Reducing the Cost of DAS and Cellular Backhaul Construction Using Pushable Fiber

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With 80% of a telecommunications build being spent on labor, conducting a thorough analysis of labor costs is critical to the containment of deployment costs. 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. 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.

With the increased usage of bandwidth, carriers are finding it necessary to reinforce their networks simply to keep up with the demand. If you haven't noticed how this has happened, just look to your kids. The younger generations are using their cell phones more and more and letting the laptop and the desktop computer sit idle. This increase in usage has pushed an already strained network to the limit. Add to this the lack of available space in both buildings and downtown areas and you get a recipe for major network failures. To combat this, carriers are looking for creative ways to maximize existing space and reinforce their fiber with new and innovative technologies.

An emerging technology is ***pushable fiber*** coupled with a ***microduct*** solution. Not to be confused with air-blown fiber, pushable fiber is a practical solution that not only allows for cost-effective deployment of fiber in cellular backhaul and DAS networks, but also provides ongoing returns by reducing the costs of maintenance and restoration.

Distributed Antenna Systems (DAS): Managing pedestrian and road traffic

DAS is an exciting technology as it allows for greater usage and bandwidth transfer in heavily populated metro areas. The challenge in a DAS environment is getting fiber to the antenna sites as they are commonly situated in or on structures that are encased in concrete. The most successful method is micro-trenching (slot cutting) a microduct from an existing manhole run where there is plenty of fiber and placing a fiber from the manhole splice into the DAS equipment on streetlight poles. The challenge is typically finding the time and or space to do this.

Traditional trenching is an expensive and labor-intensive process. It has become such a sore spot in the deployment of cable that even Wikipedia has gotten into the act providing a 14-step process on how to plan your excavation. Challenges associated with soil types have been well documented, as well as the laborious steps associated with creating the support structure to prevent cave in, dewatering and/or benching the excavation.

The need for pushable fiber and microduct is obvious when there simply is no room for a larger typical outside plant solution. The traditional method of digging a 1 foot wide trench, placing a 2-4 inch conduit, backfilling with concrete and then repaving is long gone. This older method typically costs upward of 60% more to do, and also impacts the local traffic in ways that just are not acceptable anymore. Imagine closing a lane of traffic in downtown Chicago for a week. With the pushable fiber method, a slot is cut, usually at night, and then two microducts are placed in the slot. One of these microducts typically has the ability to be located. This is critical, as when fully restored, it's virtually impossible to see where the trench is and after a season of resurfacing, it will be fully invisible.

Micro-trenching is a far superior alternative and is the ideal manner as it is less time consuming, less invasive and allows for traffic to pass over the trench line without worry of causing damage. The trench width is usually 1 inch or less, and since less material is removed, it can be easily restored.

After the microduct is placed in the trench, a small hole is bored into the manhole where the fiber ring is located. The microduct is placed into the splice case, just as a traditional cable would be, then the fiber is simply pushed through the microduct and spliced as a normal cable. The two most attractive qualities of pushable fiber is 1) that it allows for installation from either end, thus letting the installation crew work with the least amount of disruption and 2) its size. A 3mm pushable fiber can house up to 12 fibers, while a 4mm can house up to 24 fibers and still fit into a 10 mm microduct. Additionally, the placing of two ducts in a small, 1 inch footprint allows for the project to be completed in a normal shift overnight, thus reducing the impact on the local traffic and all the associated headaches that come with traffic control.

Cellular Backhaul: Reinforcement of an existing duct structure

When the requirement is for fiber reinforcement in an existing duct structure, such as rooftop sites, while the requirements change somewhat, there are some common threads: the lack of space and the costs associated with constructing new pathways through the riser space in buildings is just as prohibitive as digging up city streets.

Pushable fiber addresses this much in the same manner by installing microducts inside the existing structures to provide a distinctive pathway and using the pushable fiber, simply pushing the fiber from the top down. The added benefit of installing in buildings is gravity. Given the small size of the pushable fiber, we can easily carry it to the top floor and let gravity help with the installation.

An installation in Racine, WI serves as a good example. The cell site was on top of a ten story building with a one inch conduit running down from the rooftop to an equipment room in the basement. The connection point for the local telco was an additional 450 away in a manhole. This installation had been on hold for three years because of routing problems and the costs associated with core drilling 10 floors and installing a new conduit. Using the pushable fiber alternative, we were able to accomplish placing both the microduct and fiber in just about 8 hrs.

A 1 ¼ inch inner-duct had been previously installed from the building to the manhole, so that path was established. The challenge was that the 1 inch conduit already had 4 Cat5 cables and a 25 pair telco cable in it. Additionally, there were a total of 22 ninety degree sweeps in the route. We were able to install two 10mm microducts from the rooftop hut to the equipment room, then couple on two microducts that we had pushed through the 1 ¼ inner-duct to the manhole. After installing the microducts, we pulled the fiber from the rooftop to the equipment room in one pull through 22 ninety degree bends! After that, it was a simple pull to the manhole.

Taking a Closer Look at Pushable Fiber

Reducing the labor cost of installing fiber from the access point to the tower or DAS antenna, while improving the long-term reliability of that fiber, is the promise of an optical fiber protection system deploying pushable fiber. In fact, by eliminating splicing, pushable fiber within a ruggedized microduct can eliminate hundreds of dollars in labor costs at every connected fiber. In its simplest form, ruggedized microduct is either aerially or direct buried and the pushable fiber is either pushed by hand or machine to its desired end-point – up to 1500 feet. The pathway can transition from 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. Pushable fiber is available in bulk form or terminated with a unique pushable-connector-- as a single drop or multi-fiber assembly.

To seamlessly integrate with the ruggedized microduct, solutions are being introduced to market that allow the fiber to be pushed directly into a fiber management device such as the Clearview Cassette. This cassette provides the ultimate in fiber protection and enables the field technician to splice inside a protected environment. Taking that protection a step further, ruggedized microduct and the associated pushable fiber can be installed directly to specially designed pedestals and vaults further protecting the laid fiber.

Why Pushable Fiber?

While the need for fiber is clearly demonstrated at cell sites and DAS antennas, the cost-effective means to delivering that technology is less understood. In the examples given, pushable fiber and microduct solutions, when combined, not only saved money for the carrier, they lessened the impact on the people that are being better served by the installation.