Appendix 3.1.1
Improvements Memo

FEHR PEERS

MEMORANDUM

Date: June 20, 2016

To: Saravana Suthanthira, Alameda CTC

From: Francisco Martin and Matthew Ridgway, Fehr & Peers

Subject: Alameda Countywide Multimodal Arterial Plan – Final Proposed Improvements

OK14-0023

1. INTRODUCTION

The Alameda Countywide Multimodal Arterial Plan (MAP) is currently in its final states of developments development by Alameda CTC and the Fehr & Peers consultant team. The primary goal of the MAP is to identify and prioritize a list of short and long-term multimodal transportation infrastructure improvements based on multimodal needs to accommodate population and travel demand growth within Alameda County. This memo presents final proposed multimodal improvements for the Arterial Network. The memo briefly describes the Needs Assessment evaluation and how that analysis provided the basis for identifying recommended improvements. Draft proposed improvements were discussed with each Alameda County jurisdictions, AC Transit, LAVTA and Caltrans during one-on-one and small group meetings that took place from February 29th through March 7th earlier this year. Proposed improvements have been updated incorporating comments and are presented in this memorandum (Attachments - Figures 1 through 5). They will be packaged into short and long-term improvements in the next and final steps of the MAP.

2. MULTIMODAL IMPROVEMENTS FRAMEWORK AND APPROACH

2.1 BACKGROUND

The proposed improvement process builds on the Needs Assessment results, which are summarized in the memo titled *Alameda Countywide Multimodal Arterial Plan – Final Needs Assessment* (Fehr & Peers, February 22, 2016). The Needs Assessment evaluation identifies Arterial Network segments with a need for multimodal improvements. The Needs Assessment evaluation was conducted using the following process (outlined in **Exhibit 1**).

Step 1 – Existing Conditions

Existing Conditions data were collected and multimodal performance measures were evaluated along the Arterial Network.

Step 2 – Volume and Speed Forecast Development

Future year traffic volume and speed forecasts were developed using the Alameda Countywide Travel Demand Model (Alameda CTC Model) and existing traffic volumes.

Step 3 – Future Year (2020 and 2040) Conditions

Year 2020 and Year 2040 conditions multimodal performance measures were evaluated using data collected for existing conditions, future year traffic volume and forecasts, and assuming planned and funded roadway improvements.

Step 4 – Performance Measure Objectives Evaluation

Multimodal performance measure objectives were applied to the existing and future year conditions evaluation to identify Arterial Network segments that do not meet the objectives.

Step 5 – Needs Assessment Evaluation

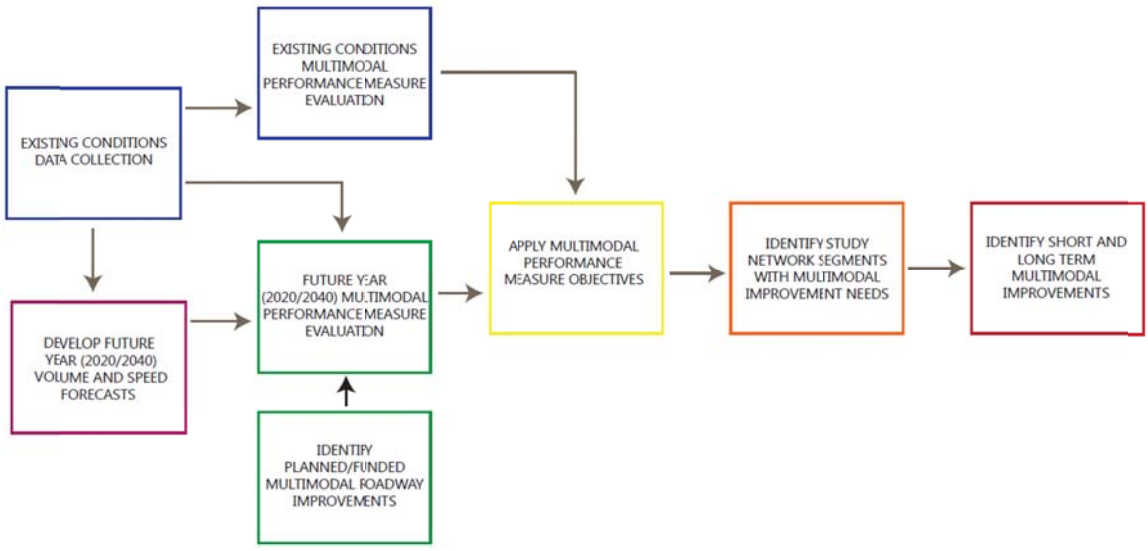
An Arterial Network segment is identified as having a need for improvement if performance of either of the top two modal priorities (developed earlier in the MAP development based on Typology framework) does not meet the performance objective.

Step 6 – Proposed Improvements

Where a need is identified and improvement implementation is feasible, proposed improvements by mode are recommended.

The Needs Assessment evaluation was informed by the Typology and modal priority tasks completed earlier in the MAP development process. MAP Typology was developed in coordination with the *Alameda Countywide Transit Plan, AC Transit Major Corridor Study, Alameda Countywide Goods Movement Plan, Alameda Countywide Bicycle and Pedestrian Plan* and with local jurisdictions who informed the bicycle Typology based on their local bicycle plans. Local jurisdictions also validated the modal priorities that were applied during the Needs Assessment evaluation.

Exhibit 1 – Needs Assessment Framework



2.1.1 Study and Arterial Network

The MAP evaluates a 1,200 mile Study Network to understand existing and future roadway conditions and the function of large network of countywide arterials in supporting all modes, and assess multimodal needs in a broader context. To identify and prioritize improvements, the MAP focuses on a core and subset, of approximately 510 miles, of the Study Network called the Arterial Network. This core network represents arterials of Countywide Significance and serves as the backbone of multimodal mobility throughout the County.

2.1.2 Needs Assessment Analysis Scenarios

The MAP evaluates multimodal performance for Existing, Year 2020 and Year 2040 Conditions. The Existing and Year 2020 Needs Assessment evaluation results will be used later in the MAP development process to prioritize proposed improvements into short and long-term projects.

The Year 2040 analysis considered three separate analysis scenarios:

- The **Standard Forecasting Scenario** – the focus scenario for improvements
- Supplemental Scenarios:
    - The **Social and Behavioral Trends Scenario**, which accounts for lower vehicle miles of travel (VMT) per capita associated with social and behavioral trends, and
    - The **Next Generation Vehicle Scenario**, which accounts for roadway capacity impacts associated with the expected increase of next generation/autonomous vehicles.

Proposed recommendations were developed based on the Needs Assessment evaluation for the Year 2040 Standard Forecasting Scenario. The Social and Behavioral Trends and Next Generation Vehicle Scenarios were evaluated as supplemental scenarios to inform Alameda County jurisdictions on how the emerging social and technology trends may impact future travel patterns and resulting improvement needs.

2.2 GIS TOOL DEVELOPMENT

A powerful geographic information system cross-sectional tool (GIS Tool) was developed to perform the Needs Assessment and inform the identification of proposed improvements. The majority of data collected for MAP development including Arterial Network Typology and modal priorities are saved in a geospatial database, which allows the GIS Tool to run various analyses to

assess the Arterial Network's multimodal performance. The GIS Tool also integrates with the CityEngine software package, which has the capabilities to automate development of 3-D street cross-section renderings. The GIS Tool has the following capabilities:

- Assess multimodal performance for all study scenarios
- Identify Arterial Network segments that do not meet multimodal performance objectives for all modes
- Input total roadway right-of-way (ROW) based on aerial image or data provided by jurisdictions
- Quantify the portion of the roadway ROW that could be repurposed by assuming the National Association of City Transportation Officials (NACTO) minimum cross-sectional elements: 10 foot travel lanes (11 foot curb lanes for bus and truck routes), 10 foot median, seven foot parking lanes (if provided) and five foot bicycle lanes (if provided)[1]
- Identify potential Arterial Network segments suitable for ROW reallocation to improve high priority pedestrian and bicycle segments
- Identify potential Arterial Network segments suitable for ROW reallocation to provide dedicated on-street transit only lanes along high priority transit segments
- Identify potential bicycle facility improvements by facility (class) type
- Integration with the CityEngine software, which has the capability of automating the creation of cross-sectional graphics for each analysis scenario
- Quantify performance measure benefits assuming implementation of proposed improvements

As listed above, the GIS Tool has various capabilities, all of which were used by the Fehr & Peers team to identify potential improvements to address the Arterial Network's multimodal needs.

2.3 MULTIMODAL IMPROVEMENTS METHODOLOGY

Improvements are proposed along Arterial Network segments identified as having a need for improvements for the top two priority modes. This did not preclude jurisdictions from identifying improvements for other modes during their review of draft improvements. The general process for identifying improvements is summarized below.

[1] The MAP adopted the NACTO Street Design Guide's cross sectional element minimums for its national based research that incorporate innovative street designs that accommodate multimodal needs.

Step 1 – Needs Assessment Determination

Identify Arterial Network segments that do not meet the performance measure objective of top two priority modes.

Step 2 – GIS Tool Determinations

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 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.

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 2 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 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. 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.

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.

Step 3 – Manually Identify Facility-Specific Improvements based on GIS Tool Determinations

Based on results from Step 1 and Step 2, identify improvements that could be implemented within the available ROW to improve the performance of the top priority mode. Repeat this process for the second priority mode. For example if: the highest priorities were bicycle then transit, neither mode met its performance objectives, and the GIS Tool determined that there was enough ROW available to implement Class 4 protected bicycle lanes, then the proposed improvement would be to implement Class 4 protected bicycle lanes. If after assuming this improvement the bicycle performance objectives were met and there were additional ROW available, transit improvements could be recommended.

Improvements for reach mode were identified on the 510 miles of Arterial Network segments with that specific mode as one of two top priority modes. The table below shows the mileage of roadway segments where each mode is a top priority.

Mode	High Priority Mileage
Transit	150 miles
Pedestrian	207 miles
Bicycle	268 miles
Automobile	250 miles
Goods Movement	135 miles

If ROW is not available to accommodate the first priority mode or the second priority mode (after the first priority mode's recommendations have been accommodated), other improvements that do not require ROW are considered; such as optimizing bus stop locations and spacing, implementing ITS improvements, adding bulbouts and high-visibility crosswalks for pedestrians, and the feasibility of bike boulevards on parallel

roads. Improvements identified during this step were primarily improvements to address the needs of the high priority modes along each Arterial Network segment.

Step 4 – Perform Network Connectivity Checks

Fehr & Peers reviewed proposed improvements after completion of Step 3 to identify potential Arterial Network gaps for each mode. Additional multimodal improvements were identified for lower priority modes during this step in an effort to develop a complete and connected network for each mode:

- **Transit Network**: Improvements were proposed along Arterial Network segments beyond those that the transit agencies recommended for the Major Corridors.
- **Pedestrian Network**: 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.
- **Bicycle Network**: 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.
- **Auto Network**: 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 Network**: Curb lane widenings were proposed along the goods movement network regardless of the goods movement priority along those specific segments.

Step 5 – Quantify Benefits of Proposed Improvements

Fehr & Peers quantified the performance measures assuming proposed improvements and the percentage of each modal network that meets performance objectives with and without the improvements.

Step 6 – Evaluate Remaining Arterial Network Needs

Finally, Fehr & Peers identified the remaining Arterial Network multimodal needs after implementation of proposed improvements.

Please refer to **Table 1** and **Table 2** below to better understand the improvement identification process; **Table 1** provides an overview of the Needs Assessment evaluation process and **Table 2** summarizes how improvements were identified based on the Needs Assessment results.

Draft proposed improvements were discussed with each Alameda County jurisdiction, AC Transit, LAVTA and Caltrans during one-on-one and small group meetings that took place from February 29th through March 7th earlier this year. Final improvements were identified after incorporating the comments provided by stakeholder agencies on the draft proposed improvements.

2.3.1 Methodology Limitations

The following presents a list of potential methodology limitations to be considered when reviewing proposed improvements:

- Cross-sectional measurements were made by utilizing online aerial imagery. Therefore, the actual available ROW may likely to be different and in many cases more ROW may be available than what was measured in the aerial imagery. It also means that the improvements proposed is very likely to be conservative given the actual ROW availability in many places, particularly for roads outside of the downtown areas.
- Study segment lengths are an average of about 2,200 lineal feet and the representative sample segment (the segment for which analysis is conducted) is generally the most constrained portion of the study segment.
- While recommending improvements to meet the respective performance objective, only existing curb-to-curb dimensions were considered to offer cost effective improvement options.
- Proposed transit improvements do not address the transit vehicle fleet as the MAP is focused on the street environment.
- Especially as it relates to bikeways, the MAP considers parallel non-arterial bikeways such as trails and bike boulevards in its network connectivity assessment. These facilities are assumed to provide a high-quality, low-stress cycling experience, but are not analyzed.

- Proposed automobile improvements are limited to Intelligent Transportation Systems (ITS) improvements. Transportation system management (TSM) improvements, such as access management, lengthening of turn pockets and provision of turn lanes are suggested to improve automobile operations along Arterial Network segments with poor automobile operations. However, facility-specific TSM or capital improvements are not proposed as part of the MAP.
- Existing on-street parking was assumed to be retained under the standard forecasting scenario. Some jurisdictions (Berkeley, Oakland, Emeryville and, to a limited extent, Hayward) requested that the team consider parking removal in order to provide additional right-of-way that could be used by priority and other modes.

TABLE 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	None	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 table 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 table above.

TABLE 2
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 bicycle 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 bicycle 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]

TABLE 2
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?
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 Multimodal Arterial Plan.
4. Improvement not proposed because roadway segment meets performance objective for that specific mode under Year 2040 baseline conditions.

3. PROPOSED IMPROVEMENTS

This section presents an overview of the type of multimodal improvements that were considered during the improvement identification process. Proposed multimodal improvements are shown in the following figures:

- **Figure 1** – Transit Network Proposed Improvements
- **Figure 2** – Bicycle Network Proposed Improvements
- **Figure 3** – Pedestrian Network Proposed Improvements
- **Figure 4** – Automobile Network Proposed Improvements
- **Figure 5** – Goods Movement Network Proposed Improvements

3.1 PROPOSED TRANSIT NETWORK IMPROVEMENTS

Transit network improvements were primarily considered along AC Transit and LAVTA major corridors. Considered improvements are grouped into the following three categories:

- **Enhanced Bus Improvements** – Enhanced Bus services are designed around on-street improvements that reduce travel time, improve passenger comfort and increase operational efficiency. 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)
    - Providing curb extensions (bulbouts) at bus stops, where feasible
    - Bus stop amenity enhancements, such as bus shelters, benches, wayfinding and real-time arrival information
- **Rapid Bus Improvements** – Rapid Bus improvements include those for the Enhanced Bus category, in addition to the following improvements:
    - Transit signal priority (TSP)
    - Queue jump lanes or queue bypass lanes at intersections, where feasible

- **Dedicated Transit Lane Improvements** – Dedicated transit lanes (also referred to as Bus Rapid Transit – BRT) is a system of improvements that build upon the features of Enhanced and Rapid Bus that, when combined, make riding the bus similar to riding light-rail. In addition to providing a high quality bus riding experience, dedicated transit lane systems focus on supporting transit-oriented development around stations, maximizing comfort of passengers and improving station access. Dedicated transit lane improvements include those for the Enhanced and Rapid Bus (with the exception of queue jump or bypass lanes) categories, in addition to the following improvements:
    - Level boarding platforms (median or curb side) so boarding is faster and easier
    - Dedicated on-street transit only lanes to improve transit speed and reliability
    - Pedestrian enhancements, such as bulbouts, pedestrian-scale lighting and high-visibility crosswalks

Example designs of improvements considered for the transit network are shown in **Exhibit 2**. Proposed transit network improvements are shown in **Figure 1**. Fehr & Peers referred to the AC Transit *Major Corridor Study* (MCS) to quantify the benefits of proposed improvements to Transit Travel Speed and Transit Reliability. Based on the information provided in the MCS, the following maximum increases to Transit Travel Speed were assumed:

- Enhanced Bus improvements – 10 percent increase in Transit Travel Speed
- Rapid Bus improvements – 23 percent increase in Transit Travel Speed
- Dedicated transit lane improvements – 42 percent increase in Transit Travel Speed

Exhibit 2 – Example Transit Network Improvement Designs

Existing AC Transit Rapid Bus stop (Image source: AC Transit)

Far-Side Bus Stop with Bulbout, ADA Compliant Loading Platform, Bus Shelter, Bench and Class 4 Protected Bicycle Lane (Image source: *San Pablo Avenue Specific Plan*)

BRT Station (Image source: AC Transit)

3.1.1 Consistency with AC Transit's Major Corridor Study

AC Transit is currently developing the *Major Corridor Study* (MCS) to identify improvements to major corridors throughout the North, Central and South Planning Areas. Preliminary MCS recommendations were provided by AC Transit in November 2015. Considering the planning work already under taken and that a continuous network is key for transit performance, MCS recommendations were given priority during the improvement identification process undertaken as part of the MAP development. The AC Transit MCS recommended dedicated transit lanes along the following corridors; however, the respective jurisdictions did not agree with the proposed dedicated transit lanes and requested Rapid Bus improvements instead:

- E.14th/Mission Boulevard between Davis Street and Decoto Road
- Decoto Road between Mission Boulevard and Fremont Boulevard
- Fremont Boulevard between Decoto Road and Walnut Avenue
- Walnut Avenue between Fremont Boulevard and Civic Center Drive

In addition to the AC Transit corridors listed above, dedicated transit lanes were initially proposed along the Dublin Boulevard corridor in the City of Dublin, however LAVTA and City of Dublin staff did not agree with the initial recommendation and requested Rapid Bus improvements instead.

