

OTA Technical Conference
September 4, 2014

Engineering Aerial Facilities

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Finley Involvement

- Broadband / Telecom Division
 - 25,358 miles
 - 122,417 subscribers
 - 7,186 miles of transport projects between 96 metropolitan areas
- Energy Division
 - Joint Use Group
- Our Value Proposition
 - Evaluate up front & avoid expensive application fees

Types of Aerial Fiber

- OPGW



Types of Aerial Fiber

- All Dielectric Self Support (ADSS Fiber)



Types of Aerial Fiber

All-Dielectric Self-Supporting (AFL-ADSS®) Fiber Optic Cable

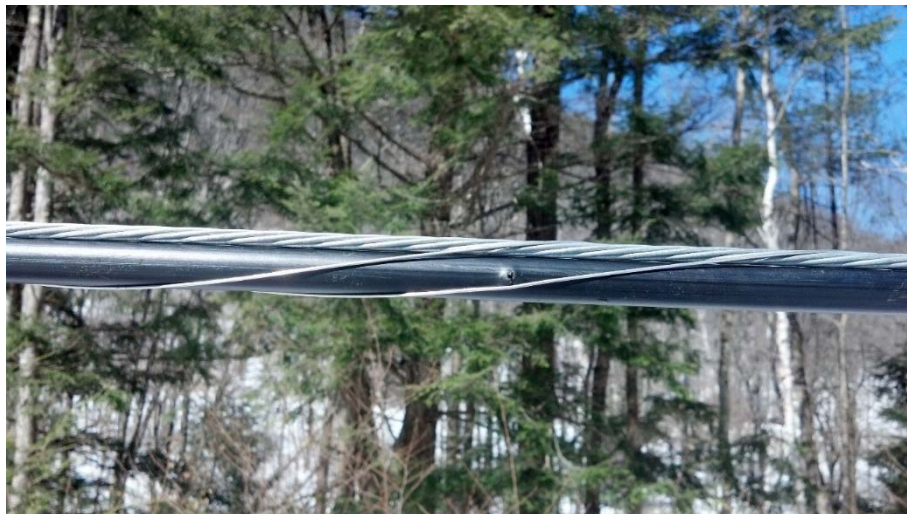
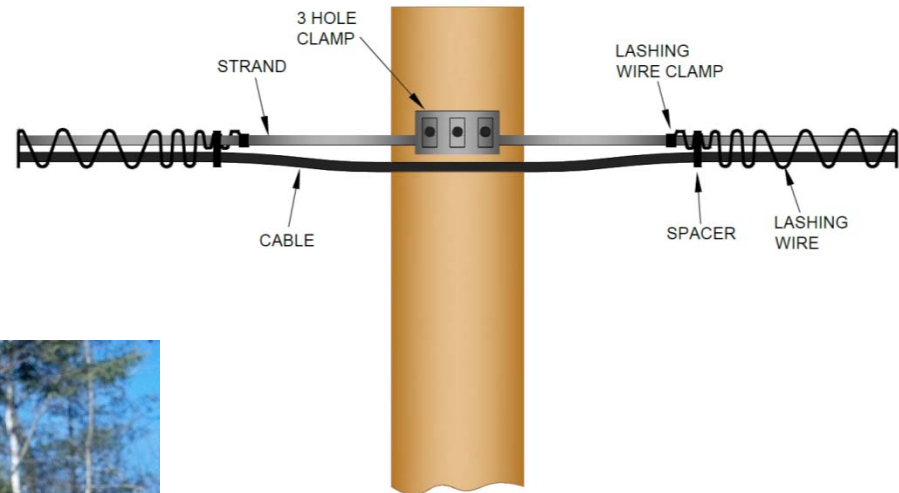
NESC HEAVY LOADING @ 1% INSTALLATION SAG

| SPAN | | WEIGHT | | DIAMETER | | MRCL | | INITIAL TENSION | | | | |
|------------------|--------|--------|-------|----------|------|------|-------|-----------------|------|--------|------|-------|
| | | | | | | | | UNLOADED | | LOADED | | |
| FEET | METERS | LBS/FT | KG/KM | INCHES | MM | LBS | N | LBS | N | SAG % | LBS | N |
| 48 FIBERS | | | | | | | | | | | | |
| 100 | 30 | 0.083 | 124 | 0.500 | 12.7 | 539 | 2398 | 104 | 463 | 3.5 | 338 | 1503 |
| 200 | 61 | 0.083 | 124 | 0.500 | 12.7 | 598 | 2661 | 209 | 930 | 4.1 | 574 | 2553 |
| 300 | 91 | 0.083 | 124 | 0.500 | 12.7 | 936 | 4162 | 313 | 1392 | 4.1 | 870 | 3870 |
| 400 | 122 | 0.087 | 130 | 0.512 | 13.0 | 1189 | 5290 | 437 | 1944 | 4.1 | 1160 | 5160 |
| 500 | 152 | 0.088 | 130 | 0.512 | 13.0 | 1506 | 6699 | 547 | 2433 | 4.1 | 1456 | 6477 |
| 600 | 183 | 0.088 | 131 | 0.512 | 13.0 | 1823 | 8108 | 658 | 2927 | 4.1 | 1752 | 7793 |
| 700 | 213 | 0.093 | 139 | 0.528 | 13.4 | 2076 | 9236 | 815 | 3625 | 4.1 | 2067 | 9194 |
| 800 | 244 | 0.093 | 139 | 0.528 | 13.4 | 2456 | 10927 | 932 | 4146 | 4.1 | 2384 | 10605 |
| 900 | 274 | 0.093 | 139 | 0.528 | 13.4 | 2710 | 12054 | 1049 | 4666 | 4.1 | 2668 | 11868 |
| 1000 | 305 | 0.093 | 139 | 0.528 | 13.4 | 3090 | 13745 | 1167 | 5191 | 4.1 | 2986 | 13282 |
| 1100 | 335 | 0.096 | 143 | 0.535 | 13.6 | 3470 | 15436 | 1322 | 5881 | 4.1 | 3332 | 14821 |
| 1200 | 366 | 0.096 | 143 | 0.535 | 13.6 | 3724 | 16564 | 1443 | 6419 | 4.1 | 3620 | 16103 |
| 1300 | 396 | 0.105 | 156 | 0.559 | 14.2 | 4104 | 18255 | 1704 | 7580 | 4.1 | 4045 | 17993 |
| 1400 | 427 | 0.105 | 156 | 0.559 | 14.2 | 4435 | 19729 | 1839 | 8180 | 4.1 | 4363 | 19408 |
| 1500 | 457 | 0.105 | 157 | 0.559 | 14.2 | 4689 | 20857 | 1974 | 8781 | 4.1 | 4660 | 20729 |

