Deletion of Distinction Between Urban and Rural in Table 242-1 and Table 242-1

A distinction was historically made in the requirements for urban districts and rural districts. However, as time has progressed, the distinction has become more difficult to ascertain and the results no longer appropriate. This is particularly the case in recent years, because some areas previously considered as rural often become urban in a very short time as development takes place.

In many areas, the urban development may not be contiguous to existing urban areas, such as when whole farms are subdivided (sometimes with golf courses, stores and offices mixed in with the residential areas), new vacation lodging and destinations are developed, etc.

As a result of changes in the growth habits of urbanized areas throughout the United States in the last few decades, few rural lines can reliably not expect to have one or more convenience stores erected at intersections or residential developments of some sort somewhere in their length during their expected lifetimes. Growth often occurs so fast or in such places that the utilities have no advance warning when designing lines in what are presently rural areas.

Further, using Grade N in some circumstances can produce undesired results, such as allowing a rural, constant-potential upper supply conductor crossing over a constant potential supply conductor in excess of 8.7 kV (which could be transmission voltage under the 2002 wording).

As a result, the 2007 Edition removed the distinction between urban areas and rural areas in both Table 242-1 (electric supply) and Table 242-2 (communication). This essentially limits application of Grade N Construction to supply service drops, some aerial high-voltage cables, and some communication cables.

Revision of Rule 250A2 to Emphasize Maintenance and Worker Loads

Rule 250A2 was added in the 1977 Edition to recognize that, especially in light-loading districts, some or all parts of structures may experience loadings during construction or maintenance that are greater than those experienced in normal operation. As a result of several foundation or groundline failures of lightly loaded poles with workers on them, the old vertical overload capacity factor for Grade C was increased to match that of Grade B to serve as a proxy for worker loads.

This rule was revised in 2007 to clarify the intent that temporary loads on structure components be considered, in addition to the main structure; bracing or other support (such as a crane) and/or load controls may be necessary to control temporary loads during stringing, worker loads, equipment installation, etc. In a companion change, Rule 261N was also revised to specify worker loads—see below.

The original set of 2007 proposals would have specified vertical and eccentric worker loads in a manner that would allow the vertical load factor for Grade C to return to its normal proportional level. However, since all of the proposed specified loads were not adopted, the load factors were not changed as proposed.

Sunset Date on Use of Alternate (Old) Calculation Methodology of Rules 253 & 261 and Tables 253-2 & 261-1B

In recent editions, the methodology for calculating load and strength requirements has been moving toward the load and resistance factor design methodology in common use for structural calculations. The transition is not complete, but the time has come to cease using the older methodology.

The older methodology that is now termed an alternate methodology cannot be used after 31 July 2010—even for existing structures that need to be checked before additions are made, such as for joint-use cable additions. As a result, existing standards need to be checked against the newer methodology using the newer load and strength factors by that time.

Deletion of Rule 261A2e Average Strength of 3 Poles

As time has progressed, larger wire sizes with both greater sags (and therefore less support from adjacent poles) and higher tensions (and therefore greater forces) have been used. As a result, Rule 261A2e—Average Strength of Three Poles is no longer reliable in many circumstances.

Wood pole strength is based upon the average strength of wood poles. Unlike metal, prestressed concrete, and fiber-reinforced polymer structures, wood has a wide variation in strength, with a typical coefficient of variation in excess of 20% of the mean.

The former average-strength rule is not applicable for other materials and, after review for the 2007 Edition, was concluded to no longer be appropriate for wood poles.

If an existing wood pole is known to be weak, that pole should be spliced or reinforced in accordance with Rule 261A2d or replaced or rehabilitated in accordance with Footnote 3 of Table 261-1A (the standard method) or Footnote 3 of Table 253-2 (the alternate method that can be used until 31 July 2010).

New Requirements for Fiber-Reinforced Polymer Structures and Components

Appropriate load factors and strength requirements have been added for fiber-reinforced polymer (FRP) structures and structural components in Table 253-1 (load factors), 260B (FRP reference documents), 261A3 (permitted load for FRP structures), 261C3 (guys on FRP structures), and 261D3 (permitted loads for FRP crossarms and braces).

