ISE, Incorporated
Structural Engineers ***Telecommunications & Industrial Design***

P.O. Box 50039 • Phoenix, Arizona 85076 • Office: (602) 403-8614 • Fax: (623) 321-1283 • www.ISE-INC.biz

CMU Wall Structural Design & Calculations
&
General Structural Notes

Client: YDC
10245 E. Via Linda
Scottsdale, AZ 85258

ISE Job Number: 15052

Project Descriptions and Address:

Verizon AZ2 Tortoise Shell
HWY 93 & Matthie Ranch Rd
Wickenburg, AZ 85390

General Information:

Code Compliance: IBC 2006

SOILS: Vann Engineering Inc. Project 25949, Dated June 08, 2018
Allowable Soil Bearing Pressure = 1750 psi at 2.0 Depth

SEISMIC: Seismic Design Category >> B
Soil Site Class >> D
S_S = 0.201, S_1 = 0.063
S_{DS} = 0.214, S_{D1} = 0.1
C_S = 0.143

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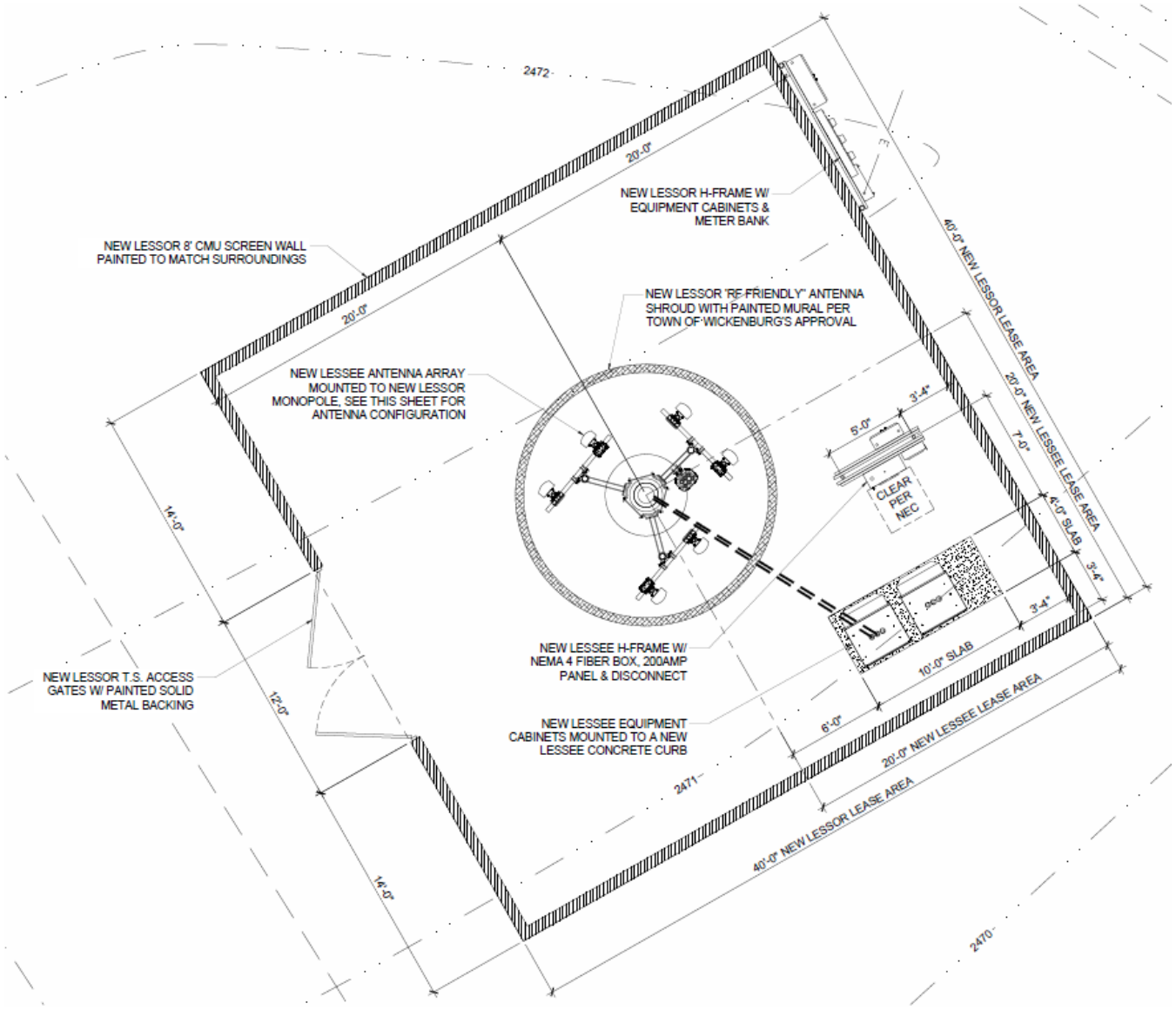
Project: Verizon AZ2 Tortois Shell Job # 15052 By: PB Date 9/23/2019 Sheet # 2

