Update on Safety Codes
National Electrical Safety Code (NESC)
California GO-95/GO-165

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PEG Protection Engineers Group

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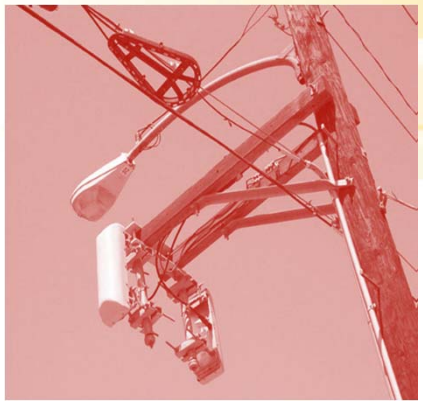


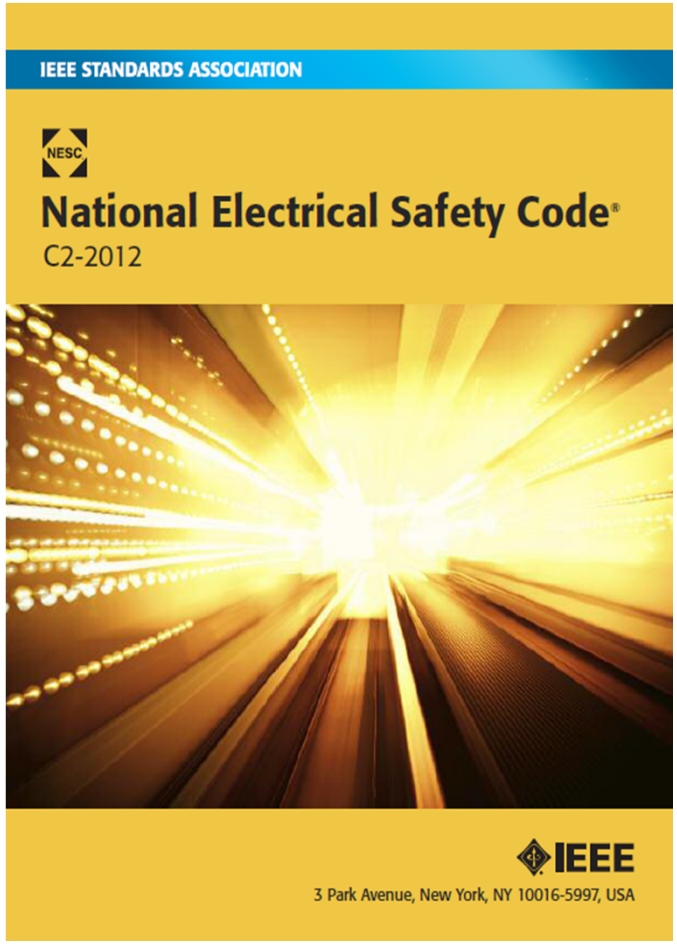
Summary

- **Code Overview**
  - Codes - NESC…GO 95…NEC….OSHA….
  - Best Practices – Personal Safety & Facilities Reliability
  - Engineering Design for Efficient & Reliable Operation

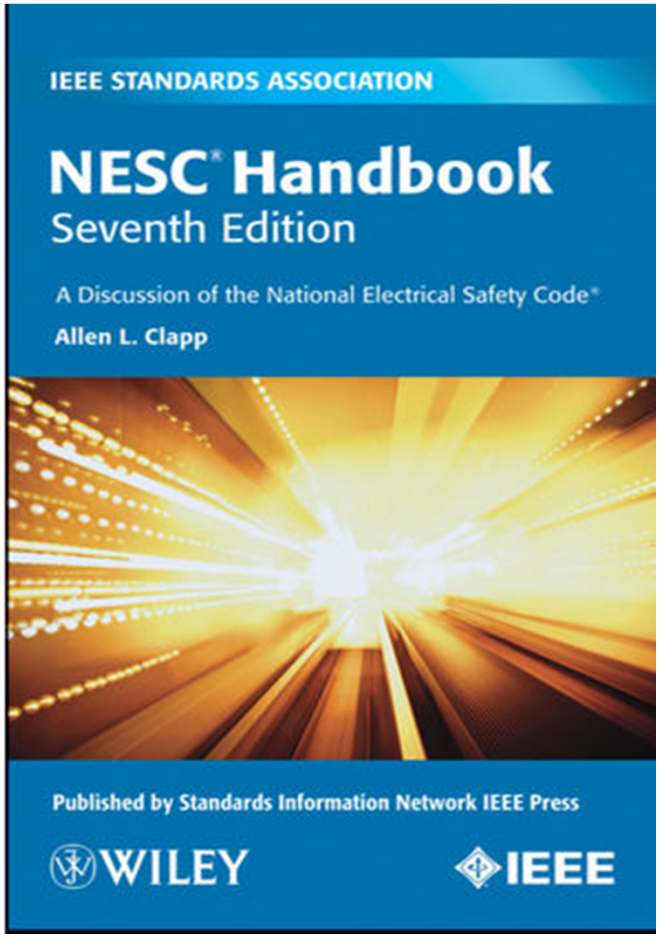
- **Issues**
  - Congested Poles – Joint Use
    - Integrating Smart Grid, Wireless, and Broadband Devices
  - Demarcation between Code/Standard/Practices
    - Joint Use and Inter-Utility Cooperation
  - Collateral Impacts from Legal Cases & Regulation
  - Grounding and Bonding

- **Future Paths**
  - Network Trends and Business Drivers
  - Change Proposals for NESC

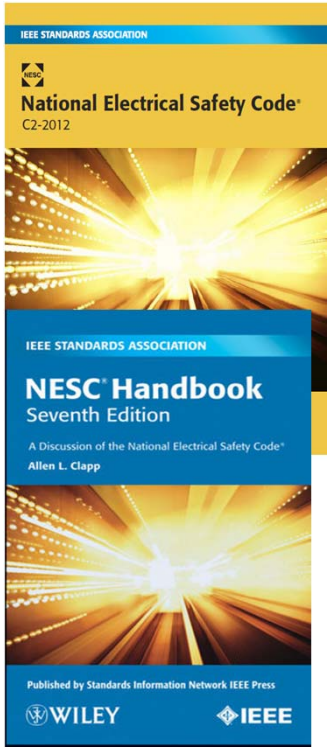
NESC Overview



- NESC
- NEC
- OSHA
- M&Ps
- IEEE
- NFPA
- UL
- JUAs
- GRs/SRs
- ATIS
- etc……



Adventures in Code Land



IEEE
Advancing Technology for Humanity

National Fire Protection Association
The authority on fire, electrical, and building safety

California Public Utilities Commission

Overhead Electric Line Construction

Prescribed by the
PUBLIC UTILITIES COMMISSION

- **IEEE – NESC**
- NFPA -- NEC
- **GO 95**
- OSHA
- Internal M&Ps
  - GRs and UL Listings
- Joint Use Agreements (JUA)
- etc……

