Memorandum

To: El Camino Real (ECR) Bus Rapid Transit (BRT) Policy Advisory Board
From: ECR BRT Independent Third-Party Review Steering Committee
Date: September 11, 2015
Subject: ECR BRT Third-Party Review Findings

To “provide confidence that established practices were followed … and therefore increase the probability of stakeholder acceptance,” the Santa Clara Valley Transportation Authority (VTA) established an independent third-party review process to assess the technical analyses underlying the Draft Environmental Impact Report/Environmental Assessment (DEIR/EA) of the El Camino Real Bus Rapid Transit Project. This memorandum summarizes the findings of the steering committee appointed to guide the review process.

The DEIR/EA (a) adequately discloses the project’s expected environmental impacts and (b) presents evidence sufficient for the relevant bodies to make an informed recommendation for a preferred alternative as required by relevant regulations. Per VTA’s analysis, repurposing a lane on El Camino Real from a mixed-use lane to a dedicated transit lane may result in “… significant and unavoidable impacts …” on vehicular traffic, as clearly stated in the DEIR/EA (page ES-9). To understand the impact of the dedicated lane on project goals, VTA first developed a range of alternatives and then performed multiple technical analyses. The alternatives and the analyses were generally similar in scope and detail to peer projects. As a result, stakeholders and decision makers have received adequate information.

The remainder of this memorandum explains the committee’s findings. The first three sections detail the committee’s composition, working arrangement, and schedule. The fourth section contains an overview of the analyses requested by the committee as part of the review process. The final section contains the committee’s recommendations to VTA.

1 Members of the steering committee members are identified in Table 1 of this memorandum.
2 Per http://www.vta.org/el-camino-brt (“Updates” tab), as accessed August 26, 2015.
Steering Committee Members
The names, titles, organizations, and relevant affiliations of steering committee members are presented in Table 1 below. The committee selected David Ory and Mark Spencer as co-chairs and spokespersons.

Table 1: Steering Committee Members

<table>
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<th>Name</th>
<th>Title</th>
<th>Organization</th>
<th>Relevant affiliation</th>
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<tr>
<td>David Ory, PhD</td>
<td>Principal, Planning</td>
<td>Metropolitan Transportation Commission</td>
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<tr>
<td>(Co-chair)</td>
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<tr>
<td>Mark Spencer, PE</td>
<td>Principal and Vice President</td>
<td>W-Trans</td>
<td>Vice President, Institute of Transportation Engineers Western District</td>
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<tr>
<td>(Co-chair)</td>
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<tr>
<td>Robert L. Bertini, PhD, PE</td>
<td>Associate Professor</td>
<td>California Polytechnic State University, San Luis Obispo</td>
<td>Chair, Transportation Research Board – Operations Section</td>
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<tr>
<td>Karen Philbrick, PhD</td>
<td>Executive Director</td>
<td>Mineta Transportation Institute at San Jose State University</td>
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<tr>
<td>Caroline Rodier, PhD</td>
<td>Research Associate</td>
<td>Mineta Transportation Institute at San Jose State University</td>
<td>Associate Director, Urban Land Use and Transportation Center, University of California, Davis</td>
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Working Arrangement
The VTA selected the steering committee members and contracted with the transportation consulting firm Hatch Mott MacDonald to support the committee’s activities. Hatch Mott MacDonald, in turn, contracted with the transportation consulting firm Iteris to assist the committee with technical matters. The steering committee developed a work plan for Iteris and
directed their activities, but their conclusions are their own. Hatch Mott MacDonald assisted in organizing conference calls, interfacing with VTA, handling contracting details with Iteris, and performing other administrative support tasks.

The results of these combined efforts include the steering committee’s key findings and recommendations, which are detailed in this memorandum, and a technical report prepared by Iteris, which is included as an attachment to this memorandum.

Schedule
The members of the steering committee were selected by VTA in late March 2015 and began working together in June 2015. A draft of this memorandum and the Iteris technical report were sent to VTA staff for review in September 2015. VTA staff comments on these documents were considered by the steering committee and Iteris in the final memorandum and the technical report, respectively.

Issues Analyzed
After reviewing the relevant planning documents and considering comments received on the DEIR/EA, particularly those from VTA’s member jurisdictions, the committee directed Iteris to examine the issues described below. The attached report details their analyses and conclusions. The committee’s conclusions are based largely on the information in that document. In some cases, the committee’s conclusions differ from those reached by Iteris due to differences in the criteria used.

The issues and conclusions are summarized as follows:

1. Are the baseline traffic levels estimates (i.e., level-of-service or LOS) of intersections included in the DEIR/EA consistent with those of other recent traffic impact analyses for the same intersections?

   Near-term LOS estimates are consistent. The LOS in the DEIR/EA is the same as, or one letter grade higher or lower than, those in other recent impact analyses. The variation is likely not significant and can be attributed to uncertainty introduced by measurement error in traffic count data or traffic counts being conducted on different days. The criteria were also consistent: all analyses used the delay-based estimates from the 2000 High-Capacity Manual and VTA’s significant traffic impact criteria (VTA, adopted October 2014).

2. How does the traffic analysis in the DEIR/EA compare to environmental analyses of similar BRT projects, particularly with respect to the definition of the study area and diverted traffic?

   The technical report indicates that the definition of the study area and analysis of diverted traffic are similar to many peer BRT analyses. Some studies are more limited and some are more detailed than the ECR BRT.
3. Are the travel demand forecasting and detailed traffic analysis in the ECR BRT DEIR/EA adequate to assess the full travel impacts?

Three key expected effects of the ECR BRT project on automobile travel were not fully considered in the DEIR/EA – specifically, changes in trip making (e.g., deciding not to go shopping because of congestion), changes in departure time (e.g., leaving for work earlier in the day to avoid congestion), and changes in destination choice (e.g., shopping elsewhere to avoid congestion). As a result, traffic diversion estimates should be viewed as conservative, which is appropriate in the context of an environmental review. In addition, Iteris reviewed the detailed inputs to the Synchro software used to simulate traffic outcomes and found only minor errors (see Section 10), which would not significantly change the outcome of the analysis.

4. Did the ECR BRT DEIR/EA include a reasonable range of alternatives?

The DEIR/EA identifies and analyzes a total of seven alternatives (see DEIR/EA Figure ES-3). These alternatives include dedicated transit lanes of length 0, 3.0, 7.1, 10.1, and 13.9 miles. Decision makers, therefore, are offered a range of alternatives.

Recommendations

The steering committee recommends that the VTA review and consider all of Iteris’s commentary regarding the DEIR/EA. In addition, it recommends the following specific improvements to the planning documents in the near term:

- Improve the presentation of the changes in travel patterns in the corridor. To better understand the relationships between traffic diversion details and the transit ridership estimates, VTA should present the movement of people through and within the corridor by mode of travel across at least the No Build alternative and alternative 4c for either the morning or evening commute period. Travelers shifting from automobile to transit in the corridor should be quantified, and an explicit connection should be made between these travelers and additional riders on routes 22 and 522.

- VTA should more carefully consider their audience when presenting technical results. For example, Table 26 in the “Traffic Operations Analysis Report” DEIR/EA appendix presents “new transit riders” with unusual directional splits (i.e., over the course of a full day, the directional splits of routes 22 and 522 should be approximately equal, but Table 26 suggests far more new riders traveling westbound than eastbound). VTA provides a good answer for the directional splits: the Federal Transit Administration (FTA) requested the results be presented in so-called “production/attraction” format – an artifact of the VTA travel model that orients all travel in an artificial but computationally convenient, manner. While FTA is an important stakeholder, presenting information in this way makes it difficult for other interested parties – such as decision makers, local and regional agencies, and the general public – to understand the results.
VTA should more explicitly disclose how the travel model was used to estimate transit ridership and traffic. Both Iteris and the steering committee struggled to understand precisely how the VTA model was applied and the reasons for the application approach. The planning documents could be improved by more clearly explaining and disclosing these details.
El Camino Real BRT:
Report to the Independent Third Party Steering Committee
Draft Environmental Impact Report/Environmental Assessment (DEIR/EA)
Final Report

September 14, 2015

17J16-1745

Innovation for better mobility
INTRODUCTION

Iteris was retained to support the peer review of the El Camino Real (ECR) Bus Rapid Transit (BRT) Corridor Draft Environmental Impact Report/Environmental Assessment (DEIR/EA). This memorandum summarizes findings related to the specific questions posed by the Steering Committee. Iteris’ review focused on the following aspects of the traffic analysis:

- Methodologies for study area selection, traffic diversion, travel forecasting, and traffic analysis;
- Calculations regarding level-of-service (LOS), operations analysis, diversion, traffic forecasting, and queuing; and
- Review of the travel demand model outputs used for vehicular and ridership forecasts.

Iteris was directed to focus primary attention on broad-picture tasks (e.g., comparison with other BRT environmental documents and methodologies) and secondary attention on technical tasks (e.g., Synchro traffic operational analysis and travel model forecasting). Per the schedule, Iteris was to complete documentation by August 20, 2015. The following list includes major milestones related to project schedule and contract execution.

- June 15, 2015: Iteris attended a kickoff meeting with the Steering Committee.
- June 18, 2015: Iteris provided redline comments and edits on the Master Agreement and Work Authorization.
- June 24, 2015: The Steering Committee accepted the action items as written by Iteris, following direction by the Steering Committee at the kickoff meeting.
- July 6, 2015: As a risk management measure in the absence of a signed contract from South Bay Transportation Associates (SBTA), Iteris put the project on hold.
- July 7, 2015: Iteris delivered the first draft document to the Steering Committee for review, including Sections 1, 2, 3, and 7. The draft document was delivered in good faith that a signed contract was forthcoming.
- July 13, 2015: Iteris attended a conference call to discuss Steering Committee comments on the first draft of document. This meeting attendance was in good faith that a signed contract was forthcoming.
- July 17, 2015: Iteris sent the signed contracts (Master Agreement and Work Authorization) to the South Bay Transportation Associates (SBTA).
- July 27, 2015: Iteris received a signed contract and approval to begin work.
- August 20, 2015: Iteris delivered a final draft document to the Steering Committee.

