ALAMEDA COUNTYWIDE TRAVEL MODEL

PLAN BAY AREA 2040 UPDATE

Final Documentation Report

January, 2019

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SUMMARY

The Alameda County Transportation Commission (Alameda CTC) maintains and updates a countywide travel demand model in compliance with Congestion Management Program (CMP) legislation. The CMP legislation requires every CMA, in consultation with the regional transportation planning agency (the Metropolitan Transportation Commission (MTC) in the Bay Area), cities, and the county, to develop a uniform database on traffic impacts for use in a countywide travel demand model. Further, the legislation mandates the countywide model to be consistent with the assumptions of the regional travel demand model developed by MTC including the most current land use and socioeconomic database adopted for regional transportation planning.

The primary objective of the update of the Alameda Countywide travel demand model is to ensure that transportation planning in Alameda County is as consistent as possible with the assumptions and findings of the Bay Area regional travel model. The MTC regional travel model was updated for the Regional Transportation Plan, Plan Bay Area 2040, which was adopted in 2017. The 2018 update of the Alameda Countywide travel model is intended to provide consistency with the travel forecasting used for Plan Bay Area 2040.

KEY FEATURES

The Alameda Countywide model is a trip-based travel demand model. It is based on the prior trip-based MTC regional travel model, but has been adjusted to provide consistency of results with the newer MTC activity-based Model One used for evaluation of Plan Bay Area 2040.

Inputs

The primary inputs to the Alameda Countywide travel model include:

- Land use data (population, housing, employment, school enrollment, income and age stratifications), consistent with Plan Bay Area 2040 at the county level but reallocated to more detailed geography (transportation analysis zones) within Alameda County based on input from local jurisdictions
- Transportation networks, including major roads (freeways, arterial streets, most collector streets and some local streets), transit routes and bicycle facilities
- Pricing information, including average auto operating costs, parking costs, bridge tolls, express lane tolls, and transit fares
- Trip generators other than population and employment, including airport passengers and truck activity at the Port of Oakland

Outputs

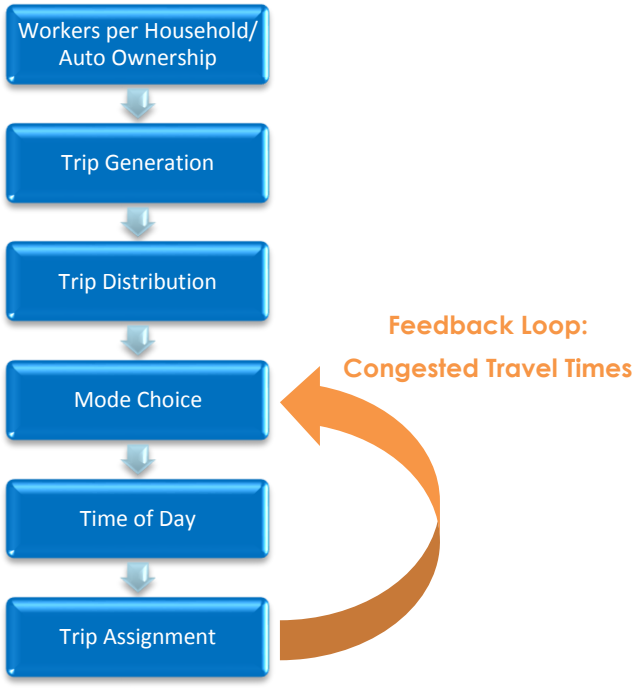
The key outputs from the travel model include:

- Traffic volumes on road segments for different time periods (daily totals, peak and off-peak periods, peak hours)
- Transit boardings by transit route, operator and/or station (for rail services), peak and off-peak periods
- Estimated bicycle volumes, both on roads and on separate bicycle paths
- System performance measures such as vehicle-miles of travel (VMT), vehicle-hours of travel (VHT), and average speeds by road facility type
- Forecasts of aggregate travel statistics by county or subarea, such as total trips by purpose, percentages of trips by travel mode, percentages of trips by travel time or distance, etc…

Model Process

The model uses several calculation steps as summarized in Figure 1. Each step is described in more detail in Section 5 of the report.

Figure 1: Model Process



The model includes an iterative feedback loop to ensure that travel choices are predicted based on congested travel conditions. After traffic is assigned to the road network, congested travel times are calculated based on traffic congestion, and these congested times are brought back to the mode choice step which considers the attractiveness of auto versus transit for each trip. The loop is repeated five (5) times to ensure stable results.

Calibration and Validation

Each step of the model process was calibrated by adjusting formulas and parameters so that each step will replicate observed data from travel surveys. The model calibration is described in more detail in Appendix B.

Once each step is calibrated, the model is validated by comparing model output to observed traffic and transit flows. The year 2010 was used for model validation, as a comprehensive database of traffic and transit counts is available for that year. Model validation is described in more detail in Section 6. Key findings from the model validation are:

- The model estimates of 2010 traffic are within the validation criteria on all 16 "screenlines" for the PM peak period and PM peak hour, on 15 of 16 screenlines in the AM peak period and AM peak hour, and on 14 of 16 screenlines for the 24-hour daily time period.
- The model is within 4 percent of total 2010 daily transit boardings, and is particularly close on BART, AC Transit and other rail services in Alameda County. The model tends to overestimate ridership on local shuttle services.
- At BART stations, the model has varying results when estimated ridership is compared to station counts at individual stations, but is generally within 10 percent of counts for groups of adjacent stations.

KEY UPDATES

The important components of the 2018 model update included:

- Land use and demographic inputs consistent with MTC Plan Bay Area 2040 as approved in 2017
- Review by local agency staff of allocations of land use within each jurisdiction, with adjustments to the allocations where requested for consistency with local planning
- Updates to representation of AC Transit and Wheels bus routes to reflect current service
- Future road and transit improvements consistent with Plan Bay Area 2040, particularly within Alameda County and on major roads outside of Alameda County
- Updated pricing inputs consistent with MTC Plan Bay Area 2040, including bridge tolls, express lane tolls and parking costs

SELECTED CONSISTENCY RESULTS

A Model Consistency Report was prepared to provide the deliverables requested by the Metropolitan Transportation Commission (MTC) to establish that the Alameda Countywide travel demand model applies a regionally consistent model set for the development of travel demand forecasts. The detailed consistency findings are described in Section 8 of the report. Key findings include:

- Land use input totals (population, housing, employment) are within acceptable ranges for all 9 Bay Area counties for the 2010 base year and 2040 forecast year.

- There are differences in the 2040 forecasts of households with zero, one, or two or more vehicles owned; however, these differences did not appear to affect the mode choice consistency.
- The total number of 2040 daily trips in the Alameda Countywide model is within 0.5 percent of the number of daily trips in Plan Bay Area 2040.
- Most key county-to-county commute trip proportions are within six percent of the Plan Bay Area 2040 estimates.
- The percentages of trip by mode are very close for work trips and total trips. The Alameda Countywide model forecasts higher shares of bike trips, possibly due to the inclusion of the attractiveness of improved bike facilities in the mode choice analysis.
- The Alameda Countywide model assigns similar total VMT on a daily basis (within 3 percent) and is close to Plan Bay Area 2040 forecasts during the AM peak period (1.2 percent).
- The Alameda Countywide model has higher regional vehicle-hours of travel (VHT) estimates than Plan Bay Area 2040.
- 2040 forecast average speeds in the Alameda Countywide model are lower than Plan Bay Area 2040, by 8 to 12 percent in the peak periods, and by an average of 7.2 percent lower for the daily time period.

MTC staff have reviewed the complete consistency report and verified that the Alameda Countywide model is generally consistent with Plan Bay Area 2040.

1. INTRODUCTION

The Alameda County Transportation Commission (Alameda CTC) maintains and updates a countywide travel demand model in compliance with Congestion Management Program (CMP) legislation. The CMP legislation requires every CMA, in consultation with the regional transportation planning agency (the Metropolitan Transportation Commission (MTC) in the Bay Area), cities, and the county, to develop a uniform database on traffic impacts for use in a countywide travel demand model. Further, the legislation mandates the countywide model to be consistent with the assumptions of the regional travel demand model developed by MTC including the most current land use and socioeconomic database adopted for regional transportation planning.

IN THIS REPORT>>

- Descriptions of model components
- Summary of model process
- Calibration and validation to observed data
- Forecast results
- Documentation of consistency with Plan Bay Area 2040 modeling

The Alameda Countywide model has its origin in the MTC BAYCAST-90 regional trip-based model and has been regularly updated at minimum every four years following each update of the MTC Regional Transportation Plan (RTP).

1.1 OBJECTIVES AND REQUIREMENTS OF THE MODEL UPDATE

The primary objective of the update of the Alameda Countywide travel demand model is to ensure that transportation planning in Alameda County is as consistent as possible with the assumptions and findings of the Bay Area RTP and regional travel model. The MTC regional travel model was updated for the Regional Transportation Plan, Plan Bay Area 2040, which was adopted in 2017. The 2018 update of the Alameda Countywide travel model is intended to provide consistency with the travel forecasting used for Plan Bay Area 2040.

Use of the Alameda Countywide Travel Demand Model

The CMP statute assigns responsibility to CMAs to develop a travel demand model "that will be used by local jurisdictions to determine the quantitative impacts of development on the circulation system." The Alameda Countywide Travel Demand Model is typically used to determine traffic volumes, transit ridership, and other information for future years. Jurisdictions are required to use the most current version of the Alameda Countywide Travel Demand Model for the CMP Land Use Analysis Program. Alameda CTC amended the CMP requirements in 1998, so that local jurisdictions are responsible for applying the travel model. All local jurisdictions have signed Master Use Agreements with Alameda CTC that outline the procedure for requesting the model for a specific application.

Per the CMP statute, jurisdictions may also use an approved subarea travel demand model. Alameda CTC has responsibility for approving subarea models based on whether these models demonstrate adequate consistency with the countywide model.

1.1. SUMMARY OF KEY FEATURES

The Alameda Countywide Transportation Demand Model generally follows the processes of the former Metropolitan Transportation Commission (MTC) trip-based BAYCAST model. A new activity-based travel model (Model One) has been implemented at MTC, and the Alameda Countywide model has not incorporated processes from that newer model. However, results are compared between the Alameda Countywide model and MTC Model One to establish consistency.

The Alameda Countywide model directly uses MTC BAYCAST formulas for trip generation, trip distribution, transit travel time analysis, peak period factors by trip purpose and traffic assignment. The mode choice model has been revised to provide further detail on types of transit and recalibrated, although it generally produces similar results as the MTC model when aggregated to the MTC level of detail.

The current version of the model incorporates the Plan Bay Area 2040 transportation investments and land use and includes 2010 as base year and 2020 and 2040 as two future years. The land use allocations were reviewed by the local jurisdictions and modified within certain limitations to maintain overall regional consistency. The Alameda Countywide model produces forecasts that are generally consistent with the travel demand forecasts that MTC has produced for Plan Bay Area 2040 for the Plan horizon year of 2040 and meets the regional model consistency requirements.

Model Calibration and Validation

The current Alameda Countywide model was originally calibrated to 2000 base year travel behavior survey data and then updated as required to achieve a 2010 validation. The model was validated to year 2010 screenline volumes for the AM and PM peak hours, peak periods and daily, and to year 2010 observed transit boardings. Daily transit boardings were validated for the year 2010 at the system level for major regional transit operators (Caltrain, BART, MUNI, VTA and AC Transit) and at the station level for BART stations within Alameda County.

Transportation Analysis Zones (TAZs)

The MTC model includes the nine Bay Area counties. The Alameda Countywide model includes the nine Bay Area counties plus San Joaquin County and the external gateways to and from San Joaquin County. Compared to the MTC model, the Alameda Countywide model has a refined transportation analysis zone (TAZ) system in Alameda County and in the immediately adjacent sections of Santa Clara and Contra Costa Counties. The model uses MTC's regional TAZ system in the remaining six Bay Area counties and includes an aggregated TAZ system for San Joaquin County.

Transportation Networks

The road network is a computerized representation of the street and highway system. It includes freeways, highways, expressways, arterials, collectors, ramps, and local roads. Intelligent transportation system (ITS) attributes can be applied to freeways, expressways, ramps, and arterials to represent benefits of technology such as signal coordination and ramp metering.

Express lane facilities, representing the Plan Bay Area 2040 express lanes system for 2020 and 2040, are included in the network with a toll facility indicator based on the highway corridor segment, direction of travel and peak period. Tolls are represented on a per-mile basis and must be predetermined before each model run.

For transit, individual transit routes are coded for each Bay Area transit operator, representing peak and off-peak service. Travel times for bus routes are scaled from the congested travel times on the corresponding road segments. Enhanced bus services such as bus rapid transit (BRT) are represented by reductions in the travel time factors on routes with bus priority treatments.

The Alameda Countywide model also includes a representation of the bicycle network infrastructure in the base year and forecast years for Alameda County, explicitly representing existing and future bike lanes and bike paths in travel time estimation, mode choice and bicycle assignments.

Trip Purposes

The Alameda Countywide model uses the following trip purposes:

- Home-based work trips (four income quartiles)
- Home-based shop/other trips
- Home-based social/recreation trips
- Non-home-based trips
- Home-based school: grade school, high school, and college trips
- Four categories of truck trips: Very Small, Small, Medium and Combo (heavy duty)

Pricing

The Alameda Countywide model uses MTC pricing assumptions for transit fares, bridge tolls, parking charges, express lane tolls and auto operating costs as assumed in MTC's Plan Bay Area 2040. All prices are expressed in year 1990 dollar values in the models. The 2040 forecasts produced by the Alameda Countywide model also assume, consistent with MTC, that only 3+ person carpools will be allowed to travel in the express/HOV lanes without a charge for the entire model region.

Auto Ownership

The Alameda Countywide model applies the BAYCAST auto ownership models to estimate the number of households with 0, 1, and 2+ autos by four income groups in each traffic analysis zone. The auto ownership models were recalibrated in 2014 to the 2005-2009 American Community Survey to match workers per household and auto ownership by county.

Mode Choice

The Alameda Countywide model uses a nested-logit mode choice model for all trip purposes. Beyond the traditional mode choices, the model further stratifies the transit choices using a nesting structure for transit submodes of local bus, express bus, light rail, heavy rail and commuter rail.

Airport Model

Separate trip generation, trip distribution and mode choice models are applied for airport passenger trips at each of the three major regional airports (San Francisco, Oakland, San Jose). The airport passenger trips are stratified by residence (Bay Area resident versus visitor) and type of trip (business versus personal). The airport passenger trips are combined with other trips prior to assignments to the networks.

Traffic Assignments

The traffic assignments produce volumes for four time periods:

- AM peak 4-hour period (6 AM to 10 AM)
- PM peak 4-hour period (3 PM to 7 PM)
- Midday 5-hour period (10 AM to 3 PM)
- Evening 11-hours (7 PM to 6 AM).

The initial AM and PM peak 4-hour period assignments are used to estimate congestion levels as input to the toll lane assignment model. The AM and PM 4-hour trips are then reassigned to the network using a toll choice model that estimates how many single-occupant and two-occupant vehicles will choose to pay tools to use express lanes on segments where they are available.

The four time period volumes are then added together to develop daily vehicle volumes.

The Alameda Countywide model has two additional vehicle assignments for the AM and PM peak hours (7:30 to 8:30 AM and 4:30 to 5:30 PM respectively). These peak one hour assignments are not included in the calculation of daily volumes.

Transit Assignments

The transit trips are assigned to the best available routes for peak (AM plus PM) and off-peak period services. The assignments are stratified by access type (park-and-ride, kiss-and-ride, walk access) and the walk access trips are further stratified by preferred submode (local bus, express bus, light rail, heavy rail and commuter rail). The separate assignments are combined to develop daily transit boardings on each route.

1.2. SUMMARY OF KEY UPDATES

The prior version of the Alameda Countywide model, as updated in 2014-2015, was based on the assumptions used for MTC Plan Bay Area as adopted in 2013. The land use forecasts were based on the Association of Bay Area Governments (ABAG) Projections 2013. The 2014-2015 update added several features including additional transportation analysis zones, recalibration of auto ownership and mode choice models, refinement of airport passenger models, and a more complete feedback loop for congested travel times in the mode choice calculations.

The following revisions were included as part of the current (2018) model update to be consistent with Plan Bay Area 2040 and its associated land use projections as adopted in 2017.

Land Use

- Jurisdiction totals for housing and employment were updated from Plan Bay Area 2013 to Plan Bay Area 2040.
- Initial land use allocations within each jurisdiction were based directly on MTC allocations by MTC regional transportation analysis zone (RTAZ) as used in the MTC Model One for analysis of Plan Bay Area 2040.
- Allocations to Alameda Countywide transportation analysis zones (TAZs) within each MTC RTAZ were initially based on the TAZ allocations from the prior Plan Bay Area 2013 model version.
- Cities provided a review and reallocation of future and, in some cases, base year housing and employment to Alameda County Model TAZs.
- San Joaquin County land uses were updated to be consistent with the San Joaquin County "Tri County" travel model used for the most current available San Joaquin County Regional Transportation Plan (2014).
- A checking and adjustment process was applied to minimize locations where land uses would decrease between 2010 and 2020 or between 2020 and 2040.

Road Network

- The road network was updated to current information for implemented projects such as the Hayward downtown loop and the Isabel connection in Livermore.
- Significant review and update of express lane projects to be consistent with MTC PBA 2040.

- Functionality added to assign different pricing assumptions by express lane corridor and by time of day.
- Review of the entire PBA 2040 project list and updates to include regionally significant PBA 2040 road projects, particularly those affecting Alameda County:
    - Addition of a planned shoulder HOV/bus lane throughout the length of I-680.
    - A number of known "road diet" projects were added to the network, but the network may not include all local street projects in all jurisdictions and should be checked for local application.
    - Future lane reductions were added associated with the East Bay BRT and San Pablo BRT projects.
- A designation for advanced traffic management, such as adaptive ramp metering, was added to designate additional future capacity on selected freeway corridors consistent with PBA 2040 and the Bay Area Forward program.

Transit Network

- Base year coding for services within Alameda County (AC Transit, Union City, Wheels, BART) was completely reviewed and updated to correctly represent current year (2017) routes and schedules. The updated 2017 inputs were used as a base for the 2020 and 2040 service assumptions.
- Estimated travel times for AC Transit were compared to actual schedule run times and factors were adjusted to standardize the estimates of bus travel times. Factors of 2.2 times congested auto times were calculated for local bus service and 1.6 times congested auto times for Transbay bus service. These standard time factors replaced time factors that varied by route in the prior versions of the model.
- Historic 2010 route and schedule information was also used to update the 2010 validation year assumptions for AC Transit and Wheels.
- Existing and planned East Bay ferry terminals were relocated to their correct locations and connections updated.
- BART fares were updated to ensure that reasonable fares were assigned to new stations (West Dublin, San Jose/Santa Clara extension).
- Ferry service was added at Alameda Seaplane Lagoon.
- Coding for East Bay transit improvements was verified and updated as required, including East Bay BRT, San Pablo BRT, Alameda BRT and Wheels 30 relocation to Dublin Boulevard.
- Major regional transit improvements were checked with the PBA 2040 project list and were generally found to be consistent. These include eBART to Antioch, BART to San Jose/Santa Clara, BART schedule improvements, Caltrain electrification and extension to Transbay Terminal, and new ferry services.

Model Process

- The model script was revised with one main script and seven separate subroutine scripts to allow for easier tracking of the feedback loop process.
- The feedback loop was rewritten to eliminate redundant processes and use the Method of Successive Averaging (MSA) to calculate congested travel times for the next iteration. The number of feedback loop iterations remains at five (5).
- The script that creates the study year road network was updated to allow for three cycles of improvements rather than two, and to calculate additional capacity for segments with advanced traffic management (TOS=2).
- The 2010 model script now includes the feedback loop and is identical to the future year scripts.
- A number of additional checks for zero values were added to the mode choice script to minimize model crashes due to zero values in the land use input file.
- Corrections to the toll assignment script to ensure that Shared Ride 2 vehicles would be eligible to pay tolls and use express lanes when the HOV requirement increases to 3+ persons.

Pricing

- Parking costs for each TAZ were updated based on MTC PBA 2040 assumptions (converted from 2000 dollars used in PBA 2040 modeling to 1990 dollars used in Alameda Countywide model).
- Bridge tolls and average auto operating cost per mile were updated consistent with MTC PBA 2040 assumptions. The bridge tolls in PBA 2040 increase by 2040 to reflect regional measures.
- Individual express lane toll rates were input for each study year based on MTC PBA 2040 assumptions.
    - By 2040, Shared Ride 2 vehicles are charged 50 percent of the drive alone tolls for express lanes.
    - Shared Ride 3+ vehicles do not have a toll to use the express lanes.
- Transit fares were not updated, but BART fare assumptions were checked against current fares and appeared to be consistent.

2. STUDY AREA AND TRANSPORTATION ANALYSIS ZONES

The study area for the Alameda Countywide travel model covers Alameda County, the other eight counties of the nine-county Bay Area, and San Joaquin County. The model area has been divided into Transportation Analysis Zones (TAZs) that are used to represent origins and destinations of travel (Figure 2 and Table 1). Travel to and from the model area is represented by external gateway zones.

IN THIS SECTION>>

- Model study area
- Transportation analysis zone maps
- Representation of areas outside Alameda COunty

2.1. ALAMEDA COUNTY TAZS

There are 1,580 TAZs within Alameda County. The Alameda County TAZs are at a more detailed level than the regional TAZs (RTAZs) used in the MTC BAYCAST regional model. The intent of the TAZs is to group together land uses which share common access to the transportation system. For roads, this may mean grouping a set of blocks which can all access the same arterial street between the same major intersections. For transit, the grouping may be based on similar walk distances to a particular transit station.

The boundaries of TAZs may be defined by political boundaries (county line, city sphere of influence), barriers to transportation access (rivers, railroads, freeways), United States census boundaries (tracts, block groups), land use types (residential versus industrial) or groupings of parcels with similar access to the road or transit systems.

The TAZs within each planning area of Alameda County (North, Central, South, East) are illustrated in Figure 3 to Figure 6. More detailed mapping of the TAZs is available on the Alameda CTC website.[1]

[1] https://www.alamedactc.org/app_pages/view/8079

Figure 2: Alameda Countywide Model Area

Table 1: Transportation Analysis Zones by Jurisdiction

Jurisdiction	Zone Number Range
Alameda County	
Alameda	461 - 530, 1463-1467
Albany	1 -13
Ashland	637 - 649, 1485-1486
Berkeley	14 -114, 1406-1423
Castro Valley	602-624, 1478-1483
Cherryland	650-654, 1487-1488
Dublin	941-1052, 1549-1569
Emeryville	115-126, 1424-1428
Fremont	802-917, 1519-1544
Hayward	655-768, 1489-1507
Livermore	1192-1375, 1575-1578
Newark	918-940, 1545-1547
Oakland	127-454, 1401-1405, 1429-1462
Piedmont	455-460
Pleasanton	1053-1191, 1570-1574
San Leandro	531-601, 1468-1474
San Lorenzo	625-636, 1484
Union City	769-801, 1508-1517
Remainder of Alameda County	1376-1400, 1579-1580
Outside Alameda County	
West Contra Costa buffer zones*	2001-2052
South Contra Costa buffer zones*	2101-2148
Santa Clara buffer zones *	2201-2233
San Joaquin County	2301-2326
Remainder of Bay Area Counties	2501-3597
External to Bay Area/San Joaquin County	
Gateways	4455-4485

*Buffer zones are TAZs subdivided from MTC RTAZs in areas outside but adjacent to Alameda County.

Figure 3: Alameda Countywide Model TAZs - North

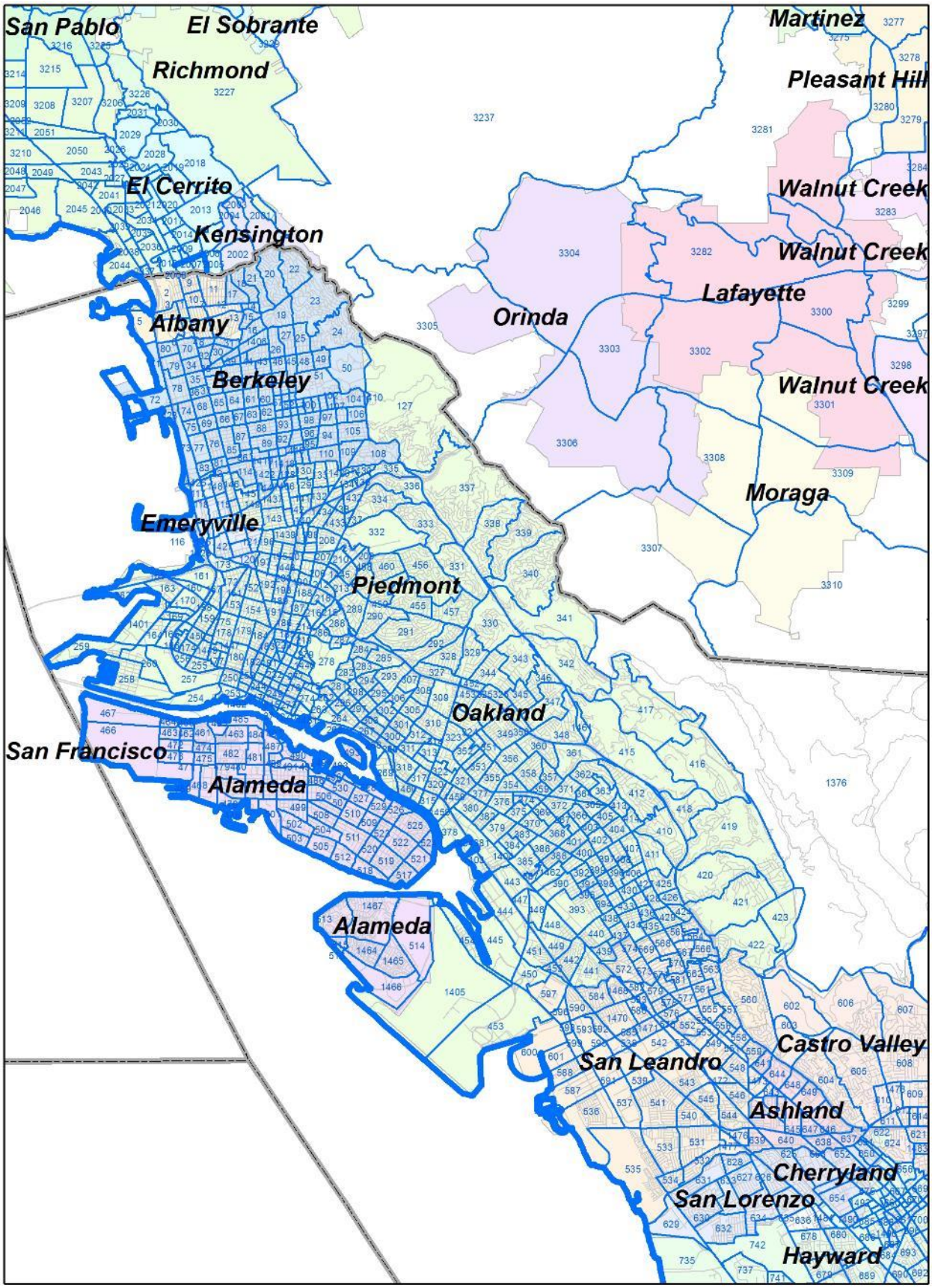


Figure 4: Alameda Countywide Model TAZs – Central

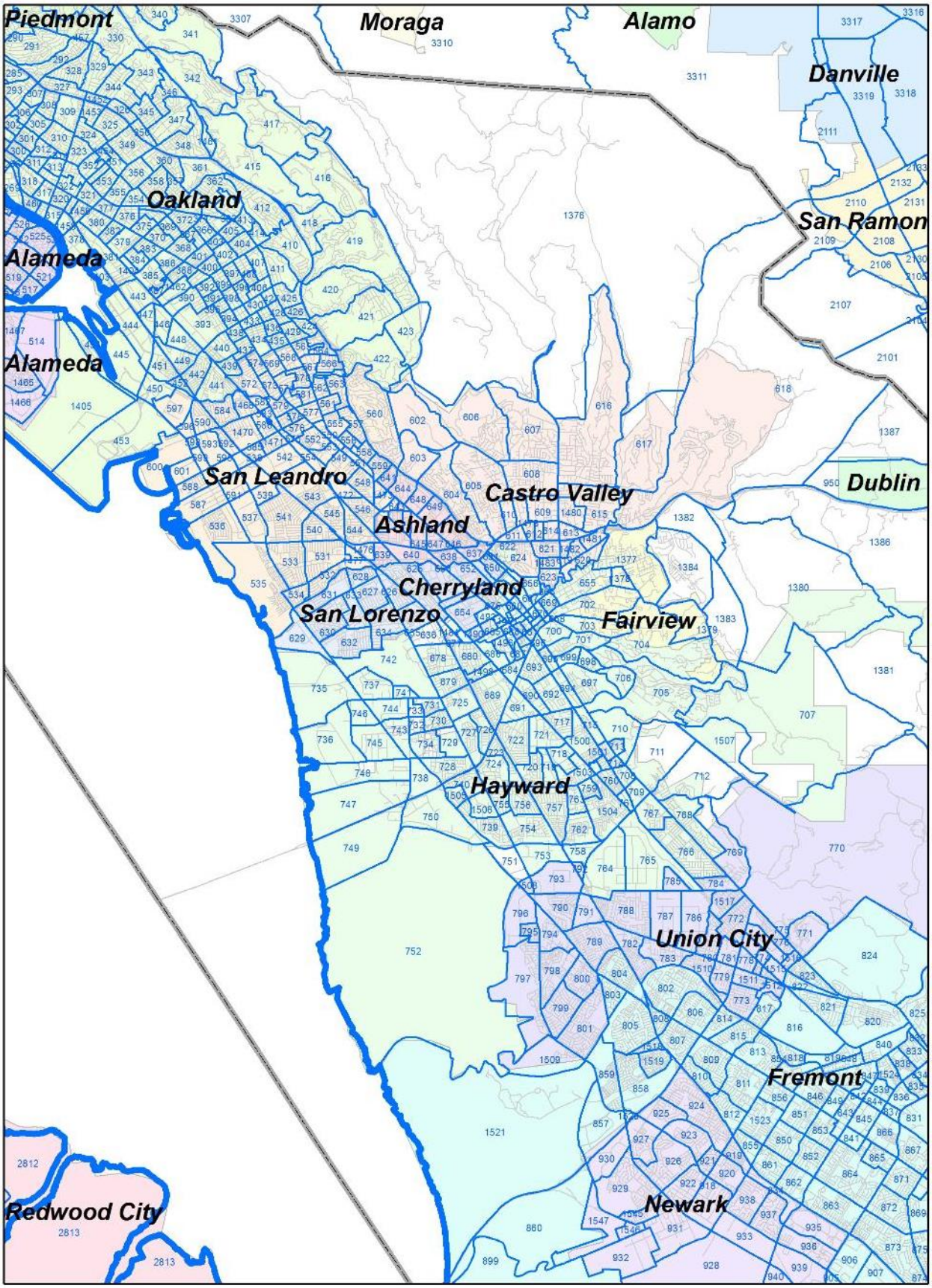


Figure 5: Alameda Countywide Model TAZs – South

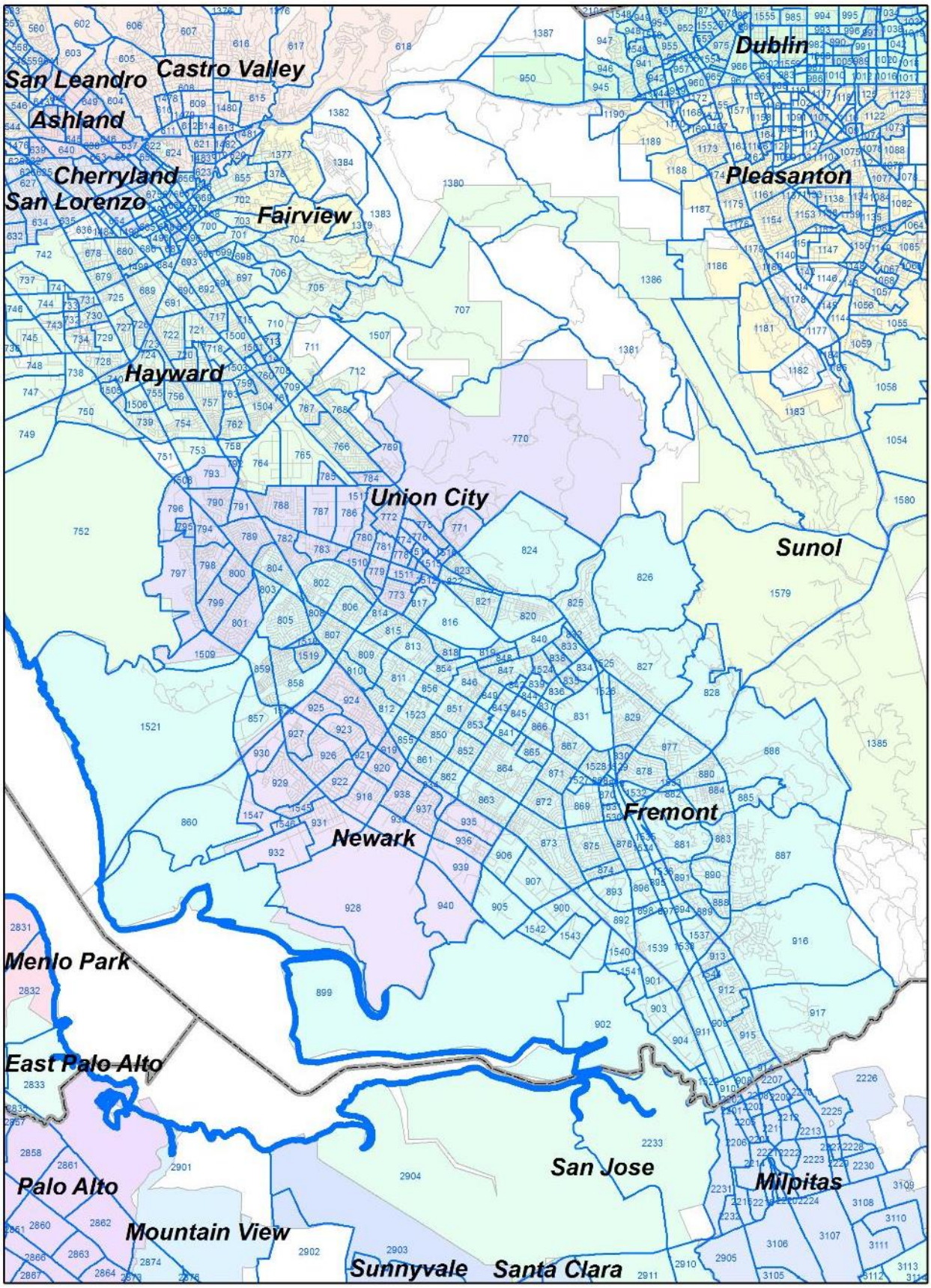
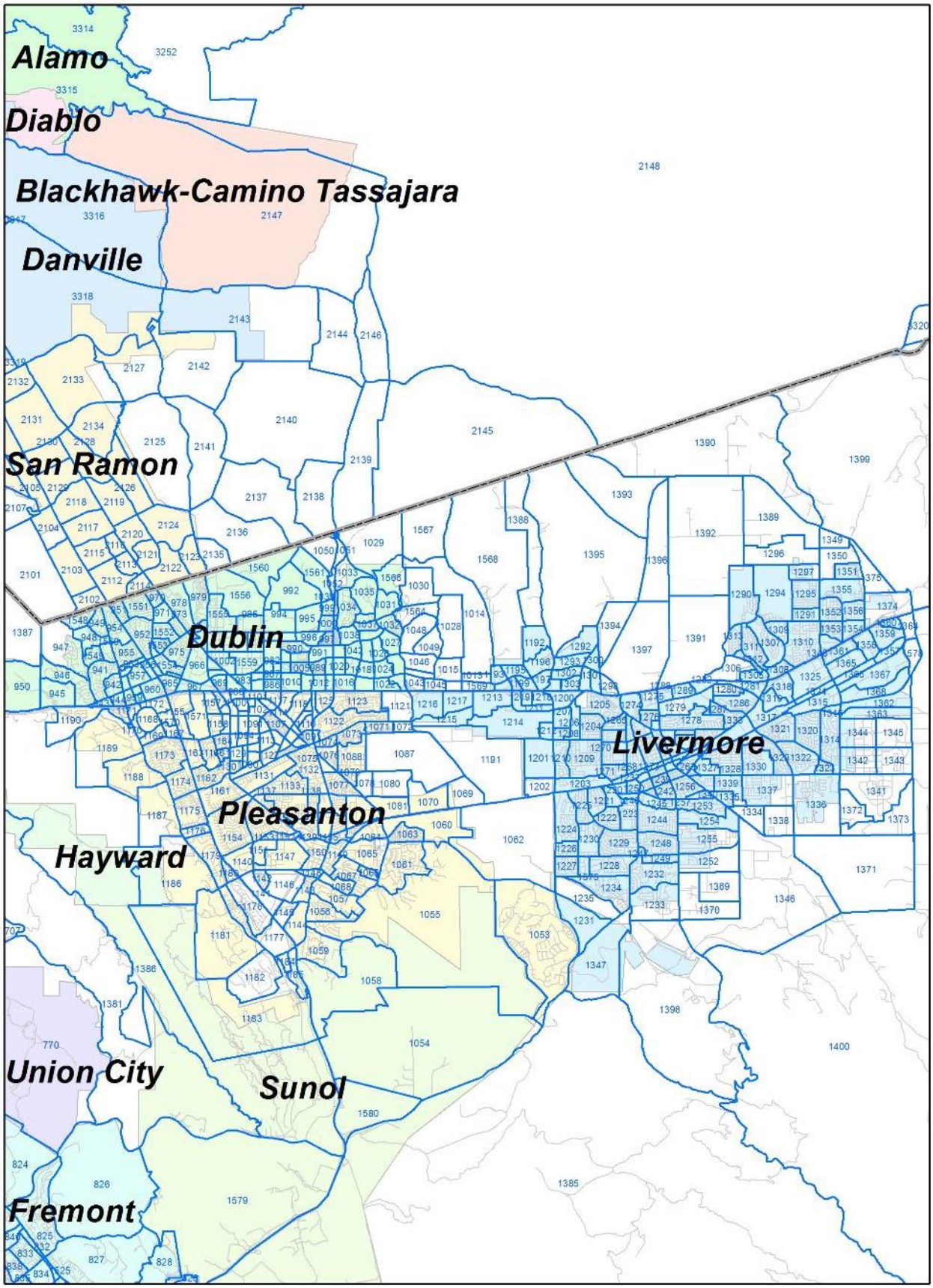


Figure 6: Alameda Countywide Model TAZs – East



TAZ Changes in 2015 Model Update

The 2014-2015 model update added additional detail to the TAZ system compared to prior versions of the Alameda Countywide model. The changes to the TAZs fell under five broad categories, however, all of five of the principles were used to define the new boundaries:

1. Changes in view of the need for TAZs maintaining consistency with the 2010 Census Tract boundaries,
2. Changes to create smaller zones near major rail stations, ferry stops and bus stops,
3. Changes to have MTC's proposed "micro-analysis zones" (MAZs) nest within the TAZs,
4. Overlay added TAZs around transit park-and-ride lots to allow the model to represent drive-access to transit auto trips in the highway assignments, and
5. Changes to create smaller TAZs consistent with the definition of the CMP roadway network.

In summary, a total of 1,175 TAZs were revised for the Alameda Countywide model using the adopted principles. Table 2 summarizes the total number of existing and new TAZs by County Planning Area.

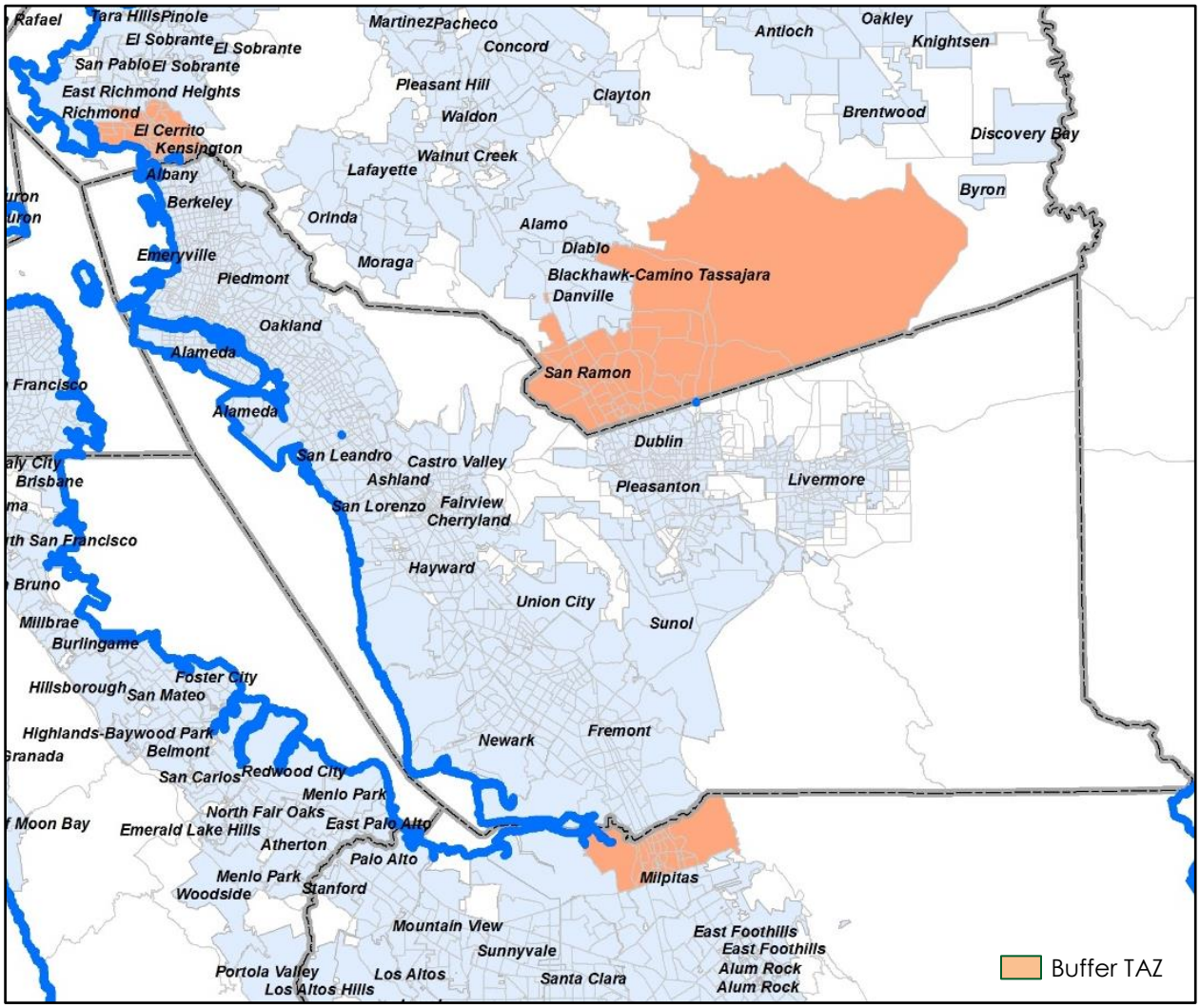
Table 2: Numbers of Alameda County TAZs Before and After 2015 Update by Planning Area

Planning Area	Name	Prior Number of TAZs	Number of TAZs After 2015 Changes
1	North County	535	597
2	Central County	248	288
3	South County	171	211
4	East County	451	484
Total		**1,405**	**1,580**

2.2. OTHER BAY AREA TAZS

The TAZs in Bay Area counties outside of Alameda County are consistent with the MTC 1,454 regional TAZs (RTAZ) except for additional TAZ detail in three "buffer" areas adjacent to Alameda County. The three buffer areas are in West Contra Costa County, San Ramon and Milpitas. The RTAZs in these areas were subdivided during the original model development in the mid-2000s to better represent travel on roads and transit routes that cross the county line.

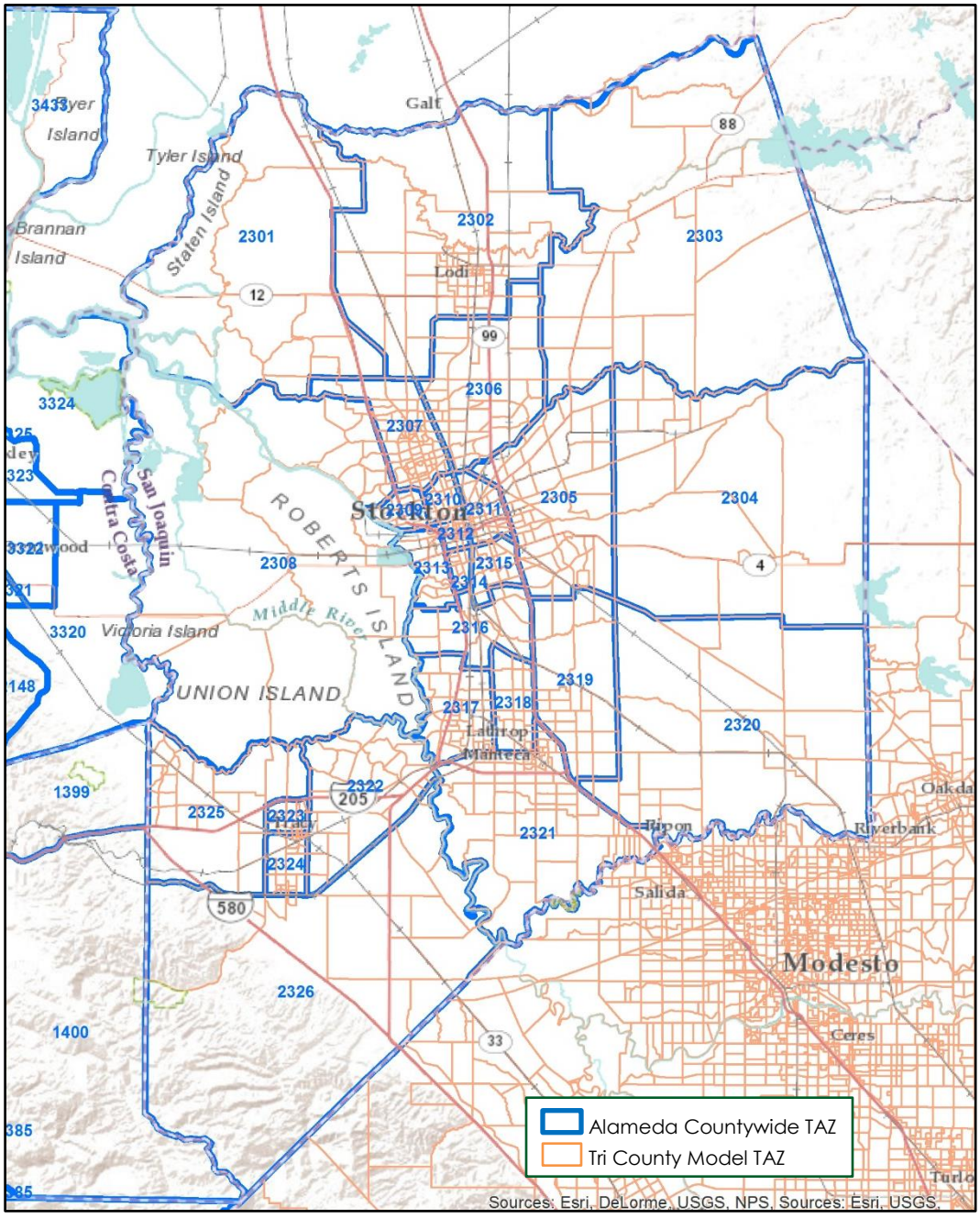
Figure 7: Locations of Buffer TAZs



2.3. SAN JOAQUIN COUNTY TAZS

There are 26 Alameda Countywide model TAZs which represent San Joaquin County. These TAZs correspond to the smaller TAZs used in the Tri County model, which is the travel model used for travel forecasts in San Joaquin, Stanislaus and Merced counties (Figure 8). The land uses from the Tri County model are aggregated into the corresponding Alameda Countywide model TAZs.

Figure 8: Alameda Countywide Model TAZs in San Joaquin County



2.4. EXTERNAL GATEWAYS

There are 31 external gateway TAZs surrounding the nine Bay Area counties and San Joaquin County (Figure 9 and Table 3). These are used to represent trips into, out of and through the model study area. The representation of activity at gateway TAZs is based on direct input of traffic volumes rather than land use quantities.

Figure 9: Alameda Countywide Model Gateway TAZs

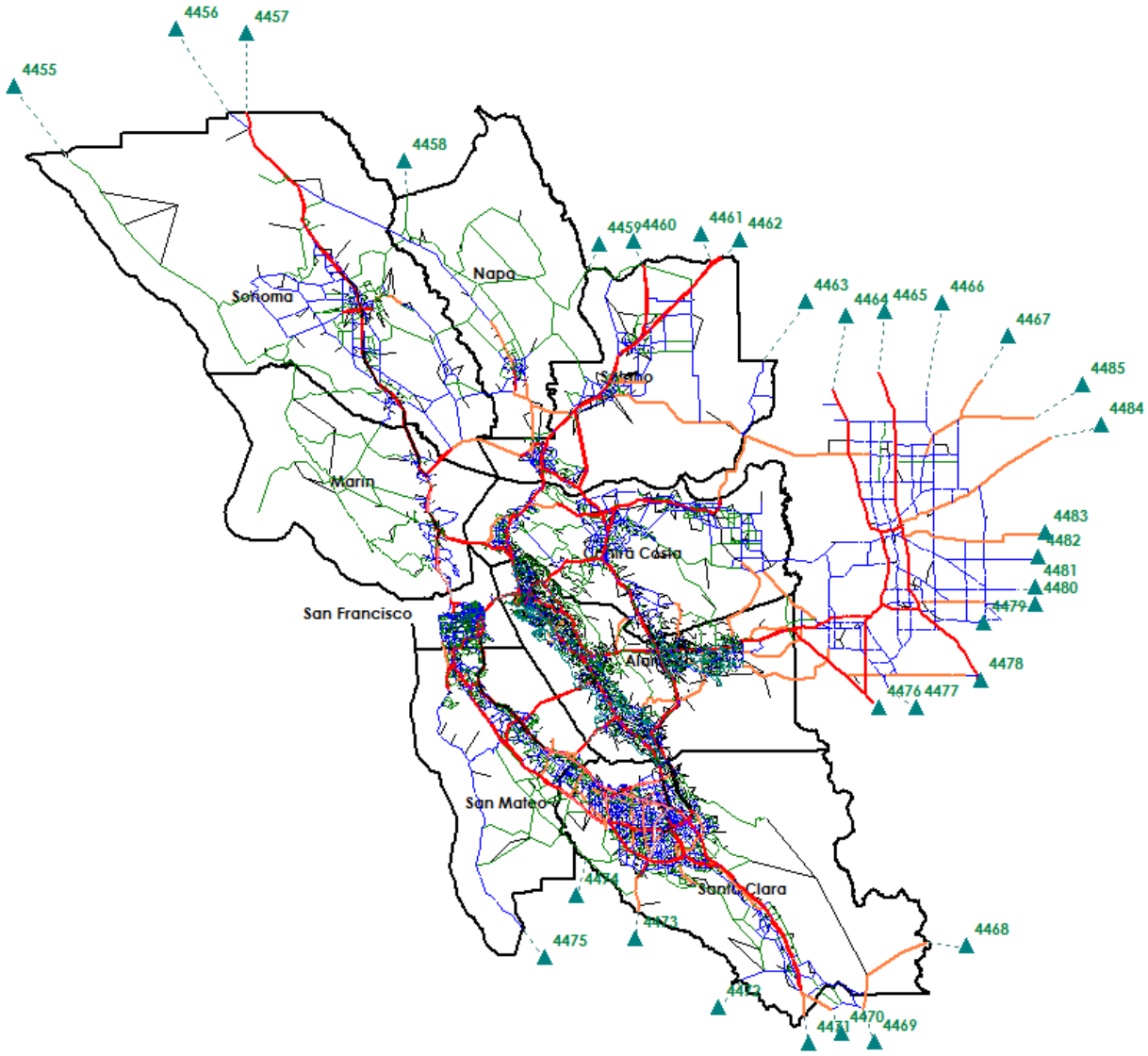


Table 3: Alameda Countywide Model Gateway Volumes

Gateway TAZ	Road	County Line	Average Annual Growth Rate	2010 ADT	2020 ADT	2040 ADT	Percent Through Traffic
4455	SR 1 N	Mendocino	2.2%	2,900	3,538	4,814	0.0%
4456	SR 128	Mendocino	0.5%	1,800	1,890	2,070	0.0%
4457	US 101 N	Mendocino	1.0%	13,000	14,300	16,900	0.0%
4458	SR 29	Lake	1.5%	8,200	9,430	11,890	0.0%
4459	SR 128	Yolo	1.2%	2,600	2,912	3,536	0.0%
4460	I-505	Yolo	2.5%	22,200	27,750	38,850	0.0%
4461	SR 113	Yolo	1.6%	39,500	45,820	58,460	0.0%
4462	I-80	Yolo	1.0%	125,000	137,500	162,500	0.0%
4463	SR 160	Sacramento	1.0%	12,300	13,530	15,990	0.0%
4464	I-5 N	Sacramento	1.7%	54,000	63,180	81,540	37.5%
4465	SR 99 N	Sacramento	1.7%	60,000	70,200	90,600	28.3%
4466	Dustin Rd	Sacramento	1.0%	1,000	1,100	1,300	0.0%
4467	SR 88	Amador	1.7%	9,000	10,530	13,590	0.0%
4468	SR 152 E	Merced	2.2%	33,000	40,260	54,780	0.0%
4469	SR 156	Santa Clara	1.5%	11,900	13,685	17,255	0.0%
4470	SR 25	San Benito	1.2%	18,600	20,832	25,296	0.0%
4471	US 101 S	San Benito	0.7%	50,000	53,500	60,500	0.0%
4472	SR 152 W	Santa Cruz	1.2%	5,900	6,608	8,024	0.0%
4473	SR 17	Santa Cruz	0.5%	56,000	58,800	64,400	0.0%
4474	SR 9	Santa Cruz	0.5%	2,700	2,835	3,105	0.0%
4475	SR 1 S	Santa Cruz	0.5%	4,100	4,305	4,715	0.0%
4476	I-5 S	Merced	2.6%	37,500	47,250	66,750	37.3%
4477	SR 33	Stanislaus	1.0%	1,550	1,705	2,015	0.0%
4478	SR 99 S	Stanislaus	2.4%	107,000	132,680	184,040	17.1%
4479	Escalon Rd	Stanislaus	1.0%	1,000	1,100	1,300	0.0%
4480	SR 120	Stanislaus	0.5%	10,700	11,235	12,305	0.0%
4481	Lone Tree Rd	Stanislaus	1.0%	1,000	1,100	1,300	0.0%
4482	Dodds Rd	Stanislaus	1.0%	1,000	1,100	1,300	0.0%
4483	SR 4	Calaveras	2.3%	4,350	5,351	7,352	0.0%
4484	SR 26	Calaveras	1.0%	4,400	4,823	5,670	0.0%
4485	SR 12	Calaveras	0.6%	6,800	7,208	8,024	0.0%

The average daily traffic volumes (ADT) at each gateway for each study year were estimated based on traffic counts and average annual growth rates. The 2010 base year traffic counts were obtained from Caltrans Traffic Volumes (for all state routes) or published information from county documents. Traffic volumes for several low volume roads were estimated at 1,000 ADT if no traffic counts were available.

Annual growth rates were estimated based primarily on an average of historic annual growth rates from the 1990-2010 and 2000-2010 periods. Forecast growth rates were also reviewed from a 2011 version of the California Statewide trip-based travel model. If the historic growth rates and/or the Statewide Model growth rates were negative, a low growth rate of 0.5 to 1.0 percent was assumed.

The 2020 and 2040 gateway volumes were calculated by applying the annual growth rate to the 2010 traffic count. A linear growth pattern was assumed rather than exponential growth, consistent with the historic growth patterns on most of the gateway routes.

The percentages of through trips (trips with no origin or destination within the model study area) at each gateway were estimated based on the Statewide Model. The through trips primarily travel north-south through San Joaquin County on I-5 or SR 99 and would not typically use Alameda County (or any Bay Area county) roads. It is assumed that a negligible number of trips would pass all the way through the 10-county model area west of San Joaquin County (for example, from Santa Cruz to Davis) without stopping.

3. TRANSPORTATION NETWORKS

The Alameda Countywide model requires input networks to define the transportation systems for each year and analysis scenario. In addition to the road and transit networks, the model includes a representation of bicycle/pedestrian paths and lanes to support the estimation of non-motorized trips.

IN THIS SECTION>>

- Road network description
- Toll facilities
- Transit networks
- Bicycle facilities
- Future improvements

3.1. ROAD NETWORK

The road network is a computerized representation of the street and highway system. The model network includes all freeways, highways, expressways, and arterial streets. The model network includes most collector streets and some local streets if they provide regional connectivity (access through or past a neighborhood as opposed to just access to properties within the neighborhood). Most local streets and driveways are represented by simplified network links ("zone centroid connectors") that represent local connections to the coded road network.

Master Network

All road network information for all base year and forecast scenarios is contained in a single "master network" file. The master network contains information on up to three levels of road or bicycle improvement projects on each road segment:

- BASE: Base Year, generally representing year 2000 conditions[2]
- IMP1: First road or bicycle improvement, if applicable
- IMP2: Second road or bicycle improvement, if applicable
- IMP3: Third road or bicycle improvement, if applicable

The purpose of creating a master network was to make the task of network maintenance more efficient. Without a master network, if a roadway network improvement was to be included in several alternatives (e.g., add a new widening to the near term network and all other future networks), the same network editing had to be performed individually for each of the scenarios. With a master network, the user need only input the improvement in one place with the appropriate implementation years designated and then all scenarios built from the master network for any study year will be consistent.

[2] The 2000 network base year has been maintained to facilitate analysis of 2005 conditions for evaluations such as SB 375 emissions comparisons.

The following network link variables are coded for each master network improvement level:

- Year of improvement (for improvement levels 1 to 3)
- Lanes in each direction (LN)
- Area type (AT)
- Facility type (FT)
- Speed
- Signal coordination (SC)
- Traffic operating system (TOS)
- Auxiliary lanes (AUX)
- High-occupancy toll/express lane (HOT)
- Vehicle occupancy requirement (USE)
- Non-motorized facility (NMT)

For example, a road which did not exist in 2000, was constructed as a two-lane road in 2005 and will be widened to four lanes in 2020 has the following model network attributes:

- BASE_LN = 0 (2000 number of lanes)
- IMP1_YEAR = 2005
- IMP1_LN = 1 (number of lanes in each direction as of 2005)
- IMP2_YEAR = 2020
- IMP2_LN = 2 (number of lanes in each direction as of 2020)

At the beginning of the model process, the master network is processed to create the individual road network for the desired year, by checking for improvements that would be in effect for that study year.

Number of Lanes

The numbers of lanes coded in the model represent the number of through lanes in each direction on the segment that best represents the capacity of the segment. A segment that narrows from three to two lanes would be coded as two lanes. Turn lanes are typically not included in the lane total, as the additional capacity provided by turn lanes is already assumed for the higher functional classifications such as expressways or major arterials. If a segment has a different number of lanes in one direction than the other, the correct number of lanes in each direction should be coded.

Auxiliary lanes are lanes that terminate at an exit ramp or turn lane rather than continuing through to the next segment. The total number of directional lanes including auxiliary lanes is coded on each segment in the LN field. If one of the lanes terminates at a ramp, the AUX field is coded with a 1, and the model assumes one-half the normal lane capacity for that auxiliary lane.

Area Type

Area types are consistent with the MTC model and generally represent the density of interactions with cross-traffic. The area type is used to determine the average capacity per lane for each facility type.

The area types are:

0. Downtown Core
1. Central Business District (CBD)
2. Urban Business District (UBD)
3. Urban
4. Suburban
5. Rural

Facility Type and Functional Classification

Functional classification is a hierarchy of street function that is used to designate speed, capacity, access control and other characteristics. The Alameda Countywide model uses facility types which are based on the MTC Functional Classification.

1. Freeway to freeway ramp
2. Freeway
3. Expressway/Highway
4. Collector
5. Ramp
6. Connector link
7. Arterial
8. Metered ramp
9. Special types

The special types include facilities with traffic operation systems (TOS) such as intelligent transportation systems (ITS) or adaptive ramp metering, or arterials with signal coordination (more detail provided in capacity section below).

Speed

The model requires input uncongested speeds for each segment. The slowing-down effects of congestion and interaction with other vehicles are accounted for within the traffic assignment process.

The speeds used in a travel model do not in general coincide with the posted speed limit or with radar speed surveys, and are not literally "free flow" speeds. The model speed should represent the average speed during off-peak hours and without congestion for vehicles to traverse the segment, including delays at signals or stop signs. The model speeds can be thought of as the "11:00 P.M." speed, when there are few conflicts with other vehicles, but signals are still operating normally at intersections.

The MTC BAYCAST model used the lookup speed values shown in Table 4. The Alameda Countywide model allows for direct coding of segment speeds that can vary from the values in the table. These values are used in the highway assignment process.

Capacity

The travel model uses an estimate of road capacity on each segment. The capacity is a one-hour capacity (passenger car equivalents or pce per hour) and is generally derived from the functional classification and the area type (Table 4 and Table 5). However, there are other characteristics such as type of traffic control or presence of pedestrians that may be important for the model.

The travel model uses level of service "E/F" capacities representing the maximum flow. However, the model may still estimate traffic demands which exceed these maximum capacities.

Table 4: Speeds and Capacities, Standard Road Types

Facility Type	Area Type	Typical Speed[1] (mph)	Capacity (pce[2] per lane per hour)
Freeway-Freeway (1)	Core/CBD (0,1)	40	1,850
	UBD/Urban (2,3)	45	1,950
	Suburban/Rural (4,5)	50	2,000
Freeway (2)	Core/CBD (0,1)	55	2,050
	UBD/Urban (2,3)	60	2,100
	Suburban/Rural (4,5)	65	2,150
Expressway/Highway (3)	Core/CBD (0,1)	40	1,450
	UBD/Urban (2,3)	45	1,600
	Suburban (4)	50	1,650
	Rural (5)	55	1,650
Collector (4)	Core (0)	10	600
	CBD (1)	15	650
	UBD (2)	20	700
	Urban (3)	20	650
	Suburban (4)	30	900
	Rural (5)	35	950
Freeway Ramp (5)	Core (0)	30	1,450
	CBD (1)	30	1,500
	UBD/Urban (2,3)	35	1,550
	Suburban/Rural (4,5)	40	1,550
Connector (6)	Core (0)	5	No limit
	CBD (1)	10	No limit
	UBD (2)	15	No limit
	Urban (3)	20	No limit
	Suburban (4)	25	No limit
	Rural (5)	30	No limit
Arterial (7)	Core (0)	20	900
	CBD (1)	25	950
	UBD/Urban (2,3)	30	1,000
	Suburban (4)	35	1,050
	Rural (5)	40	1,050

Notes:

[1]Within Alameda County, individual speeds may be coded for each road segment.