Transit improvements are also proposed along high priority transit segments in MAP that are not part of the AC Transit or LAVTA's major corridor network, such as:

- Stanley Boulevard, Railroad Avenue, Maple Street and East Avenue in Livermore and Alameda County[2]
- Foothill Road, Stoneridge Mall Road, Owens Drive, W. Las Positas Boulevard and Santa Rita Road in Pleasanton[1]
- Fremont Boulevard in Fremont
- Dyer Street and Whipple Avenue in Union City
- 73rd Avenue, Hegenberger Road, Market Street, Pleasant Valley Avenue, 51st Street and Martin Luther King Jr. Way in Oakland

[2] Proposed transit improvements in East County are consistent with the preliminary Rapid Bus route map provided by LAVTA on March 3, 2016. The preliminary Rapid Bus map may have different route alignments than the bus system changes approved by the LAVTA Board of Directors on May 4, 2016.

- Ashby Avenue, Sacramento Street, Martin Luther King Jr. Way, 7th Street and Dwight Way in Berkeley

Alameda CTC is concurrently developed the *Alameda Countywide Transit Plan*, which evaluates a larger transit network, including BART, Ferry and other inter-regional service enhancements than what is considered for evaluation in the MAP. AC Transit's MCS focuses primarily on identifying transit network recommended improvements along existing major corridor routes that operate along the MAP Arterial Network.

3.1.2 Benefits of Proposed Transit Improvements

Proposed transit network improvements are shown in **Figure 1**, the following is a summary of proposed improvements:

- 21 miles of dedicate transit lane improvements
- 82 miles of Rapid Bus improvements
- 39 miles of Enhanced Bus improvements

As discussed above, proposed improvements along the major corridor network are generally consistent with the MCS, with the exception of the corridors listed above. In addition to AC Transit's major corridors, Fehr & Peers is proposing improvements to LAVTA major corridors in East County and non-major corridors in North and South County. Fehr & Peers evaluated the Year 2040 Study Network performance assuming implementation of proposed transit network improvements. **Table 3** presents a summary of Transit Travel Speed before and after proposed improvements; **Table 4** presents a summary of Transit Reliability; **Table 5** presents a summary of Transit Infrastructure Index; and **Table 6** presents a summary of the performance measure objective evaluation.

As shown in **Table 6**, proposed improvements would result in a 24 mile increase in Arterial Network segments that meet the Transit Travel Speed performance objective and a 46 mile and 100 mile increase in segments that meet the Transit Reliability and Transit Infrastructure Index objectives, respectively.

TABLE 3
ALAMEDA COUNTYWIDE TRANSIT TRAVEL SPEED SUMMARY[1]

Threshold	Year 2040 Conditions – Without Proposed Improvements	Year 2040 Conditions – With Proposed Improvements	Net Difference
% of Segments Operating Between 20 – 30 MPH	9%	17%	8%
% of Segments Operating Between 10 – 20 MPH	44%	51%	7%
% of Segments Operating Between 5 – 10 MPH	44%	30%	-14%
% of Segments Operating Less Than 5 MPH	3%	2%	-1%

Notes:
1. Countywide data coverage for Transit Travel Speed is 240 miles.

TABLE 4
ALAMEDA COUNTYWIDE TRANSIT RELIABILITY SUMMARY[1]

Threshold	Year 2040 Conditions – Without Proposed Improvements	Year 2040 Conditions – With Proposed Improvements	Net Difference
% of Segments Operating at Ratio Greater Than 0.8	33%	58%	25%
% of Segments Operating at Ratio Between 0.6 – 0.8	52%	32%	-20%
% of Segments Operating at Ratio Between 0.4 – 0.6	13%	9%	-4%
% of Segments Operating at Ratio Less Than 0.4	2%	1%	-1%

Notes:
1. Countywide data coverage for Transit Reliability is 240 miles.

TABLE 5
ALAMEDA COUNTYWIDE TRANSIT INRASTRUCTURE INDEX SUMMARY[1]

Threshold	Year 2040 Conditions – Without Proposed Improvements	Year 2040 Conditions – With Proposed Improvements	Net Difference
% of Segments with High Rating	16%	74%	58%
% of Segments with Medium Rating	33%	8%	-25%
% of Segments with Low Rating	51%	18%	-33%

Notes:
1. Countywide data coverage for Transit Infrastructure Index is 240 miles.

TABLE 6
ALAMEDA COUNTYWIDE TRANSIT PERFORMANCE OBJECTIVE EVALUATION

Performance Measure Objective	Segment Miles That Meet Objective Along High Priority Transit Arterial Network Segments[1]		
	Year 2040 Conditions – Without Proposed Improvements	Year 2040 Conditions – With Proposed Improvements	Net Difference
Transit Travel Speed	21 mi	45 mi	+24 mi
Transit Reliability	56 mi	112 mi	+56 mi
Transit Infrastructure Index	27 mi	127 mi	+100 mi

Notes:
1. Transit is considered high priority mode if they are categorized in the top two prioritized mode along an Arterial Network segment. A total of 150 Arterial Network miles have high transit priority.

3.2 PEDESTRIAN NETWORK RECOMMENDATIONS

Considered pedestrian network improvements are categorized as follows:

- **Sidewalk Enhancements** – Improvements include widening existing sidewalks or implementing new sidewalks where missing. Generally, providing a minimum six foot sidewalk width is recommended (nine feet is the desired minimum).

- **Curb Bulbouts** – Curb extensions for pedestrian crossings at intersections or mid-block locations to reduce crossing distance and automobile turning speeds, which results in an improvement to pedestrian safety and comfort.
- **Crosswalk Enhancements** – Implement high-visibility crosswalk treatments to increase visibility of pedestrian crossing paths and discourage drivers from encroaching into crosswalks.
- **Streetscape Enhancements** – Implement landscaped buffers between sidewalks and travel lanes and/or raised landscape medians to improve pedestrian comfort.
- **Pedestrian Scale Lighting** – Implementing pedestrian scale lighting can alert drivers to the presence of pedestrians and enhance personal safety. Pedestrian scale lighting poles are generally closer to the ground and spaced closely together to create an even lighting of the sidewalk.

Example facilities considered for pedestrian network improvements are shown in **Exhibit 3**. As summarized in the Needs Assessment evaluation, the majority of Arterial Network segments with high pedestrian priority provide facilities with a High Pedestrian Comfort Index rating, thus meeting the pedestrian performance objective. Although pedestrian improvements were prioritized for Arterial Network segments that have high pedestrian priority and do not meet the objective, improvements were also proposed along segments that meet the performance objective under Existing Conditions to enhance pedestrian connectivity along corridors with dedicated transit lanes and around major transit stations as pedestrian improvements can also enhance the transit experience and encourage an increase in transit mode share.

Given the scale of the network evaluated in the MAP, it was not possible to assess the adequacy of pedestrian crossings of arterials. There has been significant evolution of design practices and standards for unsignalized pedestrian crossings including new traffic control devices such as the Rapid Rectangular Flashing Beacon and the Pedestrian Hybrid Beacon. Where Arterial Network segments are designated as high pedestrian priority, unsignalized crossing controls, which do not impact ROW, are recommended.

As shown in **Figure 2**, Fehr & Peers identified Arterial Network segments with high pedestrian and bicycle priority and low automobile priority (modal priority three, four or five) where additional ROW reallocation within the curb-to-curb travel way (e.g. travel lane removal) should be considered to improve pedestrian and bicycle performance.

Exhibit 3 – Example Pedestrian Facility Improvements

Streetscape Enhancements – Landscaped Buffer and Median (Image source: Fehr & Peers)

Pedestrian Scale Lighting (Image source: Fehr & Peers)

High-Visibility Crosswalks (Image source: NACTO)

Overhead Flashing Beacon – High-Visibility Crosswalk (Image source: Fehr & Peers)

Rectangular Rapid Flashing Beacon – High-Visibility Crosswalk (Image source: Fehr & Peers)

Curb Bulbouts (Image source: NACTO)

3.2.1 Benefits of Proposed Pedestrian Network Improvements

Proposed pedestrian network improvements are shown in **Figure 2**, the following is a summary of proposed improvements:

- 81 miles of sidewalk enhancements (including 40 miles of new sidewalk)
- 81 miles of curb bulbout improvements
- 233 miles of crosswalk enhancements
- 60 miles of streetscape enhancements
- 130 miles of pedestrian scale lighting improvements

Fehr & Peers evaluated the Year 2040 Study Network performance assuming implementation of proposed pedestrian network improvements. **Table 7** presents a summary of Pedestrian Comfort Index before and after proposed improvements and **Table 8** presents a summary of the performance measure objective evaluation. As shown in **Table 8**, proposed improvements would result in a 55 mile increase in Arterial Network segments that meet the Pedestrian Comfort Index objective.

Proposed bicycle network improvements, presented in Section 3.3, can also enhance pedestrian safety and comfort. For example, proposed Class 4 protected bicycle lanes would provide a buffer between the sidewalk and travel lanes, which improves the Pedestrian Comfort Index rating.

TABLE 7
ALAMEDA COUNTYWIDE PEDESTRIAN COMFORT INDEX SUMMARY[1]

Threshold	Year 2040 Conditions – Without Proposed Improvements	Year 2040 Conditions – With Proposed Improvements	Net Difference
% of Segments with Excellent Rating	5%	11%	6%
% of Segments with High Rating	51%	53%	2%
% of Segments with Medium Rating	42%	36%	-6%
% of Segments with Low Rating	2%	0%	-2%

Notes:
1. Countywide data coverage for Pedestrian Comfort Index is 620 miles.

TABLE 8
ALAMEDA COUNTYWIDE PEDESTRIAN PERFORMANCE OBJECTIVE EVALUATION

Performance Measure Objective	Segment Miles That Meet Objective Along High Priority Pedestrian Arterial Network Segments[1]		
	Year 2040 Conditions – Without Proposed Improvements	Year 2040 Conditions – With Proposed Improvements	Net Difference
Pedestrian Comfort Index	133 mi	188 mi	+55 mi

Notes:
1. Pedestrians are considered high priority mode if they are categorized in the top two prioritized mode along an Arterial Network segment. A total of 207 Arterial Network miles have high pedestrian priority.

3.3 PROPOSED BICYCLE NETWORK IMPROVEMENTS

Bicycle facilities are categorized as follows:

- **Class 1 Bikeway/Multi-Use Path** – These facilities are located off-street and can serve both bicyclists and pedestrians. Class I paths are generally eight to 12 feet wide excluding shoulders and are generally paved.
- **Class 2 Bicycle Lanes** – These facilities 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** – Similar facility as Class 2 bicycle lanes with the addition of a striped buffer separating the bicycle lane and travel lane. Minimum five foot bicycle lane and two foot buffer widths are generally recommended.
- **Class 3 Bicycle Routes** – These facilities are found along streets that do not provide sufficient width for dedicated bicycle lanes and are also provided on low-volume streets that have no bicycle lanes. The street is designated as a bicycle route through the use of signage and striping informing drivers to share the street with bicyclists.
- **Class 3 Enhanced Bicycle Boulevards** – Similar to Class 3 Bicycle Routes, however Bicycle Boulevards are generally designated along low-speed, low-volume streets optimized for bicycle traffic.
- **Class 4 Protected Bicycle Lanes** - Similar facility as Class 2 Enhanced buffered bicycle lanes with the addition of a vertical buffer separating the bicycle lane and travel lane. Vertical separation can include: on-street parking, flexible pylons, planters or curb

separation. Minimum five foot bicycle lane and three foot buffer widths are generally recommended (two foot buffers were considered along constrained segments).

Example facilities considered for bicycle network improvements are shown in **Exhibit 4**. As discussed above, the Needs Assessment evaluation was the basis for identifying bicycle network improvements along high priority segments. The bicycle Typology developed in coordination with all jurisdictions was used to identify improvements. For example, if the bicycle Typology identified a Class 2 bicycle lane along an Arterial Network segment, an effort was made to determine if, Class 2 Enhanced or Class 4 facilities could be implemented along that segment depending on available right-of-way. The baseline bicycle network and proposed network improvements are shown in **Figure 3**.

Exhibit 4 – Considered Bicycle Facility Improvements

Class 2 Bicycle Lanes (Image source: NACTO)

Class 2 Enhanced Buffered Bicycle Lanes (Image source: NACTO)

Class 3 Bicycle Routes (Image source: NACTO)

Class 3 Enhanced Bicycle Boulevards (Image source: NACTO)

Class 4 Protected Bicycle Lanes (Image source: NACTO)

The following is a list of key highlights regarding proposed bicycle network improvements:

- Many South and East County arterials provide Class 2 bicycle lanes under existing conditions; however, due to high travel speeds (35 MPH or greater), these facilities generally result in a Low Bicycle Comfort Index rating. Many of the existing Class 2 bicycle lanes can be upgraded to Class 4 protected bicycle lanes by re-striping and narrowing travel lanes and/or parking lanes to provide a minimum two to three foot buffer.
- Central County arterials generally lack dedicated on-street bicycle facilities compared to arterials in all other planning areas. In addition, right-of-way is generally constrained along the Arterial Network in Central County. Additional considerations, such as removing on-street parking, would be necessary if Central County jurisdictions are to provide a complete bicycle network.
- North County jurisdictions typically provide several dedicated on-street facilities (typically Class 2 bicycle lanes) under Existing Conditions. As a result, the focus of identifying improvements was to enhance existing facilities to provide buffer separation between bicycle lanes and travel lanes, in addition to identifying improvements that would provide a complete bicycle network throughout North County.
- As shown in **Figure 3**, Class 1 multi-use paths are considered adequate parallel routes along Arterial Network segments with not enough available right-of-way to implement dedicated on-street facilities. For example, the baseline network assumes implementation of a Class 1 bikeway along the BART track alignment between Oakland and Hayward, also known as the East Bay Greenway, which provides a parallel facility to the East 14th Street/Mission Boulevard corridor in North and Central County.

3.3.1 Benefits of Proposed Bicycle Network Improvements

Proposed bicycle network improvements are shown in **Figure 3**, the following is a summary of proposed improvements:

- 34 miles of Class 2 bicycle lane improvements
- 12 miles of Class 2 buffered bicycle lane improvements
- 37 miles of Class 3 bicycle route improvements
- 25 miles of Class 3 bicycle boulevard improvements
- 144 miles of Class 4 protected bicycle lane improvements

Fehr & Peers evaluated the Year 2040 Study Network performance assuming implementation of proposed bicycle network improvements. **Table 9** presents a summary of Bicycle Comfort Index before and after proposed improvements and **Table 10** presents a summary of the performance measure objective evaluation. As shown in **Table 10**, proposed improvements would result in a 111 mile increase in Arterial Network segments that meet the Bicycle Comfort Index objective.

TABLE 9
ALAMEDA COUNTYWIDE BICYCLE COMFORT INDEX SUMMARY[1]

Threshold	Year 2040 Conditions – Without Proposed Improvements	Year 2040 Conditions – With Proposed Improvements	Net Difference
% of Segments with Excellent Rating	1%	29%	28%
% of Segments with High Rating	14%	12%	-2%
% of Segments with Medium Rating	27%	23%	-4%
% of Segments with Low Rating With Class 2 Bicycle Lanes Provided	21%	12%	-9%
% of Segments with Low Rating Without Class 2 Bicycle Lanes	37%	24%	-13%

Notes:
1. Countywide data coverage for Bicycle Comfort Index is 670 miles.

TABLE 10
ALAMEDA COUNTYWIDE BICYCLE PERFORMANCE OBJECTIVE EVALUATION

Performance Measure Objective	Segment Miles That Meet Objective Along High Priority Bicycle Arterial Network Segments[1]		
	Year 2040 Conditions – Without Proposed Improvements	Year 2040 Conditions – With Proposed Improvements	Net Difference
Bicycle Comfort Index	35 mi	146 mi	+111 mi

Notes:
1. Bicycles are considered high priority mode if they are categorized in the top two prioritized mode along an Arterial Network segment. A total of 268 Arterial Network miles have high bicycle priority.

3.4 PROPOSED AUTOMBILE NETWORK IMPROVEMENTS

Proposed automobile improvements are limited to ITS improvements. Iteris performed an analysis of the ITS element of the MAP and developed an ITS framework and memorandum, which is being finalized. Based on this work, ITS infrastructure improvements are grouped into the following three categories:

- **Low Level of ITS Infrastructure** – generally corresponds to the ability to remotely monitor and manage field devices from a central location (e.g., TMC). Traffic signals along a corridor are interconnected and allow communication back to a TMC where there is a central system to actively manage field devices.
- **Medium Level of ITS Infrastructure** – corresponds to everything described above plus the additional ability 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.
- **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 (vehicle to infrastructure) capabilities.

Proposed ITS improvements are shown in **Figure 4**.

3.4.1 Benefits of Proposed Automobile Network Improvements

The following is a summary of proposed ITS improvements:

- 51 miles of Medium Level ITS improvements
- 175 miles of High Level ITS improvements

At its most basic level, the primary objective for ITS infrastructure improvements is to increase average automobile and transit speed. Quantifying the percent increase in speed directly resulting from implementation of ITS strategies is not easily accomplished. At this time, there is not enough readily-available data to quantify the percent increase in travel speed associated with implementing improvements in either of the three ITS infrastructure improvement categories. The performance measure analysis results presented in this memo do not account for improvement in automobile and transit travel speed expected from proposed ITS improvements. Therefore,

performance measure analysis *after* proposed improvements is not presented in this section. **Table 11** presents a summary of Automobile Congested Speed before proposed improvements. **Table 12** presents a summary of Automobile Reliability and **Table 13** presents a summary of the performance measure objective evaluation.

As discussed in Section 3.1, dedicated transit lane improvements are proposed along various segments of the transit major corridor network. It is assumed that travel lanes would be converted to transit only lanes along select Arterial Network segments with high transit priority. Converting a travel lane to a transit only lane would decrease Automobile Congested Speed and increase the volume-to-capacity ratio along Arterial Network segments with high transit priority. Implementation of proposed ITS infrastructure improvements are expected to increase Automobile Congested Speed, however, the increase in speed is not quantified at this time.