For the remainder of this memorandum, the El Camino Real BRT DEIR/EA (ICF International, October, 2014) project will be referred to as the ECR BRT project. The Traffic Operations Analysis Report (TOAR)
completed by DKS on August 6, 2014 (DKS, August 6, 2014) will be the primary source of documented traffic analysis used for this report.
## ACRONYMS

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<thead>
<tr>
<th>Acronym</th>
<th>Description</th>
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<td>Association of Bay Area Governments</td>
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<td>AC</td>
<td>Alameda County</td>
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<td>ADT</td>
<td>Average Daily Traffic</td>
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<td>BRT</td>
<td>Bus Rapid Transit</td>
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<td>CNG</td>
<td>Compressed Natural Gas</td>
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<td>DEIR</td>
<td>Draft Environmental Impact Report</td>
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<td>DEIS</td>
<td>Draft Environmental Impact Statement</td>
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<td>EA</td>
<td>Environmental Assessment</td>
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<td>Final Environmental Impact Statement</td>
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<td>FTA</td>
<td>Federal Transit Administration</td>
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<td>GHG</td>
<td>Greenhouse gas</td>
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<td>HCM</td>
<td>Highway Capacity Manual</td>
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<tr>
<td>LADOT</td>
<td>Los Angeles Department of Transportation</td>
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<tr>
<td>LACMTA</td>
<td>Los Angeles County Metropolitan Transportation Authority (Metro)</td>
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<td>LOS</td>
<td>Level of Service</td>
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<td>LRT</td>
<td>Light Rail Transit</td>
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<td>MIS</td>
<td>Minor Investment Study</td>
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<td>MOE</td>
<td>Measures of Effectiveness</td>
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<tr>
<td>mph</td>
<td>Miles Per Hour</td>
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<td>MUTCD</td>
<td>Manual of Uniform Traffic Control and Devices</td>
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<td>PA</td>
<td>Project Approval</td>
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<td>PDS</td>
<td>Project Development Support</td>
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<td>PHF</td>
<td>Peak Hour Factor</td>
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<td>PSR</td>
<td>Project Study Report</td>
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<td>South Bay Transportation Associates</td>
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<td>TOAR</td>
<td>Traffic Operations Analysis Report (DKS, August 6, 2014)</td>
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<tr>
<td>VMT</td>
<td>Vehicle Miles Traveled</td>
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<tr>
<td>vphpl</td>
<td>Vehicles Per Hour Per Lane</td>
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<td>Santa Clara Valley Transportation Authority</td>
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APPENDIX

Presentation made to FTA by VTA (March 24, 2015)
1 COMPARISON TO RECENT TRAFFIC IMPACT ANALYSIS

As a priority, the Steering Committee requested that Iteris verify that the traffic impacts reported in the ECR BRT project were consistent with Traffic Impact Analyses (TIAs) completed within the project study area in the last two years. The task was to compare the methodologies and the level-of-service (LOS) performance at intersections in common with other TIAs. The review concluded that the methodologies used for the ECR BRT TIA were consistent with other TIAs. The review also concluded that the future No Build (or “without project”) LOS conditions specified in the ECR BRT TIA for common intersections with other TIAs typically varied by no more than one letter grade. A comprehensive conclusion is discussed in Section 1.4.

A TIA (the ECR BRT TIA) was completed for the ECR BRT project, titled VTA El Camino Real Bus Rapid Transit Project EIR Traffic Impact Analysis for Off-Corridor Intersections (CHS Consulting Group, February 28, 2014). The ECR BRT TIA is included in its entirety in Appendix I of the TOAR (DKS, August 6, 2014).

Iteris’ comparison included investigating two main elements of the TIA projects: 1) determining whether or not the ECR BRT TIA applied methodologies consistent with other comparable TIAs and with VTA guidelines, and 2) comparing future No Build intersection LOS for each project to understand the assumed forecast conditions. When comparing future LOS, it is important to determine the extent of the differences as well as the reasons for them.

The following recently completed TIAs represent all future developments within approximately one mile of the El Camino Real corridor. Each of these TIAs was compared to the ECR BRT TIA:

- 1984 El Camino Real (SR 82) Draft TIA in the City of Mountain View (Hexagon Transportation Consultants, Inc., May 9, 2013);
- The Village at San Antonio Center (Phase 2) in Mountain View, California Final TIA (Fehr & Peers, March, 2014);
- 1050 Page Mill Road Office Development Draft TIA in the City of Palo Alto (Hexagon Transportation Consultants, Inc., January 23, 2015);
- Santa Clara Gateway Village Draft TIA (Fehr & Peers, May 2014);
- Sobrato Mixed-Use Project Draft TIA in the City of Sunnyvale (TJKM Transportation Consultants, September 20, 2013); and
- Diridon Station Area Plan TIA in the City of San Jose (Hexagon Transportation Consultants, Inc., June 28, 2013).

Figure 1 shows the location of the ECR BRT project and each future development TIA along the corridor.
1.1 Methodology

The ECR BRT project utilized the 2000 Highway Capacity Manual (HCM) delay-based methodology, which is consistent with the methodology used in the other recent TIAs along the study corridor. In addition, the significant impact criteria used in the ECR BRT TIA and in comparable TIAs is consistent with the criteria recommended in the VTA Transportation Impact Analysis Guidelines (VTA, Adopted October 2014).

1.2 LOS Comparison

Level-of-service (LOS) results were compared for near-term conditions (or future “Background” conditions) at intersections along El Camino Real that were studied in both the ECR BRT TIA and other recent TIAs. The results are summarized in Table 1. As shown, in near-term “without project” conditions, nearly all of the common intersections showed similar LOS results that differed by no more than one letter grade (e.g., LOS B versus LOS C). The purpose of selecting a one-letter-grade difference as the metric for this analysis is to acknowledge that there are multiple ways of forecasting traffic growth, and there are also unknown factors used for LOS analysis that can vary between projects (e.g., signal cycle length and existing count information). The comparable TIAs did not include long-range horizon year scenarios, thus no comparisons were made for the 2040 conditions.
### Table 1: Near-term “Background” Conditions LOS Comparisons

*Source:* Compiled by Iteris (see sources at bottom of table)

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<thead>
<tr>
<th>Intersection</th>
<th>AM</th>
<th>PM</th>
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<tr>
<td>9 El Camino Real/California Avenue</td>
<td>21.0 C 16.1 B 27.1 C 24.1 C</td>
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<tr>
<td>10 El Camino Real/Page Mill Road</td>
<td>64.9 E 55.8 E 51.0 D 63.2 E</td>
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<td><strong>Mountain View Intersection</strong></td>
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<td>1 El Camino Real/Escuela Avenue</td>
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<td>29 El Camino Real/Shoreline Boulevard</td>
<td>39.1 D 61.3 E 39.6 D 47.9 D</td>
<td></td>
</tr>
<tr>
<td><strong>Sunnyvale Intersection</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>34 El Camino Real/South Bernardo Ave</td>
<td>39.3 D 36.5 D 34.7 C 39.1 D</td>
<td></td>
</tr>
<tr>
<td>36 El Camino Real/South Mary Avenue</td>
<td>37.2 D 42.4 D 37.3 D 46.1 D</td>
<td></td>
</tr>
<tr>
<td>38 El Camino Real/South Mathilda Ave</td>
<td>34.5 C 49.0 D 32.5 C 58.9 D</td>
<td></td>
</tr>
<tr>
<td>40 El Camino Real/South Sunnyvale Ave</td>
<td>24.8 C 20.7 C 30.9 C 42.7 D</td>
<td></td>
</tr>
<tr>
<td><strong>Santa Clara Intersection</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>47 El Camino Real/Halford Avenue</td>
<td>15.8 B 16.3 B 21.0 C 21.4 C</td>
<td></td>
</tr>
<tr>
<td>51 El Camino Real/Flora Vista Avenue</td>
<td>17.4 B 14.8 B 18.2 B 14.5 B</td>
<td></td>
</tr>
</tbody>
</table>
1.3 Impact Comparisons

This section differs from Section 1.2 in that it discusses long-term conditions (or future “Build” conditions). After discussion with the Steering Committee, it was determined that comparing the impacts of the recent TIAs with the ECR BRT project would not be appropriate since the projects are depicted with different geometries along El Camino Real, and likely have different land-use assumptions. In addition, the recent TIAs along the corridor are development projects, which do not necessarily redistribute traffic patterns, but generate additional traffic. Whereas the ECR BRT project redistributes traffic, modifies geometry of El Camino Real at various locations (based on project alternative), and shifts mode selection from automobile to transit. Also, Iteris was not able to determine if the background forecast land-use for the ECR BRT project included these recent TIA assumptions within the model.

1.4 Conclusion of Recent TIA Review

Overall, it was determined that the methodologies used for the ECR BRT TIA were consistent with the methodologies used for other recent TIAs. Furthermore, the near-term “Background” conditions LOS comparison (from Section 1.2) resulted in nearly identical LOS forecasts at all common intersections. For intersections where the forecasts differed, the variance was typically by only one letter grade.
2 REVIEW OF OTHER RECENT BRT PROJECTS

After reviewing the ECR DEIR/EA (ICF International, October, 2014), Iteris began a process of brief review of other recent BRT projects similar in scope to the ECR BRT project. The brief review consisted of a broad comparison of study area, diversion, transit forecasting methodology, alternative modes, location of dedicated lane, and a very brief look at performance measures included in evaluation. The intent of the BRT comparison was to provide the Steering Committee with a general review and understanding of project scope, study area definition, traffic forecasting methodologies, and performance measure evaluation. The purpose of the BRT project comparison was to provide enough information to the Steering Committee to be able to determine if the methods and results presented in the ECR BRT project are similar to other similarly scoped BRT projects. This high-level comparison was used to set the stage for the technical investigation into the ECR BRT project (Section 3.0, Section 4.0, Section 5.0, Section 8.0, Section 9.0, and Section 10.0). Overall, and as discussed in Section 2.2, the ECR BRT project compares well with similarly scoped BRT projects at the same environmental phase of the project.

The comparative BRT projects were centered primarily in California, but similar projects in Oregon, Washington, and Hawaii are also included. Figure 2 shows the location of the comparative BRT projects. Table 2 summarizes project specifications of the comparable BRT projects including:

- Date and phase of the completed environmental documentation;
- Length of the project;
- Average stations per mile; and
- Peak period headways.

