ALAMEDA
County Transportation
Commission

ALAMEDA COUNTYWIDE MULTIMODAL ARTERIAL PLAN

FINAL SUBMITTED OCTOBER 2016 BY

FEHR & PEERS

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Table of Contents

Chapters

Figures

Appendices

Acknowledgements

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- Iteris: Pages 4-12, 4-13.
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- San Pablo Avenue Specific Plan: Page 3-9 (top).

Executive Summary

The Alameda Countywide Multimodal Arterial Plan (MAP) is the product of an unprecedented effort to address the needs and mobility of all modes on the county's arterial roadways. The MAP envisions a robust system of transportation options operating on a continuous and connected countywide network for each mode that better supports adjacent land uses. The MAP seeks to increase travel options and therefore the arterial network's throughput by expanding the number of people it serves via all modes, while supporting local jurisdictions' Complete Streets and economic development efforts. The plan explains the purpose of and critical need for such a robust system and describes the visionary and very collaborative Plan development process and its outcome.

Complete Streets

Over the past decade, the Complete Streets movement has revolutionized transportation planning by considering how all modes use roadways collectively. This trend, supported by State, regional and countywide legislative and policy requirements, encourages jurisdictions to look at how transit, walking, biking, driving and goods movement can coexist on the same streets. Cities, including Alameda, Emeryville and Fremont in Alameda County, have already developed local Complete Streets plans, but no plan before has taken on the challenge of balancing the needs of and prioritizing these modes based on local context on a countywide roadway network, particularly one with as varied and complex land use and roadway types as Alameda County's. The MAP can serve as a framework for jurisdictions to develop individual complete street plans, while understanding and planning for connectivity of all modes across jurisdictional boundaries.

Alameda County context

This ground-breaking effort was commissioned by Alameda CTC, a joint powers agency that plans, funds and delivers a broad spectrum of transportation projects and programs that serve all modes throughout Alameda County. The county's transportation system plays a central role in supporting the region's economic vitality and overall livability. By way of its central location in the Bay Area, the county's transportation system supports a significant share of Bay Area trips made by all transportation modes, most notably automobile, transit and goods movement.

Alameda County's freeway system suffers excessive congestion, causing the arterial network to serve as the backbone for both regional and local traffic, and sometimes as a bypass alternative to congested freeways. Arterials are an essential component of our transportation systems, which serve all modes and connect communities with each other, the regional transportation network, and employment and activity centers, while having a local function, context and character. In Alameda County, arterials carry about 40 percent of daily traffic volumes.[1] Unlike freeways, which have a dedicated function in facilitating longer distance vehicle trips, or collector and local streets, which are designed to facilitate local trips and provide access to individual properties, arterials serve a wide range of functions across all modes serving competing demands. In light of projected growth in employment and population (and the cohort of senior citizens), it is critical to consider innovative approaches to managing Alameda County's arterial network.

MAP development process

The strength of the Alameda Countywide Multimodal Arterial Plan lies in its bottom-up approach, which has built on the prior planning efforts of local agencies and Alameda CTC, and robust stakeholder engagement throughout the Plan development process (see Figure E.1). The Plan used the findings of already-adopted plans as a basis for its proposals, including Alameda CTC's Countywide Transportation, Transit, Pedestrian, Bicycle and Goods Movement plans and local pedestrian, bicycle and complete streets plans.

Alameda CTC worked extremely closely with the owners and operators of the arterials – the cities, the County and Caltrans – and the transit operators that operate buses on them. There were over 65 meetings held over the course of the MAP development, including planning area-level meetings with local jurisdictions, transit agencies and Caltrans, meetings with non-agency stakeholders, discussions with Alameda CTC's Technical Advisory (ACTAC) and Planning, Policy & Legislation (PPLC) committees, a set of one-on-one and small group meetings with each of the county's 15 jurisdictions, transit agencies and Caltrans, and eight public open houses.

The technical output generated by this ground-breaking effort began the conversation about how to reallocate available roadway right-of-way among competing modes. The robust technical efforts of the MAP were based on the need to better understand the

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1 Alameda CTC Countywide Travel Demand Model

function of the county's arterials in serving all modes and supporting surrounding land uses, which triggered significant data collection and analysis. Plan development included the pioneering typology process, which defines roadways based on their adjacent land uses and the unique requirements of transit, walking, bicycling, driving and goods movement; the resulting multimodal arterial network; and the modal priorities on each segment of that network, which led to the creation of continuous, connected networks for all modes. This effort formed the foundation of an approach to identify a list of short- and long-term multimodal transportation improvements on the county's arterial network and operational strategies including advanced ITS to accommodate projected population growth and travel demand in Alameda County.

The project team received over 1,000 comments on various aspects of the Plan. These comments, which largely leverage local knowledge and understanding to refine inputs and conclusions of the MAP's technical processes, have enriched the Plan and are a strong indication of the level of support local partners have for the Plan. Wherever comments received from local agencies, transit operators or Caltrans conflicted with the Plan's technical output, local knowledge was respected and their comments incorporated, while ensuring connectivity and continuity of the network. The improvements proposed in this Plan represent the product of this interaction: technical results adapted, where needed, to reflect local context while still maintaining the broader corridor- and county-level consistency. At the same time, it was impractical for a countywide plan addressing over 500 miles of arterials of countywide significance to include local community meetings to review specific roadway segments or proposed projects. Therefore, jurisdictions will need to plan community-based processes at the local level to confirm the desire for and plan the design of individual improvements. While the MAP provides a framework for multimodal arterial improvements, more detailed review of local conditions will likely lead jurisdictions to build on this framework to further expand on and refine the Plan's proposals.

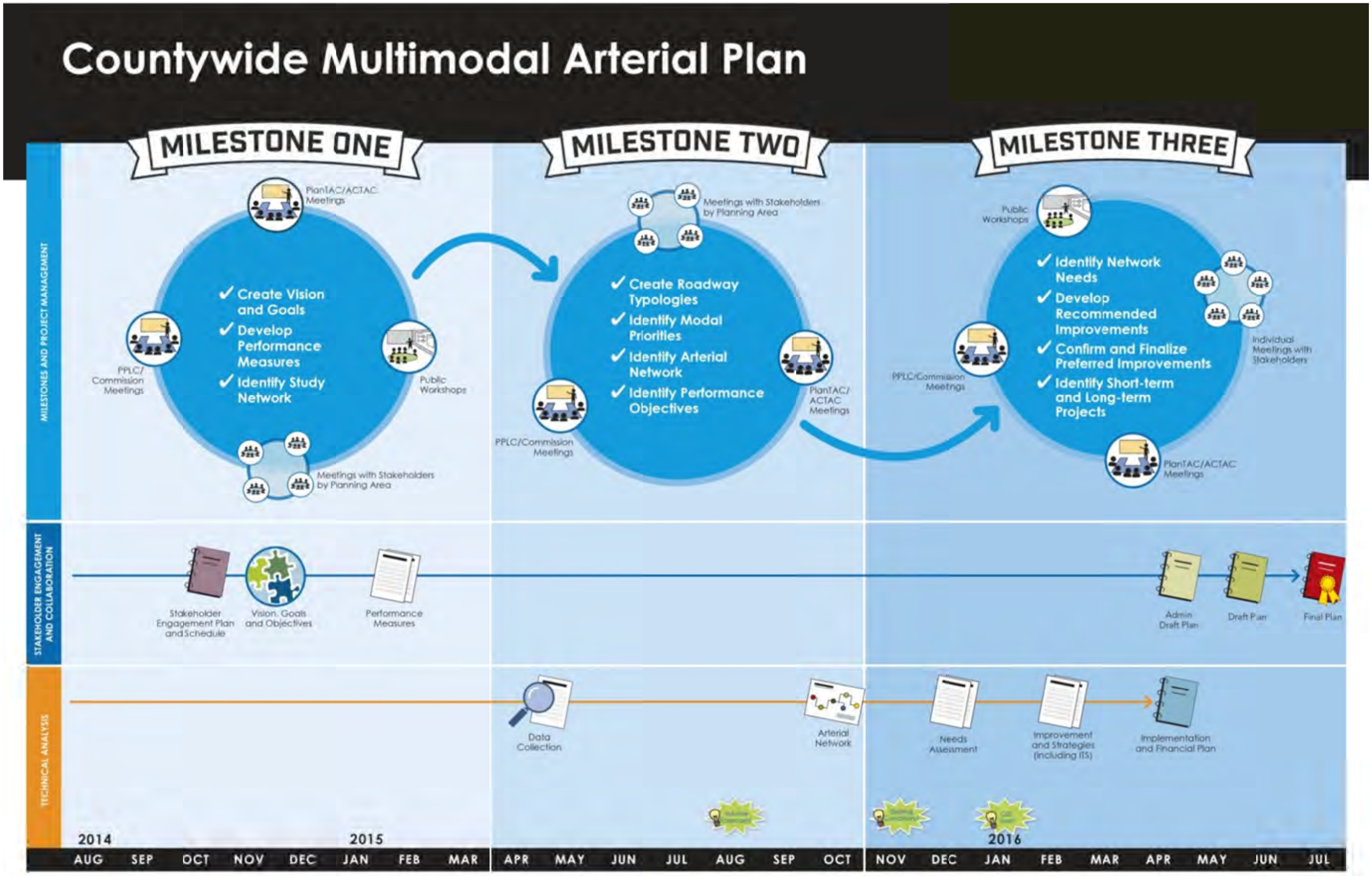
MAP Proposals

As a result of the two year collaboration and technical analysis processes, the MAP ultimately proposes the following improvements for transit, walking, biking, driving and goods movement (see Figures E.2-E.6):

- **Transit:** The BRT project currently under development is a good first step. This plan proposes tripling the miles of dedicated transit ROW and knitting them together into a connected network serving major transit corridors and PDAs throughout Alameda County, in addition to proposing Rapid Bus improvements for nearly 100 miles of major arterials.
- **Pedestrian:** To maximize non-auto transit access and improved safety for pedestrian around activity centers, this Plan proposes focused pedestrian enhancements around BART stations and along major transit hubs and corridors.
- **Bicycle:** The MAP proposes nearly 150 miles of "high comfort" bikeways, which have the potential to dramatically expand bicycle usage.

- **ITS:** Focused investment, consisting largely of Intelligent Transportation Systems (ITS) improvements that will benefit all vehicles, will move traffic more smoothly and reliably. The Plan estimates that if autonomous vehicles and other new technologies provide additional roadway capacity, future driving conditions will be similar to existing conditions despite significant population and employment growth and repurposing of travel lanes for non-auto modes as proposed by the Plan.
- **Goods movement:** This plan proposes improvements that assure that truck networks are continuous and connected throughout the county by widening curb lanes to 12 feet on designated truck routes with insufficient curb lane widths. This will facilitate and better support goods delivery and connections to warehouses and distribution centers across Alameda County.
- **Complementary strategies**: Other strategies proposed in the MAP include Transportation Demand Management (reducing auto travel by providing incentives for alternatives to single-occupant auto travel or dis-incentivizing driving alone) and on-street parking management.

Figure E.1: Overview of MAP process



MAP organization

In addition to an Introduction, the Alameda Countywide Multimodal Arterial Plan contains the following six chapters:

1. Viewing the arterial system through a multimodal lens

This chapter presents the Plan's vision and goals; the pioneering typology process developed for this Plan, which defines roadways based on their adjacent land uses and the unique requirements of each mode; the resulting multimodal arterial network; and the modal priorities on each segment of that network.

2. Is the arterial network meeting our objectives?

In this chapter, the Plan establishes mode-specific performance measures with which to evaluate how well each segment of the arterial network functions, and objectives or thresholds to identify which segments need improvements to accommodate its priority modes.

3. Improvements needed for a multimodal future

Chapter 3 identifies potential capital improvements in varying levels for each mode that would allow underperforming arterials to meet, or come as close as possible to meeting, performance objectives. It also looks at closing gaps so that each mode's arterial network is connected and continuous throughout the county.

4. Complementary strategies and potential trends that support multimodal improvements

This chapter proposes non-capital investments that would help the multimodal arterial network meet the MAP's performance objectives, including Intelligent Transportation Systems (ITS), Transportation Demand Management (TDM), parking strategies and resilient transportation strategies. Chapter 4 also discusses potential demographic and technology trends that could support multimodal improvements in the future.

5. Approach to developing packages of improvements

Rather than suggesting discrete, mode-specific investments, this chapter proposes an approach for developing packages of multi-modal improvements at the corridor or area level, which the owners and operators of the county's arterials and other agencies can consider. This integrated approach is meant to help deliver systemic improvements needed to maintain an aging infrastructure in the face of growing congestion and constrained rights-of-way.

6. Building a multimodal arterial network

This chapter summarizes elements that are needed to deliver improvements to the multimodal arterial network, including funding, community engagement and partnerships.

Figure E.2: Proposed Countywide Transit Network Improvements

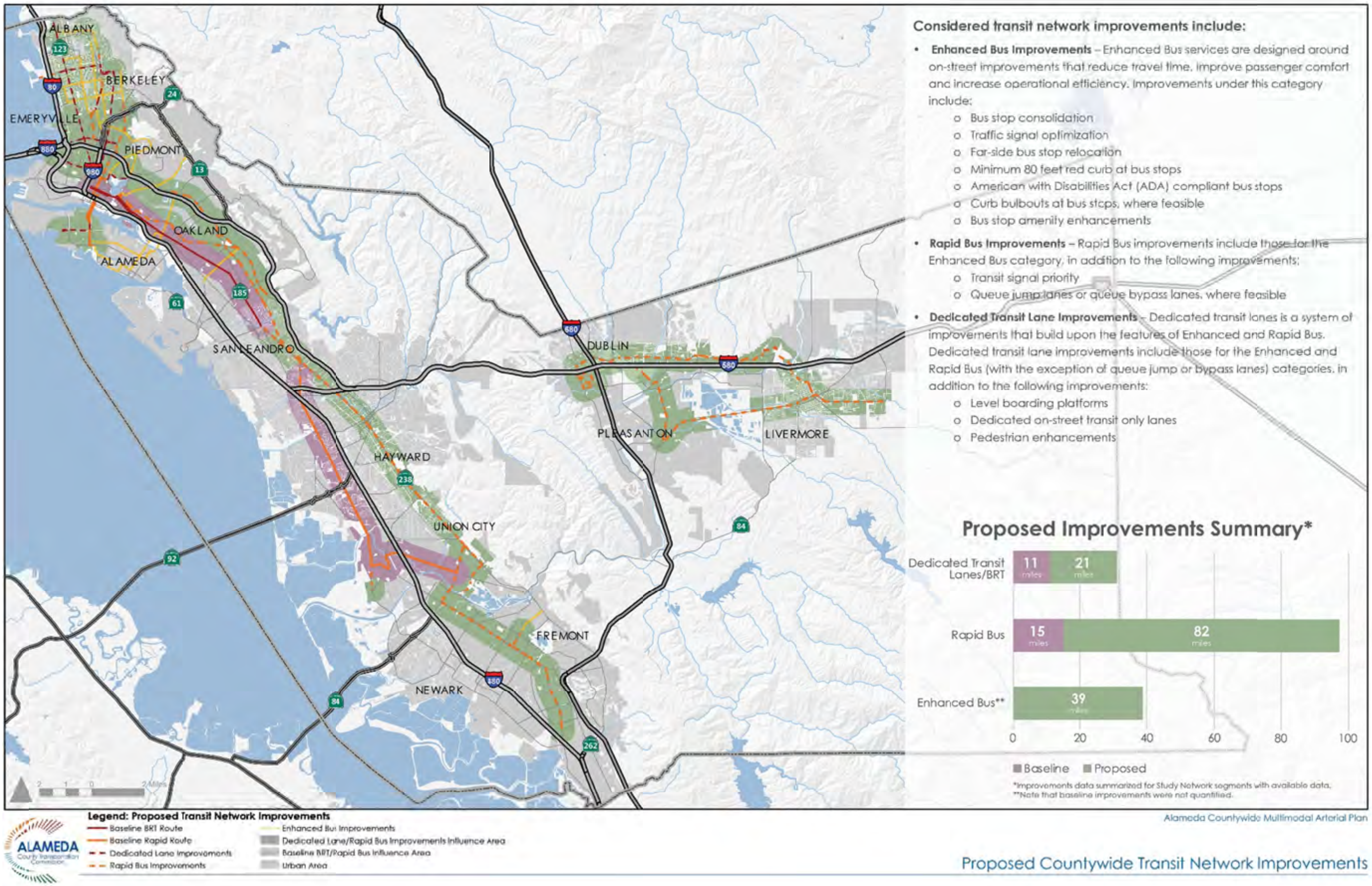


Figure E.3: Proposed Countywide Pedestrian Network Improvements

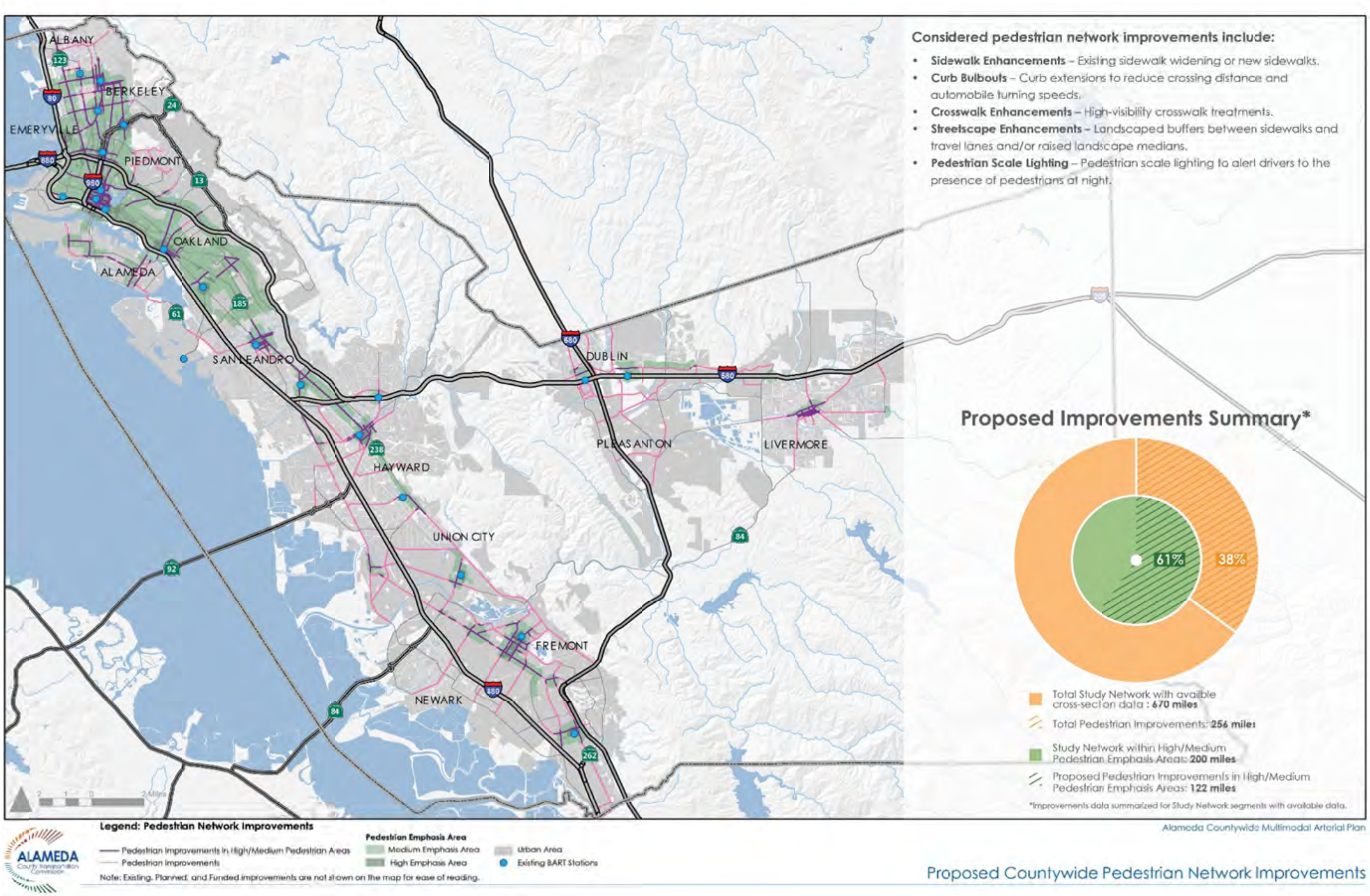


Figure E.4: Proposed Countywide Bicycle Network Improvements

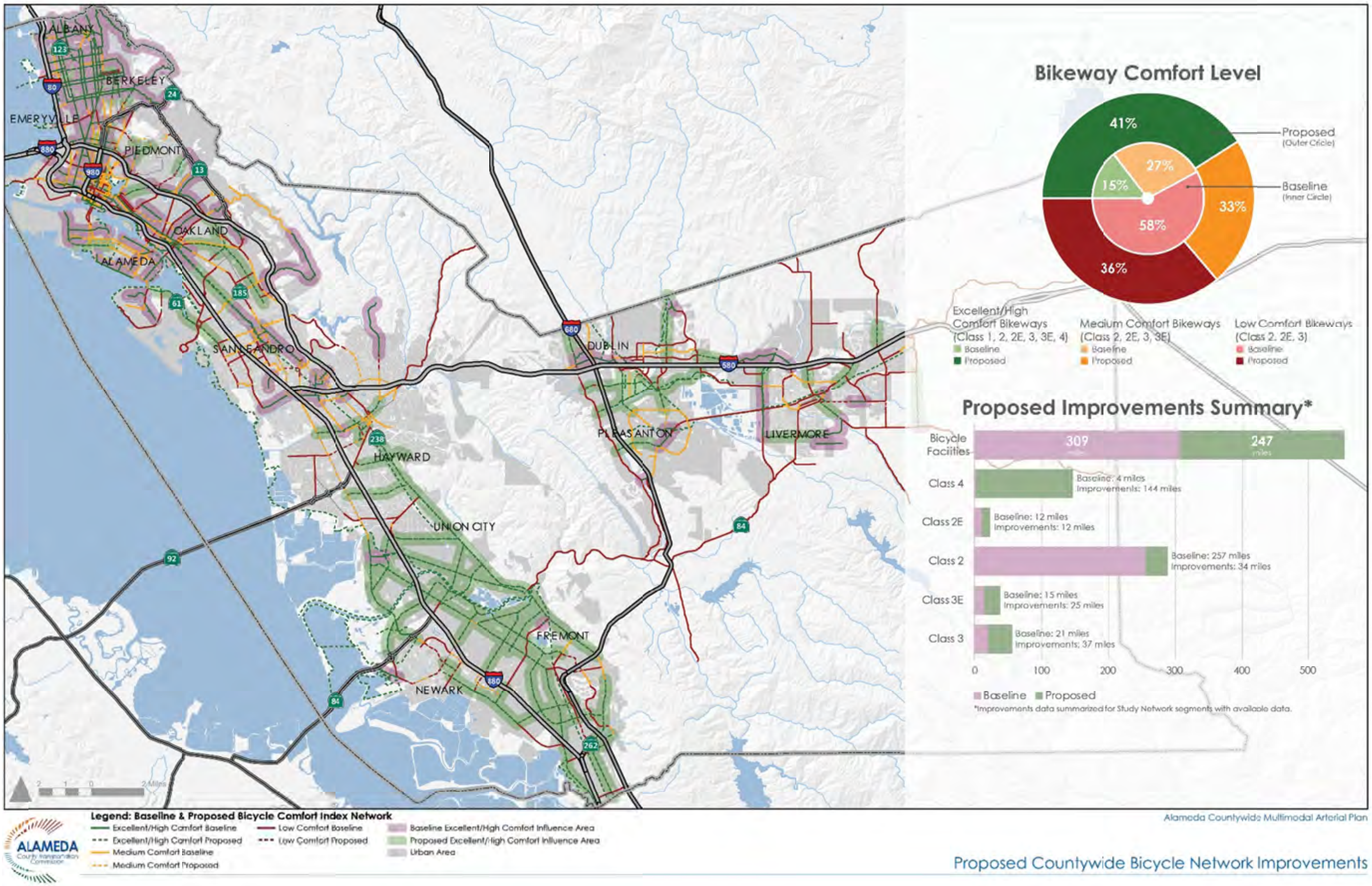


Figure E.5: Proposed Countywide ITS Network Improvements

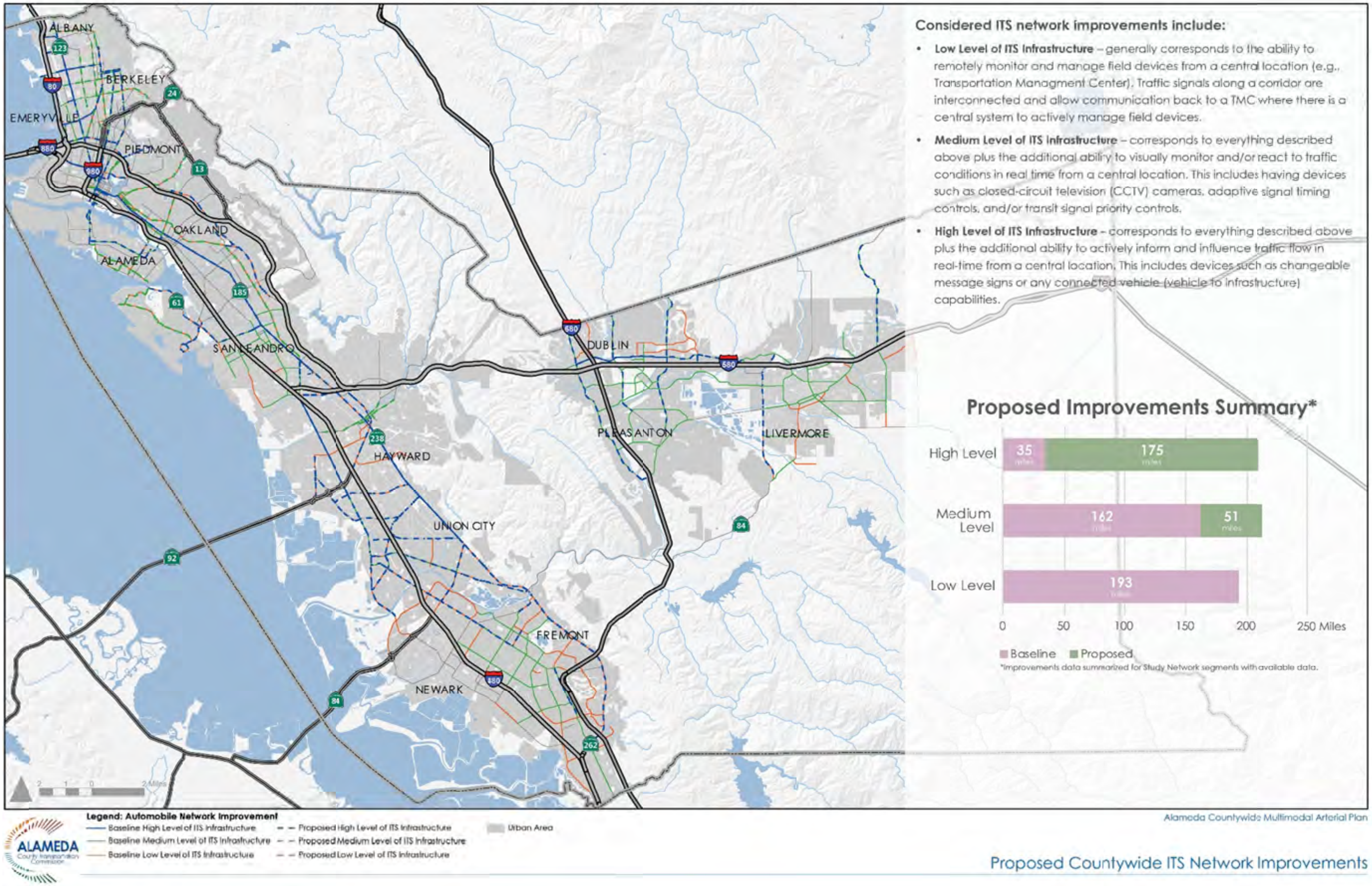
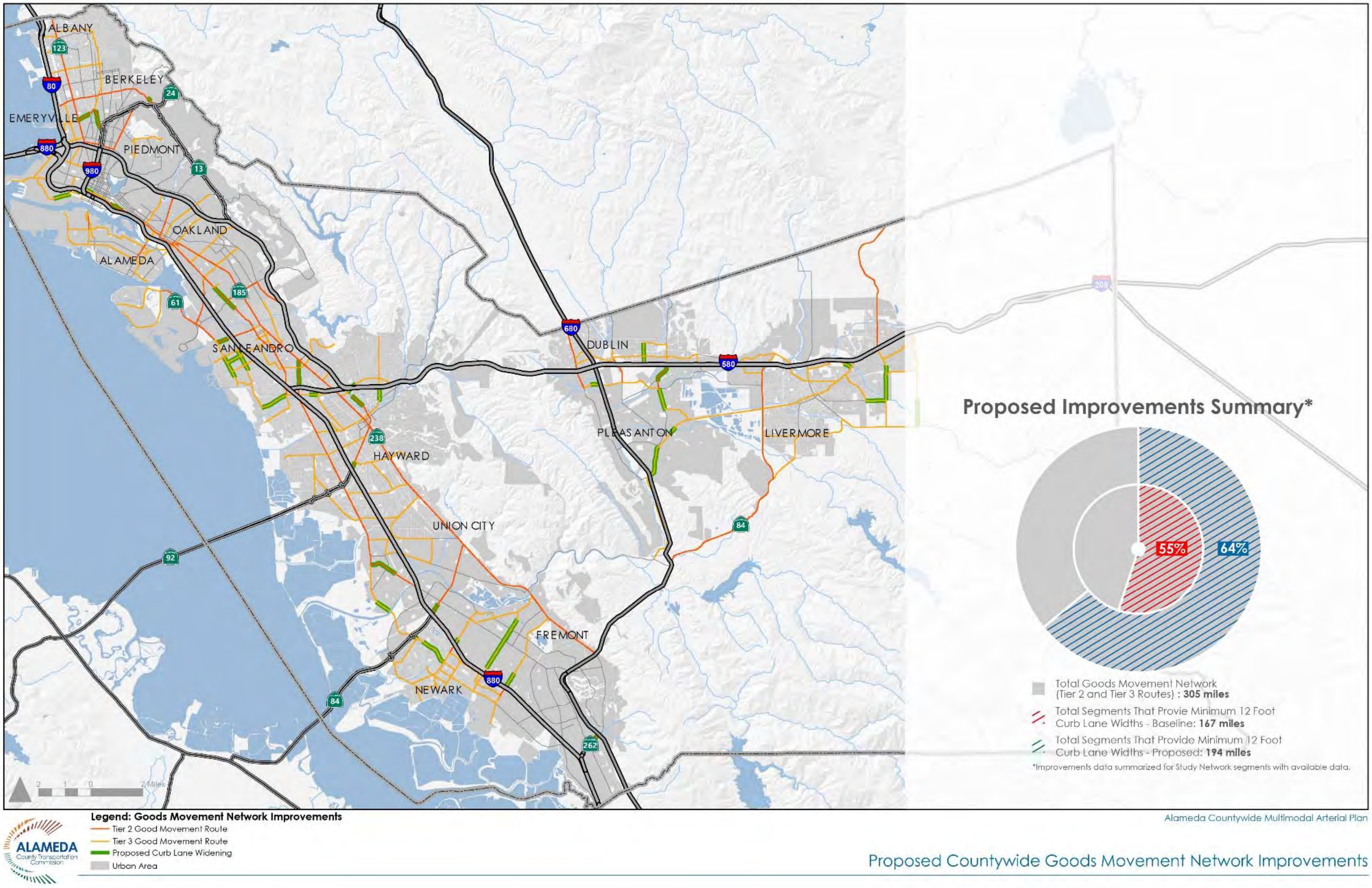


Figure E.6: Proposed Countywide Goods Movement Network Improvements




N JEFFERSON
TURNING VEHICLES
STOP
FOR
STOP FOR PEDS

Introduction

Over the past decade, the Complete Streets movement has revolutionized transportation planning by considering how all modes use a city's roadways collectively. This trend, supported by State, regional and countywide legislation, encourages jurisdictions for the first time to look at how transit, walking, biking, driving and goods movement can coexist on the same streets. Cities, including Alameda, Emeryville and Fremont in Alameda County, have developed local Complete Streets plans, but no plan before has taken on the challenge of prioritizing these modes on a multi-jurisdictional roadway network, particularly one as varied and complex as Alameda County's.

In the face of increasing traffic congestion and limited right-of-way, for the most part, local governments cannot increase the roadway network's motor vehicle capacity to meet growing needs. Therefore, the Alameda Countywide Multimodal Arterial Plan (MAP) provides a roadmap for a future with superior mobility for all modes that provides a robust system of transportation alternatives on a continuous and connected network for each mode. A key component of this new approach is to consider land uses adjacent to these roadways and how the transportation system can best support them.

The Alameda Countywide Multimodal Arterial Plan provides a roadmap for a future with superior mobility for all modes on a continuous and connected network for each mode, that better supports adjacent land uses.