TABLE 11
ALAMEDA COUNTYWIDE AUTOMOBILE CONGESTED SPEED SUMMARY[1]

Threshold	Year 2040 Conditions – Without Proposed Improvements
% of Segments Operating Greater Than 40 MPH	3%
% of Segments Operating Between 30 – 40 MPH	22%
% of Segments Operating Between 20 – 30 MPH	56%
% of Segments Operating Between 10 – 20 MPH	18%
% of Segments Operating Less Than 10 MPH	1%

Notes:
1. Countywide data coverage for Automobile Congested Speed is 980 miles. This assessment does not yet account for potential increases in Automobile Congested Speed as a result of implementing proposed ITS infrastructure improvements.

TABLE 12
ALAMEDA COUNTYWIDE AUTOMOBILE RELIABILITY SUMMARY[1]

Threshold	Year 2040 Conditions – Without Proposed Improvements
% of Segments Operating at V/C Ratio Less Than 0.8	74%
% of Segments Operating at V/C Ratio Between 0.8 – 1.0	12%
% of Segments Operating at V/C Ratio Greater Than 1.0	14%

Notes:
1. Countywide data coverage for Automobile Reliability is 640 miles.
Source: Fehr & Peers, 2016.

TABLE 13
ALAMEDA COUNTYWIDE AUTOMOBILE PERFORMANCE OBJECTIVE EVALUATION

Performance Measure Objective	Segment Miles That Meet Performance Objective Along High Priority Automobile Arterial Network Segments[1]
	Year 2040 Conditions – Without Proposed Improvements
Automobile Congested Speed	210 mi
Automobile Reliability	138 mi

Notes:
1. Automobiles are considered high priority mode if they are categorized in the top two prioritized mode along an Arterial Network segment. A total of 250 Arterial Network miles have high automobile priority.

3.4.2 Alternative Scenario Considerations

The Social and Behavioral Trends and Next Generation Vehicle Scenarios were evaluated as supplemental scenarios to inform Alameda County jurisdictions on how emerging social and technology trends may impact future travel patterns and resulting improvement needs. As presented in the Needs Assessment memo, an increase in the next generation vehicle fleet could improve Automobile Congested Speed and Reliability throughout Alameda County. Based on research conducted by Fehr & Peers, a 20 percent increase in arterial capacity may be possible with significant next generation vehicle fleet penetration by Year 2040. The increased capacity could offset the potential decrease in Automobile Congested Speed due to BRT or road diet improvements proposed as part of the MAP.

Next generation vehicles could also minimize the need for on-street parking along the Arterial Network. Fully autonomous vehicles are expected to have the capability to drop-off users at their destination and drive off to park several blocks away. Providing on-street parking along the Arterial Network may not be critical if fully autonomous vehicles can drop-off/pick-up users curbside regardless of where and how far the vehicles park. As a result, jurisdictions could consider removing on-street parking along the Arterial Network and repurposing the right-of-way to implement a variety of multimodal improvements.

3.4.3 Additional Automobile Network Improvement Considerations

Intersection operations were not evaluated as part of the MAP due to the scale of this study. While increased capacity improvements, such as roadway or intersection widening, were not considered as part of the MAP, the study has identified a list of additional transportation systems management recommendations that could improve automobile operations along segments that operate with high congestion and delay during peak hours:

- 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)
- Signal timing optimization

3.5 GOODS MOVEMENT NETWORK RECOMMENDATIONS

Widening curb lane widths to provide a minimum of 12 feet was the primary improvement considered along Arterial Network segments with high goods movement priority. Proposed goods movement network improvements are shown in **Figure 5**. Alameda CTC's *Alameda Countywide Goods Movement Plan* recommends a comprehensive set of goods movement strategies including needed general infrastructure improvements.

A few Alameda County jurisdictions requested not to widen the curb lane to 12' even if it is a priority Tier 2 or 3 truck route network. For those roads, on-street truck parking was not considered as part of the Truck Route Accommodation Index evaluation. South and East County jurisdictions do not typically provide on-street parking along the Arterial Network as the majority of truck deliveries are made via off-street loading facilities. Jurisdictions did not want to be

penalized for not providing on-street truck parking along the Arterial Network segments with available off-street loading facilities.

3.5.1 Benefits of Proposed Goods Movement Network Improvements

Fehr & Peers evaluated the Year 2040 Study Network performance assuming implementation of proposed goods movement network improvements. **Table 14** presents a summary of Truck Route Accommodation Index before and after proposed improvements; **Table 15** presents a summary of the performance measure objective evaluation. As shown in **Table 15**, proposed improvements would result in a 22 mile increase in Arterial Network segments that meet the Truck Route Accommodation Index objective.

TABLE 14
ALAMEDA COUNTYWIDE TRUCK ROUTE ACCOMODATION INDEX SUMMARY[1]

Threshold	Year 2040 Conditions – Without Proposed Improvements	Year 2040 Conditions – With Proposed Improvements	Net Difference
% of Segments with High Rating	55%	59%	+4%
% of Segments with Medium Rating	37%	34%	-3%
% of Segments with Low Rating	8%	7%	-1%

Notes:
1. Countywide data coverage for Truck Route Accommodation Index is 670 miles.

TABLE 15
ALAMEDA COUNTYWIDE GOODS MOVEMENT PERFORMANCE OBJECTIVE EVALUATION

Performance Measure Objective	Segment Miles That Meet Performance Objective Along High Priority Goods Movement Arterial Network Segments[1]		
	Year 2040 Conditions – Without Proposed Improvements	Year 2040 Conditions – With Proposed Improvements	Net Difference
Truck Route Accommodation Index	83 mi	105 mi	+22 mi

Notes:
1. Goods movement is considered high priority mode if categorized in the top two prioritized mode along an Arterial Network segment. A total of 135 Arterial Network miles have high goods movement priority.

5. NEXT STEPS

Fehr & Peers and Alameda CTC will present final proposed improvements to the Committees and Commission in June 2016 for approval as part of the Draft MAP. Please contact Francisco Martin at f.martin@fehrandpeers.com if you have any questions regarding the information presented in this memo.

Memo Attachments:

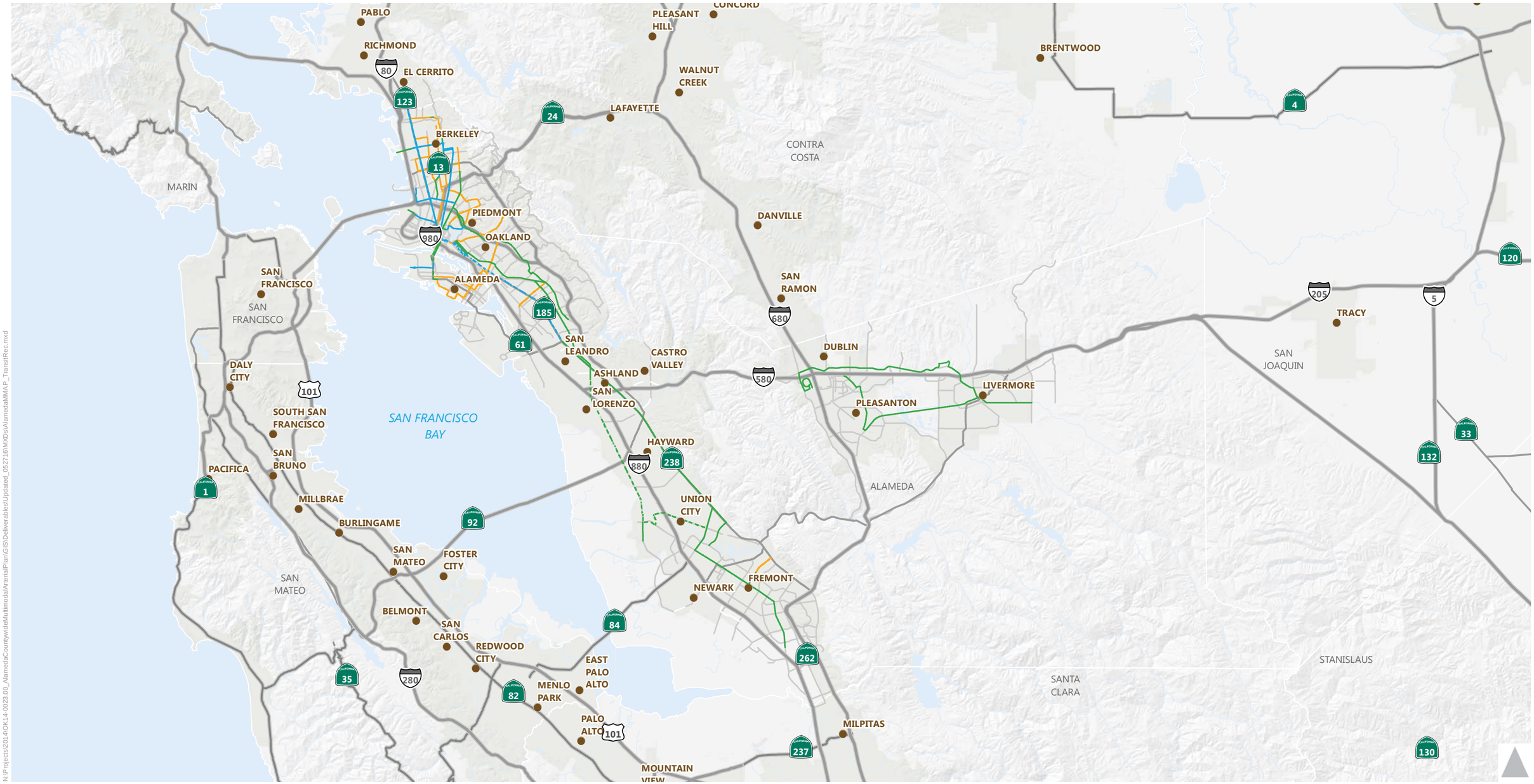
Figure 1 – Transit Network Proposed Improvements

Figure 2 – Pedestrian Network Proposed Improvements

Figure 3 – Bicycle Network Proposed Improvements

Figure 4 – ITS Network Proposed Improvements

Figure 5 – Goods Movement Network Proposed Improvements



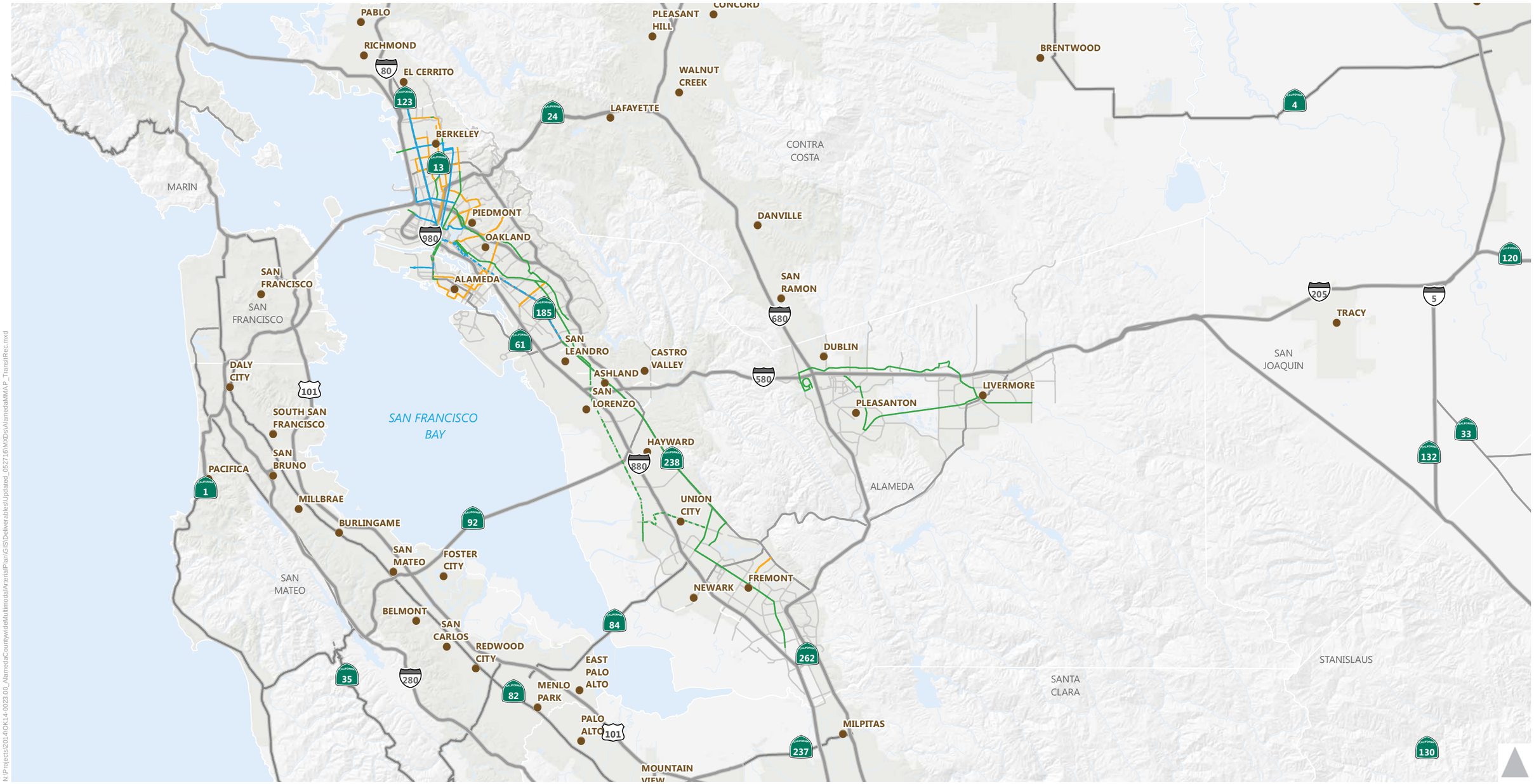
Legend

Proposed Transit Network Improvements

- Enhanced Bus Improvements
- Rapid Bus Improvements
- Dedicated Transit Lane Improvements
- Baseline Rapid Route
- Baseline BRT Routes

Figure 1A

Transit Network Proposed Improvements - Alameda County



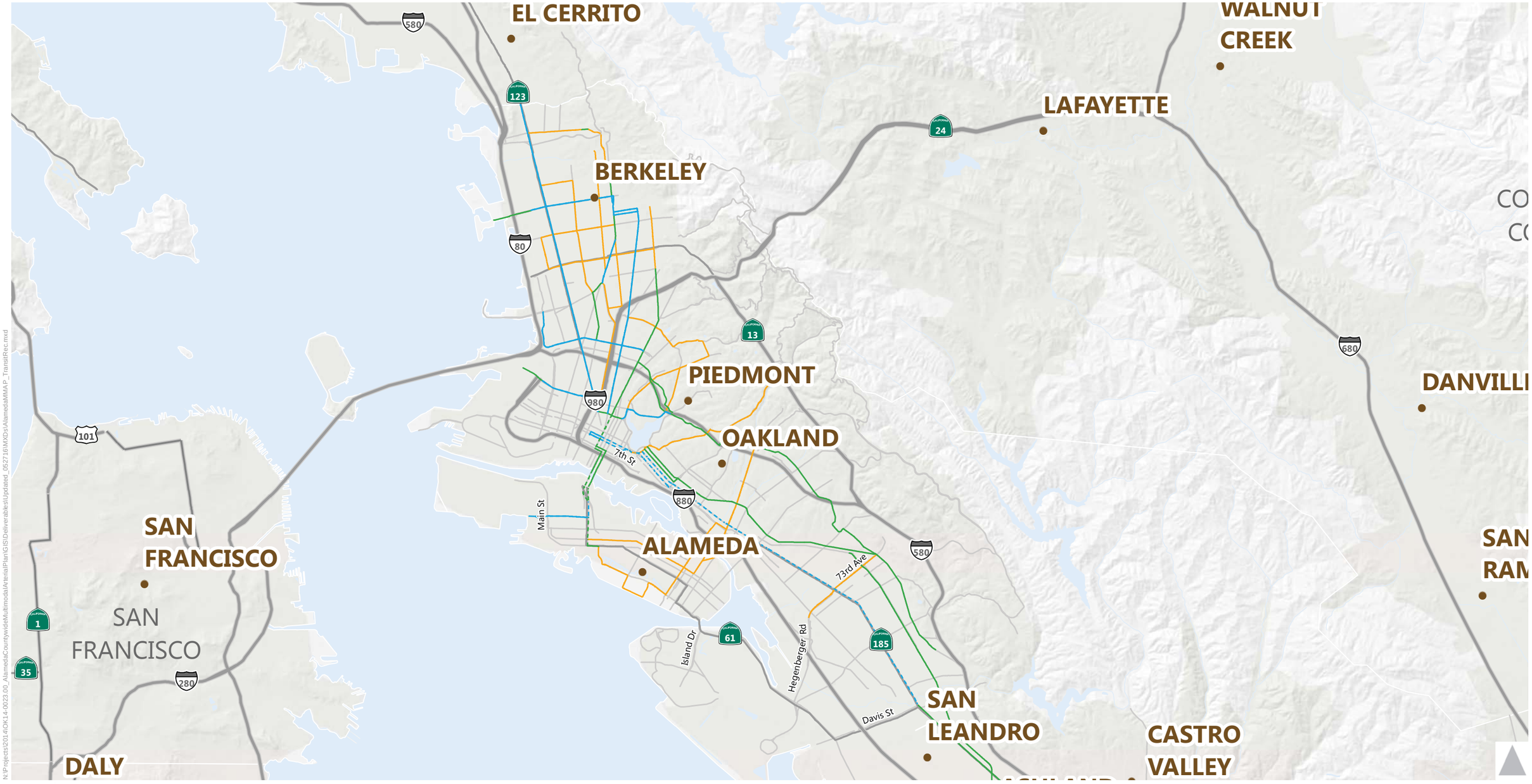
Legend

Proposed Transit Network Improvements

- Enhanced Bus Improvements
- Rapid Bus Improvements
- Dedicated Transit Lane Improvements
- Baseline Rapid Route
- Baseline BRT Routes

