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PHILADELPHIA
SEPT 29-OCT 2, 2023

How the Rural Broadband, 5G, and Other Fiber Applications are Changing and Creating Jobs

What you need to know and how to be a part.



Sean Kelly, RCDD, CFHP
Technical Director, Light Brigade







TRADE SHOW EDUCATION

This session is eligible for 1 Contact Hour.

For these hours to appear on your certificate, you must:


- Have your badge scanned at the door
- Attend 90% of this presentation
- Fill out the online evaluation for this session

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By the end, you will be able to:

- 1** Understand the technician shortage problem and the lack of training
- 2** Summarize the details of the Infrastructure Investment and Jobs Act
- 3** Demonstrate understanding of 5G, Sensing, and Air Blown fiber uses
- 4** Recognize related and adjacent opportunities for your organization

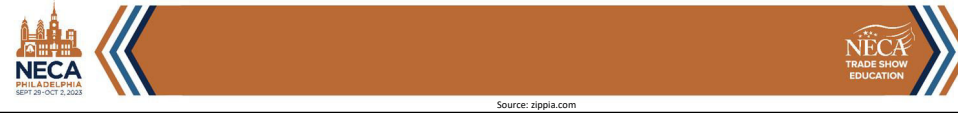
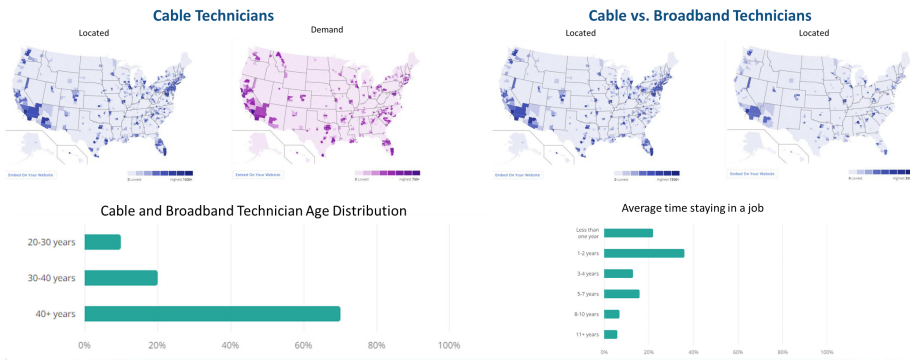


Technician Challenges

- Market Research Future¹
 - 2021 – Fiber optics market value was \$7.3B
 - Between 2022 and 2030 it is expected to grow to \$13.7B
- GMSA Intelligence²
 - The US will experience one of the fastest global 5G migration and adoption
- New Technician Estimates³
 - Fiber Broadband Association – Estimates 205,000 through 2026
 - Other estimates go as high as 850,000
 - Government Accountability Office – estimates 34,000 this year for broadband
- Wage Disparity⁴
 - Average hourly wage for fiber splicing is \$90/hour in NYC vs. \$17 to \$24/hour in Arkansas
 - Where we need fiber the most, we're not paying enough, and experienced techs are not willing to work there
 - Some are getting paid by the fusion splice or "burn" as opposed to by the hour – Those rates vary too

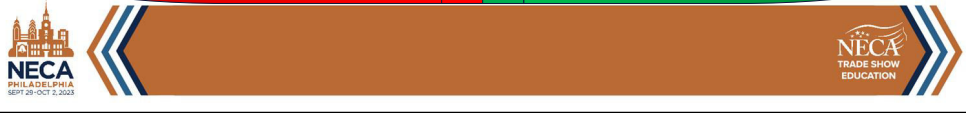
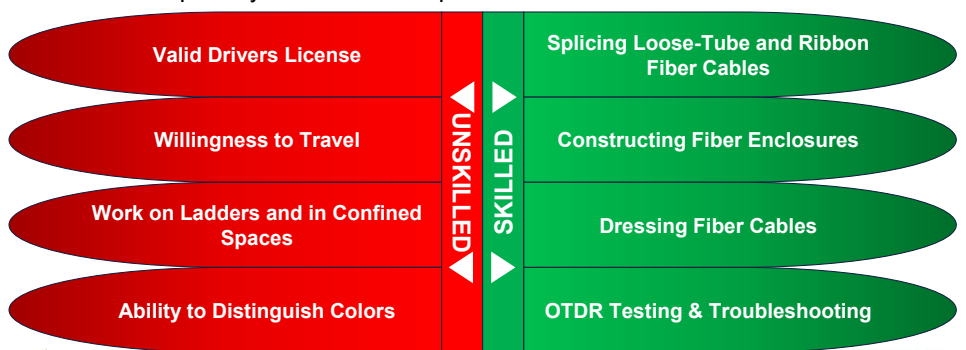