[2]pce = passenger car equivalents, calculated as Heavy Trucks * 2.0 + Medium Trucks *1.5 + All Other Vehicles

Table 5: Speeds and Capacities, Special Road Types

Facility Type	Area Type	Typical Speed[1] (mph)	Capacity (pce[2] per lane per hour)
Metered Ramp (8)	Core/CBD (0,1)	25	750[3]
	UBD/Urban (2,3)	30	900[3]
	Suburban/Rural (4,5)	35	1,000[3]
TOS[4] Freeway (9) (TOS=1)	Core/CBD (0,1)	55	2,100
	UBD/Urban (2,3)	60	2,150
	Suburban/Rural (4,5)	65	2,200
Managed Freeway (2)[5] (TOS=2)	Core/CBD (0,1)	55	2,150
	UBD/Urban (2,3)	60	2,200
	Suburban/Rural (4,5)	65	2,250
Golden Gate Bridge (9)	n/a	50	1,950
TOS[4] Freeway-Freeway (9)	Core/CBD/UBD/Urban (0-3)	45	2,000
	Suburban/Rural (4,5)	50	2,000
TOS[4] Expressway (10)	Core/CBD (0,1)	40	1,500
	UBD/Urban (2,3)	45	1,650
	Suburban/Rural (4,5)	55	1,700
SC[6] Arterial (10)	Core/CBD (0,1)	25	1,000
	UBD/Urban (2,3)	30	1,050
	Suburban/Rural (4,5)	40	1,100

Notes:

[1]Within Alameda County, individual speeds may be coded for each road segment.

[2]pce = passenger car equivalents, calculated as Heavy Trucks * 2.0 + Medium Trucks *1.5 + All Other Vehicles

[3]Within Alameda County, individual metered capacities may be coded for each ramp and peak period.

[4]TOS = Traffic Operations Systems (ramp metering, etc…)

[5]Managed freeways (adaptive ramp metering, corridor management, etc…) designated as FT= 8 and TOS=2 in MTC Model One.

[6]SC = Signal coordination

Ramp Metering

The Projections 2007 version of the Alameda Countywide model implemented ramp metering capacities and speed-flow relationships that were not part of the MTC BAYCAST model. Caltrans staff from the District 4 Division of Operations, Office of Traffic Systems, Ramp Metering Unit provided information on existing and planned ramp meters on all state highways in Alameda County, including the dates when meters became or would become operational.

Ramp Metering Rates in the Travel Model

Metered ramps in Alameda County operate using sensors which detect the flow rate on the mainline freeway and adjust the metering rate accordingly. Caltrans adjusts the metering strategy at each individual location to balance freeway mainline operations with queues and operations affecting local streets. This process cannot be easily replicated in a travel demand model. Therefore, average hourly rates were estimated for each metered on-ramp in Alameda County for the A.M. and P.M. peak periods. The average metering rates in vehicles per hour were used to set the capacities for individual metered ramps. These capacities were maintained during the 2015 and 2018 model updates.

Existing Metering Rates

Existing average ramp metering rates for travel modeling purposes were estimated based on several sources:

- Detailed ramp metering operations strategies provided by Caltrans staff
- Traffic counts at specific on-ramps with operational ramp meters
- Freeway speed data measured by loop detectors from the Performance Monitoring System (PeMS)

For the I-580 corridor in the Dublin/Pleasanton area, peak period traffic counts had been collected for every freeway ramp during the spring of 2008. These traffic counts were used to estimate the average hourly throughput on metered on-ramps.

For the I-880 corridor, Caltrans provided detailed ramp meter operational strategies. The strategies generally specify one to four different metering rates depending on conditions on the adjacent mainline freeway as measured by loop detectors. The freeway speed data from PeMS were evaluated in detail to determine the approximate percent of time during the peak period that each speed category would be in effect, and therefore which metering rate would be likely for the adjacent on-ramps. A weighted average of the various metering rates was applied for the analysis.

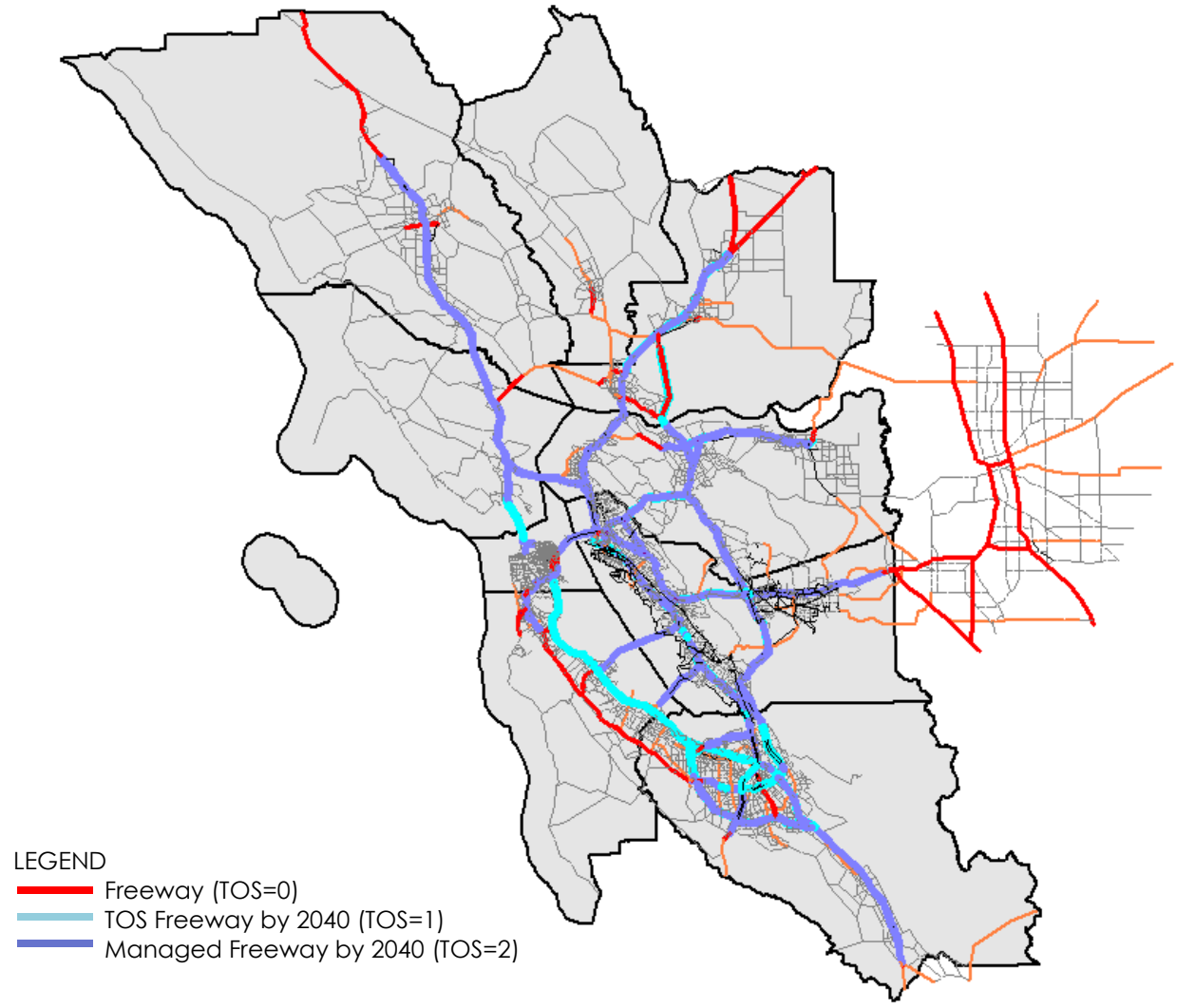
Future Metering Rates

Future traffic growth can cause conflicts between the need to increase or decrease ramp metering rates. Increases in congestion on the mainline freeway would tend to decrease the number of vehicles allowed through the on-ramp meters, if current operational strategies were left in place. However, increased traffic demand on on-ramps would tend to indicate a need to increase ramp metering rates to prevent long queues and blockages on local streets. The model currently does not estimate changes in ramp metering rates for future conditions, and instead maintains the base metering rates.

Traffic Operations Systems (TOS)

Freeway traffic operations management systems such as ramp metering are represented by a TOS code (Figure 10). In prior versions of the MTC and Alameda Countywide models, the TOS value would be either 0 or 1. A TOS value of 1 indicated the presence of ramp metering along the corridor, and an additional 50 vehicles per hour per lane was added to the capacity.

Figure 10: Road Network TOS Coding



For Plan Bay Area 2040, a second level of TOS was added. This level of managed freeway systems, indicated by a TOS value of 2, accounts for systems such as adaptive ramp metering and corridor management systems (CMS). An additional 50 vehicles per lane per hour above the TOS =1 capacity is added to the capacity for segments designated as TOS=2.

The Alameda Countywide model is consistent with the MTC PBA 2040 model for TOS coding and capacity values. However, the MTC PBA 2040 model also designates managed freeways (TOS=2) with a different facility type (FT=8). This allows the MTC model to assume different speed characteristics relative to congestion compared to standard freeways. The Alameda Countywide model uses Facility Type 8 to designate the unique capacity characteristics of metered ramps, and therefore managed freeways (TOS=2) are assumed to have the same speed versus congestion characteristics as other freeways (TOS 0 or 1)

Express Lanes and Tolls

Express lanes are an important component of the Plan Bay Area 2040 road system. Toll facilities are designated in the road network by the TOLL code (Figure 11). Prior versions of the Alameda Countywide model assumed constant toll values per mile for all express lanes. The PBA 2040 update provides the ability to code separate tolls for each facility. The actual value of the toll for each lane is set at the beginning of a model run. Table 6 lists the tolls assumed for the Alameda Countywide model, based on PBA 2040 assumptions converted from 2000 cents to 1990 cents (using a CPI factor of 130.7/172.2).

Figure 11: Road Network Express Lane Coding

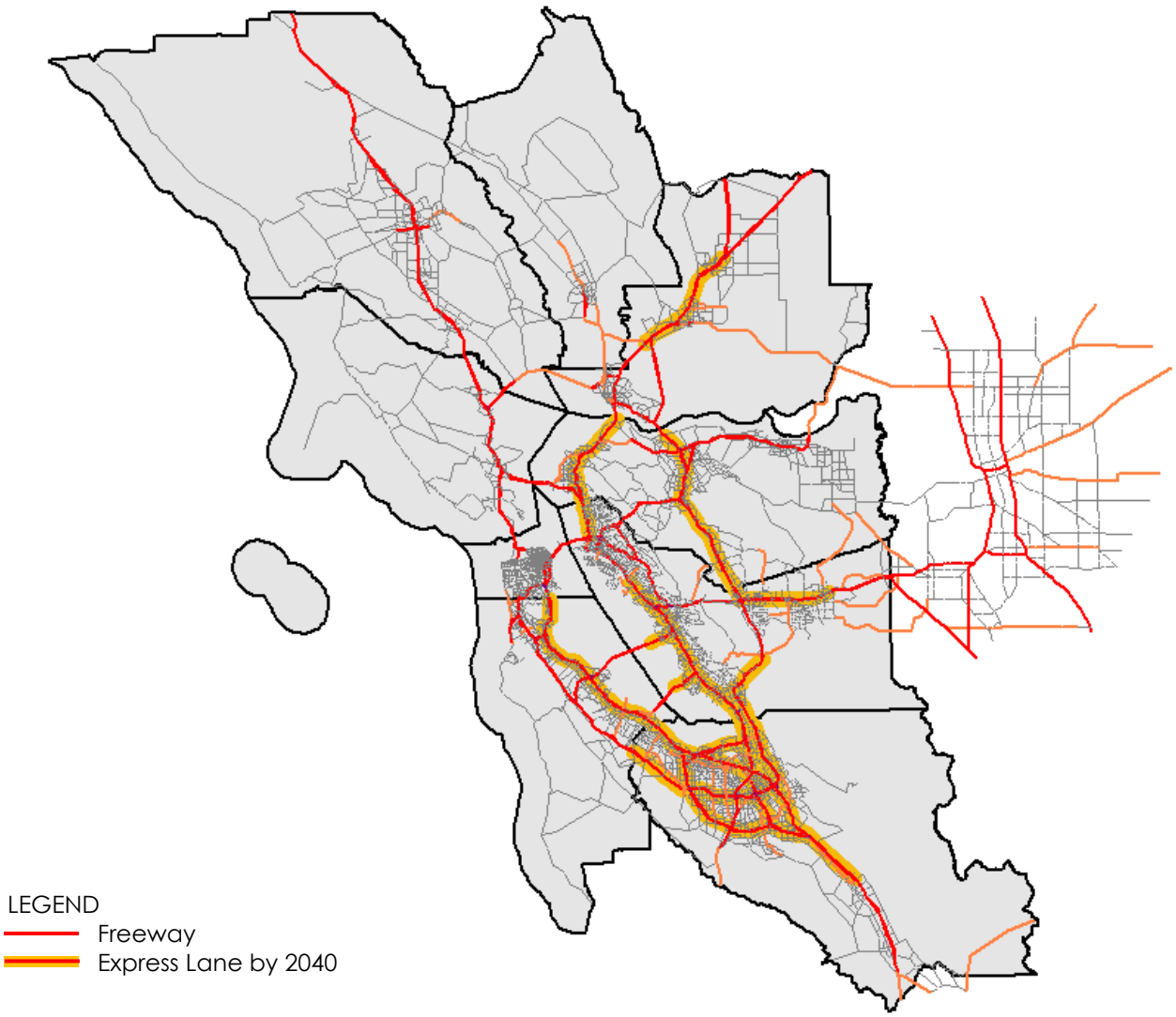


Table 6: Toll Facilities and Express Lanes, Tolls in 1990 Cents

Facility	TOLL Code	Direction	Peak Period	2010	2020	2040
Bridges				**Total Toll (1990 Cents)**		
Benicia-Martinez Bridge	1	NB	Both	379.94	379.94	379.94
Carquinez Bridge	2	NB	Both	379.94	379.94	379.94
Richmond-San Rafael Bridge	3	WB	Both	379.94	379.94	379.94
Golden Gate Bridge	4	SB	Both	339.23	339.23	339.23
San Francisco-Oakland Bay Bridge	5	WB	Both	434.22	434.22	434.22
San Mateo-Hayward Bridge	6	WB	Both	379.94	379.94	379.94
Dumbarton Bridge	7	WB	Both	379.94	379.94	379.94
Antioch Bridge	8	NB	Both	379.94	379.94	379.94
Express Lanes				**Toll per Mile (1990 Cents)**		
I-80, I-580 to Carquinez Bridge	12	EB	AM	-	-	-
			PM	-	-	26.6
	84	WB	AM	-	-	30.4
			PM	-	-	30.4
I-80, Red Top to I-505	14	EB	AM	-	-	-
			PM	-	-	-
	13	WB	AM	-	-	3.8
			PM	-	-	-
SR 84, I-880 to Bridge Toll Plaza	51	WB	AM	-	2.3	2.3
			PM	-	-	-
SR 85, US 101 to SR 87, I-280 to US 101	23	NB	AM	-	-	-
			PM	-	-	-
	24	SB	AM	-	-	-
			PM	-	-	-
SR 85, SR 87 to I-280	47	NB	AM	-	-	-
			PM	-	-	-
	48	SB	AM	-	-	-
			PM	-	-	-
SR 87, SR 85 to US 101	37	NB	AM	-	-	9.1
			PM	-	-	2.3
	38	SB	AM	-	-	-
			PM	-	-	5.3
SR 92, I-880 to Bridge Toll Plaza	52	WB	AM	-	3.0	3.0
			PM	-	-	-

Table 6: Toll Facilities and Express Lanes, Tolls in 1990 Cents

Facility	TOLL Code	Direction	Peak Period	2010	2020	2040
US 101, Cochrane to I-880	21	NB	AM	-	-	1.5
			PM	-	-	-
	22	SB	AM	-	-	-
			PM	-	-	-
US 101, I-880 to Oregon Expressway	19	NB	AM	-	-	1.5
			PM	-	-	-
	20	SB	AM	-	-	-
			PM	-	-	-
US 101, Oregon Expwy to Whipple	43	NB	AM	-	1.5	1.5
			PM	-	-	-
	44	SB	AM	-	-	-
			PM	-	-	-
US 101, Whipple to San Francisco County Line	54	NB	AM	-	-	-
			PM	-	1.5	1.5
	55	SB	AM	-	-	-
			PM	-	1.5	1.5
SR 237, US 101 to I-880	32	EB	AM	-	-	-
			PM	-	15.2	15.2
	31	WB	AM	-	13.7	15.2
			PM	-	1.9	1.9
I-280, US 101 to Santa Clara County Line	39	NB	AM	-	-	5.3
			PM	-	-	-
	40	SB	AM	-	-	-
			PM	-	-	7.6
I-580, Hacienda to Greenville	30	EB	AM	-	-	-
			PM	-	-	6.0
I-580, Greenville to San Ramon	29	WB	AM	-	2.3	2.3
			PM	-	-	-
I-680, US 101 to SR 84	26	NB	AM	-	-	-
			PM	-	-	1.5
	25	SB	AM	5.0	19.0	22.8
			PM	-	-	-
I-680, Alcosta to Benicia Bridge	28	NB	AM	-	-	-
			PM	-	1.5	1.5
	27	SB	AM	-	3.8	3.8
			PM	-	-	-

Table 6: Toll Facilities and Express Lanes, Tolls in 1990 Cents

Facility	TOLL Code	Direction	Peak Period	2010	2020	2040
I-880, US 101 to Hegenberger	15	NB	AM	-	1.9	1.9
			PM	-	8.3	8.3
	16	SB	AM	-	9.9	9.9
			PM	-	3.8	3.8

3.2. TRANSIT NETWORKS

The transit network is represented as a series of transit lines that overlay the road network. Bus lines are coded as a series of points on the road system, with certain points designated as stops. Rail and ferry lines are coded on separate segments, with connections coded to the road network at stations to represent walk, drive and bus transfer access.

Additional information coded for each transit line includes peak and off-peak headways (service frequencies) and travel time relative to the road network.

Rail Transit

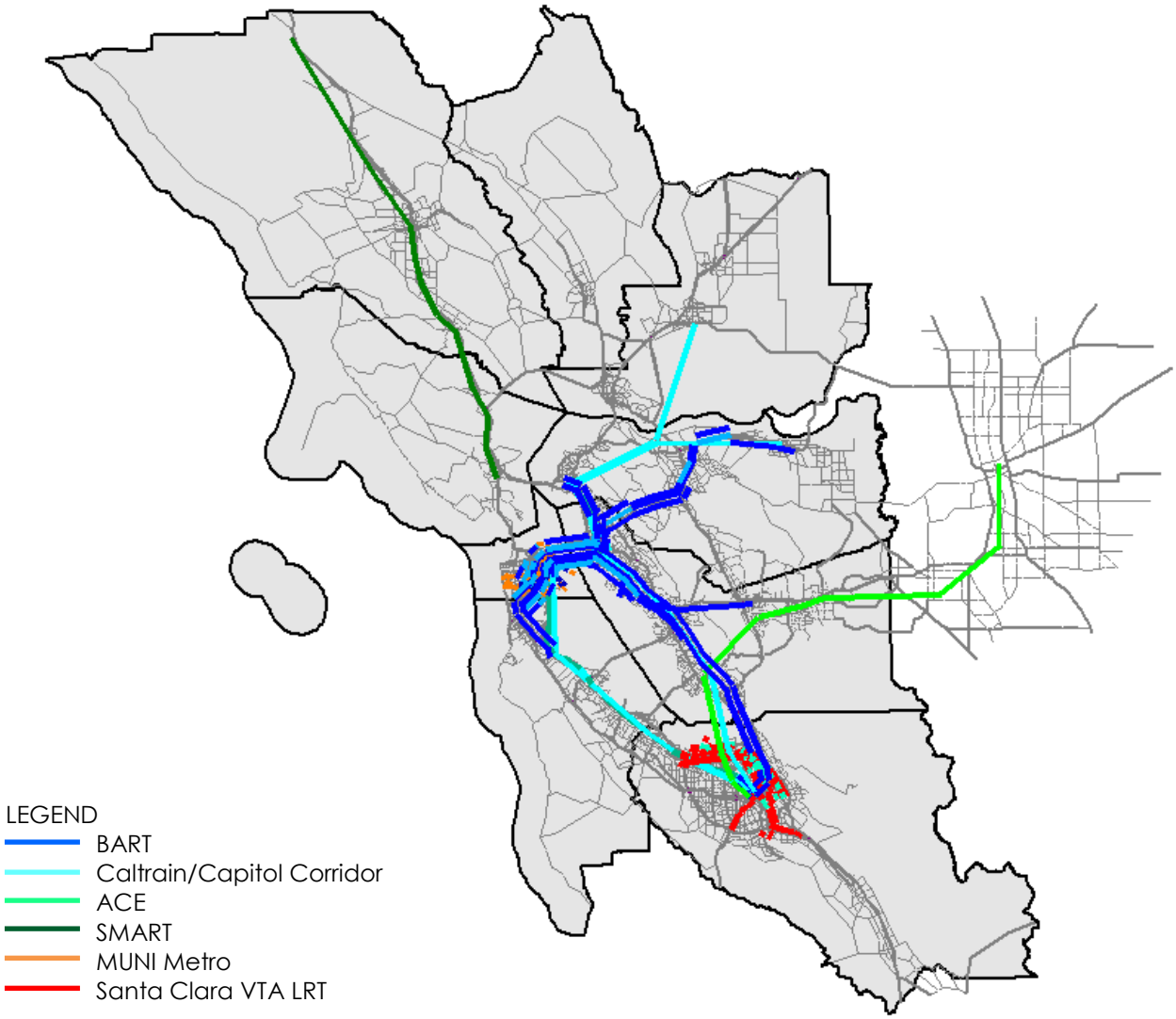
Rail transit services in the model include (Figure 12):

- ACE
- Amtrak
- BART (including the Oakland Airport Connector and eBART)
- Caltrain
- MUNI Metro
- Santa Clara VTA LRT
- SMART

The entire length of the ACE service can be included because the Alameda Countywide model includes San Joaquin County. Due to the large scale of TAZs in San Joaquin County, the access to ACE stations for San Joaquin County residents is primarily represented by auto access. The San Joaquin County portions of the ACE service are not directly represented in the MTC model.

Other rail services cannot be represented in their entirety due to the model coverage area. Capitol Corridor service is represented from San Jose to Fairfield/Suisun City, and does not include Sacramento travel. Amtrak San Joaquin service is represented from Oakland to Martinez, and does not include San Joaquin Valley trips.

Figure 12: Alameda Countywide Model Rail Transit Coverage



Bus Transit

Bus routes for all transit operators in the San Francisco Bay Area are included in the model. Separate coding is provided for express bus services and local bus services. The routes for each operator are maintained in individual input files, with file names indicating the range of years that the routes can represent.

For the Plan Bay Area 2040 update, the bus routes for services within Alameda County (AC Transit, Union City Transit, Wheels) were updated to correctly represent service for the 2010 base year and the current (2018) service. The 2018 local service coding was generally maintained for forecast years after 2018.

The bus route coding for operators outside Alameda County was not updated in detail, but provides a reasonable representation of transit access in those other counties. No local bus service is coded for San Joaquin County, although the model does include express bus services between San Joaquin County and BART.

Ferries

All existing and planned San Francisco Bay ferry services are included in the model. For the Plan Bay Area 2040 update, the locations of the ferry terminals were moved to their correct locations (prior versions of the model used a more representational location for ferry terminals consistent with the MTC BAYCAST model).

3.3. BICYCLE NETWORK

Bicycle facilities were added to the network during the 2014-2015 model update. Existing bicycle networks were developed from shapefiles maintained and collected by the Alameda CTC, shapefiles and local bicycle plan documents, and verification using Google maps. Bike lanes and routes were added as a new roadway link attribute for those roads that have these facilities. The following attributes are used:

- NMT = 0: No bicycle or pedestrian use (freeways, etc…)
- NMT = 1: Bicycles/pedestrians allowed, no special facilities
- NMT = 2: Bike lanes (Class II)
- NMT = 3: Bike paths (Class I)
- NMT = 4: Cycle tracks (Class IV)

Separate bike paths that do not follow street alignments were added as entirely new network links and nodes in the master road network, and follow shapes and contours in the bicycle network shapefiles so that distances could be coded accurately. Integration of the bicycle and roadway networks allows for the use of model outputs, such as vehicle volumes, area type densities and speeds when refining the path parameters in the bicycle assignments.

3.4. FUTURE TRANSPORTATION NETWORK UPDATES

The future transportation networks were updated based on the project list in Plan Bay Area 2040 (Appendix A). The Alameda Countywide model has full representation of projects that would directly affect travel within or to/from Alameda County. Other projects of regional significance such as express lanes or Caltrain extensions are also included to correctly represent regional congestion characteristics. The Alameda Countywide model does not include specific coding for most local circulation improvements outside Alameda County, such as freeway interchange projects on US 101 in San Mateo County.

Road Improvements

The following major road improvements are included in the future road network coding:

- I-80 interchange improvements in Berkeley area (Ashby coded for 2030, proposed Gilman changes are at level of detail that cannot be modeled)
- SR 84 Pigeon Pass widening (2030)
- I-580 interchange improvements in Dublin/Pleasanton/Livermore (2030-2035)
- I-680 hard shoulder lane use through Alameda and Contra Costa counties (2040)
- I-880 interchange improvements in Hayward area (2030)
- I-880 Broadway/Jackson interchange project in Oakland (2030)
- SR 262/Mission Boulevard connector improvements (2030)
- East-west connector in Union City/Fremont (2030)
- Santa Clara County and MTC express lanes (2019-2029)
- Bay Area Forward including adaptive ramp metering and other freeway management strategies throughout Bay Area
- Traffic operations systems (TOS) such as the I-80 and I-580 Integrated Corridor Management (ICM) projects (2030)

Local road improvements are also included in the model if the improvement was either included in the Plan Bay Area 2040 project list, or additional information has been provided by local jurisdictions. Some of these local projects include:

- Dublin Boulevard extension (2025)
- Tassajara Road widening to Contra Costa County line (2030)
- Union City Boulevard widening (2025)
- Road diets in Oakland and Alameda

Transit Improvements

Year 2020 and 2040 transit networks included major capital projects as defined in the MTC Regional Transportation Plan (RTP), to the extent possible from existing information from the current Alameda Countywide model transit networks. As with the roadway improvements, for areas located outside of Alameda County, only projects of regional significance, such as BART extensions, commuter rail extensions and upgrades, light rail, ferry and bus rapid transit (BRT), have been coded into the transit networks based on coding information provided in the Plan Bay Area 2040 transit networks, to ensure proper regional connectivity with Alameda County trip movements.

Rail Transit Improvements

Significant rail transit improvements that are included in the model are:

- BART extensions to Berryessa (by 2020) and Santa Clara (by 2040)
- BART frequency improvements (by 2040)

- Capitol Corridor frequency improvements (by 2020)
- MUNI Central Subway (by 2019)
- Caltrain extension to Transbay Terminal (by 2040)
- SMART rail service (by 2017)
- Santa Clara VTA Capitol LRT extension (2020)

Bus Rapid Transit

Bus Rapid Transit (BRT) improvements include:

- East Bay BRT on International/East 14th (2020)
- San Pablo Avenue BRT (2030)
- Alameda Point BRT (2030)
- MUNI BRT, Van Ness and Geary (2019-2020)
- Santa Clara VTA El Camino Real (2030)

Ferries

New ferry services include:

- Richmond-San Francisco (2020)
- Albany/Berkeley-San Francisco (2024)
- Alameda Seaplane Lagoon-San Francisco (2030)
- Treasure Island-San Francisco (2030)

Bicycle Network Improvements

Future bicycle improvements were coded during the 2014-2015 model update. Development of the future bicycle networks was limited since many future bicycle improvements are not well defined at an individual facility level to allow for detailed coding of bicycle infrastructure. Future bicycle infrastructure was based mostly from information gathered from adopted bicycle plans from the local jurisdictions and the Alameda CTC Countywide Bicycle Plan. Development of the 2040 bicycle network was done first, as this would represent the ultimate level of bicycle infrastructure, based on adopted county and local jurisdiction plans. The 2020 bicycle improvements were then estimated by using proximity to major activity centers and transit stops. Future bicycle networks were developed using the following guidelines:

2020 Bicycle Network

Bikeway segments were included in the 2020 network if they satisfied all of the following:

- Existing local and countywide network,
- Proposed local and countywide networks within urbanized areas based on adopted plans, and
- Proposed countywide network within CBDs or within one-half mile of transit.

2040 Bicycle Network

Bikeway segments were included in the 2040 network if they satisfied any of the following:

- Existing local and countywide network,
- 2020 network,
- Proposed local and countywide networks within urbanized areas based on adopted plans, and
- Three major inter-jurisdictional trails (Bay Trail, East Bay Greenway, and Iron Horse Trail).

The existing and future bicycle facility assumptions were reviewed by local jurisdictions during the 2014-2015 model update.

4. SOCIOECONOMIC DATA

The land use and socio-economic data used as inputs to the Alameda Countywide model were updated to reflect the latest projections developed by the Metropolitan Transportation Commission (MTC) and Association of Bay Area Governments (ABAG) for Plan Bay Area 2040. This update is required by the Congestion Management Program legislation.[3]

The land use and socio-economic databases included in the Alameda Countywide model as updated in 2015 were based on MTC Plan Bay Area (adopted in 2013) and ABAG's Projections 2013.

IN THIS SECTION>>

- Land use data sources
- Allocation of Alameda County land uses
- Comparison to Plan Bay Area 2040
- Inputs for areas outside Alameda County

In July 2017, ABAG and MTC jointly adopted Plan Bay Area 2040, which includes the Sustainable Communities Strategy (SCS), a plan that demonstrates how the region will meet its greenhouse gas reduction target through integrated land use, housing and transportation planning. As part of the current update, these SCS growth projections for the region were incorporated in the Alameda Countywide model. The Plan Bay Area 2040 inputs were provided in the 1,454 regional transportation analysis zones (RTAZ) used by MTC. The land use and socio-economic data were allocated to the countywide model TAZs, which are smaller than RTAZs, based upon review and redistribution by the jurisdictions in Alameda County.

The land use database years for the model are 2010, 2020, and 2040.

4.1. INPUT DATABASES

The input land use and socioeconomic data sources include databases from MTC, San Joaquin County and the prior Alameda Countywide model land use allocations.

Plan Bay Area 2040

Land use and socioeconomic data for MTC Plan Bay Area 2040 modeling ("tazdata" files) were downloaded from the MTC data repository (http://data.mtc.ca.gov/data-repository/) for the 2010, 2020 and 2040 study years. These files are outputs from the Urbansim land use allocation program, and were used as input to the travel forecasting for Plan Bay Area 2040. The data files were current as of August, 2017.

[3] California Government Code Section 65089, Congestion Management Program Legislation, amended by Statutes 2002, Ch. 505, Sec. 4. Effective January 1, 2003.

Three County Model

The land use inputs for San Joaquin County were obtained from the San Joaquin County Council of Governments (SJCCOG) from the Three County Model used for the San Joaquin County 2014 Regional Transportation Plan. The land use inputs were provided for the 2008, 2020 and 2040 study years in February, 2018. Updated land use forecasts have since been applied for the 2018 San Joaquin County RTP, but were not available at the time of the Alameda Countywide model update.

4.2. ALAMEDA COUNTY SOCIOECONOMIC DATA

The land use allocations within Alameda County are based on an initial allocation, local jurisdiction review, and a final adjustment to achieve required control totals.

Initial Allocations

The initial allocations of PBA 2040 land uses to Alameda Countywide model TAZs directly used the MTC/ABAG allocations to MTC RTAZs. For each MTC RTAZ, the land uses were disaggregated to the corresponding Alameda Countywide model TAZs based on the allocation splits for that MTC RTAZ from the final P2013 allocations.

For example, if a specific Alameda County Model TAZ in Fremont contained 35 percent of the manufacturing jobs in the corresponding MTC RTAZ in 2040 according to the final Plan Bay Area 2013 allocations, then the initial PBA 2040 allocations would place 35 percent of that MTC RTAZ's 2040 manufacturing jobs according to PBA 2040 in that Alameda County Model TAZ.

Base Year 2010

In preparation for PBA 2040 modeling, MTC calibrated the Urbansim land use allocation model. To provide a target for Urbansim model calibration, a "2010 baseyear" data set was developed based on 2010 Census data and other land use sources. This represented the observed condition that the Urbansim model was calibrated to represent as closely as possible. The 2010 base year "tazdata" database was an output from the Urbansim program. Because it is a simulation, there were differences from the observed 2010 base year data, although the two 2010 datasets are consistent in aggregate. However, the 2010 "tazdata" is more consistent with the future year PBA 2040 land use databases as they are all outputs from the Urbansim model.

Since the Alameda Countywide model was previously calibrated based on Census sources, the 2010 "tazdata" used for PBA 2040 would be inconsistent with the Alameda Countywide model calibration. Therefore, the 2010 base year land use allocations for the Alameda Countywide model are based on the "2010 baseyear" database rather than the 2010 "tazdata." However, there are some inconsistencies with the future PBA 2040 land use databases which are based on Urbansim output. Additional checks were applied to minimize these inconsistencies as described below.

Future Years 2020 and 2040

The 2020 and 2040 land use allocations for the Alameda Countywide model are based directly on the 2020 and 2040 "tazdata" land use databases from PBA 2040.

To minimize inconsistencies between the PBA 2040 inputs and the 2010 "baseyear" data based on Census sources, an additional adjustment was applied for each forecast year. For 2020, the initial 2020 allocations were compared to the 2010 baseyear allocations. If an individual entry (such as single family households) was decreasing between 2010 and 2020, the 2010 value was held constant and, if possible, the residual differences were allocated to other Alameda Countywide model TAZs within the same MTC RTAZ to maintain MTC RTAZ totals. The same test was applied between 2020 and 2040, ensuring that a minimal number of entries showed decreases between the 2020 and 2040 forecast years.

Local Jurisdiction Review

The initial allocations of PBA 2040 households and employment were distributed to each jurisdiction in Alameda County for review. The local jurisdictions were initially asked to maintain household and employment totals within each MTC RTAZ. Comments were received from all jurisdictions, although several did not make specific edits (Alameda County, Berkeley). Several jurisdictions provided specific edits for housing but not employment (Dublin, Hayward, Newark, Oakland, Piedmont, Pleasanton).

Control Totals

After land uses were revised based on comments from the jurisdictions and adjusted for consistency between years, the total housing and employment were compared to the jurisdiction control totals from PBA 2040 as well as the totals for Alameda County. Following incorporation of local jurisdiction review, the Alameda County totals were within the one percent consistency target for 2020 housing and employment and 2040 employment. However, the 2040 housing was 1.1 percent higher than the MTC consistency target. The longer range housing growth forecast provided by the City of Newark (the jurisdiction furthest from the PBA 2040 target) was reduced from a 2010 to 2040 growth of 5,400 units to a growth of 2,500 so that the county housing total would be within the required one percent of the consistency target.

Final Socioeconomic Inputs

Once the revised household and employment totals were established for each Alameda Countywide model TAZ, the appropriate disaggregations of population, employed residents, households by income quartile, population by age category and other inputs to the Alameda Countywide model process were estimated using the corresponding MTC RTAZ data from PBA 2040. If one MTC RTAZ contained six Alameda Countywide model TAZs, similar stratifications of housing and population were assumed for all six Alameda Countywide model TAZs.

The initial and final housing and employment totals are summarized by jurisdiction in Table 7, Table 8 and Table 9

Table 7: Land Use Comparison to PBA 2040, Year 2010

Jurisdiction	Households				Employment			
	PBA 2040 Initial Allocation	Final Adjusted	Difference	Percent Difference from PBA 2040	PBA 2040 Initial Allocation	Final Adjusted	Difference	Percent Difference from PBA 2040
Alameda County	46,700	46,700	0	0.0%	25,800	25,800	0	0.0%
Albany	7,500	7,500	0	0.0%	4,500	4,500	0	0.0%
Berkeley	45,600	45,600	0	0.0%	90,100	90,100	0	0.0%
Emeryville	6,000	6,000	0	0.0%	15,800	15,800	0	0.0%
Oakland	154,100	154,100	0	0.0%	179,900	179,900	0	0.0%
Piedmont	3,800	3,800	0	0.0%	1,800	1,800	0	0.0%
Alameda	30,400	30,400	0	0.0%	29,400	29,100	-300	-1.0%
San Leandro	31,200	31,200	0	0.0%	49,500	49,500	0	0.0%
Hayward	45,200	45,200	0	0.0%	59,000	59,000	0	0.0%
Union City	20,500	20,500	0	0.0%	21,300	20,400	-900	-4.2%
Fremont	71,000	71,000	0	0.0%	86,200	86,200	0	0.0%
Newark	13,000	13,000	0	0.0%	17,300	17,300	0	0.0%
Dublin	14,800	14,900	100	0.7%	16,400	16,400	0	0.0%
Pleasanton	25,800	25,900	100	0.4%	59,400	59,400	0	0.0%
Livermore	29,600	28,300	-1,300	-4.4%	49,400	48,000	-1,400	-2.8%
TOTAL	**545,200**	**544,100**	**-1,100**	**-0.2%**	**705,800**	**703,200**	**-2,600**	**-0.4%**

Table 8: Land Use Comparison to PBA 2040, Year 2020

Jurisdiction	Households				Employment			
	PBA 2040 Initial Allocation	Final Adjusted	Difference	Percent Difference from PBA 2040	PBA 2040 Initial Allocation	Final Adjusted	Difference	Percent Difference from PBA 2040
Alameda County	50,900	50,900	0	0.0%	27,500	27,500	0	0.0%
Albany	7,700	7,700	0	0.0%	5,100	5,100	0	0.0%
Berkeley	51,400	51,400	0	0.0%	114,900	114,900	0	0.0%
Emeryville	7,200	7,100	-100	-1.4%	19,100	19,100	0	0.0%
Oakland	185,800	185,800	0	0.0%	236,600	236,600	0	0.0%
Piedmont	3,800	3,800	0	0.0%	2,000	2,000	0	0.0%
Alameda	34,600	34,100	-500	-1.4%	36,300	36,300	0	0.0%
San Leandro	34,100	34,100	0	0.0%	54,100	54,100	0	0.0%
Hayward	48,100	50,500	2,400	5.0%	68,600	68,600	0	0.0%
Union City	22,400	21,700	-700	-3.1%	24,400	24,400	0	0.0%
Fremont	77,100	76,500	-600	-0.8%	100,400	101,700	1,300	1.3%
Newark	14,000	14,800	800	5.7%	19,900	19,900	0	0.0%
Dublin	16,000	21,000	5,000	31.3%	20,500	20,500	0	0.0%
Pleasanton	29,700	28,900	-800	-2.7%	67,500	67,500	0	0.0%
Livermore	30,900	30,300	-600	-1.9%	53,900	55,800	1,900	3.5%
TOTAL	**613,700**	**618,600**	**4,900**	**0.8%**	**850,800**	**854,000**	**3,200**	**0.4%**

Table 9: Land Use Comparison to PBA 2040, Year 2040

Jurisdiction	Households				Employment			
	PBA 2040 Initial Allocation	Final Adjusted	Difference	Percent Difference from PBA 2040	PBA 2040 Initial Allocation	Final Adjusted	Difference	Percent Difference from PBA 2040
Alameda County	53,500	53,600	100	0.2%	28,000	28,000	0	0.0%
Albany	8,000	7,900	-100	-1.3%	5,300	5,300	0	0.0%
Berkeley	54,500	54,500	0	0.0%	121,200	121,200	0	0.0%
Emeryville	19,000	19,000	0	0.0%	19,800	19,800	0	0.0%
Oakland	242,400	242,000	-400	-0.2%	274,400	274,400	0	0.0%
Piedmont	3,900	3,900	0	0.0%	1,900	1,900	0	0.0%
Alameda	35,400	36,600	1,200	3.4%	42,800	42,800	0	0.0%
San Leandro	36,300	37,500	1,200	3.3%	59,400	53,800	-5,600	-9.4%
Hayward	54,000	55,700	1,700	3.1%	75,600	75,600	0	0.0%
Union City	23,400	23,200	-200	-0.9%	28,600	28,500	-100	-0.3%
Fremont	90,200	91,100	900	1.0%	118,500	118,500	0	0.0%
Newark	14,100	15,400	1,300	9.2%	22,900	22,900	0	0.0%
Dublin	28,300	28,100	-200	-0.7%	28,700	28,700	0	0.0%
Pleasanton	33,200	31,700	-1,500	-4.5%	74,200	74,200	0	0.0%
Livermore	38,300	39,200	900	2.3%	52,300	53,500	1,200	2.3%
TOTAL	**734,500**	**739,400**	**4,900**	**0.7%**	**953,600**	**949,100**	**-4,500**	**-0.5%**

4.3. OTHER BAY AREA SOCIOECONOMIC DATA

The land use inputs for the eight Bay Area Counties outside Alameda County were derived directly from the PBA 2040 allocations to MTC RTAZs. Land uses in Alameda Countywide model TAZs that were subdivided from MTC RTAZs in west Contra Costa County, Milpitas, and San Ramon ("buffer zones") were allocated based on the prior allocations from P2013, using the same process as the initial allocations within Alameda County. These allocations in the buffer zones were not distributed to the local jurisdictions outside Alameda County for review.

4.4. SOCIOECONOMIC INPUTS FOR SAN JOAQUIN COUNTY

Household and employment inputs were obtained from the Three County travel model maintained by the San Joaquin County Council of Governments (SJCOG). The land use assumptions were current as of the 2014 Regional Transportation Plan. The land uses were aggregated from the Three County model TAZs to the Alameda Countywide model TAZs. The 2010 land uses were estimated by interpolating between the 2008 and 2020 data provided.

4.5. SPECIAL GENERATORS

In addition to trips generated by socioeconomic data inputs, additional trips are generated based on inputs for truck activity, airport passengers and school enrollment.

Truck Inputs

A truck modeling component was developed for the Alameda Countywide model in 2010 and was fully incorporated in the model structure during the Projections 2009 update. The truck modeling replaced the MTC BAYCAST trip generation formulas for small, medium and large trucks based on employment land uses with formulas calibrated to observed truck volumes in Alameda County. It also added special generator inputs to account for truck trips that are not correlated directly with employment. This particularly affects the Port of Oakland.

The truck inputs are contained in database files titled "port_sg_[Year]." These files contain values for small, medium and combo (large) trucks in each of the TAZs representing the Port of Oakland. The values do not correlate directly to specific amounts of truck activity. Rather, they represent the calibrated differences (from the 2005 truck model calibration year) between the trucks generated based on employment in the Port of Oakland and the observed trucks entering and leaving the Port. The forecast values for 2020 and 2040 represent growth factors applied to the 2005 calibration year, based on expected growth in truck activity. Therefore, changes in truck special generator inputs must always be based on a scaling from 2005 levels of truck activity at the Port.

Airport Inputs

The Alameda Countywide model includes a component that evaluates airport passenger trips for the Oakland, San Francisco and San Jose airports. The inputs to the air passenger models are the number of daily enplanements (arrivals plus departures) requiring ground access, calculated as annual passengers divided by 365 days per year and multiplied by a factor representing trips with an endpoint at the Bay Area airport (excluding transfers). For the Oakland International Airport, the factor is 0.96 corresponding to approximately 4 percent of passengers transferring within the airport.

The most current source of airport forecasts is the 2011 Regional Airport System Planning Analysis[4]. The daily ground access passengers used in the Alameda Countywide model are listed in Table 10.

Table 10: Alameda Countywide Model Airport Assumptions

	Annual Air Passengers (millions)*		Daily Ground Access Passengers		
Airport	**2020**	**2035**	**2010**	**2020**	**2040**
Oakland	16.3	20.7	25,000	44,700	61,700
San Francisco	46.1	64.3	65,000	115,300	159,100
San Jose	12.9	16.3	15,900	34,900	48,200
Total	**75.3**	**101.3**	**105,900**	**194,900**	**269,000**

*From 2011 Regional Airport System Planning Analysis, Figure 3-4, page 15

[4] Regional Airport Planning Committee, "Regional Airport System Planning Analysis, 2011 Update, Volume 1: Final Report," September, 2011, prepared by SH&E.

School Inputs

School trips are calculated separately for grade school, high school and college trips. The inputs and procedures are consistent with the MTC BAYCAST model.

Grade School

Grade school attractions for each TAZ are assumed to be equivalent to the grade school trips produced by households in that TAZ. In the MTC model, it was assumed that RTAZs were large enough that most residential RTAZs would also have an elementary school. This may be less likely with the smaller Alameda Countywide model TAZs, but the methodology has been maintained. The grade school trips are calculated based on the population in the 5 to 13 age range. This population is estimated from the input population from 5 to 19 based on factors contained in a year 2000 land use input file; the year 2000 factors were in turn based on analysis of the 2000 Census.

High School

High school trips generated by households are based on the population in the 14 to 17 age range. As with the grade school trips, this population is estimated based on updated population inputs for the 5 to 19 age range and factors from the 2000 Census contained in the year 2000 land use input file. High school trip attractions are calculated from high school enrollment in individual TAZs. The high school enrollment was obtained from the MTC PBA 2040 land use inputs, allocated to the Alameda Countywide model TAZs based on the prior P2013 allocations.

College

College trips generated by households are based on different factors applied to the populations in the 18 to 19, 20 to 24 and 25 to 44 age ranges. The population proportions within each of these age groups is estimated based on population inputs and factors from the 2000 Census contained in the year 2000 land use input file. College trip attractions are calculated from full-time and part-time college enrollment in individual TAZs. The college enrollment was obtained from the MTC PBA 2040 land use inputs, allocated to the Alameda Countywide model TAZs based on the prior P2013 allocations.

4.6. EXTERNAL GATEWAYS

The trips for external gateways are input directly as trips, rather than being calculated from land uses. The overall vehicle volumes used as input are listed in Table 3: Alameda Countywide Model Gateway Volumes, page 23. As described on that page, the growth rates for each gateway were derived from historic growth trends and the 2011 trip-based version of the California Statewide travel model. The gateway growth assumptions were not updated for the PBA 2040 model update.

The total gateway traffic volumes are converted to person trips by purpose so that the gateway trips by purpose will interact with the trips generated within the model area. Trip purpose splits for each gateway were estimated based on the Statewide Model. The conversion from vehicle trips to person trips was estimated using the ratios of persons to vehicles for each individual trip purpose from a prior version of the Alameda Countywide model.

5. MODEL PROCESS

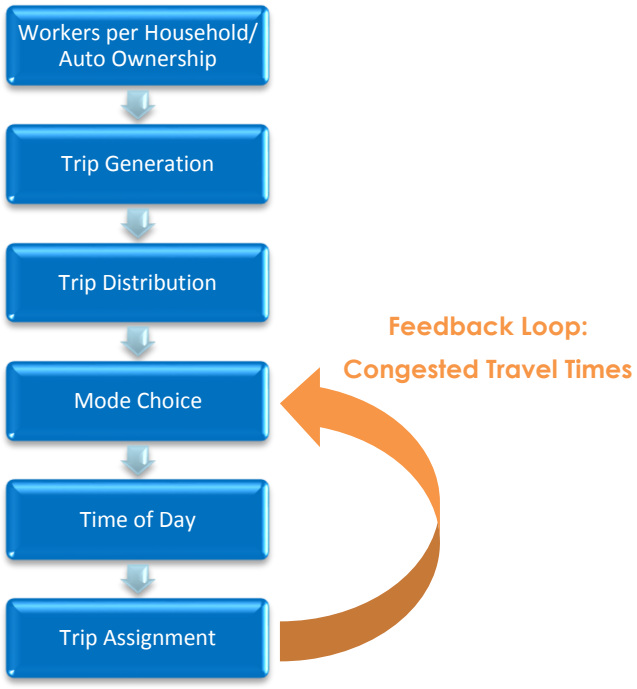
The model process consists of a series of steps which use the input data and generate travel forecasts. Each of these steps is calibrated by adjusting formulas and parameters so that each step will replicate observed data from travel surveys. Once each step is calibrated, the model is validated by comparing model output to observed traffic and transit flows. The model validation is described in Section 6. This section describes each of the key steps in the model process. Appendix B describes details of the calibration of individual steps.

IN THIS SECTION>>

- Steps in model process
- Trip generation inputs
- Time of day peaking factors

The model process is summarized in Figure 13.

Figure 13: Model Process

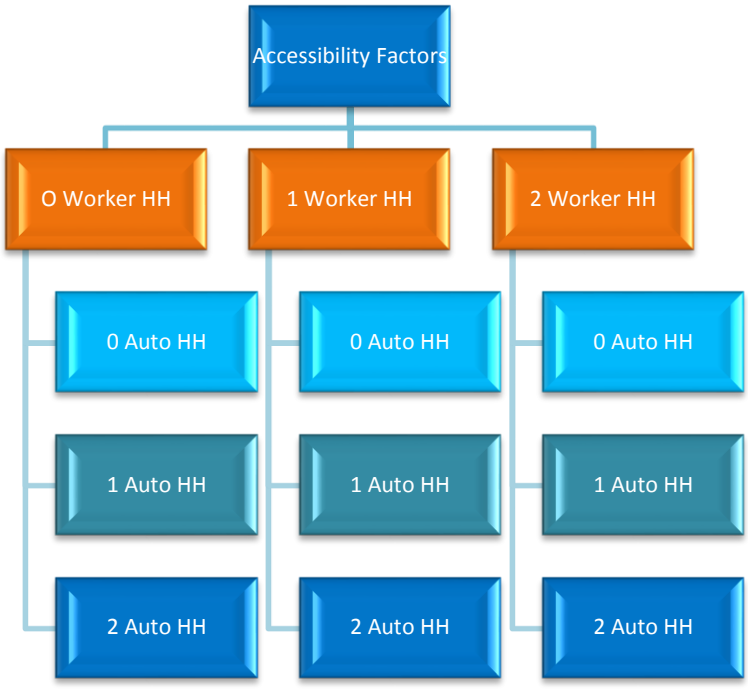


This type of travel modeling process is frequently referred to as a "trip-based" or "four step" model. The process described in this section includes several steps in addition to the typical four steps of trip generation, trip distribution, mode choice and trip assignment.

5.1. WORKERS PER HOUSEHOLD AND AUTO OWNERSHIP MODELS

There are several calculations that create inputs to the trip generation and mode choice steps (Figure 14). The calibration of these steps, conducted during the 2014-2015 model update, is described in more detail in Appendix B.

Figure 14: Workers per Household and Auto Ownership Models



Accessibility Factors

Factors representing the weighted accessibility from each TAZ to all other TAZs are calculated for road and transit travel. These factors are used as input to the auto ownership model. The accessibility calculations are based on the road and transit travel times between each pair of TAZs.

Workers per Household

Households are stratified into households with zero workers, a single worker or multiple workers. These stratifications are used in the calculation of work trips. The calculations are done separately for each of the four income quartiles. The estimates are based on inputs including population density per acre, average population per household and household incomes.

Auto Ownership

The households by number of workers are further stratified into households with zero, one, or two or more vehicles. The numbers of vehicles combined with the number of workers informs the estimates of vehicle

availability for members of the household during the mode choice calculations. The inputs include incomes and the road and transit accessibility factors calculated in the earlier step.

5.2. TRIP GENERATION

The Alameda County Model uses the same trip purposes and trip generation procedures as the MTC BAYCAST model. The trip purposes in the model are shown in Table 11.

Table 11: Trip Purposes

Trip Purpose	Definition
Home-work (4 subtypes): *Income quartile 1* *Income quartile 2* *Income quartile 3* *Income quartile 4*	Commute trips between residences and places of employment, including both trips from home to work and from work to home. The MTC model stratifies these work trips into four income groups.
Home-shop/other	Trips between residences and places of retail employment or personal errands.
Home-social/recreation	Trips between residences and social visits or recreational attractions.
Non-home-based	Trips where neither end is at home, such as trips between work and shopping.
Home-grade school	Trips between home and elementary school.
Home-high school	Trips between home and high school.
Home college	Trips between home and college/university.

Input Variables

The primary input variables for trip generation for each of the trip purposes are listed in Table 12. For work trips, the calculations are done separately for households stratified by each income quartile and auto ownership category. For other home-based trips, the calculations are done separately for households stratified by different numbers of workers and autos, but not income quartiles.

San Joaquin County Trip Generation

The MTC model treats trips from San Joaquin County as external trips. To represent more accurately the interrelation between Alameda County and San Joaquin County, San Joaquin County is included as an internal area in the Alameda Countywide model. The trip generation equations in the Alameda Countywide model for San Joaquin County trips were based on those in a prior (pre-2012) version of the San Joaquin County travel model. Trip production and trip attraction rates used are summarized in Appendix B, Table 39, page 118.

Table 12: Trip Generation Input Variables

	Trip Purpose						
Input Variable	**Home-Work**	**Home-Shop/ Other**	**Home-Social/ Rec**	**Non Home**	**Grade School**	**High School**	**College**
Population Inputs							
Employed Residents	**P**		**P**				
Population 5-13					**P,A**		
Population 14-17						**P**	
Population 18-44							**P**
Household Inputs							
Households		**P**	**P,A**	**P,A**			
Persons per Household		**P**	**P**				
Workers per Household			**P**				
Vehicles per Household		**P**	**P**				
Average Household Income		**P**	**P**				
Employment Inputs							
Total Employment	**A**						
Retail Employment		**A**	**A**	**P,A**			
Service Employment		**A**	**A**	**P,A**			
Other Employment		**A**		**P,A**			
Employment Density	**A**						
School Inputs							
High School Enrollment						**A**	
College Enrollment: Full Time							**A**
College Enrollment: Full Time							**A**

P = Input used to calculate trip productions (home end of trip)

A = Input used to calculate trip attractions (non-home end of trip)

Truck Trip Generation

The Alameda Countywide model forecasts four types of truck trips:

- Very Small trucks
- Small Trucks
- Medium Trucks
- Large or "Combo" Trucks

The trip generation rates for Very Small trucks (for example, pickup trucks used by construction companies) are consistent with the MTC BAYCAST model. The Very Small trucks are modeled as passenger autos for the purposes of traffic assignment and capacity calculations. The trip generation rates for the other three types of trucks were updated based on the Alameda County CMA truck modeling study completed in early 2010. These truck rates were based on updated research and a series of detailed truck classification counts throughout Alameda County.

5.3. TRIP DISTRIBUTION

The trip distribution process estimates how many trips travel from one zone to another. The model uses a method known as the gravity model to estimate trips between zones based on the trip productions and attractions in each zone and on factors that relate the likelihood of travel between zones to the separation between the zones.

Trip Impedance

The impedances between TAZs are represented by distances or travel times from the road network. Distances are used for non-truck trip distribution. The travel times used for truck trips are based on estimated average daily congested speeds (SPEED_D) that are looked up based on the facility type (FT) and area type (AT) for each road segment. The "skim" process identifies the shortest route through the network for each pair of TAZs. The skim process also compiles tolls for each route based on toll bridges and express lane segments traversed on the route. The distances, times and costs are tracked separately for drive alone, shared ride 2 and shared ride 3+ person vehicles.

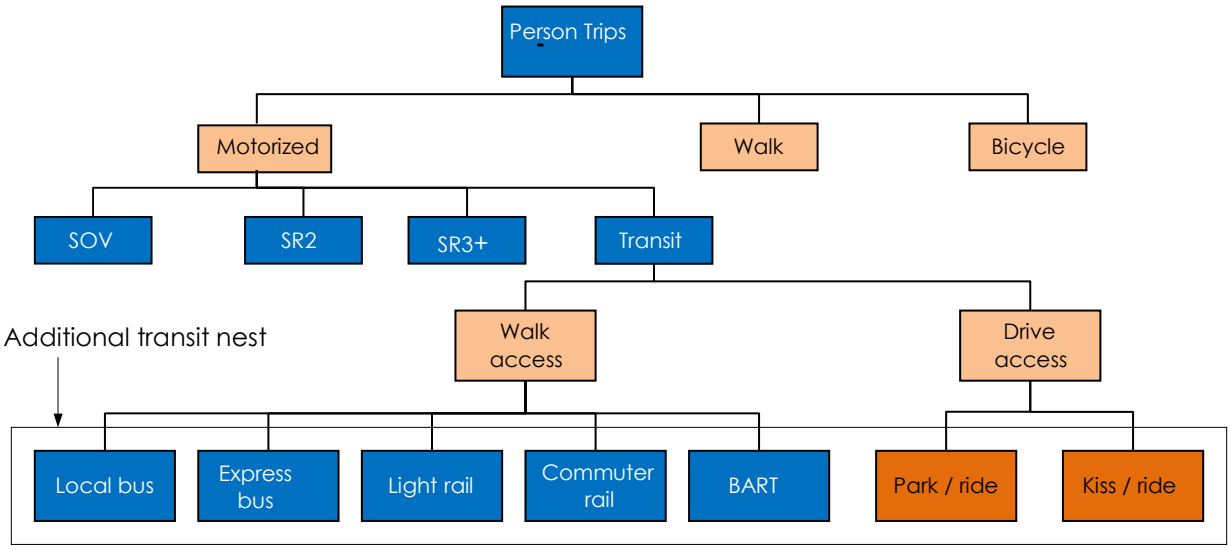
Friction Factors

The effects of spatial separation in the gravity model are represented empirically by "friction factors" that express the effect that distance or travel time exerts on the propensity for making a trip to a given zone. Typically, the probability for making a particular trip declines as the impedance increases. For non-truck purposes, the Alameda Countywide model uses the friction factors from the MTC BAYCAST model, with different sets for each of the 10 trip purposes. This accounts for the possibility that people may be willing to drive a long distance to go to work, but only short distances for most shopping or school trips. Friction factors for the four classes of truck trips were calibrated specifically for the Alameda Countywide truck model in 2010.

5.4. MODE CHOICE

The Alameda Countywide mode choice models are based on the MTC BAYCAST model but add additional detail, particularly for non-work trip purposes. The additional features in the Alameda County mode choice models were derived directly from the mode choice models developed by the Santa Clara Valley Transportation Authority (VTA) for the Santa Clara County travel model. The structure of the Alameda Countywide nested logit mode choice model is shown in Figure 15.

Figure 15. Alameda Countywide Model Mode Choice Model Structure



The MTC BAYCAST model included a nested logit mode choice model for home-based work trips. Two nests were added for the Alameda Countywide model during the original model development in the mid-2000s:

- The transit/walk access submode was subdivided into further submodes: local bus, express bus (which includes ferries), light rail, commuter rail, and BART.
- The transit/drive access submode was subdivided further into park/ride and kiss/ride submodes.

The MTC BAYCAST model used simpler choice structures for mode choice for non-work trip purposes. The Alameda Countywide model uses the full nested logit mode choice structure with transit submodes for all trip purposes. The mode choice model does not include choices between drivers who will and won't pay tolls to use express lanes; this choice is evaluated in a later step prior to the final peak period traffic assignments.

The mode choice models were recalibrated during the 2015 model update by adjusting the mode-specific constants so that outputs from the mode choice model matched transit mode shares from household travel survey data as well as transit ridership data from the operators (see Appendix B).

5.5. TIME OF DAY

The number of trips traveling during each time period are evaluated using two sets of factors:

- Regional peaking factors based on trip purpose
- Peaking factors for specific origin-destination pairs ("diurnal factors")

Regional Peaking Factors

The regional peaking factors to convert daily vehicle trips into time-of-day proportions were developed using the 2000 Bay Area Travel Survey (BATS). The factors were extracted by trip purpose from the 2000 BATS Table 2.3.7B for all of the Alameda Countywide model analysis time periods. Peaking factors by trip purpose, direction of travel, vehicle type (drive-alone, shared-ride) and time period are presented in Table 13.

Truck peaking factors were updated during the P09 update based on the Alameda County CMA truck model study completed in 2010.

Diurnal Factors

The average regional time-of-day factors are not accurate for all trip interchanges, particularly those with higher levels of congestion. An additional set of district-to-district "diurnal" factors are applied for each peak period based on traffic counts at county line crossings and other major screenlines. Prior versions of the Alameda Countywide model used diurnal factors to also adjust peak trips at the city level. The 2015 model update simplified the diurnal factors to apply to more aggregate county-to-county traffic flows. These factors were adjusted slightly during the 2018 model update.

The specific district-to-district factors for each time period are listed in Table 14. These factors are applied after the calculation of average peak period trips using the regional peaking factors.

5.6. TRIP ASSIGNMENT

Vehicle, transit and bicycle trips are assigned to the transportation networks. The road assignment considers the effects of traffic congestion and diverts vehicles to alternative routes to balance out congestion among available routes. The transit assignment assigns all transit passengers between a specific origin and destination to the best available transit path and does not divert passengers to other paths based on congestion.

