ASCE 7

1

Agenda

ASCE 7
(American Society of Civil Engineers)

- Background
  - ASCE 7 and why it is important for roof wind design
  - ASCE 7 and the IBC
- Building Characteristics
  - Location and Use
  - Physical Parameters
- Changes from ASCE 7-10, ASCE 7-16 & ASCE 7-22

2

Why is ASCE 7 important?

- **The building code (IBC)** requires roof assemblies resist the uplift pressures calculated by the **ASCE 7**
- Independent testing of the assembly **(ANSI/FM 4474)** is used to certify compliance with the **IBC**
- **Rating** achieved by assembly must be **greater than or equal** to the ASCE 7 results.

3

Background

ASCE 7
(American Society of Civil Engineers)

Provides method to calculate building pressure loads (lbs./sqft.) due to:

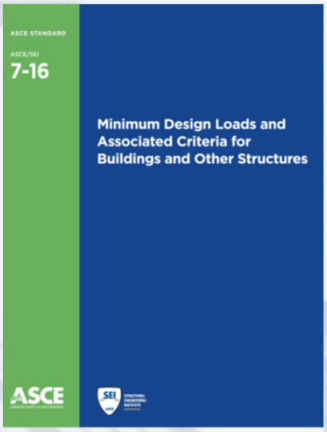
- Soil
- Hydrostatic Pressure
- Floods
- Snow
- Rain
- Earthquake
- Wind
- Etc.

4

Standard

ASCE 7
(American Society of Civil Engineers)

- 1988- first edition of the ASCE 7 was published
- Updated – 1993, 1995, 1997, 2002, 2005, 2010, 2016 & 2022
- Latest publication is 1,046-pages
- Roof Systems uplift, approximate 100-pages, explains method on how to calculated wind loads (lbs./sqft.)



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Adoption by State

International Code Council (July 2022)

IBC edition	ASCE-7 edition	States
2018 & 2021	2016	AL, CA, FL, GA, HI, ID, MD, MN, MS, MT, NE, NJ, NY, ND, OK, OR, PA, RI, SC, SD, UT, VA, WA, WV & WY Total 25 States
2012 & 2015	2010	AK, AR, CT, IN, IA, KY, LA, ME, MA, MI, NC, NH, NM, OH, TN, TX, VT & WI Total 18 States & DC*
Adopted by Local Governments	X	AZ, CO, DE, IL, KS, MO, NV Total 7 States

*District of Columbia

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Factors to Determine Uplift

ASCE 7

- **Building location**
  - Wind
  - Terrain
- **Building use**
  - Risk Category
- **Building physical parameters**
  - Height
  - Openings

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Building Location

Terrain & Wind

Terrain

- Exposure
  - "B" = urban/suburban
  - "C" = open terrain
  - "D" = close to a large body of water
- Hills & Escarpments

Wind

- ASCE 7 Basic Wind Maps (Ultimate Winds or Vult)

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Risk Categories (Building Use)

Risk Categories incorporated in the wind speed maps

Risk Category I
Low risk to human life
(Agricultural or storage)

Risk Category II
Not I, III, & IV
(Commercial Buildings)

Risk Category III/IV
Substantial risk to human life
(Schools, Public Buildings, Hospitals, Power Plants, etc.)

For complete definition of each Risk Category, refer to ASCE 7 Table 1.5-1

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Building Physical Parameters
Characteristics

Roof Area

- Height & Slope
- Parapets Heights

Building Structure

- On a hill or precipices
- Building Openings
  - Open, Partial Enclosed, Enclosed
- Building Overhangs

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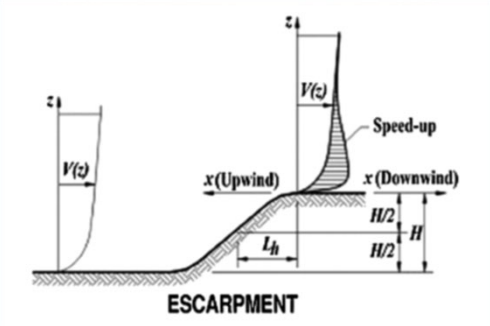
Building Location
Hills and Escarpments

Special calculations are required for hills and escarpments:



Note: No calculations available for intensified winds at the end of valleys. Local authorities would need to help.

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Building Physical Parameters
Openings

Consider closely, truck dock doors, breakable windows, or other openings on a single wall with a combined total greater than 4-sq.ft.

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Building Physical Parameters
Openings

Open Building: A building have each wall at least 80% open.

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Basic Information to Determine Uplift
Check List

- Applicable Code and Standard
- Building Location for:
  - Ultimate wind speed
  - Topography
  - Surrounding Terrain
  - Wind Direction
- Building Use
- Building Physical Parameters
  - Height
  - Openings

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Velocity Pressure Formula

ASCE 7-10: qz = 0.00256 x Kz x Kzt x Kd x V² x 0.6

ASCE 7-16: qz = 0.00256 x Kz x Kzt x Ke x Kd x V² x 0.6

ASCE 7-22: qz = 0.00256 x Kz x Kzt x Ke x ~~Kd x~~ V² x 0.6

- qz = velocity pressure
- 0.00256 = numerical coefficient (air density)
- Kz = exposure coefficient evaluated at height
- Kzt = topographic factor
- Kd = wind directionality factor
- V² = basic ultimate wind speed
- **0.6 = allowable stress factor**
- **I = Importance Factor**
- **Ke = Elevation Factor**

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Design Pressure Calculations
(Zonal Pressure Calculation)

P = qz [(GCp) – (GCpi)]

- P = Design Pressure for each roof Zone
- GCp = external pressure coefficient & gust-effect factor
- GCpi = internal pressure coefficient & gust-effect factor

