ADSS Advantages to Strand and Lash Fiber Cables in Aerial Electric Utility Applications

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ABSTRACT

All-dielectric self-supporting (ADSS) fiber cables provide advantages over strand and lash fiber networks for electric utility applications in many cases. Some of these advantages to ADSS cables include:

- No metallic components – can install in supply space and grounding is not required
- Little to no "make ready" cost
- Lower hardware costs
- Speed and ease of installation
- Minimal long term maintenance
- Longer expected design life

In most scenarios, these advantages lead to a lower total cost for the electric utility. This paper will further explore some of the advantages of using ADSS cable as opposed to a strand and lash fiber cable for aerial electric utility applications.

INTRODUCTION

As electric utility companies are considering expanding or starting fiber networks, there are two primary alternatives for aerial fiber cables: all-dielectric self-supporting (ADSS) fiber optic cable and steel messenger wire supported (strand and lash) loose tube fiber optic cable. AFL manufactures both of these types of cables. ADSS cables can span pole to pole without the need of a messenger support, while the strand and lash methodology lashes a fiber cable to a messenger wire for support between poles.

Whether the utility is using the fiber system for internal supervisory control and data acquisition (SCADA) or a revenue generating fiber-to-the-x (FTTx) solution, there are a number of considerations when deciding between these two fiber cable methods. Each application and system is unique, but in many cases an ADSS cable is advantageous to a strand and lash cable for both cost and convenience.

Figure 1: ADSS cable above neutral (left) and strand and lash cable installation (right).

POLE PLACEMENT FLEXIBILITY

ADSS cable is all-dielectric, which means that it does not contain any metallic components. The National Electric Safety Code (NESC), the authoritative body that defines the aerial distribution pole line design and application rules, made significant changes related to the use of ADSS cables in the mid-1990s. At that time, new definitions of fiber optic cables and clearance requirements allowed the use of ADSS cables in the supply space of an aerial distribution pole. NESC section 235 defines that there is no clearance specified between ADSS cables and conductors. Installing an ADSS cable in the supply space offers a higher level of physical protection than a strand and lash cable installed in the communications space of an aerial distribution pole.

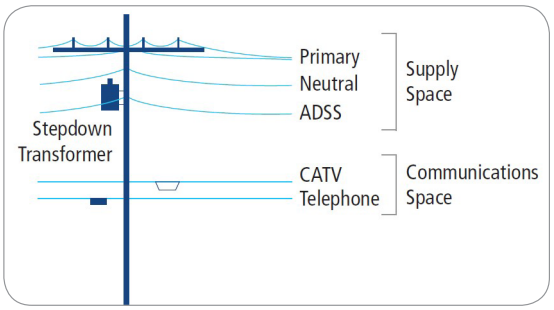

Figure 2: NESC Joint Use Pole Diagram. Depending on the location of the neutral, ADSS can go above or directly below.

"Make ready" costs can vary, but are typically much higher for strand and lash applications due to the need of guying existing structures, pole change-outs to maintain ground clearance, moving existing telecommunications cables, among many other potential changes. "Make ready" savings from using ADSS in the supply space can generally be 15-20% of the total construction cost, although in some cases the savings can be even higher.

INSTALLATION AND LONG TERM MAINTENANCE

Speed of installation can be significantly improved for ADSS cables when compared to strand and lash loose tube cables. ADSS cables are installed in a single pass, while strand and lash loose tube cables must be installed in two passes. Cable installation steps for each method are shown below.

ADSS Cable

- Pole "make ready" (pulley placement)
- Cable Installation
- Cable Sagging
- Hardware Attachment

Strand and Lash Cable

- Pole "make ready" (pole change out, guying, moving cables, etc.)
- Messenger Placement
- Messenger Pre-tensioning (creep)
- Messenger Hardware Attachment
- Cable Placement
- Lashing Wire Placement and Termination
- Bonding and Grounding

The two-pass installation method of strand and lash cables, as well as additional steps for bonding and grounding of the steel messenger, often result in installation rates at approximately half the speed or slower when compared to ADSS cables. Even when considering higher skilled labor costs for qualified personnel (working in supply space), total installation costs can be lower in many cases for ADSS cable when considering installation speed. It should also be noted that "qualified" crews only require one Class A lineman on-site.