Technician Challenges



Most Current Fiber Technician Job Postings

Especially Tier-3 last-mile providers and new small entrants⁵



Trained & Skilled Workforce

The "Boomers and GenX"

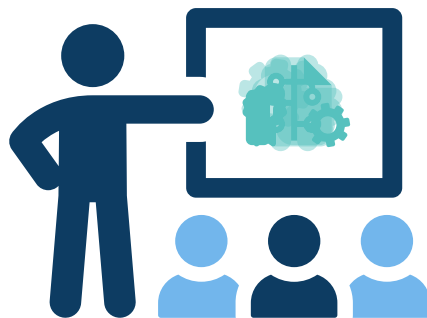
Formal Education

Certification/Credentialing Career Path

The "Next Generation"



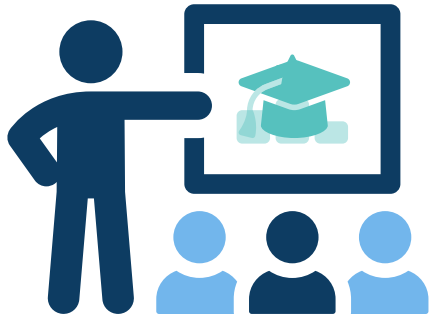
Trained & Skilled Workforce



- Training should be...
- **Engaging**
 - **Interactive**
 - **Competency based**
 - **Theory and practical based**
 - **Industry organization**
 - **Related to student outcomes**
 - **Real world experiences**



Trained & Skilled Workforce



- Properly trained staff creates higher quality work, but how well the instructor makes sure the student knows.
- YouTube does not deliver skilled workers!



Trained & Skilled Workforce



Time is Money

- Proper training prevents additional time and money for reworks
- A skilled workforce is an efficient workforce



Untrained and Unskilled Leads to:

- Mistakes
- Poor workmanship
- Decreased reliability
- Customer dissatisfaction
- Bad company reputation



Remember

- You will only become aware of your poor installation practices when it is too late.
- This will cost you money or worse; your reputation.



\$1.2T Infrastructure Investment and Jobs Act



Passenger and Freight Rail
\$66B

Electric Grid Upgrade (smart)
\$73B

Broadband (FTTH)
\$65B

These are the three fiber-rich opportunities



Funding Available for Broadband

Rural Digital Opportunity Fund (RDOF)

- Phase 1 - \$9.2B (Planned)
- ~\$6B Reality after rejections and defaults.

IJA Broadband Program (\$65B)

Broadband Equity, Access, and Deployment (BEAD) \$42.5B

Tribal \$2B

Middle Mile \$1B

Digital Equity \$2.75B

Total cost will be 2-3X Federal Contribution



Funding Available for Broadband



- Fiber Optic Cable – “Construction Material” *
 - Must be manufactured in the United States
 - 100% of sub-assemblies and primary components must be US sourced
- Fiber Optic Connectivity – “Manufactured Product”
 - Connectors, Adapters, Hubs, Terminals, Closures, etc.
 - Must be manufactured in the United States
 - Must meet a 55% domestic content requirement
- Equipment
 - Splicers, OTDRs, Test Equipment, Tooling, etc.
 - Buy America does not apply to equipment
- The entire project must comply, not just the funded portion



* According to current Office of Managing Budget (OMB) Guidance



Compliance Challenges

Products Impact Risk	
<p>US Manufactured Optical Cable Must meet US Country of Origin and content requirement</p>	MEDIUM
<p>Enclosures, Terminals Most optical connectivity being manufactured by U.S. based vendors being done outside U.S. today with Mexico making up a primary source country</p>	MEDIUM
<p>Field Installable Connectors Challenged to meet both U.S. manufacturing and domestic content requirement</p>	HIGH

