

BAY AREA REGIONAL BROADBAND COMMUNICATIONS STRATEGIC INVESTMENT PLAN



FINAL PLAN
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Glossary of Terms

BAIFA – Bay Area Infrastructure Financing Authority

CMS – Changeable Message Sign

C/CAG – City/County Association of Governments of San Mateo County

FCC – Federal Communications Commission

HDPE – High-Density Polyethylene

HOV – High-Occupancy Vehicle

CCTV – Closed-Circuit Television Cameras

ITS – Intelligent Transportation Systems

Mbps – Megabits per Second

RCN – Regional Communications Network (as defined in Section 1.5)

SMART – Sonoma Marin Area Rail Transit

SMFO – Single-mode Fiber Optic Cable

STA – Solano Transportation Authority

SV ITS – Silicon Valley Intelligent Transportation Systems

TAM – Transportation Authority of Marin

TOS – Traffic Operations Systems

TMC – Transportation Management Center

TMS – Transportation Management Systems

VTA – Santa Clara Valley Transportation Authority

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1. INTRODUCTION AND BACKGROUND

The Bay Area Regional Communications Strategic Investment Plan provides a framework to enable MTC, Caltrans, and other regional and local stakeholders to develop a regional communications network. The Plan proposes 40 projects, prioritizes them based on their benefits and costs, describes traditional and creative funding sources, and outlines best practices for sharing communications infrastructure. Vision, goals, and objectives developed by project stakeholders guided the Plan's development.

All reference to sharing in the context of a proposed project refers to sharing communications infrastructure and not sharing data. Network security will not be discussed in this document because networks are secured on a design level.

1.1 Project Background

In 2003, Caltrans District 4 and MTC collaborated on the development of a Traffic Operations System (TOS) Implementation Plan. This document presented an assessment of existing, planned, and programmed regional field device coverage on the 500-mile freeway network. Using a Systems Engineering approach to define overall system architecture and functional requirements of the TOS network, a strategy was outlined for expanding and implementing a communications infrastructure to support the TOS elements. Each segment of the freeway network was prioritized based on bandwidth needs, gap closures, cost-benefit considerations, and other needs at the time.

In 2009, the document was updated and titled Bay Area Regional Communications Plan. The focus was on identifying strategies to upgrade or enhance the communications network to expand and accommodate the Caltrans' video system, as well as other field devices. The document captured an analysis of bandwidth needs for each corridor and a cost analysis for using agency-owned or leased communications. Projects and corridors were prioritized based on cost benefits (e.g., elimination of monthly recurring leased costs), functionality provided by each alternative, and corridors of regional significance.

In 2013, the Bay Area Regional Communications Plan was updated to factor in additional programs (Express Lanes, Integrated Corridor Management, Freeway Performance Initiative), and to consider new priorities from local and regional stakeholders throughout the Bay Area. This Plan introduced a "Regional Communication Fiber Ring" around the San Francisco Bay Area, aimed to reduce lease-line recurring costs, upgrade existing infrastructure and share data among agencies.

The Bay Area Regional Communications Plan is now being updated to create a Bay Area Regional Broadband Communications Strategic Investment Plan. The Plan promotes sharing of infrastructure and lays a roadmap that will result in a regional communications network. This network will enable transportation data and information sharing and facilitate the implementation of technology-based congestion management strategies focused on enhancing the livability and economic vitality of communities through the nine-county Bay Area. It will give agencies the ability to support managed lanes, Integrated Corridor Management, Smart Cities, and other emerging, advanced technologies.

1.2 Roles and Responsibilities

The Plan lays out the purpose and need for the regional communications network - a network of regional fiber and infrastructure assets owned and maintained by multiple agencies utilized by disparate systems, but allows for sharing of physical and logical assets. MTC has been leading the development and maintenance of the Plan. Plan implementation will be the responsibility of all agencies that intend to participate in the network. Participating agencies may use this document as a guide to identify needs for additional communications infrastructure in their jurisdiction. Participation is not mandated.

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1.3 Project Vision Statement, Goals, and Objectives

The vision statement of the Bay Area Regional Broadband Communications Strategic Investment Plan is:

To provide the technical and policy framework to develop a fast, reliable, redundant, and cost-effective regional communications network that will enable the sharing of data, infrastructure, and maintenance costs among project partners; support coordinated and interoperable transportation systems across multiple jurisdictions; and facilitate technology-based strategies focused on enhancing safety, mobility, livability and economic vitality of communities throughout the nine-county San Francisco Bay Area.

Below are the goals and objectives for the Bay Area Regional Broadband Communications Strategic Investment Plan as developed by stakeholders.

- **Goal 1:** Identify projects to establish a high-bandwidth, reliable, and redundant regional communications network through the nine-county San Francisco Bay Area.
 - Objective 1-1: Identify projects that complete a redundant regional communications backbone along routes surrounding the San Francisco Bay.
 - Objective 1-2: Identify projects that connect the regional communications network to multiple Internet points-of-presence (POPs) throughout the region to support broadband connectivity to participating agencies.
 - Objective 1-3: Identify projects that complete the connection between regional communications network and express lane operators throughout the nine-county San Francisco Bay Area.
- **Goal 2:** Develop policies and strategies that encourage agencies to connect their local networks to the regional communications network.
 - Objective 2-1: Develop policy and Partnership MOU for use of and access to the network.
 - Objective 2-2: Develop strategy for shared funding (capital and O&M).
 - Objective 2-3: Develop requirements for regional communications network infrastructure.
- **Goal 3:** Facilitate development of best practices for procuring, implementing, and maintaining communications network infrastructure.
 - Objective 3-1: Develop initial procurement strategies for procurement of regional communications network equipment including shared procurement options and regionally negotiated pricing and warranties.
 - Objective 3-2: Develop best practices for implementation and maintenance of various communications media for use by partner agencies.
- **Goal 4:** Encourage the sharing of existing agency-owned infrastructure to provide secure and reliable communications for transportation agencies in the region.
 - Objective 4-1: Identify projects and opportunities to use existing communications infrastructure to complete regional communications network objectives.
 - Objective 4-2: Identify projects that complete connections between key transportation agency facilities and the proposed regional communications network

It is suggested that the Plan is updated in three years to track progress on the Goals and Objectives.

1.4 Benefits and Use Cases

This Plan highlights benefits of a regional communications network at both a regional and local level. A shared regional communications network would result in long-term cost savings by leveraging investments in existing infrastructure and eliminating monthly recurring leased line costs. Other benefits

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include but are not limited to: decreased reliance on a single communications system owned by one entity, increased coverage and capacity, and enhanced redundancy.

Potential use cases of the regional communications network for local agencies include but are not limited to: synchronized traffic signals across jurisdictions to enable better traffic flow, shared video feeds to monitor real time traffic conditions and make congestion mitigation decisions and having regional control of traffic systems to respond and adjust signal timing in the event of an emergency or natural disaster.

Collection of data would occur on an agency's communications network and sharing data would occur through the regional communications network. Owning agencies will have full autonomy over what data is shared.

2. EXISTING AND PLANNED COMMUNICATION INFRASTRUCTURE AND CAPACITY

This section presents an inventory of existing and planned fiber communications infrastructure. Currently there is no communications infrastructure dedicated to regional data transfer, which presents an opportunity to create a regional communications network utilizing existing and planned communications infrastructure. To leverage existing and planned investments and reduce program costs, some projects proposed in this Plan suggest sharing communications infrastructure.

Existing and planned infrastructure data is presented in this section by sub-region. For the purposes of this project, the nine-county Bay Area has been divided into four sub-regions:

- Peninsula (San Francisco and San Mateo Counties)
- South Bay (Santa Clara County)
- East Bay (Alameda and Contra Costa Counties)
- Solano-North Bay (Solano, Sonoma, Napa, and Marin Counties)

2.1 Existing Infrastructure/Projects

The following is a summary discussion of existing regional communications infrastructure and corresponding projects of regional significance. Existing projects are either already built or are under construction and expected to be completed in the next 2-3 years. Figure 1 provides an overview summary of existing regional fiber communications infrastructure (conduit with fiber). Figure 2 provides an overview of existing regional conduit infrastructure (conduit with and without fiber). Appendix A includes a tabulated version of the existing infrastructure data along highways.

2.1.1 Peninsula

Existing regional communications infrastructure within the Peninsula sub-region consists of approximately 20 miles of conduit and fiber along El Camino Real (SR 82) between San Bruno and Palo Alto, and several miles of fiber along US 101 in Palo Alto. The El Camino Real network consists of a 96-strand SMFO cable installed in a multi-conduit duct bank. There is also a segment of 72-strand SMFO cable that ties the El Camino Real segment to signals along SR 84/Marsh Road via US 101.

The existing communications infrastructure described above serves the C/CAG US 101 Smart Corridor network. The objective of this network is to allow partner agencies in San Mateo County access to real-time traffic data along the corridor for local day-to-day traffic management, as well as regional traffic management during major incidents along US 101.

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There is also fiber communications infrastructure owned by the San Mateo County installed on local streets in the cities of Daly City, South San Francisco, San Mateo, Belmont, San Carlos, Redwood City, Menlo Park, and Palo Alto.

2.1.2 South Bay

Existing regional communications infrastructure within the South Bay sub-region consists of fiber cable and conduit on portions of US 101 and El Camino Real installed by VTA and Caltrans. As part of the I-880 HOV Widening Project, communications conduits were installed on I-880 between SR 237 and US 101. Communications conduits were also installed as part of the Stevens Creek Boulevard interchange project in San Jose.

In addition, many local principal arterials, and almost all the expressways have fiber communications infrastructure installed. The local fiber installations are primarily owned and maintained by the City of San Jose and City of Santa Clara for city-owned traffic signal communications. The County of Santa Clara's infrastructure is used for similar purposes along the expressways.

A large portion of the existing fiber communications network in the South Bay was installed by the Silicon Valley – ITS (SV-ITS) program as a traffic management strategy. This program is a regional resource to allow communications between the Cities of San Jose, Fremont, Milpitas, Cupertino, Campbell, Santa Clara, the Town of Los Gatos, Santa Clara County, and Caltrans.

2.1.3 East Bay

Existing regional communications infrastructure within the East Bay sub-region consists of Caltrans fiber cable and conduit along I-580, I-680, and I-880, in addition to some local fiber in the Cities of Dublin, Pleasanton, Livermore, Hayward, San Leandro, Oakland, Berkeley, Emeryville, Union City, and Fremont.

The I-680 corridor includes a 144-strand SMFO cable installed in a 1 to 4-3 inch conduit duct bank installed between the I-580/I-680 interchange in Dublin, and the Benicia Bridge Toll Plaza in Martinez, approximately 27 miles. The I-680 Sunol Express Lanes project currently operates wireless communications on its southbound lanes (SR 84 to SR 262) but the northbound I-680 Sunol express lane under construction will convert that to fiber for both directions.

The I-880 communications infrastructure includes a 288-strand SMFO cable installed in a 3-3-inch or 4-1.5 inch multi-conduit duct bank. The fiber infrastructure is installed between Hegenberger Road in Oakland, and Dixon Landing Road in Milpitas, approximately 26 miles.

The I-680 Contra Costa and I-880 corridors include existing regional express lane operations. The fiber communication network is maintained by BAIFA on both existing corridors. However, the conduit infrastructure is owned by Caltrans, and is installed in Caltrans' right-of-way. Caltrans also owns 72 strands of the fiber cable along both corridors.

The I-580 corridor includes regional express lane operations. The I-580 infrastructure runs between the I-580/I-680 interchange in Dublin, and Greenville Road in Livermore, approximately 12 miles. It includes one 1.5-inch conduit with a 72-strand SMFO cable owned by Alameda County Transportation Commission (Alameda CTC), one 1.5-inch conduit with a 72-strand SMFO cable owned by Caltrans, two 1.5-inch empty conduits and one empty 3-inch conduit with pull tape for use by Caltrans. The express lanes and fiber communication network are maintained by Alameda CTC. The conduit infrastructure is owned by Caltrans.

There are several local streets with fiber communications infrastructure throughout Dublin, Livermore, and Pleasanton which were installed as part of the I-580 Smart Corridor Project. The City of Dublin owns 140-

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strand SMFO fiber which is installed along Dublin Boulevard between San Ramon Road in Pleasanton and Fallon Rd in Dublin which runs parallel to I-580 and intersects with I-680.

There is also City-owned fiber communications infrastructure installed throughout Hayward, San Leandro, Oakland, and Fremont. Fiber communications infrastructure was installed in Oakland along San Pablo Avenue from 14th St to MacArthur Boulevard as part of the I-80 Integrated Corridor Management project. AC transit projects such as Bus Rapid Transit (BRT) also helped to build out fiber communications infrastructure along local streets in the East Bay.

2.1.4 Solano-North Bay

There is currently empty conduit infrastructure in Marin County in two stretches along US 101. Along US 101 through the City of San Rafael there is nearly four miles of two 1.25" empty conduits. Through the City of Novato there are four 1.5" empty conduits for nearly three miles along US 101.

2.1.5 Regional Communications Infrastructure

Throughout the nine-county Bay Area there are 17 BayLoop Microwave sites owned and operated by the Bay Area Regional Interoperable Communications Systems Authority (BayRICS). These microwave sites make up a high-capacity network originally created to support public safety services. This is an existing communications network with locations throughout the Bay Area that is led by an inter-agency Joint Powers Authority.

BART has installed fiber communications infrastructure along their right-of-way throughout the Bay Area. Caltrans has 16 access points to BART fiber strands. BAIFA has 6 access points to BART fiber strands. The City of San Jose, City of San Francisco, City of Oakland, and the City of Dublin also have connections to BART fiber communications infrastructure.

Caltrain has a Positive Train Control Project that aims to electrify the Caltrain transit line. Caltrain right-of-way/infrastructure is currently the most available alignment for shared infrastructure, but other systems like the possible High Speed Rail alignment may be additional sources as the opportunities arise in the future.

Sonoma Marin Area Rail Transit (SMART) and Sonic, a private broadband provider, have a public-private partnership in place to share capital cost of fiber communications infrastructure installation along SMART's rail line. Sonic has non-exclusive conduit access and installed new fiber cable. Some of the fiber strands are dedicated to SMART which are used by local agencies near its right-of-way. Currently the SMART line is existing between the Sonoma County Airport and San Rafael.

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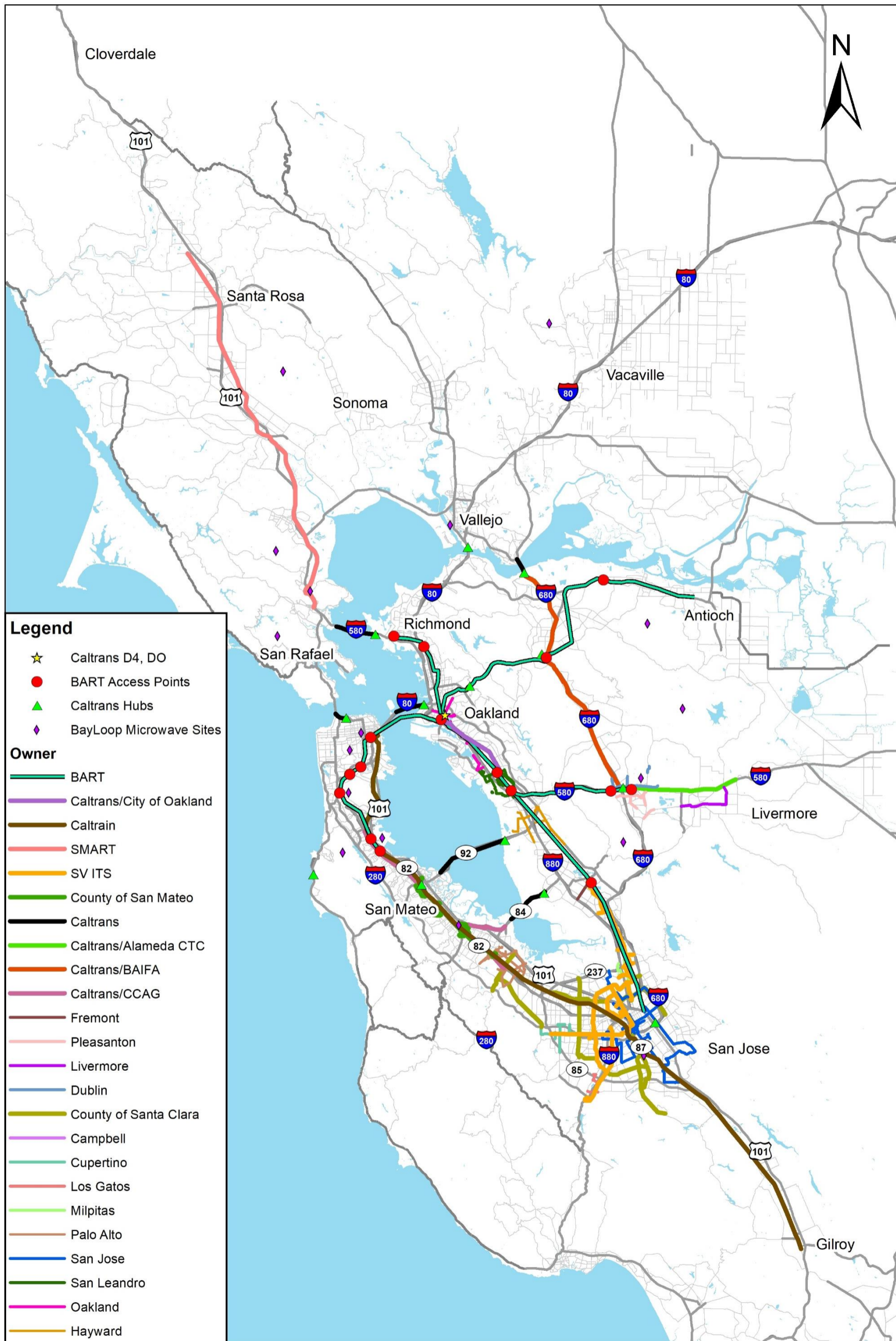


