Appendix 3KK Site Specific Seismic Evaluation Report

Appendix 3KK is comprised of the AP1000 Turkey Point Site Specific Seismic Evaluation Report, Westinghouse Document Number TPG-1000-S2R-802. This is a Westinghouse proprietary document and is withheld under 10 CFR 2.390(b).

The non-proprietary AP1000 Turkey Point Site Specific Seismic Evaluation Report, Westinghouse Document Number TPG-1000-S2R-807 is a redacted version of the proprietary AP1000 Turkey Point Site Specific Seismic Evaluation Report.

TPG-1000-S2R-807
Revision 4

August 2015

AP1000
Turkey Point Site Specific Seismic Evaluation Report

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RECORD OF REVISIONS

Rev	Date	Revision Description[1]
0	See EDMS	Original Issue
1	08/2012	Text revision to replace 'bridging mat' to 'lean concrete fill' throughout report.
2	1/2013	Addressed FPL RFI # RFI-FPL-036 including NRC RAI 03.07.01-14, 03.07.01-16, and 03.07.01-18, and FPL RFI # RFI-FPL-037 including NRC RAI 03.07.01-15. Turkey Point 2D and 3D SSI analyses were revised to incorporate a new FIRS developed by Bechtel to meet the minimum 0.1g requirement in Appendix S of 10 CFR Part 50. Revised seismic input and soil profiles from Bechtel Calculation 25409-000-K0C-0000-00066 Rev. 0 are reflected herein and the resulting in-structure floor response spectra (FRS) are compared to the AP1000 six key Nuclear Island (NI) locations FRS envelops. Also, transfer functions at the six key NI locations are presented in Appendixes B, C and D.. Finally, Seismic Category II adjacent structures SSI analyses were revised to incorporate updated Turbine Building First Bay and Annex Building stick model geometry.
3	03/2015	Performed 3D and 2D soil-structure interaction (SSI) sensitivity analyses to evaluate the potential effect on the Revision 2 design-basis SSI analyses of the Nuclear Island (NI) and Seismic Category (SC) II adjacent structures in-structure response spectra (ISRS). Sensitivity SSI analyses are based on updated (2013) site characterization data and updated (2014) site response best-estimate (BE) sensitivity analysis, performed by others, and the corresponding updated SSI soil, rock, concrete and grouted rock seismic input for Turkey Point Units 6&7. Appendix E presents detailed descriptions of the updated BE seismic input, the initial (Revision 2) near NI and far-field (FAR) BE profiles and corresponding updated (Revision 3) BE profiles, and the results of 3D SASSI SSI sensitivity analyses to evaluate and compare the design-basis Revision 2 SSI analysis ISRS to the updated Revision 3 sensitivity study ISRS at the six key NI locations. Appendix F presents the results and comparisons of the SCII Turbine Building First Bay and Annex Building adjacent structures 2D SSI sensitivity analyses. Narrative updates to describe and refer to the Appendix E and Appendix F SSI sensitivity analyses and/or results were added to Sections 1.0, 2.1.1, 2.2.1, and 7.0, and pertinent updated References 11, 12 and 13 were added to Section 8.0. Finally, clarification descriptions of the inclusion of the grouted rock zone and corresponding grouted rock properties in the design-basis and sensitivity SSI analyses were added to Sections 2.1, 2.2 and 3.3, and Figures 3.1-2 and 4.3-3 were updated. All other design-basis sections and appendixes remain unchanged. Proprietary version of this report is TPG-1000-S2R-802 Rev. 6.
4	08/2015	Revised GMRS elevation on Page 19 from El. -16 to El. -35. All other information in the report remains unchanged from the previous revision (Rev. 3).

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1.0 Purpose

Two AP1000 units are to be constructed at the Florida Power & Light (FPL) Turkey Point site. Since shear wave velocity profiles at the Turkey Point Units 6 & 7 site are different from the generic soil shear wave velocity profiles used for the AP1000 design, a site-specific Soil Structure Interaction (SSI) analysis was performed.

Westinghouse Electric Company (Westinghouse) has completed a revised site-specific SSI analysis of the Seismic Category (SC) I Turkey Point Nuclear Plant (TPNP) Nuclear Island (NI) with lean concrete (LC) fill and grouted rock, and SCII adjacent structures including the Turbine Building (TB) First Bay and Annex Building (AB) with engineered fill. This report describes the results of the revised site-specific SSI analyses and SSI sensitivity analyses that have been performed to demonstrate the acceptability of the AP1000 plant at the Turkey Point site. The analysis was revised to address the following:

1. Update the TPNP SSI model and SSI analysis using the current AP1000 NI20r three-dimensional (3D) Model, site-specific conditions including the LC fill, and TPNP Best Estimate (BE), Lower Bound (LB) and Upper Bound (UB) site soil profiles, and the revised safe shutdown earthquake (SSE) foundation level response spectra meeting the 0.1g minimum peak ground acceleration requirement of Appendix S of 10 CFR Part 50;
2. Incorporate lessons learned pertaining to justification of the NI20r 3D model and analysis results;
3. Compare the revised TPNP in-structure floor response spectra (FRS) to the AP1000 3D Certified Seismic Design Response Spectra (CSDRS) FRS envelope at six (6) key AP1000 NI locations;
4. Update the TPNP two-dimensional (2D) north-south (NS) model, which represents the AP1000 NI with the most recent Turbine Building (TB) First Bay stick model and TPNP BE, LB and UB site soil profiles, and perform the corresponding SSI analysis;
5. Update the TPNP 2D east-west (EW) model, which represents the AP1000 NI with the most recent Annex Building (AB) stick model and TPNP BE, LB and UB site soil profiles, and perform the corresponding SSI analysis;
6. Compare the TPNP TB First Bay and AB FRS to the AP1000 2D FRS envelope at the TB First Bay and AB 2D stick model base and six (6) key AP1000 NI locations;
7. Assess the relative displacements between the AP1000 NI and the TB First Bay and AB at elevations associated with the ground surface and near the top of each adjacent structure;
8. Present TPNP 3D BE, LB and UB transfer functions for the six key locations in Appendixes B, C and D, respectively.
9. Perform supplemental SSI sensitivity analyses based on a 2013 supplemental site characterization and 2014 site response sensitivity analysis, and compare the results of the sensitivity analysis to the existing design-basis analysis to assess the significance of the updated seismic input on the previous (Revision 3) site specific NI and SCII adjacent structures in-structure response spectra.

The SSI analyses results will show that the 2013 and 2014 supplemental site characterization and site response data have a negligible effect on the design basis site specific response of the NI and SCII adjacent structures, and the in-structure Floor Response Spectra (FRS) of an AP1000 plant at the Turkey Point Units 6 & 7 site is enveloped with margin by the AP1000 Certified Seismic Design Response Spectra (CSDRS) FRS at the key AP1000 NI and SCII adjacent structures locations.

2.0 Background

This section summarizes the free field response analyses, site response and SSI sensitivity analyses, and design-basis SSI analyses that have been performed for Turkey Point Units 6 & 7 to demonstrate that the AP1000 generic seismic response envelops the TPNP site specific seismic response.

2.1 Summary of TPNP Free Field Response Analyses

The overall site elevation will be raised by approximately 25.5 feet with compacted crushed limestone. Adjacent to the NI (as shown in Figure 3.1-1), a slurry wall will be constructed to facilitate dewatering of the NI excavation. Inside the slurry wall area and as shown in Figure 3.1-2, the Miami Limestone will be excavated to competent rock, a surface elevation estimated to be approximately 35 feet below the ground surface (i.e., El. –35'). On this surface, approximately 19 feet of lean concrete fill will be placed to bring the surface to El. -16' for construction of the mud mat and foundation of the NI. Adjacent to the NI, Category 1 engineered backfill will be placed to bring the ground surface to El. +25.5'. Finally, below the Miami Limestone, the Key Largo Limestone is grouted from El. -35 to El. -60.

The numerical models used for SSI analysis specifies the dynamic properties of the site by using as input the shear wave velocity (Vs), compression wave velocity (Vp), unit weight and material damping of the soil, rock, layers. The SSI analysis is performed in the frequency domain using linear-elastic material properties. In order to account for the non-linearity of the soil, rock, concrete and grouted rock materials, the SSI analysis uses strain-compatible properties that represent the stiffness and damping properties of the various materials that are compatible with the strains generated by the design earthquake motion. Two sets of three (3) soil profiles, Best Estimate (BE), Lower Bound (LB) and Upper Bound (UB) are used for two (2) site conditions including near Nuclear Island (NI) and far from Nuclear Island (FAR) to account for uncertainties in the determination of soil, rock, concrete and grouted rock material properties.

Updated free-field site response analyses results, acceleration response spectra, SSI input time histories, and strain compatible soil properties were provided by FPL in Bechtel letters 25409-000-TCM-GEG-00752 (Reference 1) and 25409-000-TCM-GEG-00581 (Reference 2) and 25409-000-TCM-GEG-00404 (Reference 3).

To satisfy the requirements of Appendix S to 10 CFR Part 50, specifically that the Safe Shutdown Earthquake (SSE) motion must be an adequate acceleration response spectra (ARS) with a minimum peak ground acceleration (PGA) of 0.1g, the TPNP site-specific design response spectra (DRS) at the foundation level (El, -16) consists of the envelope of the TPNP site-specific foundation input response spectra (FIRS) and the RG 1.60 spectra scaled to 0.1g. The resulting horizontal and vertical envelope FIRS is considered the SSE motion for the TPNP site.

Two horizontal (H1 and H2) and one vertical (UP) acceleration time histories are spectrally matched to the SSE motion. The SSI analysis of the NI uses a set of SSE acceleration time histories that are input as "within," i.e., in-column motion at the elevation of the TPNP foundation

(El. -16) located 41.5-foot depth. To obtain these “within” time histories, each of the strain compatible BE, LB and UB soil profiles is analyzed by inputting the time histories consistent with the 41.5-foot depth, minimum 0.1g SSE spectra as an “outcrop” motion at this foundation depth. Horizontal and vertical ARS at the design grade elevation were developed following the Interim Staff Guidance DC/COL-ISG-017 to check that the response due to the site-specific FIRS envelope the surface ARS using the BE, LB and UB soil properties.

Figure 2.1-1 (FSAR Figure 2.5.2-253) and Figure 2.1-1a (FSAR Figure 2.5.2-254) show the horizontal and vertical site-specific ground motion response spectra (GMRS), respectively. The GMRS was developed as the Truncated Soil Column Surface Response (TSCSR) on the uppermost in-situ competent material (El. -35’).

The horizontal and vertical TPNP site-specific FIRS and RG 1.60 spectra scaled to 0.1g envelopes are presented in Figure 2.1-2.

The horizontal and vertical BE, LB and UB “within” ARS at the TPNP foundation El. -16’ are shown in Figures 2.1-3 through 2.1-5 for the NI (near) site conditions, and Figures 2.1-6 through 2.1-8 for the FAR site conditions.

Figures 2.1-9 through 2.1-14 present the comparison of the computed surface motions to the respective DRS for each directional component (H1, H2, V), each soil case (BE, LB and UB) and each site condition (NI and FAR).

The in-column time histories at El. -16’ and the BE, LB and UB soil profiles used as input to the SSI analysis were provided by FPL in Bechtel Letter 25409-000-TCM-GEG-00752 (Reference 1). As indicated, the SSE time histories were input into the three (BE, LB and UB) soil columns as outcropping motions at El. -16’, and then output as in-column motions at El. -16 ft for use in the SSI analysis. These in-column time histories at El.-16’ are shown in Figures 3.5-1 through 3.5-3 for the NI site conditions and in Figures 3.5-4 through 3.5-6 for the FAR site conditions.

Similarly, surface founded outcrop FIRS for the SCII TB First Bay and AB adjacent structures and corresponding time histories were provided by FPL in Bechtel Letter 25409-000-TCM-GEG-00404 (Reference 3), and the horizontal and vertical FIRS are presented in Figures 2.1-15 and 2.1-16, respectively. The TB First Bay and AB time histories are presented in Figures 3.5-7 through 3.5-9 for the TB First Bay and Figures 3.5-10 through 3.5-12 for the AB, which were conservatively increased to a minimum PGA of 0.10g, and the corresponding spectra are presented in Figures 2.1-15 and 2.1-16.

The BE, LB and UB soil property profiles were developed based on the variation in the randomized soil profiles used for developing the DRS and complying with SRP 3.7.2.II.4 guidance on soil property variation for SSI analysis, i.e., the coefficient of variation used was the larger of that calculated from the randomized soil profiles or 1.5 on the shear modulus as described in FSAR Subsection 2.5.2.6.7. The soil column profile and soil properties are presented in FSAR Tables 3.2-1, 3.2-2 and 3.2-3 for BE, LB, and UB cases, respectively.

2.1.1 Summary of 2014 Updated TPNP Site Response Sensitivity Analyses

In 2013, a supplemental site subsurface investigation was performed by Rizzo & Associates (Rizzo) at the Turkey Point Units 6 & 7 site and corresponding updated site response sensitivity analyses were performed by Bechtel Corporation (Bechtel) in 2014. Supplemental site investigations at the TPNP site included collecting additional geotechnical data that resulted in updated site profiles including unit weights, thicknesses, nonlinear shear modulus (G)/Gmax and damping ratio curves, shear wave velocities (Vs) and compression wave (Vp) velocities for layers within the top 636 feet. Bechtel evaluated the sensitivity of the updated site properties on the ground motion response spectrum (GMRS), foundation input response spectrum (FIRS), and soil-structure interaction (SSI) seismic input parameters on both the near Nuclear Island (NI) and far field (FAR) profiles. Reference 12 provides the updated SSI soil/rock properties for supplemental seismic SSI sensitivity analyses, which are described in detail in Appendix E for the Nuclear Island and Appendix F for SCII Turbine Building First Bay and Annex Building adjacent structures.

Based on the results of updated site response sensitivity analyses, Bechtel concluded the following (Reference 12):

1. The RG 1.60 spectrum with a peak ground acceleration (PGA) of 0.1 g envelopes the sensitivity NI FIRS (see Figure 2.1-17). Thus, the previously established SSE is still valid, which was partially based on the RG 1.60 spectrum with a PGA of 0.1 g; and
2. The approximate sensitivity GMRS (developed in Appendix 3 of Reference 12 using the updated site characteristics) is slightly higher than the initial GMRS (computed in Reference 1). At a frequency of 100 HZ, the sensitivity horizontal GMRS increased from 0.058 g to 0.062 g (a ratio of 1.07); with a maximum ground-motion change from 0.0635 g to 0.0698 g (a ratio of 1.10) at a frequency of 45 Hz. The ratio of these differences may indicate a significant change due to the updated site properties; however the ground-motion difference of 0.004 g at a frequency of 100 Hz, and 0.006 g at a frequency of 45 Hz is well within the confidence bounds of probabilistic seismic hazard analysis (PSHA) and seismic site response. Furthermore, the GMRS developed for the initial and updated site properties both characterize Turkey Point Units 6 & 7 site as a site with low seismic hazard.

Figure 2.1-17 presents a comparison of the previous TPNP site specific FIRS (References 1,11), updated FIRS (Reference 12), and the RG 1.60 envelope safe shutdown earthquake (SSE) spectra anchored to 0.1g (References 1, 11). As shown, the initial and updated site specific FIRS are similar up to about 5 hertz (Hz) and within about 10 percent above 5 Hz; however, and most importantly, both are enveloped by the initial RG 1.60 SSE curve anchored to the 0.1g peak ground acceleration (PGA). Therefore, since the RG 1.60 SSE curve still controls the site seismic input, the previous (References 1, 11) time histories are still valid and applicable to the design-basis and sensitivity SSI analyses.

Also, in conjunction with the (Reference 12) updated site response sensitivity analyses results, Reference 13 provides confirmation that the initial, rigorously developed seismic input (References 1, 2, 3) remain unchanged and valid as noted below, and Reference 4 has been updated to Revision 5:

1. The reference and information provided through Bechtel Letter No. 25409-000-TCM-GEG-00752 ("Release of Calculation 25409-000-K0C-0000-00066, Revision 0, SSI Input Time Histories and Soil Profiles for Envelope of RG 1.60 and Site Spectra," dated August 2, 2012) (Reference 1) remain valid for design basis soil profiles and SSI inputs.
2. The reference and information provided through Bechtel Letter No. 25409-000-TCM-GEG-00581 ("Turkey Point Units 6 & 7, Effect of Grouted Rock on Seismic Site Response," dated July 20, 2011) (Reference 2) remain valid for design basis soil profiles and SSI inputs.
3. The reference and information provided through Bechtel Letter No. 25409-000-TCM-GEG-00404 ("Release of Extracted Data from Calculations 25409-000-KOC-0000-00036 Rev. 0 and -00037 Rev. 0 for Turkey Point Units 6 & 7," dated February 26, 2010) (Reference 3) remain valid for design basis soil profiles and SSI inputs.
4. The revised Bechtel drawing 25409-000-CE-0010-00001, Rev. 5 (“Nuclear Island Power Block Excavation Plan and Sections”) (Reference 4) has been updated.

Finally, Bechtel calculation 25409-000-K0C-0000-00073, Rev. 0 was provided in Reference 12, and includes approximate ground motions and SSI properties for further Westinghouse SSI sensitivity analyses of the NI and SCII adjacent structures. Appendix E and Appendix F herein summarize the updated seismic input, SSI sensitivity analyses, and present results and conclusions pertaining to the effect of these analyses on the NI and SCII adjacent structures in-structure response spectra, respectively.

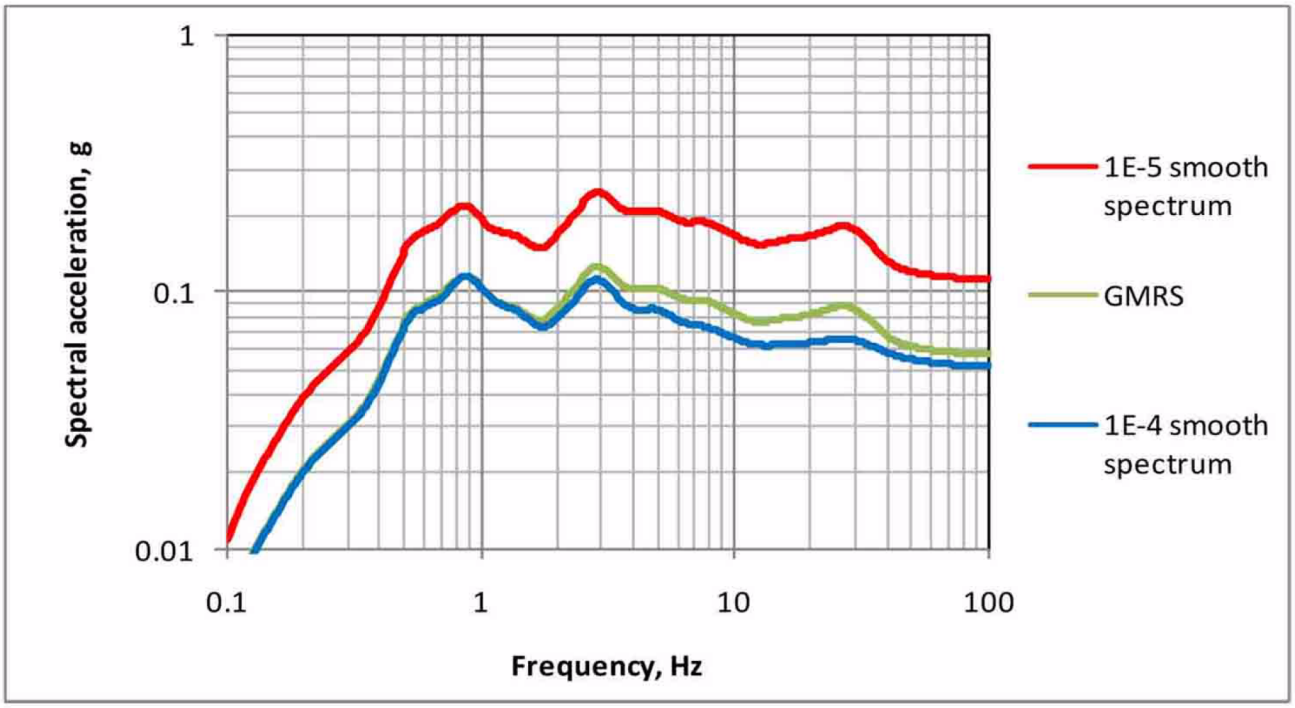

Figure 2.1-1. Horizontal GMRS for the TPNP Site (FPL FSAR Figure 2.5.2-253)

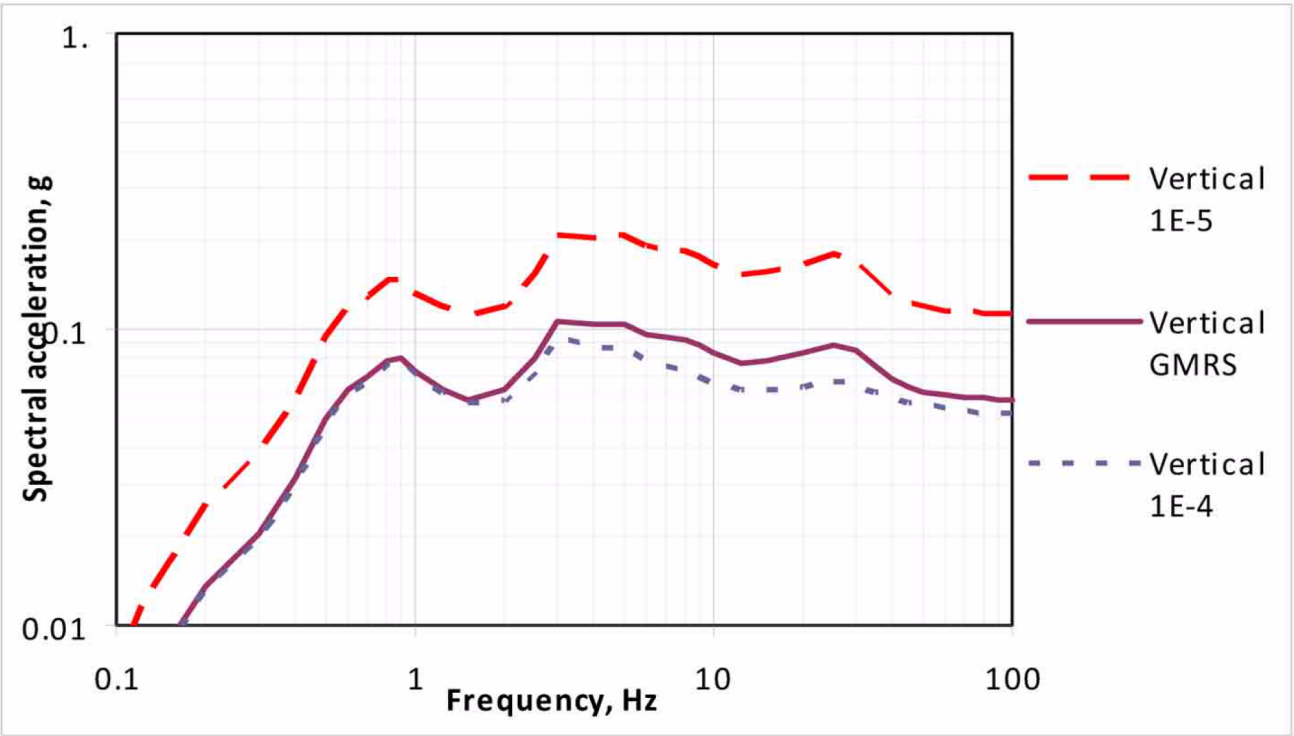

Figure 2.1-1a. Vertical GMRS for the TPNP Site (FPL FSAR Figure 2.5.2-254)

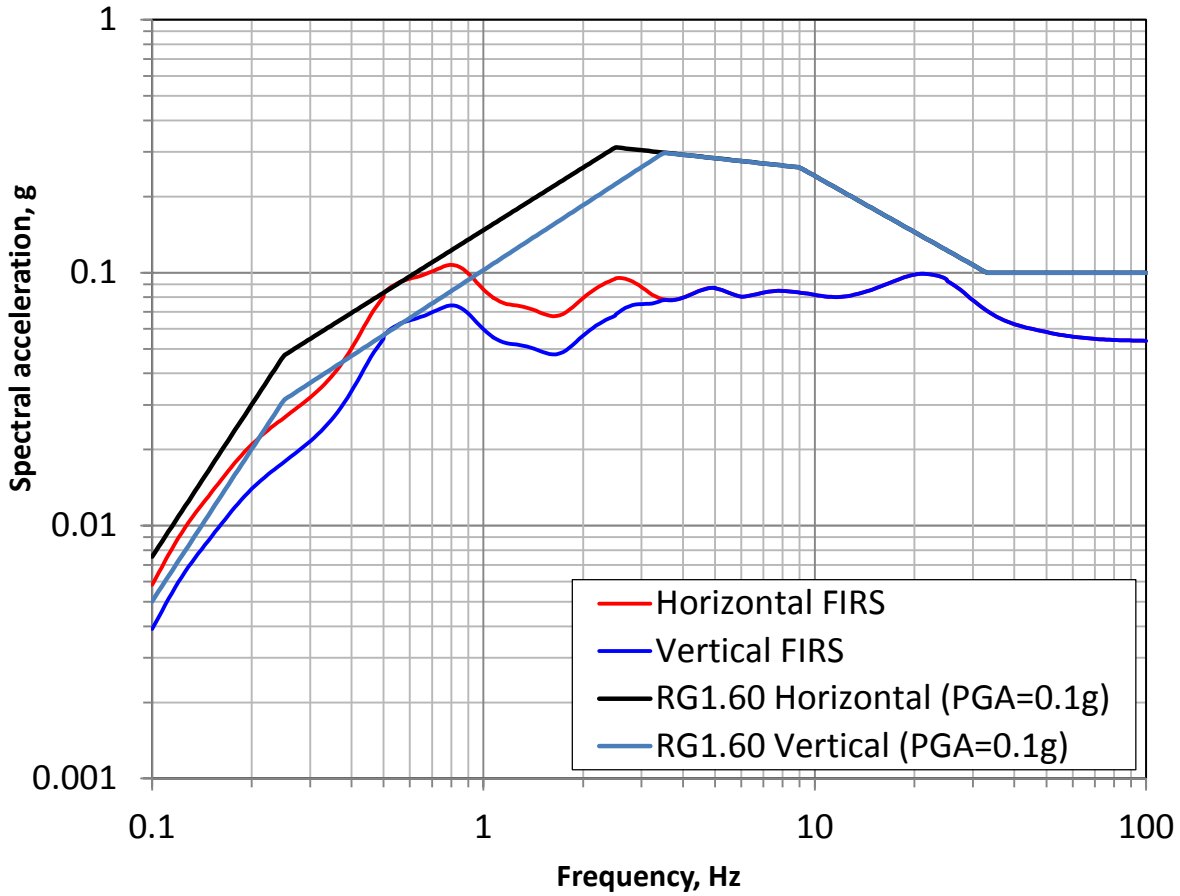

Figure 2.1-2. TPNP FIRS and RG 1.60 PGA=0.1g Foundation Level Outcrop SSE

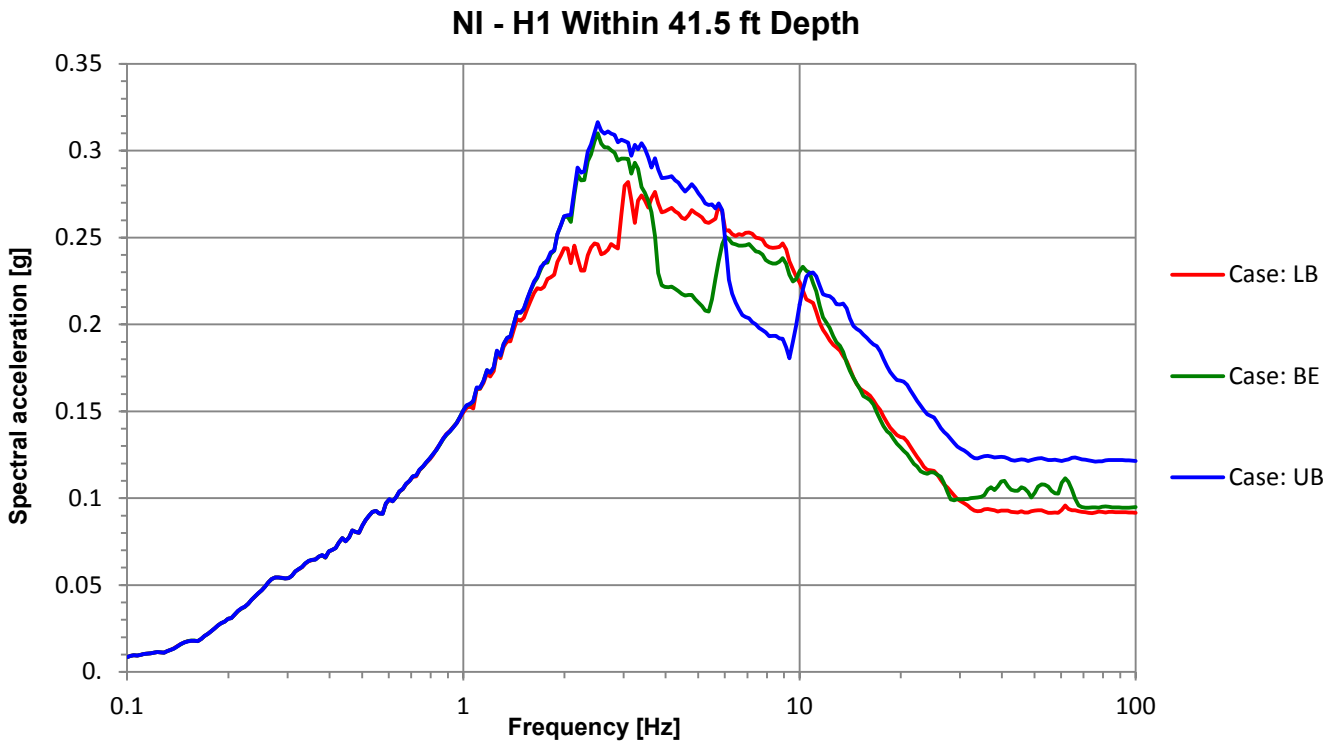

Figure 2.1-3. NI H1 Horizontal within ARS at TPNP Foundation El. -16′

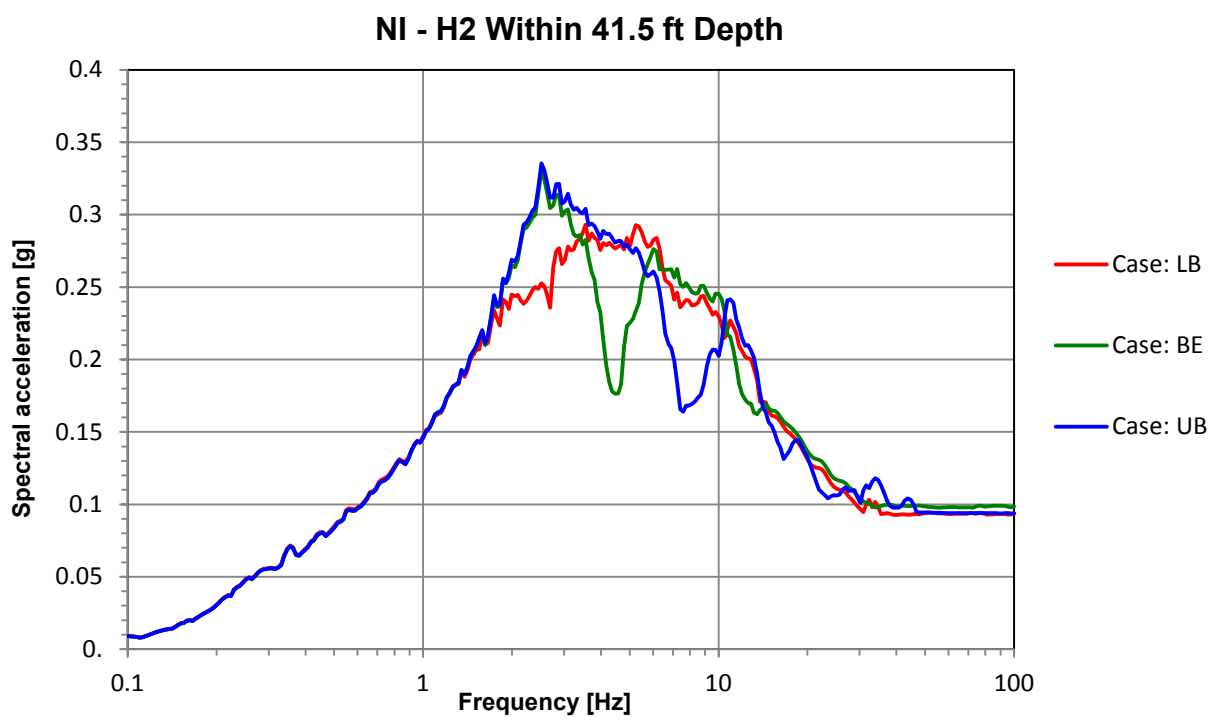

Figure 2.1-4. NI H2 Horizontal within ARS at TPNP Foundation El. -16′

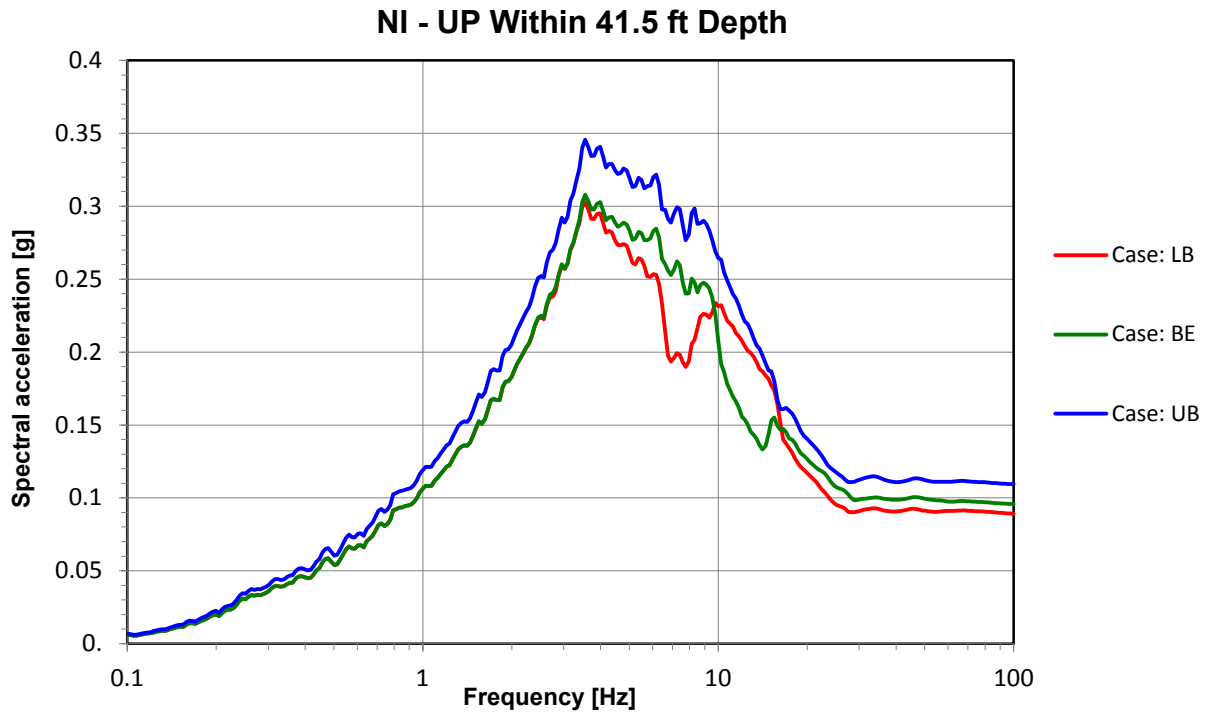

Figure 2.1-5. NI UP Vertical within ARS at TPNP Foundation El. -16′

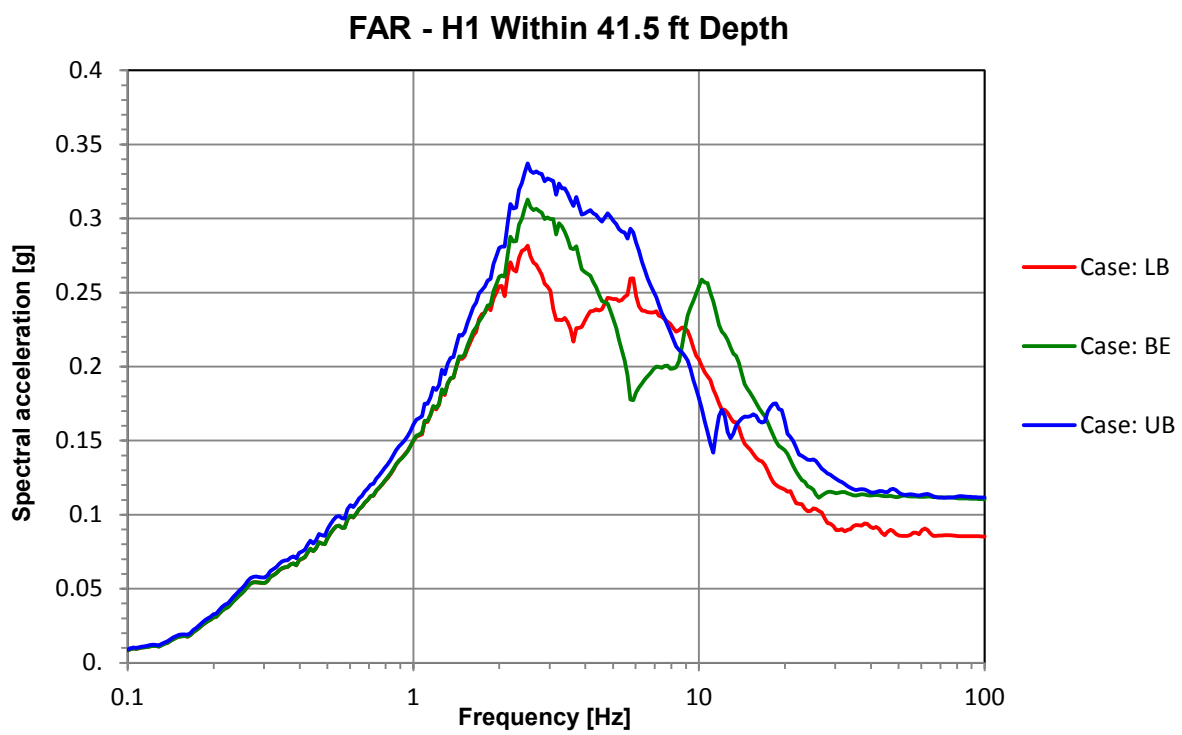

Figure 2.1-6. FAR H1 Horizontal within ARS at TPNP Foundation El. -16′

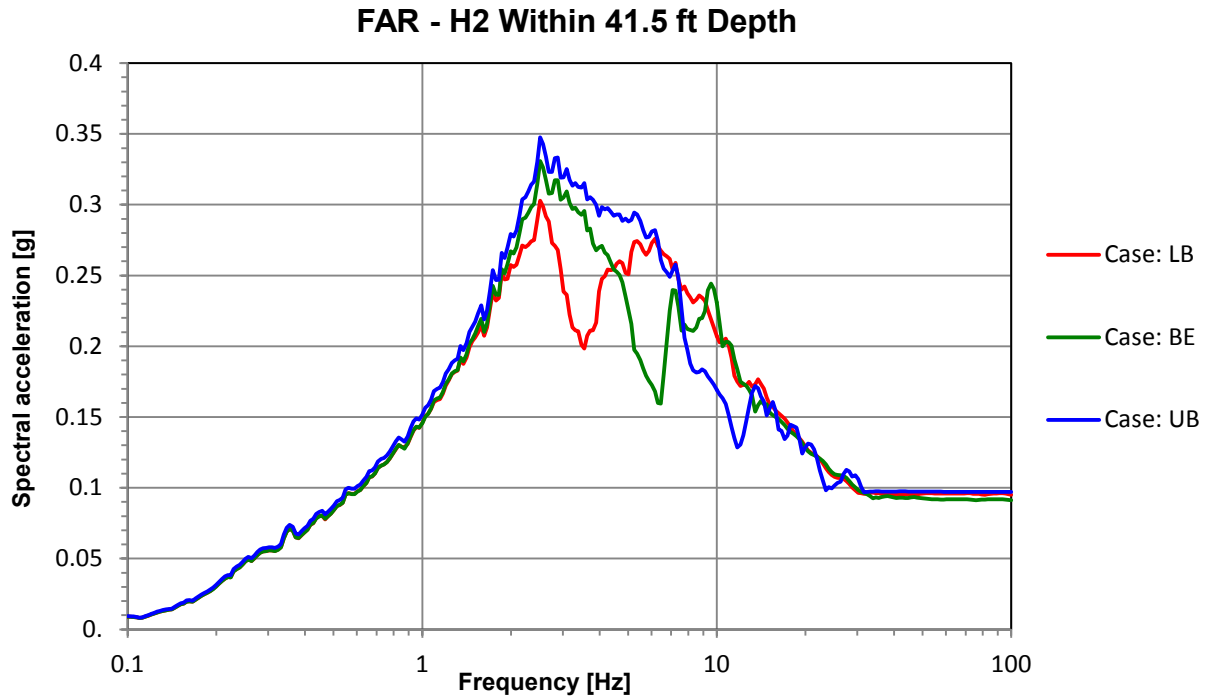

Figure 2.1-7. FAR H2 Horizontal within ARS at TPNP Foundation El. -16′

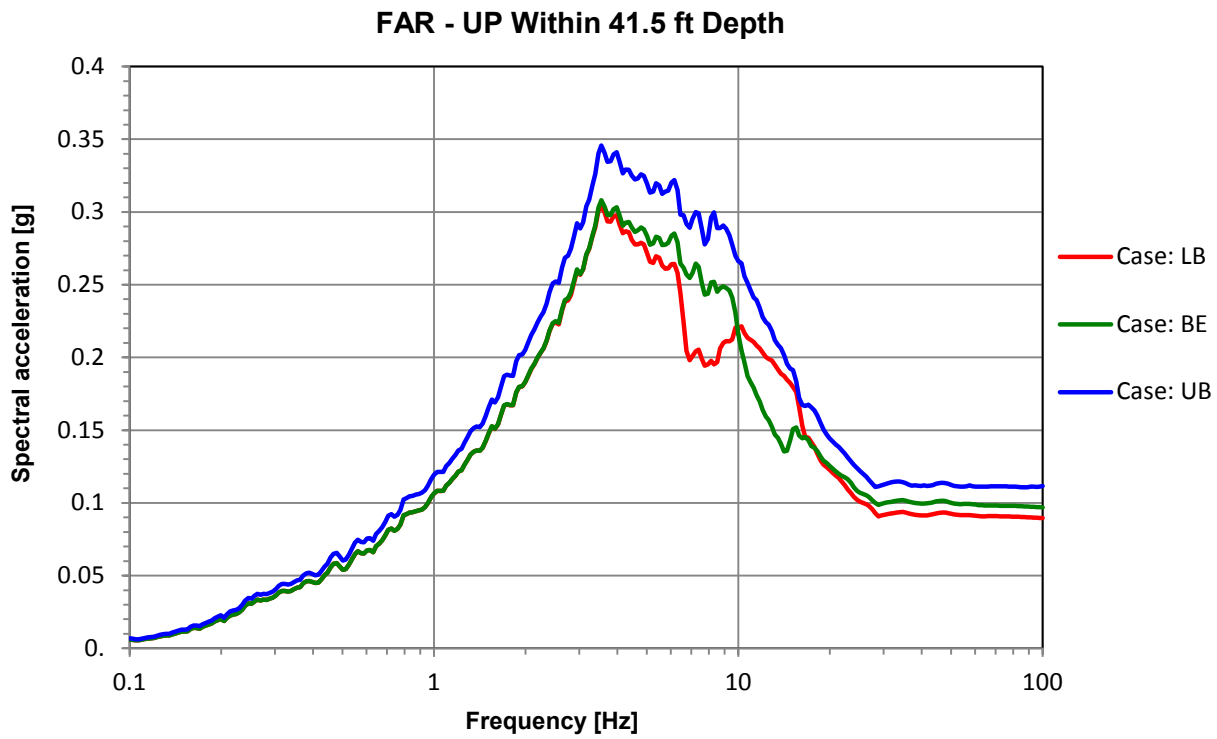

Figure 2.1-8. FAR UP Vertical within ARS at TPNP Foundation El. -16′

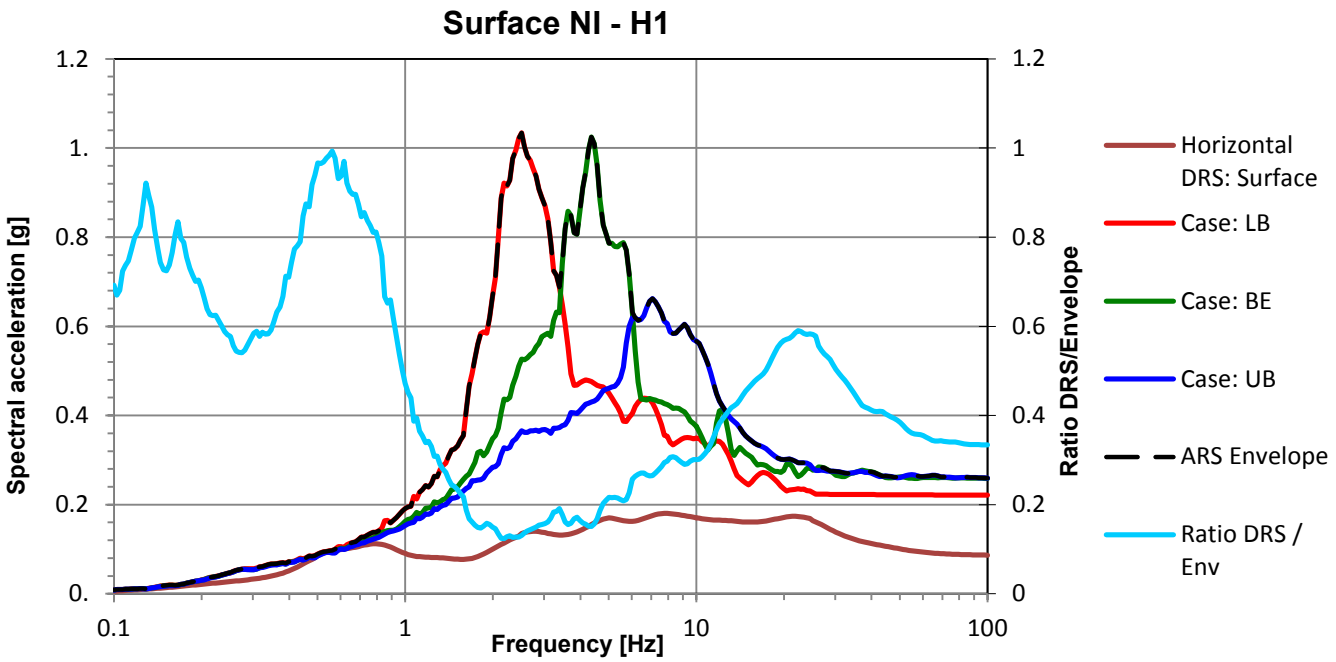

Figure 2.1-9. Comparison of Spectra of Computed H1 Component Surface Motions for NI SSI Profiles with Horizontal DRS

