TRI-VALLEY INTEGRATED TRANSIT AND PARK-AND-RIDE STUDY

FINAL REPORT SUBMITTED MAY 2017

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Executive Summary

Background

The Tri-Valley Integrated Transit and Park-and-Ride Study emerged from the concerns of three cities in the Tri-Valley – Dublin, Pleasanton and Livermore – and LAVTA – the bus operator in the Tri-Valley – about the persistent traffic congestion and how commuters in the Tri-Valley travel to and from area transit services. Traffic congestion in the area continues to increase, but available parking at the two BART and three ACE stations in the area is relatively constrained, limiting the options for new patrons wishing to access transit alternatives. There are four park-and-ride lots in the Tri-Valley, and most have adequate capacity for more users, but these facilities are not currently attracting many BART and ACE users.

In 2013, the three Tri-Valley jurisdictions and LAVTA developed a scope of work for a study of how to enable greater connections between park-and-rides and transit in the Tri-Valley. The stated goal of the study was to identify potential changes and improvements in satellite park-and-ride lots (including multi-modal access to the facilities) and local transit service to increase the use of rail and bus services in the Tri-Valley; reduce single-occupancy vehicle (SOV) trips and vehicle miles traveled (VMT); and facilitate a coordinated, efficient, and sustainable transportation system in Alameda County's portion of the Tri-Valley area. The jurisdictions and LAVTA submitted the study to the Alameda County Transportation Commission's Sustainable Communities Technical Assistance Program (SC-TAP), and the study was selected for SC-TAP funding in early 2014.

The Study Process

There were four technical tasks for this study, the results of which are summarized here in this final report. Further details are provided in the Appendices to the report that cover each of the technical tasks:

- An Existing Conditions Assessment of all nine park-and-ride facilities

- A Travel Behavior and Market Analysis of current and future demand, which included a user survey
- Development and Evaluation of Potential Improvement Measures
- Development of an Implementation Strategy

The project management has come from the Alameda CTC while the study development was guided by a Technical Advisory Committee (TAC) consisting of the three cities in the Tri-Valley (Dublin, Pleasanton, and Livermore), the three primary transit providers (BART, ACE, and LAVTA), Alameda County, Caltrans, and MTC. All technical documents were reviewed closely by the TAC members, particularly the Tri-Valley jurisdictions, BART, and LAVTA, and finalized after addressing their comments.

Summary of Improvement Measures

The technical analysis conducted during this study confirmed that improvements to various park-and-ride facilities and services in the Tri-Valley can deliver transportation benefits that will reduce SOV trips and VMT to the study area. Given the patterns of travel demand anticipated over the next fifteen years, it is expected that some or all of the improvement measures described below would be promising elements of an overall strategy for managing congestion during peak hours. One or more of the short-term strategies could be implemented in any order within the next three to five years and the rest within the next fifteen years.

Potential Short-Term Measures

- Initiate high-frequency shuttle service during peak commute period from the Airway park-and-ride lot in Livermore owned by BART to the Dublin/Pleasanton BART station as a pilot test of the service concept.
- Construct a new park-and-ride lot in Pleasanton at Bernal Avenue.
- Construct a new parking garage at the Dublin/Pleasanton BART station adding 550 net new spaces to the existing parking capacity at the station.
- Construct facility enhancements at all park-and-ride lots in the study area.
- Deploy ITS enhancements to better integrate transit and park-and-ride facilities more closely together, including: transit signal priority treatments; real-time vehicle arrival/departure information: and real-time parking occupancy information.

- Facilitate use of park-and-ride lot capacity for private employer shuttles via pricing policy.
- Implement parking pricing and management strategies to maximize facility utilization and to make payments, pricing integration, and enforcement both easy and cost-effective.

Potential Long-Term Measures

- Expand the park-and-ride lot at Airway to 500 spaces. When the BART extension to Livermore occurs in the long-term, it is anticipated that the expanded Airway lot would be converted to parking for the new station and the shuttle service would no longer be needed.
- Add high-frequency peak period shuttle service from the Bernal lot to the West Dublin/Pleasanton BART station.
- Construct a new park-and-ride lot owned by BART at Greenville Road and I-580, and provide high-frequency peak period shuttle service to the nearest BART station (Dublin/Pleasanton or a new Livermore station).
- Extend ITS improvements and parking management strategies to new park-and-ride lots, as appropriate.

Taken together, the implementation of the short-term and long-term improvement measures would lead to improvements across all three performance metrics. It is estimated that in 2030, the full set of improvement measures would lead to roughly 2200 additional daily parkers, about 2000 additional daily transit trips, and a reduction of about 1800 single-occupant vehicle commute trips. That would result in almost 105,000 fewer vehicle miles of travel per workday or over 26 million fewer vehicle miles of travel per year.

Moving Forward

Each of the individual improvement measures described in the previous section can be pursued independently at the discretion of the respective facility owners, on whatever timeline is most appropriate for the responsible jurisdiction or agency. At the same time, the transportation landscape in the Tri-Valley is currently undergoing rapid changes, with the jurisdictions and agencies in the area launching multiple initiatives to pilot new transportation concepts in the study area, such as LAVTA's Go Dublin! effort and the Carpool to BART program. Implementation of any measures identified in this study should be coordinated with on-going and other future activities contemplated within the study area, not just the current set of identified improvements. Pursuing enhanced coordination between the stakeholders in the Tri-Valley can help capture the synergies between projects and improve overall implementation of transportation improvement measures in the years ahead.

Study Overview

Background, Historical Context and Need for the Study

The Tri-Valley area has seen increasing highway congestion in recent years. The new I-580 Express Lanes project and planned improvements to upgrade BART's system infrastructure and expand their fleet will help alleviate current conditions, but future development and growth are likely to put additional pressure on the roadway system over the long run. Although existing rail transit in the area provides a potential alternative, parking demand is close to or greater than available capacity at most BART and ACE stations in the study area. In particular, both BART garages in the Tri-Valley are consistently full, and approximately 6,700 commuters are on the permit waiting list for the reserved parking at the two BART stations. Clearly, travelers need additional choices for accessing fixed-route transit and alternative travel options.

In 2013, considering the several existing park-and-ride facilities in the Tri-Valley area in addition to the rail station parking and the connection LAVTA buses provide for these lots, local jurisdictions in the Tri-Valley along with LAVTA decided to explore options to improve the attractiveness of area park-and-ride facilities in order to help shift commuters into transit and carpools, and to increase throughput without adding single occupancy vehicle trips. The jurisdictions and LAVTA developed a combined scope of work and submitted it to the Alameda County Transportation Commission's Sustainable Communities Technical Assistance Program (SC-TAP). Funded by One Bay Area Grant program federal funding and local Measure B funding, SC-TAP is intended to enable implementation of local complete streets policies, transit supportive land use projects, or bicycle and pedestrian improvement projects. The Tri-Valley Integrated Transit and Park-and-Ride Study was one of ten projects selected for SC-TAP funding in early 2014.

This is an effort that is very important to the Tri-Valley, but it is also of much broader interest in the greater Bay Area because of the commonality of issues that are being faced in many other locations. There is increasing interest in understanding how satellite park-and-ride lots can support transit, and the solutions identified in this study could have broader applicability in other locations.

Study Objectives

This study is an inter-jurisdictional and inter-agency study that addresses the high levels of congestion on freeways (I-680 and I-580), and excessive parking demand existing for the BART parking through a comprehensive, integrated and effective park-and-ride and transit strategy for the Alameda County's portion of the Tri-Valley area. The stated goal of the study is to identify potential changes and improvements in satellite park-and-ride lots (including multi-modal access to the facilities) and local transit service to increase the use of rail and bus services in the Tri-Valley; reduce single-occupancy vehicle (SOV) trips and vehicle miles traveled (VMT); and facilitate a coordinated, efficient, and sustainable transportation system in Alameda County's portion of the Tri-Valley area. Combined with other current efforts, efficiently utilizing and upgrading existing satellite park-and-ride lots, integrating the use of park-and-rides with private commuter shuttle pick-up/drop-off sites, incorporating new park-and-ride facilities, and improving park-and-ride connectivity will help meet the growing need for movement of people and goods in the Tri-Valley, positioning the area for success.

This effort was a focused technical study that has been conducted in order to inform future decision-making in the Tri-Valley. In particular, the scope of this study was focused on improving the attractiveness of park-and-ride lots in the study area and making better connections between those lots and existing transit, rather than on a broad survey of options for improving overall access to transit throughout the Tri-Valley. A variety of stakeholders involved in this study are also developing their own plans and projects designed to enhance Tri-Valley transit services in general, including infrastructure investments, technology demonstrations, and partnerships with innovative transportation providers. A comparative analysis of the costs and benefits of those other initiatives is beyond the scope of this study. It is expected that any jurisdiction or agency considering implementation of the improvement measures developed during this study will do more in-depth analysis of the refined costs and likely benefits of all potential solutions available at that time, and that they will make a final determination guided by their adopted policies and local context.

Study Partners

The project management has come from the Alameda CTC while the study development was guided by Technical Advisory Committee (TAC) consisting of three cities in the Tri-Valley (Dublin, Pleasanton, and Livermore), the three primary transit providers (BART, ACE, and LAVTA), Alameda County, Caltrans, and MTC. All technical documents were reviewed closely by the TAC members, particularly the Tri-Valley jurisdictions, BART, and LAVTA, and finalized after addressing comments. The study also benefitted from input provided by other stakeholders, including employers who operate commute shuttles, the transportation providers that operate the employer-based shuttles, and individual commuters in the Tri-Valley.

Existing Facilities, Services and Utilization

The Tri-Valley is currently served by five transit station parking facilities and four satellite park-and-ride lots, referred to in this report as "park-and-ride lots." These are depicted in Figure 1, which also shows the number of available spaces at each facility and the percentage of these spaces occupied on a typical weekday based on data collection in 2015.

Long-haul rail transit service is provided by BART with two stations: West Dublin/Pleasanton with a parking capacity of 1190 spaces and the Dublin/Pleasanton Station with 2886 spaces. The Altamont Commuter Express (ACE) has three stations: Pleasanton Station (parking owned by the Alameda County Fairgrounds) with 498 parking spaces, Livermore Station with 133 spaces allocated in the city–owned downtown Livermore Garage which has a total of 567 spaces, and the Vasco Station (owned by the City of Livermore) with 215 parking spaces in two adjacent lots.

There are four existing park-and-ride lots: located on Johnson Drive in Pleasanton (owned by the City of Pleasanton) with 92 spaces, on Tassajara Road in Dublin (owned by the City of Dublin) with 200 spaces, on East Airway Boulevard in Livermore (a BART owned lot) with 153 spaces and Portola Avenue in Livermore (a Caltrans-owned lot) with 94 spaces.

In addition to the fixed rail transit noted above, LAVTA is the main bus operator in the area. LAVTA's Wheels bus service currently offers fourteen bus routes that connect all but one of the park-and-ride lots and the rail transit stations in the study area as indicated in Figure 2. During the course of this study, LAVTA undertook a restructuring of its routes, and a connection between the Airway lot and BART was discontinued. There is also County Connection service from I-680 to the West Dublin/Pleasanton Station, mainly serving riders from Contra Costa County.

Figure 1
Transit Station Parking Facilities and Park-and-Ride Lots

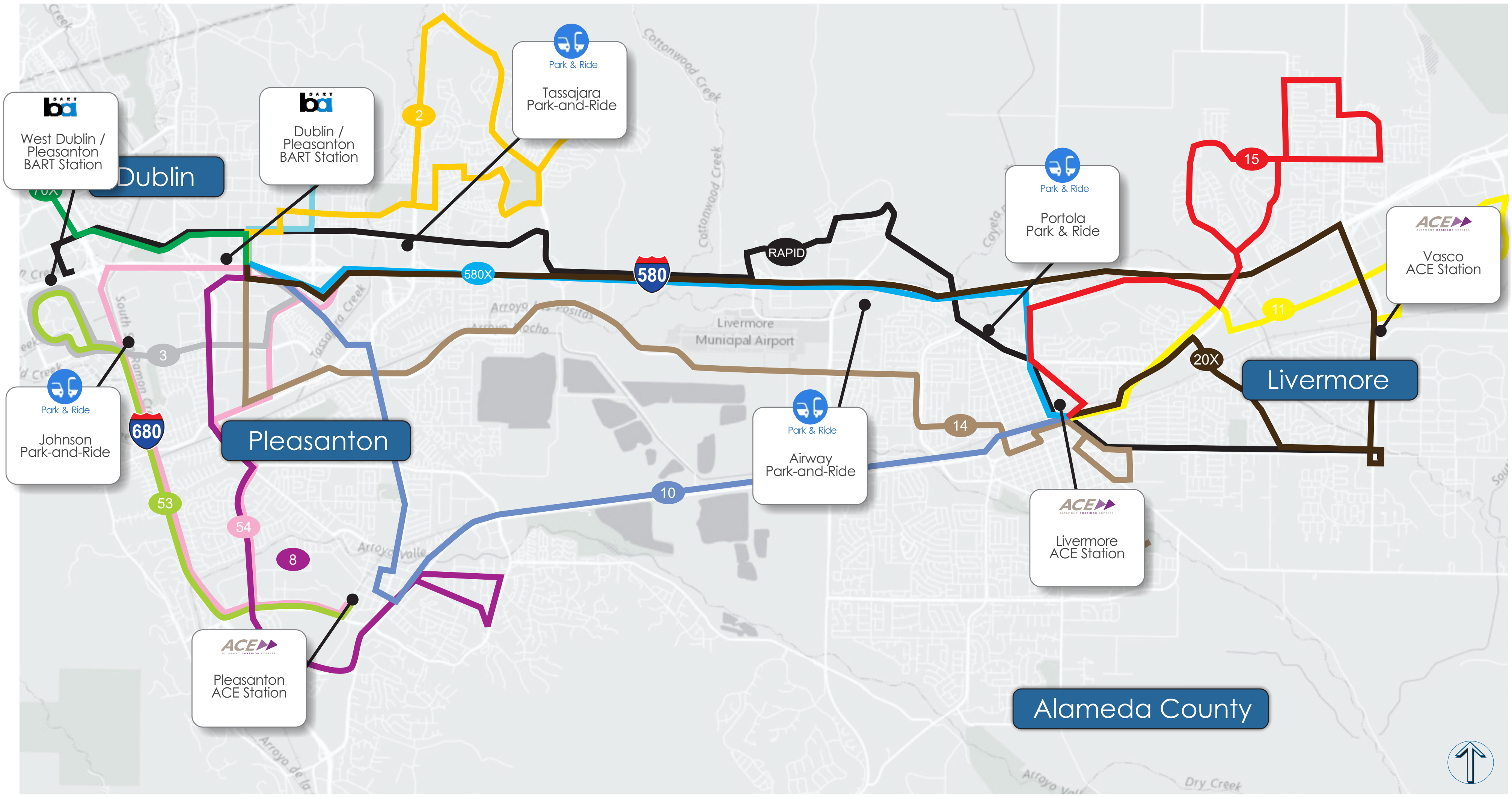
LEGEND

- Existing Park-and-Ride Locations
- BART Station
- ACE Station

(XX) (XX%) - Capacity (Utilization as of October 2015)

ALAMEDA County Transportation Commission

Figure 2
LAVTA Wheels Service Implemented in August 2016



LEGEND

LAVTA Wheels Routes

- 1
- 2
- 3
- 8
- 10
- 11
- 14
- 15
- 20X
- 53
- 54
- 70X
- 580X
- RAPID

- Existing Park-and-Ride Locations
- BART Station
- ACE Station

Tri-Valley Integrated Transit and Park-and-Ride Study

The Study Process

The study team's approach to this effort had three main cornerstone features:

- A data-driven approach to identifying potential improvements;
- Development of a comprehensive and integrated transit park-and-ride framework that recognizes the needs and contributions of all of the suppliers of transit service, parking spaces and other supporting services; and
- Development of a realistic implementation strategy that will consider funding options and partnerships involving all of the key public stakeholders represented on the TAC as well as the private sector.

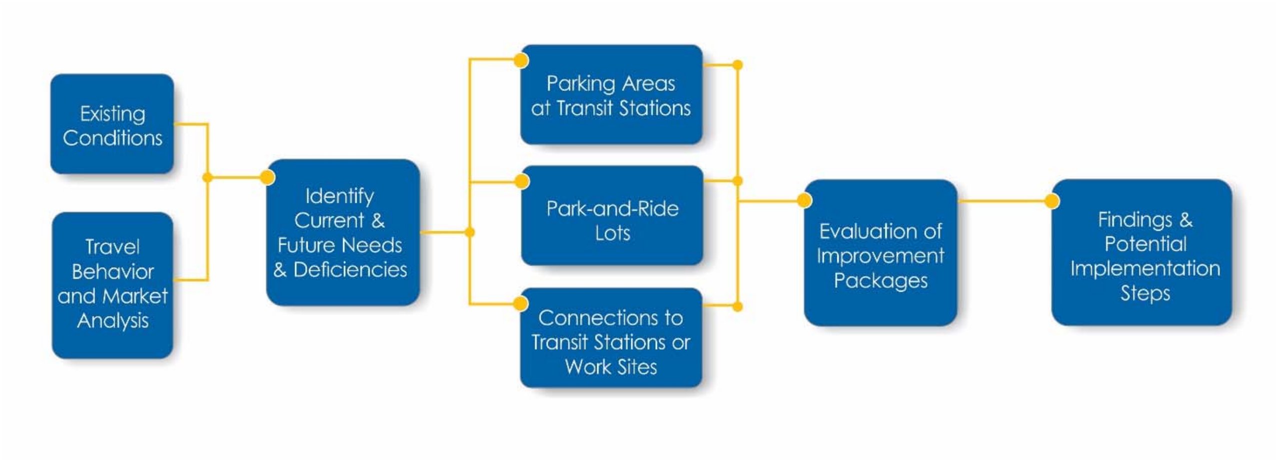
The major technical elements of the study process are depicted in Figure 3. The study began with an extensive Existing Conditions Assessment of all nine major parking facilities (BART and ACE station parking and the four park-and-ride lots) and a Travel Behavior and Market Analysis. These tasks were conducted with the specific intention of generating ideas for what kind of improvements would be most likely to increase transit ridership, reduce SOV use, and reduce VMT.

The evaluation phase of the study leveraged a wide variety of data sources and analytical tools including:

- Field survey of facility conditions
- Manual counts and video observation of facility utilization
- Intercept survey of park-and-ride users
- Inventory of private employer shuttles
- Web-based survey of Tri-Valley commuters
- Interviews with employers who offer private shuttles

The data and findings from these methods supplemented the outcome of travel demand modeling of current and future travel demand behavior, in order to examine the benefits of additional potential improvements and test what-if scenarios.

Figure 3: Diagram of Study Process



In addition to the summary of the study results presented in the remainder of this report, further details are provided in four Appendices to the report that describe the technical methods and detailed findings, grouped as follows:

- Appendix A - Existing Conditions Assessment
- Appendix B - Travel Behavior and Market Analysis
- Appendix C - Evaluation of Potential Park-and-Ride Facilities, Supporting Bus Service and Amenities
- Appendix D - Implementation Strategy

Existing Conditions Assessment

The first technical task undertaken in this study was an assessment of the capacity, utilization, and condition of the transit station parking facilities and the park-and-ride lots in the study area. Appendix A provides a detailed report on the Existing Conditions Assessment activities and their results. The Existing Conditions Assessment (Appendix A) was conducted in the Fall of 2015 while LAVTA service changes occurred in August 2016 (ten months later). As a result, the assessment did not include the implementation of the service changes. However, the existing conditions report, with its focus being the assessment of park-and-ride lots, is still relevant as documented in the findings. The key findings of the Existing Conditions Assessment can be summarized as follows:

- **BART parking in the study area is over-subscribed.** The parking available at the West Dublin/Pleasanton and Dublin/Pleasanton stations fills early each day, reaching 100% of capacity at each station by approximately 8:00 AM. In addition, there is a long waiting list for new parking permits, with approximately 6,700 drivers on the list for the two Tri-Valley BART stations combined.
- **The number of transit users using the downtown Livermore garage exceeds the 133-space allotment.** The 567 spaces in this garage are primarily oriented to local shoppers and visitors, but park-and-ride use for ACE riders is allowed on the 133 spaces of its upper deck. When the parking occupancy counts were taken, there were 180 vehicles parked in the garage at 8:00 AM including all of the floors, which were assumed to be park-and-ride users associated with riding the ACE trains to San Jose prior to 8:00 AM, well before the downtown businesses open. LAVTA also operates three major routes (10R, 30R and 580X) connecting with the Dublin-Pleasanton BART station that stop near the garage. It is likely that some of the parkers observed at 8:00 AM may have used these routes.
- **Demand for other ACE parking is nearing available capacity.** Parking at the Pleasanton ACE Station is very close to full every day (approximately 94% utilization). Utilization at the Vasco Road ACE Station is also approaching its limits (82% of capacity).

- **The four park-and-ride lots are used for a combination of purposes.** Users who park at these locations subsequently depart by carpool, by vanpool, by accessing BART or ACE using Wheels services, and by riding in private employer shuttles.
- **Park-and-ride lots in Dublin and Pleasanton are heavily used, but mostly for private employer shuttles.** Field surveys showed that utilization was 74% at Johnson and 93% at Tassajara park-and-ride lots, almost entirely for accessing private employer shuttles.
- **The largest concentration of private employer shuttle use is from Alameda County Fairgrounds.** This location was not formally part of the study, but because approximately 300 parking spaces at this location are being used for parking for private employer shuttles, the facility is serving an important and significant service. Pleasanton staff also provided information that arrangements have been made by these shuttle operators with several churches in Pleasanton for use of their lots, adding another potential 200 spaces for private employer shuttle riders.

There was so much interest in the private shuttle operations that interviews and follow-up meetings were conducted with six of the largest employers now providing service in the Tri-Valley. The six employers expressed strong interest in making arrangements for more parking for their workers, particularly in Pleasanton or western Dublin, where they would have good access to I-680 and I-580. Based on discussions with these six employers, it is estimated that the demand for this service in the Tri-Valley could grow by about 5% per year, if more parking spaces could be made available.

Figure 4 presents a list of the employer shuttles that were identified at existing ACE stations and park-and-ride lots, together with the employers providing the service and the locations of the employments sites they serve. Based on the distance from the study area to the employment sites served, it was estimated that the average trip distance captured on employer shuttles is about 36 miles each way. By comparison, the weighted average distance covered by BART

passengers from origins in the Tri-Valley to all BART-accessible destinations is about 27 miles.

Figure 4: Private Shuttle Inventory

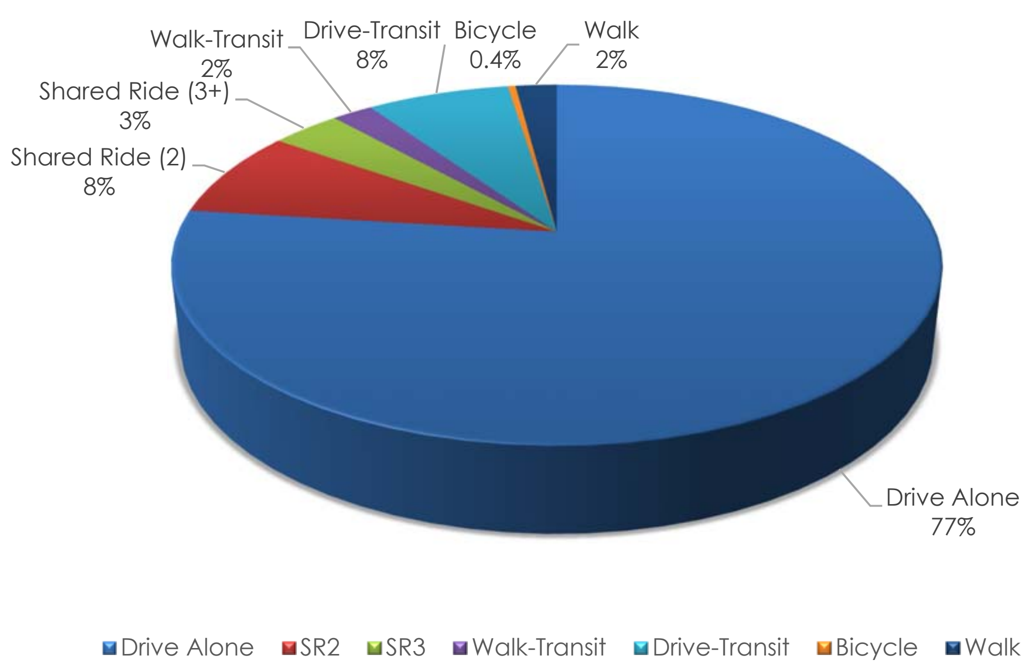
Lot	Location	Private Employer Shuttles	Destination City
Pleasanton ACE Station	Pleasanton	Clorox Safeway Thermo Fisher	Pleasanton
		Other Unidentified Shuttles	Various
Vasco Road ACE Station	Livermore	Lawrence Livermore National Lab Shuttle	Livermore
East Airway Boulevard PNR	Livermore	Amazon	Sunnyvale
		Genentech	South San Francisco
Johnson & Stoneridge	Pleasanton	Tesla	Fremont
		UBER	San Francisco
Portola PNR	Livermore	E&J Gallo Winery	Modesto
Tassajara (Dublin Corporate Center) PNR	Dublin	Amazon	Sunnyvale
		Facebook	Menlo Park
		E&J Gallo Winery	Modesto
		Genentech	South San Francisco
		GoPro	San Mateo
		Netflix	Los Gatos
		Visa	Foster City, San Mateo
		YAHOO	Fremont, Sunnyvale, San Jose
		Other Unidentified Shuttles	Various

Travel Behavior and Market Analysis

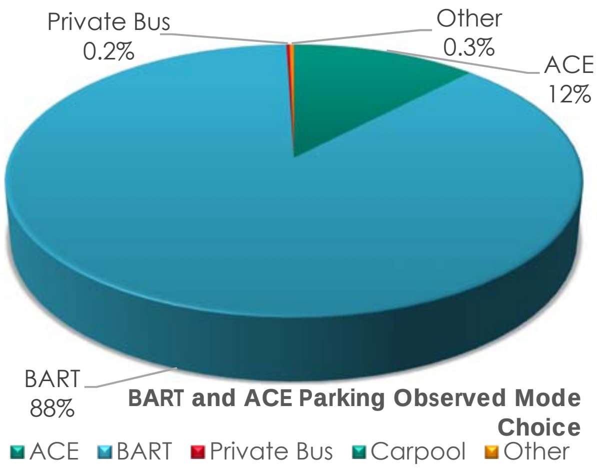
Following assessment of the supply of parking available at transit stations and park-and-ride lots in the Tri-Valley, the study focused on the level of demand for that parking by conducting an analysis of travel behavior and the origin-destination markets in the study area. Appendix B to this report provides details of the Travel Behavior and Market Analysis activities and their results.

Information about current and future commute characteristics in the Tri-Valley was obtained from the Alameda Countywide Model. The primary focus of the analysis was the travel segment known as Drive-to-Transit Trips, composed of people who drive to get to a transit service for their commute trip. They are the ones that would use a park-and-ride lot or park at a BART or ACE facility as part of a transit trip. As shown in Figure 5, the estimate from the model was that Drive-to-Transit trips comprise about 8% of all commute trips but 8 out of every 10 transit trips (when combined with Walk-to-Transit trips) in the Tri-Valley. In this context, the objective of the study can be paraphrased by observing that improvements should be designed to move more commuters from the Drive Alone category (now 77%) to the Drive-to-Transit category.

Figure 5: Commute Mode Share from Tri-Valley



The study team also conducted an intercept survey of park-and-ride users in the study area, in order to understand more about how current transit station parking and park-and-ride lot patrons use these facilities.[1] Figure 6 presents the proportion of users connecting to different modes after they park in the facility, with results segmented into transit station parking facilities and the park-and-ride lot locations. As shown in the figure, almost everyone at a BART parking garage or an ACE garage or lot was accessing a rail line – either BART or ACE. From the four park-and-ride lots, almost 70% of patrons were using private shuttles, about 17% were taking a Wheels bus to ACE or BART, and about 10% were carpooling or vanpooling.



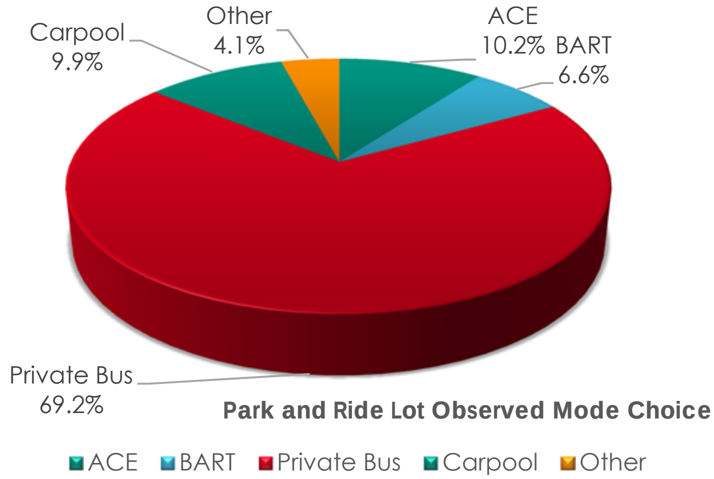


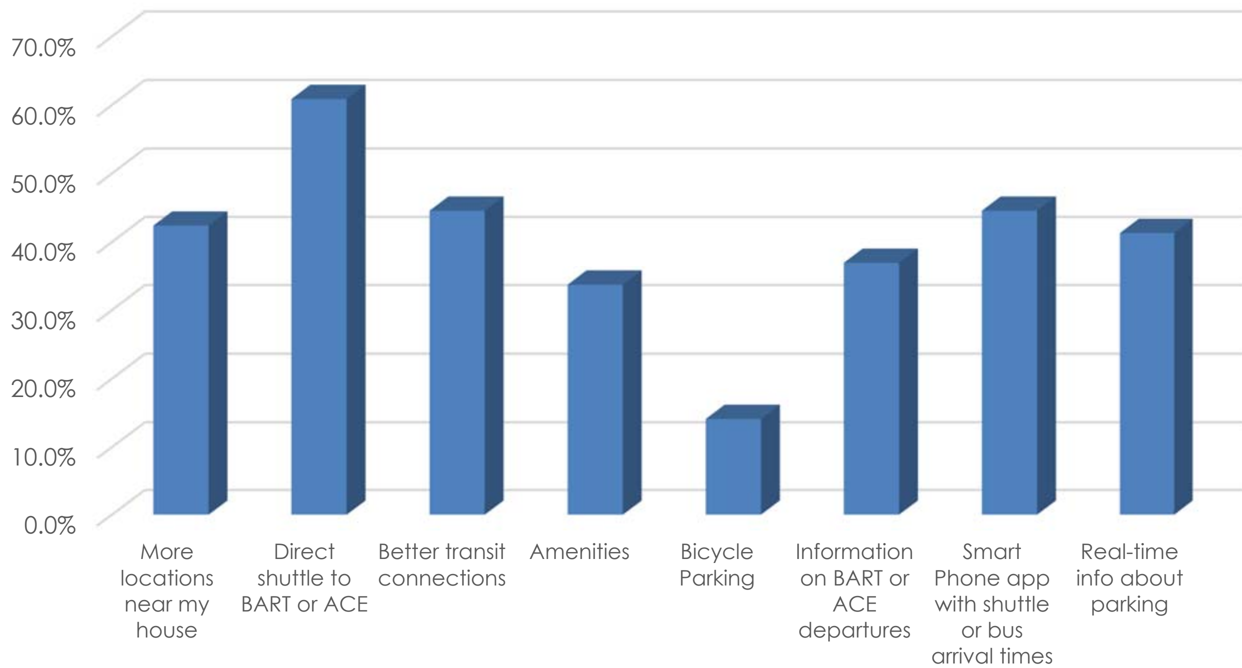
Figure 6: Share of Connecting Modes Used by Park-and-Ride Patrons

The study also included a web-based survey of commuters to get information about their commute trip, but even more important, what kinds of improvement Drive Alone commuters would like to see in park-and-ride facilities and services in order to attract them to consider switching modes. The results for this question are summarized below in Figure 7, but more detailed results from the survey are provided in Appendix B to this report. The most popular responses were:

- Direct shuttles to BART or ACE
- Better transit connections
- Smart phone apps to provide shuttle or bus arrival times
- Real-time information about whether parking is available
- Transit routes that travel closer to home locations

[1] Detailed cross-tabulations of the survey responses are included within Appendix A (the Existing Conditions Assessment), while the discussion of the survey findings and implications is included with the other Travel Behavior and Market Analysis as part of Appendix B.

Figure 7: Improvements Needed to Encourage Use of a Park-and-Ride



Development and Evaluation of Potential Improvement Measures

The web-survey suggestions as well as other improvement concepts identified by the TAC members were then selected for further analysis. The evaluation included use of the travel demand model and off-model analysis to highlight the relative performance of different improvement measures. A detailed report on the analytical methods and results of this work is provided in Appendix C to this report.

Development of Potential Improvement Measures

The potential improvements considered for this study can be grouped into five different categories. The first two categories of ideas can be handled through how facilities are managed or through additional marketing. These types of projects were not analyzed quantitatively, but recommendations for these two approaches were developed:

- Programs to promote use of carpooling and vanpooling from park-and-ride lots
- Management strategies to increase BART and/or ACE ridership through on-site measures without increasing the number of parking spaces.

Three of the five areas involved potentially significant investments in either parking facilities or shuttle service to BART or ACE, and so the greatest attention in the technical analysis was focused on these areas. These are the three types of improvements that were quantitatively evaluated using the model system for the study:

- Increasing BART and/or ACE ridership by increasing the on-site parking
- Increasing BART and/or ACE ridership by increasing park-and-ride spaces at existing or new facilities and providing direct shuttle service
- Increasing parking available to private employer buses from park-and-ride lots

To address the options for increasing parking capacity, the study team examined additional parking capacity at four different locations:

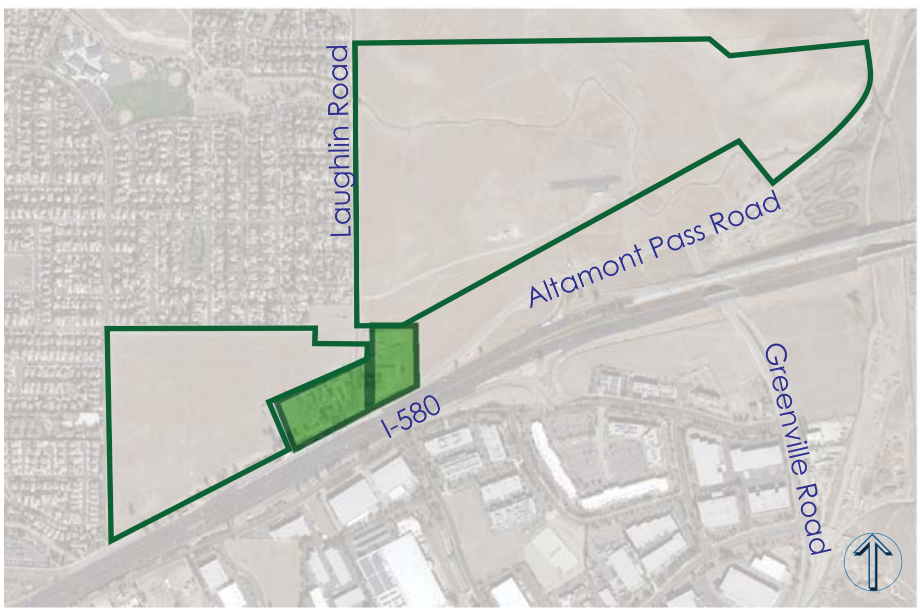
- A new lot in Pleasanton at Bernal Avenue and I-680 with a potential capacity of about 200 spaces (The City of Pleasanton is exploring options to build a park-and-lot at this location.)
- Potential expansion of the Airway lot owned by BART (the lot could be expanded to accommodate as many as 1000 parkers)
- A new lot owned by BART near Greenville Avenue and I-580 with a potential capacity of as a many as 1500 spaces
- A new garage at the Dublin/Pleasanton BART station; it would have a capacity of about 650 spaces but would replace a parking lot with 100 spaces for a net gain of 550 spaces

These locations are depicted in Figure 8.

Figure 8
Sites Identified for Potential Park-and-Ride Expansion

Bernal Ave and I-680 in Pleasanton

BART Property on E Airway Blvd



BART Property at Laughlin Road/Greenville Road

Garage Expansion at Dublin/Pleasanton BART Station

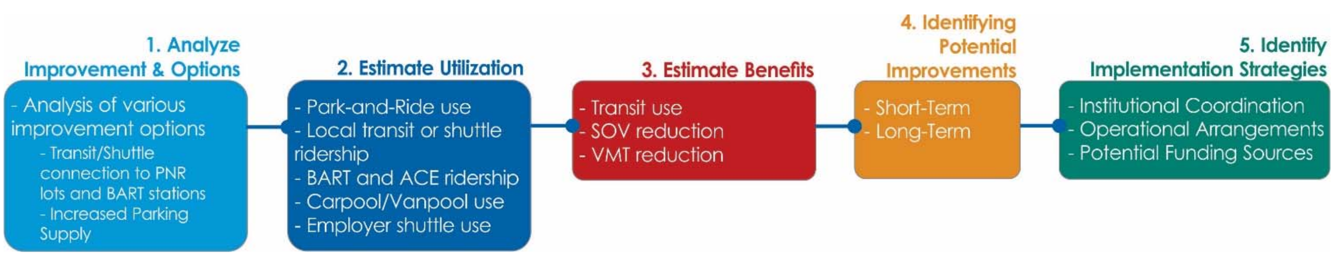
LEGEND

- Potential Parking Area
- Existing Surface Parking
- BART-owned Land

Evaluation of Potential Improvement Measures

To assess and compare the effectiveness of different improvement measures to each other, they were combined into specific packages of improvements that could be tested with the available analytical tools and other information gathered by the study. Different combinations of new BART station parking, new and expanded park-and-ride lot capacity, and shuttle connections from the park-and-ride lots to BART were evaluated for their performance. Also considered was the anticipated growth in private employer shuttle use and carpool and vanpool use. Specifically, the analysis resulted in estimates of total parking use, shuttle and local transit use, BART and ACE ridership, carpooling and vanpooling use, and employer shuttle use. These results were used to compute the three key performance measures for the packages: transit use increase, SOV reduction and VMT reduction. Based on the performance in these three metrics, the study identified the improvement measures that could be most appropriate in the short term and long term. Lastly, the study addressed the institutional feasibility, community acceptance, and potential funding sources. A diagram of the evaluation process is shown below in Figure 9.

Figure 9: Process for Evaluating Potential Improvements

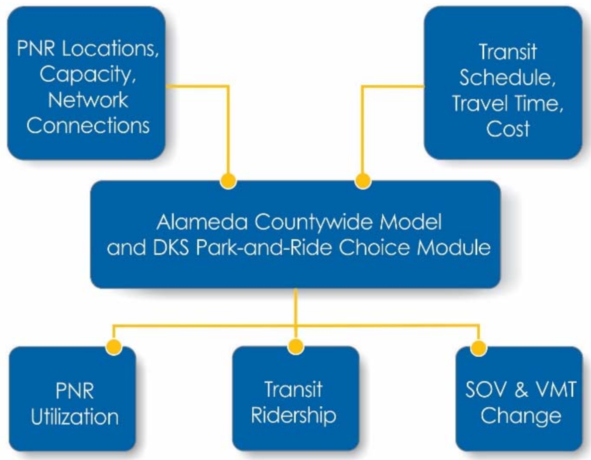


The study relied heavily on a model that had as its basis the Alameda Countywide Model, but included an enhancement – a park-and-ride choice module – that was developed by the consultant team.[2] This additional module limits the use of each parking facility to only its capacity. If more demand is predicted for the facility than it can hold, the excess demand will be sent elsewhere or to another mode. This module helps generate a more reasonable depiction of the how changes in park-and-ride capacity in the study area lead

[2] The methodology for this park-and-ride choice module was developed before the completion of the evaluation activities. A memo describing the technical approach for the park-and-ride module was presented as part of an earlier deliverable, and is included in Appendix B – Travel Behavior and Market Analysis.

to variations in the key performance metrics. The overall modeling approach is depicted below in Figure 10. Because this model is a large-scale, countywide model, even though it can predict facility level parking use based on the park-and-ride choice module, the estimates provide a general trend, not precise usage. This limitation is discussed further in the evaluation and comparisons described in Appendix C.

Figure 10: Modeling Approach for Evaluation



Evaluation Findings

Different combinations of improvements were tested under near-term conditions (2020) and longer-term conditions (2030). The findings from all of the modeling and analysis are described below and depicted in Figure 11.

Finding 1: BART parking is oversubscribed. Parking constraints limit the number of commuters who can choose transit for their trip. More BART ridership can be gained by adding more spaces to the current parking supply.

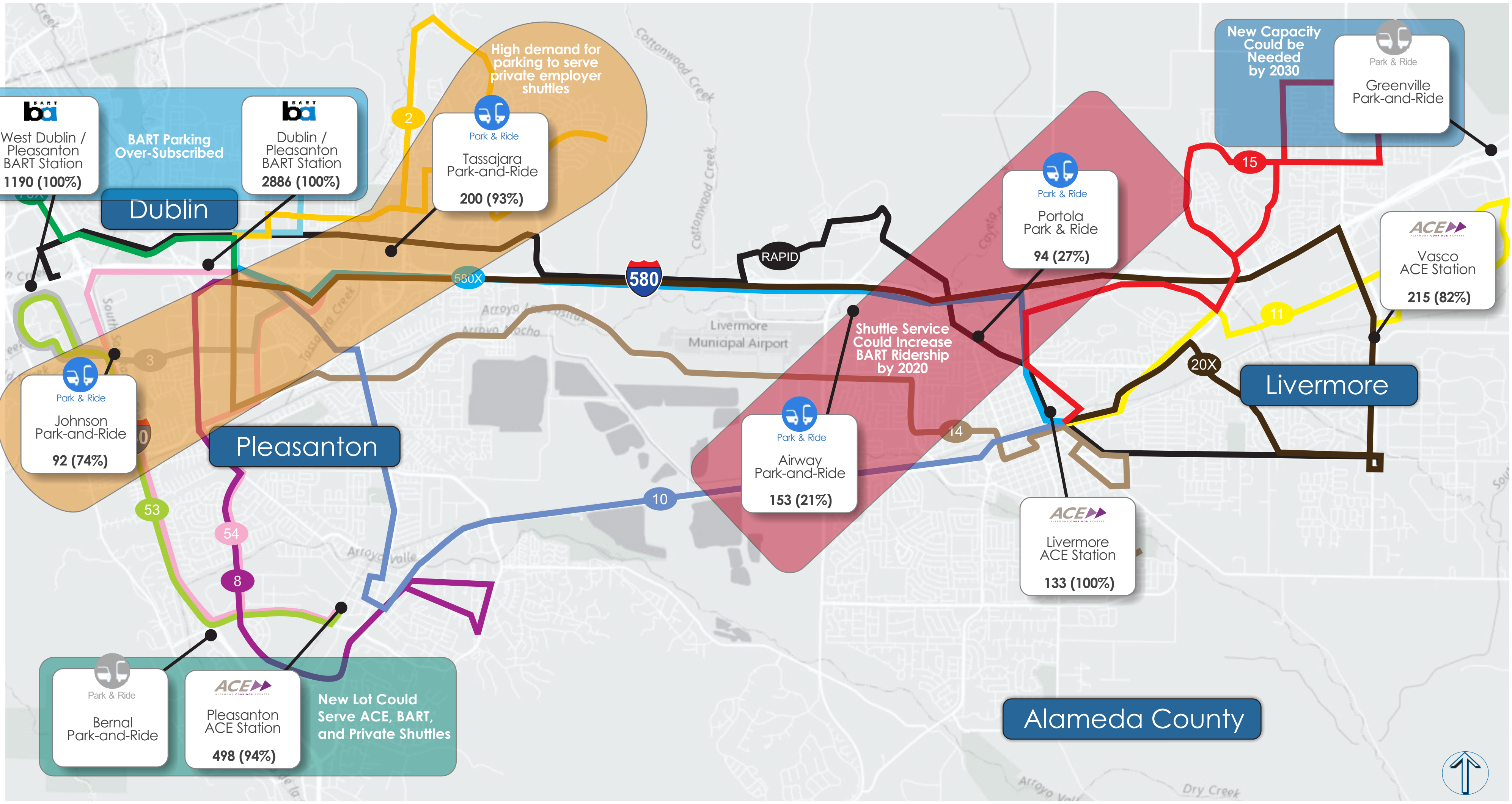
Finding 2: Shuttle service could increase BART ridership. One way to accommodate additional commuters trying to drive to BART is to provide shuttles from park-and-ride lots that have excess capacity like the Airway or Portola lots. Different types of shuttle services were tested including free shuttle service and also service with a $3/day charge (in today's dollars). Charging for parking reduced the demand by 12 to 18%.

Finding 3: There is high demand for parking to serve private employer shuttles. This demand is currently most significant at two of the park-and-ride lots – Johnson and Tassajara – as well as the Alameda County Fairgrounds.

Finding 4: A new park-and-ride lot at Bernal could service BART, ACE, and private shuttles. In the short-term, this location would provide a pick-up point for private employer shuttles because West Pleasanton was identified by current employer shuttle operators as a very desirable place for additional parking. The lot could also provide parking for the Pleasanton ACE station and the West Dublin/Pleasanton BART station because both are connected to the lot by fairly short and direct Wheels bus service. In the longer-term, shuttle service to West Dublin/Pleasanton BART station might also be warranted.

Finding 5: New parking capacity could be needed by 2030. Modeling results showed that, by 2030, there will be enough increase in total demand for parking for BART that a new park-and-ride lot may need to be added to the parking supply connected by a shuttle to BART. BART already owns land on Greenville Road, which could be considered for the additional long term park-and-ride lot option.

Figure 11
Findings from the Evaluation of Test Packages



LEGEND

LAVTA Wheels Routes

- 1
- 2
- 3
- 8
- 10
- 11
- 14
- 15
- 20X
- 53
- 54
- 70X
- 580X
- RAPID

- Existing Park-and-Ride Locations
- Potential Future Park-and-Ride Locations

(XX) (XX%) - Capacity (Existing Utilization)

- BART Station
- ACE Station

ALAMEDA County Transportation Commission

Improvement Measures

The technical analysis conducted during this study confirmed that improvements to various park-and-ride lots and transit station parking facilities and services in the Tri-Valley can deliver benefits to the study area including increased transit use, reduced use of SOVs, and reduced VMT. Given the patterns of travel demand anticipated over the next fifteen years, it is expected that some or all the improvement measures described below would be promising elements of an overall strategy for managing congestion during peak hours and increasing alternative mode travel including transit trips.

Short-term Measures

Based on the analysis described earlier in this report, one or more improvement measures could potentially be implemented in the study area within the next three to five years. Depending on locally-determined priorities and timelines, the responsible jurisdictions and agencies in the Tri-Valley may wish to pursue any or all of the measures described below, in any order.

- **Initiate high-frequency shuttle service during peak commute period from the Airway park-and-ride lot to the Dublin/Pleasanton BART** station as a pilot test of the service concept. The addition of a shuttle makes the Airway facility, with its capacity expansion potential and being close to the freeway, more attractive, and it also builds demand for the potential future BART service extension in the study area.
- **Construct a new park-and-ride lot at Bernal Avenue** and make the lot available for carpooling, vanpooling, connecting shuttle access to the Pleasanton ACE station and the West Dublin/Pleasanton BART station, and private employer shuttles. The demand for private employer shuttle service from park-and-ride lots is growing rapidly and employers are interested in using more spaces in the study area, particularly along I-680 and close to the I-580/I-680 interchange. The City of Pleasanton is exploring options to build a park-and-lot at this location.
- **Construct a new parking garage at the Dublin/Pleasanton BART station** adding 550 net new spaces to the existing capacity at the station. BART

staff has already begun preliminary planning activities for this new facility and is making a determination.

- **Facilitate more use of park-and-ride lot capacity for private employer shuttles through pricing policy.**
- **Construct facility enhancements at all park-and-ride lots in the study area.** These include improved lighting, security cameras, bicycle parking facilities, and wayfinding signage at Tassajara, Johnson/Stoneridge, Airway, Portola, and the new Bernal Ave facility.
- **Deploy ITS enhancements to better integrate transit and park-and-ride facilities** more closely together. This would include three key features:
    - ***Transit Signal Priority treatments*** at multiple intersections in the study area and the purchase of corresponding equipment with current technology for some transit and shuttle vehicles
    - ***Real-time vehicle arrival/departure information*** designed to provide park-and-ride users with vehicle arrival times for existing Wheels transit service between the Dublin/Pleasanton BART station and the Portola lot, as well as the peak period shuttle between BART and the Airway lot
    - ***Real-time occupancy information*** for park-and-ride lots, which can be coordinated with similar information available from BART parking facilities and shared with providers of trip-planning and traveler information software for mobile based applications.

Long-term Measures

In addition to the short-term measures described above, the study also identified a set of long-term potential improvement measures. The exact timing when each of these improvement measures would be needed and appropriate will need to be determined based on the pace of growth in travel demand and congestion in the study area.

- **Expand the park-and-ride lot at Airway to 500 spaces** as the demand at the Dublin/Pleasanton BART garages and the Airway lot reach capacity, or more spaces, as needed, when BART to Livermore extension is implemented.

- **Add high-frequency peak period shuttle service from the Bernal lot to the West Dublin/Pleasanton BART station.** It is anticipated that employer shuttle operators that may be operating from the Bernal lot may need to make other arrangements to allow for increased use by BART patrons.
- **Construct a new park-and-ride lot at Greenville Road and provide high-frequency peak period shuttle service to the nearest BART station** as the demand approaches the limits of the Airway lot. The analysis conducted for this study suggests that the Greenville lot should be sized to accommodate 500 parking spaces.
- **Facilitate use of excess capacity at park-and-ride lots for private employer shuttles through pricing policy.**
- **Extend ITS elements to the additional facilities and services.** This would include more intersections and vehicles equipped with transit signal priority functionality and the addition of real-time vehicle arrival time information for new peak-period shuttles at Bernal, Greenville, and the West Dublin/Pleasanton BART station.

It should be noted that at the time of this study, BART was studying a potential extension to Livermore in the I-580 corridor east of the current Dublin/Pleasanton BART station. A draft environmental impact report was being finalized at the time of the technical analysis for this study. In any case, the improvements identified for this study would not adversely impact the BART-to-Livermore project, but would support establishing its ridership.

ITS Elements, Traveler Information, and Marketing

Based in part on discussions with the stakeholders and the findings of the web survey of corridor travelers, the study concluded that a reasonable package of ITS investment and on-going traveler information and marketing elements is necessary to attract commuters to and increase the usage of park-and-ride lots. This level of amenities is fast becoming the industry standard and part of patrons' baseline expectations for use of park-and-ride lots. While each of the individual components described below could be implemented independently, these technologies are most effective when they are part of an integrated system that helps travelers and facility managers make the most of the available infrastructure.

The ITS elements requested most often by corridor travelers include technologies for real-time monitoring and reporting of parking-space availability and transit-vehicle location to inform potential commuters about transit connections. Information on parking-space availability can be gathered either with video detection or in-space detection equipment. Information on the location and next arrival time for BART trains, ACE trains, LAVTA buses, BART shuttles and private shuttles would utilize in-vehicle GPS-based vehicle location systems and will be used to provide "next-bus" or "next-train" information to commuters along with the information about parking availability.

The information gleaned from the real time parking availability and transit arrival time technologies will be provided to commuters via a data service that can be accessed by a combination of internet or smart-phone apps and changeable message signs at the parking locations and transit stations. The information communicated may also include information on drive times to the nearest BART station and a comparison between drive time and the time for a park-and-ride/shuttle option for getting to BART.

In addition, traffic signal pre-emption technology is desired so that shuttle buses can make faster and more reliable connections between park-and-ride lots and BART stations. Signal priority treatments involve detection equipment installed at key intersections and signal activation equipment installed on board shuttle buses.

ITS technologies can also be used to collect charges from commuters for use of the park-and-ride lots and/or the shuttle services connecting the lots to BART if charges are instituted. This may take the form of payment kiosks at the park-and-ride lots with capability for live monitoring of transactions, or it may be designed for by prepayment only via web or smart-phone apps linked to a specific vehicle license number and monitoring of payment by automated license plate reading equipment. If charges are instituted, information about the charges and the methods of payment will also be communicated to commuters by internet and smart phone apps along with the information on parking transit service availability.

Other applications of ITS technologies could be used to provide information for real-time curb-space management at BART and ACE stations for drop-offs and shuttle services and video-based security systems at the park-and-ride lots. Both of these applications will require communication systems that provide information about on-site activity to facility managers monitoring the activity. The facility managers will then have the capability to remotely provide information to commuters and shuttle operators in the case of the curb-space management or to the police in the case of parking lot security.

Parking Pricing and Management

As use of park-and-ride lots grows over time, it will become important to ensure there is sufficient capacity for transit riders at the subset of park-and-ride facilities that are most convenient to BART, ACE, LAVTA, and the public shuttles connecting to these systems. Other types of park-and-ride users; such as carpools, vanpools and riders of private employer shuttles; should be directed to those park-and-ride lots in the study area that are less connected to public transit services, such as the Tassajara, Johnson or Portola facilities. One mechanism to achieve this outcome would be to initiate parking management strategies and pricing policies that incentivize different types of travelers to use the most appropriate facilities and services.

After the specific short-term and long-term improvement measures were identified, the study team prepared a set of options for parking pricing and management strategies that would be most appropriate for the Tri-Valley context.[3] It is expected that an effective parking management approach would need to contain most or all of the following components:

- **Modest fees at some or all park-and-ride facilities.** Parking fees could be used to help steer prospective users towards different facilities. Revenue generated by the parking fee could be used to pay for real-time customer information services and also help off-set the operating cost of the high-frequency peak period shuttle service being proposed for Airway (short-term) and Bernal and Greenville (both long-term).
- **Coordinated pricing policies.** Although pricing policy could be set at the discretion of each facility owner, it will be more effective if prices are set in a systematic fashion, taking into account the desired user group(s) at each facility within the study area. Coordination across jurisdictions and agencies would help ensure that pricing of different facilities sends a consistent message to all potential patrons.
- **Mobile payment options to allow for more cost-effective collection and processing of fee payments.** Some parking payment systems that are available today can be integrated with transit fare payment systems, offering the possibility of discounts or rebates that further incentivize travelers.
- **Remote enforcement using cameras and targeted patrols.** Instead of costly on-site staffing, license plate reader (LPR) cameras can be used to identify whether appropriate payments have been received for all vehicles parked in each facility. A single vehicle or a third party parking management service, shared across cooperating jurisdictions and agencies, could be dispatched only when and where necessary to issue citations.

These parking management components could also be connected together with the other ITS enhancements described previously, such as real-time information on transit and shuttle services and parking lot occupancy, so that

[3] A detailed memo summarizing the parking pricing and management strategies is included as an Appendix to Appendix D – Development of Implementation Strategy.

travelers in the study area have a more comprehensive picture of the different transportation options available in real time.

Evaluation Summary

Taken together, the implementation of the short-term and long-term improvement measures can be expected to lead to improvements across all three performance metrics. The technical analysis estimated that in 2030, the combined set of improvement measures would lead to roughly 2,200 additional daily parkers, about 2,000 additional daily transit trips, and a reduction of about 1,800 morning commute trips by driving alone. That would produce a reduction of almost 105,000 vehicle miles of travel per workday or over 26 million vehicle miles of travel per year. As mentioned previously, given the macro-level of the tools used for evaluation, these estimates are conservative.

Path Towards Implementation

Each of the individual improvement measures described above can be pursued relatively independently on whatever timeline is most appropriate for the responsible jurisdiction or agency. Even so, there are steps required for implementation that are common to most or all of the improvements, and coordination on certain policy matters could be beneficial for their overall success. These include shuttle services planning, planning for the various technology elements included in the improvement measures, identification of potential funding sources for the improvements, and opportunities for institutional coordination over the course of the implementation. Highlights of these topics are provided below, and a more expansive discussion of the recommendations for implementation is provided in Appendix D, the Implementation Strategy Final Report.

Planning for Shuttle Services

The evaluation of improvement measures required development of a preliminary plan for the frequency and span of service that would be needed at each park-and-ride lot where a shuttle is anticipated. As shuttle services are implemented, the feasibility of the assumptions from that work should be validated using a more detailed service planning approach that is coordinated with the existing operations of the three public transit operators: BART, LAVTA, and ACE. In addition, service planners should also examine whether opportunities may exist to improve the overall cost-effectiveness of the shuttle service by cross-utilizing shuttle vehicles for other peak period trips in the study area, potentially filling the otherwise empty back-haul in the non-dominant commute direction.

The responsible jurisdictions and agencies (those who will be carrying the shuttle service projects forward) will need to identify how the service would be operated. Available options include: service provision as part of the transit network of an existing bus operator (to the extent permitted by available fleet and driver resources) or a separate procurement with a contract operator (a traditional transit-style vendor, a commuter transportation service provider, or a Transportation Network Company (TNC)-style partner). Regardless of which delivery model is selected, shuttle services will also need to be coordinated with the transit operators in the study area. This includes pick-up/drop-off coordination with the rail providers (BART and ACE) and schedule and routing alignment with County Connection and San Joaquin Regional Transit District services.

Planning for Technology Elements

The short-term and long-term improvement measures include numerous innovative technology features, such as real-time information and parking management elements. When implementing these components, coordination between the jurisdictions and agencies who will be implementing the technology components will likely provide economies of scale in terms of costs, more efficient facility management, and more legibility for commuters. Specific activities that should be coordinated include:

- Purchase and installation of ITS components for transit/shuttle vehicles and traffic signals;
- Selection of appropriate parking payment and enforcement technologies, consistent with the pricing policies for any paid parking;
- Provision of real-time information related to parking occupancy and shuttle arrival/departure; and
- Development of protocols for data sharing and privacy protection.

Potential Funding Options

The short-term and long-term improvement measures identified in this study include both the conventional components such as parking lots, lighting, wayfinding, and shuttle bus service, as well as leading-edge technologies such as real-time travel information and integrated payment features. These projects will readily qualify for traditional funding sources that support congestion relief, travel demand management, and transit investments. However, due to the more innovative features of the overall set of projects, project sponsors have the opportunity to pursue newer funding sources that support pilot projects and technology demonstrations, such as the FHWA Advanced Transportation and Congestion Management Technologies Deployment Program or the FTA Mobility on Demand (MOD) Sandbox Grant Program."

Institutional Coordination

The specific improvement measures identified over the course of this study are independent enough that they can be implemented individually by whichever jurisdiction owns the physical facilities and parcels involved. As a general matter, these jurisdictions and agencies will be responsible for taking the lead to implement each project. Still, some improvements will require more coordination than others in order to proceed, and in a few cases, coordination should be regular and structured to lead to a smooth roll-out. As more detailed planning for each project gets underway, project sponsors should consult with partners and stakeholders, including some less traditional participants such as the business who offer private employer shuttles, if needed, the operators who provide the physical shuttle service, and the startup companies currently operating numerous technology-enabled transportation pilot projects in the Tri-Valley area.

Given the number and variety of different improvement measures contemplated in this Study, the coordination needed to implement all projects on the list could become highly repetitive and time-consuming if there are separate coordination processes for each project location. A more desirable approach would be to find an appropriate forum for collectively exploring alternatives, reaching consensus, and monitoring and managing any emerging issues during deployment. The existing Tri-Valley Transportation Council (TVTC) already has varied membership and an established track record of joint decision-making in the Tri-Valley and could be an appropriate forum for this purpose.

Next Steps: Approach for Moving Forward

The short-term and long-term improvement measures identified over the course of this study are expected to be delivered by following a relatively traditional "Public Works" process, with each facility owner responsible for the projects within its jurisdiction. At the same time, the transportation landscape in the Tri-Valley is currently undergoing rapid changes, with the jurisdictions and agencies in the area launching multiple initiatives to pilot new transportation concepts in the study area, such as LAVTA's Go Dublin! effort and the Carpool to BART program. Implementation of any measures identified in this study should be coordinated with on-going and other future activities contemplated within the study area, not just the current set of identified improvements. Pursuing enhanced coordination between the stakeholders in the Tri-Valley can help capture the synergies between projects and improve overall implementation of transportation improvement measures in the years ahead.

Appendix A

Existing Conditions Assessment Final Report

Tri-Valley Integrated Transit and Park-and-Ride Study

Existing Conditions Assessment

FINAL

February 16, 2016

Table of Contents

Summary of Findings

The goal of the Tri-Valley Integrated Transit and Park-and-Ride Study is to identify potential changes and improvements in local park-and-ride facilities and connecting bus service. The aim is to reduce the use of single-occupancy vehicles and create a coordinated, efficient and sustainable transportation system. The Tri-Valley area today—particularly the cities of Livermore, Dublin and Pleasanton--has relatively high levels of traffic congestion and low levels of transit use. Improving the infrastructure of park-and-ride facilities and connecting transit service is one way in which travelers can be encouraged to shift from autos to public transportation during peak travel hours. Figure 1 provides a map of the parking facilities that were included in this analysis.

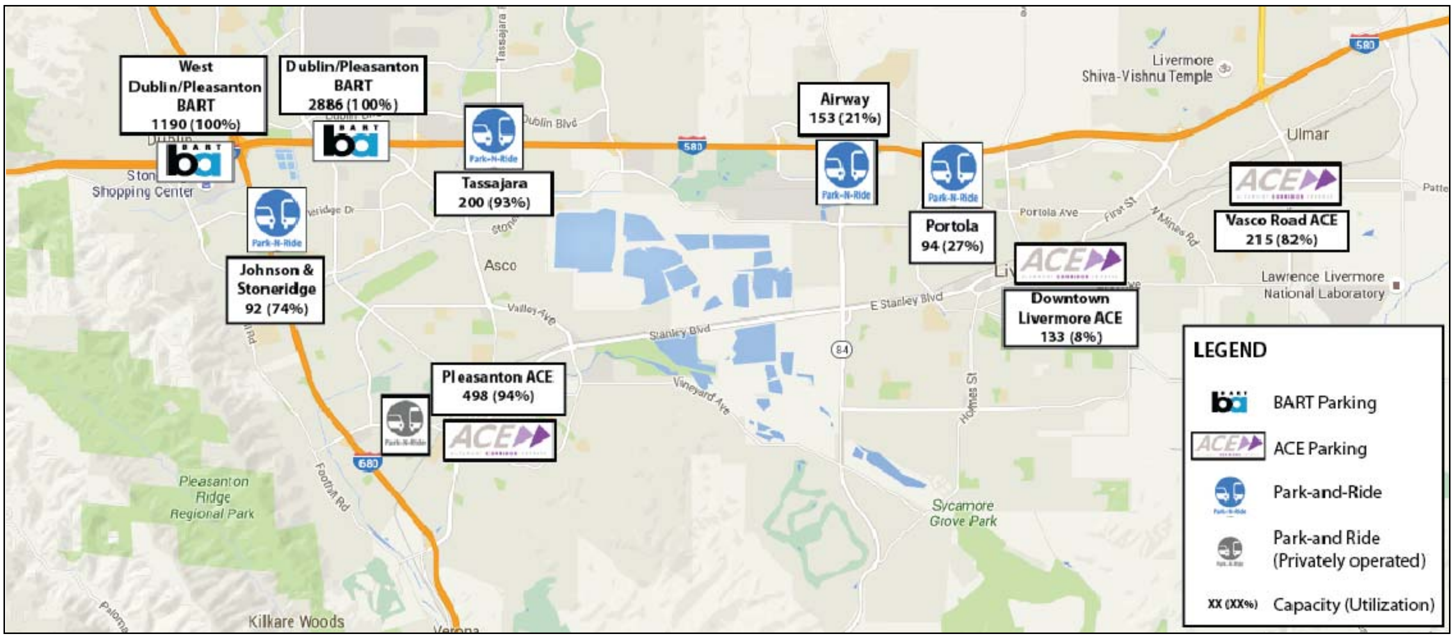


Figure 1 - Inventory of Parking Facilities and Capacity/Occupancy

Methodology

An initial task of the Study includes an inventory of existing park-and-ride facilities in the Alameda County portion of the Tri-Valley, along with the transit lines that serve them. To complete this task, a number of surveys were undertaken, all focused on the objectives mentioned above. First was a physical inventory of the park-and-ride facilities. BART operates parking lots and garages at its Dublin/Pleasanton and West Dublin/Pleasanton stations. These are filled to capacity early in the day, with little or no room for any more parkers. Additional parking lots are located at ACE commuter rail stations, and several freestanding parking lots are scattered in various locations in the Tri-Valley. In all, ten park-and-ride facilities have been inventoried and their physical facilities catalogued. This information is presented in Attachment A. (An additional facility in the Alameda County Fairgrounds is currently leased by six employers for park-and-ride connections to private shuttles. However, this facility is not available to the general public and was excluded from this survey.)

Assessing the use of these facilities was the next step. BART has extensive records on the use of the lots and garages at its stations, and these records were utilized for this study. For the other park-and-ride facilities, several surveys were conducted to reveal when and how they were being utilized. At seven parking lots, three successive mid-day manual counts were taken to identify how much usage each facility experienced. At the single free-standing parking garage in the sample (in Downtown Livermore), one mid-day manual count was taken for reasons explained below; this was supplemented by a second count several weeks later.

To determine patrons' arrival and departure patterns, more detailed information was required. This was accomplished through a video survey, in which cameras recorded arrivals and departures at each driveway of each parking lot in the sample. (The parking garage in Downtown Livermore was excluded from this and certain other surveys because park-and-ride use here is encouraged only for ACE patrons, not bus or carpool users.) A summary of the video survey's arrival and departure information is provided in Attachment B. The midday occupancy counts are detailed in Attachment C.

To better understand the motivations of park-and-rider users and their ultimate origins and destinations, an intercept survey was conducted at all but the BART facilities. In this survey, interviewers asked parkers arriving in the morning about their travel habits. The short questionnaire was designed to correlate the information being gathered by the other surveys described above, as well as to add some meaning to the statistics that were being generated. A summary of the results of the intercept survey are arrayed in Attachment D.

As final components in this assessment, the bus service available at each park-and-ride location was inventoried. Eighteen public transit bus lines serve the two BART stations and six other park-and-ride facilities. These are documented in Attachment E. In addition, numerous private shuttles connect the parking facilities with over a dozen employment locations, as summarized in Attachment F.