Like metal, wood and other materials, the stress created on FRP structures or components by the required loads multiplied by the appropriate load factors is not allowed to exceed the permitted load. In the case of FRP materials, the permitted load cannot exceed the 5% lower exclusion limit (LEL) of the material strength multiplied by the strength factor from Table 261-1A.

New Rule 261N for Strength of Climbing and Working Steps and Attachments

Rule 261N now requires all climbing devices (includes steps, ladders, platforms and their attachments) to be capable of supporting 2.0 times the maximum intended load without permanent deformation.

Unless otherwise quantified by the owner, the maximum intended load must be assumed to be 300 lb. This would include the weight of the lineman, harness, tools, and equipment being supported by the lineman. Note that the language allows a lesser number to be used if it can be quantified, but it makes little sense to use a load less than 300 lb. One never knows how large a line worker will be using the devices.

Rule 261N also refers users to IEEE Std 1307-2004 Fall Protection for Utility Work. See also the discussion of Rule 250A2 above.

Selected Major Changes in Requirements for Loadings, Strengths, and Methods of Calculation

by Allen L. Clapp, P.E., P.L.S.

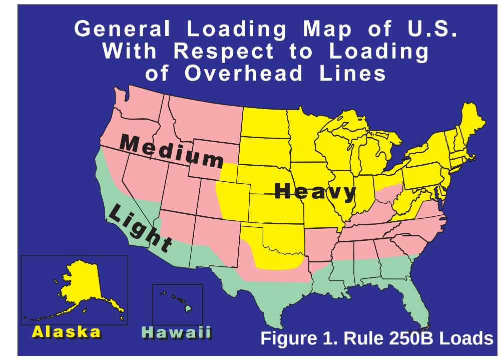

Figure 1. Rule 250B Loads

New Rule 250D for Freezing Rain & Concurrent Wind Loading

Since the original development of Rule 250B combined ice and wind loadings, (See Figure 1) additional data on freezing rain ice accumulations with concurrent wind has been developed and included in ASCE Std 7. This data was used to develop an additional ice and wind loading case based only on freezing rain in Rule 250D in the 2007 Edition. (See Figures 2A-2E.)

Rule 250D loadings are greater than Rule 250B loadings in some areas, but they can be lesser than loads from Rule 250B in other areas, because Rule 250B also considers rime ice/hoar frost, which is the greater loading in some areas. In addition, even though some of the Rule 250D radial ice loadings are greater for many areas, and even show ice accumulation in part of the Light Loading District of Rule 250B, some of these areas have a lesser concurrent wind speed and, therefore, result in less transverse loading than Rule 250B.

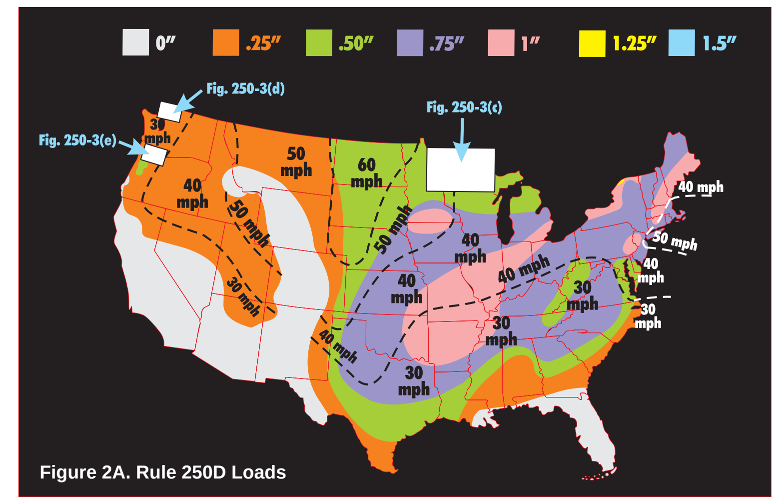

Figure 2A. Rule 250D Loads

Table 1 shows basic unfactored ice and wind loading data and resultant wind pressure loadings in lb/ft^2 applicable to selected regions under the traditional ice and wind combinations of Rule 250B, the new freezing rain and concurrent wind combinations of Rule 250D, and the extreme wind loadings of Rule 250C. (See Figure 3) The extreme wind pressures are adjusted for appropriate heights and gust response factors for spans of 0-250 ft.

