# Middle-Mile Broadband Network

## Background

In July 2021, Governor Gavin Newsom signed into law Senate Bill (SB)156 (SB-156 Communications: broadband) to create an open-access middle-mile network and bring equitable high-speed broadband service to all Californians (Middle-Mile Broadband Initiative). This effort is supported by Executive Order (EO) N-73-20 (EO N-73-20) which, among other things, directs all California state agencies to pursue a minimum broadband speed goal to guide infrastructure investments and program implementation.

## Purpose

The Middle-Mile Broadband Network Project will install broadband infrastructure along the State Highway System and Interstate System necessary to connect to a third-party operated Last Mile Broadband Network which will bring internet connectivity to homes, businesses, and community institutions.

## Need

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 is 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. This project intends to support these communities in providing critical statewide broadband infrastructure to enhance access to and increase the affordability of high-speed internet for all Californians.

## Project Description

The California Department of Transportation (Caltrans) proposes in install Middle-Mile Broadband Network (MMBN) infrastructure along approximately 3,000 miles of State Highway System in Districts 1, 2, and 3. Work would consist of the following elements, the majority of which are outlined on the attached MMBN statewide plan set.

### 1. Conduit Installation (Underground)

Four (4) two-inch diameter high-density polyethylene (HDPE) conduits would be installed underground (Figure 10). Conduit installation would occur with the Caltrans right of way (R/W) (e.g., along R/W fence, next to roadway prism, in pavement, etc.). Installation methods would be selected to avoid sensitive environmental resources and existing utilities as the first priority. Methods of conduit installation are outlined below (see MMBND-1).

a. Trench in Travel Lane – approximately 3 to 6 inches wide and minimum depth of 24 inches (Detail A).
b. Trench in Shoulder – approximately 3 to 6 inches wide and minimum depth of 24 inches (Detail B).
c. Plowing – approximately 3 to 6 inches wide and minimum depth of 42 inches (Detail C).
d. Trenching – approximately 6 to 12 inches wide and minimum depth of 42 inches (Detail D).
e. Jack and Drill – approximately 8 inches diameter and minimum depth of 42 inches (Detail E).
f. Horizontal Directional Drilling – approximately 8 inches in diameter and minimum depth of 42 inches (Detail F).

<u>Trench in Pavement (Travel Lane and Shoulder)</u>

Trenching in pavement (micro-trenching) is a construction method for installation of broadband conduits under asphalt pavement (Figure 1). Equipment would consist of a specially designed saw blade for cutting into the asphalt connected to a vacuum truck/trailer, which removes spoils and dust. Once trenching is complete, cold planning and paving would be required on an approximately 2-foot-wide area surrounding the trench.

**Figure 1. Micro-trenching**

<u>Plowing</u>

Plowed conduit installations use a tracked vehicle with a reel carrier in front and a plow blade in back (Figure 2). As the vehicle moves, it simultaneously furrows the soil and installs the conduit and cable. In some instances, the soil may be pre-ripped by a dozer equipped with a ripper blade.

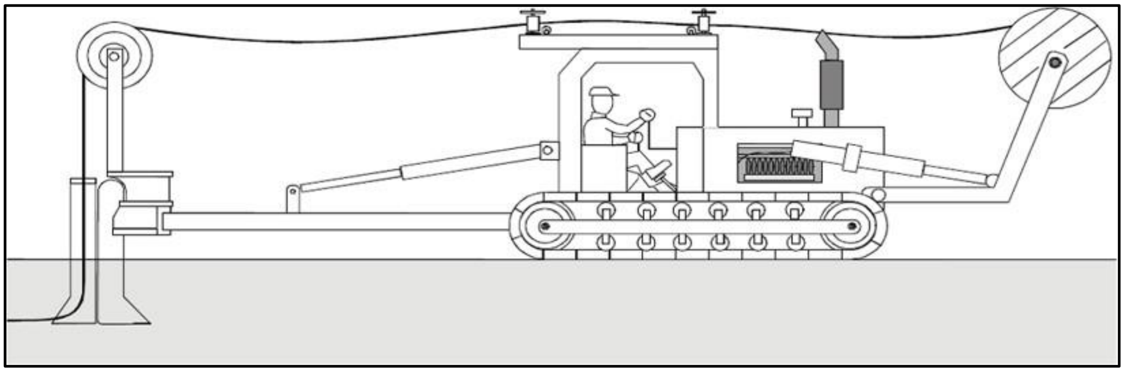

**Figure 2. Plowing**

Trenching

Trenched installations use equipment such as a trencher, excavator or backhoe to dig a trench (Figures 3 and 9). Typically, no more than 1,000 feet of trench would be exposed at any time during construction, and trenches would be filled at the end of each day.