Parking Lot Functions

The parking lots and garages examined in this assessment can loosely be categorized as either primary or satellite facilities. Those at the two BART stations and three ACE stations function as primary facilities, where parkers converge to board trains taking them to places of employment or to school. The satellite lots seem to function as distribution facilities, with parkers traveling there in order to board a bus to BART, a private shuttle to an outlying employment location, or a carpool. There are no doubt parkers at primary stations that are not using the rail service but rather transferring to an employer shuttle or carpool. These were difficult to discern from the survey data obtained, but they appear to be in the minority of those parking at primary facilities.

Physical Inventory and Utilization

The two BART stations in the study area have between them some 4,076 parking spaces. 1,374 of these are in surface lots and 2,702 are in parking garages. Even with all this capacity, the parking facilities are filled by about 8:00 AM. Midday occupancy is virtually 100% at each. Spaces at these lots available to the general public are priced at $3 per day. Over 800 parkers opt to pay a $6 daily fee (or a $105 monthly fee) to park in a permit space that is reserved for them until 10 AM, when any empty spaces are then made available to the general public. There is currently a waiting list of approximately 6,700 people for the reserved spaces at these two stations. It was partly because of the limited availability of BART parking that this Tri-Valley park-and-ride study was undertaken. The two BART stations also have 68 bike lockers between them, as well as 16 sheltered bus bays. Specific information for each of the BART station parking facilities can be found in Attachment A.

In addition to its parking facilities at stations, BART operates a satellite parking lot on East Airway Boulevard in Livermore; it averages just 21% midday occupancy in its 153 spaces.

Three park-and-ride lots operated by Altamont Corridor Express (ACE) experience high levels of use. The most popular is the 486-space lot at the Pleasanton ACE station, averaging 95% midday occupancy. Two smaller lots at the Vasco Road ACE station in Livermore average 67% occupancy in a 79-space lot and 90% occupancy in a 136-space lot.

The ACE station in Downtown Livermore is directly adjacent to the parking garage operated by the City of Livermore (Livermore Valley Center Garage). This garage is aimed primarily at local shoppers and visitors, but park-and-ride use for ACE riders is allowed on the 133 spaces of its upper deck. It first appeared that very few commuters take advantage of these, with a midday average utilization of only 8%. However, a follow-up survey revealed that over 150 cars are parked on other floors of this garage by 8:15 AM, currently the time of the last ACE inbound departure. It is suspected that many of these cars may belong to commuters who are ignoring the parking restrictions on those floors.

The remaining facilities included in this study are freestanding lots. One at Portola Avenue in Livermore averages 27% midday occupancy in its 94 spaces. A very large facility at the Dublin Corporate Center off Tassajara Road in Dublin has 200 spaces marked for park-and-ride use in a lot with a total of 1600 spaces (only 40 of which are reserved for specified individuals). Utilization averages 93% midday. The remaining lot at the intersection of Johnson and Stoneridge Drives in Pleasanton averages 78% midday occupancy in 87 spaces.

In general, all the parking facilities are in good physical condition. All are equipped with lighting, and more than half have security cameras, bike lockers and bus shelters.

Based on both the video and intercept surveys, arrivals at the eight non-BART facilities occur mainly between 5 and 9 AM. Some lots (such as Johnson & Stoneridge) have their highest arrivals in the hour starting at 5 AM, while others (such as the ACE stations) have their highest arrivals in the hour starting at 7 AM. Most departures occur between 3 and 8 PM. The highest departure hour in most facilities is at 6 PM, but two lots (Johnson & Stoneridge and Vasco ACE) have most departures beginning at 5 PM.

Parker Characteristics

The intercept survey revealed a number of characteristics about the users of the non-BART park-and-ride facilities. The responses differ so much from one facility to another that averaging them would be misleading. In general, however, it can be stated that work trips predominate for at least 74% of respondents. School trips are next in order, for 7-22% of respondents at three of the facilities.   Between 33%-86% of respondents park in the facility from over 15 days a month, with the remainder about equally divided between those parking less than 5 days and those parking 5 to 15 days a month. The predominant mode of arrival is via private automobile, with drop-offs, carpools and bikes having a much smaller share of the total.

The most common origin of parkers in our survey is from one of the cities in the Tri-Valley. A modest number come from cities in the Central Valley, with scattered origins from other cities in the East Bay. Destinations are heavily oriented towards Santa Clara and San Mateo county locations.   The only non-BART facility with strong orientation to San Francisco is the Airway park-and-ride lot, but with only four respondents in that sample, the data from this facility should not be considered representative.

Feeder Bus Connections

With the exception of the Portola and Tassajara lots, all of the Tri-Valley park-and-ride facilities are served by public transit buses. All are also served to varying extents by private employer shuttles (though the Downtown Livermore parking garage was not surveyed for this attribute). The public bus connections are presented in Attachment F. There are 18 bus routes serving both the BART and non-BART facilities included in this report. Of these routes, 14 are operated by LAVTA Wheels and four by County Connection. There is a single round trip serving the Johnson & Stoneridge lot, operated by the San Joaquin Regional Transit District (RTD) between Manteca and Sunnyvale. According to the intercept survey, the bus lines used most by those interviewed were Wheels routes 10, 12, 14 and 53. The frequencies of the routes serving the park-and-ride facilities are generally 30-60 minutes during the hours when most parkers arrive or leave. About half the routes do not offer midday service.

Private Shuttle Connections

Numerous private employer shuttles serve the park-and-ride facilities. Some were captured in the video survey and others mentioned by respondents to the intercept survey, but many more were not able to be identified. For this reason, surveyors were deployed in the park-and-ride facilities during the afternoon period when the shuttles returned employees to the lots. The surveys revealed that all the freestanding park-and-ride facilities are served by at least one shuttle trip in each direction per day. The largest concentration of trips (at least 12 round trips) was at the Tassajara lot. The array of destinations served by the shuttles includes many employers in San Mateo County (such as Genentech, Yahoo and Facebook), the Gallo winery in Modesto, and local employers within the Tri-Valley (like Clorox and Lawrence Livermore National Laboratories).

Conclusions

The ten park-and-ride locations assessed in this report offer a wide variety of facilities for the varying needs of commuters in the Tri-Valley. Most are well utilized, but some with excess capacity may be better utilized through techniques that will be explored in later phases of this study.

High parking utilization appears to be correlated with direct access to rail service or to service by many private shuttles. There seems to be a natural reluctance for patrons to park where they will have to take a feeder mode of transit to yet another transit line to complete their journey. Nonetheless, the dearth of spaces at the two BART lots so early in the day may prove to be a strong incentive for drivers to utilize other parking facilities, provided that feeder bus service is frequent and inexpensive.

Attachment A

Physical Inventory

Dublin-Pleasanton BART Station

Location

5801 Owens Drive, Dublin & Pleasanton, CA
Median of I-580
North of Owens Drive and Southeast of Iron Horse Pkwy
Data source – BART (2014)

(A) - Photograph locations

Capacity and Utilization

Parking	Supply	Average Midday Occupancy
General Purpose	2794	2794
Reserved	631	631
Disabled	62	62
Motorcycle	30	30
Total	3517	3517

Bicycles Observed: 0

Amenities

Security Cameras: 12
Pavement: Asphalt
Condition: Good

Lighting: Yes ☒ No ☐
Condition: Good

Bike Facilities

No. of bike lockers: 52
Condition: Good

No. of bike racks: 76 (50 additional racks in paid area of station)
Condition: N/A

Bus Facilities

Bus Bays: 10 bays on north side, 5 on south
Bus stop location: North and south sides
Benches: Yes ☐ No ☒

No. bus shelters: long shelter over each set of bays
Condition: Good

Adjacent Street Access

Number of general traffic lanes in each direction: 3
Sidewalks: Both sides of Owens Drive

Condition: Excellent

Curb parking: None
Bicycle lanes: Both sides of Owen Drive, close side of Iron Horse Regional Trail
Condition: Excellent

Additional Comments

Patron drop-off on north and south sides of station

A. Bus Station

B. Wheels bus service time-table

C. Park-and-Ride Lot

D. Drop-off/Pick-up loading zones

E. Station Area Ingress/Egress on DeMarcus Boulevard

West Dublin-Pleasanton BART Station

Location

6501 Golden Gate Drive, Dublin & Pleasanton, CA
North of I-580
East of Golden Gate Drive
South of St. Patrick Way
North of Stoneridge Mall Road
Data source – BART (2014)

Capacity and Utilization

Parking	Supply	Average Midday Occupancy
General Purpose	1135	1135
Reserved	230	230
Disabled	35	35
Motorcycle	20	20
Total	1420	1420

Bicycles Observed: 0

Amenities

Security Cameras: 19
Pavement: Concrete
Condition: Good

Lighting: Yes ☒ No ☐
Condition: Good

Bike Facilities

No. of bike lockers: 16
Condition: Good

No. of bike racks: 42 (20 additional racks in paid area of station)
Condition: N/A

Bus Facilities

Bus Bays: 5 bays on north side, 1 on south
Bus stop location: Close side of Stoneridge Mall Road, close side of Golden Gate Drive
Benches: Yes ☒ No ☐

No. bus shelters: 5 on north side, 1 on south side
Condition: N/A

Adjacent Street Access

Number of general traffic lanes in each direction: 2
Sidewalks: Near side and far side of Stoneridge Mall Road and Golden Gate Drive
Condition: Excellent

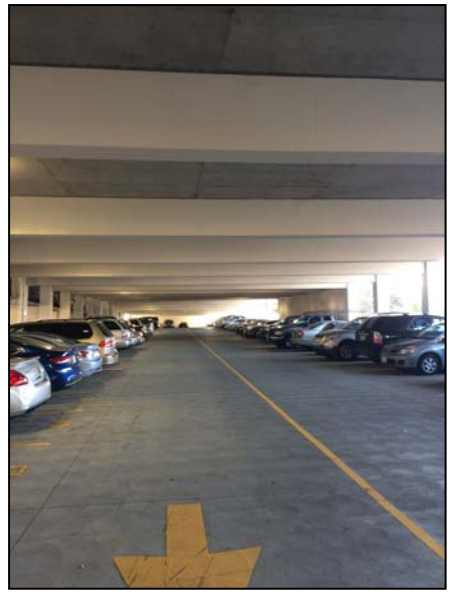
Curb parking: Far side
Bicycle lanes: Both sides of Golden Gate Drive

Condition: Excellent

Additional Comments

Patron drop-off areas located on north and south sides of station

A. Stairway to upper level parking



B. Parking garage

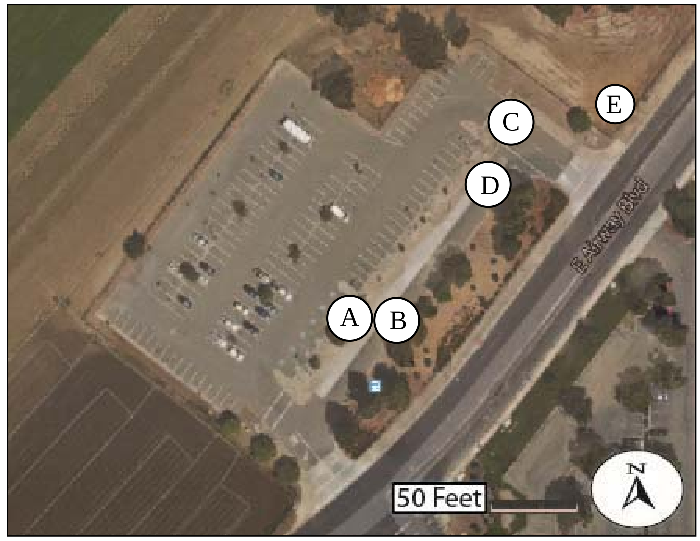
C. Garage use information signage

D. Bus stop facilities outside garage

Airway

Location

East Airway Boulevard, Livermore, CA
North of E. Airway Boulevard
Field data gathered on 9/30/15



A - Photograph locations

Capacity and Utilization

Parking	Supply	Average Midday Occupancy*
General Purpose	147	32
Disabled	6	0
Motorcycle	0	--
Total	153	32

Bicycles Observed: 0

*Average of counts taken 9/29, 10/1, 10/7

Amenities

No. of security cameras: 0
Pavement: Asphalt
Condition: Good

Lighting: Yes ☒ No ☐
Condition: Good

Bike Facilities

No. of bike lockers: 0
Condition: N/A

No. of bike racks: 0
Condition: N/A

Bus Facilities

No. of bus bays: 4
Bus stop location: Inside lot
Benches: Yes ☐ No ☒

No. bus shelters: 1
Condition: Poor

Adjacent Street Access

Number of general traffic lanes in each direction: 1
Sidewalks: Both sides of E. Airway Boulevard
Condition: Excellent

Curb parking: None
Bicycle lanes: None
Condition: N/A

Additional Comments

Call box available

A. Bus shelter

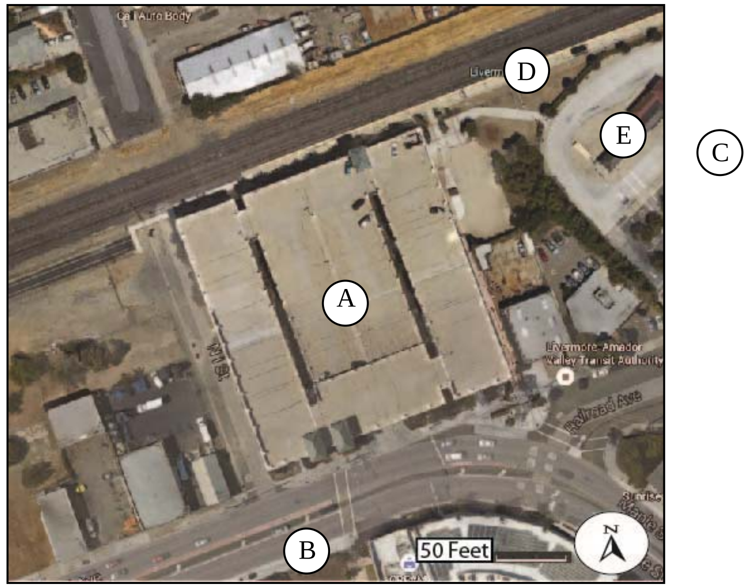
B. Bus bay near entrance of one-way bus lane

C. Car entrance to the parking lot

D. Entrance of bus lane and adjacent parking lot

E. BART logo sign at entrance

Downtown Livermore Parking Garage



Location

Livermore Valley Center Garage
Top deck only, excluding ramp
2418 Railroad Avenue, Livermore, CA
North of Railroad Avenue
East of N. Livermore Avenue
Field data gathered on 9/30/15

Capacity and Utilization

Parking	Supply	Average Midday Occupancy*
General Purpose	131	10**
Disabled	2	0
Motorcycle	0	--
Total	133	10

Bicycles Observed: 0

* Count taken on 9/30/15
** Supplementary count taken on 01/19/16 found 12 cars on upper level and 168 on other levels

Amenities

No. of security cameras: 2
Pavement: Concrete
Condition: Good - Repaired

Lighting: Yes ☒ No ☐
Condition: Good

Bike Facilities

No. of bike lockers: 9 at transit center
Condition: Excellent

No. of bike racks: 5 at garage, 4 at transit center
Condition: Good

Bus Facilities

No. of bus bays: 11
Bus stop location: At curb and nearby transit center
Benches: Yes ☒ No ☐

No. bus shelters: 3
Condition: Excellent

Adjacent Street Access

Number of general traffic lanes in each direction: 2
Sidewalks: Both sides of Railroad Avenue
Condition: Excellent

Curb parking: None
Bicycle lanes: None
Condition: N/A

Additional Comments

Ticketing and information booths, restrooms available on request at transit center. NextBus/NextTrain available at transit center.

A. Garage ramp between Level 2 and Level 3

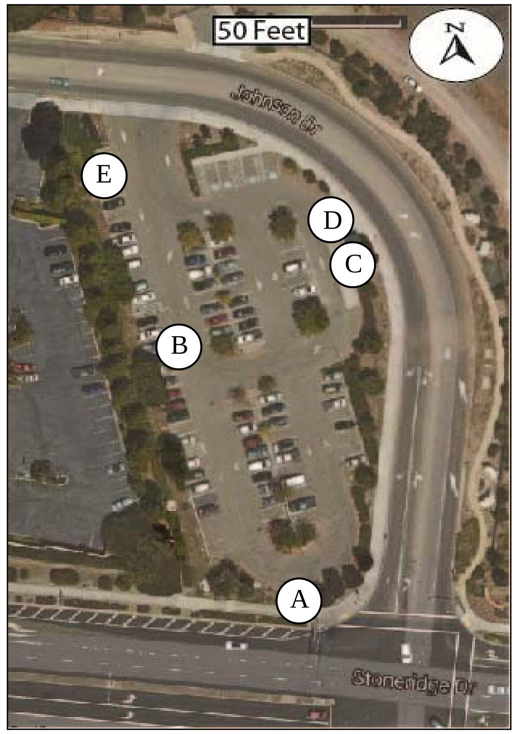
B. Bus shelter with NextBus technology across street

C. Disabled parking and temporary passenger waiting spots at nearby transit center

D. Train station with NextTrain technology

E. Bus service time table

Johnson & Stoneridge



Location

7311-7381 Johnson Drive, Pleasanton, CA
North of Stoneridge Drive
Southwest of Johnson Drive
Field data gathered on 9/30/15

Capacity and Utilization

Parking	Supply	Average Midday Occupancy*
General Purpose	83	68
Disabled	4	0
Motorcycle	5	0
Total	92	68

Bicycles Observed: 0

*Average of counts taken 9/30, 10/1, 10/7

Amenities

No. of security cameras: 0
Pavement: Asphalt
Condition: Excellent

Lighting: Yes ☒ No ☐
Condition: Excellent

Bike Facilities

No. of bike lockers: 0
Condition: Excellent

No. of bike racks:1
Condition: Good

Bus Facilities

No. of bus bays: 0
Bus stop location: Inside lot
Benches: Yes ☒ No ☐

No. bus shelters: 1
Condition: Excellent

Adjacent Street Access

Number of general traffic lanes in each direction: 1
Sidewalks: Both sides of Johnson Drive and close side Stoneridge Drive
Condition: Excellent

Curb parking: None
Bicycle lanes: Both Sides of Stoneridge Drive
Condition: Good

Additional Comments

1 Vanpool vehicle observed 9/29/2015

A. Park & Ride sign

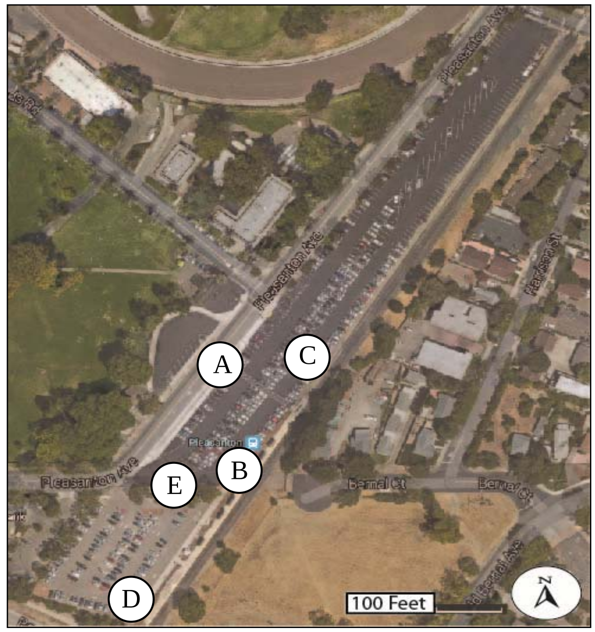
B. Westernmost parking lot aisle at full capacity

C. Bus shelter with telephone, benches, and trash cans

D. Bicycle racks near bus shelter

E. Motorcycle parking spots

Pleasanton ACE Park-and-Ride



Location

4950 Pleasanton Avenue, Pleasanton, CA
North of Bernal Avenue
East of Pleasanton Avenue
Field data gathered on 9/30/15

Capacity and Utilization

Parking	Supply	Average Midday Occupancy*
General Purpose	471	463
Disabled	15	3
Motorcycle	12	0
Total	498	466

Bicycles Observed: 6*

*Average of counts taken 9/30, 10/1, 10/7

Amenities

No. of security cameras: 12
Pavement: Asphalt
Condition: Excellent

Lighting: Yes ☒ No ☐
Condition: Excellent

Bike Facilities

No. of bike lockers: 15
Condition: Excellent

No. of bike racks: 0
Condition: N/A

Bus Facilities

No. of bus bays: 0
Bus stop location: Outside lot
Benches: Yes ☒ No ☐

No. bus shelters: 1
Condition: Good

Adjacent Street Access

Number of general traffic lanes in each direction: 1
Sidewalks: Both sides of Pleasanton Avenue
Condition: Good

Curb parking: None
Bicycle lanes: None
Condition: N/A

Additional Comments

*6 Bicycles parked along railing and sign poles

Info booth on-site, overflow parking on Pleasanton Ave (6 parked 3:25pm 9/30/15). NextTrain info available.

A. Bus shelter along Pleasanton Ave near parking lot

B. Bicycles locked along sign poles and railing

C. Parking aisle on northeastern side of parking lot

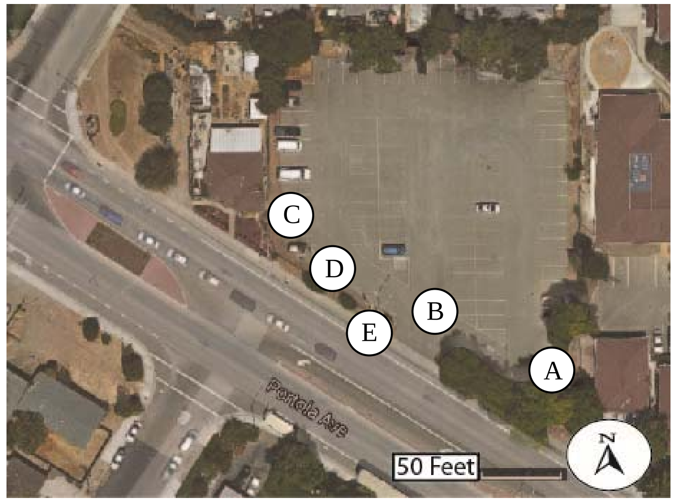
D. Bicycle locker facitilies

E. North side of parking lot

Portola

Location

1662 Portola Avenue, Livermore, CA
North of Portola Avenue and Alviso Place
Field data gathered on 9/30/15



Capacity and Utilization

Parking	Supply	Average Midday Occupancy*
General Purpose	90	25
Disabled	4	0
Motorcycle	0	--
Total	94	25

Bicycles Observed: 0

*Average of counts taken on 9/29, 10/1, 10/7

Amenities

No. of security cameras: 0
Pavement: Asphalt
Condition: Good

Lighting: Yes ☒ No ☐
Condition: Excellent

Bike Facilities

No. of bike lockers: 2
Condition: Excellent

No. of bike racks: 0
Condition: N/A

Bus Facilities

No. of bus bays: N/A
Bus stop location: N/A
Benches: Yes ☐ No ☒

No. bus shelters: N/A
Condition: N/A

Adjacent Street Access

Number of general traffic lanes in each direction: 2
Sidewalks: Both sides of Portola Avenue
Condition: Excellent

Curb parking: None
Bicycle lanes: Both sides of Portola Avenue
Condition: Good

Additional Comments

Call box available near Portola Avenue


A. Bicycle lockers at corner of parking lot


B. General parking spaces


C. Disabled parking spaces


D. Nearby bicycle facilities and park & ride sign

E. Call box near Portola Avenue side of lot

Tassajara

Location

Dublin Corporate Center
4120 Dublin Boulevard, Dublin, CA
South of Dublin Corporate Way
West of Tassajara Road
Field data gathered on 9/30/15

Capacity and Utilization

Parking	Supply	Average Midday Occupancy*
General Purpose	200	186
Disabled	0	--
Motorcycle	0	--
Total	200	186

Bicycles Observed: 0

*Average of counts taken 9/29, 10/1, 10/7

Amenities

No. of security cameras: 0
Pavement: Asphalt
Condition: Good

Lighting: Yes ☒ No ☐
Condition: Good

Bike Facilities

No. of bike lockers: 0
Condition: N/A

No. of bike racks: 0
Condition: N/A

Bus Facilities

No. of bus bays: 0
Bus stop location: Inside lot
Benches: Yes ☐ No ☒

No. bus shelters: 2
Condition: Good

Adjacent Street Access

Number of general traffic lanes in each direction: 3
Sidewalks: Both sides of Tassajara Road
Condition: Excellent

Curb parking: None
Bicycle lanes: Both Sides of Tassajara Road
Condition: Excellent

Additional Comments

Closest street with bus stops (Dublin Boulevard) is beyond convenient walking distance of facility.


A. Lot entrance with white striping for P&R cars


C. Park & Ride nearby highway surroundings

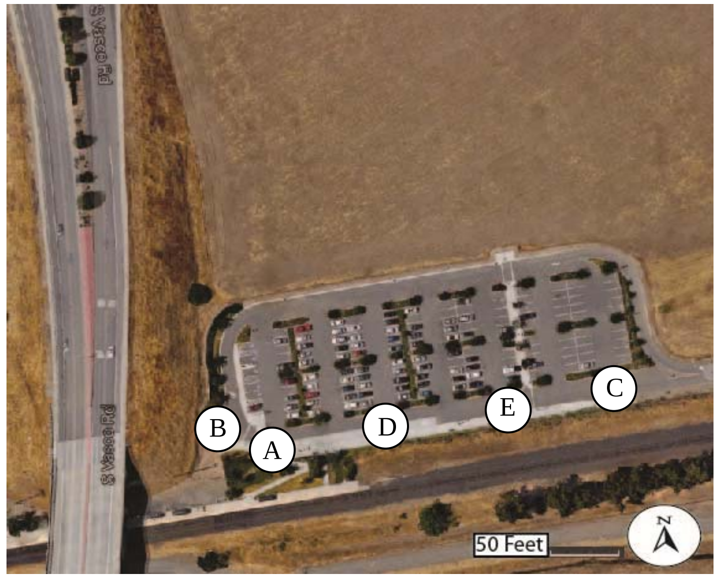
D. Park & Ride directional sign


E. Bus shelter at the entrance of Park & Ride

Vasco Road ACE (East) Park-and-Ride

Location

575 South Vasco Road, Livermore, CA
South of Brisa Street and East of S. Vasco Road
Field data gathered on 9/30/15



Capacity and Utilization

Parking	Supply	Average Midday Occupancy*
General Purpose	130	122
Disabled	6	1
Motorcycle	0	--
Total	136	123

Bicycles Observed: 0

*Average of counts taken 9/29, 10/1, 10/7

Amenities

No. of security cameras: 6
Pavement: Asphalt
Condition: Excellent

Lighting: Yes ☒ No ☐
Condition: Excellent

Bike Facilities

No. of bike lockers: 12
Condition: Excellent

No. of bike racks: 1
Condition: Good

Bus Facilities

No. of bus bays: 1
Bus stop location: Inside lot
Benches: Yes ☒ No ☐

No. bus shelters: 0
Condition: N/A

Adjacent Street Access

Number of general traffic lanes in each direction: 2
Sidewalks: Both sides of Vasco Road and Brisa Street
Condition: Excellent

Curb parking: None
Bicycle lanes: Both sides of Vasco Road
Condition: Excellent

Additional Comments

Construction occurring on close-side sidewalk along Brisa Street. Benches and nice streetscaping. NextTrain info available on station platform.

A. Bicycle racks and disabled ramp towards station platform

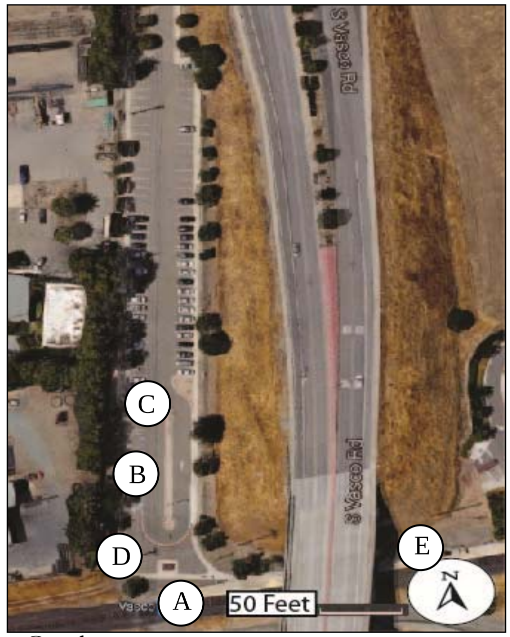
B. Bicycle lockers located near the platform and inside the station lot

C. Lighting and security camera at the entrance/exit

D. Bus stop striping inside the lot

E. Lighting and security cameras inside lot area

Vasco Road ACE (West) Park-and-Ride



Location

575 South Vasco Road, Livermore, CA
South of Brisa Street and west of S. Vasco Road
Field data gathered on 9/30/15

Capacity and Utilization

Parking	Supply	Average Midday Occupancy*
General Purpose	72	51
Disabled	7	2
Motorcycle	0	--
Total	79	53

Bicycles Observed: 0

*Average of counts taken 9/29, 10/1, 10/7

Amenities

No. of security cameras: 3
Pavement: Asphalt
Condition: Excellent

Lighting:
Condition: Good

Bike Facilities

No. of bike lockers: 6
Condition: Excellent

No. of bike racks: 0
Condition: N/A

Bus Facilities

No. of bus bays: 0
Bus stop location: Near side on Vasco at lot entrance
Benches: Yes ☐ No ☒

No. bus shelters: 0
Condition: N/A

Adjacent Street Access

Number of general traffic lanes in each direction: 2
Sidewalks: Both sides of Vasco Road and Brisa Street
Condition: Excellent

Curb parking: None
Bicycle lanes: Both sides of Vasco Road
Condition: Excellent

Additional Comments

Narrow sidewalks. NextTrain info available on station platform.

A. Rail tracks and station platform

B. Handicap parking spaces

C. General parking lot spaces and turnaround area

D. Signage of security camera presence

E. Nextrain technology and security camera along station platform

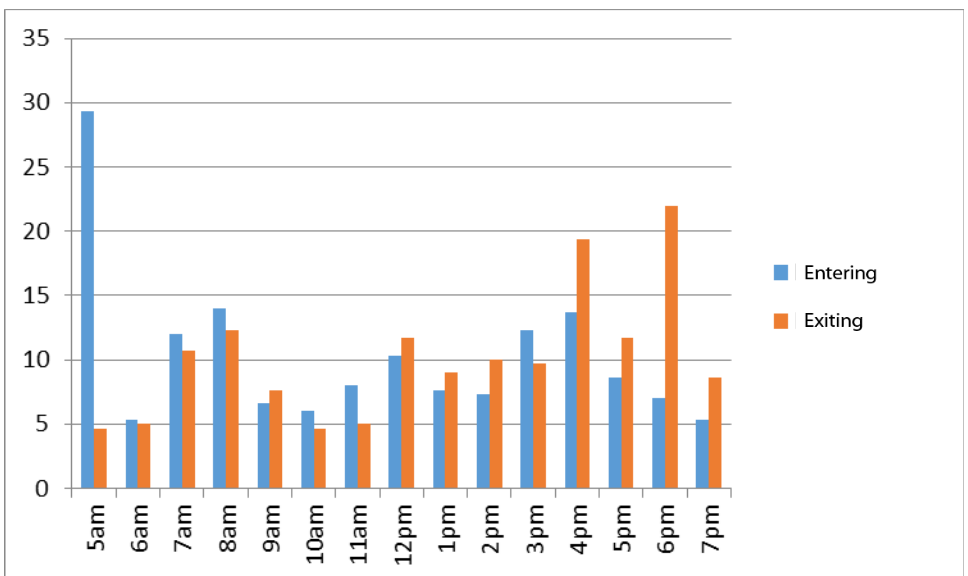
Attachment B

Arrival and Departure Counts

East Airway Boulevard Park-and-Ride Arrival and Departure Counts

Entering				
Time	Tuesday	Wednesday	Thursday	Average
5am	34	25	29	29
6am	7	4	5	5
7am	11	14	11	12
8am	15	13	14	14
9am	8	2	10	7
10am	5	6	7	6
11am	5	4	15	8
12pm	11	7	13	10
1pm	9	4	10	8
2pm	8	6	8	7
3pm	14	10	13	12
4pm	13	15	13	14
5pm	12	7	7	9
6pm	7	6	8	7
7pm	8	3	5	5

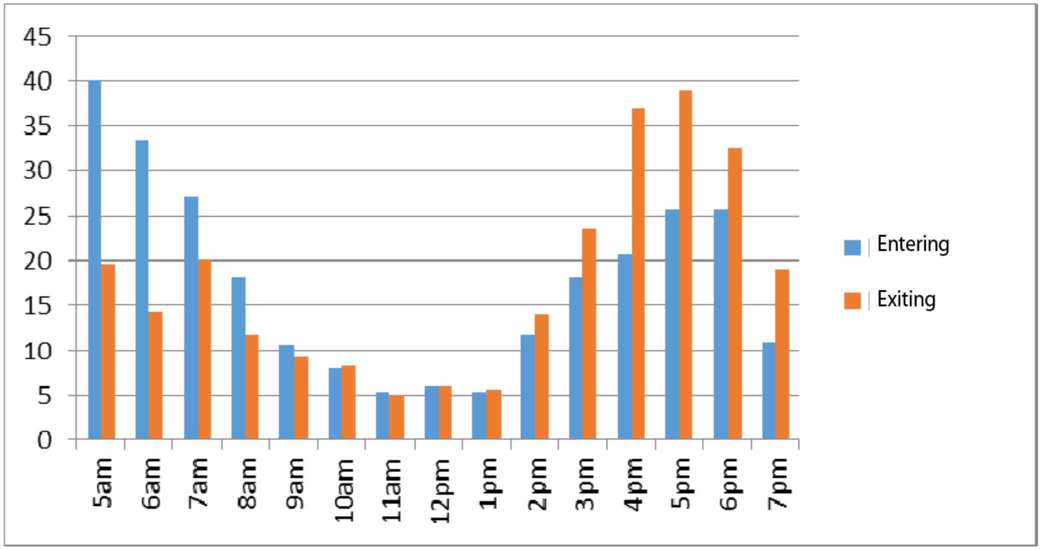
Exiting				
Time	Tuesday	Wednesday	Thursday	Average
5am	6	3	5	5
6am	7	5	3	5
7am	10	11	11	11
8am	12	15	10	12
9am	9	2	12	8
10am	3	7	4	5
11am	5	2	8	5
12pm	11	7	17	12
1pm	11	5	11	9
2pm	12	7	11	10
3pm	9	9	11	10
4pm	26	13	19	19
5pm	8	17	10	12
6pm	25	19	22	22
7pm	12	6	8	9



Johnson & Stoneridge Park-and-Ride Arrival and Departure Counts

Entering				
Time	Tuesday	Wednesday*	Thursday	Average
5am	43	42	35	40
6am	33	33	34	33
7am	30	24	27	27
8am	16	18	20	18
9am	8	12	12	11
10am	5	11	8	8
11am	3	8	5	5
12pm	8	5	5	6
1pm	4	6	6	5
2pm	8	14	13	12
3pm	16	20	18	18
4pm	21	23	18	21
5pm	28	25	24	26
6pm	26	22	29	26
7pm	13	9	11	11

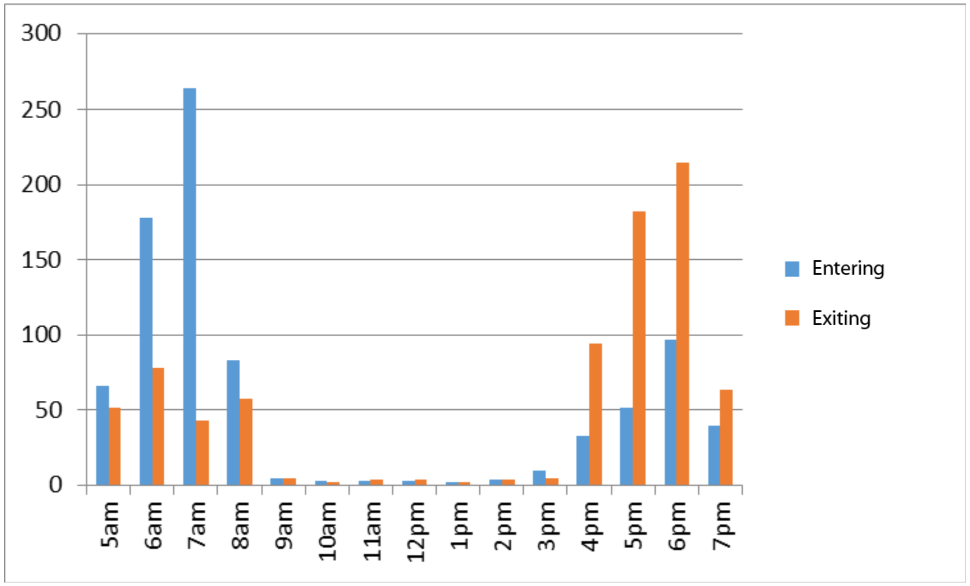
Exiting				
Time	Tuesday	Wednesday*	Thursday	Average
5am	22	19	18	20
6am	12	15	16	14
7am	21	17	22	20
8am	11	10	14	12
9am	6	10	12	9
10am	4	12	9	8
11am	3	10	2	5
12pm	8	4	6	6
1pm	5	6	6	6
2pm	10	17	15	14
3pm	23	24	24	24
4pm	36	38	37	37
5pm	42	42	33	39
6pm	35	25	38	33
7pm	19	23	15	19



Pleasanton ACE Station Arrival and Departure Counts

Entering				
Time	**Tuesday**	**Wednesday**	**Thursday**	**Average**
5am	74	69	56	66
6am	172	181	182	178
7am	264	256	272	264
8am	88	74	86	83
9am	6	4	6	5
10am	2	3	3	3
11am	5	2	3	3
12pm	2	2	4	3
1pm	2	2	3	2
2pm	4	3	5	4
3pm	14	9	6	10
4pm	36	27	36	33
5pm	33	84	40	52
6pm	43	208	40	97
7pm	14	72	34	40

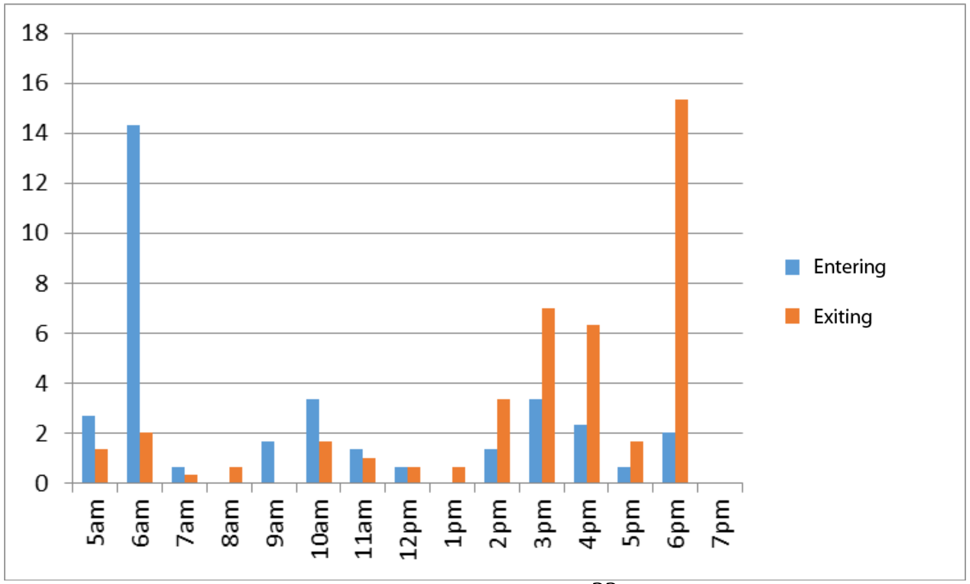
Exiting				
Time	**Tuesday**	**Wednesday**	**Thursday**	**Average**
5am-6am	12	23	17	52
6am-7am	34	156	43	78
7am-8am	37	51	42	43
8am-9am	72	33	69	58
9am-10am	5	5	6	5
10am-11am	1	2	2	2
11am-12pm	6	2	5	4
12pm-1pm	4	3	4	4
1pm-2pm	0	1	4	2
2pm-3pm	4	3	4	4
3pm-4pm	9	5	2	5
4pm-5pm	97	91	93	94
5pm-6pm	189	173	183	182
6pm-7pm	219	225	202	215
7pm-8pm	60	45	87	64



Portola Park-and-Ride Arrival and Departure Counts

Entering				
Time	Tuesday	Wednesday	Thursday	Average
5am	2	4	2	3
6am	14	16	13	14
7am	0	0	2	1
8am	0	0	0	0
9am	0	0	5	2
10am	2	3	5	3
11am	1	2	1	1
12pm	0	2	0	1
1pm	0	0	0	0
2pm	2	0	2	1
3pm	2	5	3	3
4pm	1	4	2	2
5pm	1	1	0	1
6pm	1	1	4	2
7pm	0	0	0	0

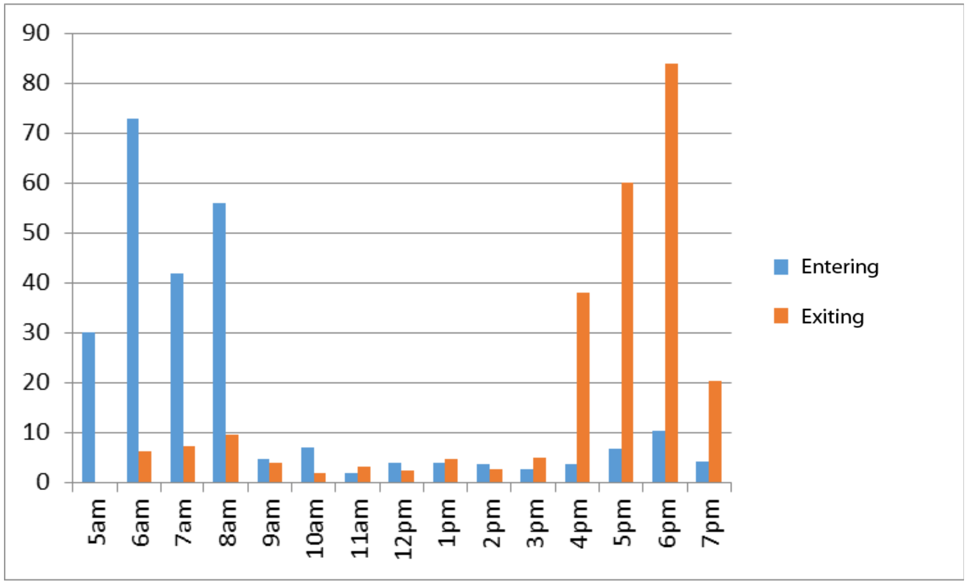
Exiting				
Time	Tuesday	Wednesday	Thursday	Average
5am	2	0	2	1
6am	2	2	2	2
7am	0	1	0	0
8am	0	0	2	1
9am	0	0	0	0
10am	2	1	2	2
11am	1	1	1	1
12pm	0	1	1	1
1pm	0	1	1	1
2pm	5	1	4	3
3pm	6	12	3	7
4pm	2	9	8	6
5pm	2	2	1	2
6pm	12	13	21	15
7pm	0	0	0	0



Tassajara Park-and-Ride Arrival and Departure Counts

Entering				
Time	Tuesday	Wednesday	Thursday	Average
5am	34	29	27	30
6am	72	80	67	73
7am	42	40	44	42
8am	57	53	58	56
9am	3	3	8	5
10am	5	6	10	7
11am	2	0	4	2
12pm	4	2	6	4
1pm	1	3	8	4
2pm	3	2	6	4
3pm	4	1	3	3
4pm	3	4	4	4
5pm	4	10	6	7
6pm	17	9	5	10
7pm	1	5	7	4

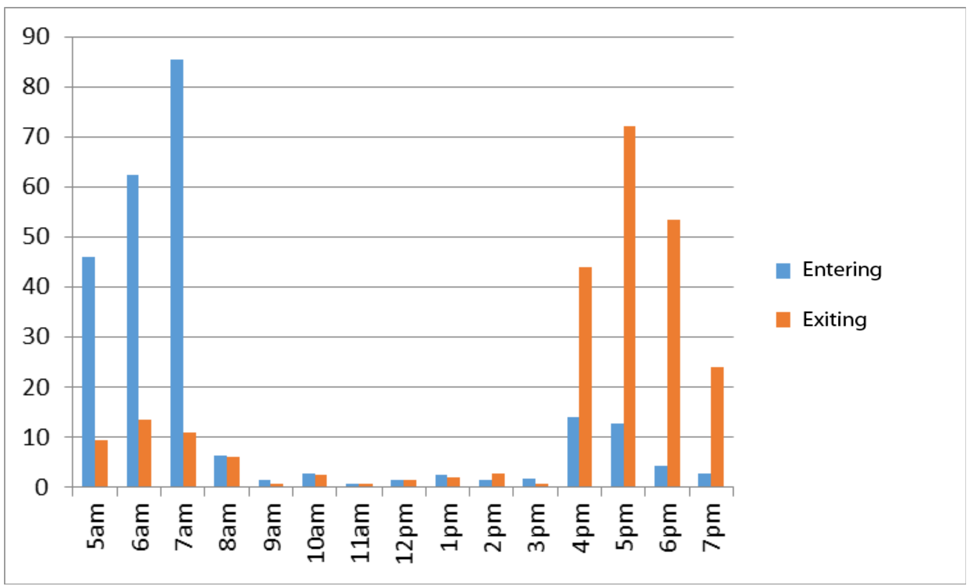
Exiting				
Time	Tuesday	Wednesday	Thursday	Average
5am	0	0	0	0
6am	7	6	6	6
7am	9	8	5	7
8am	8	11	10	10
9am	3	3	6	4
10am	2	1	3	2
11am	4	3	3	3
12pm	1	1	5	2
1pm	2	4	8	5
2pm	3	1	4	3
3pm	6	4	5	5
4pm	46	19	49	38
5pm	47	78	55	60
6pm	97	84	71	84
7pm	17	18	26	20



Vasco Road ACE Station Arrival and Departure Counts

Entering				
Time	Tuesday	Wednesday	Thursday	Average
5am	50	41	47	46
6am	61	68	58	62
7am	80	82	94	85
8am	3	12	4	6
9am	1	3	0	1
10am	3	2	3	3
11am	0	2	0	1
12pm	1	3	0	1
1pm	4	1	2	2
2pm	2	1	1	1
3pm	3	0	2	2
4pm	13	13	16	14
5pm	13	9	16	13
6pm	5	5	3	4
7pm	3	5	0	3

Exiting				
Time	Tuesday	Wednesday	Thursday	Average
5am	10	7	11	9
6am	11	14	15	13
7am	8	11	14	11
8am	5	8	5	6
9am	1	1	0	1
10am	3	2	2	2
11am	0	2	0	1
12pm	1	3	0	1
1pm	2	3	1	2
2pm	5	1	2	3
3pm	1	1	0	1
4pm	46	44	42	44
5pm	67	79	70	72
6pm	65	42	53	53
7pm	21	30	21	24



Attachment C

Peak Occupancy Counts

Table

Tri-Valley Park-and-Ride Facility Midday Occupancy

	midday auto occupancy			3-day	auto	percent
	9/29/15	10/1/15	10/7/15	average	capacity	utilization
BART Dublin/Pleasanton	--	--	--	1420[a]	1420	100%
BART West Dublin/Pleasanton	--	--	--	3517[a]	3517	100%
Airway	30	34	31	32	153	21%
Downtown Livermore Garage	--	--	--	10[b]	133	8%
Johnson & Stoneridge	69	65	71	68	87	78%
Pleasanton ACE	458	463	469	463[c]	486	95%
Portola	20	28	26	25	94	27%
Tassajara	187	185	187	186	200	93%
Vasco ACE East	128	123	118	123	136	90%
Vasco ACE West	57	50	52	53	79	67%

Unless otherwise noted, all counts taken by Counts Unlimited, Inc.
Counts represent total occupancy of general purpose + disabled spaces

[a]Counts provided by BART

[b]One-day count taken by CHS on 9/30/15; supplementary count on 1/19/16 suggested that many more commuters may be parking in non-commuter spaces

[c]Average of 5 motorcycles per day not included in this figure

Attachment D

Intercept Survey Results

To: William Lieberman
From: David Latterman
Re: Tri-Valley Park-and-Ride Intercept Survey
Date: October 25, 2015

Methodology

This memorandum summarizes an intercept interview survey of park-and-ride users in the Livermore-Dublin-Pleasanton Tri-Valley area. It was undertaken under the auspices of the Alameda County Transportation Commission. The survey was conducted over five days, in two separate weeks, by canvassers who administered the one-minute survey orally to respondents. Respondents were generally waiting for a train or bus, or they were captured moving from their car to a carpooling location.

All together, there were 181 valid completed surveys. Table 1 shows each location, the days they were canvassed, and the number of responses. The most problematic location was Airway, which was sparsely used on either day. According to the field workers, they were told that due to a recent rash of burglaries, fewer people were using this lot.

Table 1: Locations, days canvassed, and valid completes. Number indicates if the survey was administered during the first or second week, letter indicates the day of the week.

Lot	Days Canvassed	Count
Airway	W1,W2	4
DT Livermore garage	T1	24
Johnson	W1,W2	30
Pleasanton ACE	Th1	48
Portola	Th1,T1	18
Tassajara		25
Vasco E	T1	14
Vasco W	T1,T2	21
TOTAL		181

For each location, I list a brief synopsis below of the main response patterns:

Airway

Two canvassers were sent to Airway on two different days, but this was a sparsely used site. There is an Amazon shuttle that picks up from here, but it only picked up a few passengers during the shifts. A few carpoolers still use this site, but no one seemed to linger.

Downtown Livermore garage

Most of the respondents came from Livermore (87%) and were headed to Santa Clara (38%), Livermore (21%), or Pleasanton (13%). It had the most diverse mixture of transit modes, with nearly every mode over 10% of the total. 55% of respondents took ACE after arriving at the garage, with many of them going to Great America in Santa Clara for work. 74% of the trips were for work, with a majority (53%) of respondents saying they'd park in the street if no parking were available.

Johnson

Most respondents came from Pleasanton (47%) or Dublin (23%), and the plurality were header to either Santa Clara (21%) or San Jose (17%). Most drove (70%) to the lot, and were either using ACE (47%) or taking a carpool (33%). Many of the respondents were going to work Great America in Santa Clara. Nearly all were there for work.

Pleasanton ACE

Like Johnson, most respondents were from Pleasanton (56%), San Ramon (17%), or Dublin (15%). They were mainly headed to Santa Clara (57%) or San Jose (21%).   The large majority drove there (69%), and of course most took ACE to their destination (94%). The majority of respondents who took ACE were going to Great America.

Portola

The respondents came from Dublin (44%), Alameda (17%), and Livermore (17%). Nearly two-thirds of the respondents seem to drive alone in order to take the shuttle bus to the EJ Gallo winery in Modesto. The remaining portion of the respondents seemed to have driven there in order to walk to work afterwards, and a few drove there to walk to volunteer at Shepard's Gate.

Tassajara

Most Respondents began their trip in Dublin (44%) or Livermore (28%), travelling to Foster City (48%) or Sunnyvale (36%). 80% of respondents drove there and 20% were dropped off. This lot has a lot of corporate shuttles, including Facebook, Amazon, Visa, and Yahoo. It appears that the same people use this lot for all-day parking all month.

Vasco E and W

Despite being different lots, the transit patterns were pretty similar for both of them. Respondents came from Mountain House and Livermore (and few from Brentwood), with the majority travelling to Santa Clara. Over 70% of respondents drove here, and over 80% took ACE, again to Great America. These are also lots for habitual all-day parkers who drive alone to work.

Detailed Results

Frequencies are given below by location, and then each location is summarized. Overall, most people drove alone and took ACE or a corporate shuttle bus to their place of work. They tended to park there all day until the bus or train brought them back to the lot. Few respondents used these lots for school (7%), and interestingly 72% of the respondents were male.

Shuttle lot intercept survey DRAFT v1 (circle) T W Th

Location Lot # (circle) 1 2 3 4 5 6 7 8 RECORD TIME__________

Polite Intro: Alameda CTC and its partners are seeking ways to improve park-and-ride facilities in the Tri-Valley area. Would you help us with a one-minute survey?

1. Where did your trip to this park-and-ride lot begin (city and zip code)?

   City ________________________________

   Zip______________

2. What is the ultimate destination of your trip this morning (city and zip code)?

   City ________________________________

   Zip______________

3. At about what time today will you leave this parking facility to return home? ________________

4. How did you arrive here this morning? (Check only **ONE** response)

   O Drove my own car or motorcycle **--FOLLOW UP--** How many people, including the driver, were in this vehicle when you arrived? ________

   O Rode in car with someone else who drove here **--FOLLOW UP--** How many people, including the driver, were in this vehicle when you arrived? ________

   O Dropped off by someone who didn't park here

   O Bicycle

   O Other (specify mode of transportation): ____

5. Where will you go next after parking here? (Check only **ONE** response)

   O Take public bus to BART bus route number: ______ BART station: ___________________

   O Take private bus to employment area (please specify which employer): ____

   O Carpool to my destination (please specify number of people with you in the carpool today): _______

   O Take ACE train to my destination (please specify destination station): _____________________________

   O Other (specify mode of transportation): ____

6. How many days a month do you usually park here? (Circle only **ONE** response)

   More than 15 days 5-15 days Less than 5 days

7. What is usually the purpose of your trip when you park here? (Circle only **ONE** response)

   Go to work Go to school Other ____

8. If you used BART today, why didn't you park at a BART station?

   ____

9. If this lot were full when you arrived, what would you do? (Check **ONE** most likely choice)

   O Park on the street

   O Go to another lot or garage

   O Drive all the way to my destination

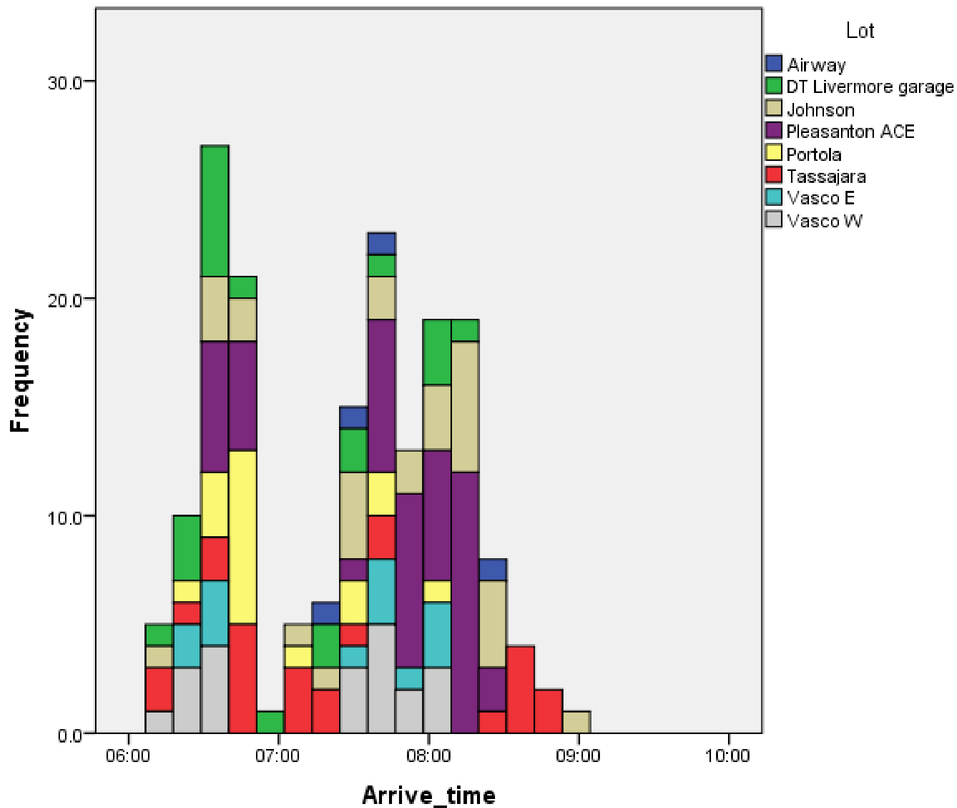
   O Other:____

Surveyor use only! Choose one. Please use a "1" if you are certain, use a "2" if you are not totally sure

6. Age
18-30______________
31-55_______________
Over 55______________

7. Gender
Male____________
Female______________

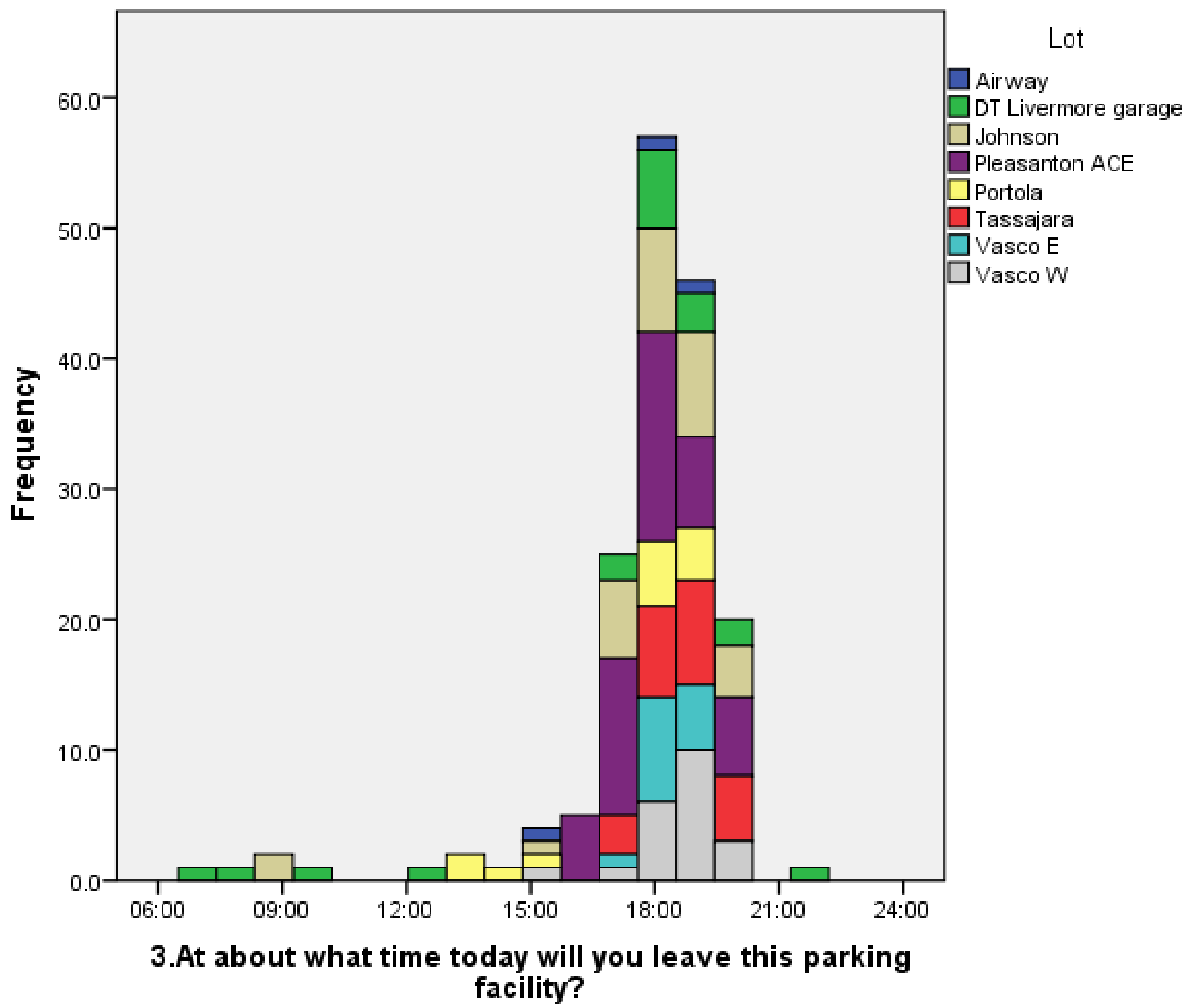
8. Important notes
(like wheelchair, small kids...)



Lot
Airway
DT Livermore garage
Johnson
Pleasanton ACE
Portola
Tassajara
Vasco E
Vasco W
Frequency
30.0
20.0
10.0
0.0
06:00
07:00
08:00
09:00
10:00
Arrive_time

		Lot							
		Airway	DT Livermore garage	Johnson	Pleasanton ACE	Portola	Tassajara	Vasco E	Vasco W
		Column N %	Column N %	Column N %	Column N %	Column N %	Column N %	Column N %	Column N %
1.Where did your trip to this park-and-ride lot begin (city)	Alameda	0.0%	0.0%	0.0%	0.0%	16.7%	0.0%	0.0%	0.0%
	Antioch	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	4.8%
	Brentwood	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	14.3%	14.3%
	Castro Valley	0.0%	0.0%	0.0%	2.1%	0.0%	0.0%	0.0%	0.0%
	Danville	0.0%	0.0%	6.7%	6.3%	0.0%	0.0%	0.0%	0.0%
	Discovery Bay	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	7.1%	0.0%
	Dublin	0.0%	0.0%	23.3%	14.6%	44.4%	44.0%	0.0%	0.0%
	Lathrop	0.0%	4.3%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Livermore	75.0%	87.0%	0.0%	0.0%	16.7%	28.0%	28.6%	42.9%
	Manteca	0.0%	0.0%	3.3%	2.1%	0.0%	0.0%	0.0%	0.0%
	Mountain House	0.0%	0.0%	3.3%	0.0%	0.0%	8.0%	50.0%	38.1%
	Newark	0.0%	0.0%	0.0%	0.0%	5.6%	0.0%	0.0%	0.0%
	Oakland	0.0%	0.0%	0.0%	0.0%	5.6%	0.0%	0.0%	0.0%
	Pleasanton	0.0%	0.0%	46.7%	56.3%	0.0%	12.0%	0.0%	0.0%
	San Francisco	25.0%	0.0%	0.0%	0.0%	5.6%	0.0%	0.0%	0.0%
	San Ramon	0.0%	0.0%	10.0%	16.7%	0.0%	8.0%	0.0%	0.0%
	Santa Rosa	0.0%	0.0%	0.0%	0.0%	5.6%	0.0%	0.0%	0.0%
	Stockton	0.0%	8.7%	3.3%	0.0%	0.0%	0.0%	0.0%	0.0%
	Tracy	0.0%	0.0%	3.3%	2.1%	0.0%	0.0%	0.0%	0.0%

		Lot							
		Airway	DT Livermore garage	Johnson	Pleasanton ACE	Portola	Tassajara	Vasco E	Vasco W
		Column N %	Column N %	Column N %	Column N %	Column N %	Column N %	Column N %	Column N %
2.What is the ultimate destination of your trip this morning (city)	Alameda	0.0%	0.0%	8.3%	0.0%	0.0%	0.0%	0.0%	0.0%
	Balboa Park	0.0%	0.0%	0.0%	2.1%	0.0%	0.0%	0.0%	0.0%
	Dublin	0.0%	0.0%	4.2%	0.0%	0.0%	0.0%	0.0%	0.0%
	Foster City	0.0%	0.0%	0.0%	0.0%	0.0%	48.0%	0.0%	0.0%
	Fremont	0.0%	4.2%	4.2%	0.0%	0.0%	0.0%	7.1%	4.8%
	Hayward	0.0%	4.2%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Livermore	25.0%	20.8%	0.0%	0.0%	33.3%	0.0%	0.0%	0.0%
	Menlo Park	0.0%	4.2%	0.0%	0.0%	0.0%	12.0%	0.0%	0.0%
	Milpitas	0.0%	0.0%	4.2%	0.0%	0.0%	0.0%	0.0%	0.0%
	Modesto	0.0%	0.0%	0.0%	0.0%	66.7%	0.0%	0.0%	0.0%
	Mountain View	0.0%	4.2%	8.3%	0.0%	0.0%	0.0%	14.3%	4.8%
	Palo Alto	0.0%	0.0%	0.0%	0.0%	0.0%	4.0%	7.1%	0.0%
	Pleasanton	0.0%	12.5%	4.2%	0.0%	0.0%	0.0%	0.0%	0.0%
	San Francisco	50.0%	4.2%	8.3%	2.1%	0.0%	0.0%	0.0%	0.0%
	San Jose	0.0%	4.2%	16.7%	20.8%	0.0%	0.0%	14.3%	9.5%
	Santa Barbara	0.0%	0.0%	0.0%	4.2%	0.0%	0.0%	0.0%	0.0%
	Santa Clara	0.0%	37.5%	20.8%	56.3%	0.0%	0.0%	50.0%	42.9%
	South San Francisco	0.0%	0.0%	4.2%	0.0%	0.0%	0.0%	0.0%	0.0%
	Stanford	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	4.8%
	Sunnyvale	25.0%	4.2%	16.7%	14.6%	0.0%	36.0%	7.1%	33.3%


Lot
Airway
DT Livermore garage
Johnson
Pleasanton ACE
Portola
Tassajara
Vasco E
Vasco W
Frequency
60.0
50.0
40.0
30.0
20.0
10.0
0.0
06:00
09:00
12:00
15:00
18:00
21:00
24:00
3.At about what time today will you leave this parking facility?

		Lot							
		Airway	DT Livermore garage	Johnson	Pleasanton ACE	Portola	Tassajara	Vasco E	Vasco W
		Column N %	Column N %	Column N %	Column N %	Column N %	Column N %	Column N %	Column N %
4.How did you arrive here this morning?	Bike	0.0%	8.3%	6.7%	8.3%	0.0%	0.0%	7.1%	0.0%
	Drop-off	25.0%	16.7%	3.3%	10.4%	0.0%	12.0%	0.0%	14.3%
	Drove	75.0%	33.3%	70.0%	68.8%	100.0%	80.0%	71.4%	76.2%
	Other	0.0%	29.2%	16.7%	10.4%	0.0%	0.0%	0.0%	9.5%
	Rode w else	0.0%	12.5%	3.3%	2.1%	0.0%	8.0%	21.4%	0.0%

For respondents who drove, 71 respondents reported the number of people in their car. Only 7 (9.9%) reported having more than one person in their car.

