         6,850,602 Stress-pt_126th-b.OUT
11/07/2005  03:32 AM         6,850,602 Stress-pt_126th-m.OUT
11/07/2005  01:01 AM         6,821,874 Stress-pt_126th-t.OUT
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11/07/2005  06:10 AM            16,291 Stress-pt_135max-b.OUT
11/07/2005  03:39 AM            16,291 Stress-pt_135max-m.OUT
11/07/2005  01:09 AM            16,210 Stress-pt_135max-t.OUT
11/07/2005  06:10 AM         6,850,602 Stress-pt_135th-b.OUT
11/07/2005  03:39 AM         6,850,602 Stress-pt_135th-m.OUT
11/07/2005  01:09 AM         6,821,874 Stress-pt_135th-t.OUT
11/07/2005  06:17 AM            16,291 Stress-pt_144max-b.OUT
11/07/2005  03:47 AM            16,291 Stress-pt_144max-m.OUT
11/07/2005  01:16 AM            16,210 Stress-pt_144max-t.OUT
11/07/2005  06:17 AM         6,850,602 Stress-pt_144th-b.OUT
11/07/2005  03:47 AM         6,850,602 Stress-pt_144th-m.OUT
11/07/2005  01:16 AM         6,821,874 Stress-pt_144th-t.OUT
11/07/2005  06:25 AM            16,291 Stress-pt_153max-b.OUT
11/07/2005  03:54 AM            16,291 Stress-pt_153max-m.OUT
11/07/2005  01:24 AM            16,210 Stress-pt_153max-t.OUT
11/07/2005  06:25 AM         6,850,602 Stress-pt_153th-b.OUT
11/07/2005  03:54 AM         6,850,602 Stress-pt_153th-m.OUT
11/07/2005  01:24 AM         6,821,874 Stress-pt_153th-t.OUT
11/07/2005  06:32 AM            16,291 Stress-pt_162max-b.OUT
11/07/2005  04:02 AM            16,291 Stress-pt_162max-m.OUT
11/07/2005  01:31 AM            16,210 Stress-pt_162max-t.OUT
11/07/2005  06:32 AM         6,850,602 Stress-pt_162th-b.OUT
11/07/2005  04:02 AM         6,850,602 Stress-pt_162th-m.OUT
11/07/2005  01:32 AM         6,821,874 Stress-pt_162th-t.OUT
11/07/2005  06:40 AM            16,295 Stress-pt_171max-b.OUT
11/07/2005  04:09 AM            16,295 Stress-pt_171max-m.OUT
11/07/2005  01:39 AM            16,214 Stress-pt_171max-t.OUT
11/07/2005  06:40 AM         6,850,602 Stress-pt_171th-b.OUT
11/07/2005  04:09 AM         6,850,602 Stress-pt_171th-m.OUT
11/07/2005  01:39 AM         6,821,874 Stress-pt_171th-t.OUT
11/07/2005  06:47 AM            16,295 Stress-pt_180max-b.OUT
11/07/2005  04:17 AM            16,295 Stress-pt_180max-m.OUT
11/07/2005  01:47 AM            16,214 Stress-pt_180max-t.OUT
11/07/2005  06:47 AM         6,850,602 Stress-pt_180th-b.OUT
11/07/2005  04:17 AM         6,850,602 Stress-pt_180th-m.OUT
11/07/2005  01:47 AM         6,821,874 Stress-pt_180th-t.OUT
11/07/2005  04:32 AM            16,291 Stress-pt_18max-b.OUT
11/07/2005  02:01 AM            16,291 Stress-pt_18max-m.OUT
11/06/2005  11:31 PM            16,210 Stress-pt_18max-t.OUT
11/07/2005  04:32 AM         6,850,602 Stress-pt_18th-b.OUT
11/07/2005  02:01 AM         6,850,602 Stress-pt_18th-m.OUT
11/06/2005  11:31 PM         6,821,874 Stress-pt_18th-t.OUT
11/07/2005  04:39 AM            16,291 Stress-pt_27max-b.OUT
11/07/2005  02:09 AM            16,291 Stress-pt_27max-m.OUT
11/06/2005  11:39 PM            16,210 Stress-pt_27max-t.OUT
11/07/2005  04:39 AM         6,850,602 Stress-pt_27th-b.OUT
11/07/2005  02:09 AM         6,850,602 Stress-pt_27th-m.OUT
11/06/2005  11:39 PM         6,821,874 Stress-pt_27th-t.OUT
11/07/2005  04:47 AM            16,291 Stress-pt_36max-b.OUT
11/07/2005  02:17 AM            16,291 Stress-pt_36max-m.OUT
11/06/2005  11:46 PM            16,210 Stress-pt_36max-t.OUT
11/07/2005  04:47 AM         6,850,602 Stress-pt_36th-b.OUT
11/07/2005  02:17 AM         6,850,602 Stress-pt_36th-m.OUT
11/06/2005  11:46 PM         6,821,874 Stress-pt_36th-t.OUT
11/07/2005  04:54 AM            16,291 Stress-pt_45max-b.OUT
11/07/2005  02:24 AM            16,291 Stress-pt_45max-m.OUT
11/06/2005  11:54 PM            16,210 Stress-pt_45max-t.OUT
11/07/2005  04:54 AM         6,850,602 Stress-pt_45th-b.OUT
11/07/2005  02:24 AM         6,850,602 Stress-pt_45th-m.OUT
11/06/2005  11:54 PM         6,821,874 Stress-pt_45th-t.OUT
11/07/2005  05:02 AM            16,291 Stress-pt_54max-b.OUT
11/07/2005  02:31 AM            16,291 Stress-pt_54max-m.OUT
11/07/2005  12:01 AM            16,210 Stress-pt_54max-t.OUT
11/07/2005  05:02 AM         6,850,602 Stress-pt_54th-b.OUT
11/07/2005  02:31 AM         6,850,602 Stress-pt_54th-m.OUT
11/07/2005  12:01 AM         6,821,874 Stress-pt_54th-t.OUT
11/07/2005  05:09 AM            16,291 Stress-pt_63max-b.OUT
11/07/2005  02:39 AM            16,291 Stress-pt_63max-m.OUT
11/07/2005  12:09 AM            16,210 Stress-pt_63max-t.OUT
11/07/2005  05:09 AM         6,850,602 Stress-pt_63th-b.OUT
11/07/2005  02:39 AM         6,850,602 Stress-pt_63th-m.OUT
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11/07/2005  12:09 AM         6,821,874 Stress-pt_63th-t.OUT
11/07/2005  05:17 AM            16,291 Stress-pt_72max-b.OUT
11/07/2005  02:46 AM            16,291 Stress-pt_72max-m.OUT
11/07/2005  12:16 AM            16,210 Stress-pt_72max-t.OUT
11/07/2005  05:17 AM         6,850,602 Stress-pt_72th-b.OUT
11/07/2005  02:46 AM         6,850,602 Stress-pt_72th-m.OUT
11/07/2005  12:16 AM         6,821,874 Stress-pt_72th-t.OUT
11/07/2005  05:24 AM            16,291 Stress-pt_81max-b.OUT
11/07/2005  02:54 AM            16,291 Stress-pt_81max-m.OUT
11/07/2005  12:23 AM            16,210 Stress-pt_81max-t.OUT
11/07/2005  05:24 AM         6,850,602 Stress-pt_81th-b.OUT
11/07/2005  02:54 AM         6,850,602 Stress-pt_81th-m.OUT
11/07/2005  12:23 AM         6,821,874 Stress-pt_81th-t.OUT
11/07/2005  05:32 AM            16,291 Stress-pt_90max-b.OUT
11/07/2005  03:02 AM            16,291 Stress-pt_90max-m.OUT
11/07/2005  12:31 AM            16,210 Stress-pt_90max-t.OUT
11/07/2005  05:32 AM         6,850,602 Stress-pt_90th-b.OUT
11/07/2005  03:02 AM         6,850,602 Stress-pt_90th-m.OUT
11/07/2005  12:31 AM         6,821,874 Stress-pt_90th-t.OUT
11/07/2005  05:40 AM            16,291 Stress-pt_99max-b.OUT
11/07/2005  03:09 AM            16,291 Stress-pt_99max-m.OUT
11/07/2005  12:39 AM            16,210 Stress-pt_99max-t.OUT
11/07/2005  05:40 AM         6,850,602 Stress-pt_99th-b.OUT
11/07/2005  03:09 AM         6,850,602 Stress-pt_99th-m.OUT
11/07/2005  12:39 AM         6,821,874 Stress-pt_99th-t.OUT
11/07/2005  04:24 AM            16,291 Stress-pt_9max-b.OUT
11/07/2005  01:54 AM            16,291 Stress-pt_9max-m.OUT
11/06/2005  11:24 PM            16,210 Stress-pt_9max-t.OUT
11/07/2005  04:24 AM         6,850,730 Stress-pt_9th-b.OUT
11/07/2005  01:54 AM         6,850,730 Stress-pt_9th-m.OUT
11/06/2005  11:24 PM         6,822,002 Stress-pt_9th-t.OUT
10/31/2005  12:13 PM             3,825 Tank-Coordinates-AY.txt
05/25/2005  03:32 PM             2,512 Tank-Mesh1.txt
11/04/2005  09:21 AM               102 tank-out.out
02/25/2005  02:24 PM             5,406 Tank-Props-BEC-250.txt
11/04/2005  09:21 AM             4,678 Tank-th.out
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
12/20/2005  01:37 PM    <DIR>          UBS PDF-Files
11/07/2005  03:13 PM             8,236 Waste-Cont_108max.OUT
11/07/2005  03:13 PM         3,151,428 Waste-Cont_108th.OUT
11/07/2005  03:18 PM             8,236 Waste-Cont_117max.OUT
11/07/2005  03:18 PM         3,151,428 Waste-Cont_117th.OUT
11/07/2005  03:23 PM             8,236 Waste-Cont_126max.OUT
11/07/2005  03:23 PM         3,151,428 Waste-Cont_126th.OUT
11/07/2005  03:29 PM             8,236 Waste-Cont_135max.OUT
11/07/2005  03:29 PM         3,151,428 Waste-Cont_135th.OUT
11/07/2005  03:34 PM             8,236 Waste-Cont_144max.OUT
11/07/2005  03:34 PM         3,151,428 Waste-Cont_144th.OUT
11/07/2005  03:39 PM             8,236 Waste-Cont_153max.OUT
11/07/2005  03:39 PM         3,151,428 Waste-Cont_153th.OUT
11/07/2005  03:45 PM             8,236 Waste-Cont_162max.OUT
11/07/2005  03:45 PM         3,151,428 Waste-Cont_162th.OUT
11/07/2005  03:50 PM             8,236 Waste-Cont_171max.OUT
11/07/2005  03:50 PM         3,151,428 Waste-Cont_171th.OUT
11/07/2005  03:56 PM             8,236 Waste-Cont_180max.OUT
11/07/2005  03:56 PM         3,151,428 Waste-Cont_180th.OUT
11/07/2005  02:20 PM             8,236 Waste-Cont_18max.OUT
11/07/2005  02:20 PM         3,151,428 Waste-Cont_18th.OUT
11/07/2005  02:25 PM             8,236 Waste-Cont_27max.OUT
11/07/2005  02:25 PM         3,151,428 Waste-Cont_27th.OUT
11/07/2005  02:30 PM             8,236 Waste-Cont_36max.OUT
11/07/2005  02:30 PM         3,151,428 Waste-Cont_36th.OUT
11/07/2005  02:36 PM             8,236 Waste-Cont_45max.OUT
11/07/2005  02:36 PM         3,151,428 Waste-Cont_45th.OUT
11/07/2005  02:41 PM             8,236 Waste-Cont_54max.OUT
11/07/2005  02:41 PM         3,151,428 Waste-Cont_54th.OUT
11/07/2005  02:47 PM             8,236 Waste-Cont_63max.OUT
11/07/2005  02:47 PM         3,151,428 Waste-Cont_63th.OUT
11/07/2005  02:52 PM             8,236 Waste-Cont_72max.OUT
11/07/2005  02:52 PM         3,151,428 Waste-Cont_72th.OUT
```

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11/07/2005  02:58 PM             8,236 Waste-Cont_81max.OUT
11/07/2005  02:58 PM         3,151,428 Waste-Cont_81th.OUT
11/07/2005  03:03 PM             8,236 Waste-Cont_90max.OUT
11/07/2005  03:03 PM         3,151,428 Waste-Cont_90th.OUT
11/07/2005  03:08 PM             8,236 Waste-Cont_99max.OUT
11/07/2005  03:08 PM         3,151,428 Waste-Cont_99th.OUT
11/07/2005  02:15 PM             8,236 Waste-Cont_9max.OUT
11/07/2005  02:15 PM         3,151,556 Waste-Cont_9th.OUT
11/29/2005  05:09 PM            45,117 Waste-Reaction.out
11/08/2005  08:53 AM               332 Waste-Reaction.txt
10/31/2005  12:01 PM             3,265 Waste-solid-AY.txt
11/29/2005  08:46 AM               776 Waste-Surface-ay.txt
11/29/2005  09:01 AM               784 Waste-Surf_0max.OUT
11/29/2005  09:01 AM           509,216 Waste-Surf_0th.OUT
11/29/2005  11:51 AM               784 Waste-Surf_108max.OUT
11/29/2005  11:51 AM           509,088 Waste-Surf_108th.OUT
11/29/2005  12:06 PM               784 Waste-Surf_117max.OUT
11/29/2005  12:06 PM           509,088 Waste-Surf_117th.OUT
11/29/2005  12:20 PM               784 Waste-Surf_126max.OUT
11/29/2005  12:20 PM           509,088 Waste-Surf_126th.OUT
11/29/2005  12:34 PM               784 Waste-Surf_135max.OUT
11/29/2005  12:34 PM           509,088 Waste-Surf_135th.OUT
11/29/2005  12:48 PM               784 Waste-Surf_144max.OUT
11/29/2005  12:48 PM           509,088 Waste-Surf_144th.OUT
11/29/2005  01:02 PM               784 Waste-Surf_153max.OUT
11/29/2005  01:02 PM           509,088 Waste-Surf_153th.OUT
11/29/2005  01:16 PM               784 Waste-Surf_162max.OUT
11/29/2005  01:16 PM           509,088 Waste-Surf_162th.OUT
11/29/2005  01:30 PM               784 Waste-Surf_171max.OUT
11/29/2005  01:30 PM           509,088 Waste-Surf_171th.OUT
11/29/2005  01:44 PM               784 Waste-Surf_180max.OUT
11/29/2005  01:44 PM           509,088 Waste-Surf_180th.OUT
11/29/2005  09:30 AM               784 Waste-Surf_18max.OUT
11/29/2005  09:30 AM           509,088 Waste-Surf_18th.OUT
11/29/2005  09:44 AM               784 Waste-Surf_27max.OUT
11/29/2005  09:44 AM           509,088 Waste-Surf_27th.OUT
11/29/2005  09:58 AM               784 Waste-Surf_36max.OUT
11/29/2005  09:58 AM           509,088 Waste-Surf_36th.OUT
11/29/2005  10:12 AM               784 Waste-Surf_45max.OUT
11/29/2005  10:12 AM           509,088 Waste-Surf_45th.OUT
11/29/2005  10:27 AM               784 Waste-Surf_54max.OUT
11/29/2005  10:27 AM           509,088 Waste-Surf_54th.OUT
11/29/2005  10:41 AM               784 Waste-Surf_63max.OUT
11/29/2005  10:41 AM           509,088 Waste-Surf_63th.OUT
11/29/2005  10:55 AM               784 Waste-Surf_72max.OUT
11/29/2005  10:55 AM           509,088 Waste-Surf_72th.OUT
11/29/2005  11:09 AM               784 Waste-Surf_81max.OUT
11/29/2005  11:09 AM           509,088 Waste-Surf_81th.OUT
11/29/2005  11:23 AM               784 Waste-Surf_90max.OUT
11/29/2005  11:23 AM           509,088 Waste-Surf_90th.OUT
11/29/2005  11:37 AM               784 Waste-Surf_99max.OUT
11/29/2005  11:37 AM           509,088 Waste-Surf_99th.OUT
11/29/2005  09:15 AM               784 Waste-Surf_9max.OUT
11/29/2005  09:15 AM           509,088 Waste-Surf_9th.OUT
11/08/2005  12:43 PM           182,272 waste_0-90.xls
11/08/2005  12:44 PM           182,272 waste_99-180.xls
             752 File(s) 40,180,214,430 bytes
               7 Dir(s)  78,397,345,792 bytes free
```

UBS-BEC Gravity File Listing

```
 Volume in drive E is 250GB HITAC
 Volume Serial Number is B4FB-DB23

 Directory of E:\PNNL-2D-NL-AY-UBS-BEC-Seismic\PNNL-2D-NL-AY-UBS-BEC-Gravity

12/20/2005  04:44 PM    <DIR>          .
12/20/2005  04:44 PM    <DIR>          ..
09/27/2005  03:47 PM                99 All-Forces.txt
10/24/2005  09:54 AM               527 atm-AY.txt
12/05/2005  11:31 AM         3,363,840 AY-2D-NL-UBS-BEC Conc Tank Demand Gravity.xls
```

```
12/02/2005  04:07 PM         1,104,896 AY-2D-NL-UBS-BEC Conc-Tank Spectra.xls
12/01/2005  12:08 PM           296,960 AY-2D-NL-UBS-BEC Free Field RS Comparision.xls
12/06/2005  09:55 AM           675,840 AY-2D-NL-UBS-BEC J Bolt Forces Gravity.xls
11/29/2005  04:37 PM         3,459,584 AY-2D-NL-UBS-BEC Liner Strain Gravity.xls
12/15/2005  01:14 PM         8,117,248 AY-2D-NL-UBS-BEC Pri Tank Stress Gravity-INT-SXY.xls
12/14/2005  12:48 PM         8,457,728 AY-2D-NL-UBS-BEC Pri Tank Stress Gravity.xls
12/13/2005  03:58 PM         2,079,744 AY-2D-NL-UBS-BEC Soil Pressures Gravity.xls
12/08/2005  10:22 AM           685,568 AY-2D-NL-UBS-BEC-Insul-Contact-Gravity.xls
11/29/2005  02:14 PM           698,880 AY-2D-NL-UBS-BEC-J-Bolt-Contact-Gravity.xls
11/29/2005  03:32 PM           764,416 AY-2D-NL-UBS-BEC-Primary-Contact-Gravity.xls
09/02/2005  02:01 PM             5,766 Bolts-Friction.txt
06/09/2005  01:59 PM               262 Boundary.txt
10/31/2005  12:25 PM               190 Contact-AY.txt
12/01/2005  09:11 AM               586 Contact-Footing.txt
09/02/2005  09:28 AM               604 Contact-Insul.txt
09/02/2005  09:51 AM               602 Contact-J-Bolts.txt
09/09/2005  09:59 AM               608 Contact-Primary.txt
11/28/2005  03:11 PM               784 Contact-Soil.txt
09/06/2005  11:16 AM               630 Contact-Waste-AY.txt
12/01/2005  09:14 AM            36,352 disp_0-90.xls
12/01/2005  09:15 AM            36,352 disp_99-180.xls
09/22/2005  04:05 PM             8,608 Far-Soil.txt
12/20/2005  04:44 PM                 0 file.txt
10/13/2005  06:54 AM               562 Fix-Soil.txt
12/01/2005  09:38 AM            10,342 Footing-Cont_max.OUT
12/01/2005  09:38 AM            11,328 Footing-Cont_th.OUT
04/06/2005  08:24 AM               894 Force-c.txt
10/31/2005  01:48 PM             4,996 Force-c_108amax.OUT
10/31/2005  01:48 PM             8,400 Force-c_108ath.OUT
10/31/2005  01:48 PM            14,716 Force-c_108max.OUT
10/31/2005  01:48 PM            16,800 Force-c_108th.OUT
10/31/2005  01:48 PM             4,996 Force-c_117amax.OUT
10/31/2005  01:48 PM             8,400 Force-c_117ath.OUT
10/31/2005  01:48 PM            14,716 Force-c_117max.OUT
10/31/2005  01:48 PM            16,800 Force-c_117th.OUT
10/31/2005  01:48 PM             4,996 Force-c_126amax.OUT
10/31/2005  01:48 PM             8,400 Force-c_126ath.OUT
10/31/2005  01:48 PM            14,716 Force-c_126max.OUT
10/31/2005  01:48 PM            16,800 Force-c_126th.OUT
10/31/2005  01:48 PM             4,996 Force-c_135amax.OUT
10/31/2005  01:48 PM             8,400 Force-c_135ath.OUT
10/31/2005  01:48 PM            14,716 Force-c_135max.OUT
10/31/2005  01:48 PM            16,800 Force-c_135th.OUT
10/31/2005  01:48 PM             4,996 Force-c_144amax.OUT
10/31/2005  01:48 PM             8,400 Force-c_144ath.OUT
10/31/2005  01:48 PM            14,716 Force-c_144max.OUT
10/31/2005  01:48 PM            16,800 Force-c_144th.OUT
10/31/2005  01:48 PM             4,996 Force-c_153amax.OUT
10/31/2005  01:48 PM             8,400 Force-c_153ath.OUT
10/31/2005  01:48 PM            14,716 Force-c_153max.OUT
10/31/2005  01:48 PM            16,800 Force-c_153th.OUT
10/31/2005  01:48 PM             4,996 Force-c_162amax.OUT
10/31/2005  01:48 PM             8,400 Force-c_162ath.OUT
10/31/2005  01:48 PM            14,716 Force-c_162max.OUT
10/31/2005  01:48 PM            16,800 Force-c_162th.OUT
10/31/2005  01:48 PM             4,996 Force-c_171amax.OUT
10/31/2005  01:48 PM             8,400 Force-c_171ath.OUT
10/31/2005  01:48 PM            14,716 Force-c_171max.OUT
10/31/2005  01:48 PM            16,800 Force-c_171th.OUT
10/31/2005  01:48 PM             4,996 Force-c_180amax.OUT
10/31/2005  01:48 PM             8,400 Force-c_180ath.OUT
10/31/2005  01:48 PM            14,716 Force-c_180max.OUT
10/31/2005  01:48 PM            16,800 Force-c_180th.OUT
10/31/2005  01:48 PM             4,996 Force-c_18amax.OUT
10/31/2005  01:48 PM             8,400 Force-c_18ath.OUT
10/31/2005  01:48 PM            14,716 Force-c_18max.OUT
10/31/2005  01:48 PM            16,800 Force-c_18th.OUT
10/31/2005  01:48 PM             4,996 Force-c_27amax.OUT
10/31/2005  01:48 PM             8,400 Force-c_27ath.OUT
10/31/2005  01:48 PM            14,716 Force-c_27max.OUT
10/31/2005  01:48 PM            16,800 Force-c_27th.OUT
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10/31/2005  01:48 PM            4,996 Force-c_36amax.OUT
10/31/2005  01:48 PM            8,400 Force-c_36ath.OUT
10/31/2005  01:48 PM           14,716 Force-c_36max.OUT
10/31/2005  01:48 PM           16,800 Force-c_36th.OUT
10/31/2005  01:48 PM            4,996 Force-c_45amax.OUT
10/31/2005  01:48 PM            8,400 Force-c_45ath.OUT
10/31/2005  01:48 PM           14,716 Force-c_45max.OUT
10/31/2005  01:48 PM           16,800 Force-c_45th.OUT
10/31/2005  01:48 PM            4,996 Force-c_54amax.OUT
10/31/2005  01:48 PM            8,400 Force-c_54ath.OUT
10/31/2005  01:48 PM           14,716 Force-c_54max.OUT
10/31/2005  01:48 PM           16,800 Force-c_54th.OUT
10/31/2005  01:48 PM            4,996 Force-c_63amax.OUT
10/31/2005  01:48 PM            8,400 Force-c_63ath.OUT
10/31/2005  01:48 PM           14,716 Force-c_63max.OUT
10/31/2005  01:48 PM           16,800 Force-c_63th.OUT
10/31/2005  01:48 PM            4,996 Force-c_72amax.OUT
10/31/2005  01:48 PM            8,400 Force-c_72ath.OUT
10/31/2005  01:48 PM           14,716 Force-c_72max.OUT
10/31/2005  01:48 PM           16,800 Force-c_72th.OUT
10/31/2005  01:48 PM            4,996 Force-c_81amax.OUT
10/31/2005  01:48 PM            8,400 Force-c_81ath.OUT
10/31/2005  01:48 PM           14,716 Force-c_81max.OUT
10/31/2005  01:48 PM           16,800 Force-c_81th.OUT
10/31/2005  01:48 PM            4,996 Force-c_90amax.OUT
10/31/2005  01:48 PM            8,400 Force-c_90ath.OUT
10/31/2005  01:48 PM           14,716 Force-c_90max.OUT
10/31/2005  01:48 PM           16,800 Force-c_90th.OUT
10/31/2005  01:48 PM            4,996 Force-c_99amax.OUT
10/31/2005  01:48 PM            8,400 Force-c_99ath.OUT
10/31/2005  01:48 PM           14,716 Force-c_99max.OUT
10/31/2005  01:48 PM           16,800 Force-c_99th.OUT
10/31/2005  01:48 PM            4,996 Force-c_9amax.OUT
10/31/2005  01:48 PM            8,528 Force-c_9ath.OUT
10/31/2005  01:48 PM           14,716 Force-c_9max.OUT
10/31/2005  01:48 PM           16,928 Force-c_9th.OUT
11/22/2005  11:54 AM          136,704 force-jb.xls
10/31/2005  01:49 PM            7,350 Force-jb_r10-th.OUT
10/31/2005  01:49 PM            5,239 Force-jb_r10_max.OUT
10/31/2005  01:49 PM            7,350 Force-jb_r11-th.OUT
10/31/2005  01:49 PM            5,239 Force-jb_r11_max.OUT
10/31/2005  01:48 PM            7,478 Force-jb_r2-th.OUT
10/31/2005  01:48 PM            5,239 Force-jb_r2_max.OUT
10/31/2005  01:48 PM            7,350 Force-jb_r3-th.OUT
10/31/2005  01:48 PM            5,239 Force-jb_r3_max.OUT
10/31/2005  01:48 PM            7,350 Force-jb_r4-th.OUT
10/31/2005  01:48 PM            5,239 Force-jb_r4_max.OUT
10/31/2005  01:48 PM            7,350 Force-jb_r5-th.OUT
10/31/2005  01:48 PM            5,239 Force-jb_r5_max.OUT
10/31/2005  01:48 PM            7,350 Force-jb_r6-th.OUT
10/31/2005  01:48 PM            5,239 Force-jb_r6_max.OUT
10/31/2005  01:49 PM            7,350 Force-jb_r7-th.OUT
10/31/2005  01:49 PM            5,239 Force-jb_r7_max.OUT
10/31/2005  01:49 PM            7,350 Force-jb_r8-th.OUT
10/31/2005  01:49 PM            5,239 Force-jb_r8_max.OUT
10/31/2005  01:49 PM            7,350 Force-jb_r9-th.OUT
10/31/2005  01:49 PM            5,239 Force-jb_r9_max.OUT
06/20/2005  10:53 AM              661 Force-j_bolt.txt
12/05/2005  11:30 AM          445,440 import_0-90.xls
12/05/2005  11:30 AM          445,440 import_99-180.xls
12/08/2005  10:21 AM           74,240 Insul-Contact_0-90.xls
12/08/2005  10:22 AM           74,240 Insul-Contact_99-180.xls
10/31/2005  01:49 PM            2,728 Insul-Cont_108max.OUT
10/31/2005  01:49 PM            3,360 Insul-Cont_108th.OUT
10/31/2005  01:49 PM            2,728 Insul-Cont_117max.OUT
10/31/2005  01:49 PM            3,360 Insul-Cont_117th.OUT
10/31/2005  01:49 PM            2,728 Insul-Cont_126max.OUT
10/31/2005  01:49 PM            3,360 Insul-Cont_126th.OUT
10/31/2005  01:49 PM            2,728 Insul-Cont_135max.OUT
10/31/2005  01:49 PM            3,360 Insul-Cont_135th.OUT
10/31/2005  01:49 PM            2,728 Insul-Cont_144max.OUT
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10/31/2005  01:49 PM            3,360 Insul-Cont_144th.OUT
10/31/2005  01:49 PM            2,728 Insul-Cont_153max.OUT
10/31/2005  01:49 PM            3,360 Insul-Cont_153th.OUT
10/31/2005  01:49 PM            2,728 Insul-Cont_162max.OUT
10/31/2005  01:49 PM            3,360 Insul-Cont_162th.OUT
10/31/2005  01:49 PM            2,728 Insul-Cont_171max.OUT
10/31/2005  01:49 PM            3,360 Insul-Cont_171th.OUT
10/31/2005  01:49 PM            2,728 Insul-Cont_180max.OUT
10/31/2005  01:49 PM            3,360 Insul-Cont_180th.OUT
10/31/2005  01:49 PM            2,728 Insul-Cont_18max.OUT
10/31/2005  01:49 PM            3,360 Insul-Cont_18th.OUT
10/31/2005  01:49 PM            2,728 Insul-Cont_27max.OUT
10/31/2005  01:49 PM            3,360 Insul-Cont_27th.OUT
10/31/2005  01:49 PM            2,728 Insul-Cont_36max.OUT
10/31/2005  01:49 PM            3,360 Insul-Cont_36th.OUT
10/31/2005  01:49 PM            2,728 Insul-Cont_45max.OUT
10/31/2005  01:49 PM            3,360 Insul-Cont_45th.OUT
10/31/2005  01:49 PM            2,728 Insul-Cont_54max.OUT
10/31/2005  01:49 PM            3,360 Insul-Cont_54th.OUT
10/31/2005  01:49 PM            2,728 Insul-Cont_63max.OUT
10/31/2005  01:49 PM            3,360 Insul-Cont_63th.OUT
10/31/2005  01:49 PM            2,728 Insul-Cont_72max.OUT
10/31/2005  01:49 PM            3,360 Insul-Cont_72th.OUT
10/31/2005  01:49 PM            2,728 Insul-Cont_81max.OUT
10/31/2005  01:49 PM            3,360 Insul-Cont_81th.OUT
10/31/2005  01:49 PM            2,728 Insul-Cont_90max.OUT
10/31/2005  01:49 PM            3,360 Insul-Cont_90th.OUT
10/31/2005  01:49 PM            2,728 Insul-Cont_99max.OUT
10/31/2005  01:49 PM            3,360 Insul-Cont_99th.OUT
10/31/2005  01:49 PM            2,728 Insul-Cont_9max.OUT
10/31/2005  01:49 PM            3,488 Insul-Cont_9th.OUT
09/01/2005  10:27 AM            1,664 Insulate.txt
10/13/2005  08:28 AM            4,031 interface-gap1.txt
09/09/2005  09:34 AM            2,616 interface1.txt
11/29/2005  12:43 PM           82,432 J-Bolt-Contact_0-90.xls
11/29/2005  12:44 PM           82,432 J-Bolt-Contact_99-180.xls
10/31/2005  01:49 PM            3,052 J-Bolt-Cont_108max.OUT
10/31/2005  01:49 PM            3,780 J-Bolt-Cont_108th.OUT
10/31/2005  01:49 PM            3,052 J-Bolt-Cont_117max.OUT
10/31/2005  01:49 PM            3,780 J-Bolt-Cont_117th.OUT
10/31/2005  01:49 PM            3,052 J-Bolt-Cont_126max.OUT
10/31/2005  01:49 PM            3,780 J-Bolt-Cont_126th.OUT
10/31/2005  01:49 PM            3,052 J-Bolt-Cont_135max.OUT
10/31/2005  01:49 PM            3,780 J-Bolt-Cont_135th.OUT
10/31/2005  01:49 PM            3,052 J-Bolt-Cont_144max.OUT
10/31/2005  01:49 PM            3,780 J-Bolt-Cont_144th.OUT
10/31/2005  01:49 PM            3,052 J-Bolt-Cont_153max.OUT
10/31/2005  01:49 PM            3,780 J-Bolt-Cont_153th.OUT
10/31/2005  01:49 PM            3,052 J-Bolt-Cont_162max.OUT
10/31/2005  01:49 PM            3,780 J-Bolt-Cont_162th.OUT
10/31/2005  01:49 PM            3,052 J-Bolt-Cont_171max.OUT
10/31/2005  01:49 PM            3,780 J-Bolt-Cont_171th.OUT
10/31/2005  01:49 PM            3,052 J-Bolt-Cont_180max.OUT
10/31/2005  01:49 PM            3,780 J-Bolt-Cont_180th.OUT
10/31/2005  01:49 PM            3,052 J-Bolt-Cont_18max.OUT
10/31/2005  01:49 PM            3,780 J-Bolt-Cont_18th.OUT
10/31/2005  01:49 PM            3,052 J-Bolt-Cont_27max.OUT
10/31/2005  01:49 PM            3,780 J-Bolt-Cont_27th.OUT
10/31/2005  01:49 PM            3,052 J-Bolt-Cont_36max.OUT
10/31/2005  01:49 PM            3,780 J-Bolt-Cont_36th.OUT
10/31/2005  01:49 PM            3,052 J-Bolt-Cont_45max.OUT
10/31/2005  01:49 PM            3,780 J-Bolt-Cont_45th.OUT
10/31/2005  01:49 PM            3,052 J-Bolt-Cont_54max.OUT
10/31/2005  01:49 PM            3,780 J-Bolt-Cont_54th.OUT
10/31/2005  01:49 PM            3,052 J-Bolt-Cont_63max.OUT
10/31/2005  01:49 PM            3,780 J-Bolt-Cont_63th.OUT
10/31/2005  01:49 PM            3,052 J-Bolt-Cont_72max.OUT
10/31/2005  01:49 PM            3,780 J-Bolt-Cont_72th.OUT
10/31/2005  01:49 PM            3,052 J-Bolt-Cont_81max.OUT
10/31/2005  01:49 PM            3,780 J-Bolt-Cont_81th.OUT
10/31/2005  01:49 PM            3,052 J-Bolt-Cont_90max.OUT
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10/31/2005  01:49 PM             3,780 J-Bolt-Cont_90th.OUT
10/31/2005  01:49 PM             3,052 J-Bolt-Cont_99max.OUT
10/31/2005  01:49 PM             3,780 J-Bolt-Cont_99th.OUT
10/31/2005  01:49 PM             3,052 J-Bolt-Cont_9max.OUT
10/31/2005  01:49 PM             3,908 J-Bolt-Cont_9th.OUT
11/22/2005  10:34 AM           158,208 liner-strain-comp_0-90b.xls
11/22/2005  10:35 AM           158,208 liner-strain-comp_0-90m.xls
11/22/2005  10:35 AM           158,208 liner-strain-comp_0-90t.xls
11/22/2005  10:35 AM           158,208 liner-strain-comp_99-180b.xls
11/22/2005  10:35 AM           158,208 liner-strain-comp_99-180m.xls
11/22/2005  10:35 AM           158,208 liner-strain-comp_99-180t.xls
06/01/2005  01:17 PM             1,708 Liner.txt
05/02/2005  02:19 PM               667 live_load.txt
09/28/2005  07:08 AM             6,183 Near-Soil-1.txt
04/20/2005  01:14 PM               508 outer-spar.txt
10/31/2005  01:48 PM             2,998 PNNL-2D-NL-AY-UBS-BEC.BCS
10/31/2005  01:48 PM        55,508,992 PNNL-2D-NL-AY-UBS-BEC.db
10/31/2005  01:46 PM        55,508,992 PNNL-2D-NL-AY-UBS-BEC.dbb
10/31/2005  01:48 PM        12,386,304 PNNL-2D-NL-AY-UBS-BEC.emat
12/16/2005  01:14 PM            41,918 PNNL-2D-NL-AY-UBS-BEC.err
10/31/2005  01:48 PM       102,563,840 PNNL-2D-NL-AY-UBS-BEC.esav
10/31/2005  01:48 PM        27,852,800 PNNL-2D-NL-AY-UBS-BEC.full
10/31/2005  01:46 PM           437,553 PNNL-2D-NL-AY-UBS-BEC.ldhi
12/16/2005  01:25 PM             3,654 PNNL-2D-NL-AY-UBS-BEC.log
10/31/2005  01:48 PM             1,559 PNNL-2D-NL-AY-UBS-BEC.mntr
10/31/2005  01:46 PM       102,563,840 PNNL-2D-NL-AY-UBS-BEC.osav
10/31/2005  01:47 PM             1,411 PNNL-2D-NL-AY-UBS-BEC.PVTS
10/31/2005  01:48 PM       103,546,880 PNNL-2D-NL-AY-UBS-BEC.r001
10/31/2005  01:32 PM        35,782,656 PNNL-2D-NL-AY-UBS-BEC.rdb
10/31/2005  01:48 PM        57,671,680 PNNL-2D-NL-AY-UBS-BEC.rst
10/31/2005  12:48 PM             2,998 PNNL-2D-UBS-BEC.BCS
10/31/2005  12:50 PM        35,913,728 PNNL-2D-UBS-BEC.db
10/31/2005  12:48 PM        55,771,136 PNNL-2D-UBS-BEC.dbb
10/31/2005  12:48 PM        12,386,304 PNNL-2D-UBS-BEC.emat
12/01/2005  09:37 AM            42,821 PNNL-2D-UBS-BEC.err
10/31/2005  12:48 PM       102,563,840 PNNL-2D-UBS-BEC.esav
10/31/2005  12:48 PM        27,852,800 PNNL-2D-UBS-BEC.full
10/31/2005  12:46 PM           912,753 PNNL-2D-UBS-BEC.ldhi
12/01/2005  09:37 AM            16,100 PNNL-2D-UBS-BEC.log
10/31/2005  12:48 PM             1,559 PNNL-2D-UBS-BEC.mntr
10/31/2005  12:46 PM       102,563,840 PNNL-2D-UBS-BEC.osav
10/31/2005  12:47 PM               451 PNNL-2D-UBS-BEC.PVTS
10/31/2005  12:48 PM       103,546,880 PNNL-2D-UBS-BEC.r001
10/31/2005  12:31 PM        35,979,264 PNNL-2D-UBS-BEC.rdb
10/31/2005  12:48 PM        57,671,680 PNNL-2D-UBS-BEC.rst
10/31/2005  01:48 PM            70,342 PNNL-AY-2D-NL-BEC-UBS-Gravity.out
11/22/2005  12:41 PM            74,240 Primary-Contact_0-90.xls
11/22/2005  12:42 PM            74,240 Primary-Contact_99-180.xls
10/31/2005  01:49 PM             2,728 Primary-Cont_108max.OUT
10/31/2005  01:49 PM             3,360 Primary-Cont_108th.OUT
10/31/2005  01:49 PM             2,728 Primary-Cont_117max.OUT
10/31/2005  01:49 PM             3,360 Primary-Cont_117th.OUT
10/31/2005  01:49 PM             2,728 Primary-Cont_126max.OUT
10/31/2005  01:49 PM             3,360 Primary-Cont_126th.OUT
10/31/2005  01:49 PM             2,728 Primary-Cont_135max.OUT
10/31/2005  01:49 PM             3,360 Primary-Cont_135th.OUT
10/31/2005  01:49 PM             2,728 Primary-Cont_144max.OUT
10/31/2005  01:49 PM             3,360 Primary-Cont_144th.OUT
10/31/2005  01:49 PM             2,728 Primary-Cont_153max.OUT
10/31/2005  01:49 PM             3,360 Primary-Cont_153th.OUT
10/31/2005  01:49 PM             2,728 Primary-Cont_162max.OUT
10/31/2005  01:49 PM             3,360 Primary-Cont_162th.OUT
10/31/2005  01:49 PM             2,728 Primary-Cont_171max.OUT
10/31/2005  01:49 PM             3,360 Primary-Cont_171th.OUT
10/31/2005  01:49 PM             2,728 Primary-Cont_180max.OUT
10/31/2005  01:49 PM             3,360 Primary-Cont_180th.OUT
10/31/2005  01:49 PM             2,728 Primary-Cont_18max.OUT
10/31/2005  01:49 PM             3,360 Primary-Cont_18th.OUT
10/31/2005  01:49 PM             2,728 Primary-Cont_27max.OUT
10/31/2005  01:49 PM             3,360 Primary-Cont_27th.OUT
10/31/2005  01:49 PM             2,728 Primary-Cont_36max.OUT
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10/31/2005  01:49 PM            3,360 Primary-Cont_36th.OUT
10/31/2005  01:49 PM            2,728 Primary-Cont_45max.OUT
10/31/2005  01:49 PM            3,360 Primary-Cont_45th.OUT
10/31/2005  01:49 PM            2,728 Primary-Cont_54max.OUT
10/31/2005  01:49 PM            3,360 Primary-Cont_54th.OUT
10/31/2005  01:49 PM            2,728 Primary-Cont_63max.OUT
10/31/2005  01:49 PM            3,360 Primary-Cont_63th.OUT
