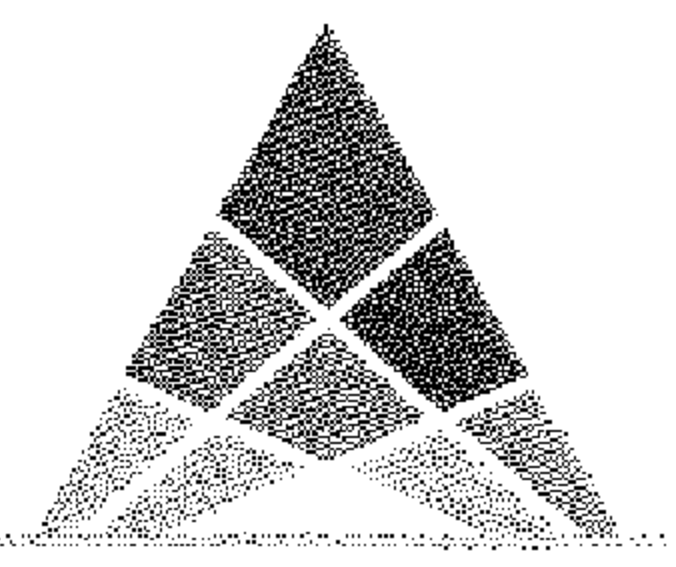


Alpha Technologies Inc.  
4003 Outlook Dr.  
Hurricane, WV 25526  
304.201.7485

alpha  
TECHNOLOGIES



June 15, 2016

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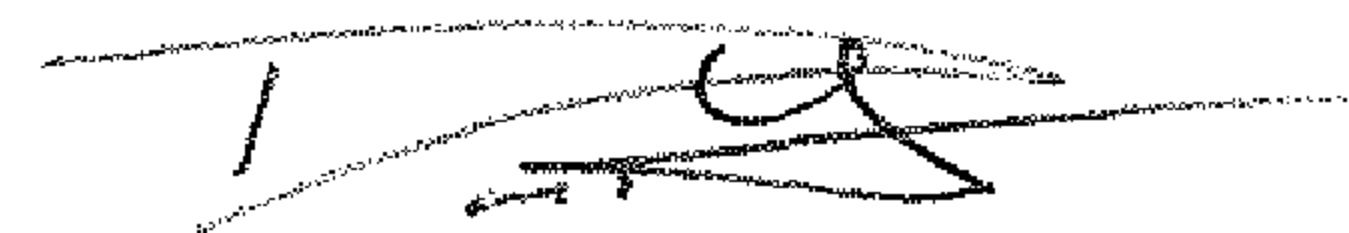
Ms. Ingrid Ferrell  
Executive Secretary  
West Virginia Public Service Commission  
201 Brooks Street  
Charleston, WV 25323

Re: GO 187.48 Rules Governing Telephone Conduit Occupancy

Dear Ms. Ferrell:

With reference to the above stated order, Alpha Technologies supports the order as written.

Sincerely yours,

  
Douglas E. Tate  
President/CEO

# Public Service Commission of West Virginia

201 Brooks Street, P.O. Box 812  
Charleston, West Virginia 25323

Phone: (304) 340-0300  
Fax: (304) 340-0325



July 7, 2016

Ingrid Ferrell, Executive Secretary  
Public Service Commission  
Post Office Box 812  
Charleston, West Virginia 25323

01:08 PM JUL 07 2016 PSC EXEC SEC DIV

RE: GENERAL ORDER NO. 187.48  
In the Matter of a Proceeding for the  
Adoption of Rules Governing Telephone  
Conduit Occupancy 150 C.S.R. Series 37

Dear Ms. Ferrell:

Enclosed for filing in the above-referenced proceeding, please find an original and twelve copies of *Staff's Initial Comments*. A copy has been provided to those individuals shown on the attached *Certificate of Service*.

Sincerely,

A handwritten signature in black ink, appearing to read "Chris Howard".

Christopher L. Howard  
Staff Attorney  
West Virginia State Bar I.D. No. 8688

CLH/sg  
Enclosures

PUBLIC SERVICE COMMISSION  
OF WEST VIRGINIA  
CHARLESTON

GENERAL ORDER NO. 187.48  
In the Matter of a Proceeding for the  
Adoption of Rules Governing Telephone  
Conduit Occupancy 150 C.S.R. Series 37

**STAFF'S INITIAL COMMENTS**

In the 2016 West Virginia Legislative Session, the West Virginia Legislature passed House Bill 678, effective immediately, which required the Public Service Commission of West Virginia to promulgate rules relating to telephone conduit occupancy.

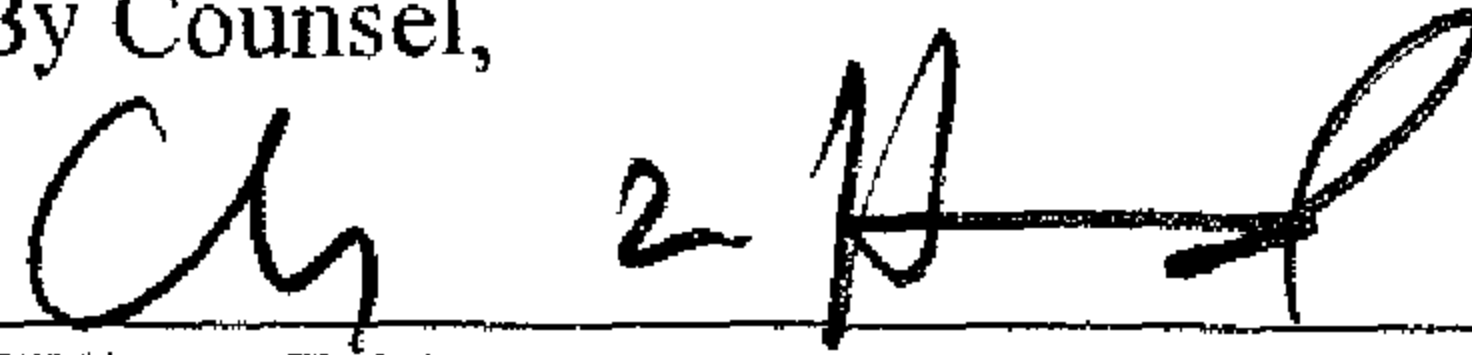
On June 7, 2016, the Commission issued an Order, with Senate Bill 678 attached. The Commission directed interested parties to file Initial Comments by July 8, 2016, and Reply Comments by July 15, 2016. The Commission will hold a hearing on this matter on July 21, 2016.

Staff reviewed the proposed Rules Governing Telephone Conduit Occupancy that are being promulgated pursuant to House Bill 678. Staff has no opposition to the proposed Rules. Staff will continue to review this issue and may propose language in its Final Comments to address this issue.

Respectfully submitted this the 7<sup>th</sup> day of July 2016.

STAFF OF THE PUBLIC SERVICE  
COMMISSION OF WEST VIRGINIA

By Counsel,

A handwritten signature in black ink, appearing to read "Ch L Howard", written over a horizontal line.

CHRISTOPHER L. HOWARD, Staff Attorney  
West Virginia State Bar I.D. 8688

**PUBLIC SERVICE COMMISSION  
OF WEST VIRGINIA  
CHARLESTON**

GENERAL ORDER NO. 187.48  
In the Matter of a Proceeding for the  
Adoption of Rules Governing Telephone  
Conduit Occupancy 150 C.S.R. Series 37

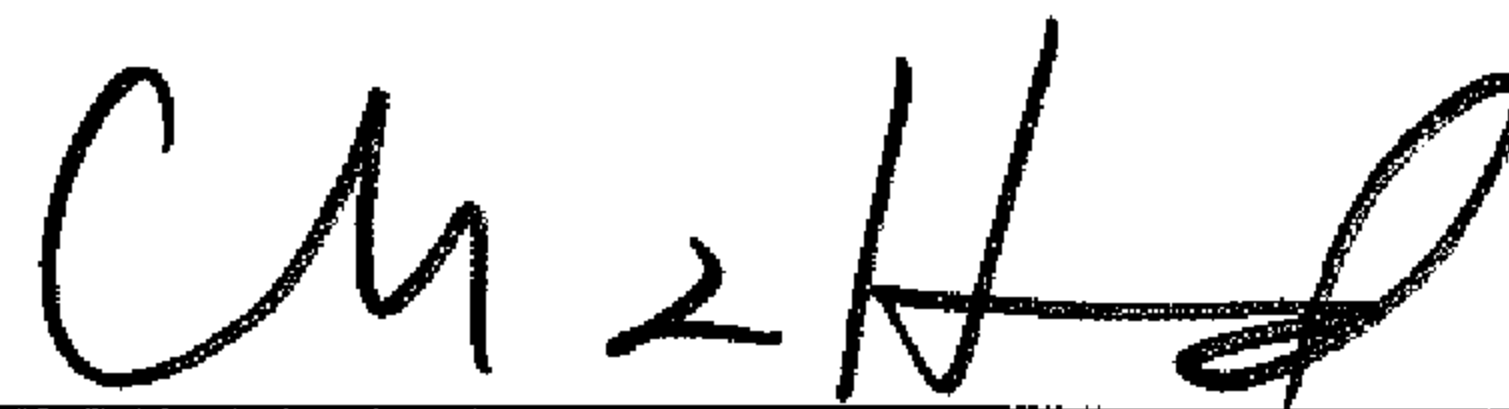
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CERTIFICATE OF SERVICE

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I, Christopher L. Howard, Counsel for the Public Service Commission of West Virginia, do hereby certify that a copy of the foregoing "*Staff Initial Comments*" has been served upon the following parties of record by First Class, United States Mail, postage prepaid this 7th day of July, 2016.

Douglas E. Tate, CEO  
Alpha Technologies, Inc.  
4003 Outlook Drive  
Hurricane, WV 25526



---

Christopher L. Howard  
WV State Bar I.D. No. 8688



**JOSEPH J. STARSICK, JR.**  
Associate General Counsel  
Frontier Communications  
1500 MacCorkle Ave., S.E.  
Charleston, West Virginia 25396  
(304) 344-7644  
[Joseph.Starsick@FTR.com](mailto:Joseph.Starsick@FTR.com)

July 8, 2016

Ingrid Ferrell  
Executive Secretary  
Public Service Commission of West Virginia  
201 Brooks Street  
Charleston, WV 25301

**Re: General Order No. 187.48  
In the matter of a proceeding for the adoption  
of Rules Governing Telephone Conduit Occupancy,  
150 C.S.R. Series 37.**

Dear Ms. Ferrell:

Please find enclosed for filing in the original plus 12 copies of the **Initial Comments On Behalf Of Frontier West Virginia Inc. and Citizens Telecommunications Company of West Virginia d/b/a Frontier Communications of West Virginia** in the above-referenced matter.

Thank you for your attention to this matter.

Sincerely,

  
Joseph J. Starsick, Jr.  
(WV State Bar #3576)

JJSjr/sc  
Enclosure

**PUBLIC SERVICE COMMISSION  
OF WEST VIRGINIA  
CHARLESTON**

**GENERAL ORDER NO. 187.48**

**In the matter of a proceeding for the adoption  
of Rules Governing Telephone Conduit Occupancy,  
150 C.S.R. Series 37.**

**INITIAL COMMENTS ON BEHALF OF FRONTIER WEST VIRGINIA INC. AND  
CITIZENS TELECOMMUNICATIONS COMPANY OF WEST VIRGINIA D/B/A  
FRONTIER COMMUNICATIONS OF WEST VIRGINIA**

Frontier West Virginia Inc. and Citizens Telecommunications Company of West Virginia d/b/a Frontier Communications of West Virginia ("Frontier") hereby submit these Initial Comments.

Crucially, all customers and carriers must comply with the applicable safety and construction standards. Proposed Section 150-37-3.2, standing alone, would accomplish that end.

Proposed Section 150-37-4, however, would take away, at least in part, what Section 150-37-3.2 would establish. Ironically styled "Best Practices," Section 150-37-4 in actuality is not in conformity with the established Code and industry practices.

This Commission need not take Frontier's word alone. Attached is the Expert Report of Trevor Bowmer, Ph.D. Among other qualifications, Dr. Bowmer is a member of the National Electrical Safety Code's Underground and Work Rules Subcommittees, which have responsibility over safety and construction rules for conduit as set forth in the Code. Dr. Bowmer's Report explains in detail the deficiencies in the so-called "Best Practices," and makes specific recommendations for new or revised language to be incorporated into the Commission's

Rules. His Curriculum Vitae, list of publications and related materials also are attached. In the final analysis, Frontier is confident that this Commission and its Staff will not sacrifice safe and proper construction and maintenance of facilities. These Comments and Dr. Bowmer's Report are submitted in that spirit.



Joseph J. Starsick, Jr (WV State Bar #3576)  
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(304) 344-7644  
[Joseph.Starsick@FTR.com](mailto:Joseph.Starsick@FTR.com)

*Attorney for Frontier West Virginia Inc. and  
Citizens Telecommunications Company of West Virginia  
d/b/a Frontier Communications of West Virginia*

# REPORT

Trevor Bowmer, Ph.D.  
Ericsson (Telcordia)  
Senior Analyst  
444 Hoes Lane  
Piscataway  
NJ 08854

Date : July 7<sup>th</sup> 2016

Subject: Expert Report of Trevor Bowmer  
Concerning “Customer-Owned Conduit” and West Virginia 150.CSR.37

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**Materials Reviewed:**

- Public Service Commission General Order 187.48 with
  - Exhibit A - West Virginia Legislature - Senate Bill 678
  - Exhibit B - Title 150 Series 37 “Rules Governing Telephone Conduit Occupancy”
- NESC - IEEE C2 - National Electrical Safety Code – In general and Part 3, Sections 30, 31, 32, 35 and 36 in particular – which covers outside plant facilities of power and communications companies
- Manual of Construction Procedures (Blue Book) – SR-1421, Issue 5 (2011) – general industry construction guidelines for communications lines and equipment
- NFPA 70 - National Electrical Code (NEC) – and its communications Chapter 8 and Article 770 that covers the installation aspects of the connections to the customer premises.

**Testimonial History (Last 4 Years)**

October 2013 - Expert Witness - Clark County, Nevada Concerning District Court Case No. A-11-650264 – Expert Witness covering the National Electrical Safety Code and communications industry best practices.

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The following observations, comments and recommendations are provided on the General Order 187.48 of the Public Service Commission of West Virginia concerning the proposed Title 150 Series 37 entitled “*Rules Governing Telephone Conduit Occupancy*” that is attached as Exhibit B to that General Order. These comments and recommendations are based on my expert knowledge and experience on being (a) a member of 5 of the 7 technical subcommittees that develop the National Electrical Safety Code (NESC) as well as the Main Committee of the NESC, (b) a member of CMP5 (Grounding) and CMP16 (Communications) the National Electrical Code (NEC), and (c) the author of the Manual of Construction Procedures (Blue Book) – SR-1421, Issue 5 (2011).

These comments are organized by subject - numbered (A) through (M) below - with cross references to the relevant paragraphs in the proposed 150.CSR.37 rule along with specific recommendations (#1 to #22) for revisions to the proposed rule. For convenience, these recommendations are located at the end of each discussion item as well as being listed at the end of the report.

**A) “Customer-Owned Conduit” – Sections 3.1, 4.1 and throughout 150.CSR.37**

*Customer-Owned Conduit* is a conduit placed at the request of the customer and at the customer’s expense between the customer premises and a network access point as a clean, protected pathway for the network provider-owned cable.

At the customer premises, the *Customer-Owned Conduit* may terminate inside the building (residential or commercial), telecom room, or other structure where connections to the customer’s internal wiring,

switching equipment or other customer premises equipment (CPE) are made. It is also possible for the conduit to terminate at an outside plant location (e.g., handhole, manhole, CEV) agreed between customer and network provider as the demarcation point.

At the network connection end, the *Customer-Owned Conduit* runs to a network node or splice point where connections are made to the main distribution or feeder cables of the communications network service provider. This demarcation point may be inside a small pedestal, inside a cabinet, in an underground handhole/vault, inside a manhole, or at an aerial closure mounted on a utility pole or strand.

The customer who owns the *Customer-Owned Conduit* and the owner of cable (the telephone company or service provider) inside the conduit, share the rights and responsibilities for the maintenance and management of the conduit and cable as documented through a formal agreement with the customer. Such agreements may be with an individual business, or residential customer, or through a Home-Owners-Association (HOA) or building developer. Whoever claims ownership assumes responsibility for any damage or the cost of re-work for new services that are required to be made. This would include removing cables and cost of adding new conduits at later stage. The “owner” of these “customer-owned conduits” needs to explicitly take responsibility for any and all damage that results from permission for a worker/company to enter this conduit. That includes any loss of service on existing lines including 911 services, alarm circuits and business communications lines.

The term “apparatus” is used in paragraph 3.1 to cover both the “conduit” and the “underground construction” but does not include the cable contained inside the conduit. Adding a definition of “apparatus” will help clarify the application of the rule.

Recommendation - [1] Editorial correction in Main Title correct “CONUDIT” to “CONDUIT”.

Recommendation - [2] Add definition of “apparatus” to Section 2 as follows

2.X. “Apparatus” – The conduit or underground structure (but not including the cable) that provides a cable pathway between the service provider network and the customer.

### **B) “Conduit” and “Inner-duct” and “ducts” – Section 2.1, 2.4 and throughout 150.CSR.37**

The use of these terms within the Rule needs to be revised and clarified to help prevent mis-interpretations and mis-applications of the Rule. The definition for “conduit” in Section 2.1 (150.CSR.37) is accurate but incomplete without a complementary definition of “duct”. The definition of “Innerduct” is confusing without a definition of “Duct” to support it.

It is common industry practice to use the terms duct and conduit interchangeably and that is one of the reasons in the NESC there are distinct definitions (Note 1 of Section 32 of the 2012 edition and in Rule 302 of the 2017 edition). Duct is a single enclosed raceway for conductors or cable; conduit is a structure containing one or more ducts; and conduit system is the combination of duct, conduit, conduits, manholes, handholes, and/or vaults joined to form an integrated whole.

The industry understands that a “conduit” has thicker-walls and mechanical rigidity to withstand the stresses of underground and direct buried construction and use; such as those compression stresses from 2-3 feet of soil, concrete or other fill above and around it. In addition, the mechanical robustness of conduits also helps to maintain an internal smooth and regular cross section that limits possible damage to the conduit and the cable being installed. Conduits are made from a variety of materials including wood, clay, PVC and PE plastics, fiberglass and metallic materials.

The term “Duct” is typically reserved for those plastic tubes with thinner but still substantial walls that provide some level of mechanical strength and robustness. For use in long distance spans, ducts are

usually placed inside a conduit with thicker walls to provide the primary physical protection necessary. Ducts can be successfully used in some direct-buried short runs (e.g., less than 50 feet) between handholes or pedestals and where soft, non-rocky soils limit the risks associated with compression and impacts damaging the duct wall.

The term “Innerduct” was originally a product tradename from the old Bell System which over time has become a generic industry term to refer to a corrugated, flexible, thin-walled duct that is placed in a conduit or duct because the innerduct does not have the mechanical robustness or rigidity necessary for direct buried applications. Even in shallow burials, innerduct products are at risk of kinking or collapsing the corrugations which would compromise the cable pathway.

For this Legislative Rule 150.37, it would be better to only use conduit and duct as the primary terms avoid confusion that may arise by using innerduct. Recommend that 2.1 be revised as shown below and adding a new definition of “Duct” as shown below.

- “Conduit” – A tube structure containing one or more ducts used to house and physically protect cables.
- “Duct” – A single tube structure placed inside a conduit to separately house cables (also known as innerducts).

Recommendation - [3] Revise definition of “conduit” in Section 2.1 to read as follows

*2.1. “Conduit” A tube structure containing one or more ducts used to house and physically protect cables.*

Recommendation - [4] Replace “innerduct” definition (paragraph 2.4) with definition of “duct” to read as follows

*2.X. “Duct” A single tube structure placed inside a conduit to separately house cables (also known as innerducts)*

Recommendation - [5] Section 4.1(g) Replace “innerduct” with “duct” to read as follows

*Initial and subsequent installations into new customer-owned conduit should use separate ducts when feasible.*

### **C) Terminology – “Telephone” and “Utility”**

The use of term “telephone” is anachronistic given the current communications industry expansion into a wide range of information services including broadband, wireless, video and internet services. It is important to clearly define the terms “telephone company” and “telephone public utility” in paragraph 2.7 to avoid confusion in the implementation of the rule. Using terms “communications services” and “communications provider” will help to clarify the rule.

Recommendation - [6] Section 2.3 change .who purchases telecommunications services....” to “... ..who purchases communications services... ”

Recommendation - [7] Section 7 change “telecommunications” to “communications” to read as follows

*2.7 “Telephone Company” or “Telephone Public Utility” -- Any provider of communications services to the public under the jurisdiction of the Commission.*

**D) Applicable Standards – Section 3.2(a) - and Article 2E of Senate Bill 678**

As currently stated in 3.2(a) of 150.CSR.37, it is appropriate that the *installation, maintenance and operation of the “Customer-Owned Conduit” shall meet NESC, Manual of Construction Practices (Blue Book) and other reasonable standards* which also means that the related demarcation points and conduit end points need to meet the applicable sections of “National Electrical Safety Code (NESC), National Electric Code (NEC), Manual of Construction Practices (Blue Book), and other reasonable standards”. The three documents explicitly listed above are in harmony with one another. Other *reasonable standards* that would apply to these facilities would include local building, electrical and fire codes for facilities on customer premises and inside buildings that would need to be complied with based on local municipality orders, West Virginia State laws and the Public Service Commission’s regulatory rules.

Although the concept of placing multiple communications cables from different companies inside a single duct or conduit is permitted in the NESC and industry practices; such a practice is not considered a standard or traditional practice, and therefore is only permitted providing all affected parties and utilities (a) are notified, (b) are in agreement, and (c) have well defined and mutually agreed working procedures for this joint-use plant. The safety and reliability rules of the NESC is explicitly built on

- Cooperation and agreement between joint users of facilities attached to poles, in aerial spans, and in belowground/underground spaces.
- Separation and clearances between cables and equipment. This principle applies between supply and communications equipment as well as between the communications cables of different utilities and companies.

The objectives and intent of these NESC rules are to help ensure the safety of people (public and workers), as well as maintain service reliability through avoiding interference and damage to adjacent and nearby facilities.

While it is common practice to use the terms duct and conduit interchangeably, in the NESC they have *distinct definitions*. Duct is a single enclosed raceway for conductors or cable; conduit is a structure containing one or more ducts; and conduit system is the combination of duct, conduit, conduits, manholes, handholes, and/or vaults joined to form an integrated whole (see Note 1 of Section 32 in current 2012 edition and Rule 302 in draft of 2017 edition). Therefore the conduit will be covered by the general rules of the NESC (e.g., General Use clauses in Rule 012) as well as the specific underground rules of Sections 30, 31, 34 and 35 for the buried conduit as well as Section 36 for vertical risers that transition from underground to aerial (pole mounted) plant.

The most relevant NESC rules that apply to this conduit include (in rule order) the following specific rules listed below with general comments and observations. In the remaining discussions of this expert report, cross references shall be made to these rules with more detailed discussions applicable to the *Customer-owned Conduit* facility.

**Applicable and Relevant NESC Rules for Customer-Owned Conduit**

- **Rule 012 – General Use clauses**
  - **Rule 012C** - *For all particulars not specified, but within the scope of in these rules, as stated in Rule 011A, construction and maintenance should be done in accordance with accepted good practice for the given local conditions known at the time by those responsible for the construction or maintenance of the communication or supply lines and equipment.*
- **Rule 302 – (see Section 32 below)**
- **Rule 311 - Installation & Maintenance**

- **Rule 311B** requires *reasonable advance notice of work that may adversely affect existing facilities.*

The frictional, abrasive and compression stresses placed on the existing cable and conduit during the new cable placement are expected to be significant and can cause damage to older cables and conduit.

- **Rule 312 Accessibility** “All parts that must be examined or adjusted during operation shall be arranged so as to be accessible to authorized persons by the provision of adequate working spaces, working facilities, and clearances.”
  - Customer-owned conduits will often begin or end in small pedestals or handholes since these locations were never envisioned to be joint-use facilities.
- **Rule 313B** This rule includes inspection, testing and management requirements for lines that are infrequently used, temporarily out of service, or permanently abandoned.
  - Lines that are only temporarily out of service or have some likelihood of being required to provide new or returned service to a customer should be left in place and tagged (labeled). The NESC recognizes that removal of truly abandoned cables may cause damage to the conduit, other facilities or the environment and it is better to abandon them in place.
- **Section 32 (Note 1)** in 2014 edition → definitions of ducts and conduit.
  - This Note will become **Rule 302** in 2017 edition
  - Section 32 covers conduit systems but there are parallel rules in Section 32 and 35 or location, routing, agreement between parties and other items discussed below.
- **Rule 341 – Installation**
  - **341A2** – Pulling tensions and sidewall pressures should be limited to avoid damage
  - **341A3** – Ducts should be cleaned of foreign material that could damage existing cables during pulling operations
  - **341A7** – Communication cables may be installed together in the same duct provided all utilities involved are in agreement.
- **Rule 350 – Covers direct buried cable and cable in a duct not part of conduit system**
  - 350F - the new communication cables shall be legibly marked to permit identification and allow provider to be contacted.

*Customer-owned conduit* is “cable in a duct not part of conduit system” as per the NESC.

- **Rule 351 – Locating and Routing**
  - **Rule 351A1-** *Cables should be located so as to be subject to the least disturbance practical.*
  - **Rule 351A2 -** *Where bends are required, the bending radius shall be sufficiently large to limit the likelihood of damage to the cable being installed.*
  - **Rule 351A3.** *Cable systems should be routed so as to allow safe access for construction, inspection, and maintenance.*

The placement of another company’s cables into a conduit or duct that already is occupied with a cable will threaten disturbance and damage to both during the pulling operation. The pathway through an occupied duct is not smooth, and has sharper bends owing to the fact that the lay of the existing cable in the conduit will restrict the pathway through the duct. Frictional forces generated by pulling one cable over another and around bends will be very much higher than for an empty smooth duct.

- **Rule 352 Installation**
  - **Rule 352 F.** Communication cables may be installed together in the same duct provided all utilities involved are in agreement.

- **Rule 354C - Communication cables or conductors** - *The cables or conductors of a communication circuit and those of another communication circuit may be buried together and at the same depth with no deliberate separation between facilities, provided all parties involved are in agreement.*
- **Rule 355. Additional rules for duct not part of a conduit system**
  - **Rule 355 A.** *Duct material shall be corrosion-resistant and suitable for the intended environment.*
  - **Rule 355 B.** *The internal surface of the duct shall be free of sharp edges or burrs, which could damage the supply or communication cable.*
  - **Rule 355 C.** *Ducts shall be joined in a manner so as to limit solid matter from entering the duct line. Joints shall form a sufficiently continuous smooth interior surface between joining duct sections so that the supply or communication cable will not be damaged when pulled past the joint.*
  - **Rule 355 D.** *The portion of duct installed through an exterior building wall, floor, or roof shall have seals inside the duct and external seals on the outside surface of the duct at the point of entry into the building intended to limit the likelihood of the entrance of gas into the building. The use of seals may be supplemented by gas-venting devices in order to limit the buildup of positive gas pressures in the conduit.*

Non-compliances with the parts of NESC **Rule 355** will be likely to occur since cutting into the conduit will (a) degrade seal integrity and introduce water, soil, particulates, or contaminants into the conduit, (b) create burrs, cracks and other discontinuities on interior surface of the duct. Pulling one cable over another is likely to create a high friction pathway that will lead to high significant tensions, abrasive damage and compression stresses. Placing a new cable into an occupied duct will require the removal of seals and if not properly replaced will create a non-compliance with this rule.

- **Section 36 - Covers, risers and associated mechanical protection for cables** in vertical runs of ducts, conduits and riser that go up walls, poles and other structures which applies to a *Customer-owned conduit* that transitions up a pole to aerial plant.
- **360. General**
  - **Rule 360A.** *Mechanical protection for supply conductors or cables shall be provided as required by Rule 239D of this Code. This protection should extend at least 300 mm (1 foot) below ground level.*
    - **Rule 239A2e** - *Communication cables may be installed together in the same duct or U-guard provided all utilities involved are in agreement.*
- **361. Installation**
  - **Rule 361A.** *The installation should be designed so that water does not stand in riser pipes above the frost line.*
  - **Rule 361B.** *Conductors or cables shall be supported in a manner designed to limit the likelihood of damage to conductors, cables, or terminals.*
  - **Rule 361C.** *Where conductors or cables enter the riser pipe or elbow, they shall be installed in such a manner that shall minimize the possibility of damage due to relative movement of the cable and pipe.*
- **362. Pole risers**
  - **Rule 362A.** *Risers should be located on the pole in the safest available position with respect to climbing space and exposure to traffic damage.*
  - **Rule 362B.** *The number, size, and location of riser ducts or guards shall be limited to allow adequate access for climbing.*
- **411. Protective methods and devices**

- **Rule 411E. Identification and location** - Means shall be provided so that identification of supply and communication lines can be determined before work is undertaken. Persons responsible for underground facilities shall be able to indicate the location of their facilities.

Rule 411E concerns the ability to identify the responsible party for this conduit/duct and the cables it contains.

- **Rule 423. Underground line operating procedures** - Employees working on or with underground lines shall observe the following rules in addition to applicable rules contained elsewhere in Sections 43 and 44.
  - **Rule 423E1.** *When underground facilities are exposed, they should be identified and shall be protected as necessary to avoid damage.*
  - **Rule 423E2.** *Where multiple cables exist in an excavation, cables other than the one being worked on shall be protected as necessary.*
  - **Rule 423E3.** *Before cutting into a cable or opening a splice, the cable should be identified and verified to be the proper cable.*

These 423E rules indicate that a communications company that adds the new cable to an occupied conduit should contact and seek agreement and permission of all parties including the conduit owner and the other communications company who owns/operates the existing cable.

**Recommendation** No recommendation is made to modify Section 3.2(a) at this time. It should be understood that the current language of Paragraph 3.2(a) implies that all the above NESC rules apply to conduit installations covered by this rule.