		Lot							
		Airway	DT Livermore garage	Johnson	Pleasanton ACE	Portola	Tassajara	Vasco E	Vasco W
		Column N %	Column N %	Column N %	Column N %	Column N %	Column N %	Column N %	Column N %
follow_up_4	No response	25.0%	54.2%	20.0%	77.1%	0.0%	100.0%	85.7%	14.3%
	Drove w/1	75.0%	16.7%	60.0%	10.4%	100.0%	0.0%	0.0%	71.4%
	Drove w/2	0.0%	4.2%	3.3%	2.1%	0.0%	0.0%	14.3%	4.8%
	Drove w/3	0.0%	0.0%	0.0%	2.1%	0.0%	0.0%	0.0%	0.0%
	92x bus	0.0%	0.0%	3.3%	0.0%	0.0%	0.0%	0.0%	0.0%
	ACE	0.0%	8.3%	0.0%	4.2%	0.0%	0.0%	0.0%	0.0%
	bus	0.0%	4.2%	0.0%	2.1%	0.0%	0.0%	0.0%	0.0%
	shuttle	0.0%	0.0%	0.0%	2.1%	0.0%	0.0%	0.0%	0.0%
	train	0.0%	0.0%	10.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	walk	0.0%	8.3%	3.3%	0.0%	0.0%	0.0%	0.0%	9.5%
	Wheels bus	0.0%	4.2%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%

		Lot							
		Airway	DT Livermore garage	Johnson	Pleasanton ACE	Portola	Tassajara	Vasco E	Vasco W
		Column N %	Column N %	Column N %	Column N %	Column N %	Column N %	Column N %	Column N %
5.Where will you go next after parking here?	ACE	0.0%	54.5%	46.7%	93.8%	0.0%	0.0%	85.7%	95.2%
	BART	25.0%	9.1%	6.7%	4.2%	0.0%	0.0%	0.0%	0.0%
	Bus	50.0%	4.5%	6.7%	2.1%	66.7%	100.0%	0.0%	0.0%
	Carpool	25.0%	0.0%	33.3%	0.0%	0.0%	0.0%	0.0%	0.0%
	Other	0.0%	31.8%	6.7%	0.0%	33.3%	0.0%	14.3%	4.8%

		Lot							
		Airway	DT Livermore garage	Johnson	Pleasanton ACE	Portola	Tassajara	Vasco E	Vasco W
		Column N %	Column N %	Column N %	Column N %	Column N %	Column N %	Column N %	Column N %
follow_up_5_rec	No response	0.0%	33.3%	16.7%	31.3%	0.0%	12.0%	57.1%	9.5%
	Amazon	25.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Bike	0.0%	4.2%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Bus - Newark	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	4.8%
	Bus rt 10	0.0%	4.2%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Bus rt 12	50.0%	4.2%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Bus rt 14	0.0%	4.2%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Bus rt 53	0.0%	0.0%	6.7%	2.1%	0.0%	0.0%	0.0%	0.0%
	Bus to Las Positas	0.0%	4.2%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Car	0.0%	4.2%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Car for work	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	7.1%	0.0%
	Carpool w/2	25.0%	0.0%	16.7%	0.0%	0.0%	0.0%	0.0%	0.0%
	Carpool w/3	0.0%	0.0%	10.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Diridon	0.0%	0.0%	6.7%	2.1%	0.0%	0.0%	0.0%	0.0%
	Dublin	0.0%	0.0%	0.0%	2.1%	0.0%	0.0%	0.0%	0.0%
	E&J Gallo Winery	0.0%	0.0%	0.0%	0.0%	66.7%	0.0%	0.0%	0.0%
	Facebook	0.0%	0.0%	0.0%	0.0%	0.0%	16.0%	0.0%	0.0%

	Fremont	0.0%	4.2%	0.0%	0.0%	0.0%	0.0%	0.0%	4.8%
	Great America	0.0%	16.7%	30.0%	54.2%	0.0%	0.0%	28.6%	71.4%
	San Jose then walk	0.0%	0.0%	0.0%	2.1%	0.0%	0.0%	0.0%	4.8%
	Santa Barbara	0.0%	0.0%	0.0%	4.2%	0.0%	0.0%	0.0%	0.0%
	Santa Clara	0.0%	8.3%	0.0%	0.0%	0.0%	0.0%	0.0%	4.8%
	Shuttle bus to work	0.0%	4.2%	0.0%	0.0%	0.0%	4.0%	0.0%	0.0%
	Tesla	0.0%	0.0%	3.3%	0.0%	0.0%	0.0%	0.0%	0.0%
	UBER	0.0%	0.0%	3.3%	0.0%	0.0%	0.0%	0.0%	0.0%
	Visa	0.0%	0.0%	0.0%	0.0%	0.0%	44.0%	0.0%	0.0%
	VTA shuttle	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	7.1%	0.0%
	Walk	0.0%	4.2%	3.3%	0.0%	33,3%	0.0%	0.0%	0.0%
	Wheels bus	0.0%	4.2%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Work on First St	0.0%	0.0%	0.0%	2.1%	0.0%	0.0%	0.0%	0.0%
	Work vanpool	0.0%	0.0%	3.3%	0.0%	0.0%	0.0%	0.0%	0.0%
	Yahoo	0.0%	0.0%	0.0%	0.0%	0.0%	24.0%	0.0%	0.0%

		Lot							
		Airway	DT Livermore garage	Johnson	Pleasanton ACE	Portola	Tassajara	Vasco E	Vasco W
		Column N %	Column N %	Column N %	Column N %	Column N %	Column N %	Column N %	Column N %
6.How many days a month do you park here?	<5	33.3%	31.6%	26.7%	20.8%	31.3%	8.0%	0.0%	0.0%
	>15	33.3%	47.4%	33.3%	56.3%	50.0%	84.0%	85.7%	81.0%
	5-15	33.3%	21.1%	40.0%	22.9%	18.8%	8.0%	14.3%	19.0%

		Lot							
		Airway	DT Livermore garage	Johnson	Pleasanton ACE	Portola	Tassajara	Vasco E	Vasco W
		Column N %	Column N %	Column N %	Column N %	Column N %	Column N %	Column N %	Column N %
7.What is usually the purpose of your trip when you park here?	Other	25.0%	4.3%	0.0%	4.2%	23.5%	0.0%	0.0%	0.0%
	School	0.0%	21.7%	6.7%	10.4%	0.0%	0.0%	0.0%	0.0%
	Work	75.0%	73.9%	93.3%	85.4%	76.5%	100.0%	100.0%	100.0%

Only 8 respondents answered question 8, "If you used BART today, why didn't you park at a BART station?" Nearly all said there isn't any parking or it's too difficult.

		Lot							
		Airway	DT Livermore garage	Johnson	Pleasanton ACE	Portola	Tassajara	Vasco E	Vasco W
		Column N %	Column N %	Column N %	Column N %	Column N %	Column N %	Column N %	Column N %
9.If this lot were full when you arrived, what would you do?	Drive	33.3%	11.8%	36.7%	41.7%	52.9%	32.0%	21.4%	23.8%
	Lot/garage	0.0%	11.8%	13.3%	0.0%	17.6%	56.0%	0.0%	28.6%
	Other	33.3%	23.5%	26.7%	20.8%	0.0%	12.0%	28.6%	28.6%
	Street	33.3%	52.9%	23.3%	37.5%	29.4%	0.0%	50.0%	19.0%

Attachment E

Transit Bus Service Inventory

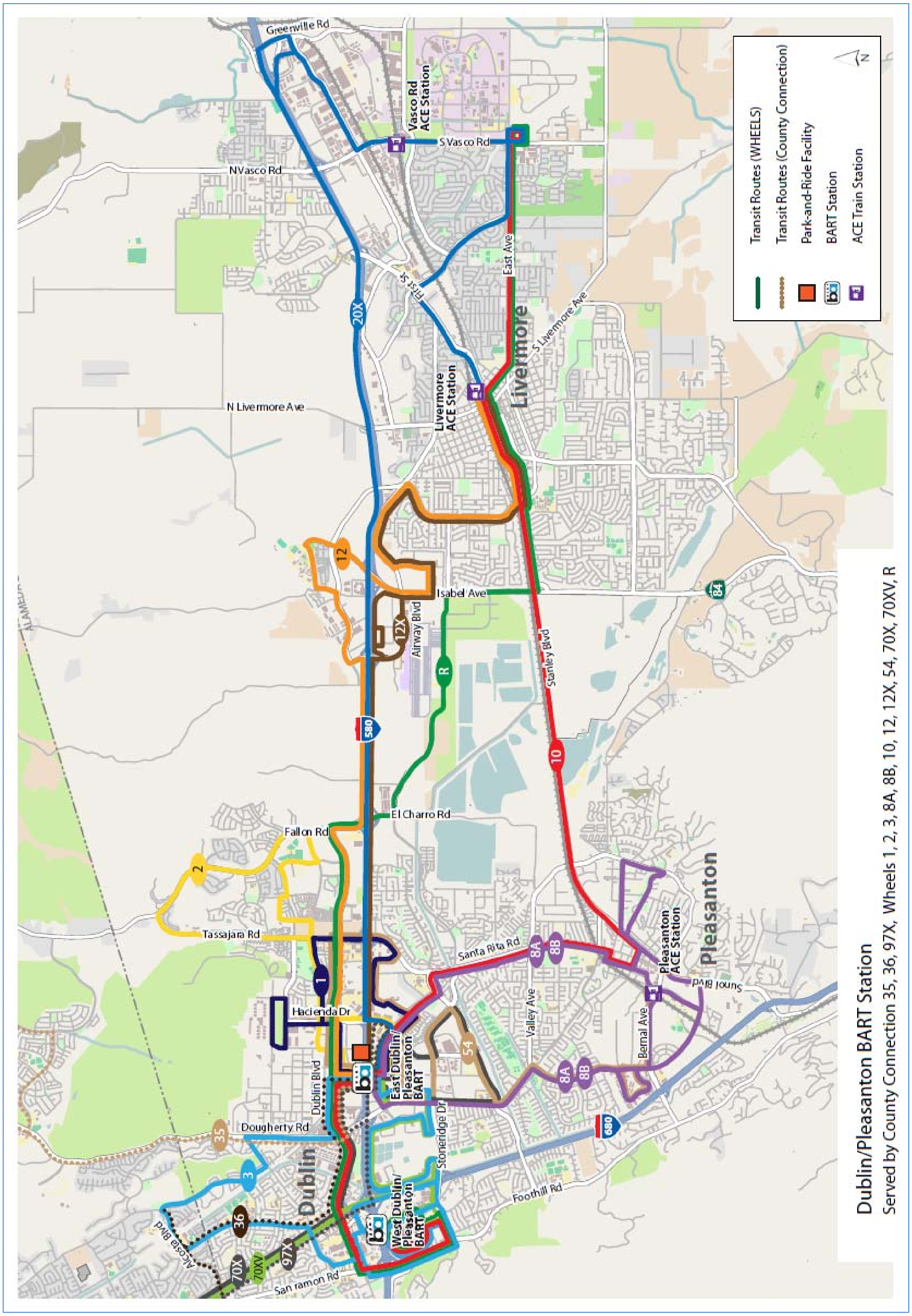
No	Facility	Transit		Weekday Headways			Travel Time	
		Bus Route	Operating Agency	AM Peak	Midday	PM Peak	To BART	From BART
1	BART: Dublin/Pleasanton Station	35	County Connection	30/60	30/60	30/60		
		36	County Connection	60	60	60		
		97X	County Connection	30	-	30		
		1	WHEELS	30	-	-		
		2	WHEELS	60	-	60		
		3	WHEELS	30	-	30		
		8A	WHEELS	60	60	60		
		8B	WHEELS	60	60	60		
		10	WHEELS	30	30	30		
		12	WHEELS	30/60	30/60			
		12X	WHEELS	30	-	30		
		54	WHEELS	60	-	60		
		70X	WHEELS	30	-	30		
		70XV	WHEELS	1 Run	-	1 Run		
		Rapid	WHEELS	15	15	15		
2	BART: West Dublin/Pleasanton Station	3	WHEELS	30	-	30		
		10	WHEELS	30	30	30		
		53	WHEELS	60 min	-	60 min		
		70XV	WHEELS	1 Run	-	1 Run		
		Rapid	WHEELS	15	15	15		
3	Airway	12	WHEELS	30	60	30	Dublin/Pleasanton BART	30 mins (To BART) 28 mins (From BART)
	Livermore, CA						Livermore ACE Station/ Transit Center	14 mins (To Transit Center) 12 mins (From Transit Center)
		12X	WHEELS	30	-	30 (To BART) 45 (From BART)	Dublin/Pleasanton BART	18 mins (To BART) 16 mins (From BART)
							Livermore ACE Station/ Transit Center	14 mins (To Transit Center) 12 mins (From Transit Center)
4	Downtown Livermore Parking Garage	10	WHEELS	30	30	30	Dublin/Pleasanton BART	34 mins (To BART) 36 mins (From BART)
	Livermore Valley Center Garage	11	WHEELS	45	-	45	-	-
	Livermore, CA	12	WHEELS	30	60	30	Dublin/Pleasanton BART	42 mins (To/From BART)
		12X	WHEELS	30	-	30 (To BART) 45 (From BART)	Dublin/Pleasanton BART	30 mins (To/From BART)
		14	WHEELS	30	30	30	-	-
		15	WHEELS	30	30	30	-	-
		20X	WHEELS	45	-	45	Dublin/Pleasanton BART	39 mins (AM - From BART) 44 mins (PM - To BART)
		51	WHEELS	-	-	30	-	-
		RAPID	WHEELS	15	15	15	Dublin/Pleasanton BART	34 mins (To BART) 25 mins (From BART)
5	Johnson & Stoneridge	164	San Joaquin RTD	Once		Once		
	Pleasanton, CA	3	WHEELS	30	-	30	W. Dublin/Pleasanton BART	4 mins (AM - To BART) 7 mins (PM - From BART)
							Dublin/Pleasanton BART	13 mins (AM - From BART; PM - To BART)
		70XV	WHEELS	Once	-	Once	W. Dublin/Pleasanton BART	9 mins (AM - From BART; PM - To BART)
							Dublin/Pleasanton BART	6 mins (AM - To BART) 17 mins (PM - From BART)
		166	San Joaquin Commuter	Once	-	Once	-	-
6	Pleasanton ACE Station Pleasanton, CA	92X	County Connection	60	-	60	-	-
		53*	WHEELS	4 times	-	4 times	W. Dublin/Pleasanton BART	12 mins (AM - To BART) 18 mins (PM - From BART)
		54*	WHEELS	3 times	-	3 times	Dublin/Pleasanton BART	27 mins (AM - To BART) 32 mins (PM - From BART)
7	Portola	-						
8	Tassajara	-						
9	Vasco Rd ACE Station Livermore, CA	20 X	WHEELS	45	-	45	Dublin/Pleasanton BART	22 mins (AM - From BART) 25 mins (PM - To BART)

Note: * This route operates according to the ACE Train Schedule

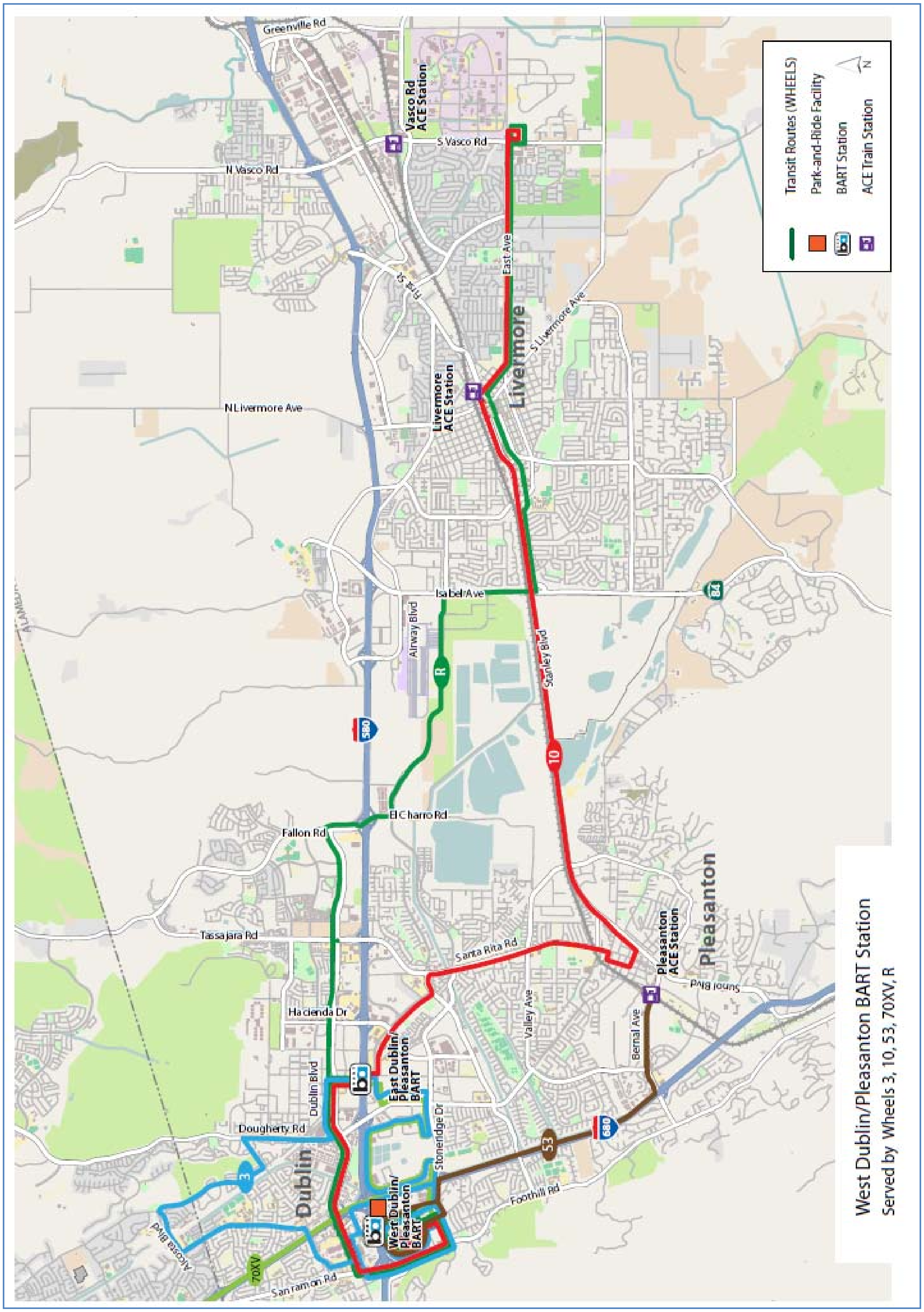
Fare: Wheels = $2 Regular, $1 from BART to Wheels, Free to/from ACE, County Connection

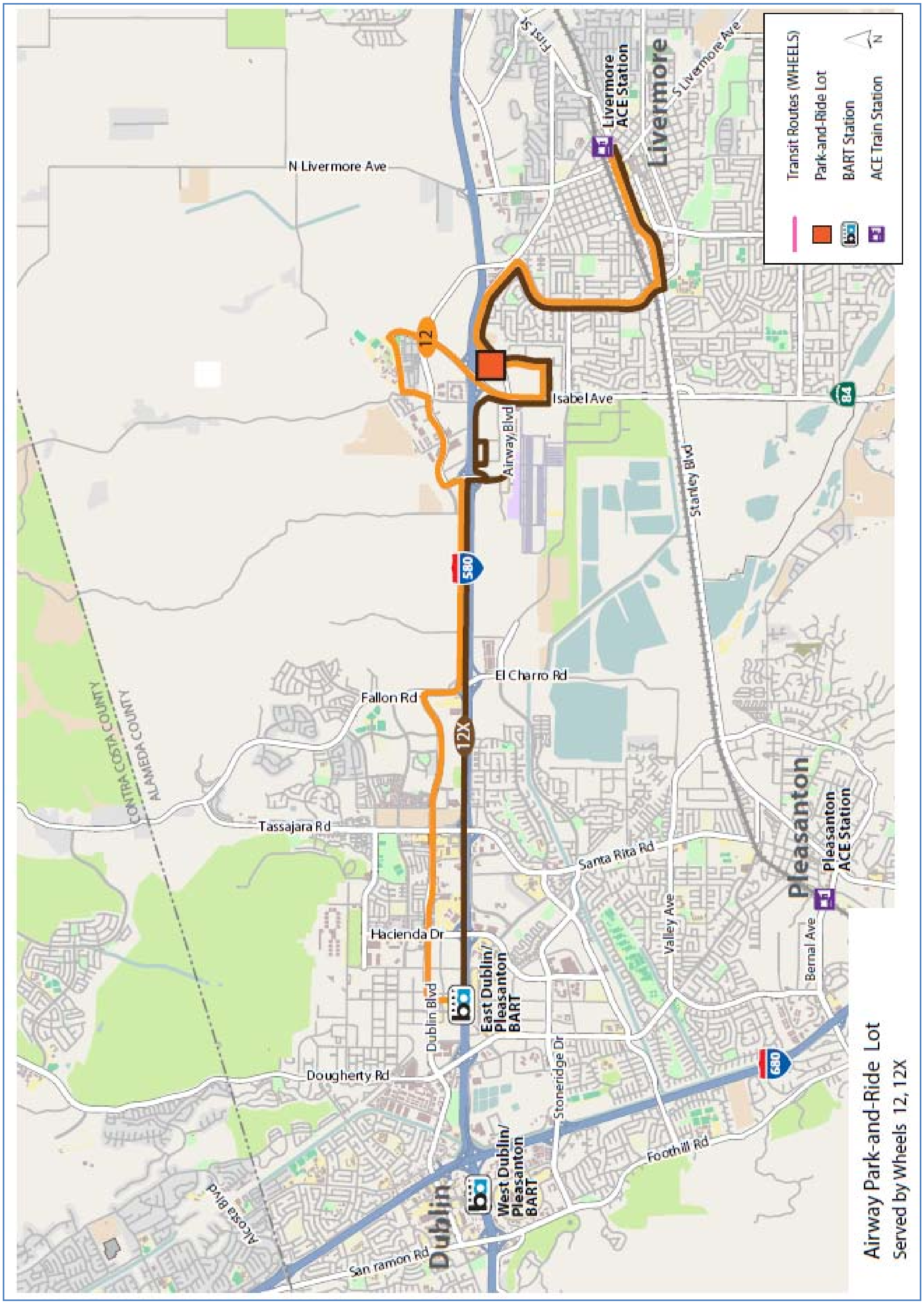
County Connection = $2 Regular, $1 from BART to County Connection, Free to/from Wheels

San Joaquin RTD = $7 one-way, $14 per day round-trip

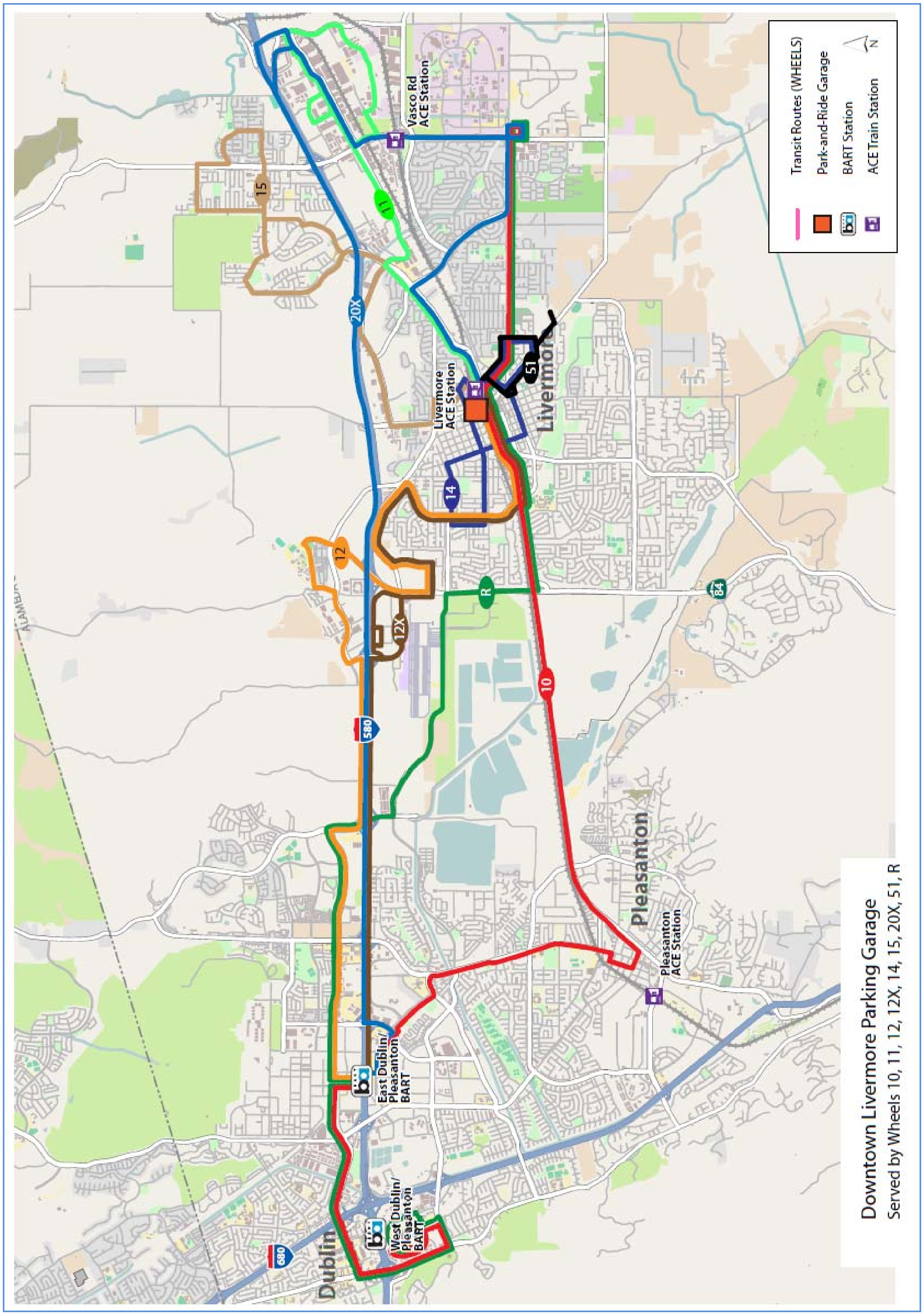


Dublin/Pleasanton BART Station
Served by County Connection 35, 36, 97X, Wheels 1, 2, 3, 8A, 8B, 10, 12, 12X, 54, 70X, 70XV, R

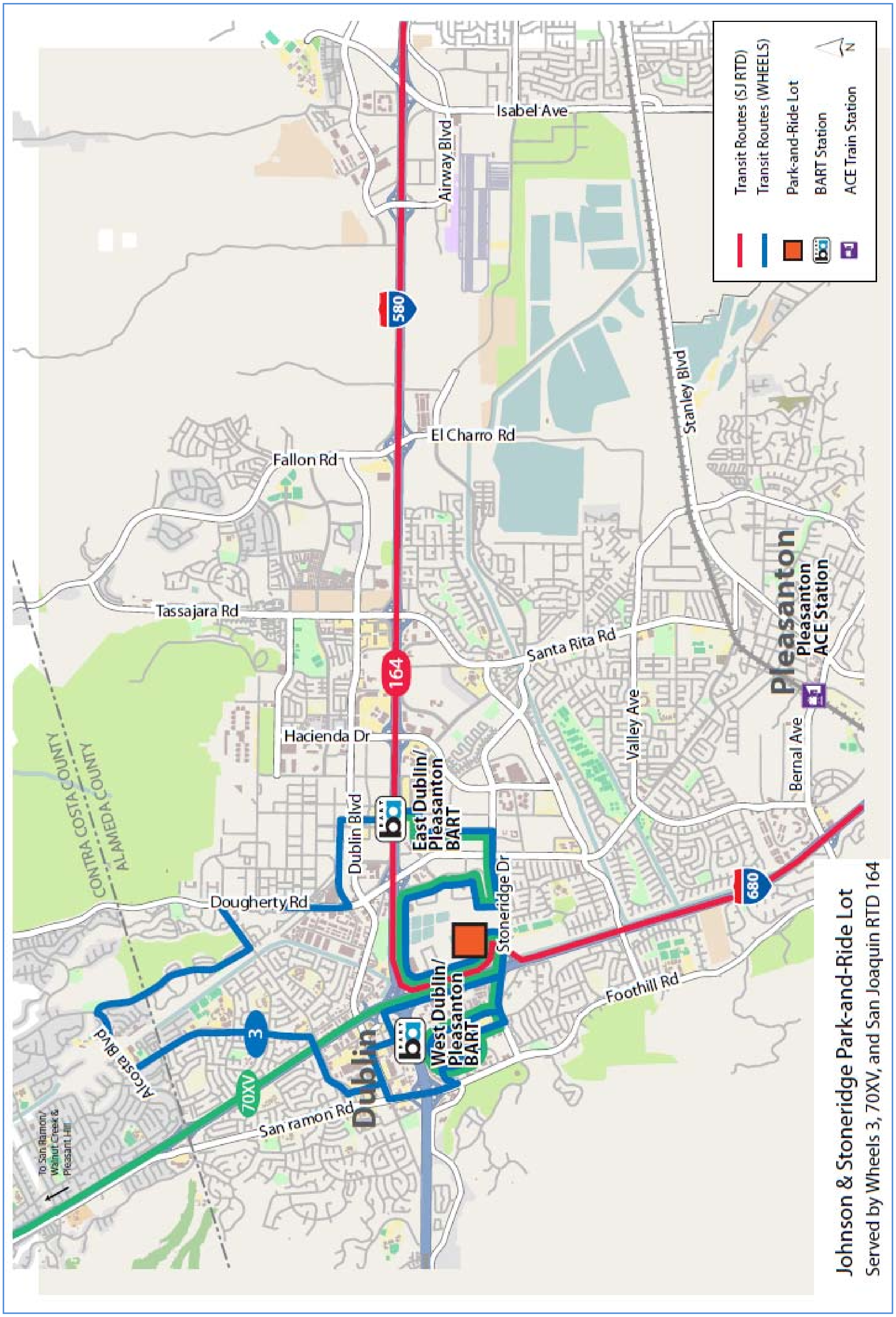

West Dublin/Pleasanton BART Station
Served by Wheels 3, 10, 53, 70XV, R
Transit Routes (WHEELS)
Park-and-Ride Facility
BART Station
ACE Train Station
N
Livermore
Dublin
Pleasanton
Vasco Rd ACE Station
Livermore ACE Station
Pleasanton ACE Station
East Dublin/ Pleasanton BART
West Dublin/ Pleasanton BART
Greenville Rd
S Vasco Rd
N Vasco Rd
East Ave
First St
S Livermore Ave
N Livermore Ave
Isabel Ave
Airway Blvd
Stanley Blvd
El Charro Rd
Fallon Rd
Tassajara Rd
Santa Rita Rd
Hacienda Dr
Dublin Blvd
Dougherty Rd
Stoneridge Dr
Valley Ave
Bernal Ave
Sunol Blvd
Foothill Rd
Alcosta Blvd
San ramon Rd
580
680
84
10
53
R
3
70XV



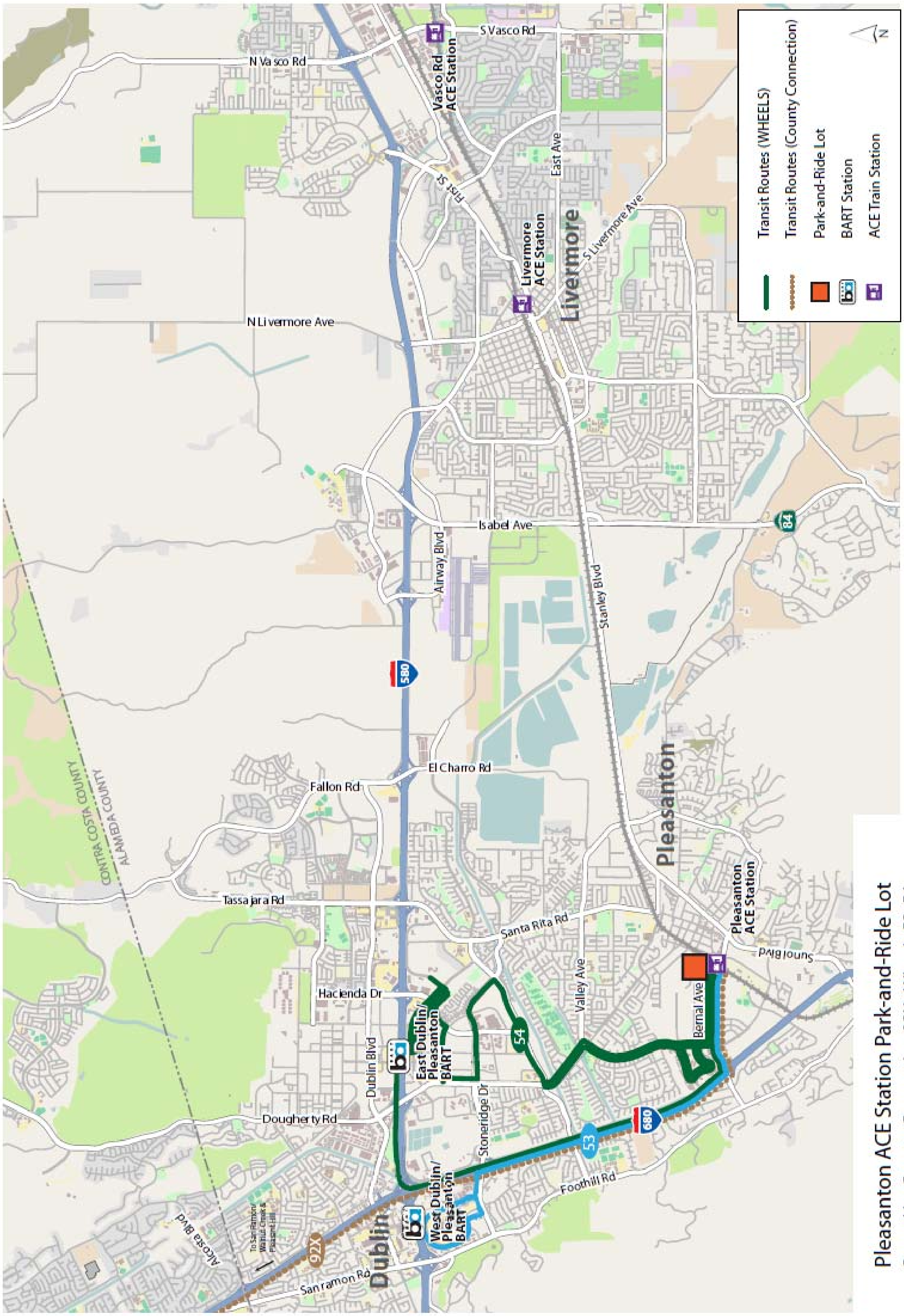
Airway Park-and-Ride Lot
Served by Wheels 12, 12X



Downtown Livermore Parking Garage
Served by Wheels 10, 11, 12, 12X, 14, 15, 20X, 51, R
Transit Routes (WHEELS)
Park-and-Ride Garage
BART Station
ACE Train Station
Vasco Rd ACE Station
Livermore ACE Station
Livermore
Pleasanton
Pleasanton ACE Station
Dublin
East Dublin/ Pleasanton BART
West Dublin/ Pleasanton BART

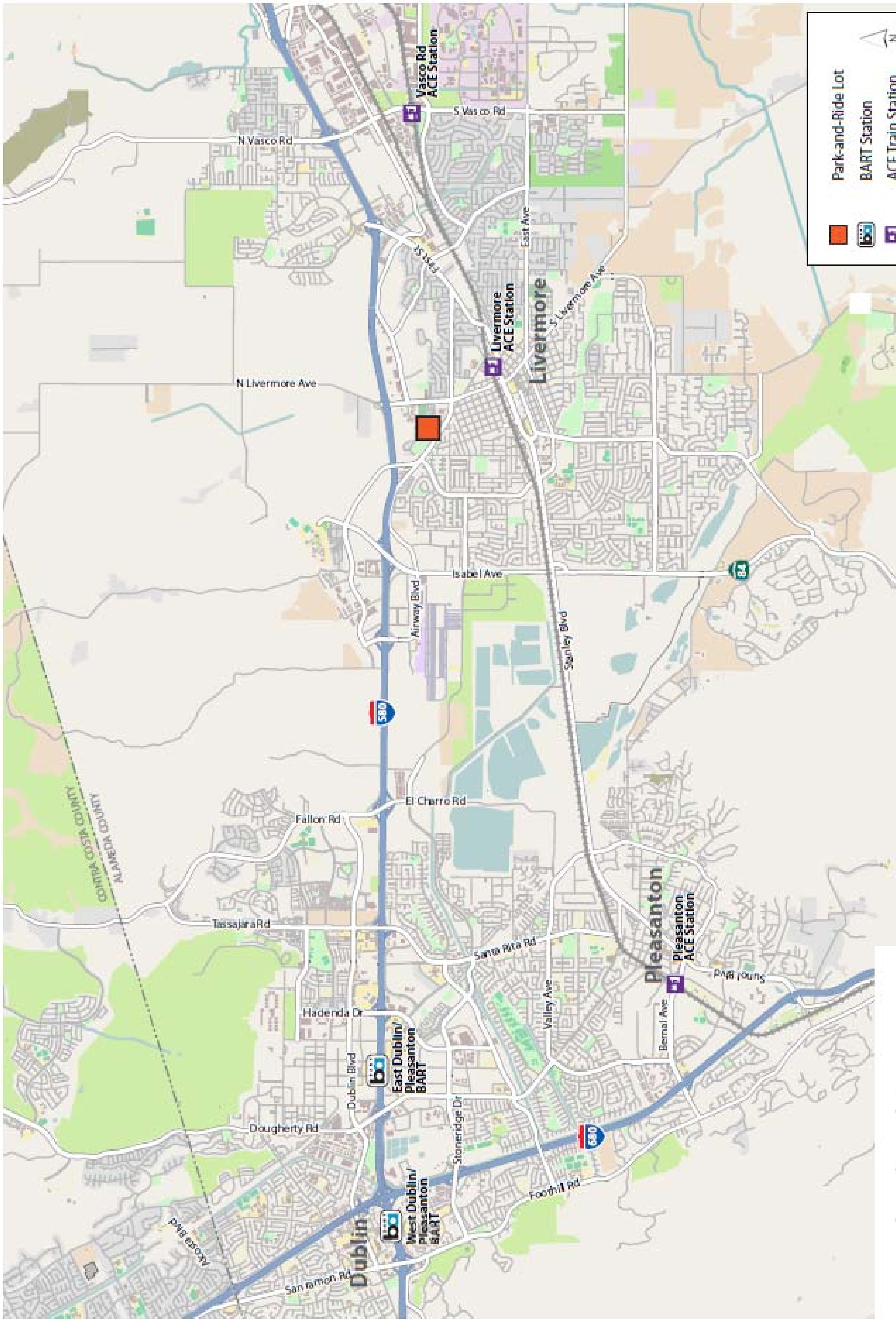


Johnson & Stoneridge Park-and-Ride Lot
Served by Wheels 3, 70XV, and San Joaquin RTD 164

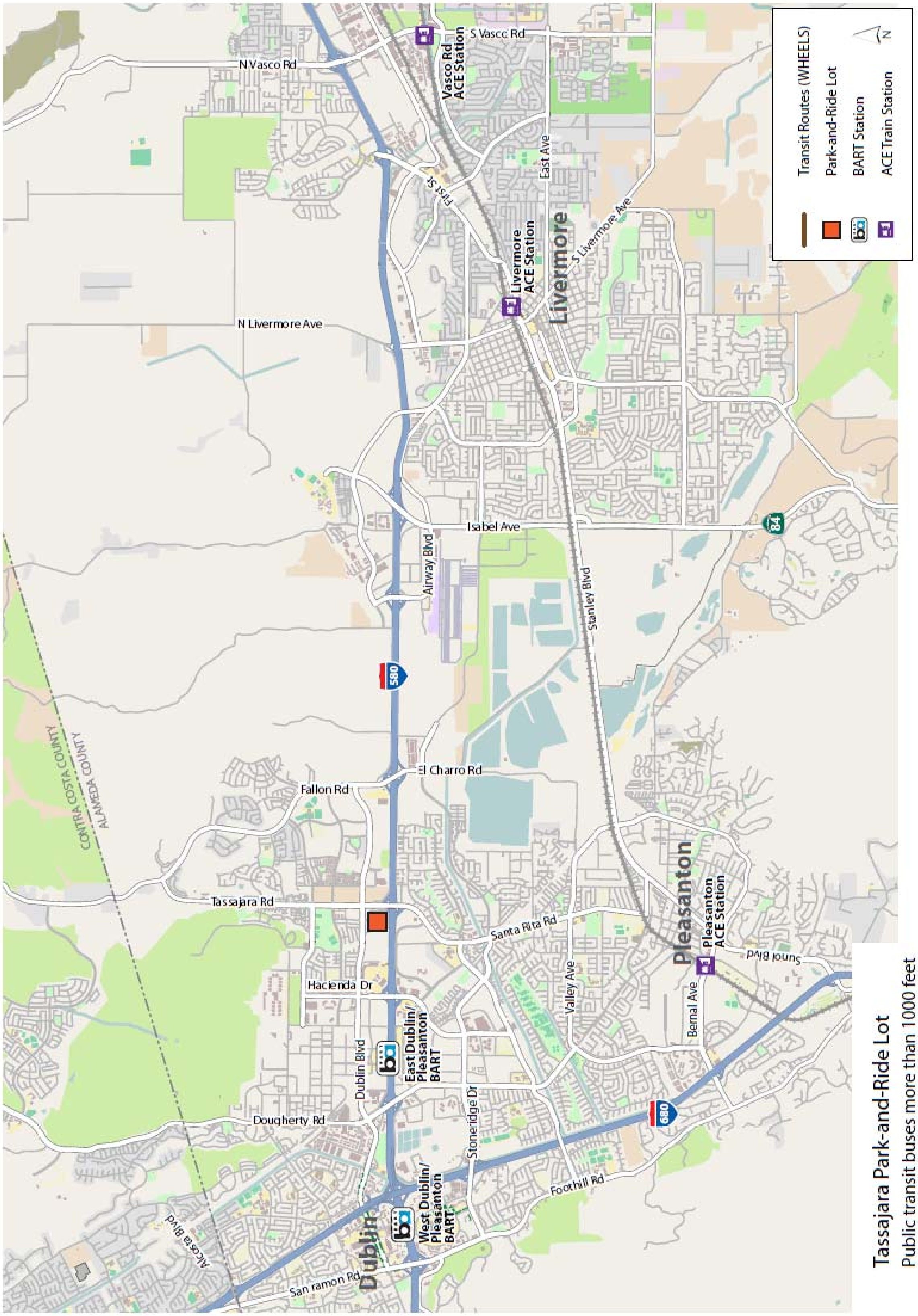


Pleasanton ACE Station Park-and-Ride Lot

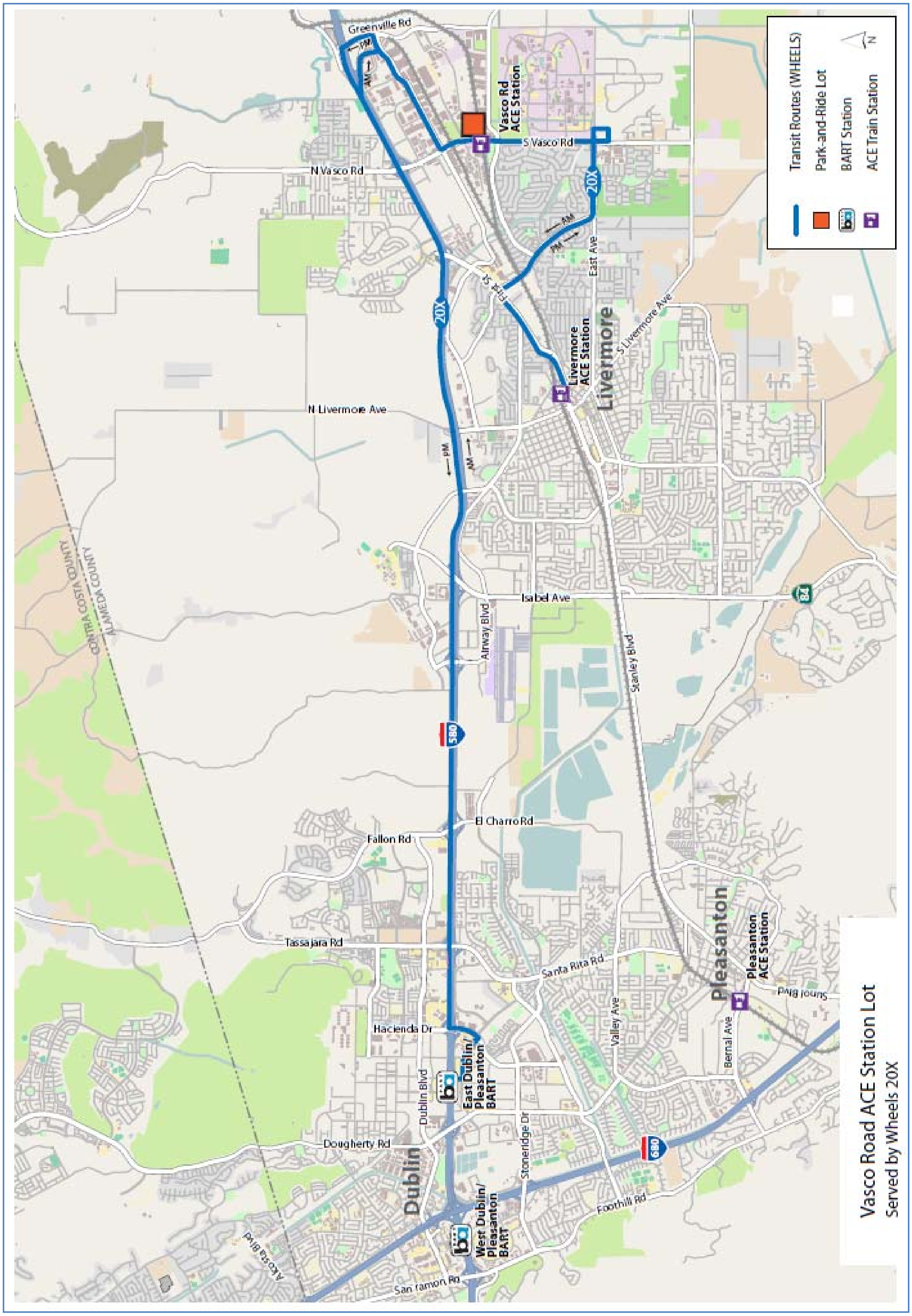
Served by County Connection 92X, Wheels 53, 54



Portola Park & Ride Lot
Not served by public transit buses



Tassajara Park-and-Ride Lot
Public transit buses more than 1000 feet walking distance from lot


Vasco Road ACE Station Lot
Served by Wheels 20X
Transit Routes (WHEELS)
Park-and-Ride Lot
BART Station
ACE Train Station
Vasco Rd ACE Station
Livermore ACE Station
Pleasanton ACE Station
East Dublin/ Pleasanton BART
West Dublin/ Pleasanton BART
Livermore
Pleasanton
Dublin
20X
580
680
84
Greenville Rd
S Vasco Rd
N Vasco Rd
N Livermore Ave
S Livermore Ave
East Ave
First St
Isabel Ave
Airway Blvd
Stanley Blvd
El Charro Rd
Fallon Rd
Tassajara Rd
Santa Rita Rd
Hacienda Dr
Dublin Blvd
Dougherty Rd
Stoneridge Dr
Valley Ave
Bernal Ave
Sunol Blvd
Foothill Rd
San Ramon Rd
Alcosta Blvd
CONTRA COSTA COUNTY
ALAMEDA COUNTY
AM
PM

Attachment F

Private Shuttle Survey Results

Tri-Valley Integrated Transit and Park-and-Ride Study

Summary of Private Shuttle Service (PM Drop-offs)

	Employer	City	No. Trips
Airway			
	Genentech	So. San Francisco	1
Johnson & Stoneridge			
	Unidentified	- -	3
Pleasanton ACE			
	Clorox	Pleasanton	2
	Safeway	Pleasanton (Stoneridge SC)	2
	Thermo Fisher	Pleasanton	1
	Unidentified	- -	1
Portola			
	E&J Gallo	Modesto	1
Tassajara			
	Amazon	Sunnyvale	1
	Facebook	Menlo Park	2
	E&J Gallo	Modesto	1
	Genentech	So. San Francisco	2
	GoPro	San Mateo	1
	Netflix	Los Gatos	1
	Visa	Foster City, San Mateo	2
	Yahoo	Fremont, Sunnyvale, S.J.	2
Vasco ACE			
	Lawrence Livermore Nat. Lab.	Livermore	2

Data compiled from video and intercept surveys, September-November 2015
CHS Consulting 11-24-2015

Appendix B

Travel Behavior and Market Analysis Summary Final Report

Tri-Valley Integrated Transit and Park-and-Ride Study

Travel Behavior and Market Analysis Summary Final Report

Prepared for
Alameda County Transportation Commission
In partnership with LAVTA, Cites of Dublin, Livermore and Pleasanton

By

DKS

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Oakland, CA 94612
(510) 763-2061

February 2, 2016

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Introduction

The purpose of the Travel Behavior and Market Analysis (Task 3 of the Tri-Valley Integrated Transit and Park-and-Ride Study**)** and this memorandum is to provide solid information as a basis for identifying the need for park-and-ride improvements and improvements in the transit services that support the park-and-ride facilities or that make better utilization of those facilities. The Tri-Valley Integrated Transit and Park-and-Ride Study was initiated because the Tri-Valley transportation system is experiencing high levels of congestion on the area's freeways (I-680 and I-580) and major arterials, overcapacity BART parking lots, and rapid growth and changing commute patterns.

The stated goal of the Tri-Valley Integrated Transit and Park-and-Ride Study is "to identify potential changes and improvements in park-and-ride facilities (including multi-modal access to the facilities) and LAVTA service so as to reduce single-occupancy vehicle trips and vehicle miles traveled and create a coordinated, efficient, and sustainable transportation system in Alameda County's portion of the Tri-Valley area." Combined with other current efforts, efficiently utilizing and upgrading existing park-and-ride facilities, integrating the use of park-and-rides with private commuter shuttle pick-up/drop-off sites, incorporating new park-and-ride facilities, and improving park-and-ride connectivity will help meet the growing need for movement of people and goods in the Tri-Valley, positioning the area for success.

The analysis in this task of the study has been focusing on providing an understanding of the existing and future travel patterns in the Tri-Valley and the characteristics of travelers and their trips. The results of this analysis provide a baseline of information about how the existing park-and-ride facilities are being used and how transit services are getting park-and-ride users to their final destinations. The results provided in this memorandum also provide a description of the current peak-period travel in the Tri-Valley as an indication of what the total market for transit might look like. The memorandum also provides an indication of how the total amount of travel and the travel patterns are expected to change over the next fifteen years and how that might affect the design and location of new services for park-and-ride and transit users.

One of the key objectives in this task of the study has been to identify unmet needs for park-and-ride and supporting transit services in the Tri-Valley. This part of the analysis focused on where transit ridership is constrained by the lack of park-and-ride facilities and where existing park-and-ride facilities are not being used because of inadequate or inconvenient connections to transit services.

A final element of the Travel Behavior and Market Analysis task has been to describe the data and tools that will be used to help formulate and evaluate improvement options in Task 4 of the study. The DKS team has developed a modeling tool that links to and supplements the Alameda Countywide Travel Model (ACTM) to evaluate park-and-ride facilities and services and the how they relate to transit services. This memorandum provides a description of the modeling tool, how it uses the travel behavior and market analysis data assembled in this task, how it will be used in helping to identify deficiencies and how it will be used to test improvement options.

Travel Behavior

CURRENT PARK-AND RIDE FACILITIES AND USERS

Location of Park-and-Ride Facilities

The park-and-ride lots and garages included in this study can be divided into two categories: primary and satellite facilities. Primary facilities are located at transit hubs and serve as an on-site source of parking for their primary mode of transportation to their ultimate destination. Parking facilities at BART or Altamont Corridor Express (ACE) stations function as primary facilities for this study. Satellite facilities are located off-site and serve as spill-over or secondary sources of parking for transit hubs. They require users to make use of an additional connection, such as a local bus service or a shuttle, to access their primary mode of transportation. Because most of the satellite lots in the Tri-Valley are not restricted to only users of public transit services, they also act as collection points for carpooling and vanpooling and for private shuttles to outlying employment locations.

The primary park-and-ride facilities in the Tri-Valley are oriented to serving BART and ACE. As indicated in **Figure 1**, Primary facilities are located at the Dublin-Pleasanton BART station, the West Dublin-Pleasanton BART station, the Pleasanton ACE station, and the Vasco Road ACE Station. The Downtown Livermore Parking Garage is located adjacent to the Livermore ACE station and the top deck is available for ACE riders, however it is not owned or operated by ACE, nor is it identified as a park-and-ride by the City of Livermore.

The satellite facilities in the Tri-Valley are generally oriented along I-580 or I-680 where the lots can supplement the parking for BART and ACE while also providing parking for Wheels services, private shuttles and carpools or vanpools using the two freeways. There is a satellite facility owned and operated by BART located on East Airway Boulevard in Livermore. Additional park-and-ride lots are located on Johnson Drive in Pleasanton, on Portola Avenue in Livermore (Caltrans operated), and as part of the Dublin Corporate Center parking lot located off of Tassajara Road in Dublin (privately owned).

There are also additional park-and-ride operations in the Tri-Valley made available through private-sector participants. As an example, a portion of the Alameda County Fairgrounds parking is leased by private companies that offer shuttle services to their employment sites.

Information about existing park-and-ride facilities and users was generated for this study using a combination of already-available data from the operators of the facilities and data collection by the DKS team during September of 2015. BART provided information about parking at its two Tri-Valley stations and the utilization of the facilities. The DKS team performed a physical inventory of parking spaces, amenities, and usage for the ACE stations and other identified park-and-ride locations. Arrival and departure patterns were gathered from a video survey which recorded driveway arrivals and departures at each facility except for the Downtown Livermore Garage, which is used for a variety of uses not included in this study. An intercept survey was conducted at each facility in which interviewers asked parkers arriving in the morning about their travel habits. The raw data and results of this data collection are provided in Existing Conditions Assessment Final Report.

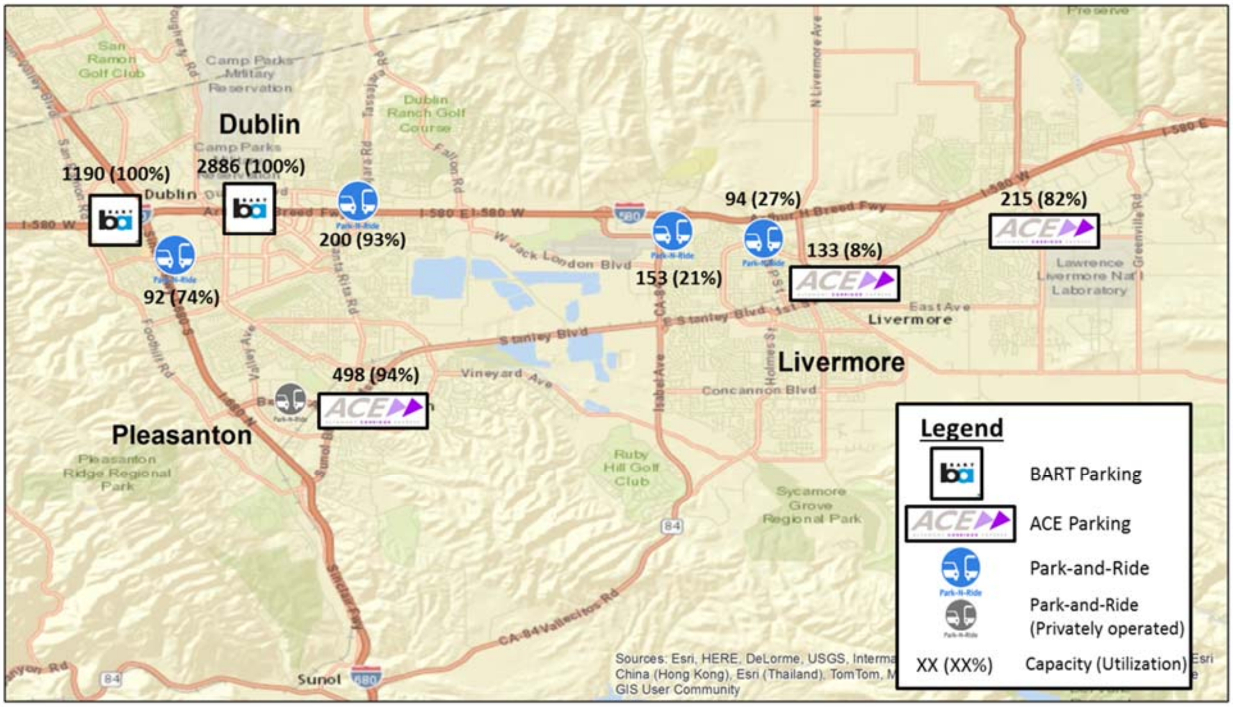


Figure 1 - Tri-Valley Park-and-Ride Locations

Current Use of Park-and Ride

The primary and satellite facilities provide connections to multiple modes as shown in **Table 1**. While public transit connections to BART and ACE are available at most lots, they are not necessarily used by people parking in the lots.

Table 1 - Park-and-Ride Transit Connections

Lot	City	Connection to BART	Connection to ACE	Private Employer Shuttles
West Dublin/ Pleasanton BART	Dublin/ Pleasanton	Located adjacent to BART Station. Must use BART to park here		
Dublin/Pleasanton BART	Dublin/ Pleasanton	Located adjacent to BART Station. Must use BART to park here		
Pleasanton ACE Station	Pleasanton	Service to W. Dublin BART via Wheels Route 10 and 53 and E. Dublin BART via Wheels Route 10	Located adjacent to Pleasanton ACE Station	Clorox, Thermo Fisher, and Safeway shuttles
Vasco Road ACE Station	Livermore	No nearby connection to BART	Located adjacent to Vasco Road ACE Station	Lawrence Livermore National Lab Shuttle
East Airway Boulevard P&R	Livermore	Service to E. Dublin BART via Wheels Route 12/12X		Amazon and Genentech shuttles

Lot	City	Connection to BART	Connection to ACE	Private Employer Shuttles
Downtown Livermore Garage	Livermore	Service to W. Dublin BART via Wheels Route 10 and E. Dublin BART via Wheels Route 10 and 12/12X	Located adjacent to Livermore ACE Station	
Johnson & Stoneridge	Pleasanton	Service to W. Dublin BART via 0.7 mi walk to Wheels Route 10 and 53	Service to Pleasanton ACE Station via 0.7 mi walk to Wheels Route 53	Tesla and UBER shuttles
Portola P&R	Livermore	No nearby connection to BART	Service to Livermore ACE Station via 0.7 mi walk to Wheels Route 14	E&J Gallo Winery shuttle
Tassajara (Dublin Corporate Center) P&R	Dublin	Service to E. Dublin BART via 0.3 mi walk to Wheels Route 12	Service to Livermore ACE Station via 0.3 mi walk to Wheels Route 12	Facebook, Visa, Genentech, E&J Gallo Winery, YAHOO, and unidentified shuttles

Primary Facilities

The two BART stations in the study area have a total of 4076 parking spaces for the two stations combined. Of these, 1374 are in surface lots and 2702 are in parking garages. Even with all this capacity, the parking facilities are filled by about 8:00 AM. Midday occupancy is virtually 100% at each location. Most spaces in these facilities are available to the general public on a first-come-first served basis at a price of $3 per day. Over 800 parkers opt to pay a $6 daily fee (or a $105 monthly fee) to park in a space that is reserved for them until 10 AM, when the space is then made available to the general public. There is currently a waiting list of roughly 9,300 people for the reserved spaces at these two stations. It was partly because of the limited availability of BART parking that this Tri-Valley Integrated Transit and Park-and-Ride Study was undertaken. The two BART stations also have 68 bike lockers between them, as well as 16 sheltered bus bays.

Two facilities operated by ACE experience high levels of use. The most popular is the 486-space lot at the Pleasanton ACE station, averaging 95% midday occupancy. The two adjacent lots at the Vasco Road ACE station in Livermore average 82% occupancy in the 215-spaces available. The ACE station in Downtown Livermore is directly adjacent to the parking garage operated by the City of Livermore (Livermore Valley Center Garage). This garage is primarily oriented to local shoppers and visitors, but park-and-ride use for ACE riders is allowed on the 133 spaces of its upper deck. Very few commuters take advantage of these, however, with a midday average utilization of only 8%. It is possible that other commuters park on the lower levels of the garage, in violation of posted regulations, but the survey was not able to measure this.

Satellite Facilities

In addition to its parking facilities at stations, BART owns and operates a satellite parking lot on East Airway Boulevard in Livermore; it averages just 21% midday occupancy in its 153 spaces.

The remaining facilities included in this study are freestanding lots. The park-and-ride lot at Portola Avenue in Livermore averages 27% midday occupancy in its 94 spaces. A very large facility at the Dublin Corporate Center off Tassajara Road in Dublin has 200 spaces marked for park-and-ride use in a lot with a total of 1600 spaces (only 40 of which are reserved for specified individuals). Utilization averages 93% midday in the designated park-and-ride spaces. The remaining lot at the intersection of Johnson and Stoneridge Drives in Pleasanton averages 78% midday occupancy in 87 spaces.

In general, all the parking facilities are in good physical condition. All are equipped with lighting and more than half have security cameras, bike lockers and bus shelters.

Based on both the video and intercept surveys, arrivals at the eight non-BART facilities occur mainly between 5 and 9 AM. Some lots (such as Johnson & Stoneridge) have their highest entries in the hour starting at 5 AM, while others (such as the ACE stations) have their highest in the hour starting at 7 AM. Most departures occur between 3 and 8 PM. The highest departure hour in most facilities is at 6 PM, but two lots (Johnson & Stoneridge and Vasco ACE) have most departures beginning at 5 PM.

Characteristics of Park-and-Ride Users and Their Trips

In order to determine the mode choice and destination of park-and-ride users, and intercept survey was conducted. The survey was conducted over five days, in two separate weeks, by canvassers who administered the one-minute survey orally to respondents. Respondents were generally waiting for a train or bus, or they were moving from their car to a carpooling location. The number of respondents at each location is shown in **Table 2**. The intercept survey revealed a number of characteristics about the users of the freestanding park-and-ride lots. Based on the unique usage and location of each lot, the responses differ much from one facility to another. In general it can be stated that work trips predominate for 89% of respondents. School trips were only documented at the Johnson & Stoneridge park-and-ride, the Pleasanton ACE Station, and the downtown Livermore garage, and make up 12% of trips to those facilities. About 59% of respondents use the facilities on a regular basis for more than 15 days each month, with the remainder about equally divided between those parking between 5 and 15 days and those parking for fewer than 5 days. For all of the lots except for the Livermore garage, 76% of the respondents drive and park at the lot, with drop-offs, carpools and bikes having a much smaller share of the total. The Livermore garage however only had 33% of respondents park at the lot with the other users spread between drop-offs, carpools and bikes.

The most common origins of respondents in our survey were the cities of the Tri-Valley with 67% of users. The only other locations with any substantial percentage of users were Mountain House with 10% and San Ramon with 7%. Destinations are heavily oriented towards Santa Clara with 32% and Sunnyvale with 17% and San Jose with 11%. Livermore, Modesto, and Foster City each made up 7% of the destinations with the remaining 19% distributed throughout the Bay Area. The East Airway Boulevard park-and-ride lot showed 50% of destinations in San Francisco, but with only four respondents in that sample, the data from this facility should not be considered representative.

Connecting Mode

DKS used information from BART and an intercept survey at all of the other park-and-ride facilities to determine the connecting mode – the mode by which the parker would reach their ultimate destination once they had parked in the morning – for all of the parkers at the park-and-ride facilities studied. The results for the primary facilities at BART and ACE stations are summarized in **Figure 2** and the results for the satellite facilities are summarized in **Figure 3**. **Table 2** provides the more detailed results by facility for the facilities included in the intercept survey. This clearly showed that while the primary facilities are being used almost exclusively for their adjacent transit use, the satellite facilities are for the most part being used as pick-up locations for private employer shuttles (69.2%). The intercept survey only identified 10.2% of people using the satellite facility for access to ACE Stations and only 6.6% for BART Stations. Each park-and-ride location appeared have a primary use. The East Airway Boulevard parking lot is primarily used for BART though it also has private employer buses. The Johnson lot saw a plurality of users split between ACE and carpool, and the Portola and Tassajara lots were primarily used for private employer bus access.

Table 2 – Park-and-Ride Facility Utilization and Connecting Mode

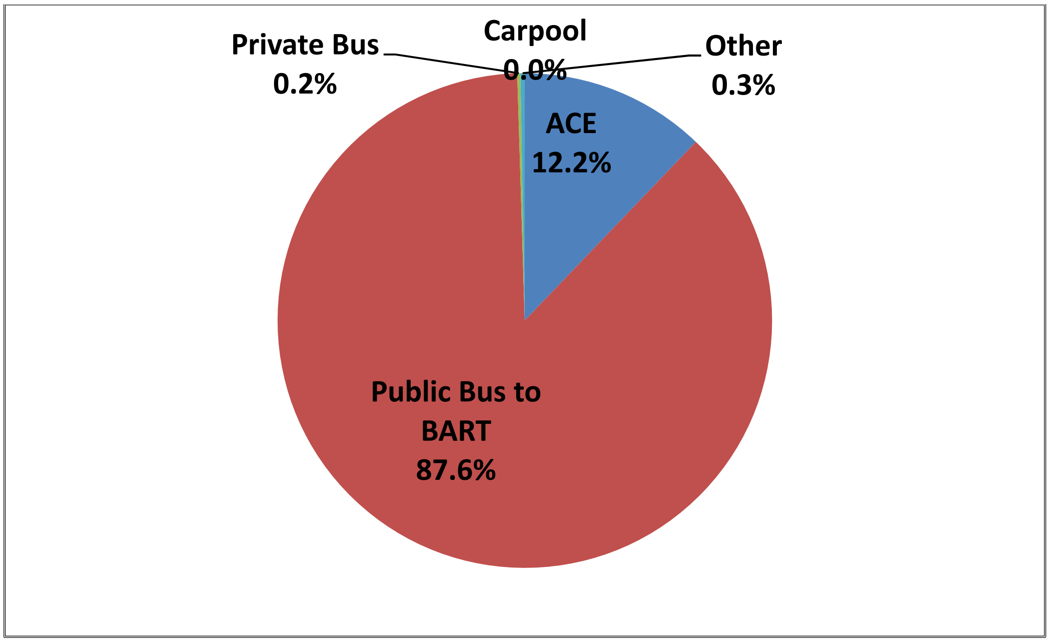


Figure 2 - Primary Park-and-Ride Facility Connecting Mode

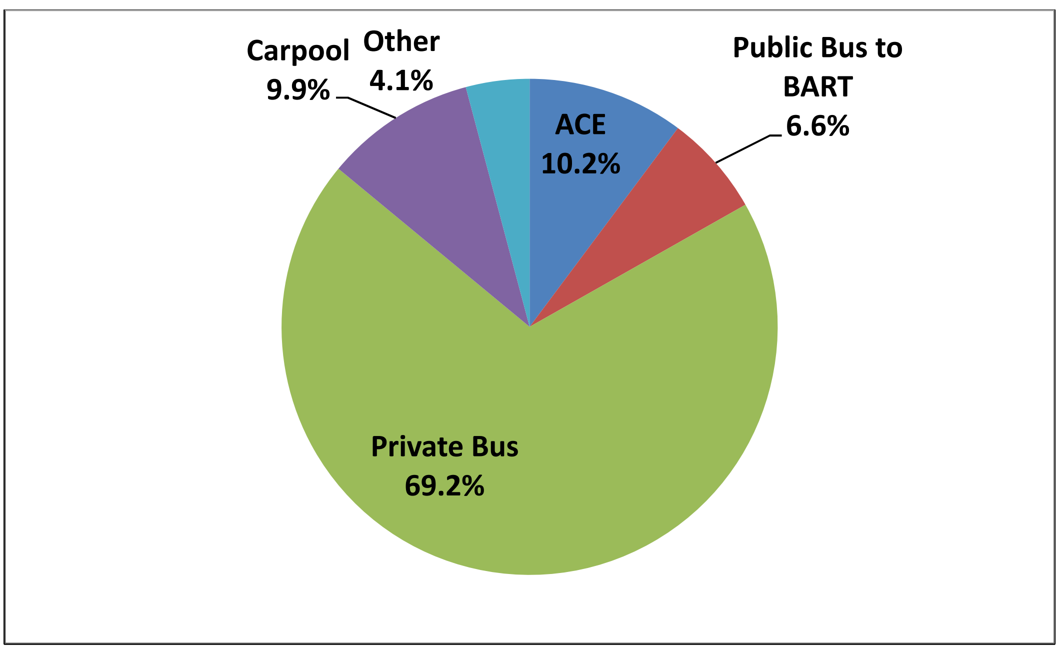


Figure 3 - Satellite Park-and-Ride Facility Connecting Mode

The following patterns were identified for each lot:

Pleasanton ACE Station

The majority of respondents were from Pleasanton (56%), San Ramon (17%), or Dublin (15%). They were mainly headed to Santa Clara (57%) or San Jose (21%). The large majority drove there (69%), and most took ACE to their destination (94%). The majority of respondents who took ACE were going to Great America.

