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BULLETIN NO.

05-2

BULLETIN

Date: **October 2005**
Revised: **December 2015**

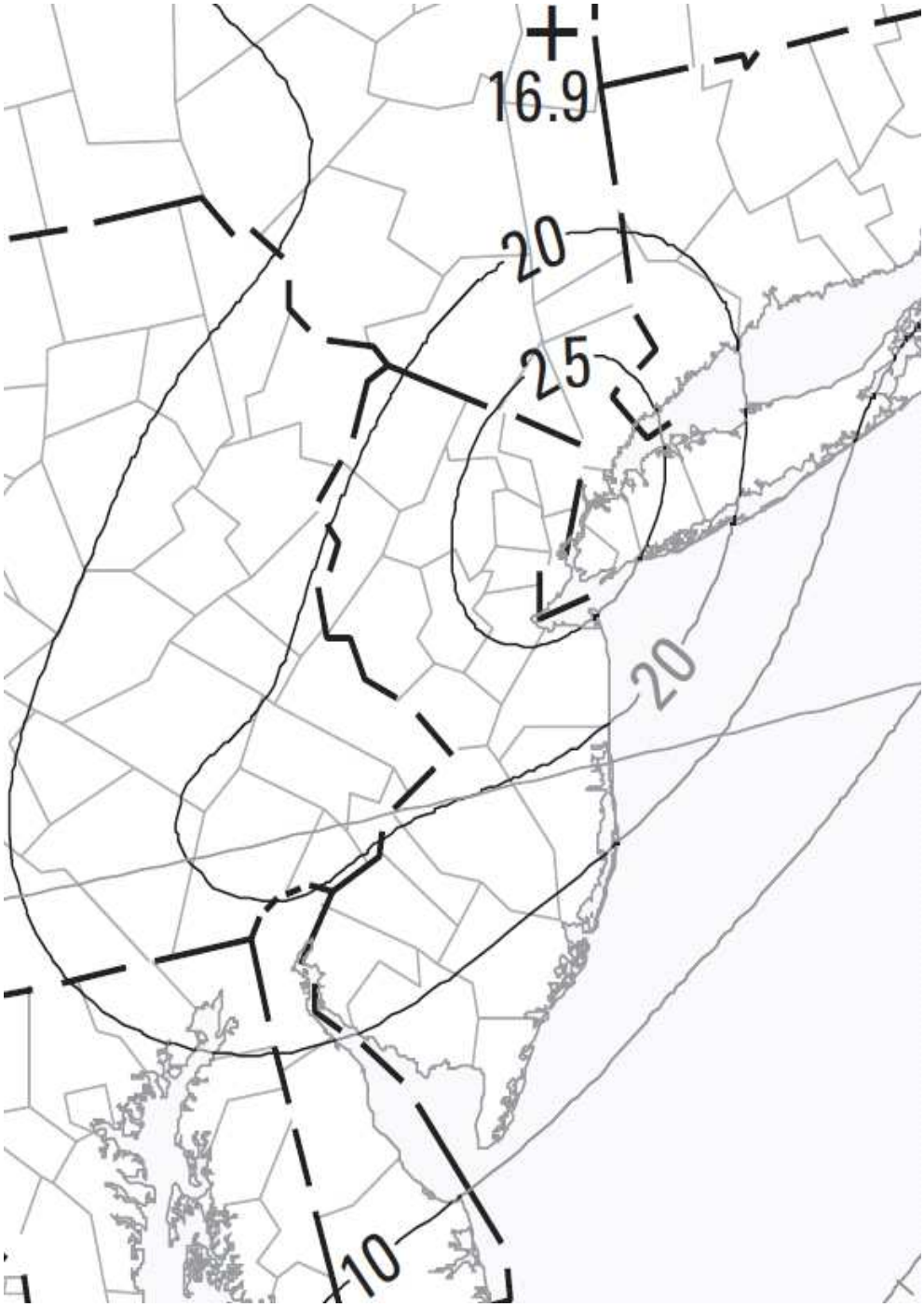
Subject: **Seismic Hazard Maps**

Reference: **N.J.A.C. 5:23-3.14, Building Subcode Section 1613.3.1, Figures 1613.3.1(1) and 1613.3.1(2)**

In order to allow easier reading of the contour lines of the Seismic Hazard Maps for the eastern United States in the Building Subcode, the New Jersey portion is shown at a greatly enlarged scale on pages 2 and 3 of this bulletin.

