Telecommunications Safety Code Violations: A Field Guide for Attorneys

By

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A damaged cable television vault and lid in the PROW waiting to catch a foot.
(See Section 4)

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Abstract

Telecommunications carriers use the public right of way (PROW) to transport telephone, cable television, fiber optic, signaling, Internet, and other communications services between their own facilities, and to serve subscribers.

Most states have established code regulations to define and govern the *minimum* safe installation and maintenance requirements for telecommunications providers. States most commonly adopt the National Electrical Safety Code for this purpose. Most local governments adopt by reference the state-level safety codes, and also adopt the National Electrical Code (NEC) to regulate the installation of service drops in the PROW and on private property.

This paper explores and illustrates many of the most common safety code violations seen in telecommunications systems, and discusses the safety code and safety implications of those common violations.

Note: Portions of this paper are reproduced from "Is the Telecom Explosion Putting Governments at Risk?" by Jonathan L. Kramer published in IMLA's Municipal Lawyer.

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Telecommunications Safety Code Violations: A Field Guide for Attorneys

1. Introduction

Telecommunications carriers use the public right of way (PROW) and private property to transport telephone, cable television, fiber optic, signaling, Internet, and other communications services between their own facilities, between their facilities and competitors, and between their facilities and their subscribers.

The foundational requirement of all of the various services, save for wireless communications to a degree, is a need for a physical platform to carry the telecommunications services from Point A to Point B.

With the January 1, 1984 break-up of AT&T—then the dominant national telecommunications provider—and the Cable Communications Act of 1984[1] many telecom providers newly released from many of the historical restraints on competition embarked on the baby-steps of what would eventually become an outside plant construction free-for-all.

The next 10 years saw many of the telecom providers stick their noses under the tents of their competitors. A few cable operators explored providing telephony services via their cable networks. Some telephony carriers attempted to nose into video distribution, most commonly by developing MMDS (wireless microwave) distribution systems.

The current massive expansion of telecommunications services, and the demand for new infrastructure to carry those services, most recently traces its impetus to the Telecommunications Act of 1996 (the "Act").[2]

As former FCC chairman Richard Wiley wrote in late 1996, "The Act is expected to transform our communications landscape by eliminating regulatory barriers and encouraging competition in nearly every sector."[3] Turning to the reality of competition, Wiley continued, "Our policymakers are all too aware of their inability in the past to regulate effectively powerful monopoly providers like AT&T and the [Bell operating companies]. Thus, *infrastructure competition* is again the key policy imperative."[4] (Emphasis added.)

[1] Public Law 98-549
[2] Public Law 101-104
[3] "The Telecommunications Act of 1996" http://www.fedsoc.org/Publications/practicegroupnewsletters/telecommunications/tc010101.htm
[4] Id.

Finally, perhaps the most important driving force in outside plant deployment today (and the growth in telecommunications-related safety code violations) is the Internet.[5] While not the most robust technology platform, the way the Internet relays information is the most common. Using the common protocol of the Internet, a single 'packet' of information can carry a portion of an email message; or a part of a telephone call; or a piece of a TV picture; or <insert any other form of data communications here!>.

Public interest in Internet access has become the great leveler of telecommunications. Before the widespread deployment of 24/7 access via Internet-over-cable and DSL, a telephone company was primarily thought of as the dial tone provider for local phone calls and long distance; video was the cable operator's realm, and accessing the Internet via an Internet Service Provider (ISP) was something that was always proceeded by the instantly recognizable modem sounds of "Weeeeeeeeeeeeee, Burrrrrr, Ding, Clunk, Bonk-Bonk, WisHHHHhhhhh!"

To borrow and extend a phrase, "Speed Kills…the competition!" To support faster Internet uploads and downloads for their customers, and to prepare their facilities to compete in non-tradition markets,[6] telecom providers have aggressively upgraded existing and installed new outside plant facilities.

Unfortunately, in the rush to compete (or to prepare to compete), many telecom providers have cut corners in plant maintenance, and during plant upgrades. Those corners have often come at the expense of safety code compliance, and thus public safety.

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[5] For a selection of historical reports regarding the development of the Internet, see www.isoc.org/internet/history

[6] For example, cable TV providers offering dial tone telephony, or telephony providers offering full motion video on twisted pair copper wires (and even some electric utilities offering Internet access via electrical outlets).

2. Sources of Authority to Regulate Telecommunications Facilities in the PROW and on Private Property

The two safety codes governing telecommunications construction most commonly adopted by federal, state, and local government agencies are the National Electrical Safety Code (NESC) and the National Electrical Code (NEC). Both codes are developed and revised by non-governmental consensus-based engineering entities. [7,8]

The NESC is revised on a 4-year cycle. The next revision is due out in 2007. The NEC is revised every 3 years. The next revision—the 2005 edition—is scheduled for public release during September, 2004.