Table 13: Regional Peaking (Time of Day) Factors

Direction	From Home		To Home	
Vehicle Type	**DA**	**SR**	**DA**	**SR**
Purpose	**Home-Based Work**			
Period				
AM 1HR	13.14%	24.72%	0.17%	0.06%
AM 2 HR	24.59%	38.56%	0.40%	0.36%
AM 4 HR	34.76%	47.41%	0.82%	0.52%
PM 1 HR	0.52%	0.34%	11.80%	11.65%
PM 2 HR	0.99%	0.78%	20.44%	19.32%
PM 4 HR	1.85%	1.96%	33.14%	27.76%
Purpose	**Home-Based Non-Work**			
Period				
AM 1HR	4.44%	6.89%	2.11%	0.89%
AM 2 HR	9.05%	11.04%	3.69%	1.41%
AM 4 HR	17.76%	16.93%	6.86%	2.89%
PM 1 HR	2.68%	3.91%	4.04%	4.08%
PM 2 HR	6.22%	8.31%	8.62%	8.83%
PM 4 HR	18.57%	19.13%	21.93%	20.17%
Purpose	**Home-Based School**			
Period				
AM 1HR	14.24%	35.31%	0.77%	0.03%
AM 2 HR	21.20%	47.93%	1.25%	0.12%
AM 4 HR	30.17%	52.36%	3.86%	0.42%
PM 1 HR	2.22%	0.53%	3.34%	5.43%
PM 2 HR	6.02%	1.05%	6.55%	11.31%
PM 4 HR	10.88%	2.94%	14.38%	23.64%
Purpose	**Non Home Based**			
Period				
AM 1HR	2.19%	2.46%	0.00%	0.00%
AM 2 HR	4.74%	4.41%	0.00%	0.00%
AM 4 HR	12.69%	9.11%	0.00%	0.00%
PM 1 HR	11.72%	9.15%	0.00%	0.00%
PM 2 HR	24.95%	19.51%	0.00%	0.00%
PM 4 HR	55.10%	42.00%	0.00%	0.00%
Purpose	**Trucks**			
Period	**Small**	**Medium**	**Large Commercial**	**Very Small**
AM 1HR	5.85%	7.03%	5.75%	5.85%
AM 2 HR	11.70%	14.05%	11.50%	11.70%
AM 4 HR	23.40%	28.10%	23.00%	23.40%
PM 1 HR	5.85%	7.03%	5.75%	5.85%
PM 2 HR	11.70%	14.05%	11.50%	11.70%
PM 4 HR	23.40%	28.10%	23.00%	23.40%

Table 14: Additional Peaking (Diurnal) Factors

Origin-Destination	AM Peak 4-Hour	AM Peak 2-Hour	AM Peak 1-Hour	PM Peak 4-Hour	PM Peak 1-Hour
East Bay to San Francisco	0.60	0.50	0.50	0.95	-
San Francisco to East Bay	0.85	0.75	0.75	0.70	0.60
Alameda Co. to San Mateo Co.	0.90	-	0.90	-	-
San Mateo Co. to Alameda Co.	-	-	-	0.90	0.90
East Bay Other to San Mateo Co.	0.70	0.50	0.60	-	-
San Mateo Co. to East Bay Other	-	-	-	0.70	0.60
Alameda Co. to Santa Clara Co.	-	0.80	0.90	-	-
Santa Clara Co. to Alameda Co.	-	-	-	0.90	0.70
East Bay Other to Santa Clara Co.	0.60	0.50	0.50	-	-
Santa Clara Co. to East Bay Other	-	-	-	0.60	0.50
East Bay to Sonoma/Marin	0.70	0.60	0.60	0.60	0.50
Sonoma/Marin to East Bay	0.60	0.50	0.50	0.70	0.60
Sonoma/Marin to SF/SM/SC Cos.	0.70	0.60	0.60	-	-
SF/SM/SC Cos. to Sonoma/Marin	-	-	-	0.70	0.90
San Joaquin Co. to Alameda Co.	-	0.50	0.60	-	0.60
San Joaquin Co. to Bay Area Other	-	-	-	-	0.75
External Gateways to Model Area	-	0.50	0.50	-	0.60
Model Area to External Gateways	-	0.50	0.50	-	0.60
Through Trips	-	0.50	0.50	-	0.50

Vehicle Assignment

The Alameda Countywide model generally follows the MTC BAYCAST traffic assignment procedures for estimating congested times and finding equilibrium travel times between all available routes. The Alameda Countywide model assigns traffic for the AM peak 1-hour, PM peak 1-hour, AM Peak 4-hour, PM Peak 4-hour, Midday 6-Hour and Evening 10-hour periods. These trips are assigned in origin-destination format (OD). Daily traffic volumes are calculated as the sum of the AM Peak 4-hour (toll assignment, described below), PM Peak 4-hour (toll assignment), Midday 6-Hour and Evening 10-hour periods. The peak 1-hour assignments are not used in the calculation of daily traffic volumes

Vehicle types are assigned separately as a multi-class assignment with seven vehicle classes stored on each road segment:

1. Drive Alone
2. Shared Ride 2
3. Shared-ride 3+
4. Very Small Trucks
5. Small Trucks
6. Medium Trucks
7. Large Combo Trucks

A separate AM 2-Hour period traffic assignment is used during the model process to estimate congested auto and transit travel times as input to the mode choice model. The AM 2-Hour traffic assignment was not validated to traffic counts and the results are not reported in the final model outputs.

Toll Assignments

The initial traffic assignments do not consider the choice that single-occupant drivers can make to pay tolls to use express lanes. This choice is based on the relative speeds and travel times in the express lanes and the parallel general purpose lanes. The estimation of speeds requires an initial estimate of traffic congestion. Therefore, the initial traffic assignments are used to estimate congestion, and then a second round of toll assignments are done to reflect the choices to use express lanes.

The toll assignments are output for the AM 4-Hour and PM 4-Hour peak periods only. The initial peak period assignments are used to estimate travel times and total tolls, for all origin-destination pairs, for trips using express lanes and for trips not using express lanes. A binomial (two option) choice model was developed to estimate the percentages of drive-alone and two-person vehicles who would choose to pay tolls to save time on each origin-destination route. The choice model was calibrated by the Santa Clara Valley Transportation Authority to replicate observed counts on the I-680 and SR 237 express lanes. After the initial AM and PM 4-Hour assignments, the choice model is applied for AM and PM 4-hour trips and the trips are then reassigned for the AM 4-Hour and PM 4-Hour periods, with the toll choice drivers permitted to use the express lanes.

Transit Assignment

Transit trips are assigned in production-attraction (P-A) format in order to keep track of the home end of trips where vehicle access to and from transit is possible as opposed to the non-home end where vehicle access is not typically possible.

The transit trips are split into peak period (approximately three hours during the A.M. and three hours during the P.M.) and off-peak period trips. The peak period trips are assumed to be 60 percent of home-work trips and 40 percent of non-work trips.

The transit trips for each period are then assigned to each of the seven transit submodes (park-ride, kiss-ride, walk to BART, walk to rail, walk to LRT, walk to express bus, walk to local bus) according to the results of the mode choice models. Peak period trips are assigned to (A.M.) peak period transit services. Off-peak period trips are assigned to midday transit services. The off-peak transit service is not assumed to include drive access (park-ride, kiss-ride). Airport passenger transit trips are assigned to the midday transit service. This results in 13 total transit assignments. The final results are obtained by adding together the results of the 13 individual transit assignments.

Bicycle Assignment

Bicycle trips are assigned to the available non-motorized network (road network without freeways but with exclusive bicycle/pedestrian facilities). The assignments are output for total daily bicycle trips and PM peak hour bicycle trips.

5.7. FEEDBACK

The model includes an iterative feedback loop to ensure that travel choices are predicted based on congested travel conditions. After traffic is assigned to the road network, congested travel times are calculated based on traffic congestion, and these congested times are brought back to the mode choice step which considers the attractiveness of auto versus transit and non-motorized modes for each trip. The loop is repeated five times to ensure stable results.

6. MODEL VALIDATION

Each step of the model was calibrated to replicate data from travel surveys, as described in Section 5 and Appendix B. The model was then validated by applying base year network and socioeconomic data inputs and comparing the model estimates to observed transportation count data. The validation for the Alameda Countywide model uses a 2010 base year, as a comprehensive count database was compiled for 2010, and 2010 is also the validation year for the MTC Model One travel model that was used for evaluation of Plan Bay Area 2040.

IN THIS SECTION>>

- Validation data sources
- Traffic validation results
- Transit validation results
- Bicycle validation

6.1. VALIDATION DATA

For the current model update, the data used to validate the year 2010 model estimates were from a variety of sources and were comprised of roadway traffic counts, transit boardings, BART station ons and offs and bicycle count data.

Traffic Count Data

During the 2015 model update, the Alameda CTC assembled a comprehensive database of traffic count data compiled from a variety of different sources, which were subsequently summarized into county screenlines and segmented by time of day. Traffic counts were compiled from several different years (2008 to 2012) to provide the most reasonable estimate for a comprehensive 2010 base year. Traffic counts on the arterials that crossed the county screenlines were obtained primarily from local jurisdiction traffic counts. Traffic counts on the freeways that crossed the screenlines were obtained directly from Caltrans or from Pems databases.

Once the counts by hour for each screenline were compiled, Alameda CTC staff developed the counts for the appropriate validation time periods, as follows:

- AM Peak Hour (7:30 to 8:30 AM)
- PM Peak Hour (4:30 to 5:30 PM)
- AM Peak period (6 to 10 AM)
- PM Peak Period (3 to 7 PM)
- Daily 24-Hour

Transit Validation Data

Average weekday transit boardings by route were provided by each Alameda County transit operator for purposes of validation, including AC Transit, LAVTA, Union City Transit, Emery-go-Round, Capitol Corridor, ACE and the East Bay Ferry system. Additional 2010 transit boarding data for other transit

operators (MUNI, Caltrain, County Connection, WestCat, SamTrans and VTA) were obtained from MTC 2010 model validation documentation. In addition, BART provided year 2010 station ons and offs, as well as BART park-and-ride lot spaces.

Bicycle Validation Data

Bicycle count data were provided by Alameda CTC during the 2015 model udpate, and consisted of PM peak hour counts collected by both Alameda CTC and MTC. Bicycle counts at 63 intersections located throughout Alameda County were summarized for validation. Inbound bicycle volumes from each leg of the intersection were tabulated as the values for validation at each location. The PM peak hour count data were expanded to represent a daily bicycle count estimate based on factors from fixed trail counts obtained by Alameda CTC staff.

6.2. ROAD SCREENLINE VALIDATION

Screenlines are imaginary lines, often along natural or man-made physical barriers (e.g., rivers, railroad tracks) that have a limited number of crossings. The screenlines should "cut" the entire study area, intercepting all travel across them, thereby eliminating issues about individual route choice. Use of a system of screenlines allows systematic comparison of total model estimated versus observed travel in different parts of the model study area. However, they do not ensure that traffic is being assigned to the correct routes across each screenline.

The study area includes 16 screenlines and a cordon line which incorporates the entire perimeter of Alameda County (Figure 16 through Figure 20). These screenlines were developed in coordination with the jurisdictions during original model development in the mid 2000s.

Validation Criteria

The validation criteria used for the vehicle assignments were the same as those used in the previous model updates, and were based on error tolerances recommended by Caltrans for screenline volumes (Figure 21)[5]. These error ranges are based on a volume value and the critieria are noted for each screenline location, as the value varies depending on the volume.

[5] California Department of Transportation, JHK and Associates, Dowling Associates, *Travel Forecasting Guidelines*, 1992.

Figure 16: Validation Screenlines: Alameda County Cordon

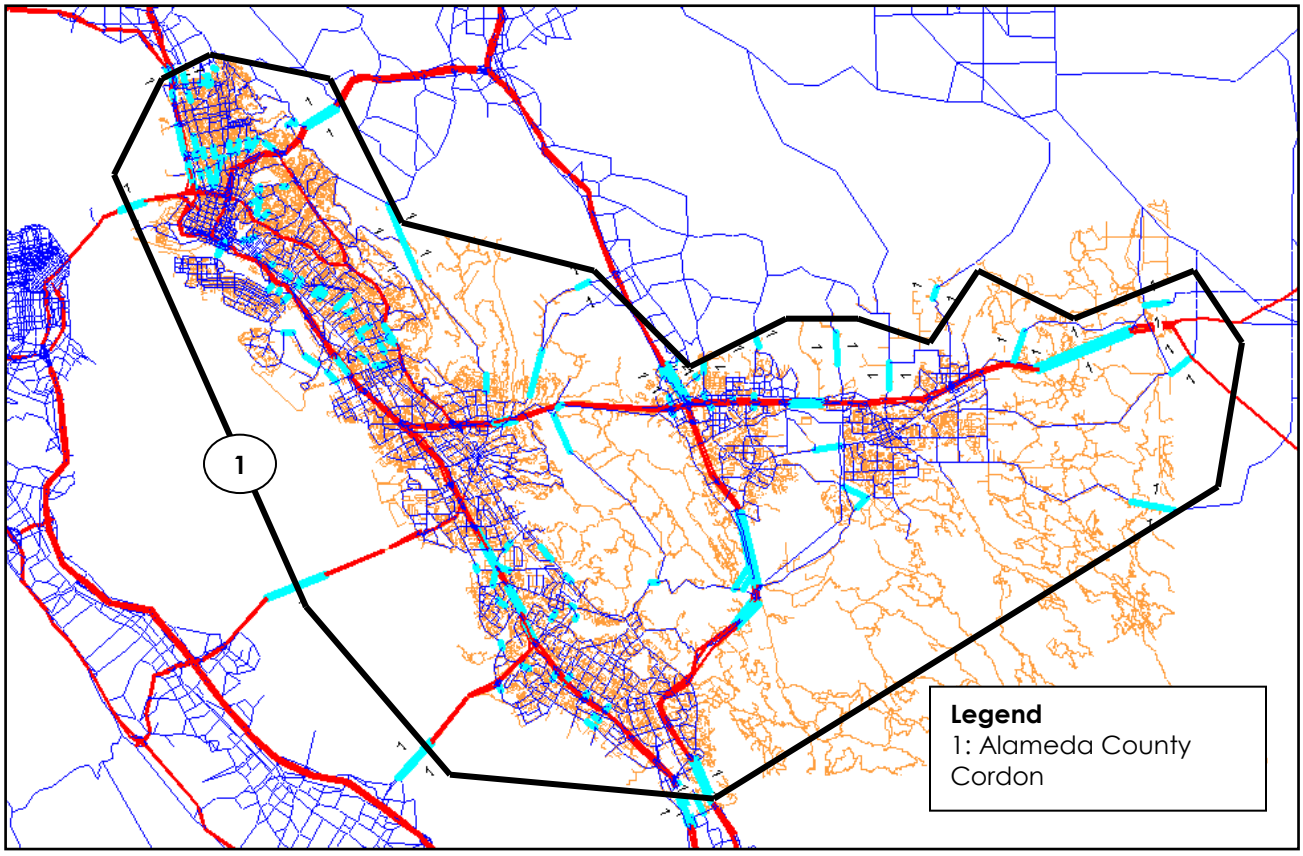


Figure 17: Validation Screenlines: North Planning Area 1

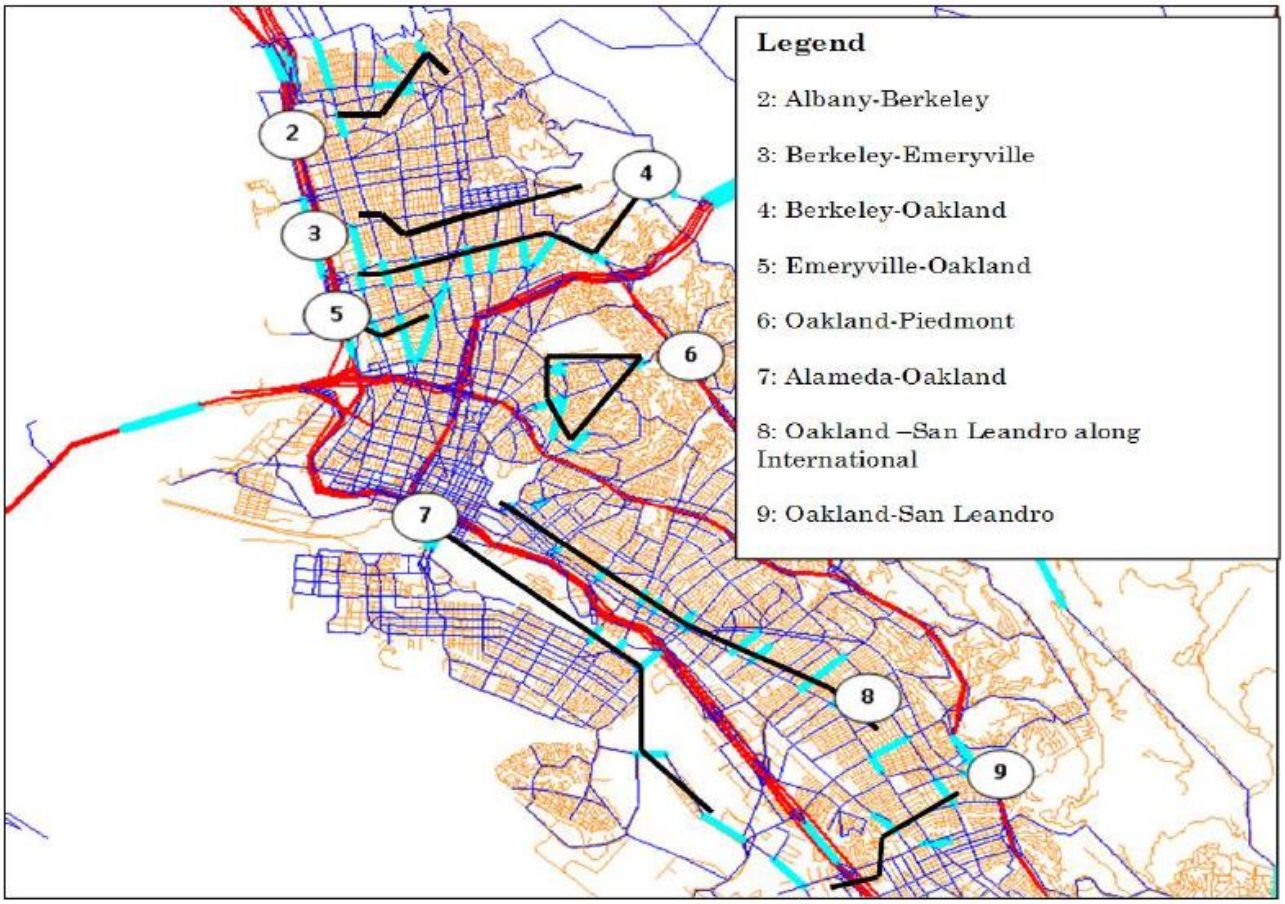


Figure 18: Validation Screenlines: Central Planning Area 2

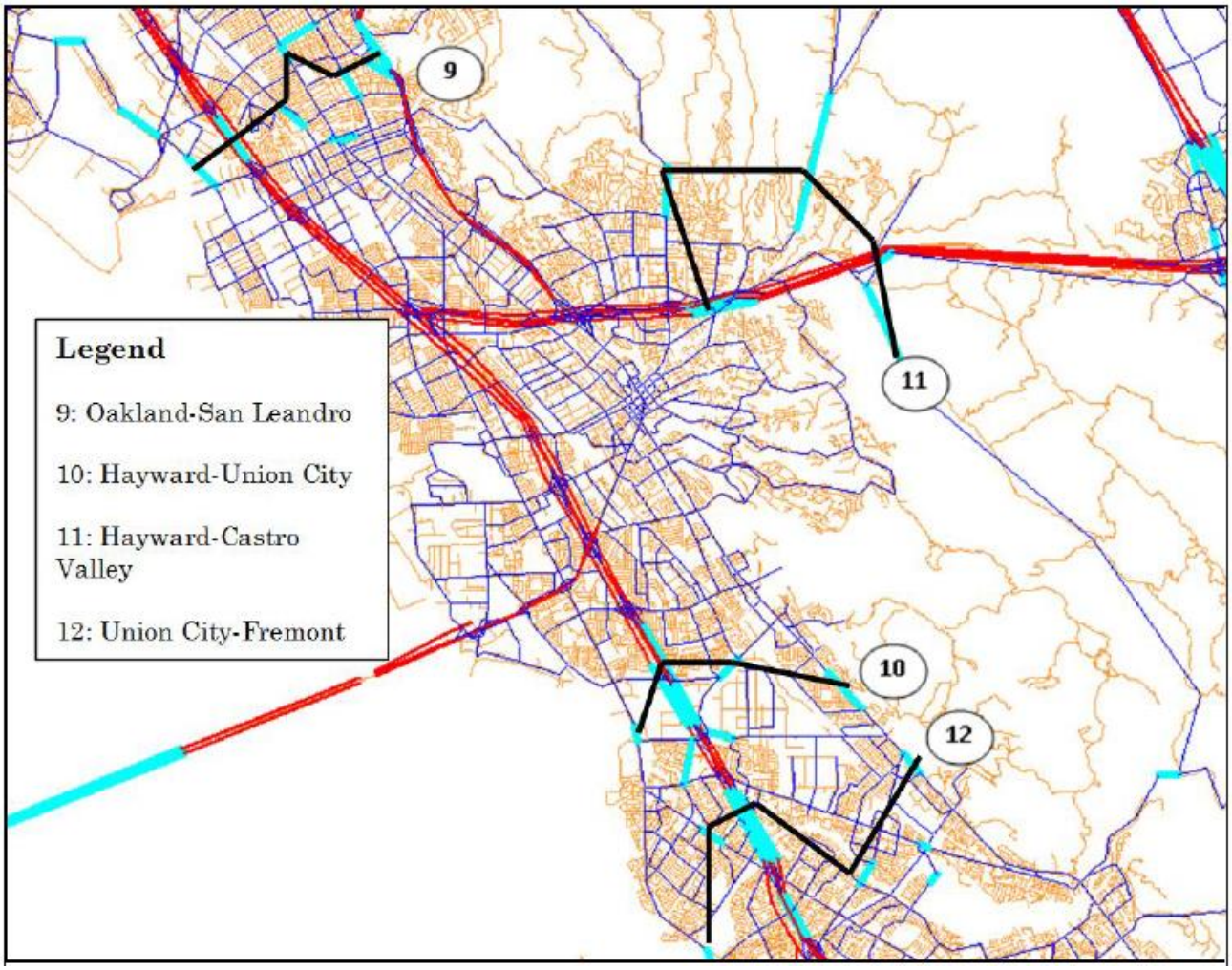


Figure 19: Validation Screenlines: South Planning Area 2

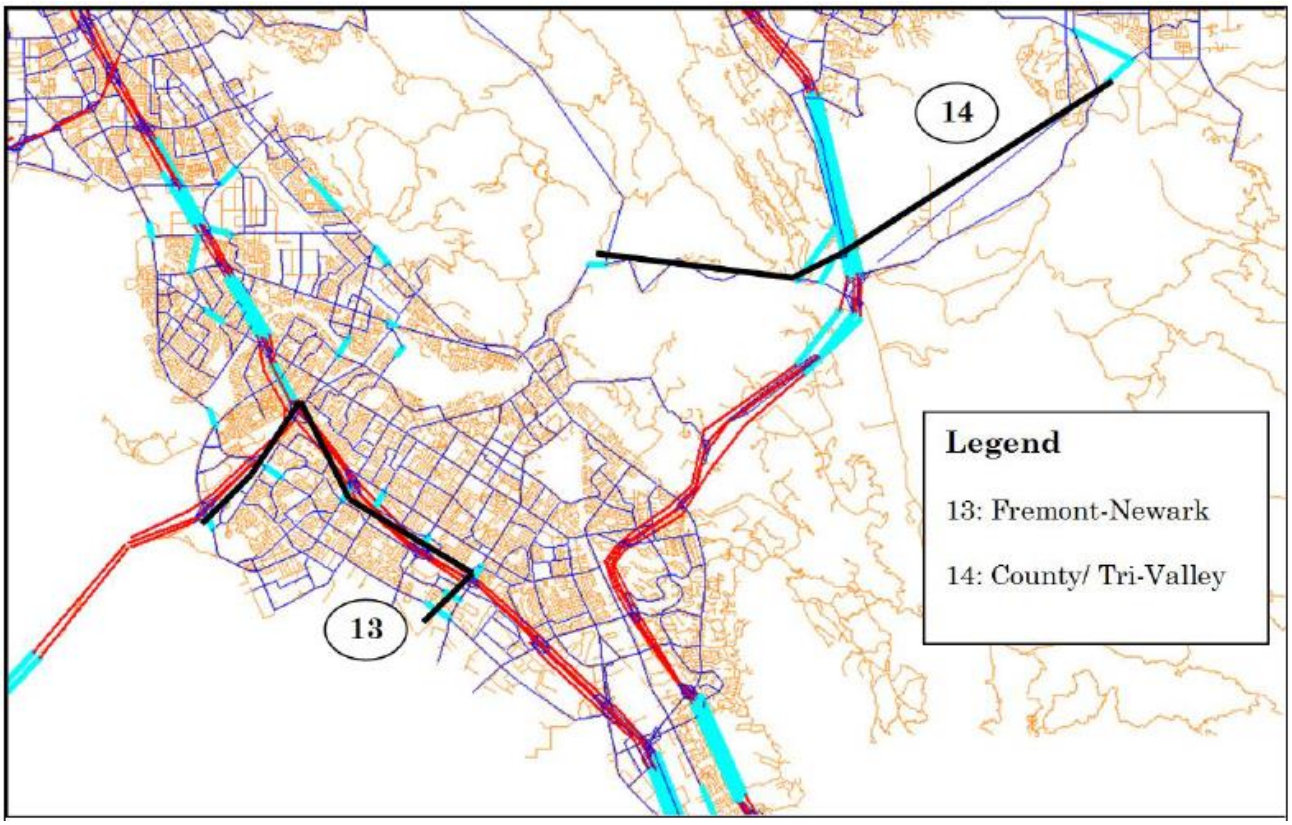


Figure 20: Validation Screenlines: East Planning Area 4

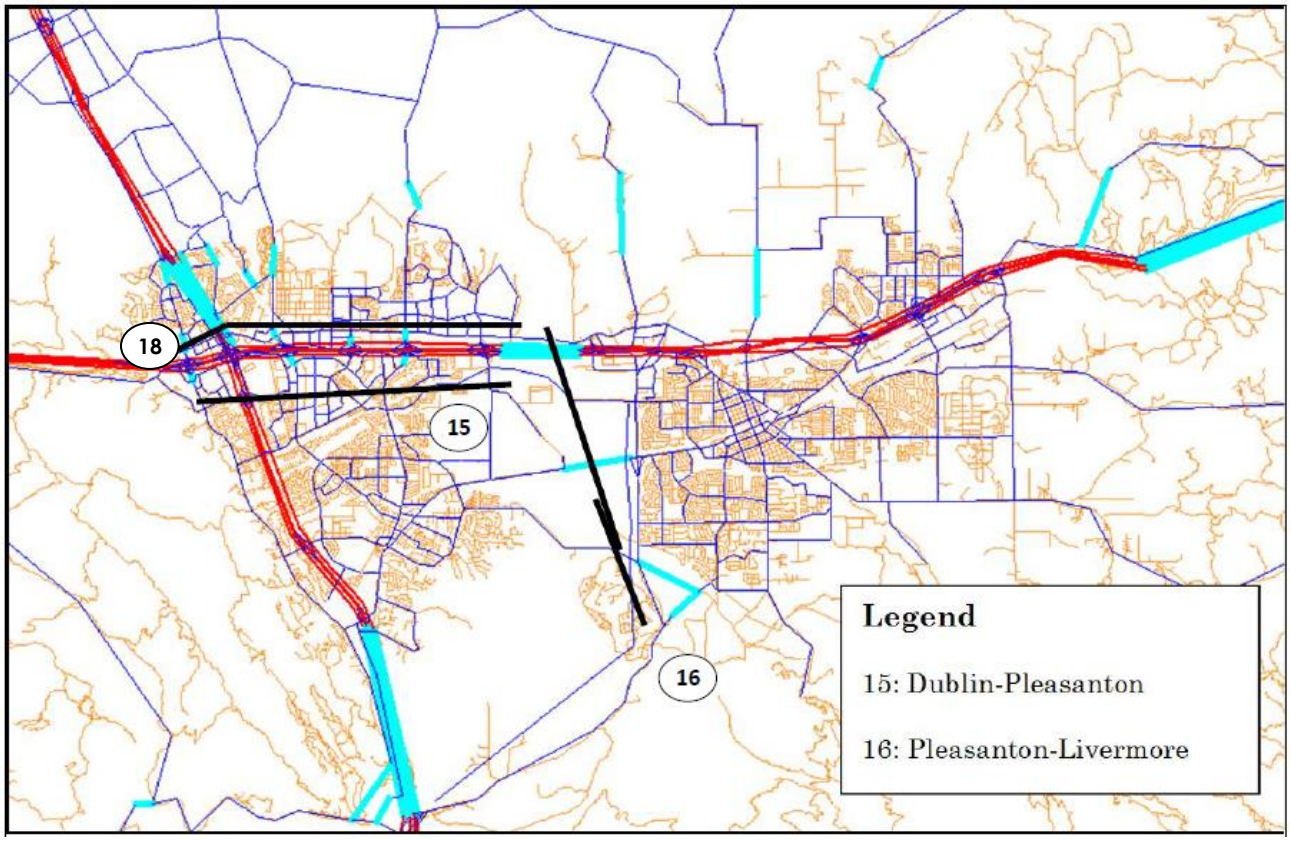
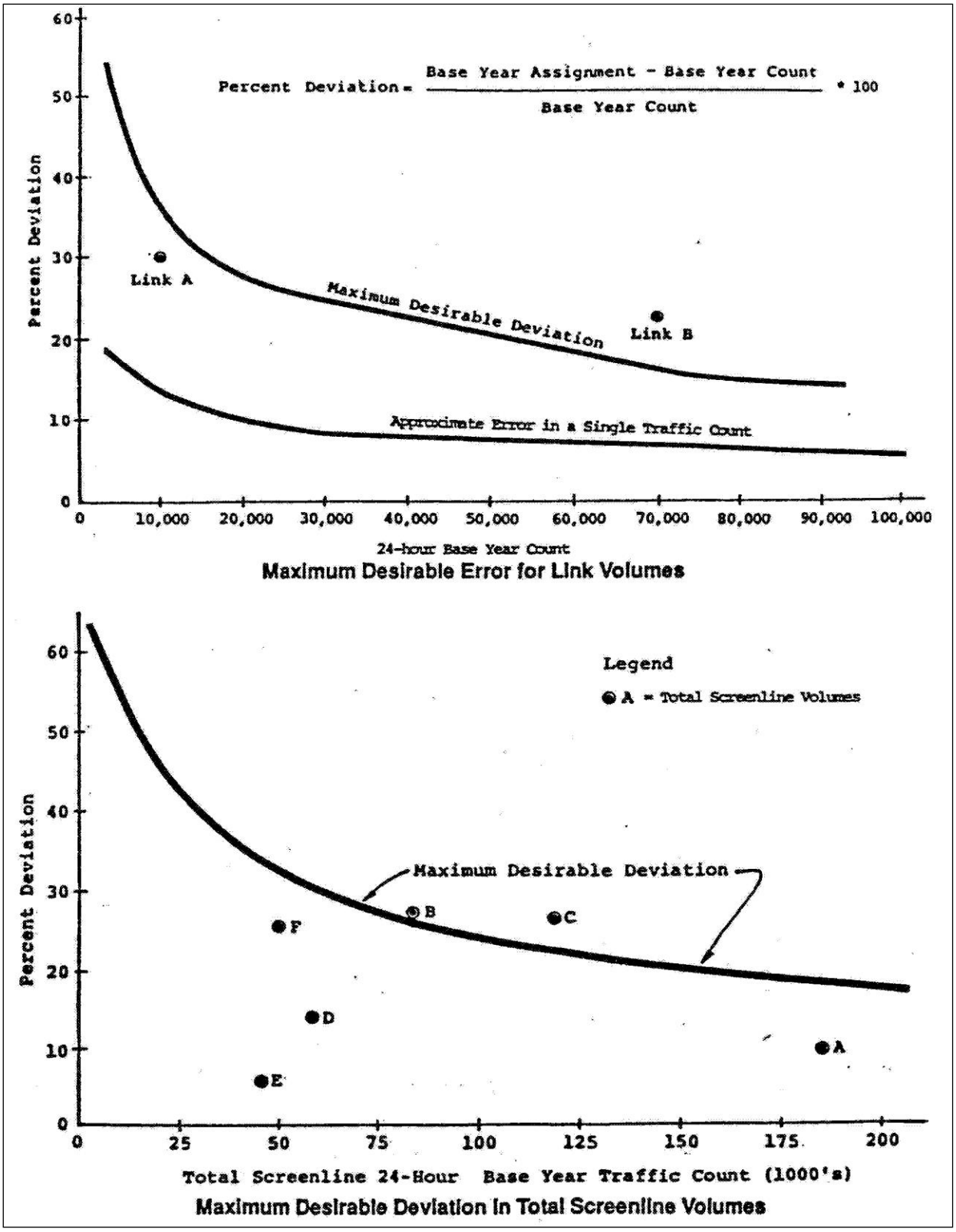


Figure 21: Caltrans Maximum Desirable Deviation in Screenline Volumes



Source: California Department of Transportation, JHK and Associates, Dowling Associates, *Travel Forecasting Guidelines*, 1992.

Screenline Validation Results

A comparison of the vehicle volumes estimated by the models to the observed counts was performed at individual screenlines for each of the five time periods.

Daily Validation

The validation results for the daily time period are listed in Table 15. The 2010 model validation meets the criteria for 15 of the 17 screenlines. The daily model volumes are low on the Fremont-Newark screenline and the Dublin-Pleasanton screenline north of I-580. The Fremont-Newark screenline is low primarily due to low model volumes on I-880 compared to the reported daily count, although the model is much closer to counts for the peak traffic direction during peak periods in this location. The Dublin-Pleasanton screenline is low primarily due to low model volumes on I-680 north of I-580. The model is closer to counts on I-680 south of I-580.

Table 15: Daily Volume Screenline Validation

	Screenline	2010 Count	2010 Model	Difference	Percent Error	Criteria	Meets Criteria
1	Cordon	1,674,437	1,770,650	96,213	6%	20%	YES
2	Albany-Berkeley	318,848	306,881	-11,967	-4%	20%	YES
3	Berkeley-Emeryville	272,342	265,709	-6,633	-2%	20%	YES
4	Berkeley-Oakland	139,982	150,159	10,177	7%	25%	YES
5	Emeryville-Oakland	268,503	252,105	-16,398	-6%	20%	YES
6	Oakland-Piedmont	50,477	41,833	-8,644	-17%	35%	YES
7	Alameda-Oakland	198,944	202,410	3,466	2%	25%	YES
8	Oakland-SL: Along Intnl	204,031	173,536	-30,495	-15%	20%	YES
9	Oakland-San Leandro	429,380	395,076	-34,304	-8%	20%	YES
10	Hayward - Union City	310,566	285,424	-25,142	-8%	20%	YES
11	Castro Vlly/Ashlnd/Chrrylnd	516,644	428,174	-88,470	-17%	20%	YES
12	Union City-Fremont	304,236	280,391	-23,845	-8%	20%	YES
13	Fremont-Newark	444,082	309,867	-134,215	-30%	20%	NO
14	Around Sunol	182,310	206,528	24,218	13%	25%	YES
15	Dublin-Pleasntn (S. of I-580)	308,638	262,773	-45,865	-15%	20%	YES
16	Pleasanton-Livermore	258,491	252,451	-6,040	-2%	20%	YES
18	Dublin-Pleasntn (N. of I-580)	304,227	226,186	-78,041	-26%	20%	NO
	TOTAL	**6,186,138**	**5,810,153**	**-375,985**	**-6%**		

Peak Period and Hour Validation

The validation results for the 4-hour peak periods are listed in Table 16, and the peak hour results are listed in Table 17. For the peak periods, the model validation meets the criteria for 16 of 17 screenlines during the AM peak period and peak hour and all screenlines during the PM peak period and peak hour. The one screenline that does not meet the validation criteria during the AM peak period and hour, the Berkeley-Oakland screenline, appears to have very low 2010 counts reported for those periods, approximately half of the corresponding PM counts reported for that location. The model is not able to replicate those low AM volumes, but the model is well within the validation criteria at that location for daily and PM periods.

Table 16: Peak Period Screenline Validation

AM Peak 4-Hour Period

	Screenline	2010 Count	2010 Model	Difference	Percent Error	Criteria	Meets Criteria
1	Cordon	419,226	431,598	12,372	3%	20%	YES
2	Albany-Berkeley	69,444	71,986	2,542	4%	30%	YES
3	Berkeley-Emeryville	62,391	61,441	-950	-2%	30%	YES
4	Berkeley-Oakland	20,920	38,160	17,240	82%	50%	NO
5	Emeryville-Oakland	59,902	59,087	-815	-1%	35%	YES
6	Oakland-Piedmont	10,388	10,557	169	2%	55%	YES
7	Alameda-Oakland	43,619	52,794	9,175	21%	35%	YES
8	Oakland-SL: Along Intnl	41,412	45,430	4,018	10%	35%	YES
9	Oakland-San Leandro	97,358	101,631	4,273	4%	30%	YES
10	Hayward - Union City	69,144	76,227	7,083	10%	30%	YES
11	Castro Vlly/Ashlnd/Chrrylnd	121,711	110,938	-10,773	-9%	25%	YES
12	Union City-Fremont	70,413	76,801	6,388	9%	30%	YES
13	Fremont-Newark	91,918	82,138	-9,780	-11%	30%	YES
14	Around Sunol	49,788	55,455	5,667	11%	35%	YES
15	Dublin-Pleasntn (S. of I-580)	49,225	47,633	-1,592	-3%	35%	YES
16	Pleasanton-Livermore	59,523	68,024	8,501	14%	35%	YES
18	Dublin-Pleasntn (N. of I-580)	68,846	57,194	-11,652	-17%	30%	YES
	TOTAL	**1,405,228**	**1,447,095**	**41,867**	**3%**		

PM Peak 4-Hour Period

	Screenline	2010 Count	2010 Model	Difference	Percent Error	Criteria	Meets Criteria
1	Cordon	452,247	497,656	45,409	10%	20%	YES
2	Albany-Berkeley	81,088	84,100	3,012	4%	30%	YES
3	Berkeley-Emeryville	61,368	69,505	8,137	13%	30%	YES
4	Berkeley-Oakland	41,353	48,062	6,709	16%	35%	YES
5	Emeryville-Oakland	64,470	66,048	1,578	2%	30%	YES
6	Oakland-Piedmont	17,999	13,176	-4,823	-27%	55%	YES
7	Alameda-Oakland	58,176	63,163	4,987	9%	35%	YES
8	Oakland-SL: Along Intnl	61,763	56,619	-5,144	-8%	30%	YES
9	Oakland-San Leandro	117,976	116,679	-1,297	-1%	25%	YES
10	Hayward - Union City	82,892	85,750	2,858	3%	30%	YES
11	Castro Vlly/Ashlnd/Chrrylnd	147,390	130,814	-16,576	-11%	25%	YES
12	Union City-Fremont	85,142	84,037	-1,105	-1%	30%	YES
13	Fremont-Newark	120,939	92,100	-28,839	-24%	25%	YES
14	Around Sunol	52,768	58,582	5,814	11%	35%	YES
15	Dublin-Pleasntn (S. of I-580)	76,101	57,956	-18,145	-24%	30%	YES
16	Pleasanton-Livermore	68,677	75,406	6,729	10%	30%	YES
18	Dublin-Pleasntn (N. of I-580)	91,339	64,719	-26,620	-29%	30%	YES
	TOTAL	**1,681,688**	**1,664,375**	**-17,313**	**-1%**		

Table 17: Peak Hour Screenline Validation

AM Peak 1-Hour

	Screenline	2010 Count	2010 Model	Difference	Percent Error	Criteria	Meets Criteria
1	Cordon	114,205	120,299	6,094	5%	25%	YES
2	Albany-Berkeley	18,742	19,561	819	4%	55%	YES
3	Berkeley-Emeryville	16,852	16,550	-302	-2%	55%	YES
4	Berkeley-Oakland	5,772	11,287	5,515	96%	60%	NO
5	Emeryville-Oakland	16,535	15,902	-633	-4%	55%	YES
6	Oakland-Piedmont	3,390	3,562	172	5%	60%	YES
7	Alameda-Oakland	13,825	16,280	2,455	18%	55%	YES
8	Oakland-SL: Along Intnl	13,753	14,261	508	4%	55%	YES
9	Oakland-San Leandro	26,926	28,445	1,519	6%	45%	YES
10	Hayward - Union City	19,764	22,700	2,936	15%	55%	YES
11	Castro Vlly/Ashlnd/Chrrylnd	34,899	30,882	-4,017	-12%	45%	YES
12	Union City-Fremont	20,433	22,846	2,413	12%	50%	YES
13	Fremont-Newark	26,297	24,436	-1,861	-7%	45%	YES
14	Around Sunol	14,166	14,277	111	1%	55%	YES
15	Dublin-Pleasntn (S. of I-580)	14,540	12,739	-1,801	-12%	55%	YES
16	Pleasanton-Livermore	16,083	18,223	2,140	13%	55%	YES
18	Dublin-Pleasntn (N. of I-580)	20,963	17,303	-3,660	-17%	50%	YES
	TOTAL	**397,145**	**409,551**	**12,406**	**3%**		

PM Peak 1-Hour

	Screenline	2010 Count	2010 Model	Difference	Percent Error	Criteria	Meets Criteria
1	Cordon	118,988	128,205	9,217	8%	25%	YES
2	Albany-Berkeley	20,764	21,455	691	3%	50%	YES
3	Berkeley-Emeryville	15,403	17,588	2,185	14%	55%	YES
4	Berkeley-Oakland	10,784	12,635	1,851	17%	55%	YES
5	Emeryville-Oakland	16,175	16,712	537	3%	55%	YES
6	Oakland-Piedmont	4,711	3,990	-721	-15%	60%	YES
7	Alameda-Oakland	14,896	18,763	3,867	26%	55%	YES
8	Oakland-SL: Along Intnl	16,159	17,808	1,649	10%	55%	YES
9	Oakland-San Leandro	30,917	30,222	-695	-2%	45%	YES
10	Hayward - Union City	21,311	22,670	1,359	6%	50%	YES
11	Castro Vlly/Ashlnd/Chrrylnd	39,069	33,906	-5,163	-13%	40%	YES
12	Union City-Fremont	21,857	22,459	602	3%	50%	YES
13	Fremont-Newark	30,713	24,659	-6,054	-20%	45%	YES
14	Around Sunol	13,784	13,974	190	1%	55%	YES
15	Dublin-Pleasntn (S. of I-580)	20,302	16,002	-4,300	-21%	50%	YES
16	Pleasanton-Livermore	17,800	18,494	694	4%	55%	YES
18	Dublin-Pleasntn (N. of I-580)	24,464	18,342	-6,122	-25%	50%	YES
	TOTAL	**438,097**	**437,883**	**-214**	**0%**		

6.3. TRANSIT VALIDATION

The results of the transit validation by operator are summarized in Table 18. Unlike the vehicle validation, transit validation does not have a standard set of validation criteria that can be applied to measure the validity of the transit assignments. For this project, the transit validation criteria is set to be within 15 percent error of observed boardings at the operator level.

Table 18: 2010 Transit Validation by Operator

	MTC 2010 Base Observed	Alameda Co Model 2010 Plan Bay Area	Percent Difference
ALAMEDA COUNTY SERVICES			
AC Transit Local	160,184	180,144	12%
AC Transit Transbay	14,704	13,799	-6%
ACE Rail	2,025	1,971	-3%
AirBART	1,800	1,324	-26%
Amtrak (Capitol, etc…)	1,754	2,013	15%
BART (Systemwide)	348,991	344,342	-1%
BART OAC	0	0	
Broadway Shuttle	1,938	355	53%
Dumbarton Express	1,118	2,603	133%
East Bay Ferries	1,853	1,354	-27%
Emery-go-Round	4,790	9,936	107%
LAVTA/Wheels	6,093	8,094	33%
San Leandro Links	658	1,247	90%
Union City	1,696	2,935	73%
West Berkeley	394	10	-97%
Subtotal Alameda Co.	**547,998**	**570,127**	**4%**
OTHER TRANSIT SERVICES			
CalTrain	37,779	41,770	11%
CCCTA	10,624	19,967	88%
eBART	0	0	
Golden Gate Bus	22,423	24,679	10%
Golden Gate Ferry	7,272	2,693	-63%
MUNI Metro	162,023	131,074	-19%
MUNI Bus	541,870	437,655	-19%
SamTrans Express Bus	1,481	1,280	-14%
SamTrans Local Bus	40,823	60,856	49%
VTA Light Rail	31,739	28,062	-12%
VTA Local Bus	100,265	137,780	37%
Vallejo Ferry	1,737	2,002	15%
WestCAT	3,652	4,439	22%
Other	44,297	93,964	
Subtotal Other	**1,005,985**	**986,221**	**-2%**
TOTAL	**1,553,983**	**1,556,348**	**0%**

There is a wide variation on the performance of the model relative to observed boardings, but the overall trend is that the model performs well for larger operators and the precision decreases for the smaller operators. Overall, the model is within 4 percent of observed boardings for all operators within and adjacent to Alameda County. For all operators in Alameda County (not including BART) the modeled transit boardings are 13 percent higher than observed system boardings. The model error in estimating total Bay Area transit ridership is less than 1 percent.

The model is within 15 percent of observed boardings on BART, AC Transit local and Transbay bus service, ACE rail and Capitol corridor service. The model significantly overestimates the attractiveness of local shuttle services such as Emery-go-Round, is 33 percent high on Wheels service, and is 27 percent low on East Bay ferry service. These validation differences should be accounted for in model forecasts by using model growth factors or increments applied to actual transit volumes rather than raw model output for transit boardings.

Table 19 summarizes a comparison of the model estimated daily BART station ons and offs to the observed station count data. The results show that while the model is within the 15 percent validation error tolerance for all stations in Alameda County, there is significant variation between the stations in terms of validation performance. The model significantly overestimates passengers at the Macarthur and West Dublin stations. The Macarthur station Is high due to the model's overestimate of passengers using the station to reach employment sites in the area, such as Kaiser Hospital. The West Dublin station is high as the model overestimates its attractiveness relative to the Dublin/Pleasanton station.

When adjacent stations are grouped, however, the model performs much more reliably, as the majority of station groups are within a 10 percent error threshold. For example, the combination of West Dublin and Dublin/Pleasanton is within 8 percent of observed station activity. While very accurate at the system level, this indicates that for BART ridership, the current countywide model also performs accurately when examined at the corridor level of detail. Added refinements (for example, refining access connections at each station with observed mode of access data) could improve the validation at the individual station level.

6.4. BICYCLE VALIDATION

Table 20 summarizes the results of the validation of base year 2010 model bicycle volumes to observed daily bicycle counts. These are results from the model validation completed in 2015, which have not been updated for this documentation. The results reported in Table 20 indicate that overall daily bicycle volumes were under estimated by the models by 26 percent. However, at the Planning Area level, the results are much closer for the central and south Planning Areas 2 and 3, at 10 percent and 3 percent difference from observed bicycle counts. It should be noted that only 63 counts were available for comparison to the model estimated volumes and this cannot be considered a representative sample of observed bicycle volumes. In the future, additional count data should be used to verify the accuracy of the estimated bicycle volumes.

Table 19: 2010 BART Station Validation

Station	Model Boardings	2010 Observed Boardings	Difference	Percent
ALAMEDA COUNTY				
Rockridge	4,335	5,267	-932	-18%
MacArthur	16,034	8,015	8,019	100%
19th Street/Oakland	10,093	9,675	418	4%
Oakland City Center/12th Street	16,658	12,181	4,477	37%
West Oakland	5,739	5,050	689	14%
North Berkeley	3,846	3,967	-121	-3%
Downtown Berkeley	12,074	11,749	325	3%
Ashby	4,100	4,129	-29	-1%
Lake Merritt	4,704	5,618	-915	-16%
Fruitvale	10,150	7,180	2,970	41%
Coliseum/Oakland Airport	5,291	6,564	-1,273	-19%
San Leandro	4,496	5,124	-629	-12%
Bay Fair	6,975	5,154	1,821	35%
Hayward	3,534	4,451	-917	-21%
South Hayward	2,494	2,966	-472	-16%
Union City	4,699	3,853	846	22%
Fremont	5,369	7,332	-1,963	-27%
Warm Springs	0		0	
Castro Valley	2,048	2,389	-341	-14%
West Dublin	1,912	652	1,260	193%
Dublin/Pleasanton	5,549	7,481	-1,933	-26%
Subtotal Alameda County	**130,096**	**118,797**	**11,299**	**10%**
STATION GROUPS				
North Oakland	52,858	40,188	12,670	32%
Berkeley	20,020	19,845	175	1%
East Oakland	20,144	19,362	782	4%
San Leandro/Hayward	17,499	17,695	-197	-1%
Fremont/Union City	10,068	11,185	-1,118	-10%
Dublin/Pleasanton	7,461	8,133	-673	-8%

Table 20: Bicycle Validation

Planning Area	2011 Bicycle Counts	2010 Model Volumes	Percent Difference
1. North	22,363	14,788	-34%
2. Central	4,557	5,015	10%
3. South	2,834	2,759	-3%
4. East	1,862	910	-51%
Total	**31,616**	**23,473**	**-26%**

7. MODEL FORECASTS

the Alameda Countywide model was applied to develop travel demand forecasts for the horizon years 2020 and 2040. The forecasts were developed based on the following input assumptions:

IN THIS SECTION>>

- Forecasts of trips and mode choice
- Traffic volume forecasts at screenlines
- Transit ridership forecasts
- System performance measures

- Socioeconomic data for 2020 and 2040 reflected the MTC Plan Bay Area 2040 data series as reviewed and modified based on local jurisdiction review.
- Year 2020 and 2040 highway, transit and bicycle network assumptions reflected projects based on the adopted Plan Bay Area 2040 Regional Transportation Plan, with the following specifications:
    - Year 2040 roadway and transit projects were based on the adopted project list from Plan Bay Area 2040.
    - Year 2040 bicycle projects were based on physical descriptions of bicycle improvements from locally adopted bicycle plans and from projects defined in the Alameda Countywide Bicycle Plan.
    - Year 2020 roadway and transit projects were based on estimated project completion timelines provided by MTC.
    - Year 2020 bicycle infrastructure improvements were based on an assumption that projects assumed for 2040 would be in place by 2020 if the projects were located within 0.5 miles of major transit stops/stations.
- Pricing assumptions for parking, tolls and auto operating costs were consistent with pricing assumptions used by MTC when modeling the Plan Bay Area 2040 horizons.

7.1. FORECAST RESULTS

The following results generated from the model forecasts are produced and summarized from the different components of the Countywide models. These include the auto ownership and workers per household, trip generation, trip distribution, mode choice, highway, transit and bicycle assignments. All model results are presented for the base year 2010 and forecast years 2020 and 2040.

Workers per Household/Auto Ownership

The results of the application of the workers and auto ownership models are presented in Table 21 and Table 22.

The percentages of zero worker households are projected to increase between 2010 and 2040 in both Alameda County and the Bay Area. This is most likely due to an increased number of households headed by older residents.

Table 21: Households by Workers per Household

Workers per Household	2010		2020		2040	
	Households	Percent	Households	Percent	Households	Percent
Alameda County						
0	127,592	23.5%	163,589	26.4%	198,599	26.9%
1	209,475	38.5%	235,866	38.0%	269,877	36.5%
2+	206,855	38.0%	220,531	35.6%	270,300	36.6%
Total	**543,922**	**100.0%**	**619,986**	**100.0%**	**738,775**	**100.0%**
Bay Area						
0	649,210	24.9%	823,523	28.5%	1,044,130	30.4%
1	980,964	37.6%	1,058,587	36.7%	1,216,560	35.5%
2+	976,774	37.5%	1,005,010	34.8%	1,170,446	34.1%
Total	**2,606,949**	**100.0%**	**2,887,120**	**100.0%**	**3,431,136**	**100.0%**

Table 22: Households by Vehicles per Household

Vehicles per Household	2010		2020		2040	
	Households	Percent	Households	Percent	Households	Percent
Alameda County						
0	65,260	12.0%	91,185	14.7%	138,072	18.7%
1	195,782	36.0%	229,828	37.1%	261,586	35.4%
2+	282,880	52.0%	298,973	48.2%	339,117	45.9%
Total	**543,922**	**100.0%**	**619,986**	**100.0%**	**738,775**	**100.0%**
Bay Area						
0	263,232	10.1%	363,996	12.6%	531,563	15.5%
1	871,490	33.4%	997,178	34.5%	1,167,364	34.0%
2+	1,472,227	56.5%	1,525,946	52.9%	1,732,209	50.5%
Total	**2,606,949**	**100.0%**	**2,887,120**	**100.0%**	**3,431,136**	**100.0%**

The shares of households with zero vehicles are projected to increase by over 50 percent for both Alameda County and the Bay Area. This change is related to increased infill development near transit associated with Plan Bay Area 2040, as well as the increased share of households headed by older residents. The proportions of households with multiple vehicles is projected to drop by about six percent between 2010 and 2040.

Trip Generation

Trip generation results are reported for work trips and for all trip purposes.

Work Trips

Work trips are summarized for individual counties and by productions (home end) and attractions (non-home end) to help illustrate the jobs-housing balances in the model (Table 23). Counties with more attractions than productions, such as San Francisco and Santa Clara, are net importers of commute trips. Counties with more productions than attractions, such as Alameda and Contra Costa, are net exporters of commuters.

Table 23: Work Trip Productions (Home End) and Attractions (Non-Home End)

County	2010		2020		2040	
	Productions	Attractions	Productions	Attractions	Productions	Attractions
San Francisco	592,999	903,657	781,477	1,267,141	878,627	1,427,174
San Mateo	483,696	514,062	586,585	615,044	630,267	706,532
Santa Clara	1,162,385	1,354,100	1,429,808	1,677,226	1,720,142	1,963,473
Alameda	1,064,884	969,965	1,352,957	1,192,607	1,509,052	1,378,790
Contra Costa	732,871	512,581	880,417	609,050	1,002,462	703,550
Solano	284,565	178,871	321,401	191,208	348,779	203,063
Napa	94,878	102,576	107,252	103,972	108,478	118,183
Sonoma	347,365	294,205	389,578	322,707	414,481	339,464
Marin	150,931	170,913	174,048	191,126	175,137	192,471
San Joaquin	341,914	325,467	393,618	338,712	502,435	427,745
Gateways	119,506	49,597	146,267	54,617	237,692	67,109
Total	**5,375,993**	**5,375,993**	**6,563,410**	**6,563,410**	**7,527,553**	**7,527,553**

For Alameda County, the productions and attractions are each projected to increase by about 42 percent from 2010 to 2040, indicating that the existing jobs-housing proportions would be maintained. However, San Francisco is projected to have much higher increases in work attractions (58 percent) than work productions (48 percent), indicating that it would become even more of a regional commute attractor. San Joaquin County is projected to have higher growth in work productions (47 percent) than attractions (31 percent) indicating that it would increase its export of commuters to other counties.

Total Trips

Total trip generation by trip purpose is listed for the entire ten county model area in Table 24. Total person trips are projected to increase by 14 percent between 2010 and 2020 and by 34 percent between 2010 and 2040. Work trips and airport trips are projected to increase by more than the average rate, and non-work trips are projected to increase at less than the average rate. This would indicate a higher proportion of the population in the workforce in future years.

Truck trips are projected to increase by 17 percent from 2010 to 2020 and by 35 percent from 2010 to 2040. The highest growth rate by 2040 would be for large combo trucks, at about 1.5 percent increase per year.

Trip Distribution

Trip distribution model outputs of significance include average trip lengths by each trip purpose and summaries of the zone to zone trips.

Table 24: Total Regional Trips by Trip Purpose

Trip Purpose	2010 Model	2020 Model	Percent Change 2010-2020	2040 Model	Percent Change 2010-2040
Person Trips (Non Truck)					
Home Based Work	5,375,993	6,563,410	22%	7,527,553	40%
Home Based Shop/Other	6,315,039	6,955,378	10%	8,451,239	34%
Home Based Social/Recreation	4,005,207	4,245,086	6%	5,129,221	28%
Non Home Based	4,926,037	5,772,945	17%	6,680,964	36%
Home-Based Grade School	1,404,619	1,524,897	9%	1,670,391	19%
Home-Based High School	582,806	629,234	8%	679,053	17%
Home-Based College	550,592	609,113	11%	676,316	23%
Air Passenger	100,821	221,858	120%	356,904	254%
TOTAL PERSON TRIPS	**23,261,114**	**26,521,920**	**14%**	**31,171,641**	**34%**
Truck Trips					
Very Small Trucks	3,122,339	3,650,691	17%	4,210,221	35%
Small Trucks	191,422	223,679	17%	255,906	34%
Medium Trucks	147,110	177,467	21%	204,100	39%
Large Combo Trucks	92,752	110,495	19%	134,289	45%
TOTAL TRUCKS	**3,553,623**	**4,162,332**	**17%**	**4,804,516**	**35%**

Trip Lengths

Table 25 summarizes the average trip lengths of Alameda County trips by trip purpose. Note that these are mean distances and times rather than median, so they can be skewed towards higher values by a small number of very long trips. The average trip distances for several purposes including work trips are projected to increase in 2020 and then decrease in 2040. This may indicate the effects of increased future infill development associated with Plan Bay Area 2040. Despite shorter trip distances in 2040, the average trip times are projected to continue to increase as a result of increased congestion.

Table 25: Alameda County Trip Lengths by Trip Purpose

Trip Purpose	2010 Model	2020 Model	2040 Model
Average Trip Length (Miles)			
Home-Work	12.7	13.4	13.7
Home-Shop/Other	7.7	8.2	7.6
Home-Social/Recreation	7.5	7.6	7.2
Non-Home	7.2	7.2	7.1
Home-School	4.6	4.9	4.9
Truck	6.3	6.5	6.8
All Trips	**8.2**	**8.6**	**8.5**
Average Trip Length (Minutes)			
Home-Work	24.0	30.8	35.9
Home-Shop/Other	15.7	18.0	18.8
Home-Social/Recreation	16.2	19.4	21.1
Non-Home	15.9	17.8	19.1
Home-School	12.4	13.5	14.3
Truck	14.6	15.7	17.0
All Trips	**17.1**	**20.3**	**22.3**

County to County Trips

Trips between Alameda County and other counties were summarized for work trips and total trips (Table 26).

Table 26: Alameda County Trip Distribution

County	2010		2020		2040	
	Trips	Percent	Trips	Percent	Trips	Percent
Alameda County Work Trips To:						
San Francisco	115,198	10.8%	177,024	13.1%	211,197	14.0%
San Mateo	55,050	5.2%	69,374	5.1%	79,428	5.3%
Santa Clara	109,837	10.3%	130,845	9.7%	135,896	9.0%
Alameda	716,648	67.3%	876,702	64.8%	960,046	63.6%
Contra Costa	44,135	4.1%	60,133	4.4%	72,182	4.8%
Solano	2,936	0.3%	6,662	0.5%	7,158	0.5%
Napa	848	0.1%	3,167	0.2%	4,462	0.3%
Sonoma	3,448	0.3%	10,235	0.8%	15,890	1.1%
Marin	8,493	0.8%	13,292	1.0%	15,010	1.0%
San Joaquin	6,524	0.6%	3,860	0.3%	4,678	0.3%
Gateways	1,767	0.2%	1,664	0.1%	3,104	0.2%
Total	**1,064,884**	**100.0%**	**1,352,957**	**100.0%**	**1,509,052**	**100.0%**
Alameda County Work Trips From:						
San Francisco	15,262	1.6%	19,823	1.7%	21,831	1.6%
San Mateo	10,148	1.0%	12,011	1.0%	13,160	1.0%
Santa Clara	32,171	3.3%	35,381	3.0%	48,593	3.5%
Alameda	716,648	73.9%	876,702	73.5%	960,046	69.6%
Contra Costa	133,387	13.8%	157,628	13.2%	167,641	12.2%
Solano	20,737	2.1%	26,806	2.2%	28,597	2.1%
Napa	1,614	0.2%	2,669	0.2%	2,744	0.2%
Sonoma	2,720	0.3%	3,862	0.3%	4,463	0.3%
Marin	4,366	0.5%	4,927	0.4%	4,766	0.3%
San Joaquin	22,118	2.3%	37,386	3.1%	52,158	3.8%
Gateways	10,793	1.1%	15,413	1.3%	74,791	5.4%
Total	**969,965**	**100.0%**	**1,192,607**	**100.0%**	**1,378,790**	**100.0%**
Alameda County Total Trips To/From:						
San Francisco	320,003	3.2%	457,508	4.0%	552,653	4.2%
San Mateo	128,855	1.3%	159,105	1.4%	184,878	1.4%
Santa Clara	312,184	3.2%	363,028	3.2%	415,391	3.1%
Alameda	8,413,463	85.0%	9,635,227	83.9%	11,054,463	83.3%
Contra Costa	479,904	4.9%	559,236	4.9%	637,069	4.8%
Solano	51,155	0.5%	64,391	0.6%	71,445	0.5%
Napa	8,716	0.1%	12,307	0.1%	14,686	0.1%
Sonoma	15,214	0.2%	23,492	0.2%	31,363	0.2%
Marin	30,449	0.3%	37,215	0.3%	40,314	0.3%
San Joaquin	50,762	0.5%	69,382	0.6%	93,074	0.7%
Gateways	83,070	0.8%	100,176	0.9%	179,720	1.4%
Total	**9,893,775**	**100.0%**	**11,481,067**	**100.0%**	**13,275,055**	**100.0%**

About two-thirds of work trips by Alameda County residents remain in Alameda County, and this proportion is projected to decrease by 2040. The percentage of Alameda County work trips to San Francisco is projected to increase by 2040, from about 11 percent to 14 percent. Although the change in percentage is not large, the number of Alameda County work trips to San Francisco is projected to increase by over 80 percent. This increase would have a significant impact on demand for transit services crossing San Francisco Bay.

The proportions of in-commute patterns to Alameda County jobs are projected to remain relatively constant from 2010 to 2040. However, a large increase is projected in trips coming from the Gateways, representing areas beyond San Joaquin County such as Sacramento or Stanislaus County.

The proportions of total Alameda County trips to and from other counties is also projected to remain relatively constant, except for a large increase of trips to and from San Francisco. Daily trips to and from San Francisco are projected to increase by 230,000 between 2010 and 2040, which includes the approximately 100,000 increase in work trips plus nearly 130,000 additional non-work trips. Large 2010 to 2040 increases in total trips are also projected to and from Contra Costa County (about 160,000 additional daily trips) and Santa Clara County (about 100,000).

Mode Choice

Mode choice estimates the trips by each mode for each trip purpose. The results of the mode choice models are presented in Table 27 for Alameda County trips by mode for the 2010 base and 2020 and 2040 forecast years. The shares of trips made by the drive alone mode are projected to decrease between 2010 and 2040 for both work and total trips. The share of shared ride 3+ trips is projected to increase, most likely related to the assumption that most HOV and express lanes will allow free travel for vehicles with three or more occupants by 2040. Transit shares are projected to increase by over 30 percent, which could be partially related to the high employment growth assumed for San Francisco. Bicycle and walk trips are projected to increase in total but not significantly increase their mode shares.

Table 27: Alameda County Trips by Travel Mode

County	2010		2020		2040	
	Trips	Percent	Trips	Percent	Trips	Percent
Alameda County Work Trips						
Drive Alone	912,478	69.0%	1,125,798	67.3%	1,245,889	64.6%
Shared Ride 2	147,156	11.1%	184,855	11.1%	214,889	11.1%
Shared Ride 3+	51,137	3.9%	64,752	3.9%	82,490	4.3%
Transit Walk	77,956	5.9%	113,826	6.8%	147,333	7.6%
Transit Drive	74,761	5.7%	109,742	6.6%	148,882	7.7%
Bicycle	12,593	1.0%	16,587	1.0%	22,255	1.2%
Walk	46,241	3.5%	57,291	3.4%	67,942	3.5%
Total	**1,322,322**	**100.0%**	**1,672,850**	**100.0%**	**1,929,679**	**100.0%**
Alameda County Total Trips						
Drive Alone	2,299,555	48.5%	2,725,253	49.0%	3,071,418	46.9%
Shared Ride 2	935,929	19.8%	1,081,148	19.4%	1,244,471	19.0%
Shared Ride 3+	703,024	14.8%	822,407	14.8%	1,009,683	15.4%
Transit Walk	210,537	4.4%	265,132	4.8%	373,403	5.7%
Transit Drive	87,736	1.9%	127,977	2.3%	178,420	2.7%
Bicycle	81,622	1.7%	89,599	1.6%	110,594	1.7%
Walk	419,177	8.8%	452,269	8.1%	554,774	8.5%
Total	**4,737,580**	**100.0%**	**5,563,786**	**100.0%**	**6,542,762**	**100.0%**

Vehicle Volume Screenline Summary

The output generated by the traffic assignments is summarized at the screenline level of detail. These screenlines are identical to the ones used for model validation. Table 28 through Table 30 summarize roadway volumes across the 17 screenlines for daily, AM peak hour and PM peak hour traffic volumes.

