Attachment 1
NRC3-12-0003

Table of RAI Response Dates
(5 pages)

RAI Number	Part	Question Summary	Submittal Date
02.05.02-17	1	Explain why such a model is appropriate for use at the Fermi site.	February 29, 2012
02.05.02-17	2	What is the impact of this assumed correlation model on site amplification?	February 29, 2012
02.05.02-17	3	If a fully correlated model were to be assumed, for example, what would be the expected increase in amplification, particularly at higher frequencies above 15 Hz?	February 29, 2012
02.05.02-18	1	Please provide more detail regarding the scaling process.	February 16, 2012
02.05.02-18	2	In addition, please quantitatively compare the mean response spectrum of each suite of scaled time histories to the respective target spectrum.	February 16, 2012
02.05.04-39	1	The technical basis for eliminating the ESBWR DCD site parameter requirement $K_0\gamma \geq$ 47 lb/ft^3 from EF3 FSAR Table 2.0-201 and Section 2.5.4.5.4.2.	February 16, 2012
02.05.04-39	2	An explanation of why site Design Commitment Item 2 of engineering properties in EF3 COL Application Part 10: ITAAC, Section 2.4 and Table 2.4.2-1 are not applicable, as well as the basis for eliminating Item 2 of site-specify ITAAC corresponding to "backfill adjacent to Seismic Category I structures" from EF3 COL Application Part 10: ITAAC, Section 2.4 and Table 2.4.2-1.	February 16, 2012
03.07.01-3	1	Explain why it is appropriate to define the FIRS for this facility on the basis of a 1D column of concrete material if the lateral extension of this material is limited to its footprint.	February 29, 2012
03.07.01-4	1	Therefore, explain the impact of the increased shear wave velocity on the computed FIRS for the FWSC, particularly at high frequency.	February 29, 2012
03.07.01-4	2	Also explain how the data from EF3 FSAR Reference 2.5.2-288 (Hasek, 2002), which is based on lean concrete with shear wave velocities between 900 fps and 1400 fps, is applicable to the aforementioned Fermi 3 site conditions.	February 29, 2012
03.07.01-5	1	Since the backfill material is limited in lateral extent, following a relatively complicated geometry in plan, explain why it is appropriate to define the PBSRS and FIRS for the RB/FB and CB (EF3 FSAR Section 3.7.1) on the basis of a 1D column of backfill material.	February 29, 2012
03.07.01-6	1	Based on the above discussion, the staff needs additional technical basis for using two components of ground motion with correlation coefficient of approximately 0.30.	February 16, 2012

RAI Number	Part	Question Summary	Submittal Date
03.07.01-6	2	If Regulatory Position C.2.2(2) of RG 1.92 is used for determining the total site-specific seismic demand for the SSCs, the applicant is requested to provide a comparison with the seismic demand as determined from the use of Regulatory Position C.2.2(1), and demonstrate that the current site-specific seismic demand as specified in EF3 FSAR is not under predicted.	February 16, 2012
03.07.01-7	1	As such, the applicant is requested to provide further justification of the acceptability of the PGV/PGA values for the artificial time histories being higher than the selected controlling earthquake.	February 16, 2012
03.07.01-7	2	The applicant is also requested to provide comparison of the response spectra of the artificial time histories and the estimated target spectra (SSI FIRS) at 2% and 10% damping values for RB/FB and CB.	February 16, 2012
03.07.01-8	1	Therefore, the applicant is requested to provide in the FSAR comparison plots of the RB/FB and CB horizontal FIRS with the RG 1.60 horizontal spectrum anchored at 0.1 g, which demonstrate that the RB/FB and CB horizontal FIRS envelope the RG 1.60 spectrum at all frequencies of interest.	February 16, 2012
03.07.02-5	1	Since the backfill requirements are not being met for the Fermi 3 site, the applicant is requested to describe in the FSAR how the above ESBWR DCD commitments and ITAAC are implemented for the site-specific conditions of the Fermi 3 site, including a description of the site-specific analysis to be performed	February 16, 2012
03.07.02-5	2	The applicant is also requested to describe how the seismic input for the Seismic Category II structures (for the site specific analysis) will consider the site-specific scale factors, including the effect of structure-soil-structure interaction, to ensure that the seismic input specified in the DCD for these structures will still be bounding.	February 16, 2012
03.07.02-5	3	In addition, explain why EF3 FSAR Figures 2.5.4-201 through 2.5.4-204, as modified by the markups included with the response to RAI Letter 55 Question 02.05.04-38, only show the TB and RW, and not the SB and ADB, and why Table 2.5.4-224 lists the TB as "nonseismic" and not as Seismic Category II.	February 16, 2012

RAI Number	Part	Question Summary	Submittal Date
03.07.02-6	1	As such, the applicant is requested to provide further justification for ignoring embedment effects on SSI response. The justification should include the potential impact of this modeling approach on in-structure response spectra (over the entire frequency range of interest), lateral wall pressures, and other seismic loads.	April 30, 2012
03.07.02-7	1	The applicant is requested to provide the geometry and properties of the excavated volume modeled in both SASSI analyses.	February 29, 2012
03.07.02-7	2	Therefore, the applicant is requested to provide an additional comparative study for the RB/FB along the lines of the study performed for the CB.	February 16, 2012
03.07.02-7	3	Details of the comparative studies discussed above should be included in the relevant sections of the EF3 FSAR.	February 16, 2012
03.07.02-8	1	Since these site conditions deviate significantly from cases CL-6 and FL-5, analyzed in the ESBWR DCD, the applicant is requested to explain how SSSI effects are evaluated between these structures.	April 30, 2012
03.07.02-8	2	What is the basis for neglecting the granular fill in the site-specific analyses in the context of SSSI, given that these structures are deeply embedded and in close proximity to each other?	April 30, 2012
03.07.02-8	3	What is the basis for including concrete fill between the RB/FB and CB gap?	April 30, 2012
03.07.02-8	4	Does the addition of the stiff concrete fill between the CB and the RB/FB introduce potential interaction between the two structures?	April 30, 2012
03.08.05-1	1	The applicant is requested to provide justification for using 2006 code edition of ACI 349.	February 16, 2012
03.08.05-2	1	(a) Provide the numerical values for each of the terms in the equation used to evaluate the factors of safety against sliding (see ESBWR DCD Section 3.8.5.5).	February 29, 2012
03.08.05-2	2	Also provide a detailed explanation of how each value was obtained, including the assumed coefficient of friction at the various foundation-rock interfaces.	February 29, 2012
03.08.05-2	3	(b) Explain if shear keys are provided as described in ESBWR DCD. The staff notes that EF3 FSAR Figures 2.5.4-201 through 2.5.4-204 do not show shear keys.	February 16, 2012
03.08.05-3	1	The applicant is requested to explain how the seismic load (in the E-W direction) imposed by the CB bearing against the concrete fill is transferred to the underlying rock.	February 29, 2012

RAI Number	Part	Question Summary	Submittal Date
03.08.05-3	2	Is base friction sufficient to resist the entire load or will a certain fraction of this load be transferred to the adjacent RB/FB?	February 29, 2012
03.08.05-3	3	Has this been considered in the design?	February 29, 2012
03.08.05-3	4	The above questions are also appropriate to the potential transfer of seismic loads from the RB/FB to the CB through the concrete fill.	February 29, 2012
03.08.05-4	1	(a) Comparison of seismic lateral earth pressures shown in EF3 FSAR Figures 2.5.4-230 and 4-231 with those obtained using the method described in ASCE 4-98 Section 3.5.3.2 and also with those given in ESBWR DCD Tables 3A.8.8-1 and 3A.8.8-2, and ESBWR DCD Sections 3G.1.5.2.1 and 3G.2.5.2 (Figures 3G.1-19, 3G.1-27, 3G.2-12, and 3G.2-15), which were used for the design of the walls.	February 16, 2012
03.08.05-4	2	(b) For the portions of below-grade walls that are embedded in rock, provide estimates of the seismic lateral pressures imposed by the surrounding rock, which are compatible with the results of the site-specific SSI analyses performed and with the assumptions of the sliding stability calculations discussed in EF3 FSAR Sections 3.7.2 and 3.8.5, as modified by the markups included with the response to RAI Letter 55 Question 02.05.04-38.	February 29, 2012
03.08.05-4	3	(c) Provide estimates of additional static and dynamic lateral pressures imposed from adjacent Seismic Category I and II structures. This should also include possible effects of structure-to-structure interaction through the surrounding backfill, concrete fill, or rock.	April 30, 2012
03.08.05-4	4	(d) Modify EF3 FSAR Figures 2.5.4-230 and 4-231 to incorporate the pressures discussed in items (b) and (c) above and compare with the lateral pressures given in ESBWR DCD Tables 3A.8.8-1 and 3A.8.8-2, and ESBWR DCD Sections 3G.1.5.2.1 and 3G..2.5.2, which were used for the design of the walls. If site-specific SSI analyses that consider the backfill become available, include the lateral pressures from the SSI analyses in the comparison.	April 30, 2012
03.08.05-5	1	Therefore, explain whether the fill concrete below the FSWC is reinforced or not. If it is not, explain how the shear resistance is developed. If it is reinforced, describe how the reinforcement is selected.	February 16, 2012

Attachment 2
NRC3-12-0003
(2 pages)

Response to RAI Letter No. 70
(eRAI Tracking No. 6217)

RAI Question No. 02.05.02-17

NRC RAI 02.05.02-17

FSAR Sections 2.5.2.5.1.3 and 3.7.1.1.4.1.1.3 describe the randomized shear wave velocity profiles used in the site response analyses to account for variations in these profiles. The correlation model described (FSAR Reference 2.5.2-286; Silva et.al, 1996) is the model developed from analyses of shear wave data taken at the Savannah River Site, a relatively deep soil site (composed primarily of sands, silty sands, and silts) of approximately 800 ft to 1,000 ft depth over hard rock. Explain why such a model is appropriate for use at the Fermi site. What is the impact of this assumed correlation model on site amplification? If a fully correlated model were to be assumed, for example, what would be the expected increase in amplification, particularly at higher frequencies above 15 Hz?

Response

The response to this RAI will be provided by February 29, 2012. The response will provide the following:

- Rationale for choice of correlation model.
- Evaluation regarding the applicability of a fully correlated model for Fermi 3.
- Results of sensitivity calculations with a fully correlated model for layer velocities and comparison to the results presented in the FSAR.

Proposed COLA Revision

None.

Attachment 3
NRC3-12-0003
(11 pages)

Response to RAI Letter No. 70
(eRAI Tracking No. 6217)

RAI Question No. 02.05.02-18

NRC RAI 02.05.02-18

FSAR Section 2.5.2.5.2 indicates that the selected time histories were scaled to approximately match the target DE spectrum using a limited number of iterations of the program RASCALS. Please provide more detail regarding the scaling process. In addition, please quantitatively compare the mean response spectrum of each suite of scaled time histories to the respective target spectrum.

Response

The program RASCALS (AMEC Geomatrix's version of RASCAL, Silva and Lee, 1987) utilizes a frequency domain approach for scaling an acceleration time history to match a target response spectrum. The specified inputs are the target response spectrum, the earthquake magnitude and source-to-site distance represented by the target response spectrum, and the input acceleration time history. The program uses the specified magnitude and distance to construct a Fourier amplitude spectrum for an earthquake using the stochastic point source model (e.g., Boore, 1983). This amplitude spectrum along with the phase spectrum from the input acceleration time history is used as the starting Fourier transform of the scaled acceleration time history. The program first uses random vibration theory (RVT) to compute the response spectrum for the input time history from the Fourier amplitude spectrum (see Boore, 1983, for the approach). Depending on the mismatch between the computed response spectrum and the target response spectrum, the Fourier amplitude spectrum is adjusted and the process repeated for the specified number of iterations. The program then utilizes the adjusted amplitude spectrum along with the phase spectrum from the input time history to produce a scaled time history by the inverse Fourier transform. This intermediate time history is then used to compute a response spectrum in the time domain using a standard response spectra computation algorithm. Mismatches between the resulting spectrum and the target spectrum are used for further adjustments of the Fourier amplitude spectrum and the process repeated for the specified number of iterations.

The application of RASCALS to scale the individual time histories to match the target deaggregation earthquake (DE) spectrum used a single iteration of the RVT scaling and a single iteration of the time domain scaling. The intent was to obtain motions that individually weakly approximated the target DE spectrum while retaining much of their individual variability.

DE target response spectra were developed to represent the contributions to the Fermi 3 site hazard for high frequency (HF) and low frequency (LF) ground motions. DE spectra were developed for hazard levels corresponding to 10^{-3}, 10^{-4}, 10^{-5}, and 10^{-6} mean annual frequencies of exceedance. The target magnitudes and distances for each DE are listed in FSAR Table 2.5.2-219. For each case, three DE spectra are defined: a high magnitude target, DEH; an intermediate magnitude target, DEM; and a low magnitude target, DEL. As described in FSAR Subsection 2.5.2.5.2, the 30 time histories in the appropriate magnitude and distance bin of the central and eastern United States (CEUS) time history database in NUREG/CR-6728 (McGuire et al., 2001) were weakly matched to each DE spectrum. Figures 1 through 8 compare the target DE spectra to the mean response spectra for the 30 scaled time histories for HF and LF motions at the four hazard levels. Each plot also shows the target DE spectrum multiplied by 1.1 and divided by 1.1 to provide a sense of the accuracy of the average fit.

The comparisons shown on Figures 1 through 8 show that the means of the response spectral ordinates for the scaled time histories are generally within a factor of 1.1 of the target DE response spectrum. All spectra shown on the figures are for 5 percent damping. In some cases, large deviations from the target spectrum occur at frequencies below about 0.2 Hz. Because the fundamental frequencies of the site profiles are approximately 3 Hz, the deviations at very low frequencies have little impact, as indicated by the amplification factors near unity for frequencies less than 1 Hz (e.g., FSAR Figure 2.5.2-270). In a few cases for the LF DE spectra (LF DEH for 10^{-5} and 10^{-6}), large deviations from the target spectrum occur at frequencies above 50 Hz. These deviations are not significant because the motions in this frequency range are not used to define the LF site amplification factors.

The results shown on Figures 1 through 8 indicate that the mean of the response spectra for the weakly scaled time histories provide a good representation of the DE target response spectra.

References:

1. Boore, D.M., 1983, Stochastic simulation of high frequency ground motions based on seismological models of the radiated spectra, Bulletin of the Seismological Society of America, v. 73, p. 1865-1894.

2. McGuire, R. W., 2001, Technical Basis for Revision of Regulatory Guidance on Design Ground Motions: Hazard- and Risk-Consistent Ground Motion Spectra Guidelines, NUREG/CR-6728. U.S. Nuclear Regulatory Commission, Washington D.C.

3. Silva, W.J., and K. Lee, 1987, WES RASCAL code for synthesizing earthquake ground motions, US Army Corps of Engineers State-of-the-Art for Assessing Earthquake Hazards in the United States, Miscellaneous Paper S-73-1.

Proposed COLA Revision

None.

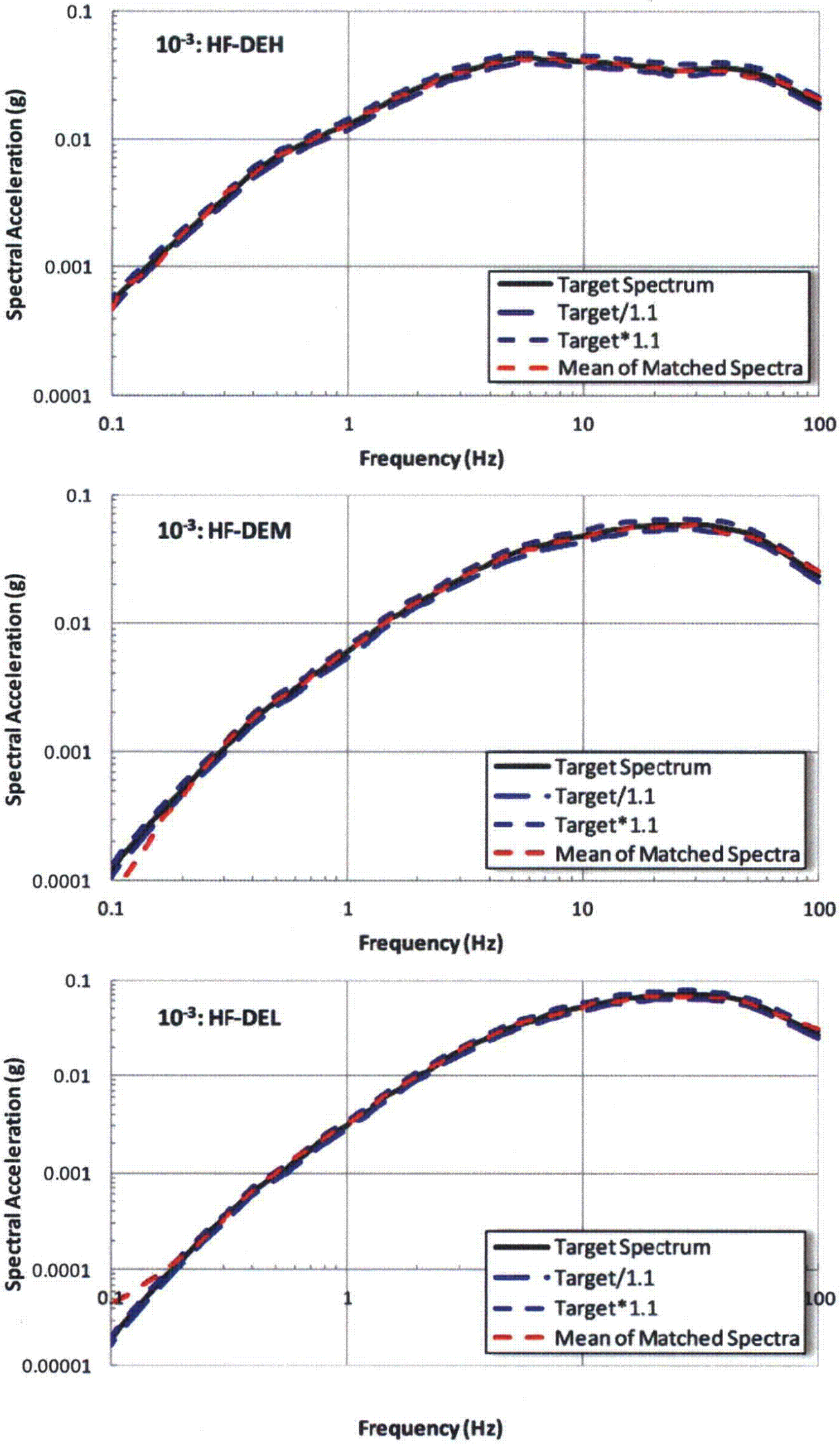


Figure 1: Comparison of mean of response spectra (5 percent damping) for weakly matched time histories to the target DE spectra for the 10^{-3} high frequency (HF) motions

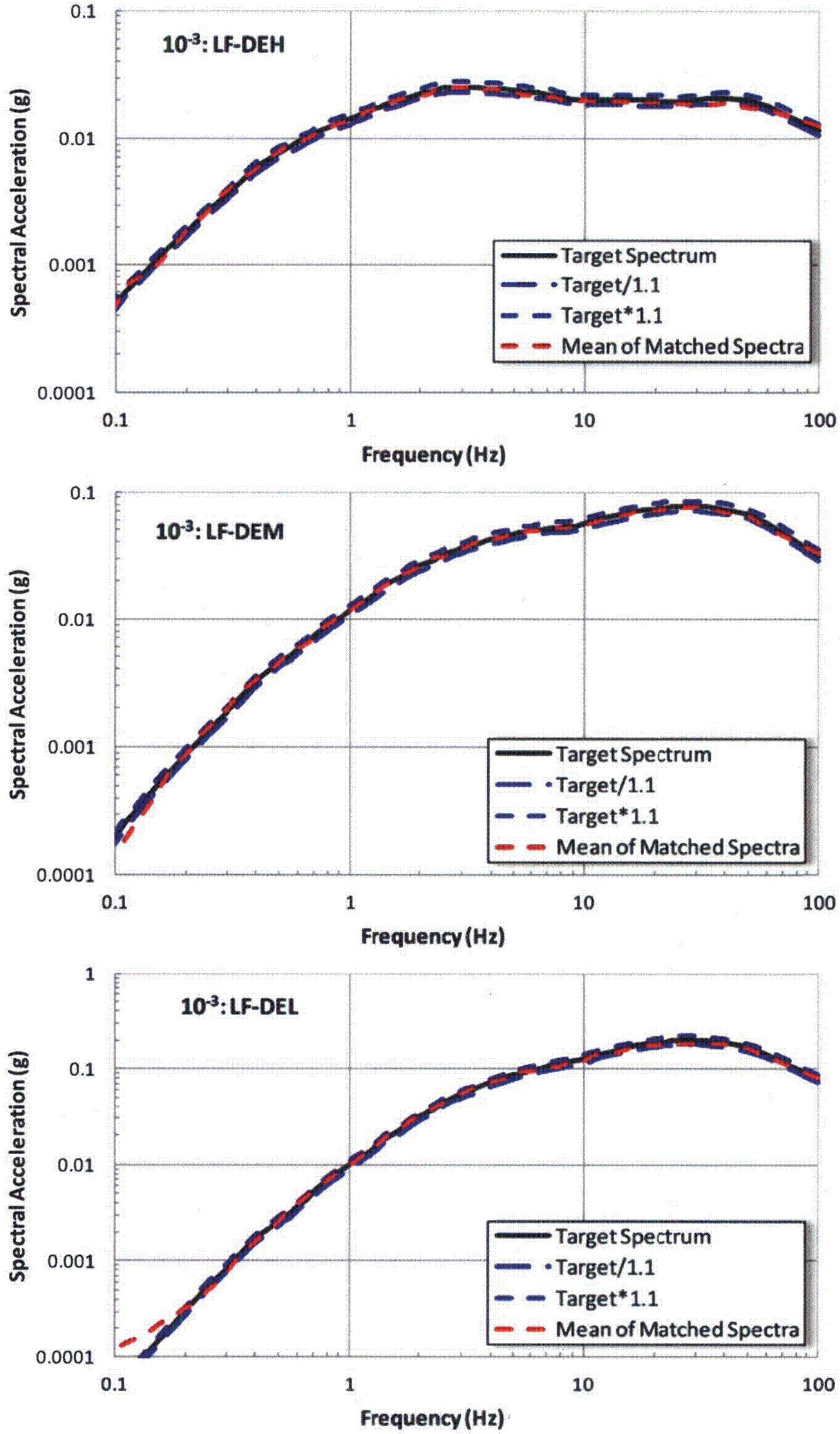


Figure 2: Comparison of mean of response spectra (5 percent damping) for weakly matched time histories to the target DE spectra for the 10^{-3} low frequency (LF) motions

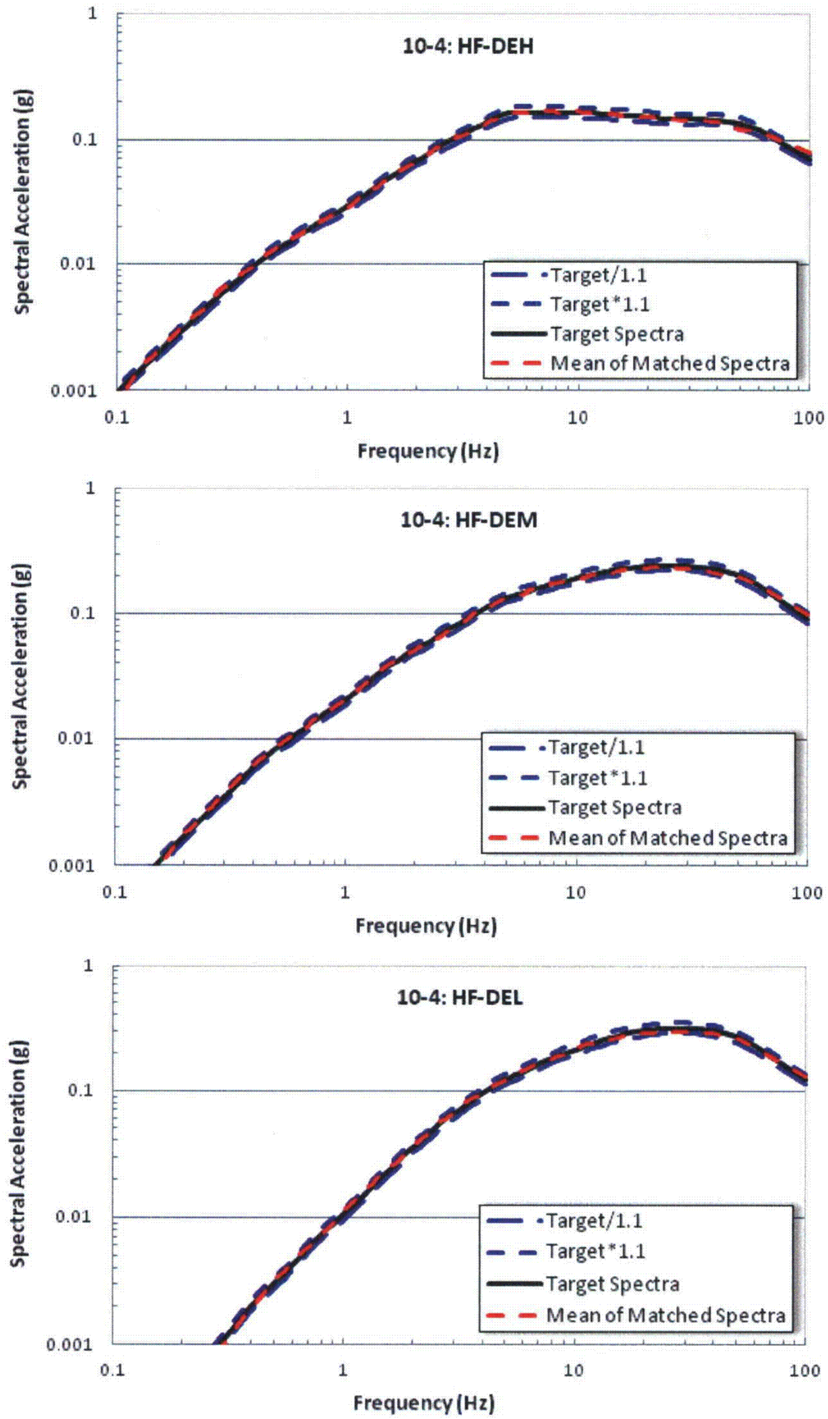


Figure 3: Comparison of mean of response spectra (5 percent damping) for weakly matched time histories to the target DE spectra for the 10^{-4} high frequency (HF) motions

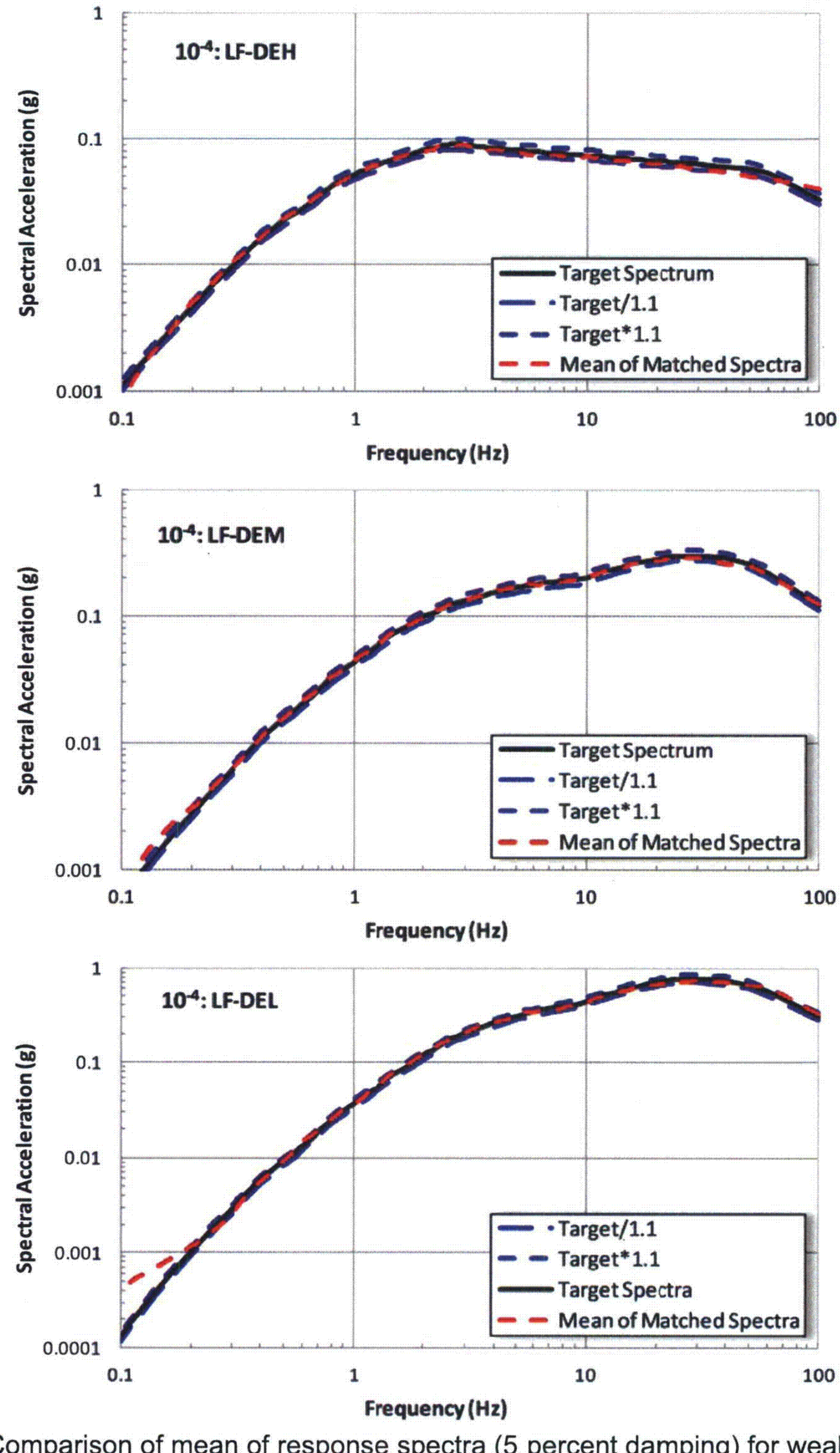
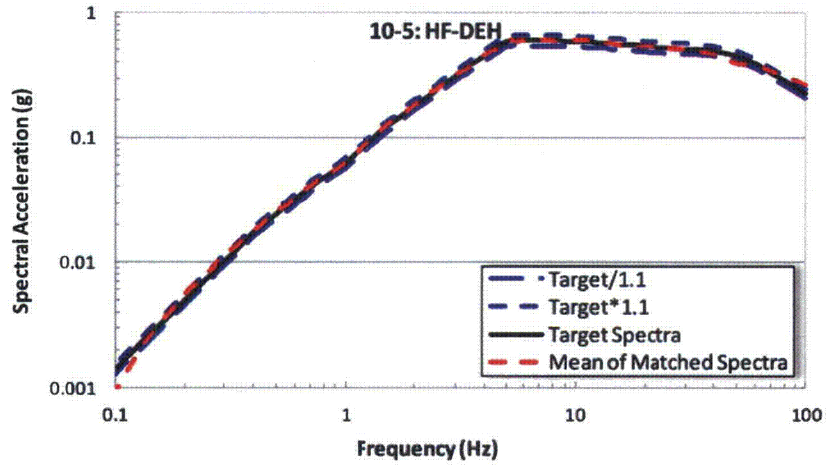
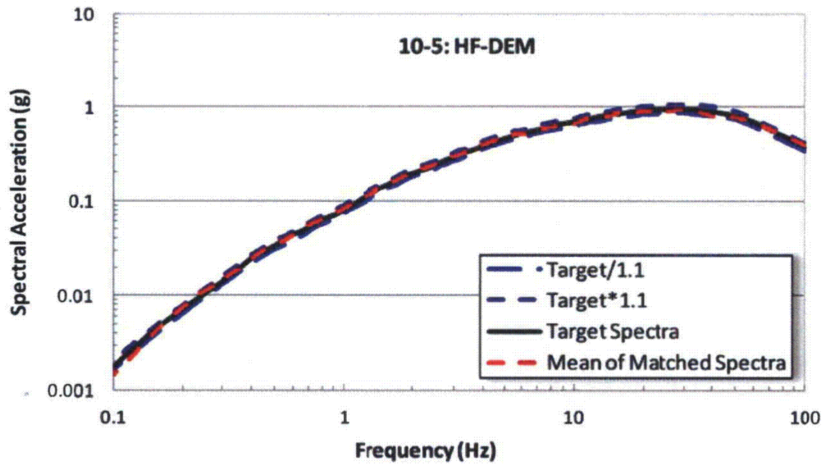


Figure 4: Comparison of mean of response spectra (5 percent damping) for weakly matched time histories to the target DE spectra for the 10^{-4} low frequency (LF) motions





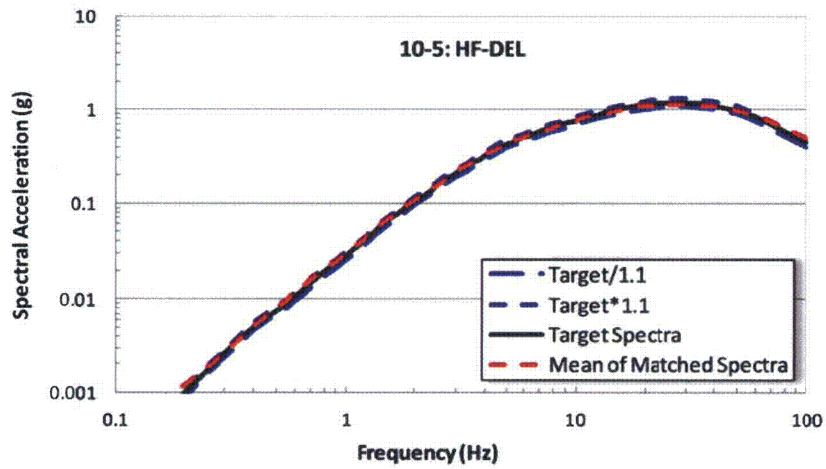


Figure 5: Comparison of mean of response spectra (5 percent damping) for weakly matched time histories to the target DE spectra for the 10^{-5} high frequency (HF) motions