Total hardware costs are typically higher for strand and lash networks as well, due to an increase in the number of parts needed to support the cable. ADSS hardware is basically just tangents and deadends. Some ADSS tangent hardware can be used in place of pulleys (sheaves) for installation, further increasing installation speeds and convenience.

Figure 3: Loosening of lashing wire

Long term maintenance costs of ADSS cables are minimal. Annual route inspections and intermittent slack storage during the initial installation can further minimize long term maintenance costs from weather damage, road moves, and other factors.

Strand and lash cables generally require more maintenance in their lifetime. Lashing wire needs to be repaired periodically. Also, bonding and grounds degrade over time, which requires repair and upgrading. Cable damage requires de-lashing to move spare cable to the damage point.

DESIGN LIFE AND RELIABILITY

ADSS cables are designed for a 25 year life based on environmental conditions such as wind and ice loading, UV exposure, and other factors. ADSS cables should be designed for the span length and loading conditions of the application, which allows low strain on the fiber at the maximum operating tension. A strand and lash loose tube fiber optic cable relies on a steel messenger for support during its design life, and is typically defined as a 20 year design life. The cable experiences fiber strain during installation process up to 600 lb of tension, which is the maximum allowed tension of the cable.

Ice loading is another advantage for ADSS cables when compared to strand and lash cables. ADSS is a smaller overall diameter, with a circular cross section that loads less ice and more uniformly compared to strand and lash cables. Heavier ice loading affects the cables as well as the poles. The non-uniform ice loading of a strand and lash cable can make the cable more susceptible to wind loading issues and galloping on longer span lengths, especially in heavy ice loading areas.

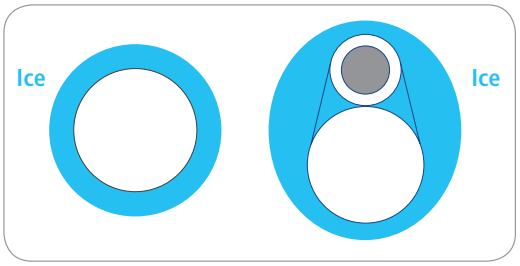

Figure 4: Ice loading comparison for ADSS cables to strand and lash or Figure-8 cables.

ADSS cables can be designed for all kinds of environments, and AFL has manufactured ADSS cables that are capable of span lengths over 6000 feet. ADSS cables should be engineered to meet the strength requirements, environmental loading (ice/wind), and sag conditions to ensure that the cable does not fail, clash with other cables, or violate clearance requirements. AFL's engineering team can provide assistance in designing the correct ADSS cable for the intended application.

CONCLUSION

When an electric utility is considering adding aerial fiber optic cables to their system, it is important to understand the total cost of ownership. There are certainly scenarios where the total cost of ownership of a strand and lash loose tube cable is lower than an ADSS cable, such as over-lashing a cable to an existing and available messenger wire. However, in many situations, the total cost of ownership can see savings for an ADSS system in the 17-20% range with just the direct cost elements. This savings even considers a higher cable and total installation cost for qualified personnel. Other impacts including not needing to ground, training ease, longer service life, and higher reliability of an ADSS cable makes it the preferred solution to a strand and lash loose tube cable network.

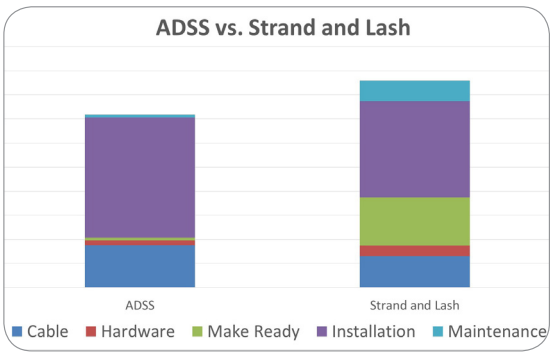

Figure 5: Graphical cost comparison ratio for ADSS verses strand and lash in new fiber builds. Although this is intended to be a general comparison, this scenario is for 100,000 feet of 72 fiber cable in a 500 foot max span length, NESC Medium loading condition.

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