

QUALITY OSP FIBER OPTIC CABLE INSTALL

Fiber Optic Cable Today
PCCA Web Portal
Process Improvements
Fiber Optic Association (FOA)


March 2020

Gerry Harvey
Corning Field Engineer (retired)

LACK OF CONSISTENT FIBER OPTIC CABLE INSTALLATION METHODS

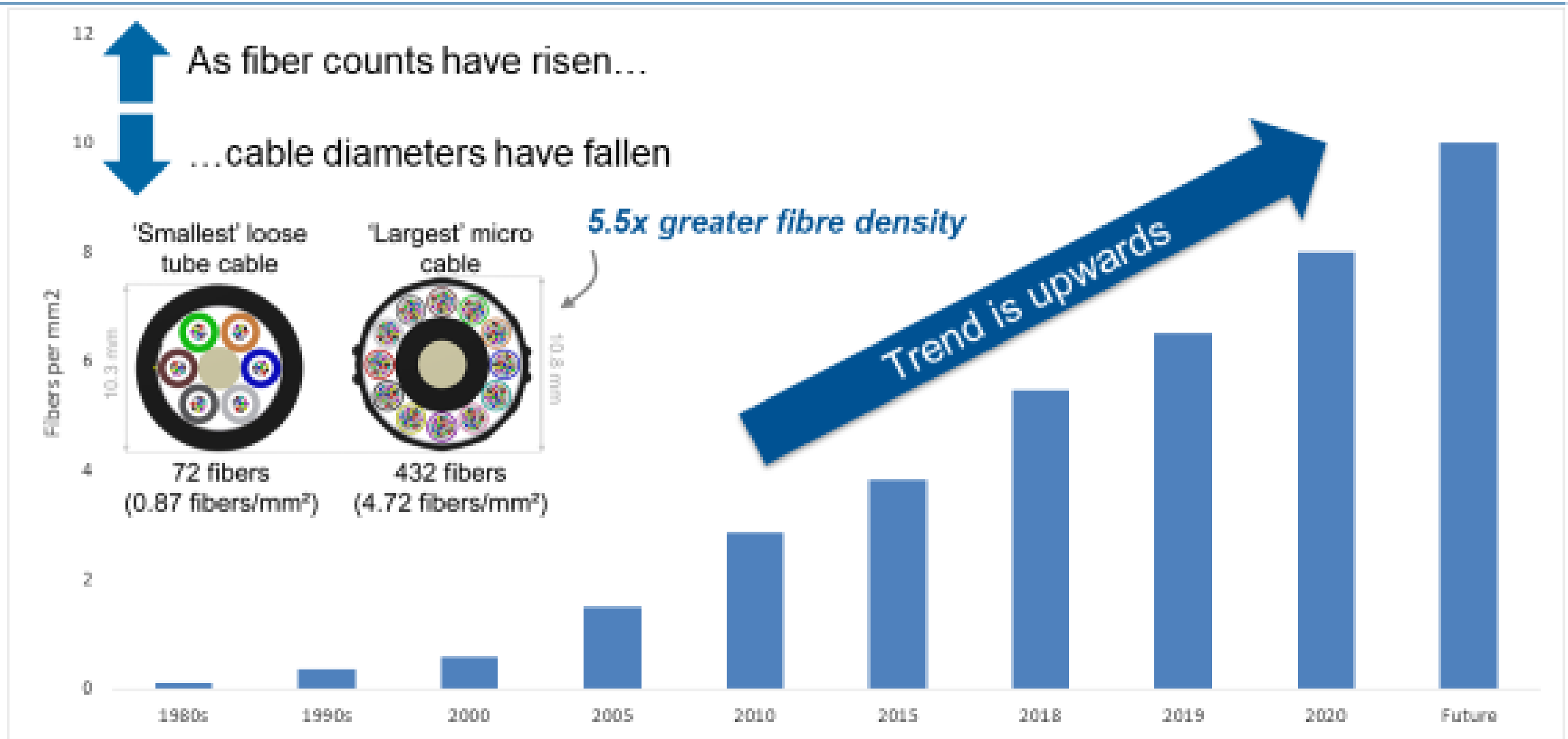
- ▶ Manufacturers Have Different Cable Installation MBR (Minimum Bend Radius) Under Load (15 X Cable OD, 20 X Cable OD, etc.)
- ▶ No Standardized OSP Installation Methods
 - ▶ Most Procedures Have not Been Updated in Over 15 Years
 - ▶ International Standards are not USA Pertinent
 - ▶ US Standards are not Specific Enough
- ▶ Some Recommend Improper Equipment - Cable Wrapping Machines