Not all of the projects are at the same stage; some are still in the planning phase. Including projects in the planning phase in the comparison is important, but is not meant to be misleading. One main comparison was to evaluate how the study area was determined, and projects in a lower phase do have processes in place that are comparable to the ECR BRT project.
Figure 2: Comparative BRT Projects

Source: Iteris

Table 2: BRT Project Specifications

Source: Compiled by Iteris (see sources at bottom of table)

<table>
<thead>
<tr>
<th>PROJECT AND LOCATION</th>
<th>DATE OF ENVIRONMENTAL DOCUMENTATION</th>
<th>PROJECT STAGE</th>
<th>LENGTH</th>
<th>STATIONS PER MILE</th>
<th>HEADWAYS</th>
</tr>
</thead>
<tbody>
<tr>
<td>El Camino Real BRT¹, Santa Clara County, CA</td>
<td>October 2014</td>
<td>DEIR/EA</td>
<td>17.6 miles</td>
<td>&lt;1</td>
<td>10 minutes</td>
</tr>
<tr>
<td>(2.1.1) AC Transit Berkeley/Oakland/San Leandro Corridor MIS² Alameda Contra Costa County, CA</td>
<td>September 2002</td>
<td>MIS</td>
<td>18 miles</td>
<td>2-2</td>
<td>5-7.5 minutes</td>
</tr>
<tr>
<td>(2.1.2) Alum Rock BRT FEIR³ Santa Clara County, CA</td>
<td>November 2008</td>
<td>FEIR</td>
<td>7.4 miles</td>
<td>1</td>
<td>6 minutes</td>
</tr>
<tr>
<td>(2.1.3) Van Ness Avenue BRT⁴ FEIS/EIR, San Francisco County, CA</td>
<td>July 2013</td>
<td>FEIR/EIS</td>
<td>2 miles</td>
<td>4</td>
<td>&lt;=8 minutes</td>
</tr>
<tr>
<td>(2.1.4) Geary Corridor BRT⁵ San Francisco County, CA</td>
<td>N/A</td>
<td>Working on DEIR/EIS – Expected late 2015</td>
<td>6.5 miles</td>
<td>3-4</td>
<td>5-7.5 minutes</td>
</tr>
<tr>
<td>PROJECT AND LOCATION</td>
<td>DATE OF ENVIRONMENTAL DOCUMENTATION</td>
<td>PROJECT STAGE</td>
<td>LENGTH</td>
<td>STATIONS PER MILE</td>
<td>HEADWAYS</td>
</tr>
<tr>
<td>----------------------</td>
<td>-------------------------------------</td>
<td>---------------</td>
<td>--------</td>
<td>------------------</td>
<td>---------</td>
</tr>
</tbody>
</table>
| (2.1.5) East San Fernando Valley Transit Corridor DEIS/EIR<sup>6</sup>  
Los Angeles County, CA | N/A | Working on Draft EIS/EIR – Expected late 2015 | 11-12 miles | 1-2 | 6 minutes |
| (2.1.6) Madison Street Corridor BRT<sup>7</sup>  
Seattle, WA | N/A | Purpose and Need Completed | 2.1 miles | 2-3 | 5-6 minutes |
| (2.1.7) Wilshire Boulevard BRT<sup>8</sup>  
EIR/EA, Los Angeles County, CA | April 2011 | EIR/EA | 12.5 miles | 2-3 | 10 minutes |
| (2.1.8) Powell-Division Transit and Development Project<sup>9</sup>  
Portland to Gresham, OR | N/A | Feasibility | 15+ miles | 2 | 3-5 minutes |
| (2.1.9) Honolulu High-Capacity Transit Corridor Environmental Impact Statement<sup>10</sup>  
Oahu, HI | June 2010 | FEIS | 23 miles | 1 | 3-6 minutes |

2.1 Comparison of BRT Projects

The purpose of this section is to compare similar BRT projects to the ECR BRT project. The comparative projects are in various forms and at different stages of planning (e.g., planning stages, DEIR, FEIR, project constructed). Several key points were compared between BRT projects. The geographical location, study year, length, daily boardings, stops per mile, and headways were key factors in the selection of projects for comparison. In addition, specific, relevant information about the study area, diversion analysis, travel demand forecasting methodology, use of alternative modes, location of the dedicated lane, and performance evaluation were looked at in greater detail and is discussed briefly.

The technical information for the ECR BRT project was obtained from the TOAR (DKS, August 6, 2014). The bullets below summarize the ECR BRT project and serve as a basis for comparison for the remainder of this section.

- Santa Clara County, California
- DEIR/EA Completed October 2014
- Length = 17.6 miles
- Boardings in Corridor:
  - Current = 12,500
  - Forecast = 21,000 to 30,000
- Stations per Mile = Less than 1
- Headways = 10 minutes

- **Study Area:** The study area for the ECR BRT project was selected based on travel model outputs. The TOAR does not physically define one study area that was used for the project, but maintains three distinct study areas used for various portions of the project. The three study areas are the “study corridor” (El Camino Real between the transit center in Palo Alto and the arena in San Jose), the “expanded geographic area” (roughly ½ to 1 mile outside of the corridor), and the “El Camino Real broader corridor” (the area between US-101 and I-280 the entire length of the corridor). A technical review of the adequacy of the study area is included in Section 3.0 of this report. The BRT project comparisons below will look at the adequacy of the ECR BRT project study area as compared to other projects. Comparisons are based on methodology for determination as well as professional judgment.

- **Diversion:** The ECR BRT project discussed diversion in two ways: a shift in transportation mode (from vehicle to bus, bicycle, or walking) and shift in path (change in route from one road to another). A comparison of Alternative 4C to No Build transit ridership in Table 2 of the TOAR results in an increase in daily ridership of up to 40 percent for the year 2040. A detailed technical review of the adequacy of the diversion analysis is included in Section 3.2 of this report. The BRT comparisons below look at the extent of diversion analysis completed for each BRT project and compare those analyses with the ECR BRT project. As a note, the VTA travel demand model only considers trip distribution and mode choice effects caused by the transit and highway network assumptions, and does not include a peak spreading or a trip suppression model. Therefore, there was no discussion in the ECR BRT project documentation about trips shifting to different times of day.
• **Transit Forecasting Methodology:** The transit forecasting methodology for the ECR BRT project utilized the growth in transit ridership demands (existing and forecast) directly from the VTA travel demand model and added them to the existing count data (2013). A technical review of the forecasting methodology is included in Section 9.0 of this report. This report compares the methodology used for the ECR BRT project with that of other studies.

• **Alternative Modes:** The selected alternatives for the ECR BRT project did not include modes other than BRT. This report note whether similarly scoped BRT projects also included enhanced bus or LRT as project alternatives. This comparison is an informative piece of information in providing context for the comparative BRT projects. A review of the completeness in evaluation of potential LRT alternatives in the ECR BRT project is included in Section 8.0 of this report.

• **Location of Lane:** The ECR BRT project included alternatives with dedicated median lanes, dedicated curb lanes, and mixed-flow BRT service. The comparisons below look at whether other studies included similar analyses. The comparison of the location of the lane is an informative piece of information providing context for BRT projects. No technical review of the alternatives was concluded.

• **Performance Measure Evaluation:** The ECR BRT project identified transit ridership, travel time, intersection level-of-service, parking, bike and pedestrian environment, vehicle screenline diversion, VMT, VHT, and average speed as measures of effectiveness for the project. The general finding from the analysis states that as the length of the dedicated BRT lane increases, there is a greater shift from travel by automobile to travel by transit, which does the following: increases transit ridership, decreases travel time, decreases diversion, decreases VMT and VHT, and increases speeds. All of this was completed within the broad project study area. The comparisons below include a brief description of performance measures evaluated for other BRT projects. This comparison is provided for informational purposes for the Steering Committee.

2.1.1 **AC Transit Berkeley/Oakland/San Leandro Corridor MIS**

The Alameda County Berkeley/Oakland/San Leandro Corridor MIS (Cambridge Systematics, Inc., September 9, 2002) was selected due to its geographical location as well as its similarity in length and boardings to the El Camino Real BRT DEIR/EA. The primary documentation used to gather comparable information is the **AC Transit Berkeley/Oakland/San Leandro Corridor MIS Summary Report** (Cambridge Systematics, Inc., September 9, 2002). Additional documentation, including an executive summary, a document about alternatives development, and an evaluation of alternatives report, are available at [http://www.actransit.org/planning-focus/your-guide-to-bus-rapid-transit/brt-project-status/](http://www.actransit.org/planning-focus/your-guide-to-bus-rapid-transit/brt-project-status/).
• **Study Area**: The study area was selected based on city and stakeholder outreach. At the current stage of the project, the study area is defined as being generally bound by major parallel facilities, and completely within the bounds of the two major parallel freeways. The overall study area is similar to the El Camino Real broader corridor area.

• **Diversion**: The MIS did not include any discussion about diversion and queuing.

• **Transit Forecasting Methodology**: The methodology for transit and automobile forecasting was discussed briefly in the Development of Alternatives Report (Cambridge Systematics, Inc., September 9, 2002), in which the Alameda Countywide Travel Model was modified to include updated land-use data. Ridership was obtained for 2005 and 2020 from the Alameda County travel demand model, and a growth factor was developed. The growth factor developed from model data was applied to existing ridership information to obtain ridership forecasts. This is similar to the ECR BRT project, however, the ECR BRT project used true growth ridership rather than a growth factor to obtain forecast ridership estimates.

• **Alternative Modes**: The MIS included enhanced bus and LRT alternatives. Alternatives also considered various alignments and corridors based on access to major employment and educational centers, as well as public outreach.

• **Location of Lane**: The recommended alternative did include a dedicated facility for BRT, but it was not immediately clear if it was a median or a curb lane.

• **Performance Measure Evaluation**: The performance evaluation was documented in the Evaluation of Alternatives Report (Cambridge Systematics, Inc., September 9, 2002). Each of the alternatives considers travel time, but does not include a comparison between automobile and transit travel time. The VMT and related GHG performance for the scenarios is documented in the Evaluation of Alternatives report on a segment-by-segment basis. The reported values shown in the document show only the estimated reduction in VMT compared to the existing bus service. As expected, the LRT and BRT alternatives showed significantly greater reduction in VMT and greenhouse gas emissions than the enhanced bus alternatives. The reduction in VMT for build alternatives is similar to the pattern shown in the ECR BRT project, which will be discussed in Section 4.0 of this report.

### 2.1.2 Alum Rock BRT FEIR

The Alum Rock BRT FEIR was selected as a comparative project because it was also identified in the VTA BRT Strategic Plan as a viable near-term BRT project in Santa Clara County. Both the ECR BRT project and the Alum Rock BRT FEIR project alignment are along existing Route 522. The technical information for the
Alum Rock BRT project was primarily obtained from Appendix C of the FEIR, the *Transportation Study 9-25-07 w_Addendum* (Korve Engineering, September 2007). All of the environmental documents for Alum Rock BRT FEIR are available at [http://www.vta.org/Projects-and-Programs/Transit/Santa-Clara-Alum-Rock-BRT-Environmental-Documents](http://www.vta.org/Projects-and-Programs/Transit/Santa-Clara-Alum-Rock-BRT-Environmental-Documents).

- Santa Clara County, California
- FEIR Completed November 2008
- Length = 7.4 miles
- Boardings on BRT Route:
  - Current = 6,220
  - Forecast = 17,070
- Stations Per Mile= 1 (8 stations for BRT, 8 to 10 stations for LRT)
- Headways = 6 minutes

- **Study Area:** The study area for the Alum Rock BRT project was defined as being fully enclosed within the Downtown East Valley Study Area, which was identified in 1999 as a part of the Downtown East Valley MIS. The corridor for the project lies within the Downtown East Valley Study Area and is characterized by a high level of small-business and community activity. The Downtown East Valley Investment Study planning area was used as guidance for selection of the study area, and the study area for the Alum Rock BRT project was extended significantly to the east to capture light rail transit alternatives. In comparison, the ECR BRT project evaluated significantly more intersections than the Alum Rock BRT project, extending the analysis for intersections between ½ and 1 mile from the principal corridor, which is above and beyond the Alum Rock BRT FEIR.

