Background

Governor Gavin Newsom signed historic broadband legislation in July 2021 to help bridge the digital divide and provide reliable and affordable internet access to all Californians. SB 156 (Chapter 112, Statutes of 2021) expands the state's broadband fiber infrastructure and increases internet connectivity for families and businesses. This essential backbone infrastructure is a foundational step towards the entire state having broadband access. This effort is supported by Executive Order (EO) 8.14.20 EO N 73 20 and Senate Bill (SB) SB-156 Communications: broadband.

Broadband Middle Mile Network (BMMN) is an open access, state-owned high-capacity fiber lines that carry large amounts of data at higher speeds over longer distances between local networks. It will connect to a last-mile broadband infrastructure that will connect homes and businesses with local networks.

The lack of available middle-mile broadband infrastructure has been a major issue in connecting California's unserved and underserved communities. The statewide open-access middle-mile network included in SB 156 will be a foundational investment to ensure every Californian has access to broadband Internet service that meets the connectivity needs of today, and well into the future. Last-mile infrastructure relies on middle-mile to provide service to residents, large and small-businesses, schools, government offices, public safety agencies, and libraries. An open-access middle-mile network can provide the backbone for last-mile providers to serve residences and reduce costs of providing service for businesses and anchor institutions.

California Department of Technology (CDT) and the Office of Broadband and Digital Literacy will oversee the acquisition and management of contracts for the development, construction, maintenance and operation of the network, retain a third-party administrator to construct and establish the network, and create a nine-member Middle-Mile Advisory Committee.

An experienced nonprofit entity will serve as the third-party administrator to manage the development, acquisition, construction, maintenance and operation of the statewide open-access middle-mile broadband network.

Caltrans will work with the third-party administrator to manage construction of the middle-mile infrastructure along state highways and rights of way.

GENERAL PROJECT DESCRIPTION

This project would include the installation of a statewide middle-mile network along approximately 10,000 miles of the State Highway System (SHS).

1. Install four (4) two-inch high-density polyethylene (HDPE) conduits, a minimum of 42 inches clearance underground.
    - Conduit installation methods: (see Electrical Systems Details plan sheet ED-1):
        a. plowing (4 inches wide) – Detail B.
        b. trenching (6-12 inches wide) – Detail C.

c. Horizontal Directional Drilling (HDD) boring (8 inches in diameter and minimum depth of 4 feet and maximum depth of 6 feet unless otherwise authorized) – Typical horizontal directional drilling detail

d. Jack and Drill-(8 inches in diameter and minimum depth of 4 feet and maximum depth of 6 feet unless otherwise authorized)- Typical Jack and Drill detail

e. trenching in-pavement (3-6 inches wide and minimum depth of 24 inches) – Detail A.

Caltrans chooses the location of conduit placement from row line to row line (along right-of-way fence, next to roadway prism, in- pavement or in between), with avoidance of sensitive environmental resources and existing utilities as the first priority.

- Longitudinal installations are prohibited in the highway median.

2. Install vaults (30"x48"x36") approximately every 2,500 feet (maximum spacing). Every 5th vault will be larger for splicing (48"x48"x48"). Vaults will be flush with the ground or buried. (note: if Caltrans secures it's own fiber then separate Caltrans pullboxes will be installed adjacent to vaults with spacing approximately every 1 mile)

    - Place vaults to avoid sensitive environmental resources and existing utilities, if possible.
    - If a vault must be accessed from the mainline on "access-control" non-Interstate routes, then the vault must be installed no more than 10 feet from the right-of-way line.
    - If a vault can only be accessed from the mainline and ramps on non- Interstate routes, then a maintenance vehicle pullout (see C-2) must be installed, unless maintenance can be performed using existing pullouts or existing maintenance access. Buried boxes do not require a maintenance vehicle pullout. (see ED-2)
    - If longitudinal installations are installed on a bridge, splice vaults are recommended to facilitate future bridge work. Splice vaults are allowed at both ends of the bridge and as maintenance access points (MAPs), the locations for these vaults should follow the criteria outlined above.

