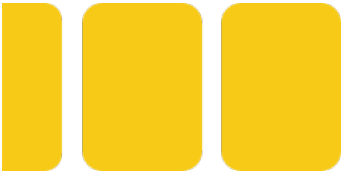


National Electric Safety Code Update and Related IEEE Joint-Use Activities

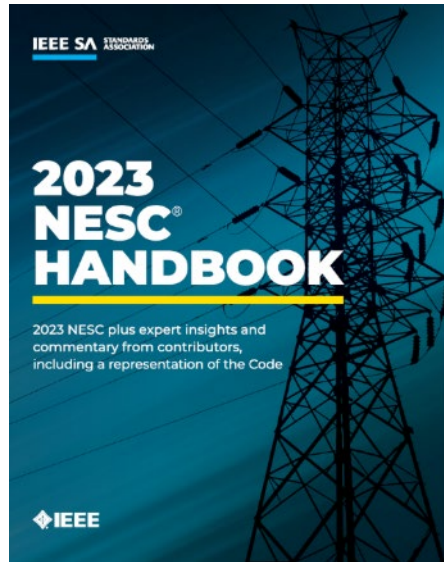


Trevor N. Bowmer, Ph.D.

Principal – Bunya Telecom Consulting LLC.



Codes in Context



- Industry Safety Codes and Standards
- Regulatory Rules..... Legal Mandates
- Internal Practices.....Engineering Design

IEEE – NESC

- NFPA -- NEC
- GO-95....GO128....GO165
- OSHA 1910.268/269
- Internal M&Ps
 - GRs and UL Listings
- Joint Use Agreements (JUA)
- UL
- GRs/SRs
- ATIS
- etc.....

National Electrical Safety Code (NESC)

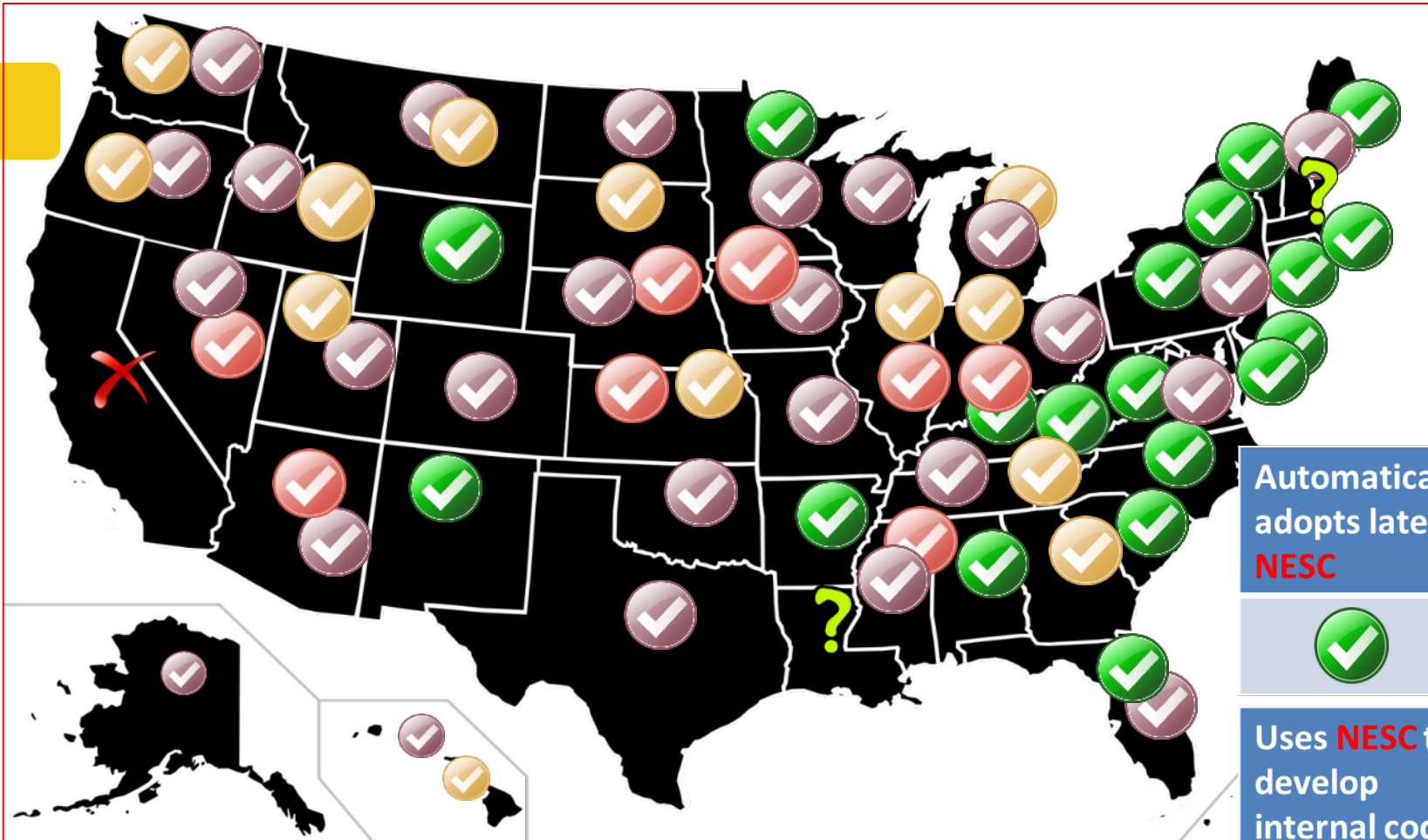
Purpose - The practical safeguarding of **persons**, during the installation, operation, and maintenance of electric supply and communications facilities.