WHAT'S DRIVING THE INDUSTRY CHANGE

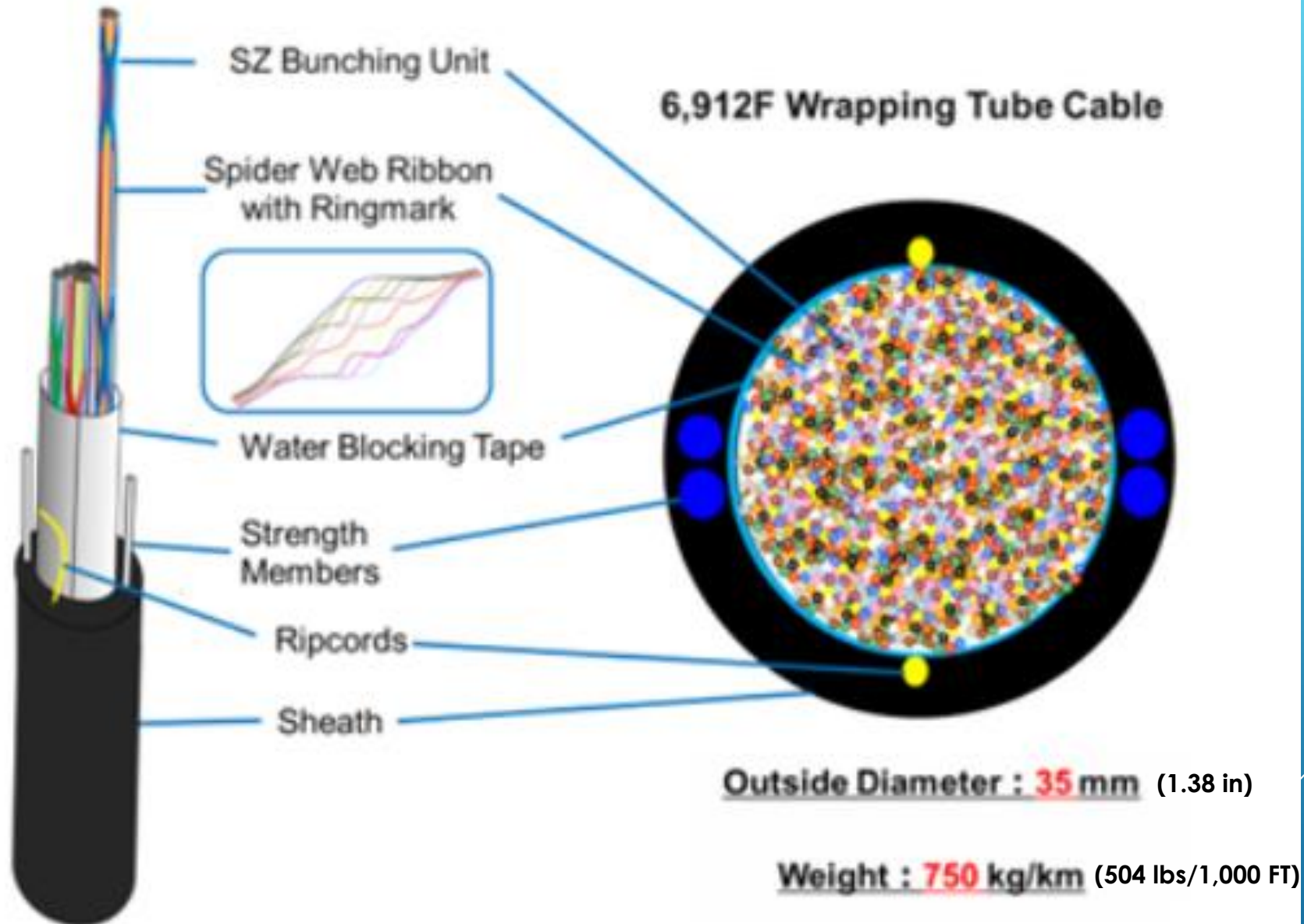
- ▶ Fiber Optic Cable Packing Density Increasing
 - ▶ Market Demand for Dry Cables
 - ▶ Bend Insensitive Fibers May Mask Cable Damage
 - ▶ Old Thumb Rule of Minimum Bend Radius =
 - ▶ 15X or 20X Cable OD Under Load
 - ▶ And 10x Cable OD for No Load are **No Longer Universally Valid**
- 