3. Cable marker posts (see ED-4) would be located at approximately 1 mile intervals to alert people of the presence of the fiber optic cable. The posts are typically x-inch-diameter round PVC posts with orange caps X feet aboveground. The caps are imprinted with embossed lettering that indicates the presence of fiber optic cable.
4. Aerial Installation on existing poles – fiber is vulnerable to fire, theft, vandalism, animal damage and exposure to weather. This is the least desired installation method
5. Aerial Installation on new poles

6. **Network Hub (Repeater Hut/Exchange Hub (see sheet ED-14)- approximately 190-200 statewide: These provide retransmission and reamplify the signals**

- Hubs exterior dimension are 12'x16'x10': fenced area approximately 29' X 32'
- Hubs are placed on concrete pad

- Hubs are located at a maximum of 50 miles apart; place to avoid sensitive environmental resources (siting guidance being written)
- Hubs can be located less than 50 miles apart if they are appropriately located
- Hubs to be furnished by CDT – pad to be constructed by Caltrans based on Hub requirements (Note: Turnkey package (racks, table ladders) supplied by CDT and installed by contractor.)
- Need to locate in proximity to power hook-up. Backup power to be supplied by- generator (propane or diesel) or solar…generators will require fuel storage; may require additional potential impacts to environmental resources
- Access road

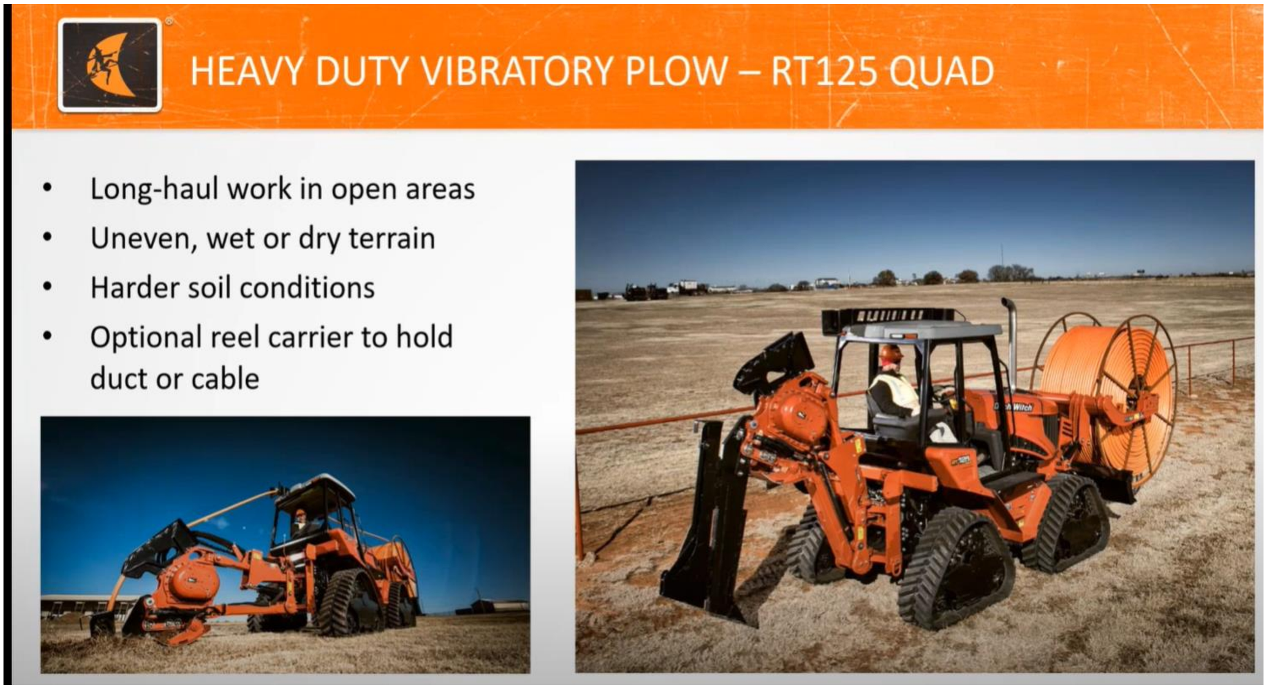
TRENCHING DETAILS FOR CONDUIT INSTALLATION

The following is a general discussion of the types of construction methods that would be used to install the broadband conduit. All of these methods would be used at various locations to accommodate constraints, including considerations for sensitive resources. Please see Attachment – Standard Plan Details and Standard Specifications Sections. The Standard Plans can be modified for specific locations.