Vasco Road ACE Station

There are two lots connected to the Vasco ACE station parking lot, one on each side of Vasco Road. Respondents came from Mountain House and Livermore (and few from Brentwood), with the majority travelling to Santa Clara. Over 70% of respondents drove to the lot, and over 80% departed on ACE, again to Great America.

East Airway Boulevard Park-and-Ride

The East Airway Boulevard is a sparsely used site, owned and operated by BART.. An Amazon shuttle picks up at the lot, but only a few passengers were seen boarding the shuttle during the observations. A few carpoolers were also observed using this site.

Downtown Livermore garage

Most of the respondents came from Livermore (87%) and were headed to Santa Clara (38%), Livermore (21%), or Pleasanton (13%). About 55% of respondents took ACE after arriving at the garage, with many of them going to Great America in Santa Clara for work. While there are multiple buses that go directly to BART, only 9% of responders reported BART as their destination. About 74% of the trips were for work, with a majority (53%) of respondents saying they would park in the street if no parking were available in the garage.

Johnson & Stoneridge

Most respondents came from Pleasanton (47%) or Dublin (23%), and the most common destinations were Santa Clara (21%) and San Jose (17%). As an isolated location, there is no bus that directly serves the lot, however 46.7% and 6.7% of respondents used the lot to access ACE and BART respectively, which requires a 0.7-mile walk to the closest bus stop. The lot is also a meeting place for carpools (33% of respondents). Many of the respondents were going to work Great America in Santa Clara. Nearly all were there for work.

Portola Park-and-Ride

The respondents came from Dublin (44%), Alameda (17%), and Livermore (17%). Nearly two-thirds of the respondents drove alone in order to take the shuttle bus to the EJ Gallo winery in Modesto. The remaining portion of the respondents drove there in order to walk to work afterwards, and a few drove there to walk to volunteer at Shepard's Gate. There was no easy connection to BART or ACE and none of the users identified that as their destination.

Tassajara (Dublin Corporate Center) Park-and-Ride

Most Respondents began their trip in Dublin (44%) or Livermore (28%), travelling to Foster City (48%) or Sunnyvale (36%). About 80% of respondents drove there and 20% were dropped off. This lot has several corporate shuttles, including Facebook, Amazon, Visa, and Yahoo. It appears that the same people use this lot for all-day parking all month. The closest bus stop is a 0.3-mile walk to Dublin Boulevard and provides connection to BART and ACE, however none of the respondents identified that as a destination.

CURRENT TRI-VALLEY USERS

Current Public Transit Services and Ridership

The Tri-Valley has public transit in several different forms. BART provides ongoing heavy-rail service throughout the day to the Bay Area. ACE operates as commuter rail between Stockton and San Jose and only in the peak direction during peak hours. LAVTA Wheels provides local Tri-Valley bus service, along with one connection to Walnut Creek and one connection to Tracy/Stockton. County Connection provides additional connections in Alameda County and Contra Costa County. **Figure 4** provides the approximate annual ridership for each of the three public transit modes operating in Tri-Valley.

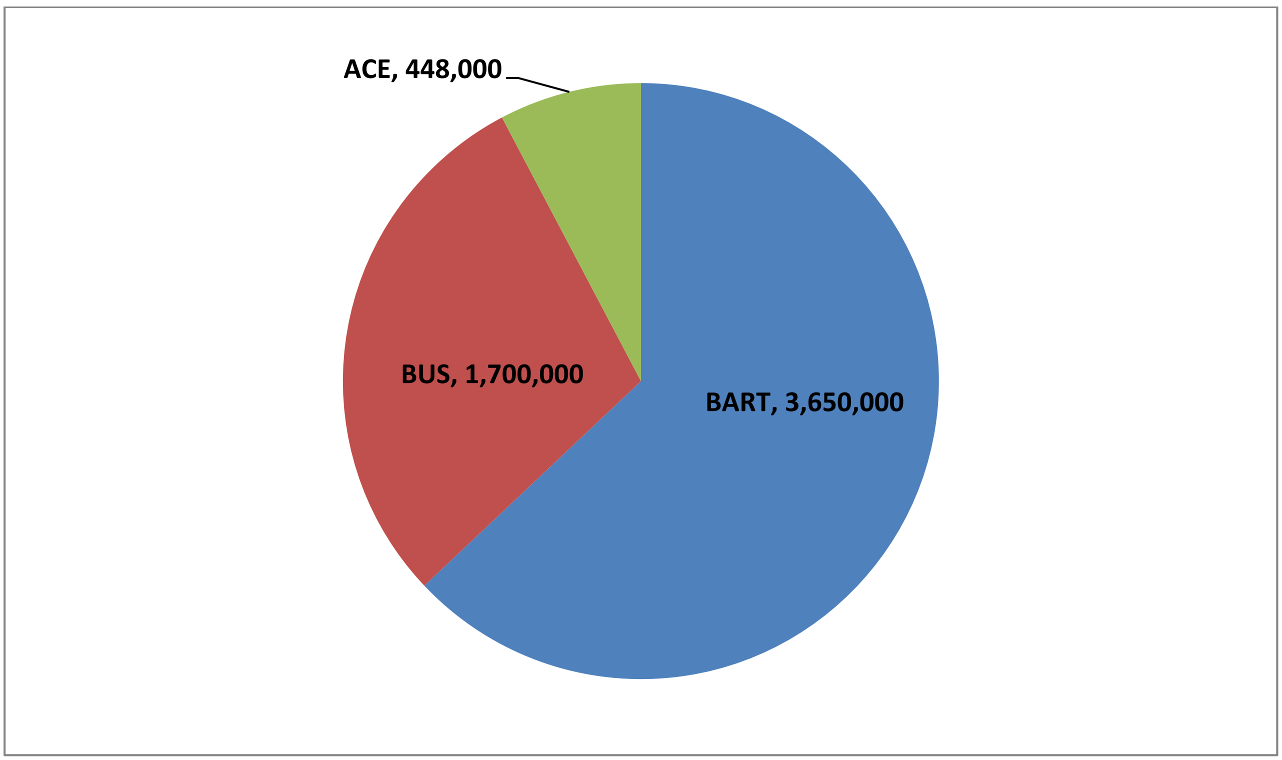


Figure 4 - Tri-Valley Public Transit Annual Ridership

BART

Within the Tri-Valley, BART operates out of the Dublin-Pleasanton BART station and the West Dublin-Pleasanton BART station. During the AM peak and PM peak, BART operates trains in both directions with a headway of 15 minutes. The Dublin-Pleasanton BART station has 15 bus bays in two locations, each location protected by an overhead covering. The West Dublin-Pleasanton BART station has six bus bays protected by overhead coverings. BART ridership for the two stations is described in **Table 3**. The distribution of destinations for BART trips from Tri-Valley is provided in **Figure 5**.

Table 3 - BART Ridership

Station	Average Daily Entries	Average Daily Exits
Dublin-Pleasanton	8,331	8,183
West Dublin-Pleasanton	3,606	3,760
Total Tri-Valley	11,937	11,943

<u>Source</u>: BART, August 2015

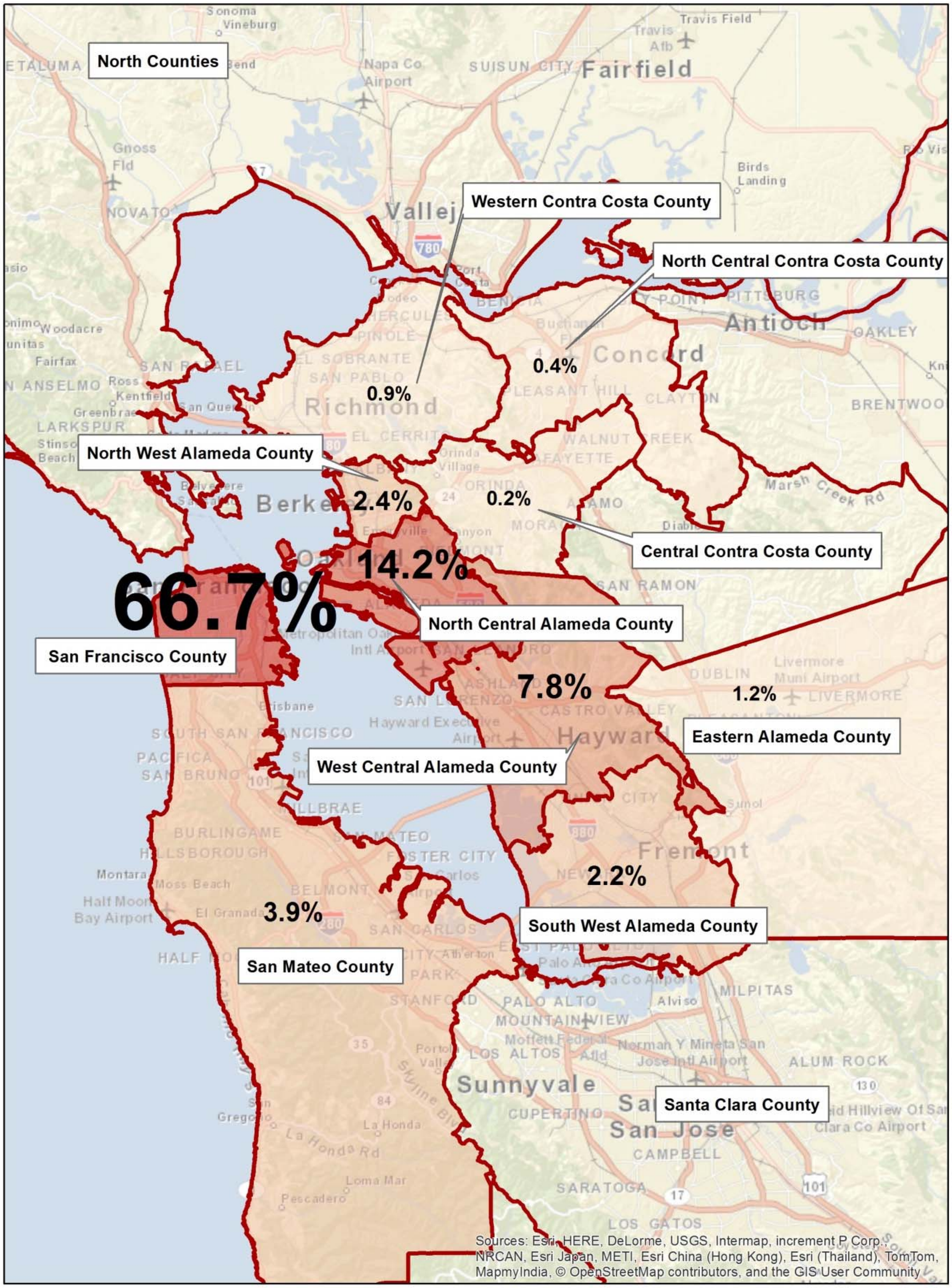


Figure 5 - BART Trip Distributions

ACE Services

Within the Tri-Valley, ACE operates out of the Pleasanton ACE station, the Livermore ACE station, and the Vasco Road ACE station. ACE runs four westbound trains in the morning from Stockton and four eastbound trains in the afternoon from San Jose. The Pleasanton ACE station does not have any bus bays and has one bus shelter. The Livermore ACE station has eleven bus bays and one large bus shelter. The Vasco Road ACE station has one bus bay and no bus shelters. Recent average weekday boardings and alightings for the three Tri-Valley stations are shown in **Table 4** below.

Table 4 - Average Weekday Ridership for Tri-Valley ACE Stations, October 2015

Station	Boardings	Alightings
Vasco Road	264	264
Livermore	303	300
Pleasanton	869	962
Total Tri-Valley	1,436	1,526

Source: San Joaquin Regional Rail Commission, 2015.

Wheels and County Connection Services

With the exception of the Portola lot, all of the Tri-Valley park-and-ride facilities are served by public transit buses. There are 18 bus routes serving the two BART stations and the freestanding facilities included in this report. Of these routes, 14 are operated by LAVTA Wheels and 4 by County Connection. According to the intercept survey, the bus lines mentioned most by those interviewed were Wheels routes 10, 12, 14 and 53. The frequencies of the routes serving the park-and-ride facilities are generally 30-60 minutes during the hours when most parkers arrive or leave. About half the routes do not offer midday service, which could discourage some drivers from using the facilities in question.

The segments with the peak ridership for the four main Wheels routes are described in **Table 5**.

Table 5 - Wheels Boardings from Parking Facilities

Parking Facility	Route	Percent of Respondents	Daily Boardings at Nearest stop
Pleasanton ACE Station	Wheels Bus Route 10 (outbound, towards BART)	0%	33
	Wheels Bus Route 53	2.1%	60
East Airway Boulevard P&R	Wheels Bus Route 12/12X (outbound, towards BART)	50%	2
	Wheels Bus Route 12/12X (inbound, towards ACE)	0%	2

Parking Facility	Route	Percent of Respondents	Daily Boardings at Nearest stop
Downtown Livermore Garage	Wheels Bus Route 10 (outbound, towards BART)	4.2%	135
	Wheels Bus Route 12/12X (outbound, towards BART)	4.2%	77
	Wheels Bus Route 14	4.2%	64
Johnson & Stoneridge	Wheels Bus Route 53 (towards BART)	6.7%	2
	Wheels Bus Route 53 (towards ACE)	46.7%	8

Private Employer Buses and Shuttle Services

Numerous private employer shuttles serve the park-and-ride facilities, but these were more difficult to identify than public transit service. Those mentioned in the intercept survey operated to Amazon in Tracy, Yahoo in Sunnyvale, and the Gallo Winery in Modesto. The video survey identified buses going to Genentech in South San Francisco. Many other private shuttles were unmarked, and the video cameras were not able to detect identifying signage. In all, the video survey revealed 66 private shuttle trips either picking up or dropping off passengers at the freestanding park-and-ride lots. The largest concentration was 31 such trips at the lot at Tassajara. The intercept survey identified the number of users boarding private employer shuttles shown in **Table 6**. In addition to the companies identified in the intercept surveys, shuttles were also observed from Clorox, Thermo Fisher, Safeway, Genentech, and Lawrence Livermore National Laboratory.

Table 6 - Private Shuttle Service and Percentage of Respondents

Employer	Airway	Johnson	Portola	Tassajara
Amazon	25%	-	-	-
E&J Gallo Winery	-	-	67%	-
Facebook	-	-	-	16%
Tesla	-	3%	-	-
VISA	-	-	-	44%
YAHOO	-	-	-	24%
Unspecified Shuttle	-	3%	-	4%

Summary of Corridor Traveler Survey

An online survey was conducted in January 2016 using the SurveyMonkey online survey tool. The purpose of the survey was to gather information on travel behavior and preferences of people living and working in the Tri-Valley area. A link to the survey was distributed via email by Alameda CTC and partner agencies through internal distribution lists. The survey consisted of 20 questions, which covered demographic information, travel information, transit use, and park-and-ride use. In addition, the survey asked about the types of improvements to facilities and transit service that would make them more convenient and attractive. Most of the questions were multiple choice and respondents also had an opportunity to provide written comments.

There were 545 responses to the survey. The results were generally divided into two groups: transit users (100 respondents) and non-transit users (445). There were park-and-ride users in both of these categories. The following sections summarize the survey results and provide conclusions.

Characteristics of Current Transit Users

There were 100 survey respondents who reported using transit as part of their commute. The vast majority of transit users (93%) also travelled by car on a portion of their commute. The most common transit mode was BART (65%) followed by Ace (33%) and LAVTA Wheels (17%). Respondents were allowed to choose multiple modes in reporting their method of travel. About 7% of transit users reported walking as part of their trip, 7% reported biking and 6% reported using Uber or Lyft. **Figure 6** shows the method of travel reported by transit users.

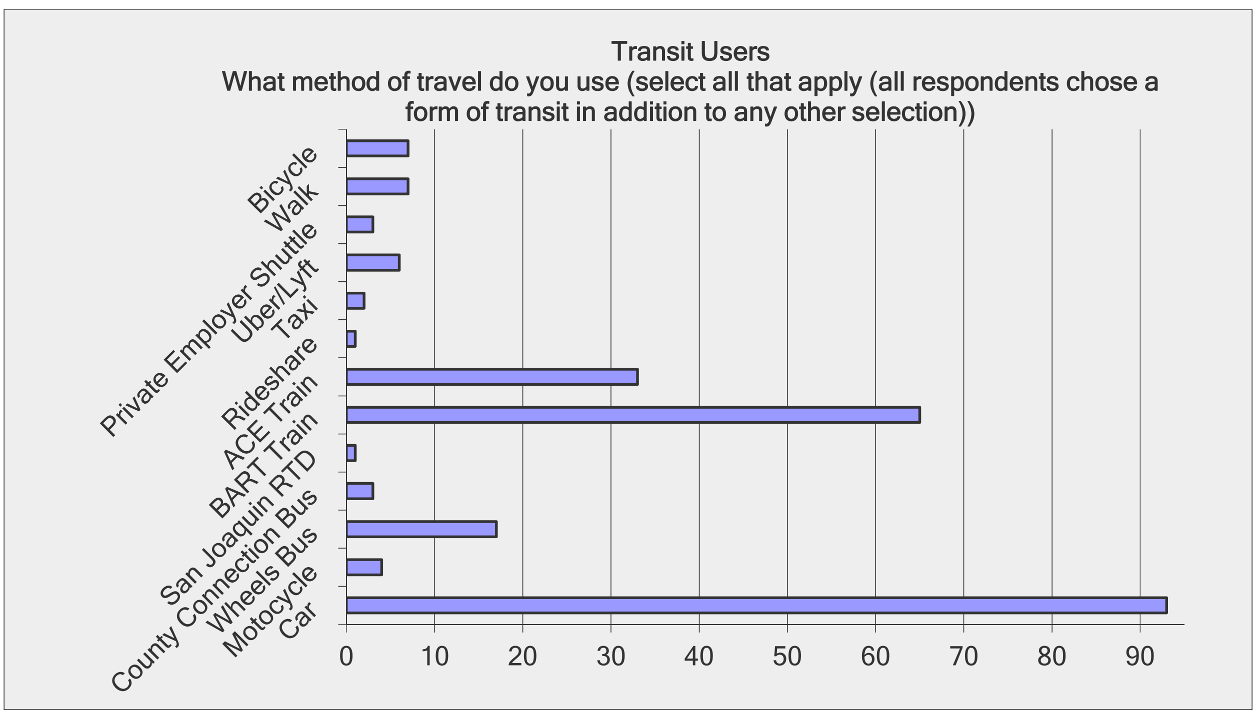


Figure 6: Method of travel for transit users

When asked about the difficulty of their trip, 11% of transit users responded that their trip leaving home was not difficult (and 4% for their return trip). About 66% of transit users responded that their trip leaving home was difficult or somewhat difficult (56% for their return trip) and about 22% said it was very difficult (36% for their return trip). **Figure 7** shows the difficulty of travel reported by transit users.

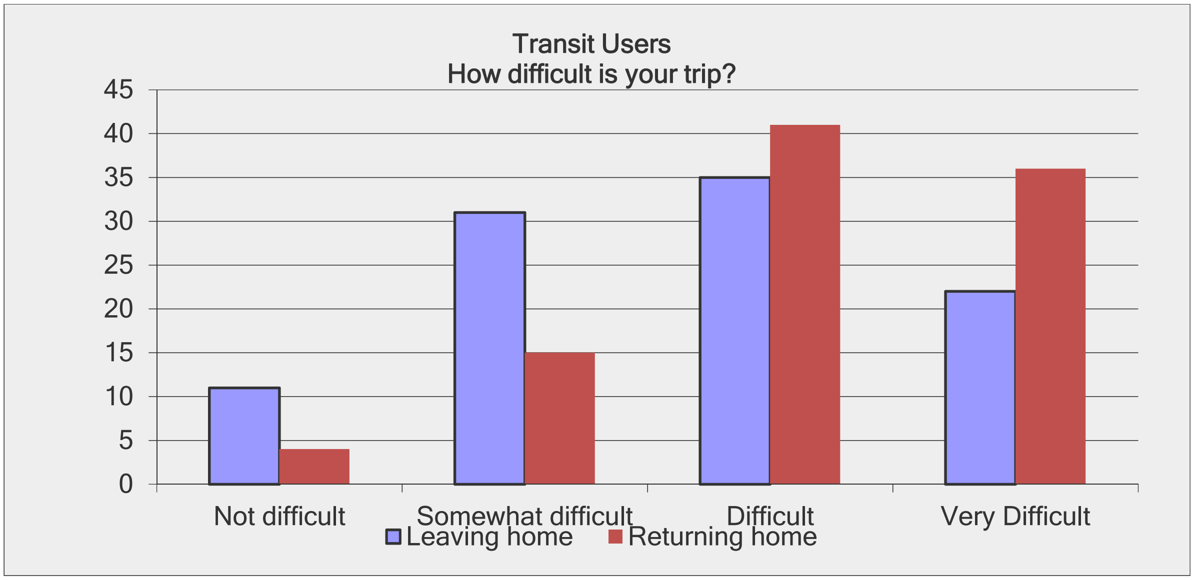


Figure 7: Difficulty of commute trips for transit users

The survey also asked about the possibility of using Wheels or County Connection bus service. About 35% of transit users indicated that it would be possible to use these services as part of their trip. For those not able to use these services, about 39% said that they would need stops closer to their house to use the service, and 31% responded that more frequent bus service would be needed (multiple responses were allowed). About 53% responded that no improvements would lead them to use the service. The responses are shown on **Figure 8.**

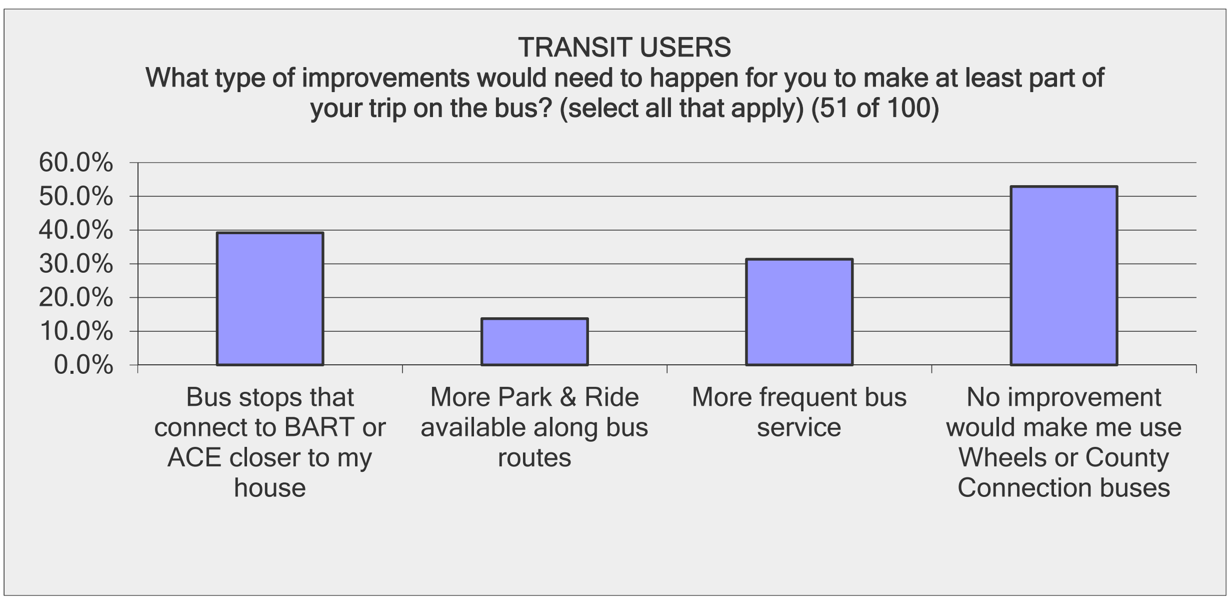


Figure 8: Improvements needed for Wheels and County Connection service for transit users

There were 15% of transit users who reported using a park-and-ride, and 86% of transit users responded that they have never used a park-and-ride lot to get to work or school. However, most of the transit users appeared to be driving to and parking at BART or ACE stations, which may not be considered "park-and-ride" for this group. The majority of the BART users reported that parking lot is sometimes or always full when arriving at the station, but this did not appear to be a problem for most ACE users. About half of the transit users responded that they were aware of park-and-ride lots near their homes. The responses are shown on **Figure 9.**

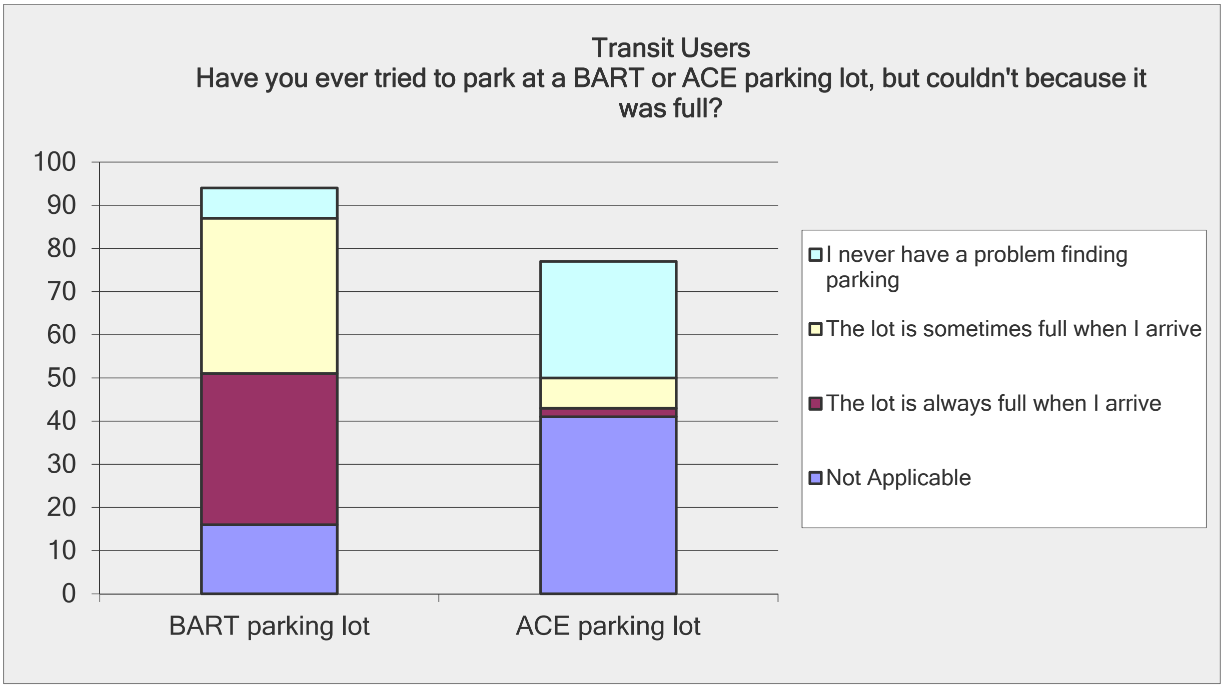


Figure 9: Ability to find parking at BART and ACE stations

When asked about potential improvements, about 40% of transit users reported that additional parking at the station is needed, 27% reported that making it easier to find a shuttle to BART or ACE is needed and 20% reported that making it easier to connect to the main station from a park-and-ride location is needed.

Transit users that did not use park-and-ride lots were asked about the type of improvements needed to consider using them. About 59% reported that direct shuttle service to BART or ACE would be a needed improvement, 42% reported that a smart phone app with arrival times was needed, and 37% reported that real-time parking information was needed. The responses are shown on **Figure 10.**

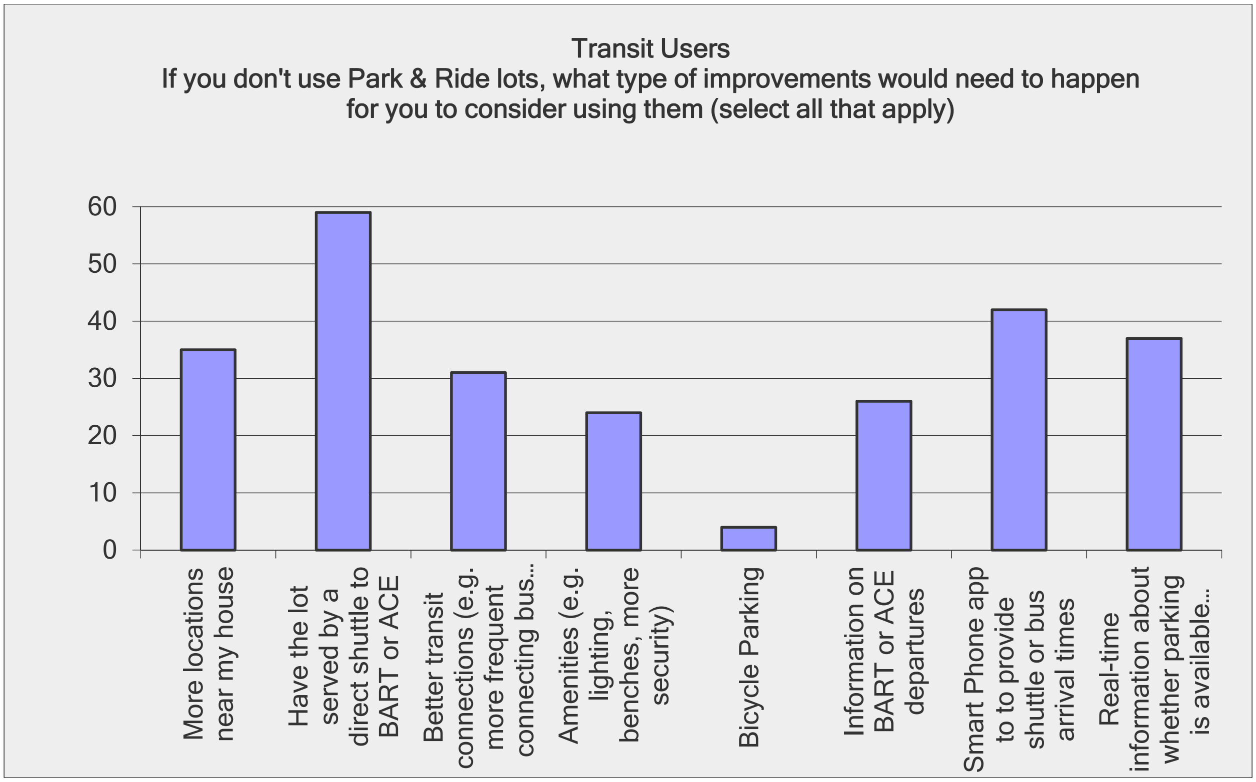


Figure 10: Types of improvements needed for transit users at park-and-ride lots

Characteristics of Non-Transit Users

There were 445 survey respondents who reported that they did not use transit as part of their trip. This group was further filtered to identify "potential transit users" by eliminating respondents that reported the following:

- Destination is too far from a BART Station
- Do not use I-580 or I-680 for a portion or all of their trip to work or school on a regular basis
- Drive a company vehicle to and from home, or their work requires them to use their own vehicle
- Walk and bike (with no portion of their commute on transit)
- No improvement to the system whatsoever would cause them to take transit

Upon filtering the responses of non-transit users, a total of 182 survey responses were left. This group is referred to throughout this report as "potential transit users".

Similar to the current transit users, the vast majority of potential transit users (91%) reported using a car as a portion of their commute trip and nearly 4% reported using a motorcycle. About 2% reported using a bicycle and the remainder reported walking using RideShare, taxi, and Uber/Lyft.

When asked about the difficulty of their trip, 17% of potential transit users responded that their trip leaving home was not difficult (and 9% for their return trip). About 72% of potential transit users responded that their trip leaving home was difficult or somewhat difficult (58% for their return trip) and about 11% said it was very difficult (33% for their return trip). **Figure 11** shows the difficulty of travel reported by transit users.

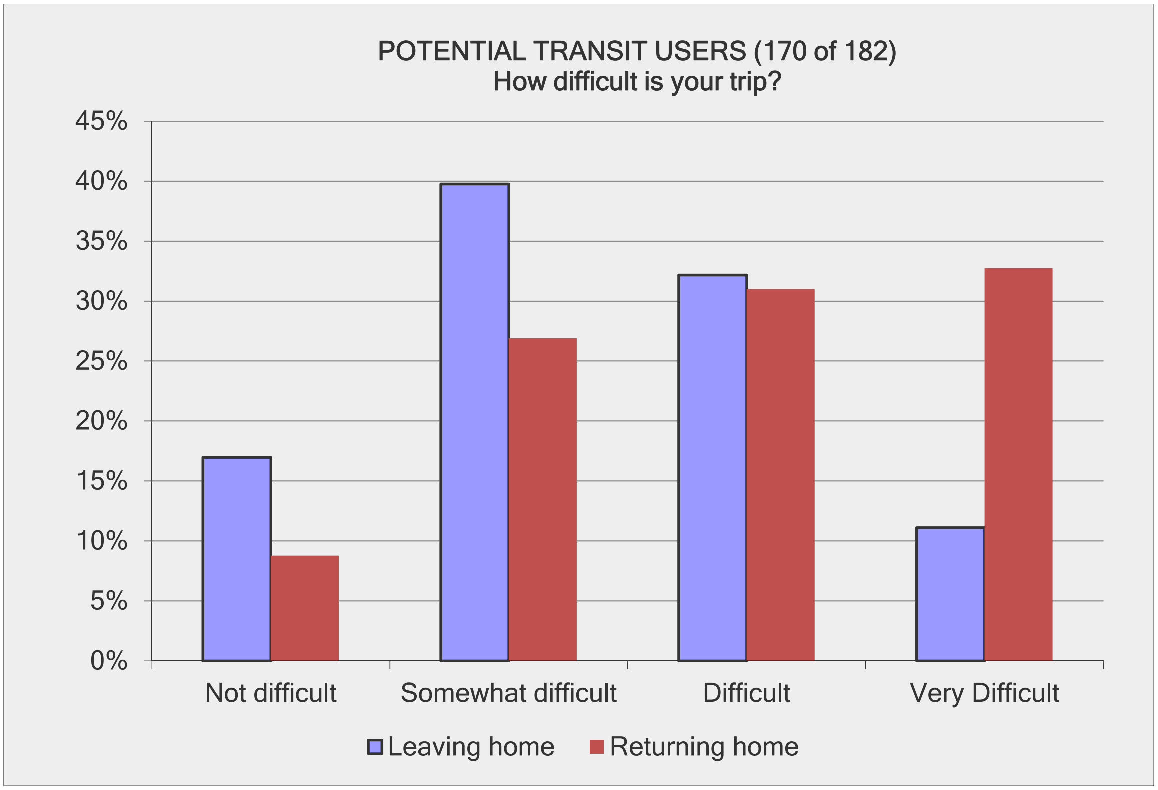


Figure 11: Difficulty of commute trip for potential transit users

When asked about reasons for not using BART or ACE, the potential transit riders primarily responded that driving was faster. A secondary reason was that that they needed to make stops along the way. Potential transit riders also indicated that parking at BART was too difficult and that the ACE service was not frequent enough or not at the times needed. A smaller number responded that the BART service was not frequent enough or that parking at ACE was too difficult. The responses are shown in **Figure 12**.

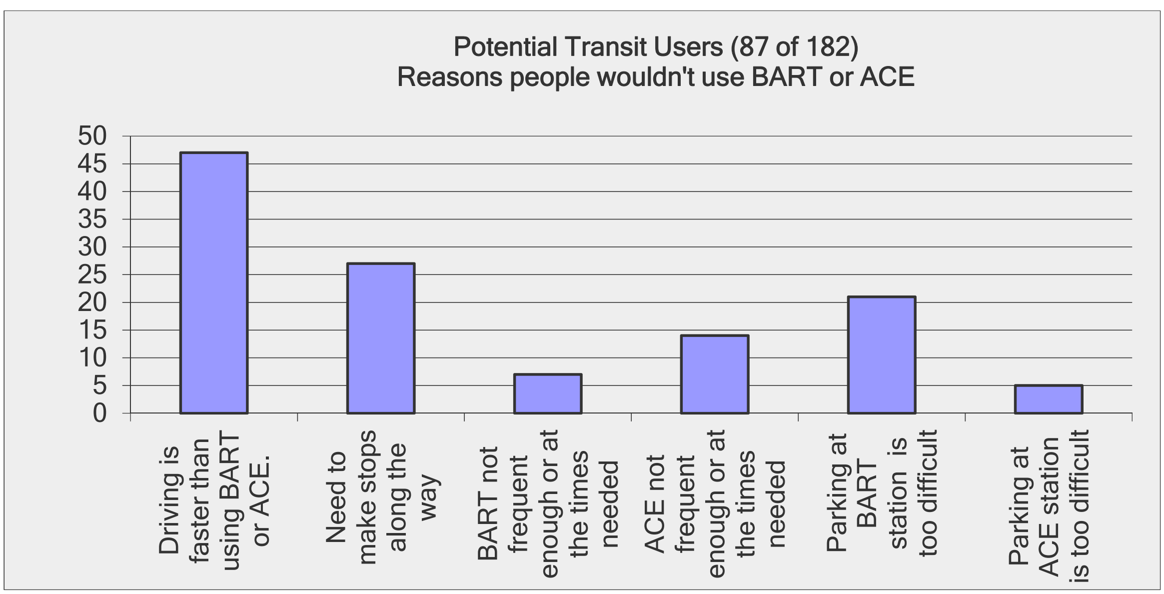


Figure 12 Reasons potential transit users do not currently use transit

In addition, the survey asked for potential improvements needed to use BART or ACE. The primary response was that more parking was needed at the main stations. A smaller number responded that easier connections from park-and-ride locations to the main station were needed.

Approximately 88% of potential transit users responded that they have never used a park-and-ride lot to get to work or school. About half of the potential transit users responded that they were aware of park-and-ride lots near their homes. A portion of the potential transit users responded that they had used park-and-ride lots in the past, with about 7% connecting with public transit/bus and 2% using it for a carpool.

Potential transit lots were asked about the types of improvements needed for them to consider using park-and-ride lots. (Full responses are shown in Figure 13 - multiple responses were allowed.) The following ranked as the highest reported improvements:

- **Direct shuttle service to BART or ACE (61%)**
- **Better transit connections (45%)**
- **Smart phone app with arrival times of transit connections (45%)**
- **More locations would be needed near their homes (42%)**
- **Real-time parking information (42%)**

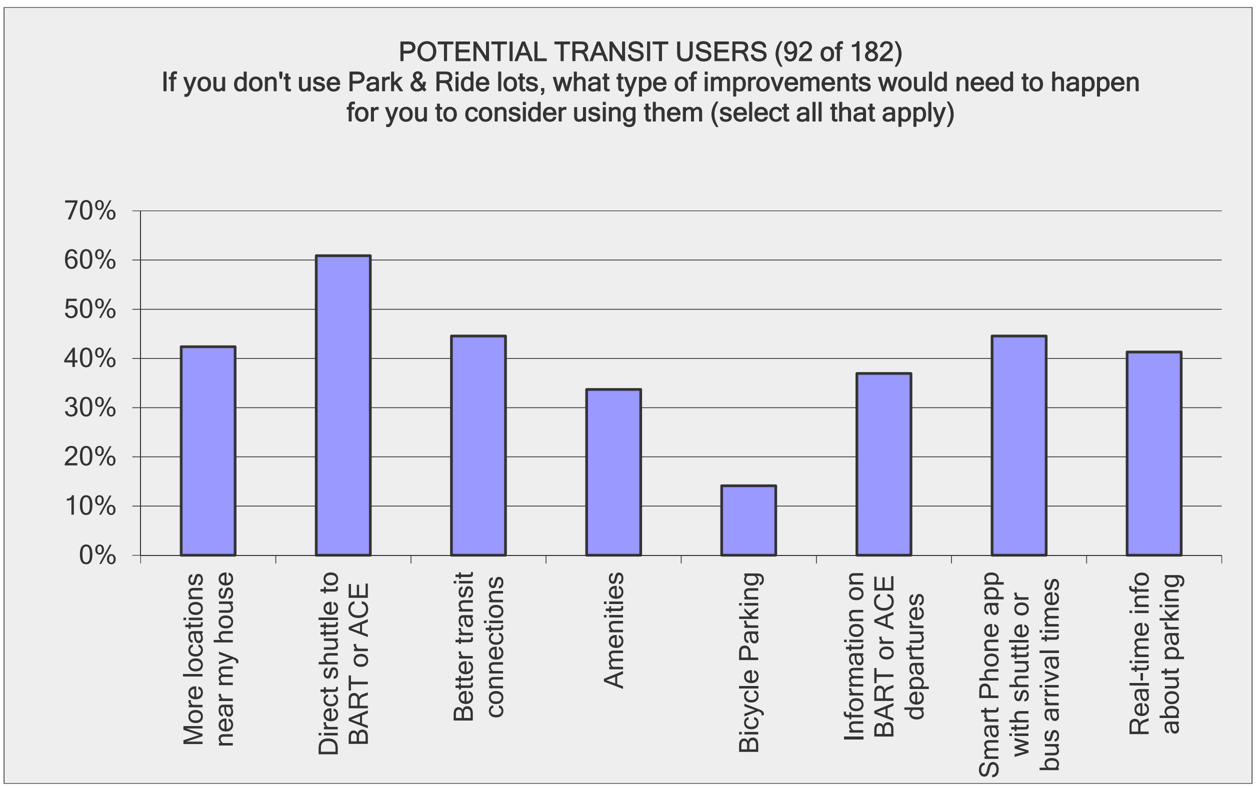


Figure 13: Types of improvements needed for potential transit users at park-and-ride lots

Conclusions from Survey Data

Comparing existing transit users with potential transit users, it appears that both groups rely on automobile use as part of their commute trip, and that neither group makes extensive use of the satellite park-and-ride lots. Transit users appear to use a higher variety of modes as part of their commute trips, such as walking and biking, while the potential transit user group used motorized vehicles almost exclusively. Transit users reported having more difficulty with their commute trip, while the majority of respondents in both groups reported at least some difficulty. The main reason given by potential users for not currently using transit was that driving was faster.

Transit users reported difficulty in finding parking near BART stations and many people responded that more parking was needed. Potential transit users also indicted that parking at BART was one of the barriers to using transit. This may be one area of opportunity to improve the ease of transit uses. In terms of bus service, majorities of both groups indicated that a direct shuttle and better transit connections would lead them to consider using remote park-and-ride lots. More convenient locations near home were also reported as a need for both groups, as were smart phone apps, real-time parking information, and improved amenities. It did not appear that bicycle parking was identified as an important need.

Based on the survey data, new bus or shuttle service would be most attractive if it offers convenient parking access; has fast, direct service to BART and ACE; and uses technology for communicating transit arrival times and parking information. Local service may not be attractive for a large number of people unless the service is conveniently located to people’s homes.

ALAMEDA COUNTYWIDE TRANSPORTATION MODEL

The Alameda Countywide Transportation Model (ACTM) is an important planning tool and source of information for travel patterns in the Tri-Valley. A four-step, trip-based model system, the ACTM has a calibrated base year of 2010 and forecast scenarios for 2020 and 2040. The most recent update of the ACTM was documented in July of 2015. The model uses the ABAG Projections 2013 socioeconomic data to generate trips by purpose, including home-based work, home-based shop/other, home-based social-recreational, home-based school, and non-home based trips. This travel behavior and market analysis focuses largely on home-based work trips.

The ACTM represents travel at the level of 4485 Travel Analysis Zones (TAZs) in Alameda County, San Joaquin County and the Bay Area, as well as zones representing external gateways and park-and-ride lots. A model of the highway and transit networks produces estimates of travel times and costs between TAZs that feed into mode choice models that predict travel by the following modes for home-based work trips: drive alone, shared ride (2 vehicle occupants), shared ride (3 vehicle occupants), transit, bicycle, and walk. Transit trips are divided into trips with auto access and trips with walk access. The auto access transit trips are further stratified into park-and-ride (PNR) and patron drop-off trips while the walk access trips are stratified by transit sub mode (BART, commuter rail, light rail or ferry, express bus, and local bus).

Additional details about the ACTM, including a description of trip generation, trip distribution, mode choice, and trip assignment to the highway and transit networks may be found in the model documentation[1].

Forecasted Traffic Volumes on I-580 and I-680

Traffic is expected to grow on I-580 and I-680 in the Tri-Valley area between 2015 and 2030. **Table 7** lists the current estimated and forecasted traffic volumes for some representative locations forecasted by the Alameda Countywide Transportation Model. As shown, the total volume at these locations is expected to increase on the order of ten to twenty percent by 2030.

Summary of Modeled Commute Trip Patterns for and through Tri-Valley

This section describes current travel patterns as output from the Alameda Countywide Transportation Model using land use, employment, and socioeconomic inputs for 2015[2]. The travel patterns are described in the context of the potential market for park-and-ride to transit usage. Travel patterns have been summarized at the level of the county and ACTM "super district", an aggregation of travel analysis zones. The Tri-Valley falls into super district 15, which consists of eastern Alameda County and includes the cities of Dublin, Pleasanton, and Livermore.

[1] (Dowling Associates, Inc., 2011) and (Alameda County Transportation Commission, 2015)

[2] The model run incorporated a park-and-ride lot choice component as described later in this report. Land use, employment and other socioeconomic inputs were developed as interpolations between the existing 2010, 2020, and 2040 inputs.

Table 7 –AM PEAK PERIOD (6AM-10AM) TRAFFIC VOLUMES FROM ALAMEDA MODEL ON I-580 AND I-680

Location	2015 Volume	2030 Volume	Pct. Change
I-580 westbound from Livermore Avenue			
Drive Alone	19,057	19,916	5%
Shared Ride	6,197	7,948	28%
Drive to Transit	4,568	4,554	-0.3%
Truck/Commercial	5,891	6,537	11%
Total	35,713	38,956	9%
I-580 Approaching 680 Junction			
Drive Alone	*19,512*	*20,015*	*3%*
Shared Ride	*5,735*	*9,221*	*61%*
Drive to Transit	*2,266*	*2,129*	*-6%*
Truck/Commercial	4,807	5,525	15%
Total	32,320	36,890	14%
I-680 northbound approaching Alcosta Blvd			
Drive Alone	12,997	14,312	10%
Shared Ride	3,915	5,165	32%
Drive to Transit	684	1,260	84%
Truck/Commercial	3,523	4,156	18%
Total	21,120	24,893	18%
I-680 southbound from SR-84			
Drive Alone	15,878	16,299	3%
Shared Ride	3,904	5,399	38%
Drive to Transit	1,984	1,951	-2%
Truck/Commercial	4,481	5,909	32%
Total	26,246	29,558	13%

Source: Alameda Countywide Transportation Demand Model and DKS Associates, 2015.

Commute Patterns & Growth in Travel from Alameda Countywide Transportation Model

As many park-and-ride users are known to be commuting to work, this analysis focused on total daily peak period which includes both the four-hour AM peak period (6AM-10AM) and four-hour PM peak period (3PM-7PM), home-based work (HBW) travel. **Table 8** through **Table 11** summarize peak period (HBW) travel derived from the Alameda Countywide Transportation Model for current (2015) and forecast (2030) years.

Currently, about 44 percent of round trips to work generated in the Tri-Valley have a work destination also in the Tri-Valley (Table 8). As shown in **Figure 14**, about a quarter of the Tri-Valley home-based work trips have a work destination within Alameda County but outside the Tri-Valley. Other significant work locations include Santa Clara County (10 percent), South Central Contra Costa County (5 percent), San Francisco County (8 percent), and San Mateo County (3 percent). The total volume of home-work travel generated in the Tri-Valley is forecasted to increase by about 18 percent by 2030.

The largest share of work travel based in the Tri-Valley is conducted by single-occupant automobile. Driving alone accounts for 77 percent of these trips (refer to **Table 8**, see **Figure 15**). Shared ride automobile travel and transit also have significant mode shares, however. Driving to transit also plays a significant role, particularly where work destinations are well-served by transit, such as along the BART lines. These mode shares are not forecasted to shift significantly by 2030.

For home-work travel attracted to the Tri-Valley, the majority of home locations are also within the Tri-Valley. The next most common home location is San Joaquin County (16 percent) followed by Contra Costa County (17 percent), San Joaquin County (16 percent), and other parts of Alameda County (about 15 percent). These home-work tours are primarily served by single-occupant automobile. Shared rides serve around 13 percent but drive-to-transit trips only constitute about two percent of the total home-work travel based outside the Tri-Valley.

Table 8. ACTM Total Daily Peak Period Home-Based Work Round Trips with Home Location in Super District 15– 2015

Work Location	Drive Alone	SR2	SR3	Walk-Transit	Drive-Transit	Bicycle	Walk	Total	Work Location Distribution
Tri-Valley	35,057	2,837	1,122	424	707	342	1,990	42,479	44%
South West Alameda County	6,833	619	267	31	110	2	-	7,862	8%
West Central Alameda County	7,699	685	293	56	132	7	-	8,872	9%
North Central Alameda County	3,692	485	226	167	1,201	2	-	5,773	6%
North West Alameda County	1,126	148	73	37	154	1	-	1,538	2%
Western Contra Costa County	335	42	20	2	4	0	-	403	0.4%
N. Central Contra Costa County	769	91	41	1	10	0	-	911	1%
Central Contra Costa County	1,156	126	55	4	21	1	-	1,363	1%
S. Central Contra Costa County	4,690	407	166	7	45	23	9	5,348	5%
Eastern Contra Costa County	268	31	14	0	1	0	-	313	0.3%
San Joaquin County	737	85	40	-	-	0	-	862	1%
San Francisco County	1,315	443	293	635	5,203	0	-	7,889	8%
San Mateo County	2,325	358	173	27	88	-	-	2,971	3%
Santa Clara County	7,781	944	438	82	231	0	-	9,476	10%
North Bay Counties	805	195	103	2	7	-	-	1,112	1%
Gateway Zones	128	40	26	-	-	-	-	194	0.2%
San Joaquin Gateways	112	37	28	-	-	-	-	178	0.2%
Total by Mode	74,829	7,573	3,377	1,476	7,912	377	1,999	97,543	100.0%
Mode Share	77%	8%	3%	2%	8%	0.4%	2%	100%	

Source: Alameda Countywide Travel Demand Model and DKS Associates, 2015

Table 9. ACTM Total Daily Peak Period Home-Based Work Round Trips with Work Location in Super District 15– 2015

Home Location	Drive Alone	SR2	SR3	Walk-Transit	Drive-Transit	Bicycle	Walk	Total	Home Location Distribution
Tri-Valley	35,057	2,837	1,122	424	707	342	1,990	42,479	46%
South West Alameda County	3,866	418	181	29	133	2	-	4,630	5%
West Central Alameda County	5,839	653	268	150	179	11	0	7,100	8%
North Central Alameda County	1,336	171	70	58	50	0	-	1,685	2%
North West Alameda County	204	25	11	10	8	0	-	258	0.3%
Western Contra Costa County	294	42	21	6	12	0	-	375	0.4%
N. Central Contra Costa County	1,078	133	60	4	35	0	-	1,311	1%
Central Contra Costa County	911	89	38	3	26	1	-	1,068	1%
S. Central Contra Costa County	7,428	603	261	9	171	30	4	8,507	9%
Eastern Contra Costa County	3,512	420	194	4	107	0	-	4,237	5%
San Joaquin County	11,541	1,831	713	1	332	0	-	14,419	16%
San Francisco County	90	17	8	14	4	-	-	134	0.1%
San Mateo County	227	39	18	4	13	-	-	301	0%
Santa Clara County	2,046	377	171	10	75	0	-	2,679	3%
North Bay Counties	800	160	88	5	50	-	-	1,103	1%
Gateway Zones	613	98	37	-	-	-	-	749	1%
San Joaquin Gateways	498	80	30	-	-	-	-	608	1%
Total by Mode	75,343	7,992	3,293	732	1,903	386	1,995	91,643	100%
Mode Share	82%	9%	4%	0.8%	2%	0.4%	2%	100%	

Source: Alameda Countywide Travel Demand Model and DKS Associates, 2015

Table 10. ACTM Total Daily Peak Period Home-Based Work Round Trips with Home Location in Super District 15 – 2030

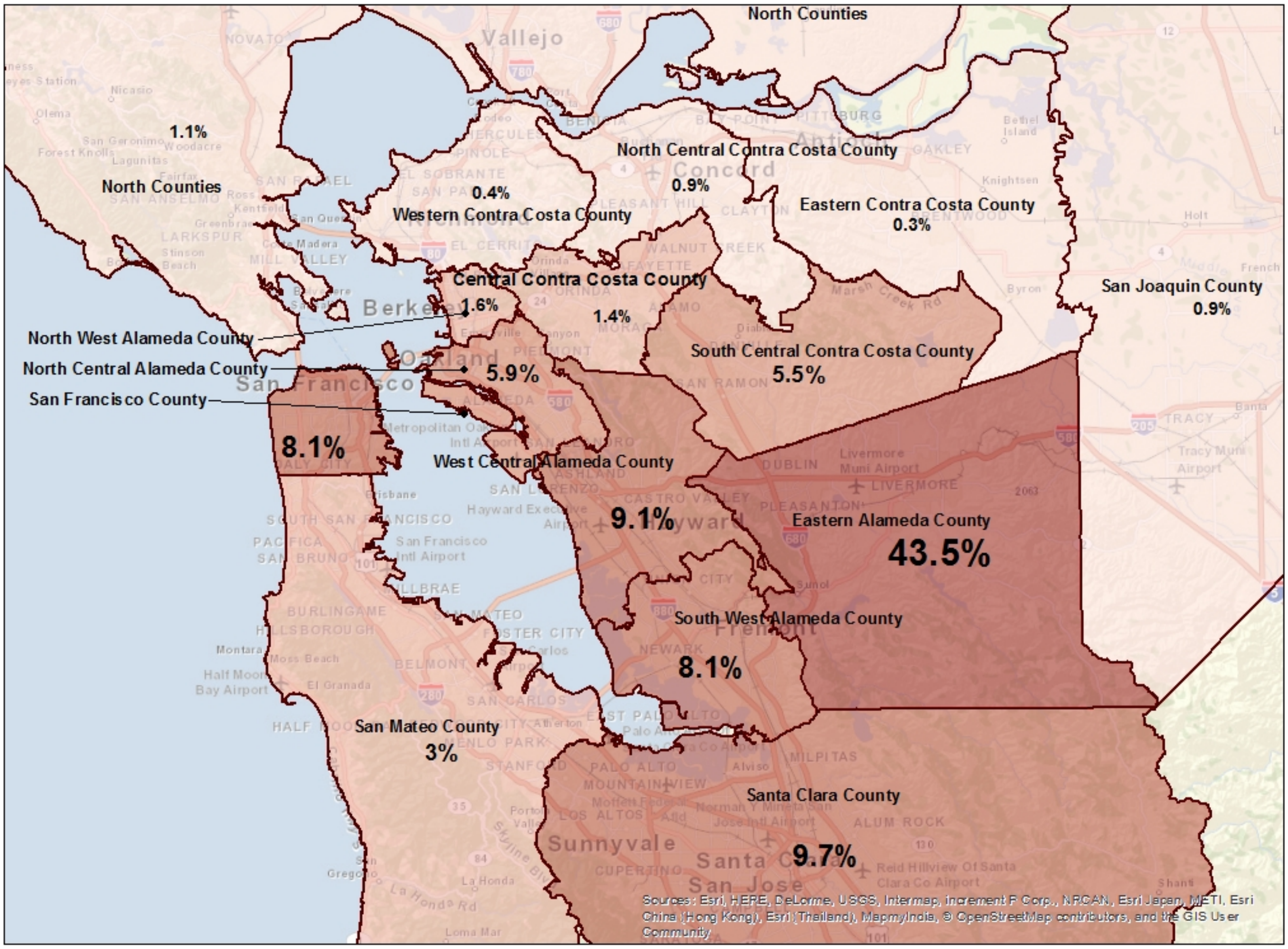
Work Location	Drive Alone	SR2	SR3	Walk-Transit	Drive-Transit	Bicycle	Walk	Total	Work Location Distribution
Tri-Valley	43,195	3,863	1,512	759	769	522	2,751	53,371	46.3%
South West Alameda County	7,409	749	327	58	108	3	-	8,653	7.5%
West Central Alameda County	8,977	862	370	114	137	12	-	10,471	9.1%
North Central Alameda County	4,444	641	302	412	1,501	4	-	7,304	6.3%
North West Alameda County	1,274	182	92	90	196	1	-	1,836	1.6%
Western Contra Costa County	404	57	28	4	5	0	-	498	0.4%
N. Central Contra Costa County	895	117	53	2	11	0	-	1,077	0.9%
Central Contra Costa County	1,311	155	68	6	21	1	-	1,562	1.4%
S. Central Contra Costa County	5,500	512	207	19	44	34	14	6,330	5.5%
Eastern Contra Costa County	336	42	19	0	1	0	-	398	0.3%
San Joaquin County	988	130	62	-	-	0	-	1,179	1.0%
San Francisco County	1,373	448	301	1,334	5,599	0	-	9,055	7.9%
San Mateo County	2,384	426	217	63	90	-	-	3,180	2.8%
Santa Clara County	6,899	995	473	130	183	0	-	8,681	7.5%
North Bay Counties	911	252	138	6	8	-	-	1,314	1.1%
Gateway Zones	117	45	31	-	-	-	-	193	0.2%
San Joaquin Gateways	124	52	42	-	-	-	-	218	0.2%
Total by Mode	86,541	9,526	4,241	2,995	8,673	578	2,765	115,319	100.0%
Mode Share	75.0%	8.3%	3.7%	2.6%	7.5%	0.5%	2.4%	100.0%	

Source: Alameda Countywide Travel Demand Model and DKS Associates, 2015

Table 11 ACTM Total Daily Peak Period Home-Based Work Round Trips with Work Location in Super District 15– 2030

Home Location	Drive Alone	SR2	SR3	Walk-Transit	Drive-Transit	Bicycle	Walk	Total	Home Location Distribution
Tri-Valley	43,195	3,863	1,512	759	769	522	2,751	53,371	46.8%
South West Alameda County	4,943	604	267	62	169	3	-	6,049	5.3%
West Central Alameda County	6,929	861	357	282	196	17	0	8,641	7.6%
North Central Alameda County	1,615	239	100	122	57	1	-	2,133	1.9%
North West Alameda County	248	35	15	20	9	0	-	327	0.3%
Western Contra Costa County	370	64	33	12	14	0	-	493	0.4%
N. Central Contra Costa County	1,396	208	97	12	45	1	-	1,758	1.5%
Central Contra Costa County	1,140	131	56	5	30	1	-	1,362	1.2%
S. Central Contra Costa County	9,311	799	342	20	208	43	4	10,729	9.4%
Eastern Contra Costa County	3,839	565	269	17	216	0	-	4,907	4.3%
San Joaquin County	13,284	2,262	895	2	356	0	-	16,798	14.7%
San Francisco County	115	27	14	33	5	0	-	194	0.2%
San Mateo County	293	62	31	10	20	-	-	416	0.4%
Santa Clara County	2,726	562	261	63	126	0	-	3,739	3.3%
North Bay Counties	893	242	140	14	76	-	-	1,364	1.2%
Gateway Zones	849	136	52	-	-	-	-	1,037	0.9%
San Joaquin Gateways	605	97	37	-	-	-	-	739	0.6%
Total by Mode	91,750	10,756	4,476	1,433	2,296	589	2,755	114,056	100.0%
Mode Share	79.6%	9.3%	3.9%	1.2%	2.0%	0.5%	2.4%	98.9%	

Source: Alameda Countywide Travel Demand Model and DKS Associates, 2015



Sources: Alameda Countywide Transportation Model Peak Period HBW Person Trips & DKS Associates, 2015

Figure 14 - Work Location of Home-Based Work Trips Produced in Tri-Valley

Comparison with AirSage Data

In recent years, data derived from mobile phone movements and connected vehicles has become an important source of information on travel patterns. These data can be used to confirm or calibrate the results of travel demand forecasting models such as the ACTM. Data provided by AirSage has been acquired for the I-680 corridor by the Metropolitan Transportation Commission and by BART for the I-580 corridor in the Tri-Valley. While detailed data have not been made available to this study, some high-level summaries have been reviewed for their potential relevance.

The I-580 corridor AirSage data suggested that for round trips from Livermore, San Francisco County was a somewhat less prominent destination than forecasted by the ACTM for the year 2035. Also, for trips produced in the San Joaquin Valley, Santa Clara County appeared to be a relatively more common attraction than predicted by the model. While not directly comparable to the commute patterns discussed above, these results should be kept in mind when planning park-and-ride facilities services in the Tri-Valley.

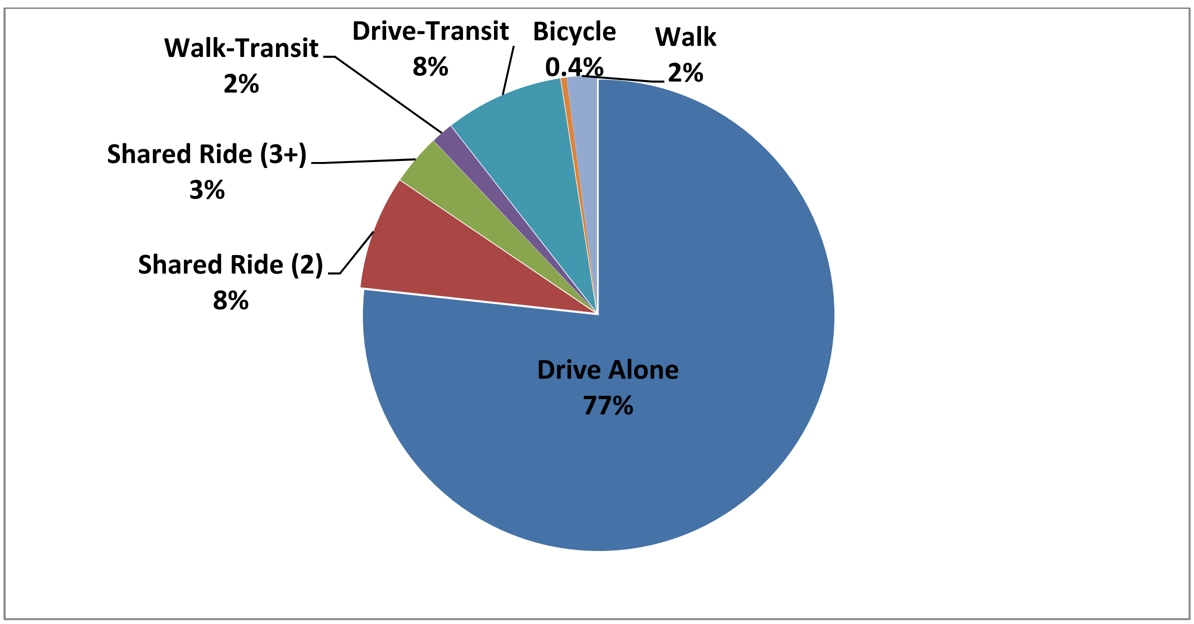
MARKET FOR NEW TRANSIT-ORIENTED PARK-AND-RIDE USERS

BART Trips

Recently reported average daily boardings at the Dublin-Pleasanton and West Dublin BART stations are 8,331 and 3606, respectively (see Table 3). A preliminary ACTM transit assignment for a horizon year of 2030 suggests that about half the daily boardings would be park-and-ride trips. If this ratio of PNR use were applied to recent BART boardings, it would translate to a daily parking demand of roughly 4,150 for Dublin-Pleasanton and 1,800 for West Dublin. Since both lots currently fill by mid-morning and there is a lengthy waiting list for reserved parking, there is obviously a demand for park-and-ride at the Tri-Valley BART stations that is not being met. Some of these would-be park-and-ride users accessing BART by other means (patron drop-off or bus transit) but there are other commuters who would use BART if they could park but instead drive to their destinations.

ACE Trips

Commuters traveling on ACE trains are another potential market for new park and ride users. Recent average weekday boardings for October 2015 for the Tri-Valley stations are shown in **Table 4**. Even accounting for some ride sharing, the parking supply would appear to be insufficient to meet demand, especially at the Pleasanton station. At the same time, the Vasco and Livermore ACE parking facilities were observed at less than full occupancy. This identifies a mismatch between the locations where people want to access the ACE system and parking capacity.



Sources: Alameda Countywide Transportation Model total daily peak period[3] HBW person trips by mode & DKS Associates, 2015

Figure 15 - Mode Share of Peak Period Home-Based Work Trips Produced in Superdistrict 15 from ACTM - 2015

[3] 6AM-10AM and 3PM-7PM

In addition, the ACE parking supply may need to be increased to accommodate projected increases in ACE ridership. Annual boardings and alightings at the Tri-Valley ACE stations have been forecasted by the San Joaquin Regional Rail Commission as 896,000 for 2015, increasing to 1,024,000 by 2020, an increase of 14 percent[4].

