2022 PLS-CADD Advanced Training and User Group

Update on Industry Codes and Standards

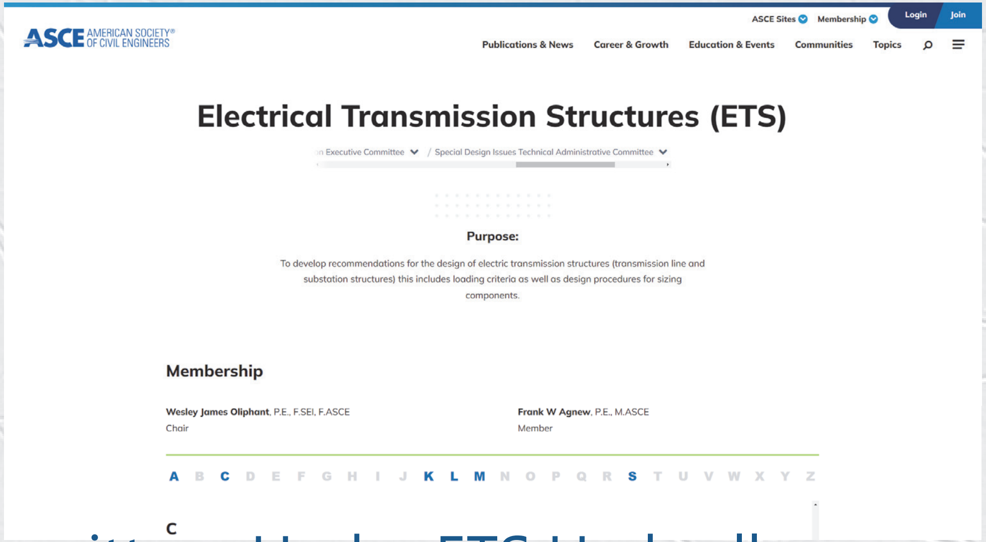
by
Otto J. Lynch, P.E.
Power Line Systems

Executive Summary - ASCE

- 4 ~~2~~ Standards Committees
  - Directly Under ASCE Structural Engineering Institute (SEI)
- 6 Task Committees
  - Under Electrical Transmission and Substation Structures (ETS) Committee
  - Chair – Wes Oliphant
  - Vice Chair – Otto Lynch
- Triennial ASCE/SEI ETS Conference
- New Task Committees
- New Standard

Electrical Transmission Structures (ETS)

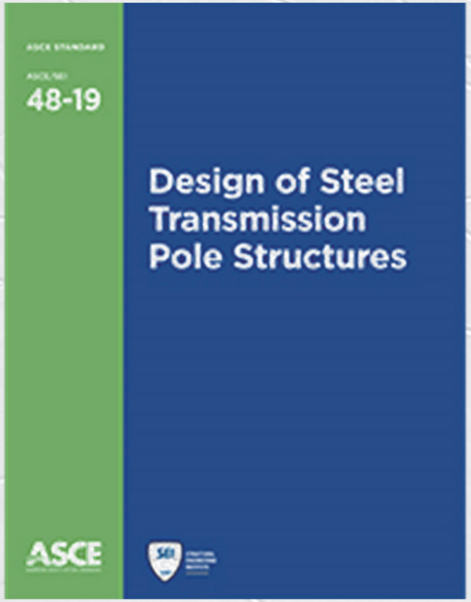
- Under ASCE's Structural Engineering Institute (SEI)
- Wes Oliphant – Chair
- Otto Lynch – Vice Chairman
  - Frank W Agnew
  - Ron Carrington
  - Tim Cashman
  - Leon Kempner
  - Mike Miller
  - Vicki Schneider

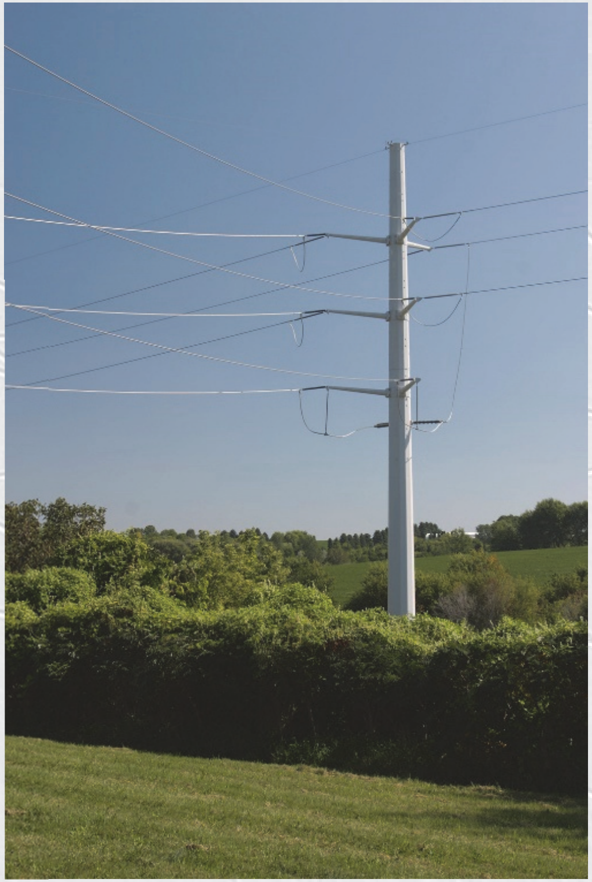


- Manual of Practice (MoP) Committees Under ETS Umbrella
- https://www.asce.org/templates/membership-communities-committee-detail.aspx?committeeid=000000885430

ASCE 48 – Tubular Steel Structures

- New Cycle Underway – 4th Edition
- Chair - Nick Grossenbach
    - American Transmission Company
- 3rd Edition (ASCE 48-19)

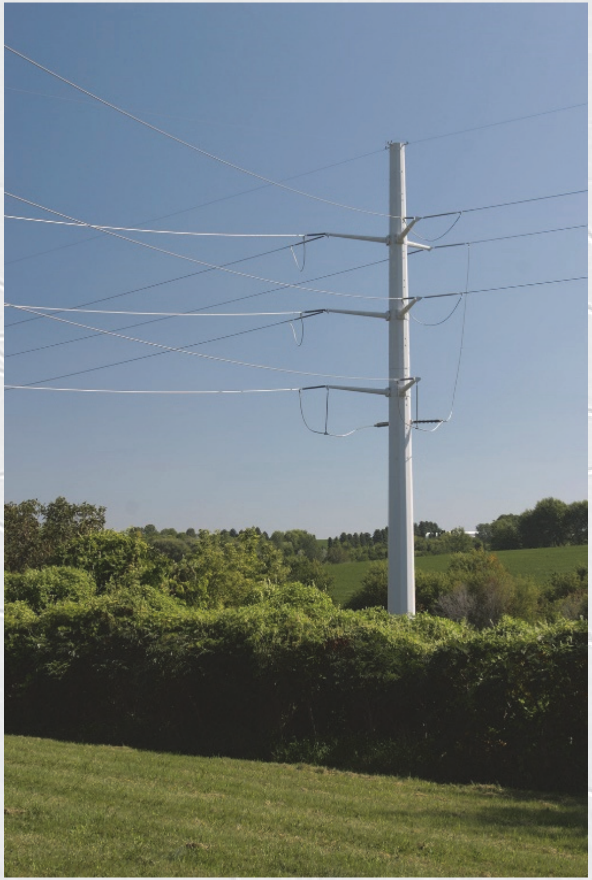




https://sp360.asce.org/PersonifyEbusiness/Merchandise/Product-Details/productId/266165183

ASCE 48 – Tubular Steel Structures

- What to look for:
  - Aesthetic design
  - Expanded Appendix
  - Vibration and Fatigue Appendix
  - Shaft to baseplate issues
  - Connections

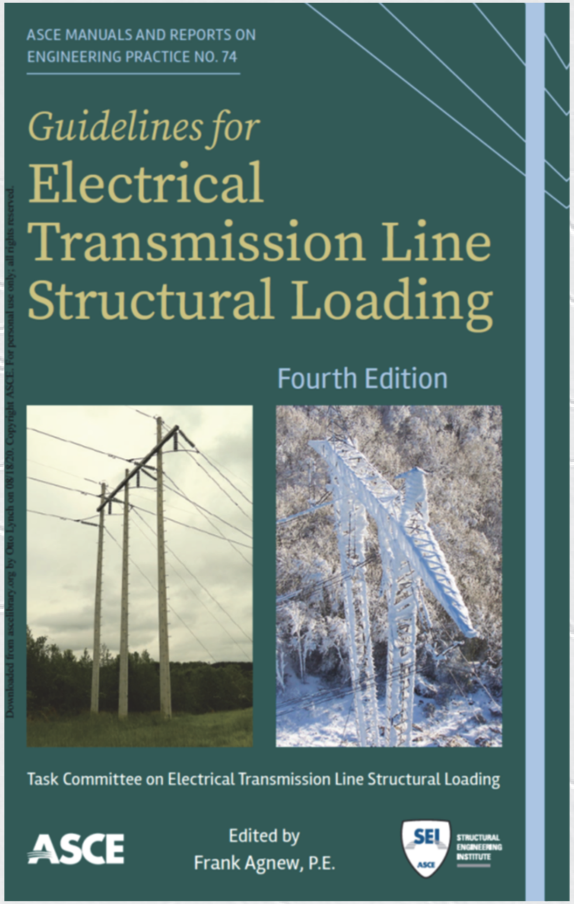


ASCE 10 – Lattice Steel Structures

- Chair – Bob Nickerson
- 3rd Edition Currently in Balloting
  - Had over 50 Change Proposals
  - Committee Voting Passed
  - Public Ballot
- Publish 2022?
- ASCE 10-15
  - Order from ASCE Bookstore
  - http://www.asce.org/templates/publications-book-detail.aspx?id=12069