Growth from 2010 to 2040 is forecast to average 42 percent for daily volumes, 46 percent for the AM peak hour and 49 percent for the PM peak hour. The highest growth is projected on Screenline 4 Berkeley-Oakland and Screenline 8 International Boulevard. Lower than average growth is projected for Screenline 3 Berkeley-Emeryville, Screenline 5 Emeryville-Oakland, Screenline 13 Fremont-Newark and Screenline 15 on the north side of Pleasanton. These lower growth rates may be related to land use forecasts or freeway segments that are already at capacity and are not able to absorb additional traffic growth.

Table 28: Daily Screenline Traffic Volume Forecasts

	Screenline	2010 Model	2020 Model	Percent Change 2010-2020	2040 Model	Percent Change 2010-2040
1	Cordon	1,770,650	2,096,562	18%	2,572,752	45%
2	Albany-Berkeley	306,881	355,846	16%	431,027	40%
3	Berkeley-Emeryville	265,709	305,292	15%	350,683	32%
4	Berkeley-Oakland	150,159	186,470	24%	247,042	65%
5	Emeryville-Oakland	252,105	290,638	15%	334,764	33%
6	Oakland-Piedmont	41,833	41,330	-1%	52,497	25%
7	Alameda-Oakland	202,410	229,451	13%	293,339	45%
8	Oakland-SL: Along International	173,536	210,209	21%	302,706	74%
9	Oakland-San Leandro	395,076	457,429	16%	577,764	46%
10	Hayward - Union City	285,424	312,945	10%	384,714	35%
11	Castro Vlly/Ashland/Cherryland	428,174	490,268	15%	610,115	42%
12	Union City - Fremont	280,391	310,565	11%	402,729	44%
13	Fremont - Newark	309,867	335,983	8%	404,570	31%
14	Around Sunol	206,528	240,963	17%	308,127	49%
15	Dublin - Pleasanton (S. of I-580)	262,773	305,913	16%	342,151	30%
16	Pleasanton - Livermore	252,451	286,232	13%	353,009	40%
18	Dublin - Pleasanton (N. of I-580)	226,186	263,160	16%	318,248	41%
	TOTAL	**5,810,153**	**6,679,980**	**15%**	**8,240,700**	**42%**

Table 29: AM Peak Hour Screenline Traffic Volume Forecasts

	Screenline	2010 Model	2020 Model	Percent Change 2010-2020	2040 Model	Percent Change 2010-2040
1	Cordon	120,299	139,716	16%	178,753	49%
2	Albany-Berkeley	19,561	22,801	17%	29,377	50%
3	Berkeley-Emeryville	16,550	19,296	17%	23,178	40%
4	Berkeley-Oakland	11,287	13,270	18%	18,954	68%
5	Emeryville-Oakland	15,902	18,293	15%	22,425	41%
6	Oakland-Piedmont	3,562	3,369	-5%	4,814	35%
7	Alameda-Oakland	16,280	17,089	5%	23,937	47%
8	Oakland-SL: Along International	14,261	16,682	17%	25,461	79%
9	Oakland-San Leandro	28,445	31,384	10%	42,841	51%
10	Hayward - Union City	22,700	23,960	6%	31,464	39%
11	Castro Vlly/Ashland/Cherryland	30,882	33,854	10%	44,038	43%
12	Union City - Fremont	22,846	23,866	4%	31,298	37%
13	Fremont - Newark	24,436	25,029	2%	34,083	39%
14	Around Sunol	14,277	16,718	17%	20,325	42%
15	Dublin - Pleasanton (S. of I-580)	12,739	14,822	16%	20,084	58%
16	Pleasanton - Livermore	18,223	20,365	12%	24,900	37%
18	Dublin - Pleasanton (N. of I-580)	17,303	20,334	18%	24,394	41%
	TOTAL	**409,551**	**457,945**	**12%**	**596,828**	**46%**

Table 30: PM Peak Hour Screenline Traffic Volume Forecasts

	Screenline	2010 Model	2020 Model	Percent Change 2010-2020	2040 Model	Percent Change 2010-2040
1	Cordon	128,205	152,705	19%	197,569	54%
2	Albany-Berkeley	21,455	24,904	16%	31,759	48%
3	Berkeley-Emeryville	17,588	20,271	15%	24,583	40%
4	Berkeley-Oakland	12,635	15,903	26%	20,452	62%
5	Emeryville-Oakland	16,712	19,777	18%	22,960	37%
6	Oakland-Piedmont	3,990	3,990	0%	5,231	31%
7	Alameda-Oakland	18,763	20,725	10%	26,942	44%
8	Oakland-SL: Along International	17,808	20,346	14%	31,325	76%
9	Oakland-San Leandro	30,222	34,218	13%	45,689	51%
10	Hayward - Union City	22,670	23,796	5%	31,951	41%
11	Castro Vlly/Ashland/Cherryland	33,906	37,601	11%	50,266	48%
12	Union City - Fremont	22,459	24,451	9%	32,118	43%
13	Fremont - Newark	24,659	25,584	4%	33,123	34%
14	Around Sunol	13,974	17,082	22%	22,132	58%
15	Dublin - Pleasanton (S. of I-580)	16,002	19,289	21%	24,654	54%
16	Pleasanton - Livermore	18,494	20,611	11%	26,350	42%
18	Dublin - Pleasanton (N. of I-580)	18,342	22,327	22%	29,227	59%
	TOTAL	**437,883**	**500,853**	**14%**	**652,993**	**49%**

Vehicle Miles Traveled (VMT)

Vehicle miles of travel (VMT) are a representation of total travel and include the effects of trip generation, trip lengths and vehicle mode share. The VMT for jurisdictions and unincorporated areas within Alameda County were calculated for household-based VMT (Table 31) and employment-based VMT (Table 32). The household-based VMT includes all home-based trips generated by households, plus an estimate of non-home-based VMT generated by households at their non-home destinations (based on proportions of trip attractions). The estimate of non-home VMT attributed to households is intended to generate VMT per capita estimates that are more consistent with those generated by MTC using their activity-based modeling system. The employment-based VMT includes the non-home ends of home-based trips plus the non-home-based trips to and from the TAZs with employment.

VMT per Capita

The VMT per capita is lowest in the north planning area, with the lowest values in Emeryville and Berkeley. The higher VMT per capita values are in the east planning area, particularly Livermore and Pleasanton which are further from major regional job centers. The overall VMT per capita is projected to increase by about 8 percent between 2010 and 2020, and decrease between 2010 and 2040, primarily due to decreases in the south planning area (Fremont/Newark).

Table 31: Daily Vehicle-Miles of Travel per Capita

Area	VMT Generated by Households			VMT per Capita		
	2010	2020	2040	2010	2020	2040
Alameda	1,042,059	1,355,348	1,472,110	14.0	15.7	15.4
Alameda County	544,274	594,852	599,840	41.6	44.2	40.1
Albany	227,030	268,987	294,327	12.0	13.8	14.2
Ashland	296,855	452,469	490,830	14.3	15.9	15.7
Berkeley	1,101,732	1,459,011	1,612,659	9.8	11.4	11.4
Castro Valley	1,346,740	1,570,204	1,592,307	24.0	26.8	25.3
Cherryland	158,741	193,676	213,280	14.1	16.3	15.8
Dublin	985,390	1,509,563	1,921,953	24.1	25.8	23.9
Emeryville	98,874	129,591	280,582	9.4	10.3	8.1
Fremont	4,916,819	5,434,959	5,658,207	22.9	23.5	20.2
Hayward	2,764,320	3,415,208	3,522,718	18.3	20.4	18.7
Livermore	2,333,147	2,859,385	3,627,762	29.5	33.5	32.5
Newark	882,103	1,098,821	1,046,051	20.7	22.4	20.2
Oakland	4,774,022	6,325,345	7,587,284	12.2	13.2	12.0
Piedmont	186,969	199,660	201,167	17.5	18.8	17.9
Pleasanton	1,892,233	2,276,665	2,430,422	26.1	28.1	26.5
San Leandro	1,358,240	1,680,792	1,804,209	15.6	17.3	16.6
San Lorenzo	478,959	563,322	573,932	17.1	19.3	18.3
Union City	1,584,439	1,740,785	1,636,716	22.6	23.5	20.1
TOTAL	**26,972,947**	**33,128,644**	**36,566,355**	**17.9**	**19.3**	**17.6**
Planning Areas						
1. North	7,430,687	9,737,942	11,448,129	12.0	13.2	12.2
2. Central	6,757,165	8,266,478	8,613,322	18.5	20.4	19.2
3. South	7,352,113	8,241,559	8,311,352	22.5	23.4	20.2
4. East	5,432,981	6,882,665	8,193,552	27.8	30.2	28.6
TOTAL	**26,972,947**	**33,128,644**	**36,566,355**	**17.9**	**19.3**	**17.6**

VMT per Employee

The VMT per employee is lowest in the north and east planning areas, with the lowest values in Berkeley and Pleasanton. The higher VMT per employee values are primarily in the central planning area, and appear to coincide with areas with relatively low employment relative to population. The overall VMT per employee is projected to stay relatively constant from 2010 to 2020 and increase by about 4 percent between 2010 and 2040.

Table 32: Daily Vehicle-Miles of Travel per Employee

Area	VMT Generated by Employment			VMT per Employee		
	2010	2020	2040	2010	2020	2040
Alameda	1,058,411	1,286,230	1,452,461	36.4	35.4	33.9
Alameda County	259,596	273,023	279,508	75.9	74.6	83.3
Albany	211,332	239,191	254,500	47.2	46.8	47.9
Ashland	152,370	177,870	193,910	51.0	55.4	57.4
Berkeley	2,031,532	2,548,022	2,719,106	22.5	22.1	22.3
Castro Valley	616,690	665,059	687,918	48.9	50.0	50.4
Cherryland	77,769	82,752	88,002	47.4	47.2	51.7
Dublin	496,444	644,218	902,518	30.3	31.5	31.4
Emeryville	472,799	534,712	627,603	29.8	28.0	31.7
Fremont	2,640,032	3,232,826	3,900,194	30.6	31.8	32.9
Hayward	2,096,023	2,439,331	2,805,826	35.4	35.4	37.0
Livermore	1,360,488	1,610,942	1,653,844	28.3	28.8	31.2
Newark	552,573	651,590	815,063	31.9	32.8	35.6
Oakland	5,510,283	7,211,134	8,871,199	30.7	30.5	32.4
Piedmont	95,813	103,240	106,907	53.6	50.8	56.1
Pleasanton	1,644,556	1,891,090	2,210,518	27.6	27.9	29.6
San Leandro	1,633,136	1,757,871	1,720,991	32.9	32.4	31.9
San Lorenzo	217,407	230,143	251,042	48.4	48.1	49.8
Union City	630,384	765,814	951,951	31.0	31.4	33.3
TOTAL	**21,757,636**	**26,345,059**	**30,493,061**	**30.9**	**30.9**	**32.1**
Planning Areas						
1. North	9,380,169	11,922,529	14,031,776	29.2	28.8	30.2
2. Central	4,967,052	5,528,955	5,919,609	37.4	37.3	38.1
3. South	3,811,810	4,636,390	5,653,961	30.8	31.8	33.3
4. East	3,598,606	4,257,185	4,887,715	28.7	29.2	30.9
TOTAL	**21,757,636**	**26,345,059**	**30,493,061**	**30.9**	**30.9**	**32.1**

Vehicle-Hours and Average Speeds

Total vehicle-miles of travel (VMT), vehicle-hours of travel (VHT) and average speeds on Alameda County roads were tabulated for five time periods (Table 33). The VMT in this table differs from the VMT reported in the prior section, as it represents all VMT on Alameda County roads regardless of the origins and destinations of the trips, while the VMT reported in the prior section is based on travel generated by Alameda County households or employees that could generate VMT on roads anywhere in the 10 county model area.

Table 33: Vehicle Miles, Hours and Average Speeds on Alameda County Roads

Time Period	2010 Model	2020 Model	Percent Change 2010-2020	2040 Model	Percent Change 2010-2040
Vehicle Miles Traveled (VMT) on Alameda County Roads					
Daily	32,048,230	39,530,162	23%	46,396,541	45%
AM Peak 1-Hour	2,325,437	2,999,235	29%	3,600,829	55%
PM Peak 1-Hour	2,458,207	3,189,148	30%	3,896,270	59%
AM Peak 4-Hour	8,265,063	10,462,065	27%	12,424,539	50%
PM Peak 4-Hour					
Freeway	5,674,679	6,890,275	21%	7,756,959	37%
Expressway	326,547	494,041	51%	815,887	150%
Arterial	2,062,678	2,744,305	33%	3,586,890	74%
Collector	576,752	798,832	39%	1,039,303	80%
Other	802,867	961,701	20%	1,077,834	34%
Total PM Peak 4-Hour	9,443,523	11,889,155	26%	14,276,873	51%
Vehicle Hours Traveled (VHT) on Alameda County Roads					
Daily	763,330	1,022,682	34%	1,319,022	73%
AM Peak 1-Hour	63,430	106,896	69%	166,596	163%
PM Peak 1-Hour	64,936	115,617	78%	202,912	212%
AM Peak 4-Hour	216,829	333,303	54%	476,912	120%
PM Peak 4-Hour					
Freeway	119,242	184,259	55%	254,944	114%
Expressway	8,675	15,999	84%	31,025	258%
Arterial	65,542	96,916	48%	150,002	129%
Collector	22,167	38,848	75%	67,143	203%
Other	36,123	50,653	40%	70,742	96%
Total PM Peak 4-Hour	251,749	386,675	54%	573,855	128%
Average Speeds (miles per hour)					
Daily	42.0	38.7	-8%	35.2	-16%
AM Peak 1-Hour	36.7	28.1	-23%	21.6	-41%
PM Peak 1-Hour	37.9	27.6	-27%	19.2	-49%
AM Peak 4-Hour	38.1	31.4	-18%	26.1	-32%
PM Peak 4-Hour					
Freeway	47.6	37.4	-21%	30.4	-36%
Expressway	37.6	30.9	-18%	26.3	-30%
Arterial	31.5	28.3	-10%	23.9	-24%
Collector	26.0	20.6	-21%	15.5	-41%
Other	22.2	19.0	-15%	15.2	-31%
Total PM Peak 4-Hour	37.5	30.7	-18%	24.9	-34%

Total daily VMT is projected to increase by 23 percent from 2010 to 2020 and by 45 percent from 2010 to 2040, with greater increases in VMT projected for the peak 1-hour periods. Total VHT is projected to increase at greater rates than VMT, particularly during peak hours and periods. As a result, average speeds are projected to decrease by 16 percent for the daily time period between 2010 and 2040, but peak hour speeds would decrease by as much as 49 percent during the PM peak hour. The largest speed impacts are forecast for collector streets and freeways, with the least impact on arterial streets.

It should be noted that the Alameda Countywide model does not assume future changes in time-of-day choice for trips, so it therefore represents a conservative estimate of future travel during peak periods and hours.

Transit Boardings

Table 34 summarizes output generated by the transit assignments models in the form of daily boardings by major transit operators serving Alameda County.

All transit operators show an increase in daily boardings from the base year 2010 to 2020, with BART showing the largest absolute increase in boardings and the East Bay ferries (not including Vallejo) showing the largest percent increase in riders from 2010 to 2020. During this time period, the AirBART shuttle bus was replaced by the BART Oakland Airport Connector (OAC).

The model forecasts significant increases in transit ridership by 2040. Systemwide ridership on BART is projected to nearly double compared to 2010 levels, and significant increases are also forecast for ferries, Amtrak, LAVTA and Emery-go-Round.

Table 34: Alameda County Transit Services Ridership Forecasts

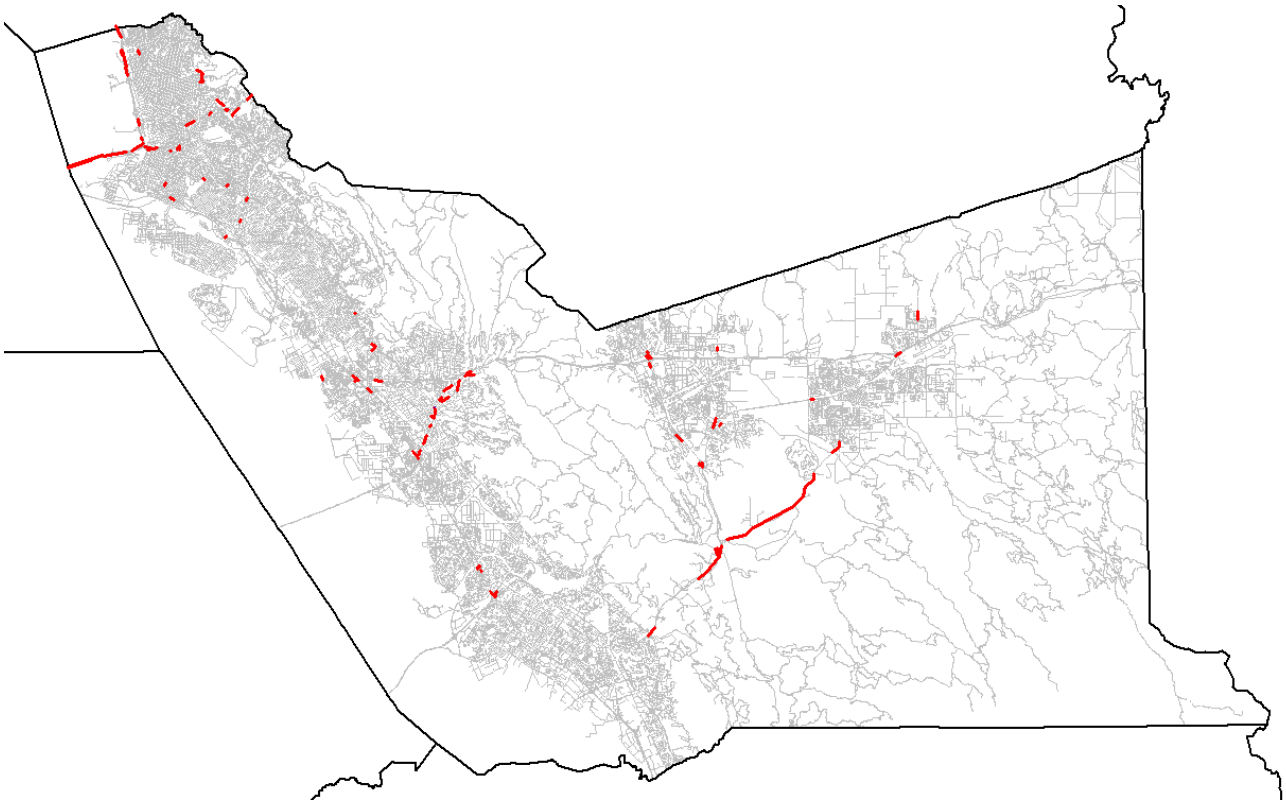
Transit Service	2010 Model	2020 Model	Percent Change 2010-2020	2040 Model	Percent Change 2010-2040
AC Transit Local	180,144	200,274	11%	294,656	64%
AC Transit Transbay	16,402	23,868	46%	24,073	47%
ACE Rail	1,971	2,556	30%	4,667	137%
AirBART	1,324	0	-	0	-
Amtrak (Capitol, etc…)	2,013	3,381	68%	6,845	240%
BART (Systemwide)	344,342	369,625	9%	655,690	93%
BART OAC	0	4,217	-	9,235	-
Broadway Shuttle	355	454	28%	340	-4%
East Bay Ferries	1,354	12,362	813%	27,555	1935%
Emery-go-Round	9,936	10,966	10%	24,356	145%
LAVTA/Wheels	8,094	10,061	24%	20,317	151%
San Leandro Links	1,247	1,284	3%	2,603	109%
Union City	2,935	3,297	12%	4,961	69%
West Berkeley	10	0	-	0	-
TOTAL	**570,127**	**642,345**	**13%**	**1,075,298**	**89%**

Road Network Volume/Capacity

Peak 4-hour period traffic volumes were compared to average link capacities for the 2010, 2020 and 2040 model years. This mapping only indicates where demand would exceed capacity, and congestion and slow speeds can occur in additional locations where demand approaches capacity and/or where queues from other bottlenecks affect traffic flow.

The 2010 model indicates demands exceeding capacity primarily on I-80 and the Bay Bridge, and on I-680 and SR 84 through the Sunol area, with additional locations in Berkeley and through central Hayward (Figure 22).

Figure 22: Segments with Demand Exceeding Capacity During AM or PM 4-Hour Peak Periods, 2010



The 2020 forecast (Figure 23) indicates a number of additional segments where peak period demand would exceed capacity, including the San Mateo and Dumbarton bridges, the I-580 corridor east of Castro Valley, and I-680 between SR 84 and I-580 in the Pleasanton area. By 2040, additional segments are projected to exceed capacity on I-880, I-680, and on I-580 and all parallel routes crossing the San Joaquin County line.

Figure 23: Segments with Demand Exceeding Capacity During AM or PM 4-Hour Peak Periods, 2020

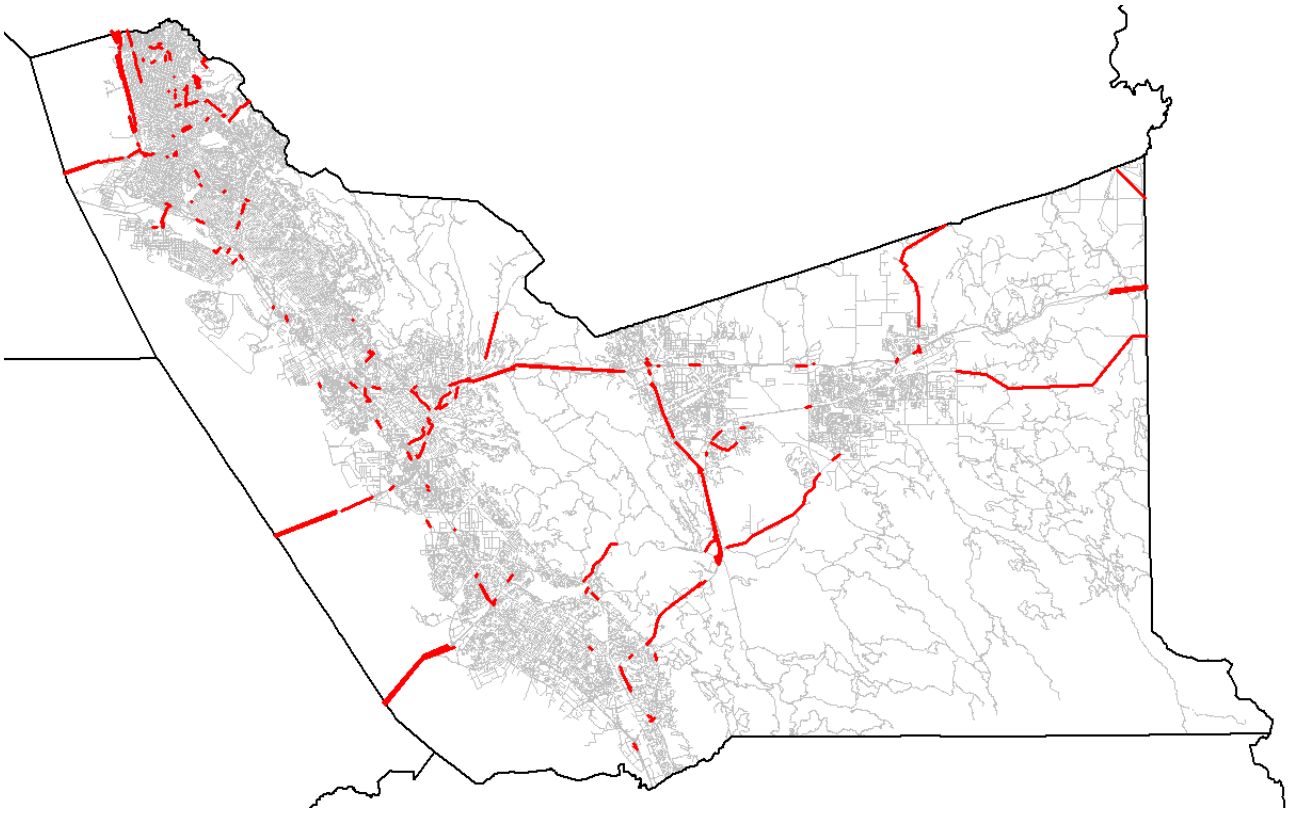
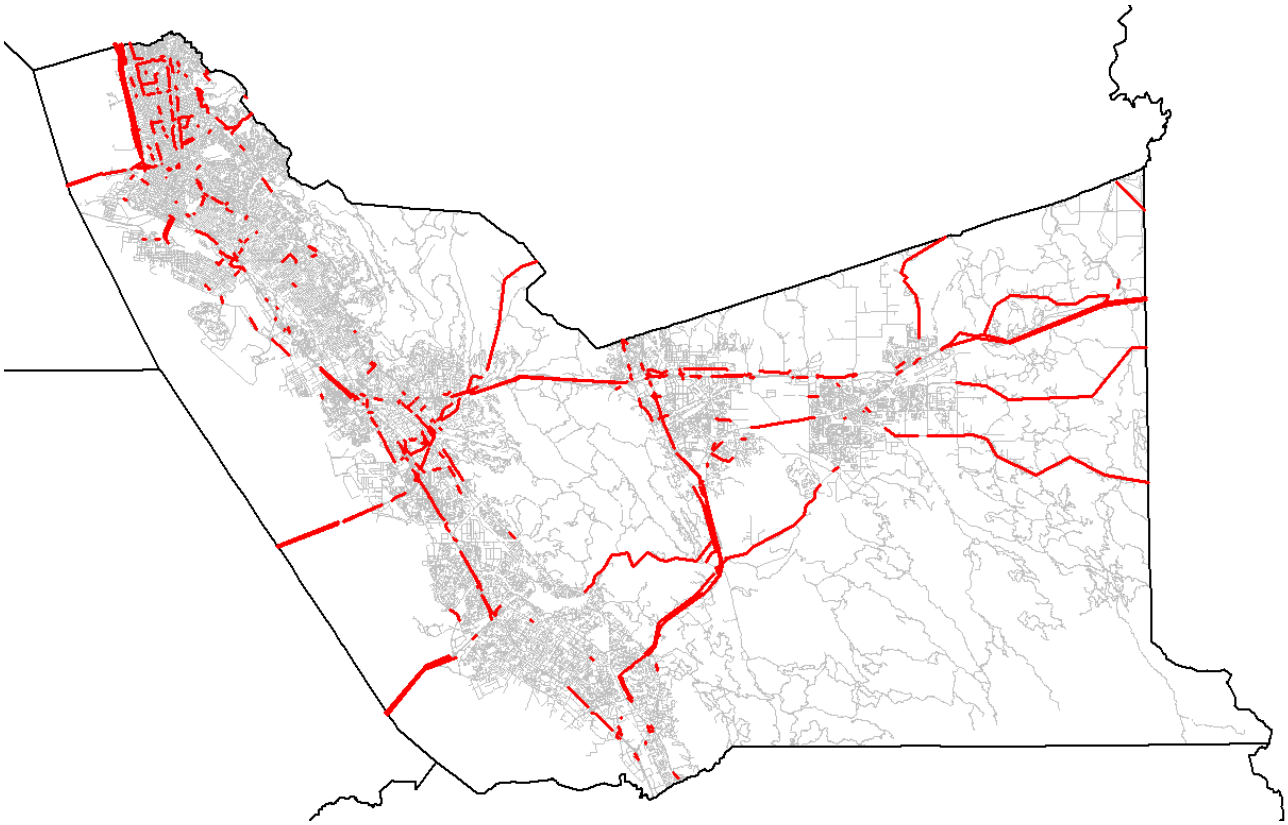


Figure 24: Segments with Demand Exceeding Capacity During AM or PM 4-Hour Peak Periods, 2040



8. MODEL CONSISTENCY

8.1. INTRODUCTION

The purpose of this Model Consistency section is to provide the deliverables requested by the Metropolitan Transportation Commission (MTC) to establish that the Alameda Countywide travel models apply a regionally consistent model set for the development of travel demand forecasts. The specific checklist of product deliverables was defined by MTC in the *2013 County Congestion Management Plans: Updated MTC Guidance and Review Process Resolution No. 3000, Revised, Attachment B* (Appendix C). The required checklist products listed below are included and described in detail in this section.

Product 1 - Description of the Alameda CTC Model

Product 2 – Description of demographic forecasts

Product 3 – Comparison of MTC/ABAG county-level estimates for population, households, jobs and employed residents

Product 4 – Identification of differences between CMA and MTC/ABAG Census Tract level forecasts

Product 5 - Regional-level auto operating costs

Product 6 – Highway network and transit Network

Product 7 – Households by number of automobiles, by county

Product 8 – Number of trips by tour (trip) purpose

Product 9 – Average trip distance by tour (trip) purpose

Product 10 – Journey to Work, county to county usual workplace

Product 11 – Region-level mode share by tour (trip) purpose

Product 12 – Region-level VMT and VHT by facility type and time period

Product 13 – Region-level average speed (VMT/VHT) by facility type and time period

8.2. PRODUCT 1

Description of the Alameda Countywide Model

The Alameda Countywide model had its origin in the MTC BAYCAST-90 regional trip-based model. The Alameda Countywide model was revised to produce an updated 2000 base year calibration and 2010 validation with selected model enhancements. These enhancements included more detailed transportation analysis zone (TAZ) and networks in Alameda County, nested-logit mode choice modeling for non-work trip purposes, detailed ramp meter capacities and delays, truck modeling, addition of bicycle network infrastructure (bike lanes and paths) and bicycle assignments in the networks, and development of a toll modeling procedure to estimate express lane vehicle volumes. The model was validated to year 2010 screenline volumes for the AM and PM peak hours, peak periods and daily, and to year 2010 observed transit boardings. The updated model incorporates the Plan Bay Area 2040 transportation investments and land use.

Consistency with MTC Travel Model One

As noted previously, the Alameda Countywide model was designed to be consistent with the prior MTC BAYCAST-90 model. MTC has since replaced the BAYCAST-90 model with an activity-based model called Travel Model One. Plan Bay Area 2040 applied the MTC Travel Model One activity-based model. This section provides a general overview of the Alameda Countywide model and also describes several basic modeling characteristics that are shared among the models.

Transportation Analysis Zones (TAZ's)

The Alameda Countywide model has a more refined TAZ system in Alameda County and immediately adjacent sections of Santa Clara and Contra Costa Counties than the MTC regional models. Additional TAZs were added to more accurately reflect and support the added roadway network and to provide more detail in transit-rich corridors and dense central business districts. In all, an additional 24 zones were added in Santa Clara County, 73 zones in Contra Costa County and 1,580 zones in Alameda County. The new model maintains the use of MTC's zone system in the remaining six Bay Area counties, but enlarges the full model region and zones to include San Joaquin County.

Highway Network and Transit Network

The roadway network used by the Alameda Countywide model includes additional detail in Alameda County and portions of Santa Clara and Contra Costa Counties. The Alameda Countywide model also includes detailed stop, station and route detail for the transit network in Alameda County, and maintains the MTC roadway and transit networks in the remaining Bay Area counties. San Joaquin County COG provided roadways for San Joaquin County, however, the detailed network was simplified to match the coarser zone structure applied for that county. Express lane facilities, representing the MTC Plan Bay Area 2040 express lanes system for 2020 and 2040, were also coded in the network with a toll facility indicator based on the highway corridor segment, direction of travel and peak period. Differential toll facility codes were required in order to apply specific toll rates to optimize utilization of the express lanes

to preserve level-of-service for free carpool users. The Alameda Countywide model also includes a representation of the bicycle network infrastructure in the base year and forecast years for Alameda County, explicitly representing existing and future bike lanes and bike paths in travel time development, mode choice and bicycle assignments.

Capacities and Speed

The Alameda Countywide model incorporates the area type and assignment group classification system used by MTC in BAYCAST-90 and used in similar form for Travel Model One. Capacity assumptions are generally identical to Travel Model One.

The Alameda Countywide model also added a facility type (FT 8) for metered ramps with specific metering rates for the AM and PM peak periods.

A new capacity type was added for the Plan Bay Area 2040 update to represent freeway facilities with advanced traffic management features such as adaptive ramp metering. These facilities are represented as Facility Type 8 and TOS 2 in Travel Model One, and are represented as TOS=2 in the Alameda Countywide model. These facilities are assigned slightly higher per-lane capacities consistent with Travel Model One.

Trip Purposes

The Alameda Countywide model uses the same trip purposes used in the BAYCAST-90 trip-based model:

- Home-based work trips (four income quartiles)
- Home-based shop and other trips
- Home-based social/recreation trips
- Non-home-based trips
- Home-based school: grade school, high school, and college trips
- Four categories of internal to internal zone truck trips: Very Small, Small, Medium and Combo (heavy duty)

These trip purposes cannot be directly compared to the tours and activity-chains used in Travel Model One.

The Alameda Countywide model uses MTC BAYCAST-90 trip generation equations for trip production and trip attraction functions for all trip purposes listed above. In order to address special markets not included in the MTC BAYCAST trip purposes, the Alameda Countywide model includes several additional trip purposes:

- Air-passenger trips to Oakland International (OAK), San Francisco International (SFO) Airport and San Jose/Mineta International Airport (SJC) and
- Small, Medium and Combo (heavy-duty) external truck trips

Market Segments

The Alameda Countywide model adopts the BAYCAST-90 disaggregate travel demand model four income group market segments for the home-based work trip purpose in trip generation, distribution and mode choice. In addition, the Alameda Countywide model also maintains the three workers per household (0, 1 and 2+ workers) and three auto ownership markets (0, 1 and 2+ autos owned) used in the BAYCAST worker/auto ownership models. Trips by peak and off-peak time period are also stratified in the trip distribution, mode choice and highway and transit assignment models.

External Trips

The Alameda Countywide model uses a different approach for incorporating inter-regional commuting estimates than MTC. For external zones consistent with the MTC model, MTC interregional vehicle volumes were applied for base year 2000 and adjusted to the future by assuming a 1 percent growth rate per year. For external gateways connected to San Joaquin County, the incorporation of that county as internally modeled areas obviated the development of external vehicle volumes for those areas of the ACTC models.

Pricing

The Alameda Countywide model uses MTC pricing assumptions for transit fares, bridge tolls, parking charges, express lane tolls and auto operating costs as assumed in MTC's Plan Bay Area 2040. All prices are expressed in year 1990 dollar values in the models.

Auto Ownership

The Alameda Countywide model applies the BAYCAST-90 auto ownership models to estimate the number of households with 0, 1, and 2+ autos by four income groups in each traffic analysis zone. Walk to transit accessibility measures were incorporated in the auto ownership models consistent with MTC BAYCAST-90 to more logically associate low auto ownership households with transit services. The auto ownership models were previously calibrated (during the 2014 update) to the 2005-2009 American Community Survey to match workers per household and auto ownership by county.

Mode Choice

The mode choice models for BAYCAST-90 include the use of nested structures for most trip purposes, however, explicit estimation of nested structures to consider transit submodes were not included in the model specification. The Alameda Countywide model added a nesting structure for transit submodes of local bus, express bus, light rail, heavy rail and commuter rail underneath the MTC BAYCAST-90 nested structures. Consistent with BAYCAST-90, mode choice coefficients are preserved by constraining the model to the BAYCAST-90 parameters, except those in the transit submode structure.

Peak Hour and Peak Periods for Highway Assignments

The highway assignments produce volumes for four time periods:

- AM peak 4-hour period (6 AM to 10 AM)
- PM peak 4-hour period (3 PM to 7 PM)
- Midday 5-hour period (10 AM to 3 PM)
- Evening 11-hours (7 PM to 6 AM).

The four time period volumes are then added together to develop daily vehicle volumes.

The assignment time periods are consistent with MTC Travel Model One, except Travel Model One has separate assignments for the Early AM time period (3 AM to 6 AM) and Evening time period (6 PM to 3 AM). These time periods are combined as the Evening time period in the Alameda Countywide model.

The Alameda Countywide model has two additional vehicle assignments for the AM and PM peak hours (7:30 to 8:30 AM and 4:30 to 5:30 PM respectively). These peak hour assignments are not included in the calculation of daily volumes.

Vehicle and Transit Assignments

The equilibrium assignment process used in the Alameda Countywide model is functionally equivalent to the MTC methodology. The Alameda Countywide model includes additional vehicle classes in the highway assignments for park-and-ride vehicles and drive-alone and carpool/toll vehicles.

Drive-alone and carpool/toll vehicles for the AM and PM four-hour peak periods are estimated using a toll model post-processor that estimates toll volumes based on a comparison of the non-toll and toll travel times and costs. This procedure assumes that toll choice occurs after the decision to choose auto versus transit has already been considered, and therefore does not influence transit mode choice. A toll choice constant for drive-alone and carpool modes was developed based on a calibration of toll volumes estimated by application of the toll model to the I-680 Express Lane facility and comparison of estimated to observed express lane volumes.

Transit passengers are assigned with a methodology analogous to that used by MTC, with separate assignments for each transit submode and access mode. Assignments are also performed separately for peak and off-peak conditions. A total of thirteen separate transit assignments are run to cover the full combination of transit submode and access modes as well as to estimate transit ridership for air-passengers.

Model Validation with 2010 Traffic and Transit Volumes

The current Alameda Countywide model is validated to year 2010 traffic volumes for county-level screenlines. Five time periods are validated for county screenlines: AM peak hour (7:30 to 8:30 AM), AM peak period (6 AM to 10 AM), PM peak hour (4:30 to 5:30), PM peak period (3 PM to 7 PM) and daily. Daily transit boardings were validated for the year 2010 at the system level for major regional transit operators (Caltrain, BART, MUNI, VTA and AC Transit) and at the route level for Alameda County transit operators.

8.3. PRODUCTS 2 AND 3

Description of Demographic Forecasts

The Alameda Countywide model uses the MTC Plan Bay Area 2040 data series (finalized in 2017) for the base year 2010, 2020 and 2040. The MTC 1,454 zone level allocations were sub-allocated to the smaller Alameda Countywide model zones (including finer zones for both Alameda and part of Santa Clara and Contra Costa counties) based on local development information and census block level data. Therefore, the Alameda Countywide model socioeconomic data inputs stay within the consistency allowances at the city jurisdiction control totals, however, slight differences do exist in parts of Santa Clara and Contra Costa Counties due to rounding errors resulting from the allocation process. Key MTC land use variables do not differ by more than one percent at the county level for any of the nine MTC region counties. No differences exist at the census tract level outside of Alameda County for any of the remaining six MTC counties.

The attached tables list the following comparisons:

- 2010 demographic comparison from MTC 2010 "baseyear" date set
- 2015 demographics (no comparison available)
- 2040 demographic comparison as provided in MTC consistency tables

The 2010 comparison uses the actual 2010 "baseyear" data provided by MTC and applies a range of plus/minus one percent. The Alameda Countywide model is within acceptable ranges for all categories and counties compared to this data set.

The Alameda Countywide model does not include a 2015 forecast year so no comparison is available.

For 2040, the Alameda Countywide model is within acceptable ranges for all categories and counties.

Product 2
ABAG County-Level Estimates for Population, Households, Jobs, and Employed Residents
Plan Bay Area 2040 (v 0.6)
2010, 2015 and 2040

2010

Plan Bay Area "Baseyear" plus/minus one percent

County	Population		Households		Jobs		Employed Residents	
	min	max	min	max	min	max	min	max
San Francisco	800,205	816,371	342,388	349,304	571,080	582,616	410,224	418,512
San Mateo	713,046	727,450	255,220	260,376	339,902	346,768	329,433	336,089
Santa Clara	1,767,319	1,803,023	598,264	610,350	902,418	920,648	783,189	799,011
Alameda	1,493,670	1,523,846	539,567	550,467	698,632	712,746	716,572	731,048
Contra Costa	1,040,728	1,061,752	371,633	379,141	356,479	363,681	492,469	502,417
Solano	409,729	418,007	140,274	143,108	128,850	131,454	198,771	202,787
Napa	134,520	137,238	48,452	49,430	69,982	71,396	65,788	67,118
Sonoma	479,467	489,153	183,970	187,686	200,705	204,759	237,943	242,749
Marin	245,587	250,549	102,176	104,240	120,567	123,003	108,226	110,412
Bay Area	7,084,272	7,227,388	2,581,943	2,634,103	3,388,615	3,457,071	3,342,615	3,410,143

2010

Alameda Countywide Model

County	Population		Households		Jobs		Employed Residents	
	Model	Within Range	Model	Within Range	Model	Within Range	Model	Within Range
San Francisco	808,288	Yes	345,846	Yes	576,878	Yes	414,368	Yes
San Mateo	720,248	Yes	257,798	Yes	343,331	Yes	332,761	Yes
Santa Clara	1,785,176	Yes	604,309	Yes	911,510	Yes	791,102	Yes
Alameda	1,505,704	Yes	543,915	Yes	703,241	Yes	722,361	Yes
Contra Costa	1,051,270	Yes	375,398	Yes	360,085	Yes	497,458	Yes
Solano	413,868	Yes	141,691	Yes	130,161	Yes	200,779	Yes
Napa	135,879	Yes	48,941	Yes	70,684	Yes	66,453	Yes
Sonoma	484,310	Yes	185,828	Yes	202,729	Yes	240,346	Yes
Marin	248,068	Yes	103,208	Yes	121,783	Yes	109,319	Yes
Bay Area	7,152,811	Yes	2,606,934	Yes	3,420,401	Yes	3,374,948	Yes

Product 2 (continued)
ABAG County-Level Estimates for Population, Households, Jobs, and Employed Residents
Plan Bay Area 2040 (v 0.6)
2010, 2015 and 2040

2015

Plan Bay Area

County	Population		Households		Jobs		Employed Residents	
	min	max	min	max	min	max	min	max
San Francisco	857,400	907,300	355,500	388,500	746,300	776,600	502,000	528,600
San Mateo	756,900	759,600	260,100	270,700	385,700	427,800	396,800	398,500
Santa Clara	1,903,200	1,909,600	623,100	649,000	1,067,600	1,091,700	952,500	972,900
Alameda	1,611,300	1,625,700	562,500	585,400	829,000	834,200	836,600	878,900
Contra Costa	1,092,500	1,111,800	386,700	387,900	406,100	409,300	538,700	579,000
Solano	413,700	427,100	141,000	146,100	130,700	156,200	197,500	221,700
Napa	136,800	140,900	48,700	49,800	69,800	82,000	71,800	73,600
Sonoma	483,200	500,000	183,400	190,400	217,300	223,400	249,600	265,500
Marin	257,300	262,400	103,100	106,700	129,500	137,800	129,900	130,700
Bay Area	7,512,300	7,644,400	2,664,100	2,774,500	3,982,000	4,139,000	3,875,400	4,049,400

Product 2 (continued)
ABAG County-Level Estimates for Population, Households, Jobs, and Employed Residents
Plan Bay Area 2040 (v 0.6)
2010, 2015 and 2040

2040

Plan Bay Area

County	Population		Households		Jobs		Employed Residents	
	min	max	min	max	min	max	min	max
San Francisco	1,157,700	1,181,100	478,800	488,500	863,700	881,200	614,000	626,400
San Mateo	907,400	925,700	314,700	321,100	467,300	476,700	441,500	450,500
Santa Clara	2,513,000	2,563,800	852,100	869,400	1,276,900	1,302,700	1,161,800	1,185,300
Alameda	2,071,400	2,113,300	726,800	741,500	943,400	962,400	1,011,800	1,032,200
Contra Costa	1,373,400	1,401,100	470,600	480,100	493,100	503,000	659,200	672,500
Solano	505,500	515,700	167,600	171,000	149,400	152,500	240,000	244,900
Napa	156,400	159,600	54,000	55,100	82,500	84,100	74,800	76,300
Sonoma	591,400	603,400	216,800	221,200	241,100	246,000	283,600	289,300
Marin	277,200	285,400	110,400	112,700	133,600	136,300	130,200	132,800
Bay Area	9,553,400	9,749,100	3,391,800	3,460,600	4,651,000	4,744,900	4,616,900	4,710,200

2040

Alameda Countywide Model

County	Population		Households		Jobs		Employed Residents	
	Model	Within Range	Model	Within Range	Model	Within Range	Model	Within Range
San Francisco	1,167,689	Yes	483,686	Yes	872,499	Yes	620,261	Yes
San Mateo	915,365	Yes	317,968	Yes	472,056	Yes	446,042	Yes
Santa Clara	2,532,773	Yes	860,925	Yes	1,289,873	Yes	1,173,565	Yes
Alameda	2,082,866	Yes	738,751	Yes	948,781	Yes	1,022,595	Yes
Contra Costa	1,385,899	Yes	475,150	Yes	497,764	Yes	665,535	Yes
Solano	509,796	Yes	169,294	Yes	150,981	Yes	242,486	Yes
Napa	158,040	Yes	54,694	Yes	83,364	Yes	75,565	Yes
Sonoma	596,627	Yes	219,066	Yes	243,588	Yes	286,492	Yes
Marin	277,254	Yes	111,584	Yes	134,960	Yes	131,575	Yes
Bay Area	9,626,309	Yes	3,431,118	Yes	4,693,866	Yes	4,664,116	Yes

8.4. PRODUCT 4

Identification of Differences between CMA and MTC

Housing and employment inputs within Alameda County were allocated to the smaller Alameda Countywide model zones using local land use development patterns, working within the constraint of 1 percent deviation from the MTC control totals for the County.

8.5. PRODUCT 5

Region-Level Auto Operating Cost, Key Transit Fares and Bridge Tolls

Tables comparing pricing assumptions are listed below.

Product 5
Region-Level Auto Operating Cost, Key Transit Fares and Bridge Tolls
Plan Bay Area 2040 (v 0.6)

Pricing Assumption	2040 Value in 2000 dollars	2040 Value in 2010 dollars	2040 Value in 2015 dollars	2040 Value in 1990 dollars	Alameda Countywide Model
Auto Operating Cost per Mile	$0.174	$0.220	$0.243	$0.13	$0.130
Bridge Tolls (2-axle, single-occupant. Note that 2-axle carpools receive discounts depending on the bridge.)					
San Francisco/Oakland Bay Bridge	$5.72	$7.22	$8.00	$4.34	$4.34
Antioch Bridge	$5.01	$6.32	$7.00	$3.80	$3.80
Benicia/Martinez Bridge	$5.01	$6.32	$7.00	$3.80	$3.80
Carquinez Bridge	$5.01	$6.32	$7.00	$3.80	$3.80
Dumbarton Bridge	$5.01	$6.32	$7.00	$3.80	$3.80
Richmond/San Rafael Bridge	$5.01	$6.32	$7.00	$3.80	$3.80
San Mateo Bridge	$5.01	$6.32	$7.00	$3.80	$3.80
Golden Gate Bridge	$4.47	$5.64	$6.25	$3.39	$3.39
Transit Fares					
Muni Local Bus	$1.57	$1.98	$2.25	$1.19	$1.26
AC Transit Local Bus	$1.47	$1.86	$2.10	$1.12	$1.18
VTA Local Bus	$1.40	$1.77	$2.00	$1.06	$1.12
SamTrans Local Bus	$1.40	$1.77	$2.00	$1.06	$1.12

8.6. PRODUCT 6

Network Assumptions

The roadway network used by the Alameda Countywide model includes additional detail in Alameda County, and adjacent parts of Santa Clara and Contra Costa Counties, compared to the MTC Model One networks. The Alameda Countywide model also includes detailed stop, station and route detail in the transit network for Alameda County, and maintains the level of detail of the MTC roadway and transit networks in the remaining Bay Area counties.

The Alameda Countywide model assumes all projects included in the Plan Bay Area 2040 Regional Transportation Plan in Alameda County and regionally significant projects in all other counties. The 2040 forecasts produced by the Alameda Countywide model also assume, consistent with MTC, that only 3+ person carpools will be allowed to travel in the express/HOV lanes without a charge for the entire model region. The Alameda Countywide model includes a representation of the bicycle network infrastructure in the 2010 base year and 2020 and 2040 forecast years for Alameda County.

8.7. PRODUCT 7

Automobile Ownership

Households by auto ownership were compared between Plan Bay Area 2040 and the Alameda Countywide model. The Alameda Countywide model estimates higher numbers of zero automobile households and correspondingly lower numbers of multiple vehicle households. The differences may be related to differences in definitions of household attributes between the trip-based and activity-based modeling systems. As shown in the following sections, this difference did not significantly affect the consistency of mode choice results.

8.8. PRODUCT 8

Tour/Trip Generation

Trip generation cannot be directly compared between trip-based and tour/activity based models. However, the total number of 2040 daily trips in the Alameda Countywide model is within 0.5 percent of the number of daily trips in Plan Bay Area 2040.

Product 7
Households by Number of Automobiles, by County
Plan Bay Area 2040 (v 0.6)

2040

Plan Bay Area

County	Zero Automobiles	One Automobile	Two Automobiles	Three Automobiles	Four-Plus Automobiles	Total
San Francisco	163,832	226,886	96,046	16,242	10,478	513,484
San Mateo	19,562	111,050	128,182	45,198	23,028	327,020
Santa Clara	71,384	296,996	344,534	121,330	60,174	894,418
Alameda	88,514	259,040	273,288	103,298	50,990	775,130
Contra Costa	17,134	147,608	208,050	78,408	35,676	486,876
Solano	7,748	45,516	73,658	32,826	14,216	173,964
Napa	3,104	16,186	24,690	11,032	4,322	59,334
Sonoma	14,320	61,616	97,546	42,292	15,848	231,622
Marin	4,218	38,058	52,542	16,108	5,866	116,792
Bay Area	389,816	1,202,956	1,298,536	466,734	220,598	3,578,640

2040

Alameda Countywide Model

County	Zero Automobiles	One Automobile	Two or More Automobiles	Total
San Francisco	167,033	199,471	117,185	483,689
San Mateo	33,417	110,042	174,500	317,959
Santa Clara	126,664	293,303	440,959	860,926
Alameda	138,066	261,575	339,102	738,743
Contra Costa	38,328	142,980	293,840	475,148
Solano	9,358	46,799	113,138	169,295
Napa	1,997	13,219	39,476	54,692
Sonoma	10,835	61,375	146,856	219,066
Marin	5,860	38,589	67,136	111,585
Bay Area	531,558	1,167,353	1,732,192	3,431,103

2040

Alameda Countywide Model Comparison

County	Zero Automobiles	One Automobile	Two or More Automobiles	Total
San Francisco	2.0%	-12.1%	-4.5%	-5.8%
San Mateo	70.8%	-0.9%	-11.2%	-2.8%
Santa Clara	77.4%	-1.2%	-16.2%	-3.7%
Alameda	56.0%	1.0%	-20.7%	-4.7%
Contra Costa	123.7%	-3.1%	-8.8%	-2.4%
Solano	20.8%	2.8%	-6.3%	-2.7%
Napa	-35.7%	-18.3%	-1.4%	-7.8%
Sonoma	-24.3%	-0.4%	-5.7%	-5.4%
Marin	38.9%	1.4%	-9.9%	-4.5%
Bay Area	36.4%	-3.0%	-12.8%	-4.1%

Product 8
Number of Trips by Tour Purpose
Plan Bay Area 2040 (v 0.6)

2040
Plan Bay Area

Tour Purpose	Trips	Share
Work	9,410,212	29.5%
University	744,554	2.3%
School	3,157,398	9.9%
At-Work	2,045,472	6.4%
Eat Out	1,447,194	4.5%
Escort	2,901,576	9.1%
Shopping	4,713,036	14.8%
Social	1,107,080	3.5%
Other	6,380,756	20.0%
Total	31,907,278	100.0%

2040
Alameda Countywide Model

Trip Purpose	Trips	Share
Home-Work	6,711,372	21.1%
Home-College	615,809	1.9%
Home-School	1,985,092	6.3%
Home-Shop/Other	7,435,133	23.4%
Home-Social/Rec	4,689,894	14.8%
Other*	10,324,098	32.5%
All Purposes	31,761,398	100.0%

*"Other" includes non-home based trips and four types of truck trips

8.9. PRODUCTS 9 AND 10

Activity/Trip Location

Tables showing average trip distances and county-to-county work trip flow estimates are attached.

The Alameda Countywide model generally reports longer average trip lengths. However, as shown in following sections, this did not significantly affect the vehicle-miles of travel (VMT) results.

The Alameda Countywide model reports home-work trips rather than usual workplace in journey-to-work format. Therefore, the flows are compared in terms of percentages of trips from each origin county to each destination county. Most key work flows are within six percent of the Plan Bay Area 2040 estimates.

8.10. PRODUCT 11

Travel Mode Choice

Mode choice percentages for the 2040 forecast year are compared for work trips and all trips. Mode choice estimates are very close for auto and transit trips. The Alameda Countywide model estimates higher bike trips, possibly partially due to the additional bike facility coding that assigns additional attractiveness to separated bike treatments.

Product 9
Average Trip Distance by Tour Purpose
Plan Bay Area 2040 (v 0.6)

2040
Plan Bay Area

Tour Purpose	Average Trip Distance
Work	10.32
University	6.05
School	4.07
At-Work	3.44
Eat Out	5.80
Escort	3.31
Shopping	4.34
Social	5.40
Other	5.42
All Purposes	6.28

2040
Alameda Countywide Model

Trip Purpose	Average Trip Distance
Home-Work	14.63
Home-College	7.68
Home-School	4.21
Home-Shop/Other	5.24
Home-Social/Rec	7.29
Non-Home Based	6.42
All Purposes (including trucks)	7.65

Product 10
Journey to Work, County-to-County Usual Workplace
Plan Bay Area 2040 (v 0.6)

2040
Plan Bay Area Journey-to-Work

	Destination County									
Origin County	San Francisco	San Mateo	Santa Clara	Alameda	Contra Costa	Solano	Napa	Sonoma	Marin	Bay Area
San Francisco	487,300	65,370	10,286	41,676	8,320	490	186	404	10,082	624,114
San Mateo	95,026	232,410	84,638	29,908	4,408	180	76	142	3,422	450,210
Santa Clara	13,150	73,236	1,017,154	73,122	5,196	120	30	24	512	1,182,544
Alameda	136,586	70,498	138,982	594,032	72,864	2,146	904	510	8,238	1,024,760
Contra Costa	76,854	18,074	22,526	166,762	340,504	14,590	5,386	1,550	14,866	661,112
Solano	17,534	3,130	1,980	23,324	42,158	116,814	20,284	4,232	7,226	236,682
Napa	4,186	768	336	5,288	7,278	7,296	40,634	6,704	3,174	75,664
Sonoma	13,030	2,678	638	6,000	5,574	3,584	10,872	219,436	24,606	286,418
Marin	33,864	6,922	1,354	10,746	6,780	1,020	722	3,502	66,356	131,266
Bay Area	877,530	473,086	1,277,894	950,858	493,082	146,240	79,094	236,504	138,482	4,672,770

2040
Alameda Countywide Model Home-Work Trips

	Destination County									
Origin County	San Francisco	San Mateo	Santa Clara	Alameda	Contra Costa	Solano	Napa	Sonoma	Marin	Bay Area
San Francisco	714,539	85,100	31,017	21,831	6,455	589	604	7,393	10,617	878,144
San Mateo	149,115	367,285	90,856	13,160	2,542	460	328	1,695	4,099	629,541
Santa Clara	36,012	104,067	1,506,741	48,593	9,113	2,123	436	551	4,075	1,711,710
Alameda	211,197	79,428	135,896	960,046	72,182	7,158	4,462	15,890	15,010	1,501,269
Contra Costa	172,170	26,798	27,321	167,641	530,551	16,715	8,461	10,482	20,606	980,745
Solano	42,827	12,174	15,776	28,597	43,618	138,221	25,250	8,531	9,804	324,798
Napa	6,328	3,195	12,850	2,744	3,734	4,470	62,688	7,026	2,532	105,567
Sonoma	26,820	6,979	57,596	4,463	3,194	993	5,057	271,891	27,568	404,561
Marin	50,932	6,088	1,763	4,766	4,147	485	684	8,370	97,041	174,277
Bay Area	1,409,939	691,115	1,879,816	1,251,841	675,536	171,215	107,969	331,829	191,352	6,710,612

Product 10 (continued)
Journey to Work, County-to-County Usual Workplace
Plan Bay Area 2040 (v 0.6)

2040

Plan Bay Area Journey-to-Work Percentages from Origin County

	Destination County									
Origin County	San Francisco	San Mateo	Santa Clara	Alameda	Contra Costa	Solano	Napa	Sonoma	Marin	Bay Area
San Francisco	78.1%	10.5%	1.6%	6.7%	1.3%	0.1%	0.0%	0.1%	1.6%	100%
San Mateo	21.1%	51.6%	18.8%	6.6%	1.0%	0.0%	0.0%	0.0%	0.8%	100%
Santa Clara	1.1%	6.2%	86.0%	6.2%	0.4%	0.0%	0.0%	0.0%	0.0%	100%
Alameda	13.3%	6.9%	13.6%	58.0%	7.1%	0.2%	0.1%	0.0%	0.8%	100%
Contra Costa	11.6%	2.7%	3.4%	25.2%	51.5%	2.2%	0.8%	0.2%	2.2%	100%
Solano	7.4%	1.3%	0.8%	9.9%	17.8%	49.4%	8.6%	1.8%	3.1%	100%
Napa	5.5%	1.0%	0.4%	7.0%	9.6%	9.6%	53.7%	8.9%	4.2%	100%
Sonoma	4.5%	0.9%	0.2%	2.1%	1.9%	1.3%	3.8%	76.6%	8.6%	100%
Marin	25.8%	5.3%	1.0%	8.2%	5.2%	0.8%	0.6%	2.7%	50.6%	100%
Bay Area	18.8%	10.1%	27.3%	20.3%	10.6%	3.1%	1.7%	5.1%	3.0%	100%

2040

Alameda Countywide Model Home-Work Percentages from Origin County

	Destination County									
Origin County	San Francisco	San Mateo	Santa Clara	Alameda	Contra Costa	Solano	Napa	Sonoma	Marin	Bay Area
San Francisco	81.4%	9.7%	3.5%	2.5%	0.7%	0.1%	0.1%	0.8%	1.2%	100%
San Mateo	23.7%	58.3%	14.4%	2.1%	0.4%	0.1%	0.1%	0.3%	0.7%	100%
Santa Clara	2.1%	6.1%	88.0%	2.8%	0.5%	0.1%	0.0%	0.0%	0.2%	100%
Alameda	14.1%	5.3%	9.1%	63.9%	4.8%	0.5%	0.3%	1.1%	1.0%	100%
Contra Costa	17.6%	2.7%	2.8%	17.1%	54.1%	1.7%	0.9%	1.1%	2.1%	100%
Solano	13.2%	3.7%	4.9%	8.8%	13.4%	42.6%	7.8%	2.6%	3.0%	100%
Napa	6.0%	3.0%	12.2%	2.6%	3.5%	4.2%	59.4%	6.7%	2.4%	100%
Sonoma	6.6%	1.7%	14.2%	1.1%	0.8%	0.2%	1.3%	67.2%	6.8%	100%
Marin	29.2%	3.5%	1.0%	2.7%	2.4%	0.3%	0.4%	4.8%	55.7%	100%
Bay Area	21.0%	10.3%	28.0%	18.7%	10.1%	2.6%	1.6%	4.9%	2.9%	100%

Product 10 (continued)
Journey to Work, County-to-County Usual Workplace
Plan Bay Area 2040 (v 0.6)

2040

Alameda Countywide Model Comparison of Home-Work Percentages from Origin County

Origin County	Destination County: San Francisco	San Mateo	Santa Clara	Alameda	Contra Costa	Solano	Napa	Sonoma	Marin	Bay Area
San Francisco	3.3%	-0.8%	1.9%	-4.2%	-0.6%	0.0%	0.0%	0.8%	-0.4%	
San Mateo	2.6%	6.7%	-4.4%	-4.6%	-0.6%	0.0%	0.0%	0.2%	-0.1%	
Santa Clara	1.0%	-0.1%	2.0%	-3.3%	0.1%	0.1%	0.0%	0.0%	0.2%	
Alameda	0.7%	-1.6%	-4.5%	6.0%	-2.3%	0.3%	0.2%	1.0%	0.2%	
Contra Costa	5.9%	0.0%	-0.6%	-8.1%	2.6%	-0.5%	0.0%	0.8%	-0.1%	
Solano	5.8%	2.4%	4.0%	-1.1%	-4.4%	-6.8%	-0.8%	0.8%	0.0%	
Napa	0.5%	2.0%	11.7%	-4.4%	-6.1%	-5.4%	5.7%	-2.2%	-1.8%	
Sonoma	2.1%	0.8%	14.0%	-1.0%	-1.2%	-1.0%	-2.5%	-9.4%	-1.8%	
Marin	3.4%	-1.8%	0.0%	-5.5%	-2.8%	-0.5%	-0.2%	2.1%	5.1%	
Bay Area										

Product 11
Region-Level Trip Mode Share by Tour Purpose
Plan Bay Area 2040 (v 0.6)

2040
Plan Bay Area

	Travel Mode				
Tour Purpose	Automobile	Walk	Bicycle	Transit	All Modes
Work	78.5%	6.0%	1.7%	13.8%	100.0%
University	59.2%	13.2%	1.5%	26.1%	100.0%
School	70.5%	19.0%	1.3%	9.2%	100.0%
At-Work	68.0%	30.3%	0.8%	1.0%	100.0%
Eat Out	82.5%	14.0%	0.8%	2.7%	100.0%
Escort	93.8%	5.9%	0.1%	0.2%	100.0%
Shopping	89.1%	8.1%	0.8%	2.1%	100.0%
Social	81.2%	12.9%	1.2%	4.7%	100.0%
Other	87.1%	8.4%	1.0%	3.4%	100.0%
All Purposes	81.5%	10.4%	1.1%	6.9%	100.0%

2040
Alameda Countywide Model

	Travel Mode				
Trip Purpose	Automobile	Walk	Bicycle	Transit	All Modes
Home-Work	80.0%	4.8%	1.5%	13.7%	100.0%
Home-College	71.9%	11.2%	1.5%	15.4%	100.0%
Home-School*	13.8%	43.4%	19.1%	23.7%	100.0%
Home-Shop/Other	81.2%	13.9%	1.2%	3.7%	100.0%
Home-Social/Rec	87.2%	8.4%	1.8%	2.6%	100.0%
Non-Home Based	83.9%	12.1%	0.8%	3.2%	100.0%
All Purposes	80.5%	10.9%	1.8%	6.8%	100.0%

*Includes trips by students only; adult drivers not included in tabulation.

8.11. PRODUCTS 12 AND 13

Traffic Assignment

The attached tables compare 2040 vehicle-miles of travel (VMT), vehicle-hours of travel (VHT) and average speeds for the comparable time periods.

The Alameda Countywide model assigns similar total VMT on a daily basis (within three percent) and is close to Plan Bay Area 2040 forecasts during the AM peak period (1.2 percent). There is some variation by facility type, as there are differences from MTC Model One in the designation of some facility types (such as Lawrence Expressway in Santa Clara County).

