

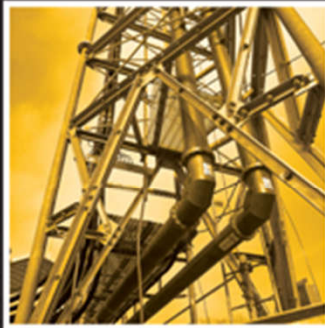


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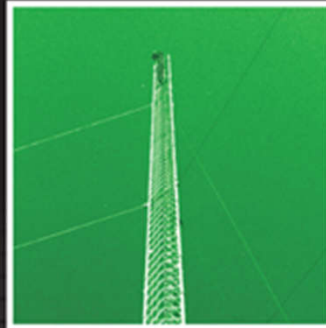
Impact of New ANSI/TIA-222-H Standard on Broadcast



Antennas



Transmission Line



Towers



Filters/Combiners



Broadcast Services

2018 NAB * ERI Breakfast * Apr 11, 2018
James Ruedlinger, P.E

ANSI/TIA-222-H Impact

Adoption

- **ANSI/TIA-222 REV H:**
 - Current industry consensus standard
 - **Effective January 1, 2018**

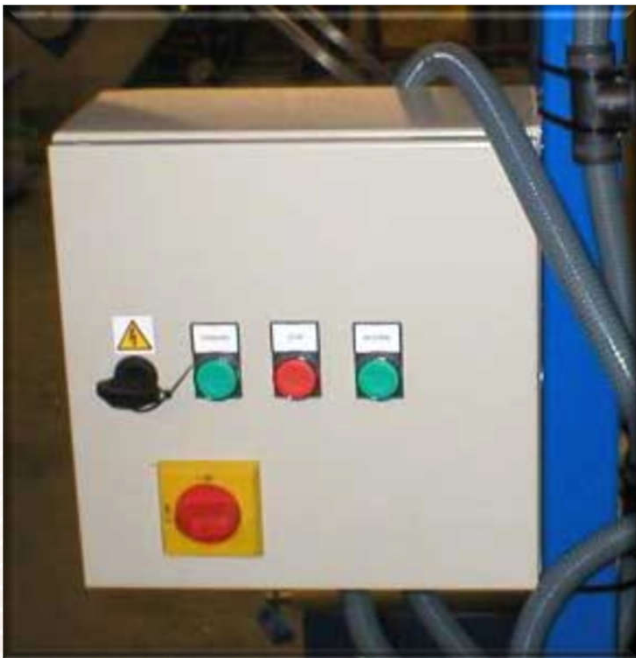


- **International Building Code (IBC):**
 - Adopted and enforced by state/local jurisdictions and contain collection of evolving standards by direct or indirect reference
 - Latest revision is the 2018 IBC → 2018 IBC references **222-H** for antenna supporting structures and antennas



ANSI/TIA-222-H Impact Site Parameters

THEN



NOW



ANSI/TIA-222-H Impact

Site Specific Parameters

- **Four** primary design parameters which must be established based upon the site-specific location to properly determine acting loads:

1) Risk Category

- Function of risk to human life, potential damage to facility, and structure's primary use

2) Environmental Loads

- Includes Wind, Ice, and Seismic loads

3) Site Exposure Category

- Based on the ground surface roughness from natural topography, vegetation, and constructed facilities of local surrounding
- *Impacts wind load*

4) Site Topographic Category

- Accounts for wind speed-up effects at isolated topographic features constituting abrupt changes in the general topography
- *Impacts both wind and ice loads*

