Denver, Colorado – Tuesday, December 11, 2018

Pinpoint Seminar: Technical Update

presented by

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National Roofing Contractors Association

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Topics

- 2018 I-code overview
- ASCE 7-16 (wind design)
- Roof drain concerns
- An electrical code (NFPA 70) issue
- Steel roof deck concerns
- Moisture in concrete roof decks
- FM VSH (hail)
- Metal stud-framed parapet walls
- “Fully” adhered
- Attic ventilation
- Questions

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International Building Code, 2018 Edition

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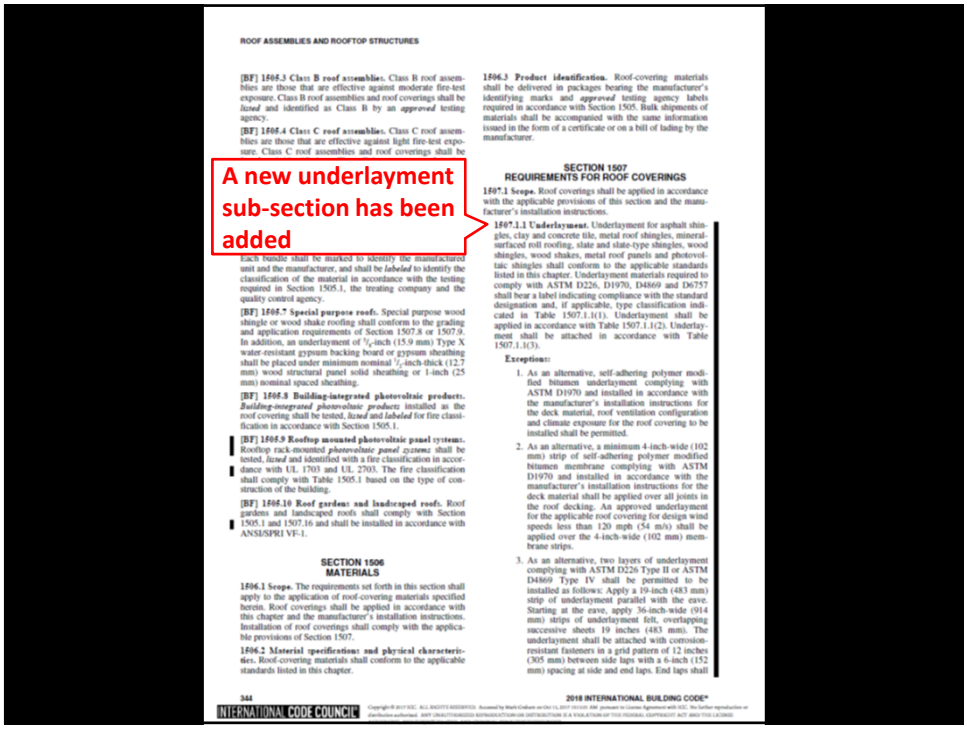

ROOF ASSEMBLIES AND ROOFTOP STRUCTURES

[BF] 1505.3 Class B roof assemblies. Class B roof assemblies are those that are effective against moderate fire-test exposure. Class B roof assemblies and roof coverings shall be *listed* and identified as Class B by an *approved* testing agency.

[BF] 1505.4 Class C roof assemblies. Class C roof assemblies are those that are effective against light fire-test exposure. Class C roof assemblies and roof coverings shall be

A new underlayment sub-section has been added

Each bundle shall be marked to identify the manufactured unit and the manufacturer, and shall be *labeled* to identify the classification of the material in accordance with the testing required in Section 1505.1, the treating company and the quality control agency.

[BF] 1505.7 Special purpose roofs. Special purpose wood shingle or wood shake roofing shall conform to the grading and application requirements of Section 1507.8 or 1507.9. In addition, an underlayment of $^{3}/_{8}$-inch (15.9 mm) Type X water-resistant gypsum backing board or gypsum sheathing shall be placed under minimum nominal $^{1}/_{2}$-inch-thick (12.7 mm) wood structural panel solid sheathing or 1-inch (25 mm) nominal spaced sheathing.

[BF] 1505.8 Building-integrated photovoltaic products. *Building-integrated photovoltaic products* installed as the roof covering shall be tested, *listed* and *labeled* for fire classification in accordance with Section 1505.1.

[BF] 1505.9 Rooftop mounted photovoltaic panel systems. Rooftop rack-mounted *photovoltaic panel systems* shall be tested, *listed* and identified with a fire classification in accordance with UL 1703 and UL 2703. The fire classification shall comply with Table 1505.1 based on the type of construction of the building.

[BF] 1505.10 Roof gardens and landscaped roofs. Roof gardens and landscaped roofs shall comply with Section 1505.1 and 1507.16 and shall be installed in accordance with ANSI/SPRI VF-1.

SECTION 1506
MATERIALS

1506.1 Scope. The requirements set forth in this section shall apply to the application of roof-covering materials specified herein. Roof coverings shall be applied in accordance with this chapter and the manufacturer's installation instructions. Installation of roof coverings shall comply with the applicable provisions of Section 1507.

1506.2 Material specifications and physical characteristics. Roof-covering materials shall conform to the applicable standards listed in this chapter.

1506.3 Product identification. Roof-covering materials shall be delivered in packages bearing the manufacturer's identifying marks and *approved* testing agency labels required in accordance with Section 1505. Bulk shipments of materials shall be accompanied with the same information issued in the form of a certificate or on a bill of lading by the manufacturer.

SECTION 1507
REQUIREMENTS FOR ROOF COVERINGS

1507.1 Scope. Roof coverings shall be applied in accordance with the applicable provisions of this section and the manufacturer's installation instructions.

1507.1.1 Underlayment. Underlayment for asphalt shingles, clay and concrete tile, metal roof shingles, mineral-surfaced roll roofing, slate and slate-type shingles, wood shingles, wood shakes, metal roof panels and photovoltaic shingles shall conform to the applicable standards listed in this chapter. Underlayment materials required to comply with ASTM D226, D1970, D4869 and D6757 shall bear a label indicating compliance with the standard designation and, if applicable, type classification indicated in Table 1507.1.1(1). Underlayment shall be applied in accordance with Table 1507.1.1(2). Underlayment shall be attached in accordance with Table 1507.1.1(3).

Exceptions:

1. As an alternative, self-adhering polymer modified bitumen underlayment complying with ASTM D1970 and installed in accordance with the manufacturer's installation instructions for the deck material, roof ventilation configuration and climate exposure for the roof covering to be installed shall be permitted.
2. As an alternative, a minimum 4-inch-wide (102 mm) strip of self-adhering polymer modified bitumen membrane complying with ASTM D1970 and installed in accordance with the manufacturer's installation instructions for the deck material shall be applied over all joints in the roof decking. An approved underlayment for the applicable roof covering for design wind speeds less than 120 mph (54 m/s) shall be applied over the 4-inch-wide (102 mm) membrane strips.
3. As an alternative, two layers of underlayment complying with ASTM D226 Type II or ASTM D4869 Type IV shall be permitted to be installed as follows: Apply a 19-inch (483 mm) strip of underlayment parallel with the eave. Starting at the eave, apply 36-inch-wide (914 mm) strips of underlayment felt, overlapping successive sheets 19 inches (483 mm). The underlayment shall be attached with corrosion-resistant fasteners in a grid pattern of 12 inches (305 mm) between side laps with a 6-inch (152 mm) spacing at side and end laps. End laps shall

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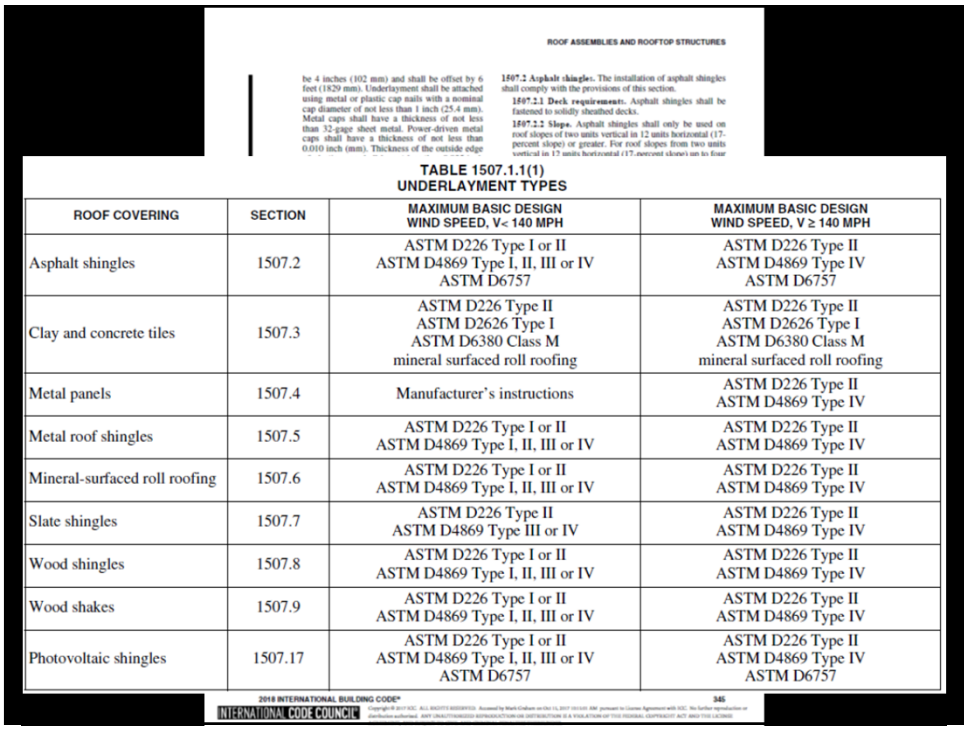

ROOF ASSEMBLIES AND ROOFTOP STRUCTURES

be 4 inches (102 mm) and shall be offset by 6 feet (1829 mm). Underlayment shall be attached using metal or plastic cap nails with a nominal cap diameter of not less than 1 inch (25.4 mm). Metal caps shall have a thickness of not less than 32-gage sheet metal. Power-driven metal caps shall have a thickness of not less than 0.010 inch (mm). Thickness of the outside edge

1507.2 Asphalt shingles. The installation of asphalt shingles shall comply with the provisions of this section.

1507.2.1 Deck requirements. Asphalt shingles shall be fastened to solidly sheathed decks.

1507.2.2 Slope. Asphalt shingles shall only be used on roof slopes of two units vertical in 12 units horizontal (17-percent slope) or greater. For roof slopes from two units vertical in 12 units horizontal (17-percent slope) up to four

TABLE 1507.1.1(1)
UNDERLAYMENT TYPES

ROOF COVERING	SECTION	MAXIMUM BASIC DESIGN WIND SPEED, V< 140 MPH	MAXIMUM BASIC DESIGN WIND SPEED, V ≥ 140 MPH
Asphalt shingles	1507.2	ASTM D226 Type I or II ASTM D4869 Type I, II, III or IV ASTM D6757	ASTM D226 Type II ASTM D4869 Type IV ASTM D6757
Clay and concrete tiles	1507.3	ASTM D226 Type II ASTM D2626 Type I ASTM D6380 Class M mineral surfaced roll roofing	ASTM D226 Type II ASTM D2626 Type I ASTM D6380 Class M mineral surfaced roll roofing
Metal panels	1507.4	Manufacturer's instructions	ASTM D226 Type II ASTM D4869 Type IV
Metal roof shingles	1507.5	ASTM D226 Type I or II ASTM D4869 Type I, II, III or IV	ASTM D226 Type II ASTM D4869 Type IV
Mineral-surfaced roll roofing	1507.6	ASTM D226 Type I or II ASTM D4869 Type I, II, III or IV	ASTM D226 Type II ASTM D4869 Type IV
Slate shingles	1507.7	ASTM D226 Type II ASTM D4869 Type III or IV	ASTM D226 Type II ASTM D4869 Type IV
Wood shingles	1507.8	ASTM D226 Type I or II ASTM D4869 Type I, II, III or IV	ASTM D226 Type II ASTM D4869 Type IV
Wood shakes	1507.9	ASTM D226 Type I or II ASTM D4869 Type I, II, III or IV	ASTM D226 Type II ASTM D4869 Type IV
Photovoltaic shingles	1507.17	ASTM D226 Type I or II ASTM D4869 Type I, II, III or IV ASTM D6757	ASTM D226 Type II ASTM D4869 Type IV ASTM D6757

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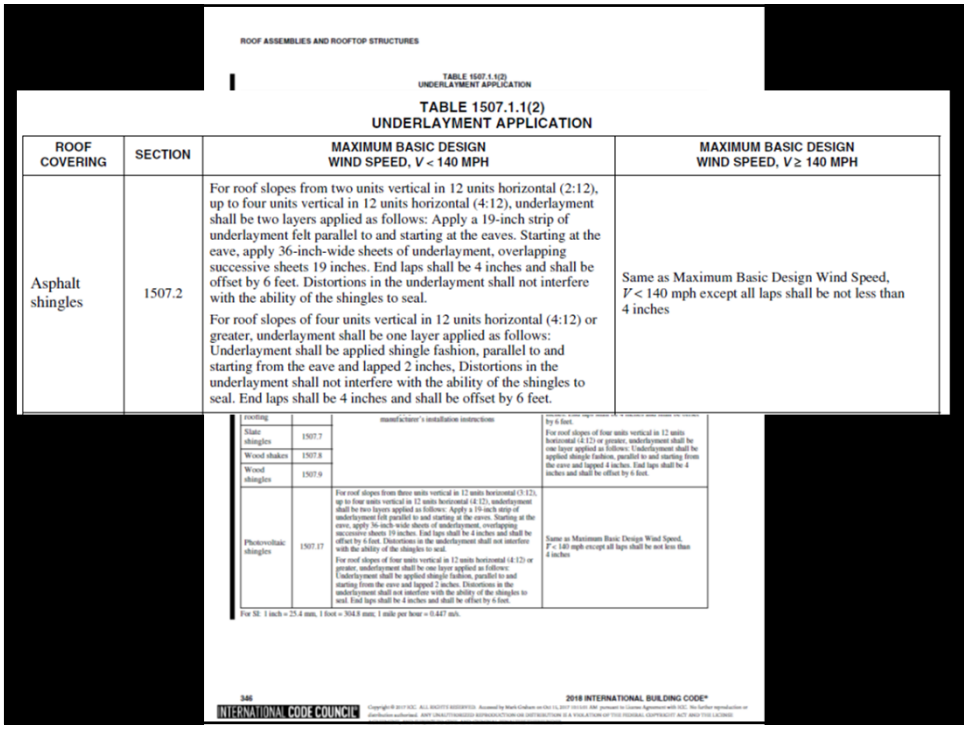

