HITACHI

Security Notice

This letter forwards Security-Related information in accordance with 10CFR2.390. Upon removal of Enclosure 2, the balance of this letter may be considered non-Security-Related.

GE Hitachi Nuclear Energy

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MFN 09-201

Docket No. 52-010

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U.S. Nuclear Regulatory Commission
Document Control Desk
Washington, D.C. 20555-0001

Subject: **Response to Portion of NRC RAI Letter No. 290 Related to ESBWR Design Certification Application - DCD Tier 2 Section 3.7 – Seismic Design; RAI Number 3.7-63 S02**

The purpose of this letter is to submit the GE Hitachi Nuclear Energy (GEH) response to the U.S. Nuclear Regulatory Commission (NRC) Request for Additional Information (RAI) letter number 290 sent by NRC letter dated January 6th, 2009 (Reference 1). RAI Number 3.7-63 S02 is addressed in Enclosure 1. Verified DCD changes associated with this RAI response are identified in the enclosed DCD markups by enclosing the text within a black box.

Enclosure 2 contains Security-Related information identified by the designation "{{{Security-Related Information - Withhold Under 10 CFR 2.390}}}." GE hereby requests this information be withheld from public disclosure in accordance with the provisions of 10 CFR 2.390. A public version is contained in Enclosure 1.

D068
NRO

If you have any questions or require additional information, please contact me.

Sincerely,

Richard E. Kingston

Richard E. Kingston
Vice President, ESBWR Licensing

Reference:

1. MFN 09-009 Letter from U.S. Nuclear Regulatory Commission to Robert E. Brown, GEH, *Request For Additional Information Letter No. 290 Related to ESBWR Design Certification Application*, dated January 9, 2009

Enclosure:

1. Response to Portion of NRC RAI Letter No. 290 Related to ESBWR Design Certification Application - DCD Tier 2 Section 3.7 – Seismic Design; RAI Number 3.7-63 S02
2. Response to Portion of NRC RAI Letter No. 290 Related to ESBWR Design Certification Application - DCD Tier 2 Section 3.7 – Seismic Design; RAI Number 3.7-63 S02 – Security Related Information – With Hold Under 10CFR2.390

cc:	AE Cubbage	USNRC (with enclosures)
	JG Head	GEH/Wilmington (with enclosures)
	DH Hinds	GEH/Wilmington (with enclosures)
	eDRF Section	0000-0095-6241(RAI 3.7-63 S02)

ENCLOSURE 1

MFN 09-201

Response to NRC RAI Letter No. 290
Related to ESBWR Design Certification Application[1]

DCD Tier 2 Section 3.7 – Seismic Design

RAI Number 3.7-63 S02

[1] Original Response and Supplement 1 previously submitted under MFNs 08-232 and 08-232, Supplement 2 without DCD updates are included to provide historical continuity during review.

DCD Revision 4 Section 3A.4.1 states:

> *"....For the generic sites defined in Subsection 3A.3.1, the design response spectra are conservatively applied at the level of foundation in the free field. The input motion for North Anna ESP site is also defined at the foundation level.*
>
> *For the layered site cases, the input ground motion is defined as an outcrop motion at the RBFB foundation level for the RBFB and CB. The corresponding surface motion is generated for use as input to the SASSI2000 calculation for each site.*
>
> *For the FWSC, which is essentially a ground surface founded structure, the input ground motion is taken to be 1.35 times the RBFB/CB foundation input motion and is applied directly at the foundation level."*

The staff requires the following clarification and additional information related to the above statements:

(a) Based on the first two sentences above, it appears to the staff that the ground motion for the CB was applied at two different elevations: at the CB foundation level for the generic sites defined in Subsection 3A.3.1, and at the RBFB foundation level for the layered site cases. Please confirm this, or clarify what was actually done. If this is the case, please describe what differences in CB response would be expected for the layered site cases if the input ground motion had been defined as an outcrop motion at the CB foundation level.

(b) The third sentence above defines the input ground motion used for the FWSC SSI analyses as "1.35 times the RBFB/CB foundation input motion...applied directly at the foundation level." Please provide a detailed technical basis for the selection of the 1.35 factor, including pertinent quantitative information upon which this determination is based.

GEH Response

(a) GEH confirms that the ground motion for the CB was applied at the CB foundation level for the generic site cases and at the RBFB foundation level for the layered site cases.

Applying the outcrop motion at the RBFB foundation level for the layered site cases is a more conservative approach than applying the outcrop motion directly at the CB foundation level. This is demonstrated in Figure 3.7-63(1) by comparing the response spectra of the surface motion when the ground motion is applied at the RBFB foundation level and at the CB foundation level for the typical layered site Case 2 described in DCD Tier 2 Table 3A.3-3. The response spectrum of the surface motion is larger in the case when the ground motion is applied at the RBFB foundation level than in the case when the ground motion is applied at the CB

foundation level. Therefore, it is expected that the CB response would be smaller for the layered site cases if the input ground motion had been defined as an outcrop motion at the CB foundation level instead at the RBFB foundation level.

(b) The technical basis for scaling the RBFB/CB foundation input motion for ground motions at other depths is to maintain a broad-band spectrum shape that is rich in all frequencies, regardless of site conditions, for the purpose of standard plant design. Broad-band design spectrum at any foundation depth is compatible with smooth site-specific ground motion response spectrum (GMRS) and associated foundation input response spectrum (FIRS) generated in accordance with RG 1.208 requirements for new units. The 1.35 scale factor was determined such that the resulting spectrum at the FWSC foundation level envelops the FIRS at the North Anna 3 site as shown in Figure 3.7-63(2) for the horizontal motion and Figure 3.7-63(3) for the vertical motion.

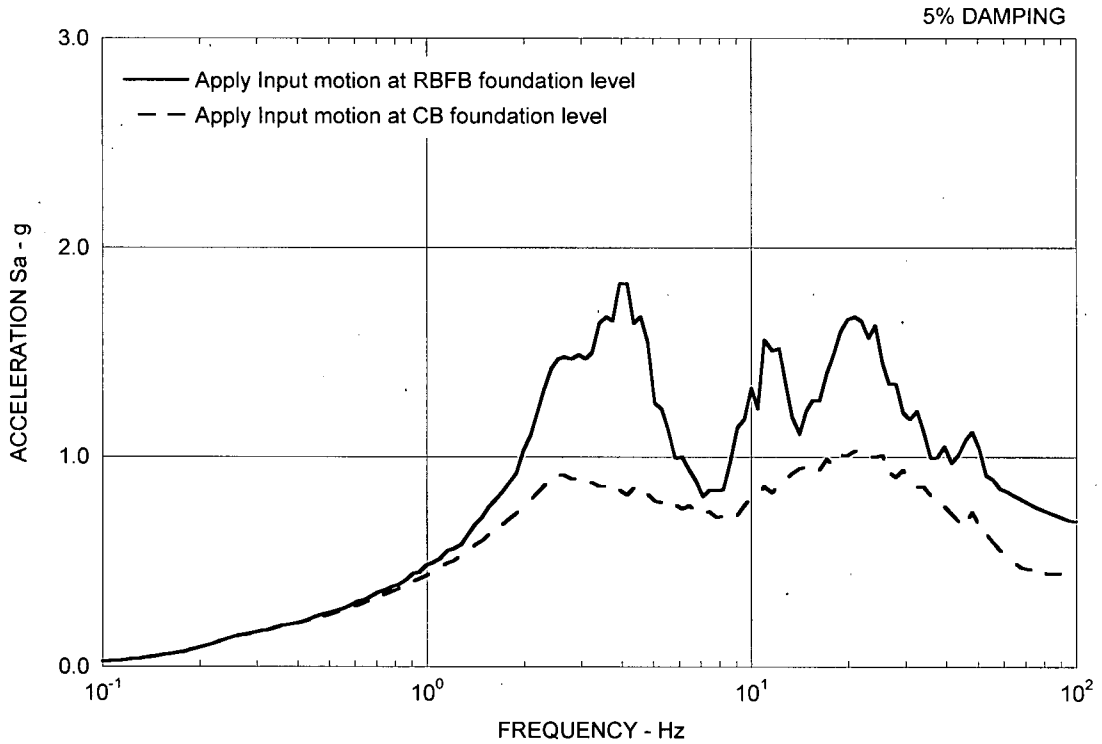


Figure 3.7-63(1) Comparison of Surface Response Spectra for Layered Case 2 when the Input Motion is applied at Different Levels

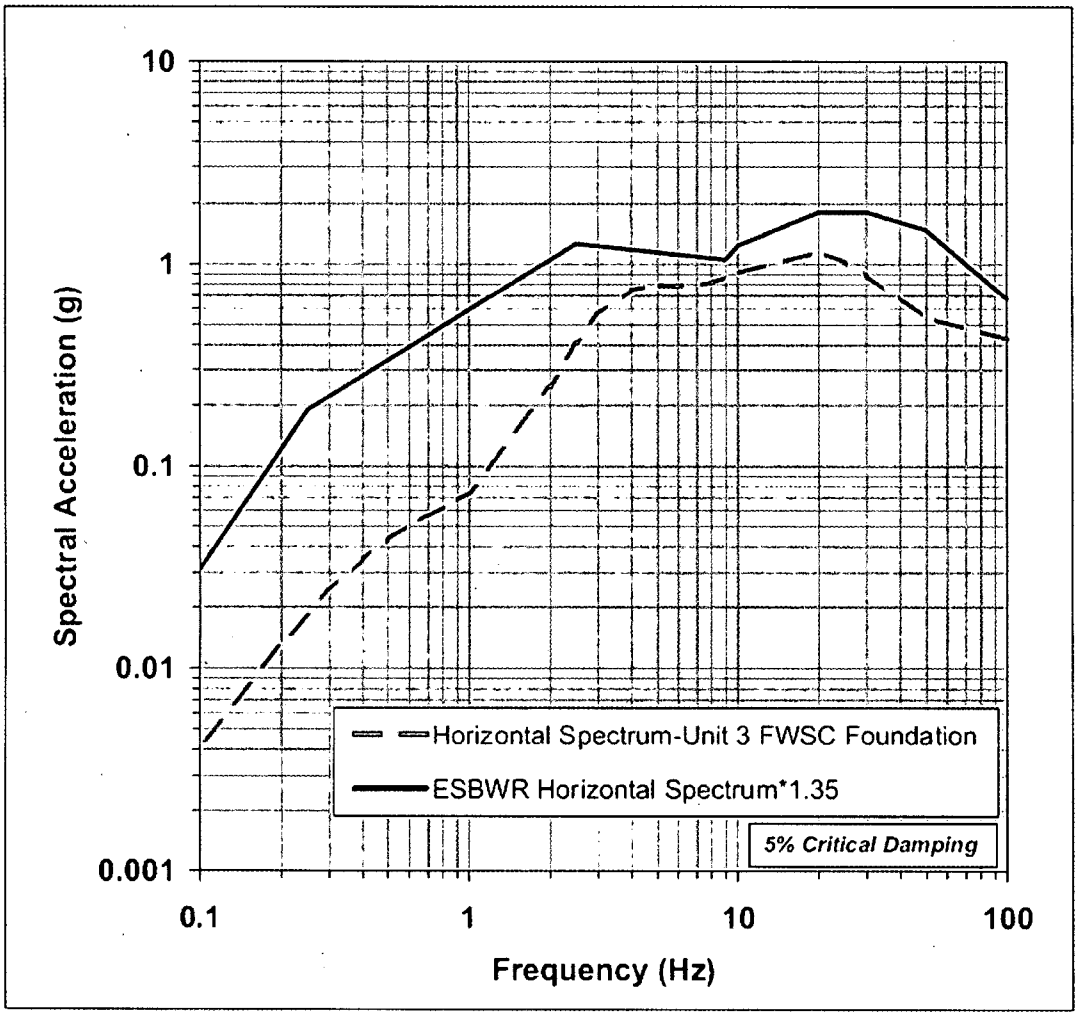


Figure 3.7-63(2) Comparison of Horizontal SSE Design Response Spectrum with NA3 Site-Specific Spectra at FWSC Foundation Level (Reproduced from North Anna 3 COLA FSAR Figure 2.0-203)

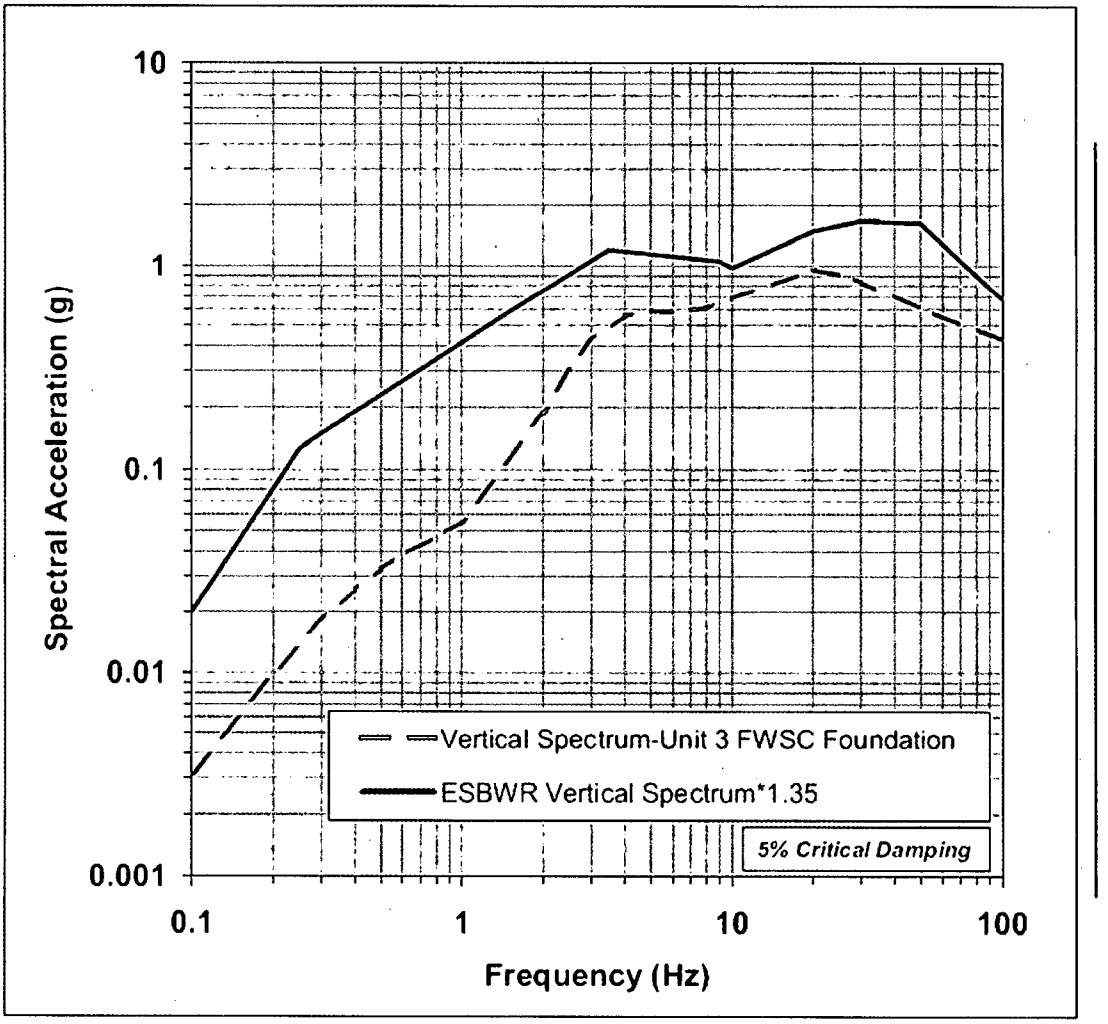


Figure 3.7-63(3) Comparison of Vertical SSE Design Response Spectrum with NA3 Site-Specific Spectra at FWSC Foundation Level (Reproduced from North Anna 3 COLA FSAR Figure 2.0-204)

DCD Impact

No DCD change was made in response to this RAI.

The staff reviewed GEH's response to RAI 3.7-63, and concluded that additional information is needed before it can complete its assessment of the two technical issues covered by this RAI.

Part (1) - GEH needs to submit a comparison of the surface spectra derived by placing the input motion at the bottom of the RB/FB foundation to the surface spectra derived by placing the input motion at the bottom of the CB foundation, for each of the 4 SASSI layered soil cases. In deriving the surface spectra from the foundation motions, the method identified as the NRC method in GEH's response to RAI 3.7-16 must be used. Submit four (4) figures, similar to Figure 3.7-63(1).

In reviewing Figure 3.7-63(1), the staff noted that the surface spectra corresponding to placing the input motion at the bottom of the CB foundation (dashed line) does not appear to be correct. It resembles the spectrum of the input motion, at the foundation level. The dashed line would be expected to exhibit the same pattern of peaks and valleys as the solid line. GEH needs to confirm that the dashed line is correct, and provide an explanation for the unexpected shape.

Part (2) – The staff notes that GEH can define any surface spectrum it chooses to for design certification of the fire water service complex (FWSC). COL applicants will need to demonstrate that the site-specific surface spectrum is enveloped by the spectrum GEH has used for design certification of the FWSC. If this is not the case, then a site-specific analysis of the FWSC will be required at the COL stage. This will be in addition to the required comparisons at the RB/FB and CB foundation levels. SRP 3.7.1 specifies a check at the foundation level for each structure.

The staff believes that the surface spectra used for seismic analysis of the FWSC should envelope the 8 surface spectral plots that the staff has asked GEH to derive under Part (1) above. This would ensure consistency between the input at the RB/FB and CB foundation levels and the input at the surface for the FWSC. GEH's proposed 1.35 factor on the input motion at the bottom of the RB/FB foundation may or may not produce a suitable envelope. Based on comparing Figure 3.7-63(1) to Figure 3.7-63(2), it appears to the staff that a 1.35 factor may not be sufficient over the entire frequency range.

The staff requests GEH to re-assess its methodology for selecting the surface spectra for seismic design of the FWSC; provide the technical basis for its selection; and identify the necessary COL applicant action items to ensure the seismic adequacy of the FWSC at each site.

Part (1) - Figures 3.7-63(4) through (7) show comparisons of the surface spectra derived by placing the input motion at the bottom of the RB/FB foundation to the surface spectra derived by placing the input motion at the bottom of the CB foundation for each of the 4 SASSI layered soil cases by using the method identified as the NRC Method in GEH's response to NRC RAI 3.7-16, Supplement 2 transmitted to the NRC via MFN 06-274, Supplement 2.

Since the fundamental frequencies of the CB in the horizontal directions are around 3 Hz, as shown in DCD Tier 2 Table 3A.7-8, the CB responses would be smaller for all layered site cases if the input ground motion had been applied at the CB foundation level instead at the RB/FB foundation level.

GEH confirms that both the solid and dashed lines in Figure 3.7-63(1) have been correctly calculated by using the method identified as the DCD Method in GEH's response to NRC RAI 3.7-16, Supplement 2 transmitted to the NRC via MFN 06-274, Supplement 2, which includes the entire soil column up to the ground surface in a single SHAKE run with outcrop motion input at the foundation level.

The reason for the dashed line resembling the foundation input spectrum is because the CB (14.9 m embedment) is shallower than the top layer (20m thick) of the layered sites (see DCD Tier 2 Table 3A.3-3). In other words, the soil properties above the foundation are the same as those below the foundation in the region of the top layer and, as a result, the surface motion resembles the foundation input motion. This can be further explained by the one-dimensional wave propagation theory below:

a. Soil displacement at layer *m* is expressed as:

$$u_m(x,t) = E_m e^{i(kx+\omega t)} + F_m e^{-i(kx-\omega t)} \qquad \text{Equation 3.7-63(1)}$$

where $k = \sqrt{\dfrac{\rho\,\omega^2}{G^*}}$, G^* is a complex soil stiffness considering damping

b. For the multi-soil layer system, the upward component, E, and the downward component, F, for each soil layer are calculated by Equation 3.7-63(2) considering the continuity of displacement and shear stress at each layer boundary.

$$E_{m+1} = \frac{1}{2}E_m(1+\alpha_m)e^{ik_m h_m} + \frac{1}{2}F_m(1-\alpha_m)e^{-ik_m h_m}$$

$$F_{m+1} = \frac{1}{2}E_m(1-\alpha_m)e^{ik_m h_m} + \frac{1}{2}F_m(1+\alpha_m)e^{-ik_m h_m} \qquad \text{Equation 3.7-63(2)}$$

where $\alpha_m = \dfrac{k_m \cdot G_m^*}{k_{m+1} \cdot G_{m+1}^*}$

c. Since the full reflection occurs at the ground surface, the E and F components are equal at the top surface layer.

$$E_1 = F_1$$ Equation 3.7-63(3)

d. From Equations 3.7-63(2) and 3.7-63(3), the motion components at the second layer are derived to be:

$$E_2 = \frac{E_1}{2}\left\{(1+\alpha_1)e^{ik_1h_1} + (1-\alpha_1)e^{-ik_1h_1}\right\}$$

$$F_2 = \frac{E_1}{2}\left\{(1-\alpha_1)e^{ik_1h_1} + (1+\alpha_1)e^{-ik_1h_1}\right\} \qquad \text{Equation 3.7-63(4)}$$

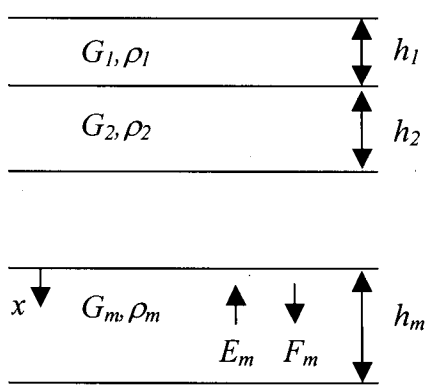
e. The transfer function of the ground surface displacement relative to the outcrop displacement ($2E_2$) at the top of the second layer becomes:

$$H(\omega) = \frac{E_1 + F_1}{2E_2} = \frac{E_1}{E_2}$$

$$= \frac{E_1}{\frac{E_1}{2}\left\{(1+\alpha_1)e^{ik_1h_1} + (1-\alpha_1)e^{-ik_1h_1}\right\}} \qquad \text{Equation 3.7-63(5)}$$

$$= \frac{2}{(1+\alpha_1)e^{ik_1h_1} + (1-\alpha_1)e^{-ik_1h_1}}$$

f. According to the above transfer function, the response at the ground surface approaches the input motion when the soil properties of the 1st layer is the same as those of the 2nd layer, since α_1 becomes 1.0 and $H(\omega)$ approaches 1.0.



Part (2) - The surface spectra computed from the input spectra defined at the RB/FB and CB foundations, as shown in Figures 3.7-63(4) through 3.7-63(7), exhibit distinct peaks and valleys. Using these surface spectra directly as input motion could under-predict or over-predict the FWSC response depending on the SSI frequencies. The more balanced approach for the standard plant design is to maintain the broad-band characteristics in the foundation input spectra that is rich in all frequencies, regardless of site conditions. This is the technical basis for the selection of FSWC input spectra to be 1.35 times the broad-band Certified Seismic Design Response Spectra (CSDRS) for the RB/FB and CB. As stated in the original response to this RAI, the 1.35 scale factor was chosen to envelop the FWSC Foundation Input Response Spectra (FIRS) at the North Anna 3 site. To ensure the seismic adequacy of the FWSC at each site, the COL applicant is required to compare the site-specific FIRS for the FWSC with the FWSC CSDRS, which is 1.35 times the values shown in DCD Tier 2 Figures 2.0-1 and 2.0-2 as stipulated in footnote 9 to DCD Tier 2 Table 2.0-1.

DCD Tier 1 Table 5.1-1, DCD Tier 2 Table 2.0-1, DCD Tier 2 Subsection 3.7.1.1 and DCD Tier 2 Subsection 3A.4.1 will be revised in Revision 6 to clarify that the input ground motion for the Firewater Service Complex is applied directly at the foundation level, specifically at the bottom of the base slab.

DCD Tier 2 Table 1.9-3, DCD Tier 2 Table 1.9-20, DCD Tier 2 Subsection 2.0.2 and DCD Tier 2 Table 2.0-2 will be revised in Revision 6 to clarify that the COL applicant confirm that the site-specific Foundation Input Response Spectra is enveloped by the ESBWR design response spectra referenced at the foundation level.