Scope - covers supply and communication facilities and associated work practices employed by a electric supply, communications, or railway in the exercise of its functions as a utility.

“NESC is Not a Design Guide or Instruction Manual “



Adoption & Use



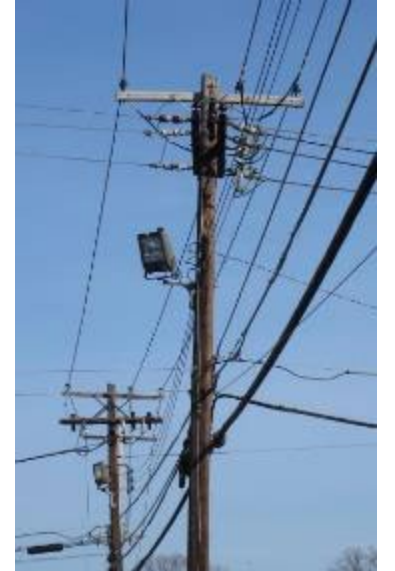
> 90% of the states use NESC in some form
 ➤ 85% use current or near current version

Automatically adopts latest NESC	Adopts current NESC after review	Currently use old Edition or part of NESC
Uses NESC to develop internal code	Does not use NESC	NESC Status Unclear

Relevance of NESC

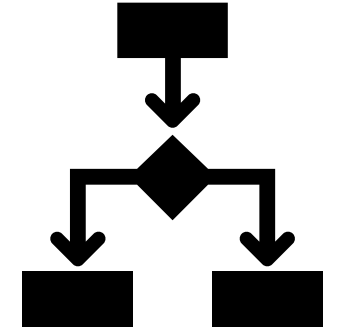
Basis of Joint-Use, License and Pole Agreements & Inter-Company Contracts.

