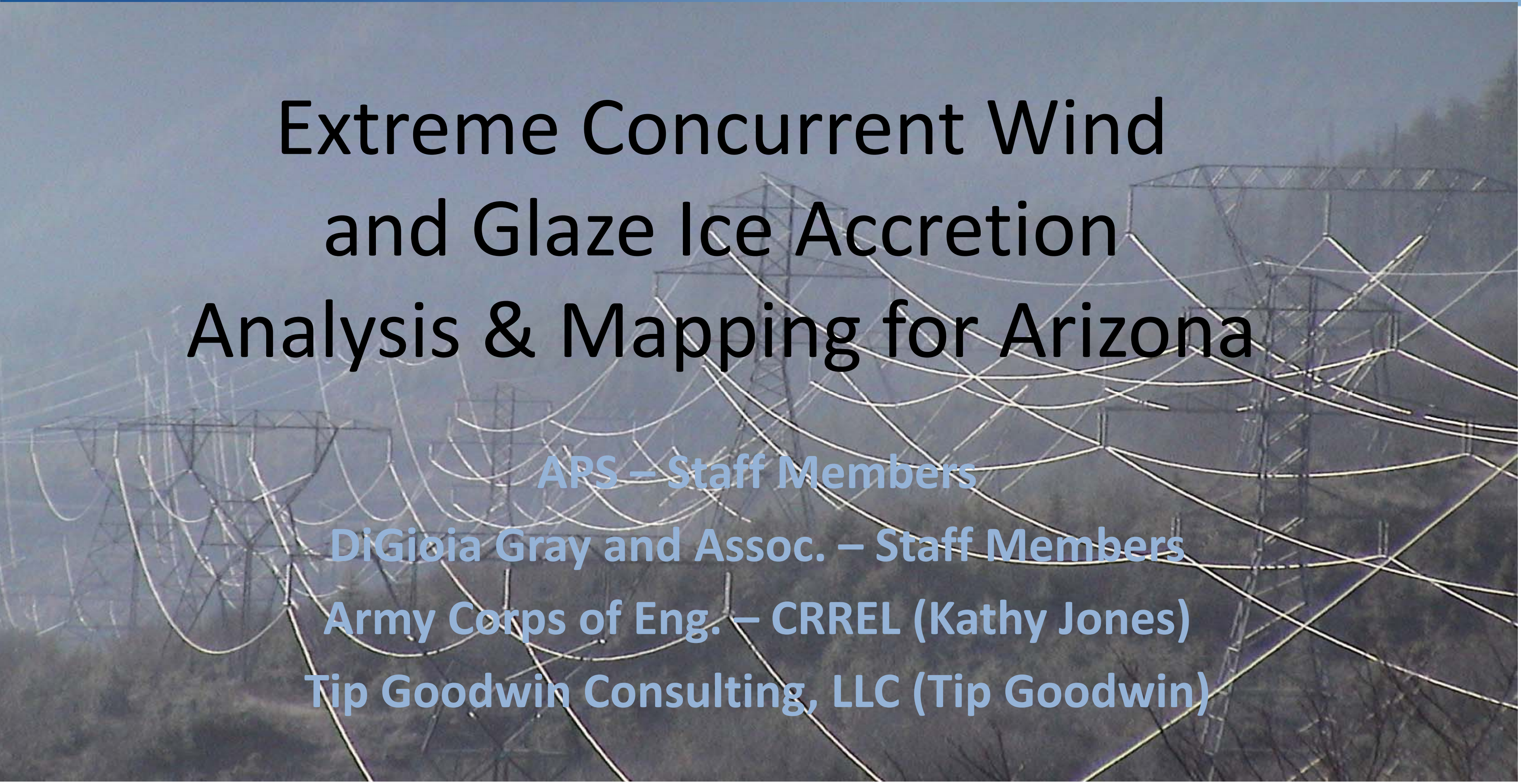
aps

June-2017
PLS-CADD ATUG

Extreme Concurrent Wind and Glaze Ice Accretion Analysis & Mapping for Arizona



APS – Staff Members

DiGioia Gray and Assoc. – Staff Members

Army Corps of Eng. – CRREL (Kathy Jones)