#### **E) “Intercept” – Sections 2.5, 4.1(a), and 4.1(c) in particular**

The definition of “intercept” as described in Sec.2.5 and 4.1 of 150.CSR.37 is an inadequate description for defining a process and does not represent a standard industry practice. Neither the NESC nor the Manual of Construction Practices (*The Blue Book*) mention “intercept” as a standard or acceptable process for accessing conduit. There are some industry references to intercepts but they all involve the placement of a handhole or manhole over an existing conduit to insert a protected access point for the conduit and the cables it contains.

To use such an intercept process, the company that intercepts the conduit run needs to supply a defined set of M&Ps (Method and Procedure) that shows how this “intercept” method for breaking into a conduit with an existing installed cable and to safely place a new cable is accomplished. Such M&Ps (Method and Procedure) and engineering drawings will need to include

- Qualification criteria for the conduit to help ensure a new cable can be added safely i.e., is there sufficient empty room and clear space within the occupied conduit to accommodate a new cable being added over the existing cable?
- Assessment of the existing conduit/duct seal integrity and quality – no breaks, no contaminants, no blockages from water or soil being present etc...
- Available space in terms of diameter of cable to be added compared to the free open space inside conduit
- Guidance on acceptable/unacceptable pulling tensions – with limits to minimize damage to pulled cable and abrasive, frictional damage to installed cable that may include breakaway swivels, lubricants, and contingency plans

- Necessary processes to be used to re-establish seals at either end of duct and at any breaks along conduit run
- Contingency plans to maintain and monitor service on existing cables during the new cable installation operation.

Breaking into an existing conduit introduces large risks associated with damaging the cable already existing in the conduit because of the

- High coefficient of friction (CoF) between the cable jackets (existing cable and newly being installed cable) surfaces compared to the CoF between cable jacket and smooth duct surface,
- High mechanical resistance to cable movement around restrictive/tight corners where the existing cable bends to the conduit profile rising off the inner duct surface, and

These frictional and mechanical factors can cause abrasive damage, high pulling tensions and point damage to cable and conduit.

- Incorrect choice or selection of conduit in so much that
  - Breaking into the wrong conduit and damaging a high traffic fiber cable, a power supply cable or a natural gas line
  - Many conduits, ducts and plastic pipes look the same during excavation of direct buried plant.
- Compromising the seal integrity of the conduit run and allowing groundwater, rainwater, soils, or other contaminating soils or liquids into the conduit.

The industry best practice for providing for multiple providers to a single customer is to run separate conduits to the customer or multiple ducts within a single large conduit. This follows the recommendations of Section 4.1(g) of the proposed Legislative Rule 150.CSR.37 but is only usually feasible for *Greenfield* applications where a new conduit is being placed in new construction. These designs and methods require most actions to be done at the initial installation of the conduit when several ducts are placed inside a conduit.

A typical new plant configuration for a customer-owned conduit for current communications network architectures would have 3 x 1.5-inch diameter ducts installed in a 4-inch diameter conduit with

- Duct #1 for twisted pair copper cables for requested services to customer
- Duct #2 for optical fiber cables for requested services to customer
- Duct #3 spare duct for future use to expand services or addition of new users/customers as requested by customer and/or anticipated by the service provider based on experience, demographic predictions or known development plans.

The term “intercept” is defined in paragraph 2.5 as the *cable* that is to be placed in the conduit, but does not include the components that are required to break into a conduit or add a new demarcation or entry point (e.g., handhole) for the underground construction run. In Section 4.1(a), (c) and (h) the term intercept also covers the additional components that are required to break into the conduit, re-seal the conduit, and restore the physical protection for the cable.

Recommendation - [8] Replace definition of “Intercept” to read as follows:

2.5. “Intercept” The cable and physical component required to insert the new cable into an occupied conduit between conduit end points while maintaining the seal integrity of the conduit and physical protection of the installed cable.

Recommendation [9] Replace 4.1(a) to read as follows:

a. ~~Intercepts should be allowed~~ are permitted providing all affected parties (customer, telephone company) agree and standardized with the use of conduit saddles

Recommendation - [10] Delete 4.1(b) since many telephone pedestals only provide 6 x 6 inch or 8 x 8 inch cross sections which is insufficient for physical access, separation and working space. A new demarcation point or separate intercept point needs to be added to avoid possible damage to installed plant and conflict with NESC rules including Rule 351 in particular.

~~b. Pedestal placements should allow ready access of conduits and ducts.~~

Recommendation [11] Existing (or legacy) intercept installations should be replaced with demarcation points that provide ready access by each user to the conduit and minimize interference with, and avoid danger to, other facilities present revise 4.1(c) as follows.

c. Existing intercept installations (or legacy ~~non-standard intercept~~ installations) ~~should be maintained as is unless damage to facilities as a direct result of these installations is proven imminent or the conduit owner requests changes to the insertion methodology~~ shall be replaced with a demarcation point that permits ready access by each user to the conduit system, and that shall minimize interference with, and avoid danger to, other Service Provider facilities. Existing installations may be permitted to remain if all affected parties agree.

#### **F) Responsibilities Towards Existing Plant – Sections 3.2 and 4.1 of 150.CSR.37**

Based on the NESC rules noted above, the communications company placing the new cable in the occupied *Customer-Owned Conduit* needs to provide

- Continuation of services on existing cable and maintaining their capacity for future use which includes keeping the existing cables tagged or labeled as temporarily out of service and not abandoned.
  - These cables may be required for adding future services to old customers, connection of new customers and possible customer requests to return to original carrier.
- Maintain adequate working space and accessibility space for technicians to work on adjacent cables (existing cable) and equipment.
- Avoid damage to proximate cables, equipment and facilities during the installation, maintenance and operation of the new cable services.

**Recommendation - [12]** Add a new item to 4.1 to define the necessary characteristics of the demarcation point for joint use (i.e., by multiple service providers of the customer-owned conduit.

4.1(x). The demarcation point for joint use of a customer-owned conduit shall under all circumstances permit ready access by each user to customer-owned conduit system, and shall minimize interference with, and avoid danger to, other Service Provider facilities. Each service provider shall maintain their own (separate) duct from their company facility into the demarcation point where transition into the customer owned conduit system/duct occurs. No Service Provider shall place any cable splice, or cable slack within the demarcation point.

**G) “Other Purposes” – Sections 3.1 and 4.1 of 150.CSR.37**

Section 3.1 in the proposed 150.37 state that the conduit can be used for “other purposes” or “purposes other the services provided by the telephone company”. The language is also in Lines 4 and 7 of the Senate Act.

The use of the conduit for “other purposes” needs to be restricted to “other communications purposes” to eliminate the possible placement of power supply cables, plastic gas pipelines or other inappropriate service lines that could create a hazardous condition.

“Other purposes” could be interpreted to mean power supply cable for which the safety concerns about damage to cables (existing and the new cable introduced into the conduit) are more stringent as well as the prohibitions and requirements for agreements between all parties are imperative to follow for safety of worker or public. NESC rules firmly discourage power and communications in same duct, manhole or other facility except under strict design criteria. The NESC (Section 35) requires at least 12 inches from any other underground facilities such as water lines, gas pipes and other structures that could possibly damage cables.

The Legislative 150.37 Rule should be explicit that these “other purposes” should be restricted to be “other communications purposes” to avoid inappropriate, unsafe and risky uses for the *Customer-Owned Conduit*.

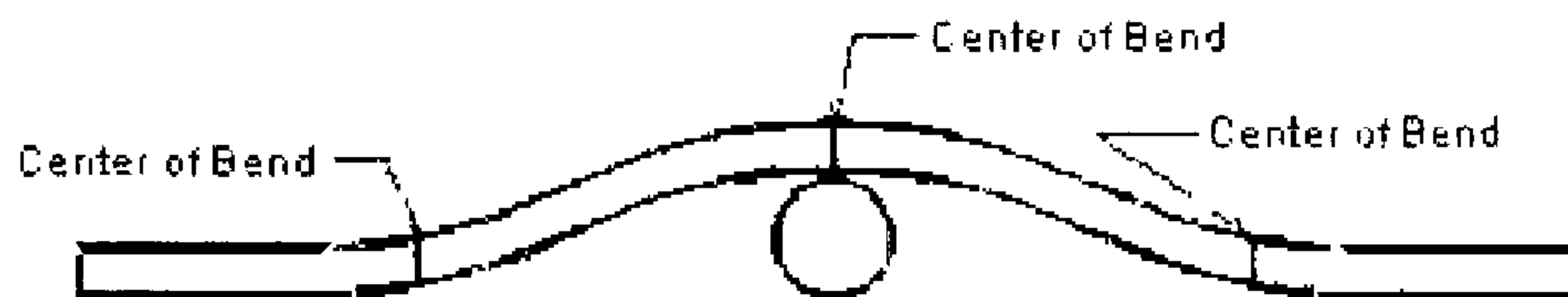
Recommendation [13] Clarify the term “purposes” in paragraph 3.1 by replacing “...for purposes other than the services” with “...for communications purposes other than the services”.

**H) “Conduit Saddles” – Sections 4.1(a) of 150.CSR.37**

The equipment denoted as “conduit saddles” to achieve the “intercept” noted in Sec.4.1(a) of 150.CSR.37 is not adequately defined and does not represent a standard industry practice. The use of these terms “intercept” and “saddle” are not industry standard terms and will create confusion for interpretation of the 150.CSR.37 Rule.

Review of various conduit industry internet sites finds a “saddle” more often defined as a device or bending configuration to facilitate a low-stress means for one conduit to be cross an obstacle -

*Three bend saddles are often used to cross or saddle a small obstruction that would prevent the electrician from installing conduit in a straight line. One of the obstructions that the electrician most often has to saddle is another run of electrical conduit or pipe that has been installed by a different trade.*



(from [http://www.porcupinepress.com/\\_bending/saddles.htm](http://www.porcupinepress.com/_bending/saddles.htm))

If this “saddle” is supposed to be the industry component known better as a Y-shaped or Y-way coupling joint (such as those shown below) then such a component needs to be more clearly defined by the intercepting company along with the M&Ps for how this component is to be inserted into an existing conduit without damage to existing cable in addition to the necessary cable installation M&Ps noted elsewhere in this report.



**“Conduit Y Fitting” - Section 4.1(h)(ii) of 150.CSR.37**

The use of a Y-shaped or Y-way coupling joint (such as those shown above) is feasible, but only where the detailed design of the piece and the associated M&Ps for its use are provided by the intercepting company to show how it is to be inserted into an existing conduit without damage to existing cable or conduit.

Recommendation - [14] Delete references to undefined “saddles” in 4.1(a) - Replace 4.1(a) to read as follows:

- a. Intercepts should be allowed are permitted providing all affected parties (customer, telephone company) agree and standardized with the use of conduit saddles

Recommendation - [15] Delete references to inadequately defined “Y fitting” in 4.1(h)(ii) - Replace 4.1(h)(ii) to read as follows:

- (ii) Installation of any conduit fitting to provide ~~Y fitting with conduit stubbed up~~ such that access for multiple service providers to ~~can~~ access the customer-owned conduit or the open stub shall
  - (a) Provide adequate working space to avoid interference or damage with existing installed cables or the conduit, and
  - (b) Maintain seal integrity of conduit system

**D) “Legacy non-standard intercept installations” – Sections 4.1(c) of 150.CSR.37**

It is confusing to speak about “non-standard intercept installations” since there is no established standard for the “intercept installation” to compare.

The long term reliability of communications services shall be reduced if this Section 4.1(c) provides a universal exception to repair clearly inadequate constructions or bring previous “intercepts” up to best

industry practices as represented by NESC, NEC and Manual of Construction Practices guidance documents.

Recommendation - [16] Existing (or legacy) intercept installations should be replaced with demarcation points that provide ready access by each user to the conduit and minimize interference with, and avoid danger to, other facilities present – same changes to paragraph 4.1(c) as proposed in Recommendation #11 above.

**J) “Inter-Company Communications and Agreements – Sections 3.2 and 4.1 of 150.CSR.37**

Section 4.1 of the 150.CSR.37 appropriately specifies that “*When multiple service providers are involved, the coordination of their activities should be guided by the best practices of the industry...*”. As defined in, and guided by, the NESC this *coordination* needs to include the following components at a minimum

- NESC Rule 311B - *Reasonable advance notice* shall be provided to customer and owners/operators of existing cable plant inside conduit. To be reasonable and advance, this notice needs to occur before access is attempted into the conduit.
- *Mutual Agreement* (NESC Rules 311B, 341A7, 352F, 351A1, 354C) between all parties to the proposed installation includes
  - *Work practices and M&Ps* planned for execution of the cable placement work within the conduit and at the access points to help ensure the other proximate facilities are not adversely affected (NESC Rule 311B, 351A1, 423E1, 423E2, 423E3)
  - *Restoration practices* to be used, after cable installation is completed, to re-establish both the seal integrity and mechanical robustness of the original conduit at both ends and across the entire conduit run. (see Rule 311B, 312, 341A2, 341A3, 351A2, 351A3, 355B, 355C, 355D, 361)

To standardize the “intercept” procedure as implicitly required by 150.CSR.37 Section 4.1(a), the intercepting communications company needs to provide detailed engineering drawings for these intrusions into installed conduit for the several cases to be expected including (1) intercept of a direct buried conduit going to an existing manhole or handhole, (2) intercept of a direct buried conduit going to a buried closure, and (3) intercept to a conduit that travels up a utility pole to connect to network aerial plant. These engineering drawings will need to include details of

- The proposed intersection joints and how they accommodate cable entry without placing excessive sidewall pressure or abrasive stress onto conduit wall or existing cables.
- Quantitative limits on pulling tensions allowed and bending radii permitted (see NESC Rule 351A2, 351A3, 361C)
- The proposed seal materials and design to be used to continue to prevent water, gas and particulate ingress into the conduit or into the customer’s buildings (see NESC Rules 355B, 355C and 355D, 361A, 361B, 361C).
- Working space and access required to safely insert a new cable into the conduit – working space for required equipment, cable reels and workers in and around the conduit entry and exit points. (see NESC Rule 312, 341A2, 341A3, 341A4, 351A1, 351A4, 354)

Recommendation - [17] Modify the opening statement to 4.1 and add two new items to list to explicitly require agreement between affected parties as follows.

4.1. Coordination of activities of multiple service providers

The use of customer-owned conduit may requires the agreement involvement of the customer and ~~more than one~~ the owner (service provider) of any installed cable present in the conduit. When multiple service providers are involved, the coordination of their activities should be guided by the best practices of the industry, as set forth below:

- x. Reasonable advance notice shall be provided to affected parties
- y. The design of the intercept shall follow generic engineering drawings as agreed to be customer and affected parties (i.e., other service providers with cables in conduit).

**K) "Dead Cables" – Section and 4.1(e) of 150.CSR.37**

To better harmonize with the NESC (see NESC Rule 313B) and other reasonable standards, the existing cables in the "Customer-Owned Conduit" should be defined as either (a) *lines in service* or (b) *lines out of service*. Within the *out of service* category there are several defined states typically identified -

- Lines infrequently used
- Lines temporarily out of service
- Lines permanently abandoned

The term "dead cables" as used in 150.CSR.37 may encompass (depending on how one company defines the term) all of the *out of service* types above and unfairly require their removal. It would be an anti-competitive action, because although the cables may not be in active service at the present time, these cables should be retained in the conduit to provide as-requested new services from new customers or changes to services requested by returning or established customers.

The clear identification (see NESC **Rule 311A**) of out-of-service lines is one of the reasons that for reasonable advance notice (NESC **Rule 311B**) and mutual agreements between all parties is required. Without such identification of lines that may be serving in-frequently used, but critical, equipment or services (e.g., emergency lines for 911 services, fire alarm circuits) may be mistakenly disconnected and removed.

The NESC recognizes that even for lines permanently abandoned, their removal may create more problems than compared to leaving the cable alone and undisturbed; providing the cable can be left in a safe condition. Pulling a cable out of an older conduit could easily damage the conduit if cable has become adhered to the inner surface or if vulnerable points in the conduit are stressed during the tension, compression and frictional forces applied to pull out the cable.

It is unclear in the proposed 150.CSR.37 Legislative Rule, who should pay the costs associated with this removal, if necessary. Since the immediate benefit is to the owner of the conduit, and the new cable occupant of the conduit, one or both should share the costs of safely removing a cable.

**Recommendation - [18]** Modify 4.1(e) as follows.

- e Permanently abandoned cables ~~Dead cables~~ that consume capacity in customer-owned conduit should be extracted in a reasonably expeditious manner unless their removal is likely to damage the conduit or other cables in the conduit.

**L) “Common Access Points” - Section 4.1(h) of 150.CSR.37**

There are three necessary access points that should be separated to help facilitate joint-use, mutual safety to workers, public and equipment, and to minimize possible interference and damage to cable and equipment.

- (1) Connection to the network facilities of the existing cable/service provider (e.g., telephone company) which is more often found in a handhole or pedestal
- (2) Connection to the network facilities of the new cable/service provider (i.e., the intercepting company)
- (3) Customer premises service demarcation point or the NEC defined point-of-entrance inside the customer building

The access points may be more accurately defined as demarcation points between customer and network equipment. The design requirements for these access or demarcation points can best be defined from a review of the relevant code rules and the best industry construction practices as documented in the Manual of Construction Practices (Blue Book). The design requirements of, functional performance of, and practical work rules for these access points needs to include the following items at a minimum.

- Minimize interference with, and possible damage to, previously installed cables and equipment (see NESC Rules 311B, 351A1 & A3, 423). Physical interference with cables and splice joints such a bending cables, compression stress on to plant and abrasive scrapping can degrade electrical insulation, dislodge connections, increase electrical resistance, increase optical losses and in general degrade transmission performance of adjacent plant.
- Permit ready access by one user to their plant while minimizing interference to other user’s plant (see NESC Rule 312, 382A, 382C, 423) which will include proving sufficient working space around the demarcation or access point to ensure adequate bending radii are possible during new cable installation to avoid stress and damage to that cable or an installed cable, the optical fibers or copper conductors they contain, and the conduit into which the cable is being placed.
  - Configuration of the demarcation or access point to reduce bending stresses will also help reduce the pulling tensions on the cable during installation that may help reduce possible abrasion damage to the conduit and installed cables owing to frictional forces during the placement operations.
- Include clear visible identification and contact information for closures and cables to facilitate rapid advance notice to other parties whose plant may be affected by work in the demarcation point (see NESC Rule 311B ) and obtain their agreement (see NESC Rules 311B, 341A7, 352F, 380B, 239A2e, 423) for work and practices.
- Shall not degrade the seal integrity of the conduit or create sharp edges, burrs along the inner surface of the conduit that will reduce the long term reliability of the conduit as a cable pathway. The access point needs to be sealed to prevent water and gas ingress into and along the conduit and possibly into the customer premises (see NESC Rule 351A2, 351A3, 355). The components and closures associated with the demarcation point needs to be designed with appropriate seals to maintain (re-establish) the water tight seal of the conduit.
- Maintain the integrity of any pole risers and minimize interference with these risers and U-guards so as to limit the likelihood of damage to conductors, cables, and terminals as well as prevent water ingress (as per NESC Rule 361 and 362)

The preferable configuration for these access points to meet all these requirements would entail separation of the different communications cables into separate closures where interference and possible damage to either plant can be minimize.

In new construction, this would be best accomplished with separate ducts being placed inside the *Customer-Owned Conduit* with, for example, 3 x 1.5-inch diameter ducts inside a 4-inch diameter conduit. The three (3) ducts can be assigned as follows

- A. Duct #1 – designated for twisted pair copper cables for requested services to customer
- B. Duct #2 – designated for optical fiber cables for requested services to customer. This second duct would be designated for the initial service provider for future cable placement or for secondary cable to provide enhanced services. It is common practice to use separate ducts for fiber optic cable and copper pair cable to avoid possible damage to the high bandwidth fiber cable and this duct #2 could be assigned as a fiber optic cable duct.
- C. Duct #3 designated as a spare duct for future use to expand services or addition of new users/customers as requested by customer and/or anticipated by the service provider based on experience, demographic predictions or known development plans. The assignment of which company would use this spare duct would be left to the customer who owns the duct or be specified as part of the contractual agreement between the initial service provider and the customer at the time of conduit/duct design choice and construction.

At the network end of the conduit, the two (or more) different communications providers would then break out the individual ducts from the *Customer-Owned Conduit* and separate the ducts and the cables in them. That separation should be at least 12 inches and will depend on the facility where the *Customer-Owned Conduit* ends.

- Handhole/vault – e.g., buried rectangular handhole flush with surrounding ground ranging from small 12-18 inch to 24-30 inches wide.
  - In larger handholes (24 inches and larger), the ducts or cables could be separated and each communications company could mount their cables, splices, closure or associated equipment on opposite side of the handholes.
  - In the smaller handhole case (less than 18 inch), it would be better to install a second handhole (or pedestal) adjacent to the initial handhole and direct the second communications company’s duct and cable into that second handhole.
- Pedestal – small (8-12 inch square) metallic or plastic aboveground pedestal with its bottom 24-30 inches section mounted into the earth.
  - These pedestals are too small to attain the necessary separation between cables and ducts.
- Cabinet pad-mounted or ground-mounted cabinets usually have an entrance splice chamber where the conduit terminates and this chamber has sufficient space and separation capacity to minimize interference between cable plants. Access to the cabinet splice chamber does need to be controlled through a joint use agreement, co-location agreement, or the second communications company could install an adjacent pedestal or adjunct cabinet for these splicing needs.
- Hut – similar to Cabinet case above
- CEV (Controlled Environmental Vault) – For security, safety and control access reasons the case where the conduit terminates in a CEV would best be addressed with a separate adjacent pedestal for the second communications company plant.
- Pole (Conduit becomes a Riser up a pole) – for the case where a *Customer-Owned Conduit* transitions from a buried location and up a utility pole, the seal integrity of the conduit and physical protection of the vertical riser (conduit or U-Guard) needs to be maintained. Preventing water ingress is important to maintaining the reliability of the cable, particularly in areas where frost and ice buildup can occur. Therefore the vertical pole risers and the transitional assembly at the base of the pole should not be cut to gain access to the cables or ducts inside the *Customer-Owned Conduit*. The separation of the different communications company’s plants should occur in a pedestal or handhole 24 inches away to the pole, or preferably up the pole where cables/ducts exit the conduit into the network aerial plant.

### Addition of Access Point to Already Installed Customer-Owned Conduit

The retrofitting of an access point to the case where cable is already installed on a *Customer-Owned Conduit* introduces significant possible risks of damaging cables and conduit. The Blue Book of Construction Practices does not contain the concept of “intercepts” as a standard process. Breaking into an existing conduit introduces large risks associated with

- Damaging the cable already in the conduit.
- Incorrect choice/selection of conduit → breaking into the wrong conduit and damaging a high traffic fiber cable, a power supply cable or a natural gas line → many conduits, ducts and plastic pipes look the same during excavation of direct buried plant.
- Compromising the seal integrity of the conduit run and allowing groundwater, rainwater, soils, or other contaminating soils or liquids into the conduit.

Placing a new cable into a duct/conduit that already contains an installed cable increases the probability of damage to all the components; i.e., the existing installed cable, new cable being placed, and the conduit/duct. Pulling one cable over another is likely to create a high friction pathway that will lead to high significant tensions, abrasive damage and compression stresses. The mechanical stresses that occur during the installation process can also initiate cracks and surface damage to older conduits and ducts.

Recommendation - [19] Modify and reformat 4.1(h) as follows.

h. Customer-owned conduit should have a common access point (or universal access point) to facilitate the customer's receipt of service from multiple providers. The common access ~~may be provided in various ways, including point~~ shall permit ready access by each user to the conduit system, and shall minimize interference with, and avoid danger to, other Service Provider facilities. It is desirable that the universal access point be provided at the time of the initial installation of the conduit.

~~(i) Placement of a pull box that may be shared by multiple service providers.~~

~~(a) When possible the pull box should be placed by The customer contractor when the customer-owned conduit is installed.~~

~~(b) The pull box also may be placed by the initial installing provider~~

~~(ii) Installation of any conduit fitting to provide Y fitting with conduit stubbed up such that access for multiple service providers to ~~can access~~ the customer-owned conduit ~~or the open stub shall~~~~

(i) Provide adequate working space to avoid interference or damage with existing installed cables or conduit

(ii) Maintain seal integrity of conduit system

(iii) Be agreed to by customer and owners of existing cable in the conduit

**M) "Transition demark between riser poles and entry points in customer-owned conduit is not necessary" – Sections 4.1(j) of 150.CSR.37**

This statement is incorrect. The need for a defined and designed demarcation point is particularly necessary for the vertical riser case to meet the NESC requirement of **Rules 239A2(e), 360A, 361A, 361B, 361C** and help ensure water, soils and other particulates are not permitted to ingress into the vertical positioned conduit. There needs to be well-designed seals to help maintain any damage caused by deliberate or accidental work impacting the vertical riser or U-guard attached to the utility pole. A separate transition point or access point is useful and desirable for this pole related case to enhance safety and reliability of all cable plants involved. In a conduit transition from a buried location and up a utility pole, the seal integrity of the conduit and physical protection of the vertical riser (conduit or U-Guard) needs to be maintained. Preventing water ingress is important to maintaining the reliability of the cable, particularly in areas where frost and ice buildup can occur.

Therefore the vertical pole risers and the transitional assembly at the base of the pole should not be cut to gain access to the cables or ducts inside the *Customer-Owned Conduit*. The separation of the different communications company's plants should occur in a transition or access pedestal or handhole located 24 inches away from the pole, or preferably up the pole where cables/ducts exit the conduit into the network aerial plant.

**Recommendation [20]** Delete 4.1(j) since demarcation points or universal access points should be required for locations where the conduit terminates in aerial facilities (on poles). The section can be replaced with a definition and properties of the demarcation point as follows

~~j. A transition demark between riser poles and entry points into customer-owned conduit is not necessary.~~ A demarcation or universal access point (UAP) shall be provided to identify the demarcation point between the customer-owned conduit and service provider conduit or facilities. The demarcation point or points shall be located at the terminus of the installed customer-owned Conduit System/Duct. It is desirable that the UAP be a handhole supplied and installed by the Customer as part of the general Customer Conduit System/Duct installation. In the event that the customer does not install the UAP, the first service provider to place duct within the customer-owned conduit system shall place this demarcation point, and transfer ownership of the demarcation point to the customer. The demarcation point shall then become the Universal Access Point for all service provider facility entry into customer-owned conduit. The demarcation point shall

- (i) Permit ready access by each user to customer Owned Conduit System/Duct capacity
- (ii) Minimize interference with, and avoid danger to, other Service Provider facilities.
- (iii) Not contain any cable splice closures or cable slack storage loops.

**Recommendation [21]** Add definition to Section 2 of the rule of a demarcation point or universal access point (UAP).

**2.X Universal Access Point (Demarcation point)** A handhole located at the terminus of the installed customer-owned Conduit System/Duct installed by the Customer or service provider to serve as an entry point for multiple service providers into the customer-owned Conduit/Duct system. The demarcation point shall under any circumstances permit ready access by each user to its own facilities and shall minimize interference with and avoid danger to other users' facilities.

## **Recommendations List**

For the convenience of the reader, the various recommendations made throughout the report are provided below in a list.

**Recommendation [1]** Editorial correction in Main Title correct ‘CONUDIT’ to ‘CONDUIT’.

**Recommendation - [2]** Add the following definition of “apparatus” to Section 2 as follows

2.X. ‘Apparatus’ The conduit or underground structure (but not including the cable) that provides a cable pathway between the service provider network and the customer.

**Recommendation [3]** Revise definition of “conduit” in Section 2.1 to read as follows

2.1. ‘Conduit’ *A tube structure containing one or more ducts used to house and physically protect cables.*

**Recommendation - [4]** Replace “innerduct” definition (paragraph 2.4) with definition of “duct” to read as follows

2.X. ‘Duct’ A single tube structure placed inside a conduit to separately house cables (also known as innerducts)

**Recommendation - [5]** Section 4.1(g) Replace “innerduct” with “duct” to read as follows

Initial and subsequent installations into new customer-owned conduit should use separate ducts when feasible.

**Recommendation - [6]** Section 2.3 change “...who purchases telecommunications services.” to “...who purchases communications services....” to read as follows

**Recommendation - [7]** Section 2.7 change “telecommunications” to “communications” to read as follows

2.7. ‘Telephone Company’ or “Telephone Public Utility” -- Any provider of communications services to the public under the jurisdiction of the Commission.

**Recommendation [8]** Replace definition of “Intercept” to read as follows:

2.5. ‘Intercept’ The cable and physical component required to insert the new cable into an occupied conduit between conduit end points while maintaining the seal integrity of the conduit and physical protection of the installed cable.

**Recommendation - [9]** Replace 4.1(a) to read as follows:

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Recommendation - [10] Delete 4.1(b) since many telephone pedestals only provide 6 x 6 inch or 8 x 8 inch cross sections which is insufficient for physical access, separation and working space. A new demarcation point or separate intercept point needs to be added to avoid possible damage to installed plant and conflict with NESC rules including Rule 351 in particular.

~~b. Pedestal placements should allow ready access of conduits and ducts~~

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Recommendation - [12] Add a new item to 4.1 to define the necessary characteristics of the demarcation point for joint use (i.e., by multiple service providers of the customer-owned conduit.

4.1(x). The demarcation point for joint use of a customer-owned conduit shall under all circumstances permit ready access by each user to customer-owned conduit system, and shall minimize interference with, and avoid danger to, other Service Provider facilities. Each service provider shall maintain their own (separate) duct from their company facility into the demarcation point where transition into the customer owned conduit system/duct occurs. No Service Provider shall place any cable splice, or cable slack within the demarcation point.

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(ii) ~~Installation of any conduit fitting to provide Y fitting with conduit stubbed up such that access for multiple service providers to enter the customer-owned conduit or the open stub shall~~

(a) Provide adequate working space to avoid interference or damage with existing installed cables or the conduit, and

(b) Maintain seal integrity of conduit system

Recommendation - [16] (same changes to paragraph 4.1(c) as proposed in Recommendation #11 above)

c. Existing intercept installations (or legacy non-standard intercept installations) should be maintained as is unless damage to facilities as a direct result of these installations is proven imminent or the conduit owner requests changes to the insertion methodology shall be replaced with a demarcation point that permits ready access by each user to the conduit system and that shall minimize interference with, and avoid danger to, other Service Provider facilities. Existing installations may be permitted to remain if all affected parties agree.

