



Santa Cruz County - Cost Estimates and Maps

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Draft

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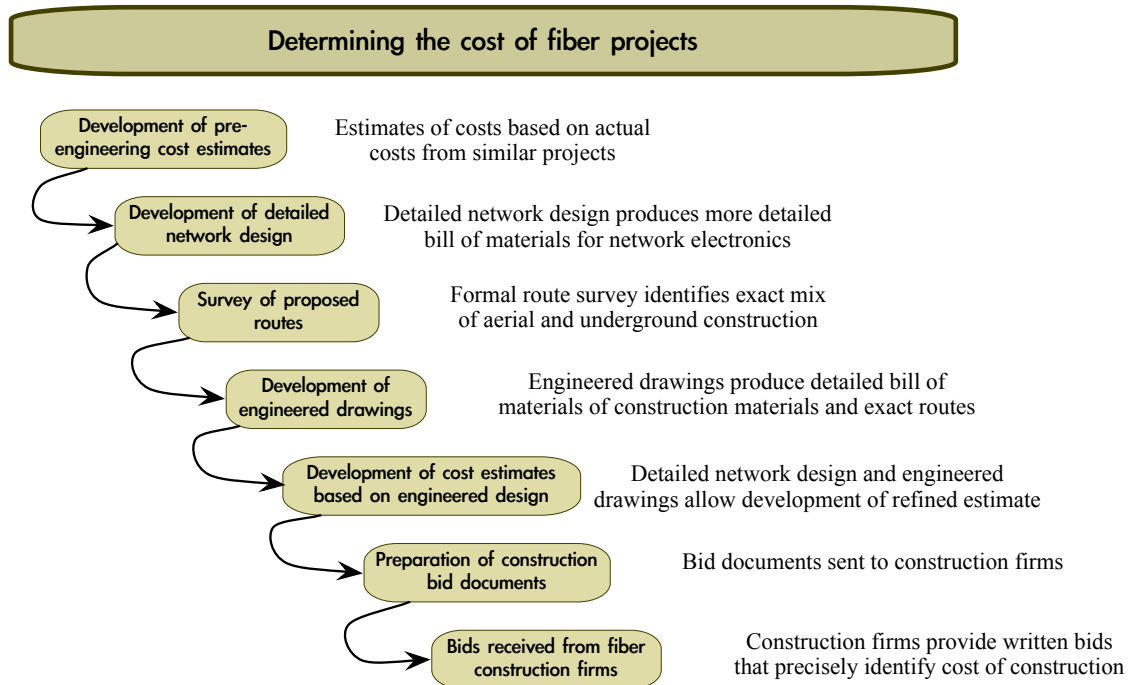
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Cost Estimates

Pre-engineering cost estimates provide an early look at the cost of build out; these estimates do not include formal pole surveys or the significant expense of route engineering. Even after route surveys are performed, and engineered route blueprints are developed, the true cost of construction is not known until the construction bid documents are prepared and bids are received. The diagram below illustrates the process of establishing the exact cost of a fiber project.



It is important to note that the fiber construction costs in this report are estimates for a “phase one” build out in Santa Cruz County. Cost savings for a larger build out and for additional phases could be substantial, especially in the network equipment, outside plant materials (e.g. fiber cable), and construction labor.

When preparing cost estimates, it is good practice to use conservative cost estimates (i.e. higher cost estimates) to ensure that the funds are adequate to complete the project, as there is usually no additional funds if actual construction or materials costs turn out to be higher than the estimates. It is always more desirable to have the actual cost of the project be under the estimated cost rather than over the estimated cost.

The project summary breaks out costs by the five identified phases that would complete a high performance fiber network in Santa Cruz County. This estimate includes two tables for each phase; one table provides a detailed estimate of the fiber construction, including drop construction, throughout that area, and one table shows a detailed description of the shelter/

cabinet and network equipment needed in that area. There is a map which corresponds to each estimate showing the locations of each of the five areas with the proposed fiber routes shown.

The fiber construction cost estimate for installation throughout the Santa Cruz County is based on primarily underground construction. The initial construction cost of this might be higher than aerial installation but it provides a lower cost for operation because there are no pole use fees or cable moving costs when a pole is replaced in the future. The cost of underground construction can actually be lower than aerial installation depending on the amount of make ready needed in a certain area (make ready is the cost of paying other pole tenants to move or modify their attachments to make room for the new attachee).

