3.7.2 Seismic System Analysis

This section provides seismic analysis details for Seismic Category I, II, Conventional Seismic (CS), and Radwaste Seismic (RS) structures that are considered in conjunction with the foundation and its supporting media as seismic systems. Other seismic structures, systems, equipment, and components that are not designated as seismic systems (i.e., heating, ventilation and air-conditioning systems; electrical cable trays; piping systems) are designated as seismic subsystems. The analysis of seismic subsystems other than piping is presented in Section 3.7.3. The analysis of piping subsystems is described in Section 3.9.2 and Section 3.12.

A three-dimensional rendering of the U.S. EPR is shown in Figure 1.2–1. Typical building locations are shown in the dimensional arrangement drawing of Figure 3B-1. The Nuclear Island (NI) Common Basemat Structures consist of ten buildings that share one common basemat. The NI common basemat is a heavily reinforced concrete slab which supports the Reactor Building (RB), Reactor Building Internal Structures, Safeguard Buildings (SB) 1 thru 4, Fuel Building (FB), SBs 2 and 3 shield structure, FB shield structure, RB shield structure, as well as the main steam valve stations (MSVS), the Vent Stack (VS), and the staircase towers (SCT) (see Figure 3B-1). Safeguards Building 2 and 3 are separate structures that share a common wall. An interior cutaway view of the U.S. EPR NI Common Basemat Structures is shown in Figure 3.7.2-1—Decoupling of the Nuclear Island Common Basemat Interior Structures from the Outer Shield Walls, which illustrates the hardened protection afforded by the aircraft protection shield structures and the decoupling between them and the remaining structures on the NI common basemat. The shield structures are discussed in more detail below.

The RB occupies the central portion of the NI common basemat and houses the reactor coolant system (RCS). The RB consists of three concrete structures:

- The inner Reactor Containment Building (RCB).
- The outer Reactor Shield Building (RSB).
- The RB Internal Structures (RBIS).

The RBIS are housed within the RCB. The main steam system (MSS) and main feedwater system valve stations are located within SBs 1 and 4. The SCTs are reinforced concrete structures located at the perimeter of the RSB. The SCTs are located in the areas where the footprints of the SBs and the FB overlap.

The primary function of the RSB is to protect the RCB from missiles and loads resulting from external design basis events such as hurricanes and tornados, as well as beyond design basis events such as extreme aircraft hazards and explosion pressure waves. The hardened cylindrical shell and dome are part of the monolithic protective shield that extends from the north wall of SBs 2 and 3, over the RCB, and to the south wall of the FB. The exterior walls and roof slab of the SCTs are part of this monolithic protective shield. The space between the interior surface of the RSB and the exterior surface of the RCB forms the RB Annulus. The approximately six-foot wide annulus serves as an access area for personnel and as a shelter for cables, piping, and heating, ventilation, air conditioning ducts, and it provides clearance to prevent structural interactions during design basis and beyond design basis events.

The common basemat provides assurance that overturning of the supported structures as a result of a seismic event or other hazards, such as aircraft impact, will not occur. To provide additional protection from external hazards and beyond design basis events, the containment interior structures are decoupled from the outer walls (see Figure 3.7.2-1). Because of the decoupling, containment interior structures are only connected by the common basemat foundation to the surrounding structure. In addition, except for electrical and mechanical system tie-ins, the NI Common Basemat Structures are structurally isolated from adjacent structures.

Two Emergency Power Generating Buildings (EPGB) and four Essential Service Water Buildings (ESWB) are situated in the vicinity of the NI Common Basemat Structures. The EPGB provides emergency power for the plant to allow safe shutdown and maintain safe shutdown, while the ESWB provides component cooling water for the safe operation and emergency shutdown of the plant. Key attributes of the two structures are:

- Each EPGB contains two diesel powered generators as well as two 120,000 gallon fuel storage tanks.
- Each ESWB includes a pumphouse and mechanical cooling towers with cells 60 feet square.

The U.S. EPR EUR-based certified seismic design response spectra (CSDRS), as described in Section 3.7.1, are associated with a variety of potential soil and rock conditions intended to encompass the majority of potential sites in the central and eastern United States. A soil-structure interaction (SSI) analysis is performed on the U.S. EPR NI Common Basemat structures, Nuclear Auxiliary Building (NAB), EPGB, and ESWB to compute the global seismic responses of the structures for the variety of soil conditions considered in Section 3.7.1.3. Stick models are used in the seismic SSI analysis of the NI Common Basemat Structures and NAB, and the stick models are dynamically compatible with the respective 3D finite element models (FEM) of the structures. For the EPGB and ESWB, 3D FEM of the structures are directly used in the seismic SSI analysis. As described in Section 3.7.1, the input ground motion for the SSI analysis of the EPGB and ESWB is different from that for the NI and NAB.

The following sections describe the seismic analyses performed for the Seismic Category I, II, CS, and RS structures of the U.S. EPR. The seismic classification of U.S. EPR structures is defined in Section 3.2. These seismic analyses meet the requirements of 10 CFR 50, GDC 2 and 10 CFR 50, Appendix S, with respect to the capability of the structures to withstand the effects of earthquakes. Application of the criteria in Section 3.7 to the seismic analysis and design of the U.S. EPR results in a robust design with significant seismic margin, as demonstrated in the seismic margin assessment of Section 19.1. A COL applicant that references the U.S. EPR design certification will confirm that the site-specific seismic response is within the parameters of Section 3.7 of the U.S. EPR standard design. The impact of changes to the standard design at the detailed design stage is evaluated using the following criteria.

- The effects of deviations are evaluated using methods that are consistent with those of Section 3.7 as used for the certified design.
- The evaluation considers the combined effect of such deviations.
- The combined deviations are acceptable if the amplitudes of the in-structure response spectra increase by less than 10 percent.
- Changes, either individually or cumulatively, that exceed these thresholds result in the evaluation of the need for reanalysis.

3.7.2.1 Seismic Analysis Methods

The response of a multi degree-of-freedom system subjected to seismic excitation may be represented by the differential equations of motion in the following general form:

Equation 1

$$[M]\{\ddot{X}\}+[C]\{\dot{X}\}+[K]\{X\}=-[M]\{\ddot{u}_g\}$$

Where:

$[M]$=mass matrix (n x n)

$[C]$=viscous damping matrix (n x n)

$[K]$=stiffness matrix (n x n)

$\{X\}$=column vector of relative displacements (n x 1)

$\{\dot{X}\}$=column vector of relative velocities (n x 1)

$\{\ddot{X}\}$=column vector of relative accelerations (n x 1)

n=number of degrees of freedom

$\{\ddot{u}_g\}$=column vector of input acceleration

Depending on the type of analysis and application, the following seismic analysis methods are used to solve the above equations of motion to determine the seismic responses of, the U. S. EPR structures.

- Time history analysis method.
- Response spectrum method.
- Complex frequency response analysis method.
- Equivalent-static load method of analysis.

Seismic analysis is performed for the three orthogonal (two horizontal and one vertical) components of earthquake motion defined in Section 3.7.1. The orthogonal axes are aligned with the global axes of the seismic analysis models.

3.7.2.1.1 Time History Analysis Method

Equation 1 is solved using the time history analysis method in the time domain for the seismic response of the system using either the direct integration technique or the modal superposition technique. The choice of the technique depends on whether or not the system is a linear one.

When nonlinearity occurs in the stiffness matrix, [K], or damping matrix, [C], the direct integration technique is used to solve Equation 1. This technique is used for the time history analysis of the NI Common Basemat safety-related structures to determine their stability against seismic sliding or overturning and their potential for seismic structural interaction. In this analysis, the approximate soil springs and dampers representing the soil under the foundation basemat are nonlinear in nature to allow for sliding or uplift of the basemat to occur. The ANSYS computer code is used in this nonlinear time history analysis of the U. S. EPR structures.

When the system is linear elastic and the damping of the system in lieu of the damping matrix [C] may be explicitly specified as modal damping ratios associated with the normal modes of the system, the modal superposition technique is used to solve Equation 1 for the seismic response of the system. The modal time history analysis technique is used in two applications. The first application is the modal time history analysis of the fixed-base NI Common Basemat Structures and NAB structures to demonstrate dynamic compatibility between the stick models used in the SSI analysis and the 3D FEM's used in the static analysis. The modal time history analysis generates in-structure response spectra (ISRS) at representative locations of the structures for both the stick models and FEMs. The stick model is considered compatible with the FEM when the ISRS of the stick model are similar to those at corresponding locations of the FEM. For the NI Common Basemat Structures, computer codes used in such modal time history analyses are the GTSTRUDL code, Version 28, for the stick models and ANSYS code, Version 10.0, for the FEMs. For the NAB, the GTSTRUDL code, Version 29, is used in the modal time history analysis of both the stick model and FEM. The second application of the modal time history analysis is the local seismic analysis of the flexible slabs and walls in the NI Common Basemat Structures subsequent to the SSI analysis. In this case, the modal time history analysis of single-degree-of-freedom (SDOF) oscillators representing the flexible slabs and walls is performed to determine the amplified out-of-plane acceleration response and ISRS at such slabs and walls. The GTSTRUDL code, Version 28, is used in this application.

To solve Equation 1 numerically in the time domain using either the direct integration or modal superposition technique, the time step for numerical integration must be sufficiently small for stability and convergence of the solution. As a general rule, the value for the maximum time step is no larger than one-fifth of the lowest natural period of interest. Normally, the lowest period of interest need not be less than the reciprocal of the zero period acceleration (ZPA) frequency.

3.7.2.1.2 Response Spectrum Method

The response spectrum method is used in the local seismic analysis of certain slabs in the NAB to determine the out-of-plane seismic loads on the slabs. Input motion to the analysis is the vertical ISRS at the slab locations generated from the seismic SSI analysis of the NI Common Basemat Structures and NAB.

Similar to the modal time history analysis method, when the response spectrum method is used it is assumed that the damping matrix [C] in Equation 1 may be explicitly represented by modal damping ratios so that the equation of motion given in Section 3.7.2.1 may be transformed to the equations of motion of the normal modes. The maximum seismic response of interest for each given mode is a function of the modal participation factor, mode shape and the input response spectrum acceleration at the corresponding modal frequency and damping ratio. The maximum modal responses are combined to determine the maximum response of interest in accordance with the combination method described in Section 3.7.2.7.

3.7.2.1.3 Complex Frequency Response Analysis Method

With this analysis method, the damping of the system is not represented by the viscous damping matrix, [C], but as the imaginary part of a complex stiffness matrix. Thus

Equation 1 becomes complex and must be solved in the frequency domain. To facilitate the analysis, the time history of input ground motion is transferred to the frequency domain by Fast Fourier Transform (FFT). The seismic responses calculated in the frequency domain are then transferred back to the time domain as outputs by inverse FFT.

The complex frequency response analysis method is used in the seismic SSI analysis of all Seismic Category I structures. AREVA computer code SASSI, Version 4.1B, is used in the SSI analysis of the NI Common Basemat Structures and NAB. Bechtel computer code SASSI 2000, Version 3.1, is used in the SSI analysis of the EPGBs and ESWBs. For the SSI analysis results to be sufficient, the following requirements are met:

- A sufficiently high cut-off frequency is selected to ensure all significant SSI frequencies are included.
- A sufficient number of frequency points is used to accurately define the transfer functions within the cut-off frequency.
- The time step size for the input ground motion time histories is sufficiently small to be compatible with the selected cutoff frequency.

The SSI analysis generates the maximum ZPA at various floor locations, the floor acceleration time histories at representative locations for ISRS generation, the maximum member or element forces and moments, and the maximum relative displacements at the structural basemats with respect to the free-field input motions.

The complex frequency response analysis method is also used in the soil column analysis using Bechtel computer code SHAKE2000, Version 1.1, to compute the free-field “in-ground” motion at the foundation level of ESWB, for use as the input motion to the SSI analysis. This is because the SSI analysis of the ESWB considers structural embedment, and the input ground motion specified in Section 3.7.1 corresponds to a hypothetical free-field “outcrop” motion at the foundation level of ESWB. Bechtel code SASSI 2000 requires that the input motion, when specified at the foundation level, be an “in-ground” motion converted from the “outcrop” motion through a soil column analysis.

3.7.2.1.4 Equivalent Static Load Method of Analysis

This analysis method is used to determine the seismic induced element forces and moments in the 3D FEMs of the NI Common Basemat Structures, EPGB, ESWB and NAB. In the analysis, equivalent static loads corresponding to the ZPAs generated from the seismic SSI analyses are applied to the 3D FEMs of the structure and basemat for the applicable SSI analysis cases. Computer codes used in the analyses include ANSYS code Version 10.0 for the NI Common Basemat Structures, GTSTRUDL code Version 27 for the EPGB and ESWB, and GTSTRUDL code Version 29 for the NAB.

Consideration of torsional loading induced by accidental eccentricities is presented in Section 3.7.2.11.

3.7.2.2 Natural Frequencies and Response Loads

In the SSI analysis, the NI Common Basemat Structures, RCS, and NAB are represented by stick models and the EPGB and ESWB are represented by 3D FEMs. The stick models are developed to ensure a reasonable dynamic compatibility with the corresponding 3D FEMs that are used in the equivalent static analysis. Section 3.7.2.3 discusses the development of the structural models.

Table 3.7.2-4 — Modal Frequencies of the Simplified Stick Model of Reactor Coolant Loop, shows the frequencies of the first 50 modes of the simplified stick model of the RCS. Table 3.7.2-5 — Modal Frequencies of the Stick Models of NI Common Basemat Structures and RCS, shows the frequencies and modal mass ratios computed by GTSTRUDL code for the first 256 modes of the stick model of the NI Common Basemat Structures including the vent stack and RCS. This overall stick model of the NI Common Basemat Structures includes applicable masses in addition to the masses of the concrete. It consists of three major stick models: STICK-1T for the RBIS, STICK-3T for the RCB, and STICK-2T for the composite sticks representing the remaining structures on the NI Common Basemat. Frequencies and modal mass ratios of these three individual major sticks are shown in:

- Table 3.7.2-1 — Frequencies and Modal Mass Ratios for Balance-of-NI Common Basemat Structures, first 110 modes of STICK-2T (Balance-of NI Common Basemat Structures).
- Table 3.7.2-2 — Frequencies and Modal Mass Ratios for Reactor Containment Building, first 16 modes of STICK-3T (RCB).
- Table 3.7.2-3 — Frequencies and Modal Mass Ratios for Reactor Building Internal Structures, first 30 modes of STICK-1T (RBIS).

Table 3.7.2-6 — Modal Frequencies of the Stick Model of NAB, shows the frequencies and modal mass ratios computed by GTSTRUDL code for the first 25 modes of the NAB stick model. Table 3.7.2-7 — Modal Frequencies of 3D FEM of Emergency Power Generating Building, and Table 3.7.2-8 — Modal Frequencies of 3D FEM of Emergency Service Water Building, show the frequencies of the 3D FEM of the EPGB and ESWB, respectively.

Since the SSI analysis is performed using the complex frequency response method where the equation of motion is solved in the frequency domain, the modal frequencies and mass ratios presented in the tables above are for reference information only.

3.7.2.3 Procedures Used for Analytical Modeling

Seismic SSI analysis of the Seismic Category I structures is performed following the guidance in ASCE 4-98 (Reference 1) and SRP 3.7.2 (Reference 2). Methodology for development of the structural models is discussed below. Methodology for development of the SSI analysis model is discussed in Section 3.7.2.4.

3.7.2.3.1 Seismic Category I Structures – Nuclear Island Common Basemat

The NI Common Basemat is approximately 10 feet thick and transitions to a thickened section where the cylindrical walls of the RSB and the RCB intersect with the basemat. The basemat then steps down at the outer edge of the tendon gallery wall and continues out under the SBs, FB, and the SCTs (see Figure 3.7.2-3 and Figure 3.7.2-4).

The SBs basemat is approximately 10 feet thick from the intersection with the outer surface of the RSB wall to the internal wall dividing the radiological control area and nonradiological control area, where it thickens to approximately 13 feet and continues to the intersection with the exterior wall.

The FB basemat is approximately 10 feet thick throughout, with the exception of an area of the basemat that steps down to form a sump at the common wall with the RSB wall, and then steps up and continues out to the intersection with the exterior wall.

A total of twelve SSI analyses are performed for the NI and NAB for the various soil and rock conditions encompassed by the EUR design spectra for the hard, medium, and soft soil conditions described in Section 3.7.1. The purpose of the SSI analyses is to generate sets of global seismic response loads which can be used in the design of the Seismic Category I SSCs. The seismic response loads generated include forces on the members and accelerations at modal locations, ISRS at representative locations, and amplified ISRS at representative flexible slabs.

In the SSI analysis, the NI Common Basemat Structures, RCS and NAB are represented by stick models. The basemats of both the NI Common Basemat Structures and NAB are assumed rigid for the purpose of SSI analysis because they are sufficiently thick and, in addition, are stiffened in out-of-plane deformation by the structural walls above the basemat. For the NI Common Basemat Structures, the stick model is an assemblage of nine individual stick models, as conceptually illustrated in Figure 3.7.2-3 — Schematic Elevation View of Stick Model for Nuclear Island Common Basemat Structures in Global Y-Z Plane, and Figure 3.7.2-4 — Schematic Elevation View of Stick Model for Nuclear Island Common Basemat Structures in Global X-Z Plane, which are rigidly tied together at their bases on the common basemat. SBs 2 and 3, which share a common wall, are represented by one stick model. The NAB, which is included in the SSI analysis for the NI Common Basemat Structures, is represented by a single stick model supported on a separate basemat. The SSI analysis is discussed in more detail in Section 3.7.2.4.

The stick models are developed by first locating key elevations (typically the major floor slab elevations) in the structure. Between two successive key elevations, two vertical massless sticks are developed. One stick is located at the center of shear area and the other at the center of axial area respectively, of the vertical structural elements between the two given key elevations. Section properties of the two sticks are determined by hand calculations based on the structural drawings. The total axial area of the vertical structural elements is assigned to the stick located at the center of axial area. The remaining five section properties, including the total shear areas along the two global axes and the total moments of inertia about the three global axes, are assigned to the stick located at the center of shear area. The two sticks are connected to each other at both their upper and lower ends with a horizontal rigid beam. For the NI stick models, no structural credit is taken for the stiffness of the steel liner plate in both the reactor containment and the spent fuel pool.

At the key elevations of the structure, a lumped mass is placed at the center of mass. The lumped mass is connected with horizontal rigid beams to the center of shear area and center of axial area located at the same elevation. It includes mass contributions from the following elements:

- Floor or roof slab(s), when applicable, at the particular elevation.
- Walls and miscellaneous floor slabs and platforms (including platform live load) within half height to the next key elevation below.
- Walls and miscellaneous floor slabs and platforms (including platform live load) within half height to the next key elevation above.
- Permanent equipment and distribution systems supported by slabs and platforms.
- Water in pools under normal operating conditions.
- Twenty-five percent of the live loads (variable loads) on floor slabs and platforms.
- Seventy-five percent of the maximum snow load on roof slabs.

The total mass of water in a pool during normal operating conditions is lumped at the bottom slab of the pool in the vertical direction. In the horizontal direction, the mass of the water is distributed to the nodes along the height of the pool using tributary areas. For the purpose of the stick model, water mass is considered as a permanent load if present during normal operating conditions. The frequency of water sloshing is typically low compared to the first horizontal mode frequency of the structure housing the pool. As such, water sloshing has a negligible effect on the global seismic response of the structure and hence may be ignored in the development of the stick model. The effect of water sloshing however, is considered in the local analysis and detailed design of the pool. For the NI Common Basemat Structures, the spent fuel racks are considered by lumping 100 percent of the spent fuel load at the bottom slab in the vertical direction and by distributing it along the height of the pool in the horizontal direction. Rack-structure interaction is not considered in development of the structural stick model for the FB as far as global seismic response is concerned.

Floor/roof slabs and walls are assumed rigid when developing the stick models for the NI Common Basemat Structures, except that out-of-plane flexibilities of the following slabs and walls are explicitly accounted for by SDOF oscillators in the stick models:

- The removable walls at the steam generator (SG) towers above elevation +63 ft, 11-1/2 inches of the RBIS.
- The walls and roof slab of the SBs 2 and 3 shield structure and FB shield structure.
- The two flexible slabs at elevation +26 ft, 7 inches of SBs 2 and 3.

At these locations, SDOF oscillators representing the out-of-plane vibration of the slabs and walls are connected to the lumped masses at the proper elevations of the respective stick models. The effect of flexible floors and walls not included in the stick models is accounted for, after the SSI analysis is completed, in subsequent modal time history analyses of the flexible slabs and walls that are represented by SDOF oscillators. The out-of-plane vibration frequency of a flexible slab or wall is determined by hand calculations if the configuration is simple, or by modal analysis of a local FEM of the slab/wall. The input motions to these subsequent time history analyses are the applicable floor acceleration time histories output from the SSI analysis (see Section 3.7.2.4.7).

The RBIS and RCB are free-standing structures supported by the common basemat. The seven balance-of-NI Common Basemat Structures (RSB, SBs 1, 2/3 and 4, FB, SBs 2 and 3 shield structure and FB shield structure) are structurally coupled to each other laterally both at and above the basemat. The lateral structural couplings above the basemat are simulated by laterally connecting the stick models of the seven structures at the necessary elevations with flexible, massless horizontal beams. The section properties of these flexible horizontal beams are estimated at the same time the properties of the individual stick models developed by hand calculations are adjusted. The adjustment provides a reasonable dynamic compatibility between the stick models and the corresponding 3D FEM of the structures when only the masses of concrete and other applicable permanent dead weights are considered. The procedure of adjustment is briefly summarized as follows.

The hand-calculated section properties of the stick models and, in the case of the balance-of-NI Common Basemat Structures, the estimated properties of the flexible horizontal beams simulating the lateral structural coupling between structures are adjusted on a trial and error basis so that the two models are reasonably similar to each other in not only the modal frequencies and mass ratios but also the ISRS at selected locations of the structure. More detailed descriptions of the development of the stick models for the NI Common Basemat Structures are given in Section 3.7.2.3.1.2.

Development of the 3D FEMs for the NI Common Basemat Structures is described in Section 3.7.2.3.1.1. The 3D FEM's not only are used in the equivalent static analysis but also provide the basis for the development of the stick models.

The RCS is represented by a simplified stick model that is separately developed and coupled with the stick model of the RBIS for the SSI analysis of the NI Common Basemat Structures. The simplified RCS stick model is shown in Figure 3.7.2-56 — Simplified Stick Model of Reactor Coolant Loop, and is compatible with a more detailed RCS model.

The stick model for the NAB is developed in a manner similar to that used for the NI Common Basemat Structures and is dynamically compatible with 3D FEM of the NAB.

3.7.2.3.1.1 3D Finite Element Models

The 3D FEMs developed for the static and/or equivalent static analysis of the NI Common Basemat Structures and NAB are used as the basis for adjusting or fine tuning the section properties of the stick models to provide a reasonable dynamic compatibility between the two types of model. The 3D FEM for the NI Common Basemat Structures consists of the following:

- A shell element 3D FEM of the seven balance-of-NI Common Basemat Structures consisting of the RSB, SB 2 and 3 shield structure, FB shield structure, SBs 1, 2/3 and 4, and FB. The FEM is developed for the ANSYS computer code. There is lateral structural coupling among the seven structures at some elevations above the top of the common basemat. Representations of the FEM are shown in Figure 3.7.2-5 — 3D Finite Element Model of Balance if NI Common Basemat Structures Perspective View, Figure 3.7.2-6 — 3D Finite Element Model of Balance of NI Common Basemat Structures Cutoff View on Y-Z Plane, and Figure 3.7.2-7 — 3D Finite Element Model of Balance of NI Common Basemat Structures Cutoff View on X-Z Plane.

- A solid element 3D FEM of the RCB is developed for the ANSYS computer code. This model is shown in Figure 3.7.2-8 — 3D Finite Element Model of Reactor Containment Building.

- A shell element 3D FEM of the RBIS developed for the ANSYS code, as shown on Figure 3.7.2-9 — 3D Finite Element Model of Reactor Building Internal Structures. The only exception is that solid elements are used to represent the lower portion of the Reactor Pressure Vessel (RPV) pedestal.

The 3D FEM of the NI Common Basemat Structures are connected to the top of the common basemat which is represented by solid elements of the ANSYS code. The particular elements of the ANSYS code used are listed below.

- SOLID45 – An eight-node solid element used to model the common basemat.
- SHELL43 – A four-node shell element used to model walls, slabs and the shell of the RB. This element is suitable for moderately thick shell structures and can also provide out of plane shear forces.
- BEAM44 – Used to model beams and columns.

As an option, the 3D FEM, or a simplified version of the 3D FEM, of the NI Common Basemat Structures may be used in the SSI analysis as a replacement for the 3D stick models. Dynamic compatibility between the simplified and detailed 3D FEM models is demonstrated when this option is adopted in the SSI analysis.

The 3D FEM of the NAB consists of shell elements and is developed using the GTSTRUDL code, Version 29. It is used in the equivalent static analysis and serves as the basis for tuning the stick model of the NAB to ensure reasonable dynamic compatibility with the FEM.

3.7.2.3.1.2 Development of Stick Models for NI Common Basemat Structures and NAB

Nine sticks, divided into three groups, represent the NI Common Basemat Structures supported on the common basemat. The three stick groups are Stick-1T (or Stick 1) for the RBIS, Stick-3T (or Stick 3) for the RCB, and Stick-2T for the seven balance-of-NI Common Basemat Structures including Stick 2 for the RSB, Stick 4 for SB 1, Stick 5 for SBs 2 and 3, Stick 6 for SBs 2 and 3 shield structure, Stick 7 for SB 4, Stick 8 for FB and Stick 9 for FB shield structure. Figure 3.7.2-2 — Plan View of Schematic Stick Model for Nuclear Island Common Basemat Structures, illustrates schematically the plan locations of the nine sticks. Figure 3.7.2-3 and Figure 3.7.2-4 illustrate elevation views of the schematic locations of the stick models in the global Y-Z and X-Z planes, respectively.

(1) Stick Model STICK-2T for Fixed Base Balance-of-NI Common Basemat Structures

One stick model is first developed for each of the seven individual balance-of-NI Common Basemat Structures. They are:

- Stick 2 (RSB) - base at elevation -14 ft, 1-1/4 inches.
- Stick 4 (SB 1) - base at elevation -28 ft, 2-1/2 inches.
- Stick 5 (SBs 2 and 3) - base at elevation -28 ft, 2-1/2 inches.
- Stick 6 (SBs 2 and 3 shield structure) - base at elevation -28 ft, 2-1/2 inches.
- Stick 7 (SB 4) - base at elevation -28 ft, 2-1/2 inches.
- Stick 8 (FB) - base at elevation -31 ft, 6 inches.

- Stick 9 (FB shield structure, including the vent stack on the roof) - base at elevation -31 ft, 6 inches.

The seven sticks are then laterally interconnected to each other to form the composite stick model, STICK-2T. The properties of the individual sticks are initially developed by hand calculations based on the structural drawings except for the RSB. For the RSB, the lower portion of the stick model representing the cylindrical walls is also developed by hand calculations while the upper portion representing the dome, which is a 2-mass stick, is developed based on the modal properties of an ANSYS shell element FEM of the dome. The individual sticks are further supplemented by the addition of the following features to form STICK-2T: (a) the SDOF oscillators representing out-of-plane flexibilities of the walls and slabs previously identified in 3.7.2.3.1 for SBs 2 and 3 (stick 5), SBs 2 and 3 shield structure (Stick 6) and FB shield structure (Stick 9), (b) one SDOF oscillator simulating the in-plane vibration of the slab at elevation +63 ft, 11-3/4 inches of the FB (Stick 8), and (c) a combination of rigid and flexible horizontal beams to link the individual sticks at applicable elevations to simulate the lateral structural coupling among the structures.

Figure 3.7.2-10 — Stick Model STICK-2T for Balance of NI Common Basemat Structures - Plan View, and Figure 3.7.2-11 — Stick Model STICK-2T for Balance of NI Common Basemat Structures - Perspective View, show a plan view and a perspective view of the composite stick model, STICK-2T, for the balance-of-NI Common Basemat Structures. Tuning of the composite stick model is done by first adjusting the total concrete mass of each individual stick where necessary, for a close correlation with the total concrete mass of the FEM shown in Figure 3.7.2-5. The total adjusted concrete mass of the composite stick model closely matches the total concrete mass of the FEM.

Section properties of the individual sticks are then adjusted in conjunction with an estimate of the section properties of the flexible radial beams and flexible horizontal beams inter-connecting the individual sticks. The sufficiency of the adjusted composite stick model (STICK-2T), with only concrete mass considered, is demonstrated by comparing the 5 percent damping response spectrum envelopes between the stick model and FEM at representative locations of the buildings. The GTSTRUDL and ANSYS codes are used in the modal time history analysis of the stick model and FEM, respectively. Seismic input ground motions used in generating the response spectrum are the synthetic time histories associated with the EUR Hard motion previously described in Section 3.7.1. The figures listed show the spectrum comparison at the following locations:

- RSB (Stick 2)
  - Apex of dome at elevation +200 ft, 5 inches. See Figure 3.7.2-14 — Stick vs. FEM Spectrum Comparison at Elev. +200 ft, 5 inches (+61.09m) (Dome Apex) of Reactor Shield Building, Figure 3.7.2-15 — Stick vs. FEM Spectrum

Comparison at Elev. +200 ft, 5 inches (+61.09m) (Dome Apex) of Reactor Shield Building, and Figure 3.7.2-16 — Stick vs. FEM Spectrum Comparison at Elev. +200 ft, 5 inches (+61.09m) (Dome Apex) of Reactor Shield Building.

- SB 1 (Stick 4)
  - Roof at elevation +95 ft, 1-3/4 inches. See Figure 3.7.2-17 — Stick vs. FEM Spectrum Comparison at Elev. +95 ft, 1-3/4 inches (+29.00m) - Safeguard Building 1, Figure 3.7.2-18 — Stick vs. FEM Spectrum Comparison at Elev. +95 ft, 1-3/4 inches (+29.00m) - Safeguard Building 1, and Figure 3.7.2-19 — Stick vs. FEM Spectrum Comparison at Elev. +95 ft, 1-3/4 inches (+29.00m) - Safeguard Building 1.
  - Floor at elevation +26 ft, 3 inches. See Figure 3.7.2-20 — Stick vs. FEM Spectrum Comparison at Elev. +26 ft, 3 inches (+8.00m) - Safeguard Building 1, Figure 3.7.2-21 — Stick vs. FEM Spectrum Comparison at Elev. +26 ft, 3 inches (+8.00m) - Safeguard Building 1, and Figure 3.7.2-22 — Stick vs. FEM Spectrum Comparison at Elev. +26 ft, 3 inches (+8.00m) - Safeguard Building 1.
- SB 4 (Stick 7)
  - Roof at elevation +95 ft, 1-3/4 inches. See Figure 3.7.2-23 — Stick vs. FEM Spectrum Comparison at Elev. +95 ft, 1-3/4 inches (+29.00m) - Safeguard Building 4, Figure 3.7.2-24 — Stick vs. FEM Spectrum Comparison at Elev. +95 ft, 1-3/4 inches (+29.00m) - Safeguard Building 4, and Figure 3.7.2-25 — Stick vs. FEM Spectrum Comparison at Elev. +95 ft, 1-3/4 inches (+29.00m) - Safeguard Building 4.
  - Floor at elevation +26 ft, 3 inches. See Figure 3.7.2-26 — Stick vs. FEM Spectrum Comparison at Elev. +26 ft, 3 inches (+8.00m) - Safeguard Building 4, Figure 3.7.2-27 — Stick vs. FEM Spectrum Comparison at Elev. +26 ft, 3 inches (+8.00m) - Safeguard Building 4, and Figure- 3.7.2-28 — Stick vs. FEM Spectrum Comparison at Elev. +26 ft, 3 inches (+8.00m) - Safeguard Building 4.
- SB 2 and 3 (Stick 5)
  - Floors at elevation +68 ft, 10-3/4 inches. See Figure 3.7.2-29 — Stick vs. FEM Spectrum Comparison at Elev. +68 ft, 10-3/4 inches (+21.00m) - Safeguard Building 2/3, Figure 3.7.2-30 — Stick vs. FEM Spectrum Comparison at Elev. +68 ft, 10-3/4 inches (+21.00m) - Safeguard Building 2/3, and Figure 3.7.2-31 — Stick vs. FEM Spectrum Comparison at Elev. +68 ft, 10-3/4 inches (+21.00m) - Safeguard Building 2/3.
  - Floors at +26 ft, 3 inches. See Figure 3.7.2-32 — Stick vs. FEM Spectrum Comparison at Elev. +26 ft, 3 inches (+8.00m) - Safeguard Building 2/3, Figure 3.7.2-33 — Stick vs. FEM Spectrum Comparison at Elev. +26 ft, 3 inches (+8.00m) - Safeguard Building 2/3, and Figure 3.7.2-34 — Stick vs. FEM Spectrum Comparison at Elev. +26 ft, 3 inches (+8.00m) - Safeguard Building 2/3.

- FB (Stick 8)
  - Floors at elevation +62 ft, 4-1/4 inches. See Figure 3.7.2-35 — Stick vs. FEM Spectrum Comparison at Elev. +62 ft, 4-1/4 inches (+19.00m) - Fuel Building, Figure 3.7.2-36 — Stick vs. FEM Spectrum Comparison at Elev. +62 ft, 4-1/4 inches (+19.00m) - Fuel Building, and Figure 3.7.2-37 — Stick vs. FEM Spectrum Comparison at Elev. +62 ft, 4-1/4 inches (+19.00m) - Fuel Building
  - Floors at +23 ft, 7-1/2 inches. See Figure 3.7.2-38 — Stick vs. FEM Spectrum Comparison at Elev. +23 ft, 7-1/2 inches (+7.20m) - Fuel Building, Figure 3.7.2-39 — Stick vs. FEM Spectrum Comparison at Elev. +23 ft, 7-1/2 inches (+7.20m) - Fuel Building, and Figure 3.7.2-40 — Stick vs. FEM Spectrum Comparison at Elev. +23 ft, 7-1/2 inches (+7.20m) - Fuel Building.

Table 3.7.2-1 lists the frequencies and modal mass ratios for the first 110 modes of STICK-2T, applicable masses included.

(2) Stick Model STICK-3T for Fixed Base Reactor Containment Building

The stick model for the RCB is designated STICK-3T. Properties of the stick model for the cylindrical wall up to the spring line at elevation +144 ft, 1-1/4 inches are developed by conventional hand calculations. The dome above elevation +144 ft, 1-1/4 inches is represented by a 2-mass stick which is developed based on the modal properties of a GTSTRUDL shell element FEM of the dome.

A single-mass rigid stick, of which the base is connected to the main stick at elevation +123 ft, 4-1/4 inches where the crane rail is located, is used to represent the polar crane. During normal operation, the polar crane is parked on the circular crane rail with the crane bridge oriented in the 0-180° direction (global Y-direction) and the main trolley and secondary trolley are parked on the zero and 180° end, respectively, of the crane bridge. The lumped mass of the SDOF oscillator is located at the center of mass of the crane assembly. The estimated location of the center of mass of the crane assembly is at elevation +141 ft, 1 inches and eccentric from the vertical axis of the containment by 13 ft, 1-1/2 inches in the positive global Y (Plant 0°) direction. The mass of the crane rail is combined with the lumped mass at elevation +123 ft, 4-1/4 inches of the containment stick.

Figure 3.7.2-12 — Stick Model STICK-3T for Reactor Containment - Perspective View, shows the stick model, STICK-3T, of the containment with the polar crane assembly represented by a rigid single-mass stick. The stick model, in the absence of the polar crane assembly, is tuned by adjusting only the section properties of the portion of the stick representing the cylindrical wall. Dynamic compatibility of the adjusted stick model with the solid element FEM of the containment shown in Figure 3.7.2-8, in the absence of the polar crane assembly, is demonstrated in Figure 3.7.2-41 — Stick vs. FEM Spectrum Comparison at Elev. +190 ft, 3-1/2 inches (+58.00m) - Containment Dome Apex (Without Polar Crane), Figure 3.7.2-42 — Stick vs. FEM

Spectrum Comparison at Elev. +190 ft, 3-1/2 inches (+58.00m) - Containment Dome Apex (Without Polar Crane), and Figure 3.7.2-43 — Stick vs. FEM Spectrum Comparison at Elev. +190 ft, 3-1/2 inches (+58.00m) - Containment Dome Apex (Without Polar Crane) and Figure 3.7.2-44 — Stick vs. FEM Spectrum Comparison at Elev. +123 ft, 4-1/4 inches (+37.60m) - Containment Building (Without Polar Crane), Figure 3.7.2-45 — Stick vs. FEM Spectrum Comparison at Elev. +123 ft, 4-1/4 inches (+37.60m) - Containment Building (Without Polar Crane), and Figure 3.7.2-46 — Stick vs. FEM Spectrum Comparison at Elev. +123 ft, 4-1/4 inches (+37.60m) - Containment Building (Without Polar Crane), which compare the five percent damping response spectrum between the two models without the polar crane, at the apex of the dome (elevation +190 ft, 3-1/2 inches) and at the circular crane rail support (elevation +123 ft, 4-1/4 inches). The GTSTRUDL and ANSYS codes are used in the modal time history analysis of the stick model and FEM, respectively. The input seismic ground motions are the same as those used previously in the tuning of the stick model, STICK-2T, for the balance of NI Common Basemat Structures.

Table 3.7.2-2 shows the frequencies and modal mass ratios of the first 16 modes of the fixed-base tuned stick model, STICK-3T, which includes the mass of the circular crane rail and the rigid single-mass stick representation of the polar crane assembly. Because the mass of the crane assembly is relatively small compared to that of the Containment Building, the seismic response of the containment is not expected to be sensitive to the modeling of the polar crane assembly. A parametric study is performed to verify the sufficiency of representing the crane assembly with a rigid single-mass stick model. This is done by comparing the five percent damping response spectrum envelope generated from the stick model, STICK-3T, with the corresponding spectrum envelope generated from a modified stick model in which the rigid single-mass stick for the crane assembly is replaced by a flexible one. In the absence of well documented frequencies for the polar crane assembly, the flexible crane assembly is conservatively assumed to have a frequency coincident with the fundamental mode frequency of the containment in each of the three directions. According to Table 3.7.2-2, the fundamental mode frequency of the stick model STICK-3T is about 4.7, 4.9, and 12.0 Hz for vibration in the global X, Y, and Z direction, respectively. Figure 3.7.2-47 — Spectrum Comparison at Elev. +123 ft, 4-1/4 inches (+37.60m) - Containment Building (Rigid vs. Flexible Polar Crane), Figure 3.7.2-48 — Spectrum Comparison at Elev. +123 ft, 4-1/4 inches (+37.60m) - Containment Building (Rigid vs. Flexible Polar Crane), and Figure 3.7.2-49 — Spectrum Comparison at Elev. +123 ft, 4-1/4 inches (+37.60m) - Containment Building (Rigid vs. Flexible Polar Crane) compare the five percent damping response spectrum envelopes for the two stick models at elevation +123 ft, 4-1/4 inches. The comparison establishes the sufficiency of the rigid polar crane representation in STICK-3T because it gives a more conservative response spectrum envelope at elevation +123 ft, 4-1/4 inches for use as the seismic input to the design of the polar crane assembly.

(3) Stick Model STICK-1T for Fixed Base Reactor Building Internal Structures

This stick model is developed using the GTSTRUDL code and is fixed at its base at elevation -21 ft., 4 inches. It is split into two sticks at and above elevation +63 ft, 11-3/4 inches because the two SG compartments are separated from each other except for a few miscellaneous walls and slabs that form a minor structural coupling between the two. The two split sticks are taken to be symmetrically located with respect to the Y-Z plane although they may have slightly different section properties and masses. As usual, rigid horizontal beams are used to link the lumped masses to the sticks where they are not coincidentally located. The only exception is taken at elevation +63 ft, 11-3/4 inches where the lumped mass is connected to the lower ends of the two split sticks of the SG compartments with horizontal flexible beams. In addition, a horizontal flexible beam is used to connect the lumped masses on the split sticks at each of the two higher elevations, +79 ft, 0-3/4 inches and +93 ft, 6 inches. Figure 3.7.2-13 — Stick Model STICK-1T for Reactor Building Internal Structure - Perspective View and Figure 3.7.2-9 show the GTSTRUDL code stick model, STICK-1T, and the ANSYS code FEM, respectively, of the fixed base RBIS.

The section properties of the vertical stick elements are adjusted and the flexible horizontal beams at and above elevation +63 ft, 11-3/4 inches are estimated, on a trial-and-error basis, to ensure a reasonable compatibility between the stick model and FEM. The sufficiency of the stick model is established by a comparison of the four percent damping ISRS envelopes between the concrete-only stick model and FEM at two representative elevations, +63 ft., 11-3/4 inches (at upper lateral supports for the SGs) and +16 ft, 10-3/4 inches (at support for the RPV). The input ground motions are the three components of synthetic time histories for the EUR Hard motion. Note that the response spectrum envelope at elevation +63 ft, 11-3/4 inches represents the envelope of the spectra at eight locations (i.e., four each for each SG compartment). The spectrum envelope in each given direction at elevation +16 ft, 10-3/4 inches represents the envelope of the spectra at four locations that are 90° apart from each other around the RPV support. The GTSTRUDL and ANSYS codes are used in the modal time history analysis of the stick model and FEM, respectively. Figure 3.7.2-50 — Spectrum Comparison at Elev. +63 ft, 11-3/4 inches (+19.50m) - Reactor Building Internal Structure, Figure 3.7.2-51 — Spectrum Comparison at Elev. +63 ft, 11-3/4 inches (+19.50m) - Reactor Building Internal Structure, Figure 3.7.2-52— Spectrum Comparison at Elev. +63 ft, 11-3/4 inches (+19.50m) - Reactor Building Internal Structure, Figure 3.7.2-53 — Spectrum Comparison at Elev. +16 ft, 10-3/4 inches (+5.15m) - Reactor Building Internal Structure, Figure 3.7.2-54 — Spectrum Comparison at Elev. +16 ft, 10-3/4 inches (+5.15m) - Reactor Building Internal Structure, and Figure 3.7.2-55 — Spectrum Comparison at Elev. +16 ft, 10-3/4 inches (+5.15m) - Reactor Building Internal Structure, show the spectrum comparison.

Table 3.7.2-3 shows the frequencies and modal mass ratios of the first 30 modes of STICK-1T with all applicable masses included.

(4) Simplified Stick Model for Reactor Coolant System

Figure 3.6.3-1 shows a plan view of the configuration of the RCS. A simplified stick model of the RCS is developed for the purpose of the SSI analysis of the NI Common Basemat Structures. The simplified stick model is shown in Figure 3.7.2-56. The simplified stick model is coupled to appropriate nodal locations of the stick model, STICK-1T, of the RBIS. The modal frequencies of the simplified RCS stick model are shown in Table 3.7.2-4.

(5) Stick Model for NAB

The stick model for the NAB is developed in a manner similar to that for the NI Common Basemat Structures. Dynamic compatibility between the stick model and 3D FEM is ensured by comparing the ISRS generated at selected locations for both models. Figure 3.7.2-66 — Elevation View of NAB Stick Model in X-Z Plane and Figure 3.7.2-67 — Elevation View of NAB Stick Model in Y-Z Plane, show elevation views of the stick model in the global X-Z and Y-Z plane, respectively.

3.7.2.3.2 Seismic Category I Structures – Not on Nuclear Island Common Basemat

Unlike the stick model approach utilized for the NI Common Basemat Structures and NAB, 3D FEM's for the EPGB and ESWB are developed with GTSTRUDL code, Version 27, for use in both the equivalent static analysis and SSI analysis. For SSI analysis, the GTSTRUDL FEM's are translated to a format suitable for the Bechtel code SASSI 2000, Version 3.1.

The reinforced concrete base mat, floor slabs, and walls of both structures are modeled in GTSTRUDL using shell elements, SBHQ6 and SBHT6, to accurately represent the structure and calculate both in-plane and out-of-plane effects from applied loads. For the EPGB, modifications are made to the slab stiffness at elevation +51 ft, 6 inches to accurately represent the stiffness of composite beams. For the ESWB, two additional modeling features are used:

- Space frame elements are used to simulate the fill support beams and the distribution header supports.
- Rigid water mass, calculated in accordance with the procedure in ASCE 4-98, Reference 1 and ACI 350.3 (Reference 3), is lumped on the appropriate basin walls. Both low water and high water level are separately considered.

Figure 3.7.2-57 — Isometric View of GTSTRUDL FEM for Emergency Power Generating Building and Figure 3.7.2-58 — Section View of GTSTRUDL FEM for Emergency Power Generating Building illustrate an isometric view and a section view of the 3D FEM of the EPGB. Figure 3.7.2-59 — Isometric View of GTSTRUDL FEM for Emergency Service Water Building and Figure 3.7.2-60 — Section View of GTSTRUDL FEM for Emergency Service Water Building, depict the 3D FEM of the ESWB.

For walls and slabs, adjustment is made to account for cracked section properties. Specifically, a value of $0.5E_c$ is typically used to determine out-of-plane stiffness of these concrete walls and floors. There remains the possibility that the wall stiffness may be between the fully cracked and uncracked conditions. To bound the dynamic response in the SSI analysis, SDOF out-of-plane oscillators based on uncracked section properties are included in the SASSI model at the center of selected slabs and walls.

3.7.2.3.3 Seismic Category II Structures

The seismic analysis and design of Seismic Category II structures and members meets the requirements for Seismic Category I structures and members.

3.7.2.3.4 Conventional Seismic (CS) Structures

The analysis and design of Conventional Seismic building structures shall be in accordance with the applicable requirements of the International Building Code (IBC) (Reference 4). Structural interaction between Conventional Seismic building structures that have the potential to interact with Seismic Category I structures is evaluated to provide reasonable assurance they do not impact or affect the functioning of Seismic Category I SSCs under SSE and tornado load conditions using the criteria presented in Section 3.7.2.8.

3.7.2.4 Soil-Structure Interaction

The SSI analysis of the NI Common Basemat Structures and NAB are performed using the AREVA computer code SASSI, Version 4.1B, for the generic soil cases specified in Table 3.7.1-6. The free-field input motion to the SSI analysis is the certified seismic design response spectra (CSDRS) previously described in Section 3.7.1.1.1 for the seismic design of NI Common Basemat Structures.

For EPGB and ESWB, Bechtel computer code SASSI 2000, Version 3.1, is used in the seismic SSI analysis. The free-field input motion to the SSI analysis is the modified CSDRS described in Section 3.7.1.1.1 and illustrated in Figure 3.7.1-30. The modified CSDRS accounts for the approximate structure-soil-structure interaction (SSSI) effect of the NI Common Basemat Structures on the free-field motions at the locations of these structures, and is developed based on the results of the SSI analysis of the NI Common Basemat Structures and NAB.

Methodology for the SSI analysis of the NI Common Basemat Structures and NAB, EPGB and ESWB is discussed in the following.

3.7.2.4.1 Step 1 - Selection of Generic Soil Profiles

The ten generic soil profiles previously specified in Table 3.7.1-6 are considered representative of potential sites in the central and eastern United States (CEUS). They are Soil Cases 1u to 5u, 5a, 1n2u, 2sn4u, 2n3u, and 3r3u ranging from soft soil to medium soil to hard rock conditions. Case 5a is intended to simulate the hypothetical condition of a hard rock approaching a rigid foundation medium. Table 3.7.2-9 —Soil Properties Associated with Different Generic Shear Wave Velocities, lists the soil properties associated with the various shear wave velocities considered in the generic soil profiles. For US EPR design certification, the generic soil properties are taken to be strain-compatible values during seismic events. Column 2 of Table 3.7.1-6 shows the free-field input motion associated with each of the ten generic soil cases considered in the SSI analysis of the NI Common Basemat Structures and NAB. Each generic soil case is associated with one of the three free-field input motions except that Soil Cases 2u and 4u are associated with two different input motions, giving rise to a total of twelve SSI analysis cases for the NI Common Basemat Structures and NAB. Figure 3.7.1-31 and Figure 3.7.1-32 illustrate the shear wave velocity profiles of the ten generic soil cases.

The same ten generic soil cases are considered in the SSI analysis of the EPGB and ESWB, and the modified CSDRS is the common free-field input motion in all soil cases.

3.7.2.4.2 Step 2 - Development of Models for Structures and Basemat

(1) NI Common Basemat Structures and NAB

Development of the lumped-mass stick models for the NI Common Basemat Structures has previously been described in Section 3.7.2.3.1.2. There are three major sticks: STICK-1T for the reinforced concrete RBIS, STICK-3T for the pre-stressed concrete RCB, and STICK-2T for the seven remaining reinforced concrete structures on the common basemat. These three major stick models are structurally uncoupled from each other except through the reinforced concrete basemat. The bases of structural sticks are at the respective tops of the concrete basemat.

According to the guidelines of ASCE 4-98, Reference 1, Section 3.3.1.6, the basemat may be taken to be rigid as far as the SSI analysis is concerned. This is especially true in view of the thickness of the basemat. Thus the basemat is represented by a stick model consisting of horizontal rigid beams at the top elevations of the basemat to connect the bases of the various NI sticks to a centrally located vertical rigid beam. The lower end of the vertical rigid beam is connected to the rigid beam grids over the footprint of the basemat at the bottom elevation, -38 ft, 10-1/2 inches, of the basemat at Node 417.

Figure 3.7.2-61 — Plan View of NI Common Basemat Structures and Stick Model, shows the plan view of the stick model representing the NI Common Basemat Structures and basemat. The bottom node, Node 417, of the stick model, is at elevation -38 ft, 10-1/2 inches and is centrally located on a grid of rigid horizontal beams spanning the footprint of the NI Common Basemat Structures. Nodes on the rigid beam grid serve the function of soil-structure interaction nodes in the SSI analysis model. Figure 3.7.2-62 — Plan View of SSI Model for NI Common Basemat Structures and NAB, shows the NI Common Basemat Structures stick model and the rigid-beam basemat grid as a part of the SSI analysis model for the NI Common Basemat Structures and NAB. Figure 3.7.2-63 — Elevation View of SSI Model for NI Common Basemat Structures and NAB in X-Z Plane, shows the elevation view of the NI Common Basemat Structures stick model and basemat grid on the surface of the schematic soil model.

The RCS components are represented by the simplified stick model previously shown in Figure 3.7.2-56 and discussed above. The simplified stick model is coupled to the stick model, STICK-1T, of the RBIS at the appropriate locations. The coupled stick models of the RBIS and RCS are shown in Figure 3.7.2-65 — RCS Stick Coupled to Model STICK-1T for Reactor Building Internal Structure.

The vent stack is a welded steel thin-wall cylindrical structure. It is 99 ft, 5 inches tall, has an outer diameter of 12 ft, 5-1/2 inches, and is mounted on the roof of the FB shield structure at elevation +111 ft, 6-1/2 inches of the composite stick model, STICK-2T, for the balance-of-NI Common Basemat Structures. The stack is modeled as a stick having four equal beam elements in the SSI analysis of the NI Common Basemat Structures. The total mass of the vent stack is negligibly small when compared to the lumped mass located at the roof elevation of the stick model for the FB shield structure. Table 3.7.2-5 lists the frequencies and modal mass ratios calculated using the GTSTRUDL code for the first 256 modes of the fixed-base stick model of the NI Common Basemat Structures. These 256 modes include the first 90 modes of the coupled stick models for the RBIS and RCS as well as the first 16 modes of the stick model for the reactor containment. The remaining modes belong to the stick models of the vent stack and balance-of- NI Common Basemat Structures. The modal properties of the containment stick correspond to those of STICK-3T previously shown in Table 3.7.2-2.

Figure 3.7.2-66 and Figure 3.7.2-67 show elevation views of the stick model of the NAB structure, which is connected to Node 930 centrally located on the grid of horizontal rigid beams representing the bottom of the NAB basemat. Figure 3.7.2-62 shows the plan view of the grid which, for the purpose of the SSI analysis, is taken to be at the same elevation, -38 ft, 10-1/2 inches, as that for the bottom of the NI Common Basemat. Table 3.7.2-6 lists the frequencies and modal mass ratios calculated using the GTSTRUDL code for the first 25 modes of the fixed-base stick model of the NAB structure.

Structural damping values used in the SSI analysis are based on Table 3.7.1-1:

- Reinforced concrete (RBIS, balance-of-NI Common Basemat Structures and NAB) – 7 percent.
- Prestressed concrete (containment) – 5 percent.
- RCS components – 4 percent.
- Vent stack – 4 percent.

As an option noted previously in Section 3.7.2.3.1.1, the 3D FEM of the NI Common Basemat Structures or a dynamically compatible simplified 3D FEM may be used in lieu of the stick models in the SSI analysis.

(2) EPGB and ESWB

Section 3.7.2.3.2 describes the development of the GTSTRUDL code 3D FEM of the structure, the translation of the FEM to that suitable for the Bechtel SASSI 2000 code, and the addition of SDOF oscillators to the FEM to simulate out-of-plane flexibility of selected slabs and walls. Table 3.7.2-7 and Table 3.7.2-8 show the frequencies computed by GTSTRUDL for the 3D FEM of the EPGB and ESWB, respectively.

Both EPGB and ESWB are reinforced concrete structures. A structural damping equal to 4 percent is conservatively used in the SSI analysis.

3.7.2.4.3 Step 3 - Development of Soil Model

To develop the soil model for use in the SSI analysis with the SASSI code, each of the ten generic soil profiles is discretized into a sufficient number of sub-layers, followed by a uniform half space beneath the lowest sub-layer. The soil properties of the sub-layers corresponding to different generic shear wave velocities are shown in Table 3.7.2-9. Generic soil cases 1n2u and 2n3u consist of a top soil layer within which the shear wave velocity increases linearly with depth. In such cases, the soil properties are linearly interpolated accordingly.

As discussed in Section 3.7.2.4.4, the NI Common Basemat Structures and NAB are analyzed as surface-founded structures and structural embedment is ignored in the SSI analysis. The surface of the soil model is placed at elevation -38 ft, 10-1/2 inches which corresponds to the bottom of the NI Common Basemat. For the SSI analysis of the EPGB and ESWB, the surface of the soil model is at the grade (elevation 0 ft, 0 inches).

3.7.2.4.4 Step 4 - Development of SSI Analysis Model

(1) NI Common Basemat Structures and NAB

The footprint of the NI Common Basemat is similar to a cross, being about 357.61 ft wide in the global X-direction and about 341.2 ft long in the global Y-direction. The area of the footprint is approximately 77,339 ft^2 (see Figure 3.7.2-64 — Schematic Footprint Area of NI Common Basemat). The radius of an equivalent circle having the same area is:

$$R_e = [77{,}339/\pi]^{1/2} = 156.82 \text{ ft}$$

The maximum depth of embedment of the NI Common Basemat is 41.34 ft. The embedment ratio is 41.34 ft/156.82 ft = 0.26. According to the guidelines of ASCE 4-98, Reference 1, Section 3.3.4.2.4, the effect of the structural embedment on the seismic SSI response of the NI Common Basemat Structures may be ignored because the embedment ratio is less than 0.30. In addition, the portions of the NI Common Basemat adjacent to the NAB and Access Building are only slightly embedded. Thus, in the SSI analysis model, the NI Common Basemat Structures and basemat are taken to be a surface founded structure and the surface of the soil profile is taken to be at elevation -38 ft, 10-1/2 inches. For the NAB, the two sides adjacent to the NI Common Basemat are unembedded, the side adjacent to the Radwaste Building, depending on its final design, may not be fully embedded, and only the south side is fully embedded. Thus, for the SSI analysis it is sufficient to take the NAB to be also surface founded and to take the bottom of the NAB basemat to be at the same elevation as that of the NI Common Basemat Structures.

The SSI analysis model is established by coupling the stick models for both the NI Common Basemat Structures and NAB with the surface of each of the ten generic soil models described in Step 3, at all nodes on the rigid-beam grids at elevation -38 ft, 10-1/2 inches that represent the bottom faces of the NI Common Basemat Structures and NAB basemats. With consideration of the soil profile and control motion combinations of Table 3.7.1-6, this gives rise to a total of twelve SSI analysis models. Figure 3.7.2-62 shows a plan view of the SSI analysis model. The surrounding Seismic Category I structures, EPGB and ESWB, are much lighter than the NI Common Basemat Structures. It is expected that, through the soil, the SSI of the NI Common Basemat Structures will have some effects on the free-field seismic ground motions at these structures. To capture such effects, simple grids of massless rigid beams representing the footprints of these surrounding structures are placed at the respective plan locations on the soil surface of the SSI analysis model. The soil surface response motions at the footprints of the surrounding structure are extracted from the SSI analysis of the NI Common Basemat Structures and NAB to serve as the basis for developing the free-field input motion for the SSI analysis of the surrounding structures.

Figure 3.7.2-63 shows an elevation view of the SSI model (NAB stick is not shown for clarity) in the X-Z plane, which includes a schematic soil model, to illustrate (a) the discretized sub-layering of the soil and the underlying half space in the soil model, (b) the interaction coupling between the soil model and NI Common Basemat Structures/ NAB basemats, and (c) the interaction coupling between the soil and the other rigid grids representing the massless footprints of the surrounding structures.

(2) EPGB and ESWB

Similarly, the SSI analysis models for EPGB and ESWB are established by coupling the 3D FEM of the structure with each of the soil models for the ten generic soil profiles. The surface of the soil models is at grade (elevation 0 ft, 0 inches). The EPGB is surface founded, and the bottom face nodes of the FEM basemat are coupled to the soil model at the surface. For the ESWB, the exterior walls and basemat bottom of the 3D FEM are embedded in the soil model.

3.7.2.4.5 Step 5 - Performing SSI Analysis

The SSI analysis of the NI Common Basemat Structures and NAB is performed using the AREVA code, SASSI. SASSI code performs the analysis in the frequency domain using the complex frequency response analysis method and then outputs the seismic responses in the time domain. One analysis is performed for each of the twelve SSI analysis cases resulting from the combination of the ten generic soil profiles and the three CSDRS design ground motions.

Similarly, the SSI analysis of the EPGB and ESWB is performed using the Bechtel code SASSI 2000. One SSI analysis is performed for each of the ten generic soil profiles, and the modified CSDRS is the input motion at the surface of the soil model for the EPGB and at the basemat elevation of the soil model for the ESWB.

3.7.2.4.6 Step 6 - Extracting Global Seismic SSI Responses

(1) NI Common Basemat Structures and NAB

The SSI analyses of the NI Common Basemat Structures generate the global seismic responses of the NI Common Basemat Structures of all of the twelve SSI analysis cases. In each analysis case, the analysis is performed for one component of the input motion at a time, and it outputs the time histories of the requested seismic responses (floor accelerations, member forces and moments, etc.) to the particular component of input motion. To account for the contributions from the three components of input motion to the floor acceleration response, the three output time histories for the floor acceleration in a given global direction and at a given location are algebraically summed to produce the total floor acceleration response time history in the corresponding global direction. The ZPA is the maximum amplitude of the total floor acceleration time history in the corresponding global direction. For global member forces and moments, only the maximum values are usually needed. In this case, the STRESS module of SASSI code is used to output the maximum global member force/ moment due to each input motion component. The maximum collinear member forces/moments due to the three input motion components are then combined by the square-root-of-sum-of-squares (SRSS) rule to obtain the global maximum total member forces/moments. In addition, as discussed in Section 3.7.2.5 below, the in-structure response spectra (ISRS) for the floor acceleration time histories at specified locations are computed using AREVA code RESPEC, Version 1.1A.

At each given elevation along the individual stick model, the worst ZPA at the lumped mass location and building corners is taken to be the ZPA representative of the particular SSI analysis case. They are shown in Table 3.7.2-10— Reactor Containment Building ZPAs to Table 3.7.2-17 — Fuel Building Shield Structure ZPAs, for the sticks for the NI Common Basemat Structures. Each table presents the individual worst ZPAs from the twelve SSI analysis cases as well as the envelope of the worst ZPA's. Table 3.7.2-18 — Maximum Base Forces and Moments at Bottom of NI Common Basemat, shows the maximum base forces and moments at the bottom face (elevation -38 ft, 10.53 inches) of the common basemat for the individual SSI analysis cases. Among the twelve SSI analysis cases, five cases are the most critical as far as ZPAs and base forces and moments for the NI Common Basemat Structures are concerned. These five cases are: 2n3um, 2sn4um, 3r3um, 4um, and 5ah. Table 3.7.2-19 — Worst Case Inter-Story Forces and Moments in Reactor Building Internal Structures to Table 3.7.2-25 — Worst Case Inter-Story Forces and Moments in Safeguard Building 2/3 Shield Structure, show the worst case inter-story forces and moments in the members of the individual sticks for the NI Common Basemat Structures.

The time history of the displacement at the NI Common Basemat relative to the input ground motion is determined by double integrating the acceleration response time history at the basemat Node 417, applying a linear baseline correction, and subtracting from it the displacement time history of the free field ground motion for each SSI analysis case. Table 3.7.2-26 — Maximum NI Common Basemat Displacement Relative to Free Field Input Motion, lists the peak relative displacement at Node 417 for all twelve SSI analysis cases. The maximum relative displacement at a given structural location in the NI Common Basemat Structures with respect to the basemat is conservatively taken from the equivalent static analysis of the FEM of the NI Common Basemat Structures described in Section 3.8.4.

(2) EPGB and ESWB

From the nodal acceleration response time histories generated from the SSI analysis, maximum nodal accelerations in each given global direction and due to each of the three components of the input ground motion are extracted. For each of the ten generic soil cases, the extracted maximum nodal accelerations are used to compute the weighted averaged maximum nodal accelerations in each direction and due to each ground motion component at each given elevation for the entire floor or for different regions on the floor. The weighting factors used in the averaging process are the applicable nodal masses. In each direction, the averaged maximum nodal accelerations due to the three ground motion components are then combined using the (1.0, 0.4, 0.4) factor rule to determine the combined average maximum nodal acceleration in the given direction. Such maximum nodal accelerations represent the seismic loads used in the equivalent static analysis of the structure. Table 3.7.2-27 — Worst Case Maximum Accelerations in EPGB and Table 3.7.2-28 — Worst Case Maximum Accelerations in ESWB, show the worst case maximum ZPAs at different elevations of the EPGB and ESWB, respectively.

As discussed in Section 3.8.4.4.3 and Section 3.8.4.4.4, subsequent analyses will incorporate certain design details for the EPGBs and ESWBs that are not reflected in the existing respective SASSI models used for the SSI analyses described in Section 3.7.2. The subsequent analyses will determine the impact of these design details on the seismic responses and ISRS presented in Section 3.7.2.

3.7.2.4.7 Step 7 – Determining Amplified Seismic Responses for Flexible Slabs and Walls

(1) NI Common Basemat Structures

A concrete slab or wall in the NI Common Basemat Structures is considered flexible when the frequency of its first out-of-plane vibration mode is less than 40 Hz assuming uncracked concrete condition. Subsequent to the SSI analysis of the NI Common Basemat Structures, modal time history analyses using the GTSTRUDL code are performed for those SDOF oscillators simulating the first out-of-plane vibration mode of the flexible slabs or walls in the NI Common Basemat Structures. Input motions to the modal time history analyses are the floor acceleration time histories output from the SSI analyses at the applicable slab or wall locations. Since the flexible slabs and walls are reinforced concrete elements, the damping ratio of the SDOF oscillators is taken to be seven percent of critical.

Each flexible slab or wall in the NI Common Basemat Structures is assumed to respond in both un-cracked and cracked condition for out-of-plane vibration. The effective moment of inertia, I_c, of the slab or wall in cracked condition is taken to be 0.5 times the un-cracked, or gross, moment of inertia, I_g. Thus the out-of-plane vibration frequency of the cracked slab or wall is equal to 0.707 times that of the uncracked slab or wall. Generation of response spectra for the flexible slabs and walls in the NI Common Basemat Structures are discussed in Section 3.7.2.5.

(2) EPGB and ESWB

The out-of-plane seismic responses of flexible slabs and walls are directly available from the SSI analysis because the meshing of the 3D FEM of the structure is sufficient to represent the flexible slabs and walls in cracked condition while the SDOF oscillators added to the 3D FEM simulate the un-cracked condition. Generation of response spectra for the flexible slabs and walls are discussed in Section 3.7.2.5.

3.7.2.5 Development of Floor Response Spectra

The ISRS for the U.S. EPR Seismic Category I structures are developed following the guidance in RG 1.122, Revision 1. They are calculated for 2 percent, 3 percent, 4 percent, 5 percent, 7 percent and 10 percent damping.

(1) NI Common Basemat Structures and NAB

For NI Common Basemat Structures and NAB, the floor acceleration response time histories in a given direction due to the three components of input motion are combined algebraically to produce the combined floor acceleration time history in the same direction, from which the ISRS in the corresponding direction is then computed. The ISRS are calculated using AREVA code RESPEC, Version 1.1A, at the following 79 frequencies:

Frequency Range (Hz)	Frequency Increment (Hz)
0.2 to 3.0	0.10
3.0 to 3.6	0.15
3.6 to 5.0	0.20
5.0 to 8.0	0.25
8.0 to 15.0	0.50
15.0 to 18.0	1.00
18.0 to 22.0	2.00
22.0 to 40.0	3.00
50 to 100	50.0

The above frequencies for ISRS generation comply with the guidelines set forth in Table 3.7.1-1 of SRP Section 3.7.1 in Reference 2. At each given structural elevation along the stick models, ISRS at the lumped mass point and building corner nodes (typically four corner nodes) are calculated for each SSI analysis case. The envelope of the ISRS at these locations represents the ISRS at the particular structural elevation for the SSI particular analysis case. The ISRS from the twelve SSI analysis cases are enveloped, and the spectrum envelope is broadened by ±15 percent and smoothed to account for uncertainty anticipated in the structural modeling and SSI analysis techniques.

(2) EPGB and ESWB

Response spectra are calculated using Bechtel computer code SASSI 2000, Version 3.1, at a total of 241 frequencies from 0.2 to 50 Hz, with 100 frequencies per decade that are uniformly spaced in the log scale. At each given direction and location in the structural model, response spectra are first computed separately for the floor acceleration response time histories due to the three components of input ground motion. The three resulting response spectra are then combined using the SRSS method to produce the ISRS in the corresponding direction and at the given structural location. The ISRS from all ten generic soil cases are then enveloped, and the ISRS envelope is broadened by ±15 percent and smoothed to account for uncertainty anticipated in the structural modeling and SSI analysis techniques.

Results of the Response Spectrum Development

The results of the response spectrum development are presented below for the NI Common Basemat Structures, EPGB and ESWB separately:

(1) NI Common Basemat Structures

Figure 3.7.2-68 — Response Spectra at NI Common Basemat Bottom Node 417 - 5% Damping, Figure 3.7.2-69 — Response Spectra at NI Common Basemat Bottom Node 417 - 5% Damping, and Figure 3.7.2-70 — Response Spectra at NI Common Basemat Bottom Node 417 - 5% Damping, show the ISRS at Node 417, the center bottom node of NI Common Basemat at elevation -38 ft, 10-1/2 inches, for five percent damping for the individual SSI analysis cases. No spectrum peak broadening and smoothing is applied.

Figure 3.7.2-71 — Soil Model Surface Response Spectra at Centers of Footprints of EPGB and ESWB - 5% Damping, Figure 3.7.2-72 — Soil Model Surface Response Spectra at Centers of Footprints of EPGB and ESWB - 5% Damping, and Figure 3.7.2-

73 — Soil Model Surface Response Spectra at Centers of Footprints of EPGB and ESWB - 5% Damping, show the 5 percent damping response spectra of the response motions from all twelve SSI analysis cases at the soil model surface (i.e., elevation -38 ft, 10-1/2 inches) at the center nodes of the footprints of EPGB 1 and 2 and ESWB 1 to 4. These response spectra are used as the basis for developing the modified CSDRS discussed in Section 3.7.1.1.1 for use as seismic input to the SSI analysis of the EPGB and ESWB.

The listed figures show the peak-broadened and smoothed ISRS envelopes at representative locations of the NI Common Basemat Structures.

- RBIS
  - Elevation +16 ft., 10-3/4 inches. See Figure 3.7.2-74 — Spectrum Envelope of Reactor Building Internal Structure - Elev. +16 ft, 10-3/4 inches (+5.15m) 2%, 3%, 4%, 5%, 7% and 10% Damping, Figure 3.7.2-75 — Spectrum Envelope of Reactor Building Internal Structure - Elev. +16 ft, 10-3/4 inches (+5.15m) 2%, 3%, 4%, 5%, 7% and 10% Damping, and Figure 3.7.2-76 — Spectrum Envelope of Reactor Building Internal Structure - Elev. +16 ft, 10-3/4 inches (+5.15m) 2%, 3%, 4%, 5%, 7% and 10% Damping.
  - Elevation +63 ft, 11-3/4 inches. See Figure 3.7.2-77 — Spectrum Envelope of Reactor Building Internal Structure - Elev. +63 ft, 11-3/4 inches (+19.50m) 2%, 3%, 4%, 5%, 7% and 10% Damping, Figure 3.7.2-78 — Spectrum Envelope of Reactor Building Internal Structure - Elev. +63 ft, 11-3/4 inches (+19.50m) 2%, 3%, 4%, 5%, 7% and 10% Damping, and Figure 3.7.2-79 — Spectrum Envelope of Reactor Building Internal Structure - Elev. +63 ft, 11-3/4 inches (+19.50m) 2%, 3%, 4%, 5%, 7% and 10% Damping.
- SB 1
  - Elevation +26 ft, 7 inches. See Figure 3.7.2-80 — Spectrum Envelope of Safeguard Building 1 - Elev. +26 ft, 3 inches (+8.10m) 2%, 3%, 4%, 5%, 7% and 10% Damping, Figure 3.7.2-81 — Spectrum Envelope of Safeguard Building 1 - Elev. +26 ft, 3 inches (+8.10m) 2%, 3%, 4%, 5%, 7% and 10% Damping, and Figure 3.7.2-82 — Spectrum Envelope of Safeguard Building 1 - Elev. +26 ft, 3 inches (+8.10m) 2%, 3%, 4%, 5%, 7% and 10% Damping.
  - Elevation +68 ft, 10-3/4 inches. See Figure 3.7.2-83 — Spectrum Envelope of Safeguard Building 1 - Elev. +68 ft, 10-3/4 inches (+21.00m) 2%, 3%, 4%, 5%, 7% and 10% Damping, Figure 3.7.2-84 — Spectrum Envelope of Safeguard Building 1 - Elev. +68 ft, 10-3/4 inches (+21.00m) 2%, 3%, 4%, 5%, 7% and 10% Damping, and Figure 3.7.2-85 — Spectrum Envelope of Safeguard Building 1 - Elev. +68 ft, 10-3/4 inches (+21.00m) 2%, 3%, 4%, 5%, 7% and 10% Damping.
- SBs 2 and 3

  - Elevation +26 ft, 7 inches. See Figure 3.7.2-86 — Spectrum Envelope of Safeguard Building 2&3 - Elev. +26 ft, 7 inches (+8.10m) 2%, 3%, 4%, 5%, 7% and 10% Damping, Figure 3.7.2-87 — Spectrum Envelope of Safeguard Building 2&3 - Elev. +26 ft, 7 inches (+8.10m) 2%, 3%, 4%, 5%, 7% and 10% Damping, and Figure 3.7.2-88 — Spectrum Envelope of Safeguard Building 2&3 - Elev. +26 ft, 7 inches (+8.10m) 2%, 3%, 4%, 5%, 7% and 10% Damping.

  - Elevation +50 ft, 6-1/4 inches. See Figure 3.7.2-89 — Spectrum Envelope of Safeguard Building 2&3 - Elev. +50 ft, 6-1/4 inches (+15.40m) 2%, 3%, 4%, 5%, 7% and 10% Damping, Figure 3.7.2-90 — Spectrum Envelope of Safeguard Building 2&3 - Elev. +50 ft, 6-1/4 inches (+15.40m) 2%, 3%, 4%, 5%, 7% and 10% Damping, and Figure 3.7.2-91 — Spectrum Envelope of Safeguard Building 2&3 - Elev. +50 ft, 6-1/4 inches (+15.40m) 2%, 3%, 4%, 5%, 7% and 10% Damping.

- SB 4

  - Elevation +68 ft, 10-3/4 inches. See Figure 3.7.2-92 — Spectrum Envelope of Safeguard Building 4 - Elev. +68 ft, 10-3/4 inches (+21.00m) 2%, 3%, 4%, 5%, 7% and 10% Damping, Figure 3.7.2-93 — Spectrum Envelope of Safeguard Building 4 - Elev. +68 ft, 10-3/4 inches (+21.00m) 2%, 3%, 4%, 5%, 7% and 10% Damping, and Figure -3.7.2-94 — Spectrum Envelope of Safeguard Building 4 - Elev. +68 ft, 10-3/4 inches (+21.00m) 2%, 3%, 4%, 5%, 7% and 10% Damping.

- RCB

  - Elevation +123 ft, 4-1/4 inches. See Figure 3.7.2-95 — Spectrum Envelope of Containment Building - Elev. +123 ft, 4-1/4 inches (+37.60m) 2%, 3%, 4%, 5%, 7% and 10% Damping, Figure 3.7.2-96 — Spectrum Envelope of Containment Building - Elev. +123 ft, 4-1/4 inches (+37.60m) 2%, 3%, 4%, 5%, 7% and 10% Damping. and Figure -3.7.2-97 — Spectrum Envelope of Containment Building - Elev. +123 ft, 4-1/4 inches (+37.60m) 2%, 3%, 4%, 5%, 7% and 10% Damping.

  - Elevation +190 ft, 3-1/2 inches. See Figure 3.7.2-98 — Spectrum Envelope of Containment Building - Elev. +190 ft, 3-1/2 inches (+58.00m) 2%, 3%, 4%, 5%, 7% and 10% Damping, Figure 3.7.2-99 — Spectrum Envelope of Containment Building - Elev. +190 ft, 3-1/2 inches (+58.00m) 2%, 3%, 4%, 5%, 7% and 10% Damping. and Figure 3.7.2-100 — Spectrum Envelope of Containment Building - Elev. +190 ft, 3-1/2 inches (+58.00m) 2%, 3%, 4%, 5%, 7% and 10% Damping).

(2) EPGB and ESWB

Figure 3.7.2-101— Spectrum Envelope of EPGB at Elev. +0 ft, 0 inches at Node 1172 2%, 3%, 4%, 5%, 7% and 10% Damping, Figure 3.7.2-102 — Spectrum Envelope of EPGB at Elev. +0 ft, 0 inches at Node 1172 2%, 3%, 4%, 5%, 7% and 10% Damping, and Figure 3.7.2-103 — Spectrum Envelope of EPGB at Elev. +0 ft, 0 inches at Node

1172 2%, 3%, 4%, 5%, 7% and 10% Damping, show the peak-broadened and smoothed ISRS envelopes at Node 1172 on elevation +0 ft, 0 inches of the EPGB.

Figure 3.7.2-104 — Spectrum Envelope of ESWB at Elev +63 ft, 0 inches at Node 12733 2%, 3%, 4%, 5%, 7% and 10% Damping, Figure 3.7.2-105 — Spectrum Envelope of ESWB at Elev +63 ft, 0 inches at Node 12733 2%, 3%, 4%, 5%, 7% and 10% Damping, Figure 3.7.2-106 — Spectrum Envelope of ESWB at Elev +63 ft, 0 inches at Node 12733 2%, 3%, 4%, 5%, 7% and 10% Damping, Figure 3.7.2-107 — Spectrum Envelope of ESWB at Elev +14 ft, 0 inches at Node 10385 2%, 3%, 4%, 5%, 7% and 10% Damping, Figure 3.7.2-108 — Spectrum Envelope of ESWB at Elev +14 ft, 0 inches at Node 10385 2%, 3%, 4%, 5%, 7% and 10% Damping, and Figure 3.7.2-109 — Spectrum Envelope of ESWB at Elev +14 ft, 0 inches at Node 10385 2%, 3%, 4%, 5%, 7% and 10% Damping, show the peak-broadened and smoothed ISRS envelopes at Node 12733 on elevation +63 ft, 0 inches and Node 10385 on elevation +14 ft, 0 inches of the ESWB.

As discussed in Section 3.8.4.4.3 and Section 3.8.4.4.4, subsequent analyses will incorporate certain design details for the EPGBs and ESWBs that are not reflected in the existing respective SASSI models used for the SSI analyses described in Section 3.7.2. The subsequent analyses will determine the impact of these design details on the seismic responses and ISRS presented in Section 3.7.2.

3.7.2.6 Three Components of Earthquake Motion

(1) NI Common Basemat Structures and NAB

As previously stated in Section 3.7.2.4.6, the floor acceleration time history in a given direction is obtained by algebraically combining the three corresponding time histories due to the three earthquake components. Therefore, both the floor ZPA and the ISRS for the floor acceleration time history properly account for the contributions from the three components of earthquake motion. For member forces and moments in the stick models, the STRESS module of SASSI code outputs the maximum member force/moment in the stick model due to each earthquake motion component. The maximum member forces/moments due to the three earthquake motion components are then combined by the SRSS rule to obtain the maximum total member force/moment. The use of the SRSS rule is consistent with the guidelines specified in RG 1.92, Revision 2.

(2) EPGB and ESWB

As previously stated in Section 3.7.2.4.6, the ZPA of the floor acceleration time histories in a given direction due to the three earthquake motion components are combined using the (1.0, 0.4, 0.4) rule. The response spectra for the floor acceleration time histories in a given direction due to the three earthquake motion components are combined using the SRSS rule to determine the combined ISRS. The (1.0, 0.4, 0.4) rule is also consistent with the guidelines specified in RG 1.92, Revision 2.

3.7.2.7 Combination of Modal Responses

When the response spectrum method of analysis is used, the maximum modal responses are combined using one of the methods specified in RG 1.92, Section C, Revision 2. Such combination methods include the grouping method, ten percent method and double sum methods, and they consider the effects of closely spaced modes having frequencies differing from each other by 10 percent or less of the lower frequency.

The effect of missing mass for modes not included in the analysis is accounted for by calculating the residual seismic load equal to the ZPA on the input response spectrum times the missing mass. The residual seismic load is added to the combined modal response determined from the response spectrum method of analysis.