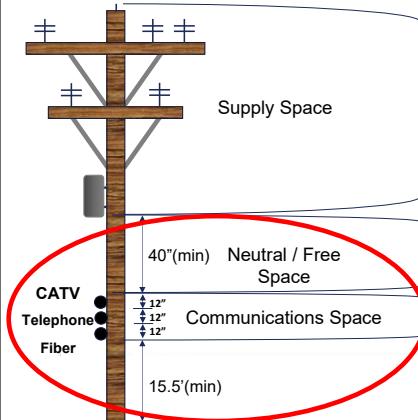
Market Impact	
<p>Hyperscale and Colocation Segment not a target for federally funding</p>	LOW
<p>Dominant RBOCs Will potentially apply for funding for regions where self-funding is not feasible</p>	MEDIUM
<p>Tier 1 Telecoms and MSOs Other Tier 1s likely to seek funding as they did in RDOF</p>	MEDIUM-HIGH
<p>Tier 2&3 Telecoms, Electric Coops Segment most impacted by federal funding</p>	HIGH
<p>Investor-Owned Utilities Major portion of electric grid funding flowing through States/Municipalities must meet "Build America, Buy America"</p>	MEDIUM



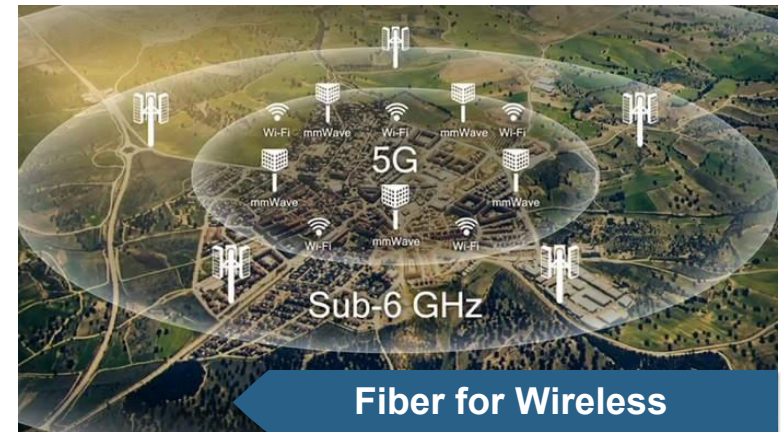
Courtesy Sean Adam - AFL



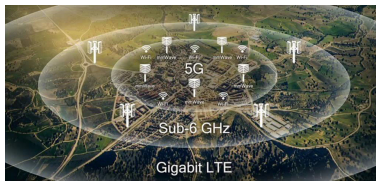
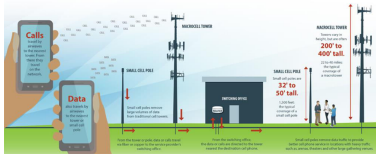
>60% of Funding Will be Construction Costs



- Less than 20% will go to actual fiber infrastructure
- *Make Ready* will be a major portion
 - Permitting, Licensing, and Approvals
 - Delays
 - Pole owner
- Many current poles do not meet spacing requirements and will need to be corrected to accommodate or meet permit requirements.
- Some poles do not have available space and will need a replacement or secondary unit.
- Cyber Security and Cyber Supply Chain Risk⁵



The Migration to 5G – There are Two 5Gs



- Sub-6GHz
 - Mid-Band 5G technology
 - Better speeds than LTE (100-400Mb/s)
 - Shorter coverage area than LTE
 - May share macrocell tower or be a small cell
- Millimeter wave (mmW)
 - The “fast” 5G technology (1-10Gb/s)
 - Extremely High Frequency (30-300GHz)
 - Current mmW 5G spectrum (24-56GHz)
 - Low latency
 - Sensitive to physical barriers
 - Very small coverage area = many microcells
 - Enables the Internet of Things (IoT)

