Wind Uplift Construction
West Coast Low-Slope Roof Construction Criteria and Requirements of the UBC
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(Edited's Note: John A. Goveia, senior consultant with Technical Roof Services, has over 17 years of experience in roof contracting, consulting, specification development and leak investigations. Committed to excellence, he served as a licensed instructor for the Bay Area Roofers Apprenticeship program and has assisted in development of licensing requirements for the Calif. State C-14 Sheet Metal Roof Contractor. Questions for Goveia can be submitted in writing to Technical Roof Services, 395 Civic Drive, Suite C, Pleasant Hill, Calif., 94523.)

Roof and Parapet Wall Coverings, like many building components, are subject to wind forces and potentially significant damage as a result of these forces. This article will address specific West Coast low-slope roof construction criteria and requirements of the Uniform Building Code. It is also the intent of this article to identify items requiring prudent judgment by specifiers and contractors, when considering uplift on roof coverings.

Many considerations that must be taken into account when designing roofs to resist wind forces, negative (uplift) or positive (pressurization). Model building codes used throughout the United States provide design values for wind loads, applicable to virtually all types of buildings.

One of the most stringent model building codes in the country is that of South Florida, Dade County. This code establishes a minimum wind speed of 120 mph for wind uplift calculations. Another example is the BOCA Code, used primarily in the Northeast which makes the following reference: "...All low-slope roof coverings which are mechanically attached or adhered to the roof slab or deck shall provide a minimum tested uplift pressure resistance equal to three times the wind loads of Section 1112.0, but not less than 30 psf (146 kg/m2) when tested in accordance with FM 4450, FM 4470 or UL 580..."

Uniform Building Code
The 1991 Uniform Building Code (UBC) contains some rather dramatic changes over the wind requirements of the 1988 UBC. The article entitled, "Hurricane Force" in the November/December issue of Western Roofing touched on some of these changes. It is important to recognize a few of the factors that contribute to the differences in the 1988 and 1991 wind load calculations.

The primary revisions include: the addition of an Exposure D corresponding to sites adjacent to large bodies of water; more refined stagnation pressures, definitions for "fastest-mile wind", "special wind regions," and "open" structures; new pressure coefficients for elements and components and a requirement for high wind area single attachment (Appendix 25).

One change in the 1991 UBC Table No. 23-H was to combine roof edge and corner conditions and assign a single pressure coefficient. For example, a coefficient of 2.3 upward is listed for "roofs eaves, rakes or ridges without overhangs" for slopes less than 2:12. Since the 1988 Code Table No. 23-H lists a coefficient of 2.0 upward for "eaves or rakes" and 3.0 upward for "eaves and roof edges at building corners," this change increases the design uplift pressure along roof edges but effectively lowers it near corners.

Based on field experience, this author recommends using a minimum coefficient of at least 3.0 when calculating wind uplift loads for roof attachment systems near roof corners on low height buildings and even greater on high-rise buildings.

It should be remembered that code provisions are minimum requirements. The specifier and installer have the option to consider more conservative requirements (e.g., higher pressure coefficients). Two examples would be buildings located in valleys or at the edge of cliffs. It should also be remembered that if a specification refers to a Factory Mutual Research Corporation (FMRC) compliant system, the FMRC Isolach map should be used, which is based on a 100-year frequency for wind, not the UBC map which is based on a 50-year frequency.

Generally, the FM wind speeds are higher as are the uplift values, perform the UBC calculations to cross check final uplift. Remember, however, there are often important considerations, not addressed by the code. For example, system air-permeability and the ability of the fasteners/plates to resist insulation or membrane pull-through. These topics are worthy of research and may be subjects of future articles.

Tributary Areas
The idea behind assigning pressure coefficients based on tributary areas relates to the dynamic and flu-
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The fluctuating nature of wind pressures. So, even though research has shown that peak coefficients (or uplift pressures) greater than 2.3 or even 3.0 (1988 UBC) can be anticipated along roof edges and near corners, if these peak pressures occur over relatively small areas and are of short duration, the “element” really only needs to resist an “average” pressure experienced over its tributary area.

Roof designers and installers, however, should consider utilizing higher coefficients for elements of some roof systems that have effective “tributary” areas less than ten square feet especially if the deck is air-permeable. Two examples are fasteners for base sheets on wood decks and mechanically attached single ply membranes.

Parapet Coverings

Parapet coverings are cladding and are often overlooked as elements that must resist air pressure differentials. In the 1988 UBC, the additive coefficient was .5. In the 1991 UBC, parapet wall coefficients are noted in “Item 2,” as 1.3, only in non-discontinuity areas. Specifiers should consider a 2.3 coefficient for perimeter parapets.

Many shingle applications are typically tested for 55 mph winds by UL, below the minimum UBC design wind speed of 70 mph. Since self-sealing shingles often do not adequately seal in a vertical position, the adequacy of some installations could be further questioned. Recently, 90 mph ratings for shingles have appeared in the UL directory. Literature from the Asphalt Roofing Manufacturer’s Association recommends using six nails and hand sealing each shingle tab for steep applications.

Appendix 25

UBC Appendix 25 addresses special requirements for light structures in high wind areas over 80 mph. The most important roofing note in the Appendix Section is for shingles. Six nails per shingle and “hand sealing” of shingles are required. Hand sealing presumably means applying dabs of mastic beneath each shingle tab.

Appendix sections though must be specifically adopted by localities when adopting the Code. It is wise, therefore, to check with the specific locality for their requirements, since hand dabbing is time consuming.

Conclusion

The new UBC changes help simplify, and clarify wind coefficients with the intent to mitigate wind damage to buildings. Those of us who install or specifier of roofs have a responsibility to comply with Code provisions and remember that they are intended to be minimum considerations.