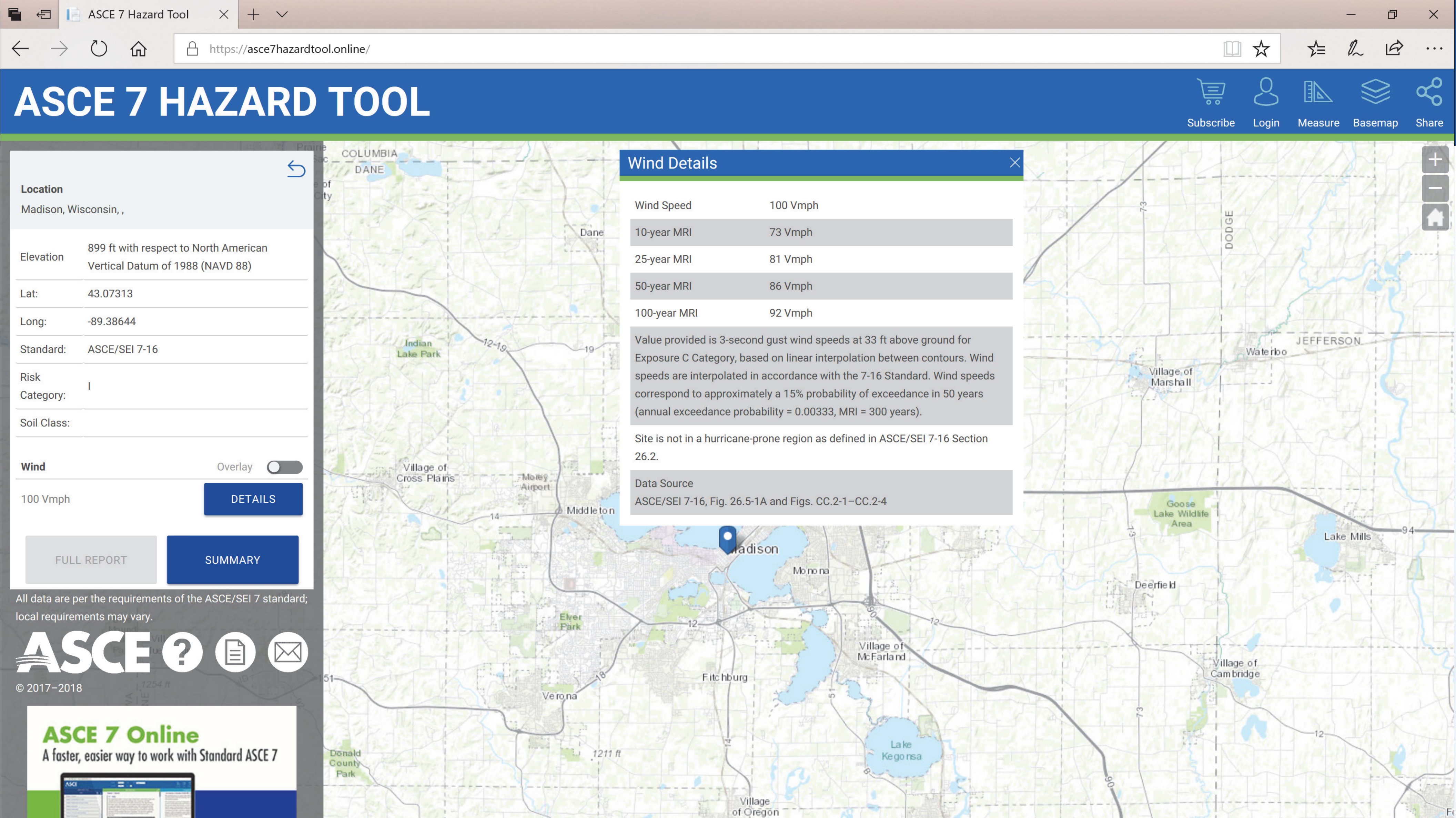
ASCE 74 – Guidelines for Structure Loadings

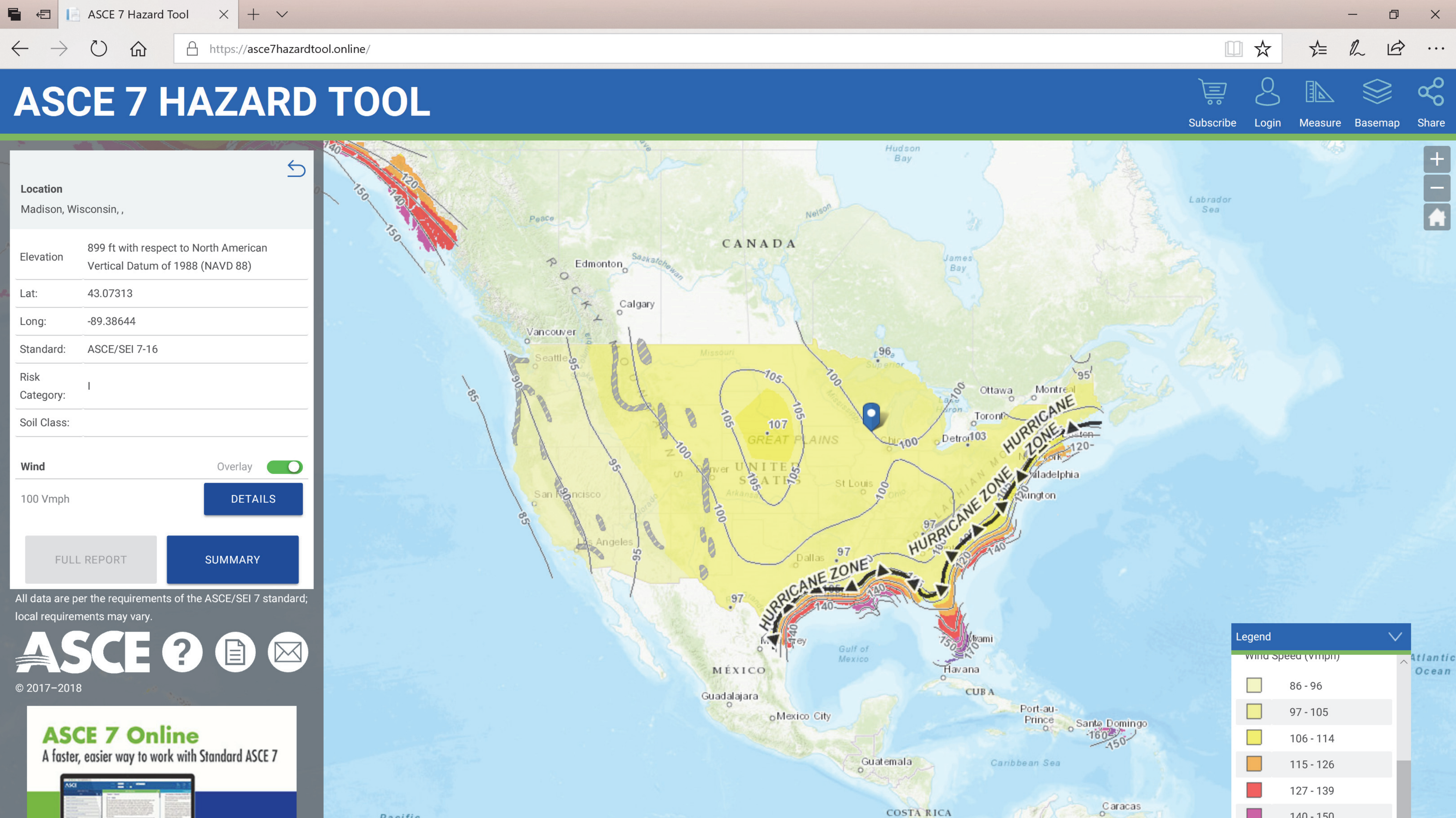
- Chair – Frank Agnew
- 4th Edition PUBLISHED!
  - https://ascelibrary.org/doi/book/10.1061/9780784415566
- What to look for:
  - Complete rewrite of 3rd Edition
  - Updated wind and ice maps (100 Year)
  - New high-intensity wind numbers
  - New gust-response factors
  - New height adjustment factors
  - Pre-standard appendix



ASCE XX – Design Loads for Structures Supporting Overhead Power Lines & Wired Telecommunications Infrastructure

- New STANDARD Underway
- Committee Approved by ASCE ExCom
- Chair - Michael Miller
- Promotion of ASCE 74 to Standard
- New Number (Assigned During Publications)
- See Appendix M of 4th Edition of 74 to see Standard - Today
- Meetings Ongoing
- Aggressive Schedule


