



Incab

# Fiber Optic Cable 101

## Finding the Right Cable

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Project Manager

# Registered Continuing Education Program

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Registered Continuing Education Program

## **PURPOSE STATEMENT/COURSE DESCRIPTION**

### **Fiber Optic Cable 101 – Finding the Right Cable will teach attendees:**

- Cable options for transmission and how to find the best specific cable to use
- Cable options for distribution and how to find the best specific cable to use
- Cable options for substations and how to find the best specific cable to use
- Cable options for FTTH projects and how to find the best specific cables to use
- Selected special cases



## Registered Continuing Education Program

# LEARNING OBJECTIVES

### After this webinar you will be able to:

1. Explain the **cable type options**, including the advantages and disadvantages of each, for:
  - a) **Transmission** applications: **OPGW, OPPC, ADSS, wrapped**
  - b) **Distribution** applications: **ADSS, Lashed, MASS, OPNW**
  - c) **Substation** applications: the different **underground** cables available
  - d) **FTTH** applications: the different **drop** cables available
2. State the key specifications that drive selection of the optimal cable for each cable type above
3. Show how select the optimal cable that meets your key specifications

# Incab University “School of Excellence in Fiber Optics”

Learning Hub

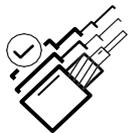


[INCABAMERICA.COM](https://www.incabamerica.com)

## Webinar Rules

- Introduction and sound check
- Presentation: 60 min
- Use chat for questions during presentation
- Q&A (NB! Technical questions only)
- Let's start!

## Finding the Right Cable



**more than 100**

types of design in production

- Which is best to use for your project?  
Let's look at it..



OPGW



BlownIn



InDuct



InArmor



InWater



ADSS



InAir Figure 8



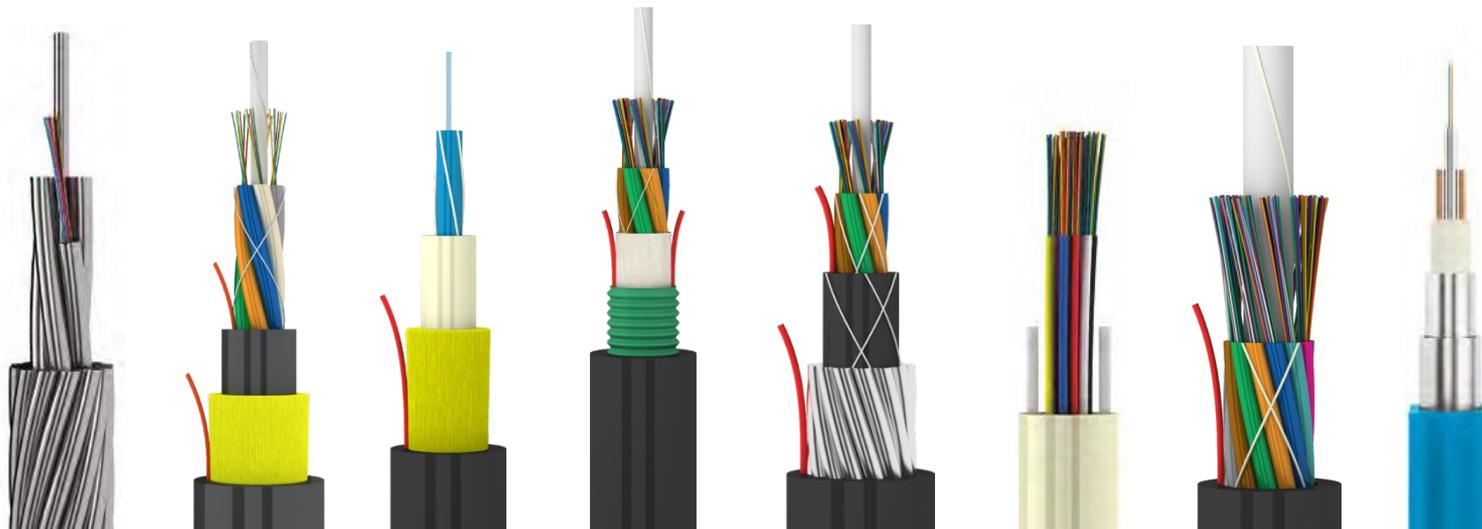
InControl



InDrop FTTH



InFire Rated





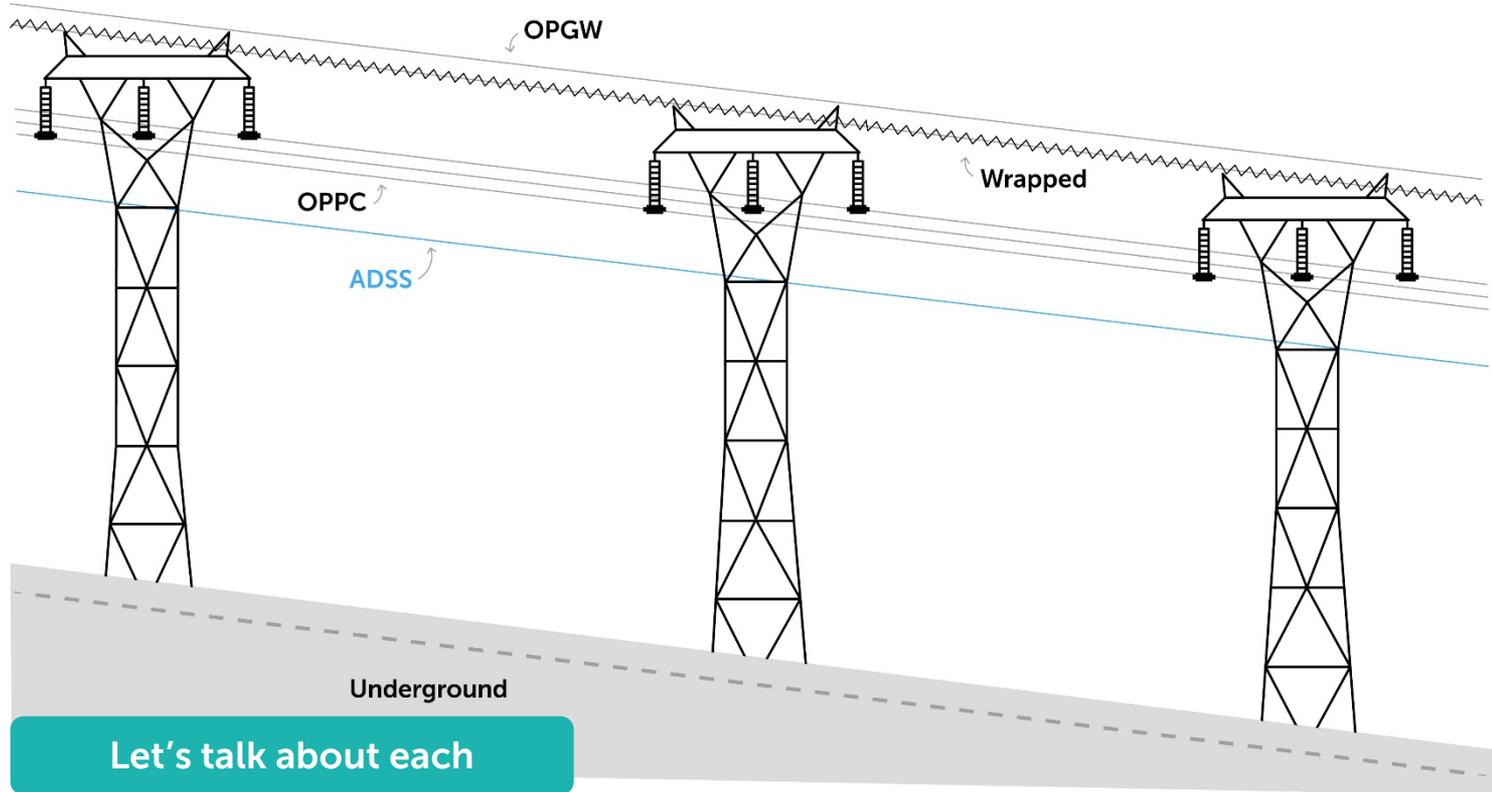
Finding the Right Cable

## **Let's Approach Cable Selection by the Application**

1. Transmission
2. Distribution
3. Substation
4. Fiber-to-the-Home (FTTH)
5. Special cases

# Finding the Right Cable

## Application - Transmission



Let's talk about each

# Cables for Transmission

## Optical Groundwire (OPGW)

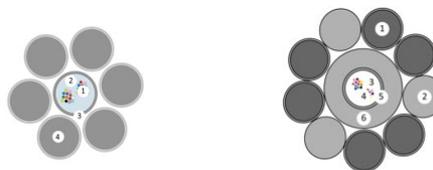
### Advantages:

- Conceptually easy to replace a conventional shieldwire with an OPGW
- Proven technology
- Excellent availability
- Multiple sources
- Wide range of designs available to meet specific mechanical, electrical, and optical requirements
- Can expect service life of 40+ years

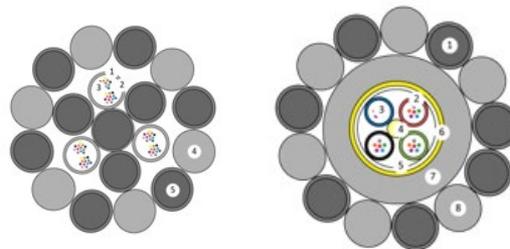
### Disadvantages:

- Cost relative to dielectric cables (2x)
- Line outages to install
  - Live-line installation possible, but...