10/31/2005  01:49 PM            2,728 Primary-Cont_72max.OUT
10/31/2005  01:49 PM            3,360 Primary-Cont_72th.OUT
10/31/2005  01:49 PM            2,728 Primary-Cont_81max.OUT
10/31/2005  01:49 PM            3,360 Primary-Cont_81th.OUT
10/31/2005  01:49 PM            2,728 Primary-Cont_90max.OUT
10/31/2005  01:49 PM            3,360 Primary-Cont_90th.OUT
10/31/2005  01:49 PM            2,728 Primary-Cont_99max.OUT
10/31/2005  01:49 PM            3,360 Primary-Cont_99th.OUT
10/31/2005  01:49 PM            2,728 Primary-Cont_9max.OUT
10/31/2005  01:49 PM            3,488 Primary-Cont_9th.OUT
10/31/2005  12:18 PM            5,549 Primary-Props-AY.txt
09/27/2005  03:52 PM            1,538 Primary.txt
10/31/2005  01:32 PM          385,204 QA.out
10/14/2005  11:18 AM           40,851 RS-OUT-Concrete.txt
10/31/2005  10:31 AM            1,108 RS_FREQ.txt
10/31/2005  01:31 PM            1,971 Run-Tank.txt
12/16/2005  01:14 PM                0 scratch.hlp
12/02/2005  11:38 AM              595 Shortcut to PNNL-2D-NL-AY-UBS-BEC-Gravity.lnk
02/11/2005  01:22 PM            1,053 Slave.txt
11/28/2005  03:14 PM            9,896 Soil-Contact_108max.OUT
11/28/2005  03:14 PM           13,160 Soil-Contact_108th.OUT
11/28/2005  03:14 PM            9,896 Soil-Contact_117max.OUT
11/28/2005  03:14 PM           13,160 Soil-Contact_117th.OUT
11/28/2005  03:14 PM            9,896 Soil-Contact_126max.OUT
11/28/2005  03:14 PM           13,160 Soil-Contact_126th.OUT
11/28/2005  03:14 PM            9,896 Soil-Contact_135max.OUT
11/28/2005  03:14 PM           13,160 Soil-Contact_135th.OUT
11/28/2005  03:14 PM            9,896 Soil-Contact_144max.OUT
11/28/2005  03:14 PM           13,160 Soil-Contact_144th.OUT
11/28/2005  03:14 PM            9,896 Soil-Contact_153max.OUT
11/28/2005  03:14 PM           13,160 Soil-Contact_153th.OUT
11/28/2005  03:14 PM            9,896 Soil-Contact_162max.OUT
11/28/2005  03:14 PM           13,160 Soil-Contact_162th.OUT
11/28/2005  03:14 PM            9,896 Soil-Contact_171max.OUT
11/28/2005  03:14 PM           13,160 Soil-Contact_171th.OUT
11/28/2005  03:14 PM            9,896 Soil-Contact_180max.OUT
11/28/2005  03:14 PM           13,160 Soil-Contact_180th.OUT
11/28/2005  03:14 PM            9,896 Soil-Contact_18max.OUT
11/28/2005  03:14 PM           13,160 Soil-Contact_18th.OUT
11/28/2005  03:14 PM            9,896 Soil-Contact_27max.OUT
11/28/2005  03:14 PM           13,160 Soil-Contact_27th.OUT
11/28/2005  03:14 PM            9,896 Soil-Contact_36max.OUT
11/28/2005  03:14 PM           13,160 Soil-Contact_36th.OUT
11/28/2005  03:14 PM            9,896 Soil-Contact_45max.OUT
11/28/2005  03:14 PM           13,160 Soil-Contact_45th.OUT
11/28/2005  03:14 PM            9,896 Soil-Contact_54max.OUT
11/28/2005  03:14 PM           13,160 Soil-Contact_54th.OUT
11/28/2005  03:14 PM            9,896 Soil-Contact_63max.OUT
11/28/2005  03:14 PM           13,160 Soil-Contact_63th.OUT
11/28/2005  03:14 PM            9,896 Soil-Contact_72max.OUT
11/28/2005  03:14 PM           13,160 Soil-Contact_72th.OUT
11/28/2005  03:14 PM            9,896 Soil-Contact_81max.OUT
11/28/2005  03:14 PM           13,160 Soil-Contact_81th.OUT
11/28/2005  03:14 PM            9,896 Soil-Contact_90max.OUT
11/28/2005  03:14 PM           13,160 Soil-Contact_90th.OUT
11/28/2005  03:14 PM            9,896 Soil-Contact_99max.OUT
11/28/2005  03:14 PM           13,160 Soil-Contact_99th.OUT
11/28/2005  03:14 PM            9,896 Soil-Contact_9max.OUT
11/28/2005  03:14 PM           13,288 Soil-Contact_9th.OUT
10/13/2005  08:19 AM            5,016 Soil-Prop-UB-Geo.txt
10/31/2005  01:51 PM          223,744 soil_0-90.xls
10/31/2005  01:51 PM          223,744 soil_99-180.xls
10/31/2005  01:30 PM            1,917 Solve-Gravity-UB.txt
10/31/2005  12:21 PM            1,934 Solve-TH-UB.txt
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10/31/2005  11:02 AM             3,363 spectra-conc-0.txt
10/14/2005  11:18 AM             2,061 spectra-concrete.txt
10/31/2005  10:17 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
10/31/2005  01:54 PM           354,816 str-comp_0-90b.xls
10/31/2005  01:54 PM           358,912 str-comp_0-90m.xls
10/31/2005  01:54 PM           352,768 str-comp_0-90t.xls
10/31/2005  01:55 PM           354,816 str-comp_99-180b.xls
10/31/2005  01:55 PM           358,400 str-comp_99-180m.xls
10/31/2005  01:55 PM           352,768 str-comp_99-180t.xls
09/02/2005  08:51 AM               707 strain-compb.txt
09/02/2005  08:51 AM               705 strain-compm.txt
09/02/2005  08:50 AM               720 strain-compt.txt
10/31/2005  01:49 PM             6,110 Strain-lb_108max-b.OUT
10/31/2005  01:49 PM             8,134 Strain-lb_108th-b.OUT
10/31/2005  01:49 PM             6,110 Strain-lb_117max-b.OUT
10/31/2005  01:49 PM             8,134 Strain-lb_117th-b.OUT
10/31/2005  01:49 PM             6,110 Strain-lb_126max-b.OUT
10/31/2005  01:49 PM             8,134 Strain-lb_126th-b.OUT
10/31/2005  01:49 PM             6,110 Strain-lb_135max-b.OUT
10/31/2005  01:49 PM             8,134 Strain-lb_135th-b.OUT
10/31/2005  01:49 PM             6,110 Strain-lb_144max-b.OUT
10/31/2005  01:49 PM             8,134 Strain-lb_144th-b.OUT
10/31/2005  01:49 PM             6,110 Strain-lb_153max-b.OUT
10/31/2005  01:49 PM             8,134 Strain-lb_153th-b.OUT
10/31/2005  01:49 PM             6,110 Strain-lb_162max-b.OUT
10/31/2005  01:49 PM             8,134 Strain-lb_162th-b.OUT
10/31/2005  01:49 PM             6,110 Strain-lb_171max-b.OUT
10/31/2005  01:49 PM             8,134 Strain-lb_171th-b.OUT
10/31/2005  01:49 PM             6,110 Strain-lb_180max-b.OUT
10/31/2005  01:49 PM             8,134 Strain-lb_180th-b.OUT
10/31/2005  01:49 PM             6,110 Strain-lb_18max-b.OUT
10/31/2005  01:49 PM             8,134 Strain-lb_18th-b.OUT
10/31/2005  01:49 PM             6,110 Strain-lb_27max-b.OUT
10/31/2005  01:49 PM             8,134 Strain-lb_27th-b.OUT
10/31/2005  01:49 PM             6,110 Strain-lb_36max-b.OUT
10/31/2005  01:49 PM             8,134 Strain-lb_36th-b.OUT
10/31/2005  01:49 PM             6,110 Strain-lb_45max-b.OUT
10/31/2005  01:49 PM             8,134 Strain-lb_45th-b.OUT
10/31/2005  01:49 PM             6,110 Strain-lb_54max-b.OUT
10/31/2005  01:49 PM             8,134 Strain-lb_54th-b.OUT
10/31/2005  01:49 PM             6,110 Strain-lb_63max-b.OUT
10/31/2005  01:49 PM             8,134 Strain-lb_63th-b.OUT
10/31/2005  01:49 PM             6,110 Strain-lb_72max-b.OUT
10/31/2005  01:49 PM             8,134 Strain-lb_72th-b.OUT
10/31/2005  01:49 PM             6,110 Strain-lb_81max-b.OUT
10/31/2005  01:49 PM             8,134 Strain-lb_81th-b.OUT
10/31/2005  01:49 PM             6,110 Strain-lb_90max-b.OUT
10/31/2005  01:49 PM             8,134 Strain-lb_90th-b.OUT
10/31/2005  01:49 PM             6,110 Strain-lb_99max-b.OUT
10/31/2005  01:49 PM             8,134 Strain-lb_99th-b.OUT
10/31/2005  01:49 PM             6,110 Strain-lb_9max-b.OUT
10/31/2005  01:49 PM             8,262 Strain-lb_9th-b.OUT
09/02/2005  08:52 AM               544 Strain-Liner.txt
10/31/2005  01:49 PM             6,110 Strain-lm_108max-m.OUT
10/31/2005  01:49 PM             8,134 Strain-lm_108th-m.OUT
10/31/2005  01:49 PM             6,110 Strain-lm_117max-m.OUT
10/31/2005  01:49 PM             8,134 Strain-lm_117th-m.OUT
10/31/2005  01:49 PM             6,110 Strain-lm_126max-m.OUT
10/31/2005  01:49 PM             8,134 Strain-lm_126th-m.OUT
10/31/2005  01:49 PM             6,110 Strain-lm_135max-m.OUT
10/31/2005  01:49 PM             8,134 Strain-lm_135th-m.OUT
10/31/2005  01:49 PM             6,110 Strain-lm_144max-m.OUT
10/31/2005  01:49 PM             8,134 Strain-lm_144th-m.OUT
10/31/2005  01:49 PM             6,110 Strain-lm_153max-m.OUT
10/31/2005  01:49 PM             8,134 Strain-lm_153th-m.OUT
10/31/2005  01:49 PM             6,110 Strain-lm_162max-m.OUT
10/31/2005  01:49 PM             8,134 Strain-lm_162th-m.OUT
10/31/2005  01:49 PM             6,110 Strain-lm_171max-m.OUT
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10/31/2005  01:49 PM             8,134 Strain-lm_171th-m.OUT
10/31/2005  01:49 PM             6,110 Strain-lm_180max-m.OUT
10/31/2005  01:49 PM             8,134 Strain-lm_180th-m.OUT
10/31/2005  01:49 PM             6,110 Strain-lm_18max-m.OUT
10/31/2005  01:49 PM             8,134 Strain-lm_18th-m.OUT
10/31/2005  01:49 PM             6,110 Strain-lm_27max-m.OUT
10/31/2005  01:49 PM             8,134 Strain-lm_27th-m.OUT
10/31/2005  01:49 PM             6,110 Strain-lm_36max-m.OUT
10/31/2005  01:49 PM             8,134 Strain-lm_36th-m.OUT
10/31/2005  01:49 PM             6,110 Strain-lm_45max-m.OUT
10/31/2005  01:49 PM             8,134 Strain-lm_45th-m.OUT
10/31/2005  01:49 PM             6,110 Strain-lm_54max-m.OUT
10/31/2005  01:49 PM             8,134 Strain-lm_54th-m.OUT
10/31/2005  01:49 PM             6,110 Strain-lm_63max-m.OUT
10/31/2005  01:49 PM             8,134 Strain-lm_63th-m.OUT
10/31/2005  01:49 PM             6,110 Strain-lm_72max-m.OUT
10/31/2005  01:49 PM             8,134 Strain-lm_72th-m.OUT
10/31/2005  01:49 PM             6,110 Strain-lm_81max-m.OUT
10/31/2005  01:49 PM             8,134 Strain-lm_81th-m.OUT
10/31/2005  01:49 PM             6,110 Strain-lm_90max-m.OUT
10/31/2005  01:49 PM             8,134 Strain-lm_90th-m.OUT
10/31/2005  01:49 PM             6,110 Strain-lm_99max-m.OUT
10/31/2005  01:49 PM             8,134 Strain-lm_99th-m.OUT
10/31/2005  01:49 PM             6,110 Strain-lm_9max-m.OUT
10/31/2005  01:49 PM             8,262 Strain-lm_9th-m.OUT
10/31/2005  01:49 PM             6,110 Strain-lt_108max-t.OUT
10/31/2005  01:49 PM             8,134 Strain-lt_108th-t.OUT
10/31/2005  01:49 PM             6,110 Strain-lt_117max-t.OUT
10/31/2005  01:49 PM             8,134 Strain-lt_117th-t.OUT
10/31/2005  01:49 PM             6,110 Strain-lt_126max-t.OUT
10/31/2005  01:49 PM             8,134 Strain-lt_126th-t.OUT
10/31/2005  01:49 PM             6,110 Strain-lt_135max-t.OUT
10/31/2005  01:49 PM             8,134 Strain-lt_135th-t.OUT
10/31/2005  01:49 PM             6,110 Strain-lt_144max-t.OUT
10/31/2005  01:49 PM             8,134 Strain-lt_144th-t.OUT
10/31/2005  01:49 PM             6,110 Strain-lt_153max-t.OUT
10/31/2005  01:49 PM             8,134 Strain-lt_153th-t.OUT
10/31/2005  01:49 PM             6,110 Strain-lt_162max-t.OUT
10/31/2005  01:49 PM             8,134 Strain-lt_162th-t.OUT
10/31/2005  01:49 PM             6,110 Strain-lt_171max-t.OUT
10/31/2005  01:49 PM             8,134 Strain-lt_171th-t.OUT
10/31/2005  01:49 PM             6,110 Strain-lt_180max-t.OUT
10/31/2005  01:49 PM             8,134 Strain-lt_180th-t.OUT
10/31/2005  01:49 PM             6,110 Strain-lt_18max-t.OUT
10/31/2005  01:49 PM             8,134 Strain-lt_18th-t.OUT
10/31/2005  01:49 PM             6,110 Strain-lt_27max-t.OUT
10/31/2005  01:49 PM             8,134 Strain-lt_27th-t.OUT
10/31/2005  01:49 PM             6,110 Strain-lt_36max-t.OUT
10/31/2005  01:49 PM             8,134 Strain-lt_36th-t.OUT
10/31/2005  01:49 PM             6,110 Strain-lt_45max-t.OUT
10/31/2005  01:49 PM             8,134 Strain-lt_45th-t.OUT
10/31/2005  01:49 PM             6,110 Strain-lt_54max-t.OUT
10/31/2005  01:49 PM             8,134 Strain-lt_54th-t.OUT
10/31/2005  01:49 PM             6,110 Strain-lt_63max-t.OUT
10/31/2005  01:49 PM             8,134 Strain-lt_63th-t.OUT
10/31/2005  01:49 PM             6,110 Strain-lt_72max-t.OUT
10/31/2005  01:49 PM             8,134 Strain-lt_72th-t.OUT
10/31/2005  01:49 PM             6,110 Strain-lt_81max-t.OUT
10/31/2005  01:49 PM             8,134 Strain-lt_81th-t.OUT
10/31/2005  01:49 PM             6,110 Strain-lt_90max-t.OUT
10/31/2005  01:49 PM             8,134 Strain-lt_90th-t.OUT
10/31/2005  01:49 PM             6,110 Strain-lt_99max-t.OUT
10/31/2005  01:49 PM             8,134 Strain-lt_99th-t.OUT
10/31/2005  01:49 PM             6,110 Strain-lt_9max-t.OUT
10/31/2005  01:49 PM             8,262 Strain-lt_9th-t.OUT
09/08/2005  10:18 AM               692 stress-compb.txt
09/08/2005  10:18 AM               692 stress-compm.txt
09/08/2005  09:20 AM               692 stress-compt.txt
04/13/2005  07:38 AM               205 Stress-Primary.txt
10/31/2005  01:48 PM            16,291 Stress-pt_108max-b.OUT
10/31/2005  01:48 PM            16,291 Stress-pt_108max-m.OUT
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10/31/2005  01:48 PM            16,210 Stress-pt_108max-t.OUT
10/31/2005  01:48 PM            21,714 Stress-pt_108th-b.OUT
10/31/2005  01:48 PM            21,714 Stress-pt_108th-m.OUT
10/31/2005  01:48 PM            21,630 Stress-pt_108th-t.OUT
10/31/2005  01:48 PM            16,291 Stress-pt_117max-b.OUT
10/31/2005  01:48 PM            16,291 Stress-pt_117max-m.OUT
10/31/2005  01:48 PM            16,210 Stress-pt_117max-t.OUT
10/31/2005  01:48 PM            21,714 Stress-pt_117th-b.OUT
10/31/2005  01:48 PM            21,714 Stress-pt_117th-m.OUT
10/31/2005  01:48 PM            21,630 Stress-pt_117th-t.OUT
10/31/2005  01:48 PM            16,291 Stress-pt_126max-b.OUT
10/31/2005  01:48 PM            16,291 Stress-pt_126max-m.OUT
10/31/2005  01:48 PM            16,210 Stress-pt_126max-t.OUT
10/31/2005  01:48 PM            21,714 Stress-pt_126th-b.OUT
10/31/2005  01:48 PM            21,714 Stress-pt_126th-m.OUT
10/31/2005  01:48 PM            21,630 Stress-pt_126th-t.OUT
10/31/2005  01:48 PM            16,291 Stress-pt_135max-b.OUT
10/31/2005  01:48 PM            16,291 Stress-pt_135max-m.OUT
10/31/2005  01:48 PM            16,210 Stress-pt_135max-t.OUT
10/31/2005  01:48 PM            21,714 Stress-pt_135th-b.OUT
10/31/2005  01:48 PM            21,714 Stress-pt_135th-m.OUT
10/31/2005  01:48 PM            21,630 Stress-pt_135th-t.OUT
10/31/2005  01:48 PM            16,291 Stress-pt_144max-b.OUT
10/31/2005  01:48 PM            16,291 Stress-pt_144max-m.OUT
10/31/2005  01:48 PM            16,210 Stress-pt_144max-t.OUT
10/31/2005  01:48 PM            21,714 Stress-pt_144th-b.OUT
10/31/2005  01:48 PM            21,714 Stress-pt_144th-m.OUT
10/31/2005  01:48 PM            21,630 Stress-pt_144th-t.OUT
10/31/2005  01:48 PM            16,291 Stress-pt_153max-b.OUT
10/31/2005  01:48 PM            16,291 Stress-pt_153max-m.OUT
10/31/2005  01:48 PM            16,210 Stress-pt_153max-t.OUT
10/31/2005  01:48 PM            21,714 Stress-pt_153th-b.OUT
10/31/2005  01:48 PM            21,714 Stress-pt_153th-m.OUT
10/31/2005  01:48 PM            21,630 Stress-pt_153th-t.OUT
10/31/2005  01:48 PM            16,291 Stress-pt_162max-b.OUT
10/31/2005  01:48 PM            16,291 Stress-pt_162max-m.OUT
10/31/2005  01:48 PM            16,210 Stress-pt_162max-t.OUT
10/31/2005  01:48 PM            21,714 Stress-pt_162th-b.OUT
10/31/2005  01:48 PM            21,714 Stress-pt_162th-m.OUT
10/31/2005  01:48 PM            21,630 Stress-pt_162th-t.OUT
10/31/2005  01:48 PM            16,295 Stress-pt_171max-b.OUT
10/31/2005  01:48 PM            16,295 Stress-pt_171max-m.OUT
10/31/2005  01:48 PM            16,214 Stress-pt_171max-t.OUT
10/31/2005  01:48 PM            21,714 Stress-pt_171th-b.OUT
10/31/2005  01:48 PM            21,714 Stress-pt_171th-m.OUT
10/31/2005  01:48 PM            21,630 Stress-pt_171th-t.OUT
10/31/2005  01:48 PM            16,295 Stress-pt_180max-b.OUT
10/31/2005  01:48 PM            16,295 Stress-pt_180max-m.OUT
10/31/2005  01:48 PM            16,214 Stress-pt_180max-t.OUT
10/31/2005  01:48 PM            21,714 Stress-pt_180th-b.OUT
10/31/2005  01:48 PM            21,714 Stress-pt_180th-m.OUT
10/31/2005  01:48 PM            21,630 Stress-pt_180th-t.OUT
10/31/2005  01:48 PM            16,291 Stress-pt_18max-b.OUT
10/31/2005  01:48 PM            16,291 Stress-pt_18max-m.OUT
10/31/2005  01:48 PM            16,210 Stress-pt_18max-t.OUT
10/31/2005  01:48 PM            21,714 Stress-pt_18th-b.OUT
10/31/2005  01:48 PM            21,714 Stress-pt_18th-m.OUT
10/31/2005  01:48 PM            21,630 Stress-pt_18th-t.OUT
10/31/2005  01:48 PM            16,291 Stress-pt_27max-b.OUT
10/31/2005  01:48 PM            16,291 Stress-pt_27max-m.OUT
10/31/2005  01:48 PM            16,210 Stress-pt_27max-t.OUT
10/31/2005  01:48 PM            21,714 Stress-pt_27th-b.OUT
10/31/2005  01:48 PM            21,714 Stress-pt_27th-m.OUT
10/31/2005  01:48 PM            21,630 Stress-pt_27th-t.OUT
10/31/2005  01:48 PM            16,291 Stress-pt_36max-b.OUT
10/31/2005  01:48 PM            16,291 Stress-pt_36max-m.OUT
10/31/2005  01:48 PM            16,210 Stress-pt_36max-t.OUT
10/31/2005  01:48 PM            21,714 Stress-pt_36th-b.OUT
10/31/2005  01:48 PM            21,714 Stress-pt_36th-m.OUT
10/31/2005  01:48 PM            21,630 Stress-pt_36th-t.OUT
10/31/2005  01:48 PM            16,291 Stress-pt_45max-b.OUT
```

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10/31/2005  01:48 PM            16,291 Stress-pt_45max-m.OUT
10/31/2005  01:48 PM            16,210 Stress-pt_45max-t.OUT
10/31/2005  01:48 PM            21,714 Stress-pt_45th-b.OUT
10/31/2005  01:48 PM            21,714 Stress-pt_45th-m.OUT
10/31/2005  01:48 PM            21,630 Stress-pt_45th-t.OUT
10/31/2005  01:48 PM            16,291 Stress-pt_54max-b.OUT
10/31/2005  01:48 PM            16,291 Stress-pt_54max-m.OUT
10/31/2005  01:48 PM            16,210 Stress-pt_54max-t.OUT
10/31/2005  01:48 PM            21,714 Stress-pt_54th-b.OUT
10/31/2005  01:48 PM            21,714 Stress-pt_54th-m.OUT
10/31/2005  01:48 PM            21,630 Stress-pt_54th-t.OUT
10/31/2005  01:48 PM            16,291 Stress-pt_63max-b.OUT
10/31/2005  01:48 PM            16,291 Stress-pt_63max-m.OUT
10/31/2005  01:48 PM            16,210 Stress-pt_63max-t.OUT
10/31/2005  01:48 PM            21,714 Stress-pt_63th-b.OUT
10/31/2005  01:48 PM            21,714 Stress-pt_63th-m.OUT
10/31/2005  01:48 PM            21,630 Stress-pt_63th-t.OUT
10/31/2005  01:48 PM            16,291 Stress-pt_72max-b.OUT
10/31/2005  01:48 PM            16,291 Stress-pt_72max-m.OUT
10/31/2005  01:48 PM            16,210 Stress-pt_72max-t.OUT
10/31/2005  01:48 PM            21,714 Stress-pt_72th-b.OUT
10/31/2005  01:48 PM            21,714 Stress-pt_72th-m.OUT
10/31/2005  01:48 PM            21,630 Stress-pt_72th-t.OUT
10/31/2005  01:48 PM            16,291 Stress-pt_81max-b.OUT
10/31/2005  01:48 PM            16,291 Stress-pt_81max-m.OUT
10/31/2005  01:48 PM            16,210 Stress-pt_81max-t.OUT
10/31/2005  01:48 PM            21,714 Stress-pt_81th-b.OUT
10/31/2005  01:48 PM            21,714 Stress-pt_81th-m.OUT
10/31/2005  01:48 PM            21,630 Stress-pt_81th-t.OUT
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10/31/2005  01:48 PM            16,291 Stress-pt_90max-m.OUT
10/31/2005  01:48 PM            16,210 Stress-pt_90max-t.OUT
10/31/2005  01:48 PM            21,714 Stress-pt_90th-b.OUT
10/31/2005  01:48 PM            21,714 Stress-pt_90th-m.OUT
10/31/2005  01:48 PM            21,630 Stress-pt_90th-t.OUT
10/31/2005  01:48 PM            16,291 Stress-pt_99max-b.OUT
10/31/2005  01:48 PM            16,291 Stress-pt_99max-m.OUT
10/31/2005  01:48 PM            16,210 Stress-pt_99max-t.OUT
10/31/2005  01:48 PM            21,714 Stress-pt_99th-b.OUT
10/31/2005  01:48 PM            21,714 Stress-pt_99th-m.OUT
10/31/2005  01:48 PM            21,630 Stress-pt_99th-t.OUT
10/31/2005  01:48 PM            16,291 Stress-pt_9max-b.OUT
10/31/2005  01:48 PM            16,291 Stress-pt_9max-m.OUT
10/31/2005  01:48 PM            16,210 Stress-pt_9max-t.OUT
10/31/2005  01:48 PM            21,842 Stress-pt_9th-b.OUT
10/31/2005  01:48 PM            21,842 Stress-pt_9th-m.OUT
10/31/2005  01:48 PM            21,758 Stress-pt_9th-t.OUT
10/31/2005  12:13 PM             3,825 Tank-Coordinates-AY.txt
05/25/2005  03:32 PM             2,512 Tank-Mesh1.txt
10/31/2005  01:31 PM               102 tank-out.out
02/25/2005  02:24 PM             5,406 Tank-Props-BEC-250.txt
10/31/2005  01:32 PM             4,697 Tank-th.out
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
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10/31/2005  01:49 PM             8,820 Waste-Cont_108th.OUT
10/31/2005  01:49 PM             8,236 Waste-Cont_117max.OUT
10/31/2005  01:49 PM             8,820 Waste-Cont_117th.OUT
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10/31/2005  01:49 PM             8,820 Waste-Cont_126th.OUT
10/31/2005  01:49 PM             8,236 Waste-Cont_135max.OUT
10/31/2005  01:49 PM             8,820 Waste-Cont_135th.OUT
10/31/2005  01:49 PM             8,236 Waste-Cont_144max.OUT
10/31/2005  01:49 PM             8,820 Waste-Cont_144th.OUT
10/31/2005  01:49 PM             8,236 Waste-Cont_153max.OUT
10/31/2005  01:49 PM             8,820 Waste-Cont_153th.OUT
10/31/2005  01:49 PM             8,236 Waste-Cont_162max.OUT
10/31/2005  01:49 PM             8,820 Waste-Cont_162th.OUT
10/31/2005  01:49 PM             8,236 Waste-Cont_171max.OUT
10/31/2005  01:49 PM             8,820 Waste-Cont_171th.OUT
10/31/2005  01:49 PM             8,236 Waste-Cont_180max.OUT
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10/31/2005  01:49 PM             8,820 Waste-Cont_180th.OUT
10/31/2005  01:49 PM             8,236 Waste-Cont_18max.OUT
10/31/2005  01:49 PM             8,820 Waste-Cont_18th.OUT
10/31/2005  01:49 PM             8,236 Waste-Cont_27max.OUT
10/31/2005  01:49 PM             8,820 Waste-Cont_27th.OUT
10/31/2005  01:49 PM             8,236 Waste-Cont_36max.OUT
10/31/2005  01:49 PM             8,820 Waste-Cont_36th.OUT
10/31/2005  01:49 PM             8,236 Waste-Cont_45max.OUT
10/31/2005  01:49 PM             8,820 Waste-Cont_45th.OUT
10/31/2005  01:49 PM             8,236 Waste-Cont_54max.OUT
10/31/2005  01:49 PM             8,820 Waste-Cont_54th.OUT
10/31/2005  01:49 PM             8,236 Waste-Cont_63max.OUT
10/31/2005  01:49 PM             8,820 Waste-Cont_63th.OUT
10/31/2005  01:49 PM             8,236 Waste-Cont_72max.OUT
10/31/2005  01:49 PM             8,820 Waste-Cont_72th.OUT
10/31/2005  01:49 PM             8,236 Waste-Cont_81max.OUT
10/31/2005  01:49 PM             8,820 Waste-Cont_81th.OUT
10/31/2005  01:49 PM             8,236 Waste-Cont_90max.OUT
10/31/2005  01:49 PM             8,820 Waste-Cont_90th.OUT
10/31/2005  01:49 PM             8,236 Waste-Cont_99max.OUT
10/31/2005  01:49 PM             8,820 Waste-Cont_99th.OUT
10/31/2005  01:49 PM             8,236 Waste-Cont_9max.OUT
10/31/2005  01:49 PM             8,948 Waste-Cont_9th.OUT
10/31/2005  11:46 AM               328 Waste-Reaction.txt
10/31/2005  12:01 PM             3,265 Waste-solid-AY.txt
             667 File(s)  1,129,934,300 bytes
               2 Dir(s)  78,397,296,640 bytes free
```

Prepared by: F.G. Abatt M&D Professional Services 12/12/05 Rev. 3	Theoretical Fluid Response for Simplified AY Flexible Wall Tank at 422 in. Waste Level, Upper Bound Soil	Checked by: B.G. Carpenter M&D Professional Services 1/10/06

$H_l := 422 \cdot in$ Baseline waste level as modeled in ANSYS

$H_t := 460 \cdot in$ Height to primary tank tangent line

$\frac{H_l}{H_t} = 0.92$ Ratio of waste height to tank height

$g := 386.4 \cdot \frac{in}{sec^2}$

$R := 450 \cdot in$ Tank radius

$\frac{H_l}{R} = 0.94$ Ratio of waste height to tank radius

$i := 0..2$

$\lambda := \begin{pmatrix} 1.841 \\ 5.331 \\ 8.536 \end{pmatrix}$ Bessel function roots

$\theta := \begin{pmatrix} 0 \cdot deg \\ 45 \cdot deg \\ 90 \cdot deg \end{pmatrix}$ Circumferential location of waste elements for which pressures are reported

Convective Frequencies

$fcon_i := \frac{1}{2 \cdot \pi} \cdot \left[\sqrt{\left[\lambda_i \cdot \left[\frac{g}{R} \cdot \tanh\left[\lambda_i \cdot \left(\frac{H_l}{R} \right) \right] \right] \right]} \right]$ Eqn. 4.14 BNL 1995

$fcon = \begin{pmatrix} 0.19 \\ 0.34 \\ 0.43 \end{pmatrix} Hz$ First three convective frequencies

$\rho_l := 1.59 \cdot 10^{-4} \cdot \frac{lbf \cdot sec^2}{in^4}$ waste density - specific gravity = 1.7

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Calculation of Impulsive Frequency:

$\rho_t := 7.35 \cdot 10^{-4} \cdot \frac{lbf \cdot sec^2}{in^4}$ Steel density

$t_{tw} := 0.65 \cdot in$ Average thickness of AY over lower 2/3.

$E_t := 29 \cdot 10^6 \cdot \frac{lbf}{in^2}$ Elastic modulus for steel

$C_{iref} := 0.102$ Table 4.4 of BNL 1995. Hinged top support condition - estimated for H_l/H_t=0.92

$C_i := C_{iref} \cdot \sqrt{127 \cdot \frac{\left(\frac{t_{tw}}{R}\right)}{\left(\frac{\rho_l}{\rho_t}\right)}}$ Eqn. 4.18 BNL 1995

$C_i = 0.09$ Impulsive coefficient for frequency calculation

$f_i := 5.5$ ANSYS Results

Determine Convective Pressures on the Tank Wall:

$$z := \begin{pmatrix} 24.5 \cdot in \\ 50.5 \cdot in \\ 77.5 \cdot in \\ 104.5 \cdot in \\ 131.45 \cdot in \\ 156.35 \cdot in \\ 179.3 \cdot in \\ 202.3 \cdot in \\ 225.65 \cdot in \\ 251 \cdot in \\ 278 \cdot in \\ 305 \cdot in \\ 332 \cdot in \\ 359.5 \cdot in \\ 386.5 \cdot in \\ 410.75 \cdot in \end{pmatrix}$$

Vertical location of element centroids at which pressures are reported.

$\eta_l := \frac{z}{H_l}$ Ratio of tank wall vertical location to waste height for waste element centroids.

$\eta_l =$

	0
0	0.06
1	0.12
2	0.18
3	0.25
4	0.31
5	0.37
6	0.42
7	0.48
8	0.53
9	0.59
10	0.66
11	0.72
12	0.79
13	0.85
14	0.92
15	0.97

Determine convective coefficients as a function of dimensionless height per BNL 1995 Eqn. 4.4

$$con_0(\eta_l) := \left[\frac{2}{(\lambda_0)^2 - 1} \cdot \frac{\cosh\left[\lambda_0 \cdot \left(\frac{H_l}{R}\right) \cdot \eta_l\right]}{\cosh\left[\lambda_0 \cdot \left(\frac{H_l}{R}\right)\right]}\right]$$

$$con_1(\eta_l) := \left[\frac{2}{(\lambda_1)^2 - 1} \cdot \frac{\cosh\left[\lambda_1 \cdot \left(\frac{H_l}{R}\right) \cdot \eta_l\right]}{\cosh\left[\lambda_1 \cdot \left(\frac{H_l}{R}\right)\right]}\right]$$

$$con_2(\eta_l) := \left[\frac{2}{(\lambda_2)^2 - 1} \cdot \frac{\cosh\left[\lambda_2 \cdot \left(\frac{H_l}{R}\right) \cdot \eta_l\right]}{\cosh\left[\lambda_2 \cdot \left(\frac{H_l}{R}\right)\right]}\right]$$

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Theoretical Fluid Response for Simplified AY Flexible Wall Tank at 422 in. Waste Level, Upper Bound Soil

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$con_0(\eta_1) =$

	0
0	0.29
1	0.29
2	0.3
3	0.32
4	0.33
5	0.35
6	0.37
7	0.39
8	0.42
9	0.45
10	0.5
11	0.54
12	0.6
13	0.66
14	0.73
15	0.8

$con_1(\eta_1) =$

	0
0	$1.03 \cdot 10^{-3}$
1	$1.16 \cdot 10^{-3}$
2	$1.43 \cdot 10^{-3}$
3	$1.84 \cdot 10^{-3}$
4	$2.44 \cdot 10^{-3}$
5	$3.21 \cdot 10^{-3}$
6	$4.17 \cdot 10^{-3}$
7	$5.45 \cdot 10^{-3}$
8	$7.16 \cdot 10^{-3}$
9	$9.64 \cdot 10^{-3}$
10	0.01
11	0.02
12	0.03
13	0.03
14	0.05
15	0.06

$con_2(\eta_1) =$

	0
0	$2.06 \cdot 10^{-5}$
1	$2.78 \cdot 10^{-5}$
2	$4.25 \cdot 10^{-5}$
3	$6.87 \cdot 10^{-5}$
4	$1.13 \cdot 10^{-4}$
5	$1.81 \cdot 10^{-4}$
6	$2.79 \cdot 10^{-4}$
7	$4.31 \cdot 10^{-4}$
8	$6.72 \cdot 10^{-4}$
9	$1.09 \cdot 10^{-3}$
10	$1.81 \cdot 10^{-3}$
11	$3.02 \cdot 10^{-3}$
12	$5.05 \cdot 10^{-3}$
13	$8.5 \cdot 10^{-3}$
14	0.01
15	0.02

Impulsive pressure coefficient as a function of dimensionless wall height

$$c_i(\eta_1) := 1 - con_0(\eta_1) - con_1(\eta_1) - con_2(\eta_1)$$

BNL 1995 Eqn. 4.7

$c_i(\eta_1) =$

	0
0	0.71
1	0.7
2	0.7
3	0.68
4	0.67
5	0.65
6	0.63
7	0.6
8	0.57
9	0.53
10	0.49
11	0.43
12	0.37
13	0.3
14	0.21
15	0.11

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Calculate maximum values of dynamic wall pressures

Consider the first three convective modes

$SA_{c0} := 0.062 \cdot g$ $\quad SA_{c0} = 23.96 \frac{in}{sec^2}$

$SA_{c1} := 0.108 \cdot g$ $\quad SA_{c1} = 41.73 \frac{in}{sec^2}$ $\quad$ 0.5% Dome RS from Spectr

$SA_{c2} := 0.163 \cdot g$ $\quad SA_{c2} = 62.98 \frac{in}{sec^2}$

Determine the spectral acceleration for the impulsive mode.

$SA_i := 0.38 \cdot g$ $\quad SA_i = 146.83 \frac{in}{sec^2}$

$$p_{maxconv}(\eta_1, \theta) := \left[\sqrt{(con_0(\eta_1) \cdot SA_{c0})^2 + (con_1(\eta_1) \cdot SA_{c1})^2 + (con_2(\eta_1) \cdot SA_{c2})^2}\right] \cdot (\rho_1 \cdot R \cdot \cos(\theta \cdot deg))$$

$$p_{maximpulsive}(\eta_1, \theta) := \left[\sqrt{[c_i(\eta_1) \cdot (SA_i)]^2}\right] \cdot (\rho_1 \cdot R \cdot \cos(\theta \cdot deg))$$

$$p_{max}(\eta_1, \theta) := \left[\sqrt{[(c_i(\eta_1)) \cdot (SA_i)]^2 + (con_0(\eta_1) \cdot SA_{c0})^2 + (con_1(\eta_1) \cdot SA_{c1})^2 + (con_2(\eta_1) \cdot SA_{c2})^2}\right] \cdot (\rho_1 \cdot R \cdot \cos(\theta \cdot deg))$$

Previous equation is Eqn. 4.24 from BNL 1995

$p_{maximpulsive}(\eta_1, 0) =$

	0
0	7.45
1	7.4
2	7.3
3	7.17
4	7
5	6.8
6	6.57
7	6.31
8	6
9	5.62
10	5.13
11	4.57
12	3.9
13	3.1
14	2.17
15	1.18

$\frac{lbf}{in^2}$

Maximum impulsive dynamic pressures at theta = 0.

$p_{maxconv}(\eta_1, 0) =$

	0
0	0.5
1	0.51
2	0.52
3	0.54
4	0.57
5	0.6
6	0.63
7	0.67
8	0.72
9	0.78
10	0.85
11	0.93
12	1.03
13	1.14
14	1.26
15	1.39

$\frac{lbf}{in^2}$

Maximum convective dynamic pressures at theta = 0.

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$p_{max}(\eta_1, 0) =$

	0
0	7.46
1	7.41
2	7.32
3	7.19
4	7.02
5	6.82
6	6.6
7	6.35
8	6.05
9	5.67
10	5.2
11	4.66
12	4.03
13	3.3
14	2.51
15	1.82

$\frac{lbf}{in^2}$

Maximum total dynamic pressure at theta = 0.

$p_{max}(\eta_1, 45) =$

	0
0	5.28
1	5.24
2	5.18
3	5.09
4	4.96
5	4.82
6	4.67
7	4.49
8	4.28
9	4.01
10	3.68
11	3.29
12	2.85
13	2.34
14	1.78
15	1.29

$\frac{lbf}{in^2}$

Maximum total dynamic pressure at theta = 45 degrees.

$p_{max}(\eta_l, 90) =$

	0
0	0
1	0
2	0
3	0
4	0
5	0
6	0
7	0
8	0
9	0
10	0
11	0
12	0
13	0
14	0
15	0

$\frac{lbf}{in^2}$

Maximum total dynamic pressure at theta = 90 degrees.

Calculate Maximum Slosh Height:

$$conmax := \begin{pmatrix} 0.837 \\ 0.073 \\ 0.028 \end{pmatrix}$$

Maximum value of convective coefficients at η_l=1

$$h_{maxslosh} := R \cdot \sqrt{\left(conmax_0 \cdot \frac{SA_{c0}}{g}\right)^2 + \left(conmax_1 \cdot \frac{SA_{c1}}{g}\right)^2 + \left(conmax_2 \cdot \frac{SA_{c2}}{g}\right)^2}$$

$h_{maxslosh} = 23.71\,in$

Calculate Maximum Total Hydrodynamic Force:

The maximum hydrodynamic force induced on the tank wall is given by Eqn. 4.31 of BNL 1995 with the instantaneous accelerations replaced by the maximum spectral accelerations. First determine the effective impulsive and convective masses.

$m_{lapprox} := \pi \cdot R^2 \cdot H_l \cdot \rho_l$ $\quad m_{lapprox} = 4.27 \times 10^4 \frac{lbf \cdot sec^2}{in}$ Total waste mass base on circular cylinder approximation.

$m_l := 4.27 \times 10^4 \cdot \frac{lbf \cdot sec^2}{in}$ Actual waste mass reported by ANSYS model.

