Electric Co-op Solutions Guide
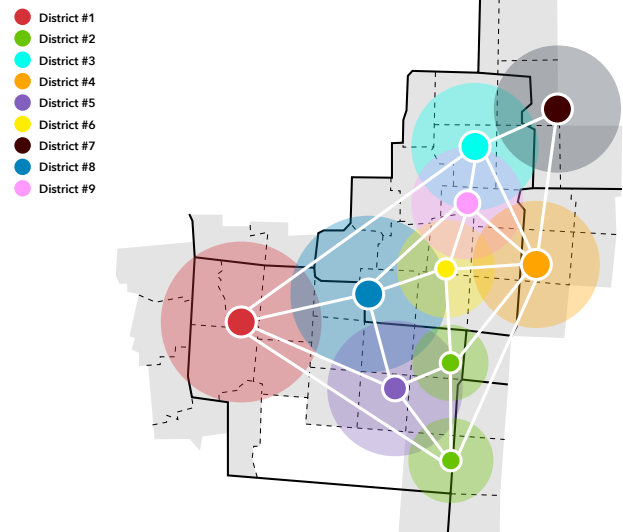
Fiber-to-the-Subscriber Deployment in Rural Areas

Backbone Networks

Co-op backbone networks often connect substations in rings or a mesh architecture. Fiber counts are typically larger to account for various applications and future growth. OFS can discuss fiber count and cable planning as part of the network planning process.

District #1
District #2
District #3
District #4
District #5
District #6
District #7
District #8
District #9

Which Cable Do I Use?

Cable types can be mixed and matched to the requirements of the network.

Key highlighted below:

ADSS

- Often better choice when going to new areas
- Lower make-ready and installation costs
- Less clean drop management
- Often faster installation
- All-dielectric – Eliminates the need for expensive cable shielding and grounding
- Much lighter weight than strand – May reduce guying costs

Lashed

- Typically more expensive unless strand is available
- Good choice for higher customer density areas and more ground clearance
- Higher make-ready costs
- Cleaner drop management

Typical Relative Deployment Costs

Relative Deployment Costs

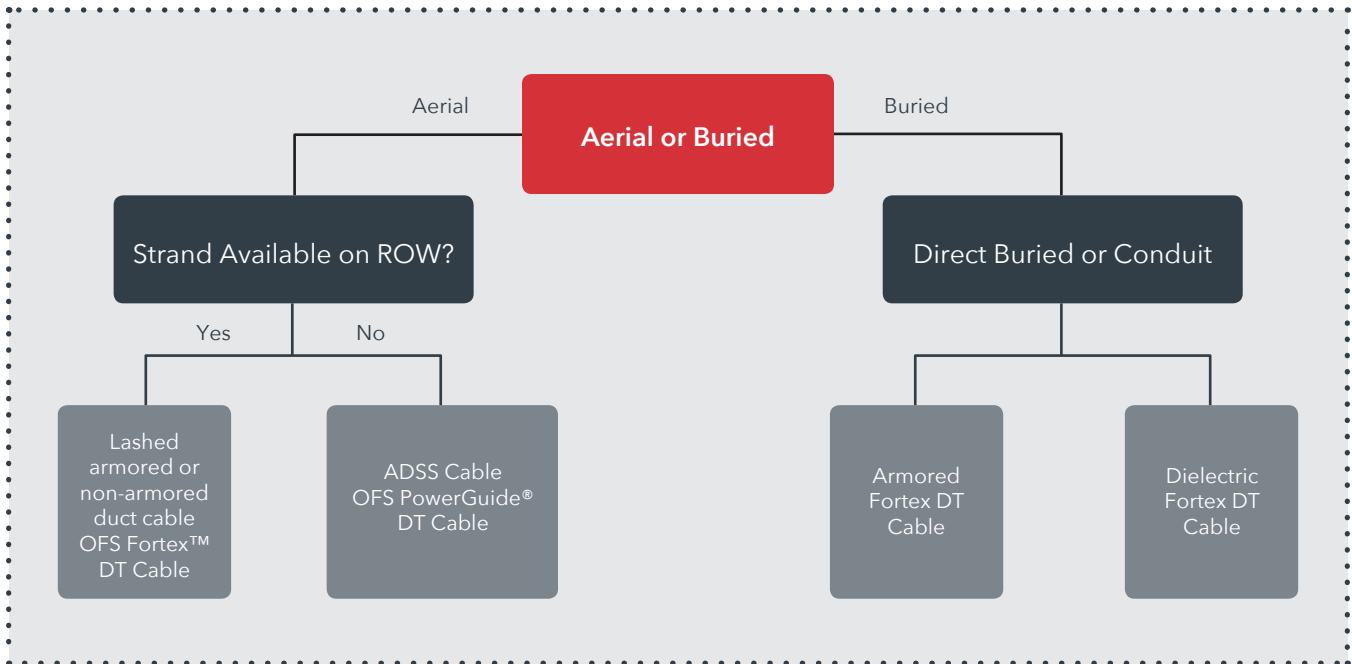- Underground - in Conduit
- Underground - Direct Buried
- Aerial - Lashed
- Aerial - ADSS
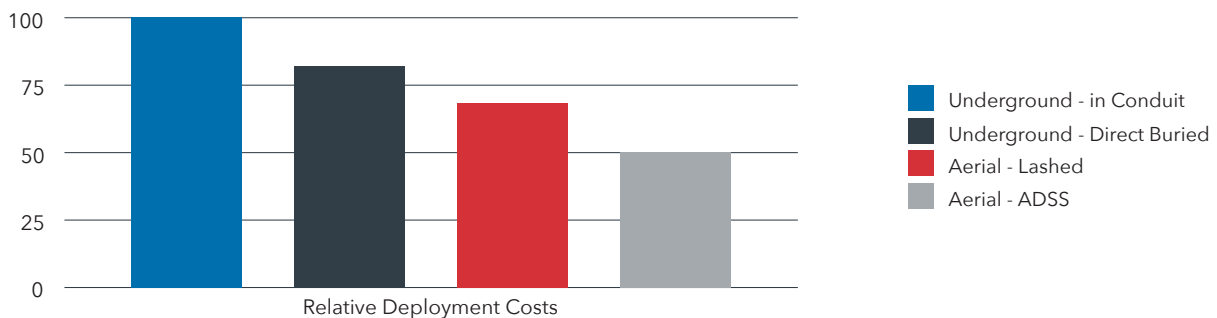
OFS Position for Co-ops:

Since most co-op networks do not have strand available, ADSS cable is a recommended backbone choice in many cases. OFS expects long-term reliability for either cable type to be similar.

Which Cable Do I Use? *(Continued)*

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                    Aerial  ┌─────────────────────┐  Buried
               ┌────────────│   Aerial or Buried  │────────────┐
               │            └─────────────────────┘            │
     ┌───────────────────────┐                    ┌───────────────────────────┐
     │ Strand Available on ROW? │                 │  Direct Buried or Conduit │
     └───────────────────────┘                    └───────────────────────────┘
       Yes          No                                  │              │
   ┌─────────┐  ┌─────────────┐              ┌──────────────┐  ┌──────────────┐
   │ Lashed  │  │  ADSS Cable │              │   Armored    │  │  Dielectric  │
   │armored or│ │ OFS PowerGuide®│           │  Fortex DT   │  │  Fortex DT   │
   │non-armored│ │  DT Cable   │             │   Cable      │  │   Cable      │
   │duct cable │ └─────────────┘             └──────────────┘  └──────────────┘
   │OFS Fortex™│
   │ DT Cable  │
   └─────────┘
```

Cable Type Decision Flowchart

A Note About Squirrels

Cables need to last for decades. Squirrels can chew through both dielectric and armored cables. While armored cables may last slightly longer, they must eventually be replaced. In fact, armored cables have their own issues related to bonding/grounding and lightning. While OFS is familiar with various additives used for "squirrel resistance," we are skeptical of their performance.
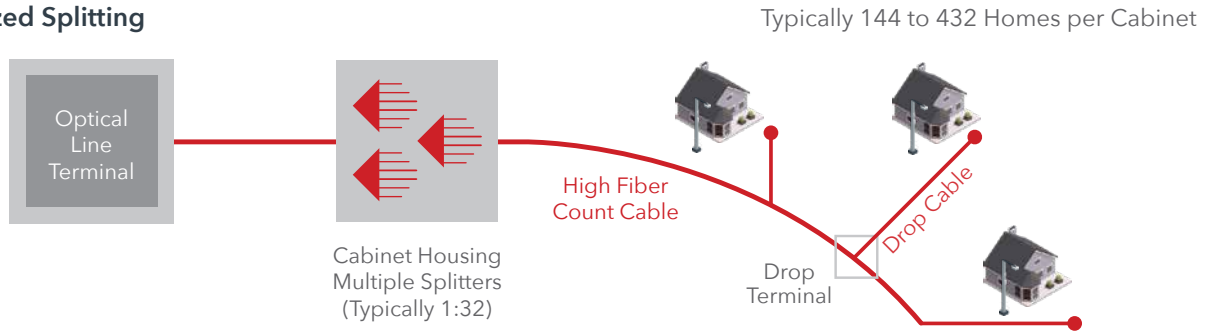
OFS Position for Co-ops:

• The best defense against squirrels is an effective tree-trimming program.

• The benefits of dielectric cables outweigh the limited additional time provided by using armored cables.

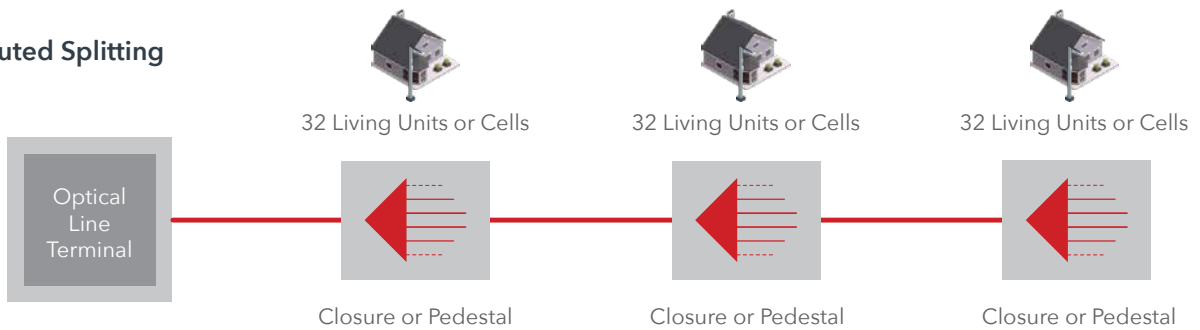# Splitter Architecture for FTTH or Mobile Backhaul