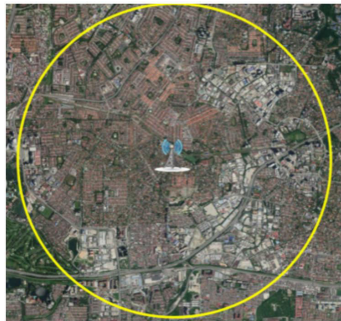


Microcells – The Path to Realizing 5G

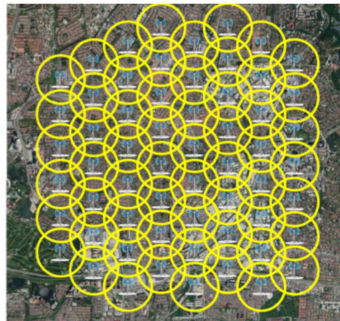
- Implementation of full 5G promises improved connectivity, which will ultimately provide:
 - Enhanced mobile broadband
 - Alternate residential broadband
 - Ultra-low latency
- Microcells will augment macrocells
- Local edge computing to support low latency and ubiquity of 5G
- Microcells are typically carrier specific as opposed to macro towers that may serve multiple carriers.



Comparison of 4G LTE Coverage Area vs. 5G



4G Network Cell coverage - 25 km²

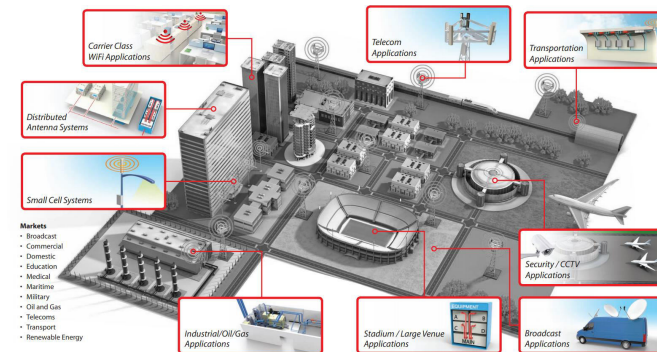


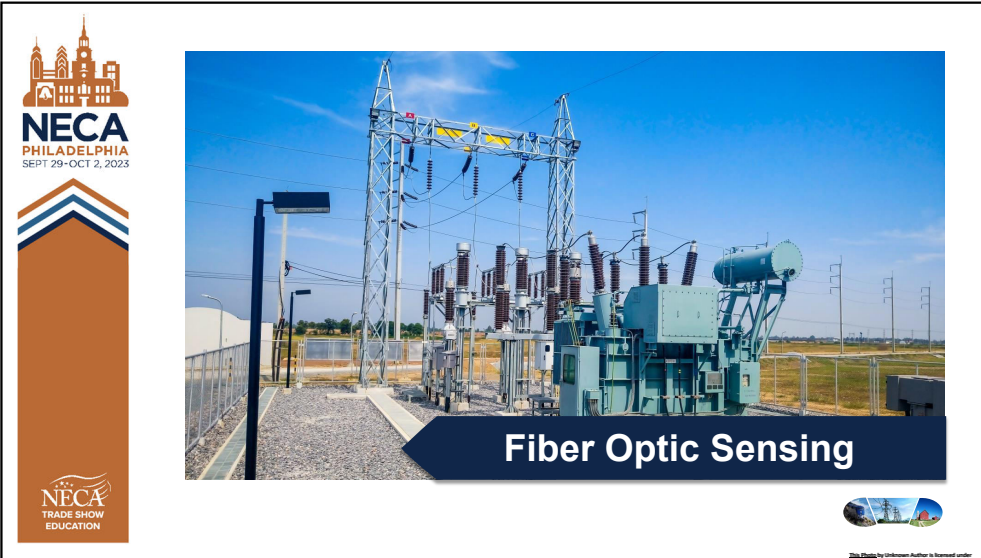
Equivalent 5G Network Cell coverage - 60x0.04 km²

Fiber is required to each yellow circle



~~Fiber~~ Wireless is Everywhere





Fiber Optic Sensing

- Monitoring of cables from a single location
 - 1000s of sensing points
 - No power – passive
 - Temperature, Strain, Vibration, Magnetic Field, Radiation, and more.
- Distributed
 - Raman Backscatter
 - Brillouin Backscatter
 - Rayleigh Backscatter
- Point Based
 - Distributed Feedback Laser w/ Fiber Bragg Grating
 - Fabry Perot Laser

Courtesy: FOS4

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Types of Fiber Optic Sensing