The Alameda Countywide model has higher regional VHT estimates than Plan Bay Area 2040. It cannot be determined how much of the differences in regional results in VHT are attributed to areas outside the detailed Alameda County area.

Similarly, 2040 forecast average speeds in the Alameda Countywide model are lower than Plan Bay Area 2040, by 8 to 12 percent in the peak periods, and by an average of 7.2 percent lower for the daily time period. As with the VHT estimated, it is not known how much of the regional differences in average speeds are attributed to areas outside Alameda County.

Product 12
Region-Level VMT and VHT by Facility Type and Time Period
Plan Bay Area 2040 (v 0.6)

2040 VMT
Plan Bay Area

Time Period	Facility Type: Freeways	Expressways	Major Arterials	Collectors	Other	All Facilities
Early AM (3 a.m. - 6 a.m.)	5,783,067	599,450	1,201,711	345,176	364,773	8,294,177
AM Peak (6 a.m. - 10 a.m.)	27,849,958	3,127,657	10,337,336	3,032,884	3,511,215	47,859,049
Midday (10 a.m. - 3 p.m.)	28,132,629	3,228,432	11,484,160	3,122,822	4,566,605	50,534,648
PM Peak (3 p.m. - 7 p.m.)	29,796,005	3,574,229	12,566,909	3,689,251	4,565,559	54,191,953
Evening (7 p.m. - 3 a.m.)	18,598,877	1,941,907	6,094,892	1,691,965	2,321,141	30,648,782
Daily	110,160,535	12,471,676	41,685,008	11,882,098	15,329,293	191,528,609

2040 VMT
Alameda Countywide Model

Time Period	Facility Type: Freeways	Expressways	Major Arterials	Collectors	Other	All Facilities
AM Peak (6 a.m. - 10 a.m.)	23,977,164	3,829,586	11,741,055	3,264,074	5,614,547	48,426,426
Midday (10 a.m. - 3 p.m.)	30,664,520	3,677,223	10,584,961	2,949,923	6,122,349	53,998,977
PM Peak (3 p.m. - 7 p.m.)	27,054,186	4,462,742	14,463,336	4,235,097	6,838,807	57,054,167
Evening (7 p.m. - 6 a.m.)	20,700,760	2,816,937	7,413,912	1,993,069	4,419,291	37,343,968
Daily	102,396,629	14,786,487	44,203,264	12,442,164	22,994,993	196,823,537

2040 VMT
Alameda Countywide Model Comparison to PBA 2040

Time Period	Facility Type: Freeways	Expressways	Major Arterials	Collectors	Other	All Facilities
AM Peak (6 a.m. - 10 a.m.)	-13.9%	22.4%	13.6%	7.6%	59.9%	1.2%
Midday (10 a.m. - 3 p.m.)	9.0%	13.9%	-7.8%	-5.5%	34.1%	6.9%
PM Peak (3 p.m. - 7 p.m.)	-9.2%	24.9%	15.1%	14.8%	49.8%	5.3%
Evening (7 p.m. - 6 a.m.)	-15.1%	10.8%	1.6%	-2.2%	64.5%	-4.1%
Daily	-7.0%	18.6%	6.0%	4.7%	50.0%	2.8%

Product 12 (continued)
Region-Level VMT and VHT by Facility Type and Time Period
Plan Bay Area 2040 (v 0.6)

2040 VHT
Plan Bay Area

	Facility Type					
Time Period	Freeways	Expressways	Major Arterials	Collectors	Other	All Facilities
Early AM (3 a.m. - 6 a.m.)	95,134	12,089	36,078	11,738	20,267	175,307
AM Peak (6 a.m. - 10 a.m.)	605,402	78,256	353,580	132,529	195,077	1,364,845
Midday (10 a.m. - 3 p.m.)	504,734	73,801	382,369	126,988	253,721	1,341,612
PM Peak (3 p.m. - 7 p.m.)	640,684	88,506	452,079	169,246	253,656	1,604,171
Evening (7 p.m. - 3 a.m.)	311,358	39,726	188,468	60,301	128,964	728,816
Daily	2,157,313	292,377	1,412,574	500,802	851,685	5,214,751

2040 VHT
Alameda Countywide Model

	Facility Type					
Time Period	Freeways	Expressways	Major Arterials	Collectors	Other	All Facilities
AM Peak (6 a.m. - 10 a.m.)	593,833	105,187	406,683	140,125	251,771	1,497,600
Midday (10 a.m. - 3 p.m.)	659,611	89,143	349,871	116,456	267,729	1,482,809
PM Peak (3 p.m. - 7 p.m.)	747,274	126,605	536,719	201,553	308,700	1,920,850
Evening (7 p.m. - 6 a.m.)	329,631	58,864	227,640	71,417	183,762	871,314
Daily	2,330,349	379,799	1,520,913	529,551	1,011,962	5,772,574

2040 VHT
Alameda Countywide Model Comparison to PBA 2040

	Facility Type					
Time Period	Freeways	Expressways	Major Arterials	Collectors	Other	All Facilities
AM Peak (6 a.m. - 10 a.m.)	-1.9%	34.4%	15.0%	5.7%	29.1%	9.7%
Midday (10 a.m. - 3 p.m.)	30.7%	20.8%	-8.5%	-8.3%	5.5%	10.5%
PM Peak (3 p.m. - 7 p.m.)	16.6%	43.0%	18.7%	19.1%	21.7%	19.7%
Evening (7 p.m. - 6 a.m.)	-18.9%	13.6%	1.4%	-0.9%	23.1%	-3.6%
Daily	8.0%	29.9%	7.7%	5.7%	18.8%	10.7%

Product 13
Region-Level Average Speed (VMT/VHT) by Facility Type and Time Period
Plan Bay Area 2040 (v 0.6)

2040
Plan Bay Area

	Facility Type		
Time Period	Freeways	All Other Facilities	All Facilities
Early AM (3 a.m. - 6 a.m.)	60.8	31.3	47.3
AM Peak (6 a.m. - 10 a.m.)	46.0	26.3	35.1
Midday (10 a.m. - 3 p.m.)	55.7	26.8	37.7
PM Peak (3 p.m. - 7 p.m.)	46.5	25.3	33.8
Evening (7 p.m. - 3 a.m.)	59.7	28.9	42.1
Daily	51.1	26.6	36.7

2040
Alameda Countywide Model

	Facility Type		
Time Period	Freeways	All Other Facilities	All Facilities
AM Peak (6 a.m. - 10 a.m.)	40.4	27.1	32.3
Midday (10 a.m. - 3 p.m.)	46.5	28.3	36.4
PM Peak (3 p.m. - 7 p.m.)	36.2	25.6	29.7
Evening (7 p.m. - 6 a.m.)	62.8	30.7	42.9
Daily	43.9	27.4	34.1

2040
Alameda Countywide Model Comparison to PBA 2040

	Facility Type		
Time Period	Freeways	All Other Facilities	All Facilities
AM Peak (6 a.m. - 10 a.m.)	-12.2%	2.9%	-7.9%
Midday (10 a.m. - 3 p.m.)	-16.6%	5.7%	-3.4%
PM Peak (3 p.m. - 7 p.m.)	-22.2%	1.1%	-12.1%
Evening (7 p.m. - 6 a.m.)	5.1%	6.4%	2.0%
Daily	-13.9%	3.1%	-7.2%

APPENDIX A: PLAN BAY AREA 2040 PROJECT LIST

The attached table contains the list of transportation projects from MTC Plan Bay Area 2040, from Appendix A: List of Plan Bay Area 2040 Transportation Projects/Programs as of July, 2017. The table indicates the year (2020, 2030 or 2040) that each project would become operational, and whether the project was included in the MTC travel modeling (some projects such as information systems or minor local street changes cannot be represented in the travel model).

The last two columns indicate the status of the projects in the Alameda Countywide model. The column "In Alameda County Model Prior to 2018 Update" indicates whether the project was included in the Alameda Countywide model prior to the current update, and what the assumptions were for implementation year. The final column has notes on the representation of the project in the updated Alameda Countywide model. The current update focused primarily on improvements within or directly affecting travel in Alameda County. A number of local freeway interchange and local transit projects outside Alameda County were not represented in the model update.

List of Plan Bay Area 2040 Transportation Projects/Programs

RTPID	County/ Sponsor	Title	Description	Complete and Operational By:			Included in the MTC Model?	MTC Model ID	In Alameda County Model Prior to 2018 Update	Alameda County Model 2018 Update Notes
				2020	2030	2040				
17-01-0001	Alameda	Bicycle and Pedestrian Program	Projects in this category are new bicycle (on-street and off-street) and pedestrian facilities, and facilities that connect existing network gaps, including but not limited to projects that would implement these components on the following facilities: Alameda Point Trail, Bay Trail Connections and Gap Closures, East Bay Greenway, Iron Horse Trail Crossing, Union City Boulevard, Pierce Street, Shattuck Avenue, 7th Street Transit Village, Lake Merritt BART, Lakeside Complete Streets, Peralta and MLK Boulevard						Many coded including East Bay Greenway, Iron Horse Trail Corssing	No new coding
17-01-0002	Alameda	Climate Program: TDM and Emission Reduction Technology	Projects in this category implement strategies and programs that reduce emissions, encourage alternative transportation modes, and manage transportation demand including but not limited to projects such as TDM program implementation, parking management, local area shuttle and paratransit services						n/a	n/a
17-01-0003	Alameda	County Safety, Security and Other	Projects in this category address safety, security and other needs, including but not limited to projects such as Central Avenue Overpass, BART Security Program						No	No new coding, Central Avenue overpass not explicitly represented, but would not significantly affect modeling.
17-01-0004	Alameda	Multimodal Streetscape	Projects in this category implement multimodal or complete streets elements, including but not limited to projects such as Grimmer Boulevard Greenway, Telegraph Avenue Complete Streets, West Grand Avenue Complete Streets, Hearst Avenue Compete Streets						No	3/14/18 - Coded existing Telegraph road diet (2016), Grand road diet (2016), Broadway road diet (2015 and 2018). No changes coded on additional Telegraph, Grimmer, W. Grand, Hearst (Hearst is mostly bus stop improvements).
17-01-0005	Alameda	PDA Planning	This category includes planning studies supporting the region's PDA framework and connecting transportation and land use						n/a	n/a
17-01-0006	Alameda	Minor Roadway Expansions	This category includes roadway capacity increasing projects (new roadways or widening/extensions of existing roadways) on minor roads such as Clement Avenue, Mariner Square, Mitchell Street, Scarlett Drive, Stoneridge Drive, Kato Road						Includes Clement (2015), Mariner Sq (2015), Mitchell (2015), Scarlett (2015), Stoneridge (2035), Kato (No)	Clement year changed to 2020, Mariner Square to 2030. Kato modification not coded, would have minimal modeling effect.
17-01-0007	Alameda	Roadway Operations	This category includes projects that improve roadway, intersection, or interchange operations, ITS, as well as other transportation system management						n/a	n/a
17-01-0008	Alameda	Minor Transit Improvements	This category includes minor projects that improve or complement existing transit operations including but not limited to projects such as rapid bus service in Alameda Point, the Bernal Park and Ride, Line 51 project completion and capital replacement, Newark Transit Station improvements, and Dumbarton Corridor Area Transportation Improvements						Line 31 serves Alameda Pt, Line 51 improvements included	Alameda Point BRT coded
17-01-0009	Alameda	New Alameda Point Ferry Terminal	Provide for new ferry terminal at Seaplane Lagoon		Yes	Yes	Yes	1206	No	3/29/18 - Moved Alameda, JLS ferry terminals and connectors to correct locations. Added Seaplane terminal and new service

List of Plan Bay Area 2040 Transportation Projects/Programs

RTPID	County/ Sponsor	Title	Description	Complete and Operational By:			Included in the MTC Model?	MTC Model ID	In Alameda County Model Prior to 2018 Update	Alameda County Model 2018 Update Notes
				2020	2030	2040				
17-01-0014	Alameda	I-680 Southbound Express Lanes (SR-237 to SR-84) Upgrades	To upgrade the existing toll system for the I-680 southbound express lane project. Additionally, it would also result in upgrades to the existing pavement for a near continuous access express lanes facility.						n/a	n/a
17-01-0015	Alameda	7th Street Grade Separation East	Project replaces the substandard 7th St. roadway & pedestrian underpass at the north end of Railport Oakland Intermodal Yard (RO-IY). The new, depressed roadway allows for new rail crossings to improve connections to the future OHIT IY and project completes a missing segment of the Bay Trail.						No	Not coded
17-01-0016	Alameda	Oakland Army Base transportation infrastructure improvements	Constructs public improvements for trade, logistics and ancillary maritime services that promote cleaner modes of transportation, efficient goods movement, congestion relief on countywide freight corridors, new jobs, and fulfills a mandate to reduce truck trips through the West Oakland community.						n/a	n/a
17-01-0017	Alameda	Outer Harbor Intermodal Terminal (OHIT) Phases 2 and 3	OHIT consists of 3 phases. Phase 1, for the lead, support and manifest tracks, is under construction. Phase 2 has two intermodal tracks; Phase 3 has six intermodal tracks and electric cranes. The Project enables a shift of cargo from truck to rail to maximize the Port's operational potential.						n/a	n/a
17-01-0018	Alameda	7th Street Grade Separation West	The Project creates a new elevated intersection at 7th & Maritime Streets, and provides new rail access between the Oakland Army Base and the Oakland International Gateway. The Project shifts cargo from truck to rail, reduces truck congestion and emissions, and improves public access.						No	Not coded
17-01-0019	Alameda	I-580 Integrated Corridor Mobility (ICM)	This project implements multiple traffic operation systems and strategies that will address the challenges of traffic congestion in the corridor. The project will install new and upgrade existing corridor management elements along Interstate 580. Full ICM depends on extending North Canyons Parkway to Dublin Boulevard (RTPID 17-01-0048)		Yes	Yes	Yes	210	No	Base TOS=1 on I-580 3/28/18 Updated to TOS=2
17-01-0020	Alameda	SR-262 Mission Boulevard Cross Connector Improvements	This project will increase mobility between I-680 and I-880 by widening Mission to 3 lanes in each direction throughout the I-680 interchange, rebuild the NB and SB 680 on and off ramps, and potentially grade separate Mission Blvd. from Mohave Dr. and Warm Springs Blvd.		Yes	Yes	Yes	211	Recent project coded for 2015	Capacity increase coded for 2030
17-01-0021	Alameda	I-880 Whipple Road Interchange Improvements	Full interchange improvements at Whipple Road/I-880, including northbound off-ramp, surface street improvements and realignment		Yes	Yes	Yes	n/a	No	No changes, should have ramp and underpass widening
17-01-0022	Alameda	Outer Harbor Turning Basin	The project will upgrade the existing Outer Harbor Turning Basin (OHTB) at the Port of Oakland from 1,650' to 1,920' in diameter to handle ships up to 1.320' long.						n/a	n/a
17-01-0023	Alameda	I-880 Industrial Parkway Interchange Reconstruction	Reconstruct the I-880/Industrial Parkway interchange to provide a northbound off-ramp and a southbound HOV bypass lane on the southbound loop off-ramp. Reconstruct the bridge over I-880.		Yes	Yes	Yes	n/a	2040	Already coded, should be 2030 improvement
17-01-0024	Alameda	I-880 A Street Interchange Reconstruction	Reconstruct interchange to widen A Street from 5 lanes to 6 lanes and add bike lanes, and provide additional lane capacity for potential future freeway widening. Project also involves modifying signals and reconfiguring intersections to improve truck-turning maneuvers.		Yes	Yes	Yes	n/a	2040	Already coded, should be 2030 improvement

List of Plan Bay Area 2040 Transportation Projects/Programs

RTPID	County/ Sponsor	Title	Description	Complete and Operational By:			Included in the MTC Model?	MTC Model ID	In Alameda County Model Prior to 2018 Update	Alameda County Model 2018 Update Notes
				2020	2030	2040				
17-01-0025	Alameda	Oakland International Airport Perimeter Dike	This project will upgrade and improve the 4.5 mile long dike protecting OAK, terminal and other facilities, roadways, transit services & trails connecting Alameda and San Leandro. Includes seismic stabilization, FEMA compliance, and protection against climate change and sea level rise.						n/a	n/a
17-01-0026	Alameda	Minor Freight Improvements Programmatic	This program includes projects that improve freight operations and reduce impacts of freight activity. This includes but is not limited to railroad quiet zones, multimodal safety projects at crossings, freight corridor upgrades, ITS improvements, terminal lighting, seismic monitoring, rail connections between Oakland and Niles Subdivisions, truck parking facilities, rail platforms, and other projects that would implement the Alameda CTC Goods Movement plan.						n/a	n/a
17-01-0027	Alameda	Middle Harbor Road Improvements	This project identifies & implements solutions to the traffic circulation issues on Middle Harbor Rd. Solutions may include dedicated queue or turn lanes, signalization, and relocation or reconfiguration of terminal gates and recommendations for Adeline St. Bridge reconfiguration as appropriate.						n/a	n/a
17-01-0028	Alameda	I-580/I-680 Interchange: Project Development and Phase 1 Short-term Operational Improvements	Improve capacity, operations and safety at the interchange, primarily in the westbound direction approaching the interchange. This project includes the Phase 1 short-term operational improvements.		Yes	Yes	Yes	n/a	No	No changes, operational improvements only
17-01-0029	Alameda	SR-84/I-680 Interchange Improvements and SR-84 Widening	Construct interchange improvements for the Route 84/I-680 Interchange, widen Route 84 from Pigeon Pass to I-680 and construct aux lanes on I-680 between Andrade and Route 84.		Yes	Yes	Yes	209	2020	3/29/18 Changed year from 2020 to 2030
17-01-0030	Alameda	I-880 Broadway/Jackson Interchange Improvements	The project proposes to improve connectivity between I-880/I-980 and Alameda and Oakland. Improvements include reconfiguration of existing ramps, demolition of existing ones, and construction of new ramps.		Yes	Yes	Yes	n/a	No	3/29/18 Coded project per Alameda CTC website for 2030
17-01-0031	Alameda	I-880 at 23rd/29th Avenue Interchange Improvements	Provide improvements to NB I-880 at 23rd and 29th Avenue interchange by improving the freeway on- and off-ramp geometrics, replacing the overcrossings, and modifying local streets, landscape enhancement, and construction of a soundwall.	Yes	Yes	Yes	Yes	n/a	2015	Overpass completions moved to 2018
17-01-0032	Alameda	SR-84 Widening (Ruby Hill Drive to Concannon Boulevard)	The Route Expressway - South Segment involves widening a 2.4 mile section of SR 84 (Isabel Ave) from Ruby Hill Drive to Concannon Boulevard from two lanes to four lanes.	Yes	Yes	Yes	Yes	n/a	2015	Already coded - No changes
17-01-0033	Alameda	I-580 Vasco Road Interchange Improvements	Modify I-580/Vasco Rd interchange. Widen I-580 overcrossing and add new loop ramp in southwest quadrant. Includes widening Vasco Road to 8 lanes between Northfront Road and Las Positas Road and other local roadway improvements.		Yes	Yes	Yes	n/a	2035	3/28/18 Changed year to 2030
17-01-0034	Alameda	I-580 Greenville Road Interchange Improvements	Construct a new interchange at I-580/Greenville Road to replace the existing interchange. Project will include widening the undercrossing to provide six lanes, and constructing ramps to achieve a modified partial cloverleaf interchange design.		Yes	Yes	Yes	n/a	2035	3/28/18 Changed year to 2030
17-01-0035	Alameda	I-580 First Street Interchange Improvements	Reconstruct and modify the I-580/First Street interchange into partial cloverleaf design with 6-lanes on First Street over I-580.		Yes	Yes	Yes	n/a	2030	Already coded - No changes

List of Plan Bay Area 2040 Transportation Projects/Programs

RTPID	County/ Sponsor	Title	Description	Complete and Operational By:			Included in the MTC Model?	MTC Model ID	In Alameda County Model Prior to 2018 Update	Alameda County Model 2018 Update Notes
				2020	2030	2040				
17-01-0036	Alameda	SR-92/Clawiter Road/Whitesell Street Interchange Improvements	The project would reconstruct the SR-92/Clawiter Rd interchange to create the SR-92/Whitesell St interchange, addressing truck traffic access needs by: reconfiguring Clawiter/SR 92 interchange, creating new access to SR 92 at Whitesell St, and consolidating access for these two local roads.		Yes	Yes	Yes	n/a	2015 for local street improvements	Local street connections coded for 2015. No drawings available for interchange improvements.
17-01-0037	Alameda	Ashby I-80 Interchange with Bicycle and Pedestrian Ramps	Reconstruct the Ashby Avenue interchange, including construction of a new bridge to replace existing bridges, a roundabout interchange, and bicycle/pedestrian access over the I-80 freeway at the Ashby-Shellmound interchange.						No	3/29/18 Coded for 2030 based on PSR
17-01-0038	Alameda	I-580 Interchange Improvement at Hacienda/Fallon Road - Phase 2	1-580/Fallon Rd I/C Improvements (Phase 2): Reconstruct overcrossing to add lanes I-580 Hacienda Dr I/C Improvements: Reconstruct overcrossing to add lanes		Yes	Yes	Yes	n/a	Fallon (2015), Hacienda (No)	3/29/18 Fallon changed to 2010, added 4th lane on Hacienda
17-01-0039	Alameda	I-580 SR-84/Isabel Interchange Improvements Phase 2	Complete ultimate improvements at I-580/Isabel/State Route 84 Interchange to provide 6-lanes over I-580 at the Isabel/State Route 84 Interchange and 4-lanes over I-580 at the Portola Avenue flyover.		Yes	Yes	Yes	n/a	Isabel (2035), Portola (2015)	3/27/18 Added missing Isabel connections on N. side
17-01-0040	Alameda	I-80 Gilman Street Interchange Improvements	The proposed project is located in northwest Berkeley and will reconfigure the I-80/Gilman interchange. The limits for the freeway and ramp traffic operations would include I-80 from east of Buchanan Street to west of University Avenue.						No	No changes - Proposed improvements would not be represented in model
17-01-0041	Alameda	I-880 Winton Avenue Interchange Improvements	This project proposes to modify the existing Winton Avenue/I-880 cloverleaf interchange to a partial cloverleaf interchange, implement Complete Street per Caltrans HDM and provide direct access to Southland Mall.		Yes	Yes	Yes	n/a	No	Not coded, should be updated
17-01-0042	Alameda	I-680 Overcrossing Widening and Improvements (at Stoneridge Drive)	Widen Stoneridge Drive overcrossing at I-680 constructing third westbound lane		Yes	Yes	Yes	n/a	2020	Exsiting model adds lane in each direction. 3/29/18 revised to 2030 add lane WB only.
17-01-0043	Alameda	42nd Ave & High St Access Improvement at I-880 On/Off Ramp	Adjacent I-880/High St, project will widen and extend existing local roads; improve vehicles level of service, pedestrian & ADA accessibility, access to ramps/Alameda; expand the region's bike route; eliminate circuitous traffic and congestion near I-880, promote edevelopment in the Estuary Area.	Yes	Yes	Yes	Yes	n/a	2018	3/29/18 recoded to match built configuration, year is 2015
17-01-0044	Alameda	I-680 Sunol Interchange Modification	Signalize Sunol @ I-680 Interchange ramps and widen Southbound on ramp	Yes	Yes	Yes	Yes	n/a	No	Widening on E. side in 2005, W. side in 2035
17-01-0045	Alameda	Santa Rita Road I-580 Overcrossing Widening	Widen Southbound Santa Rita Road overcrossing at I-580 constructing third southbound through lane at Pimlico Drive and second on ramp lane to I-580 eastbound.		Yes	Yes	Yes	n/a	No	No changes - already coded with 3 lanes
17-01-0046	Alameda	Coliseum City Transit Hub	The project is a consolidated multi-modal transit hub at the existing Coliseum BART station and Amtrak Station for patrons of the future Coliseum City Transit-Oriented Development. Includes pedestrian concourse and replacement for 1000 BART parking spaces which may be shared with other uses.						n/a	n/a
17-01-0047	Alameda	I-880 to Mission Boulevard East-West Connector	Improved east-west connection between I-880 and Route 238 (Mission Blvd.) comprised of a combination of new roadways along preserved ROW and improvements to existing roadways and intersections along Decoto Road, Fremont Boulevard, Paseo Padre Parkway, Alvarado-Niles Road and Mission Boulevard.		Yes	Yes	Yes	202	2015	3/29/18 Changes FT from 7 to 3 (capacity increase), year changed to 2030

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17-01-0048	Alameda	Dublin Boulevard - North Canyons Parkway Extension	This project will update the currently planned project by incorporating multimodal travel, and construct the street extension to connect Dublin Blvd. in Dublin with North Canyons Parkway in Livermore at Doolan Road. The existing RTP project lacks the current State, regional, and local priorities. This project was carried forward from RTPIDs 21473, 240392.		Yes	Yes	Yes	n/a	2020	Year changed to 2025
17-01-0049	Alameda	Fruitvale Avenue (Miller Sweeney) Lifeline Bridge Project	Replace the existing vehicular bridge with one structure that can provide the only Lifeline access from Alameda. Provide dedicated transit lanes, bike lanes, median and sidewalks.						n/a	n/a
17-01-0050	Alameda	SR-84 Mowry Avenue Widening (Peralta Blvd to Mission Blvd)	Widen Mowry Ave from Peralta Blvd to Mission Blvd (State Route 84) from two to four lanes and install bike lanes and sidewalks on both sides of the street.		Yes	Yes	Yes	n/a	2035	3/29/18 Changed year to 2030
17-01-0051	Alameda	Tassajara Road Widening from N. Dublin Ranch Drive to City Limit	This project will widen Tassajara Road from existing 2 lanes to 4 lanes between N/ Dublin Ranch Drive to City limit with C C County. It would add new bike lanes, construct/upgrade bus stops, and add missing sidewalks, ADA ramps, curb and gutter. Traffic signals will be upgraded.		Yes	Yes	Yes	n/a	2015, widening to 6 lanes, also 6 lanes in Contra Costa Co.	3/29/18 changed lanes to 4 and year to 2030
17-01-0052	Alameda	Auto Mall Parkway Widening and Improvements	Widen Auto Mall Parkway from four lanes to six lanes between I880 and I680 including intersection improvements and widening of the Auto Mall bridge over UPRR.		Yes	Yes	Yes	n/a	2018	Already coded - No changes
17-01-0053	Alameda	Dougherty Road Widening	This project will complete 1.83 mile of widening of Dougherty Rd. from 4 lanes to 6 lanes from Dublin Blvd. to the county line. Some of the improvements include; class II bike lanes, landscaped median islands, street lighting, traffic signal modifications, and 1.4 miles of Bike/Ped. Class I trail.	Yes	Yes	Yes	Yes	n/a	2015	Already coded - No changes
17-01-0054	Alameda	Union City Boulevard Widening (Whipple to City Limit)	Widen Union City Boulevard to three travel lanes in each direction from Whipple Road to the City limits with Hayward.		Yes	Yes	Yes	n/a	2025	Already coded - No changes
17-01-0055	Alameda	SR-84 Peralta Boulevard Widening (Fremont Blvd to Mowry Ave)	This project will widen Peralta Blvd (State Route 84) to four lanes with continuous bike lanes and sidewalks on both sides of the road from Fremont Blvd to Mowry Ave.		Yes	Yes	Yes	n/a	2020	3/29/18 Change year to 2030
17-01-0056	Alameda	Thornton Avenue Widening (Gateway Boulevard to Hickory Street)	The project will widen this undivided two-lane section of Thornton Avenue to a four-lane divided arterial street.		Yes	Yes	Yes	n/a	2035	3/29/18 Change year to 2030
17-01-0057	Alameda	Dublin Boulevard Widening - Sierra Court to Dublin Court	This project proposes to widen Dublin Boulevard from Sierra Court to Dublin Court in the westbound direction from two to three lanes in the City of Dublin. This project also includes the construction of Class II bike lanes.	Yes	Yes	Yes	Yes	n/a	No, coded as 3 lanes in base	3/29/18 corrected base, added improvement for 2020
17-01-0058	Alameda	Irvington BART Station	Construct a new BART station in Irvington PDA in Fremont on Osgood Road near Washington Boulevard as called for in the 2014 Alameda County Transportation Expenditure Plan		Yes	Yes	Yes	203	2024	Service assumed by 2040
17-01-0059	Alameda	Union City Intermodal Station Phase 4	Phase 4 is an at grade intermodal station to serve both AMTRAK, ACE and future Dumbarton Rail with elevated tracks and passengers platforms.						n/a	n/a
17-01-0060	Alameda	East Bay BRT	A 9.5 mile BRT line from downtown Oakland to the San Leandro BART station on International Blvd and East 14th St. with 80% dedicated lanes; 27 new hybrid buses; 34 level-boarding platform stations; real time arrival information; and transit signal priority. It also includes parking mitigations.	Yes	Yes	Yes	Yes	n/a	2020	Coding updated for implementation by 2020

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17-01-0061	Alameda	Ralph Appezzato Memorial Parkway BRT	To create BRT infrastructure between Webster Street and the Alameda Point PDA, connecting future residents and workers on the former base (as well as existing Alameda residents) to downtown Oakland and BART via Webster Street Tube. The BRT's Alameda term	Yes	Yes	Yes	Yes	n/a	Coded as 51 BRT	4/29/18 Replaced 51BRT with Alameda Pt alignment
17-01-0062	Alameda	BART to Livermore/ACE Project Development and Construction Reserve	BART is preparing a project-level Environmental Impact Report evaluating five alternatives for the BART to Livermore Extension Project. BART extension to Isabel Avenue, DMU/EMU to Isabel Avenue, Express Bus/BRT, Enhanced Bus, and No-build.						n/a	n/a
17-01-0063	Alameda	Broadway Shuttle Expansion	Planning and environmental analysis of the Broadway Shuttle Expansion project which seeks to extend the shuttle route and service hours, and upgrade the project to an Enhanced Bus or Electric Streetcar line to enhance transit circulation and mobility, and catalyze mixed-use TOD and economic develop					204	No	Service kept same as 2010 - revised service plan not available
17-01-0064	Alameda	Additional Local Road Preservation/Rehab	Additional funding for local streets and roads maintenance in Oakland from the City of Oakland Measure KK (Nov. 2016 ballot measure)						n/a	n/a
17-02-0001	Contra Costa	Access and Mobility Program	This category includes projects that improve access and mobility for people with disabilities, low-income residents, and seniors, such as West County Low-Income School Bus Program, paratransit through Contra Costa County, information and outreach projects, dial-a-ride, guaranteed ride home, non-operational transit capital enhancements (i.e. bus shelters), local shuttles, lighting and security projects, and discounted transit passes.						n/a	n/a
17-02-0002	Contra Costa	Innovative Transportation Technology	This category includes projects that would implement technological advances for transportation such as connected vehicle, autonomous vehicle, and other innovations.						n/a	n/a
17-02-0003	Contra Costa	Bicycle and Pedestrian Program	Projects in this category are new bicycle (on-street and off-street) and pedestrian facilities, and facilities that connect existing network gaps, such as Lamorinda Bicycle and Pedestrian Program, Wildcat Creek Trail, and Contra Costa County's Safe Routes to School Program						n/a	n/a
17-02-0004	Contra Costa	County Safety, Security and Other	Projects in this category address safety, security and other needs such as Lone Tree Way Undercrossing, Marsh Creek Road Curve Realignment, Cutting/Carlson grade crossing improvements, San Pablo Avenue overcrossing, Vasco Road safety improvement, and Viera Avenue Realignment						n/a	n/a
17-02-0005	Contra Costa	Multimodal Streetscape	Projects in this category implement complete streets improvements to roadways throughout Contra Costa County, such as on San Pablo Avenue, near the Del Norte and Concord BART stations, and in PDAs.						No	n/a
17-02-0007	Contra Costa	Minor Roadway Expansions	Funds future widening and extensions of non-regionally significant roadways such as John Muir Parkway, Slatten Ranch Road, James Donlon Blvd, Hillcrest Avenue, Sand Creek Road, San Jose Avenue and other roads throughout Contra Costa County						No	No changes

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17-02-0008	Contra Costa	Roadway Operations	Projects in this category improve roadway operations through technology and management systems on roads throughout Contra Costa County such as Clayton Road, Treat Boulevard, Contra Costa Boulevard, St. Mary's Road, Alhambra Avenue, Mt. Diablo Boulevard, roads in downtown Lafayette and Gateway/Lamorinda Traffic Program						No	n/a
17-02-0009	Contra Costa	Minor Transit Improvements	Projects in this category improve or complement existing transit operations through rolling stock, park and ride lots, express bus service expansion, technology upgrades, bus transit preferential measures, eBART support service and school bus programs						No	No changes
17-02-0010	Contra Costa	SR4 Integrated Corridor Mobility	SR4 Integrated Corridor Mobility from I-80 to SR160, including adaptive ramp metering, advanced traveler information, arterial management system, freeway management system, connected vehicle applications		Yes	Yes	Yes	n/a	No	TOS=2 added for 2030
17-02-0011	Contra Costa	I-80 ICM Project Operations and Maintenance	I-80 Integrated Corridor Mobility (ICM) Project Operations and Management - Local Portion - Maintenance in Contra Costa; This project will implement Adaptive Ramp Metering (ARM) and Active Traffic Management (ATM) strategies will be employed to reduction congestion and provide incident management capabilities.	Yes	Yes	Yes	Yes	n/a	No	TOS=2 added for 2030
17-02-0012	Contra Costa	I-680 Northbound Managed Lane Completion through 680/24 and Operational Improvements between N. Main and Treat Blvd Blvd	I-680 carpool lane completion thru 680/24 interchange and operational Improvements between N. Main and Treat Blvd		Yes	Yes	Yes	n/a	No	3/18 HOV lane coded for 2030 implementation
17-02-0013	Contra Costa	I-680 Northbound HOV lane extension between N. Main and SR-242	Provides an HOV lane in the northbound direction between N. Main and SR242, which will shorten a gap in the HOV network which currently exists between Livorna and SR242.		Yes	Yes	Yes	n/a	2035	3/18 Year changed to 2030
17-02-0014	Contra Costa	Kirker Pass Road Northbound Truck Climbing Lane, Clearbrook Drive to Crest of Kirker Pass Road	This project will add NB truck climbing lane from Clearbrook Drive in the City of Concord to a point 1,000 beyond the crest of Kirker Pass Road. The addition will include a 12-foot dedicated truck climbing lane and a Class II bike lane within an 8-foot paved shoulder.	Yes	Yes	Yes	Yes	n/a	No	No changes
17-02-0015	Contra Costa	Vasco Road Byron Highway Connector Road	New road between Vasco Road and Byron Highway that increases access to the Byron Airport. Road will be 1 lane per direction with at grade intersections at both end. Project is formerly named: SR-239: Airport Connector			Yes	Yes	n/a	No	No changes
17-02-0016	Contra Costa	Construct SR 242/Clayton Road on and off-ramps	Construct on and off-ramp for SR 242 at Clayton Road		Yes	Yes	Yes	n/a	2035	Already coded - No changes
17-02-0017	Contra Costa	SR-239 Feasibility Studies and Project Development	Environmental and design study to construct a new State Route connecting SR4 to Interstates 205/580 near Tracy. Route alignment is not yet defined.						n/a	n/a
17-02-0019	Contra Costa	I-680/SR4 Interchange Improvements - Phases 1-3	Improve I-680/SR4 interchange by implementing: direct connectors for NB I-680 to WB SR4 (Ph1) & WB SR4 to SB I-680 (Ph2), & widening SR4 btw SR242 & Morello from 2 to 3 lanes per direction (Ph3). The 2-lane direct connectors will replace a single lane loop ramp & a single lane diagonal ramp, respectively.		Yes	Yes	Yes	406	2035	3/29/18 Changed year to 2030

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17-02-0020	Contra Costa	SR-4 Operational Improvements - Initial Phases	Various operational improvements on SR-4 between SR-242 and Bailey Road, including adding auxiliary lanes in strategic locations along this corridor		Yes	Yes	Yes	411	No	No changes
17-02-0021	Contra Costa	Reconstruct I-80/San Pablo Dam Road Interchange	Phase 1 includes relocating El Portal Dr. on-ramp to WB I-80 to the north, extending the auxiliary lane along WB I-80 between San Pablo Dam Rd off-ramp and El Portal Dr on-ramp, and reconstructing the Riverside Ave pedestrian overcrossing. Phase 2 includes modifications to McBryde and SPDR I/C & Includes provisions for bicyclists and pedestrians on San Pablo Dam Rd.		Yes	Yes	Yes	n/a	No	No changes
17-02-0022	Contra Costa	I-680 Southbound HOV Lane between N. Main and Livorna	Through the I-680/SR 24 Interchange, this project adds an HOV lane on I-680 SB, through minor widening and restriping to narrower lanes. Existing number of mixed flow lanes will be kept the same.	Yes	Yes	Yes	Yes	n/a	2015	Already coded - No changes
17-02-0023	Contra Costa	State Route 4 Widening and Balfour Road IC Construction	Construct SR4 Bypass interchange at Balfour Rd and Widen SR4 from 2 to 4 lanes.	Yes	Yes	Yes	Yes	n/a	No	Added road for 2015, no I/Cs coded, simplified representation
17-02-0024	Contra Costa	I-80/SR-4 Interchange Improvements - New Eastbound Willow Avenue Ramps	New SR4 eastbound offramp and onramp at Willow north of Palm Avenue and removal of Willow Hook Ramps		Yes	Yes	Yes	n/a	No	No changes
17-02-0026	Contra Costa	I-80/Central Avenue Interchange Modification - Phases 1 & 2	Construct new signals and changeable message signs to redirect I-80 westbound on-ramp traffic during weekend peak periods to I-580, connect Pierce Street to San Mateo Street to relocate the traffic signal at Pierce Street/Central Avenue to the San Mateo/Central Avenue intersection, and construct other necessary improvements.		Yes	Yes	Yes	n/a	No	No changes
17-02-0027	Contra Costa	Construct Additional Auxiliary Lanes on I-680 - South of I-680/SR-24 Interchange	Additional I-680 NB and SB auxiliary lanes south of I-680/SR 24 Interchange, including the following locations: Alcosta Road to Bollinger Canyon Road; El Cerro Blvd to El Pintado Road; El Pintado Road to Stone Valley Road; Stone Valley Road to Livorna Road; and Livorna Road to Rudgear Road.	Yes	Yes	Yes	Yes	n/a	No	3/29/18 Updated aux lanes
17-02-0028	Contra Costa	I-80 Eastbound and Westbound Pinole Valley Road On-ramp Improvement	Improve conditions for merging onto the I-80 mainline from the eastbound and westbound Pinole Valley Road on-ramps to address vehicles accelerating uphill after stopping at ramp meter.		Yes	Yes	Yes	n/a	n/a	n/a
17-02-0029	Contra Costa	Eastbound SR-24: Construct Auxiliary Lane, Wilder Road to Camino Pablo	Construct auxiliary lane along eastbound Highway 24 from on-ramp at Wilder Road to downtown Orinda off-ramp at Moraga Way/Camino Pablo/Brookwood Road		Yes	Yes	Yes	n/a	2015	3/29/18 Coded as aux lane, 2030 implementation
17-02-0030	Contra Costa	Widen Brentwood Boulevard - Havenwood Way to north city limit; and Chestnut to Fir	Project would widen Lone Tree Way from 2 to 4 lanes for approximately 2400 linear feet. It also includes bike lanes, median islands, curb, gutter, sidewalk street lights and landscaping.		Yes	Yes	Yes	n/a	No	No changes
17-02-0031	Contra Costa	Widen Willow Pass Road, Lynwood Drive to SR 4	Widen Willow Pass Road from Lynwood Drive to State Route 4 from two lanes to four lanes and implement Complete Streets Improvements		Yes	Yes	Yes	n/a	No	3/29/18 Added widening, also corrected Kirker Pass from 3 to 2 each way
17-02-0032	Contra Costa	Widen Ygnacio Valley Road-Kirker Pass Road, Cowell to Michigan	Widen Ygnacio Valley Road from Michigan Blvd to Cowell Road from four lanes to six lanes and implement Complete Streets improvements		Yes	Yes	Yes	n/a	2035	3/29/18 Changed year to 2030, added bike lanes
17-02-0033	Contra Costa	Widen Camino Tassajara Road, Windemere to County Line	Widen Camino Tassajara Road from 2-lanes to 4-lanes, including 8-foot paved shoulders and Class II bike lanes in both directions from Windemere Parkway to the Alameda/Contra Costa County Line.		Yes	Yes	Yes	n/a	2015	3/29/18 Changed year to 2030 and widening from 6 to 4

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17-02-0034	Contra Costa	West Leland Road Extension	Construct new 4-lane arterial roadway with raised median, class 2 bike lanes, and sidewalks from San Marco Boulevard to Willow Pass Road, with a design speed of 55 mph.	Yes	Yes	Yes	Yes	n/a	No	3/29/18 Added for 2020
17-02-0035	Contra Costa	Lone Tree Way Widening	Widen Lone Tree Way to 4-lanes in order to match section west of O'Hara Avenue.		Yes	Yes	Yes	n/a	No	3/29/18 Added for 2030
17-02-0036	Contra Costa	Pittsburg-Antioch Highway Widening	Widen existing 2-lane arterial roadway to 4-lane arterial with turning lanes at appropriate locations.	Yes	Yes	Yes	Yes	n/a	2005	3/29/18 changed year to 2020
17-02-0037	Contra Costa	Widen Main St, SR 160 to Big Break Rd	Widen Main Street from Highway 160 to Big Break Road from 4 lanes to 6 lanes.		Yes	Yes	Yes	n/a	No	No changes
17-02-0038	Contra Costa	Main Street Bypass	Construct Main Street Downtown Bypass road between Vintage Parkway and 2nd Street.	Yes	Yes	Yes	Yes	n/a	No	No changes
17-02-0039	Contra Costa	Hercules Train Station - All Phases	Implement all phases of the Hercules Train Station including extending John Muir Parkway with box culvert over North Channel and Bayfront Boulevard with bridge over Refugio Creek, eliminating gap in the Bay Trail West Segment by installing new trail connecting to new rail station, relocating fuel oil & fiber optic lines, constructing transit loop promenade and civic plaza, constructing parking structure, and conducting track/signal work		Yes	Yes	Yes	n/a	No	Not updated, trains coded to run Richmond-Martinez without additional stop
17-02-0040	Contra Costa	Martinez Intermodal Project: Phase 3	Constructs Martinez Intermodal Station (Phase 3), which includes an additional 425 spaces and auto/ped bridges (on top of planned 200 interim spaces).					n/a	n/a	n/a
17-02-0041	Contra Costa	Privately Run Ferry Service including Small-Scale (non-WETA complying) Landside Improvements from Antioch, Martinez, and Hercules to San Francisco	Implement new ferry service from Antioch, Martinez, and Hercules to San Francisco. Project cost includes landside improvements and privately run ferry service, which would be provided at a lower cost than standard WETA service. Ferry service is only included in the Plan from 2020 to 2035.	Yes	Yes		Yes	410	No	3/29/18 Moved terminal to correct location in Hercules, service coded Hercules-SF only
17-02-0042	Contra Costa	Richmond-San Francisco Ferry Service	Implements ferry service from Richmond to San Francisco as identified in the Water Transit Authority's Implementation and Operations Plan.	Yes	Yes	Yes	Yes	n/a	2020	Already coded - No changes
17-02-0043	Contra Costa	BART Capacity, Access and Parking Improvements	Includes projects that improve BART station capacity and implement access and parking improvement at Contra Costa BART station						n/a	n/a
17-02-0044	Contra Costa	Landside Improvements for Richmond Ferry Service	Construct landside improvements for Richmond ferry service, including expanded parking.						n/a	n/a
17-02-0045	Contra Costa	El Cerrito del Norte BART Station Modernization, Phase 1	Project will provide improvements including, but not limited to: expansion of the paid area of the station, including a new station agent booth and new fare gates, new elevators and stairwells within the paid area providing access to the platform new passenger restrooms, new public art installations						n/a	n/a
17-02-0046	Contra Costa	Civic Center Railroad Platform Park & Ride Complex	The proposed project is the construction of an approximately 800-foot train platform along the San Joaquin Service line, which would be located north of Main Street in Oakley, between 2nd Street and O'Hara Avenue. Approximately 300 surface parking spaces, distributed in two parking lots to avoid one large surface lot off Main Street, will be included to support Park & Ride activities as well as future train riders.		Yes	Yes	Yes	n/a	No	No train station in Oakley assumed
17-02-0047	Contra Costa	East County Rail Extension (eBART), Phase 1	Construction of rail extension eastward from Pittsburg-Bay Point BART station with Phase 1 terminus at Hillcrest Avenue in Antioch.	Yes	Yes	Yes	Yes	n/a	2024	eBART included in 2020 inputs

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17-02-0049	Contra Costa	West County High Capacity Transit Investment Study Implementation - Phase 1	Environmental, engineering and initial implementation work associated with the recommendations from the study.						n/a	n/a
17-02-0050	Contra Costa	Brentwood Intermodal Transit Center	This project is a PNR facility in the City of Brentwood providing a transit connection to the current eBART terminus in Antioch. Tri-Delta transit would provide direct bus service from this facility which could serve as a future eBART station site in the future.		Yes	Yes	Yes	n/a	No	No changes
17-02-0051	Contra Costa	I-680 Transit Improvements including Express Bus Service, ITS components, and Park & Ride Lots	I-680 Transit Improvements including Express Bus Service, ITS components, and Park & Ride Lots along the I-680 corridor from Dublin to Martinez		Yes	Yes	Yes	403	No	No changes
17-02-0052	Contra Costa	Widen San Ramon Valley Boulevard from 2 to 4 lanes - Jewel Terrace to Podva Road	Widen San Ramon Valley Boulevard from 2 to 4 lanes - Jewel Terrace to Podva Road	Yes	Yes	Yes	Yes	n/a	No	Model not detailed in this area
17-03-0001	Marin	Bicycle and Pedestrian Program	Projects in this category are new bicycle (on-street and off-street) and pedestrian facilities, and facilities that connect existing network gaps throughout Marin County						n/a	n/a
17-03-0002	Marin	Climate Program: TDM and Emission Reduction Technology	Projects in this category implement strategies and programs that reduce emissions, encourage alternative transportation modes, and manage transportation demand including but not limited to projects such as TDM program implementation, parking management, local area shuttle and paratransit services						n/a	n/a
17-03-0003	Marin	County Safety, Security and Other	Projects in this category address safety and security needs including safe routes to school and coastal flood mitigation projects						n/a	n/a
17-03-0004	Marin	Roadway Operations	Projects in this category improve roadway operations through technology and management systems on roads throughout Marin County including Sir Francis Drake and other local corridor enhancements						n/a	n/a
17-03-0005	Marin	Minor Transit Improvements	Projects in this category improve or complement existing transit operations through transit management systems, bus maintenance facility relocation, local bus and ferry service expansion, countywide bus stop improvements and access improvements to SMART stations, among other bus transit capital and facility projects						n/a	n/a
17-03-0006	Marin	Implement Marin Sonoma Narrows HOV Lane and corridor improvements Phase 2 (Marin County)	Extend US 101 HOV lane from Atherton Avenue to Marin/Sonoma County line in the northbound direction and from Rowland Boulevard to Marin/Sonoma County line in southbound direction. This project will complete the HOV lane system in Marin County from Richardson Bay Bridge to Marin/Sonoma County line.		Yes	Yes	Yes	901	2035	3/29/18 Changed year to 2030, corrected existing HOV years to south
17-03-0007	Marin	US 101/580 Interchange Direct Connector - PAED	Study, design and connection for a two lane direct connector northbound US 101 to eastbound HWY 580. The project would entail PSR, PAED and construction of a direct freeway to freeway interchange instead of local arterials. Study includes 580 westbound to south US 101.						n/a	n/a
17-03-0008	Marin	Tiburon East Blithedale Interchange - PAED	Planning and environmental assessment of alternatives to improve the US 101/Tiburon Boulevard interchange						n/a	n/a

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17-03-0009	Marin	Access Improvements to Richmond San Rafael Bridge	Shift eastbound lane reduction 1,000 feet to the east on SFD and Improve shoulders from Larkspur Landing Circle to Anderson Drive. Improve bicycle access from Anderson Drive to Main Street. Add additional thru capacity at Bellam Boulevard off ramp from northbound 101 eastbound Interstate 580. Widen northbound Bellam off-ramp from US 101 to two lanes.	Yes	Yes	Yes	Yes	n/a	No	TOS=1 added in 2015
17-03-0010	Marin	Highway Improvement Studies	Operational and capacity enhancement studies to address safety, sea level rise, and congestion on US 101, HWY 1 and HWY 37. primarily focused on Interchange and ramp modifications as well as mainline improvements. PSRs level studies are funded, PAED and advanced outreach flexibility.						n/a	n/a
17-03-0011	Marin	Widen Novato Boulevard between Diablo Avenue and Grant Avenue	Widen Novato Blvd. between Diablo Ave. and Grant Ave. to accommodate future growth and enable roadway system to operate safely and efficiently, per City's General Plan.		Yes	Yes	Yes	n/a	No	No changes
17-03-0012	Marin	Sir Francis Drake Boulevard/Red Hill Avenue/Center Boulevard (known as "The Hub") - project development	Alternatives analysis, environmental and design of interchange improvements to this congested intersection. This study will include the study of a potential roundabout and improvements to this major arterial.						n/a	n/a
17-03-0013	Marin	San Rafael Transit Center (SRTC) Relocation Project	This project involves the full or partial relocation of the Bettini Transit Center/San Rafael Transit Center (SRTC). Relocating the existing transit center is necessary because SMART rail bi-sects the transit center, which eliminates one existing bus platform and renders the remaining platforms of the transit service unusable in whole or in part.						n/a	n/a
17-03-0014	Marin	Larkspur Ferry Terminal Parking Garage - Planning Study	This project would provide environmental, design, engineering and construction of a parking garage to augment existing inadequate parking at the Larkspur Ferry Terminal (LFT) and improve parking, traffic and pedestrian circulation around and within LFT. The parking garage would increase parking capacity from by approximately 36%, from 1,800 to 2,450 parking spaces.						n/a	n/a
17-03-0015	Marin	SMART Downtown San Rafael to Larkspur Rail Extension	Extend rail from Downtown San Rafael 2.2 miles to Larkspur SMART Station.	Yes	Yes	Yes	Yes	n/a	Larkspur service assumed by 2020	Already coded - No changes
17-03-0016	Marin	Multimodal Streetscape	Projects in this category implement multimodal or complete streets elements						n/a	n/a
17-04-0001	Napa	Bicycle and Pedestrian Program	Countywide bicycle network expansion, countywide bicycle network maintenance & rehabilitation, countywide pedestrian network enhancements, maintenance, rehabilitation and expansion. Also, includes countywide SRTS infrastructure and non-infrastructure projects/programs.						n/a	n/a
17-04-0002	Napa	County Safety, Security and Other	Railroad crossing safety upgrades, corridor and Safety Improvements						n/a	n/a
17-04-0003	Napa	Multimodal Streetscape	Complete streets implementation and street reconstruction.						n/a	n/a
17-04-0004	Napa	Minor Roadway Expansions	Additional road capacity and extensions including bridge construction throughout Napa County and including along Devlin Road and Eucalyptus Drive						n/a	n/a
17-04-0005	Napa	Roadway Operations	Intersection improvements and modifications, roadway capacity enhancements, including SR 221 and Soscol Avenue, and other City of Napa intersection improvements						n/a	n/a

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17-04-0006	Napa	Minor Transit Improvements	Enhanced and expanded transit services, improved commuter amenities, Vine transit maintenance and fueling station, transit fleet expansion, new transit and vehicle technology, improved signage and enhanced transit stops.						n/a	n/a
17-04-0007	Napa	Countywide Intelligent Transportation Systems Program	Technology and signalization integration, coordination and improvements.						n/a	n/a
17-04-0008	Napa	State Route 29 Improvements	Construct SR29 to a 6-lane Parkway with improved conditions for all travel modes from Napa Junction Road to South Kelly Road and increase capacity in SR-29 from 4 lanes to 6 lanes in unincorporated Napa County, between South Kelly Road and SR 12 Jameson Canyon Road, as well as other operational and intersection improvements along the SR 29 corridor countywide.		Yes	Yes	Yes	n/a	No	3/29/18 added widening for 2030
17-04-0009	Napa	Soscol Junction	Improvements at SR-29/SR-221/ Soscol Ferry Road.						n/a	n/a
17-04-0010	Napa	SR29 Gateway	Construct SR29 to 6-lanes for cars and improved conditions for other travel modes from American Canyon Road to Napa Junction Road		Yes	Yes	Yes	n/a	No	3/29/18 added widening for 2030
17-05-0001	San Francisco	Bicycle and Pedestrian Program	Projects in this category are new bicycle (on-street and off-street) and pedestrian facilities, and facilities that connect existing network gaps, including Second Street Complete Streets project						n/a	n/a
17-05-0002	San Francisco	Climate Program: TDM and Emission Reduction Technology	Projects in this category implement strategies and programs that reduce emissions, encourage alternative transportation modes, and manage transportation demand including but not limited to projects such as TDM program implementation, parking management, local area shuttle and paratransit services						n/a	n/a
17-05-0003	San Francisco	County Safety, Security and Other	Projects in this category address safety and security needs including Vision Zero improvements at ramps, local road safety and security, India Basin roadway transportation improvements, and transit safety and security						n/a	n/a
17-05-0004	San Francisco	Multimodal Streetscape	Projects in this category implement multimodal or complete streets elements in San Francisco						No	No complete streets lane changes coded in SF
17-05-0005	San Francisco	PDA Planning	This category includes planning studies supporting the region's PDA framework and connecting transportation and land use						n/a	n/a
17-05-0007	San Francisco	Transit Preservation/Rehabilitation	This project provides additional funding to transit capital preservation and rehabilitation beyond what is included in the regional transit capital project (RTPID 17-10-0026)						n/a	n/a
17-05-0008	San Francisco	Minor Roadway Expansions	This project implements roadway capacity changes to minor roads throughout San Francisco including Transit Center District Plan, Transbay Redevelopment Plan Street Network, Balboa Reservoir Street Network, Central SoMa Plan Network Changes, Central Waterfront/Pier 70 Street Network, Harney Way, HOPE SF Street Networks, Mission Bay, Mission Rock, Parkmerced, Schlage Lock, Treasure Island, Bayview, Rincon Hill, and along the Great Highway						No	No changes
17-05-0009	San Francisco	Roadway Operations	This project includes local road intersection improvements						n/a	n/a

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17-05-0010	San Francisco	Minor Transit Improvements	This project includes the transit performance initiative, transit management systems, minor transit improvements, Muni fare programs, maintenance facility projects, and transit preferential improvements						n/a	n/a
17-05-0011	San Francisco	San Francisco Late Night Transportation Improvements	New routes and increased frequency for all-night regional and local bus service, including Muni, AC Transit, Golden Gate Transit, and SamTrans routes. This is a pilot for 5 years.				Yes	n/a	No	No changes - Late night bus service not represented in model (part of "off peak")
17-05-0012	San Francisco	SFgo Integrated Transportation Management System	SFgo™ is San Francisco's Citywide ITS program. It identifies signalized and non-signalized intersections located along arterials and the Muni transit system and prioritizes them for ITS upgrades, such as controllers, cabinets, transit signal priority, fiber optic or wireless communications, traffic cameras, and variable message signs. Also improves arterial safety and pedestrian safety.						n/a	n/a
17-05-0013	San Francisco	Expand SFMTA Transit Fleet	This project entails future expansion of the SFMTA transit fleet and needed facilities to house and maintain transit vehicles. The purpose is to meet projected future transit demand, as indicated in the SFMTA Transit Fleet Plan. It will facilitate the future provision of additional service through the procurement of transit vehicles as well as the development of needed modern transit facilities. This also includes the expansion vehicles for Geary BRT (RTPID 17-05-0021) and does not include expansion vehicles for Central Subway, which are in RTPITD 17-05-0041.			Yes	Yes	313	No	MUNI local bus service held constant from 2010 to 2040
17-05-0014	San Francisco	Muni Forward (Transit Effectiveness Project)	Includes transit priority improvements along Rapid and High Frequency transit corridors, service increases, transfer and terminal investments, overhead wire changes, and street improvements in support of Vision Zero.		Yes	Yes	Yes	311	BRT added in 2019	No changes
17-05-0015	San Francisco	Rail Capacity Long Term Planning and Conceptual Design - All	Rail capacity long term planning and conceptual design for Muni, BART, and Caltrain. Planning and conceptual engineering phase for study of major corridor and infrastructure investments along existing and potential expansion rail corridors that either expand the system or provide significant increases in operating capacity to the existing rail system.						n/a	n/a
17-05-0016	San Francisco	Better Market Street - Transportation Elements	Improve Market Street between Steuart Street and Octavia Boulevard. Includes resurfacing, sidewalk improvements, way-finding, lighting, landscaping, transit boarding islands, transit connections, traffic signals, transportation circulation changes, and utility relocation and upgrade.		Yes	Yes	Yes	303	No	No changes
17-05-0017	San Francisco	Core Capacity Implementation - Planning and Conceptual Engineering	Advance planning and evaluation of recommendations that emerge from the Core Capacity Transit Study. Examples of projects under consideration include HOV lanes on the Bay Bridge for buses and carpools; BART/Muni/Caltrain tunnel turnbacks, crossover tracks, grade separations, or other operational improvements; and a second transbay transit crossing.						n/a	n/a
17-05-0018	San Francisco	Downtown San Francisco Ferry Terminal Expansion - Phase II	Expansion of berthing facilities along North Basin of Downtown San Francisco Ferry Terminal.						n/a	n/a
17-05-0019	San Francisco	Establish new ferry terminal at Mission Bay 16th Street	Establish New Ferry terminal to serve Mission Bay and Central Waterfront neighborhoods		Yes	Yes	Yes	n/a	No	No changes - RTP does not include new ferry service

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17-05-0020	San Francisco	HOV/HOT Lanes on U.S. 101 and I-280 in San Francisco	Phase 1 (full implementation): Convert an existing mixed traffic lane and/or shoulder/excess ROW in each direction to HOV 3+ lanes on US 101 from SF/SM County line to I-280 interchange and on I-280 from US 101 interchange to 6th Street off ramp to enhance carpool and transit operations during peak periods. Phase 2 (planning and environmental review only): Convert Phase 1 HOV lanes to HOT/Express Lanes. Express transit to be funded with HOT lane revenues.		Yes	Yes	Yes	101	No	3/29/18 Coded HOV on US 101, not I-280
17-05-0021	San Francisco	Geary Boulevard Bus Rapid Transit	Implement Geary Bus Rapid Transit (BRT) to improve service between Market Street and Point Lobos Avenue. This proposal includes dedicated bus lanes, enhanced platforms, new bus passing zones, adjustments to local bus stops, turn lane restrictions, new signalization with Transit Signal Priority, real-time arrival information, low-floor buses, and safety improvements in support of Vision Zero. Expansion vehicles are included in RTPID 17-05-0013.		Yes	Yes	Yes	301	2020	Already coded, no changes
17-05-0022	San Francisco	Presidio Parkway	Reconstruct Doyle Drive with standard lane widths, shoulders, and a median barrier. Reconstruct interchange at State Route 1 and State Route 101 and add an auxiliary lanes between this interchange and Richardson Avenue. Transit access will be improved through the provision of extended bus bays near Gorgas Avenue to accommodate multiple transit providers, and well defined pedestrian routes. Post 2017 costs reflect annual SHOPP contributions for operations and maintenance.	Yes	Yes	Yes	Yes	n/a	2005	Year changed to 2016
17-05-0023	San Francisco	Yerba Buena Island (YBI) I-80 Interchange Improvement	Includes two major components: 1) On the east side of the island, the I-80/YBI Ramps project will construct new westbound on- and off- ramps to the new Eastern Span of the Bay Bridge; 2) On the west side of the island, the YBI West-Side Bridges Retrofit project will seismically retrofit the existing bridge structures.	Yes	Yes	Yes	Yes	n/a	No	Not detailed in model
17-05-0024	San Francisco	Balboa Park Station Area - Southbound I-280 Off-Ramp Realignment at Ocean Avenue	This project will realign the existing uncontrolled southbound I-280 off-ramp to Ocean Avenue into a T-intersection and construct a new traffic signal on Ocean Avenue to control the off-ramp.	Yes	Yes	Yes	Yes	n/a	No	No changes
17-05-0025	San Francisco	Balboa Park Station Area - Closure of Northbound I-280 On-Ramp from Geneva Avenue	This project would study and implement closure of the northbound I-280 on-ramp from Geneva Avenue to improve safety. Closure of the ramp would initially be a pilot project, if possible, depending on the results of traffic studies. The linked on-ramp from Ocean Avenue would remain open.	Yes	Yes	Yes	Yes	n/a	No	No changes
17-05-0026	San Francisco	Bayshore Station Multimodal Planning and Design	Planning, Preliminary Engineering, and Environmental Review to re-locate the Bayshore Caltrain station and potentially extend the T-Line to the station. The project would also include inter-modal facilities and additional supporting structures and utilities.						n/a	n/a
17-05-0027	San Francisco	Hunters Point Shipyard and Candlestick Point Local Roads Phase 1	Build new local streets within the Hunters Point Shipyard and Candlestick Point area.			Yes	Yes	304	No	No changes
17-05-0028	San Francisco	Southeast San Francisco Caltrain Station - Environmental	Planning and environmental analysis of Caltrain infill station to replace Paul Ave Station in Southeast San Francisco (e.g. Oakdale).						n/a	n/a
17-05-0029	San Francisco	Downtown Value Pricing/Incentives - Pilot, Transit Service, Supportive Infrastructure	A set of street improvements to support transit operations and cycling and pedestrian safety and comfort to support the anticipated mode shift due to the implementation of congestion pricing.		Yes	Yes	Yes	306	No	No changes