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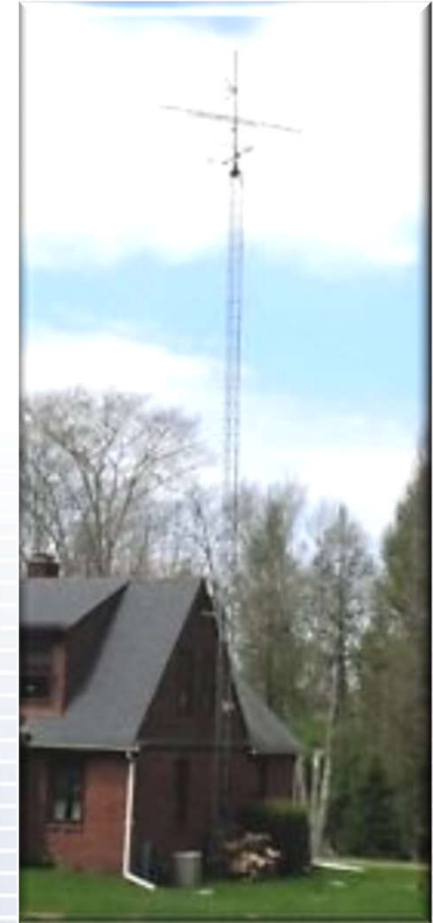
Risk Category

- **Risk Category I:** Low Risk
 - Examples: Redundant wireless antennas, small cell nodes, mobile single-load temporary structures (COW's), small residential applications, etc.
- **Risk Category II:** Moderate Risk → Default Category
 - Examples: Redundant service such as commercial TV, radio, wireless, microwave, etc. services where delay in restoring service deemed acceptable
- **Risk Category III:** Substantial Risk
 - Examples: Non-redundant services, civil or national defense, rescue or disaster operations, military and navigation facilities
- **Risk Category IV:** Substantial Hazard to Community
 - Examples: Essential services that would threaten functionality or integrity of Risk Category IV facilities

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Risk Category I Examples

LOW RISK



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Risk Category IV Examples

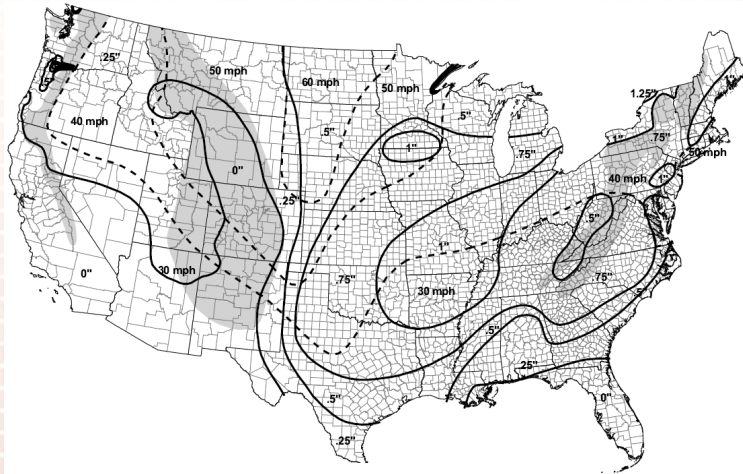
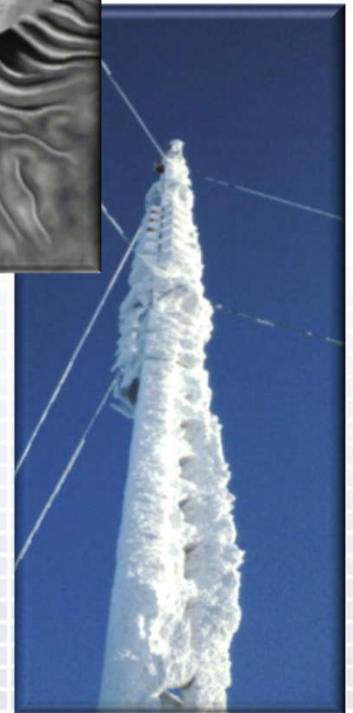
SUBSTANTIAL HAZARD



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Wind & Ice Loads

- Wind speed based on **Ultimate** wind speed
- Ice maps based upon computer modeling and empirical observations
 - *Must pay special attention to regions located within shaded areas*
 - *Note, 222-F did **NOT** provide explicit ice loading requirements*