Corning Cable Miniaturization Has Occurred Through Coordinated Effort

Tracking fiber density over time (fibers per mm²)



FIBER OPTIC CABLE TODAY




MARKET CHANGES MOVING TOO FAST FOR STANDARDS AND VENDOR WEBSITES

- ▶ Standard OSP Typically 600 lbs and Designed to Pull or Jet
 - ▶ Fiber Counts up to 6,912 fibers - 1.38 in (35.0mm) OD
 - ▶ How Many Fibers Can Fit in a 2.0 in duct?
- ▶ MicroCables Typically 300 lbs and Designed to Jet
 - ▶ Fiber Counts up to 432 fibers (Loose Tube) and 864 fibers (Ribbon)
 - ▶ How Many Fibers Can Fit in an 18/14 mm and 20/16 mm Microduct?
- ▶ Some MicroCables are 600 lbs and are designed to **Jet or Pull**


“DRY” CABLE OR GEL-FREE NO GREASE OR GEL

- ▶ New Water Blocking Materials Tapes and Powders
 - ▶ Reduce Time to Prepare Cable
 - ▶ Reduce Potential Ribbon Damage Due to Solvent Cleaning
 - ▶ Cleaner Splice Cases and Equipment Racks/Floors
 - ▶ Cables Don't Take a Set
 - ▶ Cables Will Recover From Localized Compression
- 
- A decorative graphic consisting of several parallel white lines of varying lengths, slanted diagonally from the bottom right towards the top right, set against a blue gradient background.

BEND INSENSITIVE FIBERS CAN HIDE CABLE DAMAGE

- ▶ Cables Shifting from Standard G652D Fibers - 2" Minimum Bend Diameter to G657A Fibers - $\frac{3}{4}$ " Minimum Bend Diameter
 - ▶ Leads to Potential Masking Cable Internal Damage
 - ▶ Delamination of Ribbon Matrix or Loose Fiber Coating
 - ▶ Core Tube/ Buffer Tubes Crushed
 - ▶ GRP Strength Elements Fractured and Compromised
- 

CONTRACTOR OPPORTUNITIES

- ▶ Use Required Fiber Optic Tools, not “Whatever is on the “Truck”
 - ▶ Do not Force Install
 - ▶ Follow Critical Installation Steps
 - ▶ “Soon” Use PCCA Web Portal for Safe Cable Install
- 
- A decorative graphic consisting of several parallel white lines of varying lengths, slanted upwards from left to right, located in the bottom right corner of the slide.

CRITICAL INSTALLATION STEPS

1

Utilize Tools that Provide **Minimum Cable Installation Diameter** Under Load

2

Pull Forces Less Than Manufacturer's Cable Installation Load

3

Figure 8 Cable Slack During Install to Minimize Cable Twist


4

Prevent Impact to Cable to Prevent Crush

MAINTAIN PULL FORCES UNDER RATED LOAD

- ▶ Continuously Monitor Tension/ Use Swivel or
 - ▶ At Minimum Use Proper Cable Maximum Rated Load Breakaway Swivel
- 
- A decorative graphic consisting of several parallel white lines of varying lengths, slanted diagonally from the bottom right towards the top right, set against a blue gradient background.

MAINTAIN BEND CONTROL – MINIMUM CABLE INSTALLATION DIAMETER UNDER LOAD

- ▶ Rollers and Sheaves
 - ▶ Snow Shoes/ Cable Routing Guides
 - ▶ Duct and Split Duct on Modified Tooling
 - ▶ Capstans
 - ▶ Cable Jetting Equipment
- 