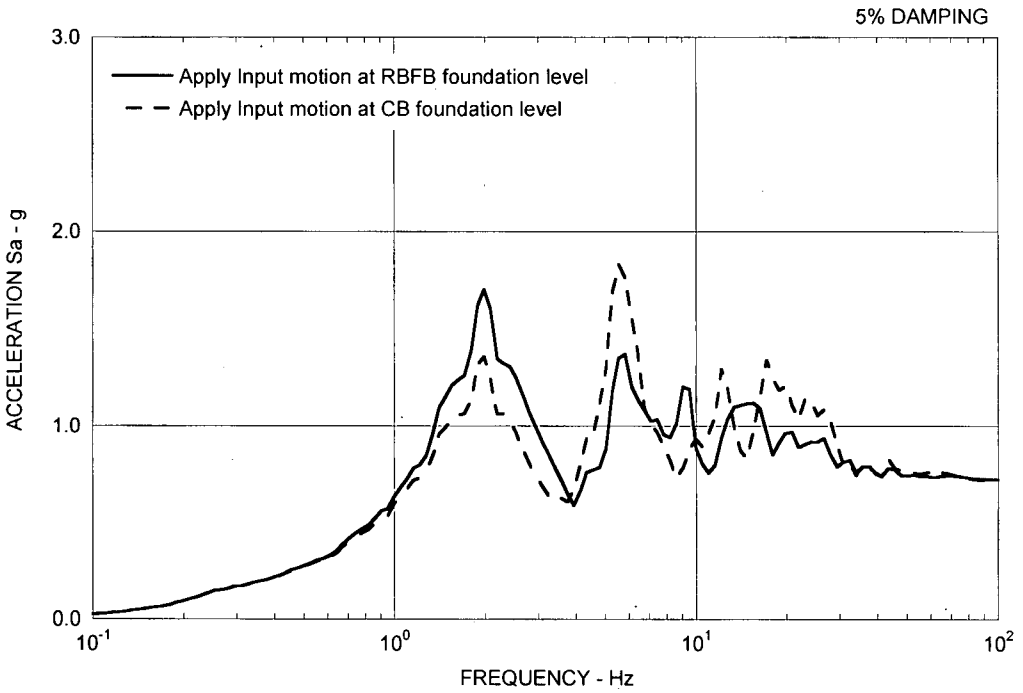


Figure 3.7-63(4) Comparison of Surface Response Spectra for Layered Case 1

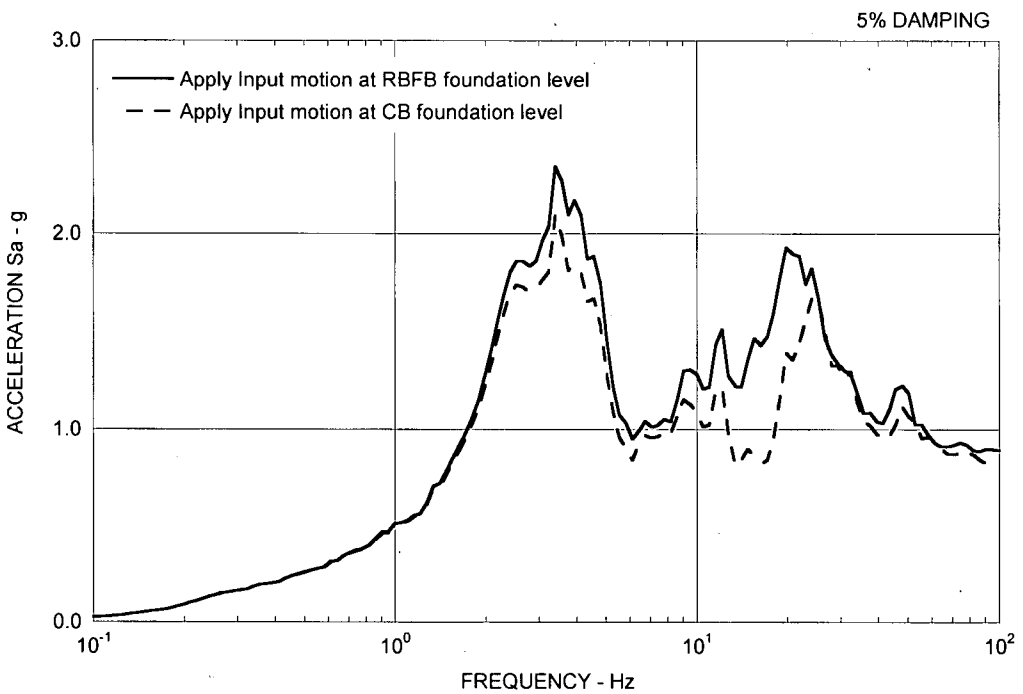


Figure 3.7-63(5) Comparison of Surface Response Spectra for Layered Case 2

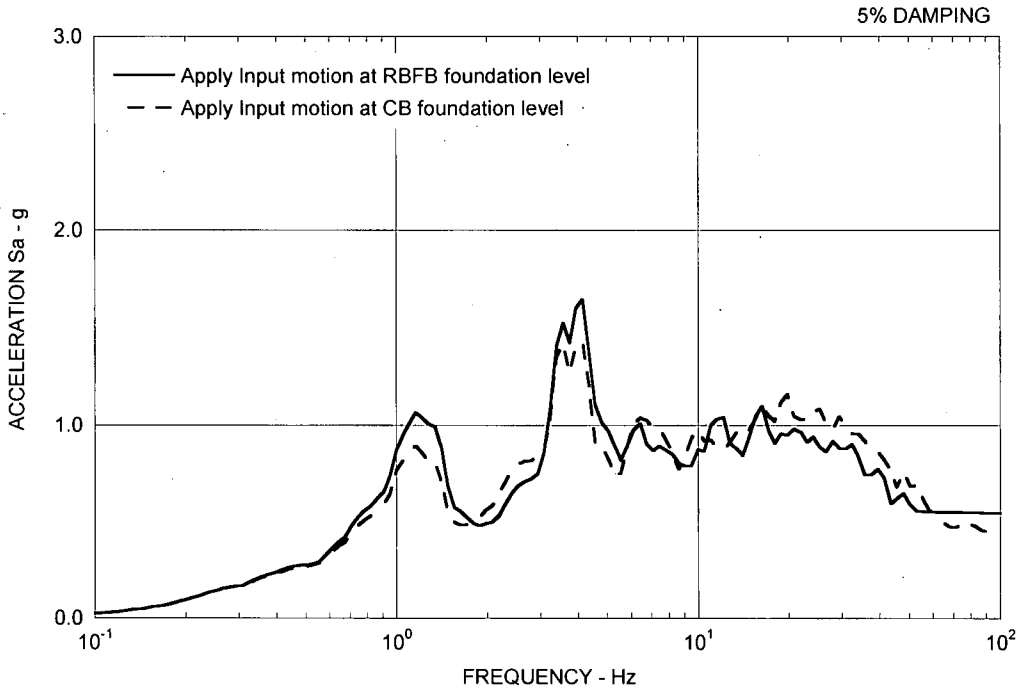


Figure 3.7-63(6) Comparison of Surface Response Spectra for Layered Case 3

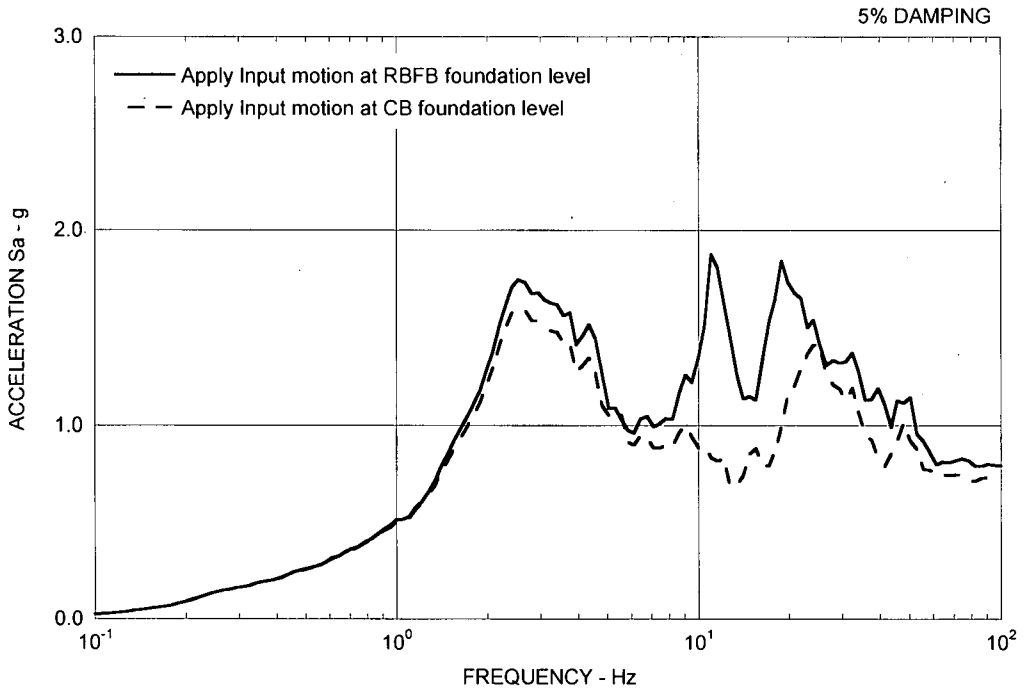


Figure 3.7-63(7) Comparison of Surface Response Spectra for Layered Case 4

DCD Impact

Markups of DCD Tier 1 Table 5.1-1, DCD Tier 2 Table 1.9-3, DCD Tier 2 Table 1.9-20, DCD Tier 2 Subsection 2.0.2, DCD Tier 2 Table 2.0-1, DCD Tier 2 Table 2.0-2, DCD Tier 2 Subsection 3.7.1.1 and DCD Tier 2 Subsection 3A.4.1 were provided to the NRC in MFN 08-232, Supplement 2, dated February 11, 2009.

During a teleconference on 12/10/2008 related to RAI 3.7-63 S01, the staff discussed with GEH how the potential for structure-soil-structure interaction was addressed in its evaluation of the FWSC. GEH indicated that it had not conducted any specific analysis due to the appreciable distance between the closest building (CB) and the FWSC. The staff considers that a quantitative evaluation of this potential effect is needed to address this issue. The following two approaches may be considered:

(1) GEH conducts a generic structure-soil-structure analysis for the FWSC.

(2) The COL applicant develops its site-specific FIRS for the FWSC foundation by an analysis that considers structure-soil-structure interaction effects. As long as the site-specific FIRS for the FWSC, including any interaction effects, falls below 1.35 x CSDRS, then the FWSC is seismically qualified by reference to the ESBWR DCD.

GEH may propose an alternative for staff consideration.

GEH Response

GEH has conducted a generic structure-soil-structure interaction analysis for the FWSC with the CB.

The analysis model is composed of these two independent structures coupled through soil, as shown in Figure 3.7-63(8), using the SASSI2000 computer code. The same layered site Case 2 considered for the interaction between the RB/FB and CB is also used in the interaction between the CB and FWSC (CL-2 for CB and FL-2 for FWSC). The input motion for the coupled CB-FWSC SSI model is the Certified Seismic Design Response Spectra (CSDRS) applied at the CB foundation level. This analysis case is named Case FL-5.

The analysis results of the structural response in terms of maximum vertical accelerations and maximum member forces are presented in Tables 3.7-63(1) and 3.7-63(2) for the FWSC and Tables 3.7-63(3) and 3.7-63(4) for the CB together with their percentage differences from the DCD Tier 2 Revision 5 design envelope loads. The design envelope loads bound all structural response results of the structure-soil-structure interaction analysis.

Figures 3.7-63(9) through 3.7-63(26) show comparisons of floor response spectra (FRS) with the design envelope spectra at selected locations in the two structures. The FRS for the corresponding analysis Cases CL-2 and FL-2 without the structure-soil-structure interaction effect are also shown in the figures for comparison. It is confirmed from the results that the FRS with the structure-soil-structure interaction effect are bounded by the DCD Revision 5 design envelope spectra in all frequency ranges. Consequently, it can be concluded that 1.35 times CSDRS is a conservative design input motion to the FWSC and can be compared with the site-specific FIRS directly without considering structure-soil-structure interaction effects in COL applications. DCD

Tier 2 Appendix 3A will be updated in Revision 6 to include the analysis performed and results obtained for structure-soil-structure interaction between the FWSC and CB.

Although the seismic design loads for the FWSC are not affected by the structure-soil-structure interaction, it should be noted that the hydrodynamic wall pressures induced by the vertical earthquake component have been updated in the stress analysis for the Firewater Storage Tank and revised stress results will be included in Revision 6 of DCD Tier 2 Appendix 3G.

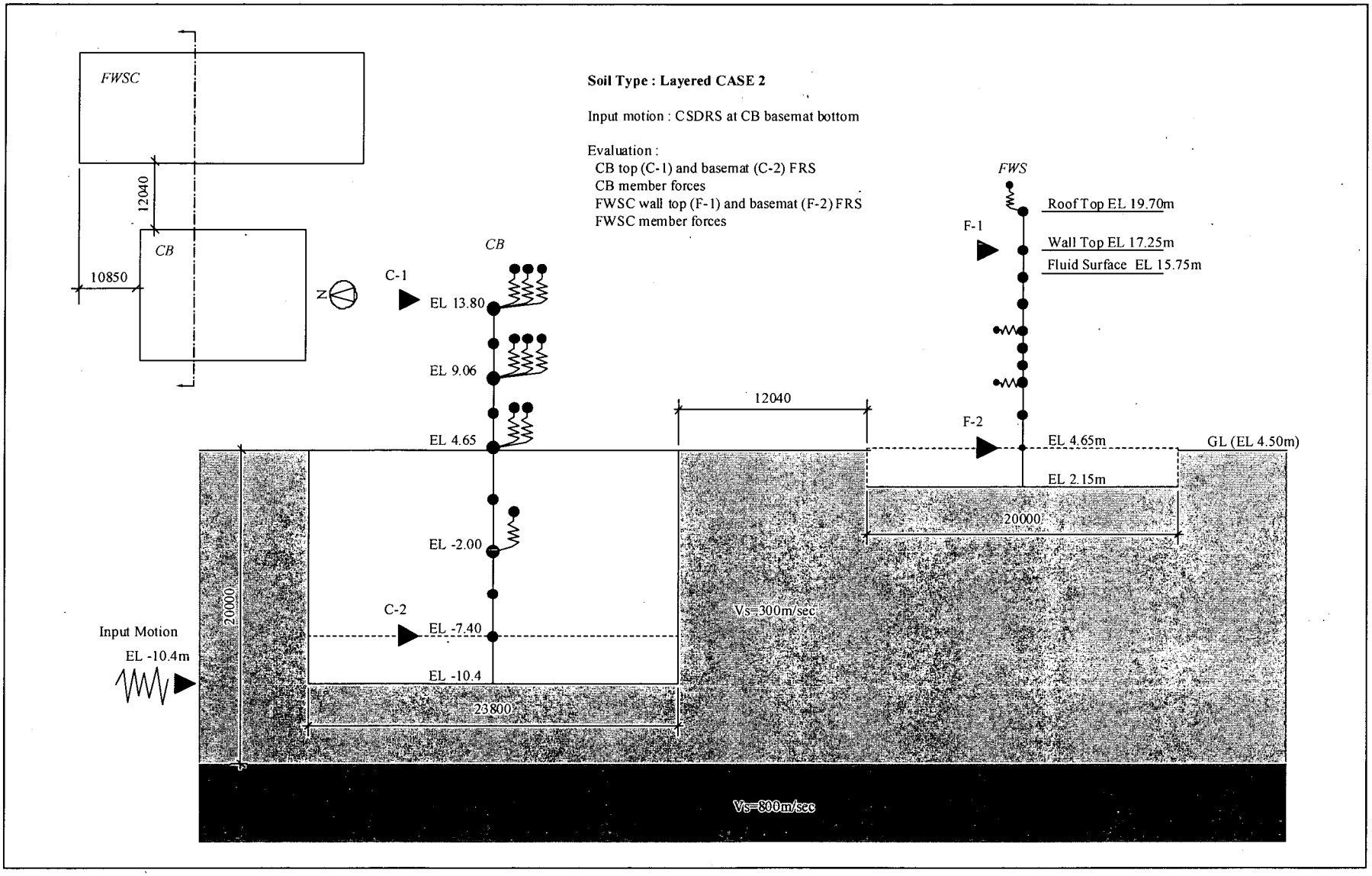


Figure 3.7-63(8) Structure-Structure Interaction Analysis Model

Table 3.7-63(1) FWSC Vertical Acceleration

(a) Structure-Structure Analysis

Elev. (m)	Node No.	Stick Model	Max. Vertical Acceleration (g)
19.70	10	FWS	0.48
17.25	9	FWS	0.48
15.53	8	FWS	0.48
13.81	7	FWS	0.48
12.10	6	FWS	0.48
11.00	5	FWS	0.48
9.90	4	FWS	0.48
8.81	3	FWS	0.48
6.73	2	FWS	0.47
4.65	8002	FWSC	0.47
2.15	8001	FWSC	0.46
19.70	11	Oscillator	1.35

Elev. (m)	Node No.	Stick Model	Max. Vertical Acceleration (g)
8.25	405	FPE	0.46
6.45	402	FPE	0.46

(b) DCD Rev.5

Elevation (m)	Node No.	Stick Model	Max. Vertical Acceleration (g)
19.70	10	FWS	1.69
17.25	9	FWS	1.64
15.53	8	FWS	1.58
13.81	7	FWS	1.58
12.10	6	FWS	1.43
11.00	5	FWS	1.23
9.90	4	FWS	1.13
8.81	3	FWS	1.05
6.73	2	FWS	1.00
4.65	8002	FWSC	0.78
2.15	8001	FWSC	0.78
19.70	11	Oscillator	3.26

Elevation (m)	Node No.	Stick Model	Max. Vertical Acceleration (g)
8.25	405	FPE	1.12
6.45	402	FPE	1.09

(c) Ratio with DCD Rev.5 ((a)/(b))

Elevation (m)	Node No.	Stick Model	Ratio with DCD Rev.5
19.70	10	FWS	29%
17.25	9	FWS	29%
15.53	8	FWS	31%
13.81	7	FWS	31%
12.10	6	FWS	34%
11.00	5	FWS	39%
9.90	4	FWS	43%
8.81	3	FWS	46%
6.73	2	FWS	47%
4.65	8002	FWSC	61%
2.15	8001	FWSC	59%
19.70	11	Oscillator	41%

Elevation (m)	Node No.	Stick Model	Ratio with DCD Rev.5
8.25	405	FPE	41%
6.45	402	FPE	42%

Table 3.7-63(2) FWSC Seismic Forces

(a) Structure-Structure Analysis

FWS

Elev. (m)	Node No.	Elem No.	Shear X-dir. (MN)	Shear Y-dir. (MN)	Moment X-dir. (MN-m)	Moment Y-dir. (MN-m)	Torsion (MN-m)
19.70	10				0.7	0.8	
		9	1.0	1.0	2.7	3.0	0.5
17.25	9				3.6	4.3	
		8	2.6	2.6	7.6	8.3	1.6
15.53	8				8.4	9.6	
		7	3.7	3.6	14.3	15.4	2.7
13.81	7				14.8	16.5	
		6	4.7	4.6	22.7	24.6	3.6
12.10	6				23.1	24.9	
		5	5.6	5.5	29.2	31.6	4.3
11.00	5				29.5	31.8	
		4	6.2	6.0	36.1	39.3	4.9
9.90	4				36.5	39.6	
		3	6.9	6.6	43.8	45.4	5.3
8.81	3				44.1	47.3	
		2	13.7	13.0	71.9	70.8	5.8
6.73	2				72.3	71.5	
4.65	1	1	14.9	14.0	103.2	97.6	6.3

FPE

Elev. (m)	Node No.	Elem No.	Shear X-dir. (MN)	Shear Y-dir. (MN)	Moment X-dir. (MN-m)	Moment Y-dir. (MN-m)	Torsion (MN-m)
8.25	405	402,			1.1	3.1	
4.65	404	401	2.1	2.1	6.6	7.4	2.7

(b) DCD Rev.5

FWS

Elev. (m)	Node No.	Elem No.	Shear X-dir. (MN)	Shear Y-dir. (MN)	Moment X-dir. (MN-m)	Moment Y-dir. (MN-m)	Torsion (MN-m)
19.70	10				4.3	7.0	
		9	4.6	5.1	14.2	19.3	0.7
17.25	9				22.1	26.7	
		8	11.1	12.1	39.0	46.9	2.2
15.53	8				45.4	57.2	
		7	15.5	16.5	70.7	84.4	3.6
13.81	7				76.1	92.3	
		6	19.3	20.1	107.5	124.5	4.9
12.10	6				111.3	128.4	
		5	22.8	23.8	133.8	152.9	5.8
11.00	5				136.4	157.0	
		4	24.6	25.3	163.4	184.2	6.4
9.90	4				165.6	187.5	
		3	26.1	26.6	194.2	216.5	6.9
8.81	3				197.0	220.6	
		2	43.3	45.5	278.9	295.0	7.5
6.73	2				280.9	298.7	
4.65	1	1	45.3	48.0	366.2	375.3	8.1

FPE

Elev. (m)	Node No.	Elem No.	Shear X-dir. (MN)	Shear Y-dir. (MN)	Moment X-dir. (MN-m)	Moment Y-dir. (MN-m)	Torsion (MN-m)
8.25	405	402,			2.2	9.7	
4.65	404	401	8.1	7.4	27.7	27.0	15.1

(c) Ratio with DCD Rev.5 ((a)/(b))

FWS

Elev. (m)	Node No.	Elem No.	Shear X-dir.	Shear Y-dir.	Moment X-dir.	Moment Y-dir.	Torsion (MN-m)
19.70	10				16%	12%	
		9	22%	20%	19%	15%	74%
17.25	9				16%	16%	
		8	23%	21%	19%	18%	74%
15.53	8				18%	17%	
		7	24%	22%	20%	18%	74%
13.81	7				19%	18%	
		6	25%	23%	21%	20%	75%
12.10	6				21%	19%	
		5	24%	23%	22%	21%	75%
11.00	5				22%	20%	
		4	25%	24%	22%	21%	76%
9.90	4				22%	21%	
		3	26%	25%	23%	21%	77%
8.81	3				22%	21%	
		2	32%	29%	26%	24%	78%
6.73	2				26%	24%	
4.65	1	1	33%	29%	28%	26%	78%

FPE

Elev. (m)	Node No.	Elem No.	Shear X-dir.	Shear Y-dir.	Moment X-dir.	Moment Y-dir.	Torsion (MN-m)
8.25	405	402,			52%	33%	
4.65	404	401	26%	28%	24%	27%	18%

Table 3.7-63(3) CB Vertical Acceleration

(a) Structure-Structure Analysis				(b) DCD Rev.5				(c) Ratio with DCD Rev.5 ((a)/(b))			
Elevation (m)	Node No.	Stick Model	Max. Vertical Acceleration (g)	Elevation (m)	Node No.	Stick Model	Max. Vertical Acceleration (g)	Elevation (m)	Node No.	Stick Model	Max. Vertical Acceleration (g)
13.80	6	CB	0.43	13.80	6	CB	1.00	13.80	6	CB	43%
9.06	5	CB	0.41	9.06	5	CB	0.86	9.06	5	CB	48%
4.65	4	CB	0.40	4.65	4	CB	0.74	4.65	4	CB	54%
-2.00	3	CB	0.37	-2.00	3	CB	0.56	-2.00	3	CB	66%
-7.40	2	CB	0.36	-7.40	2	CB	0.51	-7.40	2	CB	71%
-10.40	1	CB	0.36	-10.40	1	CB	0.51	-10.40	1	CB	71%
13.50	9001	Oscillator	0.89	13.50	9001	Oscillator	2.19	13.50	9001	Oscillator	41%
	9002	Oscillator	0.55		9002	Oscillator	1.34		9002	Oscillator	41%
	9003	Oscillator	0.58		9003	Oscillator	1.43		9003	Oscillator	41%
9.06	9101	Oscillator	0.81	9.06	9101	Oscillator	2.00	9.06	9101	Oscillator	41%
	9102	Oscillator	0.48		9102	Oscillator	1.26		9102	Oscillator	38%
	9103	Oscillator	0.53		9103	Oscillator	1.43		9103	Oscillator	37%
4.65	9201	Oscillator	0.45	4.65	9201	Oscillator	1.30	4.65	9201	Oscillator	35%
	9202	Oscillator	0.49		9202	Oscillator	1.43		9202	Oscillator	34%
-2.00	9301	Oscillator	0.41	-2.00	9301	Oscillator	1.39	-2.00	9301	Oscillator	30%

Table 3.7-63(4) CB Seismic Forces

(a) Structure-Structure Analysis

Elev. (m)	Node No.	Elem No.	Shear X-Dir. (MN)	Shear Y-Dir. (MN)	Moment X-Dir. (MN-m)	Moment Y-Dir. (MN-m)	Torsion (MN-m)
13.80	6				29	26	
		6	10.6	12.7	59	59	8.8
9.06	5				73	81	
		5	20.7	24.0	158	175	20.3
4.65	4				71	96	
		4	40.4	45.8	311	274	25.2
-2.00	3				112	145	
-7.40	2	3	74.5	84.9	466	514	40.8

(b) DCD Rev.5

Elev. (m)	Node No.	Elem No.	Shear X-Dir. (MN)	Shear Y-Dir. (MN)	Moment X-Dir. (MN-m)	Moment Y-Dir. (MN-m)	Torsion (MN-m)
13.80	6				160	124	
		6	33.1	29.1	250	197	73.2
9.06	5				360	275	
		5	53.3	54.8	573	443	127.8
4.65	4				723	540	
		4	75.6	80.1	1136	988	178.2
-2.00	3				1232	1036	
-7.40	2	3	124.4	99.4	1570	1525	248.2

(c) Ratio with DCD Rev.5 ((a)/(b))

Elev. (m)	Node No.	Elem No.	Shear X-Dir. (MN)	Shear Y-Dir. (MN)	Moment X-Dir. (MN-m)	Moment Y-Dir. (MN-m)	Torsion
13.80	6				18%	21%	
		6	32%	44%	24%	30%	12%
9.06	5				20%	29%	
		5	39%	44%	28%	40%	16%
4.65	4				10%	18%	
		4	53%	57%	27%	28%	14%
-2.00	3				9%	14%	
-7.40	2	3	60%	85%	30%	34%	16%

