Fiber Optic Services And Products

EYE ON FIBER

Knowledge Required For Designing The Fiber Optic Network

Subtleties, Specifications, Process, And Cost Estimates

INTRODUCTION

The simple way to design a fiber optic network is to reference TIA/EIA-568-B. While such a reference works, this approach does not allow the designer to achieve the highly desirable goals of maximum ROI, minimum total installed cost, optimum design and maximum reliability. To design a high ROI, cost effective, optimum and reliable fiber network, the designer needs to understand the basics of fiber optic networks, the design process and the cost impact of design decisions.

THE BASICS AND IMPORTANT SUBTLETIES

The basics include the language of fiber optic components, the optional performance numbers of those components, and the performance numbers that result from use of TIA/EIA-568-B. While the performance numbers of TIA/EIA-568-B are reasonable, their use rarely results in an optimum network design.

Heresy you say? Not at all. All standards are politically negotiated compromises.[1] As such they can never be technical or cost optimal solutions. To achieve an optimum network design, the designer must know the benefits and drawbacks inherent in TIA/EIA-568-B and the optional specifications available. Two examples will help.

Example 1: fiber characteristics such as core offset, cladding non-circularity, core diameter tolerance, and cladding diameter tolerance are critical to achieving sufficiently low connector loss. These characteristics are set by TIA/EIA-568-B through reference to two international cable standards, ICEA S-83-596-2001, for premises distribution cable and ANSI/ICEA S-87-640-1999, for outdoor cable. As international standards, the values of these four characteristics have been established through political compromise between international fiber manufacturers. Did you know that these characteristics of US-made fiber and much of the overseas-made fiber are superior to those in these two standards? Without knowledge of these characteristics, the designer can, through blindness, allow reduced reliability and increased connector loss into his design.

Example 2: blind adherence to TIA/EIA-568-B fiber performance values can result in less than ideal life cycle. Use of laser optimized, 50 µm fiber can result in increased life cycle and reduced life cycle cost. Again, without such knowledge of options, the designer can create a less than optimum design.

These two examples are of the subtlety of the design process. Often, I find that highly experienced network designers benefit from knowledge of the many subtleties in the fiber optic network design process. In addition, subtle knowledge of potential fiber specifications allows designers to create networks that would be impossible with straight TIA/EIA-568-B specifications.

THE NINE-STEP DESIGN PROCESS

The process of designing a fiber optic network can be organized in many ways. I have chosen to organize it as a series of nine steps (Table 1).

Table 1: The Nine-Step Design Process

Define basic requirements

Map the network

Make the multimode/ singlemode decision

Determine optical requirements

Determine non-optical requirements

Future proof the network

Identify potential components

Choose components

Determine acceptance requirements

Each of these steps is a series of questions. Each question has multiple answers possible, depending on the specific network to be designed. For instance, a building riser network will have answers different from those of a process control network in a steel mill.

Of these eight steps, the second and ninth have the most common difficulties.

STEP 2: MAP THE NETWORK

Step two requires the designer to map the network. On this map, he indicates the installation and environmental conditions. It is not unusual for the designer to overlook important environmental conditions and specify the cable performance inadequately.

For example, a building-to-building network in a hospital facility may have a link through a tunnel. As is common in medical facilities, this tunnel may have steam pipes. If the steam pipes, commonly located at the top of the tunnel, create a temperature above the maximum operating temperature range of the cable, as specified by TIA/EIA-568-B through its reference to ICEA S-83-596-2001, the end to end power loss will be higher than expected. More importantly, the cable materials may experience degradation that can result in cable failure years after the installation. In this case, the reference to TIA/EIA-568-B will not provide the desired reliability.

STEP 9: DETERMINE ACCEPTANCE REQUIREMENTS

Step 9 requires the designer to specify the maximum power loss that will be acceptable at the completion of the installation. While TIA/EIA-568-B allows this power loss to be at the maximum power loss values of cables and connectors, this maximum loss will not be reached unless the installer makes mistakes. Such mistakes result in reduced reliability. In other words, setting maximum power loss values with the maximum loss values from TIA/EIA-568-B can result in reduced reliability. The question becomes: how does the designer calculate acceptance values. This subject requires more space than we have in this article. In FiberPro 5, we address possible strategies and a recommended strategy.