<p>Temperature </p> <p>Applications:</p> <ul style="list-style-type: none"> ■ Leakage detection (pipelines) ■ Well inspection ■ Fire prevention ■ Environmental <p style="text-align: center;">DTS Distributed Temperature Sensing</p>	<p>Vibration </p> <p>Applications:</p> <ul style="list-style-type: none"> ■ Flow control ■ Leakage ■ Intrusion detection ■ Seismic analysis ■ Intrusion alarm <p style="text-align: center;">DAS Distributed Acoustic Sensing</p>	<p>Strain </p> <p>Applications:</p> <ul style="list-style-type: none"> ■ Geotechnics ■ Structural monitoring ■ Process optimization <p style="text-align: center;">DSS Distributed Strain Sensing</p>
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Fiber Optic Sensing – Familiar Concepts

OTDR Operation

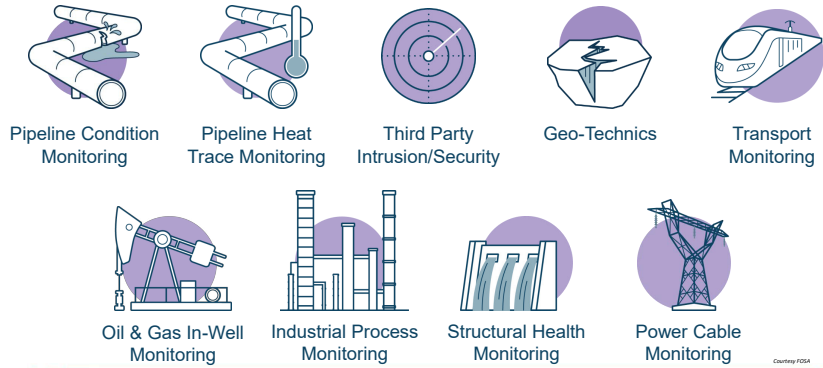
Rayleigh Scattering

Microbending

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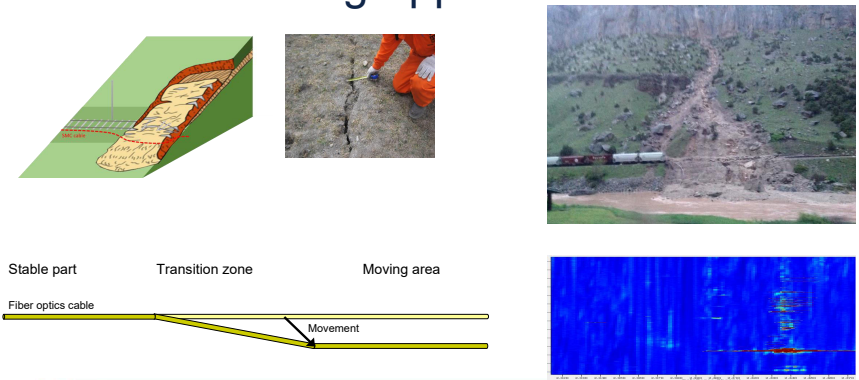
Fiber Sensing Applications



Courtesy FOSA



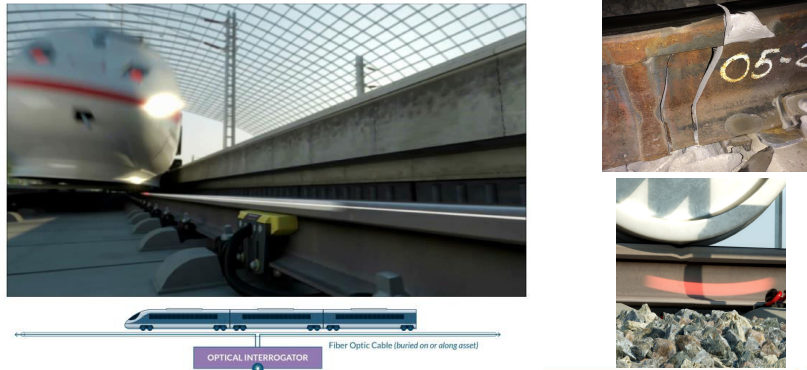
Sensing Applications



Courtesy FOSA



Sensing Applications



Courtesy FOSA



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Air Blown Fiber - ABF

- Low-strain pushing force combined with high-speed compressed air.
- Reduces friction between cable and duct.
- Method of choice for urban and long-haul installations.
- Cables are installed virtually stress-free.
- 40% cost savings are common.

