The FieldSmart Fiber Management Philosophy: "Reduce risk, headaches, and cost"

Toll Free: (800) 422-2537 Phone: (763) 476-6866 Fax: (763) 475-8457 sales@clfd.net
www.ClearfieldConnection.com

The whole point of every component within a fiber management system --- from the 125um cladding on out in fiber cable construction, cable jacketing, splitter packaging for outside plant, and the route paths within them, is to protect and reduce the risk of fiber damage. Period.

A product that does not accomplish this in an easy and intuitive way is over- thought and costs you money. At Clearfield, we approach fiber management with three simple goals in mind. Our first and most important objective is to deliver solutions that minimize your fiber risk in the cable plant. Secondly, it is our responsibility to eliminate deployment *AND* maintenance headaches. And lastly, we must reduce the cost of broadband deployment by careful attention to not only the reduction of capital equipment costs, but also the operational costs of each every deployment.

The following paper outlines how we've taken that philosophy into our design and highlights three crucial elements for you to consider:

1. Using Patch & Splice to reduce costs without giving up convenience or the quality of splicing that traditional patch-only environments provide.
2. Reducing risk by eliminating as much interaction with fiber jumpers and tail as possible, especially those with live traffic on them.
3. Remembering, it's not just the glass, but the jacket that must be considered in an unconditioned OSP deployment.

Using Patch & Splice to Reduce Costs

Building a FTTH network is a labor-intensive effort. A significant portion of this labor is associated with the hours it takes a splice crew to perform the tedious work of splicing each individual in-ground/distribution cable to the FTTH-PON cabinet. Critical to the control of operational and capital cost controls is a standard splicing methodology that guarantees a timely, quality burn.

The splicing of feeder and distribution network fibers to a FTTH-PON cabinet is traditionally done in a splice closure. The closure is installed below grade in a handhole directly beneath the cabinet or in a splice vault in near the cabinet. The cabinet is preloaded with a factory terminated OSP stub and enough slack, stored in the handhole or splice vault, to allow for the splicing crew to pull both the cabinet stubs and the in-ground feeder/distribution cables out to a desired area. For comfort, convenience and cleanliness, the best place to perform this tedious work is within a controlled environment like a splice trailer. To allow for this convenience, it is not unusual for stubbed lengths to reach 500'.

In an effort to reduce costs (and because in some harsh environmental locations the use of a below grade handlhole or splice vault was not possible), some outside plant planners instituted network designs that eliminated the use of the handhole (or splice vault) and incorporated the splicing directly inside of the cabinet. A Patch & Splice cabinet typically incorporates hardware within the cabinet to perform cable prep, cable slack storage and splicing. However, this design presents two trade-offs. The user, because pre-terminated slack storage within the cabinet is limited, is forced to perform his splicing activities within close proximity of the cabinet. Often, this distance is 15' or less. This is usually not enough distance to use the desire controlled environment splice trailer.

The result is that splicing was being done in open-air environments, not conductive to a quality burn (or happy outside plant engineers.) As an alternative, in an effort to get their splicing crews out of an open air environment, other network planners ordered the stubbed lengths of jacketed tight buffered cable at the traditionally longer lengths which created two more undesirable conditions; 1) Longer lengths of distribution style tight buffered

cables not necessarily designed for OSP environments. 2) Larger cabinet sizes to accommodate and safely store slack which limited density of the cabinet and homes-served footprint it could satisfy.

Introducing Integrated Fiber Management – The Convenience and Quality of Patch Only with the Reduced Cost of Patch & Splice

The FieldSmart Fiber Scalability Center (FSC) for PON environments allows network engineers to enjoy the cost savings of Patch & Splice without the historical trade-offs. Integral to the design of the FieldSmart FSC is its patent-pending Clearview Cassette technology. Each cassette is its own complete, cost effective, and turnkey fiber management solution.

Core to the design is that fiber is protected in sub-units of 12 fibers. Jacketed cable storage is eliminated because the 900um tight buffers have shed the outer riser-rated jacket in favor of the cassette that protects it not only from human accidental damage but also provides bend radius protection.

By eliminating the requirement for jacketed fiber, the FieldSmart FSC can accommodate all fiber management needs PLUS all the slack storage required for a 288 home served configuration in just 4 cubic feet of cabinet space. Further, due to the "nesting design" of the Clearview Cassette, splice trays are integrated into the protection of the Cassette itself, eliminating the need for space-hogging (and expensive) splice closures. The splicing solution is portable. The user can now pull his feeder/distribution cables through the cabinet and as far as his OSP slack allows to the splice trailer. Clearfield's design makes this even easier because the user does not have to manage, at the same time, an OSP tail (from the cabinet) of equal length. All he has to do is have enough splice trays (nested within in the Clearview Cassettes) to match his cable counts.

