

**Exposure D.** Exposure D shall apply where the ground surface roughness, as defined by Surface Roughness D, prevails in the upwind direction for a distance of at least 5,000 feet (1524 m) or 20 times the height of the building, whichever is greater. Exposure D shall extend inland from the shoreline for a distance of 600 feet (183 m) or 20 times the height of the building, whichever is greater.

## 1609.5 Roof systems.

**1609.5.1 Roof deck.** The roof deck shall be designed to withstand the wind pressures determined in accordance with ASCE 7.

**1609.5.2 Roof coverings.** Roof coverings shall comply with Section 1609.5.1.

**Exception:** Rigid tile roof coverings that are air permeable and installed over a roof deck complying with Section 1609.5.1 are permitted to be designed in accordance with Section 1609.5.3.

Asphalt shingles installed over a roof deck complying with Section 1609.5.1 shall comply with the wind-resistance requirements of Section 1507.2.7.1.

**1609.5.3 Rigid tile.** Wind loads on rigid tile roof coverings shall be determined in accordance with the following equation:

$$M_a = q_h C_L b L L_a [1.0 - GC_p] \quad \text{(Equation 16-33)}$$

$$M_a = \frac{q_h C_L b L L_a [1.0 - GC_p]}{1,000}$$

For SI:  $M_a =$

where:

- $b$  = Exposed width, feet (mm) of the roof tile.
- $C_L$  = Lift coefficient. The lift coefficient for concrete and clay tile shall be 0.2 or shall be determined by test in accordance with Section 1716.2.
- $GC_p$  = Roof pressure coefficient for each applicable roof zone determined from Chapter 6 of ASCE 7. Roof coefficients shall not be adjusted for internal pressure.
- $L$  = Length, feet (mm) of the roof tile.
- $L_a$  = Moment arm, feet (mm) from the axis of rotation to the point of uplift on the roof tile. The point of uplift shall be taken at  $0.76L$  from the head of the tile and the middle of the exposed width. For roof tiles with nails or screws (with or without a tail clip), the axis of rotation shall be taken as the head of the tile for direct deck application or as the top edge of the batten for battened applications. For roof tiles fastened only by a nail or screw along the side of the tile, the axis of rotation shall be determined by testing. For roof tiles installed with battens and fastened only by a clip near the tail of the tile, the moment arm shall be determined about the top edge of the batten with consideration given for the point of rotation of the tiles based on straight bond or broken bond and the tile profile.
- $M_a$  = Aerodynamic uplift moment, feet-pounds (N-mm) acting to raise the tail of the tile.
- $q_h$  = Wind velocity pressure, psf ( $\text{kN/m}^2$ ) determined from Section 6.5.10 of ASCE 7.

Concrete and clay roof tiles complying with the following limitations shall be designed to withstand the aerodynamic uplift moment as determined by this section.

1. The roof tiles shall be either loose laid on battens, mechanically fastened, mortar set or adhesive set.