Recommendation - [17] Modify the opening statement to 4.1 and add two new items to the list to explicitly require agreement between affected parties as follows.

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The use of customer-owned conduit ~~may~~ requires the agreement involvement of the customer and more than one the owner (service provider) of any installed cable present in the conduit. When multiple service providers are involved, the coordination of their activities should be guided by the best practices of the industry, as set forth below:

- x. Reasonable advance notice shall be provided to affected parties
- y. The design of the intercept shall follow generic engineering drawings as agreed to be customer and affected parties (i.e., other service providers with cables in conduit).

Recommendation - [18] Modify 4.1(e) as follows.

e. Permanently abandoned cables ~~Dead cables~~ that consume capacity in customer-owned conduit should be extracted in a reasonably expeditious manner unless their removal is likely to damage the conduit or other cables in the conduit.

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- (ii) Maintain seal integrity of conduit system
- (iii) Be agreed to by customer and owners of existing cable in the conduit

Recommendation [20] Delete 4.1(j) since demarcation points or universal access points should be required for locations where the conduit terminates in aerial facilities (on poles). The section can be replaced with a definition and properties of the demarcation point as follows

~~j. A transition demark between riser poles and entry points into customer-owned conduit is not necessary.~~ A demarcation or universal access point (UAP) shall be provided to identify the demarcation point between the customer-owned conduit and service provider conduit or facilities. The demarcation point or points shall be located at the terminus of the installed customer-owned conduit system. It is desirable that the UAP be a handhole supplied and installed by the customer as part of the general customer-owned conduit system/Duct installation. In the event that the customer does not install the UAP, the first service provider to place duct within the customer-owned conduit system shall place this demarcation point, and transfer ownership of the demarcation point to the customer. The demarcation point shall then become the universal access point for all service provider facility entry into customer-owned conduit systems. The demarcation point shall

- (i) Permit ready access by each user to the customer-owned conduit system capacity
- (ii) Minimize interference with, and avoid danger to, other service provider facilities,
- (iii) Not contain any cable splice closures or cable slack storage loops.

Recommendation - [21] Add definition to Section 2 of the rule of a demarcation point or universal access point (U.AP)

2.X Universal Access Point (Demarcation point) A handhole located at the terminus of the installed customer-owned Conduit System/Duct installed by the Customer or service provider to serve as an entry point for multiple service providers into the customer-owned Conduit/Duct system. The demarcation point shall under any circumstances permit ready access by each user to its own facilities and shall minimize interference with and avoid danger to other users' facilities.



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**CURRICULUM VITAE,  
BACKGROUND and  
PUBLICATIONS**

# Biography / Curriculum Vitae

Trevor Bowmer

**Position**

Network & Product  
Integrity - Outside Plant  
Solutions  
Senior Analyst/Consultant

**Language**

English



## Professional Background

- 36 years experience in Telecom Industry
- PhD University of Queensland (Australia)
  - Chemistry – Materials Science
- Bell Laboratories.....Bellcore.....Telcordia.....Ericsson

## Consulting Focus Areas

- Materials Expert
- Outside Plant Product Standards
- Outside Plant Installation Standards and Audits
- Industry Standards and Safety Code Compliance
  - NESC, NEC, ASTM, ATIS, GO95...
- Electrical Safety – Grounding and Bonding
- Infrastructure Needs for Broadband Networks – traditional POTs, Fiber to the Home, HFC and Wireless networks

## Industry and Project Experience

### Standards and Safety Code Work

- Member grounding, aerial clearances, underground, and work rules technical subcommittees of the National Electrical safety Code (NESC) – IEEE (Main and subcommittees SC2, 4, 5, 7, and 8)
- Alliance of Telecommunications Industry Solutions (ATIS) Protection Engineers, Network Electrical Protection, Network Power Solutions Groups
- Member ASTM D7 and ANSI O5 committees on wood products and utility poles
- Member grounding and communications technical panels - National Electrical Code (CMP 5 and CMP 16)

### Consulting and Testing Work

- Field Failure Analysis– Root Cause Investigations
- Expert Witness Testimony
- Product Testing – Development of
  - Functional Performance Criteria
  - Test Programs

### Publications – author/co-author of

- 35+ Telcordia outside plant and power-related generic requirements documents including GRs-421, -3163, & -3164 on *Metallic Cables*, GR-60, -3159 & -3174 on *Poles and Attachment Hardware*, GR-902 (Handholes/vaults), GR-3155/356 (Microducts & Conduits), GR-3108 on Electronic Equipment, GR-3155 on *Microducts* GR-513 on *Power* and GR-3171 on *Wireless Infrastructure elements*
- Over 170 technical papers, product audits and other reports including
  - *Reliability Standards for Telecommunications Emergency Backup Power Systems and Emergency Notification Systems*
  - *Telecom – Power Dependencies : A Report on the Interdependencies Between Telecommunications Services And Electric Utility Power Supply*

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**Previous Occupations :**  
1975-78 -- Tutor , University of Queensland (Australia)  
1980-84 -- Member of Technical Staff  
Bell Laboratories, Murray Hill, N.J. 07974

**Present Occupation :**

1984 -- 1998	Senior Engineering Analyst Bell Communications Research
1998 -- 2011	Senior Analyst/Senior Consultant Telcordia Technologies
2012 -- present	Senior Analyst/Senior Consultant Ericsson (Telcordia)

**Date Of Birth :** 26th February 1955

**Research Interests :**  
Telecommunications Network and Outside Plant Products  
- Performance Requirements and Field Correlation  
- Reliability Studies and Failure Mechanism  
- Materials-Related Issues and Industrial Ecology  
Degradation and Stabilization of Polymeric Materials  
Materials Structure and Characterization Techniques  
(List of publications attached or available on request)

**Organizations :**

- (1) American Chemical Society (ACS)
- (2) Panel Member of NEC (National Electric Code) – Panels 5 on Grounding and 16 on Communications
- (3) NESC Main Committee and Subcommittees 2 (Grounding), 4 (Aerial Clearances), 5 (Pole Loading), 7 (Underground and Buried Plant) and 8 (Work Rules) of the National Electric Safety Code (NESC)
- (4) Member of American Society of Testing and Materials (ASTM) – Committee D 07
- (5) Member of ATIS Committee ANSI O5 on wood poles

**Citizenship :** Australian - U.S. Permanent Resident (Green Card).

**Dr. Trevor N. Bowmer, Ph.D.**  
**Senior Analyst/Senior Consultant**

Trevor has over 36 years of experience analyzing telecommunications networks and products. His current work in Telcordia includes technology assessments, product analysis, reliability studies, and material reviews of environmental and functional performance concerns of network products and components. His technical expertise is based on a broad understanding of material requirements for telecommunications products and the correlation between field conditions and product performance demands. His experience includes international assignments in Canada, Mexico and Saudi Arabia. His recent work has concentrated around authoring various generic requirement documents on equipment and hardware in the telecommunications plant, as well as authoring the Telcordia Construction Blue Book, and consulting to governmental agencies on the issue of power interdependencies between the telecom and electric power networks. More recently he has completed considerable work on product and network assessments for communications networks with functional performance measurements of active networks as well as design review and reliability assessment of future wireless, fiber (FTTx), coaxial-cable, and copper based broadband networks; while serving on technical committees of the NESC and NEC Code making Panels.

**Project Experience**

- **Telecom Construction Consulting** Trevor was the chief author of the Telcordia Construction Blue Book (a guide for safe and reliable construction practices for the telecommunications industry) and an active member of subcommittees of the NESC (National Electric Safety Code) for the last 10+ years.
  - Author of SR-1421 Telcordia Construction Blue Book Guidelines for safe and reliable construction practices for the telecommunications industry
  - Author of GR-902 (Handholes & Vaults), GR-3155 (Microducts), GR-356 (Innerducts and Conduits), GR-60 (Wood Poles), GR-3159 covering Fiberglass, Concrete and Steel Utility Poles and GR-3174 for associated support and attachment pole hardware.
- **Generic Requirements (GR) and Functional Performance Criteria** Recently, Trevor was the author of several Generic Requirement documents that provide functional performance criteria for telecommunications network facilities such as :
  - Author of series of GRs on metallic cable plant (GR-421, GR-3163, GR-3164) covering distribution, service drop and inside cable products.
  - Author of GR-3108 covering electronic equipment used in the outside plant network
  - Author of GR-513 covering power system requirements of communications facilities.
  - Author or co-author of GR-43 (Huts), GR-487 (Cabinets) and GR-902 (Handholes and Underground Vaults).
- **Network Analysis** Trevor has contributed to functional performance assessment and reliability evaluation of fiber (FTTx), CATV-based, and copper pair networks for governmental networks, cable companies, and traditional telecom networks. This work entails not only field measurements of active networks but also design analysis of future networks in terms of individual network components and system elements. Examples of this work includes
  - Projects to measure fiber performance and assess physical facilities for a DoT backbone network across New Jersey, and
  - Reliability evaluations of current and future alternate networks for regional providers in the south-eastern, western and northern USA, and
  - Field analysis reviews of network reliability, trouble report rate, operational methods and procedures, organizational structure, and management philosophy for a several telecommunications carriers in the Middle-East and central America.
  - Analysis activities evaluating industry benchmarking of network performance and reliability, review of operational philosophies and strategies, identification of market and

business drivers, data mining of trouble report and outage data to help identify major contributors to trouble rates and laboratory testing and materials analysis of field samples.

- Expert Material Consulting for Forensic Studies and Disaster Recovery – Over the last 30+ years, Trevor has contributed to over 300 field cases covering materials analysis, legal opinions, disaster recovery and root causes of field problems associated with telecommunications equipment including wires, cables, insulations, circuit boards, batteries, fuses, coaxial components and fiber coatings. The economic and cost consequences of these field problems range from \$50,000 to \$100,000,000. Recent examples include:
  - Several projects over the last 6-7 years concerned evaluating the potential impact of World Trade Center dust on the electrical and mechanical equipment in buildings in lower Manhattan.
  - A 2003 -2005 project involved fire modeling and materials analysis as well as evaluating soot contamination of equipment/devices in a warehouse fire incident.
  - A 2005 project to investigate effects on the telecommunications equipment and infrastructure in Graniteville SC of a release of ~130 tons of chlorine gas from a tanker involved in a train derailment.
  - Risk assessment work on utility poles (wooden) was also completed where risk assessment was completed, pole testing programs and protocols developed, and individual accident cases analyzed involving defective poles and access using aerial lifts.
- Product Design, Functional Performance Analysis and Field Application Assessments. The scope of his work entailed completing network architecture assessments, application needs and operational field environments for telecommunications equipment and related hardware and facilities. This includes forward looking evaluations or new and emerging technologies.
  - Operational Field Analysis of Rehabilitation Strategies and Outside Plant (OSP) methods and procedures with focus on deployment for broadband services (DSL). Trevor provided preventive maintenance strategies and engineering recommendations for deploying installed plant for xDSL and other Broadband services. Trevor mined trouble report databases and outage data to help identify effective strategies for maintaining high network reliability.
  - Product Analysis - Trevor regularly manages technical product analysis of outside plant products and central office products to Telcordia Generic Requirements (GR) documents. Trevor has authored various GR documents as well as providing technical oversight over 40-50 other requirements documents.
    - Microduct Analysis - In this work, Trevor developed performance criteria for these new intra-building products and designed test procedures for the new product family under GR-3155.
    - Freeze-Thaw Analysis - In this work, Trevor studied the dynamics and kinetics of freeze-thaw behavior in below-ground closures. He explored the correlations with air-temperature and kinetics of heat flow into ground and into closures as a function of seasonal variations of climate and geographic location. In addition, the function of installation practice and deployment M&Ps was reviewed as to their effect on the probability of standing water in a below-ground closure.
    - Cracked PIC (Polyolefin Insulation Conductor) Insulations – Trevor was the technical lead for investigations of cracked PIC insulation field failure problems. He provided root cause analysis, remedial strategies for installed plant and generic product specification choices to improve future product performance and reliability.
- Emerging Technology Assessments – Using his in-depth materials knowledge, Trevor has provided to telecommunications clients, independent technological assessments for new material technologies,

fire-retardant products, universal drop wire products, and fuel cell power systems. These assessments include business impact analysis as well as the critical requirements and testing plans needed to help achieve the high reliability demanded for any new network product.

- Power and Energy Dependencies Trevor has researched the interdependencies between telecom services, power and energy networks, and the best practice for backup energy for these communications systems in times of natural and man-made emergencies. Trevor has been an advisor to various State and Federal governmental agencies to help design adequate safety rules and regulatory approaches to maximize the reliability of these infrastructure systems; as well as provide guidance on grounding and bonding architecture to optimize equipment performance.
- Environmental Friendly ("Green") Strategies Trevor monitors materials-related environmental issues affecting telecommunications products. He assesses the impact of governmental laws, regulations and policies on distribution network components and facilities. Furthermore, he reviews remedial actions and efficient proactive strategies to minimize such environmental costs, limit long term liability and reduce disposal costs.
- Fuel Cell Project assessing emerging fuel cell technologies as possible sources of primary power application for telecommunications Central Offices. Trevor provided technical research analysis of fuel cell technologies and prototype products as well as developed a set of guidelines and a set of design, installation, functional performance, quality, reliability and maintenance guidelines.

## **Publications**

- Trevor has authored 180+ reports, papers and presentations covering research materials issues, network analysis, product testing, field failure analysis, environmental drivers in telecommunications industry and other areas of network assessment, network reliability and product quality.  
(List available on request)

## **PUBLICATIONS AND REPORTS OF TREVOR BOWMER**

(Listed by General Subject/Date)

### **(A) Fundamental Radiation Chemistry of Polymers**

(Thesis Work)

- 1) T.N. Bowmer and J.H. O'Donnell, "THE NATURE OF THE SIDE CHAIN BRANCHES IN LOW DENSITY POLYETHYLENE: VOLATILE PRODUCTS FROM GAMMA RADIOLYSIS" *Polymer*, Vol.18, p1032 (1977).
- 2) T.N. Bowmer, L.K. Cowen, J.M. Nichol, J.H. O'Donnell, N.P. Rahman, C.A. Smith and D.J. Winzor, "DETERMINATION OF SCISSION AND CROSSLINKING YIELDS IN IRRADIATED POLYMERS : MOLECULAR WEIGHT DISTRIBUTION EFFECTS FOR SOLUBLE POLYMERS", *American Chemical Society, Polymer Preprints*, Vol.20, p425 (1979).
- 3) T.N. Bowmer, L.K. Cowen, J.H. O'Donnell and D.J. Winzor, "DEGRADATION OF POLYSTYRENE BY GAMMA-IRRADIATION. EFFECT OF AIR ON THE RADIATION-INDUCED CHANGES IN MECHANICAL AND MOLECULAR PROPERTIES", *Journal of Applied Polymer Science*; Vol.24, p425 (1979).
- 4) T.N. Bowmer, J.H. O'Donnell and P.R. Wells, "RADIATION DEGRADATION OF POLY(SULFONYLALKYLENE)S : EVIDENCE FOR CATIONIC REACTIONS", *Makromolekulare Chemie, Rapid Communications*; Vol.1, p1 (1980).
- 5) T.N. Bowmer, J.H. O'Donnell and P.R. Wells, "ISOMERIZATION IN OLEFIN FORMATION IN RADIATION DEGRADATION OF POLY(OLEFIN SULFONE)S", *Polymer Bulletin*, Vol.2, p103 (1980).
- 6) T.N. Bowmer and J.H. O'Donnell, "PROPAGATION / DEPROPAGATION EQUILIBRIUM AND THE STRUCTURAL FACTORS IN THE RADIATION DEGRADATION OF POLY(OLEFIN SULFONE)S", *Journal of Polymer Science, Polymer Chemistry Edition*; Vol.19, p45
- 7) T.N. Bowmer and J.H. O'Donnell, "POST-IRRADIATION THERMAL DEGRADATION OF POLY(OLEFIN SULFONE)S", *Polymer*, Vol.22, p71 (1981).
- 8) T.N. Bowmer and J.H. O'Donnell, "THERMAL DEGRADATION OF POLY(OLEFIN SULFONE)S. I. THE EFFECT OF OLEFIN STRUCTURE ON THE YIELDS OF VOLATILE PRODUCTS." *Polymer Degradation & Stability*, Vol.3, p87 (1981).
- 9) T.N. Bowmer and J.H. O'Donnell, "GAMMA RADIOLYSIS OF DIALKYL, ALKYL-ARYL AND DIARYL SULFONES : A VOLATILE PRODUCT STUDY", *Radiation Physics and Chemistry*; Vol.17, p177 (1981).
- 10) T.N. Bowmer, J.H. O'Donnell and D.J. Winzor, "IRRADIATION OF AROMATIC POLYMERS : THE EFFECT OF IRRADIATION TEMPERATURE ON CROSSLINKING AND SCISSION IN POLYSTYRENE", *Journal Polymer Science, Polymer Chemistry Edition*; Vol.19, p1167 (1981).
- 11) T.N. Bowmer and J.H. O'Donnell, "RADIATION DEGRADATION OF POLY(OLEFIN SULFONE)S : A VOLATILE PRODUCT STUDY", *Journal Macromolecular Science., Chemistry Edition*; Vol.A17, p243 (1982).
- 12) T.N. Bowmer, S.Y. Ho, J.H. O'Donnell, G.S. Park and M. Saleem, "CHARACTERIZATION OF THE SHORT-CHAIN BRANCHES IN POLY(VINYL CHLORIDE)S BY GAMMA-RADIATION OF THE REDUCED POLYMERS", *European Polymer Journal*; Vol.18, p61 (1982).
- 13) T.N. Bowmer, S.Y. Ho and J.H. O'Donnell, "RADIATION DEGRADATION OF COPOLYMERS OF ETHYLENE AND ALPHA-OLEFINS : THE TEMPERATURE DEPENDENCE OF YIELDS OF THE VOLATILE PRODUCTS", *Polymer Degradation and Stability*, Vol.5, p449 (1983).
- 14) T.N. Bowmer, S.Y. Ho, J.H. O'Donnell and P.W. O'Sullivan, "SCISSION EFFICIENCIES OF SHORT-CHAIN BRANCHES IN THE GAMMA-RADIOLYSIS OF ETHYLENE--ALPHA-OLEFIN COPOLYMERS", *Journal Macromolecular Science ,Chemistry Edition*; Vol. A21, p745 (1984).

(B) **Research on Lithographic Materials and Radiation Cured Systems**

(Completed at Bell Laboratories and Bellcore)

- 15) T.N. Bowmer, D.D. Davis, T.K. Kwei and W.I. Vroom, "THE RADIATION CROSSLINKING OF POLY(VINYL CHLORIDE) WITH TRIMETHYLOL-PROPANE-TRIMETHACRYLATE PART I. : DOSE DEPENDENCE AND THE EFFECTS OF THERMAL TREATMENT", *Journal Applied Polymer Science*, Vol. 26, p3669 (1981).
- 16) T.N. Bowmer, E. Reichmanis, C.W. Wilkins Jr. and M.Y. Hellman, "RADIATION DEGRADATION OF COPOLYMERS OF METHYL METHACRYLATE AND 3-OXIMINO-2-BUTANONE METHACRYLATE", *Journal Polymer Science, Polymer Chemistry Edition*; Vol.20, p2661 (1982).
- 17) M.Y. Hellman, T.N. Bowmer and G.N. Taylor, "DETERMINATION OF GEL CONTENT AND % GEL IN RADIATION-CURED POLY(VINYL CHLORIDE) CROSSLINKING-MONOMER COATINGS BY COMBINED GPC-LC TECHNIQUES", *Macromolecules*, Vol.16, p34 (1983).
- 18) T.N. Bowmer, M.Y. Hellman and W.I. Vroom, "THE RADIATION CROSSLINKING OF POLY(VINYL CHLORIDE) WITH TRIMETHYLOL-PROPANE-TRIMETHACRYLATE PART II. DEPENDENCE ON RADIATION DOSE AND BLEND COMPOSITION", *Journal Applied Polymer Science*, Vol.28, p2083 (1983).
- 19) T.N. Bowmer, M.Y. Hellman and W.I. Vroom, "THE RADIATION CROSSLINKING OF POLY(VINYL CHLORIDE) WITH TRIMETHYLOL-PROPANE-TRIMETHACRYLATE . III : EFFECT OF DIUNDECYL PHTHALATE : CHEMICAL KINETICS OF A THREE-COMPONENT SYSTEM", *Journal Applied Polymer Science*; Vol. 28, p2553 (1983).
- 20) T.N. Bowmer and W.I. Vroom, "THE RADIATION CROSSLINKING OF POLY(VINYL CHLORIDE) WITH TRIMETHYLOL-PROPANE-TRIMETHACRYLATE . PART IV ;EFFECT OF DIUNDECYL PHTHALATE - DEPENDENCE OF PHYSICAL PROPERTIES ON COMPOSITION", *Journal Applied Polymer Science*; Vol. 28, p3527 (1983).
- 21) T.N. Bowmer and M.J. Bowden, "THE RADIATION DEGRADATION OF POLY(2-METHYL-1-PENTENE SULFONE) . II : RADIOLYSIS PRODUCTS", *ACS SYMPOSIUM SERIES NO. 242, 'POLYMERS IN ELECTRONICS'*, (EDITOR T. DAVIDSON ) p153 (1984).
- 22) A.E. Novembre and T.N. Bowmer, "A NOVEL TECHNIQUE FOR DETERMINING RADIATION CHEMICAL YIELDS OF NEGATIVE ELECTRON-BEAM RESISTS", *ACS SYMPOSIUM SERIES #266 'Materials in Microlithography'* (Eds.: L.F. Thompson, G.C. Wilson & M. Frechet) p241, 1984.
- 23) T.N. Bowmer and G.S. Baker, "THERMAL STABILITY OF BROMINATED POLY(TRIMETHYLSILYL-PROPYNE)", *Proceedings - 15th Annual Conference of North American Thermal Analysis Society*. p 499 (1986)
- 24) G.T. Baker, C.F. Klausner, A.S. Gozdz, J.A. Shelburne III and T.N. Bowmer; "BROMINATED POLY(1-TRIMETHYLSILYL-1-PROPYNE) : LITHOGRAPHY AND PHOTOCHEMISTRY", *Advances in Chemistry Series*, No. 224 - Silicon-based Polymer Science, (American Chemical Society - Hawaii 1987), page 663 (1990).

(C) **Fundamental Studies of Polymeric Materials**

(Completed at Bell Laboratories and Bellcore)

- 25) T.N. Bowmer and A.E. Tonelli, "THERMAL TRANSITIONS OF ETHYLENE-VINYL CHLORIDE COPOLYMERS", *Polymer*, Vol.26, p1195 (1985).
- 26) A. Lovinger, L.A. Belfiore and T.N. Bowmer, "CRYSTALLOGRAPHIC CHANGES IN CRYOGENICALLY PULVERIZED POLYMERS", *Journal Polymer Science, Polymer Physics Edition*; Vol. 23, p1449 (1985).
- 27) T.N. Bowmer and A.E. Tonelli, "BLENDS OF HOMO- AND CO-POLYMERS OF ETHYLENE AND VINYL CHLORIDE - A COMPATIBILITY STUDY", *Macromolecules*; Vol.19, 498 (1986).
- 28) T.N. Bowmer and A.E. Tonelli, "INFRARED SPECTROSCOPY OF ETHYLENE-VINYL CHLORIDE COPOLYMERS", *Journal of Polymer Science, Polymer Physics Edition*; Vol.24, 1631 (1986).
- 29) T.N. Bowmer and A.E. Tonelli, "THERMAL TRANSITIONS OF ETHYLENE-VINYL CHLORIDE COPOLYMERS AND THEIR BLENDS", *Journal of Vinyl Technology*; Vol. 8 (3), p98 (1986).

- 30) A.E. Tonelli and T.N. Bowmer, "C-Cl STRETCHING VIBRATIONS IN ETHYLENE-VINYL CHLORIDE COPOLYMERS", *Journal of Polymer Science, Polymer. Physics Edition*, Vol. 25, 1153 (1987).
- 31) T.N. Bowmer, R.C. Haddon, S.M. Stein, S.V. Chichester-Hicks, J.M. Marshall, M.L. Kaplan and M.Y. Hellman, "POLY BIS(PYRROLO) PHOSPHAZENE", *Materials Research Bulletin*, Vol.22, p117 (1987).
- 32) T.N. Bowmer and F.K. Shokoohi, "THE CHEMISTRY OF SUPERCONDUCTOR FORMATION FROM METAL NEODECANOATES", *Proceedings - 18th Annual Conference of North American Thermal Analysis Society* (San Diego, CA) p706, 1989.
- 33) T.N. Bowmer and F.K. Shokoohi, "SYNTHESIS OF SUPERCONDUCTORS FROM METAL NEODECANOATES", *Journal of Materials Research*, Vol. 6 (4), p670 (1991).
- 34) M.A. Gomez, C. Marco, J.G. Fatou, T.N. Bowmer, R.C. Haddon and S.V. Chichester-Hicks, "THERMAL PHASE TRANSITIONS OF SUBSTITUTED POLY[BIS(4-R-PHENOXY)PHOSPHAZENES]", *Macromolecules*, Vol.24, p3276 (1991).
- 35) T.N. Bowmer, R.C. Haddon, S.V. Chichester-Hicks, M.A. Gomez, C. Marco and J.G. Fatou, "EFFECT OF SUBSTITUENTS ON THE THERMAL TRANSITIONS AND DEGRADATION BEHAVIOR OF POLY [BIS(R-PHENOXY)-PHOSPHAZENES]", *Macromolecules* , Vol. 17, p4827 (1991).

**(D) Network Reliability Assessment, Product Analysis  
and Field Failure Studies of Telecommunications Products**

(Many of these reports and publications completed at Bellcore and Telcordia are either company private or proprietary. Therefore I have summarized the content and scope of some work and deleted proprietary or other identifying information from the titles. )

**(D-1) Wire and Cable Materials**

- 36) T.N. Bowmer and P.C. Warren, "EMBRITTEMENT OF CROSSLINKED POLY(VINYL CHLORIDE) INSULATIONS", *Proceedings of the 36th International Wire and Cable Symposium*, p5 (1987).
- 37) T.N. Bowmer, E.P. Hjorth, R.J. Miner and O.S. Gebizlioglu, "STABILITY OF POLYETHYLENE INSULATIONS IN THE FIELD AND LABORATORY", *Proceedings 37th International Wire and Cable Symposium* (Reno, NV), p 490 (1988)
- 38) T.N. Bowmer , "CRACKING OF FOAM-SKIN POLYETHYLENE INSULATIONS IN PEDESTALS", *Proceedings 37th International Wire and Cable Symposium* (Reno, NV), p 475 (1988)
- 39) T.N. Bowmer, P.C. Warren and E.E. Hershkowitz, "FIELD FAILURES OF FOAM-SKIN HIGH DENSITY POLYETHYLENE INSULATION", *Proceedings - 5th International Conference on Plastics in Telecommunications*, (London) 1989
- 40) T.N. Bowmer, R.J. Miner, I.M. Plitz, J.N. D'Amico and L.M. Hore, "THERMAL STABILITY TESTS FOR POLYOLEFIN INSULATIONS", *Proceedings of 39th International Wire and Cable Symposium*, p316 (1990).  
(Outstanding Technical Paper Award at Conference)
- 41) T.N. Bowmer, R.J. Miner and R.L. Coker; "FIELD TEMPERATURES IN OUTSIDE PLANT", *Proceedings of 39th International Wire and Cable Symposium* (Las Vegas, NV) p335 (1990).
- 42) J. N. D'Amico and T.N. Bowmer, "EXTENDING THE LIFE OF POLYETHYLENE WIRE INSULATION", *Proceedings of 40th International Wire and Cable Symposium*, p476 (1991).
- 43) T.N. Bowmer and J.N. D'Amico, "REMEDIAL STRATEGIES FOR POLYOLEFIN INSULATIONS IN OUTSIDE PLANT", *Proceedings of 41st International Wire and Cable Symposium*, p310, (1992).
- 44) T.N. Bowmer, *Telcordia Proprietary Report*, "ARE POLY (VINYL CHLORIDE) MATERIALS DESTABILIZING OUTSIDE PLANT PRODUCTS", May 1990.
- 45) T.N. Bowmer, *Telcordia Proprietary Report*, "PIC (Polyolefin Insulated Cable) INSULATION STUDY AND SEALED PLANT SURVEY FOR -----", September 1997.
- 46) T.N. Bowmer, *Telcordia Proprietary Report*, "PERFORMANCE REQUIREMENTS FOR UNIVERSAL WIRE AND CABLE PRODUCTS", September 1993.
- 47) T.N. Bowmer, *Telcordia Proprietary Report*, "ANIMAL DAMAGE TO UNIVERSAL DROP SERVICE WIRE", September 1997.
- 48) I.M. Plitz, T.N. Bowmer and J. Christensen, *Telcordia Proprietary Report*, "OIL EXUDATION FROM BURIED DROP CABLES", January 1994

- 49) T.N. Bowmer, *Telcordia Proprietary Report*, "ABRASION RESISTANCE TESTS FOR INTRABUILDING CABLES", October 1994
- 50) O.S. Gebizlioglu, K.W. Moyers, T.N. Bowmer, FIBERGLASS REINFORCED AERIAL SERVICE WIRE: MATERIALS INVESTIGATION AND FAILURE ANALYSIS, Proceedings of the 48th International Wire and Cable Symposium (IWCS) , page 213, 1999.
- 51) T.N. Bowmer - *Telcordia Proprietary Report* - BRONZE VERSUS COPPER CLAD ALLOY STEEL SHIELDS FOR BURIED SERVICE WIRES (BSW), October 16, 2006