- Pole Attachments and Licensing Contracts
- Joint-Use Agreements (JUAs)
- Regulatory (PUCs, FCC) Rulings and Policy
- Safety Reviews (Internal and OSHA Related)
- Design/Engineering Considerations



NESC provides a vital safety baseline and design guideline (in some ways) to help manage the logistics, business and technical (design/engineering) complications that may arise

NESC STRUCTURE and GOVERNANCE



- SC1 - Scope and Purpose
- SC2 - Grounding Methods
- SC3 - Part 1 - Substations and Generation Facilities
- SC4 - Part 2 - Overhead Lines - Clearances
- SC5 - Part 2 - Overhead Lines - Strength & Loading
- SC7 - Part 3- Underground Lines
- SC8 - Part 4 - Work Rules

Main Committee –

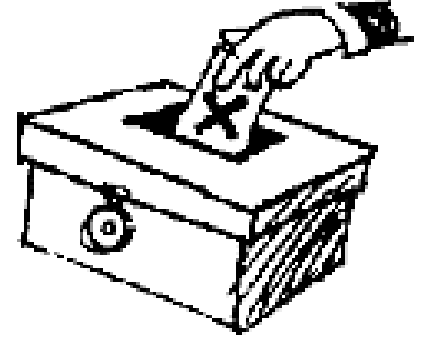
- Provides oversight responsibility

Executive Committee –

- General oversight of NESC direction and policy

2023-2028 Revision - Multi-Step Process

- **5-year Revision Schedule** ... Administered by IEEE ... ANSI Approved
 - TIA and Fast-Trac processes exist for more rapid responses as technology accelerates
- 2023 NESC issued August 2022 with Effective Date of Feb 2023
- Applies on adoption by PUC, State legislative or local AHJ bodies
- 15 May 2024 = Final date to receive Public Change Proposals (PCs)
- August–October 2024 - SCs consider change proposals to the NESC and prepare recommendations.
 - 1 July 2025 Preprint of 2028 Edition
- 24 March 2026 = The final date to submit Public Comments (PCs) on the Draft
- August–October – Working Groups and SCs reconsider all recommendations concerning the proposed amendments and prepare a final report -
 - 15 January 2027 - Proposed revision of the NESC, C2 for letter ballot and to ANSI.
- 14 May 2027 NESC Committee approved revisions submitted to ANSI for recognition as an ANSI standard.
- 1 August 2027 Publication of the 2028 Edition of the NESC



Summary Major NESC Changes for 2023 Code



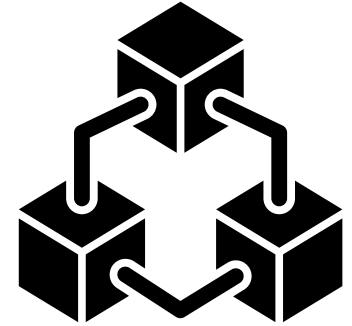
- Editorials, clarifications and format revisions
- Feet/inches = primary → metric secondary and moved to annex
- Safety of persons primary → facilities are secondary
- Add grid-connected facilities (solar & wind farms, energy storage..) – Part 1
- Clearances – 235H (communications lines) and 238F (Wireless)
- Strength and loading – new wind and ice maps
 - New Appendix C for calculation examples

Open Issues



- Ground rods – sizing and equivalency (Section 9)
 - Equivalency of driven rods, buried wire, strips, or plates –
 - Active discussion under SC 2 Working Group
- Ground Clearances for insulators on guys (Rule 215) and over driveways (Rule 232)
- Powering of communications equipment (wireline/wireless)
 - Rules 224/344
 - Working Group 4.8 → created 4 Fast Track Change proposals under active review now
- Congestion/competition on poles – (Clearances - Section 23)
 - IEEE Guide on Joint Use P2939 – 95% complete – impetus is growth of wireless attachments

Key Items - SC2 (Grounding)



- Rule 094B - Ground Rod - open issue for Working Group
 - Minimum Size - trade, nominal or exact size needs clarification
 - What is “equivalency” between driven rods, buried wire, strips, and plates
 - Our Recommendation is for a 5/8-inch diameter copper-clad stainless-steel ground rod as the primary choice rod material and size
- Rule 096C - Grounding Intervals - Effective Grounding of MGN - modified for simplicity and clarity but 4 grounds for each mile remains the basic criteria.
- Intersystem Bonding at Poles - Rule 097G - Re-affirmed – no changes
- Customer Premises Intersystem Bonding – Rule 099 – correlates with NEC