Following Clearfield's recommended order of operations for cable prep and strip length, the customer can splice all his pre terminated Clearview cassettes to this network fiber inside a controlled environment. To accommodate high density environments and/or high fiber counts, Clearview Cassettes can be "ganged" together allowing the splicer to move from 12

to 144 fibers at a time. This allows the customer to splice one sheath at a time perfectly matching the OSP fiber count to a Clearview ganged "block" without having to manage capacity and entry/exit ports associated with a splice closure.

This ganged block of Clearview Cassettes eliminates further costs in the splice closure that would have traditionally been used in a patch only environment. The costs of a splice closure loaded with splice trays, slack baskets, and the risk of an un-sealed closure in time are eliminated. Furthermore, the cumbersome tasks in network design to match cable sheaths and fiber counts inside the closure and the hassle of splitting buffer tubes are eliminated because the user's cable sheaths will always match the Clearview block of cassettes.

The following details the material and labor savings generated using of Patch & Splice within a FieldSmart outside plant enclosure from Clearfield.

Material Cost Savings By Material Elimination	Qty	Price	Extended
OSP Cable (Prysmian CF033015-E)	100	$1.35	$135.00
Splice Closure (FOSC 450-D, 288 HSF splice)	1	$350.00	$350.00
Fiber Splice Trays - Distribution (FOSC - 72 HSF)	4	$20.00	$80.00
Fiber Splice Trays - Feeder (FOSC - 24 HSF)	1	$10.00	$10.00

Material Cost Savings Through Size Reduction	Qty	Price	Extended
Handhole - 60 inch (Pencell PEM-3660-APA-SPL)	1	$1,075.00	
Hanldhole - 48 inch (Pencell PEM-3648-APA-SPL)	1	$817.00	
Difference between the two:	1	$258.00	$258.00

Labor Savings Using Clearfield Patch & Splice			
Cable Prep **Estimated Labor savings for OSP prep. Strip, buffer tube access, Clean 250UM. 60 minutes factory environment*	1	$65.00	$65.00
Trouble shooting entry of splice closure **Estimated at minimum 1 entry during lifetime*	0.33	$65.00	$21.45
Total Material and Labor Savings Using Clearfield Patch & Splice			**$919.45**

It is important to emphasize that these cost savings are gained without having to sacrifice the ease and convenience of a Patch Only installation. What the customer ends up with is

ultra modular fiber management system that feeder/distribution ratios are scalable and user-defined 12 fibers at a time. Clearfield's Clearview cassette provides a patch & splice system that is used exactly like traditional patch only AND we have eliminated costs associated with jacketed fiber, the space that was traditionally allocated to store the terminated slack, the cost of a splice case sitting below the cabinet in the handhole, and the size of the handhole necessary because no splice vault is used.

Eliminating un-necessary interaction with the fiber

In early 2000, in a joint study between two RBOC's, it was reported that in the two weeks immediately following a tech service labor strike, trouble calls into the technical assistance centers would reach or come close to all time lows. Reason: There was nobody out messing around with the cable plant. Naturally, as normal maintenance tasks went un-performed, the network began to suffer. The important thing to note is that when human interaction with revenue-generating live circuits happen, the risk of network "trouble" increases.

Any optical circuit that is being touched or that is moving is at risk. Thus, it would be make sense to use solutions that minimize the 'touches." Core to the Clearfield FieldSmart design is reducing the number of touches, re-routes, and the amount of moving fiber. Two areas of fiber management that require highlighting are the Splitter Parking Lot and Swinging Bulkheads.

Parking Lot

Clearfield minimizes risk of damage to the splitter module as it ships pre-parked within a disposable, FieldSmart Parking Block, enabling the customer to simply place the splitter into the splitter cage, route the pre-parked jumpers up to the parking block storage area and deploy subscriber circuits from there. This deployment methodology enables the majority of each output legs final destination to be touched only once. As sub-scribers are turned up, each leg is routed to the port without having to fish a jumper out a bundle of live circuits. If we do not touch live jumpers, we are not putting them at risk.