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ASCE 7-2010 & 7-2016

Minimum Design Loads and Associated Criteria for Buildings and Other Structures

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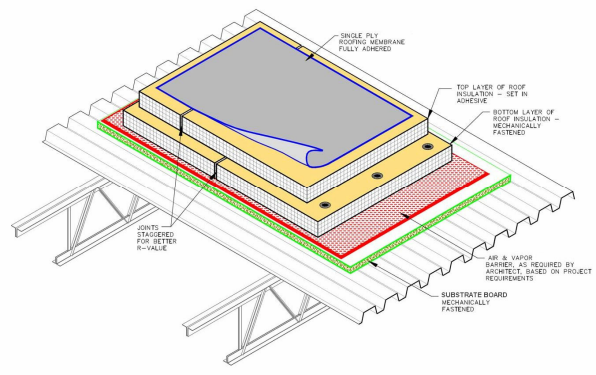
ASCE 7-10 & 7-16

Cladding and Components

Both standard refer to roofing systems and materials as cladding. Roofing assemblies are not structural members.



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ASCE 7 Similarities

Chapters

ASCE-7 edition	2010	2016
Chapter(s)	Chapters 26-31	Chapters 26-31
General Requirements	X	X
MWFRS* (Directional Procedure)	X	X
MWFRS* (Envelope Procedure)	X	X
Appurtenances and Other Structures (Directional Procedure)	X	X
Components and Cladding	X	X
Wind Tunnel Procedure	X	X

*MWFRS: Main Wind Force Resistance System

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ASCE 7

Chapter 26 – General Requirements

ASCE-7 edition	2010	2016
Scope	X	X
Definitions	X	X
Ultimate Wind Speed Maps	X	X
Exposure	X	X
Gust Factor	X	X
Topographic Factor	X	X
Elevation Above Sea Level Factor		X

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ASCE 7

Chapter 30 – Components & Cladding

ASCE-7 edition	2010 & 2016
Analytical Method (h <= 60-ft)	X
Simplified Method (h<= 60-ft)	X
Analytical Method (h> 60-ft)	X
Simplified Method (h <= 160-ft)	X
Internal Pressure Coefficient (GCpi)	X
External Pressure Coefficient (GCp)	X

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ASCE 7

Chapter 31 – Wind Tunnel Procedure

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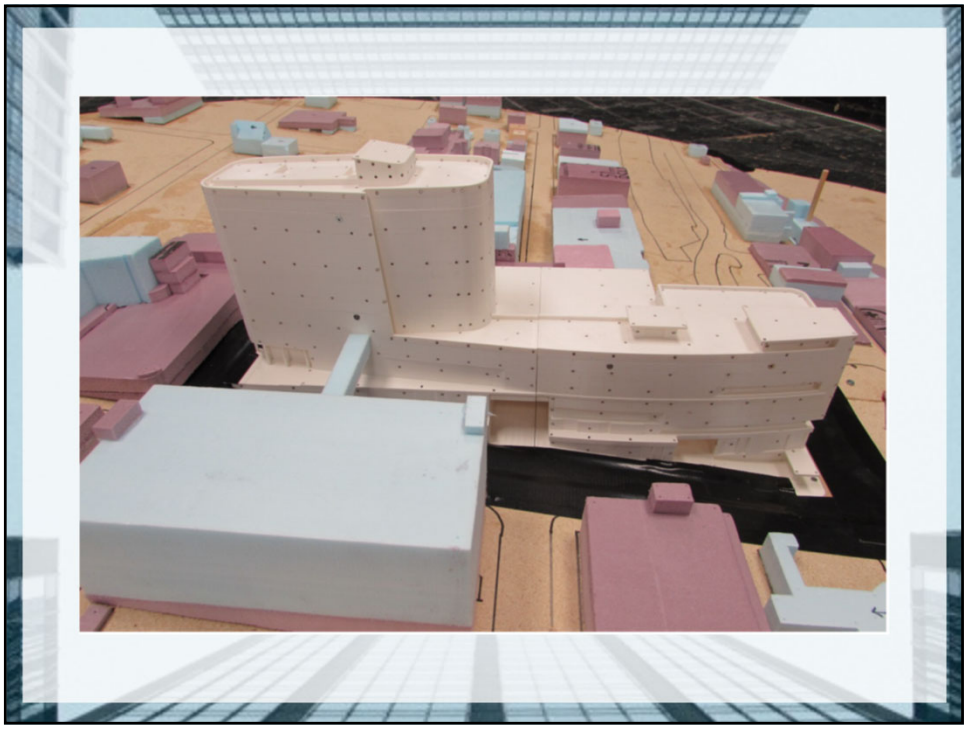