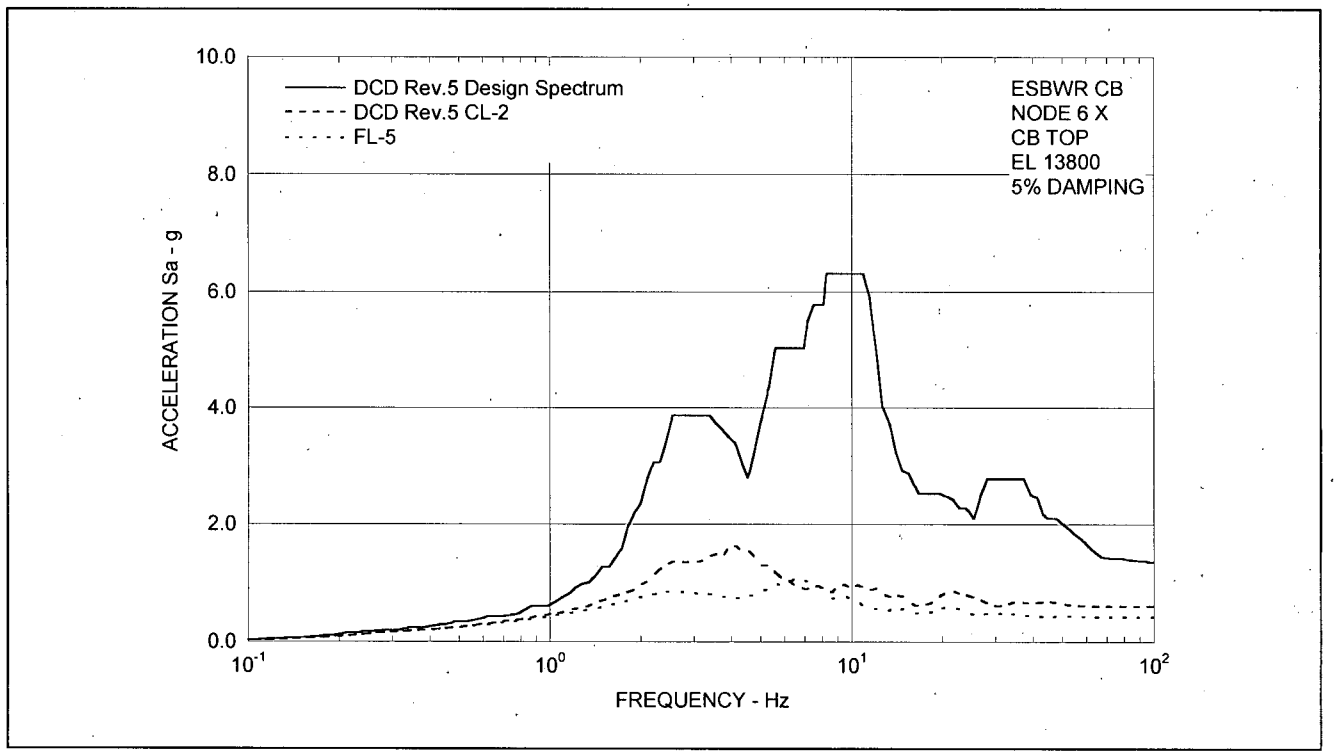


Figure 3.7-63(9) FRS (Effect of Structure-Structure Interaction) – CB Top X

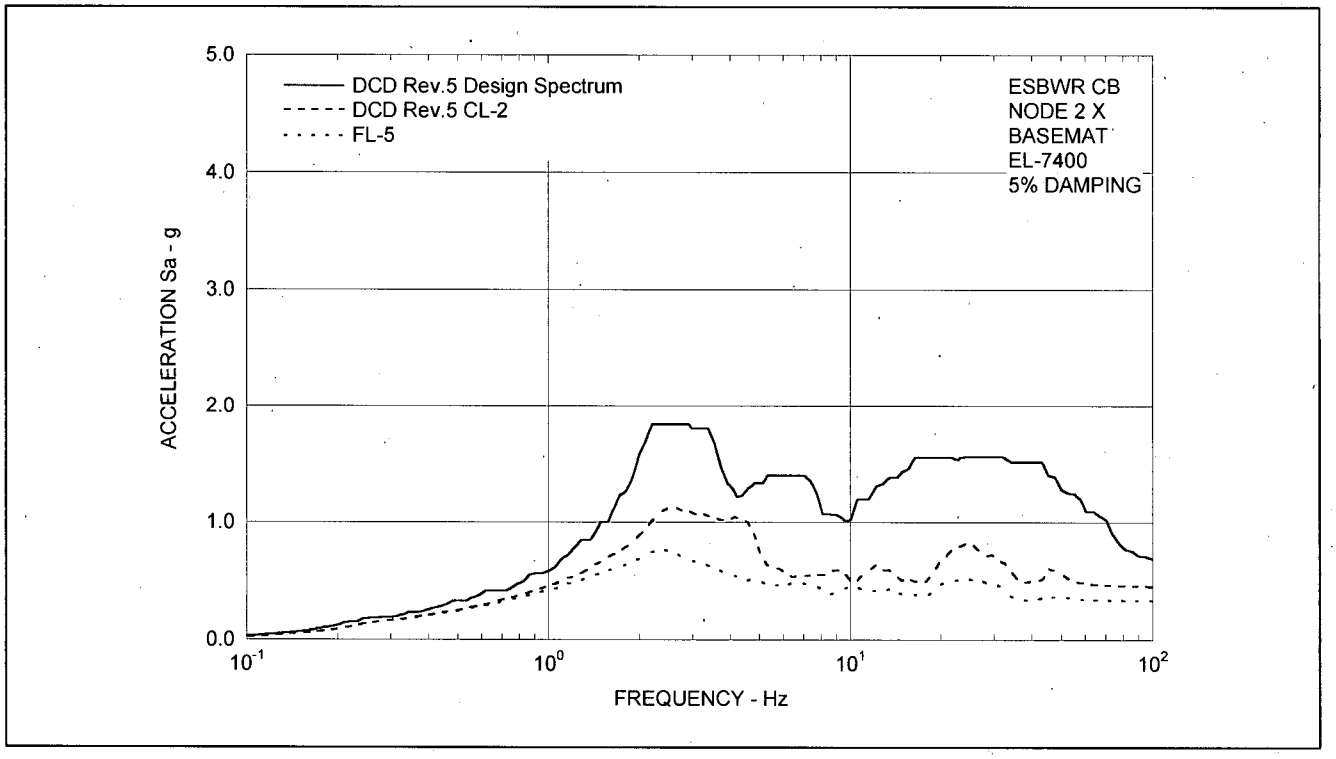


Figure 3.7-63(10) FRS (Effect of Structure-Structure Interaction) – CB Basemat X

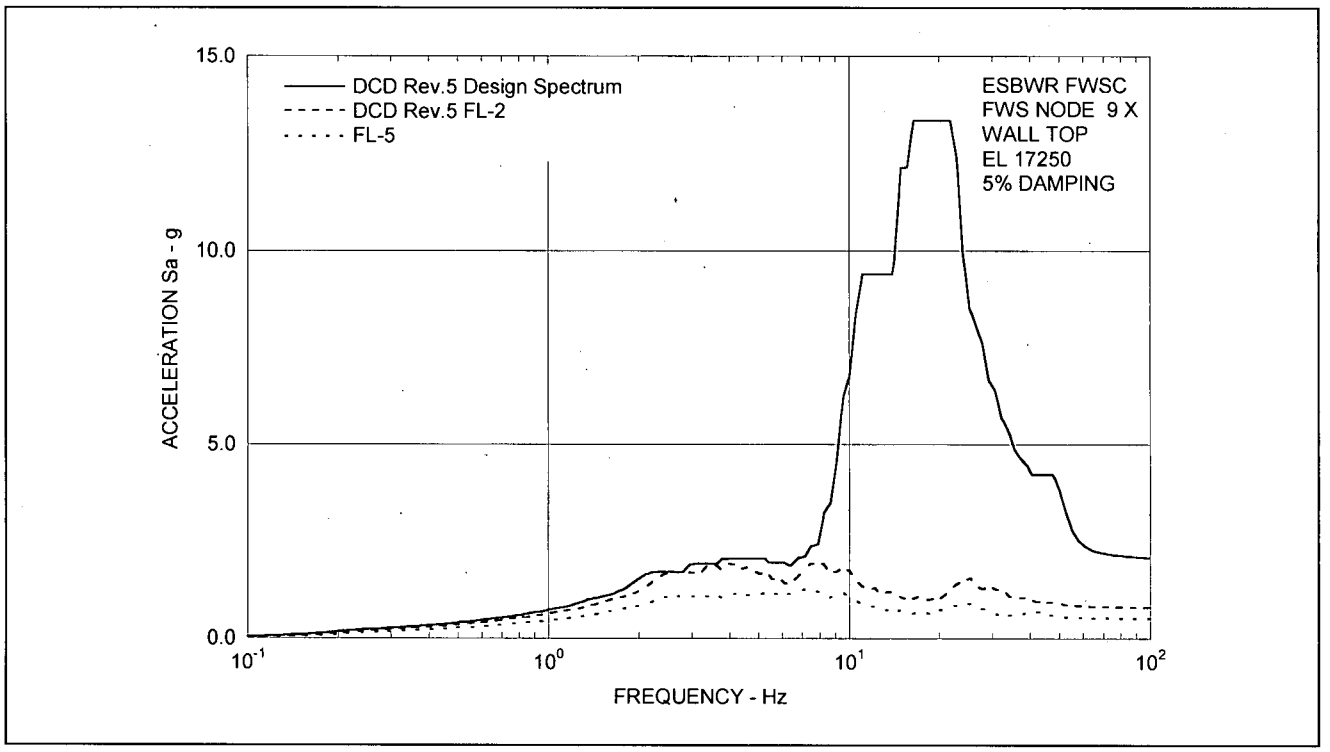


Figure 3.7-63(11) FRS (Effect of Structure-Structure Interaction) – FWS Wall Top X

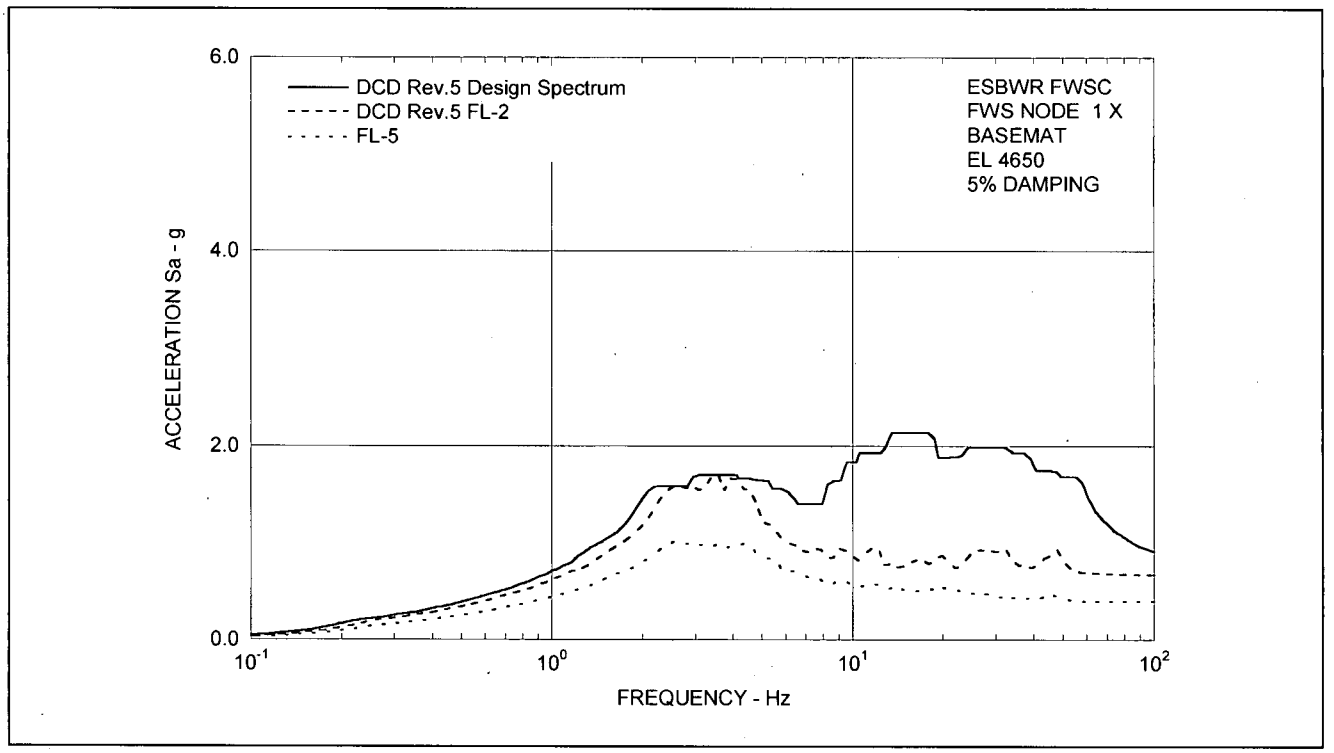


Figure 3.7-63(12) FRS (Effect of Structure-Structure Interaction) – FWS Basemat X

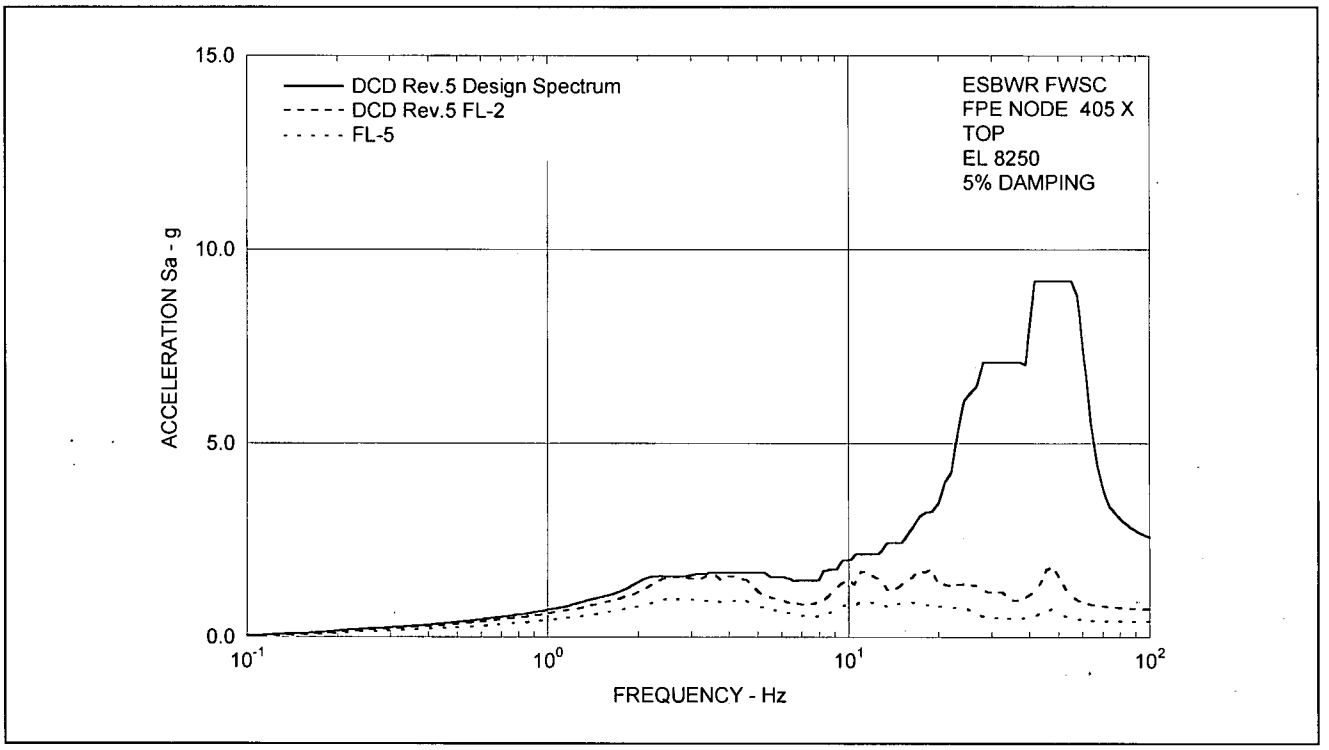


Figure 3.7-63(13) FRS (Effect of Structure-Structure Interaction) – FPE Top X

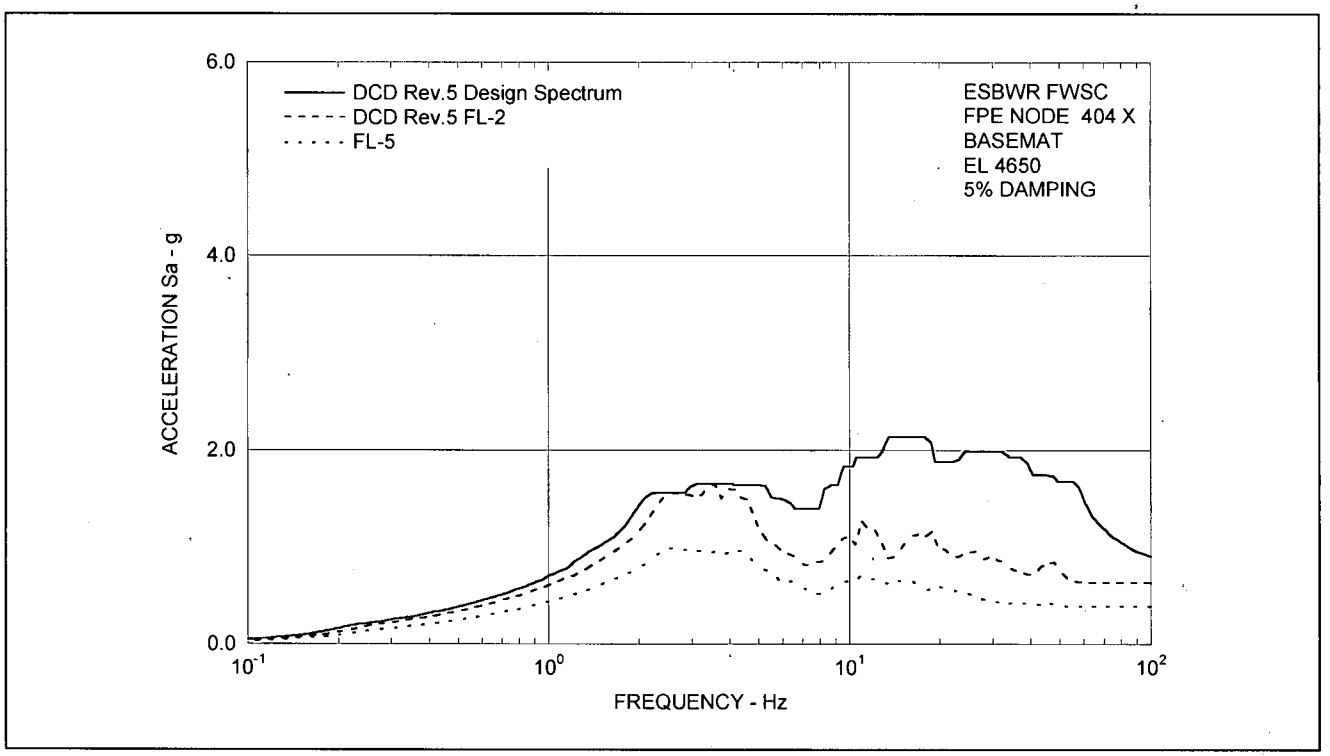


Figure 3.7-63(14) FRS (Effect of Structure-Structure Interaction) – FPE Basemat X

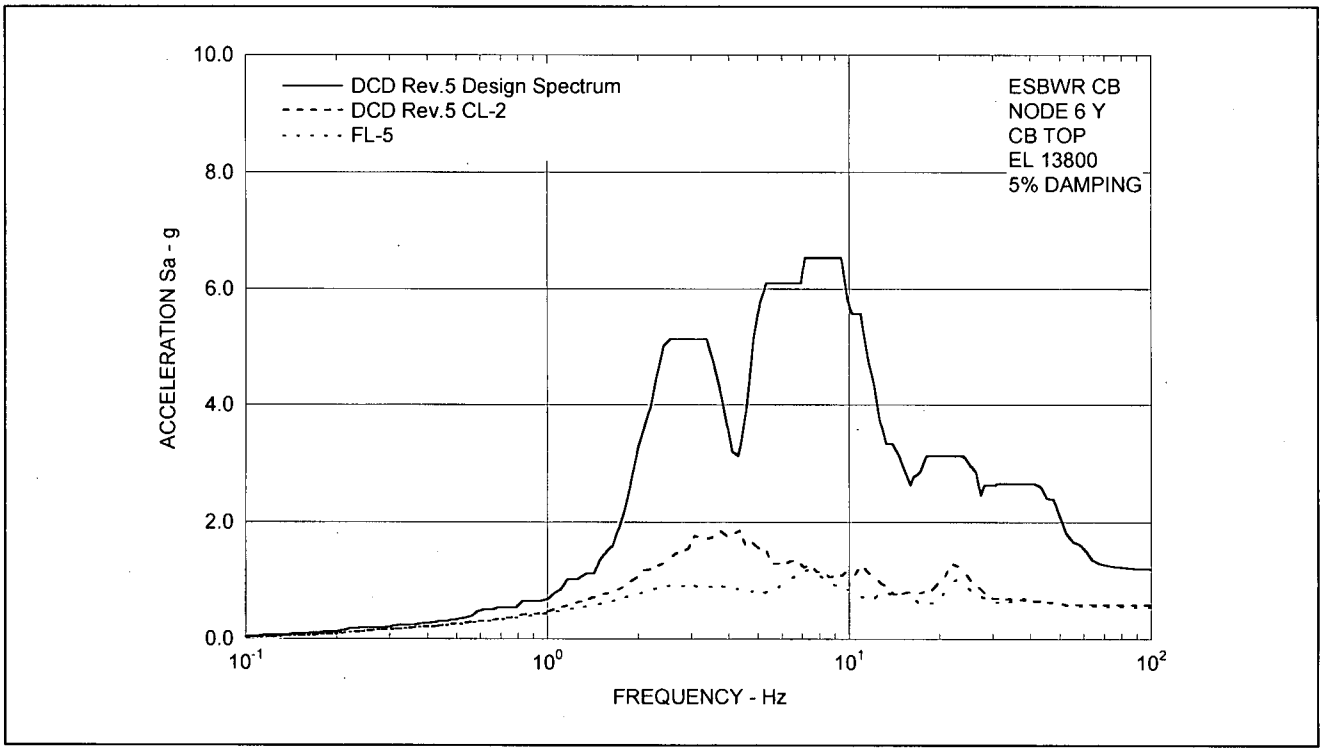


Figure 3.7-63(15) FRS (Effect of Structure-Structure Interaction) – CB Top Y

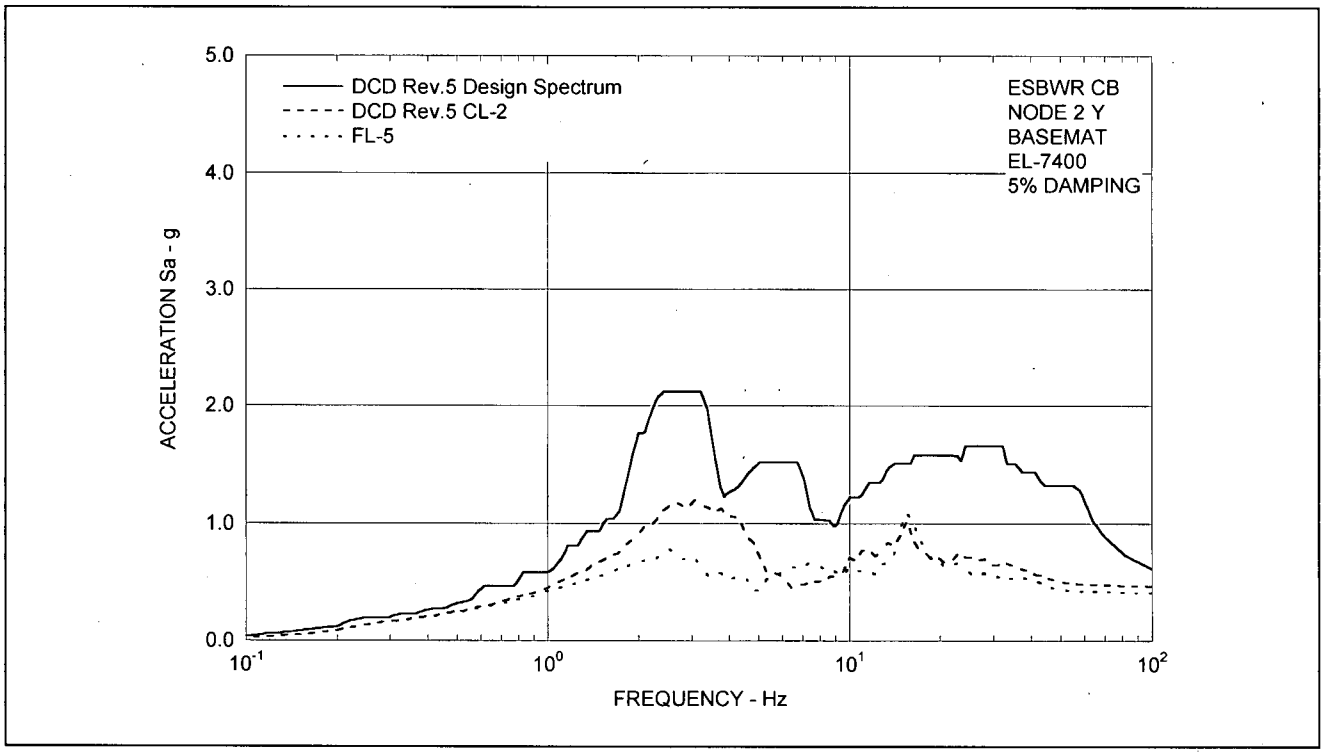


Figure 3.7-63(16) FRS (Effect of Structure-Structure Interaction) – CB Basemat Y

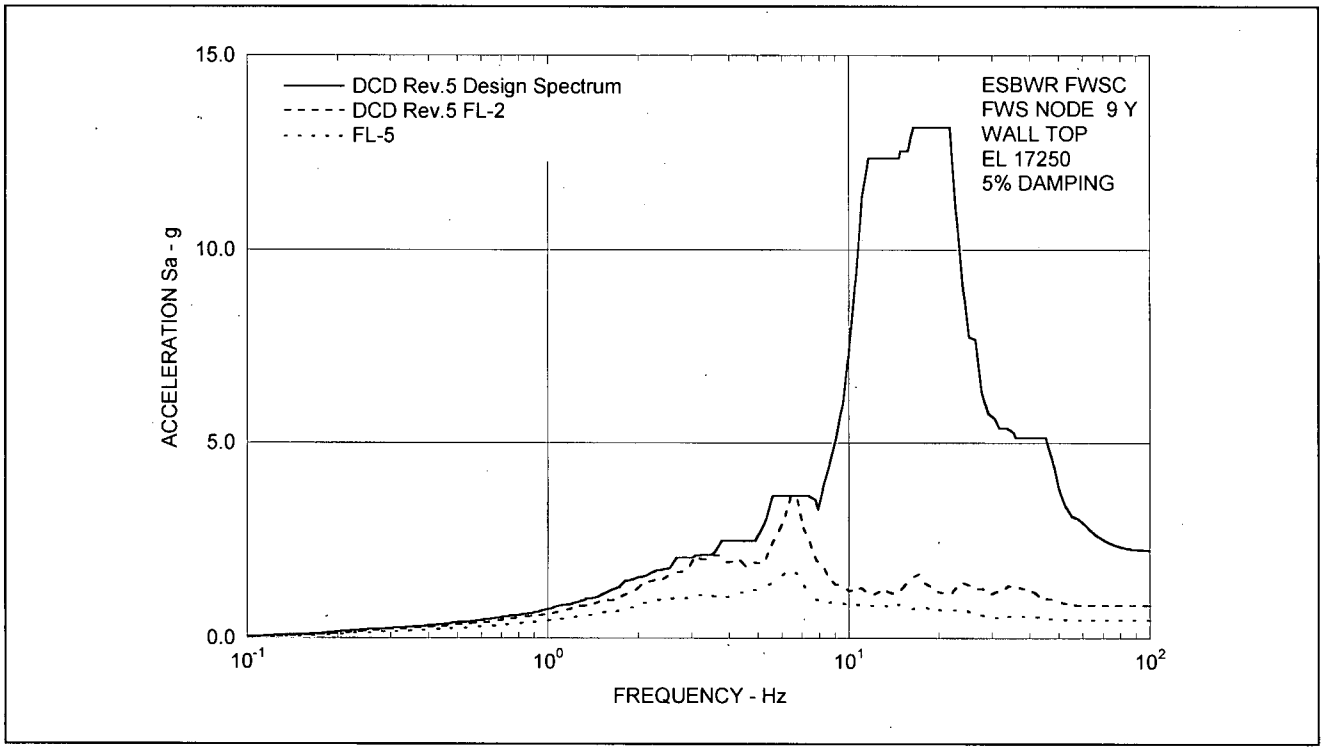


Figure 3.7-63(17) FRS (Effect of Structure-Structure Interaction) – FWS Wall Top Y

