Chapter C30
WIND LOADS—COMPONENTS AND CLADDING (C&C)

In developing the set of pressure coefficients applicable for the design of components and cladding (C&C) as given in Figs. 30.4-1, 30.4-2A, 30.4-2B, 30.4-2C, 30.4-3, 30.4-4, 30.4-5A, 30.4-5B, and 30.4-6, an envelope approach was followed but using different methods than for the MWFRS of Fig. 28.4-1. Because of the small effective area that may be involved in the design of a particular component (consider, e.g., the effective area associated with the design of a fastener), the pointwise pressure fluctuations may be highly correlated over the effective area of interest. Consider the local purlin loads shown in Fig. C28.4-1. The approach involved spatial averaging and time averaging of the point pressures over the effective area transmitting loads to the purlin while the building model was permitted to rotate in the wind tunnel through 360°. As the induced localized pressures may also vary widely as a function of the specific location on the building, height above ground level, exposure, and more importantly, local geometric discontinuities and location of the element relative to the boundaries in the building surfaces (walls, roof lines), these factors were also enveloped in the wind tunnel tests. Thus, for the pressure coefficients given in Figs. 30.4-1, 30.4-2A, 30.4-2B, 30.4-2C, 30.4-3, 30.4-4, 30.4-5A, 30.4-5B, and 30.4-6, the directionality of the wind and influence of exposure have been removed and the surfaces of the building "zoned" to reflect an envelope of the peak pressures possible for a given design application.

As indicated in the discussion for Fig. 28.4-1, the wind tunnel experiments checked both Exposure B and C terrains. Basically (GC_p) values associated with Exposure B terrain would be higher than those for Exposure C terrain because of reduced velocity pressure in Exposure B terrain. The (GC_p) values given in Figs. 30.4-1, 30.4-2A, 30.4-2B, 30.4-2C, 30.4-3, 30.4-4, 30.4-5A, 30.4-5B, and 30.4-6 are associated with Exposure C terrain as obtained in the wind tunnel. However, they may also be used for any exposure when the correct velocity pressure representing the appropriate exposure is used as discussed below.

The wind tunnel studies conducted by ESDU (1990) determined that when low-rise buildings ($h < 60$ ft) are embedded in suburban terrain (Exposure B), the pressures on components and cladding in most cases are lower than those currently used in the standards and codes, although the values show a very large scatter because of high turbulence and many variables. The results seem to indicate that some reduction in pressures for components and cladding of buildings located in Exposure B is justified. Hence, the standard permits the use of the applicable exposure category when using these coefficients.

The pressure coefficients given in Fig. 30.6-1 for buildings with mean height greater than 60 ft were developed following a similar approach, but the influence of exposure was not enveloped (Stathopoulos and Dumitrescu-Brulotte 1989). Therefore, exposure categories B, C, or D may be used with the values of (GC_p) in Fig. 30.6-1 as appropriate.

C30.1.5 Air-Permeable Cladding

Air-permeable roof or wall claddings allow partial air pressure equalization between their exterior and interior surfaces. Examples include siding, pressure-equalized rain screen walls, shingles, tiles, concrete roof pavers, and aggregate roof surfacing.

The peak pressure acting across an air-permeable cladding material is dependent on the characteristics of other components or layers of a building envelope assembly. At any given instant the total net pressure across a building envelope assembly will be equal to the sum of the partial pressures across the individual layers as shown in Fig. C30.1-1. However, the proportion of the total net pressure borne by each layer will vary from instant to instant due to fluctuations in the external and internal pressures and will depend on the porosity and stiffness of each layer, as well as the volumes of the air spaces between the layers. As a result, although there is load sharing among the various layers, the sum of the peak pressures across the individual layers will typically exceed the peak pressure across the entire system. In the absence of detailed information on the division of loads, a simple, conservative approach is to assign the entire differential pressure to each layer designed to carry load.

To maximize pressure equalization (reduction) across any cladding system (irrespective of the permeability of the cladding itself), the layer or layers behind the cladding should be

- relatively stiff in comparison to the cladding material and
- relatively air-impermeable in comparison to the cladding material.