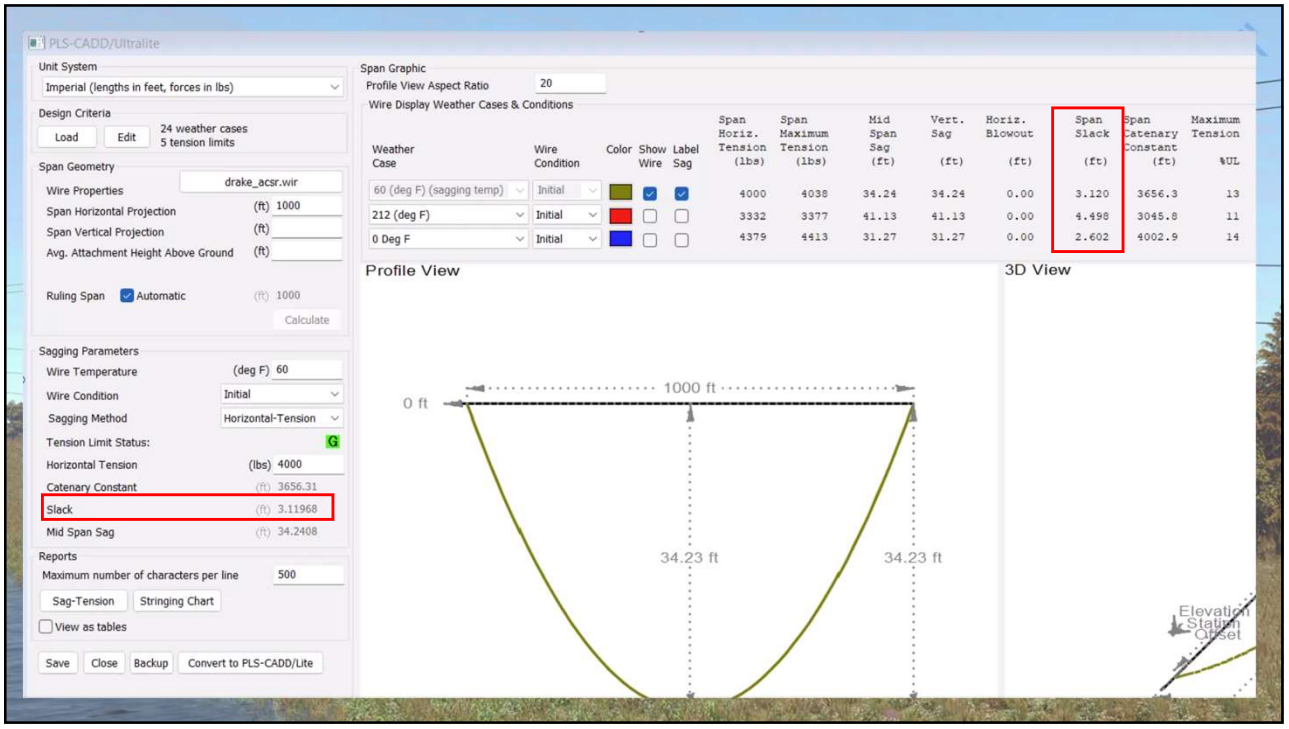
BURNS McDONNELL

ULTRALITE TO UNDERSTAND ADVANCED CONDUCTORS

JOSH SEBOLT, PE & JESS KURPIUS, PE

1



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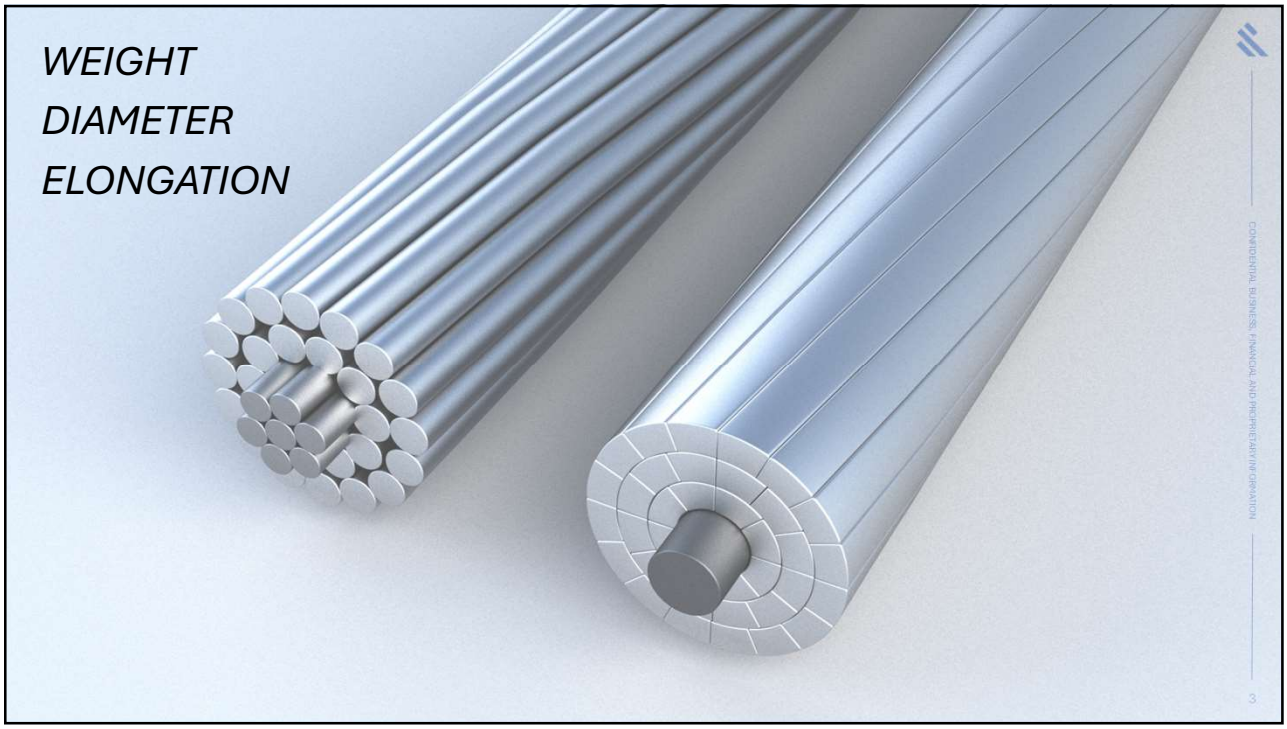