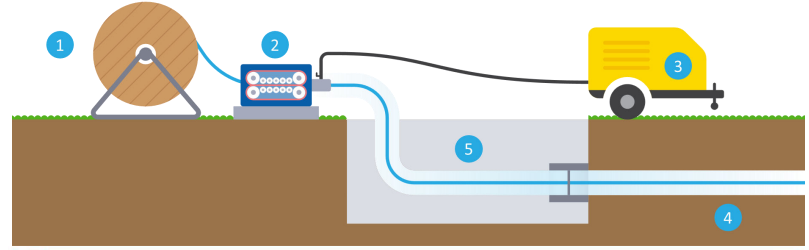
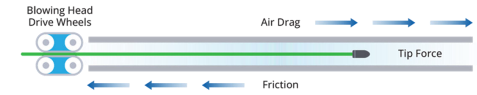


Courtesy: Hexatonic



Basic Blowing Setup

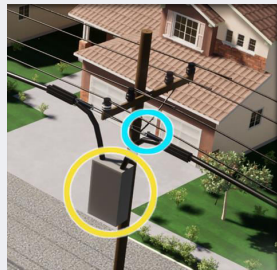
1. Cable drum with drum jack
2. Cable blowing device
3. Compressor
4. Cable duct
5. Subterranean splice chamber



Air Blown Fiber Installation



Underground



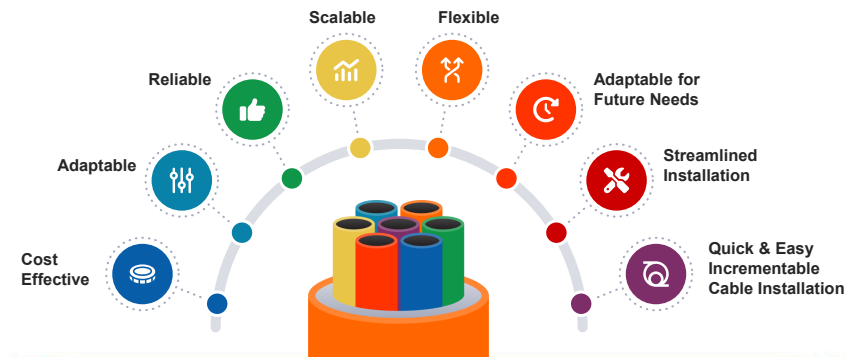
Aerial



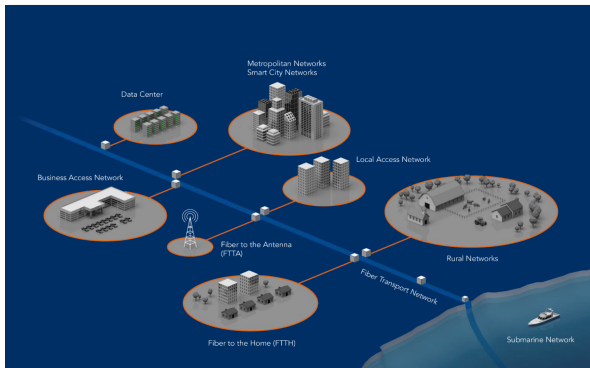
Premises



Air Blown Fiber Advantages

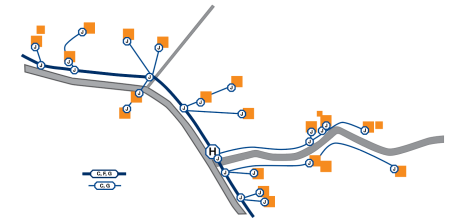


Air Blown Fiber Applications



Air Blown Fiber – How and What

- Compressed air or nitrogen
 - Blow fiber units or microcables
 - Typical rates up to 300' per minute
- Microcables (12-864F)
 - 12-864F
 - Distance 6600' and beyond
- Fiber Units
 - 1-12F
 - Typical maximum distance 3300'
- Microducts
 - Pathways for routing ABF
 - Aerial, buried, or in-building