The detailed cost estimates include a range of costs based on previous purchases and past experience with equipment vendors and contractors. This range depicts the average cost of the service or equipment and the optimism factor picks out the estimated cost from the range. The optimism factor is a number that shows the approximation of which end of the range the actual cost will be, lower or higher. These estimates are based on the routes shown in the maps for each area of Santa Cruz County.

The detailed cost estimates show the hardware and other equipment that usually is purchased by the construction contractor and is part of their overall bid price.

Some construction cost estimates include only the cost of construction labor and materials (e.g. fiber cable, attachment hardware, and splice enclosures). But a different cost estimate may include other necessary and essential costs, like project management, engineering, and network equipment. In other words, two cost estimates with the same aerial/underground and make-ready assumptions could still vary widely if one includes all necessary costs needed to produce a functional, working network and the other estimate includes only the construction costs.

The cost estimate show allowances for contingencies, engineering, project management, network integration, testing, and permitting fees. The cost estimate also include the cost of drops (the access fiber), based on a moderate percentage take rate, from the backbone fiber network to businesses along the backbone network.

It is only correct to compare the costs of two estimates from two different sources if you can reliably determine that the underlying assumptions and costs are the same for both estimates.

In other words, the percentage of aerial construction, the amount of make-ready, inclusion of engineering and equipment costs, and the inclusion of drops all must be the same. Two estimates of construction costs for the same area may appear to be widely divergent, but one estimate may include only direct labor and material costs, all aerial construction, no drops, no network equipment or design and engineering costs, and no make-ready fees.

Note that an estimate like this would be very low but would not be a functional network and no residences or businesses would actually be connected to the fiber. The other estimate may include all the necessary costs needed to actually connect customers, including reasonable

make-ready costs, some underground construction, network electronics, drop fiber cables to businesses or residents, and other costs like network design and engineering.

Estimates for construction materials and network equipment vary largely based on the amount of materials or equipment purchased. Small purchases of network electronics generally receive little or no price discount, but for larger purchases, discounts can be substantial (e.g. a range of 10% to 40% off list). Construction materials purchased in large lots also receive more discounts. Our pre-engineering estimates are conservative, with prices for materials and equipment generally using list prices or prices that we have previously seen from vendors on other similar sized projects. Labor costs are based on prices from other construction projects and knowledge of local conditions. Cost of labor can vary widely based on the time of year, the overall size of the job, the local economy, and the national economy.

Note that all costs are estimates based on current market prices for materials and construction costs are based on typical prices paid in past projects. Actual construction and materials costs may vary.

Both the estimates for fiber construction and wireless installation include a summary table with estimated costs for each area or wireless link, contingencies, engineering, project management, network integration, testing, and permitting fees. From all of these factors the estimated project total is calculated for each summary table.

COST ESTIMATE CATEGORIES

The Cost Estimate Spreadsheets are in the appendices of this document. They are organized into into sections that will allow Santa Cruz County to choose how and when it invests capital and what different options of investment may cost.

The approximate costs of materials and labor are included in the estimates. The values were sampled from actual Design Nine projects, but could vary depending on many factors including weather, labor costs, fair wage requirements, union contracts, or other factors.

The initial summary page is for a full investment and committing to build the entire network up front. There are some economies of scale to be gained when investing on a very large construction project. However, as the full capital amount may not be available, the estimates also include summary and detail pages for individual or targeted investment. If the Santa Cruz County Fiber Initiative chooses to only build or commit to build some of the individual segments the economies of a large scape project will not be realized and the sum of the smaller projects could well be higher than a full committed up front buildout. This is due to various efficiencies such as project management, permitting, and engineering.

The “Project Total” estimates in this report include estimates of the costs in the categories described below. All of these activities and efforts are generally required to produce a working network, including network hardware and (1 year) maintenance and support. As noted in the previously, some firms may provide cost estimates that only include two categories: Outside Plant Construction Materials and Outside Plant Construction Labor. Also noted previously

noted, even two estimates of just direct construction costs (materials and labor) may vary widely if one estimate includes drops and one estimate does not (these estimates include a reasonable number of drops to businesses along the segment routes).