RULE 097 – Grounding & Intersystem Bonding

Rule 097 has 7 interlocking sections with implicit/explicit links to other Rules (e.g., 096, 224, 344, 354, 384) applicable to intersystem bonds –

- Rule 097A -- separate grounding conductors
- Rule 097B – permits a bond to the power ground if MGN system is used and 4 grounds/mile
- Rule 097C - 4 grounds/mile criteria = help to define an effective ground as per NESC
- **Rule 097G** requires a single grounding conductor on structures except as required by Rule 097
 - Where both electric supply systems and communication systems are grounded on a joint use structure and a single grounding conductor is present, the grounding conductor shall be connected to both systems.



097G sets expectation that a bond to vertical ground should be made unless an explicit technical or safety reason not to bond exists.

SC3 (Part 1) Changes



- Explicit inclusion of **grid-connected generation facilities** (solar farms, battery arrays)
- Separate Generation and Substations Sections planned for Next Cycle
 - All these facilities are served by Communications utilities
 - Effectively Ground Fences with exception for engineering study Rule 110.A.3
- Revised Battery Section 14 - Substation & Plant Batteries Vs. Grid Storage Batteries
- New Photovoltaic Section 19
- Open Issue = Magnetic Field Rules – Barricades and Signage

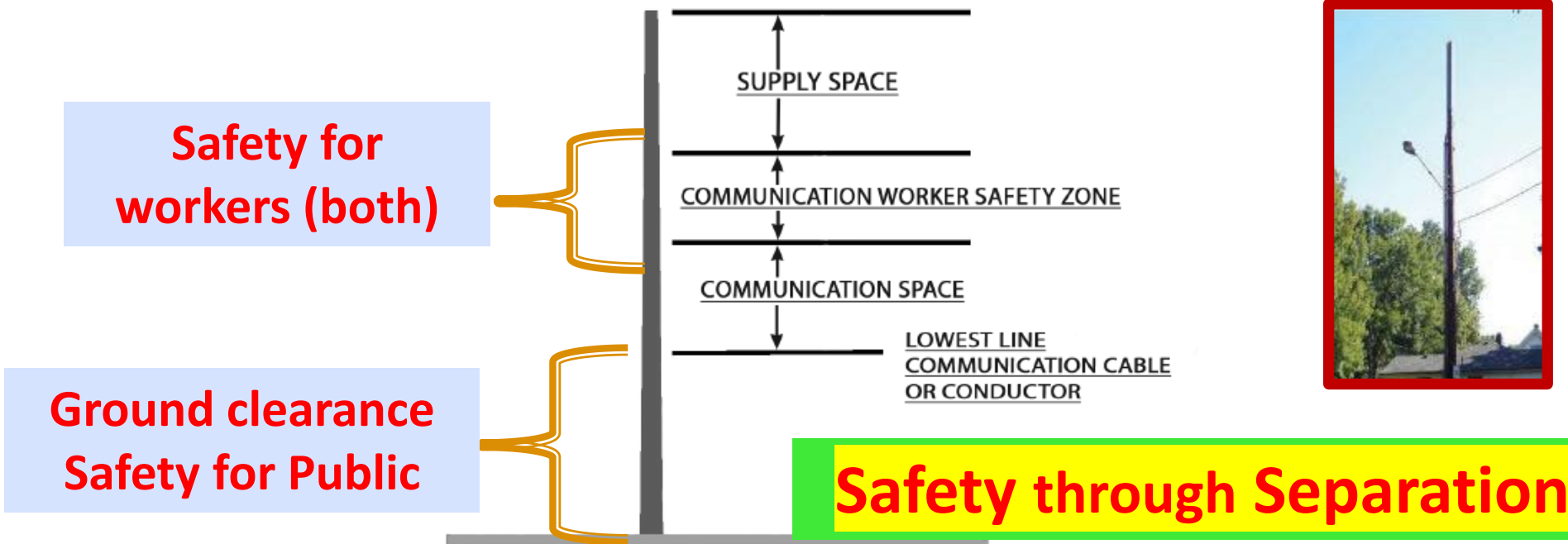
SC4 (Aerial Clearances) – Section 21



- Ground Clearances –215C2 (guys), 232 (driveways), 239 (climbable structures).
 - Reference 8-foot height - should it be raised to 9 foot or 10 feet or higher?
 - 8-foot criteria is practical for insulators on guys, and for the minimum gap between hand holds to make a structure not readily climbable.
 - Allowed clearances over a residential driveways may need to be raised (next cycle) to better correlate with height of current RV and delivery trucks.
- Rule 217A1a and C1 : Protection of structures - Physical protection is not required for supporting structures located outside of established parking areas, alleys, or driveways
- Rule 217C - Markers on anchor guys - Revisions emphasize that every guy should be routinely marked at vulnerable or susceptible locations. Companies need to cooperate where power and communications guys are on same pole or anchor.

CONGESTION AND COMPETITION FOR SPACE

