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Access and Information

2025 CBC Changes to HCAI Preapprovals

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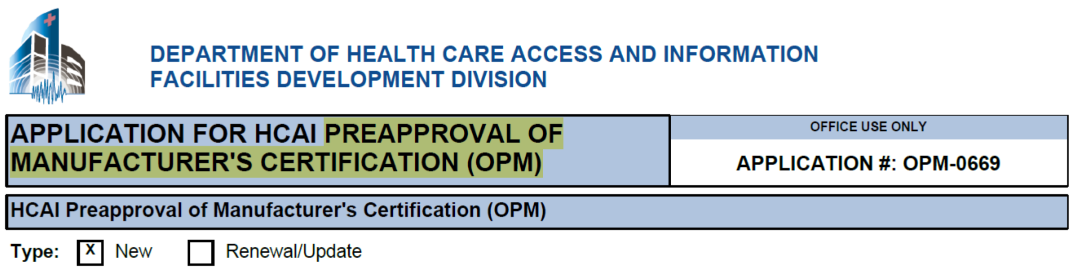
2025 CBC Changes to HCAI Preapprovals (ASCE 7-22 Chapter 13 Nonstructural Components)

ASCE 7-22 will be incorporated into the 2025 CBC, with significant changes to the seismic horizontal nonstructural component lateral forces within Chapter 13.

Specifically, Eqn 13.3-1 (F_P), Table 13.5-1 Architectural Components and Table 13.6-1 Mechanical and Electrical Components.

The changes reflect a more refined approach to the behavioral response of nonstructural components during major seismic events, via testing and the collaborative efforts of ASCE 7-22 Seismic Committee.

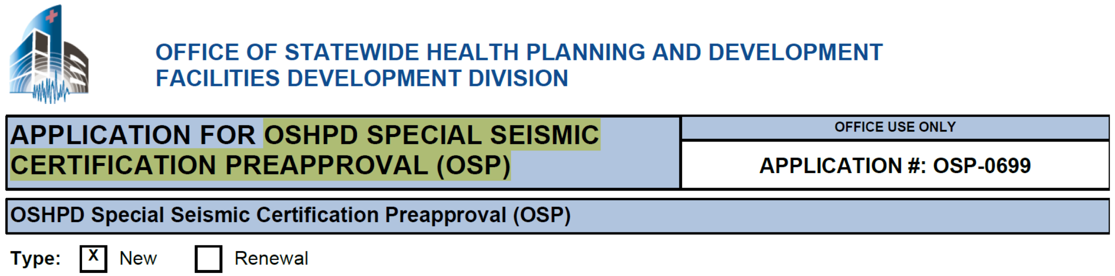


DEPARTMENT OF HEALTH CARE ACCESS AND INFORMATION
FACILITIES DEVELOPMENT DIVISION

APPLICATION FOR HCAI PREAPPROVAL OF MANUFACTURER'S CERTIFICATION (OPM)	OFFICE USE ONLY APPLICATION #: OPM-0669

HCAI Preapproval of Manufacturer's Certification (OPM)

Type: ☒ New ☐ Renewal/Update



OFFICE OF STATEWIDE HEALTH PLANNING AND DEVELOPMENT
FACILITIES DEVELOPMENT DIVISION

APPLICATION FOR OSHPD SPECIAL SEISMIC CERTIFICATION PREAPPROVAL (OSP)	OFFICE USE ONLY APPLICATION #: OSP-0699

OSHPD Special Seismic Certification Preapproval (OSP)

Type: ☒ New ☐ Renewal

2025 CBC Changes to HCAI Preapprovals (ASCE 7-22 Chapter 13 Nonstructural Components)

Webinar will review the new horizontal seismic design force, F_P (eqn. 13.3-1), within ASCE 7-22 Chapter 13, used in existing, renewal, and new HCAI preapprovals, focusing on the *DPOR responsibilities* by the:

1) DPOR for preapproval submittals (*Preapproval DPOR*) *with added focus on preapproval-project efficiency*
2) DPOR for preapproval project use (*Project DPOR*)

- Changes to the seismic design force, F_p used in eqn. 13.3-1 from ASCE 7-16 => 7-22
- Review of new variables introduced within eqn. 13.3-1
- ASCE 7-16 => 7-22 F_P comparison plots for components in Tables 13.5-1 & 13.6-1
- Application of horizontal seismic design force F_p for both preapproval submittals and projects use
- OPM and OSP preapproval examples and DPOR responsibilities

The OSHPD preapproval programs are defined on the HCAI website within PIN 62 and PIN 55 for the OPM and OSP programs, respectively.

Adaptation of the ASCE 7-22 Nonstructural Component to the Preapproval Programs; OPM/OSP

~~Preapproval capacities for F$_p$, can no longer be determined by simply specifying $\boldsymbol{S_{DS}}$ *and* ***z/h!***~~

Per ASCE 7-22, $\boldsymbol{S_{DS}}$ *and* $\boldsymbol{H_f/R_\mu}$ are now required. OSHPD, however, decided to extend the requirements to the mass coefficient (accelerations).

ASCE 7-22 Seismic Design Force, $\mathbf{F_P}$ **:**

$$F_p = 0.4 S_{DS} I_p W_p \left[\frac{H_f}{R_\mu}\right]\left[\frac{C_{AR}}{R_{po}}\right] \qquad (13.3\text{-}1)$$

Citing Sir Issac Newton's ***2nd Law of Motion***:

Force = Mass times Acceleration

$F = m * a$ where:

m = *Weight/gravity*

a = *acceleration*

Note:

$\boldsymbol{C_P}$ for the OPMs ≠ OSPs => $\boldsymbol{C_{Pm}} \neq \boldsymbol{C_{Ps}}$

OPM	$\boldsymbol{C_{Pm}}$ ~ analytical value (eqn 13.3-1)
OSP	$\boldsymbol{C_{Ps}}$ ~ tested spectral acceleration value (C_{AR} , R_{po} , and $I_P = 1$)

$F_p = \boldsymbol{C_P} W_p$ => $F_p / W_p = \boldsymbol{C_P}$

where:

$\boldsymbol{C_P}$ = ***mass coefficient*** *(accelerations),* referenced as the *component design force coefficient*

For OPMs… the *component design force coefficient,* $\boldsymbol{C_{Pm}} = 0.4 S_{DS} I_p \left[\frac{H_f}{R_\mu}\right]\left[\frac{C_{AR}}{R_{po}}\right]$ *; Analytical* ✓ *(supports and attachments)*

For OSPs… the *tested component design force coefficient,*

$\boldsymbol{C_{Ps}}$ = RRS accelerations ($A_{FLX\text{-}H}$, $A_{RIG\text{-}H}$, $A_{FLX\text{-}V}$, $A_{RIG\text{-}V}$) *; Tested Spectral Accelerations* ✓ *(SSC tested components)*

ASCE 7-16 vs 7-22 Nonstructural Horizontal Seismic Component Equation Comparison

F_p = Horizontal seismic component design force equation comparison

(similarities)

Portions remain unchanged

$$F_p = \frac{\boxed{0.4}a_p\boxed{S_{DS}W_p}}{\left(\frac{R_p}{\boxed{I_p}}\right)}\left(1 + 2\frac{z}{h}\right) \qquad (13.3\text{-}1)$$

ASCE 7-16

vs

$$F_p = 0.4S_{DS}I_pW_p\left[\frac{H_f}{R_\mu}\right]\left[\frac{C_{AR}}{R_{po}}\right] \qquad (13.3\text{-}1)$$

ASCE 7-22

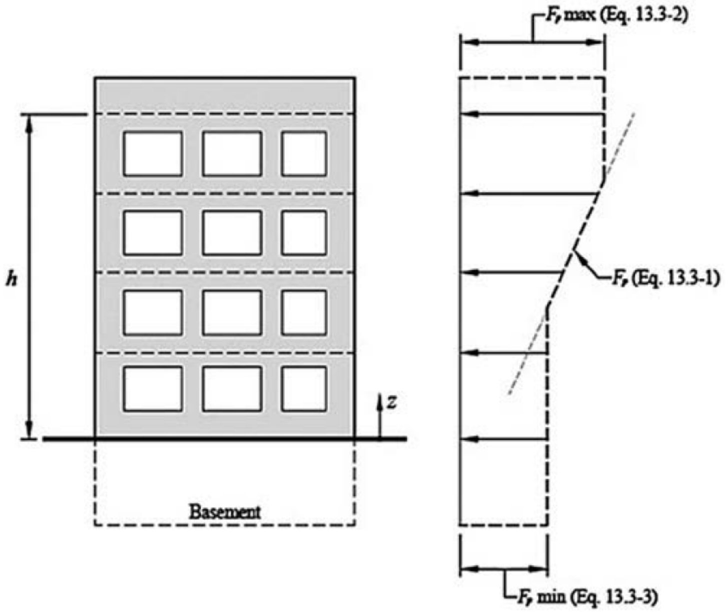
Upper and lower bounds remain unchanged

F_p is not required to be taken as greater than

$$F_p = 1.6S_{DS}I_pW_p \qquad (13.3\text{-}2)$$

and shall not be taken as less than

$$F_p = 0.3S_{DS}I_pW_p \qquad (13.3\text{-}3)$$



ASCE 7-16 vs 7-22 Nonstructural Component Equation Comparison

F_p = Horizontal seismic component design force equation comparison
(changes)

$$F_p = \frac{0.4 a_p S_{DS} W_p}{\left(\frac{R_p}{I_p}\right)}\left(1+2\frac{z}{h}\right)$$

ASCE 7-16

$$F_p = 0.4 S_{DS} I_p W_p \left[\frac{H_f}{R_\mu}\right]\left[\frac{C_{AR}}{R_{po}}\right]$$

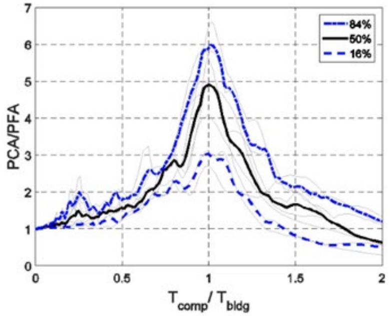
ASCE 7-22

a_p = Component amplification factor
R_p = Component response modification factor

$\left(1+2\frac{z}{h}\right)$ z = height in structure of point of attachment
h = average roof height of structure

C_{AR} = Component resonance ductility factor
R_{po} = Component strength factor

$\left[\frac{H_f}{R_\mu}\right]$ H_f = Force amplification as a function of height
R_μ = Structure ductility reduction factor



For all practical purposes:

$a_p \approx C_{AR}$ as both variables possibly amplify the component response (ability to achieve resonance)
Where: C_{AR} = Peak Component Acceleration/Peak Floor Acceleration (PCA/PFA)
(component flexibility, ratio of component to building period, and ductility)

$R_p \approx R_{po}$ as both variables possibly reduce the component response
Where: R_{po} = Component inherent overstrength

ASCE 7-16 vs 7-22 Nonstructural Component Equation Variables

H_f = Force amplification as a function of height *(New)*

Where: H_f is based upon the Ratio of *Peak Floor Acceleration / Peak Ground Acceleration (PFA)/(PGA).*

$$H_f = 1 + a_1\left(\frac{z}{h}\right) + a_2\left(\frac{z}{h}\right)^{10} \qquad (13.3\text{-}4)$$

$H_f \approx 2.46$ *($T_a = 2$; $a_1 = 0.5$; $a_2 = 0.96$) (based upon building period = 2s.)*

$$H_f = 1 + 2.5\left(\frac{z}{h}\right) \quad \text{Default} \qquad (13.3\text{-}5)$$

Above Grade:

$H_{f\,MAX} = 3.5$

At or below grade:

$H_{f\,MIN} = 1$

Where:

$a_1 = 1/T_a \leq 2.5$

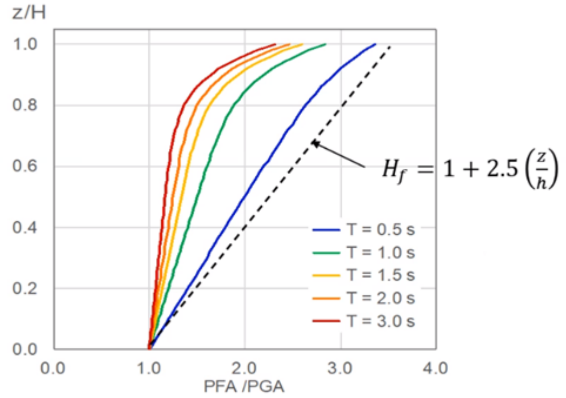
$a_2 = 1 - 0.4/T_a^{\,2} \geq 0$

z = Height above the base of structure to component attachment

h = Average roof height of structure with respect to the base

T_a = *Lowest approximate fundamental period of the supporting building or nonbuilding structure* in either orthogonal direction. For structures with combinations of seismic force- resisting systems (SFRSs), the SFRS that produces the lowest value of T_a shall be used.

$$\frac{F_p}{W_p} = (0.4S_{DS}) \times \left[\frac{H_f}{R_\mu}\right] \times \left[\frac{C_{AR}}{R_{po}}\right] \times I_p$$



F_p is *now* a function of the Building Seismic Force Resisting Systems (SFRS)

$$F_p = 0.4 S_{DS} I_p W_p \left[\frac{H_f}{R_\mu}\right]\left[\frac{C_{AR}}{R_{po}}\right]$$

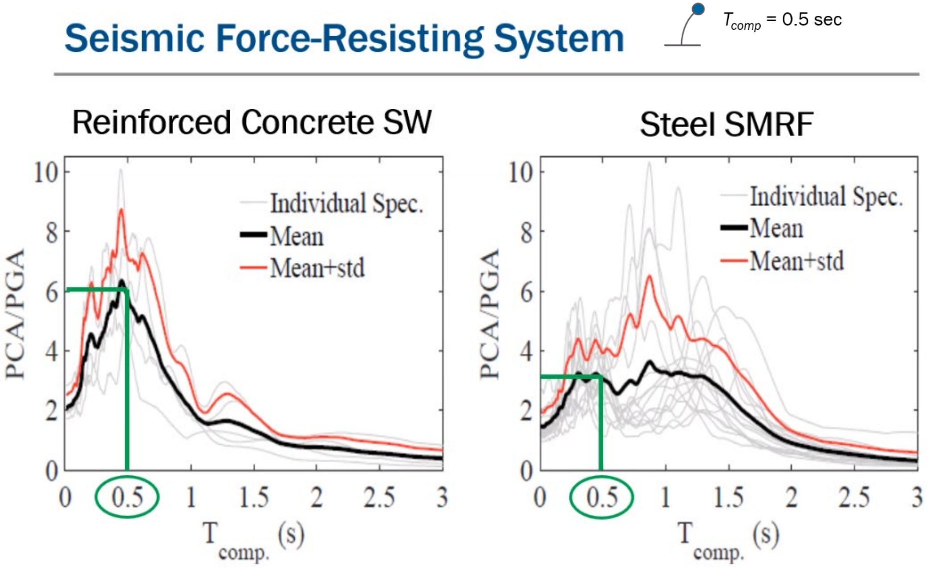
$$R_\mu = [1.1R/(I_e \Omega_0)]^{1/2} \geq 1.3 \quad (13.3\text{-}6)$$

R_μ = Structure ***ductility*** reduction factor, based upon the SFRS
R = Response modification coefficient, SFRS in Table 12.2-1, 15.4-1, or 15.4-2
I_e = Importance Factor
Ω_0 = Overstrength factor as defined in Table 12.2-1, 15.4-1, or 15.4-2

Concrete Shear wall

Moment Frame

Steel Braced Frame



Effect of building stiffness on PCA/PGA for instrumental recordings

ASCE 7-16 vs 7-22 Nonstructural Component Equation Variables

R_{μ} = Structure Ductility Reduction Factor *(New)*

Where: R_{μ} *is based upon the building's ductility* within the Seismic Lateral Force System *(SFRS)*

$$\left[\frac{H_f}{R_\mu}\right] \qquad R_\mu = [1.1R/(I_e\Omega_0)]^{1/2} \geq 1.3 \qquad (13.3\text{-}6)$$

Where:

R = Response modification factor

Ω_0= Overstrength factor

(*both from Tables 12.2-1, 15.4-1, or 15.4-2*)

Above grade:

$R_{\mu\,MAX}$ = 1.71 (only for a single SFRS within Table 12.2-1)

$R_{\mu\,MIN}$ = **1.30** (min within Table 12.2-1 or when SFRS is not listed or specified)

At or below grade:

$R_{\mu\,MIN}$ = **1.0**

Resulting in:

$$\left[\frac{H_f}{R_\mu}\right]_{MAX} = 2.69$$ (with $H_{f\,MAX}$ / $R_{\mu\,MIN}$) (**Above grade**)

$$\left[\frac{H_f}{R_\mu}\right]_{MIN} = 1.0$$ (**At or below grade**)

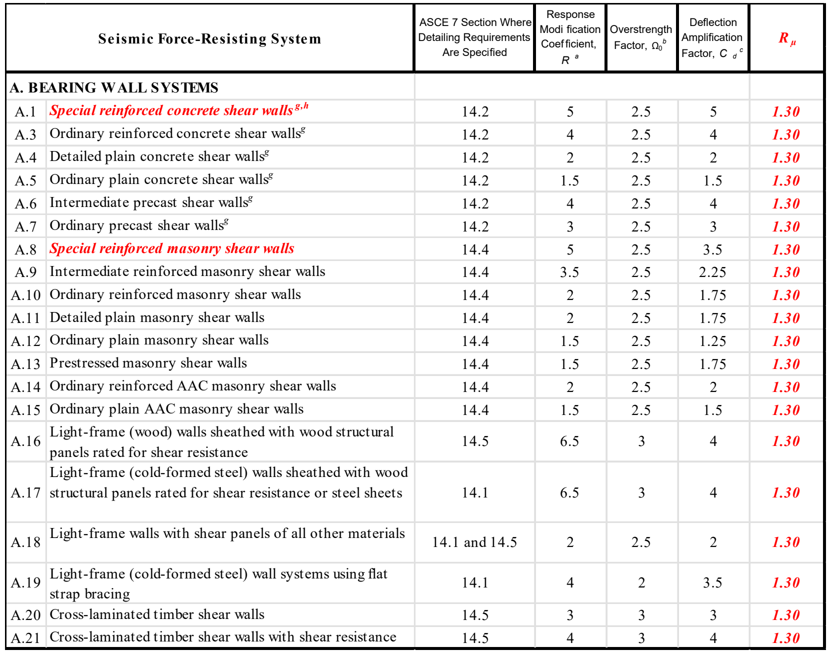
As a minimum, all preapprovals must be certified for either one or both conditions, dependent upon the nonstructural component.

