



Wednesday, August 14, 2019

Commercial roofing technical issues update

presented by



NRCA

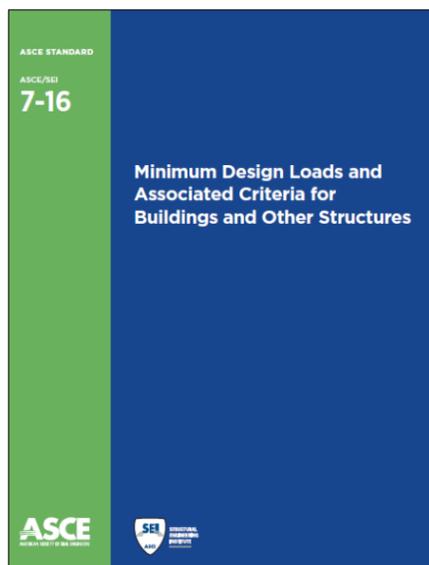
Mark S. Graham

Vice President, Technical Services
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

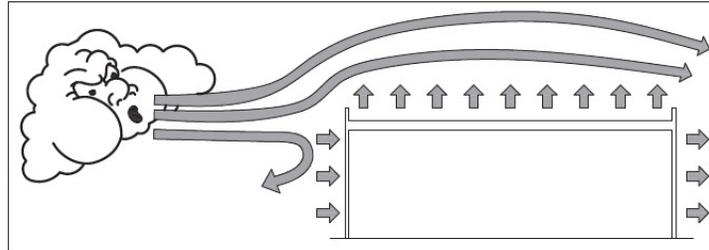


- Provisions: 402 pages
- Commentary: 417 pages

- Soft cover
- Electronic file (PDF)

www.asce.org

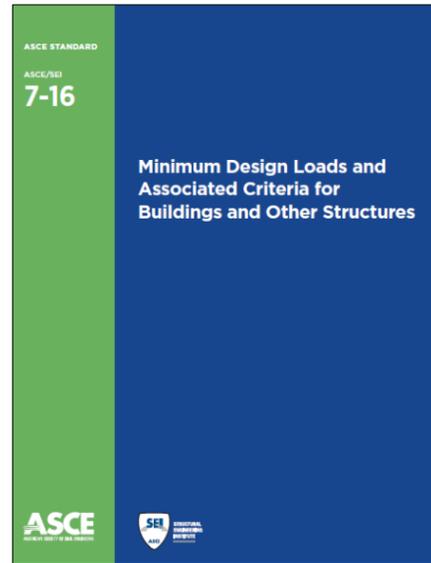
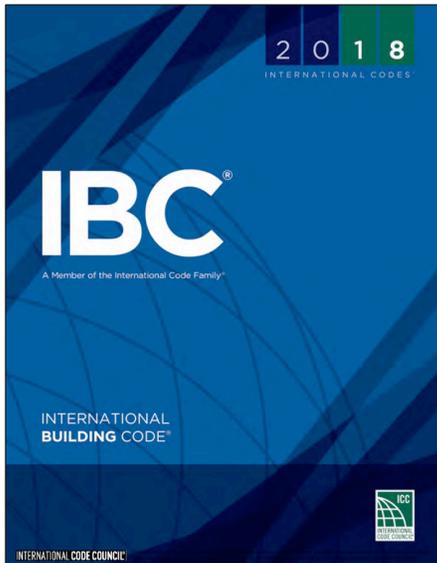
The fundamental concept of wind design



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)