http://www.aflglobal.com/Products/Fiber-Optic-Cable/ADSS/Standard-Design-Cable/Standard_ADSS_Fiber_Optic_Cable.aspx

Types of Aerial Fiber

- Strand and Lash



New Pole Selection

- Grade C construction, defined in NESC, is sufficient for most aerial plant construction
- Grade B construction should be used for crossings of railroads, limited-access highways, and other special situations
- Pole Length should be determined by ground clearances, sags, etc.
- Pole Class should be determined by the pole's strength and transverse load requirements
- We typically use Class 1, 3, and 5 poles
 - Class 5 for straight line, Class 3 for corners, Class 1 for bad corners or deadends

Strand

Per RUS:

Utilities grade, steel, seven wire

5/16" (6M) 3/8" (10M) 7/16" (16M)

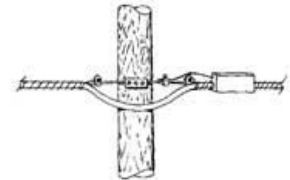
Extra High Strength grade, steel, seven wire

1/4" (6M) 5/16" (10M) 7/16" (16M)

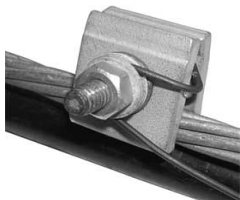
See Bakaert Strand chart for example of weights and breaking strength.

Strand Hardware

- Lashing Wire Termination
- Strand Connections
- Pole Attachments



No. 7902R



No. 7903



No. 7903L

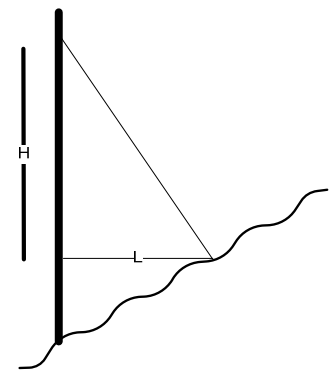
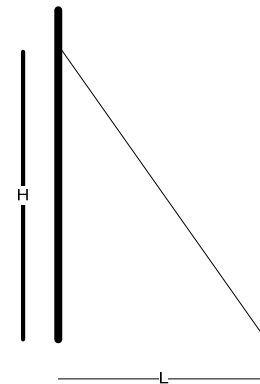
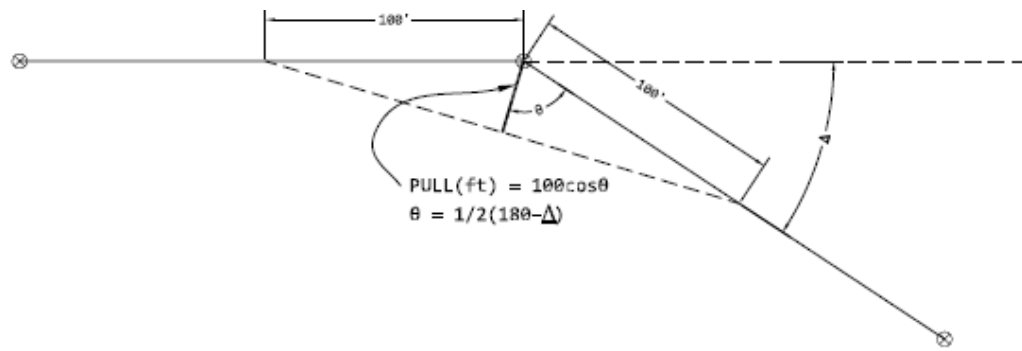
Anchors