The IEEE, which publishes the NESC, describes the purpose and scope of the rules as follows:[9]

> **010. Purpose**
>
> The purpose of these rules is the practical safeguarding of persons during the installation, operation, or maintenance of electric supply and communication lines and associated equipment.
> These rules contain the basic provisions that are considered necessary for the safety of employees and the public under the specified conditions. This code is not intended as a design specification or as an instruction manual.
>
> **011. Scope**
>
> A. These rules cover supply and communication lines, equipment, and associated work practices employed by a public or private electric supply, communications, railway, or similar utility in the exercise of its function as a utility. They cover similar systems under the control of qualified persons, such as those associated with an industrial complex or utility interactive system.
>
> B. The NESC covers utility facilities and functions up to the service point.
>
> C. NESC rules cover street and area lights (supplied by underground or overhead conductors) under the exclusive control of utilities (including their authorized

[7] Published by the Institute of Electrical and Electronics Engineers, Inc., New York. NY. The NESC is also known as ANSI Standard C2. See http://standards.ieee.org/nesc/
[8] Published by the National Fire Protection Association, Quincy, MA. The NEC is also known as NFPA 70. See http://www.nfpa.org/nec/
[9] See NESC Section 1

contractors) or other qualified persons (such as those associated with an industrial complex).

D. NESC rules do not cover installations in mines, ships, railway rolling equipment, aircraft, or automotive equipment, or utilization wiring except as covered in Parts 1 and 3.

The NFPA, publisher of the NEC, also describes its purpose and scope in two code sections:[10]

90.1 Purpose.

(A) Practical Safeguarding. The purpose of this Code is the practical safeguarding of persons and property from hazards arising from the use of electricity.

(B) Adequacy. This Code contains provisions that are considered necessary for safety. Compliance therewith and proper maintenance will result in an installation that is essentially free from hazard but not necessarily efficient, convenient, or adequate for good service or future expansion of electrical use.

(C) Intention. This Code is not intended as a design specification or an instruction manual for untrained persons.

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90.2 Scope.

(A) Covered. This Code covers the installation of electric conductors, electric equipment, signaling and communications conductors and equipment, and fiber optic cables and raceways for the following:

(1) Public and private premises, including buildings, structures, mobile homes, recreational vehicles, and floating buildings

(2) Yards, lots, parking lots, carnivals, and industrial substations

(3) Installations of conductors and equipment that connect to the supply of electricity

[10] See NEC Article 90

(4) Installations used by the electric utility, such as office buildings, warehouses, garages, machine shops, and recreational buildings, that are not an integral part of a generating plant, substation, or control center

(B) Not Covered. This Code does not cover the following:

(1) Installations in ships, watercraft other than floating buildings, railway rolling stock, aircraft, or automotive vehicles other than mobile homes and recreational vehicles

(2) Installations under ground in mines and self-propelled mobile surface mining machinery and its attendant electrical trailing cable

(3) Installations of railways for generation, transformation, transmission, or distribution of power used exclusively for operation of rolling stock or installations used exclusively for signaling and communications purposes

(4) Installations of communications equipment under the exclusive control of communications utilities located outdoors or in building spaces used exclusively for such installations

(5) Installations under the exclusive control of an electric utility where such installations

a. Consist of service drops or service laterals, and associated metering, or

b. Are located in legally established easements, rights-of-way, or by other agreements either designated by or recognized by public service commissions, utility commissions, or other regulatory agencies having jurisdiction for such installations, or

c. Are on property owned or leased by the electric utility for the purpose of communications, metering, generation, control, transformation, transmission, or distribution of electric energy.

Generally, the NESC applies to outside plant construction at and between poles and at and between underground enclosures, while the NEC applies structure wiring matters.

The codes overlap in regard to service drops (usually the cable *from* the pole, vault or pedestal *to* the end-user home or structure).[11] In the overlap areas, the common prac-

[11] Compare, for example, NEC Section 820-10 (Outside cables) with NESC Part 2 (Safety Rules for the Installation and Maintenance of Overhead Electric Supply and Communications Lines).

tice of safety code inspectors is to enforce the code that provides the higher degree of safety for the particular installation. In most cases related to telecommunications drops in general, and cable TV drops in particular, safety code inspectors are more likely to look to the NEC for guidance.

A few states have adopted their own safety codes covering, *inter alia*, telecommunications plant. For example, California has two safety codes[12] that generally replace the NESC with higher (safer) standards. California does adopt, with modifications, the NEC as a state-level safety code.[13]

While reading the following sections, please remember that there are usually several different rules that can be cited in the case of a particular observed condition. Some of the more common rule citations are given, but the reader should not hesitate to delve into the rules for alternatives and additional rules. For example, in the case of cable television wiring violations on structures, or related to cable TV drops, it's a common practice to cite the underlying violation (be it a grounding failure, a wiring problem, or some other code violation) and then to add a citation noting a violation of the workmanship rule (NEC 820.6 *et seq*)[14].