Figure 1A

Transit Network Proposed Improvements - Alameda County



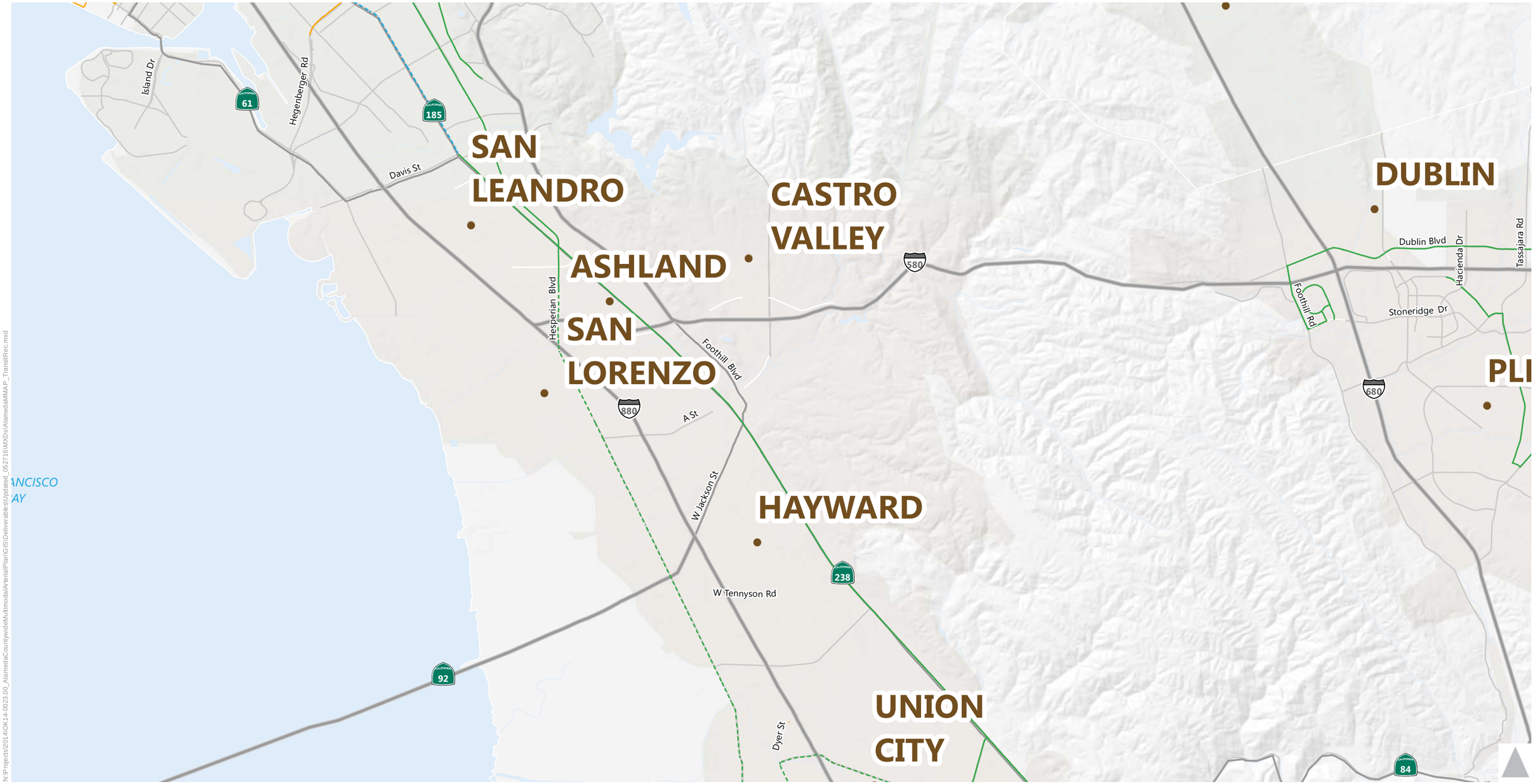
Legend

Proposed Transit Network Improvements

- Enhanced Bus Improvements
- Rapid Bus Improvements
- Dedicated Transit Lane Improvements
- Baseline Rapid Route
- Baseline BRT Routes

ALAMEDA County Transportation Commission

Transit Network Proposed Improvements - North County



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Proposed Transit Network Improvements

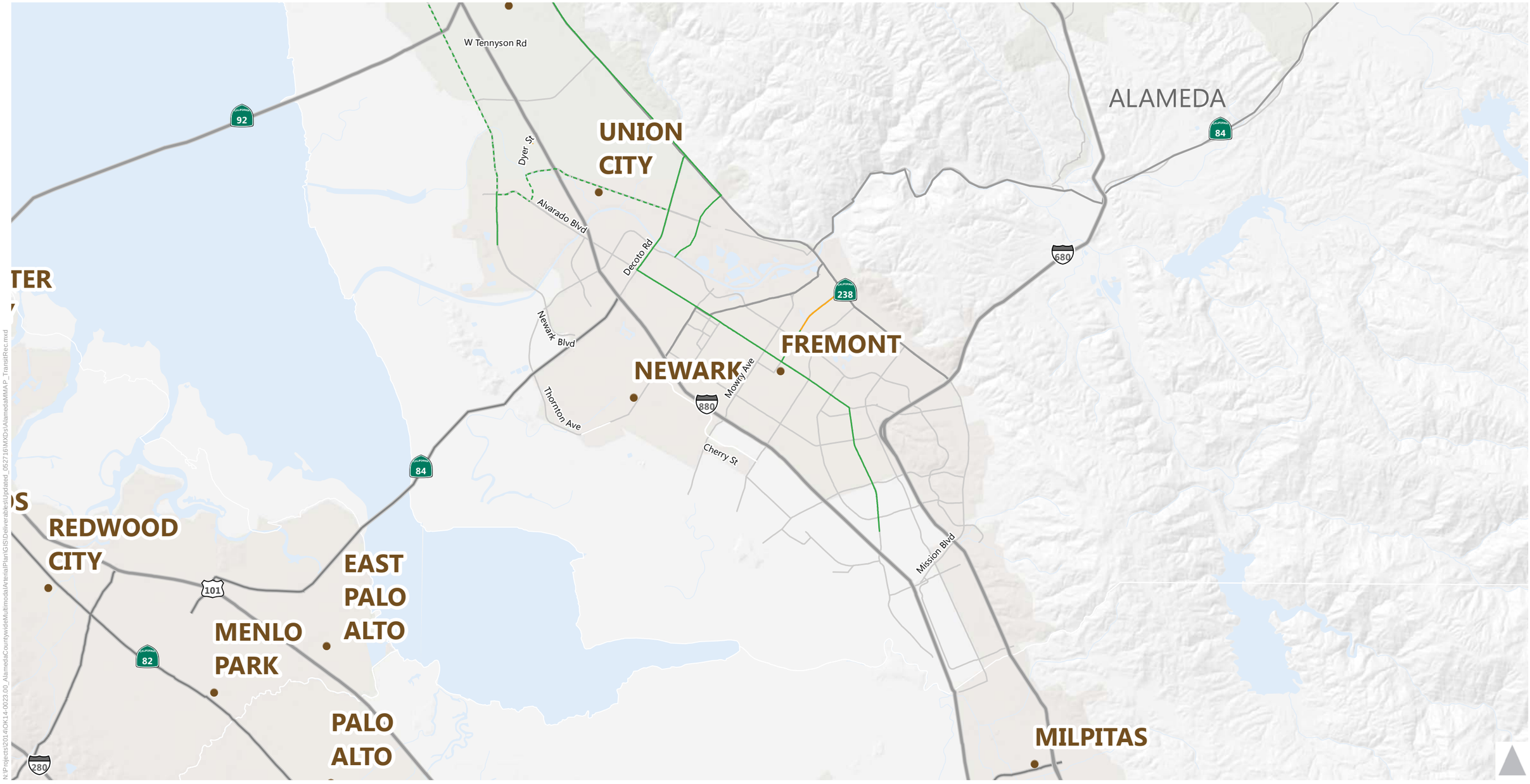
- Enhanced Bus Improvements
- Rapid Bus Improvements
- Dedicated Transit Lane Improvements
- Baseline Rapid Route
- Baseline BRT Routes

Alameda Countywide Multimodal Arterial Plan

Figure 1C

ALAMEDA County Transportation Commission

Transit Network Proposed Improvements - Central County



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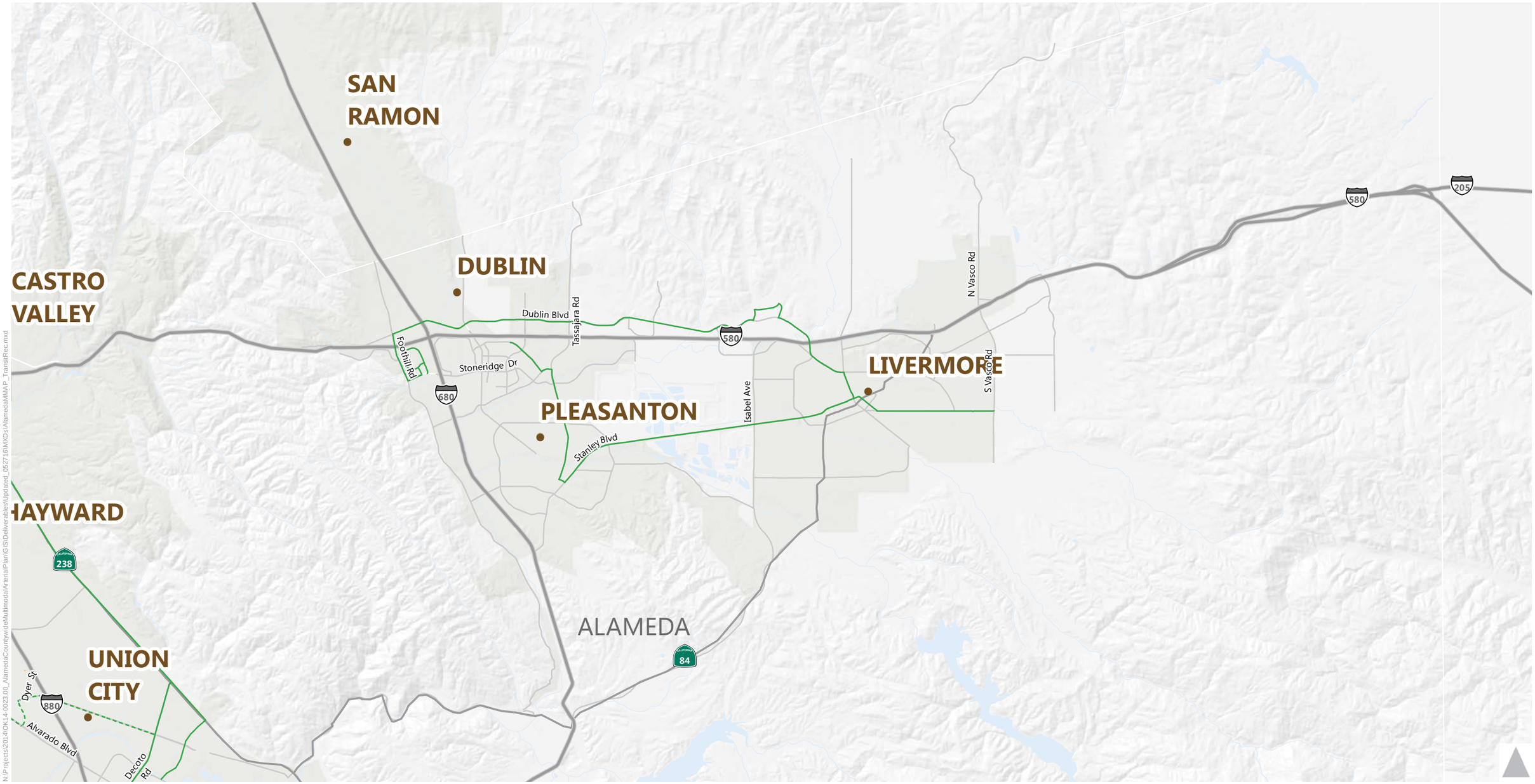
Legend

Proposed Transit Network Improvements

- Enhanced Bus Improvements
- Rapid Bus Improvements
- Dedicated Transit Lane Improvements
- Baseline Rapid Route
- Baseline BRT Routes

ALAMEDA County Transportation Commission

Transit Network Proposed Improvements - South County



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Legend

Proposed Transit Network Improvements

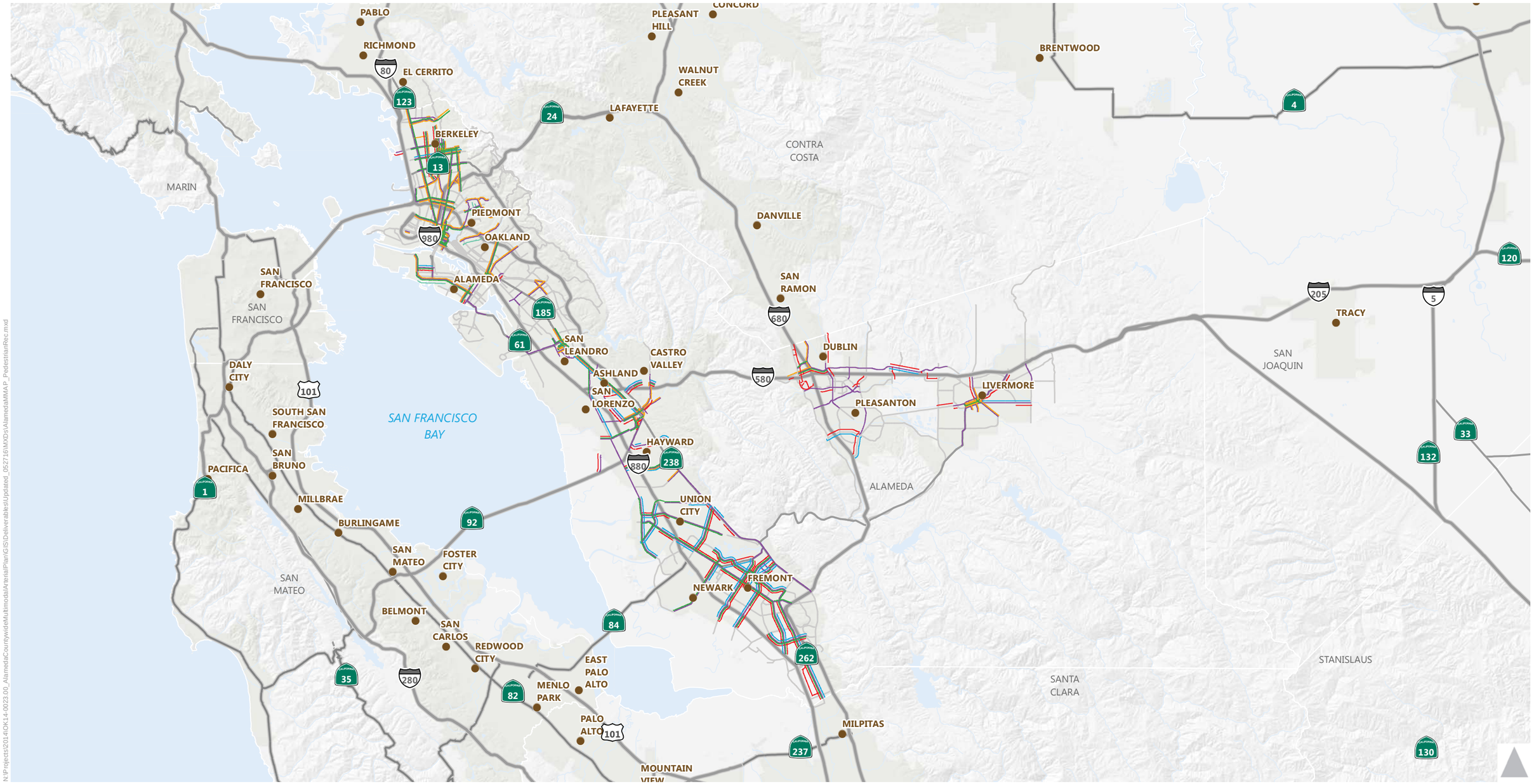
- Enhanced Bus Improvements
- Rapid Bus Improvements
- Dedicated Transit Lane Improvements
- Baseline Rapid Route
- Baseline BRT Routes

Alameda Countywide Multimodal Arterial Plan

Figure 1E

ALAMEDA County Transportation Commission

Transit Network Proposed Improvements - East County



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Proposed Pedestrian Network Improvements

- Sidewalk Enhancements
- Curb Bulbouts
- Pedestrian Scale Lighting
- Streetscape Enhancements
- Crosswalk Enhancements
- Travel Lane Removal (Road Diet)

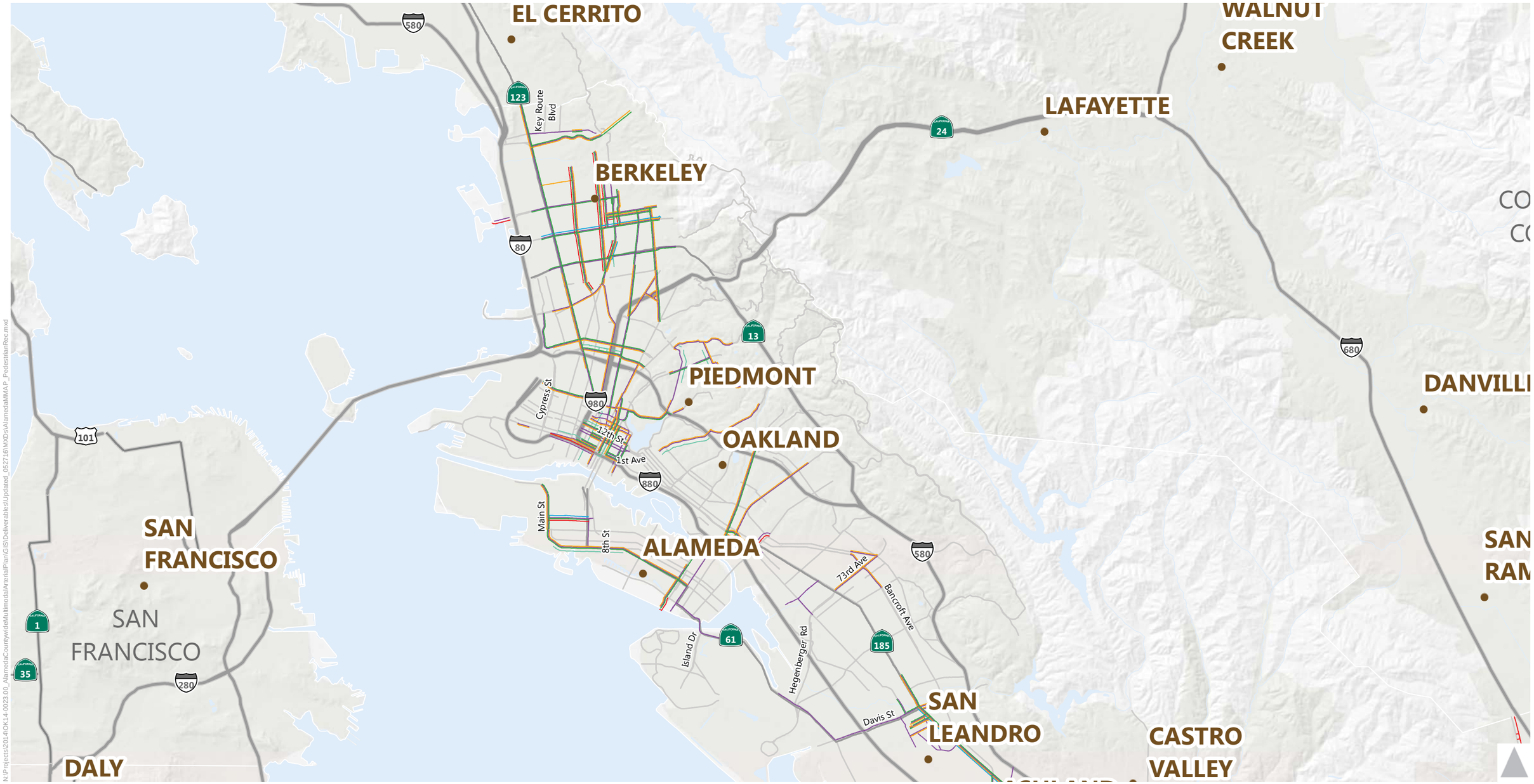
Alameda Countywide Multimodal Arterial Plan

Note: Existing, planned and funded improvements are not shown on the map for ease of reading.