Aerial installation

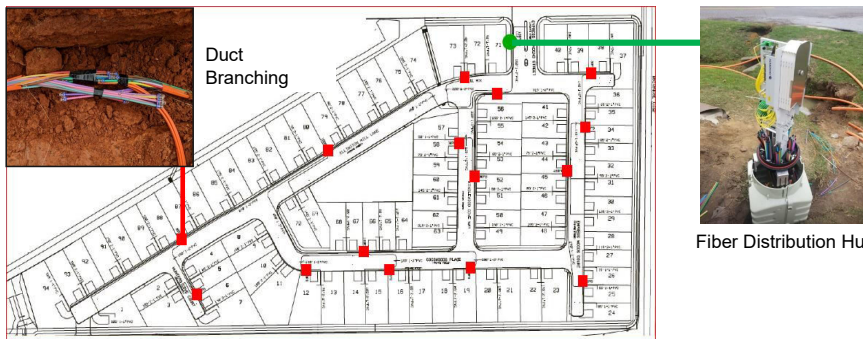


Ground installation



Indoor installation

Elements of an ABF Installation



ABF - Homes Passed

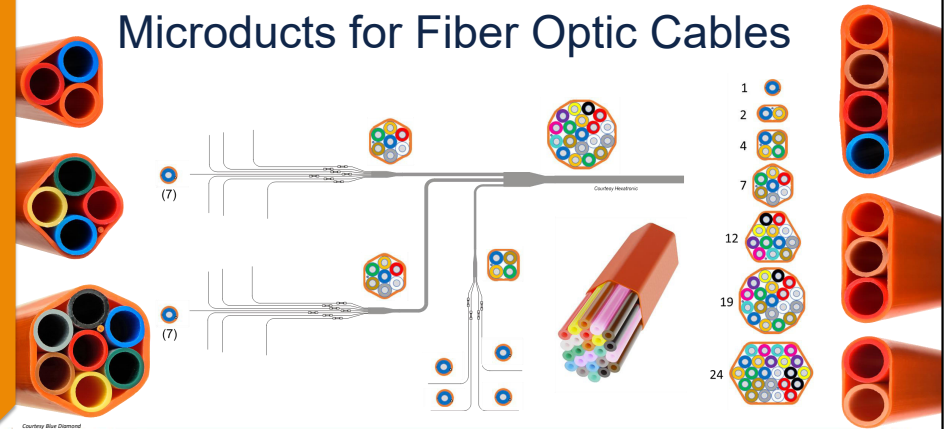


ABF - Homes Connected



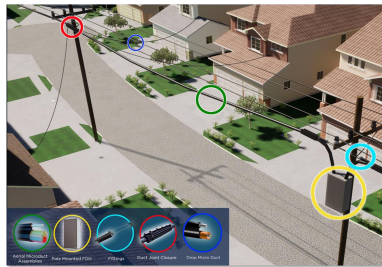
Courtesy Heasthinc

Microducts for Fiber Optic Cables



Courtesy Heasthinc

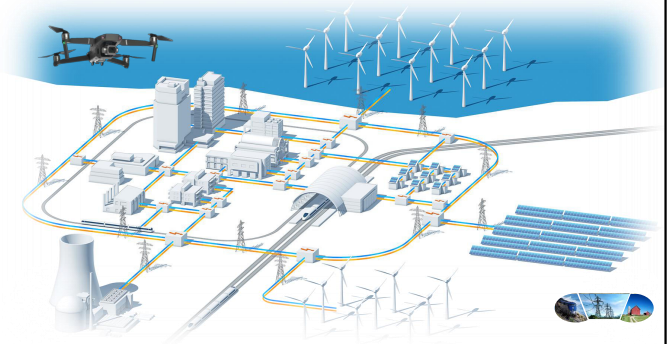
Microduct Cables



Courtesy Heasthinc

Utility/Co-op Smart Grid

- Communication
- Data Transfer
- Asset Monitoring
- Sensing
- FTTx/ISP
- Dark Fiber
- 5G
- Wireless



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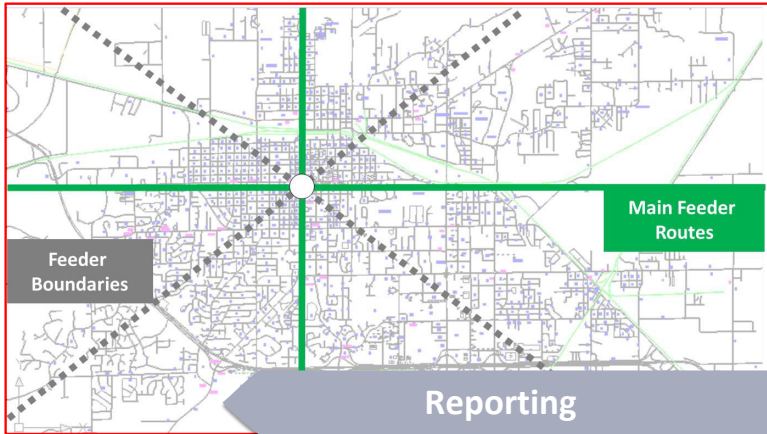