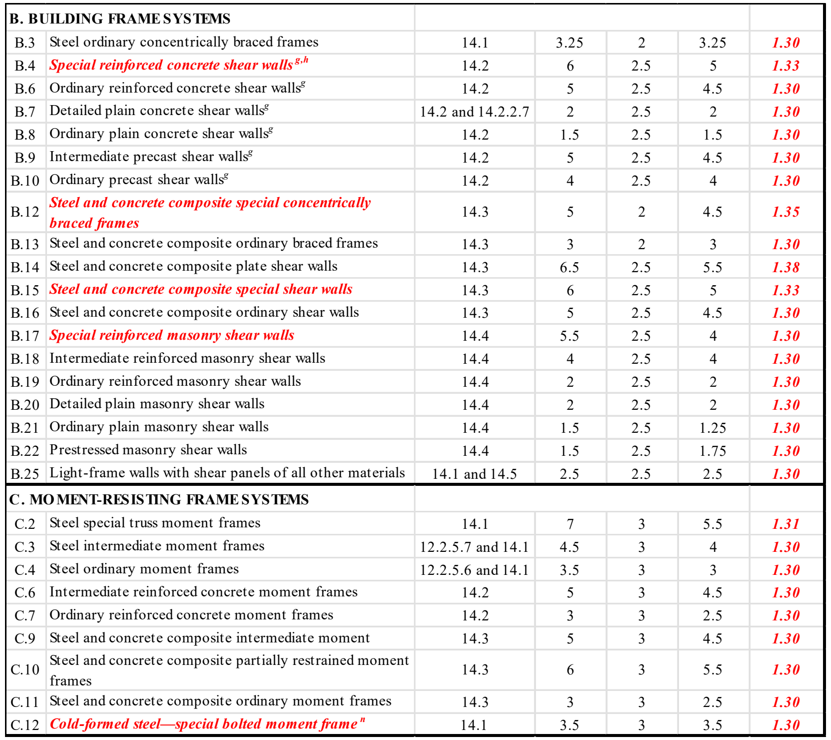
Rμ as a function of SFRS within Table 12.2-1

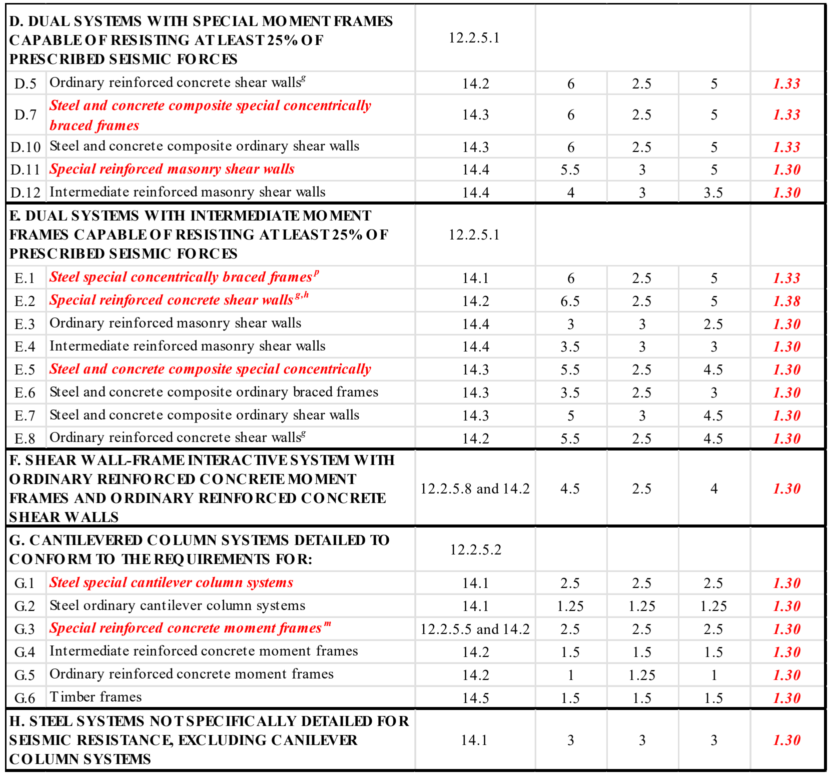
R_μ for different SFRS

$$1.30 \leq R_\mu < 1.40$$

$$F_p = 0.4 S_{DS} I_p W_p \left[\frac{H_f}{R_\mu}\right]\left[\frac{C_{AR}}{R_{po}}\right]; \quad R_\mu = [1.1R/(I_e\Omega_0)]^{1/2} \geq 1.3 \quad (13.3\text{-}6)$$







	Seismic Force-Resisting System	ASCE 7 Section Where Detailing Requirements Are Specified	Response Modi fication Coefficient, R^a	Overstrength Factor, Ω_0^b	Deflection Amplification Factor, C_d^c	R_μ
A. BEARING WALL SYSTEMS						
A.1	***Special reinforced concrete shear walls***^{g,h}	14.2	5	2.5	5	***1.30***
A.3	Ordinary reinforced concrete shear walls^g	14.2	4	2.5	4	***1.30***
A.4	Detailed plain concrete shear walls^g	14.2	2	2.5	2	***1.30***
A.5	Ordinary plain concrete shear walls^g	14.2	1.5	2.5	1.5	***1.30***
A.6	Intermediate precast shear walls^g	14.2	4	2.5	4	***1.30***
A.7	Ordinary precast shear walls^g	14.2	3	2.5	3	***1.30***
A.8	***Special reinforced masonry shear walls***	14.4	5	2.5	3.5	***1.30***
A.9	Intermediate reinforced masonry shear walls	14.4	3.5	2.5	2.25	***1.30***
A.10	Ordinary reinforced masonry shear walls	14.4	2	2.5	1.75	***1.30***
A.11	Detailed plain masonry shear walls	14.4	2	2.5	1.75	***1.30***
A.12	Ordinary plain masonry shear walls	14.4	1.5	2.5	1.25	***1.30***
A.13	Prestressed masonry shear walls	14.4	1.5	2.5	1.75	***1.30***
A.14	Ordinary reinforced AAC masonry shear walls	14.4	2	2.5	2	***1.30***
A.15	Ordinary plain AAC masonry shear walls	14.4	1.5	2.5	1.5	***1.30***
A.16	Light-frame (wood) walls sheathed with wood structural panels rated for shear resistance	14.5	6.5	3	4	***1.30***
A.17	Light-frame (cold-formed steel) walls sheathed with wood structural panels rated for shear resistance or steel sheets	14.1	6.5	3	4	***1.30***
A.18	Light-frame walls with shear panels of all other materials	14.1 and 14.5	2	2.5	2	***1.30***
A.19	Light-frame (cold-formed steel) wall systems using flat strap bracing	14.1	4	2	3.5	***1.30***
A.20	Cross-laminated timber shear walls	14.5	3	3	3	***1.30***
A.21	Cross-laminated timber shear walls with shear resistance	14.5	4	3	4	***1.30***
B. BUILDING FRAME SYSTEMS						
B.3	Steel ordinary concentrically braced frames	14.1	3.25	2	3.25	***1.30***
B.4	***Special reinforced concrete shear walls***^{g,h}	14.2	6	2.5	5	***1.33***
B.6	Ordinary reinforced concrete shear walls^g	14.2	5	2.5	4.5	***1.30***
B.7	Detailed plain concrete shear walls^g	14.2 and 14.2.2.7	2	2.5	2	***1.30***
B.8	Ordinary plain concrete shear walls^g	14.2	1.5	2.5	1.5	***1.30***
B.9	Intermediate precast shear walls^g	14.2	5	2.5	4.5	***1.30***
B.10	Ordinary precast shear walls^g	14.2	4	2.5	4	***1.30***
B.12	***Steel and concrete composite special concentrically braced frames***	14.3	5	2	4.5	***1.35***
B.13	Steel and concrete composite ordinary braced frames	14.3	3	2	3	***1.30***
B.14	Steel and concrete composite plate shear walls	14.3	6.5	2.5	5.5	***1.38***
B.15	***Steel and concrete composite special shear walls***	14.3	6	2.5	5	***1.33***
B.16	Steel and concrete composite ordinary shear walls	14.3	5	2.5	4.5	***1.30***
B.17	***Special reinforced masonry shear walls***	14.4	5.5	2.5	4	***1.30***
B.18	Intermediate reinforced masonry shear walls	14.4	4	2.5	4	***1.30***
B.19	Ordinary reinforced masonry shear walls	14.4	2	2.5	2	***1.30***
B.20	Detailed plain masonry shear walls	14.4	2	2.5	2	***1.30***
B.21	Ordinary plain masonry shear walls	14.4	1.5	2.5	1.25	***1.30***
B.22	Prestressed masonry shear walls	14.4	1.5	2.5	1.75	***1.30***
B.25	Light-frame walls with shear panels of all other materials	14.1 and 14.5	2.5	2.5	2.5	***1.30***
C. MOMENT-RESISTING FRAME SYSTEMS						
C.2	Steel special truss moment frames	14.1	7	3	5.5	***1.31***
C.3	Steel intermediate moment frames	12.2.5.7 and 14.1	4.5	3	4	***1.30***
C.4	Steel ordinary moment frames	12.2.5.6 and 14.1	3.5	3	3	***1.30***
C.6	Intermediate reinforced concrete moment frames	14.2	5	3	4.5	***1.30***
C.7	Ordinary reinforced concrete moment frames	14.2	3	3	2.5	***1.30***
C.9	Steel and concrete composite intermediate moment	14.3	5	3	4.5	***1.30***
C.10	Steel and concrete composite partially restrained moment frames	14.3	6	3	5.5	***1.30***
C.11	Steel and concrete composite ordinary moment frames	14.3	3	3	2.5	***1.30***
C.12	***Cold-formed steel—special bolted moment frame***^{n}	14.1	3.5	3	3.5	***1.30***
D. DUAL SYSTEMS WITH SPECIAL MOMENT FRAMES CAPABLE OF RESISTING AT LEAST 25% OF PRESCRIBED SEISMIC FORCES		12.2.5.1				
D.5	Ordinary reinforced concrete shear walls^g	14.2	6	2.5	5	***1.33***
D.7	***Steel and concrete composite special concentrically braced frames***	14.3	6	2.5	5	***1.33***
D.10	Steel and concrete composite ordinary shear walls	14.3	6	2.5	5	***1.33***
D.11	***Special reinforced masonry shear walls***	14.4	5.5	3	5	***1.30***
D.12	Intermediate reinforced masonry shear walls	14.4	4	3	3.5	***1.30***
E. DUAL SYSTEMS WITH INTERMEDIATE MOMENT FRAMES CAPABLE OF RESISTING AT LEAST 25% OF PRESCRIBED SEISMIC FORCES		12.2.5.1				
E.1	***Steel special concentrically braced frames***^{p}	14.1	6	2.5	5	***1.33***
E.2	***Special reinforced concrete shear walls***^{g,h}	14.2	6.5	2.5	5	***1.38***
E.3	Ordinary reinforced masonry shear walls	14.4	3	3	2.5	***1.30***
E.4	Intermediate reinforced masonry shear walls	14.4	3.5	3	3	***1.30***
E.5	***Steel and concrete composite special concentrically***	14.3	5.5	2.5	4.5	***1.30***
E.6	Steel and concrete composite ordinary braced frames	14.3	3.5	2.5	3	***1.30***
E.7	Steel and concrete composite ordinary shear walls	14.3	5	3	4.5	***1.30***
E.8	Ordinary reinforced concrete shear walls^g	14.2	5.5	2.5	4.5	***1.30***
F. SHEAR WALL-FRAME INTERACTIVE SYSTEM WITH ORDINARY REINFORCED CONCRETE MOMENT FRAMES AND ORDINARY REINFORCED CONCRETE SHEAR WALLS		12.2.5.8 and 14.2	4.5	2.5	4	***1.30***
G. CANTILEVERED COLUMN SYSTEMS DETAILED TO CONFORM TO THE REQUIREMENTS FOR:		12.2.5.2				
G.1	***Steel special cantilever column systems***	14.1	2.5	2.5	2.5	***1.30***
G.2	Steel ordinary cantilever column systems	14.1	1.25	1.25	1.25	***1.30***
G.3	***Special reinforced concrete moment frames***^{m}	12.2.5.5 and 14.2	2.5	2.5	2.5	***1.30***
G.4	Intermediate reinforced concrete moment frames	14.2	1.5	1.5	1.5	***1.30***
G.5	Ordinary reinforced concrete moment frames	14.2	1	1.25	1	***1.30***
G.6	Timber frames	14.5	1.5	1.5	1.5	***1.30***
H. STEEL SYSTEMS NOT SPECIFICALLY DETAILED FOR SEISMIC RESISTANCE, EXCLUDING CANILEVER COLUMN SYSTEMS		14.1	3	3	3	***1.30***

Rμ as a function of SFRS within Table 12.2-1

R_μ for different SFRS

$1.40 \leq R_\mu < 1.50$

$$F_p = 0.4 S_{DS} I_p W_p \left[\frac{H_f}{R_\mu}\right]\left[\frac{C_{AR}}{R_{po}}\right]; \quad R_\mu = [1.1R/(I_e \Omega_0)]^{1/2} \geq 1.3 \qquad (13.3\text{-}6)$$

Seismic Force-Resisting System		ASCE 7 Section Where Detailing Requirements Are Specified	Response Modi fication Coefficient, R^a	Overstrength Factor, Ω_0^b	Deflection Amplification Factor, C_d^c	***R_μ***
B. BUILDING FRAME SYSTEMS						
B.2	***Steel special concentrically braced frames***	14.1	6	2	5	***1.48***
B.23	Light-frame (wood) walls sheathed with wood structural panels rated for shear resistance	14.5	7	2.5	4.5	***1.43***
B.24	Light-frame (cold-formed steel) walls sheathed with wood structural panels rated for shear resistance or steel sheets	14.1	7	2.5	4.5	***1.43***
C. MOMENT-RESISTING FRAME SYSTEMS						
C.1	***Steel special moment frames***	14.1 and 12.2.5.5	8	3	5.5	***1.40***
C.5	***Special reinforced concrete moment frames***[m]	12.2.5.5 and 14.2	8	3	5.5	***1.40***
C.8	***Steel and concrete composite special moment frames***	12.2.5.5 and 14.3	8	3	5.5	***1.40***
D. DUAL SYSTEMS WITH SPECIAL MOMENT FRAMES CAPABLE OF RESISTING AT LEAST 25% OF PRESCRIBED SEISMIC FORCES		12.2.5.1				
D.2	***Steel special concentrically braced frames***	14.1	7	2.5	5.5	***1.43***
D.3	***Special reinforced concrete shear walls***[g,h]	14.2	7	2.5	5.5	***1.43***
D.8	Steel and concrete composite plate shear walls	14.3	7.5	2.5	6	***1.48***
D.9	***Steel and concrete composite special shear walls***	14.3	7	2.5	6	***1.43***

Rμ as a function of SFRS within Table 12.2-1

R_μ for different SFRS

$1.50 \leq R_\mu$

$$F_p = 0.4 S_{DS} I_p W_p \left[\frac{H_f}{R_\mu}\right]\left[\frac{C_{AR}}{R_{po}}\right]; \quad R_\mu = [1.1R/(I_e\Omega_0)]^{1/2} \geq 1.3 \qquad (13.3\text{-}6)$$

Seismic Force-Resisting System		ASCE 7 Section Where Detailing Requirements Are Specified	Response Modification Coefficient, R [a]	Overstrength Factor, Ω_0 [b]	Deflection Amplification Factor, C_d [c]	R_μ
A. BEARING WALL SYSTEMS						
A.2	Reinforced concrete ductile coupled walls[g]	14.2	8	2.5	8	*1.53*
B. BUILDING FRAME SYSTEMS						
B.1	***Steel eccentrically braced frames***	***14.1***	***8***	***2***	***4***	***1.71***
B.5	Reinforced concrete ductile coupled walls[g]	14.2	8	2.5	8	*1.53*
B.11	Steel and concrete composite eccentrically braced frames	14.3	8	2.5	4	*1.53*
B.26	Steel buckling-restrained braced frames	14.1	8	2.5	5	*1.53*
B.27	***Steel special plate shear walls***	***14.1***	***7***	***2***	***6***	***1.60***
B.28	Steel and concrete coupled composite plate shear walls	14.3	8	2.5	5.5	*1.53*
D. DUAL SYSTEMS WITH SPECIAL MOMENT FRAMES CAPABLE OF RESISTING AT LEAST 25% OF PRESCRIBED SEISMIC FORCES		12.2.5.1				
D.1	Steel eccentrically braced frames	14.1	8	2.5	4	*1.53*
D.4	Reinforced concrete ductile coupled walls[g]	14.2	8	2.5	8	*1.53*
D.6	Steel and concrete composite eccentrically braced frames	14.3	8	2.5	4	*1.53*
D.13	Steel buckling-restrained braced frames	14.1	8	2.5	5	*1.53*
D.14	***Steel special plate shear walls***	14.1	8	2.5	6.5	*1.53*
D.15	Steel and concrete coupled composite plate shear walls	14.3	8	2.5	5.5	*1.53*

ASCE 7-16 vs 7-22 Nonstructural Component Table Comparisons

Partial Table 13.6-1 **Mechanical and Electrical Components comparison 7-16 => 7-22**

(changes are also within Architectural Components Table 13.5-1)

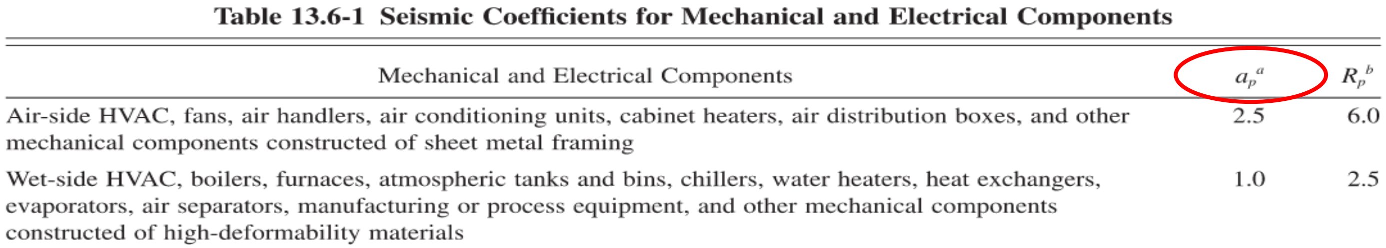


Table 13.6-1 Seismic Coefficients for Mechanical and Electrical Components

Mechanical and Electrical Components	a_p[a]	R_p[b]
Air-side HVAC, fans, air handlers, air conditioning units, cabinet heaters, air distribution boxes, and other mechanical components constructed of sheet metal framing	2.5	6.0
Wet-side HVAC, boilers, furnaces, atmospheric tanks and bins, chillers, water heaters, heat exchangers, evaporators, air separators, manufacturing or process equipment, and other mechanical components constructed of high-deformability materials	1.0	2.5

ASCE 7-16

a_p / $R_p \approx 0.41$

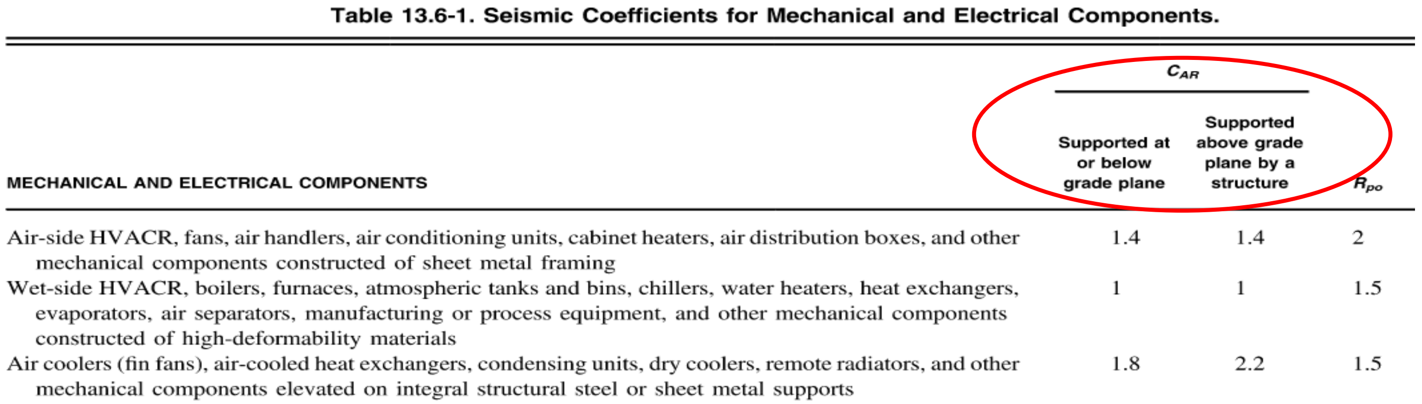


Table 13.6-1. Seismic Coefficients for Mechanical and Electrical Components.