### **(D-2) Coaxial Cables and Networks**

- 52) J.N. D'Amico and T.N. Bowmer, *Telcordia Proprietary Report*, "THE DETERIORATION OF TRANSMISSION CHARACTERISTICS AND COAXIAL DROP CABLE LONGEVITY", Oct. 1995
- 53) T.N. Bowmer, *Telcordia Proprietary Report*, "THE ROLE OF ANTIOXIDANTS IN COAXIAL CABLE RELIABILITY", July 1995
- 54) T.N. Bowmer, L.M. Slavin and K.W. Moyers, *Telcordia Proprietary Report*, "RELIABILITY AND PERFORMANCE ISSUES FOR COAXIAL COMPONENTS IN BROADBAND NETWORKS", November 1995
- 55) T.N. Bowmer and K.W. Moyers, *Telcordia Proprietary Report*, "W----- Z----- RESIDENTIAL BROADBAND TRIAL COAXIAL NETWORK RELIABILITY", December 1995.
- 56) L.M. Slavin, J.N. D'Amico and T.N. Bowmer, *Proprietary Report*, "ESTABLISHMENT OF COAXIAL CABLE PROTOTYPE TEST ROUTES AT AN ENVIRONMENTAL TEST FACILITY", May 1996.
- 57) T.N. Bowmer, *Telcordia Proprietary Report*, "FAILURE RATE PREDICTIONS FOR COAXIAL COMPONENTS AT THE P----- FACILITY", August 1996.
- 58) T.N. Bowmer and L.M. Slavin, *Telcordia Proprietary Report*, "REVISED AND UPDATED REVIEW OF RELIABILITY AND PERFORMANCE ISSUES FOR COAXIAL COMPONENTS IN BROADBAND NETWORKS", March 1996
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### **(D-3) Optical Fiber Issues**

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### **(D-4) Thermal Events – Fire, Explosions and Overheating**

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- 67) T.N. Bowmer, *Telcordia Proprietary Report*, MATERIALS ANALYSIS AND ROOT CAUSE DETERMINATION OF I----- CENTRAL OFFICE FIRE", December- January 1997

- 68) T.N. Bowmer and E. Scerbo, *INVESTIGATION OF B----- FIRE PROTECTION GEL*” May 1999 and September 2000. An investigation of the functional performance of *Fire Protection Gel* with regard to handling and storage safety, material hazard review, equipment fire protection testing, post-fire cleanup evaluation, wind resistance testing, failure mode analysis and overall environmental performance.
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- 70) T. Gmitter, R.H. Schubert, M. Herrlin and T.N. Bowmer, “THERMAL EVENT AT V--- WIRELESS SISTERS HOSPITAL CELL SITE IN B---, NY”, January 2003. Contributed materials analysis and root cause analysis.
- 71) T.N. Bowmer and T. Gmitter, “INFORMATION RELATED TO POTENTIAL IMPACTS AND RECOVERY FROM RADIOACTIVE DUST FOLLOWING DETONATION OF A CESIUM-137 DIRTY BOMB”, June 2003
- 72) T. Gmitter, L. Florez and T.N. Bowmer, “EVALUATION OF MECHANICAL AND ELECTRICAL SYSTEMS AT B , NY FOR IMPACT FROM THE SEPTEMBER 11, 2001 WTC TERRORIST ATTACK”, May 2003
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- 73) T.N. Bowmer, M. Herrlin, R. Schubert and T. Gmitter; “MODELING OF INTERNAL WAREHOUSE TEMPERATURES AND EQUIPMENT THERMAL EXPOSURE DURING THE MARCH 14, 2003 C--- WAREHOUSE FIRE IN C---- MD.” November 2003 (4432/03-134) --- T.N. Bowmer and Tom Gmitter, “RESPONSE TO BROADWING CORPORATION (FORMERLY CORVIS CORPORATION) EXPERT WITNESS REPORTS.” - March 29, 2006
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- 75) T. Gmitter, L. Florez and T.N. Bowmer, “EVALUATION OF MECHANICAL AND ELECTRICAL SYSTEMS AT 65--- B , NY FOR IMPACT FROM THE SEPTEMBER 11, 2001 WTC TERRORIST ATTACK”, Nov. 2004

#### **(D-5) Environmental Issues**

- 76) T.N. Bowmer, *Telcordia Proprietary Report*, “ENVIRONMENTAL ISSUES AND STRATEGIES FOR MATERIALS USED IN TELECOMMUNICATIONS”, August 1996.
- 77) T.N. Bowmer, Series of *Telcordia Proprietary Reports on* , “GASOLINE CONTAMINATION OF TELECOMUNICATION CABLES AND UNDERGROUND/BURIED PLANT”, November 1996.
- 78) T.N. Bowmer, “ENVIRONMENTAL ISSUES AND STRATEGIES FOR MATERIALS USED IN TELECOMMUNICATIONS”, 46<sup>th</sup> International Wire and Cable Symposium November 1997.
- 79) T.N. Bowmer, *Private Legal Opinion*, “GASOLINE FUEL CONTAMINATION ON TELECOMMUNICATION PLANT LONG TERM IMPACTS ON RELIABILITY”, April/June 1997.
- 80) T.N. Bowmer, *Telcordia Proprietary Report*, “DISTRIBUTION NETWORK COMPONENTS ANALYSIS IMPACT AND BUSINESS CONSEQUENCES OF GOVERNMENTAL REGULATORY ACTIONS AND RELATED ENVIRONMENTAL INITIATIVES”, Regular reports were issued from 1997 to 2000 including December 1997, June 1998, December 1998, June 1999 and December 1999/January 2000. During 1998, a series of interim detailed reports were prepared on a range of topics such as
- (a) EMI/EMF exposure,
  - (b) utility poles and wood preservative issues,
  - (c) pesticides, biocides and other EPA listed chemicals,
  - (d) water discharge from manholes,
  - (e) right-of-way and one-call issues,
  - (f) recycling options,
  - (g) environmentally friendly material choices, and
  - (h) impact of trade sanctions on product availability and costs.

- 81) Trevor Bowmer, "AVOID THE QUICKSANDS OF WETLAND REGULATION, *OSP Engineering and Construction*, page 11, March 1999 Issue.
- 82) T.N. Bowmer, "LEAD SHEATH CABLES "GET THE LEAD (Pb) OUT" OR "LET SLEEPING LEAD (Pb) LIE", *Presentation at IRWA (International Right-Of-Way) Conference*, Albuquerque NM (June 1999).
- 83) Trevor Bowmer, DEVELOPING A FORMULA FOR BIOCHEMICAL USE, *OSP Engineering and Construction*, June 1999 Issue.
- 84) T.N. Bowmer and S. Castellano, "EVALUATION OF IMPACTS TO CENTRAL OFFICE AND OUTSIDE PLANT EXPOSED TO CHLORINE GAS FOLLOWING A FREIGHT TRAIN DERAILMENT IN GRANITEVILLE, SOUTH CAROLINA" - February 24, 2005 and Addendum March 21, 2005

#### **(D-6) Powering Issues – Electrical Power, Batteries and Fuel Cell Analysis**

- 85) T.N. Bowmer - "ENERGY USAGE IN NETWORK SPACE – A STUDY IN THREE COS" - Extensive studies and series of PowerPoint presentations covering the efficiency and energy usage across network and building infrastructure support systems inside central offices.
- 86) T.N. Bowmer; REVIEW ARTILCE – GROUNDING AND BONDING – A TELECOMMUNICATIONS PERSPECTIVE”, Telcordia Proprietary Report – October 2008.
- 87) T.N. Bowmer, R. Kluge and J. Ken-Kwofie; PROPOSED SEPARABLE ELECTRICAL CONNECTOR REQUIREMENTS FOR USE IN PHOTOVOLTAIC ROOFING SHINGLE”, Telcordia Proprietary SR-6000, April 2009.
- 88) T.N. Bowmer, JOINT POWER – TELECOM AND MICROTRENCHING REPORT” June 2010.

#### **Batteries and Energy Storage Materials**

- 89) J.M. Tarascon, W.R. McKinnon, F. Cowar, T.N. Bowmer, G. Amatucci and D. Guyomard; "SYNTHESIS CONDITIONS AND OXYGEN STOICHIOMETRY EFFECTS ON LI INSERTION INTO THE SPINEL  $\text{LiMn}_2\text{O}_4$ ", *Journal of the Electrochemical Society*, Vol.141 (6), p1421 (1994).
- 90) T.N. Bowmer, *Telcordia Proprietary Report*, "BATTERY ANALYSIS – MATERIAL AND COMPRESSION STUDIES OF VRLA (Valve-Regulated Lead-Acid) BATTERY CASE", Nov. 1996.
- 91) T.N. Bowmer and T. O’Sullivan, *Telcordia Proprietary Report*, "FIELD STUDIES OF VRLA (Valve-Regulated Lead-Acid) BATTERIES IN CEVs AND TELECOMMUNICATION HUTS”, April 1997.
- 92) T.N. Bowmer, DUE DILIGENCE INVESTIGATION OF A----- LITHIUM METALPOLYMER BATTERIES, July, 2006.

#### **Fuel Cells**

- 93) T.N. Bowmer, "A FUEL CELL ASSESSMENT MATRIX", June/July 2002. This report provides an assessment matrix to evaluate the technical pros/cons of the different fuel cell technologies for Central Office powering applications”.
- 94) T.N. Bowmer, "FEATURES, FUNCTIONS AND PERFORMANCE GUIDELINE FOR POWER PLANT SUPPLYING CENTRAL OFFICE DC BUS AND NETWORK POWER", Series of issues written between July and October 2002.
  - T.N. Bowmer, "SUMMARY GUIDELINES COVERING FEATURES, FUNCTIONS AND PERFORMANCE FOR A POWER PLANT SUPPLYING CENTRAL OFFICE DC BUS AND NETWORK POWER", Series of issues written July--October 2002.
- 95) T.N. Bowmer, "TECHNOLOGY REVIEW REPORT - FUEL CELL TECHNOLOGY COMPARATIVE ASSESSMENT REPORT”, August 2002. Covering the technical capability and business assessments of molten-carbonate-fuel-cell (MCFC) and solid-oxide-fuel-cell (SOFC) technologies to meet the needs of Central Office Power Plant Applications.
- 96) T.N. Bowmer, "FUNCTIONAL ANALYSIS PLAN FOR PERFORMANCE TESTING OF FUEL CELL POWER PLANT FOR CENTRAL OFFICE (CO) APPLICATIONS”, September/October 2002.
- 97) T.N. Bowmer, technical author of Issue 2 of Telcordia Generic Requirements document GR-347-CORE "GENERIC REQUIREMENTS FOR TELECOMMUNICATIONS POWER CABLE”, July 2002.

### **(D-7) Codes, Requirements and Specifications Work**

- 98) T.N. Bowmer, *Telcordia Proprietary Report*, "CHEMICALS USED IN PRODUCT PERFORMANCE REQUIREMENTS", July 1998.
- 99) T.N. Bowmer, "HANDHOLE STUDY FOR ----- COMMUNICATIONS AND GENERIC REQUIREMENT FOR HANDHOLES IN "GREENWAY" ENVIRONMENTS", April 1999.
- 100) T.N. Bowmer, E. Scerbo and L. Slavin, "HANDHOLE STUDY FOR U---- COMMUNICATIONS - LOAD REQUIREMENTS AND MATERIAL ISSUES", April 1999 and November 2000. This report explored the vertical and lateral forces placed on the handholes, defined the mechanical performance requirements and test procedures, reviewed materials issues, and provide general installation guidelines for handholes.
- 101) T.N. Bowmer and J. Peters, "COMMENTARY ON EXISTING N---- COPPER WIRE AND CABLE DOCUMENTS", April 2000 – Review analysis of previous wire and cable specification documents containing a high level approach to revise and update specifications.
- 102) T.N. Bowmer and J. Peters, "COMMENTARIES ON MATERIAL AND PERFORMANCE ISSUES RELATED TO N---- WIRE AND CABLE SPECIFICATIONS", prepared and revised from January to October 2000 – Review of issues including, cable design, core wraps, shields, transmission categories, abrasion tests, non-halogen materials, product code consolidation, jacket thickness & eccentricity, cable bend requirements, immersion tests, and related industry standards.
- 103) T.N. Bowmer, "TELECOMMUNICATIONS WIRE AND CABLE SPECIFICATION, ISSUE 7" January 2001. Developed the functional performance requirements for copper cables for a major metropolitan transit system.
- 104) T.N. Bowmer, "RG WIRE AND CABLE SPECIFICATION - COAXIAL AND ANTENNA CABLES", Issue 4, January 2001 Developed the functional performance requirements for coaxial and antenna wires used within tunnels, along tracks and in buildings for a major metropolitan transit system.
- 105) T.N. Bowmer, "DATA CABLE PLACING GUIDELINES PREPARED FOR N----", January 2001, Guidelines and placing procedures overview for placing data cable (e.g., Category 5 twisted pairs) for a metropolitan transit system
- 106) T.N. Bowmer, "DATA CABLE TESTING GUIDELINES PREPARED FOR N----" January 2001, Guidelines and testing philosophy overview for placing data cable (e.g., Category 5 twisted pairs) for a metropolitan transit system.
- 107) T.N. Bowmer, technical author of new Generic Requirements GR-3108-CORE "NETWORK EQUIPMENT IN THE OUTSIDE PLANT", Issue 1, July 2004.
- 108) T.N. Bowmer, author of Issues List Report (ILR) for Generic Requirements GR-3108-CORE "NETWORK EQUIPMENT IN THE OUTSIDE PLANT", April 2005.
- 109) T.N. Bowmer and E. Gallo - GR-902-CORE - "GENERIC REQUIREMENTS FOR HANDHOLES AND OTHER BELOW-GROUND NON-CONCRETE SPLICE CLOSURES" January 2005
- 110) T.N. Bowmer, "REVIEW OF PROPOSED GR-3121, 3123 AND 3125" Covering FIBER DISTRIBUTION HUBS in different application OSP environments and Intrabuilding locations - February 9, 2006
- 111) T.N. Bowmer, "REVIEW OF GR-771" covering FIBER OPTICAL CLOSURES - March 1, 2006
- 112) T.N. Bowmer and E. Gallo, GR-3155 - GENERIC REQUIREMENTS FOR MICRODUCTS AND FIBER OPTIC CABLES, Issue 1, November 2007.
- 113) T.N. Bowmer, GR-3159 - GENERIC REQUIREMENTS FOR FIBERGLASS-REINFORCED POLYMER (FRP) UTILITY POLES, Issue 1, December 2007.
- 114) T.N. Bowmer, GR-347 - TELECOMMUNICATIONS POWER CABLE, Issue 3, July 2008.
- 115) T.N. Bowmer, GR-421 - GENERIC REQUIREMENTS FOR METALLIC TELECOMMUNICATIONS CABLES, Issue 2, October 2008.
- 116) T.N. Bowmer, GR-3108 - GENERIC REQUIREMENTS FOR NETWORK EQUIPMENT IN THE OUTSIDE PLANT (OSP), Issue 1, December 2008.
- 117) T.N. Bowmer, GR-3163 - GENERIC REQUIREMENTS FOR METALLIC TELECOMMUNICATIONS SERVICE AND DISTRIBUTION DROP WIRES, Issue 1, May 2009.
- 118) T.N. Bowmer, GR-356 - GENERIC REQUIREMENTS FOR OPTICAL CABLE INNERDUCT, ASSOCIATED CONDUIT AND ACCESSORIES, Issue 2, June 2009.

- 119) T.N. Bowmer, GR-3164 - *GENERIC REQUIREMENTS FOR METALLIC TELECOMMUNICATIONS PREMISES WIRES*, Issue 1, July 2009.
- 120) T.N. Bowmer, GR-513 - *POWER REQUIREMENTS IN TELECOMMUNICATIONS PLANT*, Issue 1, Jan 2010.

### **Code Work (NEC and NESC)**

- 121) T.N. Bowmer and D.M. Henry, "*TELECOMMUNICATIONS ISSUES IN NATIONAL ELECTRICAL SAFETY CODE (NESC) - 2003/2004 SUB-COMMITTEE ACTIVITIES AND THE 2007 CODE*" January 2004, Discusses proposed changes for the 2007 code cycle of NESC and provides recommendations and analysis from the viewpoint of a telecommunications provider. - specifically covers work under subcommittee SC4 (Clearances), SC7 (Buried/Underground) and SC8 (Work Rules). ..... including reports and analysis reports in July 2005 and October 2005 covering subcommittee hearings and public comments
- 122) T.N. Bowmer and D.M. Henry, "*THE BLUE BOOK -- MANUAL OF CONSTRUCTION PROCEDURES*", Issue 3A, December 2004 and Issue 4, December 2007.
- 123) T.N. Bowmer, SR-1421 *TELCORDIA CONSTRUCTION BLUE BOOK MANUAL OF CONSTRUCTION PROCEDURES*, Issue 5, July 2011.
- 124) T.N. Bowmer, *ARC-FLASH HAZARD ASSESSMENT*, July 2008 ----- Revised May 2009.
- 125) T.N. Bowmer, "*REPORT ON PROPOSALS AND ISSUES FROM NFPA NATIONAL ELECTRICAL CODE (NEC) PANEL MEETINGS*", Discusses proposed changes for the code cycle of NEC and provides recommendations and analysis from the viewpoint of a telecommunications provider. The reports cover work under Panel 5 (Grounding) written with R. McCarver and Panel 16 (Communications) written with J. Brunssen.
- January 2008 for 2011 NEC..... January 2011 for 2014 NEC
- 126) T.N. Bowmer, "*TELECOMMUNICATIONS ISSUES IN NATIONAL ELECTRICAL SAFETY CODE (NESC)-*" Presentations to Protection Engineering Group of ATIS (Alliance for Telecommunications Industry Solutions) Discussing NESC activities and provides recommendations and analysis from the viewpoint of a telecommunications provider. - specifically covers work under subcommittee SC4 (Clearances), SC7 (Buried/Underground) and SC8 (Work Rules).
- March 2010 - Tampa FL..... March 2011- Hunstville AL
- 127) T.N. Bowmer, *BONDING AND GROUNDING - NESC and OSP*, April 2010.

### **(D-8) Network Evaluation and Materials Reliability Analysis**

- 128) T.N. Bowmer, *Telcordia Proprietary Report*, "*RELIABILITY AND STABILITY ISSUES FOR NON-BLACK PLASTICS EXPOSED TO OUTSIDE ENVIRONMENTS*", September 1995
- 129) T.N. Bowmer, D.M. Henry and P. Devaney, *Telcordia Proprietary Report*, "*NETWORK RELIABILITY IMPROVEMENT PROJECT*", ( This project consisted of a network assessment, trouble rate analysis and audit of methods and procedures for a large international telecommunications company the focus was to benchmark the network performance and develop strategies and pathway to raise the performance up to World Class performance and establish methods and procedure s to lead the company into the future) December 1998.
- 130) T.N. Bowmer, D.M. Henry and E. Gallo, *Telcordia Proprietary Report*, "*PROJECT S----- FOR ---- ----- REHAB STRATEGIES, XDSL SERVICES AND OUTSIDE PLANT*", ( This project consisted of a network assessment, trouble rate analysis and rehabilitation strategies directed at modernizing the current telecommunications network to facilitate the next generation of broadband services.) October 1999.
- 131) T.N. Bowmer, K. Coad, C. March, E. Scerbo and B. Phillips, "*INVESTIGATIONS OF VDSL CABINET ISSUES IN P-----*". (This study involved field performance evaluation, modification of cabinet design, development of functional performance test criteria and new product audit testing for electronic cabinets for VDSL services) July 1999.
- 132) T. Bowmer, "*REVIEW OF THE ORGANIZATIONAL STRUCTURE, Staffing and Size for Information Resources of S----- C- S ---*", August 2000. The S--- C--- S---- subsidiary provides the internal telecommunications services and coordinates the repair/maintenance operations for a large electric power utility. This project reviewed their new business and reorganization plans with a particular focus on the staffing levels and skill levels requirements for repair preventive maintenance service segments.

- 133) Trevor N. Bowmer and Ken Kerpez, "B---- BROADBAND AND RESIDENTIAL WIRING ISSUES FOR DSL SERVICES", December 2000. Inside residential telephone wire is often the best existing media to carry broadband (DSL) signals throughout a home; it is ubiquitous and transceivers for it are inexpensive. However, noise on inside wiring can have high enough power to debilitate broadband digital signals, particularly DSL signals. This report presents analysis of inside residential telephone wire with a focus on noise data collected from around the country and from a selected group of representative B----- residences.
- 134) T.N. Bowmer, D.M. Henry, R. Schubert, J. Peters and M. Ozgur, *Telcordia Proprietary Report*, "NJ D---- FIBER OPTIC NETWORK FEASIBILITY ASSESSMENT PROJECT : PHYSICAL INSPECTION, OUTSIDE PLANT REVIEW AND FIBER OPTIC MEASUREMENTS OF EXISTING NJ---- NETWORK" - July 2004 ,- This project consisted of a network assessment, fiber loss and PMD measurements, physical assessment of facilities, risk management evaluation, - the focus was to benchmark the as-installed network performance and develop strategies and pathway for upgrading network and expanding the network of this governmental agency.
- 135) T.N. Bowmer, J. Peters and M. Ozgur, *Telcordia Proprietary Report*, "NJ D---- FIBER OPTIC NETWORK FEASIBILITY ASSESSMENT PROJECT : SUPPLEMENT COVERING FIBER OPTIC SPAN MEASUREMENTS" - August 2004 -
- 136) T.N. Bowmer, "COPPER LOOP RELIABILITY IN CBB AND IPTV ARCHITECTURES" - November 2, 2005 : This work entailed evaluation of field data, assessment of network architecture and facilities, calculation of FIT rates for individual copper related elements of various network architectures. Reliability and availability estimates were compiled for various network scenarios.
- 137) T.N. Bowmer , "ACOUSTIC NOISE LEVELS" - November 15, 2005 : assessment of acceptable noise levels and normal distribution across population of workers and general public associated with telecommunications equipment in offices and in cabinets in public assessable locations.
- 138) T.N. Bowmer and D.M. Henry, "FIELD PREDICTIONS FOR FREEZE-THAW FAILURE ANALYSIS", April 2006 : This work studied the dynamics and kinetics of freeze thaw behavior in below ground handholes. Correlations with air temperature and kinetics of heat flow into ground and into closures were evaluated as a function of seasonal variations of climate and geographic location.
- 139) T.N. Bowmer and Spilios Makris, "RELIABILITY STANDARDS FOR TELECOMMUNICATIONS EMERGENCY BACKUP POWER SYSTEMS AND EMERGENCY NOTIFICATION SYSTEMS", Issue 1 - December 2007 --- for California Public Utility Commission and Legislative.
- 140) T.N. Bowmer and Spilios Makris, "TECHNOLOGY INVESTIGATIONS · TELECOMMUNICATIONS AND POWER INTERDEPENDENCIES", Issue 1 - December 2007.
- 141) T.N. Bowmer and Dennis M. Henry, Report 8OSPDT - BURIED DUCT NETWORK (BDN) - REVIEW OF CONSTRUCTION, INSTALLATION AND OPERATIONAL ASPECTS ASSOCIATED WITH DEPLOYMENT OF BURIED DUCT NETWORKS FOR UTILITY LINES, Preliminary (Dec. 2008) and Final (May 2009) Reports.
- 142) T.N. Bowmer and R. McCarver, Report GROUNDING SYSTEM DESIGN, CONSTRUCTION, IT IMPLEMENTATION AND MAINTENANCE
- Recommended Grounding Architecture December 2010
  - Test and Measurement Procedures - December 2010
  - Recommended Requirements Design and Inspection - January 2011.
- 143) T.N. Bowmer and W. Rubin, Report 11TELN - CABLE\*\*\*\*\* ACCESS NETWORK ASSESSMENT, November 2011 Reports - (Mexico).
- 144) T.N. Bowmer, Report QNBN - SOHO AND RESIDENTIAL SERVICES INTERNAL CABLING GUIDE, September 2011 Report (Middle East).

### **(D-9) Light Rail Systems, Stray Current Corrosion and Network Impact**

- 145) T.N. Bowmer and D.M. Henry, "STRAY CURRENT AND INDUCED CURRENT ISSUES ASSOCIATED WITH PROPOSED LIGHT RAIL SYSTEM FOR T----", May 2000. This work covered a review of telecommunications plant - central office, as well as underground, buried and aerial outside plant with recommendations for risk mitigation to telecommunications plant from nearby construction and operation of light rail systems.
- 146) T.N. Bowmer, "REVIEW OF STRAY CURRENT MITIGATION GUIDELINES FOR PROPOSED LIGHT RAIL SYSTEM IN T----", Series of reports on structural issues, mitigation procedures and stray current measurement techniques supplied between January and May 2000. Provided network risk assessment for telecommunications

plant along with remedial strategies and operational methods and procedures to limit possible damage from mechanical stress during light rail system construction and stray current corrosion from train operation.

- 147) Trevor Bowmer and John Peters, "STRUCTURAL INTEGRITY, STRAY CURRENT CORROSION AND OTHER RELIABILITY CONCERNS FOR TELECOMMUNICATIONS PLANT RELATED TO THE PROPOSED H- LIGHT RAIL SYSTEM FOR M-----", July 2000. Provided network risk assessment for telecommunications plant along with remedial strategies and operational methods to limit damage. Focus of this study was on the possible mechanical stress and physical damage to underground plant, conduit, manholes and so forth during extensive construction activities associated with excavation and construction activities.
- 148) Trevor Bowmer and Robert Langhage, "ASSESSMENT OF IMPACT OF THE SOUTHEASTERN LIGHT RAIL TRANSIT EXPANSION PROJECT ON Q---- COMMUNICATIONS PLANT-", June 2002. Provided network risk assessment for telecommunications plant along with remedial strategies and operational methods to limit damage from mechanical stress, physical damage and stray current corrosion effects on underground telecommunications plant.

#### **(D-10) Utility Poles**

- 149) T.N. Bowmer and D.M. Henry, EXTREME WEATHER PERFORMANCE" Presentation and on the Organizing Committee for 1999 Workshop on Utility Poles . Environmental Issues, Gainesville FL. Feb. 1999.
- 150) C.J. Wescher, S. Castellano and T.N. Bowmer, *Telcordia Proprietary Report* , "MEASUREMENT OF DIOXIN CONCENTRATIONS IN PENTACHLOROPHENOL TREATED UTILITY POLES: SCREENING FIELD INVESTIGATION" October-November 1999
- 151)T.N. Bowmer and D.M. Henry "POLE ATTACHMENT HARDWARE" December 2004 - covering features of poles, attachment and support hardware with specific analysis of hardware needed for non-wood poles..
- 152)T.N. Bowmer, GR-3159 - GENERIC REQUIREMENTS FOR FIBERGLASS-REINFORCED POLYMER (FRP) UTILITY POLES, Issue 1, December 2007.
- 153)T.N. Bowmer and Dennis M. Henry, WOOD POLE INSPECTION AND TESTING GUIDELINES, August 2007.
- 154)T.N. Bowmer, GR-180 - HARDAWRE ATTACHMENTS FOR STEEL, CONCRETE AND FIBERGLASS POLES, Issue 1, May 2008.
- 155)T.N. Bowmer, POLE INSPECTION AND STRENGTH GUIDANCE, June 2010
- 156)T.N. Bowmer, GR-60 - GENERIC REQUIREMENTS FOR WOODEN UTILITY POLES, Issue 1, Nov 2011.
- 157)T.N. Bowmer, GR-3159 - GENERIC REQUIREMENTS FOR FIBER-REINFORCED COMPOSITE (FRC), CONCRETE, and STEEL UTILITY POLES, Issue 2, January 2012.

#### **(D-11) Product Analysis**

- 158) T.N. Bowmer, *Telcordia Proprietary Report*, "CHANNEL BANK CONNECTORS FOR X-----: A STUDY OF POLY(BUTYLENE TEREPHTHALATE) - POLYCARBONATE BLENDS" May 1985
- 159) T.N. Bowmer and G. Hull, "THERMAL ANALYSIS OF MAGNETIC TAPES", *Proceedings of 16th Annual Conference of North American Thermal Analysis Society* (Washington, D.C.) p 246 (1987)
- 160) T.N. Bowmer, G. Hull and I.M. Plitz, "CHARACTERIZATION AND HYDROLYSIS OF MAGNETIC TAPES", *ACS Symposium Series 'Polymers in Information Storage'*, .p 331, 1990 (Plenum Press).
- 161)T.N. Bowmer Throughout 2001-2002, thirty (30) individual proprietary product analysis reports were prepared covering telecommunications power cables, data and interconnection coaxial and inside cables, outside plant terminal blocks, Building Entrance Terminals (BETs), surge protectors, and electronic equipment cabinets.
- 162) T.N. Bowmer and R. Schubert, "EVALUATION OF THE BRIDGE STREET BRIDGE CONDUIT", May 2002. : Assessment of conduit performance during fire, material damage and contributing factors to fire spread.
- 163) T.N. Bowmer, "MATERIAL ANALYSIS OF FLOOR CLEANERS, STRIPPERS, SEALERS AND FINISHES", March 2003 : Effect of floor cleaner components in reference to their contamination (through surface and air transmittal) of air filtration and drying apparatus associated with telecommunications facilities.
- 164) T.N. Bowmer, "SHORT-CIRCUIT AND MATERIAL ANALYSIS OF THE A--- I-- SWITCH EQUIPMENT SHELF", April 2003. This report covers the short-circuit and material analysis of a switch equipment shelf;

including its plug-in board units, chassis, cooling systems and alarm control units. The material analysis was focused on the Fire Fuel Load present in the individual components and the entire shelf. The short-circuit test was focused on the requirements of GR-1089.