ROOF ASSEMBLIES AND ROOFTOP STRUCTURES

TABLE 1507.1.1(2)
UNDERLAYMENT APPLICATION

TABLE 1507.1.1(2)
UNDERLAYMENT APPLICATION

ROOF COVERING	SECTION	MAXIMUM BASIC DESIGN WIND SPEED, $V < 140$ MPH	MAXIMUM BASIC DESIGN WIND SPEED, $V \geq 140$ MPH
Asphalt shingles	1507.2	For roof slopes from two units vertical in 12 units horizontal (2:12), up to four units vertical in 12 units horizontal (4:12), underlayment shall be two layers applied as follows: Apply a 19-inch strip of underlayment felt parallel to and starting at the eaves. Starting at the eave, apply 36-inch-wide sheets of underlayment, overlapping successive sheets 19 inches. End laps shall be 4 inches and shall be offset by 6 feet. Distortions in the underlayment shall not interfere with the ability of the shingles to seal. For roof slopes of four units vertical in 12 units horizontal (4:12) or greater, underlayment shall be one layer applied as follows: Underlayment shall be applied shingle fashion, parallel to and starting from the eave and lapped 2 inches. Distortions in the underlayment shall not interfere with the ability of the shingles to seal. End laps shall be 4 inches and shall be offset by 6 feet.	Same as Maximum Basic Design Wind Speed, $V < 140$ mph except all laps shall be not less than 4 inches

roofing			
Slate shingles	1507.7	manufacturer's installation instructions	by 6 feet. For roof slopes of four units vertical in 12 units horizontal (4:12) or greater, underlayment shall be one layer applied as follows: Underlayment shall be applied shingle fashion, parallel to and starting from the eave and lapped 4 inches. End laps shall be 4 inches and shall be offset by 6 feet.
Wood shakes	1507.8		
Wood shingles	1507.9		
Photovoltaic shingles	1507.17	For roof slopes from three units vertical in 12 units horizontal (3:12), up to four units vertical in 12 units horizontal (4:12), underlayment shall be two layers applied as follows: Apply a 19-inch strip of underlayment felt parallel to and starting at the eaves. Starting at the eave, apply 36-inch-wide sheets of underlayment, overlapping successive sheets 19 inches. End laps shall be 4 inches and shall be offset by 6 feet. Distortions in the underlayment shall not interfere with the ability of the shingles to seal. For roof slopes of four units vertical in 12 units horizontal (4:12) or greater, underlayment shall be one layer applied as follows: Underlayment shall be applied shingle fashion, parallel to and starting from the eave and lapped 2 inches. Distortions in the underlayment shall not interfere with the ability of the shingles to seal. End laps shall be 4 inches and shall be offset by 6 feet.	Same as Maximum Basic Design Wind Speed, $V < 140$ mph except all laps shall be not less than 4 inches

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 mile per hour = 0.447 m/s.

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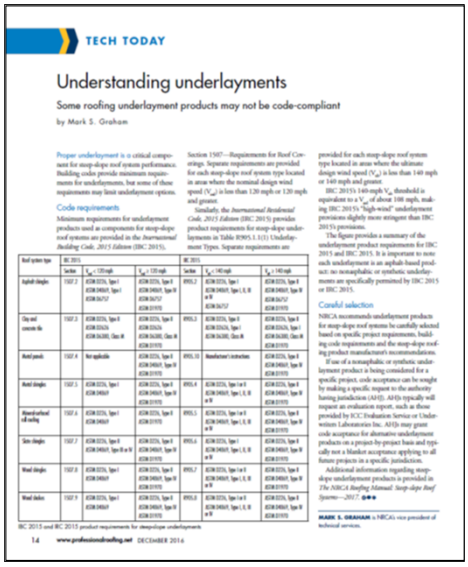

TECH TODAY

Understanding underlayments

Some roofing underlayment products may not be code-compliant

by Mark S. Graham

Proper underlayment is a critical component for steep-slope roof system performance. Building codes provide minimum requirements for underlayments, but some of these requirements may limit underlayment options.

Code requirements

Minimum requirements for underlayment products used as components for steep-slope roof systems are provided in the *International Building Code, 2015 Edition* (IBC 2015).

Section 1507—Requirements for Roof Coverings. Separate requirements are provided for each steep-slope roof system type located in areas where the nominal design wind speed (V_{nd}) is less than 120 mph or 120 mph and greater.

Similarly, the *International Residential Code, 2015 Edition* (IRC 2015) provides product requirements for steep-slope underlayments in Table R905.1.1(1) Underlayment Types. Separate requirements are provided for each steep-slope roof system type located in areas where the ultimate design wind speed (V_{ult}) is less than 140 mph or 140 mph and greater.

IRC 2015's 140-mph V_{ult} threshold is equivalent to a V_{nd} of about 108 mph, making IRC 2015's "high-wind" underlayment provisions slightly more stringent than IBC 2015's provisions.

The figure provides a summary of the underlayment product requirements for IBC 2015 and IRC 2015. It is important to note each underlayment is an asphalt-based product; no nonasphaltic or synthetic underlayments are specifically permitted by IBC 2015 or IRC 2015.

Careful selection

NRCA recommends underlayment products for steep-slope roof systems be carefully selected based on specific project requirements, building code requirements and the steep-slope roofing product manufacturer's recommendations.

If use of a nonasphaltic or synthetic underlayment product is being considered for a specific project, code acceptance can be sought by making a specific request to the authority having jurisdiction (AHJ). AHJs typically will request an evaluation report, such as those provided by ICC Evaluation Service or Underwriters Laboratories Inc. AHJs may grant code acceptance for alternative underlayment products on a project-by-project basis and typically not a blanket acceptance applying to all future projects in a specific jurisdiction.

Additional information regarding steep-slope underlayment products is provided in *The NRCA Roofing Manual: Steep-Slope Roof Systems—2017.*

MARK S. GRAHAM is NRCA's vice president of technical services.

IBC 2015 and IRC 2015 product requirements for steep-slope underlayments

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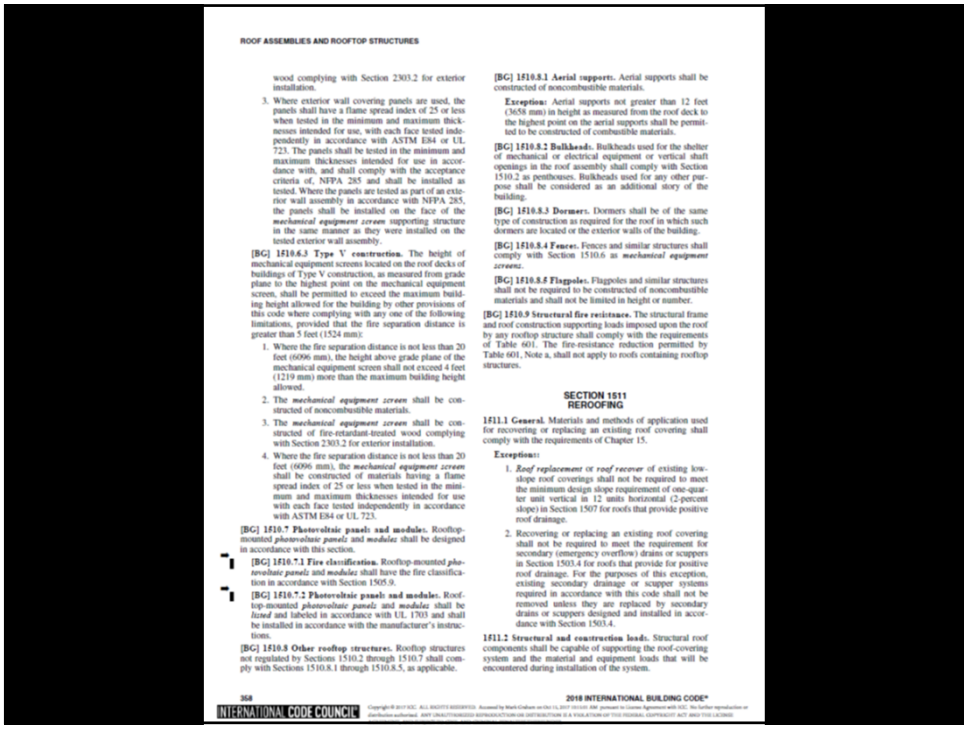

ROOF ASSEMBLIES AND ROOFTOP STRUCTURES

wood complying with Section 2303.2 for exterior installation.

3. Where exterior wall covering panels are used, the panels shall have a flame spread index of 25 or less when tested in the minimum and maximum thicknesses intended for use, with each face tested independently in accordance with ASTM E84 or UL 723. The panels shall be tested in the minimum and maximum thicknesses intended for use in accordance with, and shall comply with the acceptance criteria of, NFPA 285 and shall be installed as tested. Where the panels are tested as part of an exterior wall assembly in accordance with NFPA 285, the panels shall be installed on the face of the *mechanical equipment screen* supporting structure in the same manner as they were installed on the tested exterior wall assembly.

[BG] 1510.6.3 Type V construction. The height of mechanical equipment screens located on the roof decks of buildings of Type V construction, as measured from grade plane to the highest point on the mechanical equipment screen, shall be permitted to exceed the maximum building height allowed for the building by other provisions of this code where complying with any one of the following limitations, provided that the fire separation distance is greater than 5 feet (1524 mm):

1. Where the fire separation distance is not less than 20 feet (6096 mm), the height above grade plane of the mechanical equipment screen shall not exceed 4 feet (1219 mm) more than the maximum building height allowed.
2. The *mechanical equipment screen* shall be constructed of noncombustible materials.
3. The *mechanical equipment screen* shall be constructed of fire-retardant-treated wood complying with Section 2303.2 for exterior installation.
4. Where the fire separation distance is not less than 20 feet (6096 mm), the *mechanical equipment screen* shall be constructed of materials having a flame spread index of 25 or less when tested in the minimum and maximum thicknesses intended for use with each face tested independently in accordance with ASTM E84 or UL 723.

[BG] 1510.7 Photovoltaic panels and modules. Rooftop-mounted *photovoltaic panels* and *modules* shall be designed in accordance with this section.

[BG] 1510.7.1 Fire classification. Rooftop-mounted *photovoltaic panels* and *modules* shall have the fire classification in accordance with Section 1505.9.

[BG] 1510.7.2 Photovoltaic panels and modules. Rooftop-mounted *photovoltaic panels* and *modules* shall be *listed* and labeled in accordance with UL 1703 and shall be installed in accordance with the manufacturer's instructions.

[BG] 1510.8 Other rooftop structures. Rooftop structures not regulated by Sections 1510.2 through 1510.7 shall comply with Sections 1510.8.1 through 1510.8.5, as applicable.

[BG] 1510.8.1 Aerial supports. Aerial supports shall be constructed of noncombustible materials.

Exception: Aerial supports not greater than 12 feet (3658 mm) in height as measured from the roof deck to the highest point on the aerial supports shall be permitted to be constructed of combustible materials.

[BG] 1510.8.2 Bulkheads. Bulkheads used for the shelter of mechanical or electrical equipment or vertical shaft openings in the roof assembly shall comply with Section 1510.2 as penthouses. Bulkheads used for any other purpose shall be considered as an additional story of the building.

[BG] 1510.8.3 Dormers. Dormers shall be of the same type of construction as required for the roof in which such dormers are located or the exterior walls of the building.

[BG] 1510.8.4 Fences. Fences and similar structures shall comply with Section 1510.6 as *mechanical equipment screens*.

[BG] 1510.8.5 Flagpoles. Flagpoles and similar structures shall not be required to be constructed of noncombustible materials and shall not be limited in height or number.

[BG] 1510.9 Structural fire resistance. The structural frame and roof construction supporting loads imposed upon the roof by any rooftop structure shall comply with the requirements of Table 601. The fire-resistance reduction permitted by Table 601, Note a, shall not apply to roofs containing rooftop structures.

SECTION 1511
REROOFING

1511.1 General. Materials and methods of application used for recovering or replacing an existing roof covering shall comply with the requirements of Chapter 15.

Exceptions:

1. *Roof replacement* or *roof recover* of existing low-slope roof coverings shall not be required to meet the minimum design slope requirement of one-quarter unit vertical in 12 units horizontal (2-percent slope) in Section 1507 for roofs that provide positive roof drainage.
2. Recovering or replacing an existing roof covering shall not be required to meet the requirement for secondary (emergency overflow) drains or scuppers in Section 1503.4 for roofs that provide for positive roof drainage. For the purposes of this exception, existing secondary drainage or scupper systems required in accordance with this code shall not be removed unless they are replaced by secondary drains or scuppers designed and installed in accordance with Section 1503.4.

1511.2 Structural and construction loads. Structural roof components shall be capable of supporting the roof-covering system and the material and equipment loads that will be encountered during installation of the system.