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[12] California Public Utilities Commission General Order 95 (overhead construction); General Order 128 (underground construction). See http://www.cpuc.ca.gov/static/official+docs/i_go.htm

[13] The California Electrical Code is based on the NEC. It is adopted by Division of Codes and Standards of the California Department of Housing and Community Development. See http://www.hcd.ca.gov/codes/ and the California Code of Regulations, Title 24, Part 3.

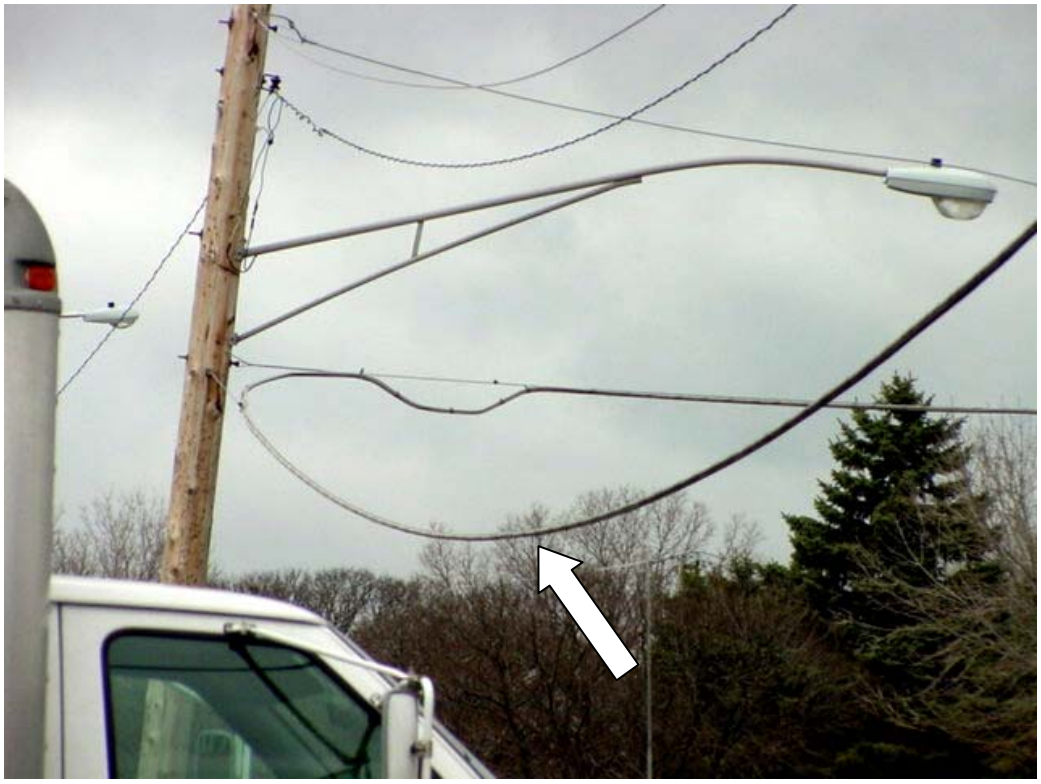
[14] 820.6 Mechanical Execution of Work.
Community antenna television and radio distribution systems shall be installed in a neat and workmanlike manner. Cables installed exposed on the surface of ceiling and sidewalls shall be supported by the structural components of the building structure in such a manner that the cable is not damaged by normal building use. Such cables shall be attached to structural components by straps, staples, hangers, or similar fittings designed and installed so as not to damage the cable. The installation shall also conform with 300.4(D).

3. PROW Outside Plant: Overhead

The overhead plant usually comprises that portion of the telecommunications system at and between utility poles in the PROW, and over roadways. In virtually all cases, the NESC is the controlling safety code authority.

The most common telecommunications plant safety code violations related to overhead construction are (in no particular order):

A. Unsafe construction and/or excessive cable weight or causing sag that can interfere with other pole occupants, and/or interfere with vehicles and the public traveling under the cables.



A cable television distribution cable sags down below 15.5 feet, primarily due to the pole sagging from the lack of pole down guying (see which, below).

See:
NESC Rule 232 (Clearances). Table 232-1. Height above roadway traveled by trucks must be at least 15 feet 6 inches.

NESC Rule 422(B)(2). Sag of wire or cables being installed or removed shall be controlled to prevent danger to pedestrian and vehicular traffic.