Alameda County context

This ground-breaking effort was commissioned by the Alameda County Transportation Commission (Alameda CTC). Alameda CTC is a joint powers agency that plans, funds and delivers a broad spectrum of transportation projects and programs that serve all modes throughout Alameda County. The county's transportation system plays a central role in supporting the region's economic vitality and overall livability. By way of its central location in the Bay Area, the county's transportation system supports a significant share of Bay Area trips made by all transportation modes, most notably automobile, transit and goods movement. Alameda County's freeway system suffers excessive congestion, causing the arterial network to serve as the backbone for regional and local traffic, and sometimes as a bypass alternative to congested freeways. In light of projected growth in employment and population (and the cohort of senior citizens), it is critical to consider innovative approaches to manage the entire transportation network.

Prior planning & stakeholder engagement

The strength of the Alameda Countywide Multimodal Arterial Plan lies in its bottom-up approach, which has built on the prior planning efforts of local agencies and Alameda CTC, and a robust stakeholder engagement process. The Plan used the findings of already-adopted plans as a basis for its recommendations, such as Alameda CTC's Countywide Transportation, Transit, Pedestrian, Bicycle and Goods Movement plans and local pedestrian, bicycle and complete streets plans.

Figure I.1: Prior Planning and Stakeholder Engagement

Alameda CTC worked extremely closely with the owners and operators of the arterials – the cities, the County and Caltrans – and the transit operators that operate buses on them. There were over 65 meetings of various types held over the course of the MAP development, including planning area[2] level meetings with local jurisdictions, transit agencies and Caltrans, meetings with non-agency stakeholders[3], discussions with Alameda CTC's Technical Advisory (ACTAC) and Planning, Policy & Legislation (PPLC) committees, a set of one-on-one and small group meetings with each of the county's 15 jurisdictions, transit agencies and Caltrans, and eight public open houses.

The project team received over 1,000 comments on various aspects of the Plan. These comments, which largely leverage local knowledge and understanding to refine inputs or conclusions of the MAP's technical processes, have enriched the Plan and are a strong indication of the level of support local partners have for the Plan.

The technical output generated by this ground-breaking effort began the conversation about how to reallocate precious roadway right-of-way among competing modes. Wherever comments received from local agencies, transit operators or Caltrans conflicted with the Plan's technical output, their local knowledge of issues and opportunities were incorporated into the Plan while ensuring coordination with proposals for adjacent segments of the corridor. The improvements proposed in this Plan represent the product of this interaction: technical results adapted, where needed, to reflect local situations while still maintaining the broader corridor- and county-level consistency. At the same time, the MAP process did not include local community meetings to review specific roadway segments or

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[2] Alameda CTC for planning purposes considers the county into four planning areas: North, Central, South and East.

[3] Representatives from United Seniors of Oakland and Alameda County, Bike East Bay, Alameda County Safe Route to Schools, Alameda CTC's PAPCO, Alameda County Emergency Response, Trucking Company.

proposed projects. Therefore, jurisdictions will need to plan community-based processes at the local level to confirm the desire for and plan the design of individual improvements.

Why are arterials important?

Arterials are an essential component of our transportation systems, which connect communities with each other, the regional transportation network, and employment and activity centers, while having a local function, context and character. In Alameda County, arterials carry about 40 percent of daily traffic volumes.[4] Figure I.2 presents the traditional countywide arterial system as classified by the California Road System (CRS). Unlike freeways, which have a dedicated function in facilitating longer distance vehicle trips, or collector and local streets, which are designed to facilitate local trips and provide access to individual properties, arterials serve a wide range of functions across all modes serving competing demands:

- **Transit:** Arterials are the primary streets carrying bus transit. In the East Bay, especially the northern area, many arterials are former elements of the Key Streetcar System and the land use pattern reflects that history, with goods and services lining the streets, making it convenient for Key System riders to travel to and from the central city along the arterials then shop at businesses along the arterials and walk home.
- **Walking:** Due to both the land uses that line arterials and their transit function, as well as the fact that generally arterials represent the shortest travel routes, many people walk along arterials.
- **Bicycling:** Arterials are often the shortest route for bicyclists and also where, as for other travelers, many desired destinations are located.
- **Automobiles:** Arterials serve a wide range of vehicle trips types – long and short distance, people trying to quickly travel through neighborhoods and people trying to get to destinations within neighborhoods and beyond.
- **Goods movement:** After freeways, arterials are the most critical transportation facility for goods movement. They facilitate access to the freeway system for truck trips originating at production and distribution facilities including ports and airports, and most importantly facilitate goods delivery to local businesses.

In order to properly design an arterial, it is critical to first understand its important multimodal functions and to determine the relative importance of those functions in the context of the land use it serves. For many decades, transportation planners and engineers have used vehicle level of service (LOS), a measure of efficiency of moving motor vehicles, as the primary or sole measure of arterial function. The Alameda Countywide Multimodal Arterial Plan moved beyond LOS by developing performance measures that reflect and prioritize these functions for all modes on each arterial segment.

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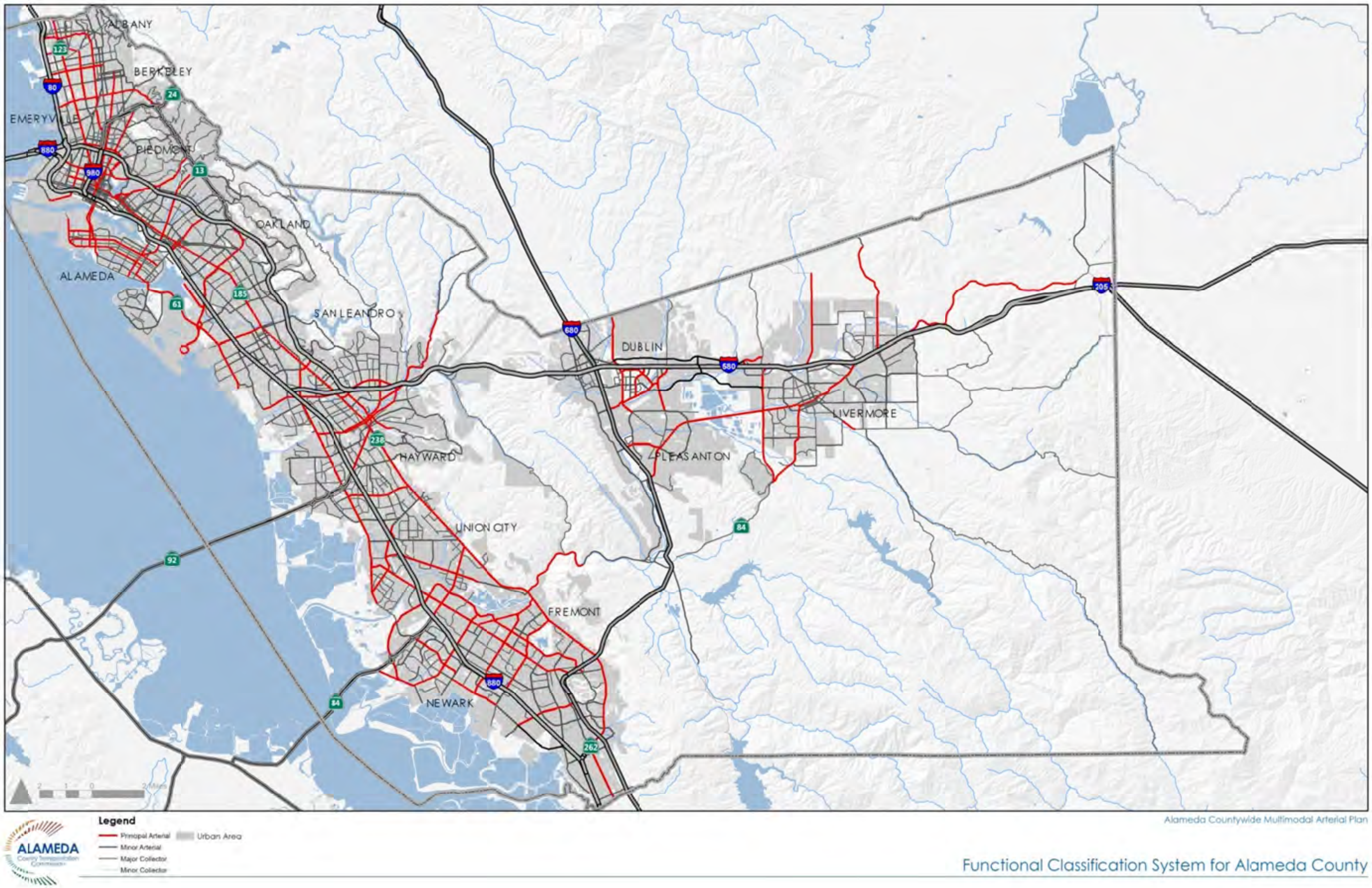
[4] Alameda CTC Countywide Travel Demand Model

Figure I.2: Functional Classification System for Alameda County



Why create a multimodal arterial network?

The mission to create a multimodal arterial network was motivated by a number of forces. As mentioned earlier, arterials throughout Alameda County are the primary multimodal route for local and regional trips, while extremely congested freeways exacerbate the situation by contributing frequent spillover traffic. Local land use context along these arterials dictates the local function that also must be served. Combined, these demands place a heavy and sometimes unmanageable burden on the county's arterial roadways. Local jurisdictions and Caltrans increasingly realize that there is neither the land nor financial resources to accommodate more automobiles on the countywide arterial network, although population and employment are both forecasted to continue growing. These challenges compel local jurisdictions to consider mobility through all modes by planning roads to maximize people throughput rather than vehicle throughput, while supporting the needs of all users.

Meanwhile, state and regional legislation calls on cities and counties to consider the needs of all users of the local transportation network when planning their facilities. The California Complete Streets Act of 2008 requires including complete streets policies in general plan circulation element updates so that, in the future, roadways are designed to safely accommodate all users, including transit riders, pedestrians, bicyclists, children, older people, disabled people and motorists. Similarly, the Metropolitan Transportation Commission's (MTC) Routine Accommodation resolution requires that any project using funding administered by MTC consider the accommodation of bicyclists and pedestrians in planning, design and construction. Given these issues and requirements, and arterials' role serving multiple modes, these roadways provide the best opportunity to address future multimodal travel demand.

With local congestion growing and these mandates in place, local governments must begin looking at their roadway systems from a multimodal perspective; however, local complete streets efforts can be hindered by the physical and political difficulty of allocating limited right-of-way among the various modes. Given the countywide nature of the arterial network, Alameda CTC commissioned the MAP to better understand the function of the county's arterials in serving all modes and supporting the surrounding land uses. The goal was to provide stakeholders with the technical tools and forum to define priorities for each mode on key arterial roadways in the county in order to create continuous, connected networks for all modes that support surrounding land uses. This effort formed the foundation of an approach to identify a list of short- and long-term multimodal transportation improvements on the county's arterial network and operational strategies to accommodate projected population growth and travel demand in Alameda County.

Plan scope

Moving from a system of arterial design and assessment that focuses on a single mode – autos – to one that considers all modes is a hugely ambitious undertaking in the following ways:

- **Geographically:** The MAP studied and evaluated over 1,200 miles of arterials.
- **Spatially:** The MAP evaluated 510 miles of cross-sections – the allocation of space within the roadway right-of-way.
- **Institutionally:** The MAP coordinated with 14 cities, the County, transit agencies, Caltrans, MTC and non-agency stakeholders for each mode.
- **Technically:** The MAP broadened performance measures from automobile LOS to 11 measures spanning all modes.

The MAP scope was carefully crafted to include the following elements in order to allow successful execution of this work within available resources and time, while introducing new concepts and methods:

- **Readily available data:** Data collection at the scale of the countywide arterial system geography would have been impractical. Therefore, the MAP relied almost exclusively on data generated and gathered from previous work.
- **Representative Segments:** The major exceptions to not collecting new data were roadway cross-sections to assess available right-of-way. To measure the 510 miles of arterials of countywide significance (see Section 1.5), the project team used aerial imagery for representative segments – individual blocks that are typical of a larger set of the adjacent blocks.
- **Automation:** A powerful geographic information system (GIS) tool was built to identify how each MAP segment performs for each mode, how much right-of-way may be available on each segment to repurpose for improvements that would help these segments better meet the priority modes' performance objectives while ultimately aiming to serve the needs of all modes. With automation comes generalization – unique local roadway and land use characteristics cannot be catalogued at the scale of the MAP.
- **Local review:** To compensate for the broad scale of the MAP analysis and to build consensus around a new way to evaluate the arterial system, this study was conducted with an unprecedented level of local agency coordination (see Stakeholder Engagement section above).

Plan organization

The Alameda Countywide Multimodal Arterial Plan contains the following chapters:

Plan Chapters

1. Viewing the arterial system through a multimodal lens
2. Is the arterial network meeting our objectives?
3. What improvements are needed for a multimodal future?
4. Complementary strategies and potential trends that support multimodal improvements
5. Developing improvement packages to implement
6. Building a multimodal arterial network

1. Viewing the arterial system through a multimodal lens

This chapter presents the Plan's vision and goals; the study network from which the sub-system of core and countywide significant "Arterial Networks" are drawn; the pioneering typology process developed for this Plan, which defines roadways based on their adjacent land uses and the unique requirements of transit, walking, bicycling, driving and goods movement; the resulting multimodal arterial network; and the modal priorities on each segment of that network.

2. Is the arterial network meeting our objectives?

In this chapter, the Plan puts forward mode-specific performance measures with which to evaluate how well each segment of the arterial network functions, and objectives or thresholds to identify which segments need improvements to meet the performance of the priority modes. The project team developed a geographic information systems (GIS) tool to measure the multimodal performance of each segment under existing conditions and in the future, assuming existing infrastructure; estimate the amount of available right-of-way; propose improvements for priority modes; and, assuming proposed improvements, estimate performance.

3. Improvements needed for a multimodal future

In this chapter, the project team identifies capital improvements for each mode that would allow underperforming arterials to meet or come as close as possible to meeting performance objectives. This chapter also looks at closing gaps so that each mode's arterial network is connected and continuous. A system-level cost estimate for the set of proposed improvements is provided.

4. Complementary strategies and potential trends that support multimodal improvements

In addition to the capital improvements proposed in chapter three, this chapter presents other investments to help the multimodal arterial network meet performance objectives. These include Intelligent Transportation Systems (ITS), Transportation Demand Management (TDM), parking strategies and resilient transportation strategies. Implementing capital improvements along with these strategies and programs would provide a more effective multimodal transportation system as the combined set of improvements influence the demand and supply components of the system. This chapter also discusses potential demographic and technology trends that could support multimodal improvements in the future.

5. Approach to developing packages of improvements

Ultimately, decisions on which MAP proposed improvements to pursue will be made by local agencies, in consultation with local residents and businesses. The technical analysis conducted as part of the MAP should inform public engagement, but MAP proposals will likely need to be refined during the process of more detailed corridor planning.

Because prioritization will be locally driven, the MAP does not present a ranked list of improvements. Instead, this Plan provides information local jurisdictions can use to help determine which improvements are needed in the short-term versus the longer term. In an effort to help local agencies prioritize these improvements, Appendix 5.2.1 to this chapter provides the number of modes each proposed improvement will benefit.

6. Building a multimodal arterial network

This chapter summarizes elements that are needed to deliver proposed investments, including local community-based engagement, design and funding. These elements include potential funding sources for proposed improvements to the multimodal arterial network and partnership opportunities.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1 Viewing the Arterial System through a Multimodal Lens

1.1 Plan Vision and Goals[5]

The vision and goals of the Alameda Countywide Multimodal Arterial Plan guide the MAP framework of assessing arterials' multimodal performance and identifying needs and appropriate improvements to address those needs. Along with the Countywide Transit Plan, Goods Movement Plan, Community Based Transportation Plans and the Bicycle and Pedestrian Plans, the Arterial Plan is a key input to the Countywide Transportation Plan. This vision and these goals are consistent with the current Countywide Transportation Plan and with MTC's Regional Transportation Plan and Sustainable Communities Strategy (RTP/SCS), called Plan Bay Area. The Multimodal Arterial Plan vision lays out the strategic direction for the Plan, while the goals and principles describe the desired outcome of the Plan.

Vision

Alameda County will have a network of efficient, safe and equitably accessible arterials that facilitate the multimodal movement of people and goods, and help create a strong economy, healthy environment and vibrant communities, while maintaining local contexts.

This vision (see box) is supported by five goals and two supportive principles:

1. **Multimodal:** Based on local context and modal priorities, the arterial network will provide high-quality, well maintained and reliable facilities.
2. **Accessible and Equitable:** The arterial network will provide access for people of all ages, abilities, incomes and geographies.
3. **Connected across the County and Region:** Using typologies that support local land use, the arterial network will provide connections for all modes within the county and across the County's and Region's network of streets, highways, and transit, bicycle and pedestrian routes.
4. **Efficient Use of Resources:** Investment in the arterial network will make efficient and effective use of resources.
5. **Safe, Healthy and Vibrant:** The arterial network will be designed, built and managed to reduce the incidence and severity of collisions, promote public health and help create vibrant local communities.

In addition to these five goals are the following two other desired outcomes of the plan. Because they are less quantifiable, they are called supportive principles rather than goals, but they are just as critical to the success of the plan. Therefore, similar to goals, the plan includes strategies and programs to address them:

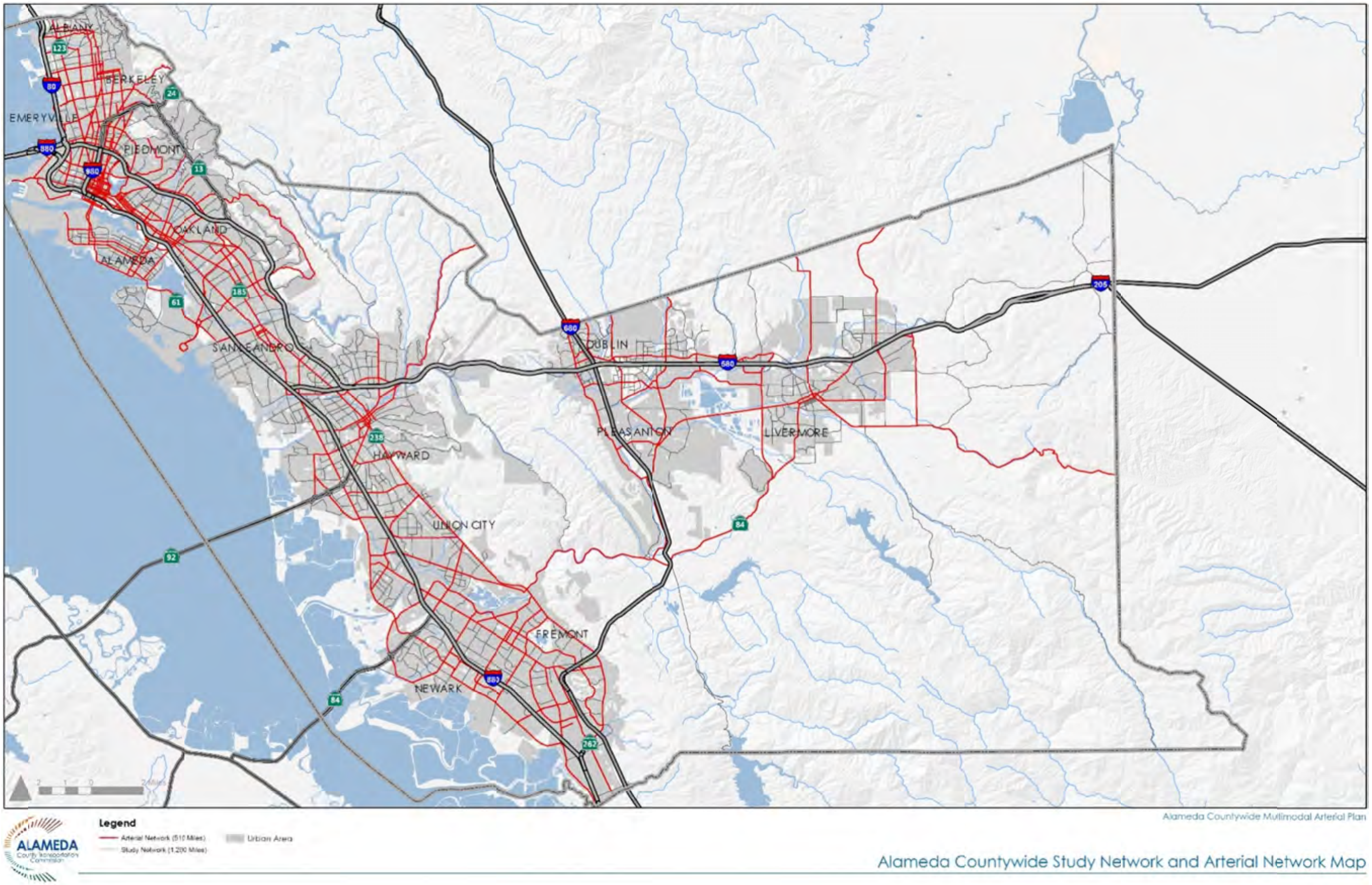
[5] See Appendix 1.1.1: Vision and Goals technical memo for more details.

- **Support Strong Economy:** Development of the arterial network will support existing land uses and encourage planned land uses.
- **Adaptable and Resilient:** The arterial network will be designed to adapt to changes in travel patterns, travel modes and technology improvements. Investments in the arterial network will enhance its ability to withstand and recover from potentially disruptive events.

1.2 Study Network

Creating complete and connected multimodal networks requires first identifying the wider system of major countywide roads called the "Study Network" – which serve as the basis to study, analyze to better understand the performance of the county's major roads – from which ultimately this multimodal network, called Arterial Network, will emerge. The Study Network comprises the Caltrans California Road System's (CRS) 1,200 miles of arterial and collector streets that are most important to supporting one or more modes (transit, walking, bicycling, auto and goods movement) across Alameda County. This network, which allows us to study, analyze and better understand the performance of the county's major roads, served as the starting point from which to identify the subset of core roadways that, through this planning process, became the 510-mile Arterial Network for more focused analysis (see Figure 1.2.1 and section 1.5 for more details).

Figure 1.2.1: Countywide Study Network Map



1.3 Typologies[6]

Traditional roadway networks are defined by their auto function. Streets are classified as arterials, collectors or local depending on the characteristics of traffic they are designed to carry. This system allows transportation planners and engineers to optimize roads to serve automobiles using tools like access management, signal timing, turn pockets and geometrics to promote smooth, and often high speed, traffic flow.

Planning and designing roadways to accommodate all modes requires a new supplemental classification, one that considers the land uses through which each roadway flows and the unique requirements of transit, walking, bicycling, driving and goods movement. Limited right-of-way, however, prevents local jurisdictions and Caltrans from optimizing all modes on every arterial. To create a truly multi-modal system, the project team created a street typology framework for this Plan, which defines all of the roadways in the Study Network in the context of adjacent land use and the various modes they carry. These typologies, which are reflective of the primary function of the road in terms of the land use it supports and the modes it serves, were used to prioritize modes on each roadway (see Section 1.5) and to later inform the identification of improvements needed to serve the priority modes (see Chapter 3). Ideally, one would try to accommodate and improve all modes; however, given resource constraints(time, data and budget), only improvements to the top two priority modes were considered, while ensuring that they are connected across the county and include supportive and needed pedestrian improvements. The resulting coordinated connected network for all modes is anticipated to support the multimodal transportation needs of a majority of users in Alameda County.

Planning and designing roadways to accommodate all modes requires a new supplemental classification, one that considers the land uses through which each roadway flows and the unique requirements of transit, walking, bicycling, driving and goods movement.

Though the Arterial Plan process is a first-of-its-kind for a countywide effort, several cities in Alameda County have developed similar street typology systems – Alameda, Emeryville and Fremont – and Alameda CTC's typology framework allows local typologies to nest within the MAP street typology framework. Similarly, the framework developed through this planning process is expected to inform or provide a base for future complete street or other efforts to develop street typologies by other local jurisdictions in Alameda County.

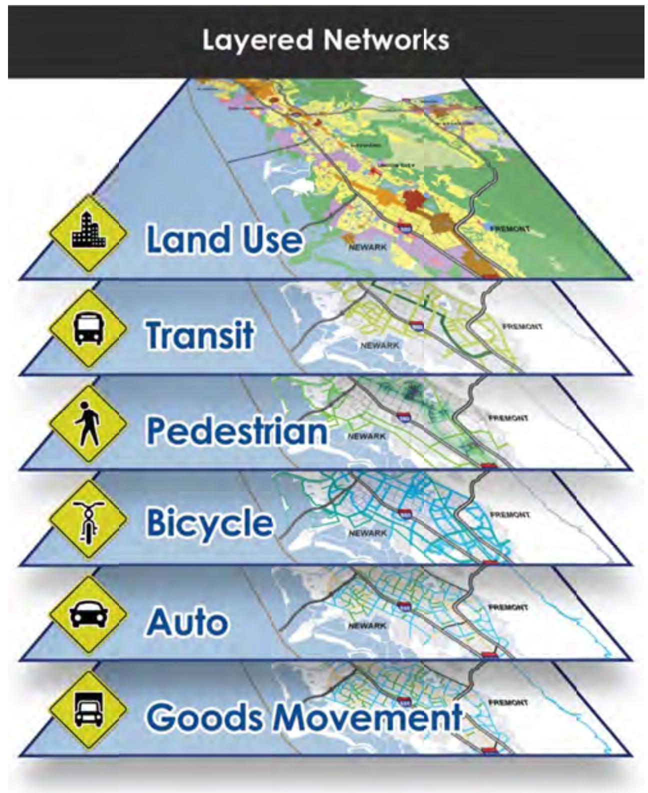
Identifying mode-specific typologies

For each mode, the project team worked collaboratively with local jurisdictions, transit agencies and Caltrans to identify the type of roadway segments for each mode. This effort

[6] See Appendix 1.3.1: Typology and Modal Priority technical memo for more details.

also closely coordinated with the Countywide Goods Movement and Transit Plans that Alameda CTC was developing in parallel. The auto and goods movement networks are primarily made of existing routes, while the bicycle, transit and pedestrian networks also include facilities in planned and aspirational locations.

Figure 1.3.1: Layered Networks Framework



Transit: The roadway segments included in the Study Network for transit included the following:

- AC Transit & LAVTA Major Corridors – representing the top 10 ridership corridors in Alameda County.
- Crosstown Routes – other high-capacity transit service identified by AC Transit as their “Crosstown” routes.
- Local Routes (includes Union City Transit & Emery Go Round) – other bus routes on segments of the Study Network operating at lower frequencies and limited service hours.

Walking: Unlike all other modes, the countywide pedestrian “network” is neither continuous nor connected; rather, it is nodal or area-based. This is because walking is driven by proximity to various land uses or destinations (including transit stops) or by virtue of living or working within a transit-served community. Therefore, the pedestrian Study Network includes segments found within:

- Priority Development Areas (PDA)
- Commercial and Mixed-Use Areas (based on local General Plans)
- MTC’s Communities of Concern
- Growth Opportunity Areas (source: Alameda County PDA and Investment Growth Strategy, 2012, Alameda CTC)
- Proximity to rail and bus facilities
- Quarter-mile buffers around activity and education centers and parks

Bicycle: The basis of the bicycle segments included in the Study Network was the 2012 Alameda Countywide Bicycle Plan and updates developed by jurisdictions since 2012 (existing and proposed). As these are limited to bikeways that occur within arterial corridors, this includes Class 2 bike lanes, Class 2 enhanced buffered bike lanes, Class 3 bike routes, and Class 4 protected bicycle lanes. This bicycle network also includes parallel (arterial-adjacent) facilities including Class 1 multi-use trails such as the East Bay Greenway and Class 3 bicycle boulevards such as those found in Berkeley.

Auto: The automobile segments of the Study Network include the CMP[7], MTS[8] and State Route networks that are considered higher order facilities for automobiles. In addition, the project team looked at the function of each roadway segment in terms of auto traffic volumes and percent of long-distance trips, which resulted in the following base street type categories (see Appendix 1.3.1):

- Throughway: Primarily high speed, with at-grade intersections, little direct relationship to surrounding context, and in some cases segments of streets connecting to a freeway with a majority of trips crossing through multiple cities/counties.
- County Connector: Generally moderate speed with a good portion of trips crossing through multiple cities/communities, and segments of streets connecting to a freeway.
- Community Connector: Streets with a good portion of trips made by those traveling across a city/community or to an adjacent city/community.
- Neighborhood Connector: Streets where most trips by those traveling across a neighborhood/district and to an adjacent neighborhood / district.

Goods Movement: The arterial goods movement segments included in the countywide Study Network are the Tier 2 and 3 routes, as defined in the concurrently developed Alameda Countywide Goods Movement Plan. Tier 2 routes are state highways that provide intra-county and intra-city connectivity and last-mile connections to the Port of Oakland and Oakland International Airport. Tier 3 routes are arterials and collectors used in a majority of local pickup and delivery. All Tier 1 goods movement routes are on freeway facilities, which are not a part of this Plan.

Once the team identified each of the mode-specific typologies, local jurisdictions, transit agencies and Caltrans reviewed and provided comments to update the typologies to reflect what is on the ground and planned locally. There were three rounds of stakeholder review plus a set of meetings at the Planning Area level.

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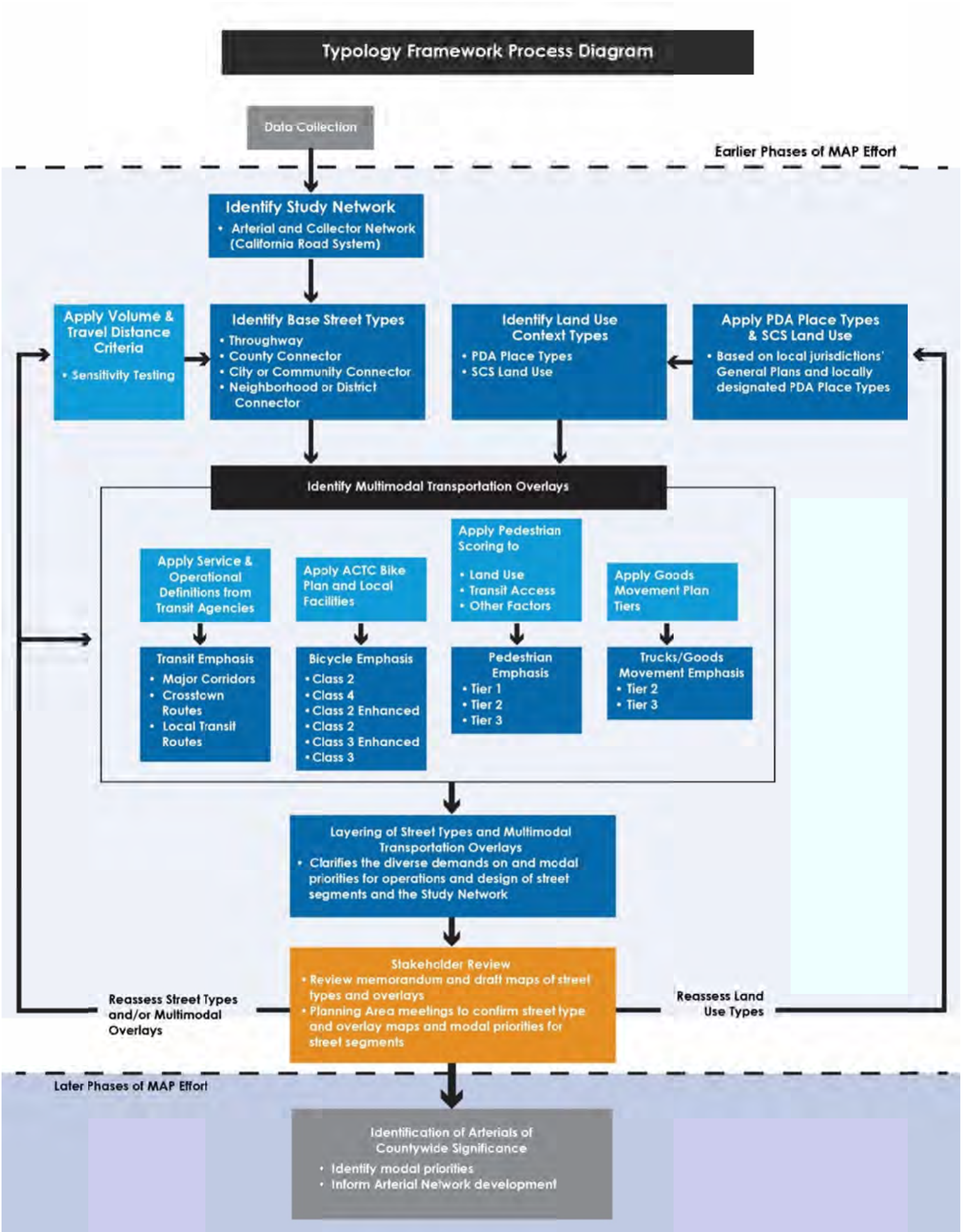
7 Congestion Management Program

8 Metropolitan Transportation System

Figure 1.3.2: Typology Framework Process for Multimodal Arterial Plan



1.4 Modal Priorities[9]

Identifying the roadways that comprise the Multimodal Arterial Network was a huge step toward the Plan's intent of creating complete and connected networks for all modes. Since right-of-way on most of these roadways is limited, many are not able to accommodate improvements for all modes. Therefore, the next step in the development of the Multimodal Arterial Network was to identify priority modes on each segment so that, in a later step, improvements needed to serve those modes could be identified.