Table 2 shows the load and strength factors used to create factored loads and factored strengths. These factors are combined to create overload capacity factors by dividing the load factor by the strength factor.

Table 3 shows the result of applying the wind pressures of Table 1 to wire/cable diameters ranging from 0.25 to 3 inches, with ice accumulations as applicable, in pounds of transverse force per lineal foot. Table 3 also includes the design factored transverse wind loads created by multiplying the overload capacity factors of Table 2 by the transverse wind loads required by Rules 250B, C, and D.

The greater of the loadings of Rules 250B, C, or

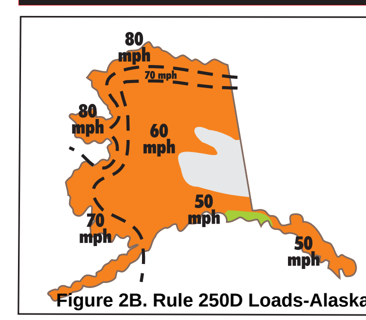

Figure 2B. Rule 250D Loads-Alaska

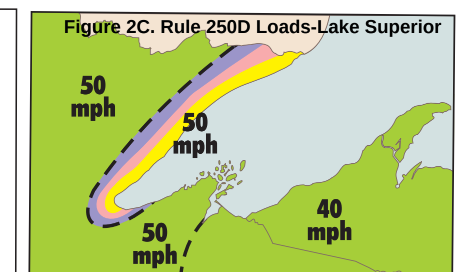

Figure 2C. Rule 250D Loads-Lake Superior

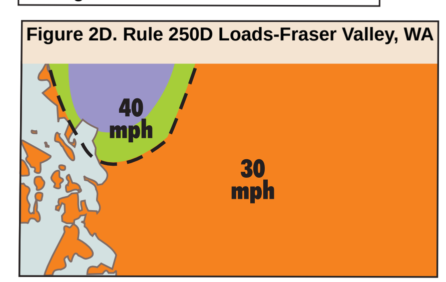

Figure 2D. Rule 250D Loads-Fraser Valley, WA

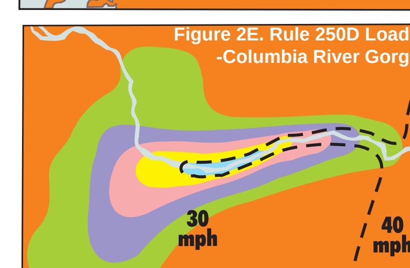

Figure 2E. Rule 250D Loads -Columbia River Gorge

Example: Central Illinois area

Table 1 shows the unfactored loadings to be (1) 0.5 in radial ice with 4 lb/ft2 wind [Rule 250B], (2) 1.0 in radial ice with 4 lb/ft2 wind [Rule 250D], and (3) 19.3 lb/ft2 wind on bare wires and cables at 0-33 ft above grade and spans of 0-250 ft.

Table 2 shows the overload capacity factor (determined by dividing the 2007 NESC load factor by the strength factor) for metal/wood to be

- 2.50/3.85 for Grade B and Rule 250B
- 2.20/2.59 for grade C and Rule 250B at crossing
- 1.00/1.33 for Grade B and Rule 250C
- 0.75/1.00 for Grade C and Rule 250C >100mph
- 1.00/1.33 for all Rule 250D

Table 3 shows that the greatest transverse load before applying load and strength factors is the load from Rule 250D for diameters up through 0.5 in. Above that size, the greatest transverse wind load for ice-covered conductors or cables is from Rule 250D, but the greatest overall transverse wind loading is from Rule 250C.

After applying the factors to the loads, the design load per lineal foot is still greatest from the loads of Rule 250D up through 0.5 in diameter. Above that size the extreme wind loads of Rule 250C control for both Grade B and Grade C.

NOTE: the results differ for other areas.

