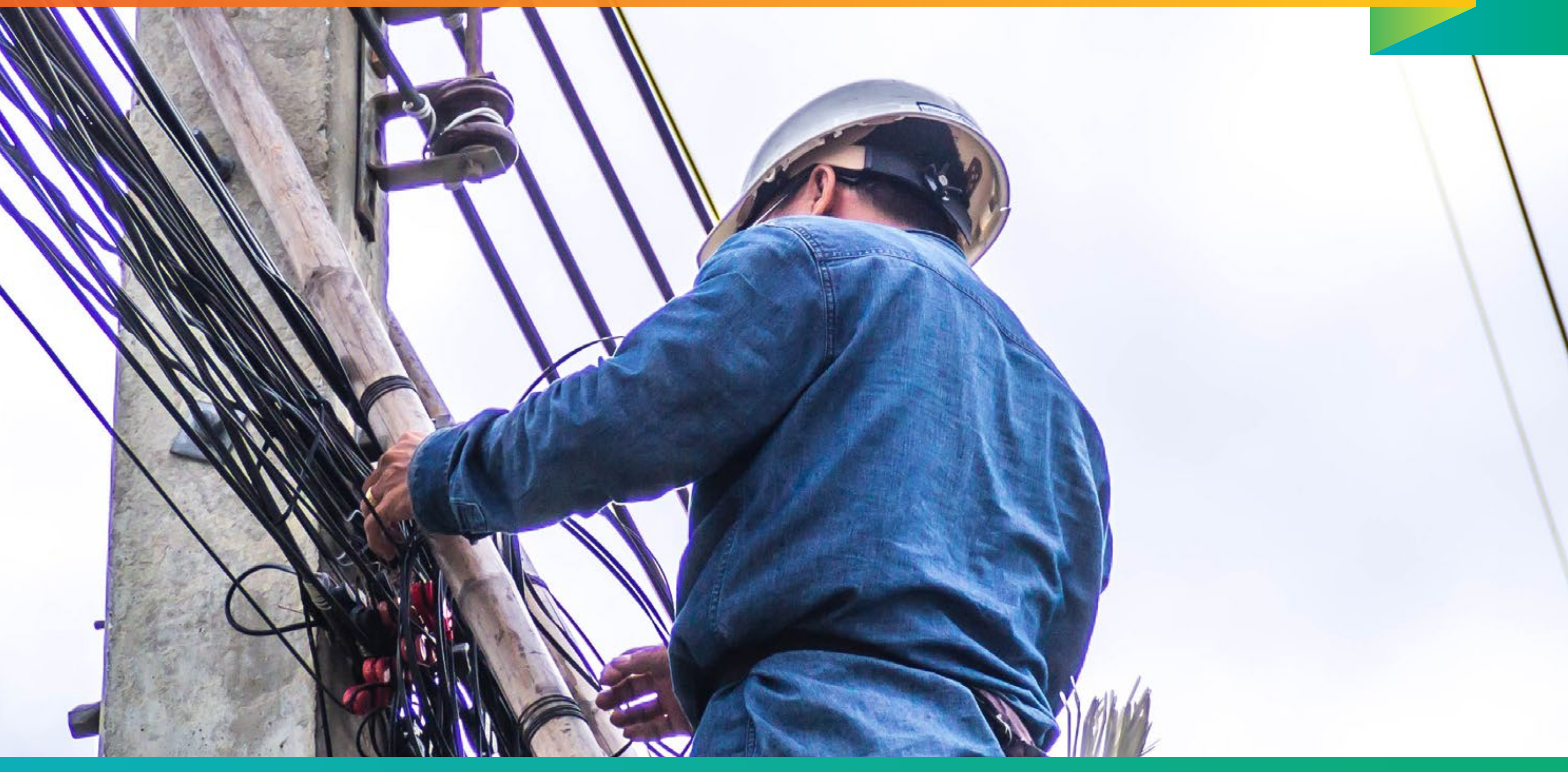
Strand and lash fiber: A smart flexible OSP construction practice



Strand and lash fiber: A smart flexible OSP construction practice

My first fiber optic construction experience was in 1988, when I was still in college and working as an OSP construction contractor to pay for tuition. It was a build for Greater Rochester Cablevision (now Spectrum) the first cable system to deploy fiber optics.

Since then, I have built thousands of miles of fiber optic networks as a project manager and engineer all over the United States. These deployments use all kinds of practices and materials: aerial and underground, direct buried, in conduit and air blown, figure-8 self-support, all dielectric self-support (ADSS), and strand and lash. I've also assisted engineers and construction managers around the globe to build even more advanced optical networks. With each build, it becomes ever clearer to me that the best OSP construction practice is stand and lashed fiber, with a few qualifications.