Splitter architecture is a key decision point for FTTH Passive Optical Network (PON) networks. The choice of splitter architecture is very important since it also drives the fiber count in the distribution network. There are three main splitter deployment methods – centralized, distributed, and distributed cascaded splitting. A fourth method, unbalanced splits, is only advocated for existing networks that are significantly fiber-count challenged. Different splitter architectures can be used in various parts of the network to correlate with network demands.

Centralized Splitting

Typically 144 to 432 Homes per Cabinet

Optical Line Terminal

High Fiber Count Cable

Cabinet Housing Multiple Splitters (Typically 1:32)
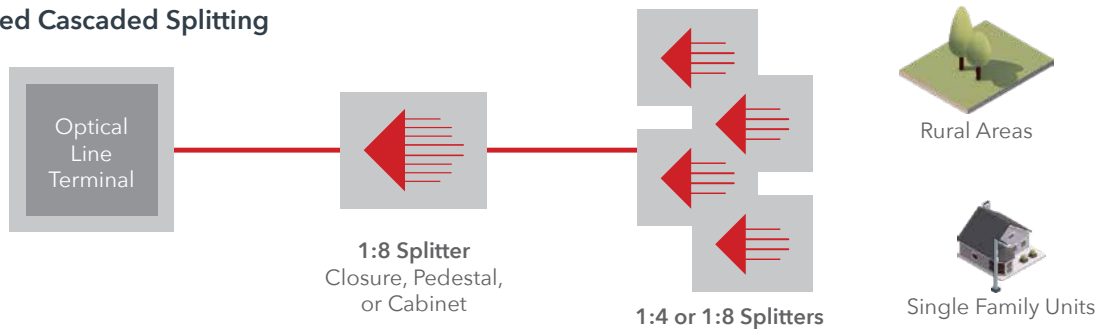
Drop Cable

Drop Terminal

Centralized splits house splitters in a central cabinet, often called a "Fiber Distribution Hub". Centralized splits use higher distribution fiber counts and have excellent splitter and OLT port efficiency. **Best for low-subscription-rate networks.** A centralized split plant is typically more expensive than other types.

Distributed Splitting

32 Living Units or Cells   32 Living Units or Cells   32 Living Units or Cells

Optical Line Terminal

Closure or Pedestal   Closure or Pedestal   Closure or Pedestal

Distributed splits house splitters in splice closures distributed near the homes. Distributed splits can lower fiber counts, but OLT port efficiency is dependent upon subscription rates. **Best for higher-subscription-rate networks.** A distributed split plant is typically less expensive than a centralized plant.

Distributed Cascaded Splitting

Optical Line Terminal

Rural Areas

1:8 Splitter Closure, Pedestal, or Cabinet

1:4 or 1:8 Splitters
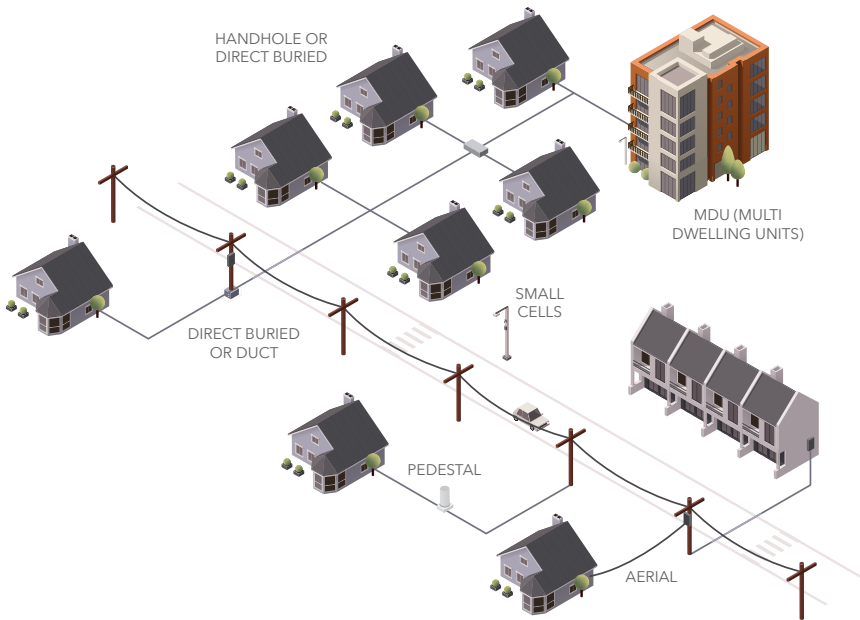
Single Family Units

Cascaded distributed splits are a subcategory of distributed splits. They use smaller splits combined to potentially lower fiber counts. A main advantage is to decrease fiber counts versus standard distributed splits.

OFS Position for Co-ops:

Due to high subscription rates and lower costs, most co-op networks are candidates for either distributed or cascaded distributed splits.

Splitter Architecture for FTTH or Mobile Backhaul *(Continued)*

Cost Versus Subscriber Density for Distributed and Cascaded Splitter Configurations

Homes per Mile (x-axis): 3, 5, 10, 15, 20

Relative Cost (y-axis)

— Cost per home passed, optical tap, 4 ports

— Cost per home passed, 1 x 4 and 1 x 8

— Cost per home passed, 1 x 2 and 1 x 16

— Cost per home passed, 1 x 32