3.7.2.8 Interaction of Non-Seismic Category I Structures with Seismic Category I Structures

Figure 1.2-1 and Figure 3B-1 show the layout of structures for a typical U.S. EPR standard plant. The potential for seismic-induced interaction between Seismic Category I structures and non-seismic Category I structures is assessed to verify the ability of Seismic Category I SSCs to perform their safety functions. The basis for the seismic interaction assessment guidelines given below is the prevention of structure-to-structure impact.

- The collapse of the non-Category I structure does not cause the non-Category I structure to strike a Category I SSC.
- The collapse of the non-Category I structure does not impair the integrity of seismic Category I SSCs, nor result in incapacitating injury to control room occupants.
- Conventional Seismic structures that have the potential to interact with Seismic Category I structures are assessed for collapse potential under SSE and tornado loading (acting independently). Seismic demand for the SSE is computed in accordance with ASCE 4-98, Reference 1 and the methodologies in Section 3.7.2. Seismic load combinations are developed in accordance with ASCE 43-05 (Reference 5), using a limiting acceptable condition for the structure characterized as short of collapse, but structurally stable (i.e., Seismic Design Category 5 - Limit State A) as specified in the Standard.
- For Conventional Seismic structures that have the potential to interact with Seismic Category I structures, the combined seismic deflection is less than the separation distance (i.e., gap) between the structures.
- In the case where damage to Category I SSCs cannot be precluded by the criteria above, the structure is classified as Seismic Category II and designed to the same criteria as Seismic Category I structures.

The seismic interaction criteria and assessment guidelines are summarized in Table 3.7.2-29 —Seismic Structural Interaction Criteria for Building Structures. The Vent Stack, NAB, Access Building (AB), and the Turbine Building (TB) are Conventional Seismic structures that have potential to interact with the NI Common Basemat Structures. Results of the seismic interaction assessment for those structures are presented below, with associated discussions of the Radioactive Waste Processing Building (RWPB) and Fire Protection Storage Tanks and Building.

Vent Stack

The vent stack is described in Section 3.7.2.4.2 as a steel structure approximately 100 ft high located on top of the stair towercase structure between the FB and SB 4 (see Figure 3B-1). The vent stack is classified as Seismic Category II and designed to the same requirements as Seismic Category I structures. The stack is also designed for design basis tornado loading. Therefore, the vent stack has no potential for adverse interaction with the NI Common Basemat Structures.

Nuclear Auxiliary Building

Figure 3B-1 shows that the separation gap between the Nuclear Auxiliary Building and the NI Common Basemat Structures is a minimum of 18 in. An evaluation of the potential for seismic interaction between the NAB and the NI Common Basemat Structures indicates that the maximum relative displacement, based on absolute values, between the two structures is slightly less than 9 in, or approximately one-half of the separation distance. The seismic induced displacements of NI Common Basemat Structures and NAB are calculated from a series of nonlinear analyses on finite element models of each structure with reduced degrees of freedom. The NI Common Basemat Structures and the NAB are modeled with five degrees of freedom each, consisting of three translations and two rotations (about the horizontal X-X and Y-Y axes). The reduced degree of freedom models capture the predominant structural and soil deformation modes, namely lateral displacements and rocking. The values of the masses, springs and dampers, as well as the geometry, are derived from the detailed finite element models of the respective structures.

To provide sufficient design margin to prevent collapse or unacceptable performance under SSE loading, the design forces and moments for critical structural elements of the NAB are modified in accordance with the guidance of Reference 5. A reduction in the forces and moments due to seismic effects is taken using an inelastic energy absorption factor (F_μ) from Table 5-1 of ASCE 43-05 (Reference 5) for reinforced concrete shear walls. The inelastic energy absorption factor is based on the Limit State A criterion of ASCE 43-05 where permanent distortion, short of collapse, is permitted. The factor is for seismic design criteria and, hence, no reduction in force and moments is taken for other load cases including tornado effects. The F_μ factor is applied to tension, in-plane shear, and out-of-plane bending moment. A value of $F_\mu = 2$ is adopted for in-plane bending moments and shear in conjunction with axial tension. Per Section C5.1.2.3 of ASCE 43-05, a value of $F_{\mu} = 1$ is used for out-of-plane shear in conjunction with axial tension. For elements subjected to combined axial force and bending, a value of $F_{\mu} = 2$ is only applied to moment. Applicable provisions and design criteria for RS structures are also applied in finalizing the design.

Access Building

[[The separation gaps between the AB and SBs 3 and 4 is 0.98 ft and 1.31 ft, respectively (see Figure 3B-1).]] The walls of the AB are not physically connected to the SBs except through crossovers (passageways) providing access to the SBs. SB 3 is protected by the aircraft hazard (ACH) shield wall which not only protects the structure but also isolates control room personnel from adverse impact effects. SB 4 is not protected by the ACH shield wall. The seismic interaction assessment of the AB confirms that the separation gaps between SBs 3 and 4 are sufficient to preclude interaction. The crossover passageways are designed to accommodate the differential displacements without imparting unacceptable loads to the supporting structures.

Turbine Building

[[The separation between the TB and NI Common Basemat Structures is approximately 30 ft (see Figure 3B-1).]] Seismic interaction between the TB and NI Common Basemat Structures is prevented through application of the following design approach, which is also summarized in Table 3.7.2-29.

- Design of the TB to the requirements of the International Building code, which invokes ACI 318 (Reference 6) for concrete structures.
- Use of AISC specification, “Seismic Provisions for Structural Steel Buildings (ANSI/AISC 341),” (Reference 7) for lateral load-carrying steel bracing. (This follows the guidance in ANSI/AISC 360, “Specifications for Structural Steel Buildings,” (Reference 7) for use of AISC 341 in a ‘High Seismic Application’ (Reference 9).
- Use of Appendix 11A, “Quality Assurance Provisions,” of ASCE Standard 7-05 for QA requirements for the lateral bracing system (Reference 9).

Structural collapse under SSE loading is prevented by using the limiting acceptance criteria of ASCE 43-05, Seismic Design Category 5 - Limit State A.

In addition, crossovers from the TB to the NI Common Basemat Structures are supported primarily by the walls or roof of the ACH shield structure. Seismic interaction through the crossover is between the TB and the ACH shield structure rather than with SBs 2 and 3. Design measures limit the interaction forces between the NI Common Basemat Structures and TB transmitted through the crossover structures. The ACH shield structure and design measures isolate control room personnel from adverse effects of the interaction forces generated through the crossover structures.

Radioactive Waste Processing Building

The RWPB has no significant potential to seismically interact with either the NI Common Basemat Structures or with the nearest Seismic Category I structure not on the common basemat (i.e., the EPGB) therefore, the RWPB is not evaluated for SSE. The NAB is located between the RWPB and the NI Common Basemat Structures and shields the NI Common Basemat Structures from potential interaction. Both the NAB and RWPB are classified as RS structures and are designed for the standard plant 1/2 SSE using criteria in RG 1.143 for RW-IIa structures. The resulting designs are ductile designs with inherent margin against catastrophic collapse under SSE. In addition, this same robust design provides inherent margin against progressive collapse of the NAB caused by seismic interaction with the RWPB. In addition, the evaluation of the NAB itself for seismic interaction with the NI Common Basemat Structures under SSE loading is described above. Therefore, the NAB shields the NI Common Basemat Structures from any adverse effect of collapse of the RWPB.

Potential interaction between the RWPB and EPGB is precluded by separation and by design and site selection and foundation design criteria for the RWPB. The RWPB is embedded over 31.5 ft below grade and has a clear height above grade of +52.5 ft, while the clearance between the RWPB and EPGB is 52.06 ft (see Figure 3B-1). Therefore, the separation between the two is only 5.28 in. less than the height above grade of the RWPB. Failure of the RWPB in such a manner as to strike the EPGB is not considered credible due to the separation distance and because of the seismic design for 1/2 SSE loading described above. In addition, site selection and foundation design criteria for the U.S. EPR standard plant ensure that the RWPB is founded on competent soils, while the embedded section 31.5 ft below grade provides additional stabilization against rotation.

Fire Protection Storage Tanks and Buildings

The Fire Protection Storage Tanks and Buildings are classified as Conventional Seismic Structures. RG 1.189 requires that a water supply be provided for manual firefighting in areas containing equipment for safe plant shutdown in the event of a SSE. Therefore, the fire protection storage tanks and building are designed to provide system pressure integrity under SSE loading conditions. Seismic load combinations are developed in accordance with the requirements of ASCE 43-05 using a limiting acceptance condition for the structure characterized as essentially elastic behavior with no damage (i.e., Limit State D) as specified in the Standard.

3.7.2.9 Effects of Parameter Variations on Floor Response Spectra

Uncertainties in seismic modeling, due to such items as uncertainties in material properties, mass properties, concrete cracking under normal loading, and structural and soil modeling techniques can affect the accuracy of floor response spectra calculated using any of the approaches for seismic analysis presented in Section 3.7.2.1. To compensate for the effect of these uncertainties, the ISRS for U.S. EPR Seismic Category I structures are broadened by ±15 percent. These broadened ISRS are used in the subsequent design of structural elements of those structures, including flexible floors and walls.

3.7.2.10 Use of Constant Vertical Static Factors

Vertical seismic loads are generated from the SSI analysis for use in the seismic design of U.S. EPR Seismic Category I structures and Seismic Category II structures. Therefore, there is no need for the use of constant vertical static factors in the design of those structures.

3.7.2.11 Method Used to Account for Torsional Effects

Torsional effects due to the eccentricity built into the stick models or 3D FEM of the structures are accounted for during the seismic SSI analysis. Additional seismic loads due to accidental torsion are accounted for as required by Standard Review Plan, Section 3.7.2, Seismic System Analysis, paragraph II.11 (Reference 2) and in ASCE 4-98, Reference 1. This is to account for uncertainties in material densities, member sizes, architectural variations, equipment loads, etc., from design assumptions. Due to these potential uncertainties, an additional torsional moment is introduced into the design and evaluation of structural members.

For the NI Common Basemat Structures, the additional torsional moment at a particular elevation is calculated as the story inertia force in each horizontal direction of interest times a moment arm equal to five percent of the building plan dimension in the perpendicular direction. Results due to the story inertia forces in both horizontal directions are summed to produce the total additional torsional moment at the particular elevation. For design purposes, this torsional moment is taken to be resisted by only selected major shear walls, and a simplified 3D FEM is developed for each of the NI Common Basemat Structures which includes only the selected shear walls. The additional torsional moment at each given elevation is applied to all wall nodes at the same elevation, constrained like a rigid diaphragm, of the simplified FEM to determine the additional design shear forces in the selected shear walls.

For the EPGB and ESWB, the additional torsional moment at a particular elevation is calculated as the story inertia force in each horizontal direction of interest times a moment arm equal to five percent of the building plan dimension in the perpendicular direction. This additional torsional moment due to the story inertia force in the given direction is converted into equivalent nodal inertial forces acting on the particular elevation where each equivalent nodal inertial force is proportional to the product of the nodal mass and the distances from the node to the shear center of the walls immediately below the elevation of interest. Equivalent nodal forces corresponding to the additional torsional moment due to the story inertia force in the other horizontal direction are calculated in the similar manner. The equivalent nodal forces at all applicable elevations are applied to the 3D FEM of the structure in the equivalent static analysis to determine the additional element forces and moments due to the accidental torsion.

3.7.2.12 Comparison of Responses

The response spectrum method is used in only the local seismic analysis of selected slabs in the NAB and not in the seismic analysis and design of the Seismic Category I structures. Comparison of responses between the response spectrum method and a time history analysis method is not applicable.

3.7.2.13 Methods for Seismic Analysis of Category I Dams

See Section 3.7.3.13.

3.7.2.14 Determination of Dynamic Stability of Seismic Category I Structures

Overturning of the common basemat of the NI Common Basemat Structures due to a seismic event, or other hazards such as aircraft, does not occur due to the inherent stability offered by its foundation dimensions and thickness. Section 3.8.5 describes specific details related to overturning analysis cases and factors of safety for the U.S. EPR structures.

3.7.2.15 Analysis Procedure for Damping

Section 3.7.1.3 describes the damping ratios used for seismic analysis of the SSCs for the U.S. EPR. These damping values are summarized in Table 3.7.1-1 as a percentage of critical damping. For the modal time history analysis applied both to the concrete-only stick models and FEM for the purpose of tuning the stick models and to the SDOF oscillators representing out-of-plane vibration of the flexible slabs and walls, only one single modal damping is required and calculation of composite modal damping is not required. For the SSI analysis of structures, the complex frequency response method does not require the computation of composite modal damping although the SSI analysis model consists of stick models and soil models having different damping values.

3.7.2.16 References

1. ASCE Standard 4-98, "Seismic Analysis of Safety-Related Nuclear Structures and Commentary," American Society of Civil Engineers, September 1986.

2. NUREG-0800, "Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants," Nuclear Regulatory Commission, March 2007.

3. ACI 350.3-06, "Seismic Design of Liquid-Containing Concrete Structures," American Concrete Institute, 2006.

4. IBC-2006 International Code Council, International Building Code, 2006 Edition.

5. ASCE/SEI 43-05, "Seismic Design Criteria for Structures, Systems, and Components in Nuclear Facilities," American Society of Civil Engineers, 2005.

6. ACI 318-05, "Building Code Requirements for Structural Concrete and Commentary," American Concrete Institute, 2005.

7. ANSI/AISC 341, "Seismic Provisions for Structural Steel Buildings," American National Standards Institute/American Institute of Steel Construction, 2005.

8. ANSI/AISC 360, "Specifications for Structural Steel Buildings," American National Standards Institute/American Institute of Steel Construction, 2005.

9. ASCE Standard 7-05, "Minimum Design Loads for Buildings and Other Structures," Appendix 11A, "Quality Assurance Provisions," American Society of Civil Engineers, January 1, 2006.

Table 3.7.2-1—Frequencies and Modal Mass Ratios for Balance-of-NI Common Basemat Structures STICK-2T with All Masses Included Sheet 1 of 2

Mode	Frequency	Modal Participating Mass Ratios		
No.	(Hz)	X	Y	Z
1	4.05	0.000	0.520	0.000
2	4.22	0.422	0.000	0.000
3	4.49	0.000	0.003	0.000
4	4.54	0.000	0.002	0.000
5	4.55	0.000	0.000	0.000
6	4.55	0.000	0.000	0.000
7	4.55	0.000	0.000	0.000
8	4.55	0.000	0.000	0.000
9	4.58	0.000	0.000	0.000
10	4.59	0.000	0.000	0.000
11	4.60	0.000	0.000	0.000
12	4.60	0.000	0.000	0.000
13	4.60	0.000	0.000	0.000
14	4.69	0.000	0.123	0.000
15	4.74	0.001	0.000	0.000
16	4.76	0.103	0.000	0.000
17	5.18	0.000	0.005	0.000
18	5.19	0.000	0.071	0.000
19	5.60	0.129	0.004	0.000
20	5.62	0.013	0.003	0.000
21	5.97	0.064	0.006	0.000
22	6.08	0.002	0.020	0.000
23	6.50	0.000	0.000	0.030
24	6.76	0.001	0.000	0.000
25	6.78	0.000	0.000	0.000
26	6.79	0.000	0.000	0.000
27	6.79	0.000	0.000	0.000
28	6.79	0.000	0.000	0.000
29	6.79	0.000	0.000	0.000

Mode	Frequency	Modal Participating Mass Ratios		
No.	(Hz)	X	Y	Z
56	10.77	0.000	0.000	0.022
57	11.39	0.000	0.022	0.000
58	11.42	0.018	0.000	0.000
59	12.04	0.000	0.003	0.000
60	12.54	0.000	0.051	0.000
61	12.83	0.000	0.014	0.001
62	13.19	0.000	0.016	0.001
63	13.39	0.000	0.003	0.000
64	13.68	0.018	0.000	0.037
65	14.10	0.000	0.004	0.014
66	14.20	0.001	0.001	0.036
67	14.36	0.005	0.000	0.096
68	14.88	0.041	0.000	0.001
69	15.10	0.001	0.000	0.006
70	15.14	0.003	0.000	0.000
71	15.71	0.000	0.010	0.005
72	15.78	0.000	0.000	0.000
73	16.27	0.000	0.001	0.001
74	16.65	0.000	0.005	0.000
75	16.78	0.000	0.000	0.014
76	17.49	0.000	0.001	0.070
77	18.06	0.001	0.001	0.000
78	18.09	0.000	0.000	0.000
79	18.18	0.007	0.001	0.001
80	18.21	0.001	0.001	0.001
81	18.32	0.000	0.007	0.000
82	18.43	0.000	0.000	0.001
83	18.49	0.001	0.000	0.005
84	18.58	0.001	0.000	0.000

Table 3.7.2-1—Frequencies and Modal Mass Ratios for Balance-of-NI Common Basemat Structures STICK-2T with All Masses Included Sheet 2 of 2

Mode	Frequency	Modal Participating Mass Ratios		
No.	(Hz)	X	Y	Z
30	6.79	0.000	0.000	0.000
31	6.80	0.000	0.000	0.000
32	6.80	0.000	0.000	0.000
33	6.80	0.000	0.000	0.000
34	6.92	0.000	0.000	0.022
35	7.01	0.003	0.000	0.000
36	7.10	0.000	0.000	0.000
37	7.30	0.000	0.000	0.061
38	7.50	0.017	0.000	0.000
39	8.01	0.004	0.000	0.000
40	8.46	0.001	0.007	0.000
41	8.84	0.002	0.000	0.000
42	8.97	0.034	0.000	0.006
43	8.97	0.000	0.000	0.000
44	8.98	0.000	0.000	0.000
45	8.99	0.000	0.000	0.000
46	8.99	0.000	0.000	0.000
47	9.01	0.000	0.000	0.027
48	9.23	0.000	0.000	0.039
49	9.24	0.002	0.000	0.025
50	9.28	0.001	0.000	0.071
51	9.40	0.009	0.000	0.147
52	9.49	0.000	0.000	0.004
53	9.76	0.003	0.000	0.100
54	10.06	0.000	0.000	0.001
55	10.20	0.000	0.012	0.000

Mode	Frequency	Modal Participating Mass Ratios		
No.	(Hz)	X	Y	Z
85	19.31	0.010	0.000	0.000
86	19.33	0.001	0.000	0.000
87	20.21	0.000	0.005	0.000
88	20.33	0.000	0.001	0.005
89	20.62	0.000	0.005	0.000
90	21.08	0.002	0.000	0.000
91	21.64	0.000	0.002	0.007
92	21.98	0.000	0.008	0.000
93	22.09	0.004	0.000	0.000
94	22.21	0.002	0.001	0.000
95	22.40	0.001	0.000	0.000
96	22.83	0.001	0.002	0.000
97	23.73	0.001	0.000	0.017
98	23.76	0.013	0.000	0.001
99	24.07	0.000	0.000	0.000
100	24.25	0.001	0.000	0.000
101	24.44	0.000	0.003	0.000
102	24.80	0.003	0.000	0.000
103	25.42	0.000	0.000	0.000
104	26.04	0.000	0.010	0.000
105	26.53	0.000	0.002	0.000
106	26.72	0.003	0.001	0.000
107	26.84	0.003	0.002	0.000
108	26.98	0.001	0.000	0.000
109	27.98	0.000	0.002	0.000
110	28.65	0.001	0.000	0.000

Table 3.7.2-2—Frequencies and Modal Mass Ratios for Reactor Containment Building STICK-3T with Polar Crane Included

Mode No.	Frequency (Hz)	Modal Participating Mass Ratios		
		X	Y	Z
1	4.78	0.749	0.000	0.000
2	5.00	0.000	0.749	0.000
3	9.70	0.000	0.000	0.000
4	12.16	0.000	0.000	0.753
5	13.73	0.162	0.000	0.000
6	14.31	0.000	0.160	0.000
7	17.45	0.000	0.000	0.078
8	18.80	0.003	0.000	0.000
9	18.85	0.000	0.005	0.000
10	21.52	0.000	0.000	0.030
11	22.30	0.002	0.000	0.000
12	22.96	0.000	0.000	0.000
13	24.85	0.003	0.000	0.000
14	25.60	0.000	0.036	0.000
15	29.33	0.000	0.000	0.000
16	34.98	0.023	0.000	0.000

Table 3.7.2-3—Frequencies and Modal Mass Ratios for Reactor Building Internal Structures STICK-1T with All Masses Included

Mode No.	Frequency (Hz)	Modal Participating Mass Ratios		
		X	Y	Z
1	6.38	0.304	0.000	0.000
2	6.77	0.132	0.001	0.000
3	6.85	0.003	0.015	0.000
4	7.65	0.000	0.519	0.001
5	9.66	0.000	0.000	0.002
6	9.96	0.028	0.000	0.000
7	10.09	0.000	0.000	0.000
8	10.09	0.000	0.000	0.000
9	10.11	0.000	0.000	0.000
10	10.32	0.059	0.000	0.000
11	11.08	0.008	0.000	0.000
12	12.53	0.157	0.000	0.002
13	13.01	0.004	0.001	0.053
14	16.05	0.000	0.062	0.345
15	17.54	0.000	0.031	0.037
16	17.76	0.000	0.100	0.064
17	17.99	0.000	0.006	0.032
18	18.46	0.000	0.000	0.009
19	20.31	0.000	0.000	0.001
20	22.94	0.109	0.000	0.000
21	24.35	0.000	0.000	0.002
22	25.07	0.000	0.000	0.002
23	25.50	0.000	0.011	0.030
24	27.95	0.000	0.000	0.070
25	29.82	0.001	0.000	0.000
26	30.26	0.000	0.069	0.006
27	31.68	0.000	0.000	0.084
28	33.05	0.013	0.000	0.000
29	35.31	0.000	0.000	0.000
30	35.44	0.000	0.000	0.001

Table 3.7.2-4—Modal Frequencies of the Simplified Stick Model of Reactor Coolant Loop
Sheet 1 of 2

Mode Number	Frequency (Hz)	Mode Characterization
1	5.5562	SG
2	5.6042	SG
3	5.6103	SG
4	5.6106	SG
5	6.5902	SG
6	6.5907	SG
7	6.5913	SG
8	6.5914	SG
9	11.804	RC Pump
10	11.807	RC Pump
11	11.818	RC Pump
12	11.819	RC Pump
13	12.300	Piping (Crossover Leg)
14	13.383	RC Pump
15	13.428	RC Pump
16	13.428	RC Pump
17	13.481	RC Pump
18	13.534	RC Pump
19	13.541	RC Pump
20	13.542	RC Pump
21	13.752	RC Pump
22	14.006	RC Pump
23	14.028	RC Pump
24	14.030	RC Pump
25	14.231	RC Pump
26	14.496	Pressurizer
27	14.496	Pressurizer
28	15.280	RV
29	15.468	Piping (Crossover Leg)
30	15.469	Piping (Crossover Leg)
31	15.499	Piping (Crossover Leg)
32	15.531	SG

Table 3.7.2-4—Modal Frequencies of the Simplified Stick Model of Reactor Coolant Loop
Sheet 2 of 2

Mode Number	Frequency (Hz)	Mode Characterization
33	16.554	SG
34	16.601	SG
35	16.739	RV
36	17.063	RV
37	19.965	Piping (Crossover Leg)
38	20.798	Piping (Crossover Leg)
39	20.803	Piping (Crossover Leg)
40	20.807	Piping (Crossover Leg)
41	22.076	RV
42	22.611	Piping (Crossover Leg)
43	24.993	Piping (Crossover Leg)
44	24.997	Piping (Crossover Leg)
45	25.042	Piping (Crossover Leg)
46	25.164	Pressurizer
47	25.164	Pressurizer
48	25.454	Piping (Crossover Leg)
49	28.756	RC Pump
50	28.757	RC Pump

**Table 3.7.2-5—Modal Frequencies of the Stick Models of NI Common Basemat Structures and RCS
Sheet 1 of 9**

Mode No.	Freq (Hz)	Modal Mass Ratios X	Modal Mass Ratios Y	Modal Mass Ratios Z	RBI-RCS Modes	CTMT Modes	Balance of NI Modes
1	3.77	0.002	0.002	0.000			Vent Stack
2	3.79	0.001	0.003	0.000			Vent Stack
3	4.04	0.000	**0.386**	0.000			SB/SG1/SG4
4	4.22	**0.317**	0.000	0.000			SB/SG1/SG4
5	4.49	0.000	0.002	0.000			
6	4.54	0.000	0.001	0.000			
7	4.55	0.000	0.000	0.000			
8	4.55	0.000	0.000	0.000			
9	4.55	0.000	0.000	0.000			
10	4.55	0.000	0.000	0.000			
11	4.58	0.000	0.000	0.000			
12	4.59	0.000	0.000	0.000			
13	4.60	0.000	0.000	0.000			
14	4.60	0.000	0.000	0.000			
15	4.60	0.000	0.000	0.000			
16	4.68	0.000	**0.092**	0.000			BONI
17	4.70	**0.064**	0.000	0.000		1	
18	4.73	0.003	0.000	0.000			
19	4.76	**0.072**	0.001	0.000			SG23
20	4.91	**0.056**	0.000	0.000	1		
21	4.92	0.000	**0.061**	0.000		2	
22	5.17	0.000	0.001	0.000			
23	5.19	0.000	**0.055**	0.000			FB
24	5.40	0.000	0.000	0.000	2		
25	5.45	0.000	**0.021**	0.000	3		
26	5.56	0.000	**0.009**	0.000	4		
27	5.60	**0.093**	0.003	0.000			SB/FBsh
28	5.62	**0.012**	0.002	0.000			FB
29	5.65	0.001	0.000	0.000	5		
30	5.71	0.000	**0.031**	0.000	6		

Table 3.7.2-5—Modal Frequencies of the Stick Models of NI Common Basemat Structures and RCS
Sheet 2 of 9

Mode No.	Freq (Hz)	Modal Mass Ratios			RBI-RCS Modes	CTMT Modes	Balance of NI Modes
		X	Y	Z			
31	5.97	**0.049**	0.005	0.000			SG23sh/FBsh
32	6.08	0.002	**0.015**	0.000			SB
33	6.17	**0.023**	0.000	0.000	7		
34	6.20	0.000	0.002	0.000	8		
35	6.50	0.000	0.000	**0.023**			SG23
36	6.52	0.000	0.000	0.000	9		
37	6.54	0.000	0.000	0.000	10		
38	6.63	0.004	0.000	0.000	11		
39	6.76	0.000	0.000	0.000			
40	6.78	0.000	0.000	0.000			
41	6.79	0.000	0.000	0.000			
42	6.79	0.000	0.000	0.000			
43	6.79	0.000	0.000	0.000			
44	6.79	0.000	0.000	0.000			
45	6.79	0.000	0.000	0.000			
46	6.80	0.000	0.000	0.000			
47	6.80	0.000	0.000	0.000			
48	6.80	0.000	0.000	0.000			
49	6.92	0.000	0.000	**0.017**			SG23sh
50	7.01	0.002	0.000	0.000			
51	7.10	0.000	0.000	0.000			
52	7.20	0.000	**0.035**	0.000	12		
53	7.30	0.000	0.000	**0.045**			SG23
54	7.50	**0.012**	0.000	0.000			SG23sh
55	8.00	0.003	0.000	0.000			
56	8.45	0.001	0.005	0.000			
57	8.84	0.001	0.000	0.000			
58	8.96	**0.025**	0.000	0.004			SB/SG1/SG4
59	8.97	0.000	0.000	0.000			
60	8.98	0.000	0.000	0.000			

Table 3.7.2-5—Modal Frequencies of the Stick Models of NI Common Basemat Structures and RCS
Sheet 3 of 9

Mode No.	Freq (Hz)	Modal Mass Ratios			RBI-RCS Modes	CTMT Modes	Balance of NI Modes
		X	Y	Z			
61	8.99	0.000	0.000	0.000			
62	8.99	0.000	0.000	0.000			
63	9.00	0.000	0.000	0.020			SG23
64	9.16	0.014	0.000	0.000	13		
65	9.22	0.000	0.000	0.031			SG1/SG4/FBsh
66	9.24	0.002	0.000	0.018			FBsh
67	9.27	0.000	0.000	0.002	14		
68	9.28	0.001	0.000	0.052			BONI
69	9.40	0.006	0.000	0.108			BONI
70	9.49	0.000	0.000	0.003			
71	9.64	0.013	0.000	0.000	15		
72	9.68	0.000	0.000	0.000		3	
73	9.75	0.002	0.000	0.078			SB/SG1/SG4
74	10.06	0.000	0.000	0.000			
75	10.08	0.000	0.000	0.000	16		
76	10.09	0.000	0.000	0.000	17		
77	10.10	0.000	0.000	0.000	18		
78	10.20	0.000	0.009	0.000			
79	10.21	0.006	0.000	0.000	19		
80	10.77	0.000	0.000	0.017			FBsh
81	10.90	0.004	0.000	0.000	20		
82	11.38	0.000	0.016	0.000			SG1/SG4
83	11.41	0.013	0.001	0.000			SG23
84	11.52	0.000	0.002	0.018	21		
85	12.00	0.000	0.000	0.064		4	
86	12.04	0.000	0.003	0.000			
87	12.13	0.000	0.004	0.000	22		
88	12.31	0.000	0.000	0.000	23		
89	12.53	0.000	0.038	0.000			SG1/SB/SG23sh/ FBsh

Table 3.7.2-5—Modal Frequencies of the Stick Models of NI Common Basemat Structures and RCS
Sheet 4 of 9

Mode No.	Freq (Hz)	Modal Mass Ratios			RBI-RCS Modes	CTMT Modes	Balance of NI Modes
		X	Y	Z			
90	12.57	0.000	0.000	0.000	24		
91	12.69	0.000	0.003	0.003	25		
92	12.71	0.000	0.000	0.000	26		
93	12.74	0.000	0.000	0.002	27		
94	12.78	0.000	0.001	0.001	28		
95	12.82	0.000	0.000	0.000	29		
96	12.83	0.000	0.011	0.000			BONI
97	12.90	0.000	0.000	0.002	30		
98	12.90	0.000	0.000	0.000	31		
99	13.04	0.000	0.000	0.002	32		
100	13.11	0.000	0.002	0.033	33		
101	13.18	0.000	0.012	0.000			SG23
102	13.38	0.000	0.002	0.000	34		
103	13.39	0.000	0.002	0.002			
104	13.47	0.000	0.000	0.000	35		
105	13.51	0.000	0.000	0.000	36		
106	13.61	0.000	0.005	0.002	37		
107	13.66	0.013	0.000	0.029			FB
108	13.72	0.013	0.000	0.000		5	
109	13.96	0.000	0.000	0.001	38		
110	14.03	0.000	0.000	0.001	39		
111	14.09	0.000	0.003	0.014			BONI
112	14.19	0.001	0.001	0.031			FBsh
113	14.28	0.000	0.013	0.000		6	
114	14.34	0.004	0.000	0.060			FB
115	14.52	0.000	0.006	0.028	40		
116	14.82	0.000	0.000	0.000	41		
117	14.87	0.031	0.000	0.001			SG1/SG4/SB/ FBsh
118	15.09	0.000	0.000	0.004			

Table 3.7.2-5—Modal Frequencies of the Stick Models of NI Common Basemat Structures and RCS
Sheet 5 of 9

Mode No.	Freq (Hz)	Modal Mass Ratios			RBI-RCS Modes	CTMT Modes	Balance of NI Modes
		X	Y	Z			
119	15.13	0.002	0.000	0.000			
120	15.54	0.000	0.000	0.001	42		
121	15.62	0.000	0.000	0.000	43		
122	15.68	0.000	0.000	0.000	44		
123	15.69	0.000	0.001	0.000	45		
124	15.71	0.000	0.008	0.004			
125	15.78	0.000	0.000	0.000			
126	16.27	0.000	0.001	0.001			
127	16.37	0.000	0.000	0.000	46		
128	16.55	0.000	0.000	0.000	47		
129	16.65	0.000	0.003	0.000			
130	16.78	0.000	0.000	0.011			SB
131	16.90	0.000	0.000	0.000	48		
132	16.99	0.000	0.002	0.000	49		
133	17.00	0.000	0.003	0.001	50		
134	17.38	0.001	0.000	0.006		7	
135	17.45	0.000	0.000	0.055			SB/SG23sh
136	17.49	0.000	0.000	0.001	51		
137	17.78	0.000	0.000	0.000	52		
138	17.85	0.000	0.000	0.000	53		
139	17.93	0.000	0.000	0.000	54		
140	17.96	0.006	0.000	0.000	55		
141	18.06	0.001	0.000	0.000			
142	18.09	0.000	0.000	0.000			
143	18.15	0.000	0.001	0.001			
144	18.20	0.000	0.000	0.000			
145	18.31	0.001	0.005	0.000			
146	18.43	0.000	0.000	0.001			
147	18.48	0.000	0.000	0.003			
148	18.57	0.001	0.000	0.000			

Table 3.7.2-5—Modal Frequencies of the Stick Models of NI Common Basemat Structures and RCS
Sheet 6 of 9

Mode No.	Freq (Hz)	Modal Mass Ratios X	Modal Mass Ratios Y	Modal Mass Ratios Z	RBI-RCS Modes	CTMT Modes	Balance of NI Modes
149	18.79	0.000	0.000	0.000		8	
150	18.84	0.000	0.000	0.000		9	
151	19.27	0.015	0.000	0.000	56		
152	19.29	0.006	0.000	0.000			
153	19.32	0.002	0.000	0.000			
154	19.65	0.000	0.000	0.000	57		
155	19.81	0.000	0.000	0.000			
156	19.90	0.000	0.000	0.000			
157	20.21	0.000	0.003	0.000			
158	20.33	0.000	0.001	0.004			
159	20.63	0.000	0.003	0.000			
160	21.07	0.002	0.000	0.000			
161	21.47	0.000	0.000	0.002		10	
162	21.63	0.000	0.002	0.005			
163	21.77	0.000	0.002	0.007	58		
164	21.97	0.000	0.006	0.000			
165	22.09	0.003	0.000	0.000			
166	22.20	0.002	0.001	0.000			
167	22.26	0.000	0.000	0.000		11	
168	22.40	0.001	0.000	0.000			
169	22.46	0.000	0.000	0.002	59		
170	22.69	0.000	0.000	0.001	60		
171	22.83	0.001	0.001	0.000			
172	22.87	0.000	0.000	0.000		12	
173	22.92	0.001	0.000	0.000	61		
174	23.06	0.000	0.000	0.000	62		
175	23.36	0.000	0.000	0.005	63		
176	23.71	0.000	0.000	0.014			SG23
177	23.74	0.000	0.000	0.007	64		
178	23.75	0.010	0.000	0.001			

Table 3.7.2-5—Modal Frequencies of the Stick Models of NI Common Basemat Structures and RCS
Sheet 7 of 9

Mode No.	Freq (Hz)	Modal Mass Ratios			RBI-RCS Modes	CTMT Modes	Balance of NI Modes
		X	Y	Z			
179	24.05	0.000	0.000	0.000			
180	24.25	0.000	0.000	0.000			
181	24.44	0.000	0.002	0.000			
182	24.57	0.003	0.000	0.000		13	
183	24.79	0.002	0.000	0.000			
184	25.36	0.000	0.003	0.000		14	
185	25.41	0.000	0.006	0.001	65		
186	25.42	0.000	0.000	0.000			
187	25.50	0.000	0.000	0.000	66		
188	26.04	0.000	0.008	0.000			
189	26.46	0.000	0.003	0.002	67		
190	26.53	0.000	0.001	0.000			
191	26.72	0.002	0.001	0.000			
192	26.82	0.002	0.001	0.000			
193	26.98	0.000	0.000	0.000			
194	27.63	0.000	0.000	0.002	68		
195	27.70	0.000	0.000	0.000	69		
196	27.86	0.000	0.000	0.000	70		
197	27.96	0.000	0.002	0.000			
198	28.02	0.000	0.000	0.000	71		
199	28.43	0.001	0.000	0.000	72		
200	28.64	0.000	0.000	0.002	73		
201	28.65	0.001	0.000	0.000			
202	29.15	0.000	0.001	0.000			
203	29.26	0.000	0.000	0.000		15	
204	29.47	0.000	0.000	0.000			
205	29.50	0.000	0.000	0.000	74		
206	29.51	0.000	0.000	0.000	75		
207	29.56	0.000	0.000	0.000	76		
208	29.57	0.000	0.001	0.000	77		

Table 3.7.2-5—Modal Frequencies of the Stick Models of NI Common Basemat Structures and RCS Sheet 8 of 9

Mode No.	Freq (Hz)	Modal Mass Ratios			RBI-RCS Modes	CTMT Modes	Balance of NI Modes
		X	Y	Z			
209	29.60	0.001	0.002	0.001			
210	29.65	0.005	0.001	0.000			
211	29.74	0.000	0.000	0.009			SG1
212	30.02	0.000	0.000	0.000			
213	30.45	0.000	0.000	0.000	78		
214	30.49	0.001	0.000	0.000			
215	30.54	0.000	0.000	0.000	79		
216	30.58	0.000	0.000	0.000	80		
217	30.72	0.000	0.000	0.000			
218	30.74	0.000	0.000	0.000	81		
219	30.81	0.000	0.000	0.003			
220	30.88	0.000	0.000	0.000	82		
221	30.91	0.000	0.000	0.008			
222	31.28	0.000	0.000	0.001	83		
223	31.84	0.000	0.000	0.000			
224	32.04	0.000	0.000	0.000			
225	32.19	0.000	0.002	0.000			
226	32.24	0.000	0.000	0.000	84		
227	32.91	0.000	0.000	0.000			
228	33.34	0.001	0.000	0.000			
229	33.62	0.000	0.000	0.000	85		
230	33.72	0.003	0.000	0.000			
231	34.16	0.000	0.002	0.000	86		
232	34.35	0.000	0.001	0.000			
233	34.61	0.000	0.002	0.000			
234	34.71	0.000	0.000	0.005			
235	34.98	0.002	0.000	0.000		16	
236	35.30	0.000	0.000	0.001			
237	35.92	0.003	0.000	0.000			
238	36.44	0.000	0.002	0.000			

Table 3.7.2-5—Modal Frequencies of the Stick Models of NI Common Basemat Structures and RCS
Sheet 9 of 9

Mode No.	Freq (Hz)	Modal Mass Ratios			RBI-RCS Modes	CTMT Modes	Balance of NI Modes
		X	Y	Z			
239	36.52	0.000	0.000	0.003			
240	36.55	0.001	0.000	0.000			
241	36.84	0.001	0.000	0.000			
242	36.98	0.000	0.000	0.000			
243	37.64	0.000	0.000	0.000			
244	37.73	0.000	0.004	0.000			
245	37.99	0.001	0.001	0.000			
246	38.30	0.001	0.001	0.000			
247	38.43	0.004	0.000	0.000	87		
248	38.45	0.000	0.000	0.001	88		
249	38.55	0.000	0.000	0.000			
250	38.64	0.000	0.000	0.000			
251	38.93	0.000	0.000	0.000	89		
252	39.87	0.000	0.000	0.000			
253	40.03	0.000	0.000	0.000			
254	40.42	0.000	0.000	0.000			
255	40.85	0.000	0.000	0.000	90		
256	40.87	0.000	0.000	0.007			
	Sum	0.965	0.961	0.901			

Table 3.7.2-6—Modal Frequencies of the Stick Model of NAB

Mode No.	Frequency (Hz)	Modal Mass Ratios		
		X	Y	Z
1	4.24	0.000	0.636	0.002
2	4.96	0.601	0.000	0.000
3	7.54	0.044	0.002	0.000
4	10.65	0.001	0.201	0.051
5	12.90	0.207	0.002	0.018
6	14.33	0.009	0.009	0.582
7	19.06	0.001	0.034	0.042
8	19.33	0.003	0.003	0.036
9	19.50	0.000	0.026	0.057
10	20.58	0.019	0.000	0.001
11	23.89	0.046	0.003	0.000
12	24.47	0.003	0.024	0.001
13	29.48	0.006	0.003	0.000
14	30.49	0.002	0.018	0.000
15	31.58	0.009	0.001	0.000
16	34.25	0.000	0.000	0.041
17	35.92	0.013	0.002	0.001
18	36.29	0.009	0.006	0.001
19	37.19	0.003	0.001	0.000
20	40.41	0.001	0.000	0.010
21	42.11	0.000	0.000	0.053
22	43.05	0.004	0.000	0.001
23	43.58	0.001	0.000	0.001
24	44.95	0.000	0.015	0.000
25	49.54	0.000	0.004	0.000

**Table 3.7.2-7—Modal Frequencies of 3D FEM of Emergency Power Generating Building
Sheet 1 of 6**

Mode No.	Freq (Hz)	X % Participating Mass	Y % Participating Mass	Z % Participating Mass	Comments
1	10.72	0.00	0.00	74.99	Z Direction Global Mode
2	11.20	69.52	0.02	0.00	X Direction Global Mode
3	11.58	0.00	0.00	0.02	
4	12.24	0.00	0.00	0.01	
5	12.75	2.81	0.30	0.00	X Direction Global Drift
6	13.50	0.75	0.01	0.00	X Direction Global Drift
7	13.51	0.00	0.00	0.01	
8	13.84	2.64	0.21	0.00	X Direction Global Drift
9	14.47	0.00	0.00	0.17	
10	14.53	0.00	4.18	0.00	Local Response from Slabs
11	14.60	0.00	0.00	0.33	
12	15.14	0.00	0.18	0.00	
13	15.39	0.00	0.00	0.03	
14	15.57	0.38	0.01	0.00	
15	16.56	0.00	0.00	2.88	Local Response from Electrical Room & Walls
16	17.33	0.00	0.00	0.15	
17	17.58	0.05	35.91	0.00	Local Response from Slabs
18	18.20	0.00	0.00	0.09	
19	18.61	0.00	0.00	0.08	
20	19.17	0.00	0.34	0.00	
21	19.18	0.00	0.00	0.01	
22	19.64	1.82	2.20	0.00	Local Response from Wall & Slabs
23	21.12	0.00	0.00	0.07	

Table 3.7.2-7—Modal Frequencies of 3D FEM of Emergency Power Generating Building
Sheet 2 of 6

Mode No.	Freq (Hz)	X % Participating Mass	Y % Participating Mass	Z % Participating Mass	Comments
24	22.42	0.00	0.00	0.06	
25	23.06	0.44	0.24	0.00	
26	23.11	0.00	0.00	2.60	Local Response from Electrical Room & Walls
27	23.52	0.00	0.00	2.77	Local Response from Electrical Room & Walls
28	23.54	0.01	0.40	0.00	
29	24.09	0.00	0.00	0.02	
30	24.36	0.40	0.06	0.00	
31	24.57	0.00	0.00	0.09	
32	24.90	0.10	0.01	0.00	
33	25.36	0.00	0.00	0.02	
34	25.86	0.00	0.00	0.08	
35	25.97	0.14	0.28	0.00	
36	26.06	0.00	0.00	0.02	
37	26.26	0.10	0.00	0.00	
38	26.31	0.00	0.00	0.09	
39	26.74	0.00	0.00	0.35	
40	26.75	0.06	0.08	0.00	
41	26.93	0.02	0.06	0.00	
42	27.30	0.00	0.00	0.01	
43	27.52	0.00	0.00	0.27	
44	27.57	0.00	0.19	0.00	
45	28.17	0.11	0.00	0.00	
46	28.30	0.01	0.09	0.00	
47	28.31	0.00	0.00	0.28	
48	28.54	0.00	0.00	0.01	
49	28.59	0.87	0.01	0.00	Local Response from Walls

**Table 3.7.2-7—Modal Frequencies of 3D FEM of Emergency Power Generating Building
Sheet 3 of 6**

Mode No.	Freq (Hz)	X % Participating Mass	Y % Participating Mass	Z % Participating Mass	Comments
50	29.10	0.00	0.00	1.70	Local Response from Walls
51	29.69	0.00	0.00	0.05	
52	29.92	0.03	0.01	0.00	
53	30.66	0.51	0.52	0.00	Local Response from Walls & Slabs
54	30.83	0.35	0.35	0.00	
55	31.58	0.00	0.00	0.01	
56	31.65	0.00	0.09	0.00	
57	32.14	0.00	0.00	0.06	
58	32.28	0.46	0.91	0.00	Local Response from Slabs
59	32.73	0.00	0.00	0.02	
60	32.91	0.27	1.66	0.00	Local Response from Slabs
61	32.96	0.00	0.00	0.05	
62	33.19	0.00	0.00	0.08	
63	33.33	0.13	0.28	0.00	
64	33.51	0.24	0.13	0.00	
65	33.57	0.00	0.00	0.04	
66	33.97	0.00	0.00	0.01	
67	34.02	0.00	1.85	0.00	Local Response from Slabs
68	34.28	0.00	0.00	0.01	
69	34.57	0.05	1.56	0.00	Local Response from Slabs
70	34.60	0.00	0.00	0.08	
71	35.14	0.30	0.17	0.00	
72	35.72	0.43	0.91	0.00	Local Response from Slabs
73	35.75	0.00	0.00	0.05	

**Table 3.7.2-7—Modal Frequencies of 3D FEM of Emergency Power Generating Building
Sheet 4 of 6**

Mode No.	Freq (Hz)	X % Participating Mass	Y % Participating Mass	Z % Participating Mass	Comments
74	36.32	0.46	1.79	0.00	Local Response from Slabs
75	36.90	0.00	0.00	0.03	
76	37.04	0.00	0.00	0.15	
77	37.51	0.06	0.13	0.00	
78	37.57	0.00	0.00	0.00	
79	37.71	0.00	0.00	0.02	
80	37.82	0.00	0.00	0.03	
81	38.02	0.01	0.01	0.00	
82	38.60	0.00	0.00	0.05	
83	38.61	0.04	0.04	0.00	
84	38.72	0.00	0.03	0.00	
85	38.86	0.00	0.00	0.01	
86	39.01	0.01	0.03	0.00	
87	39.56	0.29	0.00	0.00	
88	39.69	0.00	0.00	0.14	
89	39.79	0.00	0.00	0.21	
90	40.02	0.07	0.05	0.00	
91	40.05	0.00	0.00	0.36	
92	40.25	0.00	0.00	0.07	
93	40.35	0.09	0.43	0.00	
94	40.58	0.03	0.01	0.00	
95	41.02	0.00	0.00	0.14	
96	41.06	016	0.85	0.00	Local Response from Slabs
97	41.54	0.00	0.00	0.00	
98	41.79	0.00	0.00	0.01	
99	42.24	0.02	7.67	0.00	Local Response from Slabs
100	42.32	0.00	0.00	0.13	
101	42.52	0.00	0.00	0.00	

Table 3.7.2-7—Modal Frequencies of 3D FEM of Emergency Power Generating Building
Sheet 5 of 6

Mode No.	Freq (Hz)	X % Participating Mass	Y % Participating Mass	Z % Participating Mass	Comments
102	42.71	0.01	0.26	0.00	
103	43.50	0.00	0.00	0.09	
104	43.51	0.05	0.11	0.00	
105	43.84	0.00	0.00	0.33	
106	44.96	0.00	0.00	0.13	
107	45.66	0.03	5.10	0.00	Local Response from Slabs
108	46.04	0.00	0.00	0.01	
109	46.50	0.84	1.08	0.00	Local Response from Wall & Slabs
110	46.75	1.27	0.02	0.00	Local Response from Walls
111	46.85	0.00	0.00	0.06	
112	47.02	0.00	0.00	0.01	
113	47.31	0.13	0.01	0.00	
114	47.37	0.00	0.00	0.01	
115	47.47	0.49	1.35	0.00	Local Response from Wall & Slabs
116	47.99	0.00	0.00	0.34	
117	48.04	0.04	0.00	0.00	
118	48.13	0.00	0.00	0.00	
119	48.53	0.13	0.18	0.00	
120	48.58	0.00	0.00	0.02	
121	48.85	0.10	1.13	0.00	Local Response from Wall & Slabs
122	48.88	0.00	0.00	0.00	
123	48.96	0.00	0.00	0.17	
124	49.01	0.09	0.54	0.00	Local Response from Wall & Slabs

Table 3.7.2-7—Modal Frequencies of 3D FEM of Emergency Power Generating Building
Sheet 6 of 6

Mode No.	Freq (Hz)	X % Participating Mass	Y % Participating Mass	Z % Participating Mass	Comments
125	49.24	0.00	0.45	0.00	
126	49.27	0.00	0.00	0.01	
127	49.98	0.33	0.99	0.00	Local Response from Wall & Slabs
128	50.20	0.04	0.13	0.00	
129	50.37	0.00	0.00	0.32	
130	50.46	0.09	0.14	0.00	
131	50.72	0.37	0.17	0.00	
132	50.73	0.00	0.00	0.00	
133	50.99	0.47	0.06	0.00	
134	51.17	0.00	0.00	0.06	
135	51.28	0.00	0.00	0.00	
136	51.49	0.00	0.00	0.00	
137	51.53	0.02	0.01	0.00	
138	51.56	0.06	0.09	0.00	
139	51.70	0.00	0.00	0.00	
140	51.82	0.01	0.01	0.00	

Note:

1. Y is in vertical direction for GTSTRUL FEM of EPGB.

Table 3.7.2-8—Modal Frequencies of 3D FEM of Emergency Service Water Building
Sheet 1 of 10

Mode No.	Frequency (Hz)	X % Participating Mass	Y % Participating Mass	Z % Participating Mass
1	6.670	0.00	0.00	**25.22**
2	6.855	0.00	0.00	0.84
3	7.209	**39.61**	0.06	0.00
4	7.597	0.00	0.00	0.00
5	7.605	0.00	0.00	0.00
6	7.646	0.00	0.00	0.00
7	7.653	0.00	0.00	0.00
8	7.717	0.00	0.00	0.00
9	7.723	0.00	0.00	0.02
10	7.796	0.00	0.00	**10.92**
11	7.797	0.00	0.00	0.00
12	7.803	0.00	0.00	0.00
13	7.876	0.00	0.00	0.00
14	7.882	0.00	0.00	0.02
15	7.945	0.01	0.00	0.00
16	7.951	0.00	0.00	0.00
17	8.002	0.00	0.00	0.00
18	8.008	0.00	0.00	0.00
19	8.039	0.25	0.00	0.00
20	8.043	0.00	0.00	0.00
21	8.078	0.00	0.00	0.00
22	8.083	0.00	0.00	0.03
23	9.151	0.09	0.00	0.00
24	9.190	0.00	0.00	0.02
25	9.228	0.00	0.00	0.09
26	9.288	0.00	0.00	0.14
27	9.294	0.00	0.00	0.00
28	9.296	0.01	0.00	0.00
29	9.335	0.00	0.00	0.00
30	9.337	0.00	0.00	0.00
31	9.341	0.00	0.00	0.00

Table 3.7.2-8—Modal Frequencies of 3D FEM of Emergency Service Water Building
Sheet 2 of 10

Mode No.	Frequency (Hz)	X % Participating Mass	Y % Participating Mass	Z % Participating Mass
32	9.344	0.00	0.00	0.00
33	9.346	0.00	0.00	0.00
34	9.347	0.00	0.00	0.00
35	9.355	0.00	0.00	0.00
36	9.357	0.00	0.00	0.00
37	9.362	0.00	0.00	0.00
38	9.364	0.00	0.00	0.00
39	9.368	0.00	0.00	0.00
40	9.368	0.00	0.00	0.00
41	9.373	0.00	0.00	0.01
42	9.391	0.00	0.00	0.05
43	9.473	0.06	0.00	0.00
44	9.649	0.03	0.85	0.00
45	9.723	4.83	0.00	0.00
46	9.763	0.02	1.07	0.00
47	9.824	0.00	0.00	0.00
48	9.963	0.00	0.00	0.01
49	10.454	0.00	0.38	0.00
50	10.519	0.08	0.00	0.00
51	10.578	1.89	0.10	0.00
52	11.068	2.49	0.01	0.00
53	11.430	0.00	0.00	0.01
54	11.674	0.00	0.00	0.00
55	11.733	0.15	0.03	0.00
56	11.981	0.04	0.37	0.00
57	12.141	0.00	0.01	6.17
58	12.171	0.05	9.37	0.00
59	12.318	0.00	0.00	6.03
60	12.952	0.00	1.75	0.00
61	13.066	0.01	8.25	0.00
62	13.127	0.00	0.00	0.01

**Table 3.7.2-8—Modal Frequencies of 3D FEM of Emergency Service Water Building
Sheet 3 of 10**

Mode No.	Frequency (Hz)	X % Participating Mass	Y % Participating Mass	Z % Participating Mass
63	13.184	0.06	0.13	0.00
64	13.210	0.00	0.00	0.11
65	13.288	0.00	0.00	0.00
66	13.456	0.00	0.00	0.15
67	13.553	0.06	0.03	0.00
68	13.607	0.00	0.00	0.72
69	13.656	0.25	0.01	0.00
70	13.704	0.00	0.00	6.84
71	13.849	0.09	0.00	0.00
72	14.002	1.29	0.01	0.00
73	14.126	0.00	0.00	0.16
74	14.180	0.16	0.00	0.00
75	14.347	0.00	0.00	0.01
76	14.501	0.00	0.00	0.26
77	14.629	0.00	0.00	0.02
78	14.781	2.38	0.03	0.00
79	14.946	0.00	0.00	0.00
80	15.135	0.02	0.02	0.00
81	15.161	0.00	0.00	0.15
82	15.220	0.00	0.00	0.00
83	15.261	0.02	0.00	0.00
84	15.349	0.00	0.01	0.00
85	15.426	0.00	0.02	0.00
86	15.933	0.00	0.00	0.16
87	16.098	0.01	0.04	0.00
88	16.137	0.00	1.92	0.00
89	16.204	0.00	0.07	0.00
90	16.417	0.01	1.29	0.00
91	16.521	0.00	0.00	0.25
92	16.645	0.00	0.00	0.01
93	16.902	0.00	0.00	0.00

Table 3.7.2-8—Modal Frequencies of 3D FEM of Emergency Service Water Building
Sheet 4 of 10

Mode No.	Frequency (Hz)	X % Participating Mass	Y % Participating Mass	Z % Participating Mass
94	16.905	0.00	0.00	0.00
95	16.963	0.00	0.00	0.00
96	16.966	0.00	0.00	0.00
97	17.048	0.00	0.00	0.00
98	17.050	0.00	0.00	0.00
99	17.050	0.00	0.12	0.00
100	17.052	0.00	0.00	0.00
101	17.137	0.01	0.02	0.00
102	17.148	0.00	0.00	0.00
103	17.170	0.02	0.02	0.00
104	17.187	0.03	0.11	0.00
105	17.212	0.00	0.00	0.03
106	17.219	0.00	0.00	0.02
107	17.250	0.00	0.00	0.01
108	17.253	0.00	0.00	0.00
109	17.274	0.00	0.00	0.03
110	17.274	0.00	0.01	0.00
111	17.328	0.00	0.00	0.02
112	17.374	0.00	0.07	0.00
113	17.393	0.05	0.03	0.01
114	17.405	0.01	0.00	0.12
115	17.757	0.00	0.00	0.00
116	18.027	0.00	0.00	0.06
117	18.456	0.01	0.50	0.00
118	18.524	0.00	0.00	0.11
119	18.599	0.00	0.00	0.00
120	18.657	0.00	0.00	0.00
121	18.727	0.01	0.01	0.00
122	18.737	0.00	0.00	0.00
123	18.791	0.00	0.00	0.00
124	18.804	0.00	0.00	0.00

Table 3.7.2-8—Modal Frequencies of 3D FEM of Emergency Service Water Building
Sheet 5 of 10

Mode No.	Frequency (Hz)	X % Participating Mass	Y % Participating Mass	Z % Participating Mass
125	18.826	0.00	0.00	0.00
126	18.837	0.00	0.00	0.06
127	18.845	0.00	0.00	0.01
128	18.852	0.02	0.01	0.00
129	18.854	0.00	0.00	0.00
130	18.891	0.00	0.05	0.00
131	18.908	0.00	0.00	0.00
132	18.930	0.00	0.00	0.00
133	18.938	0.00	0.00	0.00
134	19.022	0.00	0.00	0.00
135	19.044	0.00	0.01	0.00
136	19.095	0.01	5.23	0.00
137	19.152	0.00	0.00	0.00
138	19.190	0.00	0.01	0.00
139	19.337	0.00	0.00	0.61
140	19.473	0.00	0.00	0.02
141	19.739	0.03	12.19	0.00
142	19.844	0.00	0.01	0.00
143	19.876	0.00	0.00	0.31
144	19.974	0.00	0.00	0.08
145	20.013	0.00	0.32	0.00
146	20.016	0.00	0.09	0.01
147	20.169	0.00	0.00	0.00
148	20.204	0.00	0.00	0.00
149	20.447	0.00	0.00	1.12
150	20.580	0.00	0.00	0.01
151	20.673	0.00	0.00	0.71
152	20.904	0.14	0.00	0.00
153	20.926	0.59	0.01	0.00
154	21.109	0.00	0.00	0.12
155	21.275	1.28	0.01	0.00

Table 3.7.2-8—Modal Frequencies of 3D FEM of Emergency Service Water Building
Sheet 6 of 10

Mode No.	Frequency (Hz)	X % Participating Mass	Y % Participating Mass	Z % Participating Mass
156	21.383	0.00	0.00	0.01
157	21.388	0.93	0.02	0.00
158	21.407	0.05	0.00	0.00
159	21.418	0.00	0.00	0.04
160	21.504	0.05	0.01	0.00
161	21.599	0.00	0.00	0.00
162	21.686	0.00	0.00	0.00
163	21.909	0.63	0.00	0.00
164	22.081	0.08	0.32	0.00
165	22.094	0.00	0.00	0.00
166	22.231	0.05	0.00	0.00
167	22.274	0.00	0.00	0.00
168	22.408	0.00	0.00	0.64
169	22.435	0.00	0.00	0.00
170	22.480	0.00	0.00	0.11
171	22.552	0.00	0.00	0.28
172	22.588	0.03	0.44	0.00
173	22.797	0.65	0.09	0.00
174	22.830	0.34	0.04	0.00
175	23.010	0.00	0.00	0.39
176	23.034	0.00	0.02	0.00
177	23.148	0.00	0.00	0.85
178	23.325	0.06	1.59	0.00
179	23.376	0.50	0.02	0.00
180	23.425	0.06	1.32	0.00
181	23.540	0.04	0.00	0.24
182	23.549	0.69	0.03	0.01
183	23.692	0.00	0.00	0.00
184	24.149	0.00	0.00	0.06
185	24.297	0.14	0.00	0.00
186	24.470	0.60	0.01	0.00

Table 3.7.2-8—Modal Frequencies of 3D FEM of Emergency Service Water Building
Sheet 7 of 10

Mode No.	Frequency (Hz)	X % Participating Mass	Y % Participating Mass	Z % Participating Mass
187	24.579	0.55	0.00	0.00
188	24.816	0.00	0.01	0.00
189	24.845	0.01	0.19	0.00
190	24.874	0.10	0.03	0.00
191	25.195	1.31	0.14	0.00
192	25.209	0.43	0.08	0.00
193	25.358	0.00	0.00	0.00
194	25.496	0.01	0.00	0.00
195	25.501	0.00	0.00	0.00
196	25.577	0.00	0.00	0.00
197	25.595	0.46	0.98	0.00
198	25.626	0.00	0.01	0.00
199	25.660	0.00	0.00	0.00
200	25.681	0.00	0.00	0.00
201	25.711	0.01	0.01	0.01
202	25.755	0.01	0.01	0.00
203	25.851	0.32	5.11	0.00
204	25.907	0.10	0.84	0.00
205	25.982	0.00	0.00	0.00
206	26.058	0.00	0.00	0.00
207	26.107	0.00	0.05	0.00
208	26.126	0.26	4.15	0.00
209	26.151	0.01	0.07	0.00
210	26.173	0.01	0.12	0.00
211	26.228	0.00	0.00	0.00
212	26.262	**9.74**	0.03	0.00
213	26.274	0.02	0.02	0.00
214	26.282	0.03	0.01	0.02
215	26.516	0.00	0.00	0.01
216	26.680	0.00	0.00	0.00
217	26.691	0.00	0.00	0.00

Table 3.7.2-8—Modal Frequencies of 3D FEM of Emergency Service Water Building
Sheet 8 of 10

Mode No.	Frequency (Hz)	X % Participating Mass	Y % Participating Mass	Z % Participating Mass
218	26.740	0.22	0.41	0.00
219	26.744	0.16	0.21	0.01
220	26.794	0.00	0.00	0.03
221	26.805	0.09	0.01	0.00
222	26.816	0.00	0.03	0.00
223	27.010	0.00	0.00	0.00
224	27.025	0.00	0.00	0.00
225	27.036	0.97	0.01	0.00
226	27.084	0.02	0.01	0.00
227	27.117	0.03	0.17	0.00
228	27.156	0.17	0.01	0.00
229	27.191	0.00	0.00	0.02
230	27.227	0.01	0.00	0.00
231	27.323	0.00	0.00	0.00
232	27.329	0.01	0.00	0.02
233	27.359	0.54	0.00	0.00
234	27.366	0.00	0.00	0.00
235	27.381	0.00	0.00	0.00
236	27.519	0.00	0.00	0.25
237	27.551	0.00	0.06	0.00
238	27.673	0.00	0.00	0.01
239	27.798	0.68	0.05	0.00
240	27.980	1.89	0.31	0.00
241	28.347	0.01	0.01	0.00
242	28.489	0.00	0.00	0.16
243	28.668	0.00	0.00	0.85
244	28.908	0.00	0.00	0.05
245	29.103	0.00	0.00	0.00
246	29.163	0.08	0.02	0.00
247	29.348	0.00	0.00	0.62
248	29.544	0.15	0.09	0.00

Table 3.7.2-8—Modal Frequencies of 3D FEM of Emergency Service Water Building
Sheet 9 of 10

Mode No.	Frequency (Hz)	X % Participating Mass	Y % Participating Mass	Z % Participating Mass
249	29.945	0.03	0.18	0.00
250	29.965	0.00	0.01	0.02
251	30.023	0.00	0.00	0.18
252	30.097	0.03	0.47	0.00
253	30.399	0.00	0.00	0.09
254	30.678	0.04	0.22	0.00
255	30.752	0.00	0.00	0.01
256	30.876	0.26	0.31	0.00
257	30.982	0.00	0.00	0.05
258	31.095	0.20	0.63	0.00
259	31.128	0.00	0.00	0.04
260	31.375	0.00	0.00	0.04
261	31.425	0.00	0.23	0.00
262	31.625	0.05	0.08	0.04
263	31.640	0.05	0.08	0.04
264	31.822	0.02	0.46	0.00
265	31.914	0.00	0.12	0.00
266	32.062	0.29	0.09	0.00
267	32.146	0.00	0.00	1.95
268	32.293	0.02	0.54	0.00
269	32.406	0.30	0.00	0.00
270	32.585	0.00	0.01	0.00
271	32.713	0.00	0.01	0.00
272	32.850	0.04	0.62	0.00
273	32.999	0.00	0.00	0.11
274	33.179	0.00	0.07	0.00
275	33.235	0.00	0.00	0.01
276	33.402	0.00	0.00	0.16
277	33.589	0.00	0.00	0.01
278	33.614	0.01	0.03	0.00
279	33.670	0.06	0.05	0.00

Table 3.7.2-8—Modal Frequencies of 3D FEM of Emergency Service Water Building
Sheet 10 of 10

Mode No.	Frequency (Hz)	X % Participating Mass	Y % Participating Mass	Z % Participating Mass
280	33.770	0.01	0.02	0.00
281	33.853	0.01	0.01	0.00
282	33.954	0.00	0.00	0.00
283	33.960	0.00	0.00	0.00
284	33.982	0.06	0.03	0.00
285	33.997	0.00	0.00	0.00
286	34.008	0.04	0.03	0.00
287	34.017	0.00	0.00	0.00
288	34.019	0.02	0.01	0.00
289	34.024	0.00	0.00	0.00
290	34.064	0.01	0.01	0.00

Note:

1. Y is in vertical direction for GTSTRUDL FEM of ESWB.

Table 3.7.2-9—Soil Properties Associated With Different Generic Shear Wave Velocities

Shear Wave Velocity (ft/s)	Shear Wave Velocity (m/s)	Poisson's Ratio μ	Weight Density (pcf)	Weight Density (kN/m3)	S-Wave Damping (%)
700	213	0.40	110	17.28	7
820	250	0.40	110	17.28	7
1640	500	0.40	110	17.28	4
2625	800	0.40	115	18.07	2
3937	1200	0.40	120	18.85	1
5249	1600	0.40	125	19.64	1
13123	4000	0.35	156	24.51	1

Notes:

1. P-wave damping is taken to be 1/3*S-wave damping.
2. When shear wave velocity varies linearly in a layer, other properties vary accordingly.
3. P-wave velocity = S-wave velocity*$[2(1-\mu)/(1-2\mu)]^{1/2}$.

Table 3.7.2-10—Reactor Containment Building ZPAs
Sheet 1 of 5

Containment Bldg														
Zero Period Accelerations at Each Floor Level (g)														
	Motion => Soil Case =>	EURS 1u	EURS 1n2u	EURM 2sn4u	EURM 2n3u	EURS 2u	EURM 2u	EURM 3r3u	EURM 3u	EURM 4u	EURH 4u	EURH 5u	EURH 5a	
Acceleration (g)														
Elevation (m)	Direction	Case 1us	Case 1n2us	Case 2sn4um	Case 2n3um	Case 2us	Case 2um	Case 3r3um	Case 3um	Case 4um	Case 4uh	Case 5uh	Case 5ah	Envelope All Cases
	X	0.18	0.23	0.34	0.34	0.27	0.25	0.32	0.29	0.33	0.27	0.28	0.29	0.34
-2.3	Y	0.18	0.24	0.35	0.34	0.31	0.23	0.32	0.30	0.35	0.26	0.28	0.29	0.35
	Z	0.27	0.37	0.45	0.42	0.34	0.33	0.36	0.36	0.38	0.29	0.30	0.29	0.45
	X	0.18	0.23	0.36	0.35	0.26	0.25	0.37	0.33	0.38	0.29	0.31	0.31	0.38
2.6	Y	0.17	0.24	0.36	0.35	0.31	0.23	0.31	0.30	0.35	0.26	0.31	0.33	0.36
	Z	0.27	0.36	0.47	0.43	0.36	0.35	0.39	0.38	0.43	0.31	0.33	0.32	0.47
	X	0.18	0.24	0.41	0.37	0.26	0.25	0.42	0.38	0.44	0.34	0.42	0.43	0.44

Table 3.7.2-10—Reactor Containment Building ZPAs
Sheet 2 of 5

Containment Bldg														
Zero Period Accelerations at Each Floor Level (g)														
	Motion => Soil Case =>	EURS 1u	EURS 1n2u	EURM 2sn4u	EURM 2n3u	EURS 2u	EURM 2u	EURM 3r3u	EURM 3u	EURM 4u	EURH 4u	EURH 5u	EURH 5a	
Acceleration (g)														
Elevation (m)	Direction	Case 1us	Case 1n2us	Case 2sn4um	Case 2n3um	Case 2us	Case 2um	Case 3r3um	Case 3um	Case 4um	Case 4uh	Case 5uh	Case 5ah	Envelope All Cases
8.1	Y	0.16	0.25	0.37	0.36	0.32	0.23	0.33	0.31	0.38	0.28	0.37	0.43	0.43
	Z	0.27	0.36	0.49	0.45	0.37	0.36	0.43	0.41	0.48	0.33	0.36	0.44	0.49
	X	0.18	0.25	0.45	0.38	0.28	0.26	0.44	0.41	0.48	0.39	0.48	0.51	0.51
12	Y	0.16	0.26	0.39	0.36	0.32	0.23	0.35	0.32	0.43	0.30	0.41	0.48	0.48
	Z	0.27	0.35	0.50	0.46	0.37	0.37	0.47	0.44	0.51	0.35	0.39	0.54	0.54
	X	0.18	0.26	0.51	0.43	0.31	0.26	0.50	0.45	0.55	0.43	0.56	0.61	0.61
17.8	Y	0.16	0.27	0.44	0.39	0.32	0.23	0.39	0.35	0.49	0.33	0.44	0.53	0.53
	Z	0.28	0.35	0.52	0.48	0.39	0.39	0.51	0.49	0.56	0.39	0.49	0.68	0.68

Table 3.7.2-10—Reactor Containment Building ZPAs
Sheet 3 of 5

Containment Bldg													
Zero Period Accelerations at Each Floor Level (g)													
	Motion => **Soil Case =>**	**EURS 1u**	**EURS 1n2u**	**EURM 2sn4u**	**EURM 2n3u**	**EURS 2u**	**EURM 2u**	**EURM 3r3u**	**EURM 3u**	**EURM 4u**	**EURH 4u**	**EURH 5u**	**EURH 5a**	
							Acceleration (g)							
Elevation (m)	**Direction**	**Case 1us**	**Case 1n2us**	**Case 2sn4um**	**Case 2n3um**	**Case 2us**	**Case 2um**	**Case 3r3um**	**Case 3um**	**Case 4um**	**Case 4uh**	**Case 5uh**	**Case 5ah**	**Envelope All Cases**
	X	0.18	0.27	0.56	0.46	0.34	0.27	0.53	0.49	0.57	0.45	0.60	0.67	0.67
22.5	Y	0.17	0.29	0.48	0.42	0.31	0.24	0.42	0.38	0.56	0.34	0.44	0.54	0.56
	Z	0.28	0.35	0.53	0.49	0.41	0.41	0.54	0.52	0.59	0.44	0.56	0.79	0.79
	X	0.17	0.30	0.64	0.52	0.37	0.28	0.58	0.53	0.63	0.47	0.62	0.73	0.73
28.8	Y	0.17	0.33	0.54	0.42	0.34	0.26	0.49	0.41	0.62	0.41	0.55	0.61	0.62
	Z	0.28	0.35	0.54	0.54	0.43	0.44	0.58	0.56	0.64	0.50	0.65	0.91	0.91
	X	0.17	0.32	0.70	0.56	0.38	0.32	0.61	0.57	0.67	0.51	0.61	0.75	0.75
34	Y	0.17	0.36	0.58	0.44	0.37	0.27	0.54	0.46	0.67	0.47	0.62	0.70	0.70

Table 3.7.2-10—Reactor Containment Building ZPAs
Sheet 4 of 5

Containment Bldg													
Zero Period Accelerations at Each Floor Level (g)													
	Motion => **Soil Case =>**	**EURS** 1u	**EURS** 1n2u	**EURM** 2sn4u	**EURM** 2n3u	**EURS** 2u	**EURM** 2u	**EURM** 3r3u	**EURM** 3u	**EURM** 4u	**EURH** 4u	**EURH** 5u	**EURH** 5a	
						Acceleration (g)							
Elevation (m)	**Direction**	**Case 1us**	**Case 1n2us**	**Case 2sn4um**	**Case 2n3um**	**Case 2us**	**Case 2um**	**Case 3r3um**	**Case 3um**	**Case 4um**	**Case 4uh**	**Case 5uh**	**Case 5ah**	**Envelope All Cases**
	Z	0.28	0.36	0.55	0.56	0.44	0.46	0.60	0.58	0.67	0.54	0.71	1.01	1.01
	X	0.18	0.33	0.74	0.55	0.39	0.35	0.65	0.59	0.71	0.55	0.60	0.78	0.78
37.6	Y	0.18	0.38	0.61	0.45	0.40	0.28	0.58	0.49	0.69	0.50	0.67	0.78	0.78
	Z	0.28	0.36	0.57	0.58	0.45	0.47	0.62	0.59	0.69	0.57	0.74	1.06	1.06
	X	0.19	0.37	0.81	0.57	0.40	0.40	0.68	0.63	0.76	0.61	0.66	0.86	0.86
43.92	Y	0.19	0.41	0.66	0.48	0.44	0.29	0.64	0.54	0.75	0.53	0.72	0.89	0.89
	Z	0.29	0.37	0.58	0.60	0.45	0.49	0.64	0.61	0.72	0.61	0.79	1.13	1.13

Table 3.7.2-10—Reactor Containment Building ZPAs
Sheet 5 of 5

Containment Bldg													
Zero Period Accelerations at Each Floor Level (g)													
	Motion => Soil Case =>	EURS 1u	EURS 1n2u	EURM 2sn4u	EURM 2n3u	EURS 2u	EURM 2u	EURM 3r3u	EURM 3u	EURM 4u	EURH 4u	EURH 5u	EURH 5a	
						Acceleration (g)							
Elevation (m)	Direction	Case 1us	Case 1n2us	Case 2sn4um	Case 2n3um	Case 2us	Case 2um	Case 3r3um	Case 3um	Case 4um	Case 4uh	Case 5uh	Case 5ah	Envelope All Cases
	X	0.21	0.42	0.91	0.64	0.46	0.47	0.74	0.66	0.87	0.68	0.87	0.92	0.92
53.3	Y	0.23	0.46	0.76	0.56	0.51	0.37	0.74	0.68	0.84	0.67	0.83	1.03	1.03
	Z	0.34	0.40	0.69	0.68	0.54	0.59	0.78	0.75	0.85	0.89	1.02	1.62	1.62
	X	0.23	0.49	1.01	0.72	0.53	0.51	0.90	0.75	0.97	0.92	1.33	1.39	1.39
58	Y	0.27	0.50	0.97	0.68	0.55	0.53	0.99	0.96	1.07	0.83	1.14	1.40	1.40
	Z	0.47	0.54	0.86	1.20	0.79	0.99	1.60	1.37	1.64	1.44	1.58	2.52	2.52

Table 3.7.2-11—Reactor Building Internal Structures ZPAs
Sheet 1 of 6

Reactor Building Internals														
Zero Period Accelerations at Each Floor Level (g)														
	Motion => **Soil Case =>**	**EURS** **1u**	**EURS** **1n2u**	**EURM** **2sn4u**	**EURM** **2n3u**	**EURS** **2u**	**EURM** **2u**	**EURM** **3r3u**	**EURM** **3u**	**EURM** **4u**	**EURH** **4u**	**EURH** **5u**	**EURH** **5a**	
		Acceleration (g)												
Elevation (m)	**Direction**	**Case 1us**	**Case 1n2us**	**Case 2sn4um**	**Case 2n3um**	**Case 2us**	**Case 2um**	**Case 3r3um**	**Case 3um**	**Case 4um**	**Case 4uh**	**Case 5uh**	**Case 5ah**	**Envelope All Cases**
	X	0.18	0.23	0.33	0.34	0.28	0.25	0.31	0.28	0.32	0.27	0.28	0.29	0.34
-6.15	Y	0.19	0.24	0.35	0.34	0.32	0.22	0.32	0.30	0.35	0.26	0.28	0.29	0.35
	Z	0.25	0.34	0.44	0.40	0.32	0.32	0.34	0.35	0.36	0.28	0.30	0.29	0.44
	X	0.18	0.23	0.34	0.34	0.28	0.25	0.33	0.30	0.34	0.28	0.29	0.29	0.34
-2.3	Y	0.18	0.24	0.36	0.34	0.31	0.23	0.32	0.31	0.36	0.28	0.29	0.30	0.36
	Z	0.26	0.34	0.44	0.40	0.32	0.32	0.34	0.35	0.37	0.29	0.31	0.30	0.44
	X	0.18	0.23	0.38	0.38	0.30	0.27	0.38	0.34	0.39	0.31	0.33	0.38	0.39
1.5	Y	0.18	0.23	0.39	0.34	0.31	0.24	0.33	0.33	0.38	0.31	0.31	0.35	0.39

Table 3.7.2-11—Reactor Building Internal Structures ZPAs
Sheet 2 of 6

Reactor Building Internals														
Zero Period Accelerations at Each Floor Level (g)														
	Motion => Soil Case =>	EURS 1u	EURS 1n2u	EURM 2sn4u	EURM 2n3u	EURS 2u	EURM 2u	EURM 3r3u	EURM 3u	EURM 4u	EURH 4u	EURH 5u	EURH 5a	
Acceleration (g)														
Elevation (m)	Direction	Case 1us	Case 1n2us	Case 2sn4um	Case 2n3um	Case 2us	Case 2um	Case 3r3um	Case 3um	Case 4um	Case 4uh	Case 5uh	Case 5ah	Envelope All Cases
	Z	0.26	0.34	0.47	0.43	0.33	0.33	0.37	0.37	0.40	0.34	0.36	0.41	0.47
	X	0.19	0.24	0.41	0.41	0.31	0.29	0.42	0.37	0.46	0.37	0.37	0.42	0.46
5.15	Y	0.17	0.24	0.41	0.37	0.30	0.25	0.38	0.36	0.44	0.33	0.34	0.41	0.44
	Z	0.27	0.34	0.48	0.45	0.34	0.36	0.40	0.40	0.43	0.37	0.43	0.51	0.51
	X	0.19	0.24	0.42	0.42	0.31	0.29	0.43	0.38	0.44	0.37	0.37	0.43	0.44
6.92	Y	0.16	0.24	0.43	0.38	0.30	0.26	0.41	0.38	0.47	0.34	0.38	0.43	0.47
	Z	0.27	0.34	0.49	0.45	0.35	0.37	0.41	0.41	0.44	0.39	0.47	0.56	0.56
	X	0.20	0.25	0.43	0.44	0.31	0.30	0.44	0.39	0.46	0.36	0.39	0.43	0.46

Table 3.7.2-11—Reactor Building Internal Structures ZPAs
Sheet 3 of 6

Reactor Building Internals													
Zero Period Accelerations at Each Floor Level (g)													
	Motion => Soil Case =>	EURS 1u	EURS 1n2u	EURM 2sn4u	EURM 2n3u	EURS 2u	EURM 2u	EURM 3r3u	EURM 3u	EURM 4u	EURH 4u	EURH 5u	EURH 5a	
Acceleration (g)													
Elevation (m)	Direction	Case 1us	Case 1n2us	Case 2sn4um	Case 2n3um	Case 2us	Case 2um	Case 3r3um	Case 3um	Case 4um	Case 4uh	Case 5uh	Case 5ah	Envelope All Cases
9.38	Y	0.17	0.26	0.43	0.40	0.30	0.27	0.45	0.40	0.51	0.35	0.44	0.44	0.51
	Z	0.27	0.34	0.50	0.46	0.35	0.37	0.43	0.43	0.45	0.42	0.50	0.60	0.60
	X	0.20	0.26	0.46	0.46	0.32	0.32	0.47	0.40	0.51	0.42	0.45	0.50	0.51
13.8	Y	0.18	0.28	0.45	0.43	0.30	0.29	0.51	0.44	0.58	0.40	0.42	0.50	0.58
	Z	0.28	0.34	0.51	0.47	0.36	0.39	0.45	0.45	0.49	0.47	0.55	0.68	0.68
	X	0.22	0.27	0.53	0.50	0.32	0.34	0.52	0.44	0.57	0.50	0.54	0.63	0.63
19.5	Y	0.19	0.31	0.53	0.48	0.35	0.32	0.61	0.54	0.71	0.47	0.50	0.59	0.71
	Z	0.28	0.34	0.57	0.57	0.40	0.46	0.68	0.65	0.73	0.62	0.67	0.91	0.91