Each construction practice has its own pros and cons, and rightfully each should be looked at objectively as a tool in the toolbox. There is no one size fits all solution when topology, geography and other local sensitivities to consider. However, like most practical applications, a hierarchy can be applied to the methodologies used. Focusing on aerial plant, at the top of the list for a "best in class" solution is strand and lash.

Cable types

Strand and lash consists of a steel support strand, typically a 6.6M EHS ¼ inch 7-wire galvanized steel strand used to support any type of communications cable(s), typically held in place with a stainless-steel lashing wire. A lasher can lash with one strand of lashing wire (single lashed) or with two strands (double lashed).

Figure-8 self-supporting cable consists of a messenger wire or strand that is typically jacketed to the cable. The name comes from the figure-8 appearance the cable presents when viewed from the cut end of the cable. The area of jacket material between the messenger and the cable is called the web. To separate the cable from the messenger for slack storage and cable splicing the web is slit which leaves the messenger protected in jacket material and does not compromise the integrity of the cable's jacket.

ADSS cable is a round cable design that relies on aramid yarns to provide the tensile strength needed to bear the load of the cable, plus the strain created by wind and ice loading. Larger cables and cables design to support longer spans and heavier wind/ice loading districts require more aramid yarns than smaller cables and cables designed for shorter spans and light wind/ice loading districts.

Make ready

Make-ready costs are often debated when discussing lashed fiber cable versus ADSS, but the reality is both ADSS and strand construction require some amount of make ready work.

Many networks are built with strand and lashed fiber in the power space. In order to do this in a compliant fashion, bond the strand at every other pole and follow the NESC clearance requirements for that space.

A make-ready is when existing attachments on a pole need to move in order to make room for another utility to attach to the pole and maintain proper clearance. Make-ready is not the cost of preparing a pole to accommodate building communications cables into power space when there is space and clearance available for communications cables to be placed in the communications space on a pole. As such, this is generally a neutral rating for all three methods of aerial construction.

Speed of deployment

For every system operator, speed of deployment is a key metric, as it drives how quickly new revenue generating units are added.

Regardless of construction type, framing each pole and attaching support hardware is a necessity. Overall, each method has its own advantages and disadvantages in terms of overall deployment time. Here are the pros and cons for each :

ADSS

+ Strand does not need to be placed ahead of cable.

— Every access point requires double dead ends at the pole.

— Hardware must be installed for securing cable to the pole for routing it to splice closures.

— Figure-8s require double dead ends and special hardware for slack that passes the pole to be secured properly.

Figure-8 self-support

+ Strand does not need to be placed ahead of cable.

— Every access point requires double dead ends at the pole.

— Access points require strand to be removed from a section of the fiber cable.

Strand and Lash

+ No special treatment is needed to create access points.

— Strand must be placed before installing cable.

Initial cost

+ From a material cost perspective, pole line hardware used for strand and lash and figure-8 self-support is less expensive than ADSS pole hardware primarily because it is more widely used and more commonly available.

± Figure-8 cables typically cost more than the strand and lashed cable. This additional CAPEX is recovered by the reduced installation labor and convenience.

± ADSS cables require expensive aramid yarns to support themselves making them more expensive than lashed fiber cable, but when cost of strand is added to the lashed cable, the total costs can be quite similar.

While labor costs can vary widely, depending on region and project size, the lowest installation costs are found with figure-8 self-support, since it is completed in one pass and generally does not require special installation skills like ADSS does. While strand and lash are generally two separate line item costs, the total labor cost is often about the same as ADSS since strand and lash does not incur the additional labor costs associated uniquely with the ADSS installation process.

Number of crews

Aside from framing and hardware work, figure-8 self-support holds a clear advantage in the required number of crews, followed by ADSS. The difference is that slightly larger crews are needed for ADSS, while figure-8 crews are typically leaner on personnel. It comes as no surprise that strand and lash requires more crews, as strand needs to be built out in front of the cable lashing crews. However, there exists an abundance of such crews, while there are fewer specially trained crews available for installing ADSS.

Slack storage

The purpose of slack storage is to permit an accessible network and to allow for inevitable restoration events. Slack storage will be placed at every access point and typically one figure-8 every quarter mile of strand.

+ Strand and lash installations provide the most convenient method and placement of these storage locations anywhere, directly on the strand.

— ADSS slack storage requires double dead ends and special hardware for slack that passes the pole to be secured properly along with special hardware to store the slack on the pole.

— While figure-8 self-support also requires double dead ends, the slack may be placed anywhere directly on the strand after removing a section of the messenger from the cable portion being placed as slack.

Equipment mountable on cable span

+ Strand is designed to support more than just cable; it has a proven record of supporting telecommunications equipment in addition to cables for over 50 years of continuous service. That includes splice closures and active devices like 5G small cells.

+ The same benefits apply to figure-8 self-support cable installations with adequately sized strand components.