Project Description & General Structural Notes

Verizon is constructing a new 8'-0" above finish grade CMU wall to enclose a new equipment compound. The compound is 40'-0" X 40'-0" and will consist of (4) CMU walls. The CMU walls will have a cantilever footing. Compound access will be via (2) 6'-0" wide swing gate at the West wall of the compound.

The following wall detail will be adequate for the full 8'-0" high screen wall design.

Compound Sketch



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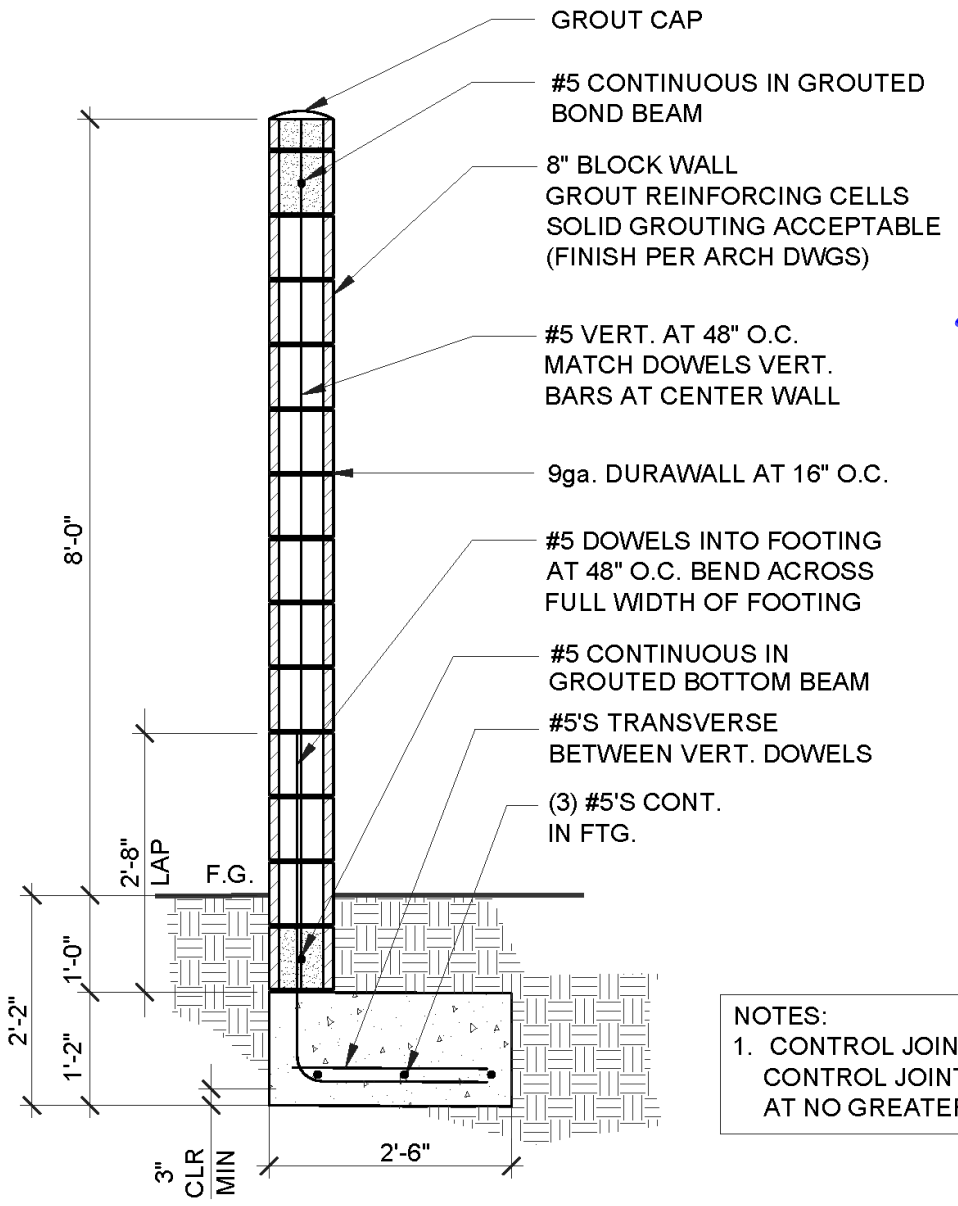
Project: Verizon AZ2 Tortois Shell Job # 15052 By: PB Date 9/23/2019 Sheet # 3