- Expanding
- Rock
- Screw
- Swamp



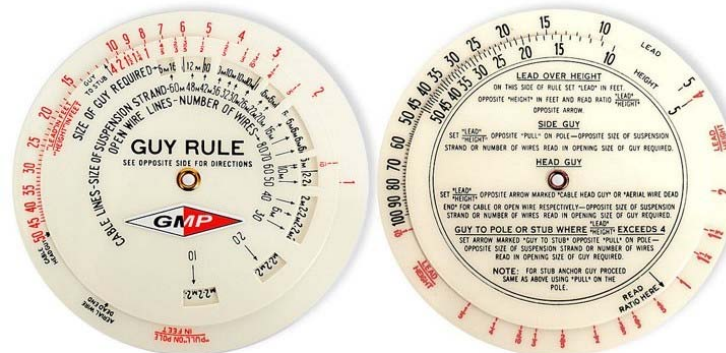
Guying and Anchoring

- Size of guy for lashed aerial plant should be based on tension in the suspension strand when the cable and strand are loaded to 60% of the rated breaking strength of the strand
- Lead to Height ratios
- Angles measured in feet of pull



Guying and Anchoring

- Guy Rule determines size of guy required based on lead, height, and pull measurements
- Assume 50 feet of pull for deadends
- Use smaller equivalent guys for larger guy sizes
 - Ex. For 26M guy size, use 1 10M guy and 1 16M guy
- Size of anchor is determined by guying requirements

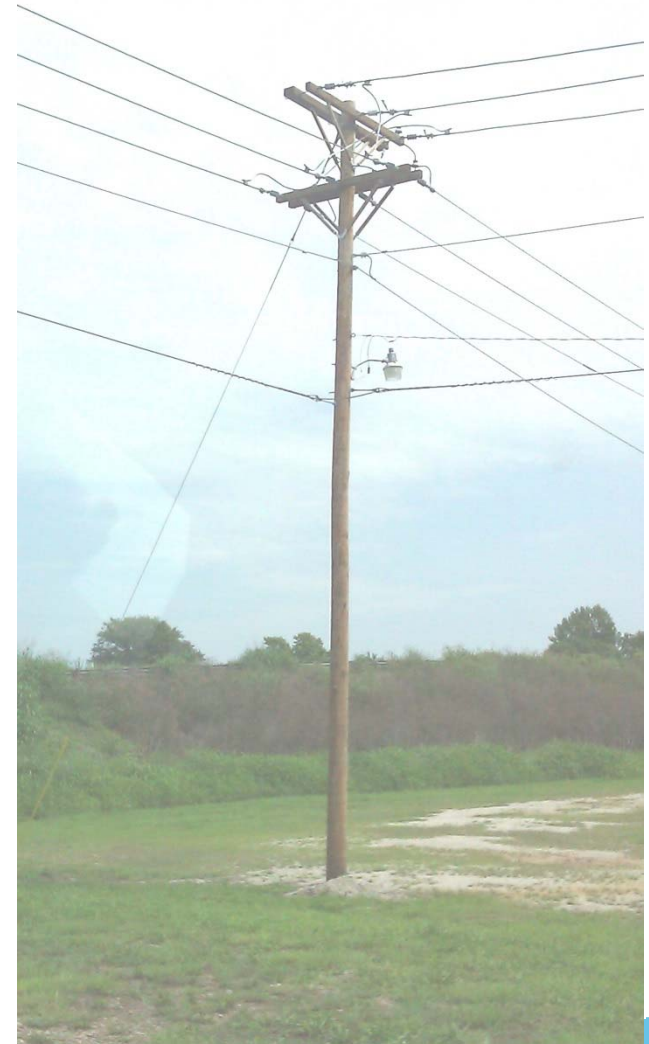


Front

Rear

Guying Tips

- Guys placed at corner angles of 60 degrees or less should be installed at the bisect of angle, unless double-deadend is required for other reasons.
- Two head guys (double-deadend) required at corners greater than 60 but less than 90 degrees.



Grounding

- Ground minimum 4 times per mile
- PM2/PM2A on one pole when crossing under any power lines
- If on telephone pole line and attach to one power pole, must ground to MGN
 - We typically ground poles on each side of the power pole as well
- At end of the line poles

NESC Code Terminology

- Communication Lines
 - Located in **Communications Space**
 - CATV
 - Traditional Copper Telephone Cables
 - Located in the **Supply Space**
 - “Qualified” work force required
 - Minimum approach distances
 - Dependent upon facility owner approval

NESC Pole Separations

- Table 235-5
- 40" vertical clearance supply equipment and communication equipment (up to 8.7 kV)
- If supply voltage is greater than 8.7 kV, clearance increases by 0.4" per kV over 8.7
- Less than 40" (e.g. 30") may be acceptable for certain grounded supply facilities