- 165) T.N. Bowmer, "MATERIAL ANALYSIS OF TIMESAVER ULTRA HIGH SOLIDS FLOOR FINISH", June 2004
- 166) T.N. Bowmer, TB-2KRCO2-1 - ANALYSIS OF KRONE OUTDOOR BUILDING ENTRANCE TERMINAL PRODUCT TO SECTIONS 4.6, 4.7 AND 4.13 OF TEELCORDIA TR-NWT-000937, January 2003.
- 167) T.N. Bowmer, DA-1302 Issue 1: "PRODUCT ANALYSIS OF KRONE/ADC BET PRODUCTS TO REQUIREMENTS OF TR-937", - December 2004.
- 168) T.N. Bowmer, DA-928, Volume 2, Issue 1, "COMPRESSION, ABRASION & COLD FLOW TESTING OF THE COBRA WIRE & CABLE INC., COP-FLEX 2000 CENTRAL OFFICE POWER CABLE" - Feb. 2005
- 169) T.N. Bowmer, DA-1232, Volume 1, Issue 2 - "FEATURES, FUNCTIONS AND PERFORMANCE ANALYSIS OF GENERAL CABLE INDUSTRIES ENERGYGUARD CENTRAL OFFICE POWER CABLE", April 2005
- 170) T.N. Bowmer, DA-1302, Issue 2 "FEATURES, FUNCTIONS, AND PERFORMANCE ANALYSIS OF THE KRONE INCORPORATED BUILDING ENTRANCE TERMINAL PRODUCT PORTFOLIO - OUTDOOR AND INDOOR BET PRODUCT FAMILIES" - April 2006 - dated October 2003
- 171) T.N. Bowmer, "ANALYSIS OF ROOFING MEMBRANE MATERIAL" - January 23<sup>rd</sup> 2006
- 172) T.N. Bowmer, DA-1533, Issue 3 - "FEATURES, FUNCTIONS AND PERFORMANCE ANALYSIS OF TYCO ELECTRONICS NPT FAMILY OF INDOOR AND OUTDOOR BUILDING ENTRANCE TERMINALS (BETs)", February 2006.
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- 176) T.N. Bowmer, TB-7MULT1-051407 - RESULTS OF IMPACT AND COMPRESSION TESTS FOR MULTILINK RACEWAYS AND MOLDED PARTS TO CUSTOMIZED TEST PROGRAM BASED ON GR-3126, May 2007.
- 177) T.N. Bowmer, DA-1737, FEATURES, FUNCTIONS AND PERFORMANCE ANALYSIS OF TYCO ELECTRONICS CORPORATION JACKMOON COUPLER PRODUCTS AND ACCESSORIES, Issue 1, 2007.
- 178) T.N. Bowmer, DA-1706, DISTRIBUTABLE ANALYSIS REPORT FOR DURA-LINE MICRODCUT FOR FIBER OPTIC CABLES TESTED TO TP-3155 REQUIREMENTS, Issue 1, October 2007.
- 179) T.N. Bowmer, DA-1232, FEATURES, FUNCTIONS AND PERFORMANCE ANALYSIS OF GENERAL CABLE INDUSTRIES ENERGYGUARD TELECOMMUNICATIONS AND CENTRAL OFFICE POWER CABLES, Issue 3, June 2008.
- 180) T.N. Bowmer and E. Gallo, REVIEW OF SALT-FOG TESTING OF GROUNDING AND BONDING BUS BAR FOR OUTSIDE PLANT APPLICATIONS, April 2009.
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- 182) T.N. Bowmer and M. Ozgur, DA-1706, DISTRIBUTABLE ANALYSIS REPORT FOR DURA-LINE MICRODCUT FOR FIBER OPTIC CABLES TESTED TO TP-3155 REQUIREMENTS, Issue 2 updated and expanded to include conduit product with cable placed inside during manufacture, September 2008.
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- 184) T.N. Bowmer, TB-9TYF25-, UV RESISTANCE OF T----- SPLICE CASE MATERIALS TESTED AGAINST GR-771 REQUIREMENTS, May 2010.
- 185) T.N. Bowmer, DA-1885 DURALINE FUTUREPATH MICRODUCT PRODUCT ANALYSIS TO GR-3155 and GR-356 June 2010.
- 186) T.N. Bowmer, TB-0EN874, STRESS CORROSION SUSCEPTIBILITY OF E\*\*\*\*\* PROTECTORS TESTED AGAINST GR-974 REQUIREMENTS, July 2010.

- 187) T.N. Bowmer, DA-1844, FEATURES, FUNCTIONS AND PERFORMANCE ANALYSIS OF MITCHELL INDUSTRIES GALVANIZED STEEL STRAND, Issue 1 (March 2010) and Issue 2 (July 2010).
- 188) T.N. Bowmer, DA-1911, FEATURES, FUNCTIONS AND PERFORMANCE ANALYSIS OF ROCKBESTOS SURPRENANT CABLE CORPORATION TELECOMMUNICATIONS POWER CABLES, Issue 1 (September 2010) and Issue 2 (November 2010).
-

July 8, 2016

**VIA HAND DELIVERY**

Ingrid Ferrell  
Executive Secretary  
Public Service Commission  
P.O. Box 812  
Charleston, WV 25323

02:10 PM JUL 08 2016 PSC EXEC SI

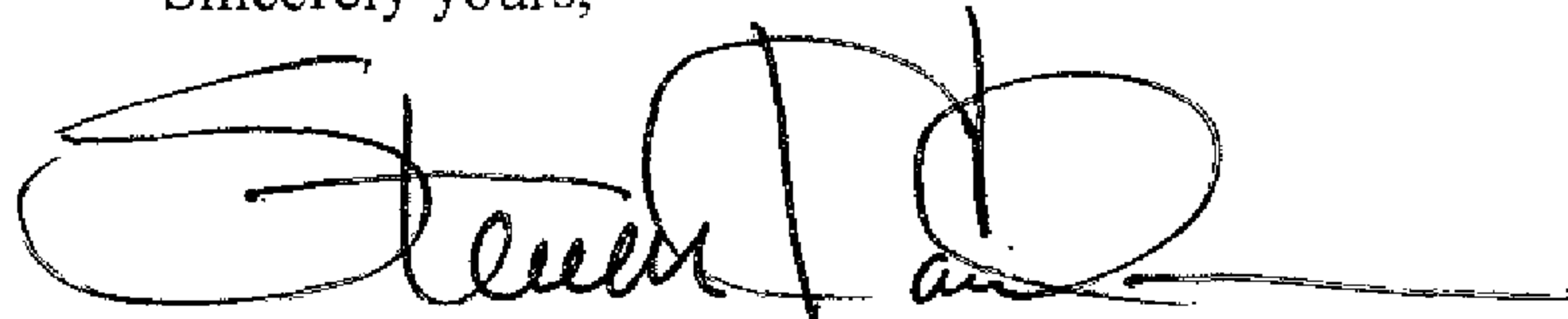
Re: GENERAL ORDER NO. 187.48  
In the matter of a proceeding for the adoption of  
Rules Governing Telephone Conduit Occupancy,  
150 C.S.R. Series 37.

Dear Ms. Ferrell:

Enclosed for filing on behalf of Lumos Networks LLC and Lumos Networks of West Virginia Inc. in the above-captioned proceeding, please find the original and twelve (12) copies of the **“Initial Comments of Lumos Networks”**.

If you have any questions, please feel free to contact me at your earliest convenience.

Sincerely yours,



STEVEN HAMULA (SB # 4580)  
Director of Regulatory Affairs  
Lumos Networks LLC & Lumos Networks of West  
Virginia Inc.

SH/s

Enclosure

THE PUBLIC SERVICE COMMISSION  
OF WEST VIRGINIA  
CHARLESTON

GENERAL ORDER NO. 187.48

In the matter of a proceeding for the adoption of  
Rules Governing Telephone Conduit Occupancy,  
150 C.S.R. Series 37.

**INITIAL COMMENTS OF LUMOS NETWORKS**

**I. Introduction**

Lumos Networks, LLC and Lumos Networks of West Virginia Inc. (collectively “Lumos”), by counsel, respectfully files these initial comments on the proposed Rules Governing Telephone Conduit Occupancy (“Conduit Occupancy Rules”) issued pursuant to the Commission Order of June 7, 2016 in the above-captioned proceeding. Overall, Lumos believes the Commission has done an excellent job in crafting rules relative to the occupancy of customer provided conduit in three important respects. First, the Commission’s Conduit Occupancy Rules will improve ease of access to customer provided conduit; second, the Commission’s Conduit Occupancy Rules will promote efficient utilization and occupancy of customer provided conduit; and third, and perhaps most importantly, the Commission’s Conduit Occupancy Rules should reduce the frequency of future disputes among competing service providers regarding access and occupancy of customer provided conduit. The foregoing notwithstanding, Lumos believes the Commission’s Conduit Occupancy Rules can be improved upon with some minor modifications, which are reflected on the attached Exhibit A.

## II. Background

In order to adequately provide telecommunications service to a prospective customer, Lumos is oftentimes required to access customer provided conduit. In Lumos' experience, this customer provided conduit is normally utilized to enter and traverse a building or other commercial enterprise in order to install cable facilities necessary to deliver telecommunications service to a customer(s) located within that building. Although accessing and occupying customer provided conduit is not generally problematic, especially where Lumos is attempting to do so with the express permission of the underlying customer, that is unfortunately not the case in every situation. Indeed, Lumos has to date encountered numerous operational difficulties in which Lumos' access to and/or occupancy of customer provided conduit was challenged by Frontier West Virginia Inc. ("Frontier").

In the past, Frontier has asserted that certain provisions contained in its General Services Tariff No. 203<sup>1</sup> gives it exclusive use of and/or management control of customer provided conduit, and as a result, Frontier has on various occasions issued "unauthorized occupancy" claims against Lumos, even in situations in which Lumos had been the only occupant of the customer provided conduit and had been so for a number of years. In order to remedy these alleged "unauthorized occupancy" claims, Frontier notifies Lumos that it must remove the occupying Lumos facilities from the involved customer provided conduit thereby necessitating an interruption of service to the customer(s) being served by those facilities to enable Frontier to use the customer provided conduit for its own purposes. After Frontier has completed its own facility installation, Lumos is then

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<sup>1</sup> See, Frontier West Virginia Inc., General Services Tariff P.S.C.-W.Va.-No. 203, Section 2, Original Page 2, B.1.f and Original Page 2.a, B.1.j.

permitted to reinstall its facilities in the customer provided conduit, provided space is still deemed to be available. To further exacerbate the situation, Frontier has also demanded that Lumos pay Frontier conduit rental charges on both a historical and going forward basis for continued use of the customer provided conduit.

In the majority of these historical customer provided conduit disputes involving Frontier, the initial placement of Lumos' cable facilities was accomplished in good faith and with the permission of the underlying customer/property owner, which has raised yet another point of contention between Lumos and Frontier. In the situations involving Frontier's assertion of unauthorized occupancy by Lumos in customer provided conduit, Lumos found that the involved property owner/customer normally had no actual knowledge of either Frontier's tariff provisions or of Frontier's rather strident interpretation of those tariff provisions relative to the installation of facilities within the customer provided conduit. Nevertheless, it has been Frontier's view that any customer provided conduit was subject to exclusive use, management, and control by Frontier regardless of whether Frontier had facilities in or had previously used this conduit. Lumos submits that such a view is at best illogical, and at worst anti-competitive in the manner in which Frontier has endeavored to enforce it.

### **III. Senate Bill 678**

It was against this backdrop of customer provided conduit access and occupancy disputes in West Virginia primarily involving Frontier that Senate Bill 678 ("SB 678") was introduced in the West Virginia Legislature (the "Legislature"). Following its introduction, SB 678 was expeditiously considered and passed on a nearly unanimous

basis in both houses of the Legislature, was signed by Governor Tomblin, and subsequently took effect 90-days from passage on June 6, 2016.

Among other things, SB 678 made clear that no telecommunications public utility, by either contract or service tariff, could require that customer provided conduit be used or controlled exclusively for use by any single telecommunications public utility. In addition, SB 678 expressly stated that any customer who provided such conduit was in fact the owner of said conduit, which hopefully puts at an end to Frontier's continued reliance upon the provisions contained in General Services Tariff No. 203 to justify its assertion of exclusivity and/or control of customer provided conduit, and more importantly, the manner such customer provided conduit is accessed and utilized by other competitive service providers.

Finally, SB 678 directed the Commission to promulgate rules necessary to effectuate the purposes of this legislation. This in turn resulted in the Commission issuing General Order No. 187.48, which permitted the filing of comments on the Commission's proposed Conduit Occupancy Rules by interested parties.

**IV. The Proposed Rules Promulgated by the Commission, including §150.37-4, Best Practices, are Necessary to Successfully Implement SB 678**

While the Commission has done an admirable job covering the essential aspects of SB 678 in its Conduit Occupancy Rules, Lumos submits that the most important element of the proposed rules relates to the establishment of best practices to be utilized by all telecommunications providers seeking access to and occupancy of customer provided conduit. Indeed, Lumos respectfully submits that the establishment of universally utilized best practices will foster and promote the efficient utilization of

customer provided conduit, which in many competitive situations is a scarce commodity. Accordingly, the continued inclusion of best practices within the proposed Conduit Occupancy Rules is of critical importance and must not be abandoned when the Commission issues its final version of these rules. Without the inclusion of these best practices, there remains the very real possibility that many of the obstacles encountered historically by Lumos regarding timely and reasonable access to and occupancy of customer provided conduit will continue despite the passage of SB 678.

As noted at the outset of these comments, the Commission has done an excellent job of incorporating recommended best practices into its proposed Conduit Occupancy Rules. However, Lumos is of the opinion that the currently proposed best practices can be improved upon, and its recommended modifications to the proposed Conduit Occupancy Rules, including those pertaining to the best practices, are reflected on Exhibit A. For example, Lumos believes that the provision of a definition for customer provided conduit is necessary in order to distinguish customer provided conduit from a service provider's conduit system. Accordingly, Lumos has proposed what it believes to be an appropriate definition for customer provided conduit consistent with the intent of SB 678, and has also proffered a recommended definition for a duct.

Similarly, Lumos submits that it is critically important for these best practices to make clear that no artificial transition or demarcation points between riser poles and entrance points into customer provided conduit should be placed by any service provider that can be used to intentionally block or inhibit reasonable access to customer provided conduit by competing service providers. Instead, the proposed best practices should require the placement of a pull box at the designated entrance point of the customer

provided conduit that can be utilized and shared on a universal basis by all service providers requiring access to the customer provided conduit.

Further, Lumos believes it is critically important for the initial installation of facilities into customer provided conduit to be simultaneously accompanied by the placement of appropriate inner-duct so that additional pathways are created for future use by more than one service provider. Without this requirement, one service provider could conceivably occupy the entirety of customer provided conduit, especially one initially lacking adequate inner-duct, simply through the placement of a single cable facility, and then relying upon the occupancy of this single cable facility to deny access to a competing service provider(s) on the basis that the placement of the new service provider's facility might potentially damage the current service provider's cable facility.

Because customer provided conduit is such a valuable and oftentimes scarce commodity in buildings and other commercial locations, cable or other service facilities belonging to the same service provider should be installed and maintained within the same duct within customer provided conduit whenever feasible. Likewise, service providers should reasonably allow shared cable installations in common ducts and inner-ducts within customer provided conduit where duct access and occupancy is restricted or limited by available capacity. The adoption of these best practices will go a long way toward ensuring that customer provided conduit is being utilized as efficiently and effectively as possible.

Finally, there must be a swift and effective enforcement process in the case of a dispute concerning access to customer provided conduit. In Lumos' experience, these disputes arise when we are constructing the "last mile" of network for a new customer to

whom Lumos has sold telecommunications services. If a dispute arises regarding access to or occupancy of customer provided conduit, the installation of service is delayed to the detriment of the customer. Therefore, Lumos urges the Commission to adopt a procedure aimed at quickly resolving disagreements between service providers about these new rules.

**V. Conclusion**

Based upon the limited competitive choices available to West Virginia customers today, it is imperative that the Commission take action to assure that prospective customers located in a building or other multi-tenant commercial property have access to the telecommunications service provider of their choice. As the history of the telecommunications industry in West Virginia demonstrates, competition brings about more advantageous pricing, technology and services that improve the way West Virginians live, work and communicate. In order to open a telecommunications market traditionally mired in the grip of incumbent monopoly providers, the Commission must avail itself of every opportunity to affirmatively establish fair rules and guidelines to ensure the continued viability of competitive service providers.

Today, unequal access to customer provided conduit is a significant obstacle to true local competition in West Virginia. As discussed hereinabove, Lumos has historically faced numerous operational impediments while attempting to serve prospective customers that it is technically capable of reaching due to restrictions imposed by Frontier on access to and occupancy of customer provided conduit. Therefore, the final adoption of these Conduit Occupancy Rules as modified, including the industry best practices, is vital to establishing open and nondiscriminatory access to

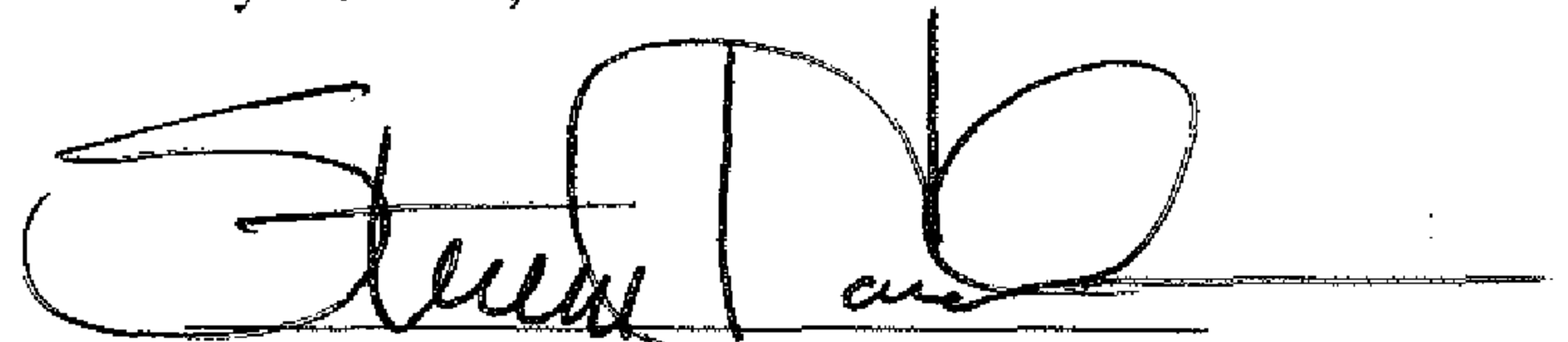
customer provided conduit, will foster telecommunications competition, and will ensure that prospective customers have timely access to their telecommunications service provider of choice.

**WHEREFORE**, for all of the foregoing reasons, Lumos Networks LLC and Lumos Networks of West Virginia Inc. respectfully request that the Commission adopt the proposed Conduit Occupancy Rules, as modified and reflected on Exhibit A hereto, consistent with these initial comments.

Respectfully submitted this 8<sup>th</sup> day of July, 2016.

Lumos Networks LLC and Lumos  
Networks of West Virginia Inc.

By Counsel,

A handwritten signature in black ink, appearing to read "Steven Hamula", written over a horizontal line.

Steven Hamula, Esquire (SB # 4580)  
1200 Greenbrier Street  
Charleston, WV 25311

Tele: (304) 720-2159

Fax: (304) 720-2121

E-mail: [hamulas@lumosnet.com](mailto:hamulas@lumosnet.com)

15OCSR37

TITLE 150

LEGISLATIVE RULE

PUBLIC SERVICE COMMISSION

SERIES 37

RULES GOVERNING TELEPHONE CONDUIT OCCUPANCY

§150-37-1. General,

1.1. Scope. -- These rules are promulgated to effectuate W. Va. Code §24-2E-3.

1.2. Authority. -- W. Va. Code §24-2E-3, 24-1-7, 24-2-1 and 24-2-6

1.3. Filing Date. -- , 2016

1.4. Effective Date. -- -, 2016.

1.5. Sunset date. This rule will sunset five years after the effective date, unless otherwise extended pursuant to W. Va. Code §29A-3-19.

§150-37-2. Definitions.

2.1. "Conduit" - A tube structure containing one or more ducts or inner-ducts used to house cables.

2.2. "Commission" -- The Public Service Commission of West Virginia.

2.3. "Customer" -- Any person, firm, partnership, corporation, municipality, cooperative, organization, governmental agency, etc., who purchases telecommunications services from a telephone company.

2.4. "Customer Provided Conduit" -- Conduit and related appurtenances either installed by or on behalf of a Customer at the Customer's expense on real property either owned, managed or administered by the Customer for purposes of installing wires, cable, facilities, and associated equipment relative to the provision of telecommunications services.

2.5 "Duct" -- A single enclosed raceway for conductors, cable, and/or wire.

2.64. "Inner-ducts" - A duct contained within another duct.

2.75. "Intercept" - A cable inserted into conduit between conduit end points.

2.86. "Service Provider" - A customer, telephone public utility, telephone company or any other entity that occupies, or desires to occupy, conduit or underground construction that provides service by a telephone public utility and that has been provided at the customer's expense.

2.97. "Telephone Company" or "Telephone Public Utility" -- Any provider of telecommunications services to the public under the jurisdiction of the Commission.

§150-37-3. Telephone Conduit Occupancy.

3.1. Prohibition and Ownership.

a. A telephone public utility may not prohibit, either by contract or service tariff, a customer who has provided conduit or other underground construction at the customer's expense from using the conduit or other underground construction for purposes other than the services provided by the telephone company. A customer who provides the conduit or underground construction is the owner of that apparatus.

b. A telephone public utility or other service provider shall not be permitted to exercise management, oversight or administrative authority relative to access, occupancy and utilization of Customer Provided Conduit.

c. A telephone public utility or other service provider shall not be permitted to unilaterally reserve space within Customer Provided Conduit.

d. Unoccupied Duct and/or Inner-duct space within Customer Provided Conduit is presumed available for use by all telephone public utilities and/or service providers with the consent of the Customer.

3.2. Compliance with Standards, Practices, Rules and Orders.

a. A customer and all occupants of conduit or other underground apparatus shall comply with the rules, regulations and orders of the Commission, the National Electrical Safety Code, the National Electric Code, the Telcordia - Blue Book, Manual of Construction Procedures, the rules and regulations of the Occupational Safety and Health Act and any other lawful and applicable federal or state laws, rules, regulations and orders.

b. No customer, telephone public utility, telephone company or other occupant of any conduit or other underground apparatus may prohibit, prevent or interfere with the compliance of any person with its obligations under the rules, regulations and orders of this Commission, including without limitation any obligation as a carrier of last resort.

§150-37-4. Best Practices.

4.1. Coordination of activities of ~~of~~ among multiple service providers.

The use of Customer Provided ~~-owned~~ Conduit may require the involvement of more than one service provider. When multiple service providers are involved in the accessing and occupancy of Customer Provided Conduit, the coordination of their activities should be guided by the best practices of the industry, as set forth below:

- a. Intercepts should be allowed and standardized with the use of conduit saddles.
- b. Pedestal placements should allow ready access of conduits and ducts.

c. Legacy ~~non-standard~~ intercept installations should be maintained as is unless damage to facilities as a direct result of these installations is proven imminent or the conduit owner requests changes to the insertion methodology.

d. ~~Companies~~ Telephone public utilities and other service providers should reasonably allow shared cable installations in common ducts and inner-ducts where duct access and occupancy is restricted or limited by available capacity.

e. Dead cables that consume capacity in Customer Provided-owned Conduit should be extracted in a reasonably expeditious manner when requested by the customer at no cost to the customer.

f. The physical access paths into buildings should be considered to determine whether plant assets may be consolidated and ensure that scarce access capacities are efficiently used.

g. Initial and subsequent installations into new Customer Provided-owned Conduit should use inner-ducts whenever feasible.

h. Customer Provided-owned Conduit should have a common access point to facilitate the customer's receipt of service from multiple Service Providers. The common access may be provided in various ways, including:

(i) Placement of a pull box that may be shared by multiple Service Providers

(a) When possible, the pull box should be placed by the customer contractor at the entrance point of the Customer Provided Conduit when the Customer Provided-owned Conduit is installed.

(b) A pull box also may be placed at the entrance point of the Customer Provided Conduit by the initial installing Service Provider.

(ii) Installation of a conduit Y fitting with conduit stubbed up such that multiple Service Providers can access the Customer Provided-owned Conduit on the open stub.

i. A Service Provider ~~shall~~ should not bill another service provider for access to or occupancy of Customer Provided -owned Conduit.

j. ~~A transition demark between riser poles and entry points into customer-owned conduit is not necessary.~~ A telephone public utility or other service provider shall not intentionally block or inhibit access to Customer Provided Conduit through the placement of pedestals or other facilities intended to establish an artificial transition or demarcation point between riser poles and entrance points into Customer Provided Conduit.

k. Upon request by the customer, a telephone public utility or other service providers shall examine and report the status of their existing entrance paths into Customer Provided Conduit in a reasonably expeditious manner.

l. Whenever technically feasible, a telephone public utility or other service providers shall consolidate and/or minimize entrance points into Customer Provided Conduit.

m. The preferred facility entrance and exit points for Customer Provided Conduit shall be at established openings, which shall include building entrances or points at which cable enters the Customer Provided Conduit, including stubbed-off ducts and preformed lateral knockouts.

n. If the preferred facility entrance or exit point is not available, intercepts (cable insertion between conduit end points) may be created and utilized with the express permission of the customer. Whenever possible, such intercepts should be standardized through the use of industry standard conduit saddles.

o. Telecommunications or other service provider facilities owned or belonging to the same entity shall be installed and maintained within the same duct within Customer Provided Conduit whenever feasible.

✓

The Law Office of Vincent Trivelli, PLLC  
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By fax and U.S. Mail

July 8, 2016

Ms. Ingrid Ferrell, Executive Secretary  
Public Service Commission of West Virginia  
P. O. Box 812  
201 Brooks Street  
Charleston, WV 25323

03:09 PM JUL 11 2016 PSC EXEC SR

RE: General Order No. 187.48

Dear Ms. Ferrell:

I am writing on behalf of Communications Workers of America, AFL-CIO (CWA) regarding the above-detailed Order. Please consider this correspondence as CWA's Initial Comments.

The CWA appreciates this opportunity to comment on the proposed Rules Governing Telephone Conduit Occupancy. CWA has significant concerns regarding these rules. Simply put, the proposed Rules leave many unanswered issues and questions regarding the implementation of SB 678. These unanswered issues and questions include issues of safety and service quality, such as:

- The intercept practice can cause damage to existing cables including high voltage cables and cables under pressure causing data and signal loss;
- The importance of insuring that fireproof sealants and grounding are not damaged and left ineffective;
- The impact of leaving or damaging exposed splices;
- The importance of maintaining separation within the conduit and issues related to the tying in the new conduit cable into existing networks; and
- Setting requirements for new cable and conduit to ease future usage;

In addition there are issues of how the ownership of older conduits is determined, the definition of "other underground construction" and a process for correcting cables damaged under this new statute.

These and other issues are critical to the safe implementation of SB 678 and these new regulations. The CWA urges the PSC to suspend these proposed rules – as well as the upcoming hearing on these proposals - and to hold a series of stakeholder meetings to discuss and attempt to resolve the many important issues involved in implementation.

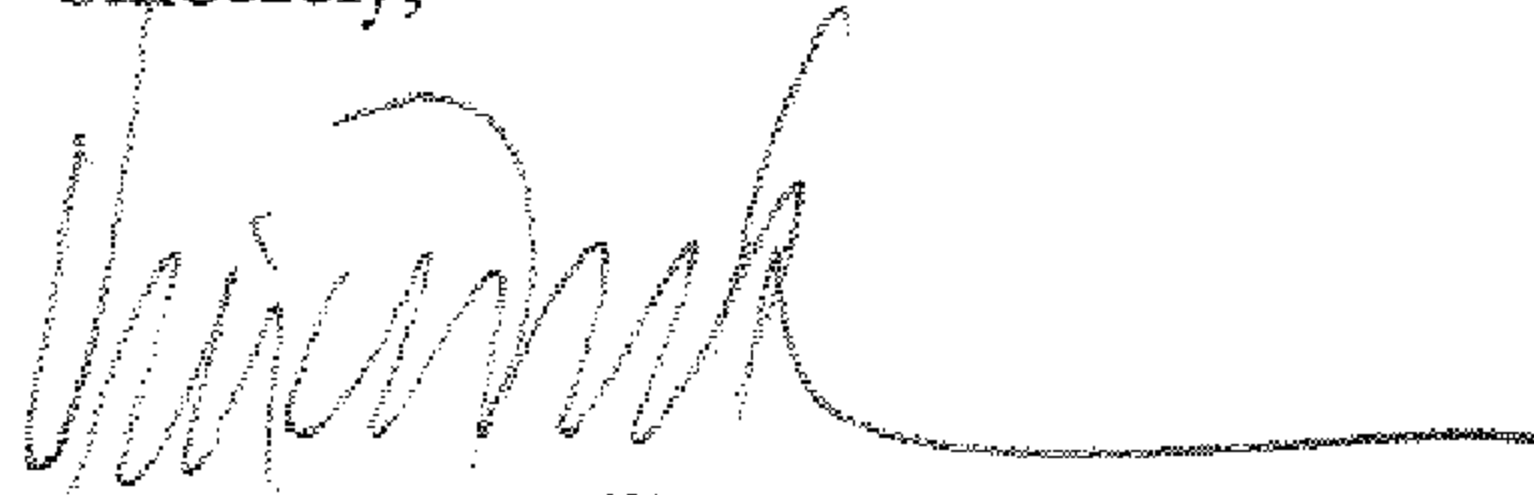


03:10 PM JUL 11 2016 FSC EXEL SE

Once again, I appreciate the opportunity to comment on these important matters. If you have any questions, please feel free to contact me at (304) 291-5223.

Thank you.

Sincerely,

A handwritten signature in black ink, appearing to read 'Vincent Trivelli', with a long horizontal flourish extending to the right.

Vincent Trivelli

West Virginia Bar #8015



JOSEPH J. STARSICK, JR.  
Associate General Counsel  
Frontier Communications  
1500 MacCorkle Ave., S.E.  
Charleston, West Virginia 25396  
(304) 344-7644  
[Joseph.Starsick@FTR.com](mailto:Joseph.Starsick@FTR.com)

July 15, 2016

Ingrid Ferrell  
Executive Secretary  
Public Service Commission of West Virginia  
201 Brooks Street  
Charleston, WV 25301

03:47 PM JUL 15 2016 PSC EXEC SERV

**Re: General Order No. 187.48  
In the matter of a proceeding for the adoption  
of Rules Governing Telephone Conduit Occupancy,  
150 C.S.R. Series 37.**

Dear Ms. Ferrell:

Please find enclosed for filing in the original plus 12 copies of the **Reply Comments On Behalf Of Frontier West Virginia Inc. and Citizens Telecommunications Company of West Virginia d/b/a Frontier Communications of West Virginia** in the above-referenced matter.

Thank you for your attention to this matter.