**Figure 3. Open Trenching**

Jack and Drill

Jack and drill or auger boring would be 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 a rotating auger inside the casing (Figures 4 and 5) (Jack and Drill Video). Jack and drill is considered a trenchless method of construction; however, digging of an entry and exit pit of varying dimensions would be required.

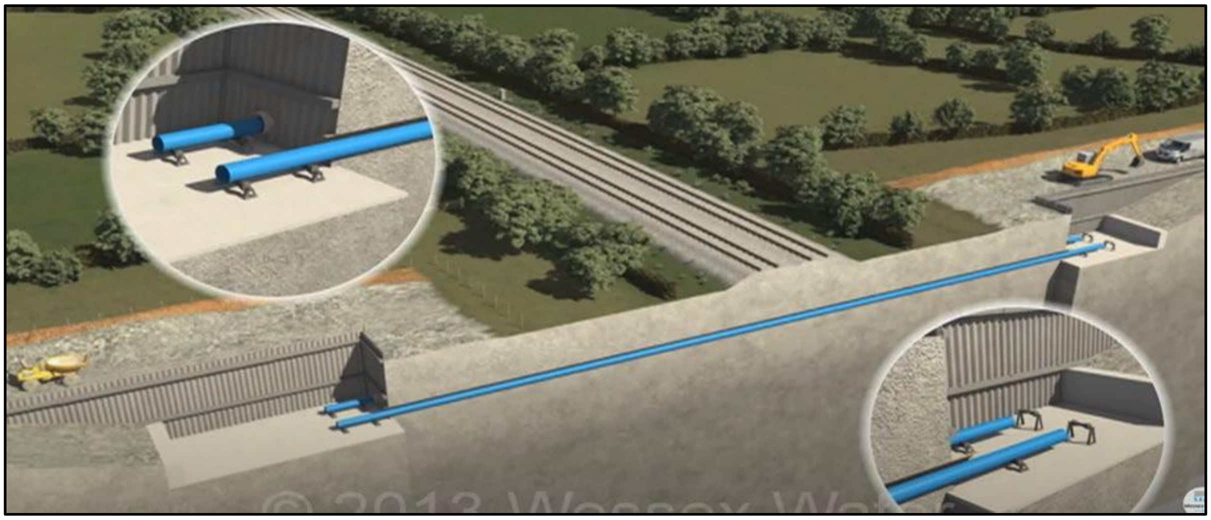

**Figure 4. Jack and Drill**

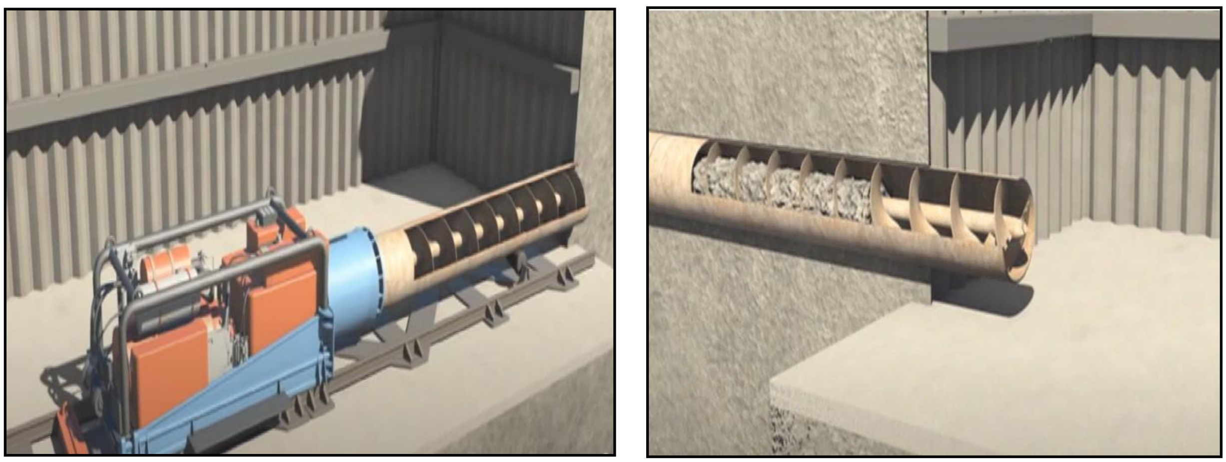

**Figure 5. Jack and Drill/Bore**

<u>Horizontal Directional Drilling</u>

Horizonal directional drilling would be used in various locations along project routes to cross areas where surface disturbance or sensitive resources must be avoided (e.g., streams/rivers, cultural resources, crossing railroads, etc.) (Figure 6). For stream/rivers, drilling would only occur if the conduit could not be attached to a structure. Directional drill lengths can range from less than 100 feet to more than 10,000 feet, depending on the type of equipment used.

To complete directional drilling, an approximately 7-foot-wide by 7-foot-long by 5-foot-deep work area would be established on each side of the crossing. One work area would contain an entry pit and drilling equipment, while the other work area would contain the exit pit. At the entry pit, a steerable drill stem would be used to bore a pilot hole to the exit pit. Once the drill stem reaches the exit pit, a reamer (i.e., device used to enlarge the pilot