- **Diversion:** The Transportation Analysis Report did not discuss diversion or queuing in any depth, though it did recognize that the diversion of traffic onto adjacent arterials would be impact significance criteria. Arterial queuing was evaluated for impacts in Appendix B to Addendum 1 for the FEIR (AECOM, May 2010). No analysis of screenline traffic was completed for the Alum Rock BRT project, making the diversion analysis not comparable to the ECR BRT project. Therefore, the ECR BRT project completed a more extensive diversion and queuing analysis than the Alum Rock BRT Project.

- **Transit Forecasting Methodology:** The Santa Clara CMP travel demand model was used to obtain ridership demands for the routes within the study area. The demand in ridership (directly from the Santa Clara CMP travel demand model) was used to obtain ridership forecasts, as well as to determine whether there was adequate capacity available on the bus system. This methodology is slightly different from that of the ECR BRT project, which did not use raw model forecasts, but calculated a growth in demand from raw model forecasts, which were then added to existing ridership information.

- **Alternative Modes:** Phase 1 of the study included only BRT as a transit mode, but Phase 2 of the study includes the construction of an LRT line in the project corridor.

- **Location of Lane:** The BRT alternative includes both a dedicated center and dedicated median lanes at different locations along the project corridor. The majority of the stops are located on the curb side of the roadway, with the King Road Station and Jackson Avenue Stations having median running alignment and stop access.
• **Performance Measure Evaluation:** The evaluation methodology used for the project was based on the policy guidelines of VTA’s Congestion Management Program (VTA, October 2013), as well as other guidelines. The discussion in the FEIR primarily focused on impacts to the 26 analyzed intersections. A separate chapter in the FEIR was used to discuss air quality performance, which was not an impact. There was no discussion of VMT in the chapter, only a presentation of the results. The performance evaluation was limited to a discussion of project mitigation, which was primarily based on intersection levels of service. The ECR BRT project expanded upon this methodology and included VMT and screenline analysis for system performance evaluation.

2.1.3 **Van Ness Avenue BRT FEIS/EIR**

The Van Ness Avenue BRT FEIS/EIR was selected as a representative project due, in part, to geography as well as project timing. The Van Ness Avenue BRT project is shorter in length than the ECR BRT project and has more peak period and daily boardings. However, the environmental documentation was completed in 2013, which is recent. The primary source of technical information used for this summary was found in the *Final Van Ness Corridor Bus Rapid Transit Traffic Analysis Vehicular Traffic Analysis Technical Memorandum* (CHS Consulting Group, July 7, 2013). Documentation for the Van Ness Avenue BRT FEIS/EIR is located at [http://www.sfcta.org/van-ness-avenue-bus-rapid-transit-planning-and-environmental-studies#DOW](http://www.sfcta.org/van-ness-avenue-bus-rapid-transit-planning-and-environmental-studies#DOW).

- San Francisco County, California
- FEIS/EIR Completed July 2013
- Length = 2 miles
- Boardings in Corridor:
  - Current = 38,100
  - Forecast = 49,100 to 52,300
- Stations Per Mile = 4
- Headways = Potentially less than the existing 8 minutes

- **Study Area:** The study area for the Van Ness Avenue BRT project was selected based on the intersections and roadways likely to see negative impacts in the build condition of the Van Ness Avenue BRT Project. The documentation was not clear on how the negatively impacted intersections and roadways were identified. The resulting Van Ness Avenue Corridor Study Area was defined as Van Ness Avenue and five parallel streets (Gough Street, Franklin Street, Polk Street, Larkin Street, and Hyde Street). The study area for the ECR BRT project is similar to the Van Ness Avenue BRT project, in that the ECR BRT project includes parallel streets that are between ½ and 1 mile from El Camino Real.

- **Diversion:** The diversion analysis discussed in the report presented 18 to 32 percent of travelers in the No Build alternative would change their trip (or divert) from auto to transit or parallel facility in the Build alternative. Diversion analysis indicated travelers in the Build alternative would shift modes, change the time of day, forego, or divert their trip to a different part of the city. The vehicle diversion analysis showed that no facility outside of Van Ness Avenue would increase by more than 50 vehicles per hour in either direction. The percentage of diversion away from the corridor is similar to what is reported in the ECR BRT project. Technical information related to the ECR BRT project diversion analysis is included in Section 3.2 of this report. The ECR
BRT project is based on the VTA travel demand model that does not include a trip suppression model, nor a peak spreading model. While the diversion analyses are similar, the Van Ness Avenue BRT project includes a more extensive analysis of the travel effects of the BRT project implementation.

- **Transit Forecasting Methodology:** Three tools were used to complete the traffic analysis: 1) The SF_CHAMP travel demand model (used to forecast ridership), 2) Synchro for traffic operations, and 3) VISSIM micro-simulation for transit analysis. Transit growth and pedestrian growth were obtained directly from the SF-CHAMP model and input into the VISSIM model, and automobile growth was processed within Synchro before being input into the VISSIM model. A significant amount of data in the Traffic Analysis Memorandum was derived directly from the travel forecast model, including mode split for daily trips, transit route ridership forecasts, and diverted and non-diverted trips. The travel model forecasts were initially validated to existing count information. This methodology is slightly different from that of the ECR BRT project, where the existing ridership was obtained, and then the change in demand between the existing and forecast years was added to the ridership data.

- **Alternative Modes:** The inclusion of enhanced bus or LRT as project alternatives was not a part of the project.

- **Location of Lane:** The BRT along Van Ness Avenue features dedicated bus lanes. There are multiple alternatives to the BRT route and various lane configurations. Lane configurations include mixed-flow, dedicated curb lane, and dedicated median lane. The preferred alternative features a dedicated center median lane with right side boarding.

- **Performance Measure Evaluation:** Intersection LOS analysis was completed for the majority of roadway intersections within the study area using the Synchro model and HCM 2000 methodology. An average speed comparison was made for auto and transit, and showed that auto speed would decrease by 1 mph from the existing condition for all alternatives, and that the transit speed would stay the same as existing for the No Build alternatives. The Traffic Analysis Memorandum concluded that there would be an increase in transit speed for Build alternatives. The Van Ness Avenue BRT project evaluated non-motorized LOS. The ECR BRT project completed a similarly scoped performance measure evaluation, but included more information related to regional statistics (including VMT and GHG performance). However, the ECR BRT project did not evaluate non-motorized transportation, including bicycle or pedestrian LOS.

2.1.4 **Geary Corridor BRT**

The Geary Corridor BRT facility is currently the most heavily used transit corridor in the northern part of San Francisco. Current bus service is often unreliable and crowded due to its high ridership – over 50,000 boardings daily. This project was selected as comparable because of its geographical proximity to the ECR BRT project as well as being a representative large-scale transit corridor. The Geary Corridor BRT project is currently in the environmental analysis phase of the project, so no EIR is available for comparison; however, the Alternatives Screening Report (San Francisco County Transportation Authority, May 19, 2009) to the EIR/EIS is available. The project documents are located at [http://www.sfcta.org/delivering-transportation-projects/geary-corridor-bus-rapid-transit-home](http://www.sfcta.org/delivering-transportation-projects/geary-corridor-bus-rapid-transit-home).
El Camino Real BRT: Report to the Independent Third Party Steering Committee (Final Report)

- San Francisco County, California
- Currently working on DEIR/EIS, expected late 2015
- Length = 6.5 miles
- Boardings in Corridor:
  - Current = 50,000
  - Forecast = ~55,000 (Obtained from 10 percent growth estimate in public presentation)
- Stations Per Mile= 3 to 4
- Headways = 5 to 7.5 minutes

- **Study Area:** There was no discussion in the Alternatives Screening Report of a study area outside of the existing Geary Corridor alignment. This is potentially due to the stage of the project, and not having a completed DEIR/EIS available for review at this time. The current study area shown in public display boards is limited to Geary Corridor.

- **Diversion:** Diversion was not discussed in the Alternatives Screening Report but may be a concern for the traffic section of the environmental report. This information is likely to be presented in the DEIR/EIS report that is currently in progress.

- **Transit Forecasting Methodology:** The available reports on the Geary Corridor BRT website do not show methodologies for travel demand forecasting. A discussion of the methodology should be included in the transportation section of the environmental documentation. This is likely due to the stage of the project, and it is likely this information will be presented at a later date.

- **Alternative Modes:** The Alternatives Screening Report included nine alternatives, of which one was surface rail, one was underground rail, and one was a combination of surface and underground rail. The rail alternatives were found to have fatal flaws and were not recommended for inclusion in the EIR/EIS.

- **Location of Lane:** The Alternatives Screening Report included variations of both curb and median dedicated transit lanes, including a one-sided, separated busway facility. Screening of the alternatives removed the bus lanes and one-sided busway alternatives from further review, and they will not be included in the EIR/EIS. The alternative recommended for the EIR/EIS was a side-running BRT with a dedicated facility.

- **Performance Measure Evaluation:** The available reports on the Geary Corridor BRT website do not present performance measures directly. However, presentations on the implementation of the BRT alternative show an increase in travel time (25 percent), a reduction in variability (20 percent), and an increase in transit service along the corridor.

2.1.5 **East San Fernando Valley Transit Corridor DEIS/EIR**

The East San Fernando Valley Transit Corridor project was selected because it is longer than ten miles and has roughly the same number of stations per mile and ridership forecasts as the ECR BRT project. The *Alternatives Analysis Report* (KOA Corporation, December 2012) was the primary source of documentation used in the comparison. The environmental document is currently being prepared as an EIS/EIR for six alternatives, including TSM, BRT, and LRT. Documentation on the project is located at [http://www.metro.net/projects/east-sfv/](http://www.metro.net/projects/east-sfv/).
Los Angeles County, California
- Alternatives Analysis Report completed in December 2012. Currently working on Draft EIS/EIR, expected mid to late 2015
- Length = 11 to 12 miles
- Boardings in Corridor:
  - Current = 25,000
  - Forecast = 33,600 (BRT) to 37,500 (LRT)
- Stations Per Mile = 1 to 2
- Headways = 6 minutes in the peak period, 12 minutes in the off-peak period

**Study Area:** The study area was selected by using the Los Angeles County Metropolitan Transportation Authority (Metro) travel forecast model and by determining the area that would likely see lower vehicle speeds and increased travel delay for a Build alternative. The project study area extended outside of the BRT corridor by approximately half a mile, and at a minimum, past the neighboring major parallel facility or freeway. The selection method and scope of the study area are similar to those of the ECR BRT project.