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D are required by the NESC to be considered, if all apply. However, the loading cases, wire size, and material all affect the factored design loading for which structures and suspended facilities should be designed—even at distribution line heights—and, therefore, all three loading cases should be considered for all structures, *regardless of height*. The extreme wind loads increase with height.

Unlike Rule 250C extreme wind loadings, neither the traditional ice and wind loadings of Rule 250B nor the freezing rain and concurrent wind loadings of Rule 250D include a height adjustment factor for wind speed, such as that used in Rule 250C.

Like Rule 250C, application of Rule 250D is not presently required by the NESC unless the structure or supported facilities exceeds 60 ft above grade. Also like the extreme wind loads of Rule 250C, recent negative experience with distribution lines supporting large power conductors and large cables suggests that such lines should be checked against both the freezing rain and concurrent wind loads of Rule 250D and the extreme wind loads of Rule 250C. These loads are based upon actual experience and can adversely affect the structural integrity of utility structures carrying large wires and cables or other facilities with large wind areas, such as capacitor banks at the top of a pole.

Table 1. Basic Loadings in Selected Regions

Selected Region	Rule 250B Ice & Wind: Radial Ice (in)	Rule 250B Ice & Wind: Wind (mph)	Rule 250B Ice & Wind: Wind (lb/ft^2)	Rule 250D Freezing Rain & Wind: Radial Ice (in)	Rule 250D Freezing Rain & Wind: Wind (mph)	Rule 250D Freezing Rain & Wind: Wind (lb/ft^2)	Rule 250C Extreme Wind on Bare Facilities: Basic Wind (mph)*	Rule 250C Extreme Wind on Bare Facilities: Basic Wind (lb/ft^2)	0-250 ft Span (lb/ft^2): Height 0-33 ft	0-250 ft Span (lb/ft^2): Height 34-50 ft
So. Central Alabama	0	59	9.0	0.25	30	2.3	120	36.86	34.3	35.8
Central Illinois	0.5	40	4.0	1.00	40	4.0	90	20.74	19.3	20.1
Central North Carolina	0.25	40	4.0	0.75	30	2.3	100	25.60	23.8	24.8
Central North Dakota	0.5	40	4.0	0.50	60	9.2	90	20.74	19.3	20.1
Northwest New York	0.5	40	4.0	1.00	40	4.0	90	20.74	19.3	20.1
Central Pennsylvania	0.5	40	4.0	0.75	40	4.0	90	20.74	19.3	20.1
Southeast Texas	0	59	9.0	0.50	30	2.3	100	25.60	23.8	24.8

*Note: Extreme wind speeds may differ from this example within the region.

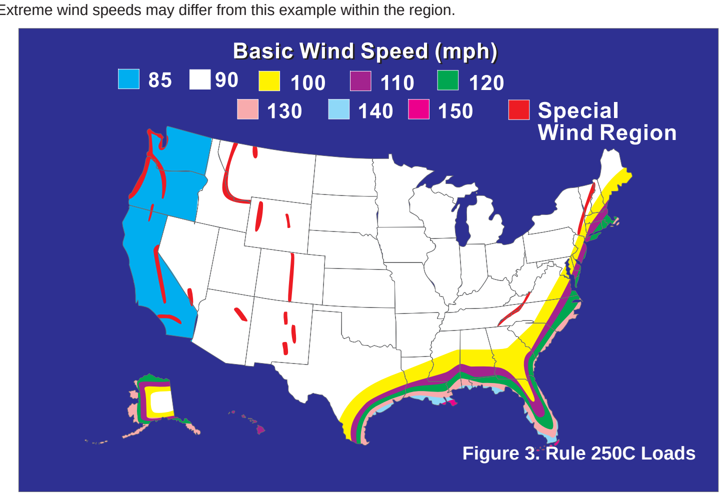

Figure 3. Rule 250C Loads

Table 2. Overload Capacity Factors Derived from 2007 NESC

Loading Case	Transverse Wind Load Factor	Strength Factor: Metal	Strength Factor: Wood	Overload Capacity Factor: Metal	Overload Capacity Factor: Wood
Rule 250B					
Grade B	2.50	1.00	0.65	2.50	3.85
Grade C					
At Crossings	2.20	1.00	0.85	2.20	2.59
Elsewhere	1.75	1.00	0.85	1.75	2.06
Rule 250C					
Grade B	1.00	1.00	0.75	1.00	1.33
Grade C 0-100 mph	0.87	1.00	0.75	0.87	1.16
Grade C >100 mph	0.75	1.00	0.75	0.75	1.00
Rule 250D	1.00	1.00	0.75	1.00	1.33