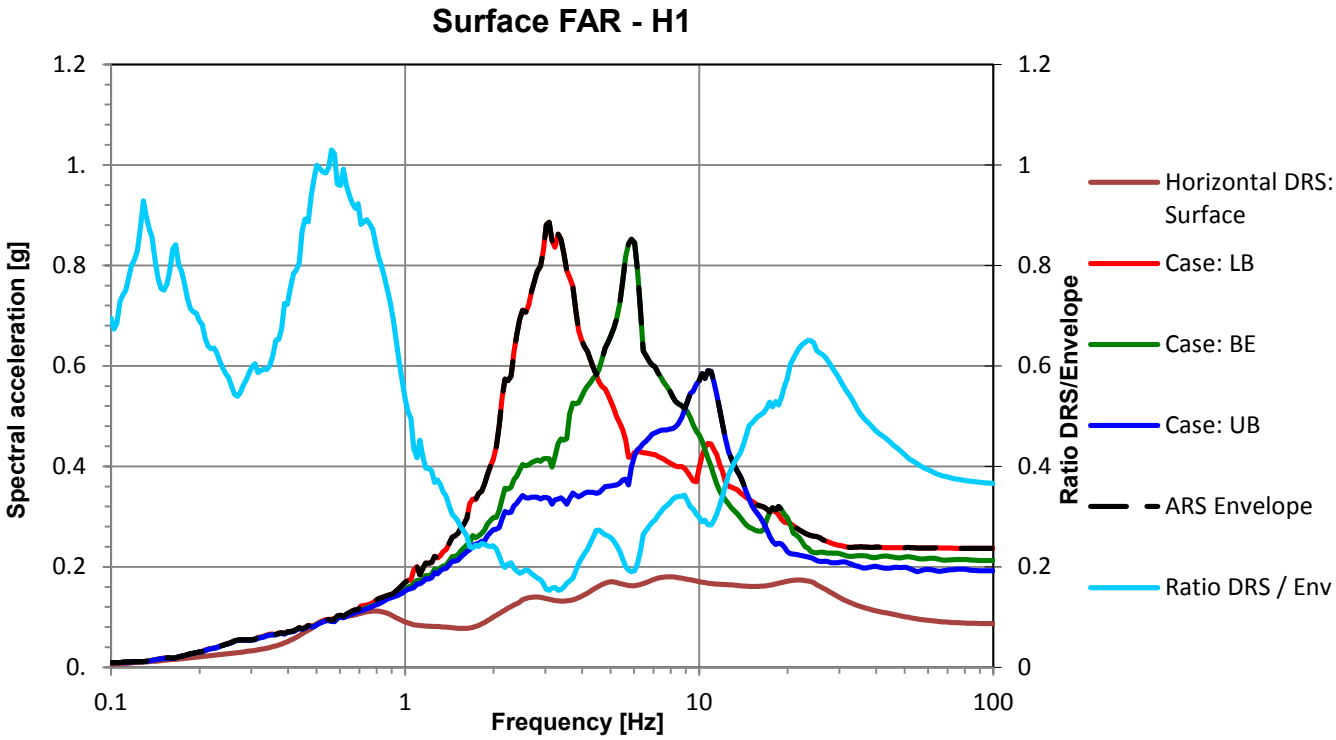

Figure 2.1-10. Comparison of Spectra of Computed H1 Component Surface Motions for FAR SSI Profiles with Horizontal DRS

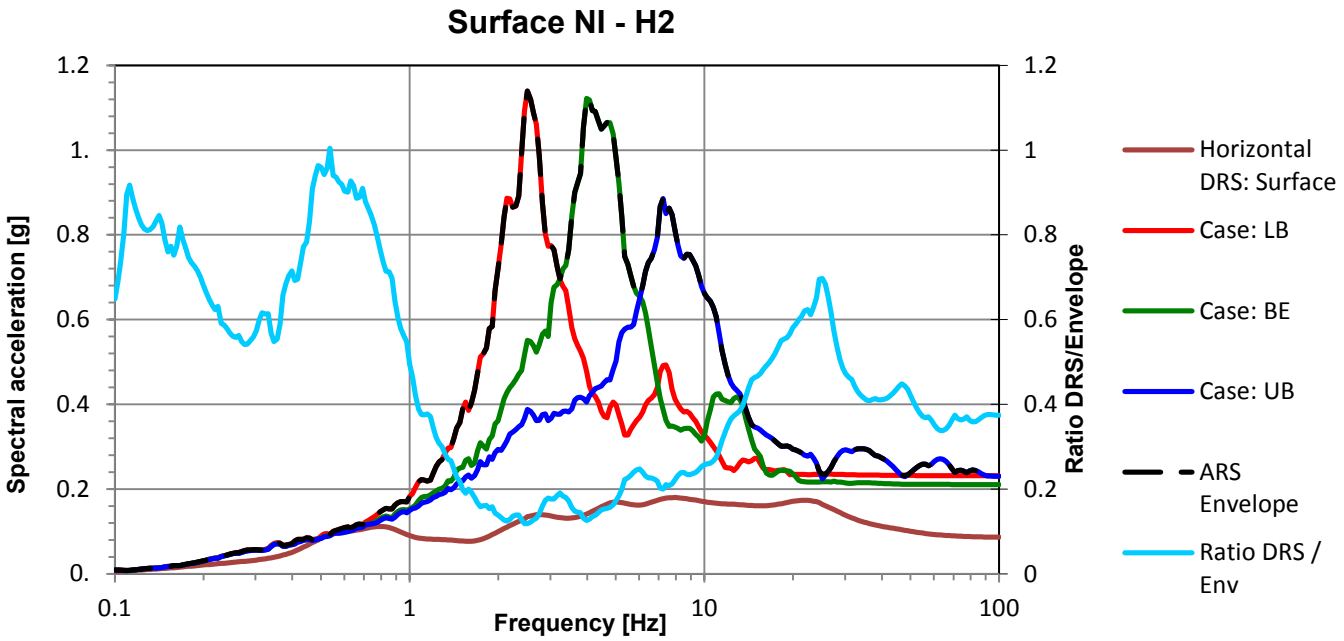

Figure 2.1-11. Comparison of Spectra of Computed H2 Component Surface Motions for NI SSI Profiles with Horizontal DRS

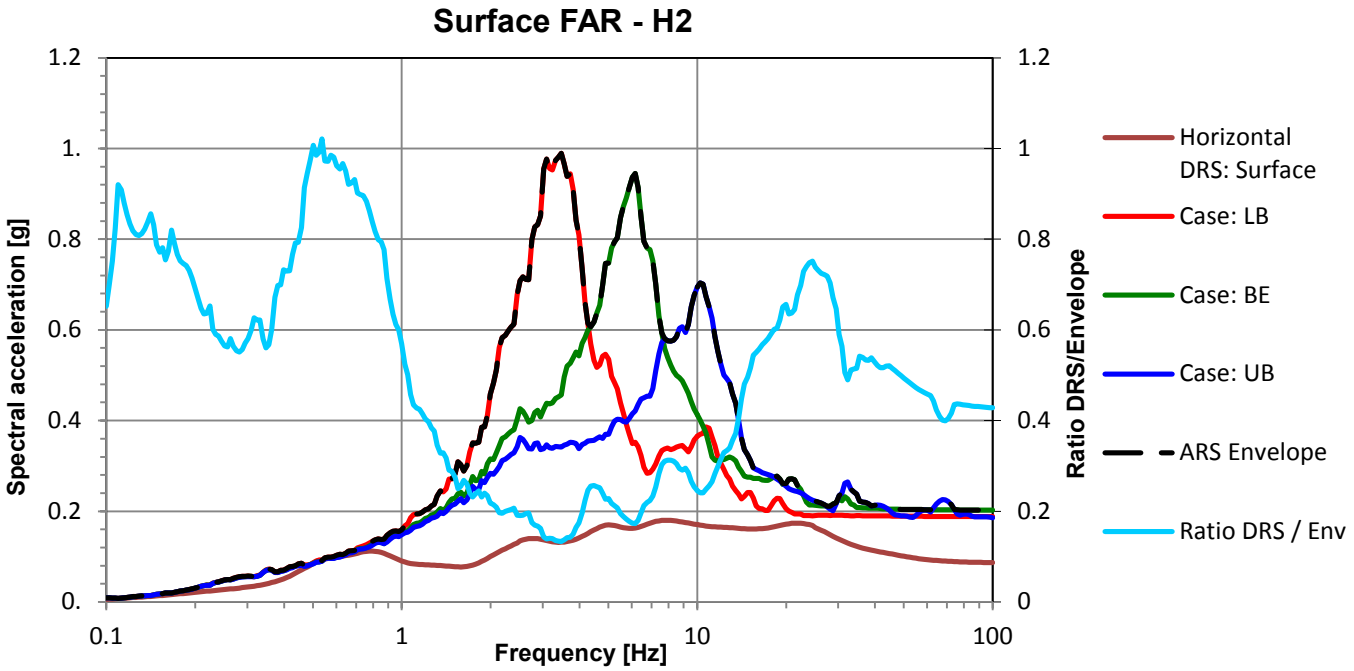

Figure 2.1-12. Comparison of Spectra of Computed H2 Component Surface Motions for FAR SSI Profiles with Horizontal DRS

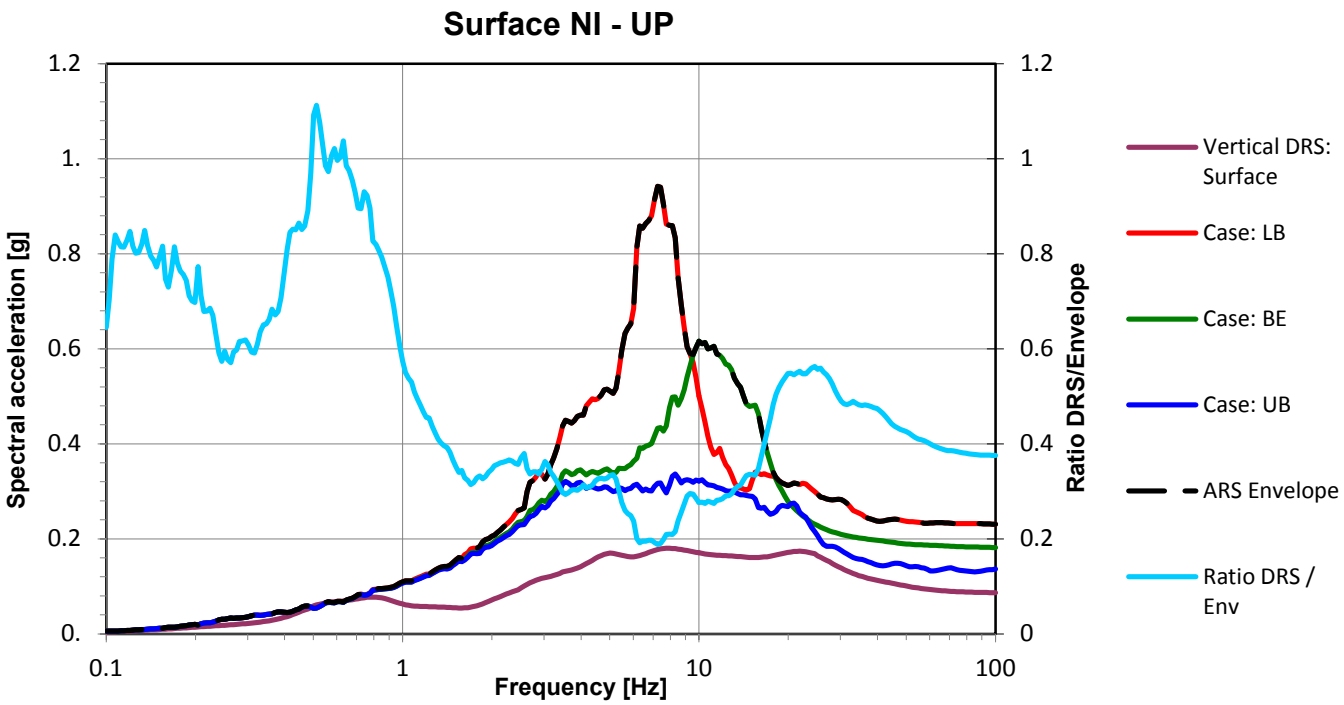

Figure 2.1-13. Comparison of Spectra of Computed V Component Surface Motions for NI SSI Profiles with Vertical DRS

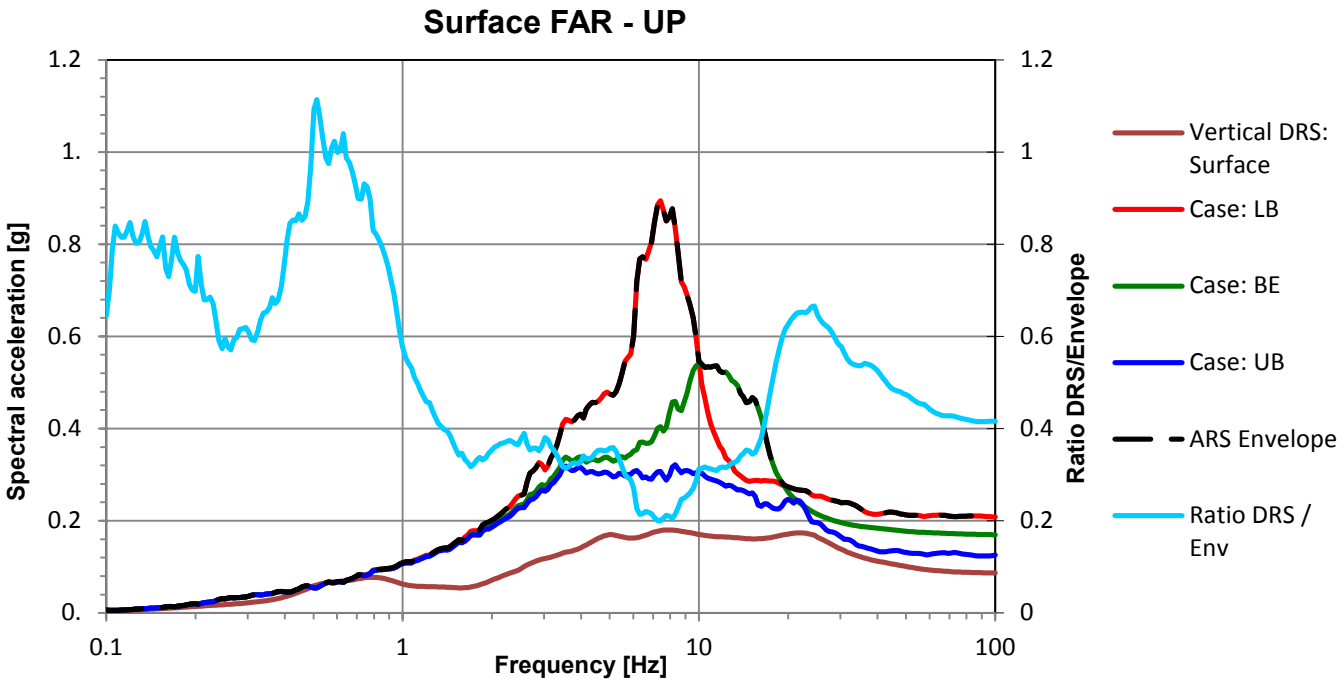

Figure 2.1-14. Comparison of Spectra of Computed V Component Surface Motions for FAR SSI Profiles with Vertical DRS

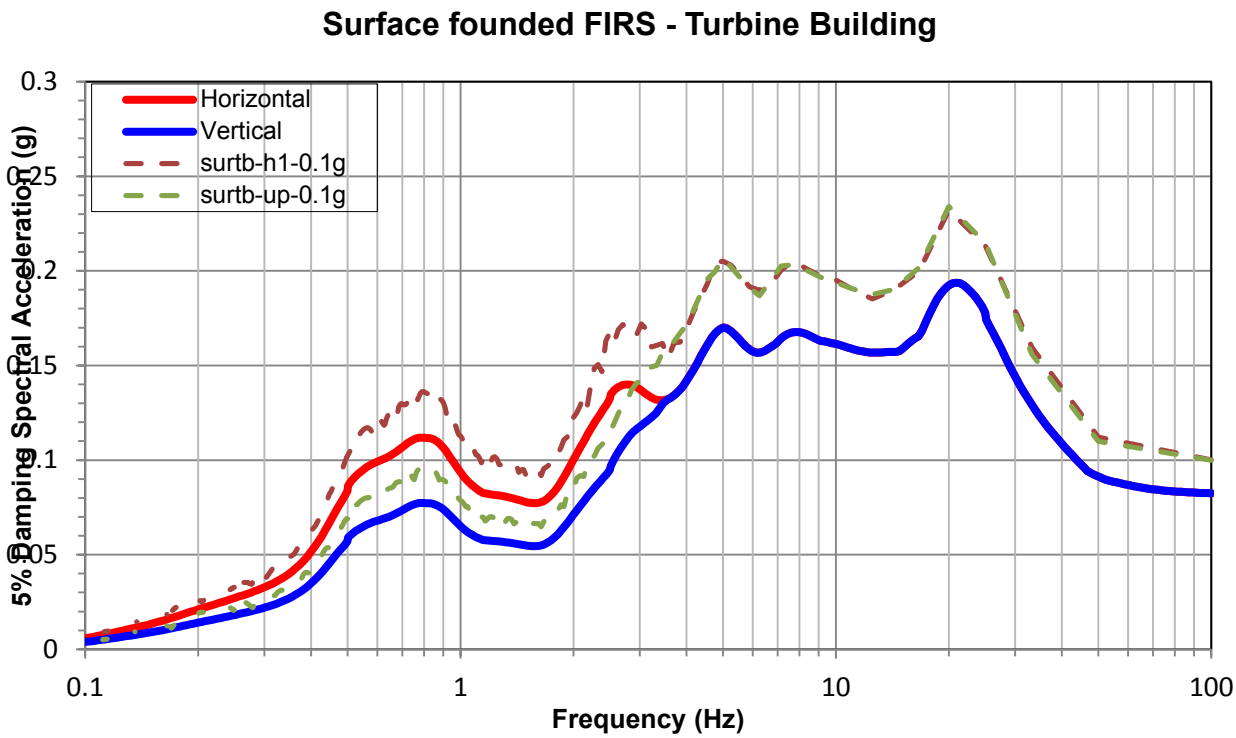

Figure 2.1-15. FIRS for the TPNP Turbine Building

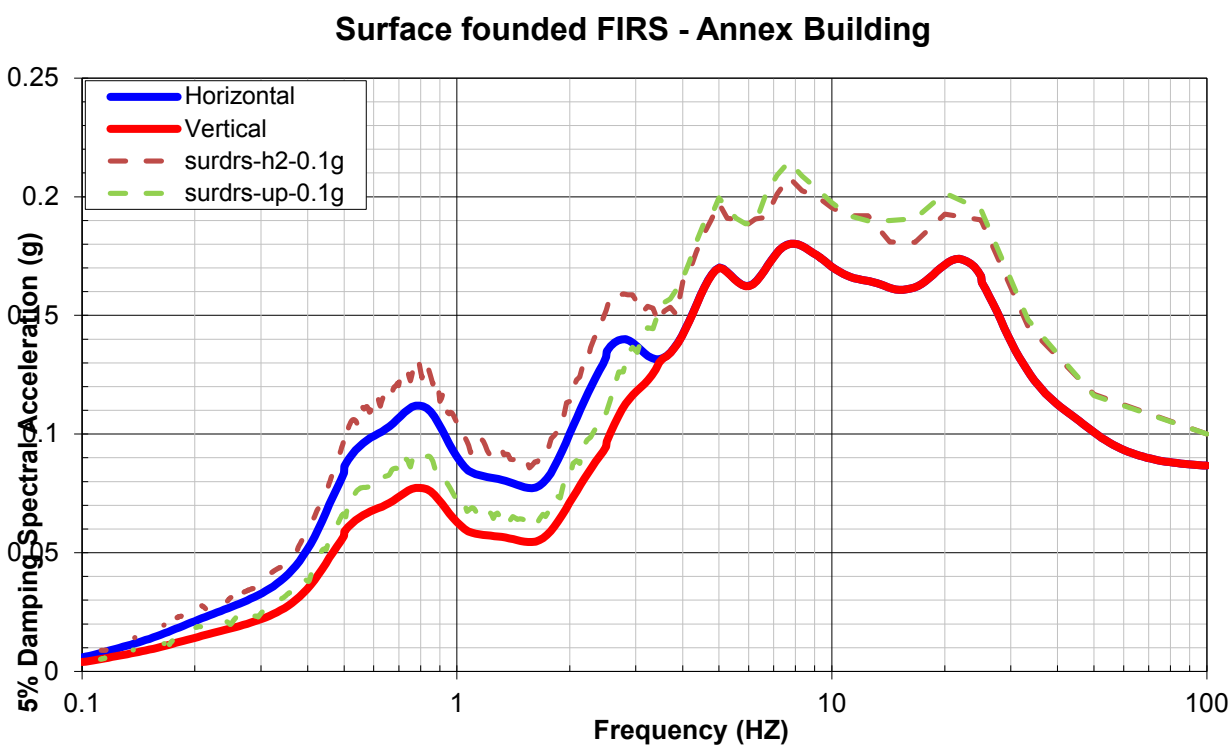

Figure 2.1-16. FIRS for the TPNP Annex Building

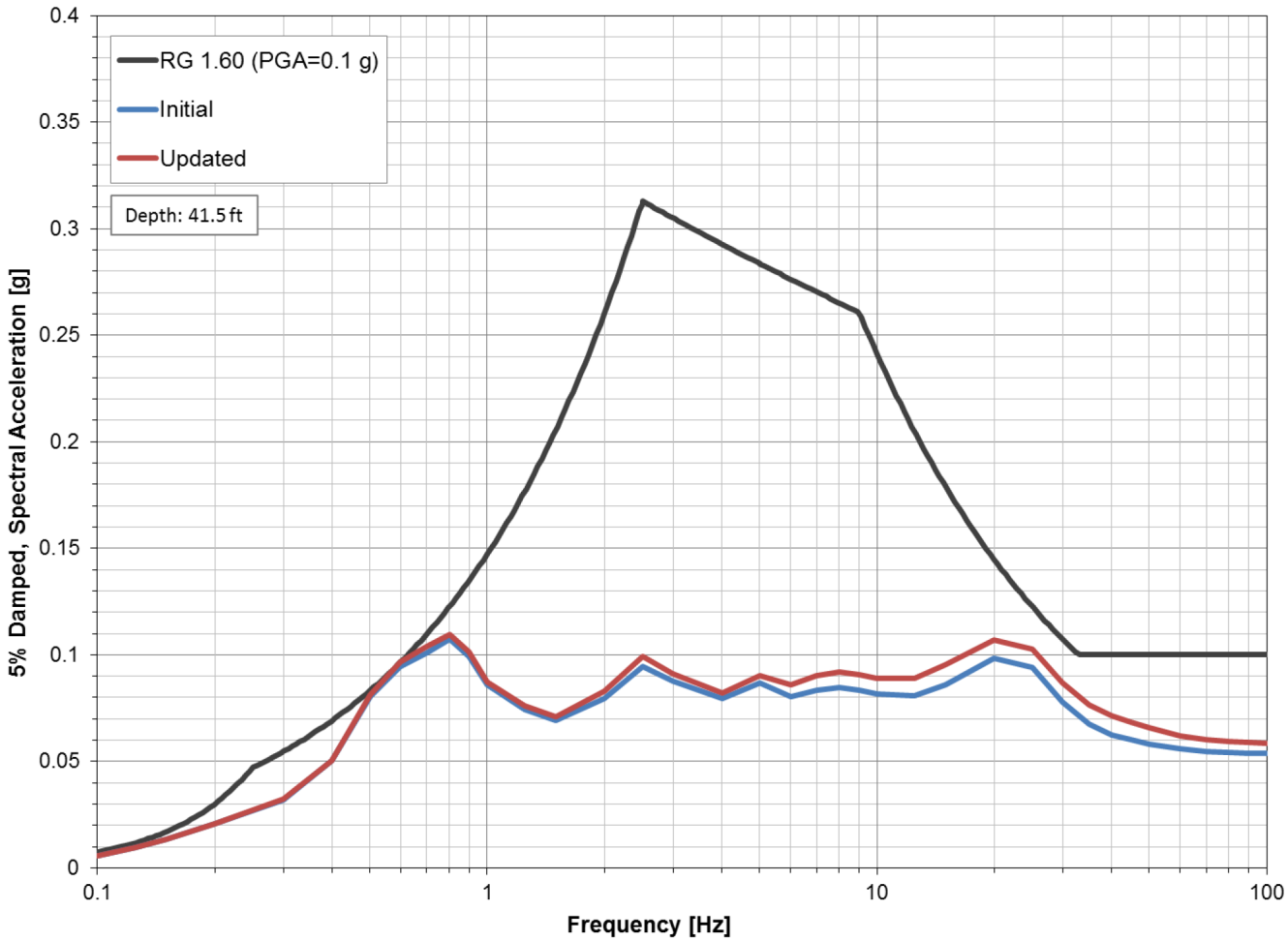

Figure 2.1-17. Comparison between the NI FIRS Computed with the Sensitivity Analysis and the Initial Analysis (NI Profile)

2.2 TPNP Soil-Structure Interaction (SSI) Analyses

TPNP site specific SSI analyses were performed and are summarized as follows:

- The TPNP specific SSI analyses utilized three-dimensional (3D) and two-dimensional (2D) parametric SSI analyses.
- For the TPNP 3D SSI analyses, the AP1000 NI20r 3D embedded finite element model (FEM) was modified to incorporate the TPNP site conditions including 19 feet of lean concrete fill constructed beneath the NI basemat and mud mat, grouted rock properties, specifically density, and engineered fill adjacent to the NI.
- The in-column ground motions at the top of the LC fill (elevation -16 ft.) for the BE, UB and LB soil profiles were the input motions for the SSI models. These in-column input motions were developed as part of the design grade deterministic surface spectra following Subsection 5.2.1 of the Interim Staff Guidance DC/COL-ISG-017.
- For the TPNP Turbine Building (TB) First Bay and Annex Building (AB) and Radwaste Building (RB), 2D embedded models were used incorporating the Seismic Category II adjacent structures and engineered fill in the TPNP 2D SSI analyses. The Seismic Category I/II interaction issues between the adjacent buildings and the NI are addressed herein.
- Supplemental TPNP 2D parametric SSI analyses were performed to demonstrate the adequacy of the 3D mesh size, the soil layer modeling used and passing frequency in the TPNP 3D models.
- TPNP 2D Coarse and Fine models were created and parametric SSI analyses performed for evaluation of TPNP 3D model frequency filtering, model mesh size limitations, and influence of the lower boundary SITE profile depth. The 2D Coarse model layer frequencies range from about 9 to 474 Hz and represent the embedded portion of the TPNP 3D model. The Fine model layer frequencies range from about 49 to 474 Hz. The 2D SSI response forms the basis for the Fine-to-Coarse response spectra ratios (Bump Factors) to account for the lower 3D model passing frequencies.
- 2D parametric SSI analysis results were used to calculate horizontal and vertical frequency-dependent Fine-to-Coarse SSI response spectra ratios (Bump Factors) at each of the six key locations.
- Factored FRS at the six key locations were calculated using the TPNP 3D Design-Basis BE, LB and UB models and the System for Soil-Structure Interaction (SASSI) Direct method SSI analyses results. The 3D Direct FRS results are amplified by the Bump Factors, broadened by $\pm$ 15 percent, and compared to the AP1000 generic FRS at the six key locations to show that the AP1000 FRS envelops the factored TPNP site specific SSI analyses FRS.

2.2.1 TPNP Updated Soil-Structure Interaction (SSI) Sensitivity Analyses

Updated TPNP site specific 3D and 2D SSI sensitivity analyses were performed to assess the potential effect of the 2013 updated site characterization data and 2014 site response sensitivity analysis results on the TPNP in-structure response spectra. Detailed descriptions of the updated seismic input, SSI sensitivity analyses, and results and conclusions are presented in Appendix E for the Nuclear Island and Appendix F for the SCII Turbine Building First Bay and Annex Building adjacent structures.

3.0 SSI Analysis Design Inputs

The following sections summarize design input information provided by FPL in Bechtel letters 25409-000-TCM-GEG-00752 (Reference 1) and 25409-000-TCM-GEG-00581 (Reference 2) pertaining to the TPNP site soil profiles, Foundation elevation (El.) -16 input time histories, and proposed LC fill and engineered fill material properties. Design inputs also include the Westinghouse generic AP1000 3D FRS envelope, and hard rock high frequency (HRHF) FRS envelope, which the TPNP SSI analyses results are compared for the structure (low frequency) and equipment (high frequency) qualification, respectively.

3.1 Foundation Concept Description

Two AP1000 units, designated Units 6 and 7 are planned at the FPL TPNP site located in south Miami-Dade County, Florida. Plan and cross-section views of the TPNP Unit 7 excavation limits are presented in Figures 3.1-1 and 3.1-2, respectively. Note that the TPNP Unit 7 plan and cross-section information are similar to that of Unit 6, thus only TPNP Unit 7 is graphically presented.

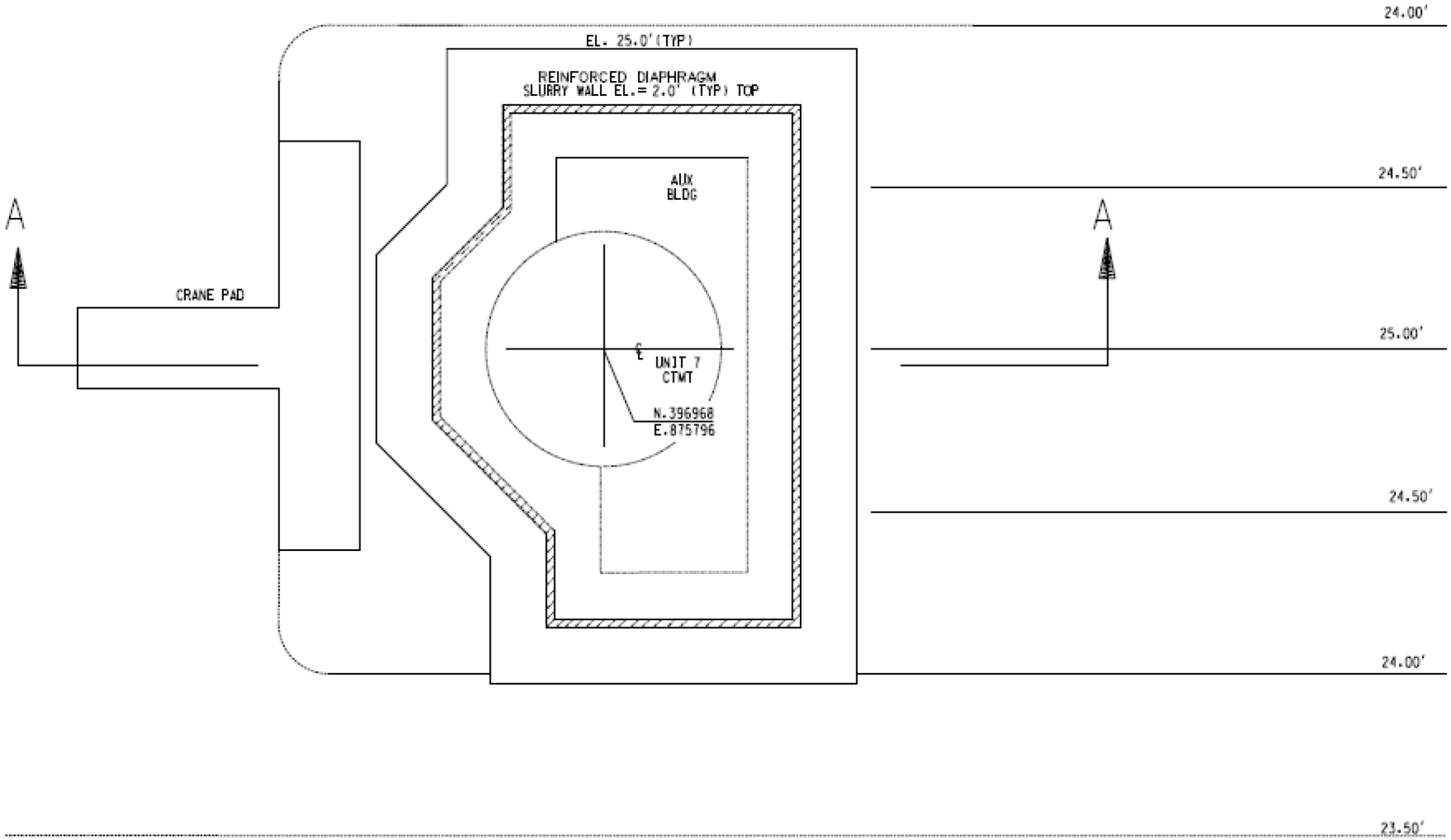

Figure 3.1-1. TPNP Unit 7 Excavation Limits Plan View (Reference 4)

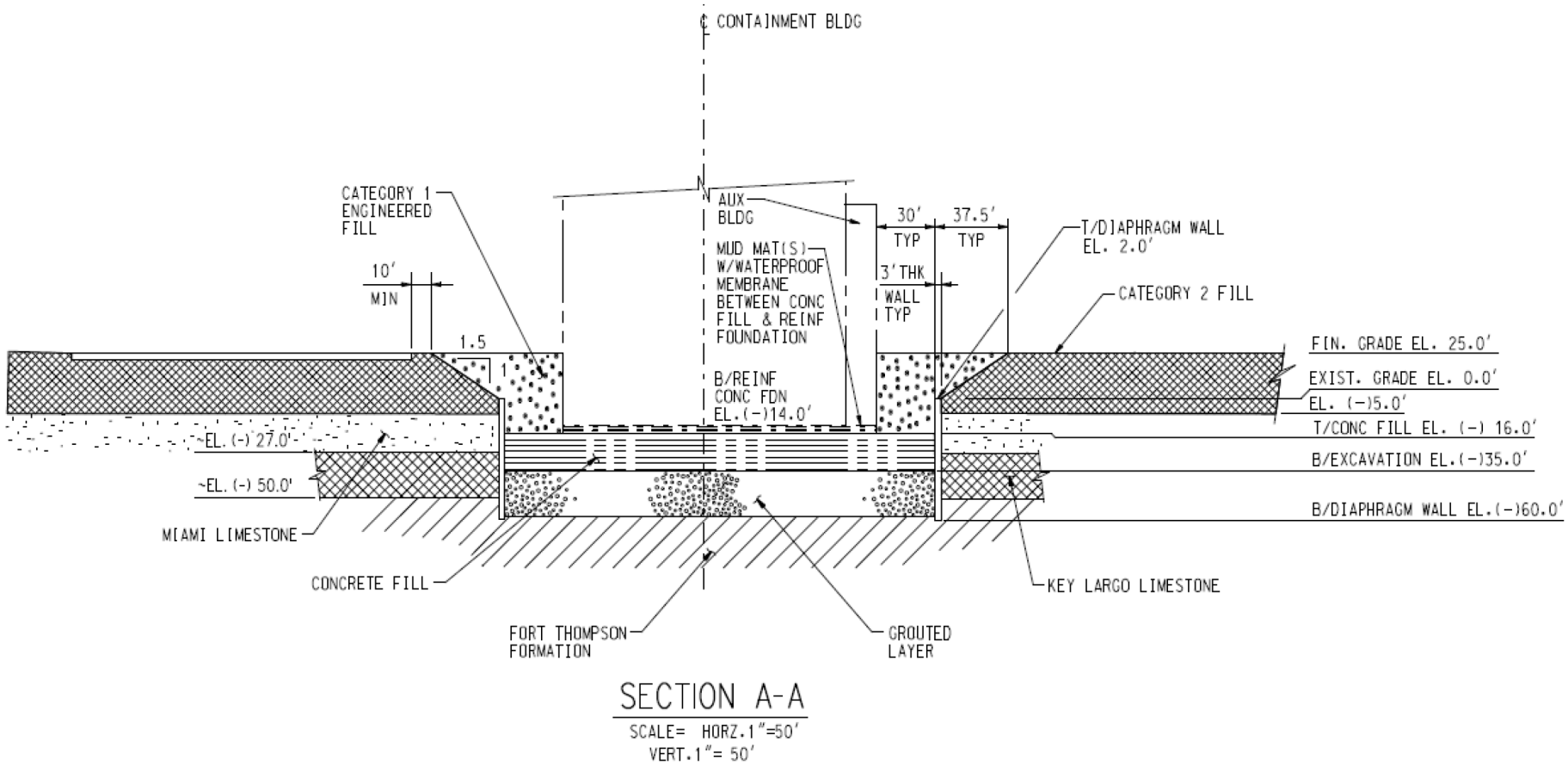

Figure 3.1-2. TPNP Unit 7 Excavation Cross-Section (Reference 4)

3.2 TPNP Best Estimate, Lower Bound and Upper Bound Soil Profiles

TPNP site soil profiles including the BE, LB and UB soil cases were provided in Bechtel letters 25409-000-TCM-GEG-00752 (Reference 1) and 25409-000-TCM-GEG-00581 (Reference 2). The layer thickness, unit weight, shear wave velocity (Vs), compression wave velocity (Vp), and damping ratio from the ground surface to the simulated halfspace are presented in Tables 3.2-1 to 3.2-3 for the near Nuclear Island (NI) BE, LB and UB conditions. Figure 3.2-1 graphically presents the TPNP NI Vs profiles within the approximately 4,300-foot TPNP site profile depth.

Table 3.2-1. TPNP Best Estimate Soil Column Profile and Soil Properties

Layer No.	Thickness [ft]	Unit Weight [kcf]	S-Wave Vel. [ft/sec]	P-Wave Vel. [ft/sec]	Damping [%]
1	5.00	0.130	610.4	1142.0	2.7223
2	5.00	0.130	715.7	1339.0	3.8302
3	5.00	0.130	756.7	1415.7	4.5882
4	5.00	0.130	756.6	1415.5	5.2148
5	5.00	0.130	761.9	1425.3	5.7405
6	5.50	0.130	728.5	3714.7	6.4187
7	6.00	0.130	721.1	3676.9	6.8292
8	5.00	0.130	726.7	3705.4	7.1026
9	6.33	0.150	5518.5	8600.0	1.0508
10	6.33	0.150	5518.5	8600.0	1.0508
11	6.33	0.150	5518.5	8600.0	1.0508
12	6.00	0.136	5674.2	8842.7	0.9853
13	10.00	0.136	5781.3	10815.9	0.9853
14	10.00	0.136	5449.9	10015.8	0.9853
15	10.00	0.136	4858.1	9006.7	0.9853
16	10.00	0.136	4768.7	9622.9	0.9853
17	10.00	0.136	4712.1	9446.3	0.9853
18	10.00	0.136	4670.9	9223.8	0.9853
19	10.00	0.136	4559.3	9080.0	0.9853
20	10.00	0.136	1847.0	5000.0	0.9853
21	10.00	0.120	1469.6	5000.0	1.8902
22	10.00	0.120	1531.8	6388.5	1.8194
23	10.00	0.120	1532.4	5079.2	1.8378
24	10.00	0.120	1596.1	6309.2	1.6993
25	10.00	0.120	1606.9	5860.8	1.6887
26	10.00	0.120	1622.1	5640.3	1.6710
27	10.00	0.120	1626.0	5819.6	1.6759
28	10.00	0.120	1647.0	5981.3	1.6664
29	10.00	0.120	1734.7	6059.5	1.5724
30	10.00	0.120	1941.1	6303.2	1.3770
31	10.00	0.120	1958.5	5563.6	1.3686
32	10.00	0.120	1886.2	5085.9	1.4253
33	10.00	0.120	1839.0	5698.6	1.4787
34	10.00	0.120	1754.1	5082.1	1.5659
35	10.00	0.120	1679.1	5410.9	1.6521
36	10.00	0.120	1675.0	5880.4	1.6566
37	10.00	0.120	1608.9	5533.7	1.7470
38	10.00	0.120	1558.7	5021.6	1.8167
39	10.00	0.120	1554.7	5327.5	1.8220
40	10.00	0.120	1518.3	5163.6	1.8882
41	10.00	0.120	1445.0	5000.0	2.0181
42	10.00	0.120	1440.3	5650.4	2.0275
43	10.00	0.120	1439.7	5745.5	2.0302

Table 3.2-1. TPNP Best Estimate Soil Column Profile and Soil Properties (cont.)

Layer No.	Thickness [ft]	Unit Weight [kcf]	S-Wave Vel. [ft/sec]	P-Wave Vel. [ft/sec]	Damping [%]
44	10.00	0.120	1438.1	5682.1	2.0373
45	10.00	0.120	1437.8	5615.5	2.0394
46	10.00	0.120	1424.5	5629.8	2.0688
47	10.00	0.120	1416.2	5707.3	2.0948
48	10.00	0.120	1407.5	5360.2	2.1168
49	10.00	0.120	1398.7	5599.0	2.1366
50	10.00	0.120	1394.9	5438.2	2.1601
51	10.00	0.120	1395.3	5586.8	2.1765
52	10.00	0.120	1390.5	5588.1	2.1939
53	10.00	0.120	1389.8	5582.4	2.2078
54	10.00	0.130	3911.1	15710.3	0.7949
55	10.00	0.130	3910.9	15709.5	0.8020
56	10.00	0.130	3910.6	8543.3	0.8076
57	10.00	0.130	3910.1	7713.9	0.8182
58	10.00	0.130	3897.2	7895.1	0.8303
59	10.00	0.130	3886.0	7881.0	0.8451
60	10.00	0.130	3866.8	8006.0	0.8506
61	10.00	0.130	3839.6	8011.6	0.8613
62	10.00	0.130	3789.4	7637.4	0.8726
63	10.00	0.130	3778.8	7913.5	0.8859
64	10.00	0.130	3568.7	7860.7	0.9281
65	10.00	0.130	3407.3	7719.2	0.9689
66	10.00	0.130	3151.4	7436.6	1.0352
67	10.00	0.130	3158.5	7682.8	1.0372
68	10.00	0.130	3189.4	7486.7	1.0346
69	10.00	0.130	3381.8	7493.4	0.9992
70	10.00	0.130	3529.0	7346.1	0.9626
71	64.00	0.130	4308.0	8967.7	0.2912
72	100.00	0.130	4304.4	8960.4	0.2912
73	200.00	0.130	4483.1	9105.3	0.2912
74	200.00	0.130	4895.2	9514.6	0.2912
75	200.00	0.130	5131.4	9600.0	0.2912
76	200.00	0.130	5375.9	10057.4	0.2912
77	200.00	0.130	5640.4	10552.3	0.2912
78	200.00	0.130	5665.1	10598.5	0.2912
79	200.00	0.130	6496.8	12154.4	0.2912
80	200.00	0.130	6705.9	12545.6	0.2912
81	200.00	0.130	6771.8	12668.9	0.2912
82	200.00	0.130	6771.8	12668.9	0.2912
83	200.00	0.130	6779.1	12682.6	0.2912
84	200.00	0.130	6717.1	12566.6	0.2912
85	200.00	0.130	6724.7	12580.8	0.2912
86	200.00	0.130	6724.7	12580.8	0.2912

Table 3.2-1. TPNP Best Estimate Soil Column Profile and Soil Properties (cont.)

Layer No.	Thickness [ft]	Unit Weight [kcf]	S-Wave Vel. [ft/sec]	P-Wave Vel. [ft/sec]	Damping [%]
87	200.00	0.130	6756.6	12640.4	0.2912
88	200.00	0.130	8996.6	16831.0	0.2912
89	200.00	0.130	9050.7	16932.3	0.2912
90	200.00	0.130	9132.9	17086.1	0.2912
91	200.00	0.130	9113.1	17049.0	0.2912
92	200.00	0.130	8800.1	16463.4	0.2912
93	200.00	0.130	8750.5	16370.7	0.2912
94	200.00	0.130	8444.8	15798.7	0.2912
95	200.00	0.130	8119.4	15190.0	0.2912
96	200.00	0.130	8034.9	15032.0	0.2912
97	200.00	0.130	7967.0	14904.9	0.2912
98	200.00	0.130	7755.8	14509.8	0.2912
99	200.00	0.130	7761.2	14519.8	0.2912
100	200.00	0.130	7676.3	14361.0	0.2912
101	200.00	0.130	7678.0	14364.3	0.2912
102	200.00	0.130	7673.1	14355.0	0.2912
103	200.00	0.130	7616.5	14249.2	0.2912
104	200.00	0.130	7601.7	14221.5	0.2912
105	200.00	0.130	7755.0	14508.2	0.2900
106	200.00	0.130	7827.7	14644.2	0.2900
107	200.00	0.130	7812.5	14615.9	0.2900
108	200.00	0.130	7823.1	14635.6	0.2900
109	200.00	0.130	7953.1	14878.8	0.2700
110	200.00	0.130	7953.1	14878.8	0.2700
111	200.00	0.130	7967.0	14904.9	0.2700
112	200.00	0.130	8059.6	15078.2	0.2600
113	200.00	0.130	8276.7	15484.3	0.2500
114	200.00	0.130	8394.8	15705.3	0.2600
115	200.00	0.130	8499.1	15900.4	0.2500
116	200.00	0.130	8499.1	15900.4	0.2500
117	200.00	0.130	8632.8	16150.6	0.2400
118	200.00	0.130	8683.6	16245.5	0.2400
119	200.00	0.130	8629.9	16145.1	0.2400
120	200.00	0.130	8655.0	16191.9	0.2500
121	200.00	0.130	8684.4	16247.0	0.2500
122	200.00	0.130	8749.0	16367.9	0.2500
123	200.00	0.130	8749.0	16367.9	0.2500
124	200.00	0.130	8760.9	16390.2	0.2500
125	200.00	0.130	8726.0	16324.9	0.2200
126	0.00	0.170	9200.0	17211.6	1.0000

Table 3.2-2. TPNP Lower Bound Soil Column Profile and Soil Properties

Layer No.	Thickness [ft]	Unit Weight [kcf]	S-Wave Vel. [ft/sec]	P-Wave Vel. [ft/sec]	Damping [%]
1	5.00	0.130	348.6	652.2	5.0459
2	5.00	0.130	410.1	767.3	7.2773
3	5.00	0.130	431.5	807.3	8.5154
4	5.00	0.130	431.8	807.7	9.5902
5	5.00	0.130	434.5	812.8	10.6477
6	5.50	0.130	411.4	2097.6	11.6194
7	6.00	0.130	406.6	2073.4	12.0646
8	5.00	0.130	416.6	2124.3	12.3661
9	6.33	0.150	4505.9	7021.9	1.4645
10	6.33	0.150	4505.9	7021.9	1.4645
11	6.33	0.150	4505.9	7021.9	1.4645
12	6.00	0.136	4633.0	7220.0	1.3666
13	10.00	0.136	4720.4	8831.1	1.3666
14	10.00	0.136	4449.8	8177.8	1.3666
15	10.00	0.136	3966.7	7353.9	1.3666
16	10.00	0.136	3893.6	7857.1	1.3666
17	10.00	0.136	3847.4	7712.9	1.3666
18	10.00	0.136	3813.8	7531.2	1.3666
19	10.00	0.136	3665.8	7300.7	1.3666
20	10.00	0.136	1408.1	5000.0	1.3666
21	10.00	0.120	1179.8	5000.0	3.0112
22	10.00	0.120	1250.7	5216.2	2.8238
23	10.00	0.120	1251.2	5000.0	2.7722
24	10.00	0.120	1303.2	5151.4	2.4188
25	10.00	0.120	1312.0	5000.0	2.3915
26	10.00	0.120	1324.4	5000.0	2.3613
27	10.00	0.120	1327.6	5000.0	2.3725
28	10.00	0.120	1344.8	5000.0	2.3484
29	10.00	0.120	1416.4	5000.0	2.2027
30	10.00	0.120	1584.9	5146.6	1.9078
31	10.00	0.120	1599.1	5000.0	1.8781
32	10.00	0.120	1540.1	5000.0	1.9890
33	10.00	0.120	1501.5	5000.0	2.0394
34	10.00	0.120	1432.2	5000.0	2.2136
35	10.00	0.120	1371.0	5000.0	2.2740
36	10.00	0.120	1367.6	5000.0	2.2892
37	10.00	0.120	1313.7	5000.0	2.4259
38	10.00	0.120	1272.7	5000.0	2.5301
39	10.00	0.120	1269.4	5000.0	2.5361
40	10.00	0.120	1239.7	5000.0	2.5854
41	10.00	0.120	1179.8	5000.0	2.7330

Table 3.2-2. TPNP Lower Bound Soil Column Profile and Soil Properties (cont.)