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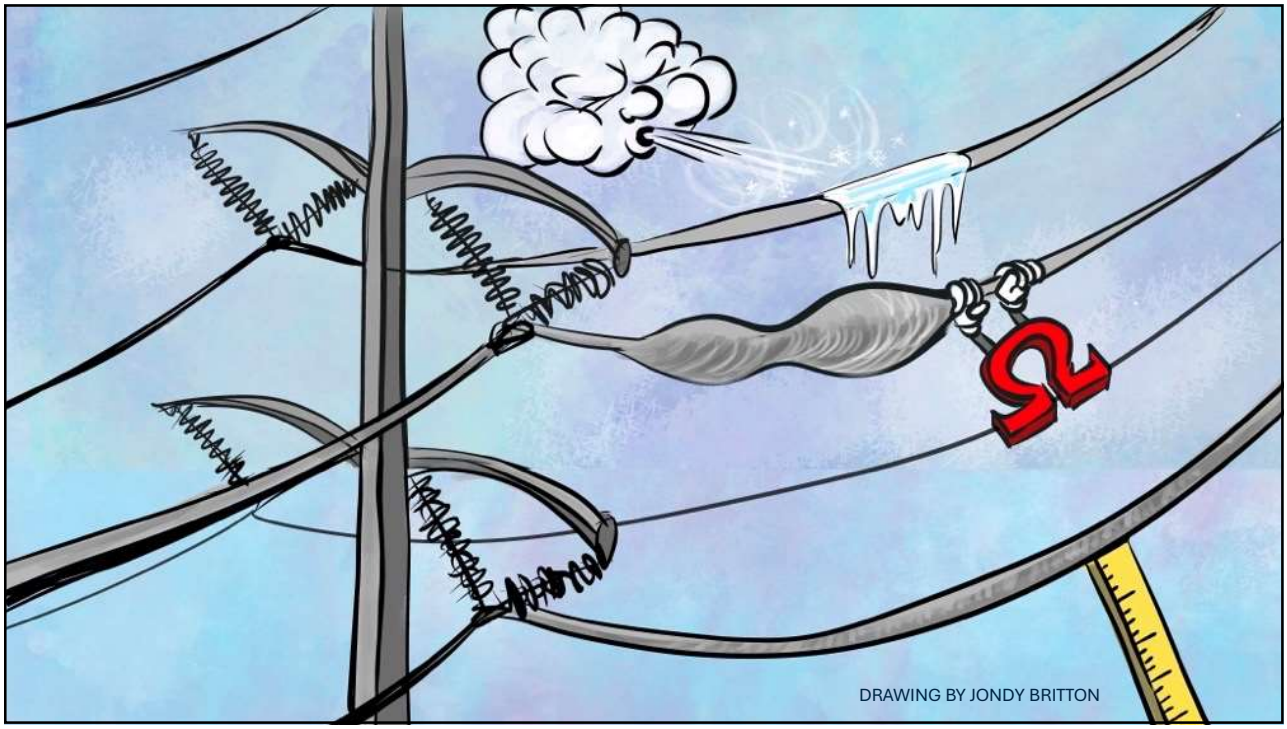
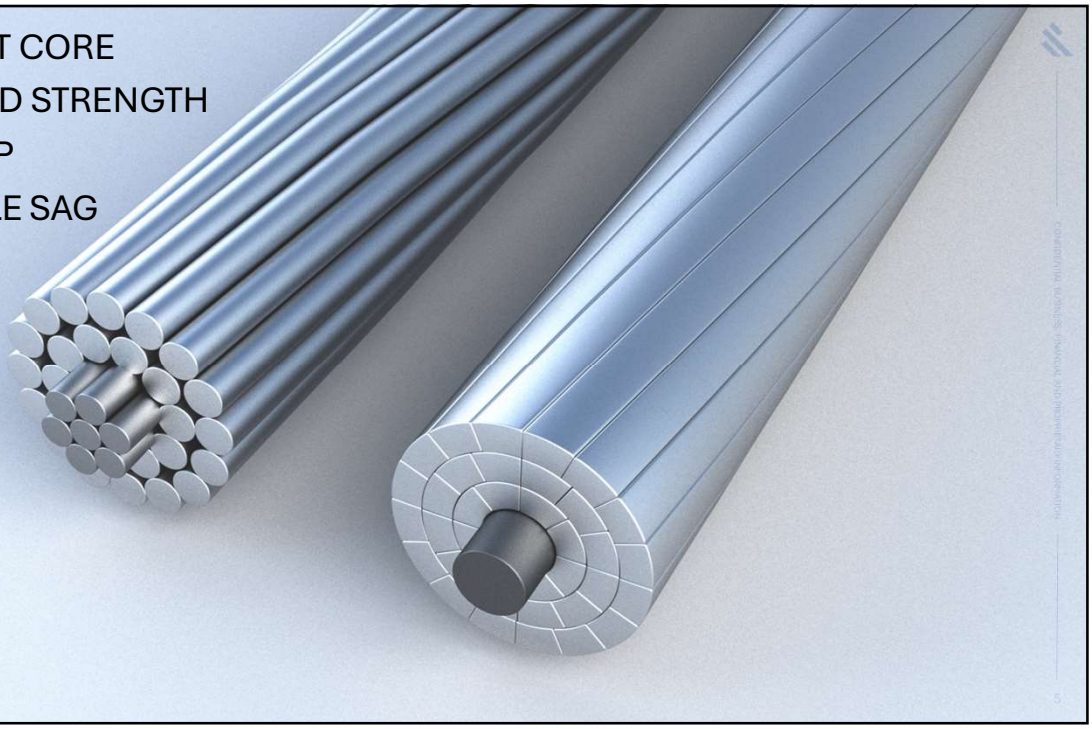