Choosing A Splitter Architecture

SUBSCRIBER DENSITY (y-axis)

SUBSCRIPTION RATE (x-axis): 0% to 100%

CENTRALIZED

DISTRIBUTED

DISTRIBUTED CASCADED (many co-ops)

Hardened Versus Non-hardened Connectors:

Co-ops have a choice of hardened or non-hardened connectors in the outside plant. In general, OFS recommends using non-hardened connectors for co-op applications for the following reasons:

- Hardened connectors are much more expensive with no improved performance.

- Limited operational benefits to hardened connectors are offset by significantly increased costs and limited availability.

- If you want the convenience of connectors, a better choice is to use non-hardened connectors.

Ruggedized and Packaged PLC Splitters

OFS combines optical splitter and packaging expertise in a compact, ruggedized planar lightwave circuit (PLC) Splitter for FTTx applications. It allows reliable, cost-effective incremental growth, and simplifies fiber routing. It is most commonly used in distributed split configurations.

Terminals, Splicing, Connectors, and Drops

The Distribution and Drop Network

HANDHOLE OR
DIRECT BURIED

MDU (MULTI
DWELLING UNITS)

SMALL
CELLS

DIRECT BURIED
OR DUCT

PEDESTAL

AERIAL

Drop Terminals

SlimBox® Drop
Terminal

- Purpose-built for aerial networks
- Pole mountable
- Handles spliced or preconnectorized drops
- Can house splitters
- Up to 16 drops
    - EZ-Bend® Ultra-Bend Insensitive Fiber or flat drop cables

SlimBox
Underground
Drop Terminal

- Handles spliced or pre-connectorized drops
- Can house splitters
- Up to 16 drops
    - 3.0 mm EZ-Bend Ultra-Bend Insensitive Drop Cable

Spliced Versus Pre-connectorized Drop Cables:

This is a decision that is best left to each co-op. OFS does not have a position regarding which method is best. Each has pros and cons.

Spliced

- Less waste
- Slightly slower installation
- Lower material cost
- Lower inventory

Pre-connectorized
Drop Cable

Pre-connectorized - One or Two Ends

- Easy to plug and play
- More waste
- More inventory

Pigtails Versus Field-Installable Connectors:

This is another decision that is best left to each co-op. However, if a co-op chooses to use field-installable connectors, OFS recommends selecting a fusion-type connector such as OFS' EZ!Fuse™ Splice On Connector for OSP applications.