Table 3.7.2-11—Reactor Building Internal Structures ZPAs
Sheet 4 of 6

Reactor Building Internals														
Zero Period Accelerations at Each Floor Level (g)														
	Motion => Soil Case =>	EURS 1u	EURS 1n2u	EURM 2sn4u	EURM 2n3u	EURS 2u	EURM 2u	EURM 3r3u	EURM 3u	EURM 4u	EURH 4u	EURH 5u	EURH 5a	
Acceleration (g)														
Elevation (m)	Direction	Case 1us	Case 1n2us	Case 2sn4um	Case 2n3um	Case 2us	Case 2um	Case 3r3um	Case 3um	Case 4um	Case 4uh	Case 5uh	Case 5ah	Envelope All Cases
	X	0.23	0.30	0.59	0.59	0.39	0.36	0.67	0.60	0.78	0.67	0.71	0.94	0.94
24.1	Y	0.22	0.35	0.59	0.54	0.41	0.42	0.74	0.62	0.81	0.61	0.68	0.84	0.84
	Z	0.27	0.35	0.57	0.61	0.48	0.49	0.67	0.63	0.72	0.77	0.90	1.38	1.38
	X	0.24	0.29	0.62	0.51	0.40	0.40	0.65	0.57	0.78	0.63	0.66	0.78	0.78
24.1	Y	0.24	0.38	0.57	0.52	0.43	0.37	0.65	0.58	0.70	0.70	0.76	0.85	0.85
	Z	0.27	0.34	0.59	0.60	0.48	0.48	0.73	0.68	0.78	0.85	0.94	1.27	1.27
	X	0.27	0.33	0.67	0.63	0.46	0.49	0.77	0.67	0.94	0.88	0.97	1.30	1.30
28.5	Y	0.25	0.37	0.66	0.58	0.46	0.50	0.89	0.72	0.94	0.77	0.89	1.13	1.13
	Z	0.28	0.36	0.60	0.64	0.51	0.52	0.72	0.68	0.78	0.88	1.03	1.56	1.56

Table 3.7.2-11—Reactor Building Internal Structures ZPAs
Sheet 5 of 6

Reactor Building Internals														
Zero Period Accelerations at Each Floor Level (g)														
	Motion => Soil Case =>	EURS 1u	EURS 1n2u	EURM 2sn4u	EURM 2n3u	EURS 2u	EURM 2u	EURM 3r3u	EURM 3u	EURM 4u	EURH 4u	EURH 5u	EURH 5a	
Acceleration (g)														
Elevation (m)	Direction	Case 1us	Case 1n2us	Case 2sn4um	Case 2n3um	Case 2us	Case 2um	Case 3r3um	Case 3um	Case 4um	Case 4uh	Case 5uh	Case 5ah	Envelope All Cases
	X	0.29	0.38	0.71	0.59	0.47	0.46	0.82	0.67	0.91	0.73	0.84	1.22	1.22
28.5	Y	0.32	0.42	0.58	0.58	0.51	0.41	0.92	0.60	0.87	0.97	0.95	1.21	1.21
	Z	0.27	0.36	0.60	0.61	0.51	0.49	0.79	0.70	0.80	0.95	1.03	1.44	1.44
	X	0.33	0.40	0.77	0.75	0.59	0.68	1.02	0.95	1.14	1.30	1.51	2.00	2.00
34.45	Y	0.28	0.41	0.71	0.63	0.48	0.53	0.97	0.75	1.01	0.91	1.01	1.23	1.23
	Z	0.28	0.36	0.59	0.60	0.44	0.46	0.68	0.59	0.69	0.71	0.87	1.25	1.25
	X	0.35	0.48	0.84	0.82	0.66	0.71	1.16	0.92	1.18	1.19	1.39	1.96	1.96
34.45	Y	0.31	0.44	0.62	0.67	0.54	0.45	0.89	0.69	0.91	1.01	1.06	1.18	1.18

Table 3.7.2-11—Reactor Building Internal Structures ZPAs
Sheet 6 of 6

Reactor Building Internals														
Zero Period Accelerations at Each Floor Level (g)														
	Motion => Soil Case =>	EURS 1u	EURS 1n2u	EURM 2sn4u	EURM 2n3u	EURS 2u	EURM 2u	EURM 3r3u	EURM 3u	EURM 4u	EURH 4u	EURH 5u	EURH 5a	
Acceleration (g)														
Elevation (m)	Direction	Case 1us	Case 1n2us	Case 2sn4um	Case 2n3um	Case 2us	Case 2um	Case 3r3um	Case 3um	Case 4um	Case 4uh	Case 5uh	Case 5ah	Envelope All Cases
	Z	0.27	0.36	0.62	0.63	0.41	0.51	0.78	0.72	0.82	0.78	0.87	1.31	1.31

Table 3.7.2-12—Safeguard Building 1 ZPAs
Sheet 1 of 4

Safeguards Building 1														
Zero Period Accelerations at Each Floor Level (g)														
	Motion => Soil Case =>	EURS 1u	EURS 1n2u	EURM 2sn4u	EURM 2n3u	EURS 2u	EURM 2u	EURM 3r3u	EURM 3u	EURM 4u	EURH 4u	EURH 5u	EURH 5a	
							Acceleration (g)							
Elevation (m)	Direction	Case 1us	Case 1n2us	Case 2sn4um	Case 2n3um	Case 2us	Case 2um	Case 3r3um	Case 3um	Case 4um	Case 4uh	Case 5uh	Case 5ah	Envelope All Cases
	X	0.18	0.23	0.32	0.34	0.28	0.25	0.30	0.28	0.32	0.28	0.28	0.29	0.34
-8.6	Y	0.21	0.24	0.34	0.33	0.32	0.21	0.31	0.29	0.33	0.25	0.28	0.29	0.34
	Z	0.32	0.40	0.55	0.52	0.40	0.42	0.44	0.46	0.37	0.33	0.30	0.29	0.55
	X	0.18	0.23	0.36	0.34	0.28	0.26	0.33	0.31	0.34	0.31	0.32	0.33	0.36
-4.5	Y	0.20	0.25	0.35	0.35	0.33	0.22	0.33	0.31	0.35	0.28	0.32	0.32	0.35
	Z	0.32	0.41	0.58	0.54	0.45	0.42	0.47	0.47	0.43	0.36	0.36	0.36	0.58
	X	0.17	0.23	0.39	0.36	0.28	0.27	0.38	0.34	0.38	0.35	0.35	0.34	0.39
0	Y	0.19	0.25	0.40	0.36	0.34	0.24	0.38	0.35	0.39	0.31	0.40	0.40	0.40

Table 3.7.2-12—Safeguard Building 1 ZPAs
Sheet 2 of 4

Safeguards Building 1													
Zero Period Accelerations at Each Floor Level (g)													
	Motion => Soil Case =>	EURS 1u	EURS 1n2u	EURM 2sn4u	EURM 2n3u	EURS 2u	EURM 2u	EURM 3r3u	EURM 3u	EURM 4u	EURH 4u	EURH 5u	EURH 5a	
Acceleration (g)													
Elevation (m)	Direction	Case 1us	Case 1n2us	Case 2sn4um	Case 2n3um	Case 2us	Case 2um	Case 3r3um	Case 3um	Case 4um	Case 4uh	Case 5uh	Case 5ah	Envelope All Cases
	Z	0.32	0.41	0.61	0.57	0.48	0.43	0.53	0.50	0.49	0.39	0.43	0.45	0.61
	X	0.17	0.24	0.45	0.37	0.28	0.28	0.44	0.40	0.43	0.36	0.37	0.39	0.45
4.7	Y	0.18	0.26	0.43	0.37	0.32	0.26	0.40	0.39	0.44	0.36	0.47	0.46	0.47
	Z	0.33	0.42	0.64	0.60	0.51	0.44	0.60	0.52	0.58	0.45	0.51	0.58	0.64
	X	0.17	0.25	0.50	0.39	0.29	0.28	0.48	0.44	0.48	0.36	0.43	0.44	0.50
8.1	Y	0.18	0.28	0.45	0.36	0.32	0.27	0.42	0.43	0.47	0.40	0.51	0.50	0.51
	Z	0.33	0.42	0.66	0.62	0.53	0.46	0.65	0.55	0.66	0.50	0.56	0.67	0.67
	X	0.18	0.26	0.55	0.40	0.30	0.30	0.53	0.49	0.53	0.38	0.52	0.49	0.55
12	Y	0.18	0.31	0.50	0.38	0.32	0.27	0.47	0.45	0.50	0.46	0.54	0.55	0.55

Table 3.7.2-12—Safeguard Building 1 ZPAs
Sheet 3 of 4

Safeguards Building 1														
Zero Period Accelerations at Each Floor Level (g)														
	Motion => Soil Case =>	EURS 1u	EURS 1n2u	EURM 2sn4u	EURM 2n3u	EURS 2u	EURM 2u	EURM 3r3u	EURM 3u	EURM 4u	EURH 4u	EURH 5u	EURH 5a	
Acceleration (g)														
Elevation (m)	Direction	Case 1us	Case 1n2us	Case 2sn4um	Case 2n3um	Case 2us	Case 2um	Case 3r3um	Case 3um	Case 4um	Case 4uh	Case 5uh	Case 5ah	Envelope All Cases
	Z	0.33	0.44	0.69	0.63	0.56	0.47	0.70	0.62	0.75	0.55	0.62	0.83	0.83
	X	0.19	0.28	0.61	0.43	0.32	0.31	0.58	0.53	0.57	0.43	0.56	0.50	0.61
16.8	Y	0.19	0.33	0.57	0.40	0.31	0.28	0.55	0.49	0.61	0.46	0.55	0.64	0.64
	Z	0.33	0.45	0.73	0.65	0.58	0.49	0.76	0.67	0.81	0.60	0.68	0.93	0.93
	X	0.19	0.29	0.66	0.46	0.33	0.33	0.63	0.57	0.62	0.47	0.59	0.55	0.66
21	Y	0.19	0.34	0.64	0.41	0.34	0.31	0.63	0.52	0.69	0.47	0.62	0.75	0.75
	Z	0.33	0.45	0.75	0.66	0.60	0.51	0.80	0.70	0.85	0.64	0.74	1.02	1.02
	X	0.20	0.31	0.71	0.48	0.34	0.34	0.67	0.59	0.68	0.52	0.65	0.60	0.71
24.7	Y	0.20	0.35	0.69	0.44	0.37	0.35	0.68	0.57	0.75	0.53	0.72	0.84	0.84

Table 3.7.2-12—Safeguard Building 1 ZPAs
Sheet 4 of 4

Safeguards Building 1														
Zero Period Accelerations at Each Floor Level (g)														
	Motion => Soil Case =>	EURS 1u	EURS 1n2u	EURM 2sn4u	EURM 2n3u	EURS 2u	EURM 2u	EURM 3r3u	EURM 3u	EURM 4u	EURH 4u	EURH 5u	EURH 5a	
Acceleration (g)														
Elevation (m)	Direction	Case 1us	Case 1n2us	Case 2sn4um	Case 2n3um	Case 2us	Case 2um	Case 3r3um	Case 3um	Case 4um	Case 4uh	Case 5uh	Case 5ah	Envelope All Cases
	Z	0.33	0.45	0.76	0.66	0.61	0.52	0.81	0.72	0.87	0.66	0.77	1.07	1.07
	X	0.20	0.32	0.76	0.53	0.36	0.36	0.70	0.62	0.76	0.60	0.71	0.66	0.76
29.3	Y	0.20	0.37	0.74	0.48	0.41	0.40	0.74	0.62	0.82	0.59	0.81	0.95	0.95
	Z	0.33	0.46	0.76	0.66	0.61	0.52	0.83	0.73	0.88	0.68	0.79	1.10	1.10

Table 3.7.2-13—Safeguard Building 2 & 3 ZPAs
Sheet 1 of 4

Safeguards Building 2/3														
Zero Period Accelerations at Each Floor Level (g)														
	Motion =>	EURS	EURS	EURM	EURM	EURS	EURM	EURM	EURM	EURM	EURH	EURH	EURH	
	Soil Case =>	1u	1n2u	2sn4u	2n3u	2u	2u	3r3u	3u	4u	4u	5u	5a	
		Acceleration (g)												
Elevation (m)	Direction	Case	Case	Case	Case	Case	Case	Case	Case	Case	Case	Case	Case	Envelope
		1us	1n2us	2sn4um	2n3um	2us	2um	3r3um	3um	4um	4uh	5uh	5ah	All Cases
	X	0.18	0.23	0.31	0.35	0.30	0.25	0.31	0.28	0.33	0.28	0.29	0.29	0.35
-8.6	Y	0.20	0.24	0.34	0.34	0.32	0.23	0.32	0.30	0.35	0.26	0.28	0.29	0.35
	Z	0.32	0.46	0.47	0.44	0.38	0.38	0.38	0.40	0.39	0.34	0.34	0.29	0.47
	X	0.18	0.24	0.33	0.36	0.32	0.26	0.36	0.32	0.37	0.29	0.31	0.34	0.37
-4.5	Y	0.19	0.25	0.37	0.36	0.34	0.25	0.34	0.31	0.36	0.34	0.32	0.33	0.37
	Z	0.33	0.47	0.52	0.47	0.40	0.37	0.41	0.43	0.43	0.45	0.45	0.39	0.52
	X	0.18	0.25	0.38	0.39	0.34	0.29	0.41	0.36	0.42	0.33	0.33	0.38	0.42
0	Y	0.19	0.27	0.40	0.39	0.37	0.27	0.36	0.33	0.42	0.40	0.36	0.38	0.42

Table 3.7.2-13—Safeguard Building 2 & 3 ZPAs
Sheet 2 of 4

Safeguards Building 2/3														
Zero Period Accelerations at Each Floor Level (g)														
	Motion =>	EURS	EURS	EURM	EURM	EURS	EURM	EURM	EURM	EURM	EURH	EURH	EURH	
	Soil Case =>	1u	1n2u	2sn4u	2n3u	2u	2u	3r3u	3u	4u	4u	5u	5a	
		Acceleration (g)												
Elevation (m)	Direction	Case	Case	Case	Case	Case	Case	Case	Case	Case	Case	Case	Case	Envelope
		1us	1n2us	2sn4um	2n3um	2us	2um	3r3um	3um	4um	4uh	5uh	5ah	All Cases
	Z	0.33	0.48	0.55	0.49	0.43	0.37	0.49	0.47	0.53	0.56	0.55	0.49	0.56
	X	0.20	0.27	0.45	0.46	0.36	0.35	0.48	0.43	0.51	0.47	0.50	0.51	0.51
4.7	Y	0.19	0.28	0.44	0.43	0.42	0.31	0.46	0.37	0.52	0.40	0.43	0.45	0.52
	Z	0.33	0.48	0.66	0.65	0.47	0.48	0.66	0.58	0.64	0.64	0.63	0.63	0.66
	X	0.22	0.27	0.51	0.50	0.37	0.37	0.52	0.47	0.58	0.54	0.60	0.67	0.67
8.1	Y	0.20	0.30	0.52	0.47	0.45	0.34	0.51	0.43	0.62	0.39	0.46	0.51	0.62
	Z	0.33	0.49	0.70	0.70	0.52	0.52	0.74	0.62	0.73	0.70	0.68	0.78	0.78
	X	0.23	0.28	0.58	0.55	0.38	0.39	0.59	0.54	0.69	0.65	0.70	0.83	0.83
12	Y	0.21	0.32	0.61	0.53	0.48	0.38	0.59	0.53	0.72	0.45	0.54	0.65	0.72

Table 3.7.2-13—Safeguard Building 2 & 3 ZPAs
Sheet 3 of 4

Safeguards Building 2/3														
Zero Period Accelerations at Each Floor Level (g)														
	Motion =>	EURS	EURS	EURM	EURM	EURS	EURM	EURM	EURM	EURM	EURH	EURH	EURH	
	Soil Case =>	1u	1n2u	2sn4u	2n3u	2u	2u	3r3u	3u	4u	4u	5u	5a	
Acceleration (g)														
Elevation (m)	Direction	Case	Case	Case	Case	Case	Case	Case	Case	Case	Case	Case	Case	Envelope
		1us	1n2us	2sn4um	2n3um	2us	2um	3r3um	3um	4um	4uh	5uh	5ah	All Cases
	Z	0.33	0.50	0.75	0.74	0.55	0.55	0.80	0.66	0.81	0.78	0.80	0.89	0.89
	X	0.25	0.29	0.63	0.57	0.39	0.40	0.66	0.59	0.78	0.73	0.77	0.92	0.92
15.4	Y	0.21	0.34	0.69	0.58	0.51	0.40	0.68	0.62	0.79	0.51	0.66	0.73	0.79
	Z	0.34	0.50	0.79	0.77	0.57	0.57	0.85	0.71	0.87	0.89	0.94	1.02	1.02
	X	0.29	0.33	0.71	0.68	0.47	0.50	0.83	0.71	0.99	0.85	0.94	1.20	1.20
21	Y	0.21	0.37	0.79	0.62	0.55	0.44	0.79	0.75	0.87	0.68	0.81	0.88	0.88
	Z	0.34	0.51	0.82	0.79	0.61	0.59	0.88	0.75	0.92	0.98	1.04	1.17	1.17
	X	0.26	0.30	0.70	0.63	0.42	0.43	0.76	0.66	0.90	0.83	0.86	1.01	1.01
26.8	Y	0.22	0.40	0.90	0.68	0.58	0.50	0.89	0.85	0.92	0.77	0.90	0.96	0.96

Table 3.7.2-13—Safeguard Building 2 & 3 ZPAs
Sheet 4 of 4

Safeguards Building 2/3														
Zero Period Accelerations at Each Floor Level (g)														
	Motion =>	EURS	EURS	EURM	EURM	EURS	EURM	EURM	EURM	EURM	EURH	EURH	EURH	
	Soil Case =>	1u	1n2u	2sn4u	2n3u	2u	2u	3r3u	3u	4u	4u	5u	5a	
Acceleration (g)														
Elevation (m)	Direction	Case	Case	Case	Case	Case	Case	Case	Case	Case	Case	Case	Case	Envelope
		1us	1n2us	2sn4um	2n3um	2us	2um	3r3um	3um	4um	4uh	5uh	5ah	All Cases
	Z	0.34	0.51	0.83	0.79	0.62	0.59	0.90	0.77	0.94	1.01	1.07	1.22	1.22

Table 3.7.2-14—Safeguard Building 4 ZPAs
Sheet 1 of 4

Safeguards Building 4														
Zero Period Accelerations at Each Floor Level (g)														
	Motion =>	EURS	EURS	EURM	EURM	EURS	EURM	EURM	EURM	EURM	EURH	EURH	EURH	
	Soil Case =>	1u	1n2u	2sn4u	2n3u	2u	2u	3r3u	3u	4u	4u	5u	5a	
		Acceleration (g)												
Elevation (m)	Direction	Case	Case	Case	Case	Case	Case	Case	Case	Case	Case	Case	Case	Envelope
		1us	1n2us	2sn4um	2n3um	2us	2um	3r3um	3um	4um	4uh	5uh	5ah	All Cases
	X	0.18	0.23	0.32	0.34	0.28	0.25	0.30	0.28	0.32	0.28	0.28	0.29	0.34
-8.6	Y	0.19	0.25	0.35	0.36	0.32	0.24	0.33	0.31	0.36	0.26	0.28	0.29	0.36
	Z	0.31	0.46	0.48	0.39	0.35	0.38	0.42	0.39	0.46	0.32	0.34	0.29	0.48
	X	0.18	0.23	0.35	0.34	0.28	0.25	0.34	0.32	0.36	0.32	0.31	0.32	0.36
-4.5	Y	0.19	0.26	0.37	0.36	0.35	0.25	0.36	0.31	0.38	0.32	0.32	0.31	0.38
	Z	0.31	0.47	0.53	0.41	0.37	0.38	0.49	0.45	0.53	0.38	0.40	0.37	0.53
	X	0.17	0.23	0.38	0.35	0.27	0.26	0.38	0.35	0.39	0.35	0.34	0.33	0.39
0	Y	0.19	0.27	0.41	0.38	0.39	0.26	0.37	0.32	0.40	0.36	0.34	0.37	0.41

Table 3.7.2-14—Safeguard Building 4 ZPAs
Sheet 2 of 4

Safeguards Building 4														
Zero Period Accelerations at Each Floor Level (g)														
	Motion =>	EURS	EURS	EURM	EURM	EURS	EURM	EURM	EURM	EURM	EURH	EURH	EURH	
	Soil Case =>	1u	1n2u	2sn4u	2n3u	2u	2u	3r3u	3u	4u	4u	5u	5a	
		Acceleration (g)												
Elevation (m)	Direction	Case	Case	Case	Case	Case	Case	Case	Case	Case	Case	Case	Case	Envelope
		1us	1n2us	2sn4um	2n3um	2us	2um	3r3um	3um	4um	4uh	5uh	5ah	All Cases
	Z	0.31	0.48	0.58	0.42	0.39	0.39	0.55	0.50	0.60	0.44	0.47	0.45	0.60
	X	0.17	0.24	0.45	0.36	0.28	0.27	0.44	0.40	0.45	0.36	0.35	0.37	0.45
4.7	Y	0.19	0.28	0.46	0.38	0.41	0.27	0.42	0.36	0.47	0.37	0.37	0.45	0.47
	Z	0.31	0.49	0.64	0.44	0.41	0.42	0.61	0.55	0.66	0.50	0.54	0.58	0.66
	X	0.17	0.25	0.49	0.40	0.29	0.28	0.48	0.43	0.51	0.35	0.41	0.42	0.51
8.1	Y	0.19	0.29	0.50	0.41	0.43	0.28	0.45	0.41	0.54	0.41	0.41	0.51	0.54
	Z	0.31	0.50	0.67	0.46	0.43	0.45	0.67	0.58	0.71	0.55	0.62	0.70	0.71
	X	0.18	0.26	0.54	0.41	0.30	0.29	0.52	0.47	0.56	0.37	0.46	0.47	0.56
12	Y	0.19	0.30	0.55	0.45	0.44	0.29	0.54	0.50	0.62	0.46	0.48	0.57	0.62

Table 3.7.2-14—Safeguard Building 4 ZPAs
Sheet 3 of 4

Safeguards Building 4													
Zero Period Accelerations at Each Floor Level (g)													
	Motion =>	EURS	EURS	EURM	EURM	EURS	EURM	EURM	EURM	EURM	EURH	EURH	EURH	
	Soil Case =>	1u	1n2u	2sn4u	2n3u	2u	2u	3r3u	3u	4u	4u	5u	5a	
		Acceleration (g)												
Elevation (m)	Direction	Case	Case	Case	Case	Case	Case	Case	Case	Case	Case	Case	Case	Envelope
		1us	1n2us	2sn4um	2n3um	2us	2um	3r3um	3um	4um	4uh	5uh	5ah	All Cases
	Z	0.31	0.51	0.70	0.48	0.46	0.48	0.71	0.61	0.75	0.60	0.73	0.84	0.84
	X	0.19	0.28	0.61	0.45	0.31	0.32	0.57	0.52	0.62	0.42	0.49	0.48	0.62
16.8	Y	0.20	0.32	0.60	0.49	0.45	0.32	0.64	0.60	0.69	0.50	0.52	0.64	0.69
	Z	0.31	0.51	0.72	0.49	0.48	0.49	0.74	0.63	0.78	0.65	0.81	0.95	0.95
	X	0.20	0.30	0.65	0.48	0.32	0.35	0.63	0.57	0.67	0.48	0.57	0.51	0.67
21	Y	0.21	0.33	0.64	0.53	0.47	0.34	0.72	0.68	0.76	0.52	0.59	0.69	0.76
	Z	0.32	0.52	0.74	0.51	0.50	0.50	0.76	0.64	0.81	0.68	0.89	1.06	1.06
	X	0.20	0.31	0.69	0.51	0.33	0.37	0.67	0.60	0.71	0.53	0.63	0.55	0.71

Table 3.7.2-14—Safeguard Building 4 ZPAs
Sheet 4 of 4

Safeguards Building 4														
Zero Period Accelerations at Each Floor Level (g)														
	Motion =>	EURS	EURS	EURM	EURM	EURS	EURM	EURM	EURM	EURM	EURH	EURH	EURH	
	Soil Case =>	1u	1n2u	2sn4u	2n3u	2u	2u	3r3u	3u	4u	4u	5u	5a	
Acceleration (g)														
Elevation (m)	Direction	Case	Case	Case	Case	Case	Case	Case	Case	Case	Case	Case	Case	Envelope
		1us	1n2us	2sn4um	2n3um	2us	2um	3r3um	3um	4um	4uh	5uh	5ah	All Cases
24.7	Y	0.22	0.34	0.67	0.55	0.48	0.35	0.77	0.72	0.81	0.56	0.67	0.77	0.81
	Z	0.33	0.52	0.76	0.51	0.51	0.51	0.77	0.65	0.82	0.71	0.93	1.12	1.12
	X	0.21	0.33	0.75	0.56	0.36	0.39	0.73	0.64	0.77	0.60	0.69	0.64	0.77
29.3	Y	0.23	0.36	0.73	0.59	0.50	0.38	0.82	0.77	0.87	0.65	0.76	0.85	0.87
	Z	0.33	0.52	0.76	0.52	0.51	0.51	0.77	0.65	0.83	0.74	0.96	1.15	1.15

Table 3.7.2-15—Reactor Shield Building ZPAs
Sheet 1 of 4

Reactor Building Shield Structure														
Zero Period Accelerations at Each Floor Level (g)														
	Motion => Soil Case =>	EURS 1u	EURS 1n2u	EURM 2sn4u	EURM 2n3u	EURS 2u	EURM 2u	EURM 3r3u	EURM 3u	EURM 4u	EURH 4u	EURH 5u	EURH 5a	
		Acceleration (g)												
Elevation (m)	Direction	Case	Case	Case	Case	Case	Case	Case	Case	Case	Case	Case	Case	Envelope
		1us	1n2us	2sn4um	2n3um	2us	2um	3r3um	3um	4um	4uh	5uh	5ah	All Cases
	X	0.18	0.23	0.34	0.34	0.28	0.25	0.34	0.30	0.35	0.30	0.30	0.31	0.35
-4.3	Y	0.19	0.25	0.37	0.36	0.33	0.24	0.33	0.31	0.37	0.29	0.30	0.31	0.37
	Z	0.28	0.35	0.47	0.42	0.36	0.34	0.36	0.37	0.39	0.30	0.32	0.30	0.47
	X	0.17	0.23	0.40	0.35	0.27	0.26	0.39	0.35	0.39	0.31	0.30	0.28	0.40
2.6	Y	0.18	0.25	0.37	0.35	0.33	0.24	0.31	0.30	0.38	0.29	0.30	0.31	0.38
	Z	0.28	0.36	0.49	0.44	0.37	0.35	0.40	0.40	0.44	0.34	0.36	0.35	0.49
	X	0.17	0.25	0.49	0.38	0.28	0.28	0.48	0.43	0.49	0.34	0.40	0.40	0.49
8.1	Y	0.17	0.26	0.40	0.36	0.37	0.25	0.36	0.34	0.42	0.33	0.36	0.37	0.42
	Z	0.28	0.37	0.50	0.47	0.41	0.36	0.45	0.42	0.48	0.38	0.40	0.42	0.50

Table 3.7.2-15—Reactor Shield Building ZPAs
Sheet 2 of 4

Reactor Building Shield Structure														
Zero Period Accelerations at Each Floor Level (g)														
	Motion => Soil Case =>	EURS 1u	EURS 1n2u	EURM 2sn4u	EURM 2n3u	EURS 2u	EURM 2u	EURM 3r3u	EURM 3u	EURM 4u	EURH 4u	EURH 5u	EURH 5a	
		Acceleration (g)												
Elevation (m)	Direction	Case	Case	Case	Case	Case	Case	Case	Case	Case	Case	Case	Case	Envelope
	X	0.18	0.26	0.55	0.40	0.30	0.29	0.52	0.48	0.55	0.35	0.47	0.44	0.55
12	Y	0.17	0.27	0.43	0.36	0.37	0.26	0.38	0.37	0.48	0.37	0.40	0.39	0.48
	Z	0.28	0.37	0.52	0.48	0.42	0.37	0.48	0.45	0.52	0.40	0.43	0.46	0.52
	X	0.19	0.28	0.61	0.43	0.31	0.31	0.57	0.53	0.61	0.40	0.52	0.47	0.61
16.8	Y	0.17	0.28	0.50	0.40	0.38	0.27	0.42	0.41	0.56	0.40	0.43	0.43	0.56
	Z	0.28	0.38	0.54	0.49	0.43	0.38	0.50	0.47	0.57	0.46	0.49	0.56	0.57
	X	0.19	0.29	0.66	0.44	0.32	0.33	0.61	0.56	0.63	0.44	0.56	0.52	0.66
22.5	Y	0.18	0.30	0.54	0.41	0.38	0.28	0.46	0.45	0.59	0.41	0.47	0.48	0.59
	Z	0.27	0.38	0.58	0.52	0.43	0.39	0.53	0.50	0.64	0.48	0.53	0.57	0.64

Table 3.7.2-15—Reactor Shield Building ZPAs
Sheet 3 of 4

Reactor Building Shield Structure														
Zero Period Accelerations at Each Floor Level (g)														
	Motion => Soil Case =>	EURS 1u	EURS 1n2u	EURM 2sn4u	EURM 2n3u	EURS 2u	EURM 2u	EURM 3r3u	EURM 3u	EURM 4u	EURH 4u	EURH 5u	EURH 5a	
		Acceleration (g)												
Elevation (m)	Direction	Case	Case	Case	Case	Case	Case	Case	Case	Case	Case	Case	Case	Envelope
	X	0.20	0.32	0.76	0.54	0.36	0.39	0.72	0.64	0.76	0.57	0.69	0.64	0.76
28.8	Y	0.18	0.34	0.66	0.45	0.42	0.30	0.55	0.50	0.73	0.53	0.61	0.60	0.73
	Z	0.28	0.39	0.59	0.51	0.45	0.43	0.56	0.52	0.66	0.52	0.55	0.66	0.66
	X	0.19	0.34	0.79	0.52	0.38	0.39	0.70	0.64	0.80	0.58	0.71	0.70	0.80
34	Y	0.20	0.36	0.72	0.51	0.48	0.34	0.63	0.59	0.78	0.60	0.66	0.66	0.78
	Z	0.27	0.39	0.60	0.54	0.46	0.41	0.59	0.56	0.68	0.58	0.63	0.68	0.68
	X	0.19	0.34	0.85	0.56	0.40	0.41	0.75	0.68	0.85	0.65	0.76	0.76	0.85
37.6	Y	0.20	0.38	0.76	0.56	0.44	0.32	0.64	0.58	0.82	0.66	0.72	0.72	0.82
	Z	0.29	0.43	0.59	0.54	0.49	0.44	0.64	0.59	0.71	0.57	0.64	0.74	0.74
	X	0.22	0.37	0.93	0.62	0.47	0.46	0.86	0.73	1.01	0.74	0.92	0.91	1.01

Table 3.7.2-15—Reactor Shield Building ZPAs
Sheet 4 of 4

Reactor Building Shield Structure														
Zero Period Accelerations at Each Floor Level (g)														
	Motion =>	EURS	EURS	EURM	EURM	EURS	EURM	EURM	EURM	EURM	EURH	EURH	EURH	
	Soil Case =>	1u	1n2u	2sn4u	2n3u	2u	2u	3r3u	3u	4u	4u	5u	5a	
		Acceleration (g)												
Elevation (m)	Direction	Case	Case	Case	Case	Case	Case	Case	Case	Case	Case	Case	Case	Envelope
45.2	Y	0.21	0.42	0.87	0.66	0.49	0.35	0.74	0.66	0.93	0.77	0.86	0.84	0.93
	Z	0.29	0.44	0.61	0.55	0.50	0.46	0.67	0.61	0.75	0.60	0.69	0.79	0.79
	X	0.27	0.45	1.04	0.77	0.59	0.57	1.14	0.96	1.28	0.85	1.16	1.13	1.28
55.2	Y	0.21	0.47	1.02	0.78	0.56	0.41	0.92	0.80	1.10	0.91	1.06	1.03	1.10
	Z	0.28	0.42	0.65	0.55	0.50	0.51	0.68	0.61	0.78	0.68	0.81	1.21	1.21
	X	0.29	0.49	1.14	0.86	0.65	0.63	1.31	1.11	1.44	0.92	1.32	1.33	1.44
61	Y	0.23	0.49	1.14	0.86	0.61	0.48	1.03	0.88	1.20	1.05	1.18	1.06	1.20
	Z	0.31	0.37	0.66	0.61	0.56	0.53	0.81	0.70	0.90	0.98	1.16	1.78	1.78

Table 3.7.2-16—Safeguard Building 2/3 Shield Structure ZPAs
Sheet 1 of 3

Safeguards Building 2/3 Shield Structure														
Zero Period Accelerations at Each Floor Level (g)														
	Motion => Soil Case =>	EURS 1u	EURS 1n2u	EURM 2sn4u	EURM 2n3u	EURS 2u	EURM 2u	EURM 3r3u	EURM 3u	EURM 4u	EURH 4u	EURH 5u	EURH 5a	
		Acceleration (g)												
Elevation (m)	Direction	Case 1us	Case 1n2us	Case 2sn4um	Case 2n3um	Case 2us	Case 2um	Case 3r3um	Case 3um	Case 4um	Case 4uh	Case 5uh	Case 5ah	Envelope All Cases
	X	0.18	0.24	0.31	0.35	0.30	0.25	0.31	0.28	0.33	0.28	0.29	0.29	0.35
-8.6	Y	0.20	0.24	0.34	0.34	0.32	0.23	0.32	0.30	0.35	0.26	0.28	0.29	0.35
	Z	0.33	0.47	0.48	0.45	0.39	0.38	0.38	0.41	0.39	0.34	0.35	0.29	0.48
	X	0.18	0.24	0.33	0.34	0.30	0.24	0.32	0.30	0.34	0.29	0.30	0.31	0.34
-4.5	Y	0.19	0.25	0.37	0.36	0.33	0.24	0.33	0.31	0.36	0.29	0.32	0.33	0.37
	Z	0.33	0.47	0.49	0.46	0.39	0.38	0.39	0.42	0.42	0.37	0.37	0.33	0.49
	X	0.18	0.25	0.36	0.35	0.30	0.25	0.36	0.33	0.37	0.33	0.32	0.31	0.37
0	Y	0.19	0.26	0.38	0.38	0.35	0.25	0.33	0.31	0.38	0.33	0.34	0.35	0.38

Table 3.7.2-16—Safeguard Building 2/3 Shield Structure ZPAs
Sheet 2 of 3

Safeguards Building 2/3 Shield Structure														
Zero Period Accelerations at Each Floor Level (g)														
	Motion => Soil Case =>	EURS 1u	EURS 1n2u	EURM 2sn4u	EURM 2n3u	EURS 2u	EURM 2u	EURM 3r3u	EURM 3u	EURM 4u	EURH 4u	EURH 5u	EURH 5a	
Acceleration (g)														
Elevation (m)	Direction	Case 1us	Case 1n2us	Case 2sn4um	Case 2n3um	Case 2us	Case 2um	Case 3r3um	Case 3um	Case 4um	Case 4uh	Case 5uh	Case 5ah	Envelope All Cases
	Z	0.33	0.47	0.51	0.48	0.39	0.38	0.41	0.44	0.44	0.39	0.40	0.36	0.51
	X	0.18	0.25	0.41	0.37	0.30	0.26	0.41	0.38	0.41	0.34	0.33	0.32	0.41
4.7	Y	0.18	0.25	0.38	0.36	0.35	0.24	0.33	0.32	0.40	0.30	0.35	0.35	0.40
	Z	0.33	0.48	0.52	0.50	0.40	0.38	0.42	0.46	0.46	0.41	0.42	0.40	0.52
	X	0.17	0.25	0.45	0.38	0.30	0.27	0.46	0.41	0.46	0.35	0.39	0.37	0.46
8.1	Y	0.17	0.26	0.39	0.36	0.36	0.25	0.35	0.34	0.42	0.30	0.34	0.35	0.42
	Z	0.33	0.48	0.53	0.51	0.40	0.40	0.44	0.47	0.48	0.42	0.44	0.42	0.53
	X	0.17	0.26	0.50	0.40	0.30	0.28	0.51	0.46	0.54	0.35	0.47	0.42	0.54
12	Y	0.17	0.26	0.42	0.37	0.36	0.26	0.37	0.35	0.45	0.32	0.37	0.36	0.45

Table 3.7.2-16—Safeguard Building 2/3 Shield Structure ZPAs
Sheet 3 of 3

Safeguards Building 2/3 Shield Structure														
Zero Period Accelerations at Each Floor Level (g)														
	Motion => Soil Case =>	EURS 1u	EURS 1n2u	EURM 2sn4u	EURM 2n3u	EURS 2u	EURM 2u	EURM 3r3u	EURM 3u	EURM 4u	EURH 4u	EURH 5u	EURH 5a	
		Acceleration (g)												
Elevation (m)	Direction	Case 1us	Case 1n2us	Case 2sn4um	Case 2n3um	Case 2us	Case 2um	Case 3r3um	Case 3um	Case 4um	Case 4uh	Case 5uh	Case 5ah	Envelope All Cases
	Z	0.33	0.48	0.54	0.52	0.41	0.41	0.46	0.48	0.50	0.44	0.45	0.46	0.54
	X	0.18	0.27	0.54	0.42	0.31	0.29	0.55	0.49	0.56	0.37	0.47	0.43	0.56
15.4	Y	0.17	0.27	0.46	0.37	0.36	0.26	0.39	0.36	0.47	0.33	0.40	0.38	0.47
	Z	0.33	0.48	0.55	0.53	0.41	0.42	0.47	0.49	0.51	0.46	0.47	0.49	0.55
	X	0.19	0.29	0.63	0.46	0.32	0.33	0.61	0.55	0.63	0.43	0.57	0.52	0.63
21	Y	0.17	0.29	0.53	0.39	0.38	0.28	0.43	0.41	0.55	0.37	0.45	0.45	0.55
	Z	0.33	0.49	0.56	0.54	0.41	0.43	0.48	0.51	0.54	0.49	0.50	0.56	0.56
	X	0.19	0.32	0.73	0.50	0.36	0.38	0.68	0.62	0.70	0.53	0.69	0.62	0.73
28.8	Y	0.18	0.32	0.60	0.43	0.40	0.29	0.51	0.46	0.63	0.46	0.51	0.54	0.63
	Z	0.33	0.49	0.57	0.55	0.42	0.44	0.51	0.52	0.57	0.55	0.58	0.66	0.66

Table 3.7.2-17—Fuel Building Shield Structure ZPAs
Sheet 1 of 4

Fuel Building Shield Structure														
Zero Period Accelerations at Each Floor Level (g)														
	Motion => Soil Case =>	EURS 1u	EURS 1n2u	EURM 2sn4u	EURM 2n3u	EURS 2u	EURM 2u	EURM 3r3u	EURM 3u	EURM 4u	EURH 4u	EURH 5u	EURH 5a	
Acceleration (g)														
Elevation (m)	Direction	Case 1us	Case 1n2us	Case 2sn4um	Case 2n3um	Case 2us	Case 2um	Case 3r3um	Case 3um	Case 4um	Case 4uh	Case 5uh	Case 5ah	Envelope All Cases
	X	0.18	0.23	0.34	0.36	0.28	0.26	0.30	0.28	0.32	0.28	0.28	0.29	0.36
-9.6	Y	0.20	0.24	0.34	0.34	0.32	0.23	0.32	0.30	0.35	0.26	0.28	0.29	0.35
	Z	0.34	0.49	0.51	0.44	0.48	0.37	0.37	0.37	0.40	0.31	0.29	0.29	0.51
	X	0.18	0.23	0.37	0.36	0.27	0.26	0.33	0.30	0.34	0.29	0.29	0.29	0.37
-6.2	Y	0.19	0.25	0.36	0.36	0.33	0.24	0.33	0.31	0.36	0.29	0.29	0.29	0.36
	Z	0.34	0.50	0.54	0.45	0.48	0.38	0.39	0.39	0.43	0.31	0.33	0.34	0.54
	X	0.18	0.23	0.40	0.35	0.27	0.26	0.34	0.31	0.35	0.31	0.30	0.30	0.40
-3.4	Y	0.19	0.25	0.37	0.37	0.34	0.24	0.32	0.31	0.38	0.30	0.31	0.32	0.38

Table 3.7.2-17—Fuel Building Shield Structure ZPAs
Sheet 2 of 4

Fuel Building Shield Structure														
Zero Period Accelerations at Each Floor Level (g)														
	Motion => Soil Case =>	EURS 1u	EURS 1n2u	EURM 2sn4u	EURM 2n3u	EURS 2u	EURM 2u	EURM 3r3u	EURM 3u	EURM 4u	EURH 4u	EURH 5u	EURH 5a	
		Acceleration (g)												
Elevation (m)	Direction	Case 1us	Case 1n2us	Case 2sn4um	Case 2n3um	Case 2us	Case 2um	Case 3r3um	Case 3um	Case 4um	Case 4uh	Case 5uh	Case 5ah	Envelope All Cases
	Z	0.34	0.50	0.56	0.46	0.50	0.39	0.41	0.40	0.44	0.32	0.34	0.38	0.56
	X	0.18	0.23	0.42	0.35	0.27	0.26	0.37	0.34	0.38	0.32	0.31	0.33	0.42
0	Y	0.18	0.25	0.38	0.36	0.35	0.25	0.33	0.32	0.39	0.31	0.34	0.35	0.39
	Z	0.34	0.50	0.59	0.47	0.51	0.39	0.43	0.42	0.46	0.34	0.37	0.42	0.59
	X	0.18	0.24	0.44	0.36	0.27	0.26	0.40	0.37	0.42	0.33	0.33	0.36	0.44
3.7	Y	0.18	0.26	0.39	0.36	0.35	0.25	0.35	0.32	0.41	0.33	0.41	0.39	0.41
	Z	0.35	0.51	0.62	0.49	0.53	0.40	0.44	0.43	0.48	0.36	0.39	0.48	0.62
	X	0.18	0.25	0.47	0.38	0.29	0.27	0.45	0.41	0.47	0.34	0.36	0.39	0.47
7.4	Y	0.18	0.27	0.40	0.36	0.36	0.26	0.36	0.35	0.42	0.38	0.46	0.44	0.46

Table 3.7.2-17—Fuel Building Shield Structure ZPAs
Sheet 3 of 4

Fuel Building Shield Structure													
Zero Period Accelerations at Each Floor Level (g)													
	Motion => Soil Case =>	EURS 1u	EURS 1n2u	EURM 2sn4u	EURM 2n3u	EURS 2u	EURM 2u	EURM 3r3u	EURM 3u	EURM 4u	EURH 4u	EURH 5u	EURH 5a	
Acceleration (g)													
Elevation (m)	Direction	Case 1us	Case 1n2us	Case 2sn4um	Case 2n3um	Case 2us	Case 2um	Case 3r3um	Case 3um	Case 4um	Case 4uh	Case 5uh	Case 5ah	Envelope All Cases
	Z	0.35	0.51	0.64	0.51	0.54	0.41	0.46	0.46	0.51	0.38	0.43	0.53	0.64
	X	0.18	0.25	0.50	0.39	0.30	0.27	0.49	0.44	0.52	0.34	0.38	0.41	0.52
11.1	Y	0.17	0.28	0.42	0.38	0.37	0.26	0.39	0.38	0.45	0.42	0.50	0.47	0.50
	Z	0.35	0.52	0.65	0.52	0.55	0.42	0.47	0.47	0.54	0.39	0.46	0.57	0.65
	X	0.18	0.26	0.55	0.41	0.32	0.29	0.52	0.48	0.56	0.35	0.42	0.44	0.56
14.8	Y	0.18	0.29	0.46	0.40	0.39	0.27	0.43	0.42	0.50	0.45	0.53	0.49	0.53
	Z	0.35	0.52	0.67	0.53	0.56	0.43	0.49	0.48	0.57	0.41	0.49	0.61	0.67
	X	0.19	0.28	0.61	0.44	0.33	0.32	0.57	0.52	0.61	0.39	0.48	0.48	0.61
19.5	Y	0.18	0.31	0.52	0.43	0.41	0.28	0.46	0.47	0.57	0.48	0.54	0.49	0.57

Table 3.7.2-17—Fuel Building Shield Structure ZPAs
Sheet 4 of 4

Fuel Building Shield Structure														
Zero Period Accelerations at Each Floor Level (g)														
	Motion => Soil Case =>	EURS 1u	EURS 1n2u	EURM 2sn4u	EURM 2n3u	EURS 2u	EURM 2u	EURM 3r3u	EURM 3u	EURM 4u	EURH 4u	EURH 5u	EURH 5a	
Acceleration (g)														
Elevation (m)	Direction	Case 1us	Case 1n2us	Case 2sn4um	Case 2n3um	Case 2us	Case 2um	Case 3r3um	Case 3um	Case 4um	Case 4uh	Case 5uh	Case 5ah	Envelope All Cases
	Z	0.35	0.53	0.68	0.55	0.57	0.44	0.51	0.50	0.60	0.42	0.52	0.64	0.68
	X	0.20	0.31	0.70	0.49	0.34	0.36	0.64	0.58	0.69	0.48	0.60	0.56	0.70
24.2	Y	0.18	0.32	0.60	0.45	0.44	0.29	0.49	0.48	0.65	0.49	0.53	0.52	0.65
	Z	0.35	0.53	0.69	0.56	0.58	0.44	0.53	0.51	0.62	0.45	0.55	0.68	0.69
	X	0.20	0.34	0.79	0.53	0.38	0.39	0.70	0.63	0.80	0.58	0.68	0.70	0.80
34	Y	0.21	0.35	0.73	0.49	0.49	0.35	0.64	0.59	0.79	0.58	0.64	0.64	0.79
	Z	0.36	0.54	0.71	0.57	0.60	0.45	0.59	0.56	0.68	0.49	0.59	0.72	0.72

Table 3.7.2-18—Maximum Base Forces and Moments at Bottom of NI Common Basemat

Maximum Forces at the Base of the NI Common Basemat Superstructure									
Square Root of Sum of Squares (SRSS)									
				(N-S)	(E-W)				
			Axial	Shear-Y	Shear-X	Torsion	Mom-YY	Mom-XX
Motion	Soil Case	Case	P1(max)	P2(max)	P3(max)	M1(max)	M2(max)	M3(max)
			kN	kN	kN	kN-m	kN-m	kN-m
EURS	1u	1us	932930	698402	739860	3554709	18465001	17360132
EURS	1n2u	1n2us	1264307	1087139	1047388	5209445	35353946	38916211
EURM	2sn4u	2sn4um	1774284	1724397	1965878	9075055	66805657	68237699
EURM	2n3u	2n3um	1713170	1496598	1591025	6703663	46549337	48710946
EURS	2u	2us	1297671	1423801	1187251	5246059	38463191	40395444
EURM	2u	2um	1272451	974226	1013483	5698046	30293679	29806465
EURM	3r3u	3r3um	1479960	1633515	1787823	5655506	56535943	57445881
EURM	3u	3um	1507621	1449604	1664432	5662896	53803700	52550945
EURM	4u	4um	1603082	1935797	1953863	5566116	65575902	66218490
EURH	4u	4uh	1397345	1186127	1332752	5360311	44773097	45195620
EURH	5u	5uh	1479772	1265928	1306525	6327764	42213283	51202071
EURH	5a	5ah	1594920	1405012	1371250	9214202	41337112	52539171
		Envelope	1,774,284	1,935,797	1,965,878	9,214,202	66,805,657	68,237,699

Table 3.7.2-19—Worst Case Inter-Story Forces and Moments in Reactor Building Internal Structures Sheet 1 of 2

Maximum Forces Profile for the Reactor Building Internals								
Square Root of Sum of Squares (SRSS)								
Envelope of All 12 Soil/Motion Combinations								
				N-S	E-W			
			Axial	Shear-Y	Shear-X	Torsion	Mom-YY	Mom-XX
Elevation	Element	Node	P1(max)	P2(max)	P3(max)	M1(max)	M2(max)	M3(max)
m	No.	No.	kN	kN	kN	kN-m	kN-m	kN-m
-6.15	1	1004	263191	279950	246495	812689	5420609	5733889
-2.3	1	1011	263191	279950	246495	812689	4480352	4696474
-2.3	2	1014	240445	246380	218889	716068	4446724	4660571
1.5	2	1021	240445	246380	218889	716068	3626493	3743655
1.5	3	1024	192444	215435	192375	864089	3555280	3652522
5.15	3	1031	192444	215435	192375	864089	2860051	2875972
5.15	4	1034	168661	190168	172364	720669	2836849	2868622
6.92	4	1036	168661	190168	172364	720669	2540619	2534041
6.92	5	1038	155251	176133	160562	677657	2521788	2552598
9.38	5	1041	155251	176133	160562	677657	2137521	2127840
9.38	6	1044	135167	152113	142655	584057	2107647	2075413
13.8	6	1051	135167	152113	142655	584057	1505885	1416453
13.8	7	1054	112362	127060	122405	448407	1476522	1375600
16.45	7	1056	112362	127060	122405	448407	1158725	1051735
16.45	8	1056	111613	126564	121510	445338	1156610	1048094
19.5	8	1061	111613	126564	121510	445338	904284	833704

Table 3.7.2-19—Worst Case Inter-Story Forces and Moments in Reactor Building Internal Structures
Sheet 2 of 2

Maximum Forces Profile for the Reactor Building Internals									
Square Root of Sum of Squares (SRSS)									
Envelope of All 12 Soil/Motion Combinations									
				N-S	E-W				
			Axial	Shear-Y	Shear-X	Torsion	Mom-YY	Mom-XX
Elevation	Element	Node	P1(max)	P2(max)	P3(max)	M1(max)	M2(max)	M3(max)
m	No.	No.	kN	kN	kN	kN-m	kN-m	kN-m
19.5	10,9	1068	68734	62897	62179	157433	579540	581721
24.1	11,9	1078	68734	62238	61845	156740	368897	318250
24.1	13,12	1075	28302	31272	31508	75313	234220	242041
28.5	13,12	1085	28302	31272	31508	75313	116719	109645
28.5	26,27	1088	7576	3868	5363	7572	3130	45507
34.45	26,28	1098	7576	3868	5363	7572	3130	534

Table 3.7.2-20—Worst Case Inter-Story Forces and Moments in Reactor Containment Building
Sheet 1 of 2

Maximum Forces Profile for the Containment									
Square Root of Sum of Squares (SRSS)									
Envelope of All 12 Soil/Motion Combinations									
				N-S	E-W				
			Axial	Shear-Y	Shear-X	Torsion	Mom-YY	Mom-XX
Elevation	Element	Node	P1(max)	P2(max)	P3(max)	M1(max)	M2(max)	M3(max)
m	No.	No.	kN	kN	kN	kN-m	kN-m	kN-m
-2.3	1	3004	181603	173306	176276	297870	6919405	7256114
2.6	1	3014	181603	173306	176276	297870	6073003	6410111
2.6	2	3014	175603	168106	168459	289386	6078004	6398110
8.1	2	3024	175603	168106	168459	289386	5169004	5474128
8.1	3	3024	168303	162806	160900	276064	5151004	5461125
12	3	3034	168303	162806	160900	276064	4526005	4826146
12	4	3034	159403	156305	153800	257715	4498005	4799141
17.8	4	3044	159403	156305	153800	257715	3605006	3893179
17.8	5	3044	147702	147404	144200	232529	3567006	3851168
22.5	5	3054	147702	147404	144200	232529	2891006	3158208
22.5	6	3054	134002	135903	132100	200275	2849003	3105153
28.8	6	3064	134002	135903	132100	200275	2053003	2262209
28.8	7	3064	117202	120702	115700	162927	1979002	2194184
34	7	3074	117202	120702	115700	162927	1488002	1581239
34	8	3074	103202	106602	101200	129021	1407002	1523214
37.6	8	3084	103202	106602	101200	129021	1110002	1147265

Table 3.7.2-20—Worst Case Inter-Story Forces and Moments in Reactor Containment Building
Sheet 2 of 2

Maximum Forces Profile for the Containment								
Square Root of Sum of Squares (SRSS)								
Envelope of All 12 Soil/Motion Combinations								
				N-S	E-W			
			Axial	Shear-Y	Shear-X	Torsion	Mom-YY	Mom-XX
Elevation	Element	Node	P1(max)	P2(max)	P3(max)	M1(max)	M2(max)	M3(max)
m	No.	No.	kN	kN	kN	kN-m	kN-m	kN-m
37.6	9	3084	81842	84122	78030	92530	998402	1058060
43.92	9	3094	81842	84122	78030	92530	590601	600573
43.92	10	3094	24511	39342	35020	0	335401	375115
53.3	10	3100	24511	39342	35020	0	7433	7471
53.3	11	3100	2465	1589	1582	0	7433	7471
58	11	3101	2465	1589	1582	0	0	0

Table 3.7.2-21—Worst Case Inter-Story Forces and Moments in Reactor Shield Building
Sheet 1 of 3

Maximum Forces Profile for the Reactor Building Shield								
Square Root of Sum of Squares (SRSS)								
Envelope of All 12 Soil/Motion Combinations								
				N-S	E-W			
			Axial	Shear-Y	Shear-X	Torsion	Mom-YY	Mom-XX
Elevation	Element	Node	P1(max)	P2(max)	P3(max)	M1(max)	M2(max)	M3(max)
m	No.	No.	kN	kN	kN	kN-m	kN-m	kN-m
-4.3	1	2004	244043	367995	411246	925810	13064261	14050984
-3.4	1	2008	244043	367995	411246	925810	12703331	13740631
-3.4	2	2008	243974	351900	406407	915162	12683416	13729972
0	2	2010	243974	351900	406407	915162	11508704	12588613
0	3	2010	243153	321556	370727	898739	11578747	12648249
2.6	3	2014	243153	321556	370727	898739	10808117	11827377
2.6	4	2014	236956	313806	358897	883341	10758092	11767340
3.7	4	2018	236956	313806	358897	883341	10437917	11426916
3.7	5	2018	236904	305998	357386	869438	10447957	11467129
4.7	5	2020	236904	305998	357386	869438	10157777	11166703
4.7	6	2020	235538	304547	348673	846675	10307934	11186614
7.4	6	2022	235538	304547	348673	846675	9535387	10375854
7.4	7	2022	235572	297472	347657	827897	9545437	10426131
8.1	7	2024	235572	297472	347657	827897	9364293	10215863
8.1	8	2024	227415	288792	321087	783489	9484383	10185908
11.1	8	2028	227415	288792	321087	783489	8720820	9328006

Table 3.7.2-21—Worst Case Inter-Story Forces and Moments in Reactor Shield Building
Sheet 2 of 3

Maximum Forces Profile for the Reactor Building Shield									
Square Root of Sum of Squares (SRSS)									
Envelope of All 12 Soil/Motion Combinations									
				N-S	E-W				
			Axial	Shear-Y	Shear-X	Torsion	Mom-YY	Mom-XX
Elevation	Element	Node	P1(max)	P2(max)	P3(max)	M1(max)	M2(max)	M3(max)
m	No.	No.	kN	kN	kN	kN-m	kN-m	kN-m
11.1	9	2028	227539	282332	320680	769347	8735879	9396255
12	9	2034	227539	282332	320680	769347	8511692	9148008
12	10	2034	218486	274901	286252	718003	8662828	9135041
14.8	10	2038	218486	274901	286252	718003	8013307	8387441
14.8	11	2038	218605	269114	286348	701076	8033371	8468892
15.4	11	2040	218605	269114	286348	701076	7894271	8311776
15.4	12	2040	219157	274408	288869	693892	7918291	8378191
16.8	12	2044	219157	274408	288869	693892	7591058	8003904
16.8	13	2044	205865	250191	257056	620174	7750283	7917599
19.5	13	2048	205865	250191	257056	620174	7151940	7254302
19.5	14	2048	206079	245229	258055	606810	7180043	7345664
21	14	2050	206079	245229	258055	606810	6863808	6984351
21	15	2050	203828	256118	248526	607333	7174266	7055674
22.5	15	2054	203828	256118	248526	607333	6857979	6676379
22.5	16	2054	189426	236791	226165	542563	6680943	6572695
24.7	16	2058	189426	236791	226165	542563	6243550	6057312

Table 3.7.2-21—Worst Case Inter-Story Forces and Moments in Reactor Shield Building
Sheet 3 of 3

Maximum Forces Profile for the Reactor Building Shield								
Square Root of Sum of Squares (SRSS)								
Envelope of All 12 Soil/Motion Combinations								
				N-S	E-W			
			Axial	Shear-Y	Shear-X	Torsion	Mom-YY	Mom-XX
Elevation	Element	Node	P1(max)	P2(max)	P3(max)	M1(max)	M2(max)	M3(max)
m	No.	No.	kN	kN	kN	kN-m	kN-m	kN-m
24.7	17	2058	187163	229082	224601	536330	6584952	6155520
28.8	17	2064	187163	229082	224601	536330	5713525	5226373
28.8	22,23	2061, 2065	168626	240375	247015	687239	5898046	5211884
34	22,23	2071, 2075	168626	240375	247015	687239	4652252	3969954
34	18	2074	154116	217121	234738	407159	4516715	3994626
37.6	18	2084	154116	217121	234738	407159	3701925	3220146
37.6	19	2084	133714	184065	201909	297558	3469722	3051552
45.2	19	2094	133714	184065	201909	297558	1979220	1666812
45.2	20	2094	73958	107996	122335	0	1389549	1225361
56.2	20	2102	73958	107996	122335	0	43999	37210
56.2	21	2102	7688	7751	9166	0	43999	37210
61	21	2104	7688	7751	9166	0	0	0

Table 3.7.2-22—Worst Case Inter-Story Forces and Moments in Safeguard Building 1

Maximum Forces Profile for the Safeguard Bldg 1								
Square Root of Sum of Squares (SRSS)								
Envelope of All 12 Soil/Motion Combinations								
				N-S	E-W			
			Axial	Shear-Y	Shear-X	Torsion	Mom-YY	Mom-XX
Elevation	Element	Node	P1(max)	P2(max)	P3(max)	M1(max)	M2(max)	M3(max)
m	No.	No.	kN	kN	kN	kN-m	kN-m	kN-m
-8.6	83	4004	192460	111154	73955	476482	2929270	2623115
-4.5	83	4011	192460	111154	73955	476482	2634179	2185457
-4.5	84	4014	176070	101731	96532	242973	2539298	2192676
0	84	4021	176070	101731	96532	242973	2108990	1789146
0	85	4024	165088	87545	100733	284494	2075939	1780002
4.7	85	4031	165088	87545	100733	284494	1606771	1398409
4.7	86	4034	151543	78215	92229	257578	1566291	1392592
8.1	86	4041	151543	78215	92229	257578	1260331	1150214
8.1	87	4044	138380	73069	89289	269046	1304628	1146223
12	87	4051	138380	73069	89289	269046	999557	889340
12	88	4054	117124	65622	85084	334754	949112	865082
16.8	88	4061	117124	65622	85084	334754	656284	569884
16.8	89	4064	86231	48492	69024	267636	694171	525206
21	89	4071	86231	48492	69024	267636	417410	376458
21	90	4074	57177	34986	54557	201098	391941	277173
24.7	90	4081	57177	34986	54557	201098	197235	219933
24.7	91	4084	26290	15409	34899	203944	182448	118670
29.3	91	4091	26290	15409	34899	203944	76675	93022

Table 3.7.2-23—Worst Case Inter-Story Forces and Moments in Safeguard Building 2/3

Maximum Forces Profile for the Safeguard Bldg 2/3								
Square Root of Sum of Squares (SRSS)								
Envelope of All 12 Soil/Motion Combinations								
				N-S	E-W			
			Axial	Shear-Y	Shear-X	Torsion	Mom-YY	Mom-XX
Elevation	Element	Node	P1(max)	P2(max)	P3(max)	M1(max)	M2(max)	M3(max)
m	No.	No.	kN	kN	kN	kN-m	kN-m	kN-m
-8.6	171	5004	220909	163129	190186	691341	4316724	4334698
-4.5	171	5011	220909	163129	190186	691341	3543104	3666177
-4.5	172	5014	197469	168090	174885	1087440	3539099	3605226
0	172	5021	197469	168090	174885	1087440	2761090	2850654
0	173	5024	174802	179734	162903	1493759	2746675	2841268
4.7	173	5031	174802	179734	162903	1493759	1981932	2001676
4.7	174	5034	149805	155085	145503	1584856	1954084	1994233
8.1	174	5041	149805	155085	145503	1584856	1460094	1537093
8.1	175	5044	118856	134124	127402	1450554	1431081	1448704
12	175	5051	118856	134124	127402	1450554	994900	989972
12	176	5054	89516	102966	100502	1184500	931804	955419
15.4	176	5061	89516	102966	100502	1184500	639631	671623
15.4	177	5064	55121	65179	67672	496805	561045	543660
21	177	5071	55121	65179	67672	496805	226857	241559
21	178	5074	13154	16094	13591	147109	106957	128834
26.8	178	5081	13154	16094	13591	147109	56737	54186

Table 3.7.2-24—Worst Case Inter-Story Forces and Moments in Safeguard Building 4

Maximum Forces Profile for the Safeguard Bldg 4								
Square Root of Sum of Squares (SRSS)								
Envelope of All 12 Soil/Motion Combinations								
				N-S	E-W			
			Axial	Shear-Y	Shear-X	Torsion	Mom-YY	Mom-XX
Elevation	Element	Node	P1(max)	P2(max)	P3(max)	M1(max)	M2(max)	M3(max)
m	No.	No.	kN	kN	kN	kN-m	kN-m	kN-m
-8.6	335	7004	175634	122493	81047	474637	2964472	2970026
-4.5	335	7011	175634	122493	81047	474637	2642289	2470291
-4.5	336	7014	168408	114531	99661	270079	2570319	2470812
0	336	7021	168408	114531	99661	270079	2127877	1984415
0	337	7024	158720	103442	104377	196427	2087773	1976018
4.7	337	7031	158720	103442	104377	196427	1602417	1550308
4.7	338	7034	147231	92156	95400	206569	1567181	1541333
8.1	338	7041	147231	92156	95400	206569	1249676	1249172
8.1	339	7044	135043	84306	91287	170315	1289151	1242530
12	339	7051	135043	84306	91287	170315	969720	926619
12	340	7054	115189	71913	85408	251459	943287	909889
16.8	340	7061	115189	71913	85408	251459	689006	587319
16.8	341	7064	85934	52341	67232	363583	701802	574708
21	341	7071	85934	52341	67232	363583	433344	419903
21	342	7074	56895	36396	52410	115620	356722	287005
24.7	342	7081	56895	36396	52410	115620	188403	203443
24.7	343	7084	26732	16463	34994	161288	163693	116050
29.3	343	7091	26732	16463	34994	161288	71062	72146

Table 3.7.2-25—Worst Case Inter-Story Forces and Moments in Safeguard Building 2/3 Shield Structure

Maximum Forces Profile for the Safeguard Bldg 2/3 Shield								
Square Root of Sum of Squares (SRSS)								
Envelope of All 12 Soil/Motion Combinations								
				N-S	E-W			
			Axial	Shear-Y	Shear-X	Torsion	Mom-YY	Mom-XX
Elevation	Element	Node	P1(max)	P2(max)	P3(max)	M1(max)	M2(max)	M3(max)
m	No.	No.	kN	kN	kN	kN-m	kN-m	kN-m
-8.6	236	6004	168476	279870	169078	1216396	5638079	7933471
-4.5	236	6011	168476	279870	169078	1216396	4976590	6795701
-4.5	237	6014	155762	274805	162957	1215400	4929550	6801721
0	237	6021	155762	274805	162957	1215400	4207806	5583067
0	238	6024	141136	255309	156754	1234539	4155140	5526144
4.7	238	6031	141136	255309	156754	1234539	3427764	4333926
4.7	239	6034	127969	239660	147530	1255714	3346064	4298374
8.1	239	6041	127969	239660	147530	1255714	2848255	3486467
8.1	240	6044	116253	217595	137243	1192292	2786204	3466407
12	240	6051	116253	217595	137243	1192292	2255179	2619862
12	241	6054	103718	188815	125196	1266542	2187519	2568937
15.4	241	6061	103718	188815	125196	1266542	1764802	1930536
15.4	242	6064	89179	167917	110854	1585441	1672780	1861597
21	242	6071	89179	167917	110854	1585441	1063502	1023005
21	243	6074	68008	121605	88477	1380985	946527	967041
28.8	243	6081	68008	121605	88477	1380985	325502	461170

Table 3.7.2-26—Maximum NI Common Basemat Displacement Relative to Free Field Input Motion

SSI Analysis Case	RD-X (inch)	RD-Y (inch)	RD-Z (inch)
1us	1.095	0.772	0.656
1n2us	0.673	0.698	0.380
2us	0.327	0.347	0.221
2um	0.250	0.252	0.183
2n3um	0.351	0.358	0.179
2sn4um	0.339	0.308	0.121
3r3um	0.145	0.108	0.084
3um	0.189	0.146	0.101
4um	0.108	0.090	0.052
4uh	0.061	0.056	0.038
5uh	0.037	0.036	0.023
5ah	0.000	0.001	0.000

Table 3.7.2-27—Worst Case Maximum Accelerations in EPGB

Slab Elevation	X-Direction	Y-Direction	Z-Direction
+68 ft, 0 inches	1.150g	1.364g	1.116g
+51 ft, 6 inches	1.010g	1.089g	0.977g
+19 ft, 3 inches	0.645g	0.756g	0.646g
0 ft, 0 inches	0.499g	0.523g	0.633g

Table 3.7.2-28—Worst Case Maximum Accelerations in ESWB

Slab Elevation	X-Direction	Y-Direction	Z-Direction
+114 ft, 0 inches	0.957g	1.018g	1.481g
+80 ft, 9 inches	0.790g	0.754g	1.218g
+61 ft, 10 inches	0.584g	1.087g	0.738g
+33 ft, 0 inches	0.586g	0.561g	0.617g
0 ft, 0 inches	0.447g	0.372g	0.568g

Table 3.7.2-29—Seismic Structural Interaction Criteria for Building Structures

Basis: Control Interaction through Prevention of Structure-to-Structure Impact[4]				
Structure	**Seismic Category**	**Design Code**	**Seismic Interaction[1] Criteria**	**Seismic Interaction Evaluation**
Turbine / SBO	CS	IBC[2] Steel – AISC 341 Concrete – ACI 318	SSE	Collapse Load Evaluation or ASCE 43-05 - Limit State A
Access	CS	IBC[2] ACI 318	SSE	ASCE 43-05 – Limit State A
NAB	CS RS	IBC[2] ACI 318 ACI 349[3]	SSE[1]	ASCE 43-05, Limit State A
RWPB	CS RS	IBC[2] ACI 318 ACI 349[3]	None[1]	No Interaction Potential

Notes:

1. The NAB and RWPB, as Radwaste Structures, are also designed for the ½ SSE in accordance with the guidance for RW-IIa structures in RG 1.143.
2. Seismic design criteria for IBC-based design to be based on SSE with design forces and moments modified per ASCE 43-05 for design to SDC 5, Limit State A.
3. ACI 349 required due to Radwaste Seismic classification.
4. This table is not applicable to equipment and subsystems qualification criteria.