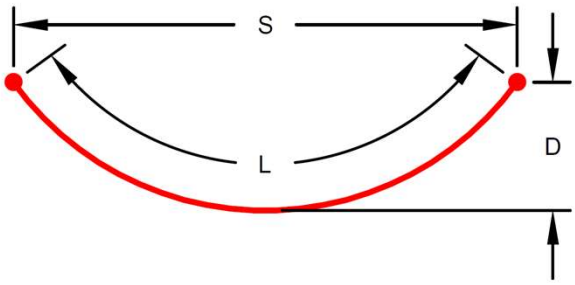
4

DIFFERENT CORE
INCREASED STRENGTH
HIGH TEMP
FAVORABLE SAG



5

SAG



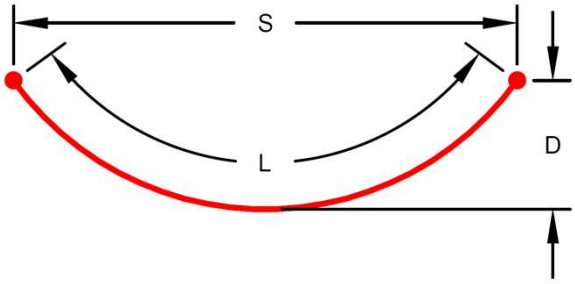
$$Sag = D = \frac{H}{w}\left[cosh\left(\frac{wS}{2H}\right) - 1\right]$$

H= Horizontal Tension
w=Unit Weight of Wire

6

6

SAG



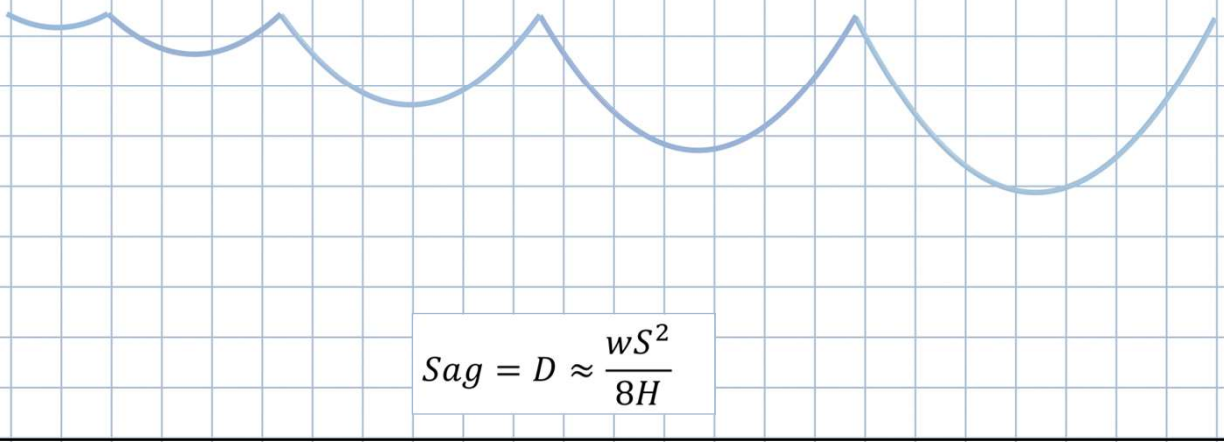
$$Sag = D \approx \frac{wS^2}{8H}$$

H= Horizontal Tension

w=Unit Weight of Wire

7

795 DRAKE ACSR
SPAN LENGTHS = 700-2,500 FT
HORIZONTAL TENSION = 7,000 LB

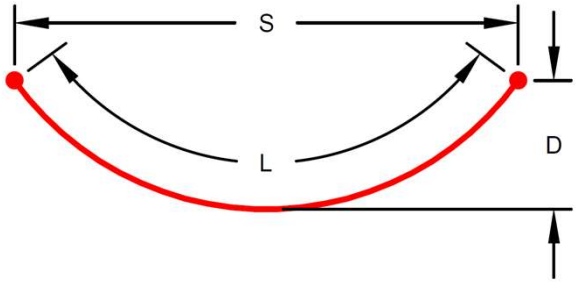


$$Sag = D \approx \frac{wS^2}{8H}$$

8

SLACK

$$\boldsymbol{L-S} = Slack \approx S^3\left(\frac{w^2}{24H^2}\right) \approx D^2\left(\frac{8}{3S}\right)$$