$$m_{c0} := \left[\frac{2}{\lambda_0 \cdot \left[\left(\lambda_0\right)^2 - 1\right] \cdot \left(\frac{H_l}{R}\right)}\right] \cdot \tanh\left[\lambda_0 \cdot \left(\frac{H_l}{R}\right)\right] \cdot m_l$$ First mode convective mass

$m_{c0} = 1.94 \times 10^4 \frac{lbf \cdot sec^2}{in}$

$$m_{c1} := \left[\frac{2}{\lambda_1 \cdot \left[\left(\lambda_1\right)^2 - 1\right] \cdot \left(\frac{H_l}{R}\right)}\right] \cdot \tanh\left[\lambda_1 \cdot \left(\frac{H_l}{R}\right)\right] \cdot m_l$$ Second mode convective mass

$m_{c1} = 622.94 \frac{lbf \cdot sec^2}{in}$

$$m_{c2} := \left[\frac{2}{\lambda_2 \cdot \left[\left(\lambda_2\right)^2 - 1\right] \cdot \left(\frac{H_l}{R}\right)}\right] \cdot \tanh\left[\lambda_2 \cdot \left(\frac{H_l}{R}\right)\right] \cdot m_l$$ Third mode convective mass

$m_{c2} = 148.46 \frac{lbf \cdot sec^2}{in}$

$m_i := m_l - \left(m_{c0} + m_{c1} + m_{c2}\right)$ Impulsive mass

$m_i = 2.25 \times 10^4 \frac{lbf \cdot sec^2}{in}$

$F_{max} := m_i \cdot SA_i + m_{c0} \cdot SA_{c0} + m_{c1} \cdot SA_{c1} + m_{c2} \cdot SA_{c2}$

$F_{max} = 3.8 \times 10^6 \, lbf$ Conservative estimate of maximum hydrodynamic force

The above expression is a conservative estimate because it assumes that the peak impulsive and convective forces occur simultaneously. A less conservative estimate can be made via a square-root-sum-of-the-squares (SRSS) combination.

$F_{srss} := \sqrt{(m_i \cdot SA_i)^2 + (m_{c0} \cdot SA_{c0})^2 + (m_{c1} \cdot SA_{c1})^2 + (m_{c2} \cdot SA_{c2})^2}$

$F_{srss} = 3.34 \times 10^6 \, lbf$ SRSS estimate of peak hydrodynamic force

$F_{con} := \sqrt{(m_{c0} \cdot SA_{c0})^2 + (m_{c1} \cdot SA_{c1})^2 + (m_{c2} \cdot SA_{c2})^2}$

$F_{con} = 4.66 \times 10^5 \, lbf$ Peak hydrodynamic force due to convective effects only

Consider Vertical Excitation:

Calculate the axisymmetric breathing mode frequency for the tank

$C_{vref} := 0.088$ Table 4.17 BNL 1995

$C_v := C_{vref} \sqrt{127 \cdot \left(\frac{t_{tw}}{R}\right) \cdot \left(\frac{\rho_l}{\rho_t}\right)}$ $C_v = 0.081$

$f_v := 4.9$

$s_{Av} := 0.36 \cdot g$ $s_{Av} = 139.1 \frac{in}{sec^2}$ Vert. Haunch 4 % RS from Spectr

The maximum dynamic wall pressure as a function of the dimensionless vertical distance is given by

$$p_{maxv}(\eta_l) := (0.8)\cdot\left(\cos\left(\frac{\pi}{2}\cdot\eta_l\right)\right)\cdot(\rho_l\cdot H_l\cdot S_{Av})$$ Eqn. 4.52 BNL 1995

$p_{maxv}(\eta_l) =$

	0
0	7.44
1	7.34
2	7.16
3	6.91
4	6.59
5	6.24
6	5.86
7	5.45
8	4.98
9	4.44
10	3.81
11	3.15
12	2.45
13	1.72
14	0.98
15	0.31

$\frac{lbf}{in^2}$

$c_{oprimeouter} := 0.28$ $c_{oprimecenter} := 0.54$ Estimated from Figure 4.7 BNL 1995

$c_{vprimeouter} := 0.72$ $c_{vprimecenter} := 0.46$

$PGA_{vert} := 0.12\cdot g$

The maximum base pressures at the outer and center elements are given by

$$p_{maxbasevertouter} := c_{oprimeouter}\cdot\rho_l\cdot H_l\cdot PGA_{vert} + c_{vprimeouter}\cdot(\rho_l\cdot H_l)\cdot S_{Av}$$ Eqn. 4.55 BNL 1995

$$p_{maxbasevertcenter} := c_{oprimecenter}\cdot\rho_l\cdot H_l\cdot PGA_{vert} + c_{vprimecenter}\cdot(\rho_l\cdot H_l)\cdot S_{Av}$$

$$p_{maxbasevertouter} = 7.59\frac{lbf}{in^2}$$

$$p_{maxbasevertcenter} = 5.97\frac{lbf}{in^2}$$

Prepared by: F.G. Abatt M&D Professional Services 12/12/05 Rev. 3	Theoretical Fluid Response for Simplified AY Flexible Wall Tank at 422 in. Waste Level, Upper Bound Soil	Checked by: B.G. Carpenter M&D Professional Services 1/10/06

Determine the maximum vertical force on the base

$m_0 := 0.402 \cdot m_l$ Component of waste mass particpating in the motion of the tank base

$m_v := 0.598 \cdot m_l$ Component of waste mass particpating in the motion of the tank wall

BNL Table 4.17

$F_{maxbasevert} := \sqrt{(m_0 \cdot PGA_{vert})^2 + (m_v \cdot S_{Av})^2}$ Eqn. 4.57 BNL 1995 modified for maximum response per p. 4-34

$F_{maxbasevert} = 3.64 \times 10^6 \, lbf$

$m_0 = 1.72 \times 10^4 \, lbf \cdot \frac{sec^2}{in}$

$m_v = 2.55 \times 10^4 \, lbf \cdot \frac{sec^2}{in}$

Appendix H

Best Estimate Soil
Fully Cracked Concrete

Results
Load Case Specific Input Files
File Listing
Theoretical Waste Pressure Calculation

Appendix H

Best Estimate Soil
Fully Cracked Concrete

Results
Load Case Specific Input Files
File Listing
Theoretical Waste Pressure Calculation

AY Primary Tank, Best Estimate Soil (Geomatrix), Gravity Only, Fully Cracked Concrete, 422 in. Waste Level at 1.7 SpG

ANSYS MAXIMUMS BY PATH

PNNL Section No.	Path (in.)	Gravity Hoop Force (kip/ft) AY-BES-FCC	Gravity Meridonal Force (kip/ft) AY-BES-FCC	Gravity -In-Plane Shear Force (kip/ft) AY-BES-FCC	Gravity Hoop Moment (ft*kip/ft) AY-BES-FCC	Gravity Meridonal Moment (ft*kip/ft) AY-BES-FCC	Gravity Through-Wall Shear Force (kip/ft) AY-BES-FCC
2	**67.727**	-52.080	-63.750	0.050	-7.804	-6.740	2.947
3	**105.668**	-40.520	-58.220	-0.084	-4.262	-1.002	2.556
4	**137.069**	-37.480	-53.890	-0.064	-3.363	3.357	2.303
6	**182.849**	-31.100	-50.090	-0.104	-1.944	5.488	0.510
8	**226.563**	-23.730	-47.740	0.096	-0.355	4.185	-1.134
9	**275.566**	-28.620	-47.740	0.055	-0.984	1.514	-1.036
11	**325.690**	-23.240	-48.340	0.043	-1.055	-1.521	-0.672
13	**372.305**	-20.520	-49.230	0.066	-2.297	-2.052	-0.556
17	**423.427**	-9.818	-51.860	0.102	-3.623	-0.306	1.592
20	**468.308**	6.748	-51.280	-0.118	-1.085	19.140	7.521
22	**515.312**	15.160	-53.340	-0.085	4.168	25.690	-3.602
24	**549.725**	1.381	-53.070	0.053	1.981	10.840	-6.412
26	**585.819**	-10.690	-54.710	0.035	-0.045	-0.236	-2.600
30	**636.369**	-23.000	-56.720	0.022	-0.546	-3.029	0.822
33	**685.619**	-27.950	-58.080	0.016	-0.134	-0.739	0.387
35	**732.719**	-29.800	-59.440	0.012	0.006	0.030	-0.049
38	**778.219**	-28.170	-60.810	-0.010	-0.165	-0.914	-0.211
41	**821.369**	-27.140	-62.600	0.008	-0.041	-0.230	-0.103
43	**874.169**	-16.970	-36.260	-0.010	-0.424	-2.331	-0.301
46	**930.544**	-18.090	-64.910	-0.075	-0.890	-4.850	-0.525
48	**977.629**	-2.657	-9.493	0.553	-2.072	8.218	-4.743
51	**1019.647**	-1.763	-11.400	0.778	-0.582	3.959	6.630
53	**1060.156**	0.857	-1.793	0.221	0.938	4.002	-5.201
55	**1109.695**	1.129	-0.382	0.129	-0.005	-0.131	0.367
57	**1155.770**	1.168	0.740	0.041	0.017	0.059	-0.134
58	**1211.956**	1.546	1.409	0.018	-0.005	-0.054	0.184
59	**1281.707**	1.588	1.863	-0.028	0.035	0.133	-0.225
60	**1330.557**	1.775	2.152	-0.036	-0.004	-0.065	0.111
61	**1374.857**	1.302	2.722	-0.119	0.020	0.057	-0.119
62	**1417.007**	4.765	4.970	-0.035	0.025	0.081	0.163

Note: Meridonal/Hoop Forces and Meridonal/Hoop Moments are Reversed in Highlighted Sections.

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AY-2D-NL-BES-FCC Conc Tank Demand Gravity.xls, FM Max

Figure H.1. BES-FCC Concrete Forces and Moments, Gravity Load Only

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AY- Primary Tank, Best Estimate Soil (Geomatrix), Fully Cracked Concrete, 422 in. Waste Level at 1.7 SpG

ANSYS MAXIMUMS BY PATH

PNNL Section No.	Path (in.)	Seismic Hoop Force (kip/ft) AY-BES-FCC	Seismic Meridonal Force (kip/ft) AY-BES-FCC	Seismic -In-Plane Shear Force (kip/ft) AY-BES-FCC	Seismic Hoop Moment (ft*kip/ft) AY-BES-FCC	Seismic Meridonal Moment (ft*kip/ft) AY-BES-FCC	Seismic Through-Wall Shear Force (kip/ft) AY-BES-FCC
2	**67.727**	-74.510	-87.390	5.447	-15.810	-17.220	5.686
3	**105.668**	-57.860	-79.300	7.302	-9.499	-6.620	5.551
4	**137.069**	-52.660	-73.090	7.829	-7.453	8.337	5.128
6	**182.849**	-45.190	-64.620	7.903	-4.219	10.980	2.541
8	**226.563**	-34.400	-59.850	7.790	-1.228	11.270	1.899
9	**275.566**	-45.530	-59.180	8.684	-1.937	4.002	1.817
11	**325.690**	-36.290	-59.970	10.770	-1.638	-2.233	1.110
13	**372.305**	-35.450	-60.970	13.180	-3.163	-4.019	1.243
17	**423.427**	-30.450	-63.420	17.840	-4.863	-3.870	2.510
20	**468.308**	30.560	-61.950	19.150	-2.918	26.690	9.104
22	**515.312**	31.670	-63.350	19.460	5.594	32.430	5.263
24	**549.725**	8.267	-62.620	19.060	2.417	13.170	8.097
26	**585.819**	-17.130	-64.960	19.030	-0.137	-0.687	3.121
30	**636.369**	-27.510	-66.370	19.180	-0.668	-3.665	1.006
33	**685.619**	-32.480	-66.820	19.440	-0.195	-0.990	0.451
35	**732.719**	-34.410	-68.260	19.780	0.045	0.228	0.104
38	**778.219**	-32.370	-69.970	20.220	-0.212	-1.136	0.313
41	**821.369**	-31.060	-72.240	21.140	-0.080	-0.409	0.199
43	**874.169**	-19.420	-42.040	13.810	-0.629	-3.450	0.547
46	**930.544**	-26.290	-75.320	23.820	-1.090	-6.084	1.310
48	**977.629**	-11.680	-14.150	8.245	-2.430	9.531	5.501
51	**1019.647**	-5.790	-16.680	5.721	-0.687	4.635	7.668
53	**1060.156**	5.698	-5.150	3.281	1.098	4.651	6.047
55	**1109.695**	5.149	-3.055	2.749	-0.018	-0.177	0.456
57	**1155.770**	3.773	2.337	1.829	0.021	0.071	0.163
58	**1211.956**	3.932	2.644	1.475	-0.008	-0.068	0.227
59	**1281.707**	3.557	3.110	1.259	0.043	0.160	0.288
60	**1330.557**	3.758	3.508	1.087	-0.011	-0.084	0.160
61	**1374.857**	2.510	4.277	1.020	0.027	0.070	0.207
62	**1417.007**	8.848	7.953	1.322	0.123	0.147	0.287

Note: Meridonal/Hoop Forces and Meridonal/Hoop Moments are Reversed in Highlighted Sections.

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Figure H.2. BES-FCC Concrete Forces and Moments, Gravity Plus Seismic Load

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AY- Primary Tank, Best Estimate Soil (Geomatrix), Fully Cracked Concrete, 422 in. Waste Level at 1.7 SpG

ANSYS MAXIMUMS BY PATH

PNNL Section No.	Path (in.)	Seismic Only Hoop Force (kip/ft) AY-BES-FCC	Seismic Only Meridonal Force (kip/ft) AY-BES-FCC	Seismic Only - In-Plane Shear Force (kip/ft) AY-BES-FCC	Seismic Only Hoop Moment (ft*kip/ft) AY-BES-FCC	Seismic Only Meridonal Moment (ft*kip/ft) AY-BES-FCC	Seismic Only Through-Wall Shear Force (kip/ft) AY-BES-FCC
2	**67.727**	22.430	23.640	5.416	8.006	10.480	2.739
3	**105.668**	17.670	21.140	7.291	5.293	5.942	2.995
4	**137.069**	16.340	19.340	7.827	4.368	4.971	2.825
6	**182.849**	14.260	16.090	7.914	2.581	5.491	2.156
8	**226.563**	11.970	15.200	7.822	0.873	7.269	0.798
9	**275.566**	17.840	14.670	8.713	0.993	2.676	0.896
11	**325.690**	13.740	14.080	10.801	0.622	0.929	0.445
13	**372.305**	17.881	13.870	13.246	0.973	2.093	0.696
17	**423.427**	21.124	13.710	17.838	1.382	3.715	1.189
20	**468.308**	25.738	11.790	19.210	2.058	7.940	2.240
22	**515.312**	20.287	10.090	19.511	1.706	7.560	1.946
24	**549.725**	8.836	9.670	19.094	0.524	2.663	1.958
26	**585.819**	6.503	10.260	19.056	0.091	0.451	0.550
30	**636.369**	5.630	9.660	19.199	0.123	0.690	0.218
33	**685.619**	5.710	9.360	19.455	0.062	0.255	0.066
35	**732.719**	5.660	9.470	19.791	0.042	0.200	0.055
38	**778.219**	4.820	10.670	20.229	0.047	0.222	0.103
41	**821.369**	4.430	13.270	21.147	0.040	0.184	0.099
43	**874.169**	2.610	9.030	13.814	0.246	1.353	0.323
46	**930.544**	11.126	15.990	23.824	0.258	1.618	1.141
48	**977.629**	9.696	4.973	7.711	0.517	2.003	1.158
51	**1019.647**	4.568	5.829	4.965	0.173	1.167	1.516
53	**1060.156**	5.001	3.360	3.077	0.233	0.969	1.275
55	**1109.695**	4.268	2.683	2.632	0.016	0.061	0.108
57	**1155.770**	2.888	1.898	1.795	0.005	0.016	0.037
58	**1211.956**	2.823	1.797	1.486	0.005	0.015	0.051
59	**1281.707**	2.275	1.794	1.237	0.010	0.030	0.068
60	**1330.557**	2.136	1.879	1.057	0.010	0.020	0.050
61	**1374.857**	1.208	2.070	0.908	0.007	0.019	0.090
62	**1417.007**	4.082	3.562	1.300	0.100	0.079	0.127

Note: Meridonal/Hoop Forces and Meridonal/Hoop Moments are Reversed in Highlighted Sections.

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Figure H.3. BES-FCC Concrete Forces and Moments, Seismic Load Only

AY Primary Tank, Best Estimate Soil, Gravity Input, Fully Cracked Tank Concrete, 422 in. Waste Level at 1.7 SpG

		Shell Top Surface (inside - waste side)					
M&D Starting M&D Element No.	Path (in.)	AY-NL-BES-FCC Gravity Only Hoop Stress (lbs/in^2) Top	AY-NL-BES-FCC Gravity Only Meridional Stress (lbs/in^2) Top	AY-NL-BES-FCC Gravity Only Stress Intensity (lbs/in^2) Top	AY-NL-BES-FCC Gravity Only In-Plane Shear Stress (lbs/in^2) Top	AY-NL-BES-FCC Gravity Only In-Plane Shear Force Stress (lbs/in^2) Top	AY-NL-BES-FCC Gravity Only Thru-Thickness Shear Stress (lbs/in^2) Top
762	**67.33**	-7263.89	0.00	7604.17	-21.56	28.74	-0.89
782	**105.04**	-6313.19	-11277.78	11277.78	36.25	-78.40	0.20
802	**136.24**	-4904.86	-9340.28	9340.28	24.69	60.01	0.14
822	**181.71**	-2582.64	-8652.78	8652.78	24.05	-16.97	0.06
842	**225.10**	-2143.75	-5959.72	5959.72	-20.65	3.75	-0.24
862	**273.66**	-815.28	-5355.56	5355.56	-8.33	2.39	-0.04
882	**323.27**	-895.83	-2958.33	2958.33	-4.19	-8.99	0.05
902	**369.20**	732.64	-2792.36	3480.56	-4.51	-6.53	-0.04
922	**419.20**	1124.31	-454.38	1573.61	-6.69	26.16	0.04
942	**444.11**	1993.75	-2434.72	4402.08	-7.38	-45.13	0.15
962	**471.06**	2303.47	61.28	2325.00	-4.37	-6.42	0.10
982	**503.51**	2741.67	-577.43	3318.75	-1.70	16.88	-0.04
1002	**527.76**	2988.89	-119.03	3104.86	-1.60	-19.74	-0.01
1022	**554.76**	3986.81	-66.18	4051.39	-1.27	-6.76	0.00
1042	**582.26**	5633.33	-265.35	5895.14	-1.26	-7.55	0.00
1062	**609.26**	7333.33	-140.07	7472.22	-1.24	-7.65	0.00
1082	**636.26**	8986.11	-412.29	9395.83	-1.26	-10.26	0.00
1102	**663.26**	10465.28	114.65	10465.28	-1.29	0.25	0.00
1122	**688.61**	12388.89	-555.49	12937.50	-1.36	3.28	0.00
1142	**711.96**	13819.44	-140.35	13958.33	-1.38	-5.64	0.01
1162	**734.96**	15319.44	-126.11	15444.44	-1.65	-6.66	0.01
1182	**757.91**	15375.00	-1966.67	17340.28	-1.65	-8.83	0.01
1202	**782.81**	12798.61	2020.14	12798.61	-1.12	-17.75	0.01
1222	**809.76**	12423.61	-390.28	12812.50	-0.89	-7.03	0.02
1242	**836.76**	13687.50	-257.64	13944.44	-1.07	-4.27	0.02
1262	**863.76**	15194.44	425.69	15194.44	-1.13	-3.47	-0.05
1282	**889.76**	13479.17	-5071.53	18548.61	2.74	-23.40	0.15
1302	**906.85**	4421.53	-10479.17	14902.78	9.24	147.22	1.25
1322	**916.04**	4454.86	7423.61	7472.22	-10.55	433.61	2.73
1342	**934.63**	3353.47	9388.89	9430.56	-480.00	10.68	-132.01
1362	**974.63**	-26.73	-1576.39	1588.19	125.07	-3.42	43.39
1382	**1040.78**	1061.11	1941.67	1948.61	-71.88	2.10	-26.64
1402	**1110.53**	170.28	-1056.94	1234.72	98.06	-2.99	37.80

Note 1: Meridonal, Hoop, and Shear Stresses are Reversed in Highlighted Sections (Floor)

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AY-2D-NL-BES-FCC Pri Tank Stress Gravity.xls, Stress Max

Figure H.4. BES-FCC Primary Tank Stresses, Shell Top, Gravity Load Only

AY Primary Tank, Best Estimate Soil, Gravity Input, Fully Cracked Tank Concrete, 422 in. Waste Level at 1.7 SpG

		Shell Mid-Plane					
M&D Starting M&D Element No.	Path (in.)	AY-NL-BES-FCC Gravity Only Hoop Stress (lbs/in^2) Mid	AY-NL-BES-FCC Gravity Only Meridional Stress (lbs/in^2) Mid	AY-NL-BES-FCC Gravity Only Stress Intensity (lbs/in^2) Mid	AY-NL-BES-FCC Gravity Only In-Plane Shear Stress (lbs/in^2) Mid	AY-NL-BES-FCC Gravity Only In-Plane Shear Force Stress (lbs/in^2) Mid	AY-NL-BES-FCC Gravity Only Thru-Thickness Shear Stress (lbs/in^2) Mid
762	**67.33**	-7777.78	-8395.83	8395.83	14.24	28.74	-0.89
782	**105.04**	-6341.67	-10805.56	10805.56	29.56	-78.40	0.20
802	**136.24**	-5179.17	-9826.39	9826.39	23.19	60.01	0.14
822	**181.71**	-2501.39	-8159.72	8159.72	-21.52	-16.07	0.06
842	**225.10**	-2379.86	-6651.39	6651.39	-18.47	3.75	-0.24
862	**273.66**	-729.86	-5023.61	5023.61	-8.01	2.39	-0.04
882	**323.27**	-1116.67	-3661.81	3661.81	-4.05	-8.99	0.05
902	**369.20**	821.53	-2465.97	3242.36	-4.48	-6.53	-0.04
922	**419.20**	933.33	-1067.36	1986.11	-6.63	26.16	0.04
942	**444.11**	2588.19	-391.18	2966.67	-6.75	-45.13	0.15
962	**471.06**	2218.75	-303.96	2522.92	-4.32	-6.42	0.10
982	**503.51**	2838.89	-263.96	3092.36	-1.86	16.88	-0.04
1002	**527.76**	2945.14	-270.56	3205.56	-1.62	-19.74	-0.01
1022	**554.76**	3945.14	-200.35	4144.44	-1.26	-6.76	0.00
1042	**582.26**	5650.00	-207.99	5854.86	-1.26	-7.55	0.00
1062	**609.26**	7305.56	-215.76	7520.83	-1.25	-7.65	0.00
1082	**636.26**	9041.67	-223.61	9263.89	-1.26	-10.26	0.00
1102	**663.26**	10361.11	-231.46	10590.28	-1.31	0.25	0.00
1122	**688.61**	12479.17	-238.89	12715.28	-1.36	3.28	0.00
1142	**711.96**	13791.67	-245.56	14034.72	-1.37	-5.64	0.01
1162	**734.96**	15277.78	-252.78	15527.78	-1.37	-6.66	0.01
1182	**757.91**	15888.89	-259.38	16145.83	-1.59	-8.83	0.01
1202	**782.81**	12138.89	-171.25	12312.50	-1.01	-17.75	0.01
1222	**809.76**	12486.11	-179.17	12659.72	-0.96	-7.03	0.02
1242	**836.76**	13708.33	-186.94	13895.83	-1.01	-4.27	0.02
1262	**863.76**	15013.89	-194.10	15201.39	-1.12	-3.47	-0.05
1282	**889.76**	14937.50	-202.92	15145.83	-2.83	-23.40	0.15
1302	**906.85**	7375.00	-196.60	7652.78	7.60	147.22	1.25
1322	**916.04**	1895.83	13.17	2322.92	-8.49	433.61	2.73
1342	**934.63**	542.15	305.00	592.99	22.77	10.68	-132.01
1362	**974.63**	655.28	641.94	658.06	3.75	-3.42	43.39
1382	**1040.78**	649.24	594.65	650.49	6.22	2.10	-26.64
1402	**1110.53**	685.56	675.76	687.57	2.17	-2.99	37.80

Note 1: Meridonal, Hoop, and Shear Stresses are Reversed in Highlighted Sections (Floor)

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AY-2D-NL-BES-FCC Pri Tank Stress Gravity.xls, Stress Max

Figure H.5. BES-FCC Primary Tank Stresses, Shell Middle, Gravity Load Only

AY Primary Tank, Best Estimate Soil, Gravity Input, Fully Cracked Tank Concrete, 422 in. Waste Level at 1.7 SpG

		Shell Bottom Surface (outside - away from waste)					
M&D Starting M&D Element No.	Path (in.)	AY-NL-BES-FCC Gravity Only Hoop Stress (lbs/in^2) Bot	AY-NL-BES-FCC Gravity Only Meridional Stress (lbs/in^2) Bot	AY-NL-BES-FCC Gravity Only Stress Intensity (lbs/in^2) Bot	AY-NL-BES-FCC Gravity Only In-Plane Shear Stress (lbs/in^2) Bot	AY-NL-BES-FCC Gravity Only In-Plane Shear Force Stress (lbs/in^2) Bot	AY-NL-BES-FCC Gravity Only Thru-Thickness Shear Stress (lbs/in^2) Bot
762	**67.33**	-8347.22	-9243.06	9243.06	-19.33	28.74	-0.89
782	**105.04**	-6377.08	-10361.11	10368.06	24.12	-78.40	0.20
802	**136.24**	-5454.86	-10333.33	10333.33	21.70	60.01	0.14
822	**181.71**	-2419.44	-7680.56	7680.56	-19.74	-16.97	0.06
842	**225.10**	-2615.97	-7354.17	7354.17	16.88	3.75	-0.24
862	**273.66**	-644.24	-4695.14	4695.14	-7.69	2.39	-0.04
882	**323.27**	-1337.50	-4370.83	4370.83	-3.92	-8.99	0.05
902	**369.20**	910.42	-2140.97	3004.86	-4.46	-6.53	-0.04
922	**419.20**	743.06	-1697.92	2398.61	-6.56	26.16	0.04
942	**444.11**	3182.64	1686.81	3183.33	-6.12	-45.13	0.15
962	**471.06**	2134.03	-628.33	2721.53	-4.27	-6.42	0.10
982	**503.51**	2936.81	74.93	2940.28	-2.02	16.88	-0.04
1002	**527.76**	2902.08	-430.97	3315.28	-1.65	-19.74	-0.01
1022	**554.76**	3905.56	-334.51	4238.19	-1.25	-6.76	0.00
1042	**582.26**	5667.36	-150.69	5814.58	-1.27	-7.55	0.00
1062	**609.26**	7284.72	-291.53	7576.39	-1.25	-7.65	0.00
1082	**636.26**	9097.22	-34.88	9131.94	-1.27	-10.26	0.00
1102	**663.26**	10256.94	-567.78	10826.39	-1.34	0.25	0.00
1122	**688.61**	12576.39	87.99	12576.39	-1.37	3.28	0.00
1142	**711.96**	13756.94	-350.83	14104.17	-1.42	-5.64	0.01
1162	**734.96**	15243.06	-379.38	15618.06	-1.42	-6.66	0.01
1182	**757.91**	16402.78	1458.33	16402.78	-1.53	-8.83	0.01
1202	**782.81**	11486.11	-2356.25	13840.28	-0.91	-17.75	0.01
1222	**809.76**	12548.61	40.79	12548.61	-1.03	-7.03	0.02
1242	**836.76**	13729.17	-116.25	13840.28	-0.94	-4.27	0.02
1262	**863.76**	14833.33	-811.81	15631.94	-1.45	-3.47	-0.05
1282	**889.76**	16402.78	4666.67	16402.78	-3.01	-23.40	0.15
1302	**906.85**	10333.33	10083.33	10333.33	5.96	147.22	1.25
1322	**916.04**	-676.39	-7402.78	7451.39	-6.44	433.61	2.73
1342	**934.63**	-2281.25	-8784.72	8833.33	519.51	10.68	-132.01
1362	**974.63**	1329.17	2852.08	2863.19	-123.33	-3.42	43.39
1382	**1040.78**	239.65	-763.19	1011.11	80.69	2.10	-26.64
1402	**1110.53**	1208.33	2404.17	2412.50	-96.39	-2.99	37.80

Note 1: Meridonal, Hoop, and Shear Stresses are Reversed in Highlighted Sections (Floor)

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AY-2D-NL-BES-FCC Pri Tank Stress Gravity.xls, Stress Max

Figure H.6. BES-FCC Primary Tank Stresses, Shell Bottom, Gravity Load Only

AY Primary Tank, Best Estimate Soil, Horizontal and Vertical Seismic Input, Fully Cracked Tank Concrete, 422 in. Waste Level at 1.7 SpG

		Shell Top Surface (inside - waste side)					
M&D Starting M&D Element No.	Path (in.)	AY-NL-BES-FCC Seismic Hoop Stress (lbs/in^2) Top	AY-NL-BES-FCC Seismic Meridional Stress (lbs/in^2) Top	AY-NL-BES-FCC Seismic Stress Intensity (lbs/in^2) Top	AY-NL-BES-FCC Seismic In-Plane Shear Stress (lbs/in^2) Top	AY-NL-BES-FCC Seismic In-Plane Shear Force Stress (lbs/in^2) Top	AY-NL-BES-FCC Seismic Thru-Thickness Shear Stress (lbs/in^2) Top
762	**67.33**	-10298.61	0.00	11111.11	-1250.00	40.17	-10.92
782	**105.04**	-9479.17	-15270.83	15277.78	-1988.89	-105.56	-5.92
802	**136.24**	-7513.89	-13298.61	13298.61	-1972.92	87.92	-3.95
822	**181.71**	-4129.86	-11701.39	11708.33	-1598.61	-28.26	0.75
842	**225.10**	-3858.33	-9020.83	9076.39	-1215.97	29.35	-1.89
862	**273.66**	-1607.64	-6979.17	6979.17	-981.25	12.16	-0.76
882	**323.27**	-2430.56	-4454.86	5849.31	-1018.06	-34.97	4.48
902	**369.20**	2038.89	-4229.17	5309.72	-1276.39	-31.39	5.34
922	**419.20**	4103.47	-1327.08	5332.64	-2023.61	72.99	8.49
942	**444.11**	4369.44	-3904.86	7826.39	2418.75	-300.56	13.60
962	**471.06**	8270.83	-2397.22	10666.67	2475.00	-25.36	9.67
982	**503.51**	6329.17	-2540.97	8805.56	2753.47	107.01	9.43
1002	**527.76**	5621.53	-644.79	6693.75	2687.50	-65.84	2.98
1022	**554.76**	8125.00	-1739.58	8125.00	1698.61	-33.84	-2.37
1042	**582.26**	10847.22	-986.11	10847.22	1469.44	-25.57	1.36
1062	**609.26**	13152.78	-1477.78	13152.78	-1275.00	-23.14	1.54
1082	**636.26**	15576.39	-1343.06	15576.39	-1120.14	-17.85	1.68
1102	**663.26**	17548.61	-1466.67	17548.61	-954.86	-14.65	1.80
1122	**688.61**	19729.17	-1456.25	19736.11	-921.53	35.07	-1.54
1142	**711.96**	21395.83	-1543.75	21402.78	-988.89	-43.94	-1.45
1162	**734.96**	22916.67	-1368.06	22916.67	1625.00	38.43	-1.36
1182	**757.91**	22437.50	-2473.61	24333.33	1625.00	-46.88	1.44
1202	**782.81**	18187.50	3454.86	18187.50	1334.03	-26.21	-2.63
1222	**809.76**	17305.56	-860.42	17500.00	1643.06	-9.84	-2.02
1242	**836.76**	18868.06	-859.72	18868.06	1975.00	-17.42	2.06
1262	**863.76**	20493.06	1082.64	20493.06	2321.53	-12.69	-1.11
1282	**889.76**	17722.22	-7875.00	25569.44	2697.92	-75.63	4.26
1302	**906.85**	5663.19	-16715.28	20361.11	2502.08	225.90	24.13
1322	**916.04**	5867.36	11680.56	11736.11	2485.42	693.13	25.41
1342	**934.63**	5572.22	14201.39	14263.89	-2434.72	15.63	-203.75
1362	**974.63**	3290.28	-2606.25	6143.75	-2845.83	-5.35	68.39
1382	**1040.78**	2938.89	2765.28	3856.94	-1901.39	3.31	-42.14
1402	**1110.53**	1903.47	-1908.33	2405.56	-915.28	-4.76	60.01

Note 1: Meridonal, Hoop, and Shear Stresses are Reversed in Highlighted Sections (Floor)

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AY-2D-NL-BES-FCC Pri Tank Stress Seismic.xls, Stress Max

Figure H.7. BES-FCC Primary Tank Stresses, Shell Top, Gravity Plus Seismic Load

AY Primary Tank, Best Estimate Soil, Horizontal and Vertical Seismic Input, Fully Cracked Tank Concrete, 422 in. Waste Level at 1.7 SpG

		Shell Mid-Plane					
M&D Starting M&D Element No.	Path (in.)	AY-NL-BES-FCC Seismic Hoop Stress (lbs/in^2) Mid	AY-NL-BES-FCC Seismic Meridional Stress (lbs/in^2) Mid	AY-NL-BES-FCC Seismic Stress Intensity (lbs/in^2) Mid	AY-NL-BES-FCC Seismic In-Plane Shear Stress (lbs/in^2) Mid	AY-NL-BES-FCC Seismic In-Plane Shear Force Stress (lbs/in^2) Mid	AY-NL-BES-FCC Seismic Thru-Thickness Shear Stress (lbs/in^2) Mid
762	**67.33**	-11159.72	-11625.00	11625.00	-1171.53	40.17	-10.92
782	**105.04**	-9659.72	-14875.00	14895.83	-1916.67	-105.56	-5.92
802	**136.24**	-8048.61	-13437.50	13444.44	-1900.69	87.92	-3.95
822	**181.71**	-3971.53	-11069.44	11069.44	-1557.64	-28.26	0.75
842	**225.10**	-4447.22	-8875.00	8875.00	-1200.69	29.35	-1.89
862	**273.66**	-1409.72	-6537.50	6614.58	-977.08	12.16	-0.76
882	**323.27**	-2966.67	-4721.53	5414.58	-1015.97	-34.97	4.48
902	**369.20**	2022.92	-3434.03	4922.92	-1268.06	-31.39	5.34
922	**419.20**	4253.47	-1915.28	5064.58	-2027.78	72.99	8.49
942	**444.11**	5013.89	-1469.44	6452.08	2437.50	-300.56	13.60
962	**471.06**	8583.33	-1331.94	9916.67	2484.03	-25.36	9.67
982	**503.51**	6661.11	-1238.89	7861.11	2709.03	107.01	9.43
1002	**527.76**	5818.75	-1354.17	6634.03	2670.14	-65.84	2.98
1022	**554.76**	7930.56	-1081.25	7937.50	1701.39	-33.84	-2.37
1042	**582.26**	10881.94	-1209.03	10881.94	1449.31	-25.57	1.36
1062	**609.26**	12986.11	-1338.89	12986.11	-1270.14	-23.14	1.54
1082	**636.26**	15590.28	-1423.61	15590.28	-1118.75	-17.85	1.68
1102	**663.26**	17368.06	-1484.03	17368.06	-947.92	-14.65	1.80
1122	**688.61**	19729.17	-1502.78	19729.17	-920.83	35.07	-1.54
1142	**711.96**	21347.22	-1503.47	21347.22	1240.97	-43.94	-1.45
1162	**734.96**	22909.72	-1474.31	22909.72	1240.97	38.43	-1.36
1182	**757.91**	23159.72	-1425.69	23159.72	1615.97	-46.88	1.44
1202	**782.81**	17298.61	-872.92	17312.50	1321.53	-26.21	-2.63
1222	**809.76**	17354.17	-800.00	17354.17	1648.61	-9.84	-2.02
1242	**836.76**	18854.17	-716.67	18854.17	1977.78	-17.42	2.06
1262	**863.76**	20354.17	-624.51	20368.06	2325.00	-12.69	-1.11
1282	**889.76**	19965.28	-587.08	20333.33	2643.75	-75.63	4.26
1302	**906.85**	9027.78	-568.75	9437.50	2335.42	225.90	24.13
1322	**916.04**	4859.03	245.14	5507.64	2329.86	693.13	25.41
1342	**934.63**	4025.00	541.81	4202.08	-1929.86	15.63	-203.75
1362	**974.63**	3572.92	915.28	5947.22	-2959.72	-5.35	68.39
1382	**1040.78**	2756.94	768.75	3737.50	-1834.03	3.31	-42.14
1402	**1110.53**	2114.58	873.61	2116.67	-1002.78	-4.76	60.01

Note 1: Meridonal, Hoop, and Shear Stresses are Reversed in Highlighted Sections (Floor)

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AY-2D-NL-BES-FCC Pri Tank Stress Seismic.xls, Stress Max

Figure H.8. BES-FCC Primary Tank Stresses, Shell Middle, Gravity Plus Seismic Load

AY Primary Tank, Best Estimate Soil, Horizontal and Vertical Seismic Input, Fully Cracked Tank Concrete, 422 in. Waste Level at 1.7 SpG

		Shell Bottom Surface (outside - away from waste)					
M&D Starting M&D Element No.	Path (in.)	AY-NL-BES-FCC Seismic Hoop Stress (lbs/in^2) Bot	AY-NL-BES-FCC Seismic Meridional Stress (lbs/in^2) Bot	AY-NL-BES-FCC Seismic Stress Intensity (lbs/in^2) Bot	AY-NL-BES-FCC Seismic In-Plane Shear Stress (lbs/in^2) Bot	AY-NL-BES-FCC Seismic In-Plane Shear Force Stress (lbs/in^2) Bot	AY-NL-BES-FCC Seismic Thru-Thickness Shear Stress (lbs/in^2) Bot
762	**67.33**	-12027.78	-12826.39	12826.39	-1093.75	40.17	-10.92
782	**105.04**	-9965.28	-15006.94	15013.89	-1844.44	-105.56	-5.92
802	**136.24**	-8597.22	-13944.44	13944.44	-1828.47	87.92	-3.95
822	**181.71**	-3813.89	-10652.78	10652.78	-1516.67	-28.26	0.75
842	**225.10**	-5036.81	-9763.89	9770.83	-1185.42	29.35	-1.89
862	**273.66**	-1264.58	-6189.58	6612.50	-972.22	12.16	-0.76
882	**323.27**	-3502.78	-6239.58	6240.28	-1013.89	-34.97	4.48
902	**369.20**	2182.64	-2847.22	4568.75	-1259.72	-31.39	5.34
922	**419.20**	4404.17	-3700.00	5237.50	-2032.64	72.99	8.49
942	**444.11**	5657.64	2898.89	5723.61	2456.94	-300.56	13.60
962	**471.06**	8895.83	-1182.64	9166.67	2492.36	-25.36	9.67
982	**503.51**	7069.44	-698.61	7131.94	2665.28	107.01	9.43
1002	**527.76**	6025.69	-3106.94	6656.25	2652.78	-65.84	2.98
1022	**554.76**	7881.94	-875.69	7888.89	1705.56	-33.84	-2.37
1042	**582.26**	11104.17	-1453.47	11111.11	1445.14	-25.57	1.36
1062	**609.26**	13020.83	-1259.72	13020.83	-1267.36	-23.14	1.54
1082	**636.26**	15722.22	-1504.17	15722.22	-1117.36	-17.85	1.68
1102	**663.26**	17256.94	-1502.08	17256.94	-940.97	-14.65	1.80
1122	**688.61**	19798.61	-1550.00	19798.61	-920.14	35.07	-1.54
1142	**711.96**	21340.28	-1463.19	21347.22	1243.75	-43.94	-1.45
1162	**734.96**	22902.78	-1581.25	22902.78	1243.75	38.43	-1.36
1182	**757.91**	23881.94	3086.11	23881.94	1606.94	-46.88	1.44