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17-05-0030	San Francisco	Treasure Island Mobility Management Program: Intermodal Terminal, Congestion Toll, Transit Service, Transit Capital	New ferry service between San Francisco and Treasure Island; AC Transit service between Treasure Island and Oakland; shuttle service on-Island; bike share on-Island; priced-managed parking on-Island; Travel Demand Management program.		Yes	Yes	Yes	302	Ferry service coded	Ferry already coded, no changes coded for AC Transit or shuttle
17-05-0031	San Francisco	Southeast Waterfront Transportation Improvements - Phase 1	Create a 5 mile multi-modal corridor of streets, transit facilities, pedestrian paths, and dedicated bicycle lanes to link the Candlestick/Hunters Point Shipyard project area to BART, T-Third light rail, Caltrain, local bus lines and future ferry service. A BRT system (included in a RTPID 17-05-0032) would use exclusive transit right-of-way, station and shelter facilities, and transit signal priority infrastructure. This project also includes express bus and enhances transit service between the Southeast Waterfront and downtown San Francisco.			Yes	Yes	304	No	No changes
17-05-0032	San Francisco	Geneva-Harney Bus Rapid Transit	Provides exclusive bus lanes, transit signal priority, and high-quality stations along Geneva Avenue (from Santos St to Executive Park Blvd), Harney Way, and Crisp Avenue, and terminating at the Hunters Point Shipyard Center. The project includes pedestrian and bicycle improvements in support of Vision Zero and connects with Muni Forward transit priority improvements west of Santos Street. This is the near-term alternative that does not rely on the full extension of Harney Way across US 101.		Yes	Yes	Yes	104	No	No changes
17-05-0033	San Francisco	Van Ness Avenue Bus Rapid Transit	Implement Van Ness Avenue Bus Rapid Transit (Van Ness BRT) to improve approximately two miles of a major north-south urban arterial in San Francisco. Project would include a dedicated lane for BRT buses in each direction between Mission and Lombard Streets. There will be nine BRT stations, with platforms on both sides for right-side passenger boarding and drop-off.	Yes	Yes	Yes	Yes	n/a	Coded for 2020	Already coded, no changes
17-05-0034	San Francisco	Arena Transit Capacity Improvements	Identifies transit improvements needed to accommodate growth in Mission Bay. Improvements might include track crossovers to allow for trains to be staged; a 6-inch raised area along existing tracks; a platform extension to accommodate crowds; other trackway modifications; and a traction power study to ensure that the power grid can accommodate a large number of idling vehicles.						n/a	n/a
17-05-0035	San Francisco	EN Trips: All Components	Implement streetscape improvements on Folsom Street between 5th and 11th Streets and on Howard Street between 4th and 11th Streets. On Folsom Street, a bi-directional cycle track, new transit bulbs and bus bulbs at intersections, and new signals would be	Yes	Yes	Yes	Yes	n/a	No	No changes
17-05-0036	San Francisco	Regional/Local Express Bus to Support Express Lanes in SF	A 5-year regional/local express bus pilot to provide service to/from downtown San Francisco to/from San Francisco neighborhoods, Marin, Contra Costa, Alameda, San Mateo and Santa Clara counties to complement other freeway corridor management strategies. Some service to be funded with HOT lane revenues. See HOV/HOT Lanes on U.S. 101 and I-280 in San Francisco project. Includes vehicles.				Yes	308	No	No changes

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17-05-0037	San Francisco	Parkmerced Transportation Improvements	Implements transportation improvements for the Parkmerced development including enhanced transit service, pedestrian and bicycle facilities, intersection improvements, parking management, carshare and bikehare stations		Yes	Yes	Yes	n/a	No	No changes
17-05-0039	San Francisco	Geneva Light Rail Phase I: Operational Improvements, Planning and Environmental	Planning and environmental analysis of extension of light rail track 2.7 miles along Geneva Avenue from the Green Railyard to Bayshore Boulevard and then to the existing T-Third terminus at Sunnydale Station. Project would increase operational flexibility, system resiliency, and provide a southern east west rail connection. Phase included in Plan Bay Area 2040 is for non-revenue service.						n/a	n/a
17-05-0040	San Francisco	T-Third Mission Bay Loop	Connect the rail turnouts from the existing tracks on Third Street at 18th and 19th Streets with additional rail and overhead contact wire system on 18th, Illinois and 19th Streets. The loop would allow trains to turn around for special events and during peak periods to accommodate additional service between Mission Bay and the Market Street Muni Metro.	Yes	Yes	Yes	Yes	n/a	No	No changes, not included
17-05-0041	San Francisco	T-Third Phase II: Central Subway	Extends the Third Street Light Rail line north from King Street along Third Street, entering a new Central Subway near Bryant Street and running under Geary and Stockton Streets to Stockton & Clay Streets in Chinatown. New underground stations will be located at Moscone Center, Third & Market Streets, Union Square, and Clay Street in Chinatown. Includes procurement of four LRVs.	Yes	Yes	Yes	Yes	n/a	Coded for 2019	Already coded, no changes
17-05-0042	San Francisco	Historic Streetcar Extension - Fort Mason to 4th & King	The project would extend historic streetcar service by extending either the E-line or the F-line service from Fisherman's Wharf to Fort Mason, using the historic railway tunnel between Van Ness Ave. and the Fort Mason Center. The project will seek non-transit specific funds and will seek to improve the historic streetcar operation as an attractive service for tourists and visitors.		Yes	Yes	Yes	n/a	No	No changes, not included
17-06-0001	San Mateo	Bicycle and Pedestrian Program	Projects in this category are new bicycle (on-street and off-street) and pedestrian facilities, and facilities that connect existing network gaps, including but not limited to new multi-purpose pedestrian/bicycle bridges over US 101 and sidewalk gap closures						n/a	n/a
17-06-0002	San Mateo	County Safety, Security and Other	17-06-0002 San Mateo County Safety, Security and Other Projects in this category address safety and security needs of San Mateo County including county-wide implementation of Safe Routes to School Program						n/a	n/a
17-06-0003	San Mateo	Multimodal Streetscape	Projects in this category implement multimodal or complete streets elements, including but not limited to projects along facilities such as El Camino Real, Bay Road, Ralston Avenue, University Avenue, Middlefield Road, Palmetto Avenue, Mission Street, Geneva Avenue, and Carolan Avenue						No	No changes
17-06-0004	San Mateo	Minor Roadway Expansions	This category includes roadway capacity increasing projects (new roadways, widening or extensions of existing roadways) on minor roads such as Blomquist Street, California Drive, Railroad Avenue, Manor Drive, and Alameda de las Pulgas						No	No changes

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17-06-0005	San Mateo	Roadway Operations	County-wide Implementation of non-capacity Increasing local road Intersection modifications and channelization countywide. County-wide implementation of local circulation improvements and traffic management programs countywide						n/a	n/a
17-06-0006	San Mateo	County-wide Intelligent Transportation System (ITS) and Traffic Operation System Improvements	County-wide Intelligent Transportation System Installation of transportation system management improvements such as Intelligent Transportation System (ITS) elements and TOS equipment throughout San Mateo County.						No	3/18 TOS designations updated per MTC
17-06-0007	San Mateo	Modify existing lanes on U.S. 101 to accommodate a managed lane	Modify existing lanes to accommodate an HOV lane from Whipple to San Francisco County Line and/ or an Express Lane from approximately 2 miles south of the Santa Clara County Line to San Francisco County Line. Work may include shoulder modification, ramp modifications, and interchange modifications to accommodate an extra lane. Work will be phased.	Yes	Yes	Yes	Yes	101	No	3/29/18 Added HOT for Year 2020
17-06-0008	San Mateo	Add northbound and southbound modified auxiliary lanes and/ or implementation of managed lanes on U.S. 101 from I-380 to San Francisco County line	Add northbound and southbound modified auxiliary lanes and/or implementation of managed lanes on U.S. 101 from I-380 to San Francisco County line.		Yes	Yes	Yes	101	2018 Aux lane from South SF to SF line	No changes, coded from South SF to SF line only
17-06-0009	San Mateo	Improve operations at U.S. 101 near Route 92 - Phased	US 101 operational improvements near Route 92. Project may have phased construction.						n/a	No changes
17-06-0010	San Mateo	Improve U.S. 101/Woodside Road interchange	Modifies the Woodside Road Interchange at US 101.		Yes	Yes	Yes	n/a	No	No changes
17-06-0011	San Mateo	US 101 Produce Avenue Interchange	Construct a new interchange on US 101 at Produce Avenue, connecting Utah Avenue on the east side of US 101 to San Mateo Avenue on the west side of US 101. This will allow for reconfiguration of the existing southbound ramps at Produce Ave and Airport Blvd, as well incorporation of the northbound off- and on- ramps at S. Airport Blvd into the interchange design.		Yes	Yes	Yes	n/a	No	No changes
17-06-0012	San Mateo	U.S. 101 Interchange at Peninsula Avenue	Construct southbound on and off ramps to US 101 at Peninsula Ave to add on and off ramps from southbound 101.		Yes	Yes	Yes	n/a	No	No changes
17-06-0013	San Mateo	Reconstruct U.S. 101/Broadway interchange	Reconstructs the US 101/Broadway interchange.	Yes	Yes	Yes	Yes	n/a	No	No changes
17-06-0014	San Mateo	Reconstruct U.S. 101/Willow Road interchange	The project proposes to reconstruct the existing US 101/Willow Road (Route 114) Interchange within the existing alignment to a partial cloverleaf interchange. Project includes class I bike paths and class II bike lanes.	Yes	Yes	Yes	Yes	n/a	No	No changes
17-06-0015	San Mateo	Construct auxiliary lanes (one in each direction) on U.S. 101 from Marsh Road to Embarcadero Road	Add northbound and southbound auxiliary lanes.	Yes	Yes	Yes	Yes	n/a	Aux lanes included in base network (2000)	No changes
17-06-0016	San Mateo	Improve access to and from the west side of Dumbarton Bridge on Route 84 connecting to U.S. 101 per Gateway 2020 Study - Phased	Improve access to /from the west side of Dumbarton Bridge (Route 84 connecting to U.S. 101) per Gateway 2020 Study (Phased implementation of short term projects. Environmental phase only for long term projects).			Yes	Yes	n/a	2005 widening of Bayfront from 4 to 6 lanes	No changes

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17-06-0017	San Mateo	Route 101/Holly St Interchange Access	The proposed project would convert the existing full cloverleaf configuration to a partial cloverleaf design by eliminating two of the existing loop off-ramps of the interchange, and realign the diagonal on- and off-ramps into signalized T-intersections with local streets. A new pedestrian and bicycle over crossing will be constructed in the south side of Holly Street Interchange.	Yes	Yes	Yes	Yes	n/a	No	No changes
17-06-0018	San Mateo	Improve local access at I-280/I-380 from Sneath Lane to San Bruno Avenue to I-380 - Environmental only	Environmental assessment of local access improvements at the existing I-280 / I-380 interchange located in the City of San Bruno. The project would provide access to I-380 from the two main east-west secondary roads of Sneath Lane and San Bruno Avenue.						n/a	n/a
17-06-0019	San Mateo	State Route 92-82 (El Camino) Interchange Improvement	Widen the existing ramps and reconfigure the existing interchange from a full cloverleaf to a partial cloverleaf. Pedestrian and bicycle improvements would be included as part of the project.	Yes	Yes	Yes	Yes	n/a	No	No changes
17-06-0020	San Mateo	Hwy 1 operational & safety improvements in County Midcoast (acceleration/deceleration lanes; turn lanes; bike lanes; pedestrian crossings; and trails)	Operational and safety improvements for vehicles, bicycles, and pedestrians, along the Highway 1 corridor between Half Moon Bay and Pacifica. This could include acceleration lanes, deceleration lanes, turn lanes, bike lanes, enhanced crossings, and trail network improvements.	Yes	Yes	Yes	Yes	n/a	No	No changes
17-06-0021	San Mateo	Environmental Studies for 101/Candlestick Interchange	Planning and environmental analysis of the reconstruction of 101/Candlestick Interchange to full all-directional interchange with a single point cross street connection. Project would provide all-direction ramp movements controlled by new signalized intersections at the cross street connections. Interchange would join an improved Harney Way to the east, and would join the Geneva Avenue Extension to the west. Accommodate E/W crossing of planned BRT facility.						n/a	n/a
17-06-0022	San Mateo	Westbound slow vehicle lane on Route 92 between Route 35 and I-280 - Environmental Phase	Planning and environmental analysis of a westbound slow vehicle lane on Route 92 between Route 35 and I-280						n/a	n/a
17-06-0023	San Mateo	Route 1 Improvements in Half Moon Bay	In Half Moon Bay, On Route 1: Improve safety and reduce congestion by providing protected left and right turn lanes, warranted traffic signals, two through lanes only at signalized intersections, bike lanes, pathways, bus stops, traffic signal interconnects, safety lighting, median and channelization improvements.		Yes	Yes	Yes	n/a	No	No changes
17-06-0024	San Mateo	Reconstruct U.S. 101/Sierra Point Parkway interchange (includes extension of Lagoon Way to U.S. 101)	Reconstruct a partial interchange and provide improved access to Brisbane, Bayshore Blvd and proposed Brisbane Baylands project. Lagoon Way extension connects to the reconstructed interchange and provides improved access to Brisbane, Daly City, and the pending 600-acre Brisbane Baylands development.		Yes	Yes	Yes	n/a	No	No changes
17-06-0025	San Mateo	US 101/University Ave. Interchange Improvements	On University Avenue across US-101, between Woodland Avenue and Donohoe Street; Add bike lanes and sidewalk and modify the NB and SB off-ramps to eliminate pedestrian/bicycle conflicts and improve traffic operations.						n/a	n/a

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17-06-0026	San Mateo	Implement incentive programs to support transit-oriented development	Implement an incentive programs to support transit-oriented developments in San Mateo County.						n/a	n/a
17-06-0027	San Mateo	Implement supporting infrastructure and Automated Transit Signal Priority to support SamTrans express rapid bus service along El Camino Real	This project will institute necessary infrastructure and Automated Transit Signal Priority necessary to accommodate express rapid bus service along the length of El Camino Real from Palo Alto to Daly City.						No	No changes assumed for SamTrans bus service
17-06-0028	San Mateo	Make incremental increase in SamTrans paratransit service - Phase	Expansion of curb-to-curb paratransit fleet and service for eligible users, compliant with ADA requirements, based on projected future demand.						n/a	n/a
17-06-0029	San Mateo	Add new rolling stock and infrastructure to support SamTrans bus rapid transit along El Camino Real- Phase	This project will institute new rolling stock and infrastructure necessary to accommodate BRT along El Camino Real			Yes	Yes	103	SamTrans service held constant from 2010 to 2040	No changes assumed for SamTrans bus service
17-06-0030	San Mateo	Environmental Clearance and Design of the Redwood City Ferry Terminal and Service	Planning and environmental analysis of the construction of a new ferry terminal, purchase of 3 new high-speed ferry vessels, and operation of new ferry service between Redwood City and San Francisco.					1201	No	No changes - RTP does not include Redwood City ferry service
17-06-0031	San Mateo	Implement Redwood City Street Car - Planning Phase	Planning and environmental analysis of Redwood City Street Car Construction and Implementation						n/a	
17-06-0032	San Mateo	Route 1 San Pedro Creek Bridge Replacement and Creek Widening Project	Replace San Pedro Creek Bridge on CA 1 with a longer bridge and widen the creek channel for 100 year storm flow capacity. Provide for a class 1 multi-purpose trail on the eastern side.	Yes	Yes	Yes	Yes	n/a	No	No changes
17-06-0033	San Mateo	Widen Route 92 between SR 1 and Pilarcitos Creek alignment, includes widening of travel lanes and shoulders	Widens shoulders and travel lanes to standard widths. Straighten curves at few locations.		Yes	Yes	Yes	n/a	No	No changes
17-06-0034	San Mateo	Construct Route 1 (Calera Parkway) northbound and southbound lanes from Fassler Avenue to Westport Drive in Pacifica	The Calera Parkway project will widen Highway 1 from four lanes to six lanes, from approximately 1,500 feet south of Fassler Avenue to approximately 2,300 feet north of Reina Del Mar Avenue, a distance of 1.3 miles, and will add a 16' wide landscaped median between concrete barriers from San Marlo Way to Reina Del Mar Avenue		Yes	Yes	Yes	n/a	No	No changes
17-06-0035	San Mateo	I-280 improvements near D Street exit	Improve the on and off-ramps and approaches for I-280 near the D Street exit in Daly City						No	No changes
17-06-0036	San Mateo	Widen Skyline Boulevard (Route 35) to 4-lane roadway from I-280 to Sneath Lane - Phased	Widens Skyline Blvd. (SR 35) between I-280 and Sneath Lane. It is currently the last portion of what is otherwise a four lane roadway along Skyline Blvd. The project widens approximately 1.3 miles of the roadway into four lanes.		Yes	Yes	Yes	n/a	No	No changes
17-06-0037	San Mateo	Widen Millbrae Avenue between Rollins Road and U.S. 101 soutbound on-ramp and resurface intersection of Millbrae Avenue and Rollins Road	Widen Millbrae Avenue between Rollins Road and US101 Southbound On Ramp and resurface the intersection of Millbrae Avenue and Rollins Road.	Yes	Yes	Yes	Yes	n/a	No	No changes

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17-06-0038	San Mateo	Construct a 6-lane arterial from Geneva Avenue/Bayshore Boulevard intersection to U.S. 101/Candlestick Point interchange - Environmental phase	Planning and environmental analysis of a 6-lane arterial from the Geneva Avenue at Bayshore Boulevard to 101/Candlestick Interchange. Grade separation at the Caltrain and Tunnel Ave, Class II bike lanes, on-street parking (travel lanes during peak periods), and sidewalks. Sections will be reserved for an exclusive lane BRT facility that connects to the Bayshore Multimodal Station and provides through service to BART Balboa Station.						n/a	n/a
17-06-0039	San Mateo	Grade Separations	This project includes grade separations of the Caltrain right of way at approximately 2 to 3 high priority locations in San Mateo County, including 25th Avenue. This project is based on San Mateo County's Measure A grade separation category.						No	No changes
17-06-0040	San Mateo	Extend Blomquist Street over Redwood Creek to East Bayshore and Bair Island Road	Redwood City Blomquist Street Extension and Blomquist Bridge over Redwood Creek		Yes	Yes	Yes	n/a	No	No changes
17-07-0001	Santa Clara	Bicycle and Pedestrian Program	Projects in this category are new bicycle (on-street and off-street) and pedestrian facilities, and facilities that connect existing network gaps, including downtown San Jose Bike Lanes						No	No changes
17-07-0002	Santa Clara	Caltrain Grade Separations	This project includes grade separations of the Caltrain right of way at priority locations throughout Santa Clara County						No	No changes
17-07-0003	Santa Clara	Multimodal Streetscape	Projects in this category implement multimodal or complete streets elements throughout Santa Clara County including but not limited to Los Gatos Boulevard, Monterey Road, Shoreline Boulevard, Stevens Creek Road, Downtown Sunnyvale Complete Streets, Wedgewood Avenue, West San Carlos, and Winchester Boulevard. This category also includes intersection improvements for non-expressways in Santa Clara County.						No	No changes
17-07-0004	Santa Clara	Additional Local Road Preservation/Rehab	This project provides additional funding to local streets and roads preservation and rehabilitation beyond what is included in the regional local roads maintenance project (RTPID 17-10-0022)						n/a	n/a
17-07-0005	Santa Clara	Minor Roadway Expansions	This category includes roadway capacity increasing projects (new roadways or widening/extensions of existing roadways) on minor roads throughout Santa Clara County such as Buena Vista Avenue, bridges over US 101 in Gilroy, Blossom Hill Road, Lark Avenue, Pollard Road, Union Avenue, Butterfield Road, San Antonio Road, Charcot Avenue, King Road, Montague Expressway, San Carlos Street, Zanker Road, Coleman Avenue, Autumn Street, Winchester Boulevard, Center Avenue, DeWitt Avenue, Hill Road, Wastonville Road, Mary Avenue, and Wildwood Avenue						No	No changes
17-07-0007	Santa Clara	Affordable Fare Program	Program objective is to increase ridership by reducing the cost of transit services for low-income populations including seniors, persons with disabilities, youth and students.						n/a	n/a
17-07-0008	Santa Clara	Implement System Operations and Management Program for Santa Clara County	This program includes projects that use technology to improve operation and management of the overall transportation system. These new technologies are collectively referred as Intelligent Transportation Systems.						n/a	n/a

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17-07-0009	Santa Clara	SR 87 Technology-based Corridor Improvements	Improvements in San Jose to address mainline congestion and system reliability through the implementation of technology-based operational improvements to the freeway.						n/a	n/a
17-07-0010	Santa Clara	Hwy. Transportation Operations System/Freeway Performance Initiative Phase 1 & 2	Implement Freeway Performance Initiative projects for Santa Clara County, which includes freeway ITS infrastructure, arterial management, incident management, emergency preparedness, and operations and maintenance of ITS infrastructure.						No	TOS improvements coded per MTC
17-07-0012	Santa Clara	BART Silicon Valley Extension - San Jose (Berryessa) to Santa Clara	The Berryessa Station to San Jose Extension Project would physically extend BART from the future BART Berryessa Station in San Jose to Downtown San Jose and then into Santa Clara. Project includes four new stations - Alum Rock, Downtown San Jose, Diridon, and Santa Clara. Project cost includes operating expenses - escalated capital cost is $5.175 billion.		Yes	Yes	Yes	501	2024	Included in 2040
17-07-0013	Santa Clara	Implement El Camino Rapid Transit Project	Implement Rapid line 522 improvements in the El Camino Real/The Alameda corridor including: dedicated guideways, signal prioritization, low-floor boarding, ticket vending machines, premium stations, real-time information, and specialized vehicles.		Yes	Yes	Yes	506	2020, may not match RTP project	No changes - SCVTA express bus service improvement assumptions retained from prior model udpate
17-07-0021	Santa Clara	Alviso Wetlands Doubletrack	Provide double track section on the UPRR Coast Subdivision from the Alameda County line to the vicinity of State Route 237. The improvements are expected to include double-tracking the segment running over the Alviso Wetlands.		Yes	Yes	Yes	518	No	No changes
17-07-0022	Santa Clara	Environmental Studies for SR-152 New Alignment	Project includes further environmental and planning studies for the SR-152 corridor, including a new alignment and potential toll options.						n/a	n/a
17-07-0023	Santa Clara	US 101/Zanker Rd./Skyport Dr./Fourth St. Interchange Improvements	Construct a new interchange at U.S. 101/Zanker Road/Skyport Drive/Fourth Street		Yes	Yes	Yes	n/a	No	No changes
17-07-0024	Santa Clara	Lawrence/Stevens Creek/I-280 Interchange	Lawrence/Stevens Creek/I-280 Interchange: Provide direct connections between Lawrence Expressway and I-280		Yes	Yes	Yes	n/a	No	No changes
17-07-0025	Santa Clara	I-280/Winchester Blvd Interchange Improvements	Improve I-280/ Winchester Blvd Interchange to relieve congestion and improve operations and local circulation.		Yes	Yes	Yes	n/a	No	No changes
17-07-0026	Santa Clara	I-280/Wolfe Road Interchange Improvements	Modify I-280/Wolfe Road Interchange to relieve congestion and improve local circulation.		Yes	Yes	Yes	n/a	No	No changes
17-07-0027	Santa Clara	US 101/Mabury Rd./Taylor St. Interchange Improvements	Construct interchange at U.S. 101/Mabury Road/Taylor Street		Yes	Yes	Yes	n/a	No	No changes
17-07-0028	Santa Clara	I-280 New HOV Lane from San Mateo County line to Magdalena Avenue	New HOV lane added to I-280 from existing HOV lane at Magdalena Avenue to the San Mateo County Line. Requires constructing a new lane.		Yes	Yes	Yes	n/a	2025	3/29/18 Added for 2030
17-07-0029	Santa Clara	I-280/Saratoga Avenue Interchange Improvements	Modify I-280/ Saratoga Avenue Interchange to relieve congestion and improve local circulation		Yes	Yes	Yes	n/a	No	No changes
17-07-0030	Santa Clara	I-280 Northbound Braided Ramps between Foothill Expressway and SR 85	Improve braided ramps on northbound I-280 between Foothill Expressway and Route 85.		Yes	Yes	Yes	n/a	No	No changes
17-07-0031	Santa Clara	US 101 Southbound/Trimble Rd./De La Cruz Blvd./Central Expressway Interchange Improvements	Improve interchange at U.S. 101 southbound Trimble Road/De la Cruz Boulevard/Central Expressway.		Yes	Yes	Yes	n/a	No	No changes

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17-07-0032	Santa Clara	I-680/ Alum Rock/ McKee Road Interchange Improvements	Reconfigure interchange, improve access for all modes of transportation, improve traffic operations and relieve congestion at the I-680/ Alum Rock and I-680/ McKee Road interchanges. Construct an Express Bus Station in the Median of I-680 to connect buses using HOV or Express Lanes with Santa Clara Alum Rock BRT Station.		Yes	Yes	Yes	n/a	No	No changes
17-07-0033	Santa Clara	SR 237/Mathilda Ave. and US 101/Mathilda Ave. Interchange Improvement	The project proposes to improve local road operations on Mathilda Avenue in the City of Sunnyvale from Almanor Avenue to Innovation Way, including on- and off-ramp improvements at the State Route (SR) 237/Mathilda Avenue and US 101/Mathilda Avenue interchanges.		Yes	Yes	Yes	n/a	No	No changes
17-07-0034	Santa Clara	US 101 Interchanges Improvements: San Antonio Rd. to Charleston Rd./Rengstorff Ave.	Improve U.S. 101 interchanges at San Antonio Road to Charleston Road/Rengstorff Avenue including new auxiliary lane.		Yes	Yes	Yes	n/a	No	No changes
17-07-0035	Santa Clara	US 101/Buena Vista Ave. Interchange Improvements	Construct a full interchange at US 101 and Buena Vista Avenue in Gilroy. The interchange includes a flyover southbound on-ramp to braid with the existing truck exit at the CHP Inspection Station. Off-ramp diagonal ramps will be constructed.		Yes	Yes	Yes	n/a	No	No changes
17-07-0036	Santa Clara	SR 85 Northbound to Eastbound SR 237 Connector Ramp and Northbound SR 85 Auxiliary Lane	Widen off-ramp from Northbound SR 85 to SR 237 Eastbound to two lanes; construct auxiliary lane on Eastbound SR 237 between SR 85 on-ramp to Middlefield Rd.; construct braid off-ramp on Eastbound SR 237 between SR 85 and Dana St.		Yes	Yes	Yes	n/a	2020	Already coded - No changes
17-07-0037	Santa Clara	SR 85/El Camino Real Interchange Improvements	Improve SR 85 auxiliary lanes between El Camino Real and SR 237, and SR 85/El Camino Real interchange.		Yes	Yes	Yes	n/a	No	No changes
17-07-0038	Santa Clara	US 101/Blossom Hill Rd. Interchange Improvements	Widen interchange at U.S. 101/Blossom Hill Road. Improvements		Yes	Yes	Yes	n/a	No	No changes
17-07-0039	Santa Clara	US 101/Old Oakland Rd. Interchange Improvements	Improve interchange at U.S. 101/Old Oakland Road.		Yes	Yes	Yes	n/a	No	No changes
17-07-0040	Santa Clara	US 101/Shoreline Blvd. Interchange Improvements	Interchange improvements at Shoreline Boulevard.				Yes	n/a	No	No changes
17-07-0042	Santa Clara	SR 237/Great America Parkway WB Off- Ramps Improvements	Modify WB off-ramps at the SR 237/Great America Parkway interchange to improve traffic operations and relieve congestion.		Yes	Yes	Yes	n/a	No	No changes
17-07-0043	Santa Clara	SR 237/El Camino Real/Grant Rd. Intersection Improvements	Widen Westbound SR 237 within the existing median to extend both of the left-turn lanes; lengthen the Northbound El Camino Real right-turn lane onto SR 237 starting the lane at Yuba Drive; widen the Southbound El Camino Real left-turn lane within the existing median; and construct a right-turn lane on Southbound El Camino Real for traffic accessing Westbound Grant Rd.		Yes	Yes	Yes	n/a	No	No changes
17-07-0044	Santa Clara	Double Lane Southbound US 101 off-ramp to Southbound SR 87	Widen Southbound US 101 freeway connector to Southbound SR 87 to add a second lane and install TOS.	Yes	Yes	Yes	Yes	n/a	2018	Added as HOT lane
17-07-0051	Santa Clara	Widen Calaveras Blvd. overpass from 4 to 6 lanes	Replaces the existing four lane bridge, which currently has a single sidewalk and no bicycle lane over the Union Pacific (UP) Railroad tracks, to a six lane bridge. Project will also add sidewalks and bicycle lanes in both directions.		Yes	Yes	Yes	n/a	2040	3/29/18 Change year to 2030
17-07-0056	Santa Clara	Bus Stop Improvements	Enhance transit waiting environments by improving accessibility and amenities at VTA bus stops.						n/a	n/a

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17-07-0057	Santa Clara	Frequent Core Bus Network - 15 minutes	Provide 15-minute all day bus service on VTA's highest ridership routes	Yes	Yes	Yes	Yes	522	2020, may not match RTP project	No changes - SCVTA local bus service improvement assumptions retained from prior model udpate
17-07-0058	Santa Clara	SR 85 Corridor Improvements - reserve amount	This program will fund corridor transit studies that improve transit connectivity and reduce traffic congestion in this corridor. It also includes a reserve amount for future projects along SR 85 that would be funded with Measure B sales tax revenue.						n/a	n/a
17-07-0059	Santa Clara	Implement Stevens Creek Rapid Transit Project	Implement Rapid Transit improvements in the Stevens Creek corridor including: dedicated guideways, signal prioritization, low-floor boarding, ticket vending machines, premium BRT stations, real-time information, and specialized vehicles.		Yes	Yes	Yes	517	No	No changes
17-07-0060	Santa Clara	North First Street light rail speed Improvements	This project would improve light rail service and reliability along North First Street. Some of the problems in this area include signal timing issues, slow speeds (maximum speed currently restricted to 35mph), and unscheduled stops. Fencing along this corridor would allow maximum speeds to increase to 45 mph combined with improvements to signal timing.	Yes	Yes	Yes			2020, may not match RTP project	No changes - SCVTA LRT improvement assumptions retained from prior model udpate
17-07-0061	Santa Clara	Extend Capitol Expressway light rail to Eastridge Transit Center - Phase II	Extends the Capitol Avenue light rail line 2.6 miles from the existing Alum Rock Transit Center to a rebuilt Eastridge Transit Center. Includes the removal of HOV lanes on Capitol Expressway between Capitol Avenue and Tully Road in San Jose.		Yes	Yes	Yes	505	2020	Already coded - No changes
17-07-0062	Santa Clara	Extend light-rail transit from Winchester Station to Route 85 (Vasona Junction)	Extends light rail from Winchester Station to Route 85 (Vasona Junction).		Yes	Yes	Yes	507	No	No changes - extension not included in transit network
17-07-0063	Santa Clara	Mineta San Jose International Airport APM connector - planning and environmental	Conduct planning and design work on a proposed project that would provide a transit link to San Jose International Airport using automated People Mover (APM) technology.						n/a	n/a
17-07-0064	Santa Clara	County Safety, Security, Noise and Other	Noise abatement program countywide - This project will implement noise reduction projects throughout Santa Clara County.						n/a	n/a
17-07-0065	Santa Clara	Caltrain Station and Service Enhancements	Projects to improve Caltrain service, system performance and stations including full EMU conversion, longer vehicles, longer platforms, level boarding, parking improvements, bike facilities, transit connectivity, other station enhancements and track reconfigurations.					1102	n/a	n/a
17-07-0066	Santa Clara	Future Transit Corridor Studies	This program includes future transit corridor studies throughout Santa Clara County.						n/a	n/a
17-07-0067	Santa Clara	SR 17 Corridor Congestion Relief in Los Gatos	Operational improvements for the SR 17 Corridor, including upgrading Highway 17/Highway 9 interchange to improve pedestrian and bicycle safety, mobility, and roadway operations; deploying advanced transportation technology to reduce freeway cut thru traffic in Los Gatos, including traffic signal control system upgrades in Los Gatos, traveler information system, advanced ramp metering systems and multi-modal congestion relief solutions		Yes	Yes	Yes	n/a	No	No changes
17-07-0068	Santa Clara	237 WB Additional Lane from McCarthy to North First	Corridor Improvements in the cities of San Jose, Santa Clara and Milpitas to address mainline congestion and regional connectivity by the addition of SR 237 westbound auxiliary lane between McCarthy Boulevard and North First Street		Yes	Yes	Yes	n/a	No	3/29/18 added lane and Aux for 2030

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17-07-0069	Santa Clara	US 101/SR 25 Interchange	The project consists of reconfiguring the interchange at US 101 and SR 25 just south of the City of Gilroy in Santa Clara County, connecting SR 25 and Santa Teresa Boulevard, and widening the existing freeway from 4 to 6 lanes from the Monterey Street interchange to the US 101/SR 25 interchange.		Yes	Yes	Yes	n/a	2018	Already coded - No changes
17-07-0070	Santa Clara	SR 237 Express Lanes: North First St. to Mathilda Ave.	Convert HOV to express lane in both directions		Yes	Yes	Yes	502	2015	3/23/18 remove lane W. of Mathilda, change year to 2020
17-07-0074	Santa Clara	SR 85 Express Lanes: US 101 (South San Jose) to Mountain View	SR 85 typically has 1 HOV lane and 2 general purpose lanes in both directions with auxiliary lane in some segments. Project will convert existing HOV lane to express lane and add a second express lane between SR 87 and I-280 in both directions.		Yes	Yes	Yes	502	2015	3/23/18 updated coding, changed year to 2020
17-07-0075	Santa Clara	US 101 Express Lanes: Whipple Ave. in San Mateo County to Cochrane Road in Morgan Hill	Convert HOV Lanes to express lane and add a second express lane in some segments.		Yes	Yes	Yes	502	2017 coded south to Gilroy	3/23/18 remove S. of Cochrane
17-07-0076	Santa Clara	Santa Clara County Express Lanes Operations and Maintenance	This program includes operations and maintenance for the Santa Clara County (VTA) Express Lanes.						n/a	n/a
17-07-0077	Santa Clara	BART – Warm Springs to Berryessa Extension (SVBX)	The project entails design, ROW, construction, equipment and Rolling Stock procurements necessary to extend BART to the future Berryessa Station in San Jose. Improvements will include track, bridges, traction electrification, stations, parking areas, fare vending equipment and other ancillary operating and/or maintenance equipment.	Yes	Yes	Yes	Yes	n/a	2020	Already coded - No changes
17-07-0078	Santa Clara	Envision Expressway (Tier 1 Expressway Plan) Major and Minor Projects	Various operational and capacity improvements to expressways in Santa Clara County comprising the Tier 1 investments from the Santa Clara County Expressway Plan. These projects include capacity improvements for Almaden Expressway, Capitol Expressway, Foothill Expressway, Lawrence Expressway, Montague Expressway, Oregon-Page Mill Expressway, San Tomas Expressway, Santa Teresa Boulevard. This project also includes the following ITS/Signal upgrades: Replace/upgrade/add fiber optic lines; upgrade equipment for new technologies; systemwide pedestrian sensors; enhance/replace bicycle and vehicle detection with new technologies on the County expressways	VARIES	Yes	Yes	Yes	n/a	No	No changes
17-07-0079	Santa Clara	Envision Highway Minor Projects	Includes: 1-280 NB Second exit lane to Foothill Expressway; SR 17 SB/Hamilton Ave Off-Ramp widening; San Tomas expressway at SR-17 Improvements; US101/SR 152 10th Street Ramp and Intersection Improvements; and Charcot Avenue Extension over I-880						No	No changes
17-07-0080	Santa Clara	Alum Rock/Santa Clara Street Bus Rapid Transit	Implement Rapid Transit improvements in the Santa Clara/Alum Rock route, including: dedicated guideways, signal prioritization, ticket vending machines, premium stations, real-time information, and specialized vehicles.	Yes	Yes	Yes	Yes	n/a	2020, may not match RTP project	No changes - SCVTA express bus service improvement assumptions retained from prior model udpate
17-07-0081	Santa Clara	I-880 Express Lanes: SR-237 to US-101	Convert existing HOV lane to an express lane in both directions between SR 237 and US 101		Yes	Yes	Yes	502	2017	3/23/18 Remove lane from I-880/SR 17 S. of US 101
17-07-0082	Santa Clara	SR-87 Express Lanes: I-880 to SR-85	Convert existing HOV lane to an express lane in both directions between I-880 and SR-85		Yes	Yes	Yes	502	2018	3/23/18 Minor correction
17-07-0083	Santa Clara	I-680 Express Lanes: SR-237 to US-101	Convert existing general purpose lane to an express lane in both directions between SR-237 and US-101		Yes	Yes	Yes	502	2023	3/23/18 OK as coded

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17-07-0084	Santa Clara	I-280 Express Lanes: US-101 to Magdalena Avenue	Convert existing HOV lane to an express lane in both directions between US 101 and Magdalena Avenue		Yes	Yes	Yes	502	2022	3/23/18 OK as coded
17-07-0085	Santa Clara	Santa Clara County Express Lanes - Environmental and Design Phase for Future Segments	This program includes environmental and design phases for future express lane segments in Santa Clara County, including along I-880, US 101 south of Morgan Hill, and for Highway 17						n/a	n/a
17-07-0086	Santa Clara	Santa Clara County Express Lanes - Reserve	This program includes future revenue from express lanes in Santa Clara County						n/a	n/a
17-07-0087	Santa Clara	Widen San Tomas Expressway to 8 Lanes from Stevens Creek Blvd to Campbell Ave	Widen San Tomas Expressway from 6 to 8 Lanes from Stevens Creek Blvd to Campbell Ave.		Yes	Yes	Yes	n/a	2035 coding does not match description	No changes, should be updated
17-07-0088	Santa Clara	Senter Road Widening from Umbarger to Lewis	Widening Senter Road between Umbarger Rd. and Lewis Rd. from 4 to 6 lanes with improved bicycle/ped facilities and install median landscaping.		Yes	Yes	Yes	n/a	No	No changes
17-07-0089	Santa Clara	South Bascom Complete Streets	On South Bascom Ave. from Parkmoor Ave. to Southwest Expressway reduce the road to two lanes and make bicycle and pedestrian improvements in the corridor.		Yes	Yes	Yes	n/a	No	No changes
17-07-0090	Santa Clara	Widen Brokaw Bridge over Coyote Creek	Widen north side of the bridge to add on additional through traffic lane on westbound Brokow Road.						No	No changes
17-07-0091	Santa Clara	Widen Oakland Road from 4-lanes to 6-lanes between U.S. 101 and Montague Expressway	Widens Oakland Rd. from 4 to 6 lanes between US 101 and Montague Expwy. Also provides median island landscaping and operational improvements in roadway corridor.		Yes	Yes	Yes	n/a	2005	No changes - has been 6 lanes since 2008
17-08-0001	Solano	Access and Mobility Program	This category includes projects that improve access and mobility for people with disabilities, low-income residents, and seniors, including providing Lifeline transit service countywide and providing transit service to seniors and individuals with disabilities separate from Lifeline						n/a	n/a
17-08-0002	Solano	Bicycle and Pedestrian Program	Projects in this category are new bicycle (on-street and off-street) and pedestrian facilities, and facilities that connect existing network gaps						n/a	n/a
17-08-0003	Solano	Climate Program: TDM and Emission Reduction Technology	Projects in this category implement strategies and programs that reduce emissions, encourage alternative transportation modes, and manage transportation demand including but not limited to projects such as TDM program implementation, parking management, local area shuttle and paratransit services						n/a	n/a
17-08-0004	Solano	County Safety, Security and Other	Projects in this category address safety, security and other needs. This project includes safety improvements to state highways throughout Solano County. This also includes countywide Safe Routes to School projects.						n/a	n/a
17-08-0005	Solano	Multimodal Streetscape	Projects in this category implement multimodal or complete streets elements						No	No changes
17-08-0006	Solano	PDA Planning	This category includes planning studies supporting the region's PDA framework and connecting transportation and land use						n/a	n/a
17-08-0007	Solano	Minor Roadway Expansions	This category includes roadway capacity increasing projects (new roadways or widening/extensions of existing roadways) on minor roads throughout Solano County						No	No changes
17-08-0008	Solano	Roadway Operations	This category includes projects that improve roadway, intersection, or interchange operations, ITS, as well as other transportation system management. This project also includes a realigning SR 113 around downtown Dixon to I-80.						No	No changes

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17-08-0009	Solano	I-80/I-680/SR12 Interchange (Packages 2-7)	Packages 2-7 provide direct connectivity from I-680 NB to SR12 WB, widens I-680 and I-80 near the interchange, and improves connections to Red Top road off-ramp. Express lane direct connectors are included in RTPID 17-10-0061.			Yes	Yes	601	No	No changes, interchange revisions not included in network
17-08-0010	Solano	Improve interchanges and widen roadways serving Solano County Fairgrounds, including Redwood Parkway	Improvements to interchanges and widening of roadways serving the Solano County Fairgrounds, including Redwood Parkway.		Yes	Yes	Yes	n/a	No	No changes
17-08-0011	Solano	Provide auxiliary lanes on I-80 in eastbound and westbound directions from I-680 to Airbase Parkway	Project provides Auxiliary Lanes on I-80 in the EB & WB directions from I-680 to Airbase Parkway; and removes the I-80/Auto Mall hook ramps and C-D road slip-ramp;		Yes	Yes	Yes	n/a	No	3/29/18 Coded for 2030
17-08-0012	Solano	Construct 4-lane Jepson Parkway from Route 12 to Leisure Town Road at I-80	Constructs phase 2,3,4,6,7,8 and 10. Road costs only - bike and other special enhancements assumed from other programs (i.e. Regional Bicycle Program).		Yes	Yes	Yes	605	2015	3/29/18 Coded for 2030
17-08-0013	Solano	Conduct planning and design studies along SR-12 corridor in Solano County	Conduct planning and design studies related to improvements from I-80 to the Rio Vista Bridge						n/a	n/a
17-08-0014	Solano	Construct train station building and support facilities at the new Fairfield / Vacaville multimodal station	Construct train station building and expanded bicycle access for the new multimodal center serving the Capitol Corridor.	Yes	Yes	Yes	Yes	n/a	No - additional stop not included in Capitol Corridor coding	No changes - Station not included in transit network
17-08-0015	Solano	Solano MLIP Support Projects	Construct projects and operate programs to support implementation of the MLIP. Projects include expansion of transit centers, including in Vallejo and Fairfield, and new bus stops served by Solano Express; construction or expansion of Park and Ride facilities; and, replacement and maintenance of intercity buses.		Yes	Yes	Yes	n/a	No	No changes
17-08-0016	Solano	Vallejo Station Parking Structure Phase B	Vallejo: Baylink Ferry Terminal; Construct two phased parking structure to consolidate surface parking for ferry patrons; create a pedestrian link between bus transit facility and existing ferry terminal building adjacent to ferry parking structure.						n/a	n/a
17-08-0017	Solano	I-80 WB Truck Scales	Project upgrades existing truck scales on WB I-80 in Solano County. Existing westbound truck scales are located on the most congested freeway segment of I-80 in Solano County. Scales are outdated and cannot process the current and future truck volumes on WB I-80. Trucks are slow to enter and leave the scales because of short ramps, adding to existing traffic congestion and safety issues on I-80.						n/a	n/a
17-09-0001	Sonoma	Bicycle and Pedestrian Program	Projects in this category are new bicycle (on-street and off-street) and pedestrian facilities, and facilities that connect existing network gaps						n/a	n/a
17-09-0002	Sonoma	SMART Rail Freight Improvements	Improvements along publicly-owned SMART rail right-of-way to accommodate rail freight services and expansions. Programmatic category that could include freight spurs, Positive Train Control/systems and crossing upgrades, track and sidings expansions and bridge improvements.						n/a	n/a
17-09-0003	Sonoma	Multimodal Streetscape	Projects in this category implement multimodal or complete streets elements.						No	No changes

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17-09-0004	Sonoma	Minor Roadway Expansions	This category includes roadway capacity increasing projects (new roadways or widening/extensions of existing roadways) on minor roads such as Airport Boulevard, Caulfield Lane, Bodway Parkway, Brickway Blvd/Laughlin Rd, Corby Avenue, Dowdell Avenue, Fulton Road, Old Redwood Highway, River Road, Snyder Lane, and Jaguar Way						No	No changes
17-09-0005	Sonoma	Roadway Operations	This category includes projects that improve roadway, intersection, or interchange operations, ITS, as well as other transportation system management. This project also includes landscaping along US 101 HOV lanes, intersection improvements at Route 116/Route 121, local circulation in Penn Grove, Sonoma Boulevard Improvements, among other operational improvements throughout Sonoma County.						No	TOS coded consistent with MTC
17-09-0006	Sonoma	Implement Marin Sonoma Narrows Phase 2 (Sonoma County)	Adds 1 HOV lane in each direction to US 101 from Old Redwood Highway in Petaluma to the Marin/Sonoma County line making the freeway 6 lanes wide. It includes widening and replacing the Hwy 116 separation bridges.		Yes	Yes	Yes	901	2035	Changed year to 2030
17-09-0008	Sonoma	Arata Lane Interchange	Construction of the Northbound on-ramp to US 101 will complete the Arata Lane interchange with US 101. This project also includes the relocation of a portion of Los Amigos Road north of Arata Lane. Rights of way have been obtained in prior phases.		Yes	Yes	Yes	n/a	No	No changes
17-09-0009	Sonoma	Cotati US 101/Railroad Avenue Improvements (incl. Penngrove)	This project is the creation of a new south bound off ramp and north bound on ramp at Railroad Avenue. There continues to be growth outside of Cotati and Penngrove that will exacerbate traffic in both Penngrove and in downtown Cotati, as these are the only options to access US 101. Improvements would include safety improvements on Railroad Avenue from Petaluma Hill to US 101.			Yes	Yes	n/a	No	No changes
17-09-0010	Sonoma	Hearn Avenue Interchange	The project would replace the existing Hearn Avenue overcrossing bridge with a new bridge to accommodate four traffic lanes with bike lanes and sidewalks on both sides of the roadway. The project would also increase the bridge height clearance and improve ramp connections to US 101 and provide continuous bike lanes and sidewalks between Corby Avenue and Santa Rosa Avenue				Yes	n/a	2035	Already coded - No changes
17-09-0011	Sonoma	Shiloh Road Interchange Reconstruction	Reconstruct the Shiloh Road/US 101 interchange to provide two lanes in each direction. It is anticipated that the existing over crossing will be replaced and ramps reconfigured. It is expected that 60% of project costs will come from federal, state or regional funds.			Yes	Yes	n/a	No	No changes
17-09-0012	Sonoma	Cotati Highway 116 Cotati Corridor Improvements	This project is a widening of Highway 116 between US 101 and Stony Point Road, including phased closure of driveway access to 116, the addition of signalized intersections, new bike lanes, and new sidewalk to improve the vehicle LOS, improve the safety of 116 for all modes of transportation, and create safe new corridors for pedestrian and bicyclists.	Yes	Yes	Yes	Yes	n/a	No	No changes
17-09-0013	Sonoma	Petaluma Crosstown Connector and Rainier Interchange	Extend Rainier Avenue from current terminus at McDowell Boulevard westerly with a bridge crossing over the railroad tracks and the Petaluma River to a terminate at Petaluma Boulevard North. A second phase of work will construct a new interchange with the 101.		Yes	Yes	Yes	n/a	No	No changes

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17-09-0014	Sonoma	Farmers Lane extension between Bennett Valley Rd and Yolanda Avenue	Construct new road with travel lanes, bike lanes and sidewalks. Expand bike, pedestrian, transit, and vehicle improvements in Southeast Santa Rosa.		Yes	Yes	Yes	n/a	2035	Already coded - No changes
17-09-0015	Sonoma	Road Diet Extension - Petaluma Boulevard South	Reduce Petaluma Boulevard from E-Street to Crystal Lane (Roundabout) from 4 through lanes to 2 through lanes and a two-way-left-turn-lane	Yes	Yes	Yes	Yes	n/a	No	No changes
17-09-0016	Sonoma	SMART Petaluma Infill Station	Construct a second SMART station in the City of Petaluma including associated amenities.	Yes	Yes	Yes	Yes	n/a	2016 - 2 Petaluma stations included in base service	No changes - 2020-2040 service assumptions include both stations. Should be shortened in short term.
17-09-0017	Sonoma	Enhance bus service frequencies in Sonoma County	Enhance transit to achieve a 50% increase in bus service countywide - this includes Sonoma County Transit, Santa Rosa CityBus, Petaluma Transit. Project also includes BRT-like facilities in Santa Rosa.	Yes	Yes	Yes	Yes	903	No	No changes - Bus service held constant from 2010
17-09-0018	Sonoma	SMART Rail Extension to Windsor + Environmental to Cloverdale + Bike Path	Project extends SMART from the Sonoma Airport to Windsor, implements the SMART bike path, and includes additional environmental/planning assessment of extending SMART to Healdsburg and Cloverdale.	Yes	Yes	Yes	Yes	n/a	2016 - Cloverdale included in base servce	No changes - 2020-2040 service assumptions include additional northern stations
17-10-0001	AC Transit	AC Transit Fleet Expansion and Major Corridors	Purchases rolling stock for enhanced transbay, local, or express services.		Yes	Yes	Yes	206	No	No changes
17-10-0003	AC Transit	San Pablo Avenue BRT	Project implements BRT along San Pablo Avenue in Alameda and Contra Costa counties. This includes a bus-only lane from 20th Street to Ashby Avenue in Alameda County and from Richmond Parkway Center to Central Avenue in Contra Costa County. Project also includes enhanced real-time info, queue jump lanes where bus-only lane is not proposed, new buses and on-board equipment, and passenger amenities.		Yes	Yes	Yes	207	No	4/29/18 Increased frequencies, speeds on 72R. Lane reductions on San Pablo.
17-10-0004	AC Transit	Environmental Studies for Bay Bridge Contraflow Lane	This project includes further environmental and planning studies for the proposed Bay Bridge Contraflow lane, which would convert an EB lane on the bottom deck of the Bay Bridge into a peak-period WB lane in the AM period. This lane would likely be used by buses and carpool vehicles.					205	n/a	n/a
17-10-0005	BART	BART Metro Program + Bay Fair Connector	Investments in support of the region's Sustainable Communities Strategy, including studies of a future Transbay Corridor rail crossing. Capital: Turnbacks/crossovers/tail track extensions (24th St, Lafayette, Glen Park, Millbrae, Dublin, Daly City, Richmond, South Hayward); Station capacity improvements (platform doors at 4 downtown SF stations, additional stairs/escalators/elevators. Operating: 12-minute headways on all lines in the peak period (instead of current 15-minutes) Bay Fair Connector: Modify BART Bay Fair Station and approaches to add one or more additional tracks and one or more passenger platforms for efficient train service and operational flexibility. Includes station modernization, modifications to switches, tracks, crossovers, train control, signaling, traction power, etc.		Yes	Yes	Yes	1001	2024	Updated existing service representation and checked future frequencies

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17-10-0006	BART	BART Transbay Core Capacity Project	The Transbay Corridor Core Capacity Project is a multi-pronged effort to address capacity issues in the Transbay corridor and is in coordination with the BART Metro Program project. The project elements are: • Communication-based train control (CBTC) system to safely enable closer headways and allow BART to operate more frequent service (12 minute frequencies); • Expansion of the rail car fleet by 306 vehicles to add cars to existing trains and operate more frequent trains; • Added traction power substations to allow more frequent service; • Expansion of the Hayward Maintenance Complex (HMC) to provide storage and maintenance capability for the expanded fleet; • Other (Unallocated contingency) Financing cost is included in RTPID 17-10-0016.					1001	n/a	n/a
17-10-0007	CAHSR	California HSR in the Bay Area	This project implements the segment of California High Speed Rail that is in the Bay Area.		Yes	Yes	Yes	?	No	No changes - HSR not included
17-10-0008	Caltrain	Caltrain Electrification Phase 1 + CBOSS	The Peninsula Corridor Electrification Project (PCEP) includes the electrification of the Caltrain corridor between San Francisco and San Jose, the procurement of new, Electric Multiple Unit rolling stock, and an increase in the Caltrain service levels. This project also includes CBOSS, which is the Communications Based Overlay Signal System (CBOSS) Positive Train Control necessary to monitor and control train movements as well as increase safety.		Yes	Yes	Yes	1101	2020	Service changes already coded - No changes
17-10-0009	GGBHTD	Golden Gate Bridge Capital and Operations	This program includes operations and maintenance for the Golden Gate Bridge.						n/a	n/a
17-10-0010	GGBHTD	Bus and Ferry Service Expansion	This program includes planned bus and ferry expansion projects such as new express bus service between East Santa Rosa and San Francisco; between Richmond and San Rafael; and between Central Marin and West San Francisco. This program also includes off-site parking and an additional Larkspur Ferry crossing.		Yes	Yes	Yes	801	No	No changes
17-10-0011	Multi-County	Lifeline, Community Based Transportation Program, and Mobility Management	The Lifeline Transportation Program funds priority projects identified by residents in MTC's Communities of Concern through locally crafted Community-Based Transportation Plans. Projects can include community shuttles, transit services, streetscape improvements and bus stop amenities. Additionally, this program includes $90 million for a future mobility management program. Mobility management enables communities to monitor transportation needs and to link individuals to appropriate, cost-efficient travel options						n/a	n/a
17-10-0012	Multi-County	Means-Based Fare Study Implementation	This program would implement the recommendations from MTC's Means-Based Fare Study, which launched in 2015 to determine if a transit fare program based on household income would be feasible and effective. This study will identify possible fare structures and payment methods, eligible recipients, overall program costs, and potential technical challenges.						n/a	n/a

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17-10-0013	Multi-County	Transportation Management Systems	This program replaces and rehabilitates the physical ramp meters, induction loops and cameras used to manage traffic real-time and to collect traffic data for planning purposes. This program also maintains and replaces telecommunication networks connecting all field devices with potential to transition from copper lines to fiber optics. Related to the SHOPP program (RTPID 17-10-0025)						n/a	n/a
17-10-0014	Multi-County	Bay Trail - non toll bridge segments	This program would complete the Bay Trail along the shoreline. This program does not include the segments of the Bay Trail that would cross the Bay via toll bridges.						No	No changes
17-10-0015	Multi-County	Climate Program: TDM and Emission Reduction Technology	MTC's Climate Initiatives Program includes transportation demand management (TDM) strategies, car sharing, vanpool incentives, alternative fuel/vehicle initiatives, targeted transportation alternatives, trip caps and commuter benefits ordinances.						n/a	n/a
17-10-0016	Multi-County	Cost Contingency and Financing	This program includes future financing costs for capital projects such as for BART's Transbay Core Capacity Project (RTPID 17-10-0006). It also would cover contingency for major capital projects, if needed.						n/a	n/a
17-10-0017	Multi-County	Capital Projects Debt Service	This program includes on-going payments to debt service resulting from past financing of revenue, especially for bridge toll and sales tax revenue sources.						n/a	n/a
17-10-0018	Multi-County	Goods Movement Clean Fuels and Impact Reduction Program	Program for implementing recommendations of the Freight Emission Reduction Action Plan and developing programs for impact reduction in neighborhoods with high levels of freight activity.						n/a	n/a
17-10-0019	Multi-County	Goods Movement Technology Program	Program for deploying communications infrastructure to increase active traffic management along freight corridors and to/from the Port of Oakland						n/a	n/a
17-10-0020	Multi-County	New/Small Starts Reserve	This is a reserve for future FTA funds (Section 5309) that are referred to as New Starts, Small Starts, or Core Capacity funding. This reserve is for future transit projects eligible for these funds and that serve the North or East Bay.						n/a	n/a
17-10-0021	Multi-County	Priority Development Area (PDA) Planning Grants	This program includes Priority Development Area (PDA) Planning Grants and associated programs						n/a	n/a
17-10-0022	Multi-County	Local and Streets and Roads - Existing Conditions	This program includes local streets and roads maintenance throughout the region, including pavement and non- County pavement assets						n/a	n/a
17-10-0023	Multi-County	Local Streets and Roads - Operations	This program includes on-going operations of the local streets and roads throughout the region						n/a	n/a
17-10-0024	Multi-County	Regional and Local Bridges - Exisiting Conditions	This program includes operations and maintenance of regional and local bridges. Golden Gate Bridge operations and maintenance is in a separate program (RTPID 17-10-0009)						n/a	n/a
17-10-0025	Multi-County	Regional State Highways - Existing Conditions	This program includes operations and maintenance of the state highways within the Bay Area. This program generally implements the SHOPP, which also includes minor mobility enhancements and management systems.						n/a	n/a

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17-10-0026	Multi-County	Regional Transit Capital - Existing Conditions	This program includes capital maintenance and replacement funding for the region's transit operators. Types of projects in this category mostly include replacing vehicles and fixed-guideway assets like rail that have a direct impact on service. To a lesser extent, this program includes station upgrades and replacing other assets that do not directly affect revenue service.						n/a	n/a
17-10-0027	Multi-County	Regional Transit Operations	This program covers the costs to operate the Bay Area's existing transit service every year through the Plan horizon.						n/a	n/a
17-10-0028	Multi-County	Clipper	This program covers annual operating costs of Clipper as well as the upgrade of Clipper to Clipper 2.0.						n/a	n/a
17-10-0029	Multi-County	511 Traveler Information Program	This program covers the 511 program in the Bay Area. 511 includes a transit trip planner, real-time transit information, up-to-the minute traffic information, carpool and vanpool formation services and parking information.						n/a	n/a
17-10-0030	Multi-County	SAFE Freeway Patrol	This program covers MTC's Service Authority for Freeways and Expressways, or SAFE, program. MTC-SAFE manages the Bay Area's fleet of Freeway Service Patrol tow trucks and roadside call boxes.						n/a	n/a
17-10-0031	Multi-County	Regional Transportation Emergency Management Program	This program enhances first responders' capabilities to clear traffic incidents and respond to major emergencies through integrated corridor management.						n/a	n/a
17-10-0032	Multi-County	Regional Rail Station Modernization and Access Improvements	This program includes station modernization and access improvements for rail station throughout the region.						n/a	n/a
17-10-0033	Multi-County	Bay Area Forward	This program includes a variety of operational and multimodal improvements, including: active traffic management - upgrades to all existing ramp meters to adaptive, implementing hard shoulder running lanes, contra-flow lanes, queue warning, and ramp modifications; arterial operations - implementation of traditional time-of-day signal timing coordination, adaptive traffic signal control systems, transit signal priority, real-time traffic monitoring devices, ped/bike detection, queue-jump lanes, etc; connected vehicles - pilot deployments of vehicle-to-infrastructure (V2I) strategies; Managed Lanes Implementation Plan - pilot express bus service for routes not currently served by operators; expands park-and-ride facilities throughout the region; and supports pilot deployment of shared-mobility solutions.	VARIES	VARIES	VARIES	Yes	1301. 1303	No	3/28/18 Recoded TOS to match MTC networks. TOS=2 equivalent to FT=8 in MTC networks - additional capacity for adaptive ramp metering. 3/28/18 Added shoulder lane on I-680. Did not recode SIGCOR on arterials. Did not do special coding for I-680 contraflow in Walnut Creek.
17-10-0034	Multi-County	San Francisco-Oakland Bay Bridge West Span Bicycle, Pedestrian, and Maintenance Path - Environmental Only	This project continues environmental and design work on the proposed bicycle, pedestrian, and maintenance path on the west span of the Bay Bridge.						n/a	n/a

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17-10-0036	Multi-County	I-580 Access Improvements Project	Project converts the right shoulder of the Richmond-San Rafael Bridge to a third freeway lane from the Sir Francis Drake Blvd. on-ramp in Marin County to the Marine Street (Richmond Parkway/Point Richmond) exit in Contra Costa County. Project also constructs a path on the north side of I-580, including the upper deck of the Richmond-San Rafael Bridge, with concrete barriers to separate bicyclists and pedestrians from westbound freeway traffic.	Yes	Yes	Yes	Yes		No	3/29/18 Coded EB for 2020
17-10-0037	Multi-County	Highway 37 Improvements and Sea Level Rise Mitigation PSR	Prepare multi-county study, to PID standard, on improvements to SR 37 to accommodate future sea level rise and existing congestion						n/a	n/a
17-10-0038	TJPA	Caltrain/HSR Downtown San Francisco Extension	The Downtown Rail Extension (DTX) will extend Caltrain commuter rail from its current terminus at Fourth and King streets and deliver the California High-Speed Rail Authority's future high-speed service to the new Transit Center. The 1.95-mile rail extension will be constructed principally below grade underneath Townsend and Second streets. The design includes an underground station at Fourth and Townsend streets, utility relocations, rail systems work, and structures for emergency exit, ventilation at six locations along the alignment, and an underground pedestrian bridge connecting the Transbay Terminal to the Embarcadero BART station. Cost includes operating expenses - capital cost is $3.999 billion		Yes	Yes	Yes	307	2040 includes extension of Caltrain bullet service to Transbay Terminal	No changes - HSR not assumed in transit network
17-10-0039	TJPA	Implement Transbay Transit Center/Caltrain Downtown Extension (Phase 1 - Transbay Transit Center)	The project has 3 components: (1) new Transbay Transit Center built on the site of the former Transbay Terminal in downtown San Francisco serving 11 transportation systems; (2) extension of Caltrain commuter rail service from its current San Francisco terminus at 4th & King Streets to a new underground terminus; and (3) establishment of a Redevelopment Area Plan with related development projects.	Yes	Yes	Yes	Yes	n/a	2040 includes extension of Caltrain bullet service to Transbay Terminal	Already coded - No changes
17-10-0040	WETA	North Bay Ferry Service Enhancement	Purchase and operate 2 new ferry vessels for WETA North Bay ferry services. Project increases frequency for the Richmond-SF and Vallejo-SF ferry lines.	Yes	Yes	Yes	Yes	1203	No	No changes - additional ferry not included in transit network
17-10-0041	WETA	Central Bay Ferry Service Enhancement	Purchase and operate 2 new ferry vessels for WETA Central Bay ferry services. Project increases frequency for the Oakland-Alameda-SF ferry line and the Harbor Bay-SF ferry line.	Yes	Yes	Yes	Yes	1202	No	No changes - additional ferry not included in transit network
17-10-0042	WETA	Albany/Berkeley Ferry Terminal	Construct a new Berkeley/Albany ferry terminal, purchase 2 new ferry vessels, operate new ferry service between Berkeley/Albany and San Francisco.		Yes	Yes	Yes	1204	2024	Already coded - No changes
17-10-0043	Multi-County	Regional Carpool Program	This program includes carpool outreach and promotion, supporting vanpools, positioning the program to rely on private sector ridematching apps, and other services. The Regional Carpool Program will support carpoolers during the launch of Bay Area Express Lanes, promote carpooling and vanpooling along high-priority congested travel corridors, and grow first/last mile carpool solutions to transit, consistent with its annual work plan. Includes MTC staff costs.						n/a	n/a
17-10-0044	Multi-County	I-80 Express Lanes in both directions: Airbase Parkway to Red Top Road	Express Lanes on I-80 in Solano County from Red Top Road to Air Base Parkway - convert existing HOV lanes to express lanes		Yes	Yes	Yes	1302	2020	3/23/18 Extended S. to Red Top, changed year from 2020 to 2030

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17-10-0045	Multi-County	I-80 Express Lanes: Westbound Bay Bridge Approaches	Express Lanes on the four westbound SFOBB bridge approaches: (1) I-80 direct connector from Powell Street to SFOBB metering lights (1.8 miles); (2) I-580 from I-80 junction to metering lights (1 mile); (3) I-880/880S direct connector from 14th Street to metering lights (1.5 miles); (4) West Grand Ave/I-880 direct connector to metering lights (0.7 miles) - convert existing HOV lanes to express lanes		Yes	Yes	Yes	1302	2029, not all approaches coded	3/23/18 Added I-880, Grand.
17-10-0047	Multi-County	I-680 Express Lanes: Northbound from Marina Vista to SR 242	Express Lanes on I-680 northbound from SR-242 to Marina Vista. Convert existing HOV lane to express lanes.		Yes	Yes	Yes	1302	2020	3/23/18 Extended from SR 4 to Marina Vista
17-10-0048	Multi-County	I-680 Express Lanes: Southbound from Marina Vista to Rudgear	Express Lanes on I-680 southbound from Marina Vista to Rudgear Rd. Convert existing and future SB HOV lane to express lane. Future SB HOV lane from North Main to Livorna/Rudgear is in RTPID 17-02-0022	Yes	Yes	Yes	Yes	1302	2020	3/23/18 Extended from SR 4 to Marina Vista
17-10-0049	Multi-County	I-680 Express Lanes in both directions: Livorna/Rudgear to Alcosta	Express lanes on I-680 in Contra Costa County from Alcosta Road to Livorna northbound and to Rudgear southbound - convert existing HOV lanes to express lanes		Yes	Yes	Yes	1302	2019	3/23/18 Change year from 2019 to 2021
17-10-0050	Multi-County	SR-84 Express Lanes: Westbound from I-880 to Dumbarton Bridge Toll Plaza	Express Lanes on Route 84 westbound in Alameda County from I-880 through Dumbarton Bridge toll plaza - convert existing HOV lane to express lane	Yes	Yes	Yes	Yes	1302	2029	3/23/18 Change year from 2029 to 2020
17-10-0051	Multi-County	SR-92 Express Lanes: Westbound from Hesperian to San Mateo Bridge Toll Plaza	Express Lanes Route 92 WB in Alameda County from Hesperian Boulevard through San Mateo-Hayward Bridge toll plaza - convert existing HOV lane to express lane	Yes	Yes	Yes	Yes	1302	2029	3/23/18 Change year from 2029 to 2020
17-10-0052	Multi-County	I-880 Express Lanes in both directions: Hegenberger/Lewelling to SR-237	Express lane on I-880 in Alameda County from Lewelling Blvd to SR 237 Direct Connector in northbound direction, Hegenberger Rd to SR 237 Direct Connector in the southbound direction- convert existing HOV lanes to express lanes.	Yes	Yes	Yes	Yes	1302	2024	3/23/18 Change year from 2024 to 2020
17-10-0053	Multi-County	I-80 Express Lanes in both directions: Carquinez Bridge to Bay Bridge	Express Lanes on westbound I-80 from Carquinez Bridge Toll Plaza to Powell St Direct Connector on eastbound I-80 from Powell St Direct Connector to Cummings Skyway. Add new express lane on eastbound I-80 from Cummings Skyway to Carquinez Bridge.		Yes	Yes	Yes	1302	2029 south, 2020 north	3/23/18 Change 2020 to 2029
17-10-0054	Multi-County	MTC Express Lane Program Cost	Includes non-corridor activities such as centralized toll system activities, start-up program management, contingency and capitalized O&M.						n/a	n/a
17-10-0055	Multi-County	East and North Bay Express Lanes Operations and Maintenance	This program includes on-going operations and maintenance for the express lanes in the East and North Bay counties						n/a	n/a
17-10-0056	Multi-County	East and North Bay Express Lanes Reserve	This program includes future revenue from express lanes in the East and North Bay counties						n/a	n/a
17-10-0057	Multi-County	I-880 Express Lanes: Northbound from Hegenberger to Lewelling and bridge improvements	I-880 Northbound express lane from Lewelling Blvd to Hegenberger Rd. and reconstruct bridges at Davis Street and Marina Boulevard - widen to add an express lane and reconstruct bridges		Yes	Yes	Yes	1302	2021, lanes coded incorrectly	3/23/18 Corrected 0 lanes to 1 lane
17-10-0058	Multi-County	I-680 Express Lanes: Northbound from SR-84 to SR-237	Express lanes on I-680 in the northbound direction from SR-84 to SR-237 which involves constructing a new lane.		Yes	Yes	Yes	201	2018	3/23/18 Corrected coding
17-10-0059	Multi-County	I-80 Express Lanes in both directions: Airbase Parkway to I-505	I-80 Solano Express Lanes from Air Base to I-505-widen to add an express lane in each direction	Yes	Yes	Yes	Yes	1302	No	3/23/18 HOV/Express lane added for 2020

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17-10-0060	Multi-County	I-680 Express Lanes: Northbound from Rudgear to SR 242 and operational improvements	Widen I-680 for a new northbound express lane between N. Main Street and Route 242 and implement operational improvements on I-680 from Rudgear to N. Main. This project complements the NB HOV lane extension through the 680/24 interchange and from N. Main to SR 242 as well as operational improvements included in RTPIDs 17-02-0012 and 17-02-0013.		Yes	Yes	Yes	1302	2035 partial coding	3/23/18 Coded from Livorna to SR 242, year 2030
17-10-0061	Multi-County	I-680 Express Lanes: I-80 westbound to I-680 southbound and I-680 northbound to I-80 eastbound direct connectors	Express lanes on I-680/I-80 interchange in Solano County - widen to add express lane direct connectors I-80 westbound to I-680 southbound and I-680 northbound to I-80 eastbound. This complements the larger interchange project of RTPID 17-08-0009.		Yes	Yes	Yes	1302	No	3/23/18 Lanes added to interchange
17-10-0062	Multi-County	East and North Bay Express Lanes - Environmental and Design Phases for Future Segments	This program includes environmental and design phases for future express lane segments in Alameda and Solano counties, including along I-80, I-680, and I-580						n/a	n/a
17-10-0063	BART	BART Seismic Safety Augmentation	Alternatives analysis and design associated with the Berkeley Hills Tunnel plus design of the A-Line structural augmentation / improvement to operability standards.						n/a	n/a
17-10-0064	BART	Hayward Maintenance Complex Phase 1	This project increases maintenance capacity as part of its Fleet of the Future program as well as to support increased service for the Berryessa Extension. This Phase I project involves constructing an outdoor storage area for maintenance and engineering materials and equipment, building track access to new maintenance facilities from the existing mainline, and improving access for BART maintenance operations.						n/a	n/a

APPENDIX B: CALIBRATION OF MODEL COMPONENTS

Model calibration is the process by which the model equations are applied using the input networks, socioeconomic data and pricing assumptions. The model estimates are then compared to observed data, and the model parameters are adjusted so that the model results more accurately compare to observed data. This section describes the calibration of key model components that was completed during the Plan Bay Area (P2013) update to the model completed in 2014-2015.