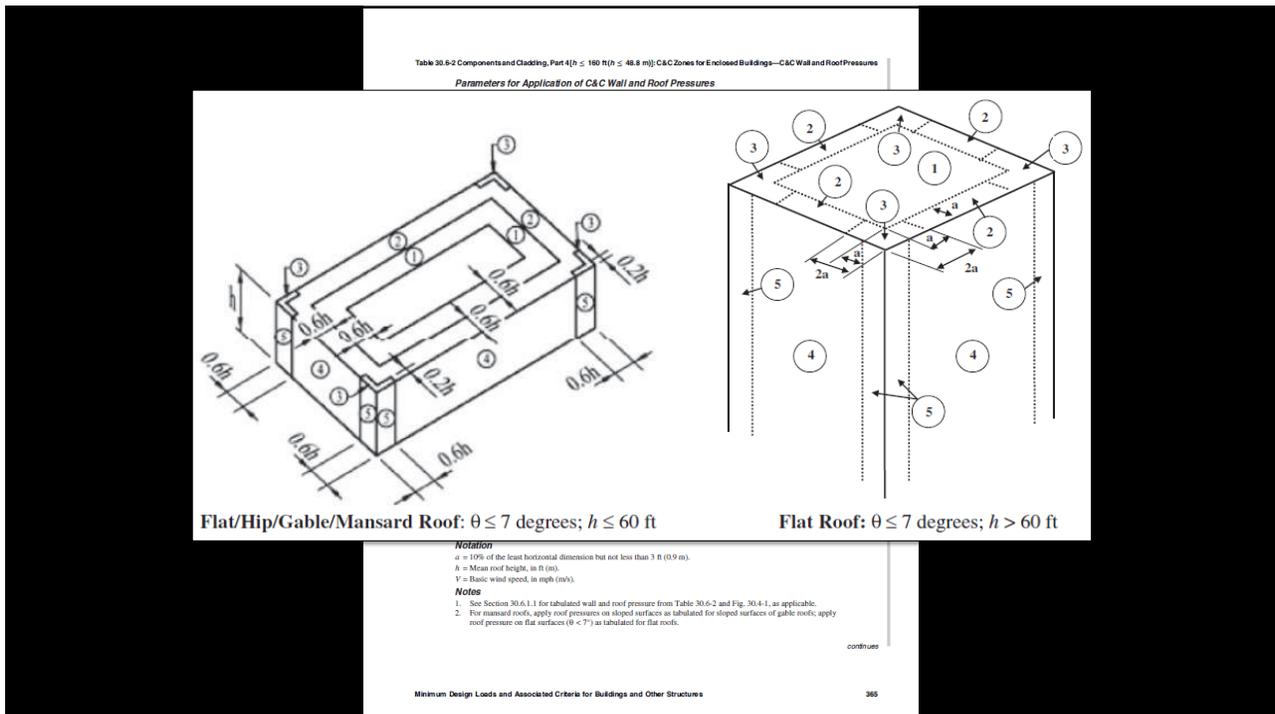
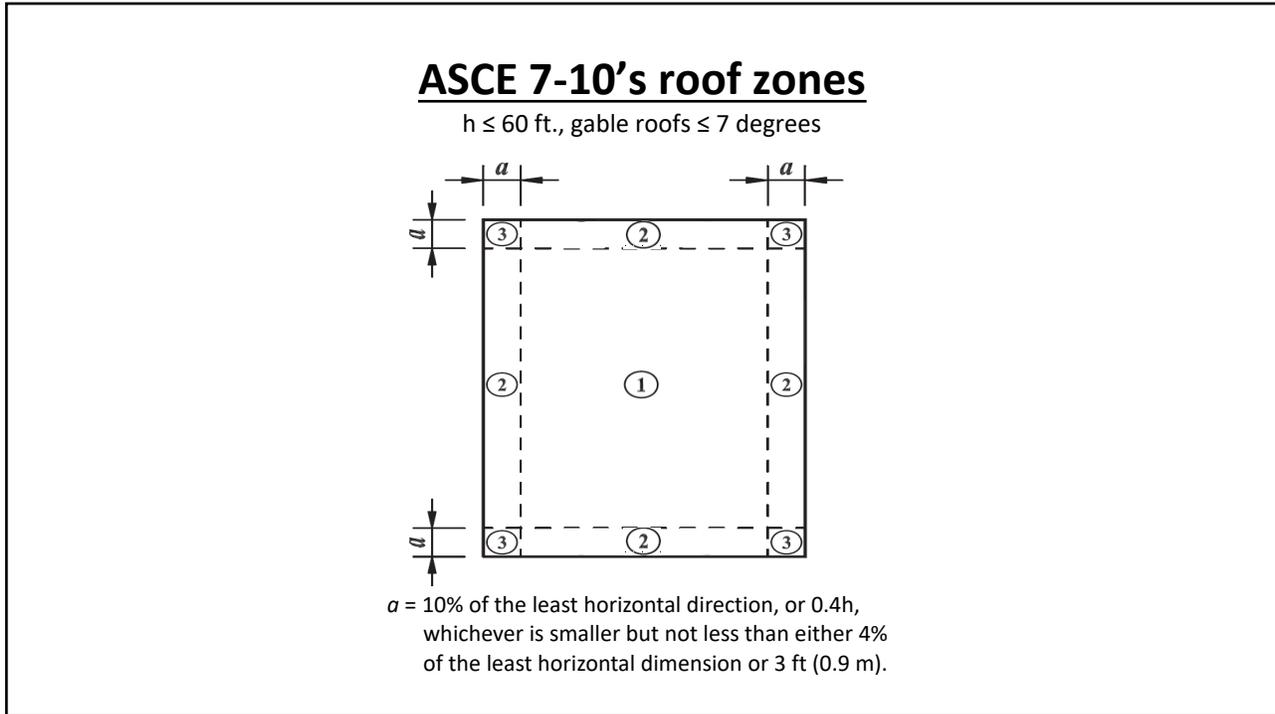
MRI		
Risk Category	ASCE 7-10	ASCE 7-16
I (Low)	300 yrs.	300 yrs.
II (not I, II or IV)	700 yrs.	700 yrs.
Category III (High risk)	1,700 yrs.	1,700 yrs.
Category IV (Essential)	1,700 yrs.	3,000 yrs.