1. **Plowing (4-inch-wide trench) – Detail B on Sheet ED-1**

Plowed installation uses a tracked vehicle with a cable reel in front and a plow blade in back. As the vehicle moves, it simultaneously furrows the soil and installs the conduit or cable. In some instances, the soil may be pre ripped by a tractor in front of the plow. Pre-rip the ground surface to a depth 8 inches greater than minimum conduit depth, in the direction conduit is to be installed. Ripping is a technique in which a slit is made in the surface of the soil to loosen it. The amount of surface disturbed by plowing is typically less than with the trenching method. The construction corridor is usually 20 feet wide. In sensitive areas, the construction corridor can occasionally be restricted to less than 20 feet, **Figure 1:**

Heavy Duty Vibratory Plow



1. **Trenching (6- to 12-inch wide trench) – Detail C on Sheet ED-1**

Trenched installations typically involve a rubber-tired backhoe or an excavator digging a trench approximately 6-12 inches wide by 46-50 inches deep (need 42-inch clearance from top of conduit). Typically, no more than 1,000 feet of trench would be exposed by a crew at any time during construction, and trenches would be filled at the end of each day. If conditions do not allow for small, isolated areas, such as handholes or assist points, to be backfilled at the end of each day, appropriate safety, erosion, and wildlife control features would be installed. Access vaults or handholes would be installed approximately every 2,500 feet (max distance between vaults, however can be installed closer together, if needed). Vault locations can be adjusted to avoid sensitive resources. The construction corridors would typically be confined to within the existing rights-of-way and approximately 20 feet wide In some cases, the conduit and cable may be installed in the roadbed to avoid sensitive resources in the road shoulder or right-of-way margin (see in-pavement trenching below).

2. **Horizontal Directional Drilling (8-inch diameter and minimum depth of 4 feet and maximum depth of 6 feet unless otherwise authorized)- Typical horizontal directional drilling detail on Sheet ED-1**

Directional boring would be used in various locations along the project routes to cross areas where surface disturbance or sensitive resources must be avoided (e.g., cultural resources, crossing railroads, highways, rivers/streams). For streams/rivers, boring would only occur if the conduit could not be attached to a structure. Directional bore lengths can range from less than 100 feet to more than 10,000 feet, depending on the type of equipment used. To complete the bore, a work area is established on each side of the crossing. For river, stream, and wetland crossings, the work areas would be located at least 100 feet from the bank or edge of the wetland resource. One work area contains the “entry point/pilot hole” and drilling equipment. The other work area contains the “exit point/receiving hole”. From the exit point, a reamer is attached along with the conduits. The drilling machine will ream a larger hole (8 inches) from the exit point while pulling the conduits at the same time back towards the entry point. Once the reamer and all the conduits are pulled back through the initial entrance pit, conduit placement is complete. For relatively short bores, smaller drilling equipment is used, and the two work areas would measure approximately 100 by 50 feet Larger equipment, and a correspondingly larger work area (approximately 150 by 100 feet), is needed for longer bores. Drilling equipment most suitable for site-specific conditions would be used for each bore. Silt fences, straw bales, and other erosion control measures would be installed around these work areas, consistent with the Stormwater Pollution Prevention Plans (SWPPPs).

During the boring process, a bentonite slurry is typically pumped through the bore hole to help lubricate the drill bit, prevent the bore tunnel from collapsing, and carry drill cuttings to the surface. Bentonite is a naturally occurring Wyoming clay known for its hydrophilic characteristics. The slurry is pumped through the bore hole, collected at the surface, passed through machinery to remove the bore cuttings, and then recirculated through the hole. The slurry is stored in tanks at the drill site when not in use. Any excess slurry remaining after the bore is complete would be removed from the site and either reused by the drilling contractor or discarded at an appropriate location.

The soil conditions at the drilling site are identified. The conditions help determine what type of additives are needed. For example, in non-reactive clay, a mixture of bentonite will likely be needed, which helps produce needed cutting carrying capacity to flush the bore hole, and a lubricant to keep soil from sticking and bit balling to your tooling. If working in reactive clay, sand or cobble, a polymer additive may be needed. Polyanionic cellulose (PAC) polymers are typically added to a bentonite mixture to help provide secondary filtration control (sands and cobbles). PAC is a water-soluble polymer derived from cellulose. In formations with high concentrations of reactive clays, partially hydrolyzed polyacrylamide (PHPA) polymers are used in place of bentonite. PHPA is used as a functional additive in water-based drilling fluids. PHPA influences cuttings and wellbore stability and enhances solids removal by flocculation.