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

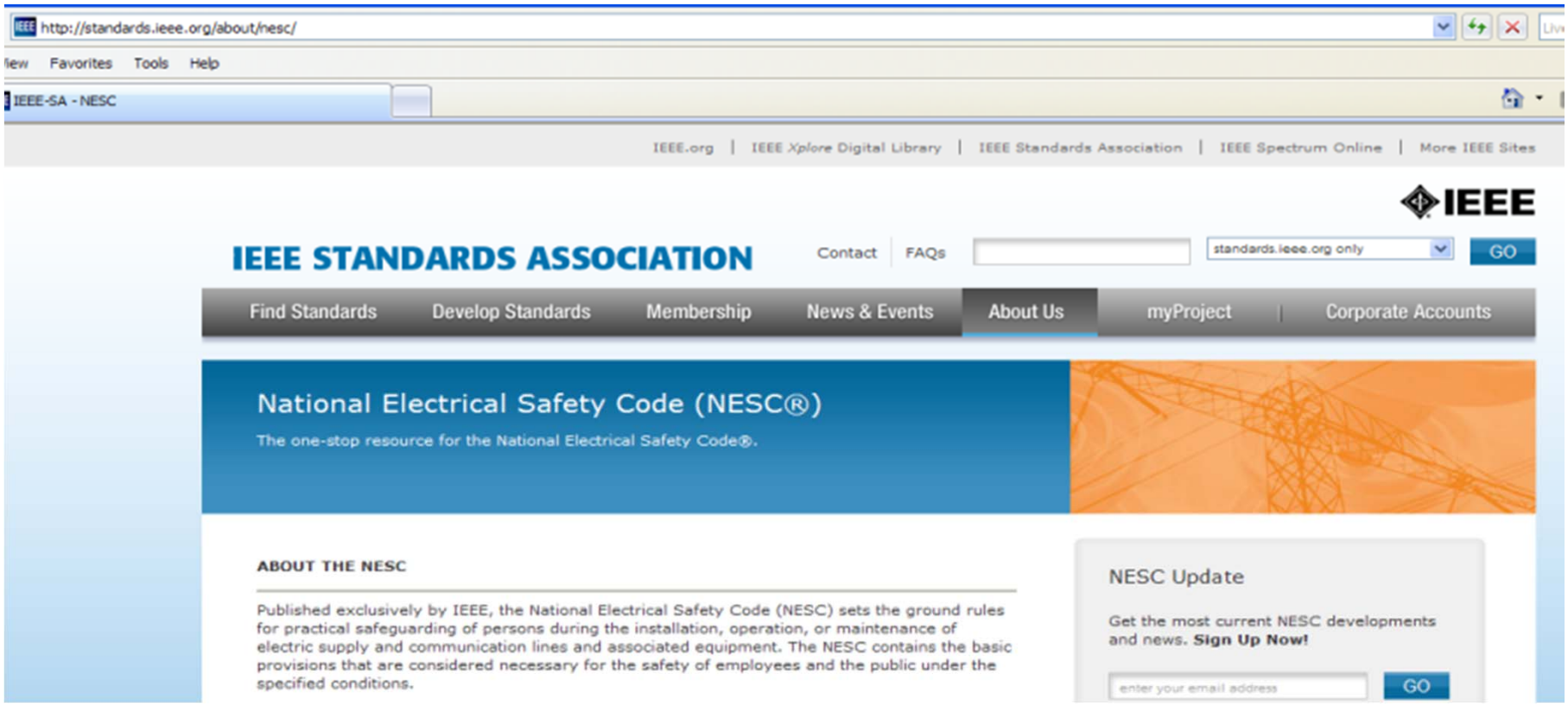
National Electrical Safety Code (NESC)

- **Purpose** : The practical safeguarding of **persons**, **utility facilities**, and **affected property** during the installation, operation, and maintenance of electric supply and communication facilities.
  - Contain the basic provisions that are considered necessary for the safeguarding of the public, utility workers and utility facilities under the specified conditions.

- **Scope** : The NESC covers supply and communication facilities and associated work practices employed by a public or private electric supply, communications, railway, or similar entity in the exercise of its function as a utility.
  - Facilities = lines and equipment and specified infrastructure (e.g., poles, sub-stations, vaults…)
  - The NESC covers similar systems under the exclusive control of the utility and being worked by qualified persons, such as those associated with an industrial complex or utility interactive system.

National Electrical Safety Code (NESC)

- NESC is not intended as a design specification or as an instruction manual – http://standards.ieee.org/nesc
- The implicit assumption exists that regular operational cooperation as well as formal joint-use agreements (JUAs) exist between all power and telecom utilities sharing a pole, underground vault, location or area.



NESC Status and Process

A. Aug 2011 – The 2012 NESC Published

B. During 2012 NESC working groups are active – formal & informal

We are here → Developing new change proposals

C. **July 15, 2013** – change proposal deadline for changes to 2012 Edition

B. Sept.– Oct. 2013 -- NESC Subcommittees meet to consider change proposals and prepare recommendations for 2017 Edition.

C. Sept. 2014 - Preprint of proposed 2017 Edition released

→ Opens the public comment period until to May 2015

D. May 1, 2015 – Final comments received on 2017 Draft

E. Sept.– Oct. 2015 -- Subcommittees and their Working Groups consider all comments and recommendations.

F. 2016 - 2017

- New NESC submitted to Accredited Standards Committee and to ANSI for recognition → ANSI approval (~June/July)
- August 2016 -- Publication of 2017 NESC → Effective no later than 2/1/2017

Drivers for NESC Changes

PRIMARY = REACTIVE

- Problems, issues and conflicts revealed during active use of NESC
  - Problems during Engineering/Design activities
  - Inspections and Joint-Use Agreement Conflicts
  - Field incidents, accidents, and legal cases
    - Root cause analysis
  - OSHA Compliance
  - Regulatory Harmonization and Feedback
    - FCC, Public utilities – Boards and Commissions

SECONDARY = PROACTIVE (5 year code cycle limits reaction time)

- Mismatch of new technologies to practices based on traditional code
  - Wireless Antennas – Growth into Femtocells and DAS systems
  - Smart Grid Devices – joint power and communications functions
  - Alternate and hybrid sources of energy – wind, solar, etc….

Key Changes in 2012 Code

- **Scope (Sections 1--- 3)**
  - Extensive revisions to clarify applicability of NESC.
  - Not changes in scope but clearer statement reflecting 100-year history
- **Grounding (Sections 9)**
  - Effectively grounded – grounded for purpose
  - Directly embedded steel pole = acceptable ground electrode
  - 14 AWG (min) → 6AWG (min) for intersystem bonds for communications ground
- **Generation - Sub-Stations (Part 1 – Sections 10 ---19)**
  - Illumination and Fences – safety signs and environment (clarifications)
- **Aerial (Part 2 – Sections 20 --- 27)**
  - K-factors versus specific ice/wind loadings
  - Clarification of grounding rules for aerial plant – guys, strand, etc…
  - Improve of strength and loading calculation methods – define conditions better
- **Buried – Underground (Part 3 – Sections 30 --- 39)**
  - Inspections and Testing – conditions, defects …..
  - Refined clearances between different facilities to enhance safety
  - Limit intersystem bonding between vertical pole grounds and buried plant
- **Work Rules (Part 4 – Sections 40 --- 44)**
  - Arc-Flash Clothing Ratings – correlated to field data and laboratory testing
  - MAD (Minimum Approach Distances) – IEEE 516

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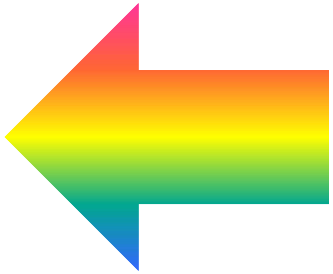


- **Future Paths**
  - Network Trends and Business Drivers
  - Change Proposals

Open Issues within Code Activity

- Supply Equipment in Communications Space
  - Definitions of “Supply” and “Communications” equipment – powering wireless….
- Grounding and Bonding… and “Effective Grounding”
  - Delineate purpose of grounding and bonding
  - Intersystem grounding and bonding at joint-use poles, buried/aerial, homes….
- Clearance and separation on congested poles
  - Safety driven guidance rules (NESC)
  - Business and regulatory driver considerations for growth
- Lines — Pole Strength and Loadings – GO-95 Vs. NESC approaches
  - Load & Resistance Factor Design (LRFD) Vs. Allowable strength Design (ASD)
  - Load and material strength factors along with load duration effects
  - Extreme Wind methodology and Ice Loading Factors
  - Correlation with ANSI O5.1 & ASCE (ASCE 7)
  - Engineered materials; e.g., Fiber-reinforced polymer & concrete structures
- Engineering Reality Vs. Regulatory/Legal Language
  - “..will not fail…”