New Rule 250D

Table 3. Transverse Loading from Wind Loadings in Selected Regions

Wire/Cable Diameter Bare (in)	Rule 250B Ice & Wind: Wire/Cable Diameter With Ice (in)	Transverse Force per Lineal Foot (lb/ft)	Factored Design Transverse Wind Loads (lb/ft): Grade B Metal	Grade B Wood	Grade C At Crossings Metal	Grade C At Crossings Wood	Rule 250D Grade B Freezing Rain & Wind: Diameter With Ice (in)	Transverse Force per Lineal Foot (lb/ft)	Factored Design Transverse Wind Loads (lb/ft): Metal	Wood	Rule 250D Grade C Freezing Rain & Wind: Diameter With Ice (in)	Transverse Force per Lineal Foot (lb/ft)	Factored Design Transverse Wind Loads (lb/ft): Metal	Wood	Rule 250C Extreme Wind; 0-250 ft Spans; 0-33 ft Height: Transverse Force per Lineal Foot (lb/ft)	Factored Design Transverse Wind Loads (lb/ft): Grade B Metal	Grade B Wood	Grade C Metal	Grade C Wood
So. Central Alabama (lb/ft²):		9.0						2.3				2.3			34.3				
0.25	0.25	0.19	0.47	0.72	0.41	0.49	0.75	0.14	0.14	0.19	0.65	0.12	0.12	0.17	0.71	0.71	0.95	0.54	0.71
0.50	0.50	0.38	0.94	1.44	0.83	0.97	1.00	0.19	0.19	0.25	0.90	0.17	0.17	0.23	1.43	1.43	1.90	1.07	1.43
0.75	0.75	0.56	1.41	2.17	1.24	1.46	1.25	0.24	0.24	0.32	1.15	0.22	0.22	0.29	2.14	2.14	2.85	1.61	2.14
1.00	1.00	0.75	1.88	2.89	1.65	1.94	1.50	0.29	0.29	0.38	1.40	0.27	0.27	0.36	2.86	2.86	3.80	2.14	2.86
1.50	1.50	1.13	2.81	4.33	2.48	2.91	2.00	0.38	0.38	0.51	1.90	0.36	0.36	0.48	4.29	4.29	5.70	3.22	4.29
2.00	2.00	1.50	3.75	5.78	3.30	3.89	2.50	0.48	0.48	0.64	2.40	0.46	0.46	0.61	5.72	5.72	7.60	4.29	5.72
3.00	3.00	2.25	5.63	8.66	4.95	5.83	3.50	0.67	0.67	0.89	3.40	0.65	0.65	0.87	8.58	8.58	11.40	6.43	8.58
Central Illinois (lb/ft2):		4.0						4.0				4.0			19.3				
0.25	1.25	0.42	1.04	1.60	0.92	1.08	2.25	0.75	0.75	1.00	1.85	0.62	0.62	0.82	0.40	0.40	0.53	0.35	0.47
0.50	1.50	0.50	1.25	1.93	1.10	1.30	2.50	0.83	0.83	1.11	2.10	0.70	0.70	0.93	0.80	0.80	1.07	0.70	0.93
0.75	1.75	0.58	1.46	2.25	1.28	1.51	2.75	0.92	0.92	1.22	2.35	0.78	0.78	1.04	1.21	1.21	1.60	1.05	1.40
1.00	2.00	0.67	1.67	2.57	1.47	1.73	3.00	1.00	1.00	1.33	2.60	0.87	0.87	1.15	1.61	1.61	2.14	1.40	1.87
1.50	2.50	0.83	2.08	3.21	1.83	2.16	3.50	1.17	1.17	1.55	3.10	1.03	1.03	1.37	2.41	2.41	3.21	2.10	2.80