23

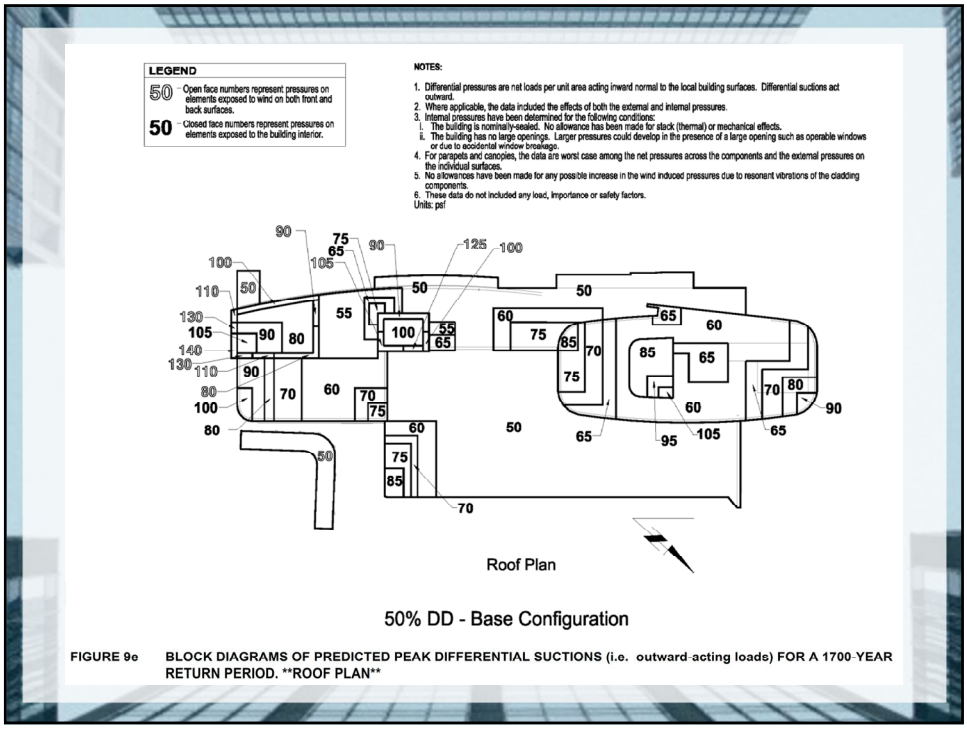

FIGURE 9e BLOCK DIAGRAMS OF PREDICTED PEAK DIFFERENTIAL SUCTIONS (i.e. outward-acting loads) FOR A 1700-YEAR RETURN PERIOD. **ROOF PLAN**

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ASCE 7-2016

Minimum Design Loads and Associated Criteria for Buildings and Other Structures

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ASCE 7-16

Adjusted from ASCE 7-10

- **Adjusted** the Calculations
- **Reduced Exposure "B" Kz factor** for bldg. heights < 30-ft
- **New** Wind Speed Maps **(4 sets)**
- **New** Roof Area Zones (60-ft or less in height)
- **Higher GCp** for 60-ft or less height

Incorporate in IBC 2018 & 2021

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ASCE 7-16

Modified Uplift Equation

ASCE 7-10

$$qz = 0.00256 \times Kz \times Kzt \times Kd \times V2$$

ASCE 7-16

$$qz = 0.00256 \times Kz \times Kzt \times Ke \times Kd \times V2$$

Ke = Ground Elevation Factor

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ASCE 7-16

Table 26.9-1 Ground Elevation Factor, K_e

Ground Elevation above Sea Level ft	
<0	See note 2
0	1.00
1,000	0.96
2,000	0.93
3,000	0.90
4,000	0.86
5,000	0.83
6,000	0.80
>6,000	See note 2

Note:

1. The conservative approximation Ke = 1.00 is permitted in all cases
2. The factor Ke shall be determined using interpolation or from another formula

Can reduce uplift from 4% to 20% depending on elevation above sea level

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ASCE 7-16

Modified Kz Factor for less than 30-ft high

Table 26.10-1 Velocity Pressure Exposure Coefficients, K_h and K_z

Exposure		
B	C	D
0.57 (0.70)[a]	0.85	1.03
0.62 (0.70)[a]	0.90	1.08
0.66 (0.70)[a]	0.94	1.12
0.70	0.98	1.16

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ASCE 7-10 & 7-16 Wind Maps

Risk Category Based

ASCE 7-10

Based on Risk Category (use of

- Risk Cat I
- Risk
-

ASCE

Based

- RI
- Risk Cat
- Risk Cat III:
- Risk Cat IV: 3,000-year *MRI (US = 105-mph <)

-mph)

)

<)

mph <)

(US = 100-mph <)

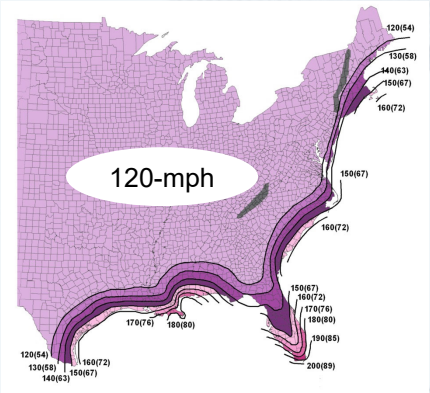
3,000-year *MRI means
1/3000 chance in one year of wind of this wind speed may happen.
(0.00033)

*Mean Recurrence Interval

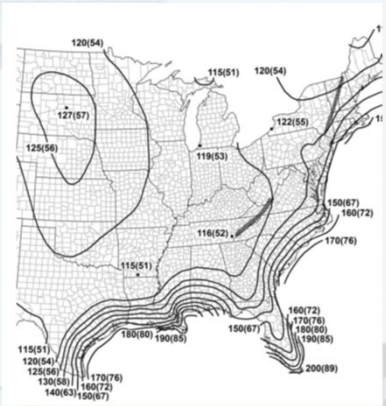
30

ASCE 7-10 & 7-16 Wind Maps

3-Sec Peak Gust Wind



ASCE 7-2010
Risk Category III/IV

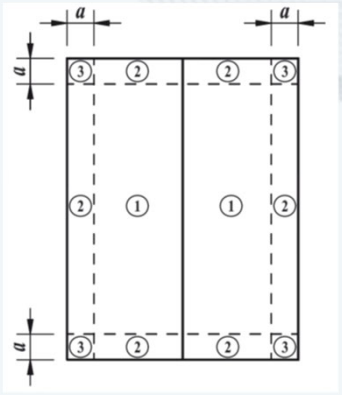


ASCE 7-2016
Risk Category IV

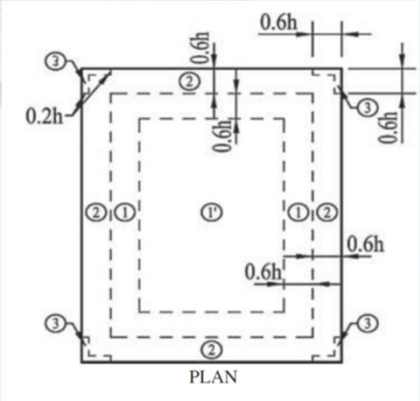
31

ASCE 7-10 & 7-16

Roof Zone Layout (60-ft or less)



- a = 0.4 x height or 0.1 x width, whichever is less, but not less than 0.04 x width or 3-ft.