COST ANALYSIS ESSENTIAL TO HIGH ROI AND MINIMUM COST

No design should be finalized until the designer performs at least two cost analyses. In many cases, the designer will perform four or five cost analyses to determine the combination of components and installation methods that result in either the lowest total installed cost and/or the highest ROI.

CAST IN CONCRETE RULE 1: CHOOSE PRODUCTS WITH LOWEST TOTAL INSTALLED COST

COROLLARY TO RULE 1: NEVER CHOOSE PRODUCTS WITH LOWEST COST

There is a tendency to choose products based on product cost. This tendency can, and often does, result in a hidden increase in cost. Four examples will help.

Example 1: some connector installation methods offer increased installation rate (Figure 1). Such methods tend to require connectors that have costs higher than those of connectors with reduced installation rates. If the reduction in labor cost is more than the premium paid for the connector method with the increased installation rate, the higher cost connector will result in a reduced total installed cost.

Does this type of cost comparison sounds simple? It is. Reality is never this simple. In any installation, there is factor I call labor utilization. Utilization (Figure 2) is the ratio of time spent in the specific activity to the total time required for that activity. If we consider connector installation, there is time for travel to the installation site, time for setting up the installation equipment, time for cleaning up and packing the installation equipment, and the time for installing the connectors. Obviously the labor utilization will be less than 100 %.

In addition, this utilization will vary from situation to situation. For example, an installer who installs four connectors at a location will experience a lower utilization than an installer who installs 48 connectors at a location. This subtle factor of labor utilization can influence the connector installation method, favoring one method in one design and a different method in a second design. The designer needs to understand and include consideration of utilization in both his total cost estimate and in his choice of connector installation method. Without such consideration and multiple cost analyses, the designer can underestimate the total cost of the network and unknowingly choose a design or product a hidden excessive cost.

Example 2: some building-to-building networks require termination of cables at a location other than the basement entry location. With this requirement, an indoor cable will connect to an outdoor cable. This connection has a cost that can be $20-$40/fiber. An alternative configuration can use an indoor-outdoor cable. Such a cable will eliminate the connection cost but can require an indoor-outdoor cable with a cost higher than the cost of the indoor and outdoor cables. In this situation, the designer will perform two total installed cost analyses to determine the alternative with the lowest total installed cost. In one case, a designer paid $700 more for the indoor-outdoor cable. This designer saved $7200 in connection costs.

Example 3: a designer chose break out cable without any cost analysis. This blind choice resulted in a total installed cost that was 50 %, and $100,000, higher than an alternative cable choice. Without multiple cost analyses, the designer risks a network with excessive cost and the resultant reduced ROI.

Example 4: fiber to the desk is commonly viewed as too expensive. Yet for new builds, many FTTD networks have initial installed costs that are less than those of traditional horizontal UTP, vertical riser fiber networks.

FIBERPROÅ 5 PROVIDES THE NEEDED KNOWLEDGE

In its three major sections, FiberPro 5 addresses the main issues of fiber optic network design: the basics, the design process, and cost analysis. As part of the cost analysis section, attendees receive three complex spreadsheets[2] that allow attendees to choose the lowest total installed cost based on the specifics of their networks. Attendees practice what they learn through development of a comprehensive design package, complete with fiber, cable, connector and optoelectronic specifications, certification specifications, and cost estimates. As tools for use in this development, attendees receive five additional computer files that can be used as specification forms in designs performed after the program. FiberPro 5 is a four-day program with BICSI CECs as shown in Table 2.

Table 2: CECs Available From FiberPro 5

RCDD	28

NTS 7

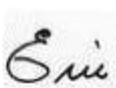
OSP 28

ITS Installer 12

Technician 12

BICSI Master Instructor, Eric R. Pearson, CPC, CFOS, developed and delivers FiberProÅ 5. Mr. Pearson is a 29-year veteran of fiber optic communications.

Respectfully submitted for your consideration,



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