— ADSS is not designed or intended to directly support equipment, which means all associated splice closures and access terminals must be mounted to the pole. This creates unnecessary congestion and additional failure points on the pole.

Drop attachment

Connecting subscribers requires a drop cable to be placed. Considerations need to be made for both how far away a subscriber may be from an optical terminal and span length limitations of fiber optic drop cables.

+ With strand and lash installations, drop and branch cables can be brought off mid-span without affecting the cable lashed to the strand. If a drop or multiple drop needs to be run down a series of poles to access the subscriber from an access point further away, those cables can also be lashed up eliminating concerns of fiber strain due to wind/ice loading on long spans. Also, NESC clearance requirements become much less of a concern.

+ The same benefits apply to figure-8 self-support cable installations.

— With ADSS, drop cables need to be fixed directly to the pole, which either requires more access locations or a need to make drop attachments on the adjacent poles until reaching the one closest to the subscriber premise. In some cases, drops must cross in front of or over adjacent properties, which is undesirable at the least. Finally, if those pole spans are too long, a drop cable under wind/ice load will typically reach fiber strain causing an outage.

Accessibility

Real estate and land development will certainly occur after a network is built, which means that where future access to the network will be needed is difficult to plan for. Also, what happens when a predetermined access point is placed in the wrong location because the preconstruction walkout missed something, or the designer mapped it wrong, or the construction crew built it wrong?

+ Strand and lash installations provide a tremendous amount of accessibility options during any phase of the networks pre and post construction life cycles.

— ADSS installations do not readily provide for improvised accessibility, everything about an ADSS network must be predesigned carefully to get it right the first time.

— The same issues apply to figure-8 self-support cable installations.

Future construction flexibility and retro cabling cost

Every effort has a cost, but it is often the hidden future costs that surprise us the most. As networks and network demands evolve, flexibility is worth the investment.

As growth occurs, which inevitably occurs when there is access to a fiber network, additional fiber cables will be required to meet that growth. Being able to easily add cable, splice locations for accessibility, and minimalizing the distance of cabling needed to be built all directly impacts a networks retro cost. it is hard to plan for the unknown, but you can prepare for it by maximizing flexibility.

+ Strand and lash dominates in this category as cables and equipment can be readily placed on the existing strand, new access points can be easily created by repositioning a slack storage by de-lashing and re-lashing the existing cable.

— ADSS and figure-8 self-support are anemic when it comes to future flexibility and expensive when it comes to retro costs.

Protection

+ In places where the risk of damage from rifles, shotguns and rodent chew are of concern, lashed fiber cables with steel tape armor may be installed. This provides a layer of protection not available in ADSS cables. For additional rodent protection, alternative jacketed cables are available that use a blend of capsaicinoids and bittering agents to deter rodent chew are only available in strand and lash cable designs.

± Figure-8 self-supporting cables only afford protection with armor, not with alternative jackets.

— ADSS provides no such protection. Additionally, since ADSS does not have a steel messenger, wind vibration can be a problem with the lightweight fiber-optic cable. Wind vibration can cause degradation of the support hardware, necessitating the installation of vibration dampers.

Restoration time

Another inevitability in OSP networks is that some form of damage will occur, requiring restoration work to be performed.