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Wind Loads

222-C (1987):

$$F = P \cdot EFP$$

;where *P* = Wind Pressure (Zone A, B or C)
 EFP = Equivalent Flat Plate Area

222-F (2005):

$$F = G_h \cdot 0.00256 \cdot K_z \cdot V^2 \cdot (C_a \cdot A_a)$$

;where *G_h* = Gust Effect Factor
 0.00256 = Air Density Constant for Standard Atmosphere (59° F) at Sea Level
 K_z = Exposure Coefficient ~ Assumed Exposure Category C
 V = Wind Speed (Fastest-Mile)
 C_a = Drag Factor
 A_a = Projected Area



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Wind Loads

222-G (2017):

$$F = G_h \cdot 0.00256 \cdot K_z \cdot K_{zt} \cdot K_d \cdot I \cdot V^2 \cdot [K_a \cdot (C_a \cdot A_a)]$$

;where

- G_h = Gust Effect Factor ~ Based On Structure Type (Includes Dynamic Factor)
- 0.00256 = Air Density Constant for Standard Atmosphere (59° F) at Sea Level
- K_z = Exposure Coefficient ~ Based On Exposure Category
- K_{zt} = Topographic Factor ~ Based On Topographic Category
- K_d = Wind Direction Probability Factor ~ Based On Structure Type
- I = Importance Factor ~ Based On Structure Class
- V = Wind Speed (3-Second Peak Gust)
- K_a = Wake Interference Factor
- C_a = Drag Factor
- A_a = Projected Area



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Wind Loads

222-H (Current):

$$F = G_h \cdot 0.00256 \cdot K_z \cdot K_{zt} \cdot K_s \cdot K_e \cdot K_d \cdot V^2 \cdot [K_a \cdot (C_a \cdot A_a)]$$

;where

G_h = Gust Effect Factor ~ Based On Structure Type (Includes Dynamic Factor)

