

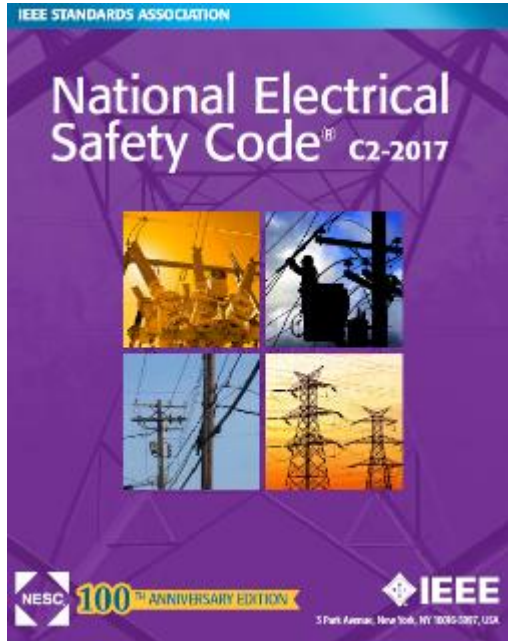
# National Electric Safety Code (NESC) Update

**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.....

## 2017 → ~~2022~~ 2023 NESC Purpose & Scope

**Purpose** - The practical safeguarding of persons, utility facilities, and affected property 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 “**



# NESC GOVERNANCE STRUCTURE

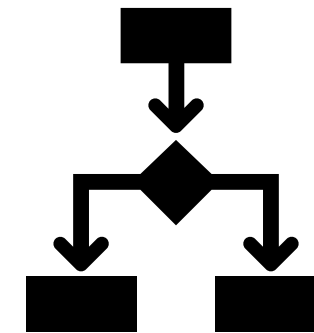
- SC1 - Scope and Purpose
- SC2 - Grounding Methods
- SC3 - Part 1 - Substations and Generation Facilities
- SC4 - Part 2 - Overhead Lines - Clearances
- SC5 - Part 2 - Overhead Lines - Strength & Loading
- SC7 - Part 3- Underground Lines
- SC8 - Part 4 - Work Rules

## Main Committee –

- Provides oversight responsibility

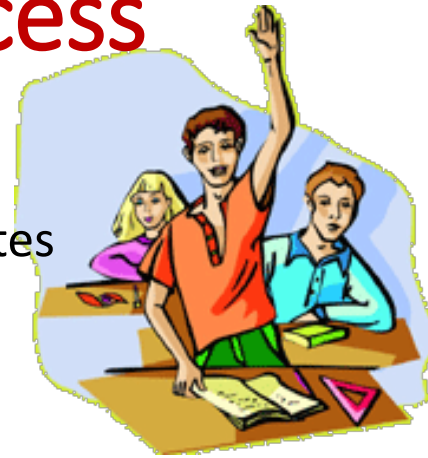
## Executive Committee –

- General oversight of NESC direction and policy



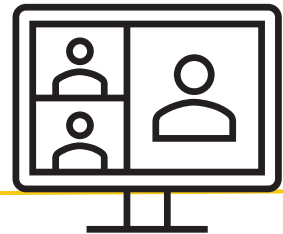
## 2017 -~~2022~~ 2023 Revision - Multi-Step Process

- **5-year Revision Schedule** ... Administered by IEEE ... ANSI Approved
  - TIA and Fast-Trac processes exist for more rapid responses as technology accelerates
- 2022 NESC Preprint issued (Sept. 2019)
- 465 Public Comments (PCs) on Preprint received March 2<sup>nd</sup> 2020



→ **\*\*\* Pandemic Pause = 1 year Deferment \*\*\***

- **SC action in Aug-Oct 2020 was delayed 1 year until Aug-Oct 2021 (tentative)**
- Release of 2023 Code now scheduled for Aug 2022 with Effective Date of Feb 2023
- Applies on adoption by PUC, State legislative or local AHJ bodies



## CHANGES ACCEPTED → Expected to be in 2023 Code



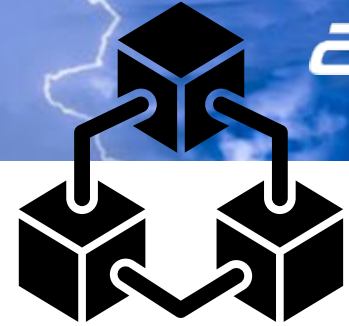
- Traditional View Reinforced - Focus on **People Safety** rather than facilities
- Explicit inclusion of **grid-connected generation facilities** (solar farms, battery arrays)
- Definitions - Clarifications of **Communications Lines** –
  - *Operate at potentials exceeding 400 V to ground or 750 V between any two points of the circuit*
  - *Transmitted power of which does not exceed 150 W*
  - *More than 150 W is permitted if operating voltages are not more than 90 V ac or 150 V dc*
- **Clearances** – Refinements to 215, 232, 235H, ....
- **Wireless** Consolidations/Clarifications - 235I, 238, 239 → **new 238F** + 410A6 & 420Q
- **Work Rules** - Harmony with OSHA, Battery Work Rules, RF Exposure (410A6, 420Q)



