Appendix 2.1.1
Performance Measure Memo

FEHR & PEERS

MEMORANDUM

Date: January 22, 2015

To: Saravana Suthanthira, Alameda CTC

From: Francisco Martin and Matthew Ridgway, Fehr & Peers

Subject: Alameda Countywide Multimodal Arterial Plan – Final Performance Measures and Evaluation Approach

OK14-0023

The Alameda Countywide Multimodal Arterial Plan's performance measures are derived from the Plan's vision and goals. These performance measures will be utilized to identify existing and future year multimodal transportation conditions across the county for the Plan's Study Network. Performance objectives[1] or thresholds for these performance measures will be developed after performance measures are approved. These performance objectives will be applied to existing and future year conditions to identify Study Network needs and will also provide guidance in identifying short-term (year 2020) and long-term (year 2040) improvements to adequately address those needs. Performance measures in combination with the performance objectives will ensure that the proposed short-term and long-term improvements meet the Plan's vision and goals. The initial list of performance measures was presented and comments received during each of the following jurisdictional outreach meetings:

- North County Planning Area meeting – October 29, 2014
- Central County Planning Area meeting – October 29, 2014
- East County Planning Area meeting – October 30, 2014
- Plan TAC/ACTAC meeting – November 6, 2014
- South County Planning Area meeting – November 13, 2014
- AC Transit focused meeting – November 14, 2014

[1] Draft performance objectives will be derived from modal priorities and presented to stakeholders in the coming months. Stakeholders will also have an opportunity to review modal priorities and performance objectives during the second set of Planning Area meetings in April.

Comments provided at each of the Planning Area meetings listed above were summarized in a memo titled *Summary of Milestone 1 Planning Area Comments* (November 14, 2014) prepared by Eisen | Letunic. Final Vison and Goals developed based on comments received were shared with the stakeholders on November 26, 2014.

The project team updated the performance measures to incorporate stakeholders' recommended initial revisions. In addition, the project team developed an evaluation approach for each performance measure, as detailed in this memo. Data collection for these performance measures is currently underway. This memo summarizes the Multimodal Arterial Plan's final vision and goals, the updated performance measures, performance measure evaluation approach and planning framework. Comments on the draft performance measures evaluation approach memorandum dated January 12, 2015 received until January 21, 2015 from stakeholders are incorporated into this updated memorandum.

FINAL MULTIMODAL ARTERIAL PLAN VISION AND GOALS

The final Vision and Goals were previously presented and distributed to the local jurisdictions in a memo titled *Alameda Countywide Multimodal Arterial Plan – Final Vision and Goals* (November 26, 2014) and are also included below.

VISION

Transportation and mobility are not goals: the movement of people and goods support economic activity and development.

> *Vision: Alameda County will have a network of efficient, safe and equitable 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.*

GOALS

This vision 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 are supportive of local land use, the arterial network will provide connections for all modes within the county and across the County 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 the above five goals, there are two supportive principles. Supportive principles are expected outcomes of the vision and goals. They are less quantifiable but the Multimodal Arterial Plan will include strategies and programs to address them:

- **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.

PERFORMANCE MEASURES AND PLANNING FRAMEWORK

Figure 1 presents a streamlined flow chart of the Multimodal Arterial Plan planning framework and illustrates how performance measures in combination with performance objectives will be used to identify short and long-term improvements. The process is also described below:

1. Performance Measures are derived from the Plan's goals, which are in turn derived from the Plan's vision.
2. Identify the larger level "Study Network" including parallel "layered network" of other modal facilities to support data collection and typology development.
3. Develop criteria to identify Arterials of Countywide Significance (Arterial Network) that will be used towards the end of the Plan development process to develop the list of

preferred improvements for the Plan. The draft criteria are summarized in a memorandum titled Alameda Countywide Multimodal Arterial Plan – Draft Criteria for Selecting Arterials of Countywide Significance (January 21, 2015). The criteria will be discussed and approved by the Alameda CTC Committees and Commission.

4. Roadway typologies[2] will be developed for the Study Network. Typologies will be descriptive of the transportation function, land use context, modal emphasis and the relative scale of local or longer distance travel. The roadway typologies will provide the basis for identifying modal priorities along each Study Network segment/corridor. Modal priority for transit and trucks will be coordinated with the Countywide Transit and Goods Movement Plans that are currently underway. Modal priorities will be vetted and confirmed during the second set of Planning Area meetings.
5. Modal priorities will inform the performance objectives by segment/corridor as different modal priorities can potentially result in different performance objectives. For example, the Bicycle Comfort Index described later in this memo identifies four different ratings, ranging from LTS1 to LTS4 (LTS1 being the highest performance level) . If a Study Network segment is identified as having a bicycle modal priority, the performance measure objective would be to achieve an LTS2 or better rating. If the segment is not identified as having a bicycle modal priority, the performance measure objective would be to achieve an LTS4 or better rating. The draft performance objectives are not provided in this memorandum as they will be presented to stakeholders in the coming months.
6. The performance objectives will be applied to the performance measure assessment of existing and future year transportation conditions to determine network gaps, deficiencies and needs. This step will occur using a GIS based automated macro analysis tool.
7. Recommended multi-modal transportation improvements will be identified to adequately address short and long-term Study Network multimodal needs.
8. The Consultant team will meet with each Alameda County jurisdiction individually to review the recommended set of multi-modal transportation improvements; each jurisdiction will have the opportunity to review and refine the set of recommended improvements which will lead to identifying the preferred set of improvements for the Arterials of Countywide Significance.

[2] The roadway typology framework is being developed. It will be presented to stakeholders in April.

9. After preferred improvements are identified, the project team will utilize the equity and active transportation mode performance measures to ensure that the list of improvements achieve the Plan's vision and goals. Equity checks ensure that a set of equitable improvements are proposed throughout the County. The potential mode shift to active transportation modes will also be assessed; preferred improvements will be revised as necessary. .
10. Prioritization criteria[3] will be developed in coordination with stakeholders to prioritize the list of preferred short and long-term improvements to be included in the Final Multimodal Arterial Plan.
    The project team will also develop a set of ITS, climate action, and TDM strategies that are complimentary to the list of preferred short and long-term improvements.

As shown in **Figure 1** and described above, performance measures play a critical role in developing the Plan and identifying the preferred set of short and long-term improvements.

[3] Short and long-term improvement prioritization criteria will be developed and presented to stakeholders later in the Plan development process. All stakeholders will have an opportunity to review and provide feedback on the prioritization criteria before the criteria are finalized.

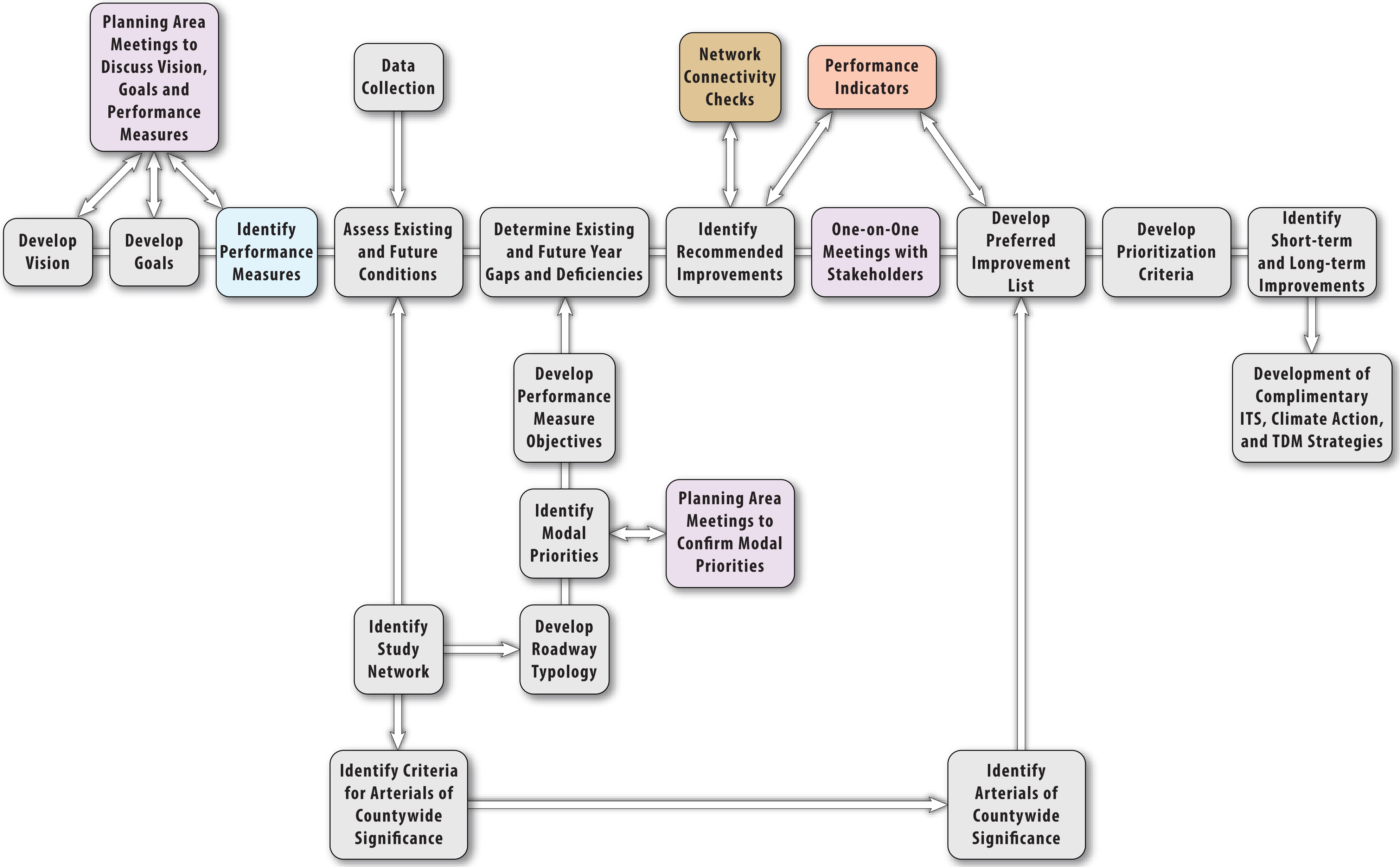


Figure 1

Alameda CTC Countywide Multimodal Arterial Plan Framework

OK14-0023_1_PlanFramework

PROPOSED PERFORMANCE MEASURES AND EVALUATION APPROACH

The proposed performance measures to be utilized as part of the Alameda Countywide Multimodal Arterial Plan development are listed in **Table 1** and described in the sections below. Performance measures will be applied to assess existing and/or future year transportation conditions; These measures also include a few 'Performance Indicators' (non-auto mode share, active transportation mode share, implementation feasibility, VMT and GHG) as these indicators by themselves do not evaluate an existing or future conditions to identify a gap or deficiency, but provide a measurement of the network or facility for a comparative assessment of the proposed improvements against the existing conditions. Therefore, these indicators will be generally applied after preferred short and long term improvements are identified to evaluate and to ensure that the preferred improvements achieve the Plan's vision and goals.