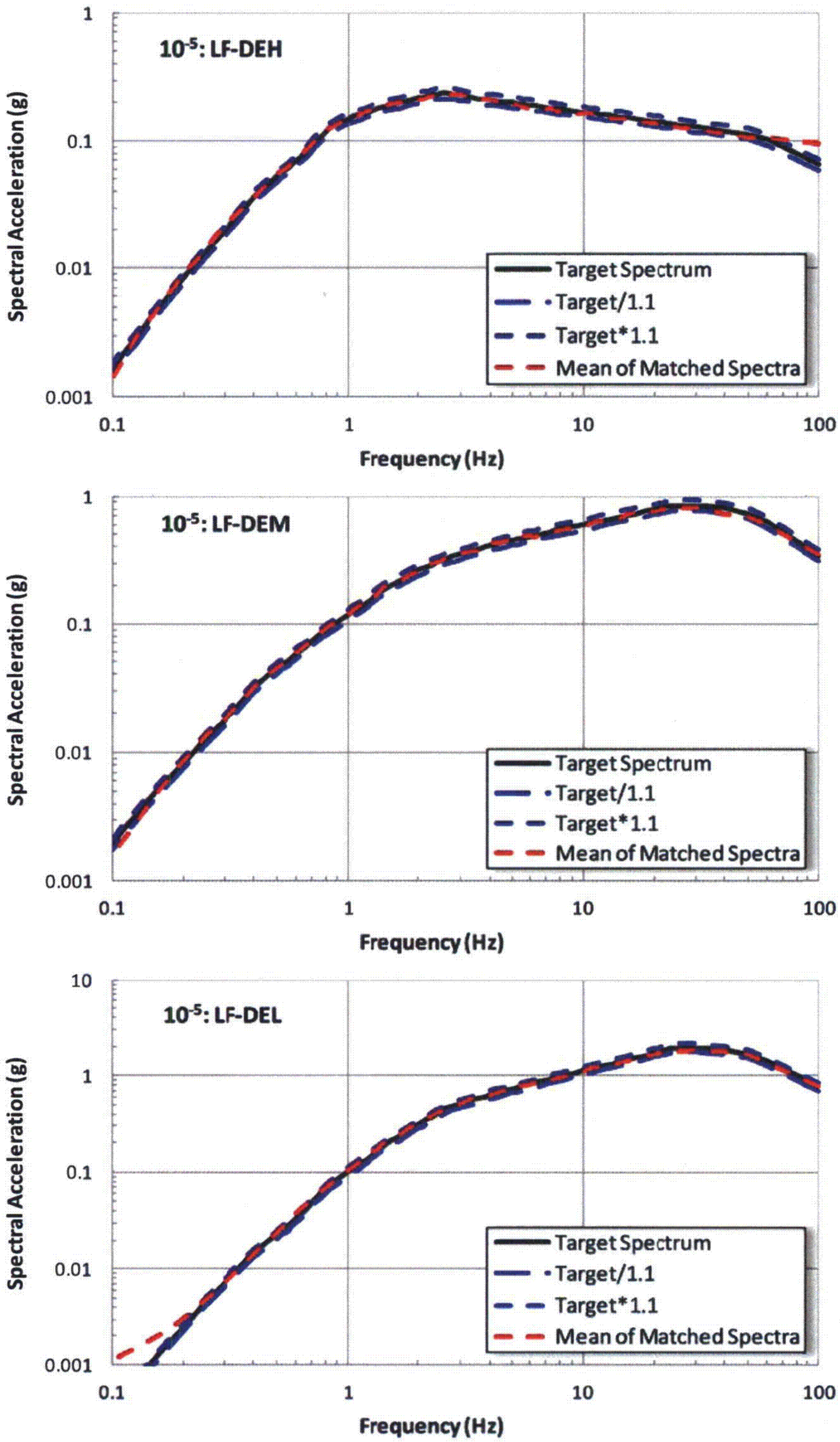


Figure 6: Comparison of mean of response spectra (5 percent damping) for weakly matched time histories to the target DE spectra for the 10^{-5} low frequency (LF) motions

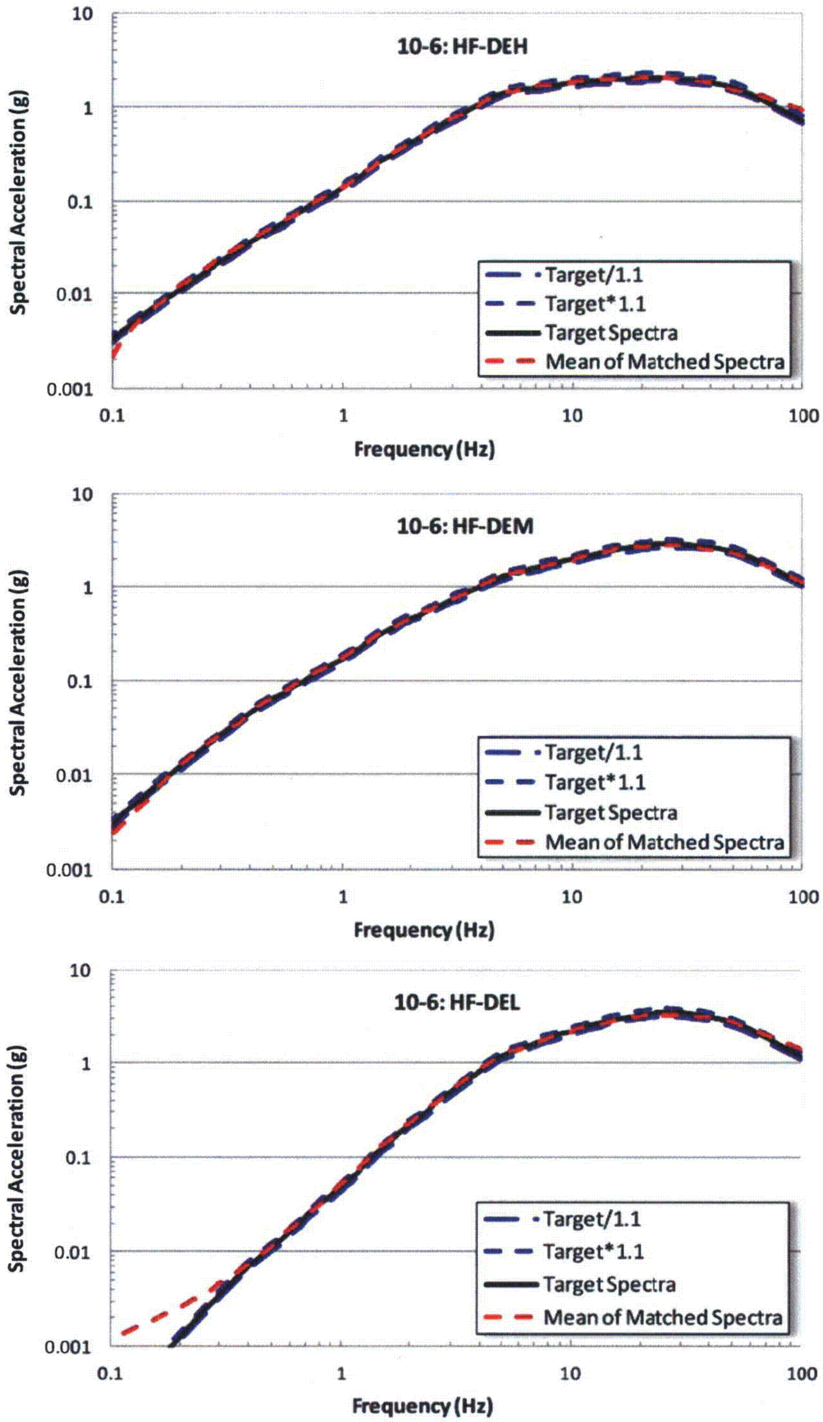


Figure 7: Comparison of mean of response spectra (5 percent damping) for weakly matched time histories to the target DE spectra for the 10^{-6} high frequency (HF) motions

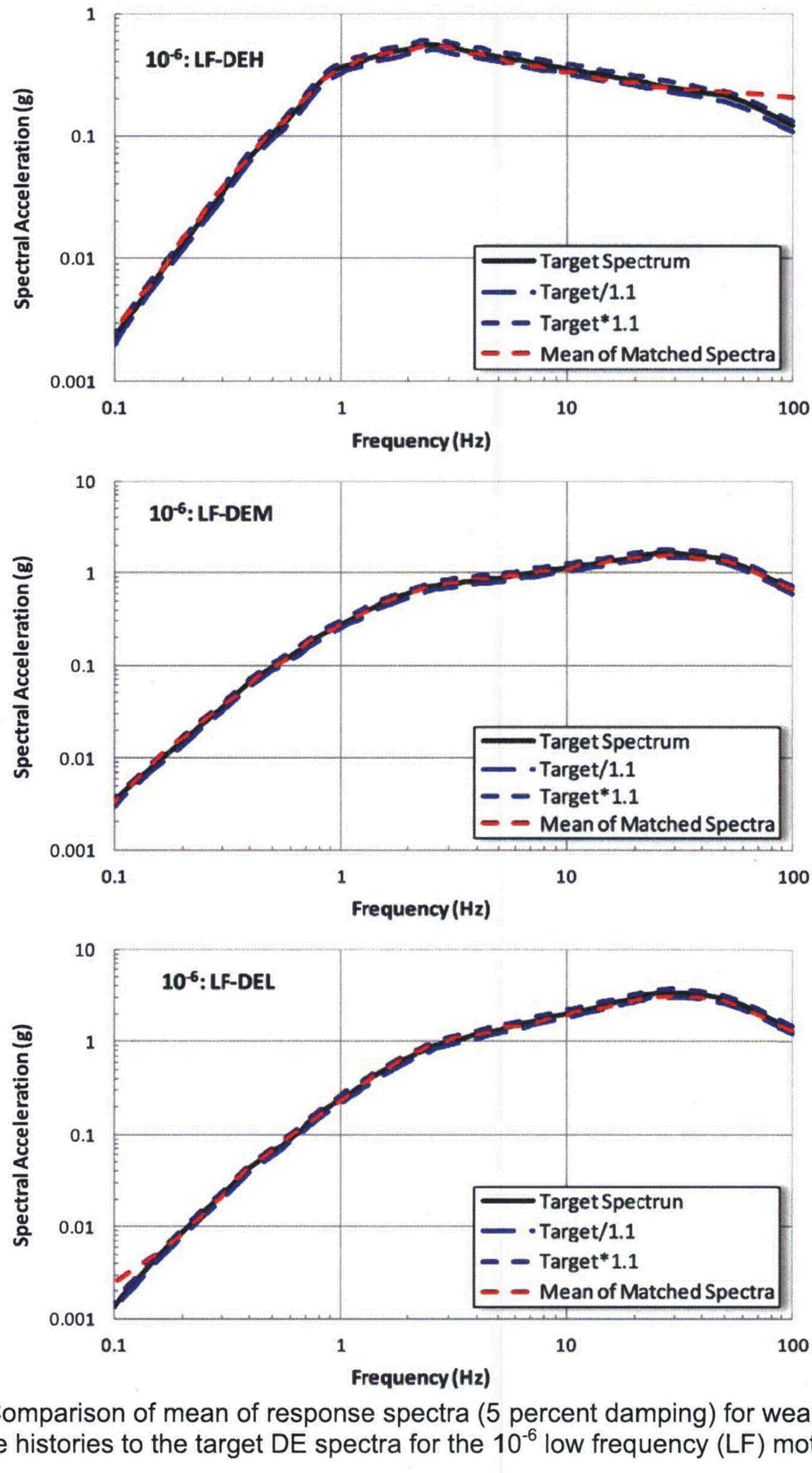


Figure 8: Comparison of mean of response spectra (5 percent damping) for weakly matched time histories to the target DE spectra for the 10^{-6} low frequency (LF) motions

Attachment 4
NRC3-12-0003
(12 pages)

Response to RAI Letter No. 70
(eRAI Tracking No. 6247)

RAI Question No. 02.05.04-39

NRC RAI 02.05.04-39

In your response to NRC RAI 2.5.4-38 dated June 17, 2011 (NRC3-11-0020), the staff noticed that the ESBWR DCD site parameter requirement $K_0\gamma \geq$ 47 lb/ft3 was eliminated for the backfill at the Fermi 3 site from EF3 FSAR Table 2.0-201 and Section 2.5.4.5.4.2. However, this requirement is not redundant with the other ESBWR DCD site parameters for the soil since, for example, a combination of soil density γ = 125 lb/ft3 and friction angle φ = 40 degrees (equivalent to K_0=0.35) satisfy the criteria $\gamma \geq$ 125 lb/ft3 and $\varphi \geq$ 35 degrees, yet $K_0\gamma = 43.8 \leq 47$ lb/ft3. Further, the staff noted that the site-specific ITAAC Item 2 of the engineering properties for backfill adjacent to Seismic Category I structures, including site parameter requirement $K_0\gamma \geq$ 47 lb/ft3, was removed from COL Application Part 10: ITAAC, Section 2.4 and Table 2.4.2-1. These engineering properties are independent from the shear wave velocity of the backfill material. Therefore, in accordance with 10 CFR 100.23, please provide the following additional information:

1. *The technical basis for eliminating the ESBWR DCD site parameter requirement $K_0\gamma \geq$ 47 lb/ft3 from EF3 FSAR Table 2.0-201 and Section 2.5.4.5.4.2.*

2. *An explanation of why site Design Commitment Item 2 of engineering properties in EF3 COL Application Part 10: ITAAC, Section 2.4 and Table 2.4.2-1 are not applicable, as well as the basis for eliminating Item 2 of site-specify ITAAC corresponding to "backfill adjacent to Seismic Category I structures" from EF3 COL Application Part 10: ITAAC, Section 2.4 and Table 2.4.2-1.*

Response

1. *The technical basis for eliminating the ESBWR DCD site parameter requirement $K_0\gamma \geq$ 47 lb/ft3 from EF3 FSAR Table 2.0-201 and Section 2.5.4.5.4.2.*

For the ESBWR Design Control Document, GE Hitachi's response to NRC RAI Letter No. 368, RAI No. 3.8-96 S05, Revision 1, dated January 20, 2010 (ML100220503), addressed sliding stability of the Seismic Category I Reactor Building/Fuel Building (RB/FB), Control Building (CB), and Fire Water Service Complex (FWSC). The sliding stability evaluation included the friction resistance between the subsurface material and the portion of the foundations parallel to the direction of sliding motion. The $k_0\gamma$ parameter was used to estimate lateral force applied to the sides of the foundations by the subsurface materials. For Fermi 3, Seismic Category I structures are either partially embedded in bedrock/fill concrete or founded on fill concrete. Due to the strength of the bedrock and fill concrete, frictional resistance along the portion of the foundation and the walls of the structure parallel to the direction of sliding motion is not credited for the Seismic Category I RB/FB, CB, or FWSC. Therefore, $k_0\gamma$ was eliminated as a required parameter.

2. *An explanation of why site Design Commitment Item 2 of engineering properties in EF3 COL Application Part 10: ITAAC, Section 2.4 and Table 2.4.2-1 are not applicable, as well as the basis for eliminating Item 2 of site-specify ITAAC corresponding to "backfill adjacent to Seismic Category I structures" from EF3 COL Application Part 10: ITAAC, Section 2.4 and Table 2.4.2-1.*

An ITAAC for backfill surrounding Seismic Category I structures will be included in Part 10, Subsection 2.4.2, to specify requirements for DCD backfill soil parameters that are applicable to Fermi 3, as shown in FSAR Table 2.0-201. As described in the response to RAI 02.05.04-38 submitted in response to NRC RAI Letter No. 55 (ML11171A568), a shear wave velocity ITAAC is not required for the compacted backfill surrounding Seismic Category I structures. Similarly, as described above, an ITAAC is not required for the $k_0\gamma$ parameter.

FSAR Subsection 2.5.4.5.4.2 will be updated to address addition of the ITAAC for the engineered granular backfill.

Proposed COLA Revision

FSAR Table 1.9-204, Table 2.0-201, Subsection 2.5.4.5.4.2, and Part 10, Subsection 2.4.2 are revised as shown on the attached markups.

Markup of Detroit Edison COLA
(following 8 pages)

The following markup represents how Detroit Edison intends to reflect this RAI response in the next submittal of the Fermi 3 COLA. However, the same COLA content may be impacted by responses to other COLA RAIs, other COLA changes, plant design changes, editorial or typographical corrections, etc. As a result, the final COLA content that appears in a future submittal may be different than presented here.

Table 1.9-204 Industrial Codes and Standards (Sheet 3 of 4) [EF3 SUP 1.9-1]

Code or Standard Number	Year	Title
D2488-06	2006	Standard Practice for Description and Identification of Soils (Visual-Manual Procedure)
American Society for Testing and Materials (ASTM) (Continued)		
D2850-03a	2003	Standard Test Method for Unconsolidated-Undrained Triaxial Compression Test on Cohesive Soils
D3080-04	2004	Standard Test Methods for Direct Shear Test of Soil Under Consolidated Drained Conditions
D3550-01	2001	Standard Practice for Thick Wall, Ring-Lined, Split Barrel, Drive Sampling of Soils
D4220-95	2000	Standard Practices for Preserving and Transporting Soil Samples
D4253-00	2000	Standard Test Methods for Maximum Index Density and Unit Weight of Soils Using a Vibratory Table
D4254-06	2006	Standard Test Methods for Minimum Index Density and Unit Weight of Soils and Calculation of Relative Density
D4318-05	2005	Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils
D4767-04	2004	Standard Test Method for Consolidated Undrained Triaxial Compression Test for Cohesive Soils
D5079-02	2002	Standard Practices for Preserving and Transporting Rock Core Samples
D5084-03	2003	Standard Test Methods for Measurement of Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter
D5607-02	2006	Standard Test Methods for Performing Laboratory Direct Shear Strength of Rock Specimens Under Constant Normal Force
D6151-97	1997	Standard Practice for Using Hollow-Stem Augers for Geotechnical Exploration and Soil Sampling
D6914-04	2004	Standard Practice for Sonic Drilling for Site Characterization and the Installation of Subsurface Monitoring Devices,
D7012-07	2007	Standard Test Methods for Compressive Strength and Elastic Moduli of Intact Rock Core Specimens under Varying States of Stress and Temperature
ASTM E-119	2007	Fire Test of Building Construction Materials
G51-95	2005	Standard Test Methods for Measuring pH of Soil for Use in Corrosion Testing
Applicable Building Codes		

D6938-10	2010	Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)

Subject (16)	DCD Site Parameter Value(1)(16)	Fermi 3 Site Characteristic	Evaluation
Soil Properties (continued)			
Backfill on sides of and underneath Seismic Category I structures		See Evaluation Column	The Fermi 3 site characteristic values for the backfill on the sides of seismic Category I structures are specified in Subsection 2.5.4.5.4.2. In accordance with Note Number 16 of the Referenced DCD, Tier 2 Table 2.0-1, Fermi 3 site-specific SSI analyses were performed for the RB/FB and CB. ~~In the Fermi 3 site-specific SSI analyses, the engineered granular backfill above the top of the bedrock was neglected; therefore, the Referenced DCD site parameters for backfill above the top of the bedrock do not apply. For the FWSC, the engineered granular backfill surrounding the basemat is not necessary for sliding as presented in Subsection 2.5.4.5.4.2. However, the engineered granular backfill will meet the values listed in the Fermi 3 Site Characteristic column. Fill concrete is used as backfill below the top of bedrock surrounding the RB/FB and CB, and below the FWSC to the top of bedrock. The parameter values for backfill in the Referenced DCD apply to compactable backfill and not to fill concrete.~~

The Fermi 3 site-specific sliding analysis for the RB/FB, CB, and FWSC does not require backfill for sliding stability. Therefore, the Referenced DCD $k_0\gamma$ site parameter for backfill above the top of the bedrock is not required. The engineered granular backfill will meet the values listed in the Fermi 3 Site Characteristic column.

, with the engineered granular backfill neglected,

against sliding and overturning, as discussed in Subsection 3.8.5.

RB/FB and CB with fill concrete included as the backfill below the top of the Bass Islands Group bedrock, and engineered granular backfill above the top of the bedrock neglected. The Fermi 3 site-specific SSI results show that the RB/FB and CB are within the Referenced DCD structural design and stable ~~with the engineered granular backfill neglected~~. The soil-structure interaction analyses in the Referenced DCD for the FWSC were performed as a surface structure, so the backfill surrounding the FWSC foundation basemat is not included in the Referenced DCD SSI. The Referenced DCD sliding analysis considers the backfill supporting and surrounding the basemat. For the FWSC, the supporting material below the FWSC at Fermi 3 is fill concrete with a mean compressive strength of 31 MPa (4,500 psi) versus the soil with an angle of internal friction of 35 degrees used in the Referenced DCD. As discussed in Subsection 3.8.5, sliding of the FWSC is not an issue when neglecting the engineered granular backfill surrounding the basemat. Therefore, the engineered granular backfill surrounding the basemat for the FWSC is not Seismic Category I backfill. ~~As a result, the Referenced DCD backfill requirements surrounding the Seismic Category I structures are not required; however, the~~ Fermi 3 engineered granular backfill surrounding the Seismic Category I structures will meet the following Referenced DCD requirements:

(New Paragraph) The

i. Product of peak ground acceleration α (in g), Poisson's ratio ν and density γ

$\alpha(0.95\nu + 0.65)\gamma$: 1220 kg/m^3 (76 lbf/ft^3) maximum

ii. An angle of internal friction equal to or greater than 35 degrees when properly placed and compacted.

iii. Soil density

γ: 2000 kg/m^3 (125 lbf/ft^3) minimum

(New Paragraph) The DCD requirement $\alpha(0.95\nu+0.65)\gamma$ is retained because it is associated with the dynamic lateral earth pressure of the engineered granular backfill on the embedded walls of Seismic Category I RB/FB and CB. The DCD requirements for angle of internal friction and density are retained to ensure a dense backfill.

The anticipated extent of fill concrete and engineered granular backfill is shown on Figure 2.5.4-202, Figure 2.5.4-203, and Figure 2.5.4-204.

Fill concrete mix designs are addressed in a design specification prepared during the detailed design phase of the project. Field observation is performed to verify that approved mixes are used and test specimens are obtained that verify that specified design parameters are reached. The foundation bedrock and fill concrete provide adequately high factors of safety against bearing capacity failure under both static and seismic structural loading. Quality Control testing requirements for bedrock include visual inspection and geologic mapping.

Engineered granular backfill sources are identified and tested for engineering properties, in accordance with recommendations from Subsection 2.5.4.5.1 and other testing as required by design specifications. The compaction effort required for the engineered granular backfill surrounding the Seismic Category I structures above the top of the Bass Islands Group bedrock will be a mean of 95 percent of the modified Proctor density or a mean of 75 percent of the maximum relative density. During detailed design, the laboratory testing in Subsection 2.5.4.5.1 is implemented to establish the required density to meet design requirements of the engineered granular backfill adjacent to Category I structures. To further confirm the density selected based on the laboratory testing results meets the design requirements, a program will be implemented to test the in-place engineered granular backfill, which could consist of construction of a test pad(s). Also during detailed design, a testing program will be implemented to confirm the engineered granular backfill placed during construction meets the design requirements. For liquefaction, the program could consist of performing standard penetration tests to confirm the fill has the minimum N_{60} in Subsection 2.5.4.8.

Engineered granular backfill is compacted to achieve a density that results in the backfill having a minimum ϕ' of 35 degrees. Based on correlations of strength characteristics for granular soils (Reference 2.5.4-242), the ϕ' of compacted granular soils can achieve 35 degrees. Engineered granular backfill materials are placed in controlled lifts and compacted. Within confined areas or close to foundation walls, smaller compactors are used to prevent excessive lateral pressures against the walls from stress caused by heavy compactors.

Evaluation and discussion of liquefaction issues related to soil backfill materials is provided in Subsection 2.5.4.8. Lateral pressures applied against foundation walls are evaluated and discussed in Subsection 2.5.4.10.

The gradation of the engineered granular backfill will be selected to approximate a hydraulic conductivity of 8.85 x 10^{-4} m/s (251 ft/day) (Subsection 2.4.12.2.4) or greater.

A quality control sampling and testing program is developed to verify that fill concrete and engineered granular backfill material properties conform to the specified design parameters. Sufficient laboratory compaction and grain size distribution tests are performed to account for variations in fill material. A test fill program may be included for the purposes of determining an optimum size of compaction equipment, number of passes, lift thickness, and other relevant data for achievement of the specified compaction.

Fill concrete used as fill under the FWSC and surrounding the RB/FB and CB to the top of bedrock will be proportioned, tested and the placement controlled in accordance with Regulatory Guide 1.142. Additionally, ACI 349 requirements for concrete exposed to sulfate-containing solutions will be implemented. The fill concrete will have a mean 28-day compressive strength of equal to, or greater than, 31 MPa (4,500 psi) with a mean shear wave velocity of equal to, or greater than, 1,100 m/s (3600 ft/s). Compressive strength of the fill concrete will be tested in accordance with Regulatory Guide 1.142. The compressive strength of the fill concrete will be used to calculate shear wave velocity to ensure that the shear wave velocity of 1,100 m/s (3600 ft/s) is met. The mix design developed for the fill concrete will control erosion and leaching due to contact with site groundwater and limit settlement to specified tolerances (Table 2.0-201), including creep and shrinkage.

The quality control program for fill concrete includes requirements for compressive strength testing. Verification will be performed to confirm that compressive strength testing results comply with mix design, minimum strengths, and placement requirements. The details of the quality control program will be addressed in a design specification prepared during the detailed design phase of the project.

The quality control program for engineered granular backfill includes requirements for field in place density tests and index tests to confirm material classification and compaction characteristics are within the compliance range of materials specified and used for design. Granular backfill placement and compaction methods will be addressed in design specifications prepared in the detailed design stage of the project.

Insert 2.5.4.5.4.2-1 Here

Thermal cracking control of the fill concrete below the FWSC and TB, and surrounding the RB/FB and CB will be addressed by implementing ACI 207.2R measures that address mass concrete.

The details of the quality control and quality assurance programs for fill concrete and engineered granular backfill are addressed in the specifications prepared during the detailed design phase of the project.

Insert 2.5.4.5.4.2-1

Test methods for index and static engineering properties of the backfill surrounding Seismic Category I structures are provided in Section 2.5.4.5.1.

The test methods, frequency, and location of testing on the backfill surrounding Seismic Category I structures are as follows:

- Direct Shear Test (ASTM D 3080) - Minimum of 3 tests per material type per borrow source.
- Maximum and Minimum Relative Density Test (ASTM D 4253, ASTM D 4254) [Minimum of 3 tests per material type per borrow source] or Modified Proctor Test (ASTM D 1557) [Minimum of 3 tests per material type per borrow source].
- In-Place Density Tests (ASTM D 6938) – test frequency and location determined during detailed design and provided in construction specifications.

2.4 SITE-SPECIFIC ITAAC

The Site Specific ITAAC are provided in the following sections. Site specific systems were evaluated against selection criteria in FSAR Section 14.3. If a site-specific system described in the FSAR does not meet an ITAAC selection criterion, only the system name and the statement "No entry for this system" is provided.

2.4.1 ITAAC FOR BACKFILL UNDER SEISMIC CATEGORY I STRUCTURES

Not applicable since no compactable backfill will be placed under Fermi 3 Seismic Category I structures.

2.4.2 ITAAC FOR BACKFILL SURROUNDING SEISMIC CATEGORY I STRUCTURES

The site parameter values in the Referenced DCD, Tier 2, Table 2.0-1 for compactable backfill surrounding the embedded walls of Fermi 3 Seismic Category I structures are not necessary as discussed in FSAR Subsection 2.5.4 and Subsection 3.7.2. Therefore, no ITAAC is necessary for compactable backfill surrounding the embedded walls of Fermi 3 Seismic Category I structures.

The ITAAC for compacted backfill surrounding the embedded walls of Seismic Category I structures is provided in Table 2.4.2-1.

Table 2.4.2-1 ITAAC for Backfill Surrounding Seismic Category I Structures		
Design Commitment	**Inspections, Tests, and Analyses**	**Acceptance Criteria**
1. The engineering properties of backfill material surrounding Seismic Category I structures are equal to or exceed the FSAR Subsection 2.5.4.5.4.2 requirements.	Laboratory tests and field measurements to evaluate the engineering properties of the backfill will be performed. Laboratory testing will include: • Relative density or Proctor tests for density, γ • Direct shear tests for angle of internal friction Field measurements will include: • In-place density tests for density, γ	An engineering report exists that concludes that the engineering properties of backfill material surrounding Seismic Category I structures are equal to or exceed the FSAR Subsection 2.5.4.5.4.2 requirements as follows: • Angle of Internal Friction: ≥ 35 degrees • Product of peak ground acceleration, α, (in g), Poisson's ratio, ν and density, γ: $\alpha(0.95\nu+0.65)\gamma$: 1220 kg/m^3 (76 lbf/ft^3) maximum • Soil Density, γ: 2000 kg/m^3 (125 lbf/ft^3) minimum

Attachment 5
NRC3-12-0003
(2 pages)

Response to RAI Letter No. 70
(eRAI Tracking No. 6244)

RAI Question No. 03.07.01-3

NRC RAI 03.07.01-3

EF3 FSAR Section 2.5.4.5 and Figure 2.5.4-202, as modified by the markups included with the response to RAI Letter 55 Question 02.05.04-38, indicate that the lateral extension of concrete fill under the FWSC is limited to its footprint. Explain why it is appropriate to define the FIRS for this facility on the basis of a 1D column of concrete material if the lateral extension of this material is limited to its footprint.

Response

The response to this RAI will be provided by February 29, 2012. The response will provide the results of 2-D site response model calculations for a large concrete block sitting on bedrock with backfill on both sides. The results of the 2-D site response will be compared to the 1-D site response presented in the FSAR. Preliminary and unverified results indicate the 2-D site response is similar to the 1-D site response presented in the FSAR.

Proposed COLA Revision

None.

Attachment 6
NRC3-12-0003
(2 pages)

Response to RAI Letter No. 70
(eRAI Tracking No. 6244)

RAI Question No. 03.07.01-4

NRC RAI 03.07.01-4

The shear wave velocity of concrete fill assumed in the site response analyses described in EF3 FSAR Section 2.5.2 is Vs = 3600 fps (EF3 FSAR Table 2.5.2-220). However, as indicated in the response to RAI Letter 55 Question 02.05.04-38, to address potentially aggressive soil and groundwater conditions, the concrete fill will have a minimum compressive strength of 4500 psi, which corresponds approximately to Vs = 7100 fps (based on standard equations, concrete density 145 lb/ft^3, and Poisson's ratio of 0.2). It is also noted that measured velocities of lean concrete placed at the Oak Ridge site, for example, were significantly higher than the assumed 3600 fps.

Therefore, explain the impact of the increased shear wave velocity on the computed FIRS for the FWSC, particularly at high frequency. Also explain how the data from EF3 FSAR Reference 2.5.2-288 (Hasek, 2002), which is based on lean concrete with shear wave velocities between 900 fps and 1400 fps, is applicable to the aforementioned Fermi 3 site conditions.

Response

The response to this RAI will be provided by February 29, 2012. The response will provide modified Fire Water Service Complex (FWSC) foundation input response spectra (FIRS) using updated Fill Concrete properties. The response will also address the applicability of the Hasek (2002) results for Fermi 3 given the updated Fill Concrete properties. Preliminary and unverified results indicate the updated Fill Concrete properties reduce the amplitude of the site amplification functions for the FWSC compared to the results presented in the FSAR.

Proposed COLA Revision

None.

Attachment 7
NRC3-12-0003
(2 pages)

Response to RAI Letter No. 70
(eRAI Tracking No. 6244)

RAI Question No. 03.07.01-5

NRC RAI 03.07.01-5

EF3 FSAR Figures 2.5.4-201 through 2.5.4-204, as modified by the markups included with the response to RAI Letter 55 Question 02.05.04-38, show the lateral extent of the engineered granular backfill surrounding the RB/FB, CB, FWSC, and other Seismic Category II structures. As shown in EF3 FSAR Figure 2.5.4-201, the backfill extends to a perimeter diaphragm wall that is used to support the excavation of in situ material. Beyond the diaphragm wall, it appears that in situ soils (fill and glacial till) will remain in place.

Since the backfill material is limited in lateral extent, following a relatively complicated geometry in plan, explain why it is appropriate to define the PBSRS and FIRS for the RB/FB and CB (EF3 FSAR Section 3.7.1) on the basis of a 1D column of backfill material.

Response

The response to this RAI will be provided by February 29, 2012. The response will provide the site response profile for the area outside of the diaphragm wall, consisting of bedrock, glacial till, lacustrine deposits, existing quarry fill, and the planned engineered granular backfill that will bring the site to final grade elevation of 589.3 ft. NAVD 88. The performance-based seismic response spectra (PBSRS) at the finished ground level grade for the profile outside the diaphragm wall will be calculated for the 1-D site response of that profile, and will be compared to the PBSRS that represents the soil profile inside the diaphragm wall.

Proposed COLA Revision

None.

Attachment 8
NRC3-12-0003
(115 pages)

Response to RAI Letter No. 70
(eRAI Tracking No. 6244)

RAI Question No. 03.07.01-6

NRC RAI 03.07.01-6

EF3 FSAR Section 3.7.1.1.5, Table 3.7.1-212, and Table 3.7.1-212, as modified by the markups included with the response to RAI Letter 55 Question 02.05.04-38, indicate that the two horizontal components of spectrum-compatible ground motion used in the seismic SSI analysis have correlation coefficients slightly under 0.30. This deviates from the guidance in SRP 3.7.1, which states that the three orthogonal components of ground motion are considered to be statistically independent if their correlation coefficient is less than 0.16.

The applicant in EF3 FSAR Section 3.7.1.1.5 further explains that the deviation from the guidance in SRP 3.7.1 is based on a recommendation from NUREG/CR-6728; however, this reference document does not provide a technical basis for this recommendation.

Regulatory Guide (RG) 1.92 provides further guidance for combining the spatial components of the earthquake motion. Per this RG, if the three components of earthquake motion are statistically independent, then the maximum response of interest of an SSC can be obtained from algebraic summation of the three component responses at each time step (Regulatory Position C.2.2(2)). Alternatively, the three spatial components can be calculated separately and the response of interest can be combined by taking the SRSS of the maximum component responses (Regulatory Position C.2.2 (1)).

Based on the above discussion, the staff needs additional technical basis for using two components of ground motion with correlation coefficient of approximately 0.30. If Regulatory Position C.2.2(2) of RG 1.92 is used for determining the total site-specific seismic demand for the SSCs, the applicant is requested to provide a comparison with the seismic demand as determined from the use of Regulatory Position C.2.2(1), and demonstrate that the current site-specific seismic demand as specified in EF3 FSAR is not under predicted.

The staff notes that, according to ESBWR DCD Table 3.7-3, which has been incorporated by reference into the EF3 FSAR, the seismic analysis of all Seismic Category I structures follows Regulatory Position C.2.2(2) (i.e., "Algebraic Sum" is specified under the column "Three Components Combination"). This is acceptable only when the three components of the earthquake motion are statistically independent.