Layer No.	Thickness [ft]	Unit Weight [kcf]	S-Wave Vel. [ft/sec]	P-Wave Vel. [ft/sec]	Damping [%]
42	10.00	0.120	1176.0	5000.0	2.7369
43	10.00	0.120	1175.5	5000.0	2.7433
44	10.00	0.120	1174.2	5000.0	2.7506
45	10.00	0.120	1174.0	5000.0	2.7579
46	10.00	0.120	1163.1	5000.0	2.7901
47	10.00	0.120	1156.3	5000.0	2.7691
48	10.00	0.120	1149.2	5000.0	2.8217
49	10.00	0.120	1142.1	5000.0	2.8919
50	10.00	0.120	1138.9	5000.0	2.8793
51	10.00	0.120	1139.3	5000.0	2.9138
52	10.00	0.120	1135.4	5000.0	2.9217
53	10.00	0.120	1134.7	5000.0	2.9424
54	10.00	0.130	3193.4	12827.4	1.0726
55	10.00	0.130	3193.3	12826.8	1.0790
56	10.00	0.130	3193.0	6975.6	1.0901
57	10.00	0.130	3192.6	6298.3	1.1063
58	10.00	0.130	3182.1	6446.3	1.1261
59	10.00	0.130	3172.9	6434.8	1.1349
60	10.00	0.130	3157.2	6536.9	1.1396
61	10.00	0.130	3135.0	6541.4	1.1572
62	10.00	0.130	3094.0	6235.9	1.1807
63	10.00	0.130	3085.4	6461.3	1.1950
64	10.00	0.130	2913.8	6418.3	1.2664
65	10.00	0.130	2782.0	6302.7	1.3247
66	10.00	0.130	2573.1	6071.9	1.3927
67	10.00	0.130	2578.9	6273.0	1.4001
68	10.00	0.130	2604.1	6112.9	1.3925
69	10.00	0.130	2761.2	6118.3	1.3322
70	10.00	0.130	2881.4	5998.1	1.3233
71	64.00	0.130	3517.4	7322.1	0.5271
72	100.00	0.130	3514.5	7316.1	0.5271
73	200.00	0.130	3660.4	7434.4	0.5271
74	200.00	0.130	3996.9	7768.6	0.5271
75	200.00	0.130	4189.8	7838.4	0.5271
76	200.00	0.130	4389.4	8211.8	0.5271
77	200.00	0.130	4605.4	8615.9	0.5271
78	200.00	0.130	4625.6	8653.7	0.5271
79	200.00	0.130	5304.6	9924.0	0.5271
80	200.00	0.130	5475.4	10243.5	0.5271
81	200.00	0.130	5529.2	10344.1	0.5271
82	200.00	0.130	5529.2	10344.1	0.5271
83	200.00	0.130	5535.1	10355.3	0.5271
84	200.00	0.130	5484.5	10260.6	0.5271

Table 3.2-2. TPNP Lower Bound Soil Column Profile and Soil Properties (cont.)

Layer No.	Thickness [ft]	Unit Weight [kcf]	S-Wave Vel. [ft/sec]	P-Wave Vel. [ft/sec]	Damping [%]
85	200.00	0.130	5490.7	10272.2	0.5271
86	200.00	0.130	5490.7	10272.2	0.5271
87	200.00	0.130	5516.7	10320.8	0.5271
88	200.00	0.130	7345.7	13742.5	0.5271
89	200.00	0.130	7389.9	13825.2	0.5271
90	200.00	0.130	7457.0	13950.8	0.5271
91	200.00	0.130	7440.8	13920.4	0.5271
92	200.00	0.130	7185.2	13442.3	0.5271
93	200.00	0.130	7144.8	13366.6	0.5271
94	200.00	0.130	6895.1	12899.6	0.5271
95	200.00	0.130	6629.4	12402.6	0.5271
96	200.00	0.130	6560.5	12273.5	0.5271
97	200.00	0.130	6505.0	12169.8	0.5271
98	200.00	0.130	6332.6	11847.2	0.5271
99	200.00	0.130	6337.0	11855.4	0.5271
100	200.00	0.130	6267.7	11725.7	0.5271
101	200.00	0.130	6269.1	11728.4	0.5271
102	200.00	0.130	6265.0	11720.8	0.5271
103	200.00	0.130	6218.9	11634.5	0.5271
104	200.00	0.130	6206.8	11611.8	0.5271
105	200.00	0.130	6331.9	11845.9	0.5203
106	200.00	0.130	6391.3	11956.9	0.5229
107	200.00	0.130	6378.9	11933.8	0.5229
108	200.00	0.130	6387.5	11949.9	0.5248
109	200.00	0.130	6493.7	12148.5	0.4643
110	200.00	0.130	6493.7	12148.5	0.4643
111	200.00	0.130	6505.1	12169.8	0.4643
112	200.00	0.130	6580.7	12311.3	0.4429
113	200.00	0.130	6757.9	12642.9	0.4206
114	200.00	0.130	6854.4	12823.3	0.4423
115	200.00	0.130	6939.5	12982.6	0.4324
116	200.00	0.130	6939.5	12982.6	0.4324
117	200.00	0.130	7048.7	13186.9	0.4125
118	200.00	0.130	7090.1	13264.4	0.4360
119	200.00	0.130	7046.3	13182.4	0.4360
120	200.00	0.130	7066.7	13220.7	0.4147
121	200.00	0.130	7090.8	13265.6	0.4305
122	200.00	0.130	7143.5	13364.3	0.4073
123	200.00	0.130	7143.5	13364.3	0.4073
124	200.00	0.130	7153.3	13382.5	0.4073
125	200.00	0.130	7124.8	13329.2	0.2856
126	0.00	0.170	9200.0	17211.6	1.0000

Table 3.2-3. TPNP Upper Bound Soil Column Profile and Soil Properties

Layer No.	Thickness [ft]	Unit Weight [kcf]	S-Wave Vel. [ft/sec]	P-Wave Vel. [ft/sec]	Damping [%]
1	5.00	0.130	1069.0	1999.9	1.4687
2	5.00	0.130	1249.0	2336.6	2.0159
3	5.00	0.130	1327.1	2482.7	2.4722
4	5.00	0.130	1325.9	2480.5	2.8356
5	5.00	0.130	1336.0	2499.4	3.0949
6	5.50	0.130	1290.1	5000.0	3.5457
7	6.00	0.130	1278.8	5000.0	3.8657
8	5.00	0.130	1267.6	5000.0	4.0795
9	6.33	0.150	6758.8	10532.8	0.7545
10	6.33	0.150	6758.8	10532.8	0.7545
11	6.33	0.150	6758.8	10532.8	0.7545
12	6.00	0.155	6949.5	10830.0	0.7104
13	10.00	0.155	7080.6	13246.7	0.7104
14	10.00	0.155	6674.7	12266.8	0.7104
15	10.00	0.136	5950.0	11030.9	0.7104
16	10.00	0.136	5840.4	11785.6	0.7104
17	10.00	0.136	5771.1	11569.3	0.7104
18	10.00	0.136	5720.7	11296.8	0.7104
19	10.00	0.136	5670.5	11293.0	0.7104
20	10.00	0.136	2422.6	5000.0	0.7104
21	10.00	0.120	1830.5	5411.8	1.1865
22	10.00	0.120	1876.0	7824.2	1.1723
23	10.00	0.120	1876.8	6220.7	1.2184
24	10.00	0.120	1954.8	7727.1	1.1938
25	10.00	0.120	1968.1	7178.0	1.1925
26	10.00	0.120	1986.7	6907.9	1.1826
27	10.00	0.120	1991.4	7127.5	1.1838
28	10.00	0.120	2017.2	7325.6	1.1824
29	10.00	0.120	2124.6	7421.3	1.1224
30	10.00	0.120	2377.3	7719.9	0.9938
31	10.00	0.120	2398.7	6813.9	0.9973
32	10.00	0.120	2310.2	6228.9	1.0214
33	10.00	0.120	2252.3	6979.4	1.0721
34	10.00	0.120	2148.4	6224.3	1.1077
35	10.00	0.120	2056.5	6626.9	1.2003
36	10.00	0.120	2051.4	7201.9	1.1989
37	10.00	0.120	1970.5	6777.3	1.2581
38	10.00	0.120	1909.0	6150.2	1.3044
39	10.00	0.120	1904.1	6524.8	1.3091
40	10.00	0.120	1859.5	6324.1	1.3790

Table 3.2-3. TPNP Upper Bound Soil Column Profile and Soil Properties (cont.)

Layer No.	Thickness [ft]	Unit Weight [kcf]	S-Wave Vel. [ft/sec]	P-Wave Vel. [ft/sec]	Damping [%]
41	10.00	0.120	1769.8	6108.0	1.4902
42	10.00	0.120	1764.0	6920.3	1.5020
43	10.00	0.120	1763.2	7036.7	1.5025
44	10.00	0.120	1761.4	6959.1	1.5089
45	10.00	0.120	1761.0	6877.6	1.5081
46	10.00	0.120	1744.7	6895.1	1.5340
47	10.00	0.120	1734.5	6990.0	1.5846
48	10.00	0.120	1723.8	6564.9	1.5880
49	10.00	0.120	1713.1	6857.4	1.5786
50	10.00	0.120	1708.4	6660.5	1.6205
51	10.00	0.120	1708.9	6842.4	1.6257
52	10.00	0.120	1703.1	6844.0	1.6474
53	10.00	0.120	1702.1	6837.0	1.6566
54	10.00	0.130	4790.1	19241.1	0.5891
55	10.00	0.130	4789.9	19240.1	0.5961
56	10.00	0.130	4789.5	10463.4	0.5982
57	10.00	0.130	4788.8	9447.5	0.6052
58	10.00	0.130	4773.1	9669.5	0.6123
59	10.00	0.130	4759.3	9652.2	0.6293
60	10.00	0.130	4735.8	9805.3	0.6349
61	10.00	0.130	4702.5	9812.2	0.6411
62	10.00	0.130	4641.0	9353.8	0.6449
63	10.00	0.130	4628.1	9692.0	0.6567
64	10.00	0.130	4370.8	9627.4	0.6802
65	10.00	0.130	4173.0	9454.0	0.7086
66	10.00	0.130	3859.6	9107.9	0.7694
67	10.00	0.130	3868.4	9409.5	0.7684
68	10.00	0.130	3906.2	9169.3	0.7687
69	10.00	0.130	4141.8	9177.5	0.7495
70	10.00	0.130	4322.1	8997.1	0.7002
71	64.00	0.130	5276.2	10983.2	0.1609
72	100.00	0.130	5271.8	10974.2	0.1609
73	200.00	0.130	5490.7	11151.6	0.1609
74	200.00	0.130	5995.4	11652.9	0.1609
75	200.00	0.130	6284.7	11757.6	0.1609
76	200.00	0.130	6584.1	12317.7	0.1609
77	200.00	0.130	6908.1	12923.9	0.1609
78	200.00	0.130	6938.4	12980.5	0.1609
79	200.00	0.130	7956.9	14886.1	0.1609
80	200.00	0.130	8213.1	15365.2	0.1609
81	200.00	0.130	8293.8	15516.2	0.1609
82	200.00	0.130	8293.8	15516.2	0.1609
83	200.00	0.130	8302.7	15532.9	0.1609
84	200.00	0.130	8226.8	15390.9	0.1609

Table 3.2-3. TPNP Upper Bound Soil Column Profile and Soil Properties (cont.)

Layer No.	Thickness [ft]	Unit Weight [kcf]	S-Wave Vel. [ft/sec]	P-Wave Vel. [ft/sec]	Damping [%]
85	200.00	0.130	8236.1	15408.3	0.1609
86	200.00	0.130	8236.1	15408.3	0.1609
87	200.00	0.130	8275.1	15481.2	0.1609
88	200.00	0.130	11018.5	20613.7	0.1609
89	200.00	0.130	11084.8	20737.8	0.1609
90	200.00	0.130	11185.5	20926.1	0.1609
91	200.00	0.130	11161.2	20880.7	0.1609
92	200.00	0.130	10777.8	20163.5	0.1609
93	200.00	0.130	10717.1	20049.9	0.1609
94	200.00	0.130	10342.7	19349.4	0.1609
95	200.00	0.130	9944.2	18603.8	0.1609
96	200.00	0.130	9840.7	18410.3	0.1609
97	200.00	0.130	9757.6	18254.7	0.1609
98	200.00	0.130	9498.9	17770.8	0.1609
99	200.00	0.130	9505.5	17783.1	0.1609
100	200.00	0.130	9401.5	17588.6	0.1609
101	200.00	0.130	9403.6	17592.5	0.1609
102	200.00	0.130	9397.5	17581.2	0.1609
103	200.00	0.130	9328.3	17451.7	0.1609
104	200.00	0.130	9310.1	17417.7	0.1609
105	200.00	0.130	9497.9	17768.9	0.1617
106	200.00	0.130	9586.9	17935.4	0.1608
107	200.00	0.130	9568.4	17900.8	0.1608
108	200.00	0.130	9581.3	17924.9	0.1603
109	200.00	0.130	9740.5	18222.8	0.1570
110	200.00	0.130	9740.5	18222.8	0.1570
111	200.00	0.130	9757.6	18254.8	0.1570
112	200.00	0.130	9871.0	18467.0	0.1526
113	200.00	0.130	10136.9	18964.3	0.1486
114	200.00	0.130	10281.5	19235.0	0.1528
115	200.00	0.130	10409.2	19473.9	0.1445
116	200.00	0.130	10409.2	19473.9	0.1445
117	200.00	0.130	10573.0	19780.3	0.1396
118	200.00	0.130	10635.2	19896.6	0.1321
119	200.00	0.130	10569.4	19773.6	0.1321
120	200.00	0.130	10600.1	19831.0	0.1507
121	200.00	0.130	10636.2	19898.4	0.1452
122	200.00	0.130	10715.3	20046.5	0.1535
123	200.00	0.130	10715.3	20046.5	0.1535
124	200.00	0.130	10729.9	20073.8	0.1535
125	200.00	0.130	10687.2	19993.8	0.1695
126	0.00	0.170	9200.0	17211.6	1.0000

Note: % = percent; ft. = feet; ft/sec = feet per second; kcf = kips per cubic foot;
SSI = soil structure interaction

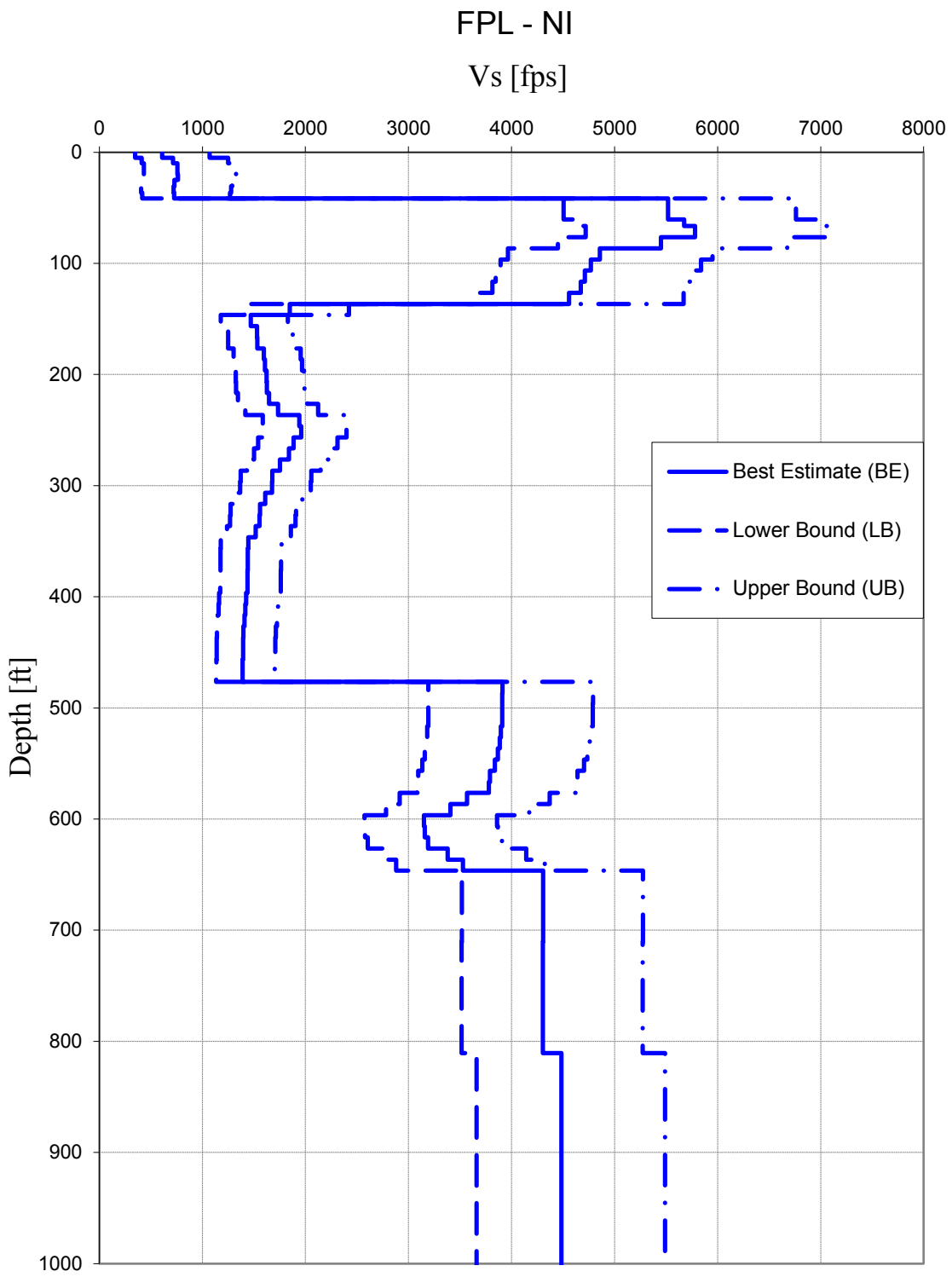

Figure 3.2-1. Turkey Point Site (FPL) − NI V_S

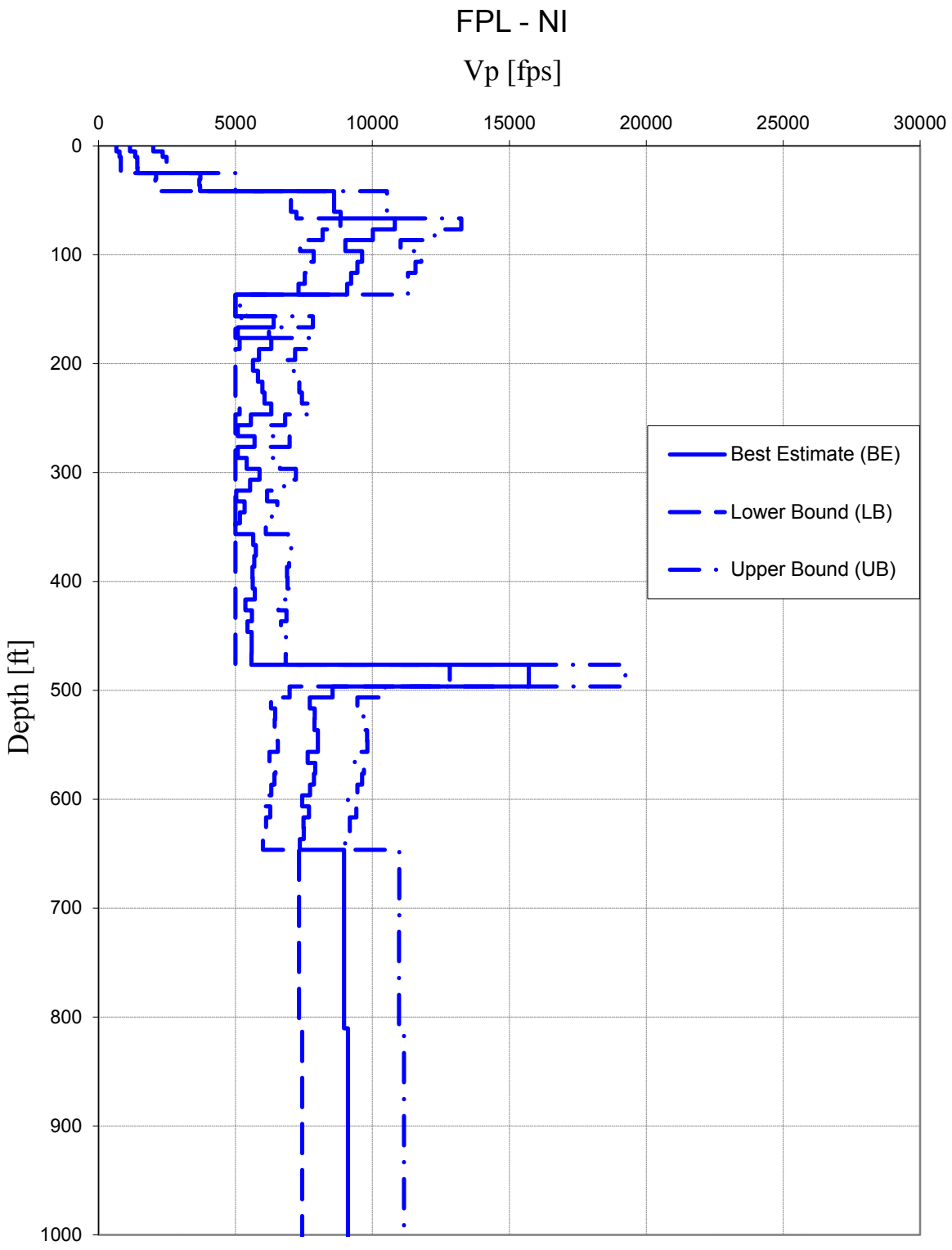

Figure 3.2-2. Turkey Point Site (FPL) − NI V_P

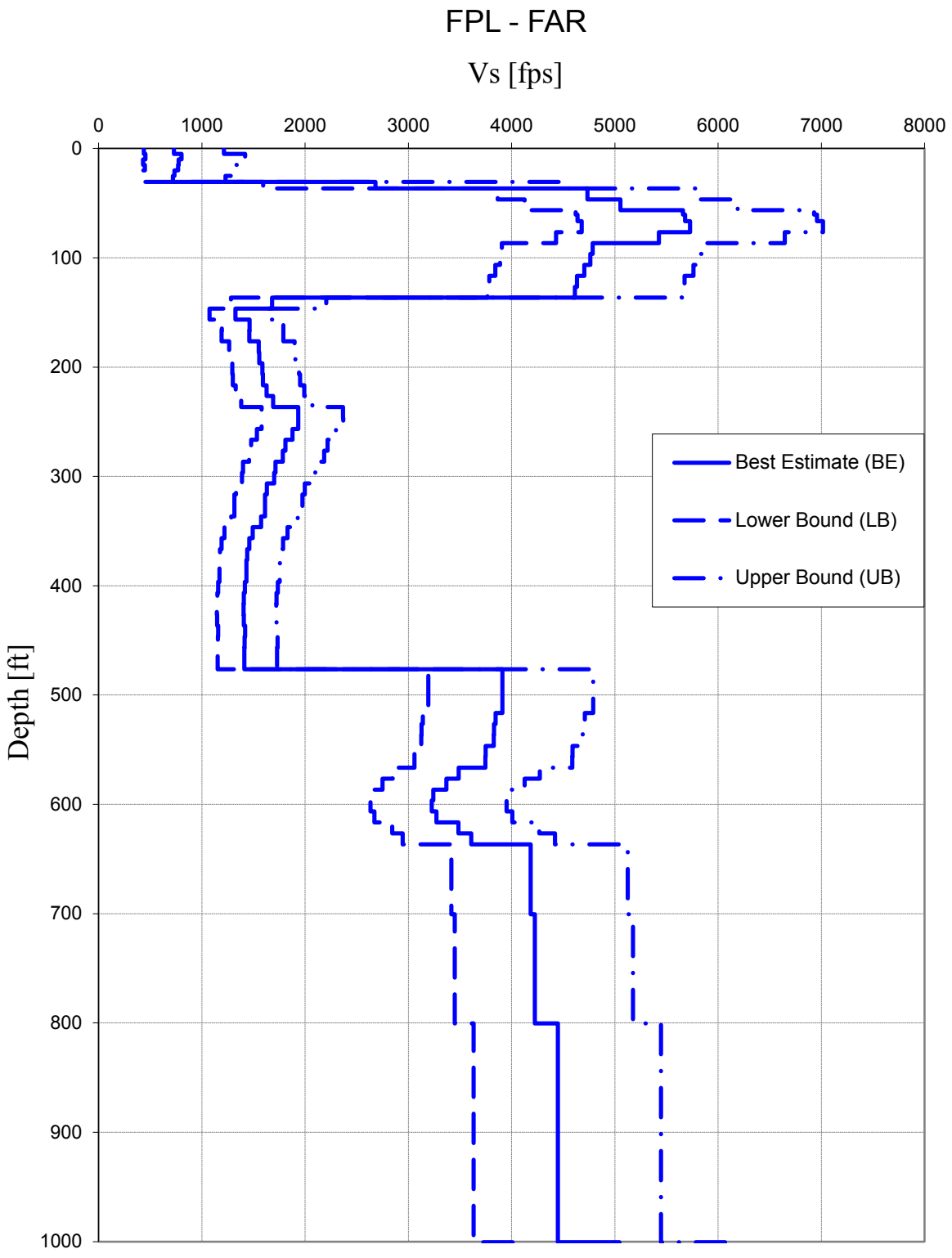

Figure 3.2-3. Turkey Point Site (FPL) - FAR V_S

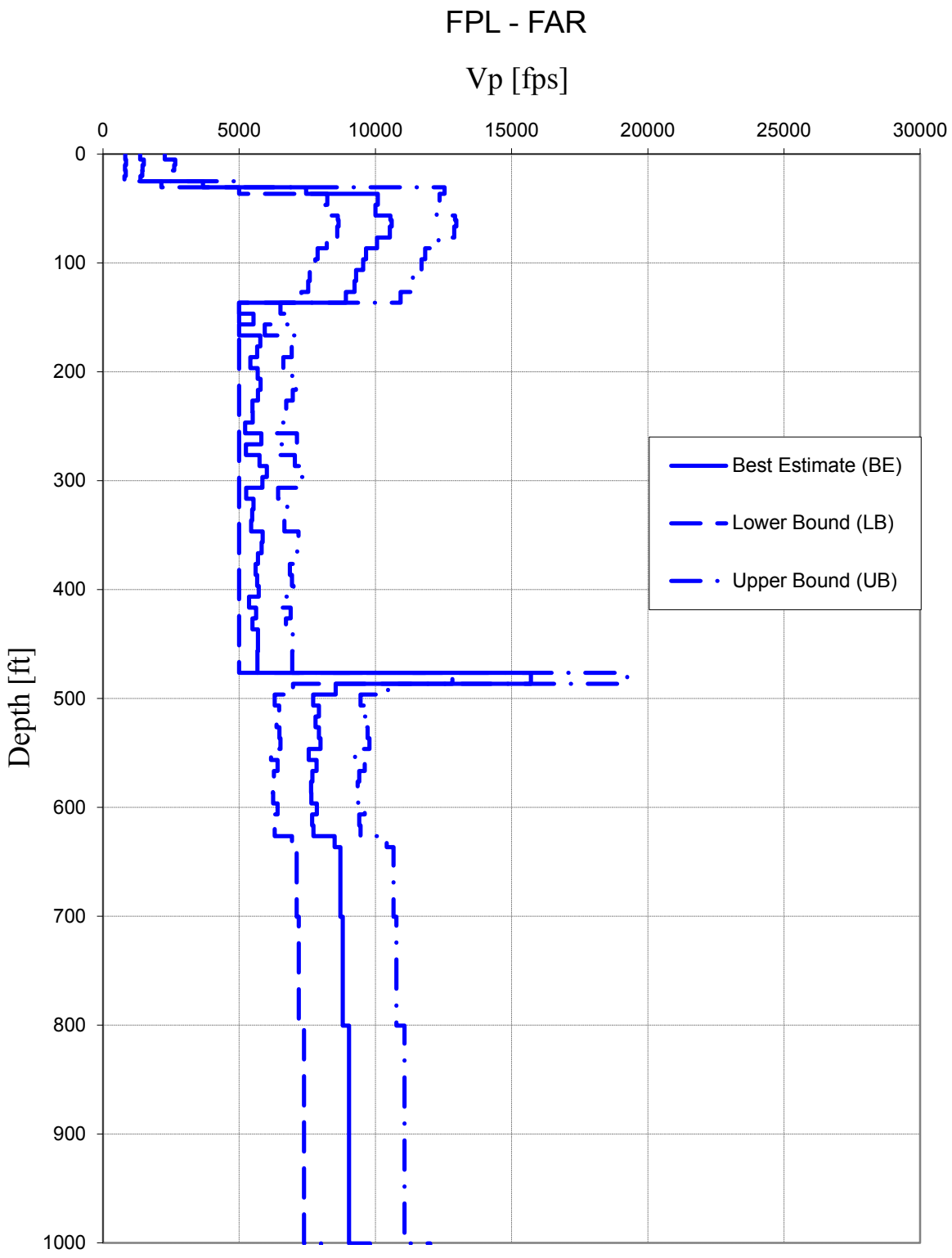

Figure 3.2-4. Turkey Point Site (FPL) − FAR V_P

3.3 TPNP Engineered Fill and Lean Concrete Fill Properties for SSI Analyses

Tables 3.3-1, 3.3-2 and 3.3-3 present the dynamic material properties for the engineered fill, lean concrete fill and grouted rock for the BE, LB and UB soil cases, which were provided by FPL in Bechtel letters 25409-000-TCM-GEG-00752 (Reference 1) and 25409-000-TCM-GEG-00581 (Reference 2) and incorporated in the respective SSI analyses of the NI and SCII adjacent structures:

Table 3.3-1. TPNP Backfill Soil and Fill Concrete Profile – BE

Material	Unit Weight [kcf]	S-Wave Vel. [ft/sec]	P-Wave Vel. [ft/sec]	Damping
Engineered Fill	0.130	610.4	1142.0	0.027
Engineered Fill	0.130	715.7	1339.0	0.038
Engineered Fill	0.130	756.7	1415.7	0.046
Engineered Fill	0.130	756.6	1415.5	0.052
Engineered Fill	0.130	761.9	1425.3	0.057
Engineered Fill	0.130	728.5	3714.7	0.064
Engineered Fill	0.130	721.1	3676.9	0.068
Engineered Fill	0.130	726.7	3705.4	0.071
Lean Concrete	0.150	5518.5	8600.0	0.011
Grouted Rock	0.155	5674.2	8842.7	0.010
Grouted Rock	0.155	5781.3	10815.9	0.010
Grouted Rock	0.155	5449.9	10015.8	0.010

Table 3.3-2. TPNP Backfill Soil and Fill Concrete Profile – LB

Material	Unit Weight [kcf]	S-Wave Vel. [ft/sec]	P-Wave Vel. [ft/sec]	Damping
Engineered Fill	0.130	348.6	652.2	0.050
Engineered Fill	0.130	410.1	767.3	0.073
Engineered Fill	0.130	431.5	807.3	0.085
Engineered Fill	0.130	431.8	807.7	0.096
Engineered Fill	0.130	434.5	812.8	0.106
Engineered Fill	0.130	411.4	2097.6	0.116
Engineered Fill	0.130	406.6	2073.4	0.121
Engineered Fill	0.130	416.6	2124.3	0.124
Lean Concrete Fill	0.150	4505.9	7021.9	0.015
Grouted Rock	0.155	4633.0	7220.0	0.014
Grouted Rock	0.155	4720.4	8831.1	0.014
Grouted Rock	0.155	4449.8	8177.8	0.014

Table 3.3-3. TPNP Backfill Soil and Fill Concrete Profile – UB

Material	Unit Weight [kcf]	S-Wave Vel. [ft/sec]	P-Wave Vel. [ft/sec]	Damping
Engineered Fill	0.130	1069.0	1999.9	0.015
Engineered Fill	0.130	1249.0	2336.6	0.020
Engineered Fill	0.130	1327.1	2482.7	0.025
Engineered Fill	0.130	1325.9	2480.5	0.028
Engineered Fill	0.130	1336.0	2499.4	0.031
Engineered Fill	0.130	1290.1	5000.0	0.035
Engineered Fill	0.130	1278.8	5000.0	0.039
Engineered Fill	0.130	1267.6	5000.0	0.041
Lean Concrete Fill	0.150	6758.8	10532.8	0.008
Grouted Rock	0.155	6949.5	10830.0	0.007
Grouted Rock	0.155	7080.6	13246.7	0.007
Grouted Rock	0.155	6674.7	12266.8	0.007

3.4 Selected NI Key Locations

The six (6) key 2D and 3D NI locations selected to obtain floor response spectra (FRS) are shown below in Table 3.4-1.

Table 3.4-1. NI Key Nodes at Location

TPNP/NI20r (3D) Node	TPNP (2D) Node	3D-X (feet)	3D-Y (feet)	3D-Z (feet)	Location
1761	4041	1000	1000	100	CIS at Reactor Vessel Support Elevation
2078	4061	1116.5	948.5	116.5	ASB NE Corner at Control Room Floor
2199	4535	1008	1014	134.25	CIS at Operating Deck
2675	4120	929	1000	179.19	ASB Corner of Fuel Building Roof at Shield Building
2788	4412	1000	1000	224	SCV Near Polar Crane
3329	4310	956.5	1000	327.41	ASB Shield Building Roof Area

3.5 TPNP Time History Inputs – El. -16′ (Foundation/Top of Lean Concrete Fill)

The revised TPNP input acceleration time histories were provided by FPL in Bechtel Letter 25409-000-TCM-GEG-00752 (Reference 1) and are graphically presented herein as Figures 3.5-1 through 3.5-6 for the TPNP BE, LB and UB soil cases. The 'within' time histories were provided at the foundation level following site response analysis at the foundation level, which included at input the minimum PGA = 0.1g outcrop SSE envelop of the site-specific FIRS and RG 1.60 spectra anchored to 0.1g as previously described in Section 2.1. The input time histories are used as seismic input in three orthogonal directions at the foundation/ top of the TPNP lean concrete fill (El. -16′) in the TPNP SSI analyses.

Reference 1 provides two horizontal (H1 and H2) and one vertical (UP) time histories (El. -16′) for each BE, LB and UB soil case with 32768 discrete values of acceleration with a time step of 0.005 seconds in files FPL-NI-BE-H1.ath, FPL-NI-BE-H2.ath, and FPL-NI-BE-UP.ath, FPL-NI-LB-H1.ath, FPL-NI-LB-H2.ath, and FPL-NI-LB-UP.ath,, FPL-NI-UB-H1.ath,, FPL-NI-UB-H2.ath, and FPL-NI-UB-UP.ath for the (near) NI conditions.

H1 and H2 time history designations correspond to the X- (north-south) and Y- (east-west) directions, respectively, and UP corresponds to the Z- (vertical) direction.

FAR conditions time histories were provided in files FPL-FAR-BE-H1.ath, FPL-FAR-BE-H2.ath, and FPL-FAR-BE-UP.ath, FPL-FAR-LB-H1.ath, FPL-FAR-LB-H2.ath, and FPL-FAR-LB-UP.ath, FPL-FAR-UB-H1.ath, FPL-FAR-UB-H2.ath, and FPL-FAR-UB-UP.ath. The seismic analysis was executed for each excitation direction separately.

3.5.1 TPNP Time History Inputs – El. +25.5′ Surface Founded Adjacent Structures

The TPNP site-specific outcrop FIRS and corresponding input acceleration time histories for the SCII adjacent structures including the TB First Bay and AB were provided by FPL in Bechtel Letter 25409-000-TCM-GEG-00404 (Reference 3). Site specific outcrop FIRS for the TB First Bay and AB are presented in Figures 2.1-15 and 2.1-16, respectively. Figure 3.5-7 through 3.5-9 present horizontal and vertical time histories for the TPNP TB First Bay, and Figure 3.5-10 through 3.5-12 present horizontal and vertical time histories for the AB. The SCII adjacent structures input time histories were increased slightly by a factor of about 10-13 percent corresponding to the ratio of a minimum 0.1g PGA and the zero-period acceleration (ZPA) of each SCII outcrop FIRS, which yields a minimum outcrop PGA = 0.1g time history for each SCII surface-founded structure for SSI analysis. The input time histories are used as seismic input in two orthogonal directions at the ground surface (El. +25.5) in the TPNP SSI analyses (X and Z for the TB First Bay, and Y and Z for the AB).

Reference 3 provides two horizontal and one vertical time history (El. +25.5′) for 28000 discrete values of acceleration with a time step of 0.005 seconds in files SURTB-H1.acc, SURTB-H2.acc, and SURTB-UP.acc for the TB First Bay, and SURDRS-H1.acc, SURDRS-H2.acc and SURDRS-UP.acc for the AB, which were modified by Westinghouse to achieve a minimum 0.1g PGA. The corresponding spectra are presented in Figures 2.1-15 and 2.1-16.

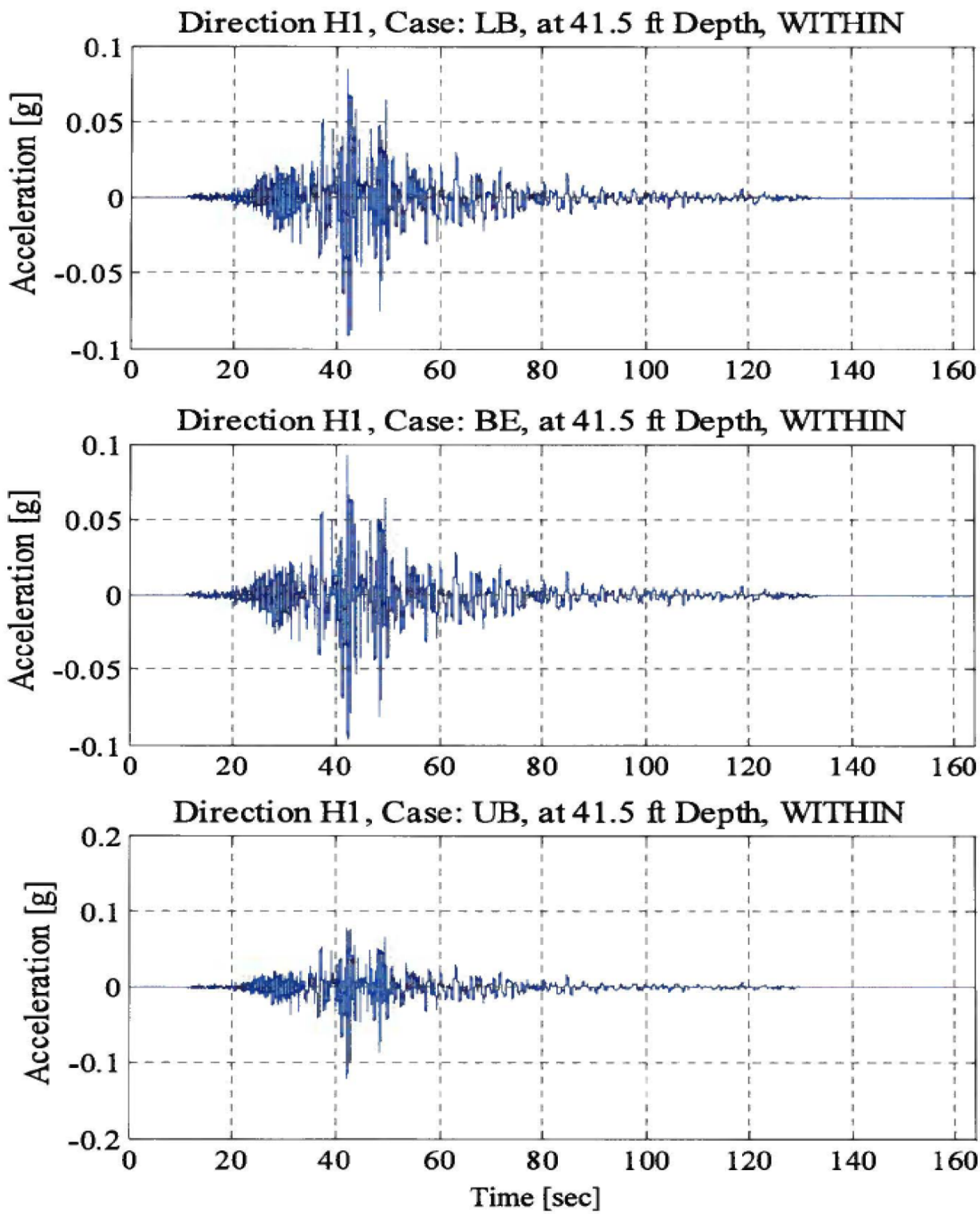

Figure 3.5-1. TPNP NI BE, LB and UB Seismic Input in H1 (X-Direction) – El. -16′

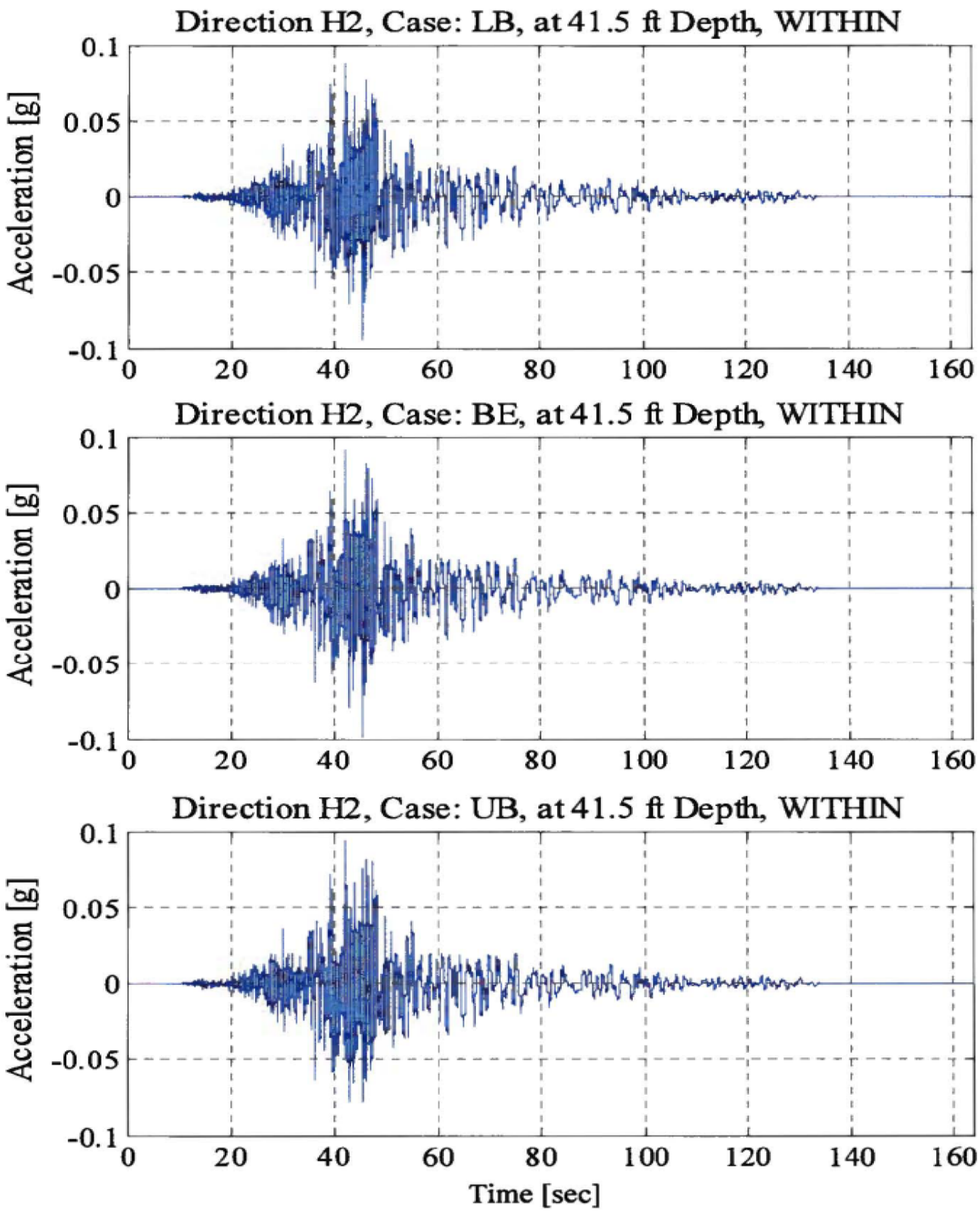

Figure 3.5-2. TPNP NI BE, LB and UB Seismic Input in H2 (Y-Direction) – El. -16′

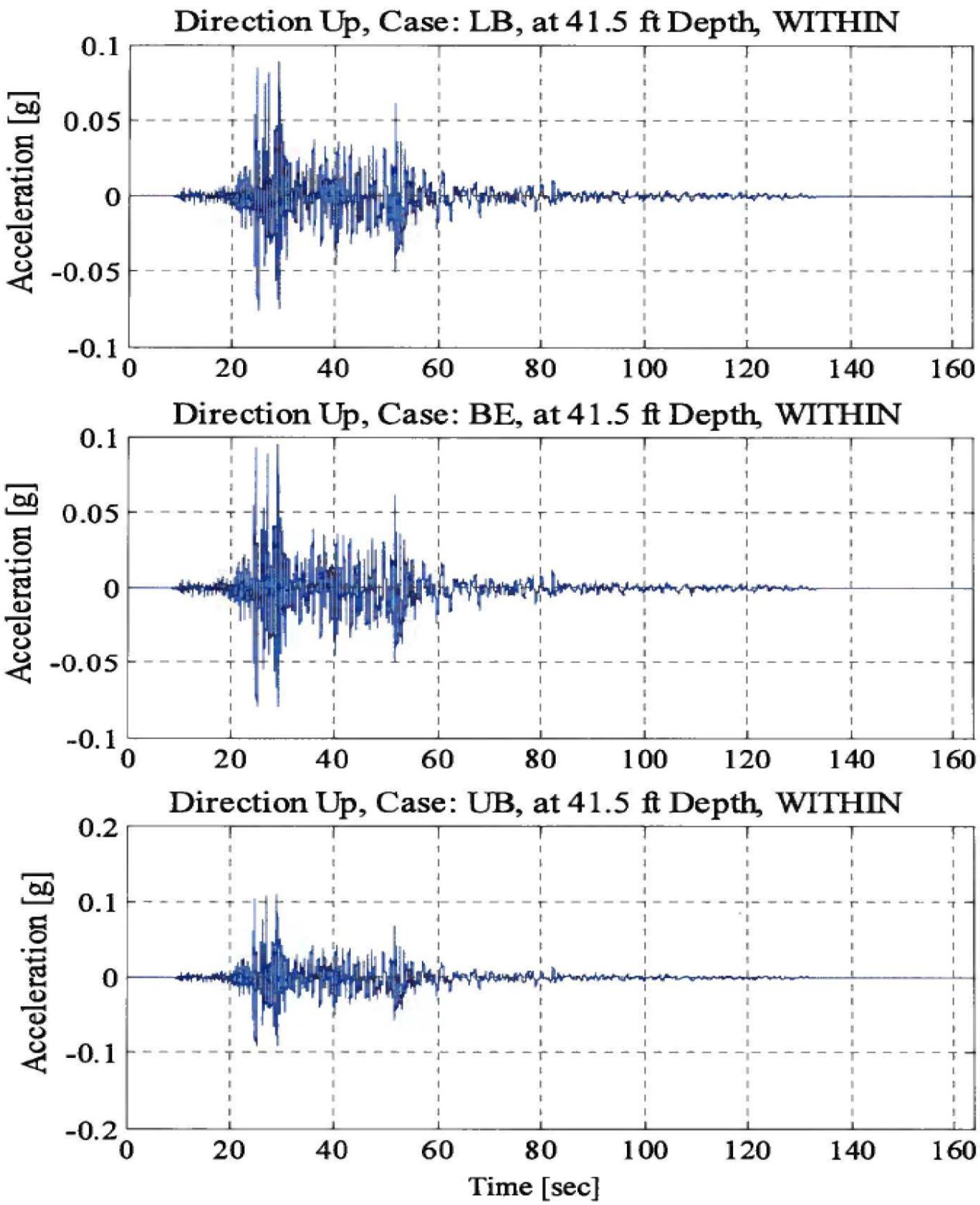

Figure 3.5-3. TPNP NI BE, LB and UB Seismic Input in UP (Z-Direction) – El. -16′

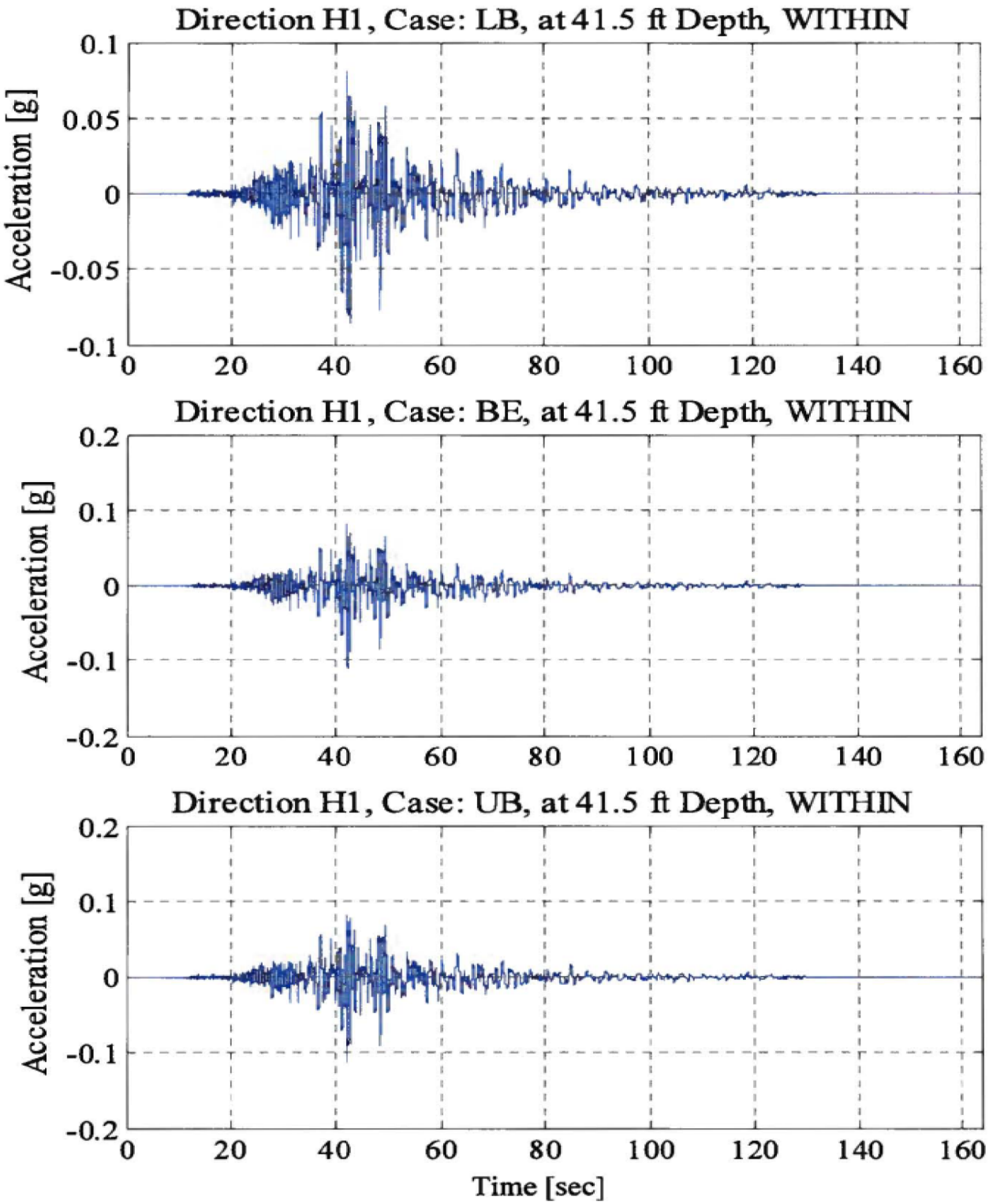

Figure 3.5-4. TPNP FAR BE, LB and UB Seismic Input in H1 (X-Direction) – El. -16′