Figure 1: Existing Regional Fiber Communications Infrastructure

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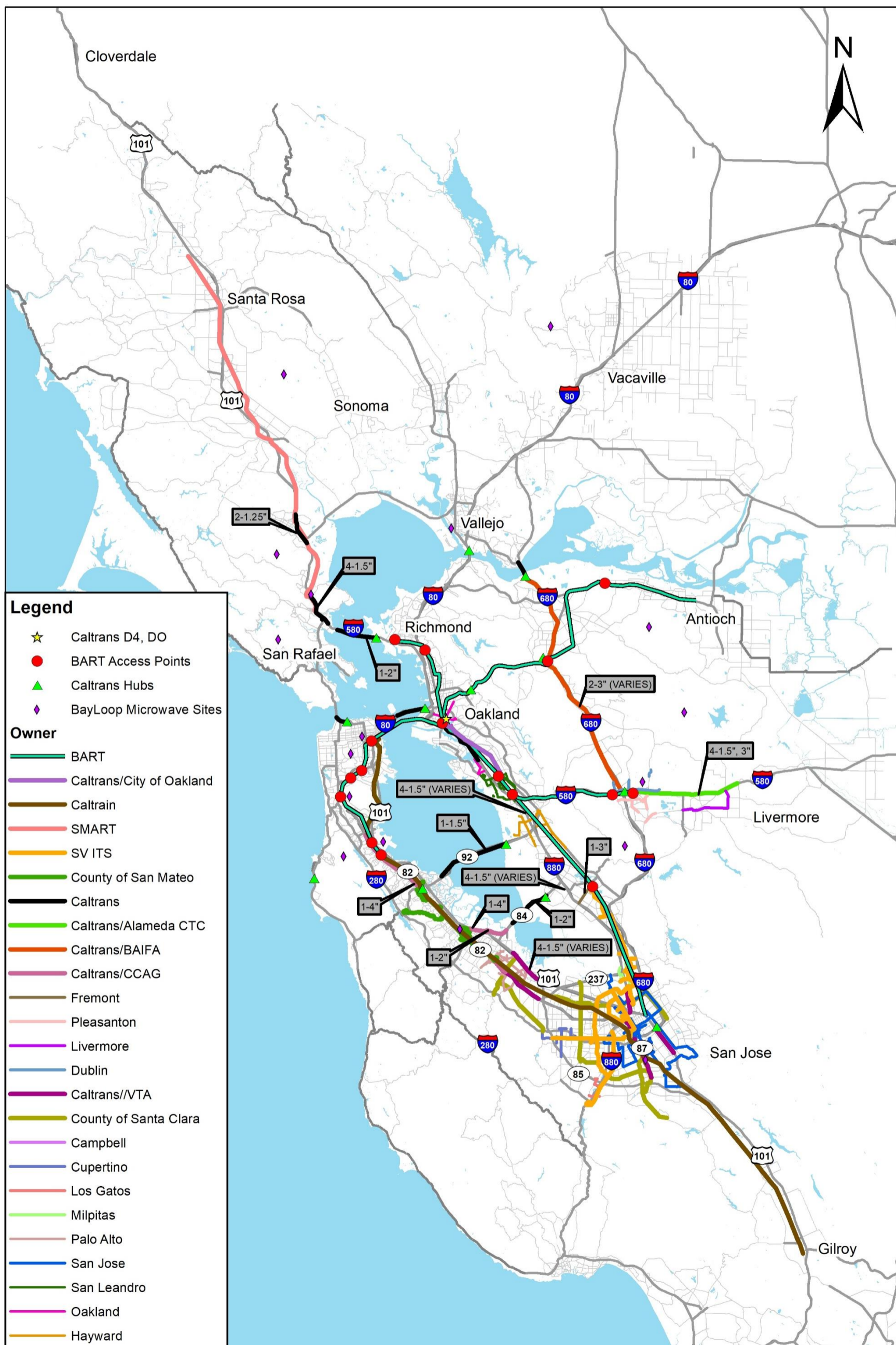


Figure 2: Existing Regional Conduit Infrastructure

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2.2 Planned Infrastructure/Projects

The following is a summary of planned regional communications infrastructure and corresponding projects of regional significance that may be implemented within the next five years. Most of the planned infrastructure is not currently funded. Figure 3 provides an overview summary of planned regional communications infrastructure. Appendix A includes a tabulated version of the planned infrastructure data.

2.2.1 Peninsula

There are three planned regional communications infrastructure projects on the peninsula. All projects entail installation of fiber. One project is planned along US 101 between Embarcadero Road in Palo Alto and Grand Avenue in South San Francisco. The other project will be along Airport Boulevard and Gateway Boulevard in South San Francisco. The third project will be along various routes parallel to I-280 in South San Francisco and Daly City. All projects will be administered by C/CAG in partnership with Caltrans. The US 101 communications infrastructure will facilitate new regional express lane implementation and separate communications to Caltrans' freeway TMS elements. The fiber infrastructure in South San Francisco and Daly City will enable the implementation of Smart Corridor projects.

2.2.2 South Bay

Four near-term freeway projects in the South Bay could provide a possible opportunity to build out portions of the regional communications network. The four projects are being administered by VTA as part of the express lanes on SR 237, SR 85 and US 101. There are two projects along US 101. Fiber communications to support Caltrans' freeway TOS elements along these corridors are being coordinated between VTA and Caltrans.

2.2.3 East Bay

There are several planned regional communications infrastructure expansions in the East Bay. The I-880 Integrated Corridor Management (ICM) Central Segment, is being administered by MTC and extends the existing I-880 ICM Project from Davis Street to Lewelling Boulevard in San Leandro to Whipple Road. Most signals along the corridors have fiber or copper interconnect currently and the project plans to fill the gaps in existing communications infrastructure. Communications infrastructure installed by the project will be owned and maintained by the City of San Leandro. The remainder of the Central Segment, from Lewelling Boulevard in San Leandro to Whipple Road in Union City, will be completed in phases as funding becomes available.

As previously mentioned, the I-680 Sunol Express Lanes project is expanding to the northbound lanes along the existing project limits. With this expansion, the project intends to add one 72-strand SMFO cable along I-680 from SR 262 to SR 84 in a 4-inch conduit with three 1-inch diameter high density polyethylene (HDPE) innerducts, two of which will be left empty to be used in the future. There is an additional project planned to complete the I-680 Sunol Express Lanes between SR 84 and Alcosta Boulevard in San Ramon.

CCTA is working on a series of projects they have combined under one large 7-step initiative called "Innovate 680." The first step in the Innovate 680 project is to close the existing HOV gap and complete the express lanes network along I-680 in Contra Costa County. Steps 2-7 include various strategies to address bottlenecks in the corridor, improve transit service, update existing ITS equipment, and ultimately

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prepare the corridor for the future. This infrastructure will supplement the existing infrastructure along the corridor.

There are also several planned projects on local routes. The City of Oakland MacArthur Smart Corridor will be an innovative incident management corridor parallel to I-580. The City intends to install fiber along MacArthur Boulevard from I-580 in San Leandro to City Hall in downtown Oakland. The anticipated project completion is 2021. The City of Oakland is also planning to install fiber communications along Telegraph Ave and Grand Ave in the near future. The San Pablo Avenue Corridor Project is an ICM project implemented by Alameda CTC. It is relieving congestion on I-80 by improving operations along San Pablo Avenue from Oakland to San Pablo.

2.2.4 Solano-North Bay

There is a planned express lanes project that has fiber communications infrastructure in Solano County administered by the Solano Transportation Authority. The planned project is along I-80 between the I-80/I-680 junction in Fairfield, and the I-80/I-505 interchange in Vacaville, approximately 17 miles. This project is anticipated to include installation of fiber conduit and cable from Manual Campos Parkway in Fairfield to Leisure Town Road in Vacaville.

The Napa Valley Transportation Authority, Sonoma County Transportation Authority, Transportation Authority of Marin, and Solano Transportation Authority are planning to build a managed lane along SR 37 between SR 121 and the West span of the Napa River as part of the State Route 37 Resilient Corridor Program. A contraflow lane and shoulder running lane are being considered as managed lane options.

The Transportation Authority of Marin has identified several projects to be considered for Regional Measure 3 funding. The US 101/I-580 Direct Connector Project is planned to include installation of fiber communications infrastructure along Sir Francis Drake Blvd between the two highways.

2.2.5 Regional Communications Infrastructure

Sonoma Marin Area Rail Transit (SMART) is planning to extend its rail line and fiber communications infrastructure from Sonoma County Airport to Cloverdale and from San Rafael to the Larkspur Ferry Terminal.

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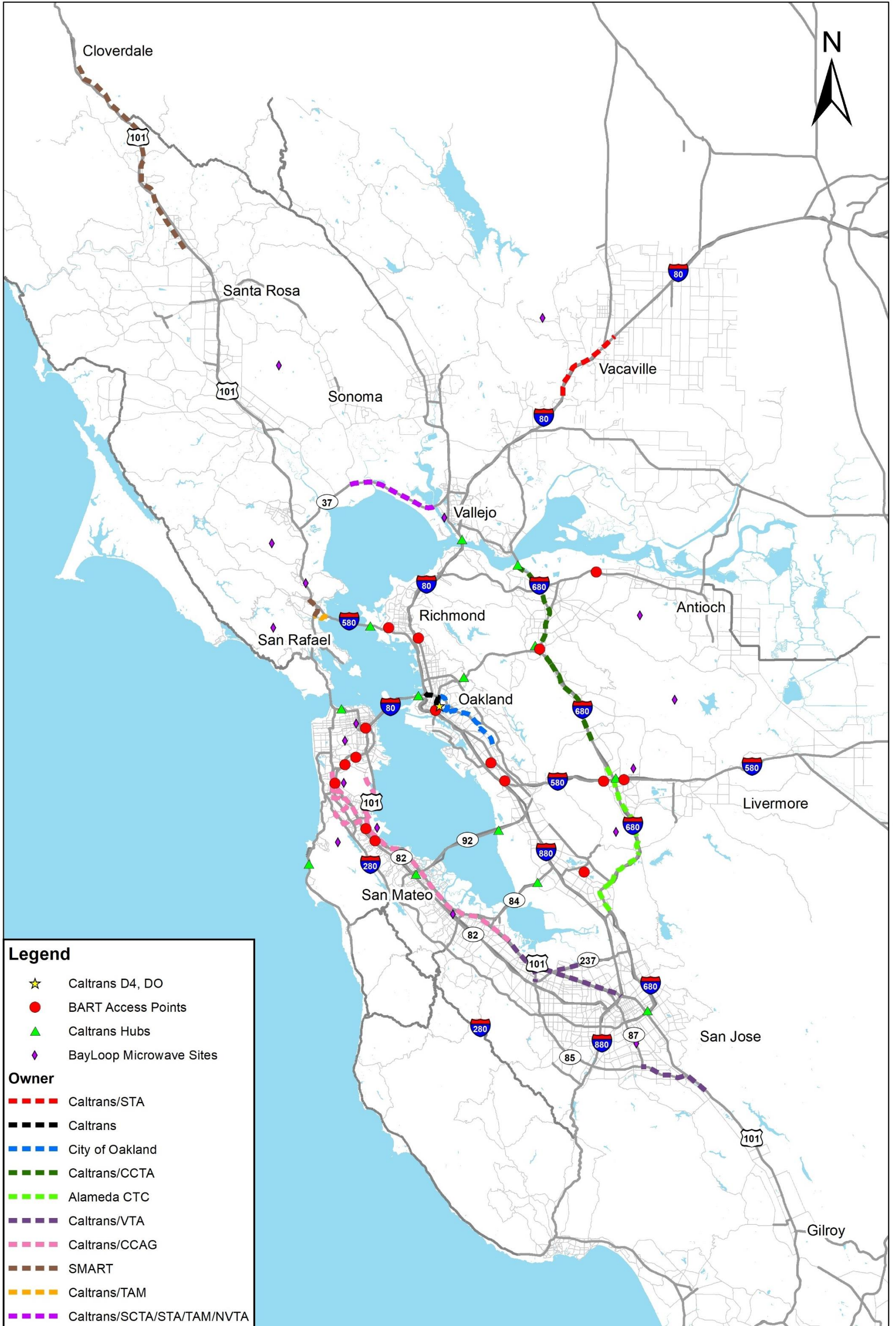


Figure 3: Planned Regional Fiber Communications Infrastructure

3. REGIONAL COMMUNICATIONS NETWORK PROJECTS AND PRIORITIZATION

Based on the Plan objectives, the following project types were proposed: completing the regional communications backbone around the Bay, and connecting Points-of-Presence (POPs), express lanes, and transportation centers to the regional communications network. A resulting list of projects are recommended to develop the regional communications network.

Currently there are no communications dedicated for regional data. There are opportunities to create a regional communications network utilizing existing and planned communications infrastructure. To leverage existing and planned investments, some proposed projects suggest sharing communications infrastructure. It is assumed that the regional communications network will be used to connect various types of devices in the future, but project cost estimates contained in this document do not include lateral connections to devices.

To align with Caltrans' vision of having four communications conduits along their right-of-way, any project that proposes fiber communications infrastructure along a freeway assumes the installation of 4-4" conduit.

3.1 Project Selection

Figure 4 shows the proposed full build out of the regional communications network throughout the nine-county Bay Area. In addition to connections to public agency facilities, the proposed projects include connections to Digital Realty, a data center with various locations throughout the Bay Area. Digital Realty locations serve as POPs. The 40 projects included in Figure 4 were selected based on their ability to meet the goals and objectives set forth by the Plan. Sharing conduit infrastructure with Caltrans is proposed along the San Mateo and Dumbarton bridges. While this is the most cost-effective alternative, it will ultimately be determined by appropriate stakeholders if this is feasible based on current conduit capacity and future Caltrans needs.

These proposed projects are not automatically linked to a form of funding and are subject to change based on stakeholder input, funding constraints, and other priorities. They are meant to be a starting point to facilitate implementation of the regional communications network and are not binding to any agency that is called out in a proposed project title. The team developed a comprehensive communications technology selection methodology to assess and evaluate the viability of various communications technologies. Based on the characteristics of proposed projects (availability of existing infrastructure, device density, location relative to an existing ITS Technology Corridor, and others), various communications mediums were evaluated to determine which would be the most appropriate technology to build out the regional communications network. The assessment yielded fiber optic communication as the most effective option of all those that were evaluated. As a result, fiber communications is the assumed preferred alternative for all future projects discussed in this document.

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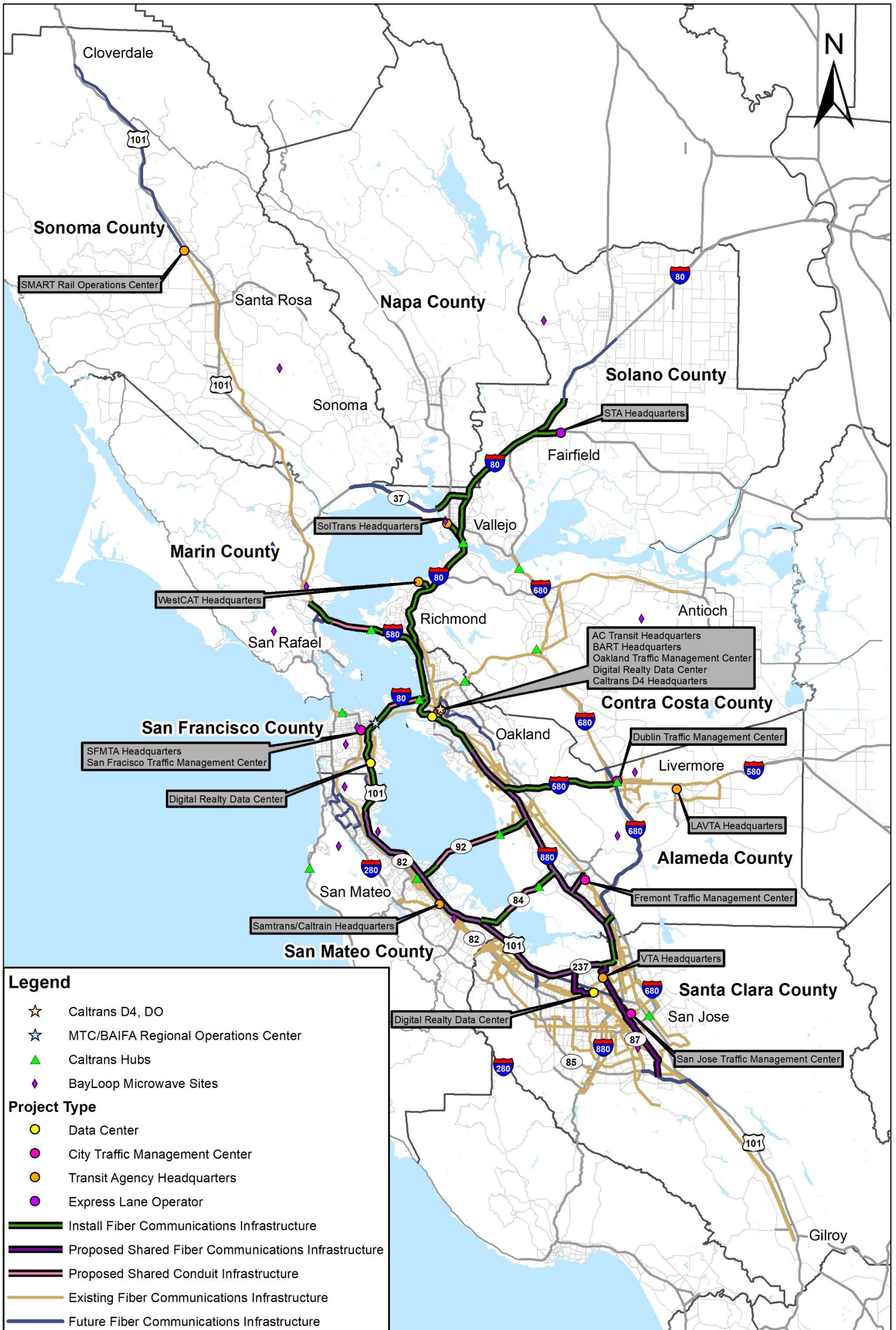


Figure 4: Proposed Regional Communications Network Build Out

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Existing infrastructure dedicated to the regional communications network does not currently exist. Support from project sponsors is required to help build this network out. The proposed projects within this Plan consider planned and existing infrastructure that can be leveraged to help build out the regional communications network. To help project sponsors incorporate a communications infrastructure element to the project development phase of future projects, and to expand the regional communications network, a decision tree was developed and shown in Figures 5 and 6 below. Figure 5 applies to development along local roads while Figure 6 applies to development along Caltrans right-of-way. The decision trees presented below may be modified in the future to facilitate expansion of the regional communications network.