CMU Typical Section



NOTES:
1. CONTROL JOINTS REQUIRED. CONTROL JOINTS SHALL BE SPACED AT NO GREATER THAN 24'-0" O.C.

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Project: Verizon AZ2 Tortois Shell Job # 15052 By: PB Date 9/23/2019 Sheet # 4

Design and Calculations:

CMU Wall - Design and Calculations:

Wind Loads Per ASCE 7-05, Basic Wind Speed 90 mph (Risk Category II), Exposure C. Wind Calculations for "Other Structures", Solid Freestanding Walls at Ground Level.

Section 29.4.1; Design Wind Force > $F = q_h G C_f A_s$

Section 29.3.2; Velocity Pressure > $q_h = 0.00256\, K_z K_{zt} K_d V^2$

Table 29.3-1; Exposure Coefficient K_z for $z \leq 15$ ft ; $K_z = 2.01(15/Z_g)^{2/\alpha}$

Table 26.9-1; Terrain Exposure Constants > $Z_g = 900$, $\alpha = 9.5$

Section 26.8.2; Topographic Factor $K_{zt} = 1.0$ for Flat Terrain

Table 26.6-1; Wind Directionality Factor $K_d = 0.85$ for Solid Sections

Section 26.9.1; Gust Effect Factor G = 0.85

Fig. 29.4-1; Force Coefficient $C_f = 1.425$ for s/h = 1

Wall Wind Pressure >

$P = (0.00256)(2.01)(15/900)^{2/9.5}(1.0)(.85)(90)^2(.85)(1.425) = 18.6$ psf

Check Lateral Seismic

$C_s = 0.143$
V = (0.143)(85psf)(1'width) = 10.12 plf/ft of Wall

Wind force P = 18.6 plf/Ft of Wall - WIND CONTROLS

RetainPro solution attached for CMU Wall design.

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Project: Verizon AZ2 Tortois Shell Job # 15052 By: PB Date 9/23/2019 Sheet # 5

GENERAL NOTES:

Masonry walls shall be constructed of 8” standard hollow concrete masonry units shall conforming to ASTM C90, Grade N, Type 1, f'm = 1,500 psi, running bond, mortar type S, 1,800 psi. Grout shall be 2,000 psi. Mechanically vibrate grout in vertical spaces immediately after pouring and again about 5 minutes later. Provide cleanouts if grout lift exceeds 4'-0" in block walls. Maximum grout lift shall be 8'-0". Control joints required in all walls greater than 24’ in length. Space control joints at 24’-0” maximum.