Consistent with typologies discussed in the previous section, the process of determining modal priorities differs by area type (urban, suburban, industrial). As shown in Figure 1.4.1, land uses along Alameda County arterials are organized into three categories:

- Urban - Downtown/town center mixed use/education/parks
- Suburban - Mixed use/commercial/residential/rural/open space
- Industrial

While Figure 1.4.1 contains generalized modal priorities associated with different land use contexts, Figure 1.4.2 breaks this down using the tiering system described in section 1.5. The technical process for developing modal priorities for each roadway segment involved iterating through the first highest order facilities for each mode shown in Figure 1.4.1, then the next highest order, and the third order. A step-by-step review of this process is provided below Figure 1.4.2.

[9] See Appendix 1.3.1: Typology and Modal Priority technical memo for details.

Figure 1.4.1: MAP Modal Priorities – General

Urban	Suburban	Industrial
Land Use Context Types		
• Downtown Mixed Use • Town Center Mixed Use • Corridor/Neighborhood Mixed Use • Education/Public/Semi-Public • Parks	• Mixed Use • Commercial • Residential • Rural/Open Space • Other/Unknown	
Associated Modal Priorities		
1. Transit 2. Pedestrian 3. Bicycle 4. Auto 5. Goods Movement / Truck	1. Transit 2. Auto 3. Goods Movement / Truck 4. Bicycle 5. Pedestrian	1. Transit 2. Goods Movement / Truck 3. Auto 4. Bicycle 5. Pedestrian

Figure 1.4.2: MAP Modal Priorities – Specific

Urban	Suburban	Industrial
Land Use Context Types		
• Downtown Mixed Use • Town Center Mixed Use • Corridor/Neighborhood Mixed Use • Education/Public/Semi-Public • Parks	• Mixed Use • Commercial • Residential • Rural/Open Space • Other/Unknown	
Associated Modal Priorities in Order		
1. Transit: Major Corridors 2. Pedestrian: Tier 1 3. Bicycle: Class 1, enhanced Class 2, enhanced Class 3 or Class 4 4. Auto: Throughway 5. Goods Movement: Tier 2 6. Transit: Crosstown Routes 7. Pedestrian: Tier 2 8. Bicycle: Class 2 9. Auto: County Connector 10. Pedestrian: Tier 3 11. Bicycle Class 3 12. Transit: Local Routes 13. Goods Movement: Tier 3 14. Auto: Community Connector 15. Auto: Neighborhood Connector	1. Transit: Major Corridors 2. Auto: Throughway 3. Goods Movement: Tier 2 4. Bicycle: Class 1, enhanced Class 2, enhanced Class 3 or Class 4 5. Pedestrian: Tier 1 6. Transit: Crosstown Routes 7. Auto: County Connector 8. Goods Movement: Tier 3 9. Bicycle: Class 2 10. Pedestrian: Tier 2 11. Auto: Community Connector 12. Bicycle Class 3 13. Pedestrian: Tier 3 14. Transit: Local Routes 15. Auto: Neighborhood Connector	1. Transit: Major Corridors 2. Goods Movement: Tier 2 3. Auto: Throughway 4. Bicycle: Class 1, enhanced Class 2, enhanced Class 3 or Class 4 5. Pedestrian: Tier 1 6. Transit: Crosstown Routes 7. Goods Movement: Tier 3 8. Auto: County Connector 9. Bicycle: Class 2 10. Pedestrian: Tier 2 11. Auto: Community Connector 12. Bicycle Class 3 13. Pedestrian: Tier 3 14. Transit: Local Routes 15. Auto: Neighborhood Connector

Figure 1.4.3 shows the factors that determine modal priorities on four sample roadways. See box for a detailed example of the stepwise process that uses these factors follows for the first sample.

Example of Process to Identify Modal Priorities

International Blvd. *(Fruitvale Ave. to 38th Ave.)*
Land use context: Corridor/Neighborhood Mixed Use (see column 1 of Figure 1.4.2)

	Factor		Modal Priority
1.	Is it a Major Corridor?	Yes	1st priority: Transit
2.	Is it a Pedestrian Tier 1?	Yes	2nd priority: Pedestrian
3.	Is it a Bicycle Class 1, Enhanced Class 2 Enhanced Class 3 or Class 4?	No	
4.	Is it a Throughway?	No	
5.	Is it a Tier 2 Truck Route?	No	
6.	Is it a Transit Crosstown Rte?	No	
7.	Is it a Pedestrian Tier 2?	No	
8.	Is it a Bicycle Class 2?	No	
9.	Is it a County Connector?	Yes	3rd priority: Auto
10.	Is it a Pedestrian Tier 3?	No	
11.	Is it a Bicycle Class 3?	No	
12.	Is it a Transit Local Route?	No	
13.	Is it a Tier 3 Truck Route?	No	
14.	Is it a Commercial Connector?	No	
15.	Is it a Neighborhood Connector?	No	

It is important to note that this is a macro-scale data driven process. It does not reflect the detailed knowledge that local transportation departments have of the streets they maintain and operate. Therefore, the results of this technical process were reviewed by local agency staff, who provided feedback and direction that augmented the technical output. Feedback came in the form of changes to the underlying data informing the modal tiers and direct changes to the modal priorities.

Figure 1.4.3: Example Streets with Street Type and Overlay Designations

Planning Area	Street Segment	Land Use Context Overlay	Street Type	Transit Overlay	Bicycle Overlay	Pedestrian Overlay	Truck Overlay	Modal Priority (in order)
NORTH COUNTY	**International Blvd.** *(Fruitvale Ave. to 38th Ave.)*	Corridor/ Neighborhood Mixed Use	**Community Connector**	Major Corridor	None	***Tier 1 - (>9.0 score)*** ▪ Neighborhood Mixed Use PDA. ▪ On AC Transit Priority Corridor. ▪ Within 1/4 mile of BART Station ▪ Community of Concern Tract.	None	Transit Pedestrian Auto Bicycle Truck
CENTRAL COUNTY	**D Street** *(Mission Blvd. to 1st Street)*	Downtown Mixed Use	**Neighborhood Connector**	Local (on part of segment)	Class 2	***Tier 1 - (>9.0 score)*** ▪ City Center PDA. ▪ Within 1/4 mile of ACT Priority Corridor. ▪ Within 1/4 mile of BART station. ▪ Community of Concern Tract.	None	Pedestrian Bicycle Transit Auto Truck
SOUTH COUNTY	**Mission Blvd.** *(Driscoll Rd. to I-680)*	Residential, and Education	**Throughway**	Local	Class 2	***Pedestrian Emphasis not considered***	Tier 2	Auto Truck Bicycle Transit Pedestrian
EAST COUNTY	**Stanley Blvd.** *(Bernal Ave. to Isabel St.)*	Rural/Open Space	**Throughway**	Local	Class 2	***Pedestrian Emphasis not considered***	Tier 2	Auto Truck Bicycle Transit Pedestrian

1.5 The Arterial Network

Studying the 1,200 miles of Study Network provided a sound understanding of the role of the county's local roads in serving various modes and users and the surrounding land uses; however, given the large countywide scope of the study, a more manageable subset of the Study Network was ultimately needed to identify mode-specific improvements. The Arterial Network is the subset of Study Network roads that are of countywide significance and constitute a set of continuous and connected networks for each mode (see Figure 1.2.1). To identify the arterials of countywide significance and the modal priorities on each Study Network segment (as discussed in Section 1.4), the project team developed a "tiering" process in coordination with stakeholders to rank the Study Network segments. This process prioritized each facility type for each mode into tiers (see Appendix 1.5.1 for details on the "tiering" process development). As explained in more detail below, the top tiers for each mode were then used to create the 510 miles of Arterial Network, which is truly a network of countywide significance.

Transit
- Tier 1 = Major Corridors
- Tier 2 = Crosstown Routes
- Tier 3 = Local Routes

Pedestrian
- Tier 1 = High Emphasis
- Tier 2 = Medium Emphasis
- Tier 3 = Low Emphasis

Bicycle
- Tier 1 = Class 2 Enhanced, Class 3 Enhanced, Class 4
- Tier 2 = Class 2
- Tier 3 = Class 3

Auto
- Tier 1 = Throughway
- Tier 2 = County Connector
- Tier 3 = Community Connector
- Tier 4 = Neighborhood Connector

Goods Movement

- Tier 1 = Tier 2 route (from Goods Movement Plan)
- Tier 2 = Tier 3 route (from Goods Movement Plan)

As shown in Figure 1.5.1, for each arterial segment, the top tier for each mode was determined based on the existing or desired facility type for each mode, with two exceptions. Land use was also considered in identifying the pedestrian network. For autos, the top tier includes the CMP and MTS (which also include non-highway State Routes), throughways (all defined previously) and rural roads with more than 7,500 vehicles per day, on average. Lower tiers were generally defined based on other adopted local and countywide plans.

Figure 1.5.1: Arterials of Countywide Significance – Summary Network Criteria

Mode	Arterial Network Selection Criteria
Auto	• CMP Network • MTS Network • Throughways • Rural roads with ADT greater than 7,500
Transit	AC Transit, LAVTA and Union City Transit Major Corridors
Bicycle	Class 2 Enhanced, Class 3 Enhanced and Class 4 bicycle facility network (Arterial Network is only streets, so no Class 1 paths)
Pedestrian	High Pedestrian Emphasis network
Goods Movement	Tier 2 Goods Movement Routes (defined in Goods Movement Plan)

For most of the MAP development process, through the "Needs Assessment" for each mode discussed in the following chapter, the project team analyzed the 1,200-mile Study Network; however, due to the significant effort involved in identifying the modal improvements needed to serve identified needs, modal improvements are identified primarily on the core network of 510 miles of Arterial Network. The rich information gathered and analyzed for the remaining Study Network can be used for other focused and localized roadway improvement projects.


BIKE ROUTE
COUNTY OF
ALAMEDA


ONE WAY
BART Station
72 SAN PABLO
HILLTOP MALL
1068

2 Is the Study Network Meeting Our Objectives?

Chapter 1 described how the project team worked with local jurisdictions, transit agencies and Caltrans to develop typologies to determine which modes should be prioritized on each segment of the 1,200 miles of Study Network, and identify the roadways of countywide significance that, therefore, belong on the multimodal Arterial Network. This chapter explains how the team developed metrics with which to evaluate how well each roadway segment performs in existing conditions and is projected to perform in the future particularly relative to the segment's priority modes.

2.1 Performance Measures[10]

Alameda CTC, local jurisdictions, transit agencies and other stakeholders can use performance measures to gauge how well the Study Network is performing in supporting each mode and adjacent land use, to meet the Plan's vision and goals. These measures – explained later in this section and summarized in Figure 2.1.1 – each assess the performance of a particular mode or roadway characteristic on a particular segment. The 1,200 miles of Study Network was divided into over 2,700 segments. Unlike LOS, the traditional performance measure, which shows how efficiently motor vehicles travel, the MAP measures were chosen to describe the traveler's experience. All apply to existing conditions, future year conditions or both.

Figure 2.1.1: Facility-Specific Performance Measures

Category	Performance Measure
Transit	• Transit Travel Speed • Transit Reliability • Transit Infrastructure Index
Pedestrian	Pedestrian Comfort Index
Bicycle	Bicycle Comfort Index
Auto	• Congested Speed • Reliability
Trucks / Goods Movement	Truck Route Accommodation Index
Intelligent Transportation Systems (ITS)	Coordinated Technology
State of Good Repair	Pavement Condition Index (PCI)
Safety	Collision Rates

[10] See Appendix 2.1.1: Performance Measures technical memo for details.

Performance measures

Transit

Three performance measures indicate how well a particular segment achieves transit goals:

- **Transit travel speed,** obtained from on-board GPS tracking devices, measures the average speed of buses (and shuttles) on Study Network segments where service was provided in 2015, when this plan was being developed. It influences the attractiveness of transit for potential passengers and transit operating costs.
- **Reliability,** estimated by comparing peak hour transit travel speed to non-peak hour speed, provides a general indication of attractiveness of transit for riders along an arterial corridor.
- **Transit infrastructure index** rates bus stops low, medium or high on each Study Network segment according to design and amenities. The methodology is based on the presence of bus bulbouts, length of bus stop, far or near-side bus stop location, sidewalk width, bus stop amenities and presence of wayfinding information. See Figure 2.1.2

Figure 2.1.2: Transit Infrastructure Index Calculation

Pedestrian

Pedestrian comfort index rates representative Arterial Network segments as low, medium, high or excellent based on pedestrian facilities and auto traffic characteristics, with pedestrian infrastructure being weighed more heavily. Factors include sidewalk presence and width; presence of a buffer between sidewalk and roadway; roadway classification, number of lanes, speed limit and traffic level; and distance between crosswalks. See Figure 2.1.3

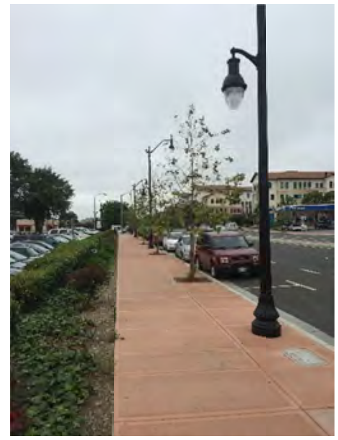
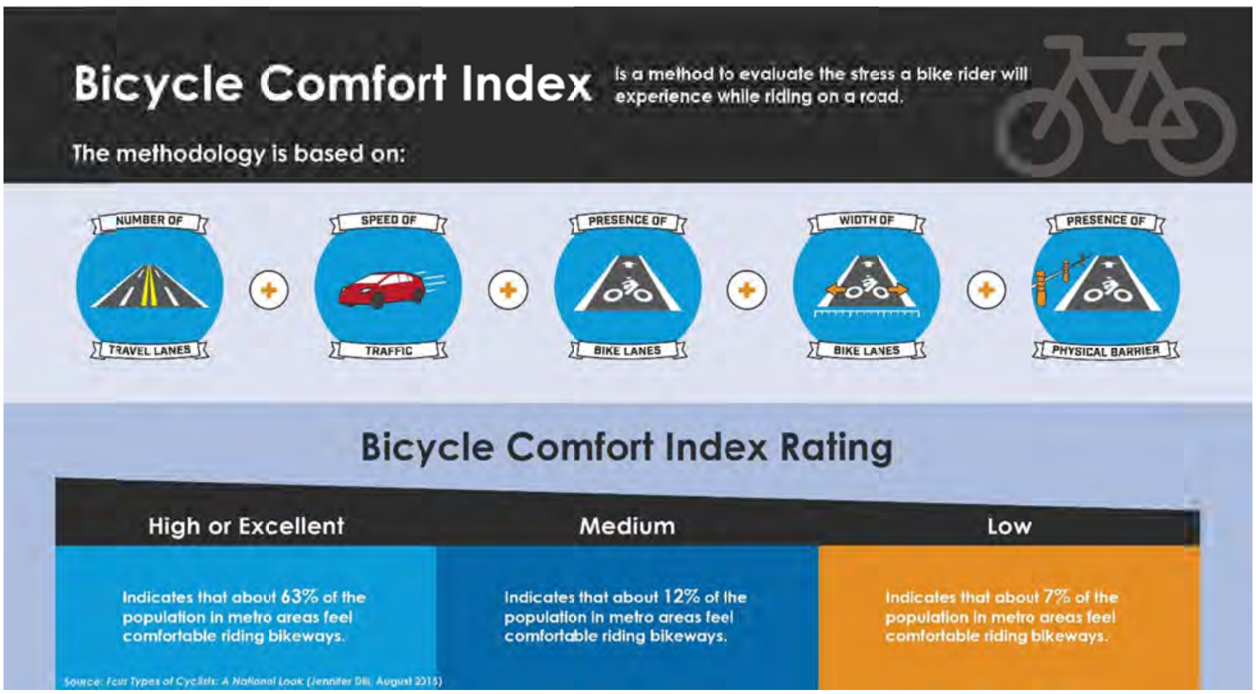


Figure 2.1.3: Pedestrian Comfort Index graphic

Bicycling

Bicycle Comfort Index is based on the concept of Level of Traffic Stress (LTS[11]) that a traveler experiences while biking on a road. LTS classifies roadway segments into one of four levels of traffic stress (LTS1 to LTS4, which correspond to excellent, high, medium or low rating, respectively) depending on how much stress a cyclist is willing to tolerate. The methodology is based on number of travel lanes, speed of traffic, presence of bike lanes, bike lane width and presence of physical barriers. See Figure 2.1.4

Figure 2.1.4: Bicycle Comfort Index graphic



- **LTS1 (Excellent rating):** Most children feel safe here.
- **LTS2 (High rating):** Mainstream adult population feels safe here.
- **LTS3 (Medium rating):** Cyclists who prefer their own dedicated space for riding will still feel safe here.

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[11] LTS is a methodology developed by the Mineta Transportation Institute (2012) that examines the characteristics of city streets and how various aspects can create stress for bicyclists, thus affecting where they are likely to ride.

- **LTS4 (Low rating):** Tolerated only by those considered “strong and fearless” feel safe. Includes roads with high speed limits, multiple travel lanes, limited on non-existent bike lanes and signage, and large distances to cross intersections.

Auto

Two performance measures indicate how well a particular segment achieves automobile goals:

- **Congested speed**, obtained from the INRIX[12], local jurisdictions or Alameda countywide travel demand model, is proportional to the quality of drivers’ experience on the roadway.
- **Reliability**, PM peak hour volume/capacity ratio, where volumes are from jurisdictions or the countywide model, indicate if a segment operates below, at or above its capacity during the evening commute hour.

Goods movement

Truck Route Accommodation Index is based on curb travel lane width to accommodate truck travel. Twelve feet or greater is the highest rating, 11 feet next and 10 feet is the narrowest curb lane width to earn any points. Roadways with on-street parking or loading/unloading areas score higher.

ITS

ITS Infrastructure is a 4-level scale indicating the level of ITS investment.

State of good repair

Pavement Condition Index (PCI) ratings from MTC’s StreetSaver database assesses when overlays and reconstruction are recommended.

Safety

Collision rates from the SWITRS[13] database (See end of Appendix 2.1.1: Performance Measure memo for a map of collision rates).

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12 INRIX is the vendor of large-scale “big data,” which is gathered from smart phones, on-board navigation systems, fleet vehicles that are tracked with GPS and other technologies that record the anonymized travel patterns of vehicles.

13 Statewide Integrated Traffic Records System.

2.2 Performance Objectives

Performance objectives establish specific thresholds to indicate the degree to which each mode is functioning or is projected to function in terms of the Plan's performance measures (see Section 2.1). For each performance measure listed in section 2.1, Figure 2.2.1 lists the corresponding performance objectives for each mode. See Appendix 2.2.1 for more information on the source of these objectives.

Figure 2.2.1: Multimodal Arterial Plan Performance Objectives

Performance Measure	Modal Objectives[1]				
	Autos	Transit	Pedestrian	Bicycle	Trucks
Transit Travel Speed	*	Greater than 75% of the Auto Congested Speed	*	*	*
Transit Reliability	*	Greater than 0.7 *(PM peak hour-to-non-peak hour transit speed ratio)*	*	*	*
Transit Infrastructure Index	*	Medium or High	*	*	*
Pedestrian Comfort Index	*	Medium, High or Excellent	High or Excellent	*	*
Bicycle Comfort Index	*	*	*	High (LTS 2) or Excellent (LTS 1)	*
Auto Congested Speed	Greater than 40% of Posted Speed Limit	*	*	*	Greater than 40% of Posted Speed Limit
Auto Reliability	Reliable (Volume-to-capacity ratio less than 0.8)	*	*	*	Reliable (Volume-to-capacity ratio less than 0.8)
Truck Route Accommodation Index	*	*	*	*	High

Notes:

1. Please see Appendix 2.2.1 for detailed explanations of terms in this figure.
2. The asterisk (*) indicates that a performance objective is not applicable for that specific modal priority in the MAP development.

2.3 Needs Assessment[14]

Study Network roadways that do not meet performance objectives today, or are not projected to do so in the future (see Tools section, below) need improvements to best serve their priority modes. Roadways that currently meet these objectives and are forecast to continuing to do so, will not need further improvements. The project team used the results of the performance objectives analysis to identify proposed improvements needed .to allow underperforming roadways to perform better and come closer to meeting performance objectives in the future (see Chapter 3). The Needs Assessment evaluation focused on the top two modal priorities along each segment to identify if the performance measure objectives were met. A segment was identified as having a need for improvement if performance objectives were not met for either of the top two modal priorities.

Figure 2.3.1 shows the needs assessment evaluation of four sample arterial segments. Land use, street type and modal typology overlays determine the modal priority on each segment. Segments that do not meet both of the top two modes' performance objectives are identified as having improvement needs. This outcome provides decision-makers with information with which to identify short-term and long-term investments needed to allow the Study Network to achieve the Plan's vision and goals, as much as possible. They can also build on this framework to include or implement improvements for other modes as needed.

[14] See Appendix 2.3.1: Needs Assessment technical memo for details.

Figure 2.3.1: Example Needs Assessment Determination

Street Segment	Land Use Context Overlay	Street Type	Transit Overlay	Bicycle Overlay	Pedestrian Overlay	Truck Overlay	Modal Priority	Year 2040 Performance Objective Met for High Priority Modes?	Need for Improvement?
San Pablo Avenue between 20th Street and 27th Street (Oakland)	Downtown Mixed Use	Community Connector	Major Corridor	Class 3	Tier 1	None	1. Transit 2. Pedestrian 3. Bicycle 4. Automobile 5. Goods Movement	Transit: • Speed – Objective Not Met • Reliability – Objective Met • Transit Infrastructure Index – Objective Not Met Pedestrian: • Pedestrian Comfort Index – Objective Met	**Yes** – Transit Mode Improvements Needed
W. Tennyson Road between Tampa Avenue and Leidig Court (Hayward)	Residential and Commercial	County Connector	Local Route	Class 2	Tier 3	Tier 3	1. Pedestrian[1] 2. Bicycle 3. Automobile 4. Transit 5. Goods Movement	Pedestrian: • Pedestrian Comfort Index – Objective Not Met Bicycle: • Bicycle Comfort Index – Objective Not Met	**Yes** – Pedestrian and Bicycle Mode Improvements Needed
Paseo Padre Parkway between Peralta Boulevard and Grimmer Boulevard (Fremont)	Downtown Mixed Use	Community Connector	Local Route	Class 2	Tier 2	None	1. Pedestrian 2. Bicycle 3. Transit 4. Automobile 5. Goods Movement	Pedestrian: • Pedestrian Comfort Index – Objective Not Met Bicycle: • Bicycle Comfort Index – Objective Not Met	**Yes** – Pedestrian and Bicycle Mode Improvements Needed
Tesla Road between S. Livermore Avenue and S. Vasco Road (Alameda County)	Rural/Open Space	Community Connector	None	Class 2	None	Tier 3	1. Automobile[2] 2. Goods Movement 3. Bicycle 4. Pedestrian	Automobile: • Speed – Objective Met • Reliability – Objective Not Met Goods Movement: • Truck Infrastructure Index – Objective Met	**Yes** – Automobile Improvements Needed

Notes:

1. Applying the modal priority methodology along W. Tennyson Road in Hayward results in the following priority: Automobile, Goods Movement, Bicycle, Pedestrian and Transit. However, Hayward staff requested that the modal priority for W. Tennyson Road be changed to that listed in the figure above.
2. Applying the modal priority methodology along Tesla Road in Alameda County results in the following priority: Goods Movement, Bicycle, Automobile and Pedestrian. However, Alameda County staff requested that the modal priority for Tesla Road be changed to that listed in the figure above.

Evaluation Tools

Geographic Information System (GIS) Tool

The project team developed a powerful geographic information system (GIS) tool to measure the performance of each mode on each Study Network segment; how much right-of-way may be available on each segment to repurpose for other modes; and the improvements that would help these segments better meet the priority modes' performance objectives. The automation of GIS tool made it possible to perform detailed evaluation of the 1,200 miles of the Study Network at segment level. The project team recommended improvements to particular segments under one or more of the following conditions:

- If a given segment did not meet the objective for either of the top two priority modes;
- If pedestrian improvements were needed regardless of priority; or
- If improvements were needed to create a continuous network for a particular mode. Chapter 3 discusses this needs assessment and how the project team identified corresponding improvements.

The GIS tool evaluated the performance of each segment according to three scenarios:

- Existing conditions (i.e., what is on the ground today?),
- 2020 network (Existing conditions plus planned and funded improvements through 2020), and
- 2040 network (2020 network plus what's planned to be on the ground in 2040, i.e., CTP investments).

Chapter 3 discusses the output of this tool, and how it was used to identify specific proposed improvements on each segment with an identified need.

Alameda Countywide Travel Demand Model and Alternative Scenarios[15]

The Alameda Countywide Travel Demand Model uses expected growth in population and jobs to project travel demand growth within Alameda County and also for the region, and corresponding changes in expected traffic volumes and speeds. The GIS tool used model results for existing conditions, and the years 2020 and 2040.

In addition to the performance analyses that used the traditional countywide travel demand model, the team also evaluated two alternative scenarios to inform Alameda County jurisdictions on how these emerging social and technological trends may impact future travel patterns by transit and auto, and how these trends could point to a different set of modal improvement needs:

- **Social and behavioral trends scenario,** which assumes lower per capita auto ownership and Vehicle Miles Traveled (VMT) rates, based on recent trends.
- **Next generation vehicle scenario,** which anticipates an increase in roadway capacity as a result of autonomous vehicles. These vehicles could also minimize the need for on-street parking along the Study Network since fully autonomous vehicles are expected to be able to drop off users at their destination and park themselves several blocks away. Providing on-street parking along the Study Network may not be critical if fully autonomous vehicles can drop off/pick up users curbside and park on another street. As a result, jurisdictions could consider removing on-street parking along the Study Network and repurposing the right-of-way to implement a variety of multimodal improvements.

[15] See Appendix 2.3.2: Travel Demand Forecasting memo for details.

3 Improvements Needed for a Multimodal Future

Chapter 2 described the Multimodal Arterial Plan's performance measures, objectives and needs assessment process. This chapter considers which segments of the countywide Multimodal Study Network are and are not projected to meet the Plan's performance objectives for the top two prioritized modes on that segment, and identifies improvements that would allow these sub-performing segments to either meet or come as close as possible to meeting the objectives. Detailed improvement options considered for each mode are also elaborated. While the improvements needed to meet the objectives for each mode were determined for the entire Study Network, corresponding improvements were identified or proposed only for the Arterial Network. Brief high level cost estimates for the proposed modal improvements and measurement of their benefits on the countywide system are also included towards the end of this chapter.

This chapter also looks at closing gaps in each mode's arterial network. The important theme of continuous and connected networks emerged during the MAP development process. Building on the concept of complete streets is the idea that, in order to facilitate more travel by transit, walking and bicycle and to enable goods movement and auto throughput, each mode needs to have a continuous and connected network throughout the county. For example, a single BRT line designed to replace a high demand bus service further enhances transit viability in one corridor, while a continuous and connected network of bus priority streets provides a reliably good transit service for any trip within the County. The same is true of cycling and walking. Increasing the number of people using these modes will require expanding beyond isolated complete streets projects to complete and connected networks for each mode.

Building on the concept of complete streets is the idea that, in order to facilitate more travel by transit, walking and bicycle and to enable goods movement and auto throughput, each mode needs to have a continuous and connected network throughout the county.

3.1 Identifying proposed improvements

As described in Section 2.3 Needs Assessment, the project team identified the segments of the Study Network not projected to meet the performance objectives. A four-step process laid out in this section was conducted for each Arterial Network segment and identified improvements that would allow these failing segments to meet performance objectives as much as possible for the high (top two) priority modes. These steps include: determining available right-of-way; identifying potential improvements; checking network connectivity; and vetting proposed improvements with local jurisdictions. The needs of all modes are typically considered when improving a given roadway segment; however, due to the large scope of this effort, the MAP focus was on providing a framework and countywide context to establish continuous and connected networks for only the high priority modes. See Figure 2.3.1 for examples of this process and Appendix 3.1.1 for more details on the GIS Tool and identification of proposed improvements.

Step 1: Determine available right-of way

Available right-of-way is the critical element in defining improvements that can be made on a particular roadway segment to better support and accommodate any modal needs. Using aerial imagery, the project team estimated available right-of-way on all Arterial Network roadways. This information was input into the project's GIS tool and used to estimate the portion of roadway that could be repurposed to better accommodate the priority modes assuming the following NACTO[16] minimums:

- 10' travel lanes (11' curb lanes for bus and truck routes in all jurisdictions; 11' travel lanes in Livermore and Alameda County per their request)
- 10' median (where provided)
- 8' parking lanes (where provided)
- 5' bike lanes (where provided)

Potential repurposing would also involve narrowing individual elements of the cross-section, by reducing the width of a 13-foot travel lane or a median, for example. Some jurisdictions requested that the team also consider parking removal in order to provide additional right-of-way that could be used to accommodate other modes.

Step 2: Identify potential improvements

For roadway segments where performance objectives for the priority modes are not being met or are not forecast to be met in the future and where Step 1 revealed the potential for excess right-of-way, the project team used the GIS tool to identify improvements that would require additional right-of-way. The tool then identified potential modal improvements that would allow these segments to best meet the plan's performance objectives for the top two priority modes and could be implemented within available right-of-way. The tool was able to suggest various improvements for each mode, based on priority, to each roadway segment where there is excess width (right-of-way); however, the tool does not have the human professional judgment required to iterate, where possible, to arrive at the set of improvements that provide the highest possible tier facilities of the two priority modes (see

[16] National Association of City Transportation Officials

Section 1.4) considering synergies while accommodating both modes. The GIS Tool identified the following set of suggested improvements by mode based on available right-of-way:

Travel Lane Repurposing

Where transit, pedestrian or bicycle were identified as the top two modal priorities, the GIS Tool suggested travel lane repurposing only if the automobile volume-to-capacity ratio after lane removal would be less than:

- 0.8 if automobiles were considered top modal priority,
- 1.0 if automobiles were considered second priority,
- 1.2 if automobiles were considered third priority, or
- Any value if automobiles were considered fourth of fifth priority.

For example, if bicycles were considered top priority and automobiles second, the GIS Tool would recommend removing a mixed-flow travel lane if the resulting volume-to-capacity ratio would be less than 1.0.

Transit

The GIS Tool suggested the following transit network improvements:

- Dedicated transit lanes if the study segment is part of a Major Corridor, the travel lane repurposing criteria described above would be met and there is sufficient right-of-way to implement minimum 12’ transit only lanes in each direction, and
- Bus stop curb extensions where there is on-street parking.

The project team identified Rapid Bus improvements manually for Major Corridors to be consistent with AC Transit’s Major Corridor Study (see Section 3.2 Transit Network Proposed Improvements for more details). The team identified Enhanced Bus improvements manually for high priority transit segments that are not part of a Major Corridor.

Pedestrians

The GIS Tool suggested the following pedestrian network improvements:

- Adding sidewalks where they are not present,
- Widening existing sidewalks to six feet in residential areas where existing sidewalks are less than six feet wide,
- Widening existing sidewalks to nine feet in commercial areas where existing sidewalks are less than nine feet wide,
- Curb extensions where there is no on-street parking,
- Streetscape improvements along segments with painted or raised medians, and
- Implementing high-visibility crosswalks.

Although not automated by the GIS Tool, the project team manually identified pedestrian-scale lighting improvements on segments with high pedestrian priority near transit hubs, downtown areas and major commercial areas.

Bicycles

The GIS Tool suggested the following bicycle network improvements:

- Minimum five-foot Class 2 bicycle lanes where available right-of-way ranged from 10 to 13 feet for two-way streets or from five to six feet for one-way streets,
- Minimum five-foot Class 2 enhanced buffered bicycle lanes with two foot buffers where available right-of-way ranged from 14 to 15 feet for two-way streets or at least seven feet for one-way streets,
- Minimum five-foot Class 4 protected bicycle lanes with three foot buffers where available right-of-way was greater than 16 feet for two-way streets, or greater than eight feet for one-way streets, and
- Class 3 bicycle routes along segments without available right-of-way to implement dedicated on-street bicycle lanes. Class 3 enhanced bicycle boulevard improvements are also proposed for collector segments with 25 MPH speed limits and one lane in each direction, that are parallel to nearby arterials.

Proposed Class 1 multi-use path improvements were based on stakeholder input, rather than the GIS Tool, as they are outside of roadway right-of-way, which was the focus of the MAP scope.

Automobiles

The GIS Tool identified study segments that did not meet the automobile mode’s congested speed and/or reliability performance objectives. The project team then applied their professional judgement to identify appropriate automobile network improvements that would enhance traffic management along these congested segments.

Goods Movement

The GIS Tool suggested minimum 12-foot curb lane widths in each direction along goods movement network routes where there is sufficient right-of-way.

In summary, the project team used professional judgment in combination with the GIS Tool’s multimodal improvement suggestions to propose improvements that can enhance study segment performance for the high-priority modes (see example in Figure 3.1.1). Where there was no excess right-of-way, other improvements to benefit these modes were considered, such as optimizing bus stop locations and spacing, implementing ITS improvements, and adding corner bulbs and high-visibility crosswalks for pedestrians.