Response

The site response for the Fermi 3 site-specific soil-structure interaction (SSI) analyses has been revised using three orthogonal components of ground motion that have correlation coefficients less than 0.16 in accordance with Standard Review Plan 3.7.1. FSAR Subsection 3.7.1 text has been updated to address revisions for the correlation coefficient plus the following items:

- Updated lower bound and upper bound deterministic soil column profiles to incorporate the minimum coefficient of variation in shear modulus of 0.5 specified in Standard Review Plan 3.7.2. This update modified the lower bound and upper bound deterministic soil column profiles that were presented previously.
- Documentation of enhanced SCOR FIRS development for horizontal and vertical components of ground motion. The enhanced SCOR FIRS were previously not used in

the development of the SSI FIRS. Use of the enhanced SCOR FIRS for the horizontal components allows full enveloping of the performance-based surface response spectrum (PBSRS) at the finished ground level grade. The SCOR FIRS without enhancement did not envelop the PBSRS at frequencies below 0.5 Hz. The enhanced SCOR FIRS for the vertical component fully envelopes the PBSRS at the finished ground level grade using only the compression wave velocities. Previously, both shear and compression wave velocities were used to confirm enveloping of the PBSRS with the vertical SCOR FIRS. Subsection 3.7.1.1.4.5 of the proposed mark-up of the FSAR provides additional details on the enhanced SCOR FIRS.

- Documentation of incorporation of enhanced SCOR FIRS into SSI FIRS. This update modified the SSI FIRS.

- Development of spectrally matched time histories compatible with the updated SSI FIRS.

- Documentation that the time histories compatible with the SSI FIRS produce surface motions that envelop the PBSRS. This comparison was previously made only for the full soil column using the methods described in the Interim Staff Guidance DC/COL-ISG-017 and the NEI developed white paper for the fully embedded case. The method used to make the direct comparison between the time histories compatible with the SSI FIRS and the PBSRS at finished ground level grade is described in FSAR Subsection 3.7.1.1.5.

- Added reference (Gülerce and Abrahamson, 2011) for vertical to horizontal (V/H) ratios based on an evaluation of Pacific Earthquake Engineering Research (PEER) Center's Next Generation Attenuation (NGA) database. This additional reference is used to support the modification of the V/H ratios for bedrock in NUREG/CR-6728 to better represent the full soil column at the Fermi 3 site. The Fermi 3 site is characterized by a thin soil layer over bedrock. The added reference replaces a more limited analysis of the NGA database completed for the Fermi 3 site.

- The attached markup includes changes to Section 3.7.1.1.4.6 (including references and new figure) to include changes described in the response to RAI 03.07.01-8.

Detroit Edison is currently performing SSI analyses with the revised seismic inputs. Work is ongoing and will be completed by April 30, 2012. In addition to using revised seismic inputs, the revised SSI analyses are utilizing the direct method of the SASSI2000 code rather than the subtraction method. The revised SSI analyses and associated FSAR markups will be available for NRC audit in April 2012. Based on preliminary analysis results with the new seismic inputs, the revised analyses are expected to produce results that are enveloped by the DCD design.

Proposed COLA Revision

FSAR Subsection 3.7.1 is revised as shown in the attached markup.

Markup of Detroit Edison COLA
(following 111 pages)

The following markup represents how Detroit Edison intends to reflect this RAI response in the next submittal of the Fermi 3 COLA. However, the same COLA content may be impacted by responses to other COLA RAIs, other COLA changes, plant design changes, editorial or typographical corrections, etc. As a result, the final COLA content that appears in a future submittal may be different than presented here.

- Partial embedment in the Bass Islands Group bedrock of the RB/FB and CB Seismic Category I structures, as shown on Figure 2.5.4-202 and Figure 2.5.4-203, to confirm that the Referenced DCD design is applicable for this case.
- To demonstrate that the Referenced DCD requirements for the backfill surrounding Seismic Category I structures above the top of bedrock can be neglected for RB/FB and CB with the RB/FB and CB partially embedded in the bedrock at the Fermi 3 site.

Figure 2.0-201, Figure 2.0-202, Figure 2.0-203, and Figure 2.0-204 show that the FIRS developed in Subsection 2.5.2 are enveloped by the CSDRS in both horizontal and vertical directions for the RB/FB, CB, and FWSC. Therefore, the Fermi 3 site-specific SSI analyses were not performed to address any exceedance of the CSDRS; rather, the Fermi 3 site-specific SSI analyses were performed to address the two Fermi 3 site-specific conditions outlined above.

The site-specific SSI analyses developed hazard-consistent seismic input for site response and SSI analyses consistent with Interim Staff Guidance DC/COL-ISG-017 and an NEI developed white paper (Reference 3.7.1-206). The design ground motion for the SSI analyses (herein called SSI FIRS) is based on an enveloped combination of the FIRS developed in Subsection 2.5.2 for a subsurface profile truncated at the foundation level (Truncated Soil Column Response [TSCR]) and outcrop response FIRS developed for the full soil column (Soil Column Outcrop Response [SCOR]) to finished ground level grade (Subsection 3.7.1.1.4). Due to the site-specific SSI analyses completed for Fermi 3, the site-specific Safe Shutdown Earthquake (SSE) applicable for plant shut down purposes is the lower of the two SSI FIRS for the RB/FB or CB.

The operating basis earthquake (OBE) is one-third of the SSE. These SSE and OBE definitions are used in conjunction with the criteria specified in DCD Section 3.7.4.4 to determine whether a plant shutdown is required following a seismic event.

EF3 SUP 3.7-1

3.7.1.1.4 Fermi 3 Site-Specific SSI Ground Motion

In the SASSI2000 model for the Fermi 3 site-specific SSI analyses, the RB/FB and CB are modeled as partially embedded structures that penetrate into the Bass Islands Group bedrock. The elevation of the top of the Bass Islands Group bedrock is 168.2 m (552.0 ft) NAVD 88. The

Subsection 3.7.1.1.4.1.2. Steps 6 and 7 are described in Subsection 3.7.1.1.4.2.

3.7.1.1.4.1.1 **Dynamic Properties for the Full Soil Column Profile**

The PBSRS surface at the finished ground level grade for the Fermi 3 site is Elevation 179.6 m (589.3 ft) NAVD 88. This elevation will be achieved by excavating and removing the existing overburden to the top of the Bass Islands Group bedrock unit at Elevation 168.2 m (552.0 ft) NAVD 88, and backfilling with engineered granular backfill to the finished ground level grade. This process results in an average engineered granular backfill thickness of approximately 11.2 m (37 ft). Below the engineered granular backfill is bedrock and the fill concrete between the foundation walls and the bedrock. Subsection 2.5.2.5.1 discusses the development of the dynamic engineering properties for the in-situ bedrock material. The dynamic engineering properties for the in-situ bedrock material used in the site response analysis for computing the PBSRS at the finished ground level grade and SCOR FIRS are provided in Table 3.7.1-201, Table 3.7.1-202, and Table 3.7.1-203 below layer number 9.

The finished ground level grade reported in Tables 3.7.1-201 through 3.7.1-203 is rounded to the nearest foot (e.g., 589 ft). This difference is not considered significant for the site response since, as discussed in Subsection 3.7.1.1.4.1.1.3, the layer boundaries of the soil profiles are randomized.

Above the bedrock, the shear-wave velocity (V_S) for the engineered granular backfill is estimated based on empirical relationships for angular-grained material from Richart et al (Reference 3.7.1-201):

$$V_S = [159 - (53.5)e](\overline{\sigma_0})^{0.25}$$

Where:

V_S is the shear wave velocity in ft/sec

e is the void ratio

$\overline{\sigma_0}$ is the average effective confining pressure $\mathrm{lb/ft^2}$ defined as

$$\overline{\sigma_0} = \frac{1}{3}(\sigma'_V + 2\sigma'_H)$$

σ'_V is the effective vertical stress in $\mathrm{lb/ft^2}$

σ'_H is the effective horizontal stress in $\mathrm{lb/ft^2}$ with $\sigma'_H = k_0\sigma'_V$

k_0 is the at-rest earth pressure coefficient

Figure 3.7.1-201 shows the estimated three shear wave velocity profiles (the lower-range [LR], intermediate-range [IR], and upper-range [UR] site response analysis profiles) for the engineered granular backfill used as input to the site response analysis for computing the PBSRS at the finished ground level grade and SCOR FIRS. A range of values for the engineered granular backfill is used to assess the potential variability of ratios; however, the full soil column profile consists of a thin layer of soil over bedrock. This profile is somewhat different than the generic rock conditions for which the V/H ratios shown on Figure 2.5.2-287 were developed. At present, there are no published V/H ratios for ground motions in the CEUS for the conditions represented by the full soil column profile, a profile with a thin soil layer over bedrock. Therefore, the V/H ratios for the vertical PBSRS were developed by examining differences between bedrock and shallow soil site V/H ratios for western US (WUS) data and using the differences to adjust the CEUS hard rock V/H values.

The WUS V/H ratios recommended in NUREG/CR-6728 (Reference 2.5.2-270) were based on ground motion relationships for a generic bedrock site classification. More recently, Campbell and Bozorgnia (Reference 3.7.1-203) developed empirical ground motion prediction equations for bedrock sites that contained explicit categorization for firm

m/s

m/s

bedrock (V_{S30} 830 m/s ± 339 [2723 ft/s ± 1112 ft/s]) and soft rock (V_{S30} 421 m/s ± 109 [1381 ft/s ± 358 ft/s]) sites, where V_{S30} is the average shear wave velocity in the upper 30 m (100 ft). The soft bedrock V/H ratios are used to indicate the potential behavior of a shallow stiff soil site. The results obtained using Campbell and Bozorgnia (2003) suggest that the peak in the V/H ratios for soft bedrock shifts slightly towards lower frequencies compared to the peak for firm bedrock sites. The V/H ratios are also lower on soft bedrock for frequencies less than about 3 Hz.

The Pacific Earthquake Engineering Research (PEER) Center's Next Generation Attenuation (NGA) Project (Reference 3.7.1-207) developed an extensive database of strong motion records from active tectonic

Insert 1

environments. The records from this database were analyzed to evaluate the appropriate WUS V/H values for soft and firm bedrock sites. A set of 21 records was selected from the PEER NGA database that met the following criteria:

- 0.2 g ≤ PGA ≤ 0.5 g, where PGA is peak ground acceleration
- Depth to V_s of 1 km/sec (3,280 ft/s) < 100 m (328 ft) to obtain records on bedrock and shallow soil sites
- Lowpass filter used in record processing ≥ 20 Hz to obtain V/H values at moderately high frequencies.
- Vertical component available from the PEER NGA database.

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The records from Reference 3.7.1-207 were analyzed by Gülerce and Abrahamson (Reference 3.7.1-208) to develop a model for V/H ratios based on V_{S30} values (the average velocity in the upper 30 meters). In order to compare the model of Gülerce and Abrahamson (Reference 3.7.1-208) to the site categories of Campbell and Bozorgnia (Reference 3.7.1-203), V/H ratios were computed using the Gülerce and Abrahamson (Reference 3.7.1-208) model for V_{S30} values of 830 m/s (2,723 ft/s) and 421 m/s (1,381 ft/s). These V_{S30} values corresponded to the firm rock and soft rock categories of Campbell and Bozorgnia (Reference 3.7.1-203). The result suggests a trend similar to the Campbell and Bozorgnia (Reference 3.7.1-203) result.

These data were used to compute average V/H ratios based on V_{S30} for bedrock sites [V_{S30} > 650 m/s (2133 ft/s)] and shallow soil sites [V_{S30} < 650 m/s (2133 ft/s)]. The PEER NGA data set is limited, but suggests a trend similar to Campbell and Bozorgnia (2003) results, with a slight shift in the peak of the V/H ratios towards lower frequencies at shallow soil sites.

Figure 3.7.1-223 shows V/H spectral ratios as a function of frequency used for generating the vertical PBSRS at the finished ground level grade, and the V/H spectral ratios recommended by NUREG/CR- 6728 (Reference 2.5.2-270) for CEUS bedrock sites with a PGA between 0.2 g and 0.5 g. The V/H spectral ratios used for generating the vertical PBSRS are based on the V/H spectral ratios recommended by NUREG/CR-6728 (Reference 2.5.2-270) for CEUS bedrock sites with a shift in the frequencies above 10 Hz to represent the shift in the peak V/H spectral ratios towards lower frequencies in the Campbell and Bozorgnia (Reference 3.7.1-203) and PEER NGA comparisons. Additionally, at frequencies below 5 Hz the V/H spectral ratio is reduced slightly to reflect the differences observed in the Campbell and Bozorgnia (Reference 3.7.1-203) comparison of firm and soft bedrock sites. The resulting vertical PBSRS is listed in Table 3.7.1-204 along with the values of V/H. Figure 3.7.1-224 shows the horizontal and vertical PBSRS (5 percent damping) at the finished ground level grade.

Gülerce and Abrahamson (Reference 3.7.1-208)

and Gülerce and Abrahamson (Reference 3.7.1-208) comparisons

3.7.1.1.4.4.3 **Deterministic Profiles for the Full Soil Column**

Three deterministic profiles, the best estimate (BE), lower bound (LB), and upper bound (UB), were developed from the PBSRS site response analysis following the requirements of SRP 3.7.2 and guidance from the Interim Staff Guidance DC/COL-ISG-017. These profiles were based on the statistics of the iterated soil properties for the randomized full soil column profile described in Subsection 3.7.1.1.4.1.1.3.

The full soil column BE profile was set equal to values interpolated between the median iterated soil properties for the 10^{-4} and 10^{-5} exceedance level ground motions. The resulting subsurface layers and the corresponding strain compatible dynamic engineering properties for the full soil column BE profile are listed in Table 3.7.1-205.

The full soil column LB profile was set equal to the 16th percentile of the distribution of randomized soil properties, and the full soil column UB profile was set equal to the 84th percentile of the distribution of

CSDRS (Reference 2.5.2-291). The SCOR FIRS for the RB/FB and CB are enveloped by the ESBWR CSDRS

Since the RB/FB and CB foundation levels are within the bedrock units, the vertical SCOR FIRS were generated using the V/H spectral ratios for hard rock recommended by NUREG/CR-6728 (Reference 2.5.2-270) for CEUS bedrock sites. The recommended CEUS hard rock V/H spectral ratios for 0.2 g ≤ PGA ≤ 0.5 g are shown on Figure 3.7.1-223 (red curve). Although the PGA for the horizontal SCOR FIRS is slightly less than 0.2 g, the V/H spectral ratios for a PGA between 0.2 g and 0.5 g were used. Because the vertical PBSRS was based on modified V/H spectral ratios for a PGA between 0.2 g and 0.5 g, use of the rock V/H spectral ratios for this PGA range to develop the vertical SCOR FIRS maintains consistent vertical to horizontal spectral ratios between the PBSRS and SCOR FIRS.

horizontal

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3.7.1.1.4.6 **SSI FIRS**

The horizontal SSI FIRS was developed by enveloping the horizontal TSCR FIRS from Subsection 2.5.2 and the horizontal SCOR FIRS developed in Subsection 3.7.1.1.4.5 to capture the maximum site response effects from full and truncated subsurface profiles. The final SSI FIRS was smoothed by log-log interpolation to remove a dip between about 0.5 and 2 Hz. Figure 3.7.1-228 and Figure 3.7.1-229 show the TSCR FIRS, the SCOR FIRS, the enveloped FIRS, and the final smoothed horizontal SSI FIRS at the RB/FB and CB foundation levels (herein called horizontal SSI FIRS), respectively. The RB/FB and CB horizontal SSI FIRS values are provided in Table 3.7.1-210.

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horizontal
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enhanced
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A similar procedure was used to construct the vertical SSI FIRS as was used for the horizontal SSI FIRS. Figure 3.7.1-230 and Figure 3.7.1-231 show the TSCR FIRS, the SCOR FIRS, the enveloped FIRS, and the final smoothed vertical SSI FIRS at the RB/FB and CB foundation levels (herein called vertical SSI FIRS), respectively. The RB/FB and CB vertical SSI FIRS values are also provided in Table 3.7.1-210.

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enhanced
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The final smoothed horizontal and vertical SSI FIRS for the RB/FB and CB used for development of the ground motion time histories are shown on Figure 3.7.1-232 and Figure 3.7.1-233, respectively. Table 3.7.1-210 provides the PGA – listed as the 100 Hz value – for the RB/FB and CB horizontal SSI FIRS. As shown on the footnote in Table 3.7.1-210, the

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Interim Staff Guidance DC/COL-ISG-017 and the NEI developed white paper (Reference 3.7.1-206) state that time histories matched to the outcrop FIRS should be convolved from the foundation level up to the finished ground level grade using the full soil column LB, BE, and UB subsurface profiles, and that the resulting envelope of the three surface spectra from the time histories should envelop the PBSRS at the finished ground level grade. This comparison was made by matching the seed time history using the methods discussed in Subsection 3.7.1.1.5 to the SCOR FIRS. The matched time histories compatible with the SCOR FIRS were then input at the appropriate foundation level into the three deterministic soil column profiles (LB, BE, and UB) for the full soil column, shown on Figure 3.7.1-225, and convolved to the PBSRS level at finished ground level grade with SHAKE analyses. Comparison of the resulting envelope of the three surface spectra from the horizontal time histories and the horizontal PBSRS showed that the resulting envelope did not envelop the PBSRS at frequencies below 0.5 Hz and at a location near 2 Hz. Comparison of the resulting envelope of the three surface spectra from the vertical time histories and the vertical PBSRS showed that the envelope did not envelop the PBSRS at frequencies below 0.5 Hz or at frequencies between about 1.5 Hz and 10 Hz.

The horizontal SCOR FIRS were then enhanced by increasing the overall level of ground motion in the frequency ranges identified during the comparison of the resulting envelope of the three surface spectra from the time histories and the PBSRS. Figure 3.7.1-228 and Figure 3.7.1-229 show the horizontal SCOR FIRS and the horizontal enhanced SCOR FIRS for the RB/FB and CB, respectively. Also shown on Figure 3.7.1-228 and Figure 3.7.1-229 are the horizontal ESBWR CSDRS (Reference 2.5.2-291). The enhanced horizontal SCOR FIRS for the RB/FB and CB are enveloped by the horizontal ESBWR CSDRS. Time histories matched to the enhanced SCOR FIRS were then convolved from the foundation level up to the finished ground level grade using the full soil column LB, BE, and UB subsurface profiles for comparison to the PBSRS at the finished ground level grade. Figure 3.7.1-230 to Figure 3.7.1-231 show the comparison of the PBSRS at the finished ground level grade with the envelope of the surface response spectra obtained from SHAKE analyses using the LB, BE, and UB full soil column profiles and the matched time histories compatible with the RB/FB and CB enhanced SCOR FIRS, respectively. The envelope of the three response spectra at the ground surface exceeds the PBSRS at the finished ground level grade for each component of motion, satisfying the Interim Staff Guidance DC/COL-ISG-017 and the NEI developed white paper (Reference 3.7.1-206). The RB/FB and CB enhanced horizontal SCOR FIRS values are provided in Table 3.7.1-210 and Table 3.7.1-211, respectively.

The vertical SCOR FIRS was also enhanced in the identified frequency ranges. Figure 3.7.1-232 and Figure 3.7.1-233 show the vertical SCOR FIRS and the vertical enhanced SCOR FIRS for the RB/FB and CB, respectively. Also shown on Figure 3.7.1-232 and Figure 3.7.1-233 are the vertical ESBWR CSDRS (Reference 2.5.2-291). The enhanced vertical SCOR FIRS for the RB/FB and CB are enveloped by the vertical ESBWR CSDRS. Vertical component time histories matched to the enhanced SCOR FIRS were then convolved from the foundation level up to the finished ground level grade using the full soil column LB, BE, and UB subsurface profiles for comparison to the PBSRS at the finished ground level grade. Figure 3.7.1-234 to Figure 3.7.1-235 show the comparison of the PBSRS at the finished ground level grade with the envelope of the surface response spectra obtained from SHAKE analyses using the LB, BE, and UB full soil column profiles and the matched time histories compatible with the RB/FB and CB enhanced SCOR FIRS. The envelope of the three response spectra at the ground surface exceeds the PBSRS at the finished ground level grade for each component of motion, satisfying the Interim Staff Guidance DC/COL-ISG-017 and the NEI developed white paper (Reference 3.7.1-206). The RB/FB and CB enhanced vertical SCOR FIRS values are provided in Table 3.7.1-210 and Table 3.7.1-211, respectively.

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PGA for RB/FB and CB horizontal SSI FIRS are higher than the 0.1 g requirement of SRP 3.7.1 Section II (Acceptance Criteria), Revision 3.

EF3 SUP 3.7-2

3.7.1.1.5 Site-Specific Design Ground Motion Time History

Two sets of three orthogonal time histories (two horizontal and one vertical component) were generated to match the horizontal and vertical SSI FIRS (Subsection 3.7.1.1.4.6) for the RB/FB and CB, respectively, in accordance with the criteria of NUREG/CR-6728 (Reference 2.5.2-270). The selected seed time history is the 1999 Chi-Chi Taiwan Earthquake, ~~KAU078 station~~ [TAP078 recording], chosen from the CEUS record library provided in NUREG/CR-6728 (Reference 2.5.2-270). This time history represents a distant recording of a large magnitude (moment magnitude 7.6) earthquake, consistent with the large contribution of the New Madrid source to the hazard at the Fermi 3 site. Details of this record are provided in Table 3.7.1-~~211~~ [213].

A single set of time histories (two horizontal and one vertical component) was developed for both the RB/FB and CB foundation levels to satisfy the enveloping requirements of Option 1, Approach 2 of SRP 3.7.1 Section II (Acceptance Criteria), Revision 3. Per paragraph 2(d) of Approach 2, in lieu of the power spectrum density requirement, the requirement that the computed 5 percent damped response spectrum of the time history does not exceed the target response spectrum at any frequency by more than 30 percent was met [at frequencies between 0.1 and 50 Hz. A few frequencies above 50 Hz do exceed the target spectrum by more than 30 percent; however, a check of the power spectral density for frequencies above 50 Hz is not required for CEUS sites by Appendix B of SRP 3.7.1.]. Table 3.7.1-~~212~~ [214] and Table 3.7.1-~~213~~ [215] present the correlation coefficients between each combination of time history components (two horizontal and one vertical). The correlation coefficients all fall below the ~~recommended~~ criteria of [0.16 in SRP 3.7.1 Section II (Acceptance Criteria), Revision 3.] ~~0.3 given in NUREG/CR-6728 (Reference 2.5.2-270). This criterion was used in place of the SRP criterion of 0.16 based on the following statements in NUREG/CR-6728 (Reference 2.5.2-270):~~

> ~~"Directional correlation coefficients between pairs of records are typically required to be relatively low to ensure that a structure or structural element cannot be oriented in an analysis in such a manner so as to minimize some important directional response quantity of interest. However, if the limiting value is made too low, a significant number of empirical recordings in any earthquake bin may unnecessarily be eliminated from further consideration as a seed for generating design ground motions. Since the response quantity is a~~

Insert 4

Appendix S of 10 CFR Part 50 requires that safety related structures be designed for a minimum PGA of 0.1g. SRP 3.7.1 further indicates that the minimum ground motion level represents a suitable smooth broad-banded response spectral shape scaled to the minimum PGA of 0.1g. As discussed in NUREG/CR-6926 (Reference 3.7.1-209), the process used to develop the site-specific ground motions for the Fermi 3 site produces a broad-band response spectrum without valleys at localized frequencies. As shown in FSAR Table 2.5.2-219, the GMRS and associated FIRS represent the contributions of ground motion from a wide range of magnitudes. Because the PGA values for the site-specific SSI FIRS exceed 0.1g, these spectra meet the requirements of the minimum ground motions specified in Appendix S of 10 CFR Part 50 and SRP 3.7.1.

The above conclusion is supported by comparing the SSI FIRS to appropriate site-independent spectral shapes scaled to the minimum PGA of 0.1g. The RB/FB and CB are to be founded on relatively hard rock. The median rock spectral shape defined in NUREG/CR-0098 (Reference 3.7.1-210) has been used in NUREG-1407 (Reference 3.7.1-211) to specify ground motions for safety evaluations of CEUS nuclear power plants. Figure 3.7.1-259 shows that the SSI FIRS envelop the median rock site spectral shape from NUREG/CR-0098 (Reference 3.7.1-210) scaled to 0.1g PGA. Alternatively, as discussed in NUREG/CR-6926 (Reference 3.7.1-209), NUREG/CR-6728 (Reference 2.5.2-255) developed appropriate spectral shapes for ground motions on CEUS rock sites. The CEUS rock site spectral relationships presented in NUREG/CR-6728 were used to develop rock spectral shapes for the DEs presented in FSAR Table 2.5.2-219. A single enveloping spectral shape was constructed. Figure 3.7.1-259 shows that the SSI FIRS also envelop this spectral shape scaled to the minimum PGA of 0.1g.

> ~~function of the structural characteristics and not of the empirical bin data sets, it is recommended that the upper limit for the zero-lag cross-correlation coefficient between any two design ground motions be 0.3. For correlation coefficients less than this limit, no significant reduction in response will be attained by orientation of the structure."~~
>
> ~~"The current NRC staff position limits the correlation between component pairs of artificial acceleration records of a three component enveloping set to a value of 0.16 or less. This is based on some early limited computational results generated by Chen (1975). More complete evaluations were generated by Hadjian (1978, 1981) who included the effect of recorder orientation to estimate maximum values of correlations for a somewhat larger data set. The results of this computation indicated maximum values of acceleration correlation coefficients of 0.32. The data summary of Tables 5-4 and 5-5 do not include the effect of recorder orientation. As mentioned in Section 5.3, a value of 0.3 is recommended for the acceptance criteria."~~

Spectral matching was performed using the time-domain spectral matching procedure proposed by Lilhanand and Tseng (Reference 3.7.1-204) and later modified by Abrahamson (Reference 3.7.1-205). Figure 3.7.1-~~234~~ 242 through Figure 3.7.1-~~239~~ 247 show the comparison of the response spectrum in the two horizontal and one vertical direction for the following:

- The SSI FIRS.
- 1.3 times (30 percent greater) the SSI FIRS.
- 0.9 times (10 percent less) the SSI FIRS at the RB/FB and CB levels.
- Response spectrum for the spectrally matched time history

The response spectra for the spectrally-matched time histories were calculated for comparison with the SSI FIRS at 301 spectral frequency points (or 100 frequencies per ~~spectral~~ frequency decade). As shown in Figure 3.7.1-~~234~~ 242 through Figure 3.7.1-~~239~~ 247, the 5 percent damped response spectra of the spectrally-matched time histories are within the range of 0.9 to 1.3 times the SSI FIRS at any frequency. Therefore, the criteria of Option 1, Approach 2 of SRP 3.7.1 Section II (Acceptance Criteria), Revision 3, are satisfied.

The time step and duration of the matched time histories are 0.005 seconds and 80 seconds, respectively. The duration of the time histories for Arias Intensity to rise from 5 percent to 75 percent is greater than the minimum 6 second duration identified in SRP 3.7.1, Section II (Acceptance Criteria), Revision 3, and consistent with the characteristic earthquake duration of NUREG/CR-6728 (Reference 2.5.2-270). Details of the matched time histories including the PGA, peak ground velocity (PGV), and peak ground displacement (PGD) are presented in Table 3.7.1-~~214~~ [216]. Figure 3.7.1-~~240~~ [248] to Figure 3.7.1-~~245~~ [253] present the matched time histories (outcropping motions) compatible with the RB/FB and CB SSI FIRS at the foundation levels. The duration, and the values of PGV/PGA and PGA*PGD/PGV^2 are generally consistent with the characteristic values reported in NUREG/CR-6728 (Reference 2.5.2-270). The hard rock UHRS for the Fermi 3 site represents a combination of hazard from large, distant earthquakes and smaller, closer earthquakes. Thus, it is expected that the PGV/PGA values would be lower than those for large, distant earthquakes as the PGA is enriched to represent smaller magnitude, closer earthquakes. Spectral matching of the time histories to response spectra extended to a period of 10 seconds also enriches the PGD values, leading to an increase in the values of PGA*PGD/PGV^2.

In accordance with Interim Staff Guidance DC/COL-ISG-017 and the NEI developed white paper (Reference 3.7.1-206), the spectrally-matched time histories compatible with the RB/FB and CB SSI FIRS were then input as outcropping motions at the foundation level into the three deterministic LB, BE, and UB SSI profiles shown on Figure 3.7.1-~~252~~ [258] (see Subsection 3.7.1.3) to compute the resulting in-column motions at the RB/FB and CB foundation levels using the program SHAKE (Reference 2.5.2-282). A total of 18 SHAKE analyses were performed using combinations of the three SSI profiles (LB, BE, UB), the three time history components (two horizontal [H1, H2] and one vertical [V] components) and the two foundation levels (RB/FB and CB). The SHAKE analyses were performed using SSI profiles shown on Figure 3.7.1-~~252~~ [258] (see Subsection 3.7.1.3) without iteration of soil properties to generate in-column motions at the foundation levels for input into the SASSI2000 computer program for the Fermi 3 sitespecific SSI analysis.

Interim Staff Guidance DC/COL-ISG-017 and the NEI developed white paper (Reference 3.7.1-206) state that time histories matched to the outcrop FIRS should be convolved from the foundation level up to the finished ground level grade using the full soil column LB, BE, and UB subsurface profiles, and that the resulting envelope of the three surface spectra from the time histories should envelop the PBSRS at the finished ground level grade. This comparison was made by matching the seed time history using the methods discussed in this section to the SCOR FIRS presented in Subsection 3.7.1.1.4.5. The matched time histories compatible with the SCOR FIRS were then input into the three deterministic soil column profiles (LB, BE, and UB) for the full soil column, shown on Figure 3.7.1-225, and convolved to the PBSRS level at finished ground level grade with SHAKE analyses. Figure 3.7.1-249 to Figure 3.7.1-251 show the comparison of the PBSRS at the finished ground level grade with the surface response spectra obtained from SHAKE analyses using the LB, BE, and UB full soil column profiles and the matched time histories compatible with the RB/FB and CB SCOR FIRS. The envelope of the three response spectra at the ground surface exceeds the PBSRS at the finished ground level grade for each component of motion, satisfying the requirement specified in Interim Staff Guidance DC/COL-ISG-017 and the NEI developed white paper (Reference 3.7.1-206).

The SSI FIRS is the envelop of the TSCR FIRS and the SCOR FIRS, resulting in spectral accelerations larger than or equal to the SCOR FIRS. Therefore, based on the comparison with the SCOR FIRS, the same comparison using the SSI FIRS would envelop the PBSRS at the finished ground level grade with a greater margin.

3.7.1.2 Percentage of Critical Damping Values

Add the following at the end of Subsection 3.7.1.2.

Table 3.7.1-215 through Table 3.7.1-217 provide the damping ratio for subsurface material properties used in Fermi 3 site-specific SSI analyses for the RB/FB and CB.

3.7.1.3 Supporting Media for Seismic Category I Structures

Add the following at the end of the first paragraph.

EF3 SUP 3.7-3 Subsection 2.5.4 provides site-specific properties of subsurface materials.

Insert 3

Both documents address cases where the SSI analyses consider surface structures, embedded structures modeled as surface structure, and fully embedded structures. The Fermi 3 SSI analyses consider partial embedment in the Bass Islands Group bedrock with the backfill above the bedrock removed. To make the comparison with the PBSRS at the finished ground level grade for the partially embedded case, the matched time histories compatible with the SSI FIRS were input into the three deterministic soil column profiles (LB, BE, and UB) for the SSI soil column, shown on Figure 3.7.1-258 (see Subsection 3.7.1.3), and convolved to the top of the in situ bedrock with SHAKE analyses. The freefield surface motions at the top of the in situ bedrock were then input as outcrop motions at the base of the engineered granular backfill (Elevation 552 NAVD 88) into the corresponding deterministic soil column profiles (LB, BE, and UB) for the full soil column, shown on Figure 3.7.1-225, and convolved to the PBSRS level at finished ground level grade with SHAKE analyses. This two step method results in the matched time histories compatible with the SSI FIRS being convolved from the foundation level to the PBSRS level at finished ground level grade for direct comparison of the two spectra. As previously stated, the SSI FIRS was developed by enveloping the TSCR FIRS and the enhanced SCOR FIRS, which are both compliant with the procedures outlined in Interim Staff Guidance DC/COL-ISG-017 and the NEI developed white paper, to capture the maximum site response effect from the full and truncated subsurface profiles.

Subsection 2.5.4 provides engineering properties of subsurface materials at the Fermi 3 site. The design groundwater elevation assumed for development of the LB, BE, and UB subsurface profiles is provided in Subsection 3.7.1.1.4.1.1. Table 3.7.1-~~216~~ 217 through Table 3.7.1-~~217~~ 219 provide the strain compatible dynamic engineering properties of subsurface material for the LB, BE, and UB subsurface profiles, respectively, used for the Fermi 3 site-specific SSI analyses for the RB/FB and CB. The three profiles are identical to the full soil column profiles developed in Subsection 3.7.1.1.4.4.3 with the approximately 11.2 m (37 ft) engineered granular fill material removed above the top of the Bass Islands Group bedrock. Figure 3.7.1-~~252~~ 258 shows the LB, BE, and UB subsurface shear wave velocity profiles for the Fermi 3 site-specific SSI analysis.

~~A 0.1 m (0.3 ft) difference~~ A difference about 0.1 m (0.4 ft) is observed between the elevation of the closest layer boundary to the RB/FB and CB foundation levels (Elevation ~~523.4~~ 524.0 ft and ~~540.1~~ 540.0 ft NAVD 88) and the actual elevation of the RB/FB and CB foundations (Elevation 523.7 ft and 540.4 ft NAVD 88). This difference is due to randomization of the dynamic properties in Subsection 3.7.1.1.4.1.1.3 which included randomization of the layer elevations. This difference is negligible and, therefore, the bottom of the RB/FB and CB foundation levels are set at Elevation ~~523.4~~ 524.0 and ~~540.1~~ 540.0 ft NAVD 88, respectively, for the Fermi 3 site-specific SSI analyses.