The standard go-to solution



Center Tube Designs



Stranded Tube Design

Aluminum Pipe Design

## Cables for Transmission

# All-Dielectric Self-Supporting (ADSS)



**Double-Jacket  
Aramid**



**Single-Jacket  
Aramid**



**Double-Jacket  
FRP**



**Double-Jacket  
Fiberglass**



**Single-Jacket  
Fiberglass**

**A solid solution when OPGW  
cannot readily be used**

### Advantages:

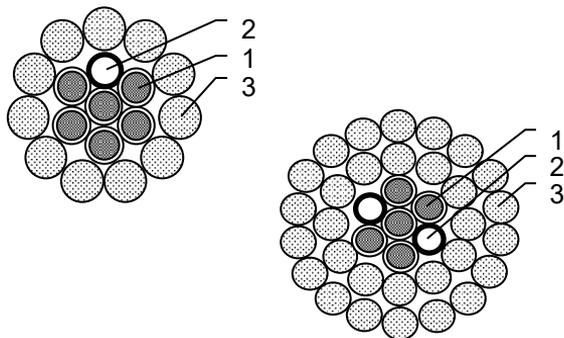
- Conceptually easy to add an ADSS below the phase conductors
- Proven technology
- Excellent availability
- Multiple sources
- Wide range of designs available to meet specific mechanical, electrical (i.e. tracking-resistant), and optical requirements
- Very economical
- Can install without taking an outage

### Disadvantages:

- Lower service life of 20+ years
- More vulnerable to damage than metallic cables
  - Shotgun, bird, and squirrels

## Cables for Transmission

# Optical Phase Conductor (OPPC)



Comment: Aluminum-pipe type designs work better for splicing, but stainless-steel tube designs work better electrically

**Use when neither OPGW  
nor ADSS can be**

### Advantages:

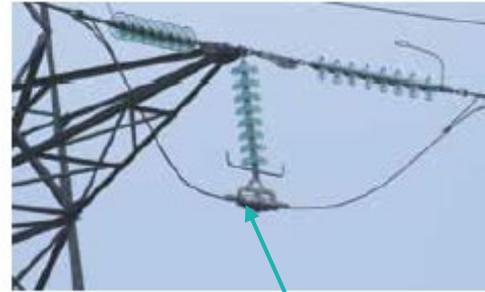
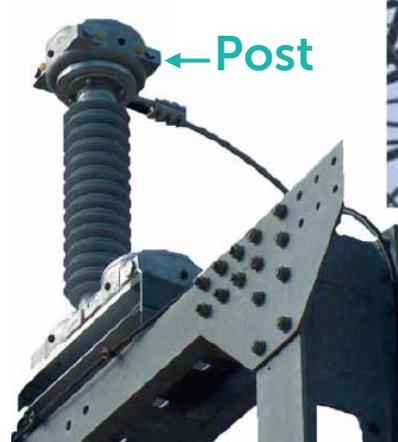
- Intuitive to replace one or more standard phase conductors with OPPC
- A variation on the OPGW design concept
- Can expect service life of 40+ years

### Disadvantages:

- Cost relative to dielectric cables (2x)
- Limited applications to date
- Access to the fibers much harder
  - “Hot” enclosures or “optical isolator (insulator)”
  - Difficult maintenance (splices)
- “Double whammy” of isolator failure
  - Lose both communications and power transmission
- Coordinating sag with non-OPPC’s
- Line operating temperature limited to 85°C (185°F) (Max sustained fiber temp)

Cables for Transmission

## Optical Phase Conductor (OPPC) - Splicing

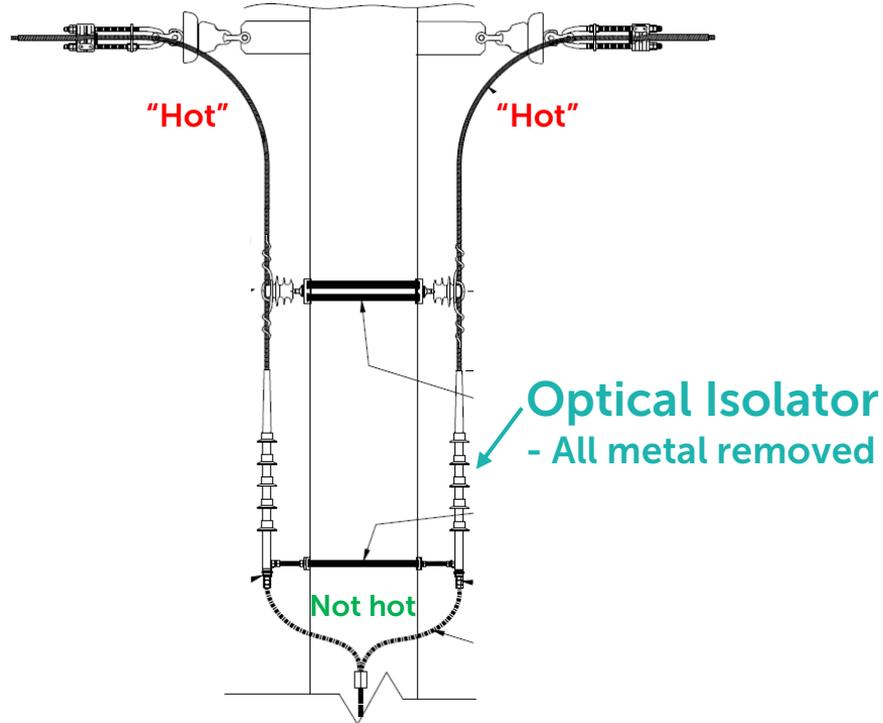


Suspended

"Hot" OPPC Enclosures

Cables for Transmission

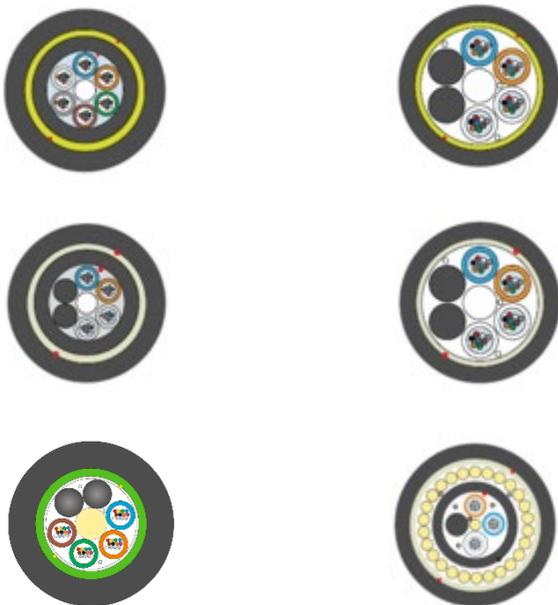
# Optical Phase Conductor (OPPC) - Splicing



"Isolated" OPPC Enclosure

# Cables for Transmission

## Underground Cable



### Advantages:

- Proven technology
- Excellent availability
- Multiple sources
- Wide range of designs available to meet specific project requirements
  - Duct, Direct Bury (armored), micro-duct/blown in
- Can install without taking an outage
- Good service life of 25+ years

### Disadvantages:

- More vulnerable to damage than you first think
  - Backhoes outnumber tornados
  - Those pesky rodents
- High installation cost (but cable itself is very economical)

More of a "special case" solution



# Cables for Transmission

## Wrapped Dielectric



**This type cable is literally wrapped around an existing groundwire (or conductor)**

Wrapping machine



### Advantages:

- Conceptually easy to wrap a cable around an existing groundwire
  - Theoretically, a great retrofit option

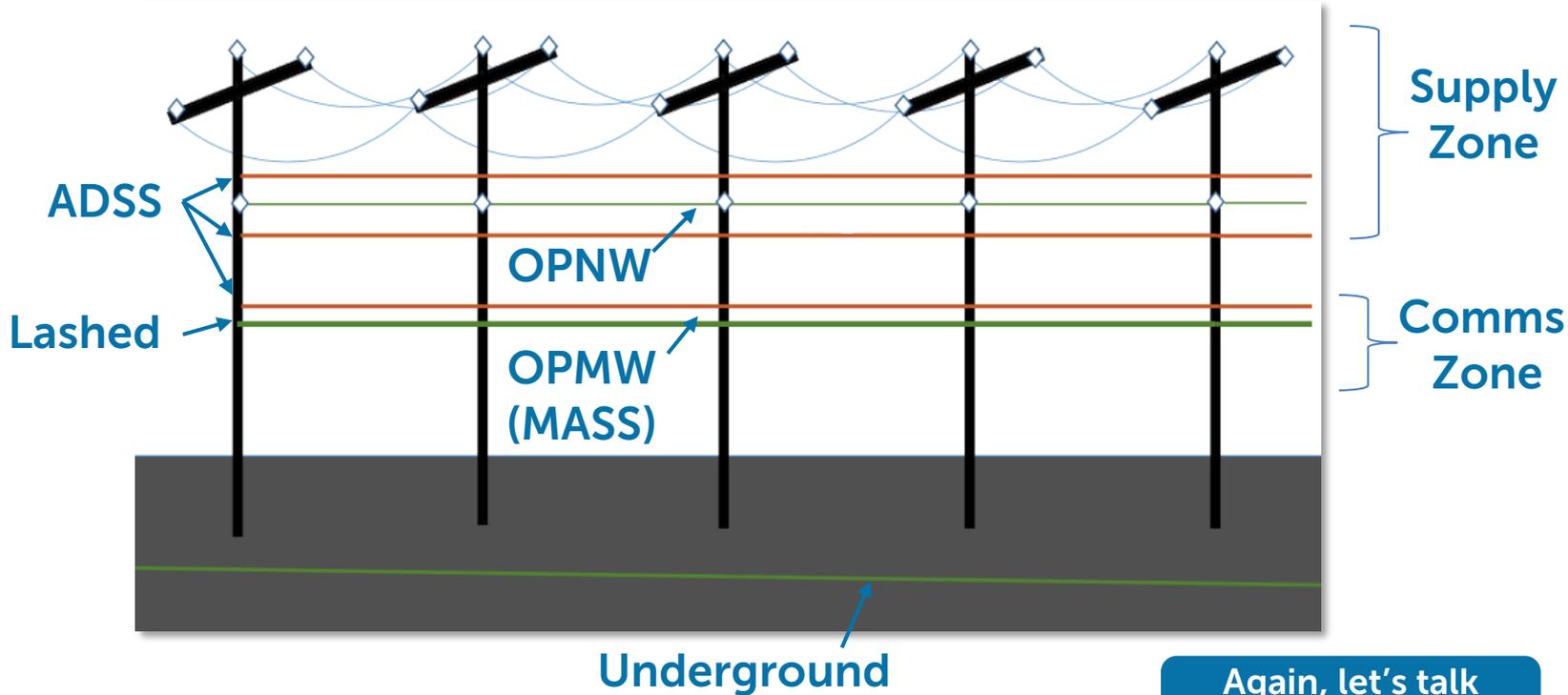
### Disadvantages:

- Much lower service life, maybe 10 years
  - Utilities have accepted < 5 years
- Very vulnerable to damage because cable must be small and light → low protection
  - Shotguns, birds, and squirrels
- Short reel lengths = more splices = splice loss and cost
- “Bunching” of cable at mid-span over time
  - Can lead to increased attenuation
- Very limited suppliers (2?)