**Diversion:** A discussion about diversion was not included in the Alternatives Analysis report, but will likely be included in the DEIS/EIR report that is currently being developed.

**Transit Forecasting Methodology:** The forecasts for vehicles and transit are based on the Metro travel forecast model. Transit forecasts were obtained directly from the Metro model. The methodology for the East San Fernando Valley project is slightly different from the ECR BRT project, where the existing counts were taken and the change in demand between the existing and forecast years were added to the ridership count data.

**Alternative Modes:** The East San Fernando Valley project studied six alternatives, including transportation systems management (TSM) alternatives, as well as curb-running dedicated BRT lanes, median-running dedicated BRT lanes, low-floor LRT, and LRT.

**Location of Lane:** All recommended alternatives for the EIR/EIS included median running dedicated lanes with either side or center platforms. This is the same for both BRT and LRT alternatives. There were some segments in the recommended alternatives where mixed-flow of travel may be expected.

**Performance Measure Evaluation:** Performance evaluation included factors related to transit ridership, system-wide user benefits, system-wide new ridership, VMT reduction, journey times, and vehicular travel time impacts. The measures used are similar to, but more extensive than those the ECR BRT project performance evaluation.

### 2.1.6 Madison Street Corridor BRT

The Madison Street Corridor BRT project was selected for comparison to the ECR BRT project due to its identification by a regional transit master plan and its forecast for significant population and employment growth in the general region. The Madison Street Corridor project is currently in the scoping and conceptual design phase, and was identified as a future high-capacity transit BRT corridor in the *Transit Master Plan* (City of Seattle Department of Transportation, April 2012). The primary source of information for the Madison Street Corridor BRT project was the *Purpose and Need* documentation (Nelson Nygaard,
El Camino Real BRT: Report to the Independent Third Party Steering Committee (Final Report)

January 8, 2015. Additional information about the project is located at http://www.seattle.gov/transportation/MadisonBRT.htm.

- Seattle, WA
- Purpose and Need: Completed January 2015
- Length = 2.1 miles
- Boardings in Corridor:
  - Current = 7,800
  - Forecast = 14,000
- Stations Per Mile = 2 to 3
- Headways = 5 to 6 minutes

- **Study Area:** The current study area for the Madison Street Corridor BRT does not extend far beyond the study corridor, and does not include parallel facilities. Text for existing conditions states that the study area extends a half mile to each side of the corridor. The ECR BRT project broader corridor area includes a greater geographical area, including intersection and diversion analysis outside of the immediate corridor.

- **Diversion:** Diversion has not been evaluated at this stage of the project.

- **Transit Forecasting Methodology:** The methodology used for forecasting transit ridership has not been discussed in public documents at this time.

- **Alternative Modes:** The Seattle Transit Master Plan identified Madison Street as a BRT corridor. Currently there are no other modes identified as alternatives.

- **Location of Lane:** At this phase of the project, both curbside and median stations were discussed for BRT alternatives.

- **Performance Measure Evaluation:** The project has not reached the performance evaluation stage; however, one of the needs of the project is due to the increase in GHG emissions between 1990 and 2008. The performance measures for various alternatives will likely include a comparison of VMT and GHG for regional and corridor level performance.

2.1.7 Wilshire Boulevard BRT EIR/EA

The Wilshire Boulevard BRT EIR/EA (Iteris, April 1, 2011) was selected as a comparative project due to the length of project, as well as the forecast mode shift and impacted study area. Both projects are similar in nature, serving a large number of riders and locations with high population and employment. Additional information about the project is located at http://www.metro.net/projects/wilshire/.
Los Angeles County, California
- EIR/EA Completed April 2011
- Length = 12.5 miles (9.9 miles of curb lane bus/right turns only and 2.6 miles mixed flow)
- Boardings in Corridor:
  - Current = 80,000
  - Forecast = Expected increases of 10-15 percent
- Stations Per Mile: 2 to 3
- Headways: 10 minutes

**Study Area:** The study area was selected using the Southern California Association of Governments (SCAG) 2008 Regional Transportation Plan (RTP) travel demand model. The results of model runs showed traffic diversion off Wilshire Boulevard onto parallel corridors. The corridors showing a potentially significant increase in traffic upon implementation of the project included portions of Sunset Boulevard (2.3 miles from project corridor), Santa Monica Boulevard (0.7 miles), Olympic Boulevard (2.3 miles), Pico Boulevard (3.2 miles), 3rd Street (0.9 miles), 6th Street (0.2 miles), and 8th Street (0.5 miles). In consultation with Los Angeles County Metropolitan Transportation Authority (LACMTA) and the Los Angeles Department of Transportation (LADOT). A final study area consisting of 74 study intersections determined that 21 intersections were impacted. The study area for the Wilshire Boulevard BRT project was much larger than the ECR BRT project, but the methodology for selection was similar.

**Diversion:** Diversion impacts were determined with the SCAG travel demand model to be significant up to 3.2 miles away from the BRT corridor. When implemented, bus passenger travel times are expected to improve by an average of 24 percent. Based on the bus travel time improvements and associated ridership increases experienced to-date with the Metro Rapid Demonstration Program (Metro, March 2002), transit ridership along the Wilshire corridor is anticipated to increase between 15 and 20 percent. It should also be noted that the Wilshire Boulevard BRT project estimated a mode shift in the corridor up to 10 percent from mixed-flow to bus use. The diversion analysis completed for the Wilshire Boulevard BRT project was similar to the ECR BRT project; however, the Wilshire Boulevard analysis was more extensive.

**Transit Forecasting Methodology:** The methodology used for forecasting transit ridership was Metro’s Federal Transit Administration (FTA) approved travel demand forecasting model. Transit forecasts were obtained directly from the model. This is different from the methodology used for the ECR BRT project, which did not utilize forecasts from the VTA regional travel model, but utilized forecast ridership growth and added that to existing ridership information.

**Alternative Modes:** Only BRT and bus lane alternatives were studied.

**Location of Lane:** Dedicated lanes are a part of the project, and the lanes are located at the curb side of the roadway.

**Performance Measure Evaluation:** The primary performance measures evaluated were related to the consistency and reasonableness of GHG and VMT. During operation of the proposed action, the documentation concluded that a beneficial impact on GHG emissions would occur due to decreased traffic congestion along the Wilshire corridor, increased efficiency and use of the Compressed Natural Gas (CNG)-fueled Wilshire BRT, and decreased personal vehicle VMTs. The proposed project would result in less-than significant greenhouse gas emissions impacts.
2.1.8 Powell-Division Transit and Development Project

The Portland Area Powell-Division Transit Development project is currently in the feasibility phase, and is not as defined as the ECR BRT project. This project was selected as comparable because Portland is considered to be advanced in their transit development process, and is a good example for other counties and agencies. The project also serves commuter transit in a fashion similar to the ECR BRT project. The primary source of technical information was found in the *Powell-Division Transit Development Project Transit Alternatives Evaluation Results Technical Report* (Unknown (Oregon Metro), March 16, 2015). Additional information on the Powell-Division Transit and Development project is located at [http://www.oregonmetro.gov/public-projects/powell-division-transit-and-development-project/project-library](http://www.oregonmetro.gov/public-projects/powell-division-transit-and-development-project/project-library).

- Portland to Gresham, Oregon
- Alternatives Evaluation completed March 2015, Currently in the feasibility phase
- Length = 15+ miles
- Boardings in Corridor:
  - Current = 17,000
  - Forecast = 28,000+
- Stations Per Mile= Anticipated to be 2 per mile
- Headways = Currently 3 to 5 minutes, less might create problems

- **Study Area:** Through a course of workshops and public outreach, an opportunity area was defined initially to address unmet transit needs within the project corridor. The resulting study area for the project extended past two parallel facilities, and into adjacent populated neighborhoods. The study area is very comparable to the ECR BRT project study area, however, the Powell-Division study area is larger due to geography, and is not bound by parallel freeway facilities.

- **Diversion:** The project has not presented a diversion analysis at this time.

- **Transit Forecasting Methodology:** The methodology used for forecasting transit ridership was completed using the Oregon Metro (Metro) travel demand model. The Transit Alternatives Evaluation Report contained no discussion of transit ridership forecast methodology.

- **Alternative Modes:** The fact sheet for the project states that any type of transit mode will be considered if it complements the neighborhoods along the corridor. Along with BRT, the project states it will investigate LRT and streetcar, at a minimum. In the initial project scoping, LRT, rapid streetcar, dedicated busway, and frequent service plus bus options were all considered.

- **Location of Lane:** Dedicated lanes are a part of the LRT, rapid streetcar, and dedicated busway options. However, the project is not far enough along to determine if the location of the lane will be median or curb lanes.

- **Performance Measure Evaluation:** The project has developed extensive evaluation measures related to ridership, travel times, congestion, service provided, environmental justice, and efficiency. Many of the same measures are evaluated for the ECR BRT project.
2.1.9 Honolulu High-Capacity Transit Corridor EIS

The Honolulu EIS project was selected as a comparative project to the El Camino Real BRT project, primarily due to the length of the project, and the number of cities traversed. In addition, the projected growth in ridership of the Honolulu project is similar to that of the ECR BRT project. The primary source of technical documentation was included in Addendum 03 to the Transportation Technical Report (Unknown (Honolulu Rail Transit), June 11, 2010). More information on the project is located at http://honolulutransit.org/document-library/eis.aspx.

- Oahu, Hawaii
- EIS Completed June 2010
- Length = 23 miles
- Boardings on Island:
  - Current = 252,200
  - Forecast = 453,400
- Stations Per Mile= Approximately 1
- Headways = 3-6 minutes in peak periods

- **Study Area:** A defined study area was not presented, but areas and districts within the study corridor were presented. The areas and districts to be studied were developed based on the identification and location of activity centers and residential locations along the entire length of the corridor. The resulting study area included 17 of the 25 identified communities on the island of Oahu. The study area for the Honolulu High-Capacity project is much larger than the project area defined for the ECR BRT project. This is primarily due to the travel patterns on the island of Oahu and does not point to an insufficiency in the ECR BRT project.

- **Diversion:** A diversion analysis was completed across six screenlines, representing approximately one screenline every three miles along the corridor. Potential impacts along the screenlines were evaluated for both the No Build and project conditions, and small shifts in traffic were seen between parallel facilities. Overall, there was no project or cumulative impact incurred at any screenline location. The total transit boardings compared to the No Build condition are estimated to grow by over 40 percent for the routes within the study corridor, which accounts for a reduction in vehicular travel across the screenlines.

- **Transit Forecasting Methodology:** The modeling approach used for the Honolulu BRT project included the use of the OahuMPO travel demand forecasting model, which is based on “best practices” for urban travel models and is consistent with FTA guidelines. The OahuMPO model was used to predict both future traffic conditions and transit ridership. This approach is slightly different than the ECR BRT project, which used travel model demand growth, rather than directly using the forecast demands.