Table 1 also lists the goal that each measure addresses, if the measure is a facility-specific or area-wide application, and whether the measure applies to either existing conditions, future year conditions or both. Arterial corridor performance measure results will be derived from the study segment results along the corridor; for example, automobile congested speed at the corridor level will be estimated by calculating the average (weighted by volume) congested speed from all the individual study segments that are within the corridor limits.

As previously mentioned, modal priorities will inform the performance objectives as different modal priorities can potentially result in different objectives to determine if an arterial study segment is performing adequately to suit the multimodal needs. Modal priorities will also address potential modal conflicts that may arise along arterial segments as short and long term improvements will be prioritized for the identified priority modes. All stakeholders will have an opportunity to review and refine the modal priorities along the Study Network. Jurisdictions will also be given the opportunity to coordinate with neighboring jurisdictions on modal priorities along multi-jurisdictional routes during the second set of Planning Area meetings in April and May of 2015. Because modal priorities are not yet identified, performance objectives will be identified at a later date and therefore are not described in this memo.

TABLE 1
MULTIMODAL ARTERIAL PLAN PERFORMANCE MEASURES

Goal	Category	Performance Measure	Evaluation Approach	Application
1. Multimodal	1.1 – Auto	1.1A – Congested Speed	Based on average PM peak period congested speed.	Facility-Specific Measure, Existing and Future Conditions
		1.1B – Reliability	Based on PM peak hour volume-to-capacity ratio, categorized as: ▪ Reliable (V/C between 0 – 0.8) ▪ Less Reliable (V/C between 0.8 – 1.0) ▪ Unreliable (V/C greater than 1.0)	Facility-Specific Measure, Existing and Future Conditions
	1.2 – Transit	1.2A – Transit Travel Speed	Based on average PM peak hour transit travel speed provided by transit agencies that operate in the County.	Facility-Specific Measure, Existing and Future Conditions
		1.2B – Transit Reliability	Based on average PM peak hour transit travel speed to non-peak hour transit speed ratio. Data provided by transit agencies that operate in the County.	Facility-Specific Measure, Existing and Future Conditions
		1.2C – Transit Infrastructure Index	Based on the following factors: ▪ Provided bus stop amenities ▪ Bus stop location ▪ Bus stop design The measure applies a 50-point scoring system that corresponds to the following rating: ▪ 36 – 50 points = High ▪ 26 – 35 points = Medium ▪ 0 – 25 points = Low	Facility-Specific Measure, Existing and Future Conditions

TABLE 1
MULTIMODAL ARTERIAL PLAN PERFORMANCE MEASURES

Goal	Category	Performance Measure	Evaluation Approach	Application
	1.3 – Pedestrian	1.3 – Pedestrian Comfort Index	Based on the following factors: ▪ Sidewalk width ▪ Presence of buffer between sidewalk and roadway ▪ Land use context ▪ Roadway classification, average daily vehicle volume, number of travel lanes and speed limit ▪ Percent heavy vehicle traffic The measure applies a 24-point scoring system that corresponds to the following rating: ▪ 21 – 24 points = Excellent ▪ 15 – 20 points = High ▪ 8 – 14 points = Medium ▪ 0 – 7 points = Low	Facility-Specific Measure, Existing and Future Conditions
	1.4 – Bicycle	1.4 – Bicycle Comfort Index	Application of the Level of Traffic Stress (LTS) methodology, which is based on the type of bicycle facility provided and separation from vehicle travel lanes. LTS methodology classifies roadway segments into one of four levels of traffic stress, which are termed as LTS1 through LTS4. Groups of cyclists are categorized by how much stress they will tolerate in different environments. For simplicity, the LTS results correspond to the following rating: ▪ LTS1 = Excellent ▪ LTS2 = High ▪ LTS3 = Medium ▪ LTS4 = Low	Facility-Specific Measure, Existing and Future Conditions
	1.5 – Trucks/ Goods Movement	1.5 – Truck Route Accommodation Index	Based on curb-lane width. The measure applies a three-point scoring system that corresponds to the following rating: ▪ 3 points = High ▪ 2 points = Medium ▪ 0-1 point = Low One point is assigned if curb lane width is less than 11, two points are assigned if the curb lane width is between 11 and 12 feet, three points are assigned if the curb lane width is 12 feet or greater.	Facility-Specific Measure, Existing and Future Conditions

TABLE 1
MULTIMODAL ARTERIAL PLAN PERFORMANCE MEASURES

Goal	Category	Performance Measure	Evaluation Approach	Application
	1.6 – Enhanced Mobility	1.6 – Non-Auto Transportation Mode Share	Qualitative assessment of cross-sectional improvements on likelihood of changes to transit, pedestrian, and bicycle travel (proxy for person throughput).	Area-Wide Indicator, Existing, Future Conditions
	1.7 State of Good Repair	1.7 Pavement Condition Index (PCI)	Based on the PCI data obtained from the MTC StreetSaver database. The PCI measure applies a 100-point scoring system that corresponds to the following rating: ▪ PCI 80 – 100 = Very Good ▪ PCI 60 – 79 = Good ▪ PCI 50 – 59 = At Risk ▪ PCI 0 – 49 = Poor	Facility-Specific Measure, Existing Conditions
2. Accessible and Equitable[1]	2.1 – Social Equity	2.1 – Benefit to Communities of Concern	After the preferred list of short and long-term improvements is identified, a ratio will be estimated by dividing the number of arterial miles of identified improvements within Communities of Concern (COC) by the number arterial miles of all identified improvements benefiting each jurisdiction. For Transit, number of population benefitted within COC versus overall population benefitted in the County will be used.	Area-Wide Indicator, Future Conditions
3. Connected Across the County and Region	3.1 – Transit	3.1 – Transit Connectivity	Connectivity measures will be assessed through a mapping exercise. The transit, pedestrian, bicycle and truck networks will be mapped to identify gaps or inconsistencies in the networks. The pedestrian and bicycle assessment will include consideration of relative comfort. The truck network connectivity assessment will be coordinated with the Countywide Goods Movement Plan consultant team to ensure that identified truck network gaps and deficiencies are adequately addressed.	Area-Wide Measure, Existing and Future Conditions
	3.2 – Pedestrian	3.2 – Pedestrian Connectivity		Area-Wide Measure, Existing and Future Conditions
	3.3 – Bicycle	3.3 – Bicycle Connectivity		Area-Wide Measure, Existing and Future Conditions

TABLE 1
MULTIMODAL ARTERIAL PLAN PERFORMANCE MEASURES

Goal	Category	Performance Measure	Evaluation Approach	Application
	3.4 – Trucks	3.4 – Network Connectivity		Area-Wide Measure, Existing and Future Conditions
4. Efficient Use of Resources[2]	4.1 – Efficient Use of Operations Funding	4.1 – Operating Cost Effectiveness	Based on the ratio of improvement costs to existing facility costs: ▪ Develop unit operating costs for cross-sectional elements, including maintenance costs ▪ Estimate operating costs to maintain existing cross-section (O_E) ▪ Estimate operating costs to maintain preferred cross-sectional improvements (O_P) ▪ Operating Cost Effectiveness = O_P/O_E	Facility-Specific Measure, Future Conditions
	4.2 – Implementation Challenge	4.2 – Implementation Challenge Score	Based on a zero to four point scale, zero being most feasible and four being the least feasible based on the following variables: ▪ Travel lane removal required (yes = 1 pt, no = 0 pts) ▪ Parking removal required (yes = 1 pt, no = 0 pts) ▪ Multi-jurisdiction coordination required (yes = 1 pt, no = 0 pts) ▪ Curb changes required (yes = 1 pt, no = 0 pts)	Facility-Specific Indicator, Future Conditions
	4.3 ITS Infrastructure	4.3 Coordinated Technology	Four-point scale (0 – 3) based on the level of ITS investment defined by built infrastructure. Consideration for coordination with adjacent jurisdictions and/or Caltrans, as applicable: ▪ 3: high investment ITS network ▪ 2: medium investment ITS network ▪ 1: basic investment ITS network ▪ 0: no ITS infrastructure	Facility-Specific Indicator, Existing and Future Conditions
5. Safe, Healthy and Vibrant	5.1 – Safety	5.1 – Collision Rates	Collision rates based on the SWITRS database.	Facility-Specific Measure, Existing Conditions

TABLE 1
MULTIMODAL ARTERIAL PLAN PERFORMANCE MEASURES

Goal	Category	Performance Measure	Evaluation Approach	Application
	5.2 – Active Transportation Mode Share	5.2 – Demand for Active Transportation	Potential for mode shift (low, medium, high) based on demand for active transportation.	Area-Wide Indicator, Future Conditions
	5.3 – VMT	VMT per Capita	Based on VMT data from the Alameda CTC Travel Demand Model.	Area-wide Indicator, Existing and Future Conditions
	5.4 – GHG	GHG per Capita	Based on VMT data from the Alameda CTC Travel Demand Model.	Area-wide Indicator, Existing and Future Conditions

Notes:
1. Accessibility is a component of the Transit Infrastructure Index, Pedestrian Comfort Index and Bicycle Comfort Index. Source:
2. Performance measures are generally applied to assess existing and/or future year transportation conditions, performance indicators will generally be evaluated after preferred short and long-term improvements are identified to ensure that preferred improvements achieve the Plan's vision and goals.

GOAL 1 – MULTIMODAL (HIGH QUALITY, WELL MAINTAINED AND RELIABLE)

1.1A – AUTOMOBILE CONGESTED SPEED

Overview

Automobile congested travel speed relates directly to the automobile traveler experience and provides a good indication of vehicular operations along an arterial study segment. This measure is facility-specific and will be applied to existing and future year conditions.

Approach

Automobile congested travel speed will be estimated for Existing and Future Year PM peak hour conditions, consistent with the Alameda County Congestion Management Program. Existing travel speeds will be obtained from either of the following data sources:

- Speed data obtained from the INRIX database, or
- Speed survey data provided by jurisdictions, or
- Speed data obtained from the base year (2010) Alameda Countywide Travel Demand Model

Speed data from the INRIX database will be prioritized, followed by speed data provided by jurisdictions, and if neither INRIX nor survey data is available for an arterial segment then speed data from the Travel Demand Model will be used. Future year 2020 and 2040 PM peak hour travel speeds will be estimated using the Alameda Countywide Travel Demand Model. Adjustment factors comparing observed PM peak hour speed data to base year (2010) modeled speed data will be estimated. This adjustment factors will be applied to modeled speed data for future years 2020 and 2040 to estimate future years 2020 and 2040 PM peak hour travel speeds for the Study Network.

1.1B – AUTOMOBILE RELIABILITY

Overview

Automobile reliability is an assessment of the vehicular volume-to-capacity (V/C) along an arterial segment. Arterial segments that operate below capacity generally provide greater travel reliability compared to segments that operate at or near capacity. This measure is facility-specific and will be applied to existing and future year conditions.