**Use as a last resort**

# Finding the Right Cable

## Application - Distribution



Again, let's talk about each

## Cables for Distribution

# All-Dielectric Self-Supporting (ADSS)



### Advantages:

- Conceptually easy to add an ADSS in either the supply or communication zones
- Proven technology
- Excellent availability
- Multiple sources
- Wide range of designs available to meet specific mechanical and optical requirements
- Very economical
- Can install without taking an outage

### Disadvantages:

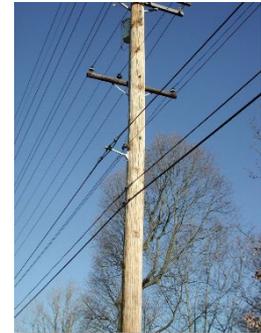
- For distribution, none
  - But, beware of shotguns, birds, and (especially) squirrels

**The standard go-to  
solution for distribution**

## Cables for Distribution

# All-Dielectric Self-Supporting (ADSS) – Supply vs. Comm

Pros	Cons
Greatly reduced make-ready costs	Power utility crews are required
No Grounding	Vulnerable to shotgun damage and squirrels (Incab does offer rodent-resistant fiber)
No competing against other companies for space (Not in Comm Zone)	Sag due to ice and wind
Very low maintenance after installation	
In most cases, additional guys not needed	
Similar installation to a conductor	



## Cables for Distribution

# Lashed Cable (communications region)



### Advantages:

- Can use any dielectric cable type that you would use in a duct
  - Can use armored cable to help mitigate shotgun, bird, and squirrel damage
- Excellent availability with multiple sources
  - Cable itself is very economical
- Wide range of designs available
- Can install without taking an outage
- Can use telco installation crews instead of power crews
- Can over-lash to add capacity
- Good service life of 20+ years

## Cables for Distribution

# Lashed Cable (communications region)



### Disadvantages:

- Potentially very high make-ready costs
  - Could be \$50,000/mile or more (yikes!)
- Higher installation and O&M costs
  - 2-step install: messenger, then cable
  - Broken lashing = constant maintenance
- Messenger must be bonded to ground
  - Induced voltage and current on metallic-armored cables
- Competition for space with telcos

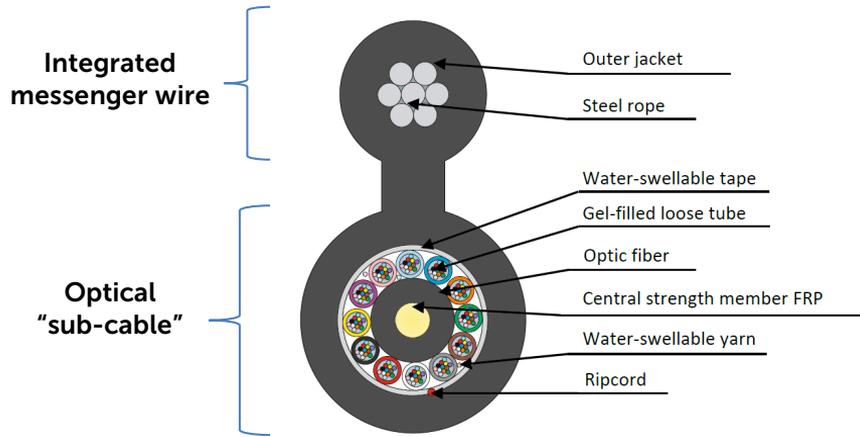


Broken lashing wire

Often a good solution

## Cables for Distribution

# Figure-8 Cable (Think "Pre-Lashed")



Another option in your cable "toolbox"

### Advantages:

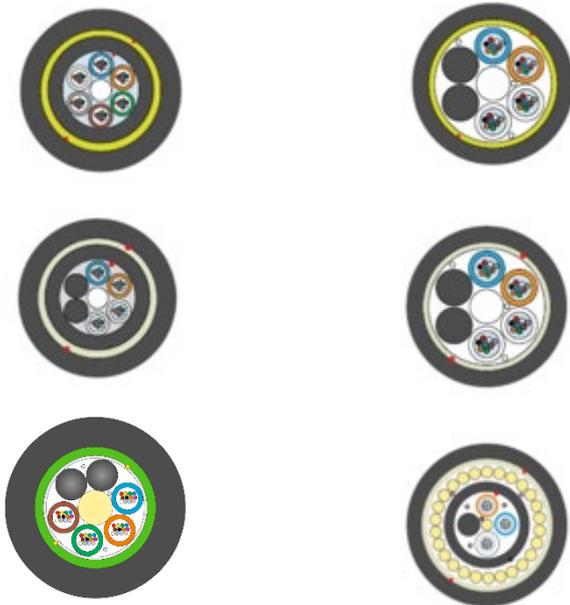
- Can install without taking an outage
- Can (perhaps) use telco installation crews instead of power crews
- Can over-lash to add capacity
- Integrated messenger means no broken lashing wires
- Can armor the optical core to help mitigate shotgun, bird, and squirrel damage
- "Not bad" economics
- Good service life of 20+ years

### Disadvantages:

- Potentially very high make-ready costs
  - Could be \$50,000/mile or more (yikes!)
- Higher installation cost than ADSS
  - Slower to string because of the shape
  - Slower to splice prep because must remove the integrated messenger wire
- Messenger must be bonded to ground
- Competition for space with telcos

# Cables for Distribution

## Underground Cable



### Advantages:

- Proven technology
- Excellent availability
- Multiple sources
- Wide range of designs available to meet specific project requirements
  - Duct, Direct Bury (armored), micro-duct/blown in (will explain later)
- Can install without taking an outage
- Good service life of 25+ years

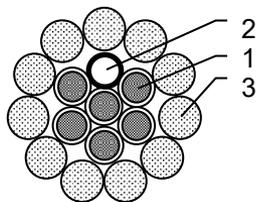
### Disadvantages:

- More vulnerable to damage than you first think
  - Backhoes outnumber tornados
  - Those pesky rodents
- High installation cost (but cable itself is very economical)

**Sometimes a good solution**

# Cables for Distribution

## Optical Neutral Wire (OPNW)



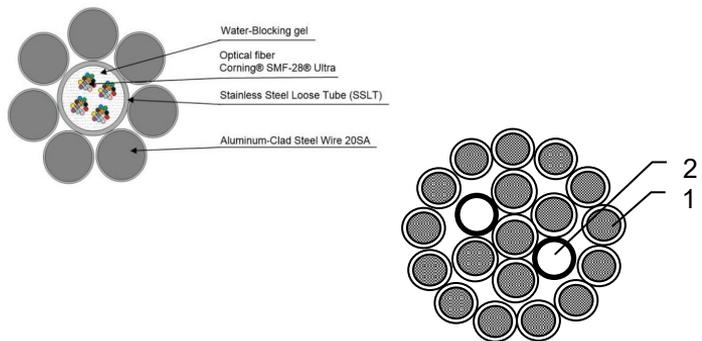
**Comment: As with OPPC, aluminum-pipe type designs work better for splicing, but stainless-steel tube designs work better electrically**

**Keep OPNW in mind**

- Advantages:
  - Intuitive (?) to replace a conventional neutral with an OPNW
  - A variation on the OPGW or OPPC design concepts
  - Can expect service life of 40+ years
- Disadvantages:
  - Cost relative to dielectric cables (2x)
  - Limited applications to date
    - Usually, it is easier to use ADSS
  - Requires new supporting hardware and changes to work practices (some folks don't like change)
  - Must distinguish between standard neutral and OPNW (easy, but different)
  - The reality of voltage and current on an OPNW
    - "Hot" enclosures or "optical isolator (insulator)"?
    - Again, different work practices

## Cables for Distribution

# Optical Messenger Wire (OPMW) or Metallic Aerial Self-Supporting (MASS)



**Comment: OPMW implies that the cable supports another, such as a lashed cable or Hendrix spacer cable system. MASS implies a stand-alone cable. Otherwise, they are the same.**

**Keep OPMW or  
MASS in mind**

### Advantages:

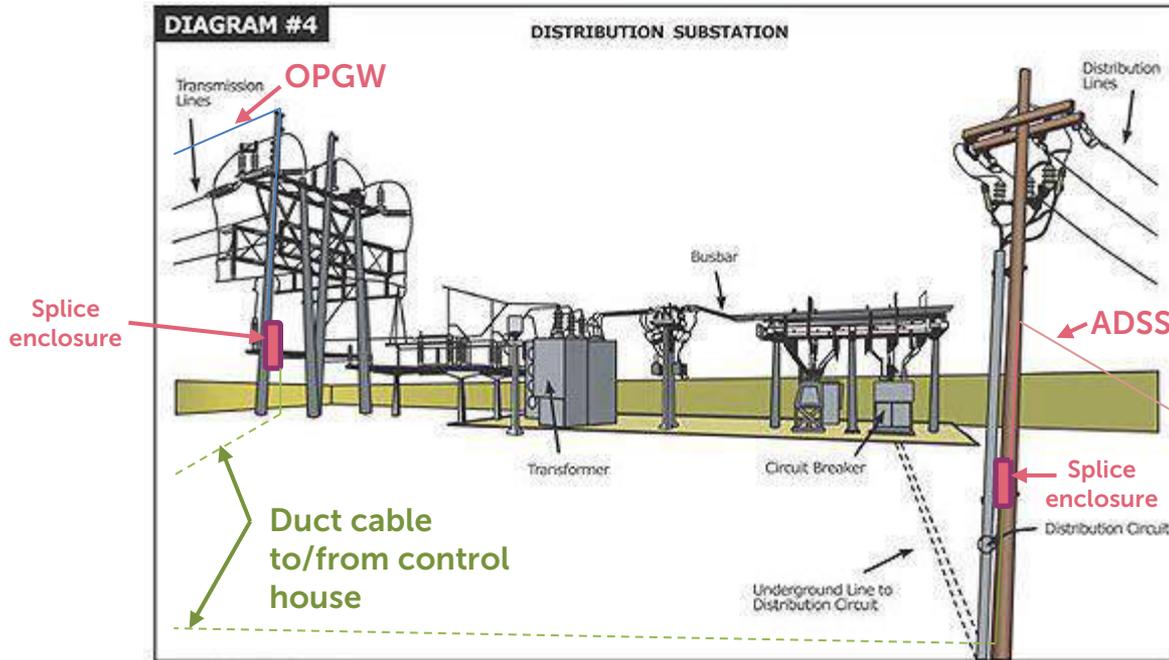
- Intuitive (?) to replace a conventional messenger wires with an OPMW or MASS
- A variation on the OPGW, OPCC, OPNW design concepts
- Great resistance against shotguns, birds, and squirrels
- Can be over-lashed to add capacity
- Can expect service life of 40+ years