Sincerely,

  
Joseph J. Starsick, Jr.  
(WV State Bar #3576)

JJSjr/sc  
Enclosure

**PUBLIC SERVICE COMMISSION  
OF WEST VIRGINIA  
CHARLESTON**

**GENERAL ORDER NO. 187.48**

**In the matter of a proceeding for the adoption  
of Rules Governing Telephone Conduit Occupancy,  
150 C.S.R. Series 37.**

**REPLY COMMENTS ON BEHALF OF FRONTIER WEST VIRGINIA INC. AND  
CITIZENS TELECOMMUNICATIONS COMPANY OF WEST VIRGINIA D/B/A  
FRONTIER COMMUNICATIONS OF WEST VIRGINIA**

Frontier West Virginia Inc. and Citizens Telecommunications Company of West Virginia d/b/a Frontier Communications of West Virginia (“Frontier”) hereby submit these Reply Comments.

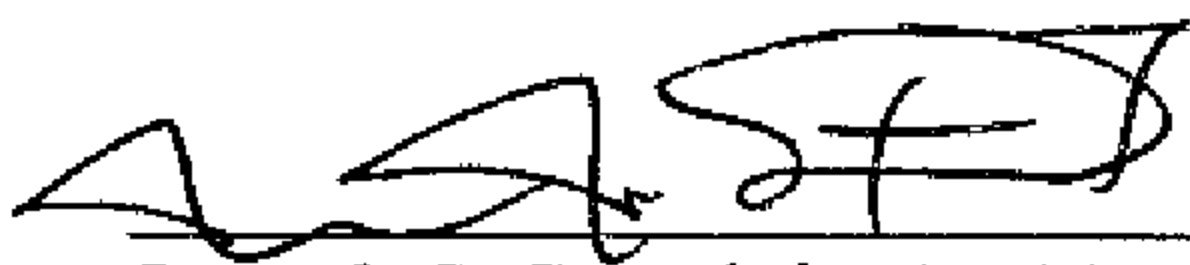
Attached is the Supplementary Expert Report of Trevor Bowmer, Ph.D. Dr. Bowmer’s supplementary comments and opinions are based on his expert knowledge and experience as (a) a member of 5 of the 7 technical subcommittees that develop the National Electrical Safety Code (NESC) as well as the Main Committee of the NESC; (b) a member of CMP5 (Grounding) and CMP16 (Communications) of the National Electrical Code (NEC); and (c) the author of the Manual of Construction Procedures (Telcordia - Blue Book) – SR-1421, Issue 5 (2011). *See* Report, p. 1. Among other things, he expands on certain points raised by the Communications Workers of America. In addition to his expert advice to the Commission, Dr. Bowmer has provided an easy-to-follow redlined version of his recommended edits to the proposed rules.

By contrast, Lumos’ so-called “best practices” seem virtually drawn out of thin air, with virtually no authority cited whatsoever in support of them, whether grounded in written standards or in general industry practice, and seemingly offered simply to favor how Lumos apparently

would prefer to operate. However, both Senate Bill 678 and the Commission's existing rules require that generally accepted industry standards and practices be followed. Dr. Bowmer explains in detail how Lumos' proposals fall short of that mark.

Lumos also casts false aspersions upon Frontier, suggesting that Frontier somewhere, somehow, perhaps, might have been allegedly, supposedly "anti-competitive" in the past. This is nonsense. To the contrary, if the Commission wanted to expand the nature of this proceeding to consider Lumos' supposed grievances, whatever they may or may not be, it also should consider Frontier's. Frontier easily could list numerous very specific instances where Lumos has violated safety and industry practices, damaged Frontier facilities, and engaged in other unsafe or non-standard acts and practices. But any such complaints by carriers against one another are for another proceeding.

Frontier's desire has been that any conduit initially provided by customers for Frontier's use continue to be used by all companies in a responsible manner, since it would have been only too easy for third parties to blame Frontier should something go wrong. Now that the Legislature has placed that burden on the Commission's shoulders, Frontier is confident that the Commission will ensure that all carriers using customer-provided conduit will do so in a responsible and safe manner, as Senate Bill 678 requires.



---

Joseph J. Starsick, Jr. (WV State Bar #3576)  
Associate General Counsel  
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(304) 344-7644  
[Joseph.Starsick@FTR.com](mailto:Joseph.Starsick@FTR.com)

**Trevor Bowmer, Ph.D.**  
Ericsson (Telcordia)  
Senior Analyst  
444 Hoes Lane  
Piscataway  
NJ 08854

**Date : July 14<sup>th</sup> 2016**

**Subject: Supplementary Expert Report of Trevor Bowmer  
Concerning “Customer-Owned Conduit” and West Virginia 150.CSR.37**

---

**Materials Reviewed and Referenced:**

- [1] Alpha Technologies Initial Comments (June 15<sup>th</sup> 2016).
  - [2] CWA Initial Comments from Law Office of Vincent Trivelli (July 8<sup>th</sup> 2016).
  - [3] Staff Initial Comments from Christopher Howard (July 7<sup>th</sup> 2016).
  - [4] Lumos Networks Initial Comments from Steven Hamula (July 8<sup>th</sup> 2016)
  - [5] Frontier West Virginia Initial comments from Joseph Starsick (July 8<sup>th</sup> 2016) with
    - a. Expert Report by Trevor Bowmer (7<sup>th</sup> July 2016) attached.
  - [6] Public Service Commission General Order 187.48 (June 7<sup>th</sup> 2016) with two exhibits
    - a. West Virginia Legislature - Senate Bill 678 attached.
    - b. Title 150 Series 37 “Rules Governing Telephone Conduit Occupancy” attached.
  - [7] NESC - IEEE C2 - National Electrical Safety Code – In general and Part 3, Sections 30, 31, 32, 35 and 36 in particular – which covers outside plant facilities of power and communications companies (2012 and 2017 editions).
  - [8] Manual of Construction Procedures (Blue Book) – SR-1421, Issue 5 (2011) – Industry construction guidelines for communications lines and equipment.
  - [9] NFPA 70 - National Electrical Code (NEC) – and its communications Chapter 8 and Article 770 that covers the installation aspects of the connections to the customer premises (2014).
  - [10] GR-1275-CORE, *Central Office/Network Environment Equipment Installation/Removal* - Telcordia Generic Requirements, Issue 12 (2010).
- 

The following responses are made to the Initial Comments (Materials #1 to #4 above) received on the General Order 187.48 of the Public Service Commission of West Virginia and its proposed Title 150 Series 37 entitled “*Rules Governing Telephone Conduit Occupancy*”.

I have reviewed these Initial Comments (Materials #1 to #4) received on July 11<sup>th</sup> 2016. As a result of this review, I have not modified any of my expert opinions set forth in my original Expert Report dated July 7<sup>th</sup> 2016 (Material #5a).

These supplementary comments and opinions are based on my expert knowledge and experience on being (a) a member of 5 of the 7 technical subcommittees that develop the National Electrical Safety Code (NESC) as well as the Main Committee of the NESC, (b) a member of CMP5 (Grounding) and CMP16 (Communications) the National Electrical Code (NEC), and (c) the author of the Manual of Construction Procedures (Telcordia - Blue Book) – SR-1421, Issue 5 (2011).

**Response to Alpha Technologies Initial Comments (June 15<sup>th</sup> 2016).**

The supportive statement by Alpha technologies for the order “as written” ignores the operational and design issues associated with the undefined “intercept” construction and procedures referenced in the draft Rules - See detailed comments and recommendation in my Expert Report dated July 7<sup>th</sup> 2016.

**Responses to CWA Initial Comments (July 8<sup>th</sup> 2016).**

I agree with the concerns raised by the CWA Initial Comments and would refer to my Expert Report (Material #5a) for more detailed discussions of each of these concerns.

I agree with the CWA comments and concerns about the conduit ownership and the need for a clear process for repairing any damage to the installed cable in the conduit by the actions during the “intercept” and cable installation methods.

The ownership of a conduit does not and should not extend to the cable inside the conduit. The rights and responsibilities of the interested and all affected parties need to be better defined. These parties include –

- **Customer** who provides (and owns) conduit – The customer could include not only the building or property owner but also would include persons or companies renting space inside a building.
- **Current service provider** who owns and operates the already installed cable in the occupied conduit. The current provider is the first occupant of the conduit and not necessarily the traditional incumbent provider for the area.
- **New service provider** to the customer who wishes to install a new cable into the occupied conduit.
- **Utility pole owners** in the case where customer-provided conduit is attached as a vertical riser to connect with the aerial network plant of the service provider.

I further agree with the CWA that there are additional bonding and grounding concerns for the installation work being proposed via this “intercept” process and during the placement of a cable in an occupied conduit. The quality and integrity of any bonding and grounding connections associated with metallic conduits or cable shielding/armoring components needs to be maintained during and after the installation of a second cable.

**Response to Staff Initial Comments (July 7<sup>th</sup> 2016).**

The supportive statement by Staff for the order “as written” ignores the operational and design issues associated with the implementation of the undefined “intercept” method and non-standard procedures identified in the order that will likely cause confusion to users and interpretations of the Rules.

**Responses to Lumos Networks Initial Comments (July 8<sup>th</sup> July 2016)**

The Initial Comments by Lumos do not resolve any of the concerns raised in my initial Expert Report dated July 7<sup>th</sup> 2016 (Material #5a). If adopted, the proposed revisions to the Rules in the Lumos Initial Comments (Material #4) would introduce new concerns and confusion into the possible implementation and application of the Rules including the fact that:

- [1] **The new proposed definition of “Customer-Provided Conduit”** is confusing and not practical.
- [2] The very similar proposed definitions of **conduit, duct and innerduct** introduces new confusion into the Rules.

- [3] The proposed exceptions and prohibitions associated with conduit attached to utility poles (**riser poles**) made on page 5 of Lumos comments and proposed revisions to 4.1j of Rules, is not warranted or useful. The designation of a pedestal as an “artificial transition” is arbitrary.
- [4] **Re-configuration of Entrance points** into customer-owned conduits – Lumos proposed new 4.1(l) states a condition of “whenever technically feasible “ that is not practical.
- [5] **Removal of Dead Cable** – The revision to Rule 4.1e proposed by Lumos in their Initial Comments does not address the concerns raised in Section K of my July 7th 2016 Expert Report.

Additional discussions are provided below on each of these above new concerns ([1] to [5]) with further detailed discussion found in my July 7<sup>th</sup> 2016 Expert Report.

- [1] **Definition of Customer-provided conduit (customer-owned conduit)** – Although a definition of the customer provided conduit may be useful, the one proposed by Lumos will only cause more confusion and disputes since the term “...related appurtenances...” is so broad that it could include many components associated with a conduit.

Appurtenances are things that belong to and go with something else. One definition of an appurtenance is *that which belongs to something else, something annexed to another thing more worthy*. In this circumstance, the term “...related appurtenances...” proposed by Lumos for the definition would incorrectly include

- The concrete manholes and the facilities inside that manhole where customer provided conduit may end and the cable exiting from the conduit is spliced or connected into the service provider’s network equipment.
- The poles to which the conduit is attached – including poles owned by a communications company or by a 3<sup>rd</sup> party (power utilities)
- The small and large handholes and pedestals where customer provided conduit may end and the cable exiting from the conduit is spliced or connected into the service provider’s network equipment.
- The cables inside the conduit along with any splice enclosures and termination equipment at either end of the customer–provided conduit.

The circumstances for the use of a customer-owned conduit could be viewed similar to a joint-use utility pole circumstances. For a joint-use utility pole, communications companies may attach under an agreement with the pole owner (often the power utility) and other attached parties providing they meet the applicable safety rules (i.e., NESC). This conduit is jointly used cable support or pathway; just like the pole is a jointly used support structure, for which each user of the resource has rights and responsibilities.

An alternative definition for a *customer-provided conduit* or *customer–owned conduit* that removes some of these terms of concerns, and therefore may be more useful, could be -

*2.4 "Customer Provided Conduit" – The conduit either installed by or on behalf of a Customer at the Customer's expense on real property either owned, managed or administered by the Customer for purposes of installing wires and cable for the provision of communications services. The cable inside the conduit remains under the ownership of the service provider until the point of entrance or service point as per the National Electrical Code (NEC).*

**“Customer-provided” versus “Customer-owned”** - There are consequences for how the conduit is described – i.e., whether it is a “customer-provided” versus being “customer–owned” conduit. The term “owned” implies ownership that more strongly implies

responsibilities for the operation, maintenance and upkeep of the conduit as a protected cable pathway.

The Lumos proposals to add new Rule 3.1b and new definition 2.4 inappropriately expands the ownership of the customer-provided conduit to include the cables inside as well as to “the related appurtenances” that would extend ownership and rights of the customer to include network facilities in manholes, on poles and in other closures.

The Lumos proposals to add new Rule 3.1c may be confusing and counter-productive to Lumos’s assumed intent because of the use of the term “unilaterally”. The definition of unilateral is “... done or undertaken by one person or party...” which would not apply if there is an agreement between the service provider and the customer (that is two parties) to only use the conduit for a single service provider.

The permission for access to, and work at either end of, the conduit needs to be achieved through a joint permission and agreement process between all affected parties. That is, the owners and operators of, not only the conduit, but also of the wire/cables it contains and the access facilities (handholes, manholes, poles, etc.).

**Cable Placement in occupied Conduits/Ducts** - The Lumos proposals to add new Rule 3.1d is confusing, unsafe and is likely to damage other installed plant. This new rule, as proposed, will apply to two distinct cases (a) “unoccupied duct” or (b) “inner-duct space”. The second item, “inner-duct space” may include space inside innerduct that already has a cable present in the innerduct. Under the proposed Rule 3.1d, as proposed, a service provider could attempt to place a new cable in that occupied innerduct and cause damage to the installed cable. Furthermore, the placement of different cable types in occupied innerducts and ducts is required under the Lumos proposed revisions to Rule 4.1d.

**Use of Separate Ducts** - The Lumos proposed Rule 4.1o would also prohibit a common industry practice of using separate ducts and raceways for fiber optic cables and twisted pair copper cables. The different pulling tensions, bending characteristics, and abrasion resistances of these different cable types results in an industry best practice to separate them in cable trays, raceways, conduits and ducts. One of the industry’s standard guideline documents for placement of fiber cables in central offices and network facilities is Telcordia GR-1275 (Material #12) where fiber optic cables are required to be maintained separate from other cable types with physical barriers – i.e., separate ducts.

*Excerpt from GR-1275 (for reference)*

**22 Workmanship Requirements - Fiber Optic**

*22.1 Introduction*

.....

*22.2 General*

.....

***CR22-13 [1137] In service provider approved applications, when fiber optic jumpers and cable need to share a cable rack, compartment, or duct, with another type of cable, they shall have a physical barrier to prevent other types of cable from being run in, over, and/or around the fiber optic jumpers or cable. No other types of cable shall be run on, over, or around fiber optic***

*jumpers or cable. Snap-on “L” shaped brackets (or approved equivalent) may be used when cable separation is required on ladder type cable racks. Snap-on brackets shall be located on alternate cable rack cross straps of secured cable runs. The snap-on cable brackets shall not be used on unsecured cable runs.*

.....

**22.5 Segregation of Fiber Optic Cable, Breakout Cable, and Inter-Bay Cable**

**R22-44 [1157]** *Separate pathways shall be used to carry fiber optic riser cable, breakout cable, or inter-bay fibers. ....*

**R22-45 [1158]** *Fiber optic riser cable shall not be run in fiber pathways along with interconnect, breakout, or inter-bay cable.*

The newly Lumos proposed Rules 4.1m and 4.1n refer to “intercepts”, “conduit saddles”, “stubbed-off ducts” and “preformed lateral knockouts” for which no definitions, descriptions or industry standards references are provided. Such terminology used in a Rule will lead to confusion and conflicts during an attempted implementation of such Rules.

- Further detailed discussions on the above concerns can be found in my July 7<sup>th</sup> 2016 Expert Report; particularly in Sections A, D, E, F, H, I, J, L, M, N and their associated recommendations.

- [2] **Conduit, Duct and Innerduct** – Having very similar definitions of conduit, duct and innerduct is confusing for when these terms are referenced repeatedly in the Lumos proposed new Rules 3.1d, 4.1d, 4.1g, and 4.1o. See discussions in Item (B) of my Expert Report (Material #5a) and Recommendations 3, 4 and 5 in particular from my July 7<sup>th</sup> 2016 Expert Report for guidance.

- Further detailed discussions on use of this terminology and recommendations are found in Section B of my Expert Report dated July 7<sup>th</sup> 2016 (Material #5a).

- [3] **Vertical Conduit on Poles (Riser Pole)** - The exceptions and special rules for conduit attached to utility poles (riser poles) is not warranted or useful as proposed on page 5 (last paragraph) of Lumos comments and its proposed revisions to Rule 4.1j.

The term “riser pole” is incorrect and confusing terminology. The pole is not a “riser”. The conduit is a vertical riser attached to a pole. The conduit attached to utility poles for transitions from underground/buried to aerial plant needs to be in compliance with the applicable NESC rules (see detailed NESC Rule list in my July 7<sup>th</sup> 2016 Expert report – Section D) to help ensure safety and reliability of the communications facilities and services.

The Lumos designation of a pedestal or a handhole as an “artificial transition” is arbitrary label without consideration of operational and design reasons for having a ground level transition point. Having a transition or demarcation point either at ground level (in a pedestal) or below ground (in a handhole) is operational design choice to help permit ready access to splices, connections and termination points without the need to climb the pole or break into (open) the conduit. The conduit running vertically up the pole is exposed to weather (rain, wind, hail, etc.), possible damage from automotive impacts and interference by public. A separate pedestal or handhole closure provides a readily accessible site that provides physical protection and an environmental seal.

- Further detailed discussions on use of this terminology and recommendations for conduits that are attached to poles are found in Section M of my Expert Report dated July 7<sup>th</sup> 2016 (Material #5a).

[4] **Re-configuration of Entrance points** – The new Lumos proposed 4.1(l) states a condition of “whenever technically feasible “ that is not practical. Such language is a very broad condition and the requirement that results may require significant re-arrangement of conduit and entrance facilities. It is unclear which party (customer, initial service provider or new service provider) would be required to pay the costs associated with meeting this new Rule including any capital costs for new conduit or components as well as technical work to re-arrange facilities.

- Further detailed discussions on use of this terminology and recommendations are found in Sections D, H and L of my Expert Report dated July 7<sup>th</sup> 2016 (Material #5a).

[5] **Removal of Dead Cable** – The revision to Rule 4.1e proposed by Lumos in their Initial Comments does not address the concerns raised in Section K of my July 7<sup>th</sup> 2016 Expert Report (Material #5a) with its associated recommendation [18] in particular for a preferable language and means to address *lines not in use*.

### Conclusions

This Supplementary Expert Report provided herein was made after a review of the Initial Comments (Materials #1 to #4) received on the General Order 187.48 of the Public Service Commission of West Virginia and its proposed Title 150 Series 37 entitled “*Rules Governing Telephone Conduit Occupancy*”.

I have reviewed these Initial Comments (Materials #1 to #4) received from interested parties and as a result provide these additional expert opinions covering the new technical concerns and issues raised by the comments received.

As a result of this review, I have not modified any of my opinions set forth in my July 7<sup>th</sup> 2016 Expert Report. I have added supplementary and additional material based on the content of those received comments along with cross references to Sections in my earlier Expert Report as applicable.



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# EXHIBIT A

150CSR37 Rule - with Proposed Relined Changes

**TITLE 150**  
**LEGISLATIVE RULE**  
**PUBLIC SERVICE COMMISSION**

**SERIES 37**

**RULES GOVERNING TELEPHONE CONDUIT OCCUPANCY**

**§150-37-1. General.**

- 1.1. Scope. -- These rules are promulgated to effectuate W. Va Code §24-2E-3.
- 1.2. Authority. -- W. Va. Code §§24-2E-3, 24-1-7, 24-2-1 and 24-2-6
- 1.3. Filing Date. -- , 2016
- 1.4. Effective Date. -- -, 2016.
- 1.5. Sunset date. This rule will sunset five years after the effective date, unless otherwise extended pursuant to W. Va. Code 529A-3-19.

**§150-37-2. Definitions.**

- 2.1. “Apparatus” – The conduit or underground structure (but not including the cable) that provides a cable pathway between the service provider network and the customer.
- 2.2. “Conduit” - A tube structure containing one or more ducts or inner ducts used to house and protect cables.
- 2.3. “Commission” -- The Public Service Commission of West Virginia.
- 2.4. “Customer” -- Any person, firm, partnership, corporation, municipality, cooperative, organization, governmental agency, etc., who purchases telecommunications services from a telephone company service provider.
- 2.5. “Customer-Provided Conduit” – The conduit either installed by, or on behalf of, a Customer at the Customer’s expense on real property either owned, managed or administered by the Customer for purposes of installing wires and cable for the provision of communications services. The cable inside the conduit remains under the ownership of the service provider until the point of entrance or service point as per the *National Electrical Code (NEC)*.
- 2.6. “Duct/inner ducts” - A single tube structure placed inside a conduit to separately house cables (also known as innerduct). duct contained within another duct.
- 2.7. “Intercept” -- A cable inserted into conduit between conduit end points. The cable and physical components required to insert the new cable into an occupied conduit between conduit end points while maintaining the seal integrity of the conduit and physical protection of the installed cable.
- 2.8. “Service Provider” - A customer, telephone public utility, telephone company or any other entity that occupies, or desires to occupy, conduit or underground construction that provides service by a telephone public utility and that has been provided at the customer’s expense.

2.97. "Telephone Company" or "Telephone Public Utility" -- Any provider of telecommunications services to the public under the jurisdiction of the Commission.

2.10 "Universal Access Point" or Demarcation Point – A handhole located at the terminus of the installed customer-provided Conduit System installed by the Customer or service provider to serve as an entry point for multiple service providers into the customer-provided Conduit system. The demarcation point shall permit ready access by each user to its own facilities and shall minimize interference with, and avoid damage to, other users' facilities.

### **§150-37-3. Telephone Conduit Occupancy.**

#### 3.1. Prohibition and Ownership.

A telephone public utility may not prohibit, either by contract or service tariff, a customer who has provided conduit or other underground construction at the customer's expense from using the conduit or other underground construction for communications purposes other than the services provided by the telephone company. A customer who provides the conduit or underground construction is the owner of that apparatus.

#### 3.2. Compliance with Standards, Practices, Rules and Orders.

a. A customer and all occupants of conduit or other underground apparatus shall comply with the rules, regulations and orders of the Commission, the National Electrical Safety Code, the National Electric Code, the Telcordia Manual of Construction Procedures, the rules and regulations of the Occupational Safety and Health Act and any other lawful and applicable laws, rules, regulations and orders.

b. No customer, telephone public utility, telephone company or other occupant of any conduit or other underground apparatus may prohibit, prevent or interfere with the compliance of any person with its obligations under the rules, regulations and orders of this Commission, including without limitation any obligation as a carrier of last resort.

### **§150-37-4. Best Practices.**

#### 4.1. Coordination of activities of multiple service providers

The use of ~~customer-owned~~ customer-provided conduit requires ~~may require the involvement agreement of the customer and the owner (service provider) of any installed cable present in the conduit, more than one service provider.~~ When multiple service providers are involved, the coordination of their activities should be guided by the best practices of the industry, as set forth below:

a. Intercepts are permitted providing all affected parties (e.g., customer, telephone company) agree. ~~should be allowed and standardized with the use of conduit saddles~~

b. ~~Pedestal placements should allow ready access of conduits and ducts.~~

be. Existing intercept installations (or legacy Legacy non-standard intercept installations) should be maintained as is unless damage to facilities as a direct result of these installations is proven imminent or the conduit owner requests changes to the insertion methodology shall be replaced with a demarcation point that permits ready access by each user to the conduit system, and shall minimize interference with, and avoid danger to, other service

- provider facilities. Existing installations may be permitted to remain if all affected parties agree.
- c. The design of the intercept shall follow generic engineering drawings as agreed to be customer and affected parties (i.e., other service providers with cables in the conduit).
- d. Companies should reasonably allow shared cable installations in common ducts where duct access is restricted by available capacity
- e. ~~Dead cables~~ Permanently abandoned cables that consume capacity in ~~customer-owned~~ customer-provided conduit should be extracted in a reasonably expeditious manner unless their removal is likely to damage the conduit or other cables in the conduit.
- f. The physical access paths into buildings should be considered to determine whether plant assets may be consolidated and ensure that scarce access capacities are efficiently used.
- g. Initial and subsequent installations into new ~~customer-owned~~ customer-provided conduit should use separate ducts ~~inner-ducts~~ when feasible.
- h. ~~Customer-owned~~ Customer-provided conduit should have a common access point (or universal access point, UAP) to facilitate the customer's receipt of service from multiple providers. The common access point shall permit ready access by each user to the conduit system, and shall minimize interference with, and avoid danger to, other Service Provider facilities. It is desirable that the universal access point (UAP) be provided at the time of the initial installation of the conduit. ~~may be provided in various ways, including~~
- (i) ~~Placement of a pull box that may be shared by multiple service providers~~
- (a) ~~When possible, the pull box should be placed by the customer contractor when the customer-owned conduit is installed.~~
- (b) ~~A pull box also may be placed by the initial installing provider.~~
- i. (ii) Installation of a conduit fitting to provide Y fitting with conduit stubbed up such that access for multiple service providers to can access the customer-owned customer-provided conduit on the open stub shall.
- (i) Provide adequate working space to avoid interference with, or damage to, existing installed cables or to the conduit.
- (ii) Maintain seal integrity of conduit system.
- (iii) Be agreed to by the customer and owners of existing cables in the conduit.
- ji. A service provider should not bill another service provider for access to or occupancy of ~~customer-owned~~ customer-provided conduit.
- jk. ~~A transition demark between riser poles and entry points into customer-owned conduit is not necessary.~~ The universal access point (UAP) shall be the demarcation point between the customer-provided conduit and service provider conduit or facilities. The UAP shall be located at the terminus of the installed customer-provided conduit system. It is desirable that the UAP be a handhole supplied and installed by the customer as part of the initial installation of the customer-provided conduit system. In the event that the customer does not install the UAP, the first service provider to place duct within the customer-provided conduit system shall place this demarcation point, and transfer ownership of the demarcation point to the customer. The demarcation point shall then become the universal

access point for all service provider facility entry into customer-provided conduit systems.  
The demarcation point shall:

- (i) Permit ready access by each user to the customer-provided conduit system capacity
- (ii) Minimize interference with, and avoid damage to, other service provider facilities,
- (iii) Not contain any cable splice closures or cable slack storage loops.

l. Each service provider shall maintain their own (separate) conduit or duct from their company facility into the UAP where transition into the customer-provided conduit system occurs.

m. Reasonable advance notice shall be provided to affected parties of work in the customer-provided conduit.

# EXHIBIT B

150CSR37 Rule – with Proposed Relined Changes all accepted

**TITLE 150**  
**LEGISLATIVE RULE**  
**PUBLIC SERVICE COMMISSION**

**SERIES 37**  
**RULES GOVERNING TELEPHONE CONDUIT OCCUPANCY**

**§150-37-1. General.**

- 1.1. Scope. -- These rules are promulgated to effectuate W. Va Code §24-2E-3.
- 1.2. Authority. -- W. Va. Code §§24-2E-3, 24-1-7, 24-2-1 and 24-2-6
- 1.3. Filing Date. -- , 2016
- 1.4. Effective Date. -- -, 2016.
- 1.5. Sunset date. This rule will sunset five years after the effective date, unless otherwise extended pursuant to W. Va. Code 529A-3-19.

**§150-37-2. Definitions.**

- 2.1. "Apparatus" – The conduit or underground structure (but not including the cable) that provides a cable pathway between the service provider network and the customer.
- 2.2. "Conduit" - A tube structure containing one or more ducts used to house and protect cables.
- 2.3. "Commission" -- The Public Service Commission of West Virginia.
- 2.4. "Customer" -- Any person, firm, partnership, corporation, municipality, cooperative, organization, governmental agency, etc., who purchases communications services from a service provider.
- 2.5. "Customer-Provided Conduit" – The conduit either installed by, or on behalf of, a Customer at the Customer's expense on real property either owned, managed or administered by the Customer for purposes of installing wires and cable for the provision of communications services. The cable inside the conduit remains under the ownership of the service provider until the point of entrance or service point as per the *National Electrical Code (NEC)*.
- 2.6. "Duct" - A single tube structure placed inside a conduit to separately house cables (also known as innerduct).
- 2.7. "Intercept" - The cable and physical components required to insert the new cable into an occupied conduit between conduit end points while maintaining the seal integrity of the conduit and physical protection of the installed cable.
- 2.8. "Service Provider" - A customer, telephone public utility, telephone company or any other entity that occupies, or desires to occupy, conduit or underground construction that provides service by a telephone public utility and that has been provided at the customer's expense.
- 2.9. "Telephone Company" or "Telephone Public Utility" -- Any provider of communications services to the public under the jurisdiction of the Commission.

- 2.10 “Universal Access Point“ or Demarcation Point – A handhole located at the terminus of the installed customer-provided Conduit System installed by the Customer or service provider to serve as an entry point for multiple service providers into the customer-provided Conduit system. The demarcation point shall permit ready access by each user to its own facilities and shall minimize interference with, and avoid damage to, other users’ facilities.

**§150-37-3. Telephone Conduit Occupancy.**

3.1. Prohibition and Ownership.

A telephone public utility may not prohibit, either by contract or service tariff, a customer who has provided conduit or other underground construction at the customer’s expense from using the conduit or other underground construction for communications purposes other than the services provided by the telephone company. A customer who provides the conduit or underground construction is the owner of that apparatus.

3.2. Compliance with Standards, Practices, Rules and Orders.

- a. A customer and all occupants of conduit or other underground apparatus shall comply with the rules, regulations and orders of the Commission, the National Electrical Safety Code, the National Electric Code, the Telcordia Manual of Construction Procedures, the rules and regulations of the Occupational Safety and Health Act and any other lawful and applicable laws, rules, regulations and orders.
- b. No customer, telephone public utility, telephone company or other occupant of any conduit or other underground apparatus may prohibit, prevent or interfere with the compliance of any person with its obligations under the rules, regulations and orders of this Commission, including without limitation any obligation as a carrier of last resort.