- Zone 1' = "One Prime"
- 0.6 x height for all areas, except corner which is 0.2 x height

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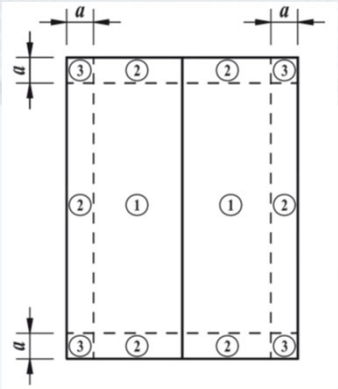
ASCE 7-10 & 7-16

Roof Zone Layout (greater than 60-ft)



a = 0.1 x width, but not less than or 3-ft.

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ASCE 7-16

GCp = external pressure coefficient

Design Pressure Calculations

- P (pressure) = q_z [(GC_p) – (GC_{pi})]
- GC_p = external pressure coefficient & gust-effect factor
- GC_{pi} = internal pressure coefficient & gust-effect factor

GCp is determined based on roof zones:

Roof Zones for Bldgs. 60 or less	ASCE 7-10 GCp Coefficient
Zone 1	1
Zone 2	1.8
Zone 3	2.8

Roof Zones for Bldgs. 60 or less	ASCE 7-16 GCp Coefficient
Zone 1’	0.9
Zone 1	1.7
Zone 2	2.3
Zone 3	3.2

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ASCE 7-16

GCpi = internal pressure coefficient

Opening Types	Amount of Openings	ASCE 7-16 GCpi Coefficient
Enclosed	Less than 10%	.18
Partially Enclosed	10% to 20%	.55
Partially Open	Does not comply with the others	.18
Open	80%	0

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ASCE 7 Calculations

Wind Loads on the Roof

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Examples

Determine the forces exposed to a roof using ASCE 7-16 Calculations

Chapter 30 Components and Cladding Examples

- **Part 1 – Analytical method for h ≤ 60 ft**
- **Part 2 – Simplified method for h ≤ 60 ft**
- Part 3 – Analytical method for h > 60 ft
- Part 4 – Simplified method for h ≤ 160 ft

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Building Configuration

Location: Chicago, IL
Building Elevation: 597-ft
Exposure Category: "C" Flat open terrain
Building Height: 40-ft
Parapet Height: 18-inches
Roof Width: 200-ft
Roof Length: 400-ft
Enclosure Type: Enclosed
Occupancy: Risk Category IV

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Example
Analytical Method for
h ≤ 60 ft

ASCE 7-16 Calculation for Wind Loads on a Roof

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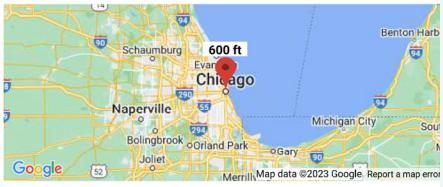
ATC Hazards by Location

Search Information

Address:	Chicago, IL, USA
Coordinates:	41.8781136, -87.6297982
Elevation:	600 ft
Timestamp:	2023-09-15T18:30:18.022Z
Hazard Type:	Wind



ASCE 7-16		ASCE 7-10		ASCE 7-05	
MRI 10-Year	74 mph	MRI 10-Year	76 mph	ASCE 7-05 Wind Speed	90 mph
MRI 25-Year	80 mph	MRI 25-Year	84 mph		
MRI 50-Year	85 mph	MRI 50-Year	90 mph		
MRI 100-Year	92 mph	MRI 100-Year	96 mph		
Risk Category I	100 mph	Risk Category I	105 mph		
Risk Category II	107 mph	Risk Category II	115 mph		
Risk Category III	114 mph	Risk Category III-IV	120 mph		
Risk Category IV	119 mph				

http://hazards.atcouncil.org

Except for Oregon

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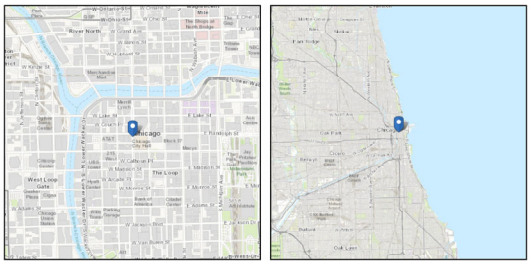
ASCE 7 Hazards Report

Address:
Chicago
Illinois,

Standard: ASCE/SEI 7-22
Risk Category: IV
Soil Class: Default

Latitude: 41.88425
Longitude: -87.63245
Elevation: 597.1553823373181 ft (NAVD 88)



Wind

Results:

Wind Speed	119 Vmph
10-year MRI	74 Vmph
25-year MRI	81 Vmph
50-year MRI	85 Vmph
100-year MRI	91 Vmph
300-year MRI	100 Vmph
700-year MRI	107 Vmph
1,700-year MRI	114 Vmph
3,000-year MRI	119 Vmph
10,000-year MRI	128 Vmph
100,000-year MRI	147 Vmph
1,000,000-year MRI	167 Vmph

http://asce7hazardtool.online

Except for Oregon

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ASCE 7-16

$qz = 0.00256 \times Kz \times Kzt \times Ke \times Kd \times V^2$

- 0.00256 = numerical coefficient to be used except where sufficient climatic data are available
- Kz = velocity pressure exposure coefficient evaluated at height z = h
- Kzt = Topographic factor
- Ke = Elevation above sea level
- Kd = wind directionality factor
- V^2 = basic ultimate wind speed base on Risk Category

$P \text{ (pressure)} = q_z [(GC_p) - (GC_{pi})]$

- GC_p = external pressure coefficient & gust-effect factor
- GC_{pi} = internal pressure coefficient & gust-effect factor

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Kz
(TABLE 26.10-1)

Table 26.10-1 Velocity Pressure Exposure Coefficients, K_h and K_z

Height above Ground Level, z		Exposure		
ft	m	B	C	D
0–15	0–4.6	0.57 (0.70)[a]	0.85	1.03
20	6.1	0.62 (0.70)[a]	0.90	1.08
25	7.6	0.66 (0.70)[a]	0.94	1.12
30	9.1	0.70	0.98	1.16
40	12.2	0.76	1.04	1.22
50	15.2	0.81	1.09	1.27
60	18.0	0.85	1.13	1.31

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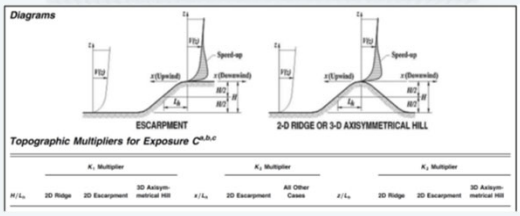
Kzt
Topographical Factor
Figure 26.8-1



$Kzt = (1+K_1K_2K_3)^2$

- K1 = Factor to account for shape of topographic feature and maximum speed-up effect.
- K2 = Factor to account for reduction in speed-up with distance upwind or downwind of crest.
- K3 = Factor to account for reduction in speed-up with height above local terrain.

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Ke

Elevation Factor

Table 26.9-1 Ground Elevation Factor, K_e

Ground Elevation above Sea Level		Ground Elevation Factor
ft	m	K_e
<0	<0	See note 2
0	0	1.00
1,000	305	0.96
2,000	610	0.93
3,000	914	0.90
4,000	1,219	0.86
5,000	1,524	0.83
6,000	1,829	0.80
>6,000	>1,829	See note 2

Notes

1. The conservative approximation $K_e = 1.00$ is permitted in all cases.
2. The factor K_e shall be determined from the above table using interpolation or from the following formula for all elevations:
   $K_e = e^{-0.0000362 z_g}$ (z_g = ground elevation above sea level in ft).
   $K_e = e^{-0.000119 z_g}$ (z_g = ground elevation above sea level in m).
3. K_e is permitted to be take as 1.00 in all cases.

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Kd

Wind Directionality

Table 26.6-1

Table 26.6-1 Wind Directionality Factor, K_d

Structure Type	Directionality Factor K_d
Buildings	
Main Wind Force Resisting System	0.85
Components and Cladding	0.85
Arched Roofs	0.85
Circular Domes	1.0[a]
Chimneys, Tanks, and Similar Structures	
Square	0.90
Hexagonal	0.95
Octagonal	1.0[a]
Round	1.0[a]
Solid Freestanding Walls, Roof Top Equipment, and Solid Freestanding and Attached Signs	0.85
Open Signs and Single-Plane Open Frames	0.85
Trussed Towers	
Triangular, square, or rectangular	0.85
All other cross sections	0.95

[a]Directionality factor $K_d = 0.95$ shall be permitted for round or octagonal structures with nonaxisymmetric structural systems.

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Velocity Pressure Calculation

$qz = 0.00256 \times Kz \times Kzt \times Ke \times Kd \times V^2$

Variable	Building	ASCE 7-16
Kz	Height & Terrain	1.04
Kzt	Topography	1
Kd	Wind Directionality	0.85
V	Risk Cat Maps	119-mph
q_z	**Results**	**19.2-lbs/sqft**

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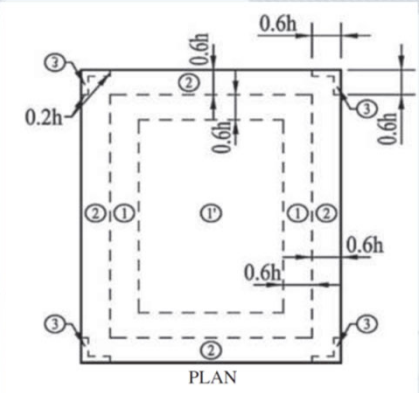
Wind Load

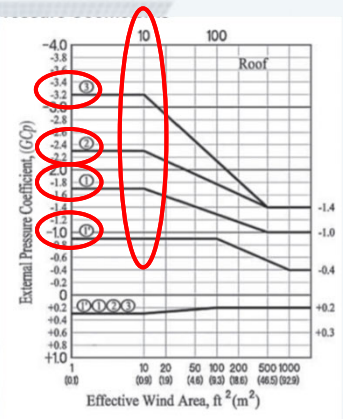
Calculating Uplift Pressure

P = qz { GCp – Gcpi }

- Gcp = External Pressure Coefficient (Table 30.3-2A)



- 0.6 x height for all areas, except corner which is 0.2 x height



ASCE 7-16

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Wind Load

Calculating Uplift Pressure

P = qz { GCp – GCpi }

- GCpi = Internal Pressure Coefficient (Table 26.13-1)