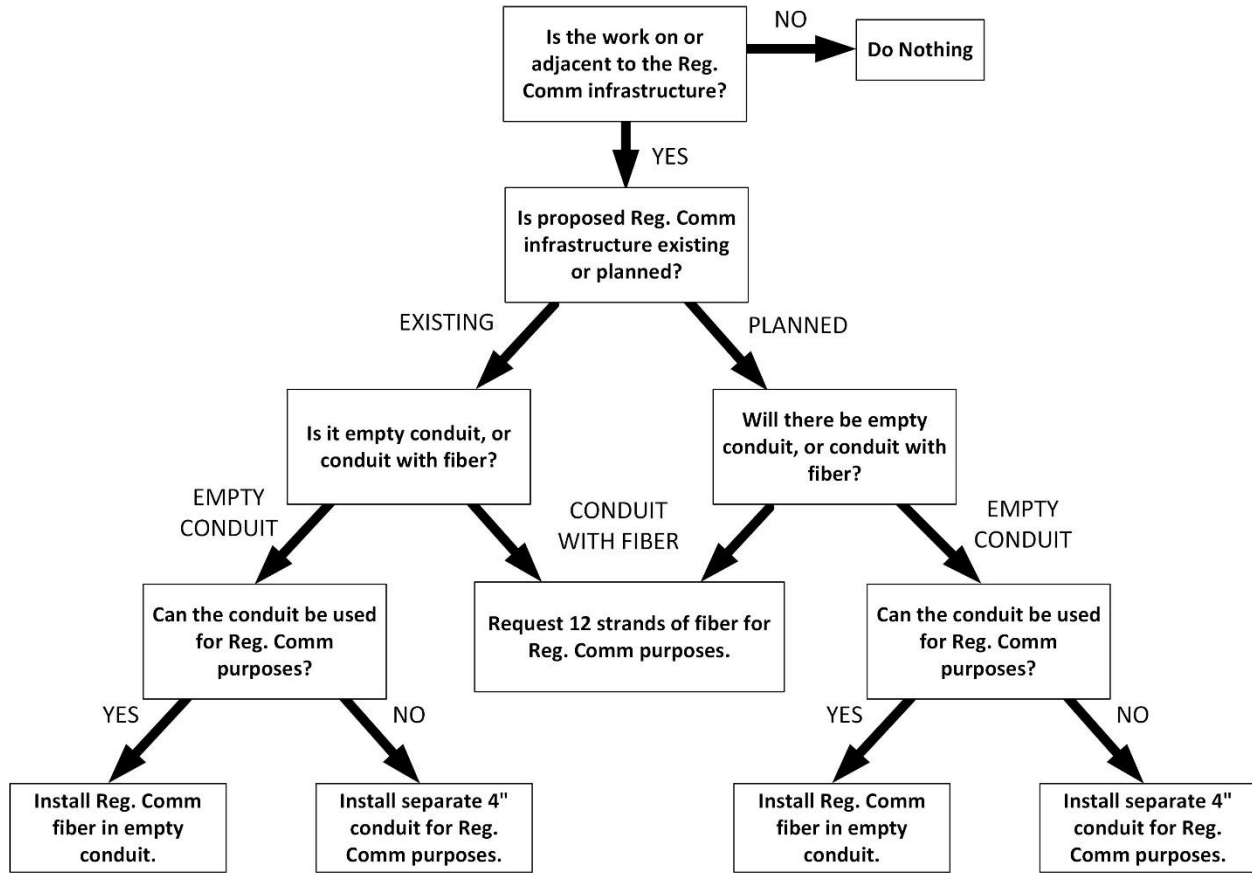


Figure 5: Decision Tree for Integrating Regional Communications during Project Development Along Local Roads

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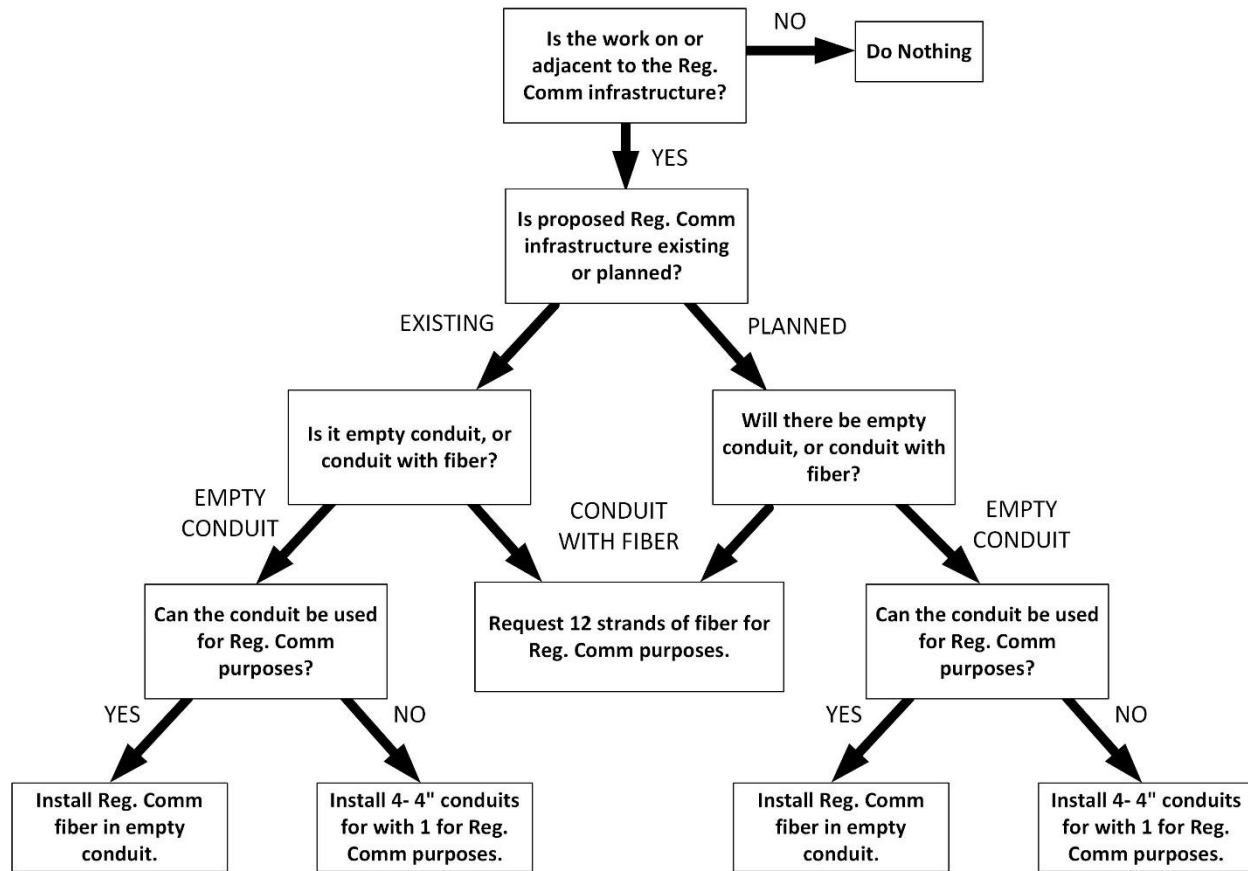


Figure 6: Decision Tree for Integrating Regional Communications during Project Development Along Caltrans Right-of-Way

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3.2 Project Phasing

The proposed projects are grouped into four phases. Phase 1 and 2 projects complete the regional fiber backbone around the San Francisco Bay. The key difference between Phase 1 and Phase 2 projects is Phase 1 projects leverage existing infrastructure, potential resulting in lower construction costs as well as comparatively easier implementation. Phases 3 and 4 build out the rest of the regional communications network through installation of new infrastructure. The key difference between Phases 3 and 4 is the jurisdiction under which the projects are built/implemented. Phase 3 builds out the regional communications network along the state highway system. Phase 4 builds out the regional communications network along local roads. Table 1 summarizes the four proposed project phases necessary to deploy the regional communications network. Section 4 of this Plan includes a more detailed breakdown of the estimated costs.

Table 1: Project Phases

Phase	Description	# of Projects	Total Estimated Cost
1	Share infrastructure to complete the regional communications backbone	5	\$8,970,000
2	Install infrastructure to complete the regional communications backbone	6	\$34,432,000
3	Install and share infrastructure to build out the regional communications network along highways	9	\$73,531,000
4	Install and share infrastructure to build out the regional communications network along local roads	20	\$31,940,000
TOTAL		40	\$148,873,000

It is possible the projects in different phases may run concurrently depending on project sponsors and availability of funding. Figure 7 provides a visual representation of where the phased projects are located.

The proposed projects were prioritized within each phase based on availability of planned or existing communications infrastructure along the project limits, ease of construction, planning level project cost estimates, availability of potential funding sources, congestion along the project limits, and required level of coordination with partner agencies. The six key criteria used to prioritize proposed projects were defined based on stakeholder input. Each criterion was given a weighting factor based on its level of importance. The higher the percentage, the more critical the criterion. The total weight is 100%. A breakdown of the percentage assigned to each criterion is presented below:

- Availability of existing/planned infrastructure – 30%
- Ease of construction – 20%
- Project cost – 20%
- Congestion – 15%
- Availability of Potential Funding Sources – 10%
- Level of coordination with partner agencies required – 5%

Table 2 shows the projects grouped by phase and listed in descending rank within each phase based on the prioritization criterion listed above. The table also shows which objective the proposed project satisfies. For the purposes of the table, “RCN” refers to the proposed regional communications network. It is assumed that “connecting” to the regional communications network requires a physical fiber cable splice.

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Table 2: Project Phasing

Phase	Project Rank	Project	Project Type	Recommended Technology	Total Cost (Over 25 Years)	Obj. 1-1: Regional Communications Backbone	Obj. 1-2: Connect POPs to RCN	Obj. 1-3: Connect Express Lanes to RCN	Obj. 4-2: Connect Transportation Agencies to RCN
1	1-1	Dedicate fiber strands installed as part of the planned SR 237 Express Lane project for regional communications purposes (VTA)	Share Infrastructure	N/A	\$ 427,000	✓			
1	1-2	Dedicate fiber strands installed as part of the planned US 101 Express Lane Project for regional communications purposes (VTA/Caltrans)	Share Infrastructure	N/A	\$ 1,469,000	✓			
1	1-3	Dedicate fiber strands installed as part of the planned San Mateo 101 Managed Lane Project for regional communications purposes (C/CAG/Caltrans)	Share Infrastructure	N/A	\$ 2,859,000	✓			
1	1-4	Dedicate existing fiber strands along I-880 from Hegenberger Road to Dixon Landing Road (BAIFA/Caltrans)	Share Infrastructure	N/A	\$ 3,206,000	✓			
1	1-5	Make existing conduit infrastructure available for regional communications purposes along I-80 from Yerba Buena Island to Bay Bridge Toll Plaza (Caltrans)	Share Infrastructure	N/A	\$ 1,009,000	✓			
2	2-1	Install communications infrastructure along US 101 from Grand Avenue, South San Francisco to I-80	Install Infrastructure	Fiber Communications	\$ 9,841,000	✓			
2	2-2	Install communications infrastructure along I-80 and I-880 from the Bay Bridge Toll Plaza to Hegenberger Road	Install Infrastructure	Fiber Communications	\$ 12,301,000	✓			
2	2-3	Install communications infrastructure along I-880 from Dixon Landing Road to SR 237	Install Infrastructure	Fiber Communications	\$ 2,460,000	✓			
2	2-4	Install communications infrastructure along SR 237 from I-880 to North 1st Street	Install Infrastructure	Fiber Communications	\$ 2,460,000	✓			
2	2-5	Install communications infrastructure to connect Sunol express lanes to nearest regional communications network connection point (I-880/SR 262 interchange) along SR 262 from I-680 to I-880	Install Infrastructure	Fiber Communications	\$ 1,215,000	✓			
2	2-6	Install communications infrastructure along I-80 from US 101 to Yerba Buena Island	Install Infrastructure	Fiber Communications	\$ 6,155,000	✓			
3	3-1	Make existing conduit infrastructure available for regional communications purposes along Richmond Bridge (Caltrans)	Share Infrastructure	N/A	\$ 1,009,000				✓
3	3-2	Install communications infrastructure along I-80 from the Carquinez bridge to I-580	Install Infrastructure	Fiber Communications	\$ 18,591,000			✓	✓

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Phase	Project Rank	Project	Project Type	Recommended Technology	Total Cost (Over 25 Years)	Obj. 1-1: Regional Communications Backbone	Obj. 1-2: Connect POPs to RCN	Obj. 1-3: Connect Express Lanes to RCN	Obj. 4-2: Connect Transportation Agencies to RCN
3	3-3	Install communications infrastructure to nearest regional communications network connection point (I-880/I-238 interchange) along I-580 from I-680 to I-238 and along I-238 from I-580 to the I-880	Express lanes	Fiber Communications	\$ 12,395,000			✓	
3	3-4	Install communications infrastructure along US 101 from 3rd St to Richmond Bridge	Install Infrastructure	Fiber Communications	\$ 3,690,000				✓
3	3-5	Create redundant loop for the regional communications network across the San Mateo Bridge	Share Infrastructure/ Install Fiber	N/A	\$ 6,904,000	✓			
3	3-6	Install communications infrastructure along US 101 from Richmond Bridge to I-80	Install Infrastructure	Fiber Communications	\$ 8,612,000				✓
3	3-7	Create redundant loop for the regional communications network across the Dumbarton Bridge	Share Infrastructure/ Install Fiber	N/A	\$ 4,057,000	✓			
3	3-8	Install communications infrastructure to connect STA I-80 express lanes to nearest regional communications network connection point (Carquinez Bridge) along I-80 from SR 12 to Carquinez Bridge	Express lanes	Fiber Communications	\$ 15,492,000			✓	
3	3-9	Install communications infrastructure along the Carquinez Bridge	Install Infrastructure	Fiber Communications	\$ 2,781,000			✓	✓
4	4-1	Dedicate existing fiber strands for regional communications purposes to connect City of Dublin TMC to nearest regional fiber network connection point (I-580, San Ramon Road interchange) (City of Dublin)	Connect to TMC	Fiber Communications	\$ 427,000				✓
4	4-2	Dedicate existing fiber strands for regional communications purposes to connect SR 85 express lanes to nearest regional fiber network connection point (I-880, Zanker Road interchange) (City of San Jose)	Express lanes	Fiber Communications	\$ 1,817,000			✓	
4	4-3	Dedicate planned fiber strands for regional communications purposes to connect Caltrans D4 office to regional communications network connection (I-80, Bay Bridge Toll Plaza) (Caltrans)	Connect to TMC	N/A	\$ 659,000				✓

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Phase	Project Rank	Project	Project Type	Recommended Technology	Total Cost (Over 25 Years)	Obj. 1-1: Regional Communications Backbone	Obj. 1-2: Connect POPs to RCN	Obj. 1-3: Connect Express Lanes to RCN	Obj. 4-2: Connect Transportation Agencies to RCN
4	4-4	Dedicate existing fiber strands for regional communications purposes to connect SMART Rail Operations Center (Santa Rosa) to nearest regional fiber network connection point (I-80/I-680 interchange) (SMART)	Connect to Transit Center	N/A	\$ 5,754,000				✓
4	4-5	Dedicate existing fiber strands for regional communications purposes to connect City of Fremont TMC to nearest regional communications network connection point (I-880, Mowry Avenue interchange) (City of Fremont)	Connect to TMC	N/A	\$ 427,000				✓
4	4-6	Dedicate existing fiber strands for regional communications purposes to connect Digital Realty data center (San Jose) to nearest regional communications network point (SR 237, Lawrence Expressway interchange) (County of Santa Clara)	Connect to Data Center	N/A	\$ 659,000		✓		
4	4-7	Dedicate existing fiber strands for regional communications purposes to connect VTA headquarters (San Jose) to nearest regional communications network point (SR 237, Zanker Road interchange) (City of San Jose)	Connect to Transit Center	N/A	\$ 1,006,000				✓
4	4-8	Dedicate existing fiber strands for regional communications purposes to connect City of San Jose TMC to nearest regional communications network connection point (SR 237, Zanker Road interchange) (City of San Jose)	Connect to TMC	N/A	\$ 1,006,000				✓
4	4-9	Connect Digital Realty data center (Oakland) to nearest regional communications network connection point (I-880, Webster Street interchange)	Connect to Data Center	Fiber Communications	\$ 694,000		✓		
4	4-10	Connect Digital Realty data center (San Francisco) to nearest regional communications network connection point (US 101, 3rd Street interchange)	Connect to Data Center	Fiber Communications	\$ 694,000		✓		
4	4-11	Connect City of Oakland TMC to nearest regional communications network connection point (I-880, Broadway interchange)	Connect to TMC	Fiber Communications	\$ 694,000				✓
4	4-12	Connect AC Transit headquarters (Oakland) to nearest regional communications network connection point (I-880, Broadway interchange)	Connect to Transit Center	Fiber Communications	\$ 810,000				✓

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Phase	Project Rank	Project	Project Type	Recommended Technology	Total Cost (Over 25 Years)	Obj. 1-1: Regional Communications Backbone	Obj. 1-2: Connect POPs to RCN	Obj. 1-3: Connect Express Lanes to RCN	Obj. 4-2: Connect Transportation Agencies to RCN
4	4-13	Connect Samtrans/Caltrain headquarters (San Carlos) to nearest regional communications network connection point (US 101, Holly Street interchange)	Connect to Transit Center	Fiber Communications	\$ 925,000				✓
4	4-14	Connect LAVTA headquarters (Livermore) to nearest regional communications network connection point (I-580, Isabel Avenue interchange)	Connect to Transit Center	Fiber Communications	\$ 1,041,000				✓
4	4-15	Connect City of San Francisco TMC to nearest regional communications network connection point (US 101/I-80 interchange)	Connect to TMC	Fiber Communications	\$ 1,156,000				✓
4	4-16	Connect SFMTA headquarters (San Francisco) to nearest regional communications network connection point (US 101/I-80 interchange)	Connect to Transit Center	Fiber Communications	\$ 1,156,000				✓
4	4-17	Connect BART headquarters (Oakland) to nearest regional communications network connection point (I-880, Broadway interchange)	Connect to Transit Center	Fiber Communications	\$ 1,156,000				✓
4	4-18	Connect WestCAT headquarters (Pinole) to nearest regional communications network connection point (I-80, Appian Way interchange)	Connect to Transit Center	Fiber Communications	\$ 2,314,000				✓
4	4-19	Install communications infrastructure to connect SR 37 managed lanes to nearest regional communications network connection point (I-80) along SR 37 from Railroad Avenue to I-80	Express lanes	Fiber Communications	\$ 6,075,000			✓	
4	4-20	Connect SolTrans headquarters (Vallejo) to nearest regional communications network connection point (I-80, Carquinez Bridge)	Connect to Transit Center	Fiber Communications	\$ 3,470,000				✓
TOTAL					\$ 148,873,000				

