Residential Building Loads: Review and Roadmap for Future Progress, Crandell, Kenney & Rosowsky, ed., 2006 (ASCE)

APPENDIX B - Simplified ASCE 7-02 Wind Loads For Typical Low-Rise Buildings January 31, 2004

A.1 General. This appendix provides simplified wind loads that result in designs reasonably consistent with the requirements ASCE 7. It is intended for use by qualified design professionals and is subject to the limitations of Section A.2. In this method, a single wind pressure for each roof and wall vertical projected area and the roof horizontal projected area is used to determine main wind force resisting system loads. For components and cladding loads, surface pressures are determined for specific building elements such that multiple pressure zones are not required to be separately evaluated.

A.2 Limitations. These provisions are applicable to buildings meeting the following conditions:

- Light-frame, concrete, or masonry construction using shear walls and horizontal diaphragms to resist lateral loads.
- Mean roof height of 40 feet or less.
- One- and two-family dwellings, apartments, commercial buildings, and other building uses or occupancies with a wind load importance factor of 1.0.

A.3 Wind Design Criteria

A.3.1 Basic Wind Speed
The basic (design) wind speed shall be determined in accordance with Figure A1 or as required by the local governing building code.

A3.2 Wind Exposure and Topography. The provisions of this Appendix are based on wind exposure category B (suburban, urban, or wooded terrain) as defined in ASCE 7. For buildings located in wind exposure category C (open or coastal terrain), tabulated exposure B wind loads shall be increased by a factor 1.4 (see table footnotes as applicable in Section A4). Buildings sited within 10 building heights from the top edge of a prominent topographic feature shall be designed in accordance with ASCE 7. A prominent topographic feature has a ground slope of greater than 15 percent and a vertical rise of greater than 50 feet, and is separated from features of similar or greater height by a distance of more than approximately 100 times the height of the topographic feature.

A3.3 Wind-borne Debris Region.
The *wind-borne debris region* shall be defined in accordance with the Figure A1 for Atlantic Ocean and Gulf of Mexico coastal areas as follows:

Basic Wind Speed ≥ 120 mph – all areas.
110 mph ≤ Basic Wind Speed < 120 mph – all areas within 1 mile of coastline.

A3.4 Building Enclosure Condition
Building enclosure condition shall be classified in accordance with Table A1 for the purpose of determining wind loads in accordance with Section A4.2 and A4.3.

A3.5 Counteracting Dead Load
When dead load is used to counteract

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effects of wind pressure, it shall be factored as follows for Allowable Strength Design (ASD) and Load and Resistance Factor or Strength Design (LRFD) methods:

ASD: W - 0.6D

LRFD: 1.6W - 0.9D

where W is wind load effect due to wind loads determined in accordance with Section A4 and D is dead load effect due to estimated actual dead load. Load effects include stresses in or forces applied to structural members, connections, or systems.

Other load combinations and design load effects shall be considered in accordance with ASCE 7, Chapter 2.

A.4 Wind Loads

A4.1 Lateral Force Resisting System Loads. Wind pressures from Table A2 shall be applied to building roof and wall vertical projected areas (VPA) corresponding to each of four elevations of the building to determine maximum lateral wind forces (shear) tributary to horizontal diaphragms, shear walls, and related connections.

A4.2 Roof System Uplift Loads. Wind pressures from Table A3 shall be applied to the horizontal projected area (HPA) of a roof system to determine uplift loads tributary to structural elements, assemblies, and connections that experience loads from multiple roof surfaces.

A4.3 Components and Cladding Loads. Table A4 shall be used to determine inward (positive) and outward (negative) acting wind loads tributary to wall and roof components, cladding, and related connections. Design wind pressures shall be applied perpendicular to the tributary area of the component, cladding, or connection under consideration.