Table 26.13-1 Main Wind Force Resisting System and Components and Cladding (All Heights): Internal Pressure Coefficient, (GC_{pi}), for Enclosed, Partially Enclosed, Partially Open, and Open Buildings (Walls and Roof)

Enclosure Classification	Criteria for Enclosure Classification	Internal Pressure	Internal Pressure Coefficient, (GC_{pi})
Enclosed buildings	A_o is less than the smaller of $0.01A_g$ or 4 sq ft (0.37 m) and $A_{oi}/A_{gi} \le 0.2$	Moderate	+0.18 −0.18
Partially enclosed buildings	$A_o > 1.1A_{oi}$ and $A_o >$ the lesser of $0.01A_g$ or 4 sq ft (0.37 m) and $A_{oi}/A_{gi} \le 0.2$	High	+0.55 −0.55
Partially open buildings	A building that does not comply with Enclosed, Partially Enclosed, or Open classifications	Moderate	+0.18 −0.18
Open buildings	Each wall is at least 80% open	Negligible	0.00

Notes

1. Plus and minus signs signify pressures acting toward and away from the internal surfaces, respectively.
2. Values of (GC_{pi}) shall be used with q_z or q_h as specified.
3. Two cases shall be considered to determine the critical load requirements for the appropriate condition:
   a. A positive value of (GC_{pi}) applied to all internal surfaces, or
   b. A negative value of (GC_{pi}) applied to all internal surfaces.

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Calculating Uplift Pressure

P = qz { GCp – GCpi }

Roof Area	qz	GCp	GCpi	Ult. Strength Result in Lbs/Sqft
Zone 1’	19.2	-0.9	0.18	-34.6
Zone 1	19.2	-1.7	0.18	-60.2
Zone 2	19.2	-2.3	0.18	-79.5
Zone 3	19.2	-3.0	0.18	-108.3

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ASCE Ultimate Wind Maps

ASCE 7-10 & ASCE 7-16

ASCE 7-05 results where Allowable Stress Design, while 7-10 & 7-16 results are Ultimate Strength

Allowable Stress Design (Vasd)

Are nominal loads for cladding so as not to exceed the structure. Roofing assemblies are defined as cladding.

Ultimate Strength (Vult)

Are the strength loads necessary for structural members

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ASCE Ultimate Wind Maps

Allowable vs. Ultimate

ASCE 7-10 & 7-16 Results are Ultimate Strength Pressures (Ult.)

But…

Cladding uses **Allowable Stress Design Pressures (ASD)**, how is this determined?

ASD = ASCE 7-16 Ult. results x 0.6

Or

Convert wind speed back to Allowable for Calculations

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International Building Code:
Editions 2012, 2015, 2018, 2021 & 2024

1609.3.1 Wind speed conversion. When required, the ultimate design wind speeds of Figures 1609A, 1609B and 1609C shall be converted to nominal design wind speeds, V_{asd}, using Table 1609.3.1 or Equation 16-33.

$$V_{asd} = V_{ult}\sqrt{0.6}$$ = Vult x 0.775 **(Equation 16-33)**

TABLE 1609.3.1
WIND SPEED CONVERSIONS[a, b, c]

V_{ult}	100	110	120	130	140	150	160	170	180	190	200
V_{asd}	78	85	93	101	108	116	124	132	139	147	155

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Design Pressure

Roof Area	ASCE 7-16 Results in lbs/sqft.
Zone 1’	-34.6 x 0.6= **-20.8**
Zone 1	-60.2 x 0.6 = **-36.1**
Zone 2	-79.5 x 0.6 = **-47.7**
Zone 3	-108.3 x 0.6 = **-65.0**

Ultimate or strength-based wind speeds are used in the wind speed maps. Apply 0.6 factor for allowable stress design

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Building Configuration

Location: St. Petersburg, FL
Building Elevation: 597-ft
Exposure Category: “D” within 1 mile of the ocean
Building Height: 100-ft
Parapet Height: 24-inches
Roof Width: 200-ft
Roof Length: 400-ft
Enclosure Type: Enclosed
Occupancy: Risk Category III/IV

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Example 3
Analytical Method for h > 60 ft

ASCE 7-16 Calculation for Design Pressures on a Roof

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ASCE 7-16

$qz = 0.00256 \times Kz \times Kzt \times Ke \times Kd \times V^2$

- 0.00256 = numerical coefficient to be used except where sufficient climatic data are available
- Kz = velocity pressure exposure coefficient evaluated at height z = h
- Kzt = Topographic factor
- Ke = Elevation above sea level
- Kd = wind directionality factor
- V^2 = basic ultimate wind speed base on Risk Category

$P \text{ (pressure)} = q_z [(GC_p) - (GC_{pi})]$

- GC_p = external pressure coefficient & gust-effect factor
- GC_{pi} = internal pressure coefficient & gust-effect factor

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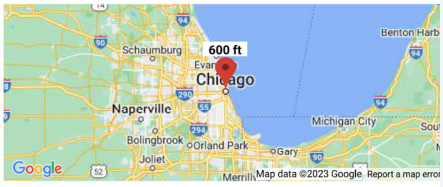
ATC Hazards by Location

Search Information

Address:	Chicago, IL, USA
Coordinates:	41.8781136, -87.6297982
Elevation:	600 ft
Timestamp:	2023-09-15T18:30:18.022Z
Hazard Type:	Wind



