Response to SDAA Audit Question

Question Number: A-3.7.2-25

Receipt Date: 08/21/2023

Question:

(Follow-on from A-3.7.2-13). In its response to Audit Question A-3.7.2-13, the applicant defers to the documents posted on the audit portal for requested information; however, these audit documents will not be docketed and cannot be used by the staff as basis for its safety evaluation. The applicant is requested to provide in the FSAR sample plots of calculated and interpolated transfer functions, explain how spurious peaks in the transfer functions are handled, and discuss the method of interpolation for the transfer functions used in the SDAA.

Response:

Licensing Topical Report, TR-0118-58005-P-A, Revision 2, “Improvements in Frequency Domain Soil-Structure-Fluid Interaction Analysis,” discusses the methodology for evaluating complex structural dynamic behavior including transfer functions. The topical report was approved by the NRC on December 10, 2020. The current content of the US460 Standard Design Approval Application (SDAA) Section 3.7.2 meets the Design Specific Review Standard (DSRS) 3.7.2 acceptance criteria without the requested information.

Graphical representations of calculated and interpolated transfer functions using SASSI interpolation method can be found in TR-0118-58005-P-A Appendix I, “Example 4, Acceleration Transfer Functions”. The SASSI interpolation method for the transfer functions is discussed in TR-0118-58005-P-A Section 5.1.7, “SASSI Transfer Function Interpolation”.

SASSI interpolation method can lead to spurious peaks to appear in the transfer function Fourier amplitude spectra. Although, the resulting spurious peaks have a tendency to go to significantly high values, due to their limited span in the frequency axis, often these peaks have negligible effect in the resulting time histories. Spurious peaks generated by the SASSI interpolation method rarely lead to continuous ripples in the time histories. For these cases, a second set of time histories are generated by interpolating the transfer functions using cubic splines, and the more reasonable time history is chosen based on the comparison of the transfer functions and time histories generated using the two interpolation methods. Thus, transfer functions are interpolated using either SASSI or Spline interpolation methods with the latter preferred wherever the former led to unrealistic spurious peaks in the transfer functions. Figure 1 to Figure 6 present the transfer functions, vertical acceleration time history and spectra at a sample basemat node for simulated cases, namely Soil-7, Soil-7 with soil separation and Soil-11.

Figure 1: Sample basemat node transfer functions calculated for the input acceleration in east-west (X) direction with Soil-7 library

{{

}}2(a),(c)

Figure 2: Sample basemat node transfer functions calculated for the input acceleration in north-south (Y) direction with Soil-7 library

{{

}}2(a),(c)

Figure 3: Sample basemat node transfer functions calculated for the input acceleration in vertical (Z) direction with Soil-7 library

{{

}}2(a),(c)

Figure 4: Sample basemat node acceleration time history Z-component calculated for Capitola input motion for Soil-7 case

{{

}}2(a),(c)

Figure 5: Sample basemat node acceleration time history Z-component calculated for Capitola input motion for Soil-7 with soil-separation case

{{

}}2(a),(c)

Figure 6: Sample basemat node acceleration time history Z-component calculated for Capitola input motion for Soil-11 case

{{

}}2(a),(c)

No changes to the SDAA are necessary.