hole) would be attached along with the conduit. The drilling machine would then ream an approximately 12-inch-diameter hole back toward the entry pit while pulling the conduit at the same time (Horizontal Directional Drilling Video). Once the reamer and conduit are pulled through the entry pit, and the entry/exit pits are backfilled and compacted, conduit placement would be complete.

During the drilling process, a bentonite slurry with polymer would be 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 would be 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 would be 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 disposed of at an appropriate location.

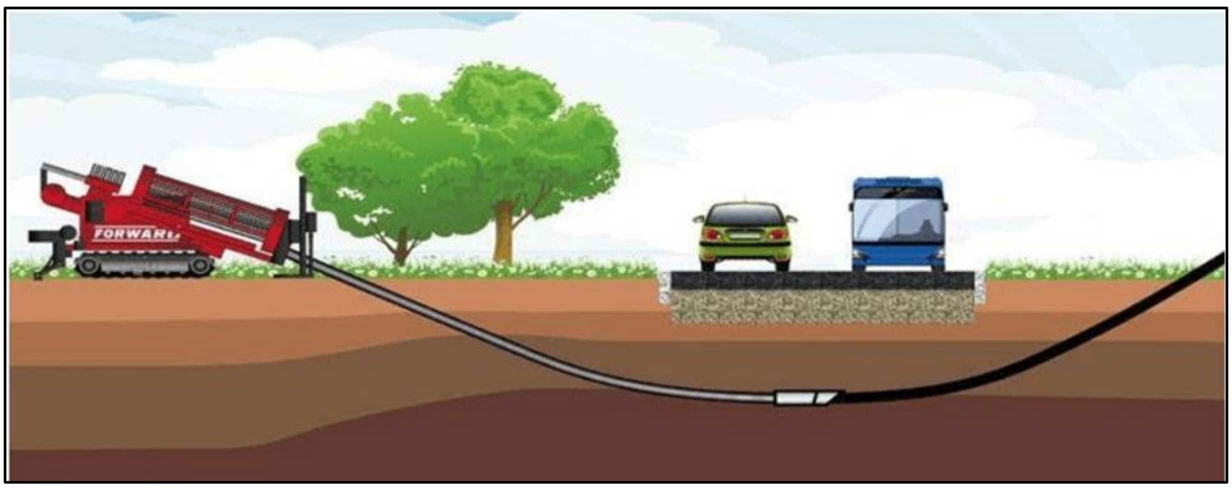


**Figure 6. Horizontal Directional Drilling**

### 2. Conduit Installation (Existing Structures and Culverts)

Bridges, Concrete Barriers, and Sound Walls

Bridge, concrete barrier, and sound wall mounted conduits would either be installed in existing unused conduit passages (if structure was designed to accommodate conduit), directly attached to the structure, or placed in approximately 8-inch diameter steel conduit attached to the structure. Bolts, clips, hangers, and/or anchors may be used to attach the conduit (see MMBND-12 to MMBND-16). When installing conduit on a bridge, an approximately 30-inch-wide by 48-inch-long by 36-inch-deep pit would be excavated at either end of the bridge to allow for pull vault installation (see vault installation below).