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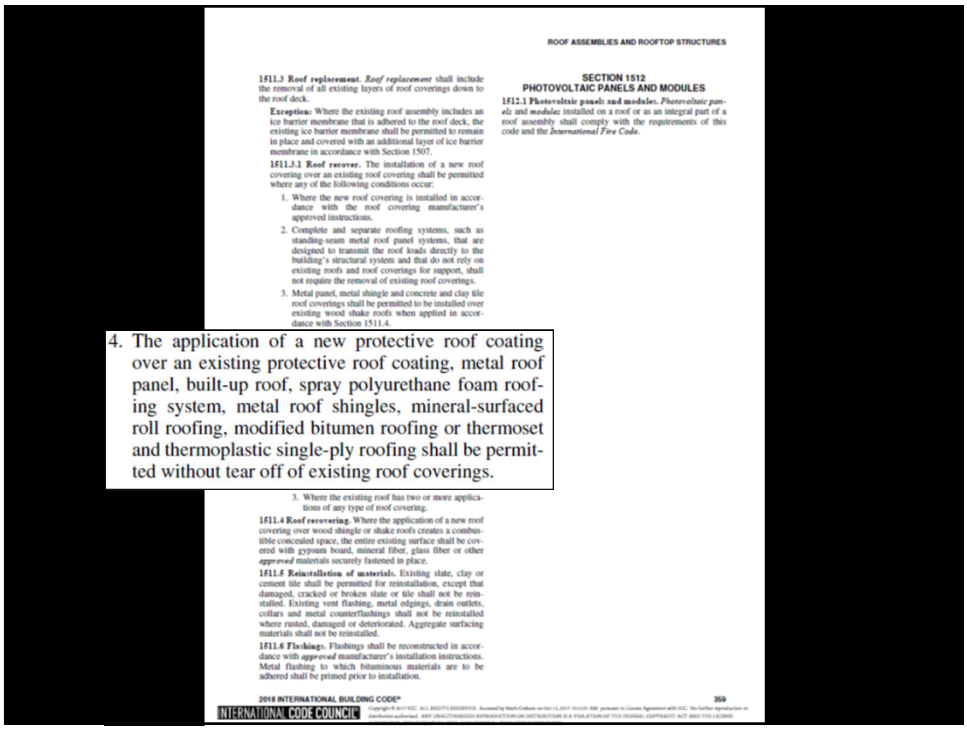

ROOF ASSEMBLIES AND ROOFTOP STRUCTURES

1511.3 Roof replacement. *Roof replacement* shall include the removal of all existing layers of roof coverings down to the roof deck.

Exception: Where the existing roof assembly includes an ice barrier membrane that is adhered to the roof deck, the existing ice barrier membrane shall be permitted to remain in place and covered with an additional layer of ice barrier membrane in accordance with Section 1507.

1511.3.1 Roof recover. The installation of a new roof covering over an existing roof covering shall be permitted where any of the following conditions occur:

1. Where the new roof covering is installed in accordance with the roof covering manufacturer's approved instructions.
2. Complete and separate roofing systems, such as standing-seam metal roof panel systems, that are designed to transmit the roof loads directly to the building's structural system and that do not rely on existing roofs and roof coverings for support, shall not require the removal of existing roof coverings.
3. Metal panel, metal shingle and concrete and clay tile roof coverings shall be permitted to be installed over existing wood shake roofs when applied in accordance with Section 1511.4.

4. The application of a new protective roof coating over an existing protective roof coating, metal roof panel, built-up roof, spray polyurethane foam roofing system, metal roof shingles, mineral-surfaced roll roofing, modified bitumen roofing or thermoset and thermoplastic single-ply roofing shall be permitted without tear off of existing roof coverings.

3. Where the existing roof has two or more applications of any type of roof covering.

1511.4 Roof recovering. Where the application of a new roof covering over wood shingle or shake roofs creates a combustible concealed space, the entire existing surface shall be covered with gypsum board, mineral fiber, glass fiber or other *approved* materials securely fastened in place.

1511.5 Reinstallation of materials. Existing slate, clay or cement tile shall be permitted for reinstallation, except that damaged, cracked or broken slate or tile shall not be reinstalled. Existing vent flashing, metal edgings, drain outlets, collars and metal counterflashings shall not be reinstalled where rusted, damaged or deteriorated. Aggregate surfacing materials shall not be reinstalled.

1511.6 Flashings. Flashings shall be reconstructed in accordance with *approved* manufacturer's installation instructions. Metal flashing to which bituminous materials are to be adhered shall be primed prior to installation.

SECTION 1512
PHOTOVOLTAIC PANELS AND MODULES

1512.1 Photovoltaic panels and modules. *Photovoltaic panels* and *modules* installed on a roof or as an integral part of a roof assembly shall comply with the requirements of this code and the *International Fire Code*.

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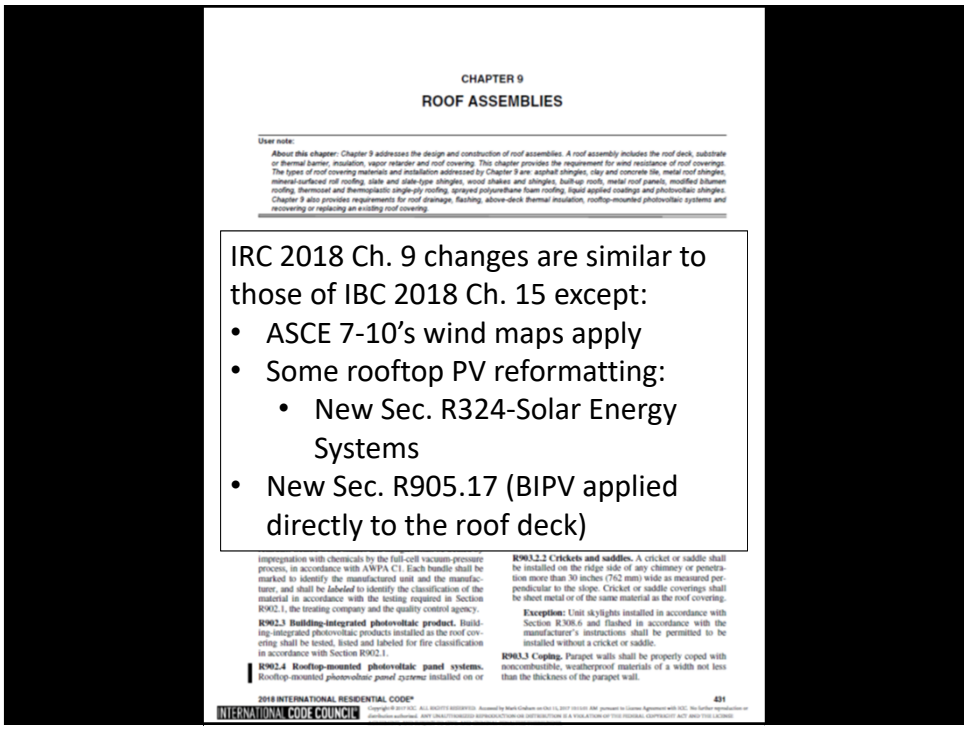

CHAPTER 9

ROOF ASSEMBLIES

User note:

About this chapter: Chapter 9 addresses the design and construction of roof assemblies. A roof assembly includes the roof deck, substrate or thermal barrier, insulation, vapor retarder and roof covering. This chapter provides the requirement for wind resistance of roof coverings. The types of roof covering materials and installation addressed by Chapter 9 are: asphalt shingles, clay and concrete tile, metal roof shingles, mineral-surfaced roll roofing, slate and slate-type shingles, wood shakes and shingles, built-up roofs, metal roof panels, modified bitumen roofing, thermoset and thermoplastic single-ply roofing, sprayed polyurethane foam roofing, liquid applied coatings and photovoltaic shingles. Chapter 9 also provides requirements for roof drainage, flashing, above-deck thermal insulation, rooftop-mounted photovoltaic systems and recovering or replacing an existing roof covering.

IRC 2018 Ch. 9 changes are similar to those of IBC 2018 Ch. 15 except:

- ASCE 7-10's wind maps apply
- Some rooftop PV reformatting:
  - New Sec. R324-Solar Energy Systems
- New Sec. R905.17 (BIPV applied directly to the roof deck)

impregnation with chemicals by the full-cell vacuum-pressure process, in accordance with AWPA C1. Each bundle shall be marked to identify the manufactured unit and the manufacturer, and shall be *labeled* to identify the classification of the material in accordance with the testing required in Section R902.1, the treating company and the quality control agency.

R902.3 Building-integrated photovoltaic product. Building-integrated photovoltaic products installed as the roof covering shall be tested, listed and labeled for fire classification in accordance with Section R902.1.

R902.4 Rooftop-mounted photovoltaic panel systems. Rooftop-mounted *photovoltaic panel systems* installed on or

R903.2.2 Crickets and saddles. A cricket or saddle shall be installed on the ridge side of any chimney or penetration more than 30 inches (762 mm) wide as measured perpendicular to the slope. Cricket or saddle coverings shall be sheet metal or of the same material as the roof covering.

Exception: Unit skylights installed in accordance with Section R308.6 and flashed in accordance with the manufacturer's instructions shall be permitted to be installed without a cricket or saddle.

R903.3 Coping. Parapet walls shall be properly coped with noncombustible, weatherproof materials of a width not less than the thickness of the parapet wall.

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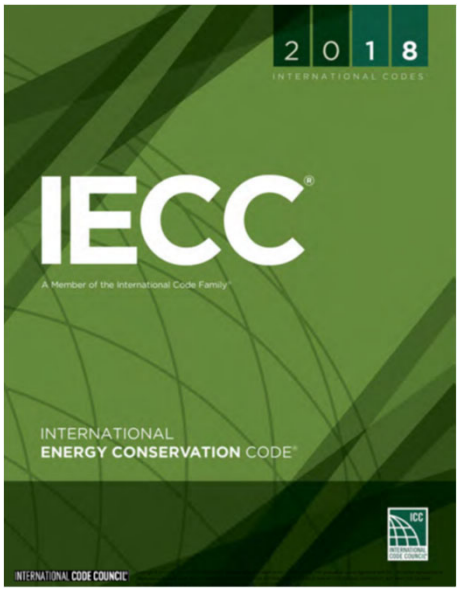

International Energy Conservation Code, 2018 Edition

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IECC 2018's roofing-related requirements

- No substantive changes from IECC 2015
  - R-value
  - Roof reflectivity and emissivity
  - Air barriers
- ASHRAE 90.1-16 alternative
  - ASHRAE 90.1-12 referenced in IECC 2015

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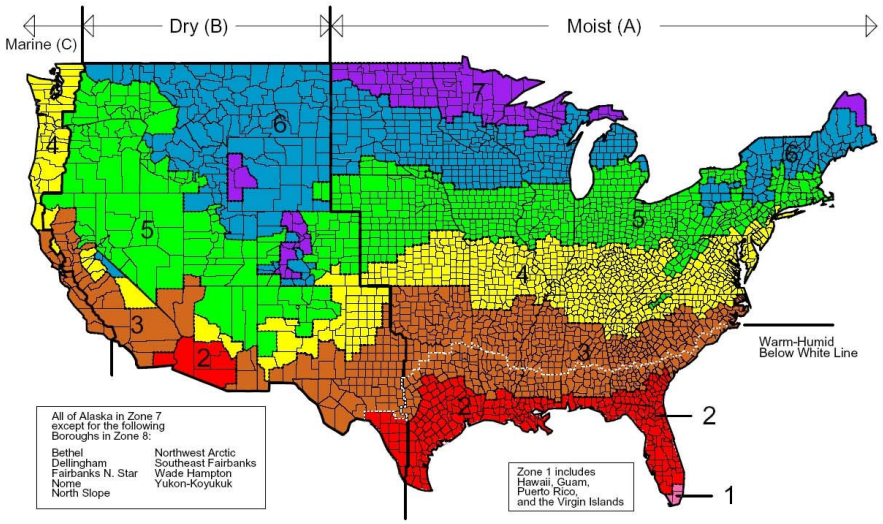
IECC 2018, Fig. C301.1-Climate zones

Fig. R301.1 (residential climate zones) is similar



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Minimum R-value

IECC 2018: Commercial Buildings (Insulation component R-value-based method)

Climate zone	Assembly description		
	Insulation entirely above deck	**Metal buildings**	**Attic and other**
1	R-20ci (all other) R-25ci (Group R)	R-19 + R-11 LS	R-38
2	R-25ci		
3			
4	R-30ci		R-38 (except Marine 4)
5			R-38 (all other) R-49 (Group R, Marine 4)
6		R-25 + R-11 LS	R-49
7	R-35ci	R-30 + R-11 LS	
8			

ci = Continuous insulation; LS = Liner system

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Comparison of IECC's various editions

Commercial Buildings (Insulation component R-value-based method)

Climate Zone	IECC 2003	IECC 2006	IECC 2009	IECC 2012*	IECC 2015*	IECC 2018*
1	R-12 ci	R-15 ci	R-15 ci	R-20 ci	R-20 ci	R-20 ci
2	R-14 ci		R-20ci		R-25 ci	R-25 ci
3	R-10 ci					
4	R-12 ci			R-25 ci	R-30 ci	R-30 ci
5	R-15 ci	R-20 ci				
6	R-11 ci					
7	R-15 ci	R-25 ci	R-25 ci	R-30 ci	R-35 ci	R-35 ci
8						

* Applies to roof replacement projects
ci = continuous insulation

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International Existing Building Code, 2018 Edition

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TECH TODAY

New roofing rules

IEBC 2015 presents challenges when reroofing

by Mark S. Graham

Where adopted, IEBC 2015's structural reroofing requirements may be more stringent

Professional Roofing, September 2016

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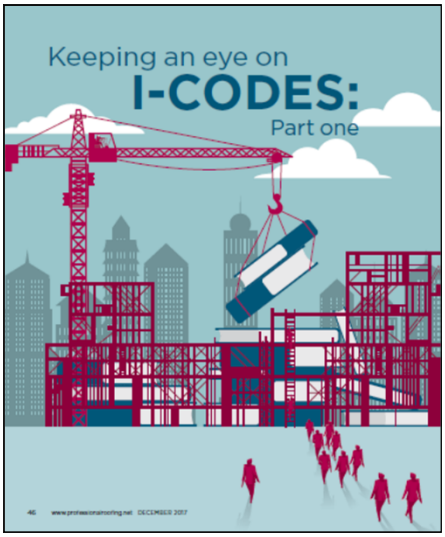

