



Entertainment Structures Group

A Division of Steven Schaefer Associates, Inc.

10411 Medallion Drive Suite 121, Cincinnati, OH 45241
 Phone: 513-542-3300 • 800-542-3302 • Fax: 513-542-5540

Project:	UBC vs IBC Seismic
Client:	ESG Report
Proj. No.:	FOR EXAMPLE ONLY
Designer:	AJG
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Date:	5/19/2008

CBC 2007(IBC Based & ASCE 7-05) w/Seismic Site Class from Geotechnical Engineer

Mapped spectral accelerations (ASCE 7-11.4.1): $S_s := 0.7$ per ASCE 7-Fig 22-3
 $S_1 := 0.25$ per ASCE 7-Fig 22-4

Seismic site class(ASCE 7-11.4.2): **B** per Geotech Report

Maximum considered spectral response (ASCE 7-11.4.3):

Site coefficients: $F_a := 1.0$ ASCE 7-Table 11.4-1

$F_v := 1.0$ ASCE 7-Table 11.4-2

$S_{MS} := F_a \cdot S_s$ ASCE 7-Eq 11.4-1

$S_{MS} = 0.7$

$S_{M1} := F_v \cdot S_1$ ASCE 7-Eq 11.4-2

$S_{M1} = 0.25$

Design spectral accelerations(ASCE 7-11.4.4):

$S_{DS} := \frac{2}{3} \cdot S_{MS}$ ASCE 7-Eq 11.4-3

$S_{DS} = 0.47$

$S_{D1} := \frac{2}{3} \cdot S_{M1}$ ASCE 7-Eq 11.4-4

$S_{D1} = 0.167$

Occupancy category: **II** ASCE 7-Table 1-1

Importance factor (ASCE 7-11.5.1): $I := 1.0$ ASCE 7-Table 11.5-1

Seismic design category(ASCE 7-11.6): **C** ASCE 7-Table 11.6-1&2

Design coefficients and factors for seismic force resisting system(ASCE 37-02):

The R factor used is consistent w/ASCE 37-02 for temporary structures. Only the requirements dealing w/ strength of the seismic system are reqd to be satisfied.

Response modification factor: $R_w := 2.5$ per ASCE 37-02 Section 6.5.2

Equivalent Lateral Force Procedure(ASCE 7-12.8)

Long period transition period(ASCE 7-11.4.5): $T_L := 16$ ASCE 7-Fig 22-16

Approximate building period(ASCE 7-12.8.2.1): $T_a := 0.02 \cdot 40^{.75}$ Structure height = 40ft $T_a = 0.318$

Maximum required site coefficient: $C_{s,max} := \text{if} \left[T_a < T_L, \frac{S_{D1}}{T_a \cdot \left(\frac{R}{I}\right)}, \frac{S_{D1} \cdot T_L}{T_a^2 \cdot \left(\frac{R}{I}\right)} \right]$ ASCE 7-Eq 12.8-3/4 $C_{s,max} = 0.21$

Seismic response coefficient(ASCE 7-12.8.1.1): $C_{s,12.8.2} := \frac{S_{DS}}{R \cdot I}$ ASCE 7-Eq 12.8-2 $C_{s,12.8.2} = 0.187$

$C_s := \text{if} (C_{s,12.8.2} \leq C_{s,max}, C_{s,12.8.2}, C_{s,max})$ $C_s = 0.187$

Per section 12.8.1, the seismic base shear for the structure shall be 0.187 X W, where W is the effective seismic weight.



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CBC 2007(IBC Based & ASCE 7-05) wo/Seismic Site Class from Geotechnical Engineer

Mapped spectral accelerations (ASCE 7-11.4.1): $S_s := 0.7$ per ASCE 7-Fig 22-3

$S_{1W} := 0.25$ per ASCE 7-Fig 22-4

Seismic site class(ASCE 7-11.4.2): **D** assumed

Maximum considered spectral response (ASCE 7-11.4.3):

Site coefficients:

$F_{aW} := 1.24$ ASCE 7-Table 11.4-1

$F_{vW} := 1.9$ ASCE 7-Table 11.4-2

$S_{MSW} := F_a \cdot S_s$ ASCE 7-Eq 11.4-1 $S_{MS} = 0.868$

$S_{M1W} := F_v \cdot S_1$ ASCE 7-Eq 11.4-2 $S_{M1} = 0.475$

Design spectral accelerations(ASCE 7-11.4.4):

$S_{DSW} := \frac{2}{3} \cdot S_{MS}$ ASCE 7-Eq 11.4-3 $S_{DS} = 0.579$

$S_{D1W} := \frac{2}{3} \cdot S_{M1}$ ASCE 7-Eq 11.4-4 $S_{D1} = 0.317$

Occupancy category: **II** ASCE 7-Table 1-1

Importance factor (ASCE 7-11.5.1): $I_W := 1.0$ ASCE 7-Table 11.5-1

Seismic design category(ASCE 7-11.6): **D** ASCE 7-Table 11.6-1&2

Design coefficients and factors for seismic force resisting system(ASCE 37-02):

The R factor used is consistent w/ASCE 37-02 for temporary structures. Only the requirements dealing w/ strength of the seismic system are reqd to be satisfied.

Response modification factor: $R_W := 2.5$ per ASCE 37-02 Section 6.5.2

Equivalent Lateral Force Procedure(ASCE 7-12.8)

Long period transition period(ASCE 7-11.4.5): $T_{LW} := 16$ ASCE 7-Fig 22-16

Approximate building period(ASCE 7-12.8.2.1): $T_{W} := 0.02 \cdot 40^{.75}$ Structure height = 40ft $T_a = 0.318$

Maximum required site coefficient: $C_{sW} := \text{if} \left[T_a < T_L, \frac{S_{D1}}{T_a \cdot \left(\frac{R}{I}\right)}, \frac{S_{D1} \cdot T_L}{T_a^2 \cdot \left(\frac{R}{I}\right)} \right]$ ASCE 7-Eq 12.8-3/4 $C_{s,max} = 0.398$

Seismic response coefficient(ASCE 7-12.8.1.1): $C_{s,12.8.2W} := \frac{S_{DS}}{R \cdot I}$ ASCE 7-Eq 12.8-2 $C_{s,12.8.2} = 0.231$

$C_{sW} := \text{if} (C_{s,12.8.2} \leq C_{s,max}, C_{s,12.8.2}, C_{s,max})$ $C_s = 0.231$

Per section 12.8.1, the seismic base shear for the structure shall be 0.231 X W, where W is the effective seismic weight.



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CBC 2001 w/Seismic Site Class from Geotechnical Engineer

Design Data: Seismic Zone 3

Soil Profile Type S_B per 1629.3

seismic zone factor:	$Z := 0.3$	
near source factor per Table 16-S:	$N_a := 1.5$	assumed worst case
near source factor per Table 16-T:	$N_v := 2.0$	assumed worst case
seismic coefficient per Table 16-Q:	$C_a := 0.3$	$C_a = 0.3$
seismic coefficient per Table 16-R:	$C_v := 0.3$	$C_v = 0.3$
importance factor per Table 16-K:	$I_E := 1.0$	
seismic force amplification factor per Table 16-P:	$\Omega_o := 2.0$	
coefficient of overstrength and global ductility per Table 16-P:	$R_{ww} := 2.9$	
fundamental period of vibration:	$T_{ww} := 0.25$	assumed

Base shear coefficient per section 1630.2:

Eq (30-4): $C_{s_{30_4}} := \frac{C_v \cdot I_E}{R \cdot T}$ $C_{s_{30_4}} = 0.414$

Eq (30-5): $C_{s_{max}} := \frac{2.5 \cdot C_a \cdot I_E}{R}$ $C_{s_{max}} = 0.259$

Seismic coefficient per 1630.2.1, the total base shear shall not be less than the following:

Eq (30-6) $C_{s_{34_2}} := 0.11 \cdot C_a \cdot I_E$ $C_{s_{34_2}} = 0.033$

Eq (30-7) $C_{s_{34_3}} := \frac{0.8 \cdot Z \cdot N_v \cdot I_E}{R}$ $C_{s_{34_3}} = 0.166$