ASCE 7 Hazard Tool
https://asce7hazardtool.online/
ASCE 7 HAZARD TOOL
Subscribe
Login
Measure
Basemap
Share
Location
Madison, Wisconsin, ,
Elevation
899 ft with respect to North American Vertical Datum of 1988 (NAVD 88)
Lat: 43.07313
Long: -89.38644
Standard: ASCE/SEI 7-16
Risk Category: I
Soil Class:
Wind
Overlay
100 Vmph
DETAILS
FULL REPORT
SUMMARY
All data are per the requirements of the ASCE/SEI 7 standard; local requirements may vary.
ASCE
© 2017–2018
ASCE 7 Online
A faster, easier way to work with Standard ASCE 7
Wind Details
Wind Speed 100 Vmph
10-year MRI 73 Vmph
25-year MRI 81 Vmph
50-year MRI 86 Vmph
100-year MRI 92 Vmph
Value provided is 3-second gust wind speeds at 33 ft above ground for Exposure C Category, based on linear interpolation between contours. Wind speeds are interpolated in accordance with the 7-16 Standard. Wind speeds correspond to approximately a 15% probability of exceedance in 50 years (annual exceedance probability = 0.00333, MRI = 300 years).
Site is not in a hurricane-prone region as defined in ASCE/SEI 7-16 Section 26.2.
Data Source
ASCE/SEI 7-16, Fig. 26.5-1A and Figs. CC.2-1–CC.2-4
COLUMBIA
DANE
JEFFERSON
DODGE
Dane
Indian Lake Park
Village of Cross Plains
Middleton
Madison
Monona
Waterloo
Village of Marshall
Goose Lake Wildlife Area
Lake Mills
Deerfield
Elver Park
Village of McFarland
Village of Cambridge
Fitchburg
Verona
Lake Kegonsa
Donald County Park
Village of Oregon


ASCE 7 Hazard Tool
https://asce7hazardtool.online/
ASCE 7 HAZARD TOOL
Subscribe
Login
Measure
Basemap
Share
Location
Madison, Wisconsin, ,
Elevation
899 ft with respect to North American Vertical Datum of 1988 (NAVD 88)
Lat:
43.07313
Long:
-89.38644
Standard:
ASCE/SEI 7-16
Risk Category:
I
Soil Class:
Wind
Overlay
100 Vmph
DETAILS
FULL REPORT
SUMMARY
All data are per the requirements of the ASCE/SEI 7 standard; local requirements may vary.
ASCE
© 2017–2018
ASCE 7 Online
A faster, easier way to work with Standard ASCE 7
CANADA
UNITED STATES
MEXICO
GREAT PLAINS
HURRICANE ZONE
Legend
86 - 96
97 - 105
106 - 114
115 - 126
127 - 139
140 - 150

ASCE 113 – Substation Design

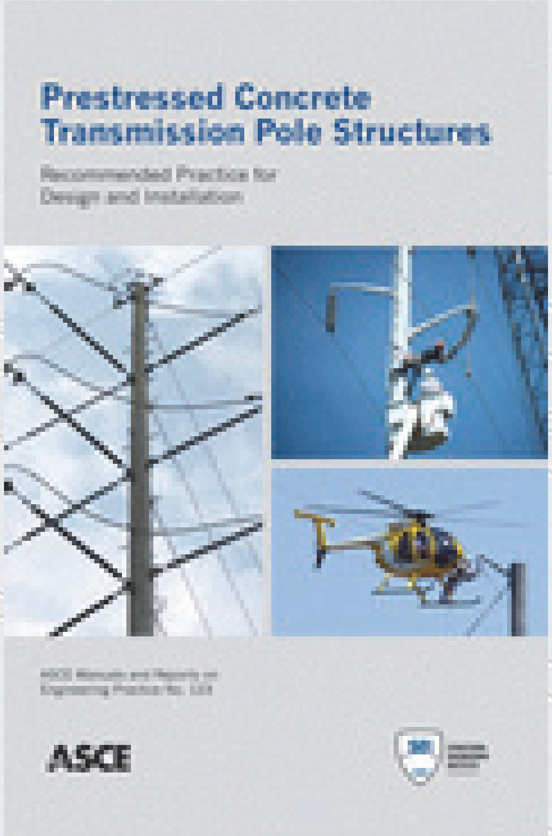
- Chair – George Watson.
- 1st edition released several years ago.
- 2nd revision currently being worked on.
- Blue Ribbon Panel Complete
- 2022 Publish Date (?)
- Numerous working groups
- What to look for:
  - 300 Year MRI per ASCE 7
  - New section on foundation design issues

ASCE 104 - FRP (Fiberglass)

- Chair – Galen Fecht
- Blue Ribbon Panel Review Complete
- PUBLISHED!
  - https://ascelibrary.org/doi/book/10.1061/9780784415443
- What to look for:
  - Updates to reflect maturing industry
  - Updated design considerations
  - Deflections
  - Foundations
  - Hardware

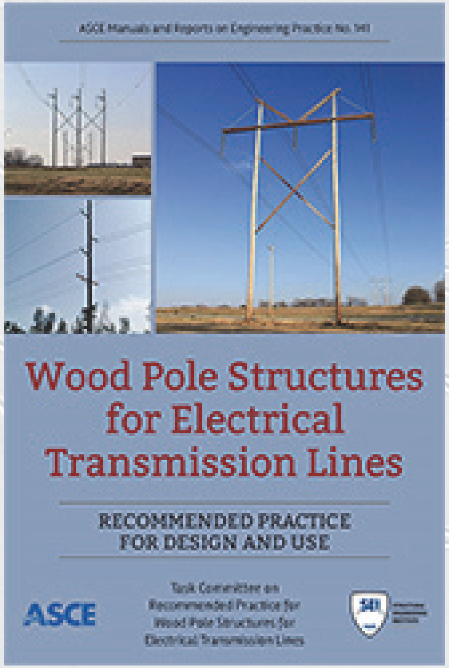
ASCE 123 - Prestressed Concrete Transmission Pole Structures: Recommended Practice for Design and Installation

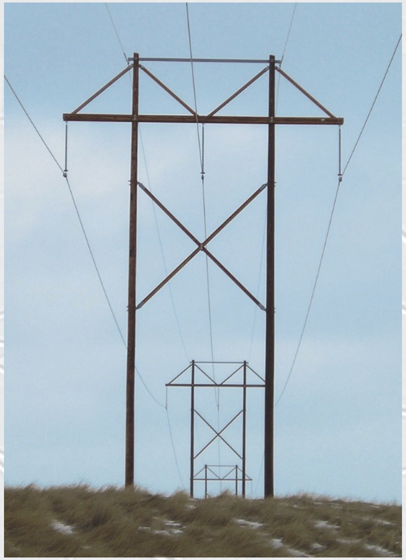
- Chairs – Wesley J. Oliphant, P.E., F.ASCE; and Douglas C. Sherman, P.E.
- Published 2011
  - https://ascelibrary.org/doi/book/10.1061/9780784412114
- Process in Place to Promote to a Standard in Next Few Months



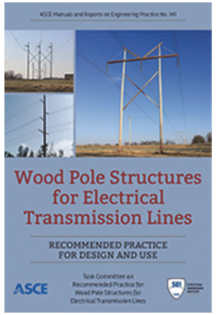
ASCE 141 - Wood Structures

- Chair – Jim McGuire of Great River Energy
- 1st Edition - PUBLISHED!
- Will Start 2nd Edition Soon
- MOP?
- Standard?





https://ascelibrary.org/doi/book/10.1061/9780784415245



Wood Pole Structures for Electrical Transmission Lines: Recommended Practice for Design and Use

ASCE Task Committee on Recommended Practice for Wood Pole Structures for Electrical Transmission Lines; Edited by James M. McGuire, P.E.; Otto J. Lynch, P.E.; Vicki Schneider, P.E.; Jaron T. Reay, P.E., S.E.; Timothy P. Wachholz, P.E., S.E.; Nelson G. Bingel III

MOP 141 | ISBN (print): 9780784415245 | ISBN (PDF): 9780784482056

TOOLS BUY E-BOOK BUY PRINT BOOK

Abstract

Prepared by the Task Committee on Wood Pole Structures for Electrical Transmission Lines of the Committee on Electrical Transmission Structures of the Structural Engineering Institute of ASCE

DETAILS RELATED

ASCE Task Committee on Recommended Practice for Wood Pole Structures for Electrical

Civil Engineering

Prepared by the Task Committee on Wood Pole Structures for Electrical Transmission Lines of the Committee on Electrical Transmission Structures of the Structural Engineering Institute of ASCE.

Wood Pole Structures for Electrical Transmission Lines: Recommended Practice for Design and Use, MOP 141, provides comprehensive knowledge of the principles and methods for the design and use of wood poles for overhead utility line structures. The use of wood pole structures, properly designed utilizing consistent structural engineering principles, may provide a simple, cost effective, and more resilient option than some of the other pole materials commonly used. This manual examines

- Structural configurations and pole applications,
- Critical factors and design considerations specific to wood pole structures,
- Mechanical properties applicable standards and specifications used to manufacture wood poles,
- Wood pole foundations and anchoring,
- Construction of wood pole structures, and
- Inspection and maintenance of wood pole structures and lines.

This Manual of Practice will be valuable to engineers involved in utility and structural engineering.

MOP 141 provides a vital overview on the design and use of wood poles for overhead utility line structures using sound engineering practices.