1202	**782.81**	16743.06	-3018.06	19222.22	1309.03	-26.21	-2.63
1222	**809.76**	17402.78	-747.22	17402.78	1654.17	-9.84	-2.02
1242	**836.76**	18847.22	-589.93	18847.22	1981.25	-17.42	2.06
1262	**863.76**	20208.33	-2122.92	20951.39	2328.47	-12.69	-1.11
1282	**889.76**	22208.33	7125.00	22208.33	2590.28	-75.63	4.26
1302	**906.85**	13041.67	15604.17	15611.11	2170.14	225.90	24.13
1322	**916.04**	-5186.81	-11472.22	11548.61	2184.72	693.13	25.41
1342	**934.63**	-6714.58	-13437.50	13506.94	1843.06	15.63	-203.75
1362	**974.63**	3884.72	4240.28	6297.22	-3072.92	-5.35	68.39
1382	**1040.78**	2579.17	-1381.94	3913.19	-1769.44	3.31	-42.14
1402	**1110.53**	2358.33	3397.22	3411.11	-1090.28	-4.76	60.01

Note 1: Meridonal, Hoop, and Shear Stresses are Reversed in Highlighted Sections (Floor)

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AY-2D-NL-BES-FCC Pri Tank Stress Seismic.xls, Stress Max

Figure H.9. BES-FCC Primary Tank Stresses, Shell Bottom, Gravity Plus Seismic Load

AY Primary Tank, Best Estimate Soil, Horizontal and Vertical Seismic Input, Fully Cracked Tank Concrete, 422 in. Waste Level at 1.7 SpG

		Shell Top Surface (inside - waste side)					
M&D Starting M&D Element No.	Path (in.)	AY-NL-BES-FCC Hoop Stress Seismic Only (LBS/in^2) Top	AY-NL-BES-FCC Meridional Stress Seismic Only (LBS/in^2) Top	AY-NL-BES-FCC Stress Seismic Only Intensity (LBS/in^2) Top	AY-NL-BES-FCC In-Plane Shear Stress Seismic Only (LBS/in^2) Top	AY-NL-BES-FCC In-Plane Shear Force Stress Seismic Only (LBS/in^2) Top	AY-NL-BES-FCC Thru-Thickness Shear Stress Seismic Only (LBS/in^2) Top
762	**67.33**	3868.06	0.00	3534.72	1241.35	19.46	11.40
782	**105.04**	4046.53	4436.81	4425.69	1987.35	49.85	5.80
802	**136.24**	3344.44	4136.81	4098.61	1972.26	47.21	3.98
822	**181.71**	1870.42	3472.22	3471.53	1602.64	14.96	0.78
842	**225.10**	2623.54	3103.47	3152.08	1218.93	27.94	1.89
862	**273.66**	1310.28	1870.14	1870.14	986.31	12.40	0.77
882	**323.27**	2397.92	1583.33	2904.17	1020.01	37.18	4.50
902	**369.20**	1306.25	1665.97	2275.69	1272.19	25.25	5.33
922	**419.20**	2979.17	876.60	3759.03	2024.18	54.63	8.48
942	**444.11**	2612.57	1375.69	3431.25	2417.84	256.76	13.56
962	**471.06**	6920.14	2385.12	8363.19	2476.72	18.96	9.57
982	**503.51**	4740.97	2173.89	5494.44	2754.34	94.34	9.46
1002	**527.76**	3189.44	616.32	3588.89	2688.33	46.14	2.98
1022	**554.76**	4293.96	1678.81	4074.31	1699.24	31.00	2.37
1042	**582.26**	5605.10	755.07	4966.67	1470.10	18.03	1.35
1062	**609.26**	7035.90	1338.13	5922.22	1274.75	15.49	1.54
1082	**636.26**	8210.42	1042.50	7350.69	1119.75	8.79	1.68
1102	**663.26**	9136.81	1571.88	7929.86	954.68	14.87	1.80
1122	**688.61**	10257.64	1174.58	9526.39	921.07	31.79	1.55
1142	**711.96**	10794.44	1403.61	9709.72	988.20	38.34	1.45
1162	**734.96**	11095.14	1242.78	10116.67	1624.94	45.08	1.38
1182	**757.91**	10349.31	1011.81	10429.86	1624.94	38.08	1.43
1202	**782.81**	7929.86	1917.15	7926.39	1334.41	9.16	2.63
1222	**809.76**	7036.81	533.40	6807.64	1643.52	15.12	2.01
1242	**836.76**	7159.03	655.97	6819.44	1975.35	13.24	2.06
1262	**863.76**	7333.33	766.81	7326.39	2321.91	15.43	1.09
1282	**889.76**	5250.00	3345.14	8590.28	2698.12	52.22	4.20
1302	**906.85**	1652.78	6236.11	5458.33	2502.43	100.02	23.63
1322	**916.04**	1889.58	5559.03	4277.78	2486.88	260.28	26.16
1342	**934.63**	2418.06	5756.94	5220.83	1958.54	6.55	81.49
1362	**974.63**	3309.90	1049.79	4559.03	2967.71	2.15	26.74
1382	**1040.78**	2027.78	1113.19	1916.67	1832.25	1.27	16.24
1402	**1110.53**	1779.17	977.49	1173.61	1010.69	1.86	23.07

Note 1: Meridonal, Hoop, and Shear Stresses are Reversed in Highlighted Sections (Floor)

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AY-2D-NL-BES-FCC Pri Tank Stress Seismic Only.xls, Stress Max

Figure H.10. BES-FCC Primary Tank Stresses, Shell Top, Seismic Load Only

AY Primary Tank, Best Estimate Soil, Horizontal and Vertical Seismic Input, Fully Cracked Tank Concrete, 422 in. Waste Level at 1.7 SpG

		Shell Mid-Plane					
M&D Starting M&D Element No.	Path (in.)	AY-NL-BES-FCC Hoop Stress Seismic Only (LBS/in^2) Mid	AY-NL-BES-FCC Meridional Stress Seismic Only (LBS/in^2) Mid	AY-NL-BES-FCC Stress Seismic Only Intensity (LBS/in^2) Mid	AY-NL-BES-FCC In-Plane Shear Stress Seismic Only (LBS/in^2) Mid	AY-NL-BES-FCC In-Plane Shear Force Stress Seismic Only (LBS/in^2) Mid	AY-NL-BES-FCC Thru-Thickness Shear Stress Seismic Only (LBS/in^2) Mid
762	**67.33**	4252.08	3576.39	3554.86	1166.75	19.46	11.40
782	**105.04**	4165.28	4484.72	4450.69	1913.97	49.85	5.80
802	**136.24**	3602.78	4085.42	4073.61	1900.56	47.21	3.98
822	**181.71**	1789.51	3337.50	3336.81	1560.62	14.96	0.78
842	**225.10**	3034.72	2645.14	2643.06	1203.56	27.94	1.89
862	**273.66**	1163.26	1822.22	1816.67	980.58	12.40	0.77
882	**323.27**	2790.28	1230.56	1760.42	1017.89	37.18	4.50
902	**369.20**	1204.86	984.72	1772.22	1263.79	25.25	5.33
922	**419.20**	3320.14	934.03	3086.11	2028.35	54.63	8.48
942	**444.11**	2587.01	1249.17	3490.28	2436.74	256.76	13.56
962	**471.06**	7238.89	1153.13	7413.19	2485.75	18.96	9.57
982	**503.51**	4993.75	1083.13	4777.78	2709.96	94.34	9.46
1002	**527.76**	3690.28	1186.32	3429.86	2670.97	46.14	2.98
1022	**554.76**	4048.26	956.46	3793.06	1702.01	31.00	2.37
1042	**582.26**	5700.94	1028.47	5027.78	1449.98	18.03	1.35
1062	**609.26**	7008.54	1123.47	5993.75	1269.86	15.49	1.54
1082	**636.26**	8270.14	1200.49	7215.97	1118.35	8.79	1.68
1102	**663.26**	9073.61	1253.13	7984.03	947.73	14.87	1.80
1122	**688.61**	10364.58	1264.51	9295.83	920.38	31.79	1.55
1142	**711.96**	10783.33	1258.61	9743.75	1241.26	38.34	1.45
1162	**734.96**	11104.86	1222.43	10103.47	1241.26	45.08	1.38
1182	**757.91**	10649.31	1167.36	9736.81	1616.01	38.08	1.43
1202	**782.81**	7504.86	702.43	6978.47	1321.93	9.16	2.63
1222	**809.76**	7093.75	621.81	6669.44	1649.08	15.12	2.01
1242	**836.76**	7152.08	530.90	6833.33	1978.13	13.24	2.06
1262	**863.76**	7284.72	436.60	7097.22	2325.42	15.43	1.09
1282	**889.76**	6229.17	384.17	6291.67	2643.95	52.22	4.20
1302	**906.85**	1652.78	372.15	1784.72	2335.78	100.02	23.63
1322	**916.04**	3197.22	249.54	3188.19	2331.06	260.28	26.16
1342	**934.63**	3485.56	415.97	3614.65	1948.85	6.55	81.49
1362	**974.63**	2919.03	793.61	5295.28	2960.86	2.15	26.74
1382	**1040.78**	2183.06	492.29	3092.36	1838.73	1.27	16.24
1402	**1110.53**	1575.63	390.83	1430.42	1003.69	1.86	52.70

Note 1: Meridonal, Hoop, and Shear Stresses are Reversed in Highlighted Sections (Floor)

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AY-2D-NL-BES-FCC Pri Tank Stress Seismic Only.xls, Stress Max

Figure H.11. BES-FCC Primary Tank Stresses, Shell Middle, Seismic Load Only

AY Primary Tank, Best Estimate Soil, Horizontal and Vertical Seismic Input, Fully Cracked Tank Concrete, 422 in. Waste Level at 1.7 SpG

		Shell Bottom Surface (outside - away from waste)					
M&D Starting M&D Element No.	Path (in.)	AY-NL-BES-FCC Hoop Stress Seismic Only (LBS/in^2) Bot	AY-NL-BES-FCC Meridional Stress Seismic Only (LBS/in^2) Bot	AY-NL-BES-FCC Stress Seismic Only Intensity (LBS/in^2) Bot	AY-NL-BES-FCC In-Plane Shear Stress Seismic Only (LBS/in^2) Bot	AY-NL-BES-FCC In-Plane Shear Force Stress Seismic Only (LBS/in^2) Bot	AY-NL-BES-FCC Thru-Thickness Shear Stress Seismic Only (LBS/in^2) Bot
762	**67.33**	4643.06	3929.86	3929.86	1092.84	19.46	11.40
782	**105.04**	4283.33	4701.39	4708.33	1840.59	49.85	5.80
802	**136.24**	3861.11	4150.69	4149.31	1828.85	47.21	3.98
822	**181.71**	1726.32	3289.58	3264.58	1518.60	14.96	0.78
842	**225.10**	3445.83	3042.36	2936.11	1188.19	27.94	1.89
862	**273.66**	1033.33	1852.08	1935.42	975.55	12.40	0.77
882	**323.27**	3182.64	2277.78	1945.14	1015.76	37.18	4.50
902	**369.20**	1330.14	779.17	1563.89	1255.38	25.25	5.33
922	**419.20**	3661.11	2323.06	2846.53	2033.22	54.63	8.48
942	**444.11**	2560.83	1716.18	2542.36	2456.34	256.76	13.56
962	**471.06**	7557.64	554.31	6461.11	2494.08	18.96	9.57
982	**503.51**	5325.00	708.88	4199.31	2666.28	94.34	9.46
1002	**527.76**	4186.81	2869.72	3343.75	2653.61	46.14	2.98
1022	**554.76**	3976.39	566.32	3712.50	1706.04	31.00	2.37
1042	**582.26**	5797.43	1333.19	5296.53	1445.63	18.03	1.35
1062	**609.26**	6981.18	1019.10	6072.22	1266.92	15.49	1.54
1082	**636.26**	8330.56	1469.83	7081.94	1116.95	8.79	1.68
1102	**663.26**	9003.47	1118.33	8149.31	940.77	14.87	1.80
1122	**688.61**	10471.53	1628.19	9147.92	919.69	31.79	1.55
1142	**711.96**	10778.47	1360.00	9770.83	1244.00	38.34	1.45
1162	**734.96**	11107.64	1202.78	10097.92	1244.00	45.08	1.38
1182	**757.91**	10949.31	2012.36	10494.44	1607.08	38.08	1.43
1202	**782.81**	7086.81	1037.50	7955.56	1309.44	9.16	2.63
1222	**809.76**	7151.39	780.57	6566.67	1654.64	15.12	2.01
1242	**836.76**	7144.44	473.68	6847.22	1981.61	13.24	2.06
1262	**863.76**	7236.11	1311.11	7256.94	2328.92	15.43	1.09
1282	**889.76**	7208.33	3204.86	7208.33	2590.46	52.22	4.20
1302	**906.85**	2784.72	5520.83	5277.78	2170.52	100.02	23.63
1322	**916.04**	4741.25	5375.69	4097.22	2185.65	260.28	26.16
1342	**934.63**	5006.94	5397.22	4673.61	1979.31	6.55	81.49
1362	**974.63**	2618.75	1881.25	3443.06	2952.85	2.15	26.74
1382	**1040.78**	2342.64	642.29	2909.03	1847.08	1.27	16.24
1402	**1110.53**	1370.83	1259.72	1006.25	996.32	1.86	52.70

Note 1: Meridonal, Hoop, and Shear Stresses are Reversed in Highlighted Sections (Floor)

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AY-2D-NL-BES-FCC Pri Tank Stress Seismic Only.xls, Stress Max

Figure H.12. BES-FCC Primary Tank Stresses, Shell Bottom, Seismic Load Only

AY Primary Tank, Best Estimate Soil, Gravity Only, Fully Cracked Concrete, 422 in. Waste Level at 1.7 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-FCC Gravity Only	Max Axial Force (kip) BES-FCC Gravity Only	Shear Force1 (kip) BES-FCC Gravity Only	Maximum Shear Force1 Model Angle	Shear Force2 (kip) BES-FCC Gravity Only	Maximum Shear Force2 Model Angle	Total Shear (kip) BES-FCC Gravity Only
Radius 2	44.72	*22.36*	*67.29*	0.55	-0.120	-0.096	0.102	36	1.699	90	1.699
Radius 3	89.87	*67.29*	*104.93*	0.89	-0.133	-0.122	0.067	54	2.232	0	2.232
Radius 4	120.00	*104.93*	*135.98*	1.03	-0.075	-0.067	0.059	117	1.726	0	1.726
Radius 5	151.97	*135.98*	*181.01*	1.97	-0.075	-0.069	0.049	63	0.559	9	0.559
Radius 6	210.05	*181.01*	*223.79*	2.41	0.026	0.032	0.015	72	1.235	90	1.235
Radius 7	237.53	*223.79*	*270.98*	3.30	0.230	0.242	0.014	144	2.124	180	2.124
Radius 8	304.43	*270.98*	*318.74*	4.04	0.074	0.080	0.005	144	2.472	45	2.472
Radius 9	333.05	*318.74*	*361.64*	4.37	0.237	0.297	0.001	36	2.555	180	2.555
Radius 10	390.22	*361.64*	*406.24*	5.36	0.180	0.461	0.002	27	3.116	180	3.116
Radius 11	422.26	*406.24*	*431.63*	3.60	0.167	0.556	0.001	90	3.325	180	3.325

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 UBS-BEC-Gravity Only	Axial Min Displacement UBS-BEC-Gravity Only	Axial Max Displacement UBS-BEC-Gravity Only
Radius 2	44.72	*22.36*	*67.29*	0.55	0.0351	1667	2222	0.01223	-0.00065	-0.00052
Radius 3	89.87	*67.29*	*104.93*	0.89	0.0715	1670	2219	0.01604	-0.00072	-0.00066
Radius 4	120.00	*104.93*	*135.98*	1.03	0.0968	1673	2215	0.01238	-0.00041	-0.00036
Radius 5	151.97	*135.98*	*181.01*	1.97	0.1252	1677	2207	0.00400	-0.00041	-0.00038
Radius 6	210.05	*181.01*	*223.79*	2.41	0.1825	1688	2192	0.00878	0.00014	0.00018
Radius 7	237.53	*223.79*	*270.98*	3.30	0.2136	1696	2172	0.01503	0.00127	0.00134
Radius 8	304.43	*270.98*	*318.74*	4.04	0.3076	1725	2132	0.01719	0.00041	0.00045
Radius 9	333.05	*318.74*	*361.64*	4.37	0.3613	1746	2086	0.01756	0.00136	0.00171
Radius 10	390.22	*361.64*	*406.24*	5.36	0.5235	1821	2006	0.02053	0.00107	0.00276
Radius 11	422.26	*406.24*	*431.63*	3.60	0.6938	1913	1933	0.02085	0.00104	0.00345

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AY-2D-NL-BES-FCC J Bolt Forces Gravity.xls, Forces

Figure H.13. BES-FCC J-Bolt Forces, Gravity Load Only

AY Primary Tank, Best Estimate Soil, Horizontal and Vertical Seismic Input, Fully Cracked Tank Concrete, 422 in. Waste Level at 1.7 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	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	-0.459	-0.010	2.759	90	4.681	180	4.703
Radius 3	89.87	*67.29*	*104.93*	0.89	-0.280	-0.033	2.078	99	4.845	0	4.900
Radius 4	120.00	*104.93*	*135.98*	1.03	-0.383	0.030	1.441	99	4.504	0	4.504
Radius 5	151.97	*135.98*	*181.01*	1.97	-0.256	0.096	0.903	108	2.970	0	2.970
Radius 6	210.05	*181.01*	*223.79*	2.41	-0.065	0.100	0.456	126	2.633	0	2.633
Radius 7	237.53	*223.79*	*270.98*	3.30	0.100	0.427	0.338	135	2.904	0	2.904
Radius 8	304.43	*270.98*	*318.74*	4.04	-0.408	0.541	0.653	90	3.230	0	3.230
Radius 9	333.05	*318.74*	*361.64*	4.37	-0.077	0.989	1.026	90	3.560	0	3.560
Radius 10	390.22	*361.64*	*406.24*	5.36	-1.973	1.506	2.266	81	4.064	18	4.368
Radius 11	422.26	*406.24*	*431.63*	3.60	-2.302	2.228	3.485	90	5.116	0	5.378

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 Plus Seismic	Axial Min Displacement BES-FCC-Gravity Plus Seismic	Axial Max Displacement BES-FCC-Gravity Plus Seismic
		min	*max*							
Radius 2	44.72	*22.36*	*67.29*	0.55	0.0351	1667	2222	0.03385	-0.00248	-0.00005
Radius 3	89.87	*67.29*	*104.93*	0.89	0.0715	1670	2219	0.03521	-0.00151	-0.00018
Radius 4	120.00	*104.93*	*135.98*	1.03	0.0968	1673	2215	0.03231	-0.00208	0.00016
Radius 5	151.97	*135.98*	*181.01*	1.97	0.1252	1677	2207	0.02125	-0.00139	0.00052
Radius 6	210.05	*181.01*	*223.79*	2.41	0.1825	1688	2192	0.01872	-0.00036	0.00055
Radius 7	237.53	*223.79*	*270.98*	3.30	0.2136	1696	2172	0.02055	0.00055	0.00236
Radius 8	304.43	*270.98*	*318.74*	4.04	0.3076	1725	2132	0.02247	-0.00230	0.00304
Radius 9	333.05	*318.74*	*361.64*	4.37	0.3613	1746	2086	0.02447	-0.00044	0.00569
Radius 10	390.22	*361.64*	*406.24*	5.36	0.5235	1821	2006	0.02878	-0.01180	0.00901
Radius 11	422.26	*406.24*	*431.63*	3.60	0.6938	1913	1933	0.03373	-0.01429	0.01383

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AY-2D-NL-BES-FCC J Bolt Forces Seismic.xls
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Figure H.14. BES-FCC J-Bolt Forces, Gravity Plus Seismic Load

AY Primary Tank, Best Estimate Soil, Horizontal and Vertical Seismic Input, Fully Cracked Tank Concrete, 422 in. Waste Level at 1.7 SpG Seismic Only

ANSYS MAXIMUMS BY RADIUS

M&D J-Bolt Radius No.	Mean J-Bolt Radius	Radius of J-Bolts min	Radius of J-Bolts 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	-0.339	0.087	2.657	108	2.981	0	3.994
Radius 3	89.87	*67.29*	*104.93*	0.89	-0.147	0.089	2.012	108	2.613	0	3.298
Radius 4	120.00	*104.93*	*135.98*	1.03	-0.308	0.098	1.381	108	2.777	0	3.102
Radius 5	151.97	*135.98*	*181.01*	1.97	-0.182	0.165	0.854	108	2.411	0	2.557
Radius 6	210.05	*181.01*	*223.79*	2.41	-0.091	0.067	0.441	108	1.397	144	1.465
Radius 7	237.53	*223.79*	*270.98*	3.30	-0.131	0.185	0.324	90	0.780	135	0.844
Radius 8	304.43	*270.98*	*318.74*	4.04	-0.481	0.461	0.648	117	0.758	117	0.997
Radius 9	333.05	*318.74*	*361.64*	4.37	-0.314	0.692	1.025	117	1.005	117	1.435
Radius 10	390.22	*361.64*	*406.24*	5.36	-2.152	1.044	2.264	108	0.948	0	2.455
Radius 11	422.26	*406.24*	*431.63*	3.60	-2.469	1.672	3.484	108	1.791	0	3.917

M&D J-Bolt Radius No.	Mean J-Bolt Radius	Radius of J-Bolts min	Radius of J-Bolts max	Average Bolts per Element	Bolt Angle (Rad)	Shear Stiffness (kip/ft)	Axial Stiffness (kip/ft)	Shear Displacement BES-FCC-Seismic Only	Axial Min Displacement BES-FCC-Seismic Only	Axial Max Displacement BES-FCC-Seismic Only
Radius 2	44.72	*22.36*	*67.29*	0.55	0.0351	1667	2222	0.02874	-0.00183	0.00047
Radius 3	89.87	*67.29*	*104.93*	0.89	0.0715	1670	2219	0.02370	-0.00079	0.00048
Radius 4	120.00	*104.93*	*135.98*	1.03	0.0968	1673	2215	0.02225	-0.00167	0.00053
Radius 5	151.97	*135.98*	*181.01*	1.97	0.1252	1677	2207	0.01830	-0.00099	0.00090
Radius 6	210.05	*181.01*	*223.79*	2.41	0.1825	1688	2192	0.01042	-0.00050	0.00037
Radius 7	237.53	*223.79*	*270.98*	3.30	0.2136	1696	2172	0.00598	-0.00072	0.00102
Radius 8	304.43	*270.98*	*318.74*	4.04	0.3076	1725	2132	0.00694	-0.00271	0.00259
Radius 9	333.05	*318.74*	*361.64*	4.37	0.3613	1746	2086	0.00987	-0.00180	0.00398
Radius 10	390.22	*361.64*	*406.24*	5.36	0.5235	1821	2006	0.01617	-0.01287	0.00625
Radius 11	422.26	*406.24*	*431.63*	3.60	0.6938	1913	1933	0.02457	-0.01533	0.01038

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AY-2D-NL-BES-FCC J Bolt Forces Seismic.xls
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Figure H.15. BES-FCC J-Bolt Forces, Seismic Load Only

AY Secondary Liner, Best Estimate Soil, Gravity Only, Fully Cracked Tank Concrete, 422 In Waste Level at 1.7SpG

M&D Starting M&D Element No.	Path (in.)	Shell Top Surface (inside - towards waste) Gravity					
		AY-NL-BES-FCC Hoop Strain (in/in) Gravity Top	AY-NL-BES-FCC Meridional Strain (in/in) Gravity Top	AY-NL-BES-FCC Strain Intensity (in/in) Gravity Top	AY-NL-BES-FCC In-Plane Shear Strain (in/in) Gravity Top	AY-NL-BES-FCC In-Plane Shear Force Strain (in/in) Gravity Top	AY-NL-BES-FCC Thru Thickness Shear Strain (in/in) Gravity Top
2062	**19.00**	8.36E-05	2.64E-04	4.13E-04	1.89E-07	2.76E-08	1.15E-09
2052	**49.28**	5.06E-05	7.74E-06	7.36E-05	9.69E-07	1.67E-05	5.65E-07
2042	**64.15**	1.87E-05	7.29E-05	1.01E-04	1.76E-05	2.17E-05	9.03E-06
2032	**72.29**	3.39E-05	3.48E-04	4.83E-04	1.75E-05	1.83E-05	8.65E-06
2022	**96.32**	1.30E-05	8.87E-05	1.23E-04	2.20E-06	8.19E-07	2.09E-07
1916	**129.82**	7.84E-06	3.20E-04	3.91E-04	2.87E-06	7.08E-06	1.90E-07
1906	**169.82**	1.80E-05	1.58E-05	2.49E-05	1.49E-06	3.40E-06	4.04E-08
1896	**235.97**	1.77E-05	2.41E-05	3.83E-05	1.23E-06	2.37E-06	1.07E-08
1886	**305.72**	1.38E-05	5.01E-05	6.38E-05	1.01E-06	3.79E-06	3.57E-09
1876	**379.62**	1.93E-05	5.59E-05	7.10E-05	1.59E-06	6.61E-06	8.36E-09
1866	**441.02**	1.31E-05	7.06E-05	8.89E-05	2.40E-06	6.01E-06	3.06E-08
1856	**487.97**	1.43E-05	6.79E-05	8.20E-05	3.35E-06	1.14E-05	2.58E-07

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Figure H.16. BES-FCC Secondary Liner Strain, Shell Top, Gravity Load Only

AY Secondary Liner, Best Estimate Soil, Gravity Only, Fully Cracked Tank Concrete, 422 In Waste Level at 1.7SpG

		Shell Mid-Plane					
M&D Starting M&D Element No.	Path (in.)	AY-NL-BES-FCC Hoop Strain (in/in) Gravity Mid	AY-NL-BES-FCC Meridional Strain (in/in) Gravity Mid	AY-NL-BES-FCC Strain Intensity (in/in) Gravity Mid	AY-NL-BES-FCC In-Plane Shear Strain (in/in) Gravity Mid	AY-NL-BES-FCC In-Plane Shear Force Strain (in/in) Gravity Mid	AY-NL-BES-FCC Thru Thickness Shear Strain (in/in) Gravity Mid
2062	**19.00**	8.36E-05	2.66E-04	4.15E-04	1.87E-07	2.76E-08	1.15E-09
2052	**49.28**	5.04E-05	5.83E-06	7.37E-05	5.28E-07	1.67E-05	5.65E-07
2042	**64.15**	1.77E-05	1.61E-05	3.59E-05	6.83E-06	2.17E-05	9.03E-06
2032	**72.29**	3.29E-05	3.21E-05	6.66E-05	7.51E-06	1.83E-05	8.65E-06
2022	**96.32**	1.21E-05	1.33E-05	2.26E-05	2.38E-06	8.19E-07	2.09E-07
1916	**129.82**	7.42E-06	1.79E-04	2.19E-04	3.15E-06	7.08E-06	1.90E-07
1906	**169.82**	1.76E-05	7.12E-05	8.88E-05	1.05E-06	3.40E-06	4.04E-08
1896	**235.97**	1.79E-05	2.21E-05	2.95E-05	9.46E-07	2.37E-06	1.07E-08
1886	**305.72**	1.38E-05	9.71E-06	2.38E-05	1.47E-07	3.79E-06	3.57E-09
1876	**379.62**	1.95E-05	3.02E-05	4.02E-05	1.01E-06	6.61E-06	8.36E-09
1866	**441.02**	1.32E-05	7.76E-06	1.78E-05	5.54E-07	6.01E-06	3.06E-08
1856	**487.97**	1.29E-05	2.25E-05	3.24E-05	7.74E-07	1.14E-05	2.58E-07

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AY-2D-NL-BES-FCC Liner Strain Gravity.xls, Strain Max

Figure H.17. BES-FCC Secondary Liner Strain, Shell Middle, Gravity Load Only

AY Secondary Liner, Best Estimate Soil, Gravity Only, Fully Cracked Tank Concrete, 422 In Waste Level at 1.7SpG

M&D Starting M&D Element No.	Path (in.)	Shell Bottom Surface (outside - away from waste) Gravity					
		AY-NL-BES-FCC Hoop Strain (in/in) Gravity Bot	AY-NL-BES-FCC Meridional Strain (in/in) Gravity Bot	AY-NL-BES-FCC Strain Intensity (in/in) Gravity Bot	AY-NL-BES-FCC In-Plane Shear Strain (in/in) Gravity Bot	AY-NL-BES-FCC In-Plane Shear Force Strain (in/in) Gravity Bot	AY-NL-BES-FCC Thru Thickness Shear Strain (in/in) Gravity Bot
2062	**19.00**	8.36E-05	2.68E-04	4.18E-04	1.86E-07	2.76E-08	1.15E-09
2052	**49.28**	5.03E-05	3.94E-06	7.40E-05	8.48E-07	1.67E-05	5.65E-07
2042	**64.15**	1.67E-05	1.04E-04	1.55E-04	3.96E-06	2.17E-05	9.03E-06
2032	**72.29**	3.18E-05	2.88E-04	4.26E-04	2.58E-06	1.83E-05	8.65E-06
2022	**96.32**	1.11E-05	1.14E-04	1.67E-04	2.56E-06	8.19E-07	2.09E-07
1916	**129.82**	7.01E-06	3.91E-05	4.87E-05	3.54E-06	7.08E-06	1.90E-07
1906	**169.82**	1.71E-05	1.36E-04	1.62E-04	8.91E-07	3.40E-06	4.04E-08
1896	**235.97**	1.80E-05	6.71E-05	8.43E-05	8.62E-07	2.37E-06	1.07E-08
1886	**305.72**	1.39E-05	6.72E-05	8.08E-05	9.04E-07	3.79E-06	3.57E-09
1876	**379.62**	1.97E-05	1.16E-04	1.44E-04	9.02E-07	6.61E-06	8.36E-09
1866	**441.02**	1.37E-05	5.65E-05	7.00E-05	1.78E-06	6.01E-06	3.06E-08
1856	**487.97**	1.35E-05	1.12E-04	1.40E-04	2.77E-06	1.14E-05	2.58E-07

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AY-2D-NL-BES-FCC Liner Strain Gravity.xls, Strain Max

Figure H.18. BES-FCC Secondary Liner Strain, Shell Bottom, Gravity Load Only

AY Secondary Liner, Best Estimate Soil, Horizontal and Vertical Input, Full Cracked Tank Concrete, 422 In Waste Level at 1.7SpG

		Shell Top Surface (inside - towards waste)					
M&D Starting M&D Element No.	Path (in.)	AY-NL-BES-FCC Hoop Strain (in/in) Top	AY-NL-BES-FCC Meridional Strain (in/in) Top	AY-NL-BES-FCC Strain Intensity (in/in) Top	AY-NL-BES-FCC In-Plane Shear Strain (in/in) Top	AY-NL-BES-FCC In-Plane Shear Force Strain (in/in) Top	AY-NL-BES-FCC Thru Thickness Shear Strain (in/in) Top
2062	**19.00**	9.98E-05	3.07E-04	4.96E-04	2.61E-04	5.03E-08	1.12E-08
2052	**49.28**	7.56E-05	2.17E-05	1.03E-04	4.03E-05	2.61E-05	1.10E-06
2042	**64.15**	5.67E-05	1.07E-04	1.63E-04	8.80E-05	3.30E-05	1.37E-05
2032	**72.29**	9.53E-05	5.34E-04	7.23E-04	9.28E-05	2.84E-05	1.42E-05
2022	**96.32**	5.86E-05	1.13E-04	1.73E-04	1.03E-04	1.15E-06	3.67E-07
1916	**129.82**	8.05E-05	4.22E-04	5.06E-04	1.95E-04	9.68E-06	2.79E-07
1906	**169.82**	9.43E-05	3.31E-05	1.15E-04	9.25E-05	4.59E-06	5.96E-08
1896	**235.97**	6.61E-05	6.89E-05	1.34E-04	8.87E-05	3.17E-06	1.60E-08
1886	**305.72**	5.31E-05	6.38E-05	8.99E-05	7.09E-05	5.03E-06	6.17E-09
1876	**379.62**	5.55E-05	1.03E-04	1.37E-04	4.90E-05	8.68E-06	1.19E-08
1866	**441.02**	3.33E-05	8.93E-05	1.16E-04	3.55E-05	7.81E-06	3.76E-08
1856	**487.97**	3.06E-05	1.08E-04	1.30E-04	2.57E-05	1.47E-05	3.44E-07

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AY-2D-NL-BES-FCC Liner Strain Seismic.xls, Strain Max

Figure H.19. BES-FCC Secondary Liner Strain, Shell Top, Gravity Plus Seismic Load

AY Secondary Liner, Best Estimate Soil, Horizontal and Vertical Input, Full Cracked Tank Concrete, 422 In Waste Level at 1.7SpG

		Shell Mid-Plane					
M&D Starting M&D Element No.	Path (in.)	AY-NL-BES-FCC Hoop Strain (in/in) Mid	AY-NL-BES-FCC Meridional Strain (in/in) Mid	AY-NL-BES-FCC Strain Intensity (in/in) Mid	AY-NL-BES-FCC In-Plane Shear Strain (in/in) Mid	AY-NL-BES-FCC In-Plane Shear Force Strain (in/in) Mid	AY-NL-BES-FCC Thru Thickness Shear Strain (in/in) Mid
2062	**19.00**	9.98E-05	3.09E-04	4.99E-04	2.61E-04	5.03E-08	1.12E-08
2052	**49.28**	7.56E-05	1.73E-05	1.03E-04	4.04E-05	2.61E-05	1.10E-06
2042	**64.15**	5.62E-05	3.68E-05	9.20E-05	8.89E-05	3.30E-05	1.37E-05
2032	**72.29**	9.42E-05	6.48E-05	1.64E-04	9.26E-05	2.84E-05	1.42E-05
2022	**96.32**	5.86E-05	4.38E-05	1.04E-04	1.04E-04	1.15E-06	3.67E-07
1916	**129.82**	8.05E-05	2.27E-04	2.86E-04	1.95E-04	9.68E-06	2.79E-07
1906	**169.82**	9.38E-05	1.09E-04	1.98E-04	9.25E-05	4.59E-06	5.96E-08
1896	**235.97**	6.59E-05	5.02E-05	9.61E-05	8.84E-05	3.17E-06	1.60E-08
1886	**305.72**	5.31E-05	2.31E-05	7.80E-05	7.10E-05	5.03E-06	6.17E-09
1876	**379.62**	5.57E-05	4.65E-05	6.98E-05	4.86E-05	8.68E-06	1.19E-08
1866	**441.02**	3.39E-05	1.72E-05	4.29E-05	3.55E-05	7.81E-06	3.76E-08
1856	**487.97**	2.99E-05	3.60E-05	4.77E-05	2.52E-05	1.47E-05	3.44E-07

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AY-2D-NL-BES-FCC Liner Strain Seismic.xls, Strain Max

Figure H.20. BES-FCC Secondary Liner Strain, Shell Middle, Gravity Plus Seismic Load

AY Secondary Liner, Best Estimate Soil, Horizontal and Vertical Input, Full Cracked Tank Concrete, 422 In Waste Level at 1.7SpG

		Shell Bottom Surface (outside - away from waste)					
M&D Starting M&D Element No.	Path (in.)	AY-NL-BES-FCC Hoop Strain (in/in) Bot	AY-NL-BES-FCC Meridional Strain (in/in) Bot	AY-NL-BES-FCC Strain Intensity (in/in) Bot	AY-NL-BES-FCC In-Plane Shear Strain (in/in) Bot	AY-NL-BES-FCC In-Plane Shear Force Strain (in/in) Bot	AY-NL-BES-FCC Thru Thickness Shear Strain (in/in) Bot
2062	**19.00**	9.98E-05	3.11E-04	5.01E-04	2.61E-04	5.03E-08	1.12E-08
2052	**49.28**	7.56E-05	1.56E-05	1.05E-04	4.05E-05	2.61E-05	1.10E-06
2042	**64.15**	5.57E-05	1.76E-04	2.44E-04	8.97E-05	3.30E-05	1.37E-05
2032	**72.29**	9.31E-05	4.05E-04	6.19E-04	9.24E-05	2.84E-05	1.42E-05
2022	**96.32**	5.86E-05	1.84E-04	2.49E-04	1.04E-04	1.15E-06	3.67E-07
1916	**129.82**	8.04E-05	5.82E-05	1.98E-04	1.95E-04	9.68E-06	2.79E-07
1906	**169.82**	9.32E-05	1.96E-04	2.82E-04	9.24E-05	4.59E-06	5.96E-08
1896	**235.97**	6.57E-05	8.24E-05	1.23E-04	8.82E-05	3.17E-06	1.60E-08
1886	**305.72**	5.31E-05	9.92E-05	1.47E-04	7.13E-05	5.03E-06	6.17E-09
1876	**379.62**	5.59E-05	1.37E-04	1.75E-04	4.83E-05	8.68E-06	1.19E-08
1866	**441.02**	3.44E-05	8.64E-05	1.14E-04	3.61E-05	7.81E-06	3.76E-08
1856	**487.97**	2.93E-05	1.40E-04	1.76E-04	2.53E-05	1.47E-05	3.44E-07

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AY-2D-NL-BES-FCC Liner Strain Seismic.xls, Strain Max

Figure H.21. BES-FCC Secondary Liner Strain, Shell Bottom, Gravity Plus Seismic Load

AY Secondary Liner, Best Estimate Soil, Horizontal and Vertical Input, Full Cracked Tank Concrete, 422 In Waste Level at 1.7SpG Seismic Only

		Shell Top Surface (inside - towards waste)					
M&D Starting M&D Element No.	Path (in.)	AY-NL-BES-FCC Seismic Only Hoop Strain (in/in) Top	AY-NL-BES-FCC Seismic Only Meridional Strain (in/in) Top	AY-NL-BES-FCC Seismic Only Strain Intensity (in/in) Top	AY-NL-BES-FCC Seismic Only In-Plane Shear Strain (in/in) Top	AY-NL-BES-FCC Seismic Only In-Plane Shear Force Strain (in/in) Top	AY-NL-BES-FCC Seismic Only Thru-Thickness Shear Strain (in/in) Top
2062	**19.00**	1.61E-05	4.29E-05	8.37E-05	2.61E-04	2.26E-08	1.00E-08
2052	**49.28**	2.51E-05	1.40E-05	2.96E-05	3.94E-05	9.43E-06	5.33E-07
2042	**64.15**	3.80E-05	3.36E-05	6.23E-05	7.04E-05	1.13E-05	4.63E-06
2032	**72.29**	6.14E-05	1.86E-04	2.40E-04	7.53E-05	1.00E-05	5.56E-06
2022	**96.32**	4.57E-05	2.42E-05	4.95E-05	1.01E-04	3.34E-07	1.58E-07
1916	**129.82**	7.27E-05	1.01E-04	1.15E-04	1.92E-04	2.60E-06	8.91E-08
1906	**169.82**	7.63E-05	1.72E-05	8.96E-05	9.10E-05	1.19E-06	1.91E-08
1896	**235.97**	4.84E-05	4.48E-05	9.60E-05	8.74E-05	7.97E-07	5.30E-09
1886	**305.72**	3.93E-05	1.37E-05	2.60E-05	6.99E-05	1.24E-06	2.59E-09
1876	**379.62**	3.62E-05	4.75E-05	6.60E-05	4.74E-05	2.07E-06	3.55E-09
1866	**441.02**	2.02E-05	1.87E-05	2.66E-05	3.31E-05	1.80E-06	7.02E-09
1856	**487.97**	1.63E-05	4.00E-05	4.80E-05	2.23E-05	3.25E-06	8.60E-08

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Figure H.22. BES-FCC Secondary Liner Strain, Shell Top, Seismic Load Only

AY Secondary Liner, Best Estimate Soil, Horizontal and Vertical Input, Full Cracked Tank Concrete, 422 In Waste Level at 1.7SpG Seismic Only

		Shell Mid-Plane					
M&D Starting M&D Element No.	Path (in.)	AY-NL-BES-FCC Seismic Only Hoop Strain (in/in) Mid	AY-NL-BES-FCC Seismic Only Meridional Strain (in/in) Mid	AY-NL-BES-FCC Seismic Only Strain Intensity (in/in) Mid	AY-NL-BES-FCC Seismic Only In-Plane Shear Strain (in/in) Mid	AY-NL-BES-FCC Seismic Only In-Plane Shear Force Strain (in/in) Mid	AY-NL-BES-FCC Seismic Only Thru-Thickness Shear Strain (in/in) Mid
