Wednesday, August 14, 2019

Commercial roofing technical issues update

presented by

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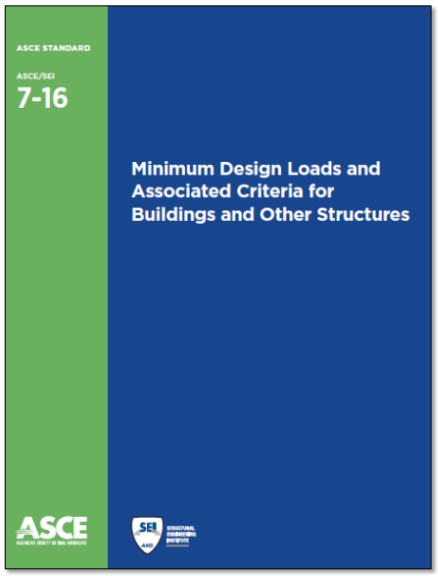
National Roofing Contractors Association

Topics

- ASCE 7-16 wind design
- Moisture in concrete roof decks
- Polyiso. issues and specifications
- Roof coatings
- FM VSH
- Full adhered
- Q & A

ASCE 7-16

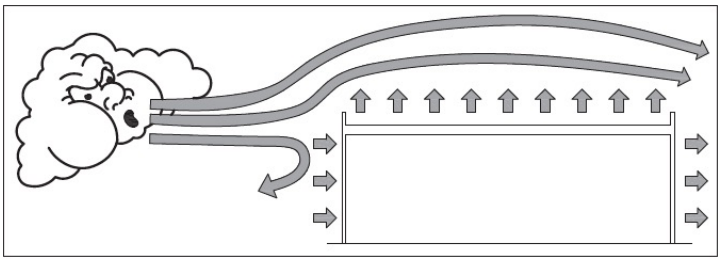


- Provisions: 402 pages
- Commentary: 417 pages

- Soft cover
- Electronic file (PDF)

www.asce.org

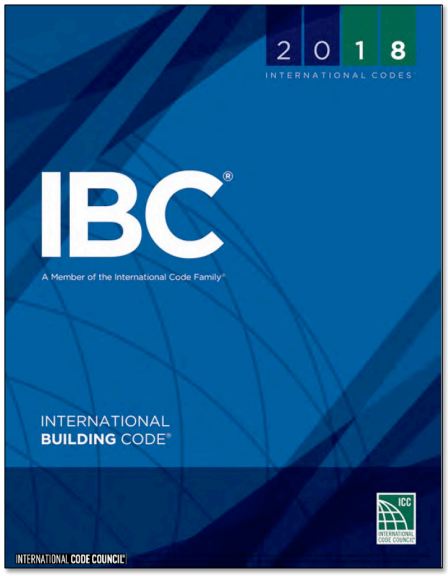
The fundamental concept of wind design

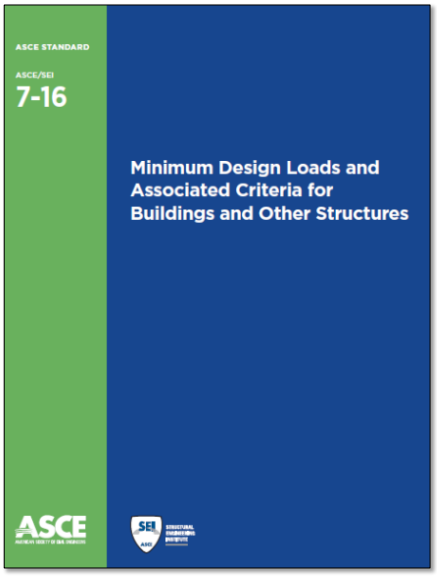


ASCE 7-16

Wind creates pressures/forces acting on building elements

ASCE 7 is referenced in the International Building Code (IBC)





Comparing IBC editions to ASCE 7 editions

IBC	ASCE 7
IBC 2006	ASCE 7-05
IBC 2009	ASCE 7-05
IBC 2012	ASCE 7-10
IBC 2015	ASCE 7-10
IBC 2018	ASCE 7-16
IBC 2021	Most likely ASCE 7-16

Noteworthy changes in ASCE 7-16

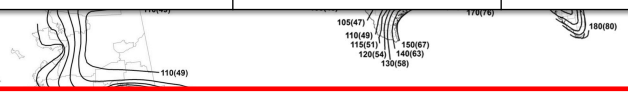
Compared to ASCE 7-10

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

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.