ISBN 978-0-7844-1524-5

ASCE AMERICAN SOCIETY OF CIVIL ENGINEERS

MOP 141

Wood Pole Structures for Electrical Transmission Lines

ASCE

ASCE Manuals and Reports on Engineering Practice No. 141

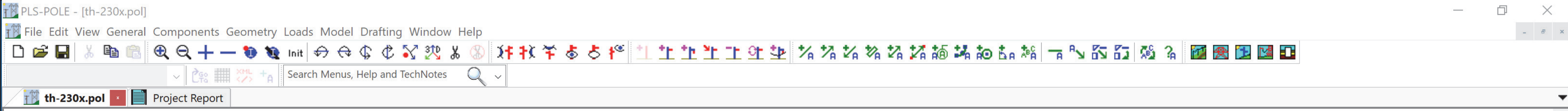
Wood Pole Structures for Electrical Transmission Lines

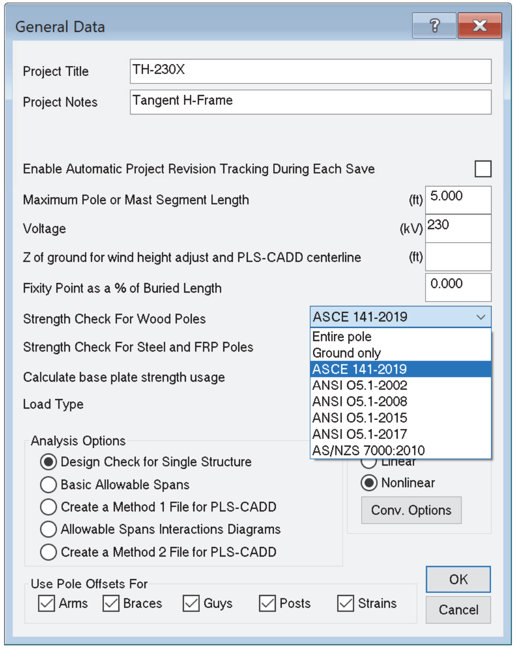
RECOMMENDED PRACTICE FOR DESIGN AND USE

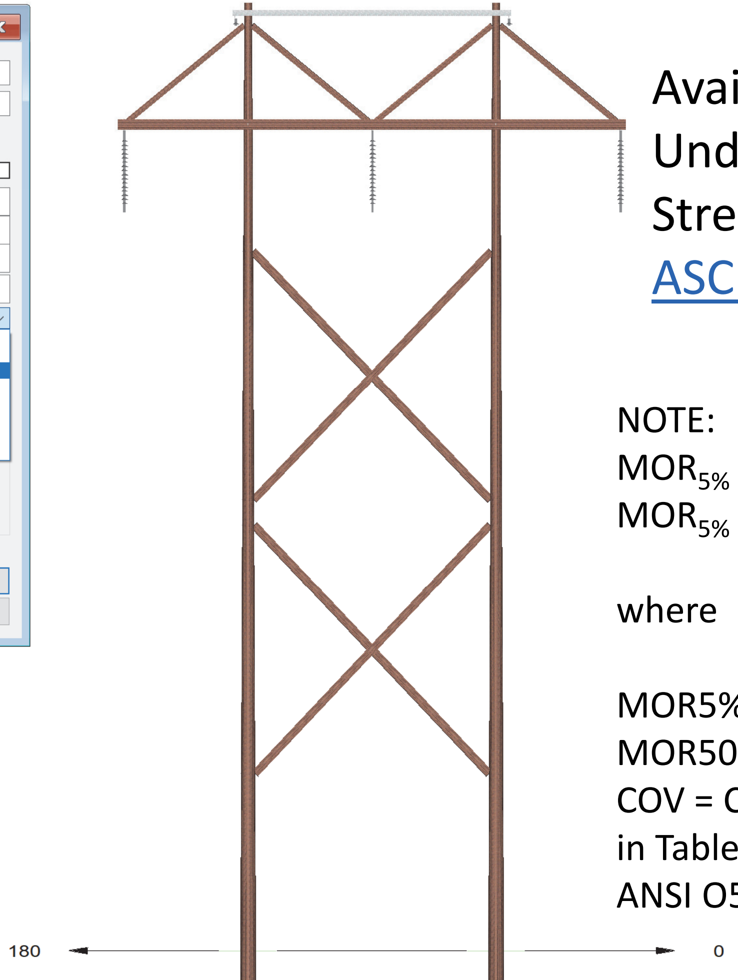
ASCE

Task Committee on Recommended Practice for Wood Pole Structures for Electrical Transmission Lines

SEI STRUCTURAL ENGINEERING INSTITUTE







Available Now in PLS-POLE Under General/General Data Strength Check For Wood Poles ASCE 141

NOTE:

$MOR_{5\%} = MOR_{50\%} (1 - 1.645 \times COV)$

$MOR_{5\%} = MOR_{50\%} * 0.671$

where

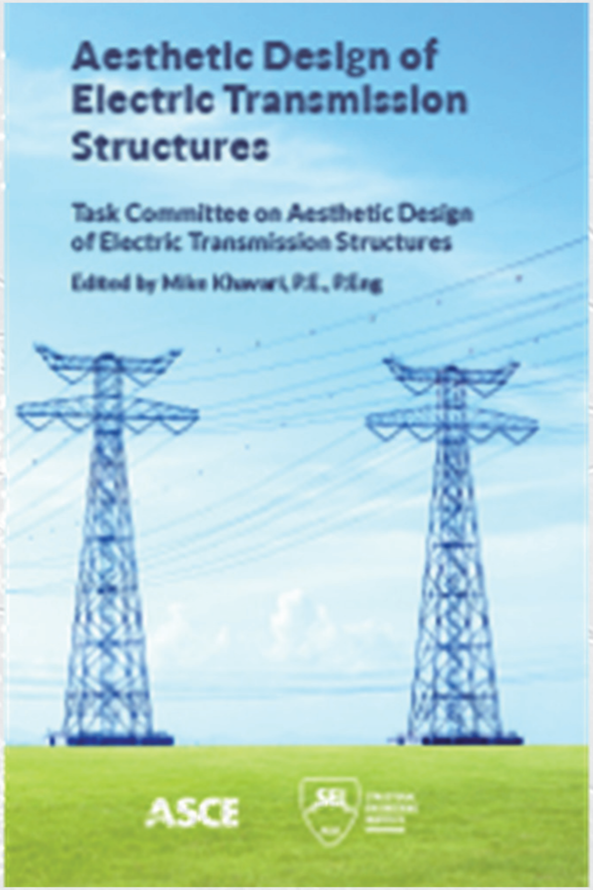
MOR5% = 5% lower exclusion limit,

MOR50% = 50% lower exclusion limit, and

COV = Coefficient of variation as designated in Table 1, footnote 4 of ANSI O5.1.

ASCE Aesthetic Structures

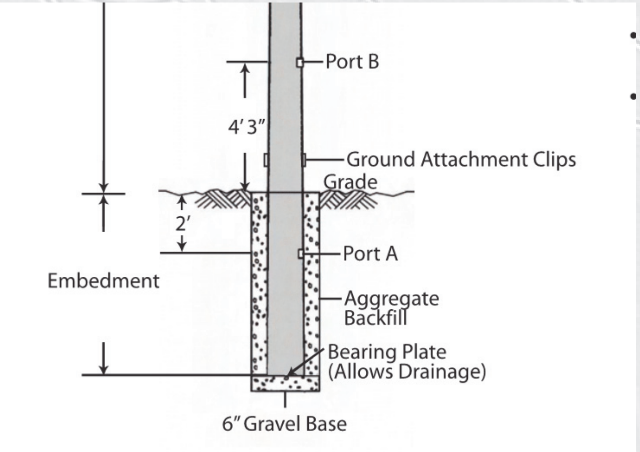
- Chair – Mike Khavari
- Committee Report
  - Guidelines to Consider
- Published!
- https://sp360.asce.org/PersonifyEbusiness/Merchandise/Product-Details/productId/268246301



ASCE Foundations – New Committee

- Chair – Vicki Schneider
  - Mortenson Engineering Services, Inc.
- Progressing Quickly
- Published 2022?

Figure 6-2. Direct embedded pole.



ASCE Resiliency – New Committee

- ETS Task Committee for Structural Resiliency and Reliability of Overhead Line Structures
- Approved by ASCE ExCom
- Chair - Leon Kempner
- HOWEVER, ASCE (SEI) has Formed a Committee to Address Resiliency Across the Entire Structural Engineering Profession.
- Ongoing…..