$$Sag = D \approx \sqrt{\frac{3S\,(\boldsymbol{L}-\mathbf{S})}{8}}$$

$$H \approx \frac{wS}{2}\sqrt{\frac{S}{6\,(\mathbf{L}-\mathbf{S})}}$$

H= Horizontal Tension

w=Unit Weight of Wire

9

9

SINGLE SPAN

SPAN LENGTH = 800 FT

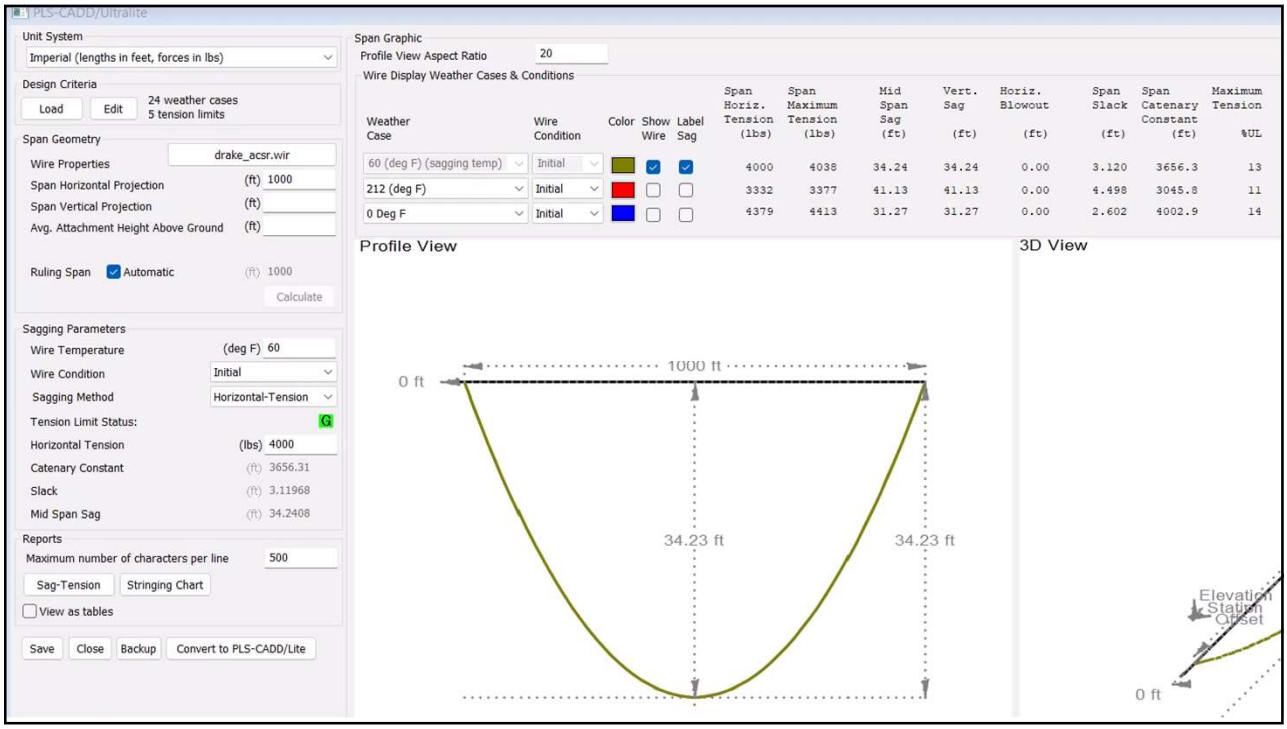
795 DRAKE ACSR

HORIZONTAL TENSION = 7,000 LBS

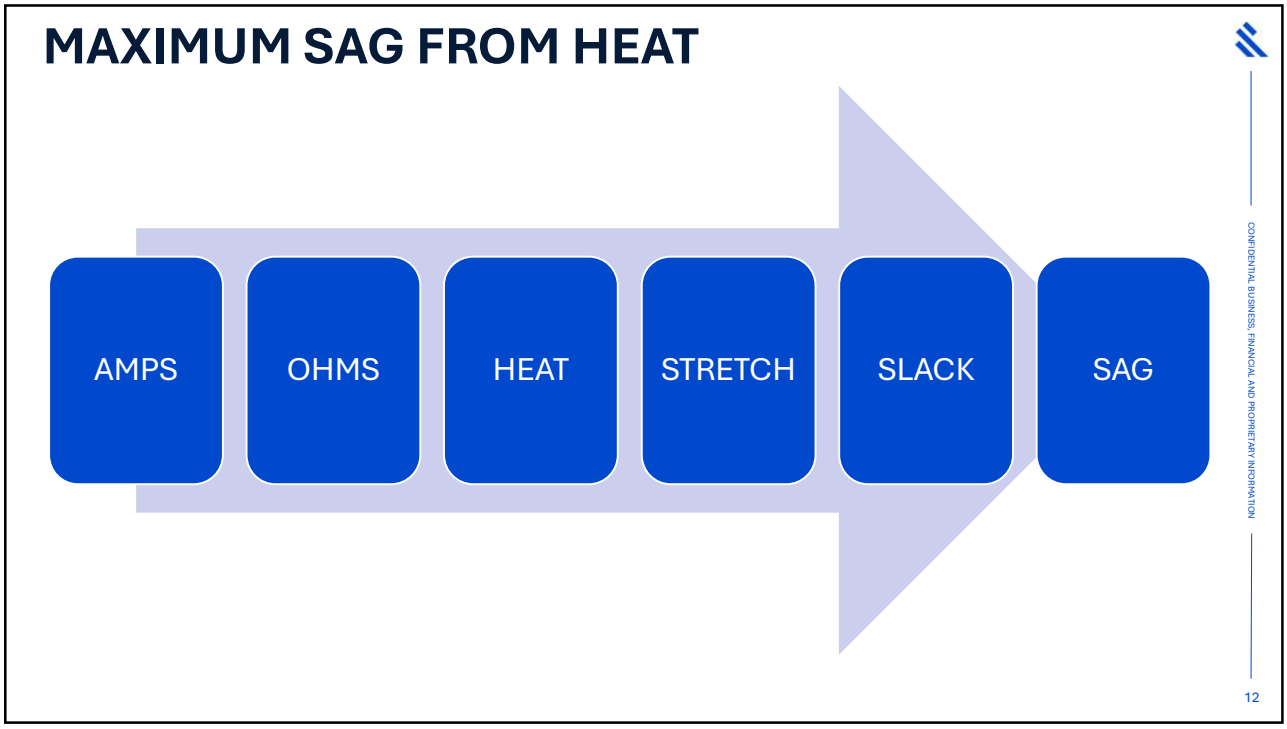
ADDED SLACK (FT)	TOTAL SLACK (FT)	HORIZONTAL TENSION (LBS)	MID SPAN SAG (FT)	DELTA TENSION FROM BASE CASE (LB)
0	**0.52**	**7,000**	**12.5**	**0**
0.25	0.77	5,754	15.21	-1,246
0.5	1.02	5,001	17.5	-1,999
1	1.52	4,097	21.36	-2,903
2	2.52	3,182	27.5	-3,818

