OVERVIEW

Fiber-optic construction projects can seem daunting, maybe even overwhelming, for those who have never done one. Although every project has its challenges, building outside plant can be especially confusing for Business Managers or IT Professionals because the projects can be so rare it might be a once in a lifetime experience. The devil is always in the details — and that’s typically where you will find much of the work involved for fiber-optic construction projects. The real challenges typically involve crystal balls, politics, and finances. Planning for a future you can’t see well, with others who can see it no better than you, within the constraints of a budget, can create the challenge of building the best fiber network with the money you have.

When taking on ANY project, the first question you should ask is “what are the goals”. In the case of fiber-optic construction the better question is “what is the long-term strategy”. Fiber is different in the sense that it is costly to construct, provides service for many decades, and has no superior competing medium on the horizon. Fiber is best upgraded through electronics; faster optical transceivers and better multiplexing technologies can future-proof the medium. It’s difficult to imagine what the technology landscape will look like 20 years from now but we have seen significant increases in bandwidth needs in recent years. This trend isn’t likely to change in the coming decades.

FIRST STEPS

If you are not experienced in planning a project building fiber you will thank yourself to find help – if not Livermore Technologies – someone else with experience. Although you can rely on the contractor for many things, they will be relying on you for guidance as to where and how you want it built. Leaving it to them will leave the door open to possible misunderstanding and poor choices since their business is to build what you want – not plan for the future business needs you have. Nobody will be happy with a poor solution that is virtually a permanent one or at least costly to physically change! Let’s delve into the steps; strategy, planning methods & pitfalls, finance & regulation, fiber route planning, and other aspects of a fiber-optic construction project.

Step 1: Long-Term Strategy

Although difficult to truly predict, it’s safe to say increasing bandwidth needs will continue. Some deeper questions include whether or not the fiber you plan to build could be used by other entities, agencies, etc. Fiber is different than IT investment in the sense that it’s outside, accessible for sale, lease, or trading. It’s a commodity. In the future another local entity along your fiber route may decide they want to hop a ride on your investment. Suddenly you have someone to share the cost of your investment. If you planned properly there will be dark fiber available to them.

The bottom line to building fiber is doing it right the first time. Never, and I say NEVER build a fiber network for only what you need today. The cost difference between 12 strand and 24 strand fiber varies from nothing to maybe 10 cents per foot. Going from 24 strand to 48 strand might be an additional 20 cents per foot. Because multiplexing can be expensive it’s better to simply buy more fiber strands and defer the need for multiplexing signals on the fiber until it really becomes a necessity. Installing more fiber strands while the contractor is building will allow you to forgo multiplexing even if other entities are allowed onto your network.
Step 2: Planning Methods & Pitfalls

How I address planning the amount of fiber for community networks is by reviewing current needs, add the surrounding potential needs (city, school, county, etc) and double, or nearly double, that. The basis for this “extreme” is the cost of construction is the highest cost by far. Going from a 24 strand cable to a 48 strand fiber is minimal compared the expense of constructing the innerduct and lashing aerial. Doing this all over again 15 years from now would be the worst option. Per foot cost of installing cable doesn’t change...contractors charge the same to blow or lash a cable whether it’s 24 strand or 48 strand fiber. The added costs are larger enclosures, termination panels, and more splicing; costs that are small compared to boring and labor. Minimally, plan for 6 enclosures per site and place at least 12 strand fiber to the building – then take 6 and multiply it by the number of current and future locations you can imagine. This number should be the minimum size of your backbone for many circumstances.

Common Pitfalls:
Pitfalls of long-term strategies for fiber can be numerous and the solutions almost always involve a lot of money. The most obvious is lacking enough fiber down the road to fulfill the needs of a growing data-hungry world. Feeding more entities with growing broadband needs will require multiplexing or more fiber to be built – neither of which is friendly to the wallet! The worst situation is lacking fiber strands in a small innerduct. The only way to increase your strand count is to “rip and replace”. Connected entities will experience downtime while this happens and coordinating the best downtime for all entities will likely be difficult.

Another pitfall concerns where the fiber is routed. Being too far from potential cost-sharing entities will pose a problem for a cost-model based on sharing fiber. If you are the group tasked with building a fiber network in your city, the route should be inviting to places that may want to connect in the future. If your fiber is too far away from a public school it might be beyond their fiscal ability to build to you. It’s a balancing act of building close to town where a vast number of locations are while stretching your route out enough to attract some future opportunities to share the network.

Step 3: Finance & Regulation

Careful consideration for how the fiber was funded when it was built. If it was paid for through grants or other public dollars, you may not be able to sell, lease, or trade any of it to certain organizations – blowing up the original idea of reducing long-term cost of ownership. There may be further regulations at the state level for fiber systems provided through a local municipality so it’s important to understand the landscape of funding before moving too far into a project with large dreams of sharing it with everyone. There may also be competitive issues if the system has public dollars involved so it may be good to set aside a legal budget for any court costs as private industry may decide to take legal actions to discourage the build. And certainly don’t plan on using existing facilities owned by private telecom; they paid a lot of money for their systems and won’t be interested in letting a competitor use it if there is nothing in it for them!