Keeping an eye on I-CODES: Part one

Professional Roofing, December 2017
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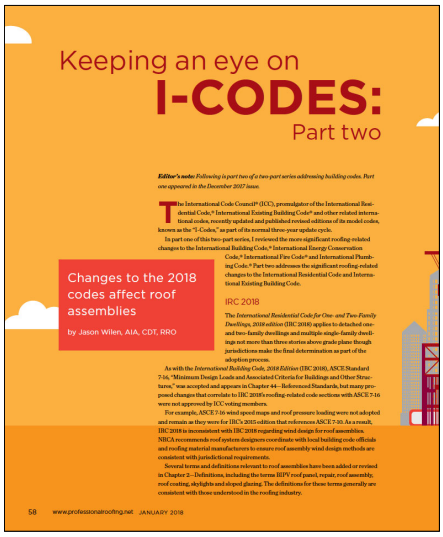

Keeping an eye on I-CODES: Part two

Changes to the 2018 codes affect roof assemblies

by Jason Wilen, AIA, CDT, RRO

Professional Roofing, January 2018
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ASCE 7-16

Design wind uplift

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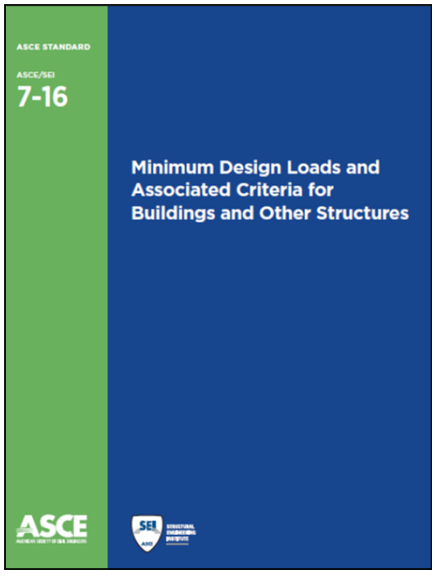

American Society of Civil Engineers Standard 7, "Minimum Design Loads and Associated Criteria for Buildings and Other Structures" (ASCE 7-16)

22

Noteworthy changes in ASCE 7-16

Compared to ASCE 7-10

- Revised basic wind speed map
- Changes (and new) pressure coefficients
- Revised perimeter and corner zones

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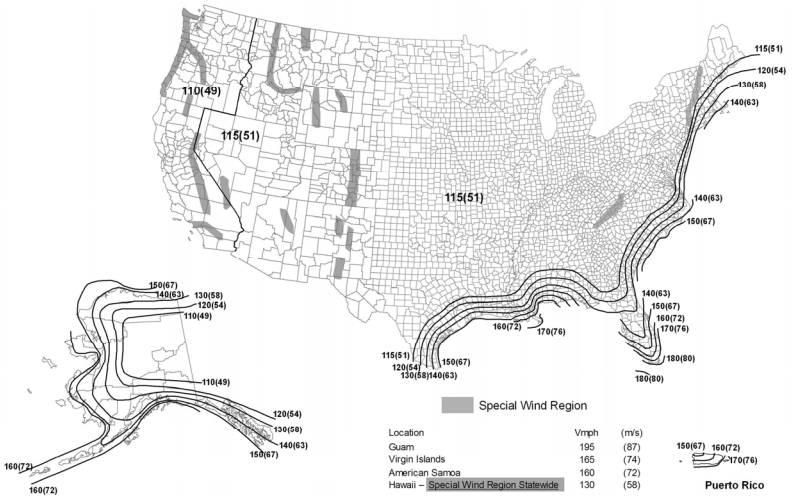
ASCE 7-10 basic wind speed map

Fig. 1607A--V_{ult} for Risk Category II Buildings



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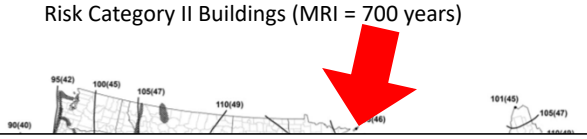
ASCE 7-16 basic wind speed map

Risk Category II Buildings (MRI = 700 years)



MRI		
Risk Category	**ASCE 7-10**	**ASCE 7-16**
I (Low)	300 yrs.	300 yrs.
II (not I, II or IV)	700 yrs.	700 yrs.
Category III (High risk)	1,700 yrs.	1,700 yrs.
Category IV (Essential)	1,700 yrs.	3,000 yrs.

Selection of the correct Risk Category/map (i.e., wind speed) is essential

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Comparing GC_p pressure coefficients

h ≤ 60 ft., gable roofs ≤ 7 degrees

Zone	ASCE 7-10	ASCE 7-16	Change
1’	n/a	0.9	-10%
1 (field)	-1.0	-1.7	+70%
2 (perimeter)	-1.8	-2.3	+28%
3 (corners)	-2.8	-3.2	+14%

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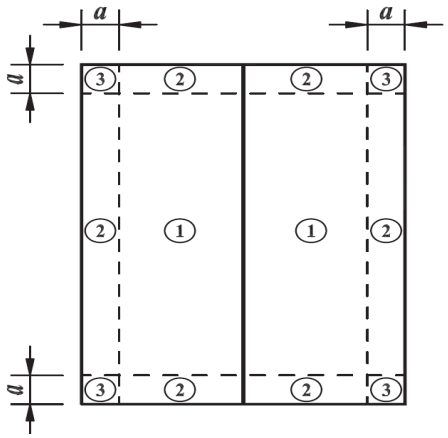
Zones

h ≤ 60 ft., gable roofs ≤ 7 degrees



ASCE 7-10

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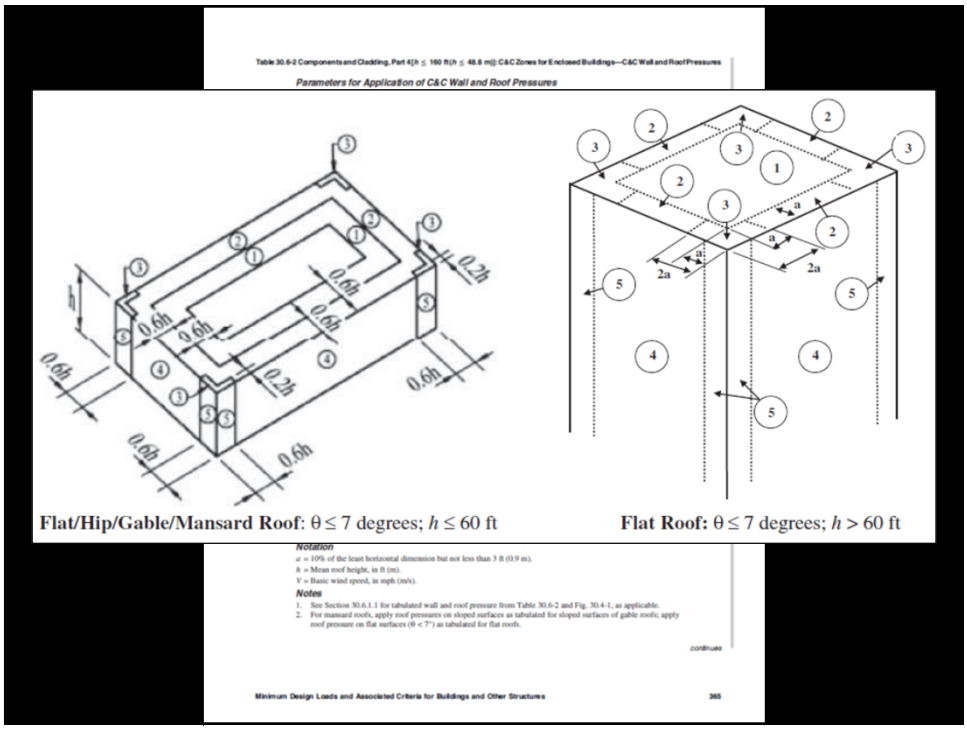

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Noteworthy changes in ASCE 7-16

Compared to ASCE 7-10

- Revised basic wind speed map
- Changes (and new) pressure coefficients
- Revised perimeter and corner zones

While center field pressures may be slightly lower, field, perimeter and corner uplift pressures will generally be greater

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How the roofing industry will adapt to ASCE 7-16 remains to be seen….

FM Global has indicated they will update their FM 1-28 to be based on ASCE 7-16 (with modifications) in mid-2019.

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Comparing ASCE 7-05, ASCE 7-10 and ASCE 7-16

Example: A office building (Risk Category II) is located in Omaha, Nebraska. The building is an enclosed structure with a mean roof height of 40 ft. The building is located in an open terrain area that can be categorized as Exposure Category C. An adhered, membrane roof systems is to be installed.

Document	Basic wind speed (mph)	Design wind pressure (psf)			
		Zone 1' (Center)	Zone 1 (Field)	Zone 2 (Perimeter)	Zone 3 (Corners)
ASCE 7-05	90	FM 1-60			
ASCE 7-10 Ult.	115	FM 1-75			
ASCE 7-10 ASD	89	FM 1-60			
ASCE 7-16 Ult.	110	FM 1-105			
ASCE 7-16 ASD	85	FM 1-75			

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This comparison illustrates why it is important for Designers to include wind design loads in their Construction Documents (per IBC Sec. 1603.1)…

…It also illustrates why specifying a wind warrantee can create an uneven playing field. Unless the Designer indicates the wind design loads, which design method will the manufacturer use (e.g., in a competitive environment)?

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TECH TODAY

Specifying wind design

Many roof system designers inadequately address wind loads in contract documents

by Mark S. Graham

NRCA is receiving an increasing number of reports indicating project drawings and specifications incompletely, inadequately or inaccurately address proper wind design for low-slope membrane roof systems. Some designs, according to reports, only include a specification requirement for the roof system manufacturer to provide a wind warranty.

But there are minimum requirements for proper wind design of low-slope membrane roof systems.

Code requirements

Building codes typically provide specific requirements for reporting design loads, including wind loads, in contract documents.

Specifying wind speed warranties is not a substitute for code-required wind design data

The *International Building Code,® 2012 Edition* (IBC 2012), Chapter 16-Structural Design, Section 1603-Contract Documents, indicates contract documents need to include a roof system's live load, snow load data, wind design data and any special loads.

Required wind design data includes identifying the ultimate design wind speed, nominal design wind speed, risk category, wind exposure and applicable internal pressure coefficient. For component and cladding systems that are not specifically designed by a registered design professional, design wind pressures in terms of psf (pounds per square foot) also are required. Roof systems typically are considered component and cladding systems. Design wind pressures in the field, perimeter and corner regions of roof areas should be noted in contract documents.

IBC's previous editions include similar contract document requirements.

For new construction projects, design loads most commonly will be identified on structural drawings in the project drawing set. For projects without specific structural drawings, design loads may be provided on architectural drawings or drawing notes or in project specifications.

ANSI/SPRI ES-1

ANSI/SPRI ES-1, "Wind Design Standard for Edge Systems Used with Low Slope Roofing Systems," which is referenced in IBC 2012, includes two primary elements: determination of design wind loads at roof edges (fascia, copings) and testing for resistance loads of copings and fascia.

Designers should not simply specify compliance with ANSI/SPRI ES-1 in project specifications; they should determine and clearly include design wind loads at roof edges in contract documents.

IBC 2012 indicates in Section 1504.5 Edge Securement for Low-slope Roofs design wind loads should be determined using the ultimate design wind speed and IBC 2012's Chapter 16, which is based on ASCE 7-10, "Minimum Design Loads for Buildings and Other Structures."

IBC 2012 references ANSI/SPRI ES-1-03. ANSI/SPRI ES-1-03 is based upon ASCE 7-02, which is not an ultimate design wind speed-based method. Therefore, the design wind load determination method contained in ANSI/SPRI ES-1 does not satisfy IBC 2012's requirements for design wind loads at roof edges.

Design wind loads at roof edges should be determined using IBC 2012's Chapter 16 and be clearly noted in contract documents.

Responsibilities

Designers should not place the responsibility for determining roof system or individual component design wind loads on manufacturers, component suppliers or installers, or roofing contractors.

Also, designers' sole reliance on specifying wind speed warranties is not a substitute for code-required wind design data. Such warranties typically do not address consideration of ultimate and nominal design wind speeds, building height, risk category, wind exposure and internal pressure coefficients applicable to the specific building necessary for properly determining roof systems' design wind loads.

Responsibility for properly determining and clearly identifying wind design data, including design wind loads for roof systems, is required by the building code and is clearly that of roof system designers. Designers may retain a structural engineer or qualified consultant to help them fulfill their design responsibilities.

To help designers determine wind loads for commonly encountered low-slope roof systems, NRCA, the Midwest Roofing Contractors Association and North/East Roofing Contractors Association have developed and offer a free online application, Roof Wind Designer.

Roof Wind Designer is a web application that allows users to determine design wind loads using ASCE 7, "Minimum Design Loads for Buildings and Other Structures," 2005 or 2010 editions.

Roof Wind Designer is accessible at www.roofwinddesigner.com.

MARK S. GRAHAM is NRCA's associate executive director of technical services.