MECHANICAL AND ELECTRICAL COMPONENTS	C_{AR}		R_{po}
	Supported at or below grade plane	Supported above grade plane by a structure	
Air-side HVACR, fans, air handlers, air conditioning units, cabinet heaters, air distribution boxes, and other mechanical components constructed of sheet metal framing	1.4	1.4	2
Wet-side HVACR, boilers, furnaces, atmospheric tanks and bins, chillers, water heaters, heat exchangers, evaporators, air separators, manufacturing or process equipment, and other mechanical components constructed of high-deformability materials	1	1	1.5
Air coolers (fin fans), air-cooled heat exchangers, condensing units, dry coolers, remote radiators, and other mechanical components elevated on integral structural steel or sheet metal supports	1.8	2.2	1.5

ASCE 7-22

C_{AR} / $R_{PO} \approx 0.67$ to 1.46

Where: The *addition of C_{AR} ≤grade & >grade* is based on the **component amplification at grade being typically < component amplification within a building**

ASCE 7-22 Nonstructural Component Table 13.6-1 Additions

New additions to ASCE 7-22 Table 13.6-1 Mechanical and Electrical Components

A new separate section for ***component supports (>24”)*** and ***distributions supports*** have been added to Table 13.6-1.

Table 13.6-1. Seismic Coefficients for Mechanical and Electrical Components.

	C_{AR}		
MECHANICAL AND ELECTRICAL COMPONENTS	Supported at or below grade plane	Supported above grade plane by a structure	R_{po}
EQUIPMENT SUPPORT STRUCTURES AND PLATFORMS			
Support structures and platforms where $T_p/T_a < 0.2$, or $T_p \leq 0.06$ s, per Section 13.6.4.6	NA	1	1.5
Seismic force-resisting systems with $R > 3$	1.4	1.4	1.5
Seismic force-resisting systems with $R \leq 3$	1.8	2.2	1.5
Other systems	2.2	2.8	1.5
DISTRIBUTION SYSTEM SUPPORTS			
Tension-only and cable bracing	1	1	1.5
Cold-formed steel rigid bracing	1	1	1.5
Hot-rolled steel bracing	1	1	1.5
Other rigid bracing	1	1	1.5
Lateral resistance provided by rods in flexure	1.8	2.2	1.5
Vertical cantilever supports such as pipe tees and moment frames above and supported by a floor or roof	1.8	2.2	1.5

ASCE 7-22 Nonstructural Component Table 13.6-1 Support Structure / Platform Definitions

New additions to ASCE 7-22 Table 13.6-1 Mechanical and Electrical Components ~ cont'd

What constitutes Equipment Support Structures and Platforms?

Per the ASCE 7-22 *Commentary* §C13.6.4

Equipment supports are classified into *three (3)* groups *(distribution supports are not equipment supports)*

- ***Integral****(1)* ***Supports* ≤ 24" (NOT an Equipment Support)**

  Supports which are directly connected to both the component and the attachment to the structure or foundation *up to 24 inches* in length (height); i.e., lugs, skirts, saddles, and short legs.

- ***Equipment Support Structures****(2) and* ***Platforms****(3)* **> 24"**

  Assemblies of structural members that provide support for a piece of equipment or system, including moment frames, braced frames, skids, or legs greater than 24 inches.

The commentary also delineates equipment Supports from equipment Platforms, with Platforms supporting multiple components or systems. The differences are inconsequential as both equipment Supports and Platforms have the same C_{AR} lateral coefficients.

ASCE 7-22 Nonstructural Component Support Structures / Platforms

New additions to ASCE 7-22 Table 13.6-1 Mechanical and Electrical Components ~ cont’d

§C13.6.4: “…The 24 in. length limit ***for legs***…”

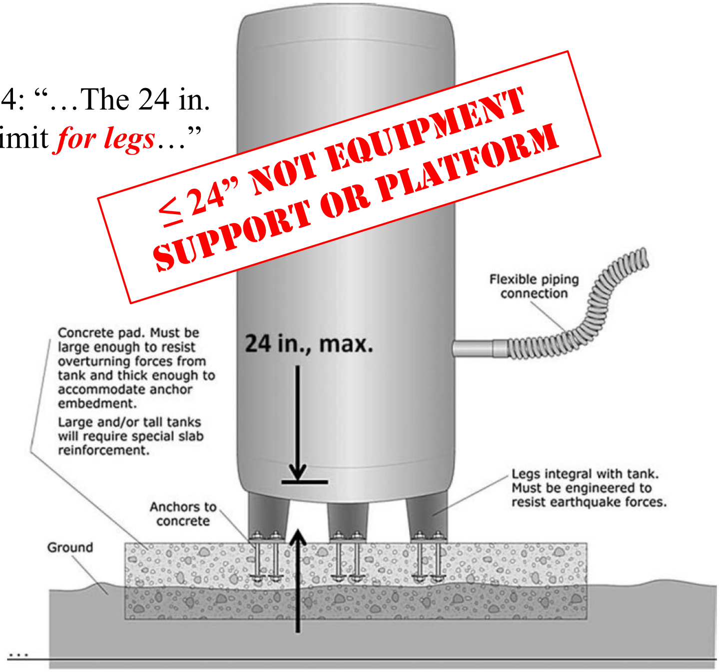


Figure C13.6.4.1. Example of a nonstructural component with integral equipment supports.
Source: FEMA E-74 (2015).

~~*Integral* equipment supports~~
~~(≤ 24” in length)~~

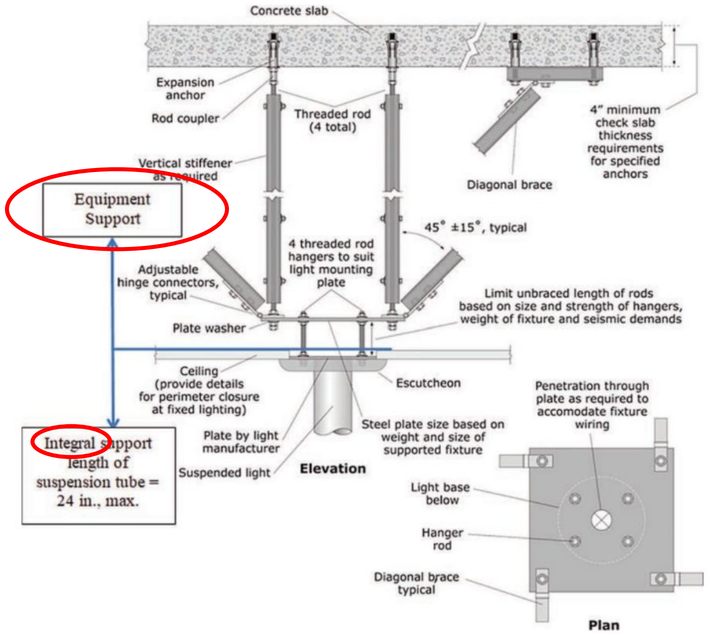


Figure C13.6.4.2. Example of an equipment support structure for a heavy light fixture.
Source: FEMA E-74 (2015).
Note: 1 in. = 25 mm.

Equipment *Support*
(> 24” in length)

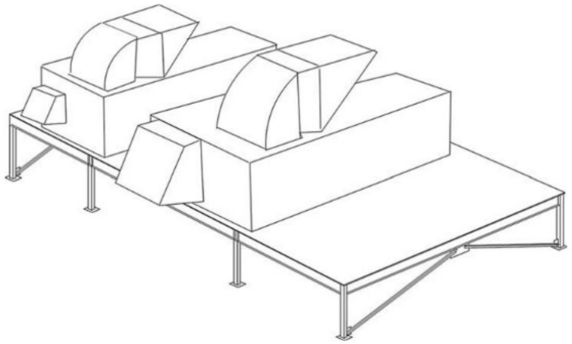


Figure C13.6.4.3. Example of an equipment support platform supporting two mechanical components.
Source: FEMA E-74 (2015).

Equipment *Platform*
(> 24” in length)

ASCE 7-22 Nonstructural Component Table 13.6-1 Support/Platform Design Requirements

New additions to ASCE 7-22 Table 13.6-1 Mechanical and Electrical Components ~ cont'd

	C_{AR}		R_{PO}
	$\leq$ *grd*	$>$ *grd*	
*EQUIPMENT **SUPPORT STRUCTURES AND PLATFORMS**			
Support structures and platforms where $T_p/T_a < 0.2$, or $T_p \leq 0.06$ s, per Section 13.6.4.6	NA	1	1.5
Seismic force-resisting systems with $R > 3$ *(from Table 12.2-1, 15.4-1)*	1.4	1.4	1.5
Seismic force-resisting systems with $R \leq 3$ *(from Table 12.2-1, 15.4-1)*	1.8	2.2	1.5
Other systems	2.2	2.8	1.5

where:

T_p = Fundamental period of the component, *including the support/platform and attachments (per Section 13.3.3)* (i.e., *the component assembly*).

T_a = Approximate fundamental period of the building as determined in Section 12.8.2

13.3.1.3 Component Resonance Ductility Factor, C_{AR}

The *component resonance ductility factor* (C_{AR}) for mechanical and electrical equipment mounted on the equipment support structures or platforms *shall not be less than* the component resonance ductility factor ***used*** for *the equipment support structure or platform itself*.

Translation:

If a component is attached to a support > 24", the *component* C_{AR}, $\geq$ *support* C_{AR}.

ASCE 7-22 Nonstructural Component Table 13.6-1 Support/Platform Design Requirements

Period Determination of Component and Component Assemblies

T_p = Fundamental period of the component, *including the support/platform and its attachment per Section 13.3.3* (i.e., *the component assembly*).

Component period, T_p *is **not** a function, nor is related to* C_{AR} (component resonance ductility factor - ability to achieve resonance).

§13.3.3 **Component Period** states in part… The fundamental period, $\mathbf{T_p}$ … shall be determined by… $T_p = 2\pi\sqrt{\frac{W_p}{K_p g}}$ Further stating: …**provided** the component, supports, and attachment can be reasonably represented analytically *by a simple single-degree-of-freedom spring-and-mass system* (active and energized systems typically cannot be modeled)

The §C13.3.3 (commentary) states …*Determination of the fundamental period of an architectural, mechanical, or electrical component using analytical, or test methods is often difficult and, if not properly performed, may yield incorrect results*.

Further stating: ...A resonant frequency search procedure, **such as that given in the *ICC-ES AC156***…, may be used to identify the dominant modes of vibration of a component.

Note: Supports used during Special Seismic Certification (SSC) of active or energized components are deemed to meet the lateral force requirements for equipment Supports/Platforms. The ***attachments***, however, must still be designed according to Table 13.6-1.

ASCE 7-22 Nonstructural Component Support/Platform

EQUIPMENT SUPPORT STRUCTURES AND PLATFORMS ~ cont'd.	C_{AR} $\leq$ *grd*	C_{AR} > *grd*	R_{PO}
[1]Support structures and platforms where [1a]$T_p/T_a < 0.2$, or [1b]$T_p \leq 0.06$ s, per Section 13.6.4.6	NA*	1	1.5
[2]Seismic force-resisting systems with $R > 3$ *(must conform to Table 12.2-1, 15.4-1)*	1.4	1.4	1.5
[2]Seismic force-resisting systems with $R \leq 3$ *(must conform to Table 12.2-1, 15.4-1)*	1.8	2.2	1.5
[3]Other systems *(none of the above)*	2.2	2.8	1.5

*must use one of the other 3 remaining supports conditions.

Clarification:

For Components on Equipment Supports or Platforms

1

[1a]Component is *within a building/nonbuilding structure*, and $T_p/T_a < 0.2$ (i.e., component assembly period < 20% building period) the component assembly $C_{AR}=1$, $R_p=1.5$, using a support/platform designed using a Chp 14 material standard.

[1b]Component is *within a building/nonbuilding structure*, the component assembly is rigid ($T_p \leq 0.06$ s), $C_{AR}=1$, $R_p=1.5$, using a support/platform designed using a Chp 14 material standard.

[2]To date, equipment supports/platforms designed using an SFRS from Tables 12.2-1, and 15.4-1 are rarely used (typically project specific).

[3]Component is *flexible ($T_p > 0.06$ s)*, regardless of the Equipment Support or Platform stiffness, *the entire component assembly is flexible and must use Other Systems* with C_{AR}=2.2 or 2.8, R_p=1.5, using a support/platform designed using a Chp 14 material standard.

ASCE 7-22 Nonstructural Component Support Structures / Platforms

Example of a *Flexible* Component on a *Rigid* Support

Support > 24”
Support is rigid, Mechanical component is flexible
Resulting *component assembly* $T_p > 0.06$ s.

Component assembly (component, support, and attachments), must be designed to ***Other Systems*** within Table 13.6-1 ***Equipment Supports and Platforms***

May apply to ***computer racks, suspended supported components***
i.e., *mobile lighting fixtures, X-ray booms.*

EQUIPMENT SUPPORT STRUCTURES AND PLATFORMS	C_{AR}		R_{PO}	Ω_0
Support structures and platforms where $T_p/T_a < 0.2$, or $T_p \le 0.06$ s, per Section 13.6.4.6	NA	1	1.5	2
Seismic force-resisting systems with $R > 3$	1.4	1.4	1.5	2
Seismic force-resisting systems with $R \le 3$	1.8	2.2	1.5	1.75
Other systems	***2.2***	***2.8***	***1.5***	***1.5***

ASCE 7-22 Nonstructural Component Distribution System Support Design Requirements

New additions *to ASCE 7-22 Table 13.6-1 Mechanical and Electrical Components*

DISTRIBUTION SYSTEM SUPPORTS*	C_{AR}		R_{PO}
Tension-only and cable bracing	1	1	1.5
Cold-formed steel rigid bracing	1	1	1.5
Hot-rolled steel bracing	1	1	1.5
Other rigid bracing	1	1	1.5
[1]Lateral resistance provided by rods in flexure	1.8	2.2	1.5
[1]Vertical cantilever supports such as pipe tees and moment frames above and supported by a floor or roof	1.8	2.2	1.5

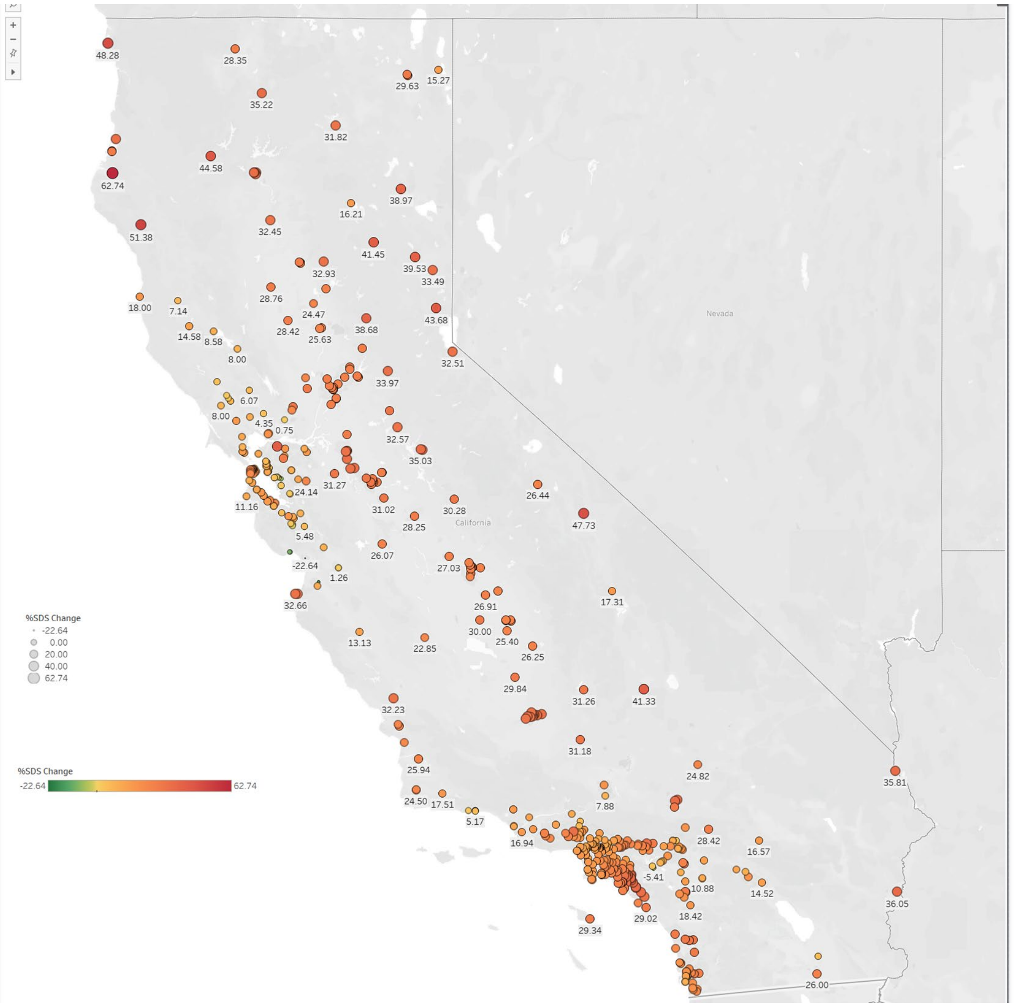
[1] *Other than bracing supports*

13.6.4.7 Distribution System Supports

Seismic loads for distribution system supports and trapeze assemblies shall be based on the *weight of the distribution system tributary to the supports*, including fittings and in-line components. See Sections 13.6.5, 13.6.6, and 13.6.7 for specific system requirements.

Note: The design of distribution system supports is now a separate design from distribution systems.

ASCE 7-16 vs ASCE 7-22 Nonstructural Component Design Force Level



Facility S_{DS} percent change enforced within ASCE 7-22.