IMPROPER TOOLS FOR AERIAL

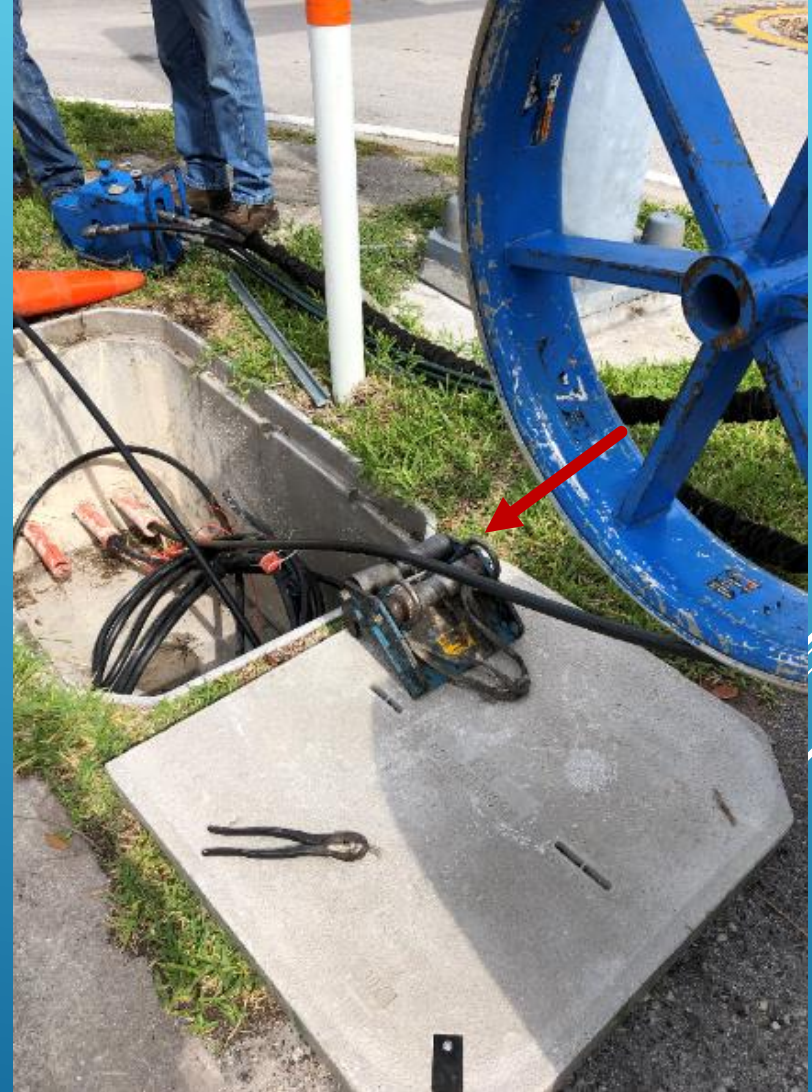


Stringing Blocks Must Not Be Used for Angle Pulls and Take-up/ Payoff Roller

IMPROPER TOOLS FOR UNDERGROUND



No Stringing Block



No Lip Roller w/o Field Modifications

IMPROPER BEND CONTROL FOR UNDERGROUND



Protect Cable Over Handhole/ Manhole Lips



Conduit Feeding Sheaves Violate Bend Diameter

IMPROPER CAPSTAN - NO COLLAPSIBLE REEL



PROPER OR MODIFIED TOOLS MAINTAIN BEND CONTROL



Split Cable Feeders




Split Duct Tied to Lip Roller

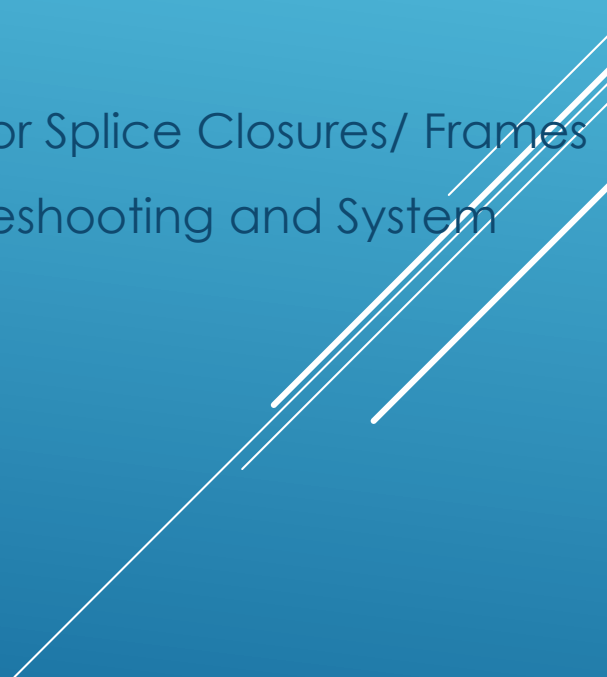


Duct Tied to Lip Roller

MINIMUM CABLE INSTALLATION DIAMETER

- ▶ Fiber Optic Cable Manufacturers
 - ▶ Minimum Bend Diameter Short Term
 - ▶ Minimum Bend Diameter Long Term
 - ▶ Tooling Manufacturers
 - ▶ Diameter - Rollers/Sheaves
 - ▶ Effective Diameter – Quadrant Blocks
 - ▶ Equipment Manufactures
 - ▶ Pulling Capstans
 - ▶ Aerial Placing Trucks
 - ▶ Fairleads
 - ▶ Cable Plows
 - ▶ Slide Chutes
 - ▶ Plow Chutes
- 