3.7.1.4 References

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Table 3.7.1-201 Full Soil Column Site Response Analysis Profile: Lower Range [EF3 SUP 3.7-1]

Layer Number	Thickness (ft.)	Shear wave Velocity (fps)	Unit Weight (kips/ft.^{3})	Material Curves	Soil/Rock Type
Finished Ground Level Grade, Top of Profile Elevation ~~589.0 ft~~. ← 589 ft					
1	2.9	418	0.119	EPRI 0 – 20 feet	Backfill
2	2.9	550	0.119	EPRI 0 – 20 feet	Backfill
3	4.2	638	0.119	EPRI 0 – 20 feet	Backfill
4	3.2	702	0.119	EPRI 0 – 20 feet	Backfill
5	2.5	733	0.119	EPRI 0 – 20 feet	Backfill
6	4.3	754	0.119	EPRI 0 – 20 feet	Backfill
7	5.0	780	0.119	EPRI 20 – 50 feet	Backfill
8	5.0	805	0.119	EPRI 20 – 50 feet	Backfill
9	7.0	834	0.119	EPRI 20 – 50 feet	Backfill
10	10.0	6650	0.150	Linear, κ layer 1	Bass Islands
11	10.0	6650	0.150	Linear, κ layer 1	Bass Islands
12	10.0	6650	0.150	Linear, κ layer 1	Bass Islands
13	10.0	6650	0.150	Linear, κ layer 1	Bass Islands
14	11.0	6650	0.150	Linear, κ layer 1	Bass Islands
15	12.0	6650	0.150	Linear, κ layer 1	Bass Islands
16	12.0	6650	0.150	Linear, κ layer 1	Bass Islands
17	15.0	4600	0.150	Linear, κ layer 2	Bass Islands
18	20.0	3350	0.150	Linear, κ layer 3	Salina F
19	20.0	3350	0.150	Linear, κ layer 3	Salina F
20	20.0	3350	0.150	Linear, κ layer 3	Salina F
21	21.0	3350	0.150	Linear, κ layer 3	Salina F
22	21.0	4050	0.150	Linear, κ layer 3	Salina F
23	21.0	4050	0.150	Linear, κ layer 3	Salina F
24	10.0	5600	0.150	Linear, κ layer 4	Salina E
25	20.0	9450	0.150	Linear, κ layer 4	Salina E
26	21.0	9450	0.150	Linear, κ layer 4	Salina E
27	21.0	9450	0.150	Linear, κ layer 4	Salina E
28	21.0	9450	0.150	Linear, κ layer 4	Salina E
29	45.0	9000	0.160	Linear, κ layer 4	Salina C
30	45.0	9000	0.160	Linear, κ layer 4	Salina C
Halfspace		9300	0.169	0.1% Damping	Salina B

Table 3.7.1-202 Full Soil Column Site Response Analysis Profile: Intermediate Range [EF3 SUP 3.7-1]

Layer Number	Thickness (ft.)	Shear wave Velocity (fps)	Unit Weight (kips/ft.^{3})	Material Curves	Soil/Rock Type
Finished Ground Level Grade, Top of Profile Elevation ~~589.3 ft~~. ← 589 ft					
1	2.9	549	0.133	EPRI 0 – 20 feet	Backfill
2	2.9	613	0.133	EPRI 0 – 20 feet	Backfill
3	4.2	690	0.133	EPRI 0 – 20 feet	Backfill
4	3.2	760	0.133	EPRI 0 – 20 feet	Backfill
5	2.5	794	0.133	EPRI 0 – 20 feet	Backfill
6	4.3	819	0.133	EPRI 0 – 20 feet	Backfill
7	5.0	850	0.133	EPRI 20 – 50 feet	Backfill
8	5.0	879	0.133	EPRI 20 – 50 feet	Backfill
9	7.0	913	0.133	EPRI 20 – 50 feet	Backfill
10	10.0	6650	0.150	Linear, κ layer 1	Bass Islands
11	10.0	6650	0.150	Linear, κ layer 1	Bass Islands
12	10.0	6650	0.150	Linear, κ layer 1	Bass Islands
13	10.0	6650	0.150	Linear, κ layer 1	Bass Islands
14	11.0	6650	0.150	Linear, κ layer 1	Bass Islands
15	12.0	6650	0.150	Linear, κ layer 1	Bass Islands
16	12.0	6650	0.150	Linear, κ layer 1	Bass Islands
17	15.0	4600	0.150	Linear, κ layer 2	Bass Islands
18	20.0	3350	0.150	Linear, κ layer 3	Salina F
19	20.0	3350	0.150	Linear, κ layer 3	Salina F
20	20.0	3350	0.150	Linear, κ layer 3	Salina F
21	21.0	3350	0.150	Linear, κ layer 3	Salina F
22	21.0	4050	0.150	Linear, κ layer 3	Salina F
23	21.0	4050	0.150	Linear, κ layer 3	Salina F
24	10.0	5600	0.150	Linear, κ layer 4	Salina E
25	20.0	9450	0.150	Linear, κ layer 4	Salina E
26	21.0	9450	0.150	Linear, κ layer 4	Salina E
27	21.0	9450	0.150	Linear, κ layer 4	Salina E
28	21.0	9450	0.150	Linear, κ layer 4	Salina E
29	45.0	9000	0.160	Linear, κ layer 4	Salina C
30	45.0	9000	0.160	Linear, κ layer 4	Salina C
Halfspace		9300	0.169	0.1% Damping	Salina B

Table 3.7.1-203 Full Soil Column Site Response Analysis Profile: Upper Range [EF3 SUP 3.7-1]

Layer Number	Thickness (ft.)	Shear wave Velocity (fps)	Unit Weight (kips/ft.^{3})	Material Curves	Soil/Rock Type
Finished Ground Level Grade, Top of Profile Elevation ~~589.0 ft~~. → 589 ft					
1	2.9	670	0.146	EPRI 0 – 20 feet	Backfill
2	2.9	722	0.146	EPRI 0 – 20 feet	Backfill
3	4.2	773	0.146	EPRI 0 – 20 feet	Backfill
4	3.2	818	0.146	EPRI 0 – 20 feet	Backfill
5	2.5	842	0.146	EPRI 0 – 20 feet	Backfill
6	4.3	867	0.146	EPRI 0 – 20 feet	Backfill
7	5.0	901	0.146	EPRI 20 – 50 feet	Backfill
8	5.0	934	0.146	EPRI 20 – 50 feet	Backfill
9	7.0	972	0.146	EPRI 20 – 50 feet	Backfill
10	10.0	6650	0.150	Linear, κ layer 1	Bass Islands
11	10.0	6650	0.150	Linear, κ layer 1	Bass Islands
12	10.0	6650	0.150	Linear, κ layer 1	Bass Islands
13	10.0	6650	0.150	Linear, κ layer 1	Bass Islands
14	11.0	6650	0.150	Linear, κ layer 1	Bass Islands
15	12.0	6650	0.150	Linear, κ layer 1	Bass Islands
16	12.0	6650	0.150	Linear, κ layer 1	Bass Islands
17	15.0	4600	0.150	Linear, κ layer 2	Bass Islands
18	20.0	3350	0.150	Linear, κ layer 3	Salina F
19	20.0	3350	0.150	Linear, κ layer 3	Salina F
20	20.0	3350	0.150	Linear, κ layer 3	Salina F
21	21.0	3350	0.150	Linear, κ layer 3	Salina F
22	21.0	4050	0.150	Linear, κ layer 3	Salina F
23	21.0	4050	0.150	Linear, κ layer 3	Salina F
24	10.0	5600	0.150	Linear, κ layer 4	Salina E
25	20.0	9450	0.150	Linear, κ layer 4	Salina E
26	21.0	9450	0.150	Linear, κ layer 4	Salina E
27	21.0	9450	0.150	Linear, κ layer 4	Salina E
28	21.0	9450	0.150	Linear, κ layer 4	Salina E
29	45.0	9000	0.160	Linear, κ layer 4	Salina C
30	45.0	9000	0.160	Linear, κ layer 4	Salina C
Halfspace		9300	0.169	0.1% Damping	Salina B

Table 3.7.1-205 Full Soil Column Deterministic Profile: Best Estimate [EF3 SUP 3.7-1]

Replace with new Table 3.7.1-205

Layer	Thickness (ft.)	Total Depth (ft)	Unit Weight (pcf)	Shear Wave Velocity (ft/sec)	Damping Ratio (%)	Compression Wave Velocity (ft/sec)	Elevation of Layer Base (ft)
1	2.9	2.9	132.5	557	2.73	1028	586
2	2.9	5.8	132.5	588	4.19	1148	583
3	4.2	10	132.5	622	5.09	1291	579
4	3.2	13.2	132.5	663	5.49	1422	576
5	2.5	15.7	132.5	680	5.87	5000	573
6	4.3	20	132.5	702	6.08	5000	569
7	5	25	132.5	750	4.39	5000	564
8	5	30	132.5	772	4.54	5000	559
9	7	37	132.5	795	4.56	5000	552
10	9.9	46.9	150.0	6689	0.95	13202	542
11	2	48.9	150.0	6592	0.95	13202	540
12	8	56.9	150.0	6592	0.95	13202	532
13	8	64.9	150.0	6745	0.95	13202	524
14	2	66.9	150.0	6745	0.95	13202	522
15	10.2	77.1	150.0	6825	0.95	13202	512
16	11.1	88.2	150.0	6790	0.95	13202	501
17	11.9	100.1	[illegible]	[illegible]	[illegible]	13202	489
18	11.7	111.8	150.0	6609	0.95	13202	477
19	15	126.8	150.0	4752	1.37	9835	462
20	20	146.8	150.0	3309	1.91	7889	442
21	19.9	166.7	150.0	3252	1.91	7889	422
22	19.9	186.6	150.0	3235	1.91	7889	402
23	21.2	207.8	150.0	3218	1.91	7889	381
24	21.1	228.9	150.0	4072	1.91	9537	360
25	21.1	250	150.0	4132	1.91	9537	339
26	9.8	259.8	150.0	5650	0.73	10477	329
27	19.7	279.5	150.0	9523	0.73	17679	310
28	21	300.5	150.0	9439	0.73	17679	289
29	20.5	321	150.0	9525	0.73	17679	268
30	22.1	343.1	150.0	9491	0.73	17679	246
31	45	388.1	160.0	8943	0.73	16282	201
32	44.6	432.7	160.0	9049	0.73	16282	156
33	Half Space	432.7	169.0	9494	0.10	17100	

New Table 3.7.1-205

Table 3.7.1-205 Full Soil Column Deterministic Profile: Best Estimate

Layer	Thickness (ft)	Total Depth (ft)	Unit Weight (pcf)	Shear Wave Velocity (ft/sec)	Damping Ratio (%)	Compression Wave Velocity (ft/sec)	Elevation of Layer Base (ft)
1	2.9	2.9	132.5	557	2.73	1028	586.1
2	2.9	5.8	132.5	588	4.19	1148	583.2
3	4.2	10.0	132.5	622	5.09	1291	579.0
4	3.2	13.2	132.5	663	5.49	1422	575.8
5	2.6	15.8	132.5	680	5.87	5000	573.2
6	4.3	20.1	132.5	702	6.08	5000	568.9
7	5.0	25.1	132.5	750	4.39	5000	563.9
8	4.9	30.0	132.5	772	4.54	5000	559.0
9	7.0	37.0	132.5	795	4.56	5000	552.0
10	10.0	47.0	150	6689	0.95	13202	542.0
11	2.0	49.0	150	6592	0.95	13202	540.0
12	8.0	57.0	150	6592	0.95	13202	532.0
13	8.0	65.0	150	6745	0.95	13202	524.0
14	2.0	67.0	150	6745	0.95	13202	522.0
15	10.2	77.2	150	6825	0.95	13202	511.8
16	11.0	88.2	150	6790	0.95	13202	500.8
17	11.9	100.1	150	6853	0.95	13202	488.9
18	11.7	111.8	150	6609	0.95	13202	477.2
19	15.0	126.8	150	4752	1.37	9835	462.2
20	20.0	146.8	150	3309	1.91	7889	442.2
21	19.9	166.7	150	3252	1.91	7889	422.3
22	19.9	186.6	150	3235	1.91	7889	402.4
23	21.3	207.9	150	3218	1.91	7889	381.1
24	21.1	229.0	150	4072	1.91	9537	360.0
25	21.1	250.1	150	4132	1.91	9537	338.9
26	9.9	260.0	150	5650	0.73	10477	329.0
27	19.7	279.7	150	9523	0.73	17679	309.3
28	21.0	300.7	150	9439	0.73	17679	288.3
29	20.5	321.2	150	9525	0.73	17679	267.8
30	22.1	343.3	150	9491	0.73	17679	245.7
31	45.0	388.3	160	8943	0.73	16282	200.7
32	44.6	432.9	160	9049	0.73	16282	156.1
33	Half Space		169	9494	0.10	17100	

Table 3.7.1-206 Full Soil Column Deterministic Profile: Lower Bound [EF3 SUP 3.7-1]

Replace with new Table 3.7.1-206

Layer	Thickness (ft.)	Total Depth (ft)	Unit Weight (pcf)	Shear Wave Velocity (ft/sec)	Damping Ratio (%)	Compression Wave Velocity (ft/sec)	Elevation of Layer Base (ft)
1	2.9	2.9	119	408	4.07	781	586
2	2.9	5.8	119	426	6.55	1028	583
3	4.2	10	119	432	7.84	1193	579
4	3.2	13.2	119	485	8.23	1314	576
5	2.5	15.7	119	501	8.5	5000	573
6	4.3	20	119	513	8.65	5000	569
7	5	25	119	574	6.45	5000	564
8	5	30	119	610	6.59	5000	559
9	7	37	119	608	6.9	5000	552
10	9.9	46.9	150	5666	1.51	10779	542
11	2	48.9	150	5780	1.51	10779	540
12	8	56.9	150	5780	1.51	10779	532
13	8	64.9	150	5761	1.51	10779	524
14	2	66.9	150	5761	1.51	10779	522
15	10.2	77.1	150	5766	1.51	10779	512
16	11.1	88.2	150	5659	1.51	10779	501
17	11.9	100.1	[illegible]	[illegible]	[illegible]	10779	489
18	11.7	111.8	150	5609	1.51	10779	477
19	15	126.8	150	4003	2.18	8030	462
20	20	146.8	150	2616	2.88	6441	442
21	19.9	166.7	150	2529	2.88	6441	422
22	19.9	186.6	150	2611	2.88	6441	402
23	21.2	207.8	150	2478	2.88	6441	381
24	21.1	228.9	150	3111	2.88	7787	360
25	21.1	250	150	3189	2.88	7787	339
26	9.8	259.8	150	4998	1.12	8554	329
27	19.7	279.5	150	8501	1.12	14435	310
28	21	300.5	150	8628	1.12	14435	289
29	20.5	321	150	8542	1.12	14435	268
30	22.1	343.1	150	8516	1.12	14435	246
31	45	388.1	160	8156	1.12	13294	201
32	44.6	432.7	160	8202	1.12	13294	156
33	Half Space	432.7	169	8490	0.1	13962	

New Table 3.7.1-206

Table 3.7.1-206 Full Soil Column Deterministic Profile: Lower Bound

Layer	Thickness (ft)	Total Depth (ft)	Unit Weight (pcf)	Shear Wave Velocity (ft/sec)	Damping Ratio (%)	Compression Wave Velocity (ft/sec)	Elevation of Layer Base (ft)
1	2.9	2.9	119	408	4.07	781	586.1
2	2.9	5.8	119	426	6.55	937	583.2
3	4.2	10.0	119	432	7.84	1054	579.0
4	3.2	13.2	119	485	8.23	1161	575.8
5	2.6	15.8	119	501	8.50	5000	573.2
6	4.3	20.1	119	513	8.65	5000	568.9
7	5.0	25.1	119	574	6.45	5000	563.9
8	4.9	30.0	119	610	6.59	5000	559.0
9	7.0	37.0	119	608	6.90	5000	552.0
10	10.0	47.0	150	5462	1.51	10779	542.0
11	2.0	49.0	150	5383	1.51	10779	540.0
12	8.0	57.0	150	5383	1.51	10779	532.0
13	8.0	65.0	150	5507	1.51	10779	524.0
14	2.0	67.0	150	5507	1.51	10779	522.0
15	10.2	77.2	150	5573	1.51	10779	511.8
16	11.0	88.2	150	5544	1.51	10779	500.8
17	11.9	100.1	150	5596	1.51	10779	488.9
18	11.7	111.8	150	5396	1.51	10779	477.2
19	15.0	126.8	150	3880	2.18	8030	462.2
20	20.0	146.8	150	2616	2.88	6441	442.2
21	19.9	166.7	150	2529	2.88	6441	422.3
22	19.9	186.6	150	2611	2.88	6441	402.4
23	21.3	207.9	150	2478	2.88	6441	381.1
24	21.1	229.0	150	3111	2.88	7787	360.0
25	21.1	250.1	150	3189	2.88	7787	338.9
26	9.9	260.0	150	4613	1.12	8554	329.0
27	19.7	279.7	150	7776	1.12	14435	309.3
28	21.0	300.7	150	7707	1.12	14435	288.3
29	20.5	321.2	150	7777	1.12	14435	267.8
30	22.1	343.3	150	7750	1.12	14435	245.7
31	45.0	388.3	160	7302	1.12	13294	200.7
32	44.6	432.9	160	7388	1.12	13294	156.1
33	Half Space		169	7752	0.1	13962	

Table 3.7.1-207 Full Soil Column Deterministic Profile: Upper Bound [EF3 SUP 3.7-1]

Replace with new Table 3.7.1-207

Layer	Thickness (ft.)	Total Depth (ft)	Unit Weight (pcf)	Shear Wave Velocity (ft/sec)	Damping Ratio (%)	Compression Wave Velocity (ft/sec)	Elevation of Layer Base (ft)
1	2.9	2.9	146	734	1.79	1253	586
2	2.9	5.8	146	751	2.84	1350	583
3	4.2	10	146	816	3.39	1446	579
4	3.2	13.2	146	891	3.48	1530	576
5	2.5	15.7	146	939	3.61	5000	573
6	4.3	20	146	930	3.85	5000	569
7	5	25	146	1021	2.81	5000	564
8	5	30	146	1032	2.86	5000	559
9	7	37	146	1041	2.97	5000	552
10	9.9	46.9	150	8063	0.48	16169	542
11	2	48.9	150	7967	0.48	16169	540
12	8	56.9	150	7967	0.48	16169	532
13	8	64.9	150	8042	0.48	16169	524
14	2	66.9	150	8042	0.48	16169	522
15	10.2	77.1	150	8130	0.48	16169	512
16	11.1	88.2	150	7924	0.48	16169	501
17	11.9	100.1	[illegible]	[illegible]	[illegible]	16169	489
18	11.7	111.8	150	7754	0.48	16169	477
19	15	126.8	150	5439	0.68	12046	462
20	20	146.8	150	4221	0.95	9662	442
21	19.9	166.7	150	4042	0.95	9662	422
22	19.9	186.6	150	4041	0.95	9662	402
23	21.2	207.8	150	4033	0.95	9662	381
24	21.1	228.9	150	4898	0.95	11681	360
25	21.1	250	150	4989	0.95	11681	339
26	9.8	259.8	150	6264	0.36	12831	329
27	19.7	279.5	150	10472	0.36	21653	310
28	21	300.5	150	10596	0.36	21653	289
29	20.5	321	150	10526	0.36	21653	268
30	22.1	343.1	150	10456	0.36	21653	246
31	45	388.1	160	10247	0.36	19941	201
32	44.6	432.7	160	10276	0.36	19941	156
33	Half Space	432.7	169	10476	0.1	20943	

New Table 3.7.1-207

Table 3.7.1-207 Full Soil Column Deterministic Profile: Upper Bound

Layer	Thickness (ft)	Total Depth (ft)	Unit Weight (pcf)	Shear Wave Velocity (ft/sec)	Damping Ratio (%)	Compression Wave Velocity (ft/sec)	Elevation of Layer Base (ft)
1	2.9	2.9	146	734	1.79	1259	586.1
2	2.9	5.8	146	751	2.84	1406	583.2
3	4.2	10.0	146	816	3.39	1581	579.0
4	3.2	13.2	146	891	3.48	1742	575.8
5	2.6	15.8	146	939	3.61	5000	573.2
6	4.3	20.1	146	930	3.85	5000	568.9
7	5.0	25.1	146	1021	2.81	5000	563.9
8	4.9	30.0	146	1032	2.86	5000	559.0
9	7.0	37.0	146	1041	2.97	5000	552.0
10	10.0	47.0	150	8192	0.48	16169	542.0
11	2.0	49.0	150	8074	0.48	16169	540.0
12	8.0	57.0	150	8074	0.48	16169	532.0
13	8.0	65.0	150	8261	0.48	16169	524.0
14	2.0	67.0	150	8261	0.48	16169	522.0
15	10.2	77.2	150	8359	0.48	16169	511.8
16	11.0	88.2	150	8316	0.48	16169	500.8
17	11.9	100.1	150	8393	0.48	16169	488.9
18	11.7	111.8	150	8094	0.48	16169	477.2
19	15.0	126.8	150	5820	0.68	12046	462.2
20	20.0	146.8	150	4221	0.95	9662	442.2
21	19.9	166.7	150	4042	0.95	9662	422.3
22	19.9	186.6	150	4041	0.95	9662	402.4
23	21.3	207.9	150	4033	0.95	9662	381.1
24	21.1	229.0	150	4987	0.95	11681	360.0
25	21.1	250.1	150	5061	0.95	11681	338.9
26	9.9	260.0	150	6920	0.36	12831	329.0
27	19.7	279.7	150	11664	0.36	21653	309.3
28	21.0	300.7	150	11560	0.36	21653	288.3
29	20.5	321.2	150	11666	0.36	21653	267.8
30	22.1	343.3	150	11625	0.36	21653	245.7
31	45.0	388.3	160	10953	0.36	19941	200.7
32	44.6	432.9	160	11082	0.36	19941	156.1
33	Half Space		169	11628	0.1	20943	

Table 3.7.1-209 Horizontal and Vertical CB SCOR FIRS with Associated V/H Ratios (Sheet 3 of 3) [EF3 SUP 3.7-1]

T (sec)	F (Hz)	Horizontal CB FIRS (g)	V/H	Vertical CB FIRS (g)
2.8000	0.3571	0.0448	0.7500	0.0336
3.0000	0.3333	0.0426	0.7500	0.0320
3.2000	0.3125	0.0406	0.7500	0.0305
3.4000	0.2941	0.0389	0.7500	0.0292
3.6000	0.2778	0.0373	0.7500	0.0280
3.8000	0.2632	0.0358	0.7500	0.0269
4.0000	0.2500	0.0345	0.7500	0.0259
4.2000	0.2381	0.0333	0.7500	0.0250
4.4000	0.2273	0.0322	0.7500	0.0241
4.6000	0.2174	0.0312	0.7500	0.0234
4.8000	0.2083	0.0302	0.7500	0.0227
5.0000	0.2000	0.0294	0.7500	0.0220
5.5000	0.1818	0.0274	0.7500	0.0206
6.0000	0.1667	0.0258	0.7500	0.0193
6.5000	0.1538	0.0243	0.7500	0.0182
7.0000	0.1429	0.0231	0.7500	0.0173
7.5000	0.1333	0.0220	0.7500	0.0165
8.0000	0.1250	0.0210	0.7500	0.0157
8.5000	0.1176	0.0201	0.7500	0.0151
9.0000	0.1111	0.0193	0.7500	0.0145
10.0000	0.1000	0.0179	0.7500	0.0134

Insert new Table 3.7.1-210 and Table 3.7.1-211.

New Table 3.7.1-210

Table 3.7.1-210 Enhanced Horizontal and Vertical RB/FB SCOR FIRS (Sheet 1 of 3)

T (sec)	F (Hz)	Horizontal RB/FB FIRS (g)	Vertical RB/FB FIRS (g)
0.0100	100.0000	0.1882	0.1882
0.0166	60.2410	0.3517	0.4000
0.0200	50.0000	0.4174	0.4694
0.0250	40.0000	0.4663	0.4862
0.0300	33.3333	0.4867	0.4709
0.0330	30.3030	0.4894	0.4600
0.0400	25.0000	0.4948	0.4500
0.0420	23.8095	0.4881	0.4497
0.0440	22.7273	0.4817	0.4494
0.0460	21.7391	0.4757	0.4491
0.0480	20.8333	0.4701	0.4489
0.0500	20.0000	0.4647	0.4486
0.0550	18.1818	0.4468	0.4480
0.0600	16.6667	0.4311	0.4475
0.0650	15.3846	0.4126	0.4470
0.0700	14.2857	0.4047	0.4465
0.0750	13.3333	0.3974	0.4461
0.0800	12.5000	0.3906	0.4457
0.0850	11.7647	0.3849	0.4453
0.0900	11.1111	0.3801	0.4450
0.0950	10.5263	0.3756	0.4446
0.1000	10.0000	0.3713	0.4443
0.1100	9.0909	0.3633	0.4437
0.1200	8.3333	0.3561	0.4432
0.1300	7.6923	0.3496	0.4427
0.1400	7.1429	0.3437	0.4423
0.1500	6.6667	0.3383	0.4418
0.1600	6.2500	0.3333	0.4414
0.1700	5.8824	0.3287	0.4411
0.1800	5.5556	0.3244	0.4407
0.1900	5.2632	0.3204	0.4404
0.2000	5.0000	0.3166	0.4401
0.2200	4.5455	0.3106	0.4395

Table 3.7.1-210 Enhanced Horizontal and Vertical RB/FB SCOR FIRS (Sheet 2 of 3)

T (sec)	F (Hz)	Horizontal RB/FB FIRS (g)	Vertical RB/FB FIRS (g)
0.2400	4.1667	0.3064	0.4336
0.2600	3.8462	0.3022	0.4276
0.2800	3.5714	0.2970	0.4203
0.3000	3.3333	0.2947	0.4170
0.3200	3.1250	0.2896	0.4098
0.3400	2.9412	0.2789	0.3767
0.3600	2.7778	0.2674	0.3480
0.3800	2.6316	0.2570	0.3228
0.4000	2.5000	0.2475	0.3006
0.4200	2.3810	0.2387	0.2809
0.4400	2.2727	0.2307	0.2633
0.4600	2.1739	0.2233	0.2476
0.4800	2.0833	0.2164	0.2334
0.5000	2.0000	0.2100	0.2205
0.5500	1.8182	0.1946	0.1932
0.6000	1.6667	0.1815	0.1712
0.6500	1.5385	0.1703	0.1532
0.7000	1.4286	0.1605	0.1382
0.7500	1.3333	0.1519	0.1256
0.8000	1.2500	0.1442	0.1148
0.8500	1.1765	0.1374	0.1055
0.9000	1.1111	0.1313	0.0975
0.9500	1.0526	0.1257	0.0904
1.0000	1.0000	0.1206	0.0842
1.1000	0.9091	0.1118	0.0779
1.2000	0.8333	0.1043	0.0725
1.3000	0.7692	0.0978	0.0679
1.4000	0.7143	0.0922	0.0639
1.5000	0.6667	0.0872	0.0604
1.6000	0.6250	0.0829	0.0572
1.7000	0.5882	0.0789	0.0545
1.8000	0.5556	0.0754	0.0520
1.9000	0.5263	0.0722	0.0497

Table 3.7.1-210 Enhanced Horizontal and Vertical RB/FB SCOR FIRS (Sheet 3 of 3)

T (sec)	F (Hz)	Horizontal RB/FB FIRS (g)	Vertical RB/FB FIRS (g)
2.0000	0.5000	0.0693	0.0477
2.2000	0.4545	0.0643	0.0442
2.4000	0.4167	0.0603	0.0414
2.6000	0.3846	0.0568	0.0390
2.8000	0.3571	0.0538	0.0370
3.0000	0.3333	0.0511	0.0352
3.2000	0.3125	0.0488	0.0335
3.4000	0.2941	0.0466	0.0321
3.6000	0.2778	0.0447	0.0308
3.8000	0.2632	0.0430	0.0296
4.0000	0.2500	0.0414	0.0285
4.2000	0.2381	0.0400	0.0275
4.4000	0.2273	0.0386	0.0266
4.6000	0.2174	0.0374	0.0257
4.8000	0.2083	0.0363	0.0249
5.0000	0.2000	0.0352	0.0242
5.5000	0.1818	0.0329	0.0226
6.0000	0.1667	0.0309	0.0213
6.5000	0.1538	0.0292	0.0201
7.0000	0.1429	0.0277	0.0190
7.5000	0.1333	0.0264	0.0181
8.0000	0.1250	0.0252	0.0173
8.5000	0.1176	0.0241	0.0166
9.0000	0.1111	0.0231	0.0159
10.0000	0.1000	0.0215	0.0147

New Table 3.7.1-211

Table 3.7.1-211 Enhanced Horizontal and Vertical CB SCOR FIRS (Sheet 1 of 3)

T (sec)	F (Hz)	Horizontal CB FIRS (g)	Vertical CB FIRS (g)
0.0100	100.0000	0.1878	0.1878
0.0166	60.2410	0.3511	0.3994
0.0200	50.0000	0.4167	0.4686
0.0250	40.0000	0.4655	0.4854
0.0300	33.3333	0.4859	0.4702
0.0330	30.3030	0.4886	0.4593
0.0400	25.0000	0.4940	0.4500
0.0420	23.8095	0.4869	0.4492
0.0440	22.7273	0.4803	0.4485
0.0460	21.7391	0.4741	0.4478
0.0480	20.8333	0.4682	0.4471
0.0500	20.0000	0.4626	0.4465
0.0550	18.1818	0.4499	0.4450
0.0600	16.6667	0.4385	0.4436
0.0650	15.3846	0.4283	0.4423
0.0700	14.2857	0.4191	0.4412
0.0750	13.3333	0.4107	0.4401
0.0800	12.5000	0.4030	0.4391
0.0850	11.7647	0.3959	0.4382
0.0900	11.1111	0.3893	0.4373
0.0950	10.5263	0.3833	0.4364
0.1000	10.0000	0.3785	0.4356
0.1100	9.0909	0.3695	0.4342
0.1200	8.3333	0.3614	0.4328
0.1300	7.6923	0.3541	0.4316
0.1400	7.1429	0.3475	0.4305
0.1500	6.6667	0.3415	0.4294
0.1600	6.2500	0.3359	0.4285
0.1700	5.8824	0.3308	0.4275
0.1800	5.5556	0.3260	0.4267
0.1900	5.2632	0.3216	0.4259
0.2000	5.0000	0.3174	0.4251
0.2200	4.5455	0.3107	0.4237
0.2400	4.1667	0.3066	0.4181

Table 3.7.1-211 Enhanced Horizontal and Vertical CB SCOR FIRS (Sheet 2 of 3)

T (sec)	F (Hz)	Horizontal CB FIRS (g)	Vertical CB FIRS (g)
0.2600	3.8462	0.3024	0.4124
0.2800	3.5714	0.2972	0.4053
0.3000	3.3333	0.2949	0.4022
0.3200	3.1250	0.2900	0.3955
0.3400	2.9412	0.2793	0.3643
0.3600	2.7778	0.2677	0.3371
0.3800	2.6316	0.2572	0.3132
0.4000	2.5000	0.2477	0.2922
0.4200	2.3810	0.2389	0.2734
0.4400	2.2727	0.2308	0.2567
0.4600	2.1739	0.2233	0.2417
0.4800	2.0833	0.2164	0.2281
0.5000	2.0000	0.2100	0.2158
0.5500	1.8182	0.1946	0.1896
0.6000	1.6667	0.1815	0.1685
0.6500	1.5385	0.1703	0.1512
0.7000	1.4286	0.1605	0.1367
0.7500	1.3333	0.1519	0.1245
0.8000	1.2500	0.1442	0.1141
0.8500	1.1765	0.1374	0.1050
0.9000	1.1111	0.1313	0.0972
0.9500	1.0526	0.1257	0.0903
1.0000	1.0000	0.1206	0.0843
1.1000	0.9091	0.1118	0.0779
1.2000	0.8333	0.1043	0.0725
1.3000	0.7692	0.0978	0.0679
1.4000	0.7143	0.0922	0.0639
1.5000	0.6667	0.0872	0.0604
1.6000	0.6250	0.0829	0.0572
1.7000	0.5882	0.0789	0.0545
1.8000	0.5556	0.0754	0.0520
1.9000	0.5263	0.0722	0.0497
2.0000	0.5000	0.0693	0.0477
2.2000	0.4545	0.0643	0.0442

Table 3.7.1-211 Enhanced Horizontal and Vertical CB SCOR FIRS (Sheet 3 of 3)

T (sec)	F (Hz)	Horizontal CB FIRS (g)	Vertical CB FIRS (g)
2.4000	0.4167	0.0603	0.0414
2.6000	0.3846	0.0568	0.0390
2.8000	0.3571	0.0538	0.0370
3.0000	0.3333	0.0511	0.0352
3.2000	0.3125	0.0488	0.0335
3.4000	0.2941	0.0467	0.0321
3.6000	0.2778	0.0447	0.0308
3.8000	0.2632	0.0430	0.0296
4.0000	0.2500	0.0414	0.0285
4.2000	0.2381	0.0400	0.0275
4.4000	0.2273	0.0386	0.0266
4.6000	0.2174	0.0374	0.0257
4.8000	0.2083	0.0363	0.0249
5.0000	0.2000	0.0352	0.0242
5.5000	0.1818	0.0329	0.0226
6.0000	0.1667	0.0309	0.0213
6.5000	0.1538	0.0292	0.0201
7.0000	0.1429	0.0277	0.0190
7.5000	0.1333	0.0264	0.0181
8.0000	0.1250	0.0252	0.0173
8.5000	0.1176	0.0241	0.0166
9.0000	0.1111	0.0231	0.0159
10.0000	0.1000	0.0215	0.0147

Table 3.7.1-210 Horizontal and Vertical SSI FIRS for RB/FB and CB (Sheet 1 of 3) [EF3 SUP 3.7-1]

Replace with new Table 3.7.1-212

Period (sec)	Frequency (Hz)	Horizontal FIRS for RB/FB (g)	Vertical FIRS for RB/FB (g)	Horizontal FIRS for CB (g)	Vertical FIRS for CB (g)
10	0.10	0.019	0.014	0.019	0.014
9	0.11	0.020	0.015	0.020	0.015
8.5	0.12	0.021	0.016	0.021	0.016
8	0.13	0.022	0.016	0.022	0.016
7.5	0.13	0.023	0.017	0.023	0.017
7	0.14	0.024	0.018	0.024	0.018
6.5	0.15	0.025	0.019	0.025	0.019
6	0.17	0.026	0.020	0.026	0.020
5.5	0.18	0.028	0.021	0.028	0.021
5	0.20	0.029	0.022	0.030	0.022
4.8	0.21	0.030	0.023	0.030	0.023
4.6	0.22	0.031	0.023	0.031	0.023
4.4	0.23	0.032	0.024	0.032	0.024
4.2	0.24	0.033	0.025	0.033	0.025
4	0.25	[illegible]	[illegible]	[illegible]	0.026
3.8	0.26	0.036	0.027	0.036	0.027
3.6	0.28	0.037	0.028	0.037	0.028
3.4	0.29	0.039	0.029	0.039	0.029
3.2	0.31	0.041	0.030	0.041	0.030
3	0.33	0.043	0.032	0.043	0.032
2.8	0.36	0.045	0.034	0.045	0.034
2.6	0.38	0.047	0.035	0.047	0.035
2.4	0.42	0.050	0.038	0.050	0.038
2.2	0.45	0.054	0.040	0.054	0.040
2	0.50	0.058	0.043	0.058	0.043
1.9	0.53	0.059	0.044	0.059	0.044
1.8	0.56	0.062	0.045	0.062	0.045
1.7	0.59	0.065	0.047	0.065	0.047
1.6	0.63	0.068	0.050	0.068	0.050
1.5	0.67	0.073	0.053	0.073	0.053
1.4	0.71	0.077	0.057	0.077	0.057
1.3	0.77	0.082	0.061	0.082	0.061
1.2	0.83	0.089	0.065	0.089	0.065

Table 3.7.1-210 Horizontal and Vertical SSI FIRS for RB/FB and CB (Sheet 2 of 3) [EF3 SUP 3.7-1]

Period (sec)	Frequency (Hz)	Horizontal FIRS for RB/FB (g)	Vertical FIRS for RB/FB (g)	Horizontal FIRS for CB (g)	Vertical FIRS for CB (g)
1.1	0.91	0.096	0.071	0.096	0.071
1	1.00	0.104	0.077	0.104	0.077
0.95	1.05	0.109	0.081	0.109	0.081
0.9	1.11	0.115	0.085	0.115	0.085
0.85	1.18	0.121	0.090	0.121	0.090
0.8	1.25	0.127	0.095	0.127	0.095
0.75	1.33	0.135	0.101	0.135	0.101
0.7	1.43	0.144	0.107	0.144	0.107
0.65	1.54	0.153	0.115	0.154	0.115
0.6	1.67	0.165	0.124	0.165	0.124
0.55	1.82	0.178	0.134	0.178	0.134
0.5	2.00	0.194	0.146	0.194	0.147
0.48	2.08	0.201	0.152	0.202	0.152
0.46	2.17	0.209	0.158	0.209	0.158
0.44	2.27	0.218	0.165	0.218	0.165
0.42	2.38	0.227	0.172	0.227	0.172
0.4	2.50	0.237	0.180	0.237	0.180
0.38	2.63	0.248	0.189	0.249	0.189
0.36	2.78	0.261	0.198	0.261	0.199
0.34	2.94	0.274	0.209	0.275	0.209
0.32	3.13	0.290	0.220	0.290	0.221
0.3	3.33	0.305	0.233	0.304	0.234
0.28	3.57	0.323	0.248	0.320	0.248
0.26	3.85	0.344	0.264	0.338	0.265
0.24	4.17	0.367	0.283	0.359	0.284
0.22	4.55	0.395	0.289	0.383	0.291
0.2	5.00	0.406	0.296	0.386	0.298
0.19	5.26	0.409	0.300	0.389	0.303
0.18	5.56	0.414	0.303	0.391	0.307
0.17	5.88	0.419	0.308	0.395	0.312
0.16	6.25	0.425	0.312	0.400	0.317
0.15	6.67	0.431	0.317	0.405	0.323
0.14	7.14	0.437	0.322	0.410	0.329

Table 3.7.1-210 Horizontal and Vertical SSI FIRS for RB/FB and CB (Sheet 3 of 3) [EF3 SUP 3.7-1]

Period (sec)	Frequency (Hz)	Horizontal FIRS for RB/FB (g)	Vertical FIRS for RB/FB (g)	Horizontal FIRS for CB (g)	Vertical FIRS for CB (g)
0.13	7.69	0.444	0.328	0.417	0.336
0.12	8.33	0.452	0.334	0.423	0.344
0.11	9.09	0.461	0.341	0.431	0.352
0.1	10.00	0.470	0.349	0.439	0.362
0.095	10.53	0.473	0.353	0.441	0.367
0.09	11.11	0.477	0.358	0.444	0.372
0.085	11.76	0.480	0.363	0.447	0.378
0.08	12.50	0.484	0.368	0.450	0.385
0.075	13.33	0.488	0.374	0.453	0.392
0.07	14.29	0.492	0.380	0.456	0.399
0.065	15.38	0.497	0.387	0.465	0.407
0.06	16.67	0.509	0.394	0.468	0.417
0.055	18.18	0.503	0.403	0.472	0.427
0.05	20.00	0.497	0.412	0.477	0.438
0.048	20.83	0.495	0.416	0.479	0.443
0.046	21.74	0.492	0.420	0.481	0.448
0.044	22.73	0.490	0.425	0.483	0.454
0.042	23.81	0.488	0.430	0.487	0.460
0.04	25.00	0.495	0.435	0.494	0.466
0.033	30.30	0.489	0.455	0.498	0.492
0.03	33.33	0.487	0.465	0.503	0.505
0.025	40.00	0.466	0.486	0.509	0.531
0.02	50.00	0.432	0.485	0.441	0.496
0.0166	60.24	0.366	0.416	0.360	0.410
0.01	100.00	0.218(1)	0.218	0.212(2)	0.212

Notes:

(1) Value indicates the peak ground acceleration for RB/FB horizontal SSI FIRS (greater than 0.1 g).