Underlying Concerns & Issues

- Codes Inter-Relationship - NESC…NEC…GO95…"Harmony?"
- Alternative and distributed generation systems:
- Bonding and Grounding
  - Terminology, definitions and defined purposes – to protect people and equipment from effects of lightning, power fault, stray current and induced voltages
- Regulatory and Legal – inspections, documentation & records
  - Conditions versus Defects
  - Extraordinary threats versus "expected" stresses
- Congested Poles
- Worker & Public Safety (Part 4 - Work Rules)
  - Work Skill/Experience/Training ….M&Ps….Engineering Controls
  - Contact Avoidance…Minimum Approach Distance - IEEE 516/OSHA
  - PPE - Voltage detectors, clothing, equipment
  - Emergency restoration Vs. standard work operations

Congested Poles

New Added Devices

Smart Grid…

Wireless…

Broadband ….

CONGESTED POLES

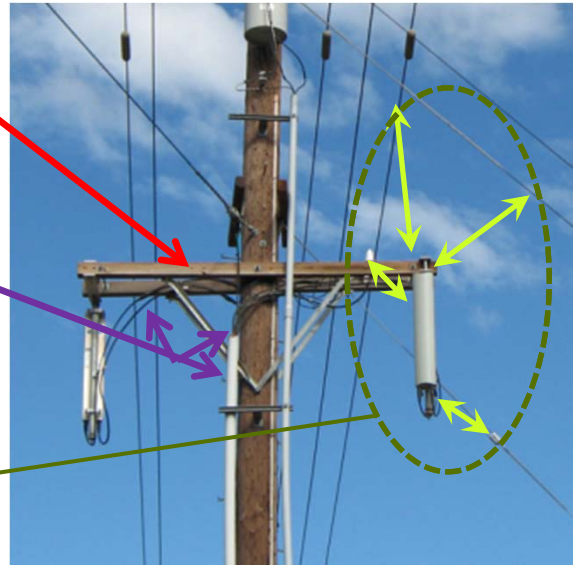
WIRELESS ANTENNAS ….

Strength of Support Elements

Vertical Conductor Protection

Obstructions to Working Space

Clearance from Supply Line Conductors



Wireless – Antenna (NESC Part 23)

Rules 231—through ---239 and 420

Antennas - Placement or where on pole is best

- Top
- In Supply Space
- In Common Space
- In Communications Space
- On Cross arms

Clearances and guarding rules for antennas and hardware

- Sufficient climbing and working space to
  - Work in Vicinity of Antenna/Wireless structures
  - Work on Antenna/Wireless structures and Equipment
- RF Radiation hazards – Rule 420Q
- Mechanical and electrical protection of associated cables and equipment closures

SMART GRID DEVICES → 2-Way Communications → Supply Equipment in Communications Space

get it right

Wireless Networks
Security, Monitors and Control Systems
Luminaries
Cabinets for Broadband components
Distributed Power Sources
Expansion of private and municipal networks

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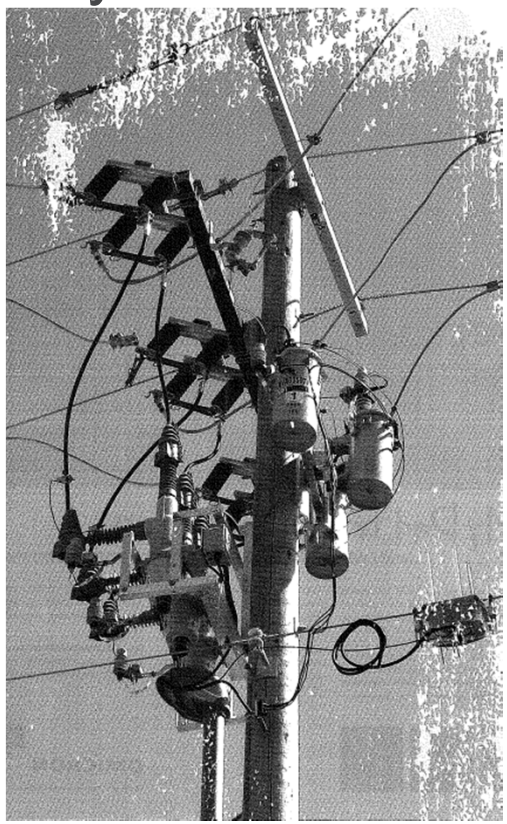
Supply Equipment in Telecom Space

Safety Code Requirements = Baseline or Minimum Level

- Adequate bonding and grounding to help prevent induced and fault voltages/currents on the communications circuits.
- Identification and marking rules to provide equipment or contact information to help identify responsible party.
- Adequate Ground clearance rules.
- Providing sufficient climbing space
- Provide sufficient working space around communications lines and facilities
- Keep minimum clearances as per the NESC to help maintain the integrity of the CWSZ around communications facilities.



Harmonization, Demarcation, and Competition, Between Codes

Joint Use

Competition -- Cooperation

Demarcation Between Codes

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Electrical Supply …….. Telecommunications

Service Points ……Network Interface

****Utility Defined Demarcation Point****

- Residence
  - Outside of house – Network Interface Device (NID)/Optical Network Unit (ONU)
  - AC Panel inside house
- Commercial Building
  - Building Entrance Terminal (BET – inside or outside)
  - Telecom Closet or Room
  - AC Panel or power Room inside building
- Communications Nodes - Electronic Hut or Cabinet or Active Fiber Hub
  - Closure Inside Hut
  - Distinct AC compartment in cabinet or separate adjacent box
- Lighting for Parking Area
- Long Rural line serving Remote Farm or Residence
  - At Main Road…….At Property Boundary…….At Buildings

California – "The Other Country" General Orders (GO 95 …… GO 165)

- Multiple Purposes of Codes
  - Safety to Workers and Public
  - Regulatory and Legal Compliance – Risk Management
  - Engineering – help ensure practical and useful rules to facilitate safe Joint Use installations and work rules
- LRFD versus ASD Engineering designs
  - Safety Factors
  - Load Calculations
  - Worst case situations Vs. "Expected" stress
- "Will Not Fail"
  - Precision of Legal/Regulatory Language
  - Engineering Reality
- Fire Hazards

Joint Use Cooperation Vs. Competition

- Mutually Beneficial Rules
  - 1990 NESC Code – Historical objectives
  - Joint Use Agreements (Contractual)
- Business Competition
  - Power Supply
  - Communications – Wireline and Wireless
  - Broadband services
- Risk Management
  - Regulatory Compliance
  - Legal Mandate

Collateral Impacts of Legal Actions and Regulation Rulings

Operational Concerns in Legal Cases

- Inspections
  - Separate Inspection Programs
  - Incidental to Regular Work Activities
  - Regulatory driven
- Documentation and Records
  - Trouble Report Calls - Response times and Access to Data
  - Installation/Maintenance/Repair
  - Engineering and Design Records
- Practices
  - Routine inspections for safety of workers and public
  - Corrections of Defects and Reporting of Conditions
  - Differences in Operations between utilities – e.g., use of metallic versus dielectric buckets on truck
- Cooperation and communications to/from other stakeholders – other utilities
  - Inter-utility reporting and communications

Facilities Inspections

- NESC Rules 214 & 313… GO 165
- Inspections and Tests
  - Conditions versus Defects
- Pole Inspections
  - Routine (visual) during other work ($ minimal)
  - Pole Test – hammer and probe ($ minor)
  - Intrusive pole test – drill, dig, core, stabilize…
  - Engineering Pole Loading Analysis
  - Last two bullets have significant $$ cost – time, effort, documentation
- Expectations of Various Interested Players/Users
- Legal Risk Management

Pole Testing and Inspection Options

get it right

- Pole Testing Prior to Work Operations
- Conditions Requiring No Testing or Supplement Support

Physical Testing

- Sound Test (Hammer)
- Prod Test - Below Ground Line Inspection
- Hand Line or Pike Test .