Figure 2: Directional Drill

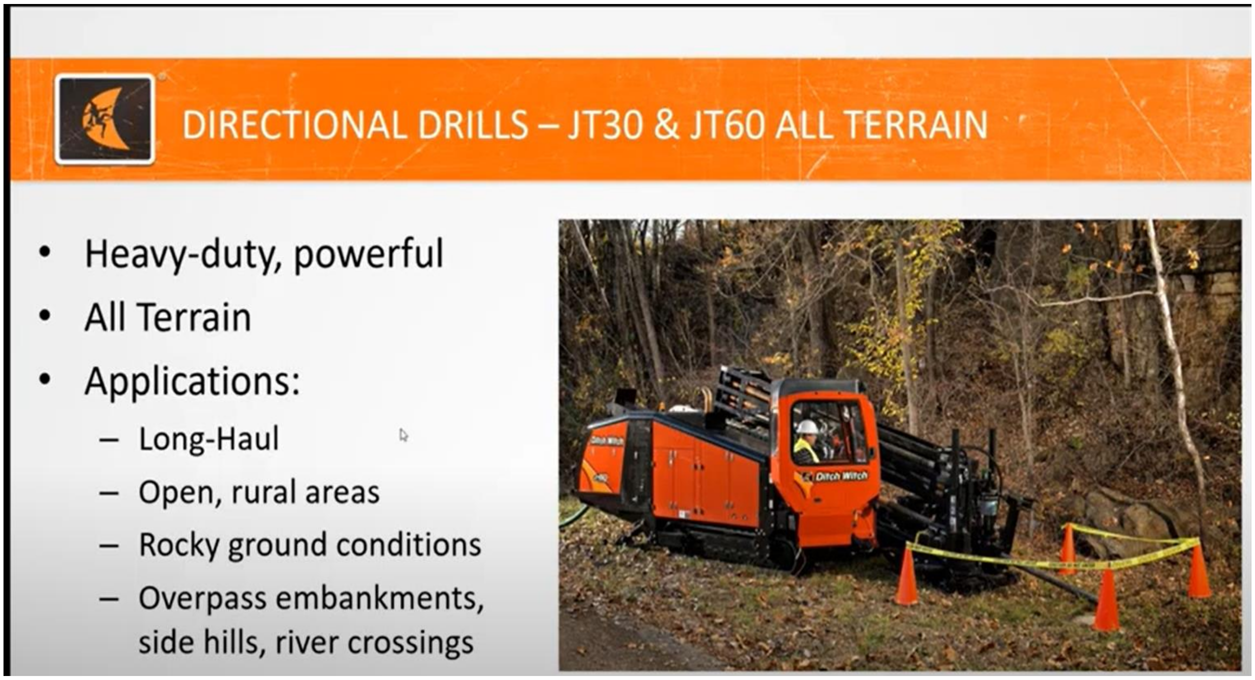


Figure 3: Vacuum with 800 gallon capacity tank to collect excess soil material

3. **Jack and Drill (8-inch diameter and minimum depth of 4 feet and maximum depth of 6 feet unless otherwise authorized)- Typical Jack and Drill detail on Sheet ED-1**

Jack and Drill is an established method when installing steel pipes or casing under roads or railways. As with horizontal directional drilling, auger boring is a useful option when trying to cause minimal disruption to traffic.

The jack and drill method has always been one of the most economical and reliable ways to bore under objects such as established highways and railroads. The Jack and Drill makes this task much simpler, while reducing labor costs and increasing productivity. Generally, jack and drill or auger boring is accomplished with an auger boring machine by jacking a casing pipe through the earth while at the same time removing earth spoil from the casing by means of rotating auger inside the casing.

Jack and Drill is **a trenchless method of construction**. It is suitable for installing short pipe runs in stable and dry soils without large boulders. Crews dig a sending pit and a receiving pit.

4. **In-pavement Trenching (3-6 inches wide trench and minimum depth of 24 inches; slurry backfill) – Detail A**

Trenching in pavement (Micro-trenching) is a construction method that can allow quick and economical installation of broadband conduits under the pavement structure. Broadband conduits should typically be installed in the ground outside of pavement structures as micro trenching through pavement pose the risk of interfering with pavement performance and future pavement rehabilitation activities. However, site specific constraints may preclude the placement of broadband conduits away from pavements. For example, in an urban environment where the edge of pavement is next to a sound wall. The equipment includes a specially designed saw blade (for cutting into the asphalt) which is connected to a vacuum truck/trailer, which removes any spoils, dust, or dirt creating a neat and tidy construction site. The construction corridor width is approximately 20 ft. The depth is shallower at (24-26 inches) and the width is 3-6 inches. Trenches in concrete pavements are not permitted at this time due to their high susceptibility for failure when continuity of concrete slabs is interfered with through trenching. It is cost effective and less disruptive to the public when compared to traditional trenching. Extensive environmental review is not typically required.