Pole Separation

260 OVERHEAD LINES

Rule 239A

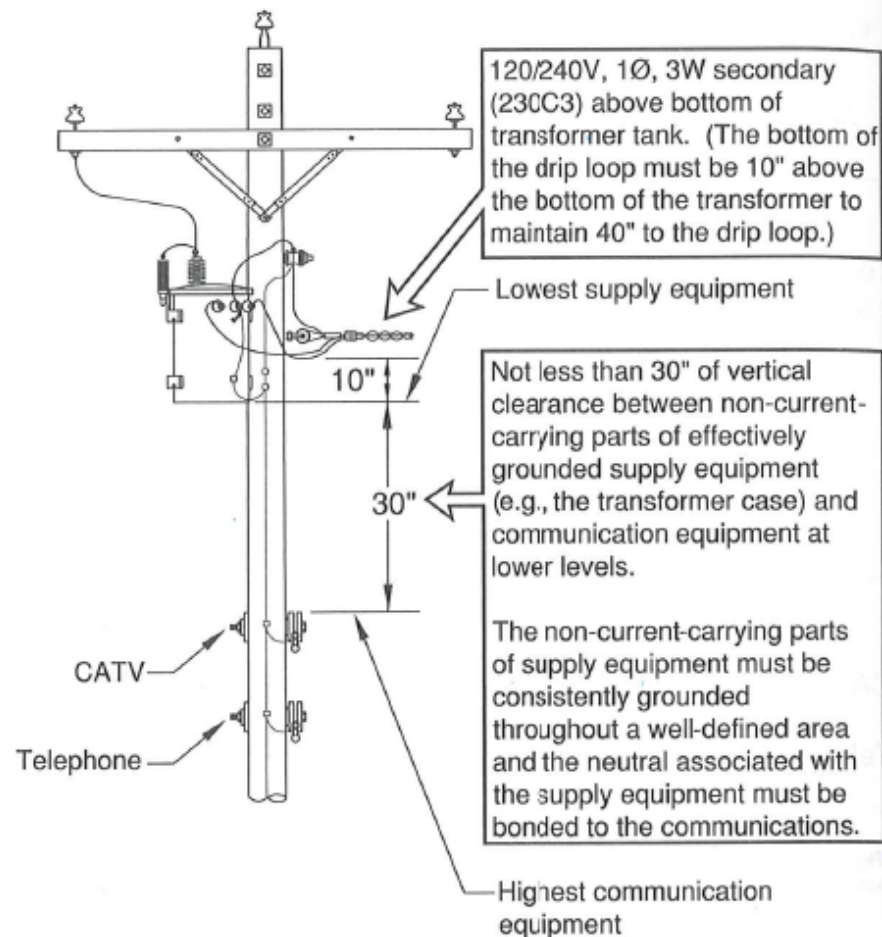
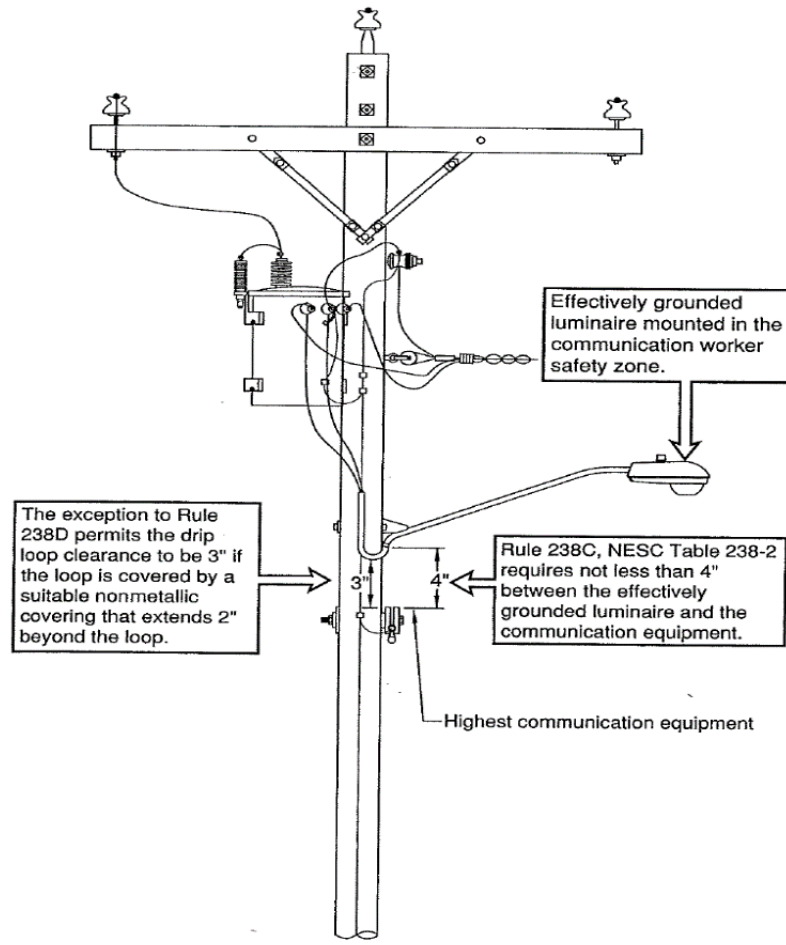


Fig. 238-6. Example of vertical clearance between supply and communication equipment on the same structure (Rule 238B).

Pole Separation

Rule 239J

CLEARANCES 269



See
Photo(s)

Fig. 238-15. Exception to vertical clearance between a drip loop feeding roadway lighting and communication equipment (Rules 238C and 238D).