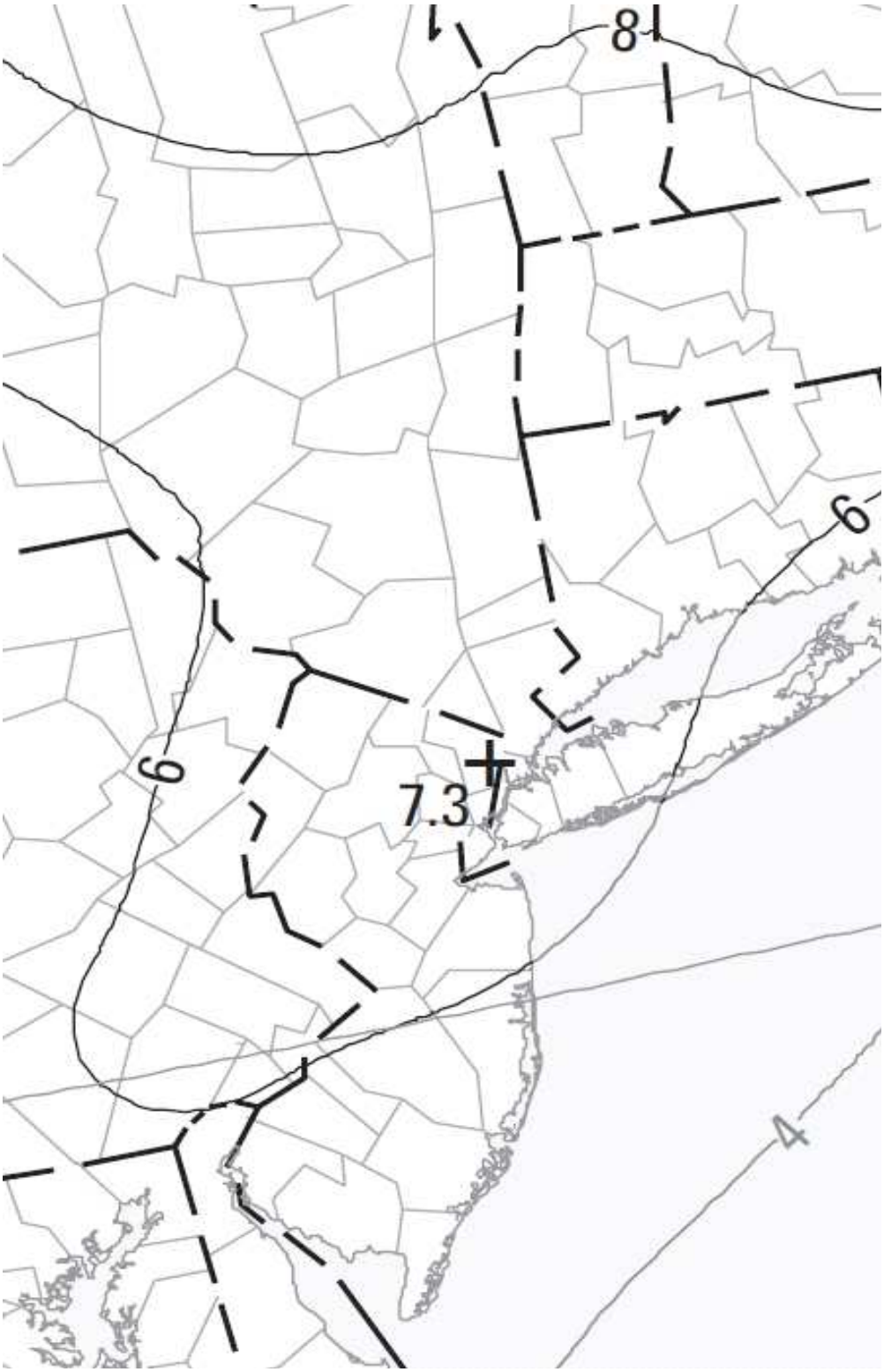
Note: Where a site is in between contours, either straight line interpolation or the value of the higher contour shall be used.