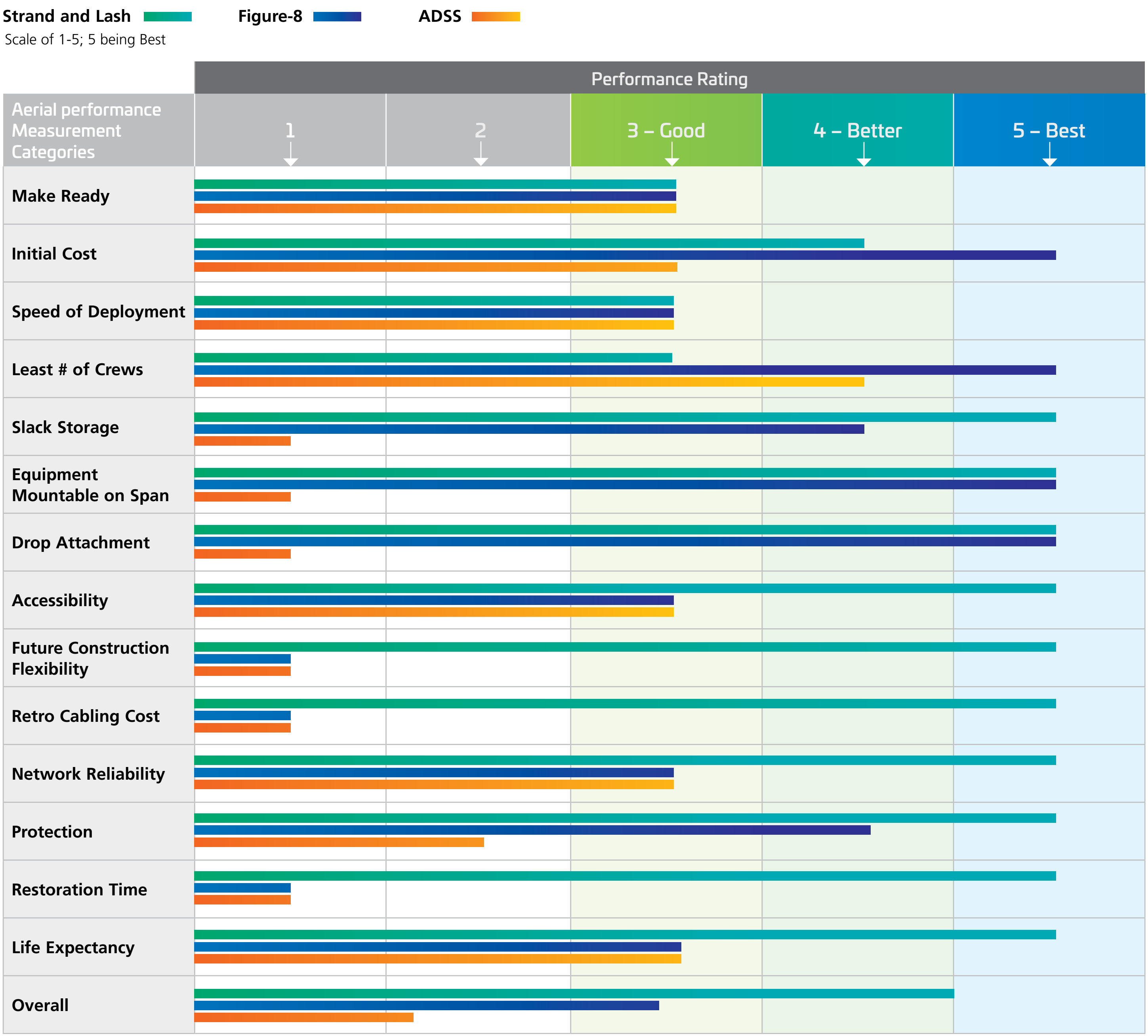
+ Strand and lash installations dominate this category. Slack fiber can easily be de-lashed and extended to the area of damage to make repairs and simply re-lashed back in place. With the exception of the lashing, this work can all be performed by a fiber technician with very little construction experience by temporarily supporting the fiber on the strand with some zip ties. This saves valuable time since it means that a construction crew is not immediately needed to make the repairs.

— ADSS and figure-8 self-supporting is not so simple. They both requires skilled construction crews to relocate slack storage to the damaged area so that restoration work can proceed. This takes time, possibly delaying restoration to connectivity that may be critical.

Life expectancy

+ When either ADSS or lashed fiber cable networks are built properly, maintenance costs are about equal. The life expectancy for both networks will likewise be similar, if good construction practices and handling processes are followed. Lashed fiber cable networks have been in operation for more than 40 years. Those networks were built before ADSS cables were introduced and are still expected to provide many more years of service.

Aerial Performance Overview



Protection Note: SaL may be armored and AJ Fig-8 may be armored, ADSS non armored and no AJ

Conclusion

Each aerial construction method should be viewed as a tool in the toolbox, and when applied appropriately they all perform their roles as intended. For instance, it's clear that the best application for ADSS cables is point-to-point transmissions, as it is not adaptable to network changes and accessibility, relative to the alternatives.

Figure-8 self-supporting cables are best utilized in areas such as rear easements that may be difficult to often access and/or areas that provide connectivity to relatively few subscribers in an area that is already built up.

In fact, most telephone and broadband operators have engineering guidelines in place that state ADSS or self-supporting cable should only be used in situations where the specific requirements warrant it. An example would be a short section into a building, where there is no way to place strand.

While strand and lash construction is best suited for networks that require branching, aerial fiber drops, future accessibility, and network growth, it is also suitable for point to point and affords many benefits in rear easements and brownfield areas.

About the Author

Chris Gemme

A trusted advisor of outside plant construction and engineering, Chris Gemme is part of the Field Application Engineering Team for CommScope, a global leader in communications networks and infrastructure solutions. Gemme has more than 30 years' experience in telecommunications. Prior to his current role, he served as director field applications engineering and as product manager of coaxial cables. Before joining CommScope, he worked at Time Warner Cable. Gemme earned his Bachelor of Science degree from Troy State University and his MBA from Regis University. He is a member of the Society of Cable Telecommunications Engineers (SCTE). He has also served on the SCTE Engineering Committee, which is responsible for all standards and recommended practices activities of the Society.

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CO-114630-EN (05-20)