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

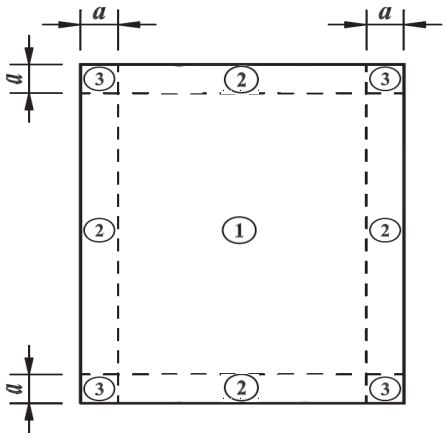
Comparing GC_p pressure coefficients

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%

ASCE 7-10's roof zones

h ≤ 60 ft., gable roofs ≤ 7 degrees



a = 10% of the least horizontal direction, or 0.4h, whichever is smaller but not less than either 4% of the least horizontal dimension or 3 ft (0.9 m).

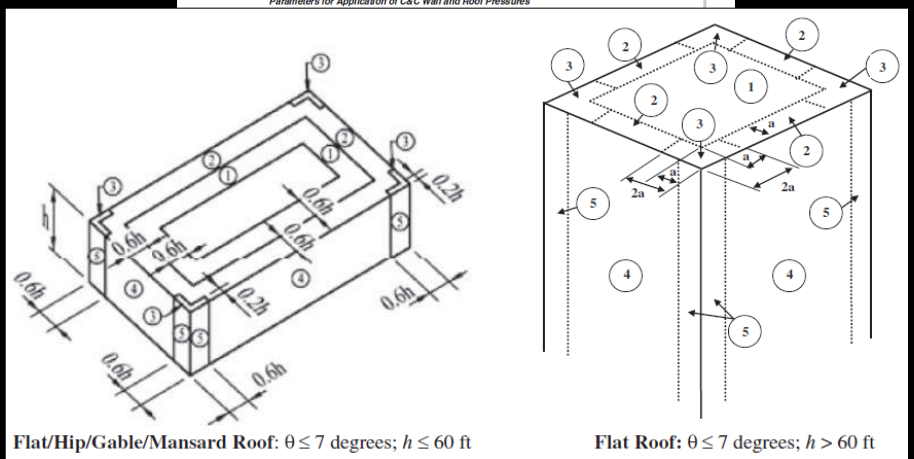


Table 30.6-2 Components and Cladding, Part 4[$h \leq 160$ ft($h \leq 48.8$ m)]: C&C Zones for Enclosed Buildings—C&C Wall and Roof Pressures

Parameters for Application of C&C Wall and Roof Pressures

Flat/Hip/Gable/Mansard Roof: θ ≤ 7 degrees; $h \leq 60$ ft

Flat Roof: θ ≤ 7 degrees; $h > 60$ ft

Notation

a = 10% of the least horizontal dimension but not less than 3 ft (0.9 m).
h = Mean roof height, in ft (m).
V = Basic wind speed, in mph (m/s).

Notes

1. See Section 30.6.1.1 for tabulated wall and roof pressure from Table 30.6-2 and Fig. 30.4-1, as applicable.
2. For mansard roofs, apply roof pressures on sloped surfaces as tabulated for sloped surfaces of gable roofs; apply roof pressure on flat surfaces (θ < 7°) as tabulated for flat roofs.

continues

Minimum Design Loads and Associated Criteria for Buildings and Other Structures 365

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

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 Oct. 2019.