Figure 1613.3.1(1), Maximum Considered Earthquake Ground Motion for the Conterminous (New Jersey) of 0.2 Seconds Spectral Response Acceleration (5% of Critical Damping), Site Class B



Seismic Hazard Map – Horizontal Spectral Response Acceleration for 0.2 Second Period with 2% Probability of Exceedance in 50 Years

Figure 1613.3.1(2), Maximum Considered Earthquake Ground Motion for the Conterminous (New Jersey) of 1.0 Second Spectral Response Acceleration (5% of Critical Damping), Site Class B



Seismic Hazard Map – Horizontal Spectral Response Acceleration for 1.0 Second Period with 2% Probability of Exceedance in 50 Years

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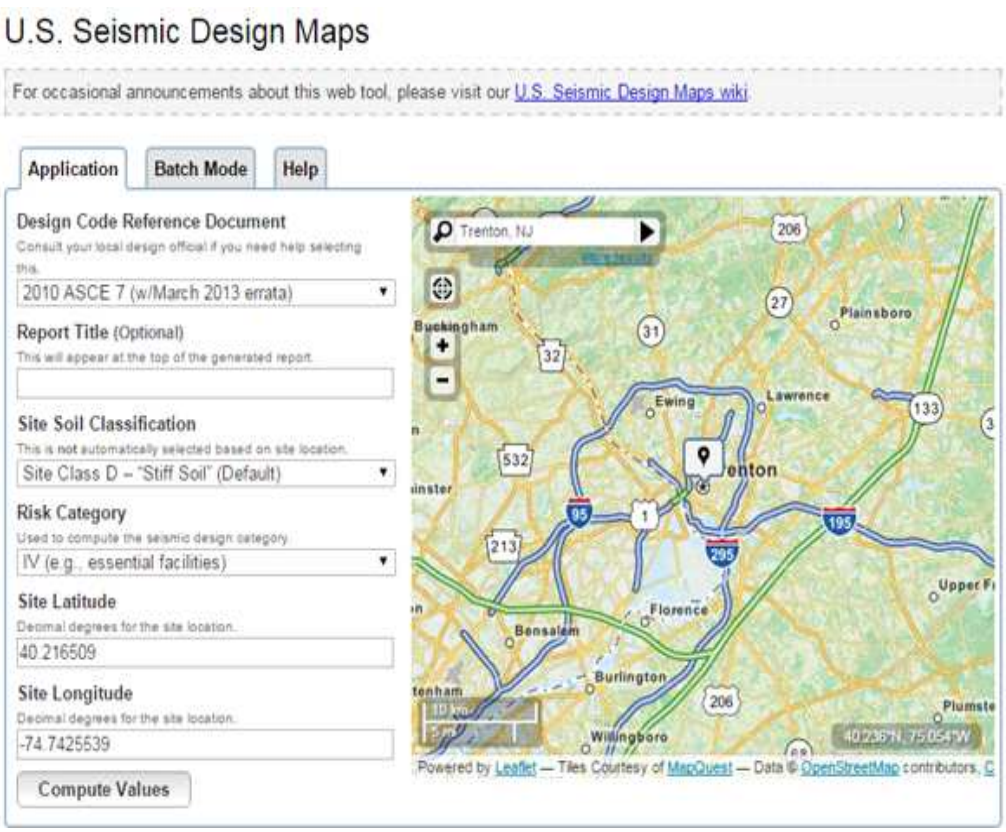
If you would like to use a more precise web-based application to determine seismic design category, the U.S. Geological Survey (USGS), part of the U.S. Department of the Interior, offers such a program. This tool may be used in lieu of the actual maps from the Building Subcode for ease of design. (Note that this bulletin does not reference the One- and Two-Dwelling Subcode as Section R301.2.2 is amended to exempt detached one- and two-family dwellings and attached single-family townhouses from the seismic requirements.) If you would like to take advantage of this application, please visit http://geohazards.usgs.gov/designmaps/us/ and click on "Use The Application." On the new page, "US Seismic Design Maps Web Application," please fill out the Application tab as follows:

- Design Code Reference Document = 2010 ASCE 7
- Site Soil Classification = (Please see Section 1613.3.2 (Site class definition) of 2015 IBC which references the 2010 ASCE 7))
- Risk Category = (Please see Section 1604.5 of the 2015 IBC)
- Site Latitude = (leave blank)
- Site Longitude = (leave blank)

Please enter the address of the property where the building is located or will be located in the search bar on the map to the right of the information you just filled in. This will automatically populate the "Site Latitude" and "Site Longitude" fields in the Application tab. Please see the example below of the information mentioned above.