2062	**19.00**	1.61E-05	4.33E-05	8.34E-05	2.61E-04	2.26E-08	1.00E-08
2052	**49.28**	2.52E-05	1.14E-05	2.97E-05	3.99E-05	9.43E-06	5.33E-07
2042	**64.15**	3.84E-05	2.07E-05	5.60E-05	8.20E-05	1.13E-05	4.63E-06
2032	**72.29**	6.13E-05	3.27E-05	9.71E-05	8.51E-05	1.00E-05	5.56E-06
2022	**96.32**	4.66E-05	3.05E-05	8.11E-05	1.01E-04	3.34E-07	1.58E-07
1916	**129.82**	7.30E-05	4.76E-05	6.64E-05	1.92E-04	2.60E-06	8.91E-08
1906	**169.82**	7.62E-05	3.81E-05	1.09E-04	9.14E-05	1.19E-06	1.91E-08
1896	**235.97**	4.81E-05	2.81E-05	6.66E-05	8.75E-05	7.97E-07	5.30E-09
1886	**305.72**	3.93E-05	1.34E-05	5.42E-05	7.09E-05	1.24E-06	2.59E-09
1876	**379.62**	3.62E-05	1.63E-05	2.96E-05	4.76E-05	2.07E-06	3.55E-09
1866	**441.02**	2.06E-05	9.47E-06	2.51E-05	3.49E-05	1.80E-06	7.02E-09
1856	**487.97**	1.70E-05	1.35E-05	1.53E-05	2.44E-05	3.25E-06	8.60E-08

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Figure H.23. BES-FCC Secondary Liner Strain, Shell Middle, Seismic Load Only

AY Secondary Liner, Best Estimate Soil, Horizontal and Vertical Input, Full Cracked Tank Concrete, 422 In Waste Level at 1.7SpG Seismic Only

		Shell Bottom Surface (outside - away from waste)					
M&D Starting M&D Element No.	Path (in.)	AY-NL-BES-FCC Seismic Only Hoop Strain (in/in) Bot	AY-NL-BES-FCC Seismic Only Meridional Strain (in/in) Bot	AY-NL-BES-FCC Seismic Only Strain Intensity (in/in) Bot	AY-NL-BES-FCC Seismic Only In-Plane Shear Strain (in/in) Bot	AY-NL-BES-FCC Seismic Only In-Plane Shear Force Strain (in/in) Bot	AY-NL-BES-FCC Seismic Only Thru-Thickness Shear Strain (in/in) Bot
2062	**19.00**	1.61E-05	4.37E-05	8.31E-05	2.60E-04	2.26E-08	1.00E-08
2052	**49.28**	2.53E-05	1.17E-05	3.07E-05	3.96E-05	9.43E-06	5.33E-07
2042	**64.15**	3.90E-05	7.22E-05	8.94E-05	8.57E-05	1.13E-05	4.63E-06
2032	**72.29**	6.12E-05	1.16E-04	1.93E-04	8.98E-05	1.00E-05	5.56E-06
2022	**96.32**	4.75E-05	7.00E-05	8.19E-05	1.01E-04	3.34E-07	1.58E-07
1916	**129.82**	7.34E-05	1.92E-05	1.49E-04	1.91E-04	2.60E-06	8.91E-08
1906	**169.82**	7.61E-05	5.94E-05	1.19E-04	9.15E-05	1.19E-06	1.91E-08
1896	**235.97**	4.77E-05	1.53E-05	3.90E-05	8.73E-05	7.97E-07	5.30E-09
1886	**305.72**	3.93E-05	3.20E-05	6.58E-05	7.04E-05	1.24E-06	2.59E-09
1876	**379.62**	3.62E-05	2.08E-05	3.05E-05	4.74E-05	2.07E-06	3.55E-09
1866	**441.02**	2.08E-05	2.99E-05	4.40E-05	3.43E-05	1.80E-06	7.02E-09
1856	**487.97**	1.58E-05	2.72E-05	3.59E-05	2.25E-05	3.25E-06	8.60E-08

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Figure H.24. BES-FCC Secondary Liner Strain, Shell Bottom, Seismic Load Only

Tank AY, 422 Inch Waste Level
SpG = 1.7
Best Estimate Soil
Fully Cracked Concrete

Angle	Vertical Min AY-BES-FCC Gravity	Vertical Max AY-BES-FCC Gravity	Shear Y Min AY-BES-FCC Gravity	Shear Y Max AY-BES-FCC Gravity	Shear X Min AY-BES-FCC Gravity	Shear X Max AY-BES-FCC Gravity	Shear Y Max AY-BES-FCC Gravity	Shear X Max AY-BES-FCC Gravity	Shear Max AY-BES-FCC Gravity	Vertical Force Max AY-BES-FCC Gravity	Vertical Force Min AY-BES-FCC Gravity
0	-209.80	-209.80	0.00	0.00	3.28	3.28	0.00	1.02	1.02	-65.56	-65.56
9	-419.20	-419.20	0.52	0.52	6.21	6.22	0.08	0.97	0.98	-65.50	-65.50
18	-418.80	-418.70	1.46	1.47	5.76	5.76	0.23	0.90	0.93	-65.44	-65.42
27	-418.60	-418.50	2.47	2.48	5.29	5.30	0.39	0.83	0.91	-65.41	-65.39
36	-418.50	-418.40	3.38	3.39	4.76	4.76	0.53	0.74	0.91	-65.39	-65.38
45	-418.40	-418.40	4.14	4.15	4.14	4.15	0.65	0.65	0.92	-65.38	-65.38
54	-418.40	-418.40	4.76	4.77	3.44	3.45	0.75	0.54	0.92	-65.38	-65.38
63	-418.40	-418.30	5.24	5.25	2.65	2.65	0.82	0.41	0.92	-65.38	-65.36
72	-418.30	-418.30	5.55	5.56	1.79	1.79	0.87	0.28	0.91	-65.36	-65.36
81	-418.30	-418.20	5.76	5.77	0.89	0.89	0.90	0.14	0.91	-65.36	-65.34
90	-418.20	-418.20	5.84	5.85	-0.03	-0.03	0.91	0.00	0.91	-65.34	-65.34
99	-418.20	-418.20	5.80	5.81	-0.94	-0.93	0.91	0.15	0.92	-65.34	-65.34
108	-418.30	-418.20	5.61	5.62	-1.83	-1.82	0.88	0.29	0.92	-65.36	-65.34
117	-418.30	-418.20	5.26	5.27	-2.67	-2.67	0.82	0.42	0.92	-65.36	-65.34
126	-418.20	-418.20	4.78	4.79	-3.45	-3.45	0.75	0.54	0.92	-65.34	-65.34
135	-418.20	-418.10	4.17	4.17	-4.15	-4.14	0.65	0.65	0.92	-65.34	-65.33
144	-418.10	-418.10	3.42	3.43	-4.76	-4.76	0.54	0.74	0.92	-65.33	-65.33
153	-418.20	-418.10	2.52	2.52	-5.29	-5.28	0.39	0.83	0.92	-65.34	-65.33
162	-418.30	-418.20	1.50	1.50	-5.73	-5.72	0.23	0.90	0.93	-65.36	-65.34
171	-418.70	-418.70	0.54	0.54	-6.18	-6.17	0.08	0.97	0.97	-65.42	-65.42
180	-209.60	-209.50	0.00	0.00	-3.26	-3.26	0.00	1.02	1.02	-65.50	-65.47

Figure H.25. BES-FCC Concrete Wall/Footing Contact Forces, Gravity Load Only

Tank AY, 422 Inch Waste Level
SpG = 1.7
Best Estimate Soil
Fully Cracked Concrete

Angle	Vertical Min AY-BES-FCC Seismic	Vertical Max AY-BES-FCC Seismic	Shear Y Min AY-BES-FCC Seismic	Shear Y Max AY-BES-FCC Seismic	Shear X Min AY-BES-FCC Seismic	Shear X Max AY-BES-FCC Seismic	Shear Y Max AY-BES-FCC Seismic	Shear X Max AY-BES-FCC Seismic	Shear Max AY-BES-FCC Seismic	Vertical Force Max AY-BES-FCC Seismic	Vertical Force Min AY-BES-FCC Seismic
0	-243.40	-158.80	0.00	0.00	-4.86	12.62	0.00	3.94	3.94	-76.06	-49.63
9	-486.30	-318.20	-19.37	20.21	-12.56	27.69	3.16	4.33	5.36	-75.98	-49.72
18	-485.50	-320.30	-36.03	38.46	-20.97	36.01	6.01	5.63	8.23	-75.86	-50.05
27	-484.80	-324.20	-48.93	53.02	-34.67	49.45	8.28	7.73	11.33	-75.75	-50.66
36	-484.00	-329.70	-57.17	62.65	-52.55	66.71	9.79	10.42	14.30	-75.63	-51.52
45	-483.10	-336.50	-59.93	66.45	-72.44	86.16	10.38	13.46	17.00	-75.48	-52.58
54	-482.10	-343.70	-56.67	64.05	-92.44	106.00	10.01	16.56	19.35	-75.33	-53.70
63	-481.00	-347.70	-47.48	55.69	-110.60	124.40	8.70	19.44	21.30	-75.16	-54.33
72	-479.70	-351.40	-33.03	42.19	-125.20	139.40	6.59	21.78	22.76	-74.95	-54.91
81	-478.30	-354.50	-14.46	24.99	-134.80	149.30	3.90	23.33	23.65	-74.73	-55.39
90	-476.90	-356.60	3.64	7.93	-138.40	152.60	1.24	23.84	23.88	-74.52	-55.72
99	-475.60	-357.80	-13.44	27.52	-135.70	149.10	4.30	23.30	23.69	-74.31	-55.91
108	-474.30	-355.70	-30.47	46.52	-127.00	138.90	7.27	21.70	22.89	-74.11	-55.58
117	-473.10	-353.30	-43.88	61.24	-113.30	122.60	9.57	19.16	21.41	-73.92	-55.20
126	-472.00	-352.10	-52.39	69.96	-96.48	102.00	10.93	15.94	19.33	-73.75	-55.02
135	-471.00	-352.10	-55.39	71.90	-78.18	79.52	11.23	12.43	16.75	-73.59	-55.02
144	-470.10	-353.10	-52.83	67.11	-60.18	57.57	10.49	9.40	14.08	-73.45	-55.17
153	-469.50	-351.50	-45.51	56.30	-44.34	38.23	8.80	6.93	11.20	-73.36	-54.92
162	-469.70	-350.40	-33.69	40.58	-31.92	23.20	6.34	4.99	8.07	-73.39	-54.75
171	-471.00	-350.40	-18.18	21.26	-24.21	13.66	3.32	3.78	5.03	-73.59	-54.75
180	-235.90	-175.40	0.00	0.00	-11.06	5.22	0.00	3.46	3.46	-73.72	-54.81

Figure H.26. BES-FCC Concrete Wall/Footing Contact Forces, Gravity Plus Seismic Load

Tank AY, 422 Inch Waste Level
SpG = 1.7
Best Estimate Soil
Fully Cracked Concrete

Angle	Vertical Min AY-BES-FCC Seismic Only	Vertical Max AY-BES-FCC Seismic Only	Shear Y Min AY-BES-FCC Seismic Only	Shear Y Max AY-BES-FCC Seismic Only	Shear X Min AY-BES-FCC Seismic Only	Shear X Max AY-BES-FCC Seismic Only	Shear Y Max AY-BES-FCC Seismic Only	Shear X Max AY-BES-FCC Seismic Only	Shear Max AY-BES-FCC Seismic Only	Vertical Force Max AY-BES-FCC Seismic Only	Vertical Force Min AY-BES-FCC Seismic Only
0	-33.60	51.00	0.00	0.00	-8.14	9.34	0.00	2.92	2.92	-10.50	15.94
9	-67.10	101.00	-19.89	19.69	-18.77	21.47	3.11	3.35	4.57	-10.48	15.78
18	-66.70	98.40	-37.49	37.00	-26.73	30.25	5.86	4.73	7.53	-10.42	15.38
27	-66.20	94.30	-51.40	50.54	-39.96	44.15	8.03	6.90	10.59	-10.34	14.73
36	-65.50	88.70	-60.55	59.26	-57.31	61.95	9.46	9.68	13.53	-10.23	13.86
45	-64.70	81.90	-64.07	62.30	-76.58	82.01	10.01	12.81	16.26	-10.11	12.80
54	-63.70	74.70	-61.43	59.28	-95.88	102.56	9.60	16.02	18.68	-9.95	11.67
63	-62.60	70.60	-52.72	50.44	-113.25	121.75	8.24	19.02	20.73	-9.78	11.03
72	-61.40	66.90	-38.58	36.63	-126.99	137.61	6.03	21.50	22.33	-9.59	10.45
81	-60.00	63.70	-20.22	19.22	-135.69	148.41	3.16	23.19	23.40	-9.38	9.95
90	-58.70	61.60	-2.19	2.08	-138.37	152.63	0.34	23.85	23.85	-9.17	9.62
99	-57.40	60.40	-19.24	21.71	-134.76	150.03	3.39	23.44	23.69	-8.97	9.44
108	-56.00	62.50	-36.08	40.90	-125.18	140.72	6.39	21.99	22.90	-8.75	9.77
117	-54.80	64.90	-49.14	55.97	-110.63	125.27	8.75	19.57	21.44	-8.56	10.14
126	-53.80	66.10	-57.17	65.18	-93.03	105.45	10.18	16.48	19.37	-8.41	10.33
135	-52.80	66.00	-59.56	67.73	-74.03	83.66	10.58	13.07	16.82	-8.25	10.31
144	-52.00	65.00	-56.25	63.69	-55.42	62.33	9.95	9.74	13.92	-8.13	10.16
153	-51.30	66.60	-48.03	53.78	-39.05	43.51	8.40	6.80	10.81	-8.02	10.41
162	-51.40	67.80	-35.19	39.08	-26.19	28.92	6.11	4.52	7.60	-8.03	10.59
171	-52.30	68.30	-18.72	20.72	-18.03	19.83	3.24	3.10	4.48	-8.17	10.67
180	-26.30	34.10	0.00	0.00	-7.80	8.48	0.00	2.65	2.65	-8.22	10.66

Figure H.27. BES-FCC Concrete Wall/Footing Contact Forces, Seismic Load Only

Tank AY 422 Inch Waste Level
SpG = 1.7
Best Estimate Soil
Fully Cracked Concrete

	Angle (rad)	Path	Max Pressure Soil (BES) AY-FCC Gravity (PSI)	Min Pressure Soil (BES) AY-FCC Gravity (PSI)	Max Meridional Friction Soil (BES) AY-FCC Gravity (PSI)	Max Tangential Friction Soil (BES) AY-FCC Gravity (PSI)	Max Contact Displacement Soil (BES) AY-FCC Gravity (PSI)	Vertical Pressure	Active Pressure Phi = 33 deg	Active Pressure Phi = 49 deg
568	-0.035089	**67.727**	15.45	11.09	3.87	0.05	0.06	7.12	7.11	7.11
565.8	-0.07135	**105.668**	7.91	6.74	1.79	0.05	0.11	7.27	7.26	7.26
563.21	-0.096521	**137.069**	8.93	8.46	2.01	0.06	0.12	7.46	7.43	7.42
559.7	-0.124516	**182.849**	5.62	4.41	1.20	0.04	0.08	7.71	7.65	7.65
550.7	-0.180521	**226.563**	6.05	5.07	1.61	0.11	0.05	8.35	8.23	8.22
545.2	-0.210395	**275.566**	8.27	7.65	1.80	0.09	0.04	8.74	8.57	8.55
527.68	-0.298426	**325.690**	7.65	7.27	1.59	0.03	0.04	9.99	9.59	9.56
518.2	-0.34673	**372.305**	9.26	9.17	2.36	0.02	0.04	10.66	10.09	10.04
494.5	-0.482293	**423.427**	16.26	16.12	3.20	0.08	0.03	12.35	11.07	10.97
476.2	-0.606571	**468.308**	27.95	27.85	3.16	0.12	0.02	13.65	11.45	11.27
447.4	-0.656685	**515.312**	30.81	30.63	5.12	0.22	0.03	15.70	12.75	12.51
407.1	-0.710341	**549.725**	26.63	26.53	5.46	0.16	0.04	18.57	14.53	14.18
382.1	-1.570796	**585.819**	14.26	14.22	3.66	0.08	0.04	20.35	6.00	2.85
335	-1.570796	**636.369**	4.95	4.94	1.29	0.01	0.04	23.70	6.99	3.32
281	-1.570796	**685.619**	3.48	3.47	0.82	0.00	0.05	27.55	8.13	3.86
236.5	-1.570796	**732.719**	4.55	4.55	0.93	0.00	0.05	30.71	9.06	4.30
186.8	-1.570796	**778.219**	4.91	4.89	1.01	0.01	0.05	34.25	10.10	4.80
145.5	-1.570796	**821.369**	4.75	4.72	1.00	0.00	0.05	37.19	10.97	5.21
70	-1.570796	**874.169**	5.85	5.74	1.34	0.01	0.04	42.57	12.56	5.96
24	-1.570796	**930.544**	11.40	11.34	2.75	0.06	0.03	45.84	13.52	6.42

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Figure H.28. BES-FCC Soil/Concrete Tank Contact Forces, Gravity Load Only

Tank AY, 422 Inch Waste Level
SpG = 1.7
Best Estimate Soil
Fully Cracked Concrete

	Angle (rad)	Path	Max Pressure Soil (BES-FCC) AY Seismic (PSI)	Min Pressure Soil (BES-FCC) AY Seismic (PSI)	Max Meridional Friction Soil (BES-FCC) AY Seismic (PSI)	Max Tangential Friction Soil (BES-FCC) AY Seismic (PSI)	Max Contact Displacment Soil (BES-FCC) AY Seismic (PSI)	Vertical Pressure	Active Pressure Phi = 33 deg	Active Pressure Phi = 49 deg
568	-0.035089	**67.727**	28.45	4.29	11.49	7.13	0.10	7.12	7.11	7.11
565.8	-0.07135	**105.668**	12.53	1.83	7.01	3.95	0.15	7.27	7.26	7.26
563.21	-0.096521	**137.069**	14.65	2.25	7.54	3.28	0.15	7.46	7.43	7.42
559.7	-0.124516	**182.849**	8.35	2.72	5.11	3.41	0.09	7.71	7.65	7.65
550.7	-0.180521	**226.563**	10.02	2.22	4.52	4.85	0.06	8.35	8.23	8.22
545.2	-0.210395	**275.566**	10.20	5.37	4.71	4.64	0.05	8.74	8.57	8.55
527.68	-0.298426	**325.690**	9.73	4.78	3.91	4.18	0.05	9.99	9.59	9.56
518.2	-0.34673	**372.305**	11.47	6.83	4.65	4.01	0.04	10.66	10.09	10.04
494.5	-0.482293	**423.427**	19.13	13.26	5.19	3.67	0.03	12.35	11.07	10.97
476.2	-0.606571	**468.308**	34.04	22.04	6.11	3.23	0.03	13.65	11.45	11.27
447.4	-0.656685	**515.312**	35.96	26.10	11.21	3.12	0.05	15.70	12.75	12.51
407.1	-0.710341	**549.725**	31.96	21.49	12.92	2.38	0.06	18.57	14.53	14.18
382.1	-1.570796	**585.819**	16.97	11.50	8.95	1.74	0.07	20.35	6.00	2.85
335	-1.570796	**636.369**	5.64	4.24	4.10	1.43	0.08	23.70	6.99	3.32
281	-1.570796	**685.619**	4.11	2.68	2.72	1.37	0.08	27.55	8.13	3.86
236.5	-1.570796	**732.719**	5.14	3.94	3.05	1.34	0.08	30.71	9.06	4.30
186.8	-1.570796	**778.219**	5.43	4.32	3.29	1.52	0.08	34.25	10.10	4.80
145.5	-1.570796	**821.369**	5.49	3.66	3.22	2.04	0.08	37.19	10.97	5.21
70	-1.570796	**874.169**	7.17	4.24	5.45	2.34	0.06	42.57	12.56	5.96
24	-1.570796	**930.544**	18.75	2.81	6.77	2.86	0.05	45.84	13.52	6.42

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Figure H.29. BES-FCC Soil/Concrete Tank Contact Forces, Gravity Plus Seismic Load

Tank AY, 422 Inch Waste Level
SpG = 1.7
Best Estimate Soil
Fully Cracked Concrete

	Angle (rad)	Path	Max Pressure Soil (BES-FCC) AY Seismic Only (PSI)	Min Pressure Soil (BES-FCC) AY Seismic Only (PSI)	Max Meridional Friction (BES-FCC) AY Seismic Only (PSI)	Max Tangential Friction (BES-FCC) AY Seismic Only (PSI)	Max Contact Displacement (BES-FCC) AY Seismic Only (PSI)
568	-0.035089	**67.727**	13.00	-11.16	7.62	7.08	0.04
565.8	-0.07135	**105.668**	4.62	-6.08	5.23	3.90	0.05
563.21	-0.096521	**137.069**	5.72	-6.68	5.53	3.21	0.03
559.7	-0.124516	**182.849**	2.73	-2.90	3.91	3.37	0.02
550.7	-0.180521	**226.563**	3.97	-3.83	2.91	4.74	0.01
545.2	-0.210395	**275.566**	1.93	-2.90	2.91	4.55	0.01
527.68	-0.298426	**325.690**	2.08	-2.86	2.32	4.15	0.01
518.2	-0.34673	**372.305**	2.20	-2.43	2.29	4.00	0.01
494.5	-0.482293	**423.427**	2.86	-3.00	1.98	3.59	0.01
476.2	-0.606571	**468.308**	6.09	-5.91	2.95	3.11	0.01
447.4	-0.656685	**515.312**	5.15	-4.71	6.09	2.90	0.01
407.1	-0.710341	**549.725**	5.33	-5.14	7.46	2.22	0.02
382.1	-1.570796	**585.819**	2.70	-2.76	5.29	1.67	0.03
335	-1.570796	**636.369**	0.69	-0.71	2.82	1.42	0.03
281	-1.570796	**685.619**	0.63	-0.79	1.91	1.37	0.04
236.5	-1.570796	**732.719**	0.58	-0.62	2.13	1.34	0.04
186.8	-1.570796	**778.219**	0.52	-0.59	2.27	1.52	0.03
145.5	-1.570796	**821.369**	0.75	-1.09	2.22	2.04	0.03
70	-1.570796	**874.169**	1.31	-1.61	4.11	2.33	0.02
24	-1.570796	**930.544**	7.35	-8.60	4.02	2.80	0.01

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Figure H.30. BES-FCC Soil/Concrete Tank Contact Forces, Seismic Load Only

Tank AY, 422 Inch Waste Level
SpG = 1.7
Best Estimate Soil
Fully Cracked Concrete

Radius	Max Pressure Primary Tank/Concrete Tank Dome AY Gravity (PSI)	Min Pressure Primary Tank/Concrete Tank Dome AY Gravity (PSI)	Max Gap Lateral Displacement Primary Tank /Concrete Tank Dome Gravity (in)	Max Gap Displacement Primary Tank/Concete Tank Dome AY Gravity (Inches)
67.727	7.840	7.479	0.008875	0.000000
105.668	3.486	3.292	0.015348	0.000000
137.069	2.851	2.734	0.010718	-0.000001
182.849	3.222	3.145	0.019692	0.000000
226.563	1.888	1.760	0.010199	-0.000224
275.566	3.306	3.269	0.021876	0.000000
325.690	0.000	0.000	0.004867	-0.000310
372.305	2.685	1.647	0.012432	-0.000784
423.427	6.958	0.000	0.003437	-1.050120

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Figure H.31. BES-FCC Primary Tank/Concrete Dome Contact Forces, Gravity Load Only

Tank AY, 422 Inch Waste Level
SpG = 1.7
Best Estimate Soil
Fully Cracked Concrete

Radius	Max Pressure Primary Tank/Concrete Tank Dome AY Seismic (PSI)	Min Pressure Primary Tank/Concrete Tank Dome AY Seismic (PSI)	Max Gap Lateral Displacement Primary Tank /Concrete Tank Dome Seismic (in)	Max Gap Displacement Primary Tank/Concete Tank Dome AY Seismic (Inches)
67.727	19.563	3.251	0.011827	0.000000
105.668	15.542	1.175	0.019620	-0.000073
137.069	14.132	0.405	0.019932	-0.000087
182.849	7.299	2.006	0.024600	-0.000007
226.563	6.243	1.029	0.012540	-0.000413
275.566	21.764	2.408	0.025848	-0.000799
325.690	16.458	0.000	0.008168	-0.001624
372.305	58.701	0.000	0.037368	-0.002575
423.427	89.306	0.000	0.033924	-1.055400

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Figure H.32. BES-FCC Primary Tank/Concrete Dome Contact Forces, Gravity Plus Seismic Load

Tank AY, 422 Inch Waste Level
SpG = 1.7
Best Estimate Soil
Fully Cracked Concrete

Radius	Max Pressure Primary Tank/Concrete Tank Dome AY Seismic Only (PSI)	Min Pressure Primary Tank/Concrete Tank Dome AY Seismic Only (PSI)	Max Gap Lateral Displacement Primary Tank /Concrete Tank Dome Seismic Only (in)	Max Gap Displacement Primary Tank/Concete Tank Dome AY Seismic Only (Inches)
67.727	11.722	-4.228	0.002952	0.000000
105.668	12.056	-2.117	0.004272	-0.000073
137.069	11.281	-2.329	0.009214	-0.000086
182.849	4.076	-1.139	0.004908	-0.000007
226.563	4.356	-0.731	0.002341	-0.000189
275.566	18.458	-0.861	0.003972	-0.000799
325.690	16.458	0.000	0.003301	-0.001314
372.305	56.016	-1.647	0.024936	-0.001791
423.427	82.347	0.000	0.030487	-0.005280

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AY-2D-NL-BES-FCC J-Bolt-Contact-Seismic.xls
Page 1

Figure H.33. BES-FCC Primary Tank/Concrete Dome Contact Forces, Seismic Load Only

Tank AY, 422 Inch Waste Level
SpG = 1.7
Best Estimate Soil
Fully Cracked Concrete

Radius	Max Pressure Primary Tank/Insulating Concrete AY Gravity (PSI)	Min Pressure Primary Tank/Insulating Concrete AY Gravity (PSI)	Max Lateral Displacement Primary Tank / Insulating Concete AY Gravity (Inches)	Min Lateral Displacement Primary Tank / Insulating Concete AY Gravity (Inches)
424.00	52.243	51.757	0.003197	0.003101
384.00	19.021	18.889	0.000286	0.000265
317.85	27.479	27.451	0.000450	0.000435
248.10	25.889	25.833	0.000357	0.000345
199.25	26.014	25.938	0.000198	0.000193
154.95	26.208	26.104	0.000162	0.000159
112.80	25.438	25.250	0.000082	0.000077
65.85	29.319	28.722	0.000171	0.000167

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Page 1
AY-2D-NL-BES-FCC-Primary-Contact-Gravity.xls, FM Max

Figure H.34. BES-FCC Primary Tank/Insulating Concrete Contact Forces, Gravity Load Only

Tank AY, 422 Inch Waste Level
SpG = 1.7
Best Estimate Soil
Fully Cracked Concrete

Radius	Max Pressure Primary Tank/Insulaiting Concrete AY Seismic (PSI)	Min Pressure Primary Tank/Insulaiting Concrete AY Seismic (PSI)	Max Lateral Displacement Primary Tank/Insulaiting Concrete AY Seismic (Inches)	Min Lateral Displacement Primary Tank/Insulaiting Concrete AY Seismic (Inches)
424.00	73.056	26.861	0.031680	0.001270
384.00	25.063	12.299	0.020940	0.000151
317.85	33.875	19.250	0.008100	0.000359
248.10	31.181	20.257	0.003002	0.000216
199.25	31.208	20.688	0.002051	0.000160
154.95	31.174	21.201	0.001493	0.000118
112.80	30.208	20.882	0.001150	0.000030
65.85	34.583	23.701	0.000991	0.000084

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Page 2
AY-2D-NL-BES-FCC Primary-Contact-Seismic.xls, FM Max

Figure H.35. BES-FCC Primary Tank/Insulating Concrete Contact Forces, Gravity Plus Seismic Load

Tank AY, 422 Inch Waste Level
SpG = 1.7
Best Estimate Soil
Fully Cracked Concrete

Radius	Max Pressure Primary Tank/Insulaiting Concrete AY Seismic Only (PSI)	Min Pressure Primary Tank/Insulaiting Concrete AY Seismic Only (PSI)	Max Lateral Displacement Primary Tank/Insulaiting Concrete AY Seismic Only (Inches)	Min Lateral Displacement Primary Tank/Insulaiting Concrete AY Seismic Only (Inches)
424.00	20.813	-24.896	0.028	-0.002
384.00	6.042	-6.590	0.021	0.000
317.85	6.396	-8.201	0.008	0.000
248.10	5.292	-5.576	0.003	0.000
199.25	5.194	-5.250	0.002	0.000
154.95	4.965	-4.903	0.001	0.000
112.80	4.771	-4.368	0.001	0.000
65.85	5.264	-5.021	0.001	0.000

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AY-2D-NL-BES-FCC Primary-Contact-Seismic.xls
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Figure H.36. BES-FCC Primary Tank/Insulating Concrete Contact Forces, Seismic Load Only

Tank AY, 422 Inch Waste Level
SpG = 1.7
Best Estimate Soil
Fully Cracked Concrete

Radius	Max Pressure Insulating Concrete/Secondary Liner AY Gravity (PSI)	Min Pressure Insulating Concrete/Secondary Liner AY Gravity (PSI)	Max Lateral Displacement Insulating Concrete/Secondary Liner AY Gravity (Inches)	Min Lateral Displacement Insulating Concrete/Secondary Liner AY Gravity (Inches)
424.00	55.993	54.882	0.005088	0.004787
384.00	20.736	20.493	0.001409	0.001285
317.85	27.278	27.250	0.000633	0.000611
248.10	26.236	26.208	0.000606	0.000588
199.25	26.340	26.319	0.000197	0.000192
154.95	26.590	26.549	0.000162	0.000155
112.80	26.361	26.313	0.000285	0.000275
65.85	26.563	26.458	0.000401	0.000396

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Page 1
AY-2D-NL-BES-FCC-Insul-Contact-Gravity.xls, FM Max

Figure H.37. BES-FCC Insulating Concrete/Secondary Liner Contact Forces, Gravity Load Only

Tank AY, 422 Inch Waste Level
SpG = 1.7
Upper Bound Soil
Best Estimate Concrete

Radius	Max Pressure Insulating Concrete/Secondary Liner AY Seismic (PSI)	Min Pressure Insulating Concrete/Secondary Liner AY Seismic (PSI)	Max Lateral Displacement Insulating Concrete/Secondary Liner AY Seismic (Inches)	Min Lateral Displacement Insulating Concrete/Secondary Liner AY Seismic (Inches)
424.00	73.125	31.576	0.013356	0.001189
384.00	26.924	13.979	0.012576	0.000384
317.85	33.563	19.458	0.009335	0.000290
248.10	31.597	20.563	0.005549	0.000255
199.25	31.576	21.049	0.003566	0.000103
154.95	31.639	21.611	0.002642	0.000112
112.80	31.319	21.688	0.002161	0.000032
65.85	31.326	21.972	0.001818	0.000024

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Page 2
AY-2D-NL-BES-FCC Liner-Contact-Seismic.xls, FM Max

Figure H.38. BES-FCC Insulating Concrete/Secondary Liner Contact Forces, Gravity Plus Seismic Load

Tank AY, 422 Inch Waste Level
SpG = 1.7
Upper Bound Soil
Best Estimate Concrete

Radius	Max Pressure Insulating Concrete/Secondary Liner AY Seismic Only (PSI)	Min Pressure Insulating Concrete/Secondary Liner AY Seismic Only (PSI)	Max Lateral Displacement Insulating Concrete/Secondary Liner AY Seismic Only (Inches)	Min Lateral Displacement Insulating Concrete/Secondary Liner AY Seismic Only (Inches)
424.00	17.132	-23.306	0.008	-0.004
384.00	6.188	-6.514	0.011	-0.001
317.85	6.285	-7.792	0.009	0.000
248.10	5.361	-5.646	0.005	0.000
199.25	5.236	-5.271	0.003	0.000
154.95	5.049	-4.938	0.002	0.000
112.80	4.958	-4.625	0.002	0.000
65.85	4.764	-4.486	0.001	0.000

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AY-2D-NL-BES-FCC Liner-Contact-Seismic.xls
Page 1

Figure H.39. BES-FCC Insulating Concrete/Secondary Liner Contact Forces, Seismic Load Only

Tank AY, 422 Inch Waste Level
SpG = 1.7
Best Estimate Soil
Fully Cracked Concrete

Waste Height	Max Pressure AY Tank, 422 in Waste Level, SpG = 1.7 Time History (PSI)	Min Pressure AY Tank, 422 in Waste Level, SpG = 1.7 Time History (PSI)	Hydrostatic (psi)	Impulsive (psi)	Convective (psi)	Breathing (psi)	Dynamic (psi)	Dynamic (SRSS) (psi)	Theoretical Max	Theoretical Min	Theoretical Max (SRSS)	Theoretical Min (SRSS)
410.75	9.403	-10.771	0.69	1.21	1.38	0.26	2.10	1.85	2.79	-1.40	2.54	-1.16
386.5	6.631	-3.592	2.18	2.23	1.25	0.82	3.38	2.68	5.56	-1.20	4.86	-0.51
359.5	11.069	-6.285	3.84	3.18	1.13	1.43	4.80	3.67	8.64	-0.97	7.50	0.17
332	12.653	-2.174	5.53	4	1.02	2.05	6.18	4.61	11.70	-0.65	10.13	0.92
305	12.493	0.625	7.18	4.69	0.93	2.63	7.41	5.46	14.59	-0.23	12.64	1.73
278	15.257	0.311	8.84	5.27	0.85	3.18	8.52	6.21	17.36	0.32	15.05	2.63
251	17.479	1.176	10.50	5.76	0.77	3.7	9.51	6.89	20.01	0.99	17.39	3.61
225.65	22.924	2.235	12.05	6.16	0.72	4.15	10.35	7.46	22.41	1.70	19.52	4.59
202.3	23.931	2.630	13.49	6.48	0.67	4.54	11.05	7.94	24.54	2.43	21.43	5.55
179.3	32.861	3.271	14.90	6.75	0.63	4.89	11.67	8.36	26.57	3.23	23.26	6.54
156.35	32.042	4.958	16.31	6.97	0.6	5.2	12.20	8.72	28.50	4.11	25.02	7.59
131.45	30.931	6.692	17.84	7.18	0.56	5.49	12.69	9.06	30.53	5.14	26.89	8.78
104.5	36.604	7.604	19.49	7.36	0.54	5.76	13.14	9.36	32.63	6.35	28.85	10.13
77.5	32.646	10.125	21.15	7.5	0.52	5.97	13.49	9.60	34.64	7.66	30.75	11.55
50.5	35.924	11.965	22.81	7.59	0.5	6.11	13.72	9.76	36.52	9.09	32.56	13.05
24.5	34.701	11.604	24.40	7.64	0.49	6.2	13.86	9.85	38.26	10.55	34.25	14.55

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AY-2D-NL-BES-FCC Waste-TH-MAX.xls, FM Max

Figure H.40. BES-FCC Waste Contact Pressures, Gravity Plus Seismic Load

Tank AY, 422 Inch Waste Level
SpG = 1.7
Best Estimate Soil
Fully Cracked Concrete

Waste Radius	Max Vertical Displacement AY-BES-FCC Time History (in)	Min Vertical Displacement AY-BES-FCC Time History (in)
95.7	2.72	-3.34
129.9	3.88	-4.53
180	4.46	-5.14
218.5	5.28	-6.01
277.7	5.66	-6.36
358	5.90	-6.63
410	6.60	-7.23
450	6.63	-7.28

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AY-2D-NL-BES-FFC Waste-Disp-TH-MAX.xls, FM Max

Figure H.41. BES-FCC Waste Surface Displacement, Gravity Plus Seismic Load

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,kmaxte
mp2+4
a,kmaxtemp2+2,kmaxtemp2+3,kmaxtemp2+6,kmaxte
mp2+5
a,kmaxtemp2+3,kmaxtemp1+1,kmaxtemp1+2,kmaxte
mp2+6
a,kmaxtemp2+4,kmaxtemp2+5,kmaxjb+9,kmaxjb+8,
kmaxjb+7,kmaxjb+6,kmaxjb+5,kmaxjb+4,kmaxjb+3
,kmaxjb+2!a,740,741,712,711,710,709,708,707,
706,705
a,kmaxtemp2+5,kmaxtemp2+6,kmaxtemp2+7,kmaxjb
+12,kmaxjb+11,kmaxjb+10,kmaxjb+9
a,kmaxtemp2+6,kmaxtemp1+2,kmaxtemp1+3,kmaxte
mp2+7
a,kmaxtemp2+7,kmaxtemp1+3,kmaxtemp1+4,kmaxjb
+12
a,kmaxjb+12,kmaxtemp1+4,kmaxtemp1+5,kmaxjb+1
4,kmaxjb+13
a,kmaxjb+14,kmaxtemp1+5,kmaxtemp1+6,kmaxjb+1
6,kmaxjb+15
a,kmaxjb+16,kmaxtemp1+6,kmaxtemp1+7,kmaxjb+1
8,kmaxjb+17
a,kmaxjb+18,kmaxtemp1+7,kmaxtemp1+8,kmaxjb+2
0,kmaxjb+19
a,kmaxjb+20,kmaxtemp1+8,kmaxtemp1+9,kmaxtemp
2+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,kma
xjb+bm_kp+2
a,kmaxjb+bm_kp+2,kmaxtemp2+4,kmaxjb+2,kmaxjb
+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

/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, Horizontal and
Vertical Seismic Inputs, Best Estimate Soil,
Fully Cracked Concrete Properties, AY
Primary Tank Geometry
```

```
!
fini
/clear
/filname,PNNL-2D-BES-BEC,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-AY,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-AY,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-AY,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,all-forces,txt         ! Extract
component forces/strains
/input,spectra-all,txt        ! Extract
Response Spectra
/input,contact-AY,txt         ! Extract
Contact data
/out
/exit
```

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
```

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,PNNL-AY-2D-NL-BEC-BES-Gravity,out
/solu
antype,trans
TRNOPT,FULL
lumpm,OFF
!nlgeom,on
NROPT,auto
NTIM-2  !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: BES-BEC, Full Non-linear,
Final PT Mesh
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,20,200,5,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+massm
_z)*g

SOLVE
SAVE
*ENDDO
FINISH
/out
```

Solve-TH-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,PNNL-AY-2D-NL-BEC-BES,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-266-Mean-geo,txt
(8(F9.6))
*VREAD,A_1_Z(1),th-266-Mean-geo-v,txt
(8(F9.6))

/Title,Load Case: BES-BEC, Full Non-linear,
Final PT Mesh
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,20,200,5,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+massm
_z)*g

SOLVE
SAVE
*ENDDO
FINISH
/out
```

Tank-Props-Crack.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 - 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 D is 300GB Maxtor
 Volume Serial Number is 5851-C3F2

 Directory of D:\Bruce\PNNL\PNNL-2D-NL-AY-BES-FCC-Seismic

12/21/2005  07:53 AM    <DIR>          .
12/21/2005  07:53 AM    <DIR>          ..