ASCE Line Design – New Committee

- ETS Task Committee for Overhead Line Design
  - Covers all Civil/Structural Aspects
  - References Existing MoPs and Standards
  - Adds Information to 'Fill the Gaps'

ASCE Electrical Transmission and Substations Conference

- 2018 Conference – Atlanta, GA
  - Over 1600 Attendees!
- 2022 Conference – Orlando, FL, October 2nd – 6^{th}, 2022
  - Rosen Shingle Creek
- Chair – Tim Cashman
- Program Complete
- Booths
- Sponsorships
- www.etsconference.org

ASCE Electrical Transmission and Substations Conference

- 2022 Conference – Orlando, FL, October 2nd – 6th, 2022
  - Rosen Shingle Creek
- Registration Open
  - Early Bird Until July 13th
  - Hotel Rooms Going Fast
- 11 Technical Sessions
- Exhibit Hall
- Golf Tournament on Thursday

National Electrical Safety Code (NESC)

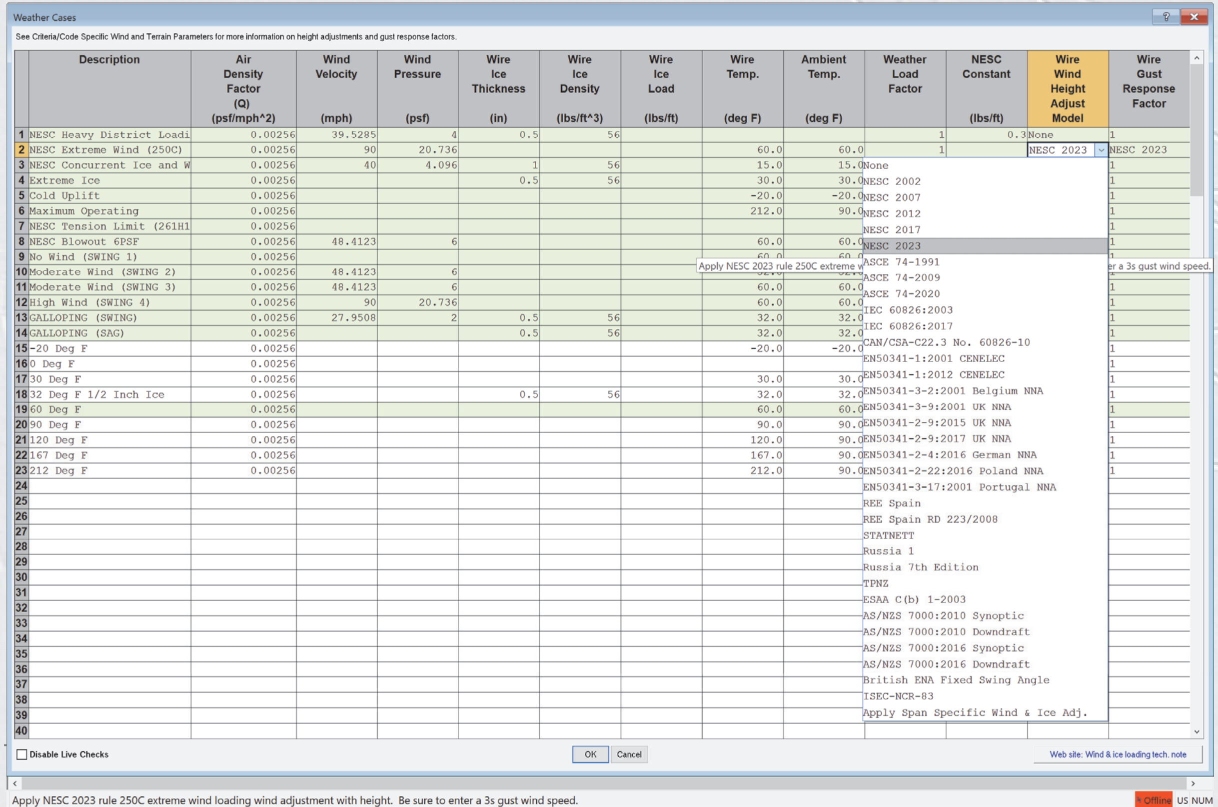
- 2023 Next Edition in Publishing
- The Major Changes:
  - Ice density changed from 57pcf to 56pcf.
  - Updated wind maps for NESC extreme wind.
  - New equations for wind height adjustment (G_{RF})

National Electrical Safety Code (NESC)

- The Major Changes (Continued):
  - Grade B and Grade C wind maps are now separate. Grade C is approximately the same as B, but 5 mph less and uses a 50 year mean recurrence interval.
  - Wire and Structure Wind Load Factor for Grade C changed from 0.87 to 1 because of the updated maps.

National Electrical Safety Code (NESC)

- Already Available in PLS-CADD



Weather Cases

See Criteria/Code Specific Wind and Terrain Parameters for more information on height adjustments and gust response factors.

	Description	Air Density Factor (Q) (psf/mph^2)	Wind Velocity (mph)	Wind Pressure (psf)	Wire Ice Thickness (in)	Wire Ice Density (lbs/ft^3)	Wire Ice Load (lbs/ft)	Wire Temp. (deg F)	Ambient Temp. (deg F)	Weather Load Factor	NESC Constant (lbs/ft)	Wire Wind Height Adjust Model	Wire Gust Response Factor
1	NESC Heavy District Loadi	0.00256	39.5285	4	0.5	56				1	0.3	None	1
2	NESC Extreme Wind (250C)	0.00256	90	20.736				60.0	60.0	1		NESC 2023	NESC 2023
3	NESC Concurrent Ice and W	0.00256	40	4.096	1	56		15.0	15.0				1
4	Extreme Ice	0.00256			0.5	56		30.0	30.0				1
5	Cold Uplift	0.00256						-20.0	-20.0				1
6	Maximum Operating	0.00256						212.0	90.0				1
7	NESC Tension Limit (261H1	0.00256											1
8	NESC Blowout 6PSF	0.00256	48.4123	6				60.0	60.0				1
9	No Wind (SWING 1)	0.00256						60.0	60.0				1
10	Moderate Wind (SWING 2)	0.00256	48.4123	6				[illegible]	[illegible]				
11	Moderate Wind (SWING 3)	0.00256	48.4123	6				60.0	60.0				1
12	High Wind (SWING 4)	0.00256	90	20.736				60.0	60.0				1
13	GALLOPING (SWING)	0.00256	27.9508	2	0.5	56		32.0	32.0				1
14	GALLOPING (SAG)	0.00256			0.5	56		32.0	32.0				1
15	-20 Deg F	0.00256						-20.0	-20.0				1
16	0 Deg F	0.00256											1
17	30 Deg F	0.00256						30.0	30.0				1
18	32 Deg F 1/2 Inch Ice	0.00256			0.5	56		32.0	32.0				1
19	60 Deg F	0.00256						60.0	60.0				1
20	90 Deg F	0.00256						90.0	90.0				1
21	120 Deg F	0.00256						120.0	90.0				1
22	167 Deg F	0.00256						167.0	90.0				1
23	212 Deg F	0.00256						212.0	90.0				1
24													
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39													
40													

None
NESC 2002
NESC 2007
NESC 2012
NESC 2017
NESC 2023
ASCE 74-1991
ASCE 74-2009
ASCE 74-2020
IEC 60826:2003
IEC 60826:2017
CAN/CSA-C22.3 No. 60826-10
EN50341-1:2001 CENELEC
EN50341-1:2012 CENELEC
EN50341-3-2:2001 Belgium NNA
EN50341-3-9:2001 UK NNA
EN50341-2-9:2015 UK NNA
EN50341-2-9:2017 UK NNA
EN50341-2-4:2016 German NNA
EN50341-2-22:2016 Poland NNA
EN50341-3-17:2001 Portugal NNA
REE Spain
REE Spain RD 223/2008
STATNETT
Russia 1
Russia 7th Edition
TPNZ
ESAA C(b) 1-2003
AS/NZS 7000:2010 Synoptic
AS/NZS 7000:2010 Downdraft
AS/NZS 7000:2016 Synoptic
AS/NZS 7000:2016 Downdraft
British ENA Fixed Swing Angle
ISEC-NCR-83
Apply Span Specific Wind & Ice Adj.

Apply NESC 2023 rule 250C extreme w... er a 3s gust wind speed.

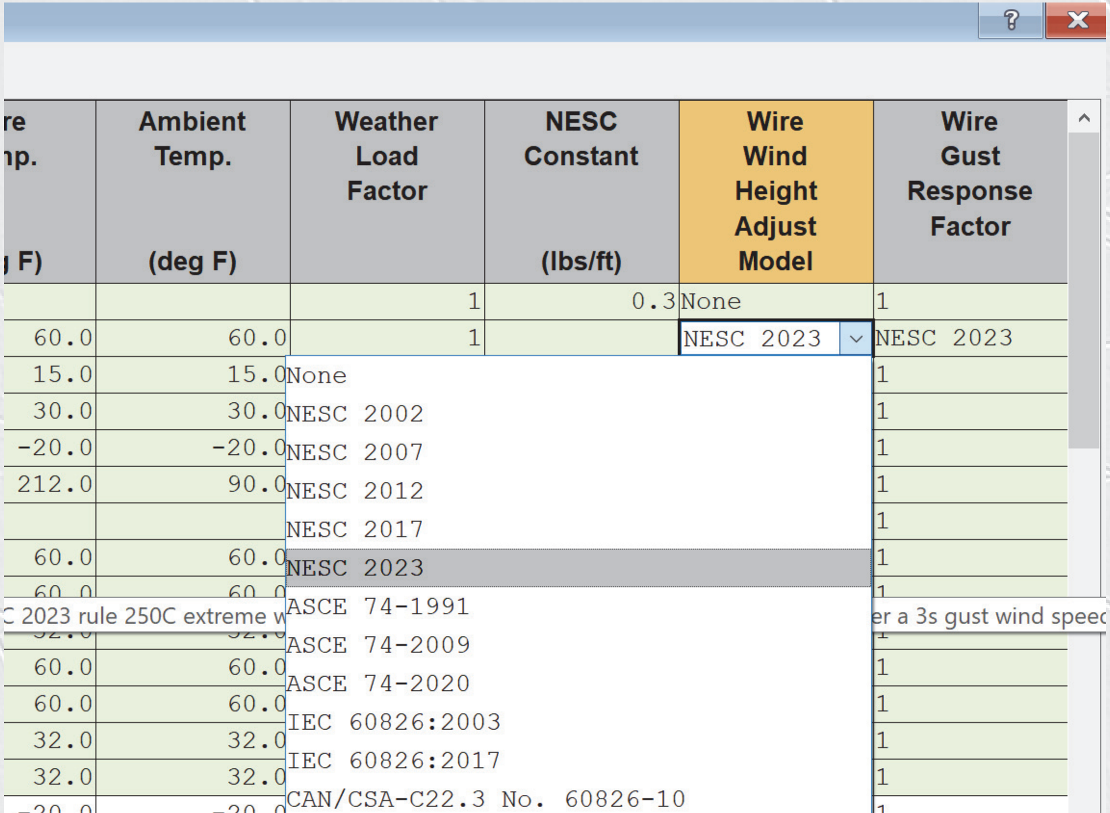
Disable Live Checks | OK | Cancel | Web site: Wind & ice loading tech. note

Apply NESC 2023 rule 250C extreme wind loading wind adjustment with height. Be sure to enter a 3s gust wind speed.