Step 3: Check network connectivity

Connectivity checks were an important part of the overall MAP scope and the basis for assuring that street-by-street proposals stitched together into continuous and connected modal networks. In this step, the project team identified additional multimodal improvements for lower priority modes along segments with available right-of-way in an effort to develop a complete and connected network for each mode across the county:

- **Transit**: Jurisdictions proposed improvements along high priority transit segments beyond those that the transit agencies recommended for the AC Transit/LAVTA Major Corridors.
- **Pedestrians**: Improvements were proposed to enhance pedestrian connectivity to transit around major transit hubs (e.g. BART stations) and along transit Major Corridors with recommended transit-only lane improvements.
- **Bicycles**: Improvements were identified along lower priority bicycle segments that are key to building a countywide bicycle network. The Network Connectivity checks also included a review of Class 1 multiuse trails, such as the Bay Trail, East Bay Greenway and Iron Horse Trail, and non-arterial Class 3 Enhanced (bike boulevard) bikeways, such as the Berkeley Bike Boulevard system, that parallel Arterial Network segments.
- **Autos**: ITS improvements were identified along segments with low auto priority but are key segments to managing traffic demand along Arterial Network corridors. ITS improvements were also identified along high priority transit segments that may have low auto priority.
- **Goods Movement**: Curb lane widenings were proposed along the goods movement arterial network.

Step 4: Review proposed improvements with local jurisdictions

The next step in the process of identifying proposed improvements that would allow the multimodal arterial network to meet this Plan's performance objectives as well as possible was to present these improvements to local agencies for their review so agency staff could consider them in light of local conditions and their communities' unique issues. Through a series of one-on-one or small group meetings, these local agency stakeholders/experts reviewed the MAP process and outcomes in terms of proposed mode-specific improvements, and directed changes as needed to suit local conditions (see Appendix 3.1.1.for more details).

The remaining sections of this chapter summarize the type of improvements considered for each mode. The chapter concludes with a summary of the projected benefits of these improvements.

Figure 3.1.1: Example Improvement Determination

Street Segment	Proposed Improvements	Year 2040 Performance Measure Results for High Priority Modes – Before Improvements	Year 2040 Performance Measure Results for High Priority Modes – After Improvements	Year 2040 Performance Objectives Met for High Priority Mode – After Improvements	Additional Need for Improvement After Implementation of Proposed Improvements?
San Pablo Avenue between 20th Street and 27th Street (Oakland)	Transit: • Dedicated Transit Lanes Pedestrian[1]: • High-visibility crosswalks • Pedestrian scale lighting	Transit: • Speed = 17.5 MPH • Reliability = 0.86 • Transit Infrastructure Index = Low Pedestrian: • Pedestrian Comfort Index = High	Transit: • Speed = 25 MPH • Reliability = 0.90 • Transit Infrastructure Index = High Pedestrian: • Pedestrian Comfort Index = High	Transit: • Speed – Objective Met • Reliability – Objective Met • Transit Infrastructure Index – Objective Met Pedestrian: • Pedestrian Comfort Index – Objective Met	**No**
W. Tennyson Road between Tampa Avenue and Leidig Court (Hayward)	Pedestrian: • High-visibility crosswalks • Landscaped buffers between sidewalk and travel lanes • Pedestrian scale lighting • Curb bulbouts Bicycle: • Class 4 protected bike lanes	Pedestrian: • Pedestrian Comfort Index = Medium Bicycle: • Bicycle Comfort Index = Medium	Pedestrian: • Pedestrian Comfort Index = High Bicycle: • Bicycle Comfort Index = Excellent	Pedestrian: • Pedestrian Comfort Index – Objective Met Bicycle: • Bicycle Comfort Index – Objective Met	**No**
Paseo Padre Parkway between Peralta Boulevard and Grimmer Boulevard (Fremont)	Pedestrian: • Widen sidewalk • Provide high-visibility crosswalks • Provide pedestrian scale lighting Bicycle: • Class 4 protected bike lanes	Pedestrian: • Pedestrian Comfort Index = Medium (10) Bicycle: • Bicycle Comfort Index = Medium	Pedestrian: • Pedestrian Comfort Index = Medium (14) Bicycle: • Bicycle Comfort Index = Excellent	Pedestrian: • Pedestrian Comfort Index – Objective Not Met Bicycle: • Bicycle Comfort Index – Objective Met	**Yes** – Additional Pedestrian Improvements Needed[2]

Street Segment	Proposed Improvements	Year 2040 Performance Measure Results for High Priority Modes – Before Improvements	Year 2040 Performance Measure Results for High Priority Modes – After Improvements	Year 2040 Performance Objectives Met for High Priority Mode – After Improvements	Additional Need for Improvement After Implementation of Proposed Improvements?
Tesla Road between S. Livermore Avenue and S. Vasco Road (Alameda County)	Automobile: • Improvements not proposed[3] Goods Movement: • Improvements not proposed[4]	Automobile: • Speed = 30 MPH • Reliability = 1.32 Goods Movement: • Truck Route Accommodation Index = High	Automobile: • Speed = 30 MPH • Reliability = 1.32 Goods Movement: • Truck Route Accommodation Index = High	Automobile: • Speed – Objective Not Met • Reliability – Objective Not Met Goods Movement: • Truck Route Accommodation Index – Objective Met	**Yes** – Automobile Improvements Needed

Notes:

1. Although pedestrian performance measure was High before improvements, MAP proposed pedestrian improvements as a part of implementing dedicated transit lanes.
2. Pedestrian performance improved along Paseo Padre Parkway with proposed improvements; however, implementation of proposed improvements would not meet the performance objective due to the segment being 4 to 6 lanes wide with a 35 MPH posted speed limit. Additional improvements, such as reducing the number of lanes to four lanes along the entire segment and/or reducing posted limits would result in the segment meeting the pedestrian performance objective; however, these additional improvements are not proposed as part of the MAP.
3. Due to the rural nature of the Tesla Road in unincorporated Alameda County, ITS improvements were not recommended. Additional improvements, such as widening Tesla Road from two to four lanes, may potentially improve the automobile performance. However, roadway widenings to provide additional travel lanes were not considered as part of the MAP.
4. Improvement not proposed because roadway segment meets performance objective for that specific mode under Year 2040 baseline conditions.

3.2 Transit Network Proposed Improvements

As described in more detail in Section 1.4, the transit components of the Arterial Network comprise AC Transit and LAVTA Major Corridors, which are also considered in the Countywide Transit Plan (see Figures 3.2.1 through 3.2.4). Concurrent with the MAP, AC Transit was developing their Major Corridor Study (MCS) to identify improvements to major corridors throughout Alameda County's North, Central and South planning areas. For the most part, the MAP proposals are in sync with the MCS (see Appendix 3.1.1 for details) and Alameda Countywide Transit Plan, though the MAP proposals are more detailed in that they are based on an analysis of available space for each improvement. The following three categories of transit improvements were considered:

Enhanced Bus Improvements are on-street improvements that reduce travel time, improve passenger comfort and increase operational efficiency. They are estimated to result in a maximum 10 percent increase in Transit Travel Speed[17]. Improvements under this category include:

- Bus stop consolidation
- Traffic signal optimization (not including transit priority detection)
- Far-side bus stop relocation at intersections
- Minimum 80 feet red curb at bus stops
- American with Disabilities Act (ADA) compliant bus stops (minimum eight foot by five foot landing area)
- Curb extensions (bulbouts) at bus stops, where feasible
- Bus stop amenities, such as bus shelters, benches, way-finding signs and real-time arrival information

Rapid Bus Improvements include Enhanced Bus improvements plus the two listed below. They are estimated to result in a maximum 23 percent increase in Transit Travel Speed.[18]

- Transit signal priority (TSP)
- Queue jump lanes or queue bypass lanes at intersections, where feasible

Dedicated Transit Lane Improvements build on the features of Enhanced and Rapid Bus to create a system that makes riding the bus similar to light rail. In addition to providing a high quality bus riding experience, Dedicated Transit Lane also focuses on supporting transit-oriented development around stations, maximizing comfort of passengers and improving station access. These improvements are estimated to result in a maximum 42 percent increase in Transit Travel Speed.[19] In addition to improvements from the Enhanced and Rapid Bus categories (with the exception of queue jump and bypass lanes), Dedicated Transit Lane improvements include the following:

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[17] AC Transit Major Corridors Study

[18] AC Transit Major Corridor Study

[19] AC Transit Major Corridor Study

- Dedicated on-street transit only lanes to improve transit speed and reliability
- Level boarding platforms (median or curb side) so boarding is faster and easier
- Pedestrian facility improvements (e.g., curb-bulbouts, high-visibility crosswalk enhancements, pedestrian scale lighting)

Existing AC Transit Rapid Bus stop

Far-Side Bus Stop with bulb-out, ADA-compliant loading platform, bus shelter, bench and Class 4 protected bicycle lane

BRT Station

Figure 3.2.1: Proposed Transit Improvements—North Planning Area

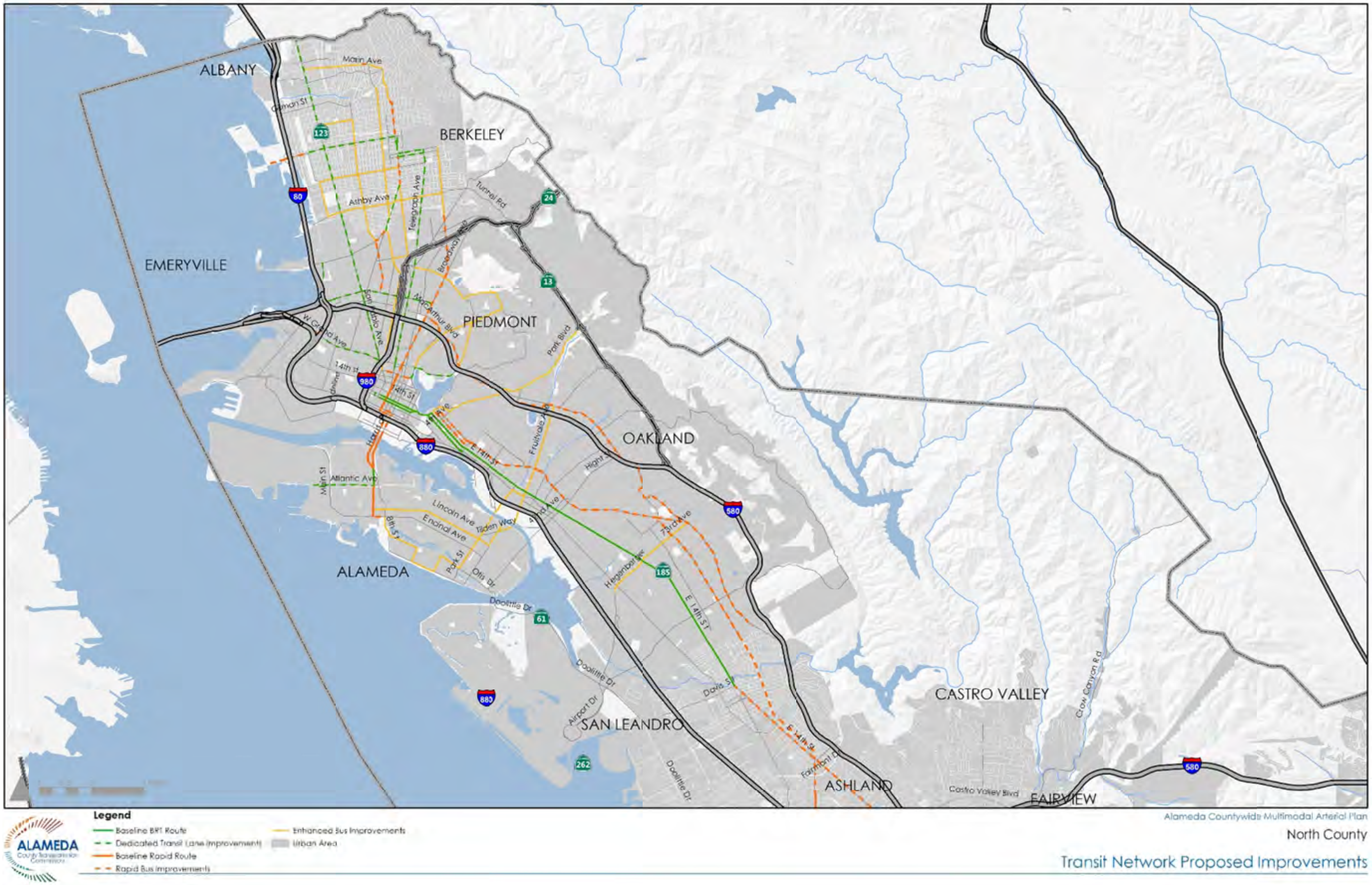


Figure 3.2.2: Proposed Transit Improvements—Central Planning Area

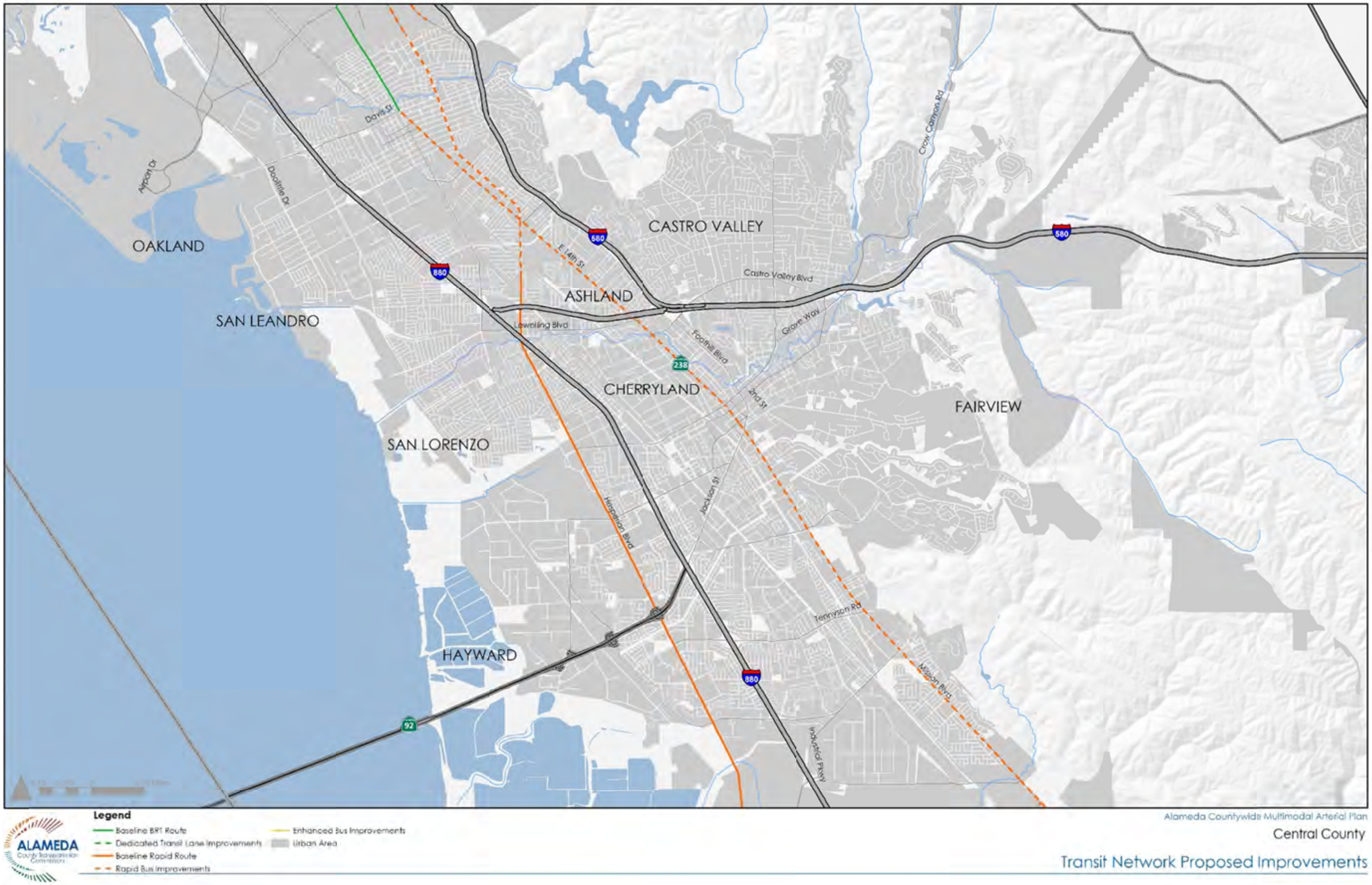


Figure 3.2.3: Proposed Transit Improvements—South Planning Area

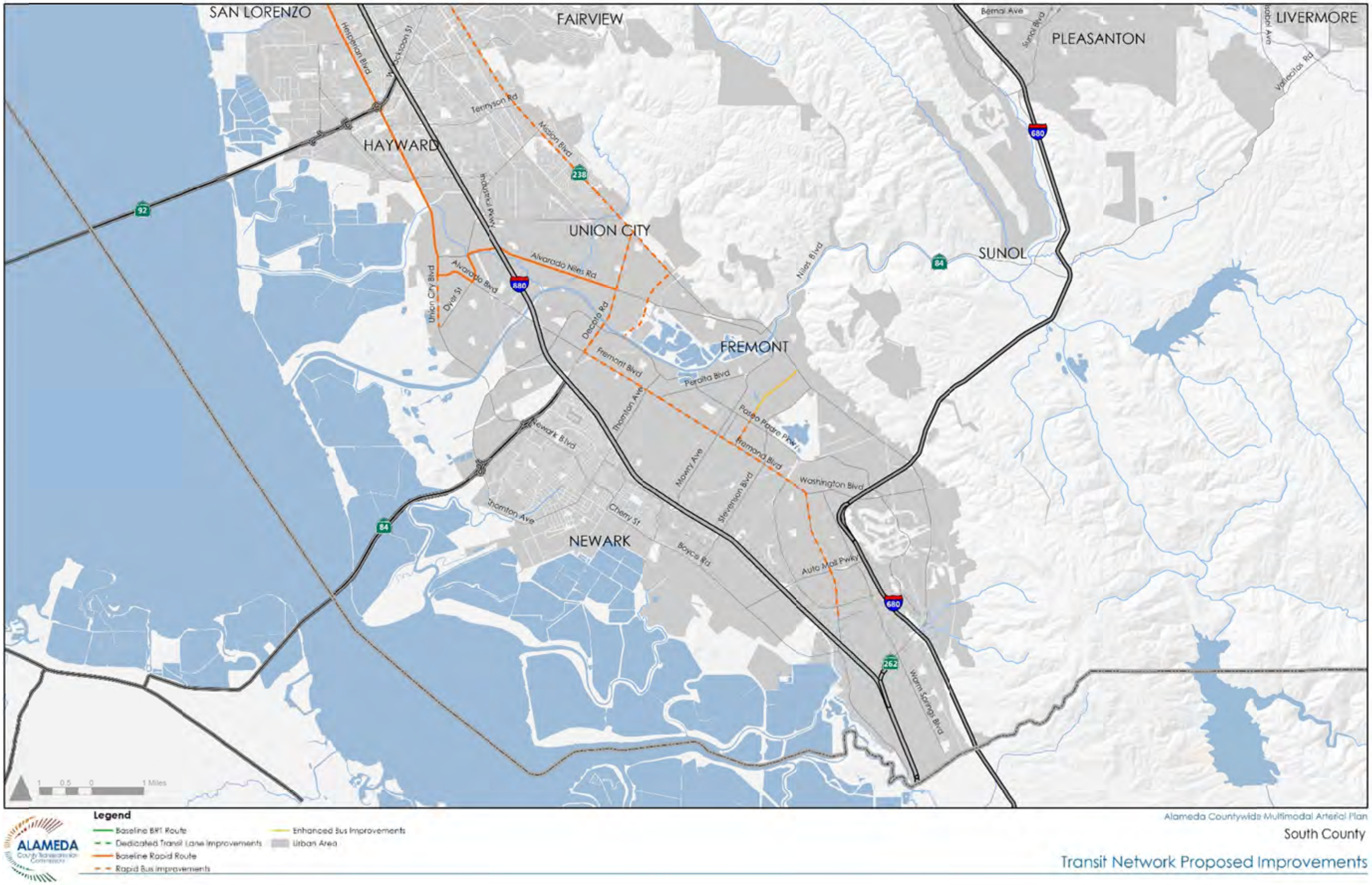
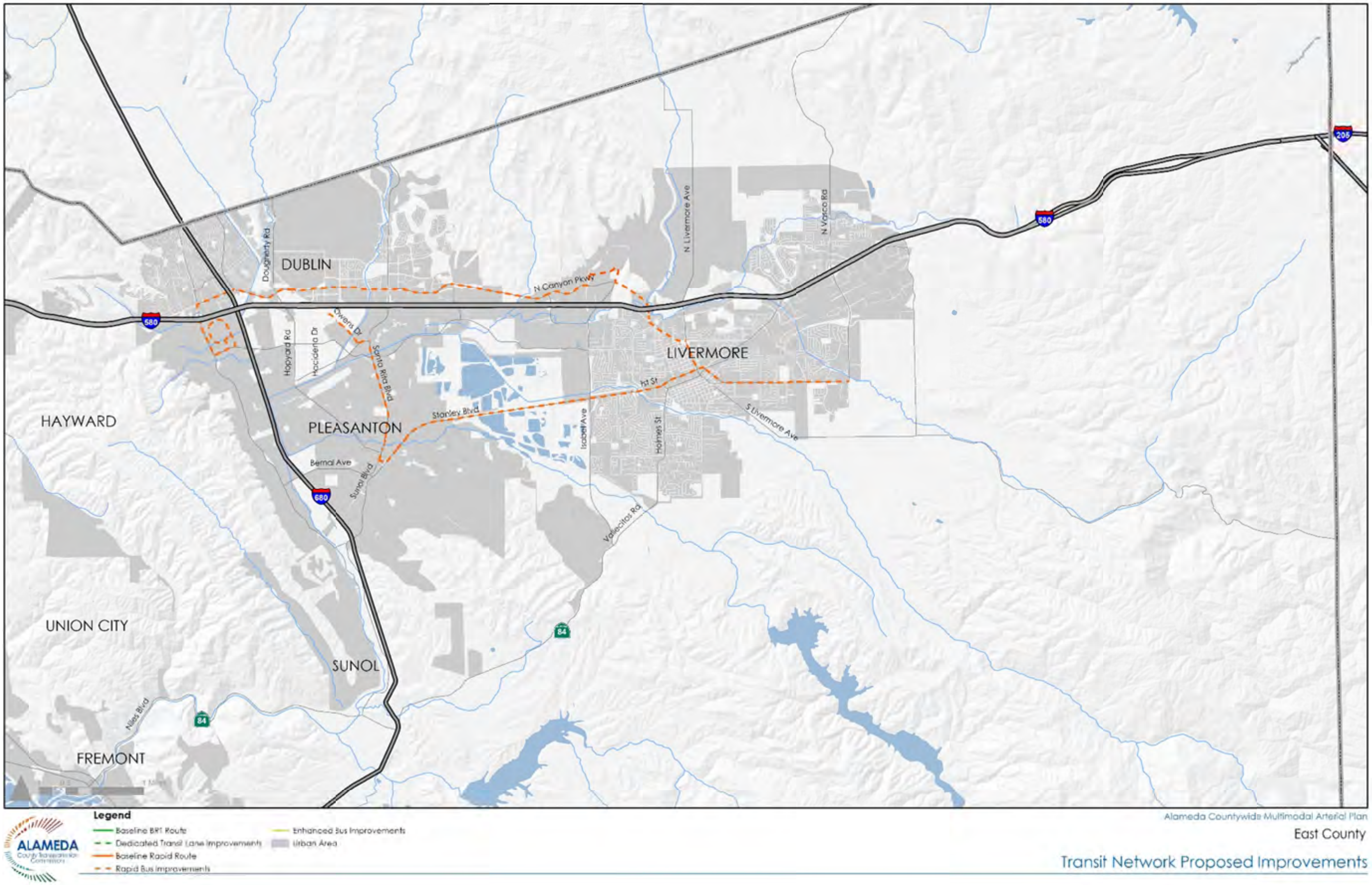


Figure 3.2.4: Proposed Transit Improvements—East Planning Area

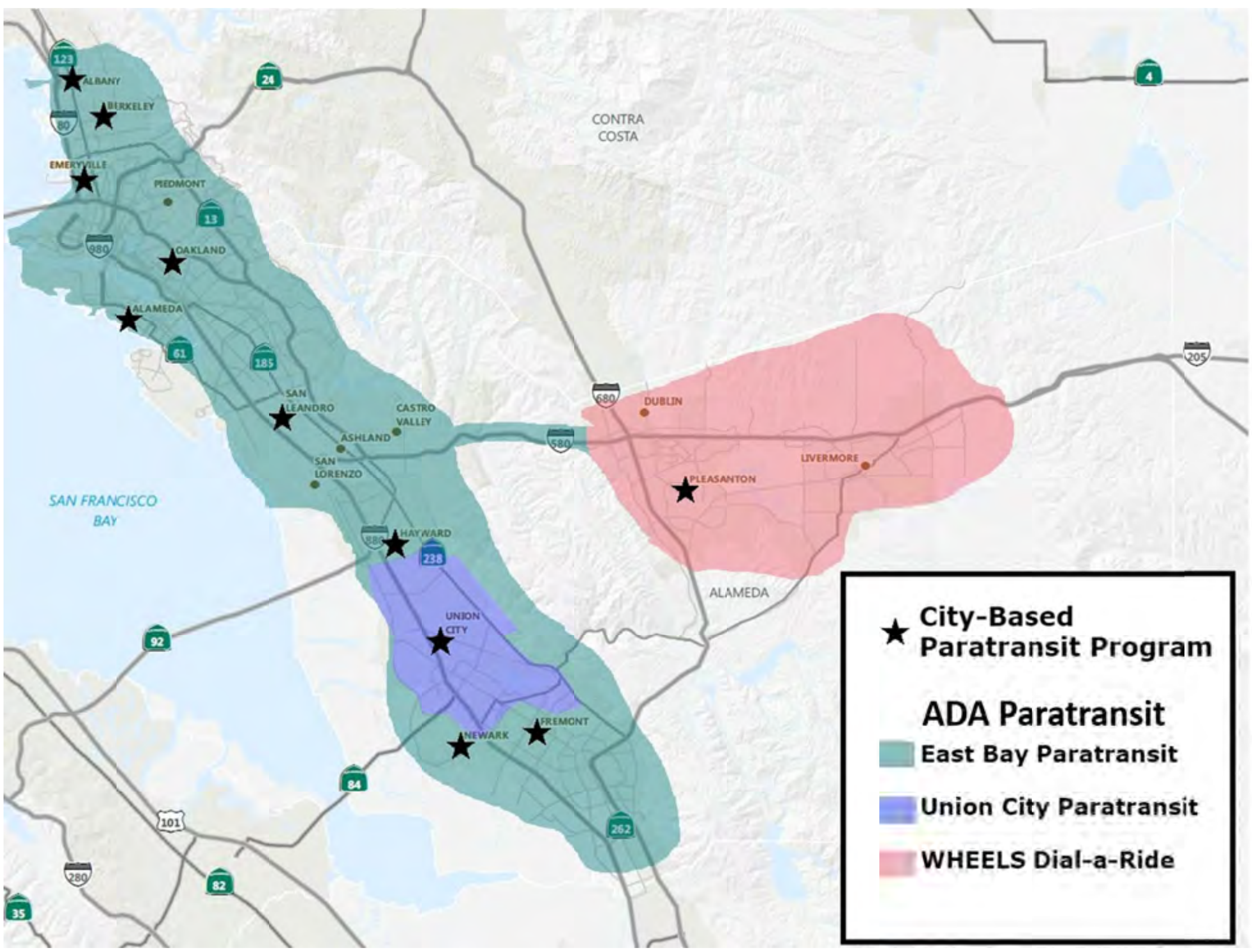


Paratransit Improvements: Paratransit, which provides rides for people whose disabilities prevent them from taking fixed route transit, operates on Alameda County's arterial roadway network. For the most part, paratransit serves particular land uses rather than bus stops, so this mode uses the Arterial Network more like an automobile than transit; however, since this Plan addresses the needs of all users and paratransit is an important component of Alameda County's multimodal transportation system, it must be considered in this multimodal arterial plan. In Alameda County, paratransit service is provided by two program types:

- Paratransit mandated by the federal Americans with Disabilities Act (ADA) that requires transit operators to provide complementary service to certified eligible users; and
- City-based paratransit programs that supplement ADA-mandated paratransit

Figure 3.2.5 shows the coverage of these two program types.

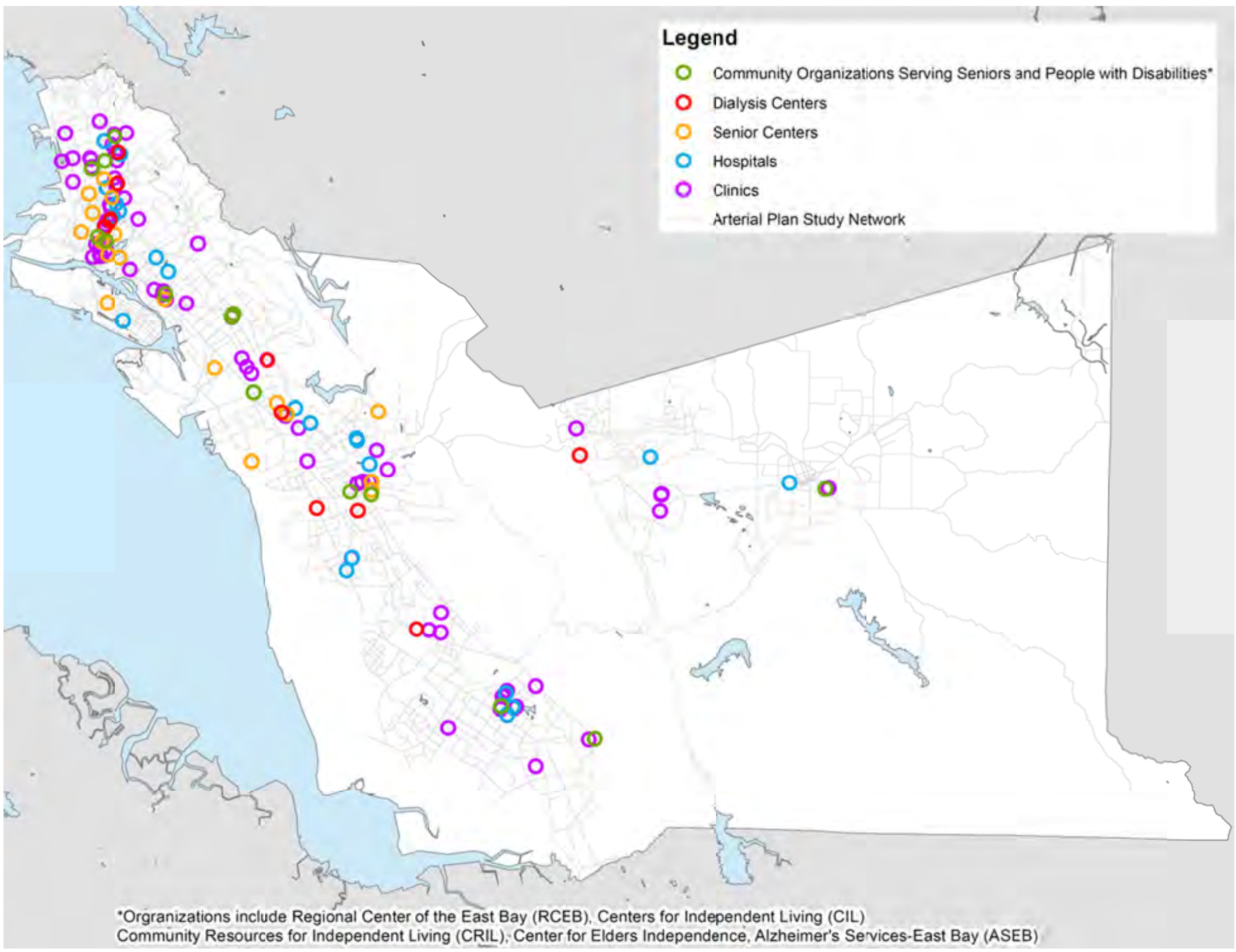
Figure 3.2.5 ADA-mandated and City-based Paratransit Service



These two paratransit program types provide access to a variety of services that are located on the Multimodal Arterial Plan's roadway network (See Figure 3.2.6) such as the following:

- Community organizations that serve seniors and people with disabilities, including the Regional Center of the East Bay (RCEB), Centers for Independent Living (CIL), Community Resources for Independent Living (CRIL), Center for Elders Independence, and Alzheimer's Services of East Bay (ASEB).
- Dialysis centers
- Senior centers
- Hospital and clinics

Figure 3.2.6 Alameda County Paratransit Service Destinations



These destinations highlight areas where pedestrian and transit improvements identified in the Multimodal Arterial Plan can also support mobility of seniors and people with disabilities. In addition, the Alameda Countywide Transit Plan identifies high level complementary transit capital improvements and strategies that could improve the experience for paratransit program users such as:

- Enhanced bus stations with amenities such as larger boarding areas and shelters;
- New buses with doors on both side that are designed for level boarding platforms and bulb outs;
- Raised platforms at transit stops;
- Off-vehicle fare payment that allow riders to pay their fare at the transit stop prior to boarding; and
- Bus bulbs that may provide ADA paratransit vehicles with necessary sidewalk space to deploy a ramp or lift.