Figure 3.7.2-1—Decoupling of the Nuclear Island Common Basemat Interior Structures from the Outer Shield Walls

Figure 3.7.2-2—Plan View of Schematic Stick Model for Nuclear Island Common Basemat Structures

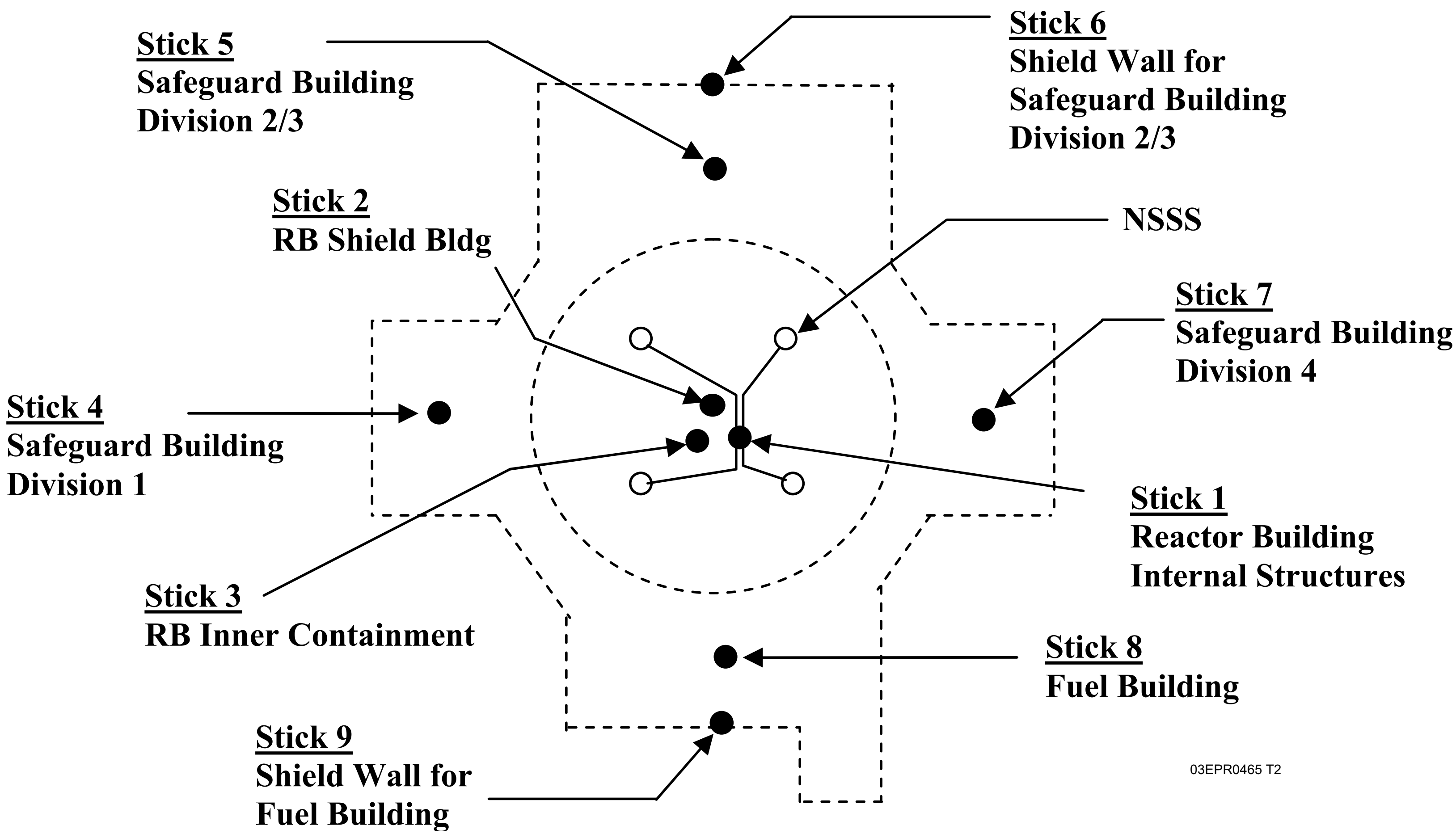


Figure 3.7.2-3—Schematic Elevation View of Stick Model for Nuclear Island Common Basemat Structures in Global Y-Z Plane

Figure 3.7.2-4—Schematic Elevation View of Stick Model for Nuclear Island Common Basemat Structures in Global X-Z Plane

Figure 3.7.2-5—3D Finite Element Model of Balance of NI Common Basemat Structures Perspective View

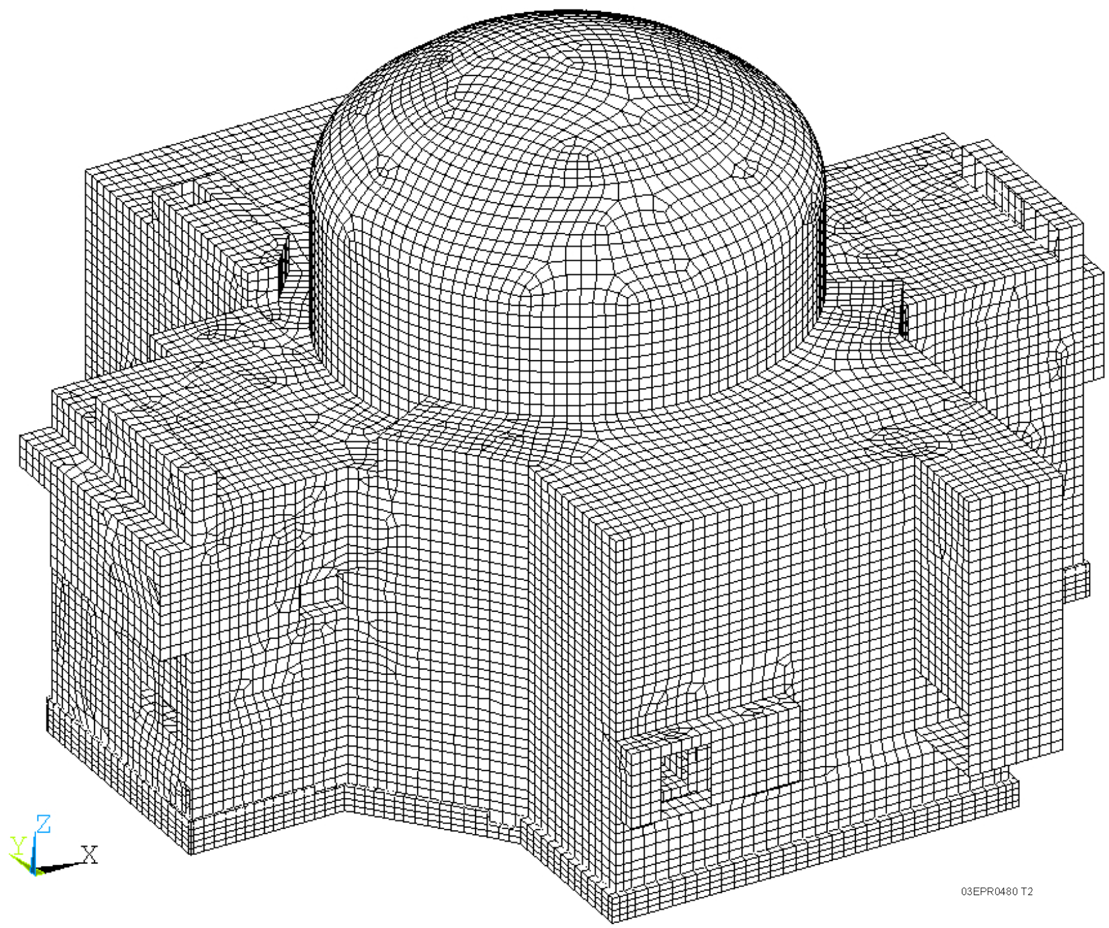


Figure 3.7.2-6—3D Finite Element Model of Balance of NI Common Basemat Structures Cutoff View on Y-Z Plane

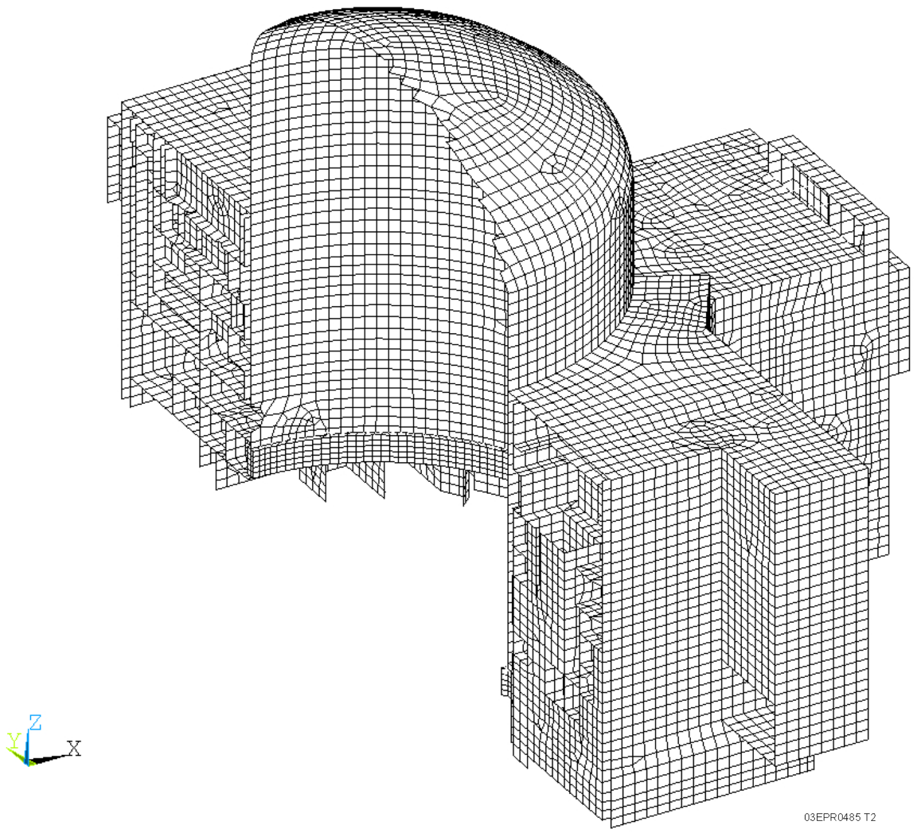


Figure 3.7.2-7—3D Finite Element Model of Balance of NI Common Basemat Structures Cutoff View on X-Z Plane

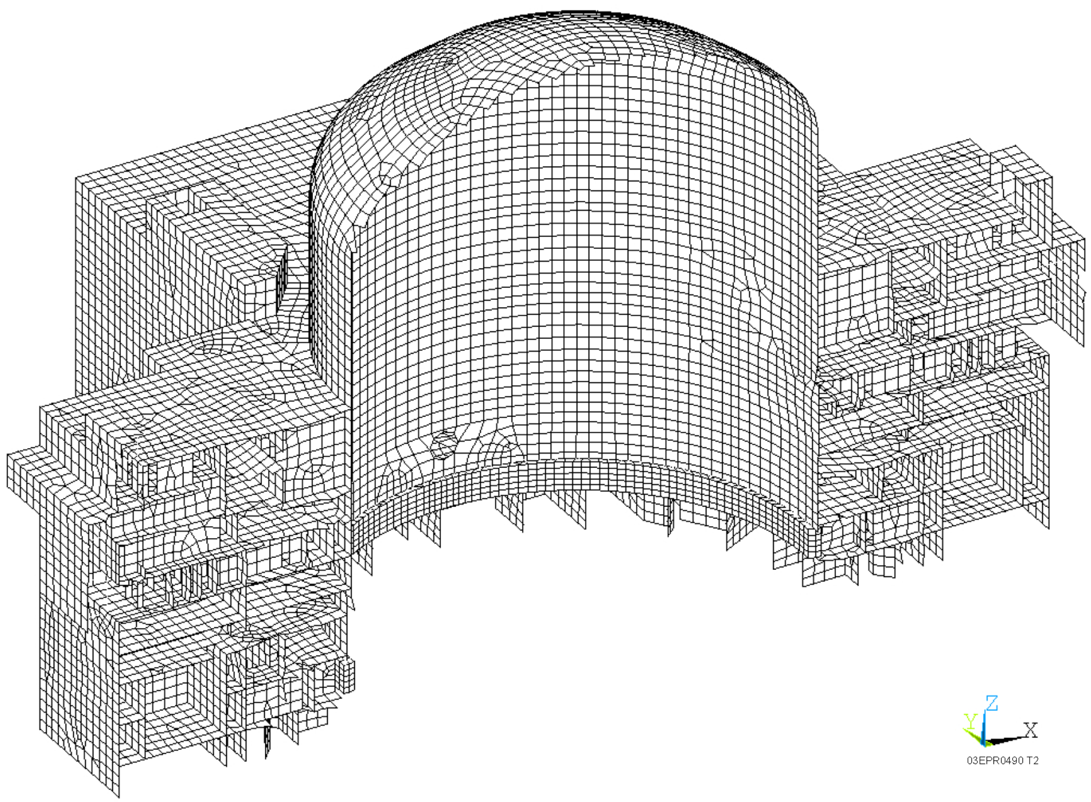


Figure 3.7.2-8—3D Finite Element Model of Reactor Containment Building

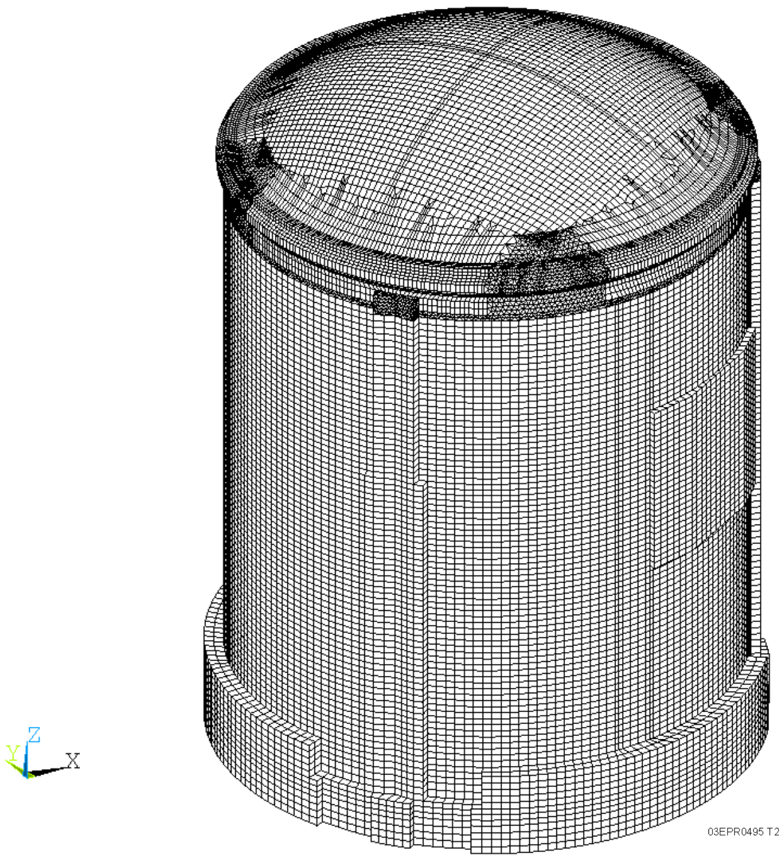


Figure 3.7.2-9—3D Finite Element Model of Reactor Building Internal Structures

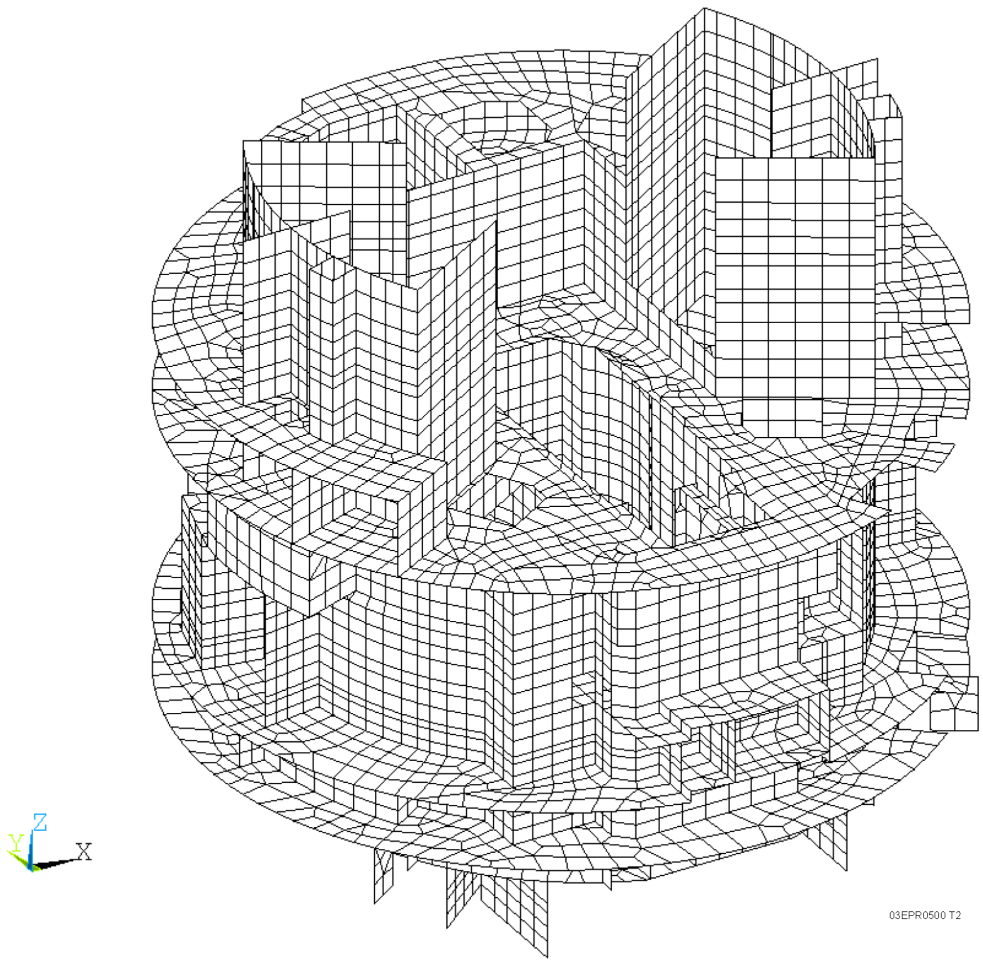


Figure 3.7.2-10—Stick Model STICK-2T for Balance of NI Common Basemat Structures - Plan View

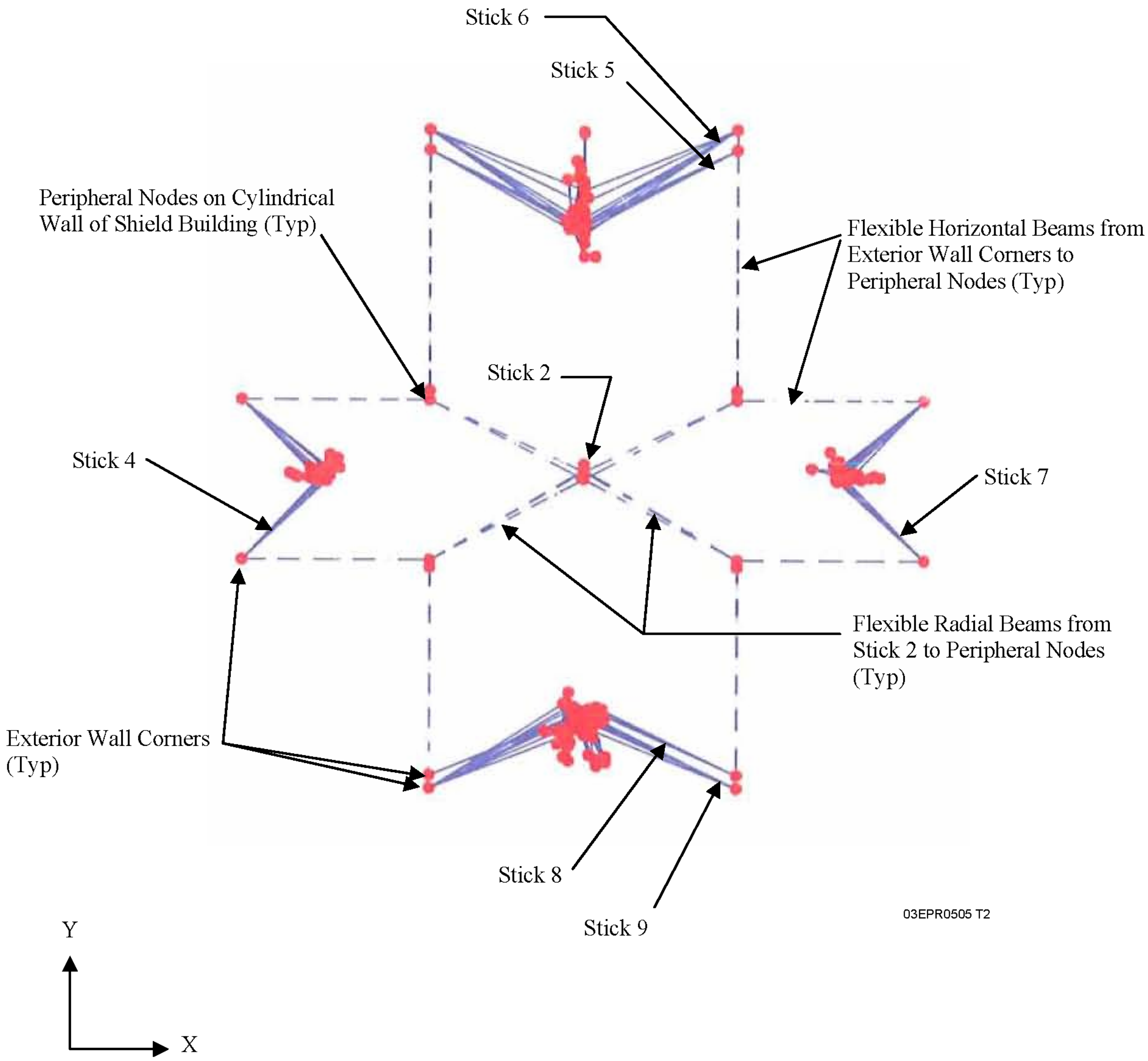


Figure 3.7.2-11—Stick Model STICK-2T for Balance of NI Common Basemat Structures - Perspective View

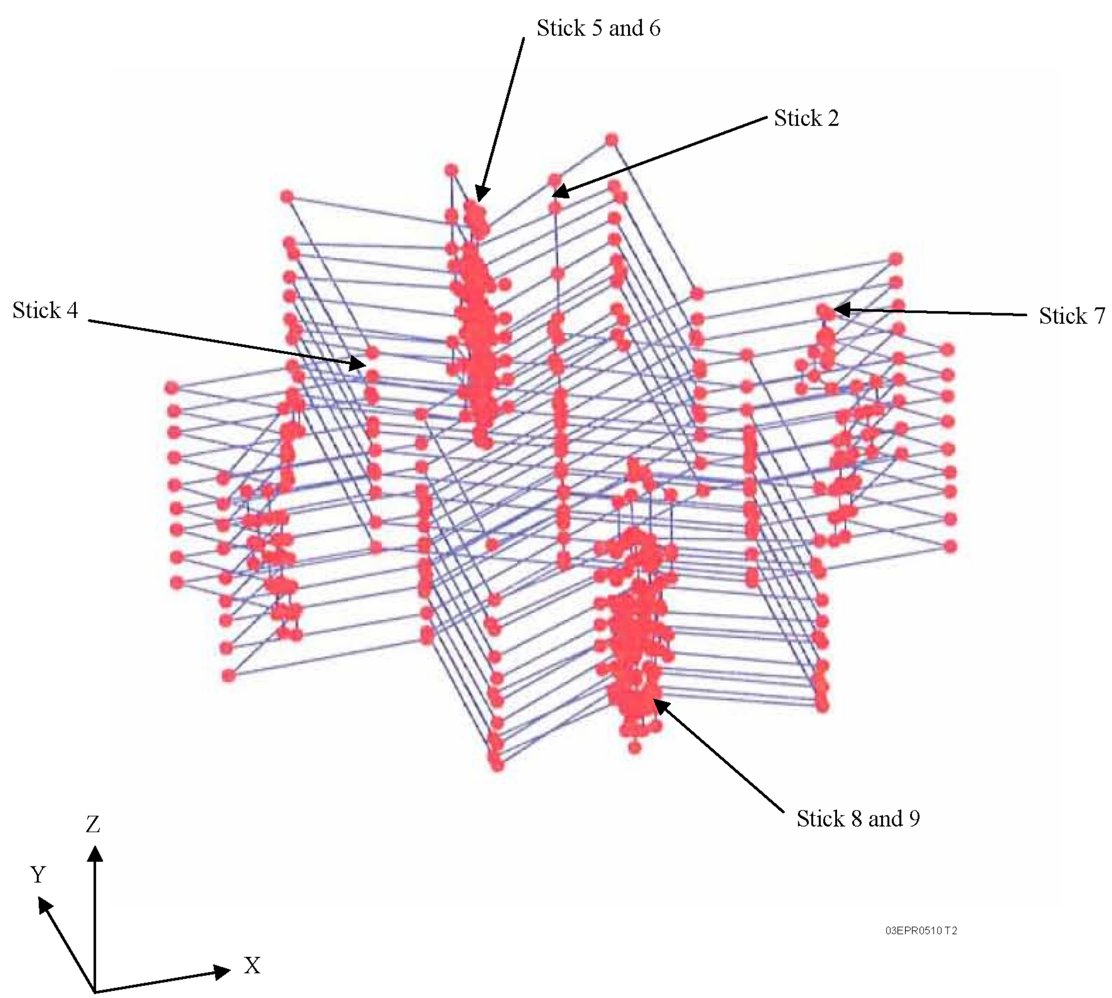


Figure 3.7.2-12—Stick Model STICK-3T for Reactor Containment - Perspective View

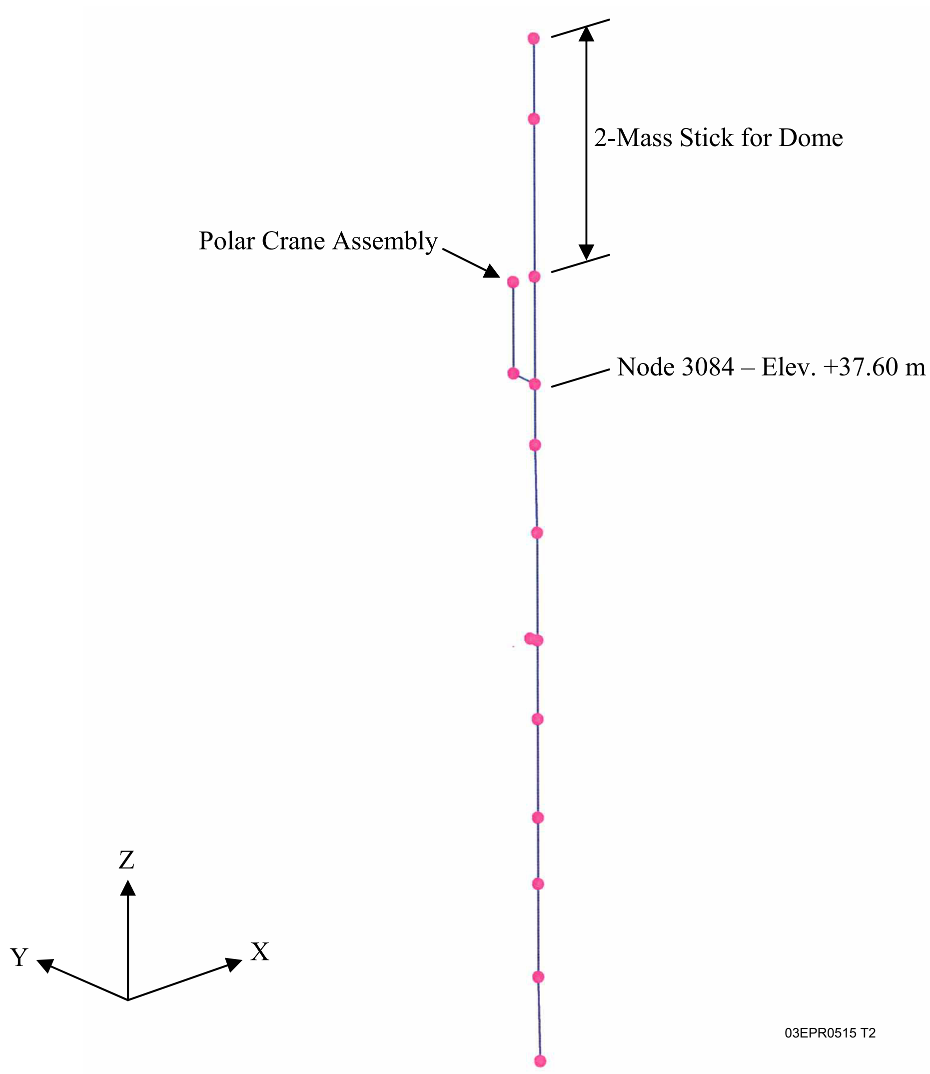


Figure 3.7.2-13—Stick Model STICK-1T for Reactor Building Internal Structure - Perspective View

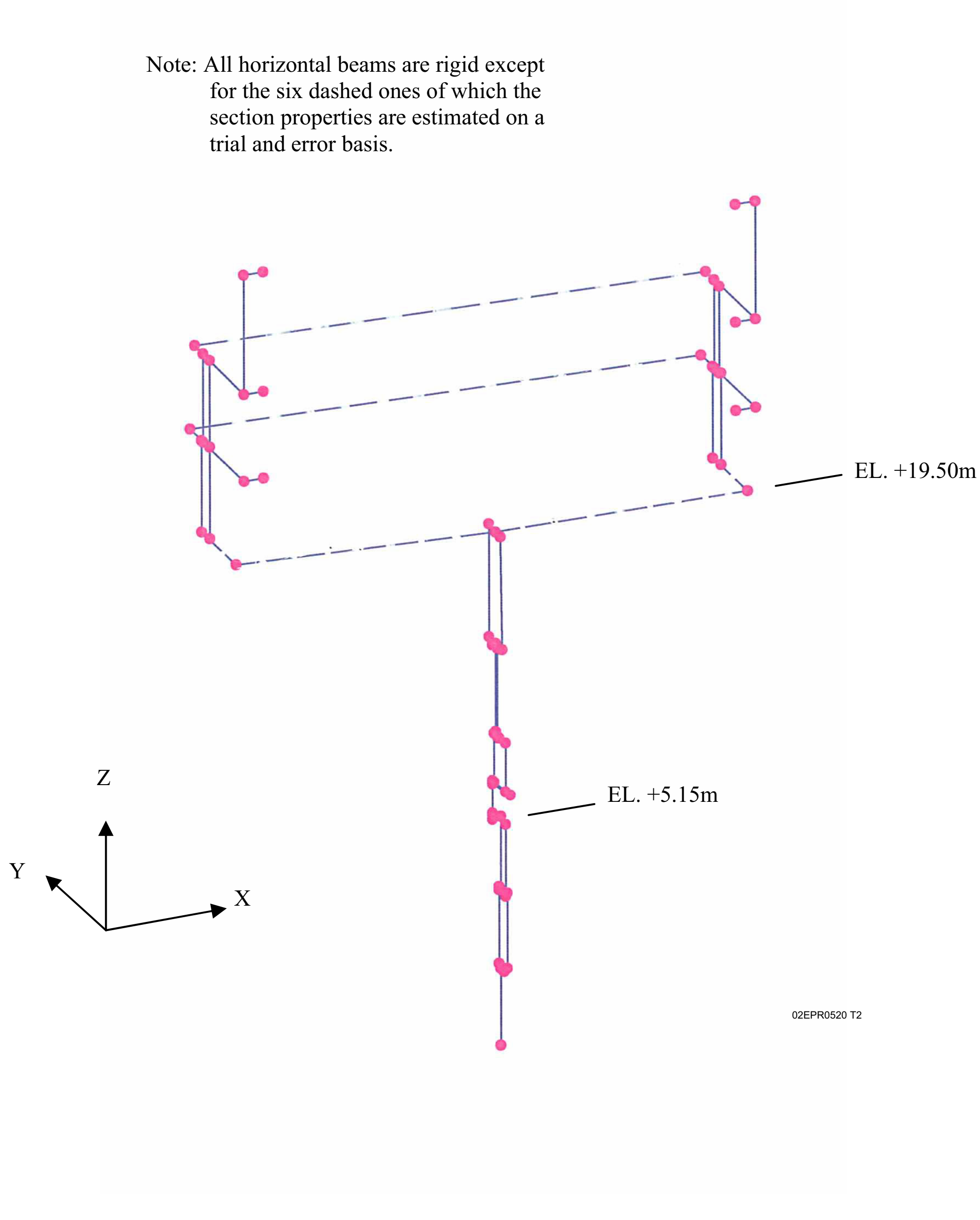


Figure 3.7.2-14—Stick vs. FEM Spectrum Comparison at Elev. +200ft, 5 inches (+61.09m) (Dome Apex) of Reactor Shield Building, 5% Damping, X-Direction

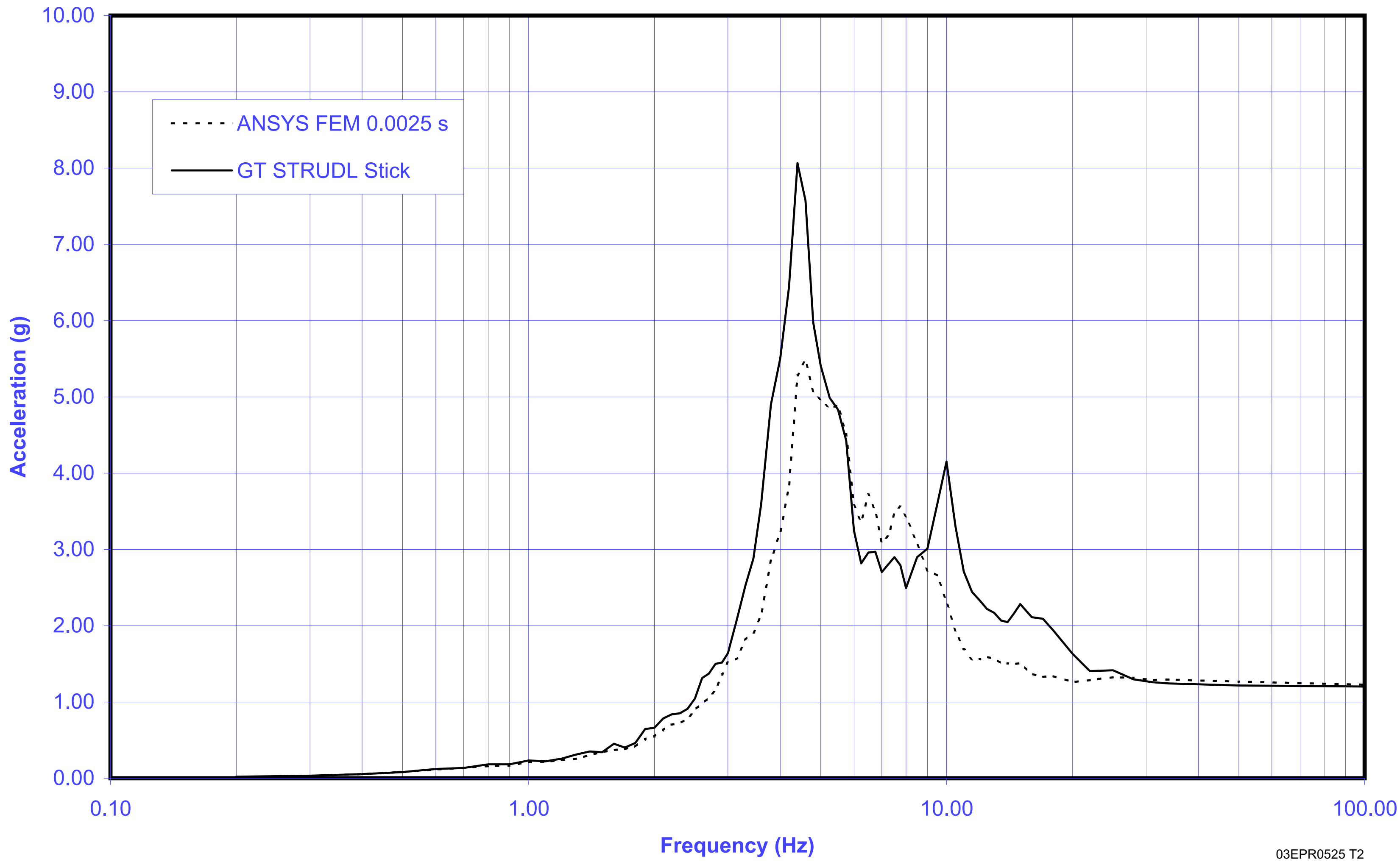


Figure 3.7.2-15—Stick vs. FEM Spectrum Comparison at Elev. +200ft, 5 inches (+61.09m) (Dome Apex) of Reactor Shield Building, 5% Damping, Y-Direction

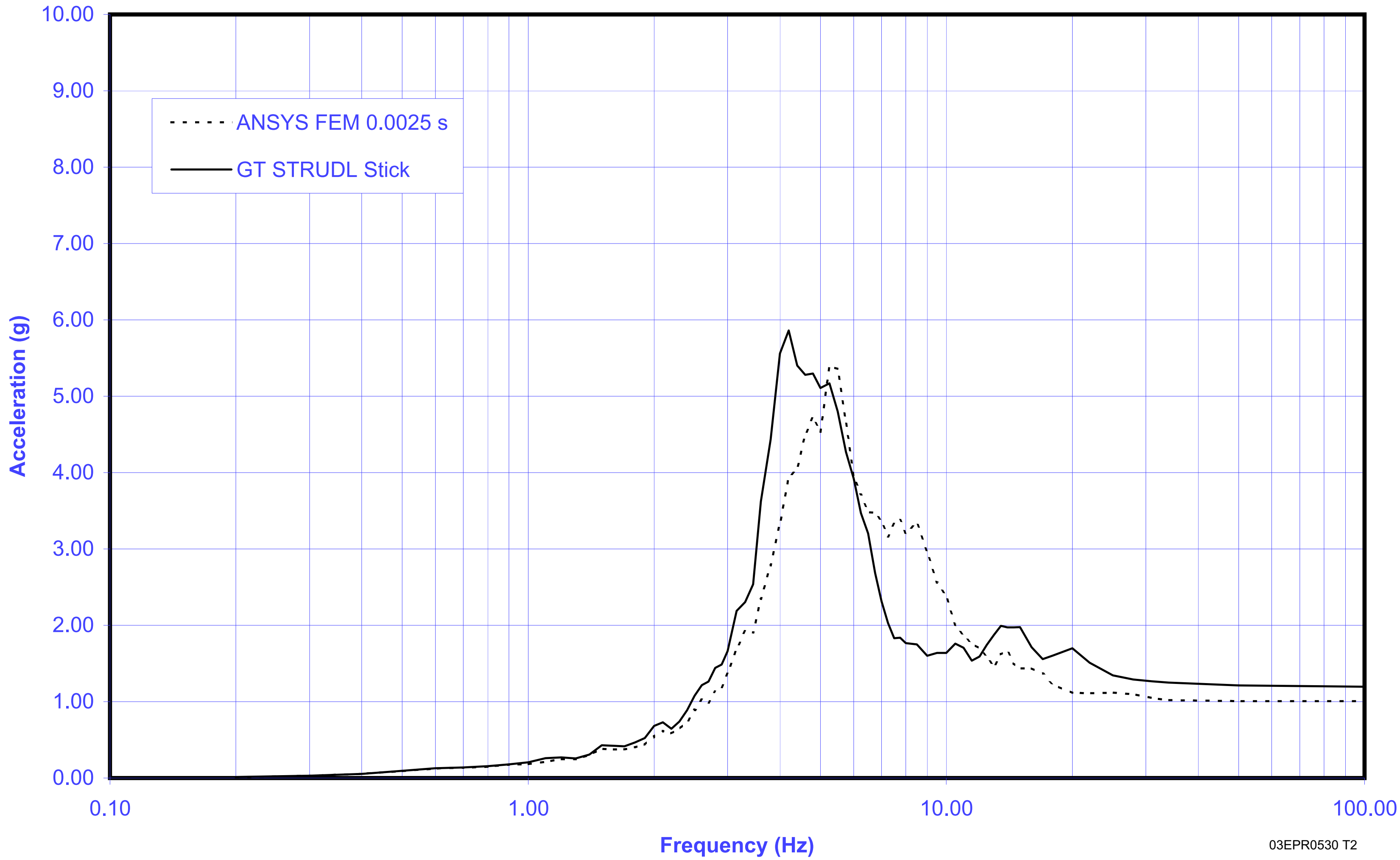


Figure 3.7.2-16—Stick vs. FEM Spectrum Comparison at Elev. +200ft, 5 inches (+61.09m) (Dome Apex) of Reactor Shield Building, 5% Damping, Z-Direction

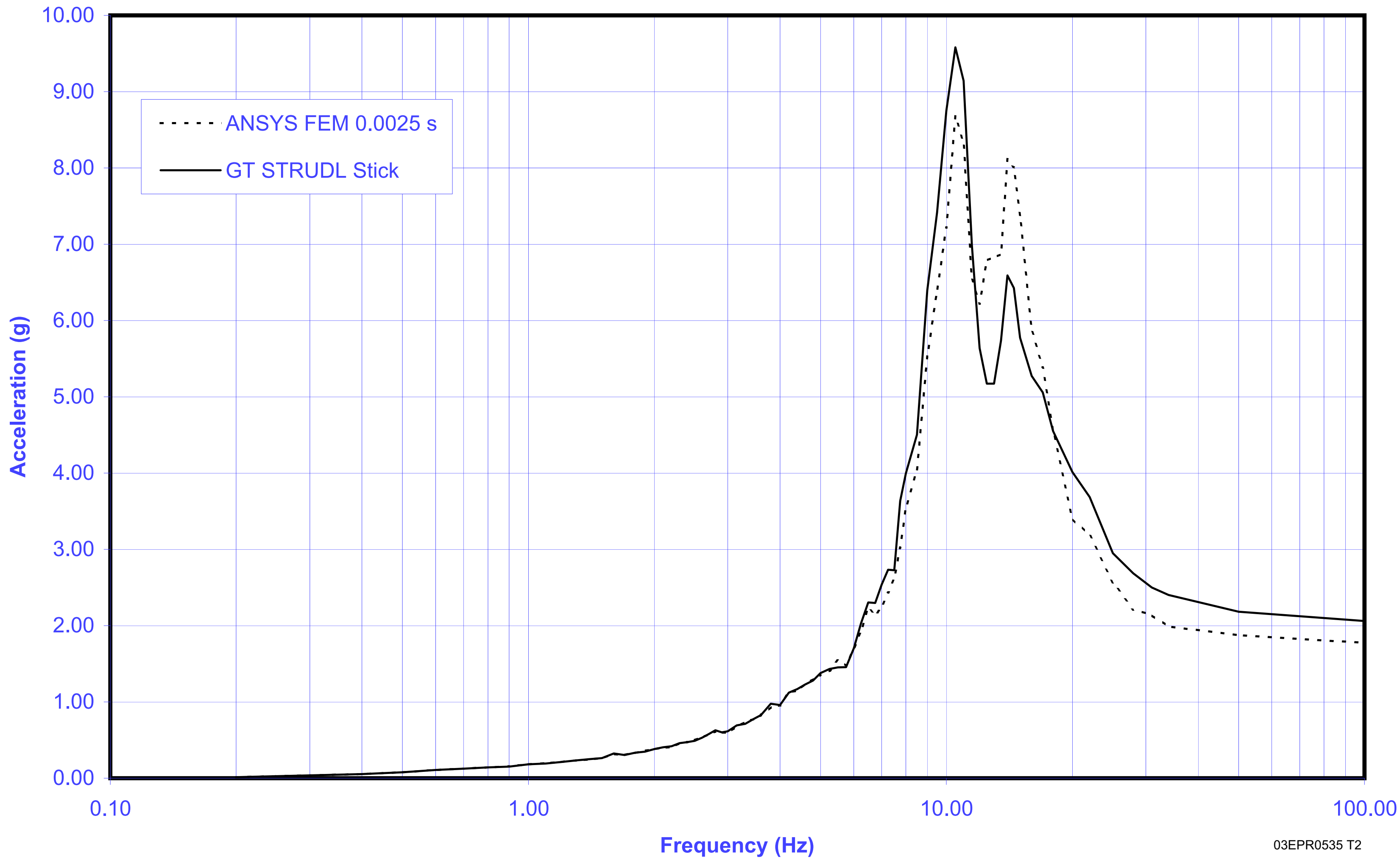


Figure 3.7.2-17—Stick vs. FEM Spectrum Comparison at Elev. +95 ft, 1-3/4 inches (+29.00m) - Safeguard Building 1, 5% Damping, X-Direction

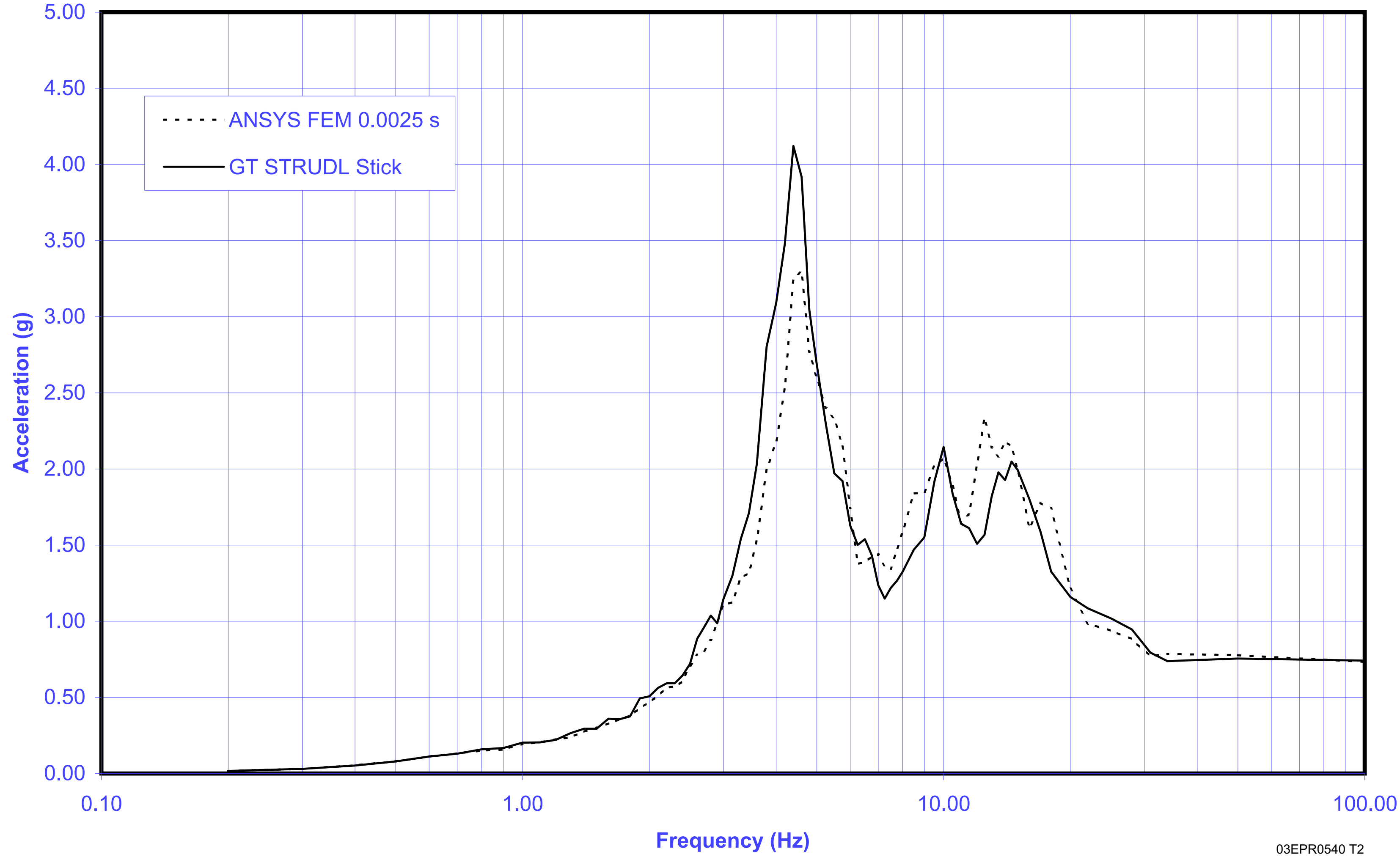


Figure 3.7.2-18—Stick vs. FEM Spectrum Comparison at Elev. +95 ft, 1-3/4 inches (+29.00m) - Safeguard Building 1, 5% Damping, Y-Direction

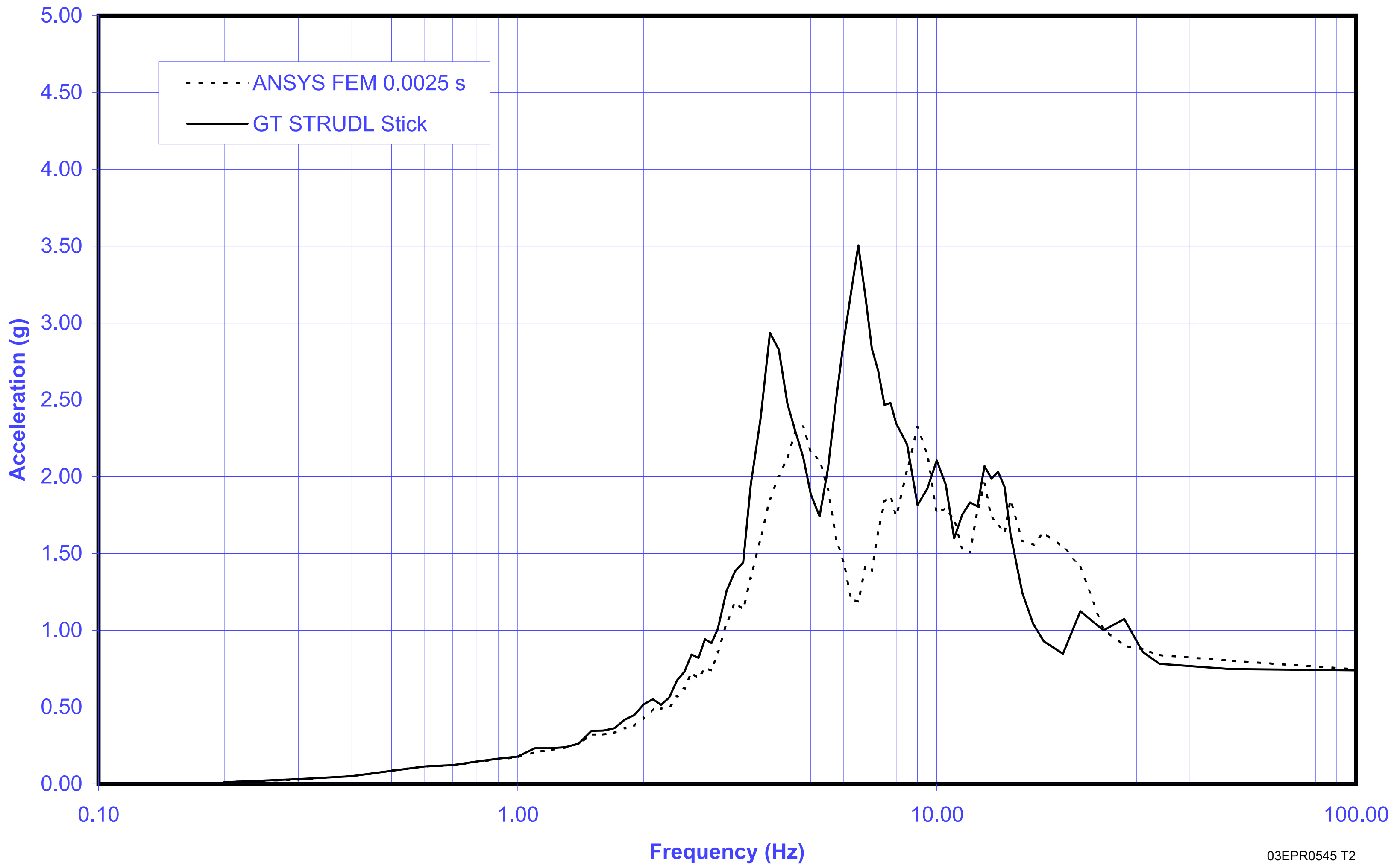


Figure 3.7.2-19—Stick vs. FEM Spectrum Comparison at Elev. +95 ft, 1-3/4 inches (+29.00m) - Safeguard Building 1, 5% Damping, Z-Direction

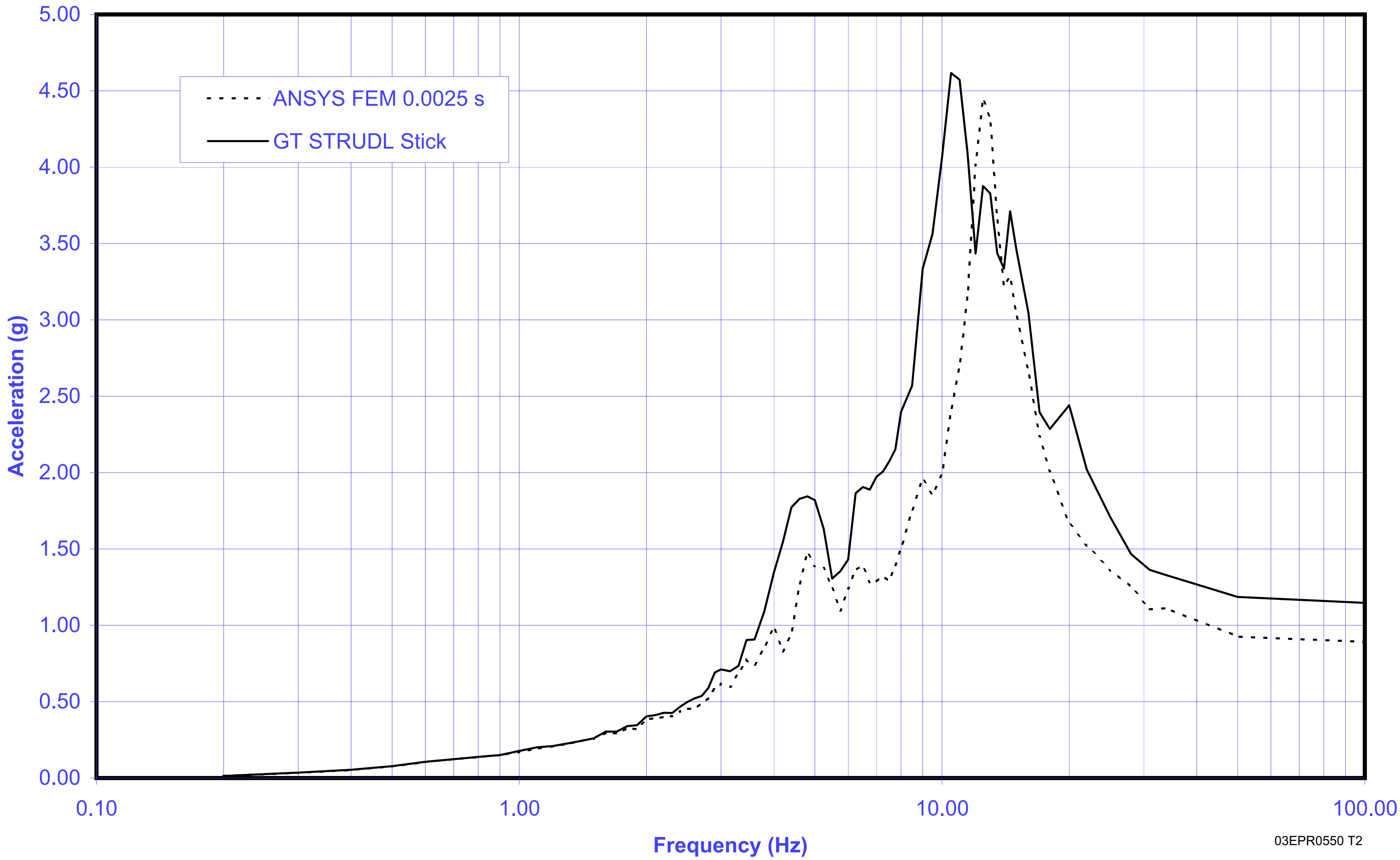


Figure 3.7.2-20—Stick vs. FEM Spectrum Comparison at Elev. +26 ft, 3 inches (+8.00m) - Safeguard Building 1, 5% Damping, X-Direction

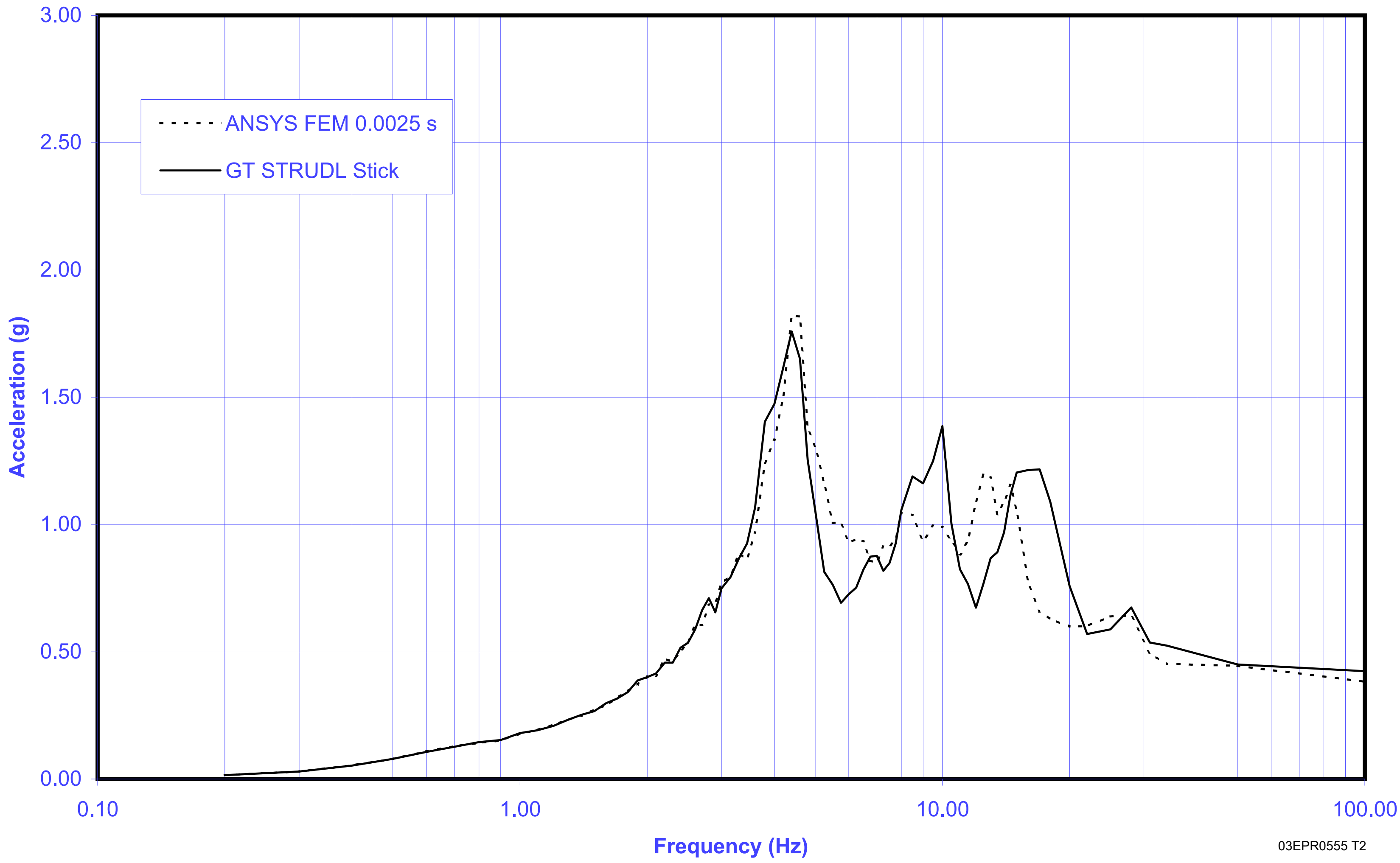


Figure 3.7.2-21—Stick vs. FEM Spectrum Comparison at Elev. +26 ft, 3 inches (+8.00m) - Safeguard Building 1, 5% Damping, Y-Direction

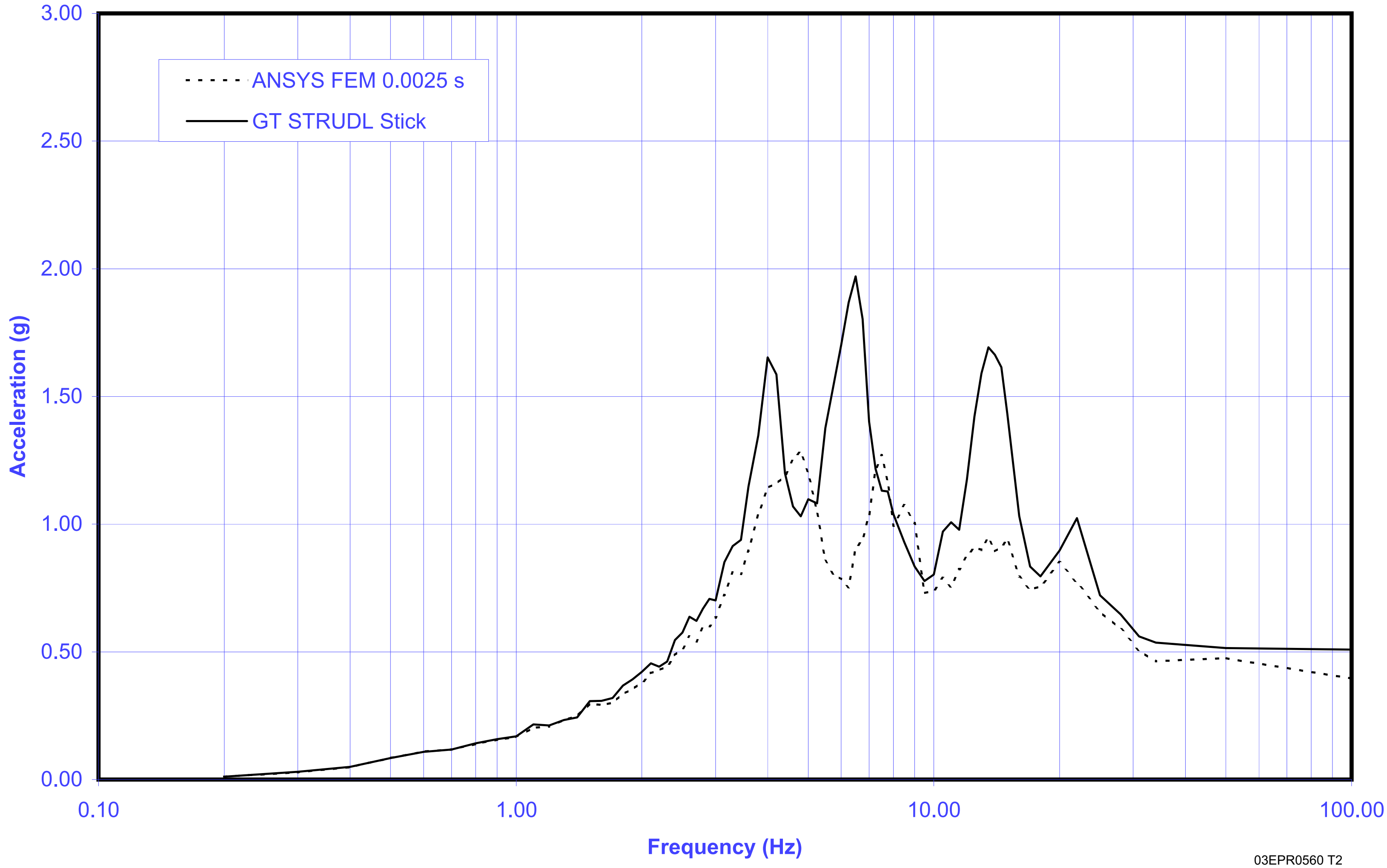


Figure 3.7.2-22—Stick vs. FEM Spectrum Comparison at Elev. +26 ft, 3 inches (+8.00m) - Safeguard Building 1, 5% Damping, Z-Direction

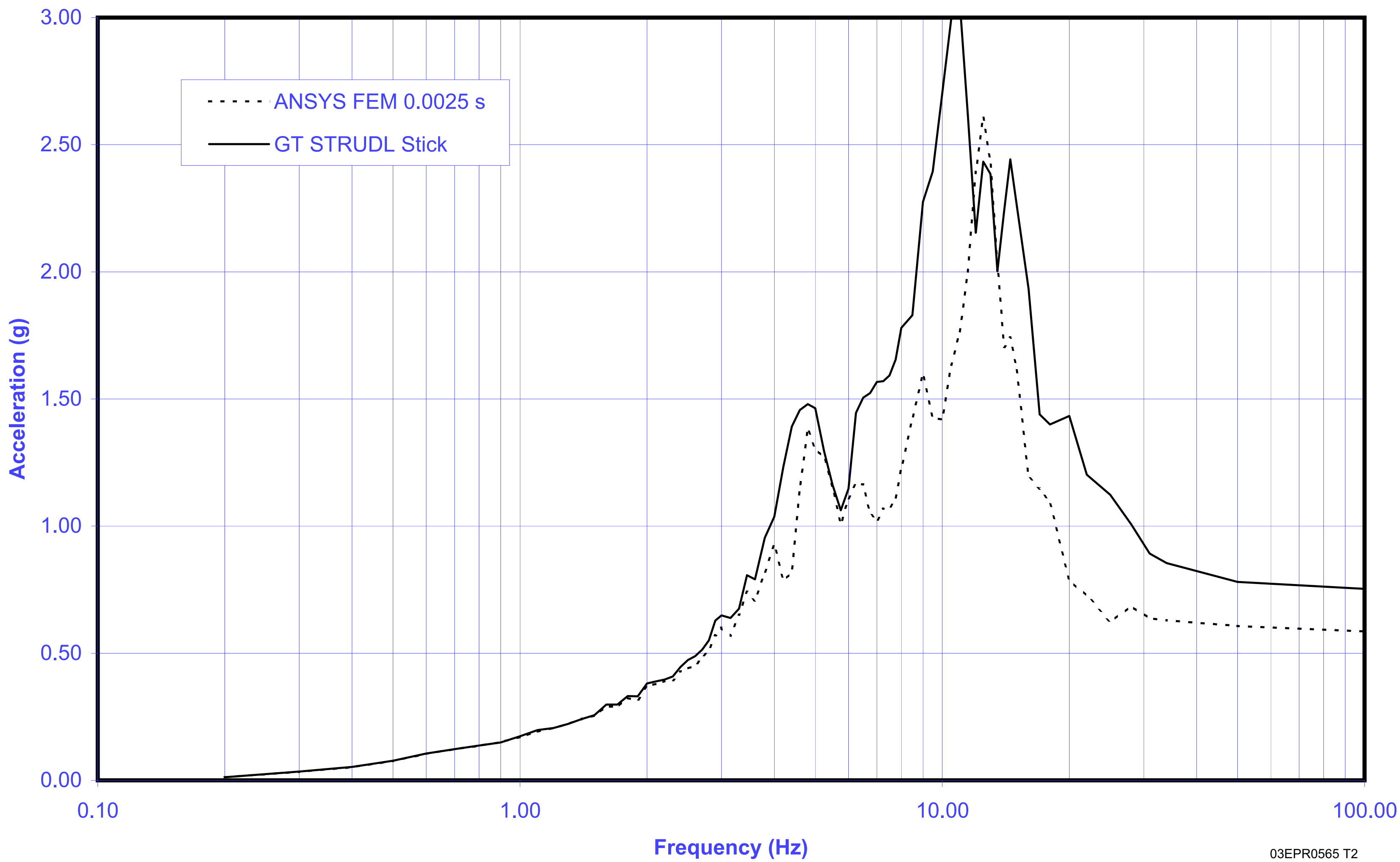


Figure 3.7.2-23—Stick vs. FEM Spectrum Comparison at Elev. +95 ft, 1-3/4 inches (+29.00m) - Safeguard Building 4, 5% Damping, X-Direction

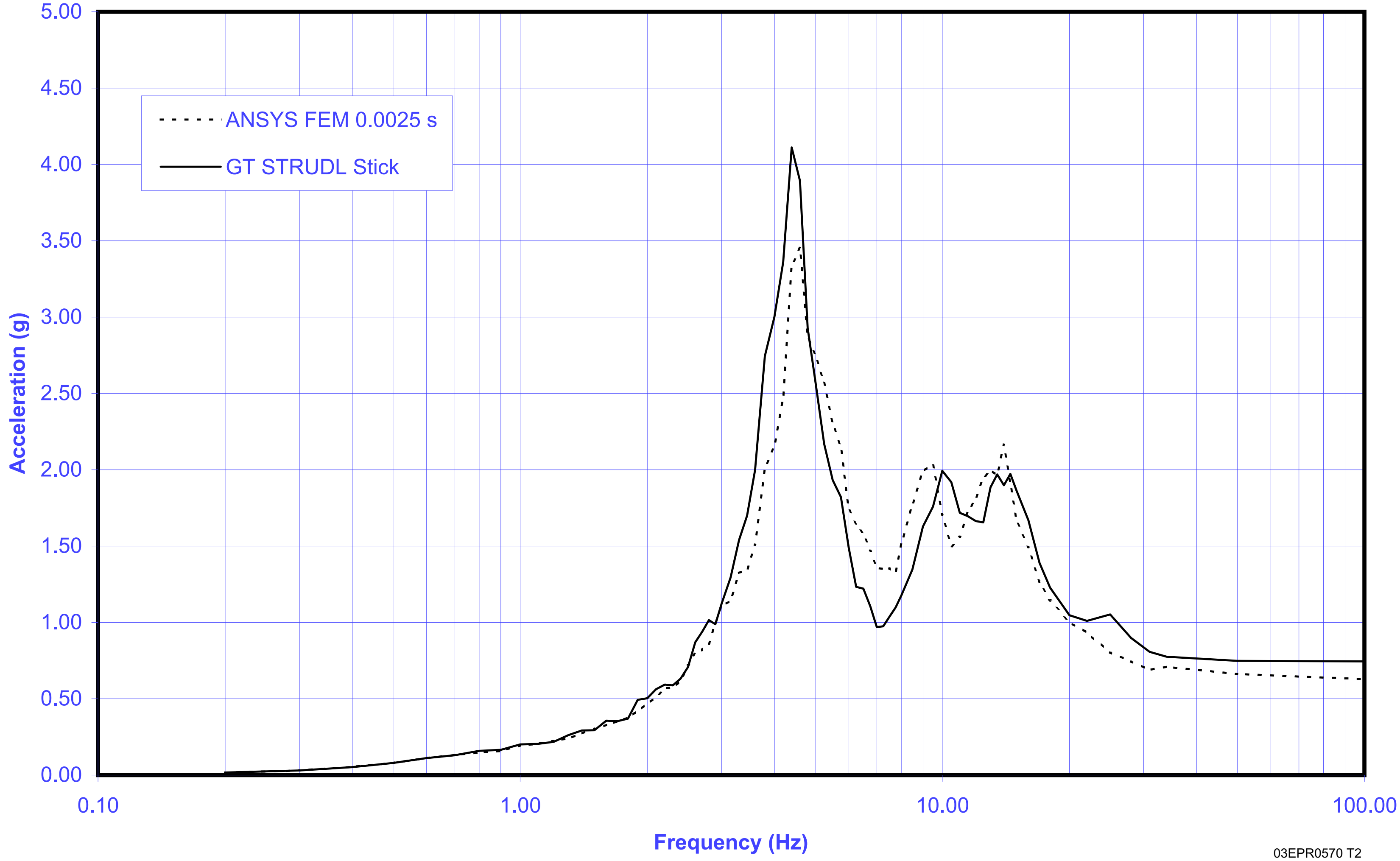


Figure 3.7.2-24—Stick vs. FEM Spectrum Comparison at Elev. +95 ft, 1-3/4 inches (+29.00m) - Safeguard Building 4, 5% Damping, Y-Direction

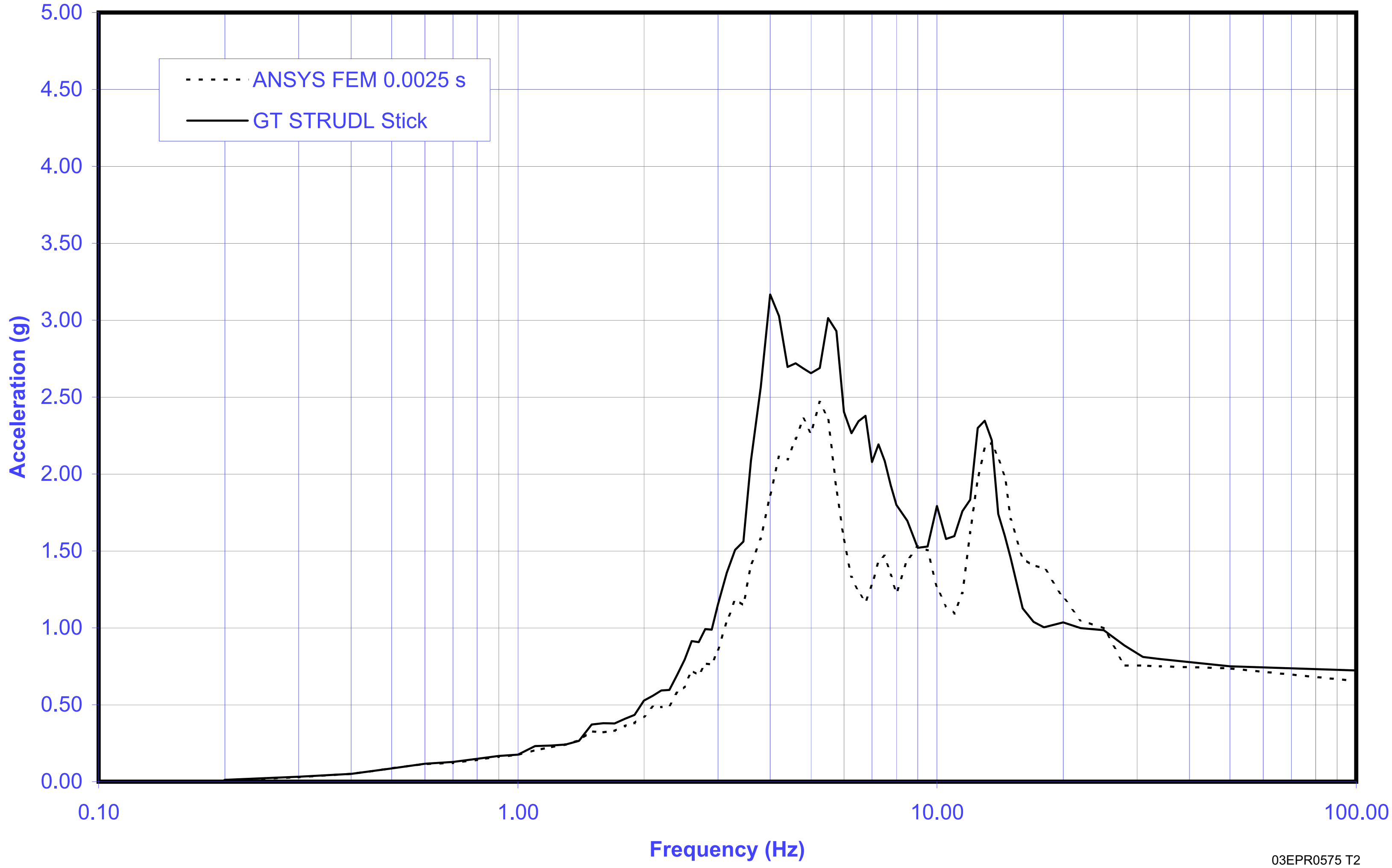


Figure 3.7.2-25—Stick vs. FEM Spectrum Comparison at Elev. +95 ft, 1-3/4 inches (+29.00m) - Safeguard Building 4, 5% Damping, Z-Direction

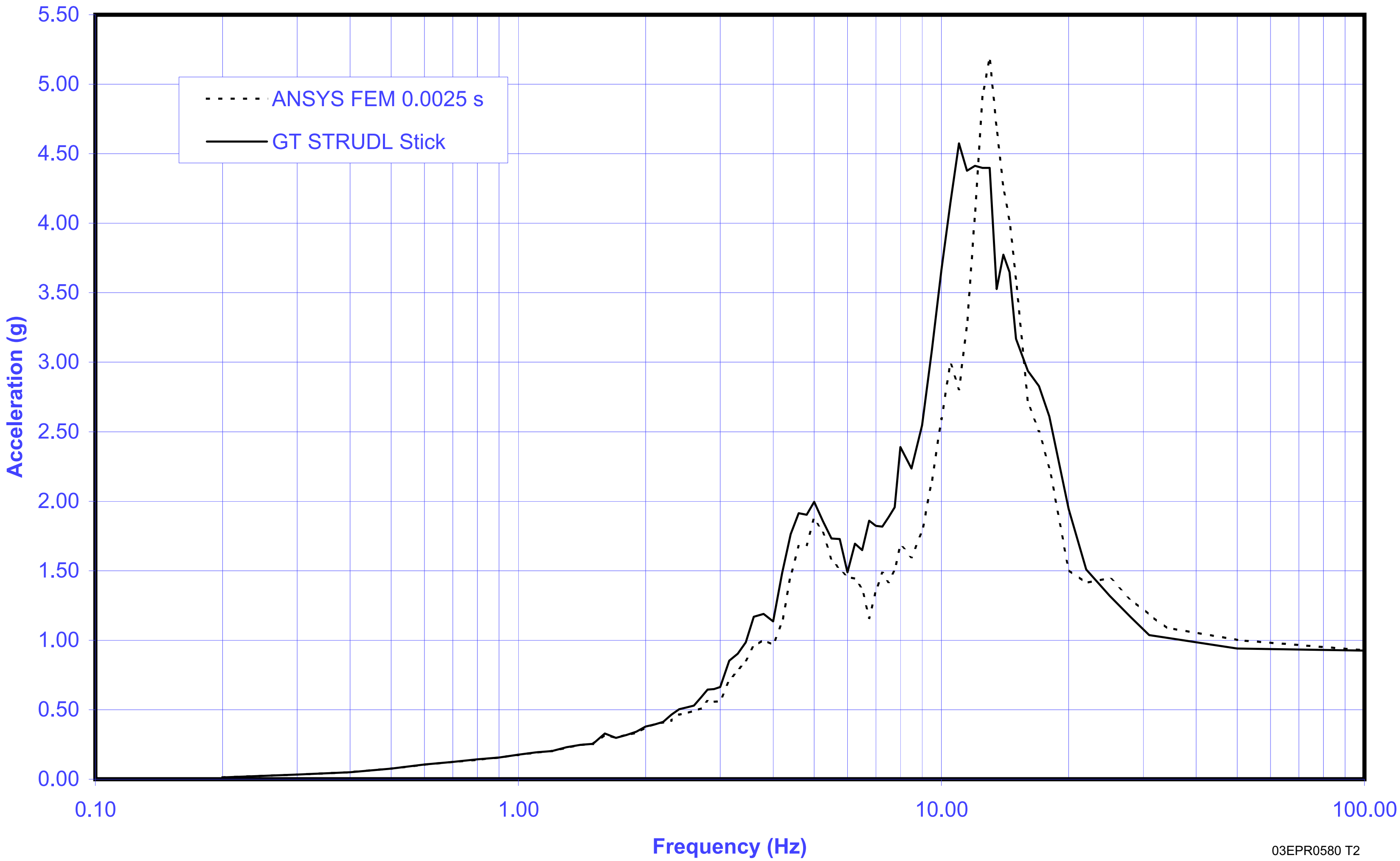


Figure 3.7.2-26—Stick vs. FEM Spectrum Comparison at Elev. +26 ft, 3 inches (+8.00m) - Safeguard Building 4, 5% Damping, X-Direction

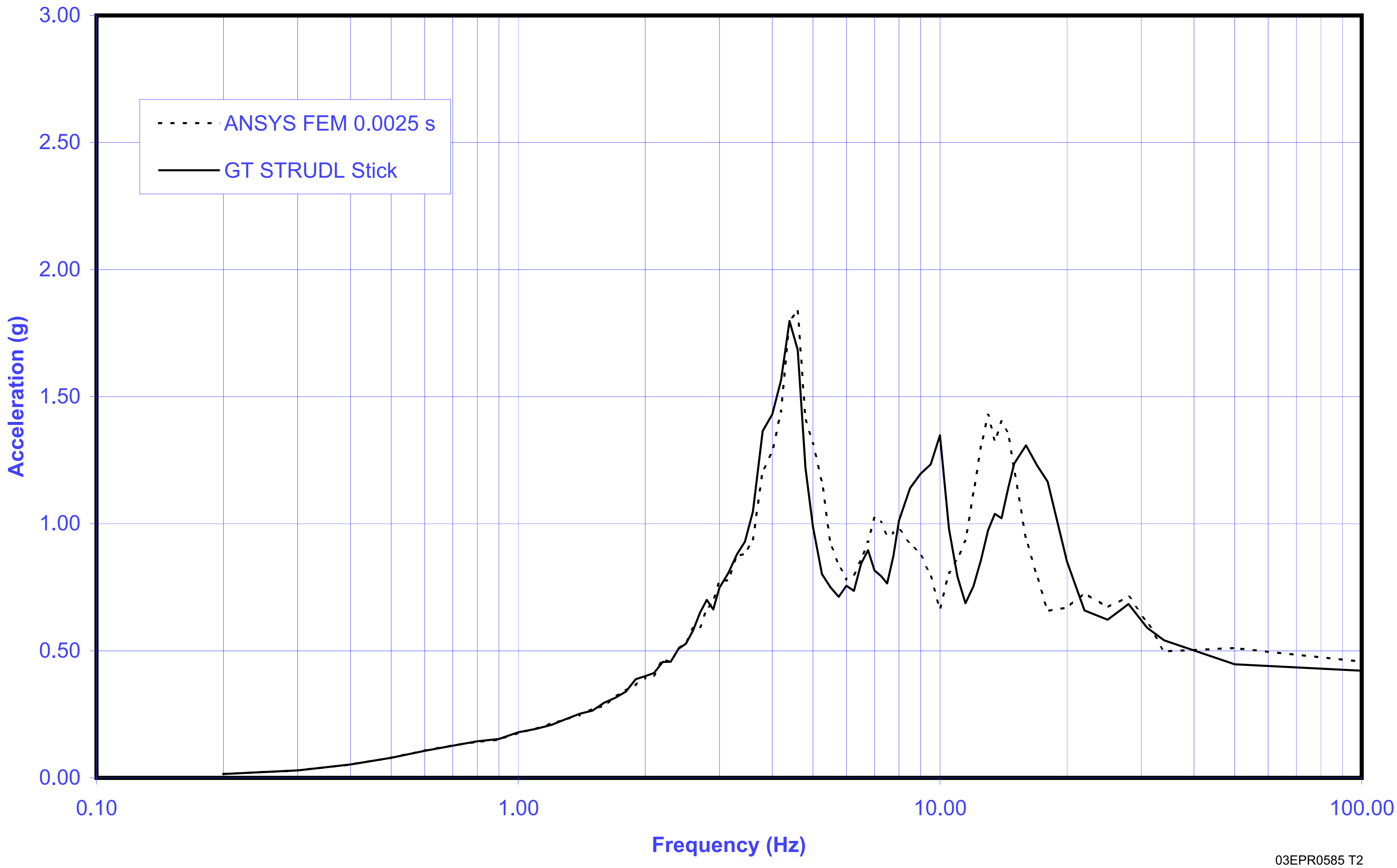


Figure 3.7.2-27—Stick vs. FEM Spectrum Comparison at Elev. +26 ft, 3 inches (+8.00m) - Safeguard Building 4, 5% Damping, Y-Direction

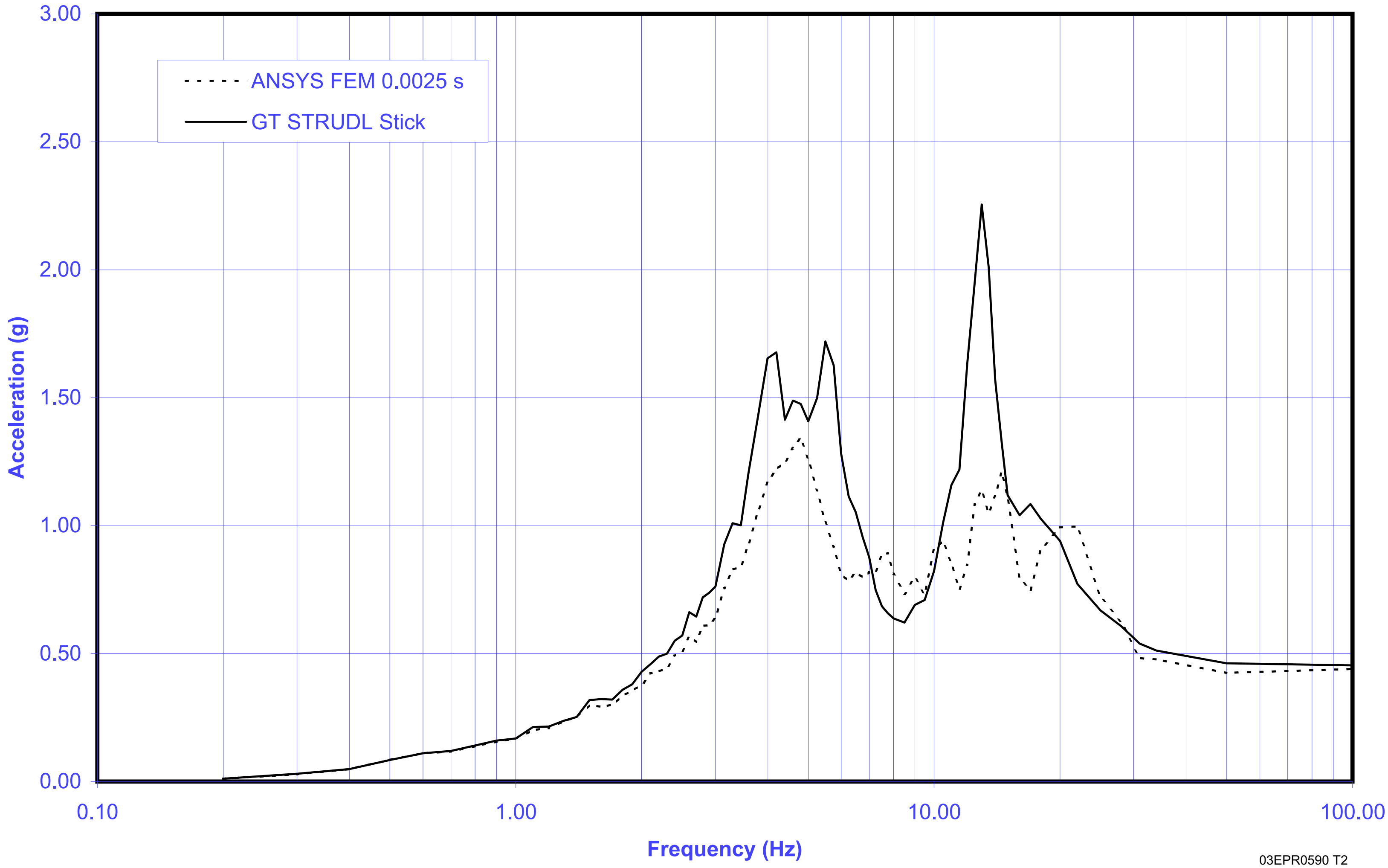


Figure 3.7.2-28—Stick vs. FEM Spectrum Comparison at Elev. +26 ft, 3 inches (+8.00m) - Safeguard Building 4, 5% Damping, Z-Direction