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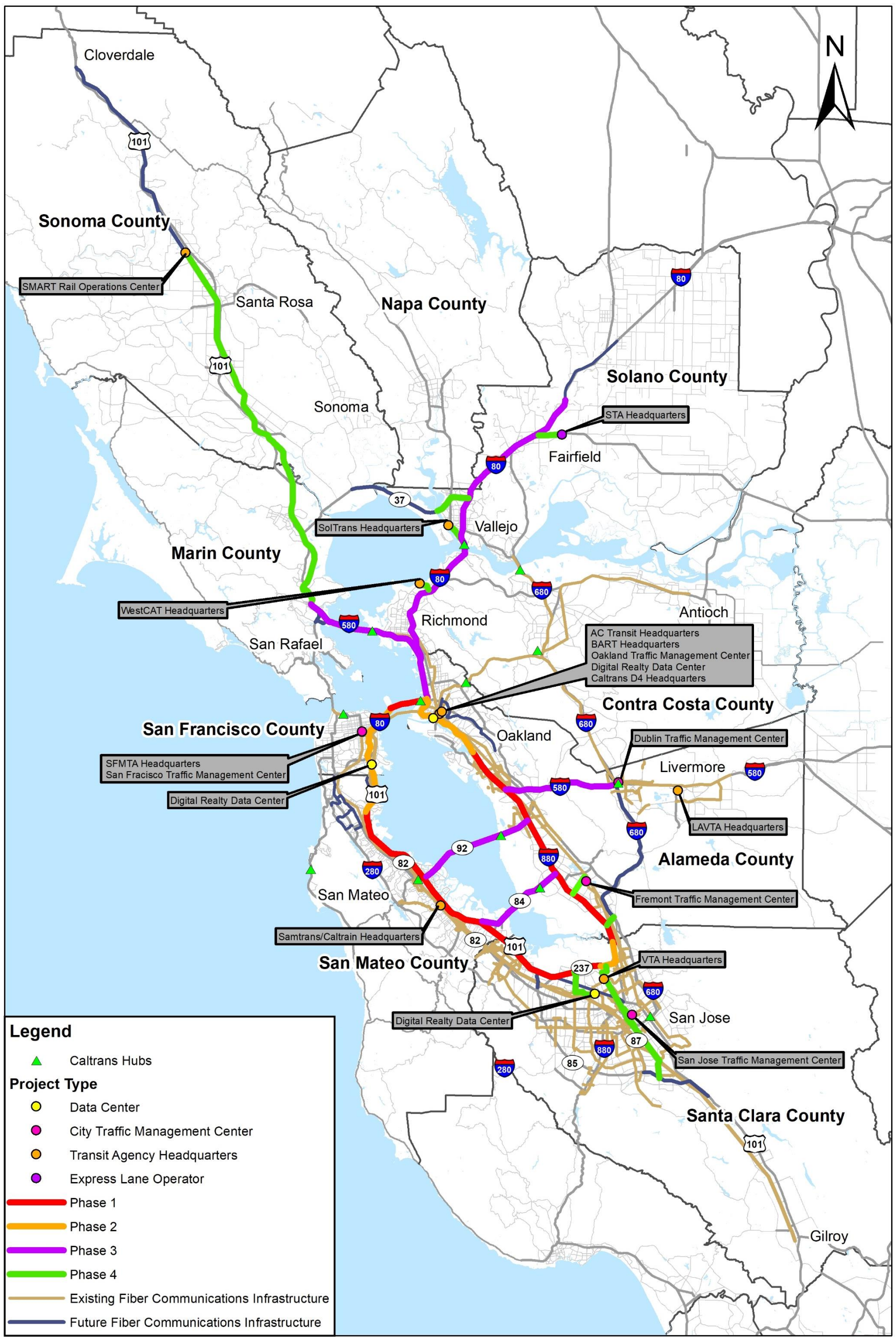


Figure 7: Proposed Project Phasing

4. COST COMPARISON AND BENEFITS

This section discusses the comparison of costs and benefits among fiber optic installation, agency-owned high-bandwidth and low-bandwidth wireless, and leased communications. Planning level cost estimates were developed for the proposed projects. Preliminary project cost estimates are inclusive of capital construction, right-of-way, hub equipment, traffic control, miscellaneous construction, systems integration, and recurring operation and maintenance costs over 25 years. The Cost Benefit Effectiveness Assessment includes supplementary calculations and a more detailed explanation of the unit costs.

Key assumptions for each of the mentioned elements included:

- Preliminary engineering costs are 30% of capital equipment construction costs.
- Preliminary engineering costs are 50% of capital equipment construction costs for projects crossing a major regional bridge.
- Right-of-way costs for projects on the freeway are assumed to be 0.5% of capital equipment construction costs.
- Hub equipment costs are \$15,000/mile for all projects along the backbone.
- Traffic control costs are 50% of capital equipment construction costs.
- Miscellaneous construction costs (such as lane closure and water control) are 20% of capital equipment construction costs.
- System integration costs are 2% of capital equipment construction costs.

Although the proposed project costs assume that excavation will be completed solely for the regional communications network infrastructure installation, there are many opportunities to share costs with other departments, agencies, and private companies. It is crucial to the success of the regional communications network for different agencies and departments to coordinate and leverage their investments. Smart Dig policies provide an opportunity to mainstream fiber infrastructure deployment and can be used to develop and expand the regional communications network. These policies focus on minimizing excavation of trenches in construction projects. Some of the ways this can be accomplished is by notifying interested parties about when a project is set to excavate a trench or by adding infrastructure for interested parties through a proposed project. The Utah Department of Transportation estimated a 15.5% per mile cost savings when conduit and fiber were installed during a road project rather than being installed independent of a road project.¹

4.1 Benefits of the Regional Communications Network

The benefits and advantages that participating agencies will gain from a regional communications network, over their existing operations and for the next decade and beyond, are numerous and include:

- A truly regional communications system that provides coverage and capacity throughout the jurisdictions of all member agencies;
- Coverage and capacity that will meet or exceed operational requirements for members and provide improvement over existing capabilities;
- Decreased reliance on a single communications system owned by a single entity;
- Enhanced redundancy for communications through the design of the regional communications backbone;
- Reuse of infrastructure assets that leverages the investments members have made in existing sites and equipment;

¹ California State Transportation Agency, "Dig Once – Policies and Best Practices."

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- Cost savings realized through leased communications cost reduction and shared costs of the regional communications network;
- Reduced duplication of costs for regional and local communications;
- Expanded opportunity for interoperability and shared control of systems (only where desired by local agencies) that can provide enhanced operational capabilities during major incidents, regional emergencies, and after hours;
- A network designed in a modular, scalable manner that allows for the addition of members as needed, necessary, and appropriate.

4.2 Potential Future Use Cases for the Regional Communications Network

Although the focus of the project is to develop a regional communications network, there are also opportunities for local agencies to benefit from the network. It is important to note that most of the case uses listed below are currently not implemented in the Bay Area outside of state-owned and maintained routes and equipment. The regional communications network would present an opportunity for agencies use the network to implement some of these strategies. Some potential use cases include:

- Sharing fiber assets to close gaps or add redundancy to an individual agency's network;
- Sharing transit related information such as route alignments and schedules along major corridors to coordinate demand and regional transit stops;
- Accessing traffic management data, such as CCTV camera feeds, along a corridor that crosses multiple jurisdictions;
- Interoperability of transportation system operations for shared control, back-up control, integrated corridor management, and/or after-hours control as desired (only where desired by participating agencies);
- More consistent and reliable communications during major incidents, emergencies, and natural disasters to facilitate the movement of traffic through the region, across jurisdictional boundaries;
- Local agency access to a regional performance metrics for arterial performance to track congestion management;
- Opportunity to integrate local transportation management strategies with regional strategies such as coordinated traffic signal timing between adjacent agencies.

The following sections have more specific explanations of four potential use cases for the regional communications network and highlight a successful example of a regional network that is in operation.

4.2.1 Traffic Signal Synchronization

Synchronization, or coordination, along a signalized corridor is an effective congestion mitigation technique. Most agencies are only responsible for coordinating signals within their jurisdiction. Many key corridors in this region pass through multiple jurisdictions, and in many situations, so does congestion along those corridors.

If agencies are able to use the regional communications network to connect adjacent transportation management centers (TMCs), they are better equipped to coordinate signal timing across jurisdictional boundaries. Agencies will be able to access real-time signal updates such as signal status (online/offline) and timing. They can update their signal timing based on the timing of adjacent agencies and troubleshoot congestion based on signal status. The regional communications network provides the infrastructure necessary to connect TMCs.

Example – Phoenix Metropolitan Area

This use case is currently being implemented in the Phoenix Metropolitan Area. Adjacent agencies are able to leverage their fiber communications network to share signal timing and synchronize traffic signals across jurisdictional boundaries. This tool is used mostly during special events.

4.2.2 Video Sharing

Traffic monitoring cameras are used by agencies to review and verify real-time traffic conditions that inform congestion mitigation decisions. Most agencies only have access to CCTV camera feeds for traffic signals in their own jurisdiction.

If infrastructure connects the TMCs of two adjacent agencies, they are able to share CCTV camera feeds. Connected agencies can make more informed decisions by accessing camera feeds along the critical corridor regardless of which agency owns/operates the camera. This is especially important during emergencies. For example, if there is a collision near an agency's jurisdictional boundary but not in their jurisdiction, they are still able to visually verify real-time traffic conditions. As a result, the agency can react efficiently by retiming their signals or updating a changeable message sign to help drivers understand real-time conditions and make better decisions.

The regional communications network could provide the infrastructure necessary to connect the two TMCs and share CCTV camera feeds near an agency's jurisdictional boundary.

Example – Phoenix Metropolitan Area

This use case is currently being implemented in the Phoenix Metropolitan Area. Adjacent agencies are able to leverage their fiber communications network to share video feeds. During special events, an agency might control signal timing and synchronize traffic signals across jurisdictional boundaries. Video sharing is used to confirm that updated traffic signal timing is relieving congestion.

4.2.3 Regional Control of Traffic Management Systems

There are many corridors throughout the Bay Area whose limits fall within multiple jurisdictions. When these corridors are not part of a State route, signal maintenance and timing are controlled by separate local agencies along the corridor. In the event of an emergency, the local agencies maintaining and operating each of the traffic signal systems would have to implement timing changes to help mitigate additional congestion. Local agencies may not have the staff needed to manage these conditions. The regional communications network could provide the infrastructure necessary to connect multiple TMCs and allow regional agencies to take control of the local agency's traffic systems when necessary.

If infrastructure connects the TMCs of agencies, the local agency can hand over controls of their traffic system to a regional agency. This connection would be especially important if there is a major incident on a freeway and vehicles are being diverted onto a corridor in a local agency's jurisdiction because the regional agency is more likely to have the resources to respond to incidents and can manage the emergency at a regional level if necessary.

Also, if a local TMC needs to be evacuated due to a natural disaster, a regional agency would be able to take control of the local traffic system. Communications infrastructure between the regional and local agency would allow the regional agency to make updates to the traffic management systems, such as updating changeable message signs and traffic signal timing, to appropriately respond to the emergencies, special events and major incidents.

Example – San Mateo County

This use case is currently being implemented in San Mateo County. Caltrans is able to take control of traffic signals along local routes which connect SR 82 and 101 to appropriately respond to the emergencies, special events and major incidents.

4.2.4 Connected and Autonomous Vehicles (CV/AV)

In addition to current technology that can be leveraged by agencies after the deployment of the regional communications network, there are also potential use cases that might arise with future technologies. CV/AV infrastructure captures location data from vehicles which are compiled at an agency's TMC. Location data includes position, speed, and other useful metrics that can be used by public agencies to

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understand traffic conditions. Hypothetically, this data transfer between vehicles and infrastructure would make traffic flow safer and more efficient.

With a regional communications network connecting the agency TMCs, agencies are able to share a CV/AV data processing system which lowers the financial barrier into investing and leveraging this technology. This potential use case can support “Smart City” initiatives throughout the region and allow agencies to be more flexible when adopting similar emerging technologies.

4.3 Communications Technology Alternatives

This section compares the proposed fiber communications infrastructure to other communications infrastructure alternatives. Costs, advantages, and disadvantages of fiber are compared to agency-owned high-bandwidth and low-bandwidth wireless, and leased communications. For each alternative, details are provided such as ease of scalability, type of supported equipment, and unit costs.

Table 3 highlights the advantages and disadvantages of the technology alternatives.

Table 3: Advantages and Disadvantages of Various Communications Technology Alternatives

Technology Name	Advantages	Disadvantages	Equipment Supported
Fiber	<ul style="list-style-type: none"> • Fastest data transmission rates and lowest latency • Reliable connection • Low recurring operations and maintenance costs • Reduces access points which increases security • Capacity only limited by end equipment - therefore most useful medium for hub-to-hub connections 	<ul style="list-style-type: none"> • High installation costs 	<ul style="list-style-type: none"> • CCTV cameras • CMS • Vehicle Detectors • Connected vehicles • Center-to-field and peer-to-peer traffic signal system • Vehicle detectors • License plate reader • Tolling systems
Low-Bandwidth Wireless Communications	<ul style="list-style-type: none"> • Provides long distance data transmission (10-20 miles) • Less prone to interference from weather or topology than High-Bandwidth Wireless Communications • Lower transmission latency 	<ul style="list-style-type: none"> • Low throughput speeds (≤ 50 Mbps) • Prone to disruption by weather or other wireless users • Requires additional poles and equipment to be installed (if not previously installed) • Cannot accommodate all equipment types 	<ul style="list-style-type: none"> • CMS • Vehicle Detectors • Connected vehicles • Peer-to-peer traffic signal system • Vehicle detectors • License plate reader • Tolling systems

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Technology Name	Advantages	Disadvantages	Equipment Supported
High-Bandwidth Wireless Communications	<ul style="list-style-type: none"> • Higher throughput speeds (≤ 300 Mbps) • Does not require a physical connection between end equipment 	<ul style="list-style-type: none"> • Prone to interference due to weather and/or other wireless signals • Limited to short distances (≤ 10 miles) • Requires additional poles and equipment to be installed (if not previously installed) 	<ul style="list-style-type: none"> • CCTV cameras • CMS • Vehicle Detectors • Connected vehicles • Center-to-field and peer-to-peer traffic signal system • Vehicle detectors • License plate reader • Tolling systems
Leased Communications	<ul style="list-style-type: none"> • Low recurring operations and maintenance costs • No or low capital costs 	<ul style="list-style-type: none"> • High recurring leasing costs • Wireless service connection may be unreliable during special events or extreme weather conditions • Wireless service can be affected by large call/data volumes • Expensive to scale because of third party rates • Current wireless services unable to support high bandwidth applications and cloud computing 	<ul style="list-style-type: none"> • CCTV cameras • CMS • Vehicle Detectors • Connected vehicles • Center-to-field and peer-to-peer traffic signal system • License plate reader • Tolling systems

To be able to compare the unit costs – it is assumed that each communications infrastructure alternative is deployed along a freeway and could potentially support 5 cabinets and 6 devices per mile (2 ramp meters, 2 vehicle detecting systems, 1 changeable message sign, and 1 CCTV camera). The costs presented in Table 4 are meant to provide a scale of comparison for the typical costs of communications infrastructure. It is important to note that the comparison below assumes that all of the different communications mediums are deployed on a freeway route. Another assumption is that the facilities have no unique conditions such as being along a bridge, in a mountainous terrain, etc. Additionally, this calculation does not reflect device density and bandwidth requirements to connect different types of devices. These values are meant to highlight only the cost differences of each technology, but when it comes to actual field deployment many more factors need to be considered. These factors were included when selecting the most appropriate technology to deploy each of the 40 proposed projects.

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Table 4 compares the unit costs of the four technology alternatives. The period of analysis is listed at 25 years to reflect the average age of a typical sharing agreement.

Table 4: Communications Technology Alternatives Cost Comparison

	Capital Cost (Per Mile)	Recurring Cost (Per Mile, Over 25 Years)	Total Unit Cost (Per Mile, Over 25 Years)
Fiber	\$ 922,000	\$ 141,000	\$ 1,063,000
LBWC	\$ 579,000	\$ 261,000	\$ 840,000
HBWC	\$ 902,000	\$ 261,000	\$ 1,163,000
Leased	\$ 15,500	\$ 342,000	\$ 357,500

Fiber infrastructure has the highest installation costs because it usually requires trenching in order to install. Smart Dig or Dig Once policies provide an opportunity to mainstream fiber infrastructure deployment and could be used to develop and expand the regional communications network. The FCC contends that the cost per mile for fiber deployment increases roughly 42% when it is not jointly deployed.² This translates to a \$273,000 per mile cost savings for fiber communications infrastructure deployment.

High-bandwidth wireless is an agency-owned infrastructure alternative that has a lower capital cost than fiber communications. Because this alternative typically involves more above-ground equipment than fiber infrastructure and is more susceptible to interference from its environment (weather, knockdowns), it has a higher maintenance cost.

Leased communications have the lowest capital cost because it is able to leverage existing communications infrastructure owned by a third party. This is an advantage for smaller agencies who do not have the budget to invest in a large construction project. Because of the monthly recurring cellular service costs associated with leasing communications, this alternative has the highest annual cost.

4.4 Return on Investment

Currently, many agencies are choosing to lease communications from private companies instead of installing their own fiber communications network. This is due to the large capital investment necessary to install conduit infrastructure. Looking at future growth and technology trends – data capacity needs will increase as more devices are added to corridors to improve congestion and safety. As data capacity needs increase, the annual cost of leasing communications increases and installing fiber could potentially become a cost-effective alternative. This section outlines a return on investment calculation proving that fiber communications can meet future data needs in a cost-efficient manner.

The return on investment calculation compares the cost of leased wireless and fiber communications infrastructure along a typical 1-mile corridor within an urban area. Bandwidth demands of typical technologies currently deployed along freeways were compared to future bandwidth needs necessary to

² Federal Communications Commission, “Connecting America: The National Broadband Plan,” 2009.

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accommodate emerging technologies such as connected/autonomous vehicles and vehicle occupancy detectors.

For existing conditions, the ROI calculation assumed connecting to 6 devices per mile. These devices include:

- 2 Ramp Meters
- 2 Vehicle Detector Stations
- 1 Changeable Message Sign
- 1 CCTV Camera

For future conditions, the ROI calculation assumed connecting to 21 devices per mile. These devices include the 6 devices mentioned in the existing conditions, as well as:

- Express Lanes equipment:
 - 2 electronic toll signs
 - 2 toll readers
 - 4 license plate reader cameras
- CV/AV equipment:
 - 2 DSRC radios
- HOV Enforcement equipment:
 - 2 Vehicle Occupancy Detection cameras
 - 2 near-infrared flashes
 - 1 laser trigger

The return on investment for fiber communications infrastructure installation drops from 30 years to 15 years when comparing existing to future bandwidth demands. In other words, even though leased wireless may require a lower capital investment compared to fiber, over time, the overall recurring costs of wireless exceed the total cost of fiber communications. Furthermore, the typical lifespan of fiber communications is estimated to be around 25 years. After recuperating costs at 15 years, agencies can potentially use the fiber for the ten years with minimal maintenance costs. Making a higher capital investment initially will result in cost savings over time without much impact to the bandwidth capacity of the overall network. The ROI calculation is summarized in Table 5.

Table 5: Return on Investment for Installing Fiber Compared to Leasing Communications

Scenario	Number of Years
Existing Conditions	30
Future Conditions	15

While end equipment is constantly getting updated, a built out fiber network will likely still be necessary to provide reliable communications in decades to come.

The return on investment is based on what is currently commercially available. There are currently downward trends in leased line costs per device and there are promising technologies, such as 5G, on the near horizon. These technologies could give us a reasonable alternative to fiber that could possibly be significantly cheaper or comparable in cost. It is important to note that even though some of these new technologies (including 5G) are on the horizon and could reduce costs, they still rely on fiber communications infrastructure to operate.

5 FUNDING OPTIONS

The following section presents potential funding sources for projects being identified in the Regional Strategic Investment Plan. The funding types identified for the proposed projects include: public funding and innovative funding sources such as public-private partnerships (P3s).