2.00	3.00	1.00	2.50	3.85	2.20	2.59	4.00	1.33	1.33	1.77	3.60	1.20	1.20	1.60	3.22	3.22	4.28	2.80	3.73
3.00	4.00	1.33	3.33	5.13	2.93	3.45	5.00	1.67	1.67	2.22	4.60	1.53	1.53	2.04	4.83	4.83	6.42	4.20	5.60
Central North Carolina (lb/ft2):		4.0						2.3				2.3			23.8				
0.25	0.75	0.25	0.63	0.96	0.55	0.65	1.75	0.34	0.34	0.45	1.45	0.28	0.28	0.37	0.50	0.50	0.66	0.43	0.58
0.50	1.00	0.33	0.83	1.28	0.73	0.86	2.00	0.38	0.38	0.51	1.70	0.33	0.33	0.43	0.99	0.99	1.32	0.86	1.15
0.75	1.25	0.42	1.04	1.60	0.92	1.08	2.25	0.43	0.43	0.57	1.95	0.37	0.37	0.50	1.49	1.49	1.98	1.29	1.73
1.00	1.50	0.50	1.25	1.93	1.10	1.30	2.50	0.48	0.48	0.64	2.20	0.42	0.42	0.56	1.98	1.98	2.64	1.73	2.30
1.50	2.00	0.67	1.67	2.57	1.47	1.73	3.00	0.58	0.58	0.76	2.70	0.52	0.52	0.69	2.98	2.98	3.96	2.59	3.45
2.00	2.50	0.83	2.08	3.21	1.83	2.16	3.50	0.67	0.67	0.89	3.20	0.61	0.61	0.82	3.97	3.97	5.28	3.45	4.60
3.00	3.50	1.17	2.92	4.49	2.57	3.02	4.50	0.86	0.86	1.15	4.20	0.81	0.81	1.07	5.95	5.95	7.91	5.18	6.90
Central North Dakota (lb/ft²):		4.0						9.2				9.2			19.3				
0.25	1.25	0.42	1.04	1.60	0.92	1.08	1.25	0.96	0.96	1.27	1.05	0.81	0.81	1.07	0.40	0.40	0.53	0.35	0.47
0.50	1.50	0.50	1.25	1.93	1.10	1.30	1.50	1.15	1.15	1.53	1.30	1.00	1.00	1.33	0.80	0.80	1.07	0.70	0.93
0.75	1.75	0.58	1.46	2.25	1.28	1.51	1.75	1.34	1.34	1.78	1.55	1.19	1.19	1.58	1.21	1.21	1.60	1.05	1.40
1.00	2.00	0.67	1.67	2.57	1.47	1.73	2.00	1.53	1.53	2.04	1.80	1.38	1.38	1.84	1.61	1.61	2.14	1.40	1.87
1.50	2.50	0.83	2.08	3.21	1.83	2.16	2.50	1.92	1.92	2.55	2.30	1.76	1.76	2.35	2.41	2.41	3.21	2.10	2.80
2.00	3.00	1.00	2.50	3.85	2.20	2.59	3.00	2.30	2.30	3.06	2.80	2.15	2.15	2.86	3.22	3.22	4.28	2.80	3.73
3.00	4.00	1.33	3.33	5.13	2.93	3.45	4.00	3.07	3.07	4.08	3.80	2.91	2.91	3.87	4.83	4.83	6.42	4.20	5.60
Northwest New York (lb/ft²):		4.0						4.0				4.0			19.3				
0.25	1.25	0.42	1.04	1.60	0.92	1.08	2.25	0.75	0.75	1.00	1.85	0.62	0.62	0.82	0.40	0.40	0.53	0.35	0.47
0.50	1.50	0.50	1.25	1.93	1.10	1.30	2.50	0.83	0.83	1.11	2.10	0.70	0.70	0.93	0.80	0.80	1.07	0.70	0.93
0.75	1.75	0.58	1.46	2.25	1.28	1.51	2.75	0.92	0.92	1.22	2.35	0.78	0.78	1.04	1.21	1.21	1.60	1.05	1.40