If your information looks like the image above, please click on "Compute Values." The application will then generate a report that looks like the following:

USGS Design Maps Summary Report

View Detailed Report Print

User-Specified Input

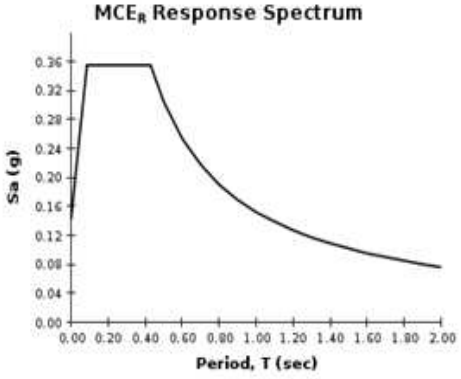
Building Code Reference Document	ASCE 7-10 Standard (which utilizes USGS hazard data available in 2008)
Site Coordinates	40.21651°N, 74.74255°W
Site Soil Classification	Site Class D – "Stiff Soil"
Risk Category	IV (e.g. essential facilities)

USGS-Provided Output

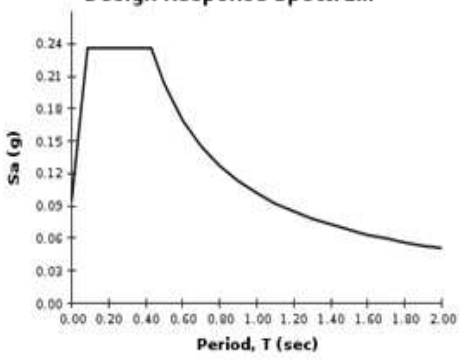
S_S =	0.222 g	S_{MS} =	0.355 g	S_{DS} =	0.236 g
S_1 =	0.063 g	S_{M1} =	0.152 g	S_{D1} =	0.102 g

For information on how the SS and S1 values above have been calculated from probabilistic (risk-targeted) and deterministic ground motions in the direction of maximum horizontal response, please return to the application and select the "2009 NEHRP" building code reference document.

MCE_R Response Spectrum



Design Response Spectrum



For PGA_M, T_L, C_{RS}, and C_{R1} values, please view the detailed report.

Although this information is a product of the U.S. Geological Survey, we provide no warranty, expressed or implied, as to the accuracy of the data contained therein. This tool is not a substitute for technical subject-matter knowledge.

As you can see, the Summary Report provides the ability to view a detailed report. The Detailed Report determines the seismic design category and provides the more severe design category in accordance with Table 1613.3.1(1) or 1613.3.1(2). An example is provided:

USGS Design Maps Detailed Report

View Summary Report Print

ASCE 7-10 Standard (40.21651°N, 74.74255°W)

Site Class D - "Stiff Soil", Risk Category IV (e.g. essential facilities)

Section 11.4.1 — Mapped Acceleration Parameters

Note: Ground motion values provided below are for the direction of maximum horizontal spectral response acceleration. They have been converted from corresponding geometric mean ground motions computed by the USGS by applying factors of 1.1 (to obtain S_s) and 1.3 (to obtain S_1). Maps in the 2010 ASCE-7 Standard are provided for Site Class B. Adjustments for other Site Classes are made, as needed, in Section 11.4.3.

From Figure 22-1 S_s = 0.222 g

From Figure 22-2 S_1 = 0.063 g

Section 11.4.2 — Site Class

The authority having jurisdiction (not the USGS), site-specific geotechnical data, and/or the default has classified the site as Site Class D, based on the site soil properties in accordance with Chapter 20.

Table 20.3-1 Site Classification

Site Class	$\bar{v}_s$	$\bar{N}$ or $\bar{N}_{ch}$	$\bar{s}_u$
A. Hard Rock	>5,000 ft/s	N/A	N/A
B. Rock	2,500 to 5,000 ft/s	N/A	N/A
C. Very dense soil and soft rock	1,200 to 2,500 ft/s	>50	>2,000 psf
D. Stiff Soil	600 to 1,200 ft/s	15 to 50	1,000 to 2,000 psf
E. Soft clay soil	<600 ft/s	<15	<1,000 psf
	Any profile with more than 10 ft of soil having the characteristics: • Plasticity index PI > 20, • Moisture content $w \geq 40\%$, and • Undrained shear strength $\bar{s}_u$ < 500 psf		
F. Soils requiring site response analysis in accordance with Section 21.1	See Section 20.3.1		

