Recommendations From An 'Old' Fiber Pro

Based on 33 years in fiber optic communications, I make the following ten observations and recommendations. Of course, these are opinions, but they are based on a significant database.

Planning Issues

1. **Plan for future needs.**

When determining both fiber specifications and number of fibers, estimate your future needs.

On fiber specifications: if future multimode bandwidth will be significantly higher than today's, choose the highest performance multimode fiber available, either OM4 or extended distance LO fiber. The cost of installing increased performance fiber in the future may be more than the cost of increased performance fiber today. If OM3 fiber will meet your future needs, choose it, as its cost is less than that of OM4 or extended distance LO fiber.

On number of fibers: if future multimode bandwidth needs will be 40 or 100 Gbps, each pair of fibers for today's needs becomes 8 fibers for future needs. Otherwise, choose a number of spare fibers that makes sense from a physical analysis of the space that such fibers will serve. In the past, many have overestimated the number of spare fibers because they, like most of us, could not predict the increased bandwidth that multimode optoelectronics would achieve (i.e., 10 Mbps to 100 Gbps).

2. **Use the same fiber in backbone and patch cords.**

This recommendation sounds like a 'no-brainer'. However, the subtleties of OM3, OM4, and bend insensitive fibers can make this a necessity. Field horror stories support the use of the same fiber type (OM3, OM4, BI) from the same manufacturer to avoid unexpected bandwidth or loss problems.

3. **If connector installation training is a major issue, consider the 'cleave and crimp' installation method.**

While this method may not provide the lowest total installed cost, it becomes preferred whenever training cost due to high personnel turnover becomes an important consideration.

Suppliers: Corning Inc. Tyco Electronics, Panduit

4. **Consider the payback from fiber optic training.**

The prime payback of training in cable installation, connector installation, and testing is reduced installation cost. Such reduced cost results from increased installation speed and reduced rework. A second payback is increased reliability. A third payback is for management: simplified evaluation of installer performance. With exposure of all personnel to the same type and level of training, differences in

performance reflect differences in installer skill. Since 1983, Pearson Technologies Inc. has been providing consulting and comprehensive training in fiber installation and design. See: http://www.ptnowire.com/training-list.htm

Design Issues

5. **Consider adopting acceptance values tighter than those in the standards.**

Some may consider this recommendation heresy, but there is logic. For increased network reliability, consider using insertion loss acceptance values that are less than those stated in the standards. Use of such reduced values can improve the reliability of the network. This improvement results from allowing an increase in the damage that can occur prior to link failure.

The logic is simple: the standards indicate values that are worst-case performance, or highest loss, values. At these values, the link will work. However, we would not expect to see the worse case performance or highest power losses. Instead we would expect to see typical losses. Our experience in both field installation and training, which includes over 46,000 connectors and 8300 trainees, supports this expectation. Almost always, a measured loss closer to the maximum loss than to the typical loss is an indication of installation error.

Use of maximum loss values runs the risk of acceptance of installation errors. However you analyze such errors, they reduce network reliability. As we present in our fiber design program, BICSI FO110 (https://www.bicsi.org/courses.aspx?l=2200&c=fo110), and in our installation training programs, FiberPro™ 1 and 2 (http://www.ptnowire.com/training-list.htm), there are several methods for determining insertion loss acceptance values that help avoid reduction in reliability.

Suppliers: too many to mention.

Installation methods: epoxy, quick cure adhesive, Hot Melt adhesive, cleave and crimp

6. **My 'best choice' for most applications is the LC connector.**

While I was not a fan of the LC when it was first offered, I am now. 11 years of use without any significant operational issues, multiple suppliers, multiple installation methods, total installed cost lower than predecessor products, and loss lower than connectors with the 2.5mm ferrule are the factors that lead me to this recommendation.

For data networks, use OM3 or OM4 fiber.

Cost Issues

7. **Consider pre-terminated solutions.**

In July of 2010, I performed a cost comparison of total installed cost of plug and play solutions, such as the pre-terminated MTP/MPO products with cassettes, to that of

field termination. This comparison indicated that the total installed cost of a pre-terminated link can be less than that of the traditional field termination. I say 'can' because all cost comparisons will depend on the specific costs used. That being said, my cost values were reasonable and without any deliberate bias.
Because of these results, I recommend clients designing networks consider this option. This option can be favored for installation in data centers as well as in vertical backbones.
For vertical backbones, an additional advantage of the pre-terminated systems comes from the small cable and connector sizes: it is possible to install the number of fibers you need now and install additional fibers, in groups of 12, when they are needed.
Suppliers: Corning Inc., NEXANS, Panduit, Tyco Electronics

8. Fusion splice pigtails can replace field-installed connectors.

The 'accepted' wisdom has been that fusion splicers were too expensive to use for connector installation. However, the availability of low cost fusion splicers, at $5500-$8500, has led to a change in the economics of connector installation. The reduction in installation cost enabled by use of fusion-spliced pigtails can pay for the cost of the splicer. This payback occurs between 700 and 3000 connectors. (See: http:// www.ptnowire.com/tpp-V3-I2.htm)

9. Perform multiple total installed cost calculations for network designs.

As I train clients in fiber network design, I find that most people do not know all the cost factors or the cost impact of their design decisions. As a result, many network designers achieve their technical goals, but at a cost higher than necessary. By performing multiple cost calculations, as we do with the spreadsheets we use in BICSI FO110, designers are able to include all cost factors and choose a combination of products that achieves low total installed cost.

10. Choose products based on total installed cost.

Of course, this makes sense. However, some do not appreciate the difference between product cost and total installed cost. I'll provide two examples, one for connector type and one for installation method.
Some ST-™ compatible and SC connectors are less expensive that LCs. However, the total installed cost includes the cost of the connectors and the cost of the enclosures on the cable ends. Enclosures can accept a larger number of the higher cost connector, LC, than they can of the lower cost connector. Thus, the cost of the enclosure used for the higher cost connector can be less than the cost of the enclosure required for the larger and lower cost connector.
Some connector installation methods offer reduced labor cost or time but require increased cost connectors. However, the cost of concern is total installed cost. If the reduction in labor cost exceeds the cost premium required for the connector, then use of an increased cost connector makes sense. However, the opposite case can be true: the reduction in labor cost may be less than the cost premium required for the connector. I advise multiple calculations of total installed cost.

About The Author

Eric R. Pearson is a 33-year veteran of fiber optic communications, with extensive experience in fiber and cable manufacturing, installation, testing, lawsuit support, network design, and design and installation training. A founding member and VP of Certification of the Fiber Optic Association, he was a Director for 12 years. Mr. Pearson has a BS from Massachusetts Institute of Technology and an MS from Case-Western Reserve University.

Eric R. Pearson, CFOS
President
Pearson Technologies Inc.
fiberguru@ptnowire.com
770-490-9991
www.ptnowire.com