0.00256 = Air Density Constant for Standard Atmosphere (59° F) at Sea Level

K_z = Velocity Pressure Coefficient ~ Based On Exposure Category

K_{zt} = Topographic Factor ~ Based On Topographic Category

K_s = Rooftop Wind Speed-Up Factor

K_e = Ground Elevation Factor ~ Air Density Adjustment Factor

K_d = Wind Direction Probability Factor ~ Based On Structure Type

V = Ultimate Wind Speed (3-Second Peak Gust) ~ Includes Importance Factor

K_a = Wake Interference Factor

C_a = Drag Factor

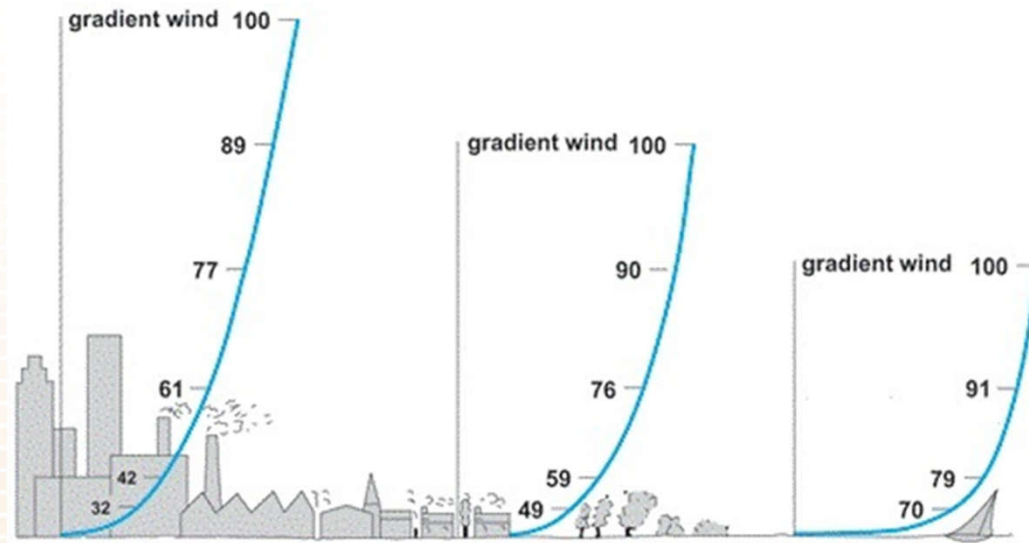
A_a = Projected Area



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Exposure Category

- **Site Exposure Category** ~ based upon local surrounding ground surface roughness from natural topography, vegetation and constructed facilities.
 - Three Categories:
 - 1) Exposure B ~ atmospheric boundary layer above 1200 ft
 - 2) Exposure C ~ atmospheric boundary layer above 900 ft
 - 3) Exposure D ~ atmospheric boundary layer above 700 ft



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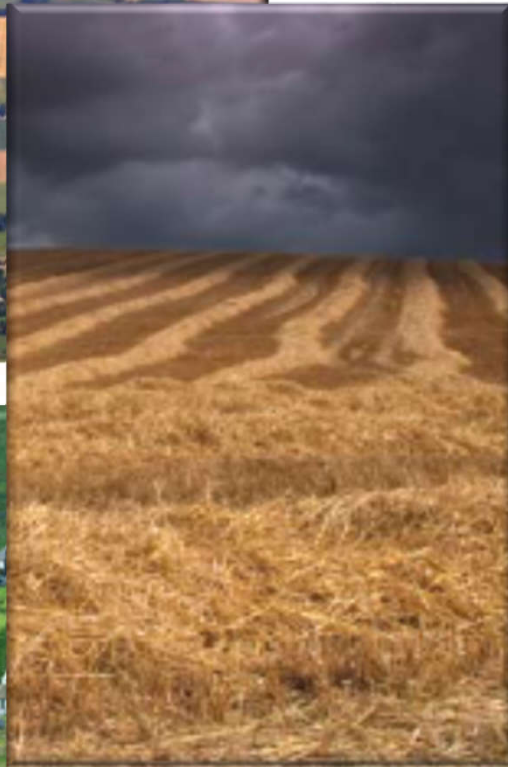
Exposure Category B



- Urban and suburban areas
- Wooded areas
- Areas with closely spaced obstructions having the size of single-family dwellings or larger
- Limited to those areas for which terrain representative of Exposure B surrounds the structure in **ALL** directions for a distance of at least 2,600 ft or twenty times the height of the structure, whichever is greater up to 24,000 ft

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Exposure Category C

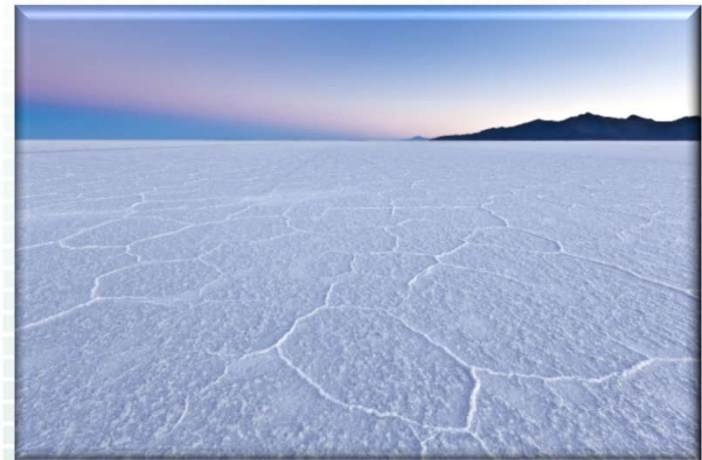


- Open terrain with scattered *obstructions* having heights generally less than 30 ft
- Includes flat open country, grasslands and athletic fields
- Applies to locations where Exposure B or D do not apply