Wheels and County Connection

The LAVTA Wheels and CCTA County Connection transit operators provide several express routes that serve travel within the Tri-Valley and/or act as feeders to rail transit. The market for bus riders supported by park-and-ride could potentially be expanded by providing additional service or increasing frequency at park-and-ride lots, particularly those that are currently less utilized. The vast majority of users are taking private employer bus shuttles while only 6.6% of users are boarding a bus to connect to BART as shown in **Figure 2**. At the Airway lot, 50 percent of respondents were taking a bus to BART and 25 percent were taking a private shuttle. Since the Airway lot is served by only the Wheels 12/12x, transit ridership could potentially be increased by adding service or increasing frequency at this location.

Private Employer Buses and Shuttles

The increased use of private bus shuttles by large employers represents an intriguing opportunity to increase transit usage and reduce vehicle miles travelled via a public-private partnership. Private employer buses already make substantial use of the lots at Tassajara, Portola, and Airway. With outreach to employers and potentially improved facilities, the use of these lots as pickup points for private shuttles could be increased. One issue that may need to be addressed at the more isolated lots is security.

Carpool/Vanpool

Increasing the use of smaller scale carpools or vanpools represents another market opportunity. Locations that evidenced significant carpool use in the intercept survey include Airway (25 percent of respondents using a carpool as mode of egress) and Johnson/Stoneridge (33 percent). The Alameda Countywide Travel Demand Model, like most regional models, does not have a mechanism to model carpool formation at lot locations. Once a trip is given a mode choice of "shared ride", that trip is then just assigned a highway network path from origin to destination without any consolidation stop in between. Expanding the market for carpool users will require a similar approach to that used for private employer shuttles: publicizing the availability of facilities with extra capacity, potentially improving amenities, and addressing any issues such as security.

[4] (San Joaquin Regional Rail Commission, 2014) These figures represent the "no build" scenario. If ACE service is expanded, ridership would be higher.

METHODOLOGY FOR EVALUATING NEW PARK-AND-RIDE AND TRANSIT SERVICES

The DKS Team has developed a park-and-ride lot choice module to supplement the Alameda Countywide Travel Demand Model. This module addresses the effect of capacity constraints on park-and-ride usage by calculating a “shadow price” or deterrence factor for each lot that fills up during the total daily peak period[5]. The park-and-ride choice module supplements the peak period mode choice step in the ACTM. The module begins with basic model level of service inputs and resulting peak period mode choice and iterates until an equilibrium condition is reached. Trip generation, distribution, non-peak mode choice, and assignment procedures from the ACTM remain unchanged. A technical description of the park-and-ride choice module may be found in **Attachment A**.

Although initial testing of the PNR lot choice module has been performed, the completion of the physical inventory identified some inconsistencies between the actual parking supply and the parking supply information used in the model. Some refinement of the model inputs will therefore be needed before applying the model to test new service or facility options. In addition, transit lines represented in the model will need review to ensure that current levels of service are accurately represented.

Once the park-and-ride choice module is sufficiently calibrated, it can be used to test the effect of options including:

- Expanding the capacity of existing park-and-ride lots,
- Adding new park-and-ride lot locations,
- Adding new bus transit service, and/or
- Increasing the frequency of existing bus transit services.

This market analysis, along with policy and resource considerations will inform the package of options for further evaluation.

[5] Consistent with the Alameda Countywide Travel Demand Model

Attachment A
Park-and-Ride Choice Mode

Park-and-Ride Lot Choice

This section describes the park-and-ride lot choice module developed to supplement the Alameda Countywide Travel Demand Model. A logit model of park-and-ride lot choice is applied with matrix calculations to obtain skims of combined auto-transit alternatives, and to generate auto and transit trip tables for assignment to their respective networks.

The premises of the park-and-ride lot choice model are:

- Commuters are free to choose any park-and-ride lot accessible from home by car and from there to the destination by transit,
- Users minimize "generalized cost" in their choice, which combines random utility with modeled network driving times and costs, transit times and costs (including walking to the destination), and a disutility penalty ("shadow-price") imposed by each lot estimated to fill up in the morning commute period,
- The random utility is independently and identically distributed for each park-and-ride lot such that a multinomial logit choice model calculates the probability of use of each lot, for a given origin and destination,
- The lot penalty for any full lot is equal for all users (and would-be users) of the lot, and satisfies equilibrium between the number of vehicles parked by users choosing the lot, and the parking lot's capacity. No such penalty applies to lots that do not fill up.

Heinz Spiess demonstrated the existence and uniqueness of the equilibrium solution of the lot penalties, and a means to solve it using EMME software. This method has gained widespread use among EMME users, and increasing application in other software. The solution algorithm is a reliable variant of iterative proportional fitting, which iteratively and simultaneously solves a converging approximation of the shadow prices (if any) on each lot.

In Cube Voyager, application is made possible by its matrix program's capabilities of user-specified looping and matrix-cell referencing. This model replaces all-or-nothing choice of parking access node in transit network path-building, which has no mechanism to respect parking capacity constraints. It is a multinomial logit choice model, giving a probability of use of each park-and-ride lot for each origin-destination pair having transit service to the destination. It satisfies parking capacity constraints by solving a "shadow-price" for each lot that fills up, sufficient to deter enough demand-choice for the lot to fill up exactly (within a close tolerance). For production zone *i*, attraction *j*, and park-and-ride zone *k*, the utility function is

$$Utility_{i,k,j} = -0.07 * (2.5 * \text{AutoTime}_{i,k} + 0.0909 * ((\text{DistAu}_{i,k} * (\text{cost/mile}) + \text{ParkCost}_{k}) * 0.89\,\text{veh/pers} + \text{Fare}_{k,j}) + \text{CompositeTransitSkim}_{k,j}) + \ln(c_k)$$

Auto time and cost skim matrix values are taken from *i* to *k*, while transit skim elements are taken from *k* to *j*, the composite being combined from in-vehicle, walk, and waiting times with their respective weights. The *k* index refers only to designated park-and-ride zones having capacity, the set referred as *K* below.

The overall utility coefficient of -0.07 (relative to transit in-vehicle time) was taken from park-and-ride lot choice models estimated from observations in the PSRC (Seattle) region. The auto time weight of 2.5 is on the low side of typical weights from 3 to 6 used in many of these models.

The scale of monetary costs is taken from the Alameda County mode choice model. The vehicle per person rate was borrowed from the Sacramento application, pending verification for the Bay Area. The shadow-price to solve parking constraint is $\ln(c_k)$, where c_k is actually simpler to solve and apply than its logarithm.

This utility is applied in a multinomial logit choice, giving the probability a transit auto-access trip (from the mode choice model) in the i-j pair chooses to park-and-ride at k:

$$\text{Prob}(k|i,j) = \frac{\exp(Utility_{i,k,j})}{\sum_{\tilde{k}\in K}\exp(Utility_{i,\tilde{k},j})}$$

Solving the parking capacity constraints

A variant of iterative proportional fitting (IPF) is used to which iteratively and simultaneously solve the shadow price (if any) on each lot. c_k is initialized to 1 for all k, then iteratively updated:

$$c_k^n = \min\left(1, c_k^{n-1}\frac{\text{Capacity}_k}{\sum_{\forall i,j}\text{Demand}_{i,j}\cdot\text{Prob}(k|i,j)}\right)$$

where n is the current iteration number, and Demandij are the AM period trips given from the mode choice model, times an accumulation factor of 0.44 (tentative, from the Sacramento application). Lot attractiveness factors are thus adjusted inversely to the current ratio of excess (or shortage). When solved, each lot that is full has ck between 0 and 1, and each not full has ck =1. If started “cold,” i.e. beginning iterations with all c=1, dozens of iterations are required to reach reasonable convergence. But starting with an approximate solution from another model (even a different year) significantly speeds up convergence. As discussed in more detail below, the present application runs three iterations of shadow-price update for each of several iterations of mode choice update, this update schedule found experimentally.

For the mid-day period, the ACTC model does not include park-and-ride and patron drop-off modes.

Skims

The effective skim value for each O-D movement is its logsum,

$$\text{Composite Utility}_{ij} = \ln\sum_{\tilde{k}\in K}\exp(Utility_{i,\tilde{k},j})$$

Dividing by the same model’s coefficient of in-vehicle time converts it to composite time:

$$\text{Composite Time}_{ij} = \frac{\text{Composite Utility}_{ij}}{\beta_{ivtt}}$$

The Alameda model’s mode choice model inputs not a single utility, but the components of travel time – in-vehicle, waiting, driving, and walking. Basic values for each are computed as a weighted average from all the park-and-ride lots available to each O-D movement. If we let $\boldsymbol{\beta}$ and $\boldsymbol{V}$ be the coefficients and skim variables in the utility expression, then we can express the utility function as $U_{i,k,j} = \boldsymbol{\beta}^T\boldsymbol{V}_{ikj} + \ln(c_k)$, and the average of the skim variables as $\overline{\boldsymbol{V}}_{ij} = \sum_{\tilde{k}\in K}\boldsymbol{V}_{i\tilde{k}j}\text{Prob}(\tilde{k}|i,j)$

Unfortunately, these average values, when recombined back to total utility, do not reconstitute the logsum. A well-known problem with average variables or utilities is that a new or improved “second-best” alternative, when it draws enough users from the “best” alternative, re-weights the average to make it worse, despite service only improving. The logsum, however, responds in the right direction to changes. The “value of choice” is the difference between the logsum and the average:

$$\text{Value-of-Choice}_{ij} = \ln\left[\sum_{\tilde{k}\in K} \exp(U_{i,\tilde{k},j})\right] - \sum_{\tilde{k}\in K} U_{i,\tilde{k},j}\text{Prob}(\tilde{k}|i,j)$$

The average skim components also do not reflect the shadow-prices, $\ln(c_k)$, i.e. the deterrence due to impaction, while the logsum does.

To correct the skim components for use in mode choice, the value of choice and the shadow-price is allocated among them. Adjustment factor *f* (for each O-D) solves

$$f_{ij}\boldsymbol{\beta}^T\overline{\boldsymbol{V}}_{ij} = \text{Composite Utility}_{ij}$$

or,

$$f_{ij} = \frac{\text{Composite Utility}_{ij}}{\boldsymbol{\beta}^T\overline{\boldsymbol{V}}_{ij}}$$

Average components of skims are multiplied by the respective *f* factor before output for use in mode choice.

Solution of Mode Choice and Parking Constraint

Parking capacity constraints determine not only the choice of which park-and-ride lots are used by particular trips, but also the skims for park-and-ride in the mode choice. The above iterative factoring solves capacity constraint for a given travel demand, but the travel demand itself depends on the resulting skims, or else it is not a consistent model.

Algorithm 1 is one potential solution, nesting IPF within iteration with skims and demand:

1. Initialize: all *c*=1, demand=0
2. Calculate zero-demand skims
3. Calculate all peak-period mode choice models, to get new demand
4. Solve capacity constraint factors with IPF algorithm
5. Calculate new skims
6. Repeat from step 3 until sufficiently converged

The time taken to perform each iteration of IPF is substantial, so applying it nested within another iterative loop compounded the computation time. It is not certain it would converge, either, without a successive-averaging technique. Solution attempts by this algorithm have been terminated before convergence due to excessive runtime.

Algorithm 2 attempts an alternative, simultaneous solution:

1. Initialize: all *c*=1, demand=0
2. Calculate zero-demand skims
3. Calculate all peak-period mode choice models, to get new demand
4. Load the demand to the park-and-ride lots, using the current *c*
5. Update *c* once, according to the new demand
6. Calculate new skims
7. Repeat from step 3 until sufficiently converged

This method has been applied successfully in manageable runtimes, although not beginning with zero demand and empty lots, but with the original Alameda model's park-and-ride trip matrices. Rather than oscillating, demand tended to creep toward convergence, a consequence of the typical slow convergence of iterative proportional fitting.

To speed it up further, three iterations of the lot-choice fitting process were nested into this loop, instead of just one (i.e. an inner loop of steps 4 and 5). Convergence is not guaranteed in principle, but experimentally has been found effective and may be difficult to achieve any faster.

Application

Following the convergence of demand and supply for the peak period, the off-peak mode choice models and the rest of the ACTC model are run. No iterating is needed, since, as applied, they depend only on peak loadings.

Patron drop-off apply the same choice model as park-and-rides except without the constraint shadow-prices. No iteration is needed, so application consists of unconstrained skims at the beginning (for use by mode choice runs), and subsequent splitting into auto and transit trips.

The modified ACTC model run procedure is summarized as follows:

1. Preliminary trip generation, distribution, assignment (unchanged from previous ACTC model), providing a simplistic "feedback" to estimate congested network travel times.
2. Calculate auto and transit skims (unchanged from ACTC).
3. Patron drop-off skims
4. Loop:
    a. Update park-and-ride skims using current constraint factors
    b. Every third loop: Update peak mode choice
    c. Update park-and-ride lot choice and constraint factors. This also splits park-and-ride trips into auto trips (homes to PNR-zones) and transit trips (PNR-zones to destinations)
5. Patron drop-off lot choice, likewise splitting into auto and transit trip legs.
6. Transit assignment (as in previous ACTC model)

Auto assignment, as in previous ACTC model, including auto trips from PNR choice model.

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Appendix C

Evaluation of Potential Park-and-Ride Facilities, Supporting Bus Service and Amenities Final Report

Tri-Valley Integrated Transit and Park-and-Ride Study

Evaluation of Potential Park-and-Ride Facilities, Supporting Bus Service and Amenities Final Report

Prepared for
Alameda County Transportation Commission
In partnership with LAVTA, Cites of Dublin, Livermore and Pleasanton

By

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April 12, 2017

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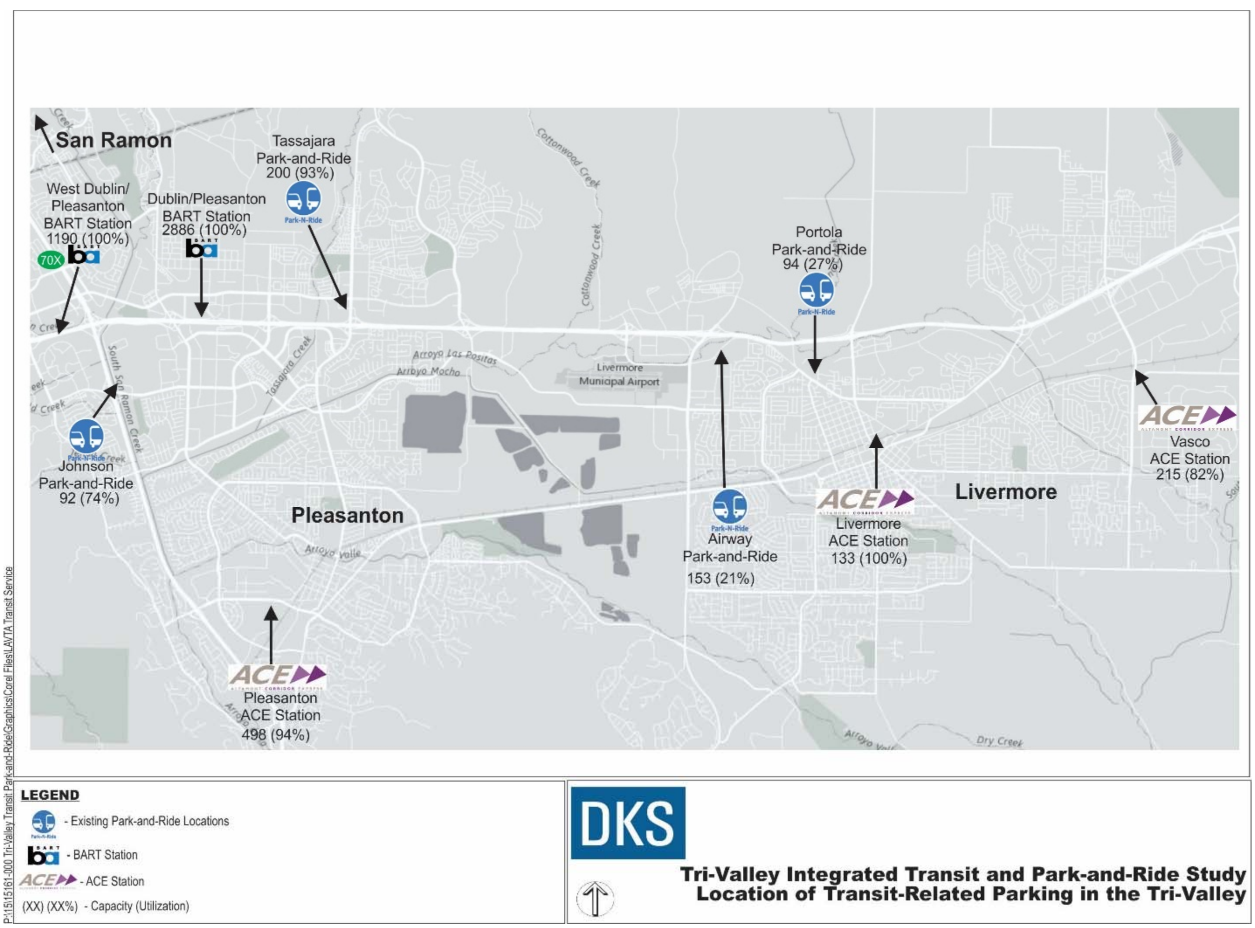
1 INTRODUCTION

The Tri-Valley Integrated Transit and Park-and-Ride Study was initiated to address the high levels of congestion on the Alameda County portion of the Tri-Valley area's freeways (I-680 and I-580) and major arterials, excessive parking demand for BART parking lots, and an increasing orientation of commute trips from the Tri-Valley to Silicon Valley, the Peninsula and San Francisco. The stated goal of the study is "to identify potential changes and improvements in park-and-ride facilities (including multi-modal access to the facilities) and LAVTA service so as to reduce single-occupancy vehicle trips and vehicle miles traveled and to facilitate creating a coordinated, efficient, and sustainable transportation system in Alameda County's portion of the Tri-Valley area."

To address the goal of the study, the study team completed an analysis of the existing park-and-ride facilities and transit services in the study area (Task 2). The team has also developed a report outlining the current and anticipated future travel patterns and modes of travel (Task 3), which included survey results from Tri-Valley commuters. The survey respondents provided information on travel modes they used, park-and-ride usage, and the types of improvements to facilities and transit service that would make them more convenient and attractive. The study team supplemented these survey results by interviewing BART, MTC and LAVTA staff to understand potential transportation system changes in the Tri-Valley that may influence transit and park-and-ride facilities usage. Figure 1 presents the location of Tri-Valley transit-related facilities in Alameda County, which include satellite lots and BART and ACE parking lots.

Figure 1: Location of Transit-Related Parking in the Tri-Valley



With an understanding of current and future travel patterns, the study team developed a methodology used in Task 4 to:

1. identify the existing and future needs for park-and-ride facilities and transit services
2. identify and evaluate various improvement options
3. develop recommendations for improving transportation options that increase transit ridership, reduce single-occupancy vehicle (SOV) travel and reduce vehicle miles traveled (VMT)

This report presents the Task 4 methodology including potential improvement options for meeting the objectives of the study by:

1. facilitating the effective use of carpooling and vanpooling from satellite park-and-ride lots,
2. increasing BART and/or ACE ridership through on-site parking-management measures without increasing the number of parking spaces
3. increasing the on-site parking at BART and/or ACE stations
4. increasing capacity of existing park-and-ride lots or increasing the number of satellite park-and-ride lots by identifying new locations
5. implementing shuttle service between park-and-ride lots and BART and/or ACE stations

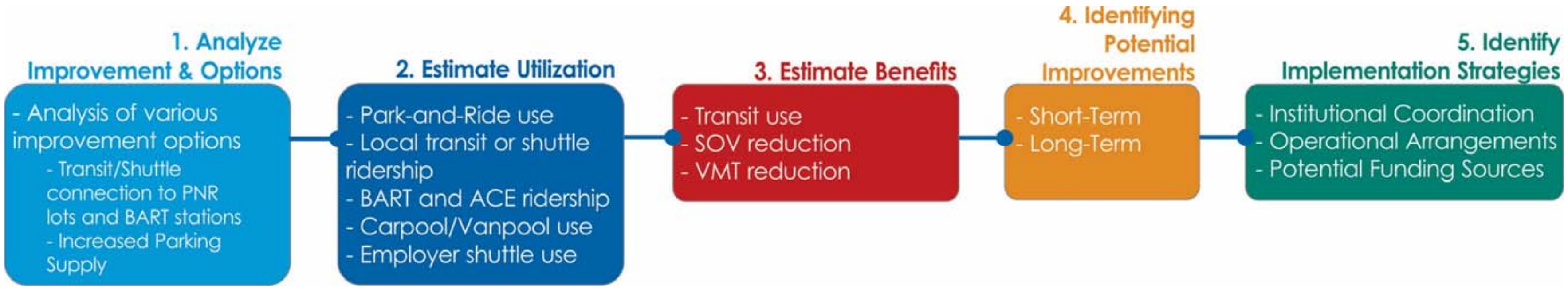
These options were further developed or grouped into sample test packages of improvements for evaluation in terms of use/ridership, cost and feasibility. These test packages were not designed to be recommendations, but were instead used to gain insight about which improvement options will have the most benefit at which location and in what time frame.

The Task 4 methodology was then used to evaluate each test package of improvements and reports the evaluation results for the following measures:

- the estimated use of park-and-ride facilities
- the estimated transit ridership including BART, ACE and LAVTA ridership; BART shuttle use and private employer shuttle use
- the estimated benefits in terms of transit use, SOV use, and VMT reduction
- the estimated implementation costs
- the estimated cost effectiveness

The overall process for evaluating the test packages is illustrated in Figure 2. Based on the evaluation results, the study team developed a set of suggested improvements for consideration as next steps for phased implementation. These suggested improvements were also evaluated using the performance measures identified above. The final tasks in the study will be developing an implementation strategy (Task 5) and producing a final report (Task 6).

Figure 2: Overview of the process for evaluating the potential improvement packages



2 DEVELOPMENT OF POTENTIAL IMPROVEMENT OPTIONS AND IMPROVEMENT TEST PACKAGES

Potential improvement options were developed based on the results of the Existing Conditions Assessment (Task 2) and the outcome of the Travel Behavior and Market Analysis (Task 3), as well as local knowledge, case studies, and peer comparisons with other regions and previous projects. The improvement options are grouped as "test packages" for the purposes of evaluation.

2.1 Improvement Options Identified from Needs Analysis and Market Research

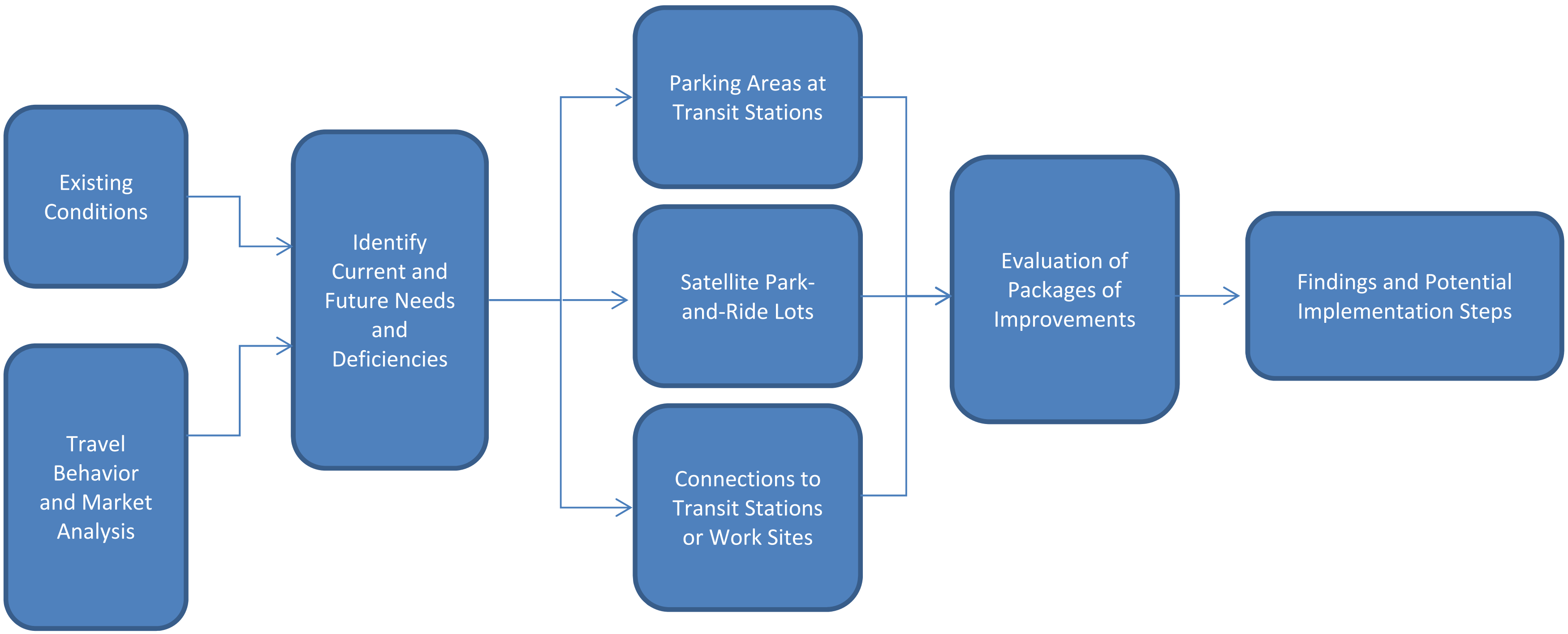
The overall process for developing the improvement options is illustrated in Figure 3. The study team began the process by assembling information on the existing park-and-ride facilities and transit services. The Existing Conditions Assessment was the primary source of information for this step. In addition, the Travel Behavior and Market Analysis was used to provide an understanding of the existing and future travel patterns in the Tri-Valley and the characteristics of travelers and their trips. The Travel Behavior and Market Analysis included information from the Alameda Countywide Travel Model and an online survey of commuters in the Tri-Valley area.

The study team then identified the current and future needs and deficiencies for the Tri-Valley. The primary sources of information for this step were assessments of the existing conditions, current and future travel markets, and the corridor commuter survey, but other sources of information for this step also included:

- Discussions with local and regional transportation agencies
- Discussions with major employers in the region that provide private shuttles
- Project Technical Advisory Committee (TAC) member input
- Review of case studies and peer comparisons from other regions and previous similar projects

The Existing Conditions Assessment indicated a higher demand for BART parking in the Tri-Valley than can currently be accommodated. This included oversubscribed parking areas at BART stations, parking on local streets in the neighborhoods in Dublin around the BART stations, and informal carpooling near Grant Line Road on the Alameda County side of the Altamont Pass. There is also a high level of demand for private employer shuttles from the Tri-Valley to employment sites in the Silicon Valley, the Peninsula and San Francisco. The Travel Behavior and Market Analysis and the travel forecast from the Countywide Travel Demand Model indicated that travel demand is expected to grow in the Tri-Valley area and the Bay Area as a whole through the study planning horizon year of 2030. The current transportation needs and deficiencies in the study area would likely intensify in the future without improvements to transportation facilities and transit service.

Figure 3: Overview of the Process for Developing the Potential Improvement Options



The next step of the process was to generate a list of potential improvements. These potential improvements were based on the current and future needs and deficiencies in the study area identified in the previous steps. The improvements generally fell into the following five categories of ways to meet the objectives of the study – increase transit ridership, reduce SOV use and reduce VMT:

Category 1: Facilitate the effective use of carpooling and vanpooling from satellite park-and-ride lots

- Provide additional lighting and security at satellite park-and-ride lots
- Provide additional marketing to promote carpooling and vanpooling
- Provide assistance to employers to encourage employees to carpool or vanpool

Category 2: Increase BART and/or ACE ridership through other on-site measures without increasing the number of parking spaces.

- Provide more bicycle parking at BART and/or ACE stations
- Institute higher pricing at over-subscribed BART and/or ACE stations in combination with providing an incentive or discount for carpool vehicles
- Provide more convenient passenger drop-off and pick-up locations with increased waiting capacity at BART and/or ACE stations
- Develop Smart Mobility Hubs at BART or ACE Stations that incorporate options such as bikesharing, carsharing, shared-use and/or demand-responsive services for last-mile connections
- Implement valet service at BART (or possibly ACE) parking facilities allowing for tandem parking or closer spacing

Category 3: Increase BART and/or ACE ridership by increasing the on-site parking at BART and/or ACE stations

- Add more auto parking spaces at the Dublin/Pleasanton BART station
- Expand the auto parking at the Vasco Road and Pleasanton ACE stations

Category 4: Increase BART, ACE and/or Wheels ridership by increasing the number of satellite park-and-ride spaces at existing or new facilities and increasing the utilization of existing or new facilities.

- Add more auto parking spaces at existing satellite park-and-ride lots
- Build new satellite park-and-ride lots
- Add more bicycle parking at existing and/or new satellite park-and-ride lots
- Provide more signage directing travelers to satellite park-and-ride lots
- Provide additional lighting and security at satellite park-and-ride lots
- Implement Intelligent Transportation System (ITS) elements to provide real-time travel information via freeway signs, text messages, websites and/or mobile apps. Examples include:
    - Monitor parking space availability at all park-and-ride lots and provide information to commuters about where spaces are available
    - Provide information to commuters about when Wheels routes, shuttle services or express bus services are leaving the satellite park-and-ride lots and the BART and ACE stations

  - Expand Clipper card use and other similar better fare collection technologies
- Increase frequency on Wheels routes linking satellite park-and-ride lots with BART or ACE stations
- Provide convenient shuttle service between satellite park-and-ride lots and BART and/or ACE coordinated with BART and/or ACE train times

Category 5: Facilitate the effective use of private employer buses from satellite park-and-ride lots or other pick up locations to employment sites throughout the Bay Area.

- Develop arrangements for commuters to use existing or new satellite park-and-ride spaces to access private employer shuttles
- Provide additional lighting and security at satellite park-and-ride lots
- Ensure adequate space for private employer buses to enter lots, board or alight passengers, turn around and depart

2.2 Test Packages Evaluated

From the five categories defined above, a series of test packages of improvements was put together and evaluated. These test packages consisted of improvement options for which the effectiveness could be measured using the available analytical tools. Options that are more qualitative in nature but cannot be analyzed using the analytical tools have not been included explicitly in the packages, but assumed to be included as a baseline future improvements. Further, these test packages were not meant to be recommendations nor alternatives, but were designed to inform the study team about which improvements were likely to be effective and which would not. The first two categories of potential improvements are ones that can be handled through how facilities are managed or through additional marketing. These two were not analyzed quantitatively, but recommendations are being developed. The test packages drew from Categories #3, #4 and #5. All of the improvement packages consider ITS technology, marketing, improvements to lighting, security systems, wayfinding and bike parking at satellite park-and-ride facilities and their annualized costs in the evaluation, however, the effects of these services and amenities on utilization of the lots was not estimated. The modeling system used in the analysis assumes that these amenities and services are available and the potential users have knowledge of which lots have spaces available and which have connections to BART. The cost of the full package of amenities and services is included in the analysis of cost and cost effectiveness for each facility. The test packages that include shuttle services from satellite lots to a BART station might also include pricing strategies that discourage the use of the lots by carpoolers, vanpoolers or users of private employer shuttles to ensure that there is adequate capacity for the BART shuttle users. This is covered in a separate memorandum on "Parking Management and Pricing" developed for the Implementation Strategy. Table 1 summarizes the improvements included in the packages evaluated. The packages could be summarized as follows:

1. Test Package 1 was used to test the concept of the free high-frequency shuttles operating directly from each of the four existing satellite park-and-ride lots to the closest BART station. The concept was tested because of the success of a shuttle service between the Hercules Transit Center and the El Cerrito del Norte BART station described in Attachment A.
2. Test Package 2 was used to test the effect of adding a new parking garage at the Dublin/Pleasanton BART station, but without the shuttle service from the satellite lots. The new BART garage was tested because of the excess demand for BART parking and because there have been plans to build a new garage on an existing parking lot.

3. Test Package 3 was used to test the combination of free shuttle service from the four existing satellite lots to BART and a new BART garage together (Test Packages 1 + 2) to see if there is adequate parking demand for both improvements.
4. Test Package 4 for was used to test the effect of expanding the overall capacity of satellite parking by adding two new lots with free shuttle service from them to BART to Package 3. This combination of improvements was tested to see if there would be enough demand over the next fifteen years to justify additional park-and-ride facilities served by shuttles to BART.
5. Test Package 5 was used to test the effect of charging for the shuttle service from the satellite lots evaluated in Test Package 4.

The test packages were used to give the project team information about how effective a variety of improvements might be in the various park-and-ride locations and in different combinations. The results from Test Package 5, in comparison to Test Package 4, were used to evaluate how sensitive the shuttle service at each of the park-and-ride locations was to a daily charge. The analysis of the test packages was not intended to be a complete analysis of how the set of improvements would work. It is possible that any parking vacancy resulting from charges for the parking or the shuttle could be used by commuters catching private employer shuttles. This will be considered for the "Potential Next Steps" described in Section 5 as part of the Implementation Strategy. Based on a survey of private employers currently providing shuttle service, the study team expects the demand to grow from the current observed level by about 5 percent per year.

The "baseline" identified in Table 1 was developed to reflect the 2015 existing conditions at the beginning of the study, but modified to reflect new bus routes and services implemented by LAVTA in August of 2016. This baseline was used for comparison to the improvement packages' model results. More details about the packages are provided later in this section.

Table 1: Summary of Test Packages Evaluated

Improvement	Baseline	Test Package 1	Test Package 2	Test Package 3	Test Package 4	Test Package 5
Local transit service from existing satellite park-and-ride facilities[1]	Yes	Yes	Yes	Yes	Yes	Yes
Shuttle service to BART from existing satellite park-and-ride facilities	No	Yes	No	Yes	Yes	Yes
Improvements to lighting, security systems, wayfinding and bike parking at satellite park-and-ride facilities	No	Yes	Yes	Yes	Yes	Yes
Parking expansion at Dublin/Pleasanton BART	No	No	Yes	Yes	Yes	Yes
Additional satellite park-and-ride facilities with shuttle BART	No	No	No	No	Yes	Yes
Parking fee for satellite park-and-ride facilities	No	No	No	No	No	Yes

[1]Note: LAVTA service was provided to the Johnson and Airway park-and-ride lots, but starting in August 2016, LAVTA served Johnson and Portola park-and-ride lots and cancelled the service to Airway.

As noted in the Table 1 footnote, all of the test packages analyzed included the changes to LAVTA service that were effective in August 2016, as shown on Figure 4. The major route changes that impacted the use of the satellite park-and-ride locations were:

- Routes 12 and 12X, which previously served the Airway Park-and-Ride with service to BART, were eliminated
- Rapid service was rerouted to serve east Livermore, Livermore Transit Center/ACE, Portola Park-and-Ride, Las Positas College, Dublin/Pleasanton BART and West Dublin/Pleasanton BART
- A new express service, Route 580X, was added between Livermore Transit Center/ACE and Dublin/Pleasanton BART

As indicated in Figure 4, BART is currently studying a potential extension to Livermore in the I-580 corridor east of the current Dublin/Pleasanton BART station. A draft environmental impact report is being finalized at the time of the technical analysis for this study. Because the Alameda Countywide Model is based on the assumptions of the adopted 2013 Plan Bay Area, the BART extension project was not included in the transportation improvement assumptions. However, the improvements identified by the study would not adversely impact the BART-to-Livermore project, but would support establishing its ridership.

Figure 4: LAVTA Wheels Service Implemented in August 2016

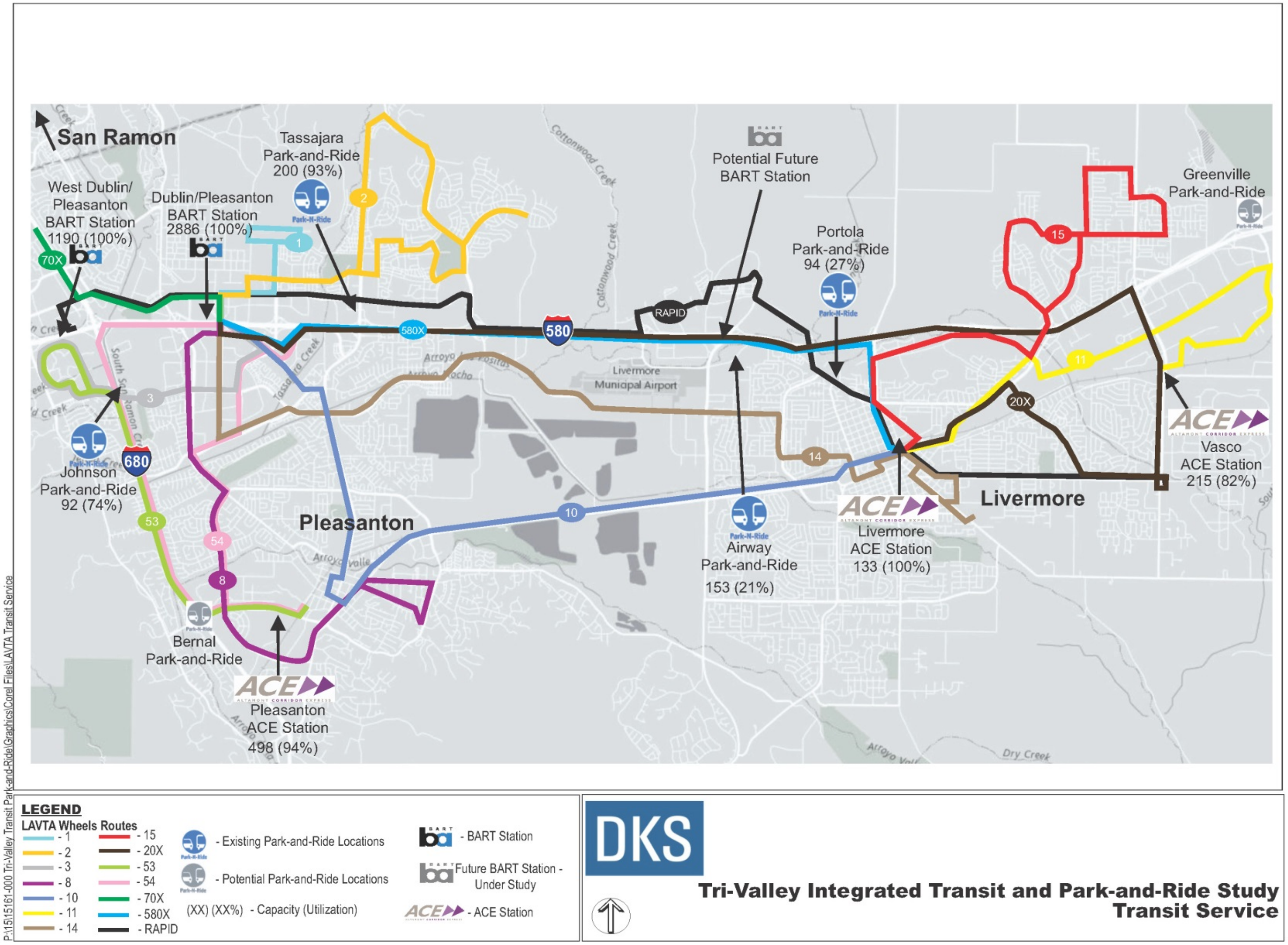


Table 2 summarizes the current parking capacity and usage at the BART stations, ACE stations and satellite park-and-ride lots. The Existing Conditions Assessment provided 2015 observed usage (vehicle occupancy and transit parking) at station parking and existing park-and-ride facilities. The observed transit parking refers to the number of vehicles using the parking area to access transit (LAVTA, BART or ACE). This value excludes vehicles using the lot for other purposes, such as accessing private employer shuttles and parking for carpools and vanpools. Only the "transit-oriented" parkers are included in the modeling analysis because the Alameda Countywide Travel Model captured only automobile trips to Tri-Valley park-and-ride facilities to access transit. Commuters who used a park-and-ride facility for carpooling, vanpooling or private employer shuttle are not captured by the model.

Table 2: Existing Satellite Park-and-Ride (PnR) and BART/ACE Station Parking Locations and Usage

Location	Parking Capacity	Observed 2015 Vehicle Occupancy	Observed 2015 Carpool, Vanpool or Private Employer Parking	Observed 2015 Public Transit Parking	Observed Percent Occupied	Observed Percent Occupied – Transit Only
Tassajara PnR lot (Dublin)	200	186	186	0	93%	0%
Johnson/Stoneridge PnR lot (Pleasanton)	92	68	32	36	74%	39%
Airway PnR lot (Livermore)	153	32	16	16	21%	10%
Portola PnR lot (Livermore)	94	25	25	0	27%	0%
Dublin/Pleasanton BART	2,886	2,886	0	2,886	100%	100%
West Dublin/ Pleasanton BART	1,190	1,190	0	1,190	100%	100%
Livermore Transit Center/ACE Parking	133	133*	52*	128**	100%*	96%
Pleasanton ACE	498	466	29	437	94%	88%
Vasco Road ACE lots	215	176	20	156	82%	73%

Note: *The observed occupancy of the Livermore Transit Center/ACE Parking is greater than the capacity because the City of Livermore designates the top floor of the garage (133 spaces) for ACE or other transit users. When the parking occupancy counts were taken, there were 180 vehicles parked in the garage at 8:00 AM including all of the floors, which were assumed to be park-and-ride users associated with riding the ACE trains to San Jose prior to 8 A.M..

**Public transit usage of 128 parkers was determined from the survey of users of the parking facilities in the Existing Conditions Survey. This was 71% of the 180 parkers observed, but 96% of the 133 spaces allocated for transit users

The Existing Conditions Assessment in Table 2 showed that:

- The parking areas for the Dublin/Pleasanton and West Dublin/Pleasanton BART stations were fully utilized and are assumed to be used exclusively for accessing BART.
- The ACE parking areas were mainly used to access ACE service, with some other uses of the lots observed in the Existing Conditions analysis.

- As shown in the table, about 10 percent (52 of 539 spaces) of the existing satellite park-and-ride facilities were used for accessing public transit.
- An estimated 215 of the 539 spaces at the satellite park-and-ride lots (about 40 percent) were currently used for accessing private employer shuttles. There was also use of the Alameda County Fairgrounds parking and parking at several churches for accessing private employer shuttles.

None of the satellite lots currently reach their parking capacity, and the Airway and Portola park-and-ride lots show minimal use. According to the Existing Conditions Assessment, the Tassajara park-and-ride lot is used almost exclusively for accessing private shuttles. The Johnson park-and-ride lot is the only satellite facility with a significant portion of users accessing public transit (39%), and it is also the only satellite park-and-ride facility that has a significant number of users accessing carpools or vanpools (33%) as indicated in the Existing Conditions survey. The former use could be attributed to LAVTA service from the Johnson lot to BART and Pleasanton ACE station observed at the time of the Existing Conditions survey. Outside of established parking facilities, the study team also learned that there was some informal park-and-ride happening at the western end of Grant Line Road and on neighborhood streets near the Dublin BART stations that are not shown in Table 2.

The following sections describe the improvements that were evaluated as part of the five test packages. The evaluation methodology is described in Section 3 of this report and the results are described Section 4.

2.2.1 Test Package 1 - Shuttle Service from Existing Satellite Park-and-Ride Lots to BART

This test package was developed to evaluate the effect of direct, high-frequency shuttle service between the four existing satellite park-and-ride facilities and BART stations. The shuttles would operate every 15 minutes during the peak commute periods (6:00 to 10:00 AM and 3:00 to 7:00 PM) to coordinate with the BART train schedules. Table 3 shows the locations of the existing park-and-ride locations and the shuttle connections that were evaluated. The route lengths, travel time and bus requirements were derived from a Remix model (a web-based transit planning platform that automates the calculations for estimating time and resource requirements of new transit routes) and these outputs were reviewed by LAVTA staff for reasonableness. Details of this analysis are presented in Attachment B.

Table 3: Existing Park-and-Ride Locations with Shuttle Service

Location	Shuttle Connection Evaluated	Estimated Travel Time to BART	Buses Required
Tassajara (Dublin)	Dublin/Pleasanton	4 minutes	1
Johnson/Stoneridge (Pleasanton)	West Dublin/Pleasanton	3.5 minutes	1
Airway (Livermore)	Dublin/Pleasanton	16 minutes	3
Portola (Livermore)	Dublin/Pleasanton	11 minutes	3

This test package would directly link the satellite park-and-ride lots to BART stations and serve as supplemental parking for BART. The existing lots would have improvements made as necessary to enhance lighting, security systems, wayfinding and bike parking. The implementation of shuttle service would include a marketing and outreach campaign to make transit users aware of the new service. Use of the lots would be free of charge.

2.2.2 Test Package 2 - Parking Expansion at Dublin/Pleasanton BART Station Only

This test package, drawing from Category #3, would add 550 parking spaces at the Dublin/Pleasanton BART station. Based on information from BART and the City of Dublin, an existing surface parking lot with approximately 100 spaces would be replaced with a 650-stall parking structure. This would increase the parking capacity at the station to 3,436 spaces. The capacity of the West Dublin/Pleasanton station was assumed to remain at 1,190 spaces, for a grand total of 4,696 parking spaces at the two BART stations. For the purposes of evaluation, it was assumed that the existing parking policies and payment systems would remain, with a parking fee of $3 per day. The existing satellite park-and-ride lots would remain with their current use and without shuttle service in this test package.

2.2.3 Test Package 3 - Shuttle Service from Existing Park-and-Ride Lots and BART Parking Expansion

This test package would combine Test Packages 1 and 2: the four existing satellite park-and-ride locations would have shuttle service to BART and parking at the Dublin/Pleasanton BART would be expanded by 550 spaces. This test package was developed to understand the level of demand for BART parking with a new BART parking garage with connecting shuttle services from the existing satellite park-and-ride lots.

2.2.4 Test Package 4 - New Park-and-Ride Lots with Shuttle Service, Shuttle Service from Existing Park-and-Ride Lots, and BART Parking Expansion

In this test package, two new satellite park-and-ride locations would be added: Bernal Avenue at I-680, with a capacity of 170 parking spaces, and Greenville Road at I-580, with a capacity of up to 950 spaces. These locations were chosen because they are already owned by participating agencies (Bernal by the City of Pleasanton and Greenville by BART) and have previously been identified by those agencies as potential park-and-ride locations. The two lots would also be near freeway interchanges with easy access by commuters traveling toward the Tri-Valley BART stations. In this test package, each of the two new lots would have dedicated shuttle service to a BART station. The four existing satellite park-and-ride locations would have shuttle service to BART and parking at the Dublin/Pleasanton BART would be expanded by 550 spaces. A map showing the potential shuttle connections to BART are shown in Figure 5. The shuttles would operate every 15 minutes during the peak commute periods to coordinate with the BART train schedules. Table 4 shows the location of the new park-and-ride locations and the shuttle services that were evaluated in Test Package 4. The analysis for the Greenville lot was based on the assumption that the shuttle service would be to the Dublin/Pleasanton BART station. If and when BART is extended to Isabel Avenue or any location east of the existing Dublin/Pleasanton Station in the long-term, the shuttle service from the Greenville lot and the Portola lot would be serving the new station instead. Further, the Airway lot is expected to stop functioning as a park-and-ride lot as it would be converted to parking for the new station.

Figure 5: Existing and New Park-and-Ride Locations and Shuttle Service Evaluated

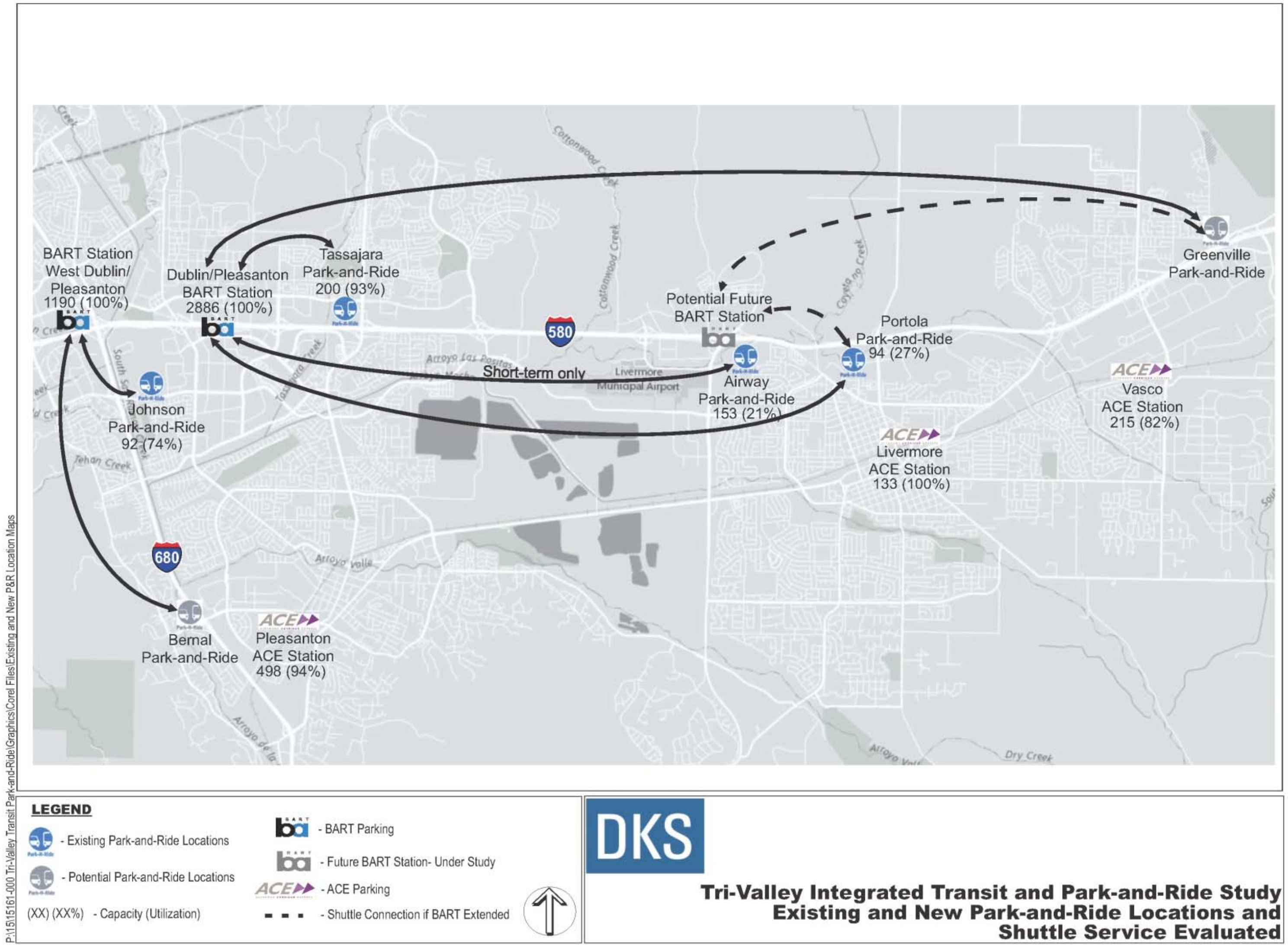


Table 4: Additional Satellite Park-and-Ride Locations Analyzed with Shuttle Service

Location	Parking Capacity	Shuttle Connection Evaluated	Estimated Travel Time to BART	Buses Required
Bernal and I-680 (Pleasanton)	170	West Dublin/Pleasanton	7.5 minutes	2
Greenville and I-580 (Alameda County)	Up to 950	Dublin/Pleasanton	20 minutes	4

2.2.5 Test Package 5 - Parking Pricing at Existing and New Park-and-Ride Locations with Shuttle Service and BART Parking Expansion

Test Package 5 was developed to test the effect of user charges on use of the satellite lots and shuttle services to BART. This test package added a parking fee ($3 per day) to all satellite lots to offset the costs of the shuttle service. The test package includes shuttle service to BART from the six satellite park-and-ride locations (two new and four existing). Parking at the Dublin/Pleasanton BART station would also be expanded by 550 spaces and the existing parking charge of $3 per day at the other Tri-Valley BART locations was assumed.

2.2.6 Supplemental Elements for Test Packages – Parking Provision for Private Employer Shuttle Riders, Carpooling and Vanpooling

As a supplement to each of the above test packages, provision of parking spaces for private employer shuttles and for carpooling and vanpooling was also evaluated. This supplement would expand parking spaces at select satellite lots to accommodate the expected growth of employer shuttle riders, carpooling and vanpooling. The study team estimated roughly 430 spaces used by private shuttle riders (assumed to be twice the 215 vehicles observed at the existing satellite park-and-ride lots – see Section 3.3.5) and 30 spaces for carpooling and vanpooling in the baseline condition. Depending on the parking demand generated by the other test package with which this supplemental element is combined, the additional demand may be accommodated with existing spaces or new capacity may have to be added.

3 EVALUATION METHODOLOGY

This section presents the modeling tool and process for evaluating the improvement packages (See Figure 1). To quantify park-and-ride utilization, the study team integrated the Alameda Countywide Travel Model with a Park-and-Ride Choice Module developed by DKS previously. The study team then used the integrated model to estimate the near-term (2015) and future (2030) use of park-and-ride facilities, local transit ridership, BART and ACE ridership, carpool and vanpool use and employer shuttle use for each improvement package. Using these utilization estimates, the study team estimated the packages' potential benefits including increased transit use, decreased SOV use, and reduced per capita VMT. The data sources to be used for the evaluation of test packages are discussed in the following sections.

As mentioned above, one of the main tools for quantifying park-and-ride utilization is the Alameda Countywide Travel Model supplemented by the DKS Park-and-Ride Choice Module. The following section describes the capabilities of the integrated model.

3.1 Alameda Countywide Travel Model and the Park-and-Ride Choice Module

The study team developed a park-and-ride lot choice module previously that addressed the effect of capacity constraints on park-and-ride usage. The park-and-ride choice module supplements the peak period mode choice step in the Countywide Model as part of the procedure for predicting the choice of transit as primary mode of a trip. The module applies only to travelers that would use BART parking, ACE parking or a park-and-ride lot to access transit. Through an iterative process, the module transit-related parking facilities that have sufficient demand will fill up during the daily peak period and no additional trips will be assigned to those parking facilities. This may be the use of a lot or garage immediately adjacent to a BART or ACE station for accessing BART or ACE, or the use of a satellite lot that offers (1) bus service to a BART or ACE station or (2) a publicly provided bus service to a final destination. The park-and-ride choice module does not model the use of park-and-ride lots for people who carpool, vanpool or use a private employer shuttle bus to an employment site.

The park-and-ride choice module begins with basic inputs for each mode, such as travel time, access time and cost, determines the resulting peak-period mode choice, and then iterates until an equilibrium condition is reached with no park-and-ride lot usage exceeding its capacity. Trip generation, distribution, non-peak mode choice, and assignment procedures from the Countywide Model remain unchanged. A technical description of the module and the process for calibrating the module can be found in Attachment A.

Once the park-and-ride choice module was sufficiently calibrated as shown in Attachment C, it was used to test the effect of improvement options. Because the Countywide Model contains projections of future population, employment, land use and travel demand for various horizon years, the park-and-ride choice module was used to estimate current (2015) and the future (2030) effects of the improvement packages in terms of change in transit ridership and utilization of the park-and-ride facilities. The study team used the utilization results to determine which combination of park-and-ride facilities and/or shuttle services would have the greatest potential benefit to improve mobility by transit in the study area in the near-term and future conditions.

3.1.1 Limitations of the Alameda Countywide Travel Model and the Park-and-Ride Choice Module

The Alameda Countywide Travel Model and the Park-and-Ride Choice Module (the model system) provide a powerful tool for the evaluation of certain improvement options designed to increase the use of park-and-ride facilities for transit-oriented trips. The model system explicitly considers the relative time and cost associated with using various park-and-ride facilities for access to transit and limits the use of these facilitates to their actual capacity. But the model system also has limitations that should be noted in considering the results of the analyses based on the model. The model system is limited to modeling only the trips that begin by automobile but access transit systems represented in the model to complete the trips. As a result, the model system does not predict carpooling or vanpooling from the park-and-ride lots or the use of private employer shuttles.

In addition, the model system's capability to predict use of individual parking facilities may be limited especially when it can assign travelers through numerous park-and-ride facilities along key commute corridors to access transit. As a result, the prediction of specific parking lots choice with the I-580 or the I-680 corridor may be difficult. For this report, the results are reported in terms of corridor demand, which is more reasonable, and not for individual lots.

Finally, the park-and-ride module constrains the potential utilization of the study area's facilities; whereas the unadjusted Alameda CTC's regional travel demand model does not have supply constraints for these parking facilities. As a result, the ridership projections developed using the unconstrained or unadjusted models would not account for users shifting modes due to the lack of parking availability. Since these models are also on a countywide or regional level, the estimates should indicate general trends and not precise utilization levels.

As previously indicated, BART is currently studying a potential extension to Livermore in the I-580 corridor east of the current Dublin/Pleasanton BART station. A draft environmental impact report is being finalized at the time of the technical analysis for this study. Because a final decision had not been made on the BART extension to Livermore at the time of this study, and since the Alameda Countywide Model is based on the assumptions of the adopted 2013 Plan Bay Area, the BART extension project was not included in the transportation improvement assumptions for this study.

3.2 Evaluation Measures

As previously stated, the goal of this study is "to identify potential changes and improvements needed for park-and-ride facilities (including multi-modal access to the facilities) and LAVTA service so as to reduce single-occupancy vehicle trips and vehicle miles traveled and to facilitate creating a coordinated, efficient, and sustainable transportation system in Alameda County's portion of the Tri-Valley area." Therefore, for a simple and direct measurement, the same metrics that are included in the objective were identified as performance measures to evaluate improvement packages:

- the increase in transit ridership;
- the reduction in single-occupancy vehicle (SOV) travel; and
- the reduction in vehicle miles traveled (VMT).

3.3 Estimation of Park-and-Ride Use and Mode Shift

The first step of the evaluation was to estimate the use of the satellite park-and-ride lots, transit services and other transportation modes for each improvement package. As mentioned above, the Alameda Countywide Travel Model/Park-and-Ride Module was the primary data source for estimating the use of satellite park-and-ride lots. From this, the change in transit ridership (including local transit, shuttle services, BART and ACE) was estimated. The study team also estimated the use of carpools, vanpools and private shuttles using information from employers and regional transportation agencies. Different estimates were developed for the future forecast years, but the estimates did not vary by package. The following subsections describe how the evaluation estimated the use of satellite park-and-ride lots, transit services and other transportation modes.

3.3.1 Park-and-Ride Use

The study team used the Alameda Countywide Travel Model/Park-and-Ride Module to estimate park-and-ride use to access BART stations through local transit connection. Dedicated high-frequency shuttle service during peak commute hours (6:00 to 10:00 AM and 3:00 to 7:00 PM) was considered for the connection between the satellite park-and-ride lots and BART stations. Since almost no riders were observed using the LAVTA service between the existing satellite park-and-ride lots and BART stations during the existing condition survey, for the improvement package analysis purposes, no LAVTA service was assumed for this connection. Lack of use of LAVTA service by the park-and-ride lot users to get to BART may likely be due to the low frequency of service, longer travel time, lack of coordination with the BART schedule, or in the case of the Tassajara lots, due to the lack of available parking that was already used by commuters that catch private employer shuttles.

Further, the assumed dedicated and direct high-frequency shuttles are similar to the high-frequency (every 15 minutes in the commute period) shuttles that currently connect the El Cerrito del Norte BART station with Hercules Transit Center park-and-ride lot. As described in Attachment A, these shuttles have been successful in connecting 150 to 200 travelers daily from these lots to the El Cerrito del Norte BART station. In addition, the model still reflected the LAVTA routes launched in August 2016 that could transport travelers from two existing lots (Portola and Johnson) to the BART stations, albeit with a longer travel time.

The study team did not evaluate additional transit connections to the ACE stations because the existing conditions survey observed that the existing Tri-Valley ACE station parking was not filling to capacity. Hence, the study team assumed that additional ACE riders would likely park at existing station parking, rather than use satellite park-and-ride lots and shuttles to access the stations.

As discussed below, use of the satellite park-and-ride lots for carpooling and vanpooling was estimated using information from MTC on expected growth in rideshare options and usage in the context of the Tri-Valley facilities. Use of the satellite lots for private employer shuttles was based on information provided by MTC and the managers of private employer shuttles about their need for more park-and-ride space and the locations most desirable for new service.

3.3.2 Local Transit and BART Shuttle Ridership

The study team estimated the change in local transit (LAVTA) ridership using the Alameda Countywide Travel Model/Park-and-Ride Module. This included ridership changes due to introduction of high-frequency shuttles between the existing and potential new satellite park-and-ride lots and the two Tri-Valley BART stations. The model was also used to estimate the ridership on the shuttles to BART that were tested.

3.3.3 BART and ACE Ridership

The study team estimated changes in BART and ACE ridership using the Alameda Countywide Travel Model/Park-and-Ride Module's estimates of park-and-ride/direct shuttle usage to BART. The private employer shuttles were not assumed to divert riders from BART or ACE because they serve very different destinations.

3.3.4 Carpooling and Vanpooling Use

Use of the satellite park-and-ride lots for carpooling and vanpooling was estimated using information provided by MTC on expected growth in these modes. Conversations with MTC staff indicated. It was found that there was not much activity to support expansion of carpooling or vanpooling in the region and significant increases in the commute share for these modes was not expected. The Environmental Impact Report (EIR) for MTC's Plan Bay Area, adopted in 2013, suggested that the share of daily trips by carpool or vanpool would decrease slightly between 2010 and 2040, but the total number of person trips by carpool or vanpool would increase by about 17 percent (0.5 percent per year) because of an almost 25 percent increase in total daily travel. For the purposes of this project, the number of carpool or vanpool trips using the satellite park-and-ride lots is assumed to increase by the average annual regional growth expected for carpooling and vanpooling: 0.5 percent per year.

3.3.5 Private Employer Shuttle Use

Use of the satellite lots for private employer shuttles was based on a survey of existing park-and-ride lots in the Tri-Valley, information provided by MTC, local jurisdictions and employers regarding private employer shuttles. The existing conditions survey identified approximately 215 parking spaces being used in the four satellite lots included in the survey, mainly at the Tassajara and Johnson park-and-ride lots. The Alameda County Fairgrounds has been extensively used by the commuters using private shuttles, and because of the demand for parking, private shuttles have begun using other private lots (i.e. Church parking, etc.) by special arrangement with those property owners. Because there is no full accounting of the total number of parking spaces currently being used for accessing private employer shuttles, given the magnitude of parking use observed at the Fairgrounds and information about the private lots, the study assumed the same amount of parking (215 spaces) to access private shuttles at these locations as with the four park-and-ride lots. Therefore, the study assumed a baseline level of total 430 spaces in the Tri-Valley was used by private shuttle riders.

The employers also indicated their need for more park-and-ride space and identified the locations most desirable for new service. Based on the interviews and surveys of the private shuttle operators (conducted as a related effort of this study), the study team assumed an average annual growth rate in the demand for private employer shuttle parking of 5 percent per year. This would produce an increase in space demand of about 119 spaces by 2020.

3.3.6 ITS Elements, Traveler Information and Marketing

The study team's assessment is that a reasonable package of ITS investment and on-going traveler information and marketing elements is necessary to attract commuters for parking at and to increase the usage of park-and-ride lots, and also this level of amenities is fast becoming the industry baseline standard for the park-and-ride lots. All of the improvement packages consider ITS and marketing and their annualized costs in the evaluation, but the benefits were not directly estimated for comparison purposes at this stage.

The ITS elements will include technologies for real-time monitoring and reporting of parking-space availability and transit-vehicle location to inform potential commuters about their park-and-ride/transit options. Information on parking-space availability will be gathered either with video detection on in-space detection equipment. Information on the location and next arrival time for BART trains, ACE trains, LAVTA buses, BART shuttles and private shuttle will be gathered by in-vehicle GPS-based vehicle location systems and will be used to provide "next-bus" or "next-train" information to commuters along with the information about parking availability. The information will be provided to commuters by a combination of internet or smart-phone apps and changeable message signs on the freeways and at the parking locations. The information communicated my also include information on drive times the nearest BART station and a comparison between drive time and the time for a park-and-ride/shuttle option for getting to BART.

ITS technologies will also be used to collect charges from commuters for use of the park-and-ride lots and/or the shuttle services connecting the lots to BART if charges are instituted. This may take the form of payment kiosks at the park-and-ride lots with capability for live monitoring of transactions, or it may be designed for by prepayment only via web or smart-phone apps linked to a specific vehicle license number and monitoring of payment by automated license plate reading equipment. If charges are instituted, information about the charges and the methods of payment will also be communicated to commuters by internet and smart phone apps along with the information on parking transit service availability.

Other applications of ITS technologies will be used to provide information for real-time curb-space management at BART and ACE stations for drop-offs and shuttle services and video-based security systems at the park-and-ride lots. Both of these applications will require communication systems that provide information about on-site activity to facility managers monitoring the activity. The facility managers will then have the capability to remotely provide information to commuters and shuttle operators in the case of the curb-space management or to the police in the case of parking lot security.

3.4 Estimation of Benefits Using Evaluation Measures

After the use of the park-and-ride lots, transit services and other transportation modes were estimated; the study team calculated the benefits of each improvement package using the identified performance measures as discussed in section 3.3 before.

The primary tool for this analysis was the Alameda Countywide Travel Model/Park-and-Ride Module, but information from employers, regional transportation agencies and other technical studies was also used to estimate the changes in travel behavior.

3.4.1 Change in Transit Use – BART, ACE, BART shuttle, LAVTA and Private Employer Shuttle Use

The study team calculated the change in Tri-Valley transit primarily by estimating the change in all forms of public transit (BART, ACE, BART shuttle, LAVTA) for each package. The change in Tri-Valley public transit boardings were derived from the Alameda Countywide Model. Only the changes in boardings by automobile access were included. This captured driving directly to BART and ACE stations, park-and-ride lots with access to BART stations as well as drop off/kiss-n-ride access. Other methods of accessing BART, including bus access, walk and bike access were not included in estimating where the predicted new trips came from.

Additionally, the study team also estimated the use of the private employer shuttles that directly serve employment sites outside of the Tri-Valley. The increase in private employer shuttle ridership was calculated from:

- the current estimates of the number of vehicles accessing private shuttles in the Tri-Valley (from the Existing Conditions Inventory),
- the estimated growth in private shuttle use (as detailed in Section 3.3.5),
- the average occupancy of vehicles parking to use the private shuttles, and
- the travel modes that shuttle riders would have used before using a private shuttle (see next section).

The evaluation has assumed that each parked car accessing private shuttles has 1.14 passengers, which is the average occupancy in the Alameda Countywide Travel Model/Park-and-Ride Module.