Comparing FM 1-28 and ASCE 7-05, -10 & -16

Example: A manufacturing building (Risk Category II) is located in Houston, TX. The building is an enclosed structure with a mean roof height of 60 ft. The building is located in an open terrain area that can be categorized as Exposure Category C. An adhered, membrane roof systems will 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	120	--	35	59	89
FM 1-28	105	--	37	62	93
ASCE 7-10 Strength design	140	--	57	96	144
ASCE 7-10 ASD	110	--	34	58	87
ASCE 7-16 Strength design	140	52	91	120	164
ASCE 7-16 ASD	108	31	55	72	98

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 illustrate 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)?

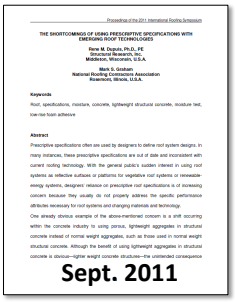
Moisture in concrete roof decks

Moisture in concrete roof decks


Moisture in concrete roof decks

Concrete's curing and drying rate can affect roof systems

Feb. 2010


THE SHORTCOMINGS OF USING PRESCRIPTIVE SPECIFICATIONS WITH EMERGING ROOF TECHNOLOGIES

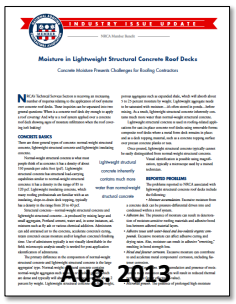
Sept. 2011


TECH TODAY

Concrete deck dryness

Alternative approaches are needed to determine when concrete decks are dry

Dec. 2012


INDUSTRY ISSUE UPDATE

Moisture in Lightweight Structural Concrete Roof Decks