Offline US NUM

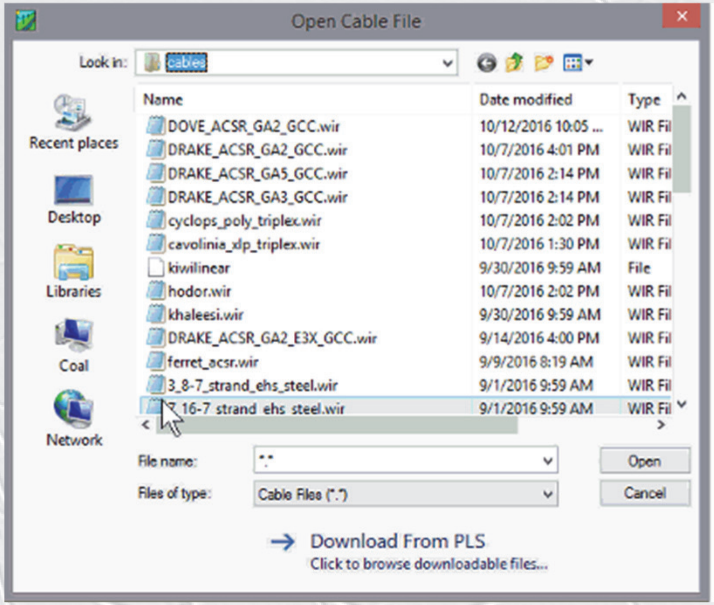
National Electrical Safety Code (NESC)

- Already Available in PLS-CADD



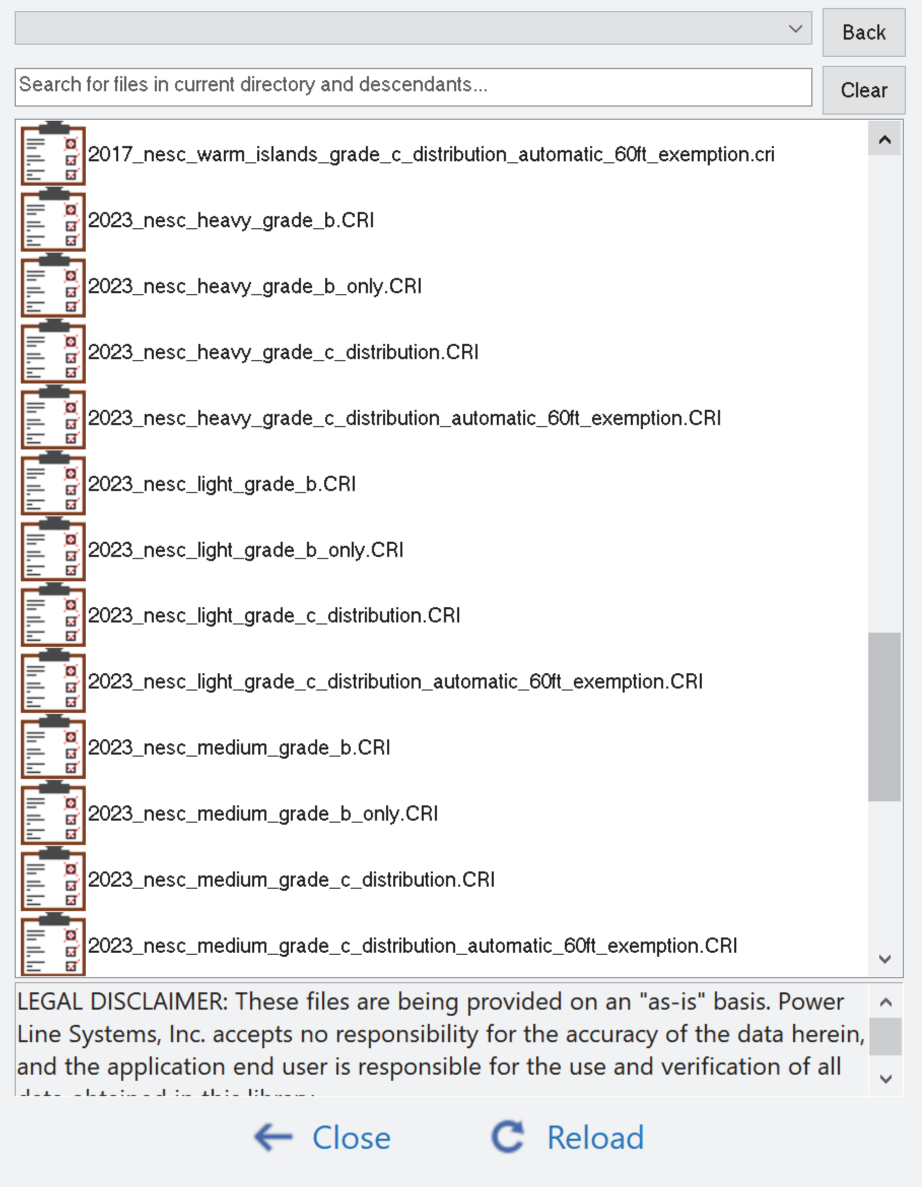
National Electrical Safety Code (NESC)

- Already Available in PLS-CADD



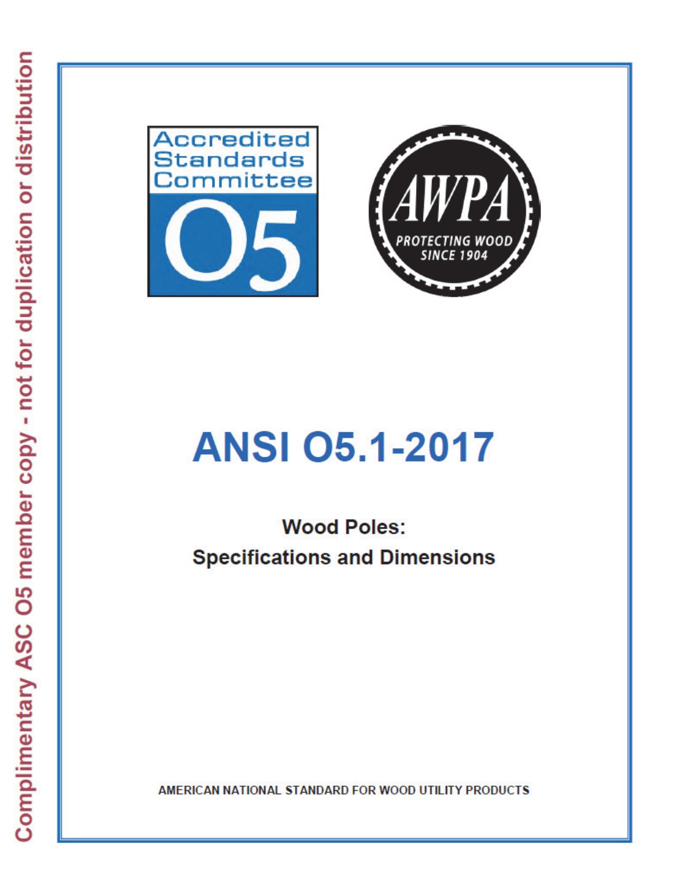
National Electrical Safety Code

- Already Available in PLS-CADD



ANSI O5.1

- 2017 Edition Published
- Table 1 – Adds MOE
- Different from REA 1724E-200 MOE
  - Values usually larger so poles will show less deflection and therefore lower stresses when using nonlinear anlaysis



ANSI O5.1

RUS 1724E-200 Values → 2017 ANSI O5.1 Values

RUS 1724E-200 Values

Wood Material Properties (From file "c:\users\public\documents\pls\pls_pole\examples\rus structur

ANSI O5.1.2008 - American National Standard for Wood Poles and Wood Products
Wood Poles - Specifications and Dimensions
Code Letters used are per Section 7.5, Page 12
Fiber Strengths used are per Table 1, Page 14, and coincide with the fiber strength of those materials listed in REA Bulletin 1728F-700, 1993, REA Specification for Wood Poles, Stubs and Anchor Logs (Table 1, Page 35). RUS does not provide properties for Scots Pine and Interior North