Measuring Extent and Effect of Decay

- Internal Exam - Drilling and Boring
  - Other methods – Resistograph (?)
- Wood Pole Decay Patterns
- Deductions for Defects
  - Hollow Hearts
  - Enclosed Pockets
  - Exposed Pockets
  - Woodpecker Damage

- Define Defective Pole
- Critical Pole Section and Circumferences
- Retained strength criteria (80%--70%--67%)
- Engineering Analysis – Loads + Safety Factors

Wooden Pole Inspection Programs

- Training……Visual and Physical Tests . . . . . Documentation

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GROUNDING AND BONDING

Why Do We Bond And Ground?

Appropriate Bonding and Grounding Helps to Ensure the Safety of the Outside Plant Network, Employees and Public

SAFETY

- Reduce the hazard of electric shock to employees and the public from unintentional contact with power faults and power crosses
- Limits the extent and minimize the damage caused by lightning (but cannot prevent damage entirely)
- To reduce corrosion and subsequent deterioration of hardware/anchors that could put a pole line's integrity in jeopardy.

QUALITY OF SERVICE To reduce noise in telecommunications circuits

INTEGRITY OF THE NETWORK -- To mitigate

- Effects of power surge voltages and currents in telecom facilities -- it is important to establish and maintain continuity of the cable shield
- Electrolysis which can cause corrosion of shield, strand, and anchor
- Damage to electronic equipment and telephone plant caused by power & lightning surges

Intersystem Bonding to Power

Function of Power System Grounding Scheme

- Multi Ground Neutral (MGN) Systems
- Delta and Wye grounding schemes

- MGN connection is the preferred method to help ensure parallel communications network is properly grounded.
- Many major power utilities in the southern and western USA(*), regardless of grounding type, deny permission to telecom to attach to their grounds.

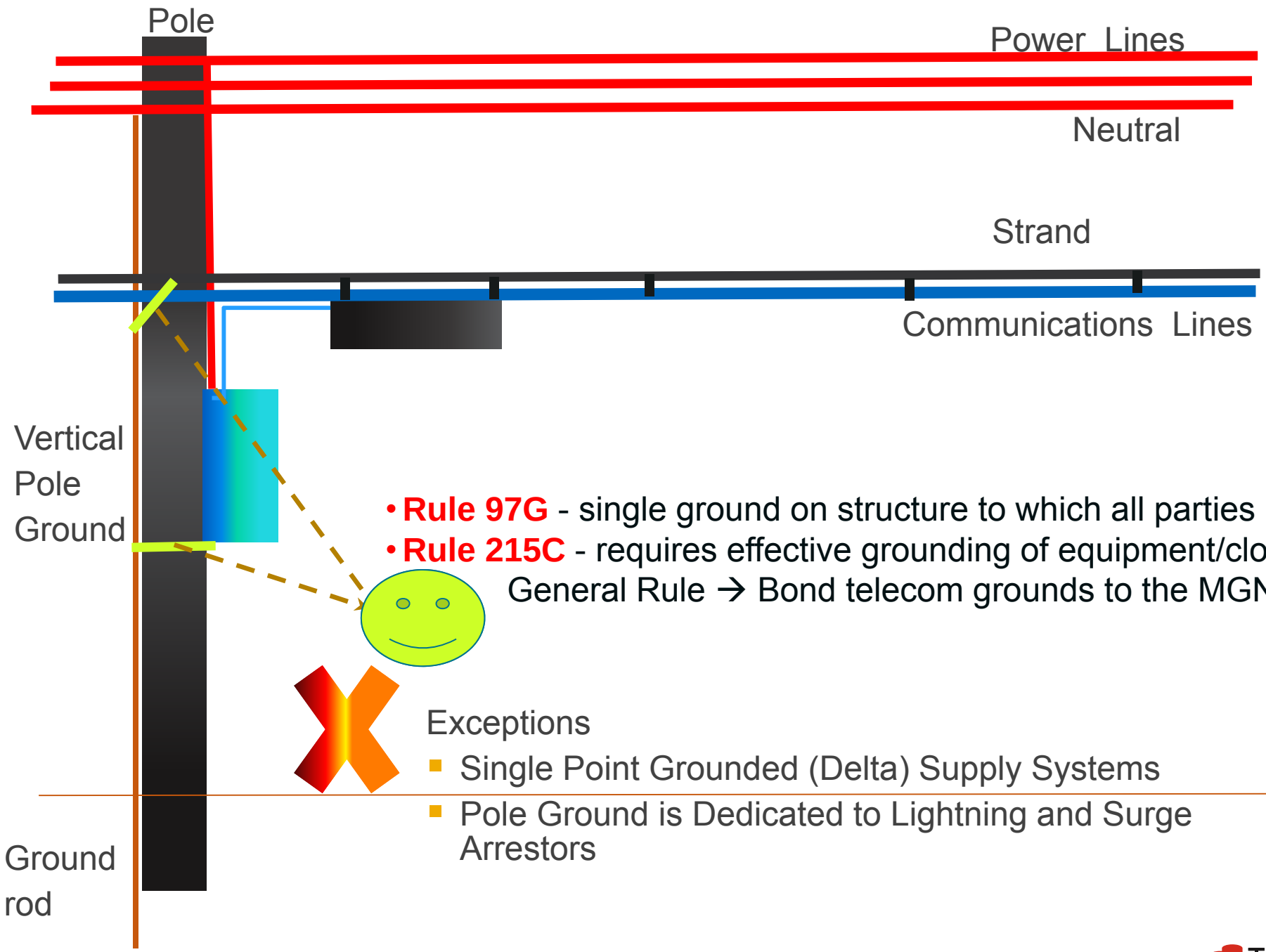
  (*) Mainly in California where 42 different power companies deny permission; but also increasing resistance to MGN bonding is found in North Carolina, Texas, Oklahoma, Louisiana, other States in the western and southern portions of the USA.