ASCE 7-22 §11.2 Definitions: USGS SEISMIC DESIGN GEODATABASE: The USGS Seismic Design Geodatabase is available at the ASCE 7 Hazard Tool https://asce7hazardtool.online/

ASCE 7-16 vs ASCE 7-22 Nonstructural Component Design Force Level *Comparisons*

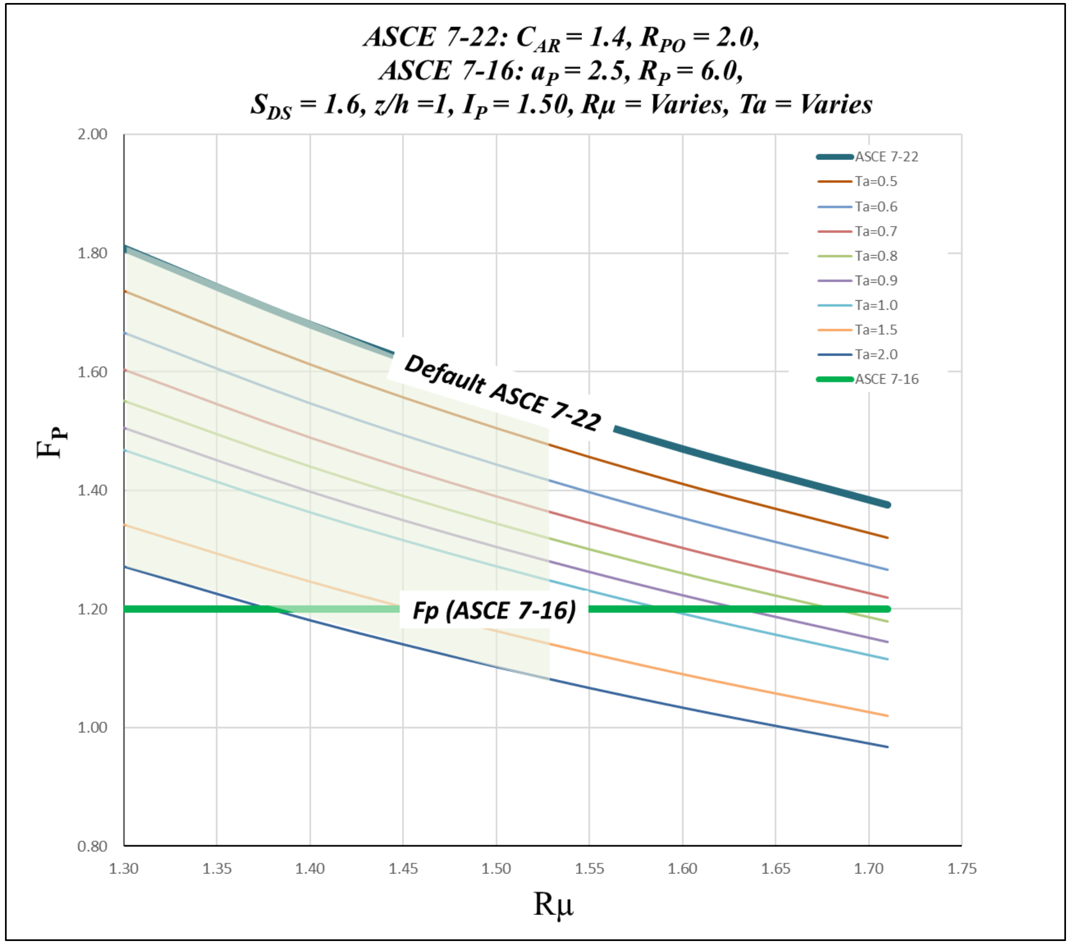


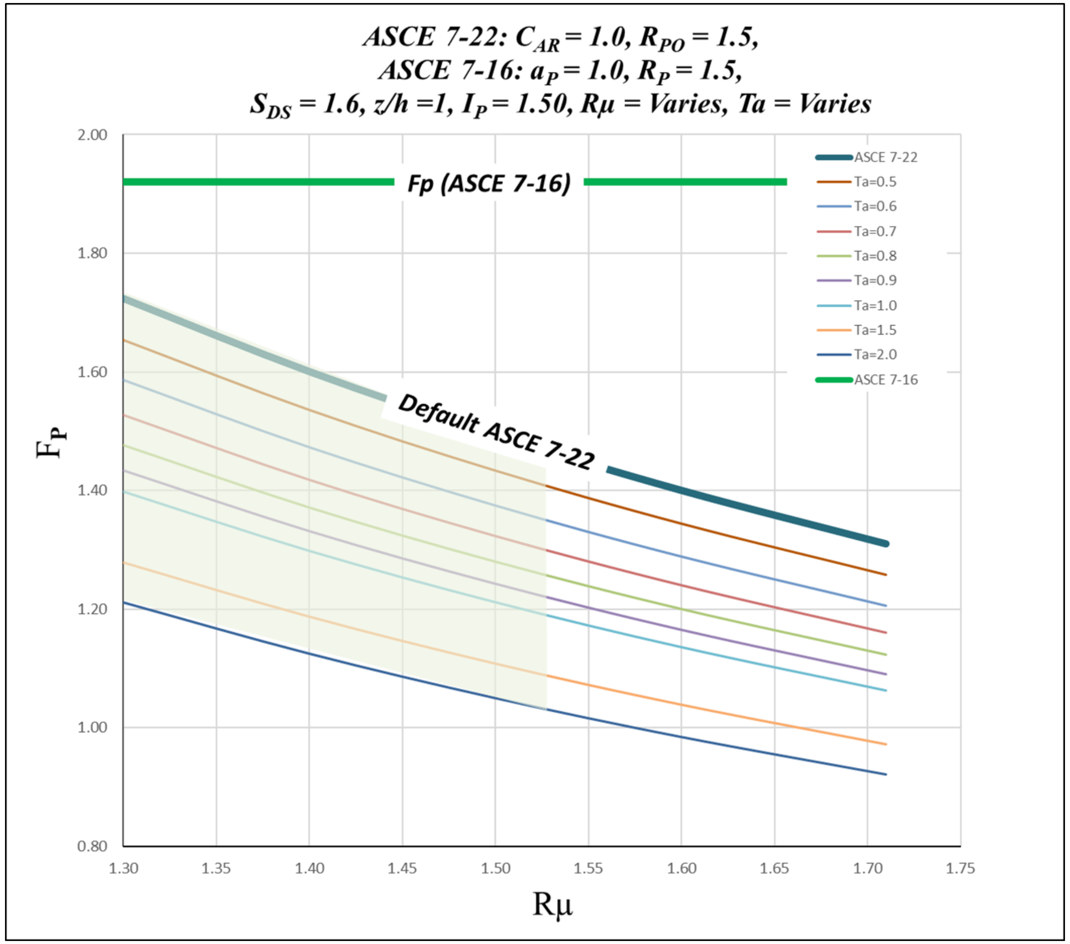
Table 13.6-1. **Seismic Coefficients for Mechanical and Electrical Components.**

Mechanical and Electrical Components
Air-side HVACR, fans, air handlers, air conditioning units…
Motor control centers, panel boards, switch gear…

On Projects:
Do not simply compare the preapproval S_{DS} to the project S_{DS}!

Other variables, i.e., ***H_f and R_μ*** may reduce project demands and use of ***Hybrid RRS spectrums for OSPs*** *may* allow for project use of preapprovals with higher S_{DS} levels.

ASCE 7-16 vs ASCE 7-22 Nonstructural Component Design Force Level *Comparisons*

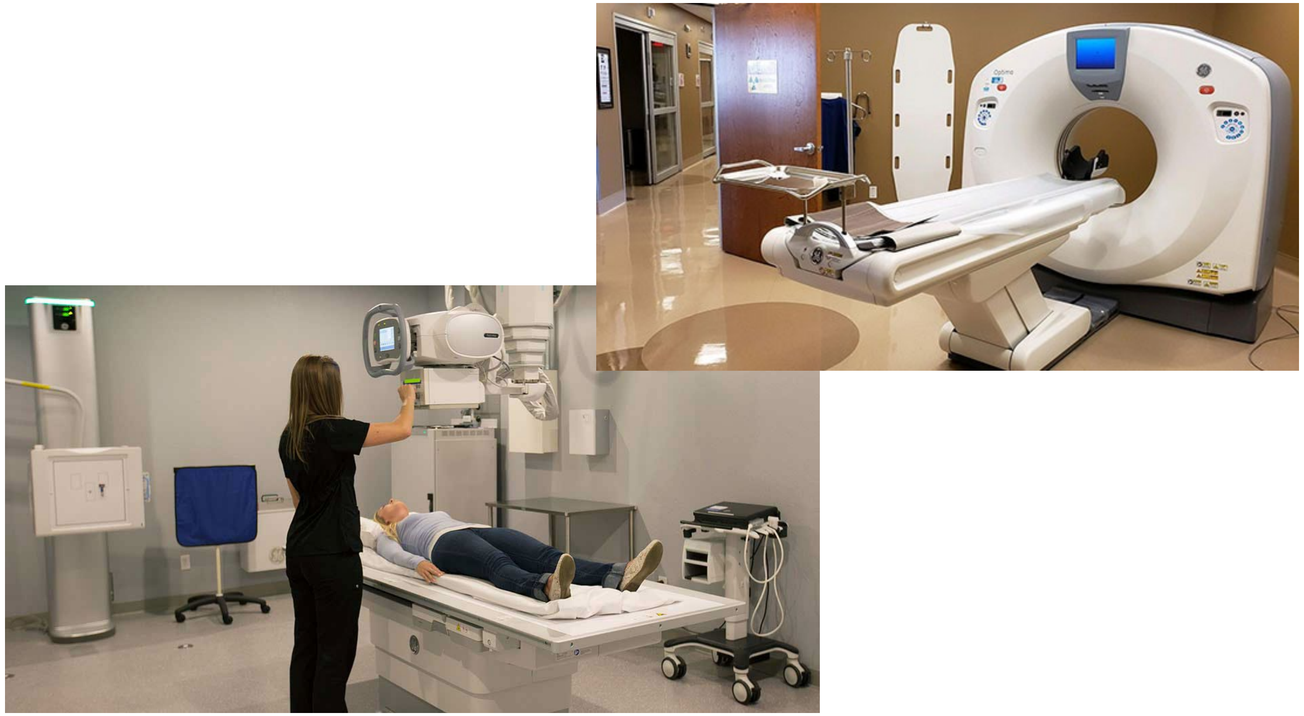


ASCE 7-22: C_{AR} = 1.0, R_{PO} = 1.5,
ASCE 7-16: a_P = 1.0, R_P = 1.5,
S_{DS} = 1.6, z/h =1, I_P = 1.50, Rμ = Varies, Ta = Varies

Table 13.6-1. **Seismic Coefficients for Mechanical and Electrical Components.**

Mechanical and Electrical Components

Other mechanical or electrical components, i.e., Medical Imaging Equipment



ASCE 7-16 vs ASCE 7-22 Nonstructural Component Design Force Level *Comparisons*

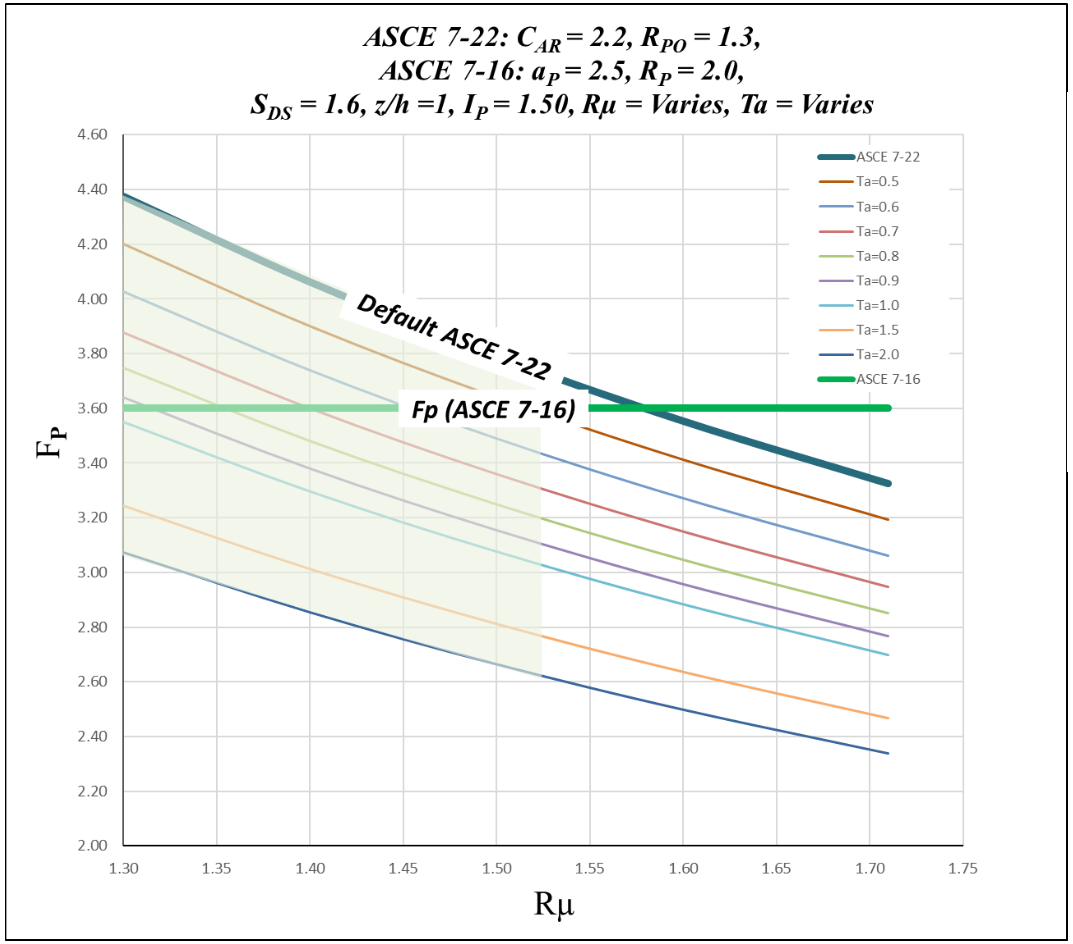


Table 13.6-1. **Seismic Coefficients for Mechanical and Electrical Components.**

Vibration-Isolated Components and Systems

Spring-isolated components and systems and vibration-isolated floors closely restrained using built-in or separate elastomeric snubbing devices or resilient perimeter stops

Internally isolated components and systems

ASCE 7-16 vs ASCE 7-22 Nonstructural Component Design Force Level *Comparisons*

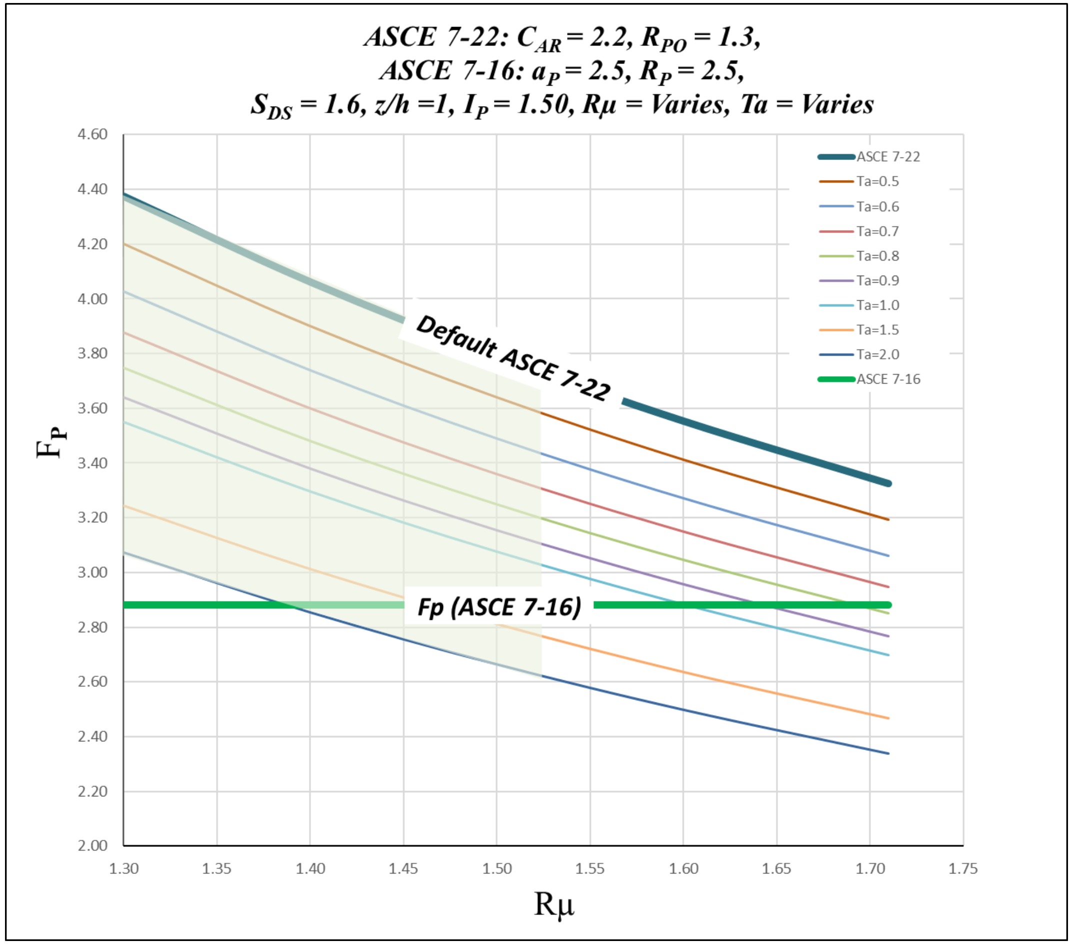


Table 13.6-1. **Seismic Coefficients for Mechanical and Electrical Components.**

Vibration-Isolated Components and Systems

Components and systems isolated using ***neoprene*** elements and neoprene isolated floors with built-in or separate ***elastomeric snubbing devices*** or resilient perimeter stops

Suspended vibration-isolated equipment, including in-line duct devices and suspended internally isolated components

ASCE 7-16 vs ASCE 7-22 Nonstructural Component Design Force Level *Comparisons*

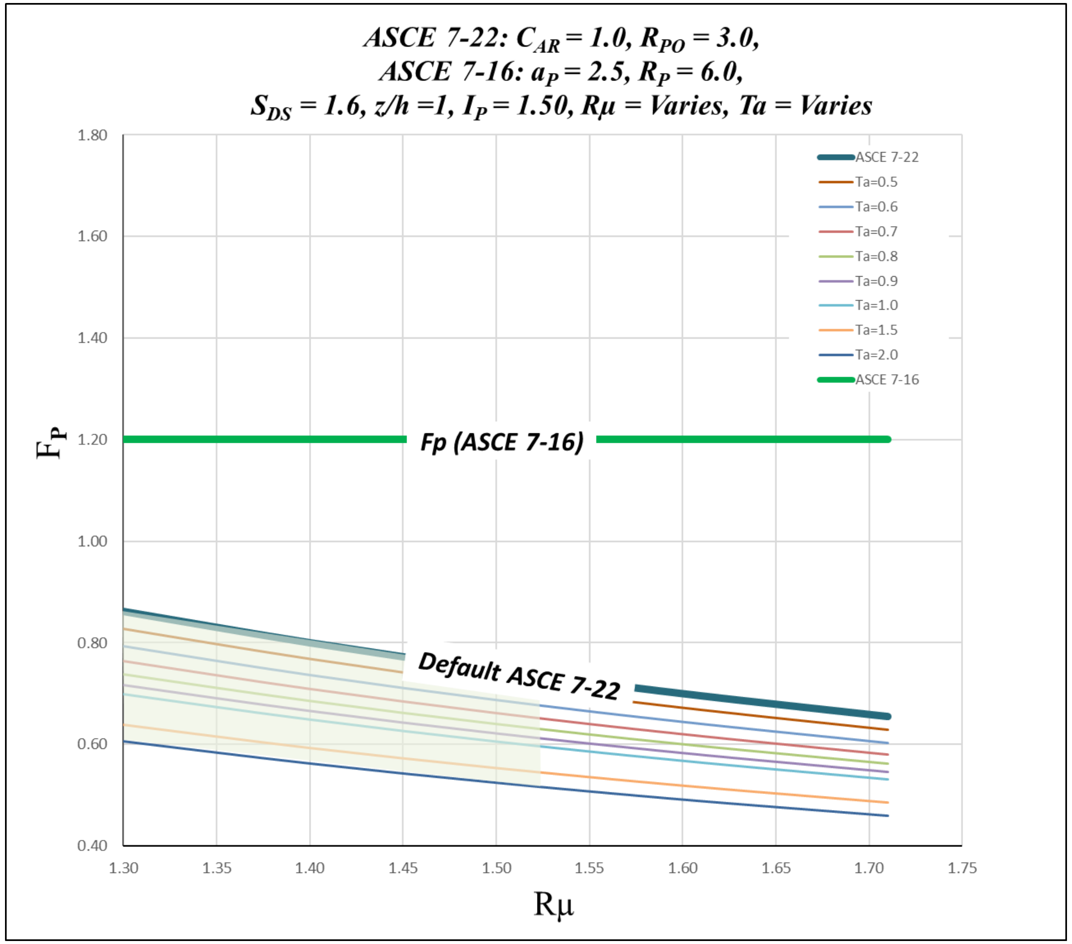


Table 13.6-1. **Seismic Coefficients for Mechanical and Electrical Components.**

Distribution Systems (copper pipe)

Piping in accordance with ASME B31 (2001, 2002, 2008, 2010), including in-line components with joints made by welding or brazing