The park-and-ride lots with shuttles to BART or private shuttles will almost certainly generate some passengers that are dropped off at the lot or who walk or bicycle to the lot to catch the shuttles. These additional trips have not been captured in the estimation of new transit riders. The Park-and-Ride Choice module and the Alameda Countywide Travel Model only assign people who are "driving to transit" to use park-and-ride lots.

3.4.2 Change in SOV Trips

To estimate the change in Tri-Valley SOV use, the study team first used the estimate of new transit riders from the park-and-ride facilities as described in the previous section. Later, where or which mode the new trips would have been shifted from was estimated. Table 5.B presents those assumptions with description of the assumptions below. The study team assumed that new trips would be drawn from the other motorized modes proportionally to their shares as the primary mode for Tri-Valley commute trips; this is because these mode share breakdowns are the most reliable source available of existing Tri-Valley commute trips and are assumed to reflect the mode choice decision-making in the area. Table 5A shows the 2015 mode share of all commute trips originating in the Tri-Valley, and Table 5B illustrates how the analysis assumed of prior commute mode for the three BART station or park and ride user types.

Table 5A: Mode Share of Tri-Valley Commute Trips -2015

Commute Mode	Existing Tri-Valley Commute Shares
Drive Alone	**77%**
Shared Ride	**11%**
Walk to Transit	**2%**
Auto to Transit*	**8%**
Bike or Walk	**2%**
TOTAL	**100%**

*Auto to Transit includes either driving directly to BART or to LAVTA to get to BART.

Source: Alameda Countywide Travel Model and DKS 2015

Table 5B: Analysis Assumptions of Prior Commute Mode of Parkers by User Type

Prior Commute Mode	User Type		
	BART Station Parkers and/or Park and Ride Parkers who Take Shuttles to BART [1]	Private Shuttle [2]	Carpool/Vanpool [3]
Drive Alone	70%	79%	89%
Shared Ride	10%	11%	
Walk to Transit		2%	2%
Auto to Transit	20%	8%	9%
Bike or Walk			
TOTAL	**100%**	**100%**	**100%**

[1] Based on a comparison of the 2015 Calibration (no-project) model run results with the Potential Next Step #1 results. It indicated that 20% of trips drawn to the shuttle came from trips that previously took LAVTA to BART. This same percentage was used for new trips attracted to the shuttle to BART in all scenarios tested. This can be considered a conservative estimate for

most of the scenarios tested as the maximum percentage that would be drawn from LAVTA services. Further, a comparison of the 2015 no-project with Test Package 1 (shuttle service to BART from all of the satellite lots) showed a 16.2% shift from LAVTA services.

The other two modes (drive alone and shared ride) were determined by dividing the remaining 80% proportionally based on the existing Tri-Valley commute shares (shown as 77% and 11% in Table 5A, respectively).

[2] Based on the assumption that private shuttle riders would previously have used all modes, except for bike or walk. The study team took the existing mode share (shown in Table 5A) and normalized it for the four remaining previous modes (Drive alone, shared ride, walk to transit, and auto-to-transit).

[3] Based on the assumption that new carpoolers and vanpoolers would previously have used all modes, except for shared ride, or biking or walking. The study team took the existing mode share (shown in Table 5A) and normalized it for the three remaining previous modes (Drive alone, walk to transit, and auto to transit).

The analysis also considered the existing trips that shuttles to BART or trips bound directly to new BART station parking would replace. Trips were not assumed to be drawn from walk or bike trips in the 2015 baseline model because of their shorter trip length. The park-and-ride trips bound for BART via the shuttle from satellite park-and-ride lots or trips bound directly to the BART station parking were assumed to draw from the other modes and the percentages were as follows (based on information from the Alameda Countywide Travel Model):

- 70% from drive alone to final destination
- 10% from shared ride to final destination
- 20% from automobile to transit (Drive to LAVTA to BART)

This assumption was applied for all of the test packages and for the potential improvements in section 5.

Private Employer Shuttle

For the park-and-ride trips using a private employer shuttle to directly access their employment site, the trips were assumed to be drawn from all of the driving and transit modes. Based on information from Tri-Valley commute trips of all modes (transit and other motorized) in the Alameda Countywide Travel Model, the percentages were as follows:

- 79% from drive alone to final destination
- 11% from shared ride to final destination
- 10% from walk to transit or bike to transit

The Alameda Countywide Model does not capture the potential use of the private employer shuttles to Silicon Valley and the Peninsula because these services are not coded into the model and the model was not calibrated for their use. The project team believes that commute trips drawn to the private employer shuttles will draw from existing transit users somewhat however, because some of the work destinations are served by a combination of BART or ACE and a local transit operator in the destination city. This probably represents a conservative estimate for evaluating mode shift in the short term, but in the longer term, BART will serve more of the Silicon Valley with the extension to San Jose and the connection to VTA services.

This assumption was applied for the supplemental test package and potential improvements in section 5 for steps 1, 2, 3, 4, and 5.

Carpooling and Vanpooling

For the park-and-ride trips using carpooling or vanpooling directly to their employment site, the trips were assumed to be drawn from the modes other than shared ride or walk or bike trips. Based on information from the Alameda Countywide Travel Model, the modal splits of non-shared ride commute trips were as follows:

- 89% from Drive Alone
- 11% from walk to transit or bike to transit

This assumption was applied for the supplemental test package and potential improvements in section 5 for steps 1, 2, 3, 4, and 5.

3.4.3 Change in Regional VMT

The change in regional VMT was calculated for the region as it appropriately captures the travel pattern from the tri-valley. It was based on using the estimates of SOV trip reductions along with an estimate of the average commute trip length for the main mode used after parking at the park-and ride lot or directly at the BART parking garage.

New trips from the park-and-ride lots to BART using the shuttle service or directly to the BART parking garage used the average length of BART trips originating in the Tri-Valley with destinations outside of the study area. A weighted average distance from the center of the Tri-Valley was estimated by weighting the trip length to each external zone by the estimated number of BART passenger trips to that zone. The weighting used the spatial 2015 distribution of BART trips from the Tri-Valley because the SOV trips reduced would primarily be trips with BART accessible destinations. The average commute distance after parking was 27 miles. The roundtrip of this commute distance (54 miles) was applied to the reduction in weekday estimated SOV for Test Packages 1, 2, and 3 in Table 6 to estimate the reduction in weekday VMT.

For new trips carpool/vanpool trips from the park-and-ride lots, the study team used the average length of commute trips in the 2015 Countywide Travel Model's commute trip table, originating in the Tri-Valley with destinations outside of the study area. A weighted average distance from the center of the Tri-Valley was estimated by weighting the trip length to each external zone by the estimated number of commute trips to that zone. The average commute distance after parking was 23 miles.

For new trips attracted to the private shuttle services serving the satellite park-and-ride lots, the average length of SOV trips eliminated was estimated based on the average distance from the center of the Tri-Valley to the actual locations of the employers currently known to operate shuttle from the Tri-Valley. Most of these are in Silicon Valley, the Peninsula or San Francisco. The average one-way trip length for SOV eliminated by the private employer shuttles was estimated to be 36 miles. The roundtrip of this commute distance (72 miles) was applied to the reduction in weekday estimated SOV for the supplemental package in Table 6 to estimate the reduction in weekday VMT.

Another estimate of VMT change was developed that considered only the change in VMT within the Tri-Valley. For the trips attracted to BART, only the portion the VMT replaced by BART between the BART station and the western edge of Pleasanton was included. For trips associated with a private employer shuttle, only the portion from the park-and-ride lot to the edge of Tri-Valley was included.

3.5 Estimation of Costs

The study team used available unit costs, as applicable, to estimate the average annual cost (in 2015 dollars) for each improvement considered. These include:

- Park-and-ride lot net costs
- Additional BART parking net costs

- Local transit service (high frequent direct shuttles) net costs
- Signage and lighting costs
- Traveler Information/ITS Costs
- Marketing Costs

Given the type of study, this is a high level cost and not meant to be a project development level specific cost. In addition to the capital costs for new parking facilities, it is expected that the improvement measures involving enhancements to fixed infrastructure will incur incremental operating costs each year on the order of 1% to 2% of the capital cost. The exact amounts will vary across the different jurisdictions and agencies, depending on the way in which operations and maintenance are currently being delivered today and extent of similar activities already undertaken by the organization. Project sponsors will need to evaluate their specific costs as part of the implementation of each improvement measure.

The net costs for park-and-ride facilities considered the expected parking fees and the cost to collect the fees. Net costs for local transit or publicly provided shuttle service considered the expected fare and the cost to collect the fares. The net parking and transit service costs are interrelated, for example parking fees could be assumed to cover costs in place of collecting a transit fare for shuttle services between satellite park-and-ride facilities and BART or ACE stations. For the alternatives considered in the study, it was assumed that the LAVTA services would charge the standard fare and that the shuttle services would not charge a fee.

For capital costs, the study team used information from existing databases for similar projects. These data were supplemented with recent experience from other relevant technical studies. The costs for the park-and-ride facilities, local transit service, and signage, lighting, and security systems were included in the comparison of the alternatives packages. A range of costs for ITS and traveler information were also developed but were not used for comparing the packages. Marketing costs will be dependent on the alternatives selected and will be addressed further during the implementation strategy phase (Task 5) of the study.

3.6 Evaluation of Implementation Feasibility

The study team will work with the TAC members to identify and assess the implementation feasibility of each package component. This will be the focus of Task 5 of the project.

4 EVALUATION RESULTS

The study team completed an preliminary analysis of the five packages (with variations) and the supplemental improvements identified and described in Section 2 using the performance measures identified in Section 3. The results of the preliminary evaluation are presented in this section. The detailed modeling results for the test packages are presented in Attachment D. The estimated benefits of the five test packages and the supplemental elements are presented in Section 4.1. The five packages tested were:

Test Package 1 - Implementation of Direct Shuttle Service from Existing Satellite Park-and-Ride Lots and BART
Test Package 2 - Parking Expansion at Dublin/Pleasanton BART Station Only
Test Package 3 - Shuttle Service from Existing Park-and-Ride Lots and BART Parking Expansion
Test Package 4 New Park-and-Ride Lots with Shuttle Service, Shuttle Service from Existing Park-and-Ride Lots, and BART Parking Expansion
Test Package 5 - Parking Pricing at Existing and New Park-And-Ride Locations with Shuttle Service and BART Parking Expansion
Supplemental Elements – Parking Provision for Private Employer Shuttles Riders, Carpooling and Vanpooling

As presented in Attachment C, the park-and-ride choice module was calibrated to the observed use of park-and-ride lots in the Existing Conditions Assessment. The calibrated model results were within an acceptable range. The observed results were then used for comparison with modeled or estimated park-and-ride utilization to measure the changes in park-and-ride use and mode shift produced by each of the packages. This method of estimating the changes in park-and-ride utilization follows the industry standard practice. However, as presented in 3.1.1, the evaluation results or the quantification of the packages needs to be viewed keeping the following limitations of the model system application into consideration:

- The park and ride module constrains the supply of the study area's parking facilities, and thereby the change in parking utilization/ridership could differ from the ridership estimated with a model that has unconstrained parking supply.
- The Alameda CTC model is a regional model with more details within the county and therefore utilization of individual lots or facilities should be understood to be a general trend and not precise utilization levels.
- The model system models only trips that begin by automobile but access transit system to complete the trip; thus, it does not predict carpooling or vanpooling from the park and ride lots or the use of private employer shuttles.

4.1 Benefits of the Improvements

The study team evaluated each test package's potential benefits (summarized in Table 6) assuming implementation in 2020 for Test Packages 1, 2 and 3 and the Supplemental Package. The potential benefits for Test Package 4 and 5 are shown for 2030. The year 2020 was selected for the analysis of Test Packages 1, 2 and 3 because that is the most optimistic implementation time frame for the improvements. Section 3.4 of this memorandum described the method for calculating each of the benefit measures.

The "Change in Weekday AM Parkers" is the difference between the "Model-Estimated Transit Parking" for each test package and the observed use, and includes all transit parking at BART, ACE and satellite park-and-ride lots. This difference was then escalated to 2020 for Test Packages 1, 2 and 3 based on an estimate of growth in demand of 3 percent per year. The estimates for Test Packages 4 and 5 used the

2030 model, which reflects the expected travel demand of commuters in 2030. The growth rate used to escalate Test Packages 1, 2, and 3 was developed by comparing forecasts of total transit-related parking utilization for Test Package 4, which had the highest level of total transit-related parking, run with the 2015 and 2030 models. The change in weekday AM travelers, weekday AM SOV reduction, and weekday AM VMT reduction are based on the change in weekday AM parkers. Transit use is derived from the model as BART boardings via park-and-ride access. The change in transit use is the difference between the calibration model run and the test package model runs.

Table 6: Summary of Benefits for the Test Packages*

Test Package	Change in Weekday AM Parkers [1]	Change in Weekday AM Travelers [2]	Reduction in Weekday AM SOV [3]	Reduction in Weekday VMT [4]	Change in Weekday AM Transit Boardings [5]
Test Package 1 - 2020	373	425	298	16,228	340
Test Package 2 -2020	484	551	386	21,031	441
Test Package 3 -2020	550	627	439	23,912	501
Test Package 4 -2030	2025	2309	1616	88,070	1847
Test Package 5 -2030	1852	2111	1478	80,546	1689
Supplemental - 2020	119	135	106	7,704	122
Supplemental - 2030	464	529	416	30,086	475

* The numbers presented in this table are based on the analysis using the countywide model and the park and ride module system. As a countywide model, the output is expected to indicate general trends in utilization rather than providing precise levels of usage.

[1] 2020 results are 2015 model results escalated by 3 percent as described in section 4.1. The supplemental package result for 2020 is based on a 5 percent annual growth from the existing (2015) number of private shuttle parkers and carpoolers and vanpoolers (430). The supplemental package result for 2030 is based on the 2020 result escalated by an annual growth of 5 percent as described in section 3.3.5

[2] Change in Weekday AM Travelers is the Change in Weekday AM Traveler [1] multiplied by the average number of travelers per vehicle according to the Alameda CTC Travel Model: 1.14

[3] Reduction in Weekday AM SOV is the Change in Weekday AM Travelers [2] multiplied by the percentage of Travelers who have previously used SOV as a primary commute mode (shown in Table 5). Test Packages 1, 2, 3, 4,and 5 include improvements that benefit users who use park and ride and shuttles to BART or drive directly to BART station parking, therefore these packages assume 70% of travelers were previously SOV users (as shown in Table 5). The supplemental package assumes private shuttle rider growth; therefore this package assumes 79% of travelers were previously SOV users (as shown in Table 5). The same shift is assumed for new carpool and vanpool trips from the park and ride lot, but the projected growth for these as almost negligible.

[4] Reduction in Weekday VMT is the Reduction in Weekday AM SOV [4] multiplied by the average commute distance as described in section 3.4.3: 54 miles for Packages 1, 2 ,3, 4, and5 where previous SOV users now use park and ride and shuttles to BART or drive directly to BART; 72 miles for the supplemental package where previous SOV users now mostly ride private shuttles to work, carpool or vanpool.

[5] Change in Weekday AM Transit Boardings is Change in Weekday AM Travelers [2] multiplied by 80%. Based on a comparison of the 2015 Calibration (no-project) model run results with the Potential Next Step #1 model results that indicated that 20% of trips drawn to the shuttle services at the new and existing park and ride lots, or directly to the expanded BART parking garage came from trips that previously took LAVTA to BART. Therefore, it is assumed that the inverse (80%) are new users who previously did not use LAVTA or BART.

4.2 Findings from Evaluation of the Test Packages

The evaluation of the packages has demonstrated that additional transit use/ridership, either public transit or privately provided transit (employer shuttles), can be achieved in the Tri-Valley through improvements to park-and-ride facilities and supporting services and expansion of parking at BART or ACE (allowance for more ACE parking at the Livermore garage). The increase in transit ridership will lead to a reduction in SOV travel and a reduction in VMT. Commute patterns from the Tri-Valley and the San Joaquin Valley to other parts of the Bay Area produces high demand on the available parking for BART, ACE and private employer shuttles carrying trips from the Tri-Valley to employment sites. This high demand is particularly evident in how early in the morning the available BART parking fills on most weekdays, by the long waiting list for reserved parking at BART (3000 at Dublin/Pleasanton and 3,700 at West Dublin/Pleasanton according to BART staff), by the on-street parking for BART in neighborhoods around the stations in Dublin, and by the informal carpooling at locations like the Grant Line Road in the Altamont Pass area.

The high level of demand for commute travel to the booming technology industry jobs in Silicon Valley and the Peninsula, areas not well served by public transportation from the Tri-Valley, is also evident in the growth of employer shuttles serving the Tri-Valley and their initiatives to identify more park-and-ride spaces in the Tri-Valley to support their growing demand. The high level of demand for transit-related parking combined with advances in smart-phone technologies and apps are already making possible a variety of cost-effective improvements in park-and-ride and supporting services that will attract more trips to transit, reduce SOV use and reduce VMT. With the expected growth in demand over the next 15 years, these opportunities will only increase.

Some of the key findings that have emerged from the evaluation of the packages and supplemental elements are the following:

- There is unmet demand for transit service from the Tri-Valley to other parts of the Bay Area especially for transit service with drive access. Information from BART on patrons on waiting list for parking at both West Dublin and Dublin-Pleasanton stations are about 6,700. The packages modeled as in Table 6 indicated that with added parking capacity and supporting shuttle services, an additional 500 - 600 spaces could be used to get commuters to BART or ACE by 2020 and 2000-2100 spaces by 2030.

- Existing satellite park-and-ride lots are successful primarily in accommodating the parking for private employer shuttles. They are not particularly successful in attracting people who then carpool or vanpool to their work. In 2015, BART and ACE passengers were not using the satellite park-and-ride lots to park and use LAVTA bus services to get to the BART or ACE stations.

- Private employers offering shuttle service from the Tri-Valley are very interested in expanding their operation if more dedicated park-and-ride spaces for their use can be made available.

- The results of Test Package 2 demonstrate that additional parking of 550 spaces at the Dublin/Pleasanton BART station would be nearly (please see notes model limitation) or completely filled with current demand.

- Test Package 3 results indicate that some additional BART ridership could be generated by adding dedicated, free, high-frequency, peak-period shuttle service from one or more of the four existing satellite park-and-ride lots to the nearest BART station (beyond what could be generated by adding a garage at the Dublin/Pleasanton BART station), but shuttle service from all four existing lots would not be fully supported by the predicted demand.

- Forecasts of park-and-ride demand in Test Packages 4 and 5 for 2030 indicate the potential for a significant increase in demand that could nearly fully fill all BART and ACE stations, and nearly fill the four existing satellite lots and the potential two new satellite lots if all of the satellite lots have shuttle service available.

- A comparison of the results of Test Package 5 with the results of Test Package 4 indicate that the demand for parking at satellite lots with shuttle service to BART is somewhat sensitive to parking cost. A $3/day charge would reduce demand for the park-and-ride and shuttle service to BART by about 12% to 15%. In the near term, instituting parking charges at the satellite lots that offer shuttle service to BART would not significantly improve the cost effectiveness of providing the parking and the supporting services because the revenue generated would be small in comparison to the incremental annualized cost of the improvements.

5 POTENTIAL NEXT STEPS

Based on the findings from the analysis of test packages, the study team explored the following potential next steps and how they can be implemented in two major phases if they were to be moved forward short-term (2020) and long-term (2030). Additionally, the steps are organized for the evaluation purposes only and their sequence is not indicative of the order of their implementation.

Potential Short-term (2020) Improvements

Step 1 – Initiate high-frequency peak period free shuttle service from the Airway lot to the Dublin/Pleasanton BART station as a pilot test of the service concept. This stage can begin immediately because there are no significant capital costs associated with initiation of the service.

Step 2 – Construct a new satellite lot at Bernal Avenue and make the lot available for carpooling, vanpooling, Wheels access to the Pleasanton ACE station and the West Dublin/Pleasanton BART station and private employer shuttles. The demand for private employer shuttle service from park-and-ride lots is growing rapidly and employers are interested in using more spaces.

Step 3 – Construct a new parking garage at the Dublin/Pleasanton BART station adding 550 spaces to the existing capacity at the station.

Potential Long-term (2030) Improvements

Step 4 – Expand the satellite lot at Airway to 500 spaces as the demand at the Dublin/Pleasanton BART garage and the Airway lot reach capacity. Although the modeling for 2015 does not show sufficient demand in the I-580 corridor to justify the expansion at Airway, the modeling for 2030 does. When the BART extension to Livermore occurs in the long-term, it is anticipated that the expanded Airway lot would be converted to parking for the new station and the shuttle service would no longer be needed. An additional element of the step would be the initiation of high-frequency shuttle service from the Bernal lot to the West Dublin BART station.

Step 5 – Construct a new satellite lot at Greenville Road with a capacity of 500 spaces and provide high-frequency peak period shuttle service to the nearest BART station (Dublin/Pleasanton or a new Livermore station) as the demand approaches the limits of the BART-related capacity in the I-580 corridor.

The short-term and long-term improvement will include ITS technology to support real-time monitoring and reporting of parking-space availability and transit-vehicle location to inform potential commuters about their park-and-ride/transit options as described in section 3.3.6. The improvements will also include marketing, improvements to lighting, security systems, wayfinding and bike parking at satellite park-and-ride facilities. The annualized cost of the full package of amenities and services have been included in the evaluation of next steps. Detailed information on the estimated cost for each step and the source of the unit costs used in the estimation of costs is provided in Attachment F.

Each of these potential steps in the two phases of improvements has been analyzed for how they would affect parking utilization, transit ridership, SOV trip reduction and VMT reduction. Table 7 below describes each of the steps (including the year for which the potential benefits were evaluated), the reasons for their sequence, and the study's estimated cumulative effectiveness and benefits. The benefits for Potential Next Steps 1, 2 and 3 were estimated using the 2015 model, but were escalated to 2020 to reflect the expected benefits at the time of likely initiation. The benefits for Potential Next Steps 4 and 5 were estimated directly using the 2030 model. Detailed model results from this analysis are present in

Attachment E. The addition of the satellite lot at Bernal Avenue in Step 2 would most likely be used for private employer shuttles and that cannot be captured in the model system. The benefits generated by Step 2 were estimated by assuming that the demand for private employer shuttle parking would grow from the use observed in 2015 (roughly 430 spaces used) by about 5% per year between 2015 and 2020 when the Bernal lot is likely to be completed. This could produce an increase in demand for parking spaces of about 119 by 2020 and 454 by 2030.

The primary benefits from the potential next steps evaluated in terms of daily increase in parkers, increase in AM transit ridership and reduction in AM SOV trip are presented in Figure 6. It can be seen from the figure that while the recommended improvements would begin with fairly modest gains, they would increase to roughly 2180 additional daily parkers, roughly 2040 additional daily morning transit trips, and a reduction of 1780 morning commute trips by driving alone. That would produce a reduction of almost 105,000 vehicle miles of travel per workday or over 26 million vehicle miles of travel per year.

Table 7: Summary of Potential Next Steps and Expected Benefits

Step	Description	Reasons for Step Sequence	Estimated Cumulative Effectiveness/Benefits*
1	By year 2020: Initiate high-frequency peak period shuttle service from the Airway lot to Dublin/Pleasanton BART Station	• Modeling of the sample packages indicates that high frequency peak period shuttle service from a park-and-ride lot in the I-580 corridor could generate additional transit ridership. • Existing 2015 conditions show that of the I-580 corridor park-and-ride lots, Airway has the most available parking spaces and no existing transit service, thereby making it ideal to attract potential new park-and-ride users and increase transit ridership. • The Airway lot can be a suitable pilot for improved park and fide facility and shuttle service to Dublin/Pleasanton BART station. Shuttle service can be implemented in the near-term, since it does not require construction of new facilities.	Benefits in 2020 • Additional daily parking space occupied over 2015 baseline: +150 • Additional daily travelers over 2015 baseline: +171 • Daily reduction in AM SOV tips over 2015 baseline: -120 • Daily reduction in VMT over 2015 baseline: -6521 • Daily increase in AM transit ridership: +137
2	By year 2020: Construct a new satellite lot at Bernal Avenue (200 spaces) and make the lot available for carpooling, vanpooling, LAVTA access to the Pleasanton ACE station and the West Dublin/Pleasanton BART station, and private employer shuttles (2015)	• The study found high existing demand for parking space along the I-680 corridor, particularly at the West Dublin/Pleasanton BART station, Pleasanton ACE station, and the Johnson lot. • The Bernal lot could potentially be geared toward commuters accessing employer shuttles, carpools, and vanpools, thereby alleviating those demands at other Tri-Valley park-and-ride lots. • Construction of a satellite lot would potentially be near- to mid-term, since it requires design and potential environmental analysis.	Benefits in 2020 • Additional daily parking space occupied over 2015 baseline: +269 • Additional daily travelers over 2015 baseline: +306 • Daily reduction in AM SOV over 2015 baseline: -226 • Daily reduction in VMT over 2015 baseline: -14,226 • Daily increase in AM transit ridership: +258

Table 7: Summary of Potential Next Steps and Expected Benefits (Continued)

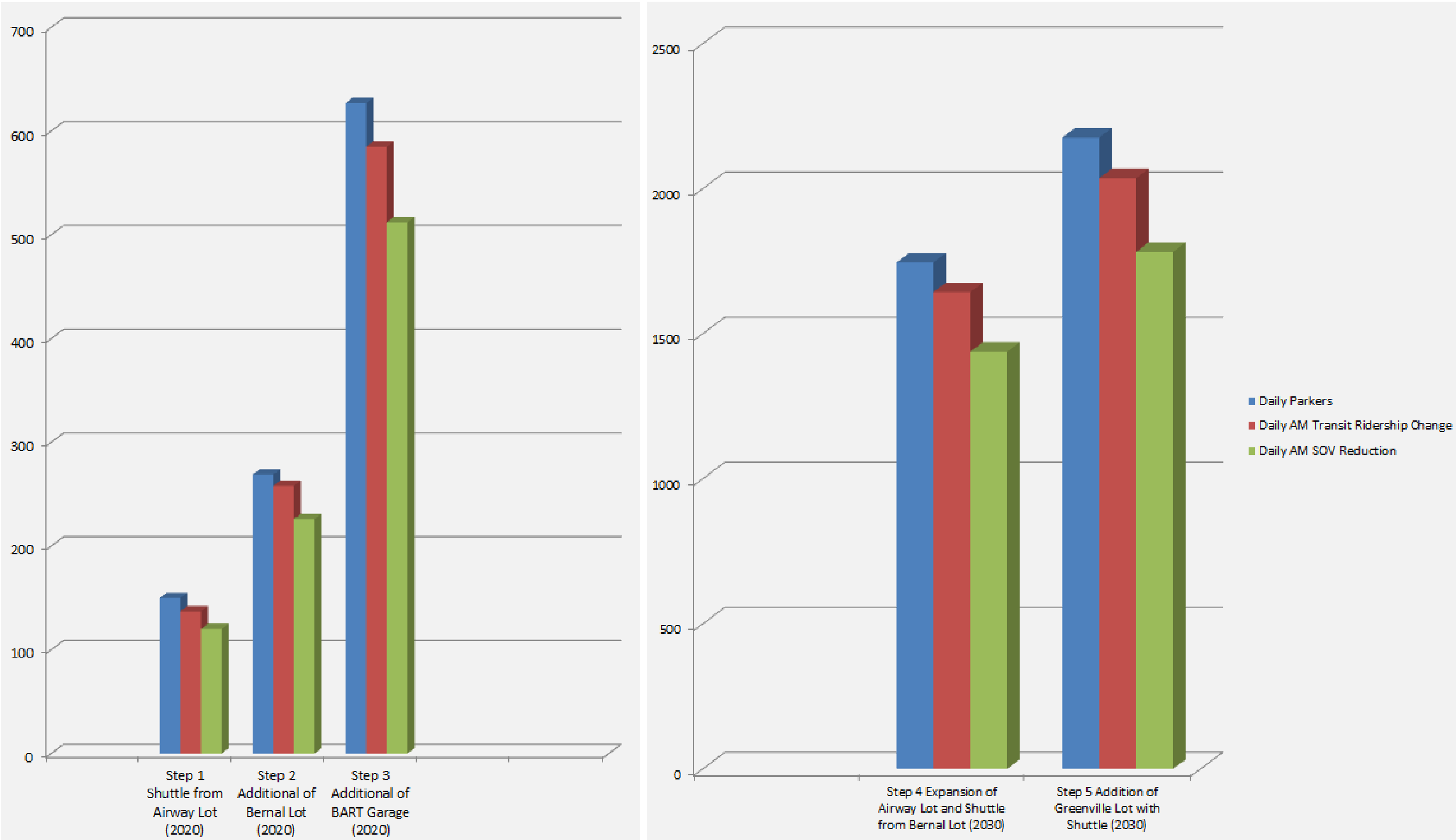
Step	Description	Reasons for Step Sequence	Estimated Cumulative Effectiveness/Benefits*
3	Year 2020: Construct a new parking garage at the Dublin/ Pleasanton BART station adding 550 spaces to the existing station capacity	• The package 2 model results show that even under existing demand itself, the expanded BART parking garage would be close to or filled to capacity and there is already a waiting list for reserved BART parking of roughly 6700 commuters. • Construction of a parking garage would potentially be near-to mid-term, since it requires design and potential environmental analysis.	Benefits in 2020 • Additional daily parking space occupied over 2015 observed: +627 • Additional daily travelers over 2015 observed: +715 • Daily reduction in AM SOV trips over 2015 observed: -512 • Daily reduction in VMT over 2015 observed: -29,796 • Daily increase in AM transit ridership: +585
4	By year 2030: Expand the satellite lot at Airway to 500 spaces and addition of peak period high frequency shuttle to Bernal park-and-ride lot	• The study found that there will be an increase in demand, in 2030, along the I-580 corridor for additional spaces at park-and-ride lots. • Since, there would be existing shuttle service and improved facility at Airway lot by 2030, further expanding this lot and its shuttle service would be appropriate. • The study estimated that providing high-frequency shuttle service to I-680 park-and-ride lots in 2030 would result in demand at the lots filling capacity. • Expansion of the Airway satellite lot and the additional Bernal park-and-ride lot shuttle could be implemented in the mid to long-term.	Benefits in 2030 • Additional daily parking space occupied over 2015 observed: +1745 • Additional daily travelers over 2015 observed: +1989 • Daily reduction in AM SOV trips over 2015 observed: -1438 • Daily reduction in VMT over 2015 observed: -85,799 • Daily increase in AM transit ridership: +1643
5	Year 2030: Construct a new satellite lot at Greenville Road with a capacity of 500 spaces and provide shuttle	• The study found that there will be an increase demand, in 2030, along the I-580 corridor for an additional lot at Greenville road. • While part of the increase in demand is captured by the expanded Airway lot (step 4), the Greenville lot can service travelers coming over the Altamont Pass.	Benefits in 2030 • Additional daily parking space occupied over 2015 observed: +2176 • Additional daily travelers over 2015 observed: +2481 • Daily reduction in AM SOV trips over 2015 observed: -1782 • Daily reduction in VMT over 2015 observed: -104,543 • Daily increase in AM transit ridership: +2036

Note:

- As noted in Table 6, the countywide model output indicates general trends in utilization rather than estimating precise levels of usage. The park-and-ride module constrains the supply of the study area's parking facilities, and thereby the change in parking utilization/ridership could differ from the ridership estimated with a model that has unconstrained parking supply.

- For each step, estimated cumulative effectiveness/benefits include effectiveness/benefits from the preceding step(s).
- Per Pleasanton staff, the capacity expansion of Bernal park-and-ride may be limited to only 100 spaces.
- “Daily parking spaces occupied” refers to all transit-related parking in the Tri-Valley Study – BART, ACE and satellite park-and-ride lots.
- “Daily travelers” refers to the number of people using the transit-related parking.
- “AM transit riders” refers to the number of people parking and using a transit mode, public or private, during the AM commute.

Figure 6: Summary of Benefits from the Potential Next Steps



Note:

- As noted in Table 6, the countywide model output indicates general trends in utilization rather than estimating precise levels of usage.
- VMT reduction is not reported in Figure 6 but is generally proportional to the "Daily AM SOV Reduction"

Attachment A:
Case Study of Hercules Transit Center

MEMORANDUM

DATE: October 17, 2016

TO: Saravana Suthanthira, Alameda CTC

FROM: Bill Loudon, DKS Associates P#15161-000

Robert Vance, DKS Associates

SUBJECT: Hercules Transit Center– A Park-and-Ride lot with connection to BART

Summary

The Hercules Transit Center is a park-and-ride and intermodal facility located on Willow Avenue near the Highway 4 and Highway 80 interchange. The facility has 12 bus bays, 422 parking spaces and 12 electronic bike lockers. An aerial photo of the transit center is shown in Figure 1. This memo provides an overview the existing bus service at the transit center and the payment system and how it serves the El Cerrito Del Norte BART station..

Hercules Transit Center Bus Service

The Hercules Transit Center is currently served by WestCAT (westcat.org) Routes 10, 11, 12, 15, 19, JX, JPX, JR, JL, 30Z, C3, and LYNX. The JX, JPX, JR and JL provide service to the El Cerrito del Norte BART station. JX is the fastest route, taking 16 minutes for a one-way trip running express on I-80. JPX takes 6 minutes longer than JX because it diverts to serve Pinole just after leaving the Transit Center and before entering I-80. The JR and JL provide less direct service to BART but have service on Saturday and Sunday.

To facilitate intermodal transfers, the BART departure times from El Cerrito to both Fremont and San Francisco are shown on the WestCAT timetable. Because of the running time differential between the routes, the JX generally makes better connections to and from BART to San Francisco, but this can vary depending on the trip. Ridership data from WestCAT indicate that the JX carries about 300 to 400 passengers per day (representing about 150 to 200 commuters).

Route JX makes 27 southbound and 28 northbound trips each weekday; headways are about 15 minutes during the peak, with no service in the middle of the day. Route JPX makes 36 southbound and 33 northbound trips each weekday; headways are about 15 minutes during the peak and approximately hourly in the middle of the day.

BART pays WestCAT a subsidy for operating routes JX and JPX but, according to WestCAT, it only partially covers the cost of operating the route. Moreover, WestCAT does not credit these two routes with this revenue but rather absorbs it into its total operating budget.

Payment Systems for Park-and-Ride and Bus Service

Users of the Hercules park-and-ride facility typically purchase parking permits by phone or through the BART permit system website (www.herculestransitcenter.com), display the permit in their car and then take connecting transit with a roundtrip voucher included in the parking fee. There is no permit vending on-site, although there is a free area for first time users who have not pre-registered. The following tables show the current rates for parking permits and WestCAT transit service.

Table 1. Hercules Transit Center Parking Permits

Permit Type	Cost	Bus Access
Monthly – Parking Only	$63/month	No bus pass
Monthly – With Bus Pass	$80/month	Parking plus monthly WestCAT pass
Daily-online reservation	$3/day	Round trip on WestCAT to El Cerrito Del Norte BART
Daily-pay by phone	$3/day	No bus pass

Source: http://herculestransitcenter.com/

Table 2. WestCAT

Fare Type	Cost	Bus Access
WestCAT monthly bus pass	$40/month	No bus pass
WestCAT round-trip to BART	$3.50	Parking plus monthly WestCAT pass
Lynx Roundtrip to SF	$10	Parking is $3 extra

Source: http://www.westcat.org/fares/

Applicability to the Tri-Valley Park-and-Ride Study

The model presented by Routes JX and JPX connecting the Hercules park-and-ride facility and the El Cerrito Del-Norte BART station could be applicable to the Tri-Valley, provided a large enough parking facility is served. The more cars parked there, the greater the number of bus patrons and the more frequent the bus service needed. In addition, being located at a transit center is an advantage, since riders on the routes serving BART could connect from other bus routes, further adding to the demand for frequent bus service. Patrons have the ability to simplify payments by combining parking with a transit pass. Direct service was an important attribute mentioned in the on-line survey of prospective park-and-ride/bus users. In the Hercules example, the JX operates express between the park-and-ride and BART, with JPX having just one diversion.

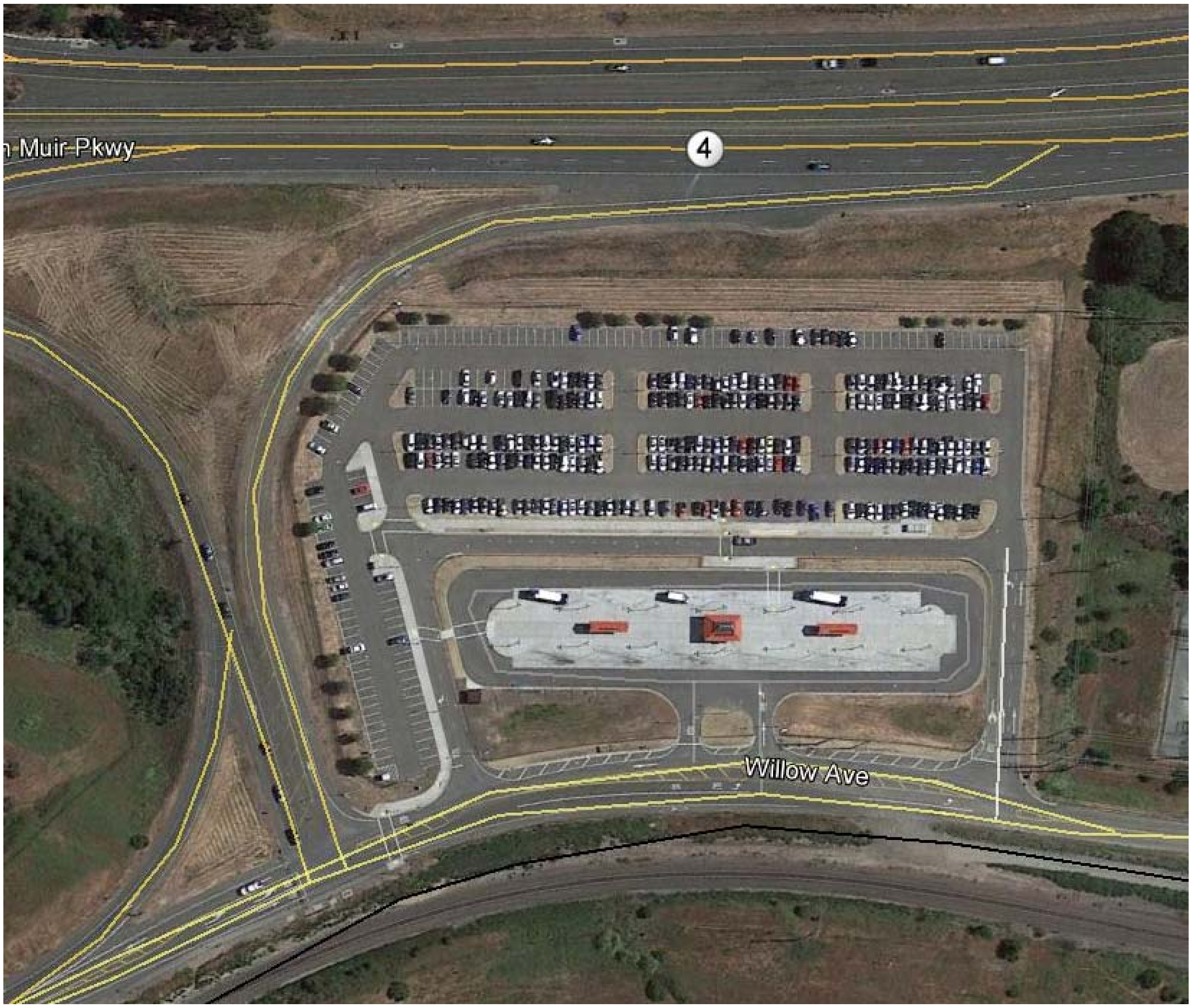


Figure 1. Aerial photo of the Hercules Transit Center

Attachment B
Analysis of Park-and-Ride/Transit Service Strategies

Tri-Valley Integrated Transit and Park-and-Ride Study

Alternative Park and Ride/Transit Analysis of Potential Shuttle Services

(prepared by CDM Smith)

November 28, 2016

Background

To help address growing traffic congestion in the Tri-Valley area, the Alameda CTC commissioned the Tri-Valley Integrated Transit and Park-and-Ride Study. The study is aimed at exploring ways of attracting more motorists to alternative forms of transportation. Presently, based on existing conditions analysis and on-line surveys, there is a demonstrated willingness on the part of many drivers to make such a modal shift. Parking facilities at the study area's two BART stations and at many of its ACE stations fill up quickly, preventing more drivers from using these modes. Additionally, private shuttles have proliferated in recent years to take residents from the Tri-Valley's park-and-ride lots to employment locations as far away as Santa Clara County.

Task 4 of the Tri-Valley study concentrates on identifying strategies developing recommendations for improving use of satellite park-and-ride facilities and connecting bus services. Satellite park-and–ride facilities are those that do not directly serve a BART or ACE station. Task 4 builds on the assessment of existing conditions completed in Task 2 and an analysis of travel behavior and the travel market in Task 3. This memorandum examines the options for improving the connections from satellite lots to BART and provides an estimate of service requirements, vehicle requirements and costs of those options.

Planning Assumptions

Understandably, motorists in the Tri-Valley area prefer to park at one of the BART stations and to be transported from there directly or close to their destinations. Parking at a satellite lot and waiting for a bus to take them to a BART station has not been popular. The latter requires an additional change of mode and an increase in overall travel time. There is currently no direct or frequent bus connection to BART. Depending on the circumstances, it could also cost a motorist more in terms of out-of-pocket expense. For these reasons, satellite lots in the Tri-Valley area have not been successful in attracting many BART users.

An Internet poll conducted by the study team of prospective park-and-ride users showed a strong preference for direct shuttles between a park-and-ride lot and a rail transit station. In this regard, an inventory of parking facilities conducted in Task 2 revealed that existing connecting bus services are generally infrequent and circuitous. To improve usage of satellite park-and-ride lots, such shuttles will be critical and should have the following attributes:

- They should travel on the most direct route between the park-and-ride facility and the transit station, as opposed to meandering to serve other destinations along the route.
- Schedules should be coordinated with the connecting rail service (in this case, BART or ACE).
- If priced, pricing should be competitive, so that the cost of parking at the satellite lot plus the cost of taking the bus do not exceed the cost of parking directly at the rail station.

Guidelines for several elements of shuttles are useful in developing a shuttle bus system to connect the Tri-Valley's satellite park-and-ride lots with its BART stations. These elements include bus route schedule, bus headways, parking facility capacity and, most importantly, their locations:

Bus Route Schedule Design

BART departures are every 15 minutes at the two Tri-Valley stations (Dublin/Pleasanton and West Dublin/Pleasanton). Missed connections at either of these stations would likely frustrate passengers who just missed a train. Moreover, those with too tight a connection would have to buy a ticket (if they are not regular commuters), dash through a fare gate, and negotiate stairs or an escalator to reach the platform in time. For these reasons, bus schedules to either rail station should allow a passenger to arrive with sufficient time to pay a fare if necessary, but not so much time that they're waiting too long on the station platform. A rough rule of thumb, consistent with the above assumptions, would be for a bus to arrive from 3 to 6 minutes in advance of a BART train. Bus departures from the rail station in the afternoon could be timed within 3 minutes of a train's arrival, assuming that passengers do not need to purchase fare to exit.

Another factor in service design is reliability. Passengers should feel confident about when they'll arrive at their destination. However, the congestion on Tri-Valley freeways and the difficulty that buses would have weaving into and out of HOV lanes result in delays and inconsistencies in bus arrival times. It may therefore be advantageous in some situations to consider alternative arterial-street routings equipped with transit signal priority (TSP) for the park-and-ride buses. These might prove faster and more reliable overall than parallel but congested freeways.

Bus Headways

To meet the demand of frequent BART schedules, shuttle bus services could operate at the same headway as trains, at least during the peak period. Survey information collected earlier in this study suggests that this period consists of the four hours between 5:00 AM and 9:00 AM and the four hours between 4:00 PM and 8:00 PM. Midday, the bus schedule could be reduced to 30 minutes, hourly, or to no service at all. (In the latter case, a parker desiring to return home before or after the evening peak would have to rely on a guaranteed-ride-home program, if eligible, or take a taxi or ride-hailing service at their own expense.)

Based on the Task 2 existing conditions inventory, parking spaces can still be found at the two BART stations until about 7:45 AM. It may be more economical to begin shuttle bus service from a satellite lot coordinating with at about that time. This suggestion is based on the assumption stated earlier that most motorists prefer to park directly at the BART station. Freeway signs informing drivers when the BART lots are filled, placed next to wayfinding signage to park-and-ride lots, would encourage them to begin using the satellite lots. To ensure that the full peak period is served, the final morning departure should be around 9:15 AM, with final drop-offs at BART between 9:10 AM and 9:30 AM depending on the shuttle route length. In the evenings, the shuttles should need to run the full span of the peak period, with final shuttle departures from BART around 8:00 PM. The service span for each route is shown in the summary table at the end of this memo.

Parking Facility Capacity to Support Shuttle Operating Criteria

To justify 15-minute bus service in the peak period for the BART shuttles, there should be enough passengers to meet the operating criteria of the agency operating the bus. As a reference, LAVTA averaged 13.2 passengers per revenue bus hour on its Wheels bus service in 2015. Its efficiency standard for 2016 is 15 passengers per bus hour. On a theoretical park-and-ride shuttle route with a 15-minute one-way travel time, a bus could make two round trips in an hour. It's likely that passengers would only be carried in the peak direction (i.e., toward the transit center in the morning and away from it in the evening). Thus, 7 or 8 passengers would be needed on each inbound trip to average 15 passengers per bus hour.

How many parking spaces does that equate to? Some passengers will arrive at the park-and-ride lot by sharing a ride with a motorist (between 0-21% at each lot based on our Task 1 intercept surveys), while others will not be occupying a parking space at all because they are dropped off, walk, or use a bicycle (between 0-25% in each lot based on the intercept survey). Conservatively, if it is assumed that *all* bus passengers occupy one parking space each, 15 spaces would be needed in this example to achieve the passenger-per-hour efficiency criterion for one hour. For a four-hour peak period that would allow for the likelihood that BART parking will fill up earlier in the future, 60 spaces would be needed. If several bus routes served a park-and-ride lot, more spaces would be required; 100 spaces would be a reasonable minimum to consider initially for four hours of service, with space for expansion allowed if the service becomes popular or if other routes or private shuttles use the lot.

Potential Park-and-Ride Locations

A number of potential park-and-ride locations were examined in this study to identify the best candidates for an improved satellite lot/shuttle bus system. Three locations (East Airway, Bernal and Greenville) seem to hold the most promise, two of which would be new facilities.

East Airway

One of the three locations would be a renewal of the existing East Airway park-and-ride lot in Livermore. This facility is owned by BART and is close to the I-80/ Isabel interchange. It has 153 parking spaces and four bus bays, with room for expansion, as BART owns some adjacent land. It is also underutilized at present, with an average of only 32 cars per day parking there. It was previously connected to the Dublin/Pleasanton BART and Downtown Livermore ACE stations by Wheels Route 12X, prior to August 2016, which ran every 30 minutes during peak hours (supplemented by the more circuitous and slower

Route 12). Due to recent LAVTA restructuring, Routes 12 and 12X have been removed, leaving the East Airway lot un-served by transit. According to BART station profile data, East Airway is well located near the residential locations of many existing BART riders. It has the potential for increased use with better bus service.

The latter seems to be the key to this facility's success. With the previous LAVTA Route 12x schedule, buses arrived either simultaneously with the departure of BART trains to San Francisco or later. This may have resulted in insufficient time for riders to transfer from the bus to the train, and therefore resulting in wait times of almost 15 minutes for the next train. Moreover, an examination of Wheels time checks at the BART Dublin/Pleasanton station revealed that buses on Routes 12 and 12X often arrived late. This introduces uncertainty about when a passenger can expect to arrive at his or her ultimate destination.

The distance between the East Airway lot and the Dublin/Pleasanton BART station is eight miles, which would take between 15 and 20 minutes to traverse during peak traffic, as the shorter distance prevents the bus from being able to take full advantage of express lanes. The return trip in the off-peak direction would be slightly shorter, resulting in an expected round trip time of approximately 40 minutes including layover time. At least 3 buses would be required to serve 15 minute frequencies on this route during the peak period.

The East Airway lot could be served by Wheels Route 580, an express bus service newly implemented by LAVTA to connect the Livermore ACE station with the Dublin/Pleasanton BART station. Its route from Downtown Livermore to BART would operate on North Livermore and Portola Avenues, stopping en-route to serve the park-and-ride lot at Portola Avenue before proceeding onto I-580. This bus could simply continue onto East Airway drive and serve the park-and-ride lot there before entering I-580 at the Isabel interchange.

The East Airway lot could also be served in combination with the Greenville Road facility with a combined shuttle. The shuttle could depart Greenville Road, travel seven miles to the East Airway lot to pick up additional passengers, and then continue the remaining distance to the Dublin/Pleasanton BART station. Because of the additional stop, the shuttle would not be able to fully utilize the express lanes, resulting in a significantly longer travel time than the Greenville Road route without a stop at Airway, even though the stop only adds a short additional distance. The shuttle would require at least 30 minutes for a one-way trip with a stop at East Airway, but the return trip would not require this stop, and thus would only take 20 minutes. This is a total round trip travel time of at least 60 minutes including layover, likely requiring 5 buses to serve 15 minute frequencies.

The East Airway lot represents the best option for a pilot test of the "shuttle to BART" concept because the lot already exists. The lot is also close to interchange on I-580 and there is significant capacity to expand the lot if the concept is successful. The lot is also owned by BART and the lots purpose would primarily to serve BART trips.

Bernal Avenue

Another location would be designed to capture motorists traveling along the I-680 corridor to the West Dublin/Pleasanton BART station. This lot would be a new facility, utilizing undeveloped land at the I-680/Bernal Avenue interchange. This site has been identified by the City of Pleasanton for a potential park-and-ride lot facility

Shuttle service between the park-and-ride lot and the station, via I-680 and stopping at the bus bay in the Stoneridge Mall parking lot for BART pickups and drop-offs, could make a round trip in approximately 15 minutes. On a short route such as this one, a shorter layover time can be utilized, allowing bus service as frequently as every 20 minutes with a single bus. To meet the BART frequencies every 15 minutes, two buses would be required.

Greenville Road

The third candidate would be a new park-and-ride lot located at Altamont Pass Road and Laughlin Road, in the vicinity of the I-80 Greenville Road interchange in Livermore. This location was purchased by BART several years ago. A lot here could intercept drivers traveling from the Central Valley to the BART stations and, ultimately, to San Francisco and East Bay employment centers. ACE would not be a very important destination for users of a Greenville Road lot, at least in the short term, as there are still vacant spaces at the ACE stations nearby at Vasco Road and in Downtown Livermore.

The distance from this park-and-ride lot to the Dublin/Pleasanton BART station is 13 miles, which would take about 15 minutes to traverse by bus off-peak and up to twice that time during the peak period, which is consistent with the travels times used in the transit analysis. Given the need for layovers at one or both ends of the route, the round trip running time of a bus in peak hours would be in the range of 30 to 60 minutes. Therefore, at least 4 buses would be required to maintain 15-minute headways during the peaks.

Other Park-and-Ride Locations

Shuttle services to other existing park-and-ride locations were also considered and evaluated. Service at these stations could be added to improve the reach of the shuttle system without developing new park-and-ride facilities. These alternatives were not studied in as great a detail as the above potential locations because these locations were either already near capacity or do not have easy connections to the freeway. Some of the route characteristics have been generalized, primarily the service span, which has been assumed to be two hours in the each of the morning and evening peak periods, or four hours per day. While the 15-minute headway was tested for each of these routes, the routes were also assumed to sufficiently serve the stations with five to seven trips per peak period, possibly at a higher headway to allow more flexibility in meeting
BART trains.

Johnson/Stoneridge

The Johnson/Stoneridge park-and-ride serves traffic travelling along I-680, and is a short distance away from the Dublin/Pleasanton BART station. Because of the short distance, the route could potentially be served by a single bus at 15-minute headways with a short layover, and one bus would certainly be enough to serve five to seven trips in the peak period at a slightly higher headway.

Portola

The Portola facility serves traffic travelling from the east along I-580 and from the south in Livermore. This facility is further from the facility, but most of the shuttle route to the Dublin/Pleasanton BART station would be on I-580, allowing the route to take advantage of express lanes for part of the trip. Two buses would be required to serve this route at a 15-minute headway or for five to seven trips in the peak period.

Tassajara

The Tassajara park-and-ride is east of Dublin/Pleasanton BART, capturing some travelers from the east on I-580 and residents of the neighborhoods north of the freeway. This facility is relatively close to Dublin/Pleasanton BART and could potentially be served by one bus at 15-minute headways.

Bus Operating Parameters and Cost

Given the concepts outlined above, calculations were made of the number of buses required and the operating costs that could be expected for each. These assumed standard-length buses with seated capacities of 39 passengers, using the most common bus in LAVTA's present fleet as a reference. For the BART shuttles using high-speed freeways, the desire was for the maximum passengers on any trip not to exceed seated capacity. For the Bernal Avenue shuttle, a short route using arterial streets, a total capacity of 50 was assumed. While less than the actual capacity of 60-67, the intent was to keep the service as attractive to discretionary riders as possible by not overloading the buses.

Operating speeds of 55 mph have been assumed for shuttle buses using I-580 express lanes and 40 mph for the regular traffic lanes; 15 mph has been assumed for buses using arterial streets. Route lengths and running times were derived from a Remix model1, while operating costs have been based on LAVTA's fully allocated cost of $100 per bus service hour as a reference. Refinement of the actual operational costs for the shuttle should occur at the project-development stage.

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[1] *Remix* is a web-based transit planning platform that automates the calculations for estimating time and resource requirements of new transit routes. For a given transit route, the software uses information about distance, travel speed, and service frequency to calculate the transit vehicle requirements and operating costs. The *Remix* software allows the user to easily change inputs, such as the routing and service patterns, to develop and compare alternate scenarios.

The following table summarizes bus operating parameters and costs for the six shuttle routes discussed above:

Shuttle Route	Length (1-way)	Round-Trip Run Time	Headway	Span of Service	Vehicles Required	Layover time	Daily Revenue Hours	Annual Bus Service Hours	Annual Operating Cost (2015$)
	miles	minutes	minutes	days/hours	number	minutes	hours	hours	Dollars
Greenville - BART Dublin/Pleasanton	12.8	41	15	Weekday 7:45 AM to 9:20 AM and 4:00 PM to 8:05 PM	4	10	5.7	5,780	$578,000
Airway – BART Dublin/Pleasanton	7.0	29	15	Weekday 7:45 AM to 9:15 AM and 4:PM to 8:15 PM	3	10	5.5	4,208	$420,750
Greenville – Airway – BART Dublin/Pleasanton	14.5	52	15	Weekday 7:45 AM to 9:30 AM and 4:00 PM to 8:15 PM	5	10	6.0	7,650	$765,000
Bernal - BART West Dublin/Pleasanton	3.6	15	15	Weekday 7:45 AM to 9:10 AM and 4:00 PM to 7:55 PM	2	6	5.33	2,720	$272,000
Johnson/ Stoneridge Park and Ride– BART Dublin/Pleasanton	1.7	7	15	2 hours per peak period (4 hours per day)	1	5	4	1,020	$102,000
Portola Park and Ride– BART Dublin/Pleasanton	7.7	34	15	2 hours per peak period (4 hours per day)	3	10	4	3,060	$306,000
Tassajara park and Ride– BART Dublin/Pleasanton	2.0	8	15	2 hours per peak period (4 hours per day)	1	5	4	1,020	$102,000

Attachment C:
Model Development and Application

MEMORANDUM

DATE: July 11, 2016

TO: Saravana Suthanthira, Alameda CTC

FROM: Erin Vaca, DKS Associates P#15161-000

SUBJECT: Tri-Valley Integrated Transit and Park-and-Ride Study – Model Development and Application

This memorandum describes the model development and application work done for the Tri-Valley Integrated Transit and Park-and-Ride Study. The demand for existing and new park-and-ride (PNR) lot locations and transit service options was forecasted using a PNR lot choice module incorporated within the Alameda Countywide Transportation Model (ACTM). Inputs were developed for a 2015 base year and 2030 forecast year. The base ACTM was also modified to incorporate travel patterns observed as part of the study of BART expansion to Livermore. Finally, some highway and transit network coding changes were made to represent existing and new PNR lot locations and transit service changes. These steps are described in detail in the following sections.

Development of Inputs for 2015 and 2030 Scenarios

Population and Employment Inputs for Trip Generation

Land use (population and employment) inputs for the ACTM are provided for the years 2010, 2020, and 2040. To develop 2015 baseline year scenarios, land use input values for these years were calculated as straight line interpolations between 2010 and 2020 values. Likewise, interpolations were made between the 2020 and 2040 values to calculate a 2030 scenario. Other inputs required for the model, including internal-external person trips, truck special generator trips, airport passengers, and external through vehicle trip tables were similarly calculated by interpolating between the given input year values.

Highway Network Options for 2015 and 2030 Scenarios

Scenarios for 2015 and 2030 were (or will be) run using the master network file provided by Alameda County Transportation Commission (ACTC) with specification of the appropriate input year ("INP_NetYear") to reflect expected highway network improvements. For 2015 scenarios, the 2010 turn penalty and ramp metering files were used. For 2030 scenarios, the provided 2035 turn penalty and 2035 ramp metering files will be used in highway network building. Base and future year transit networks are described below under "Transit Networks and LOS".

PNR Lot Choice Module

To take into account capacity constraints that will affect use of PNR lots during the peak period, DKS has incorporated a PNR lot choice module within the ACTM for peak period mode choice. This module is a logit model of PNR lot choice that is applied with matrix calculations to obtain skims of combined auto-transit alternatives, and to generate auto and transit trip tables for assignment to their respective networks. This module replaces all-or-nothing choice of parking access node in transit network path building, which has no mechanism to respect parking capacity constraints. It is a multinomial logit choice model, giving a probability of use of each PNR lot for each origin-destination (OD) pair having transit service to the destination. The module satisfies parking capacity constraints by solving a "shadow price" for each lot that fills up, sufficient to deter enough demand for the lot to fill up exactly (within a close tolerance).

PNR Lot Utility Function

The probability a transit auto-access trip (from the mode choice model) in the *i-j* pair chooses to park-and-ride at *k*:

$$\text{Prob}(k|i,j) = \frac{\exp(Utility[i,k,j])}{\sum_{\tilde{k}\in K}\exp(Utility[i,\tilde{k},j]}$$

For production zone i, attraction j, and park-and-ride zone k, the utility function is:

$$Utility_{i,k,j} = -0.07 * (2.5 * \text{AutoTime}_{i,k} + 0.0909 * ((\text{DistAu}_{i,k} * (\text{cost/mile}) + \text{ParkCost}_k) * 0.89 \text{ veh/pers} + \text{Fare}_{k,j}) + \text{CompositeTransitSkim}_{k,j}) + \ln(c_k)$$

Auto time and cost skim matrix values are taken from *i* to *k*, while transit skim elements are taken from *k* to *j*, the composite being combined from in-vehicle, walk, and waiting times with their respective weights. The *k* index refers only to designated park-and-ride zones having capacity.

The overall utility coefficient of -0.07 (relative to transit in-vehicle time) was taken from park-and-ride lot choice models estimated from observations in the PSRC (Seattle) region. The auto time weight of 2.5 is on the low side of typical weights from 3 to 6 used in many of these models. The scale of monetary costs is taken from the ACTM mode choice model. The vehicle per person rate was borrowed from the Sacramento application. The shadow-price to solve parking constraint is $\ln(c_k)$, where c_k is simpler to solve and apply than the logarithm.

Solving Parking Capacity Constraints

A variant of iterative proportional fitting (IPF) is used to iteratively and simultaneously solve the shadow price (if any) on each lot. c_k is initialized to 1 for all *k*, then iteratively updated:

$$c_k^n = \min\left(1, c_k^{n-1}\frac{\text{Capacity}_k}{\sum_{\forall i,j}\text{Demand}_{i,j}\cdot\text{Prob}(k|i,j)}\right)$$

where *n* is the current iteration number, and Demand_{ij} are the AM period trips given from the mode choice model. Lot attractiveness factors are thus adjusted inversely to the current ratio of excess (or shortage). When solved, each lot that is full has c_k between 0 and 1, and each not full has c_k =1. The present application stops when each park-and-ride lot that fills is within one vehicle of capacity.

Calculation of Skims for Use in Lot and Mode Choice

A factored skim value that incorporates the PNR lot shadow prices is calculated for each origin-PNR lot-destination movement.

Algorithm for Solution of Mode Choice and Parking Capacity Constraints

Parking capacity constraints determine not only the choice of which PNR lots are used by particular trips but also the skims for PNR used in mode choice. The above iterative factoring solves capacity constraint for a given travel demand but the travel demand itself depends on the resulting skims. To result in a consistent model the following steps have been incorporated within the ACTM model stream for peak period mode choice:

- Initialize all shadow prices to "1" and begin with initial ACTM PNR trip matrices
- Calculate zero demand skims
- Evaluate all peak-period mode choice models to get initial and revised (in subsequent iterations) demand
- Load the demand to the PNR lots using the current shadow price
- Update the shadow price according to the revised demand
- Calculate new skims

Calculations are repeated from Step 3 until sufficiently converged. Following the convergence of demand and supply for the peak period, the off-peak mode choice models are run.

Incorporation of BART Livermore Expansion Study Outputs

Because the study area coincides with the BART Livermore expansion study area, DKS sought to incorporate relevant outputs, including revised trip distribution patterns from San Joaquin County and highway network updates in the area of I-580 and Isabel Avenue. The trip distribution patterns were derived from Air Sage data. To incorporate these, DKS revised the K factors used in the trip distribution step of the ACTM to match those used in the BART Livermore study.

Highway Networks, Transit Networks and LOS, and Zone Structure

Highway Network

The master input highway network was updated with the version mentioned above in the BART Livermore Expansion study as this seemed to more accurately represent the present-day highway network in the Livermore area. In addition, overlay TAZ nodes and support nodes were added to represent the satellite (bus only) PNR lots in the Tri-Valley area where these were not already represented in the ACTM.

Transit Networks and LOS

For the 2015 baseline/calibration model run, transit line files were examined and plotted for LAVTA routes serving the study area PNR lots. The routes were updated where necessary to represent as closely as possible the LAVTA routes as of December 2015 based on information found online. For forecast runs reflecting new bus shuttle service or lot locations, LAVTA routes were edited where necessary to reflect the package of service changes scheduled to take effect in August 2016.

For 2030 scenarios, the LAVTA transit line transit line files with the proposed August 2016 changes were retained. For other transit operators, transit line files representing the appropriate future time period (as specified in the filename) were substituted for those used in the base year run where available. In particular, the "BART_2024-2040" transit line file that includes extension of BART to San Jose was incorporated in the 2030 scenarios. Extension of BART service to Livermore was NOT represented in the resulting 2030 transit network.

Calibration of PNR Lot Choice Module

The PNR lot choice module was calibrated by comparing the resulting lot loadings to observed usage. Since the ACTM does not account for private carpools, vanpools, or employer shuttles, the observed PNR lot usage was adjusted using the intercept survey data to get an idea of the actual public transit use at each location. At some locations, such as Tassajara and Portola, the number of parkers currently using regular public transportation routes is thought to be extremely low. Initial model runs showed a much higher than observed number of trips using satellite PNR lots to access regular public transit routes. This result was thought to be due to the perceived unreliability of travel time on a regular bus service making multiple stops and the uncertainty of transfer time in making connections to BART. In addition, the potentially long walks to bus stops in some cases may not have been well represented in the ACTM transit network coding scheme. To compensate for these factors, a calibration factor was introduced to the satellite (bus only) PNR lot access link via the link time variable until the model's lot loadings were within range of the observed levels. Results of this calibration are shown in Table 1.

Table 1. Model Calibration Results

Lot Name	Observed Occupancy	Observed less Private shuttles/ vanpools	Model Capacity	Model PNR Load	Raw Observed Pct.	Adjusted Observed Pct.	Model Pct.
Tassajara	186	0	200	8	0.93	0%	4%
Johnson/Stoneridge	68	36	92	48	0.74	39%	52%
Airway/Rutan	32	16	153	13	0.21	10%	8%
Portola/Alviso	25	0	94	8	0.27	0%	9%
E.Dublin	2886	2886	2886	2892	1.00	100%	100%
W.Dublin	1190	1190	1190	1193	1.00	100%	100%
Livermore ACE	180	128	133	132	1.35	96%	99%
Pleasanton ACE	466	437	498	386	0.94	88%	77%
Vasco Road ACE	176	156	215	139	0.82	73%	65%

Attachment D:
Summary Results of Analysis of Test Packages

SUMMARY RESULTS OF ANALYSIS OF TEST PACKAGES

The study team completed a preliminary analysis of the five test packages (with variations) and supplemental improvements using the performance measures identified in study. The results of the evaluation are presented in this section. The modeling results for 2015 and 2030 are first presented. The estimated benefits of each of the five packages and the supplemental elements are then presented but results for 2015 have been projected to 2020 – a more likely implementation timeframe for the initial improvements.

1. Park-and-Ride Use and Mode Shift

2015 Calibration Model

As presented in Attachment A, the park-and-ride choice module was calibrated to the observed use of park-and-ride lots in the Existing Conditions analysis. The calibrated model results are almost the same or very close to the observed values for the BART and Livermore ACE stations, for the other two ACE stations and the satellite park-and-ride lots, it is within acceptable range of 8 to 13%. Table D- 1 provides the estimates of parking use observed in 2015. The observed values were used to measure the changes in park-and-ride use and mode shift for each of the packages.

Table D- 1: 2015 Observed Parking Occupancy

Facility Type	2015 Observed Results		
	Parking Capacity	Transit Parking*	Percent Utilization
BART Stations	4076	4076	100%
ACE Stations	846	720	85%
Satellite Lots I-580	447	16	4%
Satellite Lots I-680	92	36	39%
Total Satellite	**539**	52	**10%**
Total for all Facilities	**5461**	4849	**89%**

* "Transit Parking" for the satellite lots excludes parking used by private employer shuttles. Total use of these lots is shown in Section 2.2, Table 2.

Test Package 1 - Implementation of Direct Shuttle Service from Existing Satellite Park-and-Ride Lots to BART – 2015

The model results for Test Package 1 in Table D-2 show an increase in the use of the existing satellite park-and-ride lots with the addition of shuttles to the BART stations. The number of vehicles using the satellite lots for transit parking increased by 321, and utilization of the lots increased from 10% in the 2015 observed to 77% in the Test Package 1 model results. The satellite lot along I-680 was filled completely, while the lots along I-580 had overall 72% usage. The results showed no significant change in the use of parking at the BART stations and slightly lower use of the parking at ACE stations. This is most likely due to some trips shifting from parking in the Livermore garage at the ACE station and taking a LAVTA bus to BART to parking at a satellite lot and taking the free shuttle. Overall, the model showed an increase of 321 vehicles using all of the parking facilities.