- **Alternative Modes:** The project did not explicitly include LRT as an alternative, but did include both managed lane and fixed-guideway alternatives. The fixed-guideway alternatives were found to be more cost-effective and more feasible than the managed lane alternatives.
• **Location of Lane:** Alternatives were considered for both fixed-guideway and managed lanes. The fixed-guideway alternatives were a separated facility, not located at either the median or curb lane of existing roadways.

• **Performance Measure Evaluation:** Performance evaluation was reported for transit service and ridership, access to transit, traffic impacts, traffic diversion, parking issues, and access to and from the Honolulu International Airport. The measured objectives include ridership, VMT, VHT, VHD, travel time reliability, access, and transportation equity. Compared to the No Build alternative, the project greatly improved corridor mobility and travel time reliability. The only trade-offs discussed were related to cultural and historic resources, as well as visual and aesthetic conditions. Overall, the performance measure evaluation for transit ridership, travel time, and VMT was similar to that developed for the ECR BRT project.

### 2.2 Key Findings

The BRT projects were each selected as comparative projects for different reasons. Some had similar ridership, some were in the same geographical region, some were long corridors, and some were forecast to see a large growth in ridership. Also, each of the categories selected for comparison were chosen to determine if the ECR BRT project presented enough critical data to enable easily identifiable conclusions.

The high-level comparison of BRT projects to the ECR BRT project was summarized in Section 2.1, and sets the stage for the technical investigation into the ECR BRT project (*Section 3.0, Section 4.0, Section 5.0, Section 8.0, Section 9.0, and Section 10.0*). Table 3 represents a qualitative assessment of how effectively each comparable project achieves the following:

- **Qualitative Assessment of Study Area:** A qualitative assessment of how each comparable project identified and defined the project study area. The assessment takes into account technical methodologies, public outreach, and the resulting study area definition.

- **Qualitative Assessment of Traffic Diversion:** An assessment of how each comparable project evaluated diverted traffic. The assessment takes into account technical methodologies as well as final published diversion (screenline analysis, mode shift, time-of-day shift, etc.).

### Table 3: Qualitative Analysis of Comparable BRT Projects

<table>
<thead>
<tr>
<th>PROJECT</th>
<th>STAGE</th>
<th>QUALITATIVE ASSESSMENT OF STUDY AREA</th>
<th>QUALITATIVE ASSESSMENT IN TERMS OF TRAFFIC DIVERSION</th>
</tr>
</thead>
<tbody>
<tr>
<td>El Camino Real BRT</td>
<td>DEIR/EA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(2.1.1) AC Transit Berkeley/Oakland/San Leandro Corridor MIS</td>
<td>MIS</td>
<td>Comparable</td>
<td>No discussion included</td>
</tr>
<tr>
<td>(2.1.2) Alum Rock BRT FEIR</td>
<td>FEIR</td>
<td>Comparable</td>
<td>No discussion included</td>
</tr>
<tr>
<td>(2.1.3) Van Ness Avenue BRT FEIS/EIR</td>
<td>FEIS/EIR</td>
<td>Comparable</td>
<td>No discussion included</td>
</tr>
<tr>
<td>(2.1.4) Geary Corridor BRT Project</td>
<td>DEIR/EA in progress</td>
<td>Not available</td>
<td>Not available</td>
</tr>
</tbody>
</table>
- **Study Area**: The project study areas varied greatly between the projects. Some projects considered only the corridor of the BRT alignment for study, and some included study areas much larger. The study area for the ECR BRT project (the El Camino Real broader corridor area) is consistent with the projects that have a slightly larger study area. With regard to the study area, it was noted that the ECR BRT project evaluated the performance of more intersections than all other projects that were reviewed. A technical review of the adequacy of the study area is included in *Section 3.0* of this report.

- **Diversion**: The diversion analyses for the majority of the projects were based on forecasts from selected travel demand models. For the comparable projects, diversions varied from ½ mile to over 3 miles away from the project corridor. The ECR BRT project analyzed diversion by presenting a screenline analysis between the two parallel freeway facilities. Some of the projects evaluated did not evaluate diversion. This was typically because the project was in an earlier stage or was in a location that had an existing high-capacity transit route where dedicated lanes were not going to be present. In comparison, the diversion analysis for the ECR BRT project is consistent with the extents and scope of other comparative projects. A detailed technical review of the adequacy of the diversion analysis is included in *Section 3.2* of this report.

- **Transit Forecasting Methodology**: The transit forecasting used for the ECR BRT project was based on existing count data, and then ridership growth based on the VTA travel demand model was added. While this exact methodology was not used in the comparable BRT Projects, the methodology is a logical methodology, given the fact that the existing model validated well for Routes 22 and 522. A technical review of the forecasting methodology is included in *Section 9.0* of this report.

- **Alternative Modes**: Several of the projects evaluated an LRT alternative as a part of the alternatives analysis, while some projects did not include LRT as a piece of the discussion. From

<table>
<thead>
<tr>
<th>PROJECT</th>
<th>STAGE</th>
<th>QUALITATIVE ASSESSMENT OF STUDY AREA</th>
<th>QUALITATIVE ASSESSMENT IN TERMS OF TRAFFIC DIVERSION</th>
</tr>
</thead>
<tbody>
<tr>
<td>(2.1.5) East San Fernando Valley Transit Corridor DEIS/EIR</td>
<td>DEIS/EIR</td>
<td>Comparable</td>
<td>Not available</td>
</tr>
<tr>
<td>(2.1.6) Madison Street Corridor BRT</td>
<td>Purpose and Need</td>
<td>Not Available</td>
<td>Not Available</td>
</tr>
<tr>
<td>(2.1.7) Wilshire Boulevard BRT EIR/EA</td>
<td>EIR/EA</td>
<td>Comparable, but larger</td>
<td>More extensive</td>
</tr>
<tr>
<td>(2.1.8) Powell-Division Transit and Development Project</td>
<td>Feasibility</td>
<td>Comparable</td>
<td>Not available</td>
</tr>
<tr>
<td>(2.1.9) Honolulu High-Capacity Transit Corridor Environmental Impact Statement</td>
<td>FEIS</td>
<td>More extensive</td>
<td>Comparable</td>
</tr>
</tbody>
</table>
a comparison standpoint, the ECR BRT project did not include an LRT alternative. The ECR BRT project was consistent with many of the comparative projects in only briefly mentioning LRT in the document and not having a standalone LRT alternative. A review of the completeness of the evaluation of potential LRT alternatives for the ECR BRT project is included in Section 8.0 of this report.

- **Location of Lane**: The location of the BRT lane varied among the projects, from a dedicated median lane to a dedicated curb lane to integration with mixed-flow traffic. Of the projects that include dedicated lanes, many varied in their location of the lane as well as the length of the separated facility. The location of the lane often depends on the existing facility, available ROW, and forecast vehicular traffic on the shared facility. The alternatives discussed for the ECR BRT project include sections of mixed-flow, dedicated median lane, and dedicated curbside lanes. The ECR BRT project presents alternatives that are comparable to other BRT Projects. The comparison of the location of the lane is an informative piece of information to give context for the BRT projects.

- **Performance Measure Evaluation**: The extent of performance measure evaluation varied between all of the projects. The ECR BRT project included various measures of effectiveness (MOE) that looked intersection levels-of-service, non-motorized transportation environment, VMT and VHT in the study area, and diversion. All of the comparative projects looked at some of these measures either directly, or indirectly, but not all of the projects had a consistent comparison. Travel time evaluation was one performance measurement that many of the projects looked at, but not all projects directly discussed automobile versus transit travel time. By comparison, the ECR BRT project adequately covered performance measure evaluation based on the MOE’s defined for the project. This comparison is meant for informative purposes for the Steering Committee.

### 3 Adequacy of Study Area

The adequacy of the study area is discussed in depth in this section, which builds upon Section 2.0, the comparisons with other recent BRT projects similar in scope to the ECR BRT project. This section reviews public scoping comments and investigates the technical aspects of the traffic diversion and queuing analysis presented in the TOAR (DKS, August 6, 2014).

The ECR BRT project did not physically define one study area for the project, but developed three distinct study areas used for various portions of the project. The three study areas were the “study corridor” (El Camino Real between the transit center in Palo Alto and the arena in San Jose), the “expanded geographic area” (roughly one-half to one mile outside of the corridor), and the “El Camino Real broader corridor” (the area between US-101 and I-280 the entire length of the corridor). These areas were developed based on analysis of travel demand model outputs.

Overall, the defined study areas used for performance evaluation and intersection analysis were methodologically sound and found to be adequate to perform the documented analysis.
3.1 Scoping Comments

During the scoping phase of the project, no comments were directly made about the study area. However, several comments from the public and stakeholders were indirectly related to the scope of the study area. The most prominent comment received were concerns over congestion on parallel facilities. Multiple comments were raised in concern over the removal of one traffic lane in each direction and the direct result of shifting congestion off of El Camino Real and onto parallel facilities.

Upon review of the TOAR, the ECR BRT project did include a detailed automobile traffic diversion analysis. In addition to the diversion analysis, the VTA travel demand model was used to locate roadway segments that had a change in traffic of more than fifty (50) vehicles in the peak hour (when comparing the full build alternative to the No Build alternative). These roadways were used to identify the expanded geographic area, which was used for intersection analysis.

In addition to public scoping comments, Iteris reviewed the comments received from cities on their review of the DEIR/EA and supporting documentation. One of the most frequently mentioned concerns was related to traffic diversion. There is a large amount of local concern related to diversion of automobiles from El Camino Real onto other surface streets as a result of lane reductions. As mentioned in the previous paragraph, the analysis conducted in the TOAR concluded that the study areas as defined by the ECR BRT project was sufficient to capture all of the diverted automobile traffic. The El Camino Real broader corridor study area was used for the technical analysis of traffic diversion. The technical diversion analysis is discussed in Section 3.2 of this report.

3.2 Traffic Diversion and Queuing

A thorough review of the queuing and diversion analysis was conducted to understand the process taken to complete the traffic analysis. This section lays forth a roadmap that was taken to determine the traffic diversion. Traffic diversion is analyzed and presented in the TOAR. Related queuing due to traffic diversion is included in the intersection analysis.

For traffic diversion, a screenline analysis was used to visually display (and indirectly quantify) the mode shift to transit, as well as the diversion from El Camino Real to parallel facilities. The general conclusion from the TOAR is that the implementation of the ECR BRT project will increase transit ridership and decrease auto trips within the project corridor. The TOAR also states that the reduction of one (1) lane on El Camino Real in each direction will also result in diversion of traffic off El Camino Real onto surrounding roadways. The screenline (diverted traffic) analysis is significant for two reasons:

- Quantification of potential diverted trips represents the magnitude of possible impacts to parallel facilities to El Camino Real as a result of removing one lane of traffic in each direction, and
- The magnitude of diverted trips from El Camino Real indicates how El Camino Real itself will be impacted.
3.2.1 Screenline Diversion Methodology

The methodology used for the screenline analysis documented in the TOAR was to directly use the VTA travel demand model. Full travel demand model runs were compared for Alternative 4C (the long dedicated lane) and the No Build alternative. The difference between the two full model runs represented the potential diversion reported in the TOAR.