Figure B1
Basic Gust Wind Speed (Gust), MPH

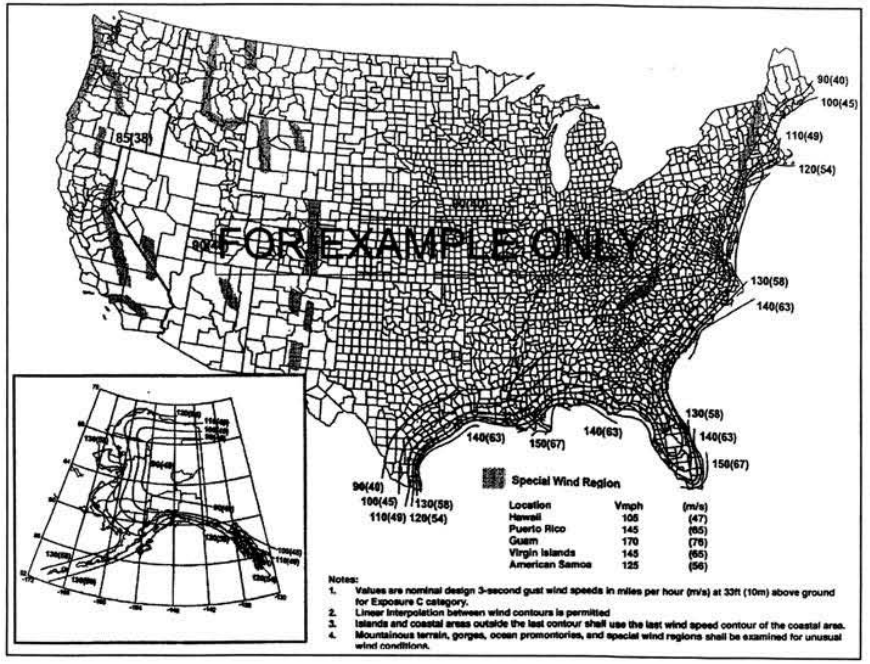

Table B1
Classification of Building Enclosure Condition

Partially-Enclosed Building	Enclosed Building
Buildings meeting one of the following: • All buildings with intentional openings in the exterior envelop exceeding the lesser of 4 ft^2 or 1 percent of the total projected wall or roof area on any building side, or • Buildings within the *wind-borne debris region* with conventional exterior glazing (unprotected from debris impact) exceeding the above opening amounts	All buildings not classified as 'partially enclosed' including: • Buildings not within the *wind-borne debris region*, and • Buildings within the *wind-borne debris region* with glazing protection or impact resistant glazing in accordance with ASCE 7 or the local governing building code.

Table B1 Notes:

1. Building enclosure condition affects internal pressures experienced within the building. Because internal pressure acts inward or outward on all exterior building surfaces simultaneously, the net effect on lateral building loads is zero. Therefore, building enclosure condition does not affect determination of lateral building loads in Section A4.1.
2. Open buildings are not addressed; refer to ASCE 7 for appropriate wind loads. Open buildings have openings in each wall which exceed 80 percent of the wall area.

TABLE B2
Lateral Wind Loads for Application to Vertical Projected Wall and Roof Area
[Exposure B, Mean Roof Height 30 feet]

Basic Wind Speed (mph)	Design Wind Pressure (psf)					
	For Roof VPA by Roof Slope			For Wall VPA by Roof Slope		
	≤ 20° (4:12)	25° (5.6:12)	≥ 30° (7:12)	≤10° (2:12)	20° (4:12)	≥30° (7:12)
85	0	2.4	7.7	10.2	12.5	11.2
90	0	2.7	8.6	11.4	14.0	12.6
100	0	3.3	10.7	14.0	17.3	15.5
110	0	4.0	12.9	17.0	20.9	18.8
120	0	4.8	15.4	20.2	25.3	22.4
130	0	5.6	18.0	23.7	29.2	26.3
140	0	6.5	20.9	27.5	33.6	30.5
150	0	7.4	24.0	31.6	38.9	35.0

Table B2 Notes:

1. Table applies to wind exposure category B (urban, suburban, or wooded terrain). For exposure category C (open or coastal exposure), multiply table values by 1.4.
2. Table applies to a mean roof height of 30 feet. For other mean roof heights from 15 feet to 40 feet, multiply table values by the following factor: f_h = 0.0087 (h) + 0.74 where h is the mean roof height in feet.
3. Interpolation between reported wind speeds and roof slopes shall be permitted. For roof slopes greater than 45° (12:12), use wall VPA value.
4. Extrapolation to wind speeds other than shown shall be permitted by multiplying tabulated values by the ratio of squared wind speeds. For example, a wall VPA pressure of 20.9 psf at 110 mph from the table can be used to determine a pressure for a 170 mph wind speed by multiplying as follows: (20.9 psf) x $(170/110)^2$ = 49.9 psf.

TABLE B3
Wind Uplift Loads for Application to Roof System Horizontal Projected Area
[Exposure B, Mean Roof Height 30 feet]

Basic Wind Speed (mph)	Roof Uplift Pressure (psf) by Building Enclosure Condition and Roof Slope				Overhang Uplift Pressure (psf) by Roof Slope	
	Partially-Enclosed		Enclosed			
	≤20° (4:12)	≥25° (5.6:12)	≤20° (4:12)	≥25° (5.6:12)	≤20° (4:12)	≥25° (5.6:12)
85	17	11	13	8	19	12
90	19	13	14	9	21	13
100	23	16	17	11	26	17
110	28	19	21	13	32	20
120	33	23	25	16	38	24
130	39	27	29	18	45	28
140	45	31	34	21	52	32
150	52	35	39	24	60	37

Table B3 Notes:

1. Table applies to wind exposure category B (urban, suburban, or wooded terrain). For exposure category C (open or coastal exposure), multiply table values by 1.4.
2. Table applies to a mean roof height of 30 feet. For other mean roof heights from 15 feet to 40 feet, multiply table values by the following factor: f_h = 0.0087 (h) + 0.74 where h is the mean roof height in feet.
3. For hip roofs, multiply roof uplift pressure by 0.9 for roof slope less than 25° (5.6:12) and 0.8 for roof slope greater than 25° (5.6:12). This adjustment does not apply to overhangs on hip roofs.
4. Apply roof uplift pressure to horizontal projected area bounded by exterior walls. Apply overhang uplift pressure to horizontal projected area of overhangs projecting outward from exterior walls.
5. Interpolation for roof slopes between 20° (4:12) and 25° (5.6:12) and reported wind speeds shall be permitted.
6. Extrapolation of tabulated pressures to wind speeds other than shown shall be done in accordance with note 4 of Table A2.