Telecom Grounding Preferences/Choices

1. MGN - Connect to an MGN
2. *Manhole Grounding System*
   - *Ground ring or ground bed*
3. *Telecom Ground Bed –*
   - *Three x 8-feet long (*) ground electrodes (ground rod)*
   - *Minimum of 8 feet apart and strapped together with a #6 AWG bare copper ground wire.*
   - *Each rod is solid corrosive-resistant copper.*
4. *Counterpoise Ground – Ground wire in an open trench to a handhole, pedestal, or manhole.*

(*) 8 foot in network….5 foot at residence

Intersystem Bonding: Pole MGN



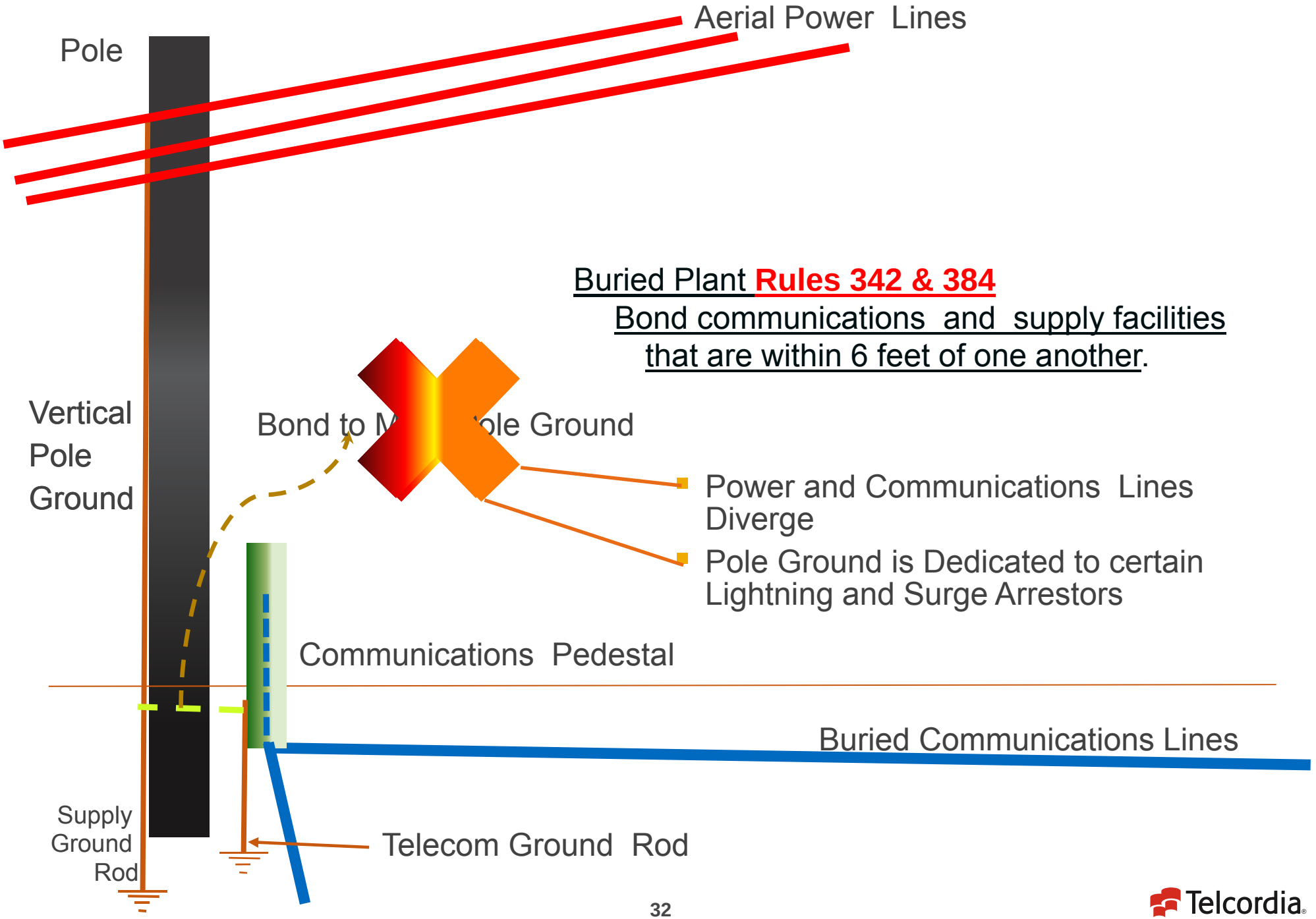
- **Rule 97G** - single ground on structure to which all parties bond
- **Rule 215C** - requires effective grounding of equipment/closures

General Rule → Bond telecom grounds to the MGN

Exceptions

- Single Point Grounded (Delta) Supply Systems
- Pole Ground is Dedicated to Lightning and Surge Arrestors

Buried—Aerial : To Bond or Not to Bond?



Buried Plant **Rules 342 & 384**

Bond communications and supply facilities that are within 6 feet of one another.

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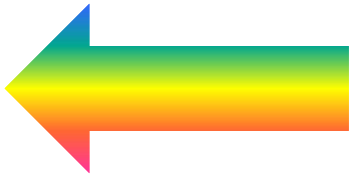
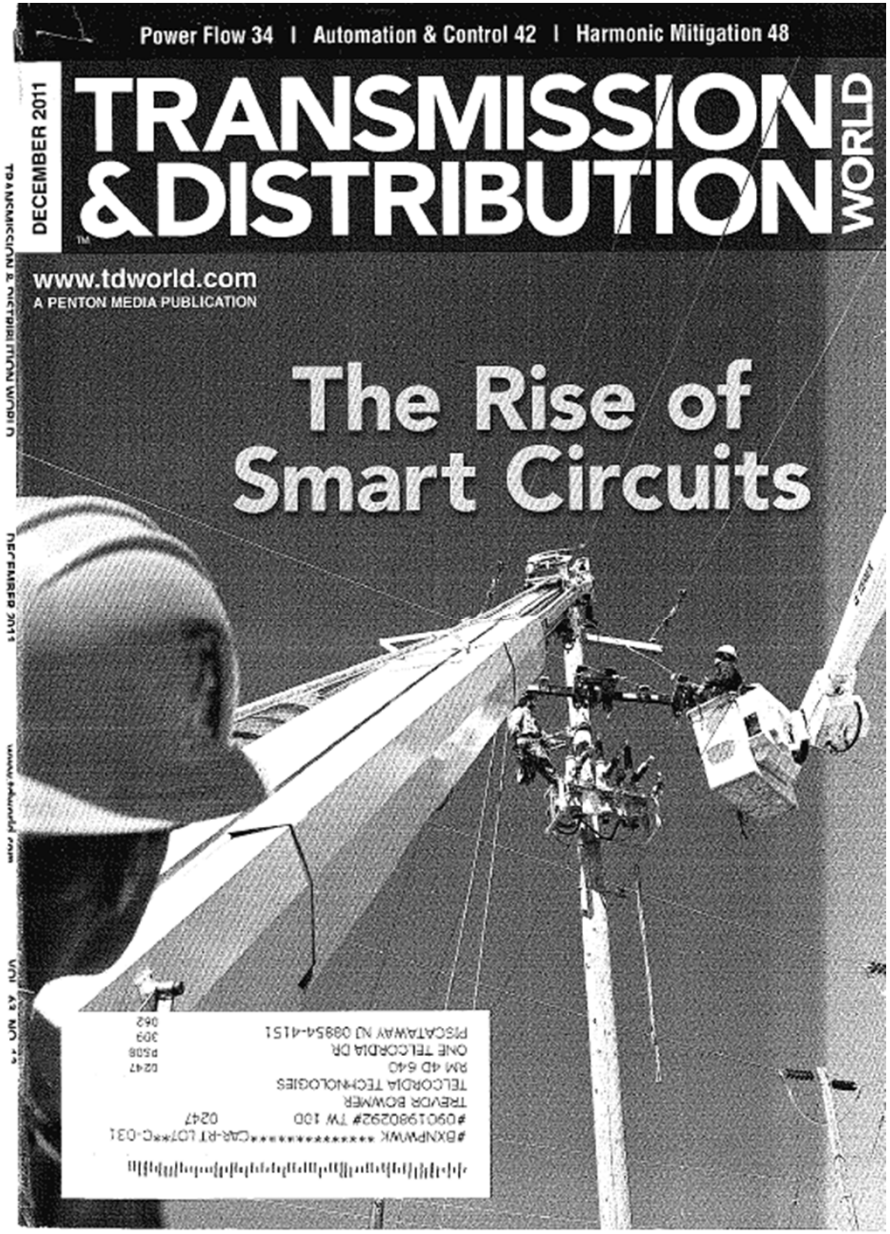


Network and Business Drivers

get it right



Crews performing the first recloser test install in 2010.