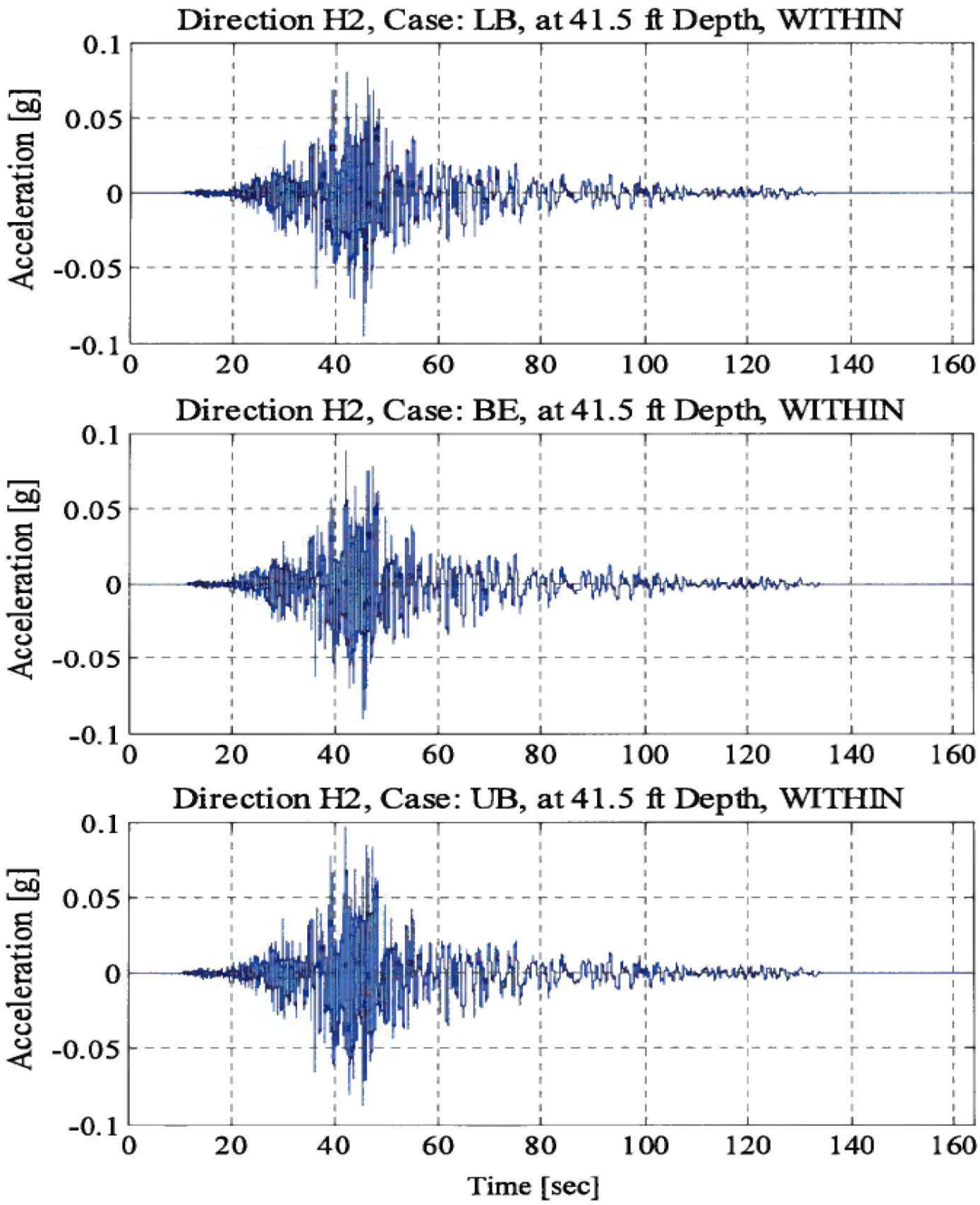

Figure 3.5-5. TPNP FAR BE, LB and UB Seismic Input in H2 (Y-Direction) – El. -16′

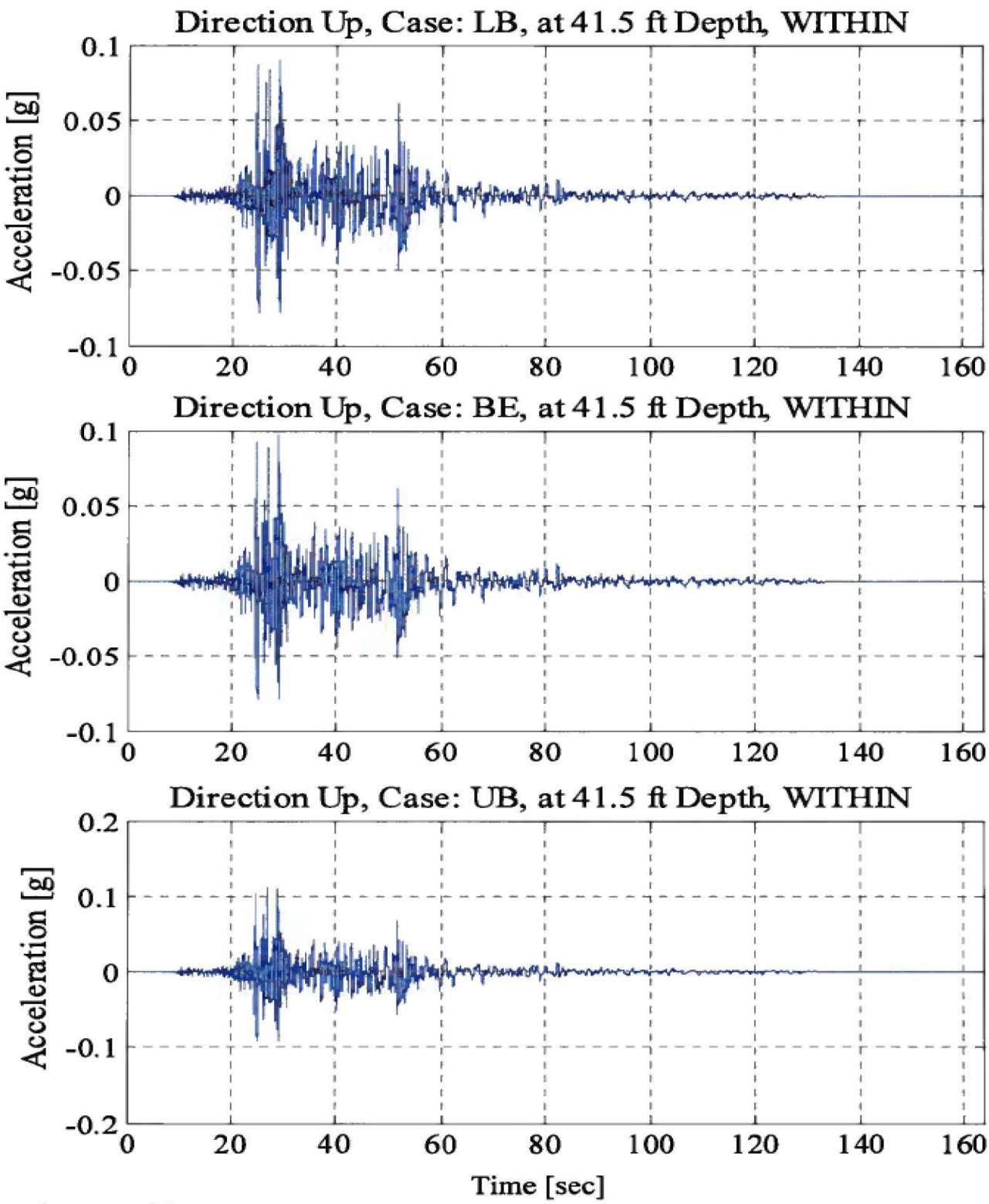

Figure 3.5-6. TPNP FAR BE, LB and UB Seismic Input in UP (Z-Direction) – El. -16′

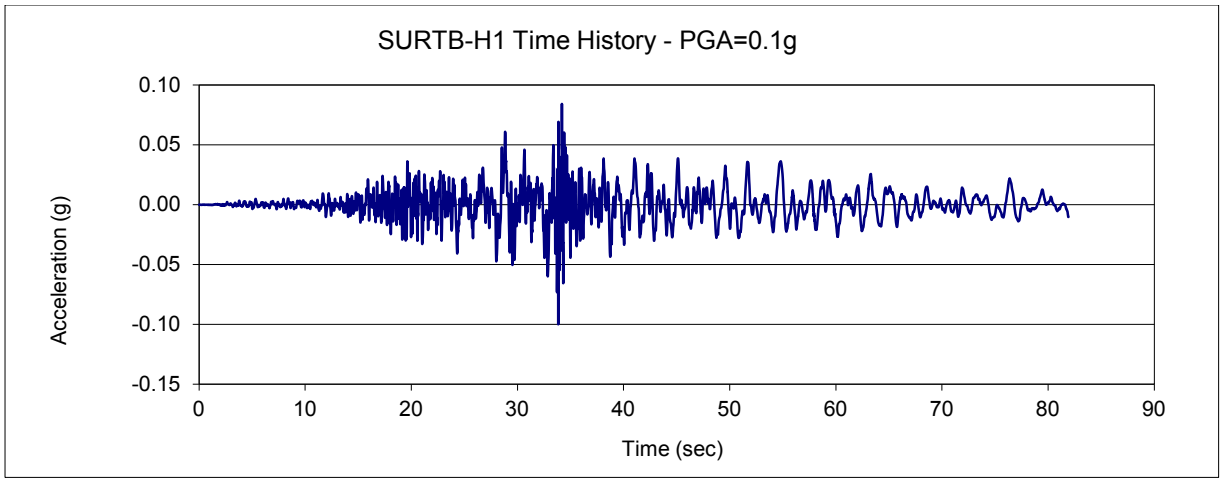

Figure 3.5-7. TPNP Turbine Building First Bay Seismic Input H1 in X-Direction – El. +25.5′

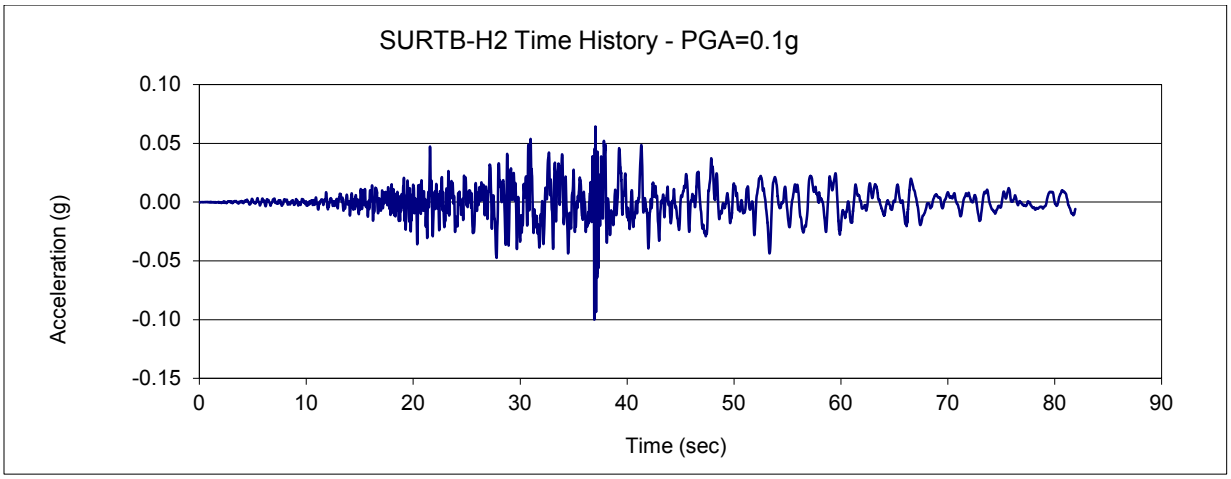

Figure 3.5-8. TPNP Turbine Building First Bay Seismic Input H2 in Y-Direction – El. +25.5′

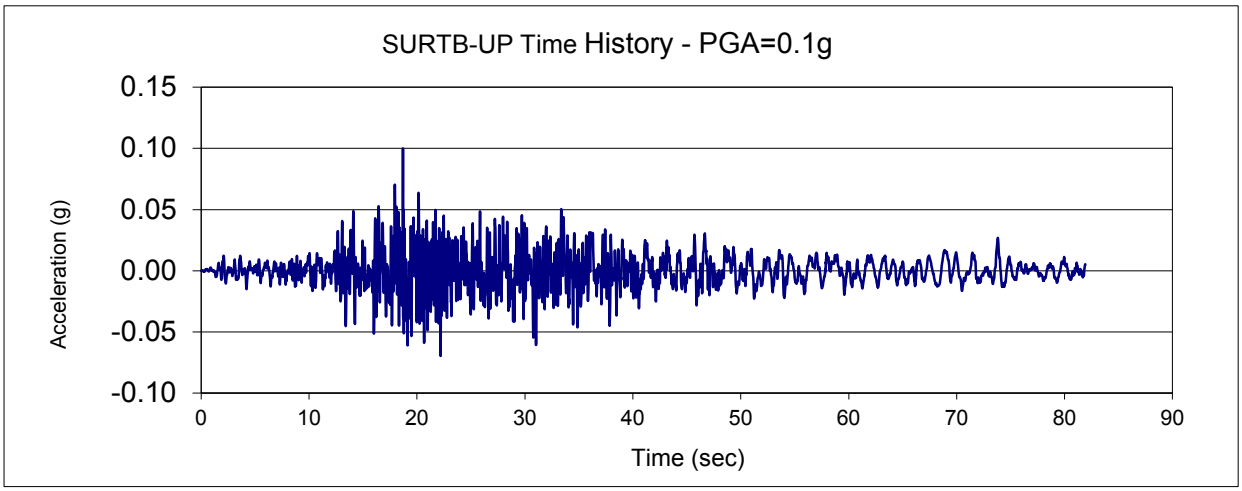

Figure 3.5-9. TPNP Turbine Building First Bay Seismic Input UP in Z-Direction – El. +25.5′

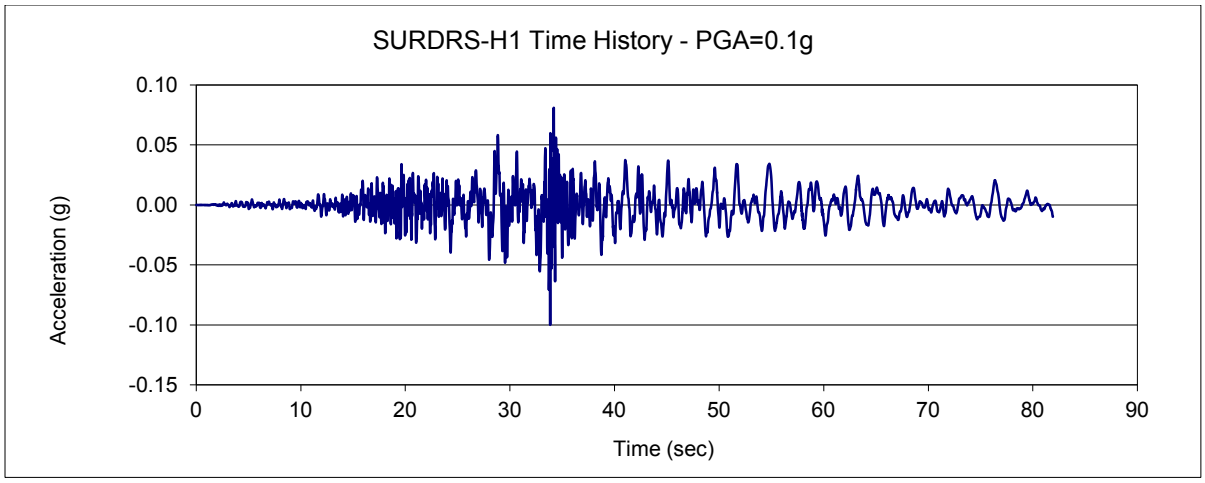

Figure 3.5-10. TPNP Annex Building Seismic Input H1 in X-Direction – El. +25.5′

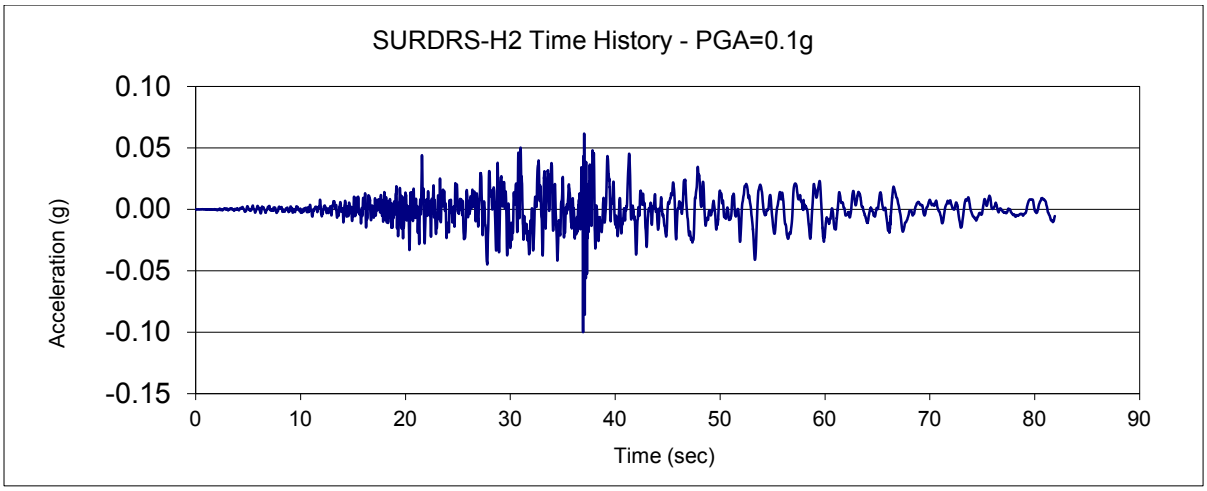

Figure 3.5-11. TPNP Annex Building Seismic Input H2 in Y-Direction – El. +25.5′

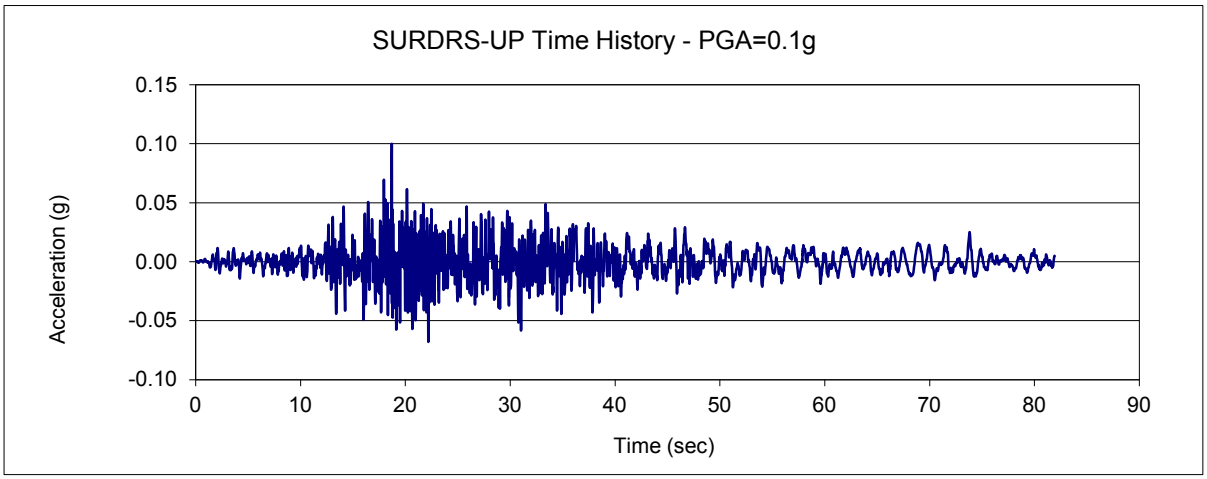

Figure 3.5-12. TPNP Annex Building Seismic Input UP in Z-Direction – El. +25.5′

3.6 AP1000 Envelope Response Spectra

The AP1000 3D FRS envelope is provided in Reference 8, and the HRHF FRS envelope (for high frequency equipment qualification) is provided in Reference 9. The TPNP 3D SSI FRS are compared to the AP1000 3D and HRHF FRS envelops at the six key locations identified in Table 3.4-1. Similarly, the AP1000 2D FRS envelops for the TB First Bay and AB are provided in Reference 10. The TPNP adjacent structures FRS are compared to the AP1000 2D FRS envelops at the six key nodes identified in Table 3.4-1. Section 6.0 presents the comparison of TPNP site specific FRS to the AP1000 and HRHF FRS envelopes.

4.0 [ ]a,c

[

]a,c

4.1 [ ]a,c

[

]a,c

[

]a,c

4.1.1 [ ]a,c

[

]a,c

Table 4.1-1. [ ]a,c

a,c

		Comments

a,c

Figure 4.1-1. [ ]a,c

4.2 [ ]a,c

[

]a,c

Table 4.2-1. [ ]a,c

a,c

Table 4.2-1. [ ]a,c (cont.) a,c

Table 4.2-1. [ ]a,c (cont.)

a,c

Table 4.2-2. [ ][a,c]

a,c

Table 4.2-2. [ ]a,c (cont.)

a,c

Table 4.2-2. [ ]a,c (cont.)

a,c

Table 4.2-3. [ ][a,c]

a,c

Table 4.2-3. [ ]a,c (cont.)

a,c

Table 4.2-3. [ ]a,c (cont.)

a,c

4.3 [ ]a,c

[

]a,c

4.3.1 [ ]a,c

[

]a,c

a,c

Figure 4.3-1. [ ]a,c

a,c

Figure 4.3-2. [ ]a,c

4.3.2 [ ]a,c

[

]a,c

Table 4.3-1. [ ]a,c

a,c

Table 4.3-1. [ ]a,c (cont.)

a,c

Table 4.3-1. [ ]a,c (cont.)

a,c

Table 4.3-1. [ ]a,c (cont.)

a,c

4.3.3 [ ]a,c

[

]a,c

a,c

[ ]

Figure 4.3-3. [ ][a,c]

4.3.4 [ ]a,c

[

]a,c

Table 4.3-2. [ ][a,c]

a,c

Table 4.3-2. [ ]a,c (cont.)

a,c

Table 4.3-2. [ ]a,c (cont.)

a,c

4.4 [ ][a,c]

[

][a,c]

a,c

Figure 4.4-1. [ ][a,c]

a,c

Figure 4.4-2. [ ][a,c]

5.0 [ ]a,c

[

]a,c

5.1 [ ]a,c

[

]a,c

5.2 [ ]a,c

[

]a,c

[

]a,c

5.3 [ ]a,c

[

]a,c

6.0 TPNP Site Specific SSI Analyses Results

6.1 TPNP 2D SSI Analysis Results and Frequency-Dependent Bump Factor

Figures 6.1-1 and 6.1-2 present the TPNP 2D horizontal and vertical Bump Factors calculated from the ratio of the TPNP 2D BE Fine and Coarse FRS for each of the six (6) key locations. As shown, the frequency-dependent TPNP 2D Bump Factors range from 1.0 to about 1.5 horizontally and 1.0 to about 1.4 vertically.

The TPNP 2D Coarse and Fine SSI acceleration response spectra for 5% damping at the six (6) key NI locations are presented in Figures 6.1-3 through 6.1-14. The results of the TPNP 2D BE SSI Y (horizontal) and Z (vertical) analysis are compared to each other and to the AP1000 3D, 2D and HRHF FRS envelopes. As shown, the TPNP 2D BE coarse and fine FRS vary in spectral acceleration across the frequency range, the spectral shapes of the 2D BE FRS are similar, and both the 2D BE coarse and fine FRS are enveloped by the AP1000 and HRHF FRS envelope spectra.

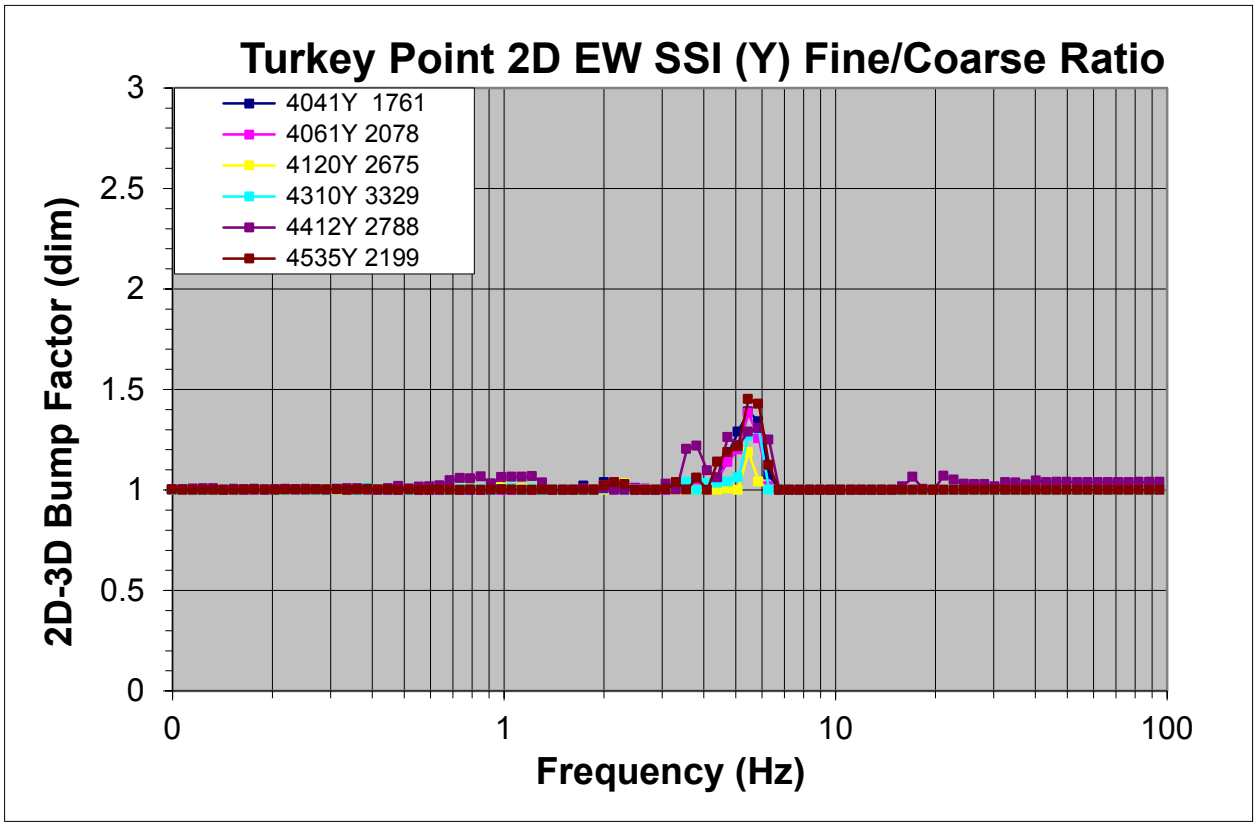

Figure 6.1-1. TPNP 2D-3D Horizontal Bump Factors – All Nodes

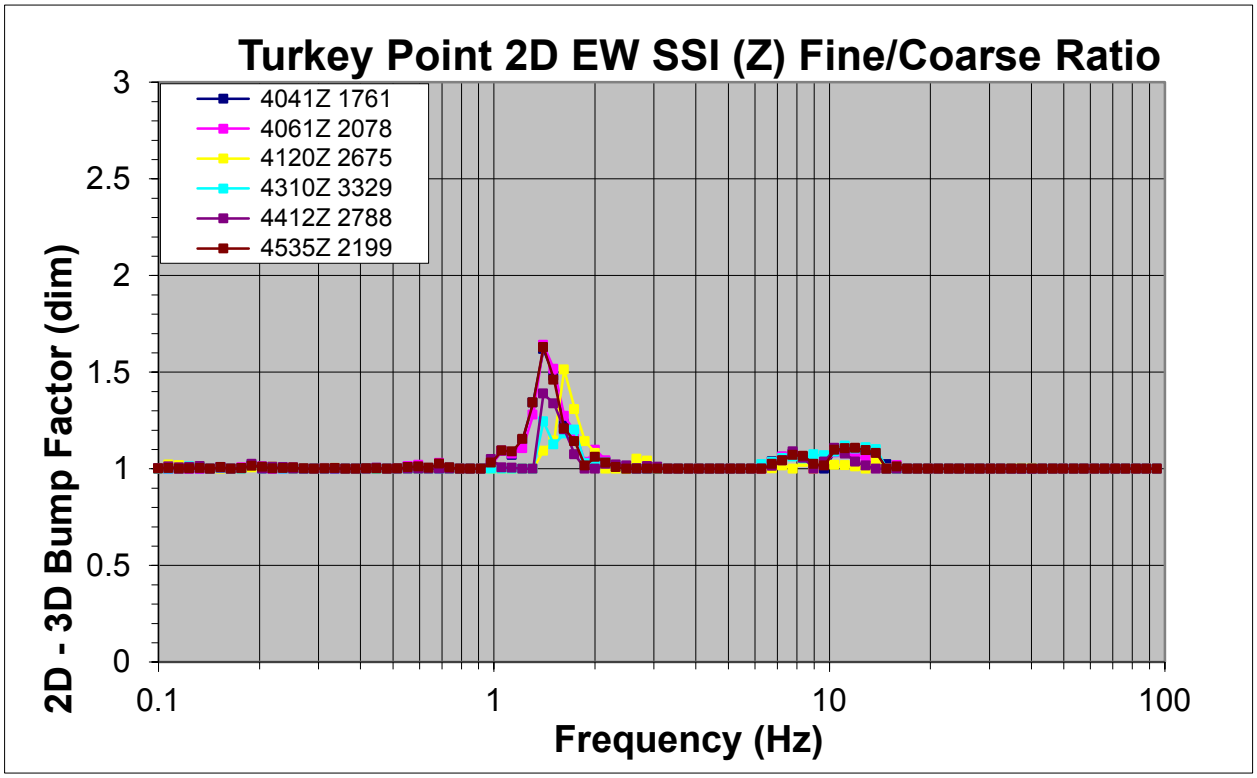

Figure 6.1-2. TPNP 2D-3D Vertical Bump Factors – All Nodes

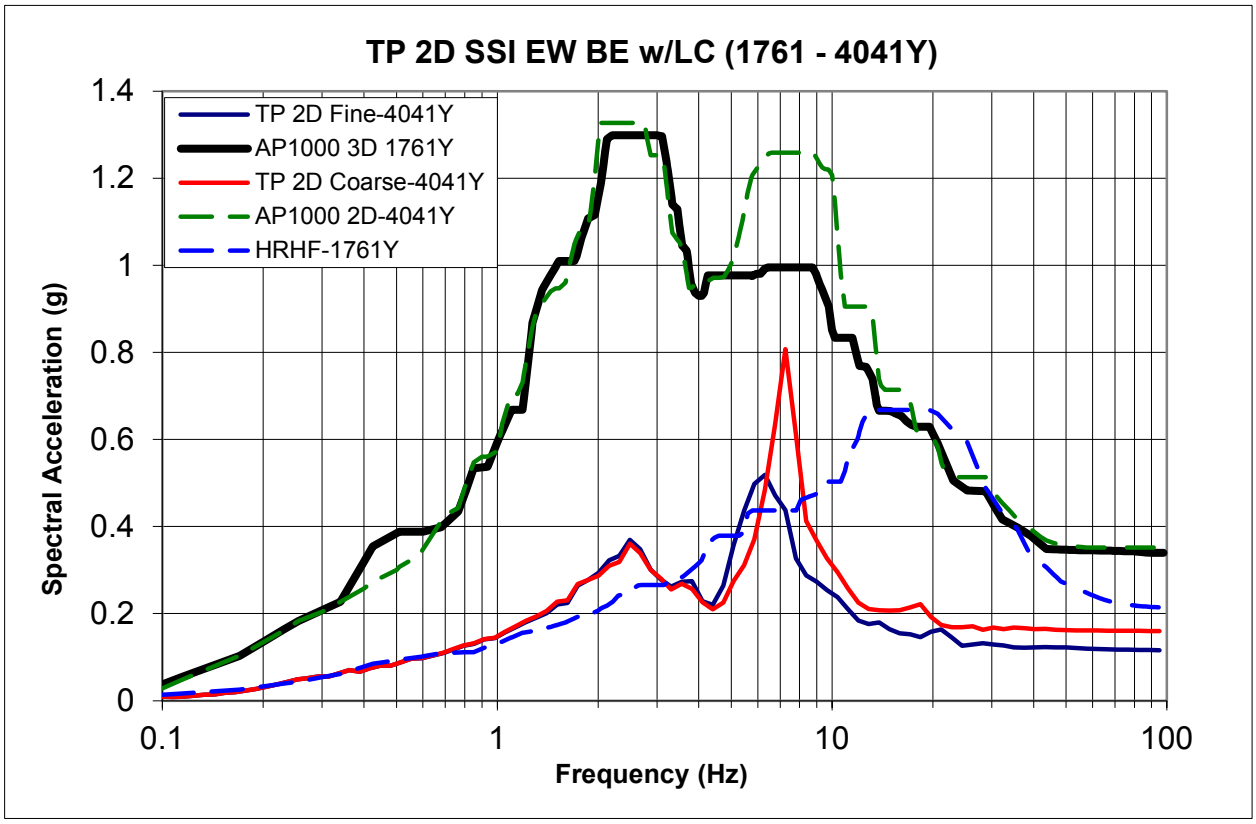

Figure 6.1-3. TPNP 2D Fine and Coarse FRS and AP1000 FRS Envelope in Y-Direction – Node 4041

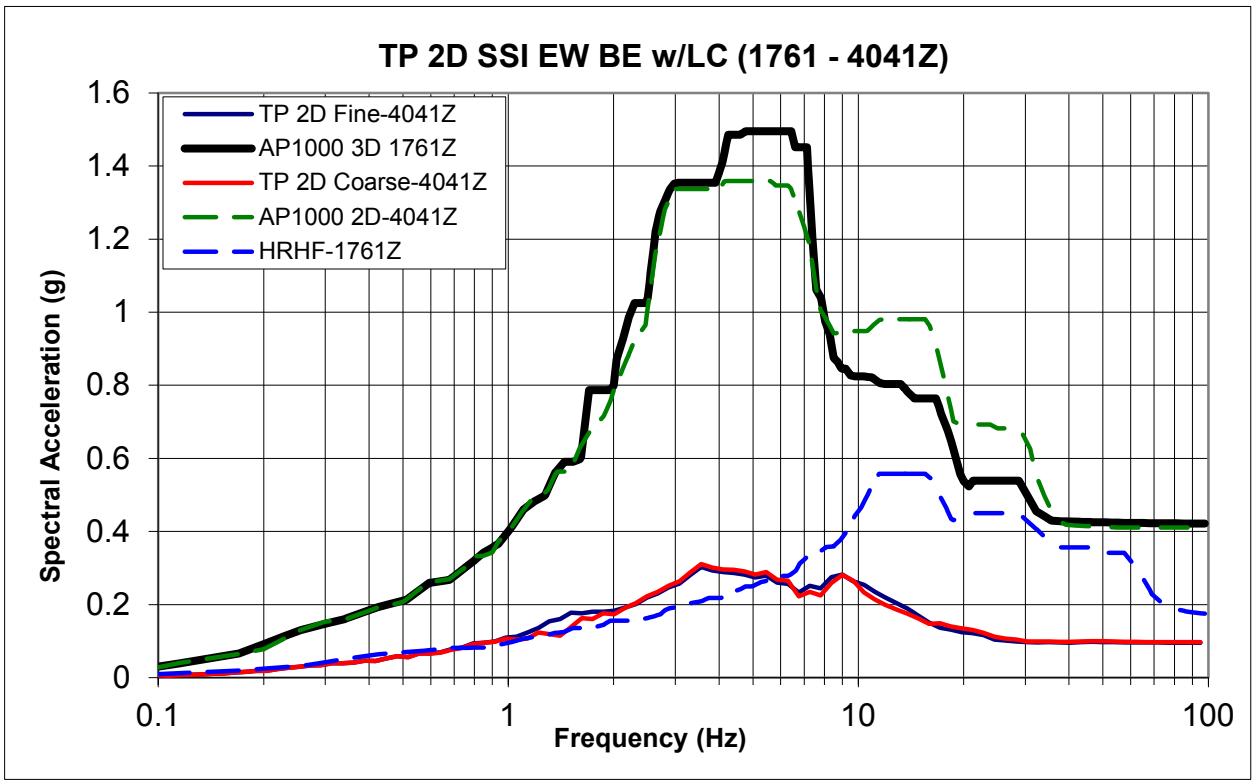

Figure 6.1-4. TPNP 2D Fine and Coarse FRS and AP1000 FRS Envelope in Z-Direction – Node 4041

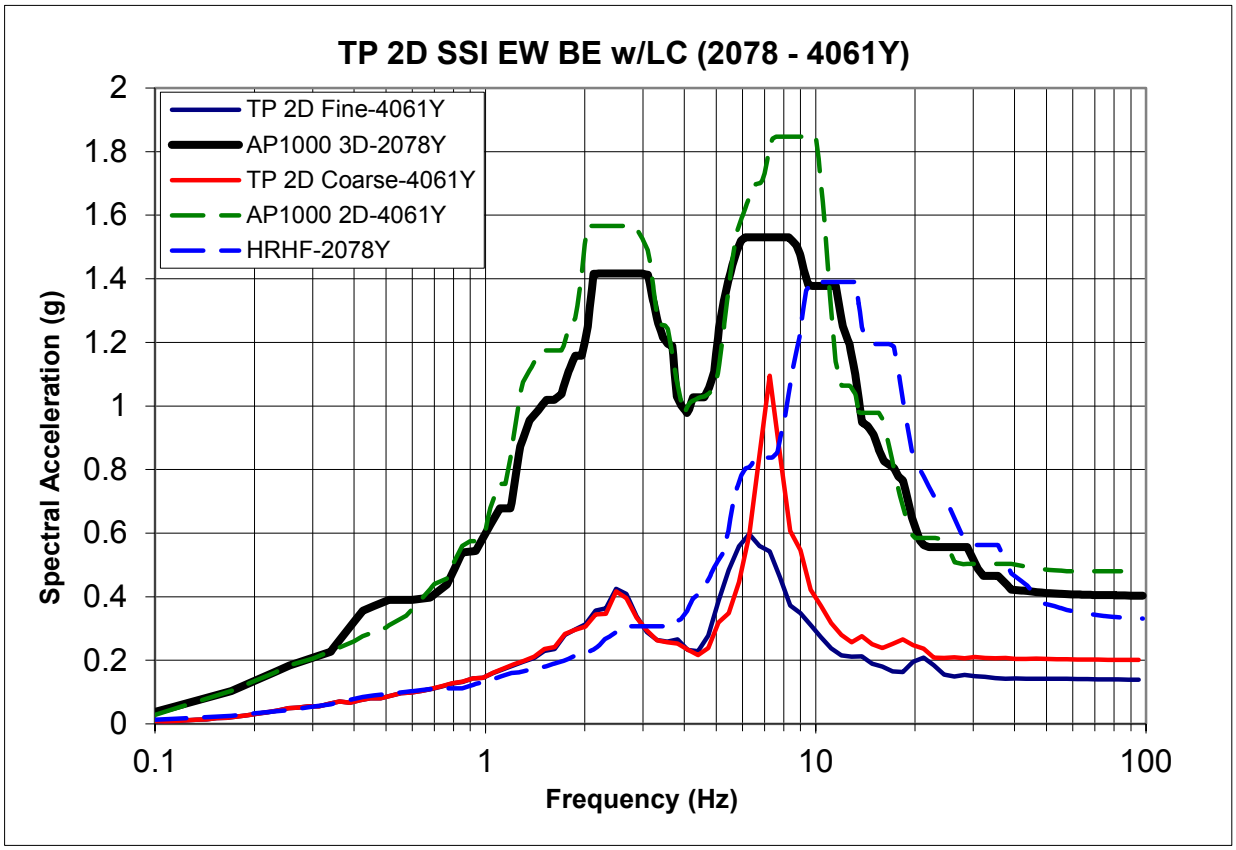

Figure 6.1-5. TPNP 2D Fine and Coarse FRS and AP1000 FRS Envelope in Y-Direction – Node 4061