(2) Value indicates the peak ground acceleration for CB horizontal SSI FIRS (greater than 0.1 g).

New Table 3.7.1-212

Table 3.7.1-212 Horizontal and Vertical SSI FIRS for RB/FB and CB (Sheet 1 of 3)

Period (sec)	Frequency (Hz)	Horizontal FIRS for RB/FB (g)	Vertical FIRS for RB/FB (g)	Horizontal FIRS for CB (g)	Vertical FIRS for CB (g)
0.010	100.000	0.2185[(1)]	0.2185	0.2125[(2)]	0.2125
0.017	60.241	0.3656	0.4158	0.3601	0.4096
0.020	50.000	0.4318	0.4855	0.4410	0.4959
0.025	40.000	0.4663	0.4862	0.5093	0.5310
0.030	33.333	0.4867	0.4709	0.5034	0.4871
0.033	30.303	0.4894	0.4600	0.4981	0.4682
0.040	25.000	0.4948	0.4500	0.4940	0.4500
0.042	23.810	0.4881	0.4497	0.4869	0.4492
0.044	22.727	0.4895	0.4494	0.4829	0.4485
0.046	21.739	0.4922	0.4491	0.4808	0.4478
0.048	20.833	0.4948	0.4489	0.4787	0.4471
0.050	20.000	0.4974	0.4486	0.4768	0.4465
0.055	18.182	0.5033	0.4480	0.4724	0.4450
0.060	16.667	0.5088	0.4475	0.4684	0.4436
0.065	15.385	0.4968	0.4470	0.4647	0.4423
0.070	14.286	0.4922	0.4465	0.4563	0.4412
0.075	13.333	0.4879	0.4461	0.4529	0.4401
0.080	12.500	0.4839	0.4457	0.4497	0.4391
0.085	11.765	0.4801	0.4453	0.4468	0.4382
0.090	11.111	0.4766	0.4450	0.4440	0.4373
0.095	10.526	0.4734	0.4446	0.4414	0.4364
0.100	10.000	0.4703	0.4443	0.4389	0.4356
0.110	9.091	0.4606	0.4437	0.4307	0.4342
0.120	8.333	0.4520	0.4432	0.4233	0.4328
0.130	7.692	0.4442	0.4427	0.4166	0.4316
0.140	7.143	0.4371	0.4423	0.4105	0.4305
0.150	6.667	0.4306	0.4418	0.4049	0.4294
0.160	6.250	0.4246	0.4414	0.3997	0.4285
0.170	5.882	0.4190	0.4411	0.3949	0.4275
0.180	5.556	0.4138	0.4407	0.3913	0.4267
0.190	5.263	0.4090	0.4404	0.3888	0.4259
0.200	5.000	0.4062	0.4401	0.3864	0.4251
0.220	4.545	0.3946	0.4395	0.3832	0.4237
0.240	4.167	0.3777	0.4336	0.3781	0.4181
0.260	3.846	0.3524	0.4276	0.3589	0.4124
0.280	3.571	0.3309	0.4203	0.3358	0.4053

Table 3.7.1-212 Horizontal and Vertical SSI FIRS for RB/FB and CB (Sheet 2 of 3)

Period (sec)	Frequency (Hz)	Horizontal FIRS for RB/FB (g)	Vertical FIRS for RB/FB (g)	Horizontal FIRS for CB (g)	Vertical FIRS for CB (g)
0.300	3.333	0.3121	0.4170	0.3155	0.4022
0.320	3.125	0.2955	0.4098	0.2977	0.3955
0.340	2.941	0.2807	0.3767	0.2819	0.3643
0.360	2.778	0.2674	0.3480	0.2677	0.3371
0.380	2.632	0.2570	0.3228	0.2572	0.3132
0.400	2.500	0.2475	0.3006	0.2477	0.2922
0.420	2.381	0.2387	0.2809	0.2389	0.2734
0.440	2.273	0.2307	0.2633	0.2308	0.2567
0.460	2.174	0.2233	0.2476	0.2233	0.2417
0.480	2.083	0.2164	0.2334	0.2164	0.2281
0.500	2.000	0.2100	0.2205	0.2100	0.2158
0.550	1.818	0.1946	0.1932	0.1946	0.1896
0.600	1.667	0.1815	0.1712	0.1815	0.1685
0.650	1.538	0.1703	0.1532	0.1703	0.1512
0.700	1.429	0.1605	0.1382	0.1605	0.1367
0.750	1.333	0.1519	0.1256	0.1519	0.1245
0.800	1.250	0.1442	0.1148	0.1442	0.1141
0.850	1.176	0.1374	0.1055	0.1374	0.1050
0.900	1.111	0.1313	0.0975	0.1313	0.0972
0.950	1.053	0.1257	0.0904	0.1257	0.0903
1.000	1.000	0.1206	0.0842	0.1206	0.0843
1.100	0.909	0.1118	0.0779	0.1118	0.0779
1.200	0.833	0.1043	0.0725	0.1043	0.0725
1.300	0.769	0.0978	0.0679	0.0978	0.0679
1.400	0.714	0.0922	0.0639	0.0922	0.0639
1.500	0.667	0.0872	0.0604	0.0872	0.0604
1.600	0.625	0.0829	0.0572	0.0829	0.0572
1.700	0.588	0.0789	0.0545	0.0789	0.0545
1.800	0.556	0.0754	0.0520	0.0754	0.0520
1.900	0.526	0.0722	0.0497	0.0722	0.0497
2.000	0.500	0.0693	0.0477	0.0693	0.0477
2.200	0.455	0.0643	0.0442	0.0643	0.0442
2.400	0.417	0.0603	0.0414	0.0603	0.0414
2.600	0.385	0.0568	0.0390	0.0568	0.0390
2.800	0.357	0.0538	0.0370	0.0538	0.0370
3.000	0.333	0.0511	0.0352	0.0511	0.0352

Table 3.7.1-212 Horizontal and Vertical SSI FIRS for RB/FB and CB (Sheet 3 of 3)

Period (sec)	Frequency (Hz)	Horizontal FIRS for RB/FB (g)	Vertical FIRS for RB/FB (g)	Horizontal FIRS for CB (g)	Vertical FIRS for CB (g)
3.200	0.313	0.0488	0.0335	0.0488	0.0335
3.400	0.294	0.0466	0.0321	0.0467	0.0321
3.600	0.278	0.0447	0.0308	0.0447	0.0308
3.800	0.263	0.0430	0.0296	0.0430	0.0296
4.000	0.250	0.0414	0.0285	0.0414	0.0285
4.200	0.238	0.0400	0.0275	0.0400	0.0275
4.400	0.227	0.0386	0.0266	0.0386	0.0266
4.600	0.217	0.0374	0.0257	0.0374	0.0257
4.800	0.208	0.0363	0.0249	0.0363	0.0249
5.000	0.200	0.0352	0.0242	0.0352	0.0242
5.500	0.182	0.0329	0.0226	0.0329	0.0226
6.000	0.167	0.0309	0.0213	0.0309	0.0213
6.500	0.154	0.0292	0.0201	0.0292	0.0201
7.000	0.143	0.0277	0.0190	0.0277	0.0190
7.500	0.133	0.0264	0.0181	0.0264	0.0181
8.000	0.125	0.0252	0.0173	0.0252	0.0173
8.500	0.118	0.0241	0.0166	0.0241	0.0166
9.000	0.111	0.0231	0.0159	0.0231	0.0159
10.000	0.100	0.0215	0.0147	0.0215	0.0147

Notes:

(1) Value indicates the peak ground acceleration for RB/FB horizontal SSI FIRS (greater than 0.1 g).

(2) Value indicates the peak ground acceleration for CB horizontal SSI FIRS (greater than 0.1 g).

Table 3.7.1-211 Seed Time History Recording Details [EF3 SUP 3.7-2]

Replace with new Table 3.7.1-213

Earthquake Event	Station	Component	Record Parameters PGA (g)	PGV (cm/s)	PGD (cm)	Duration (sec)
1999 Chi-Chi, Taiwan M 7.6	KAU078 R = 103 km	KAU078-North	0.066	2.2	1.54	30.3
		[illegible] West	[illegible]	3.7	1.05	25.4
		KAU078-Vertical	0.046	4.0	3.45	32.1

Note:

Duration is defined as the time interval between the time history points at which 5% and 75% of the normalized Arias intensity (total energy measure) has been recorded.

New Table 3.7.1-213

Table 3.7.1-213 Seed Time History Recording Details

Earthquake Event	Station	Component	Record Parameters			
			PGA (g)	PGV (cm/s)	PGD (cm)	Duration (sec)
1999 Chi-Chi, Taiwan **M** 7.6	TAP078 R = 131 km	TAP078-North	0.088	13.0	5.55	25.8
		TAP078-West	0.094	10.7	4.98	30.1
		TAP078-Vertical	0.063	8.6	8.3	30.5

Notes:

Duration is defined as the time interval between the time history points at which 5% and 75% of the normalized Arias intensity (total energy measure) has been recorded.

Table 3.7.1-~~212~~ 214 Cross Correlation Coefficients for the Matched Time Histories Corresponding to the SSI FIRS at the RB/FB Level

[EF3 SUP 3.7-2]

Correlated Components	Cross Correlation Coefficient
Horizontal (H1) – Horizontal (H2)	~~-0.28~~ -0.02
Horizontal (H1) – Vertical (V)	~~-0.06~~ 0.02
Horizontal (H2) – Vertical (V)	~~0.16~~ -0.02

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Table 3.7.1-~~213~~ Cross Correlation Coefficients for the Matched Time Histories Corresponding to the SSI FIRS at the CB Level [EF3 SUP 3.7-2]

Correlated Components	Cross Correlation Coefficient
Horizontal (H1) – Horizontal (H2)	-~~0.29~~ -0.01
Horizontal (H1) – Vertical (V)	-~~0.05~~ 0.02
Horizontal (H2) – Vertical (V)	0.~~16~~ -0.02

Table 3.7.1-214 Matched Time History (Outcrop) Parameters [EF3 SUP 3.7-2]

Replace with new Table 3.7.1-216

Response Spectrum	Component	Record Parameters					
		PGA (g)	PGV (cm/s)	PGD (cm)	Duration (sec)	PGV/PGA (cm/s/g)	PGA*PGD/ $(PGV)^2$
RB/FB SSI FIRS	Horizontal 1	0.226	11.2	10.54	30.74	49.56	18.63
	Horizontal 2	0.232	12.7	10.56	26.08	54.74	14.90
	Vertical	0.[illegible]	[illegible]	[illegible]	[illegible]	53.18	13.29
CB SSI FIRS	Horizontal 1	0.224	[illegible]	[illegible]	[illegible]	48.66	19.36
	Horizontal 2	0.219	12.9	10.42	26.50	58.90	13.45
	Vertical	0.216	11.6	8.37	34.21	53.70	13.18

Note:

Duration is defined as the time interval between the time history points at which 5% and 75% of the normalized Arias intensity (total energy measure) has been recorded.

New Table 3.7.1-216

Table 3.7.1-216 Matched Time History (Outcrop) Parameters

Response Spectrum	Component	Record Parameters: PGA (g)	PGV (cm/s)	PGD (cm)	Duration (sec)	PGV/PGA (cm/s/g)	$\frac{PGA*PGD}{(PGV)^2}$
RB/FB SSI FIRS	Horizontal 1	0.23	15.24	11.81	25.44	65.71	11.57
	Horizontal 2	0.22	15.40	11.62	29.47	68.84	10.75
	Vertical	0.22	9.51	10.20	31.66	42.72	24.62
CB SSI FIRS	Horizontal 1	0.23	15.18	11.96	25.41	67.17	11.51
	Horizontal 2	0.21	13.16	11.74	29.68	61.37	14.26
	Vertical	0.22	10.46	9.70	31.33	47.85	19.02

Notes:

Duration is defined as the time interval between the time history points at which 5% and 75% of the normalized Arias intensity (total energy measure) has been recorded.

Table 3.7.1-215 Best Estimate Properties for Fermi 3 SSI Analyses Based on the Soil Column Truncated at the Top of In Situ Bedrock [EF3 SUP 3.7-2]

Replace with new Table 3.7.1-217

Layer	Thickness (ft.)	Unit Weight (pcf)	Shear Wave Velocity (ft/sec)	Damping Ratio (%)	Compression Wave Velocity (ft/sec)	Elevation at Top of Layer (ft)
SSI Profile, Top of Profile Elevation 552.0 ft.						
1	9.9	150.0	6689	0.95	13202	552.0
2	2	150.0	6592	0.95	13202	542.1
3	8	150.0	6592	0.95	13202	540.1
4	8	150.0	6745	0.95	13202	532.1
5	2	150.0	6745	0.95	13202	524.1
6	10.2	150.0	6825	0.95	13202	522.1
7	11.1	150.0	6790	0.95	13202	511.9
8	11.9	150.0	6853	0.95	13202	500.8
9	11.7	150.0	6609	0.95	13202	488.9
10	15	150.0	4752	1.37	9835	477.2
11	20	150.0	3309	1.91	7889	462.2
12	19.9	150.0	3252	1.91	7889	442.2
13	19.9	150.0	3235	1.91	7889	422.3
14	21.2	150 [illegible]	[illegible]	[illegible]	7889	402.4
15	21.1	150.0	4072	1.91	9537	381.2
16	21.1	150.0	4132	1.91	9537	360.1
17	9.8	150.0	5650	0.73	10477	339.0
18	19.7	150.0	9523	0.73	17679	329.2
19	21	150.0	9439	0.73	17679	309.5
20	20.5	150.0	9525	0.73	17679	288.5
21	22.1	150.0	9491	0.73	17679	268.0
22	45	160.0	8943	0.73	16282	245.9
23	44.6	160.0	9049	0.73	16282	200.9
24	Half Space	169.0	9494	0.10	17100	

Notes:
1. The top of in situ (Bass Islands Group) bedrock is at EL. 552.0 ft NAVD 88 (top of layer No.1).
2. The bottom of CB basemat is at EL. 540.1 ft NAVD 88 (top of layer No. 3).
3. The bottom of RB/FB basemat is at EL. 523.4 ft NAVD 88 (within layer No. 5).
4. For SSI analyses presented in Subsection 3.7.2, the following elevation references are used in the SASSI2000 model:
   - EL. -6770 mm is the top of in-situ (Bass Islands Group) bedrock which is equivalent to EL. 552.0 ft NAVD 88.
   - EL. -10400 mm is at the bottom of CB basemat which is equivalent to EL. 540.1 ft NAVD 88.
   - EL. -15500 mm is at the bottom of RB/FB basemat which is equivalent to EL. 523.4 ft NAVD 88.
5. An interface layer is generated within layer No. 5 at EL. 523.4 ft NAVD 88 for SASSI2000 SSI analyses to define the interaction nodes at the bottom of the RB/FB.

New Table 3.7.1-217

Table 3.7.1-217 Best Estimate Properties for Fermi 3 SSI Analyses Based on the Soil Column Truncated at the Top of In Situ Bedrock

Layer	Thickness (ft)	Unit Weight (pcf)	Shear Wave Velocity (ft/sec)	Damping Ratio (%)	Compression Wave Velocity (ft/sec)	Elevation at Top of Layer (ft)
SSI Profile, Top of Profile Elevation 552.0 ft.						
1	10.0	150	6689	0.95	13202	552.0
2	2.0	150	6592	0.95	13202	542.0
3	8.0	150	6592	0.95	13202	540.0
4	8.0	150	6745	0.95	13202	532.0
5	2.0	150	6745	0.95	13202	524.0
6	10.2	150	6825	0.95	13202	522.0
7	11.0	150	6790	0.95	13202	511.8
8	11.9	150	6853	0.95	13202	500.8
9	11.7	150	6609	0.95	13202	488.9
10	15.0	150	4752	1.37	9835	477.2
11	20.0	150	3309	1.91	7889	462.2
12	19.9	150	3252	1.91	7889	442.2
13	19.9	150	3235	1.91	7889	422.3
14	21.3	150	3218	1.91	7889	402.4
15	21.1	150	4072	1.91	9537	381.1
16	21.1	150	4132	1.91	9537	360.0
17	9.9	150	5650	0.73	10477	338.9
18	19.7	150	9523	0.73	17679	329.0
19	21.0	150	9439	0.73	17679	309.3
20	20.5	150	9525	0.73	17679	288.3
21	22.1	150	9491	0.73	17679	267.8
22	45.0	160	8943	0.73	16282	245.7
23	44.6	160	9049	0.73	16282	200.7
24	Half Space	169	9494	0.10	17100	156.1

Notes:

1. The top of in situ (Bass Islands Group) bedrock is at EL. 552 ft NAVD 88 (top of layer No.1).
2. The bottom of CB basemat is at EL. 540 ft NAVD 88 (top of layer No. 3).
3. The bottom of RB/FB basemat is at EL. 524 ft NAVD 88 (top of layer No. 5).
4. For SSI analyses presented in Subsection 3.7.2, the following elevation references are used in the SASSI2000 model:
   - EL. -6770 mm is the top of in-situ (Bass Islands Group) bedrock which is equivalent to EL. 552 ft NAVD 88.
   - EL. -10400 mm is at the bottom of CB basemat which is equivalent to EL. 540 ft NAVD 88.
   - EL. -15500 mm is at the bottom of RB/FB basemat which is equivalent to EL. 524 ft NAVD 88.

Table 3.7.1-216 Lower Bound Properties for Fermi 3 SSI Analyses Based on the Soil Column Truncated at the Top of In Situ Bedrock

[EF3 SUP 3.7-2]

Layer	Thickness (ft.)	Unit Weight (pcf)	Shear Wave Velocity (ft/sec)	Damping Ratio (%)	Compression Wave Velocity (ft/sec)	Elevation at Top of Layer (ft)
SSI Profile, Top of Profile Elevation 552.0 ft.						
1	9.9	150	5666	1.51	10779	552.0
2	2	150	5780	1.51	10779	542.1
3	8	150	5780	1.51	10779	540.1
4	8	150	5761	1.51	10779	532.1
5	2	150	5761	1.51	10779	524.1
6	10.2	150	5766	1.51	10779	522.1
7	11.1	150	5659	1.51	10779	511.9
8	11.9	150	5877	1.51	10779	500.8
9	11.7	150	5609	1.51	10779	488.9
10	15	150	4003	2.18	8030	477.2
11	20	150	2616	2.88	6441	462.2
12	19.9	150	2529	2.88	6441	442.2
13	19.9	150	2611	2.88	6441	422.3
14	21.2	150	[illegible]	[illegible]	6441	402.4
15	21.1	150	3111	2.88	7787	381.2
16	21.1	150	3189	2.88	7787	360.1
17	9.8	150	4998	1.12	8554	339.0
18	19.7	150	8501	1.12	14435	329.2
19	21	150	8628	1.12	14435	309.5
20	20.5	150	8542	1.12	14435	288.5
21	22.1	150	8516	1.12	14435	268.0
22	45	160	8156	1.12	13294	245.9
23	44.6	160	8202	1.12	13294	200.9
24	Half Space	169	8490	0.1	13962	

Replace with new Table 3.7.1-218

Notes:
1. The top of in situ (Bass Islands Group) bedrock is at EL. 552.0 ft NAVD 88 (top of layer No.1).
2. The bottom of CB basemat is at EL. 540.1 ft NAVD 88 (top of layer No. 3).
3. The bottom of RB/FB basemat is at EL. 523.4 ft NAVD 88 (within layer No. 5).
4. For SSI analyses presented in Subsection 3.7.2, the following elevation references are used in the SASSI2000 model:
   - EL. -6770 mm is the top of in-situ (Bass Islands Group) bedrock which is equivalent to EL. 552.0 ft NAVD 88.
   - EL. -10400 mm is at the bottom of CB basemat which is equivalent to EL. 540.1 ft NAVD 88.
   - EL. -15500 mm is at the bottom of RB/FB basemat which is equivalent to EL. 523.4 ft NAVD 88.
5. An interface layer is generated within layer No. 5 at EL. 523.4 ft NAVD 88 for SASSI2000 SSI analyses to define the interaction nodes at the bottom of the RB/FB.

New Table 3.7.1-218

Table 3.7.1-218 Lower Bound Properties for Fermi 3 SSI Analyses Based on the Soil Column Truncated at the Top of In Situ Bedrock

Layer	Thickness (ft)	Unit Weight (pcf)	Shear Wave Velocity (ft/sec)	Damping Ratio (%)	Compression Wave Velocity (ft/sec)	Elevation at Top of Layer (ft)
SSI Profile, Top of Profile Elevation 552.0 ft.						
1	10.0	150	5462	1.51	10779	552.0
2	2.0	150	5383	1.51	10779	542.0
3	8.0	150	5383	1.51	10779	540.0
4	8.0	150	5507	1.51	10779	532.0
5	2.0	150	5507	1.51	10779	524.0
6	10.2	150	5573	1.51	10779	522.0
7	11.0	150	5544	1.51	10779	511.8
8	11.9	150	5596	1.51	10779	500.8
9	11.7	150	5396	1.51	10779	488.9
10	15.0	150	3880	2.18	8030	477.2
11	20.0	150	2616	2.88	6441	462.2
12	19.9	150	2529	2.88	6441	442.2
13	19.9	150	2611	2.88	6441	422.3
14	21.3	150	2478	2.88	6441	402.4
15	21.1	150	3111	2.88	7787	381.1
16	21.1	150	3189	2.88	7787	360.0
17	9.9	150	4613	1.12	8554	338.9
18	19.7	150	7776	1.12	14435	329.0
19	21.0	150	7707	1.12	14435	309.3
20	20.5	150	7777	1.12	14435	288.3
21	22.1	150	7750	1.12	14435	267.8
22	45.0	160	7302	1.12	13294	245.7
23	44.6	160	7388	1.12	13294	200.7
24	Half Space	169	7752	0.1	13962	156.1

Notes:

1. The top of in situ (Bass Islands Group) bedrock is at EL. 552 ft NAVD 88 (top of layer No.1).
2. The bottom of CB basemat is at EL. 540 ft NAVD 88 (top of layer No. 3).
3. The bottom of RB/FB basemat is at EL. 524 ft NAVD 88 (top of layer No. 5).
4. For SSI analyses presented in Subsection 3.7.2, the following elevation references are used in the SASSI2000 model:
   - EL. -6770 mm is the top of in-situ (Bass Islands Group) bedrock which is equivalent to EL. 552 ft NAVD 88.
   - EL. -10400 mm is at the bottom of CB basemat which is equivalent to EL. 540 ft NAVD 88.
   - EL. -15500 mm is at the bottom of RB/FB basemat which is equivalent to EL. 524 ft NAVD 88.

Table 3.7.1-217 Upper Bound Properties for Fermi 3 SSI Analyses Based on the Soil Column Truncated at the Top of In Situ Bedrock

[EF3 SUP 3.7-2]

Layer	Thickness (ft.)	Unit Weight (pcf)	Shear Wave Velocity (ft/sec)	Damping Ratio (%)	Compression Wave Velocity (ft/sec)	Elevation at Top of Layer (ft)
SSI Profile, Top of Profile Elevation 552.0 ft.						
1	9.9	150	8063	0.48	16169	552.0
2	2	150	7967	0.48	16169	542.1
3	8	150	7967	0.48	16169	540.1
4	8	150	8042	0.48	16169	532.1
5	2	150	8042	0.48	16169	524.1
6	10.2	150	8130	0.48	16169	522.1
7	11.1	150	7924	0.48	16169	511.9
8	11.9	150	7928	0.48	16169	500.8
9	11.7	150	7754	0.48	16169	488.9
10	15	150	5439	0.68	12046	477.2
11	20	150	4221	0.95	9662	462.2
12	19.9	150	4042	0.95	9662	442.2
13	19.9	150	[illegible]	[illegible]	9662	422.3
14	21.2	150	[illegible]	[illegible]	9662	402.4
15	21.1	150	4898	0.95	11681	381.2
16	21.1	150	4989	0.95	11681	360.1
17	9.8	150	6264	0.36	12831	339.0
18	19.7	150	10472	0.36	21653	329.2
19	21	150	10596	0.36	21653	309.5
20	20.5	150	10526	0.36	21653	288.5
21	22.1	150	10456	0.36	21653	268.0
22	45	160	10247	0.36	19941	245.9
23	44.6	160	10276	0.36	19941	200.9
24	Half Space	169	10476	0.1	20943	

Replace with new Table 3.7.1-219

Notes:
1. The top of in situ (Bass Islands Group) bedrock is at EL. 552.0 ft NAVD 88 (top of layer No.1).
2. The bottom of CB basemat is at EL. 540.1 ft NAVD 88 (top of layer No. 3).
3. The bottom of RB/FB basemat is at EL. 523.4 ft NAVD 88 (within layer No. 5).
4. For SSI analyses presented in Subsection 3.7.2, the following elevation references are used in the SASSI2000 model:
   - EL. -6770 mm is the top of in-situ (Bass Islands Group) bedrock which is equivalent to EL. 552.0 ft NAVD 88.
   - EL. -10400 mm is at the bottom of CB basemat which is equivalent to EL. 540.1 ft NAVD 88.
   - EL. -15500 mm is at the bottom of RB/FB basemat which is equivalent to EL. 523.4 ft NAVD 88.
5. An interface layer is generated within layer No. 5 at EL. 523.4 ft NAVD 88 for SASSI2000 SSI analyses to define the interaction nodes at the bottom of the RB/FB.

New Table 3.7.1-219

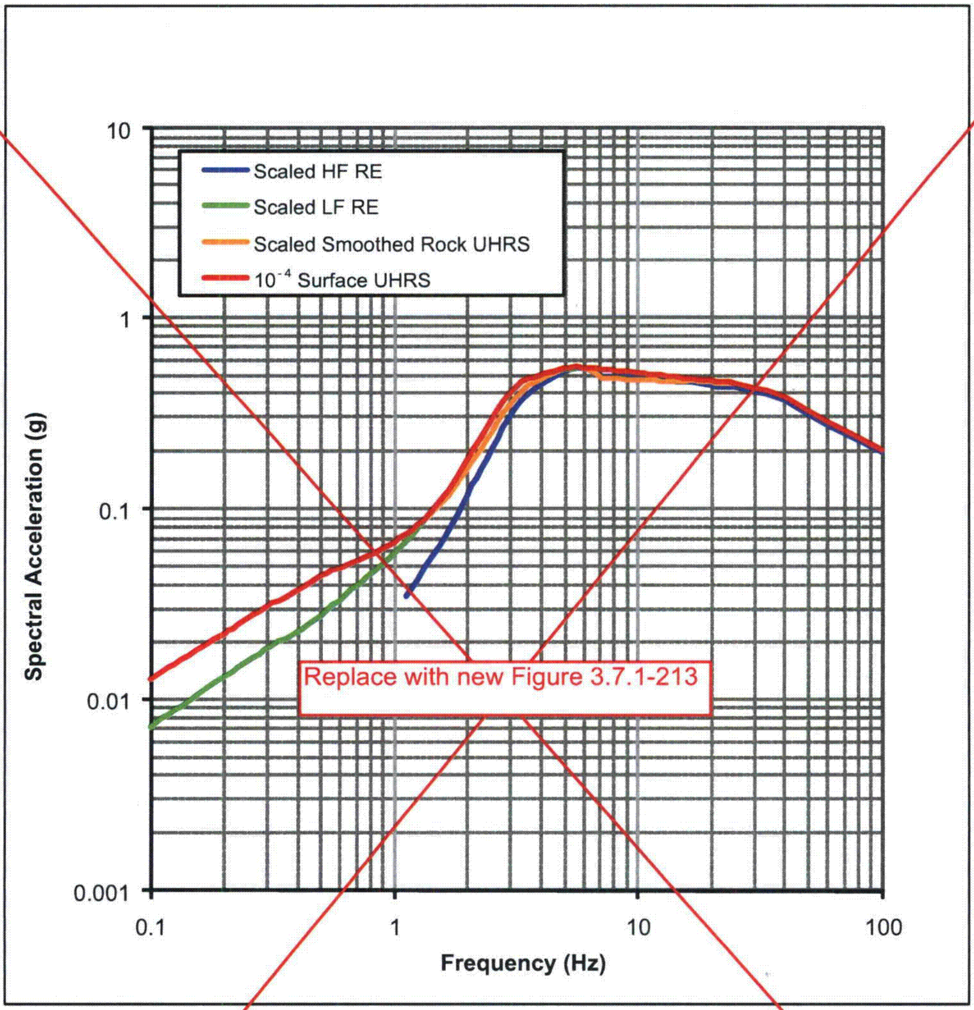
Table 3.7.1-219 Upper Bound Properties for Fermi 3 SSI Analyses Based on the Soil Column Truncated at the Top of In Situ Bedrock

Layer	Thickness (ft)	Unit Weight (pcf)	Shear Wave Velocity (ft/sec)	Damping Ratio (%)	Compression Wave Velocity (ft/sec)	Elevation at Top of Layer (ft)
SSI Profile, Top of Profile Elevation 552.0 ft.						
1	10.0	150	8192	0.48	16169	552.0
2	2.0	150	8074	0.48	16169	542.0
3	8.0	150	8074	0.48	16169	540.0
4	8.0	150	8261	0.48	16169	532.0
5	2.0	150	8261	0.48	16169	524.0
6	10.2	150	8359	0.48	16169	522.0
7	11.0	150	8316	0.48	16169	511.8
8	11.9	150	8393	0.48	16169	500.8
9	11.7	150	8094	0.48	16169	488.9
10	15.0	150	5820	0.68	12046	477.2
11	20.0	150	4221	0.95	9662	462.2
12	19.9	150	4042	0.95	9662	442.2
13	19.9	150	4041	0.95	9662	422.3
14	21.3	150	4033	0.95	9662	402.4
15	21.1	150	4987	0.95	11681	381.1
16	21.1	150	5061	0.95	11681	360.0
17	9.9	150	6920	0.36	12831	338.9
18	19.7	150	11664	0.36	21653	329.0
19	21.0	150	11560	0.36	21653	309.3
20	20.5	150	11666	0.36	21653	288.3
21	22.1	150	11625	0.36	21653	267.8
22	45.0	160	10953	0.36	19941	245.7
23	44.6	160	11082	0.36	19941	200.7
24	Half Space	169	11628	0.1	20943	156.1

Notes:

1. The top of in situ (Bass Islands Group) bedrock is at EL. 552 ft NAVD 88 (top of layer No.1).
2. The bottom of CB basemat is at EL. 540 ft NAVD 88 (top of layer No. 3).
3. The bottom of RB/FB basemat is at EL. 524 ft NAVD 88 (top of layer No. 5).
4. For SSI analyses presented in Subsection 3.7.2, the following elevation references are used in the SASSI2000 model:
   - EL. -6770 mm is the top of in-situ (Bass Islands Group) bedrock which is equivalent to EL. 552 ft NAVD 88.
   - EL. -10400 mm is at the bottom of CB basemat which is equivalent to EL. 540 ft NAVD 88.
   - EL. -15500 mm is at the bottom of RB/FB basemat which is equivalent to EL. 524 ft NAVD 88.