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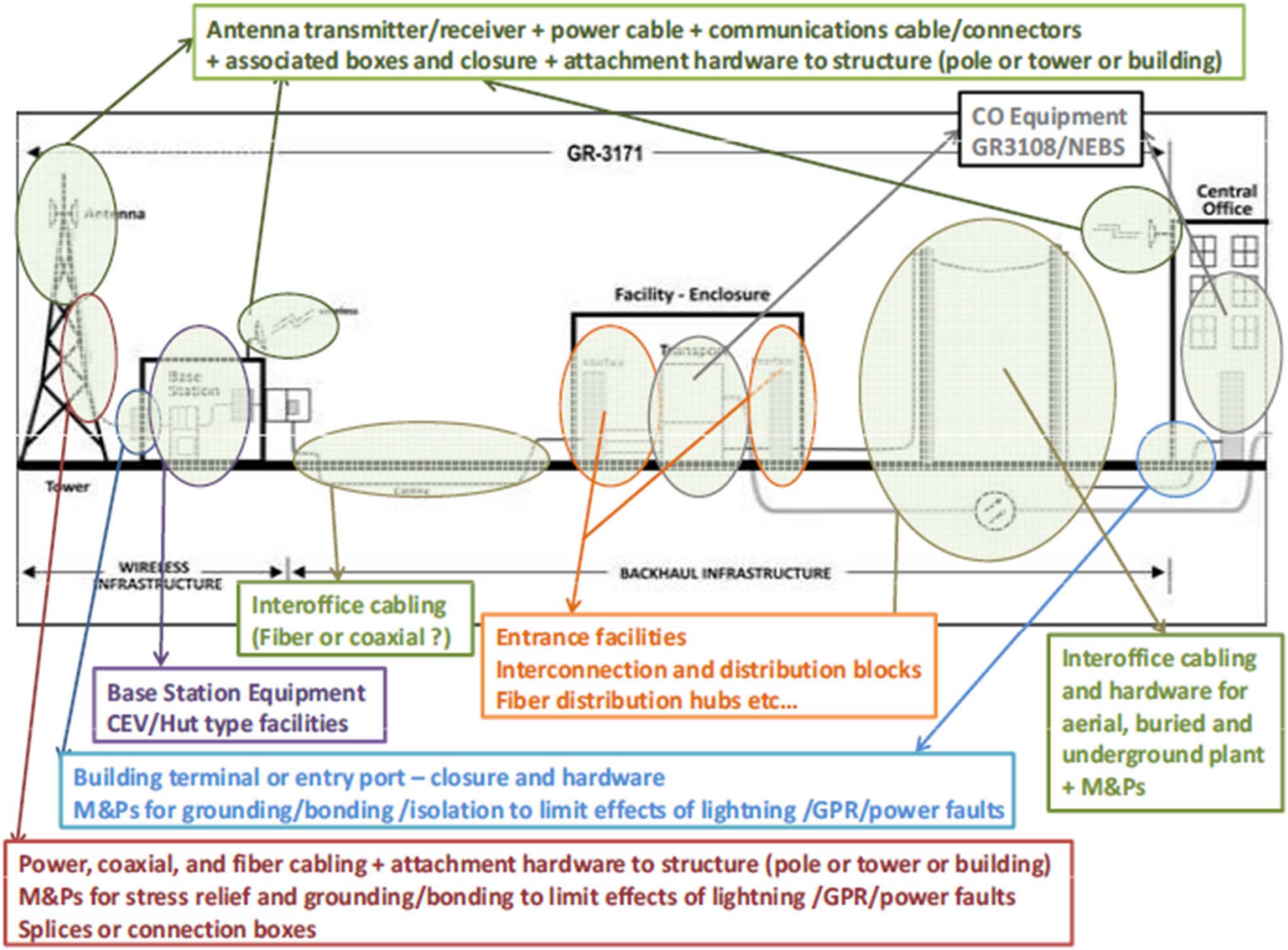
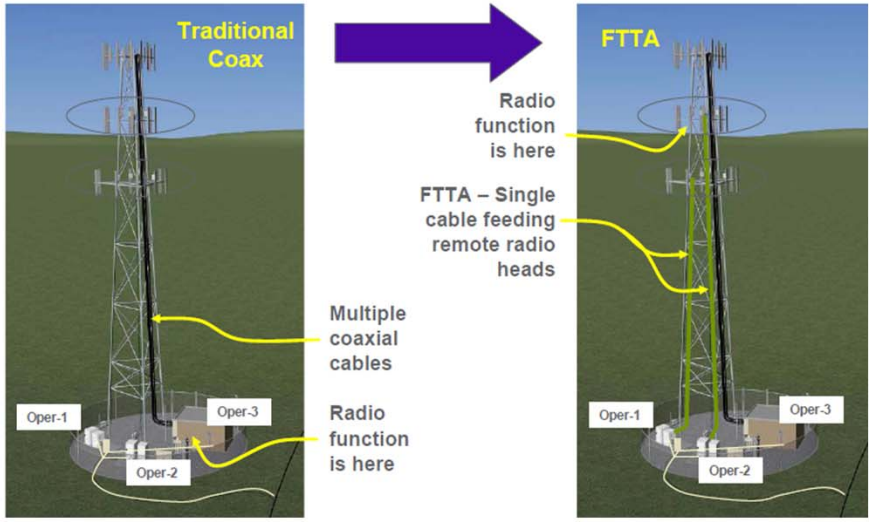
Expansion of Wireless Networks



From Telcordia GR-3171

Transition of Wireless Networks

Transition to Fiber-Fed Remote Radio Heads

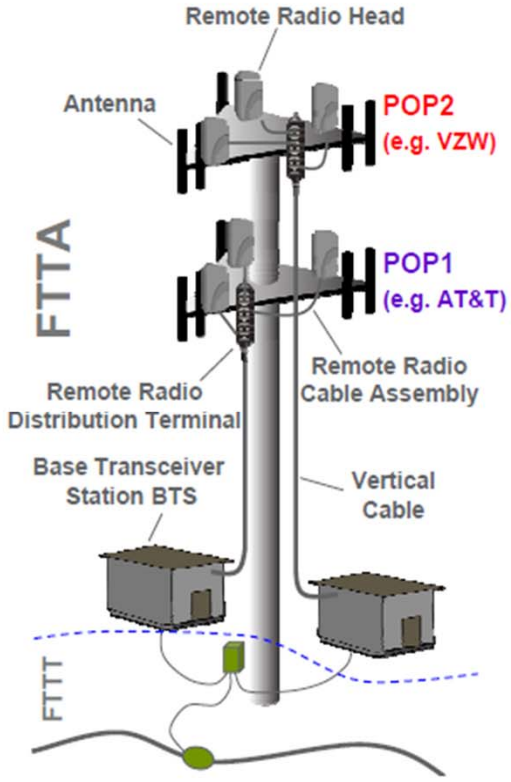


Joint Feeds to Antenna

- Power (AC/DC)
- Communications (Fiber/Copper)

Comparison of FTTA to Fiber to the Home (FTTH)

Fiber to the Antenna is different with new terminologies but some similarities



Fiber to the Antenna	Fiber to the Home
Point of Presence (POP) (wireless carrier at a cell site)	Home or Living Unit (LU) (wireline carrier at a residence)
Cell Site (cell tower, rooftop, etc.)	Neighborhood
Remote Radio Distribution Terminal (RRDT)	Network Access Point Terminal (NAP)
Remote Radio Cable Assembly (RRCA) (with Terminal and RRH connector)	Drop Cable Assembly (with Terminal Connectors)
Remote Radio Head (RRH) (electronics at top of cell site)	Optical Networking Terminal (ONT) (electronics on side of a home)
Terminal Installed (TI)	Homes Passed (HP)
RRHs Connected (RC)	Homes Connected (HC)