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Exposure Category D

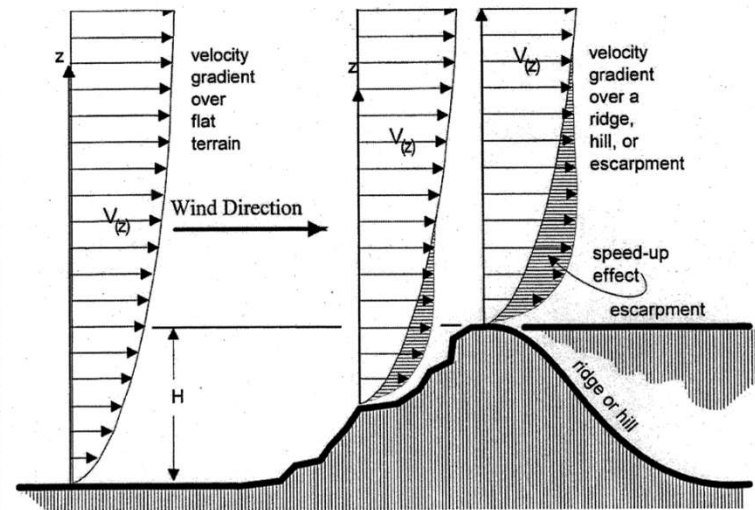
- Flat, unobstructed areas, shorelines and water surfaces
- Includes smooth mud flats, salt flats, and unbroken ice



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Topographic Category

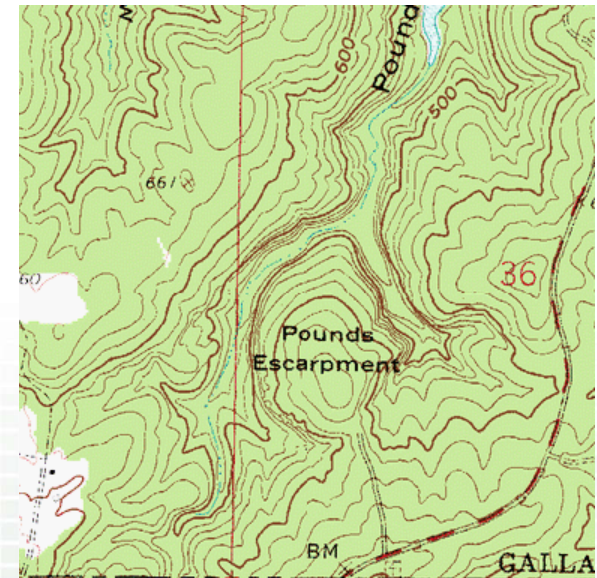
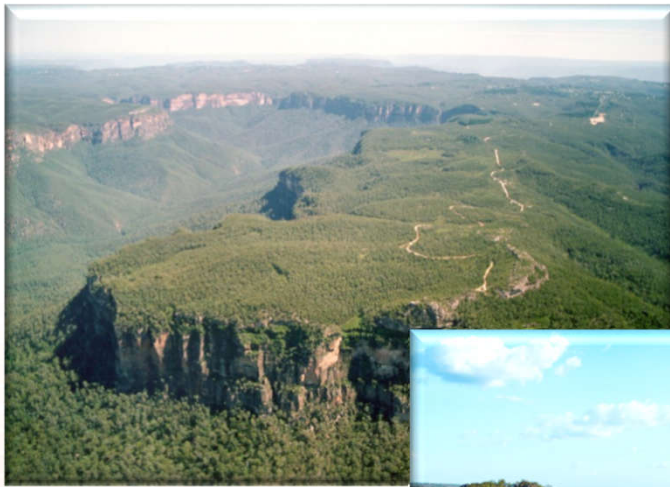
- **Site Topographic Category** ~ based on wind speed-up effects at isolated hills, ridges and escarpments constituting abrupt changes in the general topography
 - Method 1 Categories:
 - 1) Category 1 – No abrupt changes
 - 2) Category 2 – Escarpments
 - 3) Category 3 - Hills
 - 4) Category 4 – Ridges
 - Method 2 – Site-Specific
 - Method 3 – Site-Specific