Approach

Automobile reliability will be estimated for existing and future year PM peak hour conditions. Existing PM peak hour volumes will be obtained from existing count data provided by jurisdictions or base year (2010) volume data from the Alameda Countywide Travel Demand Model. Future year 2020 and 2040 volume forecasts will also be estimated using the Travel Demand Model, the process for estimating forecasts is described in a separate memo titled *Alameda Countywide Arterial Plan Travel Demand Forecasting Methods White Paper (December 31, 2014*), which is under review at Alameda CTC . Arterial segment capacity is based on the capacity rates assumed in the Travel Demand Model applied to the number of existing and future year travel lanes along an arterial segment. The volume-to-capacity ratio will be calculated and reliability will be based on the following thresholds:

- Reliable (V/C between 0 – 0.8)
- Less Reliable (V/C between 0.8 – 1.0)
- Unreliable (V/C greater than 1.0)

1.2A – TRANSIT TRAVEL SPEED

Overview

At the request of Alameda County transit agencies, transit travel speed will be included in the performance measure assessment for existing and future year conditions. Transit travel speed influences transit operating costs along an arterial corridor. This measure is facility-specific and will be applied to existing and future year conditions. In addition, the measure will only be applied to Study Network segments that currently provide transit service. Study Network segments that serve as designated transit routes will be prioritized for transit, as such, the performance measure objectives will reflect this modal priority.

Approach

Existing PM peak hour average transit travel speed will be summarized by transit agencies operating transit routes along the Study Network. Existing transit speeds will be estimated using data obtained from on board GPS tracking devices. The data accounts for bus boarding and alighting movements made by patrons at bus stops along a study segment. Future year 2020 and 2040 transit travel speeds will be estimated by applying the existing transit travel speed-to-vehicle congested speed ratio to the estimated future year vehicle congested speed. Where transit improvements are recommended such as signal priority, queue jump lanes or dedicated transit lanes, transit travel speeds will reflect these improvements.

1.2B – TRANSIT RELIABILITY

Overview

Transit reliability provides a general indication of attractiveness of transit for riders along an arterial corridor. This measure is facility-specific and will be applied to existing and future year conditions. In addition, the measure will only be applied to Study Network segments that currently provide transit service. Study Network segments that serve as designated transit routes will be prioritized for transit, as such, the performance measure objectives will reflect this modal priority.

Approach

Existing PM peak hour transit reliability will be summarized by transit agencies operating transit routes along the Study Network. The transit reliability metric is estimated by comparing peak hour transit travel speed to non-peak hour speed.

1.2C – TRANSIT INFRASTRUCTURE INDEX

Overview

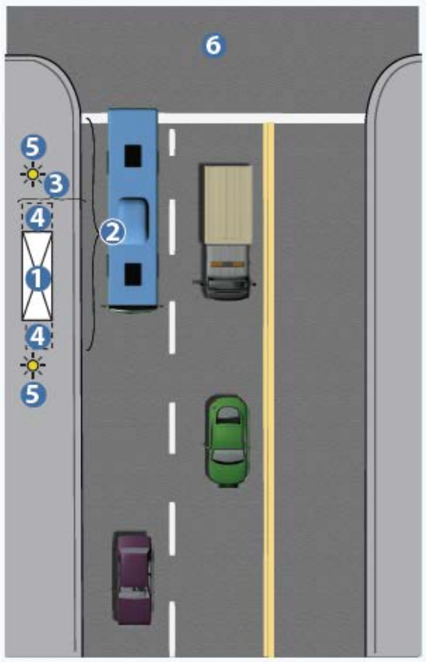
The built environment has a substantial effect on the transit user comfort and peoples' willingness to use transit. The Transit Infrastructure Index performance measure draws on research and existing evaluation tools to assess how well arterials serve transit users. The Transit Infrastructure Index is a facility-specific measure that will be applied to existing and future year conditions. The measure will only be applied to Study Network segments that currently provide transit service. Study Network segments that serve as designated transit routes will be prioritized for transit, as such, the performance objectives will reflect this modal priority.

Approach

Transit Infrastructure Index is rated as poor, good or best on an 12-point rating system based on bus stop design and provided amenities. The point rating system for the Transit Infrastructure Index can be amended if necessary; the consultant team will coordinate with Alameda County transit agencies to modify the methodology as necessary. A customized spreadsheet built into the GIS Tool will be used to calculate the Transit Infrastructure Index for any study segment that provides transit service. The measure will be applied for representative bus stops along a Study Network segment as oppose to each block within a study segment. **Exhibit 1** shows an example of the Transit Infrastructure Index calculation. Curb lane width will also be considered in addition to the bus stop amenities listed in **Exhibit 1**. A point will be scored if the curb lane width is 12 feet or greater. If available, lane width data will be obtained from local jurisdictions; if not, lane width data will be obtained from aerial imagery.

EXHIBIT 1: EXAMPLE TRANSIT INFRASTRUCTURE INDEX CALCULATION

Score one point for each bus stop amenity unless otherwise noted.



① Bus Stop Amenities	Score	
Shelter and Bench	2	
Bench Only, No Shelter	1	
Bus Bulb	1	
Wayfinding/Routing Information	1	
Bicycle Parking	1	
Total		

Enter score from #1 above and score one point for each of items 2-6 that apply.		
Field	Category	Score
1	Bus Stop Amenities	
2	Minimum Bus Stop Length & Red Curb Provided (80')	
3	Minimum Pedestrian Path of Travel (4')	
4	ADA Compliant Bus Stop Area (8' x 5' landing)	
5	Pedestrian-scale Lighting	
6	Far-side Stop	
	TOTAL	

Notes:

1. The Transit Infrastructure Index calculation methodology will be customized on data availability and evaluation needs while ensuring reasonable results.
2. Consultant team will coordinate with Alameda County transit agencies to modify the Transit Infrastructure Index scoring methodology as necessary.

1.3 – PEDESTRIAN COMFORT INDEX

Overview

The built environment has a substantial effect on the pedestrian comfort and peoples' willingness to walk. The Pedestrian Comfort Index performance measure draws on research and existing evaluation tools to assess how well arterials serve pedestrians. The Pedestrian Comfort Index will be a facility specific performance measure applied to existing and future year conditions.

Approach

The Pedestrian Comfort Index is assessed along street segments and crossing frequency is also considered.

Level of comfort is rated as poor, good or best on an assigned point system based on pedestrian facilities and automobile traffic characteristics; pedestrian infrastructure characteristics are generally weighted higher than automobile traffic characteristics when applying the methodology. A customized spreadsheet tool **StreetScore+** developed by Fehr and Peers can be used to calculate level of comfort for any facility.

The street segment calculation assigns point values (from -3 to 3) to the following variables within the built environment:

- Sidewalk width and presence
- Presence of a buffer (landscaped or hardscaped) between sidewalk and roadway
- Roadway classification, average daily vehicle volume, number of travel lanes and speed limit
- Percent heavy vehicle traffic
- Distance between crosswalks

An example of the Pedestrian Comfort Index calculation in **StreetScore+** tool is shown in **Exhibit 2** below. In regards to the **StreetScore+** tool, we will program these functions into the GIS Tool rather than use as a separate Excel process. For the Pedestrian Comfort Index evaluation, a representative location along a Study Network segment will be selected for each segment rather than assessing every block within a study segment.

EXHIBIT 2: EXAMPLE PEDESTRIAN COMFORT INDEX BASED ON STREETSCORE+

StreetScore+

Input instructions:		
1	Enter the name of the roadway segment below.	
2	All input Fields 1-10 (marked in blue) are required.	
3	The Segment LTS output is provided below the input fields.	
4	Refer to "Streetscore+ Tool Overview" and "About" tabs detailed descriptions of inputs and calculations.	
Segment (Two-Way Roadway) Pedestrian Score		
Segment:	Main Street between Oak and Elm	
Field	**Category**	**Input**
1	Location	Commercial Corridor
2	Sidewalk Present	Yes
3	Sidewalk or Clear Walkway Width (feet)	6
4	Buffer Present	Landscaped
5	Roadway Classification	Collector
6	Roadway Volume (2-way) (AADT)	32500
7	Posted Speed Limit	25
8	% Heavy Vehicle Traffic	1.5
9	Number of travel lanes (total for both directions)	4
10	Crosswalk spacing (ft)	200
	Segment (Non-Directional) Comfort Level	**Medium Level of Comfort**
	Segment score (0-16)	**3**

Notes:

1. The Pedestrian Comfort Index calculation methodology will be customized on data availability and evaluation needs while ensuring reasonable results.

1.4 – BICYCLE COMFORT INDEX

Overview

Fehr & Peers created the **StreetScore+** tool: an easy-to-use Microsoft Excel spreadsheet that calculates Levels of Traffic Stress (LTS) scores from a user's unique input. LTS is a methodology developed by Mekuria, Furth and Nixon (2012) that examines the characteristics of city streets and how various aspects can cause stress on bicyclists and affect where they are likely to ride. The Bicycle Comfort Index is a facility-specific measure based on the LTS methodology and will be applied to existing and future year conditions.

Approach

LTS methodology classifies roadway segments into one of four levels of traffic stress, which are termed as LTS1 through LTS4. Groups of cyclists are categorized by how much stress they will tolerate in different environments:

- LTS1: most children can tolerate and feel safe while bicycling.
- LTS2: the mainstream adult population will tolerate and feel safe while bicycling.
- LTS3: cyclists who are considered "enthused and confident" but still prefer having their own dedicated space for riding will tolerate and feel safe while bicycling.
- LTS4: a level tolerated only by those characterized as "strong and fearless", which comprises just 0.5 percent of the population. The high-stress streets that LTS4 groups will ride are those with high speed limits, multiple travel lanes, limited or non-existent bike lanes and signage, and large distances to cross at intersections.

LTS works on the "weakest link" principle, where the traffic stress for a given arterial corridor is dictated by the most stressful portion. This means a full segment receives the score of its lowest-scored portion. For example, a cross-town ride could have large portions of LTS1 and LTS2, but just one section of LTS3 would present a barrier. Only cyclists that could tolerate LTS3 would ride the entire route. So, LTS3 becomes the score for that route. According to the LTS methodology, Study Network segments with posted speed limits of 40 MPH or greater cannot achieve better than an LTS4 rating unless a barrier separated bicycle lane facility is provided with the exception of the "strong and fearless", typical bicyclists experience a low level of comfort riding on high speed arterials that do not provide a barrier between the cyclists and the automobile travel lanes, hence the LTS 4 rating.

An example of the **StreetScore+** tool is shown in **Exhibit 3** below. Pavement Condition Index will also be considered in addition to the built environment attributes shown in **Exhibit 3**; the recurrence of bike lane blockages will not be considered.

EXHIBIT 3: BICYCLE COMFORT INDEX BASED ON STREETSCORE+

StreetScore+

Input instructions:

1	Enter the name of the roadway segment below.
2	All input Fields 1-8 (marked in green) are required. Fields 9 and 10 will activate when the bicycle lane is selected for the mode separation in Field 2.
3	The Segment LTS output is provided below the input fields.
4	Refer to "Streetscore+ Tool Overview" and "About LTS" tabs detailed descriptions of inputs and calculations.