10

10


PLS-CADD/Ultralite
Unit System
Imperial (lengths in feet, forces in lbs)
Design Criteria
Load
Edit
24 weather cases
5 tension limits
Span Geometry
Wire Properties
drake_acsr.wir
Span Horizontal Projection
(ft) 1000
Span Vertical Projection
(ft)
Avg. Attachment Height Above Ground
(ft)
Ruling Span
Automatic
(ft) 1000
Calculate
Sagging Parameters
Wire Temperature
(deg F) 60
Wire Condition
Initial
Sagging Method
Horizontal-Tension
Tension Limit Status:
G
Horizontal Tension
(lbs) 4000
Catenary Constant
(ft) 3656.31
Slack
(ft) 3.11968
Mid Span Sag
(ft) 34.2408
Reports
Maximum number of characters per line
500
Sag-Tension
Stringing Chart
View as tables
Save
Close
Backup
Convert to PLS-CADD/Lite
Span Graphic
Profile View Aspect Ratio
20
Wire Display Weather Cases & Conditions
Weather Case
Wire Condition
Color
Show Wire
Label Sag
Span Horiz. Tension (lbs)
Span Maximum Tension (lbs)
Mid Span Sag (ft)
Vert. Sag (ft)
Horiz. Blowout (ft)
Span Slack (ft)
Span Catenary Constant (ft)
Maximum Tension %UL
60 (deg F) (sagging temp) Initial 4000 4038 34.24 34.24 0.00 3.120 3656.3 13
212 (deg F) Initial 3332 3377 41.13 41.13 0.00 4.498 3045.8 11
0 Deg F Initial 4379 4413 31.27 31.27 0.00 2.602 4002.9 14
Profile View
3D View
0 ft
1000 ft
34.23 ft
34.23 ft
Elevation
Station
Offset
0 ft