CALIBRATION DATA

The starting point for calibration was to obtain year 2000 observed data. The primary sources of data used to calibrate the trip distribution models were from the 2000 Census Transportation Planning Package (CTPP) for home-based work trips and the MTC 2000 Regional Bay Area Transportation Survey (BATS) for both work and non-work trips. Specifically, the CTPP data were used to generate commuter trips by county-to-county flow and to stratify trips by income quartile, and the MTC 2000 BATS data were used to develop county-to-county trip flows for non-work trips. The primary data sets available for model calibration included the following:

- Year 2000 households by number of workers and auto ownership from Census data
- Year 2000 Journey to Work county-to-county worker flows from 2000 Census
- Year 2000 Journey to Work by mode of travel, County-level and regional-level from Census
- MTC Year 2000 Home Interview Survey data, including:
    - County to county home-based work person trips
    - County to county non-work person trips
    - Average trip length by trip purpose
- Year 2000 mode choice calibration targets, as base estimates for transit submode shares, developed by VTA as part of the FTA New Starts model calibration
- BART 1998 and 2008 System Survey data for BART submode estimates for walk-access, park-and-ride and kiss-and-ride

WORKERS PER HOUSEHOLD AND AUTO OWNERSHIP MODELS

The model that estimates the number of workers and number of autos per household (WHHAOWN) was the first model to be recalibrated. The WHHAOWN models generate critical inputs to subsequent models in the modeling process, as the number of workers in each household and auto ownership are important characteristics that influence travel demand and choices. The base year calibration methodology agreed to by the Travel Demand Model Task Force was to recalibrate the Alameda Countywide models to a year 2000 base, using data from the 2000 Census and 2000 MTC BATS since more recent household

survey results were not available in a format that could be used for the model calibration at the time of the 2014-2015 model update.

Description of the MTC BAYCAST-90 Workers per Household/Auto Ownership Model

The workers and autos per household model (WHHAOWN) used by the Alameda Countywide model is a nested logit choice model applied at the zone-of-residence level. This model was estimated by MTC as part of the BAYCAST-90 model version. The inputs to the WHHAOWN model are the number of households stratified by household income quartile level. Variables in this choice model include mean household income, mean household size, the share of households residing in multi-family dwelling units, the share of persons age 62-or-older, and gross population density. A detailed definition of the variables used in the WHHAOWN models is included in Table 35. Coefficients for the WHHAOWN choice model are shown in Table 36.

Table 35: Definition of the Variables Used in the Workers and Autos per Household Model

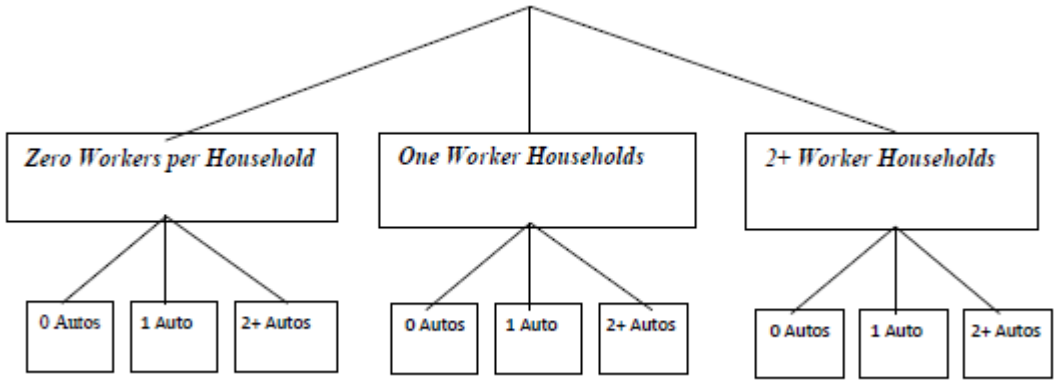
Variable Name	Model(s)	Definition
Constant	Multiple	Modal or Utility intercept.
GPOPD-Leg 1	WHHAOWN	Gross Population Density (TOTPOP/TOTACRE), MIN(10.0,GPOPD)
GPOPD-Leg 2	WHHAOWN	Gross Population Density (TOTPOP/TOTACRE), MAX(0,MIN((GPOPD-10.0),20.0))
GPOPD-Leg 3	WHHAOWN	Gross Population Density (TOTPOP/TOTACRE), MAX(GPOPD-30.0)
HH Size	WHHAOWN	Persons per Household (same as Pers/HH)
Income-Leg 1	Multiple	Income in 1989 dollars. MIN(Income,25000)
Income-Leg 2	Multiple	Income in 1989 dollars. MAX(0,MIN(Income-25000),50000))
MFDU	WHHAOWN	Multi-Family Dwelling Unit Dummy Variable
PHH	Multiple	Persons per Household (same as Pers/HH)
SHPOP62+	WHHAOWN	Share of Population Age 62+
Stanfordj	Multiple	Stanford zones, zone of attraction (zones=244, 249-252)
TOTACRE	Multiple	Total Acres (ABAG Land Use)
Veh/HH	Multiple	Vehicles Available per Household (same as VHH)
VHH	Multiple	Vehicles Available per Household (same as Veh/HH)
THACC0	WHHAOWN	Employment by Transit/Highway Accessibility Measure – Zero Auto Households
THACC1	WHHAOWN	Employment by Transit/Highway Accessibility Measure – One Auto Households

The nested structure for the WHHAOWN model is shown in Figure 25. The upper level nest of this model splits households into households by workers in household level (0, 1, 2+ workers per household). The lower nest further splits these households by auto ownership level (0, 1, 2+ vehicles per household). The output from this WHHAOWN model is the number of households by household income quartile (4) by workers in household level (3) by auto ownership level (3) or 36 different market segments per travel analysis zone.

Table 36: Workers Per Household and Auto Ownership Model Coefficients

WHH=0			WHH=1			WHH=2			Variable	Model #9W (Nested)	
AO=0	AO=1	AO=2	AO=0	AO=1	AO=2	AO=0	AO=1	AO=2		Beta	t-stat
X									Constant 1	1.615	(1.4)
	X								Constant 2	3.084	(2.6)
		X							Constant 3	1.679	(1.4)
			X						Constant 4	1.586	(1.2)
				X					Constant 5	3.284	(2.5)
					X				Constant 6	1.237	(0.9)
						X			Constant 7	-2.941	(2.8)
							X		Constant 8	-0.7834	(1.1)
	X								Income Leg1	3.956E-02	(2.1)
		X							Income Leg1	0.0888	(3.6)
			X						Income Leg1	0.2853	(2.4)
				X					Income Leg1	0.3433	(3.0)
					X				Income Leg1	0.3907	(3.3)
						X			Income Leg1	0.9325	(1.7)
							X		Income Leg1	0.9719	(1.8)
								X	Income Leg1	1.0320	(1.9)
	X								Income Leg2	9.989E-03	(0.6)
		X							Income Leg2	2.268E-02	(1.4)
			X						Income Leg2	4.776E-02	(1.4)
				X					Income Leg2	5.624E-02	(1.7)
					X				Income Leg2	7.682E-02	(2.4)
						X			Income Leg2	0.2699	(1.6)
							X		Income Leg2	0.2866	(1.7)
								X	Income Leg2	0.3048	(1.8)
		X							HH Size	0.3311	(3.8)
					X				HH Size	0.5986	(8.9)
						X	X	X	HH Size	1.3790	(2.4)
X			X			X			MFDU	0.5662	(3.0)
		X			X			X	MFDU	-1.0700	(8.8)
X	X	X							SHPOP 62+	4.5390	(2.9)
						X	X	X	SHPOP 62+	-12.1900	(1.7)
	X			X			X		GPOPD -Leg1	-0.05354	(1.6)
		X			X			X	GPOPD -Leg1	-0.07401	(2.2)
	X			X			X		GPOPD -Leg2	-0.04987	(3.6)
		X			X			X	GPOPD -Leg2	-0.11170	(6.9)
	X			X			X		GPOPD -Leg3	-2.506E-02	(4.1)
		X			X			X	GPOPD -Leg3	-2.724E-02	(2.9)
X	X	X							Theta-NWHH	0.7451	(3.0)
X			X			X			THACC0	4.732	NA
	X			X			X		THACC1	2.361	NA
			X	X	X				Theta-SWHH	0.4477	(2.7)
						X	X	X	Theta-MWHH	0.1968	(1.8)

Figure 25: Workers and Vehicles by Household Submodel Structure



Update to the Existing Workers per Household /Auto Ownership Model

The pre-2014 versions of the WHHAOWN models were updated to include a dynamic representation of the employment accessibility measure that is used as an explanatory variable for predicting auto ownership level. This variable is essentially a measure of the number of jobs available by a unit of transit time divided by the number of jobs available by the same unit of highway time applied at the zone of residence, and is used in the zero and one auto ownership choice. A value greater than one means that more jobs are accessible by transit relative to highway within a given unit of time. Most TAZs have values much less than 1.0, however, TAZs in areas with high levels of transit service have values of up to 1.8 in the base year 2000. In the versions of the WHHAOWN models prior to 2014, this value was hard coded for each TAZ and would not vary based on changes to either transit or highway infrastructure. A process was added to calculate the accessibility measure based on network characteristics from the coded transit and highway networks. All other application procedures remain unchanged from the prior WHHAOWN models.

Calibration Results

The WHHAOWN model equations are calibrated to match observed characteristics from year 2000 Census Transportation Planning Package (CTPP) data. Data from the 2000 CTPP can be tabulated to produce the number of households classified by the number of workers and the number of automobiles owned, and this data are summarized for each county in the nine county MTC model region. The model is calibrated to nine cell values for each county (three worker classifications by three auto ownership classifications) by adjusting constants applied to each cell until the model estimates can adequately match observed totals. Each cell value was calibrated to within one percent error for each county. During the course of model calibration, the adjusted constants were reviewed to ensure that overly large constants were not estimated. Large constants overwhelm the model utility equations, effectively negating the effect that the individual variables would have on the probability calculations. The results of the model calibration that compares observed to modeled households by each cell are shown in Table 37, including the ratio of modeled to observed values.

Table 37: Workers per Household and Auto Ownership Calibration Results

Observed	Zero Worker Households			One Worker Households			Two + Worker Households				
County	0 Autos	1 Auto	2+ Autos	0 Autos	1 Auto	2+ Autos	0 Autos	1 Auto	2+ Autos	Households	Workers
San Francisco	41,940	30,080	9,855	36,090	70,040	24,565	15,625	38,320	63,330	329,845	423,883
San Mateo	8,640	25,780	19,900	4,075	41,995	44,195	2,645	13,065	93,935	254,230	364,378
Santa Clara	16,415	44,170	40,190	9,075	93,695	111,670	6,230	25,690	219,350	566,485	842,615
Alameda	30,935	53,910	34,805	18,425	97,485	84,155	7,465	30,710	165,895	523,785	710,240
Contra Costa	13,220	36,140	28,685	6,110	53,900	69,380	2,910	14,275	119,810	344,430	471,878
Solano	4,835	13,015	10,940	2,395	18,960	25,460	1,300	5,725	47,810	130,440	183,903
Napa	1,905	5,970	4,215	610	6,630	8,725	290	2,050	15,015	45,410	59,353
Sonoma	6,220	20,660	15,165	2,135	27,045	32,235	1,540	6,685	60,995	172,680	234,465
Marin	2,970	11,115	8,095	1,265	19,215	20,310	780	4,750	32,245	100,745	135,228
All	127,080	240,840	171,850	80,180	428,965	420,695	38,785	141,270	818,385	2,468,050	3,425,940

Modeled	Zero Worker Households			One Worker Households			Two + Worker Households				
County	0 Autos	1 Auto	2+ Autos	0 Autos	1 Auto	2+ Autos	0 Autos	1 Auto	2+ Autos	Households	Workers
San Francisco	47,088	36,822	6,505	26,983	70,785	18,416	16,863	39,013	67,177	329,652	423,817
San Mateo	8,269	21,638	18,106	6,205	42,559	46,946	2,890	13,298	94,146	254,057	371,545
Santa Clara	16,515	43,440	35,286	12,628	89,486	104,046	6,092	31,238	227,083	565,814	867,193
Alameda	31,732	53,527	29,179	20,658	96,489	79,950	9,005	31,267	170,693	522,500	724,510
Contra Costa	10,233	33,780	31,985	6,199	53,630	72,898	2,062	12,337	120,732	343,856	470,555
Solano	3,709	13,123	13,065	2,242	20,548	29,337	602	4,374	43,386	130,386	173,032
Napa	1,382	5,768	5,830	715	7,479	9,957	151	1,236	12,869	45,387	53,791
Sonoma	4,895	20,850	20,935	2,715	29,122	37,180	627	5,012	51,040	172,376	210,715
Marin	2,522	10,666	10,220	1,423	17,084	20,656	328	3,062	34,686	100,647	134,353
All	126,345	239,614	171,111	79,768	427,182	419,386	38,620	140,837	821,812	2,464,675	3,429,509

Modeled/Observed	Zero Worker Households			One Worker Households			Two + Worker Households				
County	0 Autos	1 Auto	2+ Autos	0 Autos	1 Auto	2+ Autos	0 Autos	1 Auto	2+ Autos	Households	Workers
San Francisco	1.12	1.22	0.66	0.75	1.01	0.75	1.08	1.02	1.06	1.00	1.00
San Mateo	0.96	0.84	0.91	1.52	1.01	1.06	1.09	1.02	1.00	1.00	1.02
Santa Clara	1.01	0.98	0.88	1.39	0.96	0.93	0.98	1.22	1.04	1.00	1.03
Alameda	1.03	0.99	0.84	1.12	0.99	0.95	1.21	1.02	1.03	1.00	1.02
Contra Costa	0.77	0.93	1.12	1.01	0.99	1.05	0.71	0.86	1.01	1.00	1.00
Solano	0.77	1.01	1.19	0.94	1.08	1.15	0.46	0.76	0.91	1.00	0.94
Napa	0.73	0.97	1.38	1.17	1.13	1.14	0.52	0.60	0.86	1.00	0.91
Sonoma	0.79	1.01	1.38	1.27	1.08	1.15	0.41	0.75	0.84	1.00	0.90
Marin	0.85	0.96	1.26	1.12	0.89	1.02	0.42	0.64	1.08	1.00	0.99
All	0.99	0.99	1.00	0.99	1.00	1.00	1.00	1.00	1.00	1.00	1.00

The final model WHHAOWN model constants are shown in Table 38. Overall, the model constants are not overly large (values greater than 4 or less than -4 are a typical rule of thumb for constants outside the range of acceptance) and show reasonable trends within each group.

Table 38: Final WHHAOWN Calibration Constants

Zero Worker Households			One Worker Households			Two + Worker Households		
0 Autos	1 Auto	2+ Autos	0 Autos	1 Auto	2+ Autos	0 Autos	1 Auto	2+ Autos
2.0109	1.7322	1.8069	1.4574	1.4003	1.0638	0.6667	-0.0271	0

TRIP GENERATION

Trip generation rates for land uses within the Bay Area were calibrated by MTC for the MTC BAYCAST model using the 2000 Bay Area Household Travel Survey (BATS). These MTC BAYCAST rates were used directly in the Alameda Countywide model. The MTC trip generation calculations are too complex to easily summarize in a table.

Trip generation rates for San Joaquin County were based on rates calibrated for a prior (pre-2012) version of the San Joaquin County travel model (Table 39).

Table 39: San Joaquin County Person Trip Generation Rates

		Number of Households		Employment			Enrollment	
		Single Family	Multi Family	Retail	Service	Other	Full-time	Part-time
Trip Productions								
	Home-work	1.830	1.070	--	--	--	--	--
	Home-shop/other	2.230	2.230	--	--	--	--	--
	Home-social/recreational	1.010	1.010	--	--	--	--	--
	Non-home-based	0.707	0.707	0.798	2.984	0.916	--	--
	Home-grade school	1.005	0.571	--	--	--	--	--
	Home-high school	0.211	0.120	--	--	--	--	--
	Home-college	0.063	0.110	--	--	--	--	--
Trip Attractions								
	Home-work	--	--	1.270	1.270	1.270	--	--
	Home-shop/other	--	--	1.850	1.850	1.850	--	--
	Home-social/recreational	--	--	1.260	1.260	1.260	--	--
	Non-home-based	0.803	0.803	0.636	3.194	0.730	--	--
	Home-grade school	1.005	0.571	--	--	--	--	--
	Home-high school	0.183	0.104	--	--	--	--	--
	Home-college	--	--	--	--	--	1.470	0.969

TRIP DISTRIBUTION

Trip distribution models are the second major step in the four-step trip-based model process. Trip distribution is applied to link together the trip productions and attractions, by each trip purpose, from trip generation. The trip distribution models used in the Alameda Countywide model are typical gravity models, and are based on the methodologies used by MTC in the BAYCAST-90 model series. Gravity models use the analogy and mathematic equation of physical gravity to link the trip productions and attractions, as travel between a TAZ and all other TAZs is directly related to the relative attractiveness of the TAZ of interest to all other TAZs and inversely related to the impedance (travel time, distance or other measures) between each TAZ pair. As an example, a TAZ in the downtown Oakland business district with a large number of job attractions would draw from a very large area, but based on differences in transportation accessibility or geographical obstacles would draw trip productions from different directions in different proportions.

For the 2014-2015 model update, the trip distribution models were recalibrated using observed Census and travel survey data, as opposed to estimating new trip distribution models using a new model formulation different from the existing gravity models. At the regional level, the calibration of the trip distribution models to year 2000 observed conditions yielded a very close match to the average trip lengths estimated from the MTC BATS 2000 data. In addition, the county-to-county trip flows from the model compared to 2000 MTC BATS data, while not an exact match, show good agreement, particularly for Alameda County interchanges.

Calibration Process

Based on discussions with the Model Task Force in 2014, it was agreed that trip distribution calibration would first be based on year 2000 inputs and data and then applied for the year 2010 using the new model TAZ structure, land use data and networks for the 2010 model validation. The starting point for calibration was to obtain year 2000 observed data. The primary sources of data used to calibrate the trip distribution models were from the 2000 Census Transportation Planning Package (CTPP) for home-based work trips and the MTC 2000 Regional Bay Area Transportation Survey (BATS) for both work and non-work trips. Specifically, the CTPP data were used to generate commuter trips by county-to-county flow and to stratify trips by income quartile, and the MTC 2000 BATS data were used to develop county-to-county trip flows for non-work trips. Travel time and distance inputs were generated from the 2000 Alameda Countywide model roadway networks for peak and off-peak period times. AM peak period congested travel times were used as the impedance measure for the home-based work and home-based school trip purpose, while a blended AM peak and free flow travel time was used for the non-work trip purposes.

Trip productions and attractions were developed by applying the Alameda Countywide model trip generation models for the base year 2000. For all trip purposes, if the trip productions and attractions by County did not compare well with the MTC BATS county productions and attractions or CTPP data, the trip generation results were adjusted to more closely match the observed totals before the comparison to observed totals.

The final data element required by the trip distribution models were the model friction factors. Friction factors are applied using lookup tables that correlate calibrated friction factors with each mile of travel distance. The existing Alameda County model friction factors were used as a starting point in the application of the gravity models, as these were based on the original MTC BAYCAST-90 friction factor curves with slight adjustments applied during the previous calibration.

Trip Distribution Calibration Results

Calibration of the trip distribution models was an iterative process based on a comparison of two primary outputs: average trip lengths and county-to-county trip flows. Based on recommendations from MTC, average trip distance was used as the impedance measure in the trip distribution gravity models, consistent with what is used in the MTC activity-based models. One of the simplifying aspects of the model calibration was the use of the pre-2014 friction factor curves. The initial application of the gravity models yielded acceptable average trip lengths, reported in miles, for each trip purpose

Average Trip Lengths

Average trip lengths by trip purpose are summarized in Table 40, showing a comparison between MTC BATS 2000 average trip lengths and the Alameda Countywide model calibrated results. These are the final average trip lengths generated after the application of county-level k-factors to calibrate county-to-county trip flows (described in the next section). The calibrated model average trip lengths are very close to the MTC BATS 2000 trip lengths, when reported in miles, and not exceedingly different when reported in minutes.

County to County Trip Flows

The comparison of the 2000 county to county trip flows is an important means for assessing the reasonableness of the trip distribution models at a level more detailed than a comparison of average trip lengths that are reported at the regional level. Calibration of the county trip flows was accomplished by the application of model K-factors. The K-factors adjust the attractiveness of trip interchanges by scaling the relative attractiveness. Typically, they are applied to account for effects such as geographical barriers to travel (such as bodies of water) or corrections to socio-economic factors not directly expressed in the gravity model formulas. K-factor values greater than 1.0 increase trip interchanges, while values less than 1.0 decrease attractiveness. It is important to ensure that K-factors are not overly large or small, as they can have serious multiplicative effects when forecasts are applied, especially in rapidly changing or redeveloping areas.

By comparing the estimated trips by county to the observed trips by county, model K-factors were calibrated for each county-level interchange. This is a significant departure from the previous trip distribution models and the original application in BAYCAST-90, which applied superdistrict level K-factors. Table 41 through Table 47 summarize the trips by county for all trip purposes. As a general calibration goal, the model was deemed calibrated if county-level trips were within 5 to 10 percent of modeled versus observed, particularly for Alameda County trip interchanges and for large county flows (over 25,000 trips), and less so for other County trip interchanges or small county flows (<25,000 trips).

Table 40: Trip Distribution Calibration, Average Trip Lengths by Trip Purpose

	MTC BATS 2000			Alameda CTC-2000			Percent Difference MTC v. ACTC			
Trip Purpose	**Total Person Trips**	**Average Trip Distance, miles**	**Average Trip Time, minutes**	**Total Person Trips**	**Average Trip Distance, miles**	**Average Trip Time, minutes**	**Total Person Trips**	**Average Trip Distance, miles**	**Average Trip Time, minutes**	**Coincidence Ratio**
Home-based Work										
Income Quartile 1 (Low)	568,186	8.02	16.31	569,637	8.69	17.88	0.26%	8.35%	9.63%	0.85
Income Quartile 2 (Low-Medium)	1,009,552	11.43	21.94	1,010,193	10.9	21.7	0.06%	-4.64%	-1.09%	0.86
Income Quartile 3 (Medium-High)	1,477,524	12.73	24.69	1,593,845	12.08	23.73	7.87%	-5.11%	-3.89%	0.84
Income Quartile 4 (High)	1,991,777	13.67	26.07	1,980,138	13.83	26.32	-0.58%	1.17%	0.96%	0.89
Total Home-based Work	**5,047,039**	**12.31**	**23.74**	**5,153,813**	**12.15**	**23.68**	**2.12%**	**-1.30%**	**-0.25%**	**0.91**
Non Work										
Home-based Shopping/Other	5,348,023	4.4	9.46	5,316,725	4.91	10.4	-0.59%	11.59%	9.94%	0.84
Home-based Social-Recreational	3,624,432	6.53	13.28	3,601,625	6.37	13.14	-0.63%	-2.45%	-1.05%	0.9
Non-home-based	4,646,549	6.1	11.88	4,651,401	5.72	11.54	0.10%	-6.23%	-2.86%	0.87
Home-based Grade School	1,467,787	4.87	10.52	1,477,834	2.89	5.59	0.68%	-40.66%	-46.86%	0.75
Home-based High School	460,266	4.65	10.27	462,851	4.74	10.23	0.56%	-1.94%	-0.39%	0.85
Home-based College	522,212	7.52	14.84	522,033	8.02	16.27	-0.03%	-6.65%	-9.64%	0.80
All Trips	**21,116,308**	**9.98**	**20.12**	**21,253,973**	**9.99**	**20.42**	**0.65%**	**0.10%**	**1.49%**	**NA**

Table 41: County to County Trips – Home-based Work, All Income Quartiles, Year 2000

Modeled Trips	San Francisco	San Mateo	Santa Clara	Alameda	Contra Costa	Solano	Napa	Sonoma	Marin	San Joaquin	All
San Francisco	518,597	65,376	22,412	27,114	6,216	510	291	1,259	9,261	57	651,093
San Mateo	124,881	337,556	92,352	20,991	2,721	390	189	640	1,753	115	581,587
Santa Clara	14,414	59,540	1,174,573	50,425	4,705	808	332	690	994	461	1,306,942
Alameda	128,721	53,552	110,153	695,479	56,573	2,628	639	1,764	7,137	2,126	1,058,772
Contra Costa	89,728	15,064	31,432	133,521	388,991	12,016	2,893	2,862	11,897	4,591	692,994
Solano	24,970	4,824	5,358	17,941	33,560	148,823	13,557	4,697	6,845	477	261,051
Napa	3,049	669	971	1,672	2,884	5,452	67,541	3,677	1,344	68	87,327
Sonoma	18,620	2,362	3,313	3,599	3,110	1,801	4,659	277,149	27,121	94	341,828
Marin	53,470	3,605	4,134	5,984	5,854	782	535	5,401	113,007	131	192,903
San Joaquin	4,201	2,698	12,980	29,044	7,377	1,154	320	711	455	250,227	309,166
All	980,652	545,247	1,457,677	985,770	511,990	174,364	90,956	298,848	179,814	258,346	5,483,664

Observed Trips	San Francisco	San Mateo	Santa Clara	Alameda	Contra Costa	Solano	Napa	Sonoma	Marin	San Joaquin	All
San Francisco	522,347	63,538	24,420	27,917	6,316	550	345	1,205	9,016	27	655,681
San Mateo	129,972	333,805	94,716	21,988	2,752	427	218	550	1,511	75	586,014
Santa Clara	13,736	63,024	1,181,433	52,534	4,117	825	249	724	860	328	1,317,830
Alameda	132,001	55,135	120,602	678,471	55,174	2,848	561	1,364	5,869	2,226	1,054,251
Contra Costa	90,600	15,227	17,494	144,030	393,433	9,853	1,792	1,657	10,639	2,573	687,298
Solano	19,517	4,856	2,819	19,379	35,025	150,981	13,896	3,825	7,033	543	257,874
Napa	2,282	729	610	1,757	2,918	5,427	68,343	3,287	1,336	0	86,689
Sonoma	14,344	2,511	2,044	3,407	2,633	1,887	4,785	280,759	27,473	0	339,843
Marin	53,697	4,102	1,572	6,778	4,054	881	604	5,271	115,940	90	192,989
San Joaquin	2,155	2,320	11,967	29,508	5,568	686	162	206	139	252,484	305,195
All	980,651	545,247	1,457,677	985,769	511,990	174,365	90,955	298,848	179,816	258,346	5,483,664

Modeled/Observed Trips	San Francisco	San Mateo	Santa Clara	Alameda	Contra Costa	Solano	Napa	Sonoma	Marin	San Joaquin	All
San Francisco	0.99	1.03	0.92	0.97	0.98	0.93	0.84	1.04	1.03	2.13	0.99
San Mateo	0.96	1.01	0.98	0.95	0.99	0.91	0.87	1.16	1.16	1.53	0.99
Santa Clara	1.05	0.94	0.99	0.96	1.14	0.98	1.33	0.95	1.16	1.41	0.99
Alameda	0.98	0.97	0.91	1.03	1.03	0.92	1.14	1.29	1.22	0.95	1.00
Contra Costa	0.99	0.99	1.80	0.93	0.99	1.22	1.61	1.73	1.12	1.78	1.01
Solano	1.28	0.99	1.90	0.93	0.96	0.99	0.98	1.23	0.97	0.88	1.01
Napa	1.34	0.92	1.59	0.95	0.99	1.00	0.99	1.12	1.01		1.01
Sonoma	1.30	0.94	1.62	1.06	1.18	0.95	0.97	0.99	0.99		1.01
Marin	1.00	0.88	2.63	0.88	1.44	0.89	0.89	1.02	0.97	1.45	1.00
San Joaquin	1.95	1.16	1.08	0.98	1.32	1.68	1.97	3.45	3.27	0.99	1.01
All	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Table 42: County to County Trips – Home-based Shop/Other, Year 2000

Modeled Trips	San Francisco	San Mateo	Santa Clara	Alameda	Contra Costa	Solano	Napa	Sonoma	Marin	All
San Francisco	490,344	47,051	1,366	5,263	1,206	296	123	509	3,346	549,504
San Mateo	37,032	470,105	32,938	3,012	887	408	184	8	417	544,991
Santa Clara	1,992	14,176	1,304,774	6,444	1,411	513	67	150	313	1,329,840
Alameda	17,843	5,972	20,573	1,042,342	30,637	170	78	178	1,243	1,119,036
Contra Costa	12,404	1,112	1,846	50,760	746,134	5,285	348	469	2,292	820,650
Solano	1,466	191	162	3,345	7,687	279,199	2,967	353	498	295,868
Napa	190	92	70	233	464	3,028	87,004	1,306	444	92,832
Sonoma	2,838	382	831	761	466	414	1,921	367,810	6,364	381,787
Marin	6,294	459	275	1,243	970	378	59	4,371	200,017	214,065
All	570,403	539,541	1,362,835	1,113,404	789,861	289,692	92,751	375,154	214,933	5,348,574

Observed Trips	San Francisco	San Mateo	Santa Clara	Alameda	Contra Costa	Solano	Napa	Sonoma	Marin	All
San Francisco	484,820	43,471	2,752	5,385	1,161	693	439	487	2,917	542,125
San Mateo	40,178	476,046	32,021	3,168	934	898	404	0	400	554,050
Santa Clara	2,099	15,281	1,309,955	6,853	1,478	531	0	143	299	1,336,640
Alameda	18,914	5,923	18,460	1,040,475	33,392	184	64	167	1,160	1,118,741
Contra Costa	12,571	1,038	1,657	50,709	742,194	6,102	38	423	2,080	816,811
Solano	1,491	178	142	3,181	9,788	276,877	2,942	314	438	295,351
Napa	233	102	65	498	546	3,754	85,861	1,380	485	92,924
Sonoma	3,201	387	897	1,214	500	452	1,819	367,737	6,424	382,632
Marin	6,908	468	262	1,300	291	415	63	4,261	194,782	208,751
All	570,416	542,895	1,366,212	1,112,784	790,283	289,907	91,630	374,913	208,985	5,348,023

Modeled/Observed Trips	San Francisco	San Mateo	Santa Clara	Alameda	Contra Costa	Solano	Napa	Sonoma	Marin	All
San Francisco	1.01	1.08	0.50	0.98	1.04	0.43	0.28	1.05	1.15	1.01
San Mateo	0.92	0.99	1.03	0.95	0.95	0.45	0.46		1.04	0.98
Santa Clara	0.95	0.93	1.00	0.94	0.95	0.97		1.05	1.05	0.99
Alameda	0.94	1.01	1.11	1.00	0.92	0.92	1.22	1.07	1.07	1.00
Contra Costa	0.99	1.07	1.11	1.00	1.01	0.87	9.18	1.11	1.10	1.00
Solano	0.98	1.08	1.14	1.05	0.79	1.01	1.01	1.12	1.14	1.00
Napa	0.81	0.90	1.07	0.47	0.85	0.81	1.01	0.95	0.92	1.00
Sonoma	0.89	0.99	0.93	0.63	0.93	0.92	1.06	1.00	0.99	1.00
Marin	0.91	0.98	1.05	0.96	3.34	0.91	0.93	1.03	1.03	1.03
All	1.00	0.99	1.00	1.00	1.00	1.00	1.01	1.00	1.03	1.00

Table 43: County to County Trips – Home-based Social-Recreational, Year 2000

Modeled Trips	San Francisco	San Mateo	Santa Clara	Alameda	Contra Costa	Solano	Napa	Sonoma	Marin	All
San Francisco	350,224	25,774	9,143	12,719	2,107	463	309	500	3,330	404,571
San Mateo	46,182	298,670	22,571	4,460	1,760	317	47	142	1,095	375,244
Santa Clara	5,554	18,680	837,168	19,078	3,926	774	10	56	445	885,691
Alameda	37,879	9,146	20,696	677,213	26,693	1,538	179	686	1,248	775,279
Contra Costa	20,209	4,122	4,390	60,069	425,742	6,598	1,196	696	2,818	525,839
Solano	2,983	775	465	7,310	7,593	148,408	3,270	1,609	1,854	174,266
Napa	457	479	41	130	439	3,052	53,940	2,589	365	61,493
Sonoma	2,568	163	5	275	386	577	1,487	241,630	9,129	256,222
Marin	13,471	555	540	2,562	1,352	279	475	3,513	143,094	165,841
All	479,527	358,366	895,019	783,817	469,999	162,005	60,913	251,421	163,380	3,624,446

Observed Trips	San Francisco	San Mateo	Santa Clara	Alameda	Contra Costa	Solano	Napa	Sonoma	Marin	All
San Francisco	347,245	26,134	8,987	13,172	761	541	341	50	3,633	400,866
San Mateo	45,241	298,057	22,404	4,562	812	359	0	54	468	371,957
Santa Clara	5,499	14,916	840,976	19,710	2,101	864	0	392	65	884,523
Alameda	40,643	8,520	18,476	690,556	26,524	1,627	180	664	921	788,111
Contra Costa	18,388	3,834	3,922	57,837	431,743	3,742	0	660	2,431	522,556
Solano	2,652	697	405	6,771	4,613	152,770	3,196	1,490	1,640	174,235
Napa	425	456	144	125	187	3,289	55,792	2,501	342	63,263
Sonoma	3,558	159	1,827	273	405	640	1,609	238,755	8,631	255,856
Marin	13,359	562	526	2,659	295	126	529	3,647	141,364	163,067
All	477,012	353,335	897,667	795,666	467,440	163,957	61,647	248,213	159,494	3,624,432

Modeled/Observed Trips	San Francisco	San Mateo	Santa Clara	Alameda	Contra Costa	Solano	Napa	Sonoma	Marin	All
San Francisco	1.01	0.99	1.02	0.97	2.77	0.86	0.91	9.93	0.92	1.01
San Mateo	1.02	1.00	1.01	0.98	2.17	0.88		2.65	2.34	1.01
Santa Clara	1.01	1.25	1.00	0.97	1.87	0.90		0.14	6.86	1.00
Alameda	0.93	1.07	1.12	0.98	1.01	0.95	0.99	1.03	1.36	0.98
Contra Costa	1.10	1.08	1.12	1.04	0.99	1.76		1.05	1.16	1.01
Solano	1.12	1.11	1.15	1.08	1.65	0.97	1.02	1.08	1.13	1.00
Napa	1.07	1.05	0.29	1.03	2.35	0.93	0.97	1.04	1.07	0.97
Sonoma	0.72	1.03	0.00	1.01	0.95	0.90	0.92	1.01	1.06	1.00
Marin	1.01	0.99	1.03	0.96	4.58	2.21	0.90	0.96	1.01	1.02
All	1.01	1.01	1.00	0.99	1.01	0.99	0.99	1.01	1.02	1.00

Table 44: County to County Trips – Non-home-based, Year 2000

Modeled Trips	San Francisco	San Mateo	Santa Clara	Alameda	Contra Costa	Solano	Napa	Sonoma	Marin	All
San Francisco	604,327	43,517	9,970	29,180	17,336	2,474	419	2,666	13,589	723,477
San Mateo	26,642	371,709	41,757	11,212	2,290	791	169	360	840	455,771
Santa Clara	12,800	39,579	1,120,079	28,731	4,818	930	150	938	324	1,208,350
Alameda	25,036	13,735	29,969	815,610	56,962	3,063	285	1,373	3,514	949,545
Contra Costa	7,692	1,271	3,204	41,552	489,050	7,822	558	1,458	4,003	556,611
Solano	1,835	514	956	4,853	9,032	152,613	5,093	848	592	176,335
Napa	385	80	176	368	417	3,343	73,564	2,298	520	81,152
Sonoma	1,503	495	766	411	1,047	793	1,951	290,901	6,083	303,951
Marin	8,332	1,147	461	5,180	3,077	849	746	6,497	167,040	193,330
All	688,553	472,047	1,207,339	937,097	584,030	172,677	82,933	307,340	196,505	4,648,522

Observed Trips	San Francisco	San Mateo	Santa Clara	Alameda	Contra Costa	Solano	Napa	Sonoma	Marin	All
San Francisco	615,483	43,736	10,211	29,786	17,960	2,423	419	2,832	13,629	736,479
San Mateo	26,573	367,293	43,102	11,280	2,306	760	167	373	836	452,691
Santa Clara	12,872	39,554	1,128,121	28,641	4,756	882	82	971	253	1,216,132
Alameda	24,668	13,430	29,831	806,101	56,044	2,902	282	1,410	3,416	938,083
Contra Costa	8,988	1,554	3,263	42,164	488,417	6,987	501	1,514	3,942	557,329
Solano	1,821	505	978	4,862	9,033	148,783	5,036	880	773	172,670
Napa	390	78	235	378	256	3,311	74,793	2,488	528	82,457
Sonoma	1,435	464	776	516	998	749	1,839	290,656	5,681	303,112
Marin	8,284	1,089	451	5,116	3,030	760	714	6,644	161,509	187,596
All	700,513	467,702	1,216,967	928,844	582,799	167,557	83,832	307,766	190,568	4,646,549

Modeled/Observed Trips	San Francisco	San Mateo	Santa Clara	Alameda	Contra Costa	Solano	Napa	Sonoma	Marin	All
San Francisco	0.98	0.99	0.98	0.98	0.97	1.02	1.00	0.94	1.00	0.98
San Mateo	1.00	1.01	0.97	0.99	0.99	1.04	1.01	0.97	1.00	1.01
Santa Clara	0.99	1.00	0.99	1.00	1.01	1.05	1.83	0.97	1.28	0.99
Alameda	1.01	1.02	1.00	1.01	1.02	1.06	1.01	0.97	1.03	1.01
Contra Costa	0.86	0.82	0.98	0.99	1.00	1.12	1.11	0.96	1.02	1.00
Solano	1.01	1.02	0.98	1.00	1.00	1.03	1.01	0.96	0.77	1.02
Napa	0.99	1.03	0.75	0.97	1.63	1.01	0.98	0.92	0.98	0.98
Sonoma	1.05	1.07	0.99	0.80	1.05	1.06	1.06	1.00	1.07	1.00
Marin	1.01	1.05	1.02	1.01	1.02	1.12	1.05	0.98	1.03	1.03
All	0.98	1.01	0.99	1.01	1.00	1.03	0.99	1.00	1.03	1.00

Table 45: County to County Trips – Home-based Grade School, Year 2000

Modeled Trips	San Francisco	San Mateo	Santa Clara	Alameda	Contra Costa	Solano	Napa	Sonoma	Marin	All
San Francisco	110,981	6,972	0	125	4	0	0	0	50	118,132
San Mateo	7,213	164,431	1,576	66	0	0	0	0	0	173,286
Santa Clara	0	1,659	367,620	1,036	2	0	0	0	0	370,318
Alameda	59	245	797	355,087	3,011	0	0	0	0	359,200
Contra Costa	5	34	3	3,567	205,997	373	21	3	80	210,083
Solano	0	3	0	4	655	85,425	535	16	26	86,664
Napa	0	2	0	3	65	632	34,130	116	26	34,974
Sonoma	2	8	0	1	32	36	185	86,087	216	86,565
Marin	232	40	0	5	105	14	11	51	38,079	38,538
All	118,492	173,393	369,996	359,894	209,870	86,480	34,882	86,273	38,478	1,477,759

Observed Trips	San Francisco	San Mateo	Santa Clara	Alameda	Contra Costa	Solano	Napa	Sonoma	Marin	All
San Francisco	113,610	3,979	0	0	0	0	0	0	643	118,232
San Mateo	12,547	158,238	2,033	80	0	0	0	202	39	173,139
Santa Clara	283	1,189	367,729	1,011	260	0	0	0	0	370,472
Alameda	304	1,629	3,127	347,481	6,380	395	0	0	0	359,316
Contra Costa	0	727	0	7,306	188,216	7,713	0	0	0	203,962
Solano	328	0	0	118	3,230	81,544	717	0	0	85,937
Napa	180	0	0	315	485	218	33,716	0	0	34,914
Sonoma	0	0	0	0	0	0	139	82,327	1,375	83,841
Marin	372	325	1,513	0	118	0	0	152	35,494	37,974
All	127,624	166,087	374,402	356,311	198,689	89,870	34,572	82,681	37,551	1,467,787

Share Modeled/Observed Trips	San Francisco	San Mateo	Santa Clara	Alameda	Contra Costa	Solano	Napa	Sonoma	Marin	All
San Francisco	0.98	1.75							0.08	1.00
San Mateo	0.57	1.04	0.78	0.82					0.01	1.00
Santa Clara		1.40	1.00	1.03	0.01					1.00
Alameda	0.19	0.15	0.25	1.02	0.47					1.00
Contra Costa		0.05		0.49	1.09	0.05	0.00			1.03
Solano				0.04	0.20	1.05	0.75			1.01
Napa				0.01	0.13	2.90	1.01			1.00
Sonoma							1.33	1.05	0.16	1.03
Marin	0.62	0.12			0.89			0.34	1.07	1.01
All	0.93	1.04	0.99	1.01	1.06	0.96	1.01	1.04	1.02	1.01

Table 46: County to County Trips – Home-based High School, Year 2000

Modeled Trips	San Francisco	San Mateo	Santa Clara	Alameda	Contra Costa	Solano	Napa	Sonoma	Marin	All
San Francisco	30,295	2,162	7	50	25	0	0	0	0	32,540
San Mateo	2,408	42,910	885	103	4	0	0	0	0	46,311
Santa Clara	0	431	116,005	410	6	0	0	0	0	116,852
Alameda	285	1,044	1,457	98,185	3,900	16	1	0	0	104,887
Contra Costa	33	41	9	1,450	64,487	1,467	46	20	7	67,562
Solano	0	0	0	2	434	29,828	294	61	0	30,620
Napa	0	0	0	0	26	369	8,892	230	0	9,518
Sonoma	0	0	0	0	3	12	205	32,350	2	32,571
Marin	1,300	556	2	153	752	290	227	3,668	15,028	21,977
All	34,321	47,144	118,366	100,353	69,637	31,983	9,665	36,329	15,038	462,836

Observed Trips	San Francisco	San Mateo	Santa Clara	Alameda	Contra Costa	Solano	Napa	Sonoma	Marin	All
San Francisco	32,499	0	0	0	0	0	0	0	0	32,499
San Mateo	2,559	42,368	759	394	0	0	0	0	0	46,080
Santa Clara	174	443	115,358	529	0	349	0	0	0	116,853
Alameda	660	768	1,020	102,186	0	0	0	0	0	104,634
Contra Costa	0	0	0	4,466	61,112	0	0	50	66	65,694
Solano	219	0	0	0	730	29,037	499	0	0	30,485
Napa	0	0	0	0	0	139	9,368	0	0	9,507
Sonoma	0	0	0	0	0	0	484	31,386	640	32,510
Marin	453	0	0	128	0	0	0	90	21,333	22,004
All	36,564	43,579	117,137	107,703	61,842	29,525	10,351	31,526	22,039	460,266

Share Modeled/Observed Trips	San Francisco	San Mateo	Santa Clara	Alameda	Contra Costa	Solano	Napa	Sonoma	Marin	All
San Francisco	0.93									1.00
San Mateo	0.94	1.01	1.17	0.26						1.01
Santa Clara		0.97	1.01	0.78						1.00
Alameda	0.43	1.36	1.43	0.96						1.00
Contra Costa				0.32	1.06			0.40	0.11	1.03
Solano					0.59	1.03	0.59			1.00
Napa						2.66	0.95			1.00
Sonoma							0.42	1.03		1.00
Marin	2.87			1.19				40.76	0.70	1.00
All	0.94	1.08	1.01	0.93	1.13	1.08	0.93	1.15	0.68	1.01

Table 47: County to County Trips – Home-based College, Year 2000

Modeled Trips	San Francisco	San Mateo	Santa Clara	Alameda	Contra Costa	Solano	Napa	Sonoma	Marin	All
San Francisco	57,451	139	354	3,952	127	43	0	4	136	62,207
San Mateo	7,619	40,343	3,536	1,315	100	3	1	7	54	52,978
Santa Clara	1,265	1,703	114,248	2,833	498	31	18	35	31	120,662
Alameda	3,937	1,191	3,803	121,663	4,120	147	7	21	55	134,943
Contra Costa	1,459	115	1,240	10,184	54,481	647	83	89	403	68,699
Solano	317	26	17	925	3,337	13,598	222	335	86	18,862
Napa	204	7	4	117	278	817	4,765	564	32	6,789
Sonoma	309	30	21	162	171	217	629	40,110	503	42,152
Marin	566	79	20	1,064	329	764	37	979	10,866	14,705
All	73,127	43,631	123,242	142,216	63,442	16,268	5,762	42,144	12,166	521,998

Observed Trips	San Francisco	San Mateo	Santa Clara	Alameda	Contra Costa	Solano	Napa	Sonoma	Marin	All
San Francisco	57,567	96	525	3,872	0	50	0	0	130	62,240
San Mateo	6,392	42,491	2,900	1,163	0	0	0	0	0	52,946
Santa Clara	1,985	425	115,327	3,355	51	0	0	0	0	121,143
Alameda	4,023	458	3,024	122,684	4,137	172	0	0	0	134,498
Contra Costa	1,741	67	1,563	9,601	56,593	0	88	85	218	69,956
Solano	299	0	0	118	3,174	14,777	166	293	0	18,827
Napa	211	0	0	0	0	400	5,446	565	0	6,622
Sonoma	336	0	0	0	0	0	0	40,729	511	41,576
Marin	571	0	0	496	0	1,054	0	896	11,387	14,404
All	73,125	43,537	123,339	141,289	63,955	16,453	5,700	42,568	12,246	522,212

Share Modeled/Observed Trips	San Francisco	San Mateo	Santa Clara	Alameda	Contra Costa	Solano	Napa	Sonoma	Marin	All
San Francisco	1.00	1.45	0.67	1.02		0.86			1.05	1.00
San Mateo	1.19	0.95	1.22	1.13						1.00
Santa Clara	0.64	4.01	0.99	0.84	9.77					1.00
Alameda	0.98	2.60	1.26	0.99	1.00	0.85				1.00
Contra Costa	0.84	1.71	0.79	1.06	0.96		0.94	1.04	1.85	0.98
Solano	1.06			7.84	1.05	0.92	1.34	1.14		1.00
Napa	0.97					2.04	0.88	1.00		1.03
Sonoma	0.92							0.98	0.98	1.01
Marin	0.99			2.14		0.73		1.09	0.95	1.02
All	1.00	1.00	1.00	1.01	0.99	0.99	1.01	0.99	0.99	1.00

MODE CHOICE MODEL

The standard form for mode choice models is the logit choice model. Six of the seven mode choice models included in the model set are nested logit choice model. The mode choice model for one trip purpose, home-based grade school, is multinomial logit. The structures of the mode choice models for various trip purposes are shown in Figure 26 and Figure 27.

Figure 26: Mode Choice Model Structure: Home-Based Work, Shop-Other, Social-Recreation

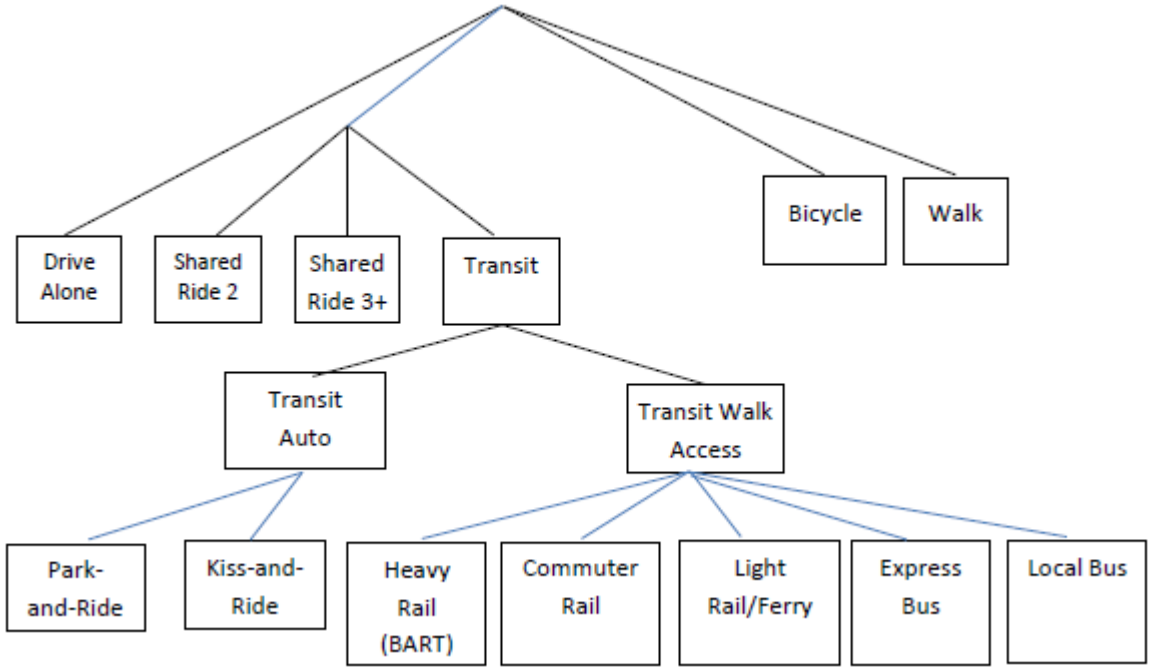
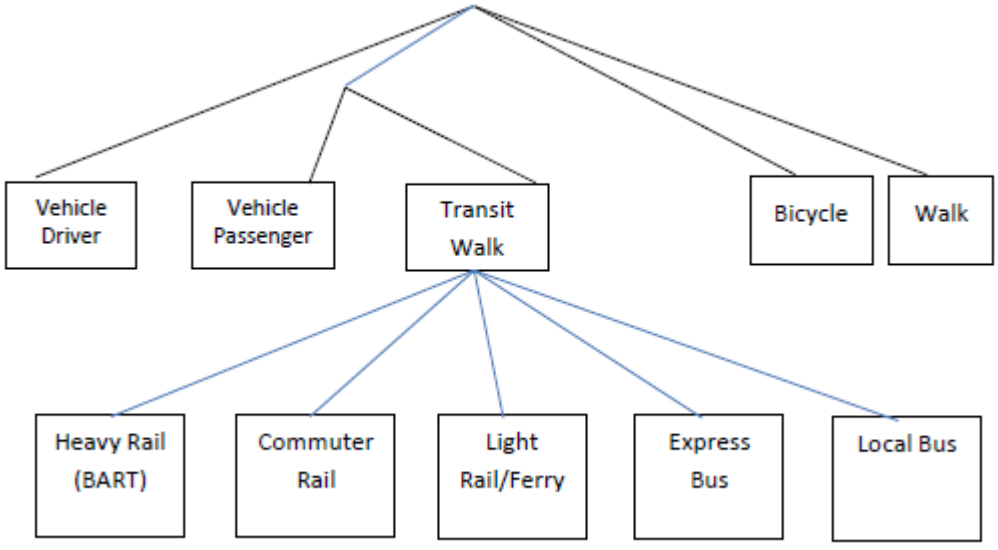


Figure 27: Mode Choice Model Structure: Home-Based School, Non-Home Based



An important characteristic of most of the mode choice models (with the exception of the three home-based school mode choice models) is that both AM peak period and off-peak period travel times and trip costs are used in the model application. In previous versions of MTC model systems, home-based work trips were only sensitive to peak period travel times and costs, and non-work trips were only sensitive to off-peak times and costs. This improvement in the model system means that mode choice for these trip purposes is sensitive to changes in both the peak and off-peak period, as opposed to just one or the other.

All mode choice models incorporate non-motorized alternatives: bicycle and walk. Travel times for bicycle and walk are based on a "non-motorized network" based on the standard regional highway network, excluding freeway facilities where bicycles and pedestrians are not allowed. Uniform speeds of 3 miles per hour are assumed for pedestrians. Bicycle speeds are based on the presence of bike infrastructure and area type classification, with 7 – 9 miles per hour (mph) perceived speed for facilities without bike lanes, 12-15 mph perceived speed for facilities with bike lanes and 15 mph perceived speed for separated bike paths.

Home-Based Work Mode Choice

The home-based work mode choice model was originally a three-level nested choice model in the BAYCAST model set. Trips are first split into motorized modes, bicycle and walk-only modes. Motorized trips are then split into drive alone, shared ride 2, shared ride 3+ and transit. Lastly, transit trips are split into transit with walk access versus transit with auto access. As part of model development for application in the BART to Santa Clara County planning, the Santa Clara Valley Transportation Authority added a lower-level transit submode nest to split walk-access to transit into the walk-access to heavy rail, commuter rail, light rail, express bus and local bus. The drive-access to transit nest was further stratified to include a lower level nest that splits out drive-access to park-and-ride access and kiss-and-ride access. These additional stratifications were incorporated into the Alameda Countywide model during the original development in the mid-2000s.

Market segmentation into the HBW mode choice model is zone-to-zone trips by auto ownership level (3) by household income quartile level (4). Where the auto ownership is zero, work trips are prohibited from using the drive alone or transit-auto access modes. Coefficients for the HBW mode choice model are shown in Table 48. The home-based work mode choice model includes variables about tripmaker demographics (auto ownership, income, household size, workers in the household); trip characteristics (travel time and trip cost); and density; "dummy" variables to represent high bicycle commute shares in Stanford, Palo Alto and Berkeley; and "dummy" variables for regional "core" zones in the San Francisco financial district.

Table 48: Home-based Work Mode Choice Coefficients

Drive Alone Auto	Shared Ride 2 Person Auto	Shared Ride 3+ Person Auto	Transit Auto-Access	Transit Walk-Access	Bike	Walk	Variable	Coefficient	t-Stat (MTC BAYCAST)
X							Constant	-9.234	(4.0)
	X						Constant	-13.310	(4.1)
		X					Constant	-13.780	(4.1)
			X				Constant	-12.250	(4.6)
				X			Constant	-10.380	(4.1)
					X		Constant	-8.268	(12.4)
					X		LnEmpDi	0.3243	(2.2)
			X	X			LnEmpDj	0.5461	(3.3)
X							Veh/HH	1.2240	(4.5)
	X						Veh/HH	0.9023	(4.2)
		X					Veh/HH	0.9357	(4.2)
	X						Single VHH	0.8370	(2.9)
			X				Veh/HH	0.5697	(3.1)
				X			No VHH	0.5501	(1.4)
X							Workers/HH	-0.2454	(2.3)
	X						Multi-Wrkr/HH	-0.9297	(3.0)
X							Persons/HH	-0.3099	(3.6)
X							Income Leg1	5.878E-05	(2.0)
	X	X					Income Leg1	5.049E-05	(1.7)
X	X	X	X	X	X		IVTT	-0.03326	(4.3)
			X	X			Wait	-0.05233	(3.1)
X	X	X	X	X			Walk	-0.09305	(2.2)
X	X	X	X	X			Cost	-0.002067	(2.6)
					X		Stanfordj	2.09	(3.0)
					X		Palo Altoj	1.584	(2.3)
					X		Berkeleyj	1.01	(1.5)
X							Corej	-1.086	(2.7)
			X				Corej	1.147	(3.3)
						X	LnWalkTime	-2.137	(13.5)
						X	LnEmpDj	0.1418	(2.1)
			X	X			Theta (Transit)	0.7194	(2.2)
X	X	X	X	X			Theta (Motor)	0.9208	(0.6)
			X	X			Theta (Submode)	0.6835	NA
Value of Time (IVTT/Cost * .60)								**$9.65**	
Ratio of Wait/IVTT								**1.57**	
Ratio of Walk/IVTT								**2.80**	

Home-based Work Mode Choice Model Calibration

The home-based work mode choice models were recalibrated to match year 2000 Census Journey to Work data mode shares for the primary modes of drive-alone, 2 person carpool, 3+ person carpool, transit, walk and bicycle modes. Transit submode calibration target values were based on shares used in the recent model calibration work done for the BART extension to Silicon Valley model calibration for transit walk-access and transit drive-access supplemented with the most recent (at the time) transit on-board survey data from Caltrain (2000) and BART (1998) for submode walk-access market shares.

Calibration of the home-based work constants followed methodologies recommended by FTA, which considered the calibration of regional mode choice constants with no stratification of transit submode walk-access or drive-access constants by income quartile. Transit access target values were calculated based on data summaries from the MTC BATS 2000 trip survey file (specifically, by tabulating the vehicle occupancy for access and egress to transit) in addition to data developed from transit passenger surveys. The final comparisons of calibration target values to model estimated trips by mode are provided in Table 49 and Table 50.

The regional constant calibration results for home-based work trips are summarized in Table 51. The results of the calibrated constants indicate that relative to walk-to-local bus submodes, heavy rail (BART), commuter rail and light rail all offer a perceived rail travel time "bonus" of + 8 minutes, +16 minutes and +10 minutes, respectively. This implies that all else being equal, there is a perceived advantage for persons to take rail modes over local bus modes expressed in equivalent minutes. These calibrated travel time bonuses, excepting commuter rail, are within the FTA recommended limit of 15 minutes equivalent travel time bonus.