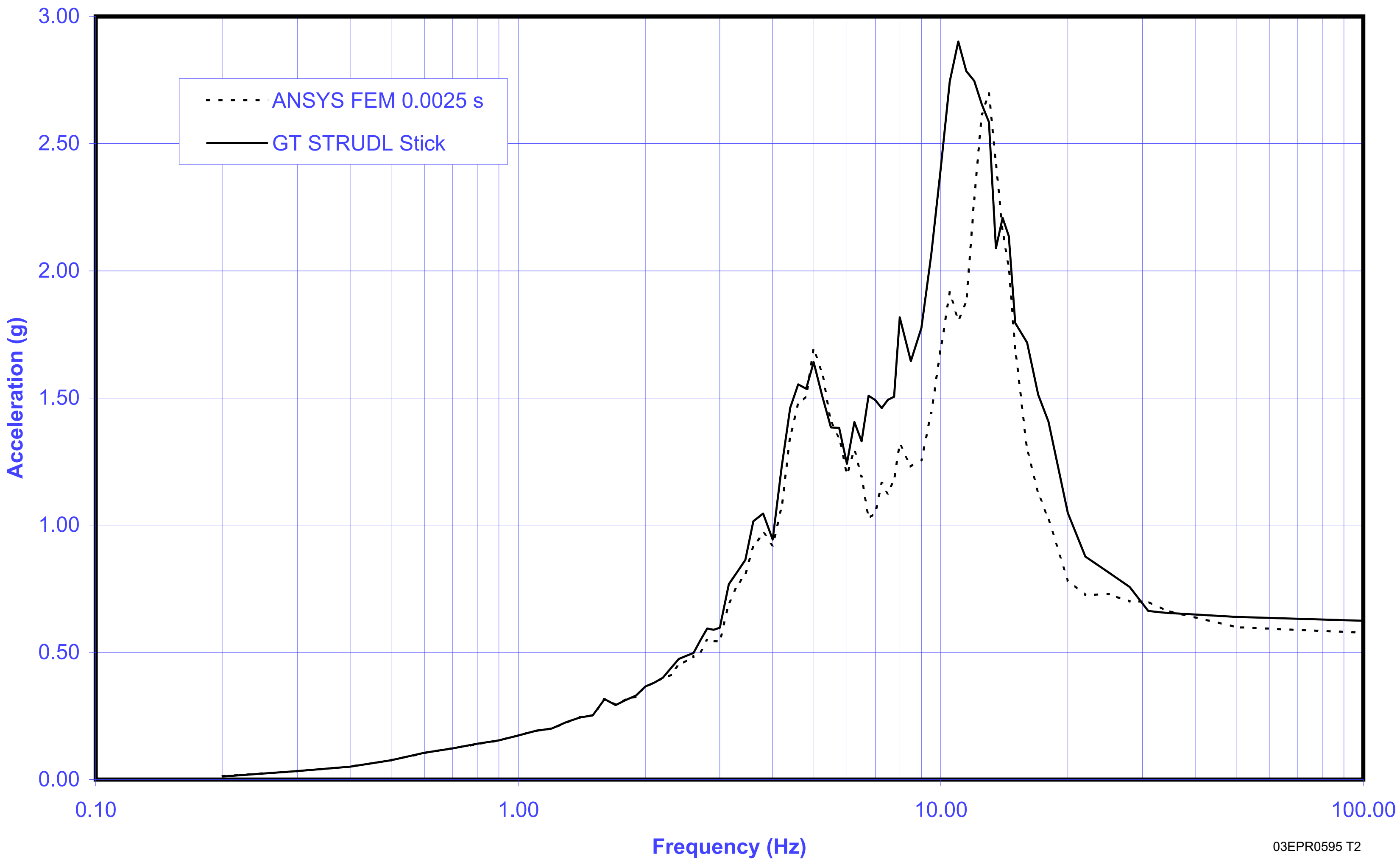


Figure 3.7.2-29—Stick vs. FEM Spectrum Comparison at Elev. +68 ft, 10-3/4 inches (+21.00m) - Safeguard Building 2/3, 5% Damping, X-Direction

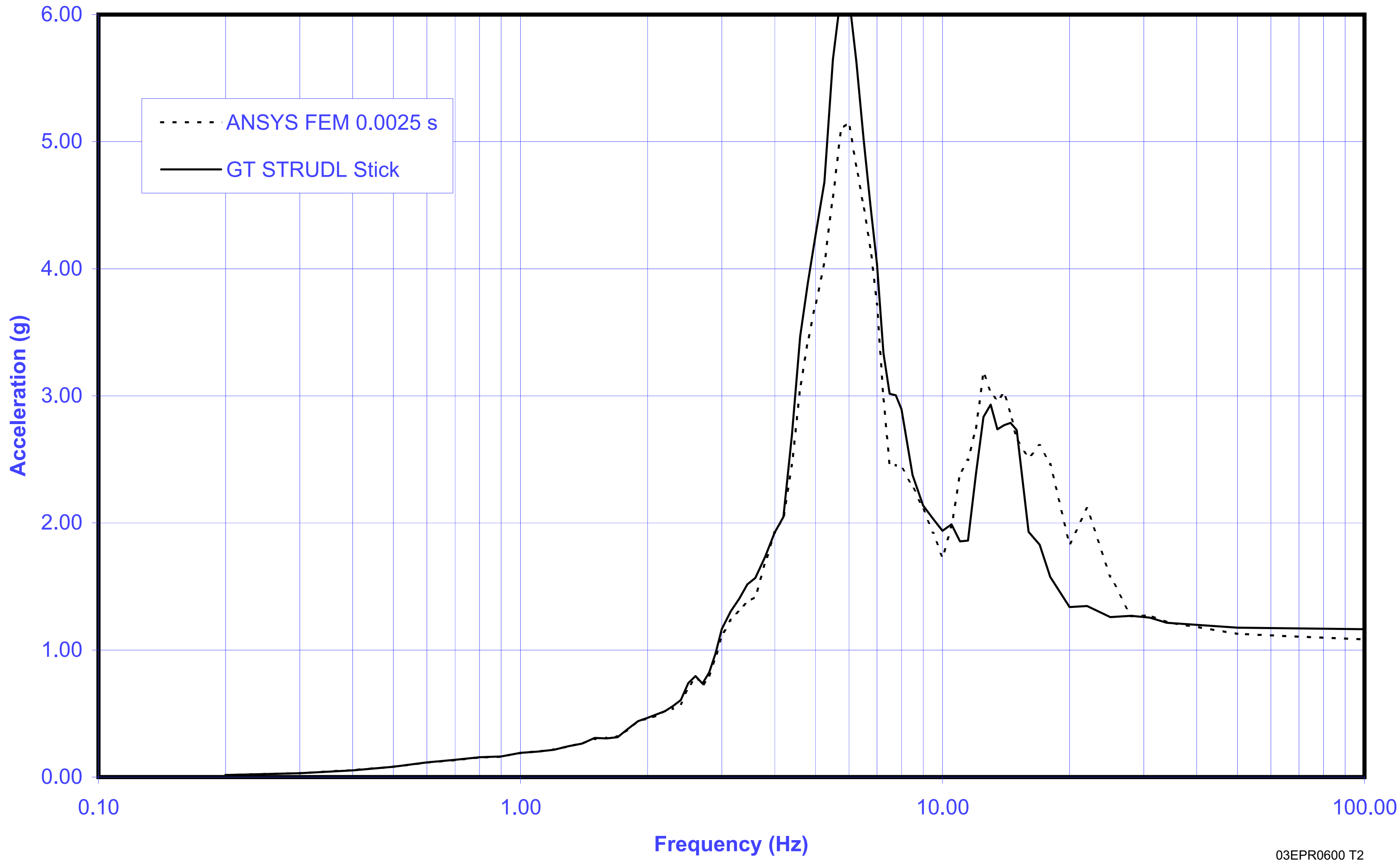


Figure 3.7.2-30—Stick vs. FEM Spectrum Comparison at Elev. +68 ft, 10-3/4 inches (+21.00m) - Safeguard Building 2/3, 5% Damping, Y-Direction

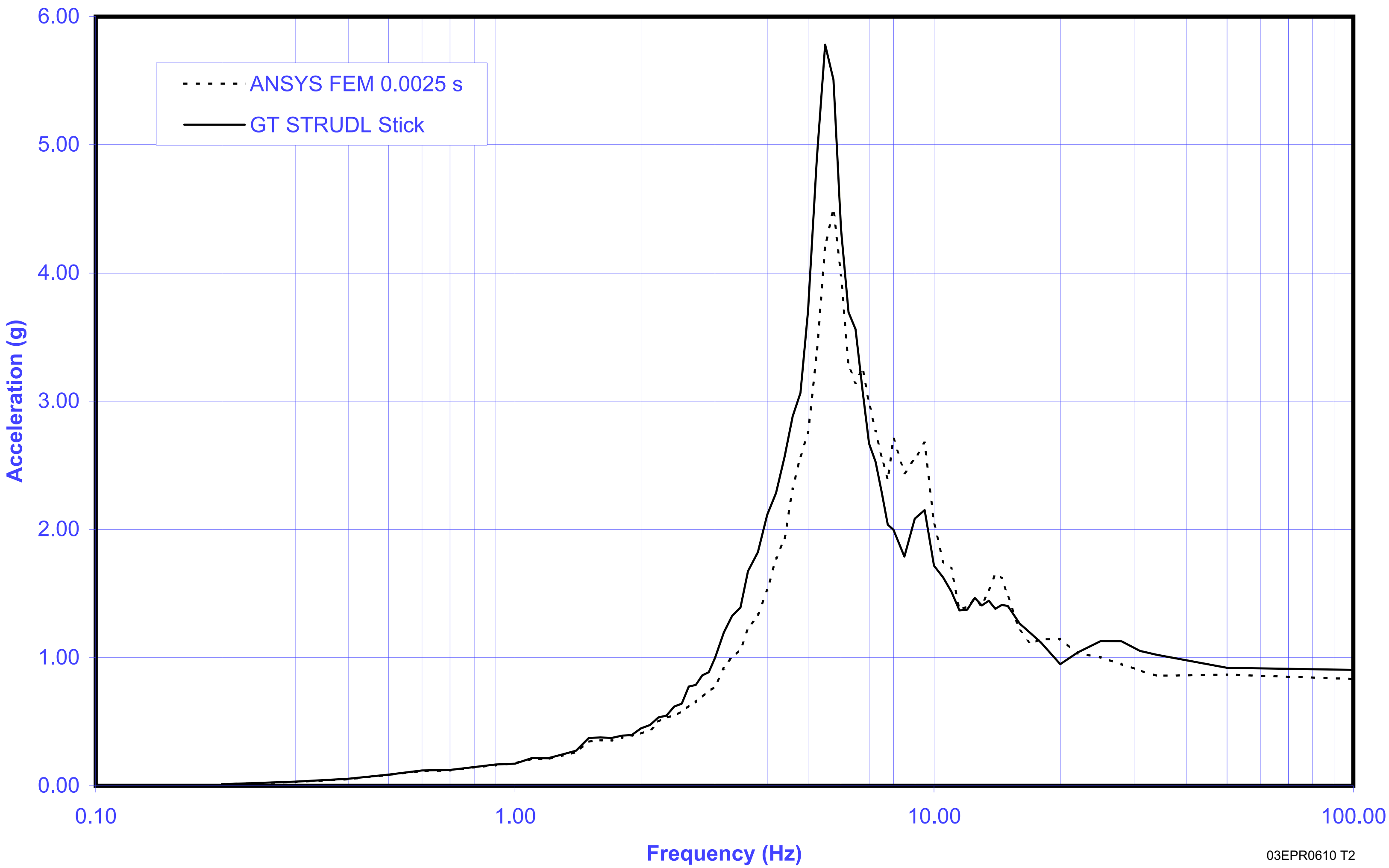


Figure 3.7.2-31—Stick vs. FEM Spectrum Comparison at Elev. +68 ft, 10-3/4 inches (+21.00m) - Safeguard Building 2/3, 5% Damping, Z-Direction

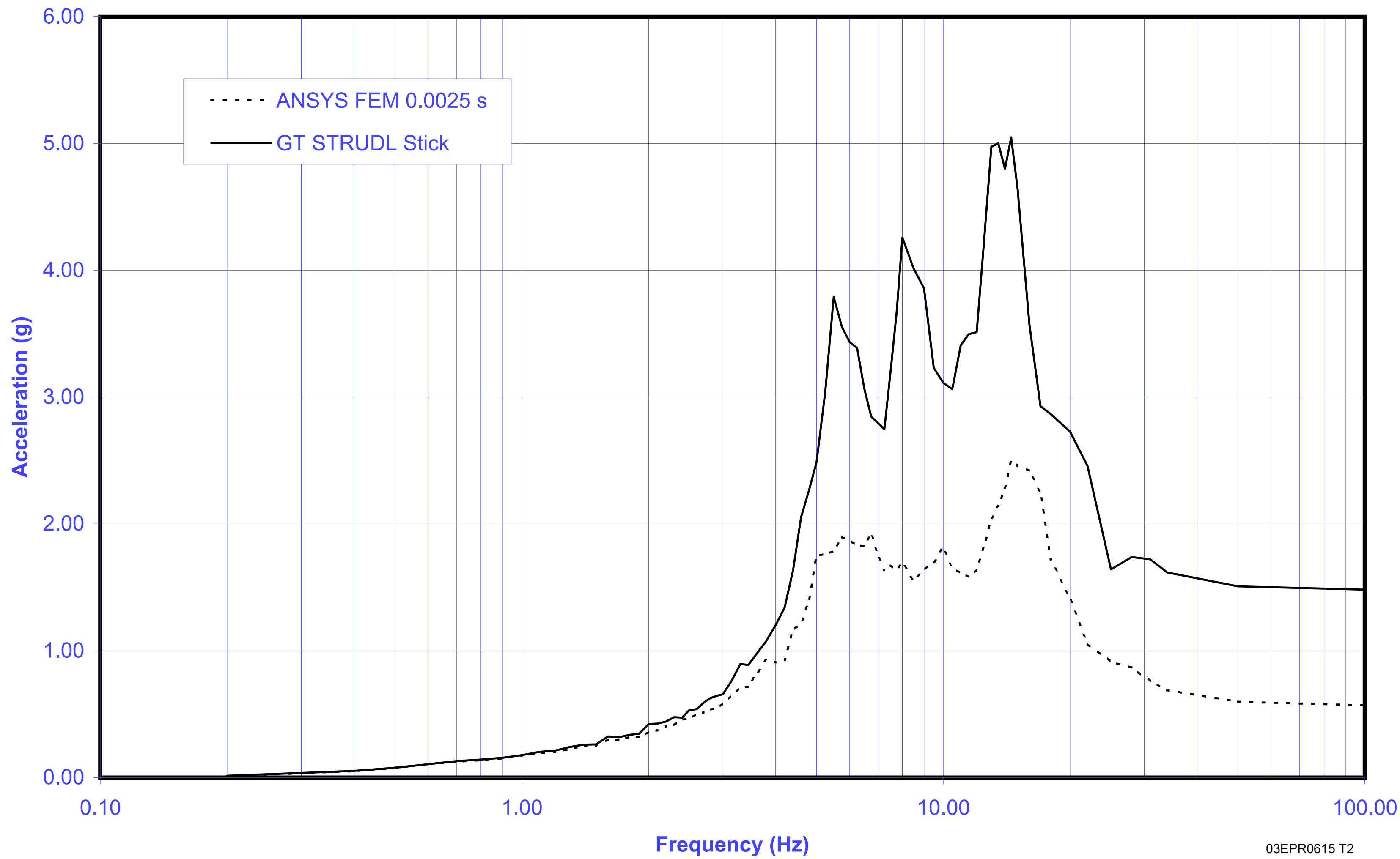


Figure 3.7.2-32—Stick vs. FEM Spectrum Comparison at Elev. +26 ft, 3 inches (+8.00m) - Safeguard Building 2/3, 5% Damping, X-Direction

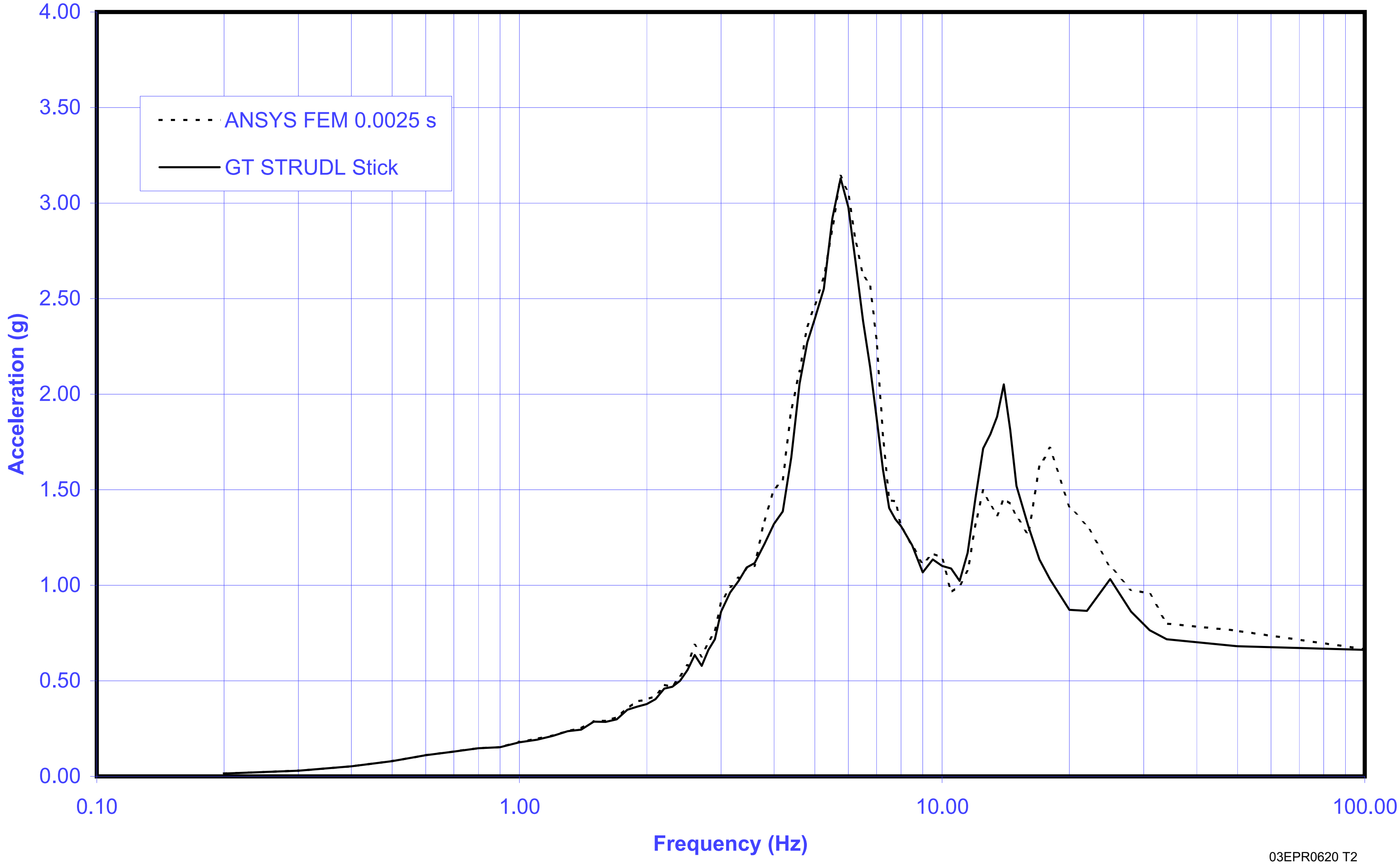


Figure 3.7.2-33—Stick vs. FEM Spectrum Comparison at Elev. +26 ft, 3 inches (+8.00m) - Safeguard Building 2/3, 5% Damping, Y-Direction

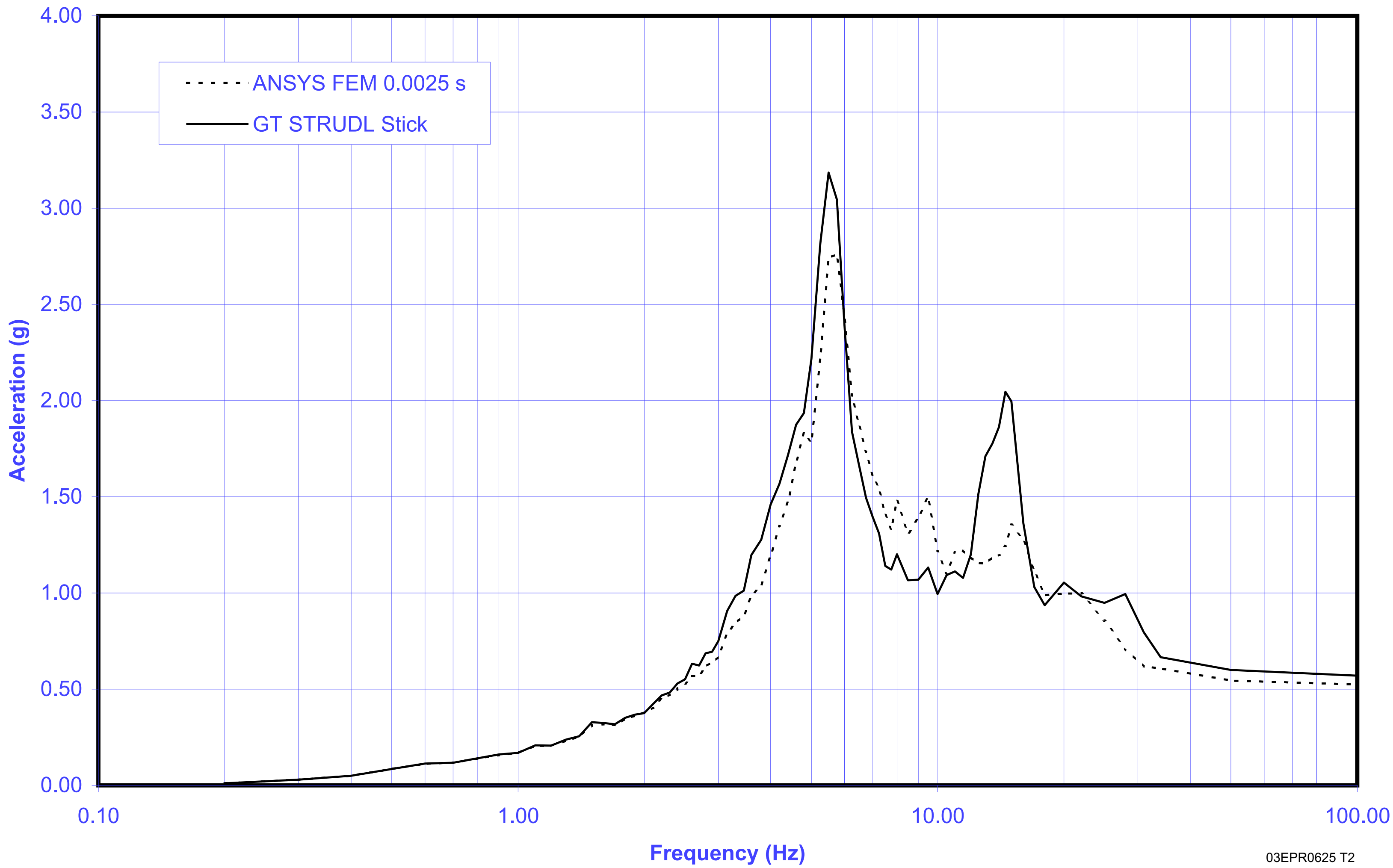


Figure 3.7.2-34—Stick vs. FEM Spectrum Comparison at Elev. +26 ft, 3 inches (+8.00m) - Safeguard Building 2/3, 5% Damping, Z-Direction

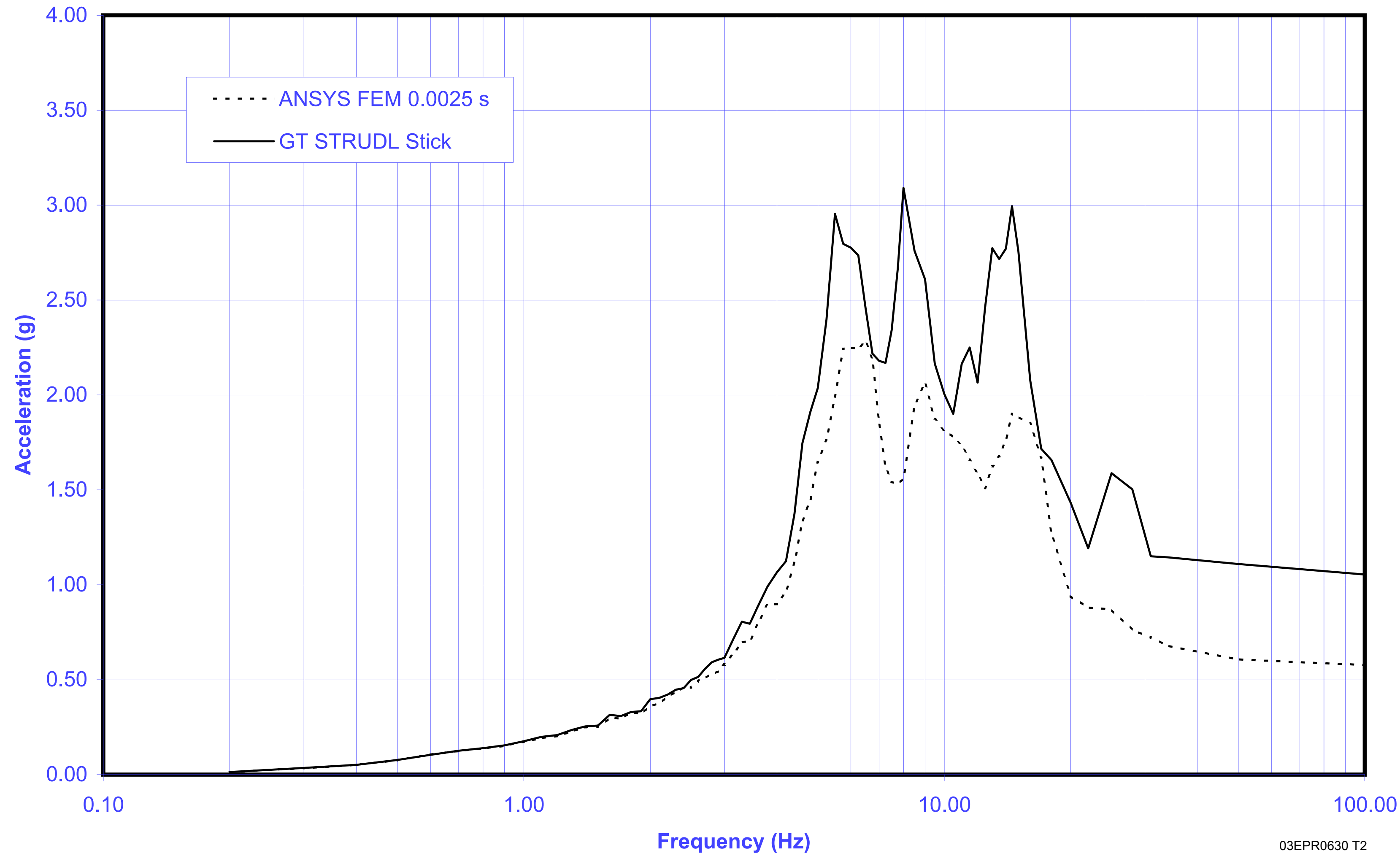


Figure 3.7.2-35—Stick vs. FEM Spectrum Comparison at Elev. +62 ft, 4-1/4 inches (+19.00m) - Fuel Building, 5% Damping, X-Direction

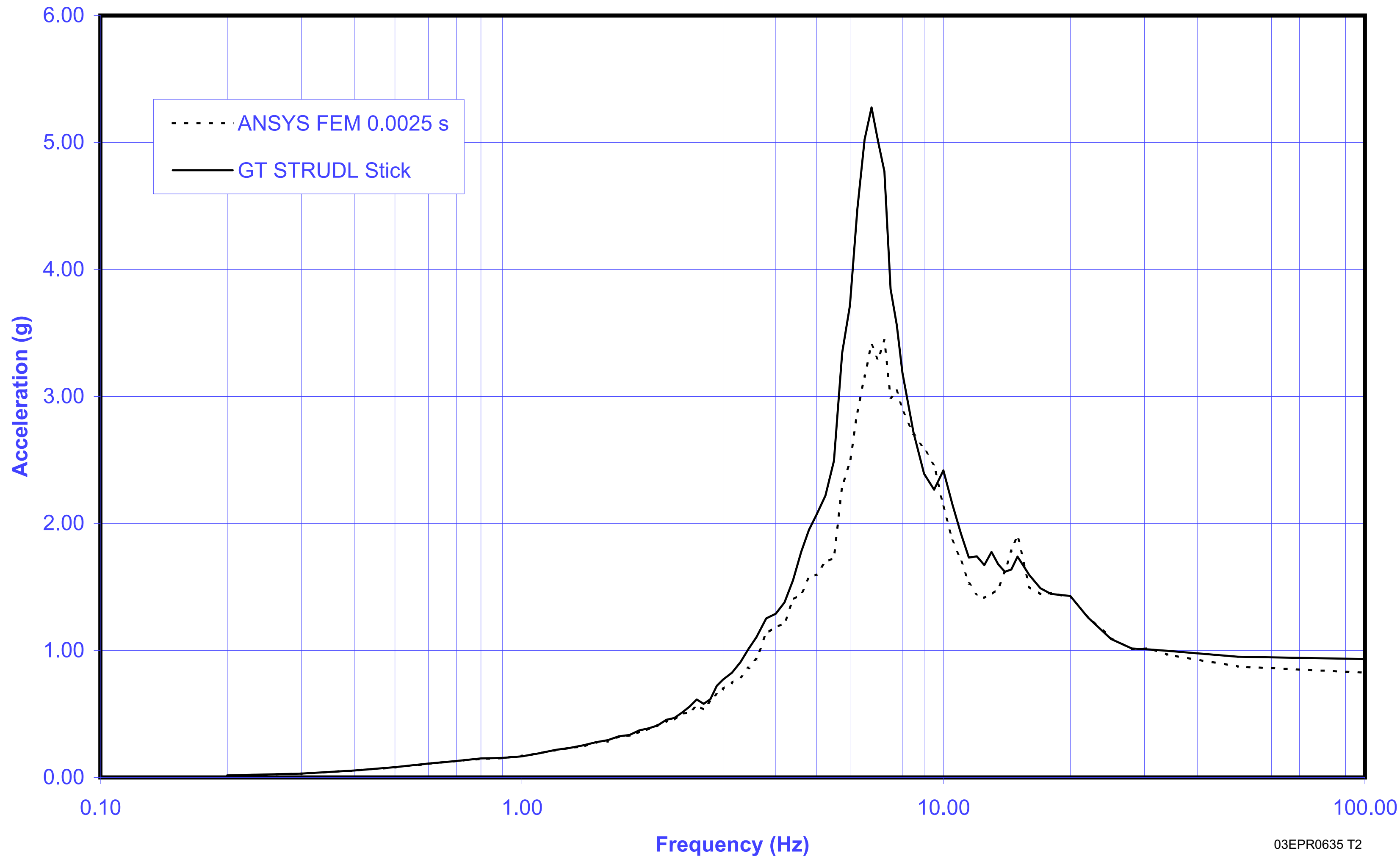


Figure 3.7.2-36—Stick vs. FEM Spectrum Comparison at Elev. +62 ft, 4-1/4 inches (+19.00m) - Fuel Building, 5% Damping, Y-Direction

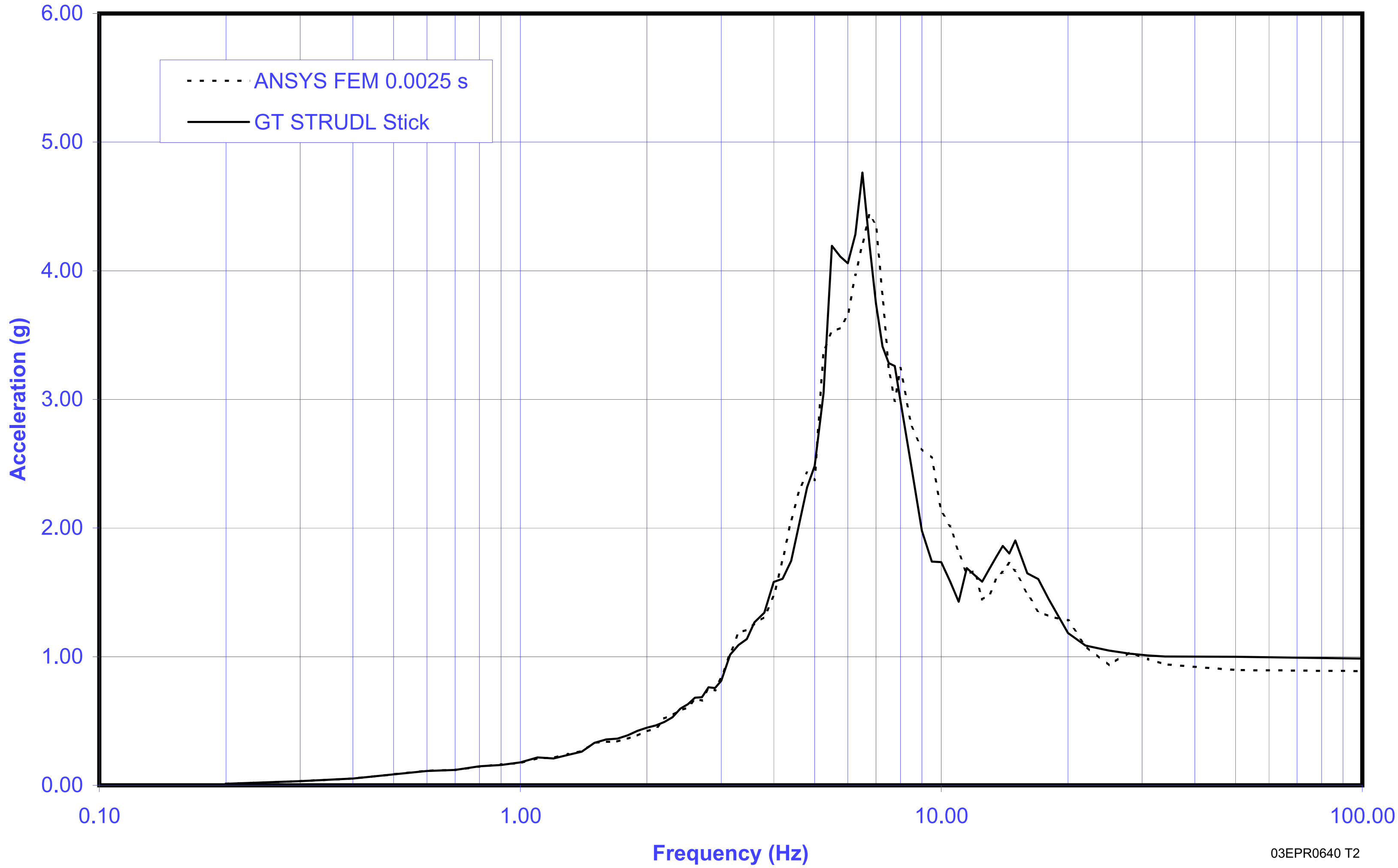


Figure 3.7.2-37—Stick vs. FEM Spectrum Comparison at Elev. +62 ft, 4-1/4 inches (+19.00m) - Fuel Building, 5% Damping, Z-Direction

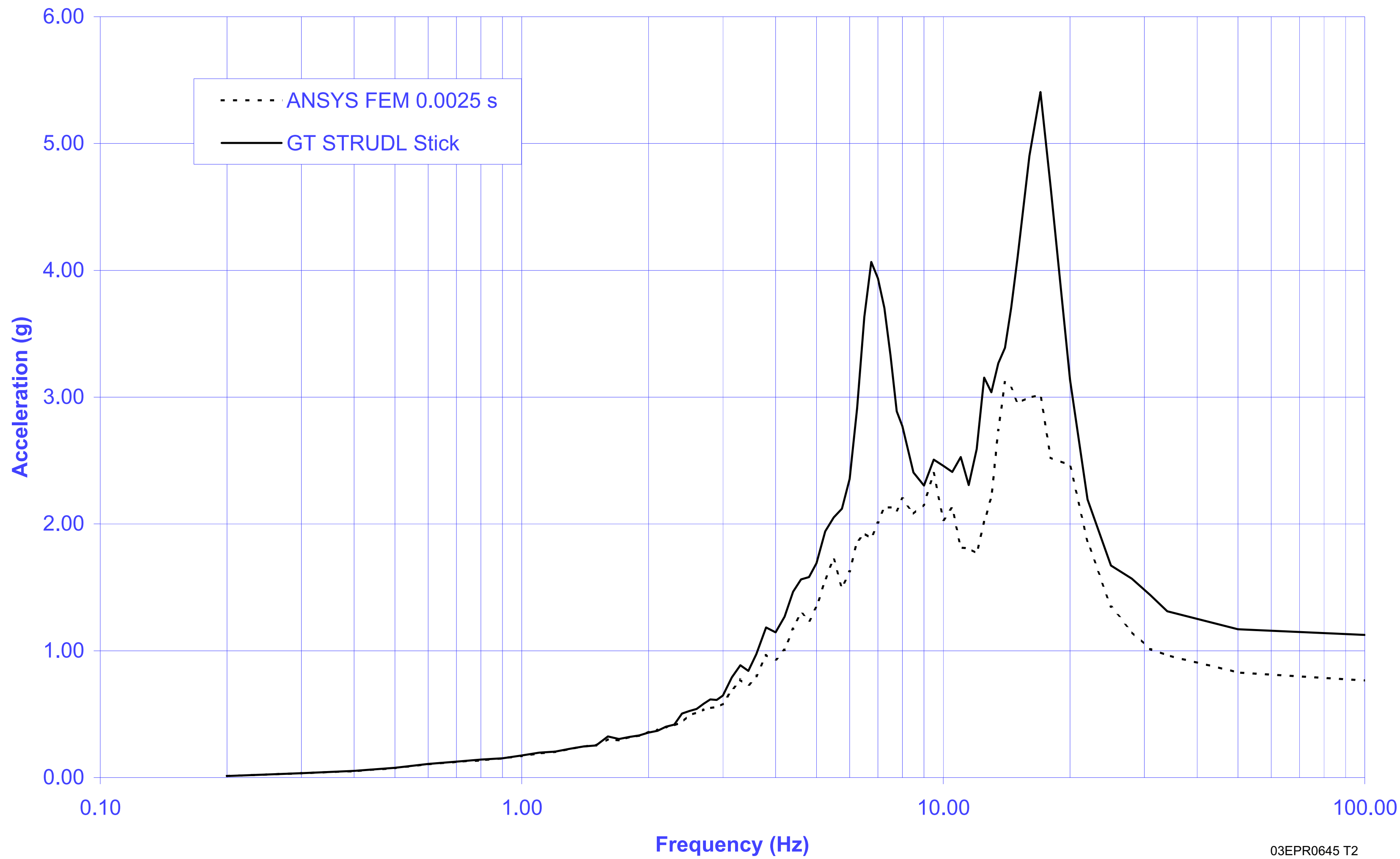


Figure 3.7.2-38—Stick vs. FEM Spectrum Comparison at Elev. +23 ft, 7-1/2 inches (+7.20m) - Fuel Building, 5% Damping, X-Direction

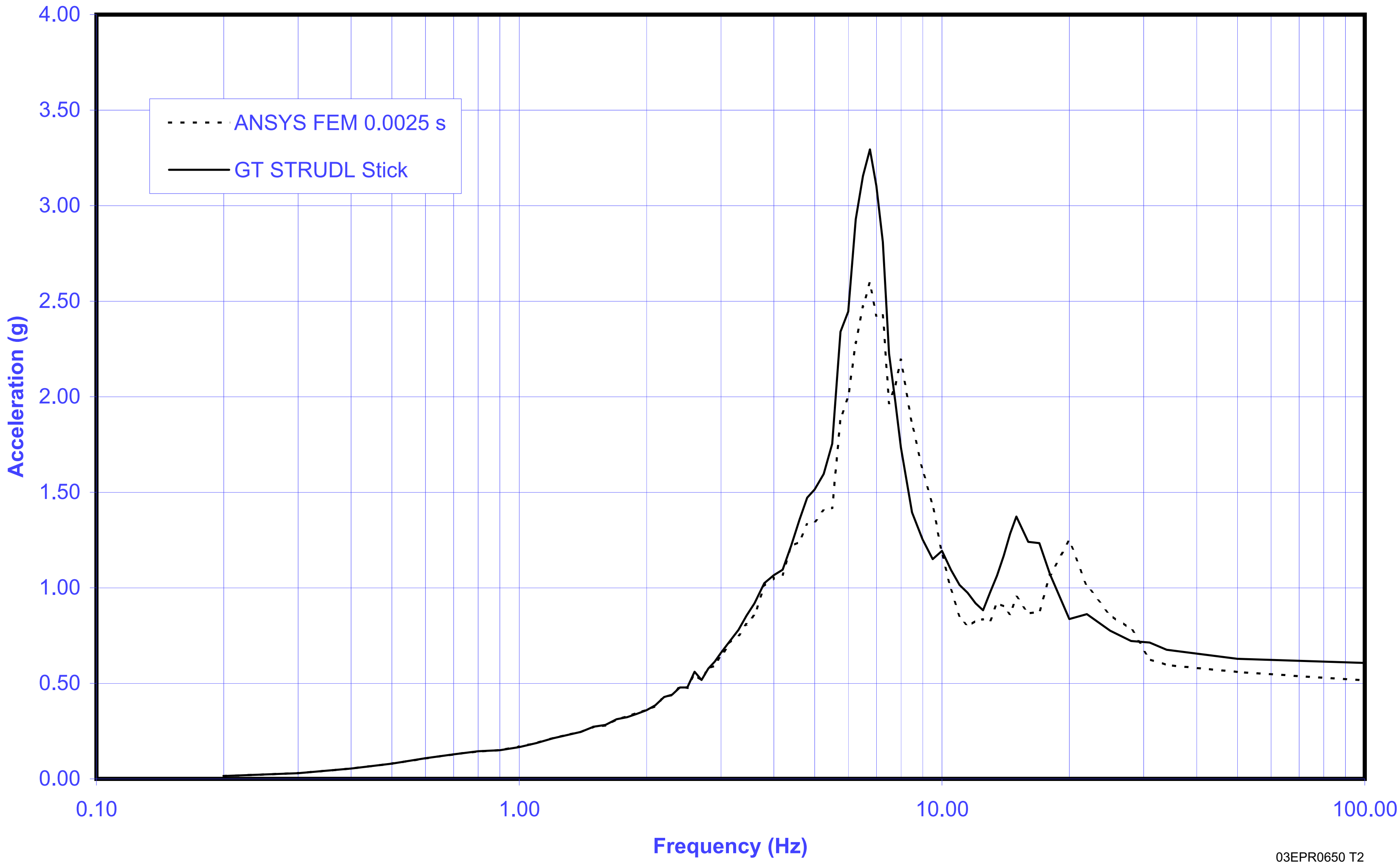


Figure 3.7.2-39—Stick vs. FEM Spectrum Comparison at Elev. +23 ft, 7-1/2 inches (+7.20m) - Fuel Building, 5% Damping, Y-Direction

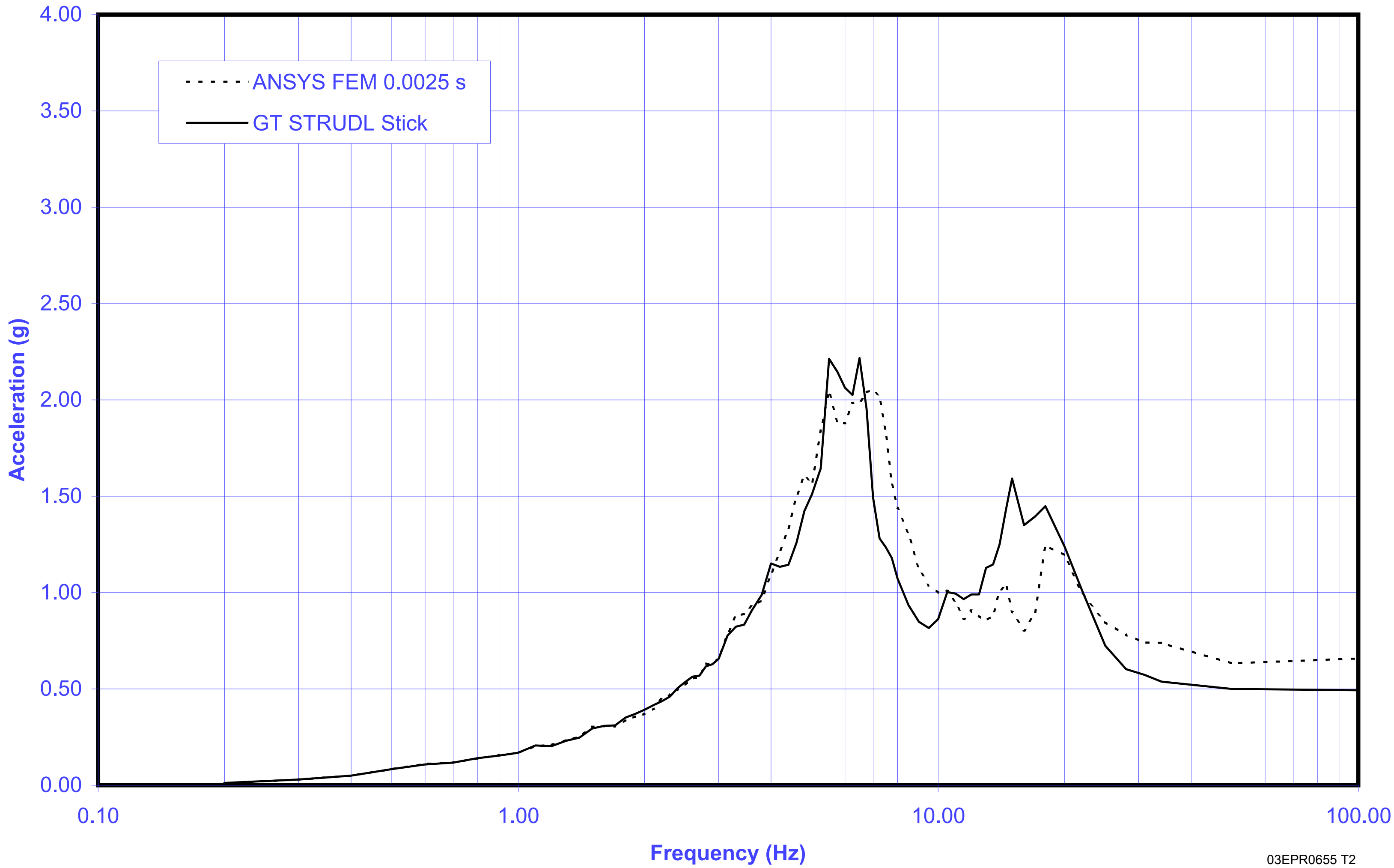


Figure 3.7.2-40—Stick vs. FEM Spectrum Comparison at Elev. +23 ft, 7-1/2 inches (+7.20m) - Fuel Building, 5% Damping, Z-Direction

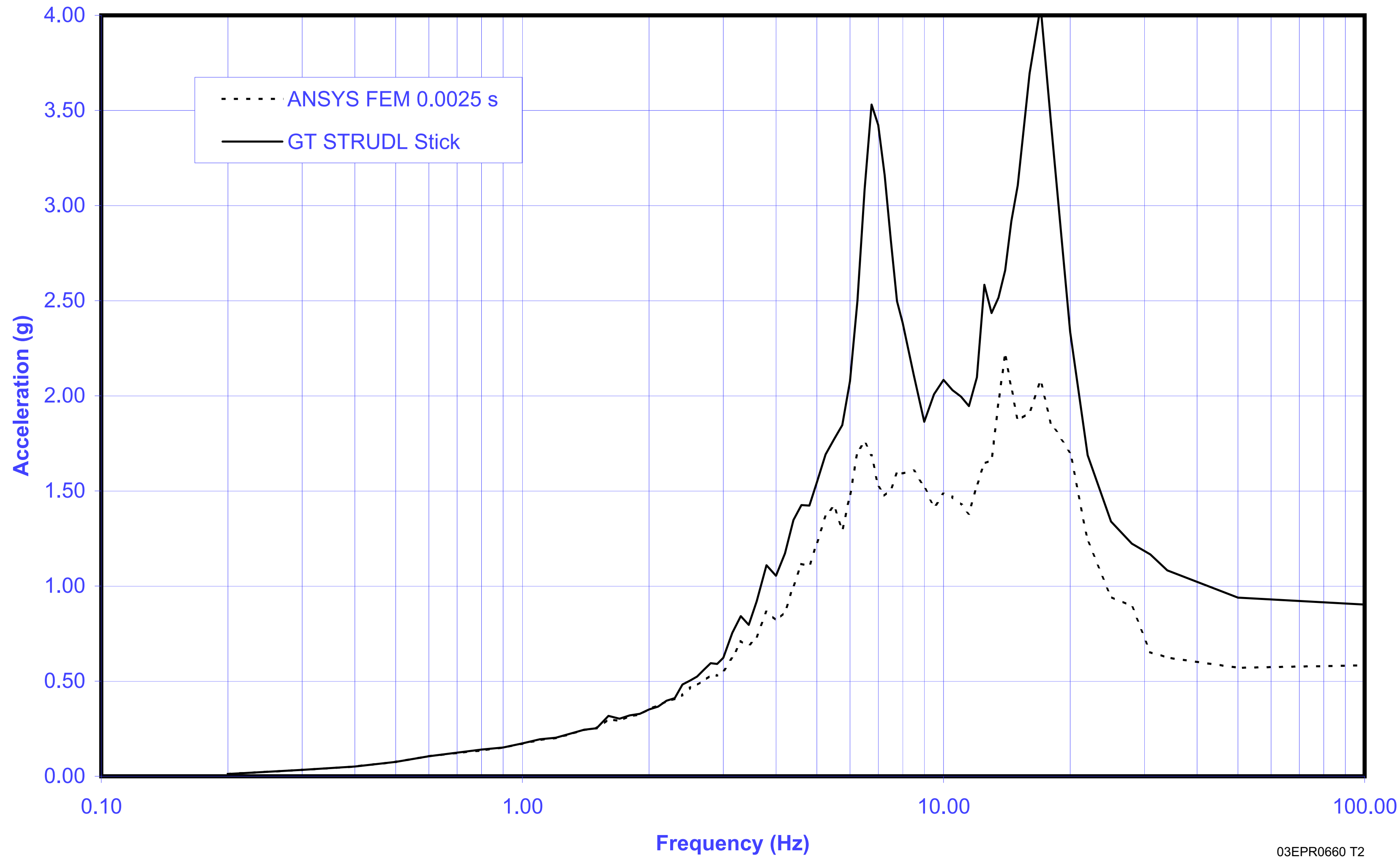


Figure 3.7.2-41—Stick vs. FEM Spectrum Comparison at Elev. +190 ft, 3-1/2 inches (+58.00m) - Containment Dome Apex (Without Polar Crane), 5% Damping, X-Direction

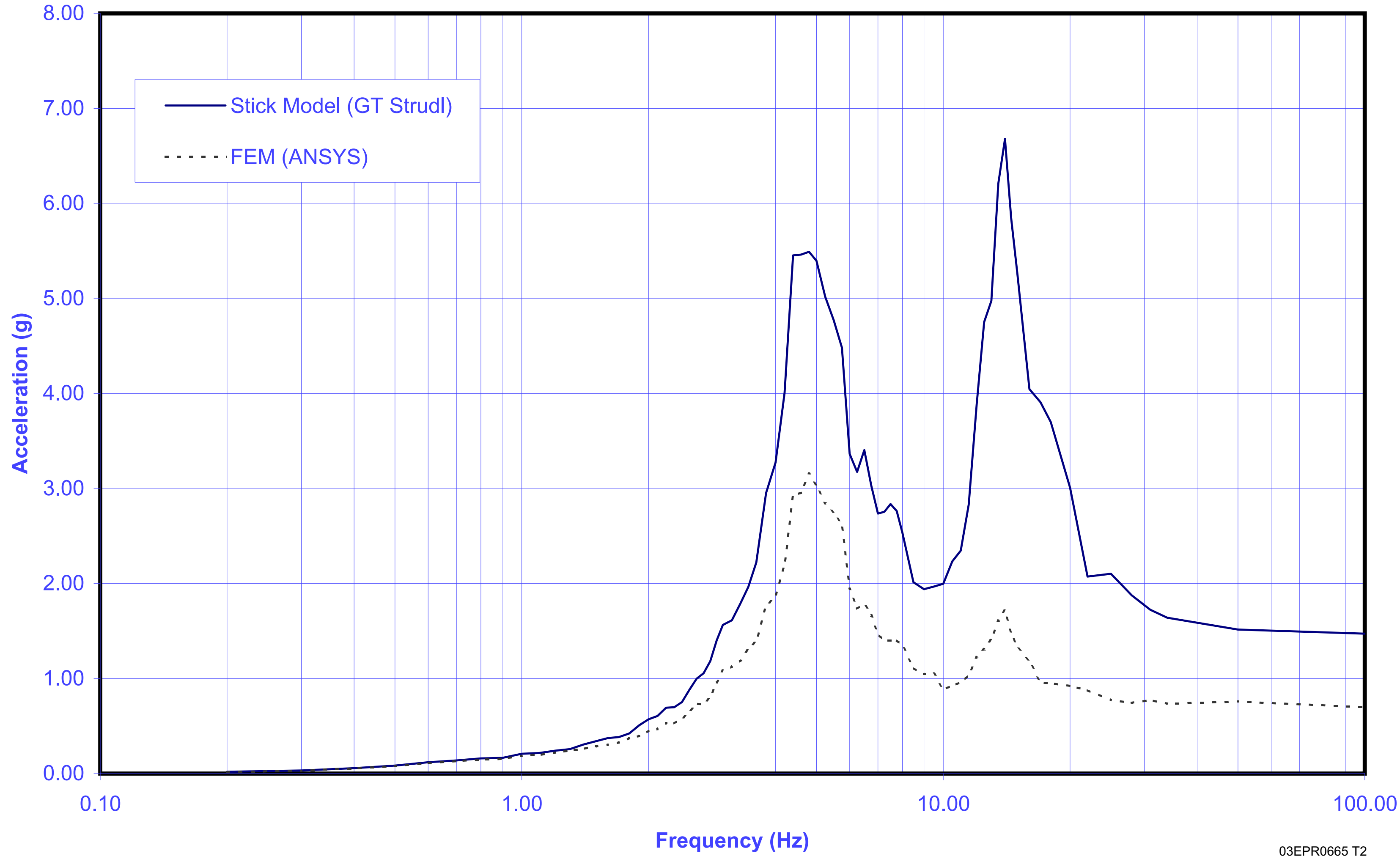


Figure 3.7.2-42—Stick vs. FEM Spectrum Comparison at Elev. +190 ft, 3-1/2 inches (+58.00m) - Containment Dome Apex (Without Polar Crane), 5% Damping, Y-Direction

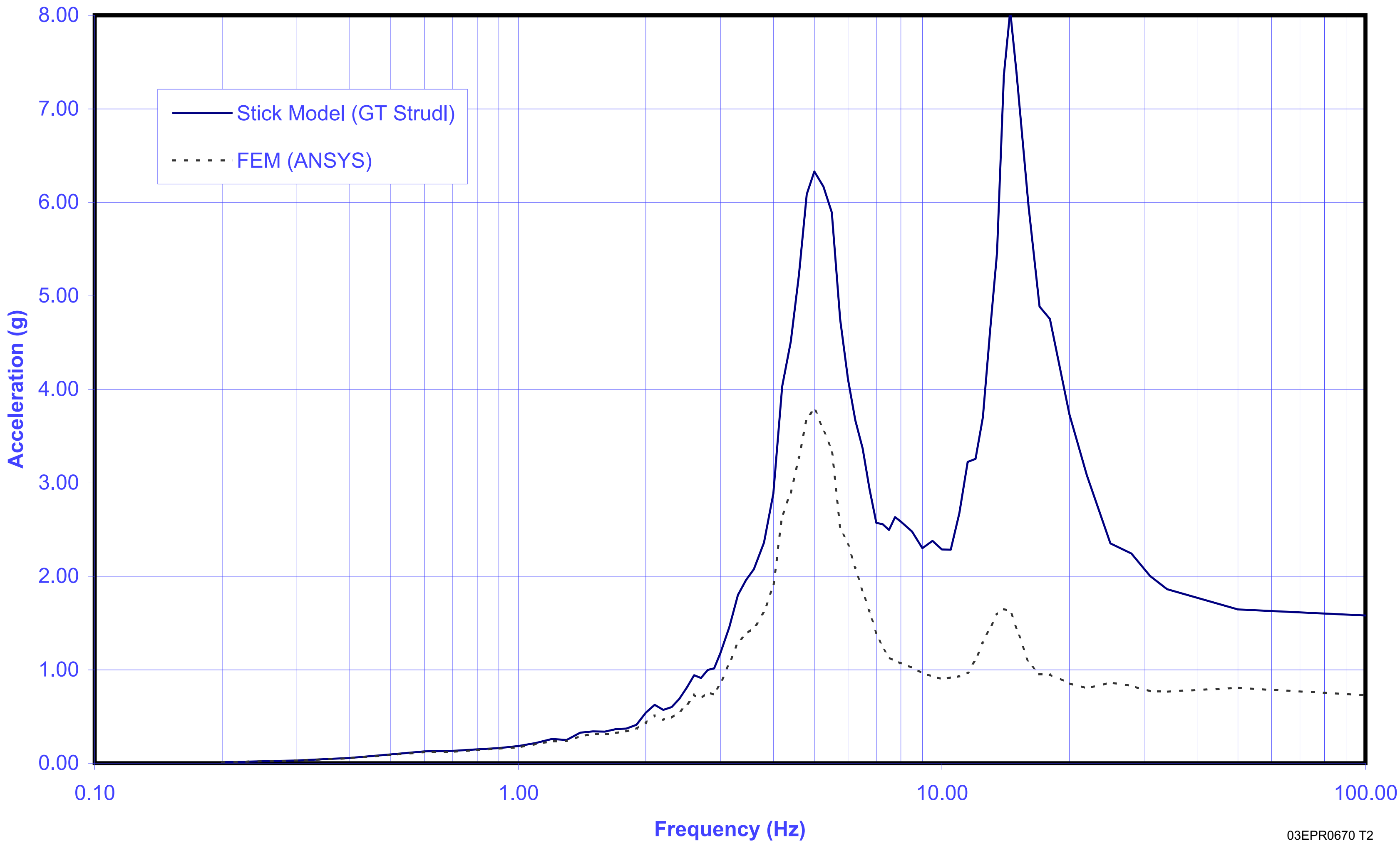


Figure 3.7.2-43—Stick vs. FEM Spectrum Comparison at Elev. +190 ft, 3-1/2 inches (+58.00m) - Containment Dome Apex (Without Polar Crane), 5% Damping, Z-Direction

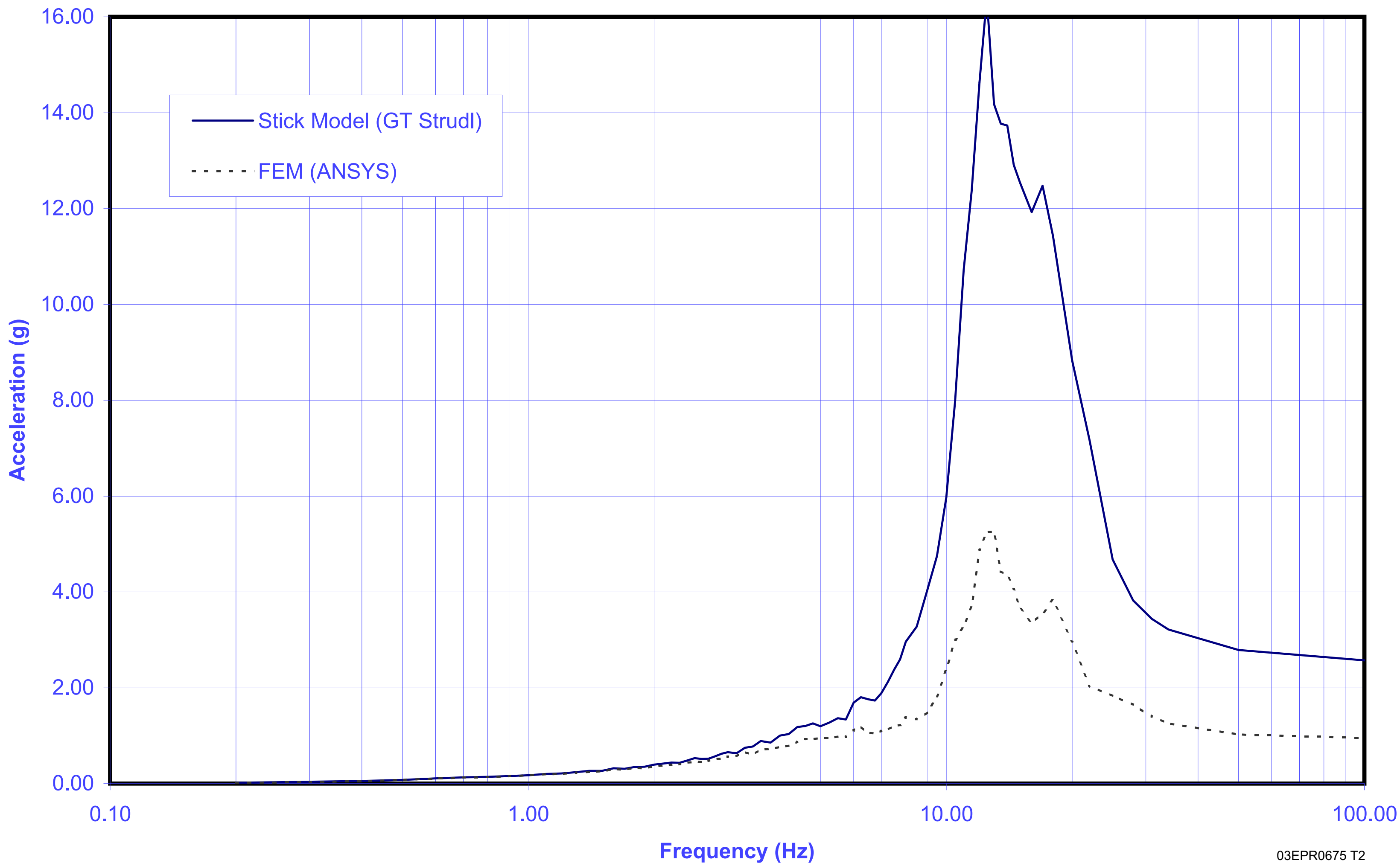


Figure 3.7.2-44—Stick vs. FEM Spectrum Comparison at Elev. +123 ft, 4-1/4 inches (+37.60m) - Containment Building (Without Polar Crane), 5% Damping, X-Direction

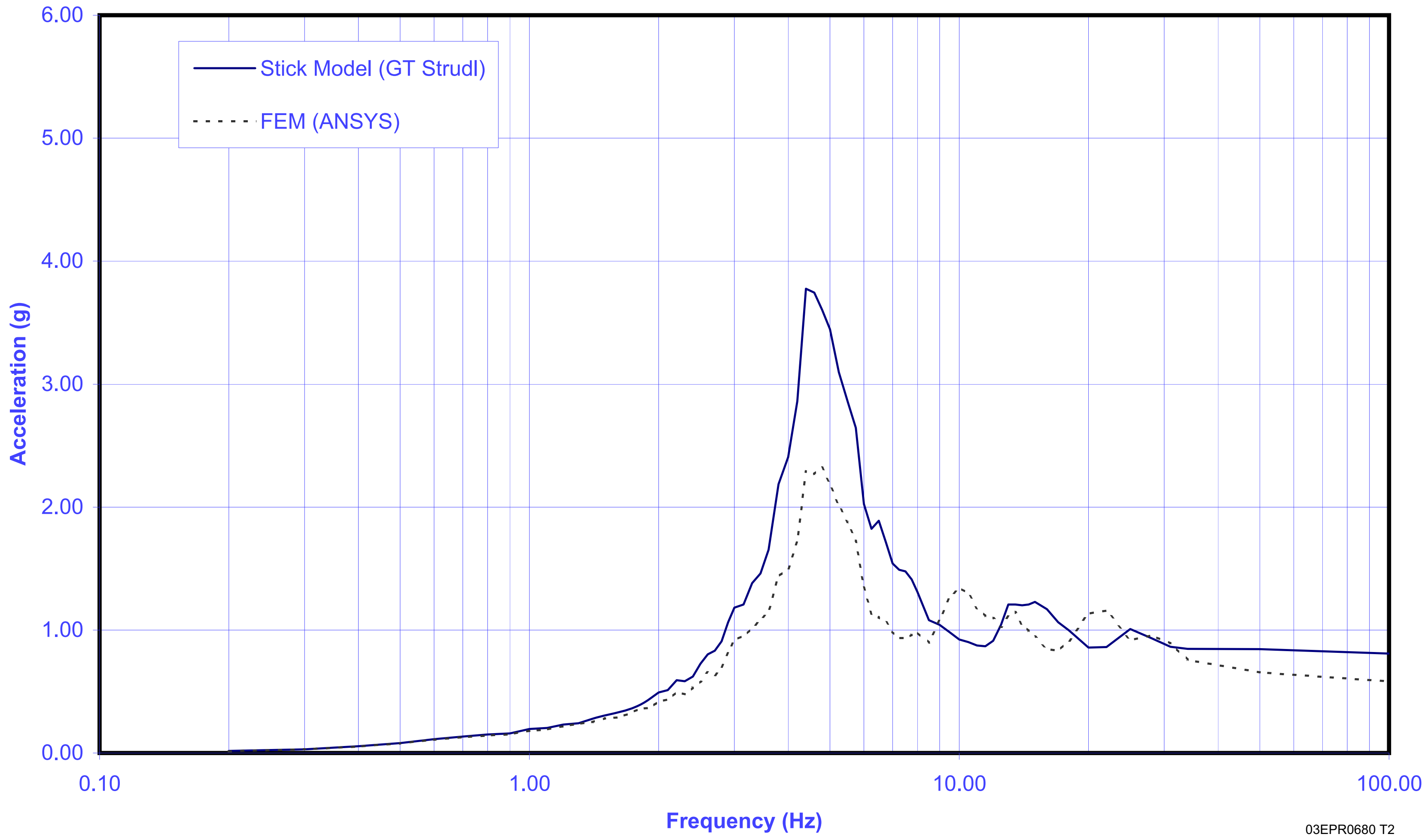


Figure 3.7.2-45—Stick vs. FEM Spectrum Comparison at Elev. +123 ft, 4-1/4 inches (+37.60m) - Containment Building (Without Polar Crane), 5% Damping, Y-Direction

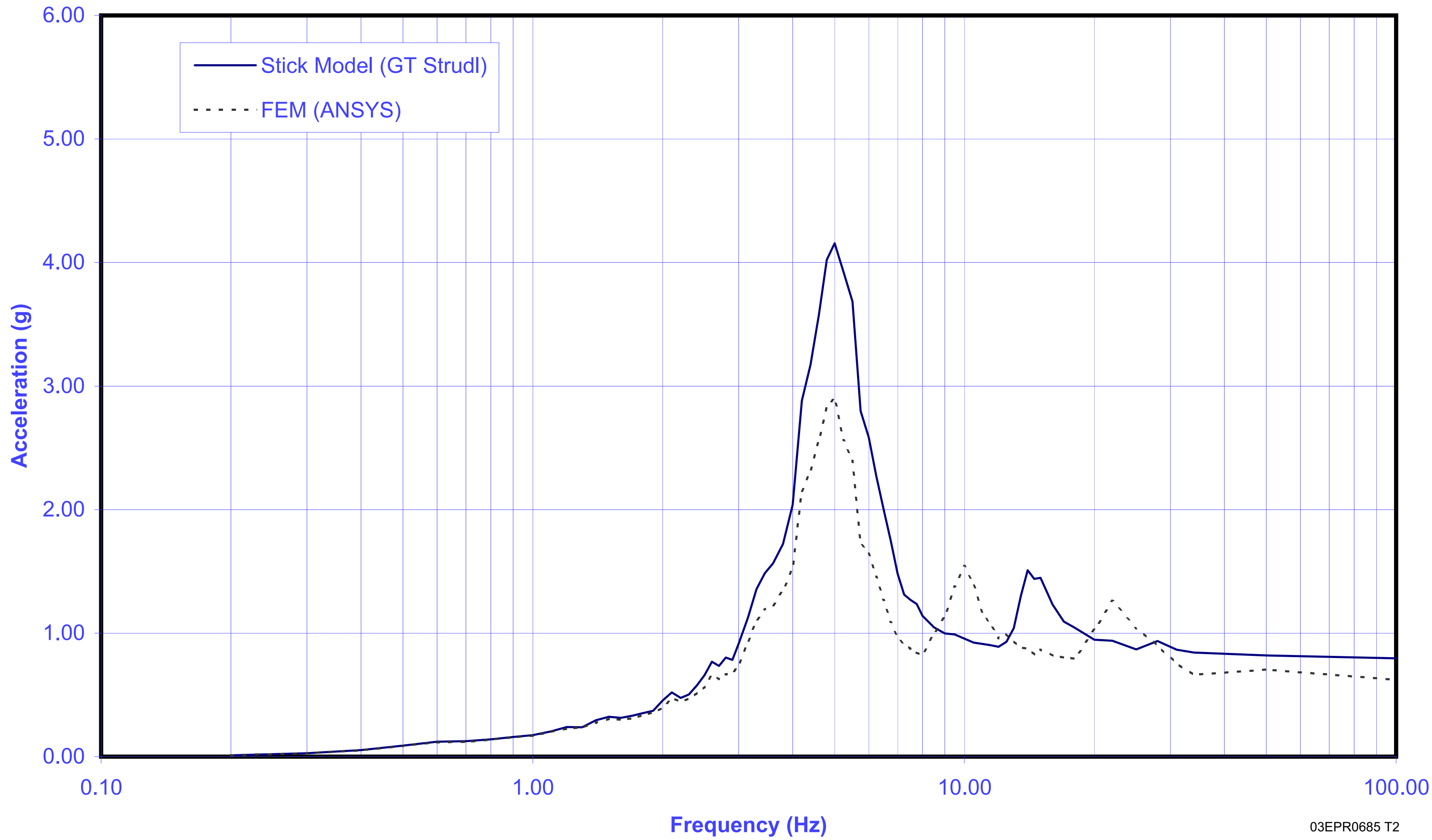


Figure 3.7.2-46—Stick vs. FEM Spectrum Comparison at Elev. +123 ft, 4-1/4 inches (+37.60m) - Containment Building (Without Polar Crane), 5% Damping, Z-Direction

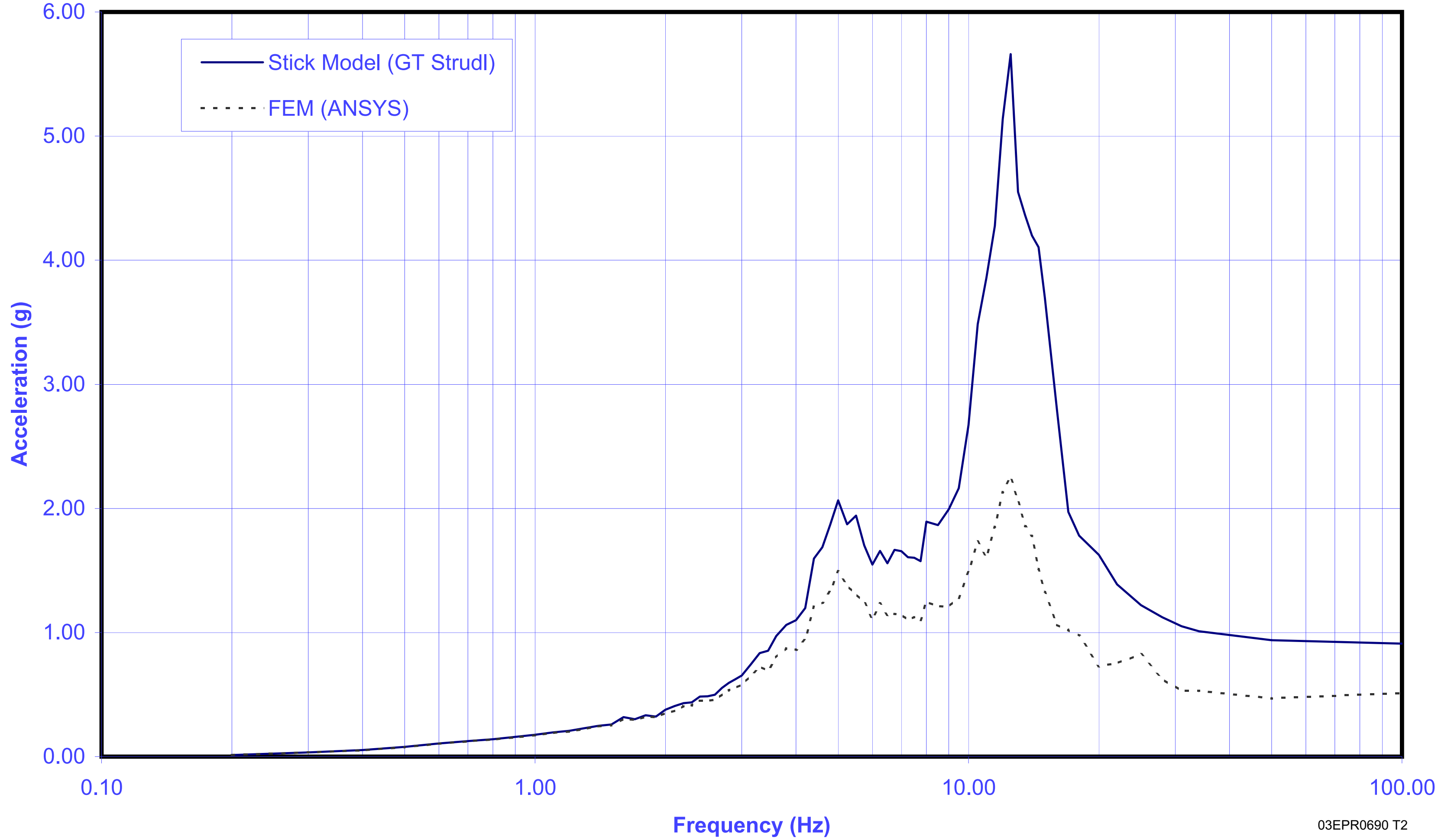


Figure 3.7.2-47—Spectrum Comparison at Elev. +123 ft, 4-1/4 inches (+37.60m) - Containment Building (Rigid vs. Flexible Polar Crane), 5% Damping, X-Direction

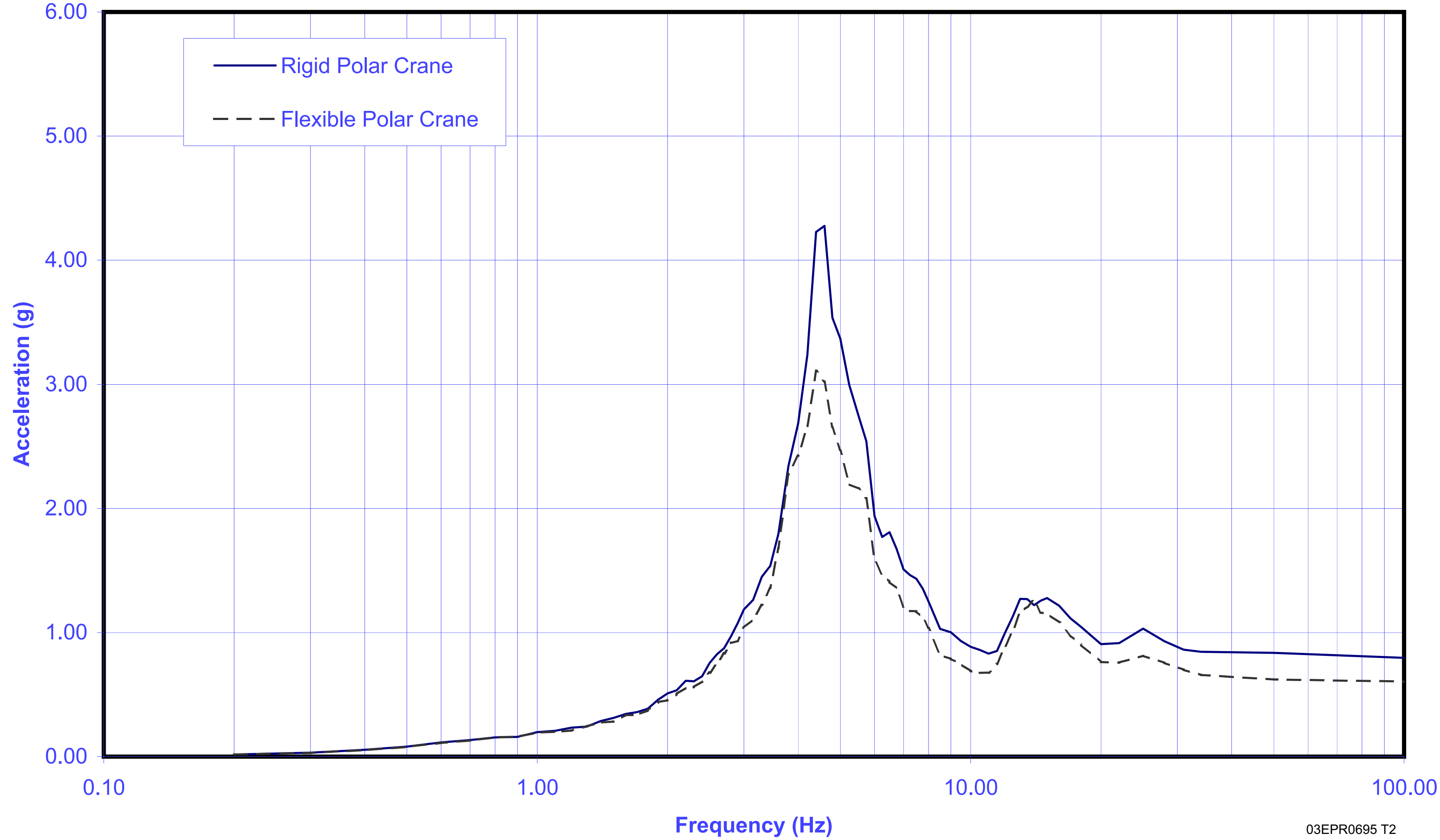


Figure 3.7.2-48—Spectrum Comparison at Elev. +123 ft, 4-1/4 inches (+37.60m) - Containment Building (Rigid vs. Flexible Polar Crane), 5% Damping, Y-Direction