B. Unsafe reductions in physical clearance between the telecommunications facilities and electrical conductors.



The orange arrow points to the cable TV coaxial and fiber optic lines (note that fiber optic lines are easily identified by the use of a slip-on colored tag on the fiber optic cable, here red, to distinguish it from coaxial or other types of cables). The green arrows point to power conductors. In this illustration, the closest distance between the cable TV and power cables is approximately 12 inches.

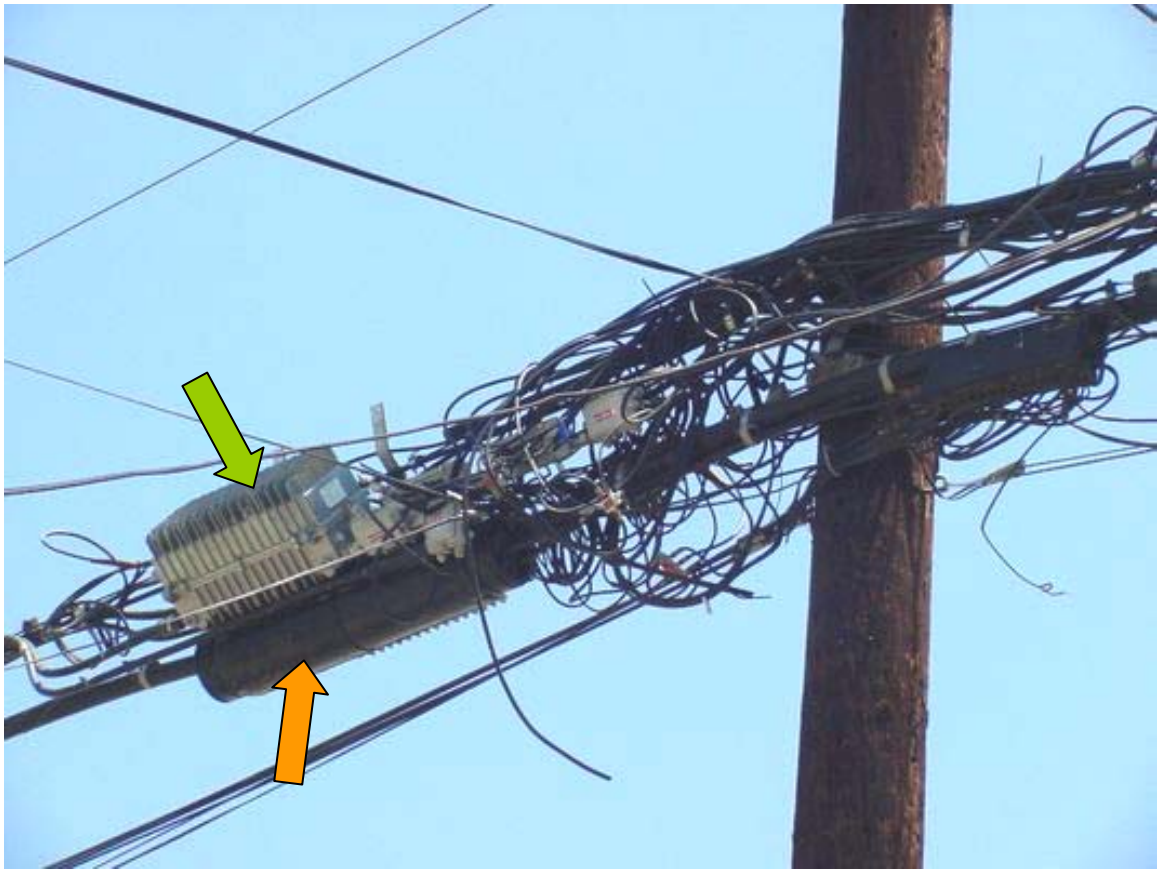
The conductor clearance requirements are designed to prevent accidental electrocution of pole workers who, due to reduced clearances, might come into contact with two energized systems, or one energized system and a different grounded system.

See:

NESC Rule 235 (Clearances). Table 233-1. Horizontal clearance between communications conductors and power conductors must be at least 24 inches.

NESC Rule 235 (Clearances). Table 235-5. Vertical clearance between communications conductors and power conductors must be at least 40 inches.

C. Reduced clearance between a telecommunications facility and one or more different telecommunications facilities on the same pole or between poles.



The green arrow points to a cable television system amplifier. The orange arrow points to a telephone company splice enclosure. Note that these devices, and their associated wires and cables, come into direct physical contact and multiple points at and adjacent to the pole. These direct contacts can—and eventually will—wear down protection insulation and cause electrical shorts and service interruptions on one or both networks. Note that in the illustration above, electrical power (independent of the RF signals containing television information) is being supplied to the amplifier via the coaxial cables.