3.3 Pedestrian Network Proposed Improvements

The Multimodal Arterial Plan considered the following six categories of walking improvements (see Figures 3.3.1 through 3.3.5):

- **Sidewalk Enhancements** include widening existing sidewalks and constructing new sidewalks where they're missing. Generally, a minimum six-foot sidewalk width is recommended.
- **Curb Bulb-outs** for pedestrian crossings at intersections or mid-block locations reduce crossing distance and automobile turning speeds, which improves pedestrian safety and comfort.
- **Crosswalk Enhancements** include high-visibility crosswalk treatments and advance limit lines to increase visibility of pedestrian crossing paths and discourage drivers from encroaching into crosswalks when they're occupied.
- **Road Diets** remove automobile travel lanes and reallocate right-of-way for pedestrian and bicycle improvements. In collaboration with city staff, particularly Oakland and Alameda, project staff considered road diets on those Arterial Network segments with high pedestrian and bicycle priority and low automobile priority. This Plan recommends only those road diet proposals that have local support.
- **Streetscape Enhancements** include landscaped buffers between sidewalks and travel lanes and/or raised landscaped medians to improve pedestrian comfort.
- **Pedestrian Scale Lighting** can alert drivers to the presence of pedestrians and enhance security for those walking. Pedestrian-scale lighting is generally closer to the ground and spaced more closely than roadway-oriented lighting.

This Plan primarily identifies macro-level improvements; however, other pedestrian infrastructure enhancements that improve the comfort and safety of walking at intersections include the following:

- Removing uncontrolled channelized right-turn lanes to require 90-degree turning angles at intersections to reduce automobile turning speed and improve pedestrian crossing safety,
- Pedestrian-actuated signals with count-down timers, and
- Creating a dedicated pedestrian phase to protect people crossing the street from left-turning traffic.

Streetscape Enhancements – landscaped buffer and median

Pedestrian Scale Lighting

Curb Bulbouts

High-Visibility Crosswalks

Overhead Flashing Beacon – High-Visibility Crosswalk

Rectangular Rapid Flashing Beacon – High-Visibility Crosswalk

Figure 3.3.1: Proposed Pedestrian Improvements—North Planning Area

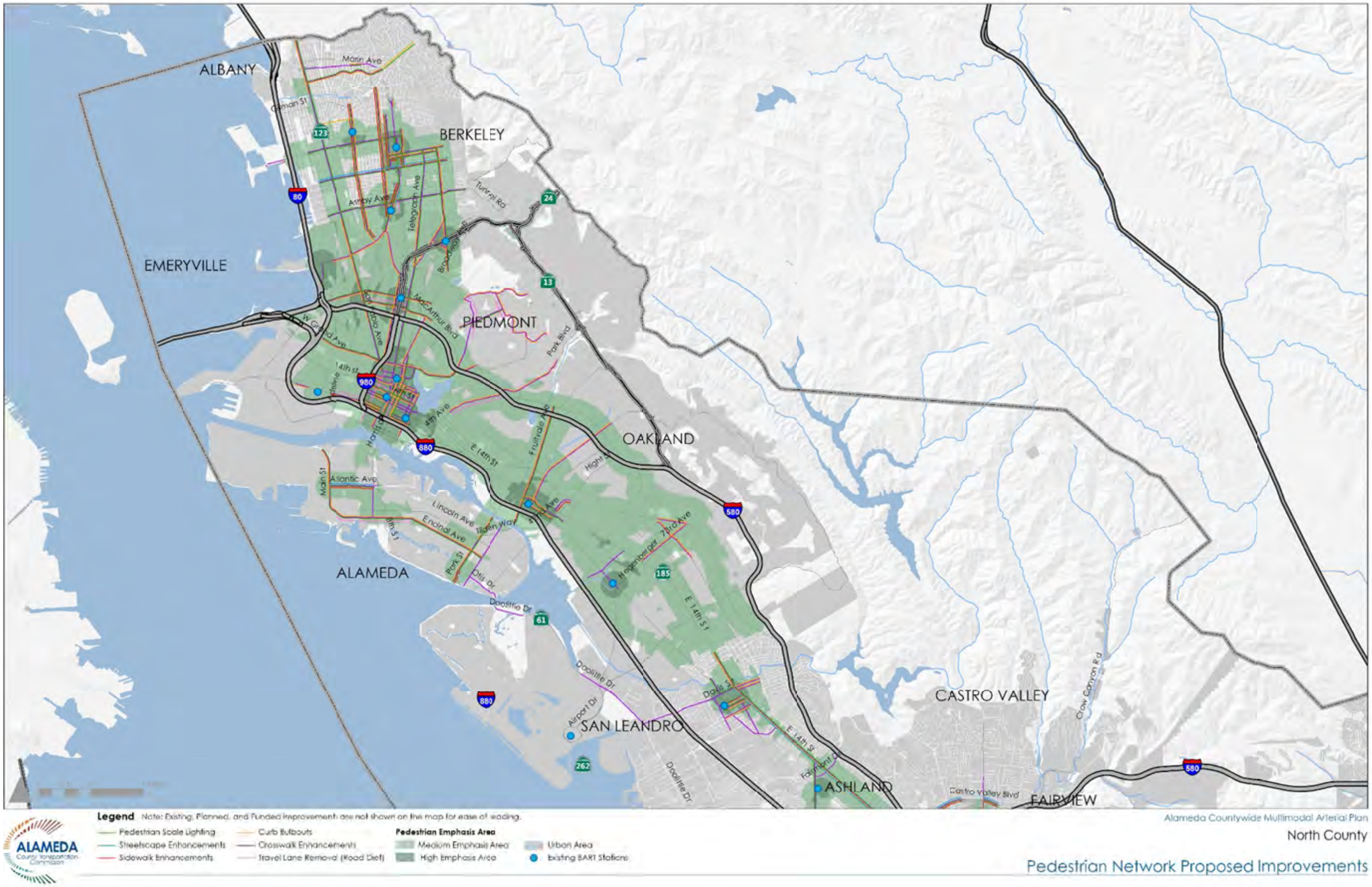


Figure 3.3.2: Proposed Pedestrian Improvements—Central Planning Area

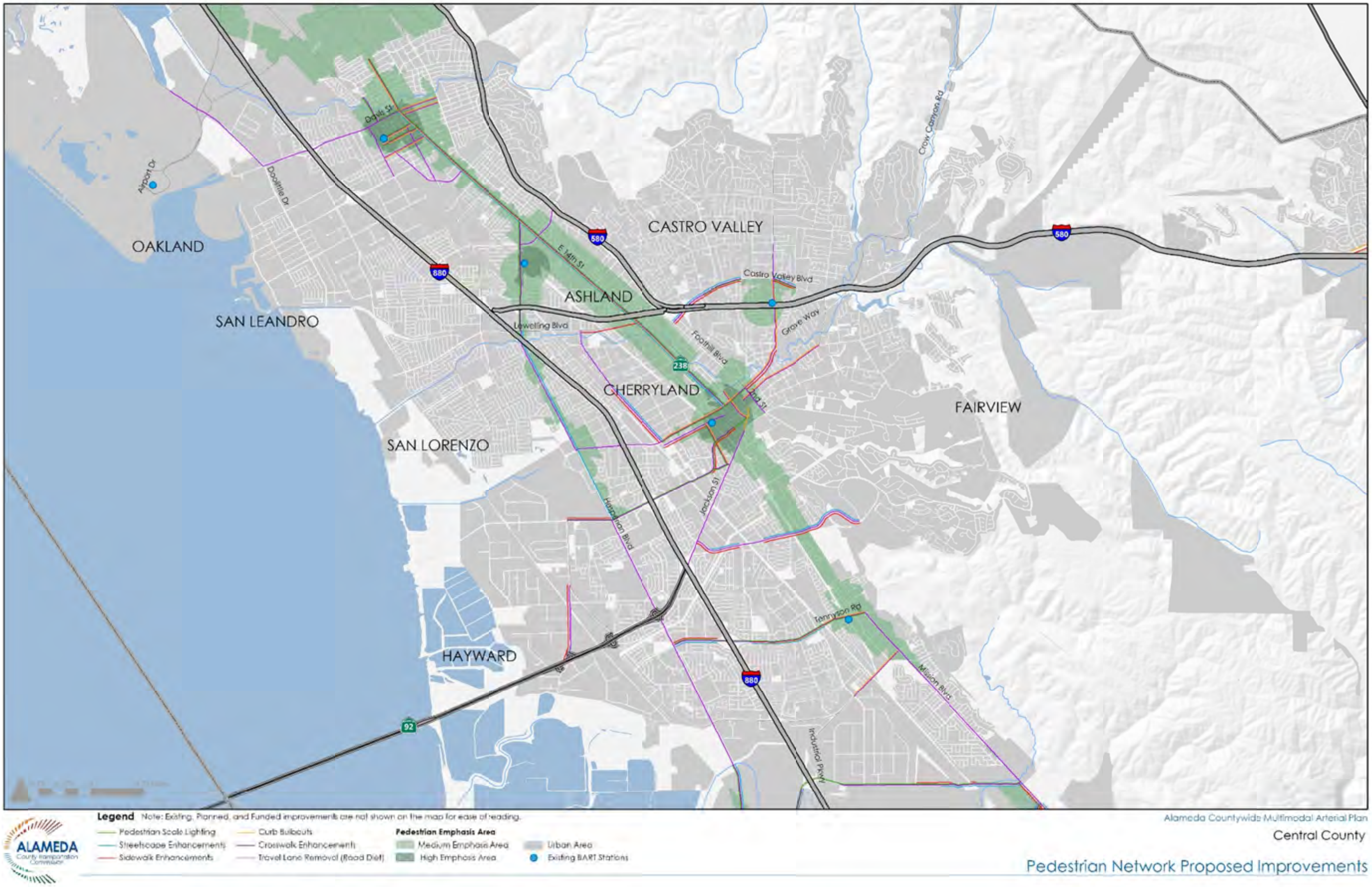


Figure 3.3.3: Proposed Pedestrian Improvements—South Planning Area

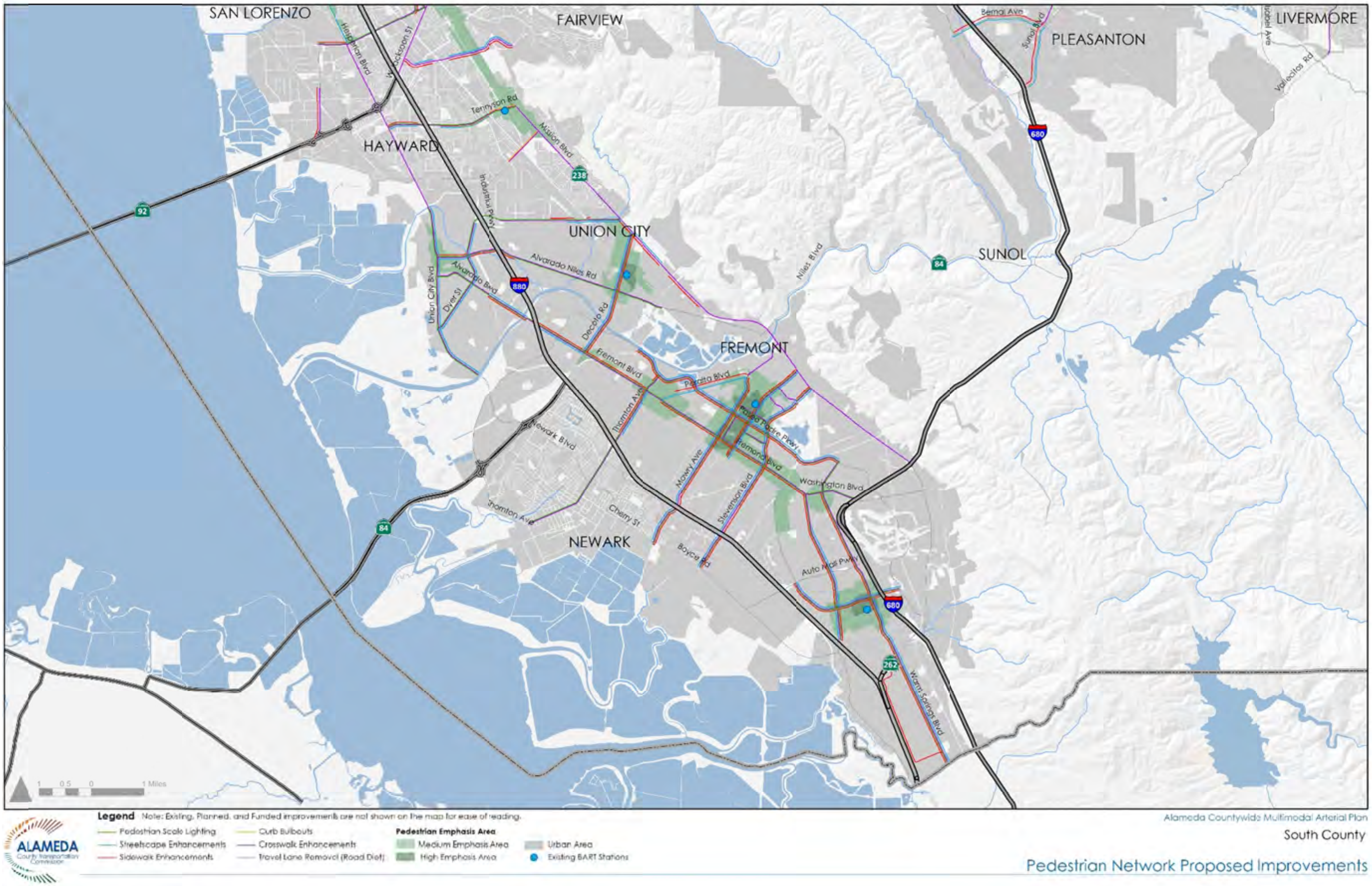
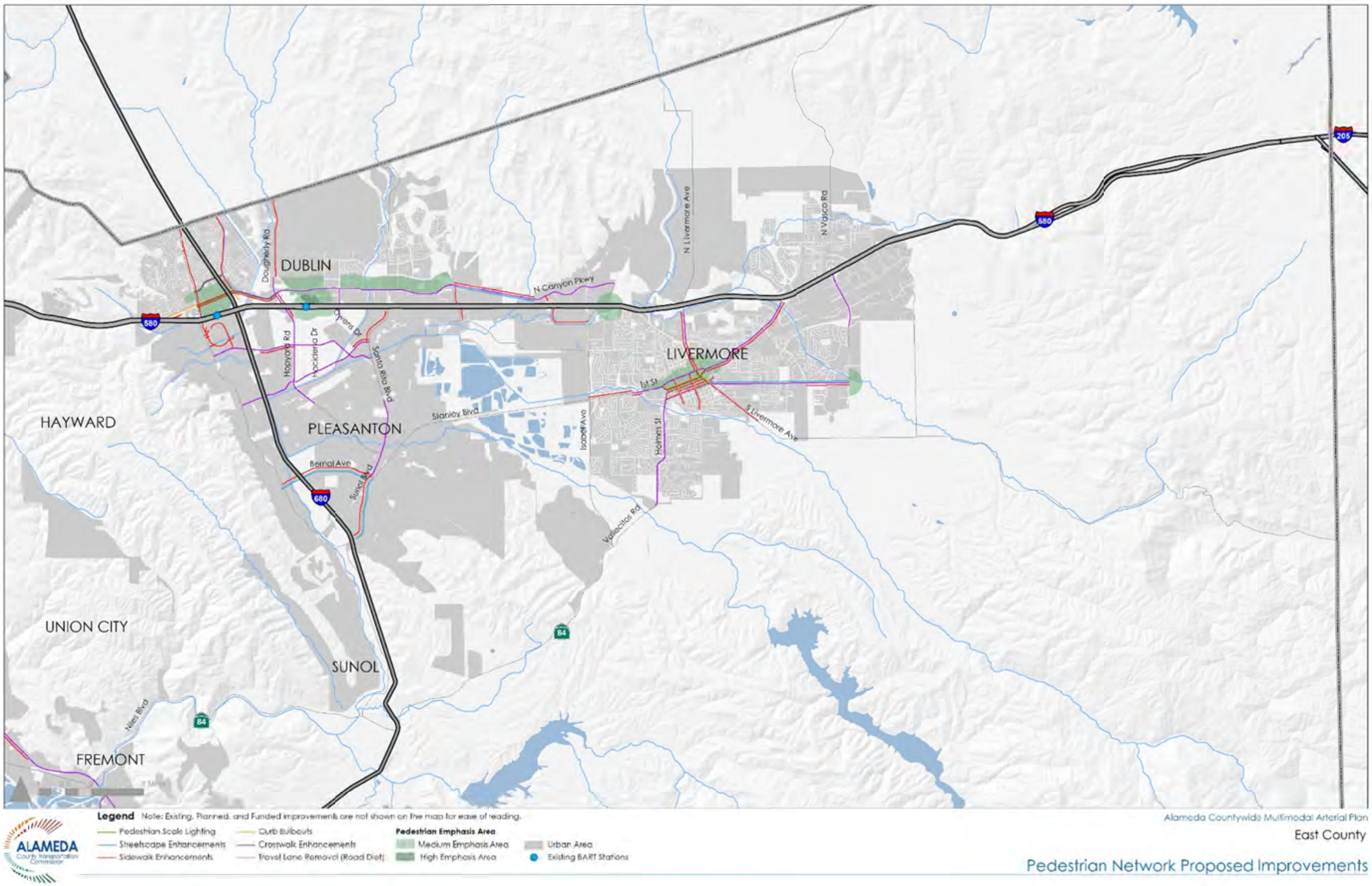


Figure 3.3.4: Proposed Pedestrian Improvements—East Planning Area



3.4 Bicycle Network Proposed Improvements

Six types of bicycle facilities are proposed for high bicycle-priority segments of the Arterial Network, as follows (see Figures 3.4.1 through 3.4.5). Note that many bicycle network improvements can also enhance pedestrian safety and comfort. For example, proposed Class 4 protected bicycle lanes provide a buffer between the sidewalk and travel lanes, which improves the Pedestrian Comfort Index rating. In addition, any bicycle facility that makes bicyclists feel safe and comfortable encourages them to avoid biking on the sidewalk.

- **Class 1 Bikeway/Multi-Use Paths** are located off-street and can serve both bicyclists and pedestrians. Class 1 paths are generally eight to 12 feet wide excluding shoulders, and are paved. The bicycle Network Connectivity checks included a review of Class 1 paths.
- **Class 2 Bicycle Lanes** provide a dedicated area for bicyclists within the paved street width through the use of striping and signage. Minimum five-foot bicycle lane widths are generally recommended.
- **Class 2 Enhanced Buffered Bicycle Lanes** are similar to Class 2 bicycle lanes, with the addition of a striped buffer separating the bicycle and travel lanes. Minimum five-foot bicycle lane and two-foot buffer widths are generally recommended.
- **Class 3 Bicycle Routes** are generally found on low-volume streets that do not have sufficient width for dedicated bicycle lanes. Bicycle routes have signage that informs drivers to share the street with bicyclists.
- **Class 3 Enhanced Bicycle Boulevards** are similar to Class 3 Bicycle Routes; however Bicycle Boulevards are generally designated along low-speed, low-volume streets optimized for bicycle traffic with diverters that filter out through automobile traffic and features to speed bicycle travel, such as 2-way stop signs for opposing traffic. The bicycle Network Connectivity checks included a review of parallel non-arterial bikeways, like Berkeley and Emeryville's bicycle boulevards.
- **Class 4 Protected Bicycle Lanes** are similar to Class 2 Enhanced Buffered Bicycle Lanes, but also have vertical buffers separating them from the adjacent travel lane. On-street parking, flexible pylons, planters or curb separation can create this vertical separation. Minimum five-foot bicycle lanes and three-foot buffer widths are generally recommended.

Although several Class 2 bicycle lane improvements are proposed, providing dedicated on-street Class 2 bicycle lanes can still result in a Low rating due to the lack of buffer separation and/or having a posted speed limit of 40 MPH or greater. Additional changes, such as removing on-street parking or implementing designs that would reduce auto speeds, would have to be considered to provide a comfortable biking experience for riders of all levels throughout the County.

Class 2 Bicycle Lanes

Class 2 Enhanced Buffered Bicycle Lanes


Class 3 Bicycle Routes

Class 3 Enhanced Bicycle Boulevards


Class 4 Protected Bicycle Lanes

Figure 3.4.1: Proposed Bicycle Improvements—North Planning Area

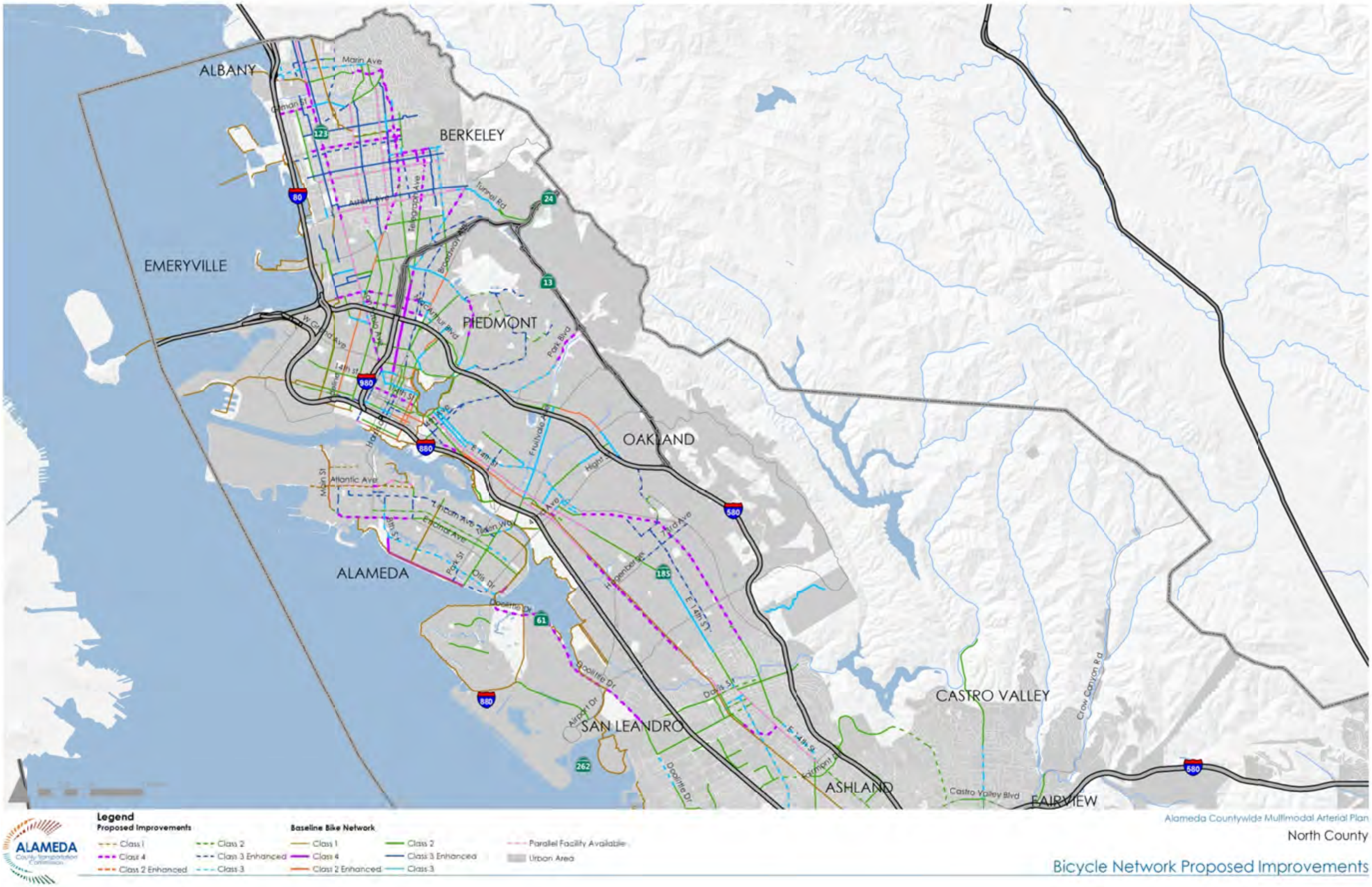


Figure 3.4.2: Proposed Bicycle Improvements—Central Planning Area

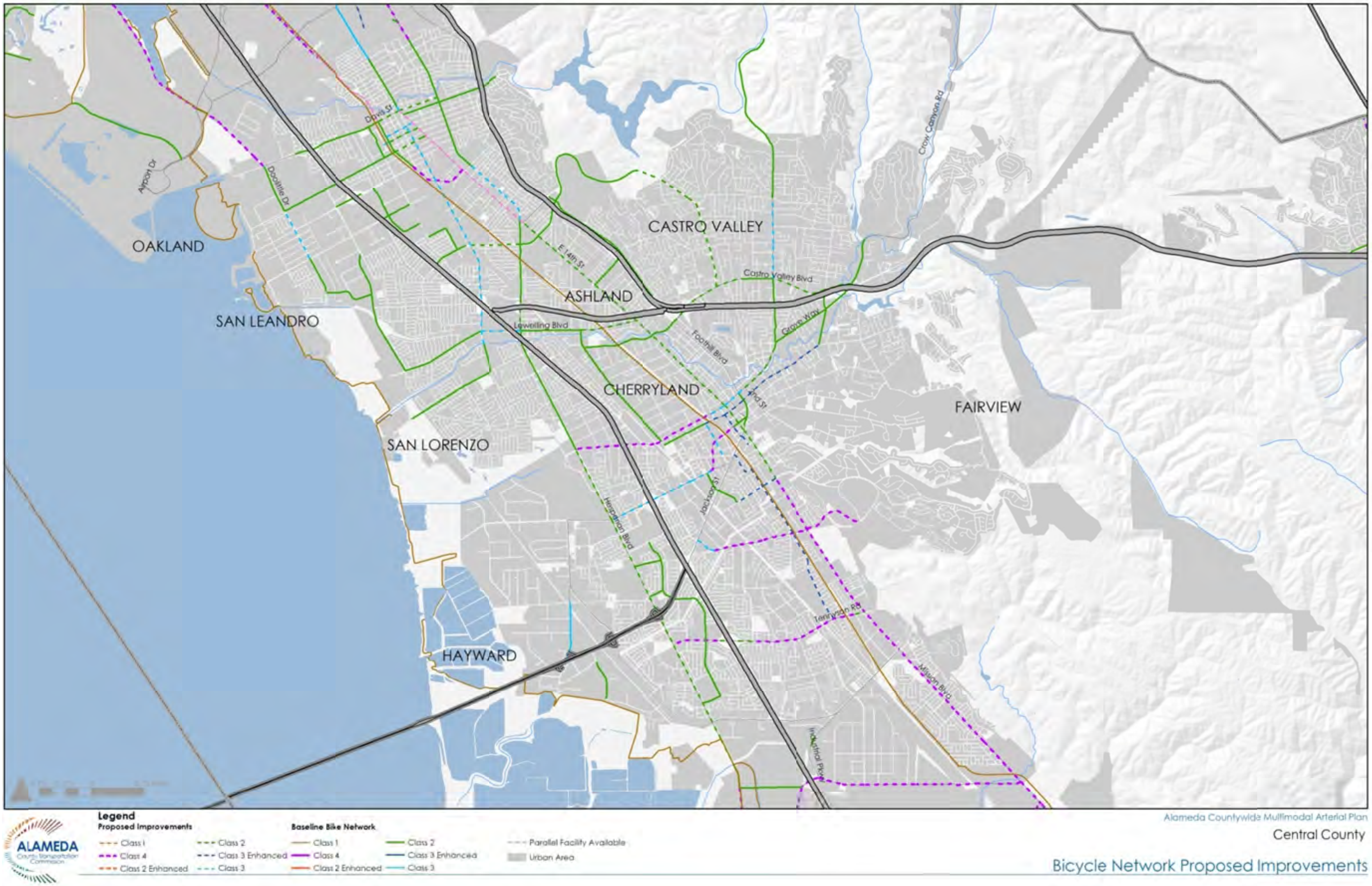


Figure 3.4.3: Proposed Bicycle Improvements—South Planning Area

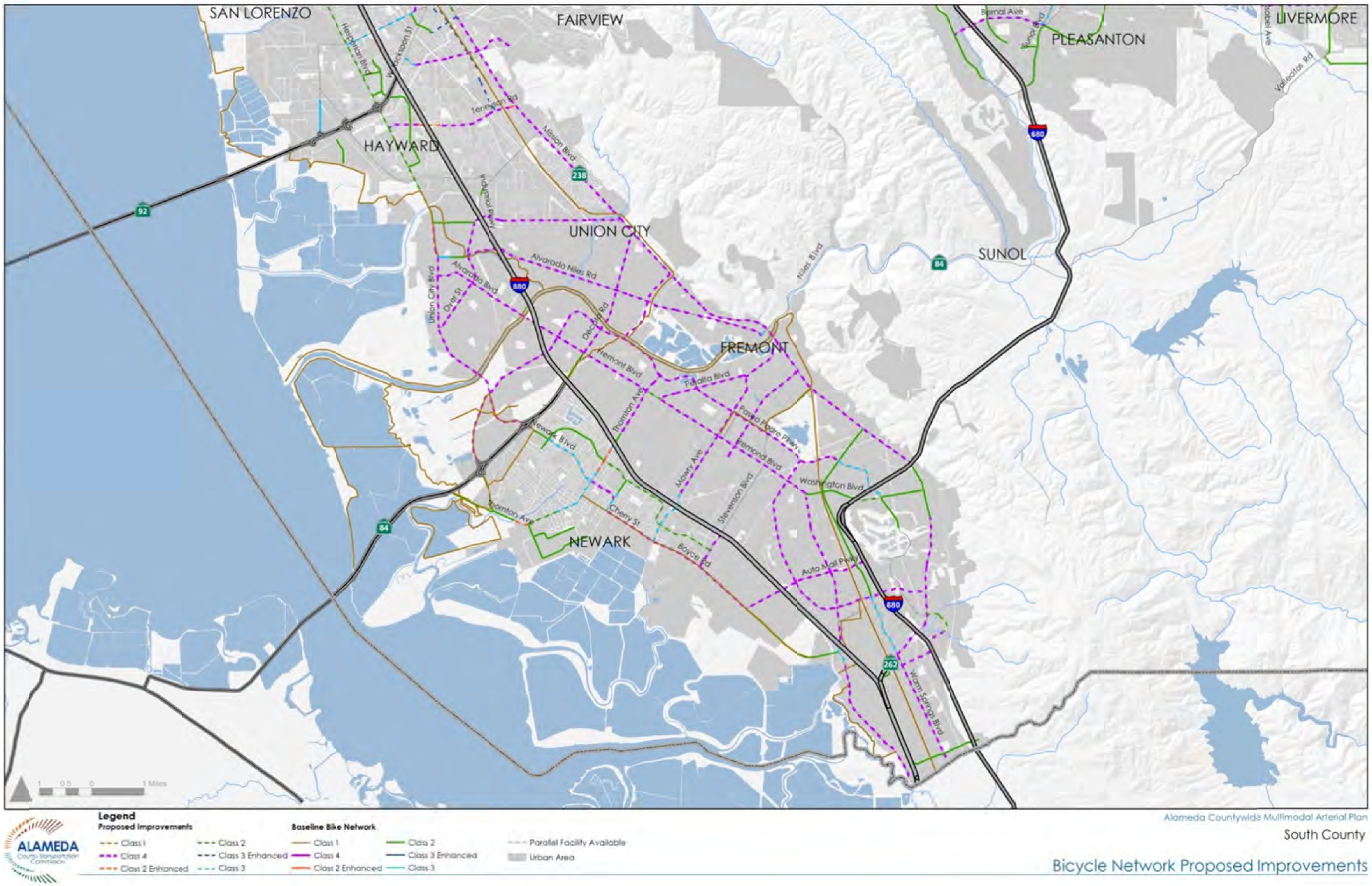
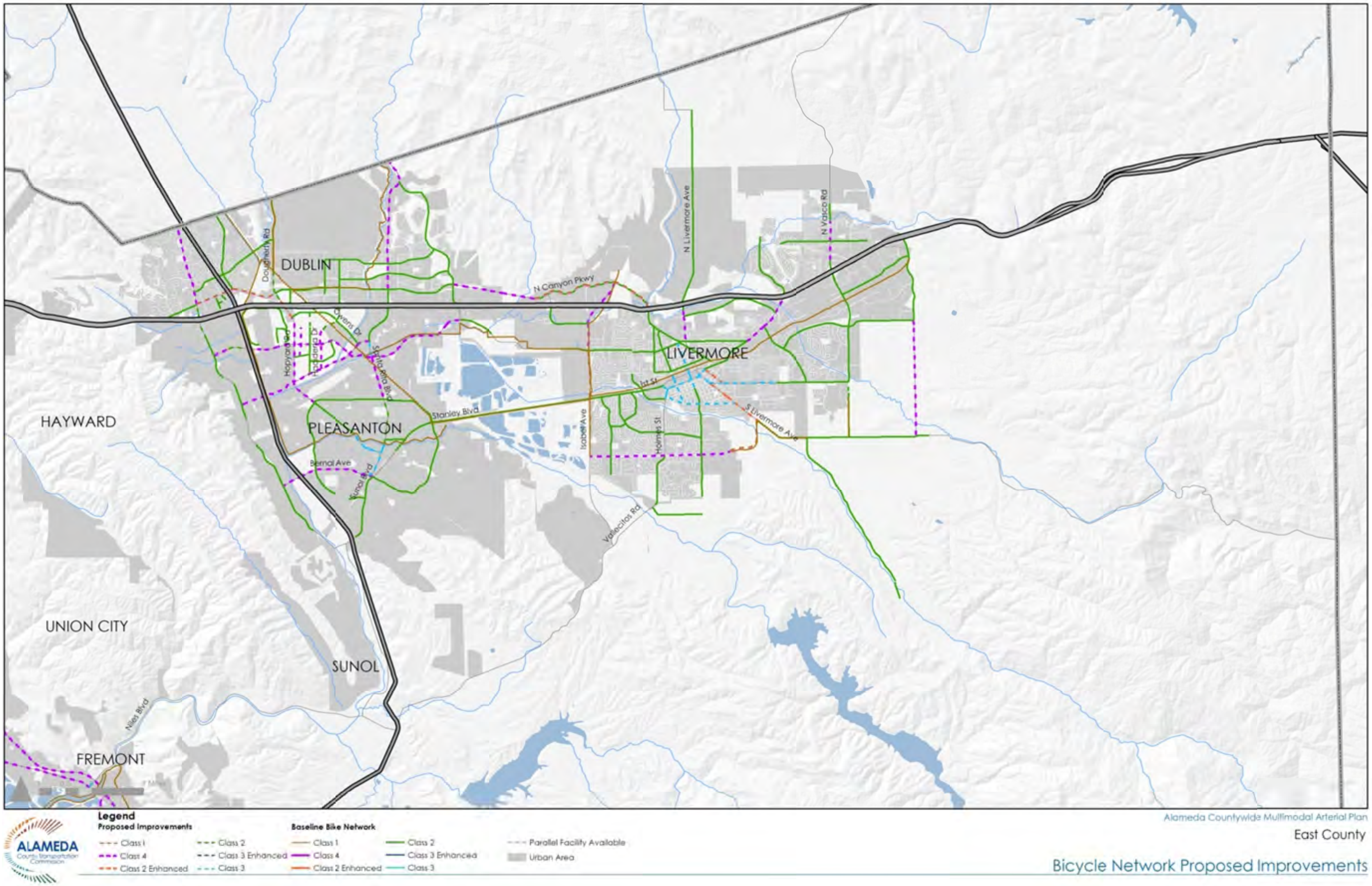


Figure 3.4.4: Proposed Bicycle Improvements—East Planning Area



3.5 Automobile Network Proposed Improvements[20]

As discussed in more detail in this Plan's Introduction, Alameda County's population, employment and traffic congestion are all forecast to increase in the coming decades. Given the built-out nature of the areas through which most of the Arterial Network travels, there are few opportunities to increase the capacity of the roadway network. As a result, the project team's task was to increase person throughput on Alameda County's arterials without relying on roadway widening for additional vehicular capacity. Therefore, the Multimodal Arterial Plan's proposed improvements for the automobile network are limited to ITS (Intelligent Transportation Systems), which describe a family of information and communications technologies that are applied to roadside infrastructure, vehicles and users, and traffic management to improve roadway mobility and system coordination. Appendix 3.5.1 inventories existing ITS infrastructure and recommended improvements, as well as strategies, policies and best practices to improve the Arterial Network's mobility, travel reliability and modal connectivity. These proposed investments can be grouped as follows (see Figures 3.5.1 through 3.5.5):

- **Low level of ITS infrastructure**, which generally corresponds to the ability to remotely monitor and manage field devices from a central location, such as a Traffic Management Center (TMC). Traffic signals along a corridor are interconnected and allow communication back to the TMC, where a central system actively manages field devices. When this plan was published, 35 percent of Arterial Network roadways provided or were planned to provide a low level of ITS infrastructure.
- **Medium level of ITS infrastructure** corresponds to everything described above plus the additional ability for staff to visually monitor and/or react to traffic conditions in real time from a central location. This includes having devices such as closed-circuit television (CCTV) cameras, adaptive signal timing controls and/or transit signal priority controls. Twenty-two percent of the Arterial Network provided or were planned to provide a medium level of ITS infrastructure when this plan was published.
- **High level of ITS infrastructure** corresponds to everything described above plus the additional ability to actively inform and influence traffic flow in real-time from a central location. This includes devices such as changeable message signs or any connected vehicle capabilities (i.e. ITS improvements that allow next generation vehicles to communicate with roadway infrastructure in real time). When this plan was published,

[20] Please see Appendix 3.5.1: Traffic Management Coordination Strategies memo for more details.

eight percent of Arterial Network roadways had or were planned to have a high level of ITS infrastructure.