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Topographic Category 2 - Escarpment

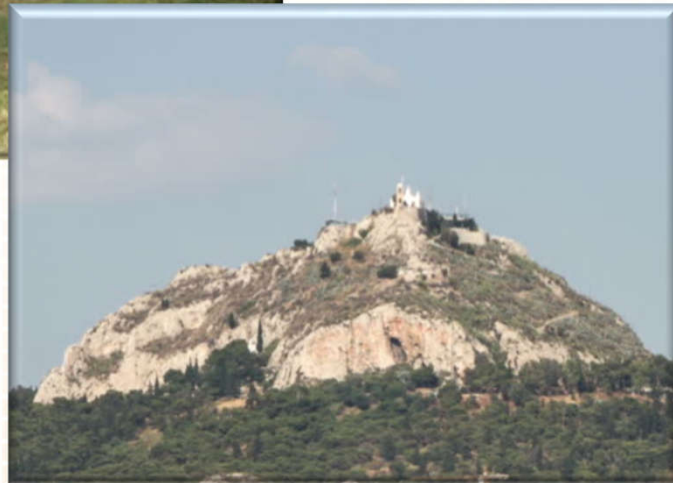
- Feature consisting of a long steep slope separating two levels of gently sloping or level areas



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Topographic Category 3 - Hill

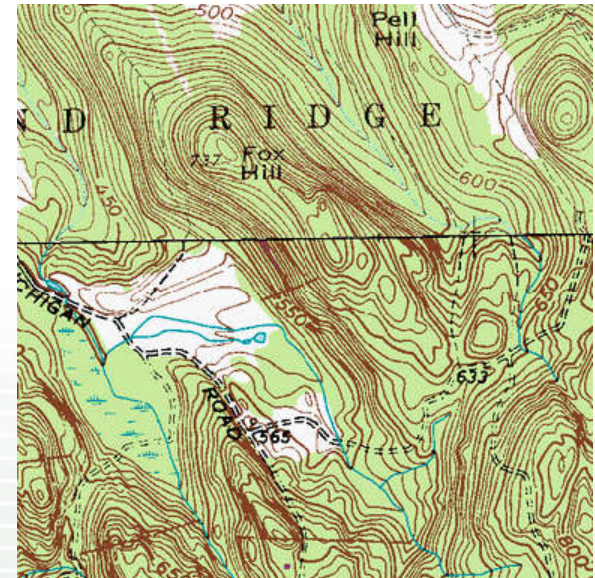
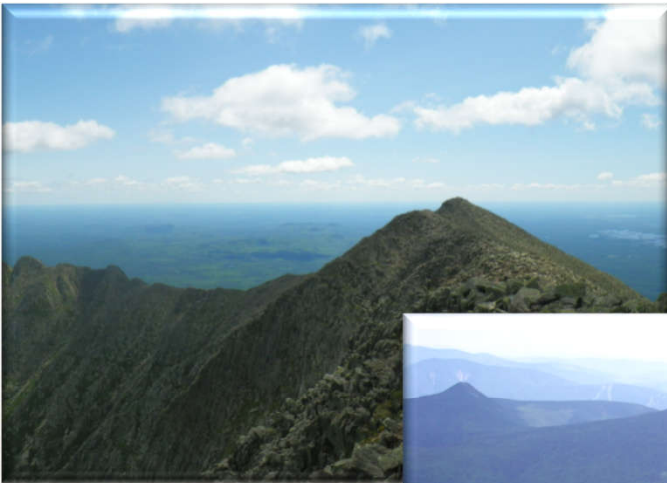
- Feature consisting of a strong relief from average terrain in all directions



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Topographic Category 4 - Ridge