1.00	2.00	0.67	1.67	2.57	1.47	1.73	3.00	1.00	1.00	1.33	2.60	0.87	0.87	1.15	1.61	1.61	2.14	1.40	1.87
1.50	2.50	0.83	2.08	3.21	1.83	2.16	3.50	1.17	1.17	1.55	3.10	1.03	1.03	1.37	2.41	2.41	3.21	2.10	2.80
2.00	3.00	1.00	2.50	3.85	2.20	2.59	4.00	1.33	1.33	1.77	3.60	1.20	1.20	1.60	3.22	3.22	4.28	2.80	3.73
3.00	4.00	1.33	3.33	5.13	2.93	3.45	5.00	1.67	1.67	2.22	4.60	1.53	1.53	2.04	4.83	4.83	6.42	4.20	5.60
Central Pennsylvania lb/ft²):		4.0						4.0				4.0			19.3				
0.25	1.25	0.42	1.04	1.60	0.92	1.08	1.75	0.58	0.58	0.78	1.45	0.48	0.48	0.64	0.40	0.40	0.53	0.35	0.47
0.50	1.50	0.50	1.25	1.93	1.10	1.30	2.00	0.67	0.67	0.89	1.70	0.57	0.57	0.75	0.80	0.80	1.07	0.70	0.93
0.75	1.75	0.58	1.46	2.25	1.28	1.51	2.25	0.75	0.75	1.00	1.95	0.65	0.65	0.86	1.21	1.21	1.60	1.05	1.40
1.00	2.00	0.67	1.67	2.57	1.47	1.73	2.50	0.83	0.83	1.11	2.20	0.73	0.73	0.98	1.61	1.61	2.14	1.40	1.87
1.50	2.50	0.83	2.08	3.21	1.83	2.16	3.00	1.00	1.00	1.33	2.70	0.90	0.90	1.20	2.41	2.41	3.21	2.10	2.80
2.00	3.00	1.00	2.50	3.85	2.20	2.59	3.50	1.17	1.17	1.55	3.20	1.07	1.07	1.42	3.22	3.22	4.28	2.80	3.73
3.00	4.00	1.33	3.33	5.13	2.93	3.45	4.50	1.50	1.50	2.00	4.20	1.40	1.40	1.86	4.83	4.83	6.42	4.20	5.60
Southeast Texas (lb/ft²):		9.0						2.3				2.3			23.8				
0.25	0.25	0.19	0.47	0.72	0.41	0.49	1.25	0.24	0.24	0.32	1.05	0.20	0.20	0.27	0.50	0.50	0.66	0.43	0.58
0.50	0.50	0.38	0.94	1.44	0.83	0.97	1.50	0.29	0.29	0.38	1.30	0.25	0.25	0.33	0.99	0.99	1.32	0.86	1.15
0.75	0.75	0.56	1.41	2.17	1.24	1.46	1.75	0.34	0.34	0.45	1.55	0.30	0.30	0.40	1.49	1.49	1.98	1.29	1.73
1.00	1.00	0.75	1.88	2.89	1.65	1.94	2.00	0.38	0.38	0.51	1.80	0.35	0.35	0.46	1.98	1.98	2.64	1.73	2.30
1.50	1.50	1.13	2.81	4.33	2.48	2.91	2.50	0.48	0.48	0.64	2.30	0.44	0.44	0.59	2.98	2.98	3.96	2.59	3.45
2.00	2.00	1.50	3.75	5.78	3.30	3.89	3.00	0.58	0.58	0.76	2.80	0.54	0.54	0.71	3.97	3.97	5.28	3.45	4.60
3.00	3.00	2.25	5.63	8.66	4.95	5.83	4.00	0.77	0.77	1.02	3.80	0.73	0.73	0.97	5.95	5.95	7.91	5.18	6.90

Color Codes:

- Greatest combined ice/wind unfactored loading
- Greatest unfactored loading--extreme wind or ice/wind
- Greatest factored loading--Grade B extreme wind or ice/wind
- Greatest factored loading--Grade C extreme wind or ice/wind