Eleven percent of the Arterial Network roadways has no existing ITS infrastructure (25 percent has no information on available ITS infrastructure).

ITS measures can help the Multimodal Arterial Network meet the Plan's performance objectives, particularly for automobile and transit travel while improving safety for other modes. The MAP anticipates that several corridors throughout Alameda County are expected to result in poor automobile operations during the PM peak period, even with the recommended ITS improvements. Additional traffic operations improvements that could improve automobile operations without affecting right-of-way include:

- Access management strategies, such as driveway consolidation and turn-restrictions
- Lengthening of turn pockets
- Provision of turn lanes
- Time-of-day parking restrictions (e.g. prohibiting on-street parking during peak periods to utilize the parking lane as an additional travel lane)

Alternative Scenarios

As discussed in the Evaluation Tools box on page 2-6, in addition to the performance analyses that used the traditional countywide travel demand model (the Standard Scenario), the project team also evaluated two alternative scenarios. The Social and Behavioral Trends scenario assumed lower per capita auto ownership and VMT rates based on recent trends. The team estimates that these trends will reduce auto travel demand by between five and ten percent for urban and suburban areas, respectively. The Next Generation Vehicle scenario anticipates an increase in roadway capacity as a result of autonomous vehicles. The team estimates that a 20 percent increase in arterial capacity may be possible with significant next generation vehicle fleet penetration by Year 2040. See Appendix 2.3.2, Attachment A for more details.

As a result of these social and technological changes, the alternative scenarios predict less auto traffic and increased lane capacity on the Arterial Network. In fact, despite forecast increases in Alameda County's population and employment of 30 and 40 percent respectively, the 2040 forecast that assumes trends in the behavior and autonomous vehicles described above shows similar performance levels of reliability and congestion as today.

Figure 3.5.1: Proposed ITS Improvements—North Planning Area

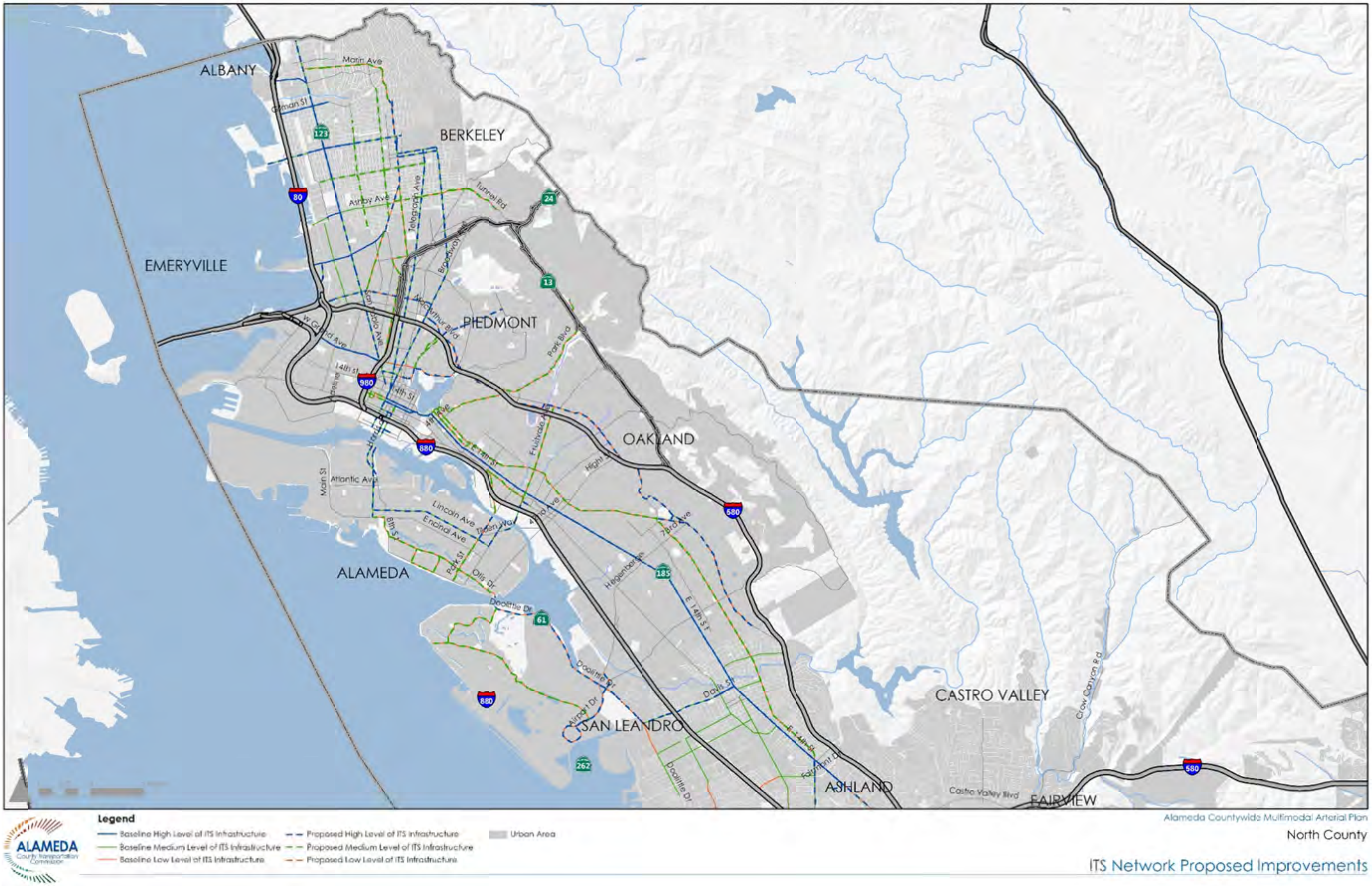


Figure 3.5.2: Proposed ITS Improvements—Central Planning Area

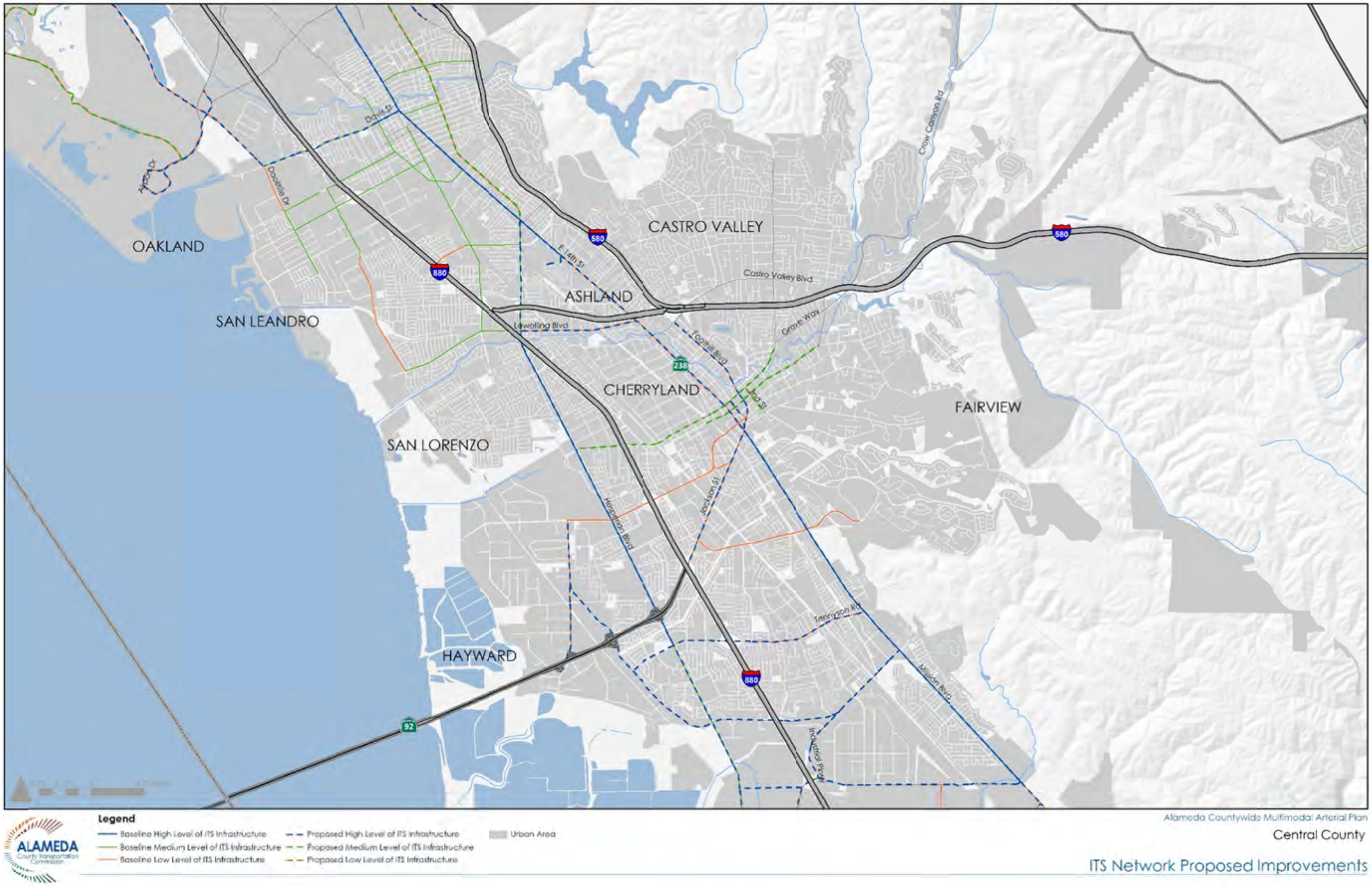


Figure 3.5.3: Proposed ITS Improvements—South Planning Area

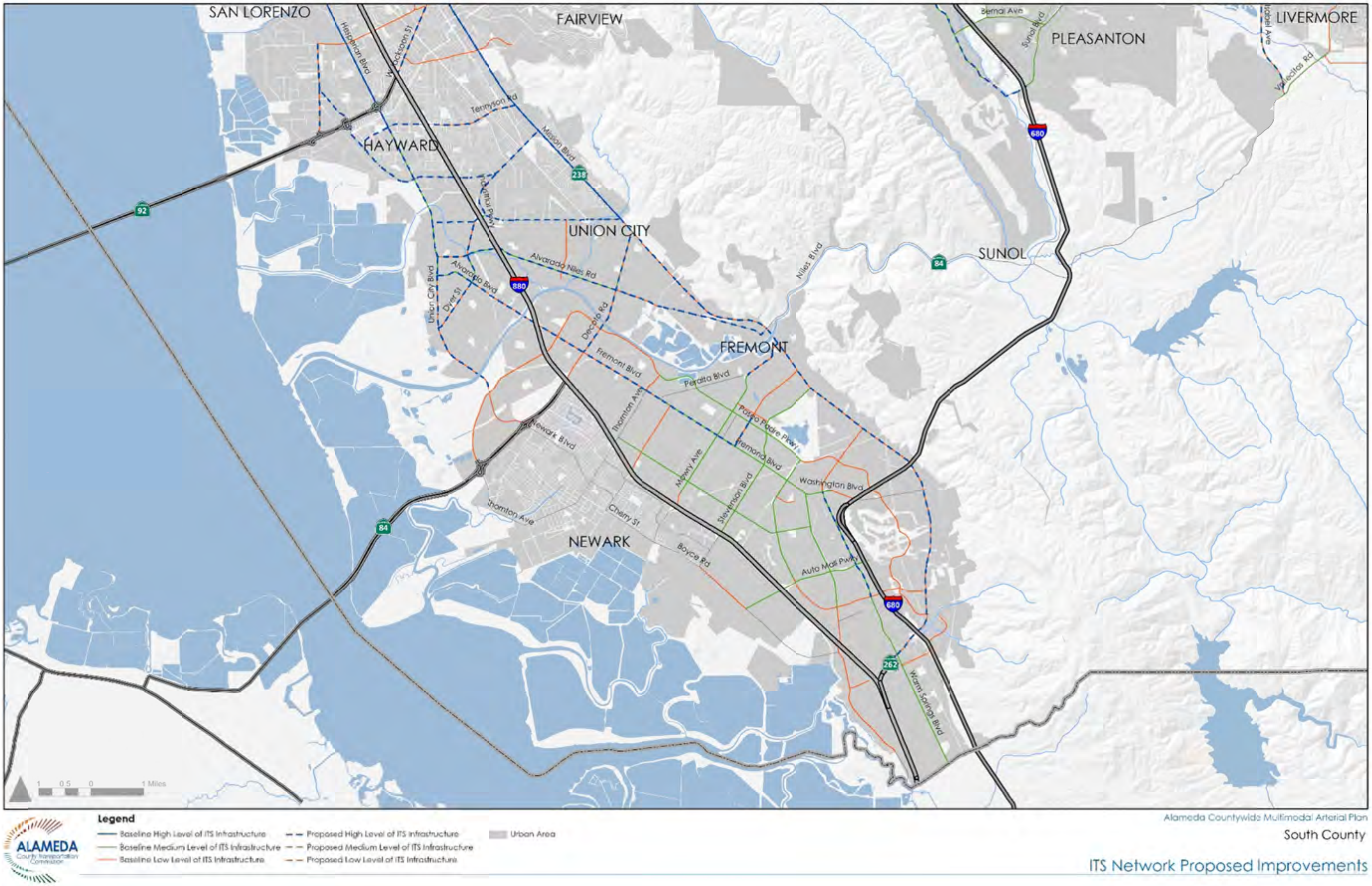
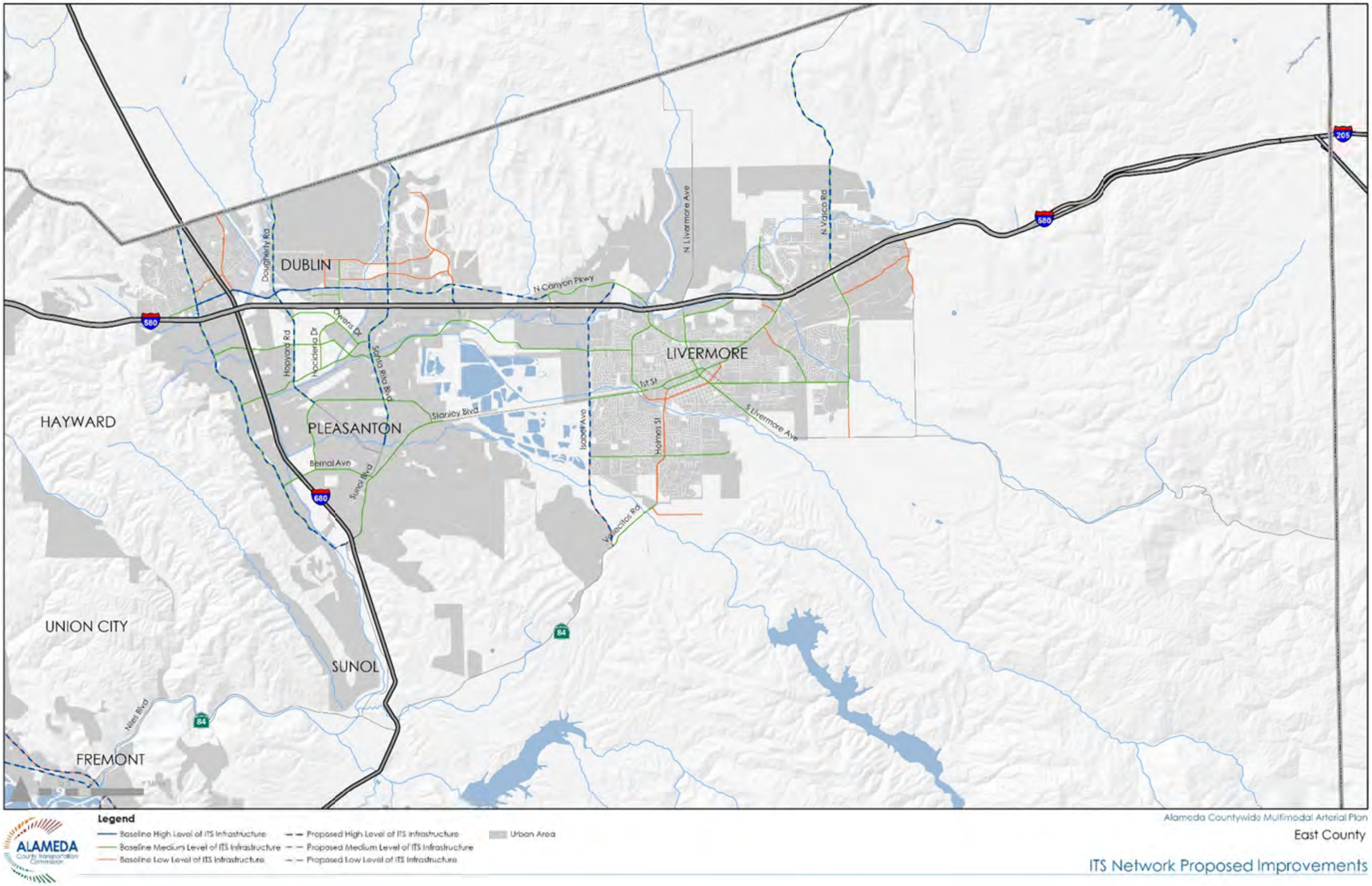


Figure 3.5.4: Proposed ITS Improvements—East Planning Area



3.6 Goods Movement Network Improvement Proposals

The primary improvement considered along Arterial Network segments where goods movement is one of the top two priority modes was widening curb lane widths to provide a minimum of 12 feet (see Figures 3.6.1 through 3.6.5) to facilitate truck travel. The Alameda Countywide Goods Movement Plan, prepared concurrent with the Multimodal Arterial Plan, analyzes goods movement in depth and sets a high level framework for policy and other improvements.

Figure 3.6.1: Proposed Goods Movement Improvements—North Planning Area

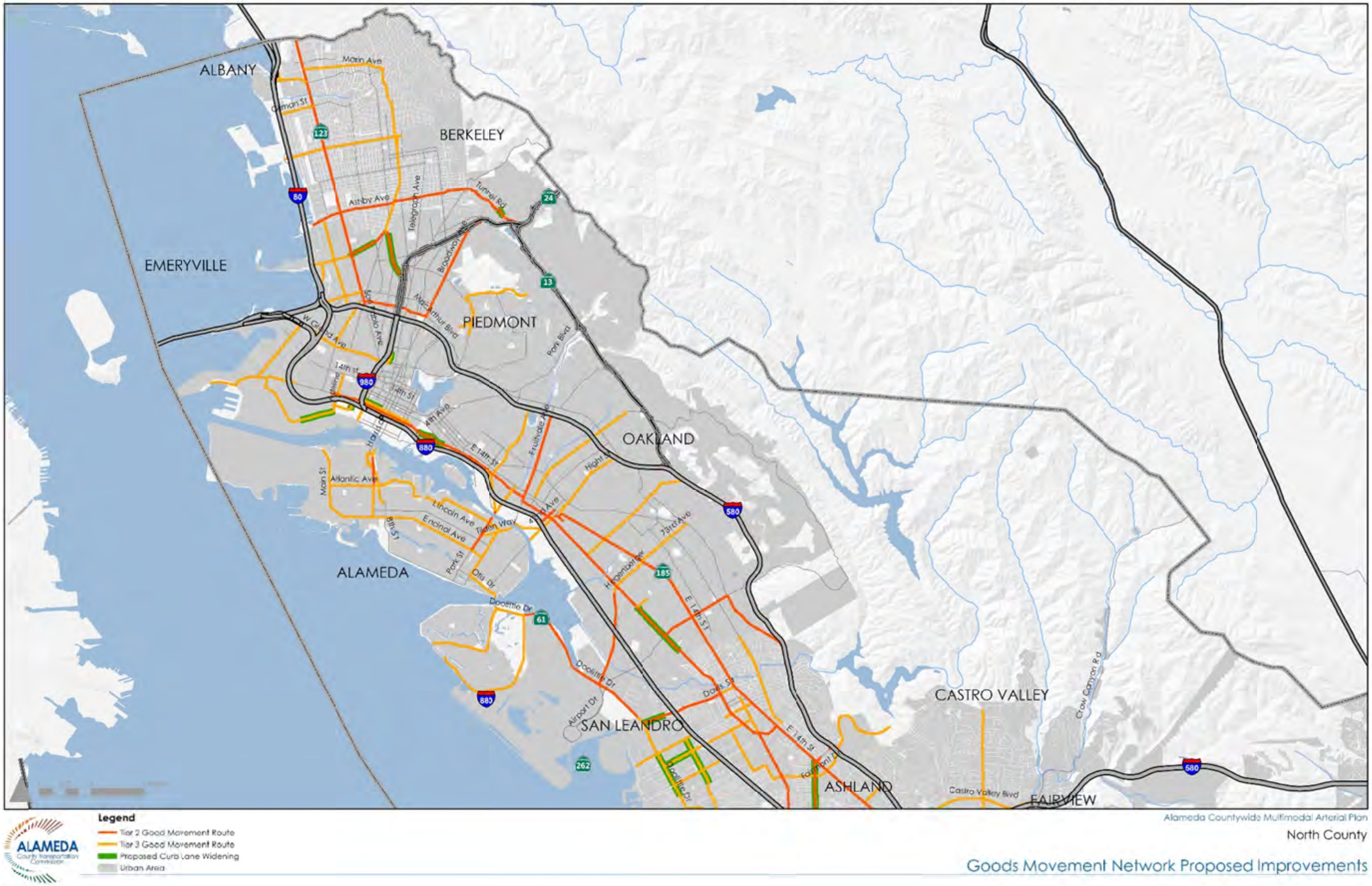


Figure 3.6.2: Proposed Goods Movement Improvements—Central Planning Area

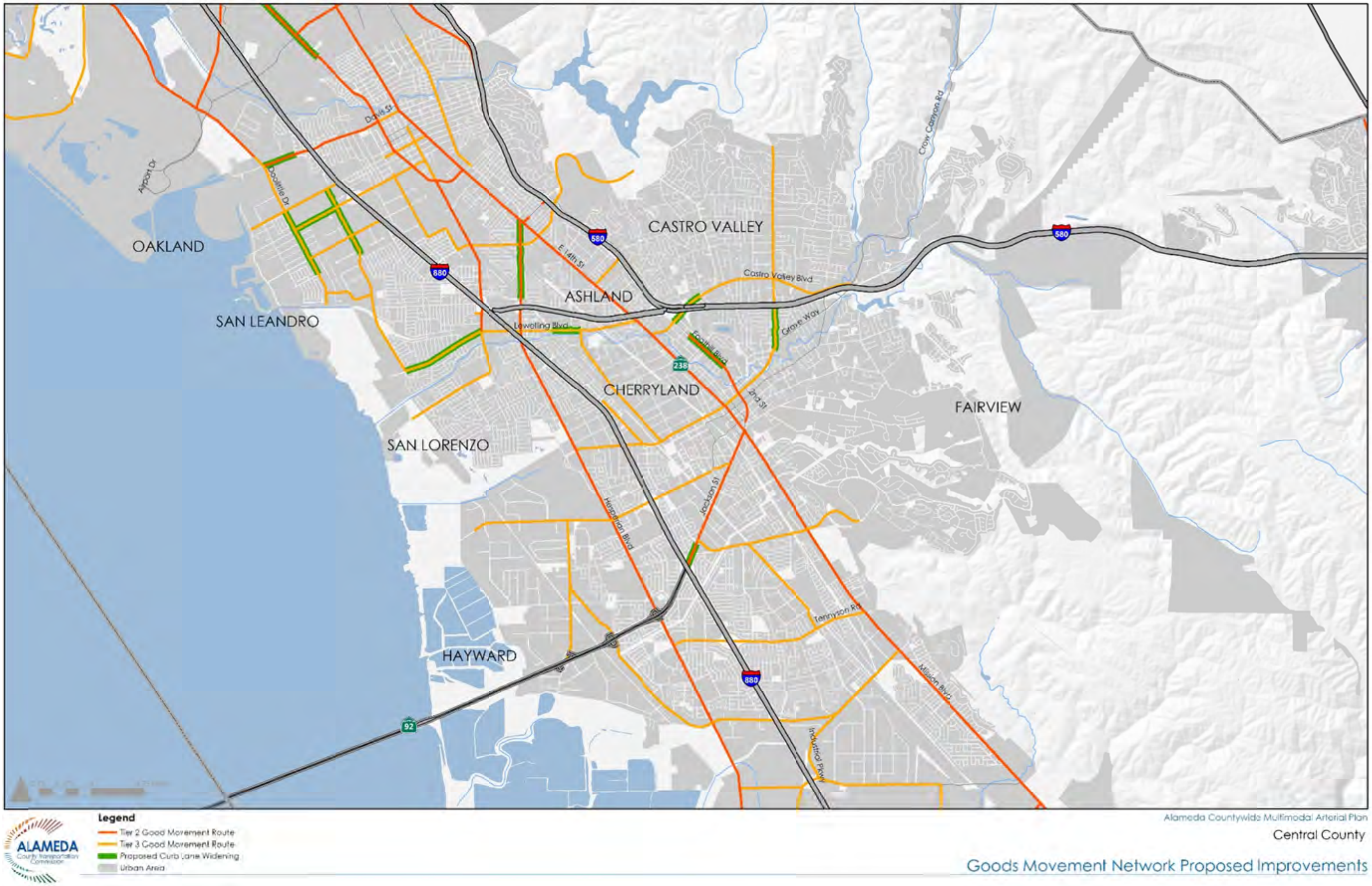


Figure 3.6.3: Proposed Goods Movement Improvements—South Planning Area

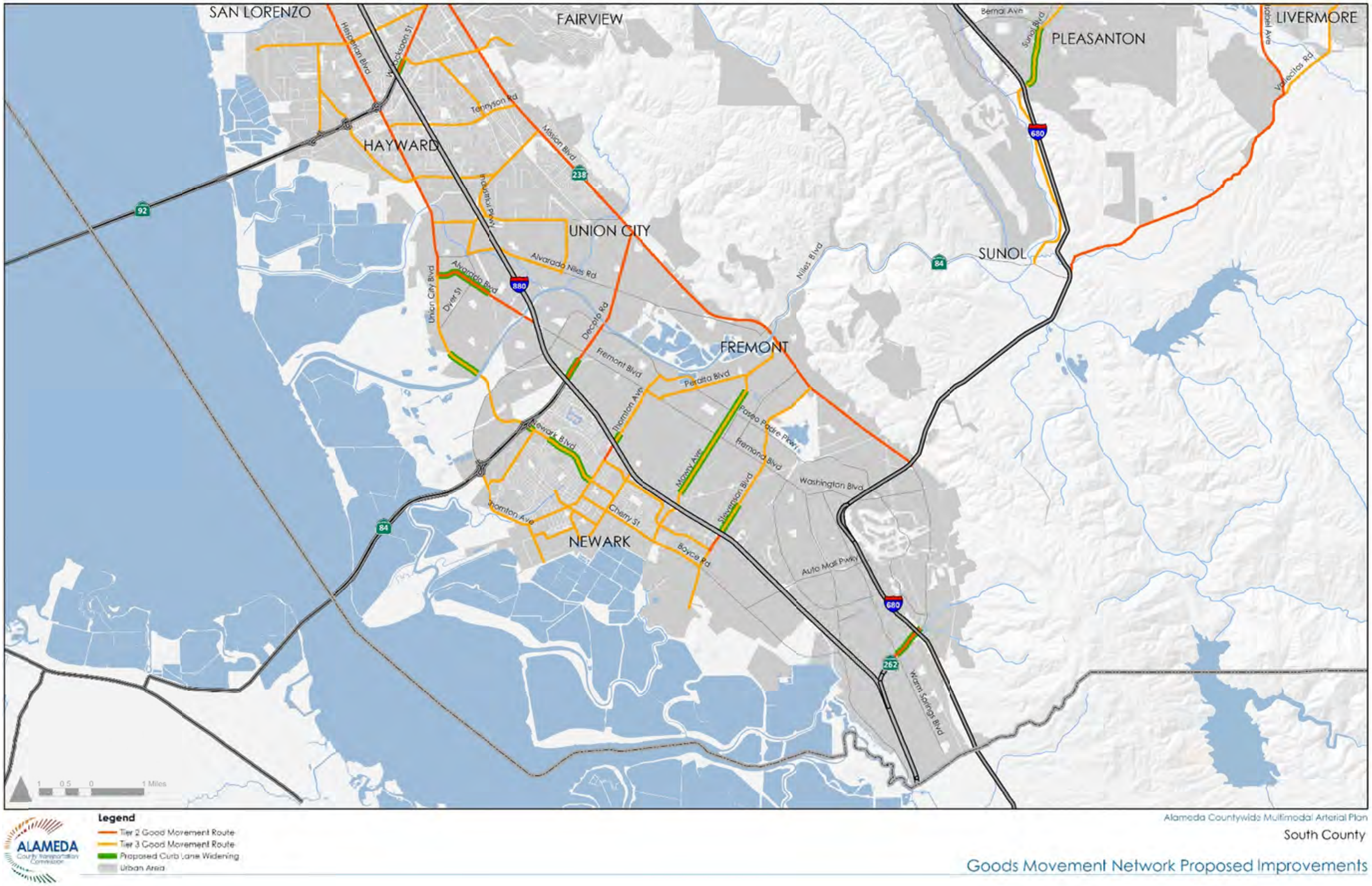
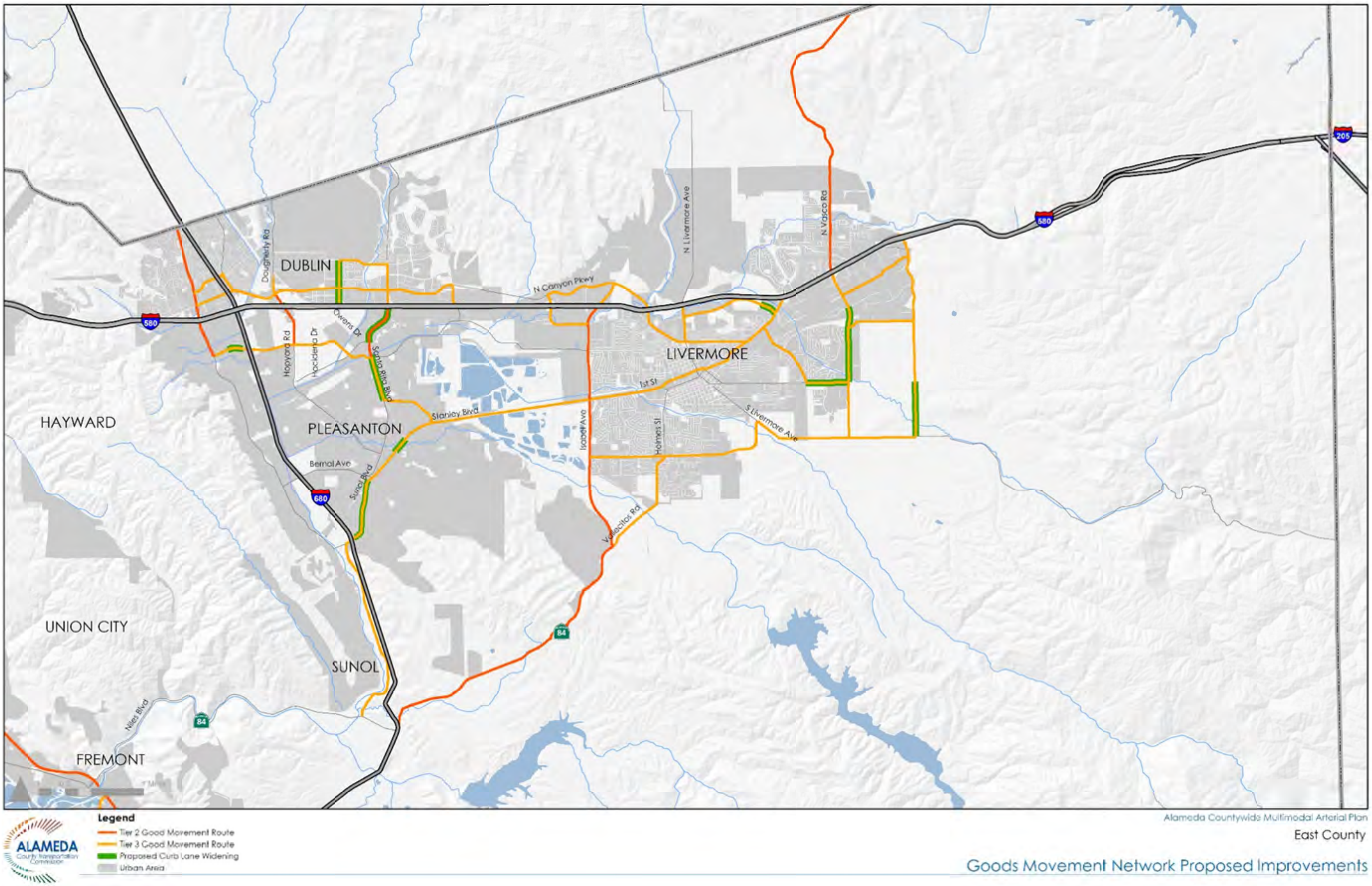


Figure 3.6.4: Proposed Goods Movement Improvements—East Planning Area



3.7 Cost Estimate

The project team developed high-level capital cost estimates to provide a general order of magnitude estimate for implementing multimodal improvements proposed in this Plan. It is expected that local jurisdictions will estimate detailed costs during the project development phase. Unit costs estimated for this Plan are based on readily available data from Caltrans, AC Transit, RSMeans[21] and recent construction bids, and include the following general items:

- Planning and design, including environmental approval and construction design documents,
- Construction management,
- Oversight by the local agency, and
- Contingency for construction.