Concrete Moisture Presents Challenges for Roofing Contractors

Aug. 2013


TECH TODAY

A troubling issue

Moisture in lightweight structural concrete presents concerns

Dec. 2013


RESEARCH+TECH

Moisture in concrete roof decks

Sept. 2017

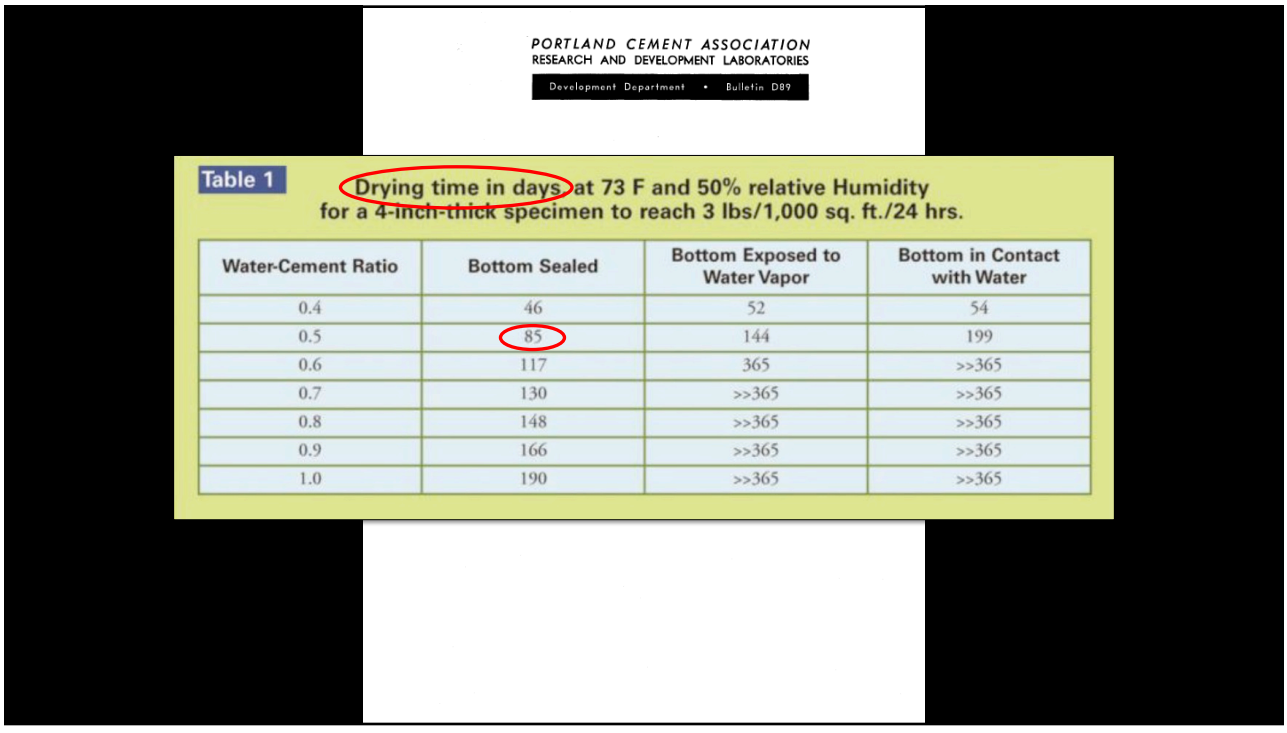

PORTLAND CEMENT ASSOCIATION
RESEARCH AND DEVELOPMENT LABORATORIES
Development Department • Bulletin D89

Table 1

Drying time in days at 73 F and 50% relative Humidity for a 4-inch-thick specimen to reach 3 lbs/1,000 sq. ft./24 hrs.

Water-Cement Ratio	Bottom Sealed	Bottom Exposed to Water Vapor	Bottom in Contact with Water
0.4	46	52	54
0.5	85	144	199
0.6	117	365	>>365
0.7	130	>>365	>>365
0.8	148	>>365	>>365
0.9	166	>>365	>>365
1.0	190	>>365	>>365

***Concrete Floors and Moisture* (2008)**
Howard Kanare

A concrete slab will reach a 75% RH
- Normal weight structural concrete
  - Less than 90 days
- Lightweight structural concrete
  - Almost 6 months


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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Professional Roofing
December 2018

Moisture vapor reduction admixtures (MVRAs)

Some examples:

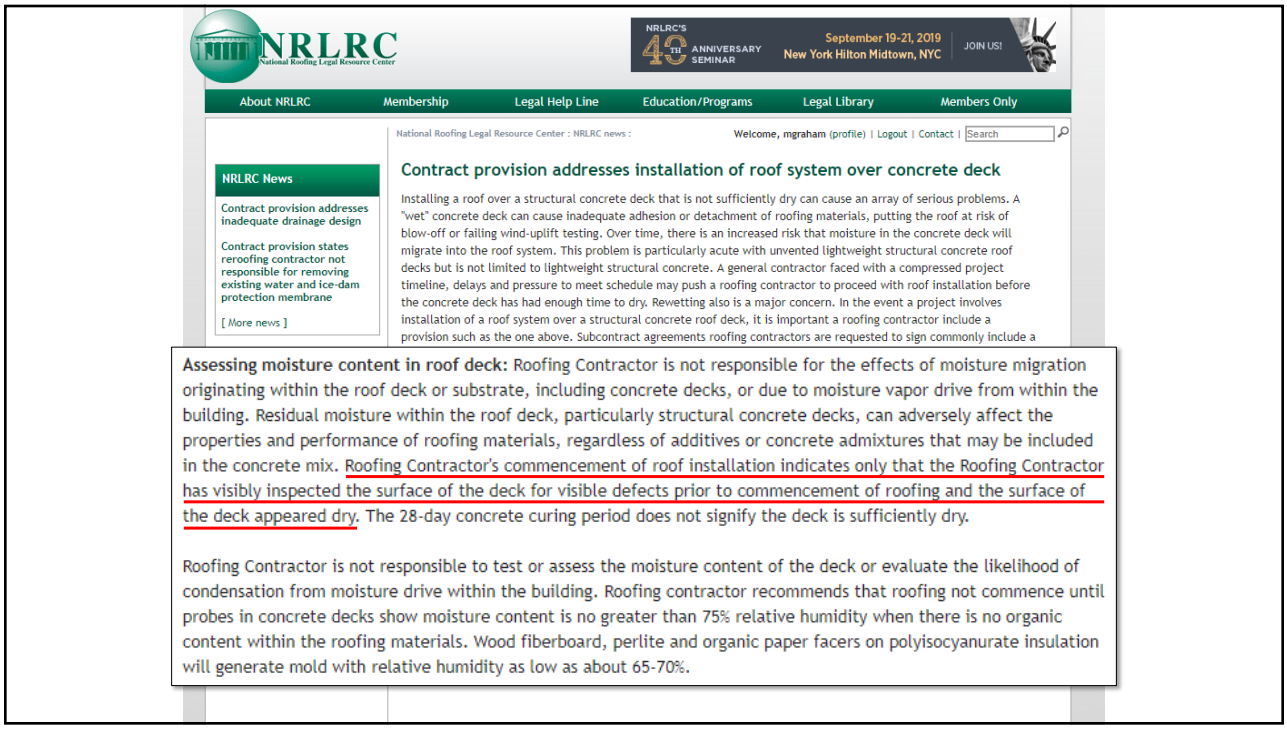
- Barrier One
- ISE Logik MVRA 9000
- SPG VaporLock