NETWORK CONSTRUCTION (ITEM/PROJECT)

The Project Summary table shows the estimated costs for each phase or segment of the proposed network. It includes not only the direct construction costs for burying conduit and cable and/or hanging aerial fiber on utility poles, but also includes the estimated costs for shelter/cabinet and network equipment for each route or portion of the network.

A reasonable number of drops (connections) are included in these estimates and will be performed during the network construction. While the initial number of drops is relatively small, the network will have the capability of serving many additional drops. Future drops will involve construction costs to be born by the network, the Service Providers, or the individual customers.

PROJECT MANAGEMENT, NETWORK INTEGRATION AND TESTING

Project management for a telecom build requires thorough and detailed planning, experience in procuring construction materials for a telecom project, and the ability to oversee and convey project information to contractors through the duration of the project, including construction inspection work (ensuring construction contractors have done their job properly).

Some configuring and testing will take place after the network is built and before it is ready for use. In a dark network this involves labeling and documenting the routes of individual fiber strands, and testing of any other features of the network such as generators, air conditioners, and locks. In an active network the testing and integration includes integration requirements for a dark fiber network plus the configuring and installation of switches, routers, and other network equipment. Work in this category requires a skilled professionals who are familiar with the network architecture and the business model (e.g. open access).

ENGINEERING, CONSTRUCTION INSPECTION, AND PERMITTING

This work include a full design of the outside plant network, cabinet and shelter specifications, and extensive detail (blueprints) that specifies how all fiber cable, wireless towers, and network equipment is to be installed. These documents have to be completed prior to bidding out any construction work, and are usually included as part of a construction bid package. The detail includes fiber optic cable route determination and size determination, active and passive network equipment selection and placement planning, splicing layouts and documentation, network configuration planning, and all engineering necessary to complete construction.

Some costs will be incurred based on the permitting requirements of the project. If shelters/cabinets are able to be placed on some properties at no charge, the cost of leases will be lower. If cabinets or shelters have to be placed on private property, the cost of the land or long term leases will increase. Some property owners prefer to receive ten or twenty years of lease payments up front, which can make this cost unpredictable. The cost of permits needed for

crossing wetlands, streams, other sensitive areas, and Department of Transportation (DOT) permits are also included in this category. Formal leases and negotiated lease payments are more desirable than providing some form of free access to services.

FTTH MAPPING AND ASSET MANAGEMENT

The record keeping related to mapping and managing fiber cable can be substantial. Once the network is built, careful records have to be maintained of where the fiber is located (e.g. in public right of way, on what poles and who owns the poles), what fiber strands are in use and by whom, and in particular, fiber strand splicing records. The engineer typically delivers an electronic “As-Built” document which includes detailed records of the network as it was constructed. To this material is added the testing results provided by the network contractors or splice contractors. Going forward, accurate splice data can generate hundreds or thousands of individual splice records that have to be maintained, updated, and tracked. A fiber and network asset management system can help control costs and preserve assets both during construction and after network operations begin. There are many commercial options for Fiber to the Premise (FTTP) Mapping and Asset Management software which can maintain records for operating the network which include both an upfront capital cost as well as cloud based OPEX type systems.

BUSINESS, SERVICE PROVIDER AND OPERATIONS DEVELOPMENT

It is important to understand that the project management and building the network can not be completed without building the business that is the network. These tasks include Business and Financial Planning and Service Provider Development and are detailed in the Santa Cruz Rapid Assessment.

MISCELLANEOUS FEES AND TECHNICAL SERVICES

Many projects routinely incur a variety of mostly small amounts for fees and services. Typical items might include railroad crossing fees, lease and title fees, notary fees, legal fees for lease agreements or other legal matters, fees for archeological studies, etc.

BOOKKEEPING AND ADMINISTRATION

Network projects create substantial amounts of paperwork, invoices, and related bookkeeping requirements. Grant-funded projects typically incur additional state level and/or Federal reporting and bookkeeping.

CONTINGENCIES

The Contingency category is included and calculated as a percentage of the construction subtotal estimated cost (e.g. 10% of subtotal cost) to provide flexibility in managing the overall budget. Equipment costs can and do change between the time an estimate is made and construction commences. Labor costs can vary depending upon the time of year the work starts, the state of the local economy, and the state of the national economy.