5.1 Public Funding Sources

Public funding is the primary method for funding transportation projects across the country. Potential public funding sources for proposed projects include federal, regional, state, and local funding programs. With voter approval, Counties may use a variety of local revenue streams to fund fiber communications infrastructure projects. These potential local funding sources include, but are not limited to, sales taxes, property taxes, and public transit fares. Additionally, other public funding sources related to economic development benefits or safety/emergency initiatives can be applicable to communications-type projects.

Table 6 summarizes the federal, state, and regional funding programs that could potentially be used to build out the regional communications network. Many of the listed public funding sources have common themes of strict application requirements. For instance, there is no direct connection between increased communications infrastructure improving safety or other such elements of transportation networks. In order to apply many of the funding sources discussed above, creative approaches have to be explored to attain the funding needed to carry out projects proposed under the Regional Communications Strategic Infrastructure Investment Plan. These approaches may include: combining communications infrastructure projects with other transportation improvement projects that may result in stronger applications. Examples of these types of projects include: Express Lanes systems, Integrated Corridor Management Projects, etc. To obtain additional funding for communications projects, research has been conducted into finding sources that might fund projects more creatively. This research resulted in the addition of a funding source related to cybersecurity and protection against terrorist attacks. These unique funding sources can really be used to complement the other traditional transportation funding sources to implement projects.

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Table 6: Public Funding Programs

Program	Important Dates	Projects Funded	Max Funds/ Match Limits	Additional Info
Federal Funding Programs				
Surface Transportation Block Grant Program (STBG)	Yearly application deadline	<ul style="list-style-type: none"> Operational improvements for traffic monitoring, management, and control facilities Projects for congestion pricing, including electronic toll collection and travel demand management 	<ul style="list-style-type: none"> Allocates \$11-12 billion a year of funding Federal share can vary from 80-100% 	<ul style="list-style-type: none"> STBG Information Page
Better Utilizing Investments to Leverage Development (BUILD) Grants	Yearly application deadline around Mid-July	<ul style="list-style-type: none"> Public transportation Highway projects Freight rail projects Port infrastructure improvements 	<ul style="list-style-type: none"> Max Grant: \$25 million May exceed 80% in rural areas 	<ul style="list-style-type: none"> BUILD Application
Advanced Transportation and Congestion Management Technologies Deployment (ATCMTD)	Yearly application deadline around Mid-June	<ul style="list-style-type: none"> Traveler information systems Transportation management technologies ITS integration with energy distribution and charging systems Advanced mobility technologies 	<ul style="list-style-type: none"> Projects can receive 12% of total available funds (\$12 million in Federal share of up to 50% of the cost of the project) 	<ul style="list-style-type: none"> ATCMTD Information ATCMT Deployment Initiative Application
Infrastructure for Rebuilding America (INFRA)	Application on a rolling basis	<ul style="list-style-type: none"> Highway Rail Port 	<ul style="list-style-type: none"> Can provide credit assistance amounting to 60% of project costs, Minimum grant is \$5 million 	<ul style="list-style-type: none"> INFRA Program Overview INFRA Application Information
State Funding Programs				
Senate Bill 1 (SB-1)	Varies per program	<ul style="list-style-type: none"> Managed lanes Express lanes AC Transit BRT Expansion BART Station Expansion 	<ul style="list-style-type: none"> Solutions for Congested Corridors Program (SCCP): \$250 million in SB1 funds; no match requirement Trade Corridor Enhancement Program (TCEP): \$300 million in SB1 funds; requires 30% match State Highway Operation and Protection Program (SHOPP): \$1.5 billion in available funds; N/A match requirement 	<ul style="list-style-type: none"> SB 1 Information Page SCCP Information Page TCEP Information Page ATP Information Page SHOPP Information Page
California State Transportation Improvement Program (STIP)	Submittal on December 15th of Odd Numbered Years	<ul style="list-style-type: none"> Transit and Rail Projects Managed lanes project HOT lanes 	<ul style="list-style-type: none"> Up to \$3.28 billion of funding for FY 2019 No specified match rate 	<ul style="list-style-type: none"> CTC STIP Information Page
California Transportation Commission Active Transportation Program (CTC ATP)	May 2019 Call for projects for Fiscal Years 19/20 – 22/23	<ul style="list-style-type: none"> East Bay Greenway Safe Route to School Programs 	<ul style="list-style-type: none"> \$440 million of available funds, appropriated to each CA region CTC does not require fund matching at state level 	<ul style="list-style-type: none"> CTC ATP Information Page Caltrans ATP Application
California Public Utilities Commission California Advanced Services Fund (CASF)	Accepted on a rolling basis	<ul style="list-style-type: none"> Rural city fiber installation 	<ul style="list-style-type: none"> No specified grant limit nor match limit 	<ul style="list-style-type: none"> CASF Application Process

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Program	Important Dates	Projects Funded	Max Funds/ Match Limits	Additional Info
Regional Funding Programs				
Regional Measure 3 (RM3)	Toll increase begins January 1, 2019	<ul style="list-style-type: none"> BART System Improvements Caltrain Extension MUNI Facility Improvements Express Lanes 	<ul style="list-style-type: none"> \$4.45 billion in highway and transit improvements 	<ul style="list-style-type: none"> List of RM3 Projects RM3 Infographic
Bay Area Urban Areas Security Initiative (UASI)	Deadline period during Mid-September through Mid-October Follows an annual programming cycle	<ul style="list-style-type: none"> Public Information and Warning Information Sharing Cybersecurity Interoperable Communications 	<ul style="list-style-type: none"> Up to \$30 million of available funding for fiscal year 2018 Can fund up to 100% of the project cost 	<ul style="list-style-type: none"> Bay Area UASI Proposal Guide
State Transit Assistance (STA)	Applications must be received by the 1 st of the month to be considered for that month's allocation considerations	Transit Improvements	<ul style="list-style-type: none"> Up to \$86 million of available funding for fiscal year 2018 	<ul style="list-style-type: none"> STA Allocation Requests and Audits
Service Authority for Freeways and Expressways (SAFE)	N/A	<ul style="list-style-type: none"> Service Patrol tow trucks Roadside Call Boxes Congestion-Relief Projects 	<ul style="list-style-type: none"> N/A 	<ul style="list-style-type: none"> SAFE Information Page
Innovative Deployment to Enhance Arterials (IDEA) Challenge Grant	Applications due in November 2017 (similar challenge grants may be distributed in the future but none are currently planned)	<ul style="list-style-type: none"> Traffic signal system improvements Transit improvements 	<ul style="list-style-type: none"> \$0.25-3 million Minimum local cash match of 15% Minimum in-kind match of 10% 	<ul style="list-style-type: none"> IDEA Information Page

5.2 Innovative Funding Sources

In order to maximize available resources to fund the regional communications network, it is important to explore innovative financing opportunities.

5.2.1 Loan Programs

There are federal and state funding opportunities outside of traditional grants. The funding sources below are distributed by public entities and can potentially be used to build out the regional communications network.

Transportation Infrastructure Finance and Innovation Act (TIFIA): TIFIA is not a grant or traditional funding program but is a credit assistance program awarded to qualified projects of regional or national significance. TIFIA credit assistance is available to ITS projects of at least \$15 million and the credit assistance is limited to 33% of the total eligible project costs. The interest rate for TIFIA projects are typically around 3% for urban projects and would decrease by half for rural projects. Repayment for TIFIA projects can be deferred for 5 years after the project's completion, the loan must be fully repaid after 25 years from the first payment.

Grant Anticipation Revenue Vehicles (GARVEEs) Bond Program: This bond program allows the State Treasurer to issue bonds and the CTC to select projects to fund. This program's goal is to accelerate construction of critical projects that will provide congestion relief benefits. Projects such as managed lanes and traffic synchronization improve congestion and potentially include in the installation of fiber communications infrastructure. The bonds have a 12-year maximum term. Applicants must be a transportation planning agency or county transportation commission. Other public agencies may apply jointly with a regional agency.

Transportation Finance Bank (TFB) Loan Program: TFB is a loan program implemented by CTC and Caltrans to provide flexible, short-term financing to public entities and public-private partnerships. Highway construction and transit capital projects are eligible, both of which could potentially include communications infrastructure. Loans are available for any phase of a project. The borrower must agree to provide collateral by pledging county shares and submit a financial plan that includes the source and timing of the repayment. The interest rate will be 1% below the three-month Treasury Bill Average Auction rate, except it shall not be lower than 1%.

State Highway Account (SHA) Loan Program: This loan program makes short-term loans to public agencies in order to advance the capital improvement phase of STIP eligible projects. STIP projects include managed lanes which could potentially include installation of fiber communications infrastructure. The project must cost more than \$10 million. An independent fiscal consultant will complete a fiscal assessment to determine whether an agency can repay a loan. Interest rates will be set at the rate paid in the State Treasurer's Pooled Money Investment Account when the money is loaned.

5.2.2 Public Private Partnerships (P3)

P3s provide alternate funding sources in which a private agency provides funding in exchange for the use of public resources. P3s may be mutually beneficial to both the public and private sector depending on the responsibilities that each party is accountable for. Depending on the funding source, there could be limitations on the use of existing communications infrastructure, such as disallowance of leasing to the private sector. Existing arrangements between public agencies and private entities might need to be considered when entering a new partnership. This section presents a selection of noteworthy successful fiber optic P3s which provide creative solutions for fiber ownership. Most P3 projects follow a procurement process in which an agency issues a request for proposals or request for qualifications and private entities bid to win the contract. Below are examples of successful public-private partnerships.

Sonoma Marin Area Rail Transit (SMART) and Sonic – Sonic and SMART used a public private partnership to share the capital cost of conduit infrastructure in SMART's right-of-way. Sonic has non-exclusive conduit access and installed new fiber cable. Some of the fiber strands are dedicated to

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SMART to be used by local agencies near its right-of-way. Sonic provides 24/7/365 emergency maintenance.

City of San Leandro and Lit San Leandro – Lit San Leandro has non-exclusive conduit access to the City’s existing conduit. In exchange, Lit San Leandro has installed new fiber cable in the city-owned conduit. Some of Lit San Leandro’s fiber strands are dedicated to the City. Lit San Leandro is responsible for installation, operation, maintenance, security, replacement and repair of the fiber cable. The City of San Leandro is responsible for inspection, maintenance, repair, and security of the conduit and vaults/pull boxes.

Utah Department of Transportation (UDOT) – UDOT trades assets with telecommunications companies by allowing companies to use their excess conduit in exchange for access to the company’s conduit where the state does not have broadband infrastructure. Trades occur by the lineal foot of conduit for 30 years with automatic 5-year renewals. UDOT has doubled its conduit infrastructure network through trading. The agency owns 900 miles of conduit and has access to 1000 additional miles of conduit through trades.

Massachusetts Department of Transportation (MassDOT) and Massachusetts Bay Transportation Authority (MBTA) – MassDOT and the MBTA are teaming up to provide developers, providers, and carriers with an infrastructure sharing financing program managed by the Office of Real Estate and Asset Development. This financing program provides third parties the opportunity to install fiber or other communications elements within MassDOT or MBTA facilities that have available capacity. In addition, this financing program provides third party users the opportunity to install their own infrastructure within MassDOT or MBTA owned land. The financing program provides annual rates at a per linear foot or per strand multiplier basis that is broken down by facilities located in tunnels, urban, suburban, or exurban areas.

6 COMMUNICATIONS INFRASTRUCTURE SHARING

A shared regional communications network would result in long-term cost savings by leveraging investments made in existing infrastructure and eliminating monthly recurring leased line costs. Other benefits include but are not limited to: decreased reliance on a single communications system owned by one agency, increased coverage and capacity, and enhanced redundancy.

The project team gathered and reviewed 26 sharing agreements from various agencies and to inform the best practices and recommendations outlined in this Section. The agreements addressed sharing of construction costs, existing communications infrastructure sharing, and operations and maintenance sharing. None of the reviewed agreements included any provisions or discussions about what kind of data could be or would be shared within their respective networks. This Section discusses sharing communications infrastructure and not the potential data sharing that could potentially occur over the regional communications network.

6.1 Case Study: Phoenix Regional Community Network

The Phoenix Regional Community Network (RCN) is a pertinent example of shared, regional fiber infrastructure. This network is used by regional and local agencies in the Phoenix area to manage congestion. Local agencies own the physical fiber communications infrastructure. The Maricopa Association of Governments (MAG) leases the infrastructure from local agencies for regional communications purposes. In this example, the agencies divide their maintenance efforts into the following two categories:

- Physical infrastructure – fiber, conduit, and pull boxes
- Active electronics – switches and servers

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Because the local agencies own the physical infrastructure they are responsible for its regular maintenance and repair in the event of damage. MAG is responsible for maintaining the active electronics in addition to running an annual test of the fiber to confirm continuity and document bandwidth loss. MAG maintains the active electronics at a total of 19 nodes throughout the Phoenix area. Their annual maintenance budget is \$50,000, which equates to approximately \$2,600 per node.

While the annual maintenance cost of a regional communications network is highly variable and based on network topology, a high-level planning cost estimate can be calculated for the Bay Area. There are 18 nodes in the Bay Area assuming one node at every transit center, transportation management center, and express lane operator connection as proposed in the Plan. Based on the Phoenix Regional Community Network, that would amount to \$46,800 for the annual maintenance budget for active electronics in the Bay Area.

The MAG maintenance budget does not include lifecycle cost of active electronics. It can be assumed active electronics includes one aggregation switch (\$25,000/unit) and three local switches (\$10,000/unit) per node. Assuming each unit has a lifecycle of 5 years, that is an additional cost of \$11,000 per year per node. With 18 nodes in the Bay Area this adds an additional \$198,000 to the annual maintenance cost, summing to a total of \$244,800 annual maintenance budget for active electronics in the Bay Area.

6.2 Findings and Best Practices

A number of key elements in the agreements were relatively consistent throughout the review. Key themes included cost allocation, and roles and responsibilities. Other critical elements deal with payment amount and structure, along with general roles and responsibilities of the parties involved. The following is a summary of best practices from the sharing agreements.

6.2.1 Usage Fees and Cost Sharing

License and usage fees are collected by the infrastructure-owning entities and levied against entities using the infrastructure. These fees were rarely charged in situations where a public agency owned the infrastructure, and a separate public agency shared/used that infrastructure. The fees were typically applied in scenarios where a private entity used public facilities, or vice versa. Usage Fees should specify who the leasing agency(ies) and the owning agency(ies) are along with the licensing fees. Licensing fees should be specified in terms of a dollar sum, agreement to share equipment, or share ROW. All prorated fees, compounded fees and interest accrued on licensing fees should be explicitly stated. Shared equipment or shared ROW must specify the item's location and/or type. Fiber owners/lessors should specify the cost of exchanged fiber strands per quantity, and/or length of the exchanged fiber strands.

Cost sharing was the more typical approach in scenarios where all the parties to the agreement are public agencies. In these cases, the infrastructure was usually already in place, and the agreements addressed how the agencies would handle the costs of infrastructure maintenance. In some cases, only Agency A was actually responsible for coordinating maintenance activities, while Agency B and Agency C simply paid into a pooled fund to help cover the cost of maintenance incurred by Agency A.

6.2.2 Roles and Responsibilities

Roles and responsibilities were consistently described in these agreements. Agreements include language noting each party and its responsibilities. Ownership, maintenance and security responsibilities should be specified and assigned to avoid confusion in future duties. Owners/lessors specify the limitations of access to ROW or infrastructure.

Under the "Mutual Agreements" section, owners/lessors list any agreements that may affect both parties. This section should state the term of the agreement (and include termination and extension language),

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extent of third-party agreements, reserved sections for future amendments, options to default, applicable laws and rules and indemnification.

6.2.3 Service Level Definitions

These definitions were not typically included in the agreements reviewed. However, if included, service level definitions should specify the agency responsible for repairs/maintenance during a service outage. Owners should specify their response time for temporary service repairs and time to fully recover the system. Leasing agencies may need to include language to permit access to physical locations during service outages. Service level agreements may include rebates for the leasing agency.

6.2.4 Securing Infrastructure

Network data security is a broad and complicated field. Most agencies/entities have their own network security protocols that they are comfortable with given agency resources, the type of data a particular agency transmits over a network, and other agency preferences.

Physical security, dealing with how communications network infrastructure in the field should be secured, was more commonly addressed in these agreements although, this topic was seldom addressed. Physical security requirements should focus on securing conduit, pull boxes, and network equipment cabinets, where appropriate.

6.2.5 Governance

Governance structures for shared infrastructure networks were wide-ranging. Most of the scenarios and agreements that were reviewed for this task did not include a formal governance structure. In nearly all cases, the agreements were one-offs used to define a party's responsibility for maintaining and operating communications infrastructure in a narrowly-defined geographic location. The Phoenix-area RCN has a governance structure in which MAG, the local MPO, manages and operates the network built out by the Arizona Department of Transportation. The agencies using the RCN in the Phoenix area are responsible for maintaining and repairing the network infrastructure within their jurisdiction.

6.3 Recommendations

Based on the agreements that were reviewed, and best practices gleaned from those agreements, initial recommendations were developed and applied to a potential regional communications network. These initial recommendations are intended to be a basis for further discussion and are not in any way binding to any agency or entity. Several elements, such as payment obligation and governance, need to be addressed on a local level and will be further defined by stakeholders. Prior to the implementation of regional communications network, detailed network design, such as capacity analysis, will be necessary.

6.3.1 Boilerplate Sharing Agreement

A boilerplate sharing agreement was created based on research of local and national sharing agreements. The sections and language contained within the boilerplate sharing agreement were developed from a thorough study of the contents of each of the existing agreements that were reviewed. It is recommended that stakeholders use this boilerplate agreement to facilitate their negotiations regarding sharing fiber communications infrastructure.

This document can be found in Appendix B and is a template to be used as a tool to facilitate inter-agency conversations about sharing communications infrastructure. Once applied to a specific project, this sharing agreement will be subject to legal review by all involved stakeholders. Details will be mutually agreed upon by all involved stakeholders on a case-by-case basis.

6.3.2 Development of Policies

Given that much of the physical network infrastructure that was proposed in the Implementation Plan has not been constructed, consideration for regional communications infrastructure should be included in

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project development phases such as initial development, scoping, and permitting. To mainstream the deployment of fiber communications on behalf of the regional communications network, we recommend the following two policies:

- **Smart Dig policy:** Agencies are required to install fiber communications infrastructure on behalf of the regional communications project if their limits overlap or are parallel with a project proposed in the final Bay Area Regional Broadband Communications Strategic Investment Plan. The governing body of the regional communications network will pay only incremental costs, such as, additional conduit added. Currently, no governing body has been established. Sample Smart Dig ordinances that have been approved in the City of San Francisco and City of South San Francisco are attached in Appendix C.
- At a minimum, it is recommended that the regional communications network infrastructure includes 12 strands of fiber, 1-4" conduit, and Caltrans No. 6E pull boxes. To align with Caltrans' vision of having four communications conduits along their right-of-way, any project proposed along their right-of-way should install 4-4" conduit and splice vaults. It is current practice to separate Caltrans fiber cables which serve TMS elements from cables that serve other purposes. Conduit should be installed at a minimum depth of 48", with consideration to required utility clearance, to avoid service disruption due to construction activity. Pull boxes and splice vaults should be installed per latest Caltrans specifications. A decision tree of technical recommendations for incorporating communications infrastructure into project design was developed to aide project sponsors (See *Figure 5 and 6*). Actual specifications may be project specific.