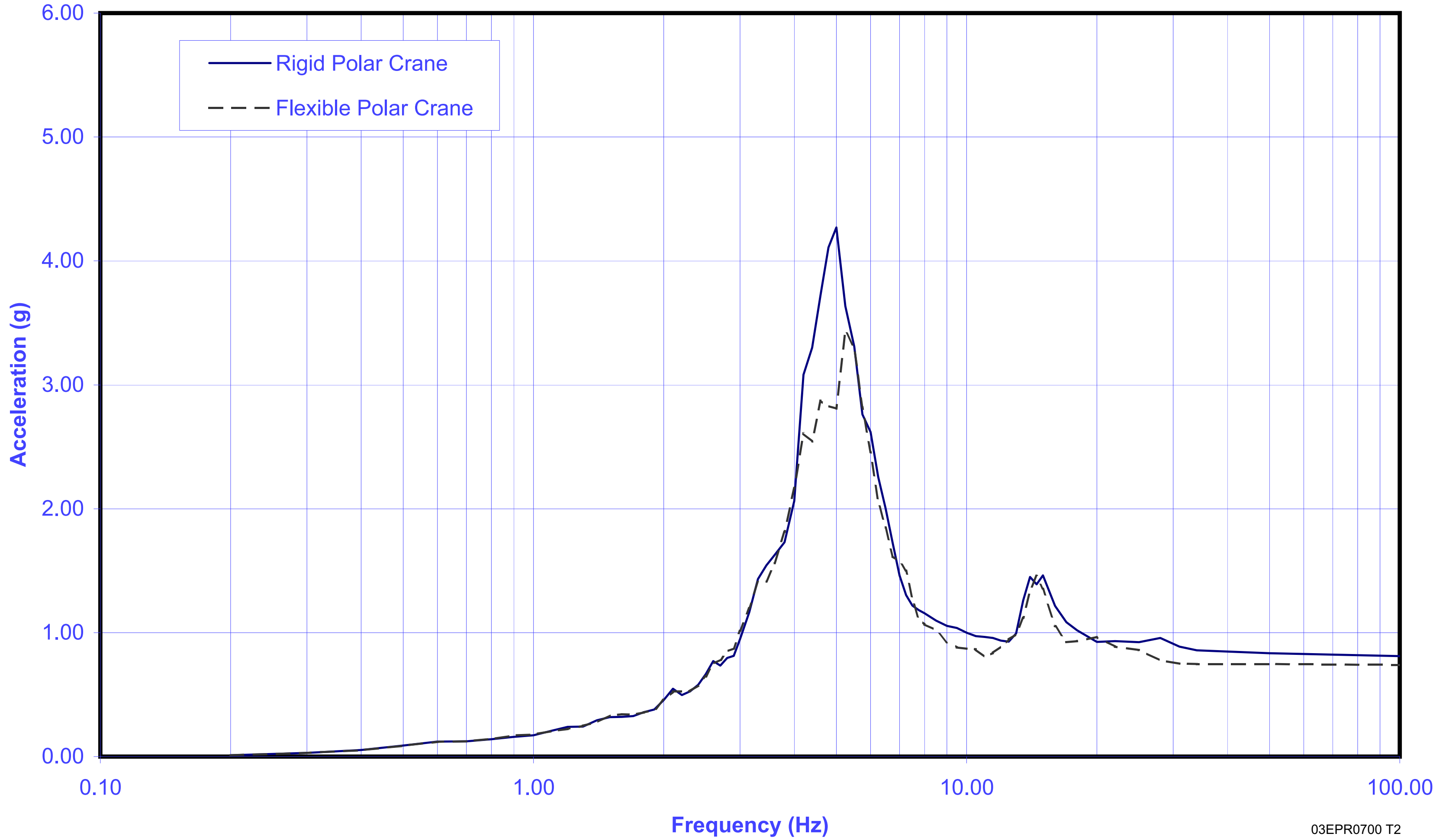


Figure 3.7.2-49—Spectrum Comparison at Elev. +123 ft, 4-1/4 inches (+37.60m) - Containment Building (Rigid vs. Flexible Polar Crane), 5% Damping, Z-Direction

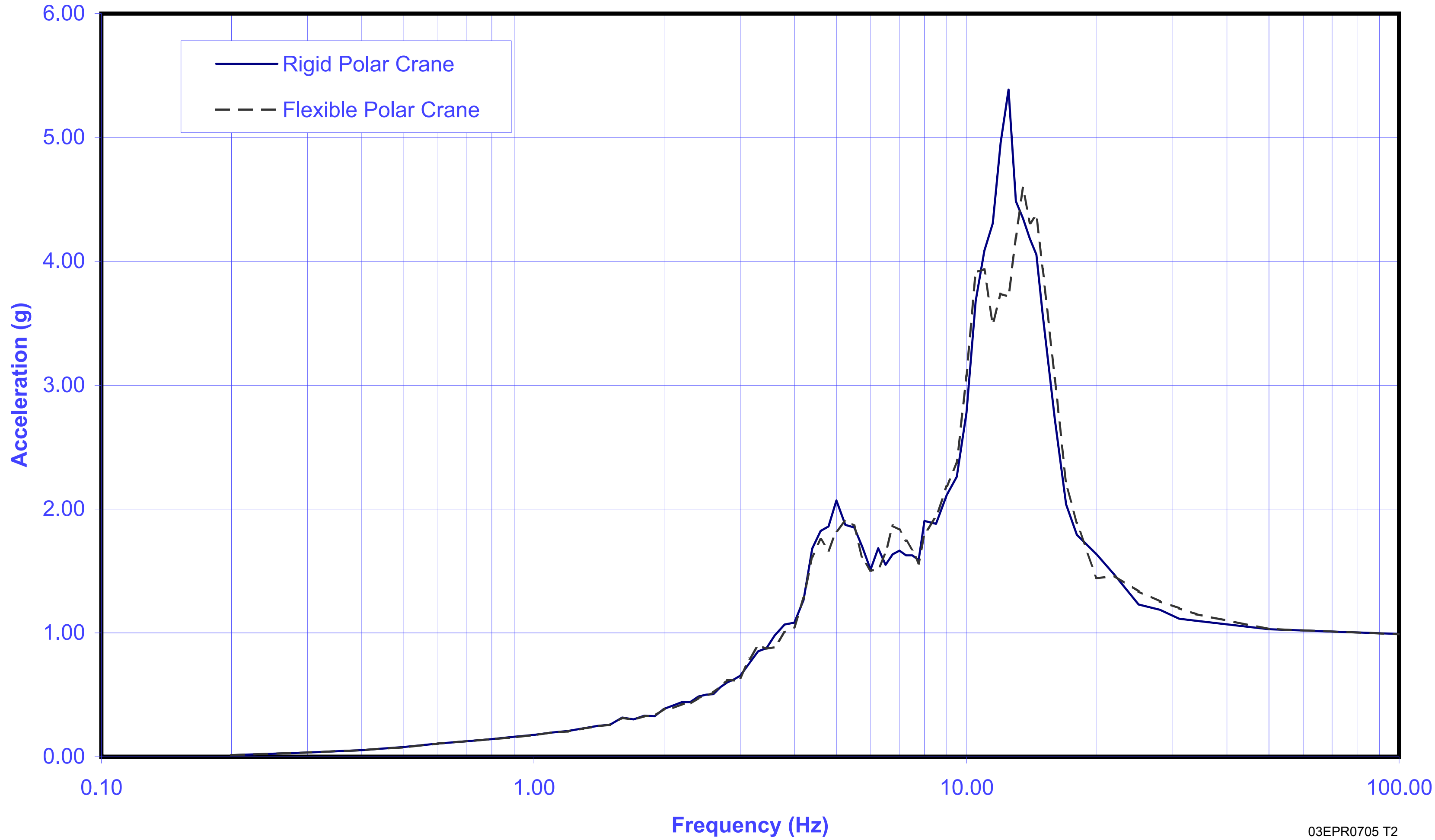


Figure 3.7.2-50—Spectrum Comparison at Elev. +63 ft, 11-3/4 inches (+19.50m) - Reactor Building Internal Structure, 4% Damping, X-Direction

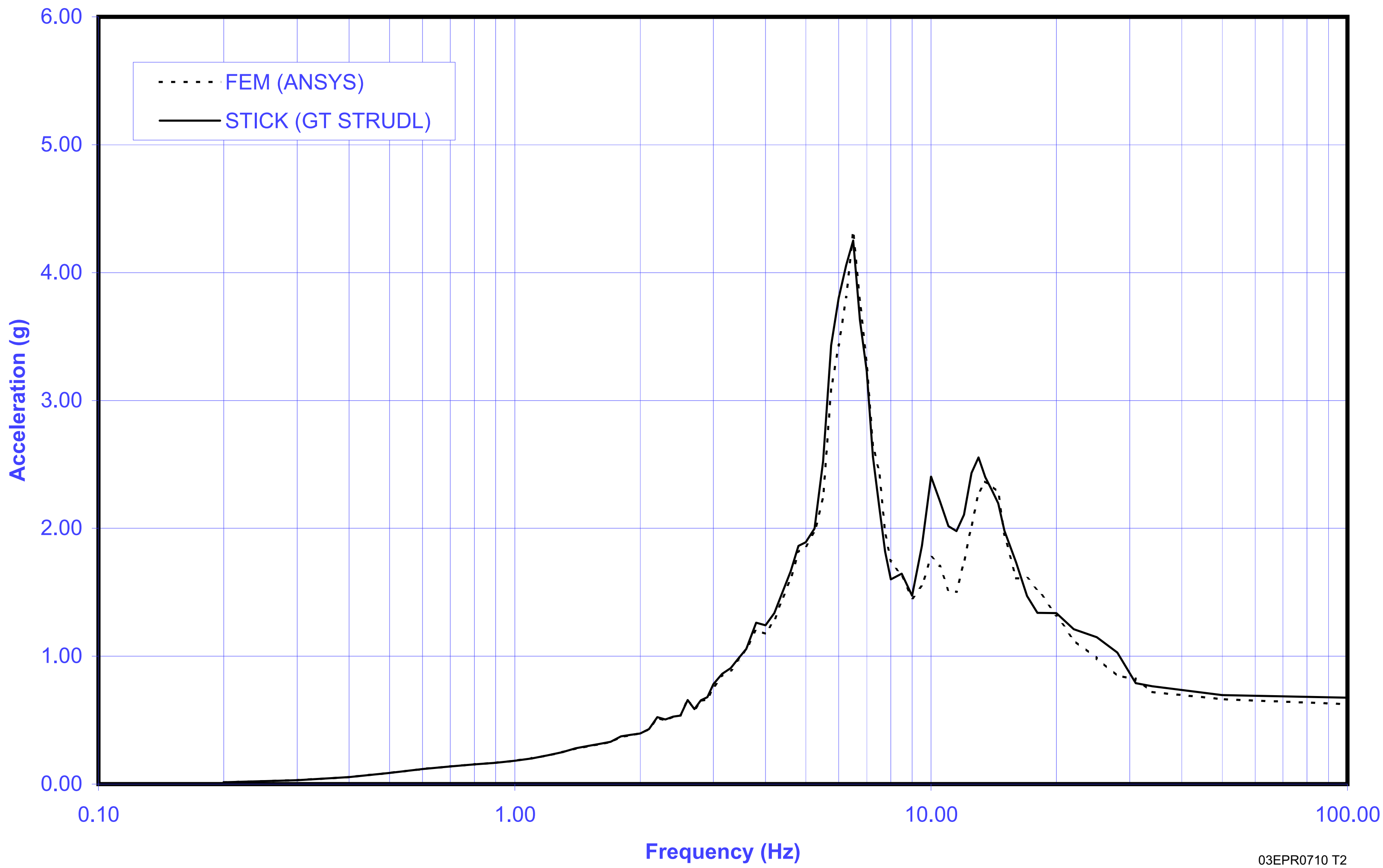


Figure 3.7.2-51—Spectrum Comparison at Elev. +63 ft, 11-3/4 inches (+19.50m) - Reactor Building Internal Structure, 4% Damping, Y-Direction

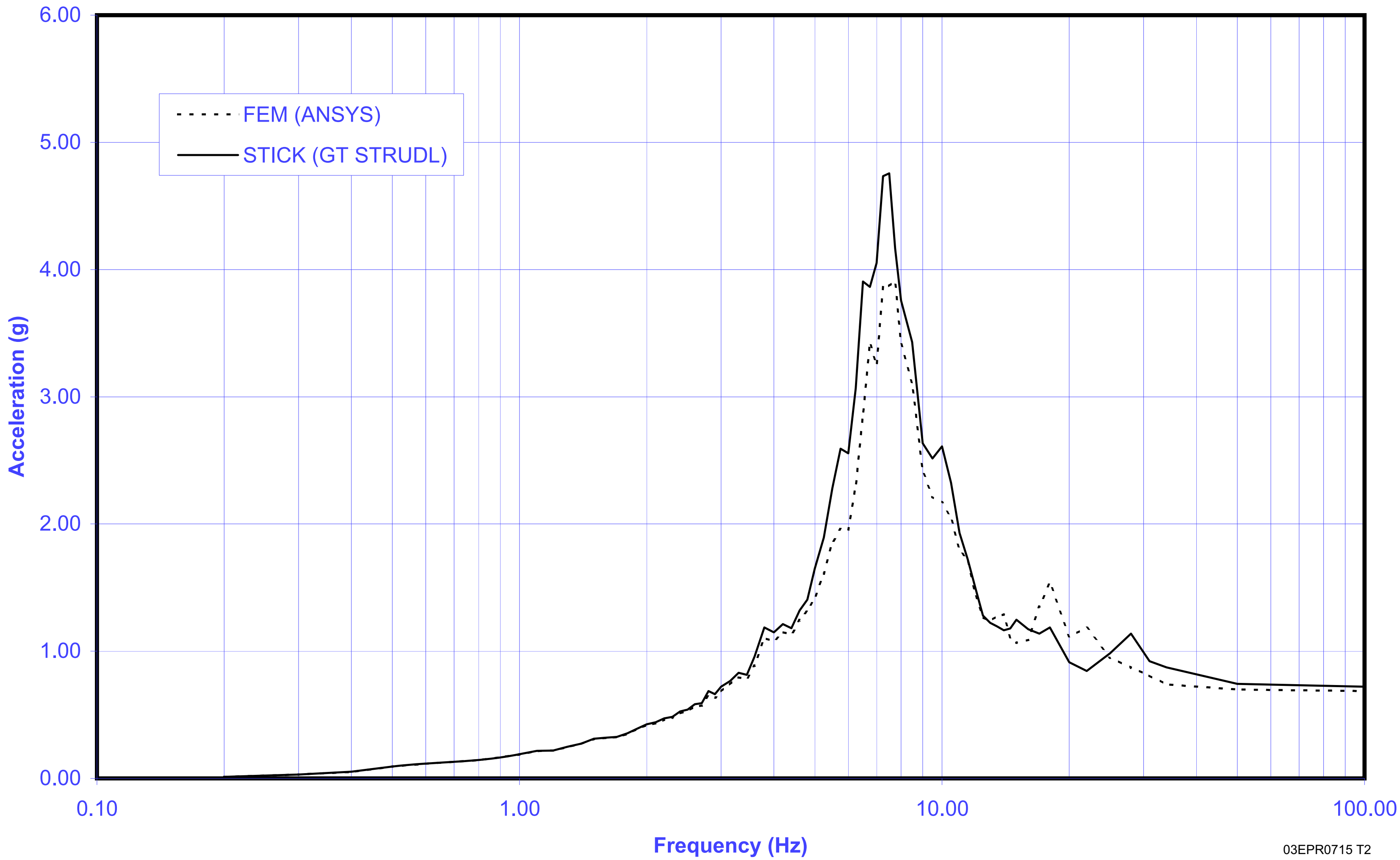


Figure 3.7.2-52—Spectrum Comparison at Elev. +63 ft, 11-3/4 inches (+19.50m) - Reactor Building Internal Structure, 4% Damping, Z-Direction

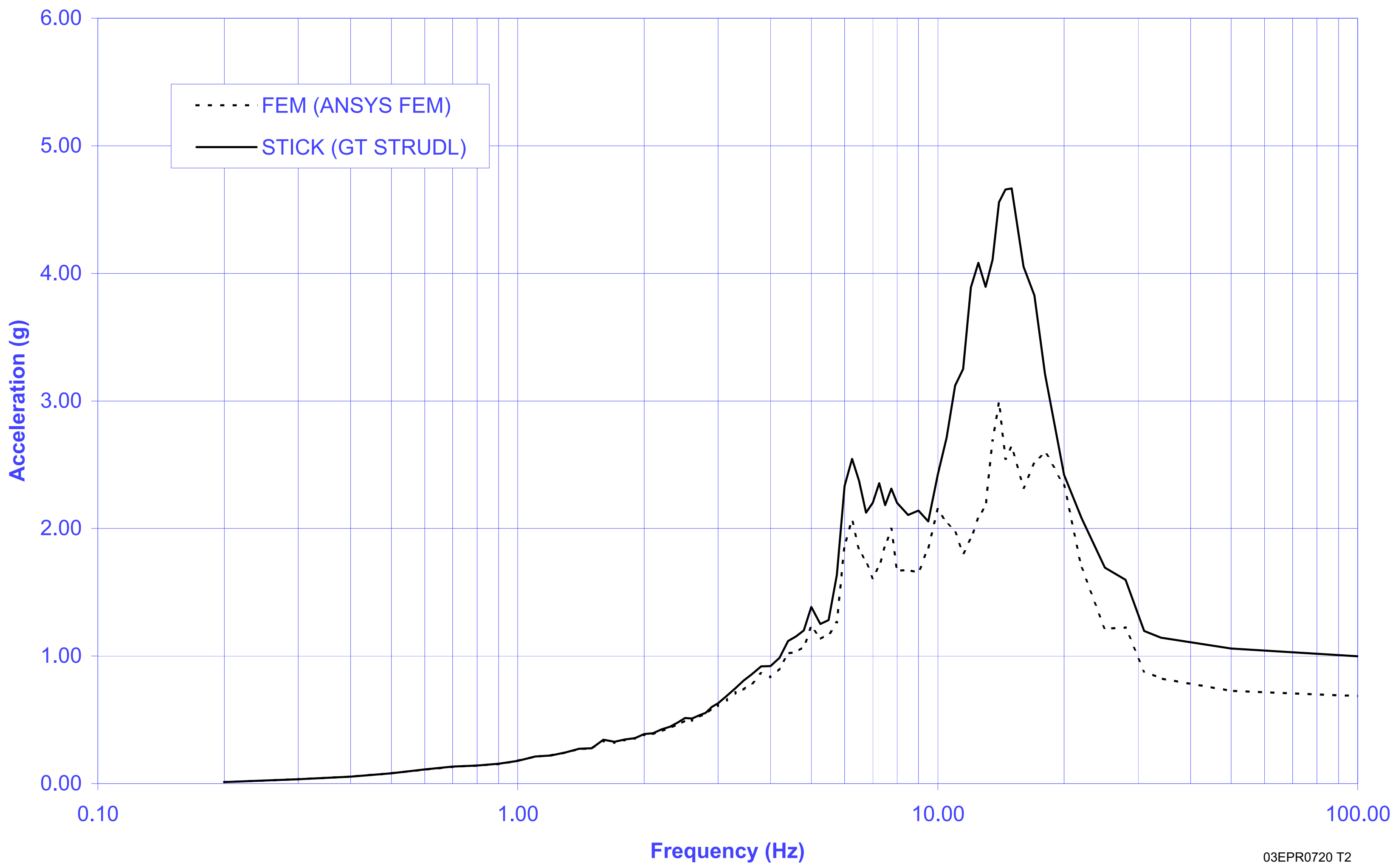


Figure 3.7.2-53—Spectrum Comparison at Elev. +16 ft, 10-3/4 inches (+5.15m) - Reactor Building Internal Structure, 4% Damping, X-Direction

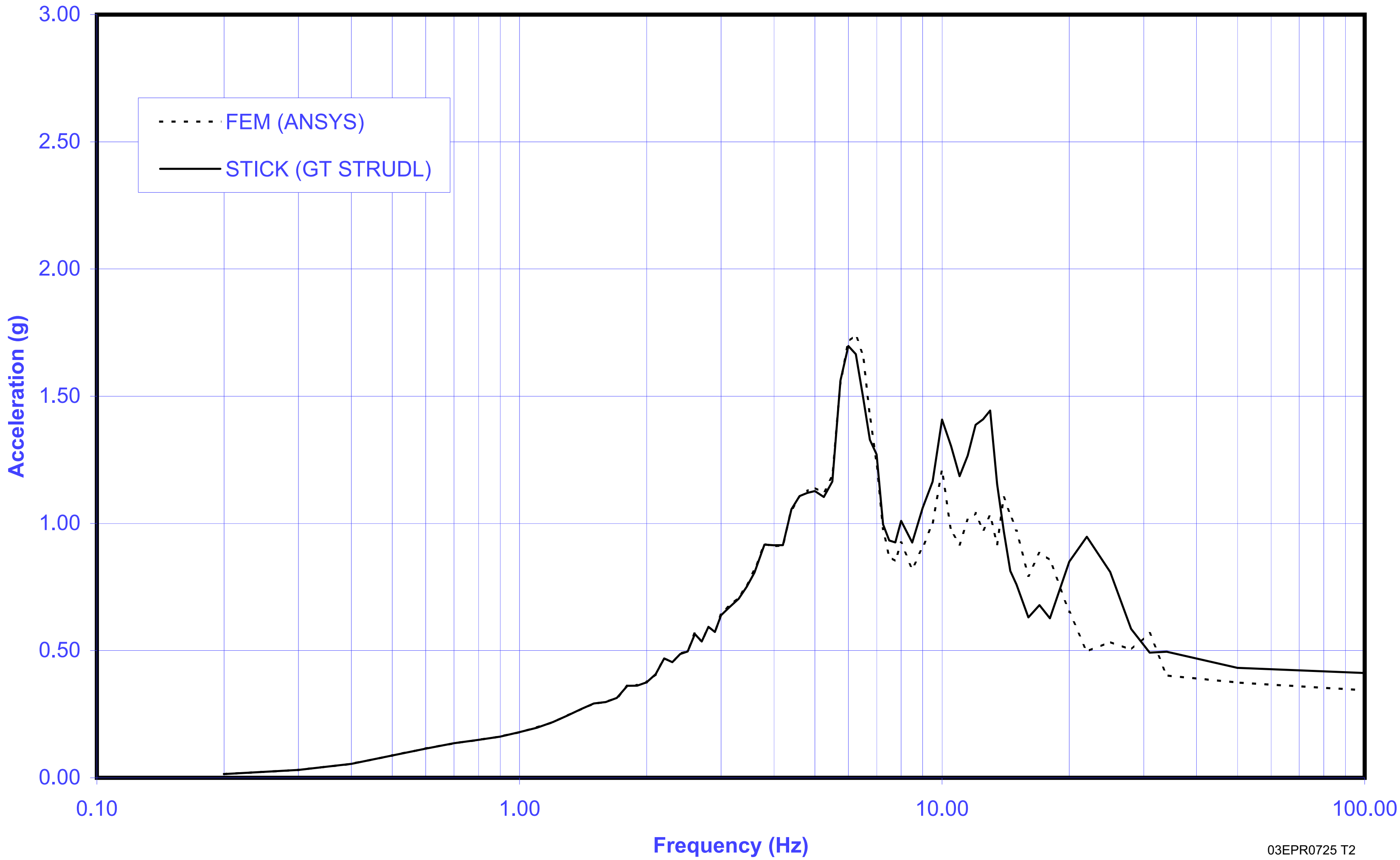


Figure 3.7.2-54—Spectrum Comparison at Elev. +16 ft, 10-3/4 inches (+5.15m) - Reactor Building Internal Structure, 4% Damping, Y-Direction

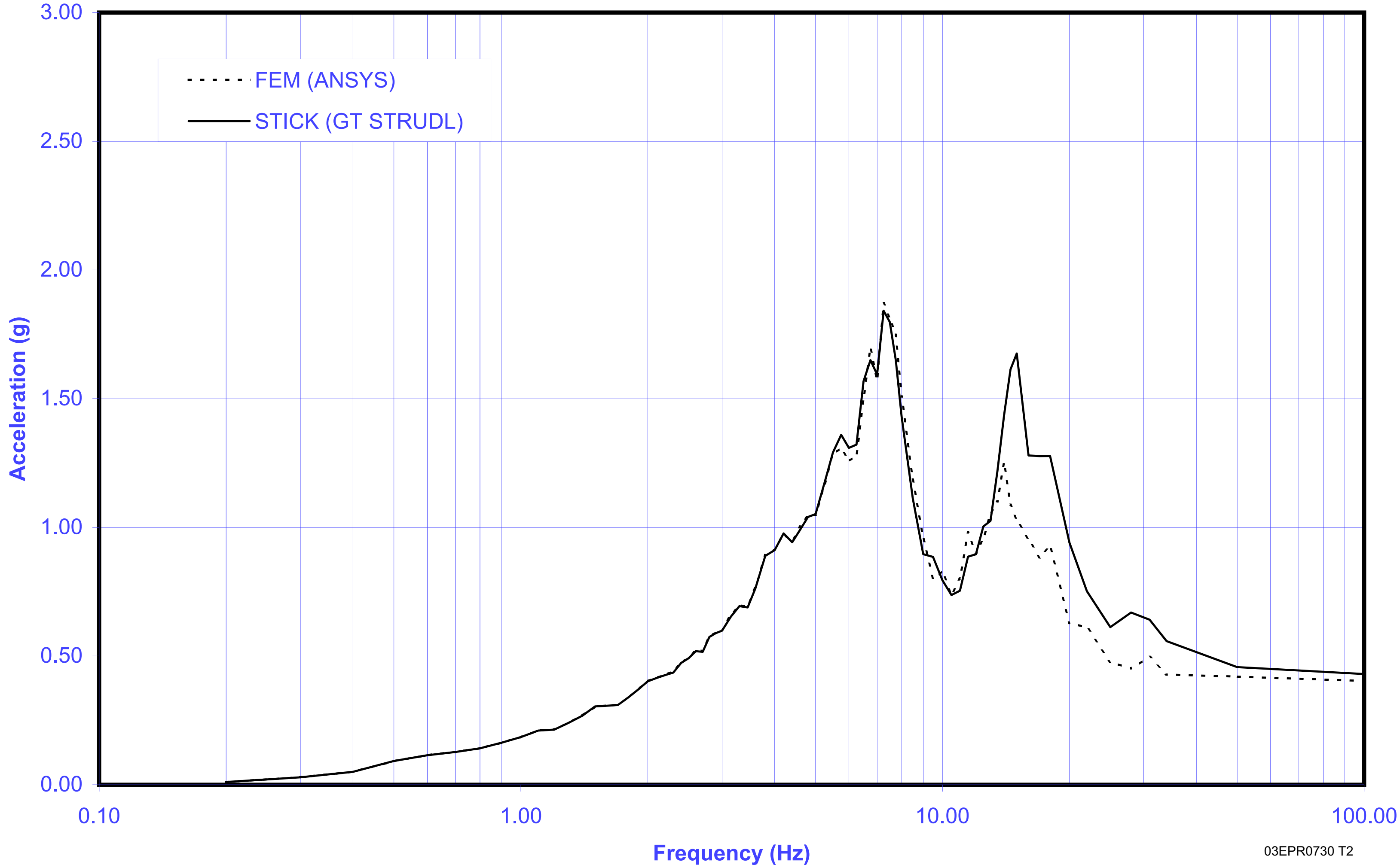


Figure 3.7.2-55—Spectrum Comparison at Elev. +16 ft, 10-3/4 inches (+5.15m) - Reactor Building Internal Structure, 4% Damping, Z-Direction

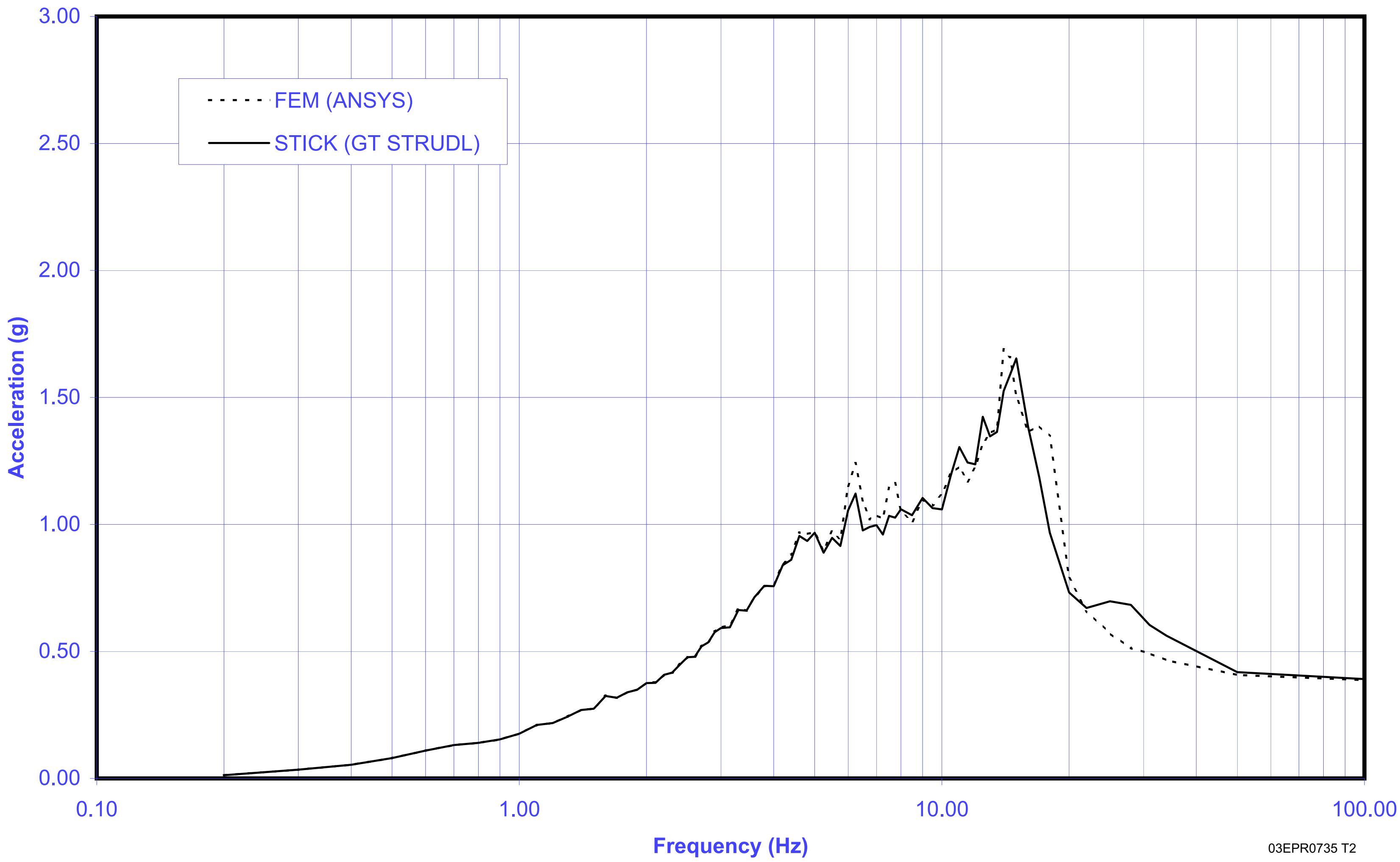


Figure 3.7.2-56—Simplified Stick Model of Reactor Coolant Loop

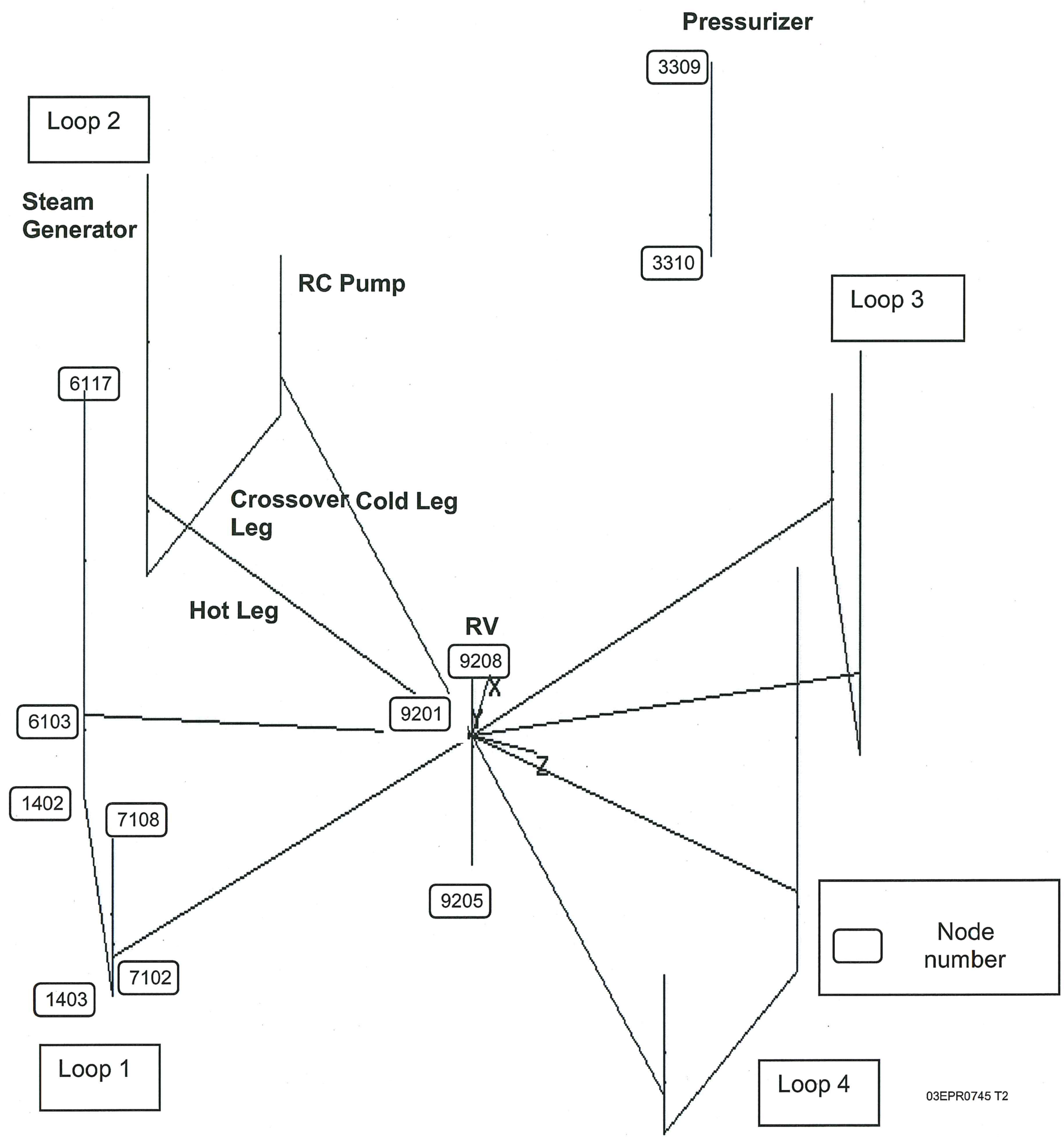


Figure 3.7.2-57—Isometric View of GTSTRUDL FEM for Emergency Power Generating Building

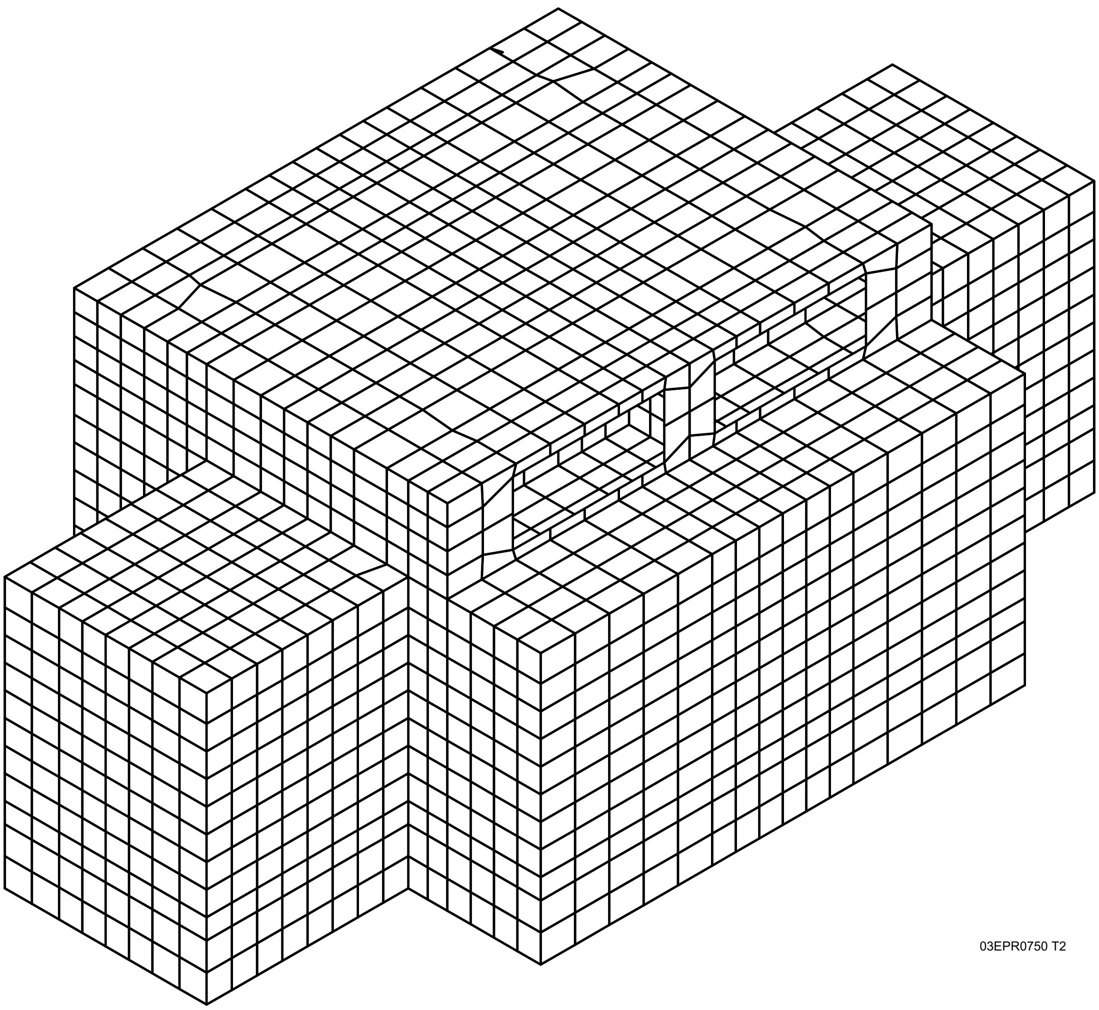


Figure 3.7.2-58—Section View of GTSTRUDL FEM for Emergency Power Generating Building

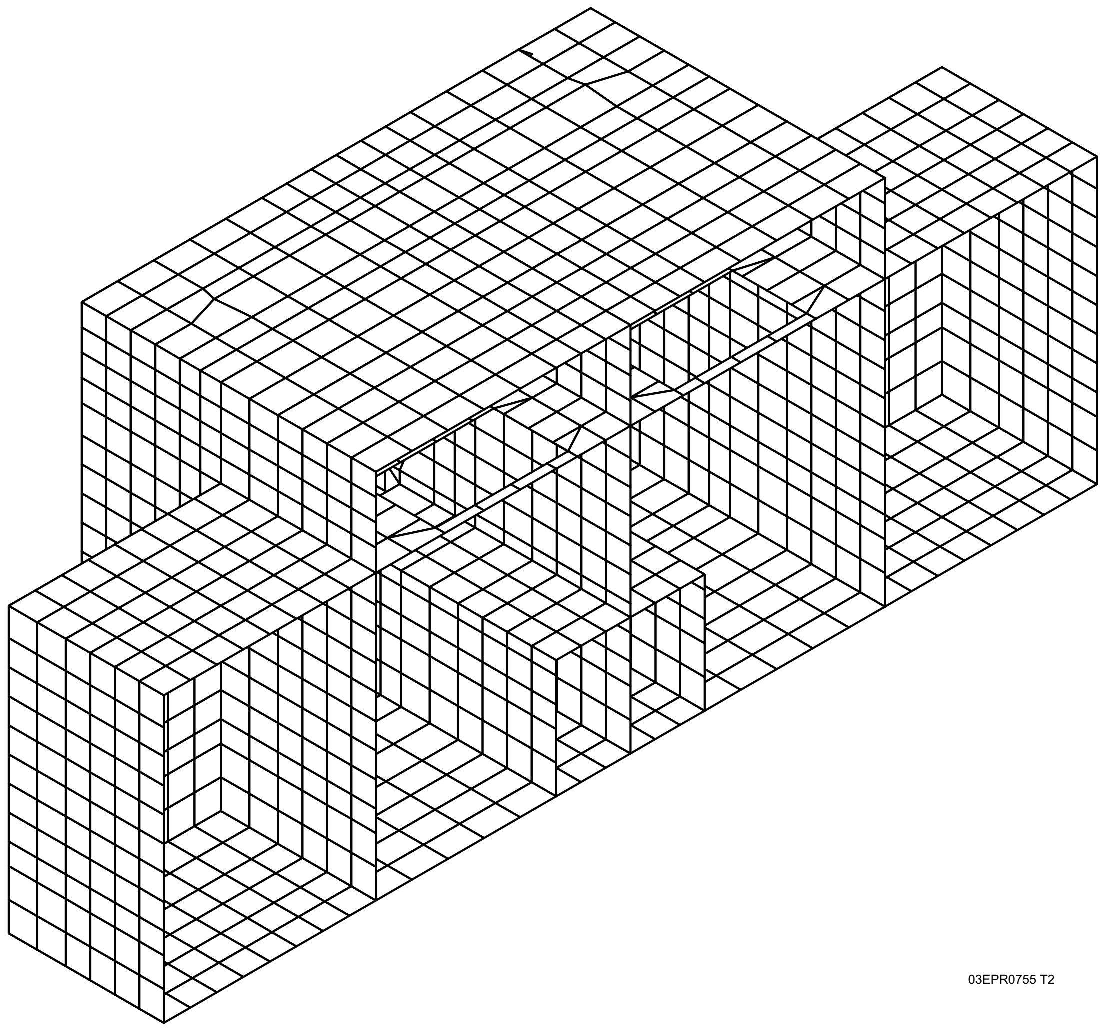


Figure 3.7.2-59—Isometric View of GTSTRUDL FEM for Emergency Service Water Building

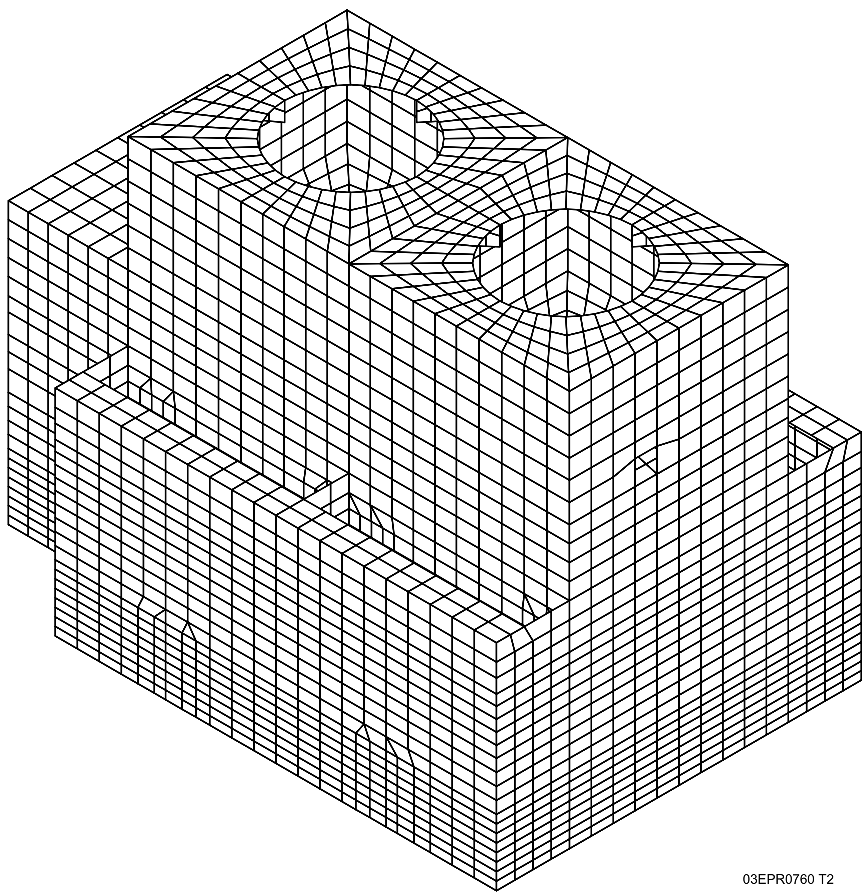


Figure 3.7.2-60—Section View of GTSTRUDL FEM for Emergency Service Water Building

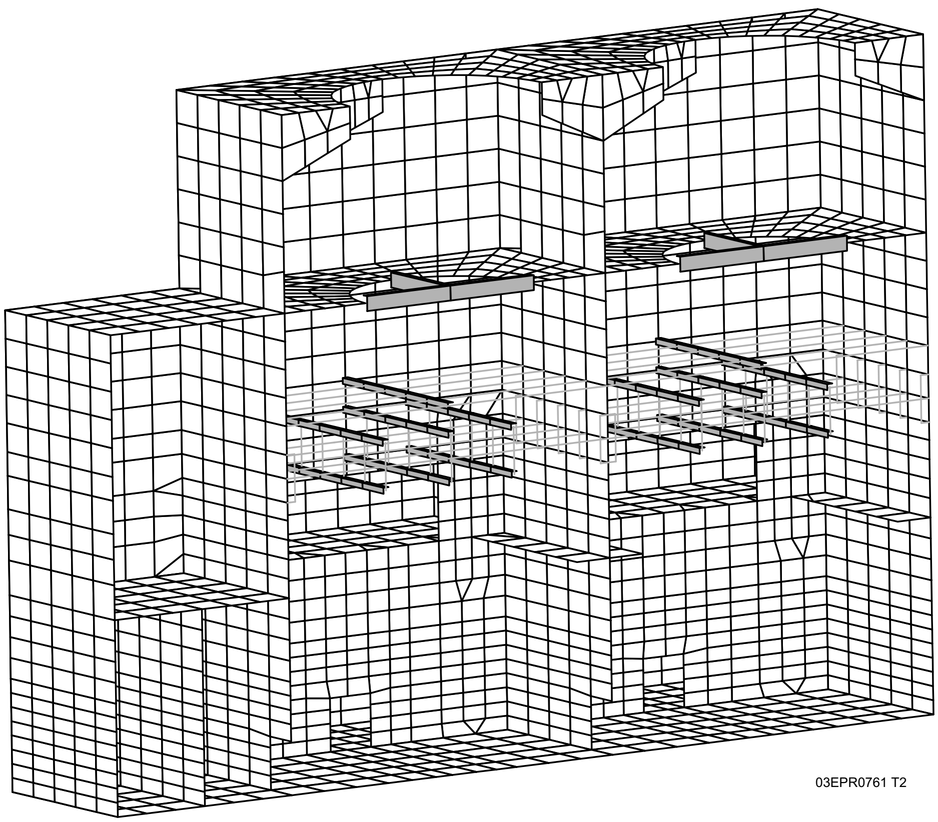
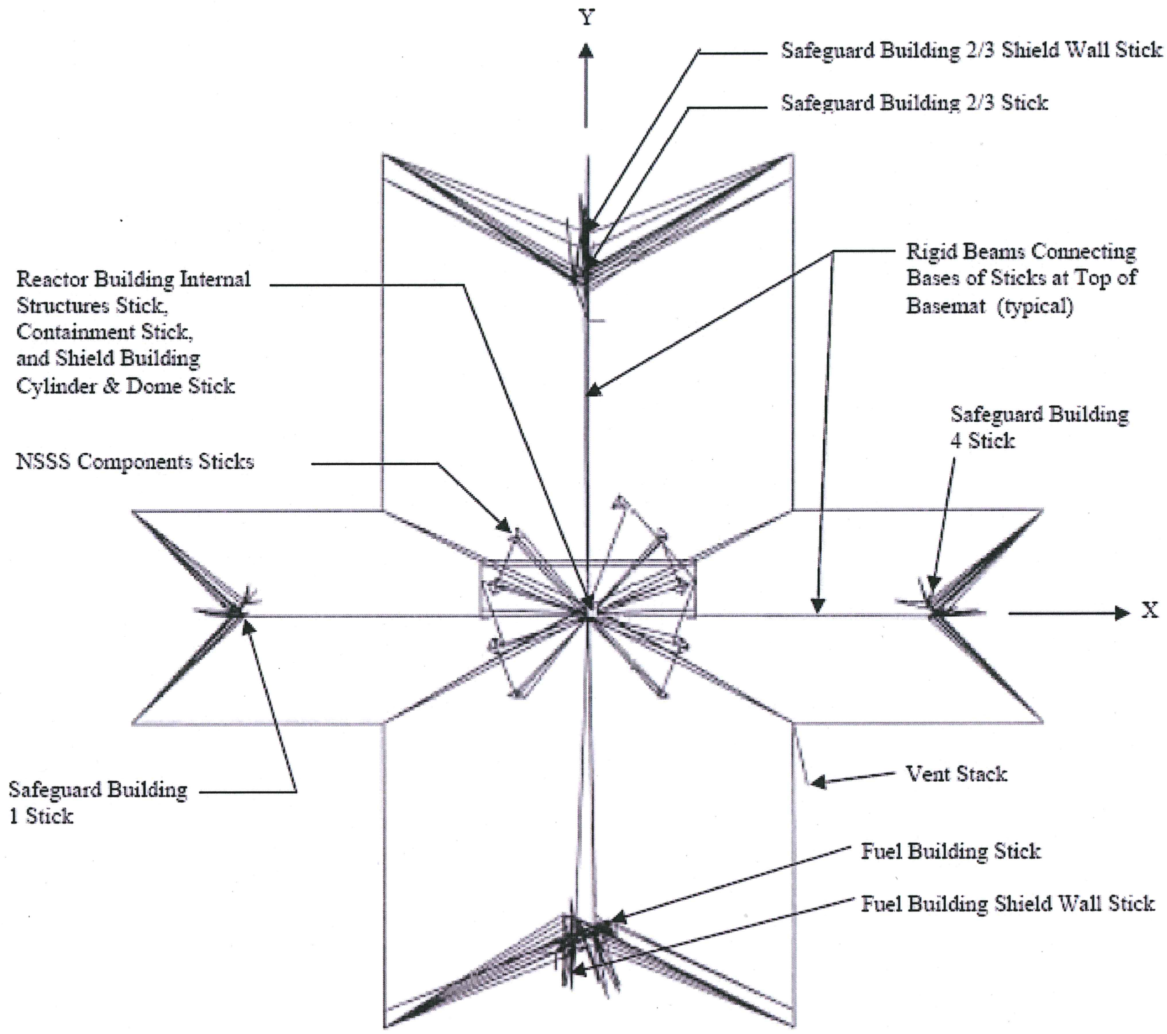


Figure 3.7.2-61—Plan View of NI Common Basemat Structures and Stick Model



Note: Rigid beams from centers of mass to wall corners for purpose of extracting seismic responses at structural corners are omitted for purpose of clarity.

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Figure 3.7.2-62—Plan View of SSI Model for NI Common Basemat Structures and NAB

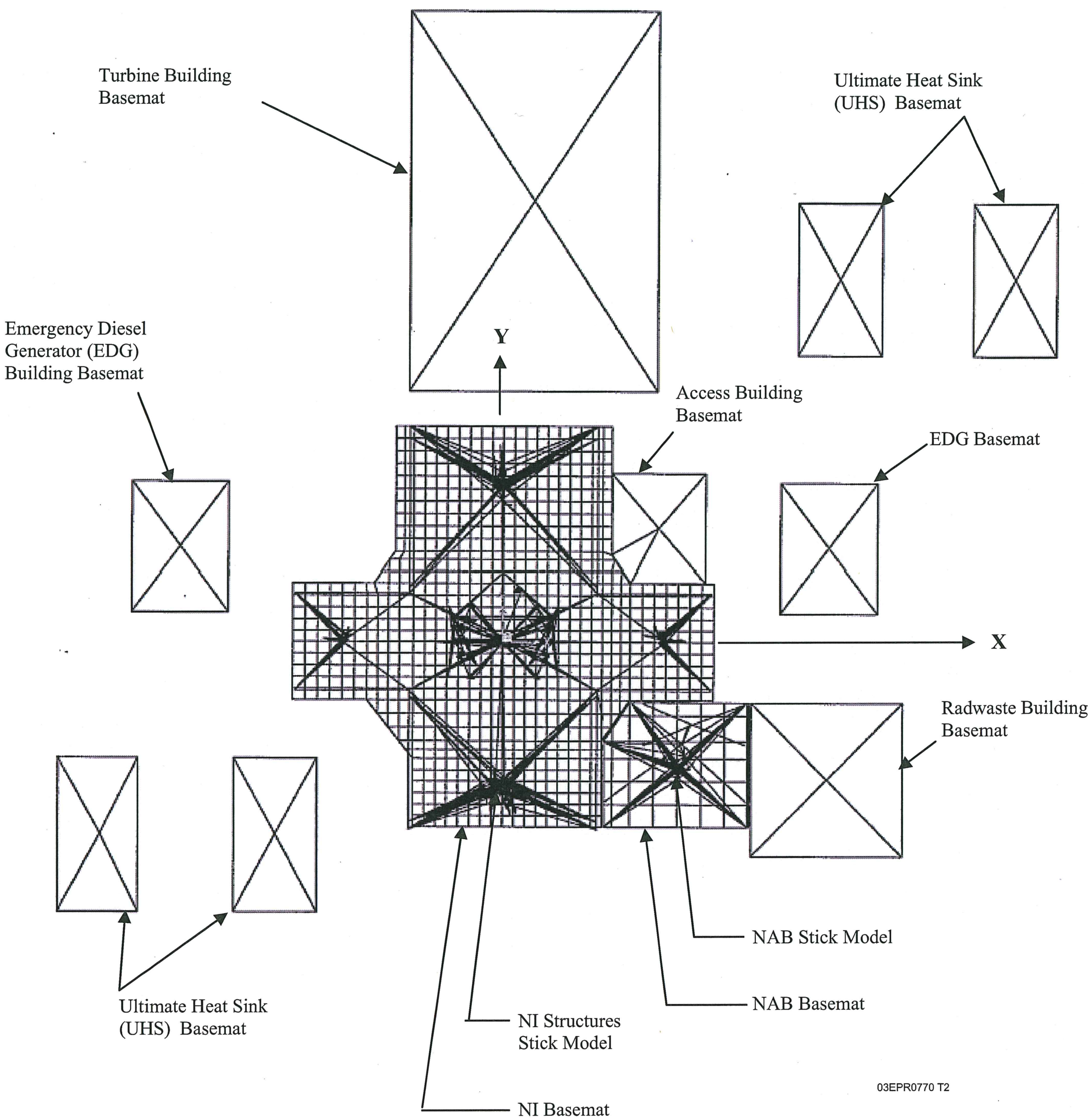
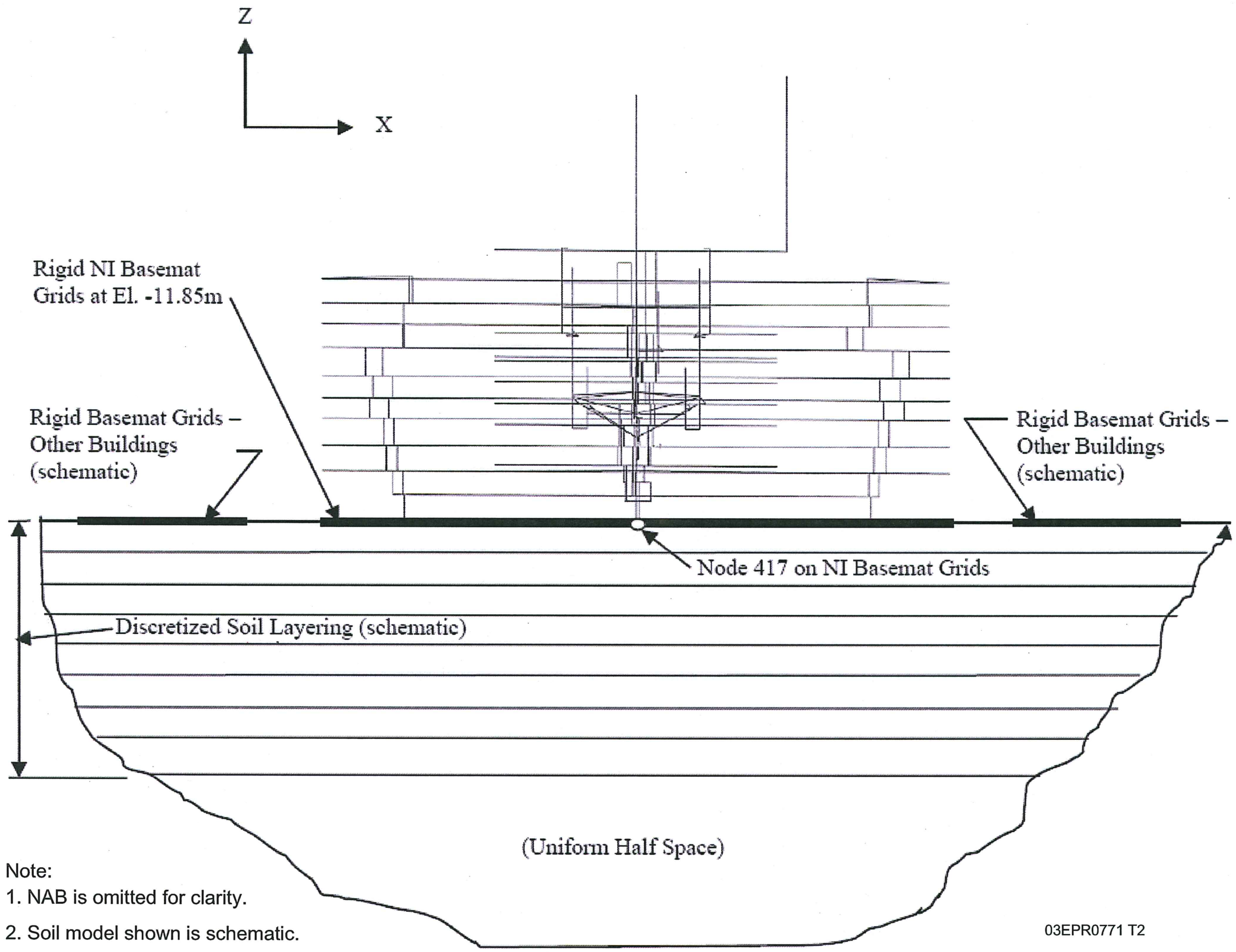


Figure 3.7.2-63—Elevation View of SSI Model for NI Common Basemat Structures and NAB in X-Z Plane



Note:
1. NAB is omitted for clarity.
2. Soil model shown is schematic.

Figure 3.7.2-64—Schematic Footprint Area of NI Common Basemat

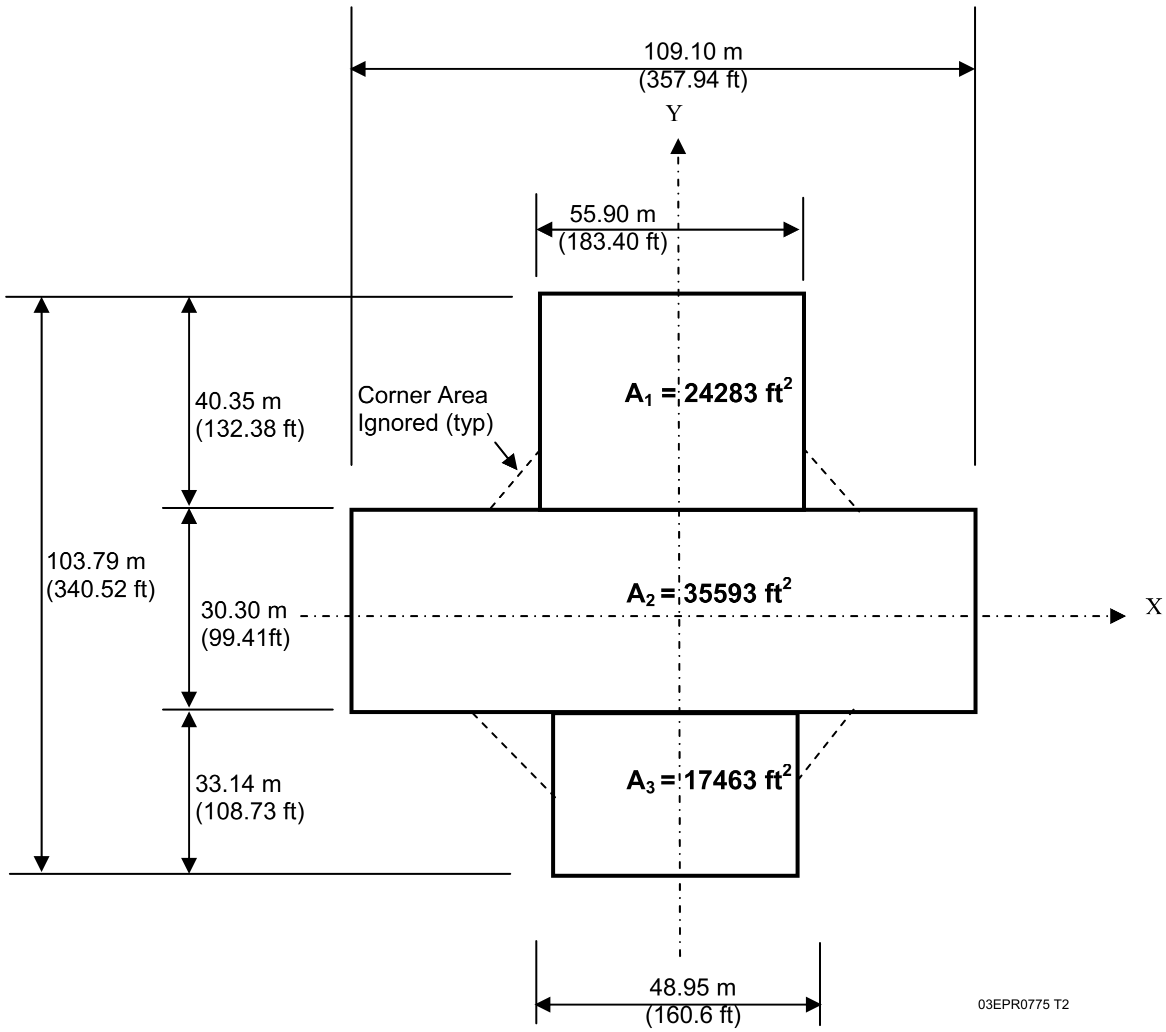


Figure 3.7.2-65—RCS Stick Coupled to Model STICK-1T for Reactor Building Internal Structure

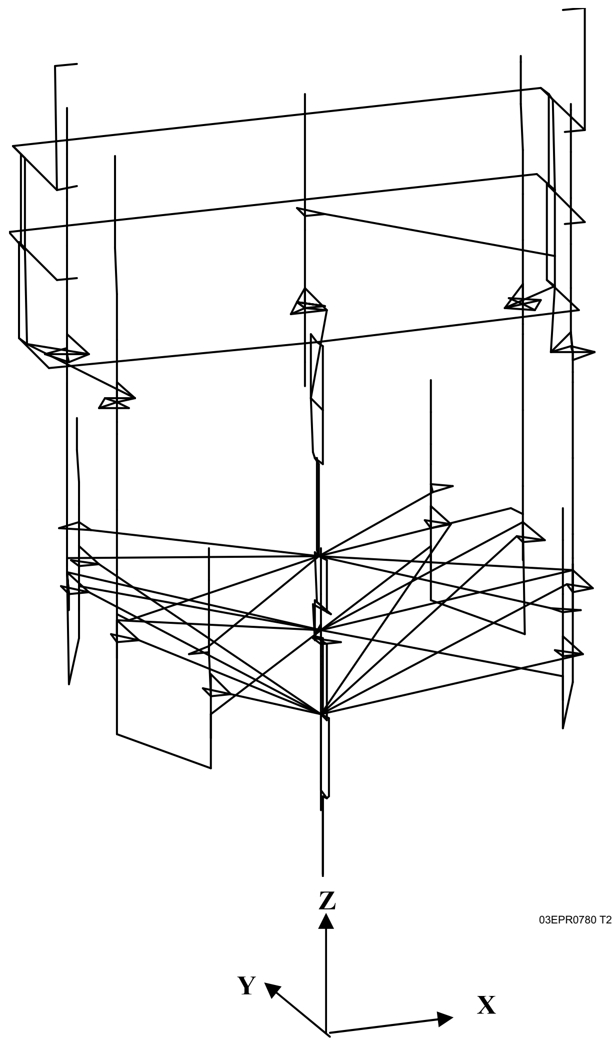


Figure 3.7.2-66—Elevation View of NAB Stick Model in X-Z Plane

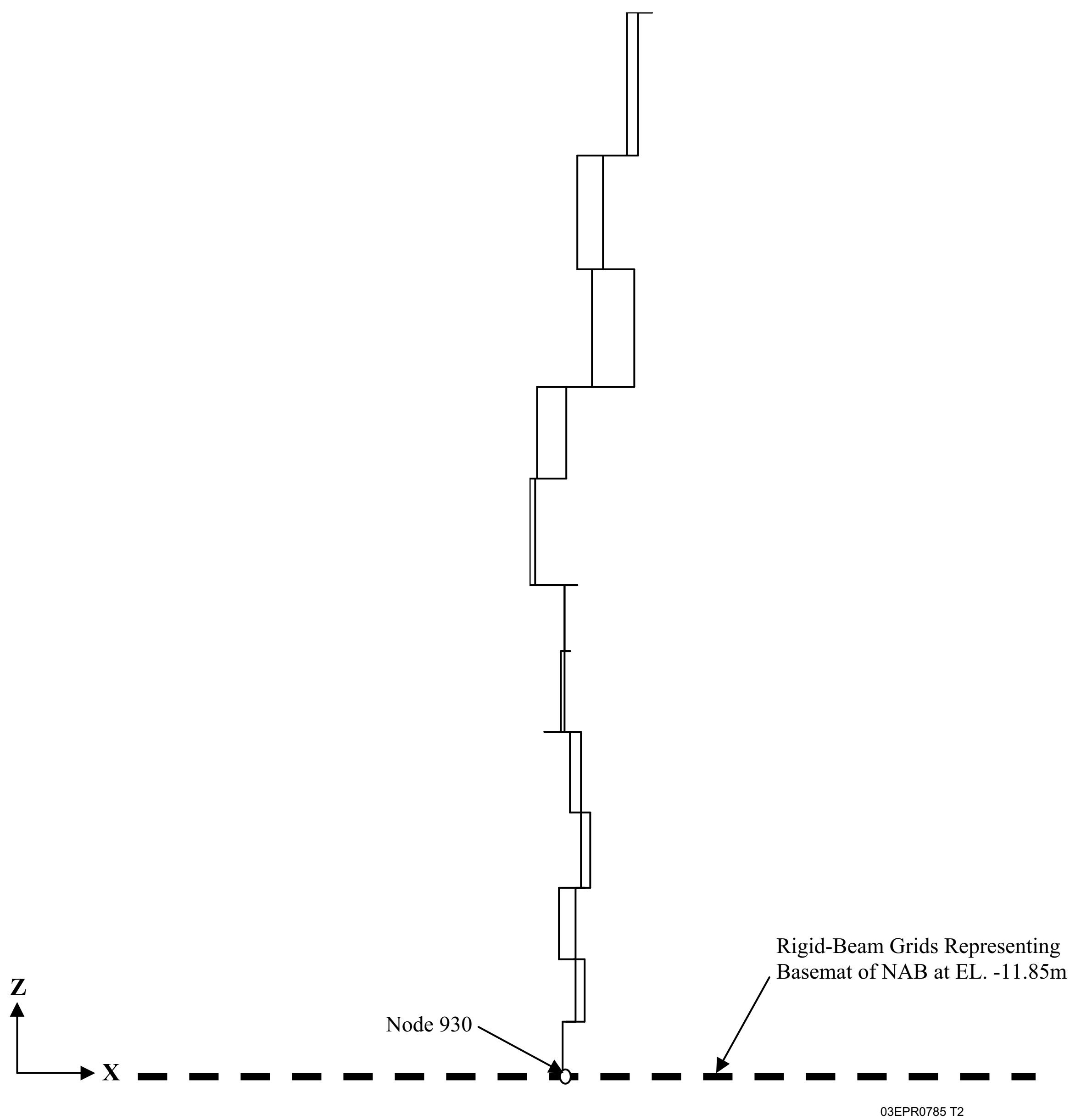


Figure 3.7.2-67—Elevation View of NAB Stick Model in Y-Z Plane

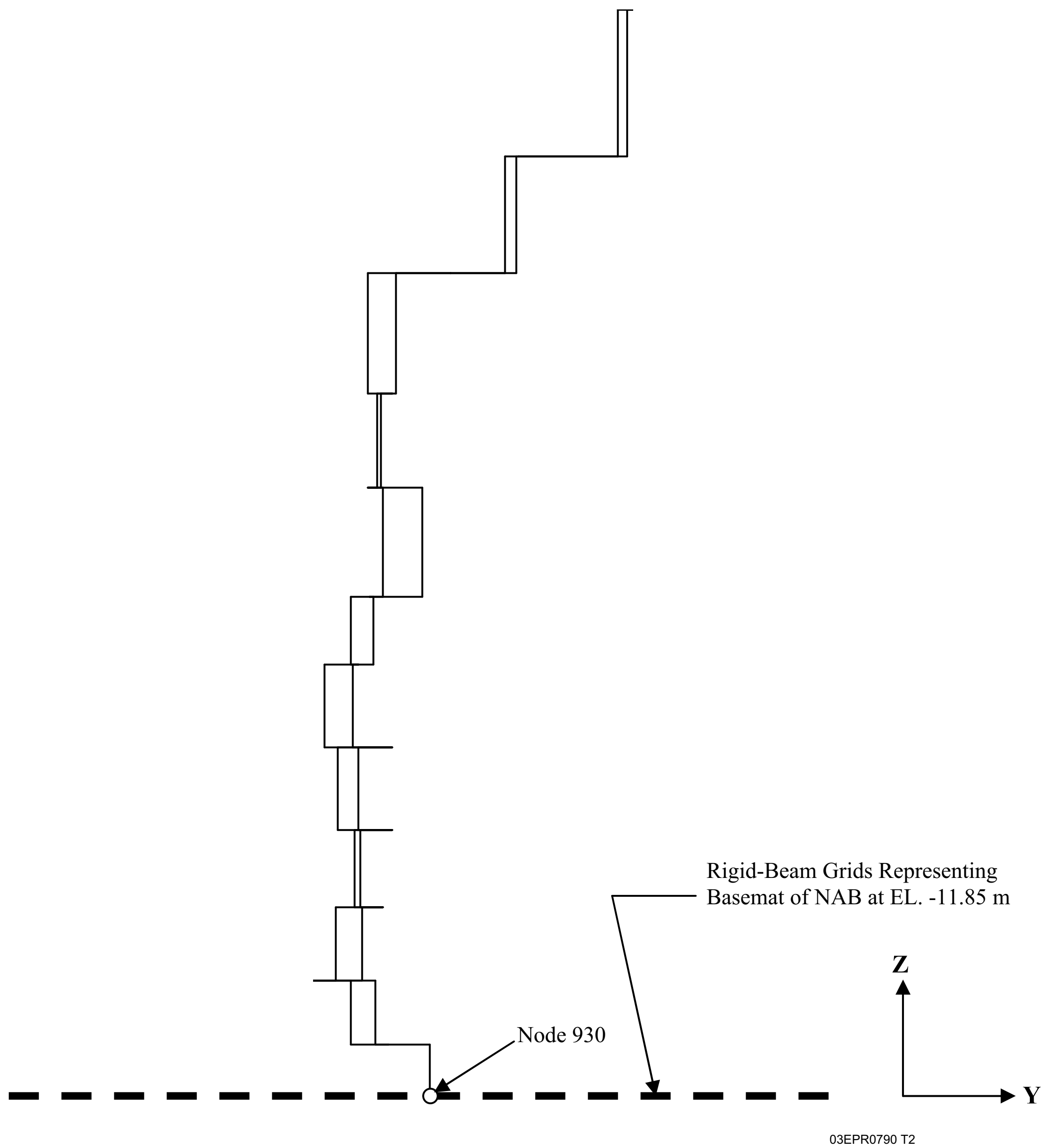


Figure 3.7.2-68—Response Spectra at NI Common Basemat Bottom Node 417 - 5% Damping X-Direction

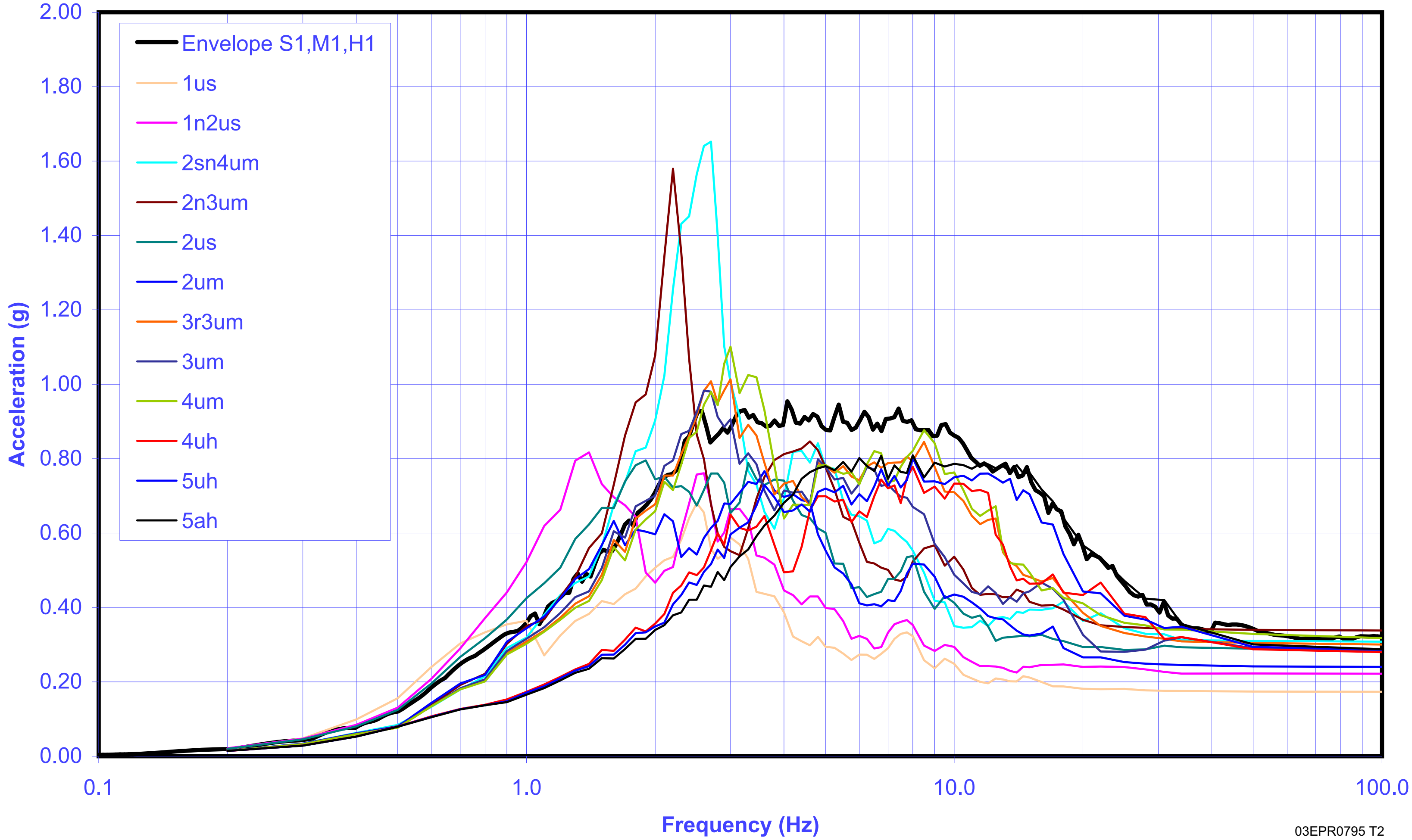


Figure 3.7.2-69—Response Spectra at NI Common Basemat Bottom Node 417 - 5% Damping Y-Direction