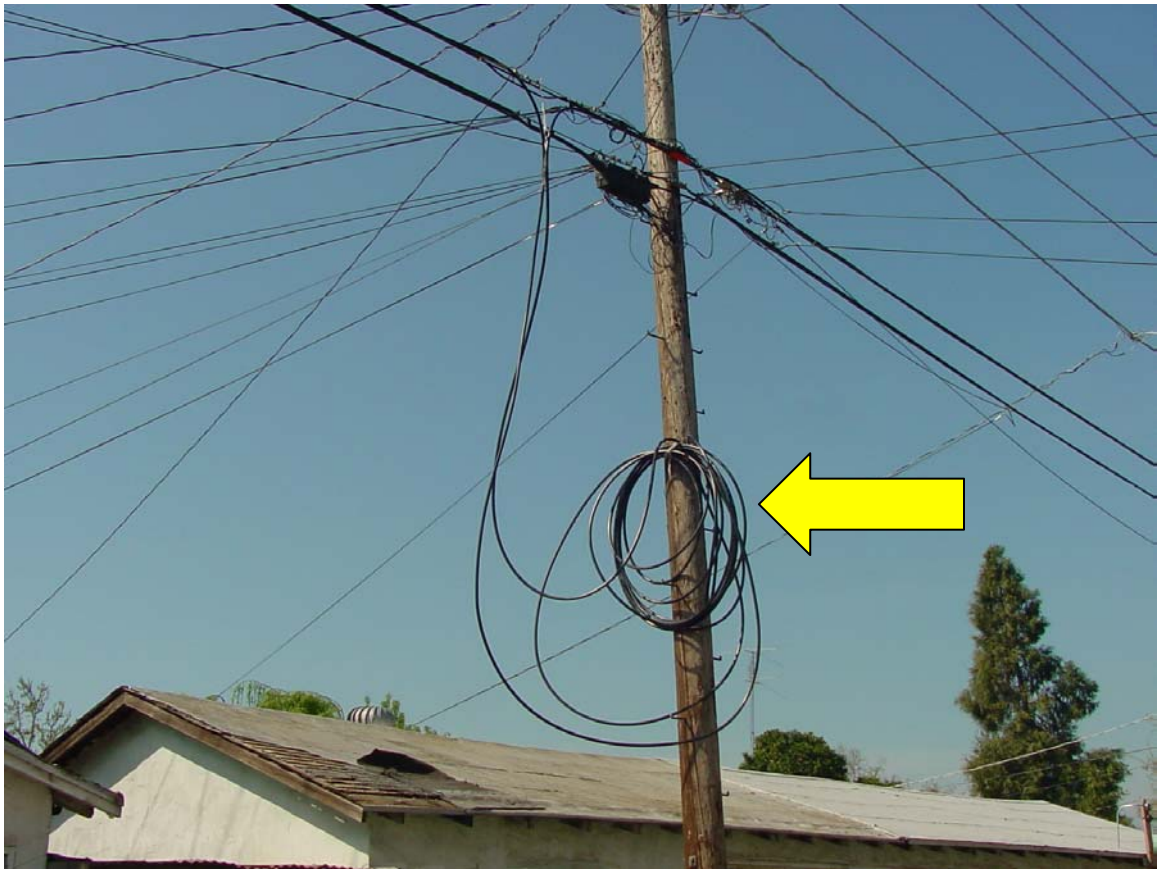
In this second, more dramatic example of multiple communications carriers coming into direct physical contact, the cable television and telephone carriers' cables are wrapped around each other. In this photograph, the telephone carrier is above the cable TV carrier.

See:

NESC Rule 221 (Avoidance of Conflict).

Two separate lines, either of which carries supply conductors, should be so separated from each other that neither conflicts with the other. If this is not practical, the conflicting line or lines should be separated as far as practical and shall be built to the grade of construction required by Section 24 for a conflicting line, or the two lines shall be combined on the same structures.

D. Unattached riser cables and improperly secured cables which interfere with pole climbing.



Improperly stored fiber optic cable hanging off of a pole step. Prevents pole workers from safely climbing the pole, and subjects the public below to the danger of the pole coming away from the step and falling to the ground.

See:

NESC Rule 239. (Clearance of Vertical and Lateral Facilities From Other Facilities and Surfaces on the Same Supporting Structure).

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B. Location of Vertical or Lateral Conductors Relative to Climbing Spaces, Working Spaces, and Pole Steps

Vertical or lateral conductors shall be located so that they do not obstruct climbing spaces, or lateral working spaces between line conductors at different levels, or interfere with the safe use of pole steps.