Vertical reinforcing with #5 bars in center of grout at center of wall, continuous height of wall at all corners, intersections, wall ends, beam bearings, jambs, each side of control joints and at intervals not to exceed 48" on center unless noted otherwise. #5 vertical dowels into footing at 48” on center with 32” extension above top of footing. Tie at 8'-0" vertically, with single wire tie. Lap splices shall be 48 bar diameters for Grade 60 bars. Lap splices shall be 1.3 x lap length when adjacent splices are separated 3" or less. Dowel all vertical reinforcing to foundation with dowels to match vertical reinforcing.

Horizontal reinforcing with #5 bars in minimum 8" deep grouted continuous bond beam at top of a freestanding wall and at first course above footing. Place these bars continuous through control joints per typical detail. Provide bent bars, per typical details, to match horizontal bond beam reinforcing at corners and wall intersection to maintain bond beam continuity. Lap splices shall be 48 bar diameters for grade 60 bars. Stagger splices a minimum of 40 bar diameters. Do not splice within 8'-0" of control joints. Lintel reinforcement shall extend beyond horizontal openings the greater of 24 inches or 40 bar diameters. Wall openings shall be horizontally reinforced above and below the opening openings the greater of 24 inches or 40 bar diameters beyond the opening. Standard weight (No. 9 Ga. wire) Dur-o-Wal or Dur-o-Wire (or equivalent) ladder type joint reinforcement shall be placed at 16" on center in masonry walls.

Deformed reinforcing bars shall conform to ASTM A615 (fy = 60 ksi) for all bars. Welded wire fabric per ASTM A185, wire per ASTM A82. No tack welding of reinforcing bars allowed without prior review of procedure with the structural engineer.

Latest ACI code and detailing manual apply.

Concrete shall have 28 day strength, f'c = 2500 psi, minimum.

Clear concrete coverage as follows:

Cast against and permanently exposed to earth ---------- 3"

This Wall in File: M:\ISE Working Directory\YDC\15052 VZW AZ2 Tortois Shell\8 ft wall.RPX

Cantilevered Retaining Wall

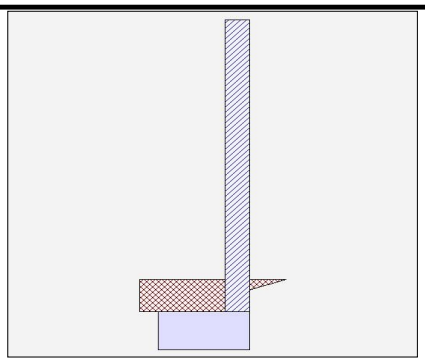
Code: IBC 2006,ACI 318-05,ACI 530-05

Criteria

Retained Height	=	1.00 ft
Wall height above soil	=	8.00 ft
Slope Behind Wall	=	0.00
Height of Soil over Toe	=	12.00 in
Water height over heel	=	0.0 ft

Soil Data

Allow Soil Bearing	=	1,750.0 psf
Equivalent Fluid Pressure Method		
Active Heel Pressure	=	33.0 psf/ft
	=	
Passive Pressure	=	250.0 psf/ft
Soil Density, Heel	=	105.00 pcf
Soil Density, Toe	=	0.00 pcf
Footing||Soil Friction	=	0.450
Soil height to ignore for passive pressure	=	0.00 in



Surcharge Loads

Surcharge Over Heel	=	0.0 psf
NOT Used To Resist Sliding & Overturning		
Surcharge Over Toe	=	0.0
NOT Used for Sliding & Overturning		

Axial Load Applied to Stem

Axial Dead Load	=	0.0 lbs
Axial Live Load	=	0.0 lbs
Axial Load Eccentricity	=	0.0 in

Lateral Load Applied to Stem

Lateral Load	=	0.0 #/ft
...Height to Top	=	0.00 ft
...Height to Bottom	=	0.00 ft
Load Type	=	Wind (W) (Service Level)
Wind on Exposed Stem (Strength Level)	=	18.6 psf

Wind acts left-to-right toward retention side.