Figure 3.7.1-213 Development of 10^{-4} SCOR UHRS at the RB/FB Foundation Level for the Full Soil Column Profile [EF3 SUP 3.7-1]



New Figure 3.7.1-213

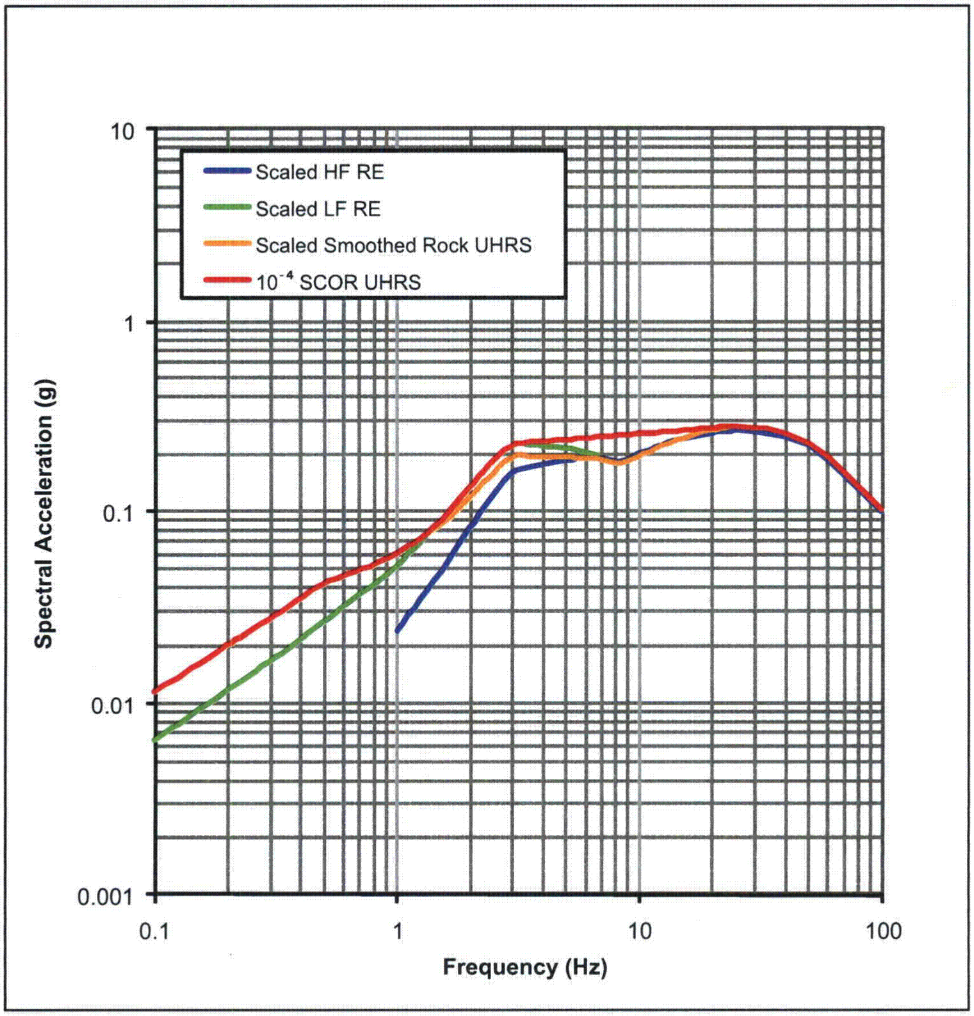
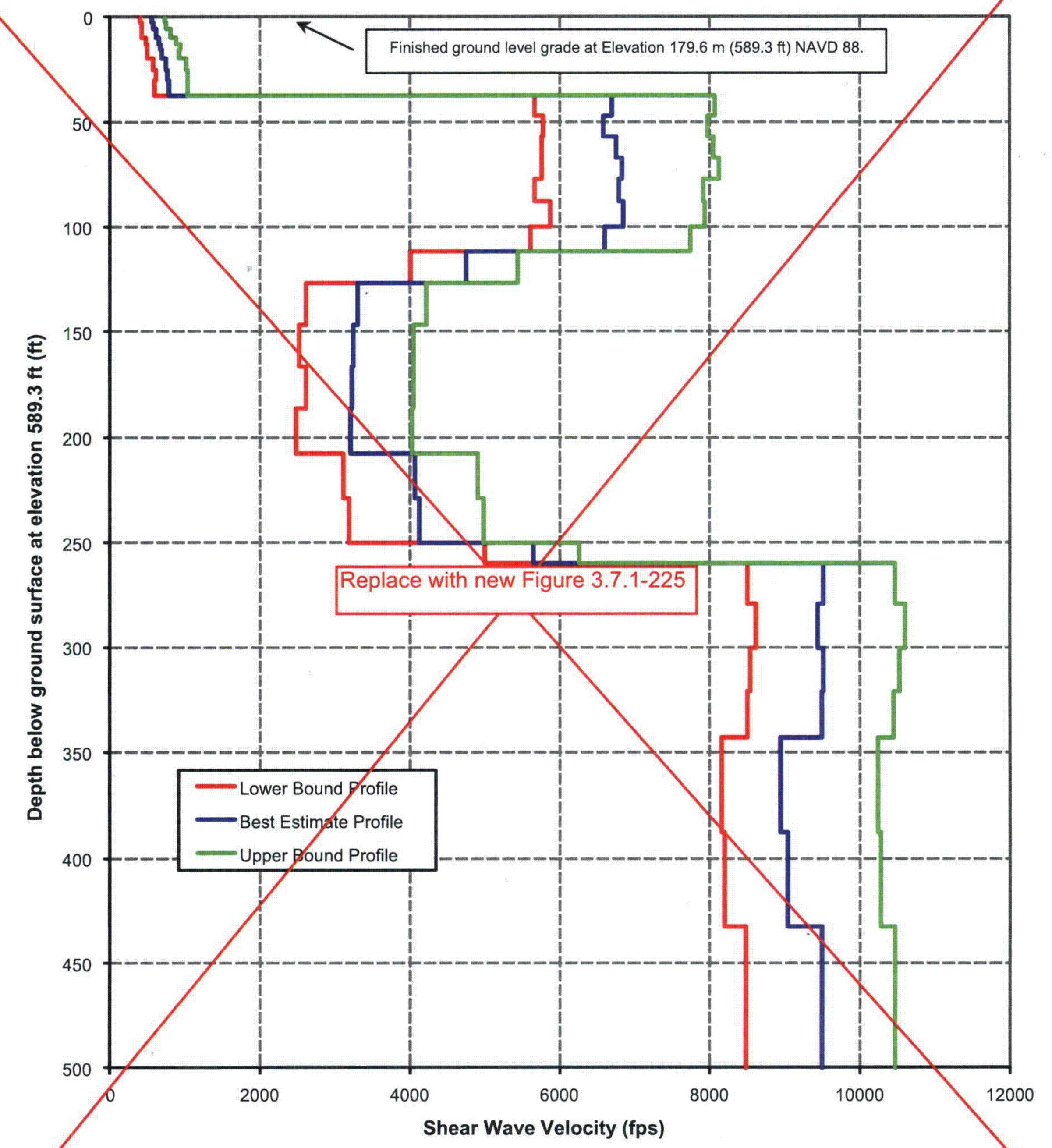


Figure 3.7.1-213: Development of 10^{-4} SCOR UHRS at the RB/FB Foundation Level for the Full Soil Column Profile.

Figure 3.7.1-225 Lower Bound, Best Estimate, and Upper Bound Shear Wave Velocity Profiles for the Full Soil Column [EF3 SUP 3.7-1]



New Figure 3.7.1-225

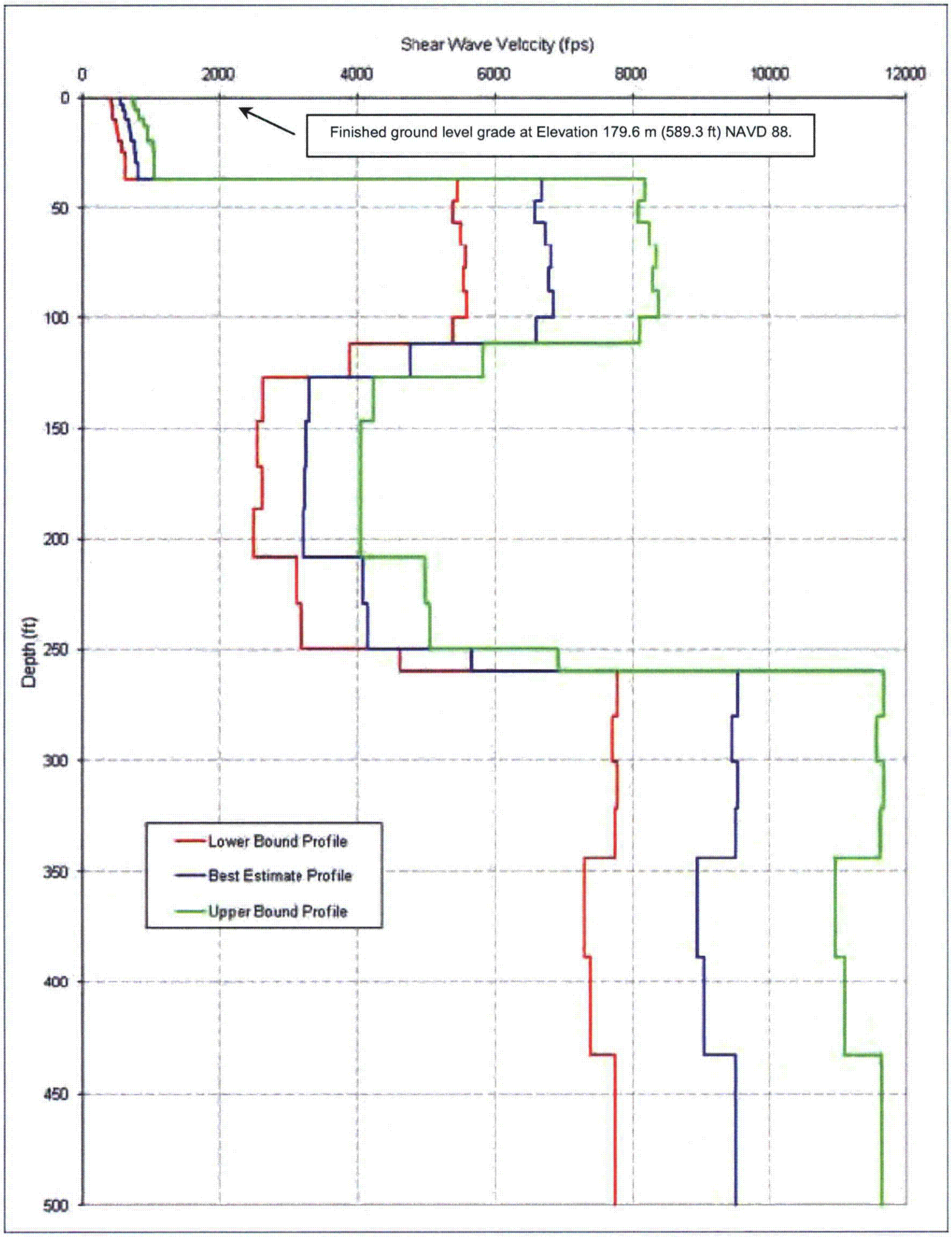
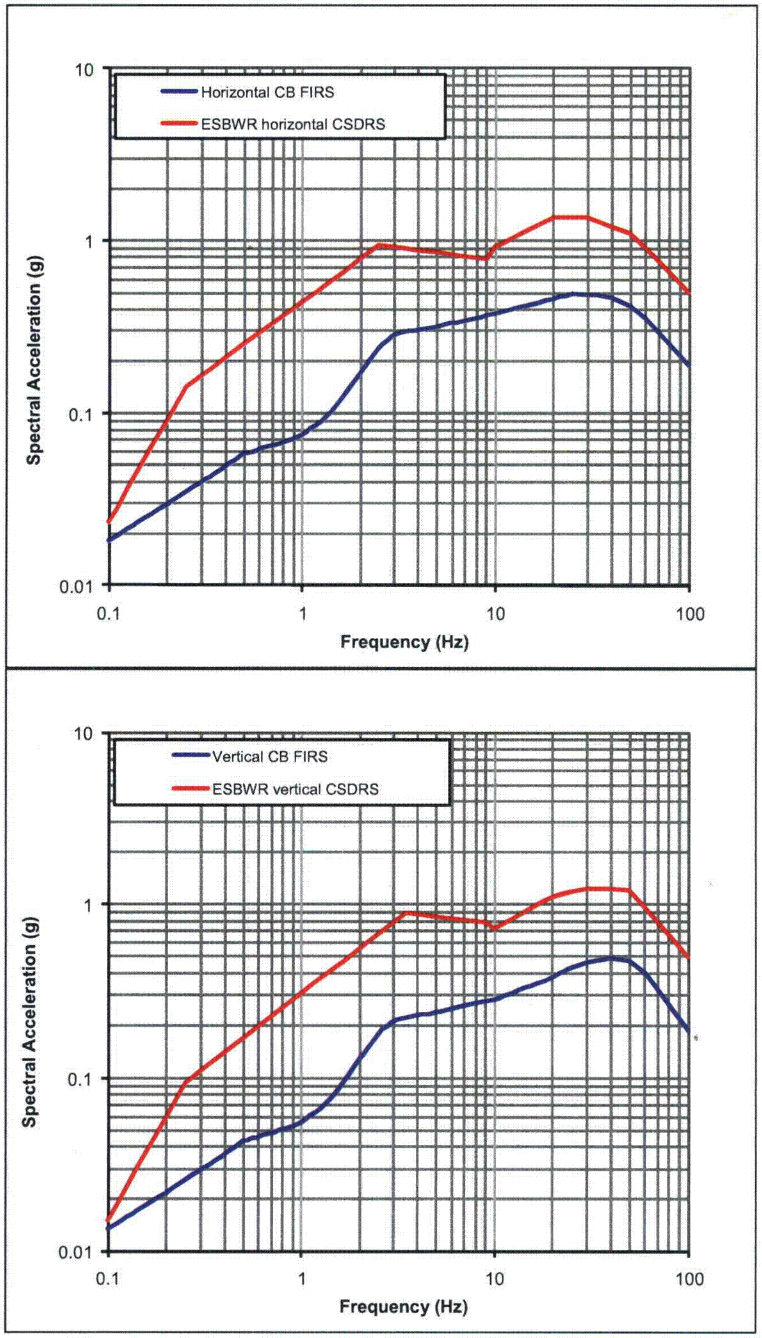


Figure 3.7.1-225: Lower Bound, Best Estimate and Upper Bound Shear Wave Velocity Profiles for the Full Soil Column.

Figure 3.7.1-227 Fermi 3 CB SCOR FIRS (5% Damping) [EF3 SUP 3.7-1]



Insert new Figure 3.7.1-228, Figure 3.7.1-229, Figure 3.7.1-230, Figure 3.7.1-231, Figure 3.7.1-232, Figure 3.7.1-233, Figure 3.7.1-234, and Figure 3.7.1-235.

New Figure 3.7.1-228

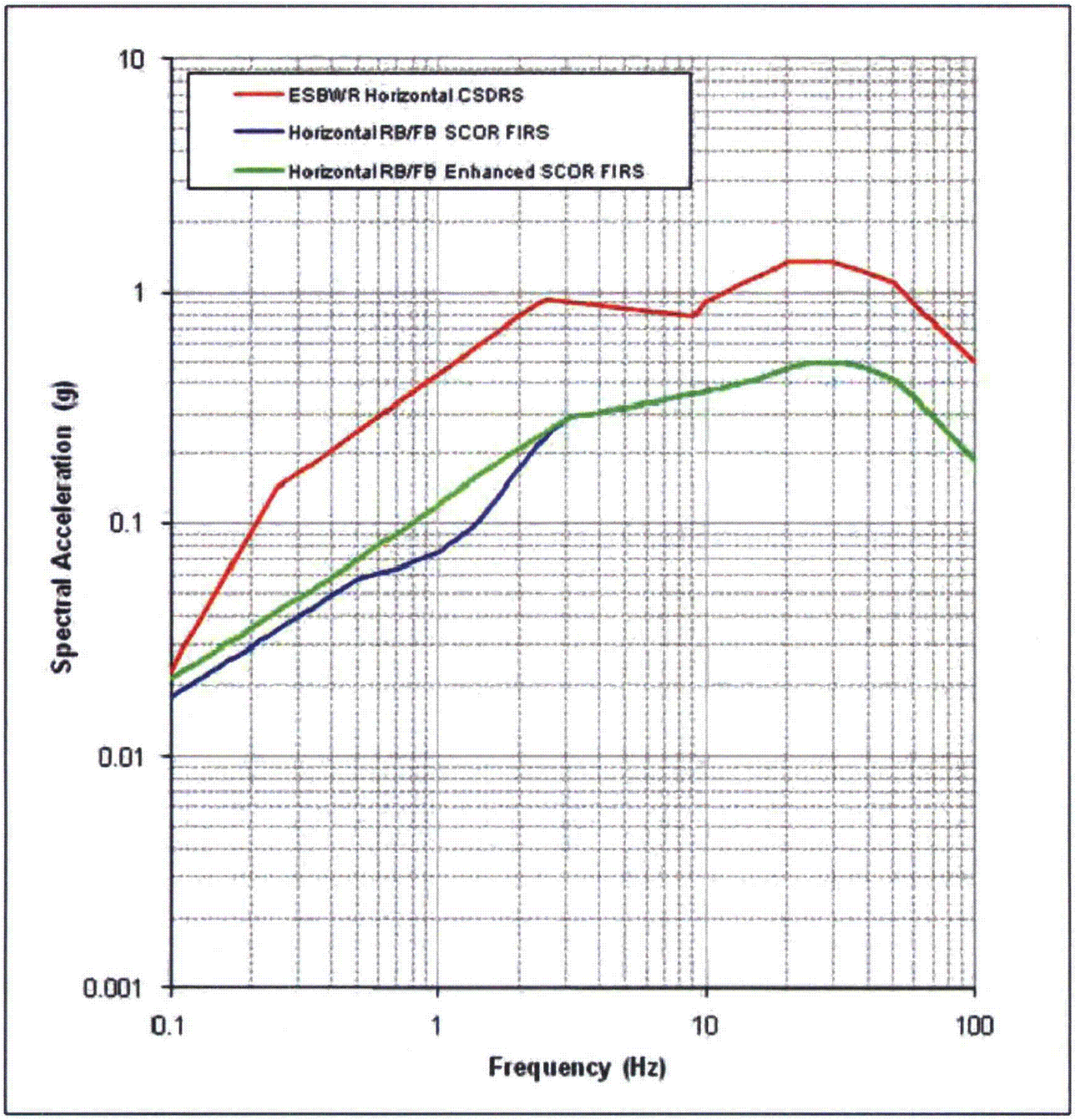


Figure 3.7.1-228: Fermi 3 Horizontal RB/FB SCOR FIRS and Enhanced SCOR FIRS (5% Damping).

New Figure 3.7.1-229

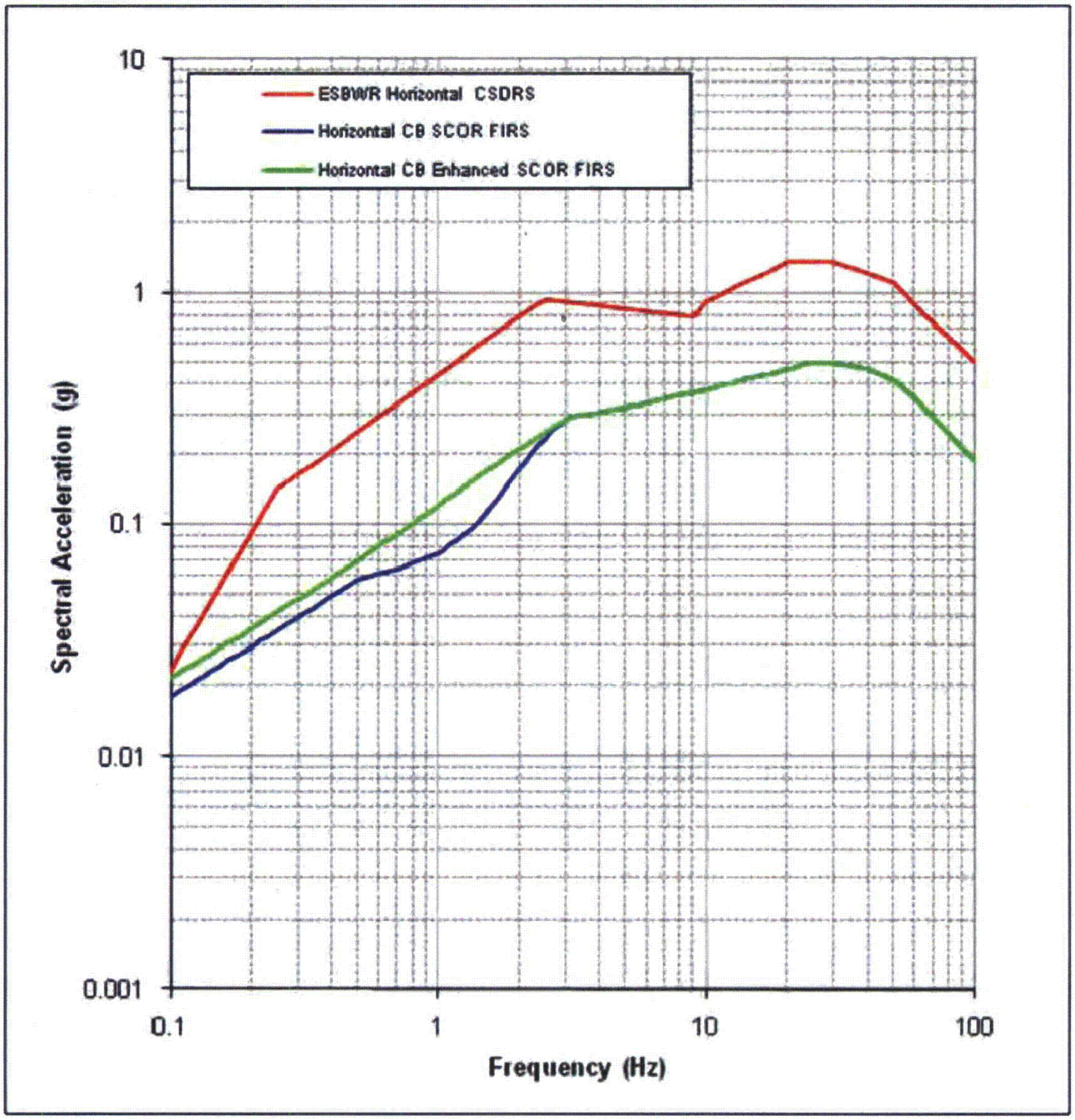


Figure 3.7.1-229: Fermi 3 Horizontal CB SCOR FIRS and Enhanced SCOR FIRS (5% Damping).

New Figure 3.7.1-230

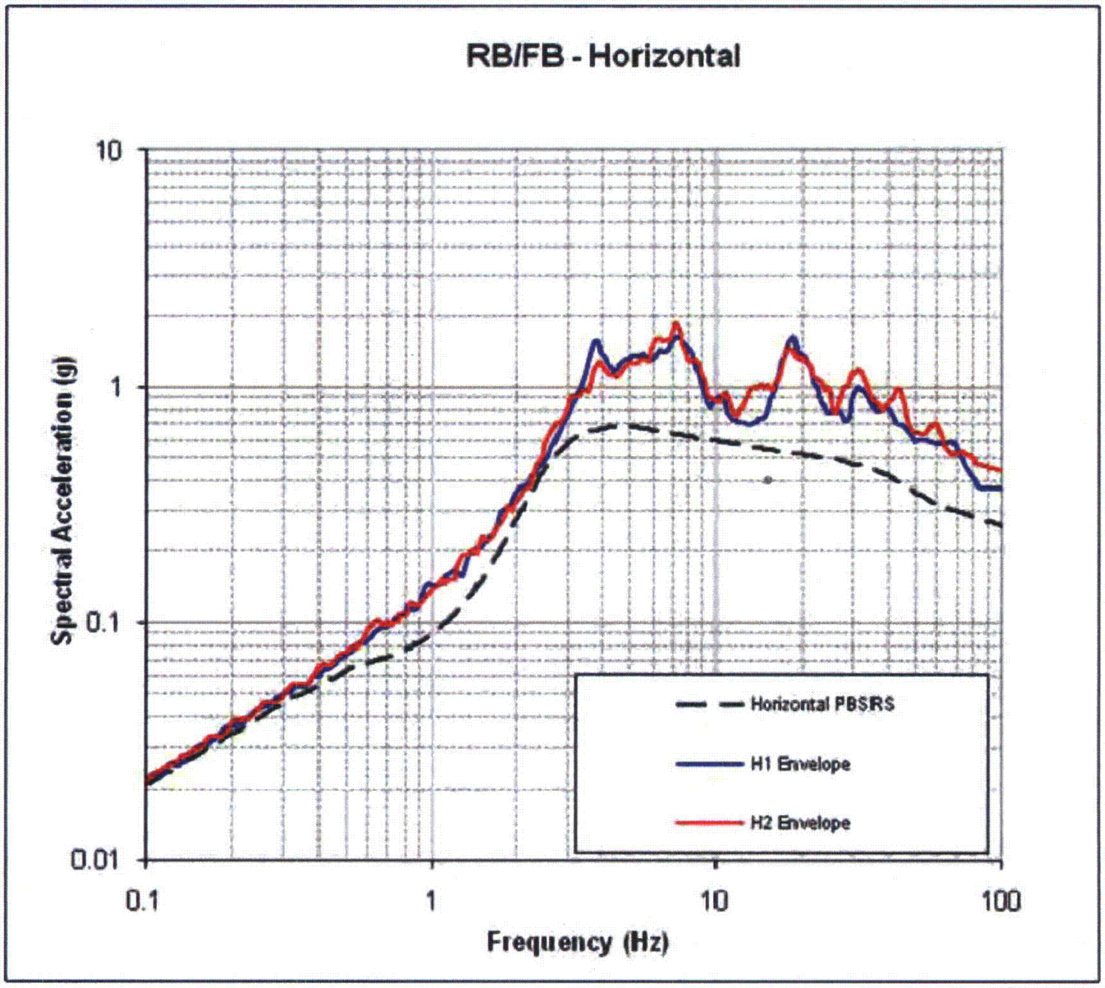


Figure 3.7.1-230: Comparison with Envelopes of the Response Spectra of Computed Horizontal Component Surface Motions for Full Soil Column Profiles Using the RB/FB Enhanced SCOR FIRS Input Motions with the Horizontal PBSRS.

New Figure 3.7.1-231

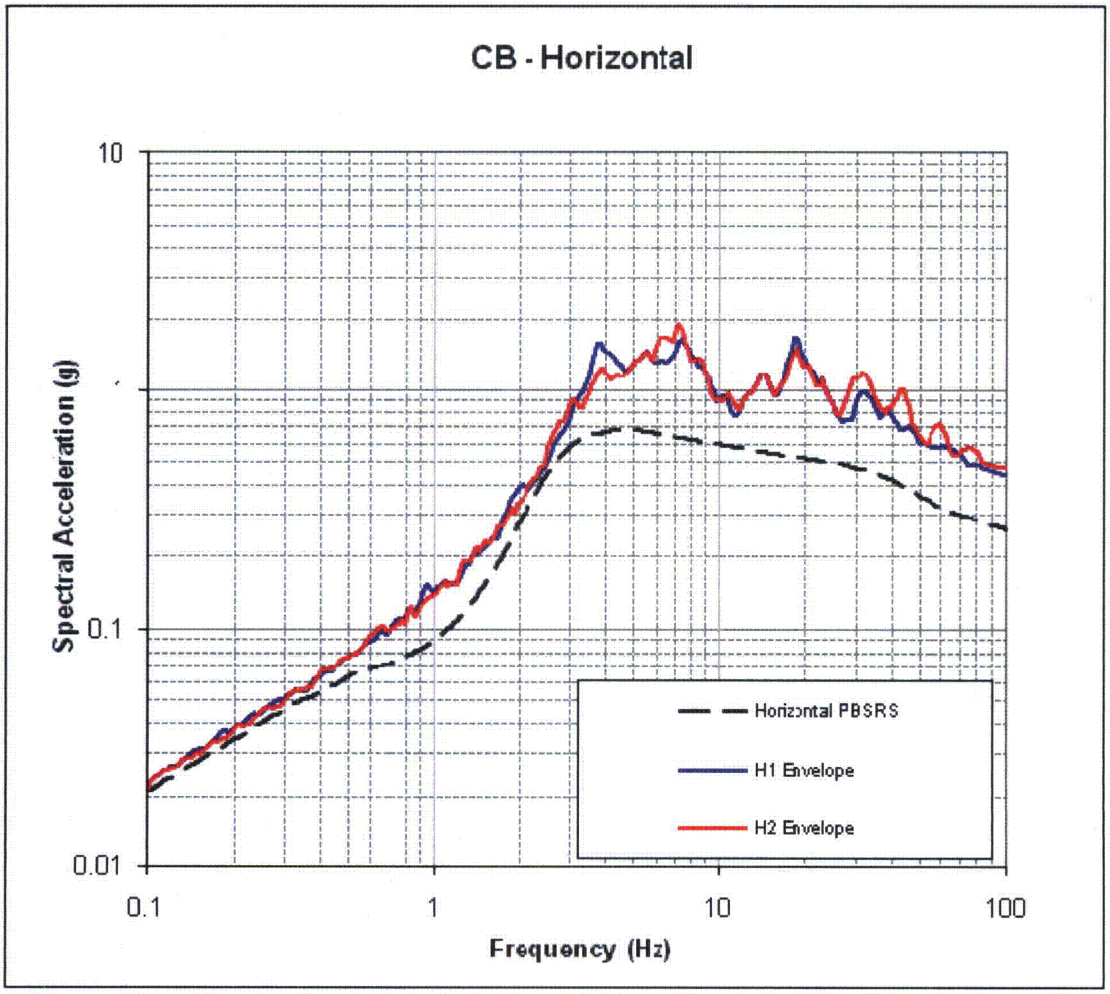


Figure 3.7.1-231: Comparison with Envelopes of the Response Spectra of Computed Horizontal Component Surface Motions for Full Soil Column Profiles Using the CB Enhanced SCOR FIRS Input Motions with the Horizontal PBSRS.

New Figure 3.7.1-232

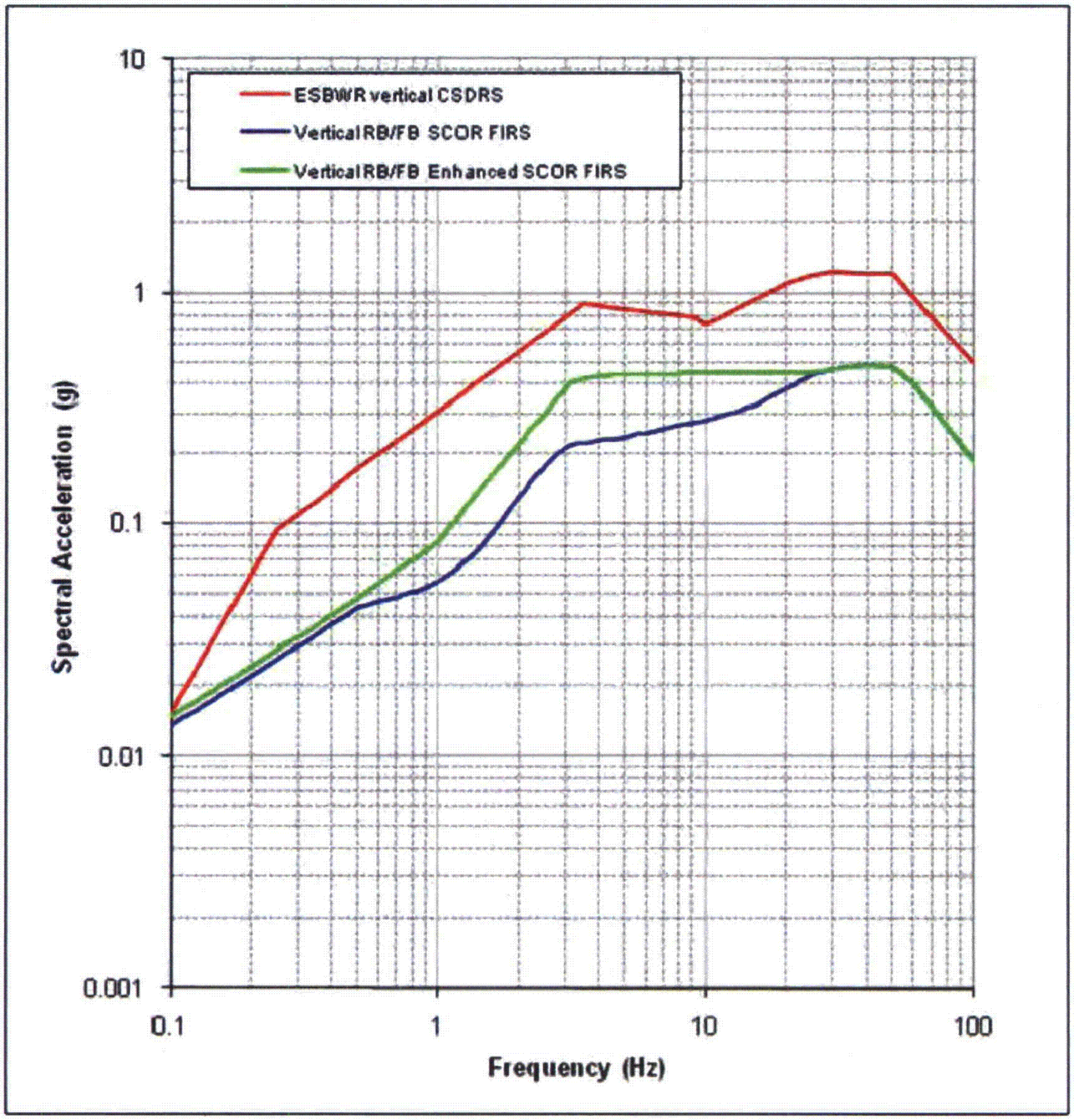


Figure 3.7.1-232: Fermi 3 Vertical RB/FB SCOR FIRS and Enhanced SCOR FIRS (5% Damping).