11


MAXIMUM SAG FROM HEAT
AMPS
OHMS
HEAT
STRETCH
SLACK
SAG
CONFIDENTIAL BUSINESS, FINANCIAL AND PROPRIETARY INFORMATION
12

12

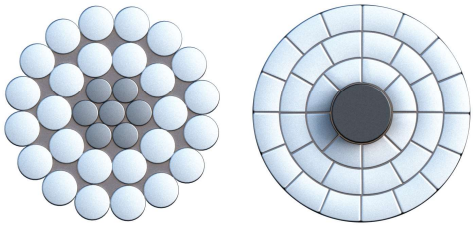
$$\Delta L = \propto L_0 \, \Delta T$$

ΔL = CHANGE IN LENGTH

∝ =COEFFICIENT OF THERMAL EXPANSION

L_0 =ORIGINAL LENGTH

ΔT=CHANGE IN TEMPERATURE

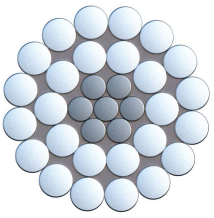


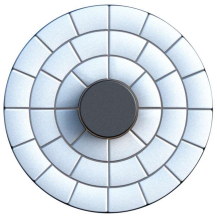
13

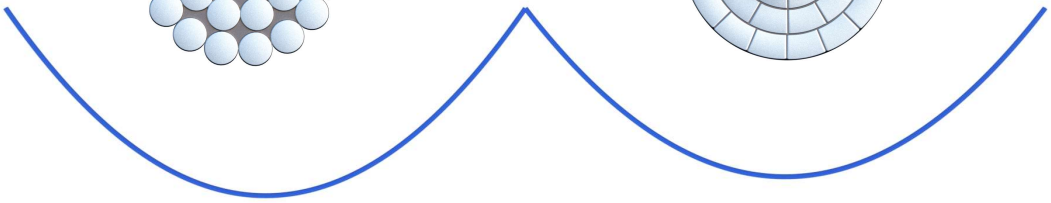
13

ACSS

ADVANCED



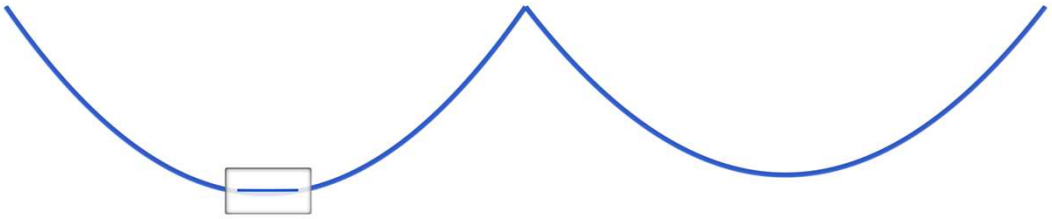




14

14

ACSS ADVANCED



15

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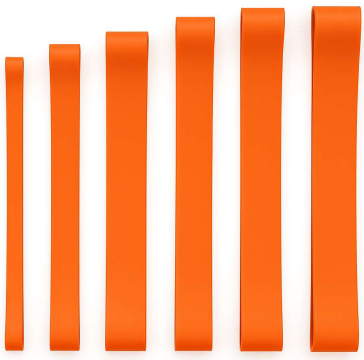
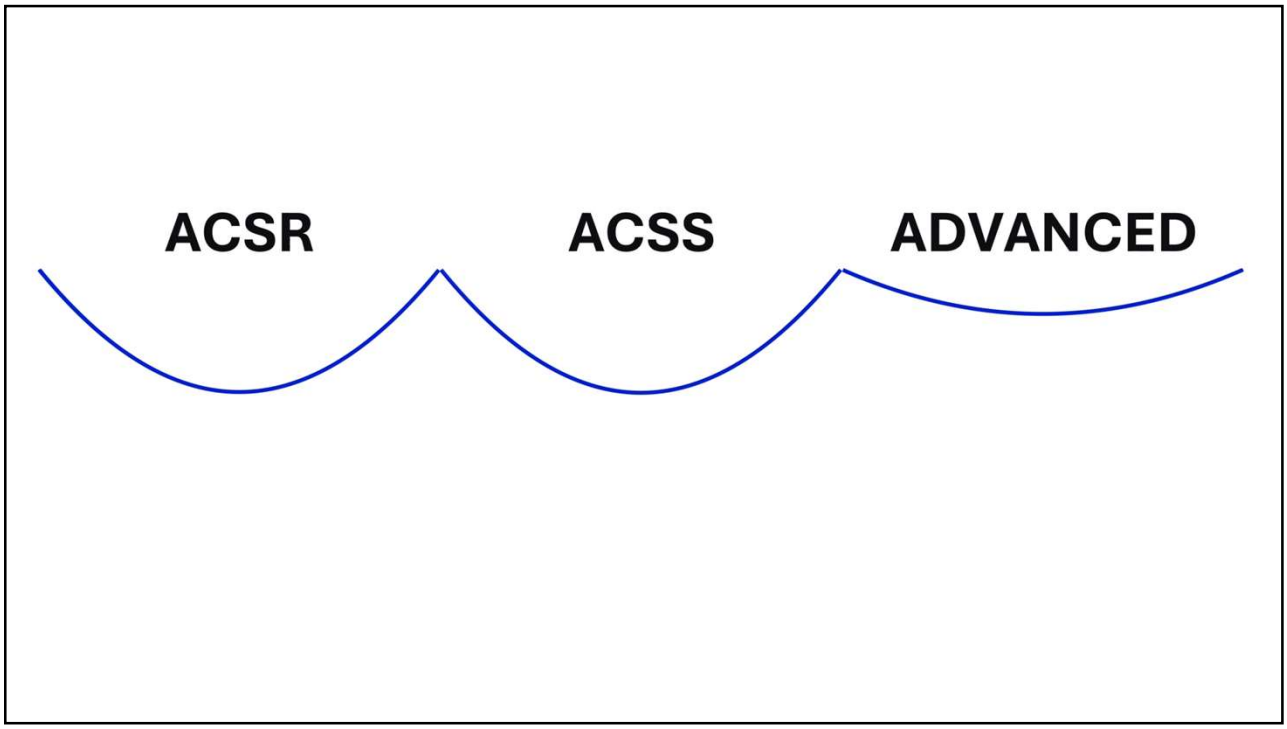
MODULUS OF ELASTICITY