Antenna Locations

- Poles
- Towers
- Roof Tops
- Church Spire
- Walls
- DAS Indoor

From Telcordia GR-3171

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Themes and Trends

- **Demarcation between Codes and Standards - NESC/NEC**
  - Codes are not in significant conflict over general intent – "Devil is in the Details"
  - Local interpretations vary greatly between inspectors, local authorities, and individual utilities → generate conflicts
  - Other (Hidden) Agendas – Business and Economic Drivers, Regulatory and Local /State/Federal Political Factors
- **Ongoing Refinements to make code practical and usable**
- **Collateral Effects of Expansion of Smart Grid Devices and Broadband/Wireless Services**
  - Congested Poles
  - Adequate clearance and separation between facilities
  - Sufficient working and climbing space
- **Communications (Lack of ?) Between Stakeholders**
  - **Cooperation between all Joint users of structure and Right-of-Ways**

Drivers that Create Congested Poles

- Competition in Telecommunications - More Joint Users
- Expansion of Broadband and Wireless Services and Applications associated with Smart Grid Developments

1. Smart grid devices to monitor and control supply circuits
2. Wireless – Antennas, power supplies and other devices/boxes
3. Cameras, monitors for traffic control and security surveillance
4. Luminaries – street lights, as well as in private lighting/luminary systems for parking lots and sports arenas
5. More and larger cabinets/boxes – Devices and components associated with communications services provided over fiber-to-the-node/home, and Broadband over Power Lines (BPL) architectures
6. Distributed Power Sources
   - Distributed power sources (e.g., solar panel assemblies) feeding power into the grid or powering specific facilities
7. Expansion of private networks with HFC and wireless (WiFi) architectures

Safety Codes Alone Are Not Enough

Baseline for Safety -- NESC…OSHA….NEC… GO 95

Limits of Safety Codes

- 5 year cycle → slow to respond to market/business initiatives
  - 3 year cycle like NEC ? Still too slow ?
  - TIA process? conservative process--takes time--requires >75% agreement
  - Develop local perturbations – Legislative, PUC, BPU, California GO95, etc…

A. Design, Engineering and Product Specifications

B. Operational M&Ps and Engineering Controls

Industry or Individual Company Driven

- ATIS – STEP, PEG … ATIS-0600333, etc…
- Telcordia GR-1089, SR-1421, GR-3171, etc…
- IEEE-516, IEEE-P487, UL-609590, IEC, …
- Supplier product specific engineering/use guidance

Safety Codes Not Enough

- **Safety Codes…….Regulatory and Legal Mandates**
  - NESC…NEC..OSHA…GO 95….
  - Local and Regional Building and Fire Codes
- **Internal Practices**
  - Telcordia Construction Blue Book – Issue 5 (2011).., new issue in 2014
  - Service Providers - ATT..Verizon… Centurylink … RUS..
  - Manufacturer/Supplier provided instructions and guidance documents
- **Product Specifications and Functional Performance Criteria**
  - Poles & Hardware - GR-60 Wood, GR-3159 Non-Wood, GR-3174 Hardware
  - Equipment - Physical Protection -- GR-3108… GR-1089 EMC…..GR-63 and most recently GR-3171 - OSP Network Elements Used in Wireless Networks
  - Enclosures and Closures - GR-43 (Huts), GR-487 (Electronic Equipment Cabinets), GR-950 (ONUs), GR-902 (Handholes)
  - Cables, .GR-421, GR-3163, GR-3164, GR-137, GR-492, GR-20, etc.……
- **Design Engineering for Network**
  - Reliability and Long Lifetimes --- 20…..40 years
  - Quality and Availability of Services (99.999+%)

Paths Forward

get it right

A. Review Incidents, Accidents and Current Practices for Operations, Personnel and Equipment Facilities

B. Identify Root-Cause Problems or Areas for Improvements

C. Determine Best Solutions and Means to Improve Personal and Public Safety along with Better Equipment and Network Reliability

- Product breaks or fails before its time → Improve Product Functional Performance Criteria
- Develop, Educate and Train staff for best-in-class installation, repairs and maintenance practices
- Formalize Best Methods and Practice (M&P) in internal practice documents – e.g., Telcordia Construction Blue Book (SR-1421)

D. For circumstances where code changes can help

- Influence GO-95 process
- Participate in NESC/NEC Subcommittees and Working Groups
- Prepare change proposals (CPs) for 2017 NESC → May 2013

Current Code Focus

A. GO95 Technical Panel Meetings

- **Influence, where possible, and respond with better practices**

B. NESC Change Proposals – under review and consideration at moment (appreciate comments and suggestions) based on the above discussions

Grounding and Bonding (Section 9)

- **Rules 099 "… Grounding & Bonding of Communications Apparatus…"**

Aerial Plant (Part 2)

- **Rules 214 & 313 "… Inspections and Tests.."**
- **Rules 222 "Joint use of Structures"**
- **Rule 224B – " supply circuits used exclusively in operation of communication circuits"**

continued…

Current Code Focus

Aerial Plant (part 2 continued)

- **Rule 235 H & I as well as Rule 238 – Clearances specifically for communications facilities**
- **Rule 236, Climbing Space, and 237, Working Space**

Buried Plant (Part 3)

- **Rules in Part 3 pertaining to joint placement of telecom-power use and joint buried plant – Section 35 (direct buried) and Section 36 (Risers on Poles)**
- **Rule 384 – Intersystem bonding and bonding to the vertical MGN on poles**

Work Rules (Part 4)

- **Rules in Section 43 (particularly Rule 423) on Minimum Approach Distances for communications workers.**

THANK YOU

Q & A

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-- Bonus Materials –

Guidelines on B&G Practices

- Aerial Plant
- Communications Ground Bed
- Grounding of Guys and Hardware
- Under High Voltage Lines
- Buried Plant
- Telcordia Construction Manual Guidelines- Blue Book

General Guidance - Aerial Plant

Bond

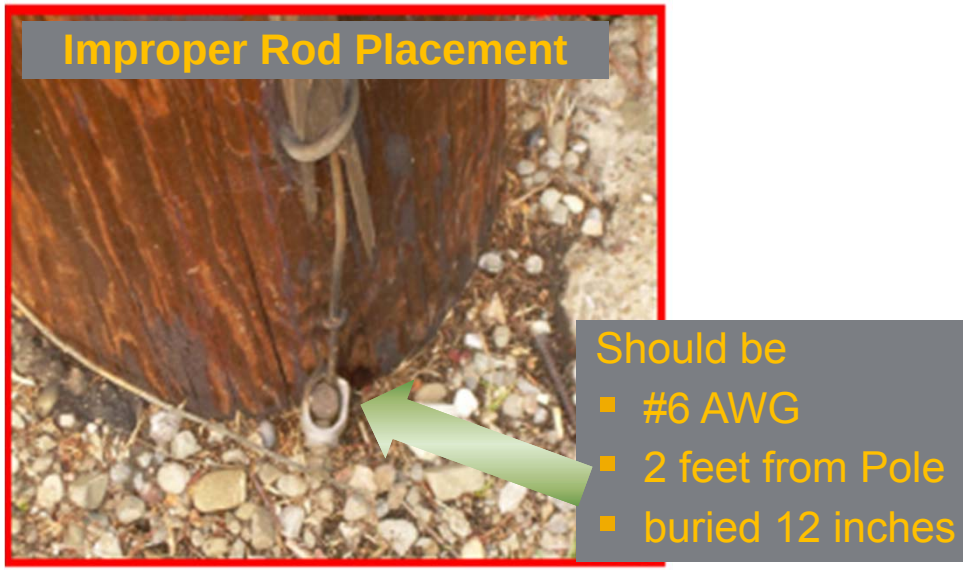
- Copper cable shield to strand at least every ¼ mile
- Strands of separate copper cables on the same pole together every ¼ mile.
- Attachments to strand dead ends.
- Communications attachments to communications grounds where they exist.
- Strands that intersect from different copper cable leads (crossover poles)