Segment (Two-Way Roadway) LTS

Segment:

Field	Category	Direction 1	Direction 2
		Input	Input
1	Direction	NB	SB
2	Mode separation	Bicycle Lane	Bicycle Lane
3	Is this a residential street?	Yes	
4	Adjacent parking	No	No
5	Lanes in analysis direction	1	1
6	Is there a median?	None or Striped	
7	Is there a center line?	No	
8	What is the prevailing speed? (Use speed limit if prevailing speed not available)	25	25
9	Bike Lane + Parking Width (if bike lane present)	15	15
10	How often do bike lane blockages occur?	Rare	Rare
	Segment LTS Output	**1**	**1**

Notes:

1. The Bicycle Comfort Index calculation methodology will be customized on data availability and evaluation needs while ensuring reasonable results.

1.5 – TRUCK ROUTE ACCOMODATION INDEX

Overview

The Truck Route Accommodation Index was identified to assess the general built environment of the Study Network in regards to accommodating trucks and goods movement. The Truck Route Accommodation Index is a facility-specific measure that will be applied to existing and future year conditions. Study Network segments that serve as designated truck routes will be prioritized for truck and goods movement, as such, the performance measure objectives will reflect this modal priority. This will be coordinated with the Goods Movement Plan.

Approach

For most contexts, truck route accommodation is based on the effective curb lane width, which is a function of lane width. The Truck Route Accommodation Index generates a score total ranging from zero to 10 points (higher point indicates better rating)

An effective curb lane width 12 feet or greater will score 9 points, compared to 5 points if the curb lane width is 11 feet, or 2 points if the curb lane width is 10 feet or less. In urban contexts, a second consideration is on-street parking. On-street parking would only be considered in urban contexts where many businesses are expected to load from the street; as such, one-point will be scored if an urban arterial provides on-street parking or loading/unloading areas.

1.6 – NON-AUTO TRANSPORTATION MODE SHARE

Overview

The Non-Auto Transportation Mode Share indicator was identified to assess existing and future year non-auto transportation (walking, biking, and transit) mode share for each jurisdiction within Alameda County. It is a proxy for increased person-carrying capacity under the assumption that there are few arterials in Alameda County where more travel lanes could be added. So, moving more people in non-auto modes is the primary basis for adding more system capacity. Similarly, it is assumed that increasing the non-auto transportation mode share correlates with lower vehicle miles traveled (VMT) and emissions (e.g., greenhouse gases, particulate matter) per capita. This measure is an area-wide application.

Approach

Non-Auto Transportation Mode Share is a qualitative indicator of proposed improvements. It assesses, based on transit, bike and pedestrian performance measure changes, whether the proposed improvements support increases in these modes. The order of magnitude of changes in Non-Auto Transportation Mode Share will be described in a low, medium or high rating. The indicator will be assessed after preferred short and long-term improvements are identified to ensure that preferred improvements achieve the Plan's vision and goals.

1.7 – PAVEMENT CONDITION INDEX

Overview

The Pavement Condition Index (PCI) is a standard performance measure that assesses the state of good repair for pavement along an arterial segment. PCI is generally monitored by public works staff at each Alameda County jurisdiction. PCI is a facility-specific measure that will be estimated for existing conditions only, but is considered in the context of future year conditions. PCI relates to the efficient use of resources because street overlays, reconstruction or other maintenance tasks are often opportune times to reconfigure street designs. On this basis, streets in poor states of repair are considered opportunities for achieving more cost-effective redesigns. PCI can also be used to assess bicycling conditions along an arterial segment. PCI is a facility-specific performance measure that will be assessed pm the future conditions.

Approach

The Metropolitan Transportation Commission's (MTC) StreetSaver database will be used to obtain existing conditions PCI estimates for Study Network segments within each jurisdiction. Permission to access the PCI data within the StreetSaver database is requested from each local jurisdiction.

Existing Conditions

The Metropolitan Transportation Commission (MTC) maintains a PCI database for the Bay Area region and categorizes PCI using thresholds that were consolidated for use on the Multimodal Arterial Plan as shown in **Figure 1**.

GOAL 2 – ACCESSIBLE AND EQUITABLE

The performance measures for "Connectivity" included under Goal 3 also address 'Accessibility'. Therefore, measures identified for this goal focus on Equitability.

2.1 – BENEFIT TO COMMUNITIES OF CONCERN

Overview

The Benefit to Communities of Concern (CoC) indicator was derived to address social equity and ensure that preferred short and long-term Study Network improvements are adequately identified for Communities of Concern. This measure will be applied area-wide by jurisdiction for future year conditions only.

Approach

Communities of Concern as defined by MTC will be the basis for estimating the performance measure. Each proposed improvement will be assessed for whether it produces benefits to CoCs. After the preferred list of short and long-term improvements is identified, a CoC ratio will be estimated by dividing the number of arterial miles of identified improvements within Communities of Concern by the number arterial miles of all identified improvements benefiting each jurisdiction. For Transit improvements, number of population benefitted within COC versus overall population benefitted will be used. The indicator will be assessed after preferred short and long-term improvements are identified to ensure that preferred improvements achieve the Plan's vision and goals.

GOAL 3 – CONNECTED ACROSS THE COUNTY AND REGION

3.1-3.4 – TRANSIT, PEDESTRIAN, BICYCLE AND TRUCK NETWORK CONNECTIVITY

Overview

Transit, pedestrian, bicycle and truck network connectivity measures were derived to ensure modal network connectivity and continuity across the countywide Study Network. Each measure will be applied at an area-wide level by Planning Area for existing and future year conditions. Connections at the county lines for Planning Areas, north, south, and east will also be reviewed.

Approach

Connectivity measures will be assessed through a mapping exercise. The transit, pedestrian, bicycle and truck networks will be mapped to identify gaps or inconsistencies in the networks based on the performance results by mode. The pedestrian and bicycle assessment will include consideration of relative comfort. Where inconsistencies are identified, alternative cross-section improvements to close modal gaps and provide complete networks by mode will be presented to jurisdictions for consideration.

GOAL 4 EFFICIENCT USE OF RESOURCES

4.1 – INFRASTRUCTURE OPERATING COST EFFECTIVENESS

Overview

The Operating Cost Effectiveness performance measure was derived to assess the relative maintenance and operating costs of proposed cross-sectional improvements along a Study Network segment compared to the maintenance and operating costs of the existing cross-section along the same segment. This is a facility-specific measure applied to future year conditions only.

Approach

The methodology to estimate the Operating Cost Effectiveness is based on the ratio of maintenance and operating costs of proposed improvements to existing facility costs:

- Develop unit operating costs for cross-sectional elements, including maintenance costs
- Estimate operating costs to maintain existing cross-section (O_E)
- Estimate operating costs to maintain recommended cross-sectional improvements (O_P)
- Operating Cost Effectiveness = O_P/O_E

The Operating Cost Effectiveness measure will be used to identify short and long-term Study Network improvements that minimize relative operating costs. Since this measure focuses on physical infrastructure maintenance and operations, it will not account for transit operating costs.

4.2 – IMPLEMENTATION FEASIBILITY SCORE

Overview

The Implementation Feasibility Score indicator was identified to gauge the general feasibility of implementing recommended short and long-term Study Network improvements. The Implementation Feasibility Score is a facility-specific indicator applied to future year conditions only.

Approach

The methodology is based on a zero to three point scale, zero being most feasible and four being the least feasible based on the following variables:

- Travel lane removal required (yes = 1 pt, no = 0 pts)
- Parking removal required (yes = 1 pt, no = 0 pts)

- Curb changes required (yes = 1 pt, no = 0 pts)

The higher the Implementation Feasibility Score, the more challenging it will be to implement recommended Study Network improvements. The indicator may potentially be used in prioritizing preferred short and long-term improvements.

4.3 – COORDINATED TECHONOLOGY

Overview

The Coordinated Technology indicator was identified to assess level of ITS infrastructure along the Study Network as it will improve the performance of the network at a relatively low cost. The indicator is facility-specific and will be applied to existing and future year conditions.

Approach

The methodology is based on a zero to four point scale based on the level of ITS investment defined by the built infrastructure. Existing and planned future levels of ITS infrastructure are identified based on the following general categories:

- 0: no ITS infrastructure

- 1: basic investment ITS network
- 2: medium investment ITS network
- 4: high investment ITS network

The level of ITS infrastructure pertaining to each category listed above will be defined later during the Plan development process with the help of Iteris, who is developing traffic management strategies and recommendations for inclusion in the Plan. The ITS infrastructure assessment will also include coordination between jurisdictions and/or Caltrans and different operators, as appropriate.

4.4 – PROPERTY VALUE INDEX

Overview

The Property Value Index was identified to assess benefits/disbenefits to adjacent property of transportation infrastructure improvements within the built environment. This indicator is facility-specific and will be applied to future year conditions only.

Approach

The Property Value Index will assess general changes in residential and commercial property values along a Study Network segment based on recommended short and long-term improvements. The methodology to assess general changes in property values is in the process of being developed by Strategic Economics in coordination with Fehr & Peers and Alameda CTC staff. The indicator will be assessed after preferred short and long-term improvements are identified to ensure that preferred improvements achieve the Plan's vision and goals.

GOAL 5 – SAFE, HEALTHY AND VIBRANT

5.1 – COLLISION RATES

Overview

The collision history will be assessed for each Study Network segment under existing conditions only, but will be considered in the context of improvement recommendations as arterial segments with high collision rates will be more likely to be included in the preferred improvement list.

Approach

The collision history for the latest three-year period will be obtained for each Study Network segment using the California Highway Patrol's Statewide Integrated Traffic Records System (SWITRS). Collision rates and severity (fatality rates) will be calculated and summarized for each Study Network segment. Using the number of total collisions and fatalities reported and existing average daily traffic (ADT), collision rates will be calculated based on the number of collisions per million vehicle miles.

Existing Conditions

The total collision rates for Existing Conditions are shown in **Figure 2**. Collision history data for the latest three-year period was obtained for each Study Network segment using the California Highway Patrol's Statewide Integrated Traffic Records System (SWITRS). Using the number of total collisions reported and existing average daily traffic (ADT), collision rates were calculated based on the number of collisions per million vehicle miles.

5.2 – DEMAND FOR ACTIVE TRANSPORTATION

Overview

The Demand for Active Transportation indicator was identified to assess the potential for shifting people from driving vehicles to active transportation modes such as walking, biking and transit. The measure will be applied at an area-wide level by jurisdiction for future year conditions only.

Approach

The Demand for Active Transportation indicator will qualitatively assess the potential of shifting from driving to active transportation modes on a low, medium or high scale. Proposed short and long-term Study Network active transportation improvements will be assessed at an area wide scale and the Demand for Active Transportation mode shift will be estimated for each Alameda County jurisdiction. The indicator will be assessed after preferred short and long-term improvements are identified to ensure that preferred improvements achieve the Plan's vision and goals.

5.3-5.4 – VMT PER CAPITA AND GHG PER CAPITA

Overview

The Vehicle Miles Traveled (VMT) per capita and Greenhouse Gas Emissions (GHG) per capita indicators were identified to assess the effectiveness of the Arterial Plan's proposed short and long term improvements on the Study Network in reducing VMT and GHG to protect the environment and respond to SB 375. These indicators will be applied at an area-wide level for the county for existing and future year conditions.