12/09/2005  07:56 AM           535,476 Accel-ct-0.out
12/09/2005  08:02 AM           535,728 Accel-ct-135.out
12/09/2005  08:03 AM           535,728 Accel-ct-180.out
12/09/2005  07:58 AM           535,476 Accel-ct-45.out
12/09/2005  08:00 AM           535,728 Accel-ct-90.out
12/09/2005  08:05 AM           277,176 Accel-ct.out
12/09/2005  08:07 AM           535,728 Accel-PT-0.out
12/09/2005  08:13 AM           535,728 Accel-PT-135.out
12/09/2005  08:15 AM           535,728 Accel-PT-180.out
12/09/2005  08:09 AM           535,728 Accel-PT-45.out
12/09/2005  08:11 AM           535,728 Accel-PT-90.out
12/09/2005  08:17 AM           535,728 Accel-SOil.out
09/27/2005  03:47 PM                99 All-Forces.txt
09/02/2005  02:01 PM             5,766 Bolts-Friction.txt
06/09/2005  01:59 PM               262 Boundary.txt
12/05/2005  10:57 AM               218 Contact-AY.txt
12/01/2005  09:11 AM               586 Contact-Footing.txt
09/02/2005  09:28 AM               604 Contact-Insul.txt
09/02/2005  09:51 AM               602 Contact-J-Bolts.txt
09/09/2005  09:59 AM               608 Contact-Primary.txt
09/15/2005  11:50 AM               742 Contact-Soil.txt
09/06/2005  11:16 AM               630 Contact-Waste-AY.txt
09/22/2005  04:05 PM             8,608 Far-Soil.txt
12/05/2005  11:40 AM             2,046 file.bat
12/05/2005  11:40 AM                68 file.err
12/05/2005  11:40 AM               684 file.log
12/21/2005  07:53 AM                 0 files.txt
10/13/2005  06:54 AM               562 Fix-Soil.txt
12/14/2005  10:25 AM            10,342 Footing-Cont_max.OUT
12/14/2005  10:25 AM         4,144,248 Footing-Cont_th.OUT
04/06/2005  08:24 AM               894 Force-c.txt
12/07/2005  06:55 PM             4,996 Force-c_108amax.OUT
12/07/2005  06:55 PM         2,779,200 Force-c_108ath.OUT
12/07/2005  04:03 PM            14,716 Force-c_108max.OUT
12/07/2005  04:03 PM         6,224,880 Force-c_108th.OUT
12/07/2005  07:03 PM             4,996 Force-c_117amax.OUT
12/07/2005  07:03 PM         2,779,200 Force-c_117ath.OUT
12/07/2005  04:12 PM            14,716 Force-c_117max.OUT
12/07/2005  04:12 PM         6,224,880 Force-c_117th.OUT
12/07/2005  07:12 PM             4,996 Force-c_126amax.OUT
12/07/2005  07:12 PM         2,779,200 Force-c_126ath.OUT
12/07/2005  04:20 PM            14,716 Force-c_126max.OUT
12/07/2005  04:20 PM         6,224,880 Force-c_126th.OUT
12/07/2005  07:20 PM             4,996 Force-c_135amax.OUT
12/07/2005  07:20 PM         2,779,200 Force-c_135ath.OUT
12/07/2005  04:29 PM            14,716 Force-c_135max.OUT
12/07/2005  04:29 PM         6,224,880 Force-c_135th.OUT
12/07/2005  07:29 PM             4,996 Force-c_144amax.OUT
12/07/2005  07:29 PM         2,779,200 Force-c_144ath.OUT
12/07/2005  04:38 PM            14,716 Force-c_144max.OUT
12/07/2005  04:38 PM         6,224,880 Force-c_144th.OUT
12/07/2005  07:37 PM             4,996 Force-c_153amax.OUT
12/07/2005  07:37 PM         2,779,200 Force-c_153ath.OUT
12/07/2005  04:46 PM            14,716 Force-c_153max.OUT
12/07/2005  04:47 PM         6,224,880 Force-c_153th.OUT
12/07/2005  07:46 PM             4,996 Force-c_162amax.OUT
12/07/2005  07:46 PM         2,779,200 Force-c_162ath.OUT
12/07/2005  04:56 PM            14,716 Force-c_162max.OUT
12/07/2005  04:56 PM         6,224,880 Force-c_162th.OUT
12/07/2005  07:54 PM             4,996 Force-c_171amax.OUT
12/07/2005  07:54 PM         2,779,200 Force-c_171ath.OUT
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12/07/2005  05:04 PM            14,716 Force-c_171max.OUT
12/07/2005  05:04 PM         6,224,880 Force-c_171th.OUT
12/07/2005  08:03 PM             4,996 Force-c_180amax.OUT
12/07/2005  08:03 PM         2,779,200 Force-c_180ath.OUT
12/07/2005  05:13 PM            14,716 Force-c_180max.OUT
12/07/2005  05:13 PM         6,224,880 Force-c_180th.OUT
12/07/2005  05:30 PM             4,996 Force-c_18amax.OUT
12/07/2005  05:30 PM         2,779,200 Force-c_18ath.OUT
12/07/2005  02:36 PM            14,716 Force-c_18max.OUT
12/07/2005  02:36 PM         6,224,880 Force-c_18th.OUT
12/07/2005  05:38 PM             4,996 Force-c_27amax.OUT
12/07/2005  05:38 PM         2,779,200 Force-c_27ath.OUT
12/07/2005  02:44 PM            14,716 Force-c_27max.OUT
12/07/2005  02:44 PM         6,224,880 Force-c_27th.OUT
12/07/2005  05:47 PM             4,996 Force-c_36amax.OUT
12/07/2005  05:47 PM         2,779,200 Force-c_36ath.OUT
12/07/2005  02:53 PM            14,716 Force-c_36max.OUT
12/07/2005  02:53 PM         6,224,880 Force-c_36th.OUT
12/07/2005  05:55 PM             4,996 Force-c_45amax.OUT
12/07/2005  05:55 PM         2,779,200 Force-c_45ath.OUT
12/07/2005  03:02 PM            14,716 Force-c_45max.OUT
12/07/2005  03:02 PM         6,224,880 Force-c_45th.OUT
12/07/2005  06:04 PM             4,996 Force-c_54amax.OUT
12/07/2005  06:04 PM         2,779,200 Force-c_54ath.OUT
12/07/2005  03:11 PM            14,716 Force-c_54max.OUT
12/07/2005  03:11 PM         6,224,880 Force-c_54th.OUT
12/07/2005  06:13 PM             4,996 Force-c_63amax.OUT
12/07/2005  06:13 PM         2,779,200 Force-c_63ath.OUT
12/07/2005  03:19 PM            14,716 Force-c_63max.OUT
12/07/2005  03:19 PM         6,224,880 Force-c_63th.OUT
12/07/2005  06:21 PM             4,996 Force-c_72amax.OUT
12/07/2005  06:21 PM         2,779,200 Force-c_72ath.OUT
12/07/2005  03:29 PM            14,716 Force-c_72max.OUT
12/07/2005  03:29 PM         6,224,880 Force-c_72th.OUT
12/07/2005  06:30 PM             4,996 Force-c_81amax.OUT
12/07/2005  06:30 PM         2,779,200 Force-c_81ath.OUT
12/07/2005  03:37 PM            14,716 Force-c_81max.OUT
12/07/2005  03:37 PM         6,224,880 Force-c_81th.OUT
12/07/2005  06:38 PM             4,996 Force-c_90amax.OUT
12/07/2005  06:38 PM         2,779,200 Force-c_90ath.OUT
12/07/2005  03:46 PM            14,716 Force-c_90max.OUT
12/07/2005  03:46 PM         6,224,880 Force-c_90th.OUT
12/07/2005  06:46 PM             4,996 Force-c_99amax.OUT
12/07/2005  06:46 PM         2,779,200 Force-c_99ath.OUT
12/07/2005  03:55 PM            14,716 Force-c_99max.OUT
12/07/2005  03:55 PM         6,224,880 Force-c_99th.OUT
12/07/2005  05:22 PM             4,996 Force-c_9amax.OUT
12/07/2005  05:22 PM         2,779,328 Force-c_9ath.OUT
12/07/2005  02:28 PM            14,716 Force-c_9max.OUT
12/07/2005  02:28 PM         6,225,008 Force-c_9th.OUT
12/08/2005  05:43 AM         2,548,434 Force-jb_r10-th.OUT
12/08/2005  05:43 AM             5,239 Force-jb_r10_max.OUT
12/08/2005  05:43 AM         2,548,434 Force-jb_r11-th.OUT
12/08/2005  05:43 AM             5,239 Force-jb_r11_max.OUT
12/08/2005  05:38 AM         2,548,562 Force-jb_r2-th.OUT
12/08/2005  05:38 AM             5,239 Force-jb_r2_max.OUT
12/08/2005  05:38 AM         2,548,434 Force-jb_r3-th.OUT
12/08/2005  05:38 AM             5,239 Force-jb_r3_max.OUT
12/08/2005  05:39 AM         2,548,434 Force-jb_r4-th.OUT
12/08/2005  05:39 AM             5,239 Force-jb_r4_max.OUT
12/08/2005  05:40 AM         2,548,434 Force-jb_r5-th.OUT
12/08/2005  05:40 AM             5,239 Force-jb_r5_max.OUT
12/08/2005  05:40 AM         2,548,434 Force-jb_r6-th.OUT
12/08/2005  05:40 AM             5,239 Force-jb_r6_max.OUT
12/08/2005  05:41 AM         2,548,434 Force-jb_r7-th.OUT
12/08/2005  05:41 AM             5,239 Force-jb_r7_max.OUT
12/08/2005  05:41 AM         2,548,434 Force-jb_r8-th.OUT
12/08/2005  05:41 AM             5,239 Force-jb_r8_max.OUT
12/08/2005  05:42 AM         2,548,434 Force-jb_r9-th.OUT
12/08/2005  05:42 AM             5,239 Force-jb_r9_max.OUT
06/20/2005  10:53 AM               661 Force-j_bolt.txt
```

```
12/08/2005  10:19 AM            2,728 Insul-Cont_108max.OUT
12/08/2005  10:19 AM        1,200,544 Insul-Cont_108th.OUT
12/08/2005  10:22 AM            2,728 Insul-Cont_117max.OUT
12/08/2005  10:22 AM        1,200,544 Insul-Cont_117th.OUT
12/08/2005  10:25 AM            2,728 Insul-Cont_126max.OUT
12/08/2005  10:25 AM        1,200,544 Insul-Cont_126th.OUT
12/08/2005  10:27 AM            2,728 Insul-Cont_135max.OUT
12/08/2005  10:27 AM        1,200,544 Insul-Cont_135th.OUT
12/08/2005  10:30 AM            2,728 Insul-Cont_144max.OUT
12/08/2005  10:30 AM        1,200,544 Insul-Cont_144th.OUT
12/08/2005  10:33 AM            2,728 Insul-Cont_153max.OUT
12/08/2005  10:33 AM        1,200,544 Insul-Cont_153th.OUT
12/08/2005  10:36 AM            2,728 Insul-Cont_162max.OUT
12/08/2005  10:36 AM        1,200,544 Insul-Cont_162th.OUT
12/08/2005  10:39 AM            2,728 Insul-Cont_171max.OUT
12/08/2005  10:39 AM        1,200,544 Insul-Cont_171th.OUT
12/08/2005  10:41 AM            2,728 Insul-Cont_180max.OUT
12/08/2005  10:41 AM        1,200,544 Insul-Cont_180th.OUT
12/08/2005  09:52 AM            2,728 Insul-Cont_18max.OUT
12/08/2005  09:52 AM        1,200,544 Insul-Cont_18th.OUT
12/08/2005  09:54 AM            2,728 Insul-Cont_27max.OUT
12/08/2005  09:54 AM        1,200,544 Insul-Cont_27th.OUT
12/08/2005  09:57 AM            2,728 Insul-Cont_36max.OUT
12/08/2005  09:57 AM        1,200,544 Insul-Cont_36th.OUT
12/08/2005  10:00 AM            2,728 Insul-Cont_45max.OUT
12/08/2005  10:00 AM        1,200,544 Insul-Cont_45th.OUT
12/08/2005  10:03 AM            2,728 Insul-Cont_54max.OUT
12/08/2005  10:03 AM        1,200,544 Insul-Cont_54th.OUT
12/08/2005  10:05 AM            2,728 Insul-Cont_63max.OUT
12/08/2005  10:05 AM        1,200,544 Insul-Cont_63th.OUT
12/08/2005  10:08 AM            2,728 Insul-Cont_72max.OUT
12/08/2005  10:08 AM        1,200,544 Insul-Cont_72th.OUT
12/08/2005  10:11 AM            2,728 Insul-Cont_81max.OUT
12/08/2005  10:11 AM        1,200,544 Insul-Cont_81th.OUT
12/08/2005  10:14 AM            2,728 Insul-Cont_90max.OUT
12/08/2005  10:14 AM        1,200,544 Insul-Cont_90th.OUT
12/08/2005  10:16 AM            2,728 Insul-Cont_99max.OUT
12/08/2005  10:16 AM        1,200,544 Insul-Cont_99th.OUT
12/08/2005  09:49 AM            2,728 Insul-Cont_9max.OUT
12/08/2005  09:49 AM        1,200,672 Insul-Cont_9th.OUT
09/01/2005  10:27 AM            1,664 Insulate.txt
10/13/2005  08:28 AM            4,031 interface-gap1.txt
09/09/2005  09:34 AM            2,616 interface1.txt
12/08/2005  11:26 AM            3,052 J-Bolt-Cont_108max.OUT
12/08/2005  11:26 AM        1,350,612 J-Bolt-Cont_108th.OUT
12/08/2005  11:30 AM            3,052 J-Bolt-Cont_117max.OUT
12/08/2005  11:30 AM        1,350,612 J-Bolt-Cont_117th.OUT
12/08/2005  11:34 AM            3,052 J-Bolt-Cont_126max.OUT
12/08/2005  11:34 AM        1,350,612 J-Bolt-Cont_126th.OUT
12/08/2005  11:37 AM            3,052 J-Bolt-Cont_135max.OUT
12/08/2005  11:37 AM        1,350,612 J-Bolt-Cont_135th.OUT
12/08/2005  11:41 AM            3,052 J-Bolt-Cont_144max.OUT
12/08/2005  11:41 AM        1,350,612 J-Bolt-Cont_144th.OUT
12/08/2005  11:45 AM            3,052 J-Bolt-Cont_153max.OUT
12/08/2005  11:45 AM        1,350,612 J-Bolt-Cont_153th.OUT
12/08/2005  11:49 AM            3,052 J-Bolt-Cont_162max.OUT
12/08/2005  11:49 AM        1,350,612 J-Bolt-Cont_162th.OUT
12/08/2005  11:53 AM            3,052 J-Bolt-Cont_171max.OUT
12/08/2005  11:53 AM        1,350,612 J-Bolt-Cont_171th.OUT
12/08/2005  11:56 AM            3,052 J-Bolt-Cont_180max.OUT
12/08/2005  11:56 AM        1,350,612 J-Bolt-Cont_180th.OUT
12/08/2005  10:49 AM            3,052 J-Bolt-Cont_18max.OUT
12/08/2005  10:49 AM        1,350,612 J-Bolt-Cont_18th.OUT
12/08/2005  10:53 AM            3,052 J-Bolt-Cont_27max.OUT
12/08/2005  10:53 AM        1,350,612 J-Bolt-Cont_27th.OUT
12/08/2005  10:56 AM            3,052 J-Bolt-Cont_36max.OUT
12/08/2005  10:56 AM        1,350,612 J-Bolt-Cont_36th.OUT
12/08/2005  11:00 AM            3,052 J-Bolt-Cont_45max.OUT
12/08/2005  11:00 AM        1,350,612 J-Bolt-Cont_45th.OUT
12/08/2005  11:04 AM            3,052 J-Bolt-Cont_54max.OUT
12/08/2005  11:04 AM        1,350,612 J-Bolt-Cont_54th.OUT
```

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12/08/2005  11:07 AM             3,052 J-Bolt-Cont_63max.OUT
12/08/2005  11:07 AM         1,350,612 J-Bolt-Cont_63th.OUT
12/08/2005  11:11 AM             3,052 J-Bolt-Cont_72max.OUT
12/08/2005  11:11 AM         1,350,612 J-Bolt-Cont_72th.OUT
12/08/2005  11:15 AM             3,052 J-Bolt-Cont_81max.OUT
12/08/2005  11:15 AM         1,350,612 J-Bolt-Cont_81th.OUT
12/08/2005  11:19 AM             3,052 J-Bolt-Cont_90max.OUT
12/08/2005  11:19 AM         1,350,612 J-Bolt-Cont_90th.OUT
12/08/2005  11:22 AM             3,052 J-Bolt-Cont_99max.OUT
12/08/2005  11:22 AM         1,350,612 J-Bolt-Cont_99th.OUT
12/08/2005  10:45 AM             3,052 J-Bolt-Cont_9max.OUT
12/08/2005  10:45 AM         1,350,740 J-Bolt-Cont_9th.OUT
06/01/2005  01:17 PM             1,708 Liner.txt
05/02/2005  02:19 PM               667 live_load.txt
11/11/2005  10:38 AM             6,185 Near-Soil-1.txt
04/20/2005  01:14 PM               508 outer-spar.txt
12/07/2005  02:18 PM             2,998 PNNL-2D-BES-BEC.BCS
12/07/2005  02:19 PM        55,574,528 PNNL-2D-BES-BEC.db
12/09/2005  08:55 AM               219 PNNL-2D-BES-BEC.DO3
12/07/2005  02:19 PM        12,386,304 PNNL-2D-BES-BEC.emat
12/14/2005  10:22 AM            49,084 PNNL-2D-BES-BEC.err
12/07/2005  02:19 PM       102,563,840 PNNL-2D-BES-BEC.esav
12/07/2005  02:19 PM        27,852,800 PNNL-2D-BES-BEC.full
12/07/2005  02:17 PM       298,920,099 PNNL-2D-BES-BEC.ldhi
12/14/2005  10:56 AM             3,308 PNNL-2D-BES-BEC.log
12/07/2005  02:19 PM           189,791 PNNL-2D-BES-BEC.mntr
12/07/2005  02:17 PM       102,563,840 PNNL-2D-BES-BEC.osav
12/07/2005  02:18 PM             1,123 PNNL-2D-BES-BEC.PVTS
12/07/2005  02:19 PM       103,546,880 PNNL-2D-BES-BEC.r001
12/05/2005  11:41 AM        35,782,656 PNNL-2D-BES-BEC.rdb
12/07/2005  02:19 PM     4,294,967,296 PNNL-2D-BES-BEC.rst
12/05/2005  10:28 PM     4,294,967,296 PNNL-2D-BES-BEC.rst02
12/06/2005  03:54 AM     4,294,967,296 PNNL-2D-BES-BEC.rst03
12/06/2005  09:28 AM     4,294,967,296 PNNL-2D-BES-BEC.rst04
12/06/2005  03:09 PM     4,294,967,296 PNNL-2D-BES-BEC.rst05
12/06/2005  08:55 PM     4,294,967,296 PNNL-2D-BES-BEC.rst06
12/07/2005  02:42 AM     4,294,967,296 PNNL-2D-BES-BEC.rst07
12/07/2005  08:40 AM     4,294,967,296 PNNL-2D-BES-BEC.rst08
12/07/2005  02:19 PM     4,002,217,984 PNNL-2D-BES-BEC.rst09
12/07/2005  02:17 PM               289 PNNL-2D-BES-BEC.stat
12/07/2005  02:19 PM         3,139,262 PNNL-AY-2D-NL-BEC-BES.out
12/08/2005  12:30 PM             2,728 Primary-Cont_108max.OUT
12/08/2005  12:30 PM         1,200,544 Primary-Cont_108th.OUT
12/08/2005  12:33 PM             2,728 Primary-Cont_117max.OUT
12/08/2005  12:33 PM         1,200,544 Primary-Cont_117th.OUT
12/08/2005  12:36 PM             2,728 Primary-Cont_126max.OUT
12/08/2005  12:36 PM         1,200,544 Primary-Cont_126th.OUT
12/08/2005  12:38 PM             2,728 Primary-Cont_135max.OUT
12/08/2005  12:38 PM         1,200,544 Primary-Cont_135th.OUT
12/08/2005  12:41 PM             2,728 Primary-Cont_144max.OUT
12/08/2005  12:41 PM         1,200,544 Primary-Cont_144th.OUT
12/08/2005  12:44 PM             2,728 Primary-Cont_153max.OUT
12/08/2005  12:44 PM         1,200,544 Primary-Cont_153th.OUT
12/08/2005  12:47 PM             2,728 Primary-Cont_162max.OUT
12/08/2005  12:47 PM         1,200,544 Primary-Cont_162th.OUT
12/08/2005  12:50 PM             2,728 Primary-Cont_171max.OUT
12/08/2005  12:50 PM         1,200,544 Primary-Cont_171th.OUT
12/08/2005  12:53 PM             2,728 Primary-Cont_180max.OUT
12/08/2005  12:53 PM         1,200,544 Primary-Cont_180th.OUT
12/08/2005  12:01 PM             2,728 Primary-Cont_18max.OUT
12/08/2005  12:01 PM         1,200,544 Primary-Cont_18th.OUT
12/08/2005  12:04 PM             2,728 Primary-Cont_27max.OUT
12/08/2005  12:04 PM         1,200,544 Primary-Cont_27th.OUT
12/08/2005  12:07 PM             2,728 Primary-Cont_36max.OUT
12/08/2005  12:07 PM         1,200,544 Primary-Cont_36th.OUT
12/08/2005  12:09 PM             2,728 Primary-Cont_45max.OUT
12/08/2005  12:09 PM         1,200,544 Primary-Cont_45th.OUT
12/08/2005  12:12 PM             2,728 Primary-Cont_54max.OUT
12/08/2005  12:12 PM         1,200,544 Primary-Cont_54th.OUT
12/08/2005  12:15 PM             2,728 Primary-Cont_63max.OUT
12/08/2005  12:15 PM         1,200,544 Primary-Cont_63th.OUT
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12/08/2005  12:18 PM             2,728 Primary-Cont_72max.OUT
12/08/2005  12:18 PM         1,200,544 Primary-Cont_72th.OUT
12/08/2005  12:21 PM             2,728 Primary-Cont_81max.OUT
12/08/2005  12:21 PM         1,200,544 Primary-Cont_81th.OUT
12/08/2005  12:24 PM             2,728 Primary-Cont_90max.OUT
12/08/2005  12:24 PM         1,200,544 Primary-Cont_90th.OUT
12/08/2005  12:27 PM             2,728 Primary-Cont_99max.OUT
12/08/2005  12:27 PM         1,200,544 Primary-Cont_99th.OUT
12/08/2005  11:59 AM             2,728 Primary-Cont_9max.OUT
12/08/2005  11:59 AM         1,200,672 Primary-Cont_9th.OUT
10/31/2005  12:18 PM             5,549 Primary-Props-AY.txt
09/27/2005  03:52 PM             1,538 Primary.txt
12/05/2005  11:41 AM           343,298 QA.out
12/09/2005  07:56 AM            47,121 RS-ct-0.out
12/09/2005  08:02 AM            47,121 RS-ct-135.out
12/09/2005  08:03 AM            47,121 RS-ct-180.out
12/09/2005  07:58 AM            47,121 RS-ct-45.out
12/09/2005  08:00 AM            47,121 RS-ct-90.out
12/09/2005  08:05 AM            27,591 RS-ct.out
12/08/2005  09:44 AM            34,971 RS-OUT-Soil.txt
12/09/2005  08:07 AM            47,121 RS-PT-0.out
12/09/2005  08:13 AM            47,121 RS-PT-135.out
12/09/2005  08:15 AM            47,121 RS-PT-180.out
12/09/2005  08:09 AM            47,121 RS-PT-45.out
12/09/2005  08:11 AM            47,121 RS-PT-90.out
12/09/2005  08:17 AM            47,121 RS-SOil.out
10/31/2005  10:31 AM             1,108 RS_FREQ.txt
12/08/2005  10:41 PM         5,345,937 Run-Tank-Out.out
09/19/2005  09:37 AM               145 run-tank.bat
12/05/2005  10:55 AM             1,957 Run-Tank.txt
12/14/2005  10:22 AM                 0 scratch.hlp
02/11/2005  01:22 PM             1,053 Slave.txt
12/08/2005  02:13 PM             9,896 Soil-Contact_108max.OUT
12/08/2005  02:13 PM         4,151,880 Soil-Contact_108th.OUT
12/08/2005  02:19 PM             9,896 Soil-Contact_117max.OUT
12/08/2005  02:19 PM         4,151,880 Soil-Contact_117th.OUT
12/08/2005  02:26 PM             9,896 Soil-Contact_126max.OUT
12/08/2005  02:26 PM         4,151,880 Soil-Contact_126th.OUT
12/08/2005  02:33 PM             9,896 Soil-Contact_135max.OUT
12/08/2005  02:33 PM         4,151,880 Soil-Contact_135th.OUT
12/08/2005  02:39 PM             9,896 Soil-Contact_144max.OUT
12/08/2005  02:39 PM         4,151,880 Soil-Contact_144th.OUT
12/08/2005  02:46 PM             9,896 Soil-Contact_153max.OUT
12/08/2005  02:47 PM         4,151,880 Soil-Contact_153th.OUT
12/08/2005  02:53 PM             9,896 Soil-Contact_162max.OUT
12/08/2005  02:53 PM         4,151,880 Soil-Contact_162th.OUT
12/08/2005  03:00 PM             9,896 Soil-Contact_171max.OUT
12/08/2005  03:00 PM         4,151,880 Soil-Contact_171th.OUT
12/08/2005  03:07 PM             9,896 Soil-Contact_180max.OUT
12/08/2005  03:07 PM         4,151,880 Soil-Contact_180th.OUT
12/08/2005  01:06 PM             9,896 Soil-Contact_18max.OUT
12/08/2005  01:06 PM         4,151,880 Soil-Contact_18th.OUT
12/08/2005  01:12 PM             9,896 Soil-Contact_27max.OUT
12/08/2005  01:12 PM         4,151,880 Soil-Contact_27th.OUT
12/08/2005  01:19 PM             9,896 Soil-Contact_36max.OUT
12/08/2005  01:19 PM         4,151,880 Soil-Contact_36th.OUT
12/08/2005  01:26 PM             9,896 Soil-Contact_45max.OUT
12/08/2005  01:26 PM         4,151,880 Soil-Contact_45th.OUT
12/08/2005  01:32 PM             9,896 Soil-Contact_54max.OUT
12/08/2005  01:32 PM         4,151,880 Soil-Contact_54th.OUT
12/08/2005  01:39 PM             9,896 Soil-Contact_63max.OUT
12/08/2005  01:39 PM         4,151,880 Soil-Contact_63th.OUT
12/08/2005  01:46 PM             9,896 Soil-Contact_72max.OUT
12/08/2005  01:46 PM         4,151,880 Soil-Contact_72th.OUT
12/08/2005  01:53 PM             9,896 Soil-Contact_81max.OUT
12/08/2005  01:53 PM         4,151,880 Soil-Contact_81th.OUT
12/08/2005  01:59 PM             9,896 Soil-Contact_90max.OUT
12/08/2005  01:59 PM         4,151,880 Soil-Contact_90th.OUT
12/08/2005  02:06 PM             9,896 Soil-Contact_99max.OUT
12/08/2005  02:06 PM         4,151,880 Soil-Contact_99th.OUT
12/08/2005  12:59 PM             9,896 Soil-Contact_9max.OUT
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12/08/2005  12:59 PM         4,152,008 Soil-Contact_9th.OUT
11/11/2005  10:36 AM             4,989 Soil-Prop-Mean-Geo.txt
11/11/2005  10:33 AM             1,893 Solve-TH-BES.txt
11/28/2005  02:23 PM               347 spectra-all.txt
11/28/2005  02:16 PM             3,483 spectra-conc-0.txt
12/09/2005  07:53 AM             3,512 spectra-conc-135.txt
12/09/2005  07:53 AM             3,512 spectra-conc-180.txt
11/28/2005  02:18 PM             3,560 spectra-conc-45.txt
12/09/2005  07:53 AM             3,440 spectra-conc-90.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
10/31/2005  10:17 AM             3,551 spectra-primary-135.txt
10/31/2005  11:02 AM             3,566 spectra-primary-180.txt
10/31/2005  10:16 AM             3,479 spectra-primary-45.txt
10/31/2005  10:16 AM             3,479 spectra-primary-90.txt
10/31/2005  11:37 AM             3,608 spectra-soil.txt
06/20/2005  09:04 AM               647 spectra-wall.txt
06/20/2005  08:52 AM               679 spectra-waste.txt
09/02/2005  08:51 AM               707 strain-compb.txt
09/02/2005  08:51 AM               705 strain-compm.txt
09/02/2005  08:50 AM               720 strain-compt.txt
12/08/2005  08:52 AM             6,110 Strain-lb_108max-b.OUT
12/08/2005  08:52 AM         2,555,082 Strain-lb_108th-b.OUT
12/08/2005  08:55 AM             6,110 Strain-lb_117max-b.OUT
12/08/2005  08:55 AM         2,555,082 Strain-lb_117th-b.OUT
12/08/2005  08:58 AM             6,110 Strain-lb_126max-b.OUT
12/08/2005  08:58 AM         2,555,082 Strain-lb_126th-b.OUT
12/08/2005  09:02 AM             6,110 Strain-lb_135max-b.OUT
12/08/2005  09:02 AM         2,555,082 Strain-lb_135th-b.OUT
12/08/2005  09:06 AM             6,110 Strain-lb_144max-b.OUT
12/08/2005  09:06 AM         2,555,082 Strain-lb_144th-b.OUT
12/08/2005  09:10 AM             6,110 Strain-lb_153max-b.OUT
12/08/2005  09:10 AM         2,555,082 Strain-lb_153th-b.OUT
12/08/2005  09:13 AM             6,110 Strain-lb_162max-b.OUT
12/08/2005  09:13 AM         2,555,082 Strain-lb_162th-b.OUT
12/08/2005  09:17 AM             6,110 Strain-lb_171max-b.OUT
12/08/2005  09:17 AM         2,555,082 Strain-lb_171th-b.OUT
12/08/2005  09:21 AM             6,110 Strain-lb_180max-b.OUT
12/08/2005  09:21 AM         2,555,082 Strain-lb_180th-b.OUT
12/08/2005  08:15 AM             6,110 Strain-lb_18max-b.OUT
12/08/2005  08:15 AM         2,555,082 Strain-lb_18th-b.OUT
12/08/2005  08:18 AM             6,110 Strain-lb_27max-b.OUT
12/08/2005  08:18 AM         2,555,082 Strain-lb_27th-b.OUT
12/08/2005  08:22 AM             6,110 Strain-lb_36max-b.OUT
12/08/2005  08:22 AM         2,555,082 Strain-lb_36th-b.OUT
12/08/2005  08:25 AM             6,110 Strain-lb_45max-b.OUT
12/08/2005  08:25 AM         2,555,082 Strain-lb_45th-b.OUT
12/08/2005  08:29 AM             6,110 Strain-lb_54max-b.OUT
12/08/2005  08:29 AM         2,555,082 Strain-lb_54th-b.OUT
12/08/2005  08:33 AM             6,110 Strain-lb_63max-b.OUT
12/08/2005  08:33 AM         2,555,082 Strain-lb_63th-b.OUT
12/08/2005  08:37 AM             6,110 Strain-lb_72max-b.OUT
12/08/2005  08:37 AM         2,555,082 Strain-lb_72th-b.OUT
12/08/2005  08:41 AM             6,110 Strain-lb_81max-b.OUT
12/08/2005  08:41 AM         2,555,082 Strain-lb_81th-b.OUT
12/08/2005  08:45 AM             6,110 Strain-lb_90max-b.OUT
12/08/2005  08:45 AM         2,555,082 Strain-lb_90th-b.OUT
12/08/2005  08:48 AM             6,110 Strain-lb_99max-b.OUT
12/08/2005  08:48 AM         2,555,082 Strain-lb_99th-b.OUT
12/08/2005  08:11 AM             6,110 Strain-lb_9max-b.OUT
12/08/2005  08:11 AM         2,555,210 Strain-lb_9th-b.OUT
09/02/2005  08:52 AM               544 Strain-Liner.txt
12/08/2005  07:39 AM             6,110 Strain-lm_108max-m.OUT
12/08/2005  07:39 AM         2,555,082 Strain-lm_108th-m.OUT
12/08/2005  07:42 AM             6,110 Strain-lm_117max-m.OUT
12/08/2005  07:42 AM         2,555,082 Strain-lm_117th-m.OUT
12/08/2005  07:45 AM             6,110 Strain-lm_126max-m.OUT
12/08/2005  07:45 AM         2,555,082 Strain-lm_126th-m.OUT
12/08/2005  07:49 AM             6,110 Strain-lm_135max-m.OUT
12/08/2005  07:49 AM         2,555,082 Strain-lm_135th-m.OUT
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12/08/2005  07:53 AM            6,110 Strain-lm_144max-m.OUT
12/08/2005  07:53 AM        2,555,082 Strain-lm_144th-m.OUT
12/08/2005  07:57 AM            6,110 Strain-lm_153max-m.OUT
12/08/2005  07:57 AM        2,555,082 Strain-lm_153th-m.OUT
12/08/2005  08:00 AM            6,110 Strain-lm_162max-m.OUT
12/08/2005  08:00 AM        2,555,082 Strain-lm_162th-m.OUT
12/08/2005  08:04 AM            6,110 Strain-lm_171max-m.OUT
12/08/2005  08:04 AM        2,555,082 Strain-lm_171th-m.OUT
12/08/2005  08:08 AM            6,110 Strain-lm_180max-m.OUT
12/08/2005  08:08 AM        2,555,082 Strain-lm_180th-m.OUT
12/08/2005  07:02 AM            6,110 Strain-lm_18max-m.OUT
12/08/2005  07:02 AM        2,555,082 Strain-lm_18th-m.OUT
12/08/2005  07:05 AM            6,110 Strain-lm_27max-m.OUT
12/08/2005  07:05 AM        2,555,082 Strain-lm_27th-m.OUT
12/08/2005  07:09 AM            6,110 Strain-lm_36max-m.OUT
12/08/2005  07:09 AM        2,555,082 Strain-lm_36th-m.OUT
12/08/2005  07:13 AM            6,110 Strain-lm_45max-m.OUT
12/08/2005  07:13 AM        2,555,082 Strain-lm_45th-m.OUT
12/08/2005  07:17 AM            6,110 Strain-lm_54max-m.OUT
12/08/2005  07:17 AM        2,555,082 Strain-lm_54th-m.OUT
12/08/2005  07:20 AM            6,110 Strain-lm_63max-m.OUT
12/08/2005  07:20 AM        2,555,082 Strain-lm_63th-m.OUT
12/08/2005  07:24 AM            6,110 Strain-lm_72max-m.OUT
12/08/2005  07:24 AM        2,555,082 Strain-lm_72th-m.OUT
12/08/2005  07:28 AM            6,110 Strain-lm_81max-m.OUT
12/08/2005  07:28 AM        2,555,082 Strain-lm_81th-m.OUT
12/08/2005  07:32 AM            6,110 Strain-lm_90max-m.OUT
12/08/2005  07:32 AM        2,555,082 Strain-lm_90th-m.OUT
12/08/2005  07:35 AM            6,110 Strain-lm_99max-m.OUT
12/08/2005  07:35 AM        2,555,082 Strain-lm_99th-m.OUT
12/08/2005  06:59 AM            6,110 Strain-lm_9max-m.OUT
12/08/2005  06:59 AM        2,555,210 Strain-lm_9th-m.OUT
12/08/2005  06:26 AM            6,110 Strain-lt_108max-t.OUT
12/08/2005  06:26 AM        2,555,082 Strain-lt_108th-t.OUT
12/08/2005  06:29 AM            6,110 Strain-lt_117max-t.OUT
12/08/2005  06:29 AM        2,555,082 Strain-lt_117th-t.OUT
12/08/2005  06:33 AM            6,110 Strain-lt_126max-t.OUT
12/08/2005  06:33 AM        2,555,082 Strain-lt_126th-t.OUT
12/08/2005  06:37 AM            6,110 Strain-lt_135max-t.OUT
12/08/2005  06:37 AM        2,555,082 Strain-lt_135th-t.OUT
12/08/2005  06:40 AM            6,110 Strain-lt_144max-t.OUT
12/08/2005  06:40 AM        2,555,082 Strain-lt_144th-t.OUT
12/08/2005  06:44 AM            6,110 Strain-lt_153max-t.OUT
12/08/2005  06:44 AM        2,555,082 Strain-lt_153th-t.OUT
12/08/2005  06:48 AM            6,110 Strain-lt_162max-t.OUT
12/08/2005  06:48 AM        2,555,082 Strain-lt_162th-t.OUT
12/08/2005  06:52 AM            6,110 Strain-lt_171max-t.OUT
12/08/2005  06:52 AM        2,555,082 Strain-lt_171th-t.OUT
12/08/2005  06:55 AM            6,110 Strain-lt_180max-t.OUT
12/08/2005  06:55 AM        2,555,082 Strain-lt_180th-t.OUT
12/08/2005  05:50 AM            6,110 Strain-lt_18max-t.OUT
12/08/2005  05:50 AM        2,555,082 Strain-lt_18th-t.OUT
12/08/2005  05:53 AM            6,110 Strain-lt_27max-t.OUT
12/08/2005  05:53 AM        2,555,082 Strain-lt_27th-t.OUT
12/08/2005  05:57 AM            6,110 Strain-lt_36max-t.OUT
12/08/2005  05:57 AM        2,555,082 Strain-lt_36th-t.OUT
12/08/2005  06:01 AM            6,110 Strain-lt_45max-t.OUT
12/08/2005  06:01 AM        2,555,082 Strain-lt_45th-t.OUT
12/08/2005  06:04 AM            6,110 Strain-lt_54max-t.OUT
12/08/2005  06:04 AM        2,555,082 Strain-lt_54th-t.OUT
12/08/2005  06:08 AM            6,110 Strain-lt_63max-t.OUT
12/08/2005  06:08 AM        2,555,082 Strain-lt_63th-t.OUT
12/08/2005  06:12 AM            6,110 Strain-lt_72max-t.OUT
12/08/2005  06:12 AM        2,555,082 Strain-lt_72th-t.OUT
12/08/2005  06:16 AM            6,110 Strain-lt_81max-t.OUT
12/08/2005  06:16 AM        2,555,082 Strain-lt_81th-t.OUT
12/08/2005  06:20 AM            6,110 Strain-lt_90max-t.OUT
12/08/2005  06:20 AM        2,555,082 Strain-lt_90th-t.OUT
12/08/2005  06:23 AM            6,110 Strain-lt_99max-t.OUT
12/08/2005  06:23 AM        2,555,082 Strain-lt_99th-t.OUT
12/08/2005  05:47 AM            6,110 Strain-lt_9max-t.OUT
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12/08/2005  05:47 AM         2,555,210 Strain-lt_9th-t.OUT
09/08/2005  10:18 AM               692 stress-compb.txt
11/01/2005  10:46 AM               702 stress-compm.txt
09/08/2005  09:20 AM               692 stress-compt.txt
04/13/2005  07:38 AM               205 Stress-Primary.txt
12/08/2005  04:21 AM            16,291 Stress-pt_108max-b.OUT
12/08/2005  01:10 AM            16,291 Stress-pt_108max-m.OUT
12/07/2005  09:58 PM            16,210 Stress-pt_108max-t.OUT
12/08/2005  04:21 AM         6,850,602 Stress-pt_108th-b.OUT
12/08/2005  01:10 AM         6,850,602 Stress-pt_108th-m.OUT
12/07/2005  09:59 PM         6,821,874 Stress-pt_108th-t.OUT
12/08/2005  04:30 AM            16,291 Stress-pt_117max-b.OUT
12/08/2005  01:19 AM            16,291 Stress-pt_117max-m.OUT
12/07/2005  10:08 PM            16,210 Stress-pt_117max-t.OUT
12/08/2005  04:30 AM         6,850,602 Stress-pt_117th-b.OUT
12/08/2005  01:19 AM         6,850,602 Stress-pt_117th-m.OUT
12/07/2005  10:08 PM         6,821,874 Stress-pt_117th-t.OUT
12/08/2005  04:39 AM            16,291 Stress-pt_126max-b.OUT
12/08/2005  01:29 AM            16,291 Stress-pt_126max-m.OUT
12/07/2005  10:17 PM            16,210 Stress-pt_126max-t.OUT
12/08/2005  04:39 AM         6,850,602 Stress-pt_126th-b.OUT
12/08/2005  01:29 AM         6,850,602 Stress-pt_126th-m.OUT
12/07/2005  10:17 PM         6,821,874 Stress-pt_126th-t.OUT
12/08/2005  04:49 AM            16,291 Stress-pt_135max-b.OUT
12/08/2005  01:38 AM            16,291 Stress-pt_135max-m.OUT
12/07/2005  10:27 PM            16,210 Stress-pt_135max-t.OUT
12/08/2005  04:49 AM         6,850,602 Stress-pt_135th-b.OUT
12/08/2005  01:38 AM         6,850,602 Stress-pt_135th-m.OUT
12/07/2005  10:27 PM         6,821,874 Stress-pt_135th-t.OUT
12/08/2005  04:58 AM            16,291 Stress-pt_144max-b.OUT
12/08/2005  01:47 AM            16,291 Stress-pt_144max-m.OUT
12/07/2005  10:36 PM            16,210 Stress-pt_144max-t.OUT
12/08/2005  04:58 AM         6,850,602 Stress-pt_144th-b.OUT
12/08/2005  01:47 AM         6,850,602 Stress-pt_144th-m.OUT
12/07/2005  10:36 PM         6,821,874 Stress-pt_144th-t.OUT
12/08/2005  05:08 AM            16,291 Stress-pt_153max-b.OUT
