Figures 1.3.4.5(b) and 1.3.4.5(d) of this manual incorporate the external and internal pressure coefficients from ASCE 7-10 and provide the recommendation for applying the pressure coefficients to single slope buildings for transverse and longitudinal directions, respectively. In the transverse direction, for a roof slope up to 20 degrees, the roof pressure zones are separated by a "pseudo" ridge line. However, where $20° < \theta \leq 30°$, the building shall be assumed to act as each half of a gable building with all cases investigated. (i.e. two cases using pressure zones 2 and 2E over the entire roof, and two cases using pressure zones 3 and 3E over the entire roof).

1.3.4.5.4 MBMA Recommendation for Open Buildings - MWFRS

ASCE 7-10, Section 27.4.3 contains provisions for the main wind force resisting systems of open buildings. The net design pressure for the MWFRS is determined from the following equation:

$$p = q_h G C_N \qquad \textbf{(ASCE 7-10, Eq. 27.4-3)}$$

where,

q_h = velocity pressure in pounds per square foot (psf).
G = gust effect factor from ASCE 7-10, Section 26.9.
C_N = net pressure coefficient from ASCE 7-10 Figures 27.4-4 through 27.4-7.

For winds perpendicular to the ridge, ASCE 7-10 Figures 27.4-4, 27.4-5, and 27.4-6 are for monosloped roofs, gable roofs, and troughed roofs, respectively. Net pressure coefficients are given for two cases: (1) where there is clear wind flow through the building, and (2) where there is obstructed wind flow. Obstructed wind flow occurs when objects below the roof produce greater than a 50% blockage of the wind flow through the building. Also, note that for gable roofs with a slope less than 7.5°, the coefficients for a monoslope roof (Figure 27.4-4) with $\theta = 0°$ are to be used.

It is important to note that the ASCE 7-10 provisions in Figures 27.4-4 through 27.4-6 have lower and upper limits on the ratio h/L, i.e. the mean roof height to the horizontal dimension of roof measured in the along wind direction. Therefore, the MBMA recommendation for building aspect ratios that fall outside the h/L limits, are to use the pressure coefficients provided in Table 1.3.4.5(a). This is consistent with previous editions of MBMA Low-Rise Building Systems Manual that were based on information found in Refs. B3.5 and B3.18.

Also, the ASCE 7-10 provisions only apply to the roof surfaces. Therefore the MBMA recommendation for wall surfaces that might be clad, is to use the wall pressure coefficients provided in Table 1.3.4.5(a) and Figure 1.3.4.5(e). This is consistent with previous editions of MBMA Low-Rise Building Systems Manual that were based on information found in Refs. B3.5 and B3.18.

For winds parallel to the ridge, net pressure coefficients are given in ASCE 7-10 Figure 27.4-7. However, this only covers pressures and suctions on the roof surfaces, which do not contribute to the longitudinal wind brace requirements. For wind pressures on the bare frames, or on clad surfaces on the endwalls, MBMA recommends using the method that was developed by researchers at the Boundary Layer Wind Tunnel Laboratory, University of Western Ontario in 2008 (Ref. 3.59, 3.64, and 3.65). Based on wind tunnel studies on multiple building configurations, the researchers developed a procedure for assessing wind drag loads on multiple bay open structures, taking into consideration wind azimuth, frame span, solidity ratio and number of frames. Part of this research is given in Appendix 7 Wind Load Commentary, Section A7.3.3.

The total wind force on the MWFRS in the longitudinal direction is given by the formula

$$F = q_h K_B K_s [GC_{pf}] A_E \qquad \textbf{(2012 MBSM, Eq. 1.3.4.5)}$$

where,

q_h = velocity pressure evaluated at mean roof height, h.

K_B = frame width factor.
= $1.8 - 0.01B$ for $B \leq 100$ ft.
= 0.8 for $B > 100$ ft.

K_s shielding factor.
$0.20 + 0.073(n - 3) + 0.4e^{(1.5\varphi)}$.

GC_{pf} external pressure coefficient, shall be taken for an enclosed building in Figure 28.4-1 of ASCE 7-10. Use building surfaces (1 and 1E) for the windward wall and building surfaces (4 and 4E) for the leeward wall. The coefficients shall be based on a flat roof, with $\theta = 0°$.

φ solidity ratio = A_S / A_E.

B width of the building perpendicular to the ridge(ft).

n number of frames, not to be taken less than n = 3.

A_S effective solid area of the end wall, i.e. the projected area of any portion of the end wall that would be exposed to the wind (See Figure 1.3.4.5(e).

A_E the total end wall area for an equivalent enclosed building (See Figure 1.3.4.5(e).

Equation 1.3.4.5 is applicable to buildings with open end walls, end walls with the gable filled with cladding and with additional end wall cladding.

1.3.4.5.5 Other MBMA Recommendations for MWFRS

It is important to note that coefficients 1 and 4 (and 1E, 4E) of Figure 1.3.4.5(c) or 1.3.4.5(d) are to be used in combination in designing the longitudinal wind-resisting system. Additionally, note that a strut purlin spanning in the longitudinal direction can conservatively be designed for the appropriate axial load based on Figure 1.3.4.5(c) or 1.3.4.5(d) in