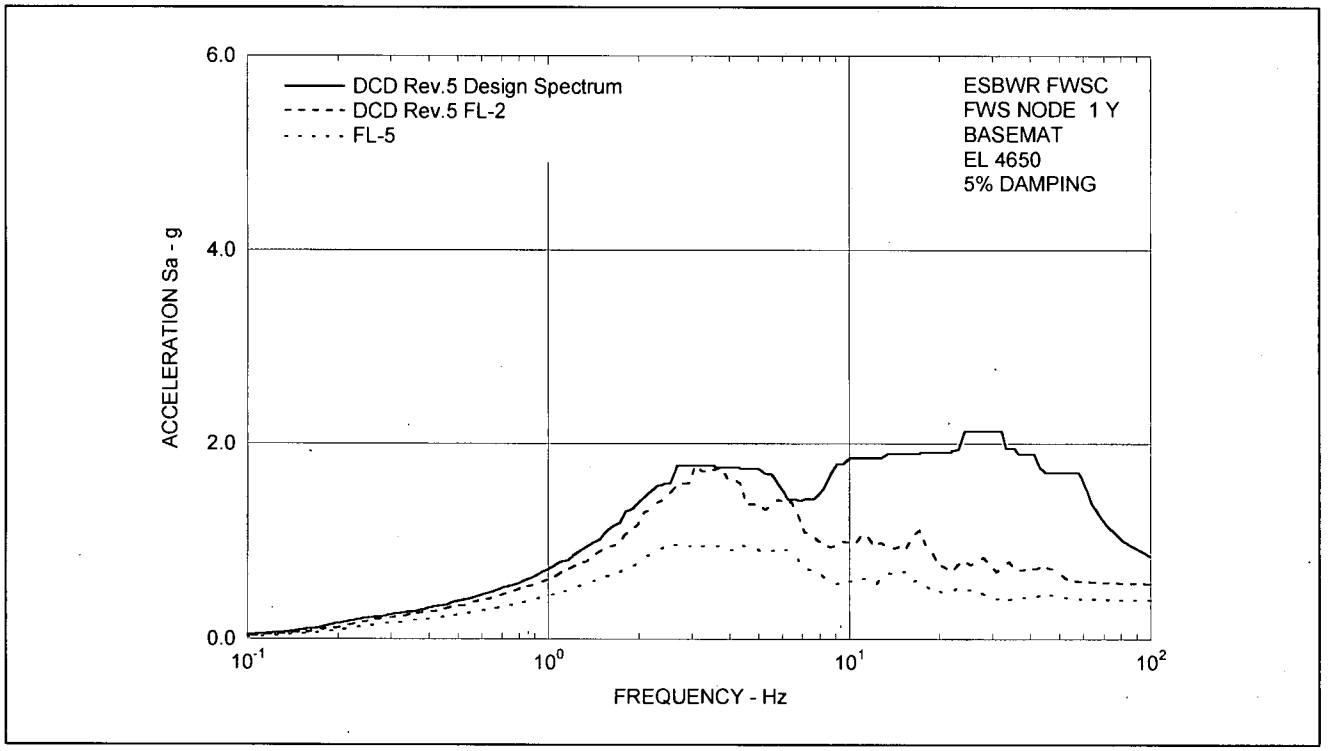


Figure 3.7-63(18) FRS (Effect of Structure-Structure Interaction) – FWS Basemat Y

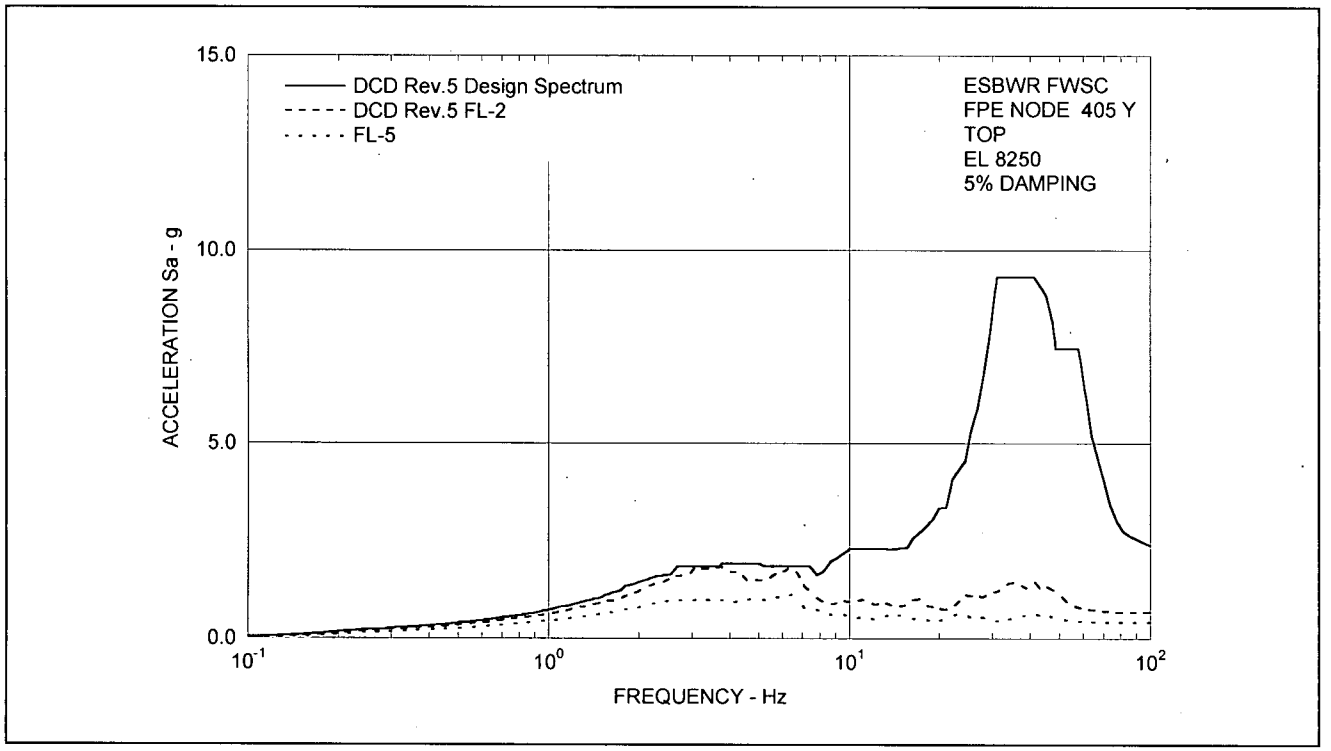


Figure 3.7-63(19) FRS (Effect of Structure-Structure Interaction) – FPE Top Y

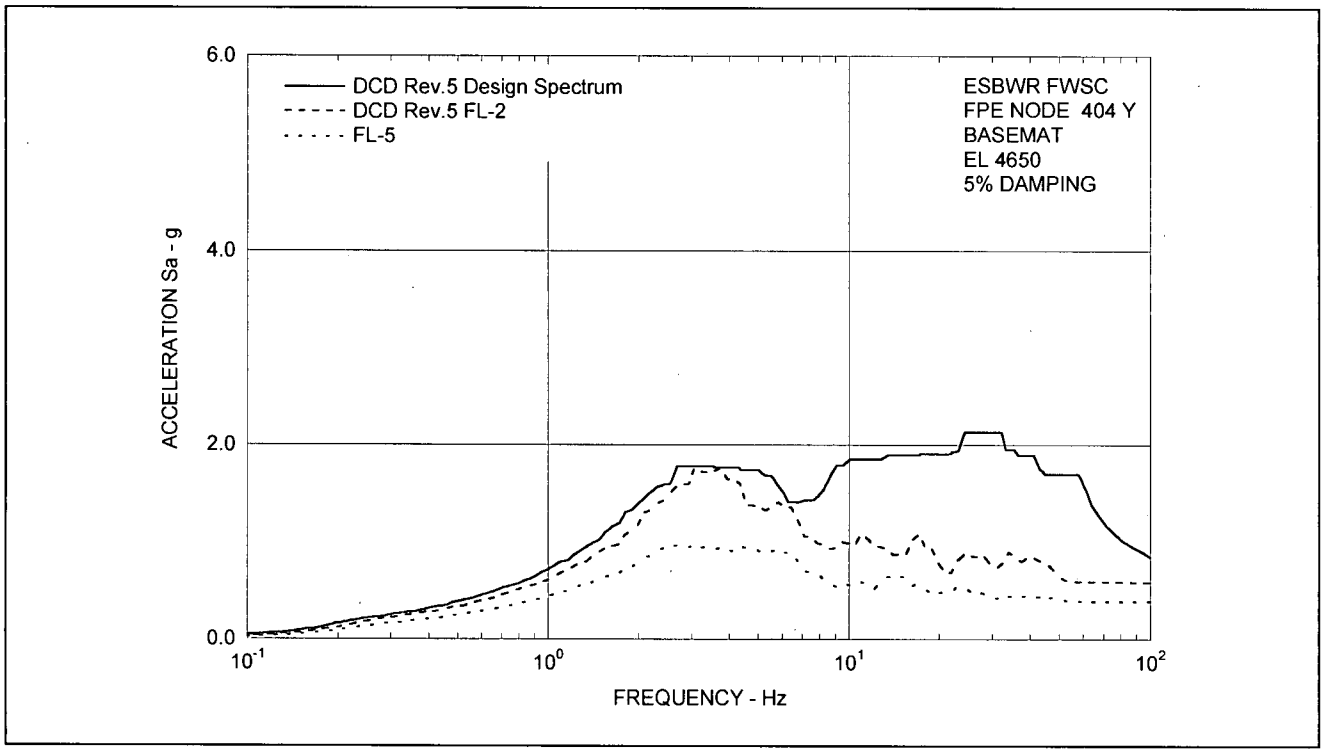


Figure 3.7-63(20) FRS (Effect of Structure-Structure Interaction) – FPE Basemat Y

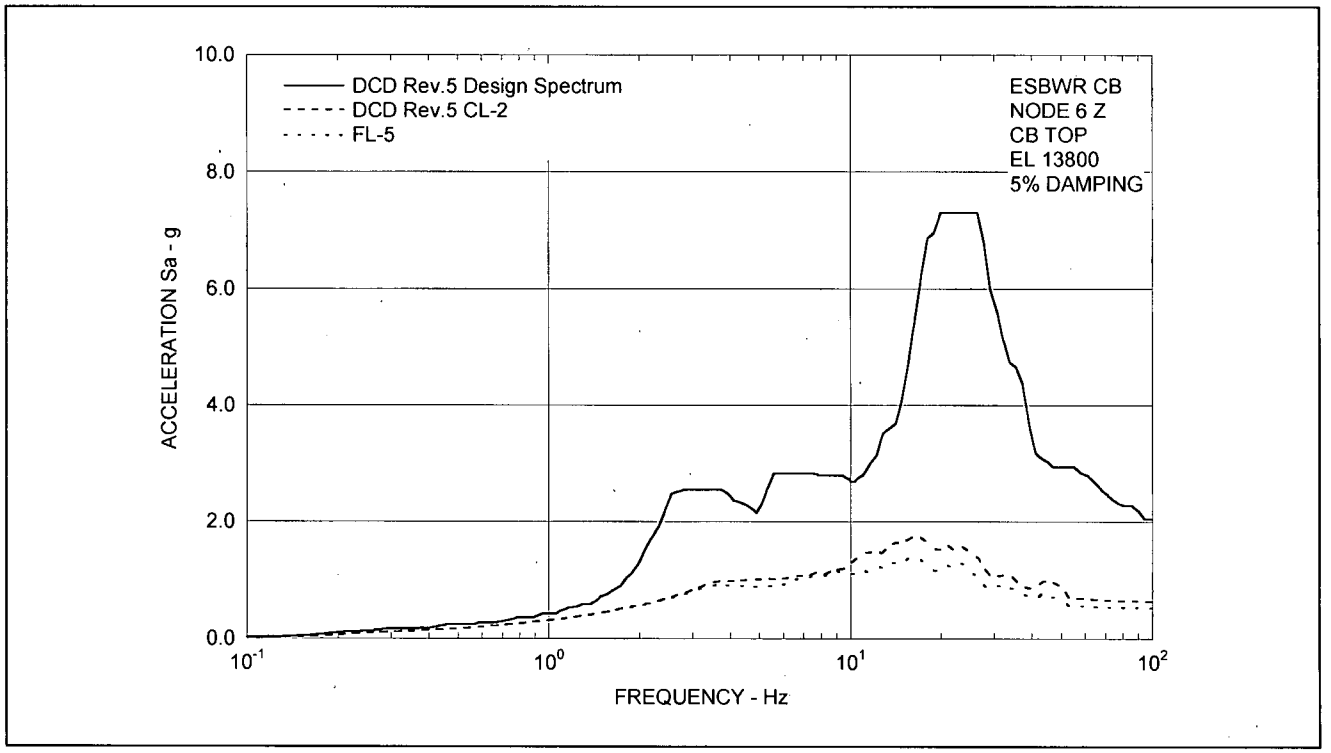


Figure 3.7-63(21) FRS (Effect of Structure-Structure Interaction) – CB Top Z

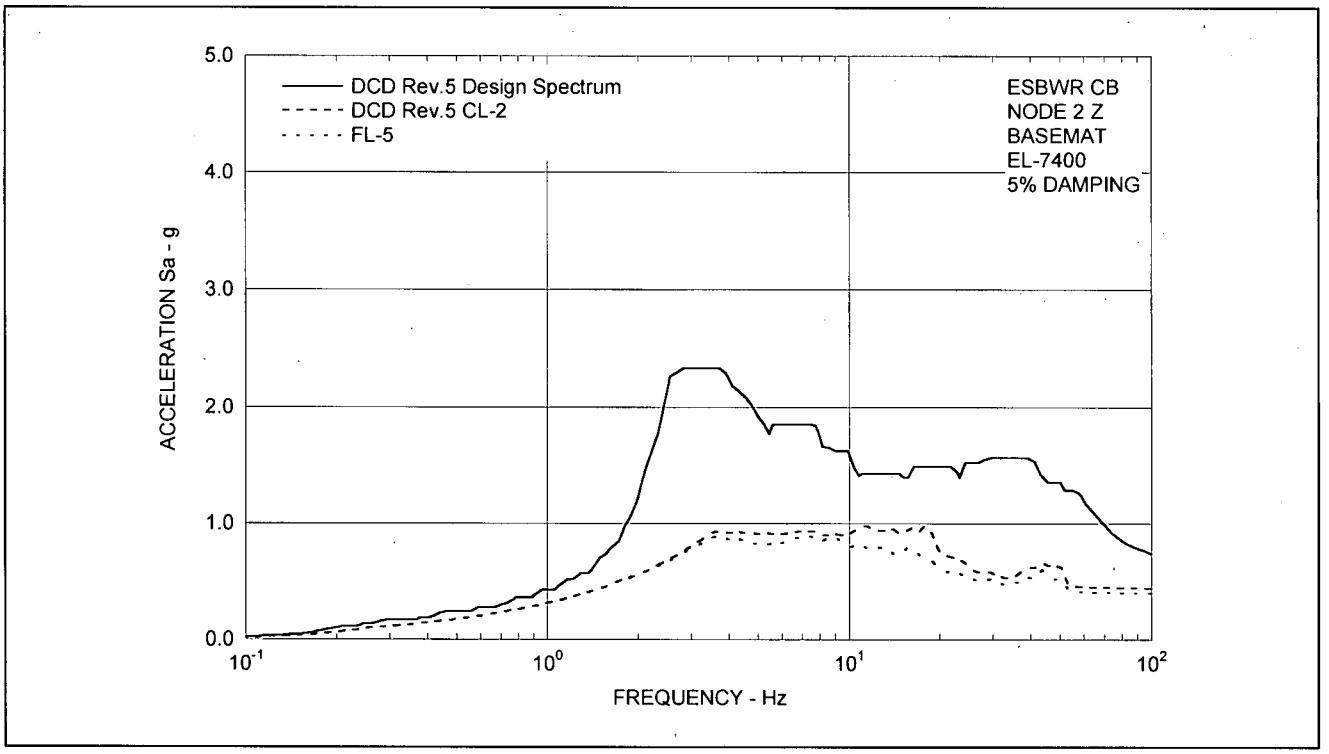


Figure 3.7-63(22) FRS (Effect of Structure-Structure Interaction) – CB Basemat Z

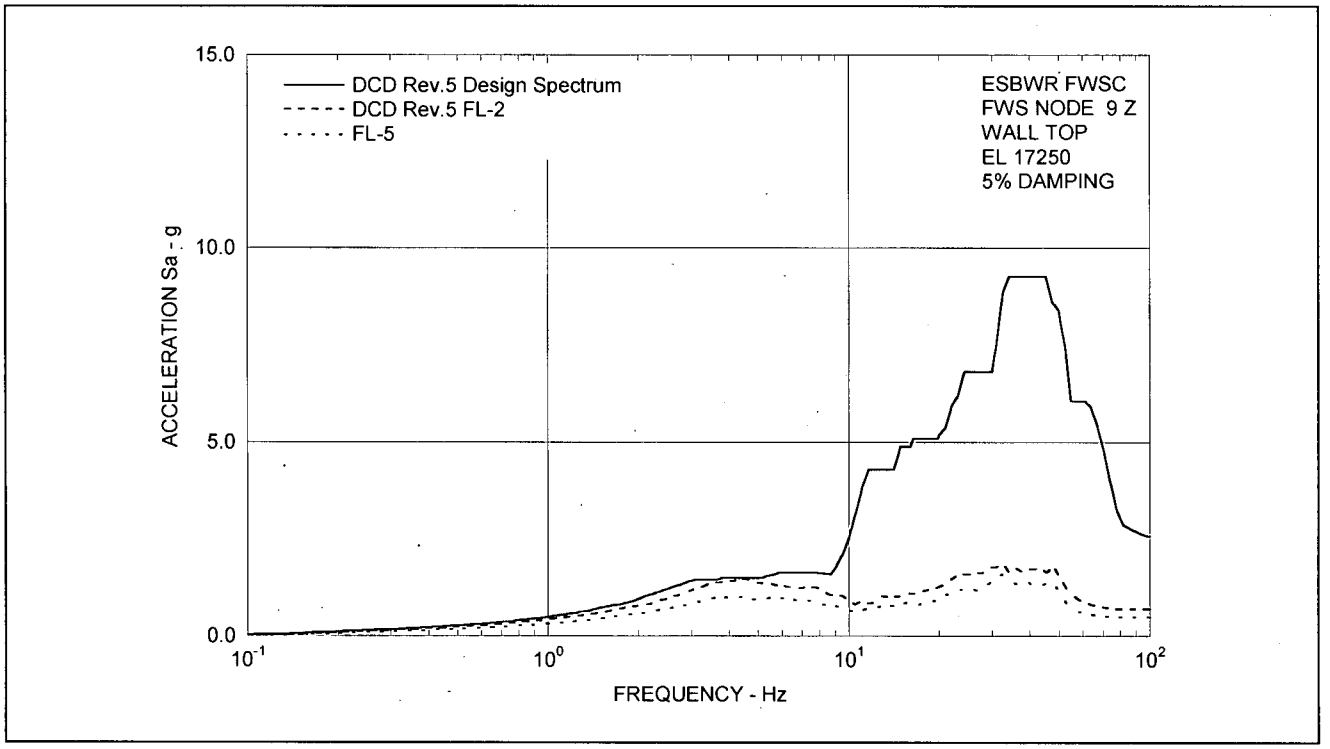


Figure 3.7-63(23) FRS (Effect of Structure-Structure Interaction) – FWS Wall Top Z

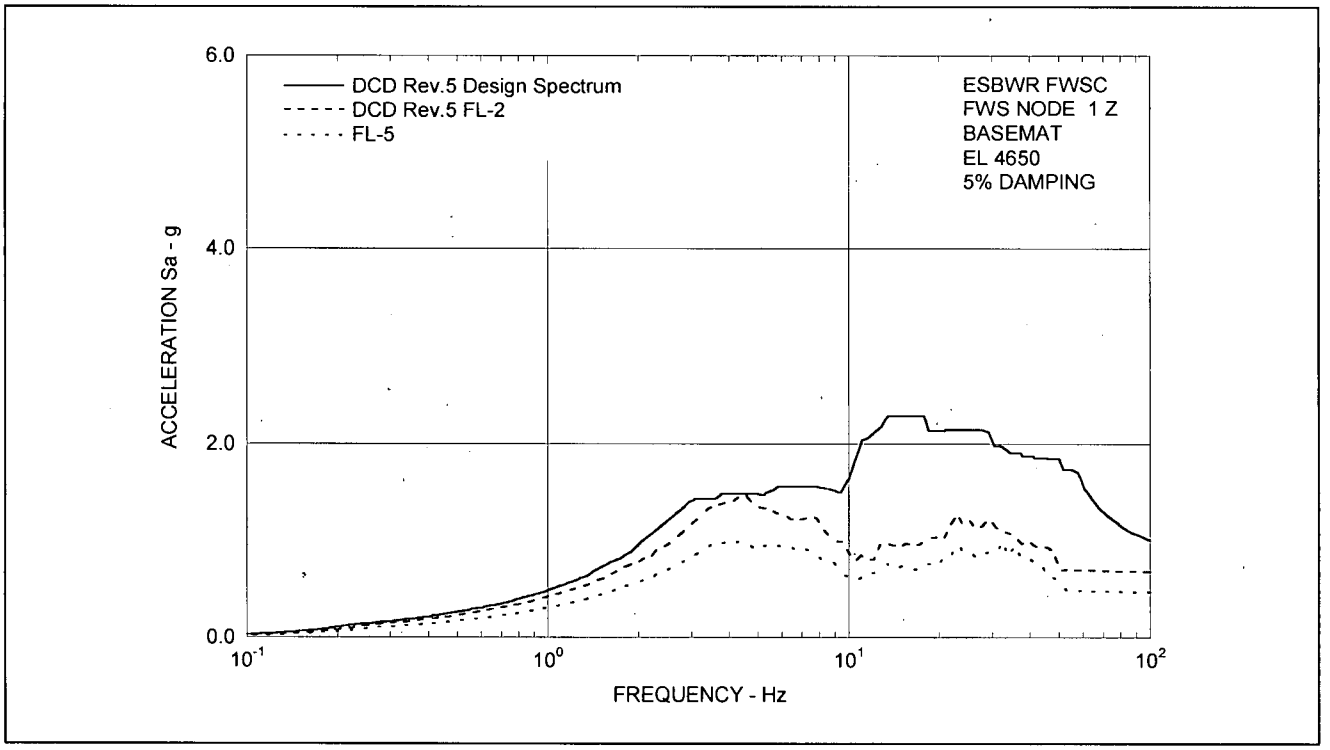


Figure 3.7-63(24) FRS (Effect of Structure-Structure Interaction) – FWS Basemat Z