For SI: 1ft/s = 0.3048 m/s 1lb/ft² = 0.0479 kN/m²

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Section 11.4.3 — Site Coefficients and Risk-Targeted Maximum Considered Earthquake (MCE_R) Spectral Response Acceleration Parameters

Table 11.4-1: Site Coefficient F_a

Site Class	Mapped MCE $_R$ Spectral Response Acceleration Parameter at Short Period				
	$S_S \le 0.25$	$S_S = 0.50$	$S_S = 0.75$	$S_S = 1.00$	$S_S \ge 1.25$
A	0.8	0.8	0.8	0.8	0.8
B	1.0	1.0	1.0	1.0	1.0
C	1.2	1.2	1.1	1.0	1.0
D	1.6	1.4	1.2	1.1	1.0
E	2.5	1.7	1.2	0.9	0.9
F	See Section 11.4.7 of ASCE 7				

Note: Use straight-line interpolation for intermediate values of S_S

For Site Class = D and S_S = 0.222 g, F_a = 1.600

Table 11.4-2: Site Coefficient F_v

Site Class	Mapped MCE $_R$ Spectral Response Acceleration Parameter at 1-s Period				
	$S_1 \le 0.10$	$S_1 = 0.20$	$S_1 = 0.30$	$S_1 = 0.40$	$S_1 \ge 0.50$
A	0.8	0.8	0.8	0.8	0.8
B	1.0	1.0	1.0	1.0	1.0
C	1.7	1.6	1.5	1.4	1.3
D	2.4	2.0	1.8	1.6	1.5
E	3.5	3.2	2.8	2.4	2.4
F	See Section 11.4.7 of ASCE 7				

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

For Site Class = D and S_1 = 0.063 g, F_v = 2.400

Equation (11.4-1): $S_{MS} = F_a S_S = 1.600 \times 0.222 = 0.355$ g

Equation (11.4-2): $S_{M1} = F_v S_1 = 2.400 \times 0.063 = 0.152$ g

Section 11.4.4 — Design Spectral Acceleration Parameters

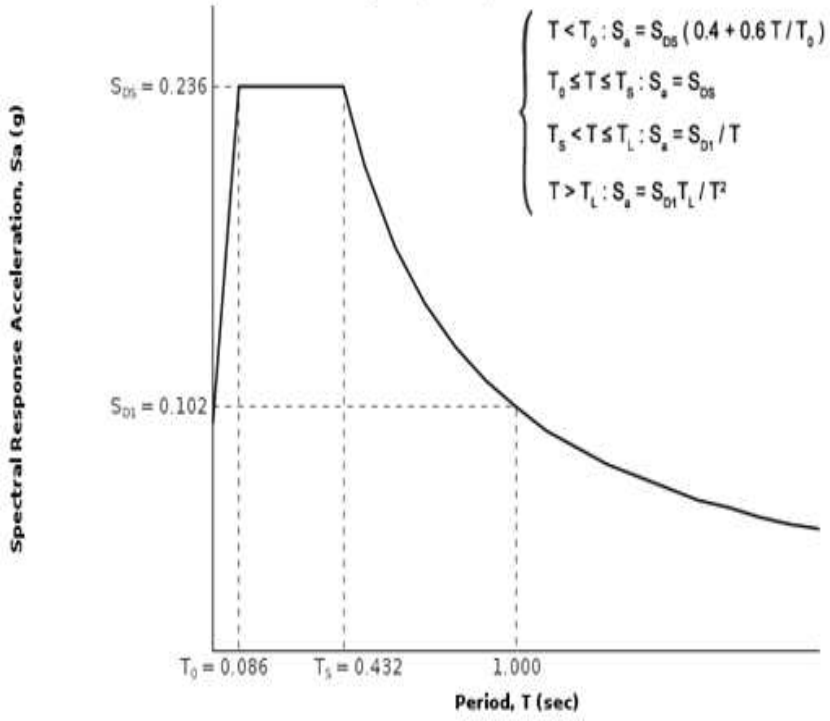
Equation (11.4-3): $S_{DS} = \frac{2}{3} S_{MS} = \frac{2}{3} \times 0.355 = 0.236$ g

Equation (11.4-4): $S_{D1} = \frac{2}{3} S_{M1} = \frac{2}{3} \times 0.152 = 0.102$ g

Section 11.4.5 — Design Response Spectrum

From Figure 22-12 T_L = 6 seconds

Figure 11.4-1: Design Response Spectrum



Section 11.4.6 — Risk-Targeted Maximum Considered Earthquake (MCE_R) Response Spectrum

The MCE_R Response Spectrum is determined by multiplying the design response spectrum above by 1.5.