16 www.professionalroofing.net MARCH 2014

Professional Roofing
March 2014

Link

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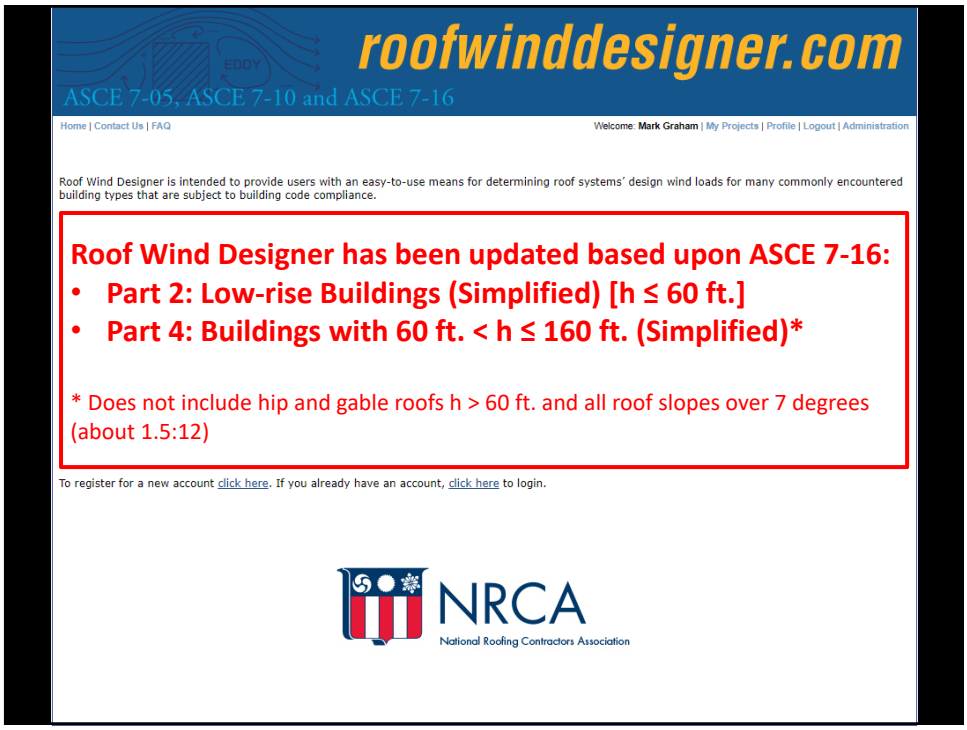

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Roof drain concerns

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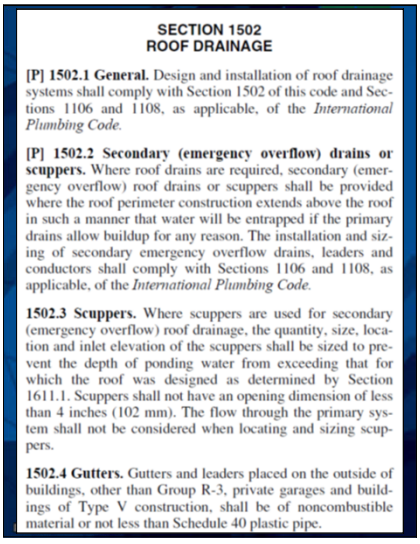
Roof drainage



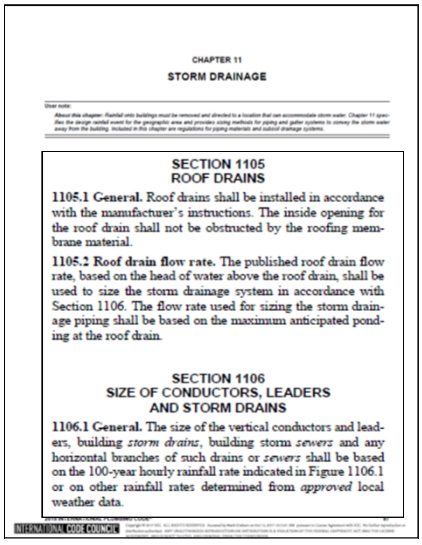
SECTION 1502
ROOF DRAINAGE

[P] 1502.1 General. Design and installation of roof drainage systems shall comply with Section 1502 of this code and Sections 1106 and 1108, as applicable, of the *International Plumbing Code*.

[P] 1502.2 Secondary (emergency overflow) drains or scuppers. Where roof drains are required, secondary (emergency overflow) roof drains or scuppers shall be provided where the roof perimeter construction extends above the roof in such a manner that water will be entrapped if the primary drains allow buildup for any reason. The installation and sizing of secondary emergency overflow drains, leaders and conductors shall comply with Sections 1106 and 1108, as applicable, of the *International Plumbing Code*.

1502.3 Scuppers. Where scuppers are used for secondary (emergency overflow) roof drainage, the quantity, size, location and inlet elevation of the scuppers shall be sized to prevent the depth of ponding water from exceeding that for which the roof was designed as determined by Section 1611.1. Scuppers shall not have an opening dimension of less than 4 inches (102 mm). The flow through the primary system shall not be considered when locating and sizing scuppers.

1502.4 Gutters. Gutters and leaders placed on the outside of buildings, other than Group R-3, private garages and buildings of Type V construction, shall be of noncombustible material or not less than Schedule 40 plastic pipe.



CHAPTER 11
STORM DRAINAGE

SECTION 1105
ROOF DRAINS

1105.1 General. Roof drains shall be installed in accordance with the manufacturer's instructions. The inside opening for the roof drain shall not be obstructed by the roofing membrane material.

1105.2 Roof drain flow rate. The published roof drain flow rate, based on the head of water above the roof drain, shall be used to size the storm drainage system in accordance with Section 1106. The flow rate used for sizing the storm drainage piping shall be based on the maximum anticipated ponding at the roof drain.

SECTION 1106
SIZE OF CONDUCTORS, LEADERS
AND STORM DRAINS

1106.1 General. The size of the vertical conductors and leaders, building *storm drains*, building storm *sewers* and any horizontal branches of such drains or *sewers* shall be based on the 100-year hourly rainfall rate indicated in Figure 1106.1 or on other rainfall rates determined from *approved* local weather data.

INTERNATIONAL CODE COUNCIL

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Primary roof drain

Retrofit roof drain insert

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NRCA recommendations

Roof drainage concerns

- Be cautious of roof drain issues, particularly in reroofing situations
  - IBC 2009 adds secondary drainage
  - IBC 2015 provides exception
  - IPC 2015 and IPC 2018 changes
- Assure membrane opening is larger than drain outlet/piping opening
- Be cautious of retrofit drain inserts
- Consider proposal/contract language

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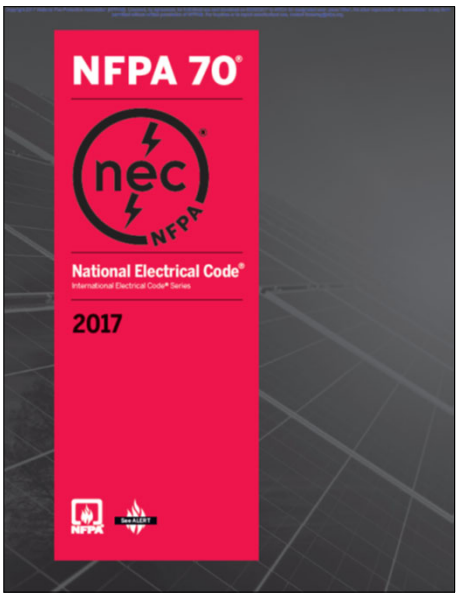

NFPA 70-2017
National Electrical Code

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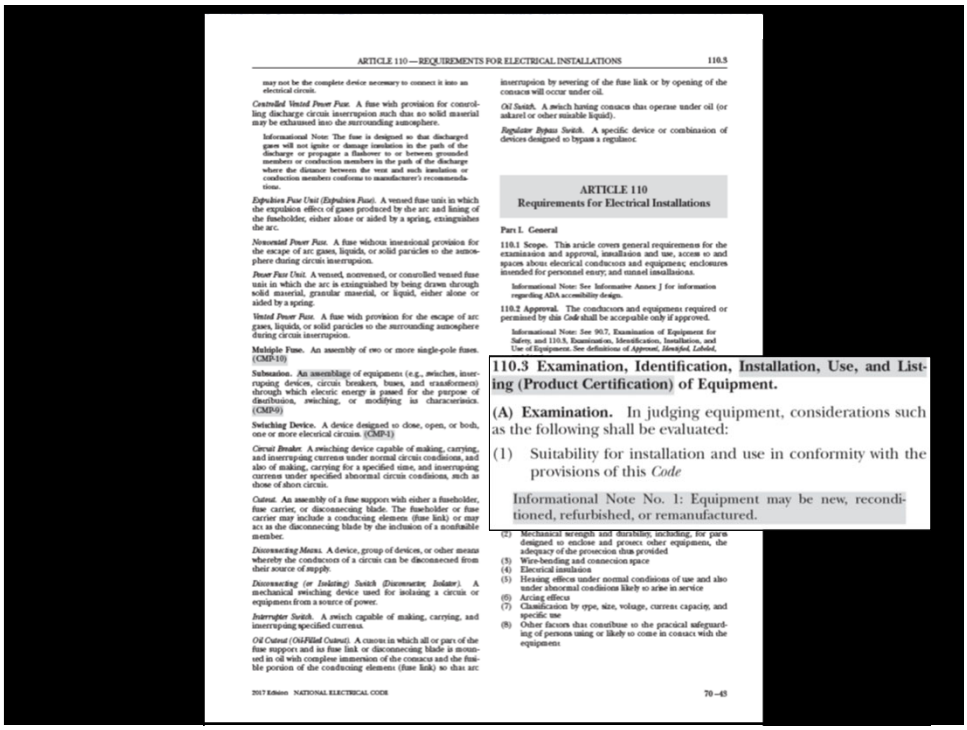

ARTICLE 110 — REQUIREMENTS FOR ELECTRICAL INSTALLATIONS 110.3

may not be the complete device necessary to connect it into an electrical circuit.

Controlled Vented Power Fuse. A fuse with provision for controlling discharge circuit interruption such that no solid material may be exhausted into the surrounding atmosphere.

Informational Note: The fuse is designed so that discharged gases will not ignite or damage insulation in the path of the discharge or propagate a flashover to or between grounded members or conductor members in the path of the discharge where the distance between the vent and such insulation or conductor members conforms to manufacturer's recommendations.

Expulsion Fuse Unit (Expulsion Fuse). A vented fuse unit in which the expulsion effects of gases produced by the arc and lining of the fuseholder, either alone or aided by a spring, extinguishes the arc.

Nonvented Power Fuse. A fuse without intentional provision for the escape of arc gases, liquids, or solid particles to the surrounding atmosphere during circuit interruption.

Power Fuse Unit. A vented, nonvented, or controlled vented fuse unit in which the arc is extinguished by being drawn through solid material, granular material, or liquid, either alone or aided by a spring.

Vented Power Fuse. A fuse with provision for the escape of arc gases, liquids, or solid particles to the surrounding atmosphere during circuit interruption.

Multiple Fuse. An assembly of two or more single-pole fuses. (CMP-10)

Substation. An assemblage of equipments (e.g., switches, interrupting devices, circuit breakers, buses, and transformers) through which electric energy is passed for the purpose of distribution, switching, or modifying its characteristics. (CMP-9)

Switching Device. A device designed to close, open, or both, one or more electrical circuits. (CMP-1)

Circuit Breaker. A switching device capable of making, carrying, and interrupting currents under normal circuit conditions, and also of making, carrying for a specified time, and interrupting currents under specified abnormal circuit conditions, such as those of short circuits.

Cutout. An assembly of a fuse support with either a fuseholder, fuse carrier, or disconnecting blade. The fuseholder or fuse carrier may include a conducting elements (fuse link) or may act as the disconnecting blade by the inclusion of a nonfusible member.

Disconnecting Means. A device, group of devices, or other means whereby the conductors of a circuit can be disconnected from their source of supply.

Disconnecting (or Isolating) Switch (Disconnector, Isolator). A mechanical switching device used for isolating a circuit or equipment from a source of power.

Interrupter Switch. A switch capable of making, carrying, and interrupting specified currents.

Oil Cutout (Oil-Filled Cutout). A cutout in which all or part of the fuse support and its fuse link or disconnecting blade is mounted in oil with complete immersion of the contacts and the fusible portion of the conducting elements (fuse link) so that arc interruption by severing of the fuse link or by opening of the contacts will occur under oil.

Oil Switch. A switch having contacts that operate under oil (or askarel or other suitable liquid).

Regulator Bypass Switch. A specific device or combination of devices designed to bypass a regulator.

ARTICLE 110
Requirements for Electrical Installations

Part I. General

110.1 Scope. This article covers general requirements for the examination and approval, installation and use, access to and spaces about electrical conductors and equipment; enclosures intended for personnel entry; and tunnel installations.

Informational Note: See Informative Annex J for information regarding ADA accessibility design.

110.2 Approval. The conductors and equipment required or permitted by this *Code* shall be acceptable only if approved.

Informational Note: See 90.7, Examination of Equipment for Safety, and 110.3, Examination, Identification, Installation, and Use of Equipment. See definitions of *Approved, Identified, Labeled,*

110.3 Examination, Identification, Installation, Use, and Listing (Product Certification) of Equipment.

(A) Examination. In judging equipment, considerations such as the following shall be evaluated:

(1) Suitability for installation and use in conformity with the provisions of this *Code*

Informational Note No. 1: Equipment may be new, reconditioned, refurbished, or remanufactured.

(2) Mechanical strength and durability, including, for parts designed to enclose and protect other equipment, the adequacy of the protection thus provided
(3) Wire-bending and connection space
(4) Electrical insulation
(5) Heating effects under normal conditions of use and also under abnormal conditions likely to arise in service
(6) Arcing effects
(7) Classification by type, size, voltage, current capacity, and specific use
(8) Other factors that constitute or affect the practical safeguarding of persons using or likely to come in contact with the equipment

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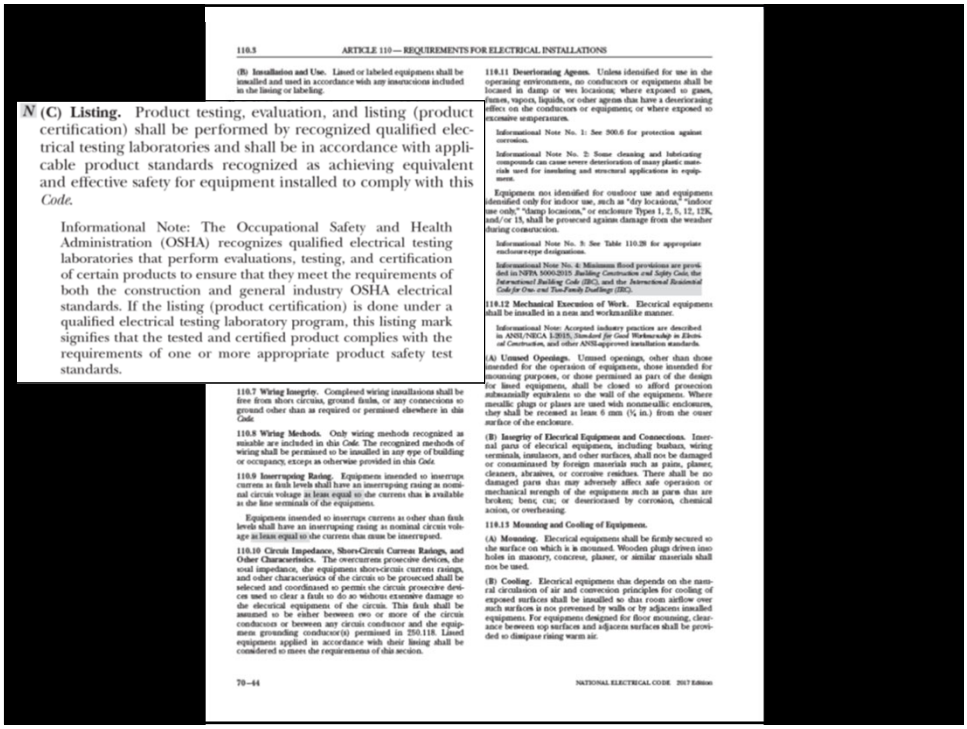

110.5 ARTICLE 110 — REQUIREMENTS FOR ELECTRICAL INSTALLATIONS

(B) Installation and Use. Listed or labeled equipment shall be installed and used in accordance with any instructions included in the listing or labeling.