E. Missing or slack down guys that can cause poles to lean over.



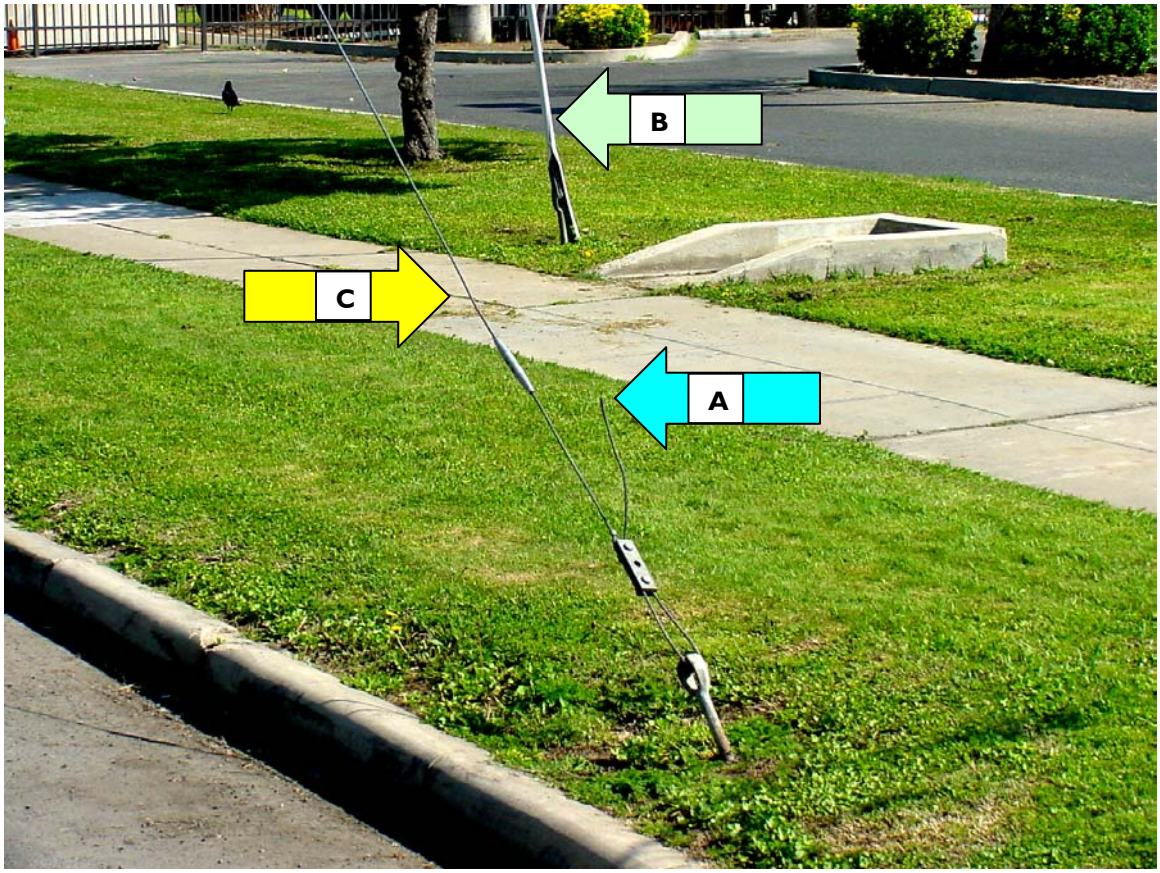
The pole is already starting to lean over due to the constant pulling of the heavy cables.

See:

NESC Rule 264. Guying and Bracing

A. Where Used
When the loads are greater than can be supported by the structure alone, additional strength shall be provided by the use of guys, braces, or other suitable construction. Such measures shall also be used where necessary to limit the increase of sags in adjacent spans and provide sufficient strength for those supports on which the loads are sufficiently unbalanced, for example, at corners, angles, dead ends, large differences in span lengths, and changes of grade of construction.

F. Missing down guy guards that can endanger the public by failing to give warning to the placement of a down guy.



Down guy guards[15] (usually plastic, steel, or wood covers securely attached to down guys) warn pedestrians of the placement of down guys. They also guard against injury to pedestrians caused by improperly secured down guy ends (see arrow A, above). Arrow B points to a down guy guard on a different down guy. Arrow C points to the location where a guy guard should be installed, but is not.

See:

NESC Rule 264E. Guy Markers and Protection
1. The ground end of anchor guys exposed to pedestrian traffic shall be provided with a substantial and conspicuous marker.
NOTE: Visibility of markers can be improved by the use of color or color patterns that provide contrast with the surroundings.
2. Where an anchor is located in an established parking area, the guy shall either be protected from vehicle contact or marked.

[15] Down guy guards are also known as "guy markers."

3. Nothing in this rule is intended to require protection or marking of structural components located outside of the traveled ways of roadways or established parking areas. Experience has shown that it is not practical to protect structures from contact by out of control vehicles operating outside of established traveled ways.