In addition to developing policies to support the installation of new regional communications network infrastructure, strategies are recommended to protect existing regional communications network infrastructure against damage due to third-party activities (e.g., damage to the system caused by a contractor doing work adjacent to the regional communications network conduit). Examples of these strategies include:

- Bond requirements to cover fiber damage
- Liquidated damage penalties incurred after damage to infrastructure
- Detailed mapping and inventory of fiber optic infrastructure through a common database with accurate GIS mapping of existing fiber and conduit infrastructure

All proposed projects must adhere to relevant, existing policies. For example, projects in Caltrans right-of-way must adhere to Caltrans' current Broadband Policy.

6.3.3 Infrastructure Financing

Many traditional funding sources, such as grants, are rarely focused on projects that solely deploy communications infrastructure. As a way to expand the potential source of funding to complete the construction of network infrastructure, the region may need to consider non-traditional funding sources. Public-private partnerships are a unique opportunity that allow public agencies to leverage private funds for public benefit. There is a high level of interest in the region from private companies looking to access public right-of-way to expand privately-owned fiber communications networks. With proper planning, infrastructure built under these arrangements could account for a significant portion of the ultimate regional network. MassDOT and the MBTA have partnered up in the greater Boston area to create one of these types of agreements, which allows third party agencies to use their land and infrastructure for communications-based projects. Public-private partnerships are not the only recommended funding source for proposed projects, but they do serve as a unique opportunity to leverage private funds for public benefit.

6.3.4 Usage Fees and Cost Sharing

The current vision for this network is to be primarily used for the public's benefit. After the capital costs for network building, the most significant costs will be on-going maintenance. In order to keep the regional

communications network in a state of good repair, one proposal is for the participating agencies to combine resources to maintain the network, ensuring network connectivity. An example of an agreement to consider is a pooled fund approach fund approach where each agency pays a comparative amount into a single fund that is used by the lead agency to administer maintenance activities that impact the regional network.

6.3.5 Roles and Responsibilities

The roles and responsibilities of each agency will be critical and will be more comprehensively defined once a governance structure has been decided. One of the major roles of this governance structure will be to protect the assets – we recommend the governing body of the regional communications network maintain a physical layer monitoring system that is a current inventory of all facilities and mark them appropriately when there is nearby construction. At this stage of the Bay Area Regional Broadband Communications Strategic Investment Plan the governing body has not been identified. It is also recommended that maintenance permits allow entities to perform maintenance on communications infrastructure outside of right-of-way.

6.3.6 Securing Infrastructure

None of the agreements that were reviewed detailed network security requirements. We recommend that network security requirements for a shared network be addressed at the individual agency level and not in the sharing agreement itself. In other words, any network firewalls should exist on the enterprise side of the regional network. This will eliminate the possibility of agencies potentially having two different types of security policies to adhere to. In addition, we recommend that configuration management best practices be implemented to ensure that any changes to network equipment are documented and accessible to all network users.

Physical infrastructure security should also continue to follow current practices based on where the infrastructure is being built. For example, Caltrans' current policy is to bury communications pull boxes. We recommend that any new regional communications network infrastructure being built along Caltrans right-of-way continue to be built under those protocols.

7 NEXT STEPS

On a local level, the recommendations made in this document require the support and participation of stakeholders to define. The regional communications network cannot be built out without the continued involvement from stakeholders. Stakeholders are a critical part of the future deployment of this network. To continue to gain momentum on the development and deployment of this network, it is recommended that MTC distributes this document to all public agencies, including those that may not actively involved in its development.

Although MTC and other regional agencies can use this as a framework for strategic investment, local agencies are encouraged to utilize traditional and innovative funding sources to fund proposed projects. Stakeholders are encouraged to integrate communications in all stages of project development. It is crucial to the success of the regional communications network for different agencies and departments to coordinate and leverage their investments.

Figure 8 shows a roadmap for future steps necessary to implement the regional communications network. Some steps have been completed as part of this initiative, but a variety of steps are still required before a network is actually implemented. We anticipate that the plan will be distributed to all stakeholders by the end of 2019.

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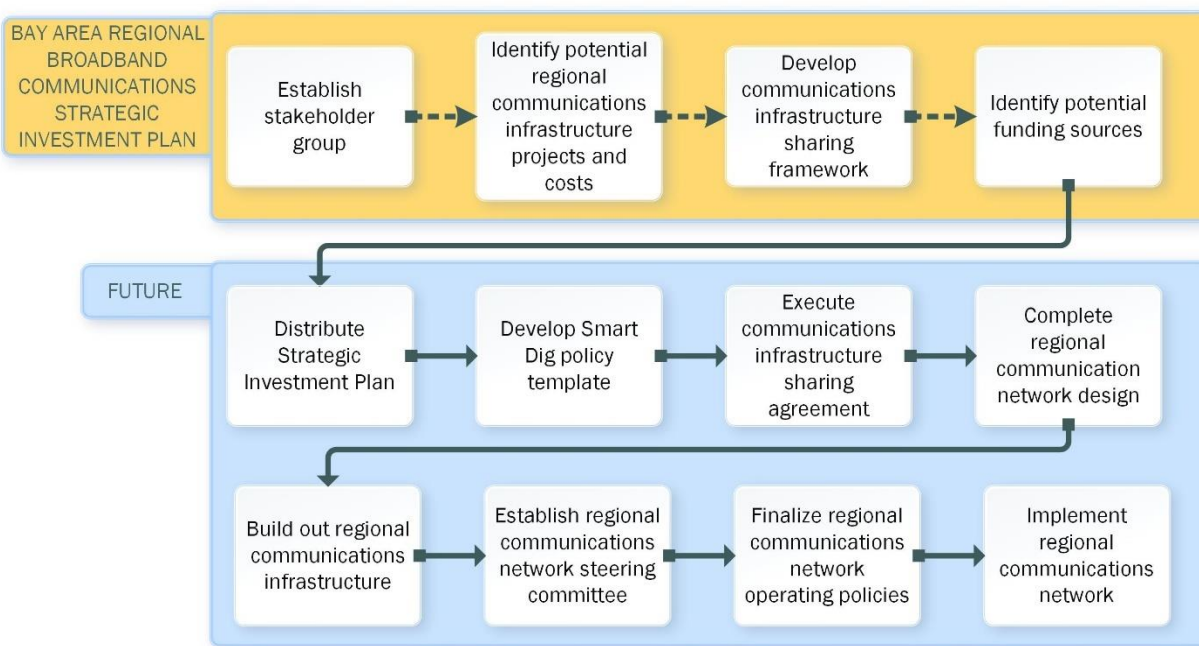


Figure 8: Implementation Road Map

Per the implementation road map, a tangible next step for the stakeholder group is to develop a Smart Dig policy template that can be used by local agencies. Sample Smart Dig ordinances that have been approved in the City of San Francisco and City of South San Francisco are attached in Appendix C. Once established, it is recommended that a regional communications network steering committee meet annually.

Table 7 outlines the roles and responsibilities of the stakeholder group moving forwards. All agencies can identify opportunities to build out the communications network and promote Smart Dig policies in their jurisdiction. Regional agencies can incorporate communications policies in funding guidelines. MTC will pilot a block grant program.

Table 7: Stakeholder Roles and Responsibilities

Role	Responsible Agency
Identify opportunities to build out the communications network	<ul style="list-style-type: none"> • Caltrans • MTC • County Transportation Agencies • Local Cities and Counties
Promote a Smart Dig policy	<ul style="list-style-type: none"> • Caltrans • MTC • County Transportation Agencies • Local Cities and Counties
Incorporate communications policies in funding guidelines	<ul style="list-style-type: none"> • Caltrans • MTC • County Transportation Agencies
Pilot block grant program – “InterConnect Bay Area Challenge Grant”	<ul style="list-style-type: none"> • MTC

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At the statewide level, Caltrans Headquarters is currently working on a study that is set to revise policies related to communications deployment and best practices with the goal of preparing for the deployment of future emerging technologies. One of the areas of focus for this study is Smart Dig policies. Development of Smart Dig policies will help mainstream fiber communications infrastructure deployment and could be used to develop and expand the regional communications network. It is suggested that agencies develop best practices for procuring communications network infrastructure. An example of how this can be done includes:

- Shared procurement options: Emerging transportation-based technologies can be expensive to deploy. By having a regional communications network, local agencies may have the opportunity to deploy some of these emerging technologies at a lower cost. Depending on the licensing capacity of these emerging technologies, several agencies may be able to deploy equipment using a single license. The regional communications network would allow these agencies to share communications using a single system. This is an opportunity for agencies to deploy new and innovative equipment while saving costs. The shared procurement options also give agencies the possibility of negotiating for prices based on a regional level, which could result in better prices and warranties to help agencies incur more cost savings.

The regional communications network also presents an opportunity for agencies to share resources. Examples of this include sharing of CCTV camera video feeds and control of traffic signal systems during significant events. The sharing of resources is especially of important for those agencies that may be constrained at the staff level and require more support to operate some of their existing systems. To make this sharing of resources a possibility, participating agencies will need to develop MOUs which include provisions about capital spending and operation and maintenance costs. The development of a sound MOU will not only help agencies to manage the sharing of resources, it will also encourage other agencies to participate in the development and deployment of the regional communications network.

The details of day-to-day regional communications network management and funding are to be determined. Detailed design parameters (e.g. infrastructure security, thorough as-built documentation, pull box spacing) will be defined as each project moves into implementation. An overall detailed communications network plan will be necessary to successfully implement the network. This plan will need to include information about the size of fiber installed and the location, as well as, where active electronics will be installed. The regional communications network cannot be built out without completing this detailed network plan. Many proposed projects include agencies sharing infrastructure; for those situations, it is important to develop asset protection and maintenance guidelines to protect investments.

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8 APPENDICES

Appendix A: Existing and Planned Fiber Infrastructure Inventory

Table 1: Existing Infrastructure Along Highways

Corridor	Limits		Owner	Purpose
	Beginning	Ending		
I-880	Hegenberger Road, Oakland	Dixon Landing Road, Milpitas	Caltrans/BAIFA	Express Lanes
I-680	Benicia - Martinez Bridge	I-580	Caltrans/BAIFA	Express Lanes
I-580	I-680	Greenville Road, Livermore	Caltrans/ACTC	Express Lanes
I-580	Richmond Bridge – San Rafael	Richmond Bridge - Richmond	Caltrans	
I-80	Bay Bridge - Yerba Buena Island	Bay Bridge Toll Plaza - Oakland	Caltrans	
US 101	SR 84	Marsh Rd, Atherton	Caltrans/CCAG	Smart Corridors
US 101	Halleck St, San Francisco	Golden Gate Bridge – San Francisco	Caltrans	
SR 92	San Mateo Bridge - Foster City	San Mateo Bridge - Hayward	Caltrans	
SR 87	Capitol Expy	I-880	Caltrans	
SR 84	Dumbarton Bridge - Palo Alto	Dumbarton Bridge - Fremont	Caltrans	
SR 84	Dumbarton Bridge, Palo Alto	El Camino Real, Redwood City	Caltrans/CCAG	Smart Corridors
SR 82	San Bruno Ave, San Bruno	Willow Rd, Palo Alto	Caltrans/CCAG	Smart Corridors
SR 82	Elmwood Drive, Saratoga	Southbay Freeway, Sunnyvale	County of Santa Clara	

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Table 2: Planned Infrastructure Along Highways

Corridor	Limits		Owner	Purpose
	Beginning	Ending		
I-680	SR 262	SR 84	Alameda CTC	Express Lanes
I-680	SR 84	Alcosta Blvd, San Ramon	Alameda CTC	Express Lanes
I-680	Benicia - Martinez Bridge	Rudgear Rd, Walnut Creek	CCTA	Express Lanes
I-680	Bollinger Canyon Rd, San Ramon	Ygnacio Valley Road, Walnut Creek	CCTA	Bus on Shoulder
I-80	Bay Bridge Toll Plaza	I-580	Caltrans	SFOBB Metering Lights Upgrade
I-80	Manual Campos Parkway, Fairfield	Leisure Town Rd, Vacaville	Caltrans/STA	Express Lanes
US 101	Grand Ave, South San Francisco	Embarcadero Road, Palo Alto	Caltrans	Managed Lanes Project
US 101	Santa Clara County Line	I-880	Caltrans/VTA	Express Lanes
SR 237	N. Mathilda Ave, Sunnyvale	Zanker Rd, San Jose	Caltrans/VTA	Express Lanes
SR 85	US 101	SR 237	Caltrans/VTA	Express Lanes
SR 85	SR 87	US 101	Caltrans/VTA	Express Lanes
SR 37	SR 121	Napa River	NVTA, SCTA, TAM, STA	State Route 37 Resilient Corridor Program

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Appendix B: Boilerplate Sharing Agreement

**FIBER INFRASTRUCTURE SHARING AGREEMENT
BETWEEN THE METROPOLITAN TRANSPORTATION COMMISSION (MTC) AND _____**

This Fiber Use Sharing Agreement (“Agreement”), dated for reference purposes as of _____, by and between the METROPOLITAN TRANSPORTATION COMMISSION, the regional metropolitan planning organization (MPO) for the San Francisco Bay Area (hereinafter “MTC”), and _____ (hereinafter “_____”), collectively referred to as the “Parties”.

(1) Recitals.

WHEREAS, Owner controls, owns or has the right to allow use of fiber optics and communications facilities;

WHEREAS, Owner and MTC desire to establish a framework under which they can make their respective communications facilities available to the parties involved in this Agreement;

NOW, THEREFORE in consideration of the mutual covenants and benefits stated herein, and in further consideration of the obligations, terms and considerations hereinafter set forth and recited, Owner and MTC agree as follows:

(2) Definitions.

(a) “Annex” is defined as an agreement made pursuant to this Agreement that may be subsequently executed and delivered by the Parties.

(b) “Fiber” is defined as strands of single mode optical dark fiber.

(c) “Fiber Access Point” is defined as any appropriate facility designated under an Annex for connection of Owner Fiber to User Fiber.

(d) “Owner” is defined as the Party that owns, controls or has the right to allow use of Owner Facilities.

(e) “Owner Facilities” is defined as telecommunications facilities a Party controls, owns, or has the rights to allow use of that such Party makes available for use by the other Party pursuant to an Annex including but not limited to, towers or other structures for radio transmitting and receiving equipment and other associated equipment, cables, wires, utility connections, communication towers, antennas, equipment, buildings, fencing, conduits, fiber optic cable trays, Fiber Access Points and other accessories, other improvements, and electronic and telecommunications transmissions lines.

(f) “Owner Fiber” is defined as Fiber that is party of Owner Facilities.

(g) “Party” is defined as MTC or Owner as applicable.

(h) “User” is defined as the Party that uses Owner Facilities hereunder.

(i) “User Facilities” is defined as telecommunications facilities a Party owns, controls, or has the right to allow use of. These facilities are connected to or used in connection with such Party’s use of Owner Facilities of the other Party; including, but not limited to, towers or other structures for radio transmitting and receiving equipment and other associated equipment, cables, wires, utility connections, communications, towers, antennas, equipment, buildings, fencing, conduits, fiber optic cable trays, Fiber Access Points and other accessories, other improvements, and electronic and telecommunications transmission lines.

(j) “User Fiber” is defined as Fiber that is part of the User Facilities.

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(3) Term of License.

(a) The term of this agreement shall commence as of the date in which this Agreement receives both signatures and shall expire on _____. After the expiration or termination of this Agreement, the Parties may not enter into new Annexes.

(b) The term of each Annex under this Agreement shall commence and expire on the dates specified in such Annex.

(c) If the term of any Annex extends beyond the date of the expiration or of the termination of this Agreement, the terms and conditions of this Agreement shall continue to apply to such Annex until its expiration or other termination.

(d) Either Party may, upon written notice to the other Party, abandon use of some or all of Owner Facilities used by it under an Annex.

(e) The User shall have the option, provided it is not then in default under this Agreement, to extend the initial term of this Agreement for one _____ period. Wherever the context of this Agreement so requires, the word "Term" shall be deemed to include the initial term and the extended term for which the User has exercised its option.

(4) Payments and Charges. Unless otherwise provided in an Annex, no payments or charges will be payable by either Party to the other Party.

(5) Owner Rights Granted to User. Unless otherwise explicitly provided in an Annex, the rights granted by Owner to User hereunder include:

(a) User exclusive rights to use Owner Fiber that is identified in an Annex. An Exhibit to the Annex will validate to User that Owner controls, owns or otherwise has the right to grant use of the specified Owner Fiber to User;

(b) User nonexclusive rights to use Owner Facilities that are identified in an Annex. The Annex will validate to User that Owner controls, owns or otherwise has the right to grant use of the specified Owner Facilities.

(6) Owner Rights Not Granted to User. Unless otherwise explicitly provided in an Annex, the rights granted by Owner to User hereunder do not include:

(a) Any right or interest in Owner Fiber, the cables containing Owner Fiber, the Fiber Access Points, or any other portion of Owner Facilities, other than the right to use the foregoing in accordance with this Agreement;

(b) Any right or access or entry to Owner's premises, except as provided in Section 7;

(c) Any right to install equipment on Owner's premises.

(7) Reasonable Access to Owner Facilities. Owner shall allow user to have reasonable access to Fiber Access Points, applicable Owner Facilities and any User Facilities located on Owner's premises. User shall provide Owner with reasonable advance notice of intent to enter and shall comply with Owner's access procedures as they may exist from time to time. Specific access rules may be included in an Annex, if desired by the Parties.

(8) Fiber Access Points. Unless otherwise explicitly provided in an Annex, the following terms apply to each Fiber Access Point that is shared with the User;

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FINAL PLAN**

(a) User has the right to route an access cable into the Fiber Access Point (using a conduit, if appropriate) for splicing to Owner Fiber in the Fiber Access Point, as shown on drawings to be attached to each Annex. User's access cable or conduit may, if necessary, cross Owner's premises along a route specified by Owner.

(b) User acknowledges that it has sole responsibility for obtaining any third party or governmental easement, license, or other permission that may be necessary to bring an access cable to any Fiber Access Point hereunder.

(9) Ownership and Use. As between the Parties, it is agreed that:

(a) Owner Facilities are and shall remain the property or under the control of Owner, or Owner does have and shall maintain a right to allow use of Owner Facilities, and User shall have no right, title, or interest herein or any component thereof, other than the right to use the same in accordance with the provisions of this Agreement;

(b) User Facilities are and shall remain the property or under the control of User, or User shall maintain a right to allow use of User Facilities, and Owner shall have no right, title, or interest therein or any component thereof, except as provided in this Agreement or an Annex.

(10) Maintenance and Repair of Owner Facilities.