Tip Goodwin Consulting, LLC (Tip Goodwin)

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Section 25.
Loadings for Grades B and C

250. General loading requirements and maps

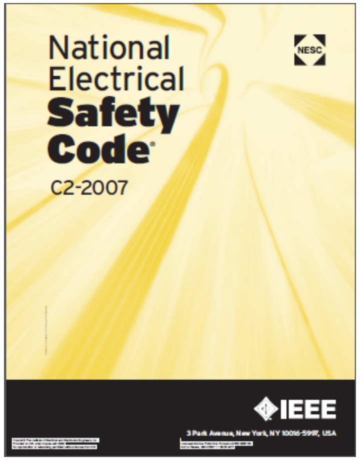
A. General

1. It is necessary to assume the wind and ice loads that may occur on a line. Three weather loadings are specified in Rules 250B, 250C, and 250D. Where all three rules apply, the required loading shall be the one that has the greatest effect.

2. Where construction or maintenance loads exceed those imposed by Rule 250A1, the assumed loadings shall be increased accordingly. When temporary loads, such as lifting of equipment, stringing operations, or a worker on a structure or its component, are to be imposed on a structure or component, the strength of the structure or component should be taken into account or other provisions should be made to limit the likelihood of adverse effects of structure or component failure.

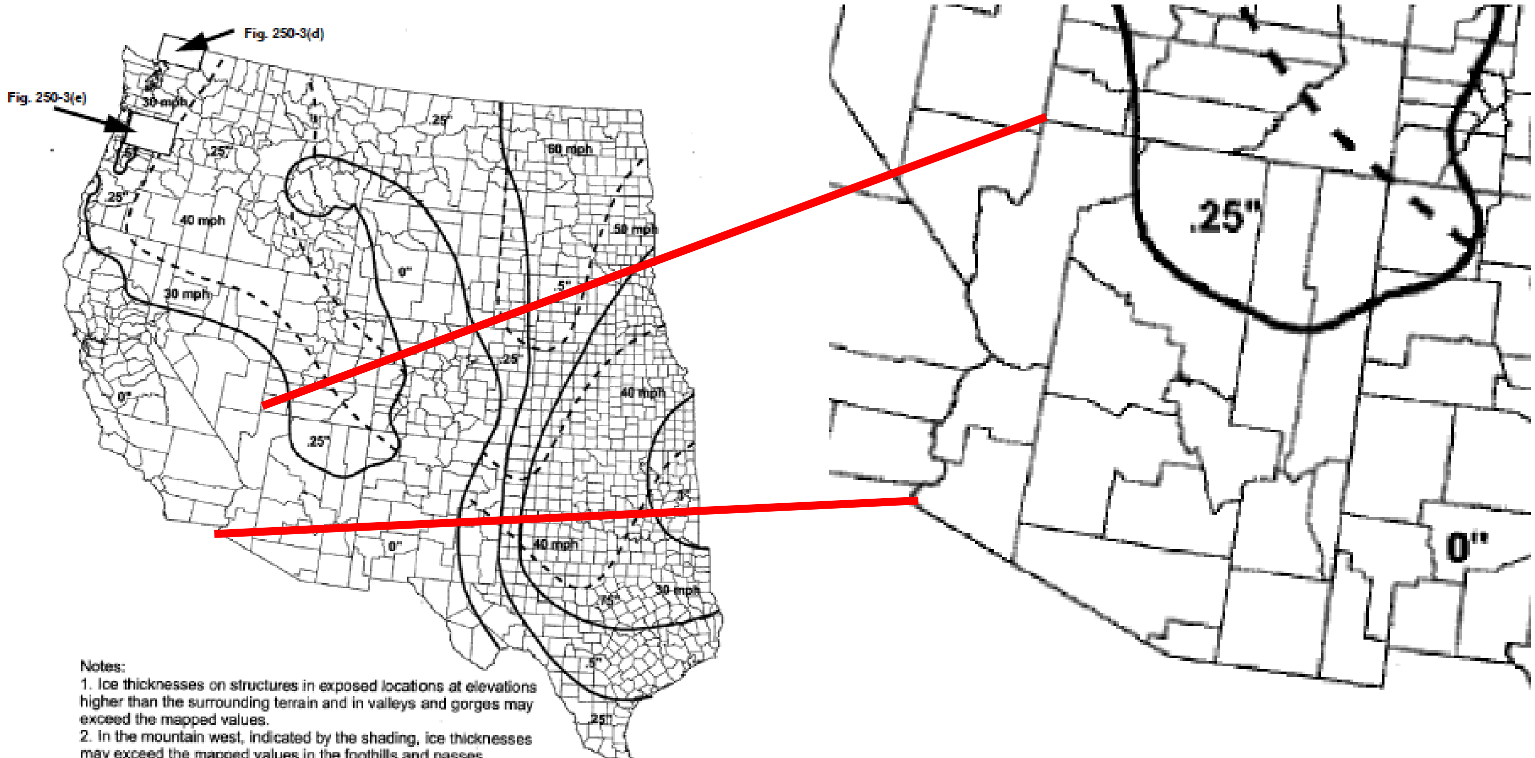
   NOTE: Other provisions could include cranes that can support the equipment loads, guard poles and spotters with radios, and stringing equipment capable of promptly halting stringing operations.