communication space. The space on joint-use structures where communication facilities are separated from the supply space by the communication worker safety zone. See Figure D-1.



supply space. The space on joint-use structures where supply facilities are separated from the communication space by the communication worker safety zone. See Figure D-5.

NOTE: Communication facilities may be located in the supply space (see Rule 224A).

SC4 – Specific Clearances for Communications

- **Rule 235** (Clearances between wires on same structure)
 - **Rule 235H** (clearances between communications lines) was revised to provide specific conditions for clearance calculation, as well as greater flexibility for communications installations on congested poles.
 - With the space demands for new wireless equipment, mounting antenna and equipment on strand messengers will become more common. One of the objectives of 235H is to minimize congestion problems and help avoid damage to lines or service.
- Other clearances for wireless facilities – grouped **in new 238F**.





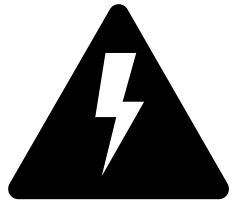
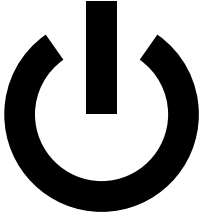
SC4 Clearances – Wireless

- **Wireless Facilities** – Clearances moved and consolidated from 235I to new Rule 238F (*Clearances between communications and supply facilities on same structure*) includes components from Rules 235, 238 and 239.
- This consolidation will be helpful for wireless network companies for their designs as well as for attachment requests for pole owners.
- IEEE joint-use guide (P2939) developed under sponsorship of Joint Use Committee of the IEEE Power and Energy Society is 95% complete.
- ***“Guide for Joint Use of Utility Poles with Wireline and/or Wireless Facilities”***

POWER CIRCUITS FOR COMMUNICATIONS EQUIPMENT

Circuits used exclusively for supplying power to communications equipment

- ❖ Are treated as “communications lines” under the NESC if
 - Less than 400 V to ground or 750 V between any two points of the circuit
 - Transmitted power does not exceed 150 W
- ❖ Operating at more than 90 Vac or 150 Vdc and more than 150W then 224B/344A apply
 - Cables will have a shield and be effectively grounded
 - Maintained by qualified (trained) persons
 - Access to Termination points are restricted
 - Under fault conditions voltage on comm circuit shall be less than 400 V to ground
 - Live parts will be inaccessible when circuit is energized.