Adjacent Footing Load

Adjacent Footing Load	=	0.0 lbs
Footing Width	=	0.00 ft
Eccentricity	=	0.00 in
Wall to Ftg CL Dist	=	0.00 ft
Footing Type		Line Load
Base Above/Below Soil at Back of Wall	=	0.0 ft
Poisson's Ratio	=	0.300

Design Summary

Wall Stability Ratios

Overturning	=	1.62	OK
Sliding	=	90.14	OK
Total Bearing Load	=	1,194 lbs	
...resultant ecc.	=	0.00 in	
Soil Pressure @ Toe	=	477 psf	OK
Soil Pressure @ Heel	=	477 psf	OK
Allowable	=	1,750 psf	
Soil Pressure Less Than Allowable			
ACI Factored @ Toe	=	668 psf	
ACI Factored @ Heel	=	668 psf	
Footing Shear @ Toe	=	5.8 psi	OK
Footing Shear @ Heel	=	0.0 psi	OK
Allowable	=	75.0 psi	

Sliding Calcs

Lateral Sliding Force	=	11.8 lbs	
less 90 % Passive Force	= -	528.1 lbs	
less 100% Friction Force	= -	537.5 lbs	
Added Force Req'd	=	0.0 lbs	OK
....for 1.5 Stability	=	0.0 lbs	OK

Vertical component of active lateral soil pressure IS NOT considered in the calculation of soil bearing pressures.

Load Factors

Building Code	IBC 2006,ACI
Dead Load	0.600
Live Load	1.000
Earth, H	1.000
Wind, W	1.600
Seismic, E	1.000

Stem Construction

	Bottom
	Stem OK
Design Height Above Ftg ft =	0.00
Wall Material Above "Ht" =	Masonry
Design Method =	ASD
Thickness =	8.00
Rebar Size =	# 5
Rebar Spacing =	48.00
Rebar Placed at =	Center
Design Data	
fb/FB + fa/Fa =	**0.988**
Total Force @ Section	
Service Level lbs =	72.8
Strength Level lbs =	
Moment....Actual	
Service Level ft-# =	440.9
Strength Level ft-# =	
Moment.....Allowable =	446.0
Shear.....Actual	
Service Level psi =	0.8
Strength Level psi =	
Shear.....Allowable psi =	44.8
Anet (Masonry) in2 =	91.50
Rebar Depth 'd' in =	3.75
Masonry Data	
f'm psi =	1,500
Fs psi =	20,000
Solid Grouting =	Yes
Modular Ratio 'n' =	21.48
Wall Weight psf =	84.0
Short Term Factor =	1.000
Equiv. Solid Thick. in =	7.60
Masonry Block Type =	Normal Weight
Masonry Design Method =	ASD
Concrete Data	
f'c psi =	
Fy psi =	

Cantilevered Retaining Wall

Code: IBC 2006,ACI 318-05,ACI 530-05

Footing Data

Toe Width	=	1.83 ft
Heel Width	=	0.67
Total Footing Width	=	2.50
Footing Thickness	=	14.00 in
Key Width	=	0.00 in
Key Depth	=	0.00 in
Key Distance from Toe	=	0.00 ft

f'c = 2,500 psi Fy = 60,000 psi
Footing Concrete Density = 150.00 pcf
Min. As % = 0.0018
Cover @ Top 2.00 @ Btm.= 3.00 in

Footing Design Results

		Toe	Heel	
Factored Pressure	=	668	668	psf
Mu' : Upward	=	1,122	0	ft-#
Mu' : Downward	=	334	0	ft-#
Mu: Design	=	789	0	ft-#
Actual 1-Way Shear	=	5.83	0.01	psi
Allow 1-Way Shear	=	36.67	36.67	psi
Toe Reinforcing	=	None Spec'd		
Heel Reinforcing	=	None Spec'd		
Key Reinforcing	=	None Spec'd		
Footing Torsion, Tu	=		0.00	ft-lbs
Footing Allow. Torsion, phi Tu	=		0.00	ft-lbs

If torsion exceeds allowable, provide supplemental design for footing torsion.