### Disadvantages:

- Cost relative to dielectric cables (2x)
- Limited applications to date
  - Usually, it is easier to use ADSS or lashed options
- Must distinguish between standard messenger and OPNW or MASS (easy, but different)
- Beware of induced voltage and current!
  - Must bonded to ground

# Finding the Right Cable

## Application - Substation



### Common practice

- Aerial cables come into the SS to a splice point, and duct cable from there to control house
- All-dielectric underground cables in conduit typical
  - ADSS can also be used
- Metallic armored cables NOT used because of induced voltage and current

### Consider

- Non-metallic armored cables could be used for direct bury or better protection against rodents
- Micro-ducting could be used to add capacity to existing ducts or to allow for increasing capacity in the future
- Newer designs to support sensing, data acquisition, and advanced control systems for Smart Grid

Finding the Right Cable

## Application – Substation: Microducts?

HDPE SUB DUCTS



MICRODUCTS



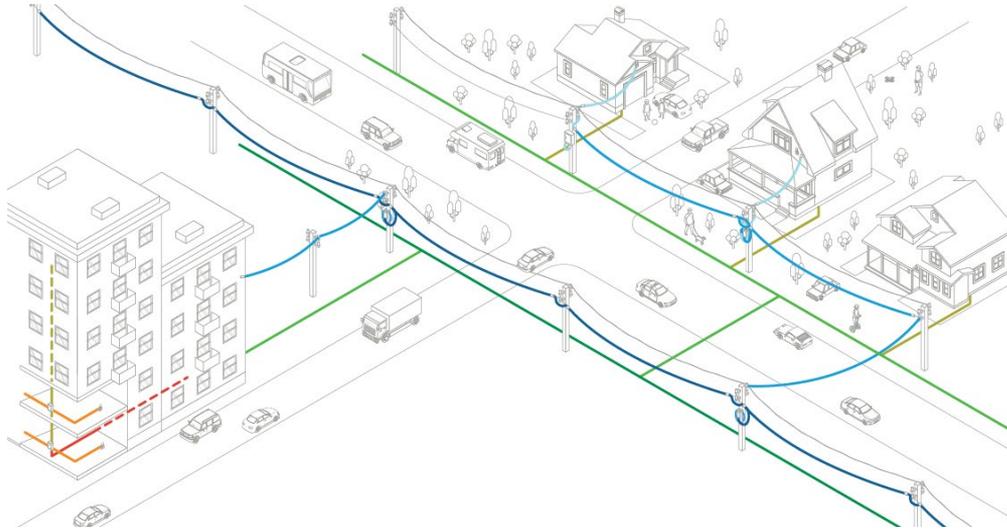
TUBE BUNDLES



**Many options! These just illustrate the underlying concept:  
→ Make better use of available conduit space!**

# Finding the Right Cable

## Application – Fiber to the Home (FTTH)



### Cables up to the curb

- Any of the cables we have discussed for Distribution applications can be used for a FTTH network
- Which type to use is up to you based your assessment of the advantages and disadvantages as applied to your service territory
- The fiber counts to use will follow from your network architecture (density is a factor)

### Drop cables

- Aerial
  - Round
  - Flat (“butterfly”)
  - Figure-8
- Underground
  - Same options as above, but...
  - Conduit versus Direct-Bury

## Finding the Right Cable

# Application – Fiber to the Home (FTTH)

### Drop cable options

- Flat (“butterfly”) Cable
  - The most popular option by far ( $\approx 90\%$ )
  - Easiest to prep of these three options
  - Widely available “universal” hardware
- Figure-8 Cable
  - The next most popular ( $\approx 6 - 7\%$ )
  - More use in rural settings where longer aerial spans are needed
  - Hardware should be blessed by cable manufacturer
- Round Cable
  - The least popular ( $\approx 2 - 4\%$ )
  - Prepped like any round cable/considered the hardest
  - Capable of the longest spans (think “micro ADSS” designed to your specs)
  - Deadends must be blessed by cable manufacturer
- Note that you can add “toneable” capability to any of the above (using a tracer wire)



# Finding the Right Cable

## Direct Bury vs Conduit

### Direct Bury



- Lower overall cost
- Multiple options for armor to protect cable
- Will need to ground/potential to carry voltage back to electronics
- Armor can be used to locate cable after install



### Conduit



- Higher overall costs
- Conduit provides protection for cable
  - Can make repair/replace faster too
- No grounding necessary
- Can use ADSS cable in duct
- Can install multiple ducts for later expansion or leasing opportunities
- Ability to utilize micro-duct to run multiple micro-cables in same conduit (more opportunity to make \$\$\$)



## Finding the Right Cable

# Application – Special Situations

From an old advertisement: “Hold the pickles, Hold the lettuce, Specialty cables don’t upset us, All we ask is that you let us, make them your way!”\*

- Sensing. Using a fiber optic cable, there’s a way to sense and collect data on just about anything you could imagine
- Submersible. Need to get across a lake or river? There are submersible cable designs readily available!
- Add Power! Need both fiber *and* power in the same cable? It can be done!

\* - If you recognize this jingle first-hand, then you’re old! (Sorry!)

# Finding the Right Cable

## What Drives Cable Design?

Cable Type	Always	Often	Sometimes
OPGW	Fiber Count Fault Current Diameter	Sag and Tension (strength/weight ratio) Design Type (plastic tubes vs Stainless Steel)	Lightning Withstand Capability Other
ADSS	Fiber Count Max. Span Length Line Voltage (need for TR jacket)	Sag as % span	Need for rodent protection
Underground/Lashed/Fig-8	Fiber Count	Diameter	
Drop Cables - Aerial - Underground	Max. Span	- Need for toneability	Fiber Count
Specialty Cables	Application Fiber Count		



## Finding the Right Cable

# The three (3) ways to choose the exact cable to use

### Method 1 – Use what's been used before

- Pro's
  - Easy!
  - For aerial cable, you already have the hardware selected too
  - Operations personnel are already used to working with it
- Con's
  - Is the cable still the best or best suited available today?
  - Have your needs changed?
  - Competition tends to reduce cost and improve quality and service (versus "sole sourced")



## Finding the Right Cable

# The three (3) ways to choose the exact cable to use

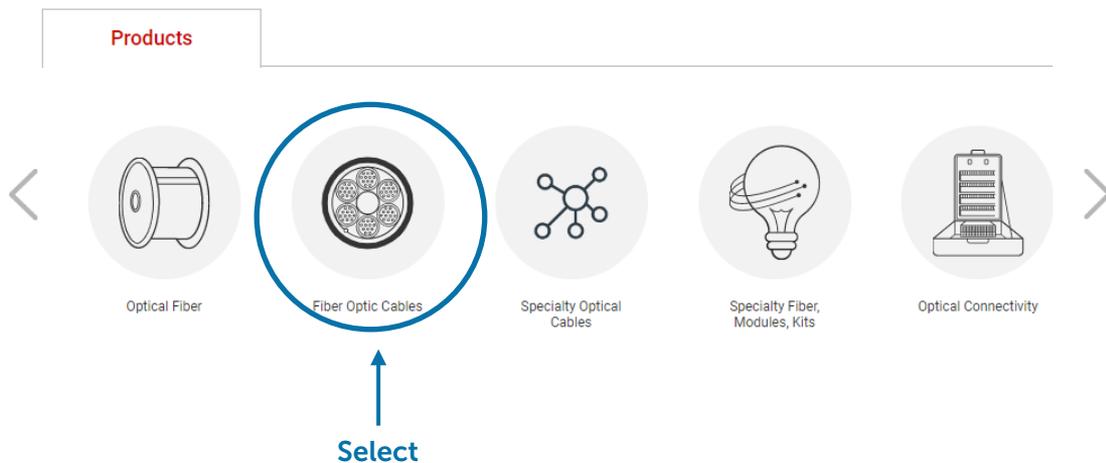
**Method 2 – Use catalogs** (whether old-fashioned print ones or on-line versions) with tabulated data

- In this method, you select the cable you need based upon key requirements such as fiber count, diameter, and so forth
- Let's try finding a 48-fiber ADSS expected to be used on a 12.5 kV distribution line with spans up to 300 ft under NESC Heavy conditions with 1% installation sag
- We'll look at how you could do this with three leading suppliers using information available on their website
  - (Comment: To the extent that I can, I will try to disguise the identity of each)

# Finding the Right Cable – Choosing the exact cable

## Method 2 – Supplier X

Supplier X – Starting at their main website... you see:

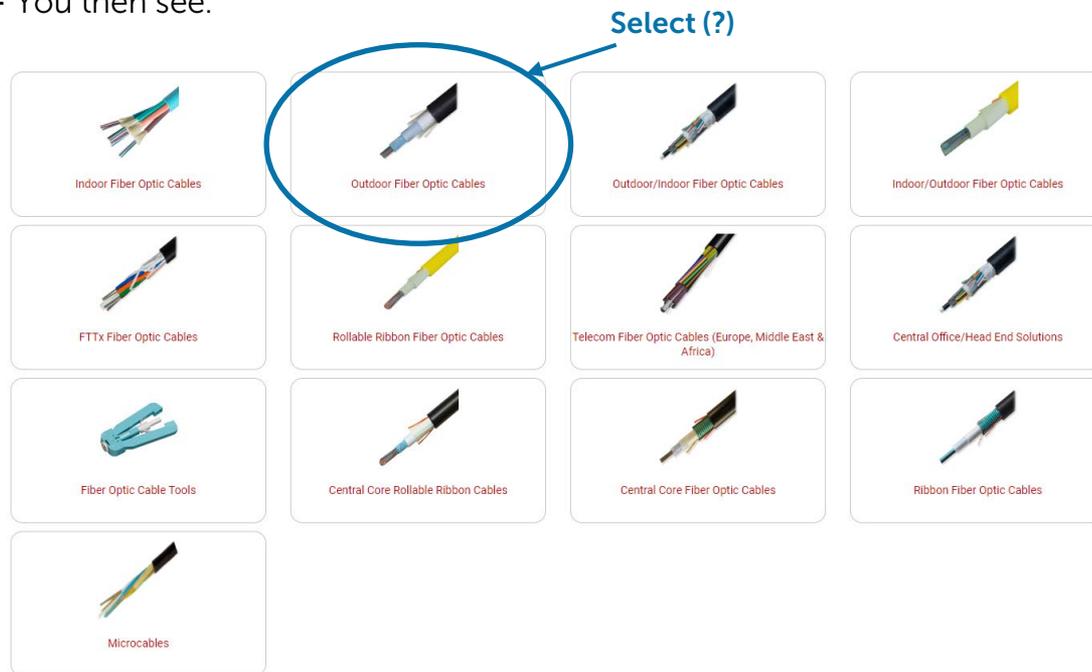


**Step 1**

# Finding the Right Cable – Choosing the exact cable

## Method 2 – Supplier X

Supplier X – You then see:



Step 2

# Finding the Right Cable – Choosing the exact cable

## Method 2 – Supplier X

Supplier X – Which brings you to:

 <p>Microcables</p>	 <p>Central Core Rollable Ribbon Cables</p>	 <p>Totally Gel-Free Fiber Optic Cables</p>	 <p>Central Core Fiber Optic Cables</p>
 <p>Drop Fiber Optic Cables</p>	 <p>Loose Tube Fiber Optic Cables</p>	 <p>Rollable Ribbon in Loose Tube</p>	 <p>Ribbon Fiber Optic Cables</p>
 <p>Sherpa CMS™ Cable Management System</p>			

Select (?)

### Step 3

# Finding the Right Cable – Choosing the exact cable

## Method 2 – Supplier X

Supplier X – And now you have:

Items Per Page:  Sort by:  Table Expanded List Compare Add to Cart

Item #	Description	Unit Price	Quantity	Unit of Measure	Compare
AccuTube® Armored DJ/SA Rib LT Cables	AccuTube® Armored DJ/SA Rib LT Cables			Each	<input type="checkbox"/>
AccuTube® Lt Armor SJ/SA Rib LT Cables	AccuTube® Lt Armor SJ/SA Rib LT Cables			Each	<input type="checkbox"/>
AccuTube® Single Jacket Rib LT Cables	AccuTube® Single Jacket Rib LT Cables			Each	<input type="checkbox"/>
DryBlock® Armored Loose Tube Cables	DryBlock® Armored Loose Tube Cables			Each	<input type="checkbox"/>
DryBlock® High-Density LT Fiber Cables	DryBlock® High-Density LT Fiber Cables			Each	<input type="checkbox"/>
DryBlock® Light Armor Loose Tube Cables	DryBlock® Light Armor Loose Tube Cables			Each	<input type="checkbox"/>
DryBlock® Single Jacket LT Cables	DryBlock® Single Jacket LT Cables			Each	<input type="checkbox"/>
Fortex™ 2DT Armored Cables	Fortex™ 2DT Armored Cables			Each	<input type="checkbox"/>
Fortex™ 2DT Light Armor Cables	Fortex™ 2DT Light Armor Cables			Each	<input type="checkbox"/>
Fortex™ 2DT Single Jacket Cables	Fortex™ 2DT Single Jacket Cables			Each	<input type="checkbox"/>
Fortex™ DT Cables - Armored	Fortex™ DT Cables - Armored			Each	<input type="checkbox"/>
Fortex™ DT Cables - Light Armor	Fortex™ DT Cables - Light Armor			Each	<input type="checkbox"/>
Fortex™ DT Cables - Single Jacket	Fortex™ DT Cables - Single Jacket			Each	<input type="checkbox"/>
Mini LT Flat Drop Cables	Mini LT Flat Drop Cables			Each	<input type="checkbox"/>
Mini LT Flat Drop Toneable Cables	Mini LT Flat Drop Toneable Cables			Each	<input type="checkbox"/>
OPTION1™ DT O/I Armored Cables	OPTION1™ DT O/I Armored Cables			Each	<input type="checkbox"/>
OPTION1™ DT O/I Cables	OPTION1™ DT O/I Cables			Each	<input type="checkbox"/>
PlenumXcel™ O/I LT Plenum Cables	PlenumXcel™ O/I LT Plenum Cables			Each	<input type="checkbox"/>
PowerGuide® AccuTube Fiber Optic Cables	PowerGuide® AccuTube Fiber Optic Cables			Each	<input type="checkbox"/>
PowerGuide® ShortSpan DT Cables	PowerGuide® ShortSpan DT Cables			Each	<input type="checkbox"/>

### Step 4

I don't know which to choose

# Finding the Right Cable – Choosing the exact cable

## Method 2 – Supplier X

Supplier X – But, hover over each choice, and you get more information:

Items Per Page: 30 | Sort by: Item Number A to Z | Table | Expanded | List

Compare | Add to Cart

Item #	Description	Unit Price	Quantity	Unit of Measure	Compare
AccuTube® Armored DJ/SA Rib LT Cables	AccuTube® Armored DJ/SA Rib LT Cables			Each	<input type="checkbox"/>
AccuTube® Lt Armor SJ/SA Rib LT Cables	AccuTube® Lt Armor SJ/SA Rib LT Cables			Each	<input type="checkbox"/>
AccuTube® Single Jacket Rib LT Cables	AccuTube® Single Jacket Rib LT Cables			Each	<input type="checkbox"/>
DryBlock® Armored Loose Tube Cables	DryBlock® Armored Loose Tube Cables			Each	<input type="checkbox"/>
DryBlock® High-Density LT Fiber Cables	DryBlock® High-Density LT Fiber Cables			Each	<input type="checkbox"/>
DryBlock® Light Armor Loose Tube Cables	DryBlock® Light Armor Loose Tube Cables			Each	<input type="checkbox"/>
DryBlock® Single Jacket LT Cables	DryBlock® Single Jacket LT Cables			Each	<input type="checkbox"/>
For	Fortex™ 2DT Armored Cables			Each	<input type="checkbox"/>
For	Fortex™ 2DT Light Armor Cables			Each	<input type="checkbox"/>
For	Fortex™ 2DT Single Jacket Cables			Each	<input type="checkbox"/>
For	Fortex™ DT Cables - Armored			Each	<input type="checkbox"/>
For	Fortex™ DT Cables - Light Armor			Each	<input type="checkbox"/>
For	Fortex™ DT Cables - Single Jacket			Each	<input type="checkbox"/>
Min	Mini LT Flat Drop Cables			Each	<input type="checkbox"/>
Min	Mini LT Flat Drop Toneable Cables			Each	<input type="checkbox"/>
OP	OPTION1™ DT O/I Armored Cables			Each	<input type="checkbox"/>
OP	OPTION1™ DT O/I Cables			Each	<input type="checkbox"/>
Pl	PlenumXcel™ O/I LT Plenum Cables			Each	<input type="checkbox"/>
PowerGuide® AccuTube Fiber Optic Cables	PowerGuide® AccuTube Fiber Optic Cables			Each	<input type="checkbox"/>
PowerGuide® ShortSpan DT Cables	PowerGuide® ShortSpan DT Cables			Each	<input type="checkbox"/>

PowerGuide® AccuTube Fiber Optic Cables

Unit of Measure : Each

Item # : PowerGuide® AccuTube Fiber Optic Cables



Short Description : PowerGuide® AccuTube Fiber Optic Cables

Long Description : Applications ADSS,Aerial

Step 5-ish

So, let's choose this one

# Finding the Right Cable – Choosing the exact cable

## Method 2 – Supplier X

Supplier X – Now you see:

### PowerGuide® AccuTube Fiber Optic Cables

This item cannot be purchased online. Contact Customer Service to purchase this item.



Item # PowerGuide® AccuTube Fiber Optic Cables

Compare

Description

Specifications

Downloads

#### Item Number

PowerGuide® AccuTube Fiber Optic Cables

#### Description

PowerGuide® AccuTube Fiber Optic Cables

#### Applications

ADSS,Aerial

## Step 6

# Finding the Right Cable – Choosing the exact cable

## Method 2 – Supplier X

Supplier X – Now you see:

### PowerGuide® AccuTube Fiber Optic Cables

This item cannot be purchased online. Contact Customer Service to purchase this item.



Item # PowerGuide® AccuTube Fiber Optic Cables

Compare



Description	<b>Specifications</b>	Downloads
-------------	-----------------------	-----------

<b>Construction</b>	Ribbon
<b>Aerial or Underground</b>	Aerial
<b>Dielectric or Metallic</b>	Dielectric
<b>Waterblocking Component</b>	DryBlock®

## Step 7

# Finding the Right Cable – Choosing the exact cable

## Method 2 – Supplier X

Supplier X – Now you see:

### PowerGuide® AccuTube Fiber Optic Cables

This item cannot be purchased online. Contact Customer Service to purchase this item.