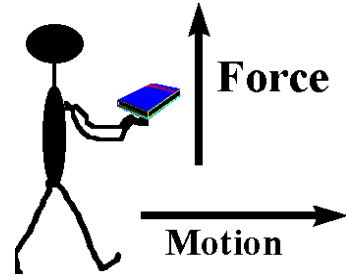
Powering Circuits Solely for Communications Equipment

- **Most Pertinent are Rules 224 and 344** - No technical changes made this cycle – Issues raised and SC4 agreed to creation of working group 4.8 to study issue.
- **Working Group 4.8 - Powering circuits for communications antennas - Recognized that new powering architectures are required to match the expansion demands of wireless antennas (span powering & FMPS) and their associated equipment.**
- FMPS systems use software systems to detect faults or problem conditions in the powering circuit and automatically, and rapidly, de-energize the powering circuits.
- Four (4) **Fast Track Change Proposals** (CPs) made to Rules 224B, 344 and definitions enabling flexibility in use of cable shields and explicit reference to ATIS 0600040.
- March 2023 CPs in active review – SC4 passed modified CPs for 224, CP on Rule 344 has passed SC7 ballot, SC1 considerations for definitions are in mid review.
- Code changes occur **slowly** with many review steps – even under **FAST TRACK**



SC5 – Strength & Loading (Sections 24-27)

- Rules 250C/250D - 60 foot criteria – Extreme wind and ice factors apply above 60ft only.
- Rule 250C - **Update of Wind Loading Maps** – using most up-to-date ASCE 7 and ASCE 74
 - 100 year MRI loading map for Grade B construction
 - 50 year MRI (Mean Return Interval) loading map for Grade C
- Table 242-1 - Construction Grade – Much revised and improved version increase clarity, accuracy and simplicity for identification of the appropriate grade.
- Rule 263 - Grade N Construction – retained - Grade N is useful for communications and power utilities in spans across customer property, and in temporary and emergency situations.
- Clarifications on various calculation methods and applications of gust response factors, ice accretion, weight and wind spans, ... as well as the general strength requirements in Section 26 and the mechanical strength of guy insulators in Section 27.



SC8 Work Rules

- Work Rules 410A6 & 420Q - Harmonized with OSHA, Battery Work Rules, RF Exposure
- Arc Flash Default PPE Tables - revised to match full scale lab test results
- Rule 410A6 - (Job Briefing) - Note moved into main rule
 - Single-person job option in the NOTE reflected the OSHA rule and is required for the vast majority of communications work.
 - The revision does not inhibit the ability of the communications utility to follow its normal best work practices and use of single person for the vast majority of their installation and maintenance work activities.
- New Rule 420G to encompass safe work practices for liquid cell and other battery types - in harmony with new Section 14 in supply facilities



RELATED EFFORTS

New Issue (7) of SR-1421 - *Telcordia Construction Blue Book – April 2023*

IEEE Guide - P2939 – Final stages of publication (soon)

IEEE Guide for the Joint Use of Utility Poles with Wireless Facilities

ATIS and UL Standards on span powering and FMPS

Telcordia Blue Book - Manual of Construction Procedures

Special Report
SR-1421
Issue 7, April 2023

Comments Requested (See Preface)

Enterprise License Restrictions

This document is available only via an Enterprise License (EL) and can only be shared among the EL licensees of this document. Violators of the EL agreement may be subject to damages for breach of the EL agreement and for copyright infringement. Ericsson strictly prohibits the unauthorized distribution, download, or sale of this copyrighted material.

Copyright © Ericsson Inc. All rights reserved.

Highlights from 2023 Blue Book Issue 7

- Expand guidance on wireless facilities, grounding & bonding practices, and powering architectures
- Harmonize with changes in the 2023 issues of NESC and NEC codes with expanded commentaries
- Sag and tension guidance information for slack span construction and over-lashing of cables
- Latest powering architectures – e.g., Fault Managed Power Systems (FMPS)
- New material on Joint-Use Agreements (JUA) and recommendations for their use
- Clearance information added from the California General Orders 95 and 128
- Updates and revisions on grounding, bonding and protection practices
- Calculation scenarios for pulling tensions in buried plant installations (optical fiber cables)
- Pole inspection and rehabilitation as well as expanded guidance sections on loading and strength factors in Chapter 13 with detailed commentaries on use of latest wind and ice maps in the NESC
- Information on pole braces and H-fixtures added
- Expanded discussions on the relationship between reliability, resiliency and network design choices
- Commentaries on the interdependence of communications and power networks



QUESTIONS

