For structural steel and concrete buildings with other lateral-force-resisting systems,

$$n_a = 75/h \qquad (26.11\text{-}4)$$

$$n_a = 22.86/h \qquad (26.11\text{-}4.SI)$$

For concrete or masonry shear wall buildings, it is also permitted to use

$$n_a = 385(C_w)^{0.5}/h \qquad (26.11\text{-}5)$$

$$n_a = 117.3(C_w)^{0.5}/h \qquad (26.11\text{-}5.SI)$$

where

$$C_w = \frac{100}{A_B}\sum_{i=1}^{n}\left(\frac{h}{h_i}\right)^2 \frac{A_i}{\left[1+0.83\left(\frac{h_i}{D_i}\right)^2\right]}$$

where

h = Mean roof height, ft (m);
n = Number of shear walls in the building effective in resisting lateral forces in the direction under consideration;
A_B = Base area of the building, ft^2 (m^2);
A_i = Horizontal cross-sectional area of shear wall i, ft^2 (m^2);
D_i = Length of shear wall i, ft (m); and
h_i = Height of shear wall i, ft (m).

26.11.4 Rigid Buildings or Other Structures For rigid buildings or other structures as defined in Section 26.2, the gust-effect factor shall be taken as 0.85 or calculated by this formula:

$$G = 0.925\left(\frac{1+1.7g_Q I_{\bar{z}} Q}{1+1.7g_v I_{\bar{z}}}\right) \qquad (26.11\text{-}6)$$

$$I_{\bar{z}} = c\left(\frac{33}{\bar{z}}\right)^{1/6} \qquad (26.11\text{-}7)$$

$$I_{\bar{z}} = c\left(\frac{10}{\bar{z}}\right)^{1/6} \qquad (26.11\text{-}7.SI)$$

where $I_{\bar{z}}$ is the intensity of turbulence at height $\bar{z}$, and $\bar{z}$ is the equivalent height of the building or structure defined as $0.6h$, but not less than z_{min}, for all building or structure heights h. z_{min} and c are listed for each exposure in Table 26.11-1; g_Q and g_v shall be taken as 3.4. The background response Q is given by

$$Q = \sqrt{\frac{1}{1+0.63\left(\frac{B+h}{L_{\bar{z}}}\right)^{0.63}}} \qquad (26.11\text{-}8)$$

where B and h are defined in Section 26.3, and $L_{\bar{z}}$ is the integral length scale of turbulence at the equivalent height given by

$$L_{\bar{z}} = \ell\left(\frac{\bar{z}}{33}\right)^{\bar{\varepsilon}} \qquad (26.11\text{-}9)$$

$$L_{\bar{z}} = \ell\left(\frac{\bar{z}}{10}\right)^{\bar{\varepsilon}} \qquad (26.11\text{-}9.SI)$$

in which ℓ and $\bar{\varepsilon}$ are constants listed in Table 26.11-1.

26.11.5 Flexible Buildings or Other Structures For flexible buildings or other structures as defined in Section 26.2, the gust-effect factor shall be calculated by

$$G_f = 0.925\left(\frac{1+1.7I_{\bar{z}}\sqrt{g_Q^2Q^2+g_R^2R^2}}{1+1.7g_vI_{\bar{z}}}\right) \qquad (26.11\text{-}10)$$

The background peak factors g_Q and g_v shall be taken as 3.4, and the resonant peak factor g_R is

$$g_R = \sqrt{2\ln(3{,}600n_1)} + \frac{0.577}{\sqrt{2\ln(3{,}600n_1)}} \qquad (26.11\text{-}11)$$

The background response factor, Q, and the intensity of turbulence at height z, I_z, are defined in Section 26.11.4. The resonant response factor is

$$R = \sqrt{\frac{1}{\beta}R_nR_hR_B(0.53+0.47R_L)} \qquad (26.11\text{-}12)$$

where n_1 is the fundamental natural frequency, and β is the damping ratio, fraction of critical (e.g., for 2% use 0.02 in the equation).

Table 26.11-1. Terrain Exposure Constants.

Customary Units

Exposure	α	z_g (ft)	$\hat{\alpha}$	$\hat{b}$	$\bar{\alpha}$	$\bar{b}$	c	l (ft)	$\bar{\varepsilon}$	z_{min} (ft)*
B	7.5	3,280	1/7.5	0.84	1/4.5	0.47	0.30	320	1/3.0	30
C	9.8	2,460	1/9.8	1.00	1/6.4	0.66	0.20	500	1/5.0	15
D	11.5	1,935	1/11.5	1.09	1/8.0	0.78	0.15	650	1/8.0	7

SI Units

Exposure	α	z_g (m)	$\hat{\alpha}$	$\hat{b}$	$\bar{\alpha}$	$\bar{b}$	c	l (m)	$\bar{\varepsilon}$	z_{min} (m)*
B	7.5	1,000	1/7.5	0.84	1/4.5	0.47	0.30	97.54	1/3.0	9.14
C	9.8	750	1/9.8	1.00	1/6.4	0.66	0.20	152.40	1/5.0	4.57
D	11.5	590	1/11.5	1.09	1/8.0	0.78	0.15	198.12	1/8.0	2.13

* z_{min} = Minimum height used to ensure that the equivalent height $\bar{z}$ is the greater of $0.6h$ or z_{min}. For buildings or other structures with $h \le z_{min}$, $\bar{z}$ shall be taken as z_{min}.