Figure 2A

ALAMEDA County Transportation Commission

Pedestrian Network Proposed Improvements - Alameda County



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Legend

Proposed Pedestrian Network Improvements

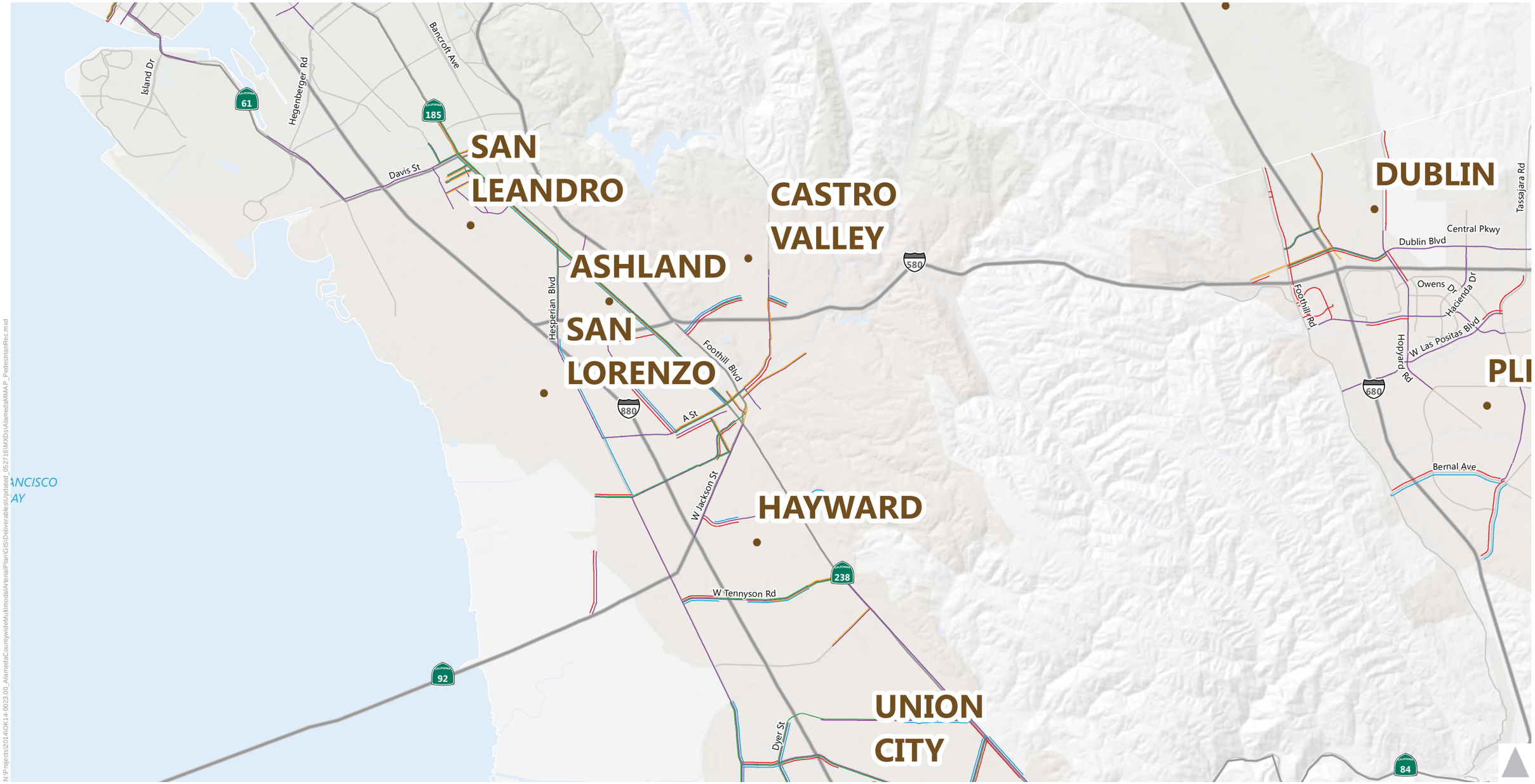
- Sidewalk Enhancements
- Curb Bulbouts
- Pedestrian Scale Lighting
- Streetscape Enhancements
- Crosswalk Enhancements
- Travel Lane Removal (Road Diet)

Alameda Countywide Multimodal Arterial Plan

Note: Existing, planned and funded improvements are not shown on the map for ease of reading.

Figure 2B

Pedestrian Network Proposed Improvements - North County



Legend

Proposed Pedestrian Network Improvements

- Sidewalk Enhancements
- Curb Bulbouts
- Pedestrian Scale Lighting
- Streetscape Enhancements
- Crosswalk Enhancements
- Travel Lane Removal (Road Diet)

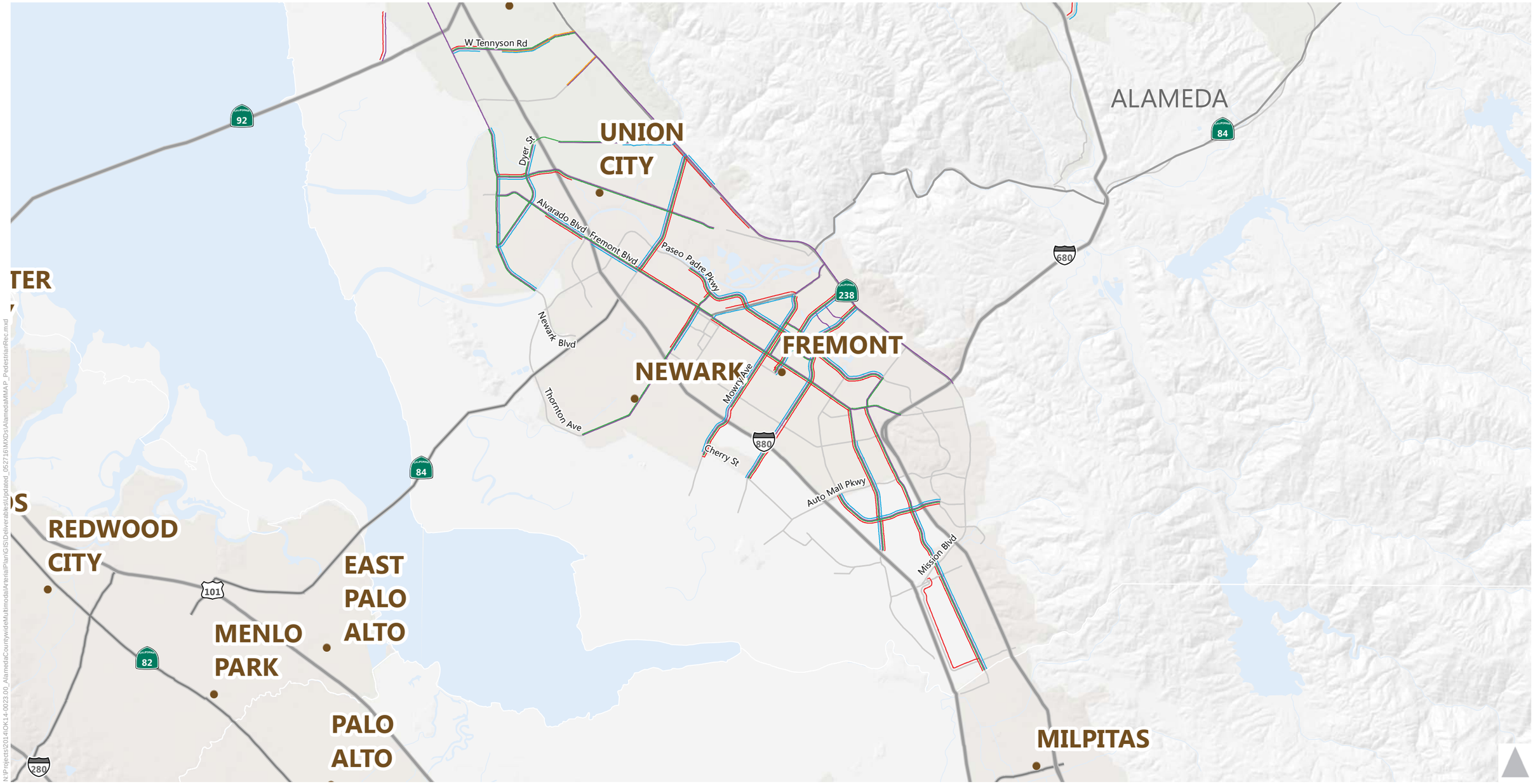
Alameda Countywide Multimodal Arterial Plan

Note: Existing, planned and funded improvements are not shown on the map for ease of reading.

Figure 2C

ALAMEDA County Transportation Commission

Pedestrian Network Proposed Improvements - Central County



Legend

Proposed Pedestrian Network Improvements

- Sidewalk Enhancements
- Curb Bulbouts
- Pedestrian Scale Lighting
- Streetscape Enhancements
- Crosswalk Enhancements
- Travel Lane Removal (Road Diet)

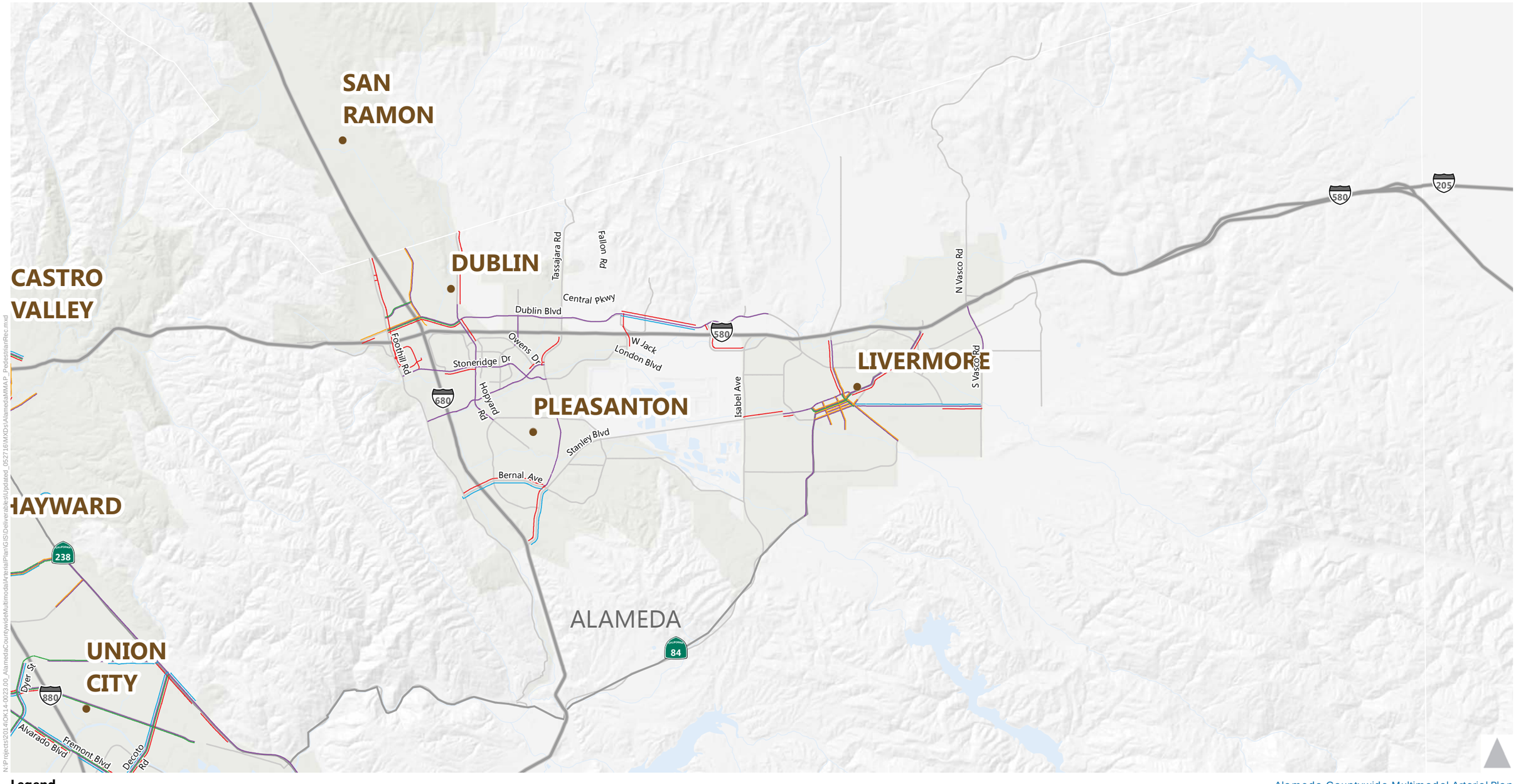
Alameda Countywide Multimodal Arterial Plan

Note: Existing, planned and funded improvements are not shown on the map for ease of reading.

Figure 2D

ALAMEDA County Transportation Commission

Pedestrian Network Proposed Improvements - South County



Legend

Proposed Pedestrian Network Improvements

- Sidewalk Enhancements
- Curb Bulbouts
- Pedestrian Scale Lighting
- Streetscape Enhancements
- Crosswalk Enhancements
- Travel Lane Removal (Road Diet)

Alameda Countywide Multimodal Arterial Plan

Note: Existing, planned and funded improvements are not shown on the map for ease of reading.