VISION FOR SYSTEM IMPROVEMENTS

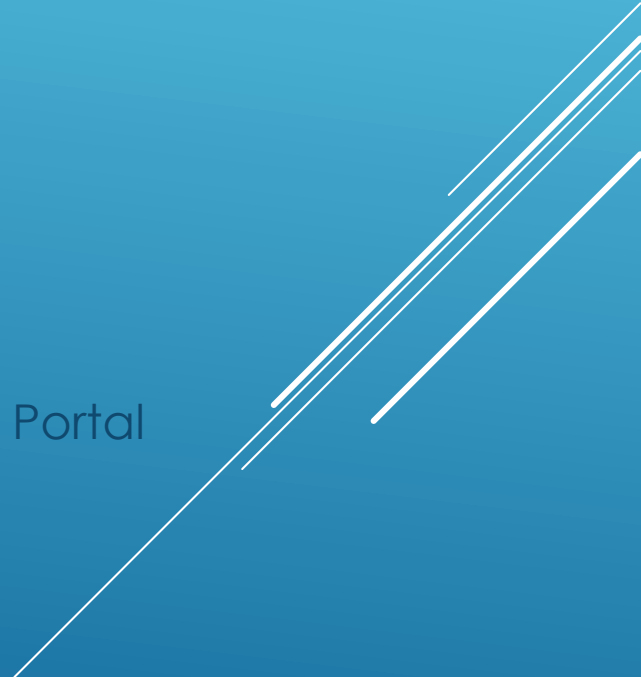
- ▶ First Focus is to implement steps for Quality Cable Install
 - ▶ Cable Installation
 - ▶ Tooling
 - ▶ Equipment
 - ▶ Handholes
 - ▶ Expand to Include Buffer Tube/ Optical Fiber Routing in Splice Points for Splice Closures/ Frames
 - ▶ Next Phase for Connector Handling/ Cleaning, Optical Testing/Troubleshooting and System Documentation
 - ▶ Design
 - ▶ Integrate sister organizations
 - ▶ CGA - Common Ground Alliance
 - ▶ FOA - Fiber Optic Association
 - ▶ FBA - Fiber Broadband Association
- 

TOOLS FOR THE CONTRACTOR

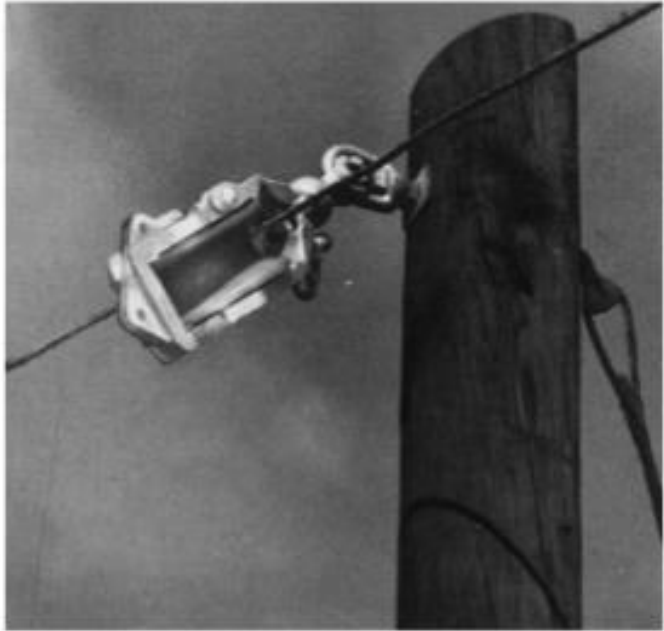
- ▶ PCCA Web Portal on Safe Cable Install (Release 1) to Include:
 - ▶ Fiber Optic Cable Critical Attributes
 - ▶ Cable OD
 - ▶ Cable Weight
 - ▶ Cable Minimum Bend Diameter (Loaded and Unloaded)
 - ▶ Cable Pull Tension (Short Term and Long Term)
 - ▶ Appropriate Tooling (Sheaves/ Blocks)
 - ▶ Appropriate Equipment – Pulling (Capstans) or Jetting (Conduit)

PCCA WEB PORTAL FOR SAFE CABLE INSTALL

- ▶ Contractor Requirements
 - ▶ Fiber Optic Cable Manufacturer (Pull Down from Menu)
 - ▶ Input the Part Number

 - ▶ Note – Terrific Support from Greg Smela of PCCA for Building the Portal
- 
- A decorative graphic consisting of several parallel white lines of varying lengths, slanted upwards from left to right, located in the bottom right corner of the slide.