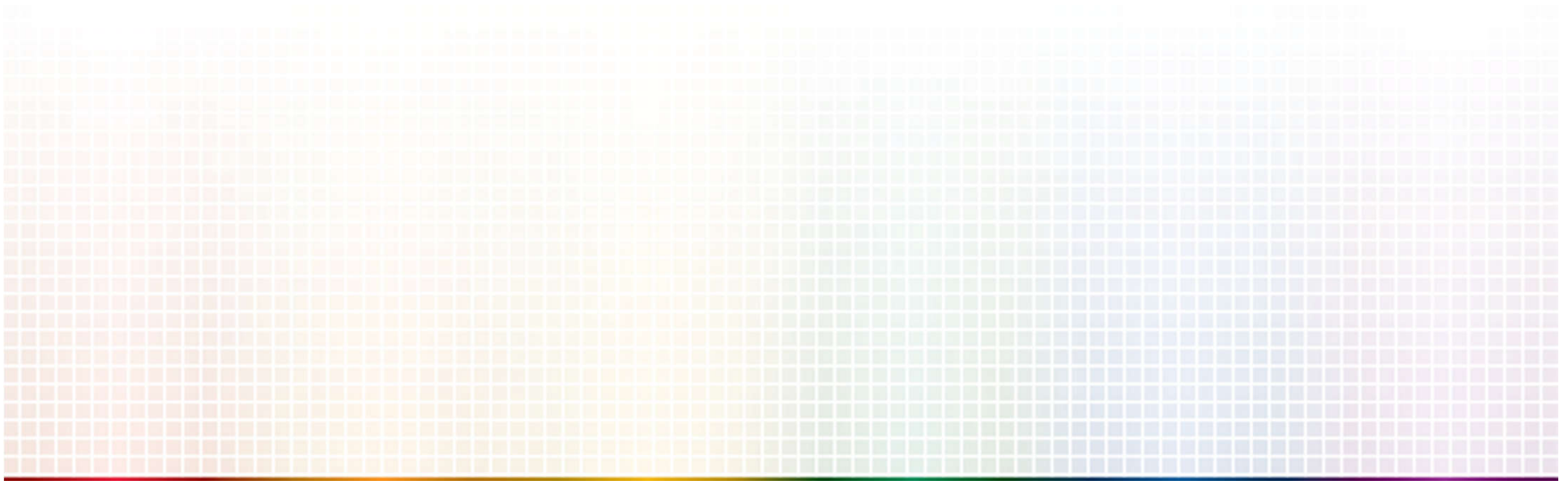
- Feature with elongated crest consisting of a strong relief from average terrain in only two directions



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Topographic Category - Method 2

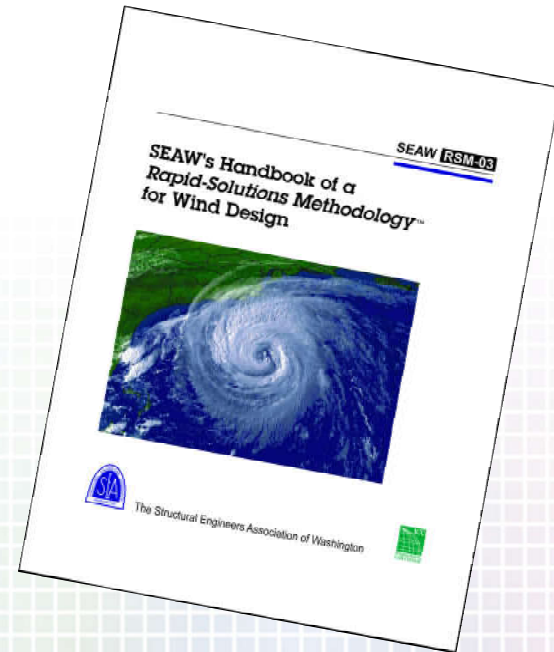
- Utilize site-specific method presented in 222-H to account for feature slope and structure setback



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Topographic Category - Method 3

- Determine site specific wind speed up effects using established site criteria or recognized methodology such as the SEAW's Rapid-Solutions Methodology



Questions?