All conduit installations on structures would be designed to accommodate thermal and/or seismic movement. In some cases, conduit may need to be painted or covered with an approved coating to match the color of the structure.

<u>Culverts</u>

Conduit would be installed under or over culverts or attached to culverts with clamps (see MMBND-15). For conduit installation in unlined channels and ditches a minimum clearance of 24 inches below the flowline would be maintained.

**3. Vault Installation**

One 30-inch-wide by 48-inch-long by 36-inch-deep pull vault would be installed approximately every 2,500 feet (maximum spacing) (Figure 7). Every 5th vault would be a 48-inch-wide x 48-inch-long x 48-inch-deep splice vault. Vaults may be installed above surrounding grade or flush with surrounding grade (see MMBND-6, MMBND-7, and MMBND-8). If conduit is installed in bridge structures, vaults would be installed at both ends of the bridge to aid conduit installation and maintenance access.

**Figure 7. Vault Installation**

**4. Network Hubs**

Network hubs would be installed on concrete pads to provide transmission and reamplify signals (Figure 8). Hubs would be located a maximum of 50 miles apart and be located in proximity to power as electrical hook-ups would be required. Perimeter fencing and standby propane or diesel generators with fuel tanks would be installed at hub locations (see MMBND-11 and MMBND-17 to MMBND-22). Typical network hub dimensions would be 50 feet wide by 50 feet long.

**Figure 8. Network Hub with Diesel Backup Generator**

**5. Maintenance Vehicle Pullouts**

To improve safety, paved maintenance vehicle pullouts of varying dimensions would be constructed to provide parking for maintenance workers and field personnel (see MMBND-4).

**6. Fiber Optic Markers**

Fiber optic markers would be installed at every pull vault and splice vault. Fiber optic markers would also be installed approximately every 500 feet along the conduit path. At curve locations along the conduit path, fiber optic markers would be installed at the beginning, middle, and end of the curve. Metallic disk markers would also be installed in the pavement (see MMBND-5).

**7. Geotechnical Borings**

Geotechnical boring may be required to determine subsurface conditions for network hub foundations or if horizontal directional drilling or jack and drill/bore construction methods can be used.

## Staging, Storage, and Access

<u>Staging/Storage</u>

Staging areas for construction equipment, materials, and fuels/lubricants would be selected by the construction contractor, as needed, before and/or during construction.

To ensure sensitive environmental resources are adequately protected, locations of staging and parking areas would be determined in consultation with the environmental team. Fuels, lubricants, and solvents would not be stored in staging areas located within 150 feet from streams or drainage features.

<u>Access</u>

Access to the majority of the project locations would be through existing developed roads; however, temporary and permanent access roads may be needed for construction and installation of network hubs and vaults.

### Additional Representative Photographs

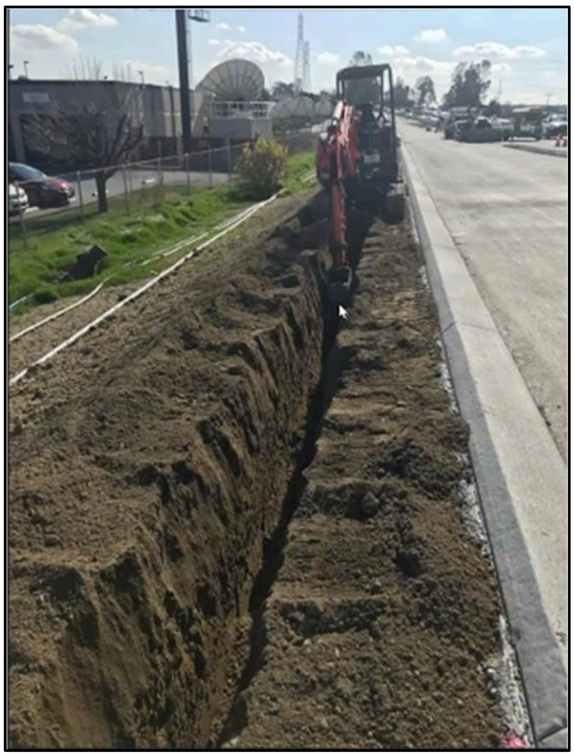

**Figure 9. Conduit Trench**

**Figure 10. Conduit Placement**