ASCE 7-16 vs ASCE 7-22 Nonstructural Component Design Force Level *Comparisons*

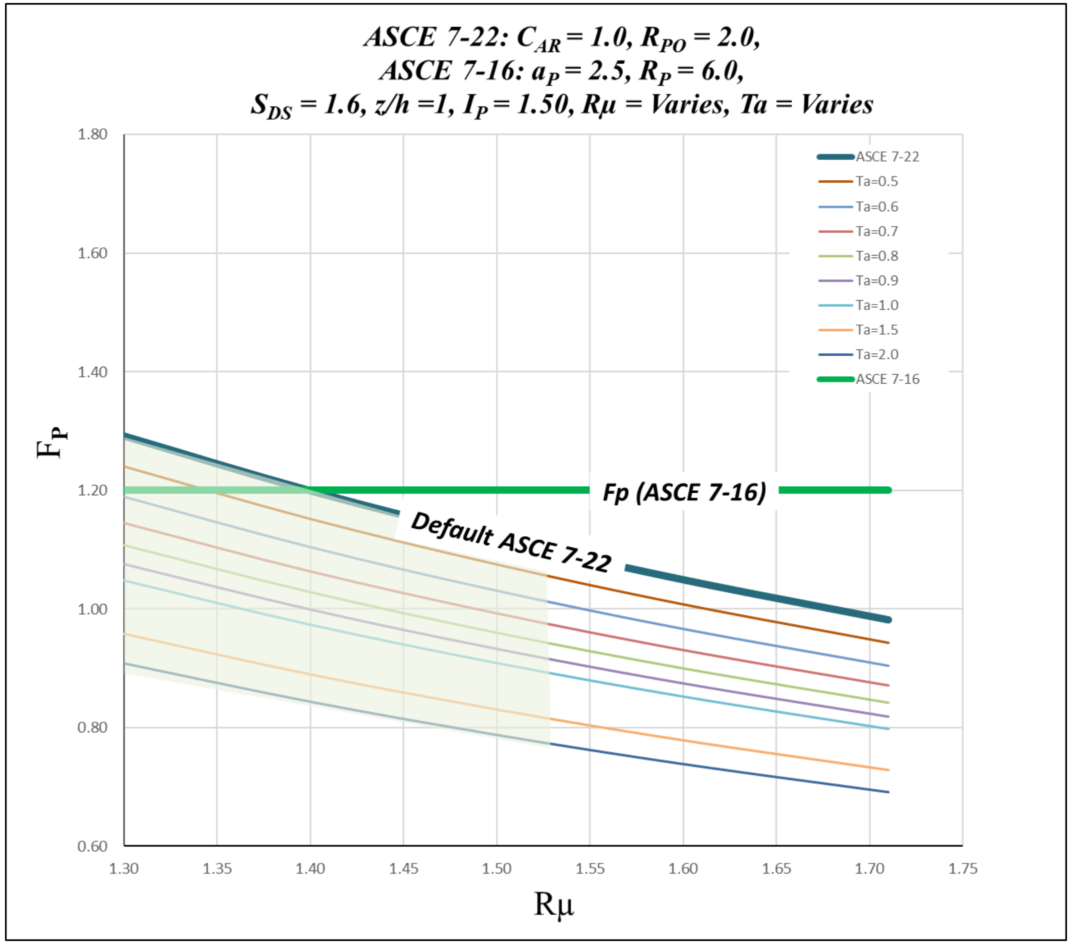


Table 13.6-1. **Seismic Coefficients for Mechanical and Electrical Components.**

Distribution Systems (scheduled pipe)

Piping in accordance with ASME B31, including in-line components, constructed of high-limited-deformability materials, with joints made by threading, bonding, compression couplings, or grooved couplings

Piping and tubing not in accordance with ASME B31, including in-line components, constructed of high-deformability materials, with joints made by welding or brazing

Duct systems, including in-line components, constructed of high-deformability materials, with joints made by welding or brazing

ASCE 7-16 vs ASCE 7-22 Nonstructural Component Design Force Level *Comparisons*

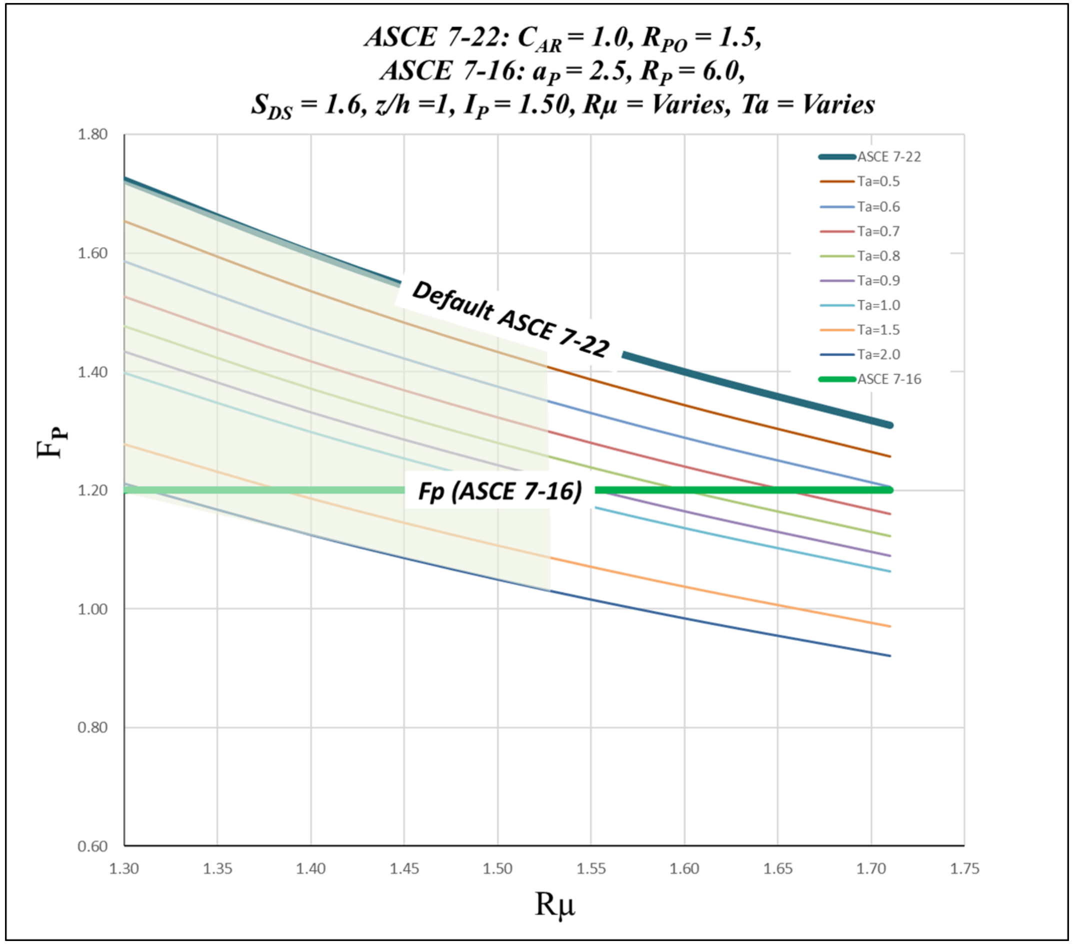


Table 13.6-1. **Seismic Coefficients for Mechanical and Electrical Components.**

Distribution System <u>Supports</u> (New)

- Tension-only and cable bracing
- Cold-formed steel rigid bracing
- Hot-rolled steel bracing
- Other rigid bracing

Distribution Systems

- Electrical conduit, cable trays, and raceways

ASCE 7-16 vs ASCE 7-22 Nonstructural Component Design Force Level *Comparisons*

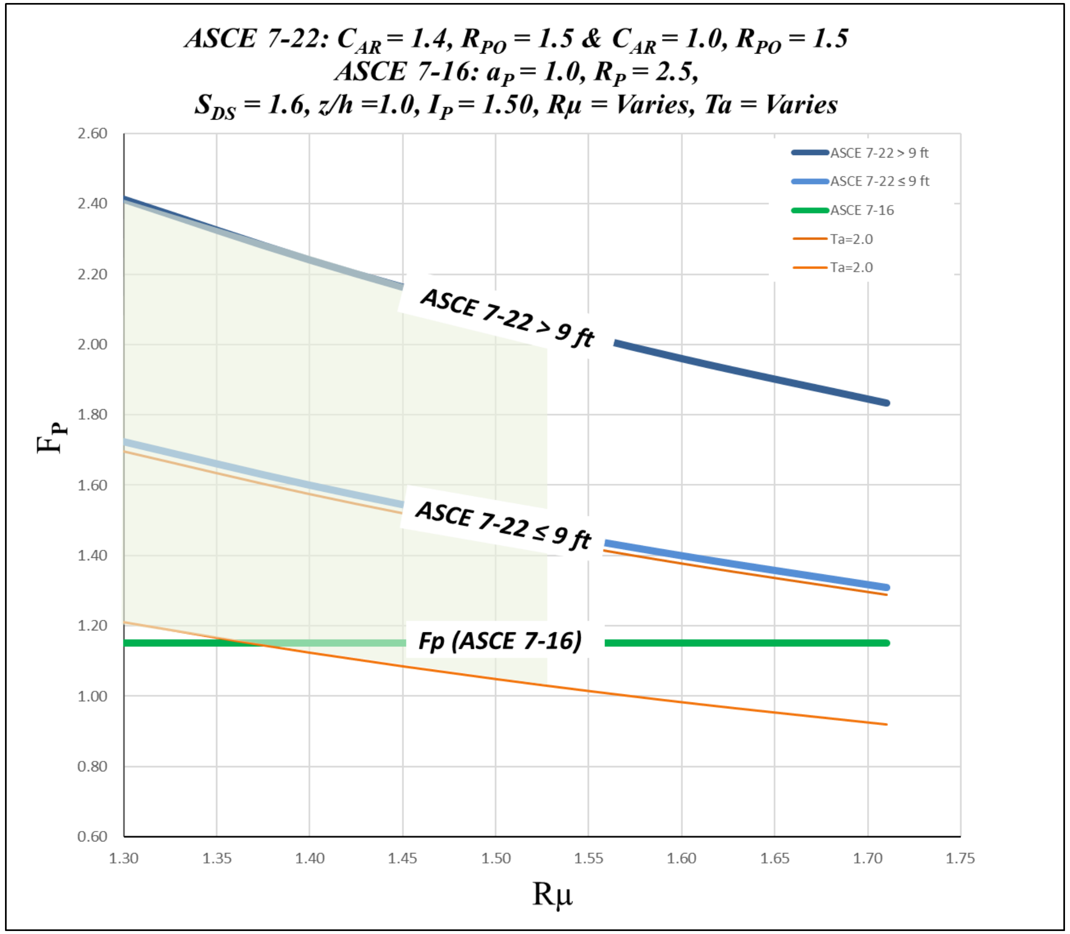
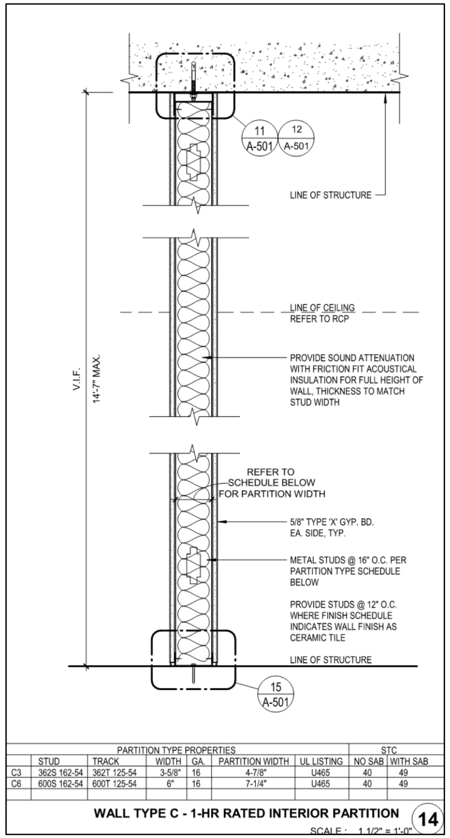

ASCE 7-22: $C_{AR} = 1.4$, $R_{PO} = 1.5$ & $C_{AR} = 1.0$, $R_{PO} = 1.5$
ASCE 7-16: $a_P = 1.0$, $R_P = 2.5$,
$S_{DS} = 1.6$, $z/h = 1.0$, $I_P = 1.50$, $R\mu$ = Varies, Ta = Varies

Table 13.5-1. **Coefficients for Architectural Components**

Interior nonstructural walls and *partitions*

Light frame ≤ 9 ft (2.74 m) in height

Light frame > 9 ft (2.74 m) in height



PARTITION TYPE PROPERTIES							STC	
	STUD	TRACK	WIDTH	GA.	PARTITION WIDTH	UL LISTING	NO SAB	WITH SAB
C3	362S 162-54	362T 125-54	3-5/8"	16	4-7/8"	U465	40	49
C6	600S 162-54	600T 125-54	6"	16	7-1/4"	U465	40	49

WALL TYPE C - 1-HR RATED INTERIOR PARTITION

SCALE : 1 1/2" = 1'-0"

Adaptation of the ASCE 7-22 Nonstructural Component Changes to the Preapproval Programs; OPM/OSP/OPD

Affected OSHPD Preapproval Programs:

OPD-0001 Standard Partition Wall Details*
OPD-0002 Standard Suspended Ceiling Details*
OPD-0003 Standard Gypsum Board Ceiling Details*
OPM – OSHPD Preapproval of Manufacturer's Certification
OSP – OSHPD Special Seismic Certification Preapproval

*Efforts to update the inhouse OPD to the current Code are currently underway.
Continued use of the all existing preapprovals, if not expired, are valid, if project demands ≤ preapproval capacities.

Adaptation of the ASCE 7-22 Nonstructural Component Changes to the Preapproval Programs; OPM/OSP/OPD

Existing OPM Preapprovals valid for use on any project, regardless of CBC version (including 2025 CBC).

Renewal and New OPM Preapprovals to the 2025 CBC (ASCE 7-22) requires updated calculations and drawing revisions reflecting the current Code. OPM will have a new updated Application for the 2025 CBC via eSP.

Existing OSP Preapprovals which have not expired, are valid for use on any project, regardless of CBC version (including 2025 CBC). Existing shake table tests are valid on any project (including 2025 CBC).

Renewal and New OSP Preapprovals to the 2025 CBC (ASCE 7-22) requires a new updated Application for the 2025 CBC via eSP.

Existing OPD Preapprovals valid for use on any project, regardless of CBC version (including 2025 CBC).

Adaptation of the ASCE 7-22 Nonstructural Component Changes to the Preapproval Programs; OPM/OSP ~ cont'd

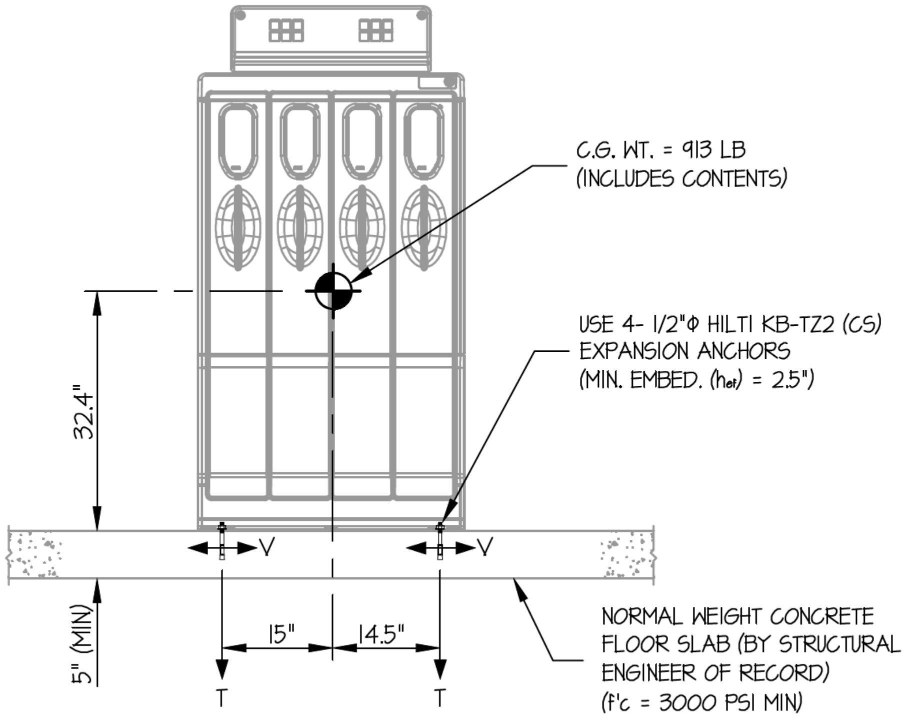
Preapproval Design Professionals of Record

Although readily apparent, two Design Professionals of Record (DPOR) are involved in preapprovals:

1. *Preapproval DPOR* who submits a new or renewal preapproval to OSHPD
2. *Project DPOR* who submits the preapproval for project use

Adaptation of the ASCE 7-22 Nonstructural Component Changes to the Existing Preapproval Programs; OPM

OPM



FRONT ELEVATION
(WITH CTS SHOWN)

Use of Existing OPM for 2025 CBC

Project DPOR Submittal Responsibilities:

Calculate the *OPM design force capacities* for both horizontal and vertical, using **ASCE 7-16** lateral coefficients

$$F_p = \frac{0.4 a_p S_{DS} W_p}{\left(\frac{R_p}{I_p}\right)} \left(1 + 2\frac{z}{h}\right) \qquad (13.3\text{-}1)$$

13.3.1.2 Vertical Force: $F_v = 0.2 S_{DS} W_p$

Calculate the *2025 CBC project demands,* using the **ASCE 7-22** lateral force eqn.

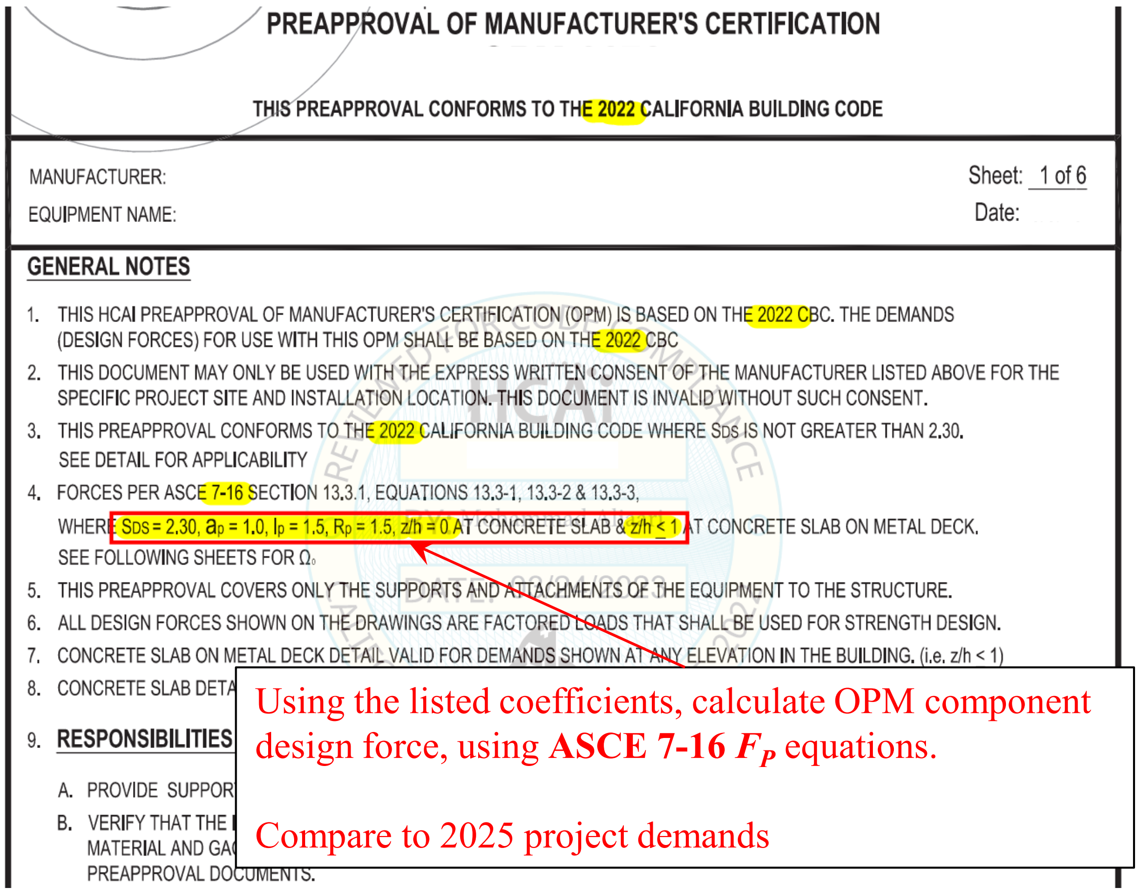
$F_{p\ (Project)}$ *demands* $\leq F_{p\ (Preapproval)}$ *capacities*

OPM design force coefficients for both the Preapproval and the Project must be listed on:

1. Project calculations.
2. May be included on the construction drawings (CD), to possibly reduce an Amended Construction Document (ACD) to a Non-Material Alteration (NMA) – saving time and costs.