	Material Label	Modulus of Elasticity (ksi)	Design Stress MOR (ksi)	Weight Density (lbs/ft^3)	ANSI O5.1 Status	Allowable Shear Stress (ksi)	All Co S
1	SP-Southern Pine	1800	8	60	Included	NA	
2	DF-Douglas Fir	1920	8	60	Included	NA	
3	JP-Jack Pine	1220	6.6	60	Not Included	NA	
4	LP-Lodgepole Pine	1340	6.6	60	Not Included	NA	
5	NP-Red Pine	1800	6.6	60	Not Included	NA	
6	WP-Ponderosa Pine	1260	6	60	Not Included	NA	
7	WC-Western Red Cedar	1120	6	50	Included	NA	

Save | Save As | Merge | Report | Cancel

2017 ANSI O5.1 Values

Wood Material Properties (From file "c:\users\otto\documents\standards\asce\wood structure mor

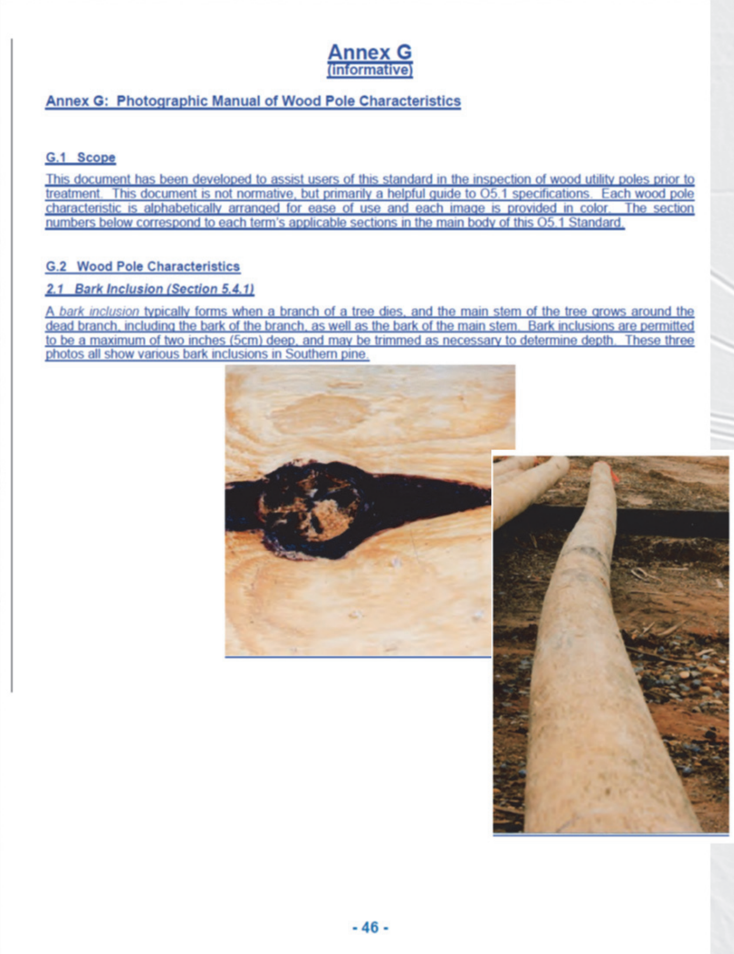
ANSI O5.1.2017 - American National Standard for Wood Poles and Wood Products
Wood Poles - Specifications and Dimensions
Code Letters used are per Section 7.5, Page 12
Fiber Strengths (MOR) and Moduluses of Elasticity (MOE) used are per Table 1, Page 14

	Material Label	Modulus of Elasticity (ksi)	Design Stress MOR (ksi)	Weight Density (lbs/ft^3)	ANSI O5.1 Status	Allowable Shear Stress (ksi)	All Co S
1	SP-Southern Pine	2130	8	60	Included	NA	
2	DF-Douglas Fir	2380	8	60	Included	NA	
3	JP-Jack Pine	1220	6.6	60	Not Included	NA	
4	LP-Lodgepole Pine	1660	6.6	60	Not Included	NA	
5	NP-Red Pine	1470	6.6	60	Not Included	NA	
6	WP-Ponderosa Pine	1260	6	60	Not Included	NA	
7	WC-Western Red Cedar	1430	6	50	Included	NA	

Save | Save As | Merge | Report | Cancel

ANSI O5.1 – Wood Poles

- Upcoming New Version
  - (ANSI O5.1-2022?)
- Addition of H1 – H6 Jack pine, Lodgepole, Red pine, Western Fir, and Radiata pine poles
- Addition of Annex G; Photographic Manual of Wood Pole Characteristics



Annex G
(informative)

Annex G: Photographic Manual of Wood Pole Characteristics

G.1 Scope

This document has been developed to assist users of this standard in the inspection of wood utility poles prior to treatment. This document is not normative, but primarily a helpful guide to O5.1 specifications. Each wood pole characteristic is alphabetically arranged for ease of use and each image is provided in color. The section numbers below correspond to each term's applicable sections in the main body of this O5.1 Standard.

G.2 Wood Pole Characteristics

2.1 Bark Inclusion (Section 5.4.1)

A bark inclusion typically forms when a branch of a tree dies, and the main stem of the tree grows around the dead branch, including the bark of the branch, as well as the bark of the main stem. Bark inclusions are permitted to be a maximum of two inches (5cm) deep, and may be trimmed as necessary to determine depth. These three photos all show various bark inclusions in Southern pine.

- 46 -

ANSI O5.1 – Wood Poles

POWER LINE SYSTEMS®

Table 6 - Dimensions of Jack pine, Lodgepole pine, Red pine, Western fir, and Radiata pine[2] (Fiber Strength 6600 psi)

Class		H6	H5	H4	H3	H2	H1	1	2	3	4	5	6	7	9	10
Minimum circumference at top (in)		39	37	35	33	31	29	27	25	23	21	19	17	15	15	12
Length of pole (ft)	Approximate Groundline[1] distance from butt (ft)	Minimum circumference at 6 ft from butt (in)														
20	4	44.5	43.0	41.0	39.0	37.0	35.0	32.5	30.5	28.5	26.5	24.5	22.5	21.0	18.0	14.5
25	5	49.0	47.0	44.5	42.5	40.5	38.0	36.0	33.5	31.0	29.0	27.0	25.0	23.0	20.0	15.5
30	5.5	53.0	50.5	48.5	46.0	43.5	41.5	39.0	36.5	34.0	31.5	29.0	27.0	25.0	21.0	-
35	6	56.5	54.0	51.5	49.0	46.5	44.0	41.5	38.5	36.0	33.5	31.0	28.5	26.5	-	-
40	6	59.5	57.0	54.5	52.0	49.0	46.5	44.0	41.0	38.0	35.5	33.0	30.5	-	-	-
45	6.5	62.5	60.0	57.0	54.5	51.5	49.0	46.0	43.0	40.0	37.0	34.5	32.0	-	-	-
50	7	65.0	62.5	59.5	56.5	54.0	51.0	48.0	45.0	42.0	39.0	36.0	-	-	-	-
55	7.5	67.5	64.5	61.5	59.0	56.0	53.0	49.5	46.5	43.5	40.5	-	-	-	-	-
60	8	70.0	67.0	64.0	61.0	57.5	54.5	51.5	48.0	45.0	42.0	-	-	-	-	-
65	8.5	72.0	69.0	66.0	62.5	59.5	56.5	53.0	49.5	46.0	43.0	-	-	-	-	-
70	9	74.0	71.0	67.5	64.5	61.0	58.0	54.5	51.0	47.5	44.5	-	-	-	-	-
75	9.5	76.0	72.5	69.5	66.0	63.0	59.5	56.0	52.5	49.0	-	-	-	-	-	-
80	10	78.0	74.5	71.0	68.0	64.5	61.0	57.5	54.0	50.5	-	-	-	-	-	-
85	10.5	79.5	76.5	73.0	69.5	66.0	62.5	58.5	55.0	51.5	-	-	-	-	-	-
90	11	81.5	78.0	74.5	71.0	67.5	64.0	60.0	56.5	52.5	-	-	-	-	-	-
95	11	83.0	79.5	76.0	72.5	69.0	65.0	61.5	57.5	-	-	-	-	-	-	-
100	11	84.5	81.0	77.5	74.0	70.0	66.5	62.5	58.5	-	-	-	-	-	-	-
105	12	86.0	82.5	79.0	75.0	71.5	67.5	63.5	60.0	-	-	-	-	-	-	-
110	12	87.5	84.0	80.5	76.5	72.5	69.0	65.0	61.0	-	-	-	-	-	-	-
115	12	89.0	85.5	81.5	78.0	74.0	70.0	66.0	62.0	-	-	-	-	-	-	-
120	12	90.5	87.0	83.0	79.0	75.0	71.0	67.0	63.0	-	-	-	-	-	-	-
125	12	92.0	88.0	84.0	80.0	76.0	72.0	68.0	64.0	-	-	-	-	-	-	-

NOTE – Classes and lengths for which circumferences at 6 feet from the butt are listed in boldface type are the preferred standard sizes. Those shown in light type are included for engineering purposes only.

[1] The figures in this column are not recommended embedment depths; rather, these values are intended for use only when a definition of groundline is necessary in order to apply requirements relating to scars, straightness, etc.

[2] Radiata pine includes only material produced in Chile between south 33° and south 40° latitude, is limited to no more than 45 feet in length, and limited to pole class sizes 4-10.