Item # PowerGuide® AccuTube Fiber Optic Cables

Compare

Description

Specifications

**Downloads**

PDF File

PowerGuide Loose Tube Fiber Optic Cables Brochure

## Step 8

So, let's download the brochure

# Finding the Right Cable – Choosing the exact cable

## Method 2 – Supplier X

Supplier X – The downloaded brochure is 8 pages, and on page 6 you find:

PowerGuide ADSS Loose Tube Cable Ordering Information		
Example: AT-3BE27DT-NNN-E1, E2, E3, E4 <sup>1</sup>		
Part Number: AT- S1 S2 SF S3 S4 S5 S6 - N N N - [E1] [E2] [E3] [E4] <sup>1</sup>		
<b>S1 = Fiber Selection</b> See S1 Fiber Table above	<b>Tensile Load</b> 7 = PowerGuide Double Jacket, PowerGuide TR, PowerGuide ShortSpan DT and PowerGuide AccuTube	<b>Fibers per Tube</b> 2 = 2 Fibers 4 = 4 Fibers 6 = 6 Fibers 8 = 8 Fibers N = 10 Fibers T = 12 Fibers (12-fiber ribbons only for AccuTube design)
<b>S2 = Fiber Transmission Performance</b> See S2 Fiber Table above		<b>S6 =</b>
<b>SF = Fiber Type<sup>2</sup></b> See SF Fiber Table above	<b>Core Type</b> D = DryBlock® A = Loose Tube Ribbon DryBlock (available in AccuTube design only)	<b>NNN = Fiber Count = 002-288</b>
<b>Sheath Construction</b> 2 = Double Jacket ADSS 1 = Single Jacket ADSS	<b>S5 =</b>	<b>Custom Special</b> [E1]* = Outer Jacket [E2][E3][E4]* = Dielectric Sheath Strength Elements
<sup>1</sup> Part Number shown is for a PowerGuide ADSS Cable with standard AllWave ZWP attenuation and standard cable print. Maximum AllWave ZWP attenuation: 0.35/0.31/0.27/0.25/0.27 dB/km @ 1310/1385/1490/1550/1625 nm. Standard Print, example for PowerGuide ADSS Cable: <b>OFS OPTICAL CABLE AT-3BE27DT-NNN-E1, E2, E3, E4 [MM-YY] [HANDSET SYMBOL] [NNN] F [SERIAL #]</b>		
<sup>2</sup> Contact OFS Order Management for information on other cable variations, including additional fiber types, attenuation, and custom cable print.		
<b>NOTE:</b> For more information regarding typical attenuation as well as attenuation parameters on Link Design Value (LDV) (Maximum end-to-end attenuation over a concatenated span), please see OFS Application Note AN-111 which can be downloaded at <a href="http://www.ofsoptics.com">www.ofsoptics.com</a> or contact your OFS representative.		
<sup>3</sup> Custom/Special: Consult with us regarding your application, span lengths and loading conditions to complete the custom design and part number or your sheath strength system.		
<b>For PowerGuide Double Jacket, PowerGuide Tracking Resistant and PowerGuide AccuTube Cables:</b> [E1][E2][E3][E4] Outer Jacket [E1] and Dielectric Sheath Strength Elements [E2][E3][E4]*		
<b>For PowerGuide ShortSpan DT Cable</b> [C][M][E][A] or [C][L][G][A] Outer Jacket [C] and Dielectric Sheath Strength Elements [M, E, A]* or [L, G, A]*		

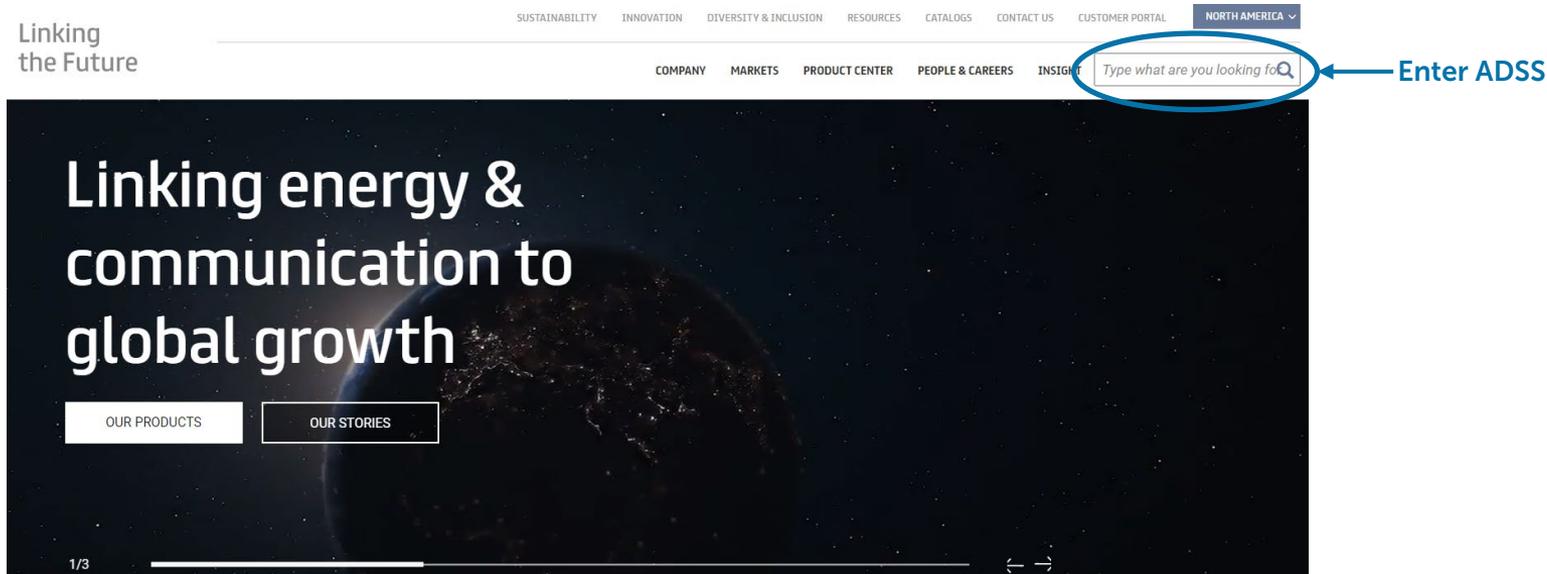
- This is the closest that you get to product specifications
- I believe that I made a good-faith effort here, but after 10 steps, I have not found any details about this supplier's cable or been able to confirm that they even have one that meets our specified requirements (but they do)
- Let's move on to Supplier Y

## Step 9

# Finding the Right Cable – Choosing the exact cable

## Method 2 – Supplier Y

Supplier Y – Starting at their main website, you select your country, and then you see:



The screenshot shows the homepage of Supplier Y. The top navigation bar includes links for SUSTAINABILITY, INNOVATION, DIVERSITY & INCLUSION, RESOURCES, CATALOGS, CONTACT US, CUSTOMER PORTAL, and a dropdown menu for NORTH AMERICA. Below this is a secondary navigation bar with links for COMPANY, MARKETS, PRODUCT CENTER, PEOPLE & CAREERS, and INSIGHT. A search bar is located to the right of the INSIGHT link, containing the placeholder text "Type what are you looking fo" and a magnifying glass icon. A blue circle highlights the search bar, and a blue arrow points to it with the text "Enter ADSS". The main content area features a dark background with a view of Earth from space. The headline reads "Linking energy & communication to global growth". Below the headline are two buttons: "OUR PRODUCTS" and "OUR STORIES". At the bottom left, there is a page indicator "1/3" and a progress bar. At the bottom right, there are navigation arrows.

### Step 1

# Finding the Right Cable – Choosing the exact cable

## Method 2 – Supplier Y

Supplier Y – Now you see:

Search results for: ADSS ( 4 )

All	WebPage	Products
<hr/>		
<b>ezSPAN® ADSS All-Dielectric Self-Supporting Loose Tube Cable</b>		→
<small>... RUS Telcordia Image: ezSPAN® ADSS All-Dielectric Self-Supporting Loose Tube Cable.png Datasheet: TLS-DS-A-501-0518_ezSPAN® ADSS All-Dielectric Self-Supporting Loose Tube Cable_LR.pdf ...</small>		
<hr/>		
<b>Long Span ADSS All-Dielectric Self-Supporting Loose Tube Cable</b>		→
<small>... RUS Telcordia Image: Long Span ADSS All-Dielectric Self-Supporting Loose Tube Cable.png Datasheet: TLS-DS-A-502-0117_Long Span ADSS All-Dielectric Self-Supporting Loose Tube Cable_LR.pdf ...</small>		
<hr/>		
<b>Telecommunication Cables and Solutions</b>		→
<small>... All Dielectric Self Supporting (ADSS) Fiber Optic Cable Installation ...</small>		
<hr/>		
<b>Telecoms - Product Centre</b>		→
<small>... ADSS ... ADSS ...</small>		

Looks like our  
best option

## Step 2

# Finding the Right Cable – Choosing the exact cable

## Method 2 – Supplier Y

Supplier Y – Followed by this:

### ezSPAN® ADSS All-Dielectric Self-Supporting Loose Tube Cable



#### DESCRIPTION

Provides reliable self-support performance for up to 1200 feet (365 meters). Each ezSPAN® ADSS cable is custom engineered for each application based on its full weather load, ensuring safe, reliable lifetime performance. Flexible buffer tubes enable ease of mid-entry, preparation and routing in splice closures. These cables uniquely combine flexible buffer tubes and swellable water-blocking to make ezSPAN the easiest ADSS cables to prep and access.

#### DATASHEET

[TLS-DS-A-501-0518\\_EZSPAN® ADSS ALL-DIELECTRIC SELF-SUPPORTING LOOSE TUBE CABLE\\_LR.PDF](#) 

← This should be what we're looking for

#### ORDERING GUIDE

[TLS-0003-0721\\_OUTDOOR ORDERING GUIDE.PDF](#) 

#### OTHERS DOCUMENTS

[TLS-0007-0121\\_COLOR CODE GUIDE FOR FIBER OPTIC SPECIFICATIONS\\_LR.PDF](#) 

## Step 3

# Finding the Right Cable – Choosing the exact cable

## Method 2 – Supplier Y

Supplier Y – The datasheet is a 10-page document. On page 5, we find this table

NESC Heavy Loading ezSPAN Single Jacket ← Question: Do we want single or double jacket?

6-30 Fibers (6 fibers per tube)

Span Distance (ft)	Cable Outside Diameter (in)	Maximum Rated Cable Load (MRCL) (lbs)	Initial Sag (%)	*Cable Part Numbers	PLP Attachment Hardware Part #			
					Dead End	AI Suspension w/o SSR (< 600 ft)	AI Suspension with SSR	AI Support Spans < 600 ft
165	0.393	465	1.5	F-ADSS0465-06-HB-XXX	287500TE	4450198S	-	4450098

Notice that we have (only) the cable's diameter and MRCL

12-72 Fibers

Closest we find... But, we said we wanted 1.0%

Span Distance (ft)	Cable Outside Diameter (in)	Maximum Rated Cable Load (MRCL) (lbs)	Initial Sag (%)	*Cable Part Numbers	PLP Attachment Hardware Part #			
					Dead End	AI Suspension w/o SSR (< 600 ft)	AI Suspension with SSR	AI Support Spans < 600 ft
up to 330	0.482	1025	1.5	F-ADES1025-12-HB-XXX	2872004C1E1	4450200S	4470200S	4450100
350	0.483	1075	1.5	F-ADES1075-12-HB-XXX	2872004C1E1	4450200S	4470200S	4450100
400	0.487	1255	1.5	F-ADES1255-12-HB-XXX	2872004C1E1	4450200S	4470200S	4450100
450	0.490	1385	1.5	F-ADES1385-12-HB-XXX	2872004C1E1	4450200S	4470200S	4450100
500	0.492	1525	1.5	F-ADES1525-12-HB-XXX	2872004C1E1	4450200S	4470200S	4450100
550	0.496	1705	1.5	F-ADES1705-12-HB-XXX	2872004C1E1	4450200S	4470200S	4450100
600	0.500	1885	1.5	F-ADES1885-12-HB-XXX	2872004C1E1	4450200S	4470200S	4450100
700	0.506	2195	1.5	F-ADES2195-12-HB-XXX	2872100C1E1	4450200S	4470201S	4450100

Let's move on to Supplier Z

Step 4

# Finding the Right Cable – Choosing the exact cable

## Method 2 – Supplier Z

Supplier Z – Starting at their main website... you see.