Figure 2E

ALAMEDA County Transportation Commission

Pedestrian Network Proposed Improvements - East County

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PABLO
PLEASANT HILL
CONCORD
BRENTWOOD
EL CERRITO
WALNUT CREEK
LAFAYETTE
BERKELEY
CONTRA COSTA
MARIN
PIEDMONT
DANVILLE
OAKLAND
SAN RAMON
ALAMEDA
SAN FRANCISCO
SAN FRANCISCO
TRACY
SAN JOAQUIN
DALY CITY
SAN LEANDRO
ASHLAND
CASTRO VALLEY
DUBLIN
LIVERMORE
PLEASANTON
SAN LORENZO
SAN FRANCISCO BAY
SOUTH SAN FRANCISCO
HAYWARD
PACIFICA
SAN BRUNO
MILLBRAE
BURLINGAME
UNION CITY
ALAMEDA
SAN MATEO
SAN MATEO
FOSTER CITY
NEWARK
FREMONT
BELMONT
SAN CARLOS
STANISLAUS
SANTA CLARA
REDWOOD CITY
MENLO PARK
EAST PALO ALTO
PALO ALTO
MILPITAS
MOUNTAIN VIEW

Legend

Proposed Bicycle Network Improvements

- Class 1
- Class 2 Enhanced
- Class 2
- Class 3 Enhanced
- Class 3
- Class 4
- Parallel Facility Available

Baseline Bicycle Network

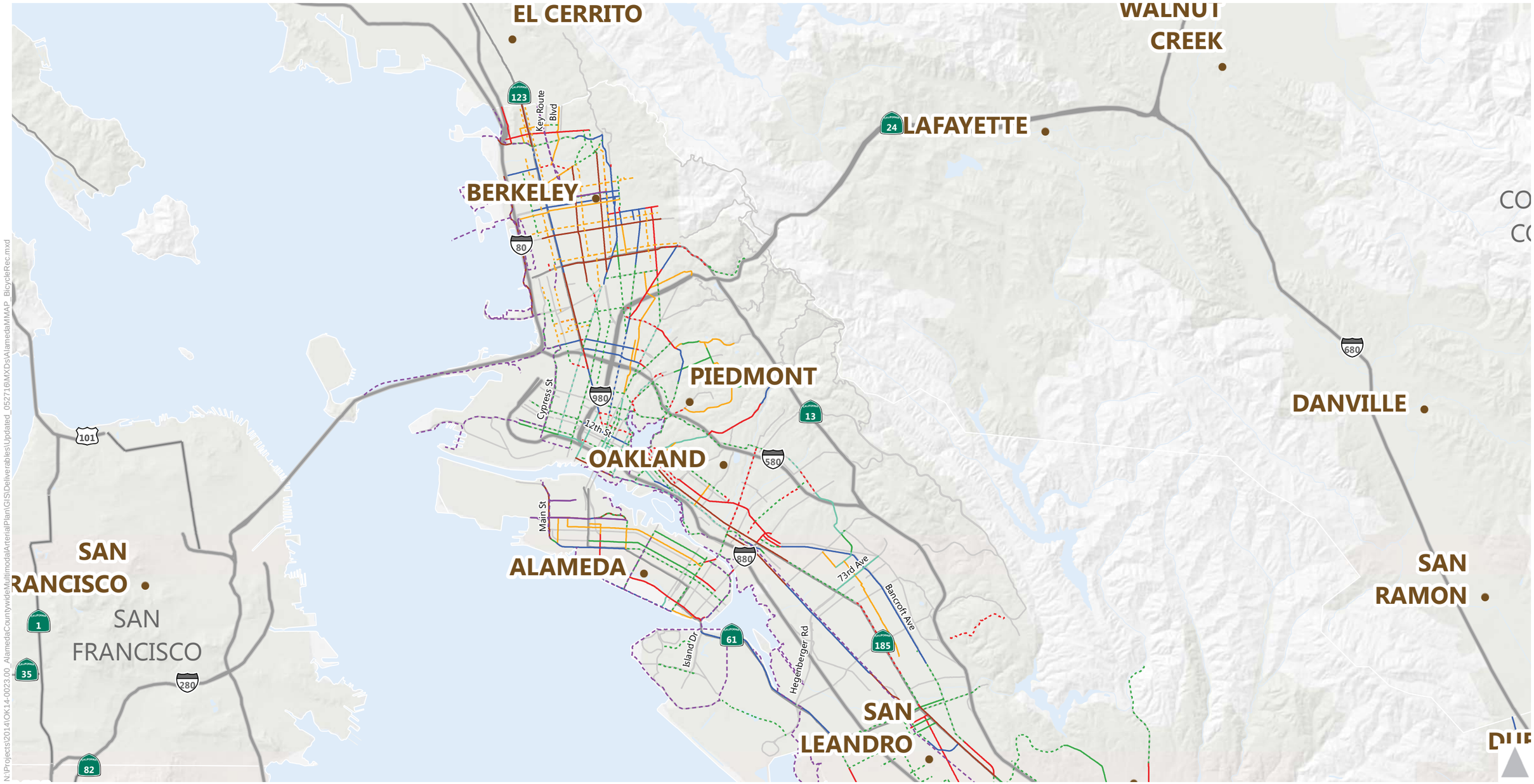
- Class 1
- Class 2 Enhanced
- Class 2
- Class 3 Enhanced
- Class 3
- Class 4

Alameda Countywide Multimodal Arterial Plan

Figure 3A

ALAMEDA County Transportation Commission

Bicycle Network Proposed Improvements - Alameda County



Legend

Proposed Bicycle Network Improvements

- Class 1
- Class 2 Enhanced
- Class 2
- Class 3 Enhanced
- Class 3
- Class 4
- Parallel Facility Available

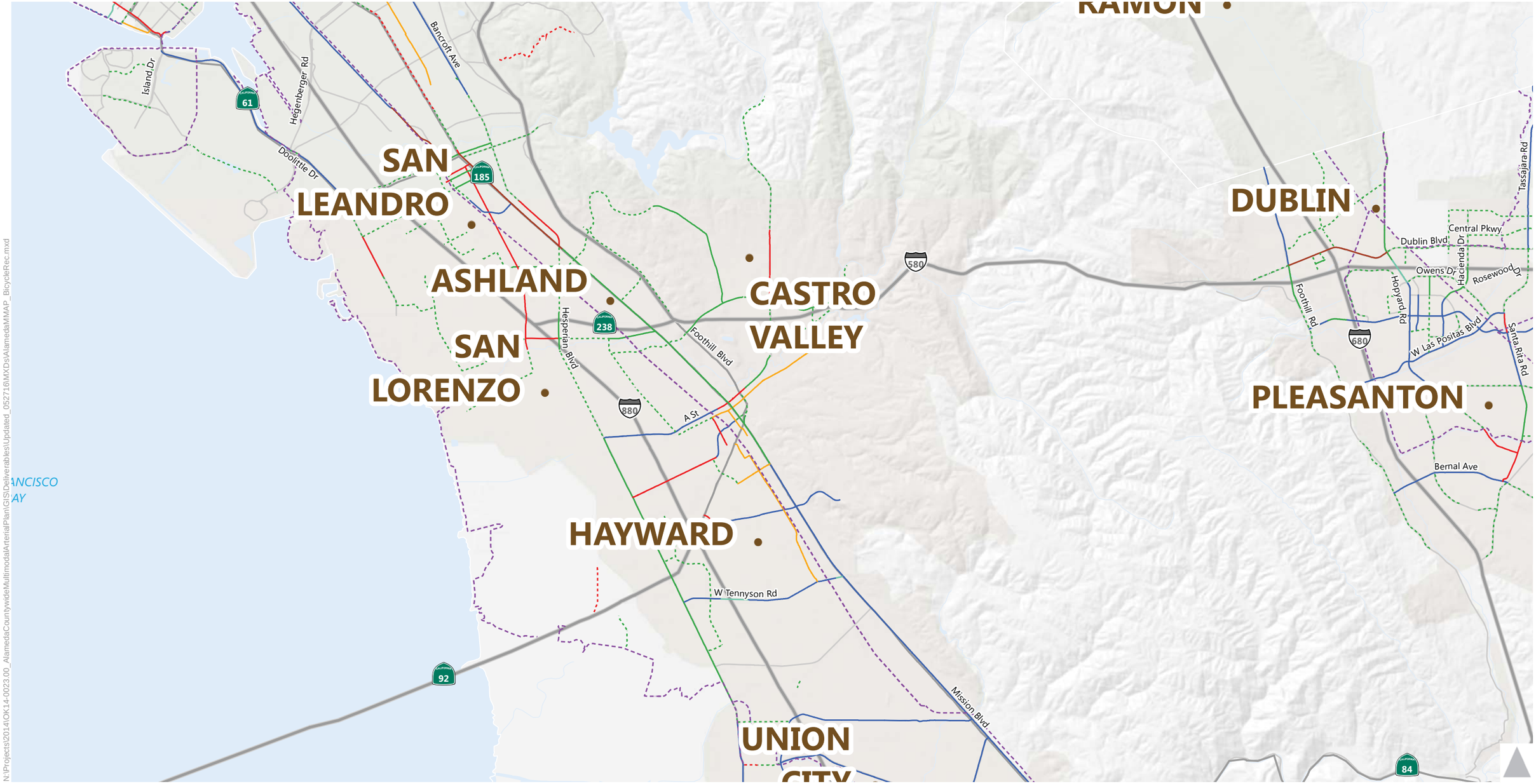
Baseline Bicycle Network

- Class 1
- Class 2 Enhanced
- Class 2
- Class 3 Enhanced
- Class 3
- Class 4

Figure 3B

ALAMEDA County Transportation Commission

Bicycle Network Proposed Improvements - North County



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Legend

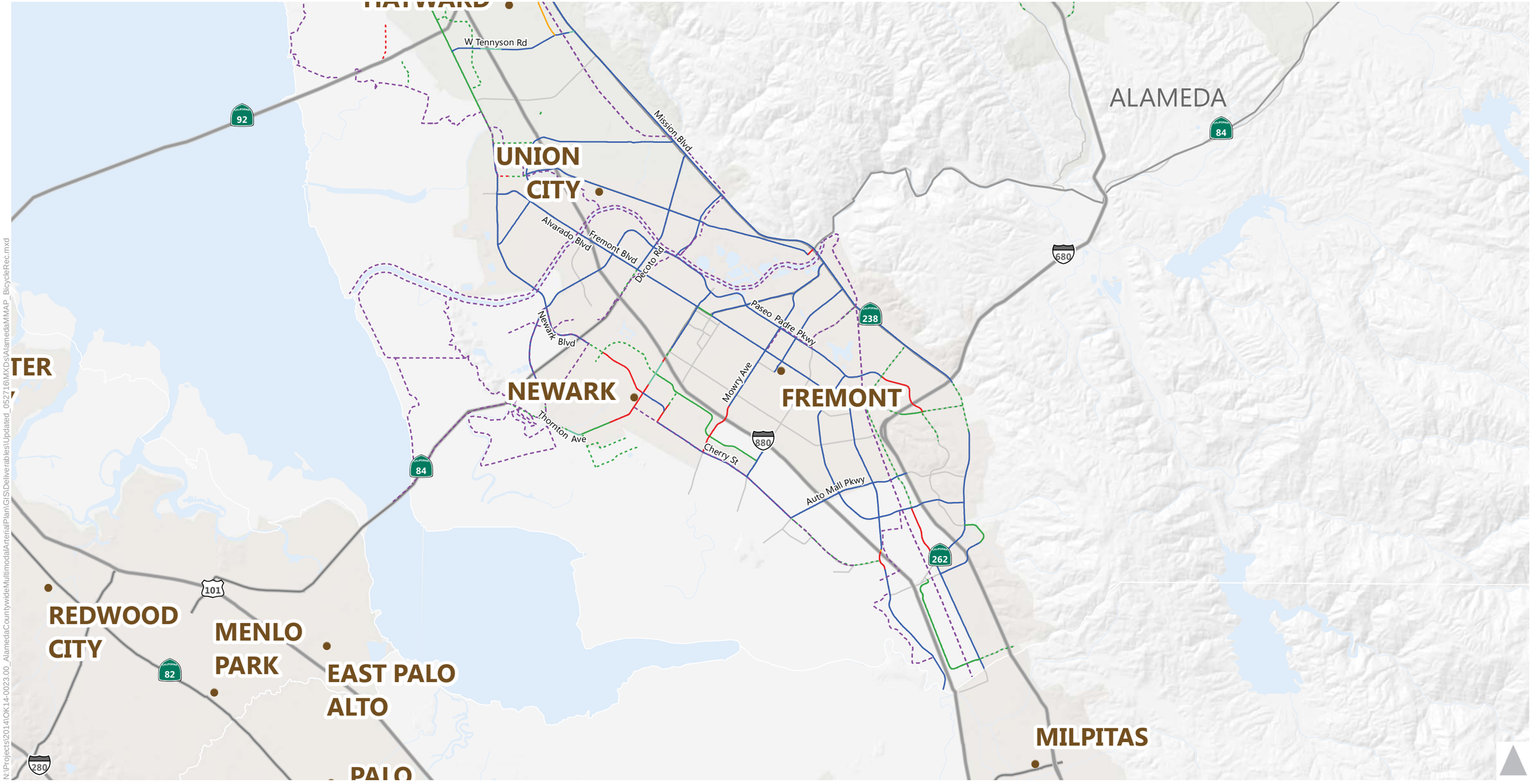
Proposed Bicycle Network Improvements	Baseline Bicycle Network
Class 1	Class 1
Class 2 Enhanced	Class 2 Enhanced
Class 2	Class 2
Class 3 Enhanced	Class 3 Enhanced
Class 3	Class 3
Class 4	Class 4
Parallel Facility Available	

Alameda Countywide Multimodal Arterial Plan

Figure 3C

ALAMEDA County Transportation Commission

Bicycle Network Proposed Improvements - Central County



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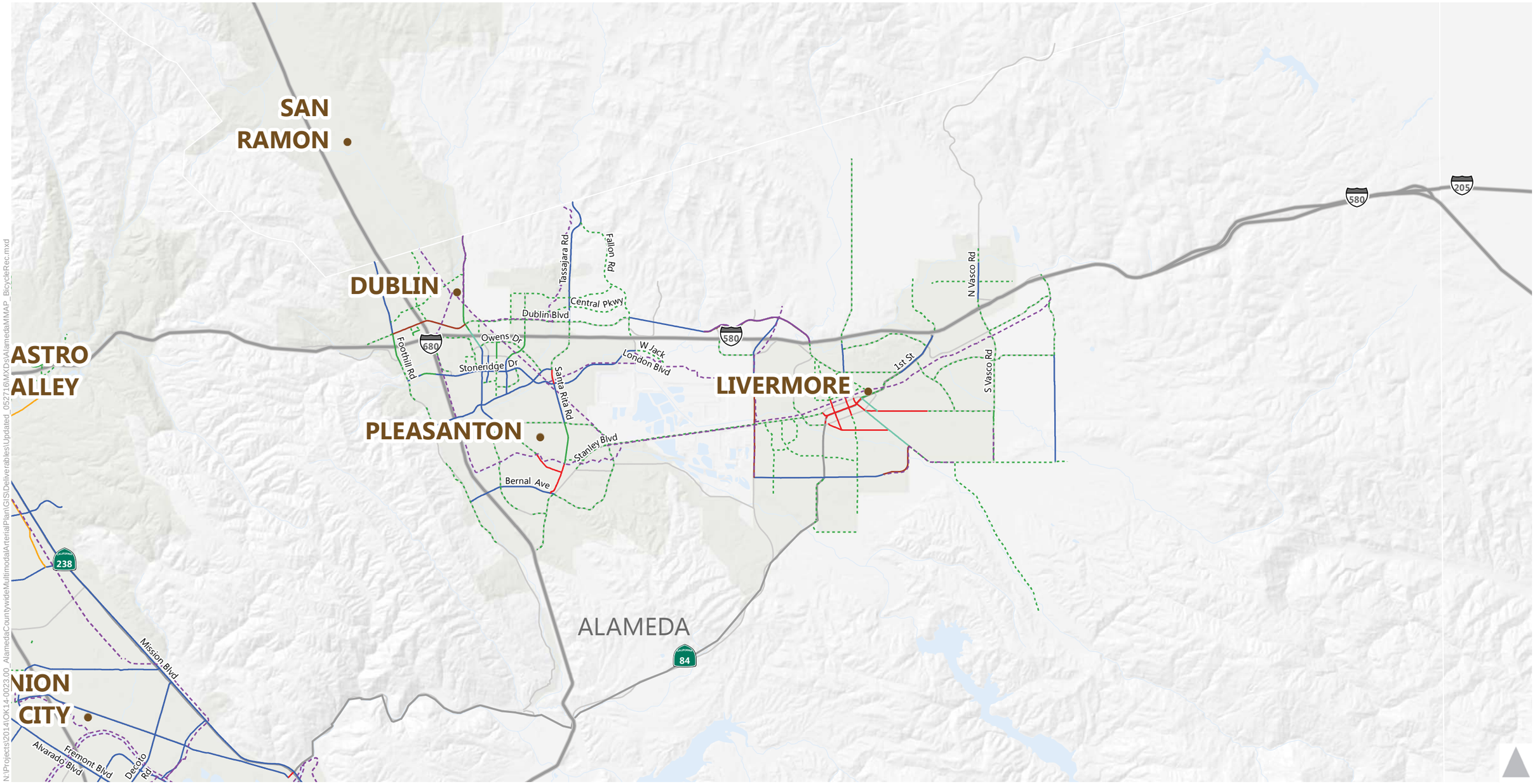
Legend

Proposed Bicycle Network Improvements		Baseline Bicycle Network	
Class 1	Class 3 Enhanced	Class 1	Class 3 Enhanced
Class 2 Enhanced	Class 3	Class 2 Enhanced	Class 3
Class 2	Class 4	Class 2	Class 4
	Parallel Facility Available		



Legend

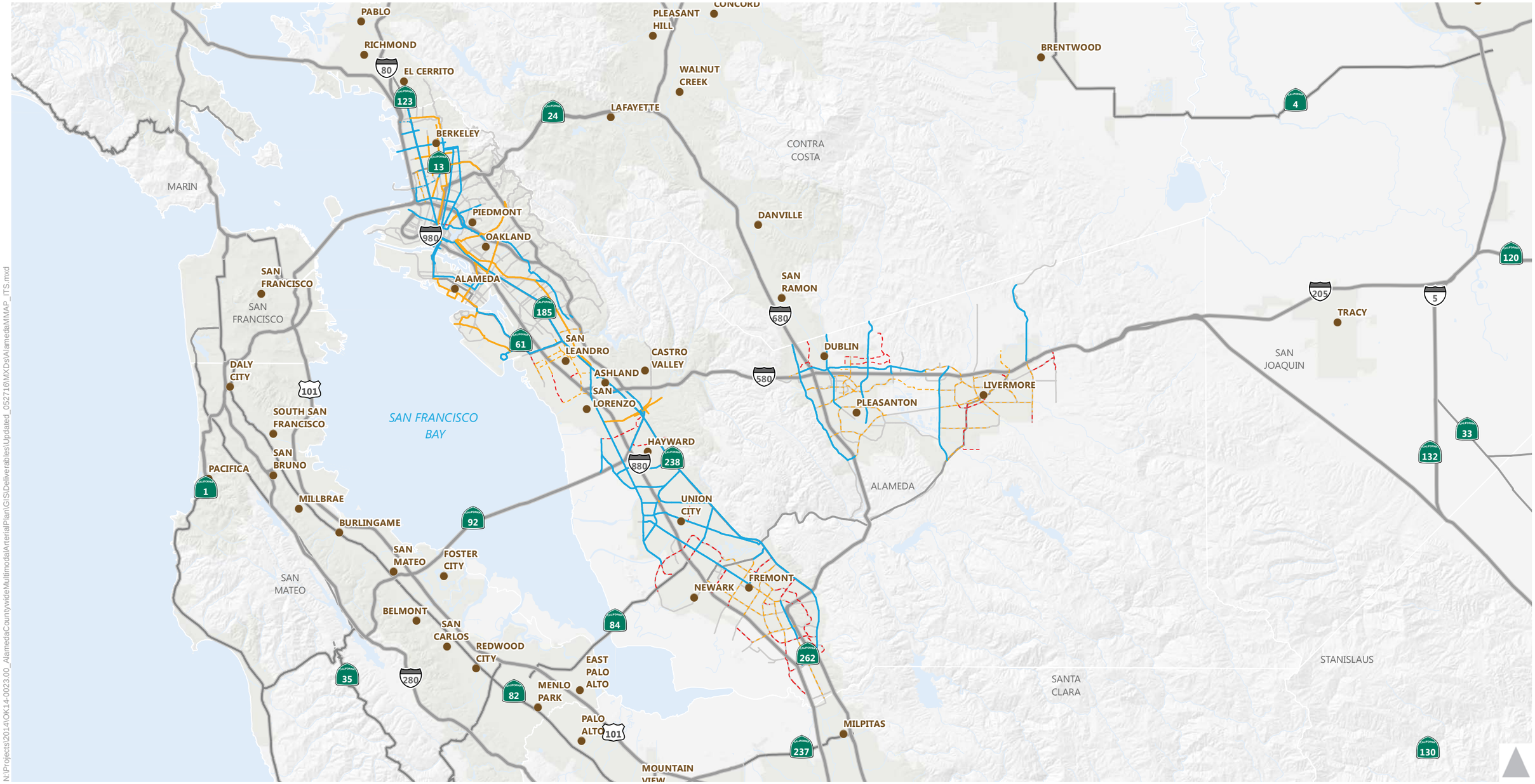
Proposed Bicycle Network Improvements		Baseline Bicycle Network	
Class 1	Class 3 Enhanced	Class 1	Class 3 Enhanced
Class 2 Enhanced	Class 3	Class 2 Enhanced	Class 3
Class 2	Class 4	Class 2	Class 4
	Parallel Facility Available		