Pole Separation

270 OVERHEAD LINES

Rule 239J

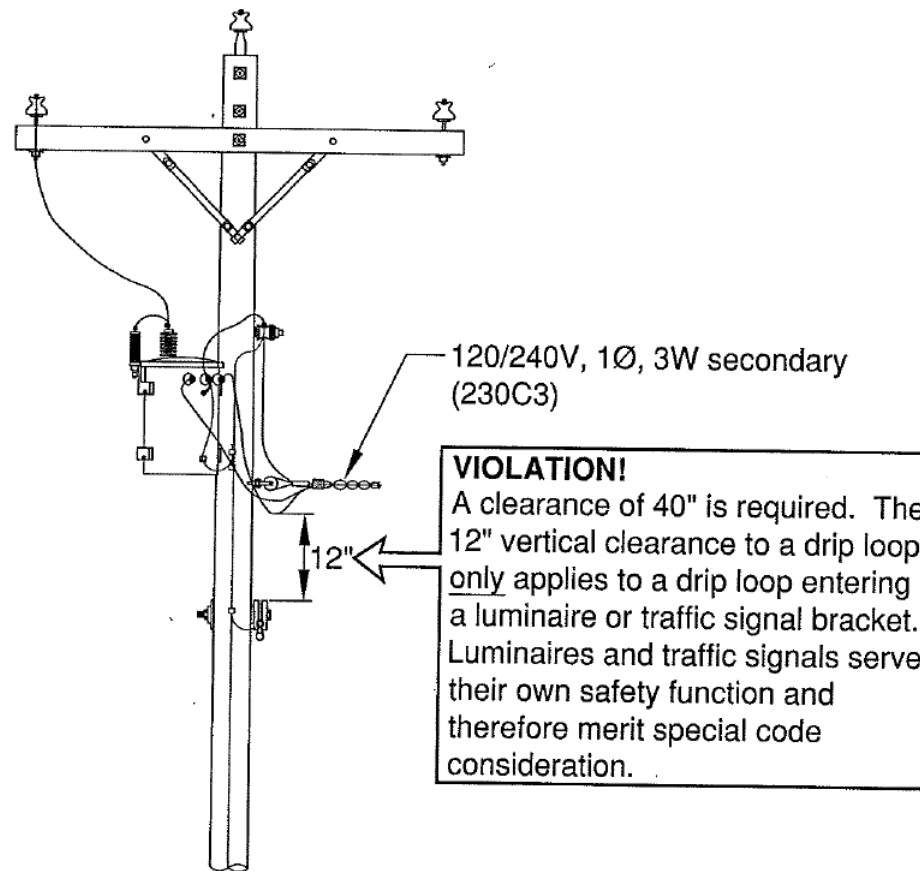


Fig. 238-16. Example of a common joint use violation (Rule 238D).

Mid-Span Separation

240 OVERHEAD LINES

Rule 235E

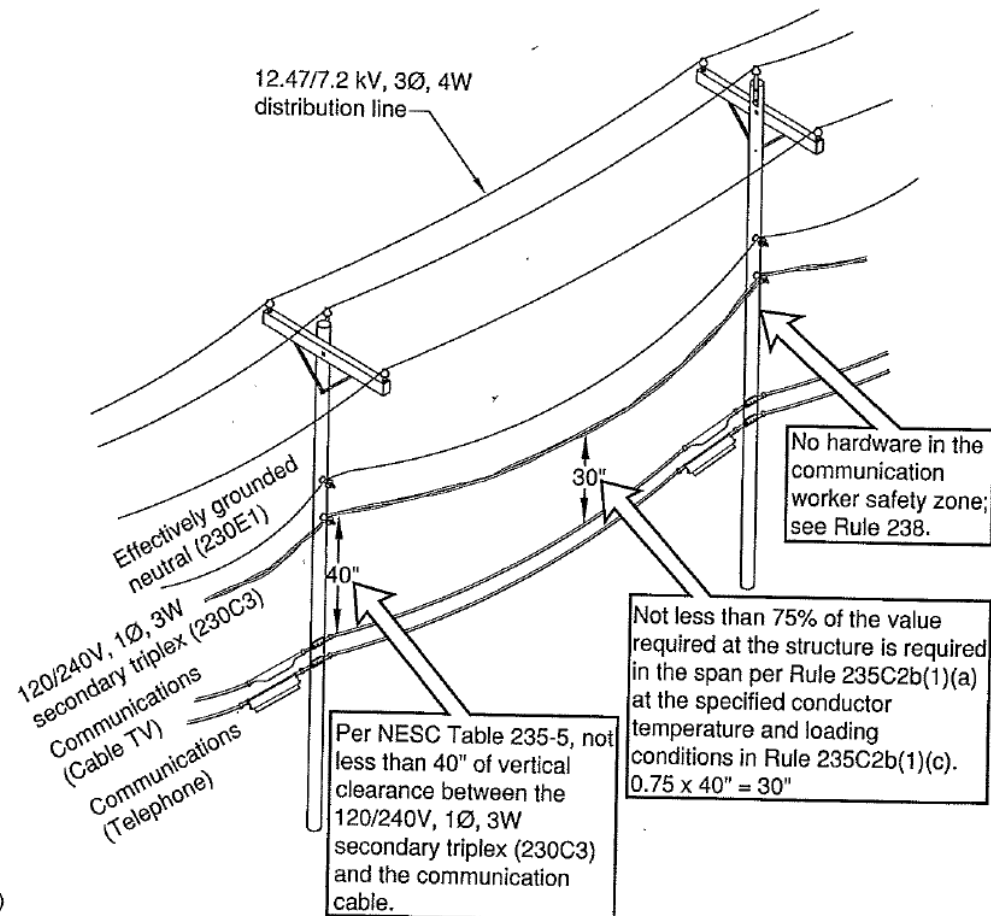


Fig. 235-12. Example of vertical clearance between joint use (supply and communication) conductors (Rule 235C).