The description of the methodology for screenline diversion in the TOAR is somewhat confusing, because it implies that the models were run with the additional capacities in place to determine the forecast vehicular volumes and transit ridership for the alternatives. It also implies that the diversion was then calculated by maintaining mode split and trip distribution, but reassigning the vehicular traffic onto a system with less capacity. This was clarified during a discussion on 8/13/2015 with VTA and DKS, and will be clarified in the FEIR/EA. To reiterate the methodology, the full travel demand model runs were compared for Alternative 4C (the long dedicated lane) and the No Build alternative. The difference between the two full model runs represented the potential diversion reported in the TOAR.

A clearer approach to representing diversion analysis in the TOAR would be to present the results as screenline person-trips for both transit and vehicular trips. In addition to person-trips by mode, the vehicle trips should have been summarized along the screenline. In theory, virtually all of the person-trips along the corridor should be conserved, and the mode shift as well as vehicle diversion would be clearly presented and visible. A thorough discussion on the technical methodologies used for travel demand modeling are discussed in Section 9.0 of this report.

3.2.2 Diversion Analysis

The analysis documented in the TOAR was presented only in graphical format and only for Alternative 4C (full corridor exclusive lane BRT) vs. Alternative 1 (No Build) for horizon year 2013, 2018, and 2040 conditions. A table of auto volume on screenlines for each alternative is presented in Appendix E to the Traffic Operations Analysis Report. There is, however, no calculation for diverted traffic, which requires the reader to calculate multiple rows of diversion independently to reach conclusions. The diversion analysis was a major concern for the public as well as City stakeholders, and should be more thoroughly documented.

The illustrated volume changes were derived from the vehicular traffic assignment results of the PM peak hour model runs for both alternatives. The diversion analysis used four screenlines, cut generally in the north-south direction across the study corridor starting from US-101 in the north to I-280 in the south. One screenline was considered in each city, from east to west, in Santa Clara, Sunnyvale, Mountain View and Palo Alto.

Each graphic showed the diverted trips (in both directions) on individual roadways, and the brief narrative analysis presented with each graphic discussed the results in very general terms. However, no total numbers were provided on diverted trips, which would have made the comparison more concise and any conclusions more clear. The conclusions that were provided with each narrative did not highlight any key points and left the analysis up to the reader.
As the diversion analysis in the TOAR stands, there is ambiguity as to the time period of data shown. The narrative discussion at the top of each graphic appears to suggest that the diverted volumes shown in the graphics are peak period numbers, while, the tables that precede the diversion graphics show average daily and AM and PM peak hour data. This presents more ambiguity and confusion when trying to draw conclusions. An email with VTA clarified that the values in the figures and tables in the TOAR represent PM peak hour data, and the PM peak period reference will be removed in the FEIR/EA.

Table 4 provides a summary of the PM peak hour trip diversion as presented in the TOAR. A summary table such as the one presented below (prepared by Iteris using the numbers from figures in the TOAR) would have been helpful in identifying trends and major results.

<table>
<thead>
<tr>
<th>Screenline Location</th>
<th>PM Peak Hour Vehicle Trips Diverted from El Camino Real (from figures 42-45)</th>
<th>Net Vehicle Trips Added to Other Facilities</th>
<th>Difference</th>
<th>Difference as a percentage of Diversion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Santa Clara</td>
<td>-608</td>
<td>395</td>
<td>-213</td>
<td>35%</td>
</tr>
<tr>
<td>Sunnyvale</td>
<td>-692</td>
<td>518</td>
<td>-174</td>
<td>25%</td>
</tr>
<tr>
<td>Mountain View</td>
<td>-1,192</td>
<td>756</td>
<td>-436</td>
<td>37%</td>
</tr>
<tr>
<td>Palo Alto</td>
<td>-709</td>
<td>402</td>
<td>-307</td>
<td>43%</td>
</tr>
</tbody>
</table>

Table 4 shows that in 2013 about 600 to 1,200 PM peak hour trips vehicle are diverted from El Camino Real due to reduction of one travel lane in each direction. In 2018 the diversion is about 770 to 1,200 vehicle trips. In 2040, the range increases to 1,200 to over 1,600 vehicle trips. In all project horizon years, the diversion is highest in the City of Mountain View. However, the lowest diversion changes from Santa Clara (in both 2013 and 2018) to Sunnyvale in 2040. These PM peak hour diverted volumes are two-way vehicle trips.
The screenline diversion graphics also show the highest one-way diverted volumes, which range from 300 to 850 vehicle trips in 2013 to 400 to 870 vehicle trips in 2018 and 780-930 vehicle trips in 2040. These volumes generally represent between one-third of one lane of hourly capacity, to more than one full lane of peak hour traffic capacity. The conclusion that can be drawn from this diverted traffic analysis is that by reducing one lane of capacity in each direction, the vehicle demand on El Camino Real is expected to be reduced by one-third to one lane of vehicular volume. This is a reasonable outcome given the fact that the lower end of the diversion range corresponds to the current conditions (2013) and the higher end to the long-range (2040) conditions when El Camino Real will be more congested and travel times will be longer.

The sections in the body of the report do not present the total PM peak hour volumes on the same screenline links. Not showing the total volumes compared to the diverted traffic volumes leaves the reviewer unclear as to what percentage of the total traffic in the PM peak hour is diverted off of El Camino Real. While this information is indirectly available in Appendix E of the TOAR, it would be helpful to add this information to the body of the report in a concise manner.

3.2.3 Diversion and Mode Split

The column titled “Difference” in Table 4 represents the difference in total vehicle trips diverted from El Camino Real, and the net vehicle trips added to other facilities within the El Camino Real broader study area. The rationale given in the TOAR is that these trips diverted to transit. This mode shift is also the reason given for general lack of significant impacts on El Camino Real (due to volume reduction) and on parallel streets (due to spreading of volumes on many alternative routes).

In order to demonstrate the relative magnitude of this mode shift, the fourth column in each set of analyses years in Table 4 presents the “shifted” vehicle trips as a percentage of the trips diverted from El Camino Real. As can be seen, the percentages are substantial and do not vary significantly from year to year for each screenline. These implied “mode shifted” volumes range from a low of 25 percent to a high of 54 percent. This suggests that between a quarter and half of the trips that are displaced from El Camino Real due to removal of one lane of traffic in each direction are potentially diverted to transit. Considering that the vehicle trip diversion does not account for auto occupancy, the mode shift percentages may even be higher when considering person-trips.

An additional investigation was completed to look at the daily ridership estimate comparisons for all alternatives (completed for 2013, 2018, and 2040). Table 26 of the TOAR details the 2040 daily ridership comparison between local bus and BRT, and also calculates the new ridership for each direction. This table shows a substantial imbalance between eastbound (1,402) and westbound (7,256) new transit riders which add up to the (8,658) total new daily riders. While the daily data are reasonable, a discrepancy in the peak data was apparent. This was due to the “production/attraction” format of the model’s mode choice results for the peak periods, which creates confusion for the reader. A discussion with DKS and VTA on 8/13/2015 resulted in a consensus that the production-attraction format of data was requested from the Federal Transit Administration (FTA) and will remain in the document. This needs to be explained thoroughly in the TOAR, since, on a daily basis, trip-making is fairly balanced in both directions in the corridor.
The absence of transit trip data on the screenlines makes the extent of mode shift difficult to verify. As can be seen in Table 4, the highest numerical value in the “difference” column is 692 PM peak hour trips that are potentially being diverted to transit in the corridor. This corresponds to 2040 conditions on the Palo Alto screenline. Table 26 in the TOAR presents the total number of daily “New Transit Riders” for Alternative 4C compared to No Build as 8,658 for the entire corridor.

It is safe to assume that typically 10 to 12 percent of the daily transit ridership occurs in the peak hour. Therefore, if we assume that 700 auto trips in the PM peak hour are shifting modes to become “new” transit riders at the Palo Alto screenline, this would potentially generate between 6,000 and 7,000 new daily transit trips near Palo Alto alone. This could imply that the overall new daily transit riders along the entire corridor should be much greater than the 8,658 shown in the TOAR (Table 26).

The ambiguities in the mode shift presentation could be easily clarified by presenting and comparing overall person-trip tables, or at least transit trips along the screenlines, between the No Build and the various alternatives.

3.2.4 Diversion Analysis Update from VTA (Dated 8/17/2015)

Based on a conversation with VTA and DKS on 8/13/2015, a revised set of drawings was prepared and sent to Iteris to be included in this peer review support. These revised figures are a work-in-progress, and will form the basis for a revised analysis to be included in the FEIR/EA. The revised tables are presented only for the PM peak hour for 2018 and 2040 (meaning that a 2013 analysis has not been conducted). The project team (VTA and DKS) is currently working to present this data in person-trip format. All of this updated information will be included in the FEIR/EA. This additional information, although not in person-trip format, provides a more direct and clear comparison of the change in trips from automobile to transit along the El Camino Real corridor. Figures 3 through 10 are the updated figures that will be included in the FEIR/EA.

The data for these figures were summarized by Iteris as shown in Table 5. Overall, the shift in trips to transit ridership is presented in a more clarified manner, and there is acknowledgement in the new data that there are also other trip changes (to smaller local streets, or possibly even bicycle or pedestrian trips).

Presumably, a portion of the other trip changes are model fluctuations, and should be discussed in the final document. It is of some interest that there are negative trip changes, which would imply a trip from other modes shifting back to the automobile mode, but the conclusion regarding this information is unclear. It is also possible that a negative number of trips in the “other trip changes” category refers to initial bicycle or pedestrian trips that shift to transit.