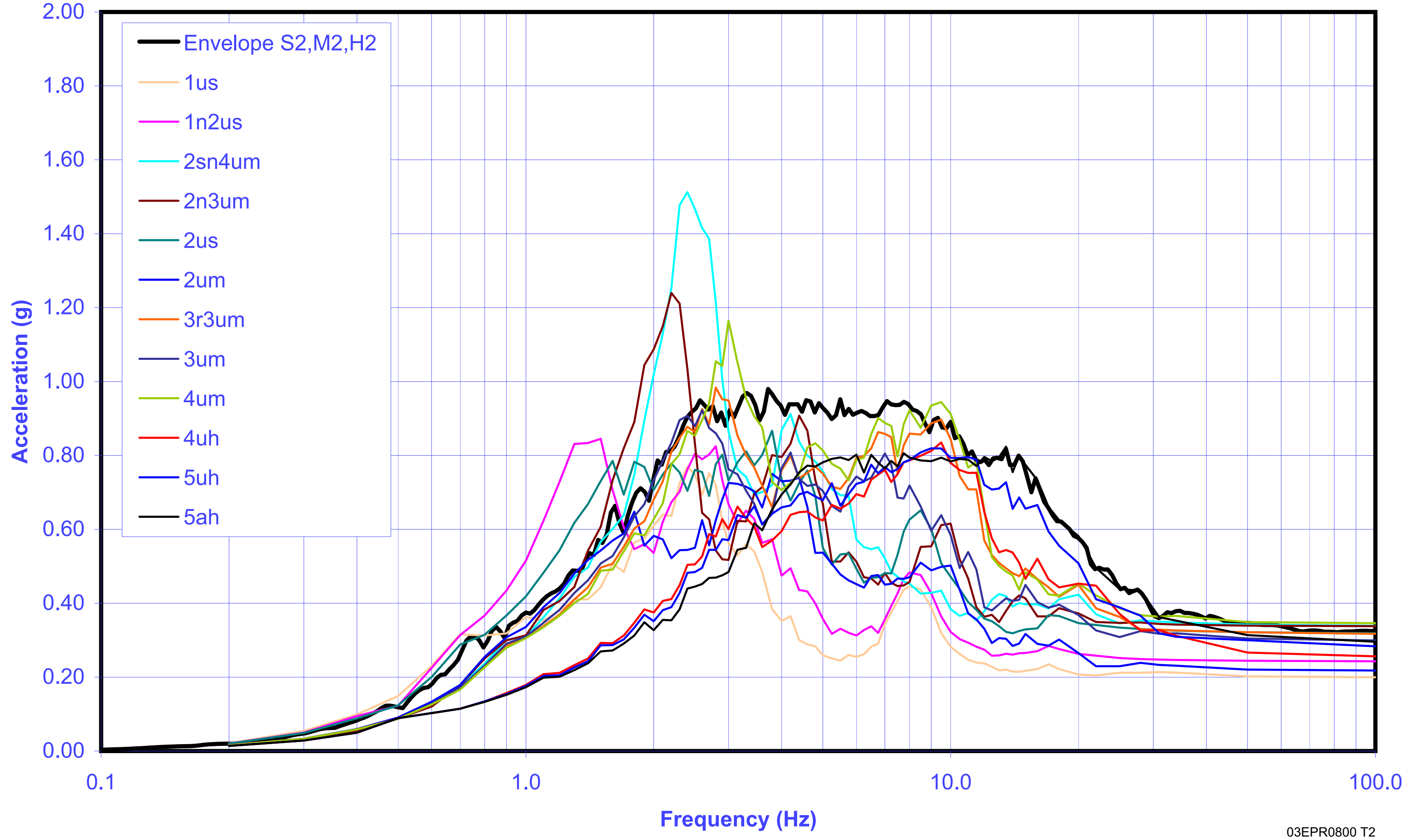


Figure 3.7.2-70—Response Spectra at NI Common Basemat Bottom Node 417 - 5% Damping Z-Direction

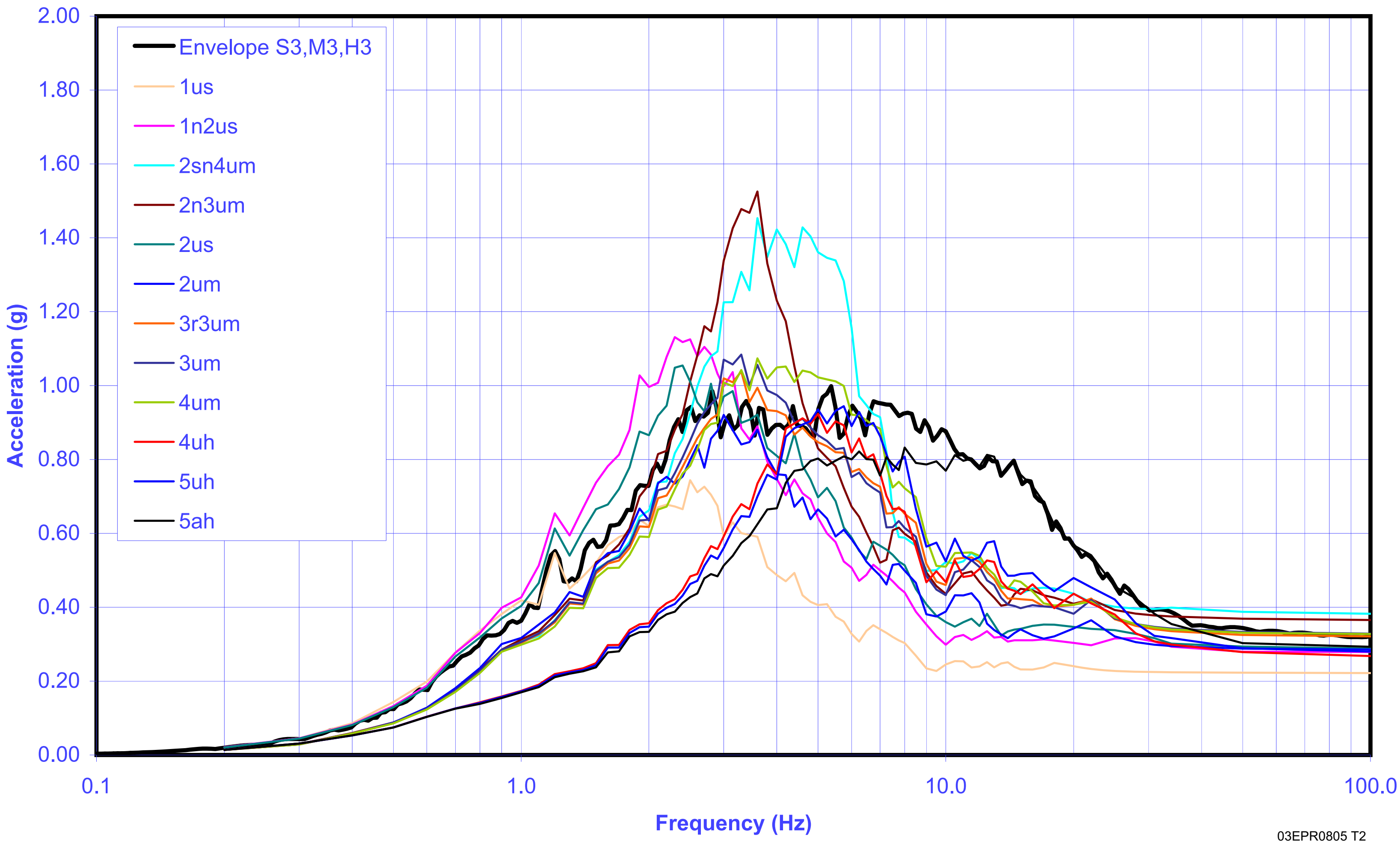


Figure 3.7.2-71—Soil Model Surface Response Spectra at Centers of Footprints of EPGB and ESWB - 5% Damping X-Direction

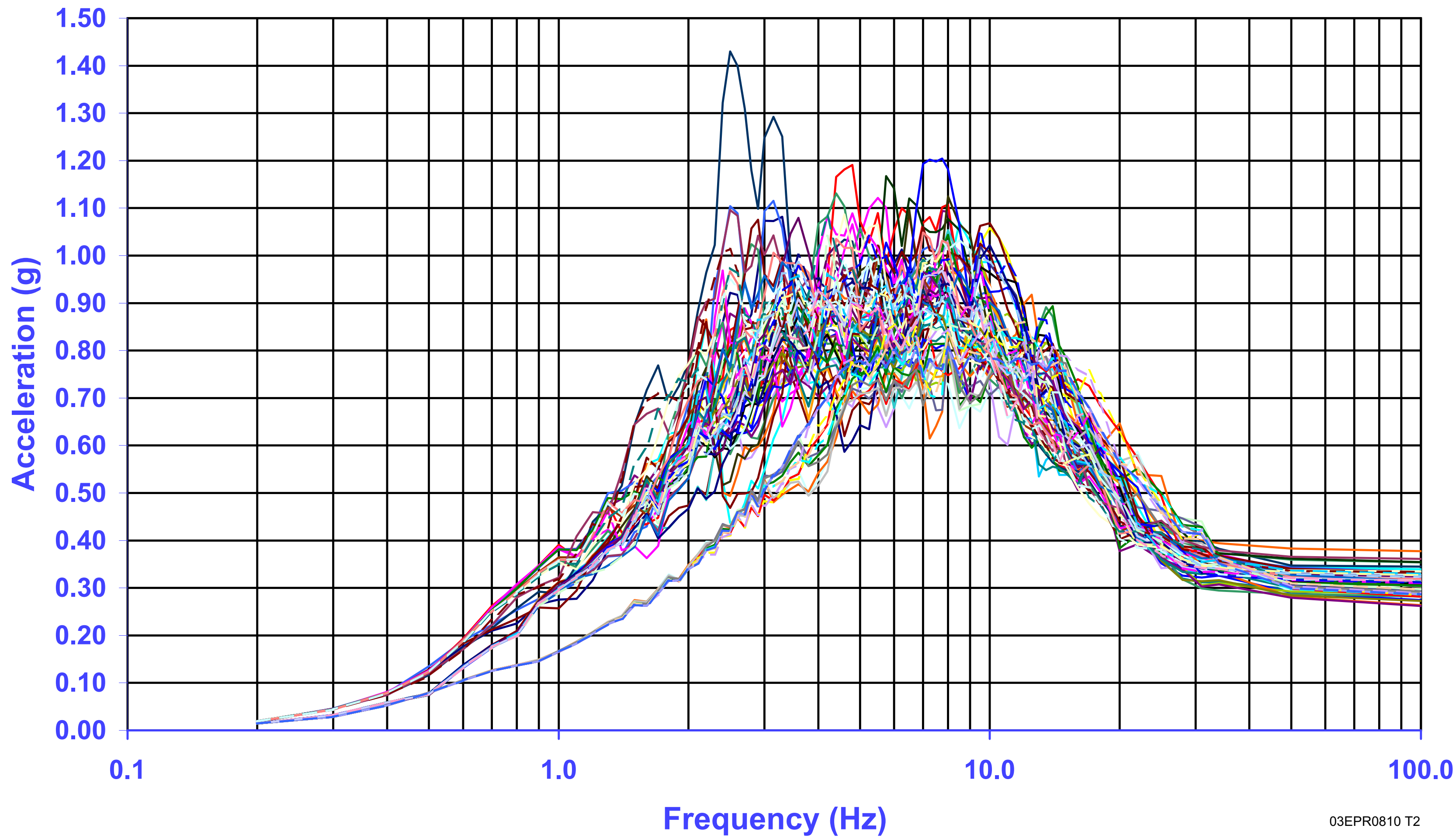


Figure 3.7.2-72—Soil Model Surface Response Spectra at Centers of Footprints of EPGB and ESWB - 5% Damping Y-Direction

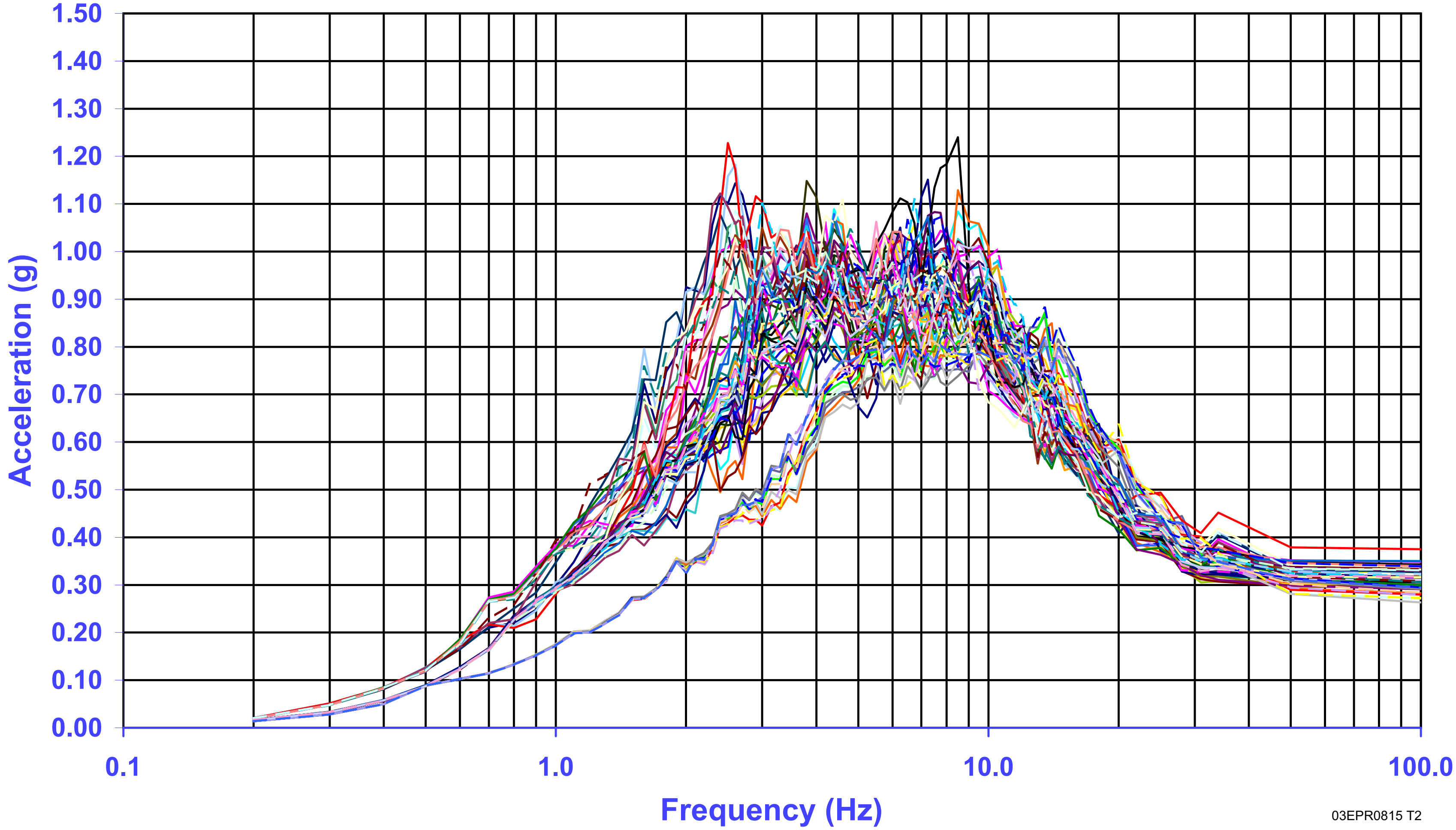


Figure 3.7.2-73—Soil Model Surface Response Spectra at Centers of Footprints of EPGB and ESWB - 5% Damping Z-Direction

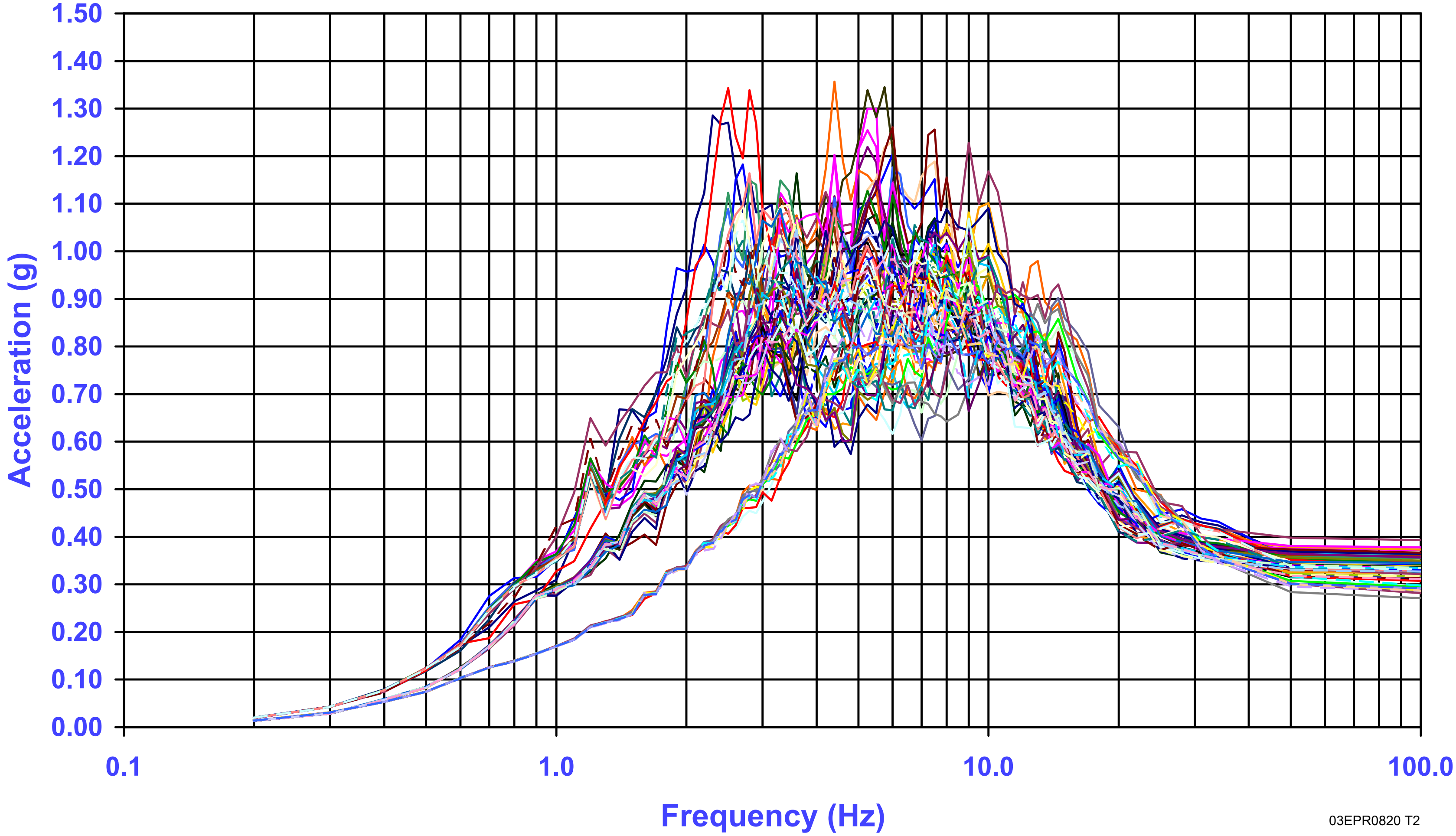


Figure 3.7.2-74—Spectrum Envelope of Reactor Building Internal Structure - Elev. +16 ft, 10-3/4 inches (+5.15m) 2%, 3%, 4%, 5%, 7% and 10% Damping X-Direction

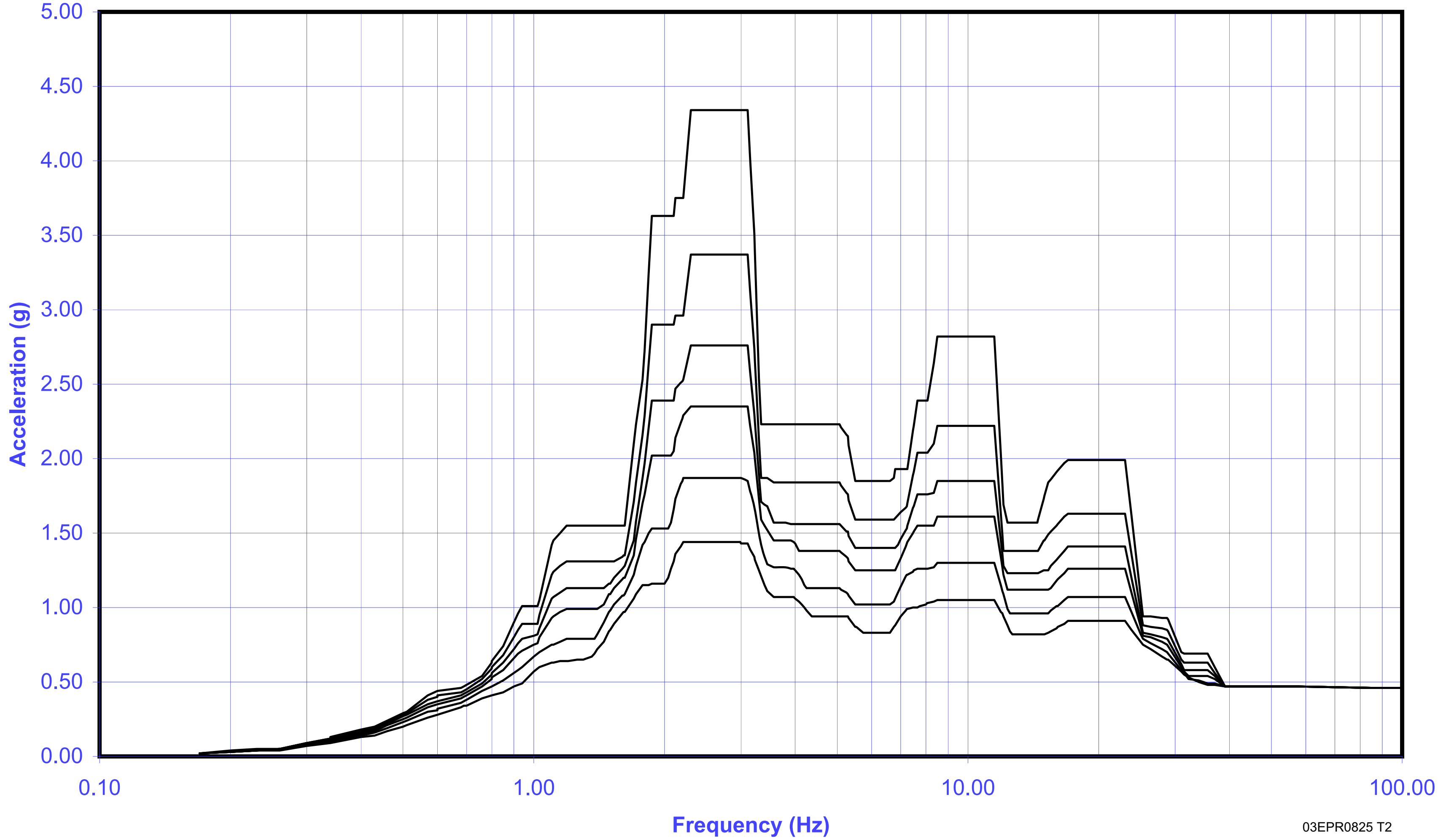


Figure 3.7.2-75—Spectrum Envelope of Reactor Building Internal Structure - Elev. +16 ft, 10-3/4 inches (+5.15m) 2%, 3%, 4%, 5%, 7% and 10% Damping Y-Direction

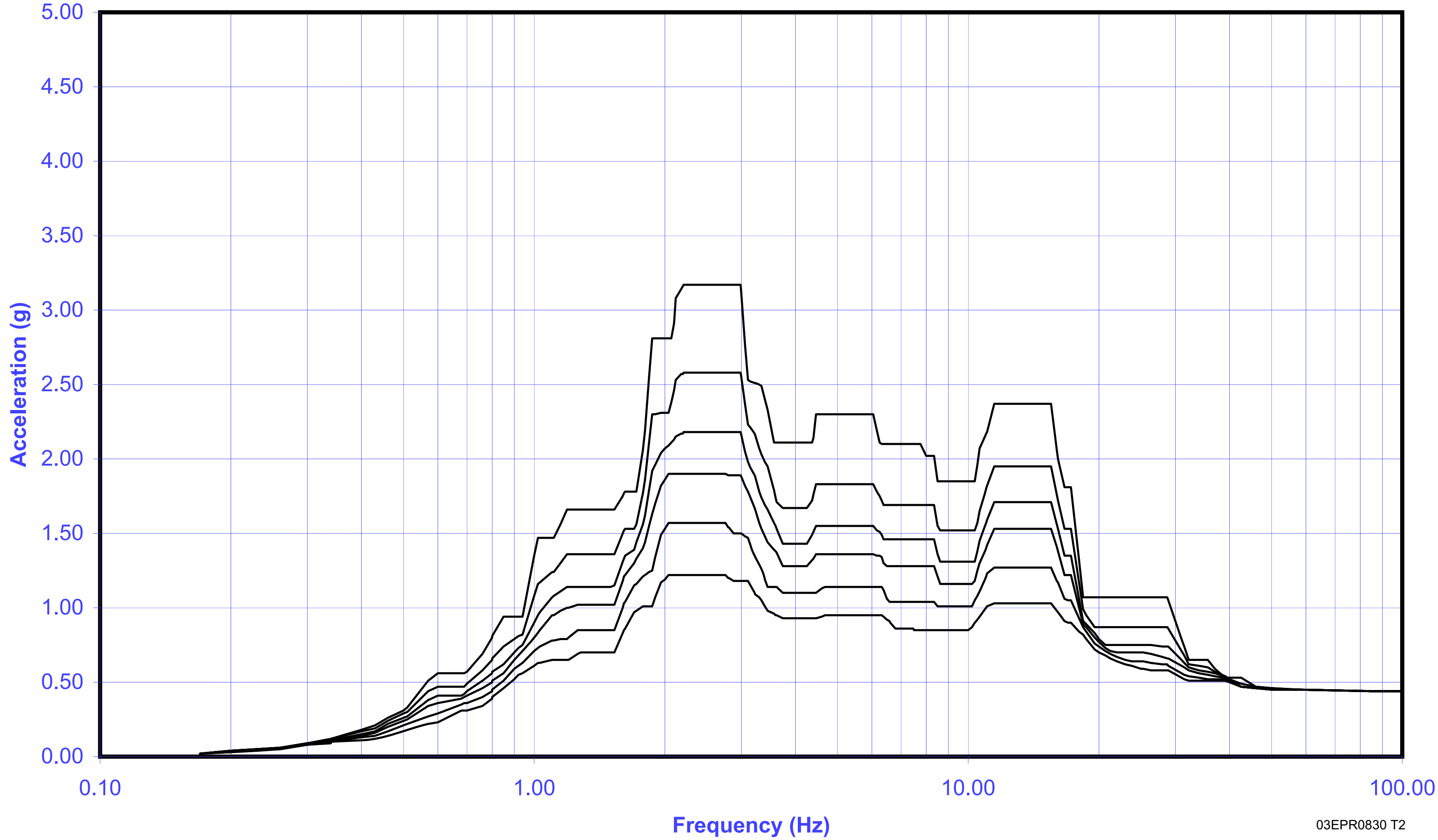


Figure 3.7.2-76—Spectrum Envelope of Reactor Building Internal Structure - Elev. +16 ft, 10-3/4 inches (+5.15m) 2%, 3%, 4%, 5%, 7% and 10% Damping Z-Direction

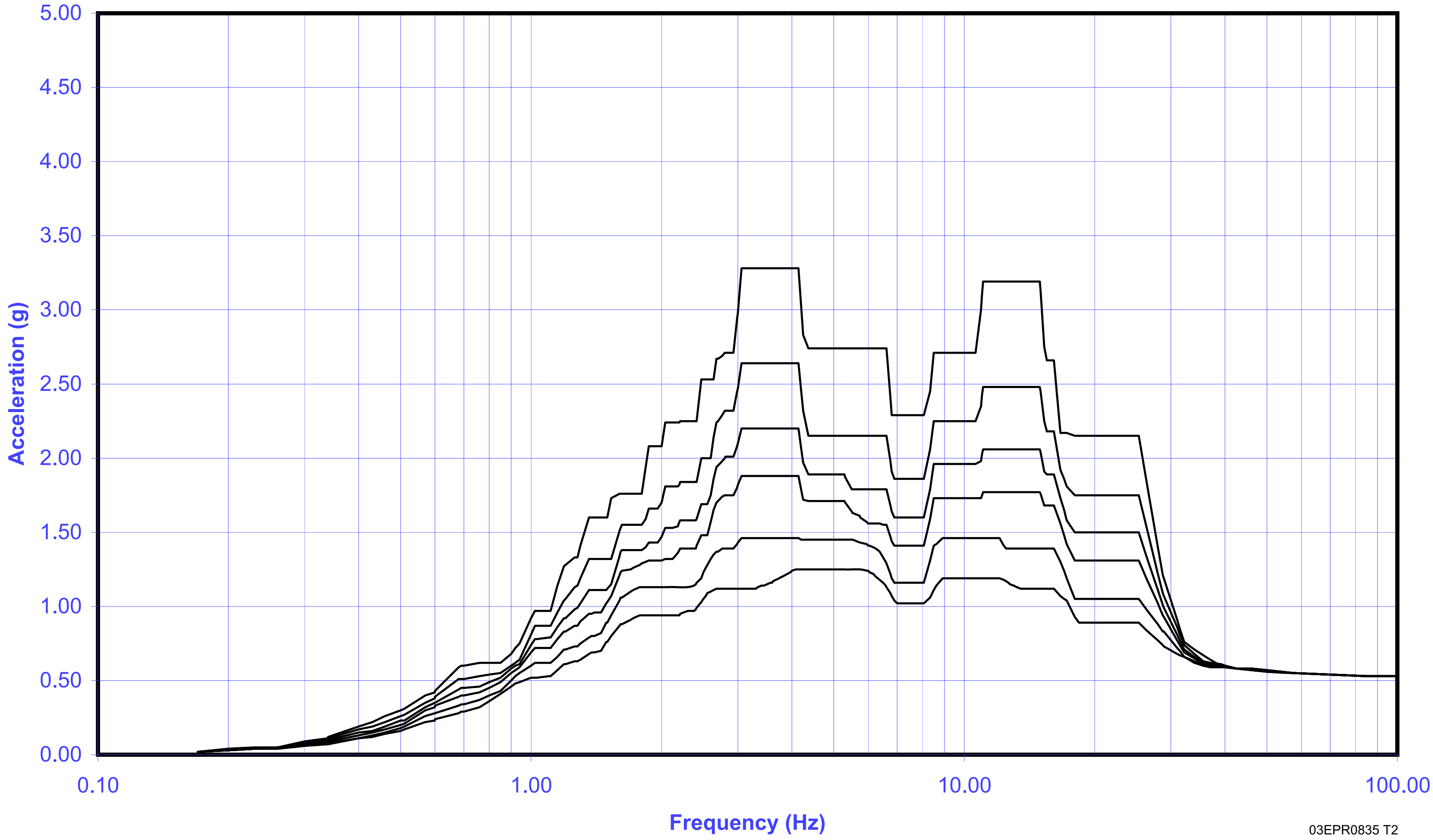
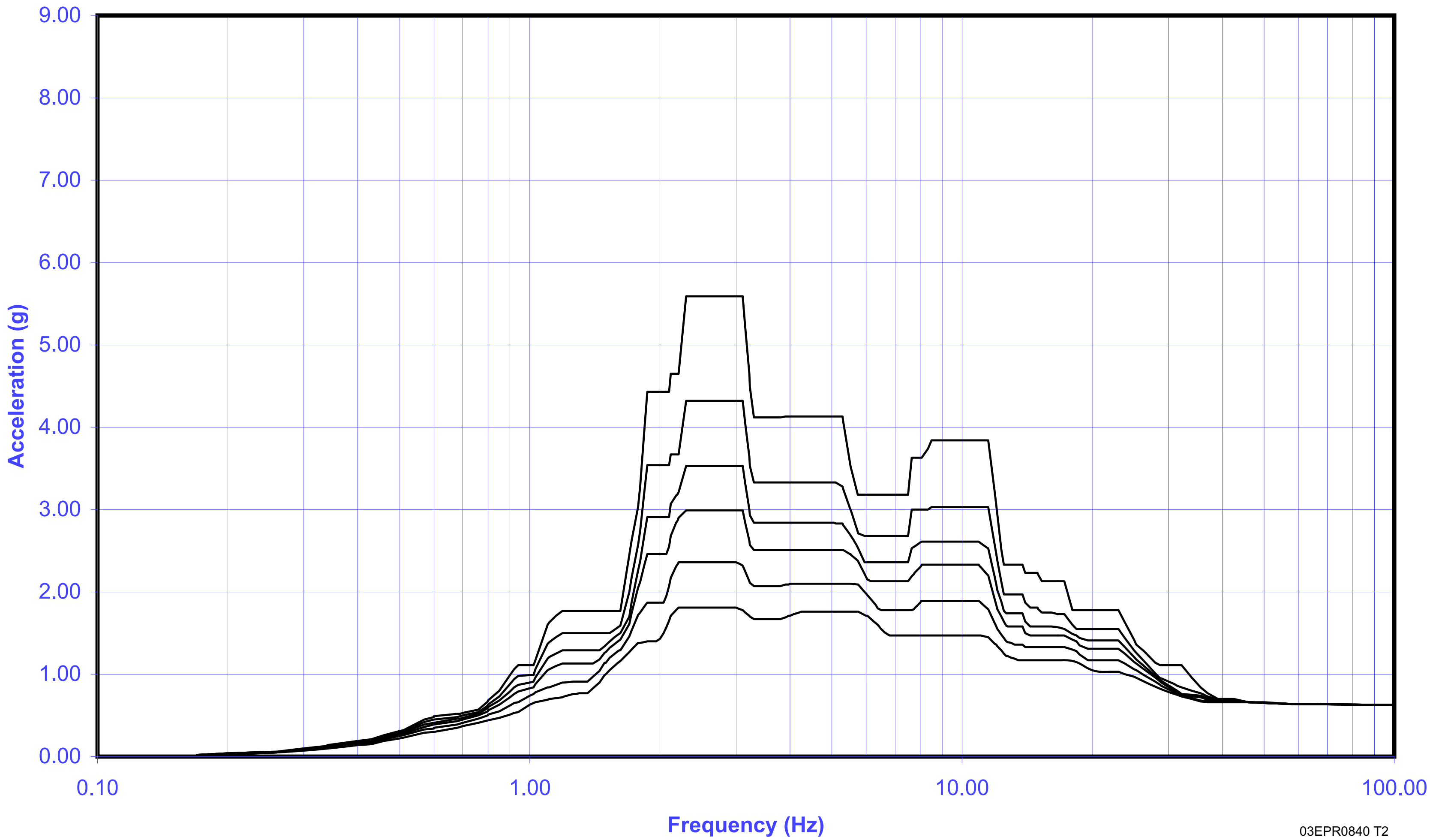


Figure 3.7.2-77—Spectrum Envelope of Reactor Building Internal Structure - Elev. +63 ft, 11-3/4 inches (+19.50m) 2%, 3%, 4%, 5%, 7% and 10% Damping X-Direction



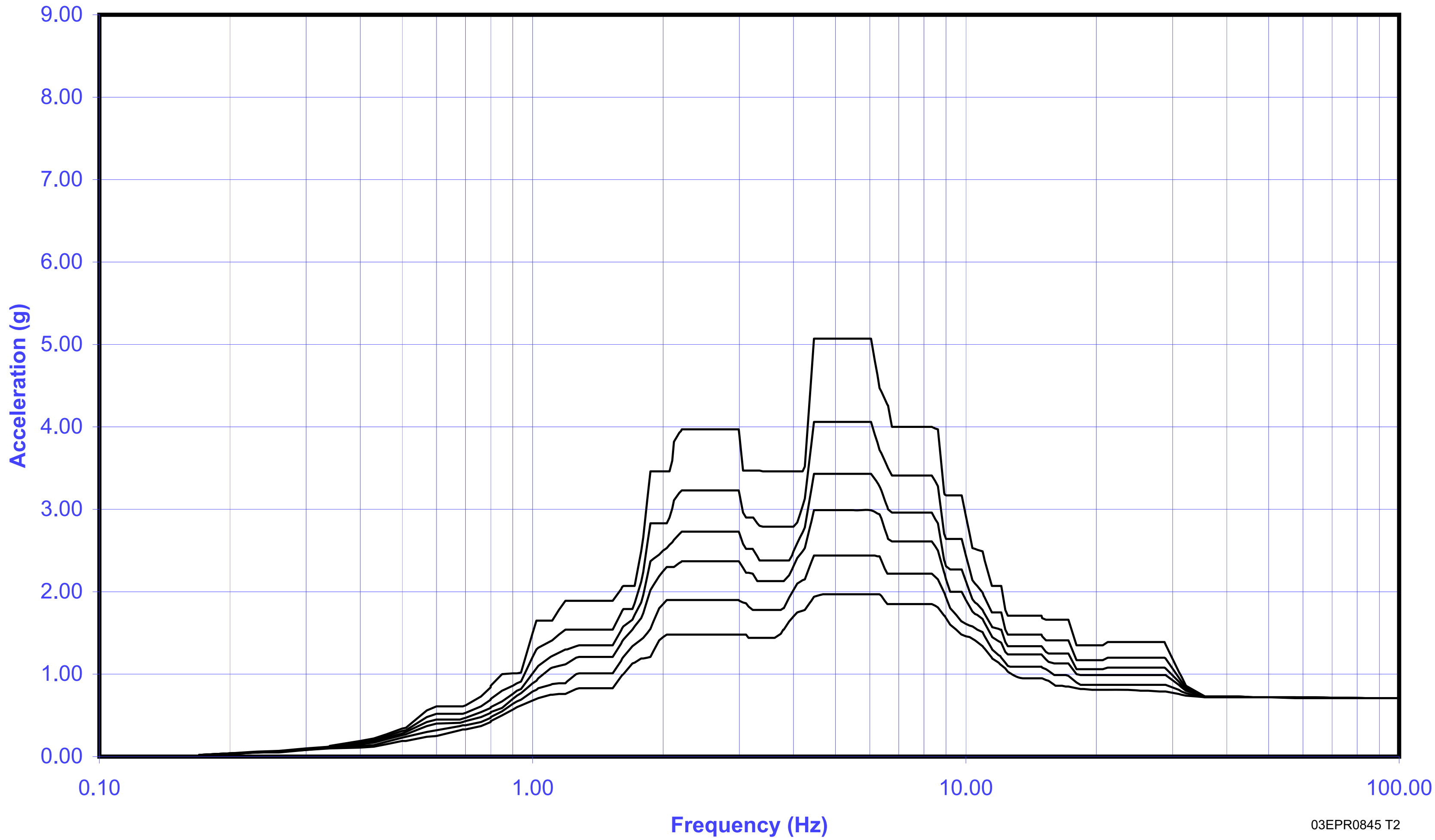


Figure 3.7.2-78—Spectrum Envelope of Reactor Building Internal Structure - Elev. +63 ft, 11-3/4 inches (+19.50m) 2%, 3%, 4%, 5%, 7% and 10% Damping Y-Direction

Figure 3.7.2-79—Spectrum Envelope of Reactor Building Internal Structure - Elev. +63 ft, 11-3/4 inches (+19.50m) 2%, 3%, 4%, 5%, 7% and 10% Damping Z-Direction

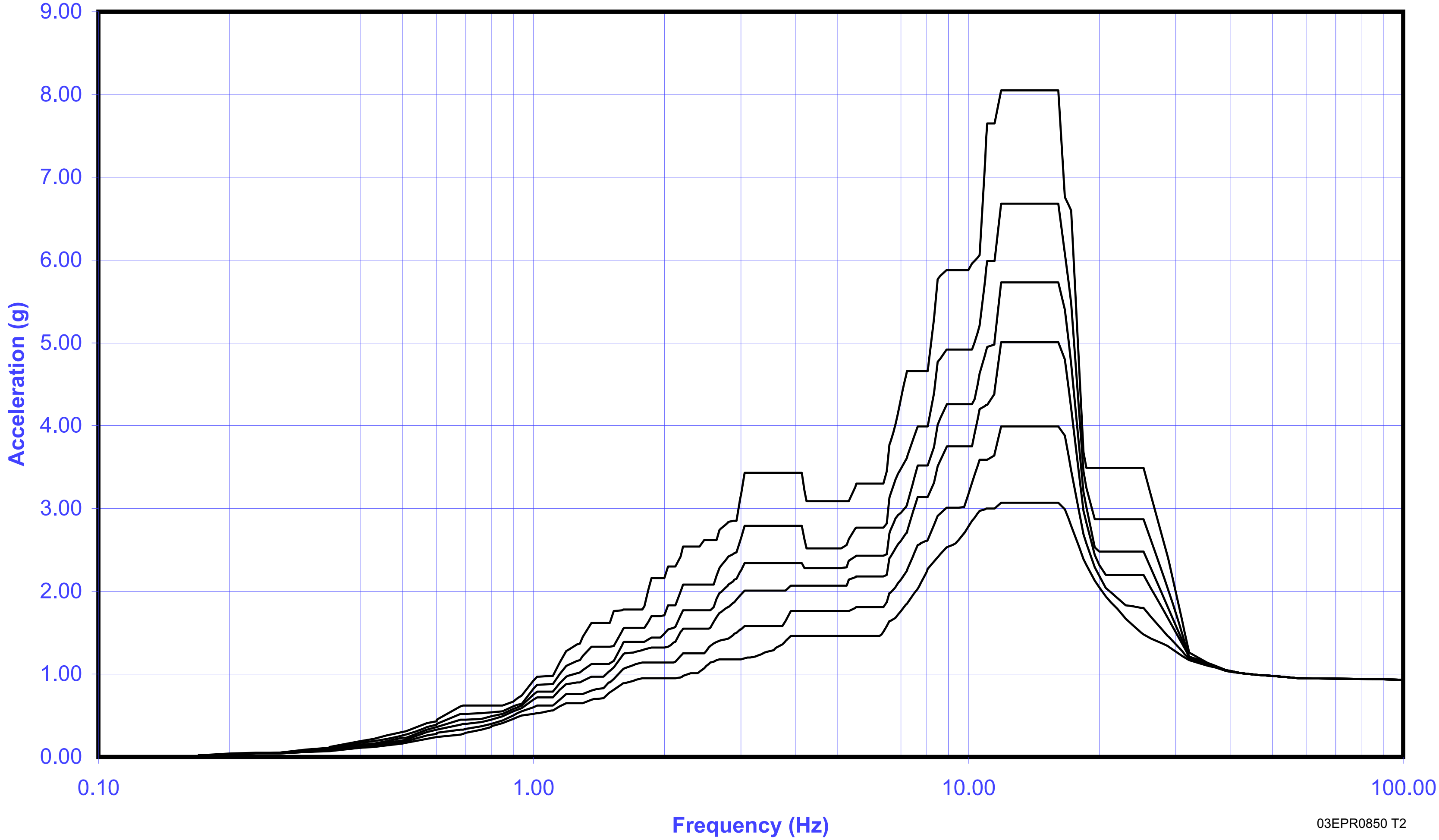


Figure 3.7.2-80—Spectrum Envelope of Safeguard Building 1 - Elev. +26 ft, 3 inches (+8.10m) 2%, 3%, 4%, 5%, 7% and 10% Damping X-Direction

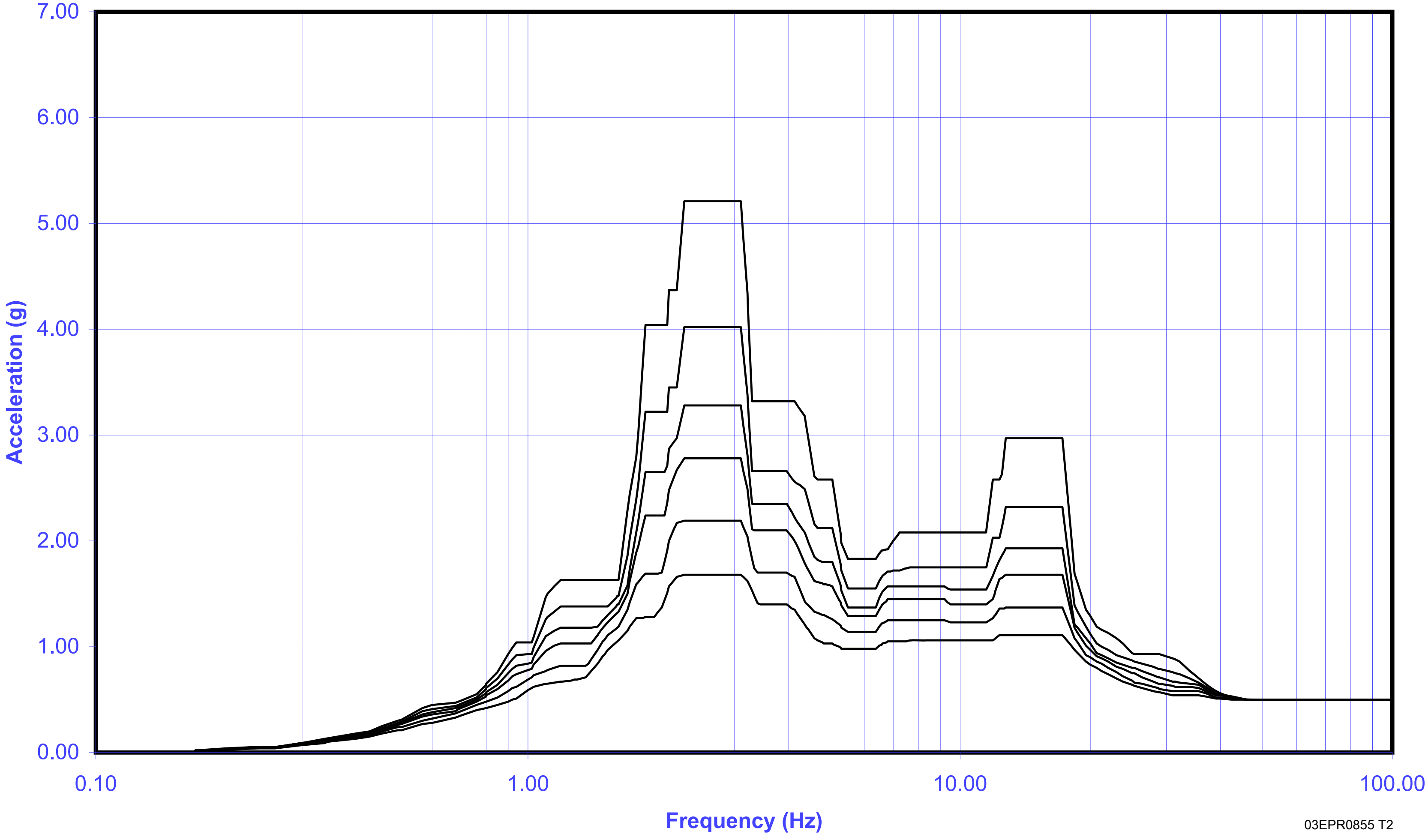


Figure 3.7.2-81—Spectrum Envelope of Safeguard Building 1 - Elev. +26 ft, 3 inches (+8.10m) 2%, 3%, 4%, 5%, 7% and 10% Damping Y-Direction

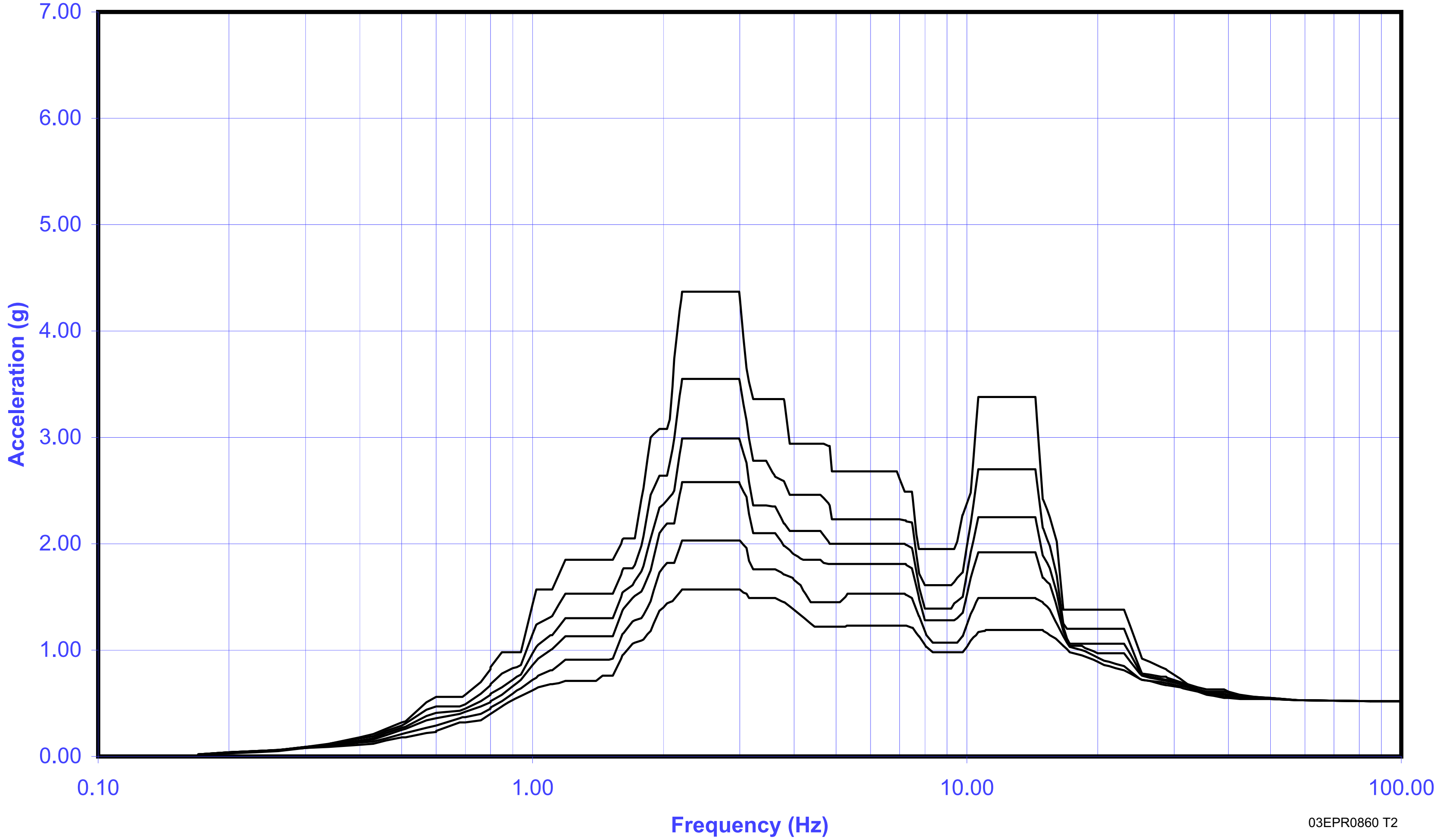


Figure 3.7.2-82—Spectrum Envelope of Safeguard Building 1 - Elev. +26 ft, 3 inches (+8.10m) 2%, 3%, 4%, 5%, 7% and 10% Damping Z-Direction

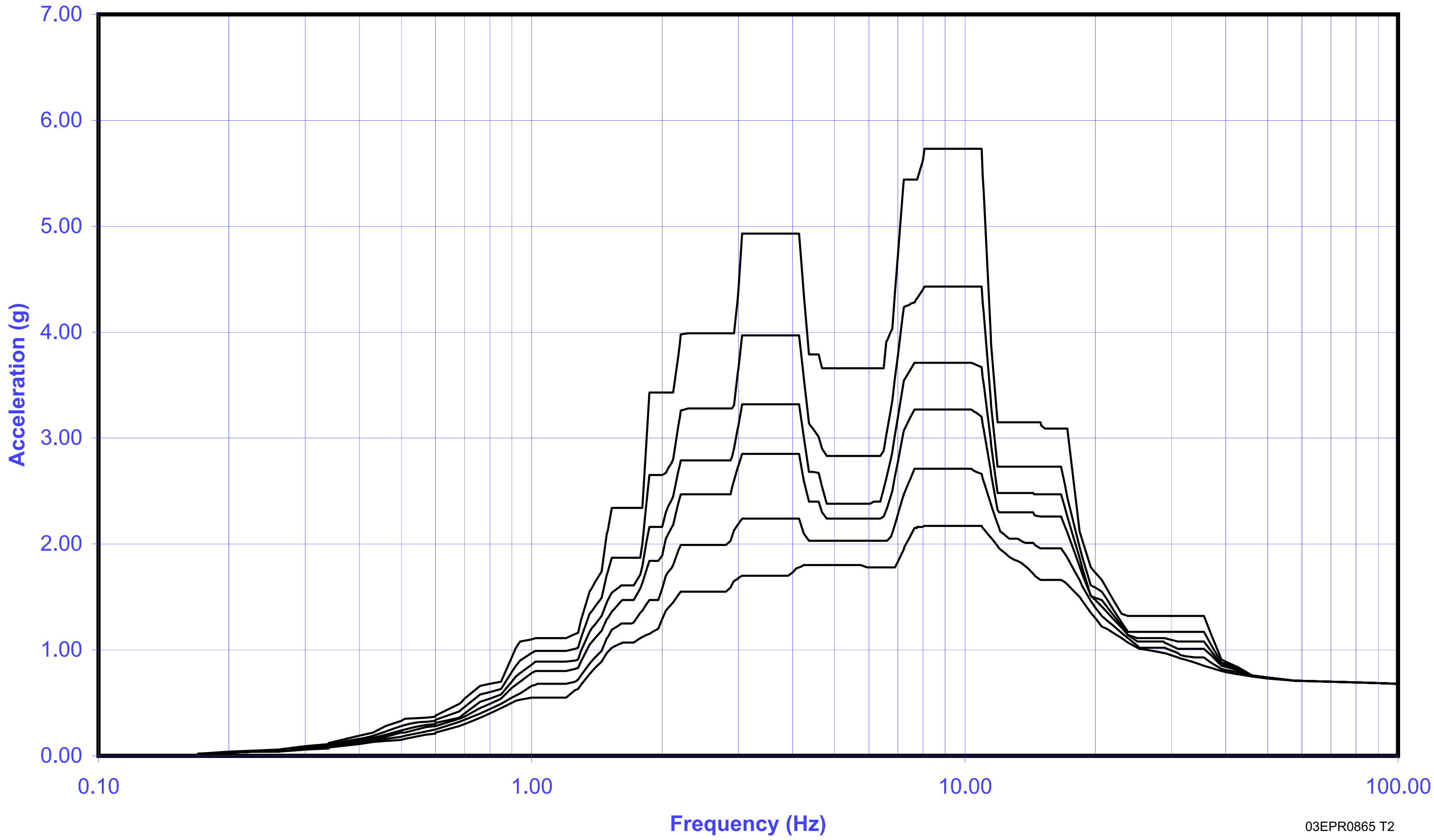


Figure 3.7.2-83—Spectrum Envelope of Safeguard Building 1 - Elev. +68 ft, 10-3/4 inches (+21.00m) 2%, 3%, 4%, 5%, 7% and 10% Damping X-Direction

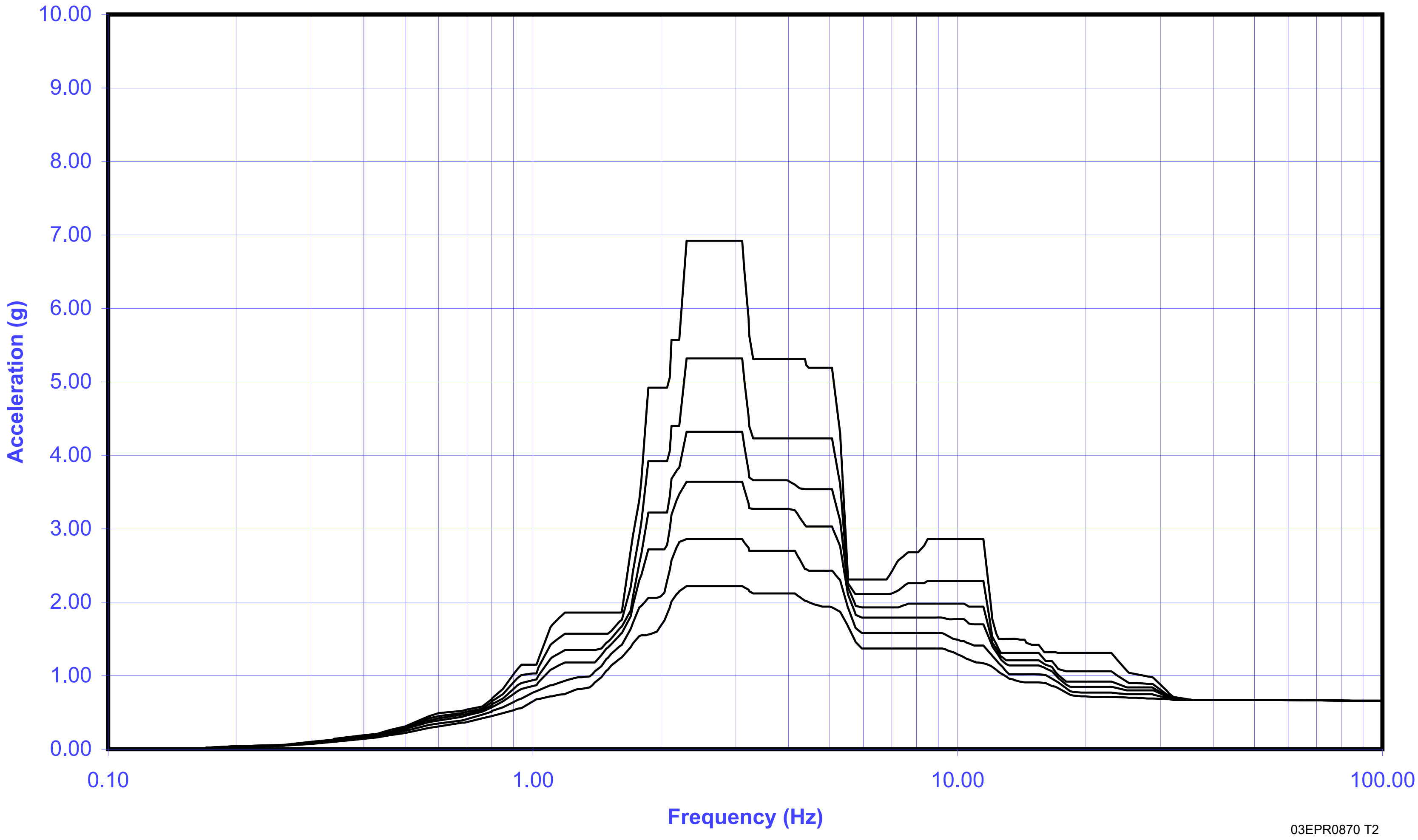


Figure 3.7.2-84—Spectrum Envelope of Safeguard Building 1 - Elev. +68 ft, 10-3/4 inches (+21.00m) 2%, 3%, 4%, 5%, 7% and 10% Damping Y-Direction

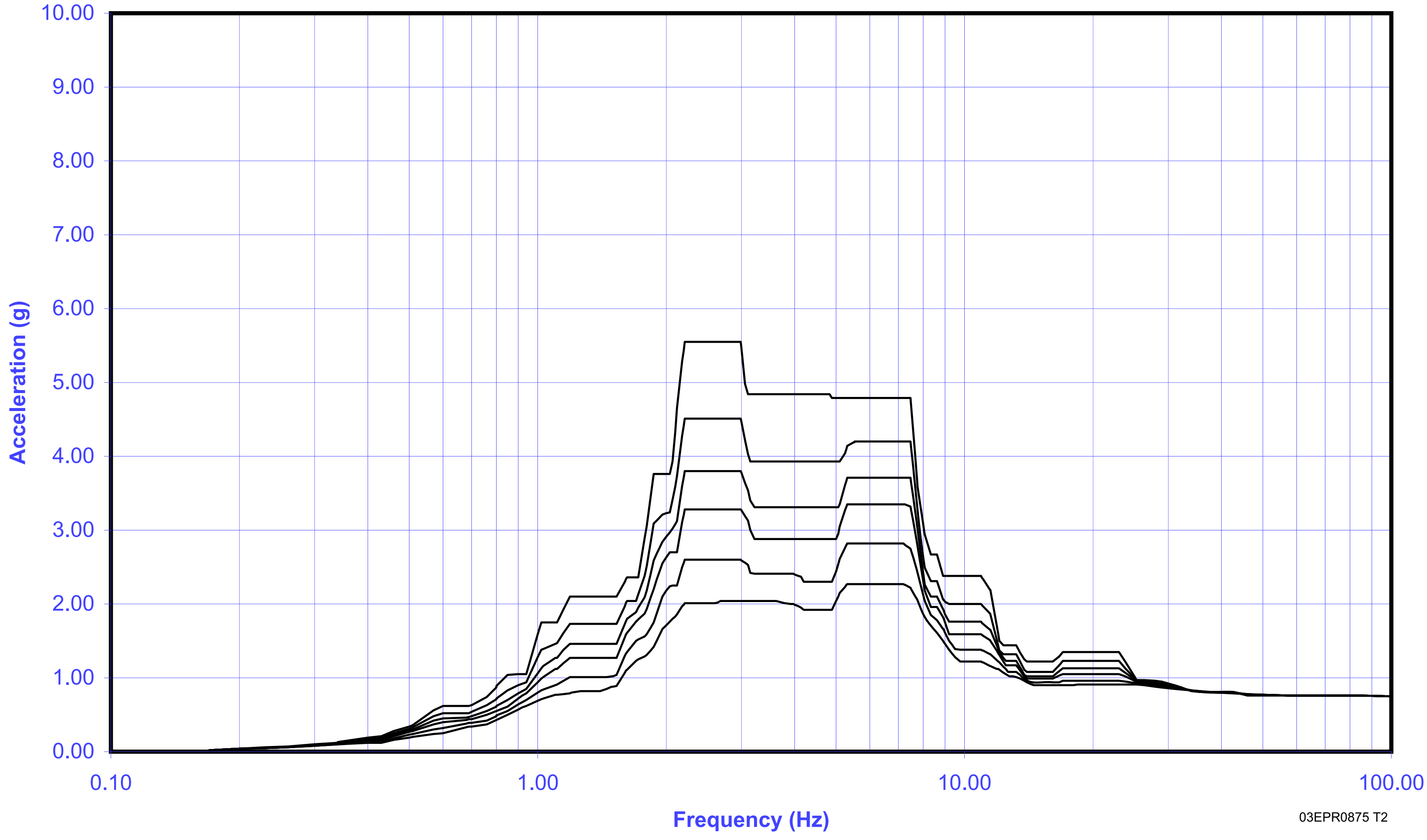


Figure 3.7.2-85—Spectrum Envelope of Safeguard Building 1 - Elev. +68 ft, 10-3/4 inches (+21.00m) 2%, 3%, 4%, 5%, 7% and 10% Damping Z-Direction

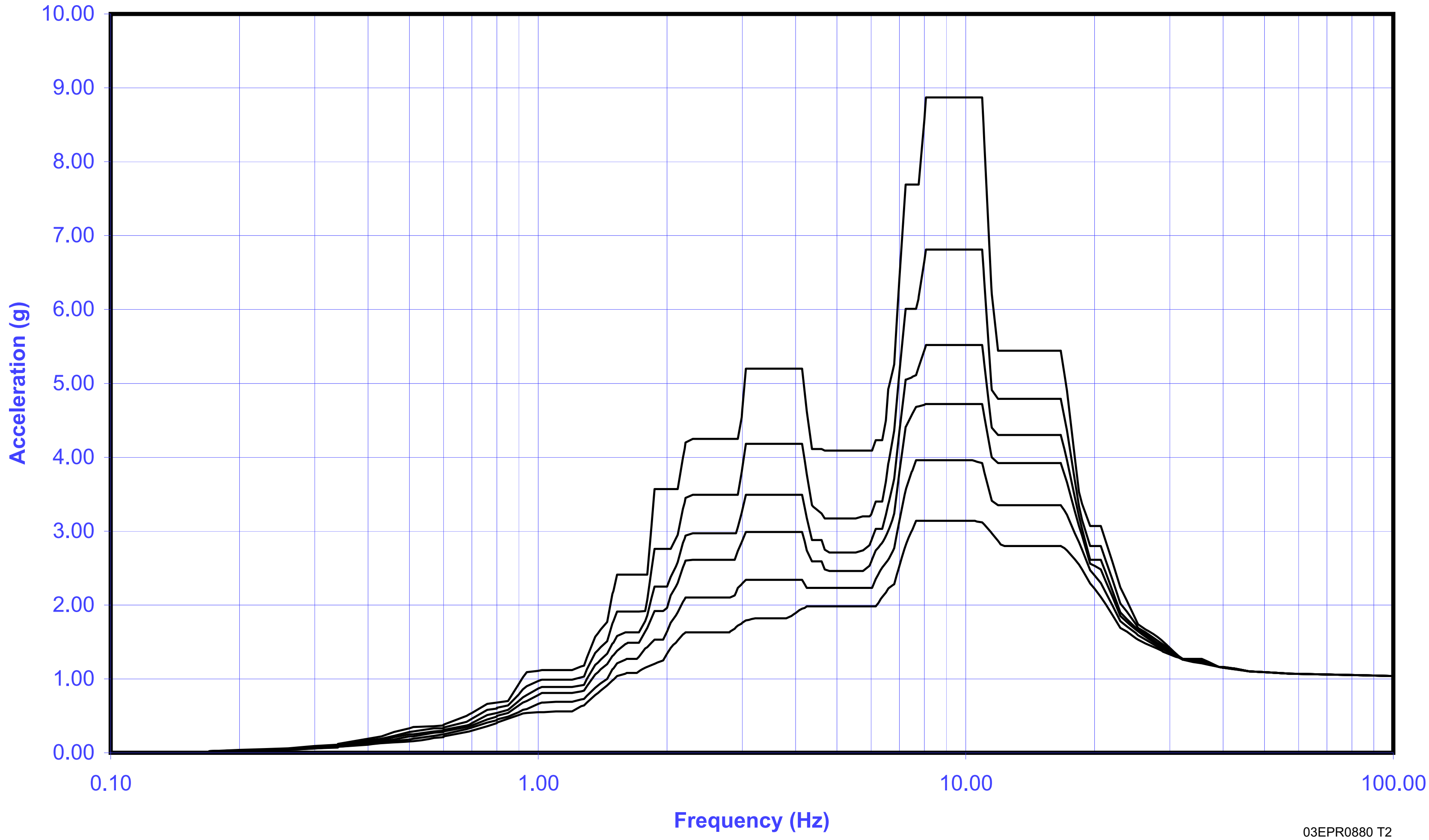


Figure 3.7.2-86—Spectrum Envelope of Safeguard Building 2&3 - Elev. +26 ft, 7 inches (+8.10m) 2%, 3%, 4%, 5%, 7% and 10% Damping X-Direction

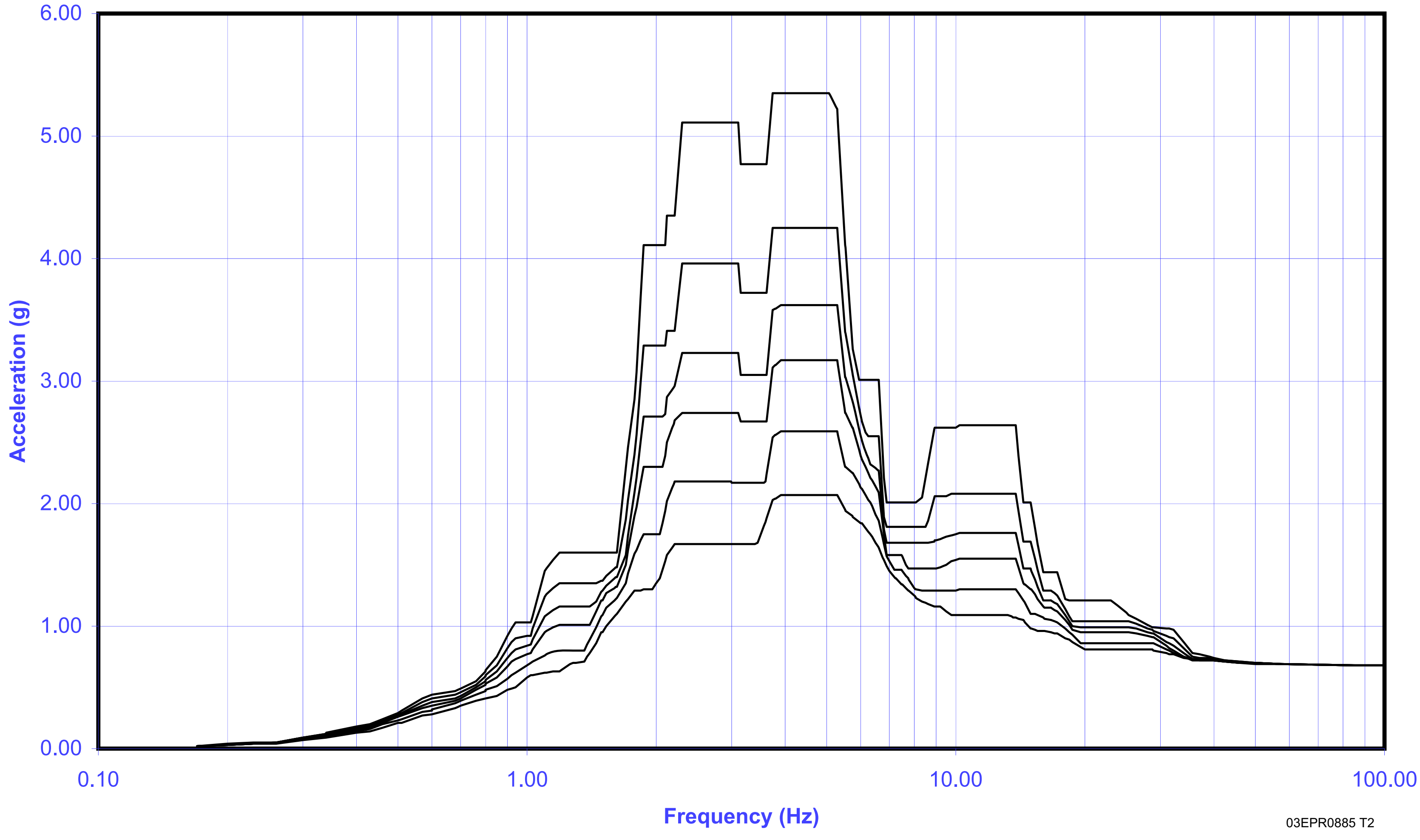


Figure 3.7.2-87—Spectrum Envelope of Safeguard Building 2&3 - Elev. +26 ft, 7 inches (+8.10m) 2%, 3%, 4%, 5%, 7% and 10% Damping Y-Direction

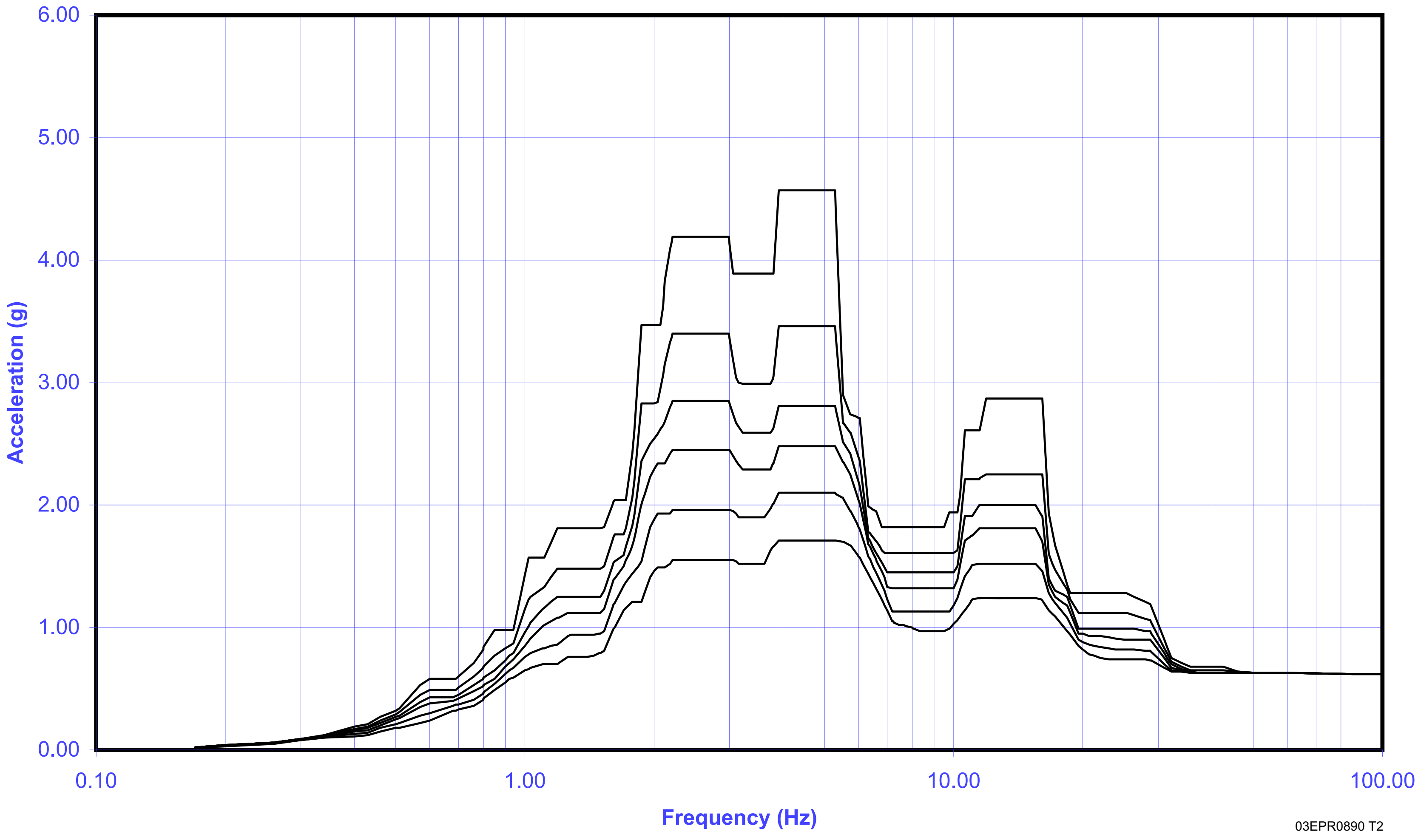


Figure 3.7.2-88—Spectrum Envelope of Safeguard Building 2&3 - Elev. +26 ft, 7 inches (+8.10m) 2%, 3%, 4%, 5%, 7% and 10% Damping Z-Direction

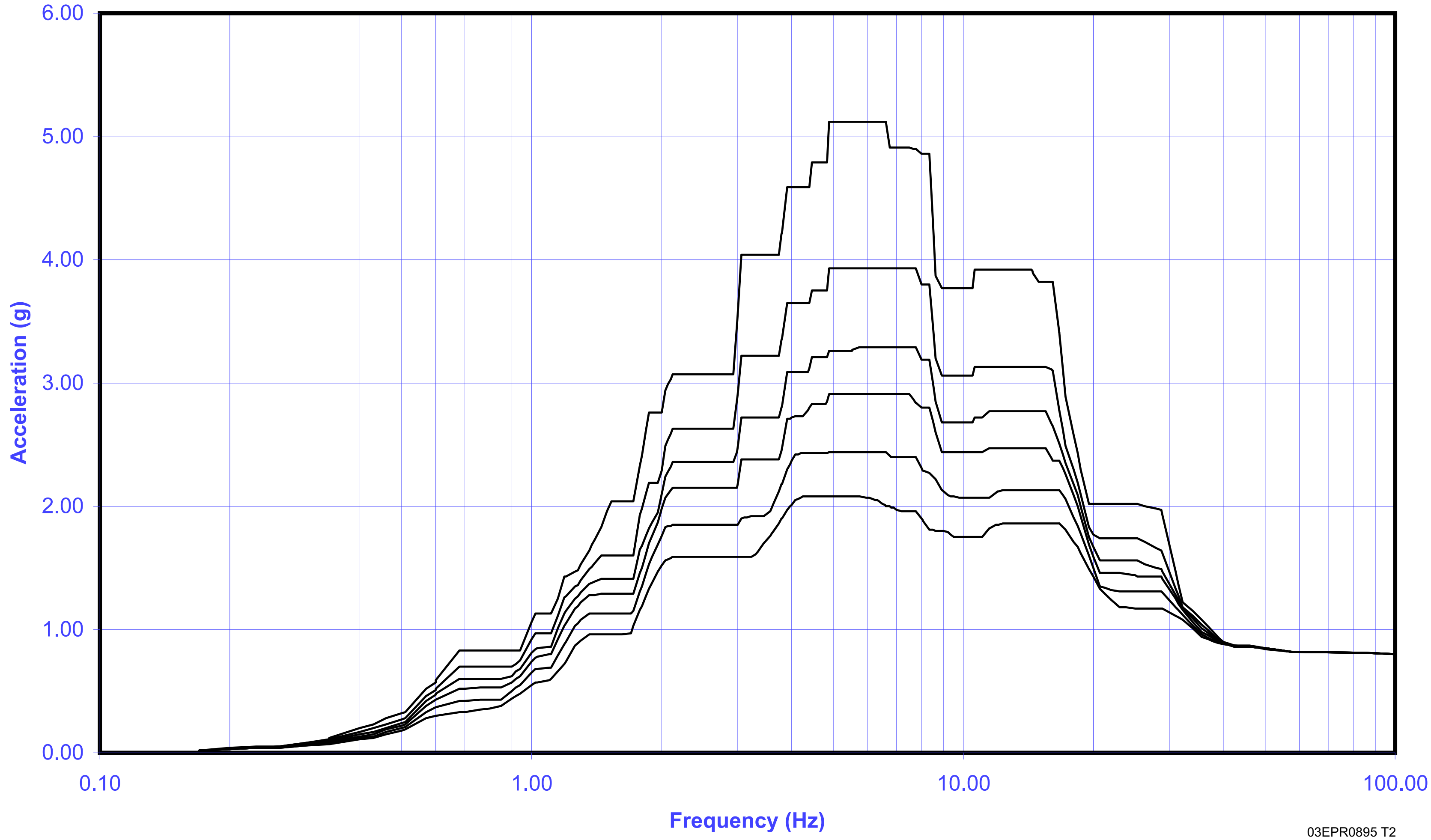


Figure 3.7.2-89—Spectrum Envelope of Safeguard Building 2&3 - Elev. +50 ft, 6-1/4 inches (+15.40m) 2%, 3%, 4%, 5%, 7% and 10% Damping X-Direction