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

Comparing GC_p pressure coefficients

$h \leq 60$ 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%



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)?



roofwinddesigner.com
ASCE 7-05, ASCE 7-10 and ASCE 7-16

Home | Contact Us | FAQ Welcome: Mark Graham | My Projects | Profile | Logout | Administration

Roof Wind Designer is intended to provide users with an easy-to-use means for determining roof systems' design wind loads for many commonly encountered building types that are subject to building code compliance.

Design-wind loads are derived using the American Society of Civil Engineers (ASCE) Standard ASCE 7, "Minimum Design Loads for Buildings and Other Structures." This standard is a widely recognized consensus standard and is referenced in and serves as the technical basis for wind load determination in the International Building Code and NFPA 5000: Building Construction and Safety Code. Roof Wind Designer allows users to choose between ASCE 7's 2005, 2010, and 2016 editions. Roof Wind Designer uses ASCE 7-05's Method 1—Simplified Method, ASCE 7-10's Envelope Procedure, Part 2: Low-rise Buildings (Simplified) of Chapter 30, ASCE 7-16's Envelope Procedure, Part 2: Low-rise Buildings (Simplified) of Chapter 30, and Part 4: Buildings with $60ft < h \leq 160ft$ (Simplified). For a more detailed explanation of ASCE 7's three editions, please [click here](#).

Also, Roof Wind Designer determines roof systems' minimum recommended design wind-resistance loads, which are derived from the building's design wind loads, taking into consideration a safety factor in reliance of [ASTM D6630](#), "Standard Guide for Low Slope Insulated Roof Membrane Assembly Performance," [AISI S100](#), "North American Specification for the Design of Cold-formed Steel Structural Members" and [AA ADM1](#), "Aluminum Design Manual: Part 1-A—Specification for Aluminum Structures, Allowable Stress Design; and Part 1-B—Aluminum Structures, Load and Resistance Factor Design." Using these minimum recommended design wind-resistance loads, users can select appropriate wind resistance classified roof systems.

Edge-metal flashing systems take into consideration a safety factor in reliance of [ANSI/SPRI ES-1](#) "Test Standard for Edge Systems Used with Low Slope Roofing Systems."

Roof Wind Designer has been developed and is maintained by the National Roofing Contractors Association (NRCA), with initial support of the Midwest Roofing Contractors Association (MRCA) and the North/East Roofing Contractors Association (NERCA). The application is currently available at no cost.

Questions regarding Roof Wind Designer can be directed to the [Contact Us](#) page.

To register for a new account [click here](#). If you already have an account, [click here](#) to login.



Moisture in concrete roof decks

Moisture in concrete roof decks

Tech Today

Moisture in concrete roof decks
Customer outcry and strong ties can affect roof systems

Feb. 2010

THE SHORTCOMINGS OF LOOSE PRESCRIPTIVE SPECIFICATIONS WITH LIGHTWEIGHT TECHNOLOGIES

Rick M. Davis, Ph.D., PE
Monsieur, Wisconsin, U.S.A.
Nathan H. Williams, Ph.D.
Research Triangle Institute

Sept. 2011

TECH TODAY

Concrete deck dryness
Alternative approaches are needed to determine when concrete decks are dry

Dec. 2012

INDUSTRY ISSUE UPDATE

MOISTURE ISSUE

Moisture in Lightweight Structural Concrete Roof Decks
Concrete Moisture Presents Challenges for Building Contractors