12/08/2005  01:57 AM            16,291 Stress-pt_153max-m.OUT
12/07/2005  10:46 PM            16,210 Stress-pt_153max-t.OUT
12/08/2005  05:08 AM         6,850,602 Stress-pt_153th-b.OUT
12/08/2005  01:57 AM         6,850,602 Stress-pt_153th-m.OUT
12/07/2005  10:46 PM         6,821,874 Stress-pt_153th-t.OUT
12/08/2005  05:17 AM            16,291 Stress-pt_162max-b.OUT
12/08/2005  02:06 AM            16,291 Stress-pt_162max-m.OUT
12/07/2005  10:55 PM            16,210 Stress-pt_162max-t.OUT
12/08/2005  05:17 AM         6,850,602 Stress-pt_162th-b.OUT
12/08/2005  02:06 AM         6,850,602 Stress-pt_162th-m.OUT
12/07/2005  10:56 PM         6,821,874 Stress-pt_162th-t.OUT
12/08/2005  05:27 AM            16,295 Stress-pt_171max-b.OUT
12/08/2005  02:16 AM            16,295 Stress-pt_171max-m.OUT
12/07/2005  11:05 PM            16,214 Stress-pt_171max-t.OUT
12/08/2005  05:27 AM         6,850,602 Stress-pt_171th-b.OUT
12/08/2005  02:16 AM         6,850,602 Stress-pt_171th-m.OUT
12/07/2005  11:05 PM         6,821,874 Stress-pt_171th-t.OUT
12/08/2005  05:36 AM            16,295 Stress-pt_180max-b.OUT
12/08/2005  02:26 AM            16,295 Stress-pt_180max-m.OUT
12/07/2005  11:15 PM            16,214 Stress-pt_180max-t.OUT
12/08/2005  05:36 AM         6,850,602 Stress-pt_180th-b.OUT
12/08/2005  02:26 AM         6,850,602 Stress-pt_180th-m.OUT
12/07/2005  11:15 PM         6,821,874 Stress-pt_180th-t.OUT
12/08/2005  02:45 AM            16,291 Stress-pt_18max-b.OUT
12/07/2005  11:34 PM            16,291 Stress-pt_18max-m.OUT
12/07/2005  08:22 PM            16,210 Stress-pt_18max-t.OUT
12/08/2005  02:45 AM         6,850,602 Stress-pt_18th-b.OUT
12/07/2005  11:34 PM         6,850,602 Stress-pt_18th-m.OUT
12/07/2005  08:22 PM         6,821,874 Stress-pt_18th-t.OUT
12/08/2005  02:54 AM            16,291 Stress-pt_27max-b.OUT
12/07/2005  11:43 PM            16,291 Stress-pt_27max-m.OUT
12/07/2005  08:31 PM            16,210 Stress-pt_27max-t.OUT
12/08/2005  02:54 AM         6,850,602 Stress-pt_27th-b.OUT
12/07/2005  11:43 PM         6,850,602 Stress-pt_27th-m.OUT
12/07/2005  08:31 PM         6,821,874 Stress-pt_27th-t.OUT
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12/08/2005  03:04 AM            16,291 Stress-pt_36max-b.OUT
12/07/2005  11:53 PM            16,291 Stress-pt_36max-m.OUT
12/07/2005  08:41 PM            16,210 Stress-pt_36max-t.OUT
12/08/2005  03:04 AM         6,850,602 Stress-pt_36th-b.OUT
12/07/2005  11:53 PM         6,850,602 Stress-pt_36th-m.OUT
12/07/2005  08:41 PM         6,821,874 Stress-pt_36th-t.OUT
12/08/2005  03:13 AM            16,291 Stress-pt_45max-b.OUT
12/08/2005  12:02 AM            16,291 Stress-pt_45max-m.OUT
12/07/2005  08:50 PM            16,210 Stress-pt_45max-t.OUT
12/08/2005  03:13 AM         6,850,602 Stress-pt_45th-b.OUT
12/08/2005  12:02 AM         6,850,602 Stress-pt_45th-m.OUT
12/07/2005  08:50 PM         6,821,874 Stress-pt_45th-t.OUT
12/08/2005  03:22 AM            16,291 Stress-pt_54max-b.OUT
12/08/2005  12:11 AM            16,291 Stress-pt_54max-m.OUT
12/07/2005  09:00 PM            16,210 Stress-pt_54max-t.OUT
12/08/2005  03:22 AM         6,850,602 Stress-pt_54th-b.OUT
12/08/2005  12:12 AM         6,850,602 Stress-pt_54th-m.OUT
12/07/2005  09:00 PM         6,821,874 Stress-pt_54th-t.OUT
12/08/2005  03:32 AM            16,291 Stress-pt_63max-b.OUT
12/08/2005  12:21 AM            16,291 Stress-pt_63max-m.OUT
12/07/2005  09:10 PM            16,210 Stress-pt_63max-t.OUT
12/08/2005  03:32 AM         6,850,602 Stress-pt_63th-b.OUT
12/08/2005  12:21 AM         6,850,602 Stress-pt_63th-m.OUT
12/07/2005  09:10 PM         6,821,874 Stress-pt_63th-t.OUT
12/08/2005  03:41 AM            16,291 Stress-pt_72max-b.OUT
12/08/2005  12:30 AM            16,291 Stress-pt_72max-m.OUT
12/07/2005  09:19 PM            16,210 Stress-pt_72max-t.OUT
12/08/2005  03:41 AM         6,850,602 Stress-pt_72th-b.OUT
12/08/2005  12:31 AM         6,850,602 Stress-pt_72th-m.OUT
12/07/2005  09:19 PM         6,821,874 Stress-pt_72th-t.OUT
12/08/2005  03:51 AM            16,291 Stress-pt_81max-b.OUT
12/08/2005  12:40 AM            16,291 Stress-pt_81max-m.OUT
12/07/2005  09:29 PM            16,210 Stress-pt_81max-t.OUT
12/08/2005  03:51 AM         6,850,602 Stress-pt_81th-b.OUT
12/08/2005  12:40 AM         6,850,602 Stress-pt_81th-m.OUT
12/07/2005  09:29 PM         6,821,874 Stress-pt_81th-t.OUT
12/08/2005  04:01 AM            16,291 Stress-pt_90max-b.OUT
12/08/2005  12:50 AM            16,291 Stress-pt_90max-m.OUT
12/07/2005  09:39 PM            16,210 Stress-pt_90max-t.OUT
12/08/2005  04:01 AM         6,850,602 Stress-pt_90th-b.OUT
12/08/2005  12:50 AM         6,850,602 Stress-pt_90th-m.OUT
12/07/2005  09:39 PM         6,821,874 Stress-pt_90th-t.OUT
12/08/2005  04:11 AM            16,291 Stress-pt_99max-b.OUT
12/08/2005  01:00 AM            16,291 Stress-pt_99max-m.OUT
12/07/2005  09:49 PM            16,210 Stress-pt_99max-t.OUT
12/08/2005  04:11 AM         6,850,602 Stress-pt_99th-b.OUT
12/08/2005  01:00 AM         6,850,602 Stress-pt_99th-m.OUT
12/07/2005  09:49 PM         6,821,874 Stress-pt_99th-t.OUT
12/08/2005  02:35 AM            16,291 Stress-pt_9max-b.OUT
12/07/2005  11:24 PM            16,291 Stress-pt_9max-m.OUT
12/07/2005  08:12 PM            16,210 Stress-pt_9max-t.OUT
12/08/2005  02:35 AM         6,850,730 Stress-pt_9th-b.OUT
12/07/2005  11:24 PM         6,850,730 Stress-pt_9th-m.OUT
12/07/2005  08:12 PM         6,822,002 Stress-pt_9th-t.OUT
10/31/2005  12:13 PM             3,825 Tank-Coordinates-AY.txt
05/25/2005  03:32 PM             2,512 Tank-Mesh1.txt
12/05/2005  11:40 AM               102 tank-out.out
02/25/2005  02:24 PM             5,406 Tank-Props-BEC-250.txt
12/05/2005  10:51 AM             5,495 Tank-Props-Crack.txt
12/05/2005  11:41 AM             4,679 Tank-th.out
05/16/2005  03:40 PM            41,470 TH-266-Mean-Geo-V.txt
05/13/2005  10:57 AM            41,472 TH-266-Mean-Geo.txt
12/08/2005  04:31 PM             8,236 Waste-Cont_108max.OUT
12/08/2005  04:31 PM         3,151,428 Waste-Cont_108th.OUT
12/08/2005  04:38 PM             8,236 Waste-Cont_117max.OUT
12/08/2005  04:38 PM         3,151,428 Waste-Cont_117th.OUT
12/08/2005  04:45 PM             8,236 Waste-Cont_126max.OUT
12/08/2005  04:45 PM         3,151,428 Waste-Cont_126th.OUT
12/08/2005  04:52 PM             8,236 Waste-Cont_135max.OUT
12/08/2005  04:52 PM         3,151,428 Waste-Cont_135th.OUT
12/08/2005  04:59 PM             8,236 Waste-Cont_144max.OUT
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12/08/2005  04:59 PM         3,151,428 Waste-Cont_144th.OUT
12/08/2005  05:06 PM             8,236 Waste-Cont_153max.OUT
12/08/2005  05:06 PM         3,151,428 Waste-Cont_153th.OUT
12/08/2005  05:12 PM             8,236 Waste-Cont_162max.OUT
12/08/2005  05:12 PM         3,151,428 Waste-Cont_162th.OUT
12/08/2005  05:19 PM             8,236 Waste-Cont_171max.OUT
12/08/2005  05:19 PM         3,151,428 Waste-Cont_171th.OUT
12/08/2005  05:27 PM             8,236 Waste-Cont_180max.OUT
12/08/2005  05:27 PM         3,151,428 Waste-Cont_180th.OUT
12/08/2005  03:21 PM             8,236 Waste-Cont_18max.OUT
12/08/2005  03:21 PM         3,151,428 Waste-Cont_18th.OUT
12/08/2005  03:27 PM             8,236 Waste-Cont_27max.OUT
12/08/2005  03:27 PM         3,151,428 Waste-Cont_27th.OUT
12/08/2005  03:34 PM             8,236 Waste-Cont_36max.OUT
12/08/2005  03:34 PM         3,151,428 Waste-Cont_36th.OUT
12/08/2005  03:41 PM             8,236 Waste-Cont_45max.OUT
12/08/2005  03:41 PM         3,151,428 Waste-Cont_45th.OUT
12/08/2005  03:49 PM             8,236 Waste-Cont_54max.OUT
12/08/2005  03:49 PM         3,151,428 Waste-Cont_54th.OUT
12/08/2005  03:56 PM             8,236 Waste-Cont_63max.OUT
12/08/2005  03:56 PM         3,151,428 Waste-Cont_63th.OUT
12/08/2005  04:03 PM             8,236 Waste-Cont_72max.OUT
12/08/2005  04:03 PM         3,151,428 Waste-Cont_72th.OUT
12/08/2005  04:10 PM             8,236 Waste-Cont_81max.OUT
12/08/2005  04:10 PM         3,151,428 Waste-Cont_81th.OUT
12/08/2005  04:17 PM             8,236 Waste-Cont_90max.OUT
12/08/2005  04:17 PM         3,151,428 Waste-Cont_90th.OUT
12/08/2005  04:24 PM             8,236 Waste-Cont_99max.OUT
12/08/2005  04:24 PM         3,151,428 Waste-Cont_99th.OUT
12/08/2005  03:14 PM             8,236 Waste-Cont_9max.OUT
12/08/2005  03:14 PM         3,151,556 Waste-Cont_9th.OUT
12/09/2005  07:52 AM            45,117 Waste-Reaction.out
12/09/2005  07:34 AM               332 Waste-Reaction.txt
10/31/2005  12:01 PM             3,265 Waste-solid-AY.txt
11/29/2005  08:46 AM               776 Waste-Surface-ay.txt
12/09/2005  08:55 AM               784 Waste-Surf_0max.OUT
12/09/2005  08:55 AM           509,216 Waste-Surf_0th.OUT
12/08/2005  08:42 PM               784 Waste-Surf_108max.OUT
12/08/2005  08:42 PM           511,408 Waste-Surf_108th.OUT
12/08/2005  08:57 PM               784 Waste-Surf_117max.OUT
12/08/2005  08:57 PM           511,408 Waste-Surf_117th.OUT
12/08/2005  09:12 PM               784 Waste-Surf_126max.OUT
12/08/2005  09:12 PM           511,408 Waste-Surf_126th.OUT
12/08/2005  09:26 PM               784 Waste-Surf_135max.OUT
12/08/2005  09:26 PM           511,408 Waste-Surf_135th.OUT
12/08/2005  09:41 PM               784 Waste-Surf_144max.OUT
12/08/2005  09:41 PM           511,408 Waste-Surf_144th.OUT
12/08/2005  09:56 PM               784 Waste-Surf_153max.OUT
12/08/2005  09:56 PM           511,408 Waste-Surf_153th.OUT
12/08/2005  10:11 PM               784 Waste-Surf_162max.OUT
12/08/2005  10:11 PM           511,408 Waste-Surf_162th.OUT
12/08/2005  10:26 PM               784 Waste-Surf_171max.OUT
12/08/2005  10:26 PM           511,408 Waste-Surf_171th.OUT
12/08/2005  10:41 PM               784 Waste-Surf_180max.OUT
12/08/2005  10:41 PM           511,408 Waste-Surf_180th.OUT
12/08/2005  06:12 PM               784 Waste-Surf_18max.OUT
12/08/2005  06:12 PM           511,408 Waste-Surf_18th.OUT
12/08/2005  06:27 PM               784 Waste-Surf_27max.OUT
12/08/2005  06:27 PM           511,408 Waste-Surf_27th.OUT
12/08/2005  06:42 PM               784 Waste-Surf_36max.OUT
12/08/2005  06:42 PM           511,408 Waste-Surf_36th.OUT
12/08/2005  06:57 PM               784 Waste-Surf_45max.OUT
12/08/2005  06:57 PM           511,408 Waste-Surf_45th.OUT
12/08/2005  07:12 PM               784 Waste-Surf_54max.OUT
12/08/2005  07:12 PM           511,408 Waste-Surf_54th.OUT
12/08/2005  07:27 PM               784 Waste-Surf_63max.OUT
12/08/2005  07:27 PM           511,408 Waste-Surf_63th.OUT
12/08/2005  07:42 PM               784 Waste-Surf_72max.OUT
12/08/2005  07:42 PM           511,408 Waste-Surf_72th.OUT
12/08/2005  07:57 PM               784 Waste-Surf_81max.OUT
12/08/2005  07:57 PM           511,408 Waste-Surf_81th.OUT
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12/08/2005  08:12 PM               784 Waste-Surf_90max.OUT
12/08/2005  08:12 PM           511,408 Waste-Surf_90th.OUT
12/08/2005  08:27 PM               784 Waste-Surf_99max.OUT
12/08/2005  08:27 PM           511,408 Waste-Surf_99th.OUT
12/08/2005  05:57 PM               784 Waste-Surf_9max.OUT
12/08/2005  05:57 PM           511,408 Waste-Surf_9th.OUT
             706 File(s) 40,124,900,331 bytes
               2 Dir(s)  176,165,613,568 bytes free
```

BES-FCC Gravity File Listing

```
 Volume in drive E is 250GB HITAC
 Volume Serial Number is B4FB-DB23

 Directory of E:\PNNL-2D-NL-AY-BES-FCC-Seismic\PNNL-2D-NL-AY-FCC-BES-Gravity

12/22/2005  08:41 AM    <DIR>          .
12/22/2005  08:41 AM    <DIR>          ..
09/27/2005  03:47 PM                99 All-Forces.txt
12/05/2005  11:29 AM         3,363,840 AY-2D-NL-BES-FCC Conc Tank Demand Gravity.xls
12/07/2005  12:36 PM           678,912 AY-2D-NL-BES-FCC J Bolt Forces Gravity.xls
12/07/2005  01:30 PM         3,470,848 AY-2D-NL-BES-FCC Liner Strain Gravity.xls
12/15/2005  03:14 PM         8,516,608 AY-2D-NL-BES-FCC Pri Tank Stress Gravity.xls
12/13/2005  04:17 PM         2,108,416 AY-2D-NL-BES-FCC Soil Pressures Gravity.xls
12/08/2005  10:26 AM           685,568 AY-2D-NL-BES-FCC-Insul-Contact-Gravity.xls
12/07/2005  12:48 PM           726,016 AY-2D-NL-BES-FCC-J-Bolt-Contact-Gravity.xls
12/07/2005  01:23 PM           768,000 AY-2D-NL-BES-FCC-Primary-Contact-Gravity.xls
09/02/2005  02:01 PM             5,766 Bolts-Friction.txt
06/09/2005  01:59 PM               262 Boundary.txt
12/05/2005  10:53 AM               164 Contact-AY.txt
12/01/2005  09:11 AM               586 Contact-Footing.txt
09/02/2005  09:28 AM               604 Contact-Insul.txt
09/02/2005  09:51 AM               602 Contact-J-Bolts.txt
09/09/2005  09:59 AM               608 Contact-Primary.txt
09/15/2005  11:50 AM               742 Contact-Soil.txt
09/06/2005  11:16 AM               630 Contact-Waste-AY.txt
09/22/2005  04:05 PM             8,608 Far-Soil.txt
12/05/2005  10:41 AM               595 file.err
12/05/2005  10:41 AM               718 file.log
12/22/2005  08:41 AM                 0 file.txt
10/13/2005  06:54 AM               562 Fix-Soil.txt
12/14/2005  04:31 PM            10,342 Footing-Cont_max.OUT
12/14/2005  04:31 PM            11,328 Footing-Cont_th.OUT
04/06/2005  08:24 AM               894 Force-c.txt
12/05/2005  11:11 AM             4,996 Force-c_108amax.OUT
12/05/2005  11:11 AM             8,400 Force-c_108ath.OUT
12/05/2005  11:10 AM            14,716 Force-c_108max.OUT
12/05/2005  11:10 AM            16,800 Force-c_108th.OUT
12/05/2005  11:11 AM             4,996 Force-c_117amax.OUT
12/05/2005  11:11 AM             8,400 Force-c_117ath.OUT
12/05/2005  11:10 AM            14,716 Force-c_117max.OUT
12/05/2005  11:10 AM            16,800 Force-c_117th.OUT
12/05/2005  11:11 AM             4,996 Force-c_126amax.OUT
12/05/2005  11:11 AM             8,400 Force-c_126ath.OUT
12/05/2005  11:10 AM            14,716 Force-c_126max.OUT
12/05/2005  11:10 AM            16,800 Force-c_126th.OUT
12/05/2005  11:11 AM             4,996 Force-c_135amax.OUT
12/05/2005  11:11 AM             8,400 Force-c_135ath.OUT
12/05/2005  11:10 AM            14,716 Force-c_135max.OUT
12/05/2005  11:10 AM            16,800 Force-c_135th.OUT
12/05/2005  11:11 AM             4,996 Force-c_144amax.OUT
12/05/2005  11:11 AM             8,400 Force-c_144ath.OUT
12/05/2005  11:10 AM            14,716 Force-c_144max.OUT
12/05/2005  11:11 AM            16,800 Force-c_144th.OUT
12/05/2005  11:11 AM             4,996 Force-c_153amax.OUT
12/05/2005  11:11 AM             8,400 Force-c_153ath.OUT
12/05/2005  11:11 AM            14,716 Force-c_153max.OUT
12/05/2005  11:11 AM            16,800 Force-c_153th.OUT
12/05/2005  11:11 AM             4,996 Force-c_162amax.OUT
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12/05/2005  11:11 AM            8,400 Force-c_162ath.OUT
12/05/2005  11:11 AM           14,716 Force-c_162max.OUT
12/05/2005  11:11 AM           16,800 Force-c_162th.OUT
12/05/2005  11:11 AM            4,996 Force-c_171amax.OUT
12/05/2005  11:11 AM            8,400 Force-c_171ath.OUT
12/05/2005  11:11 AM           14,716 Force-c_171max.OUT
12/05/2005  11:11 AM           16,800 Force-c_171th.OUT
12/05/2005  11:11 AM            4,996 Force-c_180amax.OUT
12/05/2005  11:11 AM            8,400 Force-c_180ath.OUT
12/05/2005  11:11 AM           14,716 Force-c_180max.OUT
12/05/2005  11:11 AM           16,800 Force-c_180th.OUT
12/05/2005  11:11 AM            4,996 Force-c_18amax.OUT
12/05/2005  11:11 AM            8,400 Force-c_18ath.OUT
12/05/2005  11:10 AM           14,716 Force-c_18max.OUT
12/05/2005  11:10 AM           16,800 Force-c_18th.OUT
12/05/2005  11:11 AM            4,996 Force-c_27amax.OUT
12/05/2005  11:11 AM            8,400 Force-c_27ath.OUT
12/05/2005  11:10 AM           14,716 Force-c_27max.OUT
12/05/2005  11:10 AM           16,800 Force-c_27th.OUT
12/05/2005  11:11 AM            4,996 Force-c_36amax.OUT
12/05/2005  11:11 AM            8,400 Force-c_36ath.OUT
12/05/2005  11:10 AM           14,716 Force-c_36max.OUT
12/05/2005  11:10 AM           16,800 Force-c_36th.OUT
12/05/2005  11:11 AM            4,996 Force-c_45amax.OUT
12/05/2005  11:11 AM            8,400 Force-c_45ath.OUT
12/05/2005  11:10 AM           14,716 Force-c_45max.OUT
12/05/2005  11:10 AM           16,800 Force-c_45th.OUT
12/05/2005  11:11 AM            4,996 Force-c_54amax.OUT
12/05/2005  11:11 AM            8,400 Force-c_54ath.OUT
12/05/2005  11:10 AM           14,716 Force-c_54max.OUT
12/05/2005  11:10 AM           16,800 Force-c_54th.OUT
12/05/2005  11:11 AM            4,996 Force-c_63amax.OUT
12/05/2005  11:11 AM            8,400 Force-c_63ath.OUT
12/05/2005  11:10 AM           14,716 Force-c_63max.OUT
12/05/2005  11:10 AM           16,800 Force-c_63th.OUT
12/05/2005  11:11 AM            4,996 Force-c_72amax.OUT
12/05/2005  11:11 AM            8,400 Force-c_72ath.OUT
12/05/2005  11:10 AM           14,716 Force-c_72max.OUT
12/05/2005  11:10 AM           16,800 Force-c_72th.OUT
12/05/2005  11:11 AM            4,996 Force-c_81amax.OUT
12/05/2005  11:11 AM            8,400 Force-c_81ath.OUT
12/05/2005  11:10 AM           14,716 Force-c_81max.OUT
12/05/2005  11:10 AM           16,800 Force-c_81th.OUT
12/05/2005  11:11 AM            4,996 Force-c_90amax.OUT
12/05/2005  11:11 AM            8,400 Force-c_90ath.OUT
12/05/2005  11:10 AM           14,716 Force-c_90max.OUT
12/05/2005  11:10 AM           16,800 Force-c_90th.OUT
12/05/2005  11:11 AM            4,996 Force-c_99amax.OUT
12/05/2005  11:11 AM            8,400 Force-c_99ath.OUT
12/05/2005  11:10 AM           14,716 Force-c_99max.OUT
12/05/2005  11:10 AM           16,800 Force-c_99th.OUT
12/05/2005  11:11 AM            4,996 Force-c_9amax.OUT
12/05/2005  11:11 AM            8,528 Force-c_9ath.OUT
12/05/2005  11:10 AM           14,716 Force-c_9max.OUT
12/05/2005  11:10 AM           16,928 Force-c_9th.OUT
12/07/2005  12:34 PM          134,656 force-jb.xls
12/05/2005  11:11 AM            7,350 Force-jb_r10-th.OUT
12/05/2005  11:11 AM            5,239 Force-jb_r10_max.OUT
12/05/2005  11:11 AM            7,350 Force-jb_r11-th.OUT
12/05/2005  11:11 AM            5,239 Force-jb_r11_max.OUT
12/05/2005  11:11 AM            7,478 Force-jb_r2-th.OUT
12/05/2005  11:11 AM            5,239 Force-jb_r2_max.OUT
12/05/2005  11:11 AM            7,350 Force-jb_r3-th.OUT
12/05/2005  11:11 AM            5,239 Force-jb_r3_max.OUT
12/05/2005  11:11 AM            7,350 Force-jb_r4-th.OUT
12/05/2005  11:11 AM            5,239 Force-jb_r4_max.OUT
12/05/2005  11:11 AM            7,350 Force-jb_r5-th.OUT
12/05/2005  11:11 AM            5,239 Force-jb_r5_max.OUT
12/05/2005  11:11 AM            7,350 Force-jb_r6-th.OUT
12/05/2005  11:11 AM            5,239 Force-jb_r6_max.OUT
12/05/2005  11:11 AM            7,350 Force-jb_r7-th.OUT
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12/05/2005  11:11 AM             5,239 Force-jb_r7_max.OUT
12/05/2005  11:11 AM             7,350 Force-jb_r8-th.OUT
12/05/2005  11:11 AM             5,239 Force-jb_r8_max.OUT
12/05/2005  11:11 AM             7,350 Force-jb_r9-th.OUT
12/05/2005  11:11 AM             5,239 Force-jb_r9_max.OUT
06/20/2005  10:53 AM               661 Force-j_bolt.txt
12/05/2005  11:23 AM           445,440 import_0-90.xls
12/05/2005  11:23 AM           445,440 import_99-180.xls
12/08/2005  10:26 AM            74,240 Insul-Contact_0-90.xls
12/08/2005  10:26 AM            74,240 Insul-Contact_99-180.xls
12/05/2005  11:10 AM             2,728 Insul-Cont_108max.OUT
12/05/2005  11:10 AM             3,360 Insul-Cont_108th.OUT
12/05/2005  11:10 AM             2,728 Insul-Cont_117max.OUT
12/05/2005  11:10 AM             3,360 Insul-Cont_117th.OUT
12/05/2005  11:10 AM             2,728 Insul-Cont_126max.OUT
12/05/2005  11:10 AM             3,360 Insul-Cont_126th.OUT
12/05/2005  11:10 AM             2,728 Insul-Cont_135max.OUT
12/05/2005  11:10 AM             3,360 Insul-Cont_135th.OUT
12/05/2005  11:10 AM             2,728 Insul-Cont_144max.OUT
12/05/2005  11:10 AM             3,360 Insul-Cont_144th.OUT
12/05/2005  11:10 AM             2,728 Insul-Cont_153max.OUT
12/05/2005  11:10 AM             3,360 Insul-Cont_153th.OUT
12/05/2005  11:10 AM             2,728 Insul-Cont_162max.OUT
12/05/2005  11:10 AM             3,360 Insul-Cont_162th.OUT
12/05/2005  11:10 AM             2,728 Insul-Cont_171max.OUT
12/05/2005  11:10 AM             3,360 Insul-Cont_171th.OUT
12/05/2005  11:10 AM             2,728 Insul-Cont_180max.OUT
12/05/2005  11:10 AM             3,360 Insul-Cont_180th.OUT
12/05/2005  11:10 AM             2,728 Insul-Cont_18max.OUT
12/05/2005  11:10 AM             3,360 Insul-Cont_18th.OUT
12/05/2005  11:10 AM             2,728 Insul-Cont_27max.OUT
12/05/2005  11:10 AM             3,360 Insul-Cont_27th.OUT
12/05/2005  11:10 AM             2,728 Insul-Cont_36max.OUT
12/05/2005  11:10 AM             3,360 Insul-Cont_36th.OUT
12/05/2005  11:10 AM             2,728 Insul-Cont_45max.OUT
12/05/2005  11:10 AM             3,360 Insul-Cont_45th.OUT
12/05/2005  11:10 AM             2,728 Insul-Cont_54max.OUT
12/05/2005  11:10 AM             3,360 Insul-Cont_54th.OUT
12/05/2005  11:10 AM             2,728 Insul-Cont_63max.OUT
12/05/2005  11:10 AM             3,360 Insul-Cont_63th.OUT
12/05/2005  11:10 AM             2,728 Insul-Cont_72max.OUT
12/05/2005  11:10 AM             3,360 Insul-Cont_72th.OUT
12/05/2005  11:10 AM             2,728 Insul-Cont_81max.OUT
12/05/2005  11:10 AM             3,360 Insul-Cont_81th.OUT
12/05/2005  11:10 AM             2,728 Insul-Cont_90max.OUT
12/05/2005  11:10 AM             3,360 Insul-Cont_90th.OUT
12/05/2005  11:10 AM             2,728 Insul-Cont_99max.OUT
12/05/2005  11:10 AM             3,360 Insul-Cont_99th.OUT
12/05/2005  11:10 AM             2,728 Insul-Cont_9max.OUT
12/05/2005  11:10 AM             3,488 Insul-Cont_9th.OUT
09/01/2005  10:27 AM             1,664 Insulate.txt
10/13/2005  08:28 AM             4,031 interface-gap1.txt
09/09/2005  09:34 AM             2,616 interface1.txt
12/07/2005  12:37 PM            81,408 J-Bolt-Contact_0-90.xls
12/07/2005  12:38 PM            81,408 J-Bolt-Contact_99-180.xls
12/05/2005  11:10 AM             3,052 J-Bolt-Cont_108max.OUT
12/05/2005  11:10 AM             3,780 J-Bolt-Cont_108th.OUT
12/05/2005  11:10 AM             3,052 J-Bolt-Cont_117max.OUT
12/05/2005  11:10 AM             3,780 J-Bolt-Cont_117th.OUT
12/05/2005  11:10 AM             3,052 J-Bolt-Cont_126max.OUT
12/05/2005  11:10 AM             3,780 J-Bolt-Cont_126th.OUT
12/05/2005  11:10 AM             3,052 J-Bolt-Cont_135max.OUT
12/05/2005  11:10 AM             3,780 J-Bolt-Cont_135th.OUT
12/05/2005  11:10 AM             3,052 J-Bolt-Cont_144max.OUT
12/05/2005  11:10 AM             3,780 J-Bolt-Cont_144th.OUT
12/05/2005  11:10 AM             3,052 J-Bolt-Cont_153max.OUT
12/05/2005  11:10 AM             3,780 J-Bolt-Cont_153th.OUT
12/05/2005  11:10 AM             3,052 J-Bolt-Cont_162max.OUT
12/05/2005  11:10 AM             3,780 J-Bolt-Cont_162th.OUT
12/05/2005  11:10 AM             3,052 J-Bolt-Cont_171max.OUT
12/05/2005  11:10 AM             3,780 J-Bolt-Cont_171th.OUT
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12/05/2005  11:10 AM             3,052 J-Bolt-Cont_180max.OUT
12/05/2005  11:10 AM             3,780 J-Bolt-Cont_180th.OUT
12/05/2005  11:10 AM             3,052 J-Bolt-Cont_18max.OUT
12/05/2005  11:10 AM             3,780 J-Bolt-Cont_18th.OUT
12/05/2005  11:10 AM             3,052 J-Bolt-Cont_27max.OUT
12/05/2005  11:10 AM             3,780 J-Bolt-Cont_27th.OUT
12/05/2005  11:10 AM             3,052 J-Bolt-Cont_36max.OUT
12/05/2005  11:10 AM             3,780 J-Bolt-Cont_36th.OUT
12/05/2005  11:10 AM             3,052 J-Bolt-Cont_45max.OUT
12/05/2005  11:10 AM             3,780 J-Bolt-Cont_45th.OUT
12/05/2005  11:10 AM             3,052 J-Bolt-Cont_54max.OUT
12/05/2005  11:10 AM             3,780 J-Bolt-Cont_54th.OUT
12/05/2005  11:10 AM             3,052 J-Bolt-Cont_63max.OUT
12/05/2005  11:10 AM             3,780 J-Bolt-Cont_63th.OUT
12/05/2005  11:10 AM             3,052 J-Bolt-Cont_72max.OUT
12/05/2005  11:10 AM             3,780 J-Bolt-Cont_72th.OUT
12/05/2005  11:10 AM             3,052 J-Bolt-Cont_81max.OUT
12/05/2005  11:10 AM             3,780 J-Bolt-Cont_81th.OUT
12/05/2005  11:10 AM             3,052 J-Bolt-Cont_90max.OUT
12/05/2005  11:10 AM             3,780 J-Bolt-Cont_90th.OUT
12/05/2005  11:10 AM             3,052 J-Bolt-Cont_99max.OUT
12/05/2005  11:10 AM             3,780 J-Bolt-Cont_99th.OUT
12/05/2005  11:10 AM             3,052 J-Bolt-Cont_9max.OUT
12/05/2005  11:10 AM             3,908 J-Bolt-Cont_9th.OUT
12/07/2005  01:27 PM           158,208 liner-strain-comp_0-90b.xls
12/07/2005  01:27 PM           158,208 liner-strain-comp_0-90m.xls
12/07/2005  01:27 PM           158,208 liner-strain-comp_0-90t.xls
12/07/2005  01:27 PM           158,208 liner-strain-comp_99-180b.xls
12/07/2005  01:28 PM           158,208 liner-strain-comp_99-180m.xls
12/07/2005  01:28 PM           158,208 liner-strain-comp_99-180t.xls
06/01/2005  01:17 PM             1,708 Liner.txt
05/02/2005  02:19 PM               667 live_load.txt
11/11/2005  10:38 AM             6,185 Near-Soil-1.txt
04/20/2005  01:14 PM               508 outer-spar.txt
12/05/2005  11:10 AM             2,998 PNNL-AY-2D-BES-FCC.BCS
12/05/2005  11:10 AM        55,508,992 PNNL-AY-2D-BES-FCC.db
12/05/2005  11:08 AM        55,508,992 PNNL-AY-2D-BES-FCC.dbb
12/05/2005  11:10 AM        12,386,304 PNNL-AY-2D-BES-FCC.emat
12/14/2005  04:30 PM            55,689 PNNL-AY-2D-BES-FCC.err
12/05/2005  11:10 AM       102,563,840 PNNL-AY-2D-BES-FCC.esav
12/05/2005  11:10 AM        27,852,800 PNNL-AY-2D-BES-FCC.full
12/05/2005  11:08 AM           437,553 PNNL-AY-2D-BES-FCC.ldhi
12/14/2005  04:31 PM             7,958 PNNL-AY-2D-BES-FCC.log
12/05/2005  11:10 AM             1,559 PNNL-AY-2D-BES-FCC.mntr
12/05/2005  11:08 AM       102,563,840 PNNL-AY-2D-BES-FCC.osav
12/05/2005  11:09 AM             1,411 PNNL-AY-2D-BES-FCC.PVTS
12/05/2005  11:10 AM       103,546,880 PNNL-AY-2D-BES-FCC.r001
12/05/2005  10:55 AM        35,782,656 PNNL-AY-2D-BES-FCC.rdb
12/05/2005  11:10 AM        57,671,680 PNNL-AY-2D-BES-FCC.rst
12/05/2005  11:10 AM            71,231 PNNL-AY-2D-NL-BEC-BES-Gravity.out
12/07/2005  01:20 PM            73,728 Primary-Contact_0-90.xls
12/07/2005  01:20 PM            74,240 Primary-Contact_99-180.xls
12/05/2005  11:10 AM             2,728 Primary-Cont_108max.OUT
12/05/2005  11:10 AM             3,360 Primary-Cont_108th.OUT
12/05/2005  11:10 AM             2,728 Primary-Cont_117max.OUT
12/05/2005  11:10 AM             3,360 Primary-Cont_117th.OUT
12/05/2005  11:10 AM             2,728 Primary-Cont_126max.OUT
12/05/2005  11:10 AM             3,360 Primary-Cont_126th.OUT
12/05/2005  11:10 AM             2,728 Primary-Cont_135max.OUT
12/05/2005  11:10 AM             3,360 Primary-Cont_135th.OUT
12/05/2005  11:10 AM             2,728 Primary-Cont_144max.OUT
12/05/2005  11:10 AM             3,360 Primary-Cont_144th.OUT
12/05/2005  11:10 AM             2,728 Primary-Cont_153max.OUT
12/05/2005  11:10 AM             3,360 Primary-Cont_153th.OUT
12/05/2005  11:10 AM             2,728 Primary-Cont_162max.OUT
12/05/2005  11:10 AM             3,360 Primary-Cont_162th.OUT
12/05/2005  11:10 AM             2,728 Primary-Cont_171max.OUT
12/05/2005  11:10 AM             3,360 Primary-Cont_171th.OUT
12/05/2005  11:10 AM             2,728 Primary-Cont_180max.OUT
12/05/2005  11:10 AM             3,360 Primary-Cont_180th.OUT
12/05/2005  11:10 AM             2,728 Primary-Cont_18max.OUT
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12/05/2005  11:10 AM            3,360 Primary-Cont_18th.OUT
12/05/2005  11:10 AM            2,728 Primary-Cont_27max.OUT
12/05/2005  11:10 AM            3,360 Primary-Cont_27th.OUT
12/05/2005  11:10 AM            2,728 Primary-Cont_36max.OUT
12/05/2005  11:10 AM            3,360 Primary-Cont_36th.OUT
12/05/2005  11:10 AM            2,728 Primary-Cont_45max.OUT
12/05/2005  11:10 AM            3,360 Primary-Cont_45th.OUT
12/05/2005  11:10 AM            2,728 Primary-Cont_54max.OUT
12/05/2005  11:10 AM            3,360 Primary-Cont_54th.OUT
12/05/2005  11:10 AM            2,728 Primary-Cont_63max.OUT
12/05/2005  11:10 AM            3,360 Primary-Cont_63th.OUT
12/05/2005  11:10 AM            2,728 Primary-Cont_72max.OUT
12/05/2005  11:10 AM            3,360 Primary-Cont_72th.OUT
12/05/2005  11:10 AM            2,728 Primary-Cont_81max.OUT
12/05/2005  11:10 AM            3,360 Primary-Cont_81th.OUT
12/05/2005  11:10 AM            2,728 Primary-Cont_90max.OUT
12/05/2005  11:10 AM            3,360 Primary-Cont_90th.OUT
12/05/2005  11:10 AM            2,728 Primary-Cont_99max.OUT
12/05/2005  11:10 AM            3,360 Primary-Cont_99th.OUT
12/05/2005  11:10 AM            2,728 Primary-Cont_9max.OUT
12/05/2005  11:10 AM            3,488 Primary-Cont_9th.OUT
10/31/2005  12:18 PM            5,549 Primary-Props-AY.txt
09/27/2005  03:52 PM            1,538 Primary.txt
12/05/2005  10:55 AM          385,201 QA.out
10/31/2005  10:31 AM            1,108 RS_FREQ.txt
12/05/2005  10:52 AM            1,894 Run-Tank.txt
12/14/2005  04:30 PM                0 scratch.hlp
02/11/2005  01:22 PM            1,053 Slave.txt
12/05/2005  11:10 AM            9,896 Soil-Contact_108max.OUT
12/05/2005  11:10 AM           13,160 Soil-Contact_108th.OUT
12/05/2005  11:10 AM            9,896 Soil-Contact_117max.OUT
12/05/2005  11:10 AM           13,160 Soil-Contact_117th.OUT
12/05/2005  11:10 AM            9,896 Soil-Contact_126max.OUT
12/05/2005  11:10 AM           13,160 Soil-Contact_126th.OUT
12/05/2005  11:10 AM            9,896 Soil-Contact_135max.OUT
12/05/2005  11:10 AM           13,160 Soil-Contact_135th.OUT
12/05/2005  11:10 AM            9,896 Soil-Contact_144max.OUT
12/05/2005  11:10 AM           13,160 Soil-Contact_144th.OUT
12/05/2005  11:10 AM            9,896 Soil-Contact_153max.OUT
12/05/2005  11:10 AM           13,160 Soil-Contact_153th.OUT
12/05/2005  11:10 AM            9,896 Soil-Contact_162max.OUT
12/05/2005  11:10 AM           13,160 Soil-Contact_162th.OUT
12/05/2005  11:10 AM            9,896 Soil-Contact_171max.OUT
12/05/2005  11:10 AM           13,160 Soil-Contact_171th.OUT
12/05/2005  11:10 AM            9,896 Soil-Contact_180max.OUT
12/05/2005  11:10 AM           13,160 Soil-Contact_180th.OUT
12/05/2005  11:10 AM            9,896 Soil-Contact_18max.OUT
12/05/2005  11:10 AM           13,160 Soil-Contact_18th.OUT
12/05/2005  11:10 AM            9,896 Soil-Contact_27max.OUT
12/05/2005  11:10 AM           13,160 Soil-Contact_27th.OUT
12/05/2005  11:10 AM            9,896 Soil-Contact_36max.OUT
12/05/2005  11:10 AM           13,160 Soil-Contact_36th.OUT
12/05/2005  11:10 AM            9,896 Soil-Contact_45max.OUT
12/05/2005  11:10 AM           13,160 Soil-Contact_45th.OUT
12/05/2005  11:10 AM            9,896 Soil-Contact_54max.OUT
12/05/2005  11:10 AM           13,160 Soil-Contact_54th.OUT
12/05/2005  11:10 AM            9,896 Soil-Contact_63max.OUT
12/05/2005  11:10 AM           13,160 Soil-Contact_63th.OUT
12/05/2005  11:10 AM            9,896 Soil-Contact_72max.OUT
12/05/2005  11:10 AM           13,160 Soil-Contact_72th.OUT
12/05/2005  11:10 AM            9,896 Soil-Contact_81max.OUT