Table D-2: Model Results for Test Package 1 (2015)

Facility Type	2015 Observed Results			2015 Modeled Values		
	Parking Capacity	Transit Parking*	Percent Utilization	Parking Capacity	Transit Parking*	Percent Utilization
BART Stations	4076	4076	100%	4076	4068	100%
ACE Stations	846	720	85%	846	687	81%
Satellite Lots I-580	447	16	4%	447	323	72%
Satellite Lots I-680	92	36	39%	92	92	100%
Total Satellite	539	52	10%	**539**	415	77%
Total for all Facilities	**5461**	**4849**	**89%**	**5461**	**5170**	**95%**

* "Transit Parking" for the satellite lots excludes parking used by private employer shuttles. Total use of these lots is shown in Section 2.2, Table 2.

Test Package 2 - Parking Expansion at Dublin/Pleasanton BART Station Only – 2015

The model results for Test Package 2 in Table D-3 show that the expanded parking at the Dublin/Pleasanton BART station with the addition of 550 spaces would fill to about 96% of BART's capacity at the two stations. The number of vehicles parking at BART stations would increase by 378, but some of this is drawn from ACE and satellite lot parking. These model results suggest that the overall demand for parking for BART may be largely satisfied by the new garage. The numbers presented in this table are based on the analysis using the countywide model and the park and ride module system. As a countywide model, the output is expected to indicate general trends in utilization rather than providing precise levels of usage. This test package assumes the existing $3/day parking charge at BART station parking. The existing park-and-ride lots, without direct transit connections to the BART stations, would continue to have low usage. Overall, the model showed an increase of 416 vehicles using the full set of parking facilities.

Table D-3: Model Results for Test Package 2 (2015) with the Current $3/Day Parking Charge at BART

Facility Type	2015 Observed Results			2015 Modeled Values		
	Parking Capacity	Transit Parking*	Percent Utilization	Parking Capacity	Transit Parking*	Percent Utilization
BART Stations	4076	4076	100%	4626	4454**	96%
ACE Stations	846	720	85%	846	686	81%
Satellite Lots I-580	447	16	4%	447	90	20%
Satellite Lots I-680	92	36	39%	92	36	39%
Total Satellite	539	52	10%	**539**	**126**	**23%**
Total for all Facilities	5461	4849	89%	**6011**	**5265**	**88%**

* "Transit Parking" for the satellite lots excludes parking used by private employer shuttles. Total use of these lots is shown in Section 2.2, Table 2.

** The numbers presented in this table are based on the analysis using the countywide model and the park and ride module system. As a countywide model, the output is expected to indicate general trends in utilization rather than providing precise levels of usage.

Test Package 3 - Shuttle Service from Existing Park-and-Ride Lots and BART Parking Expansion - 2015

The model results for Test Package 3 in Table D-4 show that the additional parking added at the Dublin/Pleasanton BART stations would be utilized although not fill to capacity. The number of vehicles parking at BART stations would increase by 183 over 2015 observed levels, which is fewer than in Test Package 2. The model showed that the use of the satellite park-and-ride lots would increase by 350 vehicles, which was similar to the model results for Test Package 1. This shows that introducing high-frequency shuttle service improves the use of the satellite lots significantly. Note that the parking at the satellite lots and shuttle service are free in this test package (similar to Test Package 1). The use of parking at ACE stations was shown to decrease by 59 vehicles. This decrease may be from satellite lot shuttles drawing commuters who would otherwise park at ACE stations and use LAVTA service to reach BART. Overall, the model showed an increase of 473 vehicles using all of the parking facilities, which was higher than the increases in Test Packages 1 and 2.

Table D-4: Model Results for Test Package 3 (2015)

Facility Type	2015 Observed Results			2015 Modeled Values		
	Parking Capacity	Transit Parking*	Percent Utilization	Parking Capacity	Transit Parking*	Percent Utilization
BART Stations	4076	4076	100%	4626	4259	92%
ACE Stations	846	720	85%	846	661	78%
Satellite Lots I-580	447	16	4%	447	310	69%
Satellite Lots I-680	92	36	39%	92	92	100%
Total Satellite	539	52	10%	**539**	**402**	76%
Total for all Facilities	5461	4849	89%	**6011**	**5322**	89%

* "Transit Parking" for the satellite lots excludes parking used by private employer shuttles. Total use of these lots is shown in Section 2.2, Table 2.

Test Package 4 New Park-and-Ride Lots with Shuttle Service, Shuttle Service from Existing Park-and-Ride Lots, and BART Parking Expansion –2030

Test Package 4 was run with 2030 travel demand and a 2030 transportation network because the results for Test Package 3 in Table D-4 indicated that that there was not adequate demand in 2015 for further expansion of the park-and-ride system. As shown in Table D-5, total parking capacity was nearly filled (96 percent) in the Test Package 4 2030 model run. When compared with the 2015 baseline model, the total satellite parking increased by 1,358 vehicles and the overall use of all facilities increased by 2,025 vehicles.

Table D-5: Model results for Test Package 4 (2030)

Facility Type	2015 Observed Results			2030 Modeled Values		
	Parking Capacity	Transit Parking*	Percent Utilization	Parking Capacity	Transit Parking*	Percent Utilization
BART Stations	4076	4076	100%	4626	4619	100%
ACE Stations	846	720	85%	846	845	100%
Satellite Lots I-580	447	16	4%	1397	1148	82%
Satellite Lots I-680	92	36	39%	262	263	100%
Existing Satellite Lots	539	117	22%	539	520	96%
New Satellite Lots	-	-	-	1120	891	80%
Total Satellite	**539**	**52**	**10%**	**1659**	**1411**	**85%**
Total for all Facilities	**5461**	**4849**	**89%**	**7131**	**6874**	**96%**

* "Transit Parking" for the satellite lots excludes parking used by private employer shuttles. Total use of these lots is shown in Section 2.2, Table 2.

Test Package 5 - Parking Pricing at Existing and New Park-And-Ride Locations with Shuttle Service and BART Parking Expansion at Dublin/Pleasanton BART Station – 2030

Test Package 5 was also evaluated under 2030 conditions with daily parking fees of $3 at the satellite lots. As shown in Table D-6, the total use of parking is lower than Test Package 4 (2030 conditions) by 173 vehicles, and the use of satellite park-and-ride lots is lower by 169 vehicles, or 12%. As in Test Package 4, usage at I-680 satellite lots and BART and ACE parking area were at or near capacity, while usage at the I-580 satellite lots was below capacity, but this is due to a high capacity assumed for the Greenville lot. Use of the lots satellite lots on I-580 actually increase by 964 parkers over the observed 2015 use.

Table D-6: Model results for Test Package 5 (2030)

Facility Type	2015 Observed Results			2030 Modeled Values		
	Parking Capacity	Transit Parking*	Percent Utilization	Parking Capacity	Transit Parking*	Percent Utilization
BART Stations	4076	4076	100%	4626	4618	100%
ACE Stations	846	720	85%	846	841	99%
Satellite Lots I-580	447	16	4%	1397	980	70%
Satellite Lots I-680	92	36	39%	262	262	100%
Existing Satellite Lots	539	117	22%	539	317	59%
New Satellite Lots	-	-	-	1120	924	83%
Total Satellite	**539**	**52**	**10%**	**1659**	**1242**	**75%**
Total for all Facilities	**5461**	**4849**	**89%**	**7131**	**6701**	**94%**

* "Transit Parking" for the satellite lots excludes parking used by private employer shuttles. Total use of these lots is shown in Section 2.2, Table 2.

Supplemental Element

The supplemental element includes the growth in parking to access private employer shuttles, vanpools and carpools. Using the annual growth rate of 5 percent for the private employer shuttles, and assuming that the use of park-and-ride lots for vanpools and carpools is negligible, an additional 119 vehicles parking would need to be accommodated by 2020 and 464 by 2030. For the supplemental element, the change in weekday AM travelers, weekday AM SOV reduction, and weekday AM VMT reduction, and transit ridership are based on the change in weekday AM parkers.

2. Benefits of the Improvements

The study team evaluated each test package's potential benefits (summarized in Table D-7) assuming implementation in 2020 for Test Packages 1, 2 and 3 and the Supplemental Package. The potential benefits for Test Package 4 and 5 are shown for 2030. The year 2020 was used for Test Packages 1, 2 and 3 because it is unlikely that they could be implemented before then. The benefits for Test Packages 4 and 5 were evaluated for 2030 because it does not appear that the demand would be adequate to justify the investments in those test package until then, Section 3.4 of the Task 4 report described the method for calculating each of the benefit measures. The "Change in Weekday AM Parkers" is the difference between the "Model-Estimated Transit Parking" for each test package and the baseline model run, and includes all transit parking at BART, ACE and satellite park-and-ride lots. This difference was then escalated to 2020 for Test Packages 1, 2 and 3 based on an estimate of growth in demand of 3 percent per year. The growth rate was developed by comparing forecasts of total transit-related parking utilization for 2015 and 2030 for Test Package 4, which had the highest level of total transit-related parking. The change in weekday AM travelers, weekday AM SOV reduction, and weekday AM VMT reduction are based on the change in weekday AM parkers. Transit use is derived from the model as BART boardings via park-and-ride access. The change in transit use is the difference between the baseline model run and the test package model runs. Also considered in the change in weekday AM transit boardings is the additional commuters attracted to park-and-ride lots by added private employer shuttle services. This is expected to add about 122 riders by 2020 and 475 riders by 2030. These additional riders are reflected in "Supplemental – 2020" and "Supplemental – 2030" in table 7 but not in the results for the individual test packages.

Table D-7: Summary of Benefits for the Test Packages

Test Package	Change in Weekday AM Parkers	Change in Weekday AM Travelers	Reduction in Weekday AM SOV	Reduction in Weekday VMT	Change in Weekday AM Transit Boardings
Test Package 1 - 2020	373	425	298	16,228	340
Test Package 2 -2020	484	551	386	21,031	441
Test Package 3 -2020	550	627	439	23,912	501
Test Package 4 -2030	2025	2309	1616	88,070	1847
Test Package 5 - $3 at satellite lots -2030	1852	2111	1478	80,546	1689
Supplemental - 2020	119	135	106	7,704	122
Supplemental - 2030	464	529	416	30,086	475

Attachment E:
Summary Results of Analysis of Potential Next Steps

SUMMARY RESULTS OF ANALYSIS OF POTENTIAL NEXT STEPS

1. Overview

Based on the findings from the analysis of test packages, the study team explored the following potential next steps and how they can be implemented in two major phases if they were to be moved forward short-term (2020) and long-term (2030):

Potential Short-term (2020) Improvements

Step 1 – Initiate high-frequency free shuttle service from the Airway lot to the Dublin/Pleasanton BART station as a pilot test of the service concept. This stage can begin immediately because there are no significant capital costs associated with initiation of the service.

Step 2 – Construct a new satellite lot at Bernal Avenue and make the lot available for carpooling, vanpooling, Wheels access to the Pleasanton ACE station and the West Dublin/Pleasanton BART station and private employer shuttles. The demand for private employer shuttle service from park-and-ride lots is growing rapidly and employers are interested in using more spaces.

Step 3 – Construct a new parking garage at the Dublin/Pleasanton BART station adding 550 spaces to the existing capacity at the station.

Potential Long-term (2030) Improvements

Step 4 – Expand the satellite lot at Airway to 500 spaces as the demand at the Dublin/Pleasanton BART garage and the Airway lot reach capacity. Although the modeling for 2015 does show sufficient demand in the I-580 corridor to justify the expansion at Airway, the modeling for 2030 does. It is highly likely that BART will be extended with a new terminal station at or near the Airway lot. When that occurs, the expanded Airway lot would be converted to parking for the new station and the shuttle service would no longer be needed. an additional element of the step would be the initiation of high-frequency shuttle service from the Bernal lot to the West Dublin BART station.

Step 5 – Construct a new satellite lot at Greenville Road with a capacity of 500 spaces and provide high-frequency peak period shuttle service to the nearest BART station (Dublin/Pleasanton or a new Livermore station) as the demand approaches the limits of the BART-related capacity in the I-580 corridor.

The short-term and long-term improvement will include ITS technology to support real-time monitoring and reporting of parking-space availability and transit-vehicle location to inform potential commuters about their park-and-ride/transit options as described in section 3.3.6. The improvements will also include marketing, improvements to lighting, security systems, wayfinding and bike parking at satellite park-and-ride facilities. The annualized cost of the full package of amenities and services have been included in the evaluation of next steps. Detailed information on the estimated cost for each step and the source of the unit costs used in the estimation of costs is provided in Attachment F.

Each of these steps has been analyzed for how they would affect parking utilization, transit ridership, SOV trip reduction and VMT reduction. Model results for Steps 1, 3, 4 and 5 are present in Section 2 below. The addition of the satellite lot at Bernal Avenue in Step 2 would most likely be used for private employer shuttles and that cannot be captured in the model system. Estimates of the benefits and the cost effectiveness of each are presented in Section 3.

2. Park-and-Ride Use and Mode Shift Results for Potential Next Steps

The results for Step 1 in Table E-1 indicate that the addition of high-frequency shuttle service from the Airway lot to the Dublin/Pleasanton BART station will attract 129 new transit-oriented parkers in the Tri-Valley. It will add 139 transit-oriented parkers to the satellite lots while only slightly reducing the number of parkers at the BART stations or the ACE stations.

Table E-1: Model Results for Step 1 Shuttle from Airway Lot (2015)

Facility Type	2015 Observed Results			2015 Modeled Values		
	Parking Capacity	Transit Parking	Percent Utilization	Parking Capacity	Transit Parking	Percent Utilization
BART Stations	4076	4076	100%	4076	4069	100%
ACE Stations	846	720	85%	846	718	85%
Satellite Lots I-580	447	16	4%	447	155	35%
Satellite Lots I-680	92	36	39%	92	36	39%
Total Satellite	**539**	**52**	**10%**	**539**	**191**	**35%**
Total Park-and-Ride	**5461**	**4849**	**89%**	**5461**	**4978**	**91%**

Note: The model estimates of "Transit Parking" do not account for the existing and potential additional use of the satellite lots for private employer shuttles at the lots where high-frequency shuttle service to BART is not being evaluated. This accounts for use of roughly 215 existing spaces, up to 119 additional spaces by 2020 and up to 464 additional spaces by 2030.

Step 2 was not modeled because the only change was the addition of the Bernal lots with the intention that it would be used primarily for carpooling and vanpooling and for private employer shuttles. These uses were estimated using off-model methods. This accounts for use of roughly 215 existing spaces, up to 119 additional spaces by 2020 and up to 464 additional spaces by 2030.

As indicated in Table E-2, the addition of the new BART parking garage at the Dublin/Pleasanton Station in Step 3 will generate 437 transit-oriented parkers among all of the Tri-Valley parking facilities. A total of 344 parkers would be added at the BART station with slight reductions at the ACE stations and the satellite lots along I-580.

Table E-2: Model Results for Step 3 Additional of BART Garage (2015)

Facility Type	2015 Observed Results			2015 Modeled Values		
	Parking Capacity	Transit Parking	Percent Utilization	Parking Capacity	Transit Parking*	Percent Utilization*
BART Stations	4076	4076	100%	4626	4420	96%
ACE Stations	846	720	85%	846	691	82%
Satellite Lots I-580	447	16	4%	447	139	31%
Satellite Lots I-680	92	36	39%	292	36	12%
Total Satellite	**539**	**52**	**10%**	**539**	**174**	**24%**
Total Park-and-Ride	**5461**	**4849**	**89%**	**6211**	**5286**	**85%**

Note - The numbers presented in this table are conservative as they are based on the analysis using the countywide model and the park and ride module system. As a countywide model, the output is expected to indicate general trend in utilization rather than providing specific or finite level usage. This is clear when BART garage expansion adds 550 spaces system-wide, increase in transit parking is less than 550, while it is expected to be filled in reality. Roughly, 6700 commuters are currently on a waiting list for reserved parking at either the West Dublin/Pleasanton or the Dublin/Pleasanton station reflecting a high level of latent demand. Also, the model estimates of "Transit Parking" do not account for the existing and potential additional use of the satellite lots for private employer shuttles at the lots where high-frequency shuttle service to BART is not being evaluated. This accounts for use of roughly 215 existing spaces, up to 119 additional spaces by 2020 and up to 464 additional spaces by 2030.

Table E-3 presents the results of Step 4, the first of the two 2030 steps. In this step, the capacity of the Airway lot would be expanded to 500 - an increase of 347 spaces, and shuttle service would be added connecting the Bernal lot with the West Dublin/Pleasanton BART station. With the higher level of demand in 2030 and the proposed changes, total transit-orientated parking in the Tri-Valley would increase by 844 parkers over the Step 3 estimate. BART and ACE parking would be fully utilized. For the satellite with shuttle service to BART, the Bernal Lot would be fully utilized and the Airway lot would be 65% utilized. The results in Step 4 indicate that the Airway expansion could be somewhat less or the additional capacity could be provided for private employer shuttles of for future growth beyond 2030.

Table E-3: Model Results for Step 4 Expansion of Airway Lot and Shuttle from Bernal Lot (2030)

Facility Type	2015 Observed Results			2030 Modeled Values		
	Parking Capacity	Transit Parking	Percent Utilization	Parking Capacity	Transit Parking	Percent Utilization
BART Stations	4076	4076	100%	4626	4620	100%
ACE Stations	846	720	85%	846	841	99%
Satellite Lots I-580	447	16	4%	794	426	54%
Satellite Lots I-680	92	36	39%	292	242	83%
Existing Satellite Lots	539	117	22%	886	468	53%
New Satellite Lots	-	-	-	200	200	100%
Total Satellite	**539**	**52**	**10%**	**1086**	**668**	**62%**
Total Park-and-Ride	**5461**	**4849**	**89%**	**6558**	**6130**	**93%**

Note: The model estimates of "Transit Parking" do not account for the existing and potential additional use of the satellite lots for private employer shuttles at the lots where high-frequency shuttle service to BART is not being evaluated. This accounts for use of roughly 215 existing spaces, up to 119 additional spaces by 2020 and up to 464 additional spaces by 2030.

The additional of 500 new satellite lot spaces at the Greenville Road location with shuttle service to the Dublin/Pleasanton BART station was evaluated in the Step 5 model run. As indicated in Table E-4, these improvements produce an increase of 431 transit-oriented parkers over Step 4 (represented in Table E-3). Once again, all of the spaces at BART and ACE stations would be used. For the two satellite lots on I-580 with shuttle service to BART (Airway and Greenville), the 1000 spaces would be 76% utilized. Again, the excess capacity could be used by private employer shuttles or for future growth in demand.

Table E-4: Model Results for Step 5 Addition of Greenville Lot with Shuttle (2030)

Facility Type	2015 Observed Results			2030 Modeled Values		
	Parking Capacity	Transit Parking	Percent Utilization	Parking Capacity	Transit Parking	Percent Utilization
BART Stations	4076	4076	100%	4626	4623	100%
ACE Stations	846	720	85%	846	841	99%
Satellite Lots I-580	447	16	4%	1294	856	66%
Satellite Lots I-680	92	36	39%	292	241	82%
Existing Satellite Lots	539	117	22%	886	396	45%
New Satellite Lots	-	-	-	700	701	100%
Total Satellite	**539**	**52**	**10%**	**1586**	**1097**	**69%**
Total Park-and-Ride	**5461**	**4849**	**89%**	**7058**	**6561**	**93%**

Note: The model estimates of "Transit Parking" do not account for the existing and potential additional use of the satellite lots for private employer shuttles at the lots where high-frequency shuttle service to BART is not being evaluated. This accounts for use of roughly 215 existing spaces, up to 119 additional spaces by 2020 and up to 464 additional spaces by 2030.

3. Benefits and Costs of Potential Next Steps

The methodology described in Sections 3.5 and 3.6 of the Task 4 report was used to estimate the benefits and costs of the potential next steps. The results in Tables E-5, E-6 and E-7 reflect the potential phased approach to implementation of transit-oriented parking improvements in the Tri-Valley. The initial investments in Steps 1 and 2 are much lower than the packages tested in an earlier stage of the study, but grow to higher levels in Steps 3, 4 and 5. This allows the demand for services to grow to a level where the investments are supported by demand.

For the analysis of benefits, the off-model estimates of increase in use of satellite lots for private employer shuttles has been combined with the modeling results for the expansion of BART parking and the operation of high-frequency shuttle service to BART from existing and new satellite lots. This accounts for use of roughly 215 existing spaces, up to 119 additional spaces by 2020 and up to 464 additional spaces by 2030. In the analysis of benefits, the new commuters are counted as new transit riders and the effects of these new transit trips of SOV and VMT reduction are incorporated.

All of the potential next steps were evaluated without a price being charged for use of the satellite lots or the shuttle to BART. There was also no charge for use of satellite lots for private employer shuttles carpooling or vanpooling and no increase in BART parking charge (in 2015 dollars) was assumed. Alternative pricing strategies will be explored in the development of an implementation strategy in the next task of this project.

Table E-5: Summary of Benefits for Potential Next Steps

Phase	Daily Weekday AM Parkers	Daily Weekday AM Travelers	Daily Weekday AM SOV Reduction	Daily Weekday VMT Reduction	Daily Weekday AM Transit Ridership Change
Step 1 – Addition of high-frequency peak period shuttle service from existing Airway lot to BART (2020)	150	171	120	6,521	137
Step 2 – Addition of Bernal lot for carpool, vanpool and private employer shuttles (2020)	269	306	226	14,226	258
Step 3 – Addition of BART garage at Dublin/Pleasanton BART (2020)	627	715	512	29,796	585
Step 4 – Expansion of Airway lot to 500 spaces and addition of shuttle to Bernal lot (2030)	1,745	1,989	1,438	85,799	1,643
Step 5 – Addition of Greenville lot with 500 spaces and high-frequency peak period shuttle (2030)	2,176	2,481	1,782	104,543	2,036

Note: For the analysis of benefits, the off-model estimates of increase in use of satellite lots for private employer shuttles were combined with the modeling results for the expansion of BART parking and the operation of high-frequency shuttle service to BART from existing and new satellite lots. This accounts for use of roughly 215 existing spaces, up to 119 additional spaces by 2020 and up to 464 additional spaces by 2030. In the analysis of benefits, the new commuters are counted as new transit riders and the effects of these new transit trips of SOV and VMT reduction are incorporated.

Table E-6: Summary of Costs and Revenues for the Potential Next Steps

Potential Next Step	Annualized Capital Cost	Annual Shuttle Operations Cost	Total Annual Cost	Annual Revenue	Annualized Cost
Step 1 – Addition of Shuttle service from existing Airway to BART (2020)	$110,923	$420,750	$531,673	-	$531,673
Step 2 – Addition of Bernal lot for carpool, vanpool and private employer shuttles (2020)	$291,111	$420,750	$711,861	-	$711,861
Step 3 – Addition of BART garage at Dublin/Pleasanton BART (2020)	$2,756,777	$420,750	$3,177,527	$378,675	$2,798,852
Step 4 Expansion of Airway lot to 500 spaces and addition of shuttle to Bernal lot (2030)	$3,052,154	$692,750	$3,744,904	$378,675	$3,366,229
Step 5 – Addition of Greenville lot with 500 spaces and shuttle (2030)	$3,332,256	$1,270,750	$4,603,006	$378,675	$4,224,331

Table E-7: Summary of Annual Effectiveness and Costs of Potential Next Steps

Potential Next Step	Annual Weekday AM Parkers	Annual Weekday AM Travelers	Annual Weekday AM SOV Reduction	Annual Weekday VMT Reduction	Annual Weekday Transit Ridership Change	Annualized Costs
Step 1 – Addition of shuttle service from existing Airway lot to BART (2020)	37,487	42,736	29,915	1,630,374	34,189	$531,673
Step 2 – Addition of Bernal lot for carpool, vanpool and private employer shuttles (2020)	67,188	76,594	56,518	3,556,428	64,592	$711,861
Step 3 – Addition of BART garage at Dublin/Pleasanton BART (2020)	156,693	178,630	127,943	7,449,105	146,221	$2,798,852
Step 4 – Expansion of Airway lot to 500 spaces and addition of shuttle to Bernal lot (2030)	436,235	497,308	359,449	21,449,626	410,799	$3,366,229
Step 5 –Addition of Greenville lot with 500 spaces and shuttle (2030)	543,985	620,143	445,433	26,135,799	509,067	$4,224,331

Attachment F:
Approximate Cost Estimates

Table F-1 Summary of Annualized Costs for Potential Next Steps[1]

2015	Annualized Capital Cost	Annual Shuttle Operations Cost	TOTAL ANNUAL COST	ANNUAL Revenue	Net Cost
Step 1	$110,923	$420,750	$531,673	-	$531,673
Step 2	$291,111	$420,750	$711,861	-	$711,861
Step 3	$2,756,777	$420,750	$3,177,527	$378,675	$2,798,852

2030	Annualized Capital Cost	Annual Shuttle Operations Cost	TOTAL ANNUAL COST	ANNUAL Revenue	Net Cost
Step 4	$3,052,154	$692,750	$3,744,904	$378,675	$3,366,229
Step 5	$3,332,256	$1,270,750	$4,603,006	$378,675	$4,224,331

(1) In addition to the capital costs shown above, it is expected that the improvement measures involving enhancements to fixed infrastructure will incur incremental operating costs each year on the order of 1-2% of the capital cost. The exact amounts will vary across the different jurisdictions and agencies, depending on the way in which operations & maintenance are currently being delivered today and extent of similar activities already undertaken by the organization. Project sponsors will need to evaluate their specific costs as part of the implementation of each improvement measure.

Table F-2 Detailed Annualized Costs for Potential Next Step 1

Category	Location/System	Unit Cost	Qty	Capital Costs	Expected Lifespan	Annualized Capital Cost	Annual Shuttle Operations Cost
Enhanced Bus Service	Tassajara						
	Johnson/Stoneridge						
	Airway						$420,750
	Portola						
Transit Signal Priority	TSP Buses	$650	4	$2,600	5	$617	
	TSP Intersections	$5,000	8	$40,000	5	$9,496	
Real-Time Shuttle Arrival and Departure Information	Airway	$10,000	1	$10,000	5	$2,374	
	Portola	$10,000	1	$10,000	5	$2,374	
	Dublin/Pleasanton BART	$10,000	1	$10,000	5	$2,374	
Smart Parking System	Real-time data service	$30,000	1	$30,000	3	$11,223	
	Tassajara LPR Camera	$6,500	1	$6,500	5	$1,543	
	Johnson/Stoneridge LPR Camera	$6,500	1	$6,500	5	$1,543	
	Airway LPR Camera	$6,500	1	$6,500	5	$1,543	
	Portola LPR Camera	$6,500	1	$6,500	5	$1,543	
	Pleasanton ACE LPR Camera	$6,500	2	$13,000	5	$3,086	
	Livermore ACE LPR Camera	$6,500	2	$13,000	5	$3,086	
	Vasco Road ACE LPR Camera	$6,500	2	$13,000	5	$3,086	
Lighting	Tassajara	$25,000	2	$50,000	10	$6,794	
	Johnson/Stoneridge	$25,000	1	$25,000	10	$3,397	
	Airway	$25,000	2	$50,000	10	$6,794	
	Portola	$25,000	1	$25,000	10	$3,397	
Surveillance Cameras	Tassajara	$6,500	4	$26,000	5	$6,172	
	Johnson/Stoneridge	$6,500	2	$13,000	5	$3,086	
	Airway	$6,500	4	$26,000	5	$6,172	
	Portola	$6,500	2	$13,000	5	$3,086	
Bike Parking	Tassajara	$2,900	10	$29,000	5	$6,885	
	Johnson/Stoneridge	$2,900	5	$14,500	5	$3,442	
	Airway	$2,900	10	$29,000	5	$6,885	
	Portola	$2,900	5	$14,500	5	$3,442	
Wayfinding Signage	Tassajara	$250	20	$5,000	3	$1,871	
	Johnson/Stoneridge	$250	20	$5,000	3	$1,871	
	Airway	$250	20	$5,000	3	$1,871	
	Portola	$250	20	$5,000	3	$1,871	
Total Cost				$502,600		**$110,923**	**$420,750**
						TOTAL ANNUAL COST	**$531,673**

Note: Sources for unit cost information is included in Table F-7

Table F-3 Detailed Annualized Costs for Potential Next Step 2

Category	Location/System	Unit Cost	Qty	Capital Costs	Expected Lifespan	Annualized Capital Cost	Annual Shuttle Operations Cost
New Satellite Park and Ride	Bernal	$9,000	200	$1,800,000	20	$156,924	
Enhanced Bus Service	Tassajara						
	Johnson/Stoneridge						
	Airway						$420,750
	Portola						
Transit Signal Priority	TSP Buses	$650	4	$2,600	5	$617	
	TSP Intersections	$5,000	8	$40,000	5	$9,496	
Real-Time Shuttle Arrival and Departure Information	Airway	$10,000	1	$10,000	5	$2,374	
	Portola	$10,000	1	$10,000	5	$2,374	
	Dublin/Pleasanton BART	$10,000	1	$10,000	5	$2,374	
Smart Parking	Real-time data service	$30,000	1	$30,000	3	$11,223	
	Tassajara LPR Camera	$6,500	1	$6,500	5	$1,543	
	Johnson/Stoneridge LPR Camera	$6,500	1	$6,500	5	$1,543	
	Airway LPR Camera	$6,500	1	$6,500	5	$1,543	
	Portola LPR Camera	$6,500	1	$6,500	5	$1,543	
	Pleasanton ACE LPR Camera	$6,500	2	$13,000	5	$3,086	
	Livermore ACE LPR Camera	$6,500	2	$13,000	5	$3,086	
	Vasco Road ACE LPR Camera	$6,500	2	$13,000	5	$3,086	
	Bernal LPR Camera	$6,500	1	$6,500	5	$1,543	
Lighting	Tassajara	$25,000	2	$50,000	10	$6,794	
	Johnson/Stoneridge	$25,000	1	$25,000	10	$3,397	
	Airway	$25,000	2	$50,000	10	$6,794	
	Portola	$25,000	1	$25,000	10	$3,397	
	Bernal	$25,000	2	$50,000	10	$6,794	
Surveillance Cameras	Tassajara	$6,500	4	$26,000	5	$6,172	
	Johnson/Stoneridge	$6,500	2	$13,000	5	$3,086	
	Airway	$6,500	4	$26,000	5	$6,172	
	Portola	$6,500	2	$13,000	5	$3,086	
	Bernal	$6,500	4	$26,000	5	$6,172	
Bike Parking	Tassajara	$2,900	10	$29,000	5	$6,885	
	Johnson/Stoneridge	$2,900	5	$14,500	5	$3,442	
	Airway	$2,900	10	$29,000	5	$6,885	
	Portola	$2,900	5	$14,500	5	$3,442	
	Bernal	$2,900	10	$29,000	5	$6,885	
Wayfinding	Tassajara	$250	20	$5,000	3	$1,871	
	Johnson/Stoneridge	$250	20	$5,000	3	$1,871	
	Airway	$250	20	$5,000	3	$1,871	
	Portola	$250	20	$5,000	3	$1,871	
	Bernal	$250	20	$5,000	3	$1,871	
Total Cost				$2,419,100		**$291,111**	**$420,750**
						TOTAL ANNUAL COST	**$711,861**

Note: Sources for unit cost information is included in Table F-7

Table F-4 Detailed Annualized Costs for Potential Next Step 3

Category	Location/System	Unit Cost	Qty	Capital Costs	Expected Lifespan	Annualized Capital Cost	Annual Shuttle Operations Cost
New BART Parking Garage	Dublin/Pleasanton	$57,077	650	$37,100,000	40	$2,465,666	
New Satellite Park-and-Ride	Bernal	$9,000	200	$1,800,000	20	$156,924	
Enhanced Bus Service	Tassajara						
	Johnson/Stoneridge						
	Airway						$420,750
	Portola						
	Bernal						
Transit Signal Priority	TSP Buses	$650	4	$2,600	5	$617	
	TSP Intersections	$5,000	8	$40,000	5	$9,496	
Real-Time Shuttle Arrival and Departure Information	Airway	$10,000	1	$10,000	5	$2,374	
	Portola	$10,000	1	$10,000	5	$2,374	
	Dublin/Pleasanton BART	$10,000	1	$10,000	5	$2,374	
Smart Parking	Real-time data service	$30,000	1	$30,000	3	$11,223	
	Tassajara LPR Camera	$6,500	1	$6,500	5	$1,543	
	Johnson/Stoneridge LPR Camera	$6,500	1	$6,500	5	$1,543	
	Airway LPR Camera	$6,500	1	$6,500	5	$1,543	
	Portola LPR Camera	$6,500	1	$6,500	5	$1,543	
	Pleasanton ACE LPR Camera	$6,500	2	$13,000	5	$3,086	
	Livermore ACE LPR Camera	$6,500	2	$13,000	5	$3,086	
	Vasco Road ACE LPR Camera	$6,500	2	$13,000	5	$3,086	
	Bernal LPR Camera	$6,500	1	$6,500	5	$1,543	
Lighting	Tassajara	$25,000	2	$50,000	10	$6,794	
	Johnson/Stoneridge	$25,000	1	$25,000	10	$3,397	
	Airway	$25,000	2	$50,000	10	$6,794	
	Portola	$25,000	1	$25,000	10	$3,397	
	Bernal	$25,000	2	$50,000	10	$6,794	
Surveillance Cameras	Tassajara	$6,500	4	$26,000	5	$6,172	
	Johnson/Stoneridge	$6,500	2	$13,000	5	$3,086	
	Airway	$6,500	4	$26,000	5	$6,172	
	Portola	$6,500	2	$13,000	5	$3,086	
	Bernal	$6,500	4	$26,000	5	$6,172	
Bike Parking	Tassajara	$2,900	10	$29,000	5	$6,885	
	Johnson/Stoneridge	$2,900	5	$14,500	5	$3,442	
	Airway	$2,900	10	$29,000	5	$6,885	
	Portola	$2,900	5	$14,500	5	$3,442	
	Bernal	$2,900	10	$29,000	5	$6,885	
Wayfinding	Tassajara	$250	20	$5,000	3	$1,871	
	Johnson/Stoneridge	$250	20	$5,000	3	$1,871	
	Airway	$250	20	$5,000	3	$1,871	
	Portola	$250	20	$5,000	3	$1,871	
	Bernal	$250	20	$5,000	3	$1,871	
Total Cost				$39,519,100		**$2,756,777**	**$420,750**
						TOTAL ANNUAL COST	**$3,177,527**

		Capacity	Occupancy	Gross Revenue		Collection Cost	Annual Revenue
Revenue ($3/day)	Dublin/Pleasanton	550	100%	$420,750		$42,075	$378,675
						TOTAL ANNUAL REVENUE	**$378,675**
						NET COST	**$2,798,852**

Note: Sources for unit cost information is included in Table F-7

Table F-5 Detailed Annualized Costs for Potential Next Step 4

Category	Location/System	Unit Cost	Qty	Capital Costs	Expected Lifespan	Annualized Capital Cost	Annual Shuttle Operations Cost
New BART Parking Garage	Dublin/Pleasanton	$57,077	650	$37,100,000	40	$2,465,666	
New Satellite Park-and-Ride	Bernal	$9,000	200	$1,800,000	20	$156,924	
Airway Park-and-Ride Expansion	Airway	$9,000	347	$3,123,000	20	$272,263	
Enhanced Bus Service	Tassajara						
	Johnson/Stoneridge						
	Airway						$420,750
	Portola						
	Bernal						$272,000
Transit Signal Priority	TSP Buses	$650	7	$4,550	5	$1,080	
	TSP Intersections	$5,000	18	$90,000	5	$21,366	
Real-Time Shuttle Arrival and Departure Information	Airway	$10,000	1	$10,000	5	$2,374	
	Portola	$10,000	1	$10,000	5	$2,374	
	Bernal	$10,000	1	$10,000	5	$2,374	
	Dublin/Pleasanton BART	$10,000	1	$10,000	5	$2,374	
	West Dublin/Pleasanton BART	$10,000	1	$10,000	5	$2,374	
Smart Parking	Real-time data service	$42,000	1	$42,000	3	$15,713	
	Tassajara LPR Camera	$6,500	1	$6,500	5	$1,543	
	Johnson/Stoneridge LPR Camera	$6,500	1	$6,500	5	$1,543	
	Airway LPR Camera	$6,500	2	$13,000	5	$3,086	
	Portola LPR Camera	$6,500	1	$6,500	5	$1,543	
	Pleasanton ACE LPR Camera	$6,500	2	$13,000	5	$3,086	
	Livermore ACE LPR Camera	$6,500	2	$13,000	5	$3,086	
	Vasco Road ACE LPR Camera	$6,500	2	$13,000	5	$3,086	
	Bernal LPR Camera	$6,500	1	$6,500	5	$1,543	
Lighting	Tassajara	$25,000	2	$50,000	10	$6,794	
	Johnson/Stoneridge	$25,000	1	$25,000	10	$3,397	
	Airway	$25,000	2	$50,000	10	$6,794	
	Portola	$25,000	1	$25,000	10	$3,397	
	Bernal	$25,000	2	$50,000	10	$6,794	
Surveillance Cameras	Tassajara	$6,500	4	$26,000	5	$6,172	
	Johnson/Stoneridge	$6,500	2	$13,000	5	$3,086	
	Airway	$6,500	4	$26,000	5	$6,172	
	Portola	$6,500	2	$13,000	5	$3,086	
	Bernal	$6,500	4	$26,000	5	$6,172	
Bike Parking	Tassajara	$2,900	10	$29,000	5	$6,885	
	Johnson/Stoneridge	$2,900	5	$14,500	5	$3,442	
	Airway	$2,900	10	$29,000	5	$6,885	
	Portola	$2,900	5	$14,500	5	$3,442	
	Bernal	$2,900	10	$29,000	5	$6,885	
Wayfinding	Tassajara	$250	20	$5,000	3	$1,871	
	Johnson/Stoneridge	$250	20	$5,000	3	$1,871	
	Airway	$250	20	$5,000	3	$1,871	
	Portola	$250	20	$5,000	3	$1,871	
	Bernal	$250	20	$5,000	3	$1,871	
Total Cost				$42,732,550		**$3,052,154**	**$692,750**
						TOTAL ANNUAL COST	**$3,744,904**

		Capacity	Occupancy	Gross Revenue		Collection Cost	Annual Revenue
Revenue ($3/day)	Dublin/Pleasanton	550	100%	$420,750		$42,075	$378,675
						TOTAL ANNUAL REVENUE	**$378,675**
						NET COST	**$3,366,229**

Note: Sources for unit cost information is included in Table F-7

Table F-6 Detailed Annualized Costs for Potential Next Step 5

Category	Location/System	Unit Cost	Qty	Capital Costs	Expected Lifespan	Annualized Capital Cost	Annual Shuttle Operations Cost
BART Parking Garage	Dublin/Pleasanton	$57,077	650	$37,100,000	40	$2,465,666	
New Satellite Park and Ride	Bernal	$9,000	200	$1,800,000	20	$156,924	
Airway Park-and-Ride Expansion	Airway Expansion	$9,000	347	$3,123,000	20	$226,886	
New Satellite Park-and-Ride	Greenville	$9,000	500	$4,500,000	20	$299,070	
Enhanced Bus Service	Tassajara						
	Johnson/Stoneridge						
	Airway						$420,750
	Portola						
	Bernal						$272,000
	Greenville						$578,000
Transit Signal Priority	TSP Buses	$650	12	$7,800	5	$1,852	
	TSP Intersections	$5,000	18	$90,000	5	$21,366	
Real-Time Shuttle Arrival and Departure Information	Airway	$10,000	1	$10,000	5	$2,374	
	Portola	$10,000	1	$10,000	5	$2,374	
	Bernal	$10,000	1	$10,000	5	$2,374	
	Greenville	$10,000	1	$10,000	5	$2,374	
	Dublin/Pleasanton BART	$10,000	1	$10,000	5	$2,374	
	West Dublin/Pleasanton BART	$10,000	1	$10,000	5	$2,374	
Smart Parking	Real-time data service	$42,000	1	$42,000	3	$15,713	
	Tassajara LPR Camera	$6,500	1	$6,500	5	$1,543	
	Johnson/Stoneridge LPR Camera	$6,500	1	$6,500	5	$1,543	
	Airway LPR Camera	$6,500	2	$13,000	5	$3,086	
	Portola LPR Camera	$6,500	1	$6,500	5	$1,543	
	Pleasanton ACE LPR Camera	$6,500	2	$13,000	5	$3,086	
	Livermore ACE LPR Camera	$6,500	2	$13,000	5	$3,086	
	Vasco Road ACE LPR Camera	$6,500	2	$13,000	5	$3,086	
	Bernal LPR Camera	$6,500	1	$6,500	5	$1,543	
	Greenville LPR Camera	$6,500	2	$6,500	5	$1,543	
Lighting	Tassajara	$25,000	2	$50,000	10	$6,794	
	Johnson/Stoneridge	$25,000	1	$25,000	10	$3,397	
	Airway	$25,000	2	$50,000	10	$6,794	
	Portola	$25,000	1	$25,000	10	$3,397	
	Bernal	$25,000	2	$50,000	10	$6,794	
	Greenville	$25,000	2	$50,000	10	$6,794	
Surveillance Cameras	Tassajara	$6,500	4	$26,000	5	$6,172	
	Johnson/Stoneridge	$6,500	2	$13,000	5	$3,086	
	Airway	$6,500	4	$26,000	5	$6,172	
	Portola	$6,500	2	$13,000	5	$3,086	
	Bernal	$6,500	4	$26,000	5	$6,172	
	Greenville	$6,500	4	$26,000	5	$6,172	
Bike Parking	Tassajara	$2,900	10	$29,000	5	$6,885	
	Johnson/Stoneridge	$2,900	5	$14,500	5	$3,442	
	Airway	$2,900	10	$29,000	5	$6,885	
	Portola	$2,900	5	$14,500	5	$3,442	
	Bernal	$2,900	10	$29,000	5	$6,885	
	Greenville	$2,900	10	$29,000	5	$6,885	
Wayfinding	Tassajara	$250	20	$5,000	3	$1,871	
	Johnson/Stoneridge	$250	20	$5,000	3	$1,871	
	Airway	$250	20	$5,000	3	$1,871	
	Portola	$250	20	$5,000	3	$1,871	
	Bernal	$250	20	$5,000	3	$1,871	
	Greenville	$250	20	$5,000	3	$1,871	
Total Cost				$47,362,300		**$3,332,256**	**$1,270,750**
						TOTAL ANNUAL COST	**$4,603,006**

		Capacity	Occupancy	Gross Revenue		Collection Cost	Annual Revenue
Revenue ($3/day)	Dublin/Pleasanton	550	100%	$420,750		$42,075	$378,675
						TOTAL ANNUAL REVENUE	**$378,675**
						NET COST	**$4,224,331**

Note: Sources for unit cost information is included in Table F-7

Table F-7 Sources of Data for Unit Costs

Improvement/Facility/System	Unit Cost	per	Source/Assumptions
BART Parking Garage	$57,077	space	Based on 2017 estimates by BART staff
New/Expanded Surface Satellite Park-and-Ride Lot	$9,000	space	High range of standard construction costs
Enhanced Bus Service	$100	hour	National Transit Database (typical per-hour bus operating cost)
Transit Signal Priority - Buses	$650	bus	FHWA Operations Benefit/Cost Analysis Desk Reference
Transit Signal Priority - Intersection	$5,000	intersection	FHWA Operations Benefit/Cost Analysis Desk Reference
Real-Time Shuttle Arrival and Departure Information	$10,000	location	AC Transit
Smart Parking - Real-time data service	$42,000	bundle	CDM Smith memo on parking systems (Smarking)
Smart Parking - LPR Camera	$6,500	camera	CDM Smith memo on parking systems (Gentec)
Lighting	$25,000	light	One light per 25 spaces - in addition to existing/standard new lot
Surveillance Cameras	$6,500	camera	CCTV camera, installed on pole
Bike Parking	$2,900	bike locker	bike link elocker + installation
Wayfinding	$250	sign	Typical 18' x 24' aluminum street sign, installed on pole

Appendix D

Implementation Strategy Final Report

Tri-Valley Integrated Transit and Park-and-Ride Study

Implementation Strategy
Final Report

Prepared for
Alameda County Transportation Commission
In partnership with LAVTA, Cites of Dublin, Livermore and Pleasanton

By

DKS

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Oakland, CA 94612
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March 2, 2017

Table of Contents

1. Introduction

The Tri-Valley Integrated Transit and Park-and-Ride Study is an inter-jurisdictional and inter-agency study that addresses the high levels of congestion on freeways (I-680 and I-580), and excessive parking demand existing for BART parking through a comprehensive, integrated and effective park-and-ride and transit plan for Alameda County's portion of the Tri-Valley area. The stated goal of the study is "to identify potential changes and improvements in park-and-ride facilities (including multi-modal access to the facilities) and LAVTA service so as to reduce single-occupancy vehicle (SOV) trips and vehicle miles traveled (VMT) and to facilitate creating a coordinated, efficient, and sustainable transportation system in Alameda County's portion of the Tri-Valley area." To address the goal of the study, the study team has already: analyzed the existing park-and-ride facilities and transit services in the study area (Task 2); outlined the current and anticipated future travel patterns and modes of travel (Task 3); and identified a set of improvement measures that will support increased transit use and reduce SOV trips and VMT in the study area (Task 4).

The scope of this study was focused on improving the attractiveness of park-and-ride facilities in the study area and making better connections between those facilities and existing transit, rather than on a broad survey of options for improving overall access to transit throughout the Tri-Valley. A variety of stakeholders involved in this study are also developing their own plans and projects designed to enhance Tri-Valley transit services in general, including infrastructure investments, technology demonstrations, and partnerships with innovative transportation providers. Some of these plans and projects may be able to generate similar levels of transit ridership, SOV trip reductions, and VMT reductions as the options identified during Task 4, but a detailed comparison of the costs and benefits of those other initiatives is beyond the scope of this study. It is expected that any jurisdiction or agency considering implementation of these improvement measures will do more in depth analysis of the refined costs and likely benefits of all potential solutions available at that time, and that they will make a final determination of the relative merits of the alternatives guided by their adopted policies and local context.

Based on the list of potential improvement measures identified in Task 4, this report presents a high-level implementation strategy for delivering these specific improvements in both the short-term and the long-term. It provides a general summary of the main steps required to move one or more of the improvement measures forward, guided by the need to incorporate the wishes, priorities, and funding constraints of the many stakeholders involved in this project. . It considers general industry best practices in implementing similar improvement measures such as Intelligent Transportation System (ITS) and technology elements, along with the needed agency coordination and anticipated and relevant projects in the study area that would potentially influence the performance of these improvements. This report includes discussion of robust ITS elements, policy consideration and guidance, potential coordination needs, relevant funding opportunities, and marketing approach for potential next steps.

This document is organized into the following sections:

- **Summary of Improvement Measures** – This section provides a brief overview of the individual improvement measures that were identified in Task 4, and describes a set of parking management strategies and technologies that may be able to enhance the effectiveness of the park-and-ride lot infrastructure and shuttle service improvements. A memo describing a conceptual proposal for these parking management elements is included as Attachment A to this report.
- **Policy Areas To Be Addressed** – While each individual improvement measure will proceed relatively independently, there are elements that are common to most or all of the improvements, and coordination on certain policy matters could be beneficial for their overall success. These policy considerations are discussed together in a single section of the memo.
- **Project Delivery Process** – This section summarizes the steps required to deploy the individual improvement measure. It focuses primarily on recommended schedule coordination, the marketing of study area improvements, and supporting technology elements, rather than going into details of design and construction of the physical infrastructure, which are left to the discretion of each facility owner.
- **Potential Funding Options** – This section provides a high-level overview of the funding sources that may be available to support the specific improvement measures identified in Task 4 and recommends the best-fit sources that should be targeted by project sponsors. A more detailed listing of funding sources considered for this study is included in Attachment B to this report.
- **Next Steps: Approach for Moving Forward** -- The short-term and long-term improvement measures identified in earlier tasks of this study are expected to be delivered by following a relatively traditional Public Works process, with each facility owner responsible for the projects within its jurisdiction. At the same time, this study has revealed that there may be benefits to wider coordination that encompasses other future activities contemplated in the study area, not just the current set of identified improvements. This section suggests additional opportunities for enhancing coordination, in order to capture the synergies and to improve overall implementation in the years ahead, and it also provides a brief summary of the other transportation projects currently underway in the study area.

2. Summary of Improvement Measures

This section provides a brief overview of the individual improvement measures that were identified during the technical analysis conducted during Task 4, with separate sections for the improvements contemplated in the short-term (2020) and long-term (2030) time periods.[1] There is also a section describing a set of parking management strategies and technologies that may be able to enhance the effectiveness of the infrastructure and transit service improvements. A memo describing a conceptual proposal for these parking management elements is included as Attachment A to this report.

As noted in the Introduction, the technical analysis that was conducted for this study over the past year and a half was specifically focused on identifying measures to improve the integration between park-and-ride facilities and existing transit services in the study area. There are numerous other transportation initiatives currently underway in the Tri Valley that could influence the performance of the improvement measures described below, including pilots of new vehicle technologies and innovative partnerships with private sector transportation providers.[2] Most of these other efforts are expected to complement, rather than displace, the need for the improvement measures developed during this study, but such a determination is outside the scope of this study. Responsible jurisdictions and agencies will need to monitor and evaluate the evolving transportation context within the study area and conduct additional analysis that incorporates the other solutions that are available at the time they consider pursuing implementation of the improvement measures described below.

Short-Term

The Task 4 report identified multiple near-term improvements that could provide immediate benefits to park-and-ride lots and connections to transit in the Tri-Valley area. Within the next three to five years, the following improvements could be implemented in the study area:

- **Initiate high-frequency shuttle service during peak commute period from the Airway** lot to the Dublin/Pleasanton BART station as a pilot test of the service concept. The addition of a shuttle makes the Airway facility, with its capacity expansion potential and being close to the freeway, more attractive, and it also builds demand for future BART service extension in the study area.
- **Construct a new park-and-ride lot at Bernal Avenue** and make the lot available for carpooling, vanpooling, connecting shuttle access to the Pleasanton ACE station and the West Dublin/Pleasanton BART station, and private employer shuttles. The demand for private employer shuttle service from park-and-ride lots is growing rapidly and employers are interested in using more spaces in the study area. The City of Pleasanton is exploring options to build a park-and-lot at this location.

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[1] The years 2020 and 2030 were selected for the technical analysis in Task 4, and they represent the timeframes in which the identified improvements are expected to be justified by future transportation demand in the study area. Note that the active development of other transportation initiatives in the Tri-Valley area could impact the conclusions of this study, particularly in regards to the long-term improvements measures, which are slated for implementation more than ten years from now. Therefore, the timing and nature of specific improvement measures is subject to change.

[2] These efforts are summarized for reference at the end of Section 6.

- **Construct a new parking garage at the Dublin/Pleasanton BART station** adding 550 spaces to the existing capacity at the station. BART staff has already begun an alternatives analysis of options for increasing the effective capacity at this station, potentially including the opportunity to utilize available private parking near the Dublin/Pleasanton stations before investing in new parking.
- **Facilitate more use of satellite lot capacity for private employer shuttles through pricing policy.**
- **Construct facility enhancements at all park-and-ride lots in the study area.** The improvements will include improved lighting, security cameras, bicycle parking facilities, and wayfinding signage at Tassajara, Johnson/Stoneridge, Airway, Portola, and the new Bernal Ave facility.
- **Deploy ITS enhancements** to better integrate transit and park-and-ride facilities more closely together. This will include three key features:
    - ***Transit Signal Priority*** treatments at multiple intersections in the study area and the purchase of corresponding equipment with current technology for some transit and shuttle vehicles
    - ***Real-time vehicle arrival/departure information*** designed to provide park-and-ride users with arrival times for existing Wheels transit service between the Dublin/Pleasanton BART station and the Portola lot, as well as the peak period shuttle between BART and the Airway lot
    - ***Real-time occupancy information*** for park-and-ride lots, which can be coordinated with similar information available from BART parking facilities and shared with providers of trip-planning and traveler information software.

Long-Term

In addition to the short-term measures described above, the study team also identified a long-term set of improvement measures. The exact timing when each of these improvement measures would be needed will be determined based on the pace of growth in travel demand and congestion in the study area. In addition, BART is currently studying a potential extension to Livermore in the I-580 corridor east of the current Dublin/Pleasanton BART station. A draft environmental impact report for the BART extension is still being finalized at this time. In developing and analyzing different improvement measures in earlier tasks of this study, the study team identified improvements that would not adversely impact the BART-to-Livermore project, but would support establishing its ridership. As the BART projects is advanced through environmental review and design, the improvement measures described below would be reviewed and modified, in order to ensure they remain complementary to BART service, and vice versa. Depending on future transportation investments in the study area, the following improvements may be needed sometime within the next fifteen years:

- **Expand the satellite lot at Airway to 500 spaces** as the demand at the Dublin/Pleasanton BART garages and the Airway lot reach capacity, or more spaces, as needed, if and when BART to Livermore extension is implemented.
- **Add high-frequency peak period shuttle service from the Bernal lot to the West Dublin/Pleasanton BART station.**

- **Construct a new satellite lot at Greenville Road and provide high-frequency peak period shuttle service** to the nearest BART station as the demand approaches the limits of the Airway lot. The analysis in Task 4 suggests the Greenville lot should be sized to accommodate 500 parking spaces.
- **Facilitate use of excess capacity at satellite lots for private employer shuttles through pricing policy.**
- **Extend ITS elements to the additional facilities and services.** This would include more intersections and vehicles equipped with transit signal priority functionality and the addition of real-time vehicle arrival time information for new peak-period shuttles at Bernal, Greenville, and the West Dublin/Pleasanton BART station.

Parking Management

The improvement measures listed earlier in this section are designed to increase the overall capacity and utilization of transit and park-and-ride facilities in the study area. As park-and-ride use grows over time, it will become important to ensure there is sufficient capacity for transit riders at the subset of park-and-ride facilities that are most convenient to ACE, BART, LAVTA, and the public shuttles connecting to these systems. Other types of park-and-ride users, such as carpools and riders of private employer shuttles, should be directed to those park-and-ride lots in the study area that are less connected to public transit services, such as the Johnson or Portola facilities.

One mechanism to achieve this outcome would be to initiate parking management strategies and pricing policies that incentivize different types of travelers to use the most appropriate facilities and services. The study team investigated current best practices for parking management and pricing, and then developed a conceptual proposal for a coordinated system of technology components, management techniques, and policy guidelines that could be implemented for some or all of the park-and-ride facilities in the study area, in order to maximize facility utilization and ensure sufficient parking for patrons who wish to board connecting shuttle services. A memo describing the details of the parking management strategies and technology is provided in Attachment A, and a high-level discussion of the relevant policy and coordination topics is provided in Section 3 of this document. As noted in Attachment A, it is expected that an effective parking management approach would need to contain most or all of the following components:

- **Modest fees at some or all park-and-ride facilities.** Parking fees would be used to help steer prospective users towards different facilities. Revenue generated by the parking fee could be used to pay for real-time customer information services and also help off-set the operating cost of the high-frequency peak period shuttle service being proposed for Airway (short-term) and Bernal and Greenville (both long-term).
- **Coordinated pricing policies.** Although pricing policy would be set at the discretion of each facility owner, it will be more effective if prices are set in a systematic fashion, taking into account the desired user group(s) at each facility within the study area. Coordination across jurisdictions and agencies would help ensure that pricing of different facilities sends a consistent message to all potential patrons.

- **Mobile payment options** to allow for more cost-effective collection and processing of fee payments. Some parking payment systems that are available today can be integrated with transit fare payment systems, offering the possibility of discounts or rebates that further incentivize travelers.
- **Remote enforcement using cameras and targeted patrols.** Instead of costly on-site staffing, license plate reader (LPR) cameras can be used to identify whether appropriate payments have been received for all vehicles parked in each facility. A single vehicle or a third party parking management service, shared across cooperating jurisdictions and agencies, could be dispatched only when and where necessary to issue citations.

These parking management components could also be connected together with the other ITS enhancements described previously, such as real-time information on transit and shuttle services and parking lot occupancy, so that travelers in the study area have a more comprehensive picture of the different transportation options available in real time.

3. Policy Areas To Be Addressed

While each individual improvement measure can be pursued relatively independently, there are elements that are common to most or all of the improvements, and coordination on certain policy matters could be beneficial for their overall success. These include shuttle services planning, potential cost-sharing arrangements, parking management and pricing, and advanced customer information including application of innovative technologies. These policy considerations are discussed together in this section of the memo to facilitate future conversations between project partners.

Planning for Shuttle Services

The analysis conducted in Task 4 provided a preliminary plan for the frequency and span of service that would be needed at each park-and-ride lot where a shuttle is anticipated. For example, the study analysis showed that three vehicles are needed to achieve the desired frequency of shuttle service every 15 minutes during morning and afternoon peak periods for the Airway lot. Transit riders needing midday access would be responsible for making their own arrangements to get back to the lot from BART, but could potentially take advantage of existing LAVTA bus service, guaranteed ride home services (as currently managed by Alameda CTC), or alternative arrangements, which could also include an option similar to LAVTA's current first-/last-mile demonstration project, called Go Dublin, if it becomes successful. The feasibility of the shuttle assumptions from Task 4 should be validated using a more detailed service planning approach that is coordinated with the existing operations of the three public transit operators: LAVTA, ACE, and BART.

In addition to clarifying the minimum shuttle service plan for park-and-ride users, stakeholder feedback over the course of the study suggests that opportunities may exist to improve the overall cost-effectiveness of the shuttle service by cross-utilizing shuttle vehicles for other peak period trips in the study area. For example, the leg returning from BART back to Airway in the morning would typically be empty, but the shuttle could be used to bring BART passengers to local area employers such as Hacienda Business Park or the outlet mall in Livermore. While this travel would not relieve highway congestion in the primary commute direction, it may attract financial contributions that make the entire operation more feasible overall. In addition, such an approach could make BART a more attractive option for Tri-Valley workers who live in other BART accessible parts of the region, helping to fill under-utilized BART cars in the non-dominant commute direction. Although this approach could improve overall transit access in the study area, it would likely increase total trip-time and require more than three vehicles to operate. Still, these sorts of cross-utilization opportunities for first- and last-mile routings should be explored at the outset of shuttle implementation, in case minor adjustments to the operating plan would greatly increase the overall success of shuttle operations.

Once the details of the shuttle service plan are finalized, the responsible jurisdictions and agencies (those who will be carrying the shuttle service projects forward) will need to identify how the service would be operated. There are several options that can be considered to address the shuttle service. Being the Tri-Valley's bus operator, LAVTA could be one of the options for operating the new peak period shuttle service from the Airway lot. However, LAVTA is likely to face resource limitations for the initial pilot period, due to near-term fleet constraints. Another potential option would be to have the responsible jurisdiction or agency procure the service directly from a traditional contract operator, such as MV Transportation or First Transit. Alternatively, any of the jurisdictions or agencies could partner with either newer TNC firms that provide vanpool-style services, like Chariot and Bridj, or one of the firms that operates private employer shuttles, such as Bauer, Loop, WeDriveU, or Compass Transportation. Each of these operational models will have different trade-offs in terms of the labor work rules that will govern shuttle scheduling, such as minimum shift guarantees, as well as the operating and capital costs of the available vehicles in the operator's fleet. These factors could increase or decrease the final operating costs from the preliminary estimate developed in Task 4. Regardless of which operational model is selected, the shuttle service will need to be ADA-accessible.

It should be noted that similar activities would be needed to refine the service plan and then select an operating model for the shuttles at Bernal and Greenville that are indicated for long-term implementation. There is no requirement that all three of the shuttles function in exactly the same manner, and there are likely to be different operational models available when other locations are added to the initial pilot. For example, the shuttle from Greenville could potentially be coordinated with the San Joaquin Regional Transit District (RTD), which already operates other transit service in the eastern I-580 corridor.

In addition to confirming the approach for operating the shuttle itself, coordination with BART will be needed to ensure that the core system can absorb new riders that are delivered by shuttles or who park in the new BART garage. The car design for BART's Fleet of the Future allows each car to carry more riders, and the recently-approved bond measure will fund upgraded signaling and control systems in order to increase track capacity. However, the full implementation of these BART projects is still some years off. In the meantime, the Metropolitan Transportation Commission is currently completing its Core Capacity study, and BART continues to evolve its Metro Vision concept. As these planning efforts reach their conclusions, they may yield solutions that allow BART to accommodate more passengers in the study area in the short-term without degrading service for other system users.

Potential Cost-Sharing Arrangements

Although external funding support can likely be obtained for many of the improvement measures contemplated in this study, these investments are designed to integrate transit and park-and-ride more closely together. Most external funding sources require at least a portion of project costs to be paid or contributed by the local project sponsors (the "local match" to regional, state, and federal grants). Coordinating local match funding arrangements between project sponsors and related stakeholders ahead of time sends a strong signal to other funding partners about the importance of the projects to the Tri-Valley, and it could help to achieve a full funding agreement sooner and deliver these improvement measures more quickly.

The park-and-ride facilities examined in this study are used by many different types of travelers, including individuals wishing to access transit services, individual commuters looking for a meeting place for their private carpools, and employees who want to ride on their employer's private shuttle. Based on the benefits that private employers receive from having a central location for pick-ups and drop-offs, as well as the wear-and-tear that some heavier vehicles impose on the facilities, it may be reasonable to negotiate a financial contribution towards the costs of upgrading and maintaining the park-and-ride facilities from the employers that operate the private shuttles, where this has not already been done already. Capital grants are typically easier to obtain than operating funding, so it is recommended that jurisdictions focus their negotiations on recovering the on-going costs of facility maintenance and upkeep. Parking fees can be used to off-set a portion of these costs, but full cost-recovery is unlikely in the current pricing environment in the study area.

As discussed further below, jurisdictions that charge a fee at their park-and-ride facilities may also wish to negotiate discounted pricing or rebates for those who transfer to fixed route bus transit or shuttle services to rail transit stations. Jurisdictions and agencies should collaborate both on setting the level of discount that is advertised to the public as well as how they will share costs and revenues in support of available transit services and shuttle options.

Parking Management and Pricing Coordination

Technical analysis conducted for this study (see Attachment A) showed that a coordinated approach to managing and pricing all of the park-and-ride facilities in the Tri-Valley area could greatly improve the utilization of shuttles and transit services, thereby improving the cost-effectiveness of the contemplated investments. It is recommended that the jurisdictions and agencies in the Tri-Valley area consider each of the topics below and work towards a shared consensus on how to proceed.

Leveraging parking pricing to manage overall parking demand

Although parking fees can help offset facility and shuttle costs, the primary motivation should be appropriate management of demand for parking at each facility so that they are attractive for the users while maximizing facility utilization. Specifically, it is recommended that each facility owner impose a modest charge as a default, but then make the parking free to certain targeted user groups in order to encourage demand to spread out across facilities of different types. For example, some facilities are directly adjacent to rail transit service while others are served by bus transit and still others function primarily as pooling locations for solo commuters and private employer shuttles. Discounts and rebates offered only for those users who board a transit service would incentivize transit-bound users, with the existence of the fee for non-transit users discouraging parking by travelers who do not intend to utilize the transit being provided at the facility. Travelers who do not require a transit connection would then be more likely to choose a different facility in the study area that has a lower charge. Concentrating carpoolers and private employer shuttles at specific locations also facilitates more effective carpool matching and supports more focused operations for employer shuttles. This pricing approach could be particularly beneficial as park-and-ride usage begins to approach the capacity of a given facility, for example at Tassajara (where the majority of users ride employer shuttles) or at the ACE garage at the Pleasanton station (where a number of carpoolers and employer shuttle riders are currently parking without boarding an ACE train).

Generally speaking, parking fees should be relatively low, so as not to discourage use of the park-and-ride lots. Given the presence of priced parking at BART stations in the study area, any facilities that are geared towards BART users (accessing the station via connecting shuttle) should have a price that is scaled down from the price for parking at the BART station to reflect the relative convenience of being able to park directly at the station versus off-site. BART policy currently caps the price of daily parking at $3 per day, though this policy may change in the future as more and more stations have seen full occupancy with a price at or near the cap. Monthly reserved parking rates at BART vary by station, with prices in the Tri-Valley area working out to about $5 per day.[3] The higher cost per day charged to patrons with a monthly permit reflects the added convenience of having a space waiting for the user (until 10:00 AM). In the event that parking utilization at the park-and-ride lots were to increases significantly in the future, then it may be reasonable to consider a reservation-based system at those facilities as well, with somewhat higher prices to reflect the benefit of having a guaranteed space, mirroring the relative pricing used by BART.

In addition to the relative price between BART and the park-and-rides, the construction of a second garage at the Dublin/Pleasanton BART station offers the opportunity to BART for more innovative pricing practices that could improve utilization of commuter parking in the study area and provide insights that could be applied elsewhere in the BART system. For example, BART may want to explore higher pricing in the peak periods combined with off-peak discounts, in order to protect enough parking spaces to ensure that travelers can access the station by car at other times of day. BART could also consider demand-based pricing or other forms of experimentation that provide insight into customers' price sensitivity and that encourage use of BART when there is excess capacity. If such pricing were found to be successful, the approach for setting a reasonable parking price at park-and-ride lots in the study area should also be re-visited.

Develop policies for setting parking price at each facility

Based on the selected parking pricing approach, each responsible jurisdiction and agency should establish mechanisms for future price adjustments, preferably coordinated with other park-and-ride facilities in the study area. A formal policy helps jurisdictions and agencies improve operational management of each facility, avoid budget shortfalls, and demonstrate fiscal responsibility to their stakeholders. A pricing policy should call for regularly scheduled status reviews and be structured so that the price can be modified in response to changes in:

- Parking demand and utilization levels at each facility
- Availability and frequency of transit or connecting shuttle service at the facility
- Price of parking at BART stations and peer parking facilities in the study area
- Desired targeting towards different user type(s)

Identify options for parking payment at each facility

Recent advances in mobile payments offer new options for a more seamless and convenient way to pay parking charges, and to integrate those payments with transit ticketing. This can support the parking pricing policy mentioned above, and seamless payments are also being considered as a part of the next generation of Clipper. If a discount for transit users is part of the parking pricing policy, each jurisdiction

[3] Assumes BART patron uses their monthly reserved space an average of 21 days per month.

will need to coordinate with the connecting transit operators to determine cost-sharing of the expenses for accepting transit payments through the integrated payment provider.