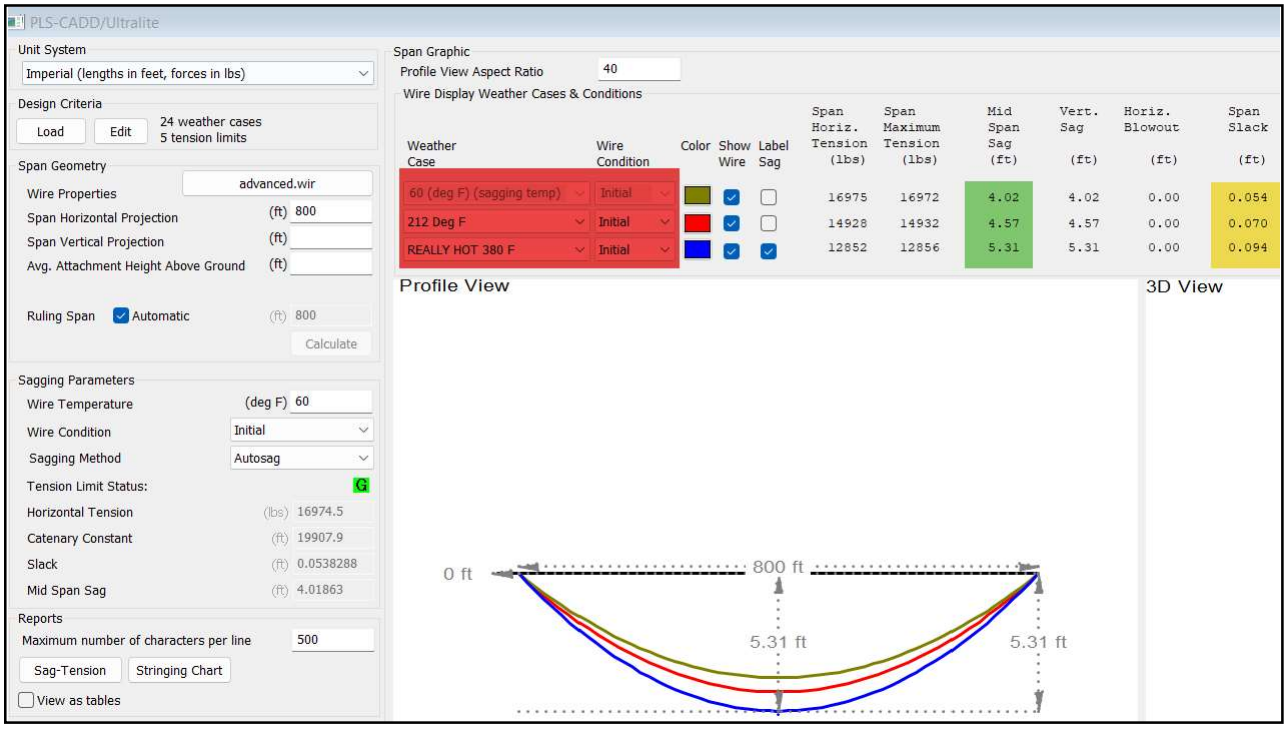


16

16


ACSR
ACSS
ADVANCED

17


PLS-CADD/Ultralite
Unit System
Imperial (lengths in feet, forces in lbs)
Design Criteria
Load
Edit
24 weather cases
5 tension limits
Span Geometry
Wire Properties
advanced.wir
Span Horizontal Projection
(ft) 800
Span Vertical Projection
(ft)
Avg. Attachment Height Above Ground
(ft)
Ruling Span
Automatic
(ft) 800
Calculate
Sagging Parameters
Wire Temperature
(deg F) 60
Wire Condition
Initial
Sagging Method
Autosag
Tension Limit Status:
G
Horizontal Tension
(lbs) 16974.5
Catenary Constant
(ft) 19907.9
Slack
(ft) 0.0538288
Mid Span Sag
(ft) 4.01863
Reports
Maximum number of characters per line
500
Sag-Tension
Stringing Chart
View as tables
Span Graphic
Profile View Aspect Ratio
40
Wire Display Weather Cases & Conditions
Weather Case
Wire Condition
Color
Show Wire
Label Sag
Span Horiz. Tension (lbs)
Span Maximum Tension (lbs)
Mid Span Sag (ft)
Vert. Sag (ft)
Horiz. Blowout (ft)
Span Slack (ft)
60 (deg F) (sagging temp)
Initial
16975
16972
4.02
4.02
0.00
0.054
212 Deg F
Initial
14928
14932
4.57
4.57
0.00
0.070
REALLY HOT 380 F
Initial
12852
12856
5.31
5.31
0.00
0.094
Profile View
3D View
0 ft
800 ft
5.31 ft
5.31 ft