Swinging Bulkheads

They may look cool and be sold to the user as providing superior access, but swinging bulkheads are not a good idea. So much energy and thought goes in to the development of a low risk dynamic optical circuit that can withstand the handle it will experience over its lifetime. And this is to handle one fiber jumper or pre-terminated splitter output. How much sense is it to then take a bulkhead and have 288, 576, or 576 delicate 900um fibers moving all at once? Fiber management should be designed to minimize your risk on both sides of the adapter from the feeder to the distribution network.

This is true whether a splitter output circuit is parked or in-service. This is especially true for multifiber OSP cables whose buffer tubes have been exposed and removed from the very material designed to protect it and allowed to move with every bulkhead opening. While the manufacturer may have taken these factors into account before releasing the design, "Murphy" is alive and well.

In comparison, Clearfield's design eliminates the risk by placing a well-designed OSP assembly with a ruggedized and proven transition into the cabinet --- and doesn't require the user to touch it. For patch only configurations, the rear door should never need to be opened. Clearfield's buffer tube slack, for patch and splice configurations, is intuitive and fast. The cable is brought to the cabinet where buffer tubes are accessed, exposed to desired length, spliced into Clearview cassettes, and easily slacked stored over radius spools directly adjacent to cassettes minimizing risk by minimizing exposed buffer tubes.

It's Not Just the Glass

The trend in outside plant cabinets is rapidly moving towards bend insensitive glass for the obvious advantages it gives to both the customer and the designer of fiber management products. As a result, the 3" bend diameter that was driven as a standard inside of GR-449 for central office mainframes, and that was core to every fiber management design for the last 20 years, seems not to be receiving the scrutiny it once was. Using fiber cabling that utilizes the G-657.A standard creates perception that users *mistakenly* seem to associate with a "fail-safe" condition.

Bend insensitive glass does not solve everything.

At tradeshows and field-installs alike, it seems that whenever BIF is being used, an increasing amount of fiber is being crammed into ever smaller places --- seemingly without regard for the need for bend radius protection.

Manufactures of fiber management are mistakenly designing route schemes where an jacketed fiber circuit travel over a 90 degree edges thinking their bend insensitive fiber can handle it. Initially, a few jumpers can handle this. Over time, as max capacity of the fiber management product, begins to be reached, weight and friction can affect the long-term reliability as the 90 degree bend c an affect even bend insensitive fiber. Try placing a bend insensitive patch cord on a light meter and pinch the cordage to a 90 and you'll know what I mean.

While the industry moves to this type of glass, and an apparent disregard of the standard, it continues to ignore the effect traditional riser-rated jacket material has on performance in harsh environments.

These jacket materials are stiff when cold and will relax when temperatures inside cabinets begin to climb. As thermal coefficient of expansion/contraction takes place through several thermal cycles, the fiber is subject to bend radius violations which can create unacceptable light conditions.

It's during these wide temperature fluctuations that the adherence to a manufactures routing recommendations within the industries...even for BIF....becomes critical. And this is only true if the scheme is a good one. If a fiber, whether it be BIF or not, is routed with a properly controlled diameter, one need not worry. However, if the fiber is not bend-radius protected, and is subjected to a hard 90 degree turn, a piece of sheetmetal or a sagging jumper being pushed into a corner, the effect can be a condition of intermittent light to no light. Many can attest to the frustration experienced when a ten- dollar patchcord brings down a million dollar network.

Plan for the Inherent Short-Cut

Once you have selected the fiber management solution that best serves the needs of long-term reliability in its design, you are halfway there.

As strongly as manufacturers may recommend a particular route path, it appears to be only human nature to "take short cuts." Depending on a variety of factors like cable pile-up and environmental conditions, the consequences of these shortcuts may either become immediately apparent or, over time, are hard to trouble-shoot.

A better approach, and the philosophy core to a Clearfield design, is to use not only bend-insensitive fiber, but also jacket materials that respond well in harsh conditions not only in cold environments but on both ends of the thermometer. The poly urethane furcation materials used in Clearfield's OSP splitter packaging remain flexible in temperatures down to -55C and, because the rubber material always wants to return to its extruded state, it resists sagging in extremely hot environments. Even performing best practices and continual training, the recommended routing path might not be maintained for a given jumper and having a material that will respond and protect your critical and most fragile points of failure will pay dividends for years to come.

In Summary

Careful attention to detail and a design philosophy that treats fiber management as core to the architecture rather than an after thought, will create a higher likelihood of deployments without headaches and a reduction in both capital equipment and operational budgets. To learn more, visit www.ClearfieldConnection.com for a complete description of the FieldSmart fiber management platform.