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

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

Whose moisture is it in the concrete?

Why should we take responsibility (or incur liability) for someone else's moisture?



Polyiso. issues and specifications

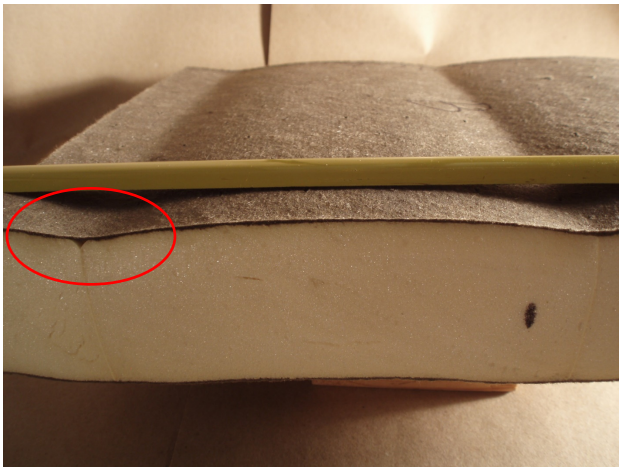
Knit lines

Photo from manufacturer's product literature

Thickness and knit lines

As delivered by manufacturer.

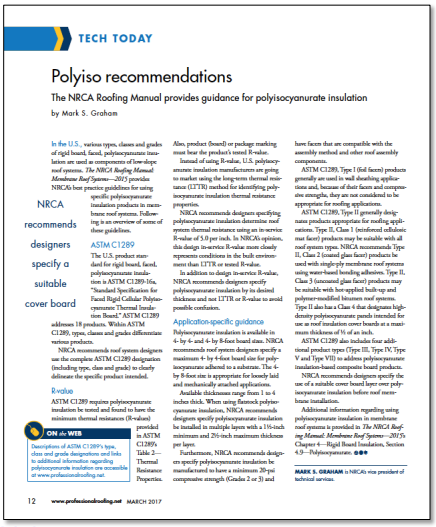
Knit lines -- continued



After conditioning: 158 ± 4 F and 97 ± 3% RH for 7 days

Knit lines -- continued

Knit line and V-groove close-up (after conditioning)



TECH TODAY

Polyiso recommendations

The NRCA Roofing Manual provides guidance for polyisocyanurate insulation

by Mark S. Graham

In the U.S., various types, classes and grades of rigid board, faced, polyisocyanurate insulation are used as components of low-slope roof systems. *The NRCA Roofing Manual: Membrane Roof Systems—2015* provides NRCA's best practice guidelines for using specific polyisocyanurate insulation products in membrane roof systems. Following is an overview of some of these guidelines.