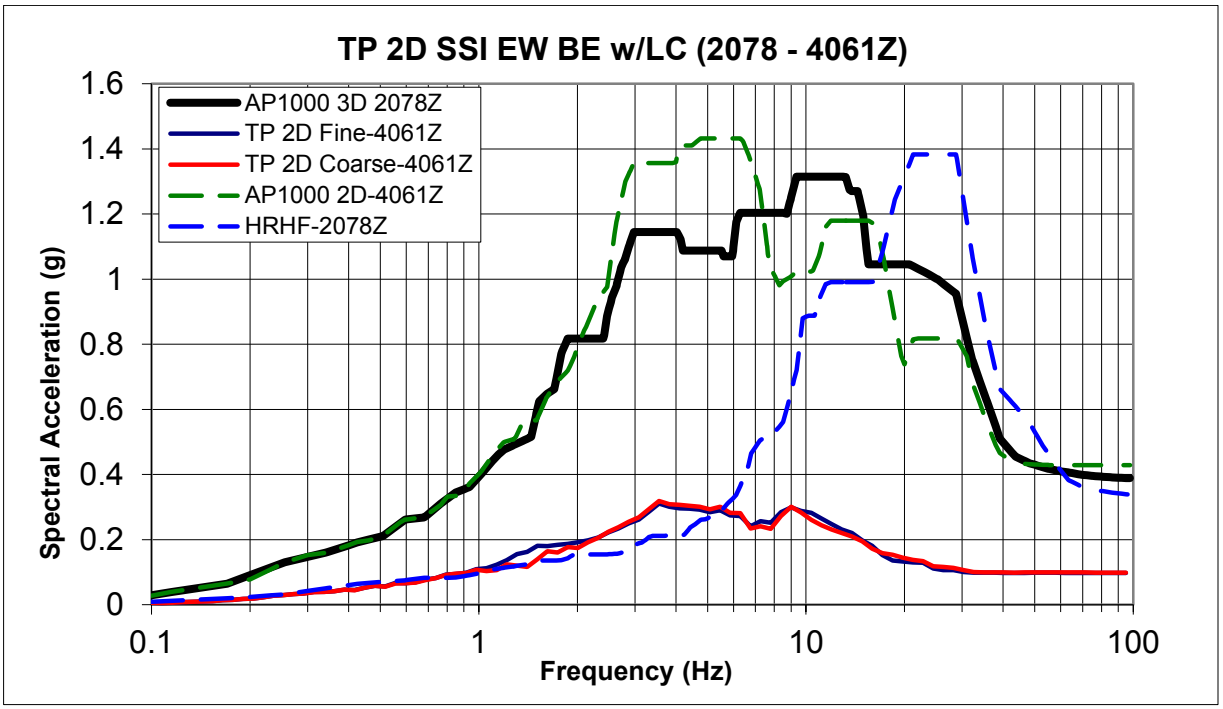

Figure 6.1-6. TPNP 2D Fine and Coarse FRS and AP1000 FRS Envelope in Z-Direction – Node 4061

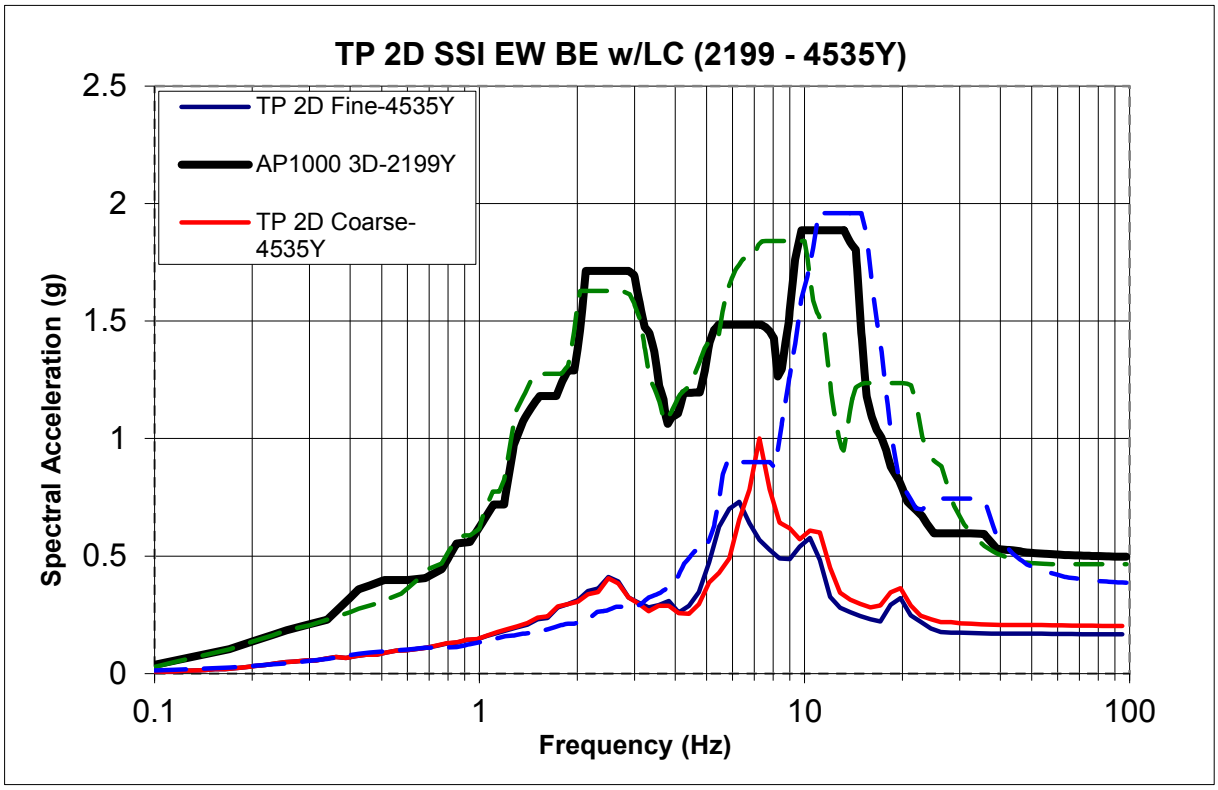

Figure 6.1-7. TPNP 2D Fine and Coarse FRS and AP1000 FRS Envelope in Y-Direction – Node 4535

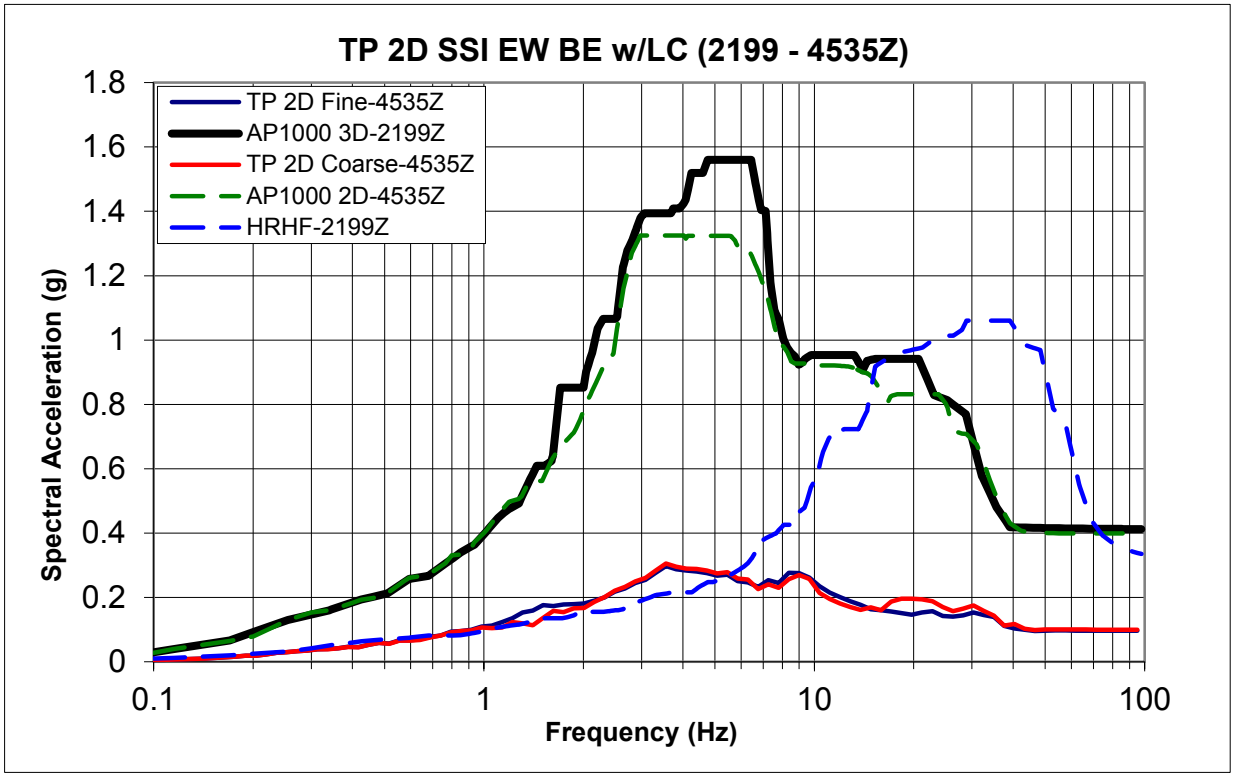

Figure 6.1-8. TPNP 2D Fine and Coarse FRS and AP1000 FRS Envelope in Z-Direction – Node 4535

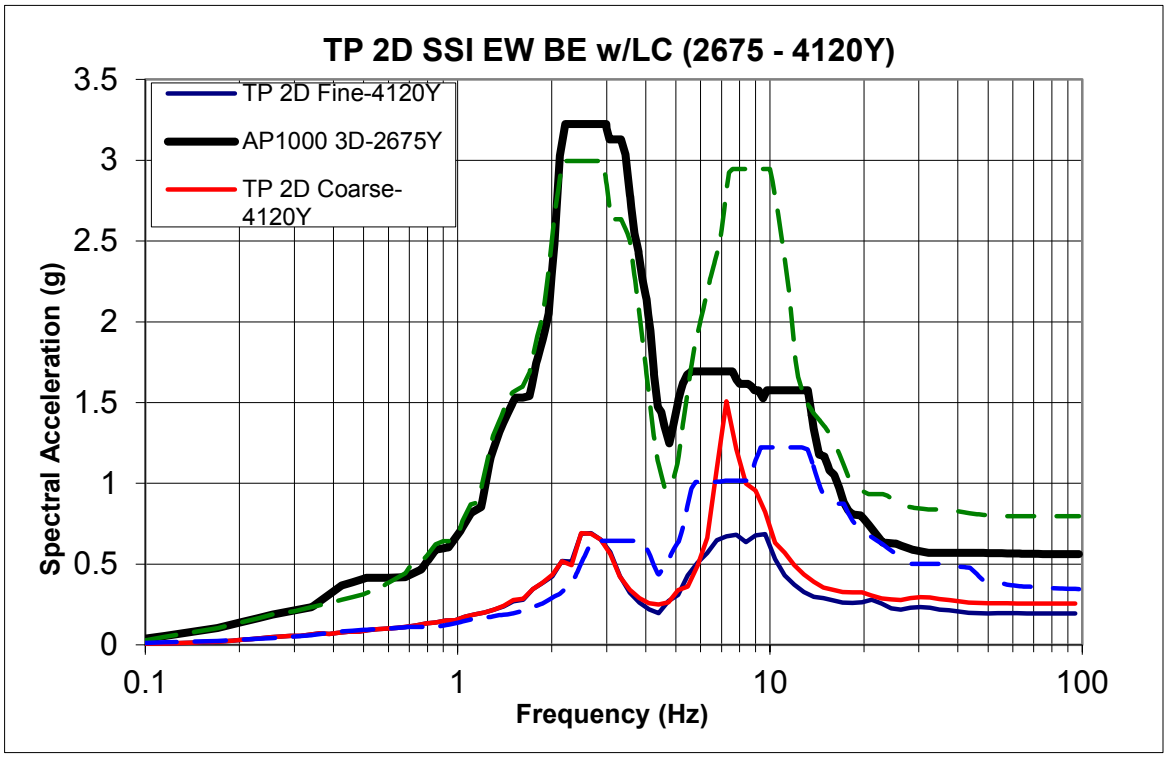

Figure 6.1-9. TPNP 2D Fine and Coarse FRS and AP1000 FRS Envelope in Y-Direction – Node 4120

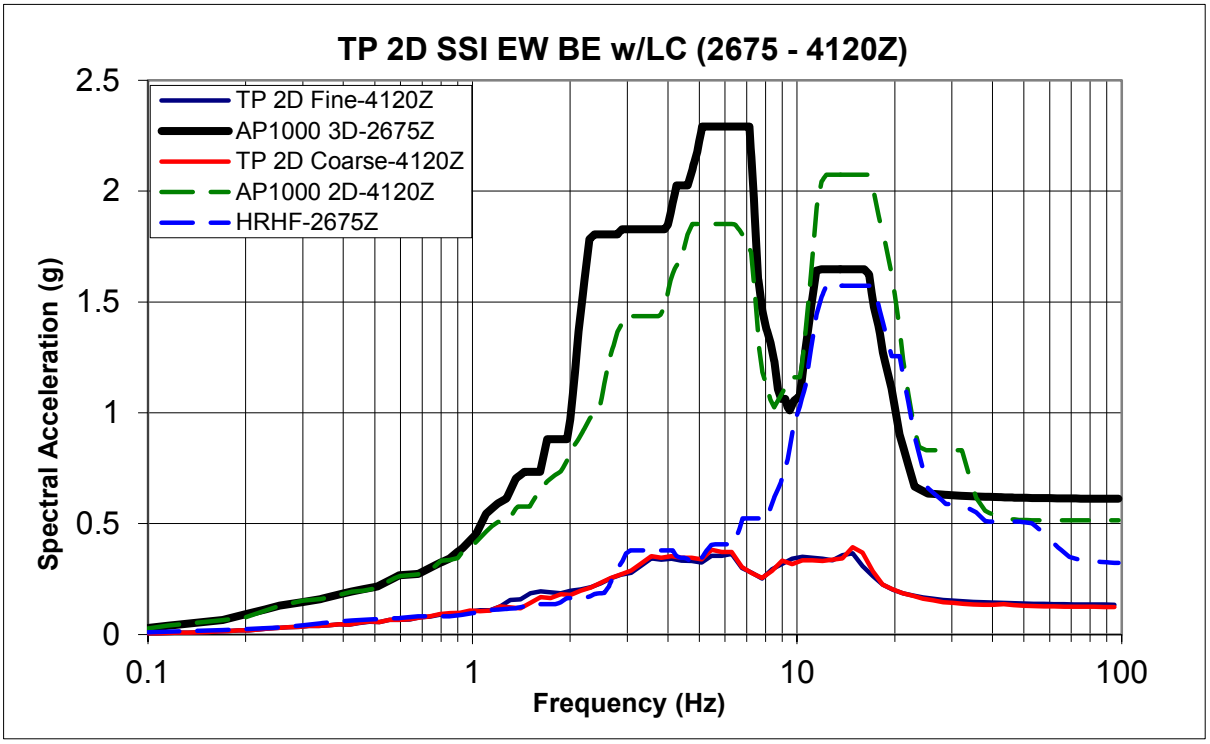

Figure 6.1-10. TPNP 2D Fine and Coarse FRS and AP1000 FRS Envelope in Z-Direction – Node 4120

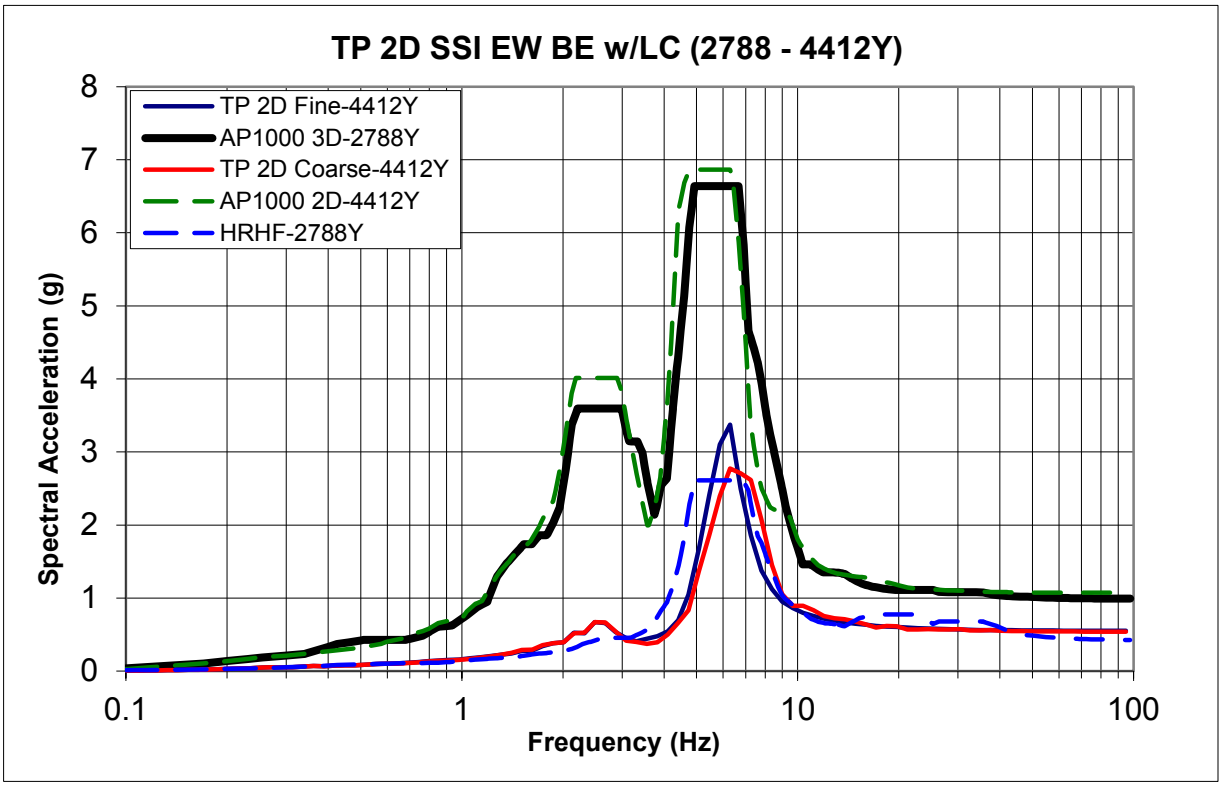

Figure 6.1-11. TPNP 2D Fine and Coarse FRS and AP1000 FRS Envelope in Y-Direction – Node 4412

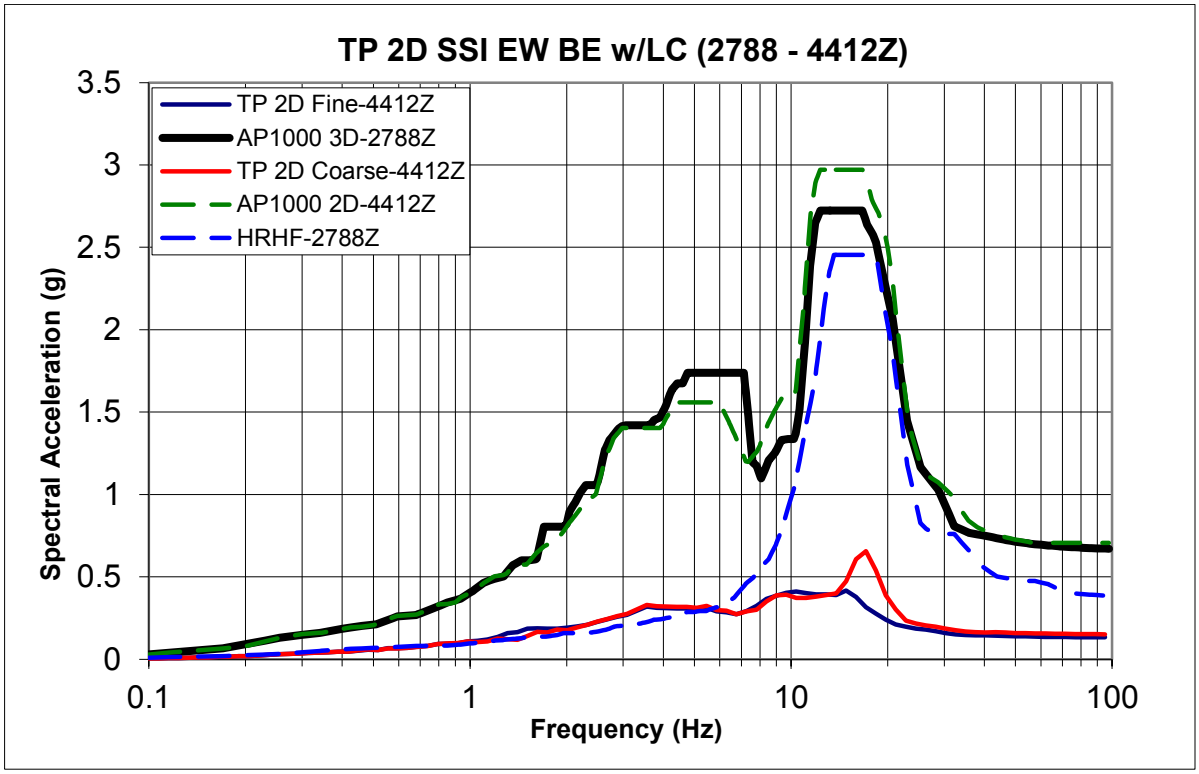

Figure 6.1-12. TPNP 2D Fine and Coarse FRS and AP1000 FRS Envelope in Z-Direction – Node 4412

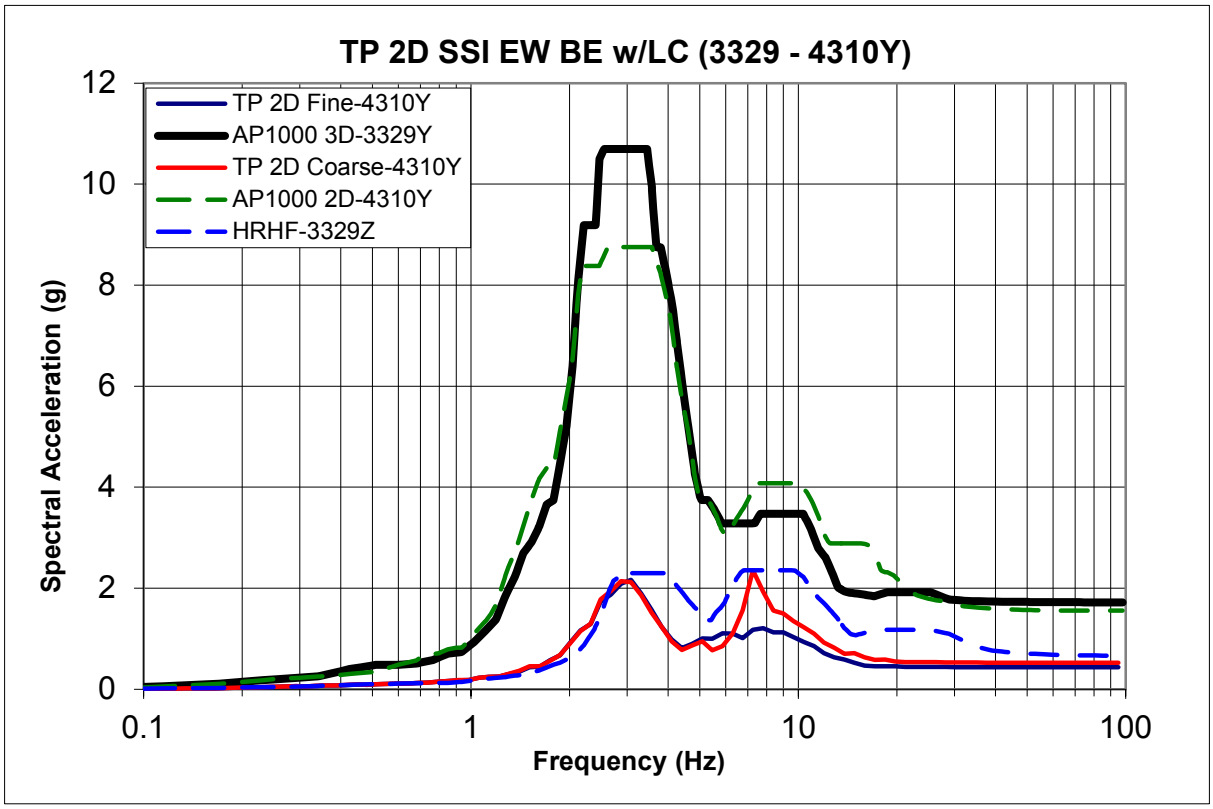

Figure 6.1-13. TPNP 2D Fine and Coarse FRS and AP1000 FRS Envelope in Y-Direction – Node 4310

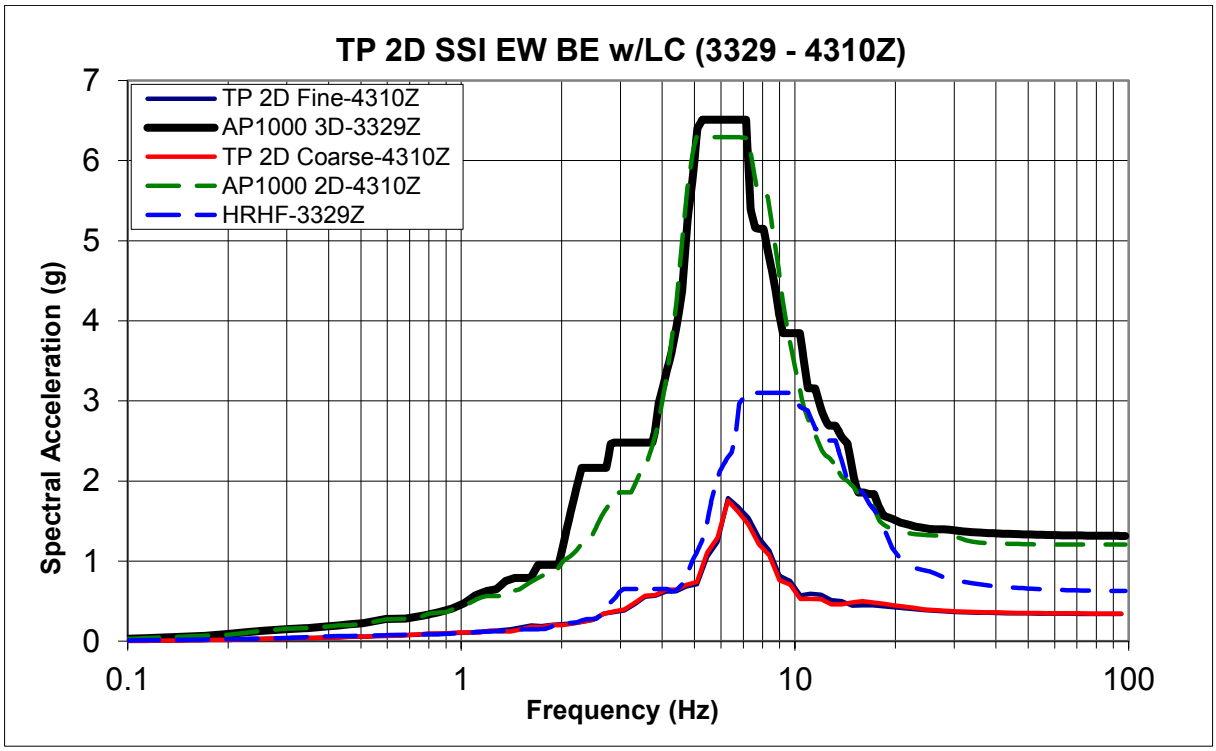

Figure 6.1-14. TPNP 2D Fine and Coarse FRS and AP1000 FRS Envelope in Z-Direction – Node 4310

6.2 TPNP 3D BE, LB and UB Factored Design-Basis SSI Analysis Results

Time history seismic analyses for the TPNP 3D Design-Basis model and the TPNP BE, LB and UB cases were performed in two horizontal and one vertical direction. The TPNP top of LC (El. -16) input time histories were used in SASSI with the SASSI Direct method of analysis. FRS for 5 percent damping were obtained at the six key NI locations shown in Table 3.4-1. The horizontal and vertical Bump Factors are applied along the frequency spectrum to amplify the TPNP 3D BE, LB and UB Design-Basis FRS based on the horizontal and vertical Bump Factors presented in Figures 6.1-1 and 6.1-2, respectively.

Finally, the factored TPNP 3D BE, LB, UB design-basis FRS are conservatively augmented by broadening the FRS envelop ±15 percent for any other potential uncertainties in the soil properties and/or seismic input.

Figures 6.2-1 through 6.2-18 present the broadened horizontal and vertical TPNP Factored 3D Design-Basis FRS, which includes the BE, LB and UB FRS and TPNP FRS envelope compared to the 3D AP1000 CSDRS and HRHF FRS envelopes at the six (6) key NI locations. The HRHF FRS envelope is presented to demonstrate that additional and margin exists at the key nodes in the high frequency range (20-50 Hz). As shown, the TPNP site specific FRS are enveloped by the AP1000 CSDRS and HRHF FRS envelopes at each of the six key NI locations.

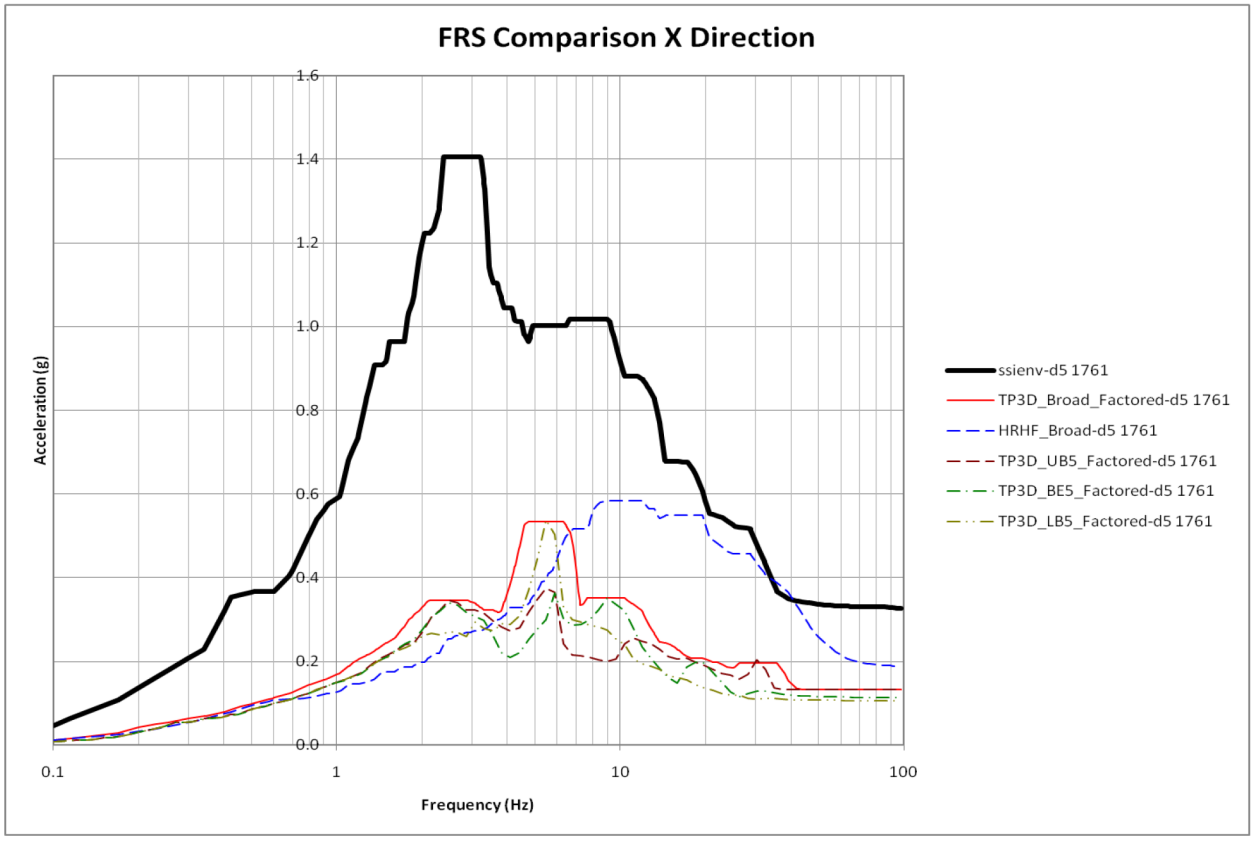

Figure 6.2-1. TPNP 3D BE, LB, UB FRS and AP1000 FRS Envelope in X-Direction – Node 1761

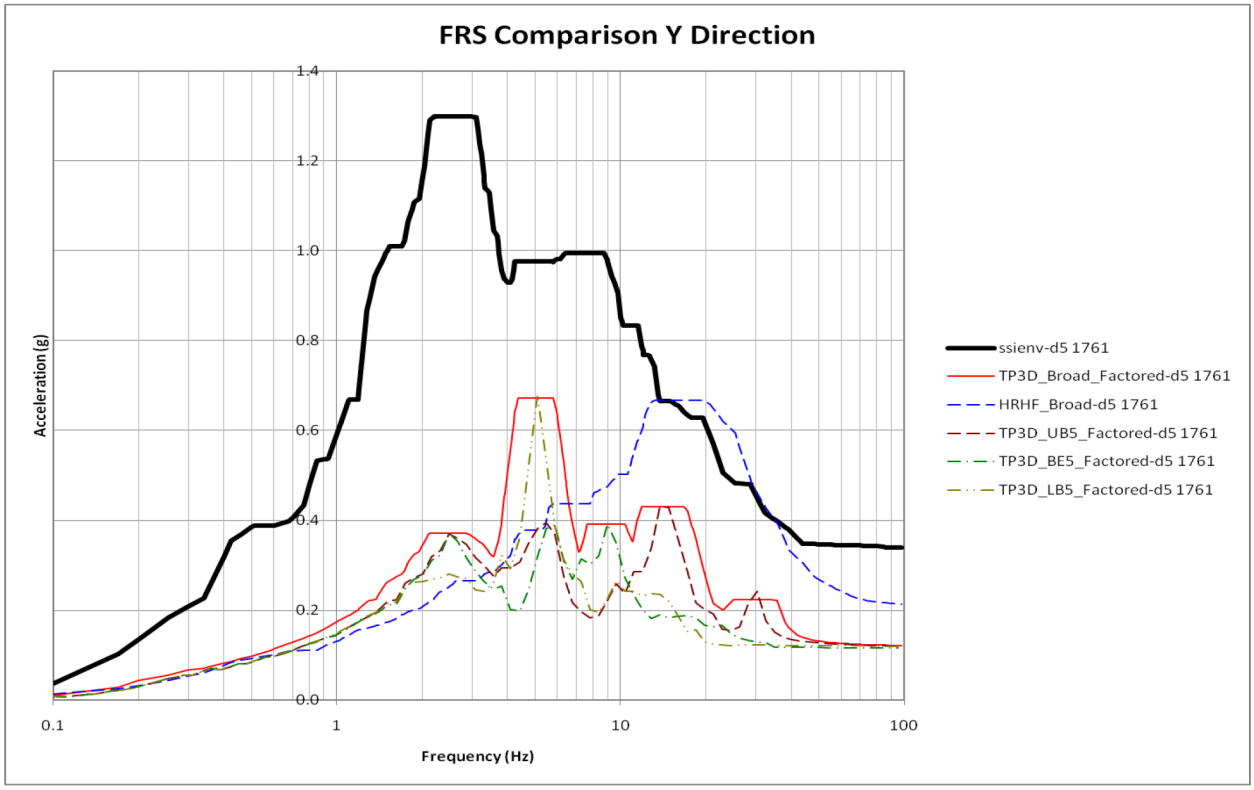

Figure 6.2-2. TPNP 3D BE, LB, UB FRS and AP1000 FRS Envelope in Y-Direction – Node 1761

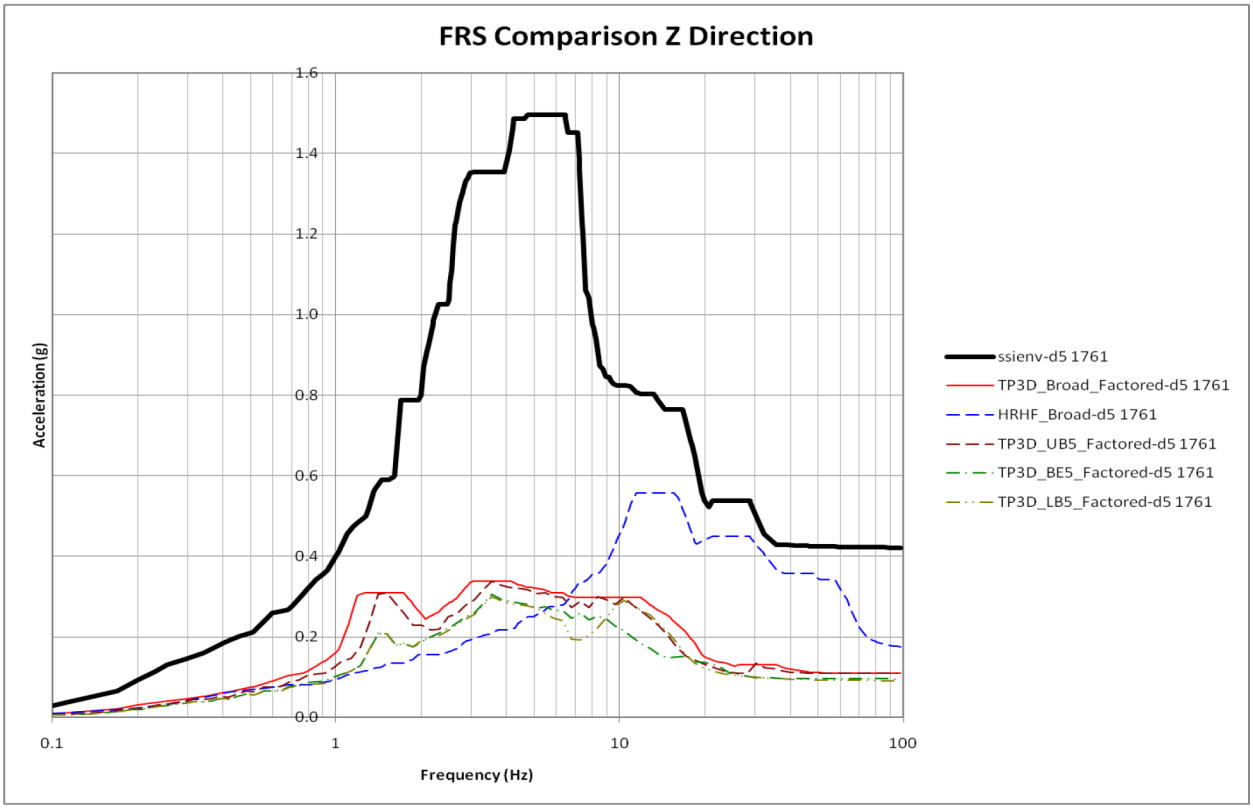

Figure 6.2-3. TPNP 3D BE, LB, UB FRS and AP1000 FRS Envelope in Z-Direction – Node 1761

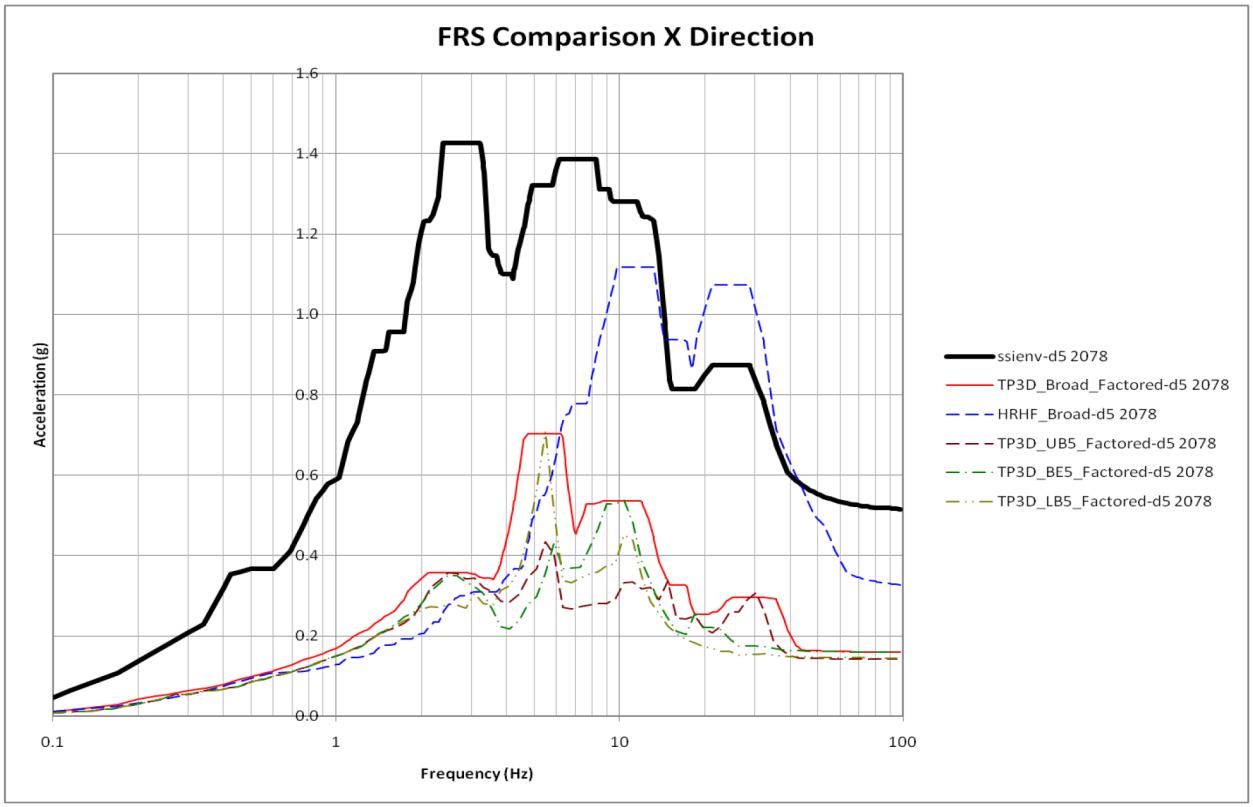

Figure 6.2-4. TPNP 3D BE, LB, UB FRS and AP1000 FRS Envelope in X-Direction – Node 2078

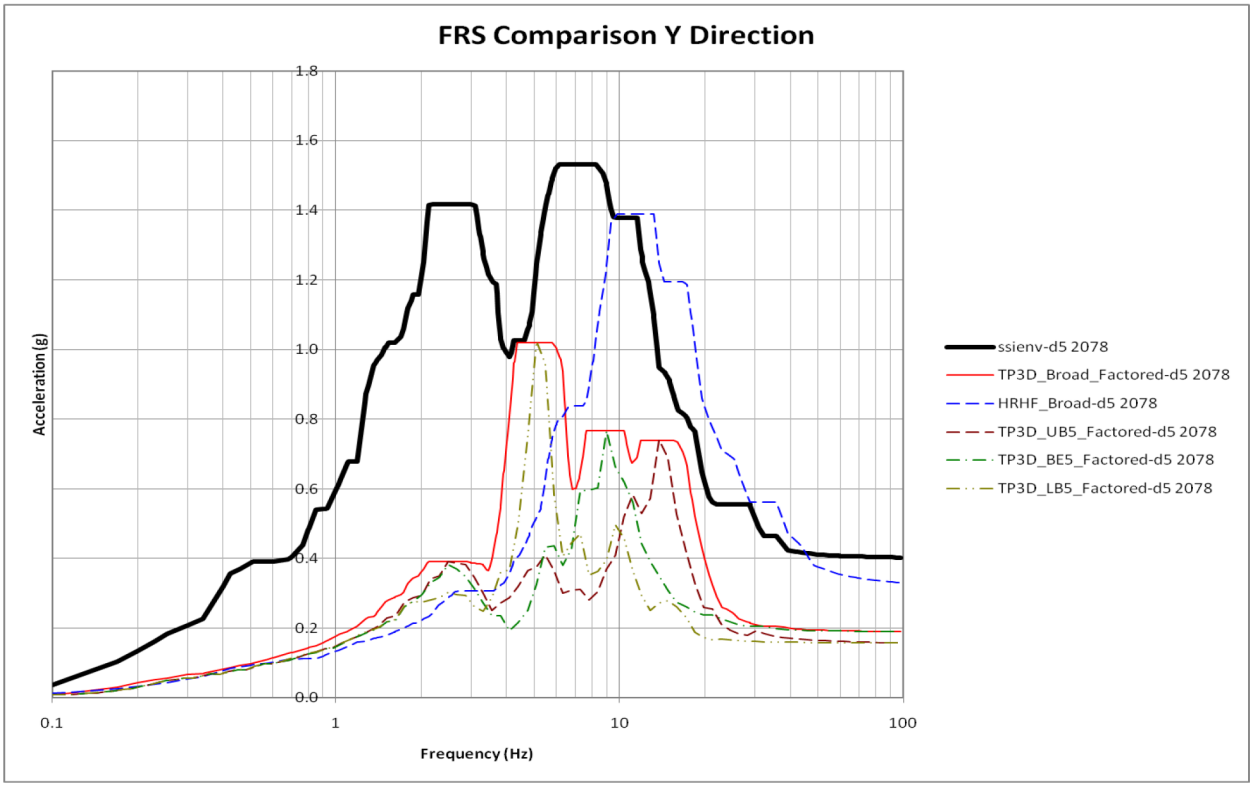

Figure 6.2-5. TPNP 3D BE, LB, UB FRS and AP1000 FRS Envelope in Y-Direction – Node 2078