The power spectral density of turbulence at the equivalent height of the structure $\bar{z}$, evaluated at the structure's natural reduced frequency, N_1, is

$$R_n = \frac{7.47N_1}{(1+10.3N_1)^{5/3}} \qquad (26.11\text{-}13)$$

$$N_1 = \frac{n_1L_{\bar{z}}}{\bar{V}_{\bar{z}}} \qquad (26.11\text{-}14)$$

where $L_{\bar{z}}$ is defined in Equation (26.11-9).

The size effect factors related to the height, breadth, and depth of the building are

$$R_h = \frac{1}{\eta_h} - \frac{1}{2\eta_h^2}(1-e^{-2\eta_h})$$
$$R_B = \frac{1}{\eta_B} - \frac{1}{2\eta_B^2}(1-e^{-2\eta_B}) \qquad (26.11\text{-}15a)$$
$$R_L = \frac{1}{\eta_L} - \frac{1}{2\eta_L^2}(1-e^{-2\eta_L})$$

where the turbulent coherence (correlation) factors in the corresponding directions, evaluated at the natural reduced frequency, are

$$\eta_h = 4.6n_1h/\bar{V}_z$$
$$\eta_B = 4.6n_1B/\bar{V}_z \qquad (26.11\text{-}15b)$$
$$\eta_L = 15.4n_1L/\bar{V}_z$$

The mean hourly wind speed (in ft/s or m/s) at the equivalent structure height, $\bar{z}$, is

$$\bar{V}_{\bar{z}} = \bar{b}\left(\frac{\bar{z}}{33}\right)^{\bar{\alpha}}\left(\frac{88}{60}\right)V \qquad (26.11\text{-}16)$$

$$\bar{V}_{\bar{z}} = \bar{b}\left(\frac{\bar{z}}{10}\right)^{\bar{\alpha}}V \qquad (26.11\text{-}16.SI)$$

where $\bar{b}$ and $\bar{\alpha}$ are constants listed in Table 26.11-1, $\bar{z}$ is obtained from Section 26.11.4, and V is the basic wind speed, mi/h (m/s).

26.11.6 Rational Analysis In lieu of the procedure defined in Sections 26.11.4 and 26.11.5, determination of the gust-effect factor by any rational analysis defined in the recognized literature is permitted.

26.11.7 Limitations Where combined gust-effect factors and pressure coefficients (GC_p), (GC_{pi}), and (GC_{pf}) are given in figures and tables, the gust-effect factor shall not be determined separately.

26.12 ENCLOSURE CLASSIFICATION

26.12.1 General For the purpose of determining internal pressure coefficients, buildings and other structures for which internal pressure coefficients (GC_{pi}) apply shall be classified as enclosed, partially enclosed, partially open, or open, as defined in Section 26.2. If a building or other structure satisfies both the "open" and "partially enclosed" enclosure classification definitions, it shall be classified as a "partially open" building or other structure.

26.12.2 Openings A determination shall be made of the amount of openings in the building envelope for use in determining the enclosure classification. To make this determination, each building wall shall be assumed as the windward wall for consideration of the amount of openings present with respect to the remaining building envelope.

26.12.3 Protection of Glazed Openings Glazed openings in Risk Category II, III, or IV buildings located in hurricane-prone regions shall be protected as specified in this section.

26.12.3.1 Wind-Borne Debris Regions Glazed openings shall be protected in accordance with Section 26.12.3.2 in the following locations:

1. Within 1 mi (1.6 km) of the mean high water line where an Exposure D condition exists upwind of the waterline and the basic wind speed is equal to or greater than 130 mi/h (58 m/s), or
2. In areas where the basic wind speed is equal to or greater than 140 mi/h (63 m/s).

For Risk Category II buildings and other structures and Risk Category III buildings and other structures, except health care facilities, the wind-borne debris region shall be based on Figure 26.5-1B. For Risk Category III health care facilities, the wind-borne debris region shall be based on Figure 26.5-1C. For Risk Category IV buildings and structures, the wind-borne debris region shall be based on Figure 26.5-1D. Risk categories shall be determined in accordance with Section 1.5.

EXCEPTION: Glazing located more than 60 ft (18.3 m) above the ground and more than 30 ft (9.2 m) above aggregate-surfaced roofs, including roofs with gravel or stone ballast, located within 1,500 ft (458 m) of the building shall be permitted to be unprotected.

26.12.3.2 Protection Requirements for Glazed Openings Glazing in buildings requiring protection shall be impact resistant or be protected with an impact-protective system.

Impact-protective systems and impact-resistant glazing shall be subjected to missile test and cyclic pressure differential tests in accordance with ASTM E1996 as applicable. Testing to demonstrate compliance with ASTM E1996 shall be in accordance with ASTM E1886. Impact-resistant glazing and impact-protective systems shall comply with the pass/fail criteria of Section 7 of ASTM E1996 based on the missile required by Table 3 or Table 4 of ASTM E1996. Glazing in sectional doors, rolling doors, and flexible doors shall be subjected to missile tests and cyclic pressure differential tests in accordance with ANSI/DASMA 115 as applicable.

Glazing and impact-protective systems in buildings and other structures classified as Risk Category IV in accordance with Section 1.5 shall comply with the "enhanced protection" requirements of Table 3 of ASTM E1996. Glazing and impact-protective systems in all other buildings covered by Section 26.12.3.1 shall comply with the "basic protection" requirements of Table 3 of ASTM E1996.

EXCEPTION: When approved, other testing methods and/or performance criteria shall be permitted to be used to demonstrate compliance with all provisions of this section.

26.13 INTERNAL PRESSURE COEFFICIENTS

Internal pressure coefficients (GC_{pi}) shall be determined from Table 26.13-1 based on building enclosure classifications determined from Section 26.12.

26.13.1 Reduction Factor for Large-Volume Buildings, R_i For a partially enclosed building containing a single,