N (C) Listing. Product testing, evaluation, and listing (product certification) shall be performed by recognized qualified electrical testing laboratories and shall be in accordance with applicable product standards recognized as achieving equivalent and effective safety for equipment installed to comply with this *Code*.

Informational Note: The Occupational Safety and Health Administration (OSHA) recognizes qualified electrical testing laboratories that perform evaluations, testing, and certification of certain products to ensure that they meet the requirements of both the construction and general industry OSHA electrical standards. If the listing (product certification) is done under a qualified electrical testing laboratory program, this listing mark signifies that the tested and certified product complies with the requirements of one or more appropriate product safety test standards.

110.7 Wiring Integrity. Completed wiring installations shall be free from shorts, grounds, ground faults, or any connections to ground other than as required or permitted elsewhere in this *Code*.

110.8 Wiring Methods. Only wiring methods recognized as suitable are included in this *Code*. The recognized methods of wiring shall be permitted to be installed in any type of building or occupancy, except as otherwise provided in this *Code*.

110.9 Interrupting Rating. Equipment intended to interrupt current at fault levels shall have an interrupting rating at nominal circuit voltage at least equal to the current that is available at the line terminals of the equipment.

Equipment intended to interrupt current at other than fault levels shall have an interrupting rating at nominal circuit voltage at least equal to the current that must be interrupted.

110.10 Circuit Impedance, Short-Circuit Current Ratings, and Other Characteristics. The overcurrent protective devices, the total impedance, the equipment short-circuit current ratings, and other characteristics of the circuits to be protected shall be selected and coordinated to permit the circuit protective devices used to clear a fault to do so without extensive damage to the electrical equipment of the circuit. This fault shall be assumed to be either between two or more of the circuit conductors or between any circuit conductor and the equipment grounding conductor(s) permitted in 250.118. Listed equipment applied in accordance with their listing shall be considered to meet the requirements of this section.

110.11 Deteriorating Agents. Unless identified for use in the operating environment, no conductors or equipment shall be located in damp or wet locations; where exposed to gases, fumes, vapors, liquids, or other agents that have a deteriorating effect on the conductors or equipment; or where exposed to excessive temperatures.

Informational Note No. 1: See 300.6 for protection against corrosion.

Informational Note No. 2: Some cleaning and lubricating compounds can cause severe deterioration of many plastic materials used for insulating and structural applications in equipment.

Equipment not identified for outdoor use and equipment identified only for indoor use, such as "dry locations," "indoor use only," "damp locations," or enclosure Types 1, 2, 5, 12, 12K, and/or 13, shall be protected against damage from the weather during construction.

Informational Note No. 3: See Table 110.28 for appropriate enclosure-type designations.

Informational Note No. 4: Minimum flood provisions are provided in NFPA 5000:2015 *Building Construction and Safety Code*, the *International Building Code (IBC)*, and the *International Residential Code for One- and Two-Family Dwellings (IRC)*.

110.12 Mechanical Execution of Work. Electrical equipment shall be installed in a neat and workmanlike manner.

Informational Note: Accepted industry practices are described in ANSI/NECA 1-2015, *Standard for Good Workmanship in Electrical Construction*, and other ANSI-approved installation standards.

(A) Unused Openings. Unused openings, other than those intended for the operation of equipment, those intended for mounting purposes, or those permitted as part of the design for listed equipment, shall be closed to afford protection substantially equivalent to the wall of the equipment. Where metallic plugs or plates are used with nonmetallic enclosures, they shall be recessed at least 6 mm (¼ in.) from the outer surface of the enclosure.

(B) Integrity of Electrical Equipment and Connections. Internal parts of electrical equipment, including busbars, wiring terminals, insulators, and other surfaces, shall not be damaged or contaminated by foreign materials such as paint, plaster, cleaners, abrasives, or corrosive residues. There shall be no damaged parts that may adversely affect safe operation or mechanical strength of the equipment such as parts that are broken; bent; cut; or deteriorated by corrosion, chemical action, or overheating.

110.13 Mounting and Cooling of Equipment.

(A) Mounting. Electrical equipment shall be firmly secured to the surface on which it is mounted. Wooden plugs driven into holes in masonry, concrete, plaster, or similar materials shall not be used.

(B) Cooling. Electrical equipment that depends on the natural circulation of air and convection principles for cooling of exposed surfaces shall be installed so that room airflow over such surfaces is not prevented by walls or by adjacent installed equipment. For equipment designed for floor mounting, clearance between top surfaces and adjacent surfaces shall be provided to dissipate rising warm air.

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NRLRC National Roofing Legal Resource Center

NRLRC 39th Annual Seminar | Sept. 6-8, 2018
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NRLRC News

OSHA issues memorandum outlining enforcement of silica standard

Contract provision to provide roofing contractor with opportunity to appeal dispute resolution decision issued by "decision maker" designated by contract

[More news]

Contract provision obligating manufacturer and seller of equipment to roofing contractor to furnish equipment that is code-compliant

When purchasing a new piece of equipment, roofing contractors should beware of signing a seller's or manufacturer's standard purchase order agreement or agreeing to a seller's or manufacturer's standard terms and conditions. This agreement could include an express disclaimer of Uniform Commercial Code warranties of merchantability and fitness and will seek to limit the liability of the seller and the remedies available to the buyer in the event of a defect or problem with the product. Prior to making a purchase, the roofing contractor should obtain written assurance the equipment or product the contractor is purchasing complies with all codes, standards and regulations applicable to that equipment or product and its installation. Roofing contractors should be certain to include a provision to that effect in the purchase agreement.

For example, if your roofing company is in the market to purchase a sheet metal folding machine, it's important the sales agreement contain a provision such as the one above that obligates the seller to furnish a machine that will comply with all applicable codes and standards pertaining to the machine in the locality where you intend to install the machine. Such a provision is especially critical considering the 2017 edition of the NFPA 70, National Electrical Code (NEC), which jurisdictions could adopt as of Jan. 1. Article 110 of the 2017 NEC contains a new provision that has been interpreted as requiring all electrical equipment installed or used in a building undergo product testing, evaluation and listing (product certification) by a recognized qualified electrical testing laboratory in accordance with applicable product safety standards recognized by the NEC. If your business is in one of the states, cities, counties or towns throughout the U.S. that has adopted the 2017 edition of the NEC, in the absence of proof your new sheet metal folding machine complies with the NEC, code officials may not permit the newly purchased machine to be used. To

Equipment and product purchase agreement: The Seller and Manufacturer warrant to the Roofing Contractor that the equipment and product manufactured by Manufacturer and sold by Seller to Roofing Contractor will comply with all codes, standards and regulations applicable to the equipment and product in the jurisdiction where the equipment and product are delivered and intended for use, including the applicable electrical code and OSHA standards. No disclaimer or limitation of warranties of merchantability or fitness or other warranties by Seller or Manufacturer and no term or condition in the sales agreement shall cause or be interpreted to void, disclaim or reduce the obligation of the Seller and Manufacturer to furnish equipment and products that are in compliance with applicable codes, standards and regulations.

7/31/2018 Link

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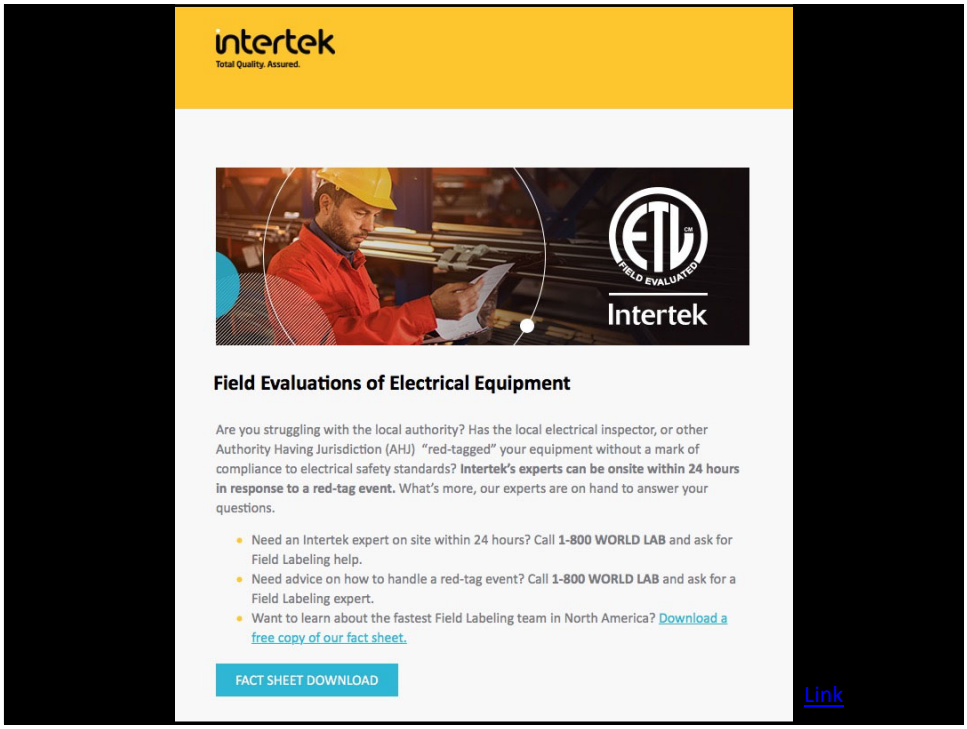

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Steel roof deck concerns

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Steel roof deck design

- SDI Design Manual
- AISI S100, "Specifications for the Design of Cold-formed Steel structural Members"
- ANSI/SDI RD1.0-2006, "Standard for Steel Roof Deck"
- ANSI/SDI RD-2010, "Standard for Steel Roof Deck"
- SDI *Roof Deck Design Manual, First Edition* (Nov. 2012)

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Steel roof deck design

Wind uplift resistance

- Minimum 30 psf uplift (uniform loading)
- Minimum 45 psf uplift (uniform loading) at roof overhangs

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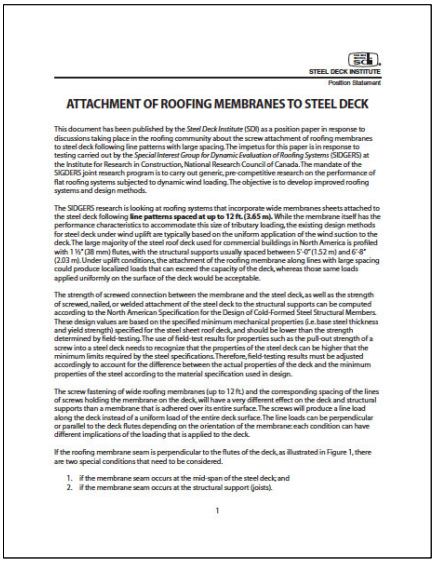
SDI bulletin

2009



STEEL DECK INSTITUTE
Position Statement

ATTACHMENT OF ROOFING MEMBRANES TO STEEL DECK

This document has been published by the *Steel Deck Institute* (SDI) as a position paper in response to discussions taking place in the roofing community about the screw attachment of roofing membranes to steel deck following line patterns with large spacing. The impetus for this paper is in response to testing carried out by the *Special Interest Group for Dynamic Evaluation of Roofing Systems* (SIDGERS) at the Institute for Research in Construction, National Research Council of Canada. The mandate of the SIDGERS joint research program is to carry out generic, pre-competitive research on the performance of flat roofing systems subjected to dynamic wind loading. The objective is to develop improved roofing systems and design methods.

The SIDGERS research is looking at roofing systems that incorporate wide membranes sheets attached to the steel deck following **line patterns spaced at up to 12 ft. (3.65 m).** While the membrane itself has the performance characteristics to accommodate this size of tributary loading, the existing design methods for steel deck under wind uplift are typically based on the uniform application of the wind suction to the deck. The large majority of the steel roof deck used for commercial buildings in North America is profiled with 1 ½" (38 mm) flutes, with the structural supports usually spaced between 5'-0" (1.52 m) and 6'-8" (2.03 m). Under uplift conditions, the attachment of the roofing membrane along lines with large spacing could produce localized loads that can exceed the capacity of the deck, whereas those same loads applied uniformly on the surface of the deck would be acceptable.

The strength of screwed connection between the membrane and the steel deck, as well as the strength of screwed, nailed, or welded attachment of the steel deck to the structural supports can be computed according to the North American Specification for the Design of Cold-Formed Steel Structural Members. These design values are based on the specified minimum mechanical properties (i.e. base steel thickness and yield strength) specified for the steel sheet roof deck, and should be lower than the strength determined by field-testing. The use of field-test results for properties such as the pull-out strength of a screw into a steel deck needs to recognize that the properties of the steel deck can be higher that the minimum limits required by the steel specifications. Therefore, field-testing results must be adjusted accordingly to account for the difference between the actual properties of the deck and the minimum properties of the steel according to the material specification used in design.