Responsible jurisdictions and agencies will also need to decide whether their park-and-ride lots need to provide a payment option for travelers who do not use credit or debit cards and those without smart-phone capabilities. A custom multi-space meter might offer the right combination of features and payment options that could integrate with the mobile payments system, but jurisdictions and agencies may prefer to use whatever hardware and software they already deploy elsewhere in their community. Lastly, responsible jurisdictions and agencies should also consider whether a joint procurement across multiple park-and-ride facilities in the study area would maximize economies of scale and obtain better terms with payment processers.

Identify approach for parking enforcement at each facility

Wherever parking fees are in place, the responsible jurisdiction or agency will need to determine how to identify and fine parking violators, i.e., people who park in the facility without paying the appropriate fee. This can occur with a combination of cameras, license plate recognition (LPR) devices, and a roving vehicle to place parking tickets on offending vehicles. If a discount for transit users is in place, the system must also have a mechanism for coordinating with transit payments.

The expense for some of these systems may be significant for smaller facilities, and may not be recovered from parking fees alone. Responsible jurisdictions and agencies should consider whether a joint procurement across multiple facilities in the study area would maximize economies of scale and reduce unit costs of enforcement.

Advanced Customer Information Using Current Technology

Much of the work in Task 4 focused on identifying the physical locations that would benefit most from added capacity, either at the park-and-ride lots themselves, or in connecting shuttle service that makes the park-and-ride option more attractive in general. The kinds of pricing policies discussed earlier in this document can help to efficiently manage customer demand towards specific facilities that best meet their needs, but this is not the only way to inform and influence customers. There are multiple options for using innovative technology to provide customers added information and incentive to use park-and-ride facilities. This section discusses policy considerations when providing prospective users with real-time information on which facilities have parking availability, so that customers have enough information to reliably plan to use the improved park-and-rides. As with other items discussed elsewhere in Section 3, a coordinated approach to selecting and implementing these technology elements could provide economies of scale and improved performance outcomes in the study area. The responsible jurisdictions and agencies should consider the topics below, and they may benefit from working towards a shared consensus on how to proceed.

Identify options for providing information for parking occupancy at each facility and for shuttle arrival/departure

To increase the use of park-and-ride lots, responsible jurisdictions and agencies may want to publicize information on the number of empty spaces available at each facility and the arrival, departure, or expected travel time for connecting shuttle service to and from each facility. This will help customers know more about their travel options, and be more confident in choosing a park-and-ride facility for their journey.

Parking availability can either be based on historical usage patterns, or tracked in real-time based on the number of vehicles that have entered and exited the facility. The technologies recommended above for payment enforcement can also be used to track facility utilization, either by gathering the historical record of facility usage, or by actively monitoring the count of empty spaces at any given time. Once the availability information has been collected, it can be communicated to prospective customers by each facility owner separately, but maintaining a custom app, webpage, or text alerts can be costly and cumbersome for individual jurisdictions. There may be benefits to choosing a third party provider to gather up and disseminate the data, because third party vendors can be more responsive to evolving technology requirements and data specifications. Responsible jurisdictions and agencies should consider whether a joint procurement across multiple facilities in the study area would maximize economies of scale and further reduce unit costs of data management.

Monitor emerging options for disseminating real-time availability information

In the recent past, transportation agencies have pursued customer information via full-scale hosted data services and dedicated web/mobile interfaces, but these solutions can require significant staff management time, and technology often changes faster than the agency is able to keep up with. The more common approach these days is to collect data, organize it, and make it available through an open-source interface, such as an API feed, that allows others to access the raw data and then layer on their own interface and functionality. The landscape of transportation-related technology solutions continues to evolve quite rapidly, so responsible jurisdictions and agencies should monitor the status of emerging technologies in order to determine whether any of them deserve further exploration for implementation in the Tri-Valley area, either directly by project sponsors, or in concert with a third party integrator.

One area that has particular relevance for the Tri-Valley is the use of connected infrastructure for communicating real-time availability information at park-and-ride lots to commuters who are still planning their daily travel. Because of the Express Lane on I-580, there is a significant amount of variable signage already installed in the study area, and it would be difficult to add parking-related signage in the freeway right-of-way. However, future developments in the area of connected vehicles and mobile apps could offer opportunities to disseminate availability information to specific customers in much more targeted ways. In-vehicle technology for trip planning is becoming more and more sophisticated, with GPS systems now routinely routing drivers based on actual travel times, instead of speed limits or historical data. The route navigation in Google Maps now offers you the option to search for places to stop for coffee or gasoline along the route between your primary origin and destination. These two concepts may converge into a more flexible form of trip planning where GPS services incorporate real-time park-and-ride availability and transit arrival time data and re-route drivers according to pre-set preferences for park-and-ride amenities and available transit services, as specified by the user. Similarly, there are now a large number of transportation planning integrator apps that synthesize data from different types of transportation providers, allowing users to quickly compare differences between modes based on travel time, price, and other factors. Responsible jurisdictions may want to explore providing an open API interface to their real-time availability data, so that app developers can integrate this information into existing and future travel planning tools, and offer customers the park-and-ride option side by side with other travel choices.

Establish protocols for data sharing and privacy protection

Real-time information services generate much more data than traditional transportation operations, which can be a valuable resource for app developers, but in some cases these data-sets contain personally identifiable information. Responsible jurisdictions and agencies should consider the sources and uses of the data they are collecting and making available to others, to ensure that data are both easily accessible and sufficiently protected, as appropriate. The most significant steps include:

- **Identify and categorize potential data sources generated for each facility.** Potential data sets related to park-and-ride lots and shuttles could include the number of parked cars, the number of passengers on each shuttle bus, and the time of day when each lot fills to capacity. Much of this data can be collected anonymously, for example by using in-ground sensors to detect vehicles, video technologies to count the number of entering/existing vehicles at a lot, or automatic passenger counters (APCs) on buses. Alternatively, data systems could track usage by recording each transaction using individual license plates or farecard ID numbers. The choice of technology often dictates the available capabilities, and it will be up to individual jurisdictions and agencies to decide on the appropriate trade-offs between accuracy, privacy, and complexity.
- **Develop appropriate policies for privacy and data retention.** Privacy policies should provide prospective users with notification on how their personal information is collected, used, stored, and shared. If data sets will be provided to any third parties for app development, policies and procedures should be implemented to ensure that personal information is only shared if and when the customer has opted-in to such disclosure. If the customer information is used to process any financial transactions, it likely must be retained for a given period of time in order to allow users to challenge fraudulent billings. Local expertise related to Clipper and Fastrak could be especially helpful in understanding the current regulatory environment on these matters, as well as baseline customer expectations in terms of privacy practices.
- **Explore potential data partnerships.** The data collected in the park-and-ride lots and shuttle vehicles in the Tri-Valley area could be especially useful to other government agencies and private actors. It may be worthwhile to pro-actively seek out data partnerships, to determine whether such coordination benefits either customers (by providing a more seamless travel experience) or the project sponsors (by improving operations management or funding prospects). For example, MTC is transitioning its Regional Rideshare Program from direct incentives to a system mediated by third party apps that match rides and track benefits. It may be the case that park-and-ride owners in the Tri-Valley area can plug into the data interfaces these systems offer, either sending or receiving data that can be used in future planning and operations.

Other Technology Innovations

This study has identified multiple opportunities to utilize innovative technologies to improve the quality of the park-and-ride experience at facilities throughout the Tri-Valley area. Real-time information and optional coordination on parking management could greatly improve facility utilization and the return on investment. In addition to these well-defined elements, jurisdictions and agencies in the Tri-Valley may want to explore features that could make park-and-rides even more attractive to area travelers.

Consider expanding one or more park-and-ride lots to full "Mobility Hubs"

Across the country, transportation planners have become increasingly interested in making non-auto travel more convenient for people by facilitating the convergence of many different transportation technologies in the same physical space, often referred to as "Mobility Hubs." Mobility Hubs are centrally located facilities that serve as central meeting and exchange points for multiple types of transportation services, typically at a minimum including most or all of the following features:

- Waiting and boarding areas for public transit service, including rail transit stations and bus stops
- Designated white curb space for passenger pickup and drop offs, with sufficient space for taxis, ride share services, planned carpools, and dynamic ridesharing;
- Bike share dock stations;
- Designated parking spots for car share and scooter-share vehicles.

These facilities often incorporate expanded traveler information resources and other customer amenities, in order to facilitate seamless connections and provide more attractive areas to wait if necessary. If traveler density is high enough at a particular mobility hub, the responsible jurisdiction and agencies may be able to attract services that provide alternative revenue generation, such as a coffee kiosk, newsstand, bicycle repair services, or pickup/dropoff for shoe repair and dry cleaning. Even if a significant partnership with multiple transportation providers is not immediately achievable, responsible jurisdictions and agencies could evaluate the potential for establishing car-share and bike-share at one or more park-and-ride lots.

Identify locations that might benefit from smart bus shelter technology

Another element of connected infrastructure that may be applicable to park-and-ride facilities is the use of newer "Smart Bus Shelters" that go well beyond the basic real-time vehicle arrival information common in the Bay Area today. Smart bus shelters utilize interactive kiosks and sensors to provide communication between the transit passenger, the transit operator, *and* the transit vehicle, in order to enhance customer information and operations planning.

For example, in addition to traditional arrival times, buses could communicate with the shelters to provide waiting passengers with information on crowding levels and whether there are available slots in the bike rack. Sensors at the bus stop could estimate the number of people waiting and signal the bus to make sure it does not accidentally pass up the customers; it could also send alerts to the transit operator and field supervisors if one or more stops are getting overloaded so that operations can be adjusted mid-route. Communication technology at the stop could also be used for pre-payment of fares, which would reduce dwell times and increase overall travel speed.

To make the wait time for transit more productive, smart bus shelters could include USB charging and WiFi hotspots. Some smart bus stops can adjust lighting depending on the time of day, weather conditions, and whether or not any customers are waiting. Digital screens could offer patrons news, games, surveys, maps, neighborhood information, and higher value advertising opportunities for revenue generation. Passengers could receive incentives to indicate how far in advance they typically arrive at the stop and their true origin/destination data; having stop-level and route-specific observed data on travel behavior and preferences can helps the transit operator improve service planning in the future.

4. Project Delivery Process

This section summarizes the steps required to deploy the individual improvement measures. It focuses primarily on recommended schedule coordination and the marketing of study area improvements, while the details of design and construction of the physical infrastructure are left to the discretion of each facility owner for addressing at the next stage of the project development. Also, it is important to continuously coordinate with the on-going and planned transportation improvements in the Tri-Valley area that would likely require some level of modifications to the proposed improvement measures as and when they are implemented. A list of on-going projects, including several first/last-mile pilots and the BART to Livermore project is presented at the end of Section 6.

Development of Implementation Schedule

Many of the improvement measures identified in Task 4 consist of the types of traditional infrastructure that are typically implemented through a well-established process of environmental review, preliminary engineering, design, construction, and operation. Thinking about each improvement in isolation, the responsible jurisdictions and agencies could easily implement the improvements that are within their purview through their existing Public Works channels on whatever timescale is consistent with relative priorities in their community.

However, as described in Section 3, there are several opportunities to pursue coordinated management and innovative technology in the study area. Successful implementation of these innovative aspects will require coordination between jurisdictions and agencies and careful schedule alignment in order to achieve the associated cost savings. In addition, it may be helpful to coordinate timing of project delivery to simplify marketing efforts about the improvements (discussed further in the next section) to commuters in the study area. To the extent that the responsible jurisdictions and agencies in the Tri-Valley wish to pursue a coordinated approach, they should follow the steps described below in developing a synchronized implementation schedule:

- Identify the improvement measures that are dependent on each other in order to deliver the full operational concept in the study area. For example, the Transit Signal Priority should be in place prior to launching the shuttle service, so that customers experience the shortest possible travel time between the park-and-ride lot and the BART station. This means that jurisdictions must agree to allow transit priority at all key intersections along the shuttle route, potentially involving multiple jurisdictions for a single shuttle service. Similarly, the ITS pieces must be put in place to collect real-time information on parking occupancy before that information can be provided to the commuters that will rely on it to decide whether to park and use the shuttle service.
- Create an activity breakdown of the development process (e.g., design, engineering, vehicle acquisition, service design, marketing/outreach, etc.), and then identify which activities can occur in parallel to help shorten overall timeline.
- Develop an unconstrained estimate of elapsed time for each activity and total overall elapsed time.

- Identify milestones or potential risk factors that could extend timeline beyond the unconstrained estimate (e.g., grant / funding cycles, service change calendars, known environmental clearance issues, etc.).
- Identify any dependencies or triggers between the various improvements in terms of planning or operational concept. For example, if one or more park-and-ride lots unexpectedly fill to capacity right away after completion of the short-term improvement measures, it could justify moving ahead with any of the long-term improvement measures earlier than initially envisioned.
- Compare the timelines developed above in relationship to County-wide and regional planning processes, and adjust project timing where necessary to meet grant deadlines, construction seasons, and other constraints.

Coordination with on-going and planned transportation projects in the Tri-Valley

One area that will need to be closely monitored is the evolving timing of efforts to extend BART in the I-580 corridor. A Draft EIR on the extension to Isabel is expected in early 2017, but it may be the case that a separate Federal-level EIS is also required for the BART project. In addition, the process of assembling a large funding package is complex and difficult to predict, so construction start and end dates could vary from current proposed timelines. If travel demand continues to increase at a rapid pace, the option to expand the Airway park-and-ride offers a relatively low-cost interim strategy to increase capacity in the I-580 corridor while BART continues its planning process. The responsible jurisdictions and agencies should monitor developments on the BART project closely, to ensure that long-term investments in park-and-ride facilities support the final alternative selected for the BART project, and vice versa.

Plan for Marketing of Improvements

In addition to the primary efforts to design, build, and operate improved park-and-ride facilities and shuttle bus services, project sponsors must be prepared to communicate the value of these improvements to potential customers, in order to encourage them to make changes to their daily travel routines. Periodic marketing efforts after the initial launch of improvements will also be needed to reach out to residents and workers who may be looking for new travel options because they are new to the area, change their commute patterns, or adjust their schedules. This section briefly describes suggested steps in developing and deploying a plan to market the improvements.

Given the scale and separate implementation of the various improvement measures currently being analyzed in this study, it is not envisioned that a full branding effort would be cost-effective. However, if the responsible jurisdictions and agencies were to engage in a heavily coordinated implementation of the infrastructure improvements and service enhancements, a coordinated marketing effort would be appropriate. Whether pursued separately or combined into a single effort, the marketing plan should include the elements described below.

Static Customer Information

- Create fact sheets about new facilities, facility enhancements, new shuttle services, and any service changes to existing shuttles
- If applicable, develop/obtain user guide for any third-party services such as real-time occupancy information, real-time arrival information, and/or mobile parking payment
- Identify appropriate point(s) of contact for patrons or members of the press seeking more information
- Select location(s) to host static information, including hard-copy and web-based options, with ADA-accessible versions, as appropriate
- Deploy static information, potentially in conjunction with Marketing Campaigns described below

Short-Term Marketing Campaigns

- Review Market Research – Scan available public opinion and user surveys to identify different customer segments to focus on
- Select Target Markets – Establish specific outreach objectives, such as increasing usage of a particular facility or attracting one or more specific user-types.
- Define Specific Campaigns – Develop key messages, themes, and graphics, and identify the appropriate communication methods and materials for reaching target markets

Options for Continuous Outreach

- Establish list of recurring newsletters in the community that will agree to placement of periodic reminders about Tri-Valley travel information
- Identify community events where advertising and/or in-person presence will be most effective (e.g., street festivals, farmer's markets, parades/fairs, Bike To Work Day)
- Coordinate with LAVTA's SmartTrips program, where applicable – The SmartTrips delivers a customized information packet to prospective customers based on their individual request for more information about travel options in their community. Targeted customers receive a mail-order form where they can choose from a menu of options that interest them. LAVTA intends to launch SmartTrips in early 2017, using a TPI grant from MTC. Operators of park-and-ride facilities and shuttle services in the LAVTA service area could ask to be included in the menu of options, either now, or in any future iteration of the program in existence after the short-term improvements are ready.
- Consider whether facility is significant enough to have its own on-going internet presence, separate from other communications strategy of project sponsor. This could include newsletters, blogs, and/or social media accounts focused exclusively on park-and-ride information.

Technology-Enabled Marketing[4]

- The capabilities of in-vehicle and smart-phone technologies now include location-based alerts and real-time re-routing based on current travel conditions. Project sponsors could consider

[4] Marketing here means alerting and informing travelers in real time of travel or park-and-ride options that they otherwise would not have known and would improve their travel decision making.

collaborating with developers of wayfinding software and travel-planning apps, in order to ensure that information about their park-and-ride facilities is accurate and also to identify emerging opportunities to disseminate availability information. This effort can be challenging in the fast-paced world of technology, so this type of marketing activity may be most efficiently pursued where project sponsors are already working with a third-party provider for some or all of their parking management functionality.

5. Potential Funding Options

This section provides a high-level overview of the funding sources that may be available to support the specific improvement measures identified in Task 4 and describes the best-fit sources that should be targeted by project sponsors. A more detailed listing of funding sources considered for this study is included in Attachment B to this report.

Overall Funding Needs

The analysis conducted in Task 4 included the preparation of a detailed initial cost-estimate for all of the short-term and long-term improvement measures.. These cost estimates have been refined based on stakeholder feedback, and extended to include placeholder costs for the parking management elements introduced in Section 2 of this memo. The capital costs associated with each fixed improvement measure and the operating costs associated with connecting shuttles and information services are portrayed in Figure 1. Because of the nature of the improvement measures analyzed in this study, different improvement measures could qualify for a wide variety of funding sources, depending on the permissible uses for each source. The remainder of this section summarized some common ways to categorize sources and uses of transportation funding to provide context on funding prospects.

Figure 1 – Preliminary Cost Estimate (2016 dollars)

Improvement Measure	Total Capital Cost	Annual Operating Cost
SHORT-TERM		
Johnson/Stoneridge – Enhancements *[1]*	$57,500	
Portola – Enhancements *[1]*	$57,500	
Tassajara – Enhancements *[1]*	$110,000	
Airway – Enhancements *[1]*	$110,000	
Airway – Peak Period Shuttle to BART *[2]*	TBD	$420,750
Bernal – New PNR lot *[3]*	$1,910,000	
Garage at Dublin/Pleasanton BART *[4]*	$37,100,000	
Transit Signal Priority *[5]*	$42,600	
Real-Time Vehicle Arrival Information *[6]*	$30,000	
Real-Time Data Service *[7]*	--	$30,000 to $42,000
LONG-TERM		
Airway – Expansion	$3,123,000	
Bernal – Peak Period Shuttle to BART *[2]*	TBD	$272,000
Greenville – New PNR lot *[3]*	$4,610,000	
Greenville – Peak Period Shuttle to BART *[2]*	TBD	$578,000
Transit Signal Priority *[5]*	$55,200	
Real-Time Vehicle Arrival Information *[6]*	$30,000	
SMART PARKING		
Mobile Payment App	--	$75,000 + transaction costs
LPR Equipment and Installation	$33,000	--
LPR Vehicle	$25,000	--
LPR Cameras *[8]*	$91,000	--
Parking Management Integrator	--	$40,000

Source: DKS Associates [05-Jan-2017] and CDM-Smith [01-Feb-2017]. Footnotes appear on the next page.

(Footnotes to Figure 1, continued from previous page)

[1] Enhancements at each facility include: lighting, security cameras, wayfinding signage, and bicycle parking.

[2] Capital costs for vehicle acquisition are unknown at this time, because service delivery method has not yet been confirmed. Operating cost estimate is based on fully-allocated operating cost for current LAVTA service, which incorporates capital renewal of fleet and maintenance assets.

[3] Capital costs for new PNR lots at Bernal and Greenville include all PNR enhancements (lighting, bicycle parking, etc.) but do not include static cameras for parking enforcement, which are included in a separate line item.

[4] Per 2017 cost estimate provided by BART.

[5] Line items for Transit Signal Priority include different quantities in the Short-Term (4 buses, 8 intersections) and Long-Term (net increase of 8 buses, 10 intersections).

[6] Line items for real-time vehicle arrival information include different facilities in the Short-Term (Airway lot, Portola lot, and Dublin/Pleasanton BART) and Long-Term (Bernal lot, West Dublin/Pleasanton BART, and Greenville lot).

[7] Real-time data service is for hosting park-and-ride occupancy information. Assumes security cameras purchased as part of standard enhancements are capable of being used to determine occupancy status.

[8] Capital cost includes static cameras at all PNRs, including new short-term (Bernal) and long-term (Greenville) locations. Cost could be reduced or eliminated if security cameras purchased as part of standard PNR enhancements can provide desired enforcement functionality.

[9] In addition to the capital costs shown above, it is expected that the improvement measures involving enhancements to fixed infrastructure will incur incremental operating costs each year on the order of 1-2% of the capital cost. The exact amounts will vary across the different jurisdictions and agencies, depending on the way in which operations & maintenance are currently being delivered today and extent of similar activities already undertaken by the organization. Project sponsors will need to evaluate their specific costs as part of the implementation of each improvement measure.

Roadways vs. Transit

Many of the most stable sources of transportation funding are divided into separate allocations for each mode of travel (car, rail transit, bus transit, pedestrian/bicycle, etc.). The permissible uses for these pools of funds are typically restricted to the mode in question, so project sponsors should be sure to demonstrate how their project is aligned with the modal focus of the funding program. For example, if a park-and-ride is intended to support the formation of private carpools and vanpools, it would likely qualify for roadway-based funding, whereas a park-and-ride that offers commuters a convenient opportunity to transfer to bus or rail might be considered a transit-supportive investment. Using this mode-based categorization, funding eligibility for the different improvement measures can be grouped as follows:

- Roadway:
  - Construction & operation of park-and-ride facilities targeted at carpools
  - Facility enhancements at auto-oriented park-and-ride lots, such as lighting, security cameras, and wayfinding
  - Transit Signal Priority (e.g., upgraded signal control hardware, arterial re-timing)
  - Real-time data on parking occupancy
  - Parking payment & enforcement
- Transit:
  - Construction & operation of park-and-ride facilities that provide satellite parking for fixed route transit
  - Facility enhancements at transit-oriented park-and-ride lots, such as lighting, security cameras, and wayfinding

- Capital and operating costs for park-and-ride shuttles that provide access to transit stations
- Parking garage at BART
- Transit Signal Priority (e.g., transit vehicle sensors, on-board equipment)
- Equipment & data service for real-time vehicle arrival/departure information

Capital vs. Operating

Similar to the mode-based grouping described previously, a number of funding sources are also restricted in terms of the phase of the project that is supported. Some sources will only provide funds for initial capital costs of design and construction, while other sources may also be used to support on-going operating & maintenance costs. In certain cases, the permitted uses for a given source depend on the size of the jurisdiction or agency receiving the funding, with smaller organizations typically granted more flexibility in allowable uses. Using this phase-based categorization, funding eligibility for the different improvement measures can be grouped as follows:

- Capital Costs:
  - Design and construction of new/expanded surface parking and garages
  - Design and construction of park-and-ride enhancements (lighting, wayfinding, security)
  - Acquisition of transit vehicles for peak period connecting shuttle service
  - Acquisition of ITS equipment for TSP, real-time vehicle arrival information, and real-time parking occupancy information
  - Acquisition of equipment for parking payment, monitoring, and enforcement
- Operating Costs:
  - Routine maintenance for parking facilities (paving, striping, sidewalk repairs)
  - Operating costs for peak period connecting shuttle service (labor, fuel, insurance, spare parts)
  - Recurring charges associated with ITS elements (hosted data services, performance-based vendor agreements)
  - Collection fees associated with transit fare products and parking payments

Traditional Infrastructure vs. Innovative Technology

The last funding grouping of relevance in this study relates to whether or not improvement measures fit within a traditional use of each funding source. Departures from historical practice may require more effort on the part of project sponsors before funding can be secured. For example, sponsors may need a special analysis to provide adequate justification for funding eligibility related to air quality benefits, or they might need to spend time tailoring the project to qualify for various "pilot" and "demonstration" programs that are typically one-time allocations, rather than structured programs that providing on-going funding over the long-term. Focusing on the continuum between traditional and innovative, funding eligibility for the different improvement measures can be grouped as follows:

- Traditional investments:
  - Parking facilities, including bicycle parking
  - Shuttle vehicle acquisition

    - Shuttle operations
    - Lighting, security, and wayfinding
- Enhancements that are now relatively common:
    - Transit Signal Priority
    - Transit vehicle arrival information
- Innovative technology applications:
    - Dissemination of real-time occupancy data
    - Web-based / mobile parking payment and enforcement

Review of Funding Sources

In order to identify the most promising funding sources, the study team reviewed recent funding plan documents prepared by regional planning agencies and the transit operators in the Tri-Valley area, as well as informational resources available at the federal, state, and local level. A brief summary of potential sources is provided here, with a more complete listing provided in Attachment B.

Established Roadway Funding Sources

As noted previously, many of the improvement measures for park-and-ride facilities and related traffic signal work likely qualify as "roadway" investments, and so project sponsors are expected to be able to tap existing sources that fund physical improvements and regular maintenance. These sources may include the local portion of vehicle registration fees, formula funding from Alameda County's Measure BB, or the Arterial Operations program funded by the Metropolitan Transportation Commission (MTC).

Some funding sources associated with roadways are actually focused on reducing pollution impacts, roadway congestion, and wear-and-tear on road facilities by providing high quality alternatives to driving. These include sources such as the Transportation Fund for Clean Air awarded by the Bay Area Air Quality Management District and Climate Initiatives grants awarded by MTC. Several of the improvement measures analyzed in this study, such as shuttle services and real-time customer information, are generally expected to be a good fit with funding programs focused on Travel Demand Management (TDM) strategies.

Established Transit Funding Sources

Transit services—and by extension any shuttle service operated in the style of public transit—typically receive only a portion of their funding directly from patrons in the form of transit fares, with the bulk of their funding coming from other government sources. Although BART does have taxation authority that covers the study area, most of this funding is already pledged to major system-wide projects at this time, and would not be available to fund the improvement measures.

Federal sources to fund transit improvements include formula and discretionary grants from the Federal Transit Administration that could be used by existing transit operators for vehicle acquisition and fixed facilities such as parking garages. Qualifying to be a recipient of federal funds can be a complex process, so these sources would be most appropriately pursued by one of the three existing transit operators: ACE, BART, or LAVTA.

At the state level, the bulk of transit-related funding comes from the Transportation Development Act (TDA), which, among its many provisions, allocates various sales and excise taxes to two major programs: State Transit Assistance and the Local Transportation Fund. A newer source of revenues for transit is the Low Carbon Transit Operations Program (LCTOP) under California's Cap-and-Trade framework. Based on current program guidelines, many of the investments called for in this analysis would clearly be eligible for TDA and LCTOP. The main challenge in securing a portion of these funds for the Tri-Valley will be uncertainty related to available funding levels, due to continued challenges in stabilizing transportation funding statewide; instability in funding for existing transit operations makes it harder to undertake new service offerings.

Locally, there are many different programs that target funds towards transit and transit-related projects. In addition to the TFCA program already mentioned, other local funding programs include the "Transit Performance Initiative" within MTC's One Bay Area Grant (OBAG) program, which rewards transit operators for improving their overall metrics, and Measure BB in Alameda County, which has a specific funding program dedicated to supporting Transit Operations.

Other Potential Funding Sources

Because this study has introduced the possibility of implementing some fairly innovative technology for customer information and operations management, project sponsors may be able to tap less common pools of transportation funds for at least a portion of project costs. For example, at the federal level, FHWA sponsors the Advanced Transportation and Congestion Management Technologies Deployment Program (ATCMTD) which provides $60 million per year (nationwide) through 2020 to fund, "cutting-edge transportation technologies that help reduce congestion and improve the safety of our transportation system."[5] Another promising federal grant opportunity is FTA's Mobility on Demand Sandbox Program.[6] This program funds demonstration projects that encourage shared mobility services to connect users to transit or work, and it is already funding the implementation of reserved parking at Dublin/Pleasanton BART station for carpools arranged using a dynamic ridesharing app called Scoop.

The other potential source of funding that should be considered for these improvement measures would be partnerships with area stakeholders and transportation providers. For example, if any Transportation Management Associations (TMAs) or Business Improvement Districts (BIDs) receive benefits from the peak period connecting shuttle services operated from area park-and-rides, it may be reasonable to negotiate a contribution towards operating expenses. In this same vein, San Francisco has recently approved a permanent version of its "Shuttle Partners Program" that is designed to avoid operational conflicts between private employer shuttles, public transit operations, and the needs of local residents. The employer shuttle operators who serve San Francisco pay a minor fee to utilize public facilities and agree to share data with the City in order to facilitate future infrastructure planning. Lastly, projects sponsors could consider tapping development impact fees for projects that will benefit

[5] Fact Sheet for the 2016 FHWA Advanced Transportation and Congestion Management Technologies Deployment Program. See: https://www.transportation.gov/sites/dot.gov/files/docs/ATCMTD_One_Pager.pdf
[6] More information about the Mobility on Demand Sandbox Program can be found here: https://www.transit.dot.gov/research-innovation/mobility-demand-mod-sandbox-program.html

from the implementation of transit and park-and-ride improvement measures throughout the Tri-Valley area.

Approach to Funding Strategy

At a high level, the strategy for securing funding to support the identified capital and operating costs will almost certainly require a mix of funding from multiple sources. This section discusses ideas for how project sponsors can navigate the current funding environment more effectively.

Programmatic flexibility

Even with a relatively strong economy, the backlog of transportation needs in the Bay Area is large enough that most transportation funding flowing through structured state and federal programs is already committed to recurring needs and existing projects. Legislators in Washington, DC and Sacramento are working to find enough revenue to expand their capacity to make new infrastructure investments, but it is unclear when or how these debates will be resolved. For several years now, local and regional planners have focused on maximizing every external dollar by finding smaller projects that can use up the last few thousand dollars in each funding program and by having projects on standby in case a funded project is unable to proceed on schedule.

Project sponsors can make themselves more attractive for these types of unexpected opportunities by defining their project in such a way that it meets eligibility criteria of many different programs, or by compartmentalizing their project into smaller pieces that can be separately implemented as funding becomes available. The compartmentalized approach may not be the best fit in the case of the improvement measures identified in this study, because so many of the anticipated benefits are derived from integrating transit with park-and-rides and from combining new technologies with traditional infrastructure. Programmatic flexibility is likely to be the more successful strategy here, and sponsors should carefully review eligibility criteria of multiple funding sources as a part of their design process, in order to ensure they are not foreclosing specific funding options prematurely.

Technology demonstrations

Transportation decision-makers are also grappling with the rapid pace at which technology advancements are changing the nature of transportation infrastructure and services. In an attempt to keep up with these developments, technology demonstrations and short-term pilot programs may become more common, and rules for existing program that were once hard-and-fast may become more flexible. Project sponsors should be alert for announcements of new programs and changes in eligibility and application requirements for established programs. Over the past several years, the U.S. DOT has funded a number of demonstration programs such as the “Smart City” challenge and the FTA Mobility on Demand Sandbox program. These grant programs are particularly attractive for the types of improvement measures identified in this study, because their selection criteria explicitly recognize and reward efforts to create more seamless transportation experiences enabled by new technology. It should be noted that federal-level demonstration grants tend to be awarded to projects that are either particularly transformative or that have the potential to be easily replicable in other locations. Project sponsors wishing to pursue such grants should make every effort to coordinate with each other to make sure that the benefits and outcomes of the combined project are significant enough to attract statewide and national attention. Coordination also provides the opportunity to leverage shared resources to cover the costs of preparing the federal grant application.

6. Next Steps: Approach for Moving Forward

The short-term and long-term improvement measures identified in earlier tasks of this study are expected to be delivered by following a relatively traditional Public Works process, with each facility owner responsible for the projects within its jurisdiction. At the same time, this study has revealed that there may be benefits to engaging in more extensive coordination that can encompass other future activities contemplated in the study area, not just the current set of identified improvements. This section discusses opportunities for enhancing coordination, in order to capture the synergies and to improve overall implementation in the years ahead.

Implementation Responsibilities

Successful delivery of the individual improvement measures analyzed in this study will require additional work in a number of technical areas. Apart from the policy and coordination topics discussed earlier in this document, each project sponsor will have the responsibility to undertake some or all of the following activities in order to implement their respective projects:

- Parking facility planning
- Service planning for peak period connecting shuttles
- Development of funding plan
- Environmental analysis
- Engineering and design
- Right-of-way acquisition
- Utilities relocation
- Construction
- Vehicle procurement (if needed)
- Operations & maintenance for peak period connecting shuttles
- Facility repair and maintenance activities
- Parking fee collection
- Coordination of payment options for parking, connecting shuttles, and transit (as appropriate)
- Parking fee enforcement
- Security
- Coordination with private employer shuttles
- Operational coordination for park-and-ride shuttles (e.g., designation of curb space at ACE and BART stations)
- Coordination with MTC Carpool Program
- Marketing and communications
- Installation of Transit Signal Priority equipment
- Installation of real-time vehicle arrival technology for connecting shuttles (NextBus or similar)
- Data collection for parking occupancy (historical and/or real-time data)
- Data service for dissemination of parking occupancy and/or shuttle arrival time information
- Procurement and contracting for any/all of the above

Project Leadership and Coordination

The specific improvement measures identified over the course of this study are independent enough that they can be implemented individually by whichever jurisdiction owns the physical facilities and parcels involved. As a general matter, these jurisdictions and agencies will be responsible for taking the lead to implement each project. Still, some improvements will require more coordination than others in order to proceed, and in a few cases, coordination should be regular and structured to lead to a smooth roll-out. For example, in order to provide a travel time benefit, the Transit Signal Priority projects would need to be coordinated between the jurisdictions implementing the traffic signal upgrades at various intersections and the shuttle service operator installing pre-emption equipment on its vehicles. In another example, coordinated marketing efforts can help improve overall utilization of park-and-ride lots, especially for launching new peak period connecting shuttle services and any changes related to parking pricing and enforcement. As more detailed planning for each project gets underway, project sponsors should consult with the following partner and stakeholder organizations in the Tri-Valley, in order to ensure that they have informed and involved all relevant parties:

- Jurisdictions and Agencies:
  - City of Dublin
  - City of Pleasanton
  - City of Livermore
  - LAVTA
  - Alameda County
  - ACE / SJRRC
  - BART
  - Alameda CTC
  - MTC (including staff for Fastrak, Clipper, 511.org, and Commuter Benefits Ordinance)
  - Caltrans
- Other stakeholders
  - County Connection
  - Tri-Delta Transit
  - San Joaquin Regional Transit District (RTD)
  - San Joaquin Council of Governments (SJCOG)
  - Private employers who provide shuttle services, as well as their contract operators (WeDriveU, Loop, etc.)
  - Transportation Network Companies (Uber, Lyft, Scoop, Bridj, Chariot, etc.)
  - Transportation Management Associations (TMAs) and any major local area employers who may benefit from specific study area enhancements

The public sector entities that comprise much of this list are relatively familiar with working closely with one another, but the relationships between project sponsors and the private sector entities on the list are still coming into focus. There are few mechanisms that create a structure for public and private actors to efficiently share information and seek input from each other, so outreach to individual employers and transportation companies remains time-consuming and inefficient. The effort to coordinate procurement and deployment between numerous projects and sites in the Tri-Valley could provide a critical mass that makes structured outreach to, and participation from, the private sector a worthwhile exercise for all involved.

Forum for Discussion and Monitoring

Given the number of different improvement measures contemplated in this Study, the coordination described above, while important, could become highly repetitive and time-consuming if there are separate coordination processes for each project location. A more desirable approach would be to find an appropriate forum for exploring alternatives, reaching consensus, and monitoring and managing any emerging issues during deployment. At this time, there is no single entity in the Tri-Valley area that formally engages all of the players who would need to be at the table for this type of partnership.

One option that could be considered is to organize around the existing Tri-Valley Transportation Council (TVTC). The TVTC was formed as a joint powers authority in order to oversee expenditures from the Tri-Valley Transportation Development Fund. Its role in evaluating regional transportation and land use dovetails well with the need to consider the policy and planning matters raised by this study across jurisdictional boundaries. The TVTC has already proven to be an effective venue for collaboration in evaluating investment options in the I-680 corridor as part of the recent Transit Investment and Congestion Relief Options Study for CCTA. Also, the TVTC is presently working to develop its Action Plan Update, which could potentially be extended to include some aspects of the improvement measures identified in this study. These activities suggest that the TVTC is already functioning as a constructive forum for dialogue and consensus-building for the Tri-Valley community.

It should be noted that the three transit operators in the Tri-Valley do not have a formal role on the TVTC at this time. If the TVTC is selected as a starting point for collaboration on transit and park-and-ride integration, a more formal outreach and engagement plan should be developed, in order to ensure that ACE, BART, and LAVTA are available to provide input and feedback at appropriate points in the implementation process.

Other Tri-Valley Transportation Efforts

The improvement measures that are being advanced from this study are not the only transportation projects currently underway in the Tri-Valley. As detailed planning on the short-term and long-term measures continues to evolve, project sponsors should monitor other related transportation projects that are now being studied or actively developed, including:

- Formal studies and plans: transit operators
    - **Results of I-680 Transit Investment and Congestion Relief Options Study** – This project is winding down, but it may be useful to coordinate the improvements recommended elsewhere on I-680 with the outcomes of this study.

- **BART Curb Management Study** – This is a system-wide analysis of how all user groups are currently utilizing curb zones within and adjacent to BART stations. The study could lead to one or more actions including: re-allocation of curb space at one or more stations; development of a set of Curb Use Guidelines; and a registration or permit system for shuttle operators.
- **Planning for BART extension east of Dublin/Pleasanton** – As noted elsewhere in this document, this major project will have a direct influence on the need for and timing of the long-term improvements identified by this study. Project sponsors should monitor the progress of the BART extension project to ensure that park-and-ride investments fully support BART and vice-versa.

- Active programs and demonstration projects
  - **Carpool-to-BART** – Funded by FTA's Mobility on Demand Sandbox program, this pilot project is a new partnership between MTC, BART, and the Scoop ridesharing app. Carpool riders and drivers sign up to be matched in advance of their trip, and then secure reserved parking at the BART station each morning, plus guaranteed ride home service in the afternoon. This program was recently launched at Dublin/Pleasanton BART station, and may eventually be extended throughout the BART system.
  - **Go Dublin Demonstration Project** – This is an active partnership between LAVTA and the private sector that is designed to determine whether subsidizing first-/last-mile travel in on-demand TNC vehicles provides reasonable levels of mobility and access in a more cost-effective way than fixed route transit using a full-size bus.
  - **City of Pleasanton Carpool Incentive Program** – City of Pleasanton and Scoop Technologies, Inc. are partnering to promote a carpool incentive pilot program to encourage residents and employees to form carpools using the Scoop carpooling application. A total of $30,000 will be available to incentivize Scoop users to request carpools and receive a discount towards every Scoop trip. A Guaranteed Ride Home benefit will also be provided as part of the pilot program. Funding for the pilot program are in cooperation with the City of Pleasanton, Bay Area Air Quality Management District's Transportation Fund for Clean Air and Alameda County Transportation Commission.
  - **BAAQMD/MTC Commuter Benefits Ordinance (CBO)** – The CBO was initially a trial program, but it was made permanent last year. Bay Area employers can satisfy the CBO requirements by subsidizing vanpools or offering their own shuttle services, and so the extension of the ordinance may lead to an increase in the growth rate of vanpools and shuttles going forward. Coordination with regional staff can help local planners to anticipate level of activity expected at Tri-Valley facilities.

- Formal studies and plans: regional-level agencies
    - **MTC Core Capacity Study** – MTC is leading an effort to identify infrastructure projects that can increase overall capacity into downtown San Francisco, including BART capacity through the inner East Bay. The project has focused much attention on the timeline for being able to deliver capacity that is paired to increases in demand; these milestones could be important for understanding when BART will be ready to accept more riders from the Tri-Valley.
    - **MTC Commuter Parking Facilities Study** – MTC is currently evaluating whether unused right-of-way under existing freeway overpasses could be converted into commuter parking facilities. Although the MTC study is focused on different types of facilities than those analyzed in the Tri-Valley, their work could provide some useful insights to local project sponsors.
- Other planning activities
    - **Alameda County Fairgrounds** – Responsible jurisdictions and agencies should monitor prospects for the continued use of fairgrounds property for commuter parking used by ACE riders at Pleasanton station.
    - **Shared Parking Opportunities** – Local jurisdictions and agencies may wish to seek out formal or informal arrangements to access under-utilized parking in shopping malls and business centers. For example, BART had previously been in discussions with Stoneridge Mall about opportunities to access under-utilized mall parking that could expand the effective vehicle capacity of the Dublin/Pleasanton BART station, potentially deferring or eliminating the need for a second garage. Additional coordination between the jurisdictions and agencies and the relevant private property owners could eventually lead to an expansion of the overall park-and-ride capacity in the study area.
    - **Dublin Boulevard Autonomous Shuttles** – The City of Dublin and LAVTA are jointly exploring deployment of autonomous first-/last-mile shuttles on Dublin Boulevard to access BART stations, with advanced transit signal priority on this arterial. Responsible jurisdictions and agencies should monitor the project to understand whether there are long-term prospects for replacing their park-and-ride shuttles with a similar approach.
    - **Preferred Transit Access on I-580/I-680** – Although not being formally advanced at this time, there are several opportunities to provide improved access for transit vehicles using I-580 and I-680. Specifically, the concept of bus-on-shoulder operations has been gaining traction in the region, and dedicated HOV ramps into one or more BART stations in the I-580 corridor could significantly improve the efficiency of bus transit services in the study area. If any of these options were to advance, stakeholders should revisit the findings of this study.

Attachment A: Tri-Valley Park-and-Ride Parking Management Strategies and Technology

Attached Separately.

Memorandum

To: *Bill Loudon, DKS*

From: *Terri O'Connor and Anne Spevack, CDM Smith*

Date: *March 2, 2017*

Subject: Tri-Valley Park-and-Ride Parking Management Strategies and Technology

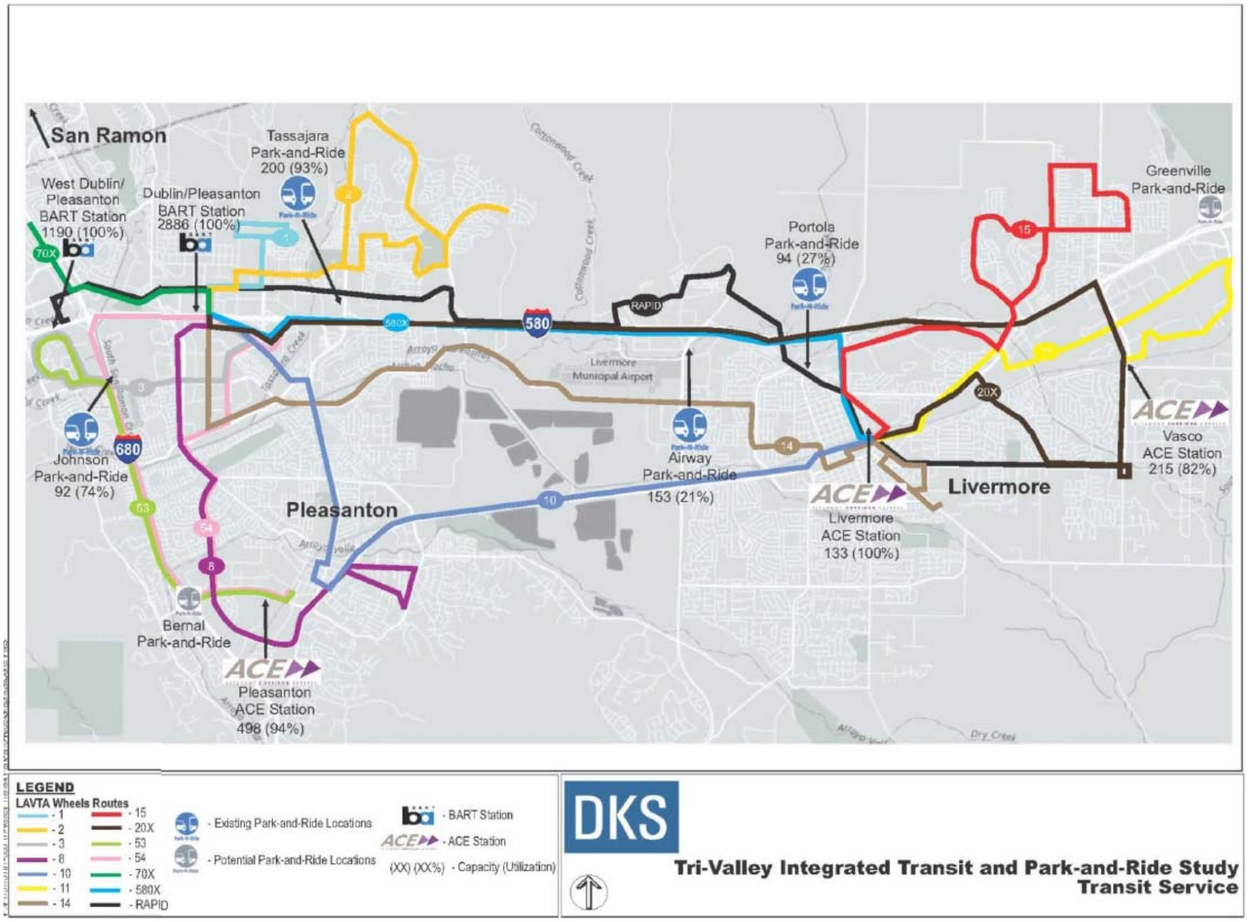
This memorandum describes possible parking management and pricing approaches for the Park-and-Ride facilities studied for the Tri-Valley Integrated Transit and Park-and-Ride Study. The previous tasks have identified opportunities to increase transit ridership by offering shuttles connecting rail transit in the study area to existing and new parking facilities. In order to supply sufficient parking for users of these services while maintaining parking resources for other users (private shuttle riders, and carpoolers), parking policies, prices, and enforcement can be implemented to guide users to appropriate facilities. In this memo, the park-and-ride facilities are categorized based on the primary user type, a suggested pricing scheme is described for each facility type, and potential technologies for implementing and monitoring the parking are identified.

Park and Ride Facilities

All park-and-ride facilities evaluated in the Task 4 report are considered a part of the park-and-ride network for the purposes of this memo.[1] These include the three ACE stations, Vasco Road, Livermore, and Pleasanton, the existing park-and-ride lots at Johnson, Tassajara, Airway, and Portola, and potential new park-and-ride lots at Bernal and Greenville. In addition to the new lots at Bernal and Greenville, which would be served by shuttle service to BART in the long term, the Task 4 report also suggested a BART shuttle from the Airway park-and-ride. A map of the existing and proposed facilities is shown on the following page, originally developed by DKS for the Task 4 report.

[1] BART station parking in the study area is not included because it is already actively managed and operated by BART.

Figure 1: Existing and proposed park-and-ride facilities and LAVTA service



Source: DKS, Task 4 Evaluation of Potential Park-and-Ride Facilities, Supporting Bus Service and Amenities Draft Report.

The parking management strategies appropriate for each lot will depend on the lot type, which is assigned based on the primary user type at the facility. The lot types are:

- Commuter rail stations: All ACE stations in the study area
- Public transit/shuttle stops: Current and future park-and-rides with convenient transit or shuttle service to a rail station
- Private shuttle/carpool lots: Lots that primarily serve users not riding a public transit service, instead parking to meet a carpool or to catch a private employer shuttle.

Table 1 below summarizes these three facility types and identifies the park-and-rides assigned to each type.

Management Approach

Management of the above facility classification requires encouraging private shuttle riders and carpoolers to use their designated facilities, and discouraging them from using the facilities designated for transit patrons. This helps ensure that the facilities connected to public transit services have sufficient availability for public transit riders, who would not be able to access the system from a different facility. Pricing in general will help manage demand at stations, and pricing by user type at the facilities will help signal to users which lots are most appropriate for them to use.

A suggested pricing scheme to send these signals would be to charge the same price at all park-and-ride facilities, but offer free parking or a discount for transit riders at their designated stations. Under this scheme, parking would be available to all users at all stations, but shuttle/bus riders would be prioritized at public bus/shuttle stop facilities, and commuter rail patrons would be prioritized at commuter rail stations. This suggested management approach is summarized by facility type in **Table 1** and detailed below

Table 1. Study Area Parking Facility and User Types

Facility Type	Primary User	Secondary User	Facilities	Management and Pricing Approach
Commuter Rail Station	Commuter Rail patron	Public Transit rider, Employer Shuttle user, Carpooler	Livermore Transit Center/ACE[2], Vasco Road ACE, Pleasanton ACE	Free for rail patrons, $1 to $2 per day for other users
Public Bus/Shuttle Stop	Public bus/shuttle patron	Private employer shuttle rider, Carpooler	Johnson/Stoneridge, Portola, Airway, Bernal (long term), Greenville (long term)	Free for public bus/shuttle users, $1 per day for other users
Employer Shuttle/Carpool	Employer shuttle rider, Carpooler	Public bus/shuttle patron (if served)	Bernal (near term), Tassajara	$1 per day for all users

[2] The parking garage at the Livermore ACE station is used by downtown business patrons, LAVTA riders, and ACE riders, and thus should be treated differently than the other ACE stations. As non-transit users are not discouraged from using the parking garage, pricing would have to be coordinated with the city to meet downtown economic development goals. An alternative to pricing would be to implement well-enforced time limits on the lower floors that would direct all-day parkers to the top level, or to prohibit or charge a fee for the use of the lower-level spaces until after the morning peak period. Any pricing or management strategies implemented at this parking garage should prioritize rail and bus patrons similarly.

Implementing and/or increasing parking prices for park and ride facilities will impact user behavior. In particular, a parker's price elasticity is expected to differ based on their user type. It is assumed that:

- Local bus, rail shuttle and carpool patrons tend to be more price sensitive than those that park directly at BART or ACE. This is due both to time value of money and cost.
    - BART/ACE rail patrons prefer station parking, considering it more convenient and valuable than a 2-seat ride. Because of their price sensitivity, a small increase in park and ride price (without a similar increase in BART parking fees) would discourage riders from using a park-and-ride to take a shuttle to BART and they may instead elect to drive to their destination.
    - Carpoolers and local bus riders are not willing to pay the BART premium. Because riders local bus service may have a shorter distance to travel, they may be more willing to drive to their destination rather than park and ride.

- Private shuttle riders will be the least elastic in response to price increases, as they are already getting a high-value service for free from their employer and/or may be more willing to pay to continue using this service. They are also more likely to be reimbursed by their employer for any parking fees.

The nearby BART stations charge a $3 daily parking rate, or around $105 per month, which is equivalent to $5 per weekday on average. As the BART station parking lots experience full occupancies on a daily basis, a higher cap on parking fees at the BART stations may be appropriate. There is an opportunity to pilot a demand-based pricing scheme at the new Dublin/Pleasanton parking garage, which would help determine more appropriate rates for the demand at the BART stations. However, as this will require changes to BART's system-wide parking policy, the existing parking prices are assumed as the baseline for the park-and-ride pricing recommendations. Because parking at the BART stations is more desirable for BART users than a satellite lot, and because BART provides the most frequent and far-reaching transit service in the area, prices at other park-and-ride facilities should not exceed the BART daily charge. An appropriate initial rate for most facilities would be $1 per day. A low fee will help ease the impact of introducing pricing. Some of the facilities are already heavily used, and may be able to support a higher fee of $2 per day: the three ACE stations and the Tassajara lot have observed occupancies over 80 percent. Transit users at rail stations or shuttle stops could have the parking fee waived or refunded to prioritize their use of the facilities over private shuttle patrons and carpoolers. Web or mobile based reservation and ticketing systems would facilitate this system, and are discussed in more detail in the following section.

Before implementation, a policy for increasing parking fees based on demand (observed parking occupancy) or service changes should be adopted. As appropriate pricing for the park-and-rides is based on BART pricing, a rate policy should be tied to future BART parking fee increases, but continue to scale downward based on location and user.

Technology Support and Seamless Integration

This section evaluates payment and enforcement technologies that are suggested for implementing the paid parking scheme described above. In general, an integrated parking and transit ticketing software, such as Passport, would allow for fees to be applied based on the user type and the facility type in a convenient, seamless app. This software would integrate with a license plate or RFID enforcement system that would also allow for automated and streamlined enforcement. A variety of technologies and tech services can be implemented and integrated to make the management strategies describe above possible. A seamless, technology-based system with centralized management will be the most efficient implementation of parking management. An estimation of the installation and operation costs of these technologies and services will be included to understand the relative costs of each technology (an RFP/RFQ would be required for vendors to provide exact costs to meet system requirements).

Mobile Payment - Passport

Payment via mobile/smart phones is a flexible system that does not require additional installation of on-site payment equipment. While companies like ParkMobile and PaybyPhone are popular phone payment systems used by cities across the Bay Area, Passport provides a similar service with the additional benefit of integrating with transit ticketing and TDM services. Passport allows deduction of the parking fee for users who also purchase a transit ticket. Users can choose to pay for parking, parking and transit, or just transit in a single, seamless transaction. Passport also supports digital parking permits that can be purchased and managed online. The app can also provide additional services, such as trip routing and transit tracking, if desired.

Passport Transit Pass

Passport's parking services cost $0.15-$0.25 per transaction, plus additional fees for customization of the app or services. The transit fare service is $75,000 per year, plus 2 to 5% of mobile (app only) revenue[3]. In order to integrate both parking and transit payments, both services would need to be provided by Passport, requiring participation by all operators serving the park-and-ride facilities. However, near-term changes to the Clipper Card vendor may allow for better integration with mobile payment options[4]. Using Passport either for parking only or as an integrated solution will be a good interim approach to introduce mobile payment in the area.

The GoTucson app is the first example of combining parking and transit payment in a single app using Passport. Users can pay for metered parking or for transit passes from the app, though the agency does not offer discounts or combined fares for using parking and transit in the same trip. In

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[3] These costs are ballpark estimates from Passport based on recent contracts. Because there are many configurations and features, the actual costs will depend greatly on the specifics of the system.

[4] During a call with Stephen Abbanat at Clipper on December 19th, 2016, confirmed that this is the direction Clipper is heading.

Northern California, Passport currently provides mobile payment service for the Sacramento Regional Transit system and for parking on the CSU Chico campus.

In addition to the base payment system via Passport, the carpool matching app Scoop could also be introduced to facilitate shared rides. BART is already partnering with Scoop to provide incentives for riders who use the program to carpool to a station. A similar program can be implemented using carpool park and ride locations as meeting points. This will encourage carpooling in the area while also increasing usage of the non-transit oriented parking facilities. Fees for mobile payment services are typically charged direct to the consumer by transaction fees. PaybyPhone charges $1/transaction. Passport charges either a transaction fee or a per site fee (by estimated transactions/site).

Enforcement Technology

In order to send out enforcement officials to the various park-and-ride facilities with paid parking, the Tri-Valley system will need at least one enforcement vehicle and set of enforcement equipment, usually a smart phone or tablet with the software associated with the payment and monitoring vendors and the ability to process and print citations. The cost per vehicle will depend on the size and type.

Enforcement vehicles can be equipped with mobile license plate recognition (mLPR) technology to identify vehicles parked in a lot. Vehicle information is sent to a parking permit database and compared with the pay-by-plate information from the multi-space-meters to identify whether vehicles have paid. MLPR allows for more efficient parking enforcement by enabling enforcement officers to verify parking payment by driving through parking lanes at a regular traffic speed. A mobile LPR bundle from Genetec, a leading provider of mLPR services, totals around $33,000 including installation.

Genetec LPR

Alternately, stationary LPR cameras or RFID sensors may be attached to the entrance gate of a facility to detect vehicles entering and exiting the facility. These cameras or sensors perform the same functions as the mLPR system, and additionally allow for more precise tracking of how long each vehicle stays in a facility. The stationary cameras require less enforcement labor, but because cameras would need to be installed in each facility, would likely have higher equipment costs per space served. The cost of a single fixed camera is around $6,500.

The most efficient enforcement strategy will be to combine both stationary cameras and mobile enforcement. Cameras at each facility can monitor occupancy and alert enforcement officials when the lot is full. This will save time for the enforcement staff and maintain the accuracy and flexibility of a staffed, mobile enforcement unit. Because real-time information technology is also being pursued, stationary cameras or sensors tracking vehicles going in and out of a facility will be able to serve both enforcement and real-time information purposes. Real-time information is discussed further in the following section.

Centralized Enforcement and Integration

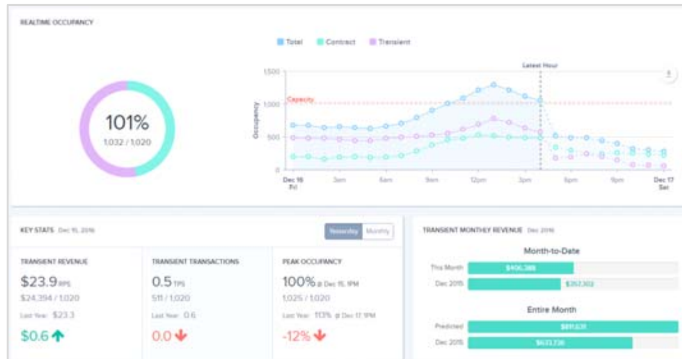
The various technologies selected to implement the parking management strategies should integrate seamlessly into a single system for centralized management, facilitating minimal capital outlay, the efficient use of labor, and tracking of parking data. A single, centralized enforcement system will allow for directed enforcement where it is needed, reducing labor costs and increasing the efficiency of the system overall. Back office staff can monitor the parking usage in real time, and send out enforcement vehicles when appropriate to check the on-the-ground conditions. The payment system along with sensors or cameras at the facility entrances can automatically track occupancy, sending out officers when the facilities are full. Additionally, cameras at the enforcement locations can allow personnel to check if the space or facility occupancy matches the payment data in the system, allowing more directed enforcement. Parking citations may also be issued and paid through the online purchasing interface. The information provided by such a system will also allow for robust reporting. Centralized systems also facilitate tracking of parking data over time, allowing for detailed analyses at the facility and user-type levels.

Integrated payment and enforcement

The Passport parking and transit ticketing service will include some of the centralized features, and can integrate with enforcement technology and software, including citation tracking (some of these services may require additional fees). Alternatively, if more customization is desired, a third-party online tracking and management software can be implemented for an annual license fee. The fee varies by the level of support and features, as well as the annual number of transactions handled by the website. Based on the size of the Tri-Valley park-and-ride system, this would likely cost around $30,000 per year. This option is not recommended, as Passport integrated with enforcement technology will serve the purposes of the park-and-ride system.

Real Time Information

Real-time parking information can be collected and communicated to users to direct them to lots with availability. Real-time parking information can be collected via cameras or sensors at the lots, as discussed in the previous section. Communicating this information to drivers can be done via freeway signs, mobile alerts, and the internet. Freeway signs may be able to help drivers quickly change their plans while already on the road. However, with many different park-and-ride locations, multiple signs with a lot of information would need to be constructed. Any signage would need to conform to Caltrans standards, and would need to be located without interfering with other signs on the road. As the corridors in this area are implementing express lanes, there is already a lot of competing signage along the freeways. This option is likely too costly and difficult to implement.



Smarking **real-time parking occupancy dashboard**

Alternatively, real-time information can be communicated via website and text alerts. Once the system is in operation, the usage of the lots is expected to settle into a regular pattern, and reasonable predictions of the time each facility will fill up can be made. A website could provide the predicted fill time, number of minutes to the fill time, and alerts for special events and unusually heavy or light days. An opt-in text alert mechanism, similar to BART's service advisory system[5], can push notifications to users when there is abnormal activity or when a facility is about to fill up, based on the camera data at each lot. This will provide enough information for regular users to make decisions before they leave and deal with unexpected situations on the way.

The parking data company Smarking[6] would provide this data analysis and support distribution of the information to users, integrating with existing websites, apps, and other resources. To serve the existing system plus the Bernal Avenue lot, the cost would be around $30,000 per year. With the expansion at Airway and the addition of the Greenville lot, the annual cost may increase to around $42,000 per year.

Summary

To manage parking at the Tri-Valley park-and-ride facilities, it is recommended that a pricing scheme be implemented as follows:

Table 2: Parking pricing summary

Facilities	Management and Pricing Approach
Vasco Road ACE, Pleasanton ACE	Free for rail patrons, $1 to $2 per day for other users
Johnson/Stoneridge, Portola, Airway, Bernal (long term), Greenville (long term)	Free for public bus/shuttle users, $1 per day for other users
Bernal (near term), Tassajara	$1 per day for all users

5 https://www.bart.gov/schedules/advisories

6 https://www.smarking.net/

Note: As previously explained, the Livermore ACE station/transit center deserves special consideration because it is a multi-purpose facility, and thus is not included in this table.

Operating and enforcing this program can be done through a combination of software and apps that facilitate mobile payment of parking, transit, or combined parking and transit fares or permits, and track real-time occupancy of each facility. To eliminate the need for a direct hire of operations staff there is also an option of contracting with a parking management/operations integrator. An integrator provides professional staff and they manage a series of vendors that have various technology and operational expertise. In this case, they would craft a package of technologies and services in the form of an annual management contract – which usually ranges between one and five years. Real-time parking availability can be communicated to users through websites and text notifications. The cost of such a system is estimated by technology in the table below:

Table 3: Parking management cost estimates

Technology or service	Cost per unit
Passport (mobile payment app)	$75,000 per year plus 2% to 5% of mobile revenue for mobile transit payment, $0.15 to $0.25 per transaction for mobile parking payment
LPR Equipment and Installation	$33,000
LPR vehicle	$25,000
Static camera (8 facilities)	$6,500
Smarking (real-time data service)	$30,000-$42,000 annually
Parking Management Integrator (service)	$40,000 annually

Attachment B: List of Potential Funding Sources Considered for Tri-Valley Improvements

In preparing the Implementation Strategy, the study team evaluated a wide variety of potential funding sources, in order to identify those sources which are likely to be the best fit with the improvement measures contemplated in this Study. This Attachment provides a listing of the funding sources, grouped into four categories: Established Roadway Funding Sources, Established Transit Funding Sources, Other Potential Funding Sources, and Funding Sources with Limited Applicability. Each of these is described separately below.

Established Roadway Funding Sources

- These sources typically fund roadway and arterial improvements, and may be a good fit for a sub-set of the improvement measures identified in this study.Caltrans: Sustainable Transportation Planning Grant (*may support design/engineeringactivities*)
- MTC Arterial Operations (*to supporttraffic signal re-timing/pre-emption*)
- MTC Cap and Trade: Transit Operating & Efficiency Program (*Cap and Trade contribution to Climate Initiatives discussed below*)
- MTC OBAG – Regional: Climate Initiatives (*check for available funding not yet allocated in OBAG Round 1*)
- Bridge Toll funding (*BART extension is considered eligible; these projects could warrant similar support*)
- BAAQMD: Transportation Fund for Clean Air (TFCA) – County Program Manager, Shuttle & Rideshare categories
- Alameda County: Measure BB sales tax, vehicle registration fees

Established Transit Funding Sources

These sources are typically used to fund transit capital and operations and could be a good fit for a sub-set of the improvement measures identified in this study.

- Transit fares (*Customer payments related to parking and/or shuttles*)
- Parking fees (*Contribution towards facility operations & maintenance*)
- Federal Transit Administration (FTA) Urbanized Area Formula Program (Section 5307 and/or 5337)
- FTA Capital Program (Section 5309)
- Transportatin Development Act (TDA) State Transit Assistance (STA)
- TDA Local Transportation Fund (LTF)
- Regional Measure 2 or potential Regional Measure 3 Funding (*used to support transit operations that serve bridge-corridors*)

- MTC OBAG: Transit Performance Initiative
- BAAQMD: Transportation Fund for Clean Air (TFCA) (*same as above; program can also fund transit operations*)
- Alameda County Measure BB: Transit Operations
- Dedicated sales tax (*BART only; funding source may already be committed to specific projects.*)
- Property tax (*BART only; funding source may already be committed to specific projects.*)

Other Potential Funding Sources

These funding sources are more flexible and may include one-time pilot or demonstration grant opportunities, as well as innovative funding and financing mechanisms that could be relevant in the Tri-Valley context.

- FHWA Advanced Transportation and Congestion Management Technologies Deployment Program (ATCMTD)
- Federal Transit Administration Mobilityy on Demand Sandbox Grant
- Community Development Block Grant Program (CDBG)
- "DD-104 (Deputy Directive) Creating New Opportunities for Solar Energy Systems Deployment on State of California-Owned/Department-Controlled Facilities"
- Environmental Enhancement and Mitigation Program (EEMP)
- Regional Surface Transportation Program
- Measure BB Technology and Innovation category
- Tri-Valley Transportation Development Fees
- Local Jurisdiction Impact Fees
- Contributions from Transportation Management Associations (TMAs) and/or Business Improvement Districts (BIDs) (*e.g., Bishop Ranch, Hacienda Business Park*)
- New partnerships with TNCs and carpool apps (*similar to: LAVTA's Wheels-on-Demand pilot program for last-mile subsidies or Carpool-to-BART program recently launched at Dublin/Pleasanton BART station*)
- Contributions from private employers who operate commuter shuttles (*potentially modeled after SFMTA Shuttle Partners program, where employer shuttles pay based on the number of stops at designated bus stop facilities*)
- Contributions from counties with major employment centers that draw from origins within the study area
  (*Contra Costa, San Francisco, San Mateo, and/or Santa Clara*)

Funding Sources with Limited Applicability

These transportation funding sources are less likely to be a good fit with the types of improvements identified in this study, but are included here for completeness.

- U.S. Dept. of Energy Vehicle Technologies Office (*scale of projects is likely too small*)
- Innovations Deserving Exploratory Analysis (IDEA) grants (*projects sponsors may not have capacity for the research element required for all projects*)

- Congestion Mitigation and Air Quality (CMAQ) funds (*Significant source for BART, but historically dedicated to car replacement*)
- State Transportation Improvement Program (STIP)
- Caltrans Active Transportation Program (ATP) (*unless PNRs include bike parking, bike access improvements*)
- Caltrans Highway Safety Improvement Program (HSIP) (*safety nexus is minimal*)
- Caltrans State Highway Operation and Protection Program (SHOPP) (*these projects have limited impact on asset management; only category with strong nexus (mobility) is lowest funding priority*)
- Cap-and-Trade: Low Carbon Transit Operations Program (LCTOP) (*uncertain allocation due to volatile auction proceeds; also, no Disadvantaged Community zones in study area*)
- Cap-and-Trade: Transit and Intercity Rail Program (TIRCP) (*some project elements likely eligible, but "CalSTA intends to fund a small number of transformative projects"*)
- MTC Climate Initiatives (*narrow eligibility*)
- MTC OBAG – County-level (*assume not applicable because no improvement measures are located in PDAs*)
- Alameda County Measure BB: BART Station Modernization and Capacity Program (*Likely that all $90M in this program is already allocated*)

ALAMEDA
County Transportation Commission