THIS WILL NOT BE TOOLING AND EQUIPMENT THAT YOU CAN SELECT:



Model XS-100-B

Model XS-100-B used as a Static Wire Stringing Block shown with a No. 8 Ball Clevis Fitting. Also can be used with ball hook, Y-clevis, eye, etc. Works well on large transmission towers, too. Should usually be used with Urethane sheave lining or ductile iron.

Universal Stringing Block



Chevy Bumper



Ford Bumper



Safe Cable Install

Safe Cable Install

Cable Manufacturer Selection: (*)

- AFL
- CommScope
- Corning
- OFS
- Prysmian
- Sumitomo
- Superior Essex

Select Manufacturer



Safe Cable Install

Safe Cable Install Database

Enter the manufacturer part number in the field and select **Go**. Then, choose the product you'd like to learn about by selecting the icons on the right. There are two - one expands the listing detail and the other allows you to download a pdf of the listing. You may also download any portion of the resulting list as a CSV file.

Enter Part Number:

LWSE-3456-K-C-144-24-00N1D

Go

Reset

Download selected as CSV

AFL Catalog PN

LWSE-3456-K-C-144-24-00N1D



Start Over

Safe Cable Install Database

Enter the manufacturer part number in the field and select **Go**. Then, choose the product you'd like to learn about by selecting the icons on the right. There are two - one expands the listing detail and the other allows you to download a pdf of the listing. You may also download any portion of the resulting list as a CSV file.

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AFL Catalog PN	LWSE-3456-K-C-144-24-00N1D
Cable Weight lbs/1000ft (KG/KM)	403 (600)
Max. Tensile Load Short-Term lbs (N)	607 (2700)
Max. Tensile Load Long-Term lbs (N)	182 (810)
Cable OD inches (mm)	1.20 (30.5)
MBD Installation inches (mm)	48 (1220)
MBD Operation inches (mm)	36 (916)
Spec Sheet	https://www.afglobal.com/productlist/Product-Lines/Fiber-Optic-Cable/Wrapping-Tube-Cable-(WTC)-with-SWR/doc/250um-WTC-SWR-Cable.aspx
Date Submitted	02-25-2020 07:43:34



Fiber Optic Cable

250 μ m Wrapping Tube Cable (WTC) with SpiderWeb Ribbon[®] (SWR[®])

Temperature Specifications

TEMPERATURE RANGE	
OPERATION	-40°F to +158°F (-40°C to +70°C)
STORAGE	-40°F to +158°F (-40°C to +70°C)
INSTALLATION	-22°F to +140°F (-30°C to +60°C)

Mechanical Data—Non-Armored

DESCRIPTION	FIBER COUNT	BINDER UNIT	NOMINAL DIAMETER	WEIGHT LBS/1,000 FT (KG/KM)	SHORT TERM / INSTALLATION		LONG TERM / STORAGE /STATIC	
			INCHES (MM)		MAX TENSILE LOAD LBS (N)	MIN BEND RADIUS INCHES (MM)	MAX TENSILE LOAD LBS (N)	MIN BEND RADIUS INCHES (MM)
LWSE-144-9-C-144-1-00N1D	144	1 X 144F	0.41 (10.5)	57 (85)	607 (2700)	9 (229)	182 (810)	6 (158)
LWSE-288-9-C-72-4-00N1D	288	4 X 72F	0.47 (12.0)	71 (105)	607 (2700)	10 (254)	182 (810)	7 (180)
LWSE-432-9-C-72-6-00N1D	432	6 X 72F	0.53 (13.5)	91 (135)	607 (2700)	11 (270)	182 (810)	8 (203)
LWSE-576-9-C-72-8-00N1D	576	8 X 72F	0.59 (15.0)	111 (165)	607 (2700)	12 (300)	182 (810)	9 (225)
LWSE-864-9-C-72-12-00N1D	864	12 X 72F	0.69 (17.5)	145 (215)	607 (2700)	14 (350)	182 (810)	11 (279)
LWSE-1152-K-C-144-8-00N1D	1152	8 X 144F	0.73 (18.5)	161 (240)	607 (2700)	15 (370)	182 (810)	11 (279)
LWSE-1728-K-C-144-12-00N1D	1728	12 X 144F	0.91 (23.0)	242 (360)	607 (2700)	18 (460)	182 (810)	14 (345)
LWSE-3456-K-C-144-24-00N1D	3456	24 X 144F	1.20 (30.5)	403 (600)	607 (2700)	24 (610)	182 (810)	18 (458)