18

ASSUMED EQUIVALENCY

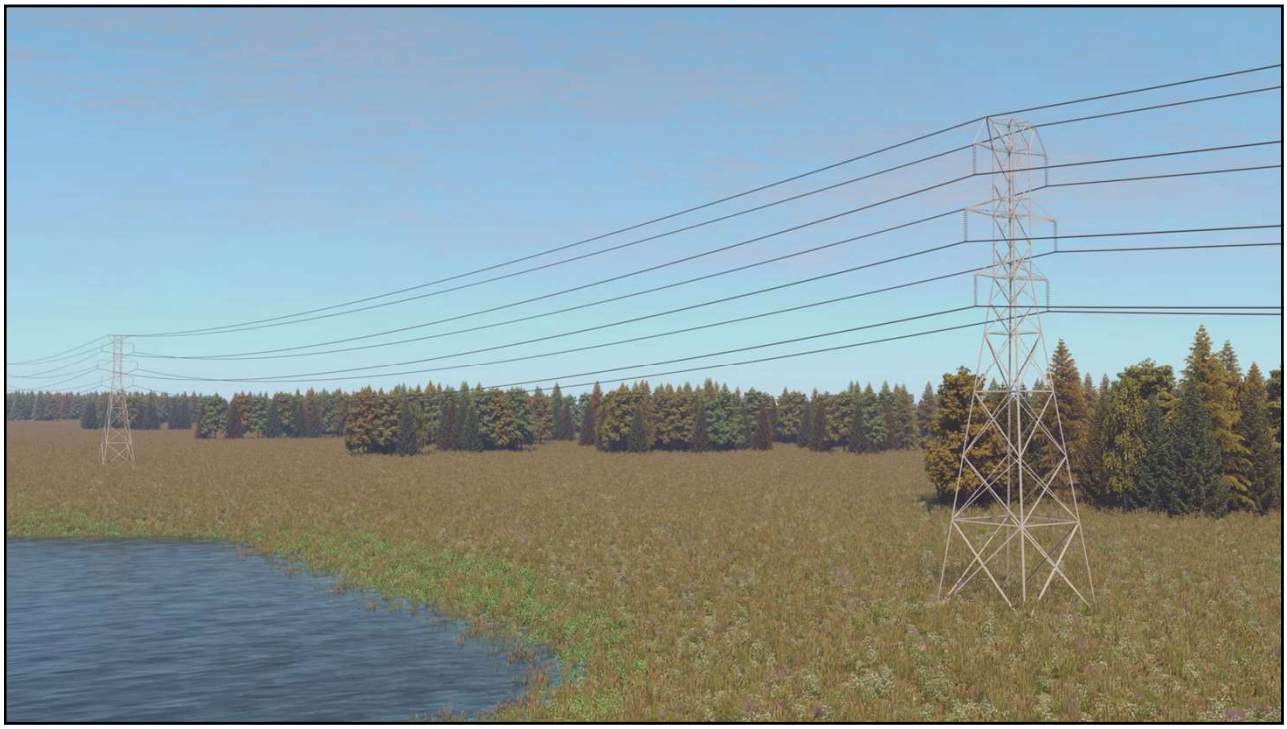
19

ASSUMED EQUIVALENCY

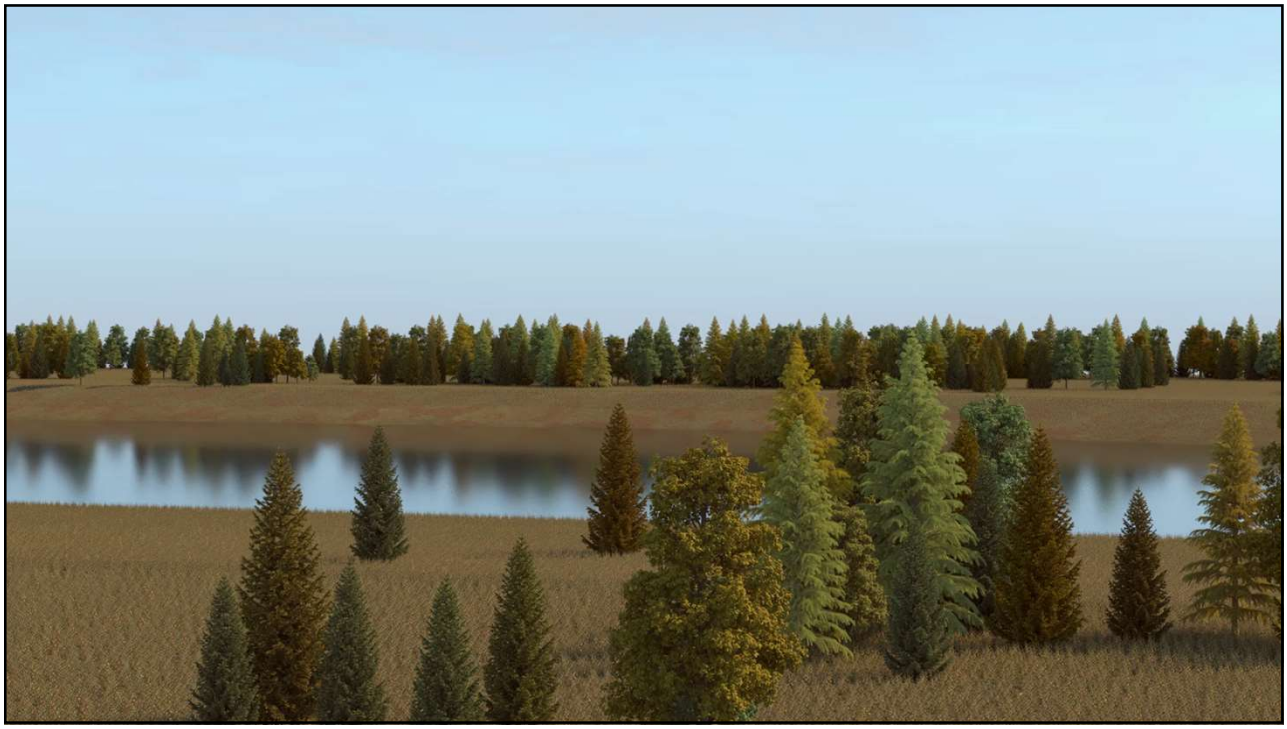
20

21

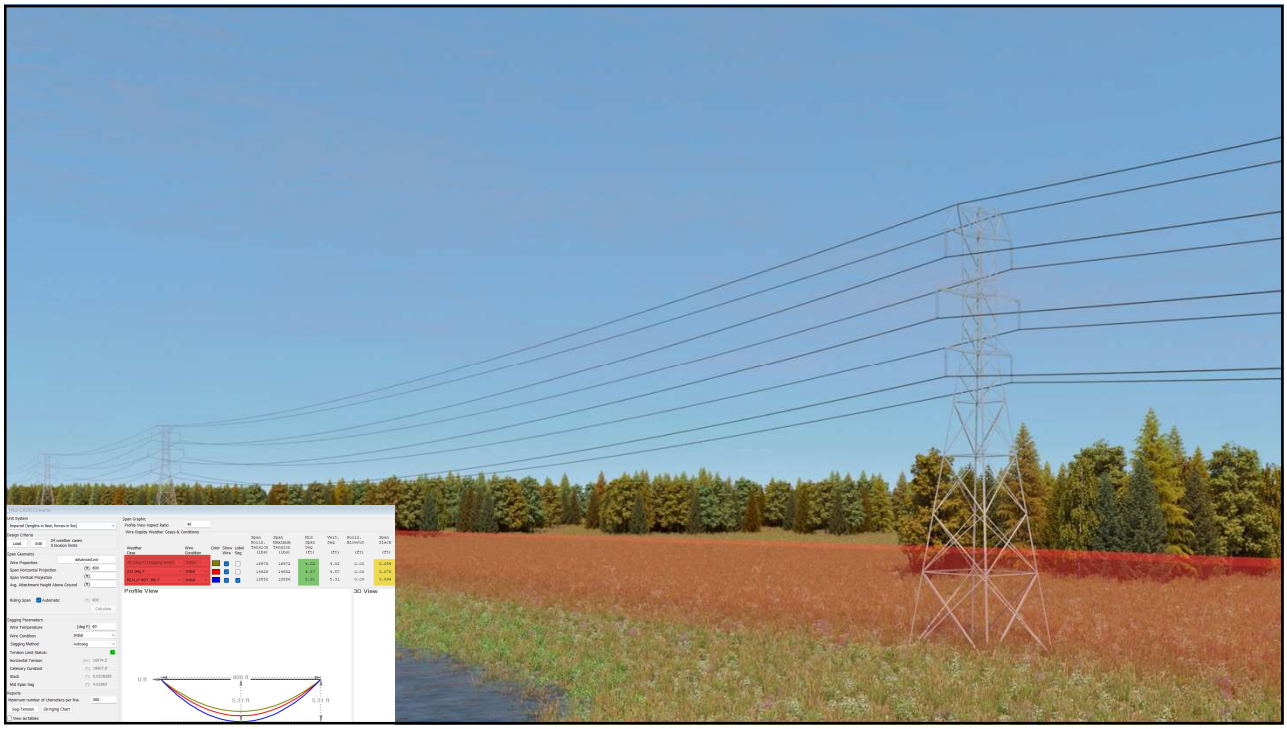
22



23



24



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