NRCA recommends designers specify a suitable cover board

ASTM C1289

The U.S. product standard for rigid board, faced, polyisocyanurate insulation is ASTM C1289-16a, "Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board." ASTM C1289 addresses 18 products. Within ASTM C1289, types, classes and grades differentiate various products.

NRCA recommends roof system designers use the complete ASTM C1289 designation (including type, class and grade) to clearly delineate the specific product intended.

R-value

ASTM C1289 requires polyisocyanurate insulation be tested and found to have the minimum thermal resistances (R-values) provided in ASTM C1289, Table 2—Thermal Resistance Properties.

ON the WEB

Descriptions of ASTM C1289's type, class and grade designations and links to additional information regarding polyisocyanurate insulation are accessible at www.professionalroofing.net.

Also, product (board) or package marking must bear the product's tested R-value.

Instead of using R-value, U.S. polyisocyanurate insulation manufacturers are going to market using the long-term thermal resistance (LTTR) method for identifying polyisocyanurate insulation thermal resistance properties.

NRCA recommends designers specifying polyisocyanurate insulation determine roof system thermal resistance using an in-service R-value of 5.0 per inch. In NRCA's opinion, this design in-service R-value more closely represents conditions in the built environment than LTTR or tested R-value.

In addition to design in-service R-value, NRCA recommends designers specify polyisocyanurate insulation by its desired thickness and not LTTR or R-value to avoid possible confusion.

Application-specific guidance

Polyisocyanurate insulation is available in 4- by 8- and 4- by 8-foot board sizes. NRCA recommends roof system designers specify a maximum 4- by 4-foot board size for polyisocyanurate adhered to a substrate. The 4- by 8-foot size is appropriate for loosely laid and mechanically attached applications.

Available thicknesses range from 1 to 4 inches thick. When using flatstock polyisocyanurate insulation, NRCA recommends designers specify polyisocyanurate insulation be installed in multiple layers with a 1½-inch minimum and 2½-inch maximum thickness per layer.

Furthermore, NRCA recommends designers specify polyisocyanurate insulation be manufactured to have a minimum 20-psi compressive strength (Grades 2 or 3) and have facers that are compatible with the assembly method and other roof assembly components.

ASTM C1289, Type I (foil facers) products generally are used in wall sheathing applications and, because of their facers and compressive strengths, they are not considered to be appropriate for roofing applications.

ASTM C1289, Type II generally designates products appropriate for roofing applications. Type II, Class 1 (reinforced cellulosic mat facer) products may be suitable with all roof system types. NRCA recommends Type II, Class 2 (coated glass facer) products be used with single-ply membrane roof systems using water-based bonding adhesives. Type II, Class 3 (uncoated glass facer) products may be suitable with hot-applied built-up and polymer-modified bitumen roof systems. Type II also has a Class 4 that designates high-density polyisocyanurate panels intended for use as roof insulation cover boards at a maximum thickness of ½ of an inch.

ASTM C1289 also includes four additional product types (Type III, Type IV, Type V and Type VII) to address polyisocyanurate insulation-based composite board products.

NRCA recommends designers specify the use of a suitable cover board layer over polyisocyanurate insulation before roof membrane installation.

Additional information regarding using polyisocyanurate insulation in membrane roof systems is provided in *The NRCA Roofing Manual: Membrane Roof Systems—2015*'s Chapter 4—Rigid Board Insulation, Section 4.3—Polyisocyanurate.

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

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Link

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Roof coatings

RESEARCH+TECH

Coating concerns

Building code compliance for roof coatings is limited

by Mark S. Graham

Protective roof coatings sometimes are used as roof covering surfacings to provide an additional layer of weather protection. Specific roof coatings also can enhance a roof covering's fire resistance, solar reflectivity and aesthetic appearance. However, not all roof coating products on the market comply with building code requirements.

IBC 2018

In the *International Building Code,® 2018 Edition*, Chapter 2—Definitions, "roof coating" is defined as "a fluid-applied, adhered coating used for roof maintenance or *roof repair*, or as a component of a *roof covering* or *roof assembly*." The italicized words denote specific additional terms also defined in Chapter 2.