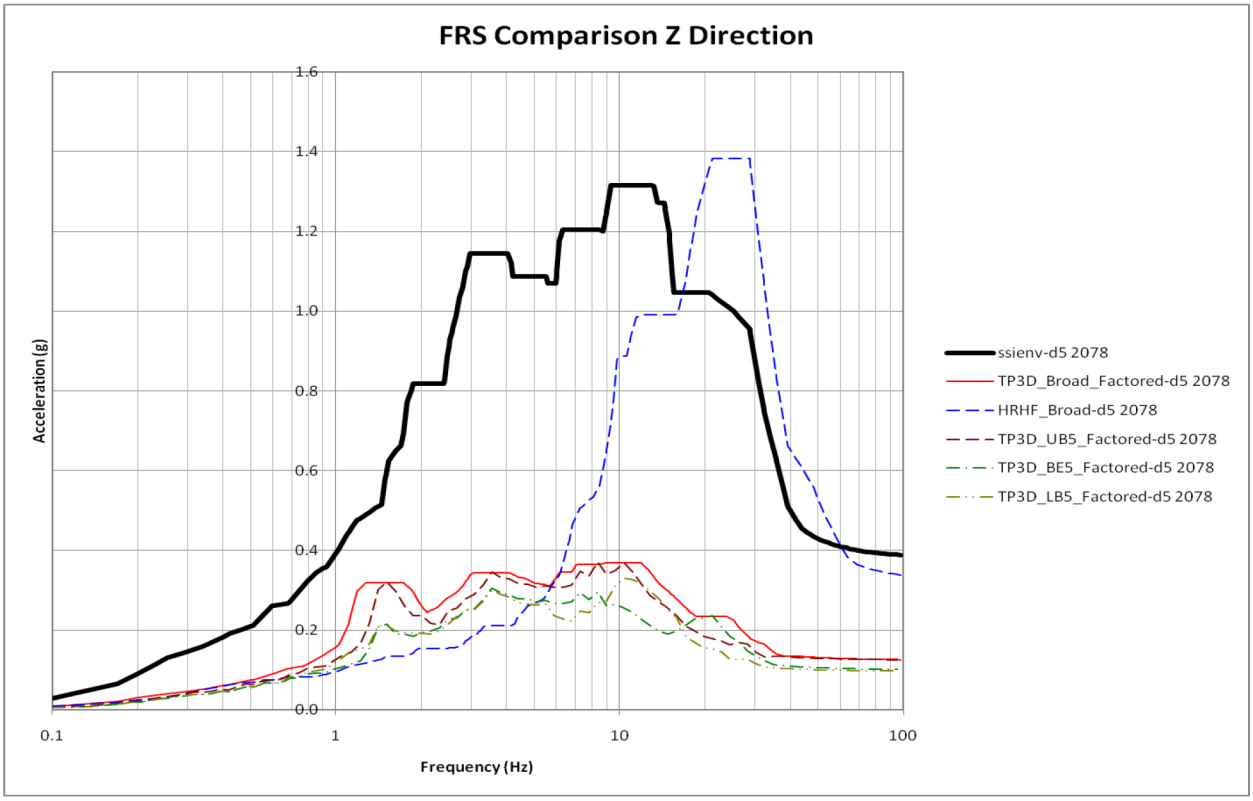

Figure 6.2-6. TPNP 3D BE, LB, UB FRS and AP1000 FRS Envelope in Z-Direction – Node 2078

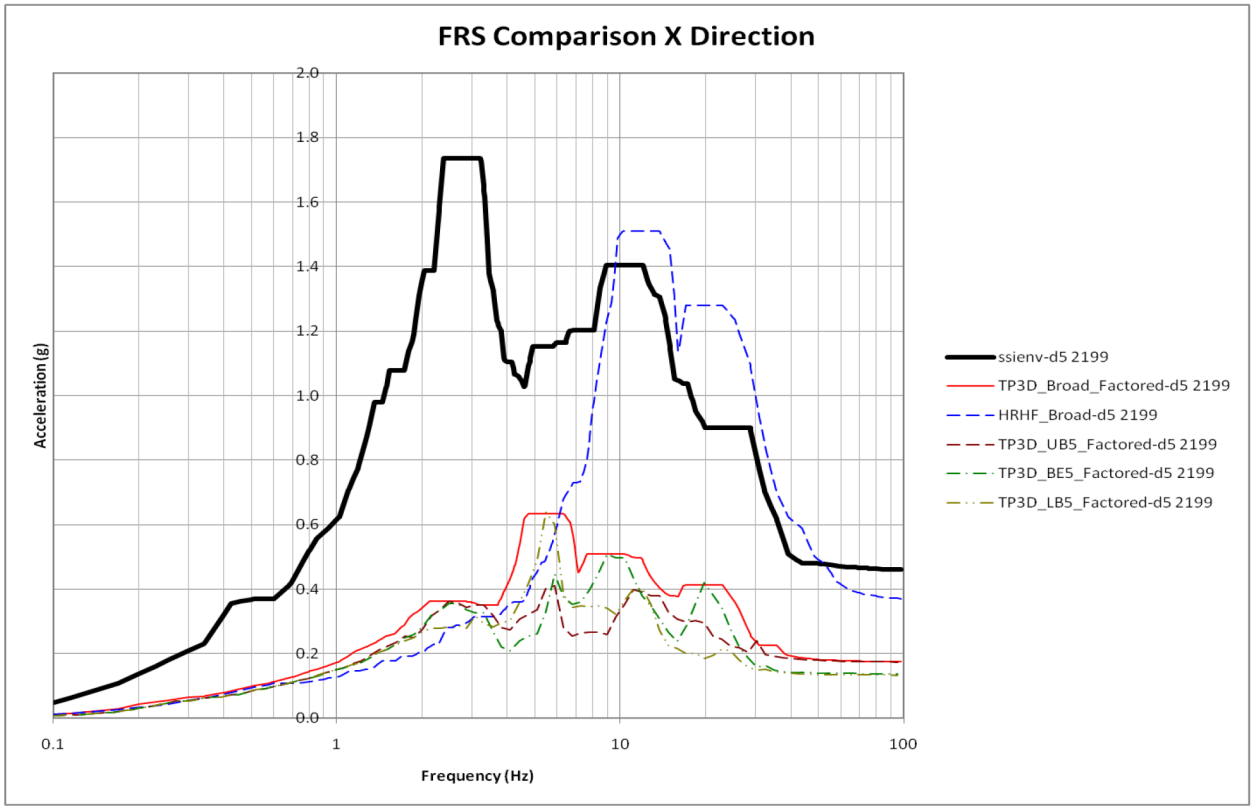

Figure 6.2-7. TPNP 3D BE, LB, UB FRS and AP1000 FRS Envelope in X-Direction – Node 2199

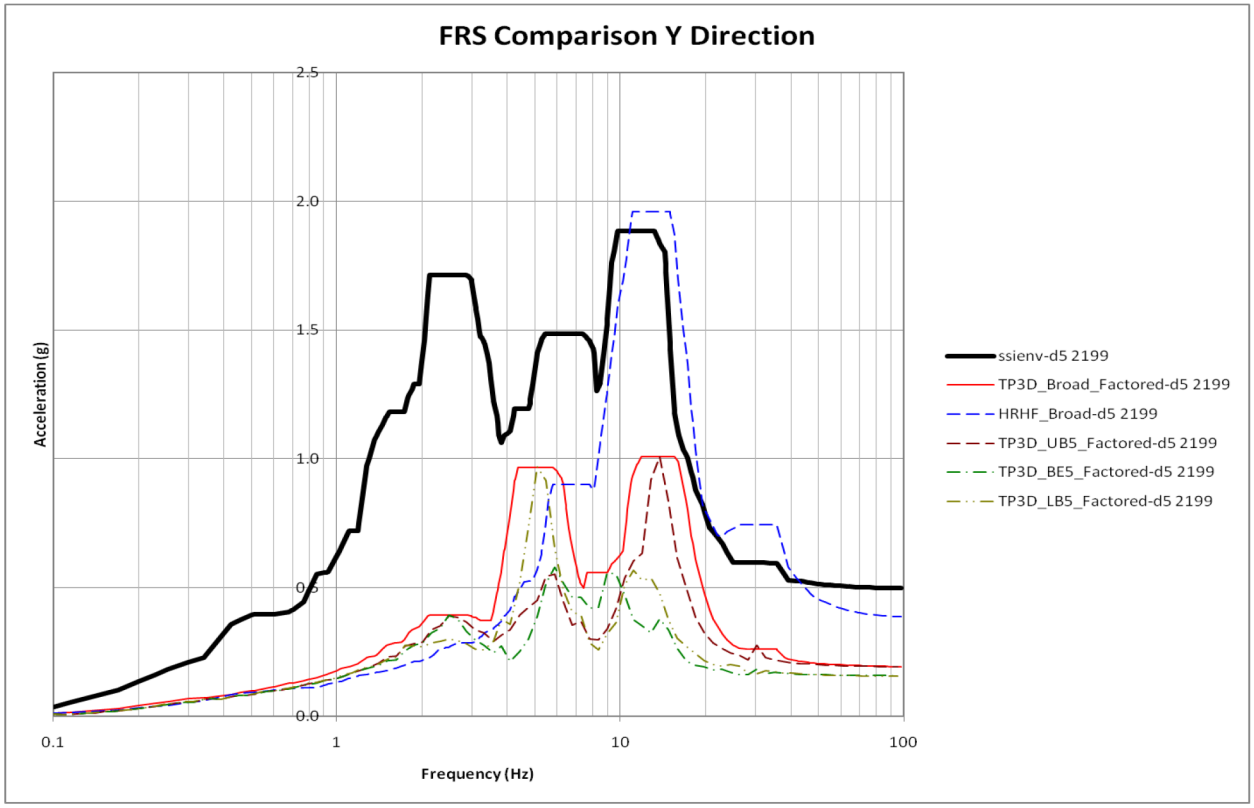

Figure 6.2-8. TPNP 3D BE, LB, UB FRS and AP1000 FRS Envelope in Y-Direction – Node 2199

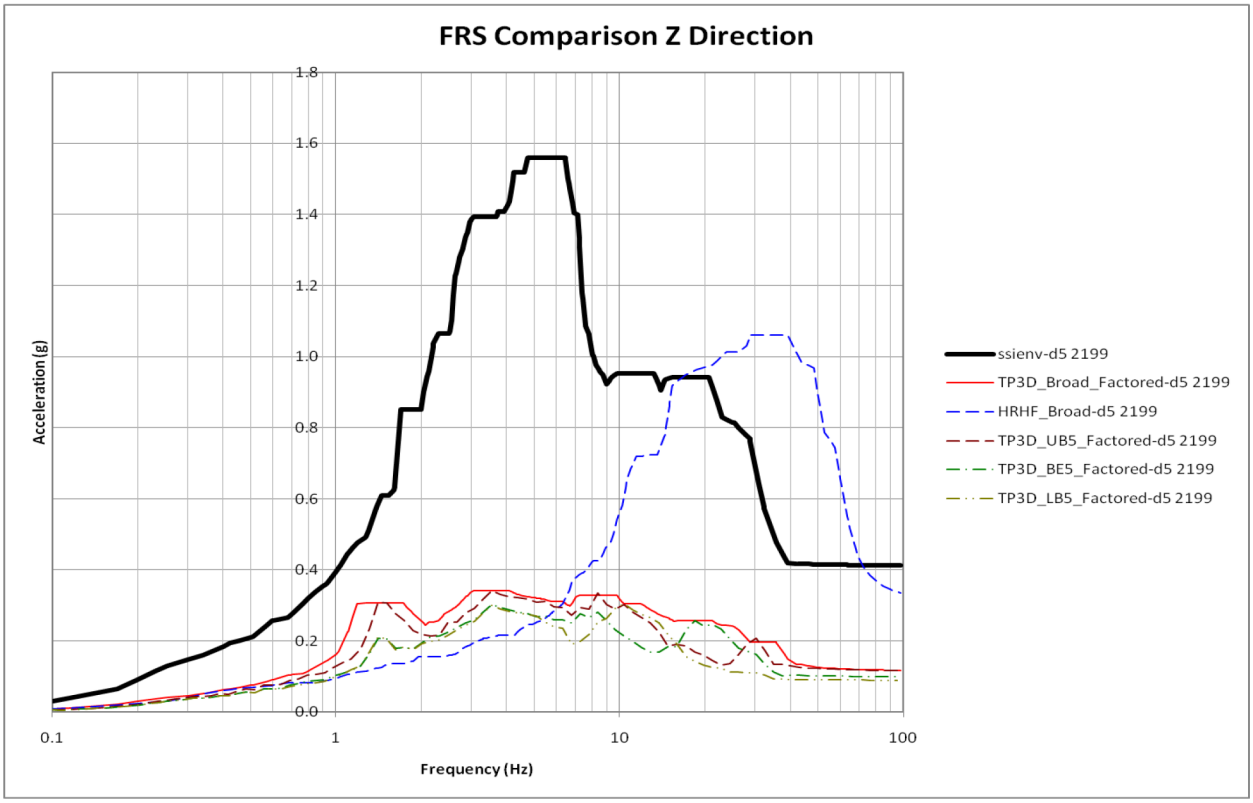

Figure 6.2-9. TPNP 3D BE, LB, UB FRS and AP1000 FRS Envelope in Z-Direction – Node 2199

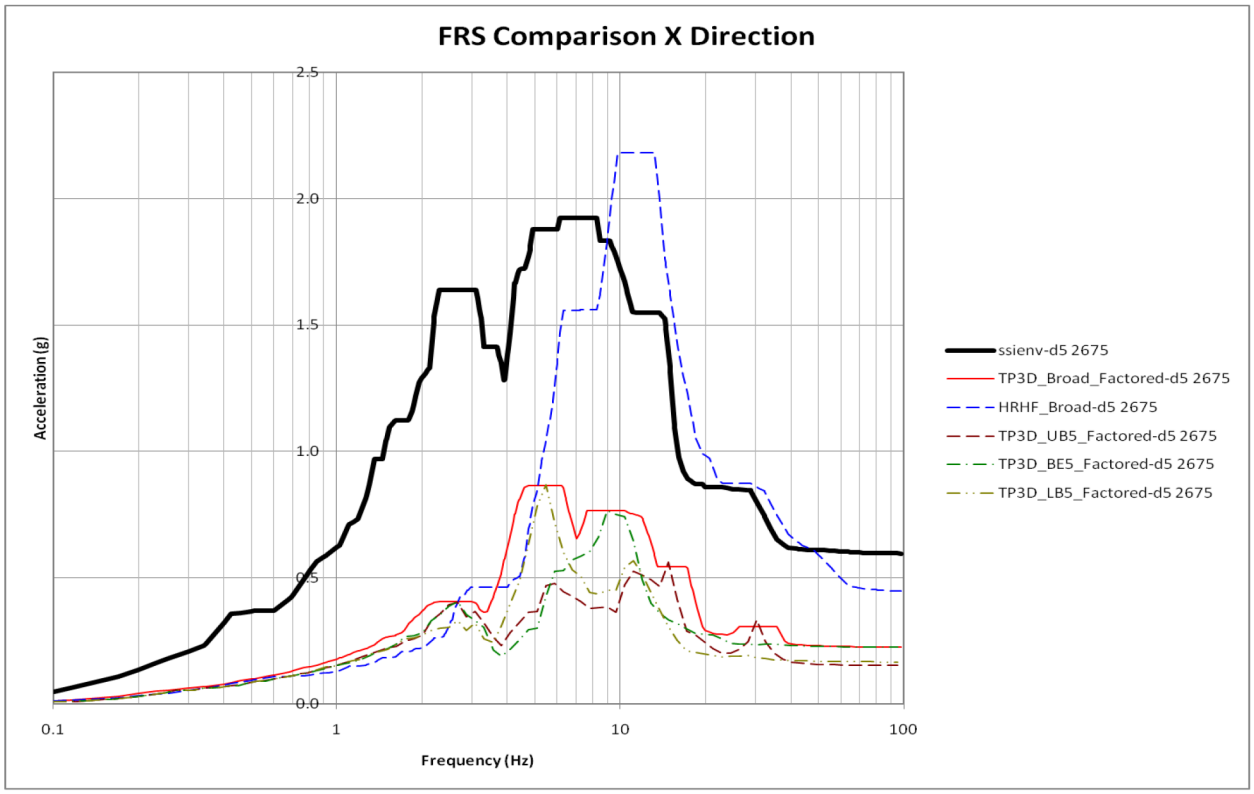

Figure 6.2-10. TPNP 3D BE, LB, UB FRS and AP1000 FRS Envelope in X-Direction – Node 2675

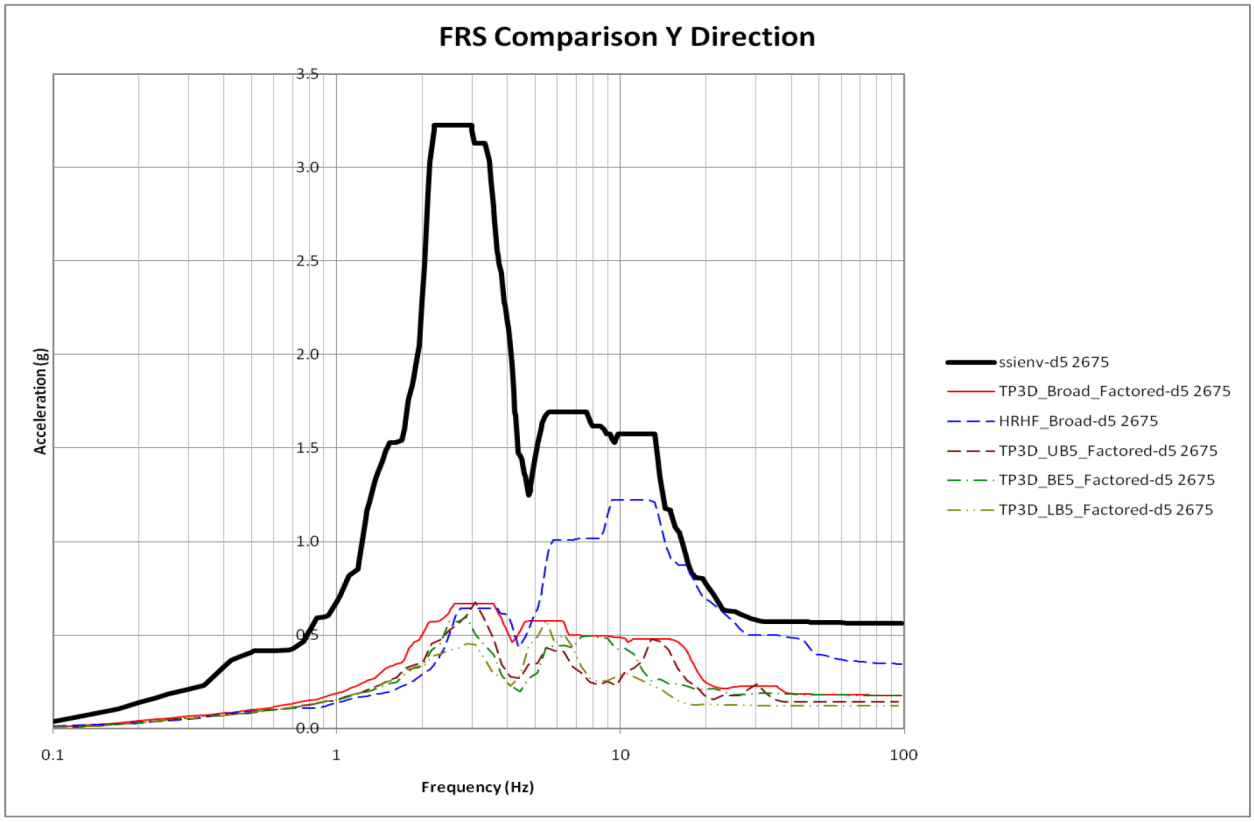

Figure 6.2-11. TPNP 3D BE, LB, UB FRS and AP1000 FRS Envelope in Y-Direction – Node 2675

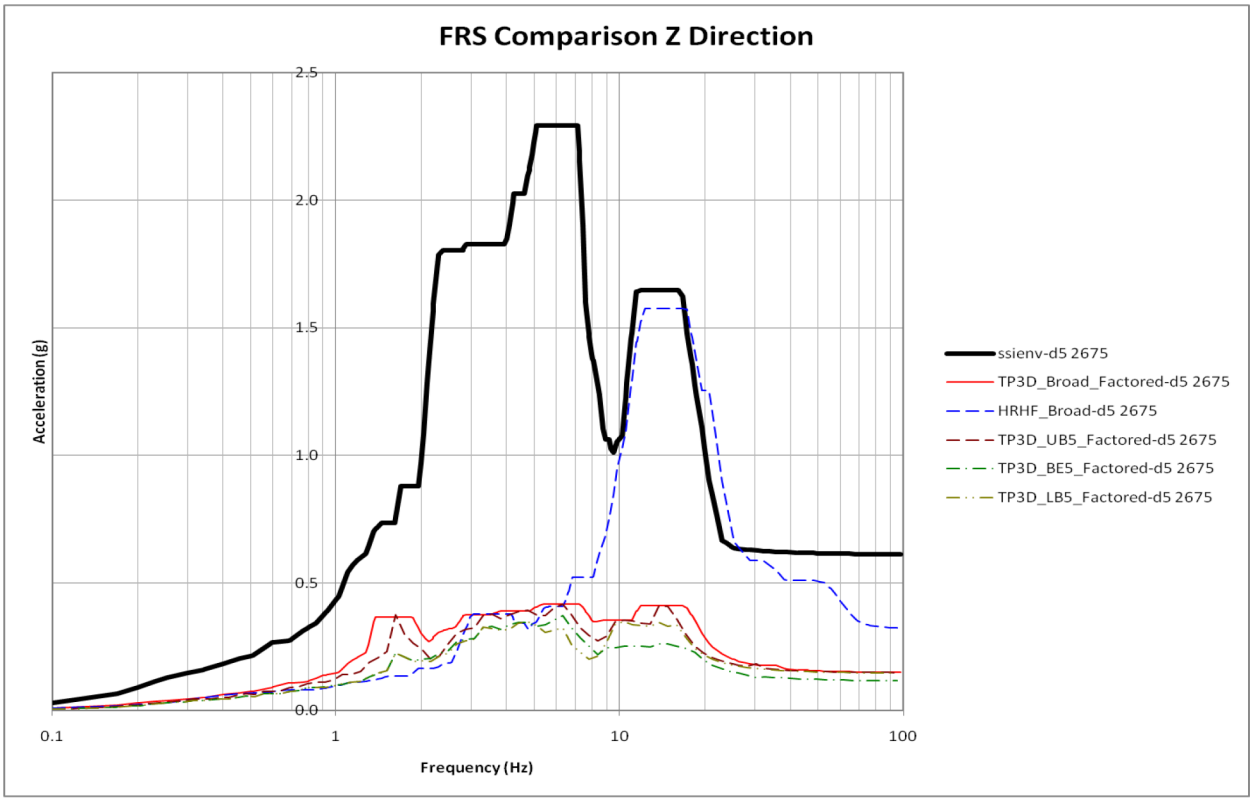

Figure 6.2-12. TPNP 3D BE, LB, UB FRS and AP1000 FRS Envelope in Z-Direction – Node 2675

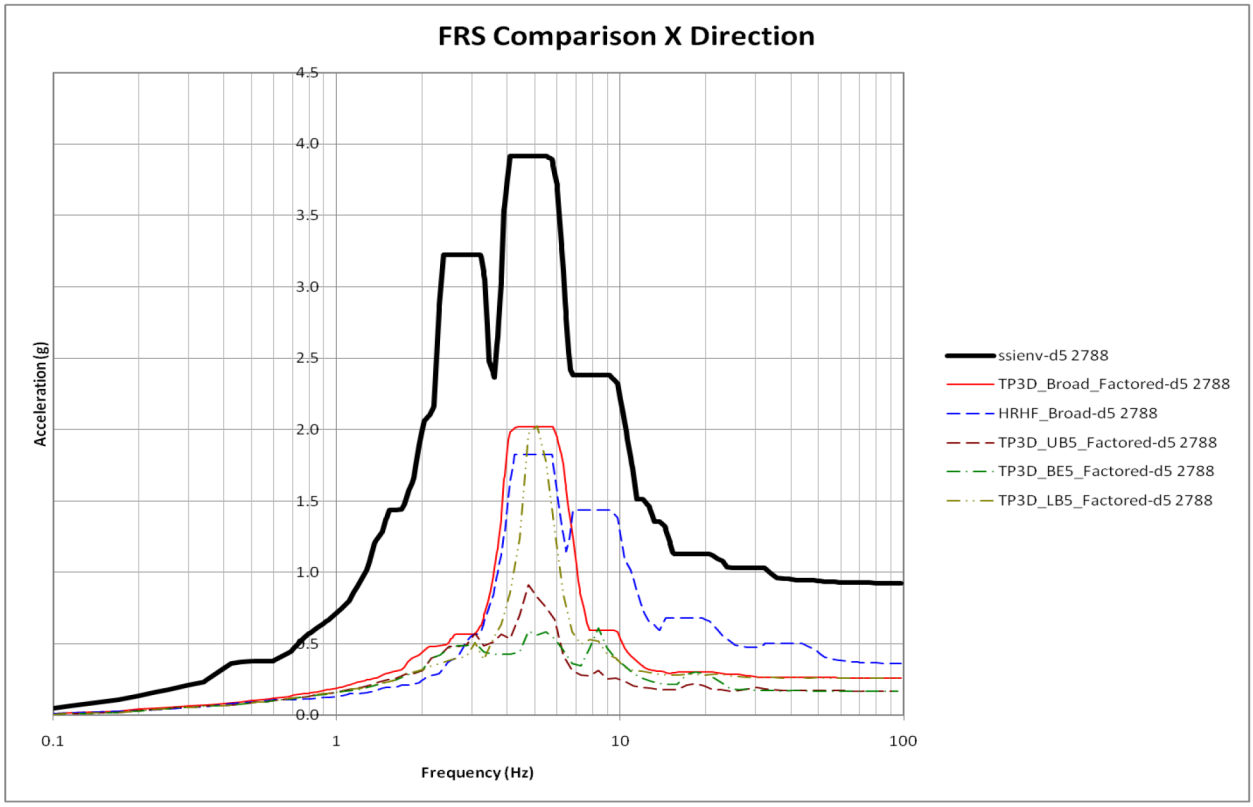

Figure 6.2-13. TPNP 3D BE, LB, UB FRS and AP1000 FRS Envelope in X-Direction – Node 2788

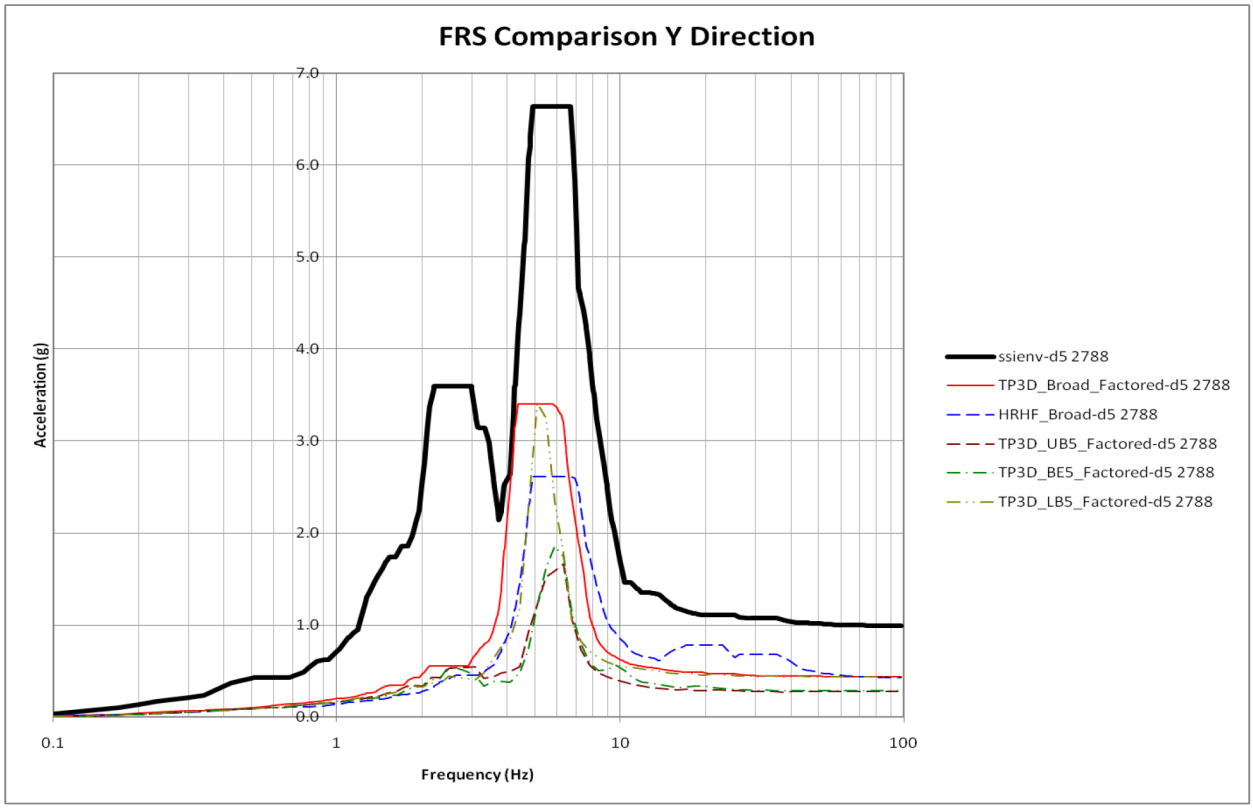

Figure 6.2-14. TPNP 3D BE, LB, UB FRS and AP1000 FRS Envelope in Y-Direction – Node 2788

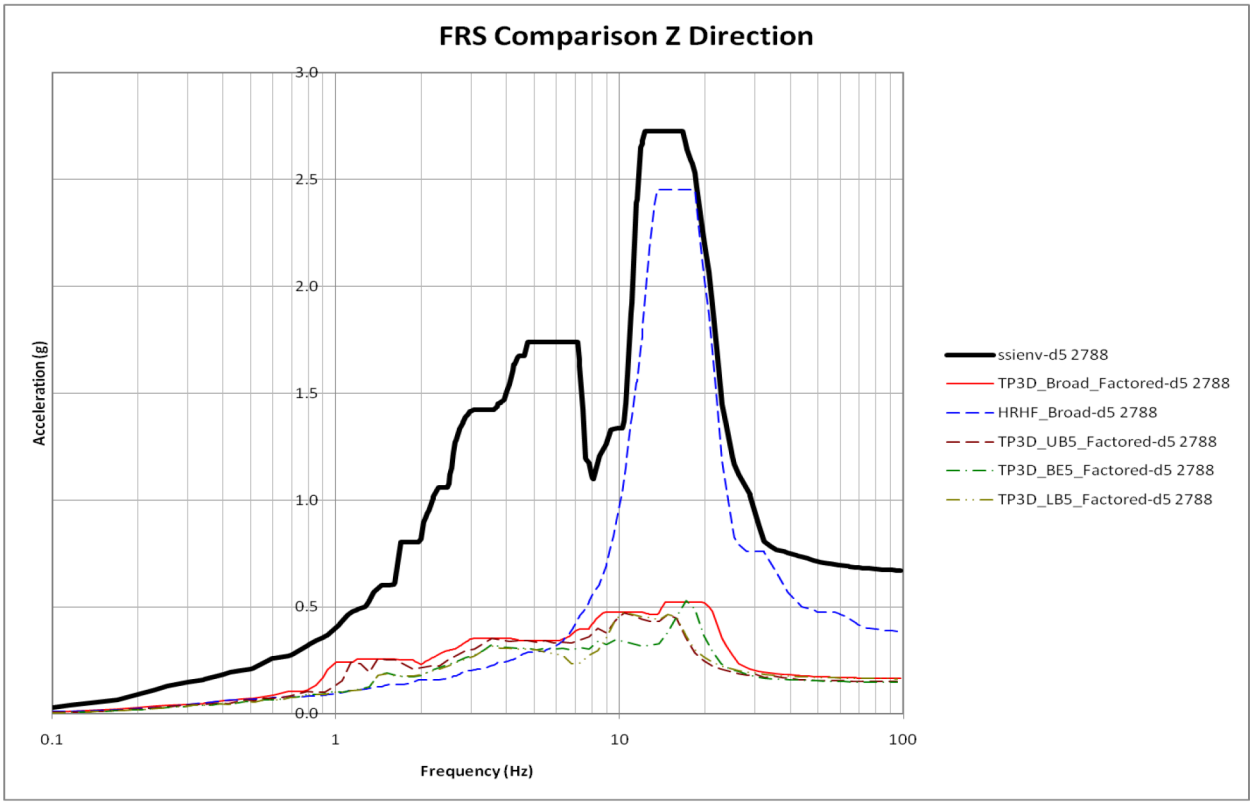

Figure 6.2-15. TPNP 3D BE, LB, UB FRS and AP1000 FRS Envelope in Z-Direction – Node 2788

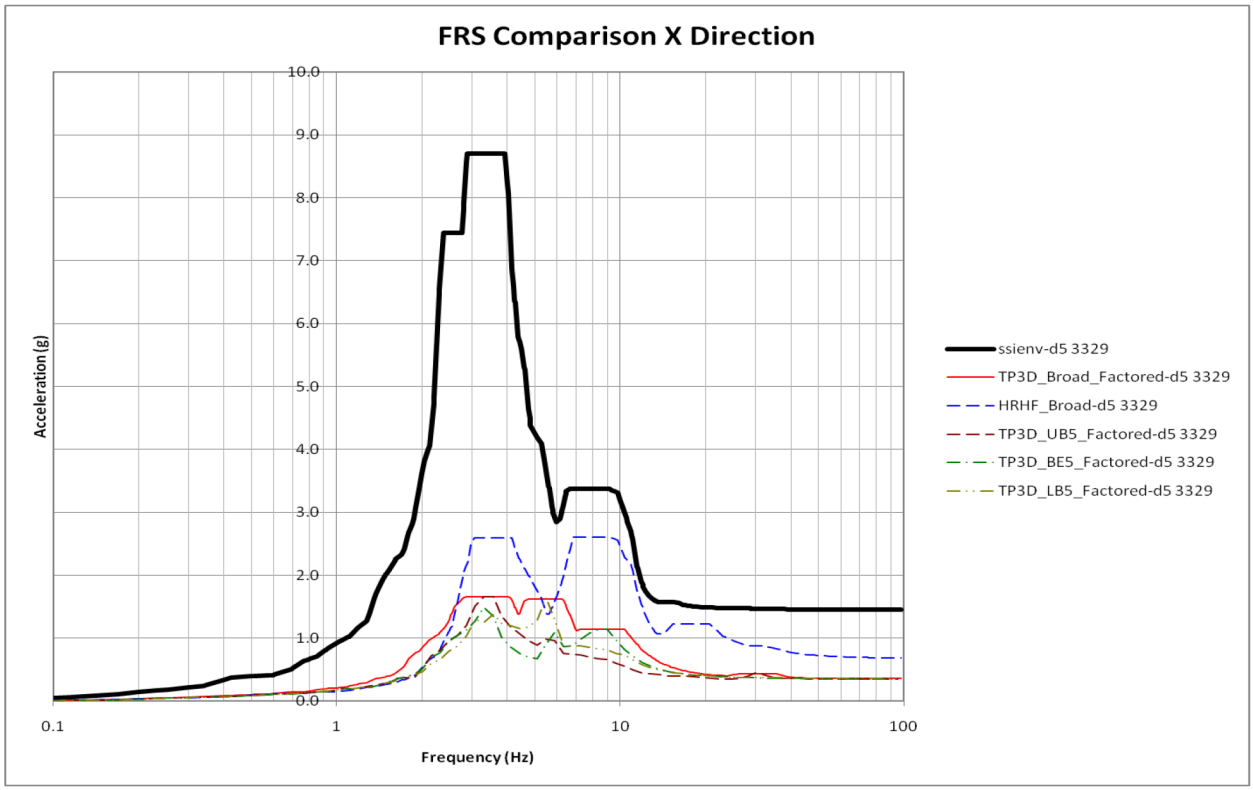

Figure 6.2-16. TPNP 3D BE, LB, UB FRS and AP1000 FRS Envelope in X-Direction – Node 3329

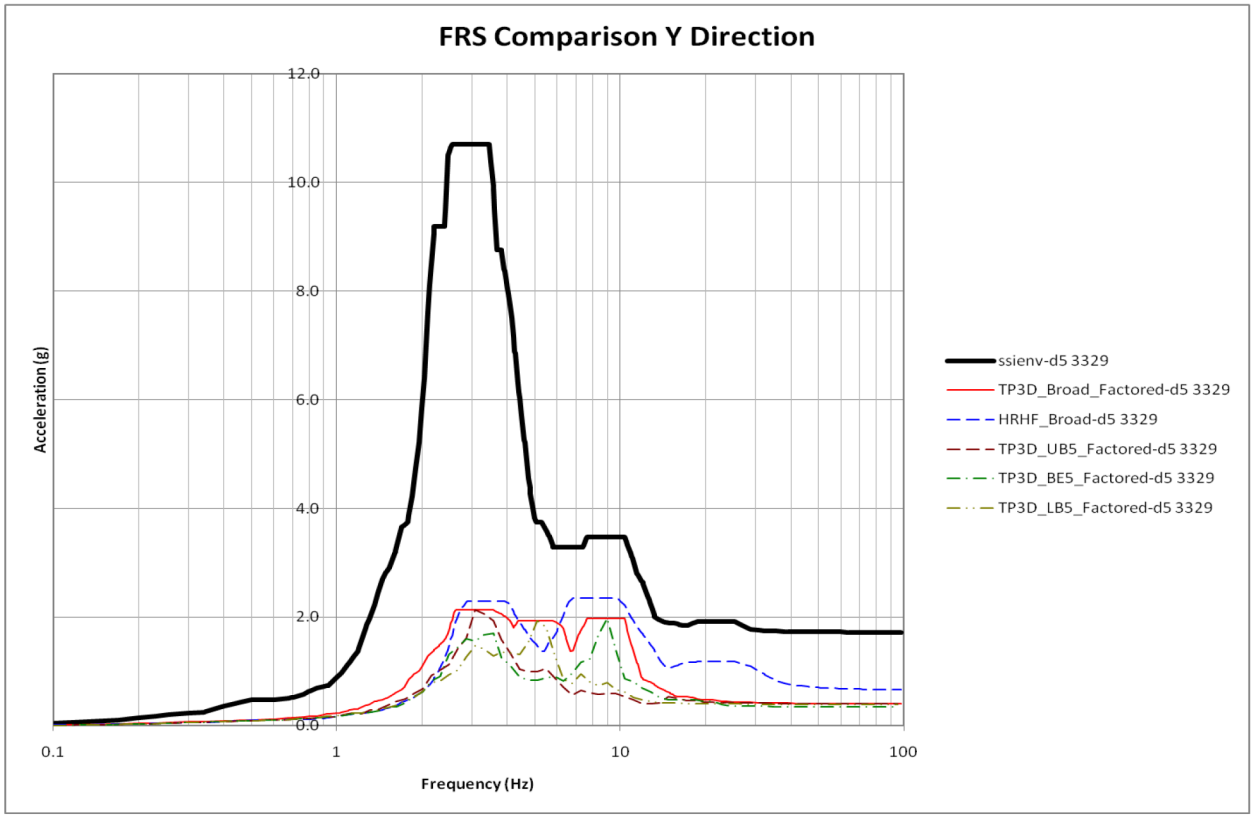

Figure 6.2-17. TPNP 3D BE, LB, UB FRS and AP1000 FRS Envelope in Y-Direction – Node 3329

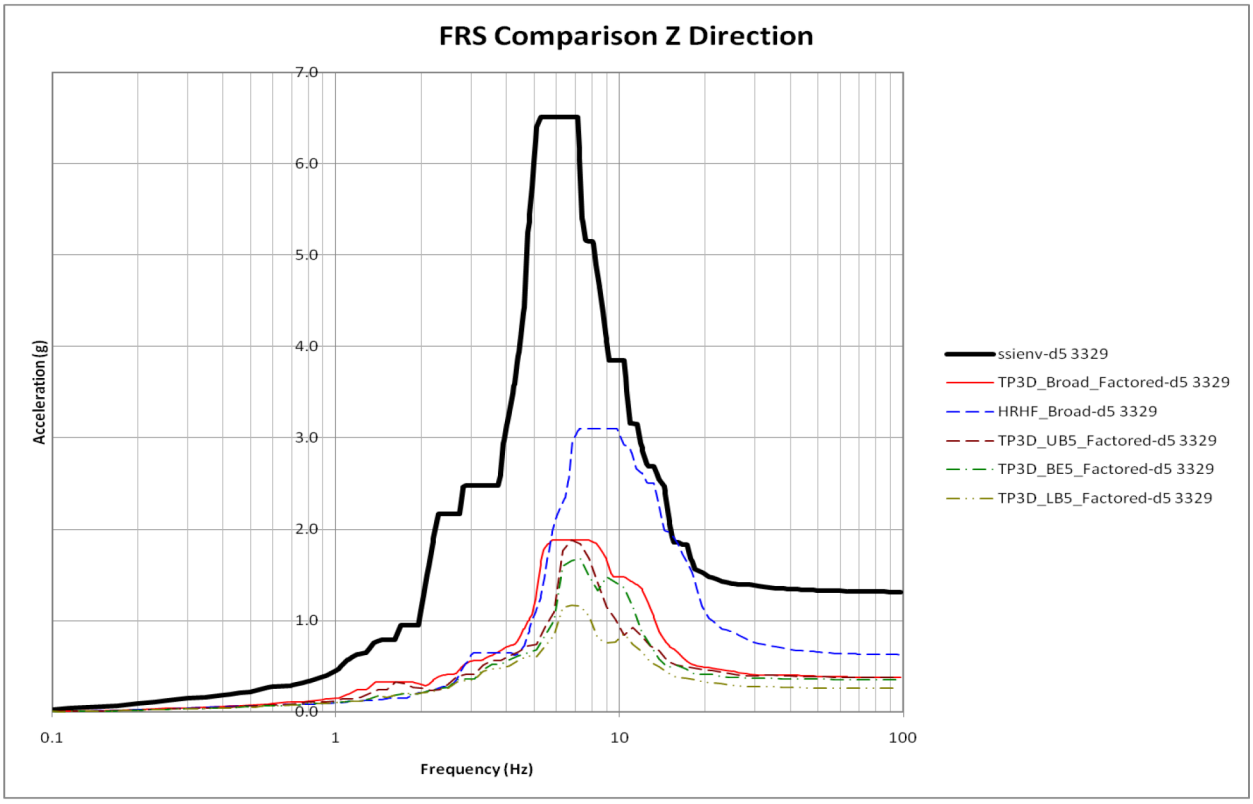

Figure 6.2-18. TPNP 3D BE, LB, UB FRS and AP1000 FRS Envelope in Z-Direction – Node 3329

6.3 TPNP 2D BE, LB and UB SSI Adjacent Building Analysis Results

TPNP adjacent building SSI analyses were performed to present FRS at the ground surface of the Turbine Building (TB) First Bay and Annex Building (AB) for the TPNP BE, LB and UB soil cases. Also, relative displacements are determined to assess the interaction between the adjacent structures and the NI. Section 6.4 presents the results of the relative displacement interaction evaluation.

Time history seismic analyses using the TPNP 2D TB First Bay (NS) model, TPNP 2D AB (EW) model, and the TPNP BE, LB and UB soil cases were performed in one horizontal and one vertical direction (X and Z for the TB First Bay model, and Y and Z for the AB model). The TPNP outcrop input time histories were provided in Reference 3 for the TB First Bay and AB, which were increased slightly to achieve a minimum PGA = 0.1g then used in SASSI in conjunction with the Direct method of analysis. FRS for 5 percent damping were obtained at the ground surface and broadened ± 15 percent for the TB First Bay (node 2951) and AB (node 2942). FRS for 5 percent damping were also obtained at the six (6) key nodes of the NI to assess any influence of the adjacent structures on the key NI nodes.

Figures 6.3-1 through 6.3-2 present the broadened TB First Bay horizontal and vertical TPNP FRS envelopes and the individual TB First Bay FRS for the TPNP BE, LB and UB soil cases compared to the AP1000 TB FRS envelope at the ground surface (AP1000 El. 100.0′ and TPNP El. +25.5′). As shown, the AP1000 TB FRS envelop the TPNP site specific FRS and broadened TPNP TB FRS at the TB First Bay surface node 2951.

Similarly, Figures 6.3-3 through 6.3-4 present the broadened AB horizontal and vertical TPNP FRS envelopes and the individual AB FRS for the TPNP BE, LB and UB soil cases compared to the AP1000 AB FRS envelope at the ground surface (AP1000 El. 100.0′ and TPNP El. +25.5′). As shown, the AP1000 AB FRS envelop the TPNP site specific FRS and broadened TPNP AB FRS at the AB surface node 2942. TB First Bay and AB FRS envelopes are from Reference 10.

Appendix A presents the FRS at the six (6) key nodes of the NI due to the TB First Bay (North-South) and AB (East-West) response for each of the TPNP BE, LB and UB soil cases.

