Reducing the Cost of Fiber Deployment with Pushable Fiber

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Few would argue that it is important to ensure that your network is strong, reliable and quickly restorable. However, the debate centers on how to build a network that isn't too costly to deploy or operate.

With 80% of a telecommunications build being spent on labor, it is critical to the containment of deployment costs that a thorough analysis of how to control labor costs be undertaken. A deployment will require a staff of planners, engineers, field crews and construction forces that are knowledgeable about the type of services to be offered and how they are to be delivered.

Broadband service providers must avoid system downtime and revenue loss due to interrupted traffic flow. Little attention has been placed on the underlying foundation of these networks – the protection and management of the physical layer. The physical fiber network must be protected as light passes from one point to the next, ensuring no degradation of performance. It is crucial that anyplace in which a fiber is terminated, connectorized or spliced, that adequate fiber management practices are followed.

Your approach to fiber management can vary greatly due to environmental, economic, and experience factors. Standards are important – but still emerging. With 50% of the cost of deployment centered on passing the home and the other 50% on connecting the home, it is crucial that a practical and pragmatic approach be chosen for ensuring the protection of the weakest portion of the network, specifically the drop to the home. The drop to the home is what connects every user to the "outside world", yet this non-redundant link is the most susceptible to breaks, cuts and other human intervention.

Early Adoption of Fiber

Since the beginning of the last decade, the past and present of copper and fiber deployment have started to converge or clash depending on who you are. Larger manufacturers looking to re-invent this method developed solutions that were airtight/watertight because of the perception that fiber was a very delicate medium. One of these methods utilized a fiber cable design consisting of a central tube or "buffer tube" (similar to construction of traditional OSP cable) capable of one to twelve 250um fibers protected by one or two strength members running lateral and an overall jacket of a flat design. This "flat drop" cable has been somewhat of an industry standard of which the single fiber design could be terminated with a hardened fiber optic connector for which Telcordia/Corning developed the standard GR-3121 for use in OSP. Early market acceptance was gained on this design and many deployments began this way influenced by the techno-head who appreciated this new kind of technology.

The traditional copper plant engineer and craftsperson answering the call of fiber were influenced early on by the marketing efforts of manufacturers of this type of hardware. As time moved on and they gained some experience with handling this amount of fiber, the mystique of fiber began to fade. Early adopters realized fiber is tougher than what manufacturers try to make it appear and began to look at deployment methods they understood with copper and apply them to the deployment of fiber where it made sense. Early on, dual terminated HFOC patch cords seemed like a good idea because plug-n-play could reduce labor costs. Unfortunately, not every location is a standard length away from the access point. The installer certainly does not want to come up a few feet short and, in turn, makes sure the assembly will reach. This often results in slack storing a cable with a rather large bend radius because of its construction. The simple answer to this was to order the cable as pigtail or terminated on one end only and then trimming the cable to length and splicing on a ruggedized pigtail or a pre-terminated connector. Hundreds of thousands of drops have been deployed this way. The problem with this method is that a plug-n-play intended technology is being used with splicing labor back into it.

Taking a closer look at the fiber splicing

For years, the approach has been that anything spliced needs to be in a sealed and pressurized closure. Why? The 250um fiber is spliced to another and protected with a steel tube and further protected with heat shrink. This final package is environmentally protected from the elements and exposure in a non-sealed environment. Fiber management, at its core objective, is to reduce the risk of damage as much as possible. The fiber optic splice procedures, used for years, poses the same amount of risk as fiber splices in a sealed closure. It is to be noted, however, that dynamic conditions of a movable and somewhat portable device such as a splice closure requires attention to strength and protection of cables entering the device as well as slack storage methods consistent with the practices of the day. This dynamic condition is not present when splicing is being used in a pedestal with exception to differing movements of cable and pedestal resulting from ground heave and swell.

Two fiber optic connectors, when mated to each other, present enough force that the ceramic ferrules will slightly deform creating a sealed and moisture proof mate inside the adapter in the fiber core, cladding, and ceramic material. This connector mate provides the same sealed/water tight condition that a splice point does. It can be argued that the methods the old copper jockeys employ with fiber is secure, robust, and reliable as indicated by the drop methods previously described. Can the traditional methods of copper plant, access pedestals, and fiber splice cases be combined along with new material technology to present a better fiber delivery system?

The Key: Reduce the cost of labor

As we've noted, 80% of the cost of fiber deployment is labor. Over the past twenty years, much has been written – and accomplished with blown fiber. A new derivative of this technology, pushable fiber, offers even more ease of use and greater cost containment for both new and existing environments.

At its simplest and most basic instructional form, pushable fiber assemblies are pushed through a ruggedized microduct to deliver fiber to the desired endpoint. When used with a pushable connector on one end and industry standard connect or on the other, all splicing and termination labor can be eliminated. When used with a pushable connector on just a single ended assembly, half the labor is eliminated. With skilled splicing labor burdened averaging over $100 hour, this labor cost savings will add up quickly.