Alameda Countywide Multimodal Arterial Plan

Figure 3E

ALAMEDA County Transportation Commission

Bicycle Network Proposed Improvements - East County



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Legend

Proposed ITS Infrastructure

- High Level of ITS Infrastructure
- Medium Level of ITS Infrastructure
- Low Level of ITS Infrastructure

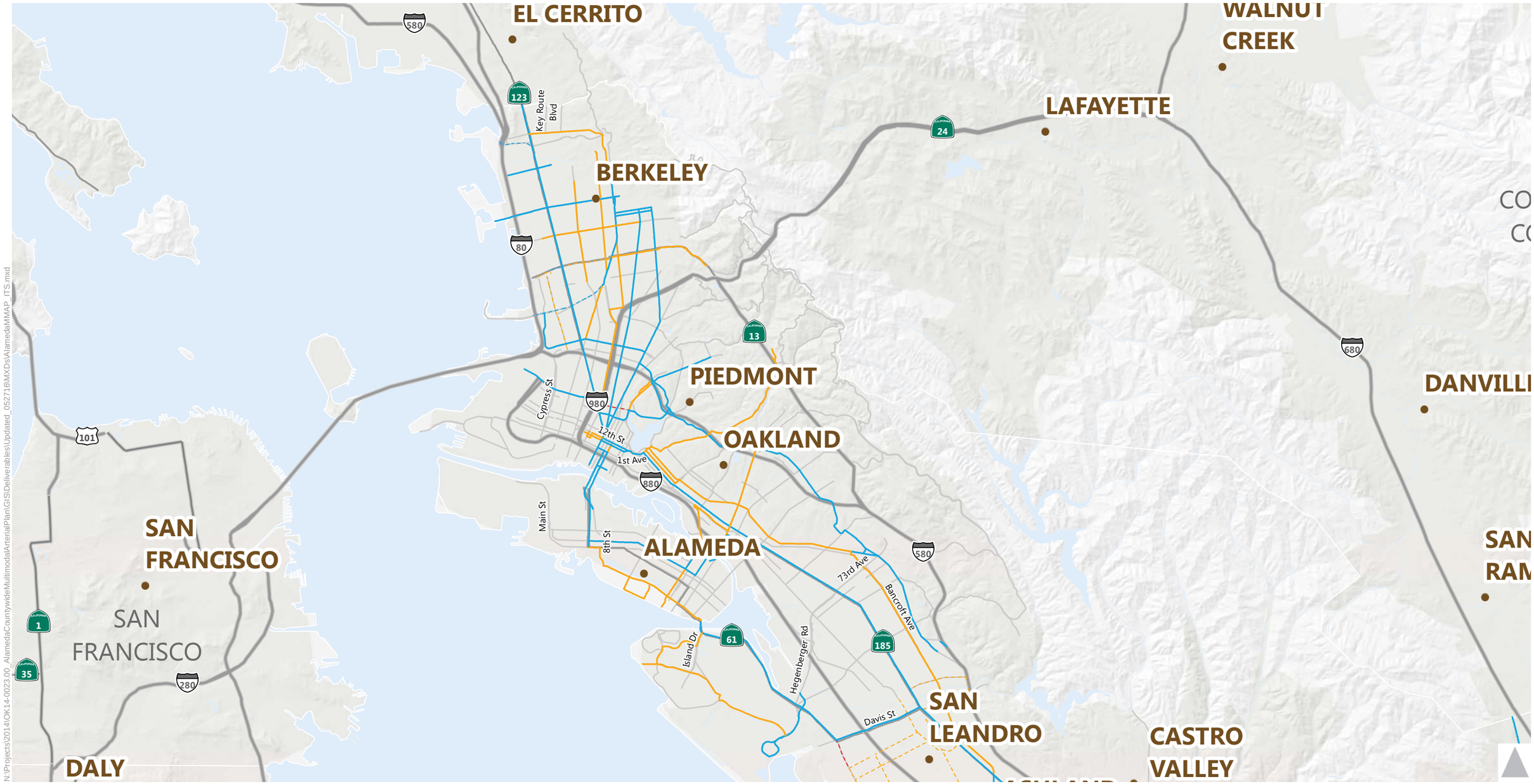
Baseline ITS Infrastructure

- High Level of ITS Infrastructure
- Medium Level of ITS Infrastructure
- Low Level of ITS Infrastructure

Figure 4A

ALAMEDA County Transportation Commission

ITS Network Proposed Improvements - Alameda County



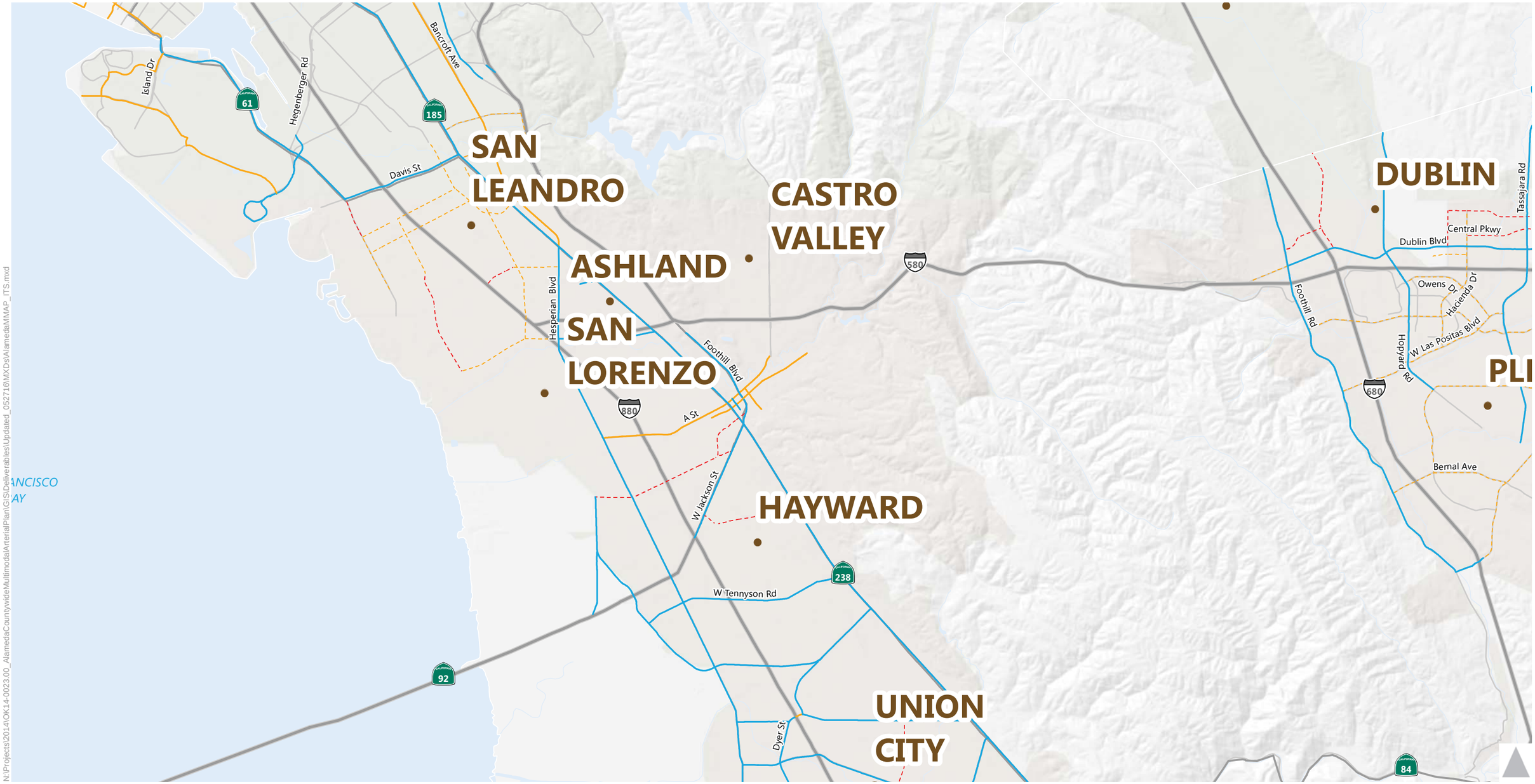
Legend

Proposed ITS Infrastructure
- High Level of ITS Infrastructure
- Medium Level of ITS Infrastructure
- Low Level of ITS Infrastructure

Baseline ITS Infrastructure
- High Level of ITS Infrastructure
- Medium Level of ITS Infrastructure
- Low Level of ITS Infrastructure

Figure 4B

ITS Network Proposed Improvements - North County



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Legend

Proposed ITS Infrastructure

- High Level of ITS Infrastructure
- Medium Level of ITS Infrastructure
- Low Level of ITS Infrastructure

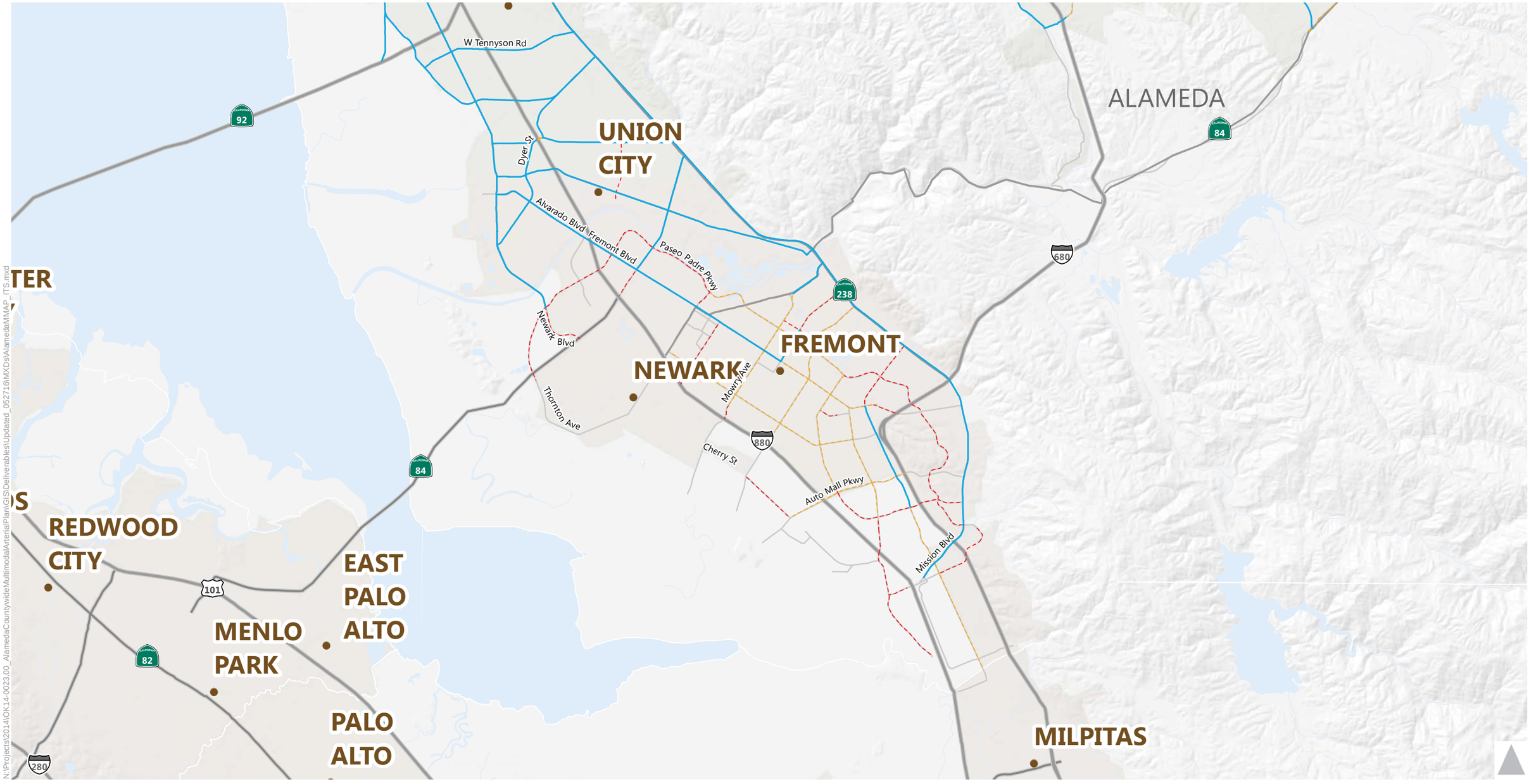
Baseline ITS Infrastructure

- High Level of ITS Infrastructure
- Medium Level of ITS Infrastructure
- Low Level of ITS Infrastructure

Figure 4C

ALAMEDA County Transportation Commission

ITS Network Proposed Improvements - Central County



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Legend

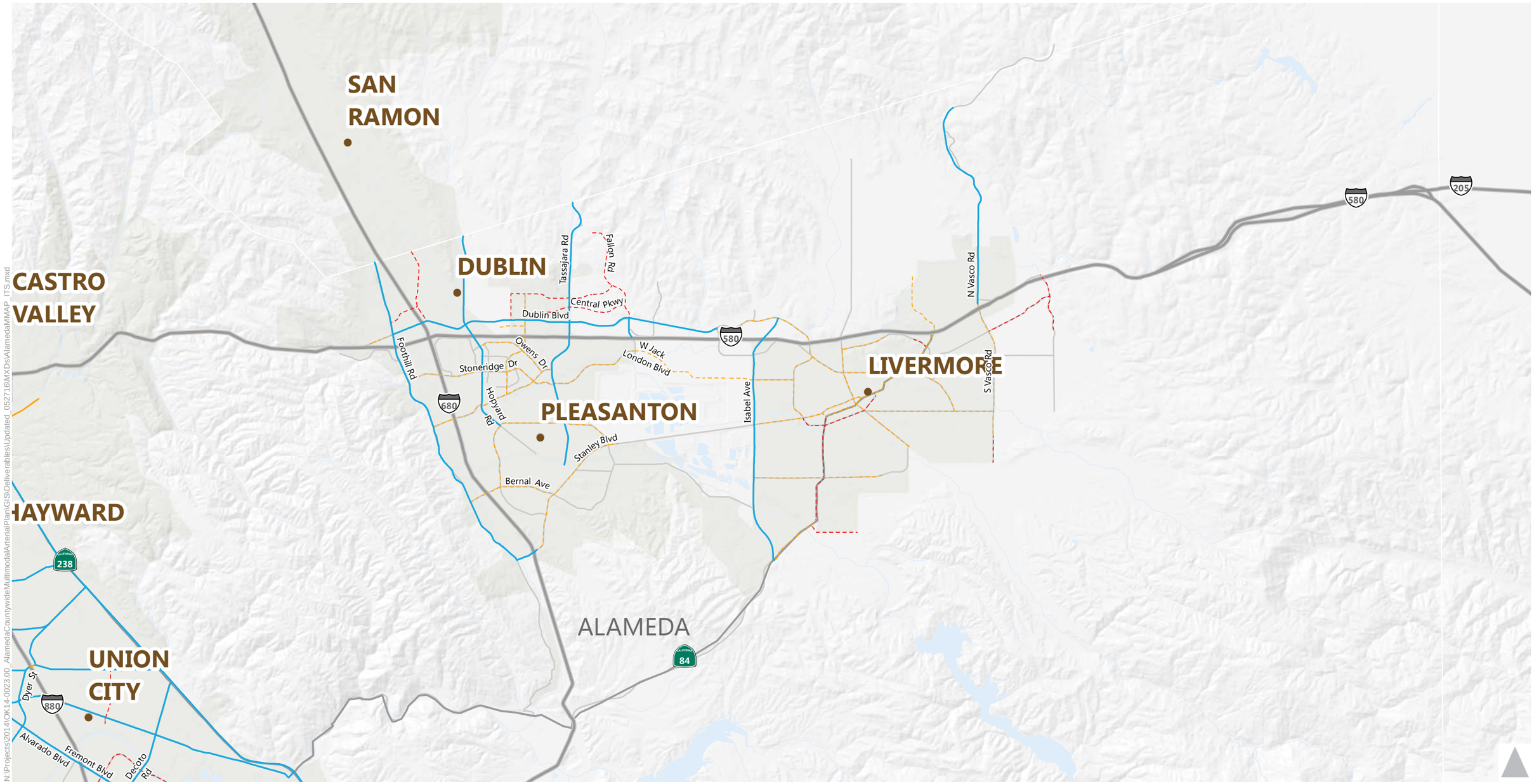
Proposed ITS Infrastructure
- High Level of ITS Infrastructure
- Medium Level of ITS Infrastructure
- Low Level of ITS Infrastructure