Aug. 2013

TECH TODAY

A troubling issue
Moisture in lightweight structural concrete presents concerns

Dec. 2013

RESEARCH+TECH



Moisture in concrete roof decks
Moisture-weight and lightweight structure concerns cause problems

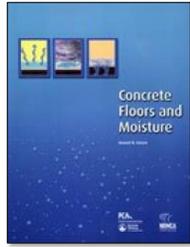
Sept. 2017

PORTLAND CEMENT ASSOCIATION
RESEARCH AND DEVELOPMENT LABORATORIES

Development Department • Bulletin DB9

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

NBCIA Technical Service Section has been receiving inquiries regarding the use and effectiveness of specific concrete admixtures and topical surface treatments to address moisture related issues on concrete roof decks. Such admixtures broadly are referred to as moisture vapor reduction admixtures (MVRAs) or porosity reducing admixtures. NBICA provides recommendations regarding these.

MVRAs
Concrete admixtures intended as MVRAs are specific chemicals added during concrete's handling and setting to provide an additional chemical reaction during the concrete's hydration and curing process. MVRAs seal the concrete mix's pores and create a capillary break between the concrete. The goal is to fill the small pores and capillary openings in curing concrete, minimizing the concrete's ability to pass and release moisture vapor. The goal is intended to be permanent and integral throughout the concrete's entire thickness.

24 www.professionalroofing.net DECEMBER 2018

[Link](#)

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?

The screenshot shows the NRLRC website interface. At the top left is the NRLRC logo (National Roofing Legal Resource Center). To the right, there is a banner for the 40th Anniversary Seminar, dated September 19-21, 2019, at the New York Hilton Midtown, NYC. Below the banner is a navigation menu with links for About NRLRC, Membership, Legal Help Line, Education/Programs, Legal Library, and Members Only. The main content area features a news article titled "Contract provision addresses installation of roof system over concrete deck". The article text discusses the risks of installing a roof over a wet concrete deck and the importance of proper contract provisions. A highlighted section titled "Assessing moisture content in roof deck" states that the Roofing Contractor is not responsible for moisture migration and that the contractor should inspect the deck surface for visible defects before installation. Below this, another paragraph notes that the contractor is not responsible for testing moisture content or evaluating condensation risk.

Polyiso. issues and specifications

Knit lines



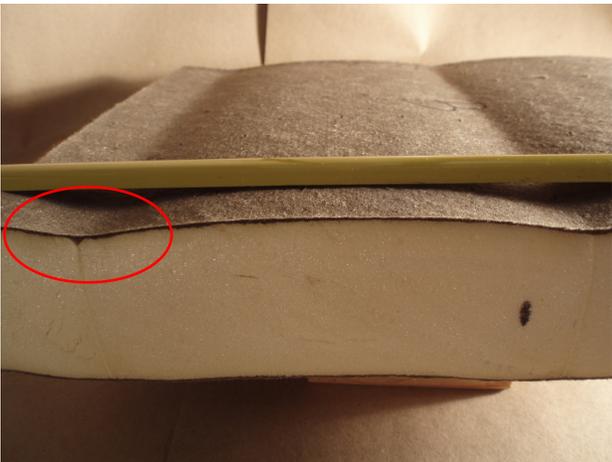
Photo from manufacturer's product literature

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, foam, polyisocyanurate insulation are used as components of low-slope and systems. The NRCA Roofing Manual, *Membrane Roof Systems—2015* provides NRCA's best practice guidelines for using specific polyisocyanurate insulation products to increase roof system performance. Following is an overview of some of those guidelines.

NRCA recommends designers specify a suitable cover board

ASTM C1289

The U.S. product standard for rigid board, foam, polyisocyanurate insulation is ASTM C1289-16a, "Standard Specification for Board 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 identify the specific product intended.

Roofing

ASTM C1289 requires polyisocyanurate insulation to be tested and found to have the minimum thermal resistance (R-value) specified in ASTM C1289, Table 2. Thermal resistance values are available at www.professionalsbuilding.net

Also, product (board) or package markings must bear the product's actual 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 average R-value of 5.31 per inch. In NRCA's opinion, this design average R-value more closely represents conditions in the field compared to LTTR in a tested R-value.

In addition to design average R-value, NRCA recommends designers specify polyisocyanurate insulation by its desired thickness and use LTTR or R-value to avoid specific conditions.