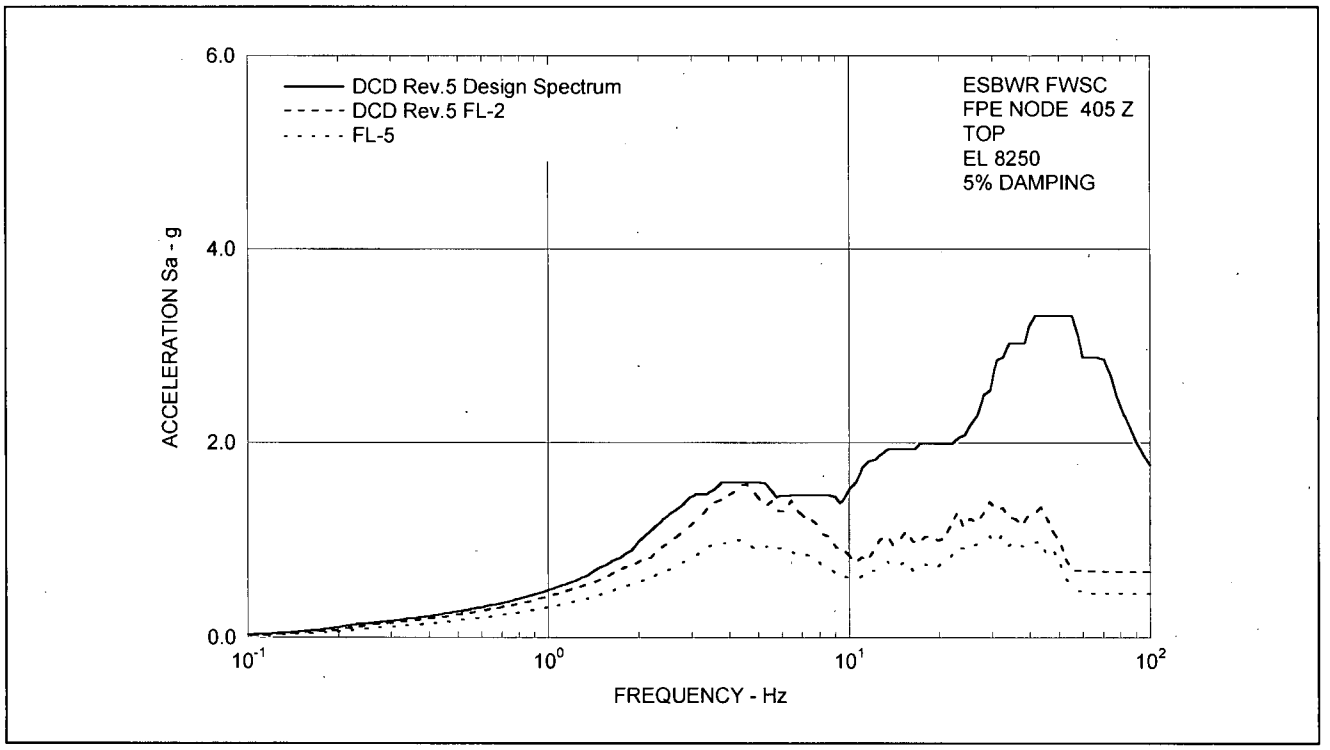


Figure 3.7-63(25) FRS (Effect of Structure-Structure Interaction) – FPE Top Z

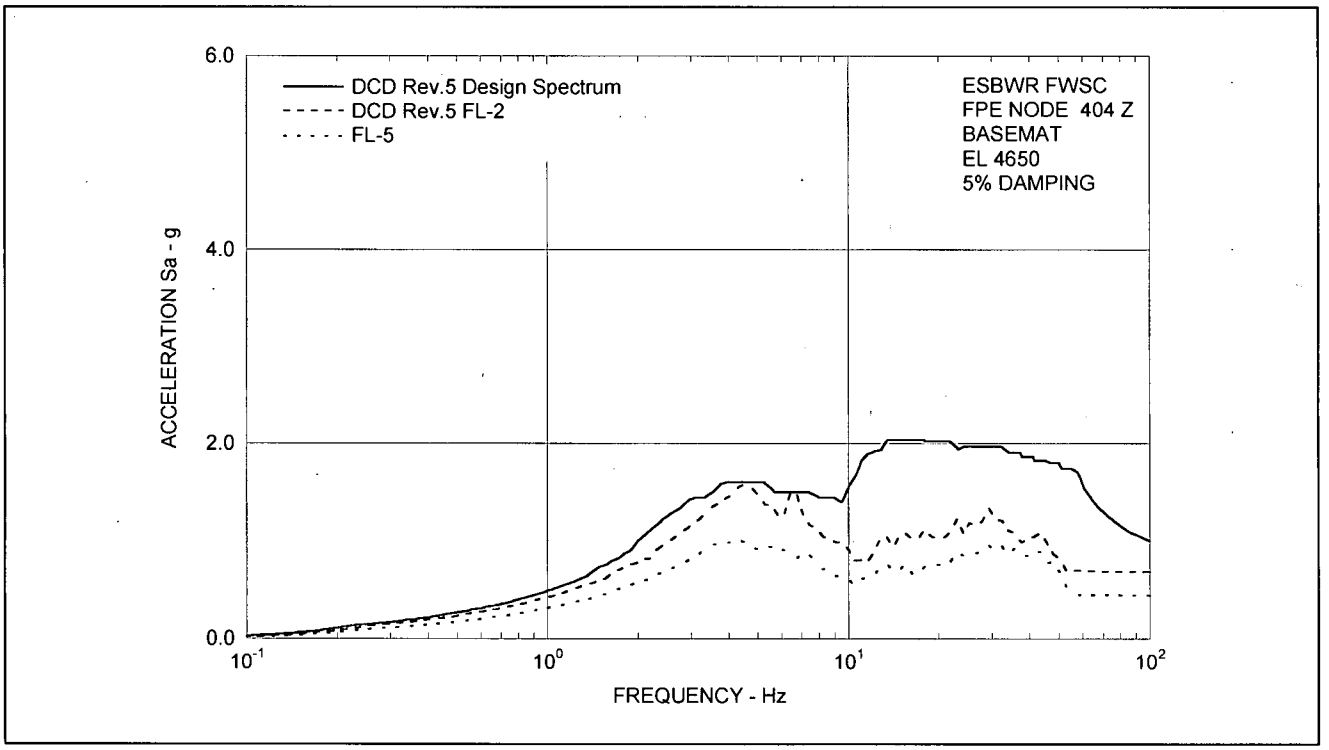


Figure 3.7-63(26) FRS (Effect of Structure-Structure Interaction) – FPE Basemat Z

DCD Impact

DCD Tier 2 Subsections 3A.1, 3A.6, 3A.8.11, 3G.4.5.4, DCD Tier 2 Tables 3A.6-1, 3G.4-10 through 3G.4-21 and DCD Tier 2 Figure 3G.4-1 will be revised in Revision 6 as noted in the attached markups.

DCD Tier 2 Figures 3A.8.11-7 through 3A.8.11-24 will be added in Revision 6 as noted in the attached markups.

through 3G.4-15 show the combined forces and moments in accordance with the selected load combinations listed in Table 3G.4-6.

Table 3G.4-16 lists the sectional thicknesses and rebar ratios used in the evaluation. The values are retrieved from the outline drawings shown in Figure 3G.4-1.

Tables 3G.4-17 through 3G.4-~~24~~-20 compares the rebar and concrete stresses at these sections for the representative elements with the allowable stresses, which are conservatively taken to be the more limiting of ACI 349-01 and ASME Section III Division 2. Table 3G.4-21 summarizes evaluation results for transverse shear in accordance with ACI 349, Chapter 11.

3G.4.5.4.1 Shear Walls

The maximum rebar stress of ~~330.2~~264.5 MPa (~~47.89~~38.36 ksi) is found in the vertical_rebar of FWS cylindrical wall due to the load combination FWSC-6 as shown in Table 3G.4-19. The maximum horizontal_rebar stress is found to be ~~154.1~~155.4 MPa (~~22.35~~22.54 ksi) in FWS cylindrical wall due to the load combination FWSC-6. The maximum transverse shear force is found to be ~~0.525~~0.563 MN/m (~~3.00~~3.21 kips/in) against the shear strength of ~~1.594~~1.550 MN/m (~~9.10~~8.85 kips/in) in the FWS cylindrical wall.

As for the FPE, the maximum rebar stress of ~~224.8~~238.7 MPa (~~32.61~~34.62 ksi) is found in the horizontal rebar of east wall due to the load combination FWSC-6. The maximum vertical rebar stress is found to be ~~191.8~~200.9 MPa (~~27.82~~29.14 ksi) in east wall in the same load combination. The maximum transverse shear force is found to be ~~0.691~~0.730 MN/m (~~3.95~~4.17 kips/in) against the shear strength of ~~1.322~~1.313 MN/m (~~7.55~~7.50 kips/in).

3G.4.5.4.2 Roof Floor Slabs

As for the FPE roof slab, the maximum rebar stress of ~~252.3~~260.7 MPa (~~36.59~~37.81 ksi) is found due to the load combination FWSC-6 as shown in Table 3G.4-19. The maximum transverse shear force is found to be ~~0.231~~0.237 MN/m (~~1.32~~1.35 kips/in) against the shear strength of ~~0.363~~0.364 MN/m (~~2.07~~2.08 kips/in) in the roof of FPE.

On the FWS roof slab, the maximum rebar stress of ~~193.2~~191.8 MPa (~~28.02~~27.82 ksi) is found due to the load combination FWSC-6. The maximum transverse shear force is found to be ~~0.105~~0.103 MN/m (~~0.60~~0.59 kips/in) against the shear strength of ~~0.389~~0.399 MN/m (~~2.22~~2.28 kips/in).

3G.4.5.4.3 Foundation Mat

The maximum rebar stress is found to be ~~293.7~~294.4 MPa (~~42.60~~42.70 ksi) due to the load combination FWSC-6 as shown in Table 3G.4-19. The maximum transverse shear force is found to be ~~2.616~~2.674 MN/m (~~14.94~~15.27 kips/in) against the shear strength of ~~4.454~~4.452 MN/m (~~25.43~~25.42 kips/in).

3G.4.5.4.4 Shear Key

The maximum rebar stress of ~~74.9~~81.9 MPa (~~10.86~~11.88 ksi) is found in the horizontal rebar of shear key due to the load combination FWSC-6 as shown in Table 3G.4-19. The maximum vertical rebar stress is found to be ~~65.7~~68.0 MPa (~~9.53~~9.86 ksi) in the same load combination. The maximum transverse shear force is found to be ~~0.374~~0.376 MN/m (~~2.14~~2.15 kips/in) against the shear strength of ~~1.247~~1.253 MN/m (~~7.12~~7.15 kips/in).

Table 3G.4-10

Results of NASTRAN Analysis: Seismic Load (Horizontal: West~~East~~ to ~~West~~East Direction)

Location	Element ID	Nx (MN/m)	Ny (MN/m)	Nxy (MN/m)	Mx (MNm/m)	My (MNm/m)	Mxy (MNm/m)	Qx (MN/m)	Qy (MN/m)
Basemat EL 4.65	18	0.800	0.595	0.472	1.071	-0.398	-0.681	0.524	0.306
	227	-0.010	0.186	1.103	-0.105	-0.555	-1.480	0.412	0.297
	237	-0.135	-0.546	0.240	1.105	1.704	-1.255	-1.153	0.983
	16085	0.067	0.055	-0.142	-0.441	-0.396	-0.583	-0.156	0.043
Roof of FPE EL 8.25	51556	0.082	0.035	-0.085	-0.009	-0.007	-0.008	-0.001	0.010
	51558	0.021	-0.112	-0.268	0.009	0.004	-0.014	-0.010	-0.010
	51576	0.827	-0.008	0.031	-0.033	-0.073	0.002	-0.001	0.027
	51578	0.249	-0.109	-0.015	0.014	-0.023	0.003	-0.033	0.031
Roof of Tank	26007	-0.004	0.004	0.037	0.000	-0.001	-0.001	0.000	-0.003
	26079	0.202	0.065	0.082	0.003	0.002	0.002	-0.003	0.014
	26082	0.126	0.074	0.140	-0.011	-0.003	0.006	-0.012	0.011
	26085	-0.116	0.069	0.091	0.004	0.001	0.001	0.002	0.004
South Wall of FPE	66004	-0.132	0.151	-0.153	-0.006	-0.019	0.006	0.002	-0.015
	66006	-0.367	0.296	0.628	-0.028	-0.088	0.002	-0.003	-0.125
	66024	-0.181	0.015	0.142	0.003	0.011	-0.003	-0.007	-0.015
East Wall of FPE	67004	0.294	-0.447	-0.157	-0.035	-0.180	0.001	-0.004	-0.108
	67006	0.374	-0.117	-0.863	-0.008	-0.099	-0.001	-0.040	-0.122
	67024	1.030	-0.143	-0.112	0.011	0.045	0.005	0.004	-0.104
Wall of South Tank	35007	-0.982	-1.785	0.030	-0.003	0.317	-0.022	-0.025	0.356
	35010	-0.396	-2.459	-0.962	0.121	0.371	-0.016	0.027	0.264
	36507	0.770	-0.853	0.028	-0.079	-0.092	0.005	-0.014	-0.036
	36510	0.591	-1.094	-0.891	0.058	-0.019	-0.006	-0.015	-0.005
	38507	0.576	-0.266	0.082	-0.025	-0.037	0.016	0.005	-0.033
	38510	0.501	-0.250	-0.181	0.009	-0.025	0.011	0.002	0.014
	45001	0.183	0.655	-1.590	-0.032	-0.096	0.021	0.032	-0.066
	46501	-0.142	0.304	-1.419	-0.021	0.001	-0.023	0.018	0.001
	48501	-0.124	0.064	-0.362	-0.005	0.006	-0.018	-0.005	-0.007
Shear Key	72008	0.258	0.178	-0.032	-0.013	0.000	0.021	0.015	0.002
	73017	-0.047	0.013	0.029	-0.025	0.219	-0.344	-0.085	-0.239

Table 3G.4-11

Results of NASTRAN Analysis: Seismic Load (Vertical: Upward Direction)

Location	Element ID	Nx (MN/m)	Ny (MN/m)	Nxy (MN/m)	Mx (MNm/m)	My (MNm/m)	Mxy (MNm/m)	Qx (MN/m)	Qy (MN/m)
Basemat EL 4.65	18	-0.236	0.036	0.135	0.943	-0.181	-0.154	0.252	0.113
	227	-0.084	-0.365	-0.358	0.152	-0.268	-0.261	0.677	0.092
	237	-0.221	-0.014	0.056	-0.064	-0.453	0.267	0.604	-0.349
	16085	-0.326	-0.406	-0.359	0.289	-0.190	-0.239	0.405	-0.026
Roof of FPE EL 8.25	51556	0.018	-0.053	-0.009	-0.079	-0.119	0.006	-0.006	-0.017
	51558	0.019	0.386	0.009	0.026	-0.031	0.016	-0.069	0.004
	51576	-0.508	0.044	-0.076	0.011	0.102	0.011	0.006	-0.113
	51578	-0.134	0.164	-0.091	0.001	0.030	0.035	0.012	-0.037
Roof of Tank	26007	0.344	0.307	0.010	-0.016	-0.016	0.000	0.001	0.000
	26079	-0.158	0.182	-0.043	0.001	0.039	-0.005	0.005	-0.044
	26082	0.033	-0.016	-0.191	0.023	0.020	-0.021	0.033	-0.031
	26085	0.098	-0.091	0.177	0.031	0.013	0.018	0.039	0.024
South Wall of FPE	66004	0.187	-0.009	-0.070	0.013	0.086	-0.002	-0.004	0.000
	66006	0.147	-0.255	-0.428	0.012	0.098	0.007	0.027	0.129
	66024	0.541	0.119	-0.029	0.014	0.091	-0.005	-0.004	-0.001
East Wall of FPE	67004	-0.357	0.551	0.144	0.012	0.084	-0.002	0.003	0.105
	67006	-0.493	-0.011	0.741	0.014	0.045	-0.002	0.003	0.071
	67024	-0.706	0.241	0.128	-0.030	-0.149	0.001	-0.001	0.109
Wall of South Tank	35007	-0.116	0.226	-0.103	-0.005	-0.126	0.004	0.012	-0.217
	35010	-0.212	0.719	0.009	-0.036	-0.159	-0.004	-0.012	-0.221
	36507	-0.773	0.317	-0.016	0.024	0.046	-0.002	0.004	0.041
	36510	-0.824	0.448	-0.016	-0.006	0.037	0.003	-0.003	0.034
	38507	-0.381	0.166	-0.002	0.007	0.020	-0.001	0.000	-0.063
	38510	-0.410	0.181	-0.022	0.001	0.021	-0.001	-0.001	-0.069
	45001	-0.170	0.472	-0.032	-0.006	-0.102	0.008	0.018	-0.200
	46501	-0.787	0.428	-0.007	0.016	0.038	-0.002	0.004	0.040
	48501	-0.425	0.187	0.006	0.004	0.020	-0.001	0.000	-0.070
Shear Key	72008	-0.225	-0.068	-0.221	-0.011	-0.010	0.002	0.000	0.005
	73017	0.888	-0.073	0.845	-0.008	-0.013	-0.009	-0.005	0.006

Location	Element ID	Nx (MN/m)	Ny (MN/m)	Nxy (MN/m)	Mx (MNm/m)	My (MNm/m)	Mxy (MNm/m)	Qx (MN/m)	Qy (MN/m)
Basemat EL 4.65	18	-0.144	0.035	0.075	0.600	-0.164	-0.094	0.162	0.104
	227	-0.037	-0.204	-0.256	0.106	-0.213	-0.170	0.406	0.044
	237	-0.124	0.013	0.096	-0.044	-0.332	0.158	0.396	-0.235
	16085	-0.010	-0.165	-0.209	-0.006	-0.179	-0.163	0.098	-0.063
Roof of FPE EL 8.25	51556	0.033	-0.016	-0.007	-0.083	-0.113	0.006	-0.008	-0.016
	51558	0.036	0.286	0.005	0.040	-0.024	0.015	-0.076	0.004
	51576	-0.319	0.054	-0.051	0.005	0.093	0.012	0.005	-0.107
	51578	-0.081	0.121	-0.057	0.008	0.027	0.034	0.004	-0.030
Roof of Tank	26007	0.343	0.309	0.010	-0.017	-0.017	0.000	0.001	0.000
	26079	-0.181	0.179	-0.045	0.002	0.045	-0.005	0.006	-0.048
	26082	0.017	-0.023	-0.194	0.026	0.023	-0.023	0.036	-0.033
	26085	0.087	-0.099	0.177	0.035	0.015	0.020	0.042	0.026
South Wall of FPE	66004	0.152	0.041	-0.054	0.007	0.046	-0.001	-0.004	-0.021
	66006	0.126	-0.119	-0.322	0.006	0.061	0.005	0.018	0.077
	66024	0.399	0.128	-0.024	0.016	0.099	-0.004	-0.002	-0.024
East Wall of FPE	67004	-0.223	0.423	0.090	0.009	0.069	-0.002	0.002	0.093
	67006	-0.310	0.049	0.474	0.011	0.036	-0.002	0.002	0.060
	67024	-0.447	0.213	0.081	-0.028	-0.141	0.002	-0.001	0.097
Wall of South Tank	35007	0.241	0.335	-0.066	0.006	-0.039	0.003	0.010	-0.046
	35010	0.169	0.653	0.008	-0.017	-0.063	-0.003	-0.008	-0.049
	36507	0.040	0.349	-0.010	0.013	0.009	-0.002	0.003	0.012
	36510	0.006	0.432	-0.009	-0.008	0.003	0.002	-0.002	0.007
	38507	-0.347	0.171	-0.001	0.008	0.034	0.000	0.000	-0.058
	38510	-0.364	0.180	-0.013	0.005	0.035	-0.001	0.000	-0.062
	45001	0.187	0.496	-0.010	0.004	-0.024	0.005	0.012	-0.034
	46501	0.031	0.418	-0.005	0.007	0.004	-0.002	0.002	0.011
	48501	-0.374	0.183	0.004	0.007	0.034	0.000	0.000	-0.062
Shear Key	72008	-0.111	-0.058	-0.038	-0.007	-0.006	0.002	0.000	0.003
	73017	0.558	-0.001	0.603	-0.005	-0.008	-0.006	-0.003	0.004

Table 3G.4-12

Combined Forces and Moments: Selected Load Combination FWSC-3

Location	Element ID		Nx (MN/m)	Ny (MN/m)	Nxy (MN/m)	Mx (MNm/m)	My (MNm/m)	Mxy (MNm/m)	Qx (MN/m)	Qy (MN/m)
Basemat EL 4.65	18	OTHR	0.220	-0.029	-0.115	-0.849	0.185	0.149	-0.185	-0.125
		TEMP	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	227	OTHR	0.166	0.374	0.255	-0.232	0.217	0.212	-0.430	-0.114
		TEMP	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	237	OTHR	0.265	-0.003	-0.040	-0.102	0.394	-0.246	-0.483	0.296
		TEMP	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	16085	OTHR	0.284	0.396	0.281	-0.271	0.152	0.190	-0.290	-0.027
		TEMP	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Roof of FPE EL 8.25	51556	OTHR	-0.039	0.031	0.006	0.101	0.138	-0.008	0.009	0.020
		TEMP	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	51558	OTHR	-0.037	-0.341	-0.008	-0.047	0.030	-0.019	0.092	-0.005
		TEMP	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	51576	OTHR	0.410	-0.058	0.057	-0.007	-0.113	-0.014	-0.007	0.131
		TEMP	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	51578	OTHR	0.107	-0.145	0.071	-0.009	-0.033	-0.042	-0.006	0.037
		TEMP	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Roof of Tank	26007	OTHR	-0.265	-0.204	-0.014	0.011	0.011	0.000	-0.002	0.000
		TEMP	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	26079	OTHR	0.107	-0.123	0.041	-0.001	-0.028	0.004	-0.004	0.032
		TEMP	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	26082	OTHR	-0.037	0.030	0.139	-0.017	-0.014	0.014	-0.022	0.021
		TEMP	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	26085	OTHR	-0.076	0.077	-0.135	-0.023	-0.009	-0.013	-0.026	-0.016
		TEMP	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
South Wall of FPE	66004	OTHR	-0.173	-0.049	0.076	-0.009	-0.061	0.001	0.004	0.028
		TEMP	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	66006	OTHR	-0.134	0.168	0.383	-0.009	-0.081	-0.007	-0.023	-0.103
		TEMP	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	66024	OTHR	-0.478	-0.157	0.030	-0.020	-0.122	0.005	0.003	0.024
		TEMP	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
East Wall of FPE	67004	OTHR	0.289	-0.539	-0.091	-0.012	-0.087	0.002	-0.003	-0.121
		TEMP	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	67006	OTHR	0.430	-0.048	-0.615	-0.014	-0.044	0.003	-0.002	-0.073
		TEMP	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	67024	OTHR	0.574	-0.264	-0.091	0.034	0.173	-0.002	0.001	-0.116
		TEMP	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Wall of South Tank	35007	OTHR	0.059	-0.269	0.029	0.001	0.097	-0.005	-0.011	0.169
		TEMP	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	35010	OTHR	0.202	-0.655	-0.110	0.027	0.103	0.003	0.012	0.149
		TEMP	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	36507	OTHR	0.595	-0.270	-0.040	-0.023	-0.038	0.001	-0.005	-0.031
		TEMP	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	36510	OTHR	0.607	-0.373	-0.054	0.008	-0.023	-0.005	0.002	-0.024
		TEMP	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	38507	OTHR	0.281	-0.120	0.003	-0.007	-0.016	0.002	0.000	0.042
		TEMP	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	38510	OTHR	0.291	-0.134	0.025	0.000	-0.012	0.003	0.001	0.050
		TEMP	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	45001	OTHR	0.171	-0.295	0.077	-0.005	0.039	-0.007	-0.015	0.120
		TEMP	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	46501	OTHR	0.557	-0.328	0.025	-0.010	-0.021	0.003	-0.002	-0.030
		TEMP	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	48501	OTHR	0.306	-0.143	-0.007	0.000	-0.009	0.000	0.000	0.054
		TEMP	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Shear Key	72008	OTHR	0.165	0.148	0.126	0.012	0.008	0.002	0.005	-0.004
		TEMP	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	73017	OTHR	-0.854	0.175	-0.613	0.006	0.010	0.007	0.004	-0.005
		TEMP	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Location	Element ID		Nx (MN/m)	Ny (MN/m)	Nxy (MN/m)	Mx (MNm/m)	My (MNm/m)	Mxy (MNm/m)	Qx (MN/m)	Qy (MN/m)
Basemat EL 4.65	18	OTHR	0.225	-0.030	-0.118	-0.872	0.187	0.153	-0.191	-0.125
		TEMP	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	227	OTHR	0.168	0.378	0.264	-0.239	0.222	0.219	-0.448	-0.114
		TEMP	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	237	OTHR	0.270	-0.003	-0.043	-0.099	0.404	-0.251	-0.498	0.304
		TEMP	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	16085	OTHR	0.282	0.400	0.288	-0.269	0.155	0.197	-0.294	-0.022
		TEMP	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Roof of FPE EL 8.25	51556	OTHR	-0.037	0.033	0.006	0.100	0.138	-0.008	0.009	0.020
		TEMP	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	51558	OTHR	-0.036	-0.348	-0.008	-0.046	0.030	-0.019	0.090	-0.005
		TEMP	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	51576	OTHR	0.423	-0.057	0.059	-0.007	-0.113	-0.014	-0.007	0.130
		TEMP	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	51578	OTHR	0.111	-0.148	0.073	-0.008	-0.033	-0.042	-0.006	0.037
		TEMP	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Roof of Tank	26007	OTHR	-0.286	-0.226	-0.013	0.012	0.012	0.000	-0.002	0.000
		TEMP	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	26079	OTHR	0.118	-0.134	0.042	-0.001	-0.030	0.005	-0.004	0.034
		TEMP	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	26082	OTHR	-0.037	0.029	0.152	-0.019	-0.015	0.016	-0.025	0.023
		TEMP	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	26085	OTHR	-0.083	0.082	-0.146	-0.025	-0.010	-0.014	-0.030	-0.018
		TEMP	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
South Wall of FPE	66004	OTHR	-0.177	-0.044	0.077	-0.010	-0.064	0.001	0.004	0.026
		TEMP	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	66006	OTHR	-0.137	0.177	0.391	-0.009	-0.084	-0.007	-0.024	-0.107
		TEMP	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	66024	OTHR	-0.489	-0.155	0.031	-0.020	-0.120	0.005	0.003	0.022
		TEMP	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
East Wall of FPE	67004	OTHR	0.298	-0.547	-0.095	-0.012	-0.088	0.002	-0.003	-0.121
		TEMP	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	67006	OTHR	0.442	-0.045	-0.633	-0.014	-0.044	0.003	-0.002	-0.074
		TEMP	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	67024	OTHR	0.593	-0.265	-0.094	0.034	0.173	-0.002	0.001	-0.116
		TEMP	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Wall of South Tank	35007	OTHR	0.053	-0.271	0.030	0.001	0.098	-0.005	-0.011	0.170
		TEMP	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	35010	OTHR	0.198	-0.668	-0.110	0.027	0.105	0.003	0.012	0.150
		TEMP	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	36507	OTHR	0.593	-0.276	-0.040	-0.024	-0.038	0.002	-0.005	-0.032
		TEMP	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	36510	OTHR	0.606	-0.383	-0.053	0.009	-0.023	-0.005	0.002	-0.024
		TEMP	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	38507	OTHR	0.301	-0.127	0.002	-0.007	-0.018	0.002	0.000	0.045
		TEMP	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	38510	OTHR	0.315	-0.144	0.025	0.000	-0.015	0.003	0.001	0.054
		TEMP	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	45001	OTHR	0.167	-0.308	0.076	-0.005	0.039	-0.007	-0.015	0.120
		TEMP	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	46501	OTHR	0.555	-0.340	0.025	-0.010	-0.021	0.003	-0.002	-0.031
		TEMP	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	48501	OTHR	0.331	-0.154	-0.007	-0.001	-0.012	0.000	0.000	0.059
		TEMP	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Shear Key	72008	OTHR	0.166	0.145	0.122	0.012	0.008	0.002	0.005	-0.004
		TEMP	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	73017	OTHR	-0.876	0.172	-0.638	0.006	0.010	0.007	0.004	-0.005
		TEMP	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