TABLE B4
Design Wind Pressures (psf)
For Components and Cladding
[Enclosed Building, Exposure B, Mean Roof Height 30 feet]

Component	85 mph		90 mph		100 mph		110 mph	
	Inward	Outward	Inward	Outward	Inward	Outward	Inward	Outward
Roof Components								
Roof Framing	12	-12	13	-13	17	-17	20	-20
Roof Sheathing, Purlins, etc.	12	-18	13	-20	17	-25	20	-30
Roof Skylights, Glazing, etc.	12	-18	13	-20	17	-25	20	-30
Roofing (non-air permeable)[6]	12	-21	13	-23	17	-29	20	-35
Roof Overhang (framing only)[7]	12	-24	13	-27	17	-33	n/a	-40
Wall Components								
Wall Framing	12	-12	13	-13	17	-17	20	-20
Wall Sheathing (panels, boards, girts)	12	-18	13	-20	17	-25	20	-30
Windows, Doors, Glazing	12	-18	13	-20	17	-25	20	-30
Garage Doors	12	-12	13	-13	17	-17	20	-20
Siding (non-air permeable)[6]	12	-18	13	-20	17	-25	20	-30
Component	**120 mph**		**130 mph**		**140 mph**		**150 mph**	
	Inward	Outward	Inward	Outward	Inward	Outward	Inward	Outward
Roof Components								
Roof Framing	24	-24	27	-27	32	-32	37	-37
Roof Sheathing, Purlins, etc.	24	-36	27	-42	32	-49	37	-56
Roof Skylights, Glazing, etc.	24	-36	27	-42	32	-49	37	-56
Roofing (non-air permeable)[5]	24	-42	27	-49	32	-57	37	-65
Roof Overhang (framing only)[6]	n/a	-48	n/a	-56	n/a	-65	n/a	-74
Wall Components								
Wall Framing	24	-24	27	-27	32	-32	37	-37
Wall Sheathing (panels, boards, girts)	24	-36	27	-42	32	-49	37	-56
Windows, Doors, Glazing	24	-36	27	-42	32	-49	37	-56
Garage Doors	24	-24	27	-27	32	-32	37	-37
Siding (non-air permeable)[5]	24	-36	27	-42	32	-49	37	-56

Table B4 Notes:

1. Table applies to wind exposure category B (urban, suburban, or wooded terrain). For exposure category C (open or coastal exposure), multiply table values by 1.4.
2. Table applies to enclosed buildings. For partially-enclosed buildings, multiply table values by 1.25.
3. Table applies to a mean roof height of 30 feet or less. For mean roof heights greater than 30 feet and not exceeding 40 feet, multiply table values by the following factor: $f_h = 0.0087\,(h) + 0.74$ where h is the mean roof height in feet.
4. Interpolation between reported wind speeds shall be permitted. Extrapolation of tabulated pressures to wind speeds other than shown shall be done in accordance with note 4 of Table A2.
5. Non-air permeable claddings (siding and roofing) do not allow venting of air either through the siding or through cavities behind the cladding that lead to vent openings on the same face of the building. Most claddings are air-permeable to some degree and provide some reduction in wind load, provided the supporting wall behind the cladding is relatively non-air permeable. For vinyl cladding, ASTM Standard D3679 permits a 50 percent reduction in wind load for this reason. Similarly, claddings such as brick veneer (with weeps and vent space) and hardboard lap siding have been reported to experience cladding wind load reductions of 30 percent or more. Wind loads on roofing, such as asphalt shingles, have been reported to experience wind load reductions of as much as 25 percent. Refer to the cladding manufacturer for an appropriate air-permeable cladding reduction factor to use. Consideration should also be given to the dynamic nature of wind pressures (e.g., fluttering) and its potential effect (e.g., fatigue) on some cladding systems and related connections.
6. Roof overhang pressure includes pressure from underside of the overhang as well as on the upper surface. If an "open soffit" is used, the roof overhang pressure should also apply to the roof sheathing (if sheathed) or the roofing (if not sheathed underneath).

References: *Minimum Design Loads for Buildings and Other Structures*, ASCE 7-02, ASCE, Reston, VA. 2002.

Structural Loads for One- and Two-Family Dwellings, U.S. Dept. of Housing and Urban Development, Washington, DC. 2001.