(a) Owner shall, at Owner's expense, perform all maintenance and repairs necessary to keep Owner Facilities in good condition and repair and in compliance with all applicable federal state, and local laws, rules, and regulations. Owner agrees to retain the services of qualified personnel or contractors to conduct such maintenance and repairs.

(b) User shall, at User's expense, perform all maintenance and repairs necessary to keep the designated User Facilities in good condition and repair and in compliance with all applicable federal, state, and local laws, rules, and regulations. User agrees to retain the services of qualified personnel or contractors to conduct such maintenance and repairs.

(c) In the event of a service interruption caused by physical damage to a communications cable containing any of the Owner Fiber, Owner shall cause such damage to be repaired expeditiously by Owner's contractor. Under normal circumstances, Owner's contractor will be required to commence work to diagnose the interruption within (4) hours after receipt of notice of interruption, subject to obtaining Owner's permission to access the area where work is required. Owner will use commercially reasonable efforts to allow such access. However, where BART is the Owner, much of the Owner Fiber is located within the operating envelope for BART trains; and access to Owner Fiber in such locations may be limited to the hours during which there is no scheduled train service, and such limitation may affect response times.

(d) In the event both Owner's operational facilities and Owner Fiber require maintenance or repair, the restoration of Owner Fiber shall be at all times subordinate to the restoration of Owner's operational facilities. Notwithstanding the foregoing, Owner shall permit repairs to Owner Fiber to proceed, so long as such activities do not interfere with Owner's operation, maintenance, or repair activities.

(11) Provisioning and Testing of Owner Fiber. As between the Parties and unless explicitly amended in an annex, it is agreed that:

(a) Owner shall provision and test Owner Fiber and shall provide written test results to User.

(b) The specifications for provisioning and testing Owner Fiber are as follows:

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Testing end-to-end measurement will be conducted for Owner Fiber between designated end points from both directions using an industry-accepted laser sources and power meter. At 1550 nanometers there should be not more than .30 loss per Km.

(c) Owner's obligations under this Section 11 shall be satisfied when Owner Fiber meets the specifications set out in Section 11(b).

(12) Miscellaneous Provisions.

(a) Neither Party shall be liable to the other Party hereunder or in connection with the transactions contemplated hereunder, whether in contract or in tort, for indirect, incidental exemplary, punitive, consequential or other special damages (including lost profits), whether or not such damages are foreseeable or unforeseeable.

(b) Neither Party shall be in default hereunder if the performance of any act required of it hereunder is prevented or delayed by reason of events contingencies or causes beyond its reasonable control and without its fault including, but not limited to:

- (i) fire, flood, earthquakes, lightning, unusually severe weather
- (ii) acts of God
- (iii) acts of any governmental authority (outside the control of the applicable party)
- (iv) war, riot, accidents, embargoes, strikes, labor disputes
- (v) shortage of labor, fuel, raw materials, or machinery
- (vi) technical or yield failure, affecting such part or its suppliers or subcontractors

(c) Neither Party may assign this Agreement, or delegate any of its duties hereunder, without the prior written consent of the other Party, which consent shall not be unreasonably withheld. For the purposes of this Section 12 (c), the use of a contractor to perform work required under Sections (5) through (11) or an Annex shall not constitute a delegation of duties.

(d) All notices under this Agreement shall be in writing and shall be deemed validly given if sent by mail or national-recognized courier and shall be effective upon receipt. If any such notice or communication is not received or cannot be delivered due to a change in the address of the receiving party of which notice was not previously given to the sending party or due to a refusal to accept by the receiving party, such notice or other communication shall be effective on the date delivery is attempted.

(e) This Agreement shall be governed by and construed under the laws of the State of California, excluding its choice of law principles.

(f) Nothing contained in this Agreement is intended to create or shall in any event or under any circumstance be construed as creating, a partnership or a joint venture between the Parties.

(g) Nothing in this Agreement is intended to create any rights in any third parties.

(h) If any provision of this Agreement is determined by a proper court to be invalid, illegal or unenforceable, such invalidity, illegality, or unenforceable shall not affect the other provisions of this Agreement and this Agreement shall remain in full force an effect without such invalid, illegal, or unenforceable provision.

(i) If either party institutes any action or proceeding to enforce any of the provisions of this Agreement, then the prevailing party in any such action or proceeding shall be entitled to receive from the losing party the prevailing part's reasonable attorney's fees and disbursements and costs incurred in connection with such action or proceeding.

(j) This Agreement, including any Annex hereto, constitutes the entire agreement and understanding between the Parties with respect to the transactions contemplated hereby, and supersedes all prior

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FINAL PLAN**

agreements and understandings, whether oral or written, between the Parties with respect to the subject matter hereof.

(k) This Agreement may not be amended except by written instrument executed by both Parties.

(l) No waiver of any provision of this Agreement or any breach of this Agreement shall be effective unless such waiver is in writing and signed by the waiving Party. Any such waiver shall not be deemed a waiver of any provision of this Agreement or any other or subsequent breach of this Agreement.

(m) The Annexes executed by the Parties from time to time pursuant to this Agreement are hereby incorporated into this Agreement. This Agreement shall benefit and bind the Parties and their respective permitted successors and assigns. This Agreement may be executed in counterparts, each of which shall be an original, but all of which shall constitute one and the same Agreement.

IN WITNESS WHEREOF, the parties have caused their duly authorized representatives to execute this Agreement

[FIBER OWNER]
[FIBER OWNER AGENCY]
ESTABLISHED PURSUANT TO _____.

METROPOLITAN TRANSPORTATION
COMMISSION,
ESTABLISHED PURSUANT TO _____.

By: _____

By: _____

Date: _____

Date: _____

Appendix C: Sample Smart Dig Ordinances

See next page.

1 [Public Works Code - Installation of Communications Infrastructure in Excavation Projects]

2 **Ordinance amending the Public Works Code to require the installation of City-owned**
3 **communications infrastructure in excavation projects where the City has determined**
4 **that it is both financially feasible and consistent with the City's long-term goals to**
5 **develop the City's communications infrastructure.**

6 NOTE: **Unchanged Code text and uncodified text** are in plain Arial font.
7 **Additions to Codes** are in *single-underline italics Times New Roman font*.
8 **Deletions to Codes** are in ~~*strikethrough italics Times New Roman font*~~.
9 **Board amendment additions** are in double-underlined Arial font.
10 **Board amendment deletions** are in ~~strikethrough Arial font~~.
11 **Asterisks (* * * *)** indicate the omission of unchanged Code
12 subsections or parts of tables.

13 Be it ordained by the People of the City and County of San Francisco:

14 Section 1. The Public Works Code is hereby amended by revising Section 2.4.4, to
15 read as follows:

16 **SEC. 2.4.4. DEFINITIONS.**

17 For purposes of this Article, the following terms shall have the following meanings:

18 (a)—"Agent" shall mean a person or persons authorized to assist an owner in the
19 permitting process or in the performance of an excavation.

20 (b)—"Applicant" shall mean an owner or duly authorized agent of such owner, who
21 has submitted an application for a permit to excavate.

22 (c)—"Article" shall mean this Article 2.4 of the Public Works Code.

23 (d)—"Block" shall mean that part of the public right-of-way that includes the street
24 area from the property line to the parallel property line in width and extending from the
25 property line of an intersecting street to the nearest property line of the next intersecting street
in length. For purposes of this definition, an intersection also shall be considered a "block."

1 (e)—"City" shall mean the City and County of San Francisco.

2 "City communications infrastructure" shall mean conduits, pull boxes, and other facilities that
3 are used by the City to provide communications services.

4 (f)—"Department" shall mean the Department of Public Works.

5 "Department of Technology" shall mean the Department of Technology or any successor City
6 agency that is responsible for managing City communications infrastructure.

7 "Department of Technology Requirements" shall mean the Department of Technology's
8 regulations implementing the Department of Technology's participation in excavation projects by
9 installing City communications infrastructure.

10 (g)—"Deposit" shall mean any bond, cash deposit, or other security provided by the
11 applicant in accordance with Section 2.4.40 of this Article.

12 (h)—"Director" shall mean the Director of the Department of Public Works or his or
13 her designee.

14 (i)—"Excavation" shall mean any work in the surface or subsurface of the public
15 right-of-way, including, but not limited to opening the public right-of-way; installing, servicing,
16 repairing or modifying any facility(ies) in or under the surface or subsurface of the public right-
17 of-way, and restoring the surface and subsurface of the public right-of-way.

18 (j)—"Facility" or "facilities" shall include, but not be limited to, any and all cables,
19 cabinets, ducts, conduits, converters, equipment, drains, handholds, manholes, pipes,
20 pipelines, splice boxes, surface location markers, tracks, tunnels, utilities, vaults, and other
21 appurtenances or tangible things owned, leased, operated, or licensed by an owner or person,
22 that are located or are proposed to be located in the public right-of-way.

23 "Incremental cost" shall mean the cost associated with adding City communications
24 infrastructure to an excavation project, including the cost of the materials needed by the City and any
25 additional labor costs.

1 ~~(k)~~—"Large excavation project" shall mean any excavation of more than 1000 square
2 feet.

3 ~~(l)~~—"Major work" shall mean any reasonably foreseeable excavation that will affect
4 the public right-of-way for more than 15 consecutive calendar days.

5 ~~(m)~~—"Medium excavation project" shall mean any excavation of more than 100 but no
6 greater than 1,000 square feet.

7 ~~(n)~~—"Moratorium street" shall mean any block that has been reconstructed, repaved,
8 or resurfaced by the Department or any other owner or person in the preceding five-year
9 period.

10 ~~(o)~~—"Municipal excavator" shall mean any agency, board, commission, department,
11 or subdivision of the City that owns, installs, or maintains a facility or facilities in the public
12 right-of-way.

13 ~~(p)~~—"Owner" shall mean any person, including the City, who owns any facility or
14 facilities that are or are proposed to be installed or maintained in the public right-of-way.

15 ~~(q)~~—"Permit" or "permit to excavate" shall mean a permit to perform an excavation as
16 it has been approved, amended, or renewed by the Department.

17 ~~(r)~~—"Permittee" shall mean the applicant to whom a permit to excavate has been
18 granted by the Department in accordance with this Article.

19 ~~(s)~~—"Person" shall mean any natural person, corporation, partnership, any municipal
20 excavator, or any governmental agency, including the State of California or United States of
21 America.

22 ~~(t)~~—"Public right-of-way" shall mean the area across, along, beneath, in, on, over,
23 under, upon, and within the dedicated public alleys, boulevards, courts, lanes, roads,
24 sidewalks, spaces, streets, and ways within the City, as they now exist or hereafter will exist
25 and which are or will be under the permitting jurisdiction of the Department of Public Works.

1 ~~(u)~~—"Responsible party" shall mean the owner for each excavation involving the
2 owner's facility or facilities. In addition, it shall mean any person who performs an excavation
3 or has a duty or right to manage or participate in the management of an excavation and whom
4 the Director designates as responsible, in whole or in part, for such excavation.

5 ~~(v)~~—"Sidewalk" shall mean the area between the fronting property line and the back
6 of the nearest curb.

7 ~~(w)~~—"Small excavation project" shall mean any excavation of 100 square feet or less.
8 "Standard City communications infrastructure specifications" shall mean the type, size, and
9 quantity of conduits, the size and frequency of pull boxes, and any other facilities that the Department
10 of Technology determines are necessary to serve the City's communications needs.

11 ~~(x)~~—"Utility excavator" shall mean any owner whose facility or facilities in the public
12 right-of-way are used to provide electricity, gas, information services, sewer service, steam,
13 telecommunications, traffic controls, transit service, video, water, or other services to
14 customers regardless of whether such owner is deemed a public utility by the California Public
15 Utilities Commission.

16
17 Section 2. The Public Works Code is hereby amended by revising Section 2.4.13, to
18 read as follows:

19 **SEC. 2.4.13. TRANSIT, PEDESTRIAN, BICYCLE, ~~AND~~ STORMWATER, AND**
20 **COMMUNICATIONS INFRASTRUCTURE IMPROVEMENTS AS PART OF PLANNING,**
21 **CONSTRUCTION, RECONSTRUCTION, AND REPAVING PROJECTS.**

22 (a) Whenever the Department or other Municipal Excavator undertakes a project
23 involving the planning, construction, reconstruction, or repaving of a public right-of-way, such
24 project shall include, to the maximum extent practicable and feasible, the following transit,
25 pedestrian, bicycle, and stormwater, and communications infrastructure improvements:

- 1 (1) Street and pedestrian-scale sidewalk lighting;
- 2 (2) Pedestrian and bicycle safety improvement measures, as established in
3 any official City adopted bicycle or pedestrian safety plan or other City adopted planning
4 documents;
- 5 (3) Appropriate access in accordance with the Americans with Disabilities
6 Act;
- 7 (4) Public transit facilities accommodation, including, but not limited to
8 designation of the right-of-way as a transit preferential street designation or bus rapid transit
9 corridor;
- 10 (5) Traffic calming devices;
- 11 (6) Landscaping;
- 12 (7) Low-impact design stormwater facilities consistent with the Stormwater
13 Design Guidelines;
- 14 (8) Other pedestrian and streetscape elements listed as appropriate to the
15 relevant street type as identified and defined in the Better Streets Plan; *and*
- 16 (9) Other street and sidewalk improvements consistent with the City's
17 "Transit First" Policy" (Section ~~16.102~~ 8A.115 of the City Charter) and "Better Streets Policy"
18 (~~Chapter Section~~ Section 98.1 of the ~~San Francisco~~ Administrative Code); *and*
- 19 (10) Communications infrastructure.

20 (b) The Director, in consultation with the Directors of the San Francisco Municipal
21 Transportation Agency, Department of Public Health, Planning Department, Department ~~on~~*of*
22 the Environment, San Francisco Public Utilities Commission, Department of Technology, and
23 Mayor's Office on Disability shall develop orders, regulations, or amendments to the
24 Department's Standard Plans and Specifications that address the improvements set forth in
25 Subsection (a).

1 (c) To the maximum extent practicable and feasible, the Director shall condition all
2 excavation and street improvement permits on the inclusion of the improvements set forth in
3 Subsection (a). If such conditions would exceed the Director's regulatory authority, the
4 Director shall coordinate with other City departments to provide, to the maximum extent
5 practicable and feasible, said improvements on behalf of the City. As part of the decision on
6 any permit or authorization pursuant to the Public Works Code, the Director shall take into
7 account the permit activity's positive and negative impacts on the integration, enhancement,
8 or preservation of the improvements set forth in Subsection (a).

9
10 Section 3. The Public Works Code is hereby amended by adding Section 2.4.14, to
11 read as follows:

12 **SEC. 2.4.14. COORDINATION WITH DEPARTMENT OF TECHNOLOGY.**

13 (a) "Dig Once." To facilitate the Department of Technology's efforts to develop City
14 communications infrastructure, and limit excavation in the public right-of-way, an applicant for a
15 permit under Section 2.4.10 for the installation of underground conduits shall comply with the
16 requirements of this Section 2.4.14.

17 (b) Notice Required.

18 (1) An applicant for a permit to install underground conduits shall notify the
19 Department of Technology of its application in the manner set forth in the Department of Technology
20 Requirements at least 14 days before submitting the application to the Department.

21 (2) Notice is only required when the minimum length of the proposed
22 excavation will be at least 900 linear feet, or such longer distance as the Department of
23 Technology may establish in the Department of Technology Requirements.

24 (c) Approval of Application.

1 (1) Where the Department of Technology Will Participate. The Department may
2 approve an application and issue a permit if the Department finds that all of the following have
3 occurred:

4 (A) The applicant has complied with the Department of Technology
5 Requirements for notice of its application;

6 (B) The Department of Technology has not notified the applicant and the
7 Department that the Department of Technology will not participate in the proposed excavation project;
8 and

9 (C) The applicant has submitted plans consistent with the standard City
10 communications infrastructure specifications.

11 (2) Where the Department of Technology Will Not Participate. The Department
12 may approve an application and issue a permit if the Department finds that both of the following have
13 occurred:

14 (A) The applicant has complied with the Department of Technology
15 Requirements for notice of its application; and

16 (B) The Department of Technology has notified the applicant and the
17 Department that the Department of Technology will not participate in the proposed excavation project.

18 (d) Denial of Application. The Department shall deny an application for a permit if the
19 Department determines that the applicant has failed to comply with the Department of Technology
20 Requirements.

21 (e) Applicant's Incremental Costs. The Department of Technology shall be responsible for
22 the applicant's incremental costs when the Department of Technology participates in an excavation
23 project by installing City communications infrastructure.

24 (f) Exception. The requirements of this Section 2.4.14 shall not apply to an application for
25 an emergency permit under Section 2.4.22.

1 Section 4. The Public Works Code is hereby amended by adding Subarticle IX,
2 Sections 2.4.95, and 2.4.96, and 2.4.97, to read as follows:

3 **SUBARTICLE IX**

4 **OBLIGATIONS OF THE DEPARTMENT OF TECHNOLOGY**

5 **SEC. 2.4.95. INSTALLATION OF CITY COMMUNICATIONS INFRASTRUCTURE.**

6 (a) Need for City Communications Infrastructure. The Department of Technology shall
7 consider adding City communications infrastructure to any permit issued for an excavation project
8 under this Article 2.4 to create more efficient delivery of communications services to the public and for
9 the City's needs.

10 (b) Response to Notice. Upon receipt of a notice issued pursuant to Section 2.4.14 that a
11 utility or municipal excavator intends to apply for an excavation permit to install underground conduit,
12 the Department of Technology shall review the application to determine whether it is both financially
13 feasible and consistent with the City's long-term goals to add City communications infrastructure to the
14 proposed excavation project.

15 (1) If the determination is affirmative, the Department of Technology does not need
16 to notify the applicant and the Department that the Department of Technology intends to
17 participate in the excavation project. The presumption will be that the Department of Technology
18 will participate in the excavation project by requiring the excavator to installing City
19 communications infrastructure.

20 (2) If the determination is negative, the Department of Technology shall notify the
21 applicant and the Department in the time required by within 7 days of issuance of the notice that
22 the Department of Technology does not intend to participate in the excavation project.

23 **SEC. 2.4.96. DEPARTMENT OF TECHNOLOGY REQUIREMENTS.**

24 (a) Adoption of Requirements. The Department of Technology, in consultation with the
25 Department, shall by order develop and implement the Department of Technology Requirements. The

1 Department of Technology shall use a process to adopt the Department of Technology Requirements
2 that ensures that municipal excavators, utility excavators, and the general public have a meaningful
3 opportunity to comment on the provisions to be contained therein before they are formally adopted by
4 the Department of Technology.

5 (b) Purpose of Requirements. The Department of Technology Requirements shall specify
6 the manner in which the Department of Technology will participate in excavation projects by installing
7 City communications infrastructure that meets the City's needs at a reasonable cost.