OTHR: Loads other than thermal loads
TEMP: Thermal loads

Table 3G.4-13

Combined Forces and Moments: Selected Load Combination FWSC-4

Location	Element ID		Nx (MN/m)	Ny (MN/m)	Nxy (MN/m)	Mx (MNm/m)	My (MNm/m)	Mxy (MNm/m)	Qx (MN/m)	Qy (MN/m)
Basemat EL 4.65	18	OTHR	0.165	-0.021	-0.086	-0.638	0.139	0.112	-0.138	-0.093
		TEMP	11.178	0.074	3.240	-10.622	-1.204	-0.488	0.078	0.719
	227	OTHR	0.126	0.281	0.190	-0.176	0.162	0.159	-0.321	-0.086
		TEMP	-3.772	14.700	-0.114	-4.782	-7.608	0.723	0.207	0.161
	237	OTHR	0.200	-0.002	-0.030	-0.079	0.295	-0.184	-0.361	0.222
		TEMP	4.252	6.441	3.070	-7.918	-4.714	-1.350	-0.640	-0.580
	16085	OTHR	0.214	0.297	0.210	-0.204	0.113	0.143	-0.217	-0.021
		TEMP	-5.946	-2.435	1.340	-1.471	-0.062	0.448	-0.833	0.007
Roof of FPE EL 8.25	51556	OTHR	-0.029	0.023	0.005	0.076	0.104	-0.006	0.007	0.015
		TEMP	0.130	0.203	0.018	-0.371	-0.308	0.001	-0.008	0.009
	51558	OTHR	-0.028	-0.255	-0.006	-0.035	0.023	-0.014	0.069	-0.004
		TEMP	0.247	-0.598	-0.050	-0.253	-0.309	-0.010	-0.040	-0.001
	51576	OTHR	0.307	-0.043	0.042	-0.005	-0.085	-0.011	-0.005	0.098
		TEMP	1.032	0.154	0.130	-0.384	-0.391	0.000	-0.003	0.032
	51578	OTHR	0.080	-0.109	0.053	-0.007	-0.025	-0.032	-0.004	0.028
		TEMP	0.250	-0.299	0.016	-0.333	-0.389	-0.023	-0.040	0.056
Roof of Tank	26007	OTHR	-0.199	-0.153	-0.011	0.008	0.008	0.000	-0.002	0.000
		TEMP	0.030	-0.047	-0.008	-0.510	-0.511	0.000	0.002	0.001
	26079	OTHR	0.080	-0.093	0.031	0.000	-0.021	0.003	-0.003	0.024
		TEMP	0.543	0.144	0.050	-0.580	-0.696	0.015	-0.013	0.102
	26082	OTHR	-0.028	0.023	0.105	-0.013	-0.010	0.011	-0.017	0.016
		TEMP	0.418	0.191	0.099	-0.631	-0.628	0.055	-0.067	0.066
	26085	OTHR	-0.057	0.058	-0.101	-0.017	-0.007	-0.010	-0.020	-0.012
		TEMP	0.311	0.235	-0.007	-0.644	-0.599	-0.046	-0.073	-0.045
South Wall of FPE	66004	OTHR	-0.130	-0.037	0.057	-0.007	-0.046	0.001	0.003	0.021
		TEMP	3.790	-0.169	-0.160	-0.538	-0.932	0.006	-0.006	-0.239
	66006	OTHR	-0.100	0.126	0.286	-0.006	-0.061	-0.005	-0.018	-0.078
		TEMP	2.355	1.227	-0.536	-0.492	-0.900	-0.032	-0.264	-0.803
	66024	OTHR	-0.358	-0.118	0.023	-0.015	-0.092	0.004	0.002	0.018
		TEMP	-0.119	0.009	-0.049	-0.453	-0.360	0.002	0.020	-0.282
East Wall of FPE	67004	OTHR	0.217	-0.404	-0.068	-0.009	-0.065	0.001	-0.002	-0.091
		TEMP	4.172	-0.810	-0.348	0.494	0.551	-0.002	0.002	0.034
	67006	OTHR	0.323	-0.036	-0.461	-0.010	-0.033	0.002	-0.001	-0.055
		TEMP	4.333	0.630	-2.681	0.412	0.518	0.008	0.176	0.222
	67024	OTHR	0.430	-0.198	-0.068	0.026	0.130	-0.002	0.001	-0.087
		TEMP	2.057	-0.179	-0.330	0.484	0.450	0.003	-0.009	0.057
Wall of South Tank	35007	OTHR	0.045	-0.203	0.020	0.001	0.073	-0.004	-0.008	0.127
		TEMP	3.916	-0.784	0.253	-1.510	-1.405	-0.012	-0.093	-0.422
	35010	OTHR	0.153	-0.491	-0.084	0.020	0.077	0.002	0.009	0.111
		TEMP	3.445	0.040	-0.257	-1.628	-1.630	0.043	0.020	-0.515
	36507	OTHR	0.447	-0.203	-0.031	-0.018	-0.029	0.001	-0.004	-0.023
		TEMP	-0.384	-0.425	0.052	-1.491	-1.464	-0.001	-0.014	0.106
	36510	OTHR	0.455	-0.279	-0.041	0.006	-0.017	-0.003	0.001	-0.018
		TEMP	-0.369	-0.033	-0.333	-1.535	-1.464	-0.006	0.019	0.102
	38507	OTHR	0.212	-0.090	0.002	-0.005	-0.012	0.001	0.000	0.032
		TEMP	0.134	-0.081	0.009	-1.437	-1.002	0.005	0.001	-0.236
	38510	OTHR	0.219	-0.100	0.019	0.000	-0.009	0.002	0.001	0.038
		TEMP	-0.065	0.003	-0.200	-1.446	-1.003	-0.023	-0.007	-0.266
	45001	OTHR	0.130	-0.220	0.059	-0.004	0.029	-0.005	-0.011	0.089
		TEMP	4.537	0.932	-0.061	-1.525	-1.682	-0.022	0.004	-0.522
	46501	OTHR	0.417	-0.245	0.019	-0.007	-0.016	0.002	-0.002	-0.023
		TEMP	-0.427	0.603	0.120	-1.560	-1.500	-0.003	-0.005	0.104
	48501	OTHR	0.230	-0.107	-0.005	0.000	-0.007	0.000	0.000	0.041
		TEMP	-0.253	0.103	0.064	-1.459	-1.004	0.008	0.002	-0.298
Shear Key	72008	OTHR	0.123	0.111	0.094	0.009	0.006	0.001	0.004	-0.003
		TEMP	0.038	-0.574	0.418	0.127	0.139	0.043	0.024	-0.076
	73017	OTHR	-0.643	0.132	-0.458	0.005	0.007	0.005	0.003	-0.004
		TEMP	-8.033	-0.578	-1.169	0.026	0.037	0.044	0.014	-0.019

Location	Element ID		Nx (MN/m)	Ny (MN/m)	Nxy (MN/m)	Mx (MNm/m)	My (MNm/m)	Mxy (MNm/m)	Qx (MN/m)	Qy (MN/m)
Basemat EL 4.65	18	OTHR	0.170	-0.022	-0.088	-0.655	0.140	0.115	-0.143	-0.094
		TEMP	11.178	0.074	3.240	-10.622	-1.204	-0.488	0.078	0.719
	227	OTHR	0.127	0.284	0.197	-0.182	0.165	0.164	-0.335	-0.086
		TEMP	-3.772	14.700	-0.114	-4.782	-7.608	0.723	0.207	0.161
	237	OTHR	0.204	-0.003	-0.032	-0.077	0.302	-0.188	-0.373	0.228
		TEMP	4.252	6.441	3.070	-7.918	-4.714	-1.350	-0.640	-0.580
	16085	OTHR	0.213	0.300	0.215	-0.203	0.116	0.148	-0.220	-0.017
		TEMP	-5.946	-2.435	1.340	-1.471	-0.062	0.448	-0.833	0.007
Roof of FPE EL 8.25	51556	OTHR	-0.028	0.025	0.005	0.076	0.104	-0.006	0.007	0.015
		TEMP	0.130	0.203	0.018	-0.371	-0.308	0.001	-0.008	0.009
	51558	OTHR	-0.027	-0.261	-0.006	-0.034	0.023	-0.014	0.068	-0.004
		TEMP	0.247	-0.598	-0.050	-0.253	-0.309	-0.010	-0.040	-0.001
	51576	OTHR	0.317	-0.043	0.044	-0.005	-0.085	-0.011	-0.005	0.098
		TEMP	1.032	0.154	0.130	-0.384	-0.391	0.000	-0.003	0.032
	51578	OTHR	0.083	-0.111	0.055	-0.006	-0.025	-0.032	-0.005	0.028
		TEMP	0.250	-0.299	0.016	-0.333	-0.389	-0.023	-0.040	0.056
Roof of Tank	26007	OTHR	-0.216	-0.170	-0.010	0.009	0.009	0.000	-0.001	0.000
		TEMP	0.030	-0.047	-0.008	-0.510	-0.511	0.000	0.002	0.001
	26079	OTHR	0.089	-0.100	0.032	-0.001	-0.023	0.003	-0.003	0.026
		TEMP	0.543	0.144	0.050	-0.580	-0.696	0.015	-0.013	0.102
	26082	OTHR	-0.028	0.022	0.114	-0.014	-0.012	0.012	-0.019	0.018
		TEMP	0.418	0.191	0.099	-0.631	-0.628	0.055	-0.067	0.066
	26085	OTHR	-0.062	0.062	-0.110	-0.019	-0.008	-0.011	-0.022	-0.014
		TEMP	0.311	0.235	-0.007	-0.644	-0.599	-0.046	-0.073	-0.045
South Wall of FPE	66004	OTHR	-0.132	-0.034	0.058	-0.007	-0.048	0.001	0.003	0.020
		TEMP	3.790	-0.169	-0.160	-0.538	-0.932	0.006	-0.006	-0.239
	66006	OTHR	-0.102	0.133	0.293	-0.007	-0.063	-0.005	-0.018	-0.080
		TEMP	2.355	1.227	-0.536	-0.492	-0.900	-0.032	-0.264	-0.803
	66024	OTHR	-0.366	-0.117	0.023	-0.015	-0.090	0.004	0.002	0.016
		TEMP	-0.119	0.009	-0.049	-0.453	-0.360	0.002	0.020	-0.282
East Wall of FPE	67004	OTHR	0.224	-0.410	-0.071	-0.009	-0.066	0.001	-0.002	-0.091
		TEMP	4.172	-0.810	-0.348	0.494	0.551	-0.002	0.002	0.034
	67006	OTHR	0.332	-0.033	-0.475	-0.011	-0.033	0.002	-0.002	-0.056
		TEMP	4.333	0.630	-2.681	0.412	0.518	0.008	0.176	0.222
	67024	OTHR	0.444	-0.199	-0.070	0.026	0.130	-0.002	0.001	-0.087
		TEMP	2.057	-0.179	-0.330	0.484	0.450	0.003	-0.009	0.057
Wall of South Tank	35007	OTHR	0.041	-0.204	0.021	0.000	0.074	-0.004	-0.008	0.127
		TEMP	3.916	-0.784	0.253	-1.510	-1.405	-0.012	-0.093	-0.422
	35010	OTHR	0.150	-0.501	-0.083	0.020	0.078	0.002	0.009	0.112
		TEMP	3.445	0.040	-0.257	-1.628	-1.630	0.043	0.020	-0.515
	36507	OTHR	0.445	-0.207	-0.031	-0.018	-0.029	0.001	-0.004	-0.024
		TEMP	-0.384	-0.425	0.052	-1.491	-1.464	-0.001	-0.014	0.106
	36510	OTHR	0.454	-0.287	-0.040	0.006	-0.017	-0.003	0.001	-0.018
		TEMP	-0.369	-0.033	-0.333	-1.535	-1.464	-0.006	0.019	0.102
	38507	OTHR	0.227	-0.095	0.001	-0.005	-0.014	0.002	0.000	0.034
		TEMP	0.134	-0.081	0.009	-1.437	-1.002	0.005	0.001	-0.236
	38510	OTHR	0.237	-0.108	0.019	0.000	-0.011	0.002	0.001	0.041
		TEMP	-0.065	0.003	-0.200	-1.446	-1.003	-0.023	-0.007	-0.266
	45001	OTHR	0.127	-0.230	0.058	-0.004	0.029	-0.005	-0.012	0.090
		TEMP	4.537	0.932	-0.061	-1.525	-1.682	-0.022	0.004	-0.522
	46501	OTHR	0.416	-0.255	0.019	-0.007	-0.015	0.002	-0.002	-0.023
		TEMP	-0.427	0.603	0.120	-1.560	-1.500	-0.003	-0.005	0.104
	48501	OTHR	0.249	-0.116	-0.005	-0.001	-0.009	0.000	0.000	0.044
		TEMP	-0.253	0.103	0.064	-1.459	-1.004	0.008	0.002	-0.298
Shear Key	72008	OTHR	0.124	0.109	0.090	0.009	0.006	0.001	0.003	-0.003
		TEMP	0.038	-0.574	0.418	0.127	0.139	0.043	0.024	-0.076
	73017	OTHR	-0.660	0.130	-0.477	0.005	0.007	0.005	0.003	-0.004
		TEMP	-8.033	-0.578	-1.169	0.026	0.037	0.044	0.014	-0.019

OTHR: Loads other than thermal loads

TEMP: Thermal loads

Table 3G.4-14

Combined Forces and Moments: Selected Load Combination FWSC-6

Location	Element ID		Nx (MN/m)	Ny (MN/m)	Nxy (MN/m)	Mx (MNm/m)	My (MNm/m)	Mxy (MNm/m)	Qx (MN/m)	Qy (MN/m)
Basemat EL 4.65	18	OTHR	0.136	-0.025	-0.082	-0.547	0.146	0.101	-0.151	-0.099
		TEMP	8.599	0.057	2.492	-8.171	-0.926	-0.375	0.060	0.553
		SEIS	1.026	0.603	0.495	1.947	0.453	0.735	0.794	0.343
	227	OTHR	0.015	0.250	0.212	-0.033	0.201	0.158	-0.382	-0.064
		TEMP	-2.901	11.308	-0.088	-3.679	-5.852	0.556	0.159	0.124
		SEIS	2.665	0.412	1.364	3.354	1.197	1.518	2.235	0.488
	237	OTHR	0.125	0.007	-0.044	0.072	0.311	-0.187	-0.371	0.229
		TEMP	3.271	4.954	2.362	-6.091	-3.626	-1.039	-0.492	-0.446
		SEIS	1.544	0.600	0.321	4.042	1.925	1.345	1.513	1.244
	16085	OTHR	0.156	0.258	0.200	-0.119	0.146	0.136	-0.186	0.007
		TEMP	-4.574	-1.873	1.031	-1.132	-0.048	0.345	-0.640	0.006
		SEIS	1.574	0.418	0.397	2.303	0.912	0.630	0.833	0.681
Roof of FPE EL 8.25	51556	OTHR	-0.033	0.013	0.006	0.080	0.108	-0.006	0.008	0.015
		TEMP	0.100	0.156	0.014	-0.286	-0.237	0.001	-0.006	0.007
		SEIS	0.088	0.081	0.130	0.079	0.120	0.010	0.007	0.020
	51558	OTHR	-0.036	-0.265	-0.005	-0.039	0.023	-0.015	0.073	-0.004
		TEMP	0.190	-0.460	-0.038	-0.194	-0.238	-0.008	-0.031	-0.001
		SEIS	0.060	0.588	0.272	0.033	0.033	0.022	0.071	0.011
	51576	OTHR	0.292	-0.052	0.047	-0.004	-0.088	-0.011	-0.005	0.102
		TEMP	0.794	0.118	0.100	-0.295	-0.301	0.000	-0.002	0.025
		SEIS	0.971	0.048	0.363	0.035	0.125	0.012	0.006	0.116
	51578	OTHR	0.074	-0.112	0.053	-0.008	-0.026	-0.032	-0.003	0.028
		TEMP	0.192	-0.230	0.013	-0.256	-0.299	-0.018	-0.031	0.043
		SEIS	0.283	0.233	0.167	0.016	0.038	0.036	0.036	0.049
Roof of Tank	26007	OTHR	-0.217	-0.194	-0.006	0.010	0.010	0.000	0.000	0.000
		TEMP	0.023	-0.036	-0.006	-0.392	-0.393	0.000	0.001	0.001
		SEIS	0.354	0.316	0.038	0.016	0.016	0.001	0.003	0.003
	26079	OTHR	0.103	-0.115	0.028	-0.001	-0.025	0.003	-0.003	0.028
		TEMP	0.417	0.111	0.038	-0.446	-0.535	0.011	-0.010	0.079
		SEIS	0.307	0.220	0.095	0.007	0.042	0.007	0.006	0.047
	26082	OTHR	-0.019	0.010	0.121	-0.015	-0.013	0.013	-0.021	0.020
		TEMP	0.322	0.147	0.076	-0.485	-0.483	0.042	-0.051	0.051
		SEIS	0.151	0.296	0.252	0.026	0.020	0.022	0.037	0.034
	26085	OTHR	-0.061	0.058	-0.111	-0.020	-0.008	-0.012	-0.025	-0.015
		TEMP	0.240	0.181	-0.005	-0.496	-0.461	-0.035	-0.056	-0.035
		SEIS	0.152	0.335	0.272	0.035	0.014	0.020	0.046	0.028

Location	Element ID		Nx (MN/m)	Ny (MN/m)	Nxy (MN/m)	Mx (MNm/m)	My (MNm/m)	Mxy (MNm/m)	Qx (MN/m)	Qy (MN/m)
Basemat EL 4.65	18	OTHR	0.139	-0.026	-0.083	-0.560	0.147	0.102	-0.154	-0.099
		TEMP	8.599	0.057	2.492	-8.171	-0.926	-0.375	0.060	0.553
		SEIS	1.009	0.603	0.482	1.806	0.447	0.725	0.770	0.341
	227	OTHR	0.018	0.252	0.217	-0.039	0.203	0.161	-0.390	-0.065
		TEMP	-2.901	11.308	-0.088	-3.679	-5.852	0.556	0.159	0.124
		SEIS	2.664	0.279	1.341	3.352	1.185	1.505	2.169	0.481
	237	OTHR	0.127	0.007	-0.045	0.071	0.316	-0.189	-0.378	0.232
		TEMP	3.271	4.954	2.362	-6.091	-3.626	-1.039	-0.492	-0.446
		SEIS	1.534	0.599	0.330	4.041	1.900	1.328	1.443	1.216
	16085	OTHR	0.156	0.260	0.204	-0.119	0.148	0.139	-0.191	0.009
		TEMP	-4.574	-1.873	1.031	-1.132	-0.048	0.345	-0.640	0.006
		SEIS	1.540	0.192	0.270	2.285	0.910	0.606	0.734	0.683
Roof of FPE EL 8.25	51556	OTHR	-0.032	0.014	0.006	0.080	0.108	-0.006	0.008	0.015
		TEMP	0.100	0.156	0.014	-0.286	-0.237	0.001	-0.006	0.007
		SEIS	0.092	0.063	0.130	0.083	0.113	0.010	0.009	0.019
	51558	OTHR	-0.036	-0.269	-0.005	-0.039	0.023	-0.015	0.072	-0.004
		TEMP	0.190	-0.460	-0.038	-0.194	-0.238	-0.008	-0.031	-0.001
		SEIS	0.067	0.528	0.272	0.045	0.027	0.021	0.077	0.011
	51576	OTHR	0.299	-0.052	0.048	-0.005	-0.088	-0.011	-0.005	0.102
		TEMP	0.794	0.118	0.100	-0.295	-0.301	0.000	-0.002	0.025
		SEIS	0.887	0.057	0.358	0.033	0.118	0.013	0.005	0.110
	51578	OTHR	0.076	-0.114	0.054	-0.008	-0.026	-0.033	-0.003	0.028
		TEMP	0.192	-0.230	0.013	-0.256	-0.299	-0.018	-0.031	0.043
		SEIS	0.263	0.205	0.152	0.018	0.036	0.034	0.034	0.044
Roof of Tank	26007	OTHR	-0.217	-0.194	-0.006	0.010	0.010	0.000	0.000	0.000
		TEMP	0.023	-0.036	-0.006	-0.392	-0.393	0.000	0.001	0.001
		SEIS	0.353	0.318	0.039	0.017	0.017	0.001	0.003	0.003
	26079	OTHR	0.103	-0.115	0.028	-0.001	-0.025	0.003	-0.003	0.028
		TEMP	0.417	0.111	0.038	-0.446	-0.535	0.011	-0.010	0.079
		SEIS	0.320	0.217	0.096	0.007	0.047	0.007	0.007	0.051
	26082	OTHR	-0.019	0.010	0.121	-0.015	-0.013	0.013	-0.021	0.020
		TEMP	0.322	0.147	0.076	-0.485	-0.483	0.042	-0.051	0.051
		SEIS	0.148	0.296	0.254	0.028	0.023	0.024	0.040	0.035
	26085	OTHR	-0.061	0.058	-0.112	-0.020	-0.008	-0.012	-0.025	-0.015
		TEMP	0.240	0.181	-0.005	-0.496	-0.461	-0.035	-0.056	-0.035
		SEIS	0.145	0.337	0.272	0.039	0.016	0.022	0.048	0.029

OTHR: Loads other than thermal and seismic loads
TEMP: Thermal loads
SEIS: Seismic loads

Table 3G.4-14

Combined Forces and Moments: Selected Load Combination FWSC-6 (Continued)

Location	Element ID		Nx (MN/m)	Ny (MN/m)	Nxy (MN/m)	Mx (MNm/m)	My (MNm/m)	Mxy (MNm/m)	Qx (MN/m)	Qy (MN/m)
South Wall of FPE	66004	OTHR	-0.132	-0.039	0.053	-0.006	-0.040	0.001	0.003	0.023
		TEMP	2.916	-0.130	-0.123	-0.414	-0.717	0.005	-0.005	-0.184
		SEIS	0.246	0.207	0.204	0.015	0.090	0.008	0.014	0.015
	66006	OTHR	-0.109	0.109	0.291	-0.006	-0.055	-0.005	-0.016	-0.069
		TEMP	1.811	0.944	-0.412	-0.378	-0.693	-0.024	-0.203	-0.618
		SEIS	0.420	0.392	0.825	0.032	0.139	0.014	0.027	0.204
	66024	OTHR	-0.367	-0.122	0.023	-0.016	-0.095	0.004	0.002	0.025
		TEMP	-0.091	0.007	-0.037	-0.349	-0.277	0.002	0.016	-0.217
		SEIS	0.772	0.129	0.167	0.018	0.095	0.006	0.009	0.016
East Wall of FPE	67004	OTHR	0.205	-0.394	-0.083	-0.009	-0.065	0.001	-0.002	-0.088
		TEMP	3.209	-0.623	-0.268	0.380	0.424	-0.001	0.002	0.026
		SEIS	0.475	0.716	0.617	0.037	0.199	0.004	0.005	0.150
	67006	OTHR	0.283	-0.042	-0.435	-0.010	-0.033	0.002	-0.002	-0.054
		TEMP	3.333	0.484	-2.062	0.317	0.398	0.006	0.135	0.170
		SEIS	0.805	0.146	1.139	0.016	0.110	0.005	0.040	0.146
	67024	OTHR	0.410	-0.200	-0.075	0.026	0.133	-0.002	0.001	-0.092
		TEMP	1.582	-0.137	-0.254	0.372	0.346	0.002	-0.007	0.044
		SEIS	1.250	0.281	0.492	0.032	0.156	0.005	0.005	0.151
Wall of South Tank	35007	OTHR	0.019	-0.186	0.072	0.000	0.070	-0.003	-0.008	0.121
		TEMP	3.012	-0.603	0.194	-1.162	-1.081	-0.009	-0.072	-0.324
		SEIS	1.167	1.897	0.991	0.006	0.368	0.029	0.028	0.445
	35010	OTHR	0.088	-0.517	-0.014	0.022	0.093	0.003	0.008	0.123
		TEMP	2.650	0.030	-0.198	-1.253	-1.254	0.033	0.015	-0.396
		SEIS	1.289	3.073	1.507	0.149	0.657	0.032	0.030	0.575
	36507	OTHR	0.401	-0.211	0.011	-0.016	-0.026	0.002	-0.003	-0.023
		TEMP	-0.295	-0.327	0.040	-1.147	-1.126	0.000	-0.011	0.082
		SEIS	1.094	1.006	1.059	0.092	0.119	0.009	0.027	0.057
	36510	OTHR	0.436	-0.296	0.006	0.005	-0.020	-0.002	0.002	-0.019
		TEMP	-0.284	-0.025	-0.256	-1.181	-1.126	-0.005	0.015	0.078
		SEIS	1.165	1.389	1.387	0.068	0.098	0.017	0.026	0.051
	38507	OTHR	0.237	-0.106	0.001	-0.005	-0.014	0.001	0.000	0.039
		TEMP	0.103	-0.062	0.007	-1.105	-0.771	0.004	0.000	-0.181
		SEIS	0.711	0.323	0.242	0.029	0.042	0.019	0.005	0.082
	38510	OTHR	0.254	-0.115	0.012	-0.001	-0.015	0.001	0.000	0.043
		TEMP	-0.050	0.003	-0.154	-1.112	-0.771	-0.018	-0.005	-0.205
		SEIS	0.810	0.372	0.415	0.015	0.043	0.029	0.009	0.071
	45001	OTHR	0.057	-0.328	0.025	0.002	0.058	-0.005	-0.011	0.111
		TEMP	3.490	0.717	-0.047	-1.173	-1.294	-0.017	0.003	-0.402
		SEIS	1.180	3.884	1.713	0.174	0.702	0.024	0.037	0.575
	46501	OTHR	0.409	-0.273	0.006	-0.010	-0.021	0.002	-0.003	-0.023
		TEMP	-0.329	0.464	0.093	-1.200	-1.154	-0.002	-0.004	0.080
		SEIS	1.154	1.634	1.448	0.054	0.075	0.024	0.022	0.048
	48501	OTHR	0.262	-0.117	-0.003	-0.003	-0.014	0.000	0.000	0.043
		TEMP	-0.195	0.079	0.049	-1.123	-0.772	0.006	0.002	-0.229
		SEIS	0.918	0.412	0.377	0.009	0.041	0.020	0.005	0.073
Shear Key	72008	OTHR	0.130	0.104	0.106	0.006	0.005	-0.001	0.000	-0.003
		TEMP	0.030	-0.442	0.322	0.098	0.107	0.033	0.018	-0.058
		SEIS	0.398	0.192	0.427	0.102	0.304	0.096	0.129	0.316
	73017	OTHR	-0.472	0.064	-0.497	0.005	0.007	0.005	0.003	-0.003
		TEMP	-6.179	-0.445	-0.899	0.020	0.028	0.034	0.011	-0.015
		SEIS	3.802	1.586	1.899	0.032	0.219	0.344	0.085	0.239