## “ACCEPTED” CHANGES - ACTIVE DEBATE

Major disputes remain – These issues are expected (or hoped) to be modified or resolved at the 2021 Public Comment SC meetings

- Grounding – Rule 094B on ground rods
  - minimum trade, nominal or exact size need clarification
- Wind Map - Modernization in Strength & Loading Section (Section 25 in flux) with new wind/ice maps needing resolution



## GROUNDING METHODS - Section 09

**Ground Rods - Rule 094B** - The requirements for ground rods were relaxed by removing material specific detail and permitting any rod to be 0.5-inch minimum diameter.

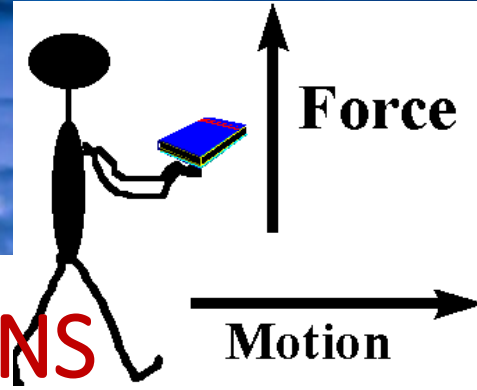
- The current 2017 Rule 094B2a(1) reflects the historical experience and field test data on ground rod performance as well as product specifications used by most utilities.
- Strongly recommend that communications companies maintain their current practices and product specifications to require **a 5/8-inch inch diameter copper-clad stainless-steel ground rod as the primary choice rod material and size** - as it has been for over 70 years.

**Grounding Intervals - Effective Grounding of MGN - Rule 096C** - Rule 096C was modified for simplicity and clarity particularly within the exceptions. **4 grounds for each mile** remains the basic effectively grounded criteria.

**Intersystem Bonding at Poles - Rule 097G** - The previously revised Rule 097G was re-affirmed

**Customer Premises Intersystem Bonding – Rule 099** – correlates mostly with NEC





## MODERNIZATION OF POLE LOADING CALCULATIONS

- NESC Sections 24-26 (Loading) and new wind and ice maps in ASCE-7 and ASCE-74
- Current approach is to retain continuity of traditional approaches to pole strength and loading while updating to the latest wind/ice maps to maintain or enhance pole safety without resulting in over-designing of pole plant. Therefore, our preferred strategy is to
  - Retain the 60-foot limit
  - Clarify Grade N criteria
  - Update to 100-MRI (mean-return-interval) maps with 0.87 for Grade B and 1.0 for Grade C
  - Clarify appropriate construction grades
  - Continue the use of additive k-factor to maintain consistency as an interim measure, and to not disadvantage current industry best practices.

# CONGESTION AND COMPETITION FOR SPACE



## NESC RELEVANT RULES – Wireless and Broadband Deployments

- Definition of Communications Lines (Section 02) – provides flexibility to designers
- Intersystem Bonding and Grounding (Section 09) – Rules 097 and 099
- Powering Circuits in Communications Cables – Rules 224 and 344
- Strand Mounted Facilities – 235H and Section 25 (loading)
- New Rule 238F – Communication antenna clearances – consolidation has benefits
- Work Rules – Revised Rule 410A6 and 420Q - RF Exposure – RF safety training with reference to IEEE 1654 and C95 = useful additions for safety guidance.



Other design/engineering choices about wireless deployments in general and about 5G installations in particular, are better addressed and more appropriately covered by industry forums, product specifications, IEEE initiatives, and inter-utility agreements.

## RULE 097 – Grounding & Intersystem Bonding

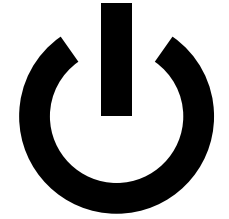
Rule 097 has 7 interlocking sections with implicit/explicit links to other Rules (e.g., 096, 224, 344, 354, 384) applicable to intersystem bonds

- 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 097A
  - 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.**

## 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 communications circuit shall be less than 400 V to ground
  - Live parts will be inaccessible when circuit is energized.