8 (c) Minimum Requirements. At a minimum, the Department of Technology Requirements
9 shall contain the following procedural and substantive requirements for the installation of City
10 communications infrastructure in excavation projects:

11 (1) The process for the Department of Technology to review planned excavation
12 projects in a timely manner to determine if City participation is feasible and to verify its participation
13 by informing the applicant and the Department within 7 days of receiving notice;

14 (2) The criteria to be used by the Department of Technology to decide whether to
15 decline to participate in excavation projects;

16 (3) The standard technical specifications for City communications infrastructure;

17 (4) The standard methodology for determining the incremental costs associated with
18 installing City communications infrastructure in excavation projects;

19 (5) The requirements and process for excavators to seek exemptions from using the
20 City's standard methodology for determining incremental costs when installing standard City
21 communications infrastructure in excavation projects; and

22 (6) Alternative methodologies for determining the City's incremental costs when
23 exemptions are granted.

24 **SEC. 2.4.97. REPORTING REQUIREMENTS.**

1 The Department of Technology shall file quarterly reports with the Board of Supervisors
2 and Mayor containing the following information: (a) the number of excavation permits issued
3 by the Department for projects meeting the criteria for Department of Technology participation
4 set forth in Section 2.4.14(b)(2); (b) the locations of the excavations identified in the
5 excavation projects; (c) the identities of the applicants for the excavation permits; (d) whether
6 the Department of Technology received any objections to its participation in the excavation
7 projects from the municipal or utility excavators submitting the applications; (e) whether the
8 Department of Technology opted to participate in the excavation projects by installing City
9 communications infrastructure; (f) the City's costs to participate in the excavation projects by
10 installing City communications infrastructure; and (g) the status of the installation of City
11 communications infrastructure in the excavation projects.

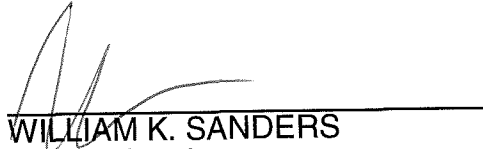
12
13 Section 5. Effective Date. This ordinance shall become effective 30 days after
14 enactment. Enactment occurs when the Mayor signs the ordinance, the Mayor returns the
15 ordinance unsigned or does not sign the ordinance within ten days of receiving it, or the Board
16 of Supervisors overrides the Mayor's veto of the ordinance.

17
18 Section 6. Scope of Ordinance. In enacting this ordinance, the Board of Supervisors
19 intends to amend only those words, phrases, paragraphs, subsections, sections, articles,
20 numbers, punctuation marks, charts, diagrams, or any other constituent parts of the Municipal
21 Code that are explicitly shown in this ordinance as additions, deletions, Board amendment
22 additions, and Board amendment deletions in accordance with the "Note" that appears under
23 the official title of the ordinance.

1 Section 7. Department of Technology Implementation. The Department of Technology
2 shall adopt the order required by Section 2.4.96 of the Public Works Code within 90 days of
3 the effective date of this ordinance.
4

5 APPROVED AS TO FORM:
6 DENNIS J. HERRERA, City Attorney

7
8 By:


9 WILLIAM K. SANDERS
Deputy City Attorney

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City and County of San Francisco

Tails Ordinance

City Hall
1 Dr. Carlton B. Goodlett Place
San Francisco, CA 94102-4689

File Number: 130412

Date Passed: October 28, 2014

Ordinance amending the Public Works Code to require the installation of City-owned communications infrastructure in excavation projects where the City has determined that it is both financially feasible and consistent with the City's long-term goals to develop the City's communications infrastructure.

October 06, 2014 Land Use and Economic Development Committee - AMENDED, AN AMENDMENT OF THE WHOLE BEARING SAME TITLE

October 06, 2014 Land Use and Economic Development Committee - RECOMMENDED AS AMENDED

October 21, 2014 Board of Supervisors - PASSED, ON FIRST READING

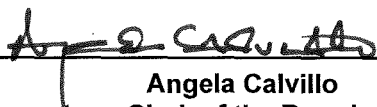
Ayes: 11 - Avalos, Breed, Campos, Chiu, Cohen, Farrell, Kim, Mar, Tang, Wiener and Yee

October 28, 2014 Board of Supervisors - FINALLY PASSED

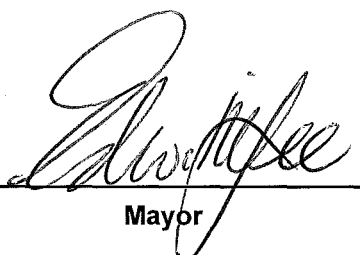
Ayes: 11 - Avalos, Breed, Campos, Chiu, Cohen, Farrell, Kim, Mar, Tang, Wiener and Yee

File No. 130412

I hereby certify that the foregoing Ordinance was FINALLY PASSED on 10/28/2014 by the Board of Supervisors of the City and County of San Francisco.



Angela Calvillo
Clerk of the Board



Mayor



Date Approved



City of South San Francisco

P.O. Box 711 (City Hall, 400
Grand Avenue)
South San Francisco, CA

Legislation Text

File #: 18-957
Version: 1

Agenda Date: 1/9/2019
Item #: 11a.

Ordinance amending Section 13.04 of the South San Francisco Municipal Code, adding Section adding Chapter 13.40 of the South San Francisco Municipal Code pertaining to open trench notification and telecommunication infrastructure improvements.

WHEREAS, broadband services provides fast, reliable and high quality links to the Internet, and is a necessity for residents and businesses in the City of South San Francisco (“City”); and

WHEREAS, high quality broadband service supports economic and educational development, and promotes equal access to opportunities and a higher standard of living; and

WHEREAS, broadband service and advanced telecommunications infrastructure is also essential for the City to perform its governmental functions, provide emergency services, and sustain many other municipal operations; and

WHEREAS, the City owns and maintains an extensive system of streets, sidewalks, and other infrastructure in the public right of way; and

WHEREAS, the paving and surfaces of the public right of way infrastructure are significantly reduced each time construction work involving excavation is performed thereupon;

WHEREAS, construction work involving excavations also creates significant traffic congestion and presents numbers safety issues;

WHEREAS, the City is responsible for acting in the public interest and preserve its investment in streets and public infrastructure; and

WHEREAS, the City desires to provide incentives for collaborative projects in the right of way to reduce the present and long-term impact of construction and excavation work on City streets and sidewalks; and

WHEREAS, the City also desires to minimize disruption to traffic and pedestrian access, and to encourage infrastructure development, including broadband and other telecommunications infrastructure; and

WHEREAS, the City maintains a citywide broadband network that supports all aspects of municipal operations, which requires constant upgrades to meet increasing demands; and

WHEREAS, the City desires to proactively develop this its broadband network and resources to support a growing population and economy; and

WHEREAS, the City has the authority to issue discretionary permits and other types of authorizations for construction projects in the public right of way, and to create development standards;

WHEREAS, to effectuate its intents described herein, the City is proposing to amend the South San Francisco Municipal Code to create an “open trench” notification requirement.

NOW, THEREFORE, based on the entirety of the record before it, as described below, the City Council of the City of South San Francisco does hereby ordain as follows:

SECTION 1. The City Council of South San Francisco finds that all Recitals are true and correct and are incorporated herein by this reference.

SECTION 2. Chapter 13.04 “Excavation and Construction on Public Property Regulated” is hereby amended to read as follows (with text in ~~strikeout~~ indicating deletion and double underline indicating addition). Sections and subsections that are not amended by this Ordinance are not included below, and shall remain in full force and effect.

...

13.04.010 Encroachment permit required.

A. It is unlawful for any person, firm, corporation or other association of any description not otherwise under written contract to the city for such purpose to make, or cause to be made, any construction or excavation in, over or under the surface of any public street, lane, sidewalk or other public place for the installation, repair or removal of any pipe, conduit, duct or tunnel, or telecommunications or utility infrastructure or improvements, or for any other purpose, without first obtaining from the department of public services an encroachment permit to make such excavation. The director of public services, before issuing such a permit, shall require:

...

SECTION 3. Title 13, “Public Improvements” of the South San Francisco Municipal Code is hereby amended by adding Chapter 13.40, “Open Trench Notification and Telecommunication Infrastructure Improvements,” to read as follows:

Chapter 13.40

OPEN TRENCH NOTIFICATION AND TELECOMMUNICATION INFRASTRUCTURE IMPROVEMENTS

13.40.001 Purpose.

The city council finds and determines that the requirements and conditions in this chapter are necessary for the following reasons:

- (a) To encourage the systematic development of telecommunications infrastructure and in turn maximize the availability of telecommunication and broadband service to residents and businesses within the city.
- (b) To protect and control access to the public right-of-way, and to extend the life of city streets and other civil infrastructure, and reduce the cost of ongoing maintenance by encouraging cooperation between utility

companies, public agencies, and city departments.

(c) To streamline and simply the process of installing and upgrading telecommunications equipment throughout the city, and to encourage the improvement and modernization of the city's telecommunication infrastructure.

13.40.002 Definitions.

As used in this chapter, the following terms shall have the following meanings:

- a) "Applicant" means an individual or entity submitting an encroachment permit application for an excavation project pursuant to section 13.40.003.
- b) "Public right-of-way" or "ROW" shall mean the area across, along, beneath, in, on , over, under, upon, and within the dedicated public alleys, boulevards, courts, lanes, roads, sidewalks, spaces, streets, and ways within the city.
- c) "Conduit" refers to a tube, duct, structure, or other device designed for enclosing telecommunication wires or cables.
- d) "Enhanced Remediation" means any and all standards and/or processes established by the Public Works Director that are intended to serve the purpose of ensuring that excavations performed in an area where an Open Trench Notification process has been completed will include all work necessary to restore the area to its original or enhanced condition prior to the excavation.
- e) "Excavation" refers to any process which breaks up or removes material from the ground through any digging, drilling, boring or other activity for the purpose of installing underground utilities, infrastructure, structures, or other equipment.
- f) "Facilities" and "Infrastructure" refer to wires, cables, conduit, switches, transmission equipment or other equipment for use in transmitting or processing telecommunications services or for providing support or connection to such equipment.
- g) "Open Trench Notification" shall mean the notification process set forth under Section 13.40.004.
- h) "Service providers" refers to any person, company, corporation or other entity providing data, voice, cable, video or other information services by wire, fiber optic cable or other technology.
- i) "Telecommunication" refers to data, voice, video or other information provided by wire, fiber optic cable or other technology.

13.40.003 Open Trench Notification Triggered for Excavation Projects.

(a) The Public Works Director shall determine, upon receipt of an encroachment permit application for an excavation project pursuant to Section 13.04.010 or approval of specifications for a public works project, that if either criteria in subsection (i) or (ii) below are met:

(i) The application or specification involves utility infrastructure construction, road construction or resurfacing, or other work that will result in an excavation that could reasonably include, or prepare for, the installation of broadband conduit, or is part of the Information Technology Strategic Plan.

(ii) It spans 900 feet or three city blocks within the ROW, or involves terrain that is difficult or expensive to traverse (e.g. a bridge), or is an element of a larger project that will require installation or upgrading of utility infrastructure.

(b) If an encroachment permit application for an excavation project or approval of specifications for a public works project satisfies either subsection (i) or (ii) above, the applicant shall be required to comply with the Open Trench Notification as provided in Section 13.40.004.

(c) The Public Works Department shall initiate the Open Trench Notification process by delivering notice and instructions for participation in accordance with the requirements of provided in Section 13.40.004.

13.40.004 Notification Process.

(a) In compliance with section 13.40.005, all Service Providers and third parties interested in collocating conduits and telecommunication facilities in the project excavation area shall inform the Public Works Department of the interest to participate in the manner set forth in subsection (a) of section 13.40.005 from the date of an Open Trench Notice issued pursuant to subsection (b) of this section.

(b) The Public Works Director, in consultation with the Information Technology Department, shall develop and implement an Open Trench Notification Policy, as may be amended from time to time, that establishes the standards and processes to carry out the intent and requirements of this chapter.

(c) At a minimum, the Open Trench Notification Policy shall include the following:

(i) The procedure by which the Public Works Department will initiate the Open Trench Notification process for each qualified excavation project pursuant to subsection (b) of section 13.40.003.

(ii) The procedure for receiving, processing, and reviewing of notices of intent to participate from interested Service Providers and third parties for collocation of conduits and telecommunication facilities in the project area.

(iii) The timeline for interested Service Providers and third parties to submit notices of intent to participate in collocation work and delivering notices received to the project applicant.

(iv) The criteria for determining whether responses received from interested Services Providers and third parties for collocation work are competent and may be forwarded to the applicant.

(v) The procedure for receiving, processing, and reviewing of any protests regarding negotiations

between the parties for collocation of conduits and telecommunication facilities in the project area.

(vi) The criteria for determining whether the information provided in support of a protest sufficiently demonstrate that further negotiation is appropriate, and the timeline for such further negotiation if warranted.

13.40.005 Response to Open Trench Notifications

(a) Services Providers and third parties interested in participating in the open trench collocation pursuant to section 13.40.004 shall submit a notice of intent to participate to the Public Works Department within 30 days of an Open Trench Notice issuance. The notice of intent shall contain sufficient information to constitute a competent response to be forwarded to the project applicant pursuant to subsection (c)(iv) of section 13.40.004.

(i) Responses to open trench notifications shall be forwarded to the project applicant. The applicant is responsible for negotiating collocation of conduits and/or other telecommunication facilities with any interested third parties for the project location.

(ii) Protests regarding negotiations between the parties for collocation work and any information in support thereof may be submitted to the Public Works Department. The Public Works Department shall be responsible to determine whether the information provided sufficiently demonstrate that further negotiation is warranted.

(b) The Information Technology Department Director shall designate staff to receive notifications of pending excavation projects, broadband-related work, and other encroachment permit applications that are subject to the Open Trench Notification process.

(c) The Information Technology Director shall determine whether to submit a response to the Open Trench Notification for collocating conduits or telecommunication facilities at the project location, by considering the following:

(i) The collocation of city-owned conduit in a given project is consistent with the Information Technology Strategic Plan, or will support the achievement of other city objectives.

(ii) The incremental installation cost is reasonable.

(iii) The cost of maintaining the conduit over time is proportionate to its value to the city.

(iv) Sufficient funds are available within existing budgets, or can be obtained from other sources.

(v) Collocation should be pursued in furtherance of overall city goals and priorities, the collocation makes sense.

(d) If the Information Technology Director submits a response to the Open Trench Notification for collocation work, the Information Technology Director or his designee shall attempt to negotiate an acceptable agreement with the project applicant. If negotiation is successful, the Information Technology Department shall coordinate

the design and construction of the collocation work with the Public Works Department, including whether installation of facilities in addition to conduits would be necessary.

(e) Any conduits or telecommunication facilities collocated pursuant to subsection (b) shall be the property of the City.

(f) The Information and Technology Department shall maintain a geodatabase of communications assets located within or connecting to the city, including but not limited to:

- (i) city-owned conduit and appurtenant facilities;
- (ii) fiber optic cable;
- (iii) towers and tower sites;
- (iv) communications facilities and services belonging to third parties that are used by the city;

(v) real estate, poles, and other city-owned assets leased to third parties for telecommunication purposes.

(vi) Third party network data provided to the City in conjunction with such leases or permitting processes, or as may become available through other means, including but not limited to a future electronic plans submission program, or as collected by other agencies or provided by telecommunications companies.

13.40.006 Compliance with the Open Trench Notification Process; Enhanced Remediation.

(a) The Open Trench Notification Process shall be deemed complete if no responses were received from interested parties pursuant to subsection (a) of section 13.40.005, or if the applicant has negotiated collocation of conduits and/or other telecommunication facilities with any interested third parties pursuant to subsection (a) of section 13.40.005.

(b) The Open Trench Notification Process shall also be deemed complete if either party to the collocation negotiation required herein submits a protest to the Public Works Department regarding the negotiation, and the Public Works Department determines that, pursuant to subsection (c) of section 13.40.004 and based on the information provided to it, further negotiation is inappropriate or not warranted.

(c) The Public Works Director shall not approve any project application that is subject to the Open Trench Notification process and requirements of this chapter unless an application has satisfied the Open Trench Notification requirements established herein. A project that has satisfied the requirements of this chapter may be approved by the Director, subject to other applicable requirements and authorizations in the most current editions of the City's Municipal Code or any applicable public works construction standards, to allow permitted work to commence.

(d) After an application has been approved, any subsequent excavation work or project by the applicant or any other Service Provider or third party in the project area shall be subject to Enhanced Remediation requirements

for five years following the completion or abandonment of such subsequent work or project. Enhanced Remediation may include general standards or standards specific to an excavation. The Public Works Department shall adopt policies and guidelines to set forth such Enhanced Remediation requirements consistent with the intents of this chapter.

13.40.007 Implementation.

Within 60 days after this chapter takes effect, the city shall email, fax, mail or deliver a copy of it to telecommunications service providers and other affected entities doing business within the city.

13.40.008 Waivers.

(a) In the event of an emergency or urgent conditions that require immediate action, or for other good cause relating to the public health, safety or welfare, the Public Works Director may waive or modify, in whole or in part, the Open Trench Notification requirements established by this chapter.

(b) The Public Works Director may exempt projects from the requirements of this chapter where compliance has been determined by the Public Works Director to be not practical or feasible. Requests for an exemption shall be made in writing and the Public Works Director's decision shall be final. A request for exemption shall include all information necessary for the Public Works Director to make a decision, including but not limited to documentation showing factual support for the requested exemption. The Public Works Director may approve the exemption request in whole or in part, with or without conditions.

13.40.009 Violations

Violations of this chapter is hereby declared to be a public nuisance. Any violation of this chapter shall be subject to abatement by the city, as well as any other remedies that may be permitted by law for public nuisances, and may be enforced by injunction, upon a showing of violation.

13.40.010 No Conflict with Federal or State Law.

Nothing in this chapter shall be interpreted or applied so as to create any requirement, power, or duty in conflict with nay Federal or State law.

SECTION 4. Severability

If any provision of this Ordinance or the application thereof to any person or circumstance is held invalid or unconstitutional, the remainder of this Ordinance, including the application of such part or provision to other persons or circumstances, shall not be affected thereby and shall continue in full force and effect. To this end, provisions of this Ordinance are severable. The City Council of the City of South San Francisco hereby declares that it would have passed each section, subsection, subdivision, paragraph, sentence, clause, or phrase hereof irrespective of the fact that any one or more sections, subsections, subdivisions, paragraphs, sentences, clauses, or phrases be held unconstitutional, invalid, or unenforceable.

SECTION 5. Publication and Effective Date

Pursuant to the provisions of Government Code section 36933, a summary of this Ordinance shall be prepared by the City Attorney. At least five (5) days prior to the Council meeting at which this Ordinance is scheduled to be adopted, the City Clerk shall (1) publish the Summary, and (2) post in the City Clerk's Office a certified copy of this Ordinance. Within fifteen (15) days after the adoption of this Ordinance, the City Clerk shall (1) publish the summary, and (2) post in the City Clerk's Office a certified copy of the full text of this Ordinance along with the names of those City Council members voting for and against this Ordinance or otherwise voting. This Ordinance shall become effective thirty (30) days from and after its adoption.

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