G. Placement interference with traffic and other warning signals lights.



An energized coaxial cable television line is constructed inside and resting on an enclosed traffic signal frame.

See:

NESC Table 238-2 (Vertical Clearance of Span Wires and Brackets From Communication Lines). A minimum separation of 20 inches is required.



Editorial comment: In the photograph above and in the previous photograph, the telecommunications lines are constructed in such a way as to partially obscure these traffic signals. While not directly addressed in the NESC or NEC, this type of installation practice should be prohibited at the permitting and inspection stages as a matter of public policy.

4. PROW Outside Plant: Underground

The underground plant usually comprises that portion of the telecommunications system at and between utility pedestals and vaults in the PROW. Once again, in virtually all cases, the NESC is the controlling safety code authority.

The most common telecommunications plant safety code violations related to underground construction in the PROW are (in no particular order):

A. Damaged pedestals creating injury hazards for pedestrians



This is a damaged telecommunications pedestal with exposed cables and sharp edges that is partially intruding into the public sidewalk.



Here, a cable television operator discontinued a system rebuild mid-project. This is an example of a partially rebuilt location in the PROW that was left in this state for many months.



This cable television equipment vault is cracked and unable to support the lid, which is also cracked and ajar.

See:

NESC Rule 381G: (Pad-Mounted and Other Above-Ground Equipment)
1. Pad-mounted and other above-ground equipment shall have an enclosure that is either locked or otherwise secured against unauthorized entry.

Also, look to the mandatory inspection and records rules at NESC Rule 313, discussed *infra*, for additional requirements that should have resulted in the detection and repair of this vault and lid.

5. Inspection Duties

The NESC places a clear duty on telecommunications providers to inspect their overhead systems and their underground systems on a regular basis. In the photo illustrations presented *supra,* I have focused on clearly visible violations that should have been but weren't detected and corrected by the telecommunications providers.

NESC Rule 214 establishes the inspection and record requirements regarding overhead plant. NESC Rule 313 does the same in relation to underground plant.

> NESC Rule 214. Inspection and Tests of Lines and Equipment
> A. When In Service
> 1. Initial Compliance With Rules
> Lines and equipment shall comply with these safety rules when placed in service.
> 2. Inspection
> Lines and equipment shall be inspected at such intervals as experience has shown to be necessary.
> *NOTE:*
> It is recognized that inspections may be performed in a separate operation or while performing other duties, as desired.
> 3. Tests
> When considered necessary, lines and equipment shall be subjected to practical tests to determine required maintenance.
> 4. Record of Defects
> Any defects affecting compliance with this code revealed by inspection or tests, if not promptly corrected, shall be recorded; such records shall be maintained until the defects are corrected.
> 5. Remedying Defects
> Lines and equipment with recorded defects that could reasonably be expected to endanger life or property shall be promptly repaired, disconnected, or isolated.
> B. When Out of Service
> 1. Lines Infrequently Used
> Lines and equipment infrequently used shall be inspected or tested as necessary before being placed into service.
> 2. Lines Temporarily Out of Service
> Lines and equipment temporarily out of service shall be maintained in a safe condition.
> 3. Lines Permanently Abandoned
> Lines and equipment permanently abandoned shall be removed or maintained in a safe condition.

NESC Rule 313. Inspection and Tests of Lines and Equipment

A. When In Service

1. Initial Compliance With Safety Rules

Lines and equipment shall comply with these safety rules upon being placed in service.

2. Inspection

Accessible lines and equipment shall be inspected by the responsible party at such intervals as experience has shown to be necessary.

3. Tests

When considered necessary, lines and equipment shall be subjected to practical tests to determine required maintenance.

4. Record of Defects

Any defects affecting compliance with this code revealed by inspection, if not promptly corrected, shall be recorded; such record shall be maintained until the defects are corrected.

5. Remedying Defects

Lines and equipment with recorded defects that would endanger life or property shall be promptly repaired, disconnected, or isolated.

B. When Out of Service

1. Lines Infrequently Used

Lines and equipment infrequently used shall be inspected or tested as necessary before being placed into service.

2. Lines Temporarily Out of Service

Lines and equipment temporarily out of service shall be maintained in a safe condition.

3. Lines Permanently Abandoned

Lines and equipment permanently abandoned shall be removed or maintained in a safe condition.

Our experience shows that cable television operators usually fail to conduct the required inspections and keep the required records.

6. Closing Comments

Having inspected hundreds of thousands of miles of telecommunications plant around the country over the past 20 years, I have observed a shift away from the attitude that plant maintenance is a long term investment in supporting subscriber services.

Rather, today, the emphasis seems to be to spend the least amount of money and time required to maintain the physical plant, much less to maintain it to meet safety code requirements. Not surprisingly, today capital dollars are spent on the equipment to provide new revenue-producing services.