These cost estimates do not include costs associated with new right-of-way purchases, major utility relocations, modification of major structures (e.g., bridges), environmental mitigation or operations and maintenance. Based on this methodology, the approximate capital cost estimates for implementing proposed improvements are as follows (in 2015 dollars):

- $900 million for transit network improvements,
- $540 million for pedestrian network improvements,
- $50 million for bicycle network improvements,
- $570 million for ITS network improvements, and
- $10 million for Goods Movement network improvements.

Implementing the full set of proposed improvements will cost more than $2 billion. Based on RSMeans data for 1996-2015, a five percent annual escalation factor is reasonable to estimate future year capital costs.

[21] RSMeans is a national database of construction cost information, which collects cost data from the construction industry and organizes it in an easy-to-use format.

3.8 Measuring the Benefits of a Multimodal System

Sections 3.1 through 3.7 of this chapter described the proposed investments to allow arterials to meet the performance objectives established in this Plan for priority modes on each roadway to the degree possible. This section quantifies the performance benefits on each segment to accrue from the proposed improvements and concludes with a discussion of measures of benefits to the entire system. Note that not all originally proposed improvements are included in this plan. Right-of-way constraints preclude improvements to many facilities that would have benefits to one or more modes. As important, is the need to achieve the plan's vision statement's call to maintain local context along the Arterial Network. Therefore, when a local jurisdiction objected to a particular recommended improvement, it was not included in the set of proposed improvements, and its potential benefits will not be experienced. Figure 3.8.1 summarizes the extent to which Arterial Network segments are forecast to meet performance objectives before and after proposed improvements. Figures E.2 through E.6 in the Executive Summary present this information, identifying locations, extent and type of improvements by mode.

As discussed below, not all segments of the Arterial Network are expected to meet the performance objectives for high priority modes even after implementation of proposed improvements. This is due to a variety of factors, including limited right-of-way and the unwillingness of most jurisdictions to consider the repurposing of on-street parking lanes and excess travel lanes. The MAP framework identifies the segments that would continue to have a need for improvements so jurisdictions can evaluate potential improvements as part of local planning efforts in the future.

Transit Network Proposed Improvements

Twenty-nine percent (or 150 miles) of the Arterial Network have transit as one of the high priority modes. Proposed improvements include three categories of transit infrastructure improvements described above, which together are estimated to result in the following benefits based on meeting the three transit performance objectives:

- 16 percent increase in high-priority transit Arterial Network segments that would meet the Transit Travel Speed performance objective (about 24 miles);
- 37 percent increase (about 56 miles) in segments that would meet the Transit Reliability performance objective;
- 67 percent increase (about 100 miles) in segments that would meet the Transit Infrastructure Index performance objective; and

About 70 percent of Arterial Network segments with high-transit priority would continue to not meet either of the three transit performance objectives, even after proposed improvements are implemented.

Pedestrian Network Proposed Improvements

Of the Arterial Network's 510 miles, 207 (40 percent) have walking as one of its high priority modes. There are six categories of pedestrian improvements proposed for these roadways. Together, they are estimated to result in a 27 percent increase in high-priority pedestrian Arterial Network segments that would meet the pedestrian performance objective (about 55 miles). About nine percent of Arterial Network segments with high pedestrian priority would continue not to meet the performance objective, even after proposed improvements are implemented.

Bicycle Network Proposed Improvements

Just over half of the Arterial Network (268 miles) has bicycling as a high priority mode. Improvements to these roadways are estimated to result in about 111 more miles of Arterial Network segments that provide a High or Excellent Bicycle Comfort index rating, or a 41 percent increase in high-priority bicycle segments that would meet the bicycle performance objectives. About 46 percent of high priority Arterial Network segments would continue to fail to meet this performance objective, even with proposed investments.

Automobile Network Proposed Improvements

Nearly half of Arterial Network roadways have driving as a priority mode. Proposed improvements are in the realm of ITS infrastructure improvements, whose primary objective is to increase average vehicle speed; however, at this time, there is not enough readily-available research or data to quantify the percent increase in vehicle speed associated with these improvements.

Goods Movement Network Proposed Improvements

Twenty-six percent (or 135 miles) of the Arterial Network have goods movement as a priority mode. Proposed improvements were primarily limited to widening curb lane widths to provide a minimum of 12 feet, which is estimated to increase the mileage of segments that would meet the performance objective by 16 percent (about 22 miles).

Climate Change Indicators (VMT and GHG)

Given the transportation industry's current focus on addressing climate change issues, VMT and greenhouse gas (GHG) emissions are also important performance measures for the MAP. It is expected that the cumulative effect of improvements proposed in the MAP on

VMT and GHG emissions will accrue from shifting automobile drivers to other modes, particularly transit and bicycling.[22]

The Plan proposes 21 miles of Dedicated Transit Lanes, 82 miles of Rapid Bus improvements and 144 miles of Class 4 protected bicycle lanes along the Arterial Network. According to the AC Transit Major Corridor Study, Dedicated Transit Lanes and Rapid Bus improvements will result in average ridership increases of 84 percent and 36 percent respectively on the corridors where these improvements are proposed. The Countywide Transit Plan documents systemwide ridership increases from various investments. Proposed bicycle network improvements are expected to increase biking by 141 percent.

Figure 3.8.1: Arterial Network Performance Objective Evaluation

	Segment Miles That Meet Performance Objective Along High Modal Priority Arterial Network Segments – 2040 Conditions[1]		
Performance Measures	Without Proposed Improvements (miles)	With Proposed Improvements (miles)	Net Difference (miles)
Transit Travel Speed	21	45	+24
Transit Reliability	56	112	+56
Transit Infrastructure Index	27	127	+100
Pedestrian Comfort Index	133	188	+55
Bicycle Comfort Index	35	146	+111
Automobile Congested Speed	210	N/A[2]	N/A[2]
Automobile Reliability	138	N/A[2]	N/A[2]
Truck Route Accommodation Index	83	105	+22

Notes:

1. A mode is considered high priority if the mode is categorized in the top two prioritized mode along an Arterial Network segment. A total of 150 Arterial Network miles have high transit priority, 207 Arterial Network miles have high pedestrian priority, 268 Arterial Network miles have high bicycle priority, 250 Arterial Network miles have high automobile priority and 135 Arterial Network miles have high goods movement priority.
2. There is not enough readily-available research or data to quantify the improvements to automobile speed or reliability associated with ITS improvements.

Equity Indicator (Benefits to Communities of Concern)

The MAP includes a performance measure that indicates how equitable the distribution of proposed improvements is throughout the county. This analysis compared this distribution within "Communities of Concern," as defined by MTC, to improvements proposed in the rest

[22] The project team attempted to measure the effect of proposed improvements on mode choice and, therefore, VMT and GHG emissions. They found that, since VMT and GHG are area-wide measures, projections encompassing trips made on Alameda County's freeway, local streets and BART overshadow the effectiveness of proposed improvements to shift people from driving on the Arterial Network to transit and biking. Therefore, as an objective measurement of direct benefit of the MAP in terms of VMT and GHG reduction, change in alternative modal trips, particularly by transit and bicycle modes, were assessed along corridors where those modal improvements are proposed.

of the county. It found that about 38 percent (194 miles) of the total 510 miles of Arterial Network is within a Community of Concern and that about 43 percent (158 miles) of the 367 miles of Arterial Network with proposed improvements are within a Community of Concern, which confirms that proposed improvements are more than proportionally distributed within Communities of Concern.


City of Alameda
Paratransit Shuttle
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4 Complementary Strategies and Potential Trends that Support Multimodal Improvements

While the multimodal improvements proposed in Chapter 3 are extensive, the MAP estimates that even if all are implemented, a sizeable portion of the Arterial Network will still not meet the Plan's performance objectives. Therefore, operational programs and strategies that aim to improve the efficiency of the transportation system by reducing automobile demand and increasing demand for transit, walking and biking can be as important as capital improvements. Together, the operational programs and strategies highlighted in this chapter, combined with the capital improvements proposed in Chapter 3, will benefit the performance of the Arterial Network and will allow Alameda County to achieve the vision of complete and connected multimodal networks better than either approach by itself. This chapter presents complimentary programs and strategies that can influence travel trends and help the multimodal Arterial Network meet the performance objectives laid out in Chapter 2. These programs and strategies include:

- Intelligent Transportation Systems (ITS) beyond the improvements proposed in Section 3.5,
- Transportation Demand Management (TDM), and
- Parking strategies.

Beyond these strategies, this chapter also addresses three important trends and how they will impact the arterial system:

- Demographic shifts that influence lifestyle choices, including housing type and location and vehicle ownership,
- Technology changes that will likely enable driverless vehicles to represent a sizable portion of the fleet by the year 2040, and
- Global warming that will result in increased incidences of severe weather events and sea level rise.

4.1 Implementing ITS Strategies

As discussed in Section 3.5, the MAP classified existing and proposed ITS infrastructure using three general categories: low, medium and high levels of ITS infrastructure. The project team identified additional ITS strategies, policies and best practices to complement existing and proposed ITS infrastructure in order to advance Alameda CTC's goals for improved mobility, travel reliability and modal connectivity on the Arterial Network. Many of these complementary strategies were identified from existing and in-progress projects and programs with ITS elements that involve multiple stakeholders, including:

- I-80 Integrated Corridor Management (ICM)
- I-580 ICM
- Interstate 580/680 Tri-Valley Smart Corridor Program
- I-880 ICM
- Webster Street Smart Corridor

- East Bay SMART Corridor (San Pablo Avenue)
- East Bay Bus Rapid Transit
- AC Transit Line 97 Transit Performance Initiative (TPI)
- Silicon Valley Intelligent Transportation System (SV-ITS)
- International Boulevard/Telegraph Avenue/East 14th Street Smart Corridor
- Interstate 580/680 Tri-Valley Smart Corridor Program

Terms for Understanding Projects with ITS Elements

Integrated Corridor Management (ICM)

The coordination of individual network operations between adjacent roadway facilities that creates an interconnected system. It is an effective way to manage congestion and enhance safety by appropriately diverting traffic to parallel routes with excess capacity. The diversion is usually, but not always, from a freeway to an arterial.

Smart Corridor project

Typically involve the design, deployment and integration of ITS field elements along a major freeway and/or arterial corridor. They often include a Traffic Management Center (TMC) which can consist of a physical facility or be virtual (i.e., staff access and control the field devices remotely).

Bus Rapid Transit

High-quality bus transit that achieves light rail-like efficiencies with features such as dedicated rights-of-way, off-board fare collection, platform-level boarding and preferential intersection signal treatments.

Transit Performance Initiative

A regional program that makes capital investments aimed at improving the performance of transit along major corridors.

The strategies and policies discussed in this section enable the following improvements for advancing the Arterial Network toward the performance objectives for transit and automobile speed and reliability:

- Better-coordinate traffic signals, including adaptive traffic systems and transit signal priority,
- Expedite traffic incident responses,
- Manage traffic flows, and
- Improve real-time traveler information.

Multi-Jurisdictional ITS Project/Program Agreement

Collaboration between Alameda CTC, MTC, Caltrans, local agency transportation departments, transit agencies and other stakeholders is critical to successfully addressing regional mobility issues on arterials that span multiple jurisdictions. By working together, partner agencies can achieve significant benefits by addressing arterial operations from a system-level perspective.

There are currently a number of existing and in-progress ITS projects and programs that involve MTC, Caltrans, AC Transit, Alameda CTC and various local municipalities. This experience points towards the following governance trends:

- **Ownership:** Any equipment and/or improvements deployed by a particular project/program that are located within a particular agency's right-of-way are owned by that agency.
- **Maintenance:** ITS equipment and/or improvements in a particular jurisdiction are maintained by that jurisdiction in most cases; however, there are some exceptions in which an agency other than the local jurisdiction is responsible for maintenance and/or reimburses maintenance costs.
- **Operation:** The trend for ITS operations is shifting towards a more centralized format. There are currently no cases of one jurisdiction controlling day-to-day traffic signal operations within another jurisdiction; however, one agency (Caltrans) will be allowed to change the operation of traffic signals owned by local cities in the I-80 and I-880 ICM programs. It should be noted that this arrangement is pre-defined, pre-approved by the local cities and will be implemented only during an incident situation.

To ensure success, multi-jurisdictional efforts need a lead agency. That role can range from centralized, where the lead agency develops, operates and maintains the ITS infrastructure (while, of course, representing the interests of other affected agencies), to more distributed decision-making and authority. Historically, Alameda CTC has followed a more centralized approach; however, this could change in the future depending on stakeholder needs. The following questions can help shape the organizational structure and roles for a particular multi-jurisdictional ITS project:

- Who is responsible for purchasing and deploying communications and field equipment?
- Who has ownership of the equipment (and/or software licenses)?
- Who is responsible for testing and inspecting the equipment?
- Who develops the timing/operational plans?
- Who implements the timing/operational plans?
- Who evaluates the project?
- Who is responsible for operations and maintenance?
- What are the channels of approval and on-going communication?

The answers to these questions are typically documented in a project/program Concept of Operations report, which also defines the most appropriate and effective type of agreement. Potential agreement types include (for details of each see Appendix 3.5.1):

- Memorandum of Understanding (MOU)
- Cooperative Agreement
- Project Agreement
- Funding Agreement

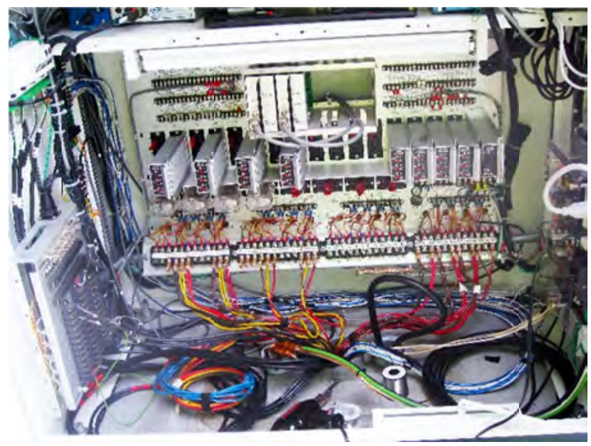
- Operations and Maintenance (O&M) Agreement
- Maintenance Agreement (Caltrans)

In addition, all multi-jurisdictional ITS efforts need the following:

- Formal reporting structure,
- Roles and responsibilities of participating agencies,
- Authority of any regional entity,
- Cost sharing arrangements,
- Structure for day-to-day operations, and
- Performance measures for continued assessment.

ITS Infrastructure Maintenance Considerations

Two challenges of many ITS programs nationwide is staff training and funding to maintain them.



- **Staff Training:** In the first few years after a project is deployed and accepted, most system components are under an extended manufacturer's warranty. During this period, maintenance needs are relatively small and any staff training is not put to significant use. In most cases, by the time system components begin to fail or require troubleshooting, staff maintenance skills have either eroded through non-use or have disappeared through staff turnover.
- **Funding:** While there is a plethora of state and Federal grant programs that provide capital funds for ITS, most local agencies are expected to pay for ongoing maintenance using their own staff, who may or may not be adequately trained and frequently have many other responsibilities. Alternately, local agencies can outsource maintenance to a third party provider. In either case, paying staff or a third party provider frequently comes from the agency's general fund, which typically has competing demands and priorities.

The following maintenance strategies are recommended to minimize the effects of these unavoidable challenges:

- Include long-term operations and maintenance (O&M) costs in cost estimates of any ITS project.
- Specify each participating agency's operations and maintenance responsibilities at the outset of each project so all parties have a clear understanding of their obligations in terms of labor and finances.
- Include Service Level Agreement provisions and cooperative agreements in all agency MOUs so that stakeholder agencies understand what is expected in terms of resource availability. Contracts with third party maintenance providers should also include these Service Level Agreements.

4.2 TDM Strategies

Transportation Demand Management (TDM) is the practice of reducing auto travel by providing incentives for alternatives to non-single-occupant auto travel or dis-incentivizing driving alone. TDM is a complimentary strategy to many of the infrastructure improvements included in the MAP, whose premise is that increasing non-auto travel options will increase the number of people who can travel on arterials across Alameda County.

TDM measures can dramatically reduce peak period auto trip making. Jurisdictions often recommend them to mitigate impacts associated with new development, now possible since the effect of various TDM measures on trip-making can now be predicted (see Figure 4.2.1)[23]. A host of TDM programs operate throughout Alameda County, including Alameda CTC's 511 traveler information program; programs operated by local jurisdictions, which often target municipal employees; programs operated by employers, especially major employers; and TDM programs operated by Transportation Management Associations (TMAs). TMAs are generally nonprofit agencies that pool resources from a number of employers or developments in a particular geography.

Given their proven effectiveness at reducing per capita VMT, the role of TDM in the environmental review process is about to become even more important than it is today. In 2013, California enacted Senate Bill (SB) 743, which precludes the use of level of service (LOS) to determine transportation impacts under the California Environmental Quality Act (CEQA). The Office of Planning and Research (OPR), which is responsible for implementing this directive, is recommending that VMT be the new basis for determining transportation impacts, specifically VMT per capita; draft guidelines for SB 743 were expected to be released for public comments at the time this Plan was being developed. While new practices are still evolving to meet the new CEQA requirements, the most effective way to implement TDM programs is likely to continue to be through TMAs of multiple adjacent developments or potentially for an entire jurisdiction or set of jurisdictions.

23 California Air Pollution Control Officer's Association (CAPCOA), Quantifying Greenhouse Gas Mitigation, 2010.

Figure 4.2.1: TDM Strategies that Reduce Vehicle Trips

TDM Strategy	Estimated Maximum VMT Reduction
Commute Trip Reduction Strategies	
Mandatory Strategies	21.0% commute VMT
Transit Fare Subsidy	20.0% commute VMT
Workplace Parking Pricing	19.7% commute VMT
Ride Share Program	15.0% commute VMT
Employer-Sponsored Vanpool/Shuttle	13.4% commute VMT
Employee Parking Cash-out	7.7% commute VMT
Voluntary Strategies	6.2% commute VMT
TDM Marketing and Education	4.0% commute VMT
Bike Share Program	N/A[1]
Parking Policy/Pricing Strategies	
Unbundled Parking Costs	13.0%
Parking Supply Limits	12.5%
On-Street Parking Market Pricing	5.5%
Residential Area Parking Permits	N/A[1]
Transit System Improvements	
Local Shuttles	8.2%
Neighborhood/Site Enhancement Strategies	
Car-Share Spaces	0.7%

Source: *Quantifying Greenhouse Gas Mitigation Measures* (CAPCOA, August 2010)

1. At the time of the CAPCOA report development, existing literature did not provide a robust methodology for calculating this measure's effectiveness.

City of Alameda Transportation Management Association

Several jurisdictions in Alameda County have already implemented TMAs, but none more effectively than the City of Alameda. Their citywide program is unique in the following ways:

- **Consistently Applied:** All new development is required to contribute a set amount of on-going funding toward TDM as a Condition of Approval, usually via an obligation to join and contribute to a TMA. This ongoing obligation is associated with the property, so it applies to initial, as well as future, occupants, even if the parcel changes hands.
- **Organization:** As with ITS, systems that require ongoing activities require an organizational structure. TMAs present an option for developments to manage TDM without requiring additional City staff time.

Alameda requires new development to report the status of their TDM programs, such as what components their program includes and participation and ridership rates. Larger developments, such as Alameda Point, must also annually report their progress toward reducing vehicle traffic, per their environmental clearance documents.

The City of Alameda program has largely operated through Conditions of Approval, based on each project's projected contributions to traffic on a limited number of congested arterials. Alameda's island geography has helped its TDM program succeed because limited access makes monitoring congestion more practical than in more dispersed networks; however, SB 743 provides an opportunity to develop effective TDM programs in jurisdictions throughout Alameda County.

As more property is developed and mandated to join a TMA, some smaller development-specific TMAs are planning to merge into a more integrated organization that will be able to share costs and better-coordinate with shuttles and transit service.

4.3 Parking Management Strategies

Jurisdictions throughout Alameda County provide the following on-street and off-street parking options:

- **Unrestricted on-street parking:** On-street parking that is free of charge and without time restrictions, with the exception of for regular street sweeping.
- **Time limits and restrictions for on-street parking:** In commercial areas, cities use time limits to encourage turnover of parking spaces to provide short-term parking for visitors and patrons. In residential areas adjacent to commercial districts, parking time limits are used to discourage parking by employees and other long-term parkers.
- **Parking pricing:** A system of differentiated pricing rates is a key element in encouraging drivers to use parking efficiently, by directing long-term parking to less convenient on-street and off-street spaces and gaining the most productivity from the most attractive on-street spaces. Parking pricing also helps reduce automobile demand and encourage mode shifts to transit, walking and biking. Options for collecting on-street parking charges include traditional parking meters and centralized parking machines, both of which can be configured to accept credit cards. In addition to variable parking depending on

location, meters can be programmed to implement different pricing rates by time of day.

- **Assigned parking:** This strategy involves reserving particular spaces for particular uses and users. For instance, an employer could require its workers to park in remote facilities to free up attractive parking spaces for customer parking, pick-up and drop-off or for goods movement loading and unloading.
- **Permit parking programs:** Jurisdictions create preferential on-street parking districts in residential areas to protect neighborhoods from parking intrusion by employees and patrons of nearby attractions, such as stores, restaurants, offices and public transit. In these areas, residents (and their guests who purchase a special permit) have unlimited parking privileges, while anyone without a permit may only park for a limited time, typically two hours.
- **Park-and-ride lots:** Public agencies typically provide these off-street parking facilities to encourage commuters to park in less congested locations and take public transit to work.

Jurisdictions in North and Central Alameda County generally allow more on-street parking along the Arterial Network than those in the South and East; there are off-street parking lots and structures throughout the county. On-street parking spaces play the following roles on arterials[24]:

- Convenient and desirable parking for local businesses,
- Goods-delivery (including marked and unmarked curb space),
- Bus passenger loading and some layovers,
- Passenger loading for transit and paratransit,
- ADA accessible parking spaces and
- Where offered, valet parking.

Managing curb space is vitally important to assuring that these functions occur predictably and safely. Well managed curb space has three critical elements:

- Designation for specific uses,
- Pricing to optimize demand, and
- Enforcement of regulations to limit violations.

In most jurisdictions, these elements develop organically based on the requests of individual property owners or tenants, but Parking Management Plans commissioned by jurisdictions are increasingly common. Part of the impetus for these plans is the recognition that parking

[24] Although this section presents off-street parking management strategies, on-street parking is the primary focus of this chapter because the MAP primarily evaluates the arterial right-of-way.

needs to be actively managed in order to function optimally. While there has traditionally been resistance to pricing on-street parking from merchants concerned about the convenience and cost to their patrons, programs like SF Park have demonstrated that pricing actually assures patrons a parking space, even on blocks with high demand. These programs demonstrate that the keys to on-street parking in retail areas are:

- Parking fee collection systems that are convenient and intuitive, such as smart meters and pay stations, which accept credit card payment,
- Fee structures that support the intended use of curb space. For instance, limiting allowable parking to a time period sufficient to patronize local businesses, and establishing a parking fee structure that encourages long-term parkers to park on a nearby block with less parking demand or in a nearby structure.
- Enforcement plans that deter long-term users from repeatedly moving their vehicles. Parking enforcement technology that includes character recognition cameras can help.

Figure 4.3.1 summarizes issues related to on-street parking and potential strategies to address them.

Figure 4.3.1: On-Street Parking Management Strategies

Potential Issues	Parking Permit Programs	Enforcement	Merchant Programs	Time Limits and Restrictions	Urban Design/Signage/ Traffic Calming	Assignment of Parking Locations	Parking Charges	Parking Benefit Districts	Restriping to Create More Parking Spaces	Adding Off-Street Parking	Alternatives to Driving
Residents cannot find spaces in their neighborhoods	●	●		●	●			●	●	●	●
Convenient spaces are not available to shoppers in commercial areas		●	●	●	●	●	●	●	●	●	●
It is difficult to find on-street parking		●		●		●	●	●	●	●	●
Traffic congestion as a result of drivers searching for on-street parking		●	●		●	●	●			●	●

Although off-street parking lots and structures are generally not considered within the arterial right-of-way, off-street parking facilities can affect traffic operations along arterials in the vicinity of the off-street parking facilities. Figure 4.3.2 summarizes issues related to off-street parking and potential strategies to address them.

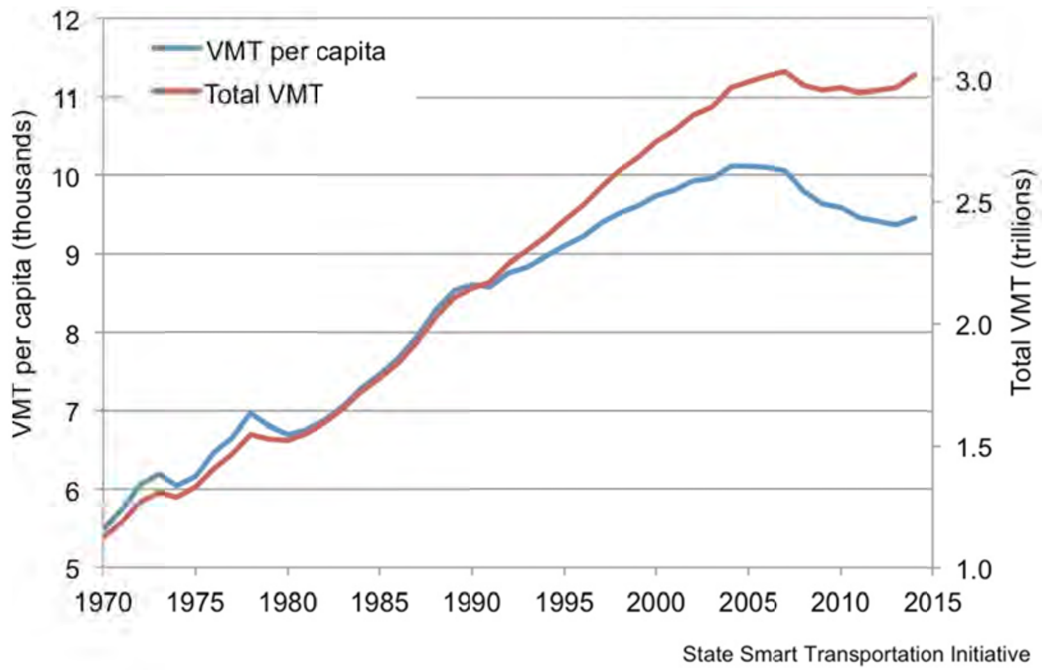
Figure 4.3.2: Off-Street Parking Management Strategies

Potential Issues	Access Management	Enforcement	Employer Programs	Time Limits and Restrictions	Signage/ITS/Design	Shared Parking	Parking Cash-Out	Parking Charges	Providing More Parking	Alternatives to Driving
Convenient spaces are not available to shoppers in commercial areas	•	•	•	•	•	•	•	•	•	•
Parking lots and structures are usually full			•	•		•	•	•	•	•
Parking patterns are uneven	•	•		•	•	•	•	•		
Parking "poaching" is occurring where patrons from one use occupy parking provided for another use	•	•	•	•	•			•	•	
Cars are parked for long periods of time, excluding daily parkers		•		•				•		

4.4 VMT trends resulting from demographic shifts

After 50 years of steady growth, national per capita VMT leveled off in 2004 and declined by eight percent between 2004 and 2012. Research has narrowed the possible reasons for the decline to macroeconomic factors, including technology and social networking, and shifting lifestyle and generational trends that influence society's transportation priorities (see Appendix 2.3.2). As shown in Figure 4.4.1**,** per capita VMT began to increase again in 2014, likely due to the decrease in fuel prices and improvements in the economy. What travel will do in the future is of critical importance to decision-makers in business and government at the local, state and national levels because VMT is a key indicator of the cost and societal and environmental impacts of public policy, community planning and infrastructure investment.