Approach

VMT will be assessed using the Alameda Countywide Travel Demand Model. GHG will be estimated using the GHG Estimator, a tool based on Emissions Factors (EMFAC) model developed by California Air Resources Board, added to the Alameda Countywide Travel Demand Model. These indicators will be assessed after preferred short and long-term improvements are identified to ensure that preferred improvements achieve the Plan's vision and goals in reducing VMT and GHG.

OTHER CONSIDERATIONS

Performance measures or indicators specifically relating to parking management or transportation demand management (TDM) policies are not proposed as part of the Multimodal Arterial Plan. Parking management and TDM strategies will however be recommended for each Alameda County jurisdiction as part of the Plan development. Although specific parking performance measures are not proposed, on-street parking will be assessed by various other performance measures listed above, such as the Pedestrian Comfort Index, Bicycle Comfort Index and Truck Route Accommodation Index. Similarly, existing TDM policies and strategies adopted by Alameda County jurisdictions will be inventoried. The consultant team will review existing TDM practices by jurisdiction and recommend additional strategies that build upon existing ones.

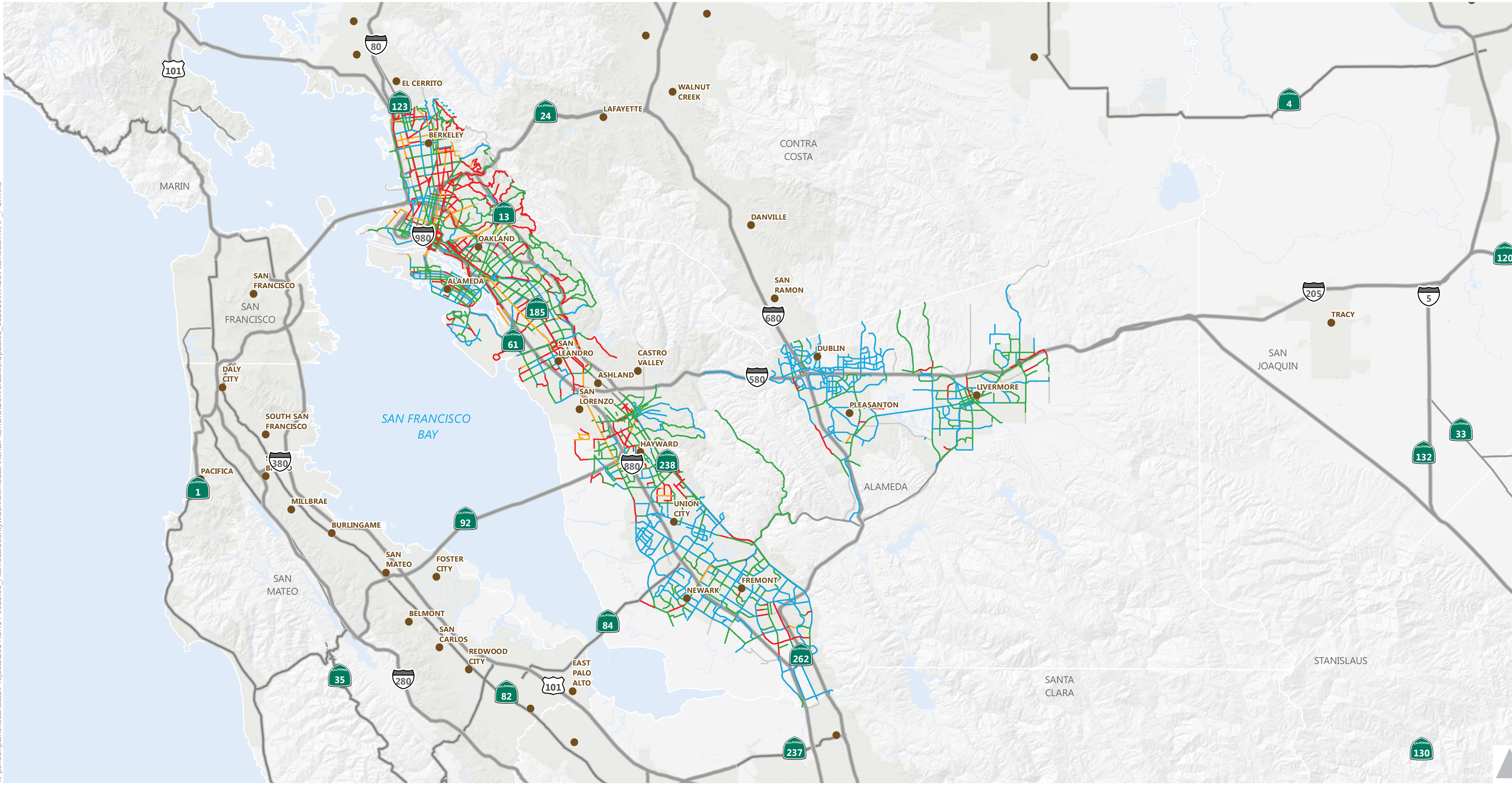
NEXT STEPS

The consultant team and Alameda CTC staff will present the final vision, goals and performance measures for approval at the February 5th ACTAC and February Planning Policy and Legislation Committee and Commission meetings. After receiving approval on the performance measures, the consultant team will move forward with assessing Study Network existing conditions.

Attachments:

Figure 1 – Pavement Condition Index (PCI) Ratings – Existing Conditions

Figure 2 – Collision Rates – Existing Conditions



Pavement Condition Index Rating

- At Risk
- Poor
- Good
- Very Good

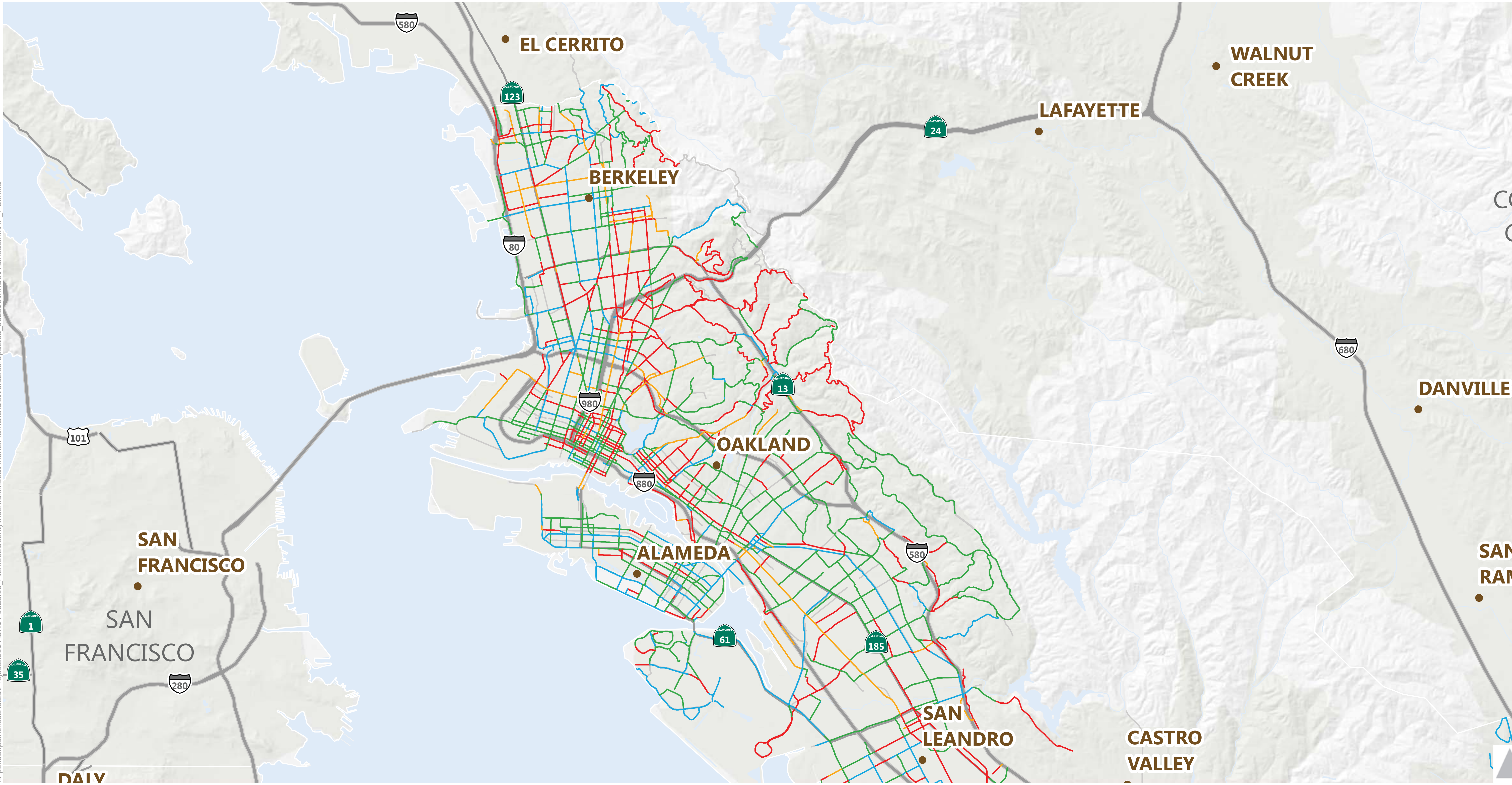
Alameda Countywide Multimodal Arterial Plan

ALAMEDA County Transportation Commission

Figure 1A

Pavement Condition Index (PCI) Ratings - Existing Conditions - Alameda County

\\Fpok03.fpainc.local\data\Projects\2014\OK14-0023.00_AlamedaCountywideMultimodalArterialPlan\GIS\Deliverables\Updated_052516\MXDs\AlamedaMMAP_PCI.mxd