NETWORK SEGMENTS (MAPS)

A series of 6 maps have been included in a separate document that includes the full detail of the cost estimates. The maps are as follows:

- ▶ Map 1- Basemap - shows the entire County and the five focus areas
- ▶ Map 2 - Davenport - detailed
- ▶ Map 3 - Live Oak - detailed
- ▶ Map 4 - Upper 41st Avenue Focus Area - detailed
- ▶ Map 5 - Medical Center Focus Area - detailed
- ▶ Map 6 - Aptos Focus Area - detailed

ESTIMATES (BASE NETWORK + LATERALS AND PER SEGMENT)

The estimates are attached as an appendix to this document. The estimates are broken up into sections. Each section has a short description in the notes adjacent to the summary tables. The network and segments are described below. The segments reflect the County's focus areas for economic development.

DAVENPORT

This segment (Map 2) will initiate in the center of the County, near the City of Santa Cruz and will include a small FTTP build in and around Davenport, including the old cement factory. This segment includes 17 miles of new fiber and only connects 12 buildings (out of a total of 593 passed). This limited number is due to the nature of this build as mostly a "middle mile" segment to connect the cement factory. Due to the designation of US 1 as a Scenic Highway, any new utility line construction (including fiber optics) may be required to be placed underground. This will add costs to this build. However, as the Regional Transportation Commission has ownership of the old rail line, most of the construction for this would take place using vibratory plowing along the old rail line.

It was noted by Design Nine in early December that there are at least two fiber providers with fiber optic lines to Davenport (assuming AT&T and NextG). If the County requires high speed broadband to encourage development of the cement factory, it should examine the cost of leasing capacity from NextG and/or AT&T and compare it to the cost of this build.

URBAN CORE BACKBONE

This segment wasn't a focus area requested by the County to be examined by Design Nine. However, based upon the three areas in the center of the County (Live Oak, the Medical Area, and Upper 41st Avenue) in close proximity, this small build would enable all three of those areas to be developed without their own link back to a central location (Cabrillo College). This segment only consists of 5 miles of fiber and would pass 553 premises and connect 28 (a higher percentage than the Davenport backbone due to its many potential businesses as network users. This can also be tied into the Sunesys middle mile fiber.

LIVE OAK

This segment covers the dense residential area of Live Oak. There are approximately 2500 premises passed by the 17 miles of fiber optic laterals in this neighborhood. This would be the best area for Santa Cruz to use as a FTTH pilot area due to the density.

MEDICAL FOCUS AREA

This segment only has 4 miles of new fiber and would connect approximately 23 buildings. Out of the five focus areas examined by Design Nine, this area would probably bring the most benefit to a needed market segment, namely medical offices. Due to this area's lack of symmetrical high speed broadband, it was reported during the early meetings with stakeholders, that only DSL is available to the medical offices in this area which was not adequate for transmitting the large files (images, radiographs, etc.) between offices or between the offices and the hospital. Like the Urban Core segment, this can also be connected to the Sunesys middle mile fiber.

UPPER 41ST AVENUE

This is the smallest and lowest cost focus area to build a pilot network. The build would only be one mile of new fiber and would pass 218 premises and connect 11. If this area is being considered for a redevelopment effort, deploying a fiber optic network would be a cost effective method of lowering the cost of operating a business in the redeveloped area. Additionally, if high speed symmetric service were available, it may be attractive to knowledge economy businesses and professionals. The Sunesys middle mile fiber also enhances the value of this investment.

APTOS FOCUS AREA

Towards the eastern (or southern) half of the County, the Aptos area would require a backbone link back to the center of the County. This segment includes 6.5 miles of fiber and would pass 632 premises and connect 16. The link back to the center of the County could use the Regional Transportation Commission owned rail for underground construction. It was also noted that there is limited areal opportunities in this area and that there are many underground utilities and obstacles. This area can also benefit from the Sunesys fiber, although the Sunesys route does not pass directly through the Village.

PROJECT SUMMARY - SANTA CRUZ COUNTY FIBER NETWORK FULL BUILDOUT

This "whole network" estimate includes all segments for a total of 43 miles of new fiber construction and connects 193 buildings (out of a total of 4,176 passed). This initial fiber network would be considered the core for a larger buildout for the entire County.

APPENDIX - DETAILED COST ESTIMATES