Use of Existing ASCE 7-16 OPM for 2025 CBC

Use of Existing OPM: Example



PREAPPROVAL OF MANUFACTURER'S CERTIFICATION

THIS PREAPPROVAL CONFORMS TO THE 2022 CALIFORNIA BUILDING CODE

MANUFACTURER:

EQUIPMENT NAME:

Sheet: 1 of 6

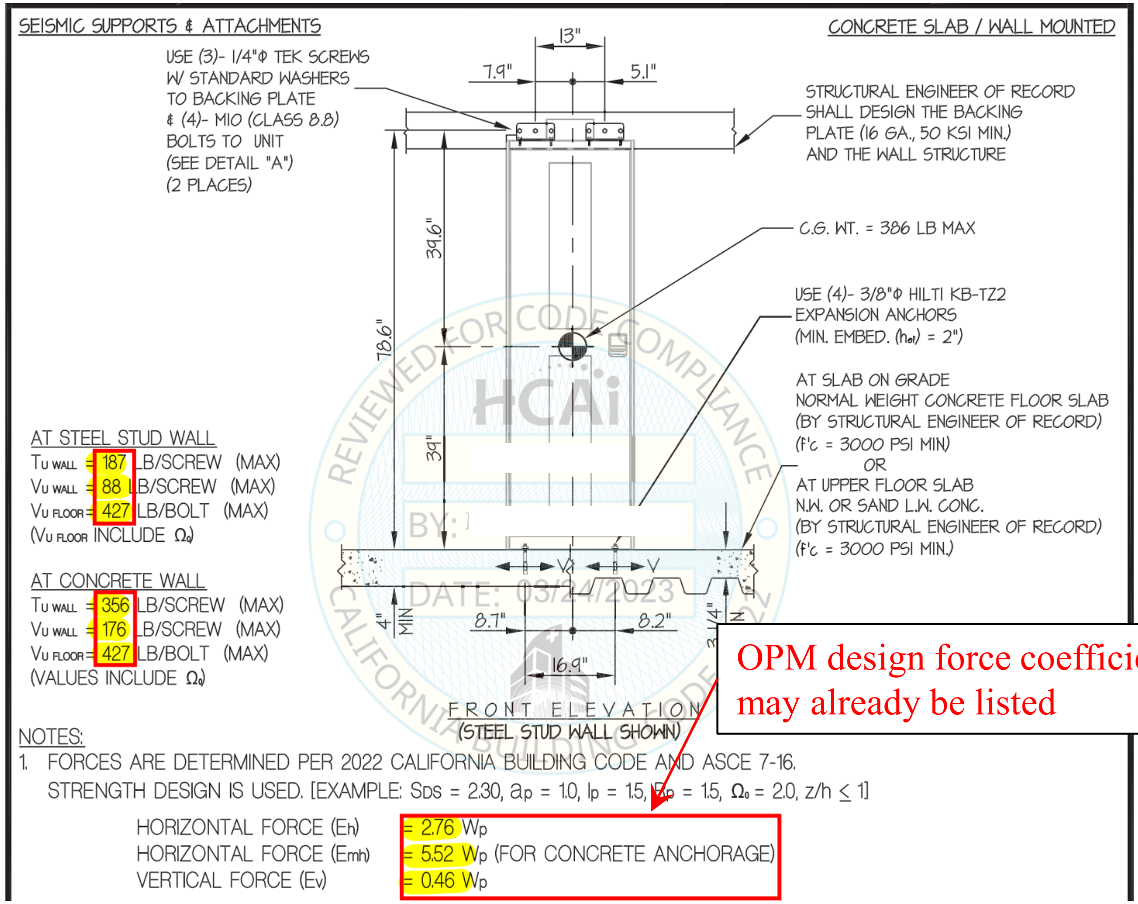
Date:

GENERAL NOTES

1. THIS HCAI PREAPPROVAL OF MANUFACTURER'S CERTIFICATION (OPM) IS BASED ON THE 2022 CBC. THE DEMANDS (DESIGN FORCES) FOR USE WITH THIS OPM SHALL BE BASED ON THE 2022 CBC
2. THIS DOCUMENT MAY ONLY BE USED WITH THE EXPRESS WRITTEN CONSENT OF THE MANUFACTURER LISTED ABOVE FOR THE SPECIFIC PROJECT SITE AND INSTALLATION LOCATION. THIS DOCUMENT IS INVALID WITHOUT SUCH CONSENT.
3. THIS PREAPPROVAL CONFORMS TO THE 2022 CALIFORNIA BUILDING CODE WHERE S_{DS} IS NOT GREATER THAN 2.30. SEE DETAIL FOR APPLICABILITY
4. FORCES PER ASCE 7-16 SECTION 13.3.1, EQUATIONS 13.3-1, 13.3-2 & 13.3-3, WHERE $S_{DS} = 2.30$, $a_p = 1.0$, $I_p = 1.5$, $R_p = 1.5$, $z/h = 0$ AT CONCRETE SLAB & $z/h \le 1$ AT CONCRETE SLAB ON METAL DECK. SEE FOLLOWING SHEETS FOR Ω_0
5. THIS PREAPPROVAL COVERS ONLY THE SUPPORTS AND ATTACHMENTS OF THE EQUIPMENT TO THE STRUCTURE.
6. ALL DESIGN FORCES SHOWN ON THE DRAWINGS ARE FACTORED LOADS THAT SHALL BE USED FOR STRENGTH DESIGN.
7. CONCRETE SLAB ON METAL DECK DETAIL VALID FOR DEMANDS SHOWN AT ANY ELEVATION IN THE BUILDING. (i.e. $z/h < 1$)
8. CONCRETE SLAB DETA
9. **RESPONSIBILITIES**
   - A. PROVIDE SUPPOR
   - B. VERIFY THAT THE MATERIAL AND GA PREAPPROVAL DOCUMENTS.

Using the listed coefficients, calculate OPM component design force, using **ASCE 7-16 F_p** equations.

Compare to 2025 project demands



SEISMIC SUPPORTS & ATTACHMENTS

CONCRETE SLAB / WALL MOUNTED

USE (3)- 1/4"Φ TEK SCREWS W/ STANDARD WASHERS TO BACKING PLATE & (4)- M10 (CLASS 8.8) BOLTS TO UNIT (SEE DETAIL "A") (2 PLACES)

STRUCTURAL ENGINEER OF RECORD SHALL DESIGN THE BACKING PLATE (16 GA., 50 KSI MIN.) AND THE WALL STRUCTURE

C.G. WT. = 386 LB MAX

USE (4)- 3/8"Φ HILTI KB-TZ2 EXPANSION ANCHORS (MIN. EMBED. (h_{ef}) = 2")

AT SLAB ON GRADE
NORMAL WEIGHT CONCRETE FLOOR SLAB
(BY STRUCTURAL ENGINEER OF RECORD)
(f'c = 3000 PSI MIN)
OR
AT UPPER FLOOR SLAB
N.W. OR SAND L.W. CONC.
(BY STRUCTURAL ENGINEER OF RECORD)
(f'c = 3000 PSI MIN.)

AT STEEL STUD WALL
$T_{u\ WALL}$ = 187 LB/SCREW (MAX)
$V_{u\ WALL}$ = 88 LB/SCREW (MAX)
$V_{u\ FLOOR}$ = 427 LB/BOLT (MAX)
($V_{u\ FLOOR}$ INCLUDE Ω_0)

AT CONCRETE WALL
$T_{u\ WALL}$ = 356 LB/SCREW (MAX)
$V_{u\ WALL}$ = 176 LB/SCREW (MAX)
$V_{u\ FLOOR}$ = 427 LB/BOLT (MAX)
(VALUES INCLUDE Ω_0)

FRONT ELEVATION
(STEEL STUD WALL SHOWN)

NOTES:

1. FORCES ARE DETERMINED PER 2022 CALIFORNIA BUILDING CODE AND ASCE 7-16. STRENGTH DESIGN IS USED. [EXAMPLE: $S_{DS} = 2.30$, $a_p = 1.0$, $I_p = 1.5$, $R_p = 1.5$, $\Omega_0 = 2.0$, $z/h \le 1$]

HORIZONTAL FORCE (E_h) = 2.76 W_p
HORIZONTAL FORCE (E_{mh}) = 5.52 W_p (FOR CONCRETE ANCHORAGE)
VERTICAL FORCE (E_v) = 0.46 W_p

OPM design force coefficients may already be listed

Renewal Update or New OPM to 2025 CBC

The OPM *component design force coefficient,* C_P must be determined.

$$F_p/W_p = C_{Pm}$$

where:

C_{Pm} = *Component design force coefficient*

W_P = Component operating weight

$$F_p/W_p = C_{Pm} = 0.4 S_{DS} I_p W_p \left[\frac{H_f}{R_\mu}\right]\left[\frac{C_{AR}}{R_{po}}\right]$$

$$C_{Pm} = 0.4 S_{DS} I_p \left[\frac{H_f}{R_\mu}\right]\left[\frac{C_{AR}}{R_{po}}\right]$$ ✓

Renewal Update or New OPM to 2025 CBC

Preapproval DPOR Submittal Responsibilities:

Updated ASCE 7-22 drawings, depicting:

a. C_{Pm} for both F_P/W_P and F_V/W_P , S_{DS} , I_P , C_{AR} , R_{PO} , Ω_0 , H_f , R_μ , *updated or added* anchorage forces (T_U & V_U) specifying Ω_0 , *for each different component configuration*, for ease of use by the *Project DPOR.*

b. As a minimum, H_f/R_μ must be listed for above grade (2.69) and/or at or below grade (1).
  - Specific intermediate building elevations and SFRS only, *are not allowed,* as specific conditions may be overlooked during design / installation or future equipment relocation.

c. Revise KB-TZ anchors to KB-TZ2 (if applicable)

d. Update anchorage capacities to latest ICC-ESR version

e. Update all listed reference Standards

f. Manufacturer's cut sheets depicting model numbers, configurations, dimensions, wts, etc. used within the OPM.
  - Catalogs may be provided, but only for units included within the preapproval, depicting the above cut sheet requirements. Do not submit entire manufacturer’s catalogs for review.

g. Additional top-sided only post-installed anchor configuration & drawings – see next slide

Renewal Update or New OPM to 2025 CBC

Preapproval DPOR Submittal Responsibilities: ~ cont'd

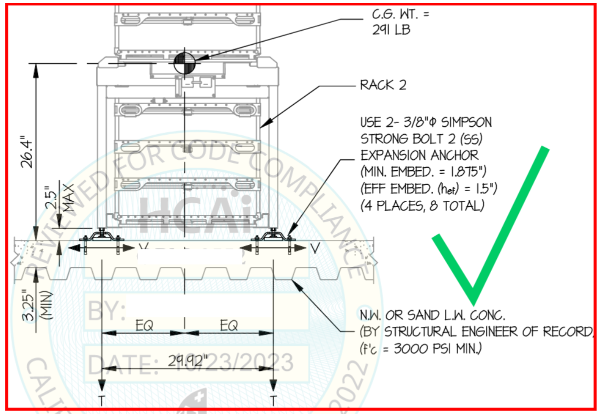
Additional requirements to the OPM Preapprovals:

If applicable and within reason, add conc/mtl deck component anchorage, using *top-sided only* post-installed anchor connections, as opposed to through-bolts, which may be achieved by:

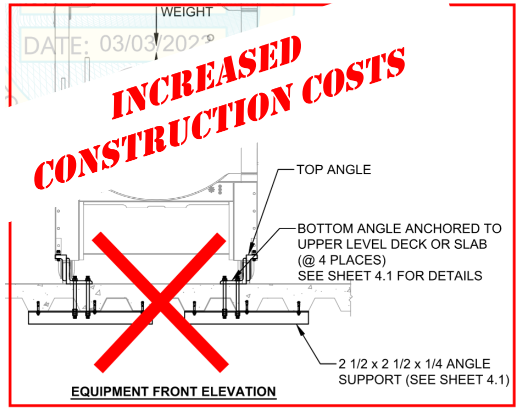
1. Reducing the OPM design force (F_P), albeit within reason, i.e.; an $S_{DS} = 0.25$ serves no purpose.
2. Providing additional supports and attachments, may redistribute the component attachment forces.
3. Using larger post installed anchors.
4. Changing the mounting configuration, if possible.
5. If omitted, a written valid basis must be provided.

Intended to:

1. ***Reduce project change orders*** observed with through-bolts.
2. ***Reduce labor costs*** associated with through-bolts.



Top Sided
Post-Installed Anchor

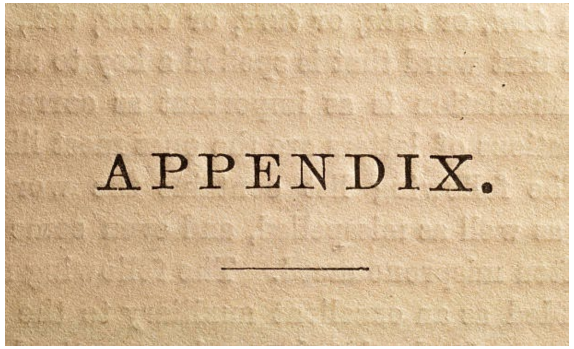


Through-bolt
Post-Installed Anchor

Renewal Update or New OPM to 2025 CBC

Preapproval DPOR Submittal Responsibilities: ~ *cont'd*

Although not required, may be beneficial listing both the ASCE 7-16 AND the 7-22 versions within the same preapproval, for use with past and current codes. Within the preapproval drawings, one version would be attached as an ***Appendix***, referenced within the Table of Contents.



Project DPOR Submittal Responsibilities

Calculate the *2025 CBC project demands,* using the **ASCE 7-22** lateral force eqn.

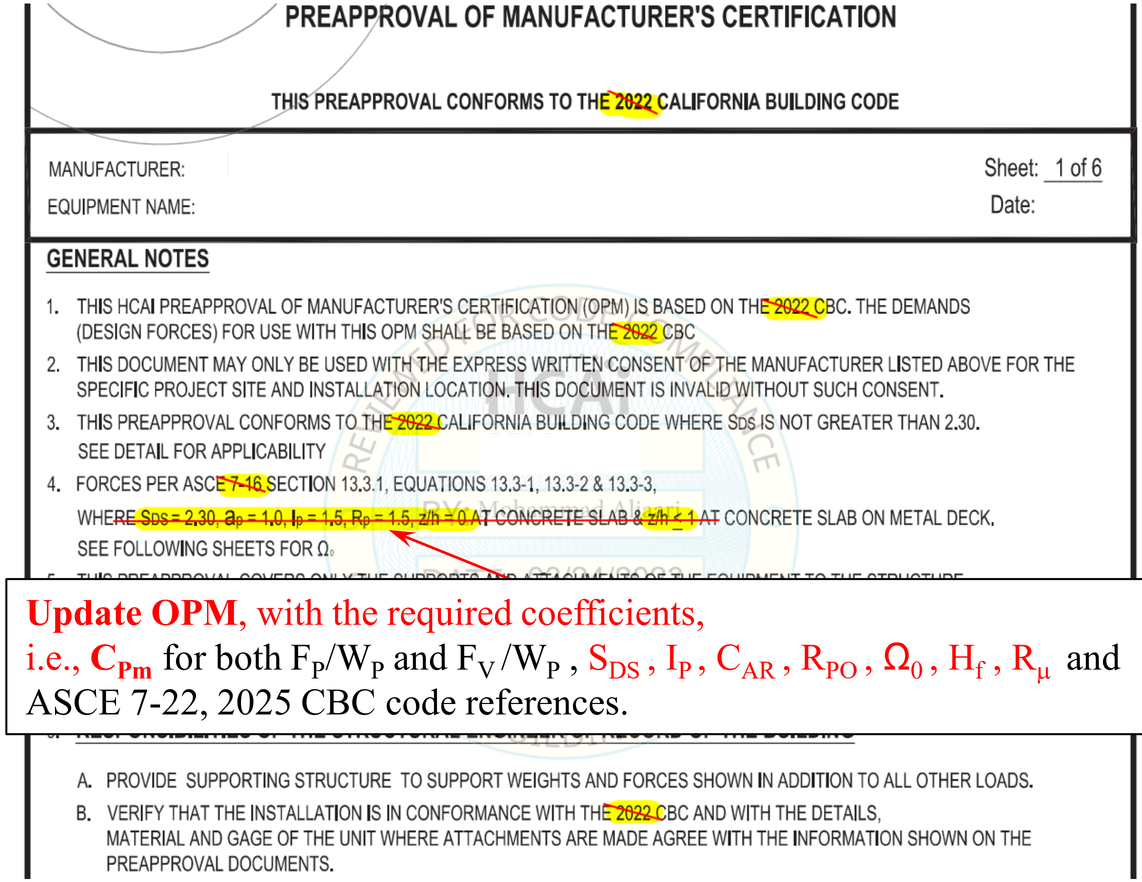
$F_{p\ (Project)}$ *demands* $\leq F_{p\ (Preapproval)}$ *capacities*

OPM design force coefficients for both the Preapproval and the Project must be listed on:

1. Project calculations.
2. May be included on the construction drawings (CD), to possibly reduce an Amended Construction Document (ACD) to a Non-Material Alteration (NMA) – saving time and costs.