3. It is recognized that loadings actually experienced in certain areas in each of the loading districts may be greater, or in some cases, may be less than those specified in these rules. In the absence of a detailed loading analysis, using the same respective statistical methodologies used to develop the maps in Rule 250C or 250D, no reduction in the loadings specified therein shall be made without the approval of the administrative authority.



ASCE 7-05

F-250-3(a) Part 2: Safety Rules for Overhead Lines F-250-3(a)



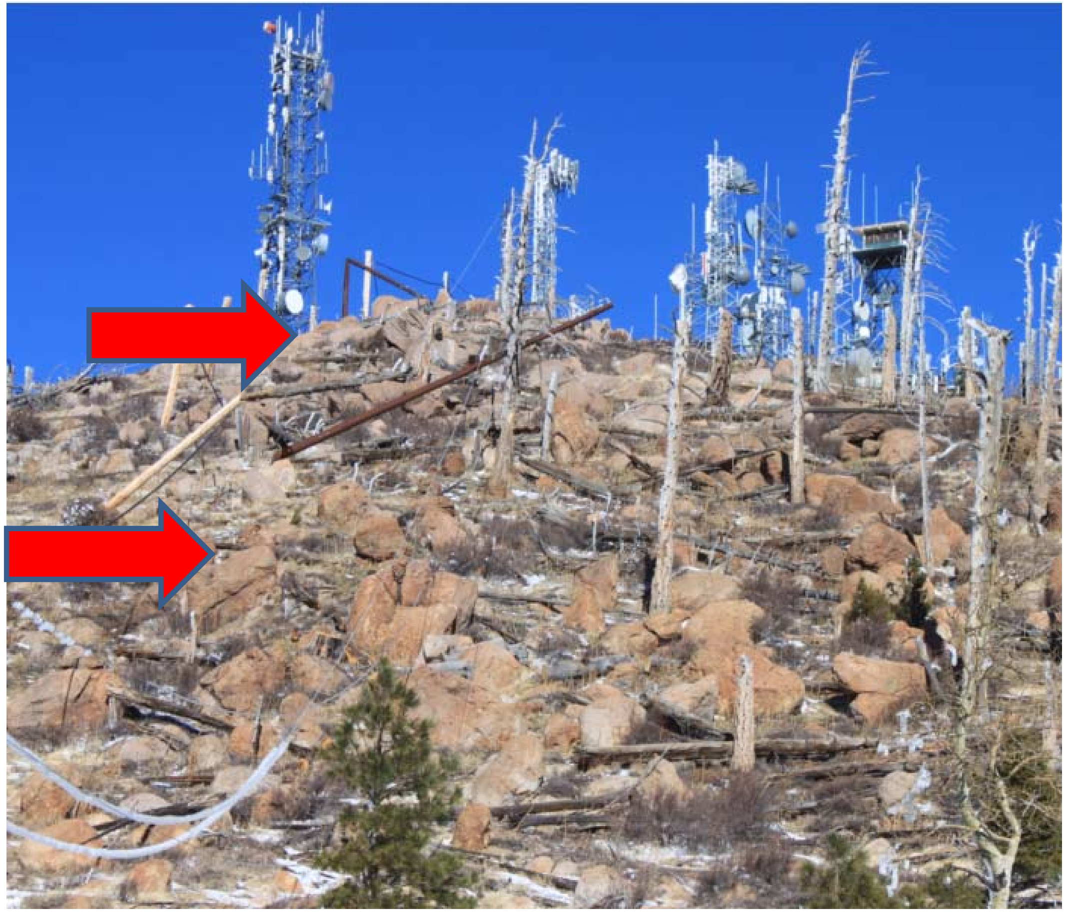
Notes:
1. Ice thicknesses on structures in exposed locations at elevations higher than the surrounding terrain and in valleys and gorges may exceed the mapped values.
2. In the mountain west, indicated by the shading, ice thicknesses may exceed the mapped values in the foothills and passes. However, at elevations above 5,000 ft, freezing rain is unlikely.
3. In the Appalachian Mountains, indicated by the shading, ice thicknesses may vary significantly over short distances.

50-YEAR MEAN RECURRENCE INTERVAL UNIFORM ICE THICKNESSES DUE TO FREEZING RAIN WITH CONCURRENT 3-SECOND GUST SPEEDS: CONTIGUOUS 48 STATES.