Mainline Power Violations



Separation to Power Conduit

Rule 239J

CLEARANCES 277

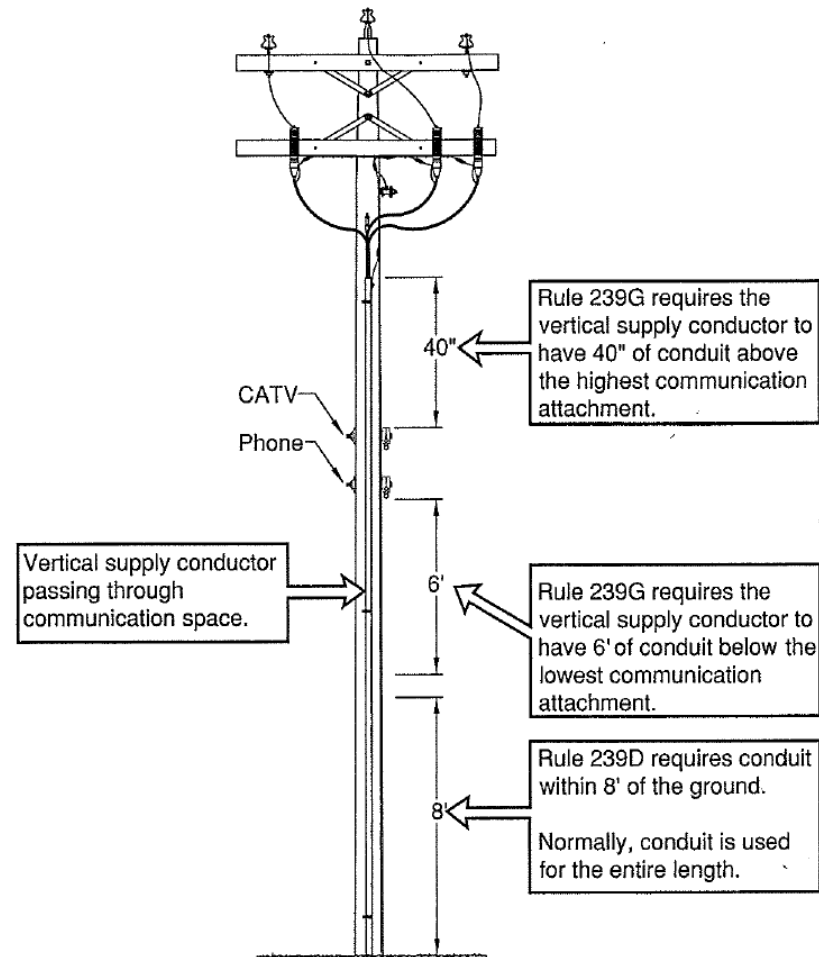


Fig. 239-7. Example of vertical supply conductors on a joint use pole (Rule 239G1).

Violation to Power Conduit



Vertical Ground Clearances

- Table 232-1
- Roads, streets, alleys, & other areas subject to traffic: 15.5 feet
- Railroads: 23.5 feet
- 230.A.2.a clarification on 9.5 feet
 - “spaces and ways subject to pedestrians or restricted traffic only are those areas where riders on horseback or other large animals, vehicles, or other mobile units exceeding (8 ft.) in height are prohibited by regulation or permanent terrain configurations or are otherwise neither normally encountered nor reasonably anticipated or are otherwise limited.”*
- Minimum clearance under fully loaded conditions.

Aerial Pole Line Review

ADSS Fiber

| <u>Fiber</u> | <u>Spans</u> | | | | | |
|--------------|--------------|-------------|-------------|-------------|-------------|----------------------------|
| | <u>400'</u> | <u>350'</u> | <u>300'</u> | <u>250'</u> | <u>200'</u> | |
| ■ 24 | 16.4' | - | 12.3' | - | 8.2' | Projected Sag (In Feet) |
| ■ 96 | 15.6' | - | 11.1' | - | 6.6' | |
| ■ 288 | 13.6' | - | 10.2' | - | 6.6' | |

NESC Heavy Loading @ 1% Installation Sag (Per AFL Manuf.)

Aerial Pole Line Review

Strand and Lash

| <u>Fiber</u> | <u>Spans</u> | | | | | |
|--------------|--------------|-------------|-------------|-------------|-------------|---------------|
| | <u>400'</u> | <u>350'</u> | <u>300'</u> | <u>250'</u> | <u>200'</u> | |
| ■ 24 | 7.4' | 6.0' | 4.7' | 3.5' | - | Sag 10 |
| ■ 96 | 7.7' | 6.3' | 4.9' | 3.6' | - | Projected Sag |
| ■ 288 | 8.4' | 6.8' | 5.4' | 4.0' | - | (In Feet) |

3/8"; Steel; High Strength; .5" Ice; @32 Deg

Aerial Service Drops

- NEC 840 - Premises Powered Broadband Communication Systems
- NEC 840.44 - Overhead Optical Fiber Cables
 - Where practicable, outside plant optical fiber cables shall be located below electric light or power conductors
 - Maintain 40" separation at pole
 - Maintain 12" separation in-span and at house