New Figure 3.7.1-233

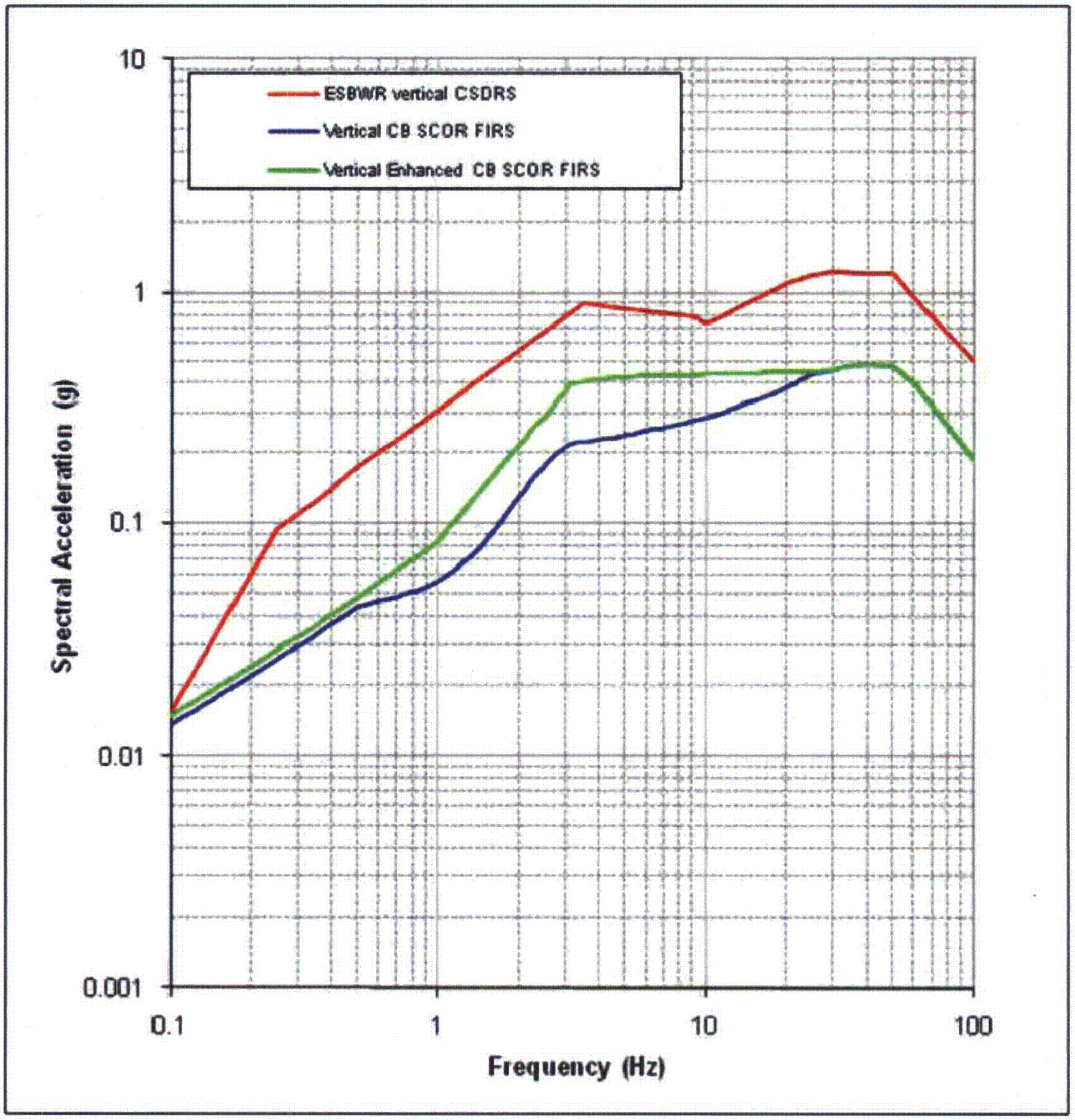


Figure 3.7.1-233: Fermi 3 Vertical CB SCOR FIRS and Enhanced SCOR FIRS (5% Damping).

New Figure 3.7.1-234

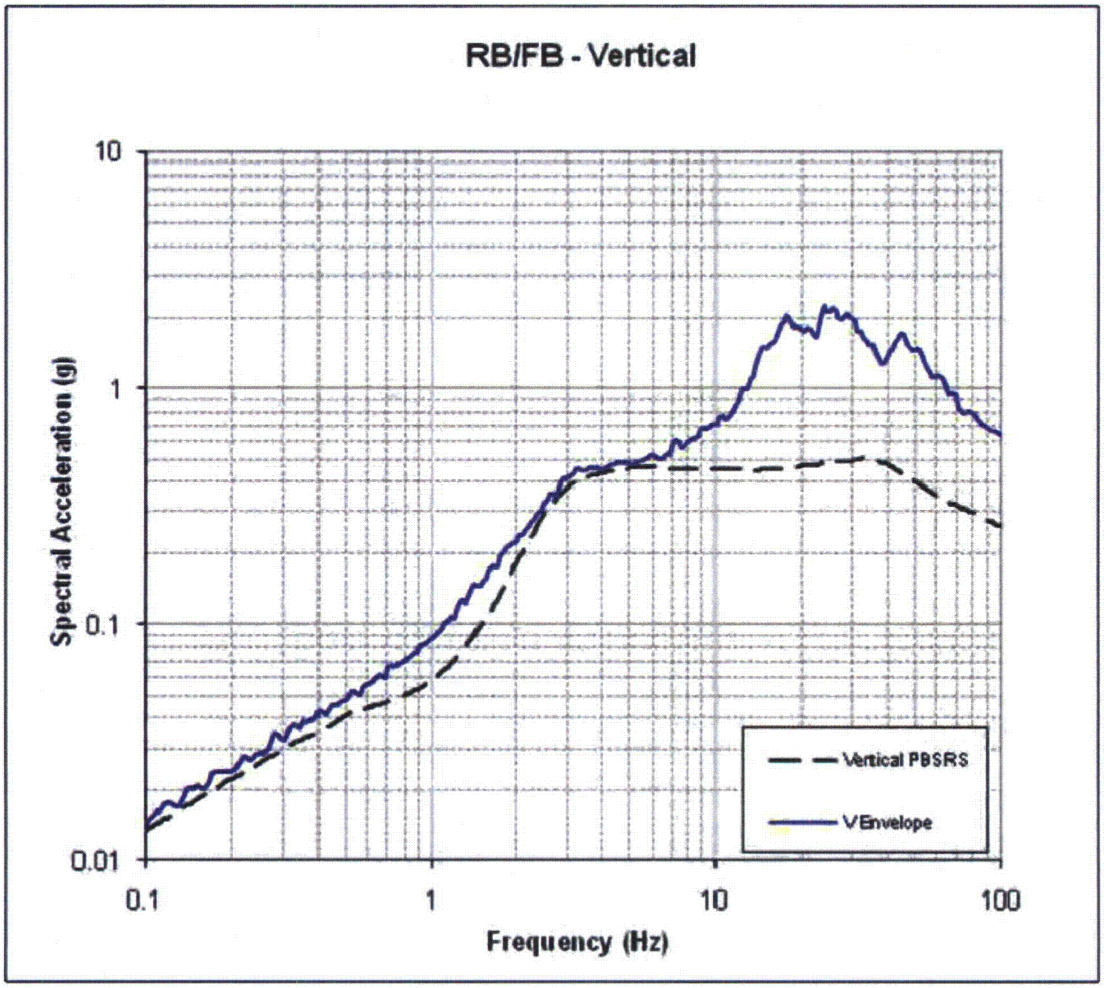


Figure 3.7.1-234: Comparison of the Envelope of the Response Spectra of Computed Vertical Component Surface Motions for Full Soil Column Profiles Using the RB/FB Enhanced SCOR FIRS Input Motions with the Vertical PBSRS.

New Figure 3.7.1-235

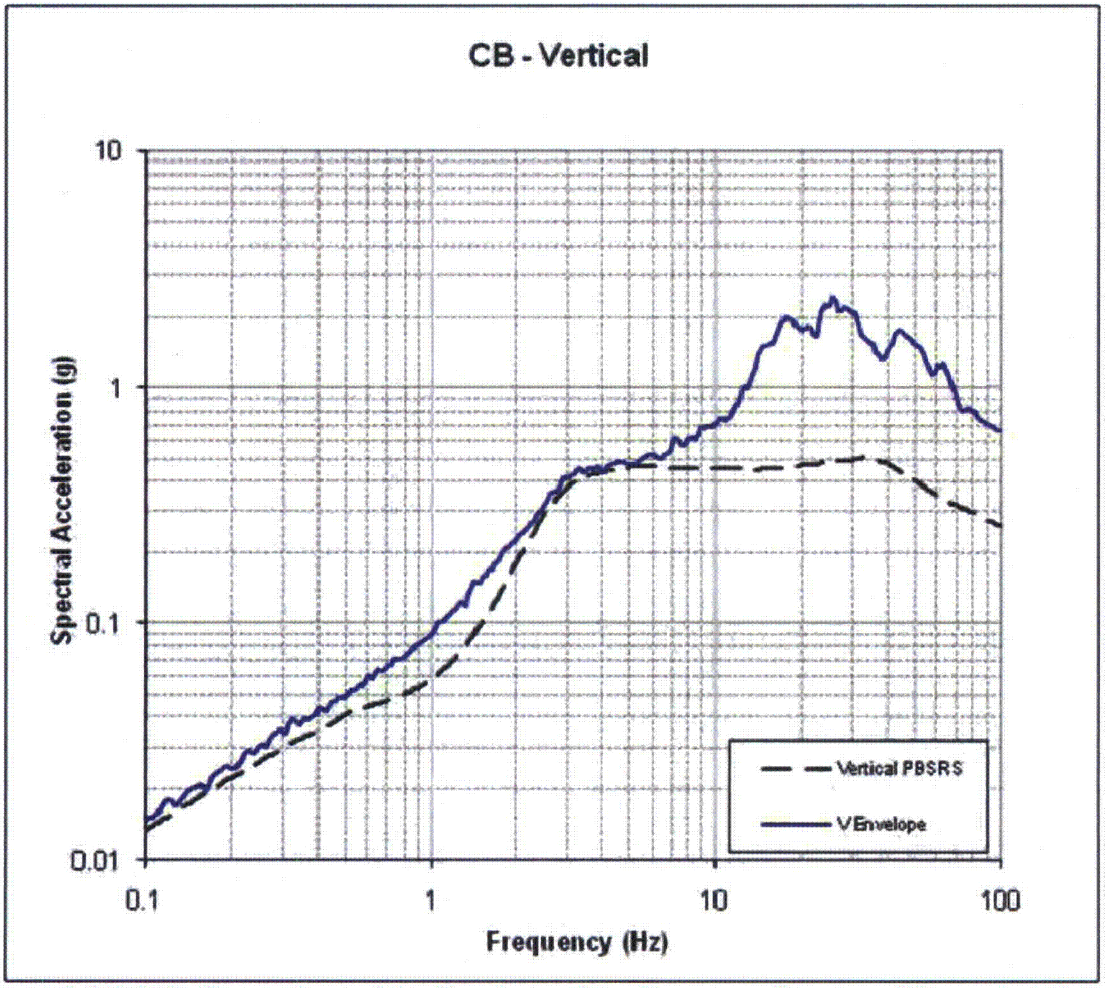
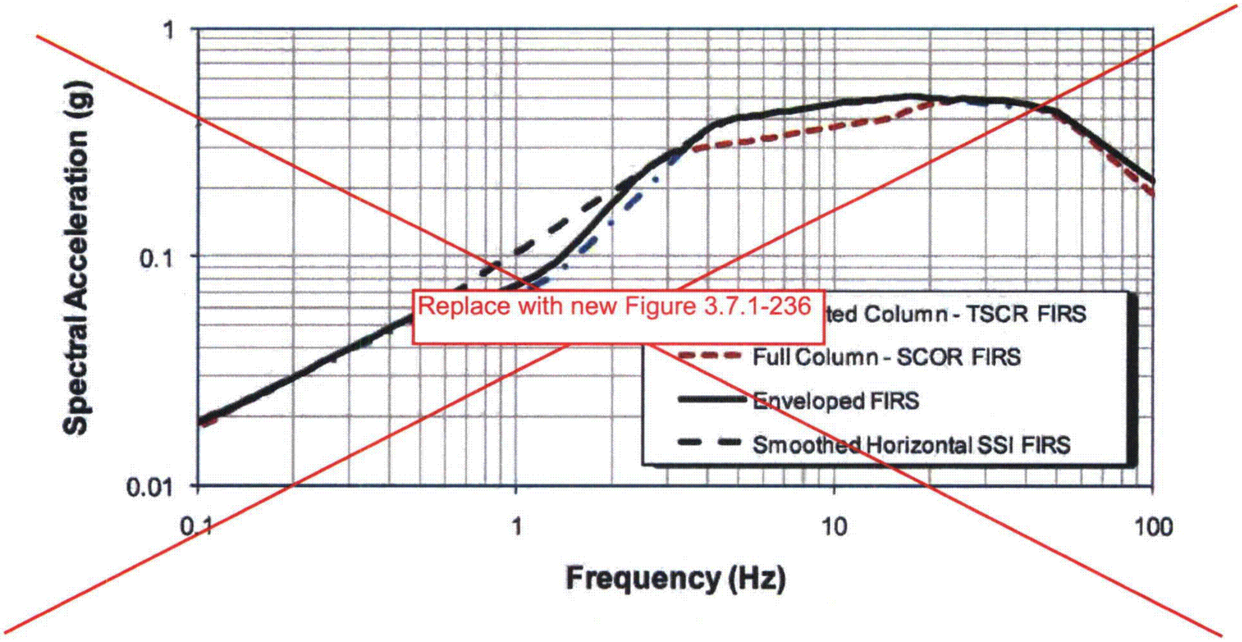


Figure 3.7.1-235: Comparison of the Envelope of the Response Spectra of Computed Vertical Component Surface Motions for Full Soil Column Profiles Using the CB Enhanced SCOR FIRS Input Motions with the Vertical PBSRS.

Figure 3.7.1-228 Development of Horizontal Fermi 3 SSI FIRS for the RB/FB [EF3 SUP 3.7-1]



New Figure 3.7.1-236

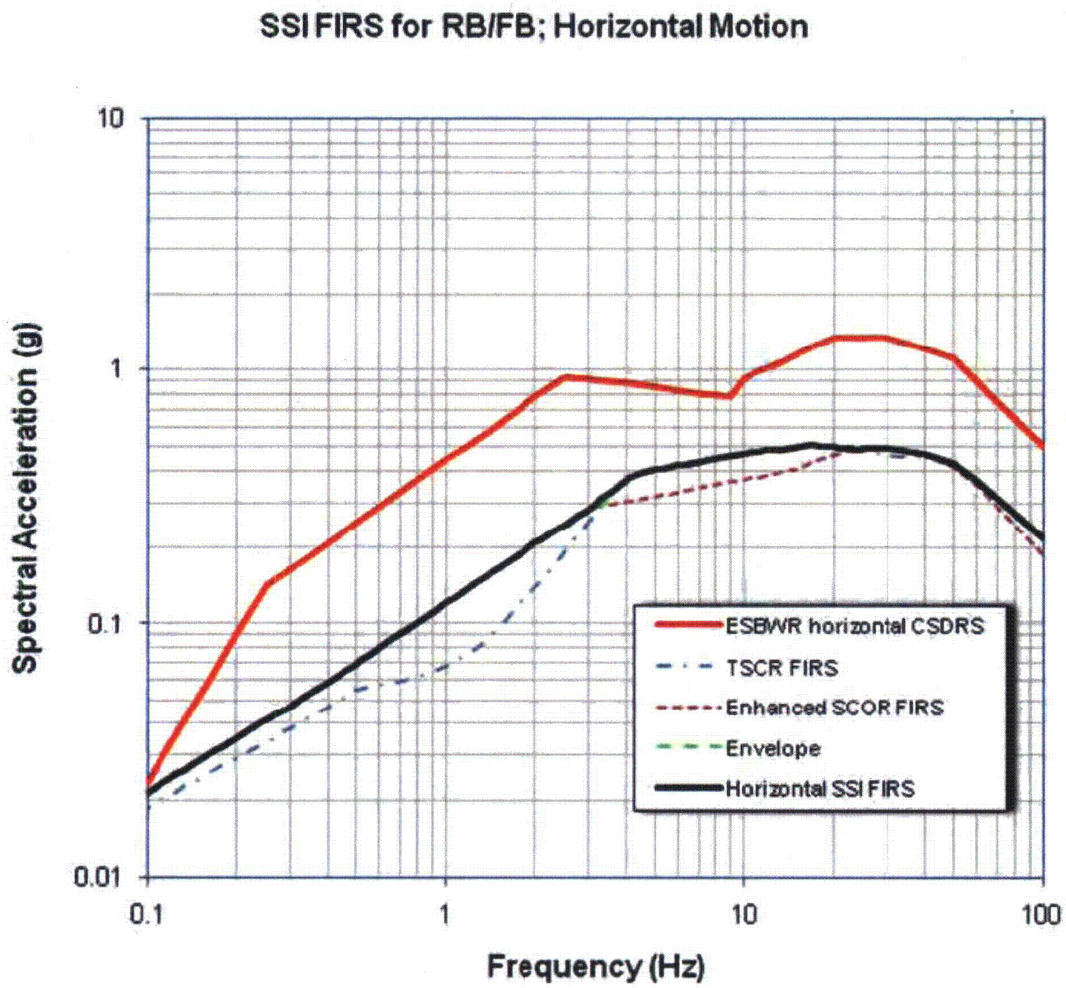
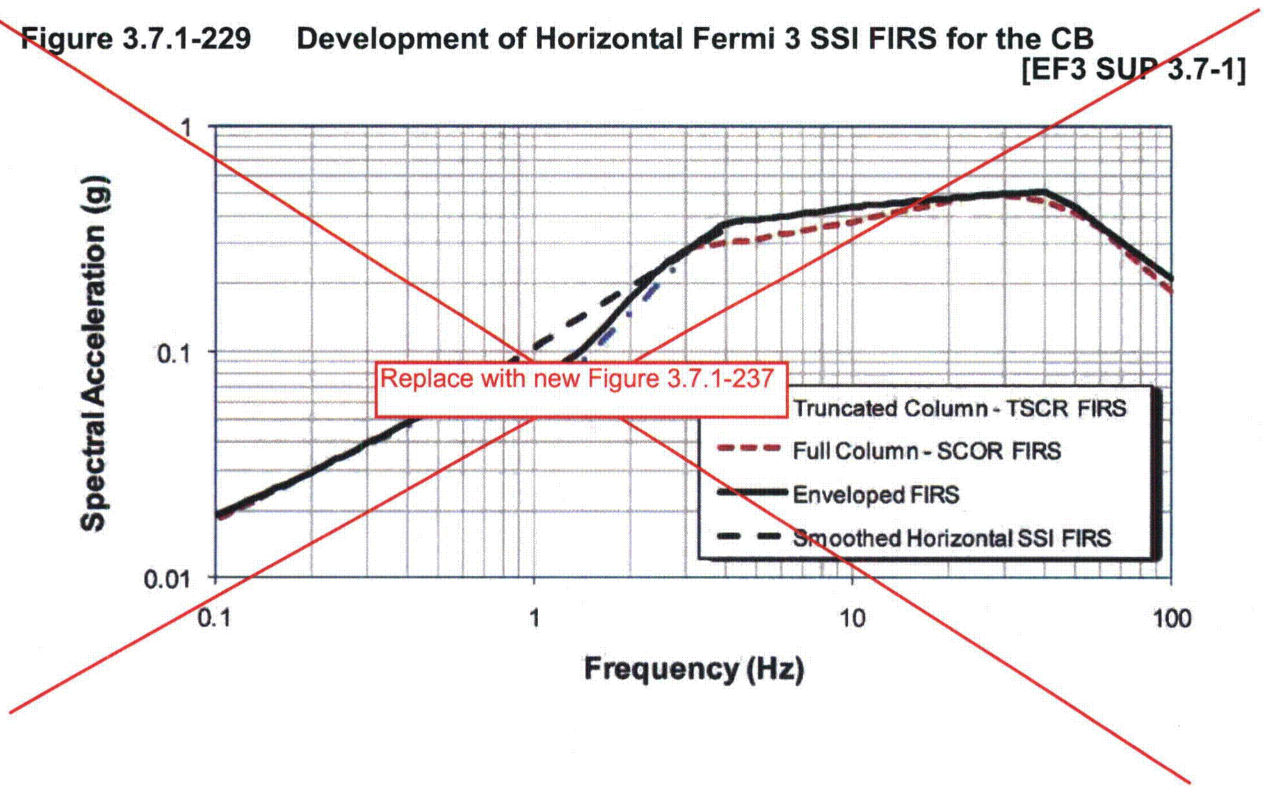


Figure 3.7.1-236: Development of Horizontal Fermi 3 SSI FIRS for the RB/FB.

Figure 3.7.1-229 Development of Horizontal Fermi 3 SSI FIRS for the CB
[EF3 SUP 3.7-1]



New Figure 3.7.1-237

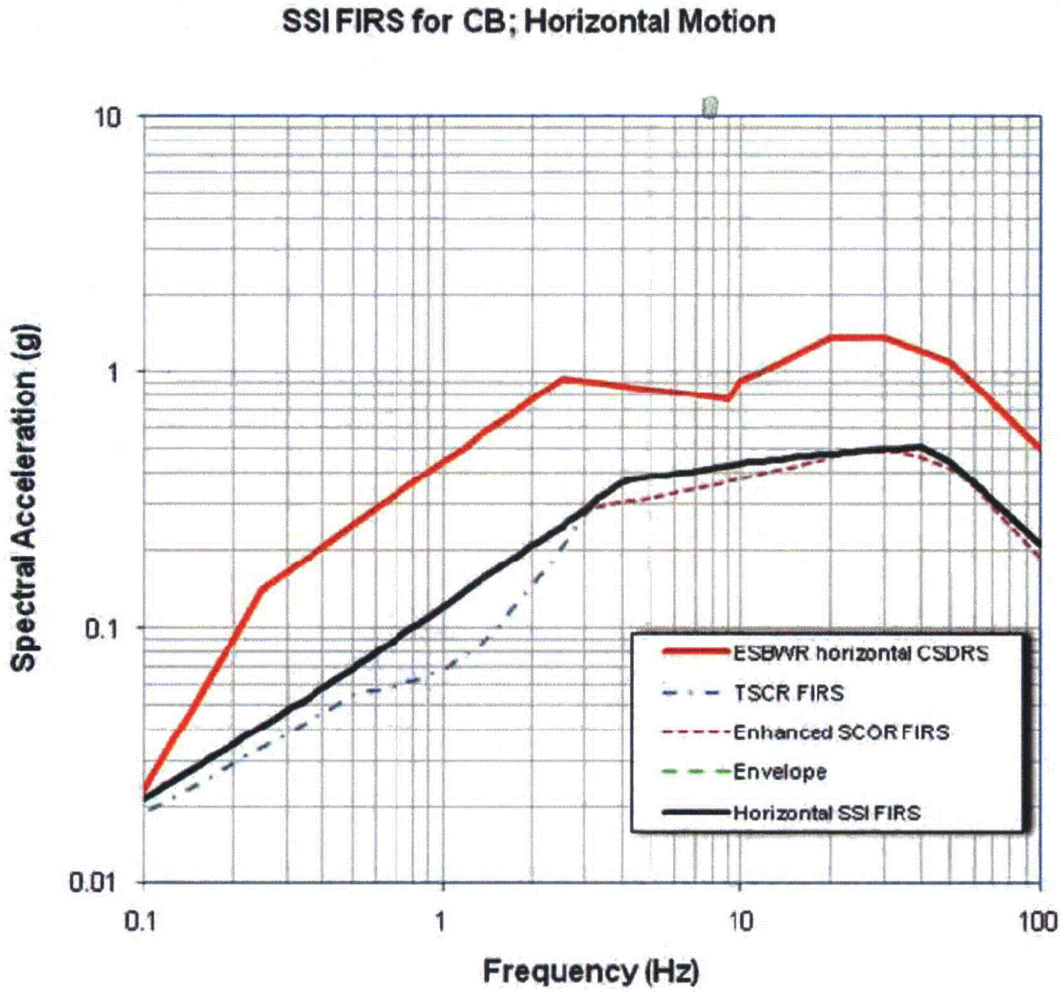
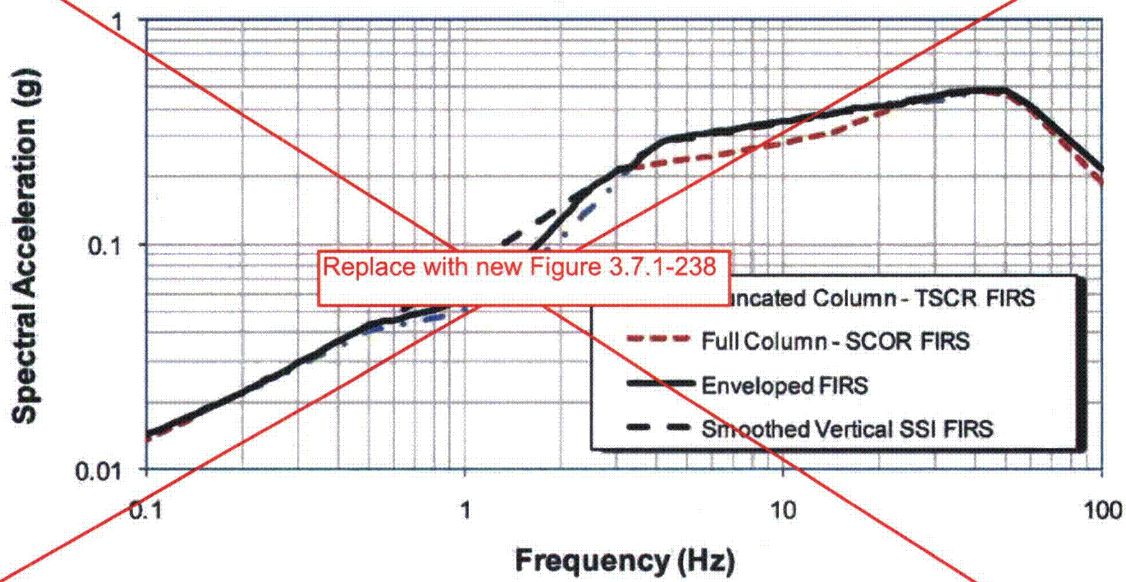


Figure 3.7.1-237: Development of Horizontal Fermi 3 SSI FIRS for the CB.

Figure 3.7.1-230 Development of Vertical Fermi 3 SSI FIRS for the RB/FB [EF3 SUP 3.7-1]



New Figure 3.7.1-238

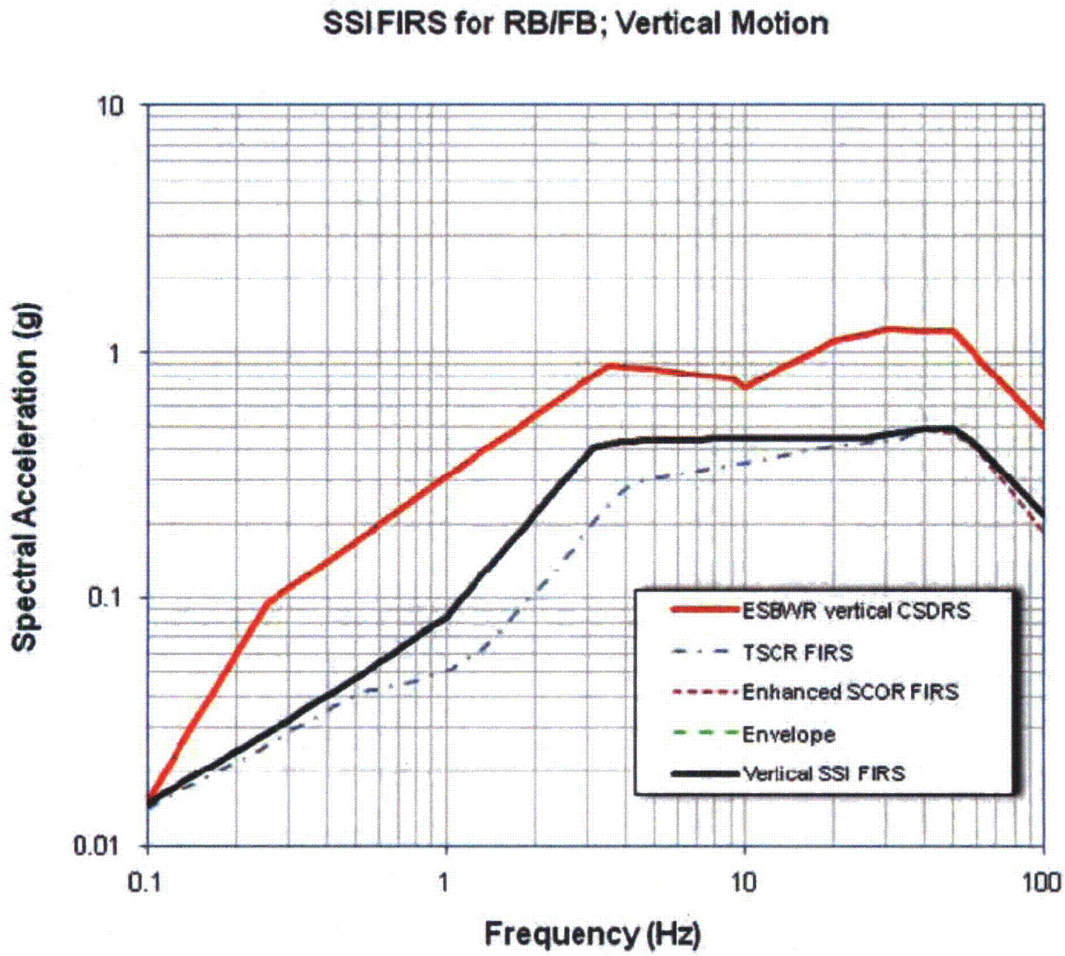
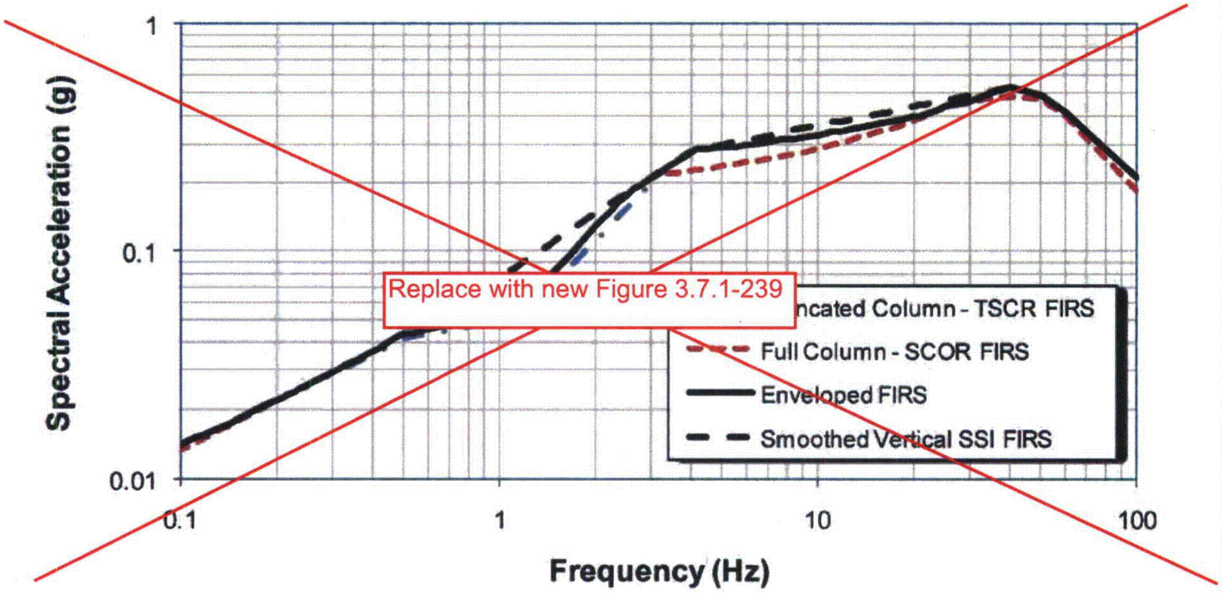


Figure 3.7.1-238: Development of Vertical Fermi 3 SSI FIRS for the RB/FB.