MARKETS **PRODUCTS** SERVICES RESOURCES CONTACT COMPANY

**PRODUCTS >**

- FIBER OPTIC CABLE >
- CONDUCTOR ACCESSORIES >
- FIBER OPTIC CONNECTIVITY >
- TEST AND INSPECTION >
- FUSION SPLICING >
- SPECIALTY OPTICAL FIBER >
- ALUMINUM CLAD STEEL >
- RAIL TRANSIT SYSTEMS >
- COPPER APPARATUS >
- FIBER OPTIC CLEANING >
- NEW PRODUCTS

**FIBER OPTIC CABLE >**

**Aerial**

- OPGW
- ADSS **Select**
- Skywrap
- Fiber Optic Cable Hardware

**Data Center**

- CPR Construction Products Regulation
- Inside Plant
- Outside Plant

**High Density**

- Wrapping Tube Cable
- OSP MicroCore
- Premise MicroCore

**Structured Cabling**

- Indoor/Outdoor
- Inside Plant
- Outside Plant
- Cordage

**Harsh Environment**

- Industrial
- Subsea
- Downhole
- Sensing

**Surplus Inventory**

Step 1

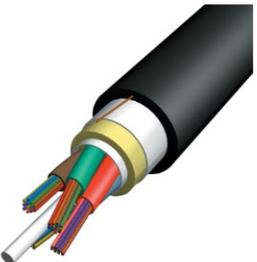
# Finding the Right Cable – Choosing the exact cable

## Method 2 – Supplier Z

Supplier Z – Now you see..

### ADSS Products

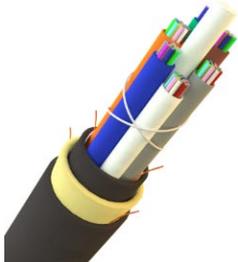
Select



**Flex-Span® ADSS Fiber Optic Cable**

Flex-Span ADSS expands or 's single jacket ADSS portfolio. Flex-Span designs are optimized for a broader combination of fiber counts and...

Information Tab



**Standard ADSS Fiber Optic Cable**

-ADSS® (All-Dielectric Self-Supporting) cable is ideal for installation in distribution as well as transmission environments, even when live-line...

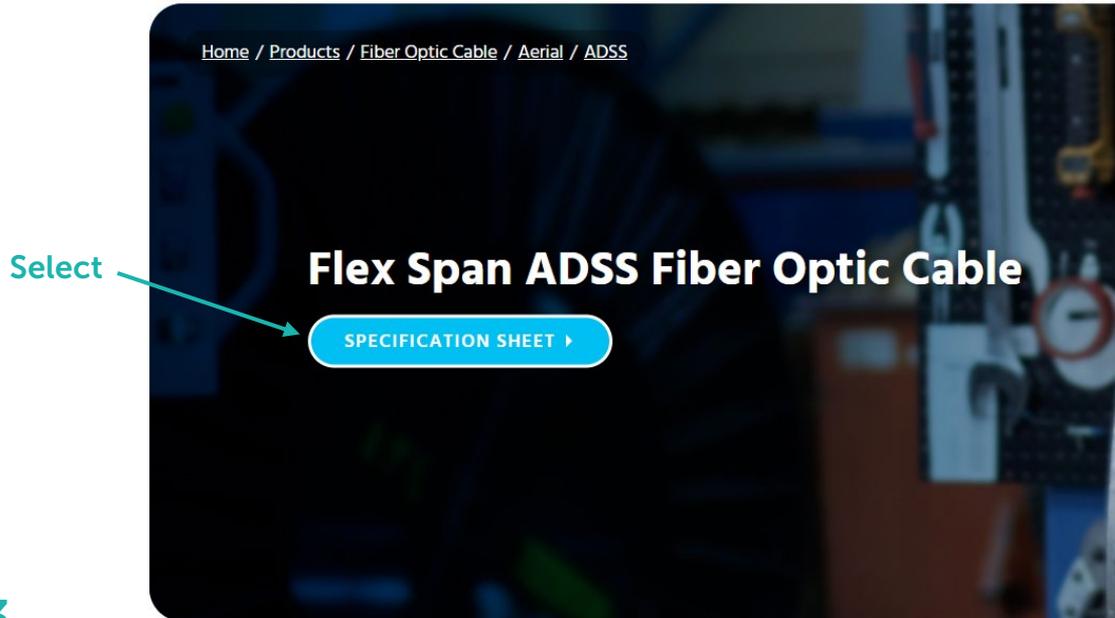
- We see two choices
- The difference between them is single-jacket versus double-jacket construction
- The information tabs provide only very general information
- Let's assume that single-jacket will work for us and keep moving

## Step 2

# Finding the Right Cable – Choosing the exact cable

## Method 2 – Supplier Z

Supplier Z – Which brings you to this page where we'll select "Specifications Sheet"



Step 3

# Finding the Right Cable – Choosing the exact cable

## Method 2 – Supplier Z

Supplier Z – The last step required you to download a 3-page PDF. On page 3, you find:

NESC HEAVY @ 1.5% INSTALLATION SAG				
SPAN (ft)	NO.	WEIGHT (lbs/ft)	DIAMETER (inches)	MRCL (lbs)
48 FIBERS				
300	AE048*W520AA4	0.049	0.382	698
450	AE048*W520EA3	0.052	0.390	1089
72 FIBERS				
300	AE072*O620A08	0.080	0.484	913
450	AE072*O620EA1	0.083	0.492	1338
96 FIBERS				
300	AE096*O620A08	0.082	0.484	913
450	AE096*O620EA1	0.085	0.492	1338
144 FIBERS				
300	AE144*O620A08	0.085	0.484	913
450	AE144*O620EA1	0.087	0.492	1338
288 FIBERS				
300	AE288*OC20EA0	0.185	0.732	1594
450	AE288*OC20EA3	0.187	0.736	1780

Step 4

- Once again, we find 1.5% installation sag, not the 1.0% we said we wanted
- 1% sag is commonly used (Arguably, the most used)
- Notice that now we have a cable diameter, MRCL, and weight



## Finding the Right Cable

# The three (3) ways to choose the exact cable to use

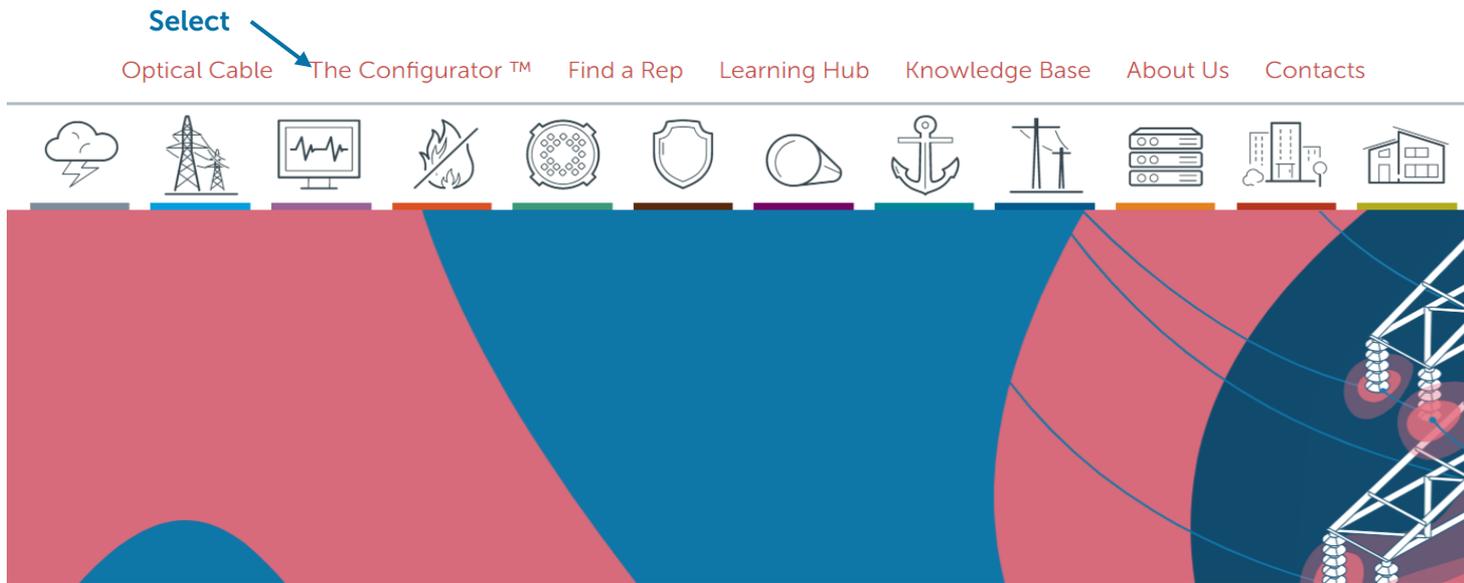
### Method 2 – Use catalogs with tabulated data

- I find these results unsatisfying...Do you also?
- Pushback: “I can just go ask the manufacturer or their local rep to tell me what I should use given my requirements” (Method 2.1)
  - Counter-Pushback: “OK, but if you were buying a car, would you go to a manufacturer and say, “Tell me what I ought to buy?””
    - Don’t you want to take a proactive role in selecting the right cable?
    - Just saying
- It is 2022, and I submit that there should be a better way!
- In that spirit, I offer you **The Configurator™** as our **Method 3**