**§150-37-4. Best Practices.**

4.1. Coordination of activities of multiple service providers

The use of customer-provided conduit requires the agreement of the customer and the owner (service provider) of any installed cable present in the conduit. When multiple service providers are involved, the coordination of their activities should be guided by the best practices of the industry, as set forth below:

- a. Intercepts are permitted providing all affected parties (e.g., customer, telephone company) agree.
- b. Existing intercept installations (or legacy installations) shall be replaced with a demarcation point that permits ready access by each user to the conduit system, and shall minimize interference with, and avoid danger to, other service provider facilities. Existing installations may be permitted to remain if all affected parties agree.
- c. The design of the intercept shall follow generic engineering drawings as agreed to be customer and affected parties (i.e., other service providers with cables in the conduit).
- d. Companies should reasonably allow shared cable installations in common ducts where duct access is restricted by available capacity

- e. Permanently abandoned cables that consume capacity in customer-provided conduit should be extracted in a reasonably expeditious manner unless their removal is likely to damage the conduit or other cables in the conduit.
- f. The physical access paths into buildings should be considered to determine whether plant assets may be consolidated and ensure that scarce access capacities are efficiently used.
- g. Initial and subsequent installations into new customer-provided conduit should use separate ducts when feasible.
- h. Customer-provided conduit should have a common access point (or universal access point, UAP) to facilitate the customer's receipt of service from multiple providers. The common access point shall permit ready access by each user to the conduit system, and shall minimize interference with, and avoid danger to, other Service Provider facilities. It is desirable that the universal access point (UAP) be provided at the time of the initial installation of the conduit.
- i. Installation of a conduit fitting to provide access for multiple service providers to the customer-provided conduit shall.
  - (i) Provide adequate working space to avoid interference with, or damage to, existing installed cables or to the conduit.
  - (ii) Maintain seal integrity of conduit system.
  - (iii) Be agreed to by the customer and owners of existing cables in the conduit.
- j. A service provider should not bill another service provider for access to or occupancy of customer-provided conduit.
- k. The universal access point (UAP) shall be the demarcation point between the customer-provided conduit and service provider conduit or facilities. The UAP shall be located at the terminus of the installed customer-provided conduit system. It is desirable that the UAP be a handhole supplied and installed by the customer as part of the initial installation of the customer-provided conduit system. In the event that the customer does not install the UAP, the first service provider to place duct within the customer-provided conduit system shall place this demarcation point, and transfer ownership of the demarcation point to the customer. The demarcation point shall then become the universal access point for all service provider facility entry into customer-provided conduit systems. The demarcation point shall:
  - (i) Permit ready access by each user to the customer-provided conduit system capacity
  - (ii) Minimize interference with, and avoid damage to, other service provider facilities,
  - (iii) Not contain any cable splice closures or cable slack storage loops.
- l. Each service provider shall maintain their own (separate) conduit or duct from their company facility into the UAP where transition into the customer-provided conduit system occurs.
- m. Reasonable advance notice shall be provided to affected parties of work in the customer-provided conduit.

July 15, 2016

**VIA HAND DELIVERY**

Ingrid Ferrell  
Executive Secretary  
Public Service Commission  
P.O. Box 812  
Charleston, WV 25323

03:04 PM JUL 15 2016 PSC EXEC SEC DIV

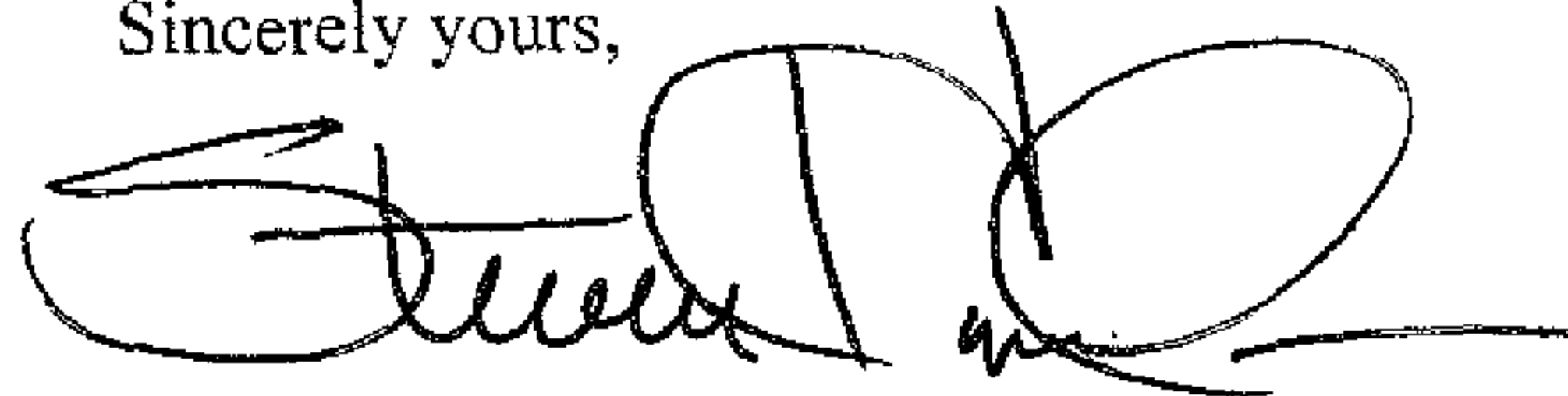
Re: GENERAL ORDER NO. 187.48  
In the matter of a proceeding for the adoption of  
Rules Governing Telephone Conduit Occupancy,  
150 C.S.R. Series 37.

Dear Ms. Ferrell:

Enclosed for filing on behalf of Lumos Networks LLC and Lumos Networks of West Virginia Inc. in the above-captioned proceeding, please find the original and twelve (12) copies of the **“Reply Comments of Lumos Networks”**.

If you have any questions, please feel free to contact me at your earliest convenience.

Sincerely yours,



STEVEN HAMULA (SB # 4580)  
Director of Regulatory Affairs  
Lumos Networks LLC & Lumos Networks of West  
Virginia Inc.

SH/s

Enclosure

THE PUBLIC SERVICE COMMISSION  
OF WEST VIRGINIA  
CHARLESTON

GENERAL ORDER NO. 187.48

In the matter of a proceeding for the adoption of  
Rules Governing Telephone Conduit Occupancy,  
150 C.S.R. Series 37.

**REPLY COMMENTS OF LUMOS NETWORKS**

**I. Introduction**

Lumos Networks, LLC and Lumos Networks of West Virginia Inc. (collectively “Lumos”), by counsel, respectfully files these reply comments on the proposed Rules Governing Telephone Conduit Occupancy (“Conduit Occupancy Rules”) issued pursuant to the Commission Order of June 7, 2016 in the above-captioned proceeding. After having had the opportunity to review the initial comments of the other parties filed in this proceeding, Lumos remains convinced that its initial comments and suggested modifications to the proposed Conduit Occupancy Rules are still appropriate and should be adopted by the Commission.

For its part, Frontier provided a listing of 21 individual recommendations sponsored by an outside consultant regarding modifications to the proposed Conduit Occupancy Rules. Lumos has since reviewed Frontier’s recommended modifications and provides appropriate commentary thereon in the attached Exhibit A. Some of Frontier’s proposed recommendations were deemed acceptable, but unfortunately, others were not for reasons more fully discussed in Exhibit A. In addition to its individual recommendations, there were a couple of supporting points emphasized by Frontier that warrant further comment and discussion. Accordingly, Lumos will endeavor to briefly

comment upon these points, which were not adequately addressed in Lumos' initial comments.

## **II. THE ACHIEVEMENT OF COMPLETE AGREEMENT AMONG SERVICE PROVIDERS MUST NOT BE PERMITTED TO THWART A COMPETITIVE SERVICE PROVIDER'S ACCESS TO AND USE OF CUSTOMER PROVIDED CONDUIT**

In support of its proposed recommendations to the Commission's Conduit Occupancy Rules, Frontier's consultant makes the point at various places within his supporting material and accompanying recommendations that the use of intercepts or certain other activities attendant to the placement of cable facilities within the same conduit by multiple service providers can only be accomplished if there is agreement among the service providers, or in some cases, agreement among the service providers and the customer. (See, FTR Recommendations [9], [11], [14], [16], [17], and [19]). Assuming agreement on the part of the customer, it will always be better if multiple service providers seeking to use the same customer provided conduit for the placement of facilities can agree upon the appropriate process to be utilized, but what if the involved service providers cannot agree. What happens then? Where should these service providers go in an effort to seek resolution of their disagreement? Not surprisingly, Frontier's recommendations are completely silent with respect to this all important question, which is why Lumos continues to urge the Commission to incorporate an accelerated dispute resolution process into its final Conduit Occupancy Rules so that such disputes can be addressed and remedied on an expedited basis.

Moreover, because of its historical position as the incumbent service provider in West Virginia, Frontier is more than likely to be the initial and/or current occupant of existing customer provided conduit today. As a result, Frontier would be in a position to

thwart a competitive service provider's access to and occupancy of customer provided conduit by simply not agreeing to utilization of the same by the competitive service provider, or by conditioning its agreement upon the fulfillment of requirements that potentially make it difficult, if not impossible, for the competitive service provider to meet its customer request for service installation in a timely and economically feasible manner, which is exactly what SB 678 was intended to prevent.

For example, Frontier has previously maintained that allowing competitive service providers to install cable into customer provided conduit already occupied by Frontier cable with no partitioning constituted a violation of NESC rules. As a result, Frontier contends that it is necessary for competitive service providers to seek permission from Frontier before installing such cables, asserting in effect that because Frontier is the lone occupant in a customer provided conduit with no partitioning or inner-duct, the conduit must therefore be considered a duct. Due to Frontier's classification of the entire customer provided conduit as a duct in this situation, Frontier maintains that its permission must first be obtained in order to share this single customer provided conduit as per NESC rules.

Lumos believes Frontier's position is unreasonable, and is based on an erroneous interpretation of NESC rules. As an initial matter, it is important to note that the NESC was careful to define the terms "conduit" and "duct" separately at the outset of *NESC Part 32: Underground Conduit Systems*. In Note 1 at the beginning of Part 32, the NESC carefully defines a conduit as "*a structure containing one or more ducts*". Ducts are defined as "*a single enclosed raceway for conductors or cable,*" and a conduit system is defined as "*the combination of conduit, conduits, manholes, and/or vaults joined to*

*form an integrated whole*". These precise definitions are even cited by Frontier's consultant who correctly points out that "while it is common practice to use the terms duct and conduit interchangeably, in the NESC they have distinct definitions". (See, Page 4, Expert Report of Trevor Bowmer, July 7, 2016).

Therefore, Lumos disputes Frontier's position relative to the interchangeable use of the terms "conduit" and "duct", and maintains instead that customer provided conduit must be appropriately considered as a structure or container for ducts consistent with the aforementioned NESC definition, and more importantly, customer provided conduit does not become a "duct" by virtue of the fact that Frontier may have a cable facility located within unpartitioned customer provided conduit.

In short, it is plainly obvious that Frontier's desire is to remain in a position of having to grant permission to competitive service providers before additional cable facilities can be placed into customer provided conduits in which Frontier has previously placed cable. Because it can no longer rely upon its local tariff provisions to frustrate competitive service providers desiring access to customer provided conduit, the interchangeable use of the terms "conduit" and "duct" by Frontier for purposes of requiring "its agreement" prior to the use of customer provided conduit by a competitive service provider is little more than an intentional end run around the letter and spirit of SB 678, which will in turn allow Frontier to continue to assert managerial control over customer provided conduit, thereby delaying competitor installations, and unnecessarily driving up costs for competitive service providers.

### **III. POTENTIAL DAMAGE TO EXISTING SERVICE PROVIDER FACILITIES LOCATED WITHIN CUSTOMER PROVIDED CONDUIT RESULTING FROM A COMPETITIVE SERVICE PROVIDER'S PLACEMENT**

**OF ADDITIONAL FACILITIES WITHIN THE SAME CUSTOMER PROVIDED CONDUIT IS RARE AND CAN BE AVOIDED THROUGH THE USE OF MAXCELL**

In addition to the emphasis placed by Frontier regarding the need for agreement amongst service providers before new facilities can be placed into customer provided conduit when such conduit is already occupied, Frontier's consultant similarly emphasizes the point that the use of intercepts and/or the placement of facilities within the same customer provided conduit by more than one service provider can result in disturbance and/or damage to the facilities of both service providers. (See, Pages 5-6, Expert Report of Trevor Bowmer, July 7, 2016). While the potential for disturbance and/or damage is admittedly possible in any installation scenario, Lumos submits that it is the very rare exception, rather than the rule in the operational situations it has encountered in West Virginia. Indeed, Lumos cannot recall a single verified instance in which its placement of cable facilities into customer provided conduit already occupied by another service provider resulted in damage to either its facilities or those of the other service provider.

However, Lumos believes that there exists today a reasonable and effective way customer provided conduit containing unpartitioned space can be readily partitioned, even with existing cable facilities in place, in a safe manner through the use of product known as MaxCell. MaxCell is a patented, industry recognized, flexible fabric inner-duct product, utilized by telecommunications firms world-wide, such as AT&T, Verizon, Comcast, Cox, and Time Warner, as well as China and France Telecom. MaxCell has also been successfully used by municipalities and for government and military

installations. In fact, upon information and belief, Frontier has even utilized MaxCell in some of its own installations within its conduit system in West Virginia.

MaxCell can easily be placed using the procedure described below, which readily demonstrates that there is no opportunity for damaging existing cables within an already occupied customer provided conduit:

1. Blow or place string through occupied conduit utilizing air compressor or vacuum.
2. Attach Maxcell to placed string, and pull Maxcell through the conduit.
3. Place cable within one cell of the MaxCell inner-duct, pull cable through MaxCell using integrated string contained in each cell of the MaxCell inner-duct.

Because the installation process described above involves nothing more than air movement and pulling fabric through the customer provided conduit using a string, it is virtually impossible for damage to occur to existing cables presently located within the customer provided conduit. Consistent use of MaxCell and the aforementioned installation process should eliminate Frontier's concerns about damage to its facilities occurring during the installation of additional cables by competitive service providers.

More importantly, because the installing service provider is first portioning the customer provided conduit via use of MaxCell, before installing its cable, and because the cable is subsequently placed within its own dedicated raceway within the MaxCell inner-duct, Frontier's concerns about "duct sharing" and possible NESC rules violations are likewise rendered moot. The strategic use of MaxCell thus provides a rare win-win situation for both the competitive service provider seeking timely access to customer provided conduit and protection to Frontier or another service provider with facilities that

may currently be in place within the customer provided conduit. Photographs depicting the utilization of MaxCell in both an overlay and new installation situation within a standard 4" conduit is attached hereto as Exhibit B.

#### **IV. Conclusion**

As noted in Lumos' initial comments, operational difficulties historically encountered regarding access to and occupancy of customer provided conduit have been a significant obstacle to competitive service providers in West Virginia. Senate Bill 678 was recently enacted in large measure to address and hopefully ease those operational difficulties. Despite this fact, Frontier nevertheless attempts to cling to the competitive advantages previously provided by virtue of its incumbency through the use of nuanced modifications proposed to the Commission's Conduit Occupancy Rules. In promulgating final rules in this proceeding, however, the Commission must be vigilant and reject such attempts where appropriate.

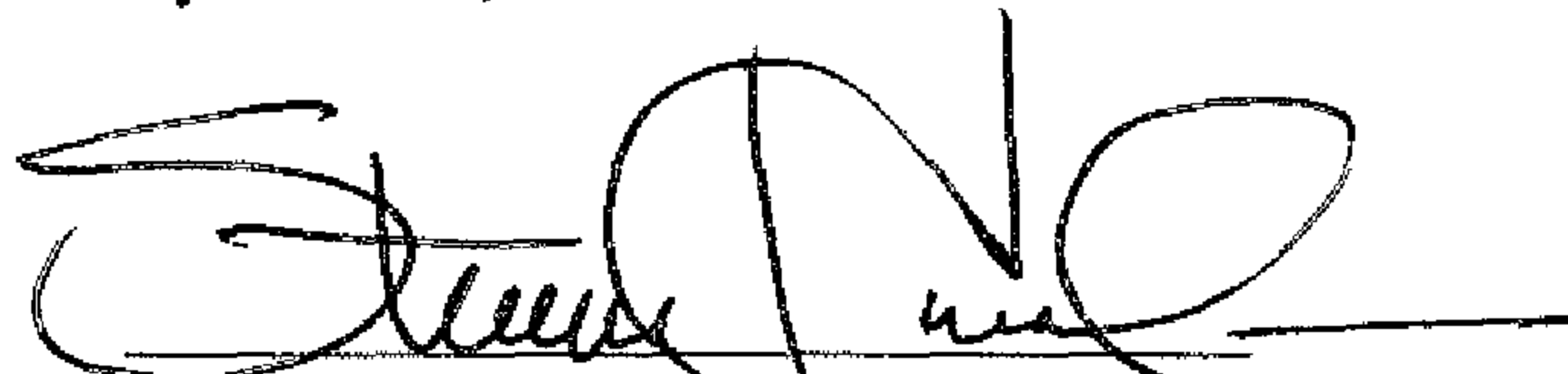
Without question, the final adoption of comprehensive Conduit Occupancy Rules, complete with the inclusion of those industry best practices supported by Lumos and other competitive service providers, is vitally important if nondiscriminatory access to and occupancy of customer provided conduit in West Virginia is to be provided in the manner that Senate Bill 678 clearly envisioned.

**WHEREFORE**, for all of the foregoing reasons, Lumos Networks LLC and Lumos Networks of West Virginia Inc. respectfully request that the Commission adopt final Conduit Occupancy Rules consistent with its initial and reply comments in this proceeding.

Respectfully submitted this 15<sup>th</sup> day of July, 2016.

Lumos Networks LLC and Lumos  
Networks of West Virginia Inc.

By Counsel,

A handwritten signature in black ink, appearing to read 'Steven Hamula', written over a horizontal line.

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## Exhibit A- Lumos' Response to Frontier's Recommendations List

**FTR Recommendation – [1]** Editorial correction in Main Title – correct “CONUDIT” to “CONDUIT”.

**LUMOS RESPONSE:** This recommendation is acceptable to Lumos.

**FTR Recommendation – [2]** Add the following definition of “apparatus” to Section 2 as follows:

2.X. ‘Apparatus’ – The conduit or underground structure (but not including the cable) that provides a cable pathway between the service provider network and the customer.

**LUMOS RESPONSE:** This recommendation is acceptable to Lumos.

**FTR Recommendation – [3]** Revise definition of “conduit” in Section 2.1 to read as follows:

2.1 ‘Conduit’ – *A tube structure containing one or more ducts used to house and physically protect cables.*

**LUMOS RESPONSE:** This recommendation is not acceptable to Lumos. Lumos would propose removing the word “tube” so that Frontier’s proposed definition matches the NESC definition, which reads in pertinent part, “a structure containing one or more ducts”. The introduction of the word “tube” into this definition serves no meaningful purpose, but could arguably preclude the use of MaxCell, which is a specialized fabric duct. MaxCell is a product necessary for the procedure Lumos has recommended in its written reply comments for successfully portioning customer provided conduit when said conduit is already occupied.

**FTR Recommendation – [4]** Replace “innerduct” definition (paragraph 2.4) with definition of “duct” to read as follows:

2.X. ‘Duct’ – A single tube structure placed inside a conduit to separately house cables (also know as innerducts).

**LUMOS RESPONSE:** This recommendation is not acceptable to Lumos. As noted above in its response to Frontier’s Recommendation [3], the use of the term “tube” serves no meaningful purpose and should be deleted. If a definition for the term “duct” is to be provided for in the Commission’s Conduit Occupancy Rules, Lumos’ recommendation is to utilize the NESC definition for “duct” as provided for in Note 1 to NESC Section 32, which is “a single enclosed raceway for conductors and cables”. This definition varies only slightly from that proposed by Lumos in its initial comments.

**FTR Recommendation – [5]** Section 4.1(g) Replace “innerduct” with “duct” to read as follows:

Initial and subsequent installations into new customer-owned conduit should use separate ducts when feasible.

**LUMOS RESPONSE:** This recommendation is acceptable to Lumos.

**FTR Recommendation – [6]** Section 2.3 change “.....who purchases telecommunications services...” to “...”who purchases communications services....

**LUMOS RESPONSE:** This recommendation is acceptable to Lumos.

**FTR Recommendation – [7]** Section 2.7 change “telecommunications” to “communications” to read as follows:

2.7. “Telephone Company” or “Telephone Public Utility” – Any provider of communications services to the public under the jurisdiction of the Commission.

**LUMOS RESPONSE:** This recommendation is not acceptable to Lumos. Lumos would recommend that the proposed definition be modified by the addition of the words “or data” between the words “communications” and “services” so that the definition for “Telephone Company” or “Telephone Public Utility” reads “Any provider of communications or data services to the public under the jurisdiction of the Commission”.

**FTR Recommendation [8]** – Replace definition of “Intercept” to read as follows:

2.5. “Intercept” – The cable and physical component required to insert the new cable into an occupied conduit between conduit end points while maintaining the seal integrity of the conduit and physical protection of the installed cable.

**LUMOS RESPONSE:** This recommendation is not acceptable to Lumos. Lumos submits that competitive service providers should be allowed to “intercept” empty conduit in cases where existing conduit access is restricted by the installation of another service provider’s apparatus, even in cases where no actual cable installations have yet to occur. Lumos is concerned about cases where service providers have installed an apparatus over access points on empty conduit. This type of operational situation should not preclude the use of an intercept. Additionally, service providers utilizing an intercept should only have responsibility for ensuring seal integrity at the intercept installation point of the conduit.

Lumos’ alternative definition would read as follows:

2.5. “Intercept” – The physical component(s) required to insert a cable raceway into a conduit while maintaining seal integrity at the intercept installation point of the conduit and physical protection of any installed cable.

**FTR Recommendation [9]** – Replace 4.1(a) to read as follows:

a. ~~Intercepts should be allowed~~ are permitted providing all affected parties (customer, telephone company) agree and standardized with the use of conduit saddles .

**LUMOS RESPONSE:** This recommendation is not acceptable to Lumos. The trigger for utilization of intercepts should be predicated upon impeded access to the customer provided conduit. If practices for partitioning customer provided conduit through use of MaxCell placement are adopted, there would be no need for agreements among service providers for accessing customer provided conduit. As noted earlier in its written reply comments, partitioning via MaxCell placement would effectively eliminate potential conflicts, delays and unnecessary costs, related to requested service deployment.

If the use of intercepts is predicated on securing the agreement of all affected parties, which will normally include Frontier, the use of intercepts will never be realized with any degree of regularity. Practical experience indicates that regardless of the intended spirit of SB 678, Frontier when approached to “agree,” will simply not do so on account of competitive considerations. This will in turn require competitive service providers to regularly seek out the assistance of the Commission for purposes of mediating and/or formally resolving conduit disputes, which will be both administratively inefficient and will unnecessarily delay broadband deployment in West Virginia.

**FTR Recommendation [10]** – Delete 4.1(b) since many telephone pedestals only provide 6x6 inch or 8x8 inch cross sections which is insufficient for physical access, separation and working space. A new demarcation point or separate intercept point needs to be added to avoid possible damage to installed plant and conflict with NESC rules including Rule 35.1 in particular.

b. ~~Pedestal placements should allow ready access of conduit and ducts.~~

**LUMOS RESPONSE:** This recommendation is acceptable to Lumos, provided that in cases where a service provider has installed a hand hole over customer provided conduit, but has yet to install cable, this hand hole can be utilized by all service providers as the Universal Access Point (“UAP”).

**FTR Recommendation [11]** – Existing (or legacy) intercept installations should be replaced with demarcation points that provide ready access by each user to the conduit and minimize interference with, and avoid danger to, other facilities present – revise 4.1(c) as follows:

c. Existing intercept installations (or legacy non-standard intercept installations) should be maintained as is unless damage to facilities as a direct result of these installation is proven imminent or the conduit owner requests changes to the insertion methodology shall be replaced with a demarcation point that permits ready access by each user to the conduit system, and shall minimize interference with, and avoid danger to, other service provider facilities. Existing installations may be permitted to remain if all affected parties agree.

**LUMOS RESPONSE:** This recommendation is not acceptable to Lumos. The benchmark for augmented demarcation should be predicated strictly upon any existing impediment for additional competitive service provider access. Existing or legacy installations should remain as is unless imminent danger

and/or damage to existing service provider facilities can be conclusively proven. Remediation simply for the sake of remediation would be costly and would likely create a service outage situation for customers currently receiving service via those intercepts. Leaving existing interceptions in place will also avoid potential disturbance or damage to other service provider's facilities that may also be located within said customer provided conduit. Finally, any additional demarcation placement, and cost for said placement, should be borne by the installing service provider seeking to add new installations.

**FTR Recommendation [12]** – Add a new item to 4.1 to define the necessary characteristics of the demarcation point for joint use (i.e., by multiple service providers of the customer-owned conduit.

4.1(x) The demarcation point for joint use of a customer-owned conduit shall under all circumstances permit ready access by each user to customer-owned conduit system, and shall minimize interference with, and avoid danger to, other Service Provider facilities. Each service provider shall maintain their own (separate) duct from their company facility into the demarcation point where transition into the customer-owned conduit system/duct occurs. No Service Provider shall place any cable splice, or cable slack within the demarcation point.

**LUMOS RESPONSE:** This recommendation is acceptable to Lumos, provided that service providers installing new facilities are responsible for the costs necessary to establish a UAP with the requisite separation for additional access consistent with the Commission's Conduit Occupancy Rules.

**FTR Recommendation [13]** – Clarify the term "purposes" in paragraph 3.1 by replacing "...for purposes other than the services ..." with "...for communications purposes other than the services..."

**LUMOS RESPONSE:** This recommendation is acceptable to Lumos.

**FTR Recommendation [14]** – Delete references to undefined "saddles" in 4.1(a) – Replace 4.1(a) to read as follows:

a. Intercepts ~~should be allowed~~ are permitted providing all affected parties (customer, telephone company) agree and standardized with the use of conduit saddles.

**LUMOS RESPONSE:** This recommendation is not acceptable to Lumos. Although Lumos would concur with the recommended removal of the term "saddle", Lumos disagree that all service providers must agree to an intercept. Again, if partitioning practices such as the placement of MaxCell (which eliminates damage risks) is adopted and included in the Commission's final rules, the need for agreement by existing service providers to allow access to customer provide conduit, especially in cases where existing service providers have legacy cable installations present, would not be necessary, and would greatly simplify the process for accessing and occupying customer provided conduit consistent with the intent of SB 678.

**FTR Recommendation [15]** – Delete references to inadequately defined “Y fitting” in 4.1(h)(ii) – Replace 4.1(h)(ii) to read as follows:

(ii) Installation of any conduit fitting to provide Y fitting with conduit stubbed up such that access for multiple service providers to ~~can access~~ the customer-owned conduit ~~or the open stub~~ shall

(a) Provide adequate working space to avoid interference or damage with existing installed cables or the conduit, and

(b) Maintain seal integrity of conduit system.

**LUMOS RESPONSE:** This recommendation is not acceptable to Lumos. Subsection (ii)(b) should either be stricken or modified. As presently drafted, subsection (ii)(b) could imply that installing service providers have responsibility for maintaining seals outside of the intercept point.

**FTR Recommendation [16]** – (same changes to paragraph 4.1(c) as proposed in Recommendation #11 above)

c. Existing intercept installations (or legacy non-standard intercept installations) should be maintained as is unless damage to facilities as a direct result of these installation is proven imminent or the conduit owner requests changes to the insertion methodology shall be replaced with a demarcation point that permits ready access by each user to the conduit system, and shall minimize interference with, and avoid danger to, other service provider facilities. Existing installations may be permitted to remain if all affected parties agree.

**LUMOS RESPONSE:** This recommendation is not acceptable to Lumos. As noted previously herein, references to “agreement by all affected parties” should be stricken. A well-crafted conduit partitioning methodology involving the use of MaxCell will effectively negate the need for collaboration and agreement among service providers, and therefore render more efficient and cost effective service deployment.

**FTR Recommendation [17]** – Modify the opening statement to 4.1 and add two new items to the list to explicitly require agreement between affected parties as follows:

#### 4.1 Coordination of activities of multiple service providers

The use of customer-owned conduit ~~may requires~~ the agreement involvement of the customer and more than one the owner (service provider) of any installed cable present in the conduit. When multiple service providers are involved, the coordination of their activities should be guided by the best practices of the industry as set forth below:

.....

- x. Reasonable advance notice shall be provided to affected parties.
- y. The design of the intercept shall follow generic engineering drawings as agreed to be customer and affected parties (i.e., other service providers with cables in conduit).

**LUMOS RESPONSE:** This recommendation is not acceptable to Lumos. As noted above in its response to FTR Recommendation [16], a well-crafted conduit partitioning methodology will negate the need for collaboration and agreement among service providers, and therefore render more efficient and cost effective service deployment. Design of such installations should follow NESC guidelines and adhere to the general rules respecting access for other service providers. That being said, Lumos does not object to the provision of reasonable advance notice to other affected service providers.

**FTR Recommendation [18]** – Modify 4.1(e) as follows:

- e. Permanently abandoned cables ~~Dead cables~~ that consume capacity in customer-owned conduit should be extracted in a reasonably expeditious manner unless their removal is likely to damage the conduit or other cables in the conduit.

**LUMOS RESPONSE:** This recommendation is not acceptable to Lumos. As an initial matter, how will other service providers or the underlying customer be able to reasonably determine that either a Frontier cable or that of another service provider is or will be “permanently abandoned”? The answer is that they will not be able to do so, which simply adds yet another impediment to requested service installation in customer provided conduit.

In addition, to imply that damage may occur during extraction of abandoned cables, would be to likewise imply that the existing installation is in some manner deficient, or that conduit integrity issues may exist. In either case, the dead or unused cables should be extracted in a timely manner, and any resulting conduit deficiencies repaired. Under no circumstances, should sub-standard legacy cable installations preclude the utilization of customer owned conduit by additional service providers.

Lumos respectfully recommends that its version of 4.1(e) as outlined in its initial comments be adopted by the Commission as modified by the addition of a 30-day timeframe for the requested removal of dead or unused legacy cables by the customer. Accordingly, Lumos would recommend that revised Rule 4.1(e) read as follows:

- e. Dead or unused cables that consume capacity in Customer Provided-owned Conduit should be extracted in a reasonably expeditious manner not to exceed thirty (30) days when requested by the customer at no cost to the customer.