Figure 3.7.1-231 Development of Vertical Fermi 3 SSI FIRS for the CB [EF3 SUP 3.7-1]



New Figure 3.7.1-239

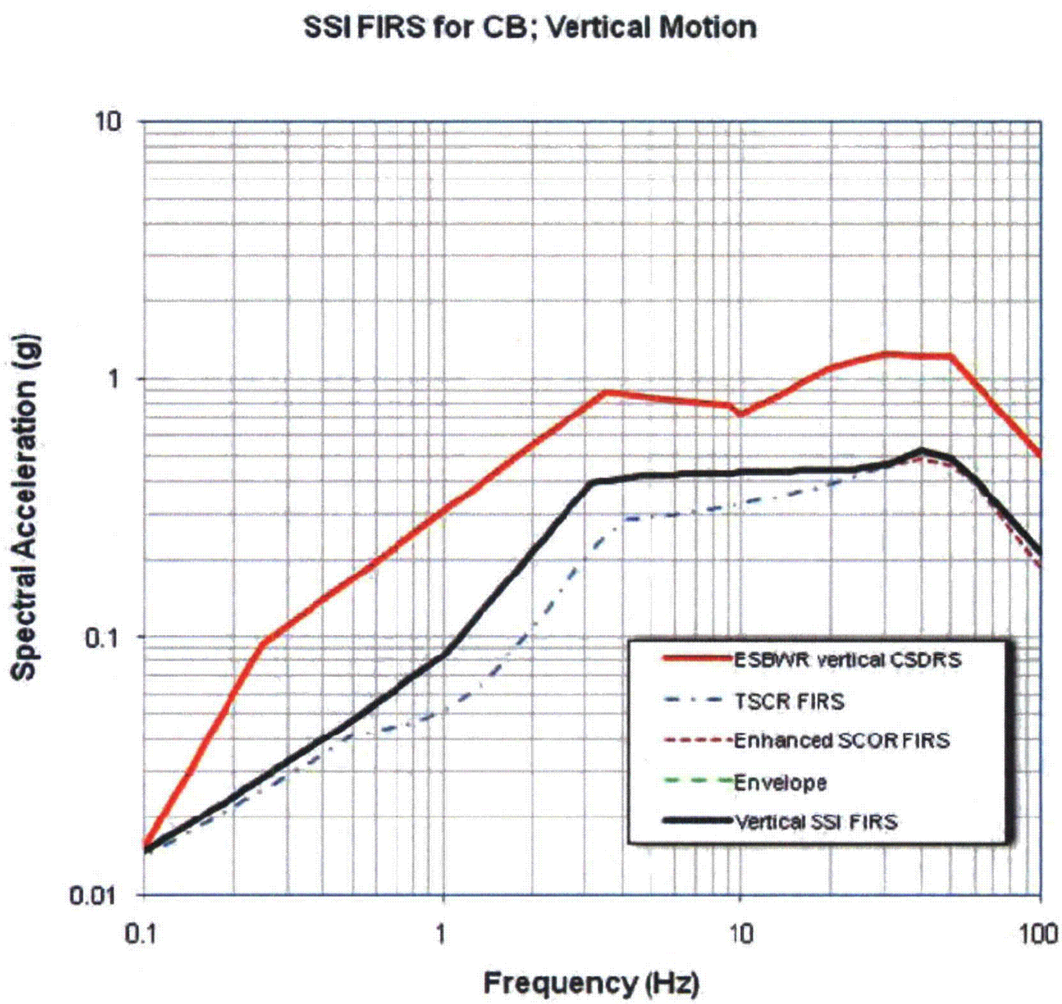
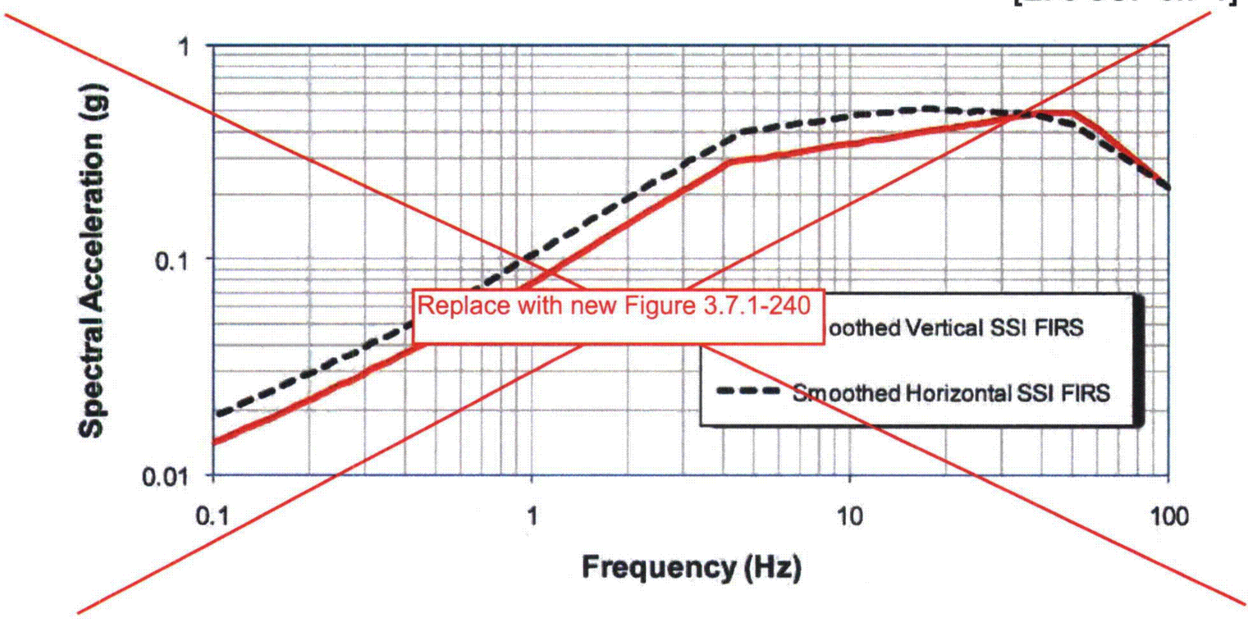


Figure 3.7.1-239: Development of Vertical Fermi 3 SSI FIRS for the CB.

Figure 3.7.1-232 Horizontal and Vertical Fermi 3 SSI FIRS for the RB/FB [EF3 SUP 3.7-1]



New Figure 3.7.1-240

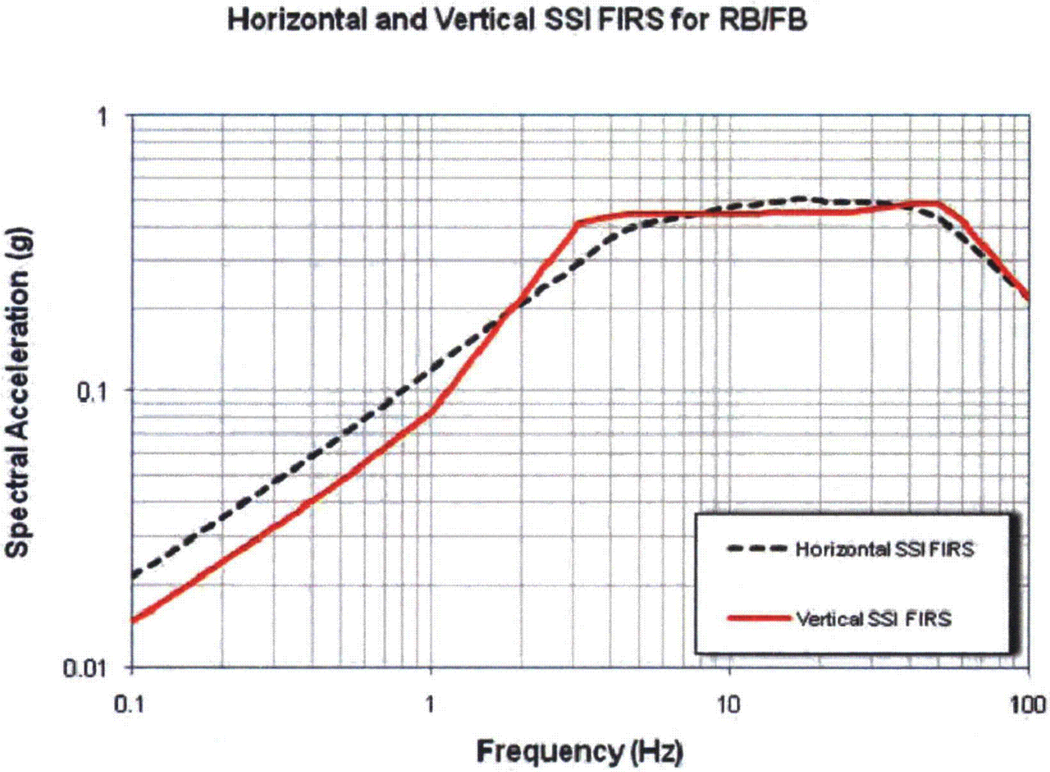
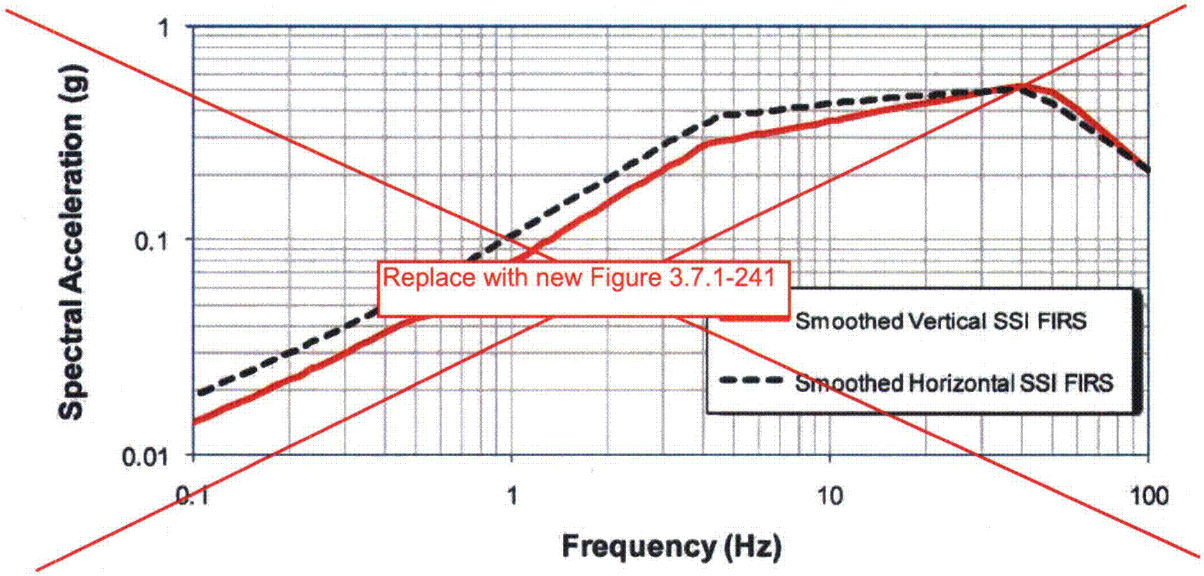


Figure 3.7.1-240: Horizontal and Vertical Fermi 3 SSI FIRS for the RB/FB.

Figure 3.7.1-233 Horizontal and Vertical Fermi 3 SSI FIRS for the CB
[EF3 SUP 3.7-1]



New Figure 3.7.1-241

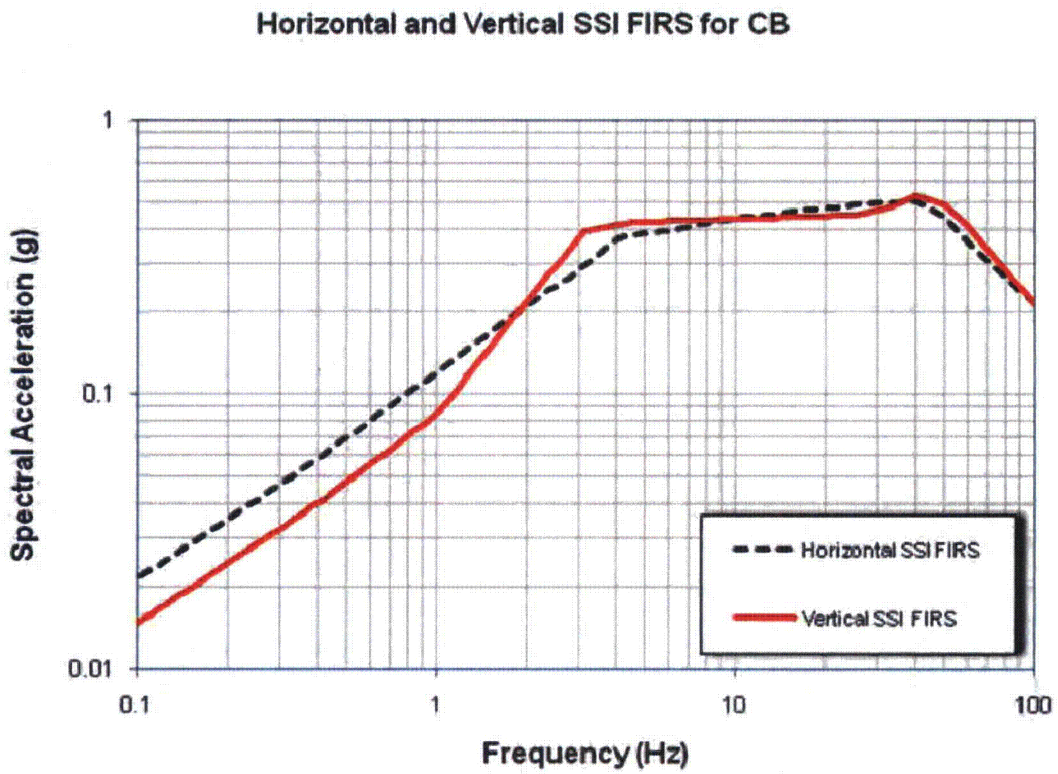
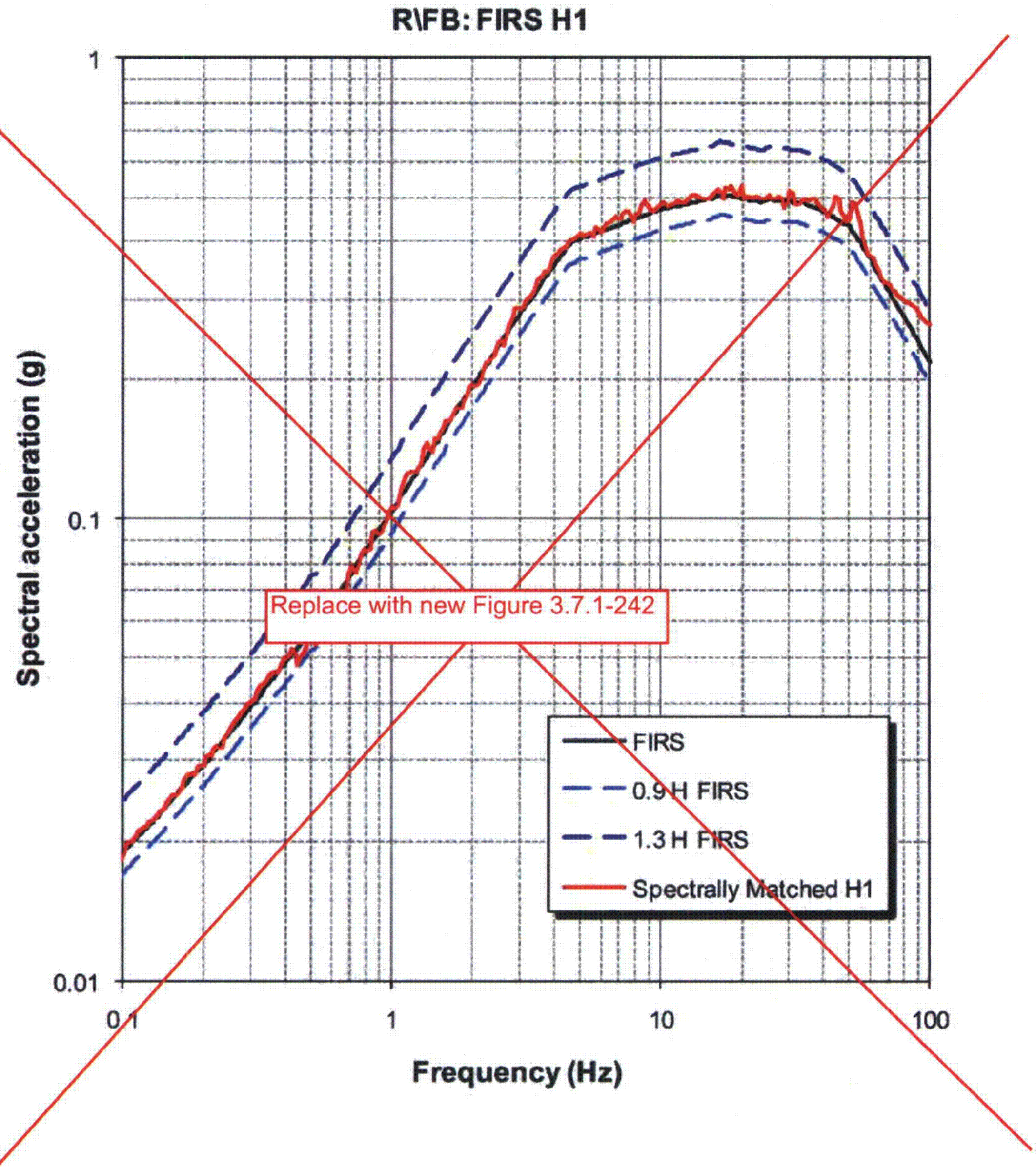


Figure 3.7.1-241: Horizontal and Vertical Fermi 3 SSI FIRS for the CB.

Figure 3.7.1-234 Response Spectrum for Spectrally Matched Horizontal (H1) Component for the Fermi 3 RB/FB SSI FIRS [EF3 SUP 3.7-2]



New Figure 3.7.1-242

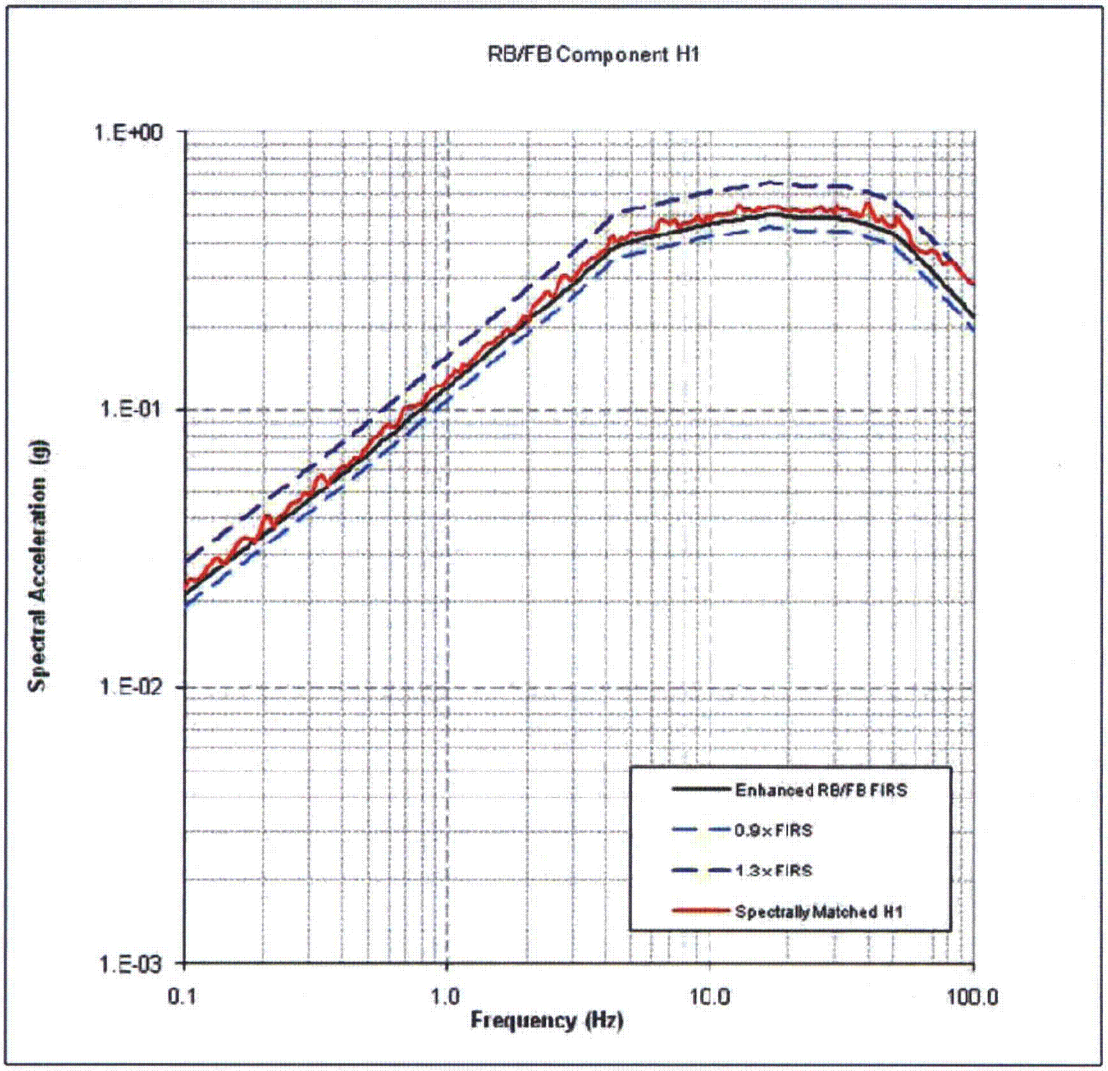
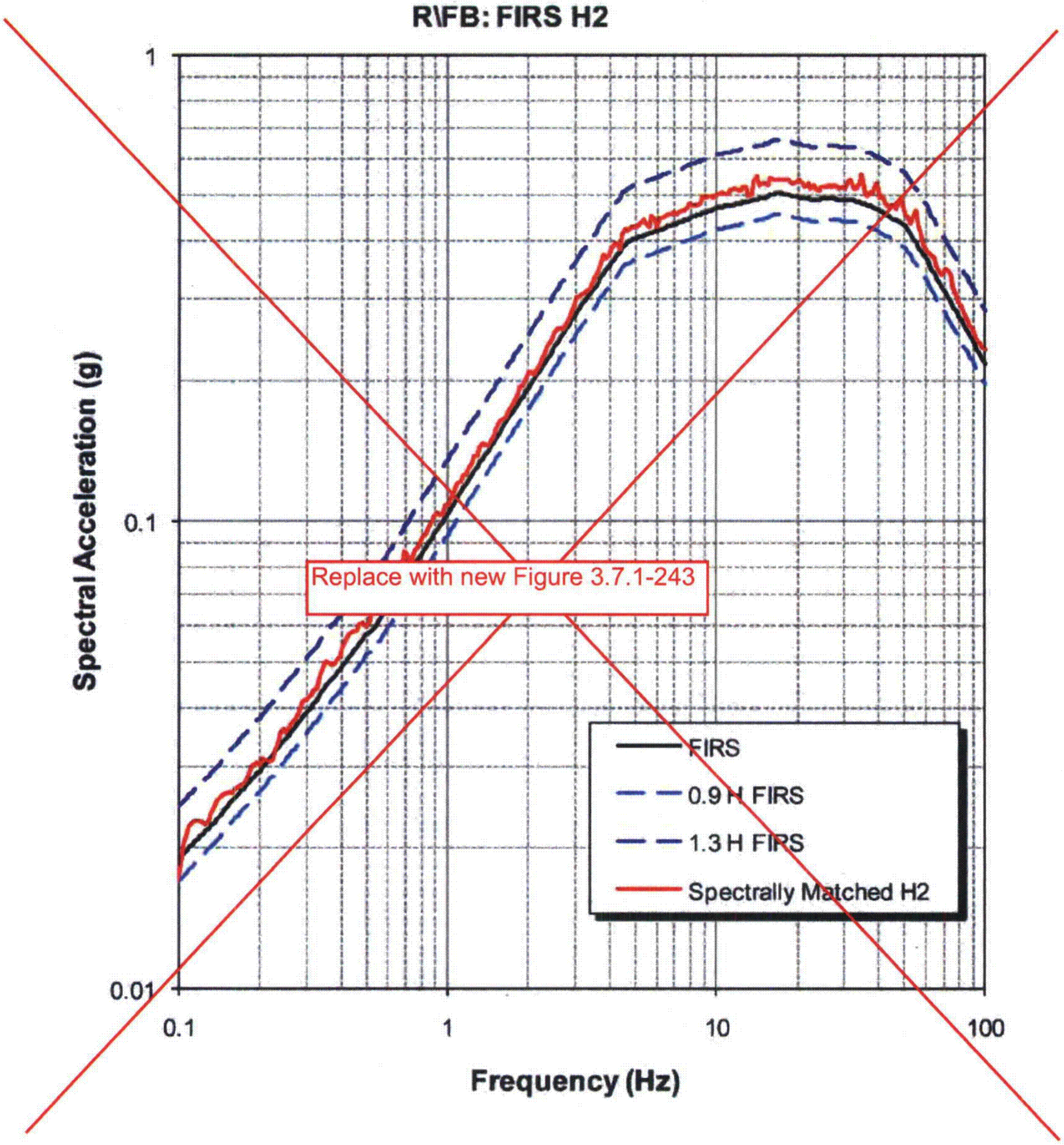


Figure 3.7.1-242: Response Spectrum for Spectrally Matched Horizontal (H1) Component for the Fermi 3 RB/FB SSI FIRS.

Figure 3.7.1-235 Response Spectrum for Spectrally Matched Horizontal (H2) Component for the Fermi 3 RB/FB SSI FIRS [EF3 SUP 3.7-2]



New Figure 3.7.1-243

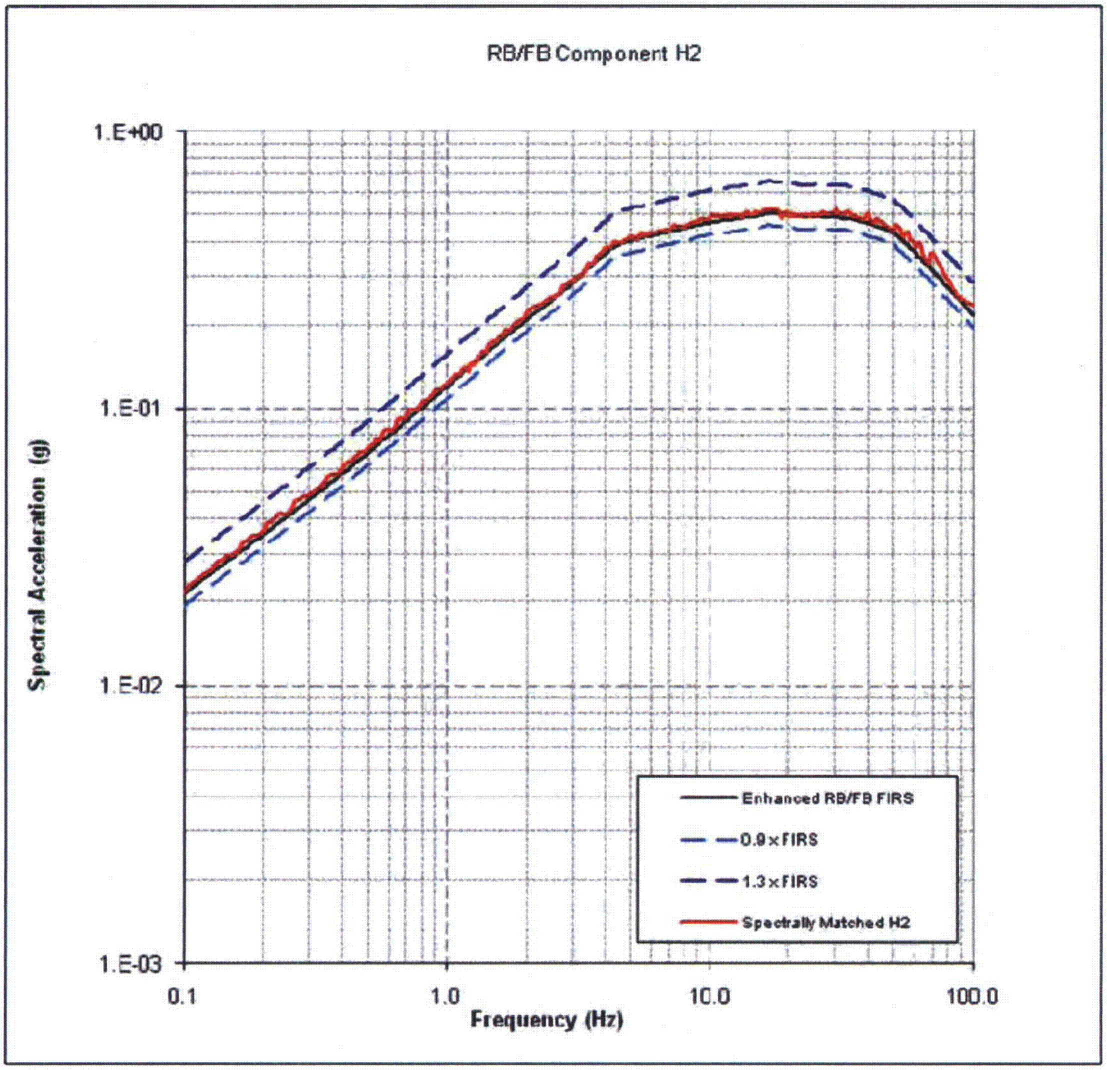
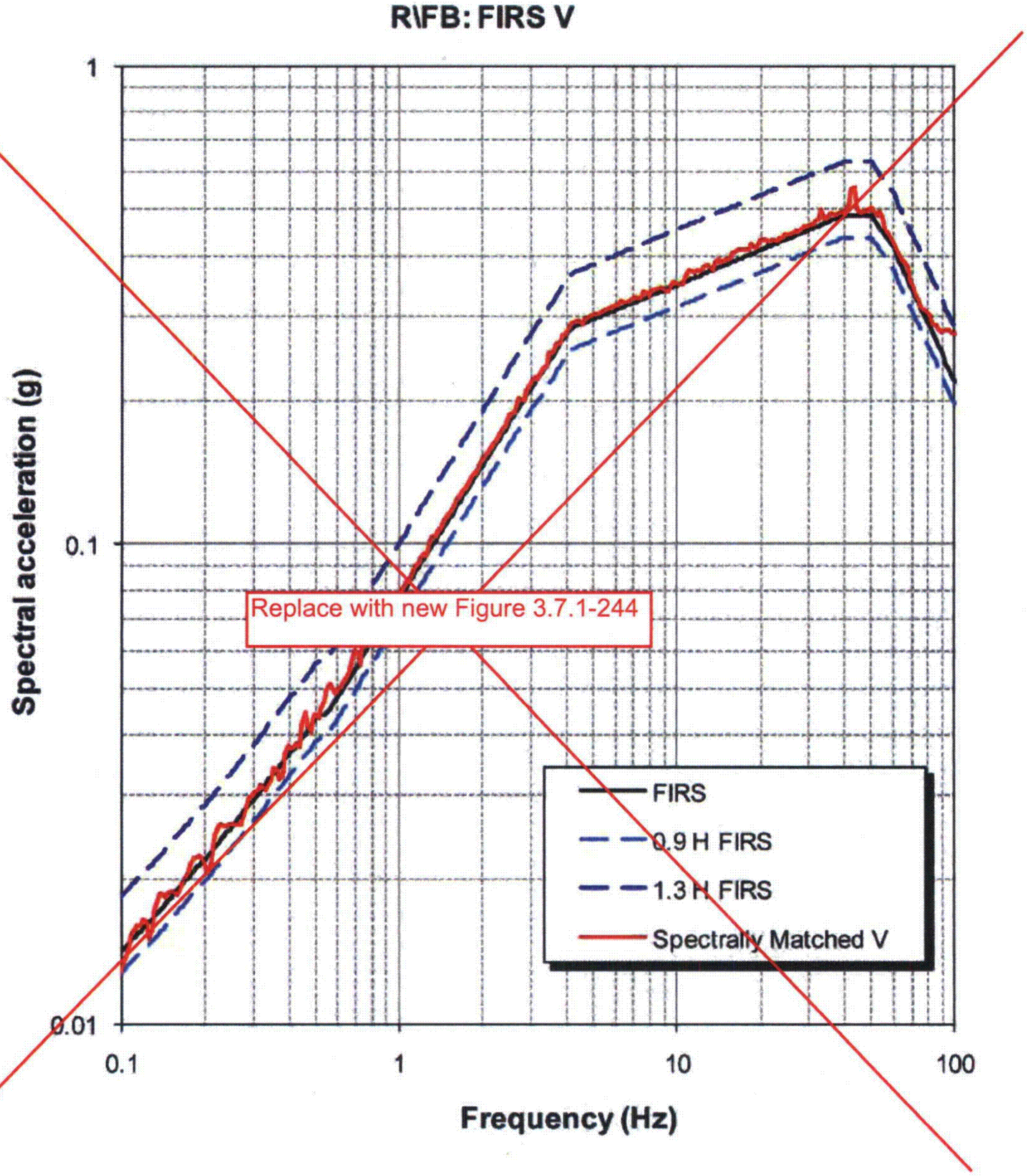


Figure 3.7.1-243: Response Spectrum for Spectrally Matched Horizontal (H2) Component for the Fermi 3 RB/FB SSI FIRS.

Figure 3.7.1-236 Response Spectrum for Spectrally Matched Vertical (V) Component for the Fermi 3 RB/FB SSI FIRS [EF3 SUP 3.7-2]



New Figure 3.7.1-244

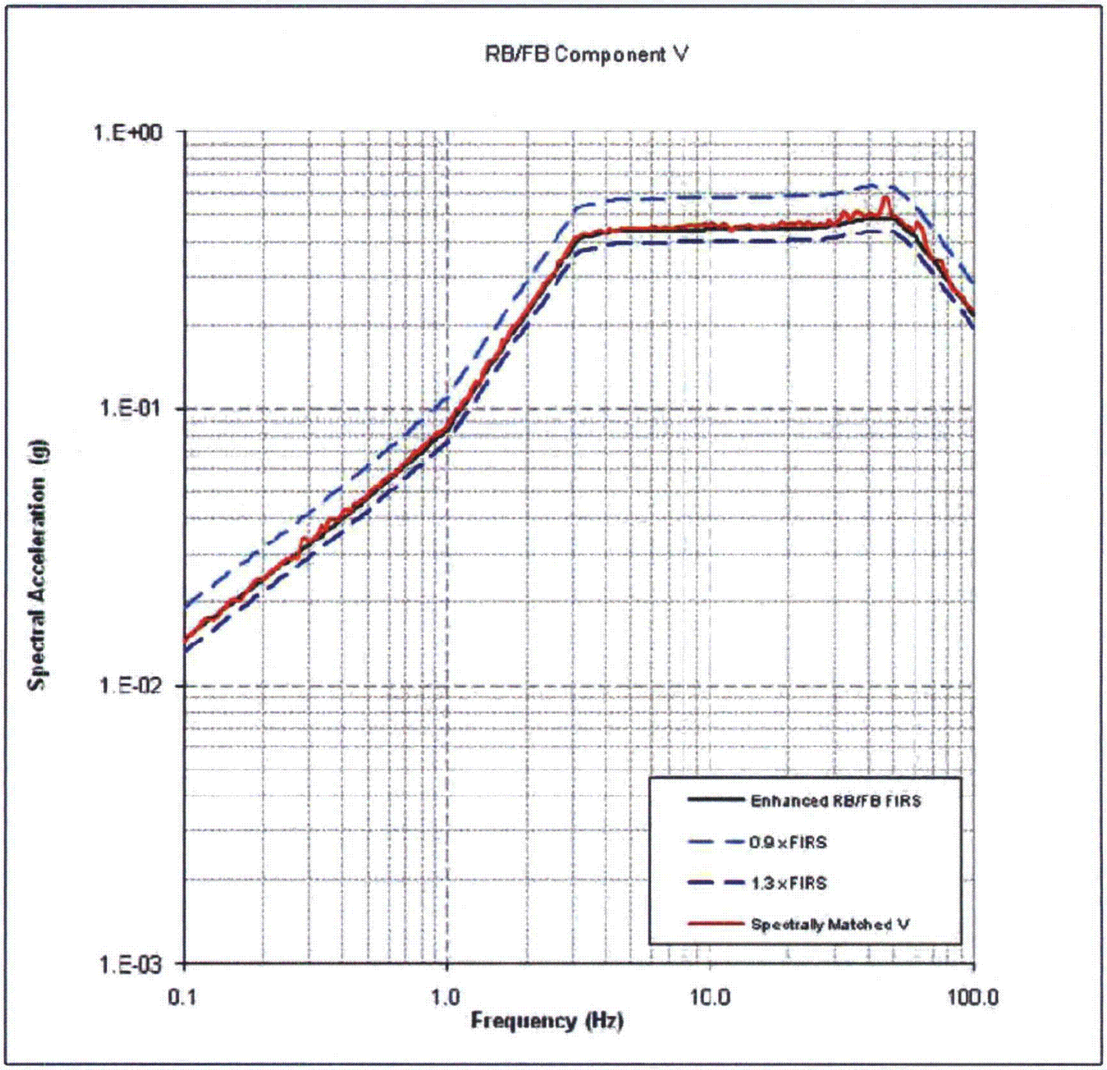


Figure 3.7.1-244: Response Spectrum for Spectrally Matched Vertical (V) Component for the Fermi 3 RB/FB SSI FIRS.