Seismic coefficient: $C_{ww} := \begin{cases} C_{s_{max}} & \text{if } (C_{s_{max}} < C_{s_{30_4}}) \cdot (C_{s_{max}} > C_{s_{34_2}}) \cdot (C_{s_{max}} > C_{s_{34_3}}) \\ C_{s_{30_4}} & \text{if } (C_{s_{max}} > C_{s_{30_4}}) \cdot (C_{s_{30_4}} > C_{s_{34_2}}) \cdot (C_{s_{30_4}} > C_{s_{34_3}}) \\ C_{s_{34_2}} & \text{if } (C_{s_{34_2}} > C_{s_{30_4}}) \cdot (C_{s_{34_2}} > C_{s_{max}}) \cdot (C_{s_{34_2}} > C_{s_{34_3}}) \\ C_{s_{34_3}} & \text{otherwise} \end{cases}$

$C_s = 0.259$

Per section 1630.2.1, the seismic base shear for the structure shall be $0.259 \times W$, where W is the effective seismic weight.



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CBC 2001 **wo/Seismic Site Class from Geotechnical Engineer**

Design Data (no geotechnical report): Seismic Zone 3

Soil Profile Type S_D per 1629.3 - assumed when no geo report

seismic zone factor:

$$\frac{Z}{W} := 0.3$$

near source factor per Table 16-S:

$$\frac{N_a}{W} := 1.5 \quad \text{assumed worst case}$$

near source factor per Table 16-T:

$$\frac{N_v}{W} := 2.0 \quad \text{assumed worst case}$$

seismic coefficient per Table 16-Q:

$$\frac{C_a}{W} := 0.36$$

seismic coefficient per Table 16-R:

$$\frac{C_v}{W} := 0.54$$

importance factor per Table 16-K:

$$\frac{I_E}{W} := 1.0$$

seismic force amplification factor per Table 16-P:

$$\frac{\Omega}{W} := 2.0$$

coefficient of overstrength and global ductility per Table 16-P:

$$\frac{R}{W} := 2.9$$

fundamental period of vibration:

$$\frac{T}{W} := 0.25 \quad \text{assumed}$$

Base shear coefficient per section 1630.2:

Eq (30-4):
$$\frac{C_{s_{30_4}}}{W} := \frac{C_v \cdot I_E}{R \cdot T} \quad C_{s_{30_4}} = 0.745$$

Eq (30-5):
$$\frac{C_{s_{max}}}{W} := \frac{2.5 \cdot C_a \cdot I_E}{R} \quad C_{s_{max}} = 0.31$$

Seismic coefficient per 1630.2.1, the total base shear shall not be less than the following:

Eq (30-6):
$$\frac{C_{s_{34_2}}}{W} := 0.11 \cdot C_a \cdot I_E \quad C_{s_{34_2}} = 0.04$$

Eq (30-7):
$$\frac{C_{s_{34_3}}}{W} := \frac{0.8 \cdot Z \cdot N_v \cdot I_E}{R} \quad C_{s_{34_3}} = 0.166$$

Seismic coefficient:

$$\frac{C_s}{W} := \begin{cases} C_{s_{max}} & \text{if } (C_{s_{max}} < C_{s_{30_4}}) \cdot (C_{s_{max}} > C_{s_{34_2}}) \cdot (C_{s_{max}} > C_{s_{34_3}}) \\ C_{s_{30_4}} & \text{if } (C_{s_{max}} > C_{s_{30_4}}) \cdot (C_{s_{30_4}} > C_{s_{34_2}}) \cdot (C_{s_{30_4}} > C_{s_{34_3}}) \\ C_{s_{34_2}} & \text{if } (C_{s_{34_2}} > C_{s_{30_4}}) \cdot (C_{s_{34_2}} > C_{s_{max}}) \cdot (C_{s_{34_2}} > C_{s_{34_3}}) \\ C_{s_{34_3}} & \text{otherwise} \end{cases}$$

$$C_s = 0.31$$

Per section 1630.2.1, the seismic base shear for the structure shall be 0.31 X W, where W is the effective seismic weight.