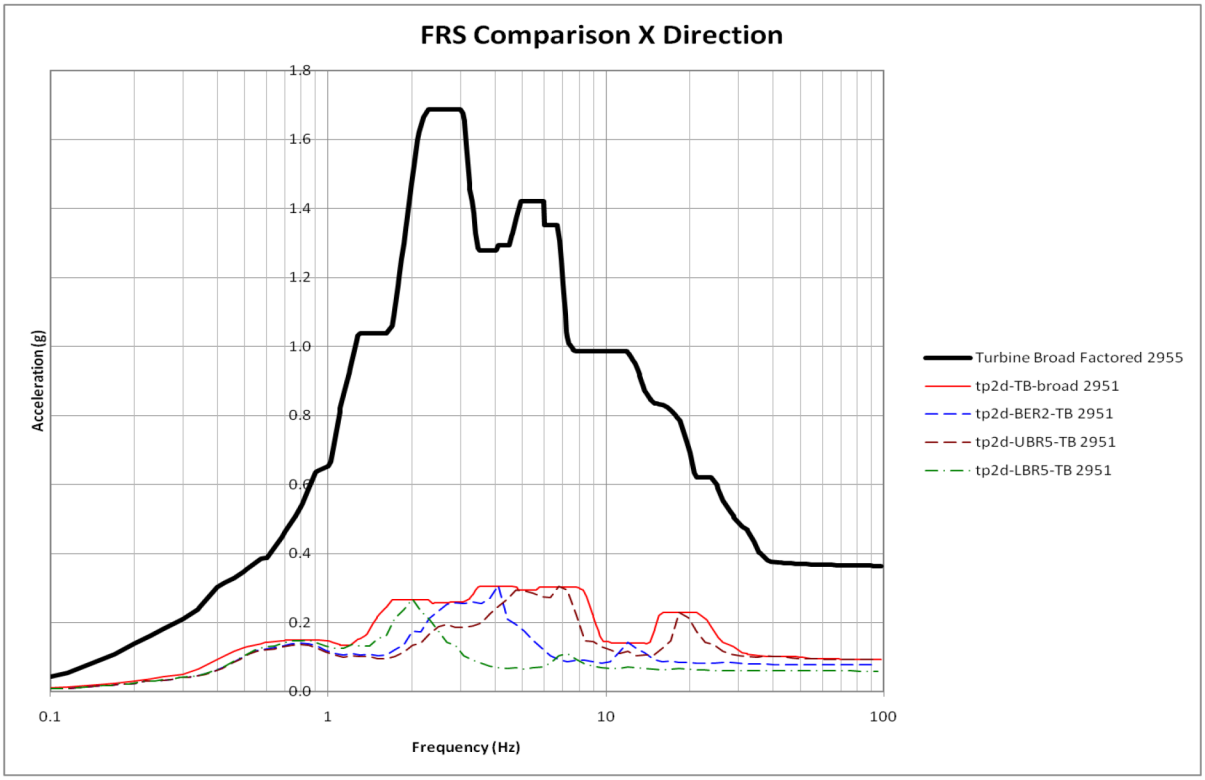

Figure 6.3-1. TPNP TB First Bay BE, UB, LB FRS and AP1000 FRS Envelope in X-Direction – Node 2951

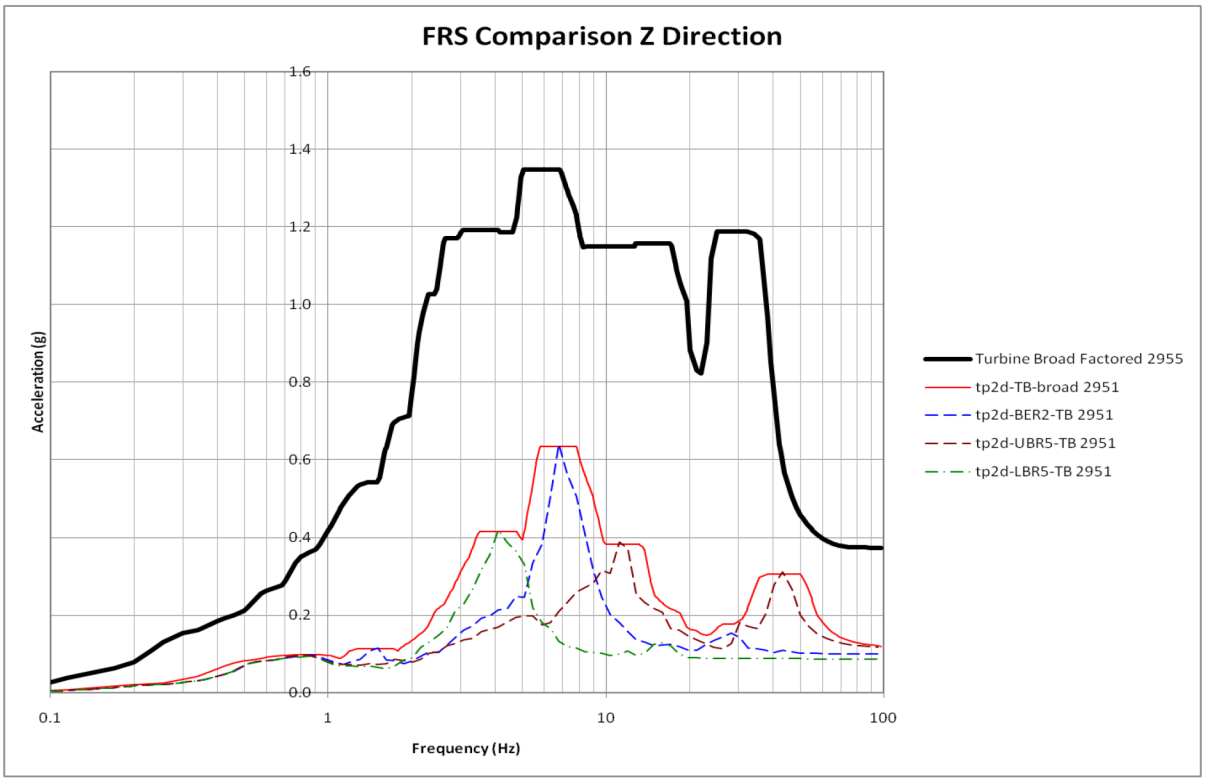

Figure 6.3-2. TPNP TB First Bay BE, UB, LB FRS and AP1000 FRS Envelope in Z-Direction – Node 2951

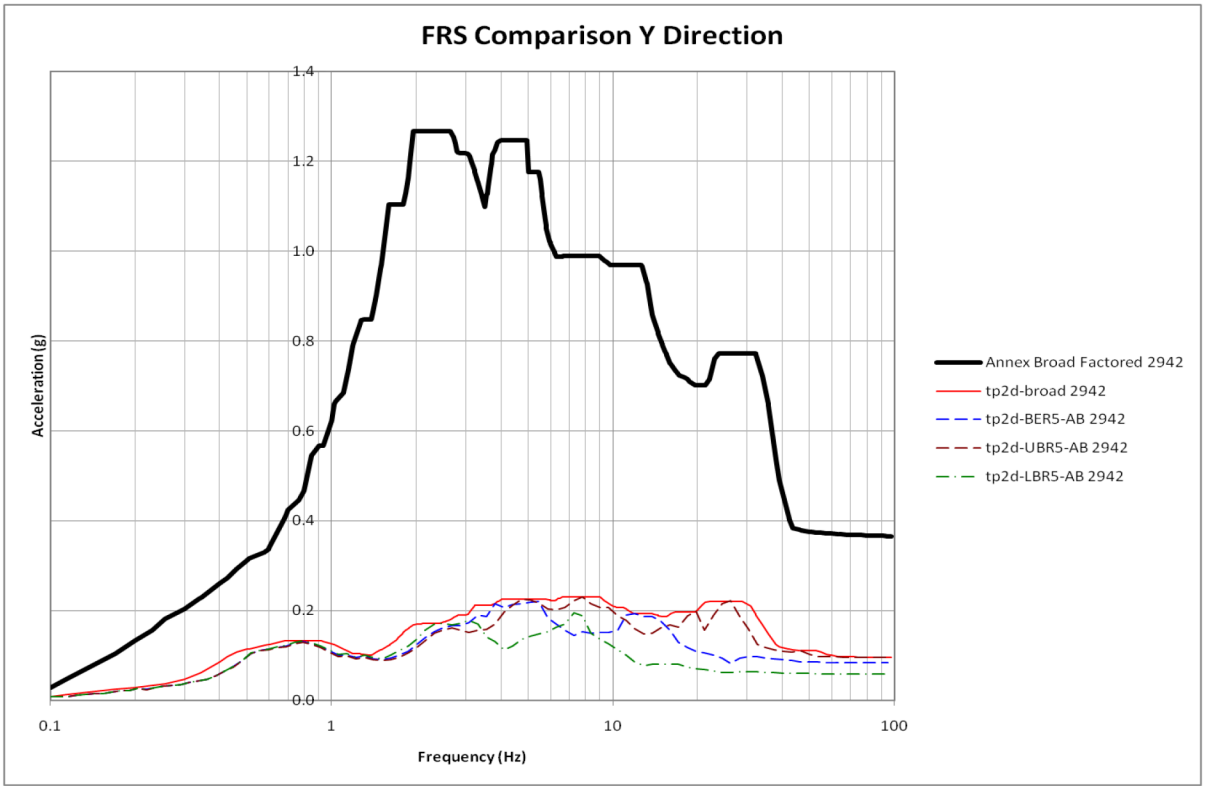

Figure 6.3-3. TPNP Annex Building BE, UB, LB FRS and AP1000 FRS Envelope in Y-Direction – Node 2942

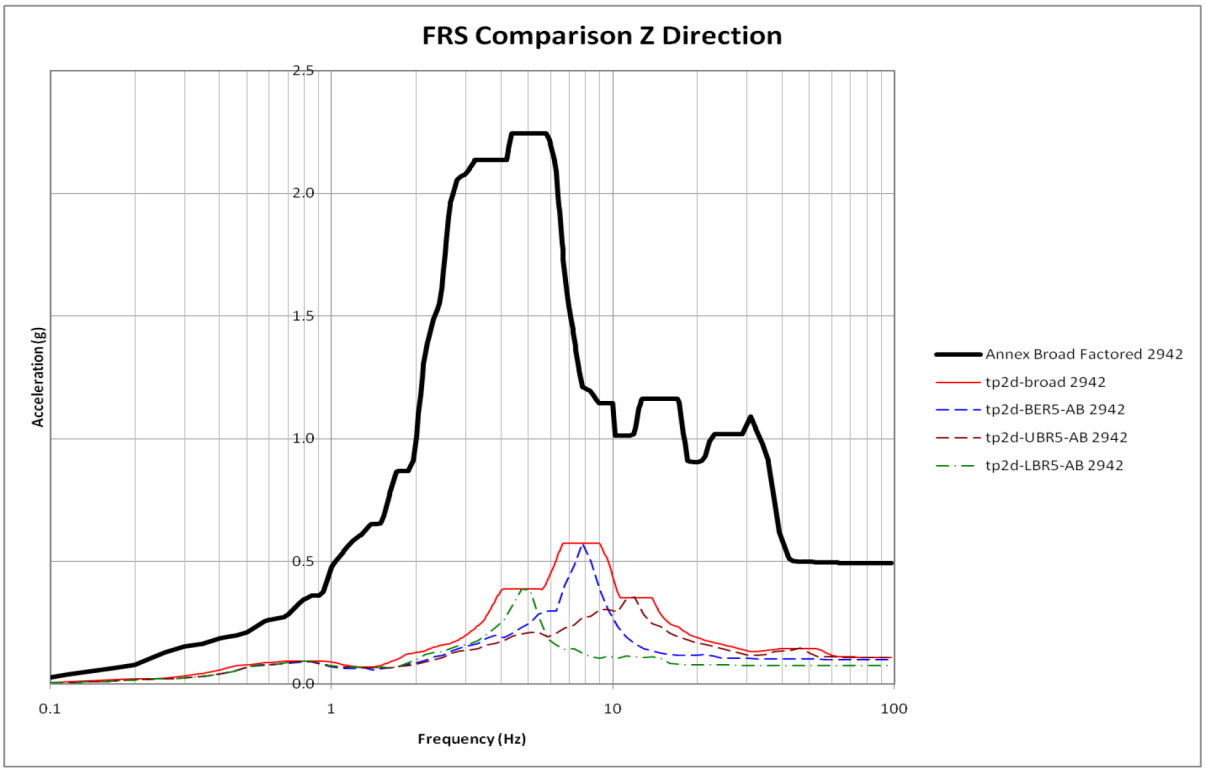

Figure 6.3-4. TPNP Annex Building BE, UB, LB FRS and AP1000 FRS Envelope in Z-Direction – Node 2942

6.4 TPNP Adjacent Structure Relative Displacements

The TPNP 2D NS and EW models were used to obtain the relative displacements at the locations listed below:

- Turbine Building Foundation to Nuclear Island
- Top of Turbine Building to Nuclear Island (El.170)
- Annex Building Foundation to Nuclear Island
- Top of Annex Building to Nuclear Island (El.180)

The relative displacements were calculated to ensure that there is no contact between the structures at the foundations or at the superstructure. To prevent contact, the relative displacements between the NI and the foundations of the adjacent buildings must be less than 2 inches. To avoid contact between the NI and the Top of the Turbine Building (elevation 170') and Top of the Annex Building (elevation 180'), the relative displacement between the superstructures must be less than 4 inches. The relative displacements, shown in Table 6.4-1, are less than the space allocated; therefore there is no contact between the NI and the adjacent structures.

Table 6.4-1. Relative Displacements

TPNP Soil Case	North South Model		East West Model	
	Turbine Building Foundation to Nuclear Island (inches)	Top of Turbine Building to Nuclear Island (El.170±) (inches)	Annex Building Foundation to Nuclear Island (inches)	Top of Annex Building to Nuclear Island (El.180±) (inches)
BE	0.050	0.159	0.023	0.081
LB	0.117	0.179	0.056	0.100
UB	0.028	0.157	0.009	0.067

7.0 Conclusions

Based on the information presented in this report, the following conclusions are presented:

- The TPNP 3D BE, LB and UB Factored Design-Basis FRS and the corresponding TPNP 3D broadened envelop are enveloped by the AP1000 3D CSDRS and HRHF (high frequency) FRS envelops;
- The SCII TPNP 2D BE, LB and UB Turbine Building First Bay and Annex Building broadened FRS are enveloped by the corresponding adjacent structure AP1000 2D-3D FRS envelop with margin;
- The TPNP Turbine Building First Bay relative displacements of 0.117 inches and 0.179 inches at the bottom and top of the structure, respectively are less than the 2-inch and 4-inch top and bottom NI gaps; and
- The TPNP Annex Building relative displacements of 0.056 inches and 0.100 inches at the bottom and top of the structure, respectively are less than the 2-inch and 4-inch top and bottom NI gaps.
- Westinghouse further concludes that the broadened, factored TPNP seismic analyses results are enveloped by the AP1000 and HRHF FRS envelops, with respect to low (structure) and high (equipment) frequency response, respectively for the TPNP BE, LB and UB soil cases evaluated.
- The TPNP 2D BE, LB and UB Turbine Building First Bay and Annex Building FRS are enveloped by the AP1000 2D and HRHF (high frequency) FRS envelope with sufficient margin;
- Finally, based on the results of the TPNP 3D NI and 2D SCII adjacent structures SSI sensitivity analyses presented in Appendixes E and F, respectively, the effect on the NI and SCII in-structure FRS is considered negligible due to the 2014 updated BE seismic input at Turkey Point Units 6&7. Therefore, the analysis presented in this report, specifically the results presented in Sections 6.2, 6.3, and 6.4, Appendixes A through D, and the conclusions presented above are still valid.

8.0 References

1. Bechtel Letter No. 25409-000-TCM-GEG-00752,"Release of Calculation 25409-000-K0C-0000-00066, Revision 0, SSI Input Time Histories and Soil Profiles for Envelope of RG 1.60 and Site Spectra," dated August 2, 2012.
2. Bechtel Letter No. 25409-000-TCM-GEG-00581,"Turkey Point Units 6 & 7, Effect of Grouted Rock on Seismic Site Response," dated July 20, 2011.
3. Bechtel Letter No. 25409-000-TCM-GEG-00404,"Release of Extracted Data from Calculations 25409-000-K0C-0000-00036 Rev. 0 and 00037 Rev. 0 for Turkey Point Units 6 & 7," dated February 26, 2010.
4. Bechtel Drawing 25409-000-CE-0010-00001, Rev. 5, "Nuclear Island Power Block Excavation Plan and Sections."
5. SASSI2000, User's Manual, A System for Analysis of Soil-Structure-Interaction, Rev. 1, November 1999, Geotechnical Engineering Division Civil Engineering Department, University of California, Berkeley, CA 94720.
6. ACS SASSI NQA Version 2.3.0 Verification & Quality Assurance Plan.
7. FPL Turkey Point Units 6 & 7 COLA (Final Safety Analysis Report), Rev. 6, Chapter 2.0, Section 2.5, Geology, Seismology and Geotechnical Engineering.
8. APP-GW-S2R-010, Rev. 5, TR03, "Extension of Nuclear Island Seismic Analyses to Soil Sites."
9. APP-GW-GLR-115, Rev. 3, TR115, "Effect of High Frequency Seismic Content on SSC's."
10. DCP_NRC_002981, Rev. 3, Enclosure 2, "AP1000 Response to Request for Additional Information (SRP3)," dated July 28, 2010.
11. Westinghouse Electric Company Report No. TPG-1000-S2R-807, Revision 2, "Turkey Point Site Specific Seismic Evaluation Report," dated January 30, 2013.
12. Bechtel Calculation No. 25409-000-K0C-0000-00073,"Turkey Point Unit 6&7 COL, Sensitivity Assessment of Updated Site Properties on GMRS, FIRS and SSI Inputs," dated February 18, 2015.
13. FPL NNP PTN 6&7 COL Application, Response to Request for Information, Request Number RFI-FPL-0070, dated March 17, 2015.

Appendix A
TPNP Adjacent Structure SSI Analysis Results – NI Key Nodes

Floor response spectra (FRS) for the TB First Bay (TP2DNS) and AB (TP2DEW) models and the TPNP BE, LB and UB soil cases were obtained and compared. Note that for the TP2DNS analysis, X and Z due to X (North-South), and TP2DEW analysis, Y and Z due to Y (East-West) directions are presented on the figures below. For X-direction comparisons, the Y is zero and for Y-direction comparisons, the X is zero. For vertical, Z comparisons, Z due to X (North–South) and Z due to Y (East-West) are presented.

FRS for 5% damping and the TP2DNS model FRS at the six (6) key NI nodes are provided in Figures A-1 through A-12. FRS for 5% damping and the TP2DEW model FRS at the six (6) key NI nodes are provided in Figures A-13 through A-24.

Based on the adjacent structure SSI analyses results, the TP3DNS and TP2DEW FRS obtained are similar for the BE, LB and UB soil cases, and all nodes are enveloped by the AP1000 2D FRS envelope. Therefore, the TPNP TB First Bay and AB adjacent structures do not affect the NI structure responses.

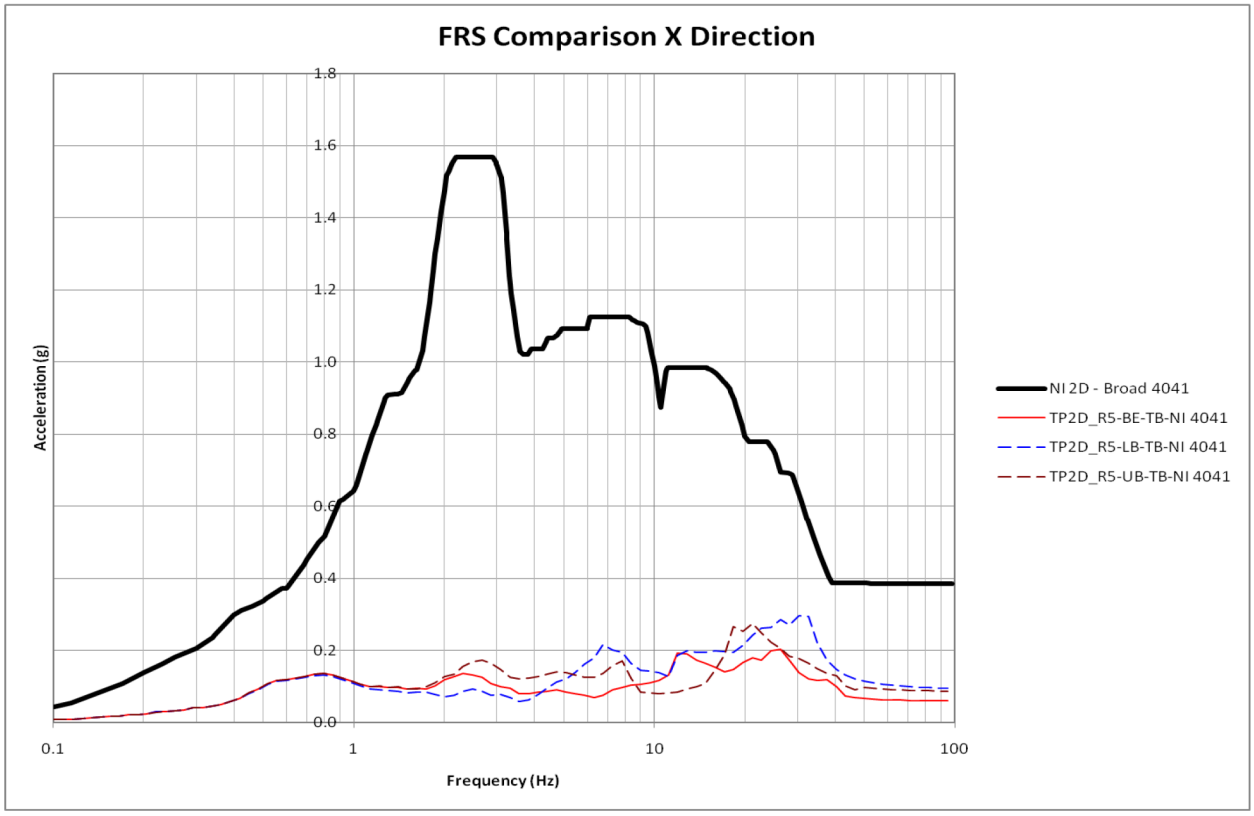

Figure A-1. TPNP Turbine Building First Bay BE, LB and UB in X-Direction – Node 4041

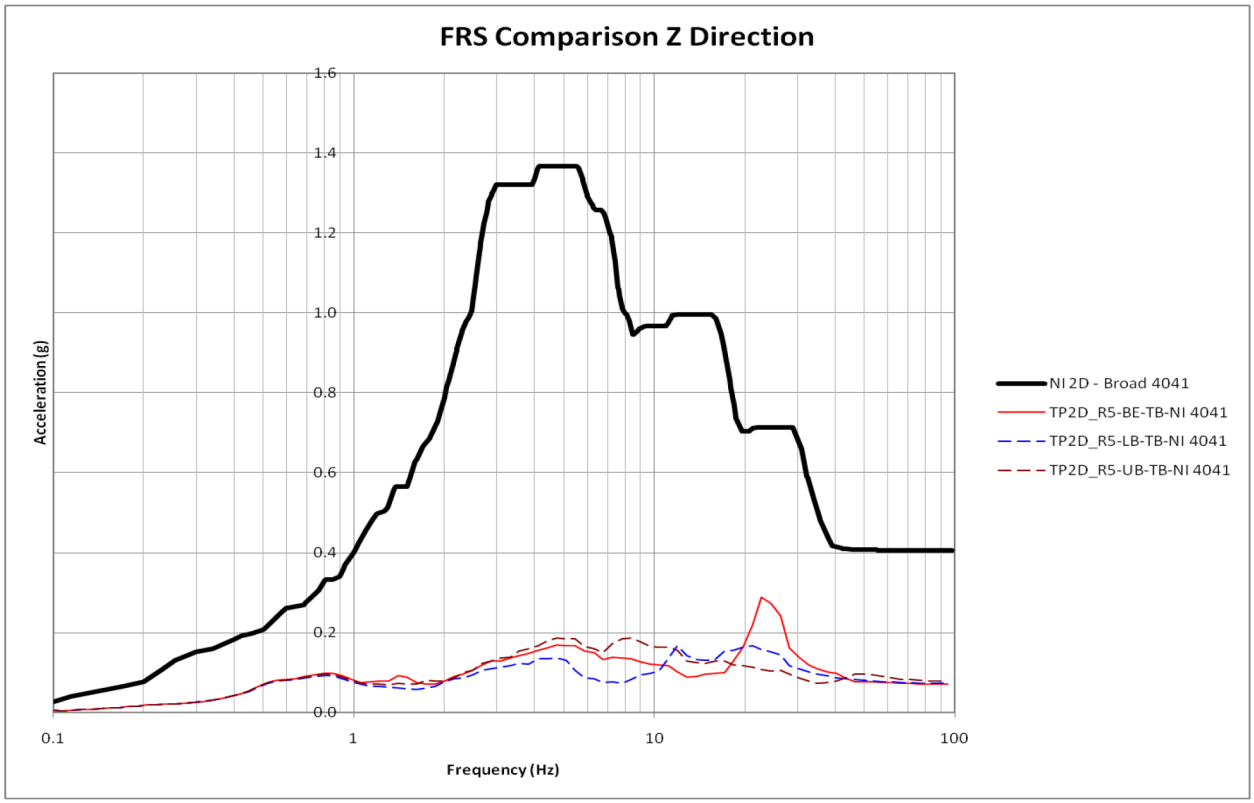

Figure A-2. TPNP Turbine Building First Bay BE, LB and UB in Z-Direction – Node 4041

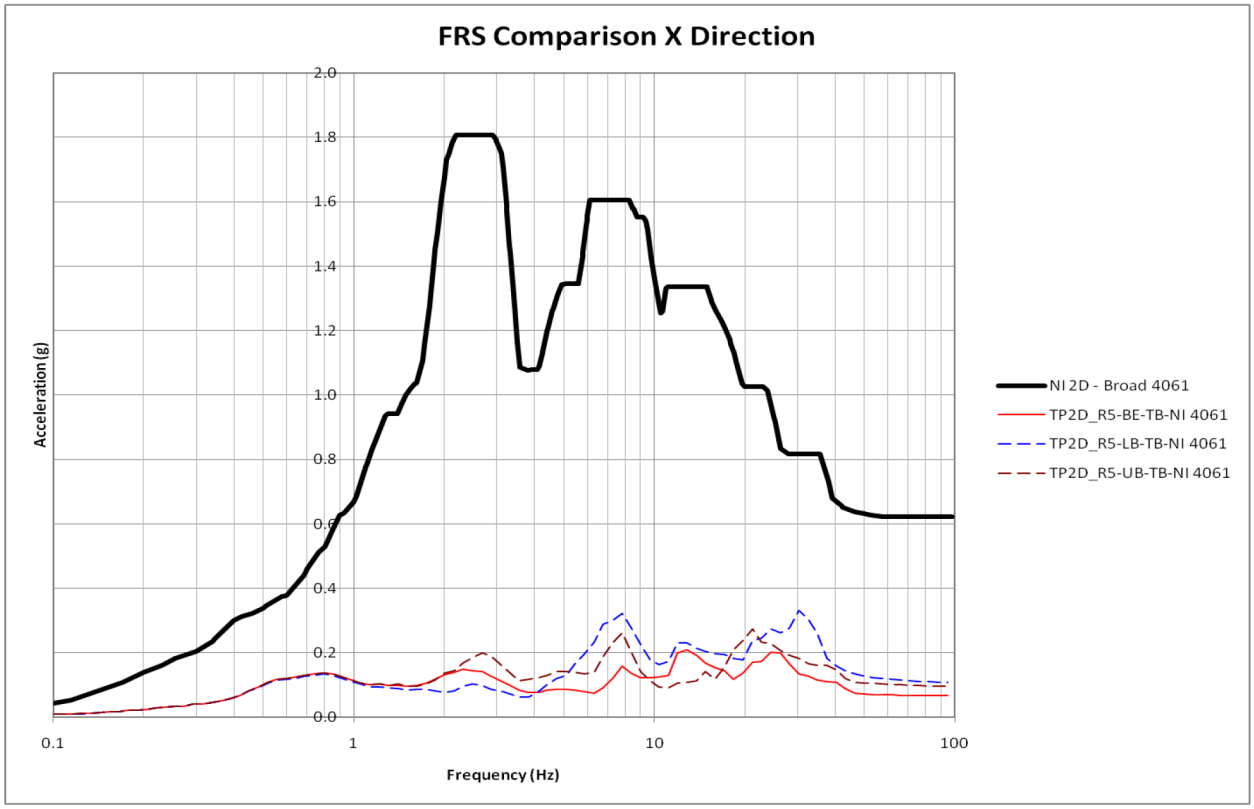

Figure A-3. TPNP Turbine Building First Bay BE, LB and UB in X-Direction – Node 4061

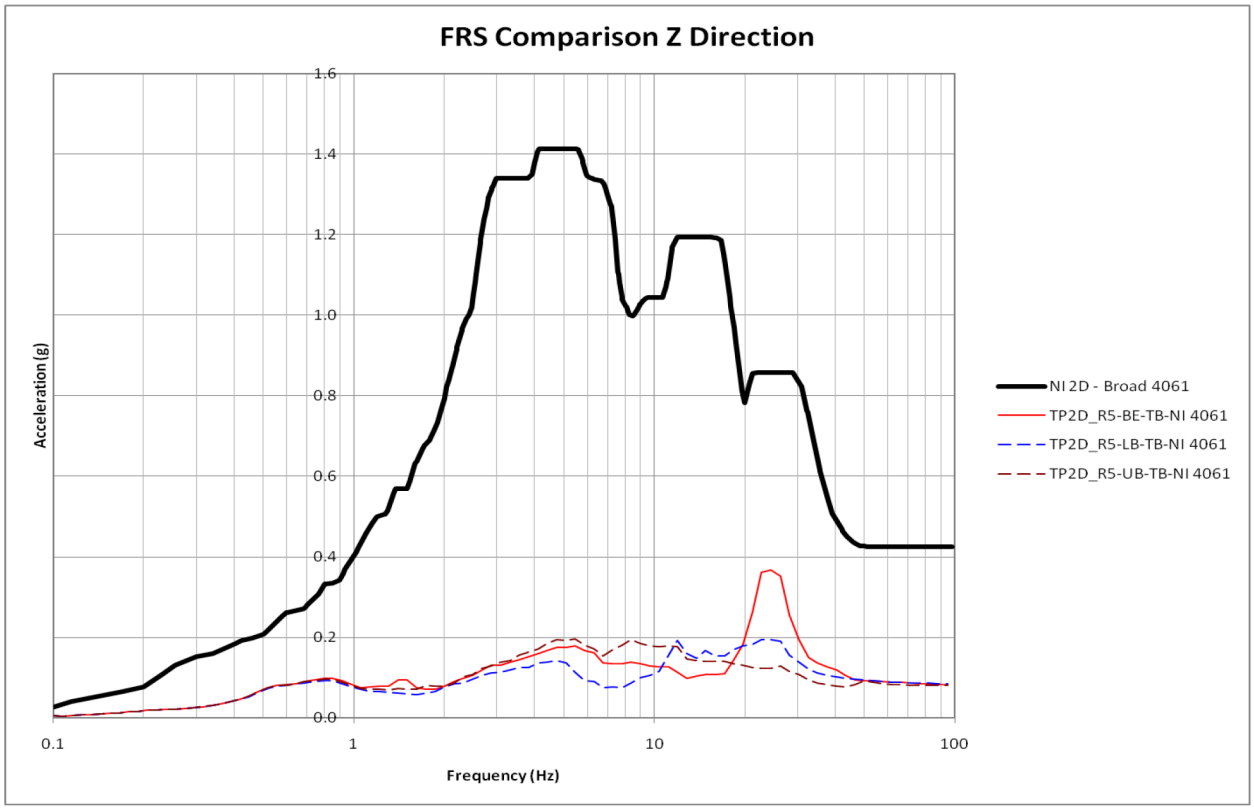

Figure A-4. TPNP Turbine Building First Bay BE, LB and UB in Z-Direction – Node 4061

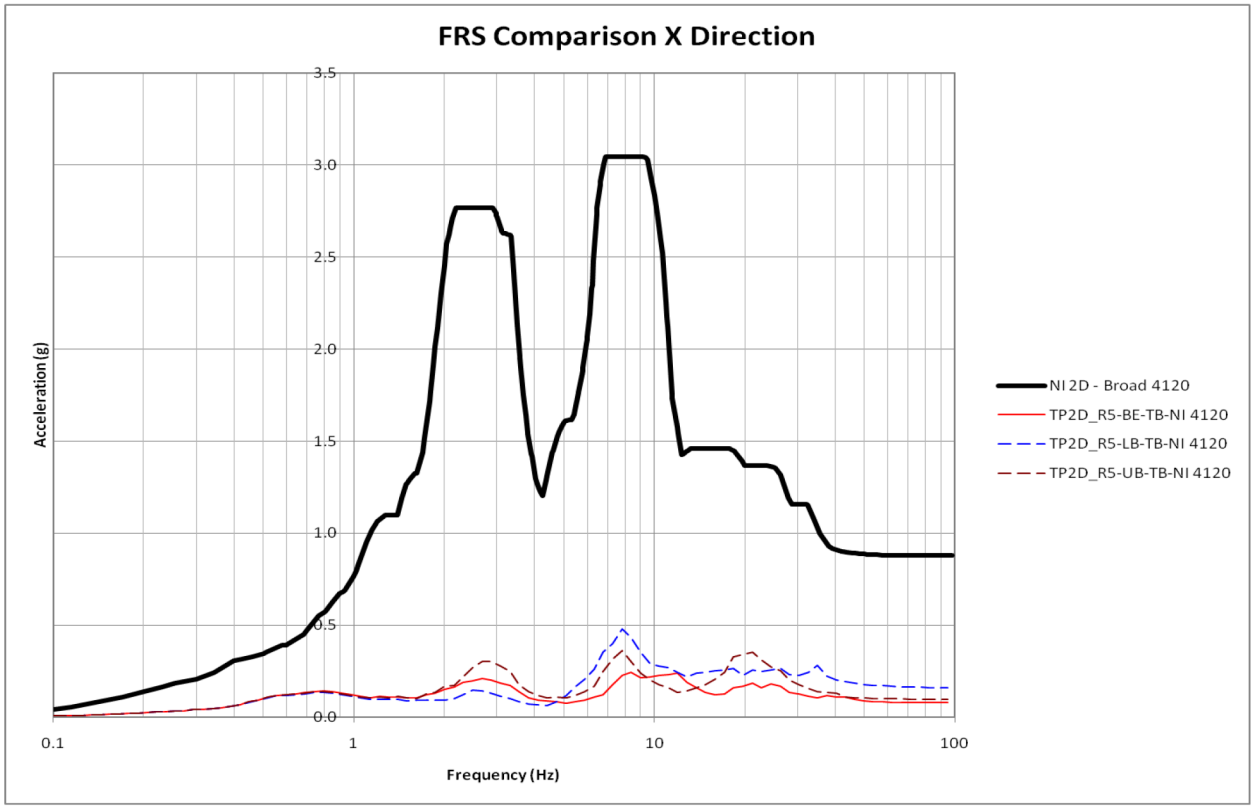

Figure A-5. TPNP Turbine Building First Bay BE, LB and UB in X-Direction – Node 4120

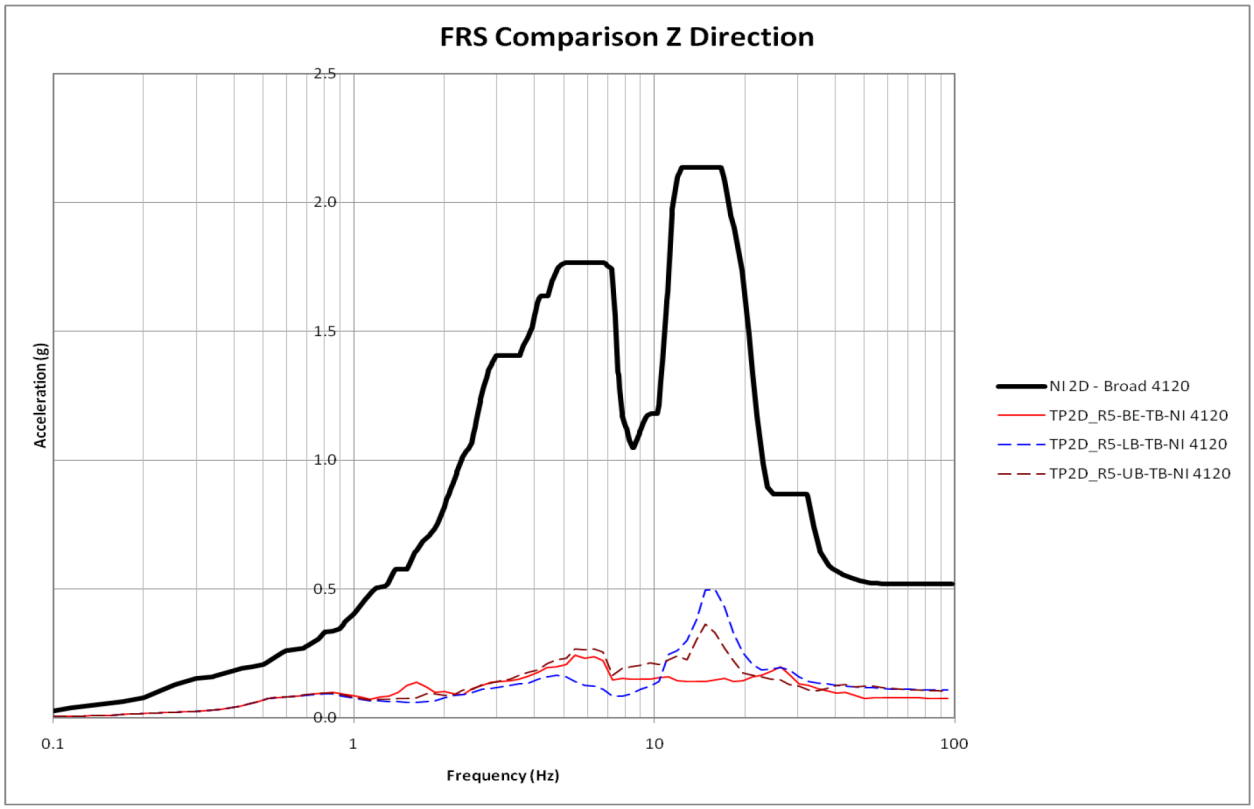

Figure A-6. TPNP Turbine Building First Bay BE, LB and UB in Z-Direction – Node 4120

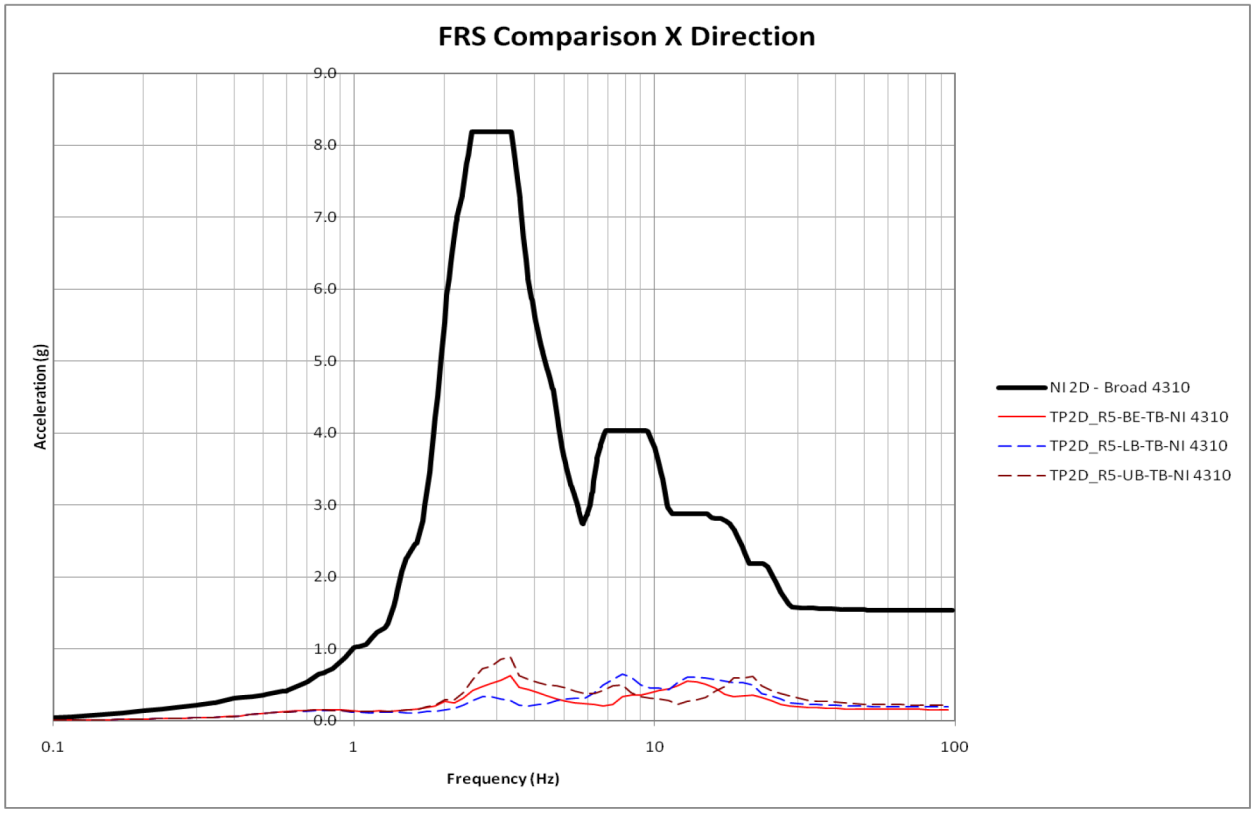

Figure A-7. TPNP Turbine Building First Bay BE, LB and UB in X-Direction – Node 4310

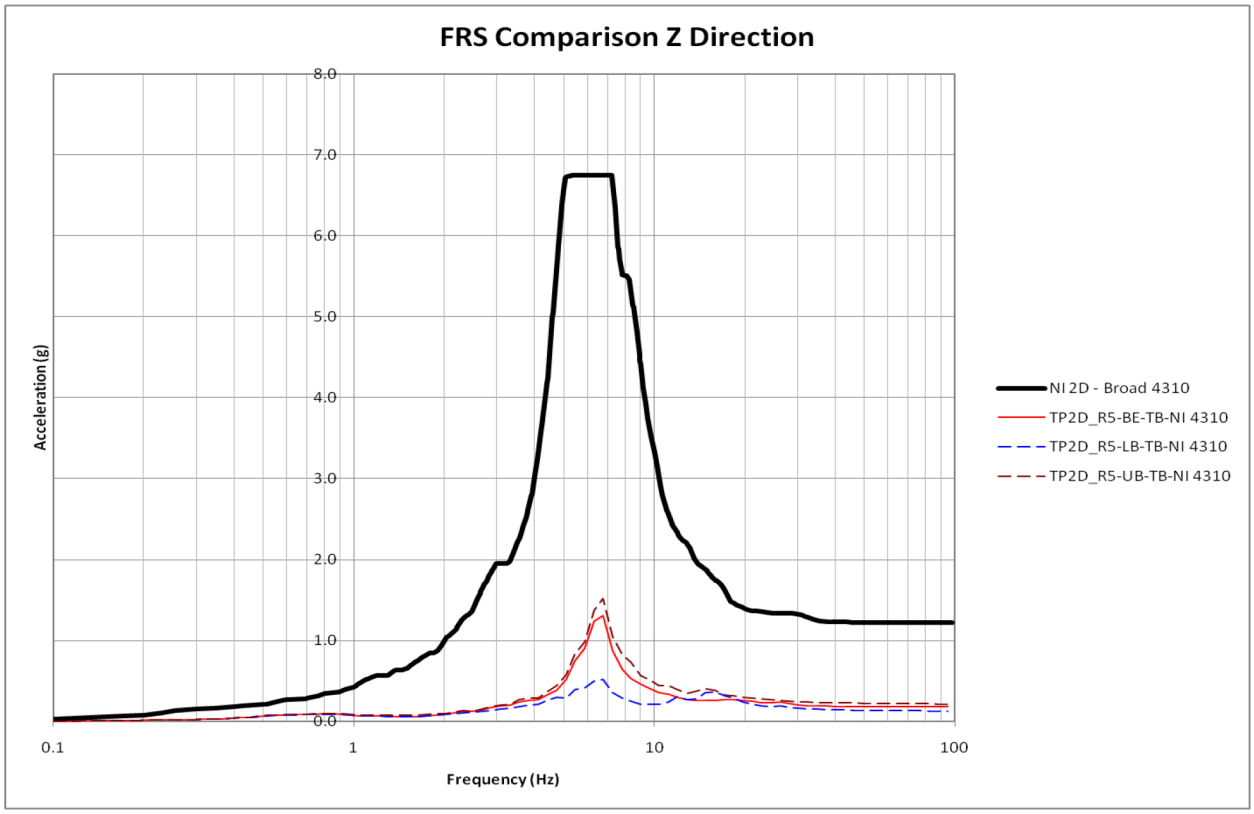

Figure A-8. TPNP Turbine Building First Bay BE, LB and UB in Z-Direction – Node 4310

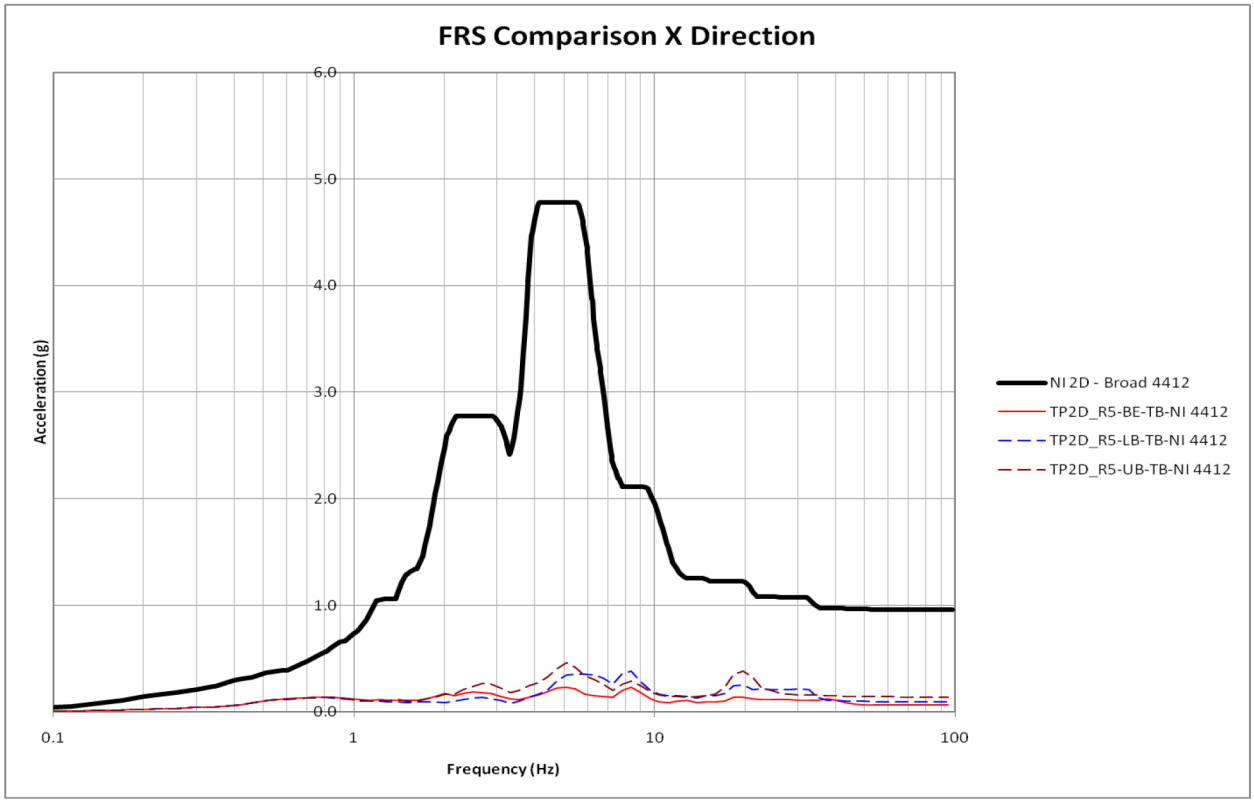

Figure A-9. TPNP Turbine Building First Bay BE, LB and UB in X-Direction – Node 4412