12/05/2005  11:10 AM           13,160 Soil-Contact_81th.OUT
12/05/2005  11:10 AM            9,896 Soil-Contact_90max.OUT
12/05/2005  11:10 AM           13,160 Soil-Contact_90th.OUT
12/05/2005  11:10 AM            9,896 Soil-Contact_99max.OUT
12/05/2005  11:10 AM           13,160 Soil-Contact_99th.OUT
12/05/2005  11:10 AM            9,896 Soil-Contact_9max.OUT
12/05/2005  11:10 AM           13,288 Soil-Contact_9th.OUT
11/11/2005  10:36 AM            4,989 Soil-Prop-Mean-Geo.txt
12/05/2005  11:17 AM          223,744 soil_0-90.xls
12/05/2005  11:17 AM          224,256 soil_99-180.xls
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11/11/2005  10:54 AM             1,898 Solve-Gravity-BES.txt
10/31/2005  11:02 AM             3,363 spectra-conc-0.txt
10/14/2005  11:18 AM             2,061 spectra-concrete.txt
10/31/2005  10:17 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
12/07/2005  01:09 PM           354,304 str-comp_0-90b.xls
12/07/2005  01:09 PM           355,328 str-comp_0-90m.xls
12/07/2005  01:09 PM           352,768 str-comp_0-90t.xls
12/07/2005  01:10 PM           354,304 str-comp_99-180b.xls
12/07/2005  01:10 PM           355,328 str-comp_99-180m.xls
12/07/2005  01:10 PM           352,768 str-comp_99-180t.xls
09/02/2005  08:51 AM               707 strain-compb.txt
09/02/2005  08:51 AM               705 strain-compm.txt
09/02/2005  08:50 AM               720 strain-compt.txt
12/05/2005  11:11 AM             6,110 Strain-lb_108max-b.OUT
12/05/2005  11:11 AM             8,134 Strain-lb_108th-b.OUT
12/05/2005  11:11 AM             6,110 Strain-lb_117max-b.OUT
12/05/2005  11:11 AM             8,134 Strain-lb_117th-b.OUT
12/05/2005  11:11 AM             6,110 Strain-lb_126max-b.OUT
12/05/2005  11:11 AM             8,134 Strain-lb_126th-b.OUT
12/05/2005  11:11 AM             6,110 Strain-lb_135max-b.OUT
12/05/2005  11:11 AM             8,134 Strain-lb_135th-b.OUT
12/05/2005  11:11 AM             6,110 Strain-lb_144max-b.OUT
12/05/2005  11:11 AM             8,134 Strain-lb_144th-b.OUT
12/05/2005  11:11 AM             6,110 Strain-lb_153max-b.OUT
12/05/2005  11:11 AM             8,134 Strain-lb_153th-b.OUT
12/05/2005  11:11 AM             6,110 Strain-lb_162max-b.OUT
12/05/2005  11:11 AM             8,134 Strain-lb_162th-b.OUT
12/05/2005  11:11 AM             6,110 Strain-lb_171max-b.OUT
12/05/2005  11:11 AM             8,134 Strain-lb_171th-b.OUT
12/05/2005  11:11 AM             6,110 Strain-lb_180max-b.OUT
12/05/2005  11:11 AM             8,134 Strain-lb_180th-b.OUT
12/05/2005  11:11 AM             6,110 Strain-lb_18max-b.OUT
12/05/2005  11:11 AM             8,134 Strain-lb_18th-b.OUT
12/05/2005  11:11 AM             6,110 Strain-lb_27max-b.OUT
12/05/2005  11:11 AM             8,134 Strain-lb_27th-b.OUT
12/05/2005  11:11 AM             6,110 Strain-lb_36max-b.OUT
12/05/2005  11:11 AM             8,134 Strain-lb_36th-b.OUT
12/05/2005  11:11 AM             6,110 Strain-lb_45max-b.OUT
12/05/2005  11:11 AM             8,134 Strain-lb_45th-b.OUT
12/05/2005  11:11 AM             6,110 Strain-lb_54max-b.OUT
12/05/2005  11:11 AM             8,134 Strain-lb_54th-b.OUT
12/05/2005  11:11 AM             6,110 Strain-lb_63max-b.OUT
12/05/2005  11:11 AM             8,134 Strain-lb_63th-b.OUT
12/05/2005  11:11 AM             6,110 Strain-lb_72max-b.OUT
12/05/2005  11:11 AM             8,134 Strain-lb_72th-b.OUT
12/05/2005  11:11 AM             6,110 Strain-lb_81max-b.OUT
12/05/2005  11:11 AM             8,134 Strain-lb_81th-b.OUT
12/05/2005  11:11 AM             6,110 Strain-lb_90max-b.OUT
12/05/2005  11:11 AM             8,134 Strain-lb_90th-b.OUT
12/05/2005  11:11 AM             6,110 Strain-lb_99max-b.OUT
12/05/2005  11:11 AM             8,134 Strain-lb_99th-b.OUT
12/05/2005  11:11 AM             6,110 Strain-lb_9max-b.OUT
12/05/2005  11:11 AM             8,262 Strain-lb_9th-b.OUT
09/02/2005  08:52 AM               544 Strain-Liner.txt
12/05/2005  11:11 AM             6,110 Strain-lm_108max-m.OUT
12/05/2005  11:11 AM             8,134 Strain-lm_108th-m.OUT
12/05/2005  11:11 AM             6,110 Strain-lm_117max-m.OUT
12/05/2005  11:11 AM             8,134 Strain-lm_117th-m.OUT
12/05/2005  11:11 AM             6,110 Strain-lm_126max-m.OUT
12/05/2005  11:11 AM             8,134 Strain-lm_126th-m.OUT
12/05/2005  11:11 AM             6,110 Strain-lm_135max-m.OUT
12/05/2005  11:11 AM             8,134 Strain-lm_135th-m.OUT
12/05/2005  11:11 AM             6,110 Strain-lm_144max-m.OUT
12/05/2005  11:11 AM             8,134 Strain-lm_144th-m.OUT
12/05/2005  11:11 AM             6,110 Strain-lm_153max-m.OUT
12/05/2005  11:11 AM             8,134 Strain-lm_153th-m.OUT
12/05/2005  11:11 AM             6,110 Strain-lm_162max-m.OUT
12/05/2005  11:11 AM             8,134 Strain-lm_162th-m.OUT
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12/05/2005  11:11 AM             6,110 Strain-lm_171max-m.OUT
12/05/2005  11:11 AM             8,134 Strain-lm_171th-m.OUT
12/05/2005  11:11 AM             6,110 Strain-lm_180max-m.OUT
12/05/2005  11:11 AM             8,134 Strain-lm_180th-m.OUT
12/05/2005  11:11 AM             6,110 Strain-lm_18max-m.OUT
12/05/2005  11:11 AM             8,134 Strain-lm_18th-m.OUT
12/05/2005  11:11 AM             6,110 Strain-lm_27max-m.OUT
12/05/2005  11:11 AM             8,134 Strain-lm_27th-m.OUT
12/05/2005  11:11 AM             6,110 Strain-lm_36max-m.OUT
12/05/2005  11:11 AM             8,134 Strain-lm_36th-m.OUT
12/05/2005  11:11 AM             6,110 Strain-lm_45max-m.OUT
12/05/2005  11:11 AM             8,134 Strain-lm_45th-m.OUT
12/05/2005  11:11 AM             6,110 Strain-lm_54max-m.OUT
12/05/2005  11:11 AM             8,134 Strain-lm_54th-m.OUT
12/05/2005  11:11 AM             6,110 Strain-lm_63max-m.OUT
12/05/2005  11:11 AM             8,134 Strain-lm_63th-m.OUT
12/05/2005  11:11 AM             6,110 Strain-lm_72max-m.OUT
12/05/2005  11:11 AM             8,134 Strain-lm_72th-m.OUT
12/05/2005  11:11 AM             6,110 Strain-lm_81max-m.OUT
12/05/2005  11:11 AM             8,134 Strain-lm_81th-m.OUT
12/05/2005  11:11 AM             6,110 Strain-lm_90max-m.OUT
12/05/2005  11:11 AM             8,134 Strain-lm_90th-m.OUT
12/05/2005  11:11 AM             6,110 Strain-lm_99max-m.OUT
12/05/2005  11:11 AM             8,134 Strain-lm_99th-m.OUT
12/05/2005  11:11 AM             6,110 Strain-lm_9max-m.OUT
12/05/2005  11:11 AM             8,262 Strain-lm_9th-m.OUT
12/05/2005  11:11 AM             6,110 Strain-lt_108max-t.OUT
12/05/2005  11:11 AM             8,134 Strain-lt_108th-t.OUT
12/05/2005  11:11 AM             6,110 Strain-lt_117max-t.OUT
12/05/2005  11:11 AM             8,134 Strain-lt_117th-t.OUT
12/05/2005  11:11 AM             6,110 Strain-lt_126max-t.OUT
12/05/2005  11:11 AM             8,134 Strain-lt_126th-t.OUT
12/05/2005  11:11 AM             6,110 Strain-lt_135max-t.OUT
12/05/2005  11:11 AM             8,134 Strain-lt_135th-t.OUT
12/05/2005  11:11 AM             6,110 Strain-lt_144max-t.OUT
12/05/2005  11:11 AM             8,134 Strain-lt_144th-t.OUT
12/05/2005  11:11 AM             6,110 Strain-lt_153max-t.OUT
12/05/2005  11:11 AM             8,134 Strain-lt_153th-t.OUT
12/05/2005  11:11 AM             6,110 Strain-lt_162max-t.OUT
12/05/2005  11:11 AM             8,134 Strain-lt_162th-t.OUT
12/05/2005  11:11 AM             6,110 Strain-lt_171max-t.OUT
12/05/2005  11:11 AM             8,134 Strain-lt_171th-t.OUT
12/05/2005  11:11 AM             6,110 Strain-lt_180max-t.OUT
12/05/2005  11:11 AM             8,134 Strain-lt_180th-t.OUT
12/05/2005  11:11 AM             6,110 Strain-lt_18max-t.OUT
12/05/2005  11:11 AM             8,134 Strain-lt_18th-t.OUT
12/05/2005  11:11 AM             6,110 Strain-lt_27max-t.OUT
12/05/2005  11:11 AM             8,134 Strain-lt_27th-t.OUT
12/05/2005  11:11 AM             6,110 Strain-lt_36max-t.OUT
12/05/2005  11:11 AM             8,134 Strain-lt_36th-t.OUT
12/05/2005  11:11 AM             6,110 Strain-lt_45max-t.OUT
12/05/2005  11:11 AM             8,134 Strain-lt_45th-t.OUT
12/05/2005  11:11 AM             6,110 Strain-lt_54max-t.OUT
12/05/2005  11:11 AM             8,134 Strain-lt_54th-t.OUT
12/05/2005  11:11 AM             6,110 Strain-lt_63max-t.OUT
12/05/2005  11:11 AM             8,134 Strain-lt_63th-t.OUT
12/05/2005  11:11 AM             6,110 Strain-lt_72max-t.OUT
12/05/2005  11:11 AM             8,134 Strain-lt_72th-t.OUT
12/05/2005  11:11 AM             6,110 Strain-lt_81max-t.OUT
12/05/2005  11:11 AM             8,134 Strain-lt_81th-t.OUT
12/05/2005  11:11 AM             6,110 Strain-lt_90max-t.OUT
12/05/2005  11:11 AM             8,134 Strain-lt_90th-t.OUT
12/05/2005  11:11 AM             6,110 Strain-lt_99max-t.OUT
12/05/2005  11:11 AM             8,134 Strain-lt_99th-t.OUT
12/05/2005  11:11 AM             6,110 Strain-lt_9max-t.OUT
12/05/2005  11:11 AM             8,262 Strain-lt_9th-t.OUT
09/08/2005  10:18 AM               692 stress-compb.txt
11/01/2005  10:46 AM               702 stress-compm.txt
09/08/2005  09:20 AM               692 stress-compt.txt
04/13/2005  07:38 AM               205 Stress-Primary.txt
12/05/2005  11:11 AM            16,291 Stress-pt_108max-b.OUT
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12/05/2005  11:11 AM            16,291 Stress-pt_108max-m.OUT
12/05/2005  11:11 AM            16,210 Stress-pt_108max-t.OUT
12/05/2005  11:11 AM            21,714 Stress-pt_108th-b.OUT
12/05/2005  11:11 AM            21,714 Stress-pt_108th-m.OUT
12/05/2005  11:11 AM            21,630 Stress-pt_108th-t.OUT
12/05/2005  11:11 AM            16,291 Stress-pt_117max-b.OUT
12/05/2005  11:11 AM            16,291 Stress-pt_117max-m.OUT
12/05/2005  11:11 AM            16,210 Stress-pt_117max-t.OUT
12/05/2005  11:11 AM            21,714 Stress-pt_117th-b.OUT
12/05/2005  11:11 AM            21,714 Stress-pt_117th-m.OUT
12/05/2005  11:11 AM            21,630 Stress-pt_117th-t.OUT
12/05/2005  11:11 AM            16,291 Stress-pt_126max-b.OUT
12/05/2005  11:11 AM            16,291 Stress-pt_126max-m.OUT
12/05/2005  11:11 AM            16,210 Stress-pt_126max-t.OUT
12/05/2005  11:11 AM            21,714 Stress-pt_126th-b.OUT
12/05/2005  11:11 AM            21,714 Stress-pt_126th-m.OUT
12/05/2005  11:11 AM            21,630 Stress-pt_126th-t.OUT
12/05/2005  11:11 AM            16,291 Stress-pt_135max-b.OUT
12/05/2005  11:11 AM            16,291 Stress-pt_135max-m.OUT
12/05/2005  11:11 AM            16,210 Stress-pt_135max-t.OUT
12/05/2005  11:11 AM            21,714 Stress-pt_135th-b.OUT
12/05/2005  11:11 AM            21,714 Stress-pt_135th-m.OUT
12/05/2005  11:11 AM            21,630 Stress-pt_135th-t.OUT
12/05/2005  11:11 AM            16,291 Stress-pt_144max-b.OUT
12/05/2005  11:11 AM            16,291 Stress-pt_144max-m.OUT
12/05/2005  11:11 AM            16,210 Stress-pt_144max-t.OUT
12/05/2005  11:11 AM            21,714 Stress-pt_144th-b.OUT
12/05/2005  11:11 AM            21,714 Stress-pt_144th-m.OUT
12/05/2005  11:11 AM            21,630 Stress-pt_144th-t.OUT
12/05/2005  11:11 AM            16,291 Stress-pt_153max-b.OUT
12/05/2005  11:11 AM            16,291 Stress-pt_153max-m.OUT
12/05/2005  11:11 AM            16,210 Stress-pt_153max-t.OUT
12/05/2005  11:11 AM            21,714 Stress-pt_153th-b.OUT
12/05/2005  11:11 AM            21,714 Stress-pt_153th-m.OUT
12/05/2005  11:11 AM            21,630 Stress-pt_153th-t.OUT
12/05/2005  11:11 AM            16,291 Stress-pt_162max-b.OUT
12/05/2005  11:11 AM            16,291 Stress-pt_162max-m.OUT
12/05/2005  11:11 AM            16,210 Stress-pt_162max-t.OUT
12/05/2005  11:11 AM            21,714 Stress-pt_162th-b.OUT
12/05/2005  11:11 AM            21,714 Stress-pt_162th-m.OUT
12/05/2005  11:11 AM            21,630 Stress-pt_162th-t.OUT
12/05/2005  11:11 AM            16,295 Stress-pt_171max-b.OUT
12/05/2005  11:11 AM            16,295 Stress-pt_171max-m.OUT
12/05/2005  11:11 AM            16,214 Stress-pt_171max-t.OUT
12/05/2005  11:11 AM            21,714 Stress-pt_171th-b.OUT
12/05/2005  11:11 AM            21,714 Stress-pt_171th-m.OUT
12/05/2005  11:11 AM            21,630 Stress-pt_171th-t.OUT
12/05/2005  11:11 AM            16,295 Stress-pt_180max-b.OUT
12/05/2005  11:11 AM            16,295 Stress-pt_180max-m.OUT
12/05/2005  11:11 AM            16,214 Stress-pt_180max-t.OUT
12/05/2005  11:11 AM            21,714 Stress-pt_180th-b.OUT
12/05/2005  11:11 AM            21,714 Stress-pt_180th-m.OUT
12/05/2005  11:11 AM            21,630 Stress-pt_180th-t.OUT
12/05/2005  11:11 AM            16,291 Stress-pt_18max-b.OUT
12/05/2005  11:11 AM            16,291 Stress-pt_18max-m.OUT
12/05/2005  11:11 AM            16,210 Stress-pt_18max-t.OUT
12/05/2005  11:11 AM            21,714 Stress-pt_18th-b.OUT
12/05/2005  11:11 AM            21,714 Stress-pt_18th-m.OUT
12/05/2005  11:11 AM            21,630 Stress-pt_18th-t.OUT
12/05/2005  11:11 AM            16,291 Stress-pt_27max-b.OUT
12/05/2005  11:11 AM            16,291 Stress-pt_27max-m.OUT
12/05/2005  11:11 AM            16,210 Stress-pt_27max-t.OUT
12/05/2005  11:11 AM            21,714 Stress-pt_27th-b.OUT
12/05/2005  11:11 AM            21,714 Stress-pt_27th-m.OUT
12/05/2005  11:11 AM            21,630 Stress-pt_27th-t.OUT
12/05/2005  11:11 AM            16,291 Stress-pt_36max-b.OUT
12/05/2005  11:11 AM            16,291 Stress-pt_36max-m.OUT
12/05/2005  11:11 AM            16,210 Stress-pt_36max-t.OUT
12/05/2005  11:11 AM            21,714 Stress-pt_36th-b.OUT
12/05/2005  11:11 AM            21,714 Stress-pt_36th-m.OUT
12/05/2005  11:11 AM            21,630 Stress-pt_36th-t.OUT
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12/05/2005  11:11 AM            16,291 Stress-pt_45max-b.OUT
12/05/2005  11:11 AM            16,291 Stress-pt_45max-m.OUT
12/05/2005  11:11 AM            16,210 Stress-pt_45max-t.OUT
12/05/2005  11:11 AM            21,714 Stress-pt_45th-b.OUT
12/05/2005  11:11 AM            21,714 Stress-pt_45th-m.OUT
12/05/2005  11:11 AM            21,630 Stress-pt_45th-t.OUT
12/05/2005  11:11 AM            16,291 Stress-pt_54max-b.OUT
12/05/2005  11:11 AM            16,291 Stress-pt_54max-m.OUT
12/05/2005  11:11 AM            16,210 Stress-pt_54max-t.OUT
12/05/2005  11:11 AM            21,714 Stress-pt_54th-b.OUT
12/05/2005  11:11 AM            21,714 Stress-pt_54th-m.OUT
12/05/2005  11:11 AM            21,630 Stress-pt_54th-t.OUT
12/05/2005  11:11 AM            16,291 Stress-pt_63max-b.OUT
12/05/2005  11:11 AM            16,291 Stress-pt_63max-m.OUT
12/05/2005  11:11 AM            16,210 Stress-pt_63max-t.OUT
12/05/2005  11:11 AM            21,714 Stress-pt_63th-b.OUT
12/05/2005  11:11 AM            21,714 Stress-pt_63th-m.OUT
12/05/2005  11:11 AM            21,630 Stress-pt_63th-t.OUT
12/05/2005  11:11 AM            16,291 Stress-pt_72max-b.OUT
12/05/2005  11:11 AM            16,291 Stress-pt_72max-m.OUT
12/05/2005  11:11 AM            16,210 Stress-pt_72max-t.OUT
12/05/2005  11:11 AM            21,714 Stress-pt_72th-b.OUT
12/05/2005  11:11 AM            21,714 Stress-pt_72th-m.OUT
12/05/2005  11:11 AM            21,630 Stress-pt_72th-t.OUT
12/05/2005  11:11 AM            16,291 Stress-pt_81max-b.OUT
12/05/2005  11:11 AM            16,291 Stress-pt_81max-m.OUT
12/05/2005  11:11 AM            16,210 Stress-pt_81max-t.OUT
12/05/2005  11:11 AM            21,714 Stress-pt_81th-b.OUT
12/05/2005  11:11 AM            21,714 Stress-pt_81th-m.OUT
12/05/2005  11:11 AM            21,630 Stress-pt_81th-t.OUT
12/05/2005  11:11 AM            16,291 Stress-pt_90max-b.OUT
12/05/2005  11:11 AM            16,291 Stress-pt_90max-m.OUT
12/05/2005  11:11 AM            16,210 Stress-pt_90max-t.OUT
12/05/2005  11:11 AM            21,714 Stress-pt_90th-b.OUT
12/05/2005  11:11 AM            21,714 Stress-pt_90th-m.OUT
12/05/2005  11:11 AM            21,630 Stress-pt_90th-t.OUT
12/05/2005  11:11 AM            16,291 Stress-pt_99max-b.OUT
12/05/2005  11:11 AM            16,291 Stress-pt_99max-m.OUT
12/05/2005  11:11 AM            16,210 Stress-pt_99max-t.OUT
12/05/2005  11:11 AM            21,714 Stress-pt_99th-b.OUT
12/05/2005  11:11 AM            21,714 Stress-pt_99th-m.OUT
12/05/2005  11:11 AM            21,630 Stress-pt_99th-t.OUT
12/05/2005  11:11 AM            16,291 Stress-pt_9max-b.OUT
12/05/2005  11:11 AM            16,291 Stress-pt_9max-m.OUT
12/05/2005  11:11 AM            16,210 Stress-pt_9max-t.OUT
12/05/2005  11:11 AM            21,842 Stress-pt_9th-b.OUT
12/05/2005  11:11 AM            21,842 Stress-pt_9th-m.OUT
12/05/2005  11:11 AM            21,758 Stress-pt_9th-t.OUT
10/31/2005  12:13 PM             3,825 Tank-Coordinates-AY.txt
05/25/2005  03:32 PM             2,512 Tank-Mesh1.txt
12/05/2005  10:54 AM               102 tank-out.out
12/05/2005  10:51 AM             5,495 Tank-Props-Crack.txt
12/05/2005  10:55 AM             4,997 Tank-th.out
05/16/2005  03:40 PM            41,470 TH-266-Mean-Geo-V.txt
05/13/2005  10:57 AM            41,472 TH-266-Mean-Geo.txt
12/05/2005  11:10 AM             8,236 Waste-Cont_108max.OUT
12/05/2005  11:10 AM             8,820 Waste-Cont_108th.OUT
12/05/2005  11:10 AM             8,236 Waste-Cont_117max.OUT
12/05/2005  11:10 AM             8,820 Waste-Cont_117th.OUT
12/05/2005  11:10 AM             8,236 Waste-Cont_126max.OUT
12/05/2005  11:10 AM             8,820 Waste-Cont_126th.OUT
12/05/2005  11:10 AM             8,236 Waste-Cont_135max.OUT
12/05/2005  11:10 AM             8,820 Waste-Cont_135th.OUT
12/05/2005  11:10 AM             8,236 Waste-Cont_144max.OUT
12/05/2005  11:10 AM             8,820 Waste-Cont_144th.OUT
12/05/2005  11:10 AM             8,236 Waste-Cont_153max.OUT
12/05/2005  11:10 AM             8,820 Waste-Cont_153th.OUT
12/05/2005  11:10 AM             8,236 Waste-Cont_162max.OUT
12/05/2005  11:10 AM             8,820 Waste-Cont_162th.OUT
12/05/2005  11:10 AM             8,236 Waste-Cont_171max.OUT
12/05/2005  11:10 AM             8,820 Waste-Cont_171th.OUT
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12/05/2005  11:10 AM             8,236 Waste-Cont_180max.OUT
12/05/2005  11:10 AM             8,820 Waste-Cont_180th.OUT
12/05/2005  11:10 AM             8,236 Waste-Cont_18max.OUT
12/05/2005  11:10 AM             8,820 Waste-Cont_18th.OUT
12/05/2005  11:10 AM             8,236 Waste-Cont_27max.OUT
12/05/2005  11:10 AM             8,820 Waste-Cont_27th.OUT
12/05/2005  11:10 AM             8,236 Waste-Cont_36max.OUT
12/05/2005  11:10 AM             8,820 Waste-Cont_36th.OUT
12/05/2005  11:10 AM             8,236 Waste-Cont_45max.OUT
12/05/2005  11:10 AM             8,820 Waste-Cont_45th.OUT
12/05/2005  11:10 AM             8,236 Waste-Cont_54max.OUT
12/05/2005  11:10 AM             8,820 Waste-Cont_54th.OUT
12/05/2005  11:10 AM             8,236 Waste-Cont_63max.OUT
12/05/2005  11:10 AM             8,820 Waste-Cont_63th.OUT
12/05/2005  11:10 AM             8,236 Waste-Cont_72max.OUT
12/05/2005  11:10 AM             8,820 Waste-Cont_72th.OUT
12/05/2005  11:10 AM             8,236 Waste-Cont_81max.OUT
12/05/2005  11:10 AM             8,820 Waste-Cont_81th.OUT
12/05/2005  11:10 AM             8,236 Waste-Cont_90max.OUT
12/05/2005  11:10 AM             8,820 Waste-Cont_90th.OUT
12/05/2005  11:10 AM             8,236 Waste-Cont_99max.OUT
12/05/2005  11:10 AM             8,820 Waste-Cont_99th.OUT
12/05/2005  11:10 AM             8,236 Waste-Cont_9max.OUT
12/05/2005  11:10 AM             8,948 Waste-Cont_9th.OUT
11/01/2005  12:19 PM               342 Waste-Reaction.txt
10/31/2005  12:01 PM             3,265 Waste-solid-AY.txt
             645 File(s)    585,213,840 bytes
               2 Dir(s)  78,360,641,536 bytes free
```

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$H_l := 422 \cdot in$ Baseline waste level as modeled in ANSYS

$H_t := 460 \cdot in$ Height to primary tank tangent line

$\frac{H_l}{H_t} = 0.92$ Ratio of waste height to tank height

$g := 386.4 \cdot \frac{in}{sec^2}$

$R := 450 \cdot in$ Tank radius

$\frac{H_l}{R} = 0.94$ Ratio of waste height to tank radius

$i := 0..2$

$\lambda := \begin{pmatrix} 1.841 \\ 5.331 \\ 8.536 \end{pmatrix}$ Bessel function roots

$\theta := \begin{pmatrix} 0 \cdot deg \\ 45 \cdot deg \\ 90 \cdot deg \end{pmatrix}$ Circumferential location of waste elements for which pressures are reported

Convective Frequencies

$$fcon_i := \frac{1}{2 \cdot \pi} \cdot \left[\sqrt{\left[\lambda_i \cdot \left[\frac{g}{R} \cdot \tanh\left[\lambda_i \cdot \left(\frac{H_l}{R} \right) \right] \right] \right]} \right]$$ Eqn. 4.14 BNL 1995

$fcon = \begin{pmatrix} 0.19 \\ 0.34 \\ 0.43 \end{pmatrix} Hz$ First three convective frequencies

$\rho_l := 1.59 \cdot 10^{-4} \cdot \frac{lbf \cdot sec^2}{in^4}$ waste density - specific gravity = 1.7

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Calculation of Impulsive Frequency:

$\rho_t := 7.35 \cdot 10^{-4} \cdot \frac{lbf \cdot sec^2}{in^4}$ Steel density

$t_{tw} := 0.65 \cdot in$ Average thickness of AY over lower 2/3.

$E_t := 29 \cdot 10^6 \cdot \frac{lbf}{in^2}$ Elastic modulus for steel

$C_{iref} := 0.102$ Table 4.4 of BNL 1995. Hinged top support condition - estimated for H_l/H_t=0.92

$C_i := C_{iref} \cdot \sqrt{127 \cdot \frac{\left(\frac{t_{tw}}{R}\right)}{\left(\frac{\rho_l}{\rho_t}\right)}}$ Eqn. 4.18 BNL 1995

$C_i = 0.09$ Impulsive coefficient for frequency calculation

$f_i := 5.54$ ANSYS Results

Determine Convective Pressures on the Tank Wall:

$$z := \begin{pmatrix} 24.5 \cdot in \\ 50.5 \cdot in \\ 77.5 \cdot in \\ 104.5 \cdot in \\ 131.45 \cdot in \\ 156.35 \cdot in \\ 179.3 \cdot in \\ 202.3 \cdot in \\ 225.65 \cdot in \\ 251 \cdot in \\ 278 \cdot in \\ 305 \cdot in \\ 332 \cdot in \\ 359.5 \cdot in \\ 386.5 \cdot in \\ 410.75 \cdot in \end{pmatrix}$$

Vertical location of element centroids at which pressures are reported.

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$\eta_l := \frac{z}{H_l}$ Ratio of tank wall vertical location to waste height for waste element centroids.

$\eta_l =$

	0
0	0.06
1	0.12
2	0.18
3	0.25
4	0.31
5	0.37
6	0.42
7	0.48
8	0.53
9	0.59
10	0.66
11	0.72
12	0.79
13	0.85
14	0.92
15	0.97

Determine convective coefficients as a function of dimensionless height per BNL 1995 Eqn. 4.4

$$con_0(\eta_l) := \left[\frac{2}{(\lambda_0)^2 - 1} \cdot \frac{\cosh\left[\lambda_0 \cdot \left(\frac{H_l}{R}\right) \cdot \eta_l\right]}{\cosh\left[\lambda_0 \cdot \left(\frac{H_l}{R}\right)\right]}\right]$$

$$con_1(\eta_l) := \left[\frac{2}{(\lambda_1)^2 - 1} \cdot \frac{\cosh\left[\lambda_1 \cdot \left(\frac{H_l}{R}\right) \cdot \eta_l\right]}{\cosh\left[\lambda_1 \cdot \left(\frac{H_l}{R}\right)\right]}\right]$$

$$con_2(\eta_l) := \left[\frac{2}{(\lambda_2)^2 - 1} \cdot \frac{\cosh\left[\lambda_2 \cdot \left(\frac{H_l}{R}\right) \cdot \eta_l\right]}{\cosh\left[\lambda_2 \cdot \left(\frac{H_l}{R}\right)\right]}\right]$$

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$con_0(\eta_1) =$

	0
0	0.29
1	0.29
2	0.3
3	0.32
4	0.33
5	0.35
6	0.37
7	0.39
8	0.42
9	0.45
10	0.5
11	0.54
12	0.6
13	0.66
14	0.73
15	0.8

$con_1(\eta_1) =$

	0
0	$1.03 \cdot 10^{-3}$
1	$1.16 \cdot 10^{-3}$
2	$1.43 \cdot 10^{-3}$
3	$1.84 \cdot 10^{-3}$
4	$2.44 \cdot 10^{-3}$
5	$3.21 \cdot 10^{-3}$
6	$4.17 \cdot 10^{-3}$
7	$5.45 \cdot 10^{-3}$
8	$7.16 \cdot 10^{-3}$
9	$9.64 \cdot 10^{-3}$
10	0.01
11	0.02
12	0.03
13	0.03
14	0.05
15	0.06

$con_2(\eta_1) =$

	0
0	$2.06 \cdot 10^{-5}$
1	$2.78 \cdot 10^{-5}$
2	$4.25 \cdot 10^{-5}$
3	$6.87 \cdot 10^{-5}$
4	$1.13 \cdot 10^{-4}$
5	$1.81 \cdot 10^{-4}$
6	$2.79 \cdot 10^{-4}$
7	$4.31 \cdot 10^{-4}$
8	$6.72 \cdot 10^{-4}$
9	$1.09 \cdot 10^{-3}$
10	$1.81 \cdot 10^{-3}$
11	$3.02 \cdot 10^{-3}$
12	$5.05 \cdot 10^{-3}$
13	$8.5 \cdot 10^{-3}$
14	0.01
15	0.02

Impulsive pressure coefficient as a function of dimensionless wall height

$$c_i(\eta_1) := 1 - con_0(\eta_1) - con_1(\eta_1) - con_2(\eta_1)$$

BNL 1995 Eqn. 4.7

$c_i(\eta_1) =$

	0
0	0.71
1	0.7
2	0.7
3	0.68
4	0.67
5	0.65
6	0.63
7	0.6
8	0.57
9	0.53
10	0.49
11	0.43
12	0.37
13	0.3
14	0.21
15	0.11

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Calculate maximum values of dynamic wall pressures

Consider the first three convective modes

$SA_{c0} := 0.062 \cdot g$ $\quad SA_{c0} = 23.96 \frac{in}{sec^2}$

$SA_{c1} := 0.108 \cdot g$ $\quad SA_{c1} = 41.73 \frac{in}{sec^2}$ $\quad$ 0.5% Dome RS from Spectr

$SA_{c2} := 0.163 \cdot g$ $\quad SA_{c2} = 62.98 \frac{in}{sec^2}$

Determine the spectral acceleration for the impulsive mode.

$SA_i := 0.39 \cdot g$ $\quad SA_i = 150.7 \frac{in}{sec^2}$

$$p_{maxconv}(\eta_1, \theta) := \left[\sqrt{\left(con_0(\eta_1) \cdot SA_{c0}\right)^2 + \left(con_1(\eta_1) \cdot SA_{c1}\right)^2 + \left(con_2(\eta_1) \cdot SA_{c2}\right)^2}\right] \cdot \left(\rho_1 \cdot R \cdot \cos(\theta \cdot deg)\right)$$

$$p_{maximpulsive}(\eta_1, \theta) := \left[\sqrt{\left[c_i(\eta_1) \cdot (SA_i)\right]^2}\right] \cdot \left(\rho_1 \cdot R \cdot \cos(\theta \cdot deg)\right)$$

$$p_{max}(\eta_1, \theta) := \left[\sqrt{\left[\left(c_i(\eta_1)\right) \cdot (SA_i)\right]^2 + \left(con_0(\eta_1) \cdot SA_{c0}\right)^2 + \left(con_1(\eta_1) \cdot SA_{c1}\right)^2 + \left(con_2(\eta_1) \cdot SA_{c2}\right)^2}\right] \cdot \left(\rho_1 \cdot R \cdot \cos(\theta \cdot deg)\right)$$

Previous equation is Eqn. 4.24 from BNL 1995

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$p_{maximpulsive}(\eta_1, 0) =$

	0
0	7.64
1	7.59
2	7.5
3	7.36
4	7.18
5	6.97
6	6.75
7	6.48
8	6.16
9	5.76
10	5.27
11	4.69
12	4
13	3.18
14	2.23
15	1.21

$\frac{lbf}{in^2}$

Maximum impulsive dynamic pressures at theta = 0.

$p_{maxconv}(\eta_1, 0) =$

	0
0	0.5
1	0.51
2	0.52
3	0.54
4	0.57
5	0.6
6	0.63
7	0.67
8	0.72
9	0.78
10	0.85
11	0.93
12	1.03
13	1.14
14	1.26
15	1.39

$\frac{lbf}{in^2}$

Maximum convective dynamic pressures at theta = 0.

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$p_{max}(\eta_1, 0) =$

	0
0	7.66
1	7.61
2	7.51
3	7.38
4	7.2
5	7
6	6.78
7	6.51
8	6.2
9	5.82
10	5.34
11	4.78
12	4.13
13	3.38
14	2.56
15	1.84

$\frac{lbf}{in^2}$

Maximum total dynamic pressure at theta = 0.

$p_{max}(\eta_1, 45) =$

	0
0	5.42
1	5.38
2	5.31
3	5.22
4	5.09
5	4.95
6	4.79
7	4.61
8	4.39
9	4.11
10	3.77
11	3.38
12	2.92
13	2.39
14	1.81
15	1.3

$\frac{lbf}{in^2}$

Maximum total dynamic pressure at theta = 45 degrees.

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$p_{max}(\eta_l, 90) =$

	0
0	0
1	0
2	0
3	0
4	0
5	0
6	0
7	0
8	0
9	0
10	0
11	0
12	0
13	0
14	0
15	0

$\frac{lbf}{in^2}$

Maximum total dynamic pressure at theta = 90 degrees.

Calculate Maximum Slosh Height:

$$conmax := \begin{pmatrix} 0.837 \\ 0.073 \\ 0.028 \end{pmatrix}$$

Maximum value of convective coefficients at η_l=1

$$h_{maxslosh} := R \cdot \sqrt{\left(conmax_0 \cdot \frac{SA_{c0}}{g}\right)^2 + \left(conmax_1 \cdot \frac{SA_{c1}}{g}\right)^2 + \left(conmax_2 \cdot \frac{SA_{c2}}{g}\right)^2}$$

$h_{maxslosh} = 23.71\,in$

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Calculate Maximum Total Hydrodynamic Force:

The maximum hydrodynamic force induced on the tank wall is given by Eqn. 4.31 of BNL 1995 with the instantaneous accelerations replaced by the maximum spectral accelerations. First determine the effective impulsive and convective masses.

$m_{lapprox} := \pi \cdot R^2 \cdot H_l \cdot \rho_l$ $\quad m_{lapprox} = 4.27 \times 10^4 \frac{lbf \cdot sec^2}{in}$ Total waste mass base on circular cylinder approximation.

$m_l := 4.27 \times 10^4 \cdot \frac{lbf \cdot sec^2}{in}$ Actual waste mass reported by ANSYS model.

$$m_{c0} := \left[\frac{2}{\lambda_0 \cdot \left[\left(\lambda_0\right)^2 - 1\right] \cdot \left(\frac{H_l}{R}\right)}\right] \cdot \tanh\left[\lambda_0 \cdot \left(\frac{H_l}{R}\right)\right] \cdot m_l$$ First mode convective mass

$m_{c0} = 1.94 \times 10^4 \frac{lbf \cdot sec^2}{in}$

$$m_{c1} := \left[\frac{2}{\lambda_1 \cdot \left[\left(\lambda_1\right)^2 - 1\right] \cdot \left(\frac{H_l}{R}\right)}\right] \cdot \tanh\left[\lambda_1 \cdot \left(\frac{H_l}{R}\right)\right] \cdot m_l$$ Second mode convective mass

$m_{c1} = 622.94 \frac{lbf \cdot sec^2}{in}$

$$m_{c2} := \left[\frac{2}{\lambda_2 \cdot \left[\left(\lambda_2\right)^2 - 1\right] \cdot \left(\frac{H_l}{R}\right)}\right] \cdot \tanh\left[\lambda_2 \cdot \left(\frac{H_l}{R}\right)\right] \cdot m_l$$ Third mode convective mass

$m_{c2} = 148.46 \frac{lbf \cdot sec^2}{in}$

$m_i := m_l - \left(m_{c0} + m_{c1} + m_{c2}\right)$ Impulsive mass

$m_i = 2.25 \times 10^4 \frac{lbf \cdot sec^2}{in}$

$F_{max} := m_i \cdot SA_i + m_{c0} \cdot SA_{c0} + m_{c1} \cdot SA_{c1} + m_{c2} \cdot SA_{c2}$

$F_{max} = 3.89 \times 10^6 \, lbf$ Conservative estimate of maximum hydrodynamic force

The above expression is a conservative estimate because it assumes that the peak impulsive and convective forces occur simultaneously. A less conservative estimate can be made via a square-root-sum-of-the-squares (SRSS) combination.

$F_{srss} := \sqrt{(m_i \cdot SA_i)^2 + (m_{c0} \cdot SA_{c0})^2 + (m_{c1} \cdot SA_{c1})^2 + (m_{c2} \cdot SA_{c2})^2}$

$F_{srss} = 3.42 \times 10^6 \, lbf$ SRSS estimate of peak hydrodynamic force

$F_{con} := \sqrt{(m_{c0} \cdot SA_{c0})^2 + (m_{c1} \cdot SA_{c1})^2 + (m_{c2} \cdot SA_{c2})^2}$

$F_{con} = 4.66 \times 10^5 \, lbf$ Peak hydrodynamic force due to convective effects only

Consider Vertical Excitation:

Calculate the axisymmetric breathing mode frequency for the tank

$C_{vref} := 0.088$ Table 4.17 BNL 1995

$C_v := C_{vref} \cdot \sqrt{127 \cdot \frac{\left(\frac{t_{tw}}{R}\right)}{\left(\frac{\rho_l}{\rho_t}\right)}}$ $C_v = 0.081$

$f_v := 4.9$

$s_{Av} := 0.30 \cdot g$ $s_{Av} = 115.92 \frac{in}{sec^2}$ Vert. Haunch 4 % RS from Spectr

The maximum dynamic wall pressure as a function of the dimensionless vertical distance is given by

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$p_{maxv}(\eta_1) := (0.8)\cdot\left(\cos\left(\frac{\pi}{2}\cdot\eta_1\right)\right)\cdot(\rho_l\cdot H_l\cdot S_{Av})$ Eqn. 4.52 BNL 1995

$p_{maxv}(\eta_1) =$

	0
0	6.2
1	6.11
2	5.97
3	5.76
4	5.49
5	5.2
6	4.89
7	4.54
8	4.15
9	3.7
10	3.18
11	2.63
12	2.05
13	1.43
14	0.82
15	0.26

$\frac{lbf}{in^2}$

$c_{oprimeouter} := 0.28$ $c_{oprimecenter} := 0.54$ Estimated from Figure 4.7 BNL 1995

$c_{vprimeouter} := 0.72$ $c_{vprimecenter} := 0.46$

$PGA_{vert} := 0.12\cdot g$

The maximum base pressures at the outer and center elements are given by

$p_{maxbasevertouter} := c_{oprimeouter}\cdot\rho_l\cdot H_l\cdot PGA_{vert} + c_{vprimeouter}\cdot(\rho_l\cdot H_l)\cdot S_{Av}$ Eqn. 4.55 BNL 1995

$p_{maxbasevertcenter} := c_{oprimecenter}\cdot\rho_l\cdot H_l\cdot PGA_{vert} + c_{vprimecenter}\cdot(\rho_l\cdot H_l)\cdot S_{Av}$

$p_{maxbasevertouter} = 6.47\frac{lbf}{in^2}$

$p_{maxbasevertcenter} = 5.26\frac{lbf}{in^2}$

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Determine the maximum vertical force on the base

$m_0 := 0.402 \cdot m_l$ Component of waste mass particpating in the motion of the tank base

$m_v := 0.598 \cdot m_l$ Component of waste mass particpating in the motion of the tank wall

BNL Table 4.17

$F_{maxbasevert} := \sqrt{(m_0 \cdot PGA_{vert})^2 + (m_v \cdot S_{Av})^2}$ Eqn. 4.57 BNL 1995 modified for maximum response per p. 4-34

$F_{maxbasevert} = 3.07 \times 10^6 \, lbf$

$m_0 = 1.72 \times 10^4 \, lbf \cdot \frac{sec^2}{in}$

$m_v = 2.55 \times 10^4 \, lbf \cdot \frac{sec^2}{in}$