**FTR Recommendation [19]** – Modify and reformat 4.1(h) as follows:

h. Customer-owned conduit should have a common access point (or universal access point) to facilitate the customer’s receipt of service from multiple service providers. ~~The common access may be provided in various ways, including point~~ shall permit ready access by each user to the conduit system, and shall minimize interference with, and avoid danger to, other Service Provider facilities. It is desirable that the universal access point be provided at the time of the initial installation of the conduit.

~~(i) Placement of a pull box that may be shared by multiple service providers.~~

~~(a) When possible, the pull box should be placed by the customer contractor when the customer owned conduit is installed.~~

~~(b) The pull box also may be placed by the initial installing provider.~~

~~(ii) Installation of any conduit fitting to provide Y-fitting with conduit stubbed up such that access for multiple service providers to can access the customer-owned conduit or the open stub shall~~

~~(i) Provide adequate working space to avoid interference or damage with existing installed cables or conduit;~~

~~(ii) Maintain seal integrity of conduit system;~~

~~(iii) Be agreed to by customer and owners of existing cable in the conduit.~~

**LUMOS RESPONSE:** This recommendation is not acceptable to Lumos. The currently promulgated provision (i) in the Commission's Conduit Occupancy Rules, including current subsections (a) and (b), regarding the placement of a pull box should not be removed. Frontier's proposed (ii) should be removed for reasons previously stated by Lumos in response to Frontier Recommendations [8] and [15] with respect to a service provider's responsibility to maintain seal integrity at intercept points only. Similarly, Frontier recommendation (iii) should be removed for reasons stated by Lumos in its previous responses to Frontier Recommendations [9], [14], [16], and [17].

**FTR Recommendation [20]** – Delete 4.1(j) since demarcation points or universal access point should be required for locations where the conduit terminates in aerial facilities (on poles). The section can be replaced with a definition and properties of the demarcation point as follows:

~~j. A transition demark between riser pole and entry points into customer-owned conduit is not necessary. A demarcation or universal access point (UAP) shall be provided to identify the demarcation point between the customer-owned conduit and service provider conduit or facilities. The demarcation point or points shall be located at the terminus of the installed customer-owned conduit system. It is desirable that the UAP be a handhole supplied and installed by the customer as part of the general customer-owned conduit system/Duct installation. In the event that the customer does not install the UAP, the first service provider to place duct within the customer-owned conduit system shall place this demarcation point, and transfer ownership of the demarcation point to the customer. The demarcation point shall then become the universal access point for all service provider facility entry into customer-owned conduit systems. The demarcation point shall:~~

~~(i) Permit Provide ready access by each user to the customer-owned conduit system capacity;~~

~~(ii) Minimize interference with, and avoid danger to, other service provider facilities;~~

~~(iii) Not contain any cable splice enclosures or cable slack storage loops.~~

**LUMOS RESPONSE:** This recommendation is not acceptable to Lumos. At a minimum, Lumos recommends changing the word "Permit" in subsection (i) to the word "Provide" to preclude any possible confusion regarding the need for actual "permitting" in order to access a UAP. In addition, the initial sentence in 4.1(j) – "A transition demark between riser pole and entry points into customer-owned conduit is not necessary" -- should be reinserted to prevent the establishment of an artificial requirement for a transition point at the base of Frontier riser poles. Finally, Lumos would recommend deleting references in 4.1(j) to "demarcation", "demarcation point" or "demarcation points" and

replacing those references with the term Universal Access Point (“UAP”), which Lumos believes is a more appropriate term for utilization within the Commission’s Conduit Occupancy Rules. With these suggested revisions as noted hereinabove, Frontier’s recommendation is acceptable to Lumos.

**FTR Recommendation [21]** – Add definition to Section 2 of the rule of a demarcation point or universal access point (UAP).

2.X. Universal Access Point (Demarcation point) – A handhole located at the terminus of the installed customer-owned Conduit System/Duct installed by the Customer or service provider to serve as an entry point for multiple service providers into the customer-owned Conduit/Duct system. The demarcation point UAP shall under any circumstances permit ready access by each user to its own facilities and shall minimize interference with and avoid danger to other users’ facilities.

**LUMOS RESPONSE:** This recommendation is acceptable to Lumos, provided any reference to a demarcation or demarcation point is eliminated. Indeed, it is Lumos’ recommendation to utilize the term Universal Access Point (“UAP”) in place of the term “demarcation” or “demarcation point” as appropriate throughout the Commission’s Conduit Occupancy Rules. In the context of these Conduit Occupancy Rules, the use of the term “demarcation” or “demarcation points” can become ambiguous and confusing.

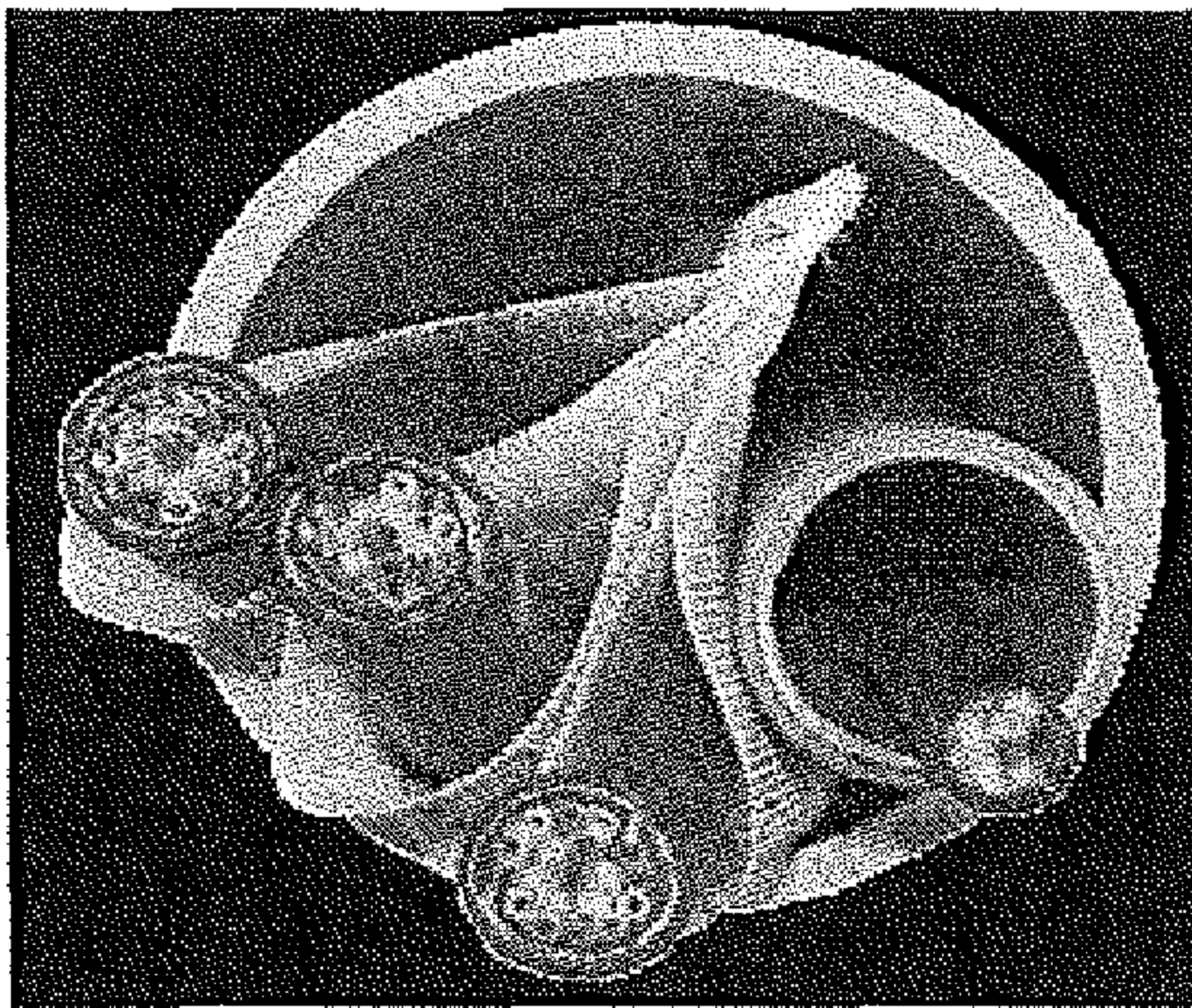
## Exhibit B

### MaxCell 4" 3-CELL

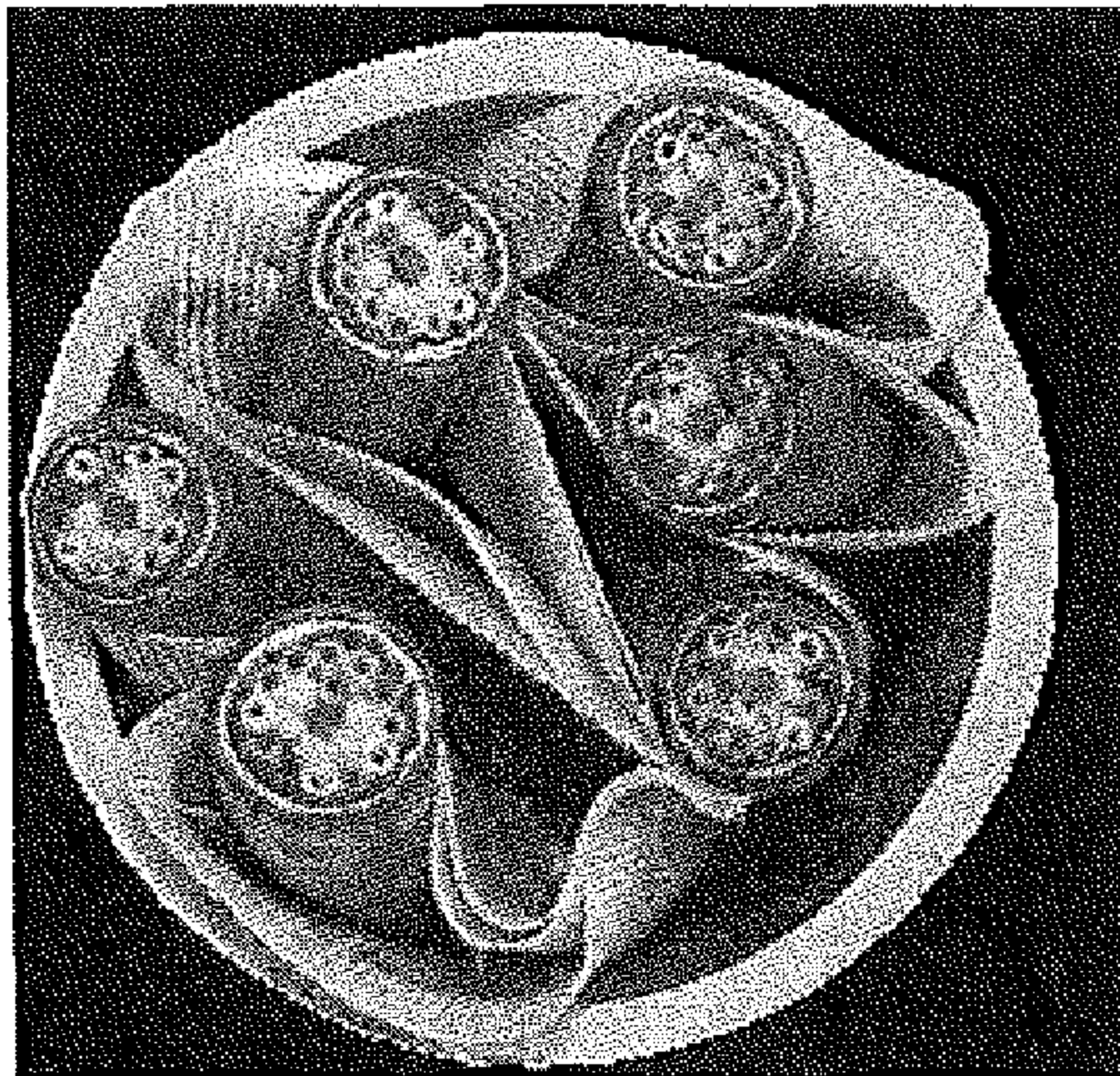
For use in 4" or larger conduits, the 4" 3-Cell product is designed to hold larger backbone cables up to 1.5" in diameter in each cell.

Up to two packs can be placed in a 4" conduit.

- Standard color is green
- Color-coded pull tapes are preinstalled
- Factory lubricated



*4" 3-Cell packs overriding existing cable plant*



*4" 3-Cell packs with 6 1" OD cables in 4" conduit*

**\*Above images and information taken directly from current MaxCell Product Guide, Page 11.**



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July 15, 2016

**VIA HAND DELIVERY**

Ingrid Ferrell  
Executive Secretary  
Public Service Commission  
201 Brooks Street  
Charleston, WV 25301

10:41 AM JUL 15 2016 PSC EXEC SEC DIV

Re: GENERAL ORDER NO. 187.48  
In the matter of a proceeding for the  
adoption of Rules Governing Telephone  
Conduit Occupancy, 150 C.S.R. Series 37.

Dear Ms. Ferrell:

On behalf of Cebridge Acquisition, LLC, dba Suddenlink Communications ("Suddenlink"), Suddenlink has no comment on the proposed Rules at this time but reserves the right to appear and participate in the hearing and file any brief or other further filings in this matter. A copy of this letter has been served on all parties of record as indicated by the attached certificate of service.

If you have any questions, please contact me.

Sincerely,

David B. Hanna  
WV State Bar # 8813  
dhanna@hannalawpllc.com

DBH/dh  
Enclosure  
cc: C. Howard, Esq.

**CERTIFICATE OF SERVICE**

I, David B. Hanna, counsel for Cebridge Acquisition, LLC d/b/a Suddenlink Communications, hereby certify that copies of the foregoing **letter**, have been served upon the following, by United States first class mail, postage prepaid, this 15<sup>th</sup> day of July 2016:

Douglas E. Tate, CEO  
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**VIA HAND DELIVERY**

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Charleston, WV 25301



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DAVID B. HANNA

August 4, 2016

**VIA HAND DELIVERY**

Ingrid Ferrell  
Executive Secretary  
Public Service Commission  
P.O. Box 812  
Charleston, WV 25323

04:19 PM AUG 04 2016 PSC EXEC SEC DIV

Re: GENERAL ORDER NO. 187.48  
In the matter of a proceeding for the adoption of  
Rules Governing Telephone Conduit Occupancy,  
150 C.S.R. Series 37.

Dear Ms. Ferrell:

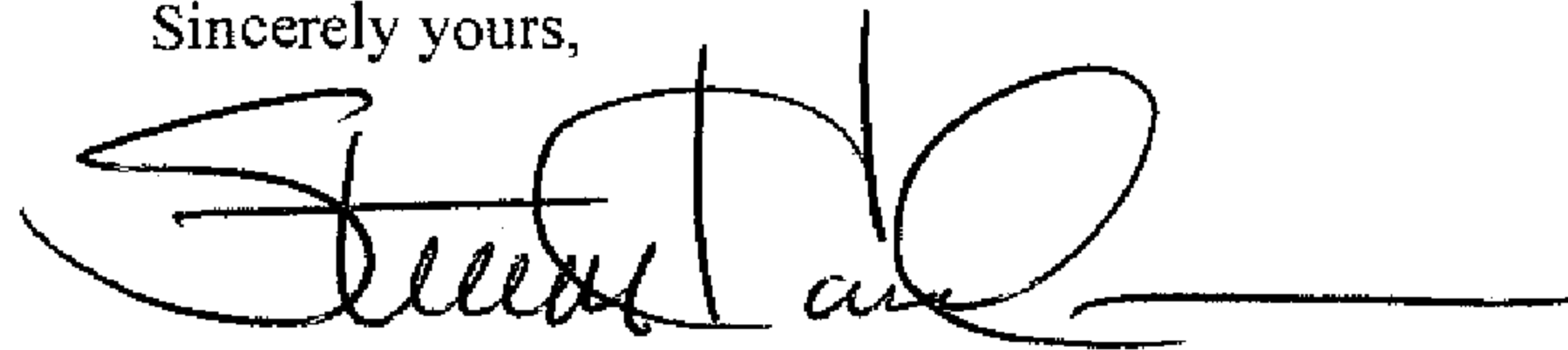
On behalf of Frontier West Virginia Inc. ("Frontier") and Lumos Networks ("Lumos"), enclosed for filing please find an original and twelve (12) copies of **Commission Request Exhibit No. 1** in the above-captioned proceeding.

Although Frontier and Lumos have made a good faith effort to address the relevant issues/recommendations as raised either in filed comments or during the hearing held in this matter, it is likely that some issues/recommendations may not have been addressed. Accordingly, if a particular issue or recommendation raised by either Frontier or Lumos is not expressly covered in **Commission Request Exhibit No. 1**, said issue or recommendation should be considered as remaining in dispute. In such case, Frontier and Lumos maintain their respective positions on said issue/recommendation as contained in their filed comments and hearing testimony.

Finally, Frontier and Lumos wish to thank the Commission for its patience and cooperation relative to the timing and ultimate filing of Commission Request Exhibit No. 1.

If you have any other questions or concerns, please feel free to contact me at your earliest convenience.

Sincerely yours,



STEVEN HAMULA (SB # 4580)  
Director of Regulatory Affairs  
Lumos Networks LLC & Lumos Networks of West Virginia Inc.

SH/s

TITLE 150  
LEGISLATIVE RULE  
PUBLIC SERVICE COMMISSION

SERIES 37

RULES GOVERNING TELEPHONE ~~CONDUIT~~ CONDUIT OCCUPANCY

§150-37-1. General.

- 1.1. Scope. -- These rules are promulgated to effectuate W. Va Code §24-2E-3.
- 1.2. Authority. -- W. Va. Code §§24-2E-3, 24-1-7, 24-2-1 and 24-2-6
- 1.3. Filing Date. -- , 2016
- 1.4. Effective Date. -- -, 2016.
- 1.5. Sunset date. This rule will sunset five years after the effective date, unless otherwise extended pursuant to W. Va. Code §29A-3-19.

§150-37-2. Definitions.

2.1. “Apparatus” – The conduit or underground structure (but not including the cable) that provides a cable pathway between the service provider network and the customer.

- **AGREED ADDITION**

2.21. “Conduit” - A tube-structure containing one or more ducts or inner-ducts used to house and protect cables.

- **AGREED REVISION**

2.32. “Commission” -- The Public Service Commission of West Virginia.

- **AGREED**

2.43. “Customer” -- Any person, firm, partnership, corporation, municipality, cooperative, organization, governmental agency, etc., who purchases telecommunications services from a telephone company service provider.

- **AGREED REVISION**

2.5 “Customer-Provided Conduit”— The conduit either installed by, or on behalf of, a Customer at the Customer's expense on real property either owned, managed or administered by the Customer for purposes of installing wires and cable for the provision of communications services. The cable inside the conduit remains under the ownership of the service provider until the point of entrance or service point as per the *National Electrical Code* (NEC).

- **AGREED ADDITION**

2.64. “Duct~~inner-ducts~~”— A single enclosed race way placed inside a conduit for conductors or cables. A duct contained within another duct.

- **AGREED REVISION**

2.75. “Intercept” -- A cable inserted into conduit between conduit end points. The physical component (including conduit, duct and fittings) require to insert a cable into an empty or occupied conduit while maintaining the seal integrity at the intercept installation point of the conduit and physical protection of any installed cable.

- **PARTIALLY AGREED: PARTIALLY DISAGREED REVISION**

**Lumos Comment:** Lumos does not agree to this definition of intercept as being only applicable to accessing an empty conduit. Lumos believes access should be provided to either an empty or occupied conduit as per Lumos Exhibit 2, Exhibit A, p. 2.

**Frontier Comment:** Dr. Bowmer: Breaking into occupied conduit compromises the seal integrity of the conduit run and allowing groundwater, rainwater, soils, or other contaminating soils or liquids into the conduit, leading to unacceptable risk of damage to existing facilities, as per his July 7<sup>th</sup> Expert Report, p. 7-8.

2.86. “Service Provider” - A customer, telephone public utility, telephone company or any other entity that occupies, or desires to occupy, conduit or underground construction that provides communications services by a telephone public utility and that has been provided at the customer’s expense.

- **AGREED REVISION**

2.97. “Telephone Company” or “Telephone Public Utility” -- Any provider of telecommunications or data services to the public under the jurisdiction of the Commission.

- **AGREED REVISION**

2.10 “Universal Access Point (UAP)” - An access point located at the terminus of the installed customer provided conduit installed by the customer or service provider to serve as an entry point for multiple service providers into the customer provided conduit. The UAP shall permit ready access by each user to its own facilities and shall minimize interference with, and avoid damage to, other users’ facilities.

- **AGREED ADDITION**

**§150-37-3. Telephone Conduit Occupancy.**

3.1. Prohibition and Ownership.

A telephone public utility may not prohibit, either by contract or service tariff, a customer who has provided conduit or other underground construction at the customer’s expense from using the conduit or other underground construction for communications purposes other than the services provided by the telephone company. A customer who provides the conduit or underground construction is the owner of that apparatus.

- **AGREED AS TO THE USE OF THE TERM “COMMUNICATIONS”**
- **PORTION IN DISPUTE:**

**Lumos Comment** - In Lumos Exhibit #1, Lumos has proposed the adoption of additional subsections (b), (c), and (d) in Section 3.1. Lumos continues to support their adoption as part of the final rules promulgated by the Commission.

**Frontier Comment** –Frontier refers to page 4 of Dr. Trevor Bowmer’s Supplementary Report for his advice and edits on these subjects.

3.2. Compliance with Standards, Practices, Rules and Orders.

- a. A customer and all occupants of conduit or other underground apparatus shall comply with the rules, regulations and orders of the Commission, the National Electrical Safety Code, the National Electric Code, the Manual of Construction Procedures (*The Blue Book*), the rules and regulations of the Occupational Safety and Health Act and any other lawful and applicable laws, rules, regulations and orders.

• **AGREED REVISION**

- b. No customer, telephone public utility, telephone company or other occupant of any conduit or other underground apparatus may prohibit, prevent or interfere with the compliance of any person with its obligations under the rules, regulations and orders of this Commission, including without limitation any obligation as a carrier of last resort.

§150-37-4. Best-General Practices.

• **AGREED REVISION**

4.1. Coordination of activities of multiple service providers.

• **IN DISPUTE**

**Lumos Comment** – Lumos continues to dispute the necessity of agreement among customer and/or service providers in Section 4.1 generally , as well as similar “agreement” requirements being proposed by FTR in subsections (a), (b), (c) and (i) of these proposed rules for the reasons articulated in Lumos’ filed comments. References to “agree” or “agreement” are highlighted below

**Frontier Comment** – Dr. Bowmer: Agreement of involved parties is required by the National Electrical Safety Code (NESC) Rule 352. Compliance with the NESC is required by Senate Bill 678. All affected parties must act in good faith and be reasonable. Tr. 33.

~~The use of customer owned-customer-provided conduit requires may require the involvement-agreement of the customer and the owner (service provider) of any installed cable present in the conduitmore than one service provider.-~~ When multiple service providers are involved, the coordination of their activities should be guided by the general practices of the industry, as set forth below:

- a. ~~Intercepts are permitted providing all affected parties (e.g., customer, telephone company) agree. should be allowed and standardized with the use of conduit saddles~~
- b. ~~Pedestal placements should allow ready access of conduits and ducts.~~
- be. ~~Existing intercept installations (or legacy Legacy-non-standard intercept installations) should be maintained as is unless damage to facilities as a direct result of these installations is proven imminent or the conduit owner requests changes to the insertion methodology shall be replaced with a Universal Access Point (UAP) that permits ready access by each user to the conduit system, and shall minimize interference with, and avoid danger to, other~~

service provider facilities. Existing installations may be permitted to remain if all affected parties agree.

- c. The design of the intercept shall follow generic engineering drawings as agreed to by the customer and affected parties (i.e., other service providers with cables in the conduit).
  - d. Companies should reasonably allow shared cable installations in common ducts where duct access is restricted by available capacity
  - e. ~~Dead cables~~ Permanently abandoned cables that consume capacity in customer-owned customer-provided conduit should be extracted in a reasonably expeditious manner unless their removal is likely to damage the conduit or other cables in the conduit.
- **IN DISPUTE**

**Lumos Comment:** In addition to the issue of who decides when a cable has been “permanently abandoned” as Lumos raised in Lumos Exhibit #2, Lumos has recommended that “dead or unused” cables be removed within 30 days at no additional expense to the Customer.

**Frontier Comment:** Dr. Bowmer: The “permanently abandoned” language is consistent with the NESC. Cable that may later be used to serve customers at the location and that is not abandoned should remain in place. Tr. 37-38 [Dr. Bowmer]. All parties should act reasonably and in good faith. Tr. 33 [Dr. Bowmer]; See Section K, July 7<sup>th</sup> Expert Report.

- f. The physical access paths into buildings should be considered to determine whether plant assets may be consolidated and ensure that scarce access capacities are efficiently used.
- g. Initial and subsequent installations into new ~~customer-owned~~ customer-provided conduit should use separate ducts ~~inner ducts~~ when feasible.
- h. ~~Customer-owned~~ Customer-provided conduit should have a common access point (or Universal Access Point) to facilitate the customer's receipt of service from multiple providers. The common access point shall permit ready access by each user to the conduit system, and shall minimize interference with, and avoid danger to, other Service Provider facilities. It is desirable that the universal access point be provided at the time of the initial installation of the conduit. ~~may be provided in various ways, including~~
  - (i) ~~Placement of a pull box that may be shared by multiple service providers~~
    - (a) ~~When possible, the pull box should be placed by the customer contractor when the customer-owned conduit is installed.~~
    - (b) ~~A pull box also may be placed by the initial installing provider.~~

- **IN DISPUTE**

**Lumos Comment:** Lumos does not agree to the removal of subsections (i) (a) & (b) regarding the placement of a pull box in the Rules as originally promulgated by the Commission, and continues to support the inclusion of the originally promulgated language at the end of subsection h. See, Lumos Exhibit #2, Exhibit A, p. 7.

**Frontier Comment:** Dr. Bowmer recommends the deletion of those subsections for the reasons stated on page 16 of his July 7<sup>th</sup> Expert Report.

(ii) Installation of a conduit fitting to provide ~~Y fitting with conduit stubbed up such that access for multiple service providers to can access the customer-owned customer-provided conduit on the open stub~~ that shall.

(i) Provide adequate working space to avoid interference or damage with existing installed cables or the conduit, and

(ii) Maintain seal integrity of conduit; system

(iii) Be agreed to by the customer and owners of existing cables in the conduit.

ji. A service provider should not bill another service provider for access to or occupancy of ~~customer-owned customer-provided~~ conduit.

jk. ~~A transition demark between riser poles and entry points into customer-owned conduit is not necessary.~~ A Universal Access Point (UAP) shall be provided to identify the demarcation point between the customer-provided conduit and service provider conduit or facilities. The UAP point or points shall be located at the terminus of the installed customer-provided conduit system.

It is desirable in the future that the UAP be a handhole supplied and installed by the customer as part of the general customer-provided conduit system installation. In the future, in the event that the customer does not install the UAP, the first service provider to place duct within the customer-provided conduit system shall place the UAP(s) point, and transfer ownership of the demarcation point to the customer. The UAP shall then become the universal access point for all service provider facility entry into customer-provided conduit systems. The UAP shall

(i) Provide ready access by each user to the customer-provided conduit system capacity

(ii) Minimize interference with, and avoid danger to, other service provider facilities,

(iii) Not contain any cable splice closures or cable slack storage loops.

- **IN PARTIAL DISPUTE:**

**Lumos Comments:** Lumos did not agree to the deletion of the original 4.1(j) contained in the Commission's initially promulgated rule stating that "A transition demark between riser pole and entry points into customer owned conduit is not necessary".

**Frontier Comment:** Dr. Bowmer explains his rationale on this issue under Section F on page 9 of his July 7<sup>th</sup> Expert Report.

l. The UAP point for joint use of a customer-provided conduit shall under all circumstances permit ready access by each user to conduit system, and shall minimize interference with, and avoid danger to, other service provider facilities. Each service provider shall maintain their own (separate) duct from their company facility into the UAP point where transition into the customer-provided conduit system/duct occurs. No service provider shall place any cable splice, or cable slack within the UAP point.

m. Reasonable advance notice shall be provided to affected parties of work in the customer-provided conduit.

- **IN DISPUTE**

**Lumos Comment** - As per Lumos Exhibit #1, Lumos has proposed additional subsections (k) thru (o) in Section 4.1, the adoption of which Lumos continues to support.

**Frontier Comment** – Per Dr. Bowmer: Advance notice is required by the NESC. In addition, compliance with the NESC is required by Senate Bill 678. Further, [from Dr. Bowmer]:

The Lumos proposed additions referred to in the above comment are assumed to be from their July 8<sup>th</sup> report (Lumos Exhibit #1).

Lumos proposed 4.1 k - This issue is already covered under proposed 4.1 d, e, and f above

Lumos proposed 4.1 l - This issue is already covered under proposed 4.1 f above

Lumos proposed 4.1 m - This issue is already covered under proposed 4.1 f above

Lumos proposed 4.1 n - The general issue is already covered under proposed 4.1 b, h, I and k above

Lumos proposed 4.1 o - The issue is already covered under proposed 4.1 d, f, g, above

**PUBLIC SERVICE COMMISSION  
OF WEST VIRGINIA  
CHARLESTON**

GENERAL ORDER NO. 187.48

In the matter of a proceeding for the adoption  
of Rules Governing Occupancy of Customer-Provided Conduit,  
150 C.S.R. Series 37.

**COMMISSION HEARING**

The Public Service Commission of West Virginia conducted a hearing at 9:30 a.m. on July 21, 2016, in the Howard M. Cunningham Hearing Room at the Commission offices, 201 Brooks Street, Charleston, WV 25301.

The following persons appeared at the hearing:

Frontier Communications

Trevor Bowman, Ph.D., commenting on behalf of Frontier Communications

Lumos Networks

Suddenlink

Commission Staff

Communication Workers of America, AFL-CIO