Location	Element ID		Nx (MN/m)	Ny (MN/m)	Nxy (MN/m)	Mx (MNm/m)	My (MNm/m)	Mxy (MNm/m)	Qx (MN/m)	Qy (MN/m)
South Wall of FPE	66004	OTHR	-0.134	-0.037	0.054	-0.006	-0.041	0.001	0.003	0.022
		TEMP	2.916	-0.130	-0.123	-0.414	-0.717	0.005	-0.005	-0.184
		SEIS	0.221	0.211	0.198	0.011	0.053	0.008	0.015	0.026
	66006	OTHR	-0.110	0.114	0.296	-0.006	-0.056	-0.005	-0.016	-0.071
		TEMP	1.811	0.944	-0.412	-0.378	-0.693	-0.024	-0.203	-0.618
		SEIS	0.414	0.320	0.776	0.030	0.115	0.013	0.018	0.176
	66024	OTHR	-0.373	-0.122	0.024	-0.015	-0.095	0.004	0.002	0.024
		TEMP	-0.091	0.007	-0.037	-0.349	-0.277	0.002	0.016	-0.217
		SEIS	0.681	0.138	0.166	0.020	0.102	0.005	0.008	0.029
East Wall of FPE	67004	OTHR	0.209	-0.398	-0.085	-0.009	-0.065	0.001	-0.002	-0.088
		TEMP	3.209	-0.623	-0.268	0.380	0.424	-0.001	0.002	0.026
		SEIS	0.385	0.623	0.607	0.036	0.193	0.004	0.005	0.143
	67006	OTHR	0.289	-0.041	-0.445	-0.010	-0.034	0.002	-0.002	-0.055
		TEMP	3.333	0.484	-2.062	0.317	0.398	0.006	0.135	0.170
		SEIS	0.708	0.153	0.986	0.014	0.108	0.005	0.041	0.141
	67024	OTHR	0.419	-0.201	-0.077	0.026	0.134	-0.002	0.001	-0.093
		TEMP	1.582	-0.137	-0.254	0.372	0.346	0.002	-0.007	0.044
		SEIS	1.124	0.258	0.482	0.030	0.148	0.006	0.004	0.142
Wall of South Tank	35007	OTHR	0.017	-0.183	0.073	0.000	0.071	-0.003	-0.008	0.121
		TEMP	3.012	-0.603	0.194	-1.162	-1.081	-0.009	-0.072	-0.324
		SEIS	1.186	1.913	0.988	0.007	0.347	0.029	0.028	0.391
	35010	OTHR	0.086	-0.518	-0.013	0.022	0.094	0.003	0.008	0.124
		TEMP	2.650	0.030	-0.198	-1.253	-1.254	0.033	0.015	-0.396
		SEIS	1.283	3.058	1.507	0.145	0.640	0.032	0.028	0.533
	36507	OTHR	0.401	-0.210	0.011	-0.016	-0.026	0.002	-0.003	-0.023
		TEMP	-0.295	-0.327	0.040	-1.147	-1.126	0.000	-0.011	0.082
		SEIS	0.776	1.017	1.058	0.090	0.110	0.009	0.027	0.041
	36510	OTHR	0.436	-0.296	0.007	0.005	-0.020	-0.002	0.002	-0.019
		TEMP	-0.284	-0.025	-0.256	-1.181	-1.126	-0.005	0.015	0.078
		SEIS	0.822	1.384	1.387	0.068	0.090	0.017	0.025	0.038
	38507	OTHR	0.237	-0.106	0.001	-0.005	-0.014	0.001	0.000	0.039
		TEMP	0.103	-0.062	0.007	-1.105	-0.771	0.004	0.000	-0.181
		SEIS	0.693	0.326	0.242	0.029	0.050	0.019	0.005	0.078
	38510	OTHR	0.254	-0.115	0.012	-0.001	-0.015	0.001	0.000	0.043
		TEMP	-0.050	0.003	-0.154	-1.112	-0.771	-0.018	-0.005	-0.205
		SEIS	0.788	0.372	0.415	0.015	0.051	0.029	0.008	0.065
Wall of South Tank	45001	OTHR	0.056	-0.329	0.025	0.002	0.058	-0.005	-0.011	0.111
		TEMP	3.490	0.717	-0.047	-1.173	-1.294	-0.017	0.003	-0.402
		SEIS	1.182	3.887	1.713	0.174	0.695	0.024	0.035	0.540
	46501	OTHR	0.409	-0.274	0.006	-0.010	-0.021	0.002	-0.003	-0.023
		TEMP	-0.329	0.464	0.093	-1.200	-1.154	-0.002	-0.004	0.080
		SEIS	0.844	1.632	1.449	0.053	0.065	0.024	0.022	0.030
	48501	OTHR	0.262	-0.117	-0.004	-0.003	-0.014	0.000	0.000	0.043
		TEMP	-0.195	0.079	0.049	-1.123	-0.772	0.006	0.002	-0.229
		SEIS	0.895	0.410	0.377	0.011	0.049	0.021	0.006	0.066
Shear Key	72008	OTHR	0.132	0.101	0.104	0.006	0.005	-0.001	0.000	-0.003
		TEMP	0.030	-0.442	0.322	0.098	0.107	0.033	0.018	-0.058
		SEIS	0.347	0.189	0.367	0.102	0.304	0.096	0.129	0.316
	73017	OTHR	-0.485	0.065	-0.509	0.005	0.007	0.005	0.003	-0.004
		TEMP	-6.179	-0.445	-0.899	0.020	0.028	0.034	0.011	-0.015
		SEIS	3.739	1.584	1.805	0.030	0.219	0.344	0.085	0.239

Table 3G.4-15

Combined Forces and Moments: Selected Load Combination FWSC -7

Location	Element ID		Nx (MN/m)	Ny (MN/m)	Nxy (MN/m)	Mx (MNm/m)	My (MNm/m)	Mxy (MNm/m)	Qx (MN/m)	Qy (MN/m)
Basemat EL 4.65	18	OTHR	0.182	-0.015	-0.085	-0.690	0.111	0.118	-0.114	-0.073
		TEMP	8.599	0.057	2.492	-8.171	-0.926	-0.375	0.060	0.553
	227	OTHR	0.259	0.286	0.149	-0.352	0.101	0.147	-0.228	-0.107
		TEMP	-2.901	11.308	-0.088	-3.679	-5.852	0.556	0.159	0.124
	237	OTHR	0.269	-0.015	-0.012	-0.258	0.245	-0.158	-0.316	0.189
		TEMP	3.271	4.954	2.362	-6.091	-3.626	-1.039	-0.492	-0.446
	16085	OTHR	0.267	0.311	0.209	-0.294	0.070	0.142	-0.250	-0.054
		TEMP	-4.574	-1.873	1.031	-1.132	-0.048	0.345	-0.640	0.006
Roof of FPE EL 8.25	51556	OTHR	-0.015	0.042	0.002	0.046	0.070	-0.004	0.004	0.010
		TEMP	0.100	0.156	0.014	-0.286	-0.237	0.001	-0.006	0.007
	51558	OTHR	-0.004	-0.215	-0.008	-0.014	0.018	-0.010	0.040	-0.002
		TEMP	0.190	-0.460	-0.038	-0.194	-0.238	-0.008	-0.031	-0.001
	51576	OTHR	0.306	-0.017	0.032	-0.007	-0.059	-0.006	-0.003	0.066
		TEMP	0.794	0.118	0.100	-0.295	-0.301	0.000	-0.002	0.025
	51578	OTHR	0.086	-0.089	0.046	0.000	-0.017	-0.021	-0.008	0.022
		TEMP	0.192	-0.230	0.013	-0.256	-0.299	-0.018	-0.031	0.043
Roof of Tank	26007	OTHR	-0.124	-0.051	-0.015	0.003	0.004	0.000	-0.004	0.000
		TEMP	0.023	-0.036	-0.006	-0.392	-0.393	0.000	0.001	0.001
	26079	OTHR	0.023	-0.033	0.030	0.000	-0.008	0.003	-0.001	0.010
		TEMP	0.417	0.111	0.038	-0.446	-0.535	0.011	-0.010	0.079
	26082	OTHR	-0.034	0.036	0.053	-0.006	-0.003	0.004	-0.005	0.005
		TEMP	0.322	0.147	0.076	-0.485	-0.483	0.042	-0.051	0.051
	26085	OTHR	-0.037	0.044	-0.059	-0.008	-0.003	-0.004	-0.006	-0.004
		TEMP	0.240	0.181	-0.005	-0.496	-0.461	-0.035	-0.056	-0.035

Location	Element ID		Nx (MN/m)	Ny (MN/m)	Nxy (MN/m)	Mx (MNm/m)	My (MNm/m)	Mxy (MNm/m)	Qx (MN/m)	Qy (MN/m)
Basemat EL 4.65	18	OTHR	0.185	-0.016	-0.087	-0.703	0.112	0.120	-0.118	-0.074
		TEMP	8.599	0.057	2.492	-8.171	-0.926	-0.375	0.060	0.553
	227	OTHR	0.261	0.288	0.154	-0.357	0.104	0.150	-0.237	-0.108
		TEMP	-2.901	11.308	-0.088	-3.679	-5.852	0.556	0.159	0.124
	237	OTHR	0.271	-0.015	-0.013	-0.259	0.250	-0.160	-0.323	0.193
		TEMP	3.271	4.954	2.362	-6.091	-3.626	-1.039	-0.492	-0.446
	16085	OTHR	0.267	0.312	0.213	-0.294	0.072	0.145	-0.254	-0.052
		TEMP	-4.574	-1.873	1.031	-1.132	-0.048	0.345	-0.640	0.006
Roof of FPE EL 8.25	51556	OTHR	-0.014	0.043	0.002	0.046	0.070	-0.004	0.004	0.010
		TEMP	0.100	0.156	0.014	-0.286	-0.237	0.001	-0.006	0.007
	51558	OTHR	-0.004	-0.218	-0.008	-0.014	0.019	-0.010	0.040	-0.002
		TEMP	0.190	-0.460	-0.038	-0.194	-0.238	-0.008	-0.031	-0.001
	51576	OTHR	0.313	-0.016	0.033	-0.007	-0.060	-0.006	-0.003	0.067
		TEMP	0.794	0.118	0.100	-0.295	-0.301	0.000	-0.002	0.025
	51578	OTHR	0.088	-0.091	0.048	0.000	-0.017	-0.021	-0.008	0.022
		TEMP	0.192	-0.230	0.013	-0.256	-0.299	-0.018	-0.031	0.043
Roof of Tank	26007	OTHR	-0.124	-0.051	-0.015	0.003	0.004	0.000	-0.004	0.000
		TEMP	0.023	-0.036	-0.006	-0.392	-0.393	0.000	0.001	0.001
	26079	OTHR	0.023	-0.033	0.030	0.000	-0.008	0.003	-0.001	0.010
		TEMP	0.417	0.111	0.038	-0.446	-0.535	0.011	-0.010	0.079
	26082	OTHR	-0.034	0.036	0.053	-0.006	-0.003	0.004	-0.005	0.005
		TEMP	0.322	0.147	0.076	-0.485	-0.483	0.042	-0.051	0.051
	26085	OTHR	-0.037	0.044	-0.060	-0.008	-0.003	-0.004	-0.006	-0.004
		TEMP	0.240	0.181	-0.005	-0.496	-0.461	-0.035	-0.056	-0.035

OTHR: Loads other than thermal loads
TEMP: Thermal loads

Table 3G.4-15

Combined Forces and Moments: Selected Load Combination FWSC -7 (Continued)

Location	Element ID		Nx (MN/m)	Ny (MN/m)	Nxy (MN/m)	Mx (MNm/m)	My (MNm/m)	Mxy (MNm/m)	Qx (MN/m)	Qy (MN/m)
South Wall of FPE	66004	OTHR	-0.114	-0.002	0.058	-0.008	-0.054	0.001	0.002	0.005
		TEMP	2.916	-0.130	-0.123	-0.414	-0.717	0.005	-0.005	-0.184
	66006	OTHR	-0.082	0.139	0.253	-0.008	-0.064	-0.005	-0.017	-0.084
		TEMP	1.811	0.944	-0.412	-0.378	-0.693	-0.024	-0.203	-0.618
	66024	OTHR	-0.309	-0.074	0.021	-0.008	-0.055	0.003	0.002	-0.006
		TEMP	-0.091	0.007	-0.037	-0.349	-0.277	0.002	0.016	-0.217
East Wall of FPE	67004	OTHR	0.215	-0.353	-0.045	-0.008	-0.055	0.001	-0.002	-0.073
		TEMP	3.209	-0.623	-0.268	0.380	0.424	-0.001	0.002	0.026
	67006	OTHR	0.341	-0.019	-0.454	-0.009	-0.028	0.002	-0.001	-0.047
		TEMP	3.333	0.484	-2.062	0.317	0.398	0.006	0.135	0.170
	67024	OTHR	0.426	-0.150	-0.053	0.018	0.090	-0.001	0.001	-0.059
		TEMP	1.582	-0.137	-0.254	0.372	0.346	0.002	-0.007	0.044
Wall of South Tank	35007	OTHR	0.060	-0.180	-0.040	0.001	0.071	-0.005	-0.007	0.123
		TEMP	3.012	-0.603	0.194	-1.162	-1.081	-0.009	-0.072	-0.324
	35010	OTHR	0.209	-0.397	-0.158	0.016	0.052	0.001	0.010	0.086
		TEMP	2.650	0.030	-0.198	-1.253	-1.254	0.033	0.015	-0.396
	36507	OTHR	0.451	-0.152	-0.075	-0.019	-0.031	0.001	-0.005	-0.020
		TEMP	-0.295	-0.327	0.040	-1.147	-1.126	0.000	-0.011	0.082
	36510	OTHR	0.428	-0.216	-0.091	0.008	-0.013	-0.005	0.000	-0.014
		TEMP	-0.284	-0.025	-0.256	-1.181	-1.126	-0.005	0.015	0.078
	38507	OTHR	0.115	-0.043	0.005	-0.005	-0.004	0.003	0.000	0.012
		TEMP	0.103	-0.062	0.007	-1.105	-0.771	0.004	0.000	-0.181
	38510	OTHR	0.112	-0.056	0.026	0.003	0.003	0.004	0.001	0.021
		TEMP	-0.050	0.003	-0.154	-1.112	-0.771	-0.018	-0.005	-0.205
	45001	OTHR	0.195	-0.053	0.094	-0.011	-0.009	-0.004	-0.011	0.054
		TEMP	3.490	0.717	-0.047	-1.173	-1.294	-0.017	0.003	-0.402
	46501	OTHR	0.379	-0.173	0.032	-0.003	-0.007	0.003	-0.001	-0.019
		TEMP	-0.329	0.464	0.093	-1.200	-1.154	-0.002	-0.004	0.080
	48501	OTHR	0.126	-0.068	-0.007	0.004	0.006	-0.001	0.000	0.026
		TEMP	-0.195	0.079	0.049	-1.123	-0.772	0.006	0.002	-0.229
Shear Key	72008	OTHR	0.112	0.106	0.084	0.012	0.007	0.004	0.007	-0.003
		TEMP	0.030	-0.442	0.322	0.098	0.107	0.033	0.018	-0.058
	73017	OTHR	-0.800	0.216	-0.375	0.004	0.007	0.005	0.003	-0.003
		TEMP	-6.179	-0.445	-0.899	0.020	0.028	0.034	0.011	-0.015

Location	Element ID		Nx (MN/m)	Ny (MN/m)	Nxy (MN/m)	Mx (MNm/m)	My (MNm/m)	Mxy (MNm/m)	Qx (MN/m)	Qy (MN/m)
South Wall of FPE	66004	OTHR	-0.116	0.000	0.059	-0.008	-0.056	0.001	0.002	0.004
		TEMP	2.916	-0.130	-0.123	-0.414	-0.717	0.005	-0.005	-0.184
	66006	OTHR	-0.083	0.144	0.258	-0.008	-0.065	-0.005	-0.018	-0.086
		TEMP	1.811	0.944	-0.412	-0.378	-0.693	-0.024	-0.203	-0.618
	66024	OTHR	-0.315	-0.073	0.021	-0.008	-0.055	0.003	0.002	-0.007
		TEMP	-0.091	0.007	-0.037	-0.349	-0.277	0.002	0.016	-0.217
East Wall of FPE	67004	OTHR	0.220	-0.357	-0.047	-0.008	-0.056	0.001	-0.002	-0.073
		TEMP	3.209	-0.623	-0.268	0.380	0.424	-0.001	0.002	0.026
	67006	OTHR	0.348	-0.018	-0.464	-0.009	-0.029	0.002	-0.001	-0.048
		TEMP	3.333	0.484	-2.062	0.317	0.398	0.006	0.135	0.170
	67024	OTHR	0.435	-0.151	-0.055	0.018	0.090	-0.001	0.001	-0.060
		TEMP	1.582	-0.137	-0.254	0.372	0.346	0.002	-0.007	0.044
Wall of South Tank	35007	OTHR	0.058	-0.177	-0.039	0.001	0.072	-0.005	-0.007	0.123
		TEMP	3.012	-0.603	0.194	-1.162	-1.081	-0.009	-0.072	-0.324
	35010	OTHR	0.207	-0.399	-0.158	0.016	0.053	0.001	0.010	0.087
		TEMP	2.650	0.030	-0.198	-1.253	-1.254	0.033	0.015	-0.396
	36507	OTHR	0.450	-0.151	-0.074	-0.019	-0.031	0.001	-0.005	-0.020
		TEMP	-0.295	-0.327	0.040	-1.147	-1.126	0.000	-0.011	0.082
	36510	OTHR	0.428	-0.217	-0.091	0.008	-0.013	-0.005	0.000	-0.014
		TEMP	-0.284	-0.025	-0.256	-1.181	-1.126	-0.005	0.015	0.078
	38507	OTHR	0.115	-0.043	0.006	-0.005	-0.004	0.003	0.000	0.012
		TEMP	0.103	-0.062	0.007	-1.105	-0.771	0.004	0.000	-0.181
	38510	OTHR	0.113	-0.056	0.026	0.003	0.003	0.004	0.001	0.021
		TEMP	-0.050	0.003	-0.154	-1.112	-0.771	-0.018	-0.005	-0.205
	45001	OTHR	0.193	-0.053	0.094	-0.011	-0.009	-0.005	-0.011	0.054
		TEMP	3.490	0.717	-0.047	-1.173	-1.294	-0.017	0.003	-0.402
	46501	OTHR	0.379	-0.173	0.032	-0.003	-0.008	0.003	-0.001	-0.019
		TEMP	-0.329	0.464	0.093	-1.200	-1.154	-0.002	-0.004	0.080
	48501	OTHR	0.127	-0.068	-0.007	0.004	0.006	-0.001	0.000	0.026
		TEMP	-0.195	0.079	0.049	-1.123	-0.772	0.006	0.002	-0.229
Shear Key	72008	OTHR	0.114	0.103	0.082	0.012	0.007	0.004	0.007	-0.003
		TEMP	0.030	-0.442	0.322	0.098	0.107	0.033	0.018	-0.058
	73017	OTHR	-0.813	0.216	-0.387	0.004	0.007	0.005	0.003	-0.003
		TEMP	-6.179	-0.445	-0.899	0.020	0.028	0.034	0.011	-0.015

Table 3G.4-16

Sectional Thicknesses and Rebar Ratios Used in the Evaluation (Continued)

Location	Element ID	Thickness (m)	Primary Reinforcement					Shear Tie	
			Position	Directtion 1*1		Directtion 2*1			
				Arrangement	Ratio (%)	Arrangement	Ratio (%)	Arrangement	Ratio (%)
South Wall of FPE	66004	0.65	Inside	1-#11@200	0.774	1-#11@200	0.774	-	-
			Outside	2-#11@200	1.548	2-#11@200	1.548		
	66006	0.65	Inside	1-#11@200	0.774	1-#11@133	1.164	#6@200x200	0.710
			Outside	2-#11@200	1.548	1-#11@133 + 1-#11@200	1.938		
	66024	0.65	Inside	1-#11@200	0.774	1-#11@200	0.774	-	-
			Outside	1-#11@200 + 1-#11@400	1.161	1-#11@200 + 1-#11@400	1.161		
East Wall of FPE	67004	0.65	Inside	1-#11@200	0.774	1-#11@133	1.164	-	-
			Outside	2-#11@200	1.548	2-#11@200	1.548		
	67006	0.65	Inside	1-#11@200	0.774	1-#11@133	1.164	#6@200x200	0.710
			Outside	2-#11@200	1.548	1-#11@133 + 1-#11@200	1.938		
	67024	0.65	Inside	1-#11@200	0.774	1-#11@133	1.164	-	-
			Outside	1-#11@200 + 1-#11@400	1.161	1-#11@200 + 1-#11@400	1.161		
Wall of South Tank	35007 35010 45001	1.00	Inside	1-#11@150 + 1-#11@300	1.006	2-#11@150*2	1.342	#6@150*2x300	0.631
			Outside	2-#11@150 + 1-#11@300	1.677	2-#11@150*2 + 1-#11@300*3	1.677		
	36507 36510 46501	1.00	Inside	1-#11@150	0.671	1-#11@150*2	0.671	-	-
			Outside	2-#11@150	1.342	2-#11@150*2	1.342		
	38507 38510 48501	1.00	Inside	1-#11@150	0.671	1-#11@150*2	0.671	-	-
			Outside	1-#11@150	0.671	1-#11@150*2	0.671		
Shear key	72008	2.00	Inside	1-#11@200 + 1-#11@400	0.377	1-#11@200 + 1-#11@400	0.377	-	-
			Outside	1-#11@200 + 1-#11@400	0.377	1-#11@200 + 1-#11@400	0.377		
	73017	2.00	Inside	3-#11@200	0.755	2-#11@200 + 1-#11@400	0.629	#6@400x400	0.177
			Outside	3-#11@200	0.755	2-#11@200 + 1-#11@400	0.629		

Note *1: Wall — Direction 1:Horizontal, Direction 2:Vertical
Basemat, Slab ,Roof — Direction 1:N-S, Direction 2:E-W
Note *2: Rebar described as @150 is arranged by @1°
Note *3: Rebar described as @300 is arranged by @2°

Location	Element ID	Thickness (m)	Primary Reinforcement					Shear Tie	
			Position	Direction 1*1		Direction 2*1			
				Arrangement	Ratio (%)	Arrangement	Ratio (%)	Arrangement	Ratio (%)
South Wall of FPE	66004	0.65	Inside	1-#11@200	0.774	1-#11@200	0.774	-	-
			Outside	2-#11@200	1.548	2-#11@200	1.548		
	66006	0.65	Inside	1-#11@200	0.774	1-#11@133	1.164	#6@200x200	0.710
			Outside	2-#11@200	1.548	1-#11@133 + 1-#11@200	1.938		
	66024	0.65	Inside	1-#11@200	0.774	1-#11@200	0.774	-	-
			Outside	1-#11@200 + 1-#11@400	1.161	1-#11@200 + 1-#11@400	1.161		
East Wall of FPE	67004	0.65	Inside	1-#11@200	0.774	1-#11@200	0.774	-	-
			Outside	2-#11@200	1.548	2-#11@200	1.548		
	67006	0.65	Inside	1-#11@200	0.774	1-#11@200	0.774	#6@200x200	0.710
			Outside	2-#11@200	1.548	1-#11@133 + 1-#11@200	1.938		
	67024	0.65	Inside	1-#11@200	0.774	1-#11@200	0.774	-	-
			Outside	1-#11@200 + 1-#11@400	1.161	1-#11@200 + 1-#11@400	1.161		
Wall of South Tank	35007 35010 45001	1.00	Inside	1-#11@150 + 1-#11@300	1.006	1-#11@150*2 + 1-#11@300*3	1.006	#6@150*2x300	0.631
			Outside	2-#11@150 + 1-#11@300	1.677	2-#11@150*2 + 1-#11@300*3	1.677		
	36507 36510 46501	1.00	Inside	1-#11@150	0.671	1-#11@150*2	0.671	-	-
			Outside	2-#11@150	1.342	2-#11@150*2	1.342		
	38507 38510 48501	1.00	Inside	1-#11@150	0.671	1-#11@150*2	0.671	-	-
			Outside	1-#11@150	0.671	1-#11@150*2	0.671		
Shear key	72008	2.00	Inside	1-#11@200 + 1-#11@400	0.377	1-#11@200 + 1-#11@400	0.377	-	-
			Outside	1-#11@200 + 1-#11@400	0.377	1-#11@200 + 1-#11@400	0.377		
	73017	2.00	Inside	3-#11@200	0.755	2-#11@200 + 1-#11@400	0.629	#6@400x400	0.177
			Outside	3-#11@200	0.755	2-#11@200 + 1-#11@400	0.629		

Note *1: Wall — Direction 1: Horizontal — Direction 2: Vertical
Basemat, Slab, Roof — Direction 1: N-S — Direction 2: E-W

Note *2: Rebar described as @150 is arranged by @1°

Note *3: Rebar described as @300 is arranged by @2°

Table 3G.4-17

Rebar and Concrete Stresses: Selected Load Combination FWSC-3

Location	Element ID	Concrete Stress (MPa)		Primary Reinforcement Stress (MPa)				
		Calculated	Allowable	Calculated				Allowable
				X-direction*		Y-direction*		
				+Z side*	-Z side*	+Z side*	-Z side*	
Basemat EL 4.65	18	-1.6	-20.7	40.2	-5.6	5.9	6.0	372.2
	227	-0.8		13.2	14.6	4.6	34.1	
	237	-1.1		21.5	8.1	-10.0	30.0	
	16085	-0.7		19.5	15.6	9.1	33.0	
Roof of FPE EL 8.25	51556	-5.0	-25.9	-4.9	39.6	2.3	69.8	372.2
	51558	-1.5		18.3	-3.8	-4.5	-1.4	
	51576	-5.2		56.6	23.1	62.9	-5.1	
	51578	-2.8		34.1	6.2	23.3	-1.4	
Roof of Tank	26007	-0.6	-25.9	-3.2	-1.9	-2.3	-1.2	372.2
	26079	-0.8		18.4	17.9	4.9	-1.9	
	26082	-1.0		18.9	17.1	26.1	21.9	
	26085	-0.9		19.5	9.5	28.4	28.3	
South Wall of FPE	66004	-1.9	-25.9	1.3	-0.9	15.3	-1.7	372.2
	66006	-2.8		23.2	7.9	45.1	5.0	
	66024	-3.5		-3.8	-4.3	29.4	-4.0	
East Wall of FPE	67004	-2.5	-25.9	32.5	14.1	4.1	-6.5	372.2
	67006	-2.0		89.6	52.5	83.0	16.8	
	67024	-6.1		25.2	62.5	-9.0	45.2	
Wall of South Tank	35007	-0.9	-25.9	1.7	3.3	-3.4	2.5	372.2
	35010	-1.1		4.3	16.1	-5.2	-1.0	
	36507	-0.4		24.9	39.7	2.6	-4.7	
	36510	-0.5		21.4	48.8	-1.5	-1.4	
	38507	-0.2		20.1	21.8	-0.6	-0.9	
	38510	-0.2		19.4	24.7	-0.7	-0.8	
	45001	-0.5		6.2	8.6	-1.6	-0.3	
	46501	-0.4		21.6	40.0	-1.7	-1.8	
	48501	-0.2		20.4	25.2	-0.5	-1.1	
Shear Key	72008	-0.1	-20.7	18.1	20.2	17.5	19.1	372.2
	73017	-0.7		5.8	5.6	20.8	21.4	

Note: Negative value means compression.