The search for profit gains (and survival for some telecommunications companies) has increased avoidable dangers to subscribers, the public at large, and utility workers. Governments—in performing their police power functions of establishing and enforcing public safety—must look beyond what "gee-whiz" telecommunications services are offered to their constituents to determine whether the facilities used to transport those new services are free of avoidable safety hazards.

"People do what you inspect, not what you expect" – *Dr. Henry Brandt*

Appendix A: Abbreviated Glossary

Term	Definition
Amplifier	A device used to increase signal strength. Usually associated with cable television systems, an amplifier takes a weakened incoming signal and boosts it. The amplification process also adds unavoidable thermal distortions that practically limit the number of times a signal can be amplified.
CATV	Abbreviation: "Community Antenna Television" Commonly: A cable TV system that occupies PROW.
Coaxial cable	A cable consisting of a single center conductor surrounded by an insulation material, and the insulation material surrounded by a conductive shield which has been grounded.
Conduit	A plastic or steel lateral underground enclosure used to house cables between vaults and/or pedestals.
Down guy	A steel rope connected between the pole and an anchor point (usually in the ground). A down guy shunts the accumulated pole line stresses to ground, thus helping to minimize pole leaning and failures.
Drop	A drop (or service drop, or service lateral) is a cable intended to serve a single (or a few) subscribers at a particular location. It is usually the cable between the pole and a building, or between a service pedestal or vault and a building.
Fiber optic cable	A fiber optic cable uses glass (or glass-like) fibers as the transmission medium. Light (at wavelengths above what can been seen by humans) is modulated by the desired information to be transported and inserted at one end of the fiber optic run, and recovered and demodulated at the other end. Fiber optic cables have low-loss properties, and are immune from most outside-world interferences sources that negatively impact radio frequency or audio frequency signals traveling in coaxial or twisted pair cables.

Term	Definition
Guy Marker	A plastic, metal, or wood cover attached at the ground-level end of a down guy. The purpose is to warn the public of the placement of the down guy (see which). Also known as a "guy guard."
Headend	The location where a cable operator receives its over-the-air, local, and satellite signals and places those signals on the cable plant to serve its subscribers.
Lashing Wire	A single or double wire wound around the telecommunications cable and the strand (see which) to hold the cable to the strand between poles.
MMDS	Abbreviation: "Multipoint Microwave Distribution System" (Commonly: A terrestrial wireless multichannel cable TV-like system using small roof-mounted antennas to receive multiple channels of programming transmitted from a local tall building or mountain.)
NEC	National Electrical Code (published by the National Fire Protection Association, Quincy, MA)
NESC	National Electrical Safety Code (published by the Institute of Electrical and Electronics Engineers, New York, NY)
OH	Abbreviation: "Overhead"
Overlash	Placing a new cable on top of an existing cable that is strung between poles, and using lashing wire (see which) to hold that new cable in place. Overlashing adds weight to the existing spans causing them to sag closer to the ground level.
Packet	As used on the Internet, think of a packet as a 'bucket' containing some information. Each packet has an electronic header containing the 'from' address and the 'to' address. The packet also contains the data to be conveyed and an ending frame containing information that is used to verify whether the data arrived intact at the receiving end.
Pedestal	An equipment enclosure that projects above the finished grade and is mounted at grade level.

Term	Definition
Pole Step	An "L" shaped hook screwed into a pole to provide a stepping point for pole workers.
PROW	Abbreviation: "Public right-of-way"
Riser	A cable physically attached to a pole that transitions between the underground and overhead plant systems.
SMATV	Abbreviation: "Satellite Master Antenna Television System" (Commonly: A cable TV system that does not encroach into the PROW)
Strand	A steel rope strung between poles used to support the weight of telecommunications cables.
Telco	Abbreviation: "Telephone Company"
Twisted pair cable	Usually copper cables associated with the delivery of telephone services.
UG	Abbreviation: "Underground"
Vault	A flush-to-grade equipment and/or cable enclosure. A vault has a lid to provide access to the equipment and/or cables inside of it.

Appendix B: About the Author



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Since 1984, Kramer's firm has conducted cable TV, wireless, broadband, telephony and RF safety and plant inspections for nearly 500 local, state, and federal government units in over 25 states.

Kramer serves as an expert witness in plant safety litigation, and wireless tower siting and radio frequency emissions litigation.

Licensed by the Federal Communications Commission, Kramer is a Senior Member of the Society of Cable Telecommunications Engineers (U.S. Society), a Fellow Member of the Society of Cable Telecommunication Engineers (U.K. Society), and a Fellow of the Institute for the Advancement of Engineering. He is NATOA's only twice-honored Member-of-the-Year.

Kramer.Firm's website, www.KramerFirm.com, is a primary government resource for outside plant and right-of-way safety matters.

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