ASCE 7-16		ASCE 7-10		ASCE 7-05	
MRI 10-Year	74 mph	MRI 10-Year	76 mph	ASCE 7-05 Wind Speed	90 mph
MRI 25-Year	80 mph	MRI 25-Year	84 mph		
MRI 50-Year	85 mph	MRI 50-Year	90 mph		
MRI 100-Year	92 mph	MRI 100-Year	96 mph		
Risk Category I	100 mph	Risk Category I	105 mph		
Risk Category II	107 mph	Risk Category II	115 mph		
Risk Category III	114 mph	Risk Category III-IV	120 mph		
Risk Category IV	119 mph				

http://hazards.atcouncil.org

Except for Oregon

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Kz

(TABLE 26.10-1/Exposure D)

Height above Ground Level, z		Exposure		
ft	m	B	C	D
0–15	0–4.6	0.57 (0.70)[a]	0.85	1.03
20	6.1	0.62 (0.70)[a]	0.90	1.08
25	7.6	0.66 (0.70)[a]	0.94	1.12
30	9.1	0.70	0.98	1.16
40	12.2	0.76	1.04	1.22
50	15.2	0.81	1.09	1.27
60	18.0	0.85	1.13	1.31
70	21.3	0.89	1.17	1.34
80	24.4	0.93	1.21	1.38
90	27.4	0.96	1.24	1.40
100	30.5	0.99	1.26	1.43
120	36.6	1.04	1.31	1.48

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Velocity pressure calculation

$$qz = 0.00256 \times Kz \times Kzt \times Kd \times Ke \times V^2$$

Variable	Building	ASCE 7-16
Kz	Hight & Terrain	1.43
Kzt	Topography	1
Kd	Wind Directionality	0.85
Ke	Elevation Factor	1
V	Risk Cat Maps	119-mph
q_z	**Results**	**44.1-lbs/sqft**

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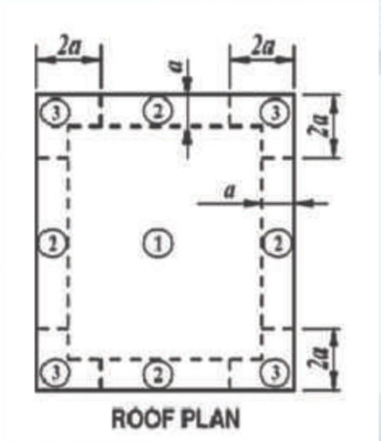
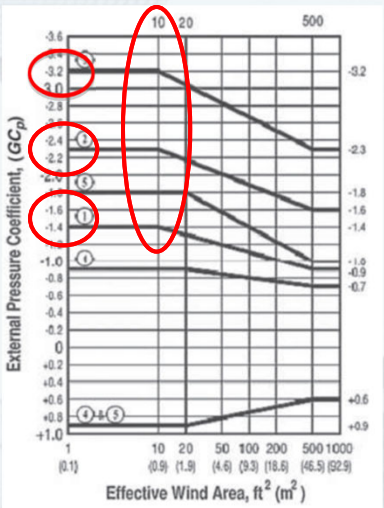
GCp Coefficient
Figure 30.5-1



0.1 x width but not less than 3-ft.



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Gcpi Coefficient
Table 26.13-1

Enclosure Classification	Internal Pressure Coefficient, (GC_{pi})
Enclosed buildings	+0.18 −0.18
Partially enclosed buildings	+0.55 −0.55
Partially open buildings	+0.18 −0.18
Open buildings	0.00

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Calculating Design Pressure

$$P = qz \{ GCp - GCpi \}$$

Roof Area	qz	GCp	GCpi	Result in Lbs/Sqft
Field	44.1	-1.4	0.18	-69.6
Perimeter	44.1	-2.3	0.18	-109.3
Corner	44.1	-3.2	0.18	-148.9

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Design Pressure

Roof Area	ASCE 7-16 Results in Lbs/Sqft
Field	-69.6 x 0.6= **-41.8**
Perimeter	-109.3 x 0.6 = **-65.6**
Corner	-148.9 x 0.6 = **-89.4**

Ultimate or strength-based wind speeds are used in the wind speed maps.
Apply 0.6 factor for allowable stress design

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ASCE 7-2022

Minimum Design Loads and Associated Criteria for Buildings and Other Structures

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ASCE 7-22

Adjusted from ASCE 7-16

- **Adjusted** the Calculations (moving wind directionality factor)
- **Removed Simplified Methods** to determine uplift pressures
- **New** Roof Area Zones for Steep Sloped Roofs
- **New Chapter 32 on Tornados Loads**
- **New Calculations** for tornados
- **New Maps** for tornados

Incorporate in IBC 2024

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Tornado Loads

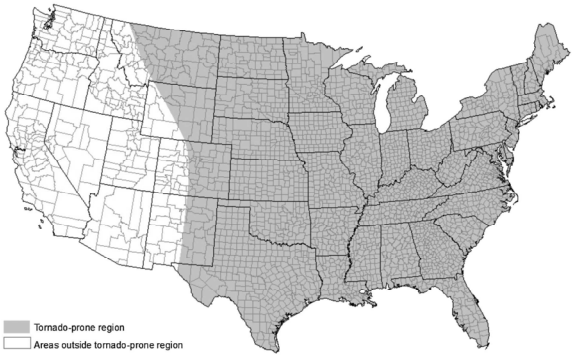

Figure 32.1-1. Tornado-prone region.