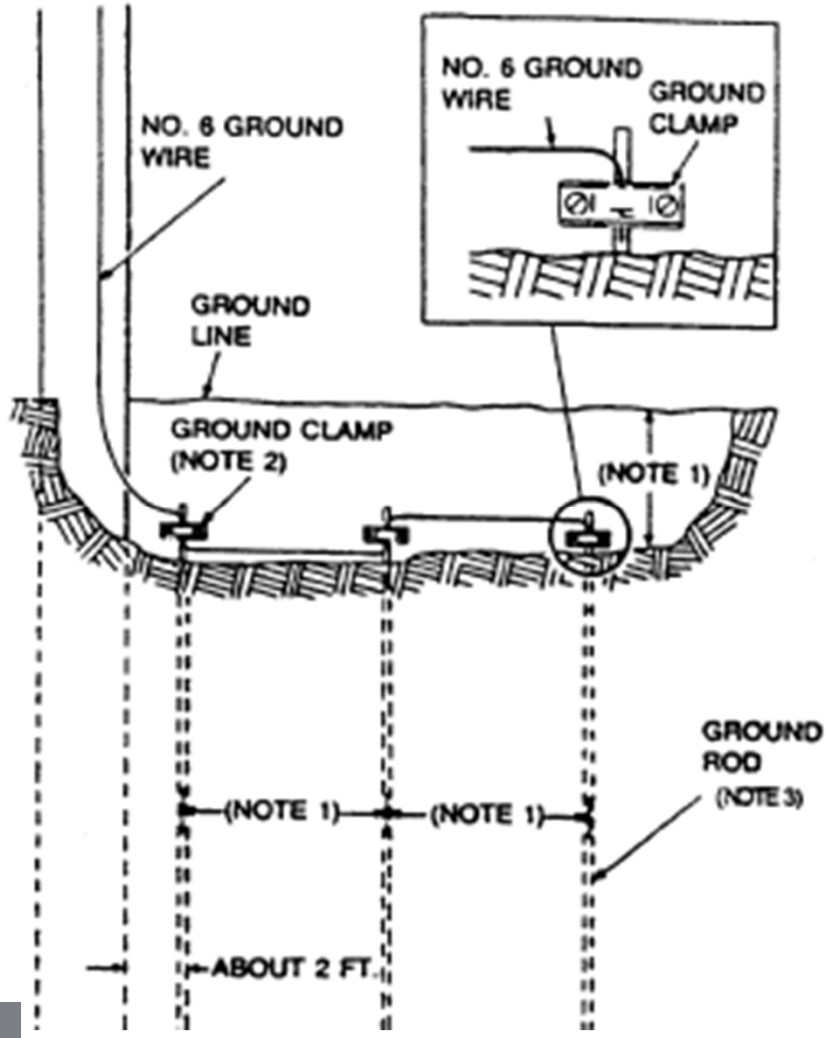
Ground

- Strand dead ends
- Supporting messenger (strand) every 1320 feet (1/4 mile) with Ground Bed

Telecom Grounding Bed – Ground Rod System

- Note (1) defined by application and available space – 8 or more feet desired for 8 foot rods.
- Note (2) – crimped or welded connection using a 2-hole/lug ground connector is preferred
  - Crimp/weld → better electrical and mechanical bond
  - Screw-type → more easily reconfigured.
- Note 3 – Rods shall be 8 feet minimum length and 5/8-inch diameter for iron/steel, or ½ inch diameter of stainless steel or copper-clad stainless-steel.





Grounding of Guys and Support Hardware

NESC Rule 215 requires a guy to be effectively grounded or isolated.

Intentions of Rules 215 & 233 is to make sure that if a line conductor or guy goes slack then fault current/voltage will not expose the public, supply/communications workers or equipment to power.

- Telecommunications guys are presently electrically bonded through their attachment hardware . The grounding path can include
  - Anchors
  - Strand
  - Through the pole attachment hardware
  - Vertical pole ground wires (MGNs) → 4 grounds in a mile (Rule 97)

The telecom equipment is "effectively grounded" since there is a permanent bond to the pole ground and supply neutral. A solidly attached guy forms a low resistance connection to earth through the attachment hardware, strand and MGN connections. The interconnected system meets the definition of effectively grounded since it is "*designed to minimize hazard to personnel and having resistances to ground low enough to permit prompt operation of circuit protective devices*".

Under High Voltage Lines

- If bonding to Power Utility Grounding Scheme is NOT permitted the Ground Bed shall be placed subject to power voltage limitations:
  - 500 Volts to 26 kV, place a ground bed and attach a bare #6 ground wire from the new or existing strand to the ground bed at both ends of the pole lead and every 1320‟ (1/4 mile).
  - 26 kV to 60 kV, place a ground bed and attach a bare #6 ground wire from the new or existing strand to a ground bed at both ends of the pole lead and every 660‟ (1/8 mile).

Buried Plant

Bond cable shield to power neutral ground at

- At least every other terminal not to exceed 1000 feet
- At terminal nearest each transformer
- At all aboveground terminals, apparatus cases, and cable closures which are within 6 feet of any above ground power apparatus

Since in many or most cases, no access to power bonding & grounding source is available.

- Place a ground bed
- Place ground at the beginning and end of the laterals and major branch splices
- Bond cable shields
  - Within 500 ft of first transition point (e.g., pedestal, crossbox)
  - Within 500 ft of the CO side of any new buried cable pulling off from an existing route (branch location).
  - At least every other terminal so as not to exceed 1000 ft to a ground bed.
  - Within 500 ft of the end of the cable route, no additional ground rods are required.

Internal Practices – e.g., Telcordia Construction Blue Book (SR-1421)

get it right

General Scope Chapters 1 and 2

- Scope, Purpose and List of Changes
- Coordination with Other Codes and Standards
- General Safety Precautions and Guidelines
  - Working in Vicinity of Power Conductors
  - Minimum Approach Distances, Arc-Flash…
  - Visual Pole Inspection.
  - Buried Plant Precautions and Manholes
  - Fiber Optics
- Inspection and Make-Ready Survey Checklists

Aerial Plant Chapters 3 –to-14

- Clearances
- Strand
- Pole Line Hardware
- Guying
- Insulating Guys
- Anchors and Guy Rods
- Suspension Strand
- Bonding and Grounding
- Aerial Markers
- Pole Testing and Inspection
- Pole Strength
- Supply Equipment in/near Telecom Space

Underground & Buried Plant Chapters 15 - to - 25

Manholes

- General Precautions
- Testing Atmosphere and Ventilating
- Bonding Cables
- Cable Markers
- Sealing Ducts and Conduits

Buried Plant

- General Construction
- High-Speed Blown Cable
- Direct Buried Duct
- Directional Drilling
- Bonding Drop Cable
- Placing Cable Guards

Chapter 26-27-Appendices

- FTTx Deployments
- Symbols for Grids and Mapping Diagram
- Appendices
  - Background on Ice-Wind Load Map used for Reliability-Based Design of Required Pole Strength
  - NESC 2012-2017 Cycle Schedule
  - NESC Active Issues – Working Groups (WGs)

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