# Finding the Right Cable

## The three (3) ways to choose the exact cable to use

Method 3 – The Configurator™. Start at website of Supplier “1”



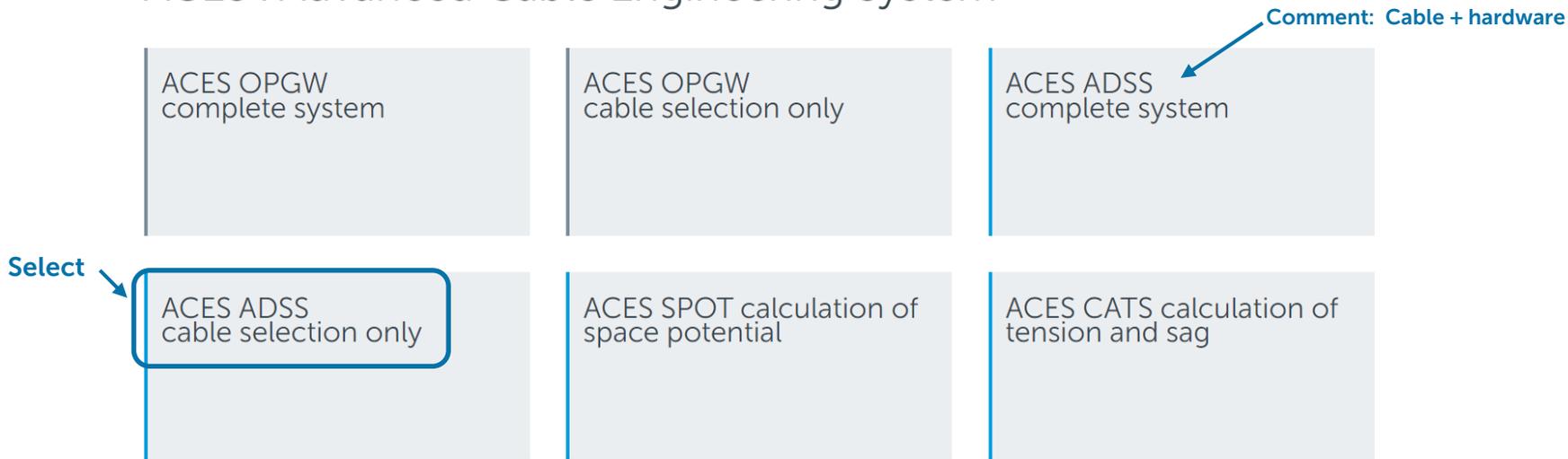
Step 1

# Finding the Right Cable – Choosing the exact cable

## Method 3 – The Configurator™

### The Configurator™

ACES : Advanced Cable Engineering System



**Step 2**

# Finding the Right Cable – Choosing the exact cable

## Method 3 – The Configurator™

### ACES ADSS cable selection only

ACES OPGW complete system

ACES OPGW cable selection only

ACES ADSS complete system

ACES ADSS cable selection only

ACES SPOT calculation of space potential

ACES CATS calculation of tension and sag

Comment: Cable + hardware

Welcome to Advanced Cable Engineering System (ACES), a unique software tool designed for automatic selection of the required ADSS cable design. By answering a few questions, it will help you choose the optimal ADSS design to your requirements. Please contact [aces@incabamerica.com](mailto:aces@incabamerica.com) or +1 833-344-6222 if you have questions or requests related to the configurator. In email subject, please specify ACES ADSS.

“Hints” provide useful insights into cable selection

Show hint

Is protection against rodents, including squirrels, important for you? Please characterize your level of concern:

Select level of concern

Answer this question and those that follow

## Step 3

# Finding the Right Cable – Choosing the exact cable

## Method 3 – The Configurator™

[Show hint](#)

Is protection against rodents, including squirrels, important for you? Please characterize your level of concern:

No danger of damage by rodents

Power line voltage:

Less than 69 kV

Please select fiber count: [?]

48 (4x12)

Do you know the necessary value of Maximum Rated Design Tension (MRDT)?

Yes

No

Select this

### Step 4

# Finding the Right Cable – Choosing the exact cable

## Method 3 – The Configurator™

Two other ways to choose standard loading districts

### Select loading conditions

#### Standard NESC Load Conditions

- Light
- Medium
- Heavy
- Custom

#### Ice thickness

0.5 in

12.7 mm

#### Maximum span length between structures

300 ft

91 m

#### Initial sag in the longest span, %

1.0

Entered 300 ft (meters auto-converted)

Entered 1% as we want

## Step 4, cont.

#### By climate map



#### By state and city

Start entering the name of a state

#### Wind pressure

4 lb/ft<sup>2</sup>

200 Pa

For custom loading (note: auto-converts to other units)

Specify the maximum distance between two adjacent structures, either suspensions or dead-ends. This distance together with the installation location will determine the maximum tensile load that the ADSS will have to withstand throughout its entire service life.

Example:

10 poles. Distances between them: 750, 600, 600, 950, 750, 750, 600, 600, 750 feet. For this example, enter the distance: 950 feet (the maximum of all the distances).

# Finding the Right Cable – Choosing the exact cable

## Method 3 – The Configurator™

**InAir ADSS Aramid DJ** – Aramid yarns, Double Jacket.  
Enhanced ruggedness and reliability.

**InAir ADSS Aramid** – Aramid yarns, Single Jacket. Smaller diameter and lower cost, but reduced ruggedness and reliability.

**InAir ADSS FiberGlass** – Fiberglass yarns, Single Jacket.  
The lowest cost, smaller diameter, reduced ruggedness and reliability.

Insights into advantages and disadvantages of available constructions

Please select ADSS type:

Select ADSS type

- InAir ADSS Aramid Double Jacket Cable
- InAir ADSS Aramid Single Jacket Cable
- InAir ADSS FiberGlass Single Jacket Cable

Select single-jacket construction

Step 4, cont.

# Finding the Right Cable – Choosing the exact cable

## Method 3 – The Configurator™

Selected: InAir ADSS Aramid-P-48U (4x12)-6kN

Cable designation

Loads of data!

Fiber Count		48
Number of loose tubes		4
Fibers per loose tube		12
Number of PBT fillers		2
Loose tube diameter	mm	2.6
	in	0.102
Inner jacket thickness	mm	0.7
	in	0.028
Outer jacket thickness	mm	1.7
	in	0.067
Cable diameter $\pm 0.2$ (0.008)	mm	11.4
	in	0.449
Cable weight	kg/km	99
	lbs/ft	0.067
Maximum rated design tension	kN	6
	lbs	1,349

Installation tension (for stringing)	kN	1.5
	lbs	337
Rated Breaking Strength (RBS)	kN	10.4
	lbs	2,336
Cable cross-sectional area	mm <sup>2</sup>	102.9
	in <sup>2</sup>	0.159
Modulus of elasticity, initial	kN/mm <sup>2</sup>	6.3
	ksi	915
Modulus of elasticity, final	kN/mm <sup>2</sup>	6.8
	ksi	988
Modulus of elasticity, creep	kN/mm <sup>2</sup>	4.4
	ksi	641
Temperature coefficient of linear expansion	1/°C	1.2E-05
	1/°F	0.7E-05

For sag and tension calculations (See next slide)

[Download the full characteristics, pdf](#)

Download the full cable specs with even more data!

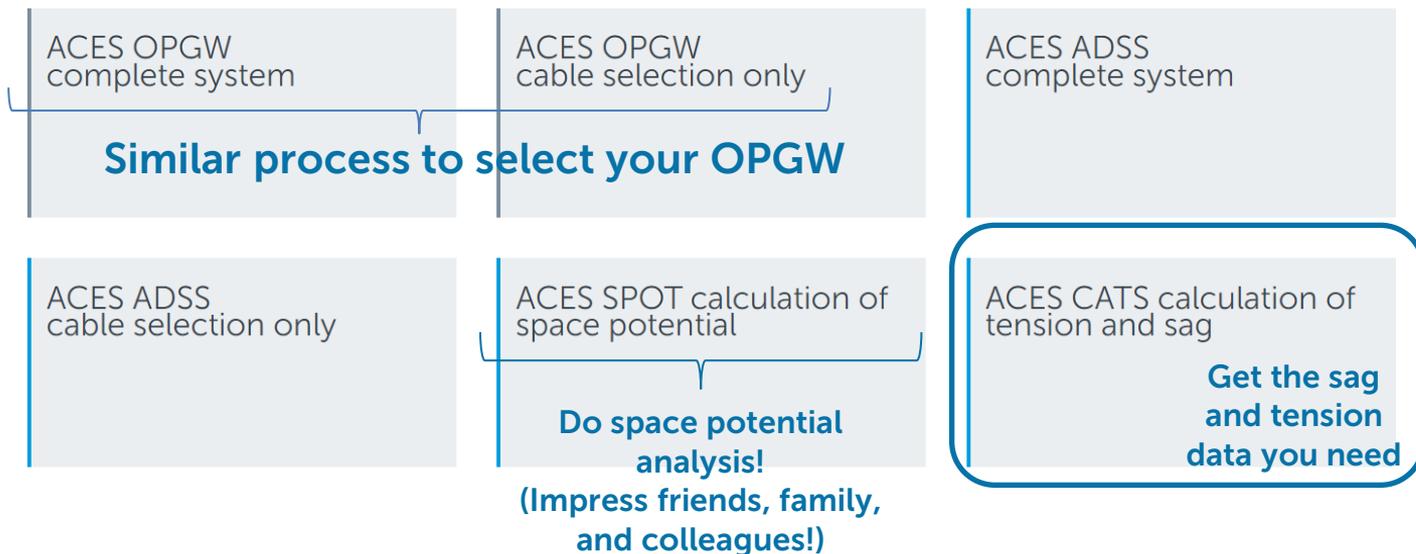
Step 4, cont.

Finding the Right Cable

**Wait! There's more! Recall ...**

## The Configurator™

ACES : Advanced Cable Engineering System



## Finding the Right Cable

# The three (3) ways to choose the exact cable to use

Conclusion – I say that in 2022, everyone should be able to:

- Easily verify that “what we’ve always used” is truly optimal for your projects today
- Easily find the optimal cable you need without using old-fashioned, clunky data tables, whether print ones or online ones
- Use **The Configurator™** free of charge (oh wait...you can!) 😊
  - Or something comparable



Incab

**Thank you!**

[INCABAMERICA.COM](https://INCABAMERICA.COM)