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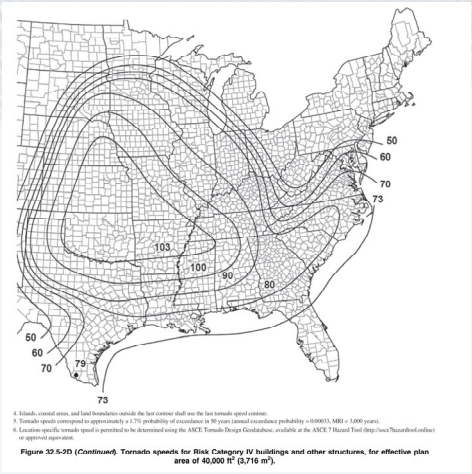

Figure 32.5-9D (*Continued*). Tornado speeds for Risk Category IV buildings and other structures, for effective plan area of 40,000 ft² (3,716 m²).

Risk Cat III & IV Tornado Wind Maps based on sqft effective plan area.

16 total maps

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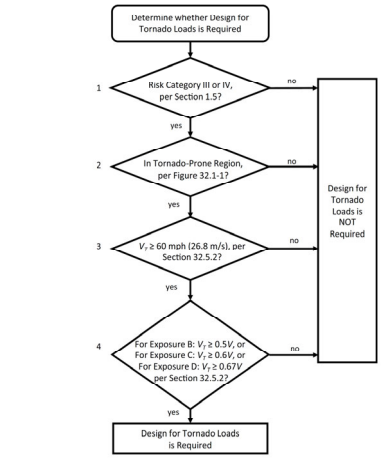

Figure 32.1-2. Flowchart of process for determining when design for tornado loads is required.

Hospital: Risk Category IV

Chicago, IL

ASCE 7-22 Wind Speed: 119-mph

Effective Plan Area: 40,000 sqft

Tornado Wind Speeds (Vt): 82-mph

Risk Category III or IV **(Yes)**

In Tornado-Prone Region **(Yes)**

Vt ≥ 60-mph **(Yes)**

Exposure B: 82-mph ≥ 59.5-mph **(Yes)**

Exposure C: 82-mph ≥ 71.4-mph **(Yes)**

Exposure D: 82-mph ≥ 79.7-mph **(Yes)**

All Terrain: Tornado Loads

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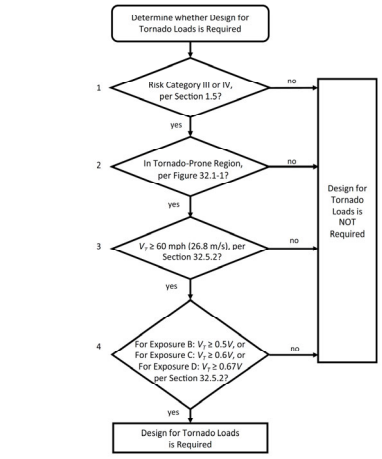

Figure 32.1-2. Flowchart of process for determining when design for tornado loads is required.

Hospital: Risk Category IV

Miami, FL

ASCE 7-22 Wind Speed: 189-mph

Effective Plan Area: 40,000 sqft

Tornado Wind Speeds (Vt): 73-mph

Risk Category III or IV **(Yes)**

In Tornado-Prone Region **(Yes)**

Vt ≥ 60-mph **(Yes)**

Exposure B: 73-mph ≥ 94.50-mph **(No)**

Exposure C: 73-mph ≥ 113.4-mph **(No)**

Exposure D: 73-mph ≥ 126.6-mph **(No)**

All Terrain: Wind Loads

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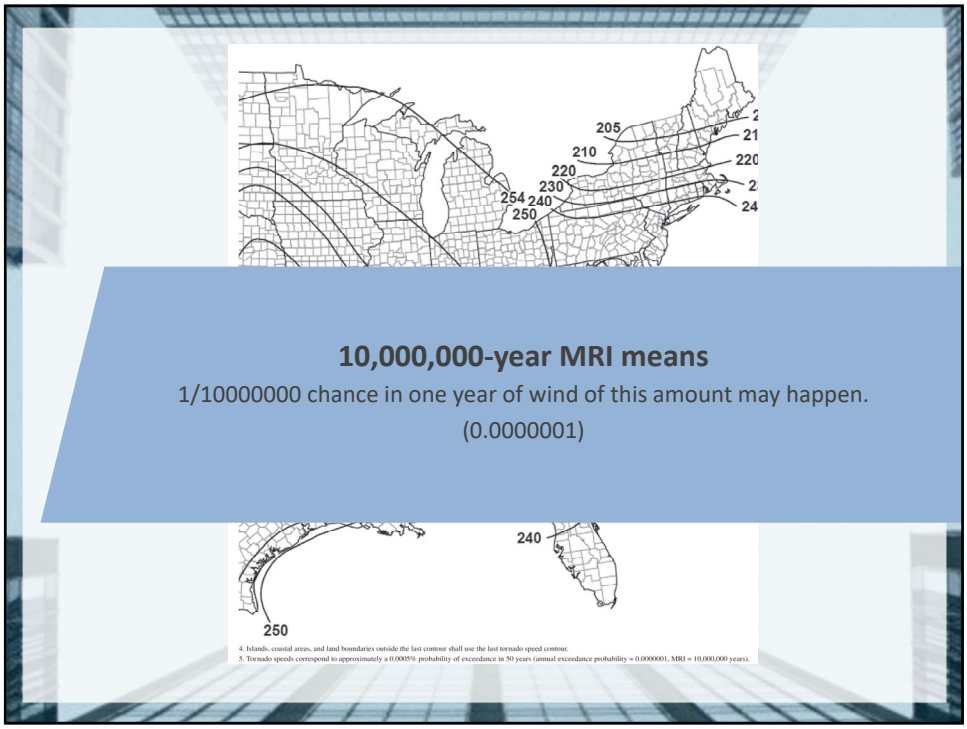

10,000,000-year MRI means

1/10000000 chance in one year of wind of this amount may happen.

(0.0000001)

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