The screw fastening of wide roofing membranes (up to 12 ft.) and the corresponding spacing of the lines of screws holding the membrane on the deck, will have a very different effect on the deck and structural supports than a membrane that is adhered over its entire surface. The screws will produce a line load along the deck instead of a uniform load of the entire deck surface. The line loads can be perpendicular or parallel to the deck flutes depending on the orientation of the membrane: each condition can have different implications of the loading that is applied to the deck.

If the roofing membrane seam is perpendicular to the flutes of the deck, as illustrated in Figure 1, there are two special conditions that need to be considered.

1. if the membrane seam occurs at the mid-span of the steel deck; and
2. if the membrane seam occurs at the structural support (joists).

1

- Decks designed for joist spacing between 5’ and 6’ 8” o.c.
- Decks designed for uniform loading
- Seam-fastened single-ply membranes are a concern

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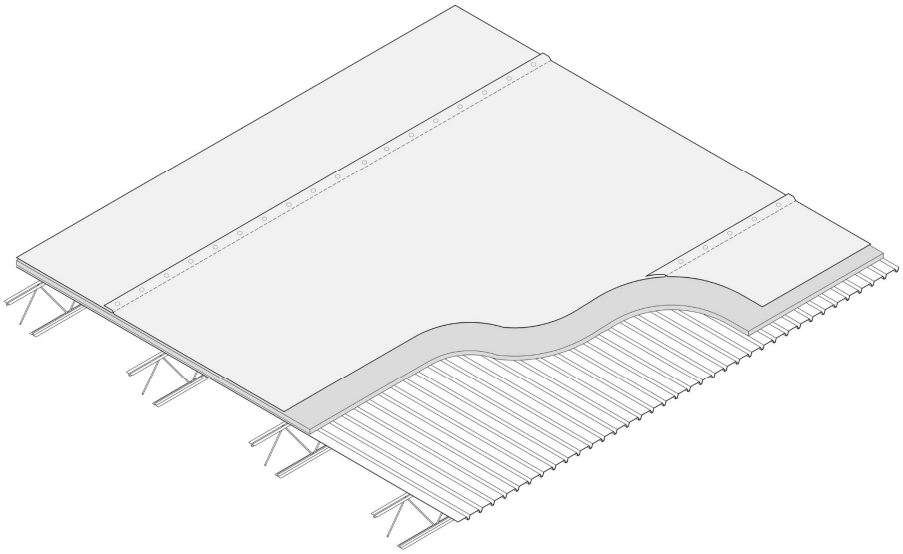
Membrane seams across deck flutes



SDI: 3.8 X moment (deck); 2 X load (joists)

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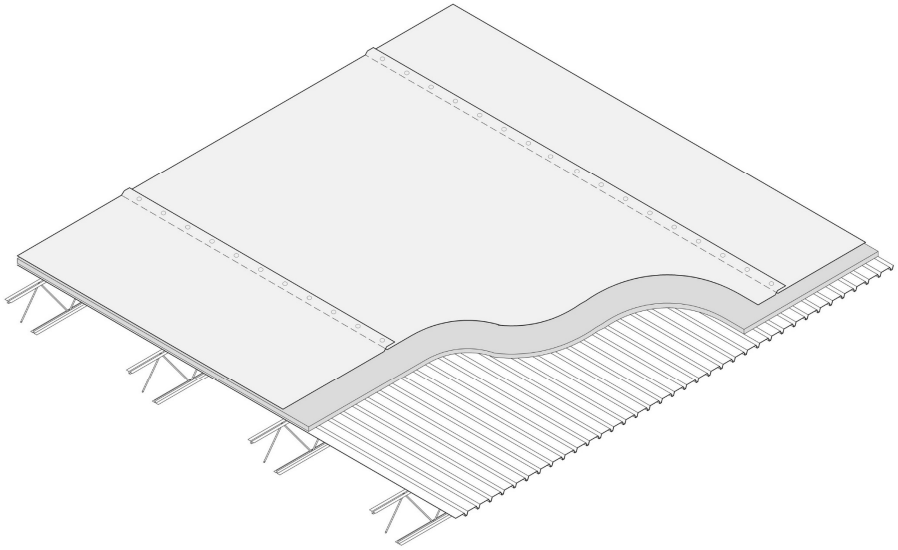
Membrane seams in deck flute direction



SDI: 12 X bending moment and shear (deck)

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SDI bulletin -- Conclusion

"…SDI does not recommend the use of roofing membranes attached to the steel deck using line patterns with large spacing unless a structural engineer has reviewed the adequacy of the steel deck and the structural supports to resist to wind uplift loads transmitted along the lines of attachment. Those lines of attachment shall only be perpendicular to the flutes of the deck."

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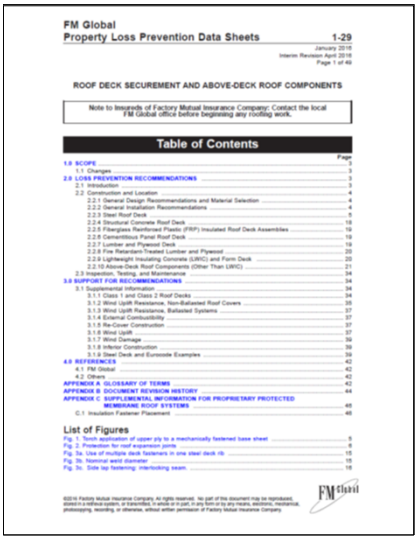
FM 1-29 updated

www.fmglobaldatasheets.com



FM Global
Property Loss Prevention Data Sheets 1-29

ROOF DECK SECUREMENT AND ABOVE-DECK ROOF COMPONENTS

Table of Contents

List of Figures

New criteria for steel roof deck uplift:

- Uniformly-distributed loading
- Concentrated loading

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An example

Hypothetical analysis using FM 1-29

- Adhered (uniform loading) roof system:
  - 6 ft. joist spacing → Class 165
- Seam-fastened (nonuniform, linear load) roof system:
  - 6 ft. seam spacing → Class 90 (33 ksi steel deck)
  - 9.5 ft. seam spacing → Class 90 (80 ksi steel deck)
  - 6 ft. seam spacing → Class 165 (80 ksi steel deck)

Seam spacing wider than joist spacing is problematic

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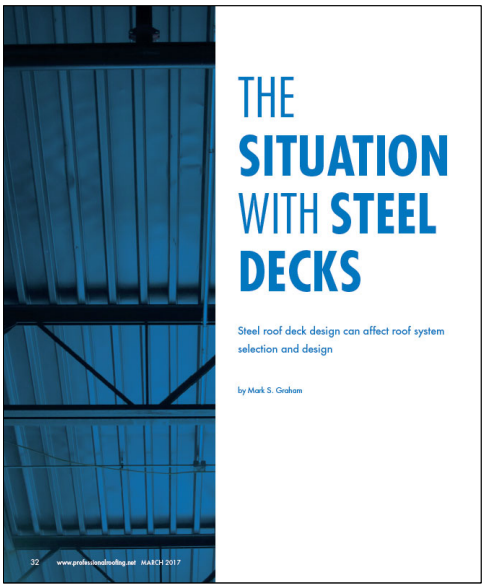

Professional Roofing
March 2017
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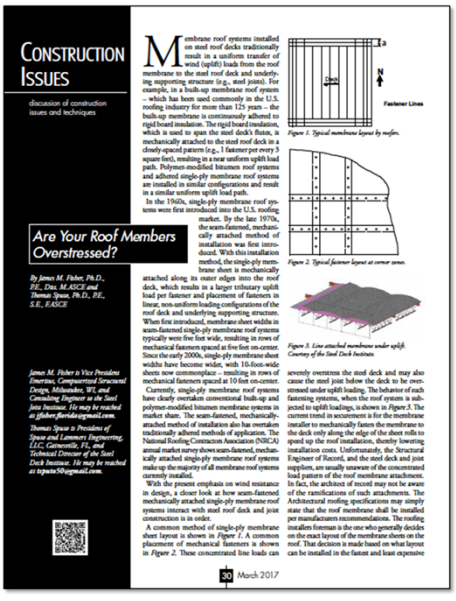

***Structure* magazine**
March 2017
www.structuremag.org

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Fastener pull-out tests…

There is little correlation between fastener pull-out resistance and a steel roof deck's yield strength and uplift (bending) strength

55

Although roofing contractors sometimes are given the responsibility of inspecting and accepting steel roof decks to receive a new roof system, determining a roof deck's design adequacy is beyond the expertise of most roofing contractors.

This determination is best made during a project's design phase.

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Moisture in concrete roof decks

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Concrete Floors and Moisture, 2nd Edition

Howard M. Kanare, CTL Group

75% internal RH can be achieved:

- Normal weight structural concrete
  - Less than 90 days
- Lightweight structural concrete
  - Almost 6 months

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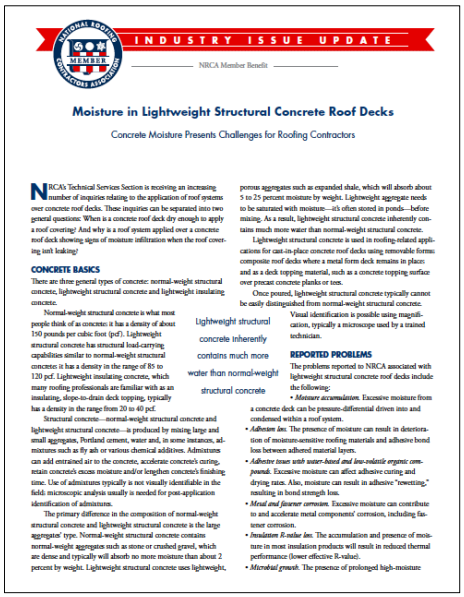
NRCA Industry Issue Update, August 2013



INDUSTRY ISSUE UPDATE

NRCA Member Benefit

Moisture in Lightweight Structural Concrete Roof Decks

Concrete Moisture Presents Challenges for Roofing Contractors

NRCA's Technical Services Section is receiving an increasing number of inquiries relating to the application of roof systems over concrete roof decks. These inquiries can be separated into two general questions: When is a concrete roof deck dry enough to apply a roof covering? And why is a roof system applied over a concrete roof deck showing signs of moisture infiltration when the roof covering isn't leaking?

CONCRETE BASICS

There are three general types of concrete: normal-weight structural concrete, lightweight structural concrete and lightweight insulating concrete.

Normal-weight structural concrete is what most people think of as concrete: it has a density of about 150 pounds per cubic foot (pcf). Lightweight structural concrete has structural load-carrying capabilities similar to normal-weight structural concrete; it has a density in the range of 85 to 120 pcf. Lightweight insulating concrete, which many roofing professionals are familiar with as an insulating, slope-to-drain deck topping, typically has a density in the range from 20 to 40 pcf.

Structural concrete—normal-weight structural concrete and lightweight structural concrete—is produced by mixing large and small aggregates, Portland cement, water and, in some instances, admixtures such as fly ash or various chemical additives. Admixtures can add entrained air to the concrete, accelerate concrete's curing, retain concrete's excess moisture and/or lengthen concrete's finishing time. Use of admixtures typically is not visually identifiable in the field; microscopic analysis usually is needed for post-application identification of admixtures.

The primary difference in the composition of normal-weight structural concrete and lightweight structural concrete is the large aggregates' type. Normal-weight structural concrete contains normal-weight aggregates such as stone or crushed gravel, which are dense and typically will absorb no more moisture than about 2 percent by weight. Lightweight structural concrete uses lightweight, porous aggregates such as expanded shale, which will absorb about 5 to 25 percent moisture by weight. Lightweight aggregate needs to be saturated with moisture—it's often stored in ponds—before mixing. As a result, lightweight structural concrete inherently contains much more water than normal-weight structural concrete.

Lightweight structural concrete is used in roofing-related applications for cast-in-place concrete roof decks using removable forms; composite roof decks where a metal form deck remains in place; and as a deck topping material, such as a concrete topping surface over precast concrete planks or tees.

Once poured, lightweight structural concrete typically cannot be easily distinguished from normal-weight structural concrete. Visual identification is possible using magnification, typically a microscope used by a trained technician.

Lightweight structural concrete inherently contains much more water than normal-weight structural concrete

REPORTED PROBLEMS

The problems reported to NRCA associated with lightweight structural concrete roof decks include the following:

- *Moisture accumulation.* Excessive moisture from a concrete deck can be pressure-differential driven into and condensed within a roof system.
- *Adhesion loss.* The presence of moisture can result in deterioration of moisture-sensitive roofing materials and adhesive bond loss between adhered material layers.
- *Adhesive issues with water-based and low-volatile organic compounds.* Excessive moisture can affect adhesive curing and drying rates. Also, moisture can result in adhesive "rewetting," resulting in bond strength loss.
- *Metal and fastener corrosion.* Excessive moisture can contribute to and accelerate metal components' corrosion, including fastener corrosion.
- *Insulation R-value loss.* The accumulation and presence of moisture in most insulation products will result in reduced thermal performance (lower effective R-value).
- *Microbial growth.* The presence of prolonged high-moisture

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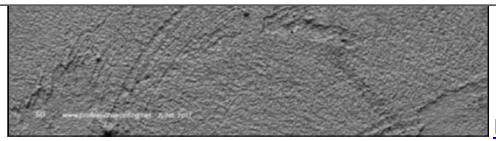
June 2017

	ASTM E96 calculated perm			
	Lightweight structural concrete		Normal weight concrete	
Age	Wet cup	Dry cup	Wet cup	Dry cup
28 days	1.48	0.78	3.42	1.05
60 days	1.45	0.47	2.03	1.13

The figure shows results of ASTM E96 water vapor transmission testing. Note the lightweight structural concrete has about half of the permeability of regular weight concrete. Considering lightweight structural concrete arrives with more than twice the evaporable water of regular weight concrete, this explains why lightweight structural concrete retains moisture for so long.