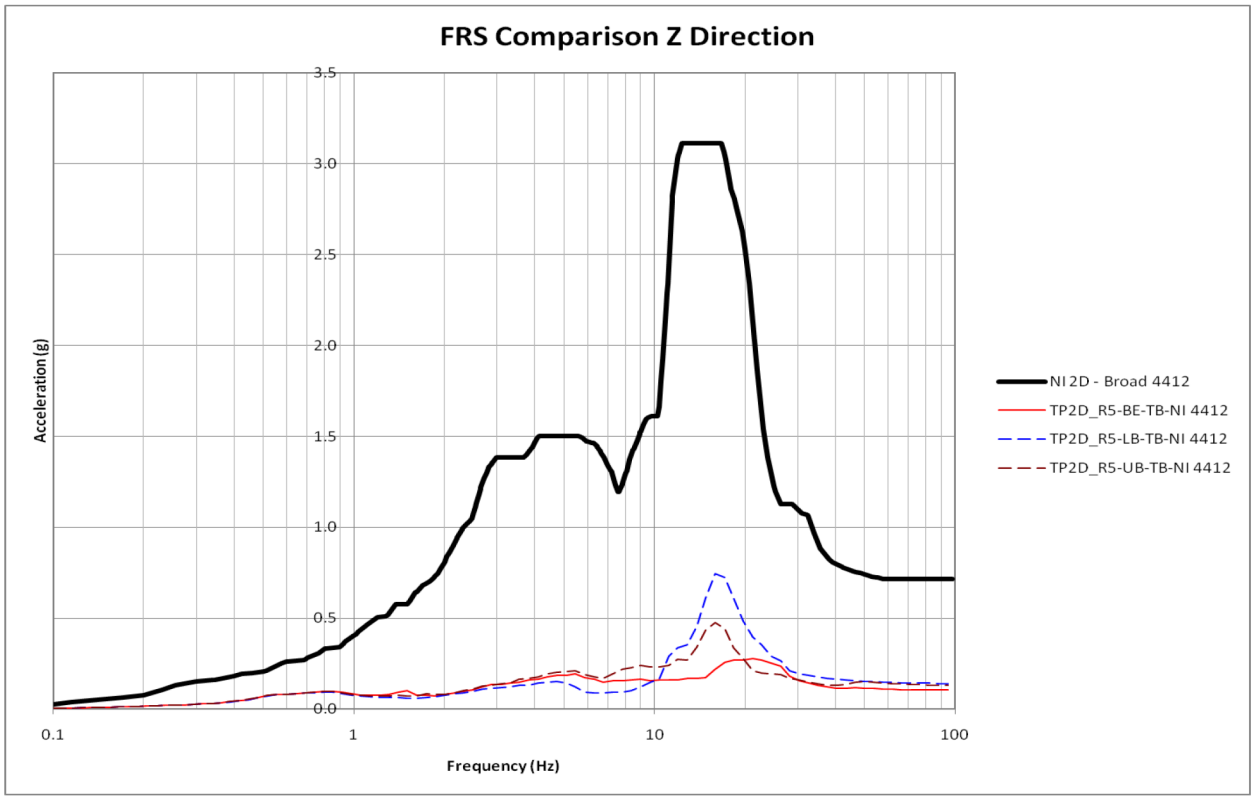

Figure A-10. TPNP Turbine Building First Bay BE, LB and UB in Z-Direction – Node 4412

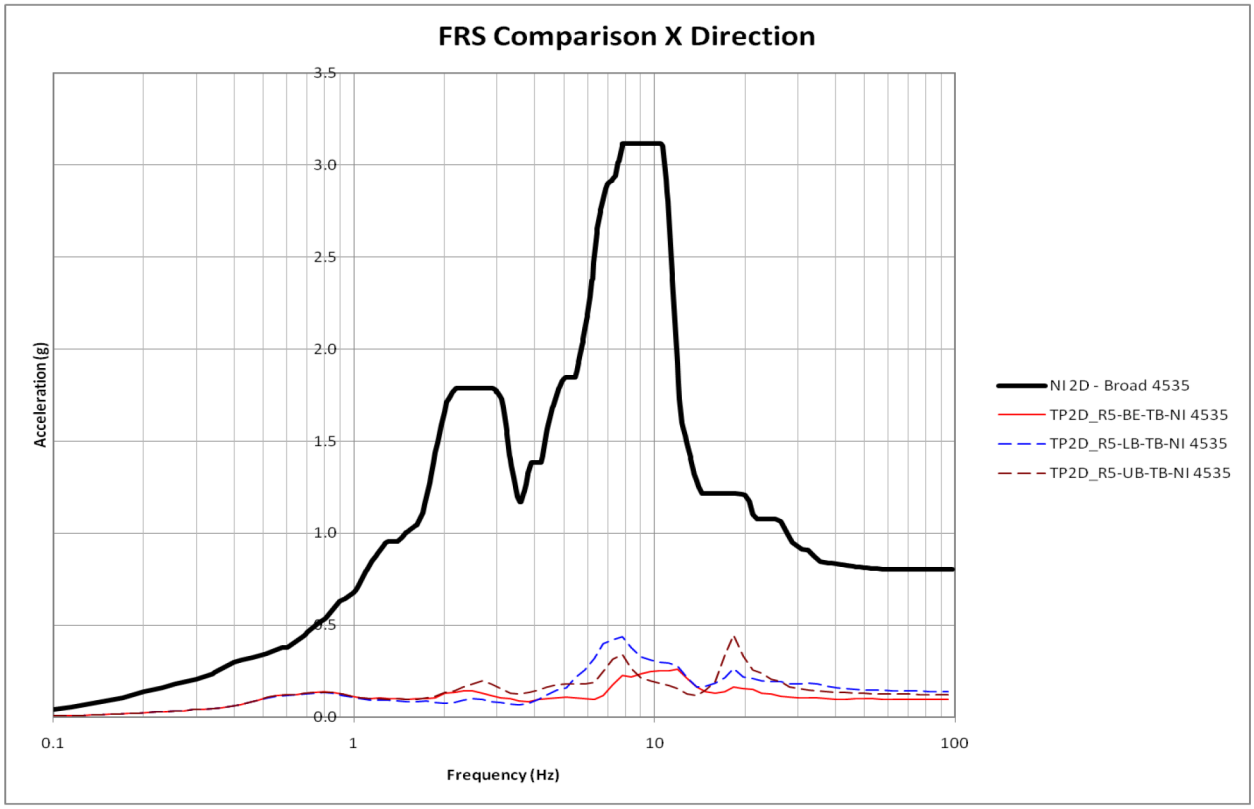

Figure A-11. TPNP Turbine Building First Bay BE, LB and UB in X-Direction – Node 4535

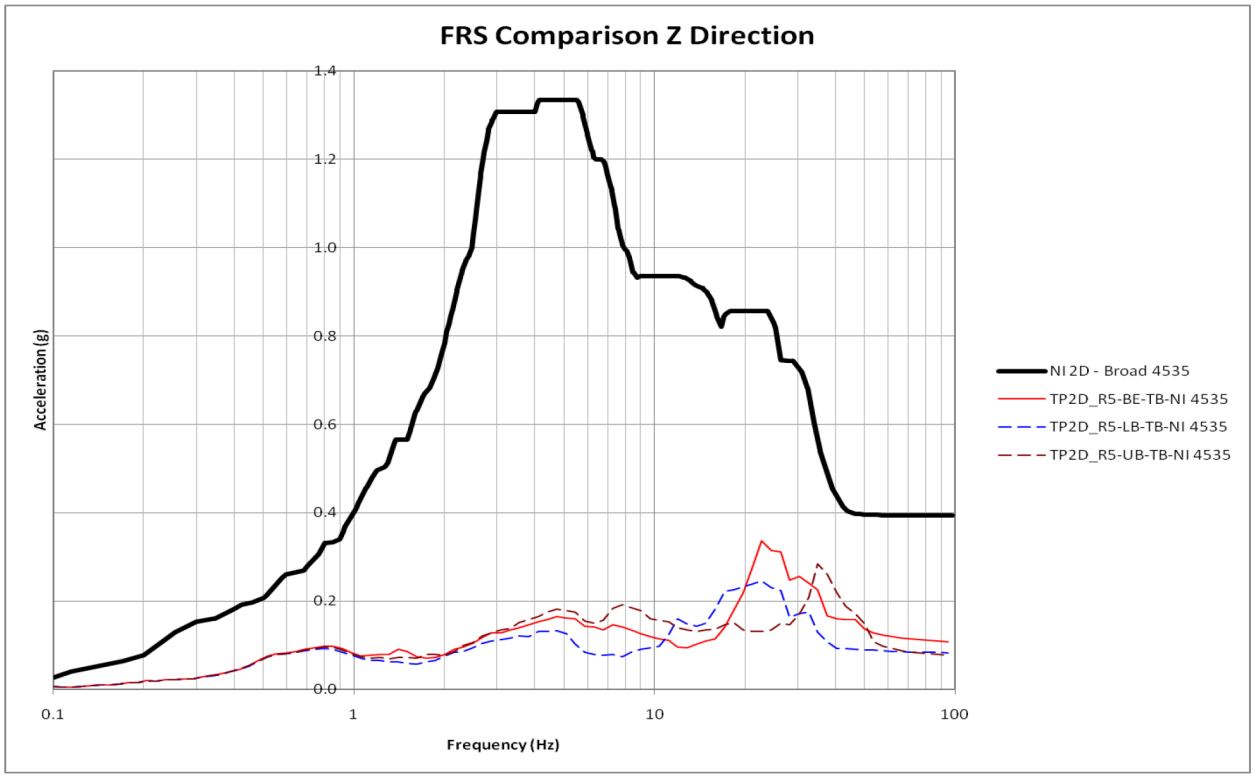

Figure A-12. TPNP Turbine Building First Bay BE, LB and UB in Z-Direction – Node 4535

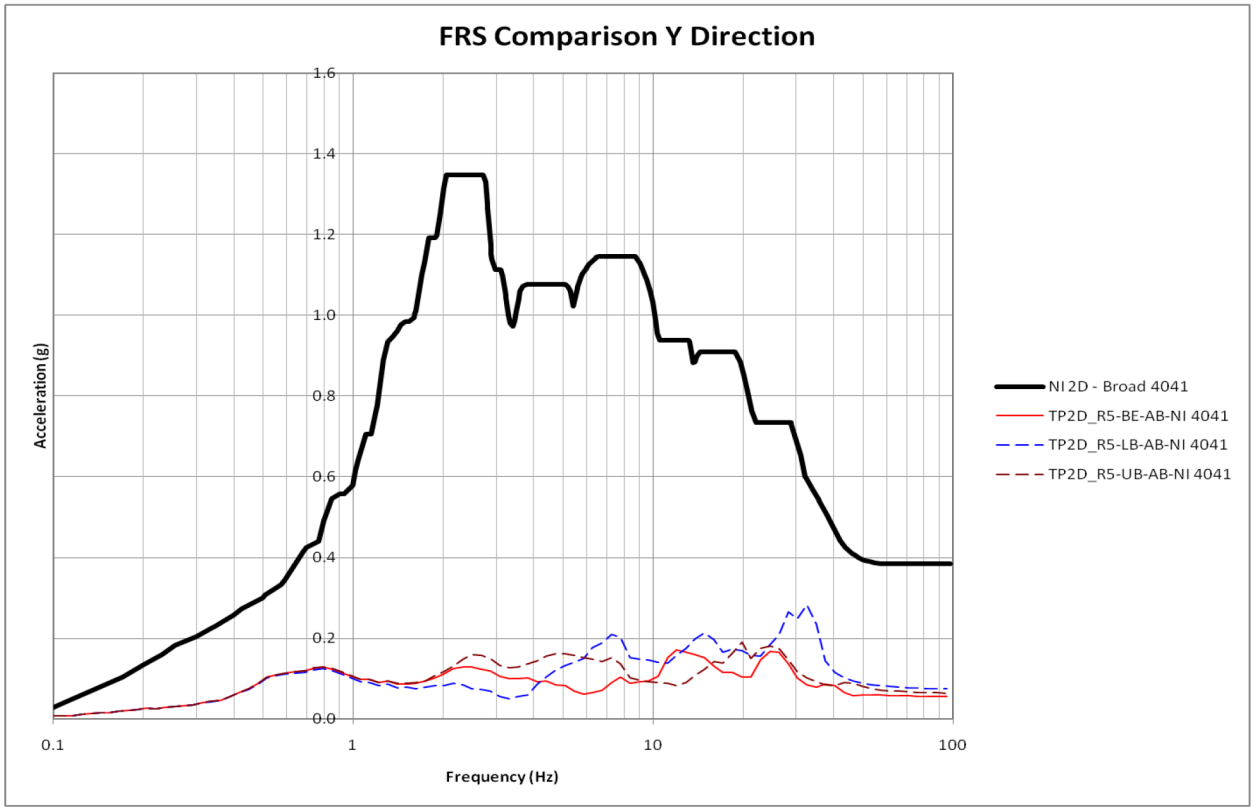

Figure A-13. TPNP Annex Building BE, LB and UB in Y-Direction – Node 4041

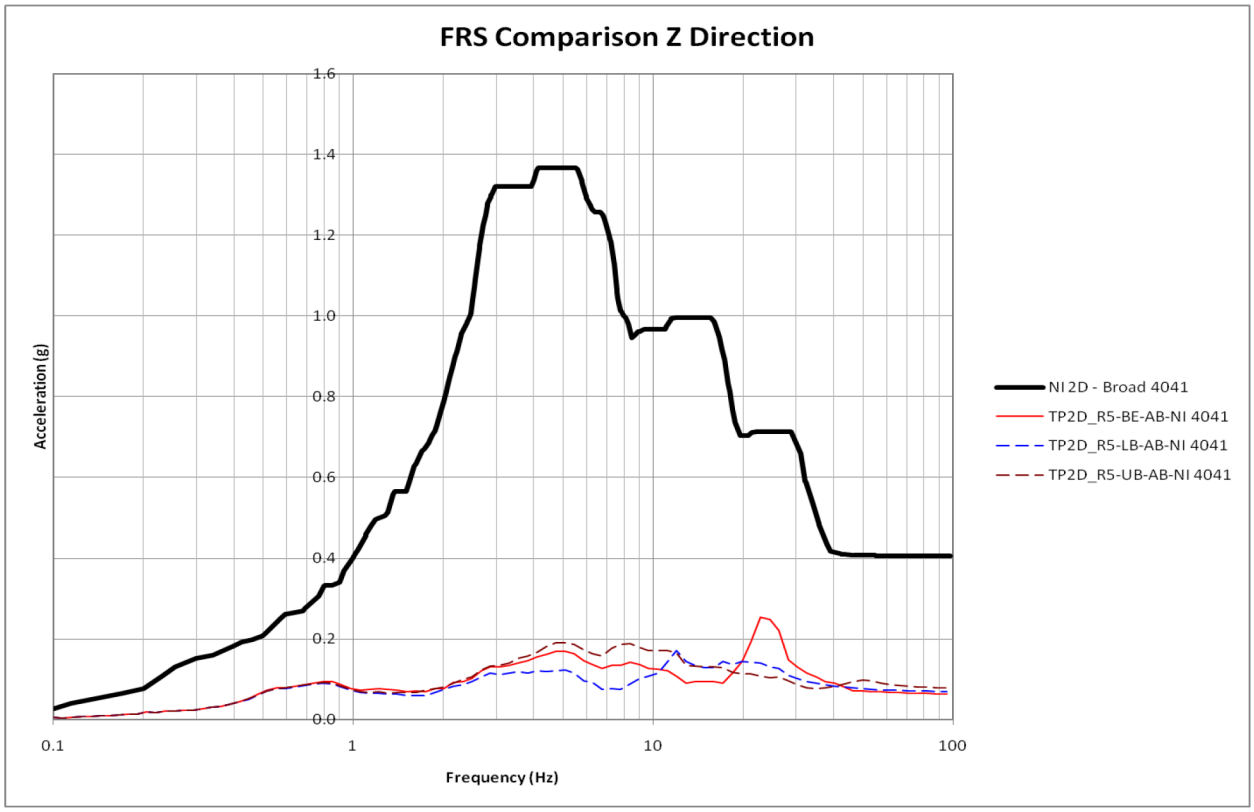

Figure A-14. TPNP Annex Building BE, LB and UB in Z-Direction – Node 4041

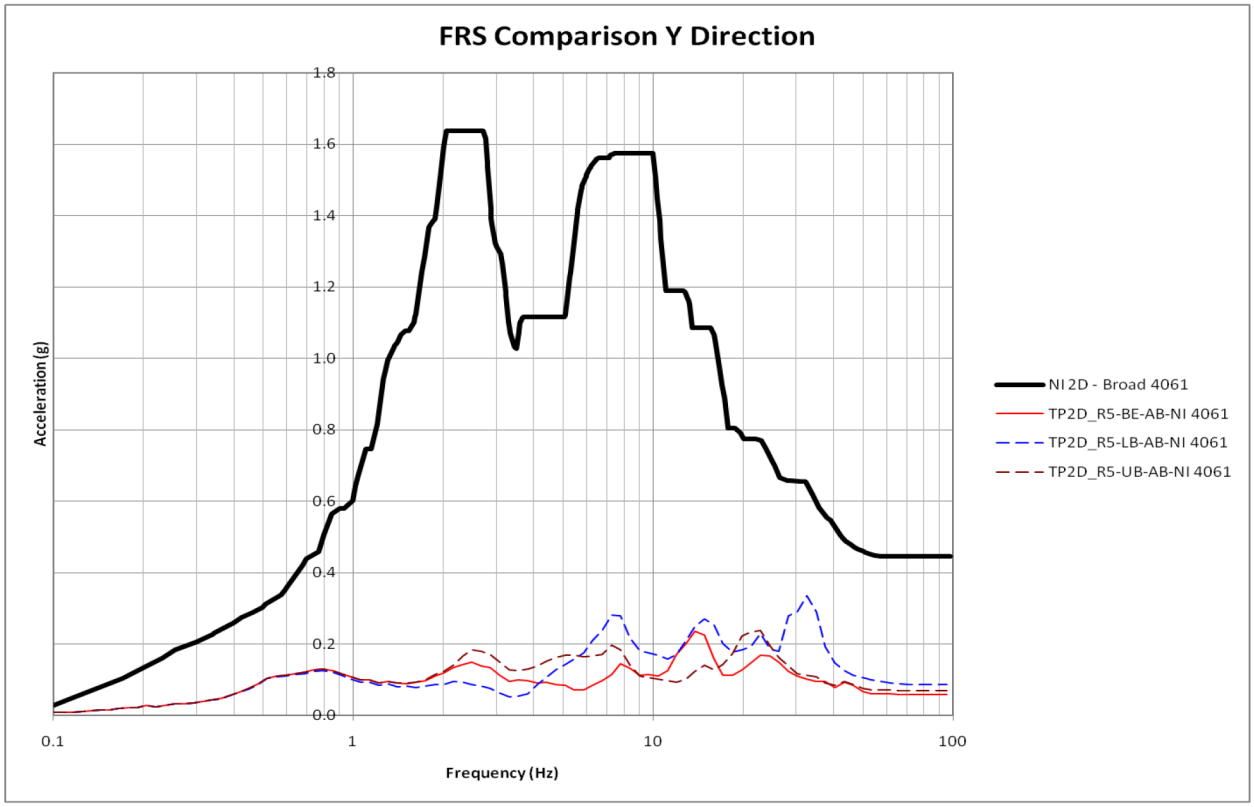

Figure A-15. TPNP Annex Building BE, LB and UB in Y-Direction – Node 4061

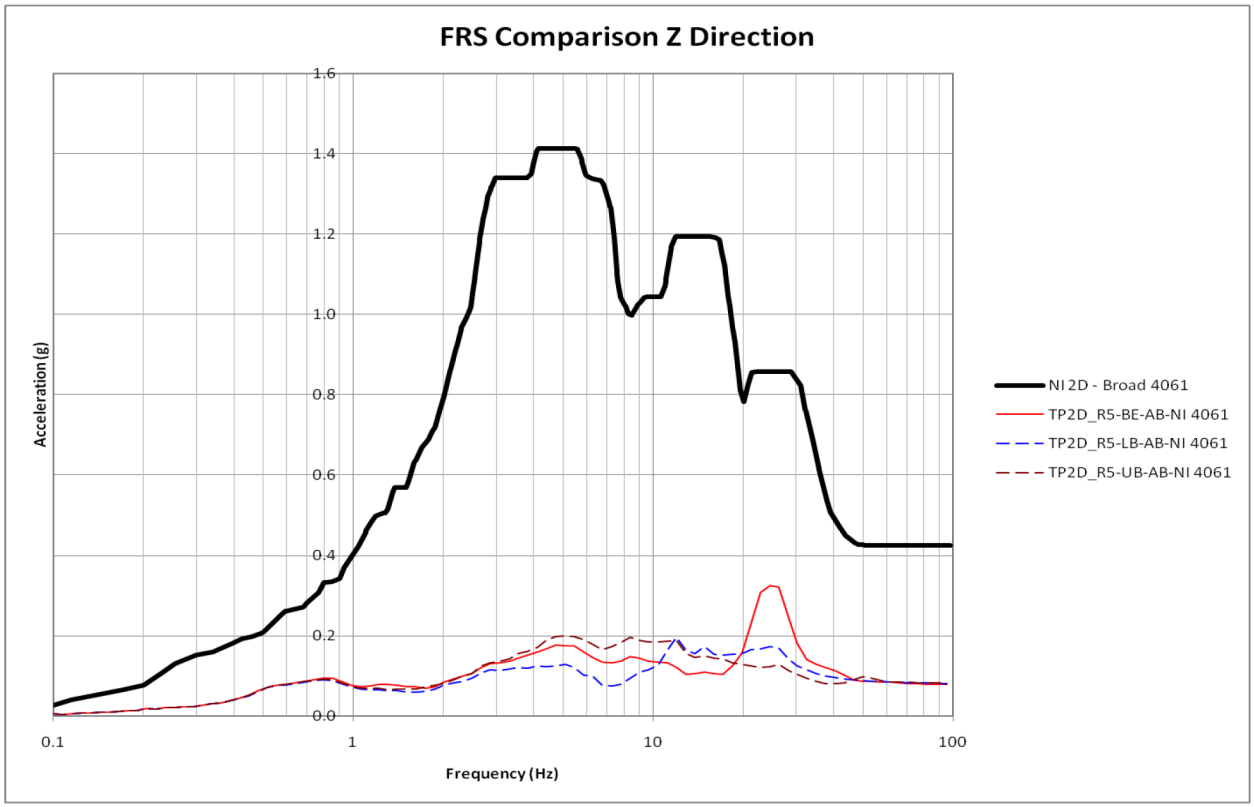

Figure A-16. TPNP Annex Building BE, LB and UB in Z-Direction – Node 4061

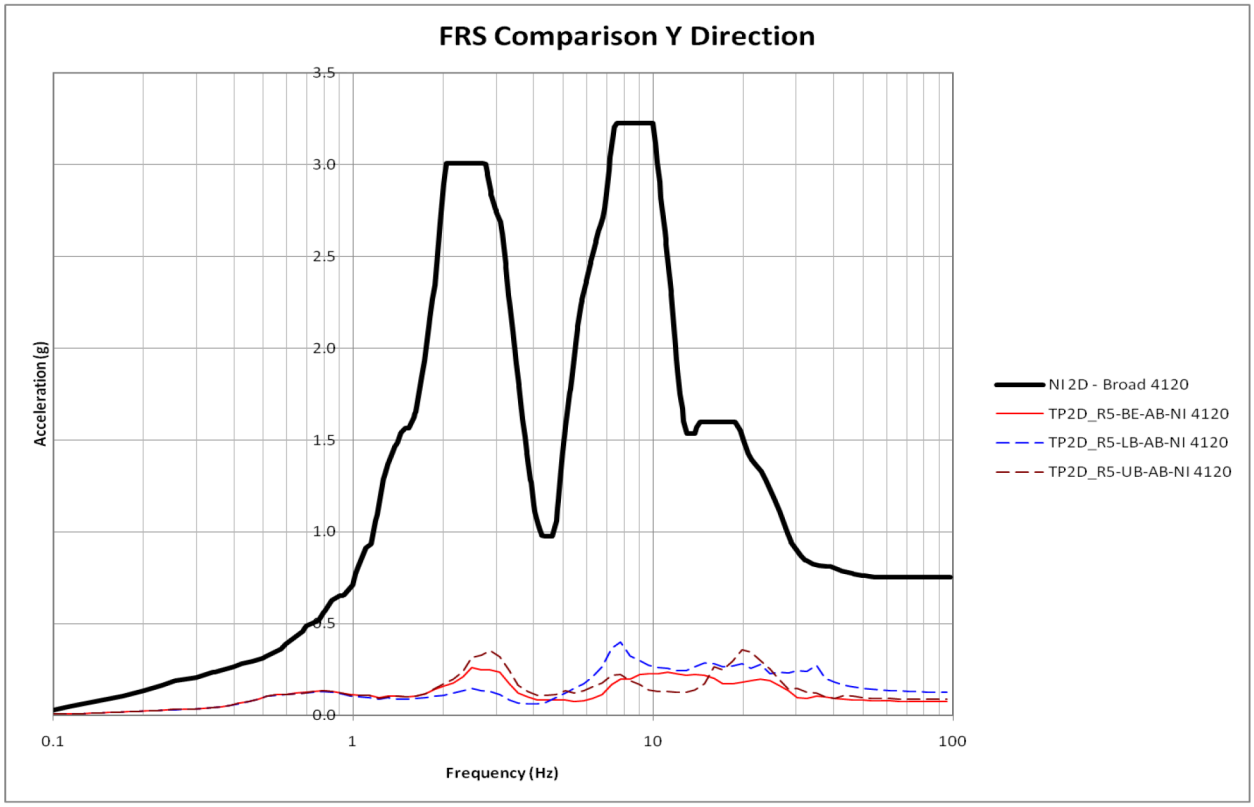

Figure A-17. TPNP Annex Building BE, LB and UB in Y-Direction – Node 4120

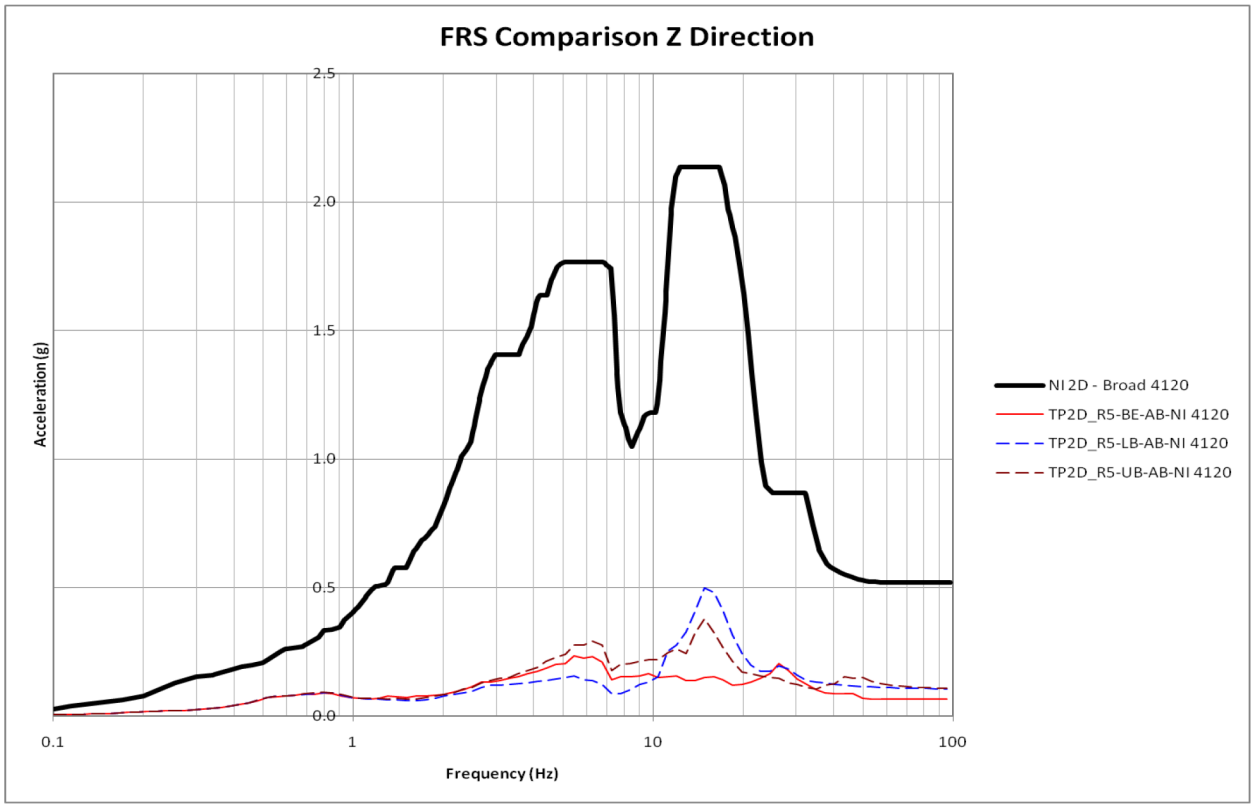

Figure A-18. TPNP Annex Building BE, LB and UB in Z-Direction – Node 4120

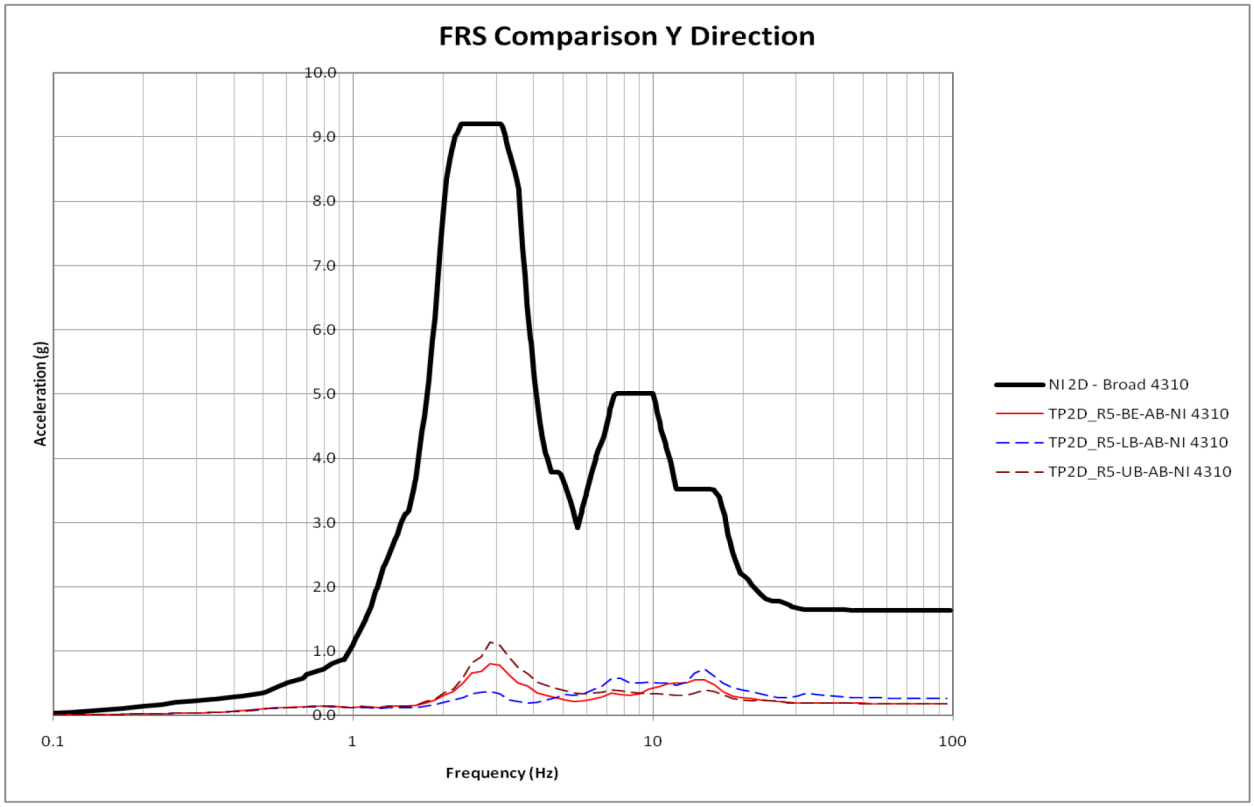

Figure A-19. TPNP Annex Building BE, LB and UB in Y-Direction – Node 4310

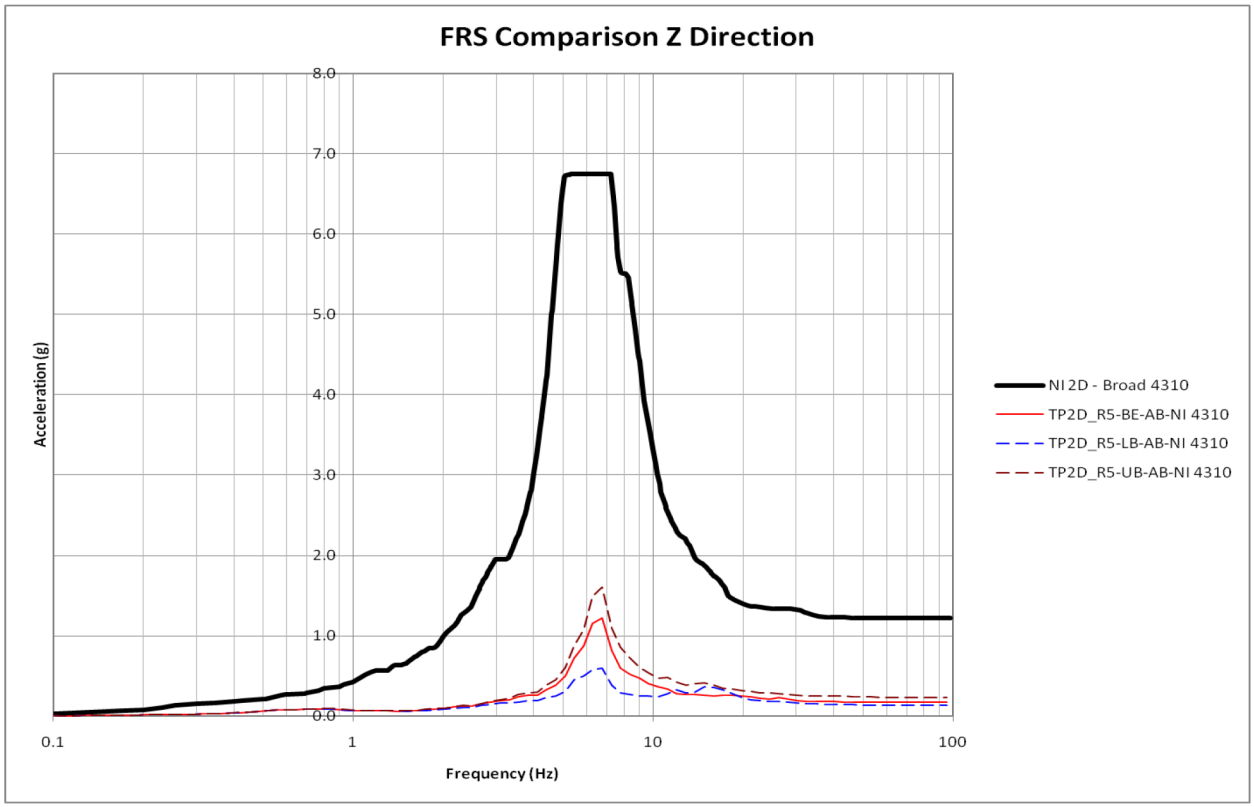

Figure A-20. TPNP Annex Building BE, LB and UB in Z-Direction – Node 4310

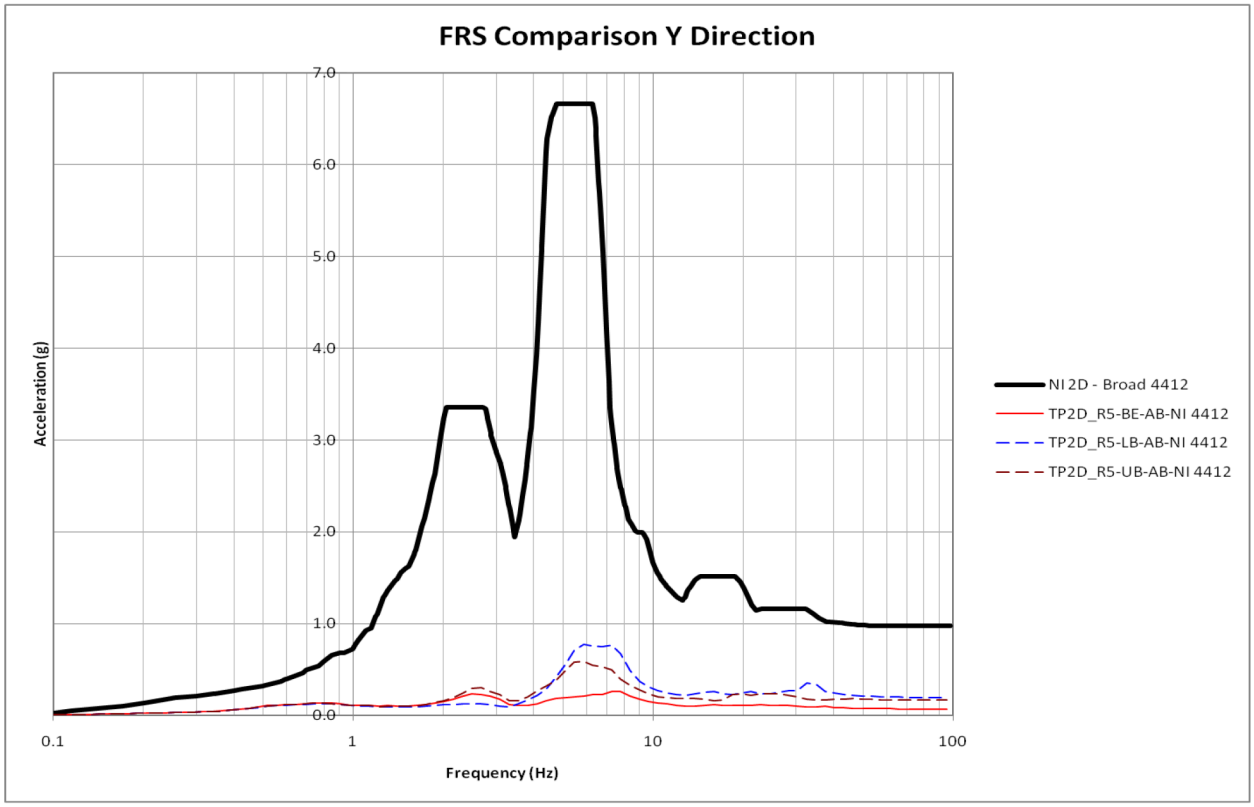

Figure A-21. TPNP Annex Building BE, LB and UB in Y-Direction – Node 4412

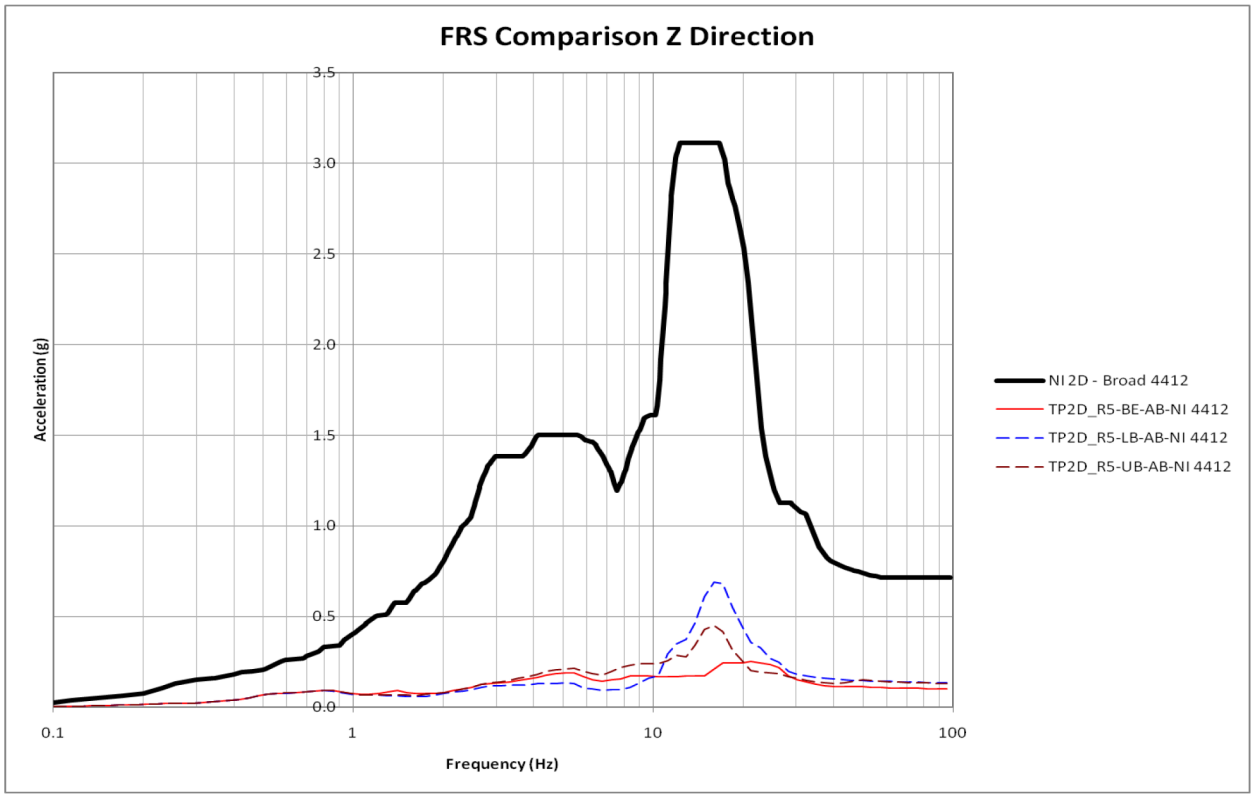

Figure A-22. TPNP Annex Building BE, LB and UB in Z-Direction – Node 4412

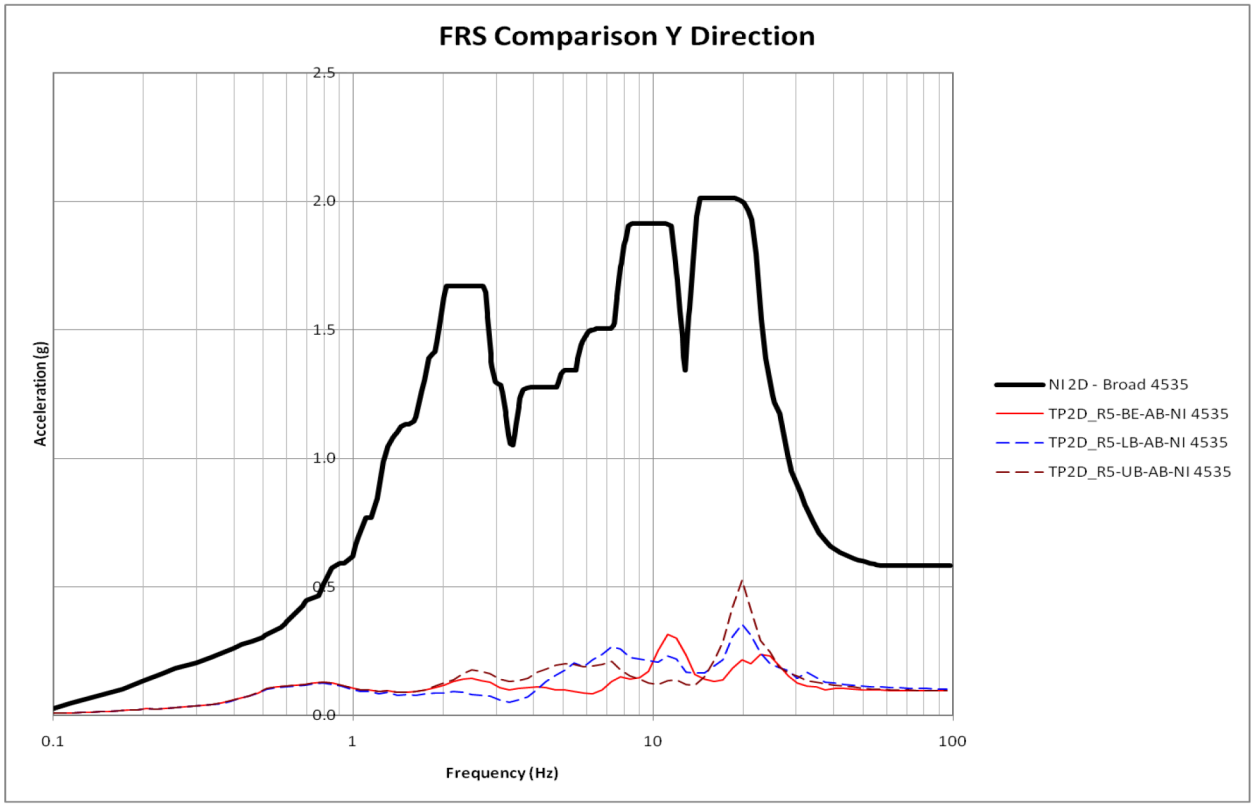

Figure A-23. TPNP Annex Building BE, LB and UB in Y-Direction – Node 4535

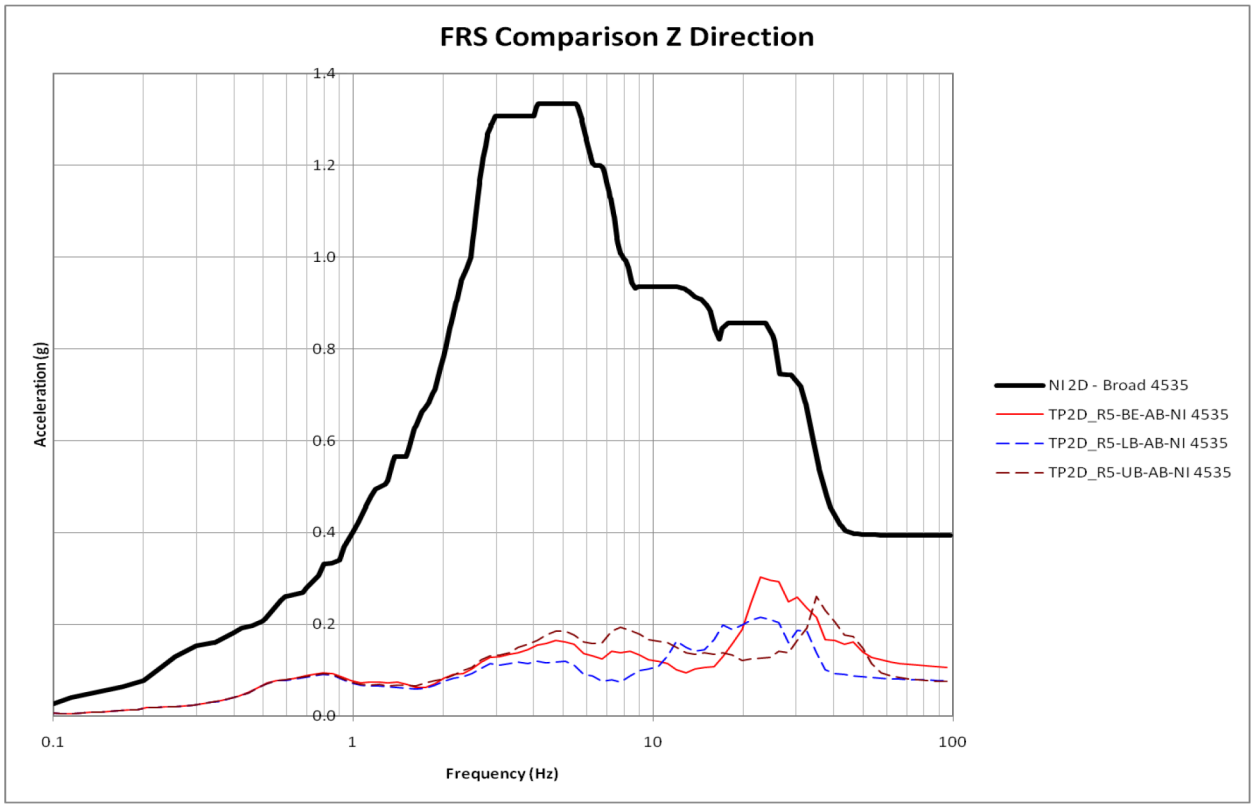

Figure A-24. TPNP Annex Building BE, LB and UB in Z-Direction – Node 4535