Photo Credit: The Unknown Author in Barnwell under

Importance of Reporting



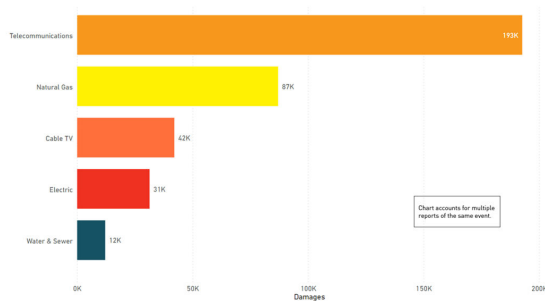
Know what's below.
Call before you dig.

- Telecommunications is the leading facility damaged of all utilities as the result of not calling or not abiding by locators?
- These damages are not always by another trade.
- One of the largest problems is the lack of self-reporting of where telecommunications lines are placed so 811 knows where to mark.
- Bottom line, we have a bad reputation for not reporting location information and not calling before we dig!
- Nobody wants to find rainbow roots!

Reporting

Importance of Reporting

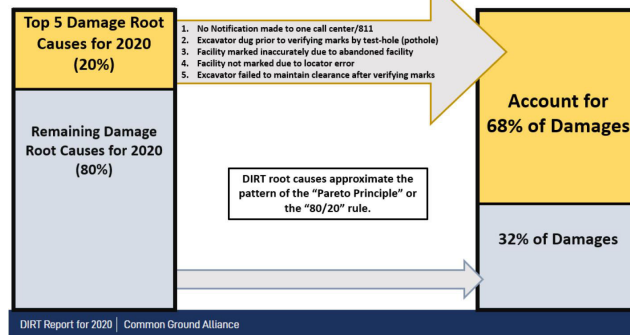
Damages by Facility Operation



DIRT Report for 2020 | Common Ground Alliance

Reporting

Underground Installation Techniques

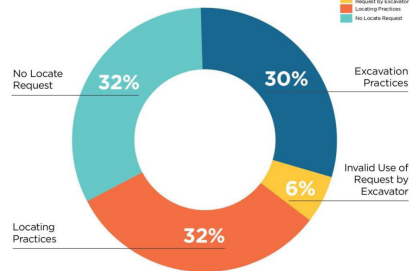


DIRT Report for 2020 | Common Ground Alliance

Reporting

Underground Installation Techniques

Reported Damages by Root Cause Group



Legend
■ Excavation Practices
■ Invalid Use of Request by Excavator
■ Locating Practices
■ No Locate Request

Report what you lay to prevent others from digging it up.

Call for location identification before you dig something up.

Failure to do so can lead to extremely costly repairs.

DBI Report for 2020 | Common Ground Alliance



Thank You for Attending!



Sean Kelly, RCDD, CFHP
Technical Director

Mobile: (717) 578-3990
skelly@lightbrigade.com

835 N Central Ave.
Kent, WA 98032

www.lightbrigade.com

Scan the QR code and add me to your contacts.



Complete the Online Evaluation



Sources

¹ <https://www.marketresearchfuture.com/reports/fiber-optic-market-1169>

² <https://www.gsma.com/publicpolicy/wp-content/uploads/2018/03/The-5G-era-in-the-US.pdf>

³ https://www.wsj.com/articles/high-speed-internet-plan-worker-shortage-be83a843?st=mwp25ufi0kizz1k&reflink=desktopwebshare_permalink

⁴ <https://www.cablinginstall.com/design-install/article/14292878/bridging-the-digital-divide-faces-a-workforce-challenge>

⁵ https://cdn.baseplatform.io/files/base/ebm/isemag/document/2023/05/2305ISE_DE.646fa729c136a.pdf#page=42