Link

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Moisture on concrete roof decks


RESEARCH+TECH

Moisture in concrete roof decks

Normal-weight and lightweight structural concrete cause some concern

by Mark S. Graham

Professional Roofing,
Sept. 2017

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Moisture vapor reduction admixtures (MVRAs)

Some examples:

- Barrier One
- ISE Logik MVRA 9000
- SPG VaporLock

NRCA has still not seen an MVRA perform successfully in concrete roof deck applications

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Moisture vapor reduction admixtures (MVRAs)


RESEARCH + TECH

Are admixtures the answer?

Moisture in concrete roof decks continues to be problematic

by Mark S. Graham

NRCA's Technical Services Section has been receiving inquiries regarding the use and effectiveness of specific concrete mix additives and topical surface treatments to address moisture release–related concerns with concrete roof decks. Such admixtures broadly are referred to as moisture vapor reduction admixtures (MVRAs) or porosity-inhibiting admixtures. NRCA provides recommendations regarding their use.

MVRAs

Concrete admixtures intended as MVRAs are specific chemicals added during concrete's batching and mixing to provide an additional chemical reaction during the concrete's hydration and curing process. MVRAs use the concrete mix's excess water and chlorides to create a calcium silicate hydrate gel within the concrete. The gel is said to fill the small pores and capillary openings in curing concrete, minimizing the concrete's ability to pass and release moisture vapor. The gel is intended to be permanent and integral throughout the concrete's entire thickness.

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December 2018

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The roofing industry needs to re-think
the concept of concrete roof deck "acceptance"

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FM's very severe hail (VSH) classifications

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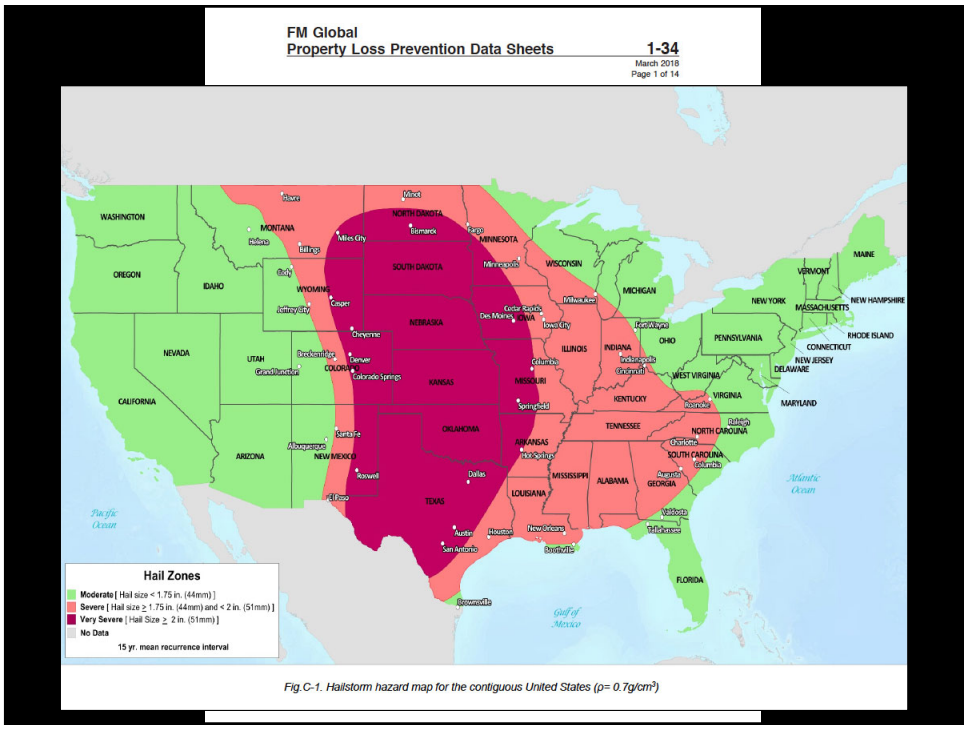

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Of the 911,562 roof assemblies in FM's RoofNav, only 312 have a VSH classification

As of December 11, 2018

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RESEARCH+TECH

Understanding FM VSH

FM has implemented a new impact-resistance classification

by Mark S. Graham

Commercial and industrial insurer FM Global and its code-approved testing agency subsidiary, FM Approvals, have implemented a Very Severe Hail (VSH) impact-resistance classification that could affect some of the work you do.

FM Global guidelines

FM Global traditionally has recommended its insured building owners use moderate hail- (MH-) and severe hail- (SH-) classified roof systems for buildings located in areas FM Global considers to be susceptible to moderate or severe hail impacts. FM Loss Prevention Data Sheet 1-34 (FM 1-34), "Hail Damage," provides a map identifying those regions.

In recent years, the U.S. insurance industry has experienced increases in losses from hail in terms of the number of claims experienced and costs of those claims. A majority of the hail damage occurs to roof systems and other rooftop components.

In the latest version of FM 1-34, dated October 2014, FM Global has identified a new VSH region, encompassing Oklahoma, Kansas and some northern counties in Texas. FM 1-34's Table 3 identifies the specific northern Texas counties.

To access FM Global Data Sheets, including FM 1-34—"Hail Damage," go to www.professionalroofing.net.

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Professional Roofing, December 2017
Link to access this article

RESEARCH+TECH

Designing for hail resistance

Did you know FM Global has updated its hail design guidance?

by Mark S. Graham

In March, property and building loss insurer FM Global updated its Property Loss Prevention Data Sheet 1-34, "Hail Damage" (FM 1-34). If you work on buildings insured by FM Global, you should be aware of its latest hail-resistance guidelines and the effects they may have on roof system selection and design.

FM 1-34

FM 1-34 provides loss-prevention guidelines to minimize the potential for hail damage to buildings, roof-mounted equipment and other outdoor equipment. FM Global intends FM 1-34 and its other Property Loss Prevention Data Sheets to apply to its insured buildings. However, some designers use the Property Loss Prevention Data Sheets as design guidelines for buildings (and roof systems) other than those insured by FM Global.

FM Global contends hailstorms are a widespread hazard affecting many areas of the world that can severely damage buildings' roof systems, rooftop HVAC units and skylights. Cooling towers and exposed glass and plastic components of outdoor equipment also can be

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Metal stud-framed parapet walls

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Metal stud-framed parapet walls

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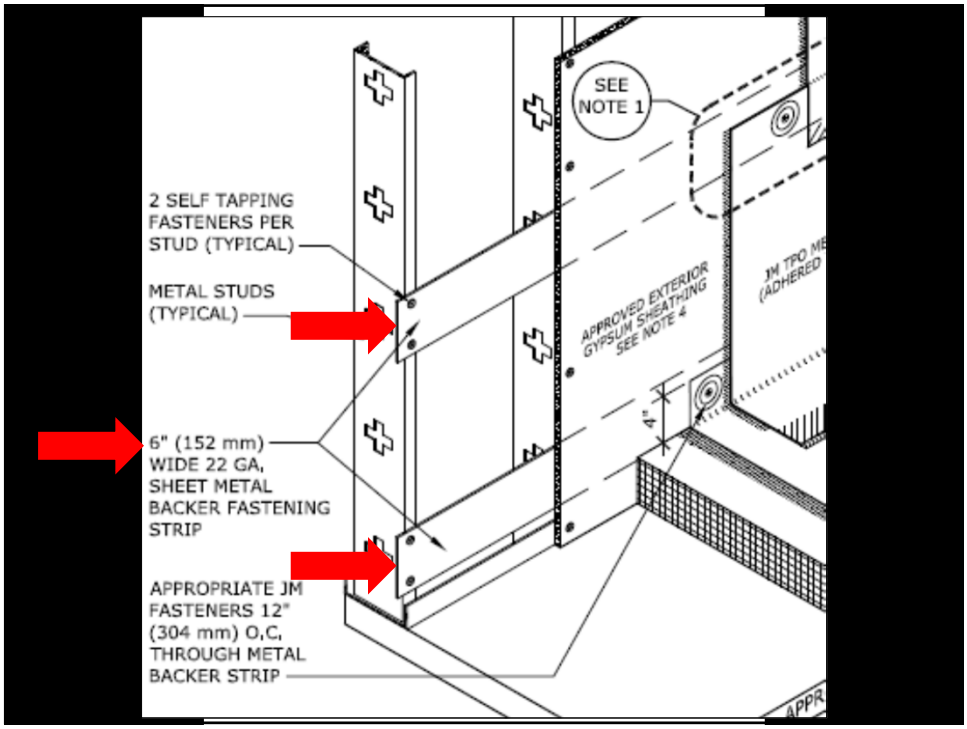

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“Fully” adhered

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TECH TODAY

The fully adhered misnomer

Terminology can create unrealistic expectations within the roofing industry

by Mark S. Graham

NRCA recommends the term "fully adhered" be avoided

Professional Roofing, January 2017

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Attic ventilation

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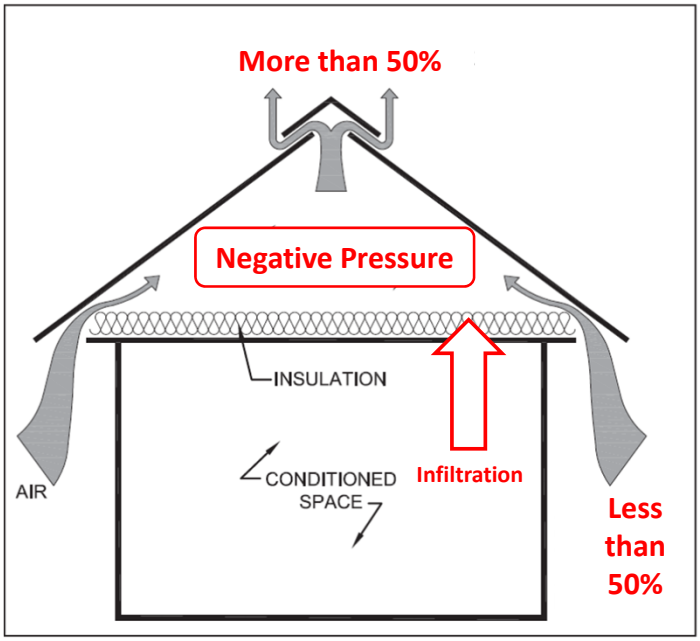

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Be careful not to install excess amounts of ridge vents…. It can have undesirable consequences.

If your company is selling ridge vents, you should also be selling soffit or eave vents.

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RESEARCH+TECH

Clearing the air

Considerations for attic ventilation

by Mark S. Graham

Proper attic ventilation can be an important consideration when designing high-performing, steep-slope roof assemblies. For example, with some asphalt-shingle products, proper attic ventilation may be a warranty requirement. Following is a review of code requirements and NRCA's guidelines for attic ventilation in steep-slope roof assemblies.

Code requirements

Code requirements for attic ventilation have varied between the International Building Code® (IBC) and International Residential Code® (IRC) and have changed with each edition up to the 2015 editions.

Beginning with the IBC's and IRC's 2015 editions, both codes require the net free ventilating area (NFVA) to be at least a 1:150 ratio of the space being vented. Any blocking or bridging in attics must not interfere with air movement, and an air space of at least 1 inch must be provided between the bottom of the roof deck and any attic insulation. Vent openings must protect against the entrance of rain and snow and be installed according to manufacturer's installation instructions.

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NRCA

ROOFING DAY IN D.C.

April 3-4, 2019

Hyatt Regency Washington on Capitol Hill

Washington, DC

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NRCA ProCertification

Recognition of expertise level of field workers

Launch on December 17, 2018

www.nrca.net/NRCA-ProCertification

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Questions… and other topics

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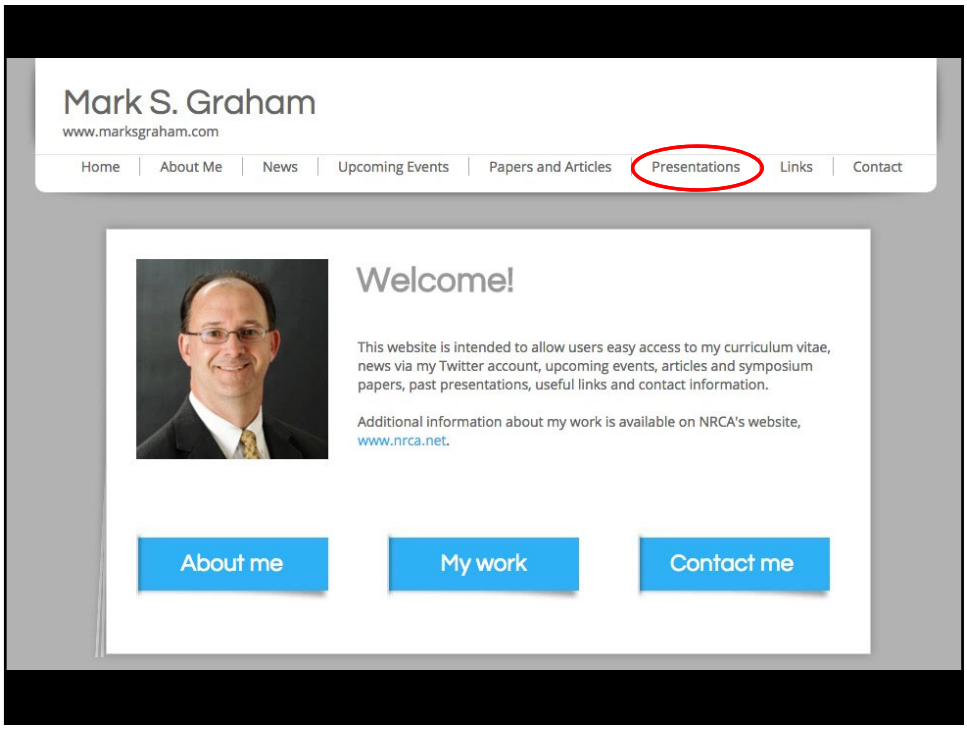

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