Pavement Condition Index Rating

- At Risk
- Poor
- Good
- Very Good

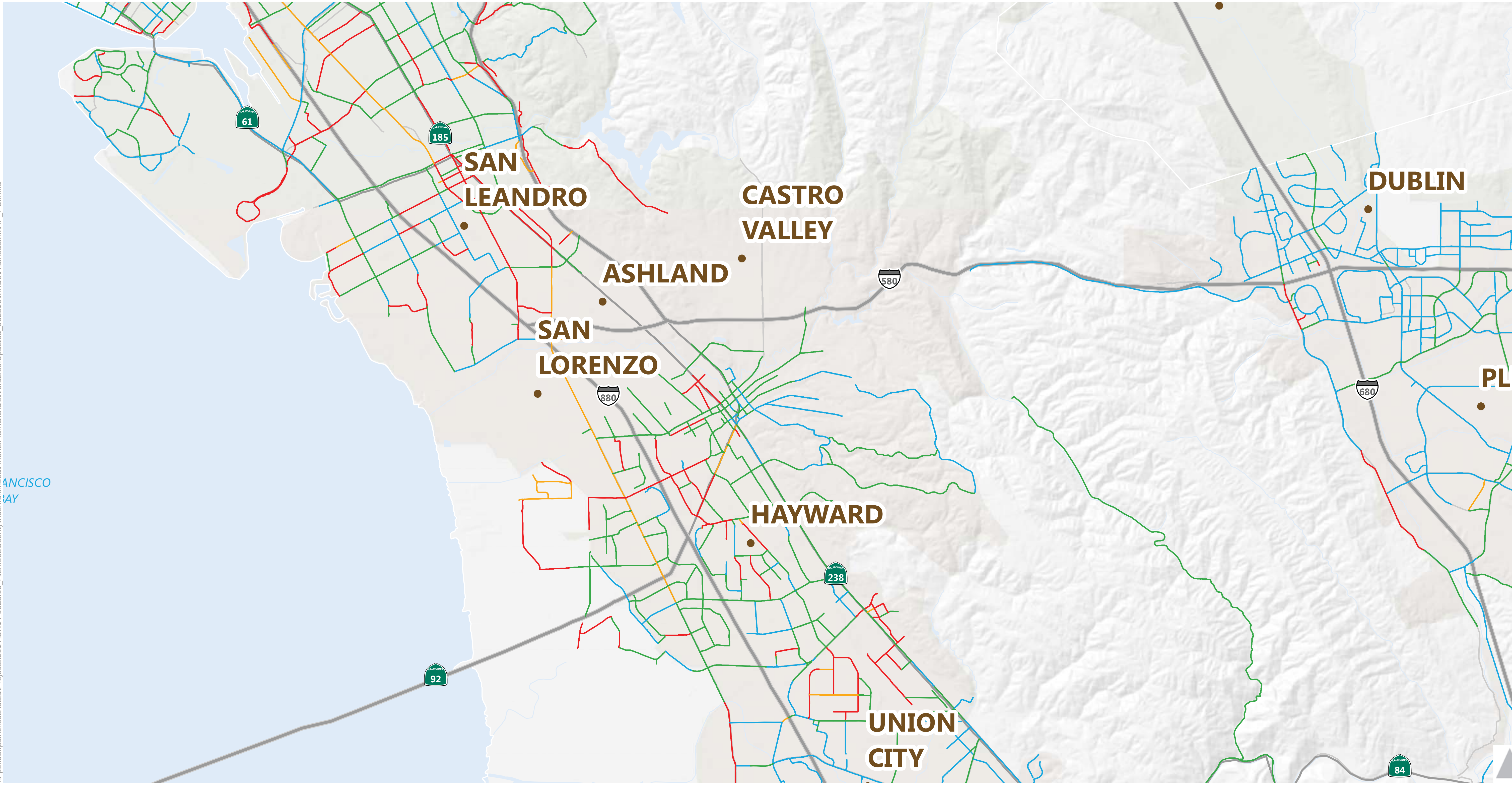
Alameda Countywide Multimodal Arterial Plan

ALAMEDA County Transportation Commission

Figure 1B

Pavement Condition Index (PCI) Ratings - Existing Conditions - North County

\\Fpok03.fpainc.local\data\Projects\2014\OK14-0023.00_AlamedaCountywideMultimodalArterialPlan\GIS\Deliverables\Updated_052516\MXDs\AlamedaMMAP_PCI.mxd



Pavement Condition Index Rating

- At Risk
- Poor
- Good
- Very Good

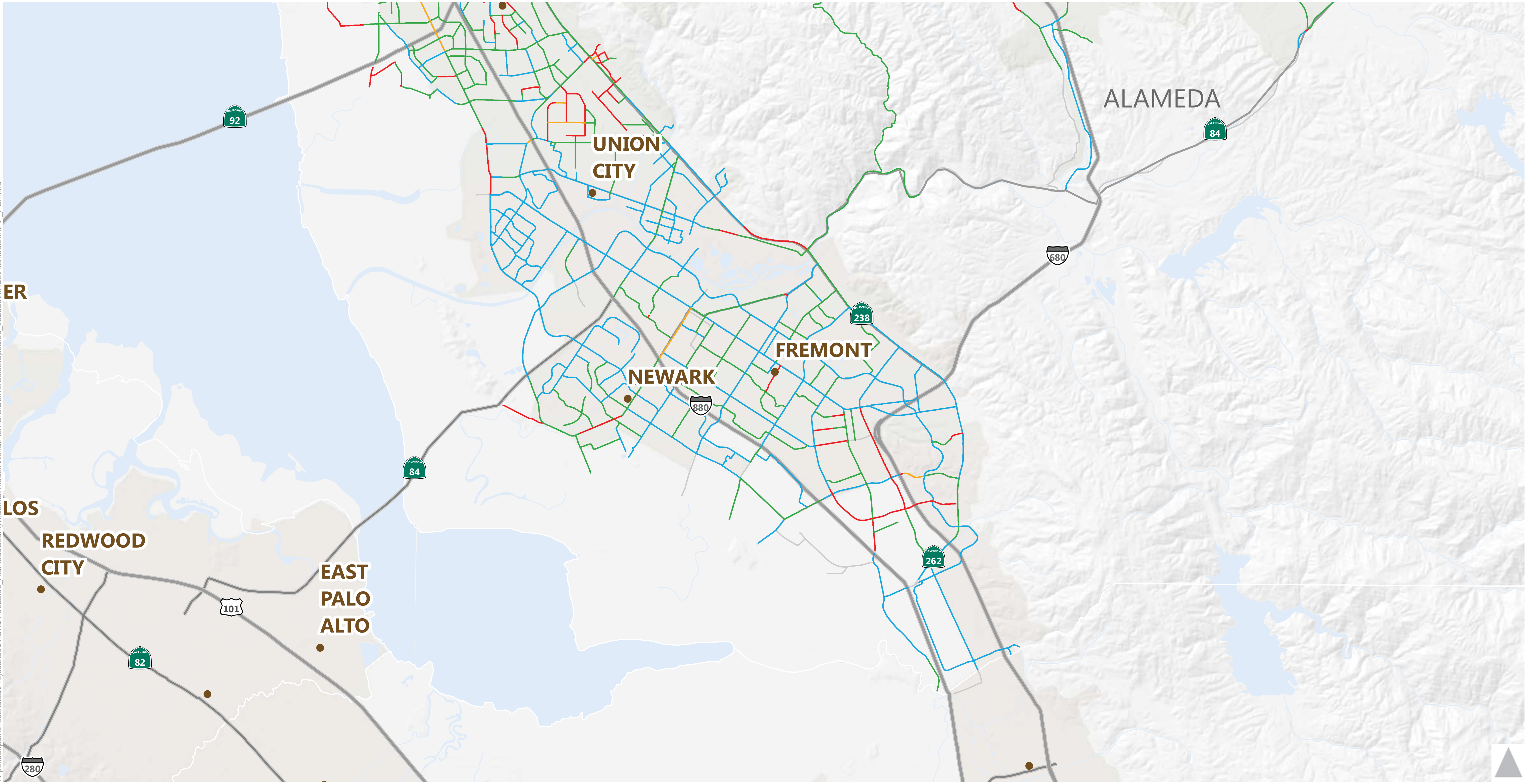
Alameda Countywide Multimodal Arterial Plan

ALAMEDA County Transportation Commission

Figure 1C

Pavement Condition Index (PCI) Ratings - Existing Conditions - Central County

\\Fpok03.fpainc.local\data\Projects\2014\OK14-0023.00_AlamedaCountywideMultimodalArterialPlan\GIS\Deliverables\Updated_052516\MXDs\AlamedaMMAP_PCI.mxd



Pavement Condition Index Rating

- At Risk
- Poor
- Good
- Very Good

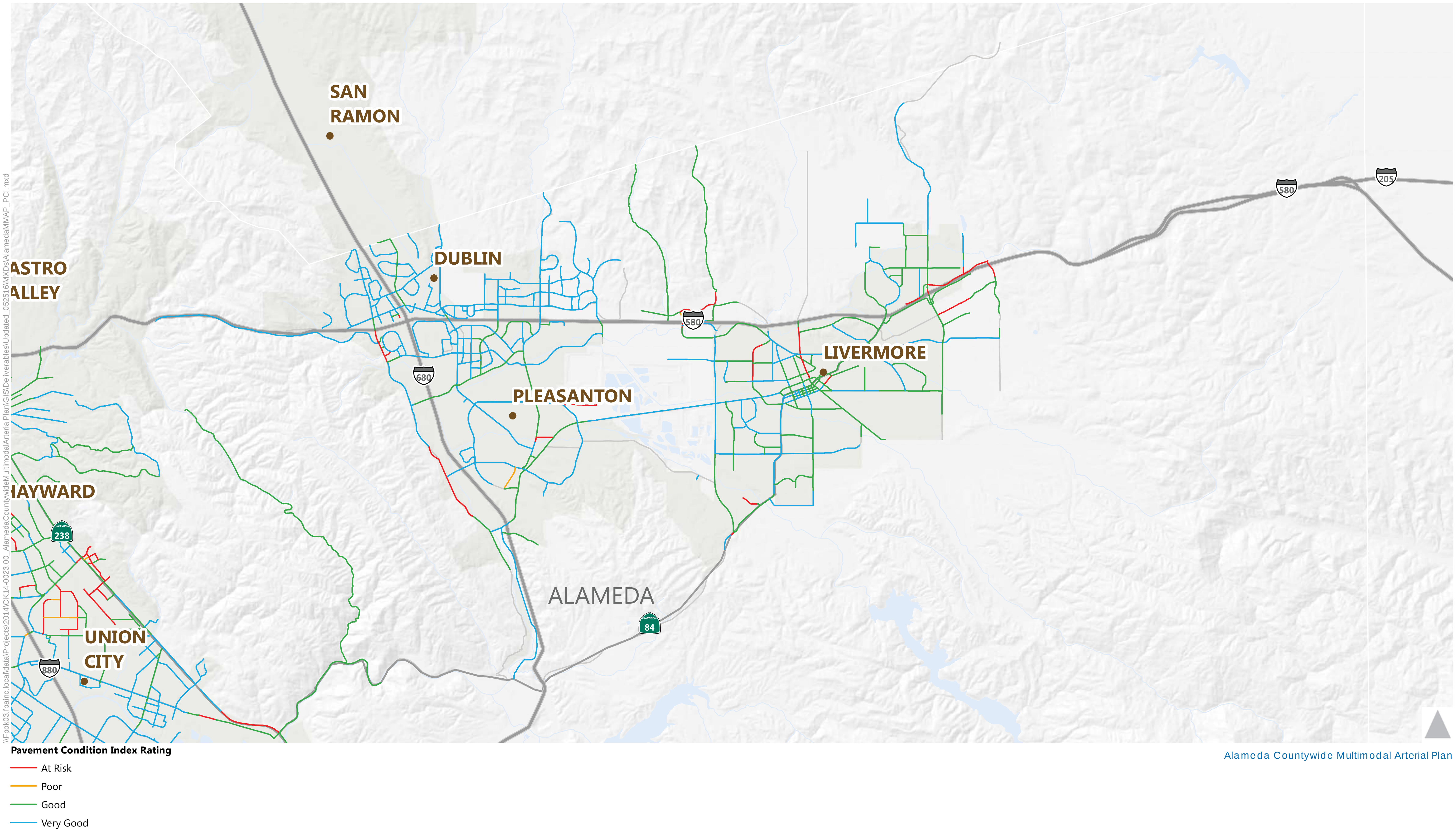
Alameda Countywide Multimodal Arterial Plan