* for denominations of table columns, see the definition of local coordinate in Figure 3G.4-10

Location	Element ID	Concrete Stress (MPa)		Primary Reinforcement Stress (MPa)				
		Calculated	Allowable	Calculated				Allowable
				X-direction*		Y-direction*		
				+Z side*	-Z side*	+Z side*	-Z side*	
Basemat EL 4.65	18	-1.6	-20.7	41.2	-5.7	6.1	6.1	372.2
	227	-0.9		13.5	15.0	4.7	34.9	
	237	-1.1		21.6	8.6	-10.2	30.6	
	16085	-0.7		19.4	16.2	9.1	33.7	
Roof of FPE EL 8.25	51556	-5.0	-25.9	-4.8	39.3	2.4	70.0	372.2
	51558	-1.5		17.8	-3.7	-4.6	-1.5	
	51576	-5.2		58.3	23.8	63.4	-5.2	
	51578	-2.8		34.2	6.5	23.2	-1.5	
Roof of Tank	26007	-0.6	-25.9	-3.5	-2.0	-2.6	-1.4	372.2
	26079	-0.8		20.4	19.3	5.3	-2.3	
	26082	-1.0		20.8	18.8	28.0	23.6	
	26085	-1.0		17.6	12.8	31.9	27.9	
South Wall of FPE	66004	-1.9	-25.9	1.4	-1.0	16.4	-1.6	372.2
	66006	-2.9		23.8	8.1	46.5	5.2	
	66024	-3.5		-4.0	-4.4	29.0	-3.9	
East Wall of FPE	67004	-2.5	-25.9	33.5	14.6	4.2	-6.6	372.2
	67006	-2.0		92.0	54.1	85.4	17.7	
	67024	-6.2		26.6	64.2	-9.6	45.5	
Wall of South Tank	35007	-0.9	-25.9	1.6	3.0	-3.4	3.1	372.2
	35010	-1.2		4.2	15.9	-5.4	-1.0	
	36507	-0.4		24.9	39.4	2.5	-4.8	
	36510	-0.5		21.3	48.7	-1.7	-1.4	
	38507	-0.2		21.5	23.4	-0.5	-1.1	
	38510	-0.2		21.1	26.5	-0.4	-0.7	
	45001	-0.5		6.1	8.3	-1.7	-0.4	
	46501	-0.5		21.5	39.9	-2.0	-2.3	
	48501	-0.2		22.2	27.2	-0.5	-1.3	
Shear Key	72008	-0.1	-20.7	17.7	19.9	17.0	18.6	372.2
	73017	-0.7		6.1	5.9	21.4	22.0	

Note: Negative value means compression.

* for denominations of table columns, see the definition of local coordinate in Figure 3G.4-10

Table 3G.4-18

Rebar and Concrete Stresses: Selected Load Combination FWSC-4

Location	Element ID	Concrete Stress (MPa)		Primary Reinforcement Stress (MPa)				
		Calculated	Allowable	Calculated				Allowable
				X-direction*		Y-direction*		
				+Z side*	-Z side*	+Z side*	-Z side*	
Basemat EL 4.65	18	-3.9	-23.5	179.4	0.6	62.2	6.8	372.2
	227	-5.1		17.0	-29.7	84.2	27.7	
	237	-4.9		129.0	-7.5	87.7	15.1	
	16085	-3.9		-8.4	-24.1	-5.0	-2.1	
Roof of FPE EL 8.25	51556	-2.7	-29.3	45.4	-5.3	26.3	6.5	372.2
	51558	-4.4		47.4	-2.0	5.4	-15.9	
	51576	-9.0		121.0	19.9	124.3	0.0	
	51578	-7.3		69.1	3.9	59.0	-7.3	
Roof of Tank	26007	-3.3	-29.3	32.3	-8.6	28.7	-2.8	372.2
	26079	-5.3		92.7	6.5	78.8	1.7	
	26082	-6.2		141.1	0.1	127.4	14.7	
	26085	-4.7		105.0	-2.9	97.8	15.0	
South Wall of FPE	66004	-9.9	-29.3	55.3	23.3	71.4	-13.9	372.2
	66006	-9.5		82.7	26.7	120.4	13.9	
	66024	-5.1		16.5	-11.0	48.0	-2.0	
East Wall of FPE	67004	-5.5	-29.3	42.4	72.7	-24.6	8.5	372.2
	67006	-8.9		51.7	148.5	11.9	135.5	
	67024	-9.4		35.0	111.7	-9.4	76.3	
Wall of South Tank	35007	-7.1	-29.3	82.5	19.3	38.2	-10.2	372.2
	35010	-6.7		84.5	17.8	44.2	-5.9	
	36507	-5.8		73.6	-5.0	44.4	-9.8	
	36510	-6.4		74.9	-4.5	48.4	-7.2	
	38507	-3.7		87.6	2.2	35.6	-1.2	
	38510	-4.0		86.1	0.8	34.9	-0.7	
	45001	-5.4		85.2	25.1	48.0	0.8	
	46501	-5.9		73.5	-6.0	50.9	-3.3	
	48501	-4.1		86.1	-0.5	35.0	0.1	
Shear Key	72008	-0.5	-23.5	24.5	32.2	7.7	14.9	372.2
	73017	-4.1		-31.0	-30.6	3.2	3.8	

Note: Negative value means compression.

* for denominations of table columns, see the definition of local coordinate in Figure 3G.4-10

Location	Element ID	Concrete Stress (MPa)		Primary Reinforcement Stress (MPa)				
		Calculated	Allowable	Calculated				Allowable
				X-direction*		Y-direction*		
				+Z side*	-Z side*	+Z side*	-Z side*	
Basemat EL 4.65	18	-3.9	-23.5	180.0	0.5	62.0	6.8	372.2
	227	-5.0		16.1	-29.3	84.2	28.0	
	237	-4.7		127.3	-6.0	95.4	15.7	
	16085	-3.9		-8.4	-24.1	-5.0	-2.1	
Roof of FPE EL 8.25	51556	-2.5	-29.3	42.3	-4.6	26.4	6.4	372.2
	51558	-4.5		47.0	-1.9	5.3	-16.1	
	51576	-8.5		121.2	21.3	117.8	0.3	
	51578	-7.3		68.7	4.0	58.9	-7.4	
Roof of Tank	26007	-3.2	-29.3	29.3	-8.8	25.9	-3.5	372.2
	26079	-5.3		94.2	6.8	78.8	1.3	
	26082	-6.2		142.1	0.3	128.9	15.0	
	26085	-5.2		113.3	-4.2	107.5	17.1	
South Wall of FPE	66004	-10.2	-29.3	59.5	25.8	66.3	-16.7	372.2
	66006	-9.6		84.9	27.7	122.5	13.8	
	66024	-5.1		16.1	-11.2	47.8	-1.9	
East Wall of FPE	67004	-5.3	-29.3	42.5	73.5	-24.4	8.0	372.2
	67006	-8.8		52.7	149.8	12.3	136.2	
	67024	-9.4		35.0	112.7	-9.4	76.5	
Wall of South Tank	35007	-7.1	-29.3	82.4	19.1	37.6	-12.5	372.2
	35010	-5.9		82.3	18.0	36.7	-7.4	
	36507	-5.8		73.6	-5.0	44.3	-9.9	
	36510	-6.4		75.1	-4.8	47.3	-7.2	
	38507	-3.7		88.7	2.6	35.5	-1.4	
	38510	-4.0		87.5	1.2	34.8	-0.8	
	45001	-5.2		83.4	23.2	45.5	-1.8	
	46501	-5.8		73.2	-6.1	50.2	-3.2	
	48501	-4.1		87.6	-0.1	34.9	-0.1	
Shear Key	72008	-0.5	-23.5	24.2	31.9	7.4	14.6	372.2
	73017	-4.1		-31.0	-30.7	3.2	3.8	

Note: Negative value means compression.

* for denominations of table columns, see the definition of local coordinate in Figure 3G.4-10

Table 3G.4-19

Rebar and Concrete Stresses: Selected Load Combination FWSC-6

Location	Element ID	Concrete Stress (MPa)		Primary Reinforcement Stress (MPa)				
		Calculated	Allowable	Calculated				Allowable
				X-direction*		Y-direction*		
				+Z side*	-Z side*	+Z side*	-Z side*	
Basemat EL 4.65	18	-5.7	-23.5	229.9	3.9	43.4	33.9	372.2
	227	-12.4		30.2	124.9	111.0	117.3	
	237	-13.7		294.4	97.7	195.0	98.8	
	16085	-5.8		-12.6	-35.5	-11.0	9.3	
Roof of FPE EL 8.25	51556	-10.2	-29.3	33.5	16.8	33.5	108.2	372.2
	51558	-4.9		63.9	5.2	51.2	-19.6	
	51576	-15.1		260.7	78.9	246.7	6.2	
	51578	-8.8		123.1	15.9	67.8	-11.6	
Roof of Tank	26007	-2.4	-29.3	64.6	-10.9	57.4	9.7	372.2
	26079	-6.1		140.6	29.6	72.5	11.5	
	26082	-4.4		179.2	21.9	191.8	42.9	
	26085	-3.3		171.9	13.6	180.0	63.5	
South Wall of FPE	66004	-10.0	-29.3	75.9	31.6	72.8	-13.7	372.2
	66006	-12.8		145.4	66.3	192.4	14.6	
	66024	-7.4		70.6	-16.1	67.4	7.1	
East Wall of FPE	67004	-12.8	-29.3	60.1	121.3	-35.5	43.2	372.2
	67006	-7.4		157.1	222.4	9.1	200.9	
	67024	-17.4		103.2	238.7	-17.5	159.2	
Wall of South Tank	35007	-11.4	-29.3	121.6	58.6	74.1	35.0	372.2
	35010	-11.3		141.1	51.9	61.5	194.1	
	36507	-6.9		139.3	31.1	92.4	22.8	
	36510	-4.7		149.4	41.5	115.3	70.9	
	38507	-2.8		137.9	27.9	50.7	9.6	
	38510	-3.5		149.9	42.5	64.8	15.4	
	45001	-11.9		138.0	102.7	83.3	264.5	
	46501	-4.5		147.8	39.0	131.3	122.2	
	48501	-3.0		155.4	39.6	64.1	16.5	
SHEARKEY	72008	-1.2	-23.5	66.1	81.9	22.2	41.1	372.2
	73017	-5.8		-36.4	-36.2	68.0	39.5	

Note: Negative value means compression.

* for denominations of table columns, see the definition of local coordinate in Figure 3G.4-10

Location	Element ID	Concrete Stress (MPa)		Primary Reinforcement Stress (MPa)				
		Calculated	Allowable	Calculated				Allowable
				X-direction*		Y-direction*		
				+Z side*	-Z side*	+Z side*	-Z side*	
Basemat EL 4.65	18	-5.5	-23.5	225.2	-1.9	44.3	32.0	372.2
	227	-12.4		29.2	126.0	106.4	118.9	
	237	-13.7		293.7	96.6	192.9	98.5	
	16085	-5.8		-12.6	-35.1	-10.2	11.2	
Roof of FPE EL 8.25	51556	-10.1	-29.3	34.7	-9.7	26.6	103.6	372.2
	51558	-4.9		69.8	6.1	46.1	-18.5	
	51576	-14.8		252.3	74.3	243.3	7.0	
	51578	-8.6		120.9	14.6	63.8	-11.1	
Roof of Tank	26007	-2.4	-29.3	63.7	-11.0	57.2	9.8	372.2
	26079	-6.4		142.9	30.7	72.5	10.8	
	26082	-4.2		179.9	21.7	193.2	42.8	
	26085	-3.0		168.7	11.0	176.9	68.0	
South Wall of FPE	66004	-9.4	-29.3	68.9	32.7	65.4	-14.7	372.2
	66006	-12.1		139.6	63.2	180.1	13.2	
	66024	-7.6		62.8	-15.2	69.5	7.3	
East Wall of FPE	67004	-12.6	-29.3	55.3	116.6	-33.7	45.1	372.2
	67006	-7.0		154.4	209.9	1.9	191.8	
	67024	-16.4		98.4	224.8	-15.2	154.9	
Wall of South Tank	35007	-6.9	-29.3	121.9	59.0	78.5	40.6	372.2
	35010	-11.3		141.0	52.2	71.0	235.6	
	36507	-5.4		127.2	18.4	96.4	28.1	
	36510	-5.2		137.1	28.0	118.5	74.2	
	38507	-2.9		136.7	27.2	49.5	9.8	
	38510	-3.8		150.6	41.8	63.5	15.8	
	45001	-11.4		136.3	104.7	91.8	330.2	
	46501	-4.7		136.5	26.4	134.5	123.7	
	48501	-3.1		154.1	38.2	62.6	16.9	
Shear Key	72008	-1.2	-23.5	59.1	74.9	18.6	36.9	372.2
	73017	-5.8		-36.3	-36.0	65.7	39.0	

Note: Negative value means compression.

* for denominations of table columns, see the definition of local coordinate in Figure 3G.4-10

Table 3G.4-20

Rebar and Concrete Stresses: Selected Load Combination FWSC-7

Location	Element ID	Concrete Stress (MPa)		Primary Reinforcement Stress (MPa)				
		Calculated	Allowable	Calculated				Allowable
				X-direction*		Y-direction*		
				+Z side*	-Z side*	+Z side*	-Z side*	
Basemat EL 4.65	18	-3.2	-23.5	144.8	-0.3	46.0	5.7	372.2
	227	-4.2		20.6	-23.0	67.6	22.6	
	237	-4.3		114.4	-6.3	79.4	11.2	
	16085	-3.1		-5.6	-18.9	-3.7	-1.4	
Roof of FPE EL 8.25	51556	-2.7	-29.3	7.0	-6.4	-1.9	25.9	372.2
	51558	-3.3		32.2	-0.2	3.4	-12.8	
	51576	-5.8		93.7	18.9	79.8	-0.1	
	51578	-5.3		50.8	3.9	41.9	-5.7	
Roof of Tank	26007	-2.9	-29.3	32.7	-5.9	34.0	0.8	372.2
	26079	-3.8		67.8	4.6	64.3	3.4	
	26082	-4.8		105.3	-1.6	95.9	12.0	
	26085	-4.6		97.0	-4.1	84.9	12.9	
South Wall of FPE	66004	-10.3	-29.3	44.6	26.6	57.3	-14.5	372.2
	66006	-7.8		67.6	16.8	101.5	9.3	
	66024	-3.5		10.7	-9.1	33.2	-1.0	
East Wall of FPE	67004	-4.3	-29.3	37.3	58.1	-19.0	4.3	372.2
	67006	-6.9		44.3	124.3	10.8	109.8	
	67024	-7.4		30.8	94.2	-8.2	58.5	
Wall of South Tank	35007	-4.7	-29.3	61.2	14.0	19.6	-9.0	372.2
	35010	-5.5		71.2	16.8	37.6	-4.3	
	36507	-5.1		63.3	-1.3	38.7	-6.8	
	36510	-5.9		69.4	-1.3	55.4	-3.9	
	38507	-2.9		64.0	0.6	28.3	-0.4	
	38510	-3.1		62.1	-0.6	26.2	0.2	
	45001	-4.8		72.7	21.1	52.5	4.4	
	46501	-4.5		59.1	-3.5	40.0	-1.9	
	48501	-3.2		61.9	-1.5	25.7	0.5	
Shear Key	72008	-0.4	-23.5	20.4	27.6	6.9	13.4	372.2
	73017	-3.3		-23.9	-24.1	11.8	12.8	

Note: Negative value means compression.

* for denominations of table columns, see the definition of local coordinate in Figure 3G.4-10

Location	Element ID	Concrete Stress (MPa)		Primary Reinforcement Stress (MPa)				
		Calculated	Allowable	Calculated				Allowable
				X-direction*		Y-direction*		
				+Z side*	-Z side*	+Z side*	-Z side*	
Basemat EL 4.65	18	-3.2	-23.5	145.2	-0.4	45.8	5.7	372.2
	227	-4.2		20.9	-22.9	67.6	22.8	
	237	-4.3		113.2	-6.0	79.9	12.0	
	16085	-3.1		-5.6	-18.9	-3.7	-1.4	
Roof of FPE EL 8.25	51556	-1.9	-29.3	31.8	-3.8	19.0	5.7	372.2
	51558	-3.1		32.0	-0.3	2.2	-12.2	
	51576	-5.8		94.6	19.4	80.2	-0.3	
	51578	-5.3		50.8	4.0	41.5	-5.7	
Roof of Tank	26007	-2.9	-29.3	32.7	-5.9	34.0	0.8	372.2
	26079	-3.8		67.8	4.6	64.3	3.4	
	26082	-4.8		105.3	-1.6	95.9	12.0	
	26085	-4.6		97.0	-4.1	84.5	12.9	
South Wall of FPE	66004	-6.8	-29.3	44.9	29.6	60.2	-12.0	372.2
	66006	-7.9		69.1	17.8	103.1	10.3	
	66024	-3.5		10.5	-9.2	33.1	-0.9	
East Wall of FPE	67004	-4.1	-29.3	37.3	58.7	-18.7	3.5	372.2
	67006	-6.9		44.7	125.2	11.1	110.4	
	67024	-7.4		31.2	95.2	-8.2	58.9	
Wall of South Tank	35007	-4.7	-29.3	61.1	14.0	19.2	-10.4	372.2
	35010	-5.4		71.1	16.8	37.2	-6.1	
	36507	-5.1		63.4	-1.3	38.7	-6.8	
	36510	-5.9		69.2	-1.2	55.2	-3.9	
	38507	-2.9		63.9	0.6	28.3	-0.4	
	38510	-3.1		62.1	-0.6	26.2	0.2	
	45001	-4.9		74.4	21.3	55.8	3.1	
	46501	-4.5		59.1	-3.5	40.0	-1.9	
	48501	-3.2		61.9	-1.5	25.7	0.5	
Shear Key	72008	-0.4	-23.5	20.3	27.5	6.7	13.1	372.2
	73017	-3.3		-24.0	-24.1	11.7	12.8	

Note: Negative value means compression.

* for denominations of table columns, see the definition of local coordinate in Figure 3G.4-10

Table 3G.4-21

Calculation Results for Transverse Shear

Location	Element ID	Load ID	d (m)	ρ_w (%)	ρ_v (%)	Shear Forces (MN/m)				Vu/ϕVn
						Vu	Vc	Vs	ϕVn	
Basemat EL 4.65	18	FWSC-6	2.243	0.673	0.242	1.036	1.362	2.247	3.067	0.338
	227	FWSC-6	2.055	0.858	0.484	2.674	1.120	4.118	4.452	0.601
	237	FWSC-6	2.045	0.862	0.484	2.432	1.217	4.098	4.517	0.538
	16085	FWSC-6	2.044	0.862	0.242	1.228	1.609	2.048	3.108	0.395
Roof of FPE EL 8.25	51556	FWSC-6	0.465	1.082	0.000	0.039	0.406	0.000	0.345	0.113
	51558	FWSC-6	0.499	1.008	0.000	0.132	0.453	0.000	0.385	0.343
	51576	FWSC-6	0.450	1.118	0.000	0.237	0.428	0.000	0.364	0.651
	51578	FWSC-6	0.462	1.090	0.000	0.078	0.442	0.000	0.375	0.208
Roof of Tank	26007	FWSC-6	0.473	0.682	0.000	0.005	0.427	0.000	0.363	0.013
	26079	FWSC-6	0.451	0.716	0.000	0.094	0.454	0.000	0.386	0.243
	26082	FWSC-6	0.476	0.678	0.000	0.102	0.457	0.000	0.389	0.263
	26085	FWSC-6	0.486	0.664	0.000	0.103	0.469	0.000	0.399	0.258
South Wall of FPE	66004	FWSC-4	0.422	2.387	0.000	0.215	0.459	0.000	0.390	0.551
	66006	FWSC-6	0.436	2.873	0.710	0.730	0.263	1.282	1.313	0.556
	66024	FWSC-4	0.443	1.701	0.000	0.192	0.491	0.000	0.418	0.460
East Wall of FPE	67004	FWSC-6	0.485	1.037	0.000	0.226	0.826	0.000	0.702	0.322
	67006	FWSC-6	0.436	2.862	0.710	0.206	0.257	1.282	1.308	0.158
	67024	FWSC-6	0.443	1.702	0.000	0.243	0.494	0.000	0.420	0.579
Wall of South Tank	35007	FWSC-6	0.735	2.285	0.631	0.553	0.282	1.920	1.871	0.295
	35010	FWSC-6	0.698	1.919	0.631	0.452	0.155	1.823	1.682	0.269
	36507	FWSC-6	0.779	1.721	0.000	0.049	0.499	0.000	0.424	0.116
	36510	FWSC-4	0.772	1.735	0.000	0.084	0.753	0.000	0.640	0.132
	38507	FWSC-6	0.835	0.804	0.000	0.122	1.075	0.000	0.914	0.133
	38510	FWSC-4	0.835	0.804	0.000	0.228	0.896	0.000	0.762	0.299
	45001	FWSC-6	0.698	1.918	0.631	0.563	0.000	1.823	1.550	0.363
	46501	FWSC-6	0.780	1.718	0.000	0.039	0.270	0.000	0.229	0.170
	48501	FWSC-7	0.835	0.804	0.000	0.089	0.810	0.000	0.688	0.130
Shear Key	72008	FWSC-6	1.798	0.419	0.000	0.376	1.474	0.000	1.253	0.300
	73017	FWSC-6	1.737	0.741	0.177	0.259	0.966	1.273	1.903	0.136

Location	Element ID	Load ID	d (m)	ρ_w (%)	ρ_v (%)	Shear Forces (MN/m)				Vu/ϕVn
						Vu	Vc	Vs	ϕVn	
Basemat EL 4.65	18	FWSC-6	2.243	0.673	0.242	1.016	1.368	2.247	3.073	0.331
	227	FWSC-6	2.055	0.858	0.484	2.616	1.122	4.118	4.454	0.587
	237	FWSC-6	2.044	0.862	0.484	2.365	1.216	4.096	4.515	0.524
	16085	FWSC-6	2.043	0.863	0.242	1.156	1.618	2.047	3.115	0.371
Roof of FPE EL 8.25	51556	FWSC-6	0.466	1.080	0.000	0.039	0.409	0.000	0.348	0.111
	51558	FWSC-6	0.499	1.008	0.000	0.138	0.451	0.000	0.383	0.359
	51576	FWSC-6	0.450	1.118	0.000	0.231	0.427	0.000	0.363	0.638
	51578	FWSC-6	0.458	1.100	0.000	0.115	0.682	0.000	0.579	0.199
Roof of Tank	26007	FWSC-6	0.473	0.682	0.000	0.005	0.427	0.000	0.363	0.013
	26079	FWSC-6	0.451	0.716	0.000	0.097	0.452	0.000	0.384	0.254
	26082	FWSC-6	0.476	0.678	0.000	0.105	0.457	0.000	0.389	0.271
	26085	FWSC-6	0.487	0.663	0.000	0.105	0.471	0.000	0.400	0.262
South Wall of FPE	66004	FWSC-4	0.422	2.387	0.000	0.217	0.460	0.000	0.391	0.555
	~~66006~~	~~FWSC-6~~	~~0.436~~	~~2.874~~	~~0.710~~	~~0.691~~	~~0.274~~	~~1.282~~	~~1.322~~	~~0.523~~
	66024	FWSC-4	0.443	1.701	0.000	0.194	0.493	0.000	0.419	0.462
East Wall of FPE	67004	FWSC-6	0.485	1.037	0.000	0.218	0.663	0.000	0.564	0.387
	67006	FWSC-6	0.436	2.856	0.710	0.202	0.255	1.282	1.307	0.155
	67024	FWSC-6	0.443	1.702	0.000	0.236	0.493	0.000	0.419	0.563
Wall of South Tank	35007	FWSC-6	0.735	2.285	0.631	0.501	0.280	1.920	1.870	0.268
	35010	FWSC-6	0.718	1.407	0.631	0.409	0.163	1.876	1.733	0.236
	36507	FWSC-6	0.779	1.720	0.000	0.071	0.757	0.000	0.644	0.110
	36510	FWSC-4	0.772	1.735	0.000	0.083	0.753	0.000	0.640	0.129
	38507	FWSC-6	0.835	0.804	0.000	0.118	1.020	0.000	0.867	0.136
	38510	FWSC-4	0.835	0.804	0.000	0.220	0.894	0.000	0.760	0.290
	45001	FWSC-6	0.718	1.407	0.631	0.525	0.000	1.876	1.594	0.329
	46501	FWSC-6	0.774	0.867	0.000	0.033	0.326	0.000	0.277	0.117
	48501	FWSC-7	0.835	0.804	0.000	0.089	0.810	0.000	0.688	0.129
Shear Key	72008	FWSC-6	1.798	0.419	0.000	0.374	1.467	0.000	1.247	0.300
	73017	FWSC-6	1.737	0.741	0.177	0.259	0.978	1.273	1.913	0.135

Figure 3G.4-1. FWSC Concrete Outline and Typical Rebar Arrangement