Newly Installed Steel Pole

Storm Event - Dec 2015

Recently Failed Steel Poles



Measured Ice Accretion 2015

4"+
Dia

Flagstaff, AZ

Measured Ice Accretion

6"+
Dia

Prescott, AZ

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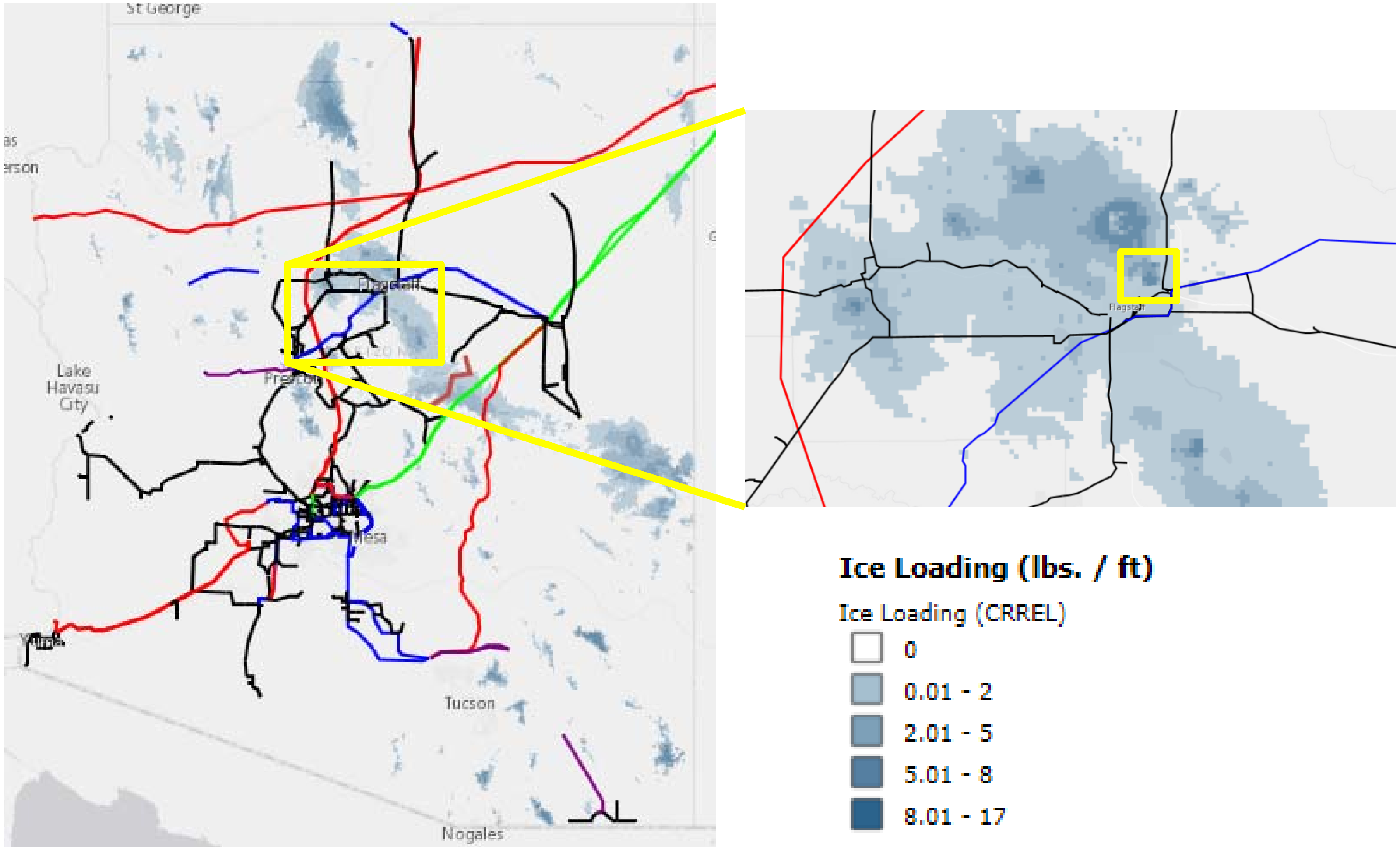
APS - HV Power Lines



Wire Ice Thickness

$$w\left(\frac{lbs}{ft}\right) = A(ft^2) \times \rho\left(\frac{lbs}{ft^3}\right)$$

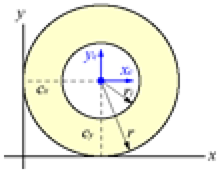
A795V

$w =$ 2 lb/ft

$\rho =$ 57 lb/ft³

$d_i =$ 1.026 in

$r_i =$ 0.513 in



$A = \pi(r^2 - r_i^2)$

r_i *is wire radius*

Ice Loading (lbs. / ft)

Ice Loading (CRREL)

- 0
- 0.01 - 2
- 2.01 - 5
- 5.01 - 8
- 8.01 - 17

Determine A_{ice}

$A_{ice} = {}^{w}/_{\rho} =$ 0.04 ft² = 5.05 in²

Determine r

$r = \sqrt{{}^{A}/_{\pi} + r_i^{\,2}} =$ 1.37 in

Determine t

$t = r - r_i = 2.12 - 0.752 =$ **0.86** in

Wire Ice Thickness

$$w\left(\frac{lbs}{ft}\right) = A(ft^2) \times \rho\left(\frac{lbs}{ft^3}\right)$$

