Short-Period, Fa and Long Period Fv Site Coefficients

Table 11.4-1 Short-Period Site Coefficient, F_a

Mapped Risk-Targeted Maximum Considered Earthquake (MCER) Spectral Response Acceleration Parameter at Short Period

Site Class	$S_S \leq 0.25$	$S_S = 0.5$	$S_S = 0.75$	$S_S = 1.0$	$S_S = 1.25$	$S_S \geq 1.5$
A	0.8 0.8	0.8 0.8	0.8 0.8	0.8 0.8	0.8 0.8	0.8
B	0.9 1.0	0.9 1.0	0.9 1.0	0.9 1.0	0.9 1.0	0.9
C	1.3 1.2	1.3 1.2	1.2 1.1	1.2 1.0	1.2 1.0	1.2
D	1.6 1.6	1.4 1.4	1.2 1.2	1.1 1.1	1.0 1.0	1.0
E	2.4 2.5	1.7 1.7	1.3 1.2	See Section 11.4.7 0.9	See Section 11.4.7 0.9	See Section 11.4.7
F	See Section 11.4.7	See Section 11.4.7	See Section 11.4.7	See Section 11.4.7	See Section 11.4.7	See Section 11.4.7

Note: Use straight-line interpolation for intermediate values of S_1.

Table 11.4-2 Long-Period Site Coefficient, F_v

Mapped Risk-Targeted Maximum Considered Earthquake (MCE_R) Spectral Response Acceleration Parameter at 1-s Period

Site Class	$S_1 \leq 0.1$	$S_1 = 0.2$	$S_1 = 0.3$	$S_1 = 0.4$	$S_1 = 0.5$	$S_1 \geq 0.6$
A	0.8 0.8	0.8 0.8	0.8 0.8	0.8 0.8	0.8 0.8	0.8
B	0.8 1.0	0.8 1.0	0.8 1.0	0.8 1.0	0.8 1.0	0.8
C	1.5 1.7	1.5 1.6	1.5 1.5	1.5 1.4	1.5 1.3	1.4
D	2.4 2.4	2.2[1] 2.0	2.0[1] 1.8	1.9[1] 1.6	1.8[1] 1.5	1.7[1]
E	4.2 3.5	3.3[1] 3.2	2.8[1] 2.8	2.4[1] 2.4	2.2[1] 2.4	2.0[1]
F	See Section 11.4.7	See Section 11.4.7	See Section 11.4.7	See Section 11.4.7	See Section 11.4.7	See Section 11.4.7

Note: [1]Also, see requirements for site-specific ground motions in Section 11.4.7.

Note: Use straight-line interpolation for intermediate values of S_1.

Site Coefficient FPGA

Table 11.8-1 Site Coefficient F_{PGA}

Mapped Maximum Considered Geometric Mean (MCE_G) Peak Ground Acceleration, PGA

Site Class	PGA ≤ 0.1	PGA = 0.2	PGA = 0.3	PGA = 0.4	PGA = 0.5 ≥0.5	PGA ≥ 0.6 N/A
A	0.8 0.8	0.8 0.8	0.8 0.8	0.8 0.8	0.8 0.8	0.8
B	0.9 1.0	0.9 1.0	0.9 1.0	0.9 1.0	0.9 1.0	0.9
C	1.3 1.2	1.2 1.2	1.2 1.1	1.2 1.0	1.2 1.0	1.2
D	1.6 1.6	1.4 1.4	1.3 1.2	1.2 1.1	1.1 1.0	1.1
E	2.4 2.5	1.9 1.7	1.6 1.2	1.4 0.9	1.2 0.9	1.1
F	See Section 11.4.7	See Section 11.4.7	See Section 11.4.7	See Section 11.4.7	See Section 11.4.7	See Section 11.4.7

Note: Use straight-line interpolation for intermediate values of PGA.

Note:

- The new site coefficients (black) are based on Vs30 site condition of 760 M/s
- The old site coefficients (red) are based on Vs30 site condition of 1050 M/s

$$A_s = F_{pga} PGA$$

$$S_{DS} = F_a S_s$$

$$S_{D1} = F_v S_1$$

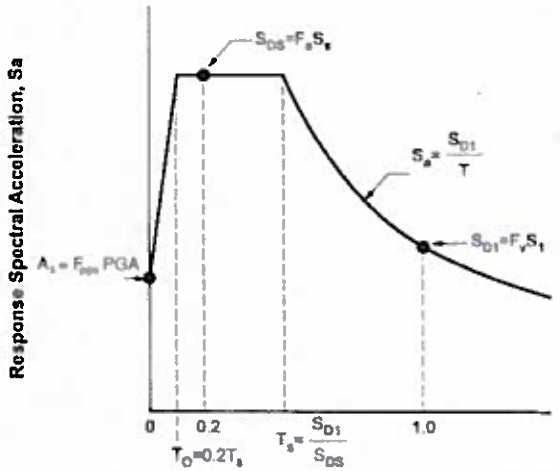

Figure 3.4.1-1—Design Response Spectrum, Construction Using Three-Point Method

Washington State Department of Transportation

Replace *AASHTO Guide Spec Table 3.4.2.3-1* with two following tables:

Table 1.17.3-1A

Values of Site Factor, F_{pga}, at Zero-Period on Acceleration Spectrum

Site Class	Mapped Peak Ground Acceleration Coefficient (PGA)[1]					
	PGA ≤ 0.1	PGA = 0.2	PGA = 0.3	PGA = 0.4	PGA = 0.5	PGA ≥ 0.6
A	0.8	0.8	0.8	0.8	0.8	0.8
B	0.9	0.9	0.9	0.9	0.9	0.9
C	1.3	1.2	1.2	1.2	1.2	1.2
D	1.6	1.4	1.3	1.2	1.1	1.1
E	2.4	1.9	1.6	1.4	1.2	1.1
F[2]	*	*	*	*	*	*

Table 1.17.3-1B

Values of Site Factor, F_a, for Short-Period Range of Acceleration Spectrum

Site Class	Mapped Spectral Acceleration Coefficient at Period 0.2 sec (S_S)[1]					
	$S_S \leq 0.25$	$S_S = 0.5$	$S_S = 0.75$	$S_S = 1.0$	$S_S = 1.25$	$S_S \geq 1.5$
A	0.8	0.8	0.8	0.8	0.8	0.8
B	0.9	0.9	0.9	0.9	0.9	0.9
C	1.3	1.3	1.2	1.2	1.2	1.2
D	1.6	1.4	1.2	1.1	1.0	1.0
E[3]	2.4	1.7	1.3	*	*	*
F[2]	*	*	*	*	*	*

Replace *AASHTO Guide Spec Table 3.4.2.3-2* with following table:

Table 1.17.3-1C

Values of Site Factor, F_v, for Long-Period Range of Acceleration Spectrum

Site Class	Mapped Spectral Response Acceleration Coefficient at Period 1.0 sec (S_1)[1]					
	$S_1 \leq 0.1$	$S_1 = 0.2$	$S_1 = 0.3$	$S_1 = 0.4$	$S_1 = 0.5$	$S_1 \geq 0.6$
A	0.8	0.8	0.8	0.8	0.8	0.8
B	0.8	0.8	0.8	0.8	0.8	0.8
C	1.5	1.5	1.5	1.5	1.5	1.4
D[4]	2.4	2.2[4]	2.0[4]	1.9[4]	1.8[4]	1.7[4]
E[4]	4.2	3.3[4]	2.8[4]	2.4[4]	2.2[4]	2.0[4]

F[2]	*	*	*	*	*	*

Notes:

[1] – Use straight-line interpolation for intermediate values of PGA, S_S, or S_1.

[2] – Perform a site-specific geotechnical investigation and dynamic site response analysis for all sites in Site Class F.

[3] – Perform a ground motion hazard analysis for structures on Site Class E sites with S_S greater than or equal to 1.0.

[4] – Perform a ground motion hazard analysis for structures on Site Class D and E sites with S_1 greater than or equal to 0.2.

"Operational" Criteria: Design all bridges on and West of US97 to remain "Operational" after a full rupture of Cascadia Subduction Zone Earthquake (CSZE). The full rupture CSZE hazard maps are available at the ODOT Bridge Section website.

The CSZE is a deterministic event, and a deterministic Design Response Spectrum must be generated. To allow for consistency and efficiency in design for the CSZE, an application for generating the Design Response Spectra has been developed by Portland State University. Latitude, Longitude, and $V_{s,30}$ are the needed input for running the application. This application can be accessed at the following link:

http://www.oregon.gov/ODOT/HWY/BRIDGE/Pages/seismic.aspx

To satisfy the "Operational" criteria, comply with the following requirements and guidelines:

Seismic Design Categories (SDC) A, B, C and D

- Verify the "Operational" performance for Cascadia Subduction Zone Earthquake when potentially liquefiable soils are present on site.

Seismic Design Categories (SDC) A and B

- No structural analysis is required for "Operational" criteria.

Seismic Design Category (SDC) C

- Satisfy *equation 4.8-1* of the AASHTO Guide Spec ($\Delta^L_D < \Delta^L_C$) for each bridge bent, where Δ^L_C is determined from the *equation 4.8.1.1* of the AASHTO Guide Spec (displacement capacity for SDC B).

Seismic Design Category (SDC) D

- Meet all design requirements for SDC D according to the *AASHTO Guide Specifications for LRFD Seismic Bridge Design*, except as modified below:
  - Ensure the maximum concrete strain in confined section of the columns does not exceed $\varepsilon_{cc} = 0.005$
  - Ensure the maximum strain of reinforcing steel does not exceed $2*\varepsilon_{sh}$, where ε_{sh} is defined on *Table 8.4.2-1* of the AASHTO Guide Spec.
  - Ensure the maximum strain of prestressing steel (for 270 ksi strands) does not exceed $\varepsilon_{ps,EE} = 0.0086$

Non-conventional Bridges: *Guide Spec. 3.1* states that the seismic provisions of this Manual are