ANSI O5.1 – Wood Poles

Table 6M - Metric dimensions of Jack pine, Lodgepole, Red pine, Western fir, and Radiata pine [2] (Fiber Strength 45.5 MPa)

Class		H6	H5	H4	H3	H2	H1	1	2	3	4	5	6	7	9	10
Minimum circumference at top (m)		0.99	0.94	0.89	0.84	0.79	0.74	0.69	0.64	0.58	0.53	0.48	0.43	0.38	0.38	0.30
Length of pole (m)	Approximate Groundline[1] distance from butt (m)	Minimum circumference at 1.8 m from butt (m)														
6.1	1.2	1.13	1.09	1.04	0.99	0.94	0.89	0.83	0.77	0.72	0.67	0.62	**0.57**	**0.53**	**0.46**	**0.37**
7.6	1.5	1.24	1.19	1.13	1.08	1.03	0.97	0.91	0.85	0.79	0.74	0.69	**0.64**	**0.58**	**0.51**	**0.39**
9.1	1.7	1.35	1.28	1.23	1.17	1.10	1.05	0.99	**0.93**	**0.86**	**0.80**	**0.74**	**0.69**	**0.64**	**0.53**	-
10.7	1.7	1.44	1.37	1.31	1.24	1.18	1.12	1.05	**0.98**	**0.91**	**0.85**	**0.79**	**0.72**	**0.67**	-	-
12.2	1.8	1.51	1.45	1.38	1.32	1.24	1.18	**1.12**	**1.04**	**0.97**	**0.90**	**0.84**	**0.77**	-	-	-
13.7	2.0	1.59	1.52	1.45	1.38	1.31	1.24	**1.17**	**1.09**	**1.02**	**0.94**	**0.88**	0.81	-	-	-
15.2	2.1	1.65	1.59	1.51	1.44	1.37	1.30	**1.22**	**1.14**	**1.07**	0.99	0.91	-	-	-	-
16.8	2.3	1.71	1.64	1.56	1.50	1.42	1.35	**1.26**	**1.18**	**1.10**	1.03	-	-	-	-	-
18.3	2.4	1.78	1.70	1.63	1.55	1.46	1.38	**1.31**	**1.22**	**1.14**	1.07	-	-	-	-	-
19.8	2.6	1.83	1.75	1.68	1.59	1.51	1.44	**1.35**	**1.26**	**1.17**	1.09	-	-	-	-	-
21.3	2.7	1.88	1.80	1.71	1.64	1.55	1.47	**1.38**	**1.30**	**1.21**	1.13	-	-	-	-	-
22.9	2.9	1.93	1.84	1.77	1.68	1.60	1.51	**1.42**	**1.33**	**1.24**	-	-	-	-	-	-
24.4	3.1	1.98	1.89	1.80	1.73	1.64	1.55	**1.46**	**1.37**	1.28	-	-	-	-	-	-
25.9	3.2	2.02	1.94	1.85	1.77	1.68	1.59	**1.49**	**1.40**	1.31	-	-	-	-	-	-
27.4	3.4	2.07	1.98	1.89	1.80	1.71	1.63	**1.52**	**1.44**	1.33	-	-	-	-	-	-
29.0	3.4	2.11	2.02	1.93	1.84	1.75	1.65	**1.56**	**1.46**	-	-	-	-	-	-	-
30.5	3.4	2.15	2.06	1.97	1.88	1.78	1.69	**1.59**	**1.49**	-	-	-	-	-	-	-
32.0	3.7	2.18	2.10	2.01	1.90	1.82	1.71	**1.61**	**1.52**	-	-	-	-	-	-	-
33.5	3.7	2.22	2.13	2.04	1.94	1.84	1.75	**1.65**	**1.55**	-	-	-	-	-	-	-
35.1	3.7	2.26	2.17	2.07	1.98	1.88	1.78	**1.68**	**1.57**	-	-	-	-	-	-	-
36.6	3.7	2.30	2.21	2.11	2.01	1.90	1.80	**1.70**	**1.60**	-	-	-	-	-	-	-
38.1	3.7	2.34	2.24	2.13	2.03	1.93	1.83	**1.73**	**1.63**	-	-	-	-	-	-	-

NOTE – Classes and lengths for which circumferences at 1.8m from the butt are listed in boldface type are the preferred standard sizes. Those shown in light type are included for engineering purposes only.

[1] The figures in this column are not recommended embedment depths; rather, these values are intended for use only when a definition of groundline is necessary in order to apply requirements relating to scars, straightness, etc.

[2] Radiata pine includes only material produced in Chile between south 33° and south 40° latitude, is limited to no more than 13.7m in length, and limited to pole class sizes 4-10.

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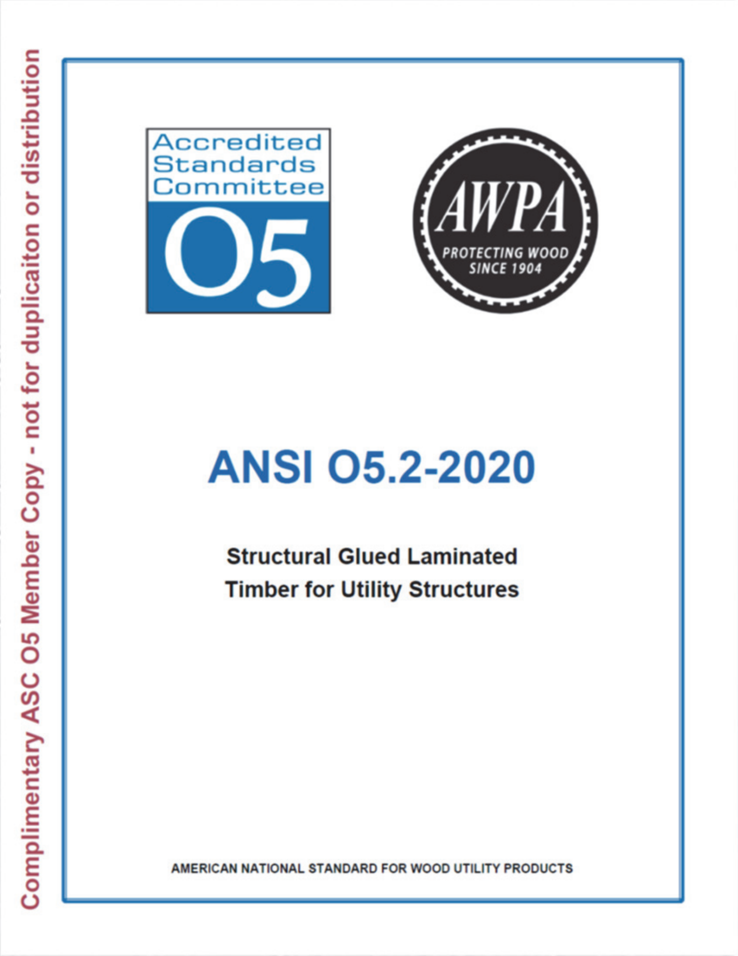

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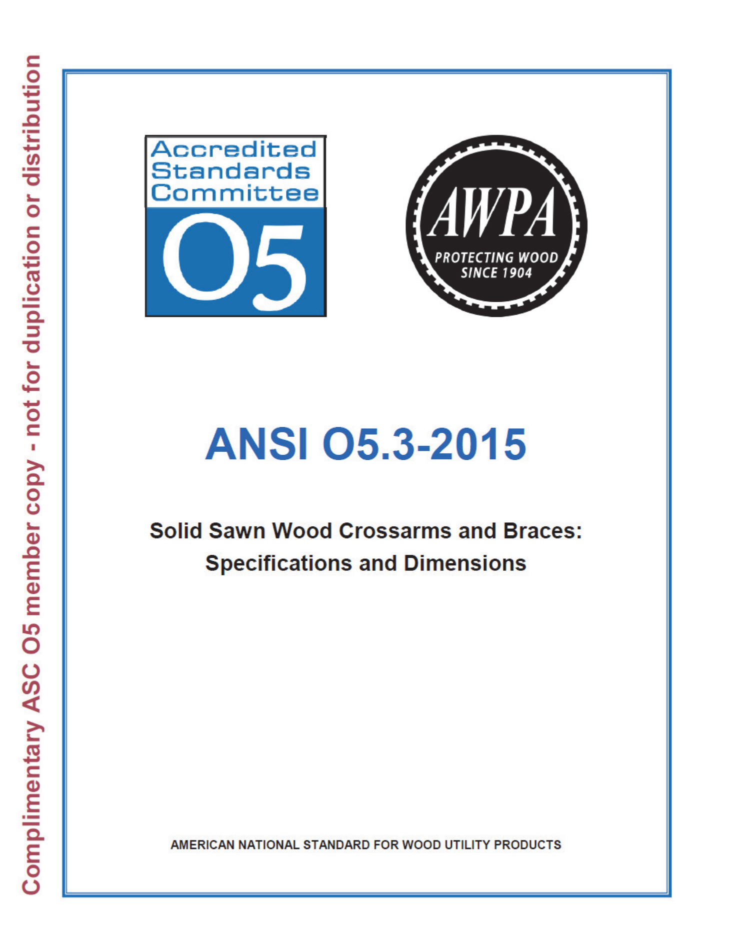
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Any Questions About ASCE / NESC / ANSI O5?

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