Other Acceptable Sizes & Spacings

Toe: #4@ 7.93 in, #5@ 12.29 in, #6@ 17.45 in, #7@ 23.80 in, #8@ 31.34 in, #9@ 39
Heel: Not req'd: Mu < phi*5*lambda*sqrt(f'c)*Sm
Key: No key defined

Min footing T&S reinf Area	0.76	in2
Min footing T&S reinf Area per foot	0.30	in2 /ft

If one layer of horizontal bars:	If two layers of horizontal bars:
#4@ 7.94 in	#4@ 15.87 in
#5@ 12.30 in	#5@ 24.60 in
#6@ 17.46 in	#6@ 34.92 in

Summary of Overturning & Resisting Forces & Moments

		.....OVERTURNING..... Force lbs	Distance ft	Moment ft-#		.....RESISTING..... Force lbs	Distance ft	Moment ft-#
HL Act Pres (ab water tbl)		77.5	0.72	55.9	Soil Over HL (ab. water tbl)	0.4	2.50	0.0
HL Act Pres (be water tbl)					Soil Over HL (bel. water tbl)		2.50	0.0
Hydrostatic Force					Watre Table			
Buoyant Force	=				Sloped Soil Over Heel	=		
Surcharge over Heel	=				Surcharge Over Heel	=		
Surcharge Over Toe	=				Adjacent Footing Load	=		
Adjacent Footing Load	=				Axial Dead Load on Stem	=		
Added Lateral Load	=				* Axial Live Load on Stem	=		
Load @ Stem Above Soil	=	-89.3	6.17	-550.6	Soil Over Toe	=	1.59	
	=				Surcharge Over Toe	=		
					Stem Weight(s)	=	756.0	0.34	254.5
					Earth @ Stem Transitions	=		
					Footing Weight	=	438.0	1.25	548.2
					Key Weight	=		
					Vert. Component	=		
Total	=	-11.8	**O.T.M.** =	-494.6	**Total =**	1,194.4 lbs	**R.M.=**	802.7

Resisting/Overturning Ratio = **1.62**
Vertical Loads used for Soil Pressure = 1,194.4 lbs

* Axial live load NOT included in total displayed, or used for overturning resistance, but is included for soil pressure calculation.

Vertical component of active lateral soil pressure IS NOT considered in the calculation of Sliding Resistance.

Vertical component of active lateral soil pressure IS NOT considered in the calculation of Overturning Resistance.

Tilt

Horizontal Deflection at Top of Wall due to settlement of soil

(Deflection due to wall bending not considered)

Soil Spring Reaction Modulus	250.0	pci
Horizontal Defl @ Top of Wall (approximate only)	0.067	in

The above calculation is not valid if the heel soil bearing pressure exceeds that of the toe, because the wall would then tend to rotate into the retained soil.