Renewal Update or New OPM to 2025 CBC: Example

Renewal Update or New OPM: *Example*



PREAPPROVAL OF MANUFACTURER'S CERTIFICATION

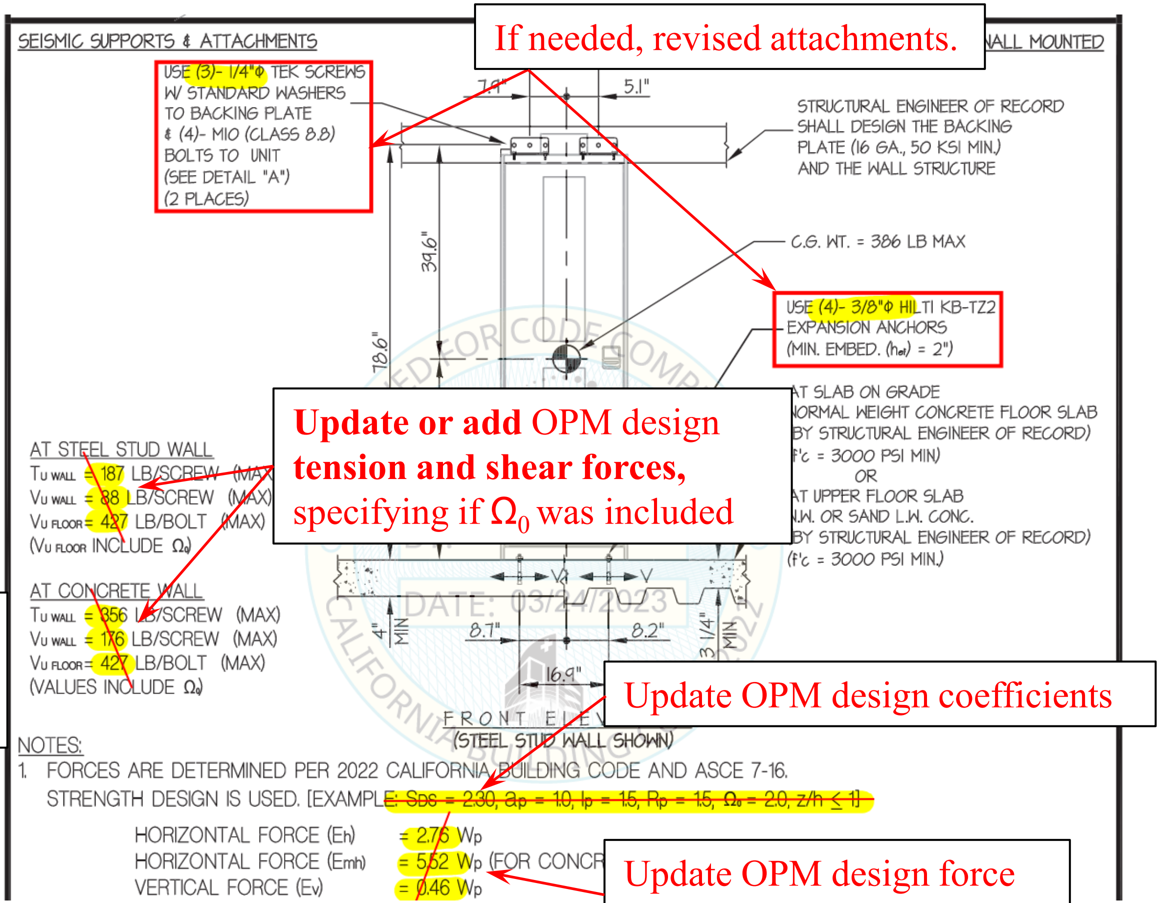
THIS PREAPPROVAL CONFORMS TO THE ~~2022~~ CALIFORNIA BUILDING CODE

MANUFACTURER:	Sheet: 1 of 6
EQUIPMENT NAME:	Date:

GENERAL NOTES

1. THIS HCAI PREAPPROVAL OF MANUFACTURER'S CERTIFICATION (OPM) IS BASED ON THE ~~2022~~ CBC. THE DEMANDS (DESIGN FORCES) FOR USE WITH THIS OPM SHALL BE BASED ON THE ~~2022~~ CBC
2. THIS DOCUMENT MAY ONLY BE USED WITH THE EXPRESS WRITTEN CONSENT OF THE MANUFACTURER LISTED ABOVE FOR THE SPECIFIC PROJECT SITE AND INSTALLATION LOCATION. THIS DOCUMENT IS INVALID WITHOUT SUCH CONSENT.
3. THIS PREAPPROVAL CONFORMS TO THE ~~2022~~ CALIFORNIA BUILDING CODE WHERE S_{DS} IS NOT GREATER THAN 2.30. SEE DETAIL FOR APPLICABILITY
4. FORCES PER ASCE ~~7-16~~ SECTION 13.3.1, EQUATIONS 13.3-1, 13.3-2 & 13.3-3, WHERE ~~S_{DS} = 2.30, a_p = 1.0, I_p = 1.5, R_p = 1.5, z/h = 0 AT CONCRETE SLAB & z/h ≤ 1~~ AT CONCRETE SLAB ON METAL DECK. SEE FOLLOWING SHEETS FOR Ω_0
5. THIS PREAPPROVAL COVERS ONLY THE SUPPORTS AND ATTACHMENTS OF THE EQUIPMENT TO THE STRUCTURE
6. RESPONSIBILITIES OF THE STRUCTURAL ENGINEER OF RECORD OF THE BUILDING
   A. PROVIDE SUPPORTING STRUCTURE TO SUPPORT WEIGHTS AND FORCES SHOWN IN ADDITION TO ALL OTHER LOADS.
   B. VERIFY THAT THE INSTALLATION IS IN CONFORMANCE WITH THE ~~2022~~ CBC AND WITH THE DETAILS, MATERIAL AND GAGE OF THE UNIT WHERE ATTACHMENTS ARE MADE AGREE WITH THE INFORMATION SHOWN ON THE PREAPPROVAL DOCUMENTS.

Update OPM, with the required coefficients, i.e., **C_{Pm}** for both F_P/W_P and F_V/W_P , S_{DS} , I_P , C_{AR} , R_{PO} , Ω_0 , H_f , R_μ and ASCE 7-22, 2025 CBC code references.



SEISMIC SUPPORTS & ATTACHMENTS

WALL MOUNTED

USE (3)- 1/4"Φ TEK SCREWS W/ STANDARD WASHERS TO BACKING PLATE & (4)- M10 (CLASS 8.8) BOLTS TO UNIT (SEE DETAIL "A") (2 PLACES)

STRUCTURAL ENGINEER OF RECORD SHALL DESIGN THE BACKING PLATE (16 GA., 50 KSI MIN.) AND THE WALL STRUCTURE

C.G. WT. = 386 LB MAX

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$V_{U\,FLOOR}$ = ~~427~~ LB/BOLT (MAX)
($V_{U\,FLOOR}$ INCLUDE Ω_0)

AT CONCRETE WALL
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$V_{U\,FLOOR}$ = ~~427~~ LB/BOLT (MAX)
(VALUES INCLUDE Ω_0)

FRONT ELEVATION
(STEEL STUD WALL SHOWN)

NOTES:
1. FORCES ARE DETERMINED PER 2022 CALIFORNIA BUILDING CODE AND ASCE 7-16. STRENGTH DESIGN IS USED. [EXAMPLE~~: S_{DS} = 2.30, a_p = 1.0, I_p = 1.5, R_p = 1.5, Ω_0 = 2.0, z/h ≤ 1]~~

HORIZONTAL FORCE (E_h) = ~~2.76~~ W_p
HORIZONTAL FORCE (E_{mh}) = ~~5.52~~ W_p (FOR CONCR
VERTICAL FORCE (E_v) = ~~0.46~~ W_p

If needed, revised attachments.

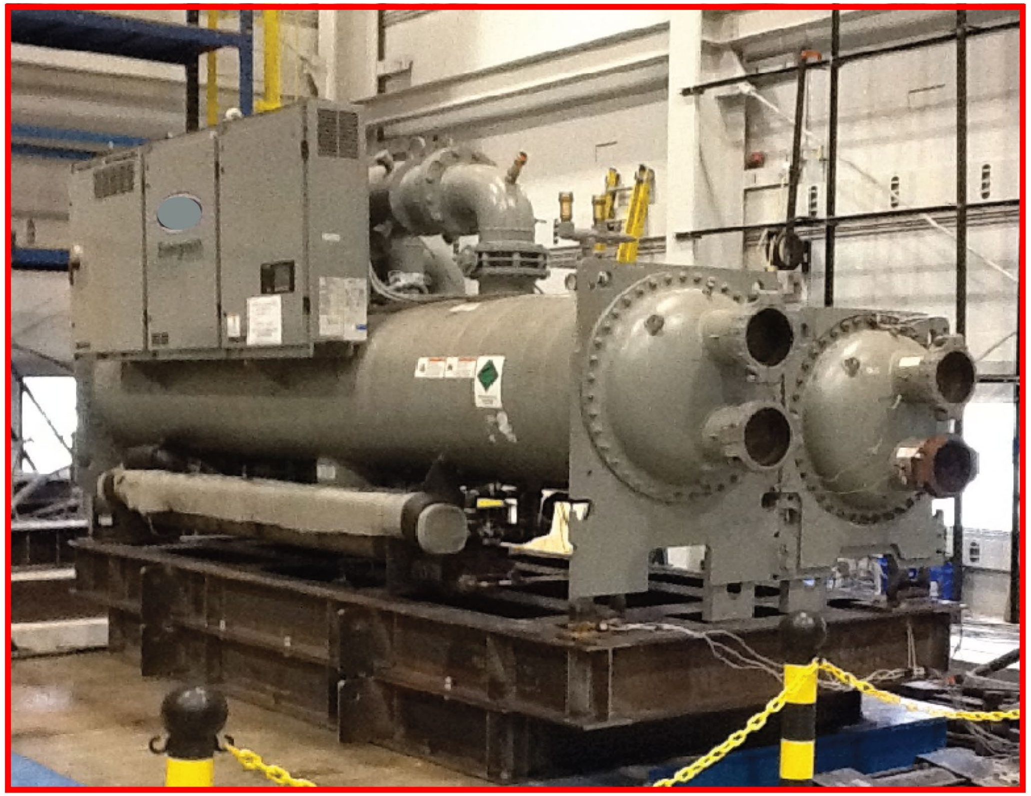
Update or add OPM design **tension and shear forces,** specifying if Ω_0 was included

Update OPM design coefficients

Update OPM design force coefficients to ASCE 7-22

Adaptation of the ASCE 7-22 Nonstructural Component Changes to the Preapproval Programs; OSP

OSP



Adaptation of the ASCE 7-22 Nonstructural Component Changes to the Preapproval Programs; OSP ~ cont'd

OSP Preapproval

The OSP *tested component design force coefficient,* C_{Ps}, is defined using a simple method.

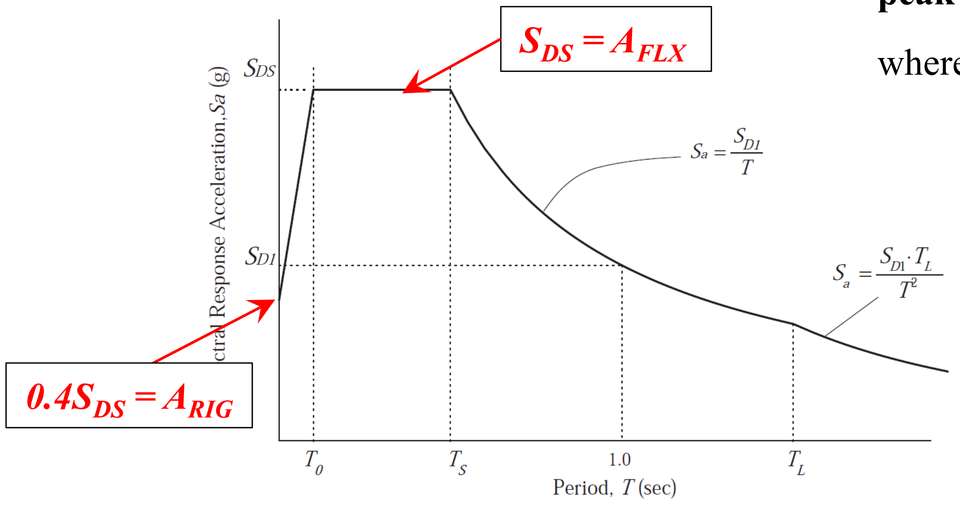
F_p = RRS accelerations ($A_{FLX\text{-}H}$, $A_{RIG\text{-}H}$, $A_{FLX\text{-}V}$, $A_{RIG\text{-}V}$) $* \, W_p$

Where: RRS accelerations = C_{Ps} *(tested component design force coefficient)* ✓
The certified RRS values are listed on the UUT sheets.

Adaptation of the ASCE 7-22 Nonstructural Component Changes to the Preapproval Programs; OSP ~ cont’d

ASCE 7-22 Proposed Changes to ICC-ES AC156 Required Response Spectra (RRS)

The equation parameters [C_{AR}/R_{po}] represent the dynamic characteristics and capacity of the component and *do not affect the dynamic test demand motion*. Thus, [C_{AR}/R_{po}] = 1.0 for all spectra. *I_P is a measure of the component's functionality* after the test $\therefore I_P = 1$.



$S_{DS} = A_{FLX}$

$0.4S_{DS} = A_{RIG}$

Figure 11.4-1. Two-period design response spectrum.

For the *normalized response spectra accelerations* within **ICC-ES AC156**:

$0.4S_{DS}$ (40% of **peak spectral design response** acceleration) is an accepted approximation of the **peak ground** acceleration at **zero period, T = 0** (**rigid** region)

where: S_{DS} = the **peak spectral design response** acceleration at **0.2s period (T = 0.2s)** (5Hz **flexible** region)

Resulting in:

$2.5(0.4\,S_{DS}) = S_{DS}$ => 2.5*(Peak Ground) equates to Peak Response*

ICC-ES AC156 RRS Eqns for ASCE 7-22

Horizontal Response:

$A_{FLX-H} = (2.5)\,0.4\,S_{DS}\,({}^{Hf}/_{R\mu})$ $\quad$ $A_{RIG-H} = 0.4\,S_{DS}\,({}^{Hf}/_{R\mu})$

$= S_{DS}\,({}^{Hf}/_{R\mu}) : S_{DS}\,(1.6)_{cap}$

Vertical Response: *Per the 1991 UBC* = $({}^{2}/_{3})$ horizontal with ${}^{z}/_{h} = 0$, ${}^{Hf}/_{R\mu} = 1$

$A_{FLX-V} = ({}^{2}/_{3})\,S_{DS}\,({}^{Hf}/_{R\mu})$ $\quad$ $A_{RIG-V} = ({}^{2}/_{3})\,0.4\,S_{DS}\,({}^{Hf}/_{R\mu})$

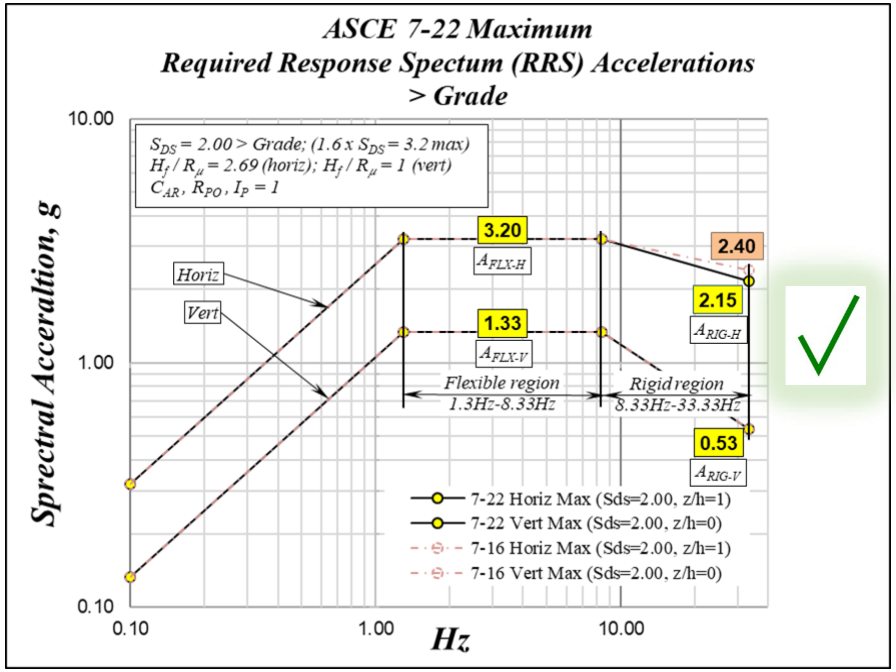
$= ({}^{2}/_{3})\,S_{DS}$ $\quad$ $= 0.27\,S_{DS}$

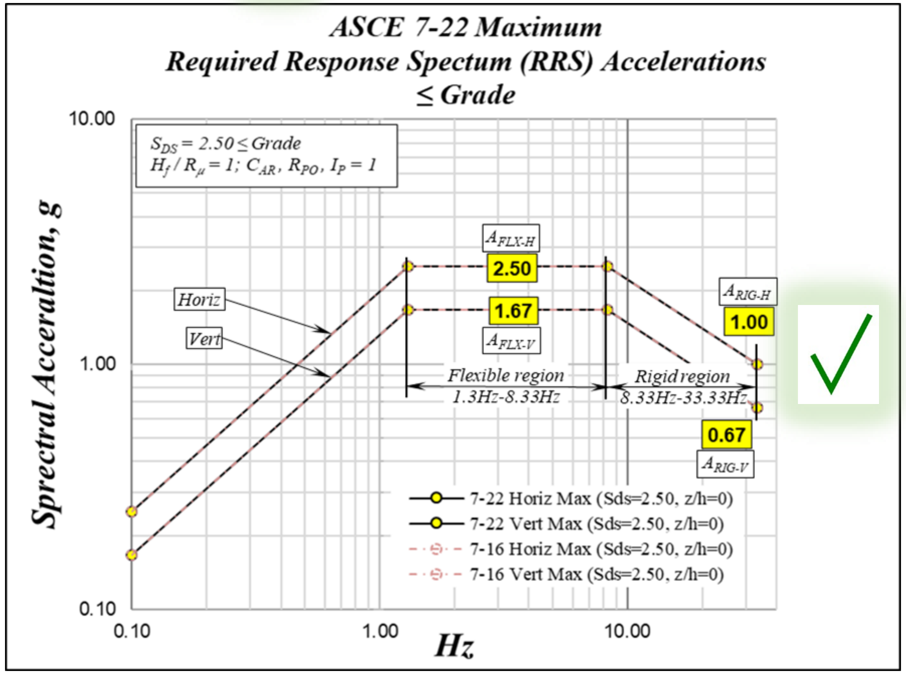
Adaptation of the ASCE 7-22 Nonstructural Component Changes to the Preapproval Programs; OSP ~ cont’d

ICC-ES AC156 Required Response Spectrums (RRS)

Using the *maximum ASCE Code limits* of the RRS, only results in a slight reduction for $A_{RIG-H} = 2.15 >$ grade (***2.40 for ASCE 7-16***) , with all other spectral accelerations remaining the same, as in ASCE 7-16.