Mechanical Data—OSP Armored

DESCRIPTION	FIBER COUNT	BINDER UNIT	NOMINAL DIAMETER	WEIGHT	SHORT TERM / INSTALLATION		LONG TERM / STORAGE /STATIC	
			INCHES (MM)	LBS/1,000 FT (KG/KM)	MAX TENSILE LOAD LBS (N)	MIN BEND RADIUS INCHES (MM)	MAX TENSILE LOAD LBS (N)	MIN BEND RADIUS INCHES (MM)
LWSE-144-9-C-144-1-10S1D	144	1 X 144F	0.63 (16.0)	148 (220)	607 (2700)	13 (320)	182 (810)	10 (254)
LWSE-288-9-C-72-4-10S1D	288	4 X 72F	0.69 (17.5)	172 (255)	607 (2700)	14 (350)	182 (810)	11 (279)
LWSE-432-9-C-72-6-10S1D	432	6 X 72F	0.75 (19.0)	202 (300)	607 (2700)	15 (380)	182 (810)	11 (285)
LWSE-576-9-C-72-8-10S1D	576	8 X 72F	0.81 (20.5)	235 (350)	607 (2700)	16 (410)	182 (810)	12 (308)
LWSE-864-9-C-72-12-10S1D	864	12 X 72F	0.91 (23.0)	286 (425)	607 (2700)	18 (460)	182 (810)	14 (345)
LWSE-1728-K-C-144-12-10S1D	1728*	12 X 144F	1.14 (29.0)	410 (610)	607 (2700)	23 (580)	182 (810)	17 (435)

* NOTE: Modified temperature performance

Optical Fiber

FIBER COUNT	FIBER DESIGNATOR	MFD	MAXIMUM ATTENUATION (CABLED) dB/km		
			1310 NM	1383 NM	1550 NM
144, 288, 432, 576, 864	9 (ITU-T G.652D/G.657.A1)	9.2 ± 0.4 μm	≤0.40	≤0.40	≤0.30
1152, 1728, 3456	K (ITU-T G.652D/G.657.A1)	8.6 ± 0.4 μm	≤0.40	≤0.40	≤0.30

Stripe Ring Fiber Identification

R NO.	STRIPE RING MARKING	R NO.	STRIPE RING MARKING
1	█	7	█ █ █
2	█ █	8	█ █ █ █
3	█ █ █	9	█ █ █ █ █
4	█ █ █ █	10	█ █ █ █ █ █
5	█ █ █ █ █	11	█ █ █ █ █ █ █
6	█ █ █ █ █ █	12	█ █ █ █ █ █ █ █

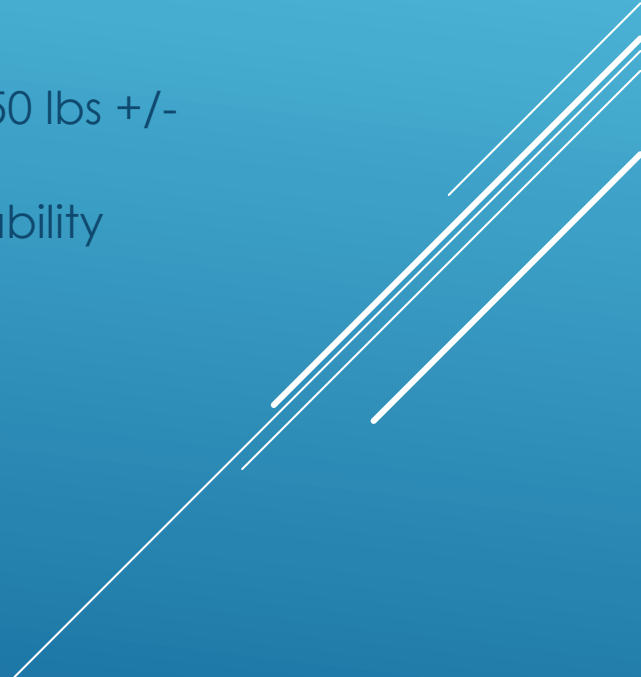
FIBER COUNT	BINDER UNIT (BU)	RING MARKINGS
144F	No Binder Unit	1-12 Ring Marking
288F	4 Binder Units	1-6 Ring Marking
432F	6 Binder Units	
576F	8 Binder Units	
864F	12 Binder Units	
1152F	8 Binder Units	1-12 Ring Marking
1728F	12 Binder Units	1-12 Ring Marking
3456F	24 Binder Units	1-12 Ring Marking