ALAMEDA County Transportation Commission

Figure 1D

Pavement Condition Index (PCI) Ratings - Existing Conditions - South County

\\Fpok03.fpainc.local\data\Projects\2014\OK14-0023.00_AlamedaCountywideMultimodalArterialPlan\GIS\Deliverables\Updated_052516\MXDs\AlamedaMMAP_PCI.mxd

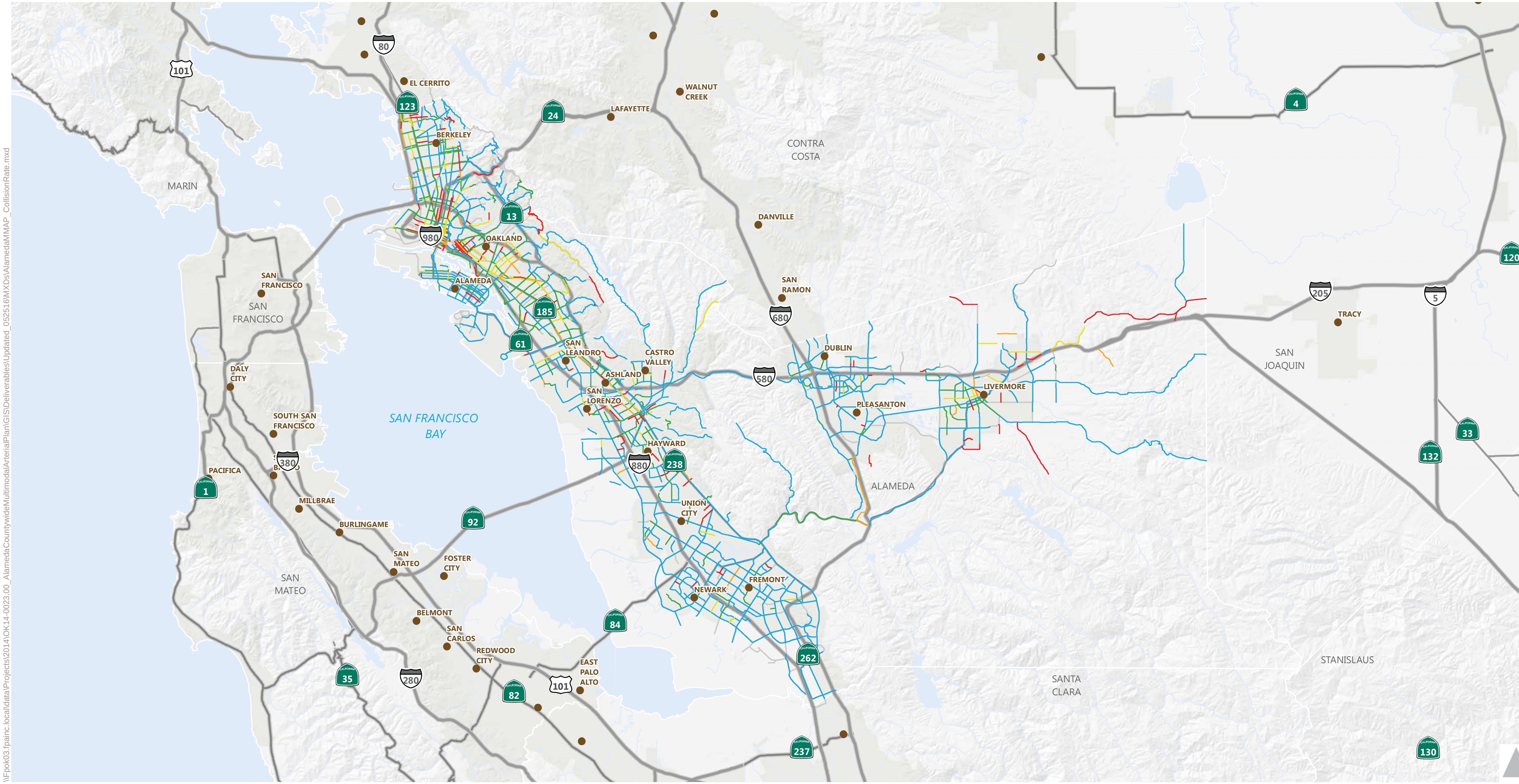


Alameda Countywide Multimodal Arterial Plan

ALAMEDA County Transportation Commission

Figure 1E

Pavement Condition Index (PCI) Ratings - Existing Conditions - East County



Collision Rates

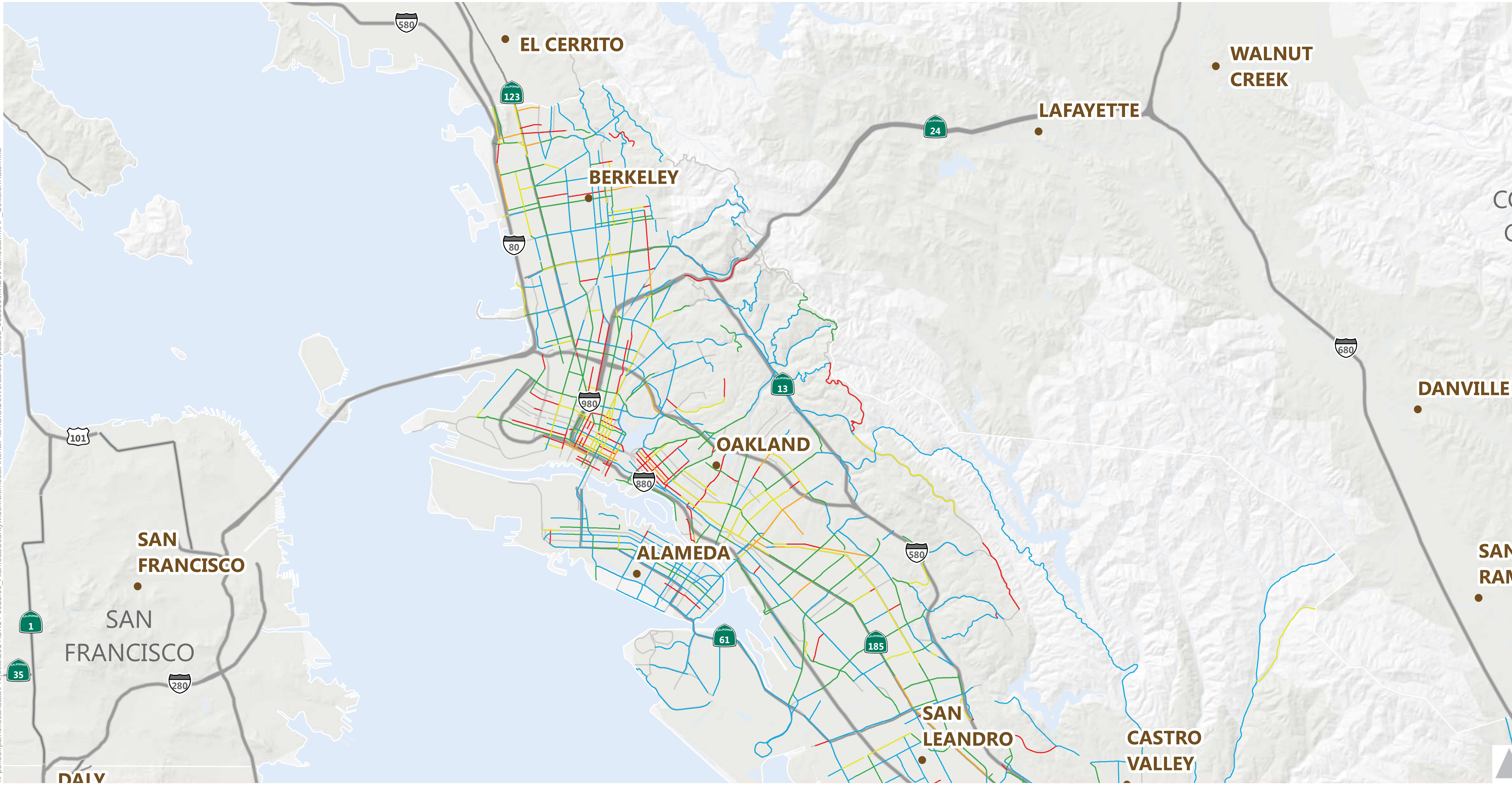
- < 1.0
- 1 - 2
- 2 - 3
- 3 - 4
- > 4.0

Alameda Countywide Multimodal Arterial Plan

Figure 2A

Collision Rates (2009-2012) - Alameda County

\\Fpok03.fpainc.local\data\Projects\2014\OK14-0023.00_AlamedaCountywideMultimodalArterialPlan\GIS\Deliverables\Updated_052516\MXDs\AlamedaMMAP_CollisionRate.mxd



\\Fpok03.fpainc.local\data\Projects\2014\OK14-0023.00_AlamedaCountywideMultimodalArterialPlan\GIS\Deliverables\Updated_052516\MXDs\AlamedaMMAP_CollisionRate.mxd