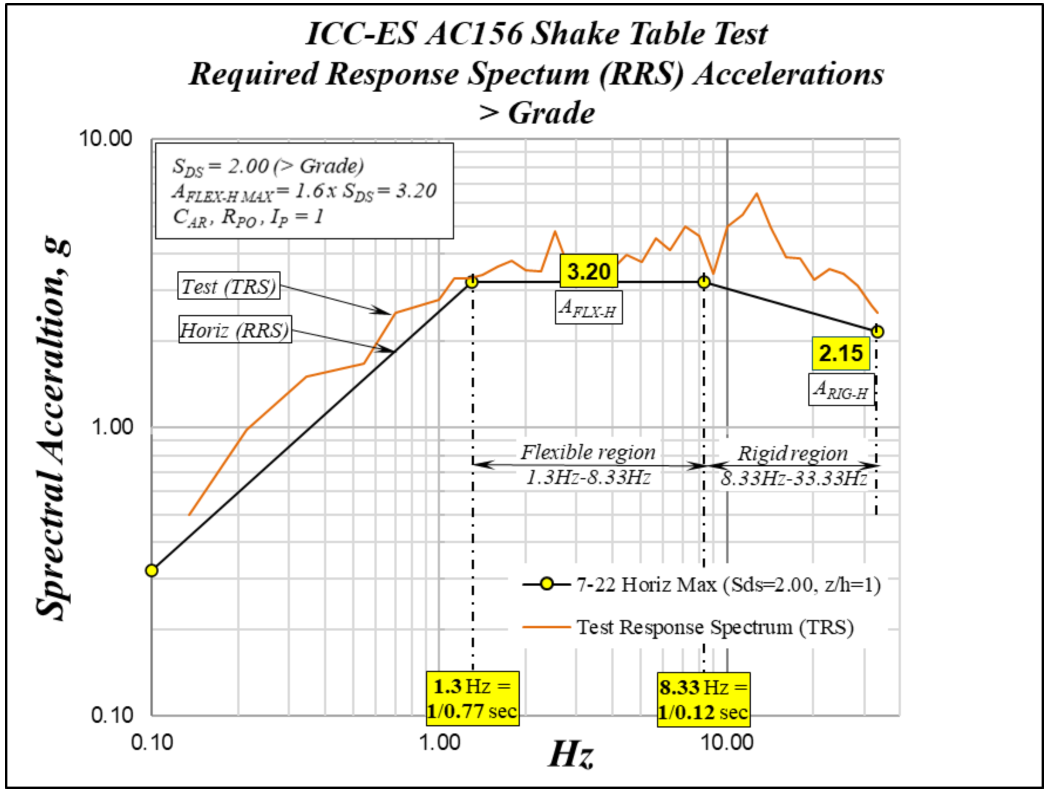
The ***RRS accelerations*** are the OSP ***tested component design force coefficients***, C_{Ps} ✓

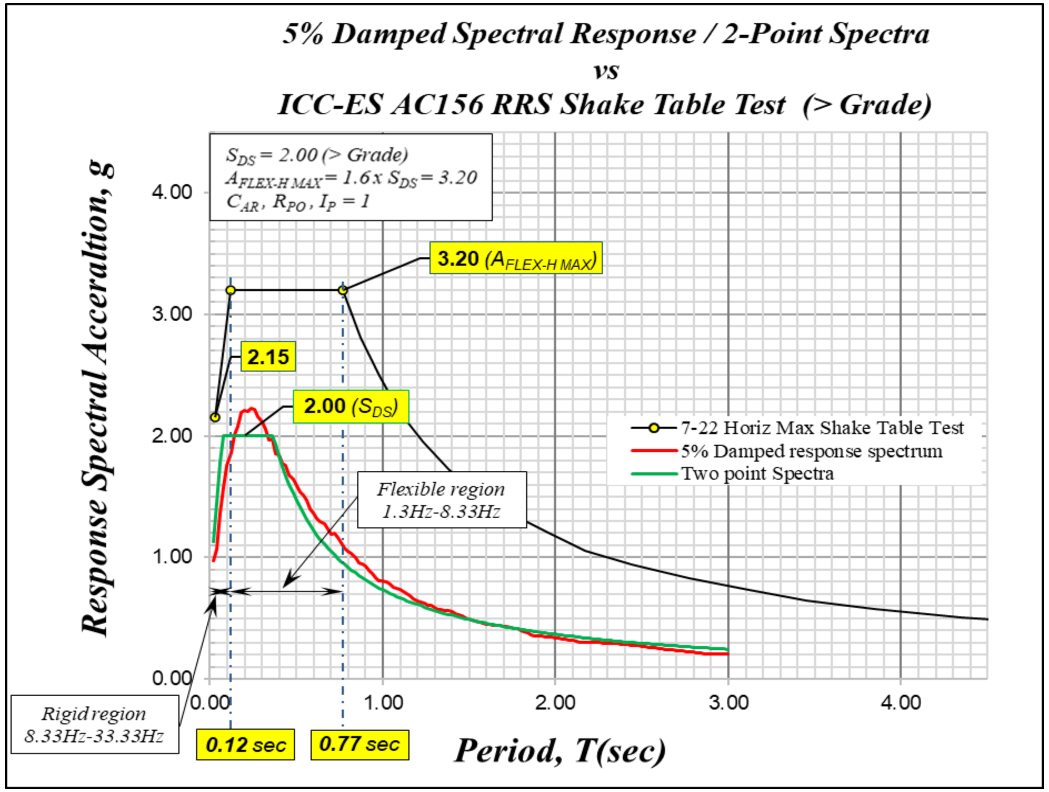




Adaptation of the ASCE 7-22 Nonstructural Component Changes to the Preapproval Programs; OSP ~ cont'd

5% Damped Spectral Response / 2-Point Spectra relative to ICC-ES AC156 Shake Table Test (> Grade)
Response spectrum regions, as related to shake table tested regions.


ICC-ES AC156 Shake Table Test
Required Response Spectum (RRS) Accelerations
> Grade

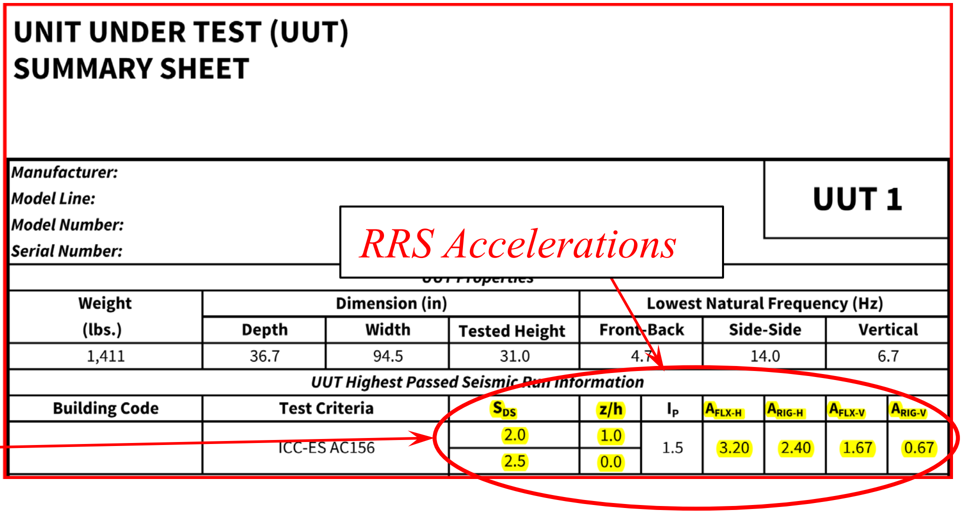

5% Damped Spectral Response / 2-Point Spectra
vs
ICC-ES AC156 RRS Shake Table Test (> Grade)

Use of Existing OSP for 2025 CBC

Use of Existing OSP: Example

Project DPOR Responsibilities:

RRS accelerations are listed, for all tested components, on the UUT Sheets
Interpolated values must use the most conservative value.



UNIT UNDER TEST (UUT)
SUMMARY SHEET

Manufacturer:
Model Line:
Model Number:
Serial Number:

UUT 1

RRS Accelerations

UUT Properties

Weight (lbs.)	**Dimension (in)**			**Lowest Natural Frequency (Hz)**		
	Depth	**Width**	**Tested Height**	**Front-Back**	**Side-Side**	**Vertical**
1,411	36.7	94.5	31.0	4.7	14.0	6.7

UUT Highest Passed Seismic Run Information

Building Code	**Test Criteria**	S_{DS}	**z/h**	I_p	$A_{FLX\text{-}H}$	$A_{RIG\text{-}H}$	$A_{FLX\text{-}V}$	$A_{RIG\text{-}V}$
	ICC-ES AC156	2.0	1.0	1.5	3.20	2.40	1.67	0.67
		2.5	0.0					

The OSP *component tested capacities*:

$$F_{ph\,(Tested)} = \text{RRS Accelerations}\ (A_{FLX\text{-}H}\ \&\ A_{RIG\text{-}H}) * W_p$$

$$F_{pv\,(Tested)} = \text{RRS Accelerations}\ (A_{FLX\text{-}V}\ \&\ A_{RIG\text{-}V}) * W_p$$

✓

By substituting the project variables S_{DS}*,* H_f*, and* R_μ into the *ICC-ES AC156 RRS eqns., the project component demands:*

$$F_{ph\,(Project)} = \text{Calculated accelerations}\ (A_{FLX\text{-}H}\ \&\ A_{RIG\text{-}H}) * W_p$$

$$F_{pv\,(Project)} = \text{Calculated accelerations}\ (A_{FLX\text{-}V}\ \&\ A_{RIG\text{-}V}) * W_p$$

$$\boldsymbol{F_{p\,(Project)}\ \textit{demands} \le F_{p\,(Tested)}\ \textit{capacities}}$$

ICC-ES AC156 RRS Eqns

Horizontal Response:

$$A_{FLX-H} = (2.5)\,0.4\,S_{DS}\,({}^{Hf}/_{R\mu}) = S_{DS}\,({}^{Hf}/_{R\mu}) \qquad A_{RIG-H} = 0.4\,S_{DS}\,({}^{Hf}/_{R\mu})$$

Vertical Response: $({}^{2}/_{3})$ horizontal with ${}^{z}/_{h} = 0,\ {}^{Hf}/_{R\mu} = 1$

$$A_{FLX-V} = ({}^{2}/_{3})\,S_{DS}\,({}^{Hf}/_{R\mu}) = ({}^{2}/_{3})\,S_{DS} \qquad A_{RIG-V} = ({}^{2}/_{3})\,0.4\,S_{DS}\,({}^{Hf}/_{R\mu}) = 0.27\,S_{DS}$$

Use of Existing OSP for 2025 CBC

Use of Existing OSP: *Example ~ cont'd*

2025 CBC OSP Applications will be modified to remove any possible confusion.

Note:

On **Existing OSP (designed to ASCE 7-16)**, F_p/W_P on the 3rd **Application** page:

✗ F_p/W_P **≠ OSP** C_{Ps} (RRS accelerations ($A_{FLX\text{-}H}$, $A_{RIG\text{-}H}$, $A_{FLX\text{-}V}$, $A_{RIG\text{-}V}$)

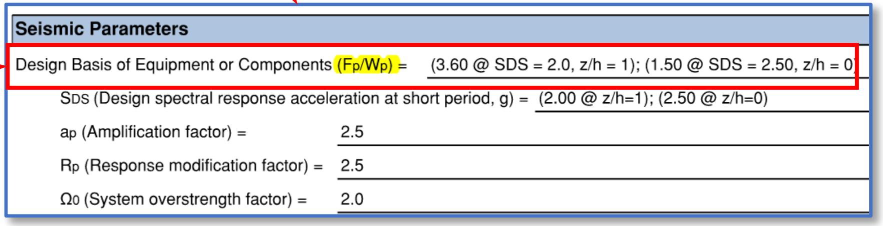
The $F_p/W_P = C_{Pm}$ for *OPMs*

The ***analytical*** C_{Pm} that may be used for support and attachments

where:

$F_p/W_p = C_{Pm}$

OPMs… the *component design force coefficient,* $C_{Pm} = \dfrac{0.4 a_p S_{DS}}{\left(\dfrac{R_p}{I_p}\right)}\left(1 + 2\dfrac{z}{h}\right)$; *ASCE (7-16)* ***Analytical***



Seismic Parameters

Design Basis of Equipment or Components (Fp/Wp) = (3.60 @ SDS = 2.0, z/h = 1); (1.50 @ SDS = 2.50, z/h = 0

SDS (Design spectral response acceleration at short period, g) = (2.00 @ z/h=1); (2.50 @ z/h=0)

ap (Amplification factor) = 2.5

Rp (Response modification factor) = 2.5

Ω0 (System overstrength factor) = 2.0

Use of Renewal Update or New OSP for 2025 CBC

Use of Renewal or New OSP: *Example*

Project DPOR Responsibilities:

RRS accelerations are listed, for all tested components, on the UUT Sheets and will be listed on the New OSP Applications and/or within the Certified Product tables. Interpolated values must use the most conservative values.

The OSP *component tested capacities*:

$$F_{ph\ (Tested)} = \text{RRS Accelerations } (A_{FLX\text{-}H} \ \& \ A_{RIG\text{-}H}) * W_p$$

$$F_{pv\ (Tested)} = \text{RRS Accelerations } (A_{FLX\text{-}V} \ \& \ A_{RIG\text{-}V}) * W_p$$

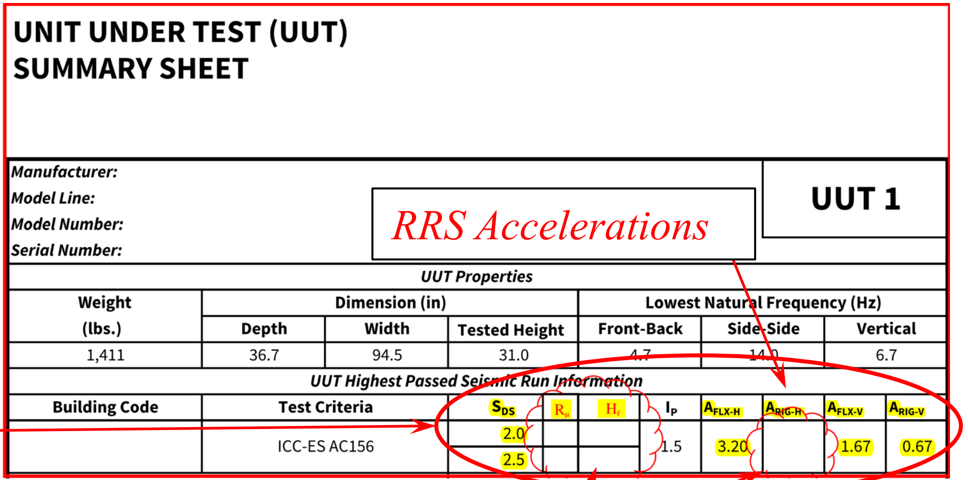
✓

By substituting the project variables S_{DS}, H_f, and R_μ into the *ICC-ES AC156 RRS eqns., the project component demands:*

$$F_{ph\ (Project)} = \text{Calculated accelerations } (A_{FLX\text{-}H} \ \& \ A_{RIG\text{-}H}) * W_p$$

$$F_{pv\ (Project)} = \text{Calculated accelerations } (A_{FLX\text{-}V} \ \& \ A_{RIG\text{-}V}) * W_p$$

$$\boldsymbol{F_{p\ (Project)}\ \textit{demands} \leq F_{p\ (Tested)}\ \textit{capacities}}$$



UNIT UNDER TEST (UUT)
SUMMARY SHEET

Manufacturer:
Model Line:
Model Number:
Serial Number:

UUT 1

UUT Properties						
Weight (lbs.)	**Dimension (in)**			**Lowest Natural Frequency (Hz)**		
	Depth	**Width**	**Tested Height**	**Front-Back**	**Side-Side**	**Vertical**
1,411	36.7	94.5	31.0	4.7	14.0	6.7

UUT Highest Passed Seismic Run Information									
Building Code	**Test Criteria**	**S_{DS}**	**R_μ**	**H_f**	**I_P**	**$A_{FLX\text{-}H}$**	**$A_{RIG\text{-}H}$**	**$A_{FLX\text{-}V}$**	**$A_{RIG\text{-}V}$**
	ICC-ES AC156	2.0			1.5	3.20		1.67	0.67
		2.5							

RRS Accelerations

New variables (R_μ, H_f)
and may have revised $A_{RIG\text{-}H}$

ICC-ES AC156 RRS Eqns

Horizontal Response:

$$A_{FLX-H} = (\mathbf{2.5})\ 0.4\ S_{DS}\ (^{Hf}/_{R\mu}) \qquad A_{RIG-H} = 0.4\ S_{DS}\ (^{Hf}/_{R\mu})$$

$$= S_{DS}\ (^{Hf}/_{R\mu})$$

Vertical Response: $(^2/_3)$ horizontal with $^z/_h = 0$, $^{Hf}/_{R\mu} = 1$

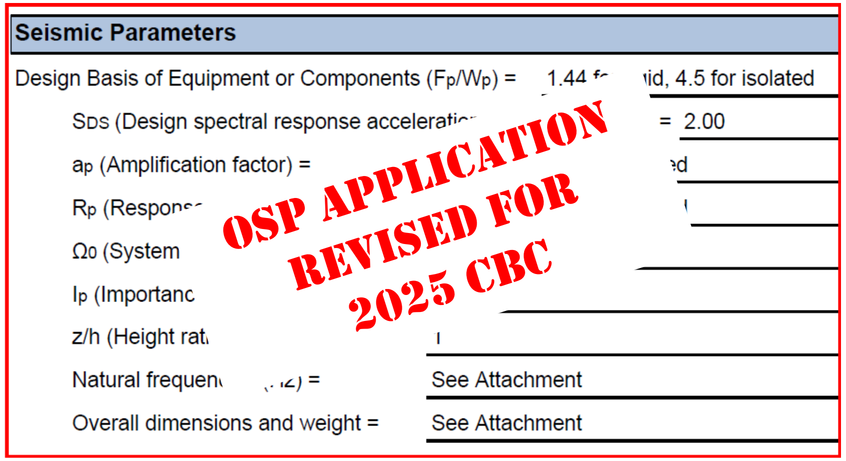
$$A_{FLX-V} = (^2/_3)\ S_{DS}\ (^{Hf}/_{R\mu}) \qquad A_{RIG-V} = (^2/_3)\ 0.4\ S_{DS}\ (^{Hf}/_{R\mu})$$

$$= (^2/_3)\ S_{DS} \qquad = 0.27\ S_{DS}$$

Renewal Update or New OSP to 2025 CBC

Preapproval DPOR Responsibilities:

1. Updated Application with minimum seismic parameters as listed below:
    - C_{Ps} for both horizontal and vertical forces (i.e., $A_{FLX\text{-}H}$, $A_{RIG\text{-}H}$, $A_{FLX\text{-}V}$, $A_{RIG\text{-}V}$), and corresponding S_{DS}, H_f, R_μ, and I_P .
2. Manufacturer's cut sheets depicting model numbers, configurations, dimensions, wts, etc. used within the OSP.
    - Catalogs may be provided, but only for units included within the preapproval, depicting only the above cut sheet requirements. Do not submit entire manufacturer's catalogs for review.
3. Other submittal requirements as listed within PIN 55.



Seismic Parameters

Design Basis of Equipment or Components (F_p/W_p) = 1.44 f id, 4.5 for isolated

S_{DS} (Design spectral response accelerati = 2.00

a_p (Amplification factor) = ed

R_p (Respon

Ω_0 (System

I_p (Importanc

z/h (Height rat 1

Natural frequen z) = See Attachment

Overall dimensions and weight = See Attachment

OSP APPLICATION REVISED FOR 2025 CBC

Comparing Component SSC Capacity to Project Site-Specific Demand

If not readily apparent that component capacity meets project specific demand, a more detailed approach may be used.

Method: For a specific component*, per direction (horizontal and vertical)

1) Using an OSP, UUT sheets, or Test Report, select:
    a. The component's resonance natural frequencies (x,y,z: typically, front-back, side-side, vertical) and corresponding RRS accelerations ($A_{FLX\text{-}H}$, $A_{RIG\text{-}H}$, $A_{FLX\text{-}V}$, $A_{RIG\text{-}V}$)
2) Using the site-specific 2-point design response spectral acceleration plot, select:
    a. $S_{a\ \text{Resonance Period}}$ (design response acceleration) corresponding to the *period* of the above component *lowest* NF, *per direction*.

Example:

For the *horizontal direction*, the component *lowest* NF *between the x and y directions* is either within the *flexible or rigid* region.

1) If within ***flexible*** region (*1.30Hz - 8.33Hz*), $A_{FLX\text{-}H}$ (value is *constant*)
    a. Calculate $F_{PH\text{-}TESTED}$; $F_{PH\text{-}TESTED} = \mathbf{A_{FLX\text{-}H}} (W_P)$
    b. Calculate $F_{PH\text{-}PROJECT} = \mathbf{S_{a\ Resonance\ Period}} (H_f/R_\mu)W_P$: $F_{PH\text{-}PROJECT} \leq F_{PH\text{-}TESTED}$
2) If within ***rigid*** region (*8.34Hz - 33.33Hz*), $A_{RIG\text{-}H\ \text{Resonance}}$ (value *varies*)
    a. Calculate $F_{PH\text{-}TESTED}$; $F_{PH\text{-}TESTED} = \mathbf{A_{RIG\text{-}H\ Resonance}}$ (corresponding to component NF) (W_P)
    b. Calculate $F_{PH\text{-}PROJECT} = \mathbf{S_{a\ Resonance\ Period}} (H_f/R_\mu)W_P$: $F_{PH\text{-}PROJECT} \leq F_{PH\text{-}TESTED}$

Vertical direction must be checked similar to above horizontal direction, using equations for $A_{FLX\text{-}V}$, $A_{RIG\text{-}V}$

*may only be valid for the tested component, not interpolated or extrapolated components, as NF may vary.

Questions/Thoughts?

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