Trenching in pavement is permitted in asphalt pavement shoulders only when all the following conditions apply:

- Off-pavement solutions are not feasible due to site specific restrictions,

- Shoulders are not used as part time lane,
- Shoulder/lane widening is not anticipated soon,
- Shoulders do not contain high-risk utility lines.

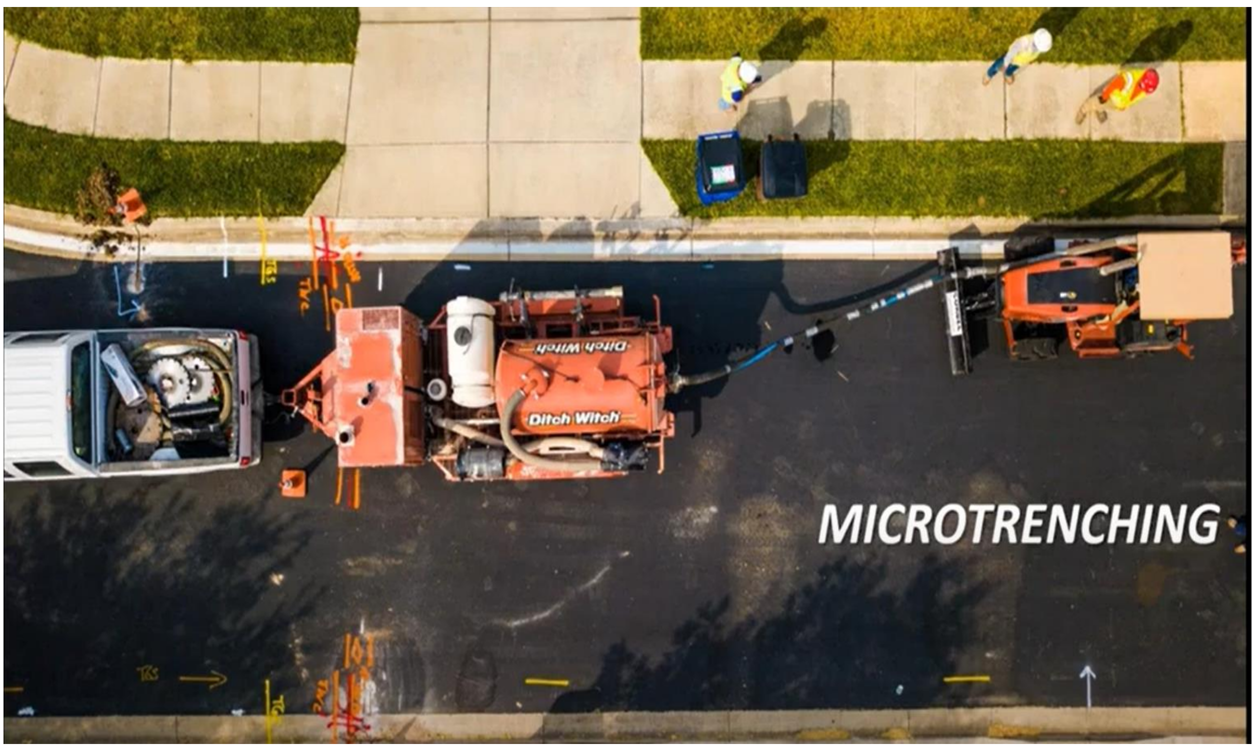


Figure 4: Trench in pavement (Microtrenching)

STRUCTURE (BRIDGE) AND CULVERT DETAILS

<u>ACCEPTABLE BRIDGE MOUNTED BROADBAND LOCATIONS</u>

1.Bridge mounted fiber optic conduits (see Sheets SES-1 thru 5). The sheets show acceptable locations for mounting broadband utilities on bridges or bridge length culverts.