Section 11.4.6 — Risk-Targeted Maximum Considered Earthquake (MCE_R) Response Spectrum

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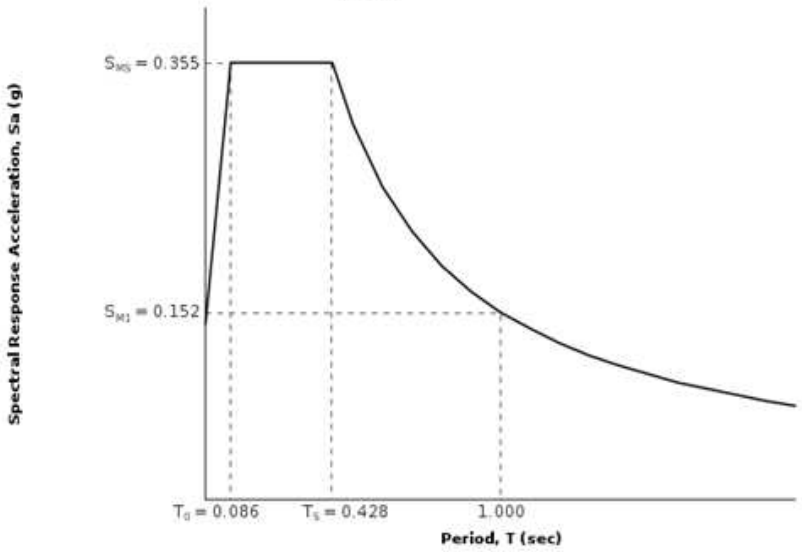

Section 11.8.3 — Additional Geotechnical Investigation Report Requirements for Seismic Design Categories D through F

From Figure 22-7 PGA = 0.124

Equation (11.8-1): $PGA_M = F_{PGA}PGA = 1.551 \times 0.124 = 0.193$ g

Table 11.8-1: Site Coefficient F_{PGA}

Site Class	Mapped MCE Geometric Mean Peak Ground Acceleration, PGA				
	PGA ≤ 0.10	PGA = 0.20	PGA = 0.30	PGA = 0.40	PGA ≥ 0.50
A	0.8	0.8	0.8	0.8	0.8
B	1.0	1.0	1.0	1.0	1.0
C	1.2	1.2	1.1	1.0	1.0
D	1.6	1.4	1.2	1.1	1.0
E	2.5	1.7	1.2	0.9	0.9
F	See Section 11.4.7 of ASCE 7				

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

For Site Class = D and PGA = 0.124 g, F_{PGA} = 1.551

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Section 21.2.1.1 — Method 1 (from Chapter 21 – Site-Specific Ground Motion Procedures for Seismic Design)

From Figure 22-17 C_{RS} = 0.881

From Figure 22-18 C_{R1} = 0.908

Section 11.6 — Seismic Design Category

Table 11.6-1 Seismic Design Category Based on Short Period Response Acceleration Parameter

VALUE OF S_{DS}	RISK CATEGORY		
	I or II	III	IV
$S_{DS} < 0.167g$	A	A	A
$0.167g \le S_{DS} < 0.33g$	B	B	C
$0.33g \le S_{DS} < 0.50g$	C	C	D
$0.50g \le S_{DS}$	D	D	D

For Risk Category = IV and S_{DS} = 0.236 g, Seismic Design Category = C

Table 11.6-2 Seismic Design Category Based on 1-S Period Response Acceleration Parameter

VALUE OF S_{D1}	RISK CATEGORY		
	I or II	III	IV
$S_{D1} < 0.067g$	A	A	A
$0.067g \le S_{D1} < 0.133g$	B	B	C
$0.133g \le S_{D1} < 0.20g$	C	C	D
$0.20g \le S_{D1}$	D	D	D

For Risk Category = IV and S_{D1} = 0.102 g, Seismic Design Category = C

Note: When S_1 is greater than or equal to 0.75g, the Seismic Design Category is **E** for buildings in Risk Categories I, II, and III, and **F** for those in Risk Category IV, irrespective of the above.

Seismic Design Category ≡ "the more severe design category in accordance with Table 11.6-1 or 11.6-2" = C

Note: See Section 11.6 for alternative approaches to calculating Seismic Design Category.