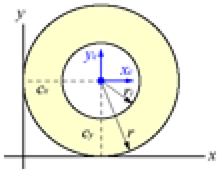
A795V

$w =$ 17 lb/ft

$\rho =$ 57 lb/ft³

$d_i =$ 1.026 in

$r_i =$ 0.513 in



$A = \pi(r^2 - r_i^2)$

r_i *is wire radius*

Ice Loading (lbs. / ft)

Ice Loading (CRREL)

- 0
- 0.01 - 2
- 2.01 - 5
- 5.01 - 8
- 8.01 - 17

Determine A_{ice}

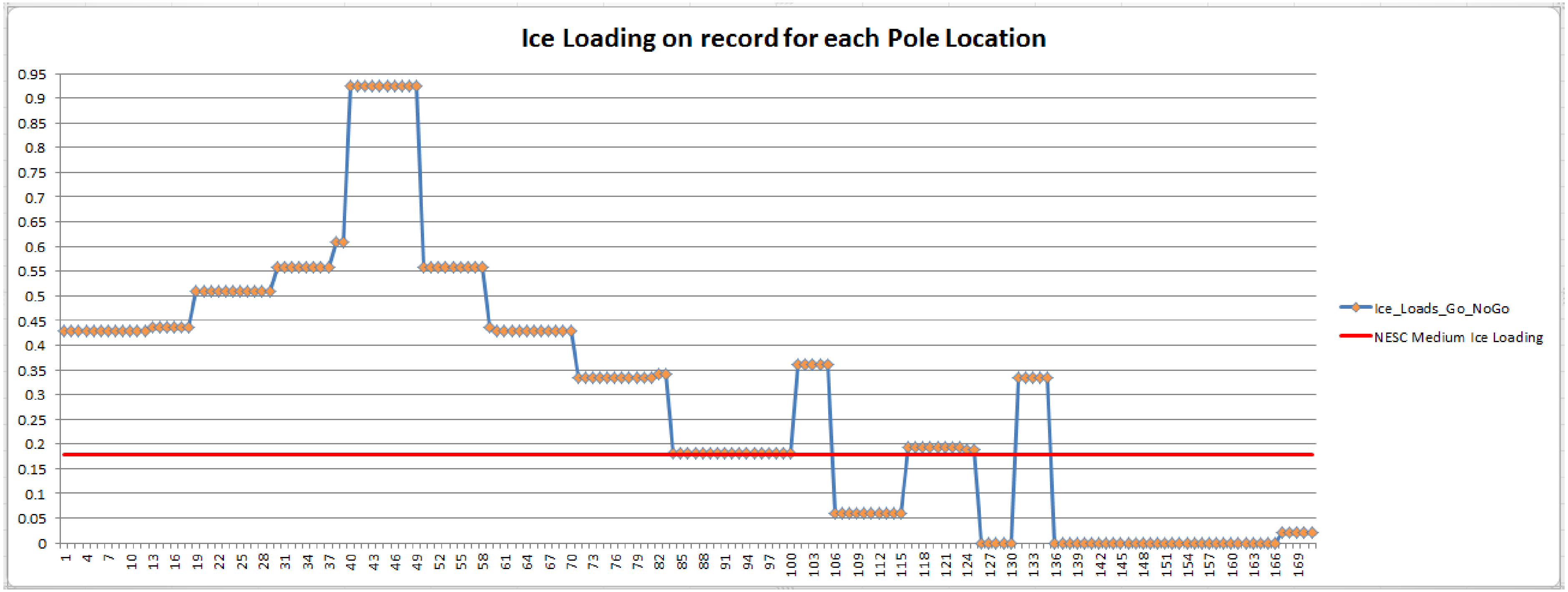
$A_{ice} = {}^{w}/_{\rho} =$ 0.30 ft² = 42.95 in²