2. Install 4-2" conduits

The table provided below will assist in assessing the risk of installation method:

Location/Installation Method:	**Comments:**
Underground/off bridge	No/low risk, fully protected from damage/vandalism
Utilizing existing bridge utility openings inside box girder bridges between girders, or existing utility openings in sidewalk(s) or in bridge rail(s) (District personnel are responsible for reviewing all as-built plans from BIRIS to determine the availability of any utility openings in bridges)	Minimal risk as conduit is usually surrounded by concrete and not accessible to vandalism, however bridge rail location is susceptible to vehicular impact and conduit may be damaged or may need to be relocated for bridge rail upgrade or bridge widening projects
Attached to exterior surface of concrete bridge rail, or soffit of bridge deck overhang	Moderate/high risk as conduit will be accessible to vandalism, may be damaged by vehicular impact, or may need to be relocated for future bridge rail upgrade or bridge widening projects

No attachments will be allowed to bridge rails classified as poor/substandard. The list of bridges with rails classified as poor/substandard can be requested from the Asset Management groups in each District.

Attachments to slab bridges or bridge length culverts will be permitted on the waterway downstream side of the structure only and may be attached to the edge of slab deck or concrete culvert headwall.

All broadband utility installations on bridges shall be designed to accommodate thermal and/or seismic movements at bridge joints located at abutments, bents and hinges.

All broadband mounting installations on bridges shall conform to the Caltrans Standard Specifications. Concrete anchors shall conform to the requirements of Section 75-3. Additionally, for concrete anchors, reinforcement must be located by nondestructive means before installing holes for anchors. Rotary drills are to be used, no impact drills or coring. If reinforcement is encountered, the anchor hole shall be abandoned, patched, and a new hole installed. Anchors must be on Caltrans' Authorized Materials List for Concrete Anchorage Devices (https://dot.ca.gov/programs/engineering-services/authorized-materials-lists) and installed per recommendations by manufacturer.

In some cases, the conduit may need to be painted or covered with an approved coating that must match the color of the structure.

CULVERTS

Install conduit under or over culvert or other obstructions (see details Sheet ED-2) or attach conduit to downstream headwall

The depth of fiber optic conduit path in unpaved areas must be a minimum of 42 inches to the top of conduit. In addition to the minimum conduit cover, the following requirements for fiber optic conduit path apply for:

- Culverts – conduits must be a minimum 12 inches above or below the culvert.
- Lined channels – conduits must be 12 inches below the channel.
- Unlined channels or ditches – conduits must be 24 inches below the channel or ditch

DETAILS FOR VAULTS/OTHER PROJECT FEATURES

flexibility for placement to avoid wetlands/waters US/cultural and tribal resources.

VAULTS (see sheets ED-6-10)

- Maximum spacing is 2500' between vaults
- Vaults will be flush with the ground or buried
- Vaults cannot be placed in the pavement/roadway

<u>Closer spacing of vaults is expected at the following locations</u>:

- To avoid sensitive environmental areas or utilities
- if 360 degrees of conduit bends is exceeded between vaults
- sharp change in conduit alignment
- before or after bridge attachment
- before or after wall attachment
- before or after a long length of boring
- branching in the network

When installing vaults, every 5th vault will be a splice vault. A splice vault performs all of the functions of a pull vault but also allows for the splicing of the of the fiber optic cable segments based on the maximum spool length and serves as a demarcation point for broadband middle mile network trunk cable. A demarcation point is the physical point at which the last mile broadband provider connects to the statewide broadband middle mile network. As an example, a splice vault accepts a large cable 288 stands, 432 stands or 864 stands where the network cable segments are spliced and allows for fiber optic cable splices for delivery to last mile broadband network provider. Splice vaults also allow for

Caltrans to access the broadband middle mile middle mile network for connecting to Traffic Management System (TMS) elements.

Pull vaults must be placed at the end of structures to allow for conduit transitions and to allow for easier installation of the fiber because of the number of conduit bends required at a structure.

Pull vaults, commonly referred to as “hand holds” perform several important functions:

- Facilitate pulling cables for long distances.
- Provide drainage for the conduit system so that freezing water does not damage the conduit or cables.
- Provide a location for bending the conduit run without damaging the cables.
- Provide a junction for conduits coming from different directions.
- Provide access to the system for maintenance.
- In some situations, provides a location where a splice is made to allow local access to the fiber backbone.