Aerial Service Drops

- NEC 840.44 (B) - Vertical clearance of not less than 8' from all points of roofs above which cables pass
 - Exception 1: Does not apply to auxiliary buildings such as garages and the like
 - Exception 2: Reduction in clearance above only the overhanging portion of the roof to not less than 18" shall be permitted if (a) not more than 4' of drop cable passes above roof overhang and (b) the cable is terminated at a through- or above-the-roof raceway or approved support

Aerial Service Drops

- NEC 230.28 - Service Masts as Supports
 - Only power service drop conductors shall be permitted to be attached to service mast
 - Communication conductors such as those for cable TV or telephone service are not permitted to be attached to the service mast

Service Drop Power Violation



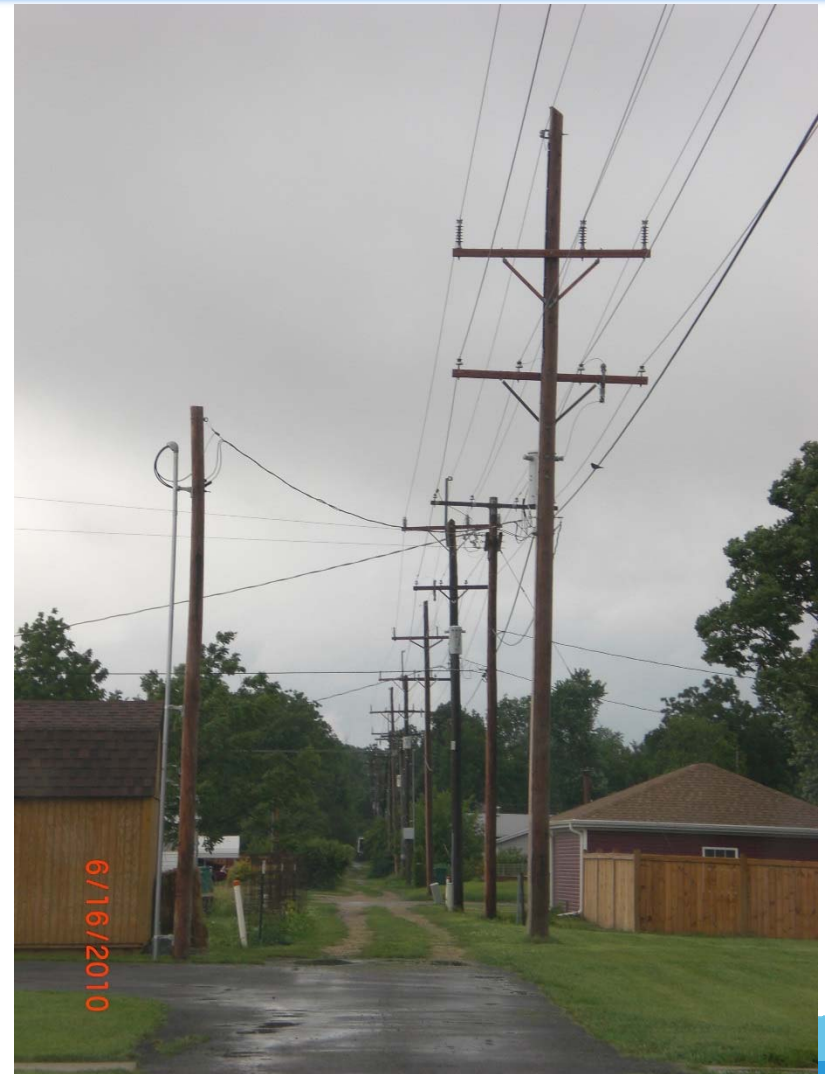
Service Drop Power Violation



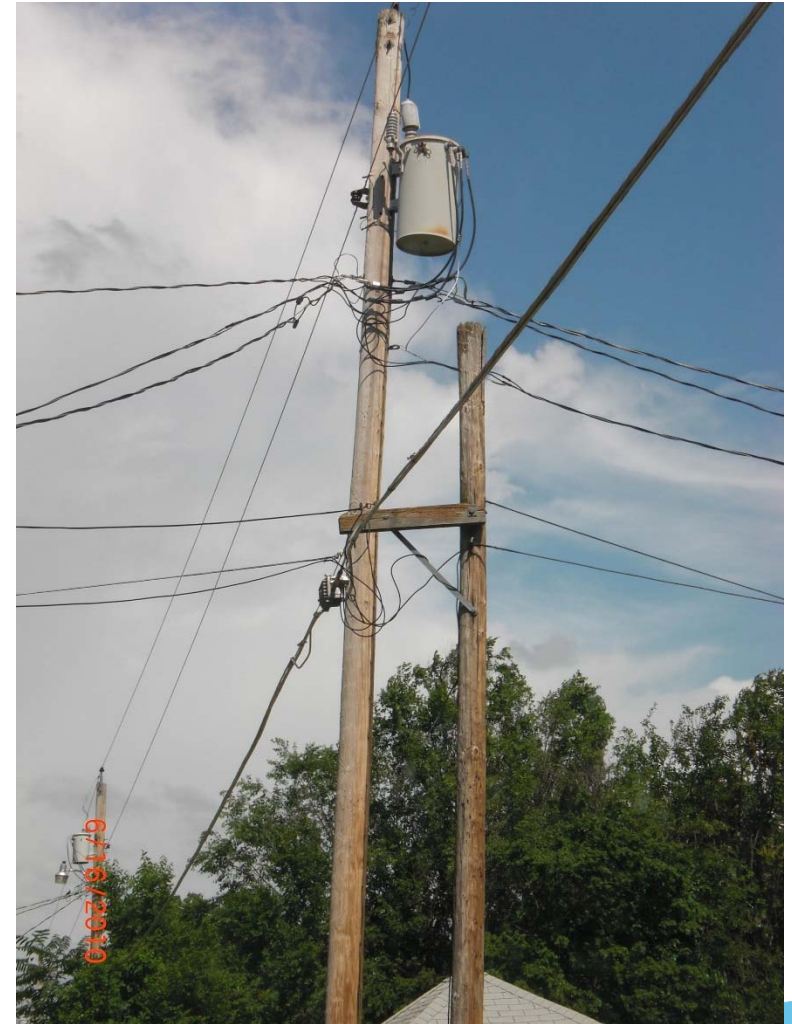
Service Drop Power Violation



Go or No Go



Go or No Go

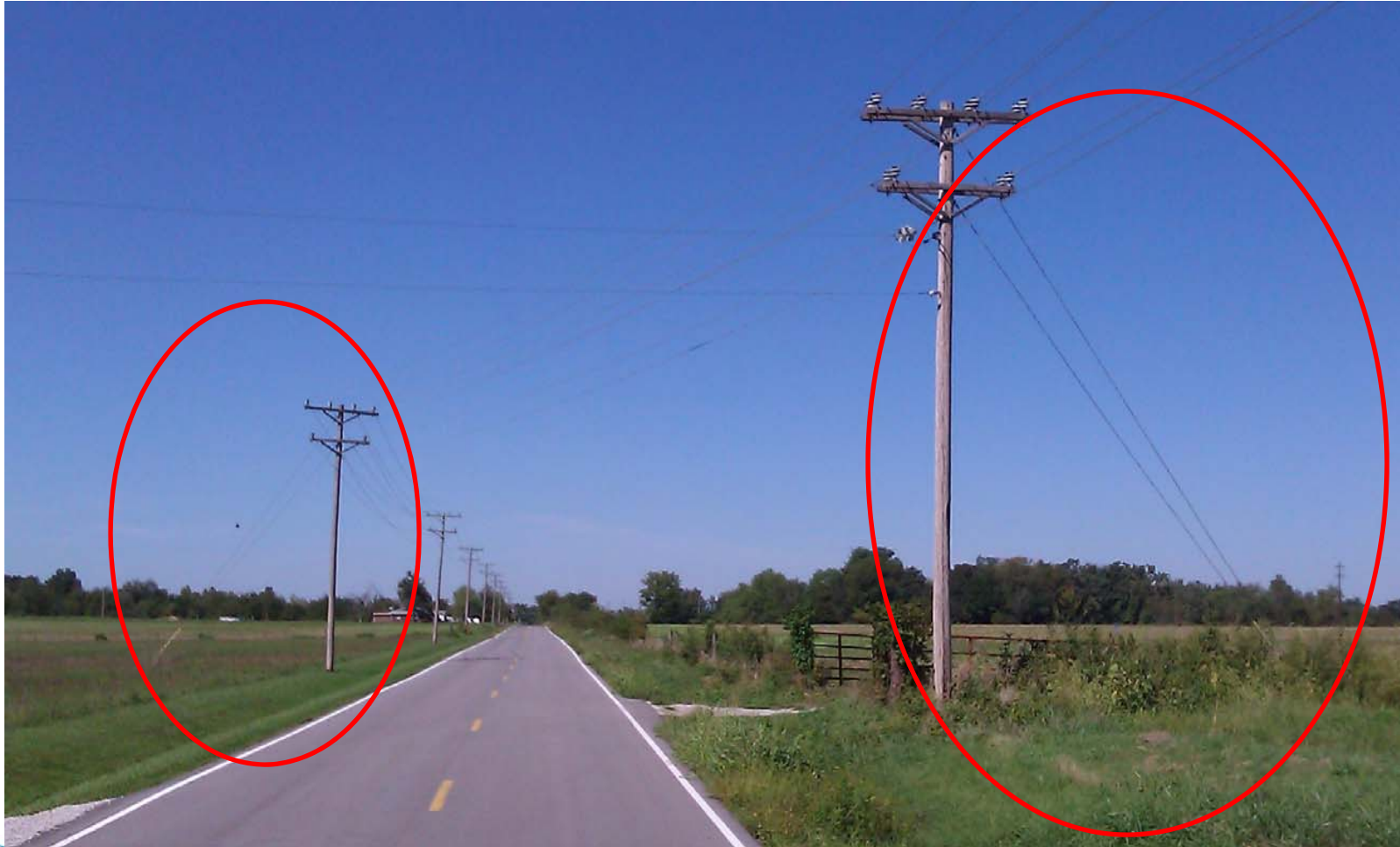


Right-of-Way Considerations

- Easement Acquisition
 - Do the ownership research
 - Prepare the easement document
 - Sign and notarize
 - Have a checkbook in hand
 - Record at courthouse
 - IRS paperwork may be required
 - \$600.00



Right-of-Way Considerations



Thank you

Questions?

Please hold
till the end

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