Figure 4.4.1: Annual VMT (1970-2015)



Given the possibility of continued decline in VMT in a time of uncertainty, the following proposals should be considered for those involved in transportation policy setting and planning of infrastructure and transportation program investments, and for evaluating the impacts of travel on community well-being, economic productivity, air quality and other environmental issues:

- Understand uncertainties, and forecast travel for scenarios or probable ranges of outcomes, not absolute values.
- Discuss with stakeholders the key underlying factors that influence per capita VMT, recent trends and the plausible ranges of future rates.
- If VMT per capita trends downward in the years to come, forecast VMT growth at rates lower than historic trends. Rather than continuing the upward trajectory exhibited from 1970 to 2004 (a 63 percent increase in VMT per capita), future VMT per capita may remain constant or decline.
- In travel behavior forecasts, include credible forecasts of driving age, household formation, labor force participation, vehicle ownership, gasoline prices, relationship between time-use budgets and travel time growth, telecommuting, internet shopping, and methods of delivering goods and services.
- Continue to research, narrow the range of uncertainty and strengthen the reasonableness of forecasts. Suggested variables for statistical or structural equations modeling of factors correlated with annual VMT from 1950 to 2010 include the economy, demographics, technology and urban form/built environment.
- Monitor changes in demographic and economic data and concurrent changes in VMT per capita to verify or adjust forecasts.

4.5 Transportation Technology Trends

Significant penetration of next generation vehicles in the Alameda County vehicle fleet is expected to increase arterial capacity and thus reduce vehicle delay and congestion. This new technology includes three strategies discussed in this section: connected vehicles, autonomous vehicles and shared mobility.

Connected Vehicles

Looking ahead, next generation automobiles, trucks, buses, infrastructure and personal mobile devices will communicate with each other. They will exchange information that will enable “connected vehicle” (CV) applications to reduce collisions, improve incident response times, increase roadway capacity and reduce congestion (see Appendix 3.5.1). There are three types of connected vehicle interactions: vehicle-to-vehicle (V2V), vehicle-to-infrastructure (V2I) and vehicle-to-everything (V2X).

V2V-Vehicle to Vehicle Technology

The advancement of V2V applications is being led by the automotive industry, independent of public transportation agency support. The focus for the public sector should be on V2I applications, with particular emphasis on what agencies can do to be prepared. V2X applications include all V2V and V2I interactions plus the ability of vehicles to communicate with smart phones, bicyclists, pedestrians and the owner’s home. The process by which next generation vehicle infrastructure and applications will be planned and implemented by public agencies is similar to that for any other transportation infrastructure and is generally an extension of existing ITS practices.

V2I-Vehicle to Infrastructure Technology

Autonomous Vehicles

Tesla has already developed software enabling its vehicles to pilot themselves and every major automobile manufacturer has indicated that it will have a fully autonomous vehicle (AV) for sale by 2018. The question is not whether or when the technology will be available, but whether consumers will prefer autonomous vehicles and, if so, how long it will take until AVs constitute a significant portion of the vehicle fleet. Given normal vehicle turnover rates, AVs won't likely represent a high percentage of cars on the road for several decades, but they're already an important consideration for medium and long-range planning and environmental assessments.

Significant penetration of next generation vehicles within the Alameda County vehicle fleet is expected to increase arterial capacity and thus reduce vehicle delay and congestion. The MAP alternative forecasting scenario (presented in Section 3.5) assumed that a 50 percent penetration of AVs by 2040 would result in a 20 percent increase in lane capacity. There may also be an increase in vehicle travel (VMT), but this is an area of significant debate with two opposing perspectives: (1) AVs will grow VMT by as much as 35 percent due to an expanded pool of private auto travelers (including people under 16 and people with physical conditions preventing driving) and a less stressful travel experience; or (2) when combined with car sharing and other shared mobility options, vehicle occupancies will increase such that even with an increase in person miles of travel, VMT will trend downward.

The MAP is the first planning level study in Alameda County to prepare for changes in vehicle technology. The concurrent Connected Vehicle Program, sponsored by the U.S. Department of Transportation, is also considering next generation vehicles. Through this program, Caltrans, in partnership with MTC, is working with private sector companies and academic and research institutions to develop and deploy connected vehicle technologies that can make travel in the Bay Area safer, easier and friendlier to the environment.

Case Study

The City of Los Angeles has taken a proactive approach to vehicle technology, acknowledging that there is a high degree of uncertainty and controlling risk associated with that uncertainty. In its *Urban Mobility in a Digital Age, A Transportation Strategy for Los Angeles* (Draft, May 7, 2016) the City defines its objectives and role as:

- Promote affordable, walkable, high-quality development around transportation hubs for the efficient use and access to services.
- Maintain the public right-of-way and keep digital and physical infrastructure in a state of good repair.
- Ensure safety, equity, and access of mobility systems through regulation and enforcement.
- Be an effective regulator and service provider by preparing to respond and anticipate changes to the mobility marketplace.

Shared Mobility

Shared mobility is an industry term describing services like car share and bike share. At present, most shared mobility options are offered commercially, but peer-to-peer, joint-use or subscription-based shared mobility options are becoming more prevalent. In 2016, BMW equipped Minis with fare collection systems enabling peer-to-peer car sharing. Shared mobility offers a scalable alternative to traditional car ownership, maximizing the use of individual automobiles and potentially eliminating the need for some people to own a car.

4.6 Global Warming and Resiliency

Alameda County's transportation system is vulnerable to disasters, such as inundation from climate change-induced sea level rise, periodic flooding from increasingly intense storms, destruction of transportation infrastructure due to earthquake and fire, and breakdowns of key infrastructure elements as a result of age and deferred maintenance. Regional and local planning efforts are in various stages of identifying and evaluating these risk factors to develop resilient transportation strategies.

The San Francisco Bay Conservation and Development Commission (BCDC), in partnership with local agencies and organizations, conducted an assessment to address sea level rise and storm event impacts along the Alameda County shoreline (see Appendix 4.6.1)[25]. This assessment identified 14 vulnerability areas related to transportation. Figure 4.6.5 summarizes the four vulnerabilities and corresponding recommended actions that most apply to the Alameda Countywide Arterial Network.

[25] San Francisco Bay Conservation and Development Commission, Adapting to Rising Tides – Vulnerability & Risk Assessment Report, 2012.

Figure 4.6.5: Transportation System Vulnerabilities and Recommended Actions

Vulnerability	Recommended Actions
T5: Alternative routes have limited additional capacity to accommodate re-routed commuter traffic (e.g., buses or carpools) or goods movement. If significant roadways or nodes are disrupted, re-routing would result in heavy congestion that could overwhelm the region's roadways and interstates as well as non-motorized transportation corridors (bike and pedestrian).	T5.1: Conduct a "hot spot" analysis to identify key routes and nodes critical to traffic flow, assess their vulnerability and risk, and develop actions to improve their resilience to sea level rise and storm events.
	T5.2: Identify and invest in non-motorized transportation corridors (bike and pedestrian) that will provide alternatives if significant roadways and interstates are disrupted.
	T5.3: Increase the capacity to accommodate re-routed traffic on alternative routes, or build new routes, in areas not at risk from sea level rise and storm events.
	T5.4: Develop currently underused, unused, or new pedestrian rights of-way as non-motorized emergency evacuation alternative routes.
	T5.5: Prioritize funding to improve alternative ground transportation routes, enhance or develop public transportation, bike and pedestrian options, and replace or retrofit vulnerable critical lifeline infrastructure.
T6: The temporary disruption or permanent loss of public transportation assets due to sea level rise and storm events, and the lack of sufficient alternatives, could leave residents in some communities unable to travel on a day-to-day basis, compounding evacuation challenges during an emergency.	T6.1: Identify public transportation assets at-risk of flooding that serve transit-dependent populations.
	T6.2: Proactively protect public transportation assets that serve transit-dependent populations, or prioritize development of alternative transit options to serve these populations.
	T6.3: Include strategies that ensure the safe evacuation of transit-dependent populations in emergency response plans, e.g., designate evacuation routes and bus assignments, and coordinate with local school bus fleets, transportation service providers, and wheelchair accessible vehicles to expand the pool of available vehicles for evacuation.
T8: Certain communities or facilities are linked by only one or two access-ways (e.g., road, rail, or transit) and could become isolated during disasters. For example, the majority of access roads to the Port of Oakland's seaport and Oakland International Airport are vulnerable, and if they flood they could isolate these regionally significant facilities.	T8.1: Identify specific communities and facilities served by limited or sole access-ways that are vulnerable to sea level rise and storm events.
	T8.2: Proactively protect public transportation assets that serve transit-dependent populations, or prioritize development of alternative transit options to serve these populations.
	T8.3: Develop and adopt plans for future relocation of people, uses, and services that are at risk of becoming isolated where sole or limited access-ways cannot be improved or protected, and where no other alternative means of access is feasible.

Vulnerability	Recommended Actions
T12. Many high-cost and critical elements of transportation infrastructure are highly vulnerable to flooding because they are located at or below grade (tubes, tunnels, ventilation), in low-lying areas (airport runways, storage and maintenance facilities), or on top of levees (rail alignments).	Manage storm water at or near critical facilities and transportation elements by prioritizing regular maintenance, investing in drainage improvements (under or cross drains, backflow or flex valves, perimeter walls or pile/column foundations), and using low impact development (LID) techniques
	Prepare for recovery from flooding by stockpiling materials, establishing turnkey agreements for equipment rental, and pre-positioning emergency power generation capacity, portable pumps, and debris removal equipment
	Identify locations that are not at risk of flooding to temporarily store mobile equipment, rolling stock, or other assets (may require agreements or permission from private property owners), and develop clear procedures for how and when to use these sites when flooding is predicted
	Install manual, remote control, or automatic temporary barriers or waterproof closures to protect at- or below-grade critical elements such as roadways, tube and tunnel openings, ventilation grates, switchgears, maintenance facilities, and asset storage areas
	Construct permanent structures to protect at- or below-grade critical elements such as roadways, tube and tunnel openings, ventilation grates, switchgears, maintenance facilities, and asset storage areas
	Raise the elevation of at- or below-grade critical elements such as entrances, mechanical or electrical equipment, and ventilation grates
	Develop or improve design standards to require protection of new infrastructure and capital improvement investments from sea level rise, storm events, and elevated groundwater levels

Source: *Adapting to Rising Tides – Subregional Adaptation Responses* (San Francisco Bay Conservation and Development Commission, July 2013)

The MAP identifies the following multimodal improvements that are consistent with strategies identified in the BCDC report (see MAP Chapter 3):

- Identify and invest in non-motorized bicycle and pedestrian transportation,
- Prioritize funding to enhance public transportation, bicycle and pedestrian options, and
- Proactively protect public transportation assets that serve transit-dependent populations.

The MAP also proposes several landscape improvements to enhance the pedestrian environment along arterials throughout the county (see Section 3.3). The MAP recommends that all proposed landscape improvements along arterials incorporate rain gardens in their designs to:

- beautify landscaped medians and sidewalk buffers,
- manage water runoff,
- enhance curb appeal,
- filter runoff pollution,
- recharge local groundwater,
- conserve water,
- improve water quality, and
- reduce the potential for flooding

Rain gardens are landscaped areas that use plants, hardscape and topography to take advantage of rainfall and stormwater runoff.


FRUITVALE VILLAGE

5 Approach to Developing Packages of Improvements

Alameda CTC and its partner agencies have historically implemented changes to the transportation system by evaluating and selecting discrete projects for implementation. This process has not resulted in the kind of systemic performance improvements needed to maintain an aging infrastructure in the face of growing congestion and constrained right-of-way. As a result, these agencies have recently begun considering a different approach for investing in the transportation system (e.g., freeway express lanes, I-80 ICM). Rather than considering a list of discrete improvements, several investments at a time are being linked together at the corridor or area level to capture synergies between the modal improvements. This suggested integrated approach provides a unified and effective way to move these investments forward so that Alameda County can achieve its vision of improving multimodal mobility and providing continuous and connected multimodal networks. This chapter presents an approach to packaging and implementing multimodal improvements at the corridor- or area-level for short- and long-term implementation.

5.1 Identifying Improvement Corridors and Areas

This section of the MAP outlines an approach to packaging the segment-level improvements proposed in Chapter 3 into corridors and areas: primarily corridors for transit, bicycle, auto and goods movement; and areas for pedestrian improvements, which are typically focused on nodes. This approach applies the following criteria to identify packages of improvements:

- **MAP Improvement Corridors:** Proposed improvements along a single roadway that extend more than a mile in length could be grouped to form MAP improvement corridors. Some of these corridors could also include improvements on adjacent parallel or connecting roadways because improvements to these facilities can enhance operations along the main corridor.
- **MAP Improvement Areas:** Proposed improvements along various roadways within the same geographic area could be grouped and packaged as multimodal improvement packages. These improvement areas would mainly be in downtown areas and around BART stations.

A majority of these corridor and area packages call for improvements to more than one mode. For example, San Pablo Avenue between the Alameda County line and 20th Street in Oakland, a potential MAP improvement corridor, includes the following proposed multimodal improvements along its entire length (with the exception of the Class 4 protected bicycle lanes):

- Dedicated Transit Lanes,
- Crosswalk enhancements,
- Pedestrian scale lighting,

- Class 4 protected bicycle lanes (along segments in Berkeley and Oakland only), and
- High level ITS infrastructure.

Similarly, multimodal improvements along 1st Street, 2nd Street, 4th Street, L Street P Street, Livermore Avenue, College Avenue and Holmes Street are recommended in downtown Livermore, a potential MAP improvement area, including:

- Crosswalk enhancements,
- Pedestrian scale lighting,
- Curb bulbouts (to support transit and walking), and
- Class 3 bicycle routes.

The complimentary ITS, TDM and parking strategies, policies, and best practices described in Chapter 4 are assumed to be implemented in addition to proposed infrastructure improvements, and therefore are not specified for any MAP improvement corridor or area.

5.2 Identifying Short- and Long-Term Improvement Packages

This section describes a method for identifying the improvement packages described in Section 5.1, for both short-term and long-term implementation.

The highest order improvements recommended in Chapter 3 are the improvements most likely to enhance overall mobility. High-order facilities correspond to the Tier 1 facilities identified during the Typology phase, as described in Section 1.4:

- Transit: Dedicated Transit Lanes on Major Corridors
- Walking: High Pedestrian Emphasis
- Bicycle: Class 2 Enhanced, Class 3 Enhanced, Class 4
- Auto: Throughway
- Goods Movement: Tier 2 routes

These high order facilities are considered to be the most critical for developing continuous and connected multimodal networks, since they can maximize the potential for mode shifts to transit, walking and biking. The MAP proposes that improvement packages with high-order improvements should be implemented in the short-term, using criteria such as the following:

- Dedicated Transit Lanes along any Major Transit Corridor segment,
- Pedestrian improvements along any High Pedestrian Emphasis segment,
- Class 2 Enhanced, Class 3 Enhanced or Class 4 bicycle lanes,
- High Level of ITS Infrastructure improvements along any Throughway segment, and
- Curb lane widening along any Tier 2 route.

Since high order improvements are, by definition, those that are expected to have the most multimodal benefits; other proposed improvements are considered long-term. Long-term improvements are also important to developing continuous and connected multimodal networks; however they are expected to have a relatively lower effect on mode shift than the high order improvements. For example, where there is insufficient right-of-way for a Class 4 protected bike lane (a Tier 1 facility), a traditional Class 2 bicycle lane (Tier 2) can still help achieve the Plan goal of a continuous and connected bikeway network.

Other Considerations

While the approach described in this section identifies short-term and long-term improvement packages, it does not rank or prioritize these packages or the improvements within them. Ultimately, the highest priority improvements will be those advanced by local agencies according to their priorities. This section provides three sets of data that local jurisdictions can use to prioritize improvements. This information indicates the benefits expected to accrue from each type of improvement.

<u>Year 2020 and 2040 Performance Measure Results</u>

The MAP process relied on a rigorous Geographic Information System (GIS) that mapped the physical characteristics of each roadway's right-of-way, existing multimodal facilities and proposed improvements. As laid out in Chapters 2 and 3, the system used this information to project how well each facility would perform for each mode with and without these improvements. The GIS tool can also be used to determine the top 20 short term improvements that would benefit transit, walking, bicycling and driving.

Collision Rates

Alameda County jurisdictions that want to invest in arterial roadways with the highest collision rates may want to prioritize recommended improvements that would also serve as countermeasures for primary collision factors. Examples include narrowing lanes to reduce vehicle speeds and pedestrian crossing enhancements. The end of Appendix 2.1.1 shows these rates for all collisions on the Arterial Network; jurisdictions can disaggregate this information by primary collision factor.[26]

Pavement Condition Index (PCI)

Jurisdictions are likely to pave roadway segments with “Poor” or “At Risk” PCI ratings before other roadways. This maintenance work provides an opportunity to implement some improvements recommended in the MAP at a lower cost than if they were applied as stand-alone projects. For example, several of the proposed bicycle lane improvements can be implemented by re-striping certain corridors as part of repaving projects (see end of Appendix 2.1.1).

Number of Modes Improved

In many cases, the packages of proposed improvements described earlier in this chapter benefit more than the two primary modes on a given roadway segment. Some local agencies may want to prioritize improvements projected to improve the performance of the highest number of modes (see Appendix 5.2.1).

[26] Transportation Injury Mapping System (TIMS) (2009-2012).

Via Granada
LANE
CLOSED

6 Building a Multimodal Arterial Network

For Alameda County's arterials to carry more people, they will need to provide complete and connected networks for all modes. Investments in these arterial networks also spur economic growth as evidenced by a new Urban Land Institute report[27]. The full benefits of proposed new advancements, like multimodal improvements and complimentary technology and operational strategies and programs proposed in the MAP, are sometimes not achieved until they have been widely adopted.

Implementing the full scope of capital improvements proposed in Chapter 3 of the MAP is estimated to cost more than $2 billion. Funding is the greatest challenge to implementing transportation improvements in Alameda County as existing resources are not sufficient to fund the transformative multimodal improvements proposed in this Plan. Leveraging available, although limited, local, regional, state and federal funding sources will be vital to achieving a transportation system consistent with the vision and goals of this Plan. Forming partnerships among Alameda County's numerous and diverse public agencies and private industries, particularly along MAP improvement corridors and in MAP improvement areas that cross multiple jurisdictional boundaries, is one opportunity to help overcome this funding challenge. This chapter provides an overview of various sources available to fund transportation infrastructure improvements and a discussion of how partnerships can help agencies implement recommended improvements.

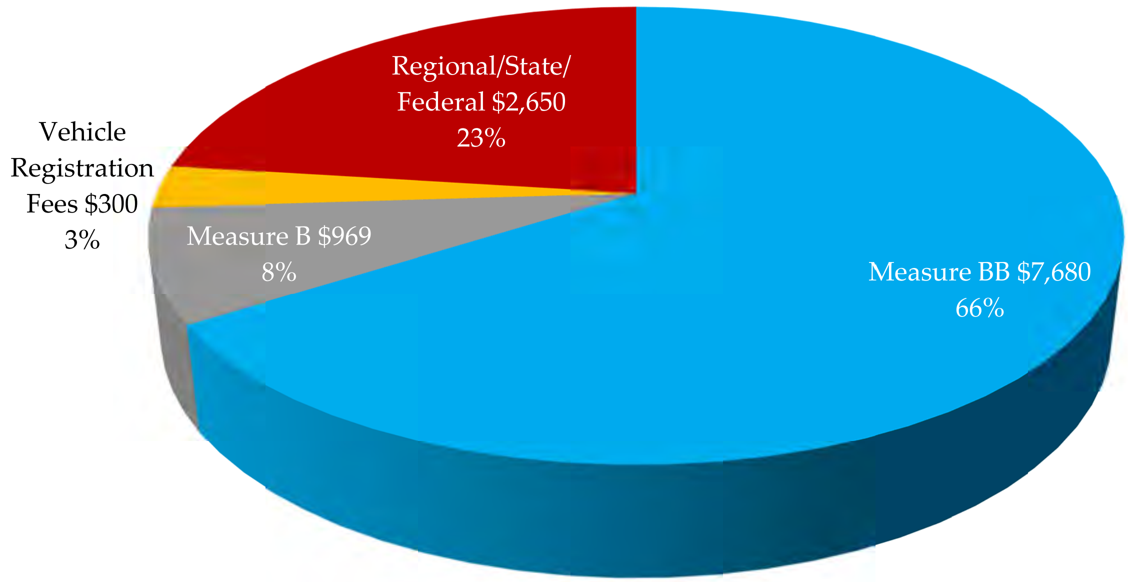
6.1 How do we pay for it?

Alameda County uses a variety of local, regional, state and federal sources to fund the transportation system. Figure 6.1.1 shows that over three-quarters of this funding through 2040 will come from local sources. Alameda County has a long history as a "self-help" county because the voters have approved tax measures that fund transportation projects. The county will need to continue to rely heavily on local sources as federal and state funding has declined in recent years. See Figure 6.1.2 below and the *Alameda Countywide Transportation Plan*[28] for detailed information on local, regional, state and federal funding sources

[27] Urban Land Institute, Active Transportation and Real Estate, 2016.

[28] Alameda CTC, April 2016.

Figure 6.1.1: Alameda County Funding Breakdown FY 15/16 - FY 39/40 (Millions of dollars)



Source: 2016 *Countywide Transportation Plan* (Alameda CTC, May 2016).

Local Funding Sources

Local funding has become critically important in Alameda County given the reduction in state and federal funding. In November 2000, Alameda County voters passed Measure B, authorizing a half-cent sales tax to fund transportation improvements through 2020. Fourteen years later, they increased this tax to one-cent with the passage of Measure BB, which extended the tax through 2045. Measure BB is estimated to generate about $8 billion for transportation projects and programs. In November 2010, Alameda County voters also passed Measure F, which increased annual vehicle registration fees by ten dollars per vehicle, generating revenue for transportation projects within the county. As shown in Figure 6.1.1, about 77 percent ($8.9 billion) of transportation funding in Alameda County is expected to be generated by Measure B, Measure BB and Measure F between FY 15/16 and FY 39/40; other regional, state and federal sources are expected to generate the remaining 23 percent ($2.7 billion).

Regional Funding Sources

Regional funding sources comprise a relatively small share of the resources available for funding transportation projects in Alameda County (see Figure 6.1.1). MTC and Alameda CTC manage and distribute these funds.

Figure 6.1.2: Potential Funding Sources (Local, Regional, State and Federal Programs)

Funding Source	Description	Eligible Uses	Responsible Agency
Local Sources			
Measure B	Half-cent sales tax for transportation	Capital and operating expenses for highway, local roads, transit operations, paratransit and bicycle/pedestrian facilities.	Alameda CTC
Measure BB	One cent sales tax for transportation projects in Alameda County.	Capital and operating expenses for highway, local roads, transit operations, paratransit and bicycle/pedestrian facilities.	Alameda CTC
Measure F	$10 annual vehicle registration fee.	Capital and operating expenses for local roads, transit operations, local transportation technology, pedestrian/bicycle facilities.	Alameda CTC
Impact and Development Fees	Funds from developers to fund capacity-enhancing improvements.	Capital and operating expenses for local roads, transit operations, pedestrian/bicycle facilities.	Multiple Local Agencies
Regional/State Sources			
Regional Measure 2 (RM2)	Funded by revenues from tolls on the region's seven state owned toll bridges.	Capital and operating expenses for highway, local roads, transit operations, and bicycle/pedestrian facilities in the bridge corridors and their approaches.	Bay Area Toll Authority (BATA), MTC
Assembly Bill (AB) 664	Bridge tolls collected on the San Francisco-Oakland Bay, Dumbarton, and San Mateo-Hayward Bridges.	Capital and operating expenses for transit improvements in the bridge corridors and their approaches.	BATA, MTC
AB 1107	Half-cent sales tax for transit projects	Capital and operating expenses for transit improvements	MTC, Local Transit Operators
Transportation Fund for Clear Air (TFCA)	$4 annual vehicle registration fee	Capital and operating expenses for transit operations and pedestrian/bicycle	Alameda CTC

Funding Source	Description	Eligible Uses	Responsible Agency
		facilities	
One Bay Area Grant Program (OBAG)	Federal Surface Transportation Program and Congestion Mitigation and Air Quality funding sources	Capital expenses for transportation projects within priority development areas	MTC, Alameda CTC
Transportation Development Act (TDA)	Quarter-cent sales tax and tax on diesel fuel	Capital and operating expenses for local roads and transit operations.	MTC, Local Transit Operators
State Transportation Improvement Program (STIP)	Multi-year capital improvement program of transportation projects on and around the State Highway System	Capital expenses for highway and local road projects	California Transportation Commission, MTC, Alameda CTC
Caltrans Local Assistance Programs	Active Transportation Program (ATP) to encourage more walking and biking	Capital and operating expenses for local roads, transit operations and bicycle/pedestrian facilities	Caltrans
Caltrans Sustainable Transportation Planning Grant Program	Supports Caltrans' Mission: *Provide a safe, sustainable, integrated and efficient transportation system to enhance California's economy and livability.*	Planning expenses for highway, local roads, transit operations and bicycle/pedestrian facilities	Caltrans
Greenhouse Gas Reduction Fund (GGRF or cap and trade)	Sustainable communities and clean transportation funding, clean energy and energy efficiency funding, and natural resources and waste diversion.	Capital and operating expenses for rail, transit and pedestrian/bicycle facility projects that result in reduced greenhouse gas emissions.	Multiple State Agencies
State Infrastructure Bank Financing	Flexible project funding through loans, debt service guarantees, lines of credit and other capital financing support	Capital expenses for new highway and local street projects	Caltrans

Federal Sources

Funding Source	Description	Eligible Uses	Responsible Agency
Fixing America's Surface Transportation Act (FAST)	Five year authorization (FY 16/17 – FY 20/21) of federal transportation funding programs.	Capital and operating expenses for highway, local roads, transit operations, and bicycle/pedestrian facilities	FHWA, MTC
Advanced Transportation and Congestion Management Technologies Deployment (ATCMTD)	Grants for constructing and operating advanced transportation technologies to improve safety, efficiency, system performance and infrastructure return on investment	Capital and operating expenses for ITS projects	FHWA, MTC
Federal and State Gas Tax	Federal tax rate is $0.18 per gallon; state tax rate is $0.41 per gallon.	Capital and operating expenses for highway, local roads and transit projects	Multiple Agencies
Federal Transit Administration (FTA) Programs	Grants for public transportation capital, planning and preventative maintenance	Capital and operating expenses for transit projects	FTA, MTC
Surface Transportation Block Grant Program (STBG)	Program funds to states and metropolitan planning organizations	Capital and operating expenses for highway, local roads, transit operations and bicycle/pedestrian facilities	California Transportation Commission, MTC
Congestion Mitigation and Air Quality	Program funds to air quality maintenance or non-attainment areas, including Alameda County	Capital and operating expenses for rail, transit and pedestrian/bicycle facility projects that reduce greenhouse gas emissions	California Transportation Commission, MTC
Transportation Investment Generating Economic Recovery (TIGER)	Highly competitive, discretionary grant program for capital costs of road, rail, transit and port projects	Capital and operating expenses for highway, local roads, transit operations and bicycle/pedestrian facilities	US DOT
Transportation Infrastructure Finance and Innovation (TIFIA)	Federal credit assistance to finance surface transportation projects of national and regional significance	Capital expenses for highway, local roads, and transit projects	US DOT

State Funding Sources

California's transportation funding comes from a combination of taxes, fees and bonds. Gas taxes – which are a percentage of the amount motorists pay at the pump – make up a majority of maintenance dollars. Therefore, California legislators are exploring a VMT-based pricing model that would levy a fee based on the number of miles a car is driven, rather than by how much gasoline it consumes. The state is studying the potential for a VMT-based driving fee in a pilot expected to be completed in 2017.

In 2014, the California Cap-and-Trade Program established the Greenhouse Gas Reduction Fund to support transportation projects of regional significance that are designed to reduce greenhouse gas emissions. The Cap-and-Trade Program – a key element of California's climate plan (required under Assembly Bill 32) – sets a statewide limit on sources of greenhouse gas emissions, and establishes a pricing system to drive long-term investment toward cleaner fuels and more efficient uses of energy. Funding is generated through the sale and trade of permits that allow certain industries (such as power plans and factories) to exceed established pollution caps.

Federal Funding Sources

In 2015, President Barack Obama signed Fixing America's Surface Transportation (FAST) Act, a five-year (FY 16/17 – FY 20/21) $305 billion authorization of federal transportation funding programs. The FAST Act allocates funding for various programs administered by the FHWA and FTA (see Figure 6.1.2).

6.2 Moving Forward

An important goal of the Alameda Countywide Multimodal Arterial Plan is to provide all 14 cities, the County of Alameda, transit agencies and Caltrans with the technical tools and framework to define priority modes on key arterial roadways in order to create continuous, connected networks for each mode. Multimodal improvements and operational strategies identified in this Plan are the result of high level, but focused, technical analyses, and will require additional steps before implementation can occur. These steps will mainly include community engagement, project design, possible formation of public and private partnerships, environmental clearance, and securing full funding. The MAP identifies each mode's network and proposes improvements needed to create continuous and connected modal networks; however, the Plan is not an explicit project approval or programming document, nor does it specify a particular course of action to pursue any improvements or packages of improvements. To move forward, any project included in the MAP will need to undergo an independent project development process according to all applicable environmental and regulatory policy requirements.

Community Engagement

Improvements proposed in this Plan were identified via a technical process that included extensive coordination with public works and planning department staff throughout all 14 cities, the County, transit agencies and Caltrans. These improvements were not vetted with local residents or businesses during the MAP development process beyond a set of workshops aimed at identifying high level issues and outlining general strategies. Community engagement is critical for building consensus and developing the design details of the multimodal transportation improvements identified in this Plan. Since MAP proposals are at the planning, not the design, level, engaging local residents and business-owners in a community-driven process will ensure that the improvements' final designs reflect their local context.

Partnerships

Partnerships of all kinds are needed to realize the vision outlined in this Plan. It will be essential for public agencies to work together to create continuous and connected multimodal networks, such as between neighboring jurisdictions and with regional and state agencies. Stakeholders will need to embrace new perspectives and establish new ways of working together.

Partnerships between the public and private sectors will be equally important to realize the vision outlined in this Plan. New contracting methods, such as design/build and design/build/operate, may allow public dollars to go farther. Public sector agencies will also need to work with private technology companies to understand the implications of new technologies on the multimodal transportation system.

Public/private partnerships may also create new opportunities that help the transportation system better serve Alameda County residents and workers. Examples include new technologies and greenway maintenance, as follows:

- **New Technologies**: Transportation Network Companies, like Uber and Lyft, could serve low density residential areas that today have fixed route transit service with demand-responsive, privately operated/publicly subsidized "micro-transit," using passenger cars or vans instead of buses. Recently, LAVTA has partnered with Transportation Network Companies (TNCs) to offer customers in low-density suburban areas a discount rate when they use services like Uber, Lyft or participating taxi companies. Similarly, AC Transit's new Flex service in Newark and Castro Valley allows customers to request a trip to and from any bus stop within the service zone on demand via smart devices. Operating resources saved in these arrangements can be used to enhance core transit services such as those called for in AC Transit's Major Corridors Plan. While this vision of transit may take years to realize, several paratransit operators in the U.S. are already evaluating options for replacing publicly operated paratransit with ADA accessible micro-transit options.
- **Greenways**: Private developers that are obligated to reduce the amount of traffic their projects generate have an incentive to increase the portion of trips their projects generate that are made by bicycle and on foot. Public agencies charged with maintaining transportation facilities near these developments could enter into private/public partnerships to allow developers to mitigate their traffic impacts by building and maintaining nearby multi-use pathways, like the East Bay Greenway.

Inter-jurisdictional partnerships, like those in the ITS realm discussed in Section 4.1, can use an organizational structure that is centralized (i.e., a lead agency assumes all responsibilities and represents the interests of other affected agencies) or decentralized (i.e., multiple agencies share responsibilities). Regardless of which approach is followed, partnership agreements should specify the following:

- Formal reporting structure,
- Roles and responsibilities of participating agencies,
- Authority of any regional entities,
- Cost sharing arrangements,
- Structure for day-to-day operations, and
- Performance measures for continued assessment.

Final Improvements

The proposed MAP improvements considered cross-sectional measurements and capital costs at a very high level; detailed design, specifications and cost estimates will be needed to deliver them. The project team believes that all proposed improvements will fit within available arterial right-of-way; however, the design, specifications and cost estimate process may reveal constrained locations where additional right-of-way is needed. In addition, if there is more available right of way than assumed by the GIS tool, it could be used for additional multimodal improvements. Therefore, the improvements proposed in Chapter 3 provide a starting point for conceptual designs, appropriate for use in the community engagement process that agencies will use to build consensus on final project definitions and designs.

Funding

As discussed in Section 6.1, various sources are available to fund the capital projects and operations proposed in this plan. Leveraging local and regional sources to attract state and federal funding will be crucial to delivering the MAP vision and goals. Local jurisdictions will need to continue to collaborate with neighboring jurisdictions, regional and state agencies and private sector partners to attract new funding sources.

An example of a broad approach to funding would be to establish a best practice on the use of Transportation Management Associations (TMAs; see Section 4.2) within each jurisdiction to collect ongoing funding for operations and maintenance of key transportation facilities. Building on the model of Measure BB, developing a predictable and ongoing resource for maintenance would allow projects that rely on landscaping to move forward.

Other Considerations

Although this Plan considered local land use context when developing proposed improvements, some MAP proposals may conflict with improvements envisioned in local planning documents (e.g. General Plans, Specific Plans, local Active Transportation Plans). MAP improvements were identified based on a quantitative technical analysis in consultation with local stakeholders; nonetheless, they may not fully capture local community desires. Since maintaining local context is an important part of the MAP vision, improvements proposed in this Plan are expected to be further refined and modified to fully reflect local planning efforts and community needs. This will become all the more important as local conditions and context undergo changes.

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