Application-specific guidance

Polyisocyanurate insulation is available to be used in a by foam board form. NRCA recommends roof system designers specify a minimum 6- by 6-foot board size for polyisocyanurate adhered to a substrate. The 6- by 6-foot size is appropriate for hand-laid and mechanically attached applications.

Available thickness ranges from 1 to 4 inches thick. When using foamed polyisocyanurate insulation, NRCA recommends designers specify polyisocyanurate insulation be installed in multiple layers with a 1/4-inch minimum and 2/3-inch maximum thickness per layer.

Furthermore, NRCA recommends designers specify polyisocyanurate insulation be manufactured to have a minimum 30-psi compressive strength (Grade 2 or 3) and

have faces that are compatible with the assembly method and other roof assembly components.

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

ASTM C1289, Type II (foam facer) products generally are used in wall sheathing applications and, because of their faces and compressive strength, they are not considered to be appropriate for roofing applications.

ASTM C1289, Type III (reinforced cellulose 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 1/2 of an inch.

ASTM C1289 also includes four additional product types (Type IV, Type V, Type VI 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*, Chapter 6—Rigid Board Insulation, Section 6.5—Polyisocyanurate.

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

12 www.professionalsbuilding.net MARCH 2017

[Link](#)

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 cellulose 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 1/2 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.

Roof coatings

RESEARCH+TECH



Coating concerns
Building code compliance for roof coatings is limited
by Mark S. Graham

Professional roof coating contractors are used as roof covering technology to provide an additional layer of weather protection. Specific roof coatings can contribute to roof covering fire resistance, solar reflectivity and aesthetic appearance. However, not all roof coating products on the market comply with building code requirements.

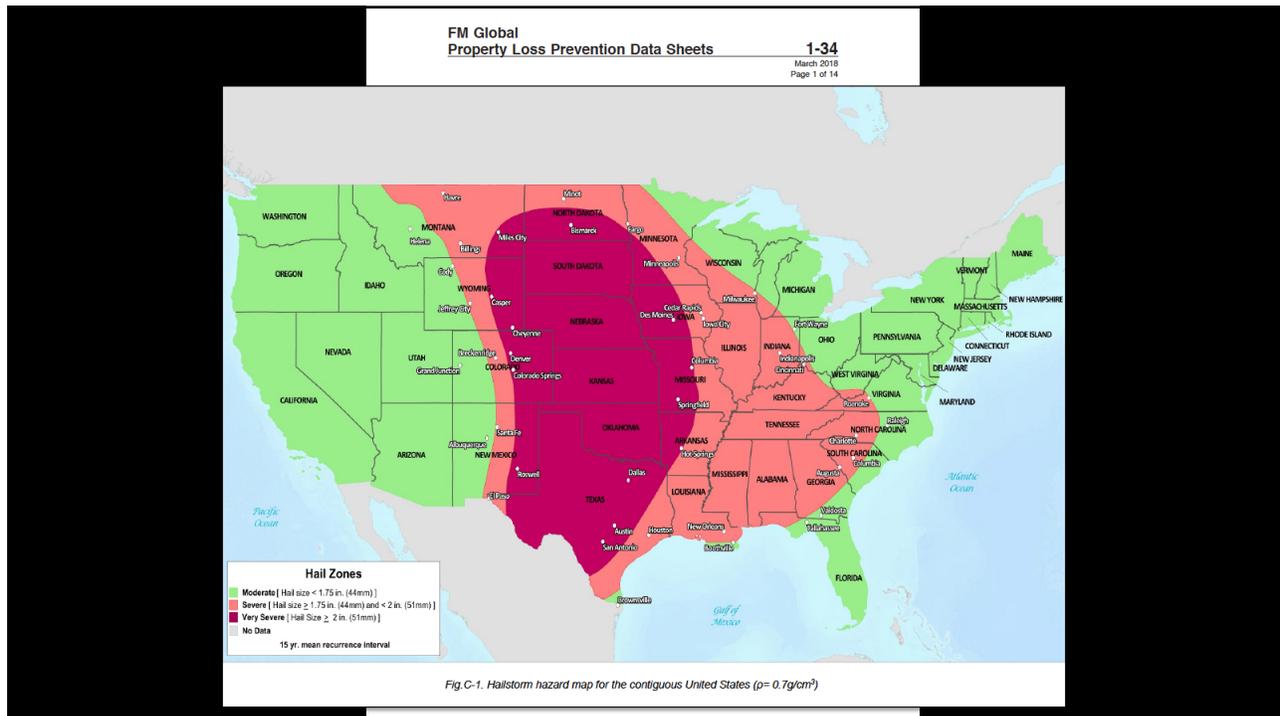
ICC 2018
In the International Building Code® 2018 Edition, Chapter 2—Definitions, “roof coating” is defined as “a fluid applied, without cost, big used for roof maintenance or roof repair, or as a component of a roof covering or roof assembly.” The italicized words denote specific definitions with an exception in Chapter 2.
In ICC 2018 Chapter 15—Roof Assemblies and Insulation, Section 1507.01 Built-up Roofs, Table 1507.01.2 Built-up Roofing Materials lists the following roof coating products as acceptable to be applied to built-up membrane roof systems.
* Acrylic roof coating complying with ASTM D3082, “Specification for Liquid Applied Acrylic Coating Used in Roofing.”