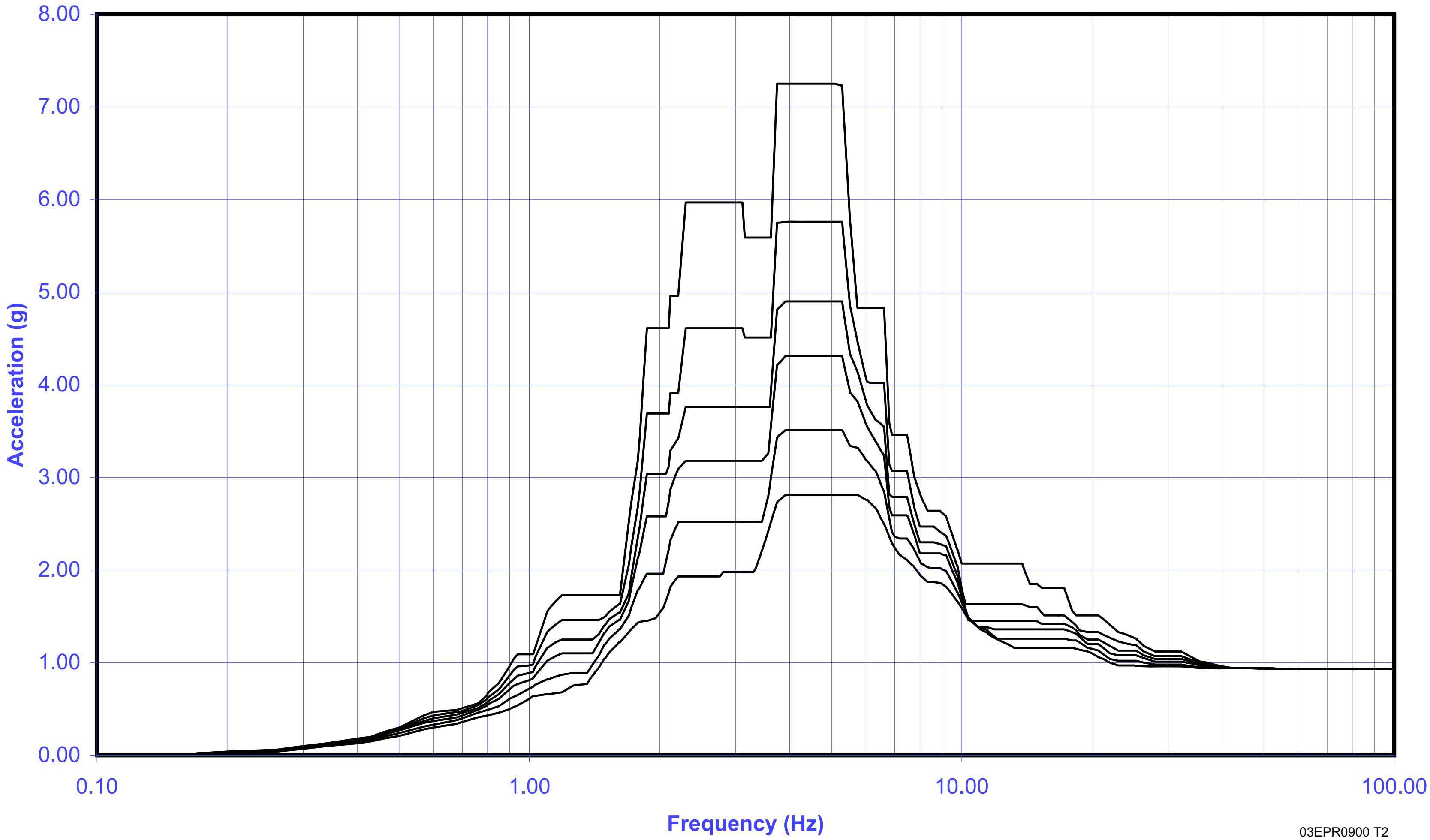


Figure 3.7.2-90—Spectrum Envelope of Safeguard Building 2&3 - Elev. +50 ft, 6-1/4 inches (+15.40m) 2%, 3%, 4%, 5%, 7% and 10% Damping Y-Direction

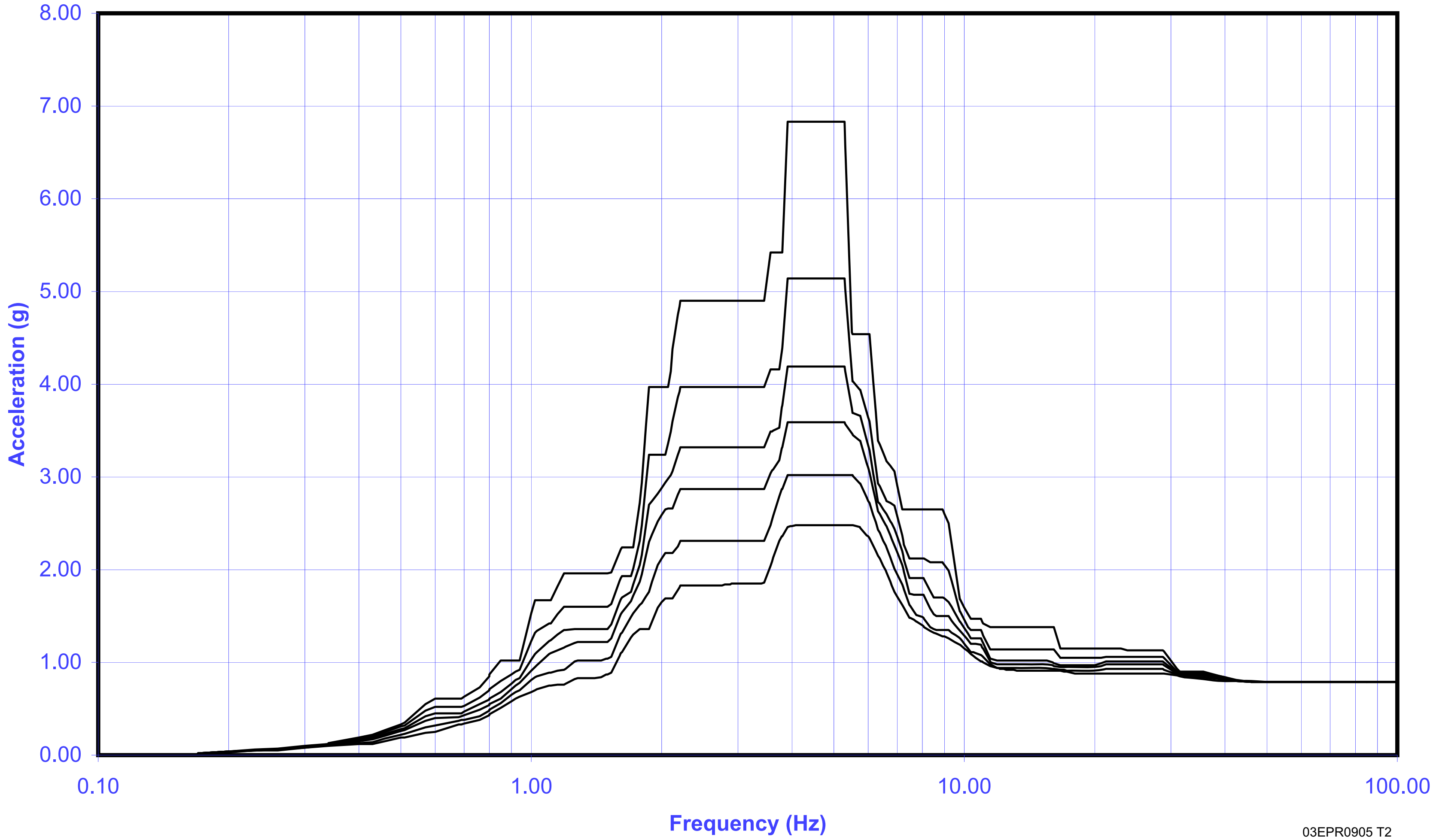


Figure 3.7.2-91—Spectrum Envelope of Safeguard Building 2&3 - Elev. +50 ft, 6-1/4 inches (+15.40m) 2%, 3%, 4%, 5%, 7% and 10% Damping Z-Direction

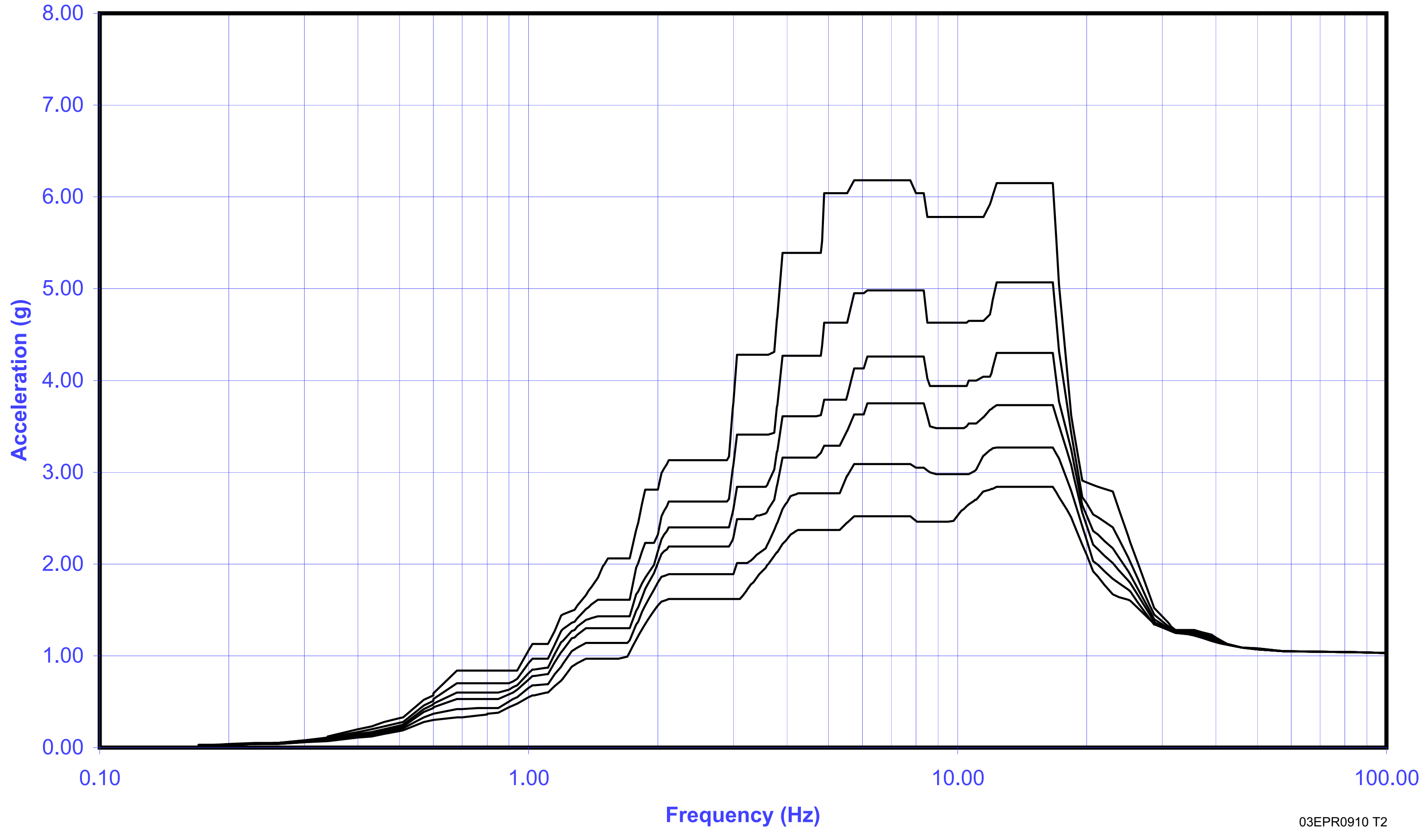


Figure 3.7.2-92—Spectrum Envelope of Safeguard Building 4 - Elev. +68 ft, 10-3/4 inches (+21.00m) 2%, 3%, 4%, 5%, 7% and 10% Damping X-Direction

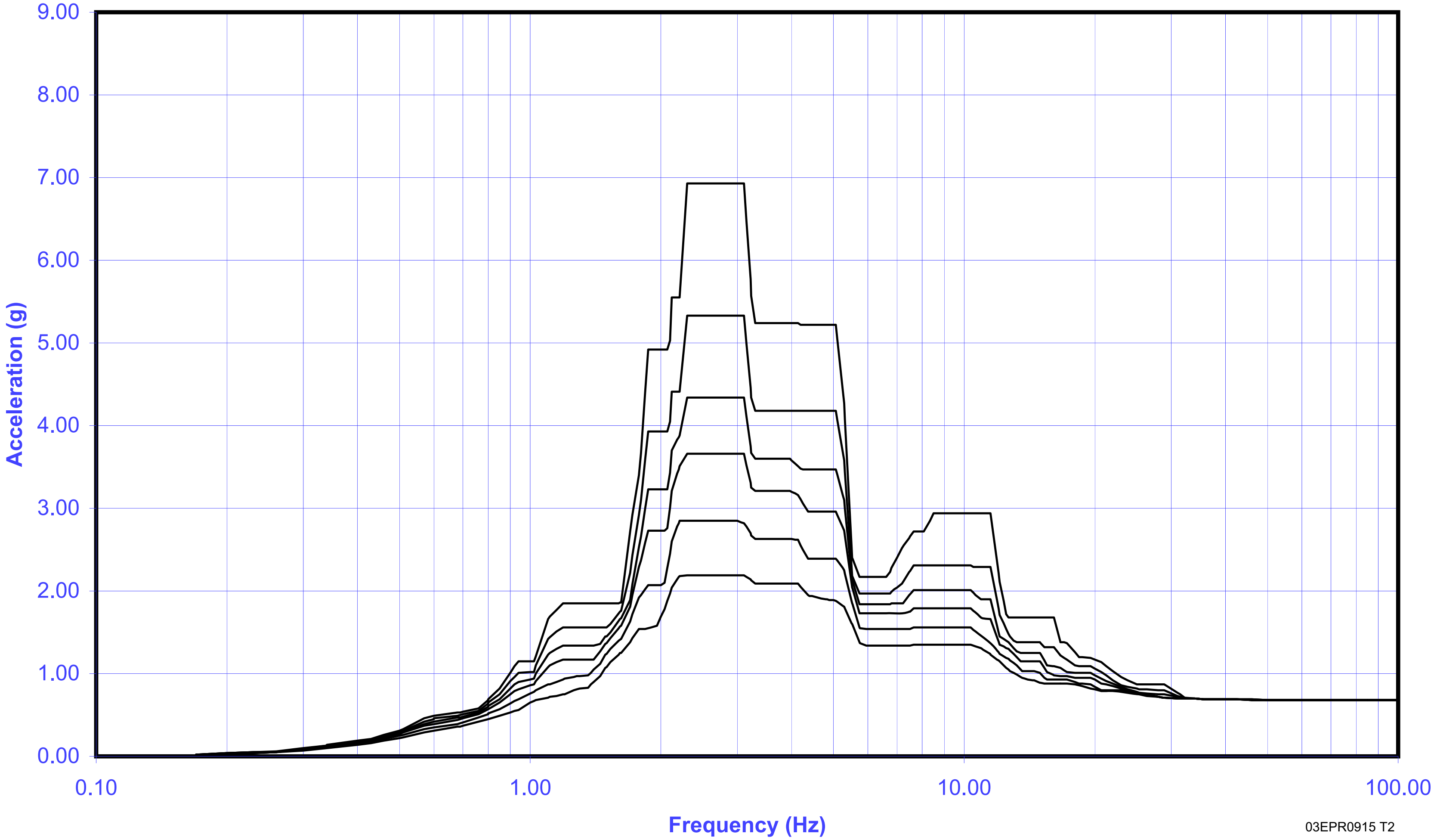


Figure 3.7.2-93—Spectrum Envelope of Safeguard Building 4 - Elev. +68 ft, 10-3/4 inches (+21.00m) 2%, 3%, 4%, 5%, 7% and 10% Damping Y-Direction

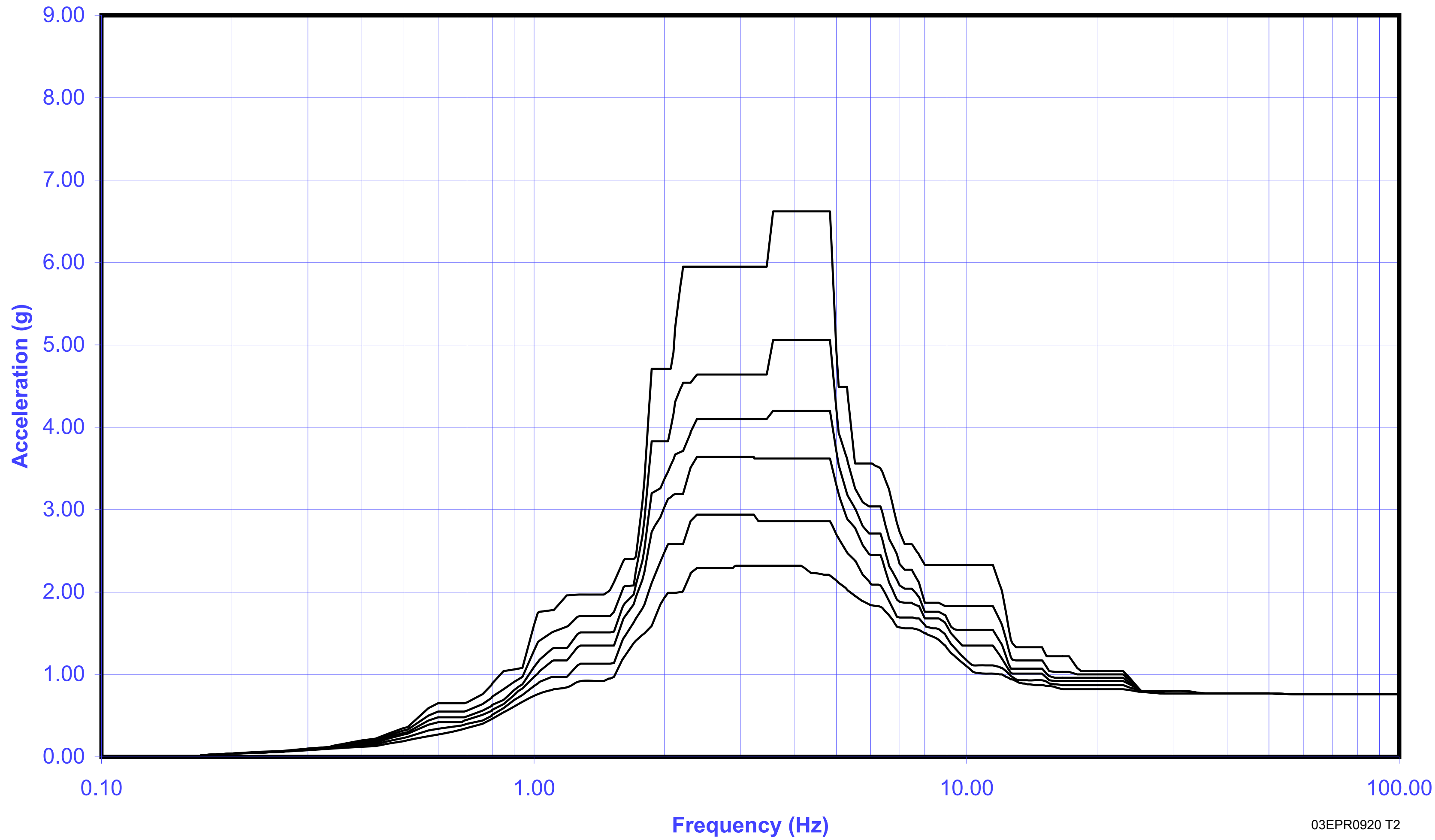


Figure 3.7.2-94—Spectrum Envelope of Safeguard Building 4 - Elev. +68 ft, 10-3/4 inches (+21.00m) 2%, 3%, 4%, 5%, 7% and 10% Damping Z-Direction

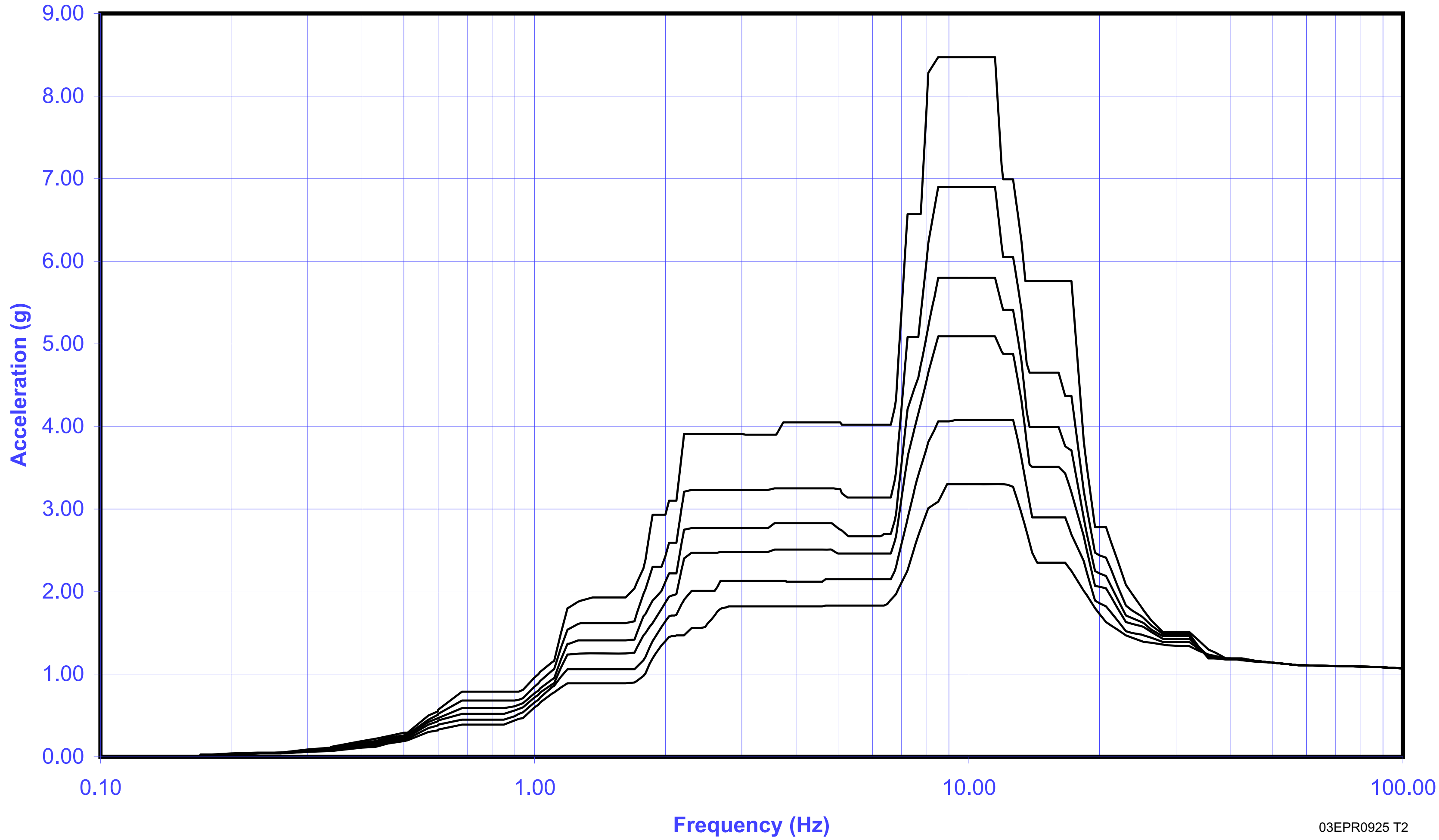


Figure 3.7.2-95—Spectrum Envelope of Containment Building - Elev. +123 ft, 4-1/4 inches (+37.60m) 2%, 3%, 4%, 5%, 7% and 10% Damping X-Direction

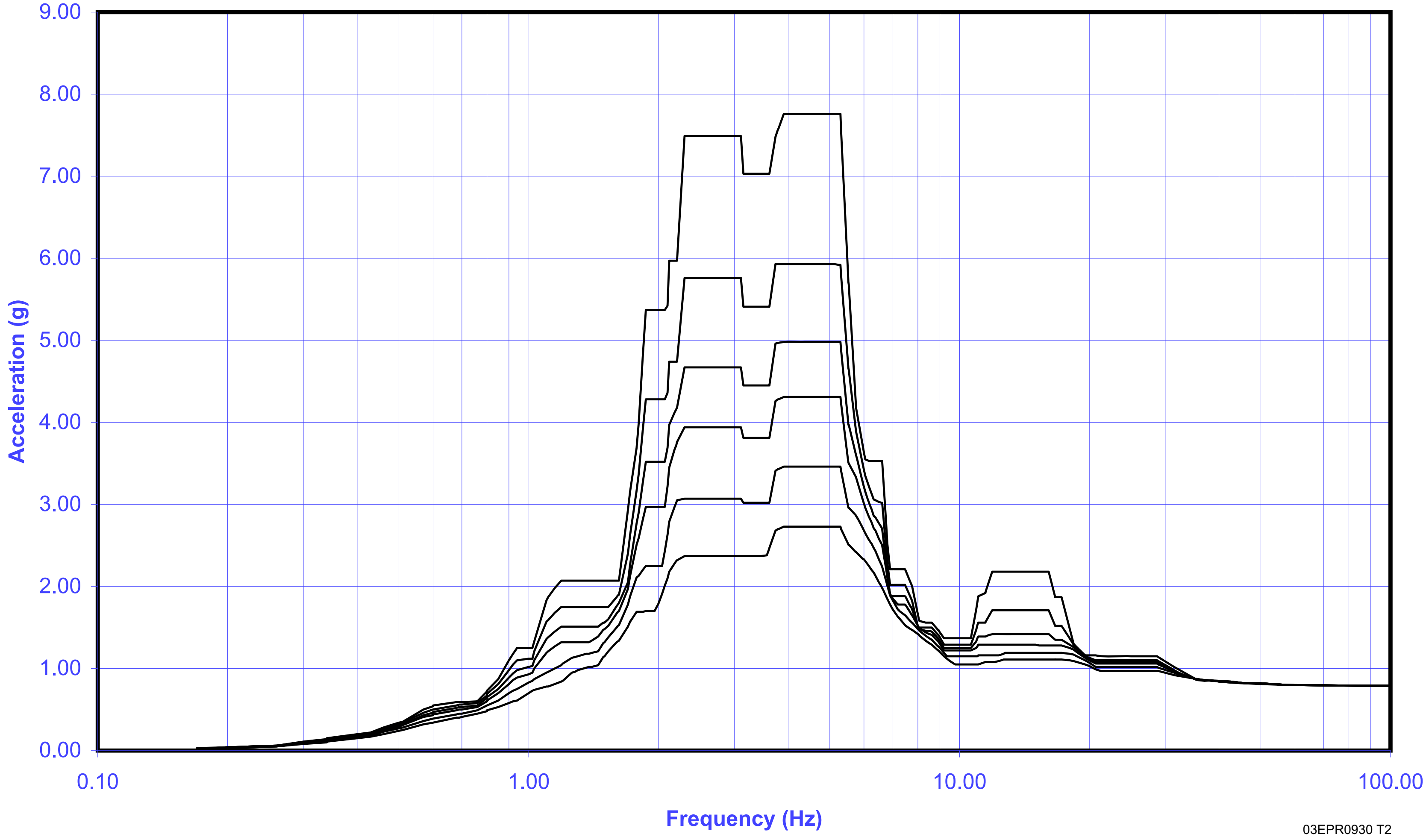


Figure 3.7.2-96—Spectrum Envelope of Containment Building - Elev. +123 ft, 4-1/4 inches (+37.60m) 2%, 3%, 4%, 5%, 7% and 10% Damping Y-Direction

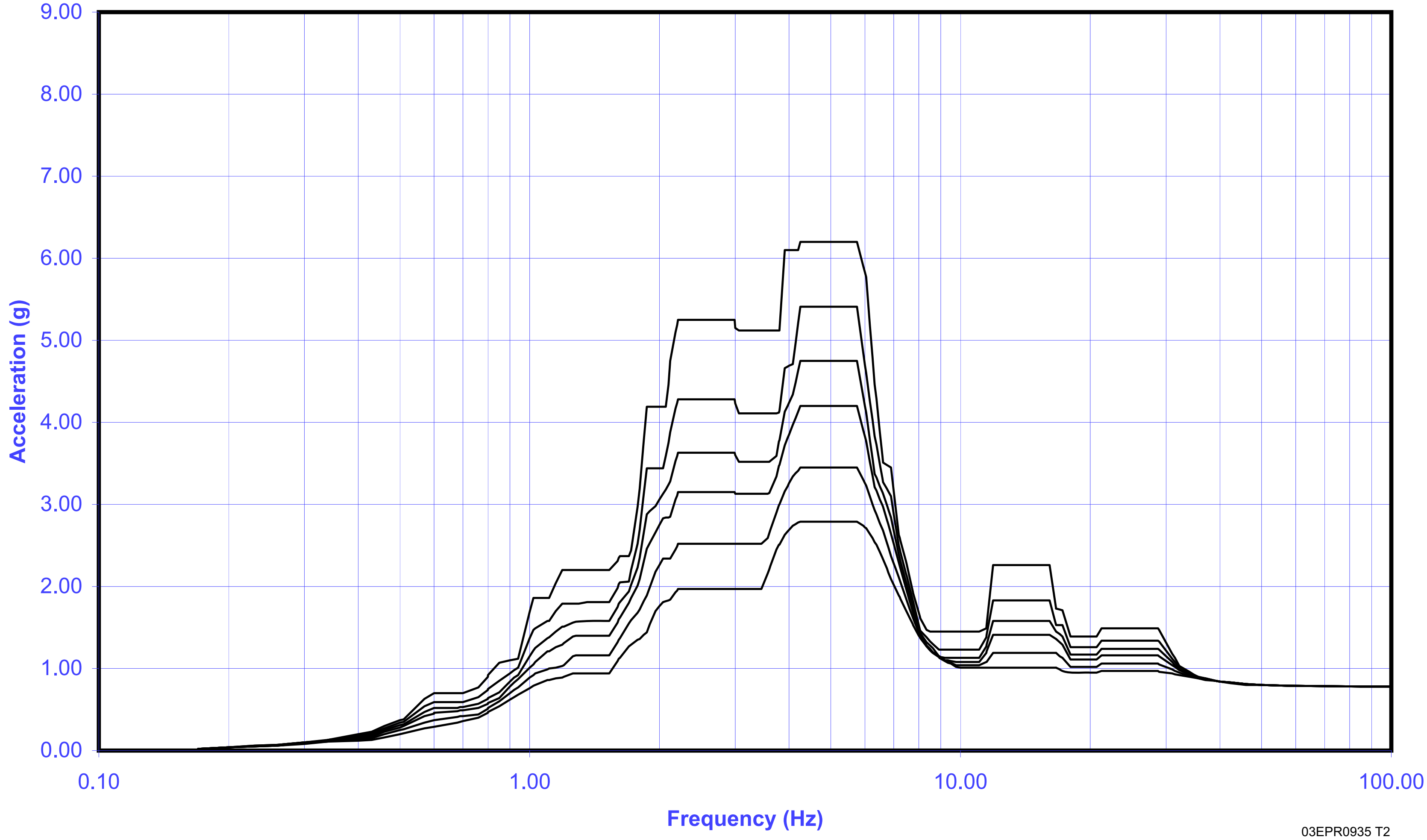


Figure 3.7.2-97—Spectrum Envelope of Containment Building - Elev. +123 ft, 4-1/4 inches (+37.60m) 2%, 3%, 4%, 5%, 7% and 10% Damping Z-Direction

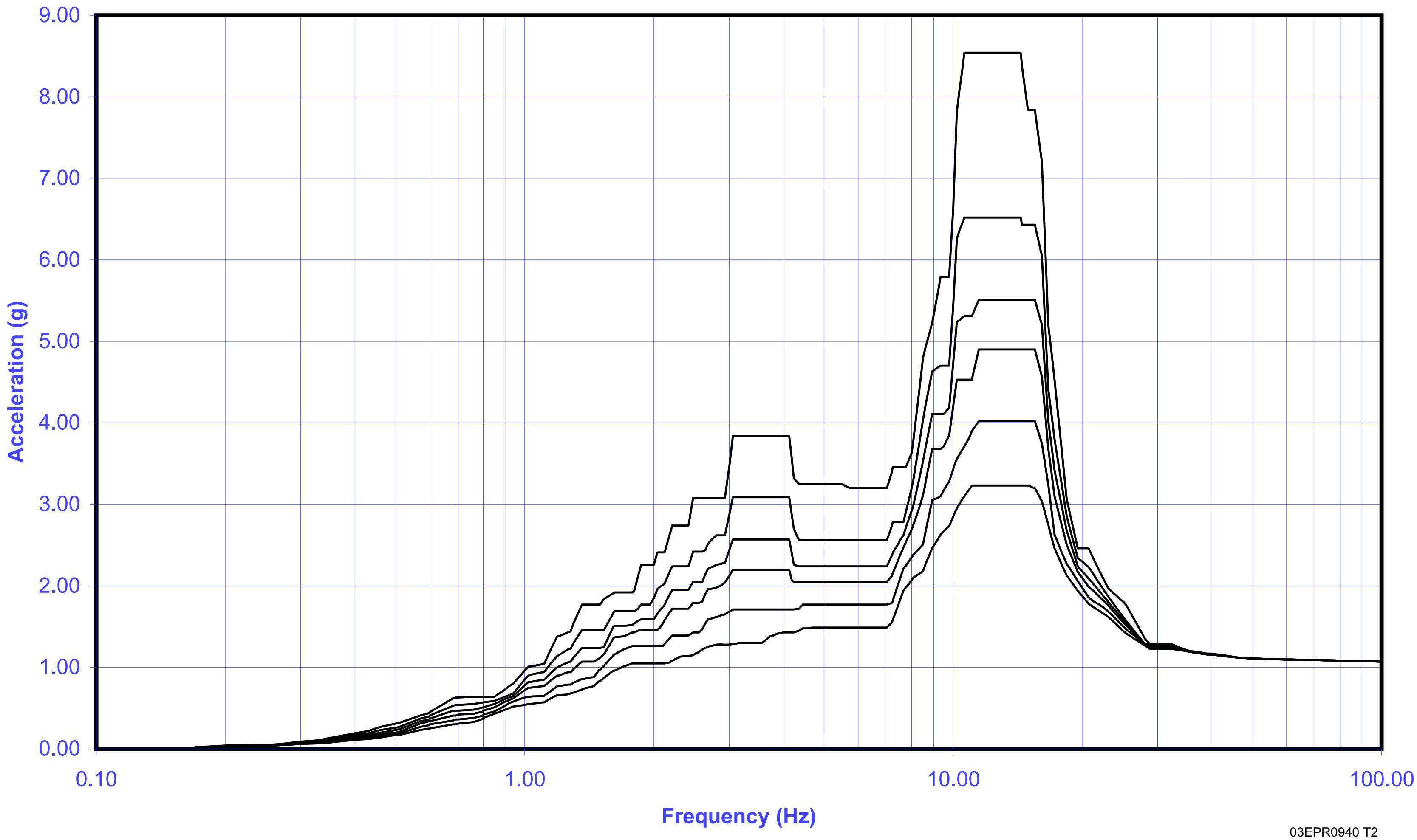


Figure 3.7.2-98—Spectrum Envelope of Containment Building - Elev. +190 ft, 3-1/2 inches (+58.00m) 2%, 3%, 4%, 5%, 7% and 10% Damping X-Direction

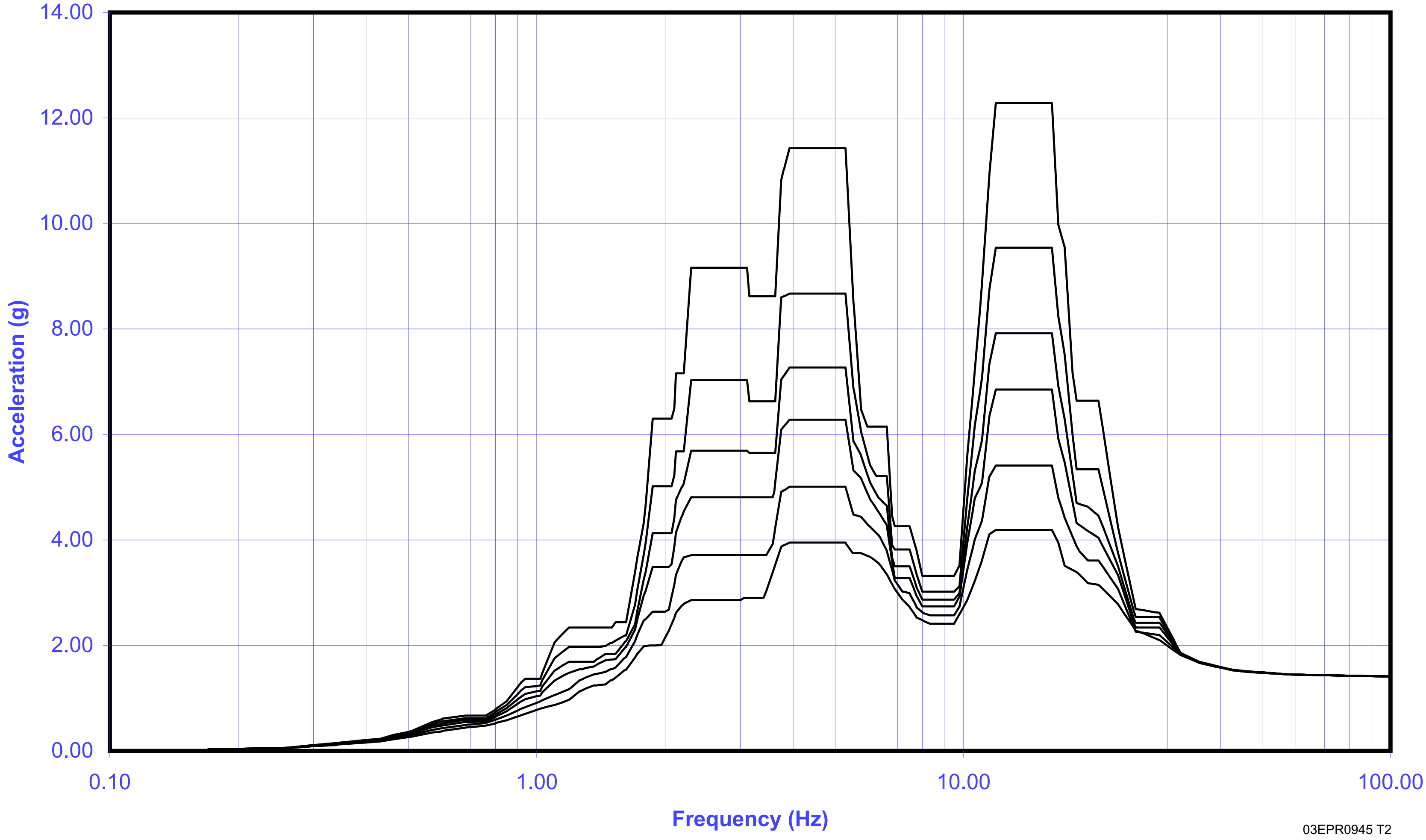


Figure 3.7.2-99—Spectrum Envelope of Containment Building - Elev. +190 ft, 3-1/2 inches (+58.00m) 2%, 3%, 4%, 5%, 7% and 10% Damping Y-Direction

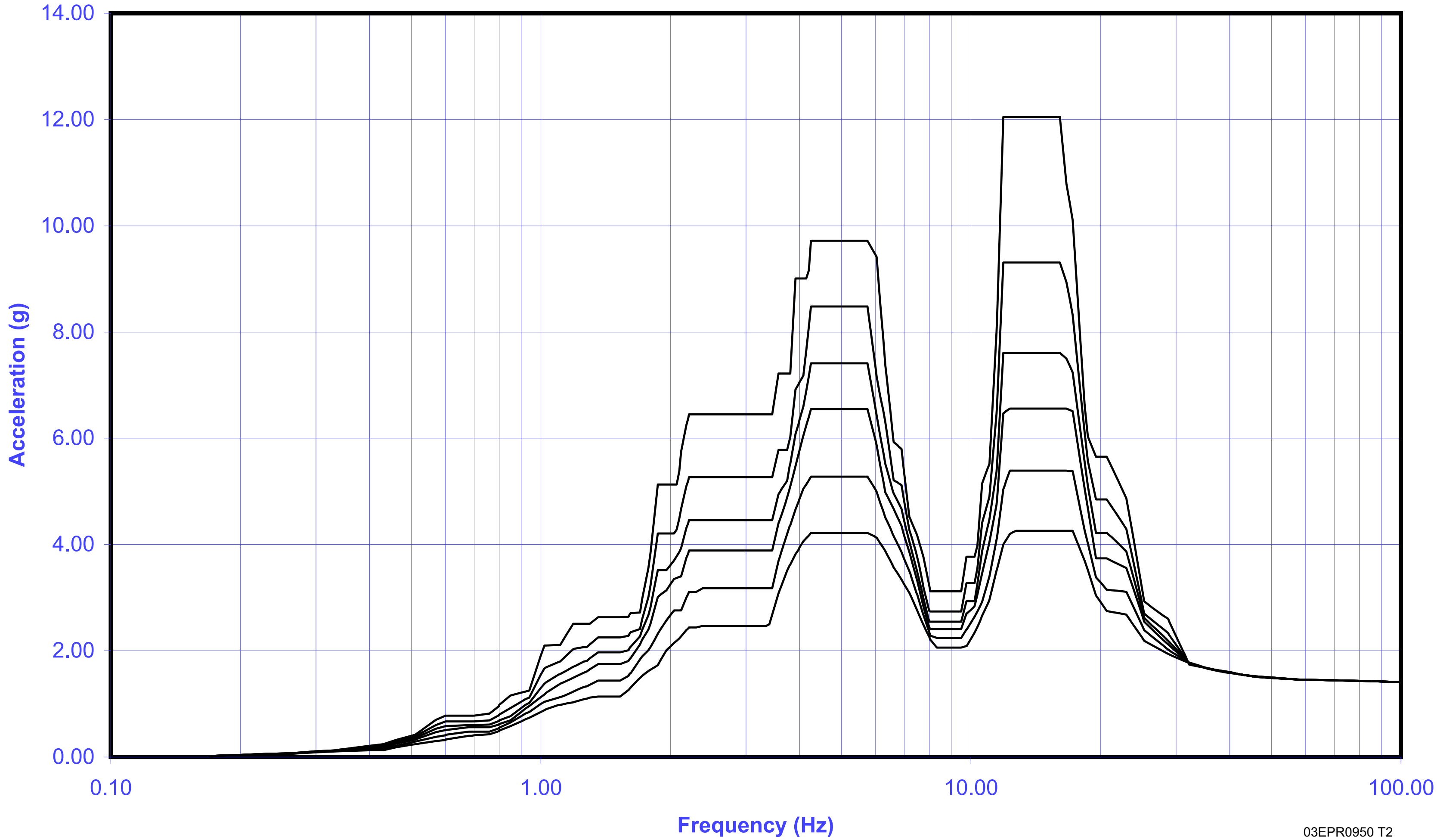


Figure 3.7.2-100—Spectrum Envelope of Containment Building - Elev. +190 ft, 3-1/2 inches (+58.00m) 2%, 3%, 4%, 5%, 7% and 10% Damping Z-Direction

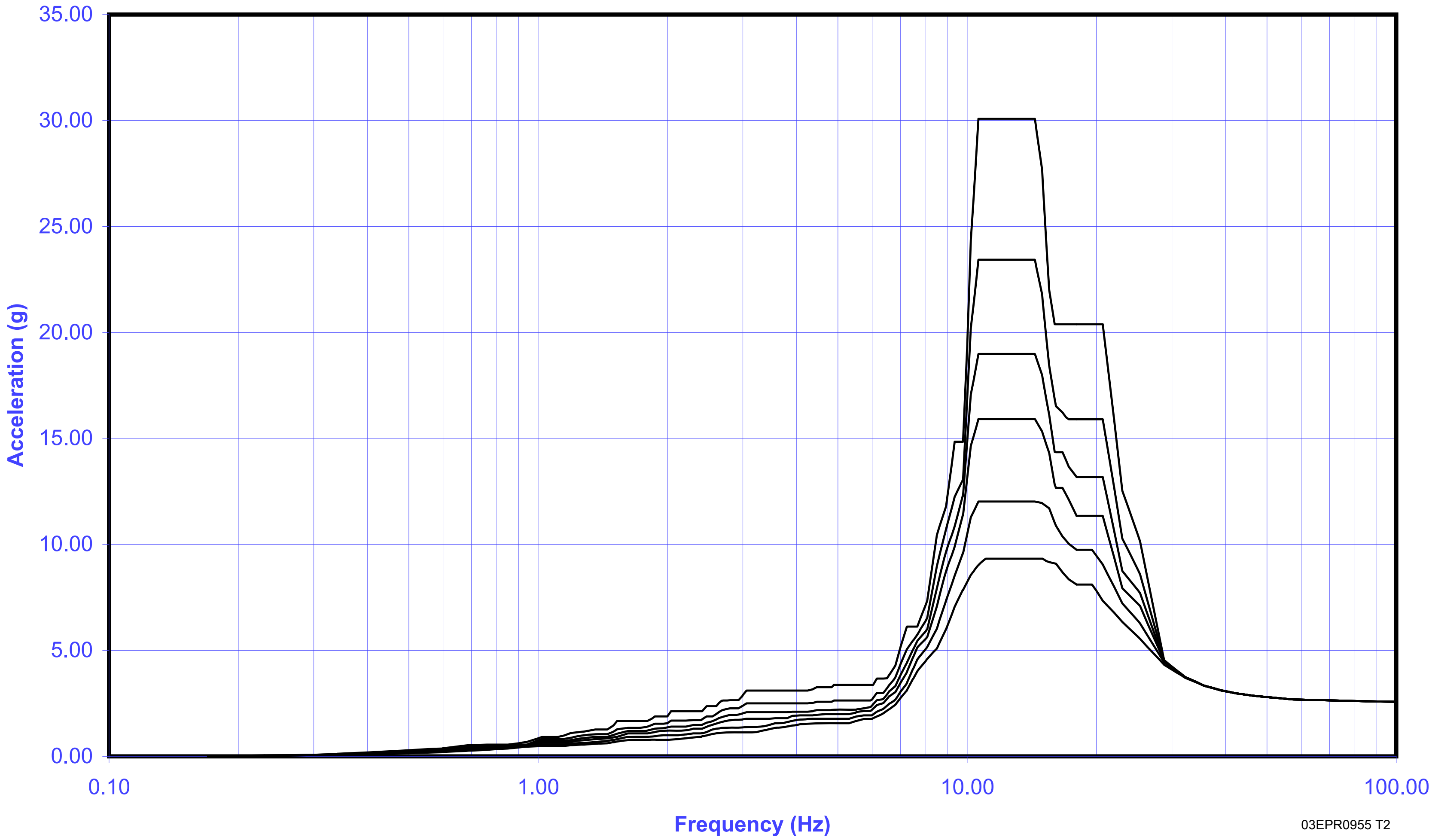


Figure 3.7.2-101—Spectrum Envelope of EPGB at Elev. +0 ft, 0 inches at Node 1172 2%, 3%, 4%, 5%, 7% and 10% Damping X-Direction

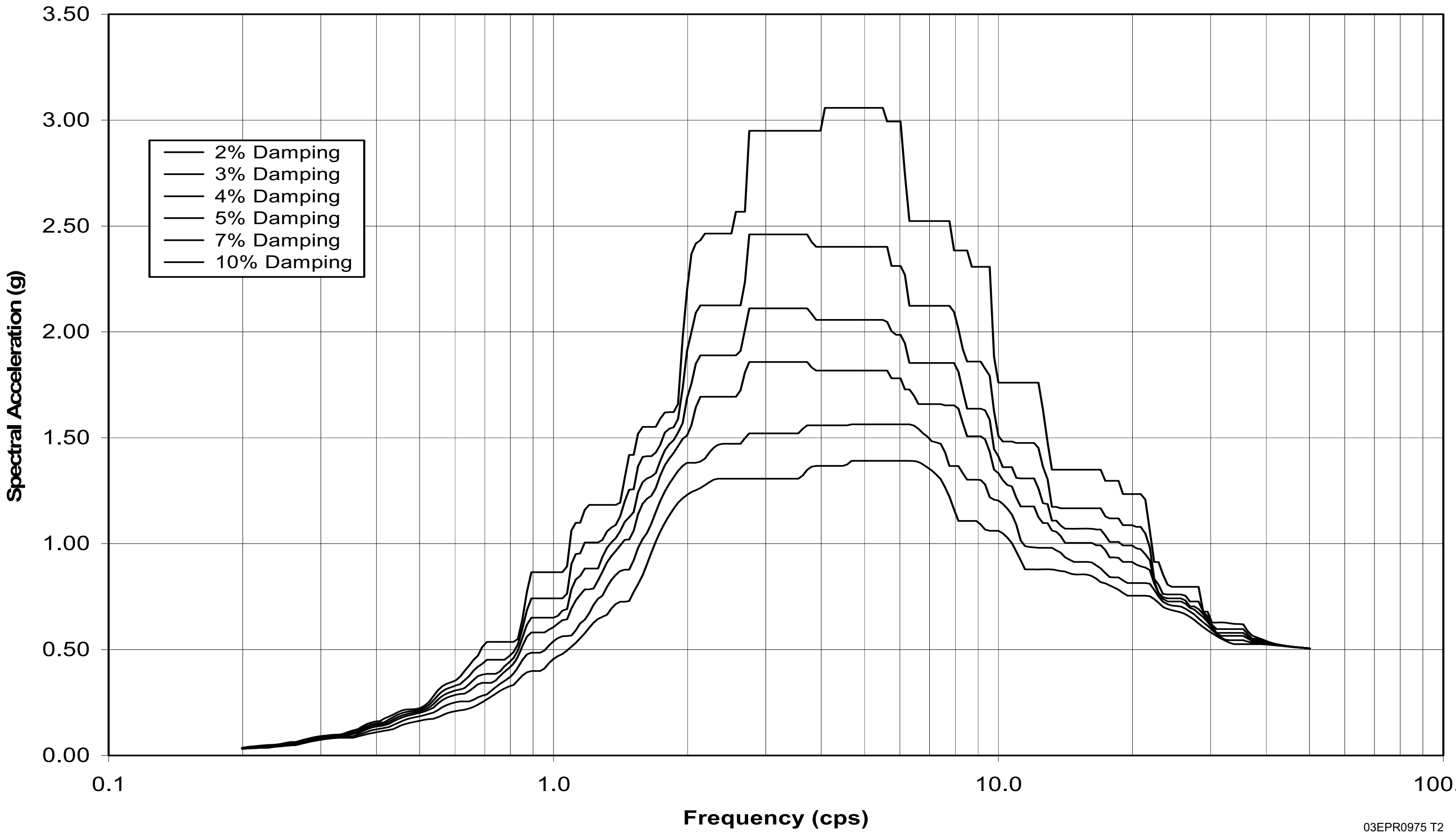


Figure 3.7.2-102—Spectrum Envelope of EPGB at Elev. +0 ft, 0 inches at Node 1172 2%, 3%, 4%, 5%, 7% and 10% Damping Y-Direction

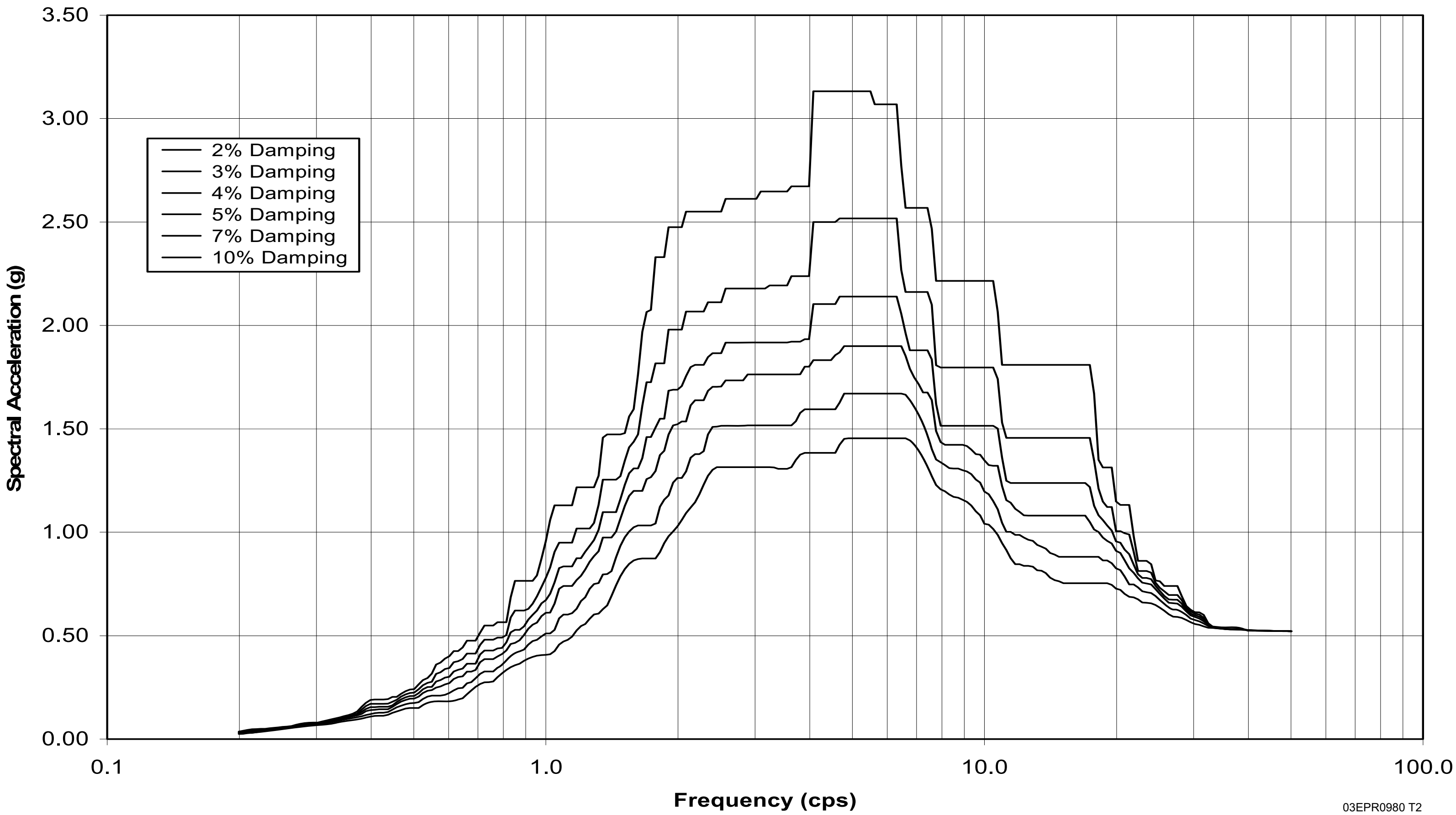


Figure 3.7.2-103—Spectrum Envelope of EPGB at Elev. +0 ft, 0 inches at Node 1172 2%, 3%, 4%, 5%, 7% and 10% Damping Z-Direction

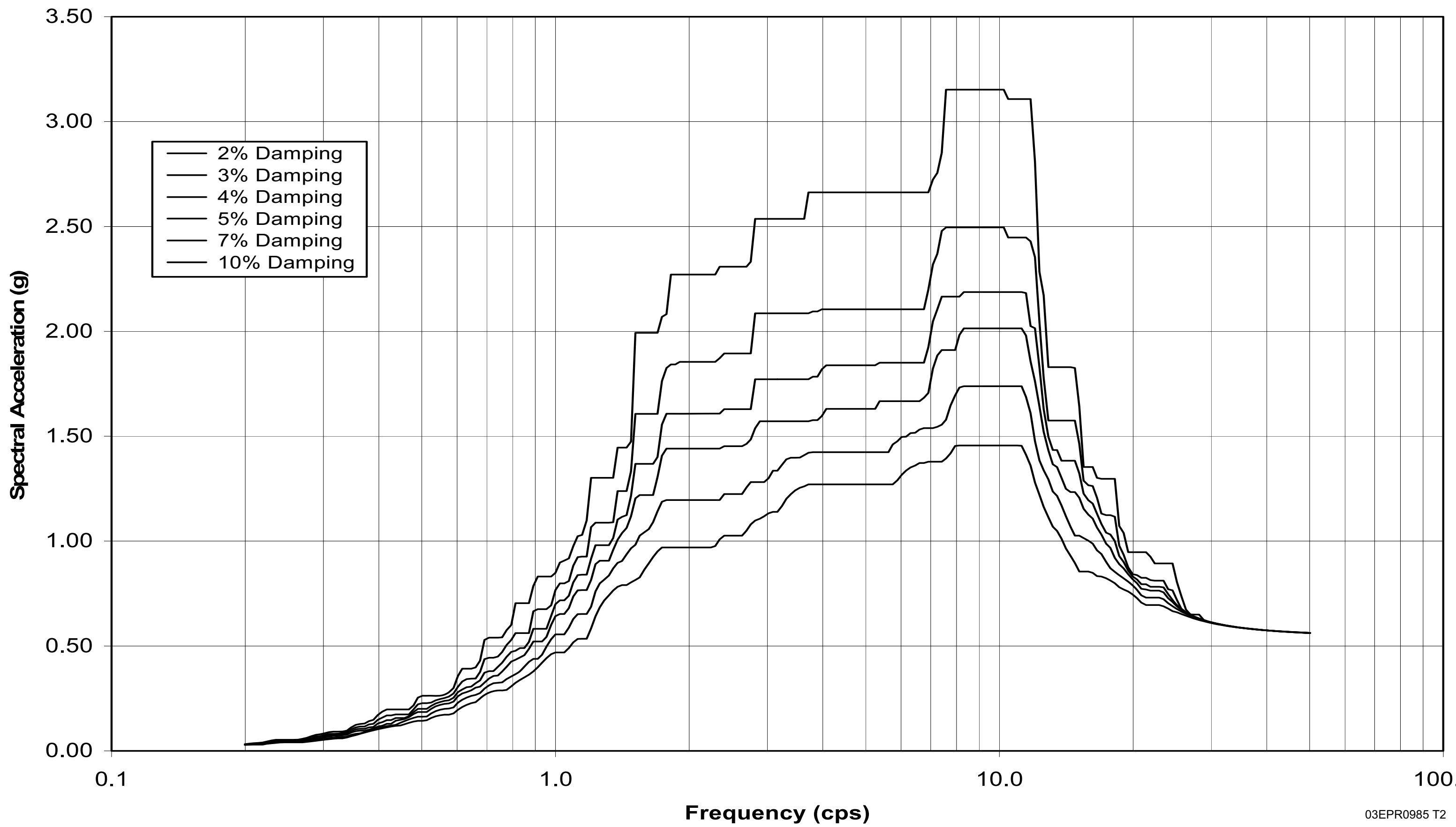


Figure 3.7.2-104—Spectrum Envelope of ESWB at Elev +63 ft, 0 inches at Node 12733 2%, 3%, 4%, 5%, 7% and 10% Damping X-Direction

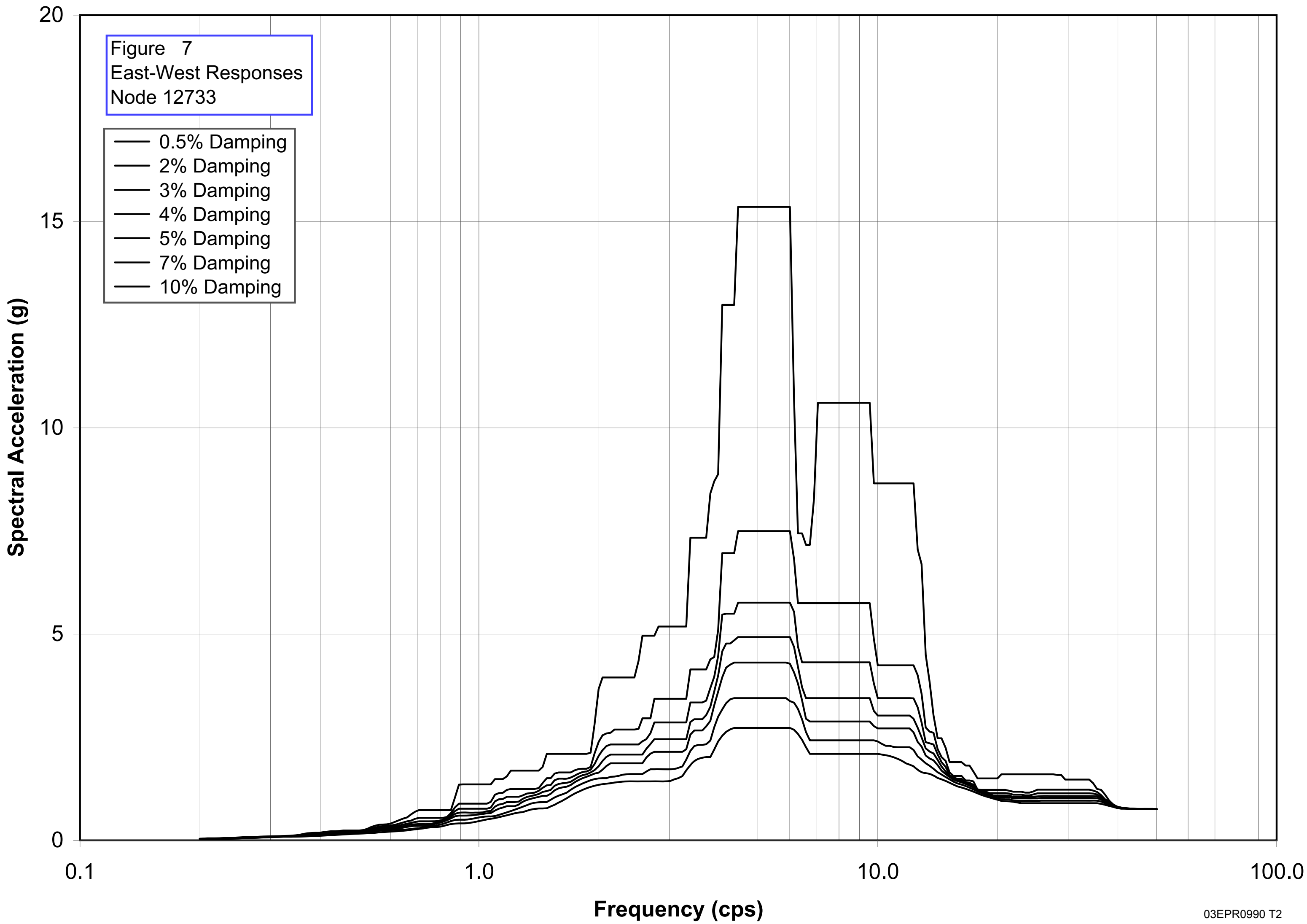


Figure 3.7.2-105—Spectrum Envelope of ESWB at Elev +63 ft, 0 inches at Node 12733 2%, 3%, 4%, 5%, 7% and 10% Damping Y-Direction

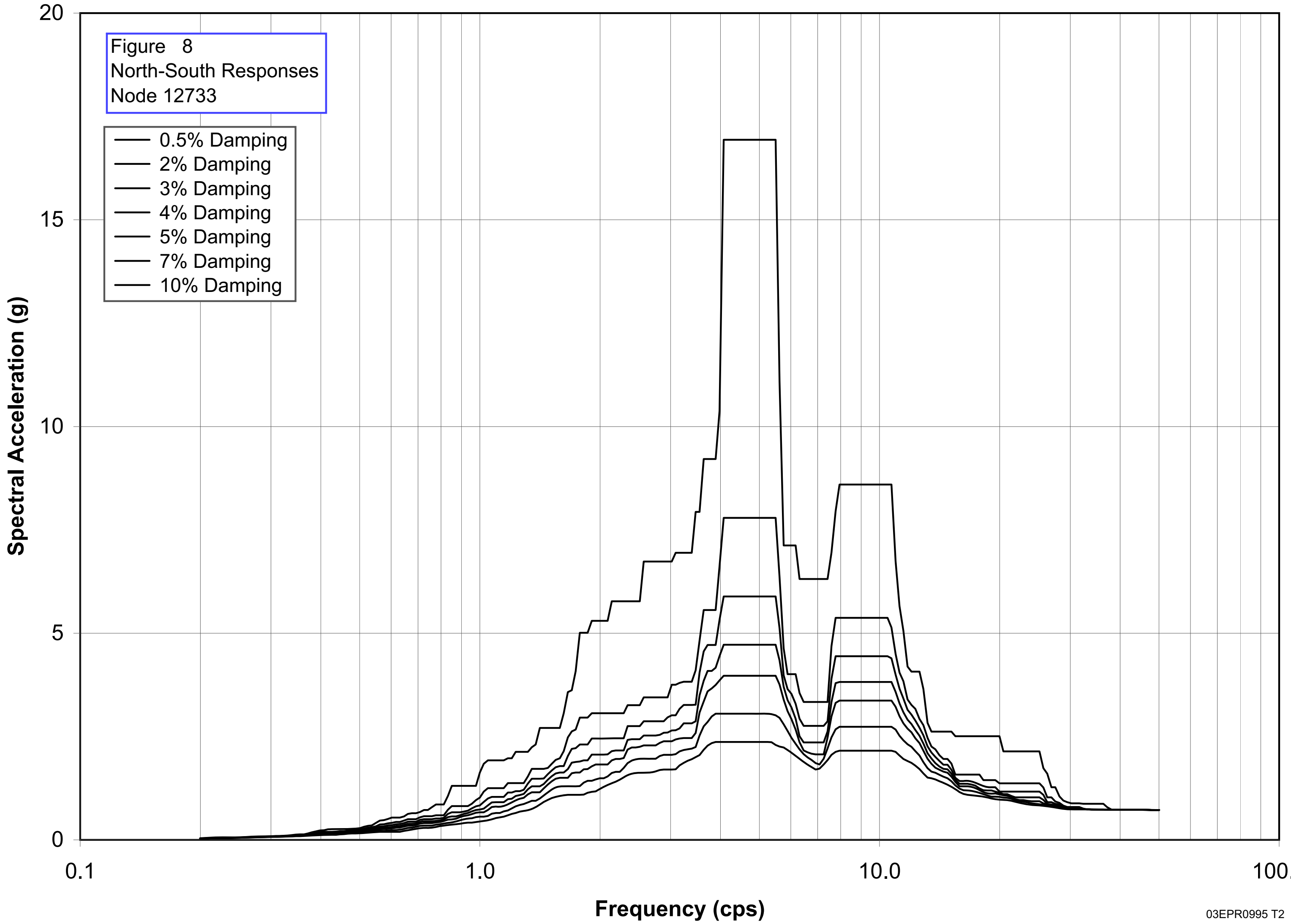


Figure 3.7.2-106—Spectrum Envelope of ESWB at Elev +63 ft, 0 inches at Node 12733 2%, 3%, 4%, 5%, 7% and 10% Damping Z-Direction

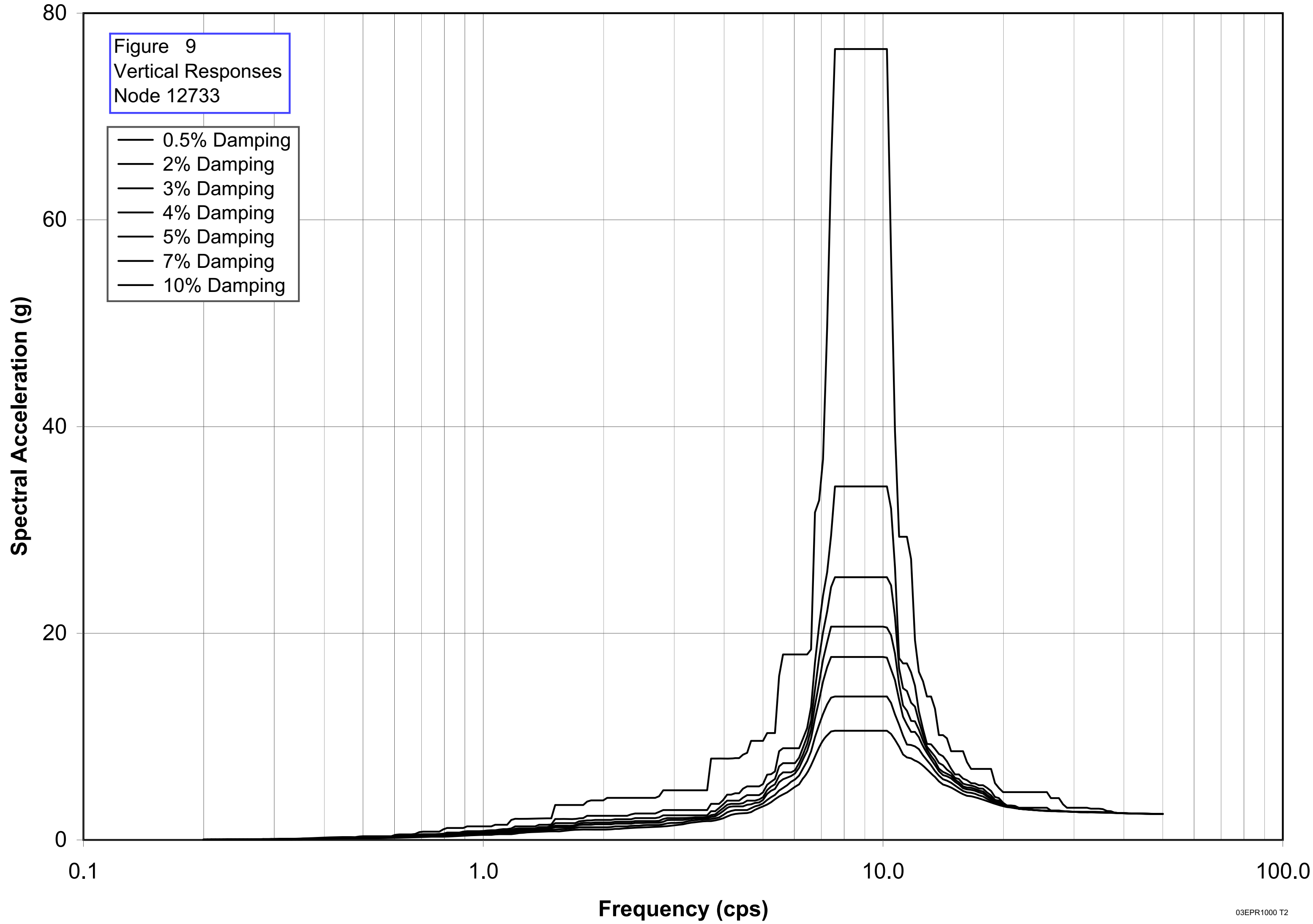


Figure 3.7.2-107—Spectrum Envelope of ESWB at Elev +14 ft, 0 inches at Node 10385 2%, 3%, 4%, 5%, 7% and 10% Damping X-Direction

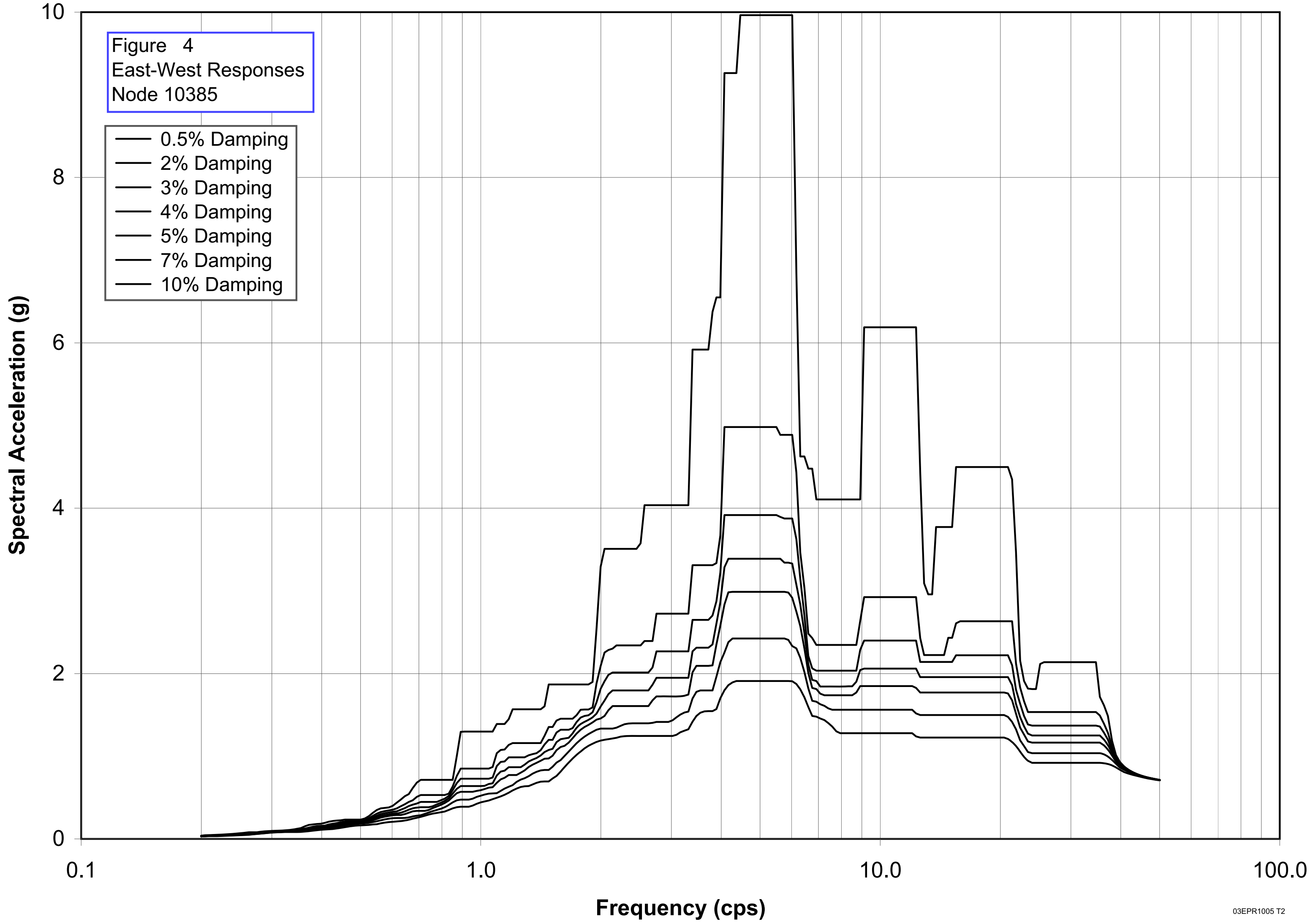


Figure 3.7.2-108—Spectrum Envelope of ESWB at Elev +14 ft, 0 inches at Node 10385 2%, 3%, 4%, 5%, 7% and 10% Damping Y-Direction

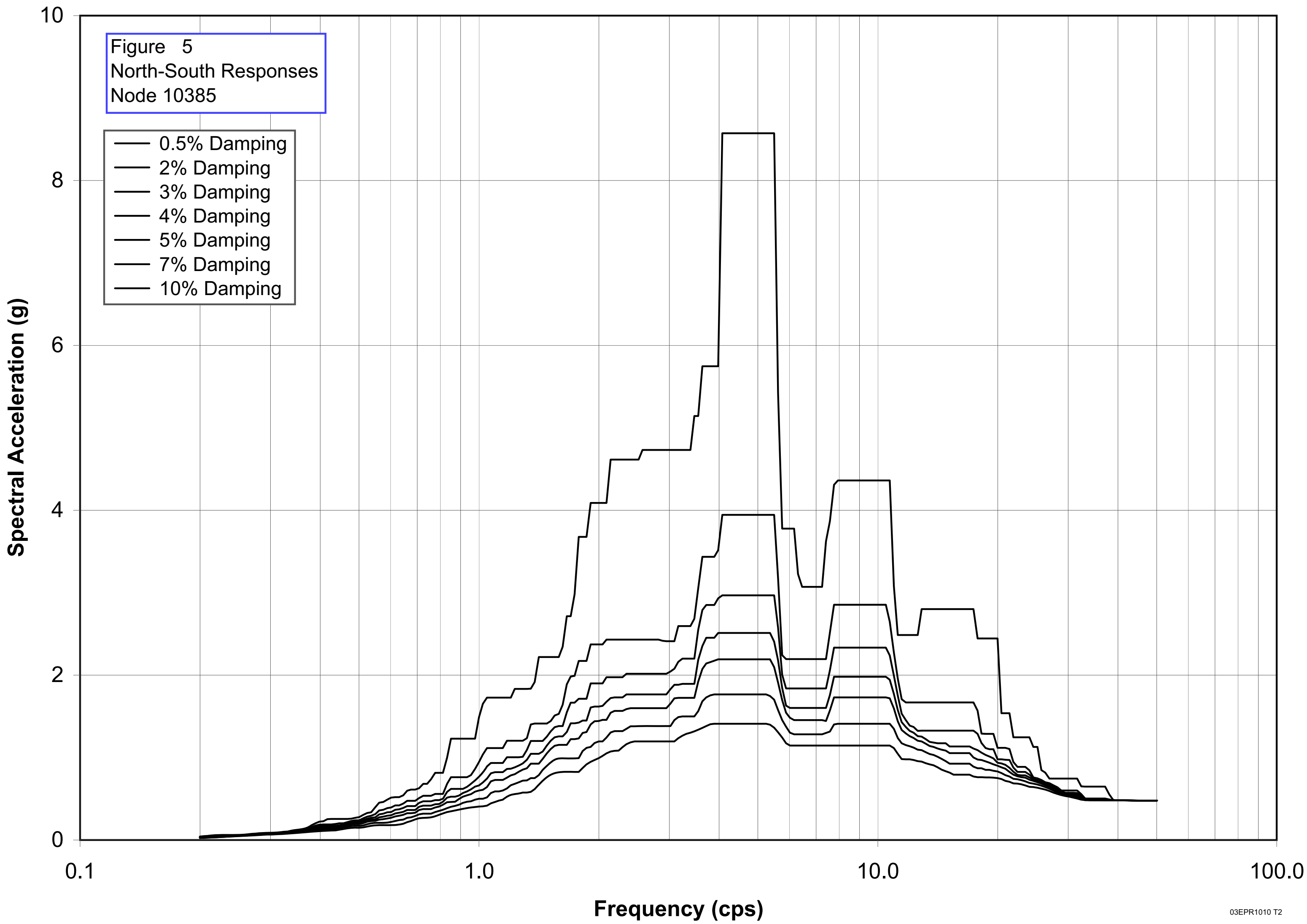


Figure 3.7.2-109—Spectrum Envelope of ESWB at Elev +14 ft, 0 inches at Node 10385 2%, 3%, 4%, 5%, 7% and 10% Damping Z-Direction