Geotechnical Borings

Subsurface exploration boring may be required along the 10,000-mile installation in areas where trenchless technology (HDD or Jack and Drill) is used to determine the suitability of the construction, i.e. jacking and receiving pits, and ground movement at surface. These borings may be extended to about 5- to 10-foot below the bottom of the pits typically. Boring may also be required to determine the suitability of the subsurface conditions for the Repeater Hub foundations and would include sampling and testing. Where a majority of the 10,000-mile installation appears to be less than 5-foot construction using cut-and-cover method (trenching, plowing, trench in pavement), it’s anticipated that subsurface exploration boring may not be necessary unless there is substantial rock.

OTHER FOOTPRINT CONSIDERATIONS

The following describes staging and storage areas, access roads or other access needs.

- Conduit, vaults, and fiber will be delivered to the construction site, stored and staged.
- The bulk of the construction materials will be stored in warehouses throughout the state and then delivered to the contractor.
- Staging areas for construction equipment, materials, fuels, lubricants, and solvents will be established along the project routes during construction to allow more efficient use and

distribution of materials and equipment. Staging areas are typically locations where materials or equipment are stored for more than two days. Temporary parking areas may also be established to park vehicles and equipment during the workday or overnight. No new staging areas would be established in undisturbed areas. All staging areas will be located on private lands in existing contractor yards; existing commercial areas used for storing and maintaining equipment; previously cleared, graded, or paved areas; or level areas where grading and vegetation clearing are not required. Staging and parking areas are typically selected by the construction contractor, as needed, before and/or during construction. This practice is consistent with construction methods used throughout California and the United States. To ensure that sensitive environmental resources are avoided or adequately protected, the locations of all staging and parking areas would be determined in consultation with qualified biologists and archaeologists. Because fuels, lubricants, and solvents would be stored in staging areas, all staging areas would be located at least 150 feet from sensitive stream/drainages.

- Access to projects will be by existing access roads. Access roads will be needed to access the Repeater Huts. New access roads may be necessary to access vaults, but these will be avoided if possible. If a need for new access roads is determined, then the areas for these roads will require environmental compliance to be completed.

TYPICAL TIMING/SEQUENCING AT EACH LOCATION

Typical sequence and duration of activities and details and methods in the standard plans and standard specifications.

Standard Specifications: NSSP 87-19 FIBER OPTIC CABLE SYSTEMS (what other sections 86, 87? Section 9 Vegetation removal

Standard Plans curb gutter sidewalk, striping, drainage,

MMBN Standard Details Sheets 1-47- which includes trenching and other installation methods, bridge attachment, obstructions, culvert

Duration of Activities

Installation is typically linear parallel to the state highway and is continually moving. Duration: plowing is the fastest and can install up to a few miles per day of conduit; Boring is at a medium rate (unless challenging soils encountered) and can install 2 to 3 runs of 500-700 feet each; Trenching is the slowest and has the largest disturbed footprint; trench-in-pavement (slower than plowing but quicker than boring) least footprint as it is within the road prism

Typical Sequence

a. Trench/bore/ or place on structure

b. Install vaults

c. Install conduit

d. Backfill – at the end of each day of trenching

e. Pull fiber

f. Splice fiber

FUTURE MAINTENANCE NEEDS

California Department of Technology (CDT) is the owner/operator and will be maintaining the middle mile. This will be done through the encroachment permit process. The encroachment permit issued by Caltrans will include the requirements for future permits, mitigation, etc. The permittee will be responsible for this prior to initiating construction.

AVOIDANCE OF SENSITIVE RESOURCES

Caltrans Environmental staff will work to design the project routes around sensitive resources and to site repeater stations, directional drilling points, vaults, and other project features in areas that do not support sensitive resources.

Sensitive resources (i.e., biological resources, cultural resources, waters, etc.) can be avoided through various means identified during the project design phase. However, there would also be avoidance measures occurring in the field during construction as a result of preconstruction surveys by qualified environmental staff. As required, the construction technique would be coordinated through a resource specialist (i.e., wildlife biologist, wetland ecologist, botanist, archaeologist, cultural resource specialist, tribes, water quality) familiar with the resource issue being avoided. Typical avoidance measures include minor modification of the project routes around the sensitive resource within the disturbed right-of-way, boring under the resource, or attaching the fiber optic cable to an existing bridge (in consideration of the historic status of the bridge). The locations of all sensitive resources and the methods to avoid them would be shown on the construction drawings. All sensitive resources would be staked and flagged in the field and marked on the construction drawings. Monitoring of these areas by biologists, archaeologists, and tribal members may be necessary and required.