24 www.professionalroofing.net MARCH 2019

[Link](#)

Professional Roofing
March 2019

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

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 L-24 (FM L-24), "Hail Damage," provides a map identifying these regions.

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

In the latest revision of FM L-24, dated October 2014, FM Global has identified a new VSH region, encompassing Oklahoma, Kansas and some northern counties in Texas. FM L-24's Table 3 identifies the specific northern Texas counties.

To access FM Global Data Sheets, including FM L-24—"Hail Damage," go to www.professionalroofing.net.

22 www.professionalroofing.net DECEMBER 2017

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 L-24, "Hail Damage" (FM L-24). 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 L-24
FM L-24 provides loss prevention guidelines to minimize the potential for hail damage to buildings, roof-mounted equipment and other outdoor equipment. FM Global updates FM L-24 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 considers hailstones are a widespread hazard affecting many areas of the world that can severely damage buildings' roof systems, roofing (EVC), walls and skylights. Cooling towers and exposed glass and plastic components of outdoor equipment also can be

20 www.professionalroofing.net MAY 2018

Professional Roofing, May 2018
[Link to access this article](#)



“Fully” adhered



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

defined, the
100 percent
or materials.

professionals
plete adhe-
ch as a single-
rigid board.
fully cannot be

se, complete
y membrane and
ate is impos-
membrane
nch” joints.
in insulation
ion needs to be
U.S. product
of insulation.
ification
specification
membrane
forms a bond
ch and crushing
in inch in depth
specification
h. Because
ins used to lay
ed membrane
y and remains
spected irrespe-
ctively.

Irregular, nonsmooth roof deck surfaces
create similar situations. Because board-edge
insulation is relatively rigid, it generally will
not readily conform to irregularities in roof
deck substrates. Individual rigid boards tend
to rest on the high points in a roof deck’s dis-
tributed surface and span the low points.
As a result, rigid board insulation seldom
is completely adhered to roof deck substrates.
It generally is adhered at the relative high
points in the roof deck’s surface and may
be partially or marginally adhered and even
unadhered at the relative low points. Specifying
smaller insulation board sizes (4 by 4 feet
instead of 4 by 8 feet) generally is suggested
to minimize rigid insulation boards from
spanning substrate low-point irregularities.

In practice
The concept of lacking 100 percent, complete
adhesion between two adhered surfaces
is not new to the roofing industry; it has long
been recognized in the application of built-
up roof membranes where work between
plies can occur. To address this, NRCA’s
“Quality Control Guidelines for the Application
of Built-up Roofing” indicates interply
mopping was intended to be continuous,
however, work of limited size was permitted.
provided overlapping voids do not occur
between two or more plies. NRCA has main-
tained this position since the late 1970s, and
it has become well-accepted by the roofing
industry.

As it applies to adhering rigid board insu-
lation in continuously applied adhesive appli-
cations, actual adhesion rates of about 60 to
90 percent are common (even less in some
specific instances) in successfully performing
adhered roof systems.

On this basis, NRCA recommends the
term “fully adhered” be avoided and suggests
the term “adhered” for field applications
because it is more realistic. ●●●

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

12 www.professionalroofing.net JANUARY 2017

Professional Roofing,
January 2017

Q & A...



Mark S. Graham

Vice President, Technical Services
National Roofing Contractors Association
10255 West Higgins Road, 600
Rosemont, Illinois 60018-5607

(847) 299-9070
mgraham@nrca.net
www.nrca.net

Twitter: @MarkGrahamNRCA
Personal website: www.MarkGrahamNRCA.com