*For binder units 13-24, the second binder unit is clear

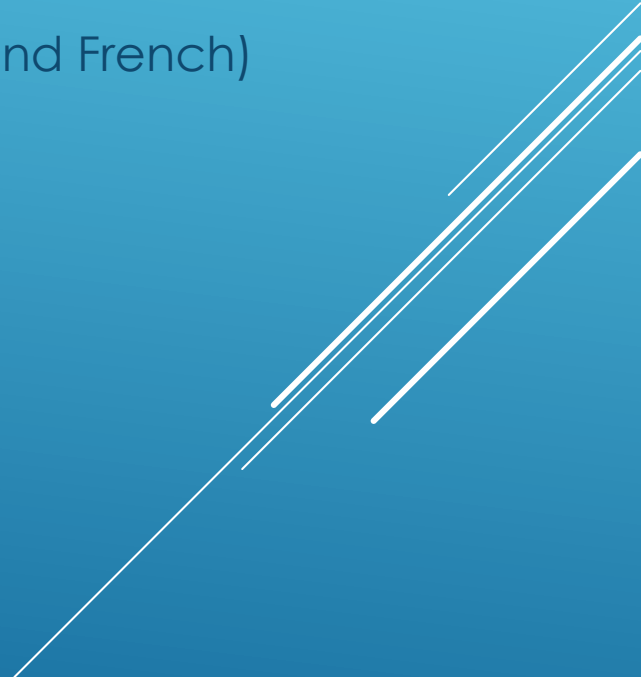
CONTRACTOR PROCESS STEPS FOR OSP

- ▶ Builds From Design to Documentation
 - ▶ Initial Work Addresses:
 - ▶ Cable Installation
 - ▶ Critical Cable Attributes
 - ▶ Tooling
 - ▶ Equipment
 - ▶ Cable Hardware Preparation and Build
 - ▶ Splice Closures
 - ▶ Frames
 - ▶ Snow Shoes
 - ▶ Splicing, Testing and Documentation
 - ▶ Output for Contractor is Quality Assurance Install for Your Client

PROCESS IMPROVEMENTS

- ▶ American Polywater Providing Link to Pull Planner on PCCA Website
 - ▶ Thanks Tom Fredericks
 - ▶ Running Line Dynamometer
 - ▶ Breakaway Swivels
 - ▶ Recommend Tooling Vendors Change Design to 575 lbs +/- 25 lbs or 550 lbs +/- 50 Lbs
 - ▶ Maximize Pulling Potential for Contractor to Maximize FO Cable's Capability
 - ▶ Over-under Figure Eighting Techniques to Preclude Flipping Cable
 - ▶ Plastic Mesh Pulling Grips for Lowest Profile Congested Duct Pulls
 - ▶ Implement More Reasonable Cable Slack for Handholes
- 

FOA – FIBER OPTICS ASSOCIATION

- ▶ Great Resource for Training Material and Fiber Optic Certifications
 - ▶ FOA.org - Jim Hayes
 - ▶ <https://foa.org/NECA301.html> (Fiber Optic Cable Installation Guide)
 - ▶ The FOA Reference Guide to Fiber Optics (in English, Spanish and French)
 - ▶ The FOA Reference Guide to Premises Cabling
 - ▶ The FOA Reference Guide to Outside Plant Fiber Optics
 - ▶ The FOA Outside Plant Construction Guide
 - ▶ The FOA Reference Guide To Fiber Optic Network Design
 - ▶ The FOA Reference Guide To Fiber Optic Testing
- 

PLEASE PROVIDE FEEDBACK

- ▶ Members and Associate Members
 - ▶ Are We Addressing All of Your Needs
 - ▶ What are We Missing
 - ▶ Share Success Stories
 - ▶ Decision on Release of Tool
 - ▶ PCCA Members Only
 - ▶ Open to Public
 - ▶ Develop a Limited Contractor Access for the Tool and not full access to PCCA data
- 