Pigtails

- Lower cost
- Pigtail slack must be managed

EZ!Fuse Splice On
Connector

Field-Installable Connectors
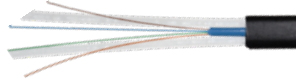
- Higher cost
- Eliminates slack management

Drop Cables - Round or Flat

Drop cables are typically either round or flat. Listed below are some decision factors regarding the use of drop cables.

PowerGuide® TTH (To the Home) Round Drop Cable

- Aerial or underground
- Capable of longer aerial spans
- Typically more expensive cable and hardware
- Dielectric only

Mini LT Flat Drop Cable

- Aerial or underground
- Capable of shorter aerial spans
- Typically less expensive cable and hardware
- Dielectric or toneable versions available

EZ-Bend Ultra-Bend Insensitive Fiber Drop Cable

- Features EZ-Bend Ultra-Bend Insensitive Fiber
- 3.0 or 4.8mm
- Black or white
- Stapleable
- Dielectric or toneable versions available

In-Home Fiber

Demarcation Devices

SlimBox CSP (Customer Splice Point)

- Internal and external versions
- Holds splices or connectors
- Compatible with flat and EZ-Bend Ultra-Bend Insensitive Fiber round drops

2-Fiber Outdoor SlimBox

- Internal and external versions
- Holds splices or connectors

In-Home Drop Materials

EZ-Bend Ultra-Bend Insensitive Fiber Drop Cable

- Features EZ-Bend Ultra-Bend Insensitive Fiber
- 3.0 or 4.8mm
- Black or white
- Stapleable

InvisiLight® Optical Solution

- Features EZ-Bend Ultra-Bend Insensitive Fiber
- Almost invisible
- Different module types to connect to ONT

SlimBox Wall Plate

- Compatible with wall electrical boxes
- Compact dimensions
- Discreet appearance

About OFS

Emmy® award-winning OFS is an original inventor of fiber.

Born from the legacy of Bell Labs fiber development, we're responsible for inventions as important to the fiber optic industry as the LC connector, gel-free cables, and zero water peak fiber.

We have decades of experience with utility fiber optic applications, including a 30+ year deployment history with ADSS cables.

We manufacture fiber in Norcross (Atlanta) Georgia, and cable in Carrollton, Georgia.

You can trust your network to OFS.
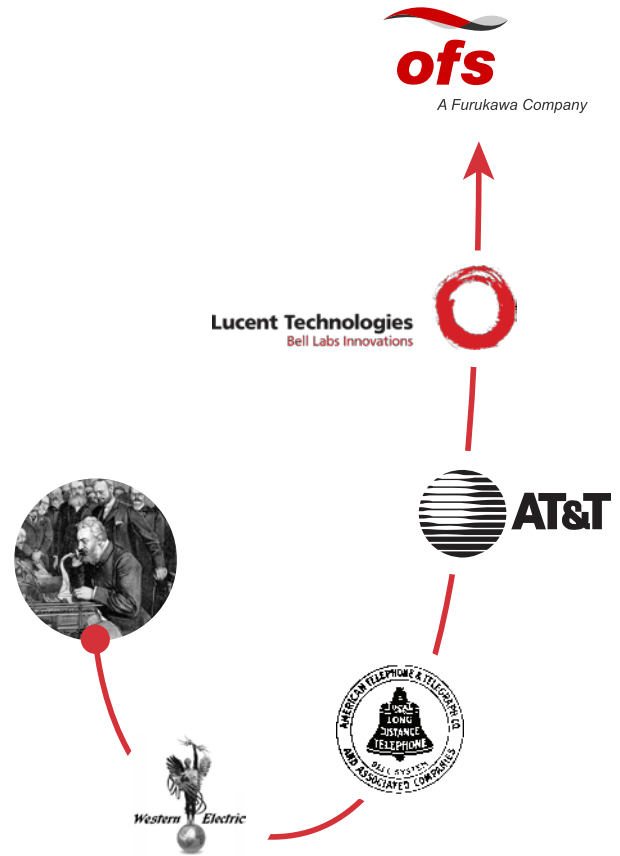
For additional information please contact your sales representative.

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