Table 49: Home-based Work Mode Choice Trips by Mode, Observed

Mode	HBW IQ1	HBW IQ1 %	HBW IQ2	HBW IQ2 %	HBW IQ3	HBW IQ3 %	HBW IQ4	HBW IQ4 %	HBW ALL	Observed %
Drive Alone	354,024	59.7%	694,267	68.6%	1,158,932	72.7%	1,537,221	75.9%	3,744,444	71.7%
SR 2	60,212	10.2%	107,921	10.7%	162,171	10.2%	194,787	9.6%	525,091	10.1%
SR 3+	21,971	3.7%	38,728	3.8%	55,122	3.5%	61,466	3.0%	177,287	3.4%
Transit Walk	85,903	14.5%	94,696	9.4%	109,574	6.9%	101,877	5.0%	392,050	7.5%
Transit Auto	5,145	0.9%	22,974	2.3%	52,270	3.3%	70,851	3.5%	151,240	2.9%
Bike	12,520	2.1%	12,934	1.3%	21,181	1.3%	17,831	0.9%	64,466	1.2%
Walk	52,966	8.9%	39,906	3.9%	35,477	2.2%	40,030	2.0%	168,379	3.2%
Transit Submodes										
Walk to BART	20,666	3.5%	26,916	2.7%	27,111	1.7%	31,213	1.5%	105,906	2.0%
Walk to Commuter Rail	1,369	0.2%	2,487	0.2%	3,378	0.2%	3,806	0.2%	14,431	0.3%
Walk to LRT	14,177	2.4%	22,844	2.3%	14,154	0.9%	10,416	0.5%	67,647	1.3%
Walk to Express	4,651	0.8%	6,130	0.6%	5,285	0.3%	5,073	0.3%	21,139	0.4%
Walk to Local	41,679	7.0%	38,507	3.8%	55,359	3.5%	47,383	2.3%	182,928	3.5%
Park-and-Ride	3,597	0.6%	17,778	1.8%	41,691	2.6%	60,779	3.0%	123,845	2.4%
Kiss-and-Ride	1,548	0.3%	5,196	0.5%	10,579	0.7%	10,072	0.5%	27,395	0.5%
ALL	**592,741**	**100.0%**	**1,011,426**	**100.0%**	**1,594,727**	**100.0%**	**2,024,063**	**100.0%**	**5,222,957**	**100.0%**

Table 50: Home-based Work Mode Choice Trips by Mode, Estimated

Mode	HBW IQ1	HBW IQ1 %	HBW IQ2	HBW IQ2 %	HBW IQ3	HBW IQ3 %	HBW IQ4	HBW IQ4 %	HBW ALL	Modeled %	Observed %	Modeled/ Observed
Drive Alone	341,678	60.1%	685,462	67.9%	1,142,611	71.6%	1,489,883	74.8%	3,659,634	70.8%	71.7%	98.8%
SR 2	58,121	10.2%	106,569	10.6%	159,908	10.0%	188,826	9.5%	513,423	9.9%	10.1%	98.8%
SR 3+	21,208	3.7%	38,243	3.8%	54,355	3.4%	59,587	3.0%	173,392	3.4%	3.4%	98.9%
Transit Walk	83,640	14.7%	93,801	9.3%	108,118	6.8%	98,912	5.0%	384,471	7.4%	7.5%	99.1%
Transit Auto	4,905	0.9%	22,740	2.3%	51,768	3.2%	68,943	3.5%	148,357	2.9%	2.9%	99.2%
Bike	12,077	2.1%	12,801	1.3%	20,945	1.3%	17,343	0.9%	63,165	1.2%	1.2%	99.0%
Walk	46,884	8.2%	50,117	5.0%	58,936	3.7%	68,502	3.4%	224,439	4.3%	3.2%	134.7%
Transit Submodes												
Walk to BART	25,598	4.5%	26,068	2.6%	29,179	1.8%	22,936	1.2%	103,781	2.0%	2.0%	99.1%
Walk to Commuter Rail	3,152	0.6%	3,049	0.3%	3,886	0.2%	4,026	0.2%	14,113	0.3%	0.3%	98.9%
Walk to LRT	9,096	1.6%	14,653	1.5%	20,675	1.3%	21,932	1.1%	66,356	1.3%	1.3%	99.2%
Walk to Express	3,937	0.7%	4,225	0.4%	5,356	0.3%	7,176	0.4%	20,694	0.4%	0.4%	99.0%
Walk to Local	41,837	7.4%	45,780	4.5%	48,992	3.1%	42,813	2.1%	179,423	3.5%	3.5%	99.1%
Park-and-Ride	3,422	0.6%	17,590	1.7%	41,288	2.6%	59,138	3.0%	121,438	2.4%	2.4%	99.1%
Kiss-and-Ride	1,471	0.3%	5,136	0.5%	10,468	0.7%	9,792	0.5%	26,868	0.5%	0.5%	99.1%
ALL	**568,512**	**100.0%**	**1,009,733**	**100.0%**	**1,596,641**	**100.0%**	**1,991,996**	**100.0%**	**5,166,882**	**100.0%**	**100.0%**	**100.0%**

Table 51: Home-based Work Mode Choice Final Constants

Mode	HBW IQ1	HBW IQ2	HBW IQ3	HBW IQ4	ALL	IVTT Bonus[1]
Drive Alone	1.5137	2.0994	2.1508	2.2246		
SR 2	3.2807	3.9470	4.0088	4.0128		
SR 3+	2.6519	3.0754	2.9450	2.8132		
Transit Walk	-1.8100	-2.0397	-2.5208	-3.5006		
Transit Auto	-4.3836	-2.9074	-2.2879	-2.1706		
Bike	-0.5826	-0.6325	-0.4261	-0.8793		
Walk	0.0000	0.0000	0.0000	0.0000		
Transit Submodes						
Walk to BART	-1.2004	-1.2004	-1.2004	-1.2004	-1.2004	8
Walk to Commuter Rail	-0.6577	-0.6577	-0.6577	-0.6577	-0.6577	16
Walk to LRT	-1.0883	-1.0883	-1.0883	-1.0883	-1.0883	10
Walk to Express	-2.2898	-2.2898	-2.2898	-2.2898	-2.2898	
Walk to Local	-1.7341	-1.7341	-1.7341	-1.7341	-1.7341	
PNR	-3.6850	-2.2724	-1.6925	-1.5503		
KNR	-4.2580	-3.1115	-2.6290	-2.7778		

[1] Minutes compared to local bus

The overall characteristics and trends of the home-based work constants appear to be reasonable. The constants for both the upper-level choices of drive-alone, shared ride, transit walk and drive access, bicycle and walk and the transit submode choices show reasonable patterns across income quartiles.

Home-based Work Mode Choice Model Calibration - Conclusions

The results of the home-based work mode choice calibration yield promising results overall, as the calibrated constants are not overly large and the calibrated rail travel time bonuses are within or very near FTA recommendations. However, it should be noted that the walk modes are overestimated after the calibration by approximately 35 percent.

Non-Work Mode Choice Models

The trip purposes that comprise non-work trips consist of the following:

- Home-based Shopping/Other – these trips are produced from the home to shop or for essentially personal business trips,
- Home-based Social-Recreational – these trips are produced from the home for social and/or recreational purposes,
- Home-based School trips – there are three types of home-based school trips modeled as separate trip purposes. These trips are made from the home to either grade school, high school or college, and
- Non-home-based – these trips are not produced or attracted at the home-end. Examples of these types of trips would be travel from work to a restaurant during the mid-day, or from shopping to the dry cleaners.

The non-work mode choice models were calibrated by adjusting mode specific constants, using observed travel survey data from the 2000 MTC BATS. At the regional level, the calibration of the non-work mode choice models to year 2000 observed conditions yielded a close match to the mode shares for the most significant non-work travel markets of home-based shop/other, home-based social-recreational and non-home-based. Home-based school calibration yielded a calibration less accurate than the other non-work trips, however, these trips comprise a smaller share of the overall travel market.

Non-Work Mode Choice Model Structure and Model Coefficients

The non-work models follow the same structure as the home-based work models in that they are nested logit models, with a lower-level transit submode nest added to split walk-access to transit into the walk-access to heavy rail, commuter rail, light rail, express bus and local bus submodes. The original MTC BAYCAST-90 transit nest was further stratified to include a new lower level nest that splits transit drive-access into park-and-ride access and kiss-and-ride access where data were available to support this distinction. Drive to transit was not assumed for the non-home-based and home-based school trips to simplify the choices – only walk to transit is allowed.

The nesting coefficients applied to the transit access and transit submode nests were borrowed from the home-based work models, applying a nesting coefficient for the transit access nest of 0.7194 and a transit submode nest of 0.6835. Coefficients for the non-work models, by trip purpose, are shown in Table 52 through Table 57.

Table 52: Home-based Shop/Other Mode Choice Coefficients

Choice								
DA	SR2	SR3+	Transit Walk	Transit Drive	Bike	Walk	Variable Name	Coeff.
X							Constant	0.5495
	X						Constant	-0.3612
		X					Constant	-2.4860
			X	X			Constant	-1.7470
					X		Constant	-3.9280
	X						LnPHH	0.6635
		X					LnPHH	2.2360
			X				Veh/HH	-0.3352
X							LnIncome	0.1952
	X						LnIncome	0.1118
X	X	X	X	X	X	X	Time (Total)	-0.05815
X	X	X	X	X			LnCost	-0.2262
			X	X			Corej	2.3750
X	X	X					LnAreaDeni	-0.4701
					X		Stanfordj	2.488
					X		Berkeleyj	1.630
					X		Palo AltoJ	1.377
X							Zero WHH	-0.2273
			X				Zero VHH	3.2910
						X	Zero VHH	1.7350
X	X	X	X	X			Theta (Motor)	0.4847
			X	X			Theta (Access)	0.7194
			X	X			Theta (Submode)	0.6835

Source: Travel Demand Models for the San Francisco Bay Area (BAYCAST-90). Technical Summary MTC June 1997. Theta for Access and Submode calibrated by Santa Clara VTA.

Non-work Mode Choice Model Calibration

The non-work mode choice models were recalibrated to match year 2000 mode shares from the MTC BATS 2000 regional survey observations for non-work trip purposes, for the primary modes of drive-alone, 2 person carpool, 3+ person carpool, transit, walk and bicycle modes. For non-home-based and home-based school trips, auto mode shares were estimated for vehicle driver and vehicle passenger modes.

Transit submode calibration target values were based on shares used in the VTA's model calibration work done for the BART extension to Silicon Valley project for transit walk-access and transit drive-access supplemented with the most recent (at the time) transit on-board survey data from Caltrain (2000) and BART (1998) for submode walk-access market shares. Transit walk and drive access target values were calculated based on data summaries from the MTC BATS 2000 trip survey file (again, by tabulating the vehicle occupancy for access and egress to transit as was done for the home-based work trips) in addition to data developed from the observed transit surveys.

Table 53: Home-based Social-Recreational Mode Choice Coefficients

Choice							Variable Name	Coeff.
DA	SR 2	SR3+	Transit Walk	Transit Drive	Bike	Walk		
X							Constant	1.295
	X						Constant	-1.437
		X					Constant	-2.486
			X	X			Constant	1.703
					X		Constant	-3.149
		X					LnPHH	1.8340
			X				Veh/HH	-0.7475
	X						LnIncome	0.2305
					X		Income	-0.0088.88
X	X	X	X	X	X		IVTT	-0.02745
X	X	X	X	X		X	OVTT	-0.06806
X	X	X	X	X			LnCost	-1.1600
			X	X			Corej	0.9694
			X	X			LnAreaDeni	0.3217
					X		Stanfordj	2.2090
	X	X	X	X			Theta (Group)	0.6271
			X	X			Theta (Access)	0.7194
			X	X			Theta (Submode)	0.6835

Source: Travel Demand Models for the San Francisco Bay Area (BAYCAST-90). Technical Summary MTC June 1997. Theta for Access and Submode calibrated by Santa Clara VTA.

Table 54: Non-home-based Mode Choice Coefficients

Choice					Variable Name	Coeff.
Vehicle Driver	Vehicle Passenger	Transit Walk	Bike	Walk		
X					Constant	2.233
	X				Constant	0.5104
		X			Constant	-2.0540
			X		Constant	-4.769
X					AreaDeni	-0.0005277
				X	AreaDeni	0.0004173
X	X	X	X		IVTT	-0.03237
		X			Wait	-0.07583
X	X	X		X	Walk	-0.07836
X	X	X			LnCost	-0.9862
X	X	X			Theta (Motor)	-0.6271
		X			Theta (Submode)	0.6835

Source: Travel Demand Models for the San Francisco Bay Area (BAYCAST-90). Technical Summary MTC June 1997. Theta for Access and Submode calibrated by Santa Clara VTA.

Table 55: Home-based Grade School Mode Choice Coefficients

Choice				Variable Name	Coeff.
Vehicle Passenger	Transit	Bike	Walk		
X				Constant	2.6250
	X			Constant	7.3003
		X		Constant	-3.1550
	X		X	PHH^3	0.004436
	X			Rurali	1.5440
X				Income (000s)	0.009757
X	X	X		IVTT	-0.05855
X	X		X	OVTT	-0.06384
X	X			LnCost	-1.93000
	X			Theta (Submode)	0.6835

Source: Travel Demand Models for the San Francisco Bay Area (BAYCAST-90). Technical Summary MTC June 1997. Theta for Access and Submode calibrated by Santa Clara VTA.

Table 56: Home-based High School Mode Choice Coefficients

Choice					Variable Name	Coeff.
Vehicle Driver	Vehicle Passenger	Transit	Bike	Walk		
X					Constant	-0.6729
	X				Constant	0.1929
		X			Constant	2.9550
			X		Constant	-3.5240
X					Veh/HH	3.5580
	X				Veh/HH	0.5994
X					Pers/HH	-1.5000
		X			Net ResDensI	0.1442
X	X	X	X		IVTT	-0.03228
X	X	X		X	OVTT	-0.03463
X	X	X			LnCost	-2.0340
	X	X			Theta (Group)	0.2583
		X			Theta (Submode)	0.6835

Source: Travel Demand Models for the San Francisco Bay Area (BAYCAST-90). Technical Summary MTC June 1997. Theta for Access and Submode calibrated by Santa Clara VTA.

Transit submode targets for BART and commuter rail were adjusted to match data from the transit on-board surveys, as the rail submode totals from the MTC BATS survey for BART and Caltrain were much higher than the total boardings from the actual transit surveys.

Table 57: Home-based College Mode Choice Coefficients

Choice						
Vehicle Driver	Vehicle Passenger	Transit	Bike	Walk	Variable Name	Coeff.
X					Constant	-1.461
	X				Constant	-5.506
		X			Constant	-1.4480
			X		Constant	-3.3980
X					Veh/HH	0.7728
X					Pers/HH	-0.2638
X					Net ResDensI	-0.3973
			X		STANFORD TAZ	3.216
			X		PALO ALTO TAZ	2.668
			X		BERKELEY TAZ	1.711
X	X	X	X		IVTT	-0.02731
X	X	X		X	OVTT	-0.03923
X	X	X			LnCost	-0.6920
	X	X			Theta (Group)	0.5302
		X			Theta (Submode)	0.6835

Source: Travel Demand Models for the San Francisco Bay Area (BAYCAST-90). Technical Summary MTC June 1997. Theta for Access and Submode calibrated by Santa Clara VTA.

The final comparison of calibration target values to model estimated trips by mode are provided in Table 58 through Table 61. In particular, the home-based shopping/other, home-based social/recreation and non-home-based trips have a very good agreement between estimated and observed trips by mode. Home-based school trips show a less favorable comparison of observed to estimated trips, however, it should be noted that school trips comprise a smaller proportion of the total non-work trip market in total person trips.

Table 58: Home-based Shopping/Other Trips by Mode, Observed versus Estimated

Mode	Observed	Observed %	Estimated	Estimated %	Observed/ Estimated
Drive Alone	2,099,075	39.2%	2,066,336	39.2%	99.9%
Shared Ride 2 Person	1,432,357	26.8%	1,410,029	26.8%	99.9%
Shared Ride 3+ Person	979,793	18.3%	964,523	18.3%	99.9%
All Transit	184,129	3.4%	180,570	3.4%	100.3%
Transit Walk-access	168,150	3.1%	164,675	3.1%	100.4%
Transit Drive-access	15,979	0.3%	15,895	0.3%	98.9%
Bike	76,269	1.4%	75,044	1.4%	100.0%
Walk	580,867	10.9%	568,583	10.8%	100.5%
Other					
All	**5,352,491**	**100.0%**	**5,265,086**	**100.0%**	**100.0%**
Transit Submodes					
Walk to BART	21,722	0.4%	21,553	0.4%	99.1%
Walk to Commuter Rail	1,553	0.0%	1,535	0.0%	99.5%
Walk to LRT	16,968	0.3%	16,822	0.3%	99.2%
Walk to Express Bus	7,796	0.1%	7,721	0.1%	99.3%
Walk to Local Bus	120,111	2.2%	117,030	2.2%	101.0%
Park-and-ride	12,903	0.2%	12,874	0.2%	98.6%
Kiss-and-ride	3,076	0.1%	3,012	0.1%	100.5%

Table 59: Home-based Social-Recreational Trips by Mode, Observed versus Estimated

Mode	Observed	Observed %	Estimated	Estimated %	Observed/ Estimated
Drive Alone	981,885	27.4%	1,020,340	28.3%	96.8%
Shared Ride 2 Person	926,804	25.9%	963,091	26.7%	96.8%
Shared Ride 3+ Person	1,115,843	31.2%	1,159,443	32.2%	96.8%
All Transit	110,839	3.1%	114,367	3.2%	97.5%
Transit Walk-access	100,400	2.8%	103,660	2.9%	97.5%
Transit Drive-access	10,439	0.3%	10,706	0.3%	98.1%
Bike	56,443	1.6%	59,188	1.6%	96.0%
Walk	389,351	10.9%	286,943	8.0%	136.5%
All	**3,581,166**	**100.0%**	**3,603,371**	**100.0%**	**100.0%**
Transit Submodes					
Walk to BART	6,365	0.2%	6,751	0.2%	94.9%
Walk to Commuter Rail	1,815	0.1%	1,926	0.1%	94.8%
Walk to LRT	15,929	0.4%	16,922	0.5%	94.7%
Walk to Express Bus	1,815	0.1%	1,926	0.1%	94.8%
Walk to Local Bus	74,465	2.1%	76,103	2.1%	98.5%
Park-and-ride	8,206	0.2%	8,319	0.2%	99.2%
Kiss-and-ride	2,233	0.1%	2,374	0.1%	94.6%

Table 60: Non-home-based Trips by Mode, Observed versus Estimated

Mode	Observed	Observed %	Estimated	Estimated %	Observed/ Estimated
Vehicle Driver	2,740,387	58.9%	2,763,612	59.4%	99.2%
Vehicle Passenger	1,022,623	22.0%	1,031,140	22.2%	99.2%
All Transit	213,128	4.6%	215,415	4.6%	98.9%
Bike	48,938	1.1%	49,171	1.1%	99.5%
Walk	629,224	13.5%	594,962	12.8%	105.8%
All	4,654,300	100.0%	4,654,300	100.0%	100.0%
Transit Submodes					
Walk to BART	39,899	0.9%	39,898	0.9%	100.0%
Walk to Commuter Rail	3,492	0.1%	3,496	0.1%	99.9%
Walk to LRT	26,940	0.6%	26,905	0.6%	100.1%
Walk to Express Bus	7,271	0.2%	7,278	0.2%	99.9%
Walk to Local Bus	138,150	3.0%	137,804	3.0%	100.3%

Table 61: Home-based School Trips by Mode, Observed versus Estimated

Mode	Observed	Observed %	Estimated	Estimated %	Observed/ Estimated
Home-Based College					
Vehicle Driver	336,732	74.1%	272,896	58.9%	125.8%
Vehicle Passenger	49,870	11.0%	42,409	9.2%	119.9%
Transit	74,440	16.4%	58,533	12.6%	129.6%
Bike	10,416	2.3%	10,176	2.2%	104.3%
Walk	57,566	12.7%	137,857	29.8%	42.6%
All	**454,584**	**100.0%**	**463,337**	**100.0%**	**100.0%**
Home-Based High School					
Vehicle Driver	68,343	14.8%	62,226	13.4%	109.8%
Vehicle Passenger	256,007	55.3%	237,811	51.4%	107.7%
Transit	48,070	10.4%	52,034	11.2%	92.4%
Bike	5,609	1.2%	66,985	14.5%	8.4%
Walk	84,819	18.3%	43,792	9.5%	193.7%
All	**462,848**	**100.0%**	**462,848**	**100.0%**	**100.0%**
Home-Based Grade School					
Vehicle Driver	0	0.0%	0	0.0%	0.0%
Vehicle Passenger	1,042,168	70.5%	1,044,391	70.7%	99.8%
Transit	90,433	6.1%	162,249	11.0%	55.7%
Bike	28,759	1.9%	26,312	1.8%	109.3%
Walk	316,183	21.4%	244,590	16.6%	129.3%
All	**1,477,542**	**100.0%**	**1,477,542**	**100.0%**	**100.0%**

The regional constant calibration results for non-work trips are summarized in Table 62.

Table 62: Non-work Mode Choice Constants

Mode	Home-based Shop/Other	Travel Time Bonus[1]	Home-based Social Recreational	Travel Time Bonus[1]
Drive Alone	-0.17250		0.30386	
SR 2	0.67729		0.21099	
SR 3+	1.97792		1.67123	
Transit Walk	-1.13135		-0.23152	
Transit Auto	0.61840		-0.86661	
Bike	0.73596		-0.41389	
Walk	0		0	
Walk to BART	0.12395	+1	-0.71474	-7
Walk to Commuter Rail	1.24012	+15	0.94455	+9
Walk to LRT	-0.03096	0	0.48451	+5
Walk to Express	0.81711	+10	-1.34725	-14
Walk to Local	0		0	
PNR	0		0	
KNR	-0.99118		-0.85449	

Mode	Non-home-based	Travel Time Bonus[1]	Home-based Grade School	Home-based High School	Home-based College
Vehicle Driver	-0.21007		NA	1.33926	5.45558
Vehicle Passenger	0.83201		0.29576	2.13442	6.03074
Transit	1.98608		-10.14806	-8.44962	4.38209
Bike	0.33608		-0.88420	-28.04515	1.88392
Walk	0		0	0	0
Walk to BART	1.04417	+22	NA	NA	NA
Walk to Commuter Rail	0.88665	+19	NA	NA	NA
Walk to LRT	0.45551	+10	NA	NA	NA
Walk to Express	-0.04144	-1	NA	NA	NA
Walk to Local	0		NA	NA	NA

[1] Minutes relative to local bus

The results of the calibrated constants summarized in Table 5.26 actually show wide variation in the relative travel time "bonus" of the transit submodes relative to local bus, and show patterns less well-behaved then the results from the home-based work calibration. For example, for home-based shopping/other trips, heavy rail (BART), commuter rail and light rail all offer a rail travel time "bonus" of + 1 minutes, +15 minutes and +0 minutes, respectively, relative to local bus. However, for home-based social/recreational trips, heavy rail (BART), commuter rail and light rail all offer a rail travel time "bonus" of -7 minutes, +9 minutes and +5 minutes, respectively, relative to local bus. And finally, for non-home-based trips, heavy rail (BART), commuter rail and light rail all offer a rail travel time "bonus" of + 22 minutes, +19 minutes and +10 minutes, respectively, relative to local bus. While it is difficult to determine a reason for the variation, particularly for the -7 minutes for BART for the home-based social/recreational trips, in

general, fixed guideway modes tend to offer a perceived travel time advantage over the local bus mode, which is the general expectation given the implied reliability and perceived comfort of the guideway transit modes.

Non-work Mode Choice Model Calibration – Conclusions

As with the home-based work trips, the results of the non-work mode choice calibration yield promising results overall, and with the exception of a few choices in the school trip purposes, the calibrated constants are not overly large. In addition, the calibrated rail travel time bonus is within FTA recommendations for all but BART and commuter rail for the non-home-based trip purpose.

APPENDIX C: MTC MODELING CONSISTENCY REQUIREMENTS

Appendix B: MTC Checklist for Modeling Consistency for CMPs

Overall approach
MTC's goal is to establish regionally consistent model "sets" for application by MTC and the CMAs. In the winter of 2010/2011, MTC replaced the modeling tool – named *BAYCAST-90* – that had been in place, with relatively minor modifications, for the past two decades with a more sophisticated, so-called "activity-based" model – named *Travel Model One*. This change required a broad re-thinking of these guidelines as they now require a framework in which trip-based and activity-based models can be aligned. The approach remains the same: a checklist is used to adjudge consistency across model components.

Checklist
This checklist guides the CMAs through their model development and consistency review process by providing an inventory of specific products to be developed and submitted to MTC, and by describing standard practices and assumptions.

Because of the complexity of the topic, the checklist may need additional detailed information to explain differences in methodologies or data. Significant differences will be resolved between MTC and the CMA, taking advantage of the Regional Model Working Group. Standard formats for model comparisons will be developed by MTC for use in future guidelines.

Incremental updates
The CMA forecasts must be updated every two years to be consistent with MTC's forecasts. Alternative approaches to fully re-running the entire model are available, including incremental approaches through the application of factors to demographic inputs and/or trip tables. Similarly, the horizon year must be the same as the TIP horizon year. However, interpolation and extrapolation approaches are acceptable, with appropriate attention to network changes. These alternatives to re-running the entire model should be discussed with MTC before the CMP is adopted by the CMA.

Defining the MTC model sets
The MTC model sets referred to below are defined as those in use on December 31st of the year preceding the CMP update.
Key Assumptions
Please report the following information.

A. General approach:
Discuss the general approach to travel demand modeling by the CMA and the CMA model's relationship to either *BAYCAST-90* or *Travel Model One*.

PRODUCT 1: Description of the above.

B. Demographic/economic/land use forecasts:
Both base and forecast year demographic/economic/land use ("land use") inputs must be consistent – though not identical – to the census tract-level data provided by ABAG.

Specifically, if CMAs wish to reallocate land use within their own county (or counties), they must consult with the affected city (or cities) as well as with ABAG and MTC.

Further, the resulting deviation in the subject county (or counties) should be no greater than plus or minus one percent from the county-level totals provided by ABAG for the following variables: population, households, jobs, and employed residents. Outside the subject county (or counties), the land use variables in the travel analysis zones used by the county must match either ABAG's estimates exactly when aggregated/disaggregated to census tracts or the county-in-question's estimates per the revision process noted above (e.g. Santa Clara county could use the revised estimates San Mateo developed through consultation with local cities, ABAG, and MTC). Forecast year demand estimates should use either the *Plan Bay Area* or Draft Proposed Plan (used in the *Plan Bay Area* DEIR) land use data, both generated by ABAG. CMAs may also analyze additional, alternative land use scenarios that will not be subject to consistency review.

PRODUCTS: 2) A statement establishing that the differences between key ABAG land use variables and those of the CMA do not differ by more than one percent at the county level for the subject county. A statement establishing that no differences exist at the census-tract-level outside the county between the ABAG forecast or the ABAG/CMA revised forecast.

3) A table comparing the ABAG land use estimates with the CMA land use estimates by county for population, households, jobs, and employed residents for both the base year and the horizon year.

4) If land use estimates within the CMA's county are modified from ABAG's projections, agendas, discussion summaries, and action items from each meeting held with cities, MTC, and/or ABAG at which the redistribution was discussed, as well as before/after census-tract-level data summaries and maps.

C. Pricing Assumptions:

Use MTC's automobile operating costs, transit fares, and bridge tolls or provide an explanation for the reason such values are not used.

PRODUCT 5: Table comparing the assumed automobile operating cost, key transit fares, and bridge tolls to MTC's values for the horizon year.

D. Network Assumptions:

Use MTC's regional highway and transit network assumptions for the other Bay Area counties. CMAs should include more detailed network definition relevant to their own county in addition to the regional highway and transit networks. For the CMP horizon year, to be compared with the TIP interim year, regionally significant network changes in the base case scenario shall be limited to the current Transportation Improvement Program (TIP) for projects subject to inclusion in the TIP.

PRODUCT 6: Statement establishing satisfaction of the above.

E. Automobile ownership:
Use *Travel Model One* automobile ownership models or forecasts, *BAYCAST-90* automobile ownership models, or submit alternative models to MTC for review and comment.

PRODUCT 7: County-level table comparing estimates of households by automobile ownership level (zero, one, two or more automobiles) to MTC's estimates for the horizon year.

F. Tour/trip generation:
Use *Travel Model One* tour generation models or forecasts, *BAYCAST-90* trip generation models, or submit alternative models to MTC for review and comment.

PRODUCT 8: Region-level tables comparing estimates of trip and/or tour frequency by purpose to MTC's estimates for the horizon year.

G. Activity/trip location:
Use *Travel Model One* activity location models or forecasts, *BAYCAST-90* trip distribution models, or submit alternative models to MTC for review and comment.

PRODUCTS: 9) Region-level tables comparing estimates of average trip distance by tour/trip purpose to MTC's estimates for the horizon year.

10) County-to-county comparison of journey-to-work or home-based work flow estimates to MTC's estimates for the horizon year.

H. Travel mode choice:
Use *Travel Model One* models or forecasts, *BAYCAST-90* models, or submit alternative models to MTC for review and comment.

PRODUCT 11: Region-level tables comparing travel mode share estimates by tour/trip purpose to MTC's estimates for the horizon year.

I. Traffic Assignment
Use *Travel Model One* or *BAYCAST-90* models, or submit alternative models to MTC for review and comment.

PRODUCTS: 12) Region-level, time-period-specific comparison of vehicle miles traveled and vehicle hours traveled estimates by facility type to MTC's estimates for the horizon year.

13) Region-level, time-period-specific comparison of estimated average speed on freeways and all other facilities, separately, to MTC's estimates for the horizon year.

Alternatively, CMAs may elect to utilize MTC zone-to-zone vehicle trip tables, adding network and zonal details within the county as appropriate, and then re-run the assignment. In this case, only Products 12 and 13 are applicable.

APPENDIX D: USER GUIDE

This chapter provides instructions on using the Alameda Countywide Travel Demand Model. Users should be familiar with the CUBE/Voyager modeling environment.

MODEL PROCESS

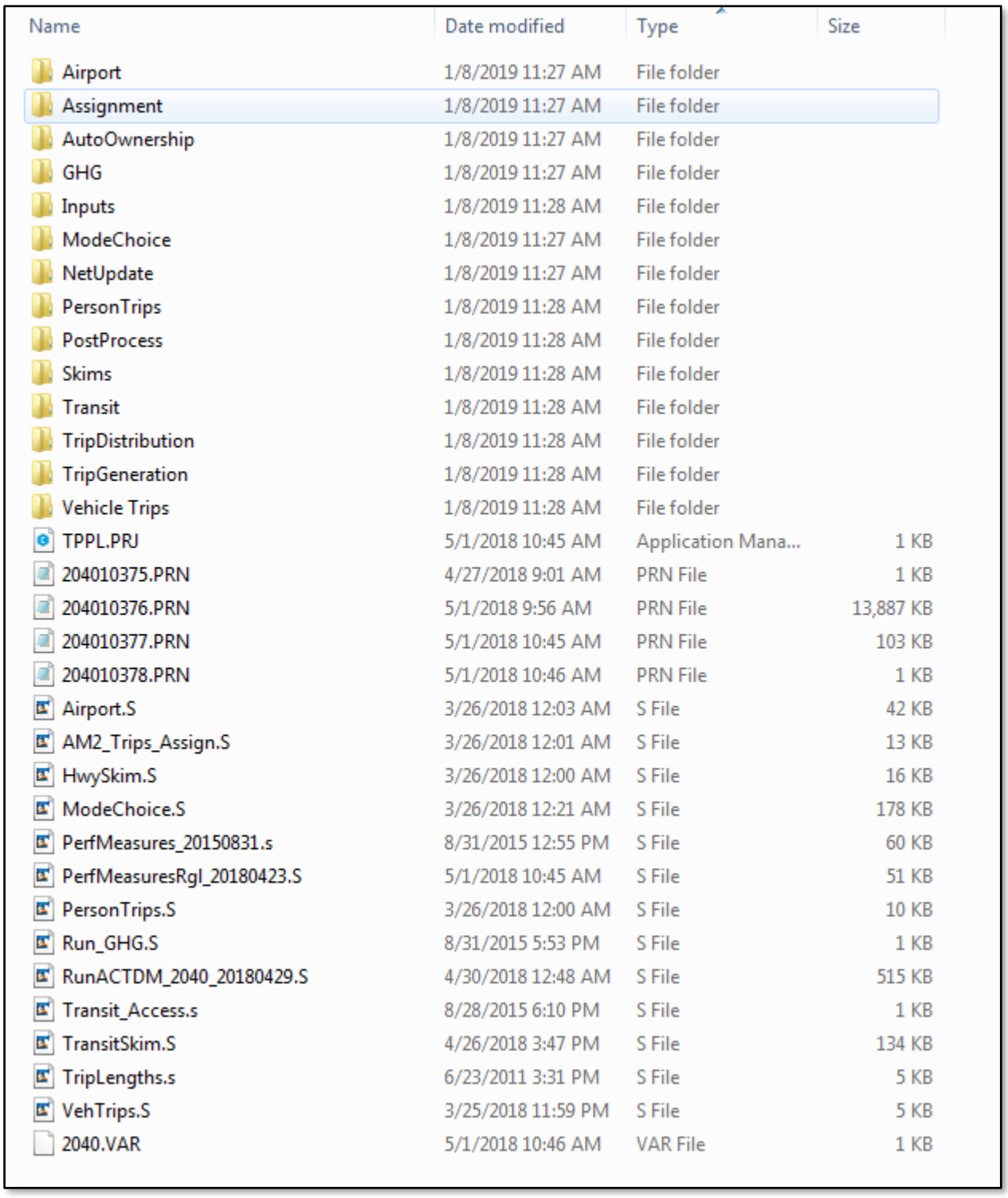
The Alameda Countywide model is a Cube Voyager model that is run using Voyager scripts rather than the Cube Scenario and Application managers. The scripts, input files and output files are contained in a single directory for each scenario (Figure 28). All subdirectories except "Inputs" are created automatically when the model is run.

Plan Bay Area 2040 Update

The Plan Bay Area 2040 update included the following process changes:

- The model script was revised with one main script and seven separate subroutine scripts to allow for easier tracking of the feedback loop process.
- The feedback loop was rewritten to eliminate redundant processes and use the Method of Successive Averaging (MSA) to calculate congested travel times for the next iteration. The number of feedback loop iterations remains at five (5).
- The script that creates the study year road network was updated to allow for three cycles of improvements rather than two, and to calculate additional capacity for segments with advanced traffic management (TOS=2).
- The 2010 script now includes the feedback loop and is identical to the future year scripts.
- A number of additional checks for zero values were added to the mode choice script to minimize model crashes due to zero values in the land use input file.
- Minor corrections to the toll assignment script to ensure that Shared Ride 2 vehicles would be eligible to pay tolls and use express lanes when the HOV requirement increases to 3+ persons.

Figure 28. Alameda County Model Directory Structure

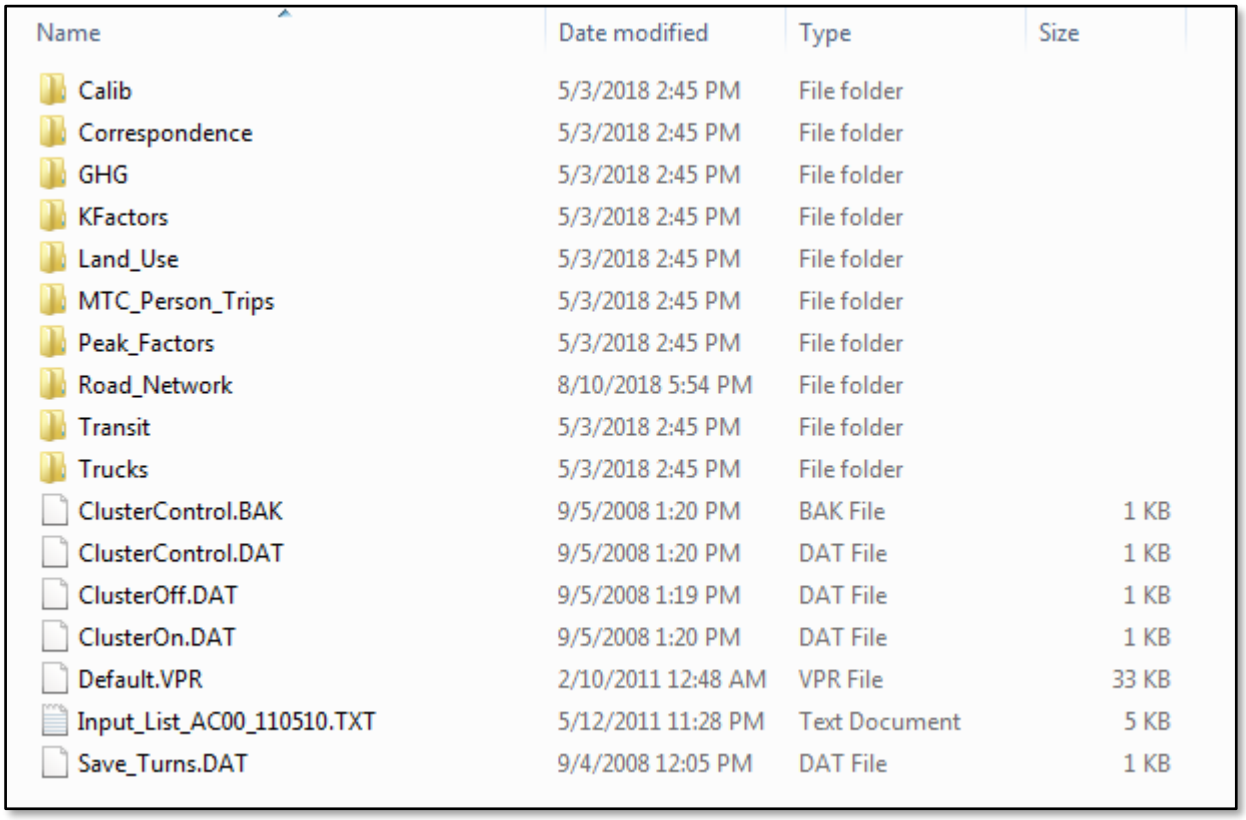


Name	Date modified	Type	Size
Airport	1/8/2019 11:27 AM	File folder	
Assignment	1/8/2019 11:27 AM	File folder	
AutoOwnership	1/8/2019 11:27 AM	File folder	
GHG	1/8/2019 11:27 AM	File folder	
Inputs	1/8/2019 11:28 AM	File folder	
ModeChoice	1/8/2019 11:27 AM	File folder	
NetUpdate	1/8/2019 11:27 AM	File folder	
PersonTrips	1/8/2019 11:28 AM	File folder	
PostProcess	1/8/2019 11:28 AM	File folder	
Skims	1/8/2019 11:28 AM	File folder	
Transit	1/8/2019 11:28 AM	File folder	
TripDistribution	1/8/2019 11:28 AM	File folder	
TripGeneration	1/8/2019 11:28 AM	File folder	
Vehicle Trips	1/8/2019 11:28 AM	File folder	
TPPL.PRJ	5/1/2018 10:45 AM	Application Mana...	1 KB
204010375.PRN	4/27/2018 9:01 AM	PRN File	1 KB
204010376.PRN	5/1/2018 9:56 AM	PRN File	13,887 KB
204010377.PRN	5/1/2018 10:45 AM	PRN File	103 KB
204010378.PRN	5/1/2018 10:46 AM	PRN File	1 KB
Airport.S	3/26/2018 12:03 AM	S File	42 KB
AM2_Trips_Assign.S	3/26/2018 12:01 AM	S File	13 KB
HwySkim.S	3/26/2018 12:00 AM	S File	16 KB
ModeChoice.S	3/26/2018 12:21 AM	S File	178 KB
PerfMeasures_20150831.s	8/31/2015 12:55 PM	S File	60 KB
PerfMeasuresRgl_20180423.S	5/1/2018 10:45 AM	S File	51 KB
PersonTrips.S	3/26/2018 12:00 AM	S File	10 KB
Run_GHG.S	8/31/2015 5:53 PM	S File	1 KB
RunACTDM_2040_20180429.S	4/30/2018 12:48 AM	S File	515 KB
Transit_Access.s	8/28/2015 6:10 PM	S File	1 KB
TransitSkim.S	4/26/2018 3:47 PM	S File	134 KB
TripLengths.s	6/23/2011 3:31 PM	S File	5 KB
VehTrips.S	3/25/2018 11:59 PM	S File	5 KB
2040.VAR	5/1/2018 10:46 AM	VAR File	1 KB

INPUT FILES

All model input files are contained in the subdirectory "Inputs," except for script files which are contained in the main directory for each scenario.

Figure 29: Inputs Subdirectory



Name	Date modified	Type	Size
Calib	5/3/2018 2:45 PM	File folder	
Correspondence	5/3/2018 2:45 PM	File folder	
GHG	5/3/2018 2:45 PM	File folder	
KFactors	5/3/2018 2:45 PM	File folder	
Land_Use	5/3/2018 2:45 PM	File folder	
MTC_Person_Trips	5/3/2018 2:45 PM	File folder	
Peak_Factors	5/3/2018 2:45 PM	File folder	
Road_Network	8/10/2018 5:54 PM	File folder	
Transit	5/3/2018 2:45 PM	File folder	
Trucks	5/3/2018 2:45 PM	File folder	
ClusterControl.BAK	9/5/2008 1:20 PM	BAK File	1 KB
ClusterControl.DAT	9/5/2008 1:20 PM	DAT File	1 KB
ClusterOff.DAT	9/5/2008 1:19 PM	DAT File	1 KB
ClusterOn.DAT	9/5/2008 1:20 PM	DAT File	1 KB
Default.VPR	2/10/2011 12:48 AM	VPR File	33 KB
Input_List_AC00_110510.TXT	5/12/2011 11:28 PM	Text Document	5 KB
Save_Turns.DAT	9/4/2008 12:05 PM	DAT File	1 KB

Calib

The Calib subdirectory contains calibrated model parameters such as trip generation rates, trip distribution friction factors and mode choice coefficients. The model user generally should not have to modify any of these files.

Correspondence

The Correspondence subdirectory contains files that relate the Alameda County model TAZs to other grouping systems such as counties, MTC Superdistricts or MTC RTAZs.

The model user would need to edit the correspondence files if any new TAZs are added to the Alameda Countywide model.

GHG

The GHG subdirectory contains files used to run the EMFAC emissions post-processor. The GHG post-processor uses the EMFAC2007 software which is no longer the current version supported by the California Air Resources Board.

KFactors

The KFactors subdirectory contains trip distribution adjustment factors (K Factors) from the MTC model as well as the county-to- county adjustments to the MTC K Factors used for versions of the Alameda Countywide model prior to the 2014 update. The files in this subdirectory are no longer used. The updated K factors are in the Calib subdirectory.

Land Use

The Land_Use subdirectory contains the ZMAST land use input file. The subdirectory also contains the internal-external and through trips produced by the gateway workbook. The subdirectory also must contain ZMAST00.DBF which is a 2000 land use database used as a reference for the MTC BAYCAST school trip generation calculations.

MTC Person Trips

The MTC_Person_Trips subdirectory contains the person trip outputs from the MTC 2009 RTP BAYCAST mode choice model results for the 2000 calibration year. These trips are used to provide an initial estimate of mode choice to provide for estimation of congested travel times prior to the first run of the Alameda Countywide model mode choice step. There is a script in the subdirectory that reformats the MTC outputs into the form required for the Alameda Countywide model. The model user should not have to modify any of these files.

Peak Factors

The Peak_Factors subdirectory contains district-specific peak spread or diurnal factors for each time period, as well as an Excel workbook that contains original MTC BAYCAST and adjusted versions of the factors, used in versions of the model prior to the 2014 update. The files in this subdirectory are no longer used. The updated peak factors are contained within the model scripts.

Road Network

The Road_Network subdirectory contains the user input master road network, turn penalties and ramp metering rates. When the model is run, there is a process that creates the specific year scenario network from the master network.

The subdirectory also contains files that do not generally need to be modified by the model user, including the 2000 traffic count validation database, the road capacity lookup tables and the lane switch between AM and PM peak periods (such as the Golden Gate Bridge).

Transit

The Transit subdirectory contains inputs relating to the transit system.

The Transit_List files are user inputs that specify which specific versions of each transit operator's transit line files should be used for this model scenario.

Transit Fares

Transit fare inputs are contained in the "tfares" subdirectory. The fares are in 1990 dollars. Most standard bus fares are specified in the "Xfare.far" file. Rail station-to-station fares (such as BART) are specified by service provider.

Transit Lines

The "tlines" subdirectory contains separate transit line files for each provider and service type. The Transit List files are used to specify which line file will be used for each scenario.

Transit Access

The "tsupport" subdirectory contains specifications for walk access and drive access for each of the transit providers. These files should only need editing if new or relocated rail stations or ferry terminals are tested, or if new TAZs are added to the model.

Trucks

The Trucks subdirectory contains the special generator inputs for truck trips, as calibrated during the development of the Alameda County truck model. The truck special generators were calibrated to 2005 conditions, and forecast values should be based on factoring of the 2005 values rather than independent estimates of truck volumes.

Other Inputs

There are several additional input files in the Inputs subdrectory. The Input_List_ files are no longer used in the model. The ClusterControl files do not need to be modified by the user unless a special setup is required to use Cube Cluster on the user's computer.

Save Turns

The file Save_Turns.DAT can be edited in a text editor to specify intersection node numbers where turn movements should be saved during the peak hour traffic assignments.

SCRIPT FILES

The main script file has a file name beginning with "RunACTDM" with ".S" as the file extension. It is recommended that the scenario year and run date be added to the file name, such as "RunACTDM_2040_20180429.S" as an example.

The main script includes the beginning steps of the model run (identify input files, process networks, trip generation, trip distribution) and the final assignment steps. The main script calls the following seven (7) script files which also must be present in the scenario directory:

- HwySkim.S
- TransitSkim.S
- ModeChoice.S
- Airport.S
- PersonTrips.S
- VehTrips.S
- AM2_Trips_Assign.S

Some or all of these seven script files are called during each cycle of the five feedback loops.

PREPARE A MODEL RUN

The basic steps to run the Alameda Countywide model are:

- Copy the input files to a new scenario directory
- Edit the land use and/or network inputs
- Edit other inputs if needed (nodes for turn movements, turn penalties, etc…)
- Edit the top portion of the model script to specify input files
- Run the script in Cube Voyager

Copy Files

Copy files from the model run closest to the scenario year (for example, copy 2020 for a 2025 model run) to a new scenario directory. The files to be copied are:

- The script files (*.S) in the main directory
- The Inputs subdirectory

These are all of the files required to generate a new model run. All other subdirectories and files will be created when the model is run.

Edit Land Use

Land use changes are input by editing the zmast input file. The zmast file is in DBF format, which can be read in MS Excel but cannot be saved in DBF format in any versions of Excel after Excel 2003. Options to edit the file include:

- Edit the file in Cube
- Edit the file in Excel and use MS Access to save the edited sheet to DBF format
- Maintain an old version of Excel 2003 alongside the newer MS Office products on the computer

The fields in the ZMAST file are listed in Table 63. In general, the user will edit the numbers for total, single-family and multi-family households and/or employees by type. Other household and population numbers should then be recalculated in proportion the changes in household numbers. The total employment should also be updated to equal the total of all six employment types.

Edit Road Network

Road network changes are made in the master network format. Road improvements can be moved to different implementation years by revising the IMPx_Year field rather than deleting long-term improvements. For example, changing the improvement year to 9999 will ensure that the improvement is not included in the scenario, but allows for later testing of scenarios with the improvement.

It is strongly recommended that all transit line files in the editing area be read into Cube prior to changing the road network. If road links are split, Cube will automatically update the overlying transit lines. The user must remember to save the transit line files after edits are made to the road network.

It is often useful to check the turn penalty input file and the Ramp_Metering input file to make sure that the assumptions are valid for the specific study area.

Edit Transit Network

Transit network edits are made on individual line files. These changes would include routing and peak (FREQ[1]) and off-peak (FREQ[2]) frequencies. The RUNTIME parameter is no longer used, and bus times are calculated from congested road times using the TIMEFAC parameter.

Changes in rail transit or ferries must also consider the "tsupport" files, which specify connections for walk and drive access to stations. These files must also be updated if new TAZs are added to the network.

Table 63: ZMAST Field Descriptions

Field	Description	Comments
Geographic Inputs		
ZONE	Alameda Countywide model Transportation Analysis Zone (TAZ)	
DIST	MTC Superdistrict	34 Superdistricts in 9 county Bay Area, DIST=35 added for San Joaquin County
SDIST	MTC Superdistrict	Duplicate of DIST
COUNTY	County code	1=San Francisco 2=San Mateo 3=Santa Clara 4=Alameda 5=Contra Costa 6=Solano 7=Napa 8=Sonoma 9=Marin 10=San Joaquin
Residential Inputs		
TOTHH*	Total households	Not equivalent to housing units as it accounts for vacancies
HHPOP**	Household population	Excludes group quarters
TOTPOP**	Total population	Includes group quarters
EMPRES**	Employed residents	
SFHH*	Single-family households	
MFHH*	Multi-family households	
HH1,HH2,HH3,HH4**	Households by income quartile	Number of total households in each income quartile, incomes in 1990 dollar values: Quartile 1: <$25,000 Quartile 2: $25,000-$45,000 Quartile 3: $45,000-$75,000 Quartile 4: >$75,000
INC1,INC2,INC3,INC4	Mean incomes by quartile	Mean household income for each quartile.
MHHINC	Mean household income	All households
Acreage Inputs		
TACRES	Total acres in TAZ	May be greater than sum of RESACRE and CIACRE
RESACRE	Residential acres in TAZ	
CIACRE	Net commercial/industrial acres in TAZ	

Table 63: ZMAST Field Descriptions

Field	Description	Comments
Population Share		
Z2SHARE	Share of total population age 62 and over	
Employment Inputs		
TEMP*	Total employment	
RETEMP*	Retail employment	Does not include restaurants
SEREMP*	Service employment	Includes restaurants
OTHEMP*	Other employment	Includes construction, utilities
AGEMP*	Agricultural employment	Includes landscaping, animal care
MANEMP*	Manufacturing employment	
WHOEMP*	Wholesale trade employment	
School Inputs		
AGE0519**	Population ages 5 to 19	
AGE2044**	Population ages 20 to 44	
HSENR*	High school enrollment	
COLLENR*	College enrollment, total	Sum of COLLENRF and COLLENRP
COLLENRF*	College enrollment, full time	
COLLENRP*	College enrollment, part time	
City Name		
CITY	City where majority of TAZ is located	
Worker Income Inputs		
WQ1A, WQ2A, WQ3A, WQ4A	Workers at work by household income quartile	
TOTWA	Total workers at work	Not identical to sum of WQ1A, WQ2A,WQ3A,WQ4A
School Inputs, Additional		
SHR_GS	Share of persons age 5-13 out of persons age 5-19	
SHR_HS	Share of persons age 14-17 out of persons age 5-19	
SHR_COLC	Share of persons age 18-19 out of persons age 5-19	
SHR_COLA	Share of persons age 20-24 out of persons age 20-44	
SHR_COLB	Share of persons age 25-44 out of persons age 20-44	

Table 63: ZMAST Field Descriptions

Field	Description	Comments
SHARE1819	Share of persons age 18-19 enrolled in college	
SHARE2024	Share of persons age 20-24 enrolled in college	
SHARE2544	Share of persons age 25-44 enrolled in college	
AHBGSP	Calibration Adjustment Factor for HBGS Productions	
AHBHSP	Calibration Adjustment Factor for HBHS Productions	
AHBCOLP	Calibration Adjustment Factor for HB College Productions	
AHBGSA	Calibration Adjustment Factor for HBGS Attractions	
AHBHSA	Calibration Adjustment Factor for HBHS Attractions	
AHBCOLA	Calibration Adjustment Factor for HB College Attractions	
Auto Parking and Access Inputs		
PRKCST*	Peak period parking cost	Cents, in 1990 dollar values
WTERMP	Walk Terminal Time, Production Zone, Peak	Hundredths of minutes
WTERMA	Walk Terminal Time, Attraction Zone, Peak	Hundredths of minutes
PTERMP	Park Terminal Time, Production Zone, Peak	Hundredths of minutes
PTERMA	Park Terminal Time, Attraction Zone, Peak	Hundredths of minutes
ACTIMEP	Zonal Access Terminal Time, Production Zone, Peak	Hundredths of minutes
ACTIMEA	Zonal Access Terminal Time, Attraction Zone, Peak	Hundredths of minutes
OPRKCST*	Off-peak period parking cost	Cents, in 1990 dollar values
OWTERMP	Walk Terminal Time, Production Zone, Off peak	Hundredths of minutes
OWTERMA	Walk Terminal Time, Attraction Zone, Off peak	Hundredths of minutes
OPTERMP	Park Terminal Time, Production Zone, Off peak	Hundredths of minutes
OPTERMA	Park Terminal Time, Attraction Zone, Off peak	Hundredths of minutes

Table 63: ZMAST Field Descriptions

Field	Description	Comments
OACTIMEP	Zonal Access Terminal Time, Production Zone, Off peak	Hundredths of minutes
OACTIMEA	Zonal Access Terminal Time, Attraction Zone, Off peak	Hundredths of minutes
ACDISTP	Zonal Access Terminal Distance, Production Zone	Hundredths of miles
ACDISTA	Zonal Access Terminal Distance, Attraction Zone	Hundredths of miles
Accessibility Inputs		
AREATYPE	Area Type	Based on density = (Total Population + 2.5*Total Employment)/(RESACRES + CIACRES) 0=Regional Core (>300) 1=CBD (100-300) 2=Urban Business (55-100) 3=Urban (30-55) 4=Suburban (6-30) 5=Rural (<6)
HWYACC	Highway accessibility factor	No units, recalculated during model process
TRACC	Transit accessibility factor	No units, recalculated during model process
MTC Zone		
Z1454	Corresponding MTC regional TAZ	

Notes

*Indicates field that is frequently edited by model users

**Indicates field that is typically recalculated in proportion to changes in housing units

Set User Inputs

The top section of the main script must be edited for each scenario to call the correct input files for land use, networks and other inputs. The locations of these input settings are shown in Figure 30, Figure 31 and Figure 32. The key inputs are listed in Table 64.

Figure 30: Model Script Input Settings, Section 1

```
;;<<VOYAGER>>;;
;============================================================================
; This section is updated for each model alternative.
;
;-----------------
; Set User Inputs
;-----------------

INP_Year        = 2040

ZONES   = 4500
NumZones        = 4500

; Network Input Files

INP_NetMaster   = 'AlamedaCo_MASTER_20180429.net'     ; Master road network
INP_NetYear   = '2040'      ; Used for building correct network year from master network
INP_TurnPen = 'TURNPEN2040.PEN'    ; Use appropriate turn penalty file for network year (2000 for 2000/2005, 2015 for 2015/2035)
INP_RampMeter = 'Ramp_Metering_2040.DBF'  ; Use appropriate ramp metering rates for network year
INP_SaveTurns = 'SAVE_TURNS.DAT'     ; Use to define nodes at which to save assigned turn volumes

; Land Use Input Files

INP_Landuse   = 'ZMAST40_20180425.DBF'      ; Land use scenario for alternative being analyzed; IF ZMAST...
INP_IX_Ptrips = 'AC40IXXI.DBF'     ; Internal/external P/A person trips for appropriate analysis year
INP_XX_Vtrips = 'AC40XX.DBF'      ; External through vehicle trips for appropriate analysis year
INP_Landuse2000 = 'ZMAST00.DBF'     ; FIXED: 2000 base year PUMA data used for all years in trip generation
INP_SG            = 'PORT_SG_2040.DBF'          ; Truck special generators

; Trip Distribution Iterations

; Number of gravity model iterations (standard is 99)
INP_Iter_TripDist   = 99

; Mode Choice Inputs

INP_MTC_Year  = 'MTC2000'     ; MTC mode choice data for appropriate year
;INP_Z_ACC  = 'ZACC00'

```

Figure 31: Model Script Input Settings, Section 2

```
; Auto Operating Cost Assumptions (in 1990 dollars)
;  Consumer Price Index Values:
;    1990:  130.7
;    2000:  172.2
;    2010:  218.1
;    2017:  245.1
;    Conversion 2000 to 1990 = 130.7/172.2 = 0.76

; P2009 Calibrated Values:
;   Gas Cost = 6.13 cents/mile - assumed 129.6 cents/gallon (1990 dollars) and 22 MPG Fuel Efficiency
;     Equivalent of $1.70/gallon in 2000 or $2.06/gallon in 2007
;   Non-Gas Costs = 4.09 cents/mile
;
; MTC Plan Bay Area 2040
;  Average auto operating cost in 2000 Dollars is 0.17/mile
;  1990 dollars = 0.17*0.76=0.13
;  Split as 60% gas, 40% non-gas
;
 INP_GCOST       = 7.80
 INP_NGCOST      = 5.20
;
; Bridge Tolls (1990 cents)
;
INP_TOLL_BEN = 379.94
INP_TOLL_CAR = 379.94
INP_TOLL_RSR = 379.94
INP_TOLL_GGB = 339.23
INP_TOLL_BAY = 434.22
INP_TOLL_SMH = 379.94
INP_TOLL_DUM = 379.94
INP_TOLL_ANT = 379.94
;
; Express Lane Tolls (1990 cents per mile)
; Numbering and toll values consistent with MTC PBA 2040 network
;
INP_EL_12_AM = 0.0  ; I-80, I-580 to Carquinez Bridge, EB
INP_EL_12_PM = 26.6 ; I-80, I-580 to Carquinez Bridge, EB
INP_EL_84_AM = 30.4 ; I-80, I-580 to Carquinez Bridge, WB
INP_EL_84_PM = 30.4 ; I-80, I-580 to Carquinez Bridge, WB
INP_EL_14_AM = 0.0  ; I-80, Red Top to I-505, EB
INP_EL_14_PM = 0.0  ; I-80, Red Top to I-505, EB
```

Figure 32: Model Script Input Settings, Section 3

```
INP_EL_16_AM = 9.9  ; I-880, US 101 to Hegenberger, SB
INP_EL_16_PM = 3.8  ; I-880, US 101 to Hegenberger, SB
;
; Airport Inputs
;
; Number of daily enplanements requiring ground access at Oakland Airport
;   Calculated as (Annual Air Passengers) /365 * 96% origin/destination in Bay Area (4% transfer)
; Oakland passenger forecasts from 2000 RASP and BART OAC EIS, converted to average daily ground access trips:
;   1999: 24,600
;   2005: 35,100
;   2010: 25,000
;   2020: 65,000
; 25,000 assumed for 2010 base year

; 2040
 INP_OAK_Passengers    =  61700
 INP_SFO_Passengers    =  159100
 INP_SJC_Passengers    =  48200

; Traffic Assignment Iterations

; Number of assignment iterations for AM and PM 1-Hour (standard is 50)
INP_Iter_Peak   = 50

; Number of assignment iterations for Daily, PM 4-Hour and AM 4-Hour temporary assignment (standard is 20)
INP_Iter_Other  = 20
;
; Greenhouse Gas Calculation Input File
;
GHG_Input_File = 'Alameda_2000'
;
; Run Cube Cluster
;
INP_RunCluster = 'Y'
```

Table 64: Input Settings in Main Model Script

Input	Description
General Inputs	
INP_Year	Year of the model scenario (such as 2035)
ZONES	Value should remain at 4500
NumZones	Value should remain at 4500
Network Input Files	
INP_NetMaster	File name for master network in Inputs\Road_Network subdirectory
INP_NetYear	Year to designate level of improvements to use in master road network (can be different than INP_Year)
INP_TurnPen	File name for turn penalty file network in in Inputs\Road_Network subdirectory
INP_RampMeter	File name for ramp metering rates in in Inputs\Road_Network subdirectory
INP_SaveTurns	File name for text file containing list of nodes to report turn movements, in Inputs subdirectory
Land Use Input Files	
INP_Landuse	File name for land use scenario in in Inputs\Land_Use subdirectory
INP_IX_Ptrips:	File name for internal/external trips from gateway workbook in in Inputs\Land_Use subdirectory
INP_XX_Vtrips	File name for through trips from gateway workbook in in Inputs\Land_Use subdirectory
INP_Landuse2000	File name ZMAST00.DBF which is a 2000 land use database used as a reference for the MTC BAYCAST school trip generation calculations
INP_SG	File name for truck special generators in in Inputs\Trucks subdirectory
Miscellaneous	
INP_Iter_TripDist	Iterations for trip distribution gravity model, set at 99
INP_MTC_Year	MTC mode choice data for initial estimates, set at MTC2000 for all scenario years as of 2014 model update
Pricing Inputs	
INP_GCOST	Gas cost per mile in 1990 cents (set at 7.80 for PBA 2040)
INP_NGCOST	Non-gas auto operating cost per mile in 1990 cents (set at 5.20 for PBA 2040)
INP_TOLL_xxx	Bridge tolls in 1990 cents, set at values consistent with PBA 2040
INP_EL_xx_xx	Express lane tolls in 1990 cents per mile, set at values consistent with PBA 2040
Airport Inputs	
INP_OAK_Passengers	Daily average air passengers requiring ground access at Oakland International Airport based on RASP
INP_SFO_Passengers	Daily average air passengers requiring ground access at San Francisco International Airport based on RASP
INP_SJC_Passengers	Daily average air passengers requiring ground access at San Jose International Airport based on RASP
Model Run Inputs	
INP_Iter_Peak	Traffic assignment iterations for AM and PM 1-hour (set at 50)
INP_Iter_Other	Traffic assignment iterations for other periods (set at 20)
GHG_Input_File	File name if EMFAC emissions calculations are being run
INP_RunCluster	"Y" if the computer has Cube Cluster available, otherwise set to "N"

RUN THE MODEL

Once the input files are prepared, the following steps are used to run the model.

1. Start the Cube software
2. Open the file "RunACTDM_xxxxxxx.S" in the correct scenario directory
3. Select Run from the top menu and then Current File. A Voyager run window will appear.
4. In Project Prefix, type in a 3 or 4 character identifier which will be part of each output file name (for example, "AC35" or "Alt1").
5. (OPTIONAL) In Run ID, type in a description of the model run.
6. Click Start.
7. Model run is complete when it indicates in the Cube Run Window.

If the GHG processor has been included in the model run, the model run will stop with the window for the Emfac software still open. This window cannot be closed automatically. Close the window to complete the model run.

OUTPUT FILES

Output files generated by the model run will be located in appropriate sub-directories. Important output files and their locations are listed in Table 65. The code "xxxx" is a placeholder for a four (or three) character file prefix selected by the user when starting each model run.

Table 65: Model Output Files

Output Information	File Name	Location
Person trips by TAZ by purpose	xxxx_[TripPurpose]PA.DBF	\TripGeneration
Trip distribution and summaries	xxxx_[TripPurpose].MAT xxxx_CO2CO.MAT (county summary)	\TripDistribution
Person trips by mode by trip purpose	xxxx_PTrips_[TripPurpose].MAT	\PersonTrips
Road network with volumes for all periods	xxxx_MERGE.NET	\Assignment
Transit volumes	xxxx_TR_Links_[Submode]_[Period].DBF (13 files) xxxx_Transit_Assign_[Period]_[Submode].PRN (13 files)	\Transit\tassign