In IBC 2018's Chapter 15—Roof Assemblies and Rooftop Structures, Section 1507.10–Built-up Roofs, Table 1507.10.3–Built-up Roofing Material Standards lists the following roof coating products as acceptable to be applied to built-up membrane roof systems:

- Acrylic roof coatings complying with ASTM D6083, "Specification for Liquid Applied Acrylic Coating Used in Roofing"

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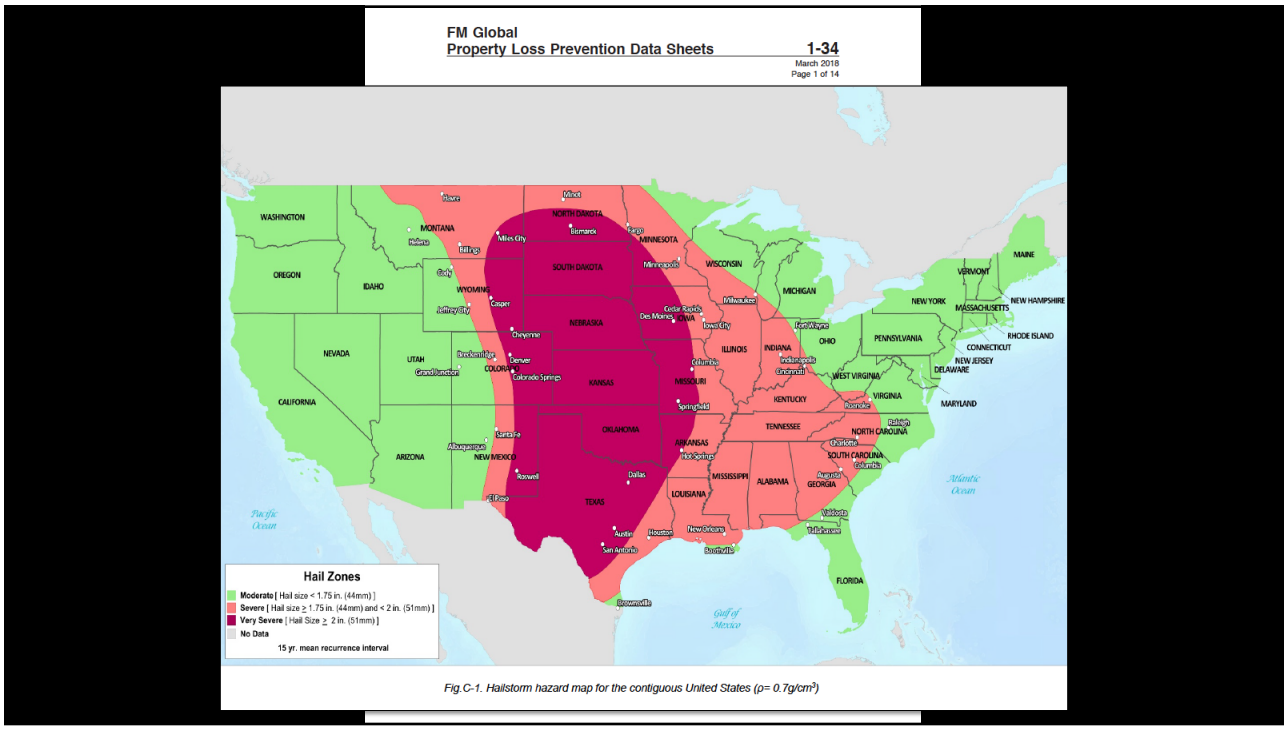
FM's very severe hail (VSH) classifications



Of the 925,930 roof assemblies in FM's RoofNav, only 588 have VSH classifications

As of August 13, 2019

RESEARCH+TECH

Understanding FM VSH

FM has implemented a new impact-resistance classification

by Mark S. Graham

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

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.

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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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“Fully” adhered

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

Q & A…

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