Baseline ITS Infrastructure
- High Level of ITS Infrastructure
- Medium Level of ITS Infrastructure
- Low Level of ITS Infrastructure

Figure 4D

ALAMEDA County Transportation Commission

ITS Network Proposed Improvements - South County



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Legend

Proposed ITS Infrastructure
- High Level of ITS Infrastructure
- Medium Level of ITS Infrastructure
- Low Level of ITS Infrastructure

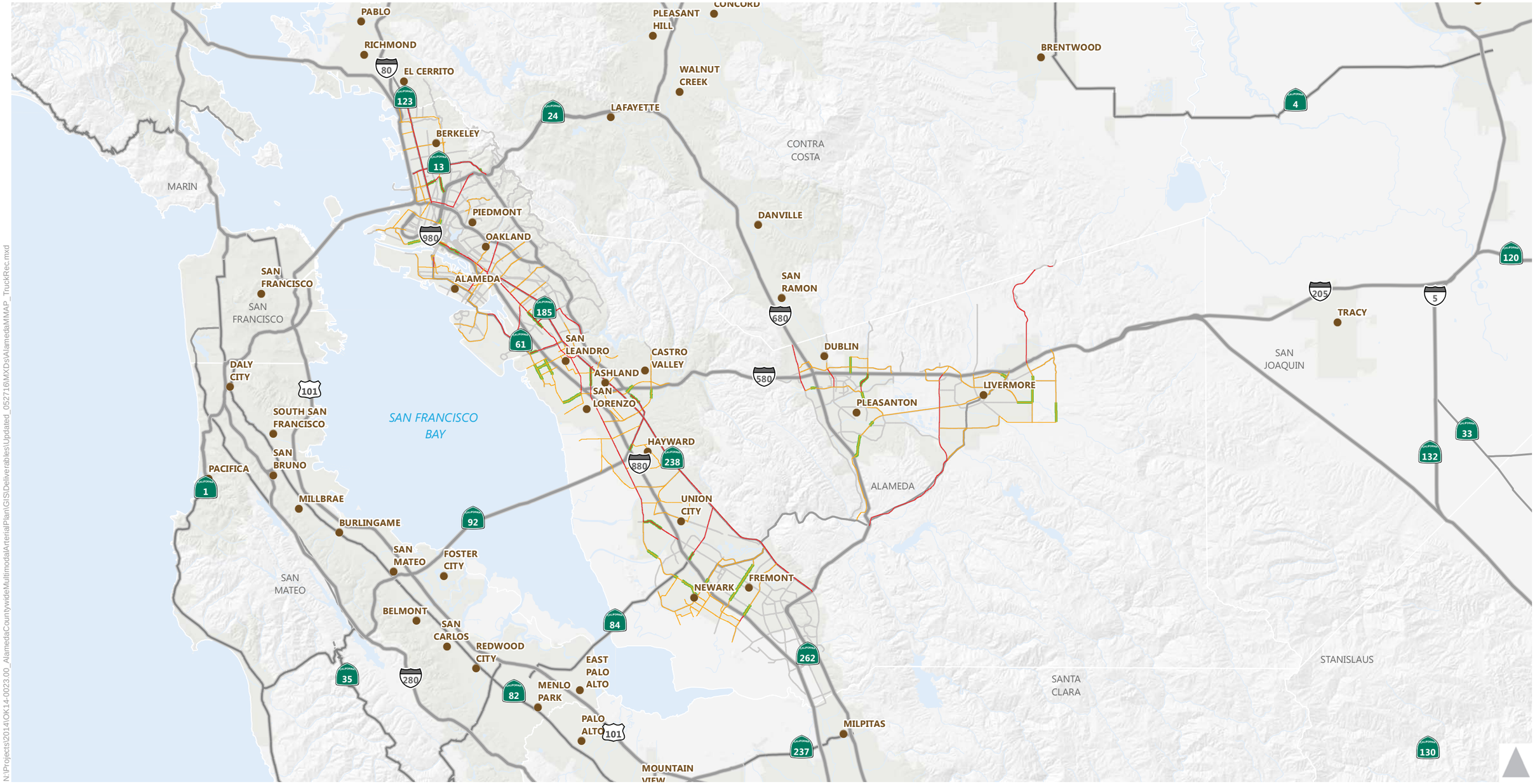
Baseline ITS Infrastructure
- High Level of ITS Infrastructure
- Medium Level of ITS Infrastructure
- Low Level of ITS Infrastructure

Alameda Countywide Multimodal Arterial Plan

Figure 4E

ALAMEDA County Transportation Commission

ITS Network Proposed Improvements - East County



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Legend

Tier 2 Good Movement Route

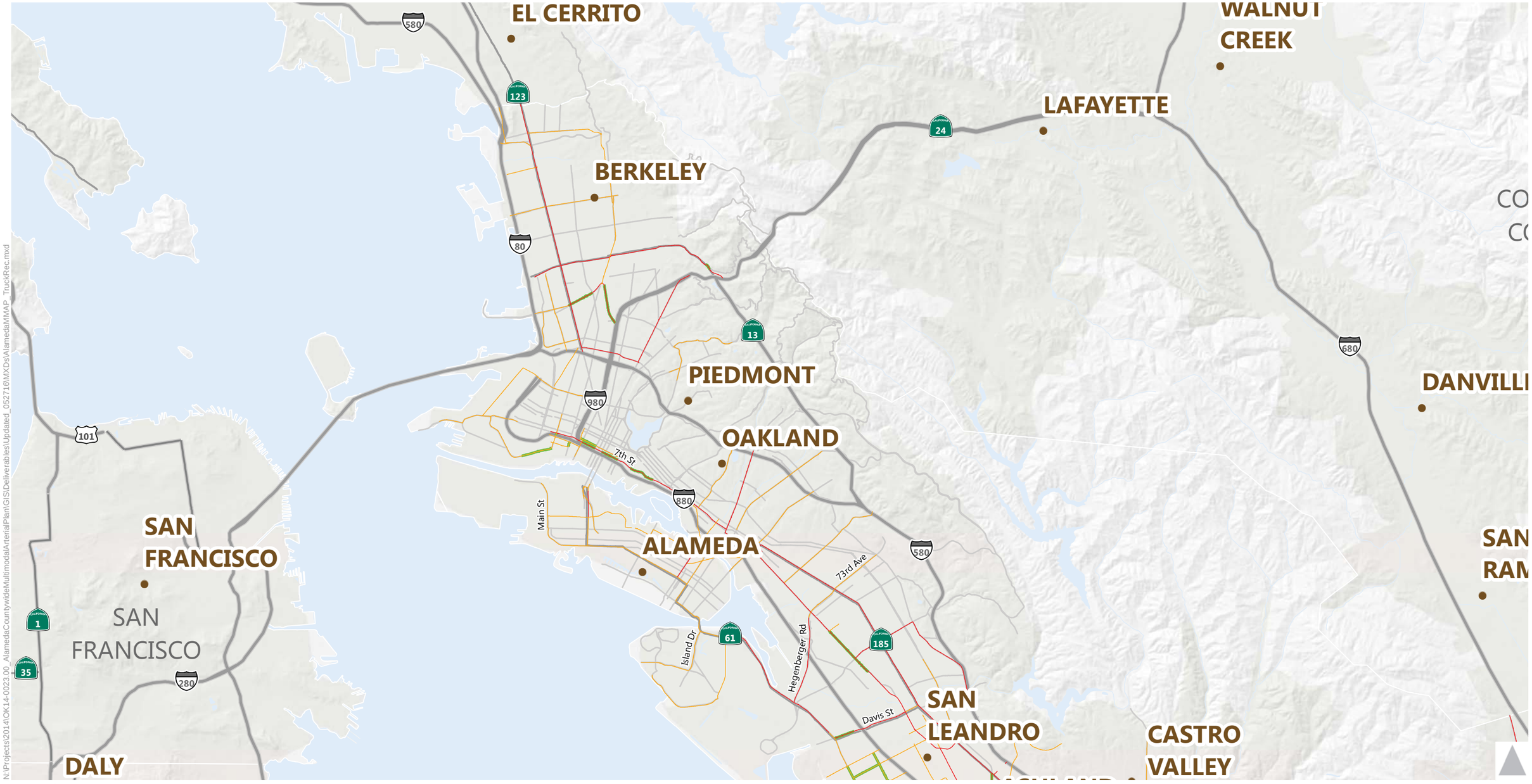
Tier 3 Good Movement Route

Proposed Curb Lane Widening

Alameda Countywide Multimodal Arterial Plan

Figure 5A

Goods Movement Network Proposed Improvements - Alameda County



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Alameda Countywide Multimodal Arterial Plan

Figure 5B

Goods Movement Network Proposed Improvements - North County

SAN LEANDRO
CASTRO VALLEY
ASHLAND
SAN LORENZO
HAYWARD
UNION CITY
DUBLIN
PLE
Island Dr
Hegenberger Rd
Davis St
Hesperian Blvd
Foothill Blvd
A St
W Jackson St
W Tennyson Rd
Dyer St
Dublin Blvd
Hacienda Dr
Tassajara Rd
Foothill Rd
Stoneridge Dr
61
185
580
880
238
92
680
84
NCISCO
AY

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Legend

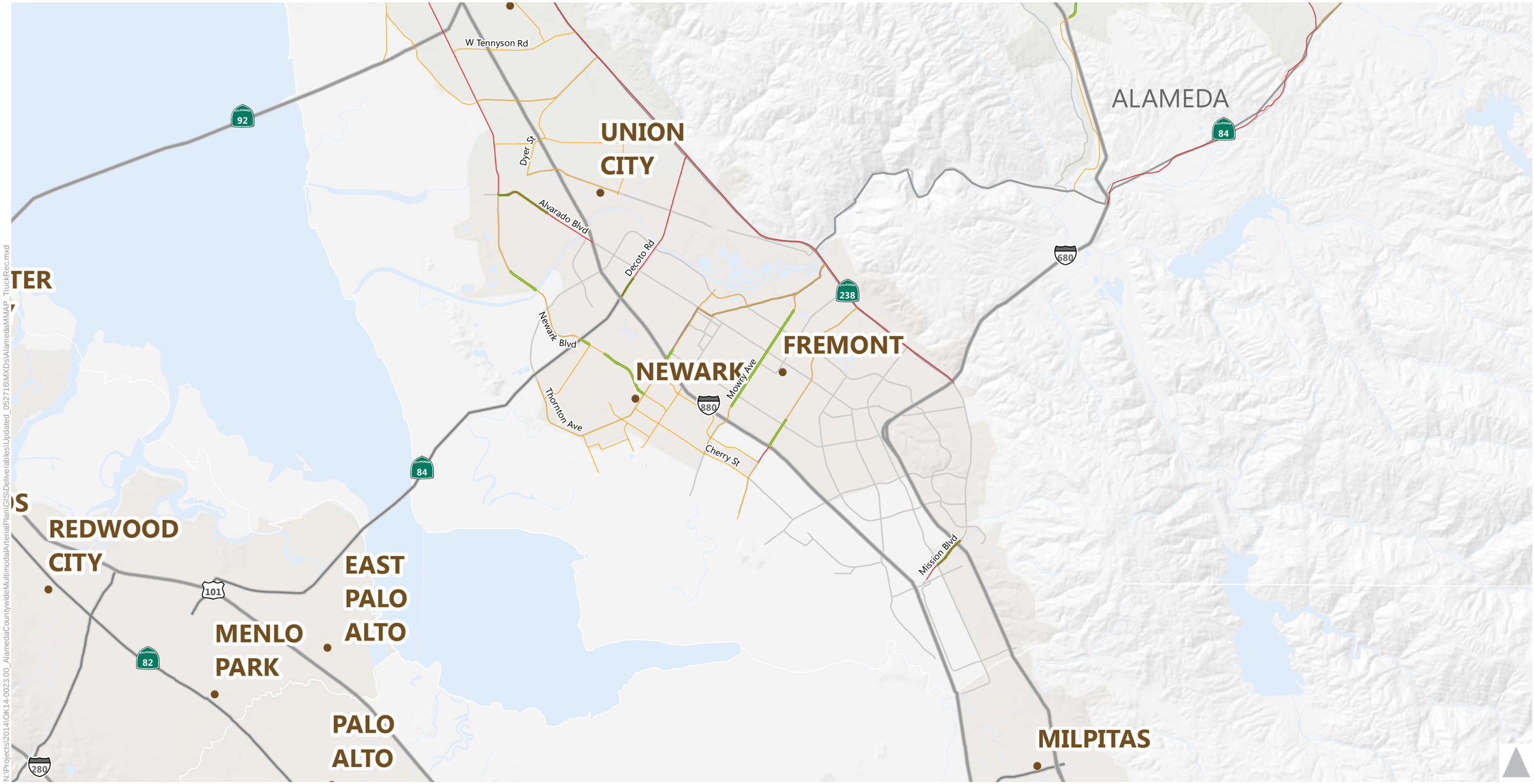
Tier 2 Good Movement Route
Tier 3 Good Movement Route
Proposed Curb Lane Widening

Alameda Countywide Multimodal Arterial Plan

Figure 5C

ALAMEDA County Transportation Commission

Goods Movement Network Proposed Improvements - Central County



Legend

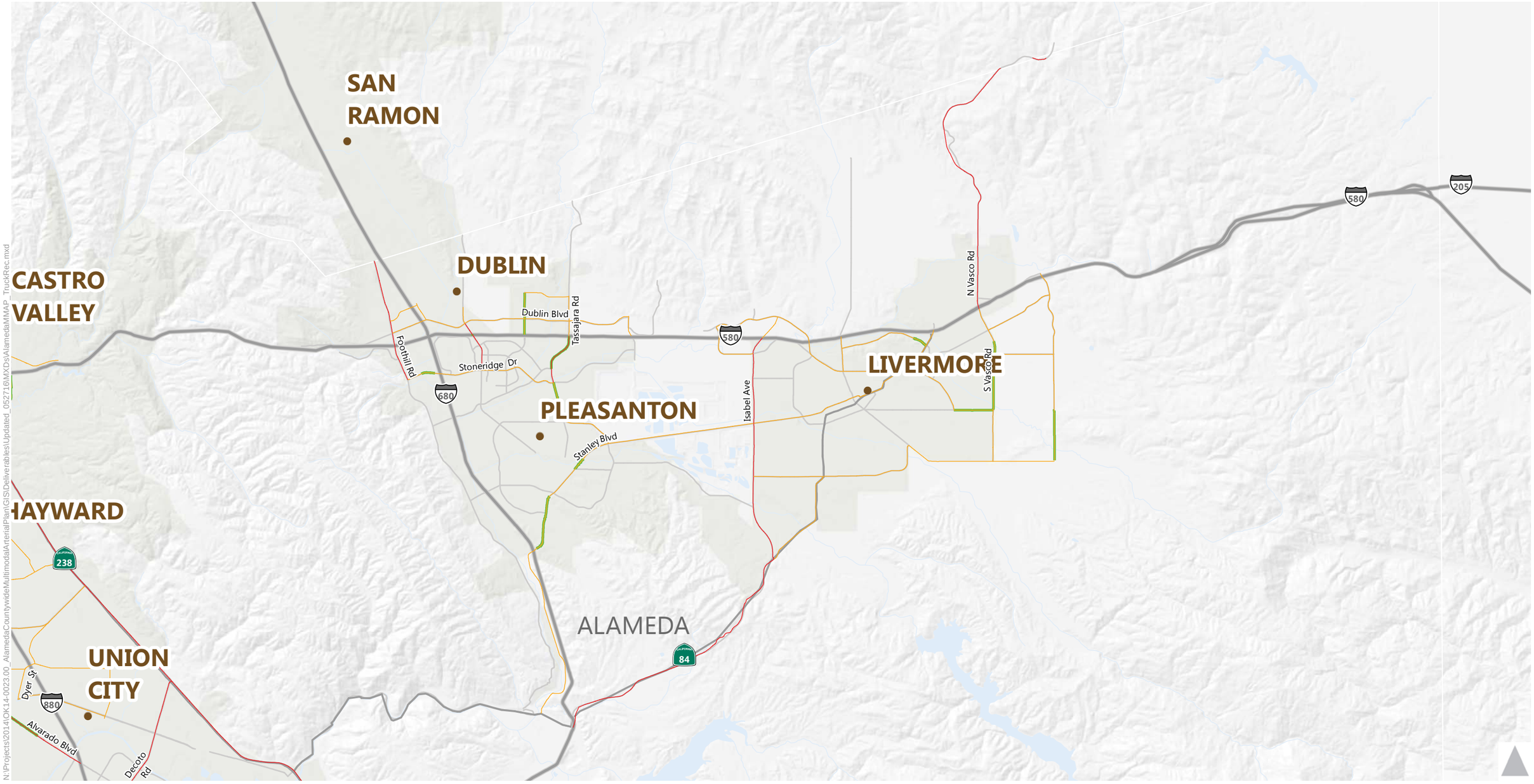
- Tier 2 Good Movement Route
- Tier 3 Good Movement Route
- Proposed Curb Lane Widening

Alameda Countywide Multimodal Arterial Plan

Figure 5D

ALAMEDA County Transportation Commission

Goods Movement Network Proposed Improvements - South County



Legend

- Tier 2 Good Movement Route
- Tier 3 Good Movement Route
- Proposed Curb Lane Widening

Alameda Countywide Multimodal Arterial Plan

Figure 5E

ALAMEDA County Transportation Commission

Goods Movement Network Proposed Improvements - East County