Step 4: Fiber Route Planning & Other Considerations

Every fiber project I have ever worked on starts by playing in the “sandbox”. This can be as simple as using Google Earth to draw your route – in fact this is a great tool for your sandbox drawings. It’s easy to use and simple to share the files...and free to everyone. It’s important to play in the sandbox several times to allow input from key stakeholders and stir up ideas about plans for the future. Once a game plan is set, it’s important to get into the field and do some validation.

Fielding the route is nothing more than validating the route and collecting important information. One consideration when planning a route is to avoid main streets in town (if you can). These streets are heavy with existing utilities and your project will require repairs to the concrete and asphalt you’ll need to damage in the process. Certain situations may also require you to close busy lanes of traffic...something no town or city is too excited about. If you need to connect downtown locations, look one street over to determine if there is a better opportunity there – you can design a lateral down an alley or build the fiber across a building inside EMT conduit to get where you need to be. Every situation is unique so be inventive and open to ideas from others.
Other Considerations:

It’s also important to identify and design some good interconnection points in areas with obvious growth potential. This is more important in underground designs since it’s easier and less costly to simply install a vault or handhole while doing the construction. These “future” connection points should also include some thought as to the amount of fiber strands to plan for in that area.

Another consideration is how the lateral is fed to the building. The route should be planned to go to the location where it is needed – not necessarily where other utilities are entering the building. The building owner or maintenance people are your biggest asset to determining the best way to enter and navigate through a building to the network closet requiring the connectivity.

On that note, always pay attention to the grade of the innerduct/conduit coming to the building. I always prefer entering the building at a higher elevation than the innerduct (not below grade). Placing a vault at the building and going vertical above grade with a way for water to escape is a good plan. Don’t trust sealants alone, it’s never worth the chance of water intrusion. If you don’t plan this right your worst day could be the one that includes water in your MDF!

My final pieces of advice are to submit permits early for locations such as railroad crossings. These permits can sometimes take a good amount of time and this will hold up installation of fiber. Also pay attention to areas of possible wildlife that may be under federal protection; nothing will shut down your project faster than crossing any government agency!

THE HIGH-LEVEL PLAN

Planning fiber construction is a lot like most other projects. Identifying goals and performing some fact-finding is a good start. To do a proper early-stage plan, you’ll need to go out into the field to measure and document any obstacles including bridges, existing utilities, or mountains of solid rock and other natural features. It’s important to collect this information in order to prepare a well-written RFP. As a project manager, this information becomes the basis for most of the answers a contractor will have concerning the build.

At a high level, I plan in this order:

1. Talk with client, learn the strategy and advise them on improvements
2. Write a Scope of Work that encompasses that strategy, obtain a PO and start project planning
3. Plan the route “on paper” and then field the route to collect data and identify project issues
4. “Demarc” assessment, typically for the MDF or another network closet to ensure the locations readiness
5. Data collected from fielding and assessments is used to create maps and compile a bill of material
6. A rough estimate of cost is determined based on current costs experienced in the industry
7. RFP is written using the collected information and bill of material for the build, revised until final draft
8. Contractor is selected, contract signed, kick-off meeting set, and start date affirmed
9. Periodic onsite construction reviews to ensure specs are being followed and work is acceptable
10. Final walk-out of the project, authorization of final invoice payment, and project closed
11. Finally, ensure Digger’s registration, any insurances, and OTDR test results are complete/provided

FINAL THOUGHTS...

There are many more steps involved in a project of this magnitude but I hope I was able to shed some light on how a fiber construction project is formed and executed. It’s important to have an active person involved who can dedicate plenty of time to answer contractor questions quickly and keep them moving. A good Project Manager dedicating time to your fiber project will go a long way in keeping tabs on progress, issues, budget, and other loose ends that may otherwise get lost for someone who already works at their everyday job! Often times the cost of a good Project Manager is partially offset by the savings he/she can identify and avoiding some of the pitfalls that might otherwise be costly.
Typical Fiber Construction Project Workflow

**Requirements Gathering**
- Obtain PO
- Create Scope of Work
- Plan Route
- Route Optimal?
- Cost Sharing?
- Draft OSP & Demarc Routes
- Cost/Budget
- BOMs Per Build
- Project Total Estimate

**Presales**
- Requirements Gathering
- Create Scope of Work
- Scope Good?
- Obtain PO

**Engineering & Costing**
- Demarc Assess.
- Aerial/UG Footage
- Vault, Locate Vault Counts
- Easement/Permit Concerns
- Aerial – Make-Ready Locations
- Splice Needs, Marker Needs
- Project Risk Mitigation

**Project Management**
- Write RFP
- RFP Review Good?
- Issue RFP
- Review/Select Contractor
- Onsite Management
- Weekly Status Call
- Break Ground
- Kick-Off
- Hold Final Invoice
- Final OSP Walkout
- Project Accepted?
- Project Closing

- Verify Digger’s Registration
- Pay Final Invoice
- OSP Insurance
- Maintenance/Emerg. Repair
- Ownership Transfer

- Confirm Insurance/Bonding
- Affirm Kick-Off Meeting
- Affirm Project Start
- Review RACI per Stakeholder
- Setup Weekly Status Calls
- Setup Budget/Invoice Tracking
- Setup Issues Log, Task Management (RACI)