Determine r

$r = \sqrt{{}^{A}/_{\pi} + r_i^2} =$ 3.73 in

Determine t

$t = r - r_i = 2.12 - 0.752 =$ **3.22** in


Ice Loading on record for each Pole Location
0.95
0.9
0.85
0.8
0.75
0.7
0.65
0.6
0.55
0.5
0.45
0.4
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0
1 4 7 10 13 16 19 22 25 28 31 34 37 40 43 46 49 52 55 58 61 64 67 70 73 76 79 82 85 88 91 94 97 100 103 106 109 112 115 118 121 124 127 130 133 136 139 142 145 148 151 154 157 160 163 166 169
Ice_Loads_Go_NoGo
NESC Medium Ice Loading

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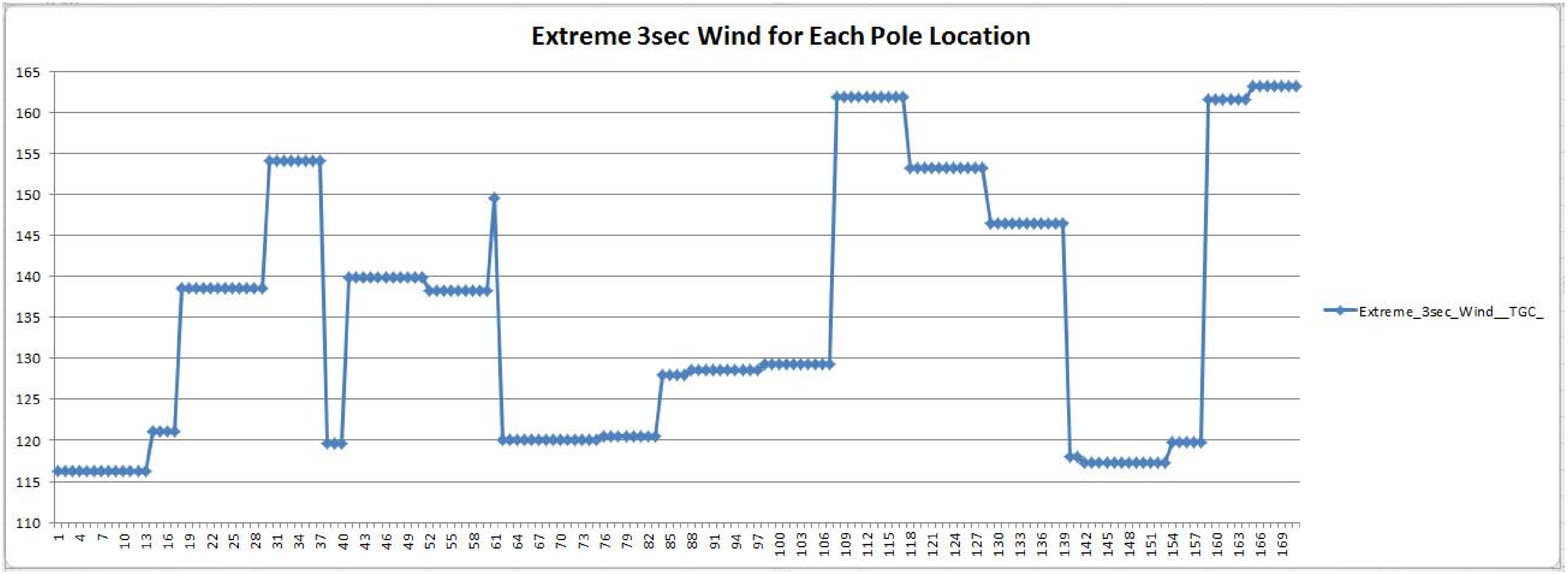
IT'S ALL ABOUT YOUR POWER LINES



Advanced Sag & Tension
LiDAR Modeling
Materials Management
NESC
PLS-CADD
Structural Analysis
Distribution

What are the appropriate design forces in your area???

Line Optimization
ASCE
Vegetation Management
PLS-POLE
Joint Use
Storm Hardening
Drafting
Pole Analysis
IEEE
Transmission
TOWER

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