Collision Rates

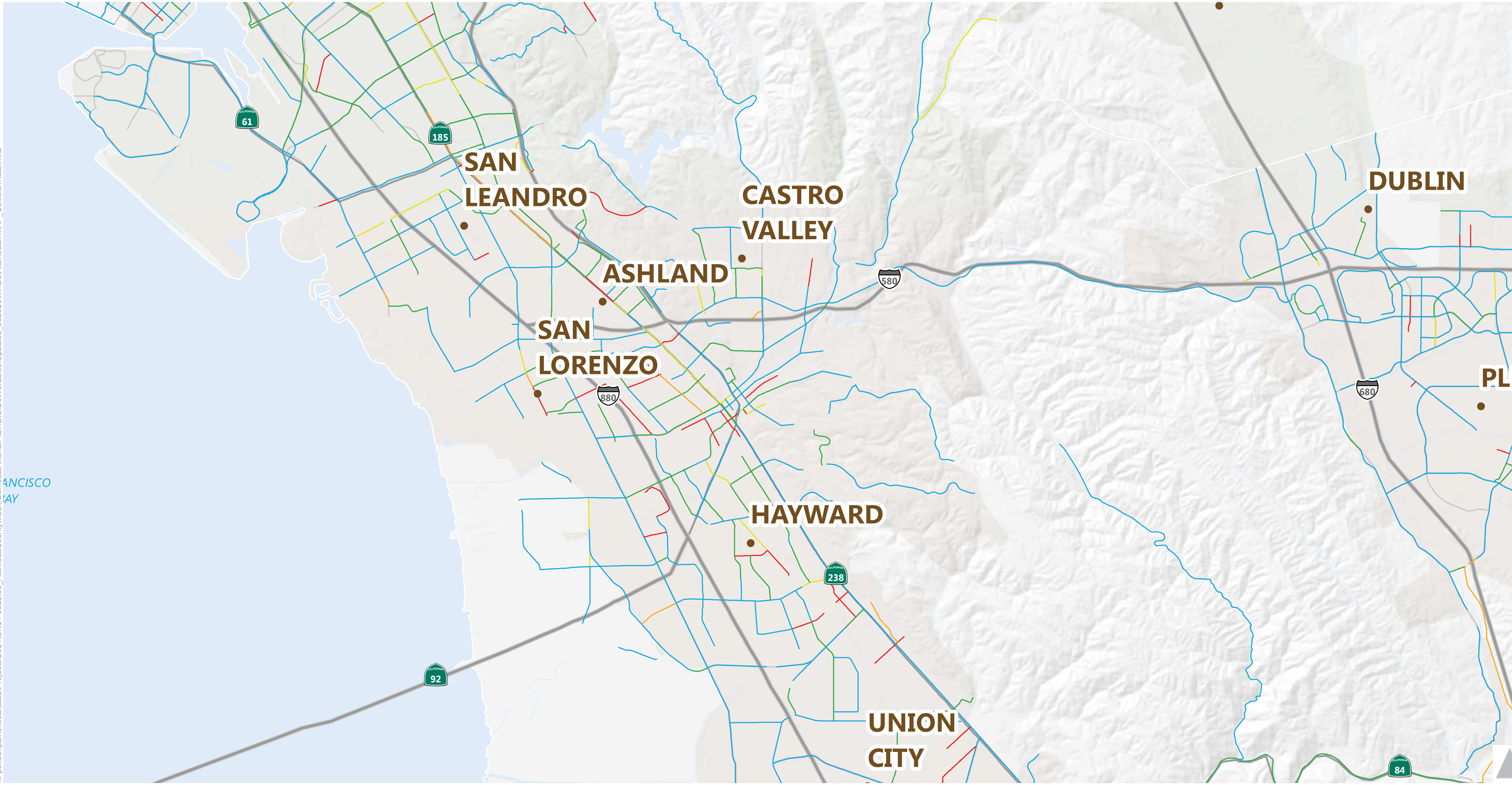
- < 1.0
- 1 - 2
- 2 - 3
- 3 - 4
- > 4.0

ALAMEDA County Transportation Commission

Alameda Countywide Multimodal Arterial Plan

Figure 2B

Collision Rates (2009-2012) - North County



\\Fpok03.fpainc.local\data\Projects\2014\OK14-0023.00_AlamedaCountywideMultimodalArterialPlan\GIS\Deliverables\Updated_052516\MXDs\AlamedaMMAP_CollisionRate.mxd

Collision Rates

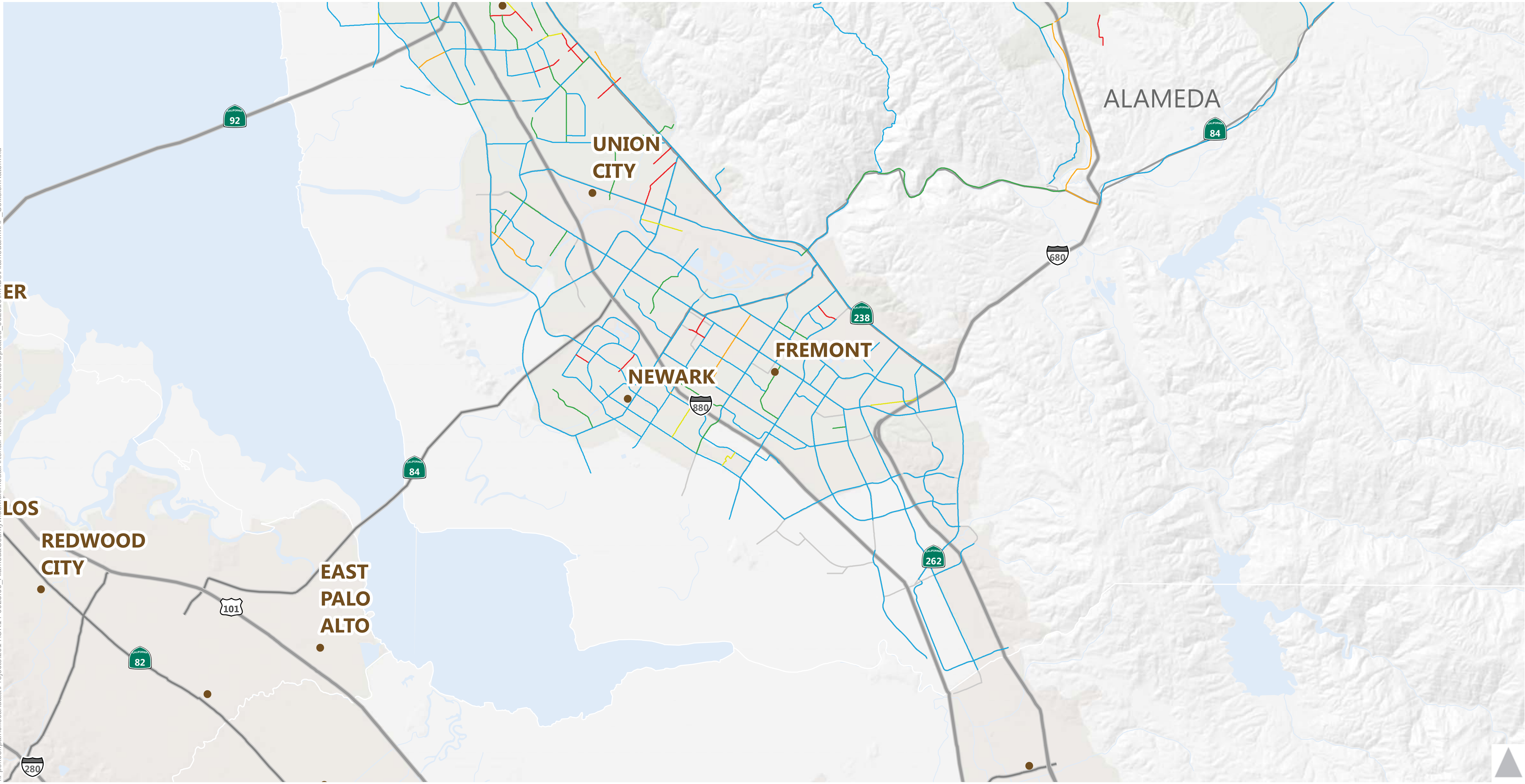
- < 1.0
- 1 - 2
- 2 - 3
- 3 - 4
- > 4.0

ALAMEDA County Transportation Commission

Alameda Countywide Multimodal Arterial Plan

Figure 2C

Collision Rates (2009-2012) - Central County



\\Fpok03.fpainc.local\data\Projects\2014\OK14-0023.00_AlamedaCountywideMultimodalArterialPlan\GIS\Deliverables\Updated_052516\MXDs\AlamedaMMAP_CollisionRate.mxd

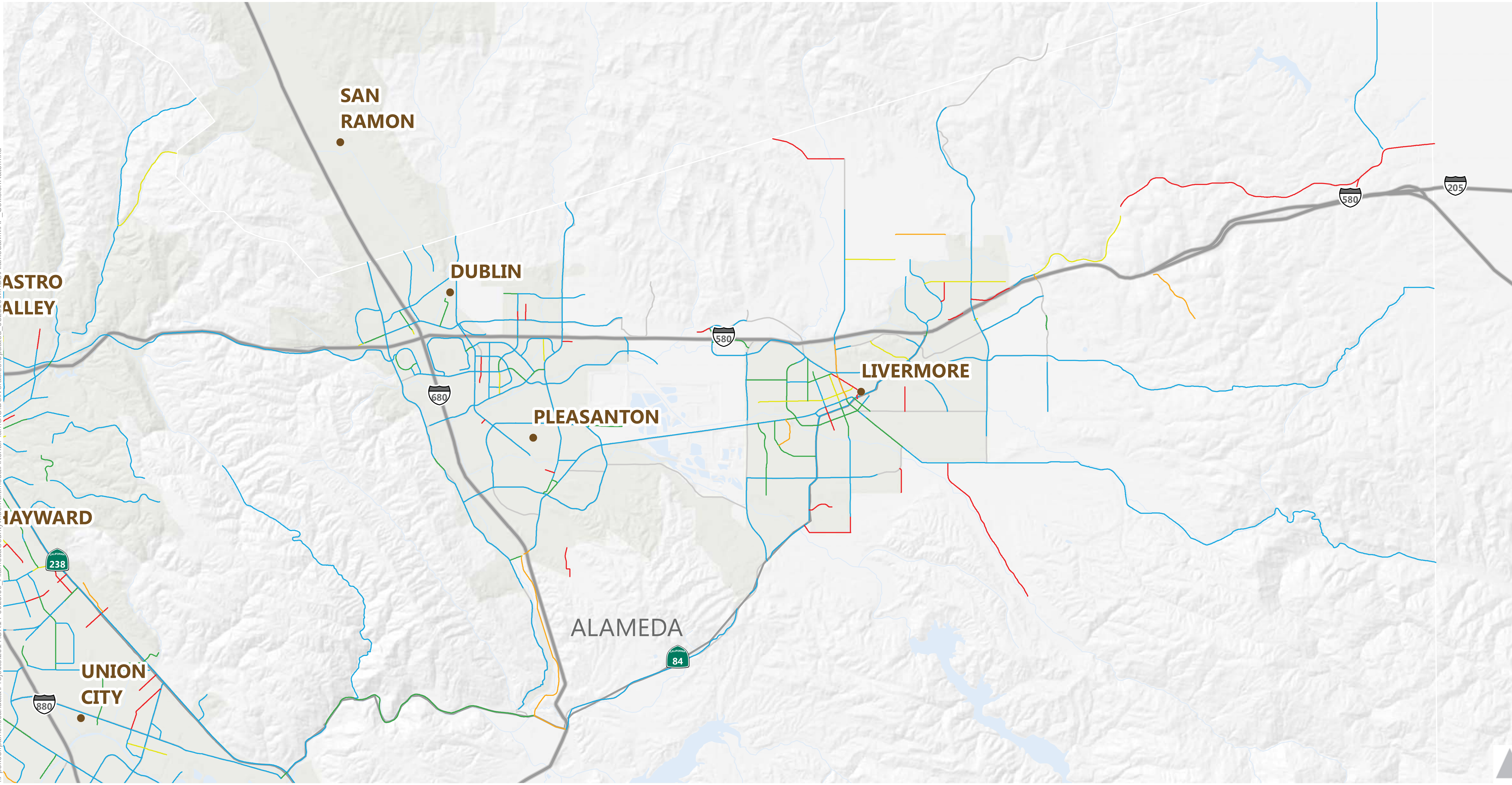
Collision Rates

- < 1.0
- 1 - 2
- 2 - 3
- 3 - 4
- > 4.0

ALAMEDA County Transportation Commission

Figure 2D

Collision Rates (2009-2012) - South County



Collision Rates

- < 1.0
- 1 - 2
- 2 - 3
- 3 - 4
- > 4.0

Alameda Countywide Multimodal Arterial Plan

Figure 2E

Collision Rates (2009-2012) - East County

\\Fpok03.fpainc.local\data\Projects\2014\OK14-0023.00_AlamedaCountywideMultimodalArterialPlan\GIS\Deliverables\Updated_052516\MXDs\AlamedaMMAP_CollisionRate.mxd