## IEEE 5G JOINT ALLIANCE

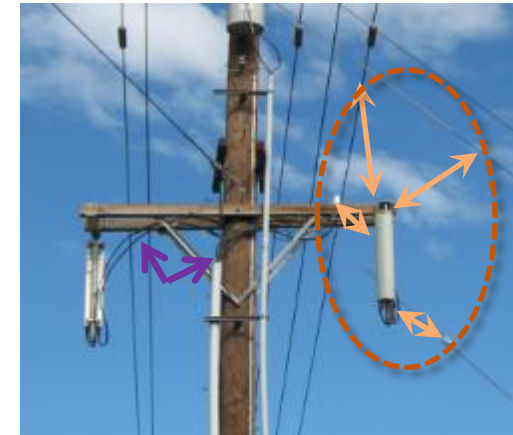
**October 2019** – IEEE White Paper – “Establishing Consistency in Joint Use Applications with 5G Wireless Facilities”  
<https://standards.ieee.org/industry-connections/facilities-joint-use-program.html>

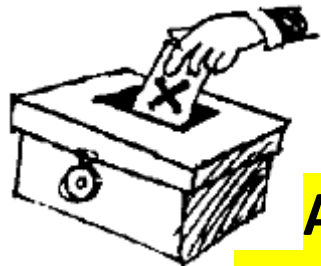
**May 2020 to Jan 2021** → IEEE Guide 2939 being developed under sponsorship of Joint Use Committee of the IEEE Power and Energy Society [https://standards.ieee.org/project/2939.html] with objectives to

- Help establish the requirements of a “complete application”
- Identify ways/means to share information regarding facility availability.
- Guidelines on Clearances and Loading Analysis – based on NESC
- Installation and Maintenance Procedures and Work Rules
- RF Emissions and Interference guidelines

Working Title - **IEEE Guide for the Joint Use of Overhead Lines, Including Wireless Facilities**

Coordinate and develop consistent approaches, methodologies and rules for the sharing and co-location of equipment with electric facilities including wireless facilities.





**Aug-Oct 2021**

Public Comment  
Subcommittee Meetings

**2022**

NESC 2023 settled

**NESC - ongoing interactions**

Interpretation Requests (IRs)

Tentative Interim Amendments (TIAs)

Fast Trac Procedures



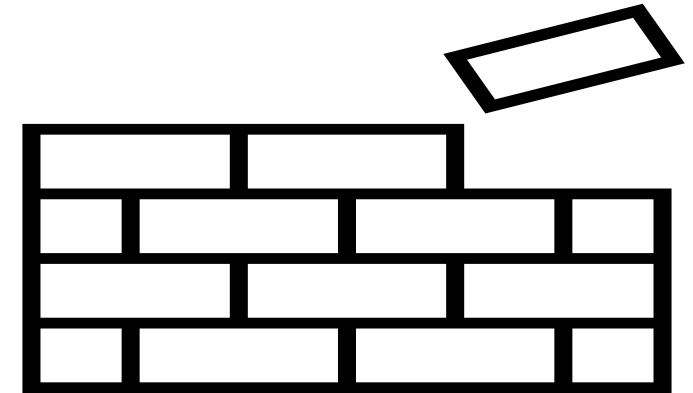
Design – Engineering  
Operational M&Ps  
Functional Performance  
Specifications  
GRs, ATIS,...

Industry Guides  
Best Practices  
Regulations

## RELATED EFFORTS – Harmonized with NESC

### Examples of Functional Performance Documents

- GR-1089 – EMC
- GR-3108 – OSP Equipment
- GR-3171... GR-3178... Wireless Facilities
- GR-513 – Powering
- FCC - OET Bulletin 65





## RELATED EFFORTS – ATIS Examples

- 0600030 - Line-Powering of Telecom Equipment on Outside Plant Copper Twisted Pair Loops
- 0600012 - Electrical Protection Considerations for Broadband Systems
- 0600013 - Electromagnetic Compatibility (EMC) and Electrical Protection
- 0600315 - Voltage Levels for DC-Powered Equipment Used in the Telecom Environment
- 0600316 - Electrical Protection of Telecommunications Outside Plant.
- 0600318 - Electrical Protection Applied to Telecom Network Plant at Customer Entrances
- 0600332 - Electrical Protection of Network-Powered Broadband Facilities
- 0600334 - Electrical Protection of Communications Towers and Associated Structures
- 0600337 - Maximum Voltage, Current, and Power Levels Used in Communications Circuits
- 0600338 - Electrical Coordination of Primary and Secondary Surge Protection



## RELATED EFFORTS

2021-2022

Issue 7 Planned



**Blue Book - Manual of Construction  
Procedures**