obtained from wind-tunnel tests conducted at the University of Western Ontario (Davenport et al. 1977, 1978), at the James Cook University of North Queensland (Best and Holmes 1978), and at Concordia University (Stathopoulos 1981, Stathopoulos and Zhu 1988, Stathopoulos and Luchian 1990, 1992, and Stathopoulos and Saathoff 1991). These coefficients were refined to reflect results of full-scale tests conducted by the National Bureau of Standards (Marshall 1977) and the Building Research Station, England (Eaton and Mayne 1975). Pressure coefficients for hemispherical domes on the ground or on cylindrical structures were based on wind-tunnel tests (Taylor 1991). Some of the characteristics of the values in the figure are as follows:

1. The values are combined values of (GC_p). The gust effect factors from these values should not be separated.
2. The velocity pressure q_h evaluated at mean roof height should be used with all values of (GC_p).
3 The values provided in the figure represent the upper bounds of the most severe values for any wind direction. The reduced probability that the design wind speed may not occur in the particular direction for which the worst pressure coefficient is recorded has not been included in the values shown in the figure.
4. The wind-tunnel values, as measured, were based on the mean hourly wind speed. The values provided in the figures are the measured values divided by $(1.53)^2$ (see Fig. C26.5-1) to adjust for the reduced pressure coefficient values associated with a 3-s gust speed.

Each component and cladding element should be designed for the maximum positive and negative pressures (including applicable internal pressures) acting on it. The pressure coefficient values should be determined for each component and cladding element on the basis of its location on the building and the effective area for the element. Research (Stathopoulos and Zhu 1988, 1990) indicated that the pressure coefficients provided generally apply to facades with architectural features, such as balconies, ribs, and various facade textures. In ASCE 7-02, the roof slope range and values of (GC_p) were updated based on subsequent studies (Stathopoulos et al. 1999, 2000, 2001).

Figures 30.4-4, 30.4-5A, and 30.4-5B. These figures present values of (GC_p) for the design of roof components and cladding for buildings with multispan gable roofs and buildings with monoslope roofs. The coefficients are based on wind tunnel studies (Stathopoulos and Mohammadian 1986, Surry and Stathopoulos 1988, and Stathopoulos and Saathoff 1991).

Figure 30.4-6 The values of (GC_p) in this figure are for the design of roof components and cladding for buildings with sawtooth roofs and mean roof height, h, less than or equal to 60 ft (18 m). Note that the coefficients for corner zones on segment A differ from those coefficients for corner zones on the segments designated as B, C, and D. Also, when the roof angle is less than or equal to 10°, values of (GC_p) for regular gable roofs (Fig. 30.4-2A) are to be used. The coefficients included in Fig. 30.4-6 are based on wind tunnel studies reported by Saathoff and Stathopoulos (1992).

Figure 30.4-7. This figure for cladding pressures on dome roofs is based on Taylor (1991). Negative pressures are to be applied to the entire surface, because they apply along the full arc that is perpendicular to the wind direction and that passes through the top of the dome. Users are cautioned that only three shapes were available to define values in this figure ($h_D/D = 0.5$, $f/D = 0.5$; $h_D/D = 0.0$, $f/D = 0.5$; and $h_D/D = 0.0$, $f/D = 0.33$).

Figure 30.6-1. The pressure coefficients shown in this figure reflect the results obtained from comprehensive wind tunnel studies carried out (Stathopoulos and Dumitrescu-Brulotte 1989). The availability of more comprehensive wind tunnel data has also allowed a simplification of the zoning for pressure coefficients, flat roofs are now divided into three zones, and walls are represented by two zones.

The external pressure coefficients and zones given in Figure 30.6-1 were established by wind tunnel tests on isolated "box-like" buildings (Akins and Cermak 1975 and Peterka and Cermak 1975). Boundary-layer wind-tunnel tests on high-rise buildings (mostly in downtown city centers) show that variations in pressure coefficients and the distribution of pressure on the different building facades are obtained (Templin and Cermak 1978). These variations are due to building geometry, low attached buildings, nonrectangular cross-sections, setbacks, and sloping surfaces. In addition, surrounding buildings contribute to the variations in pressure. Wind tunnel tests indicate that pressure coefficients are not distributed symmetrically and can give rise to torsional wind loading on the building.

Boundary-layer wind-tunnel tests that include modeling of surrounding buildings permit the establishment of more exact magnitudes and distributions of (GC_p) for buildings that are not isolated or "box-like" in shape.