Hazards by Location

Search Information

Address: HWY 93 & Matthie Ranch Rd Wickenburg, AZ 85390

Coordinates: 34.023751, -112.80742700000002

Elevation: ft

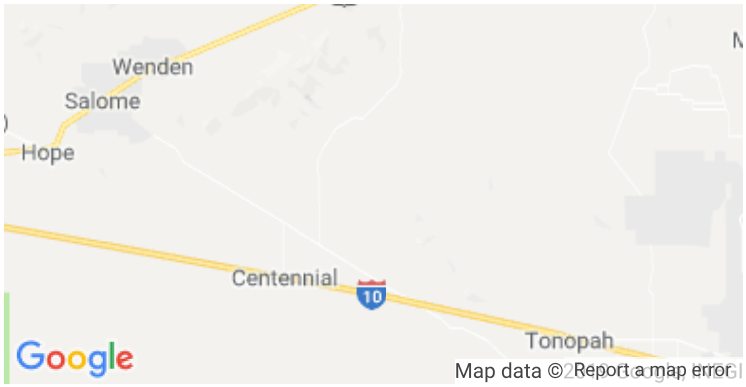
Timestamp: 2019-09-20T18:57:05.248Z

Hazard Type: Seismic

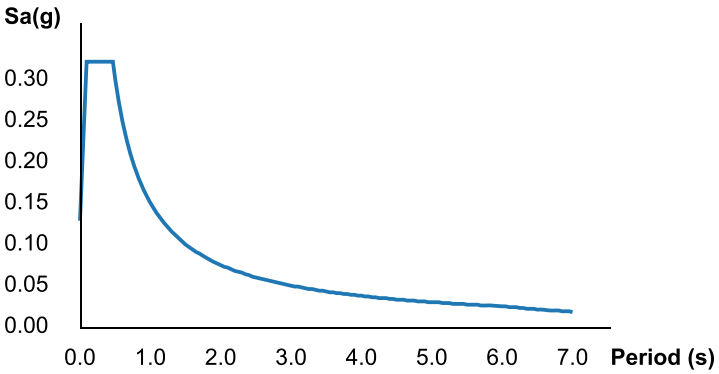
Reference Document: IBC-2012

Risk Category: II

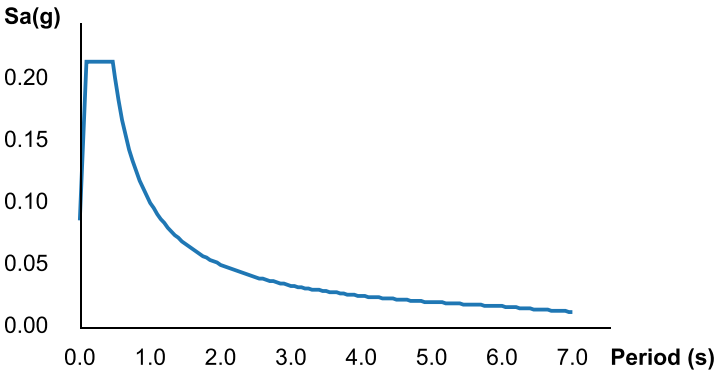
Site Class: D



MCER Horizontal Response Spectrum



Design Horizontal Response Spectrum



Basic Parameters

Name	Value	Description
S_S	0.201	MCE_R ground motion (period=0.2s)
S_1	0.063	MCE_R ground motion (period=1.0s)
S_{MS}	0.322	Site-modified spectral acceleration value
S_{M1}	0.151	Site-modified spectral acceleration value
S_{DS}	0.214	Numeric seismic design value at 0.2s SA
S_{D1}	0.1	Numeric seismic design value at 1.0s SA

Additional Information

Name	Value	Description
SDC	B	Seismic design category
F_a	1.6	Site amplification factor at 0.2s
F_v	2.4	Site amplification factor at 1.0s

CR_S	0.903	Coefficient of risk (0.2s)
CR_1	0.919	Coefficient of risk (1.0s)
PGA	0.083	MCE_G peak ground acceleration
F_{PGA}	1.6	Site amplification factor at PGA
PGA_M	0.134	Site modified peak ground acceleration
T_L	6	Long-period transition period (s)
SsRT	0.201	Probabilistic risk-targeted ground motion (0.2s)
SsUH	0.223	Factored uniform-hazard spectral acceleration (2% probability of exceedance in 50 years)
SsD	1.5	Factored deterministic acceleration value (0.2s)
S1RT	0.063	Probabilistic risk-targeted ground motion (1.0s)
S1UH	0.068	Factored uniform-hazard spectral acceleration (2% probability of exceedance in 50 years)
S1D	0.6	Factored deterministic acceleration value (1.0s)
PGAd	0.6	Factored deterministic acceleration value (PGA)

The results indicated here DO NOT reflect any state or local amendments to the values or any delineation lines made during the building code adoption process. Users should confirm any output obtained from this tool with the local Authority Having Jurisdiction before proceeding with design.

Disclaimer

Hazard loads are provided by the U.S. Geological Survey Seismic Design Web Services.

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