Pushable fiber pathways are established either aerially or buried, or they are placed in new or existing conduit that oftentimes is otherwise thought of as exhausted (no room left for traditional conduits or cable). The pathway can transition from an outside plant (aerial or buried) to an inside plant environment with a simple airtight and watertight coupler that requires minimal tools to install allowing for a single and continuous pathway from A to B.

Additionally the restoration capabilities of a "cut" or "severed" fiber should not be overlooked. Should a fiber be cut, the pushable fiber can be located, pulled from the duct – which then serves as your "marker" or tape measure" so that the distance required for a replacement product is easily calculated. The ruggedized microduct can then be accessed at that point, quickly repaired with the airtight and watertight couplers to make the pathway whole again. The replacement assembly is pushed back in – all without rolling a splicer and all with unskilled labor. Additionally, the yard does not have to be torn up by trenching or plowing in a new cable. The pathway is quickly repaired and service restoration and turn-up is quickly done with on the shelf product.

When comparing a 150' pushable fiber drop against a dual-terminated HFOC assembly that is direct buried (non-conduit) or aerial deployed, the product material and labor costs are virtually the same. However, the restoration advantages described above far outweigh the peace of mind gained for unplanned maintenance concerns that the life of the cable plant will experience. Cables will get cut, ripped out, and a host of other un-thought of events. Having a solution that minimizes the cost to restore against these events is worth its weight in gold.

Seeing the Costs in Action: Field Trials

To validate the cost savings, Clearfield undertook a field trial of pushable fiber with a major broadband service provider. The goal was to establish the actual cost difference between a spliced solution and a pushed fiber deployment.

In the trial, two different 12-home neighborhoods were connected with fiber. These neighborhoods were similar in size and scope to ensure an equal comparison. One of the neighborhoods was connected to a fiber network using a traditional spliced install from the access point to the home while the other utilized a push technology. Microduct was trenched from the access point to the home in the pushable fiber deployment. At each site, the homes averaged 100 feet of drop cable each. For the spliced solution, all 12 homes were spliced at a single access point and then again at each home.

At this field trial, we used a standard labor rate of $72 hour and a skilled labor rate of $132 an hour. We found that it took 12 hours to install the drop cable in the spliced solution and an equal 12 hours to install the hardened microduct using the pushable fiber. The largest difference was that splicing required 11 hours of skilled labor in the Spliced Drop Cable solution while the pushed fiber was routed through the duct and final assembly facilitated in only 1 hour and 15 minutes of skilled labor.

Deployment Method	Standard Labor	Skilled Labor	Materials	Total for 12-home neighborhood
Spliced Drop Cable	$864	$1452	$763	$3079
Pushed Fiber	$864	$165	$918	$1947

These figures represent a total savings of about $100 per home using the pushed fiber over the HFOC cable solution. The previously described method of using a flat drop and terminating on one end only so that the stiff flat drop can be trimmed to desired length reduces this delta between traditional and pushable fiber but, nevertheless, the savings are still substantial.

Pushable Fiber versus a HFOC connector

Clearfield customers have provided market data on their costs of deploying a HFOC cable in a similar neighborhood environment. These studies indicate that the labor cost and methodologies of deploying an HFOC Cable to a pushable fiber solution are similar, with a material cost reduction of approximately $25 per home because these solutions are traditionally direct buried and no microduct is used.

Deployment Method	Standard Labor	Skilled Labor	Materials	Total for 12-home neighborhood
Pushable Fiber	$864	$165	$918	$1947
HFOC Cable	$864	$165	$596	$1625

However, in addition the restoration capabilities of a “cut” or “severed” fiber cable must be considered. In the event of a cut fiber, an HFOC cable will need be replaced and the entire material and labor costs will need to be duplicated. In contrast, using the tracing capabilities of a toneable microduct, the fault can be easily located using traditional location techniques. The microduct can then be accessed at that point, quickly repaired (rather than replaced) with airtight and watertight couplers to make the pathway whole again. The pushable fiber assembly is then pulled out and a new one is pushed back in – all without rolling a splicer and all with 30 minutes of unskilled labor. Additionally, the yard does not have to torn up by trenching or plowing in a new cable. The pathway is quickly repaired and service restoration and turn-up is quickly done with on the shelf product. Our customer studies indicate this will save the service provider as much as $200 per fiber cut.

Restoration Cost Comparison per Individual Home

Deployment Method	Standard Labor	Skilled Labor	Materials	Total for single fiber cut/restoration
Pushable Fiber	$36	0	$50	$86
HFOC Cable	$144	$85	$50	$279

The restoration advantages described above far outweigh the peace of mind gained for unplanned maintenance concerns that the life of the cable plant will experience. Cables will get cut, ripped out, and a host of other un-thought of events. Having a solution to minimize the cost to restore against these events is worth its weight in gold.