A thorough discussion on the technical methodologies used for travel demand modeling are discussed in Section 9.0 of this report.
Table 5: 2018 and 2040 Revised Screenline Diversion Summary

**Source:** VTA Update Sent to Iteris on 8/18/2015

<table>
<thead>
<tr>
<th>Screenline Location</th>
<th>2018</th>
<th></th>
<th>2040</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>PM Peak Hour Vehicle Trips Diverted from El Camino Real</td>
<td>Transit Ridership Increase</td>
<td>Diversion to Alternative Major Routes</td>
<td>Other Trip Changes</td>
</tr>
<tr>
<td>Santa Clara</td>
<td>-772</td>
<td>255</td>
<td>534</td>
<td>-17</td>
</tr>
<tr>
<td>Sunnyvale</td>
<td>-788</td>
<td>277</td>
<td>446</td>
<td>65</td>
</tr>
<tr>
<td>Mountain View</td>
<td>-1,163</td>
<td>281</td>
<td>882</td>
<td>0</td>
</tr>
<tr>
<td>Palo Alto</td>
<td>-903</td>
<td>237</td>
<td>412</td>
<td>254</td>
</tr>
<tr>
<td></td>
<td>-1,445</td>
<td>644</td>
<td>976</td>
<td>-175</td>
</tr>
<tr>
<td>Sunnyvale</td>
<td>-1,154</td>
<td>621</td>
<td>703</td>
<td>-170</td>
</tr>
<tr>
<td>Mountain View</td>
<td>-1,612</td>
<td>600</td>
<td>1,073</td>
<td>-61</td>
</tr>
<tr>
<td>Palo Alto</td>
<td>-1,336</td>
<td>425</td>
<td>568</td>
<td>343</td>
</tr>
</tbody>
</table>
Figure 3: Santa Clara Screenline – 2018 – Alternative 4C PM Peak Hour Traffic Diversion

Source: VTA Update Sent to Iteris on 8/18/2015
Figure 4: Sunnyvale Screenline – 2018 – Alternative 4C PM Peak Hour Traffic Diversion

Source: VTA Update Sent to Iteris on 8/18/2015
Figure 5: Mountain View Screenline – 2018 – Alternative 4C PM Peak Hour Traffic Diversion

Source: VTA Update Sent to Iteris on 8/18/2015
Figure 6: Palo Alto Screenline – 2018 – Alternative 4C PM Peak Hour Traffic Diversion

Source: VTA Update Sent to Iteris on 8/18/2015
Figure 7: Santa Clara Screenline – 2040 – Alternative 4C PM Peak Hour Traffic Diversion

Source: VTA Update Sent to Iteris on 8/18/2015
Figure 8: Sunnyvale Screenline – 2040 – Alternative 4C PM Peak Hour Traffic Diversion

Source: VTA Update Sent to Iteris on 8/18/2015
Figure 9: Mountain View Screenline – 2040 – Alternative 4C PM Peak Hour Traffic Diversion

Source: VTA Update Sent to Iteris on 8/18/2015
Figure 10: Palo Alto Screenline – 2040 – Alternative 4C PM Peak Hour Traffic Diversion

Source: VTA Update Sent to Iteris on 8/18/2015
3.2.5 Diversion Analysis Conclusion

The following questions and responses were evaluated to support the discussion on whether or not the El Camino Real broader corridor area is adequate for the traffic diversion and queuing analysis for the project:

- **Are there potential traffic diversions as a result of the project that would likely have impacts outside of the study area that were not adequately addressed in the study due to the possible limitation of the study area?**

  Based on comparison with similar projects, as well as the screenline analysis depicted in the TOAR, the study area appears to be of adequate size for the project, and encapsulates the majority of traffic diversions.

- **Would it have been reasonable to look at traffic diversion and queues in the traffic analysis?**

  The discussion about traffic diversion is a reasonable discussion in the TOAR. There is no formal discussion about queuing, other than mentioning that additional volume was added to parallel facilities. A discussion about queuing would be reasonable to include in the documentation.

- **Was there enough diversion that it should have been looked at more?**

  The extent of the PM peak hour diversion depicted in the TOAR is shown in Figures 3 through 10 of this report. As described in Section 2.3 of the TOAR, 165 signalized and unsignalized intersections within close proximity to El Camino Real (within ½ to 1 mile) were selected for operational analysis, because the forecasted increase in traffic demand was generally greater than 50 vehicles in the peak hour. The TOAR adequately addressed traffic diversion analysis.

- **Is the forecast for diversion and mode shift typical for what Iteris would expect to see on a similar project in another part of the country?**

  Based on Iteris experience with other BRT projects, achieving a range of 25 to 50 percent mode shift from auto to transit (calculated using data from Table 5) in a corridor where an improved transit service is introduced is high. Such high mode shifts are uncommon even with major new fixed guideway rail transit projects, which typically draw a large portion of their transit ridership from existing transit services in the corridor. It should be noted that the calculated estimate of mode shift is not intended to be confused with transit mode share within the project study area or a larger geographical area. The calculated percentages are the result of mode shift from automobile to transit at each specific screenline location. The mode shift percentage (between 25 and 50 percent) is not a direct correlation to mode share, but is an indication of an increase in transit trips, with a decrease in automobile trips.

  If the high mode shift is an accurate forecast, it could be interpreted that vehicle miles of travel in the corridor would also be significantly reduced. However, the model results shown in the TOAR indicate that even though VMT with the project decreased compared to No Build, the
difference is not as high as the magnitude of the reduced vehicle trips. This discrepancy could be clarified by including the mode share for the same geographical area as the VMT calculations in the TOAR.

- **Looking at queues in Synchro analysis, should queuing have been looked at further?**

  A discussion about queuing was not included in the TOAR. In locations where significant impacts are forecast to occur due to traffic diversion, an assessment of current turn pocket storage lengths versus projected queue lengths would be valuable from a planning perspective. This would be beneficial to the project evaluation, because it may have identified additional locations of impact that were not identified by looking only at intersection LOS.

### 3.3 Study Area Definition Consensus

*Section 2.0* included a thorough review of similarly scoped BRT projects, and the review resulted in the conclusion that the study area was sufficiently large and comparable to similar projects based on the methodology used to define the study area. Based on the traffic information presented in the report, the scope of the diversion analysis is an adequate representation of PM peak hour traffic diversion, as reported in the TOAR (DKS, August 6, 2014).

Based on Iteris’ knowledge of similar BRT analyses in other areas, Iteris’ review of the available documentation was used to answer the following questions:

- **Is the study area appropriate?**

  Some of the comparable BRT projects (*Section 2.0*) had study areas that included primarily the study corridor, and some projects included study areas up to three (3) miles outside of the corridor. The general methodology for developing study areas included investigations into travel demand model forecasts, and determining areas of impact in a Build scenario (as compared to a No Build scenario). The ECR BRT project broader corridor study area is consistent with similar projects, and is adequate for use in the project. The use of three different study areas is appropriate because of how they were used. The “expanded geographic area” is appropriate for use in identifying intersections to be analyzed for the intersection LOS, and the “El Camino Real broader corridor” is appropriate for use in the vehicle screenline diversion analysis, the VMT and VHT, and the average speed calculations.

- **Is the geographic scope for a study such as this typically broadened?**

  The El Camino Real broader corridor area is adequately scoped to quantify the regional impacts, including VMT, VHT, and air quality impacts.
• If not for the freeway on one side of the study corridor, should this have been a bigger geographic area?

The freeways on both sides of the corridor create logical edges to the study area. If freeways did not exist in those locations, it is possible that the “El Camino Real broader corridor” area would be extended beyond the location of the existing freeways.

• Would there have been a benefit of expanding the study area as requested by specific jurisdictions?

The review of the traffic diversion and intersection analysis in the report does not suggest a need for expanding the study area as requested by specific jurisdictions.

• Would an expanded study area have yielded something beneficial to the project/study?

It is not anticipated that using different study areas than those derived for the TOAR would have yielded any additional benefit to the project evaluation. It is not recommended that the study area be modified, as it is concluded to be adequate for traffic diversion analysis of the proposed alternatives.

4 REVIEW OF GREENHOUSE GAS (GHG) EVALUATION

The Steering Committee expressed a general interest in the presented greenhouse gas (GHG) evaluation in the ECR BRT DEIR/EA (ICF International, October, 2014). The greenhouse gas emissions reported in the CEQA and NEPA analyses are discussed in depth in Appendix H in the Air Quality Technical Report (ICF International, August 2014). It should be noted that while GHGs are discussed in the report, there are no federal or state air quality standards that exist for these pollutants. Therefore, Iteris contained their review to the travel demand model outputs (VMT) used in calculations for the GHG analysis. This review of VMT used for GHG concludes that VMT inconsistencies should be explained in the TOAR to provide a more thorough understanding of VMT in the region for No Build and Build alternatives.

GHG emissions are directly related to the VMT and that is calculated from the travel demand model. The methodology for obtaining the VMT was described as using a subarea definition that was broader than the study area to calculate the daily VMT by 5 mph speed ranges for each alternative. While this methodology is acceptable, it is unclear what the broader study area size is. It is important to know the size of the study area, because larger study areas do decrease the changes in VMT and speed when comparing Build alternatives to the No Build alternative. For example, a subarea size that is as large as the entire VTA region would be expected to show no changes in VMT or speed, and a subarea size that is small and limited to the study area would be expected to show a noticeable difference in VMT and speed. The subarea used for the VMT analysis should be determined as the area larger than the study area that includes any link with a possible change in vehicle volumes when comparing the most intense Build alternative (Alternative 4C) compared to the No Build alternative (Alternative 1).
4.1 VMT Comparison

VMT by speed range is presented for 2013, 2018, and 2040 for each alternative. The VMT is presented in Appendix G of the TOAR (DKS, August 6, 2014) and is also shown in Appendix B to the Air Quality Technical Report. The VMT in the report was segregated into 5 mph speed bins. VMT by 10 mph speed bin is represented in Table 6 of this report. Figure 3 was developed directly from TOAR tables to graphically show the 2018 and 2040 No Build and Alternative 4C VMT by 10 mph speed bin. Overall, the patterns shown in Table 6 and Figure 11 are relatively consistent between all years.

Table 6: VMT by 10 mph Speed bin for No Build and Alternative 4C (for 2013, 2018, and 2040)

Source: Table summarized by Iteris. Data available from El Camino Real BRT DEIR/EA Traffic Operations Analysis Report (DKS, August 6, 2014)

| Speed Range (mph) | 2013 EXISTING | | | | 2018 | | | | 2040 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | No Build | Alternative 4C | Percent Change | No Build | Alternative 4C | Percent Change | No Build | Alternative 4C | Percent Change |
| 0 - 9.99 | 741,400 | 724,900 | -2.2% | 759,000 | 759,400 | 0.1% | 918,700 | 919,300 | 0.1% |
| 10 - 19.99 | 463,900 | 424,400 | -8.5% | 446,300 | 453,200 | 1.5% | 627,600 | 657,600 | 4.8% |
| 20 - 29.99 | 2,929,200 | 2,771,800 | -5.4% | 2,835,500 | 2,822,700 | -0.5% | 4,189,200 | 4,166,000 | -0.6% |
| 30 - 39.99 | 2,323,400 | 2,259,000 | -2.8% | 2,538,400 | 2,538,300 | 0.0% | 3,451,500 | 3,461,900 | 0.3% |
| 40 - 49.99 | 1,857,100 | 1,846,500 | -0.6% | 1,871,500 | 1,824,200 | -2.5% | 2,230,000 | 2,139,300 | -4.1% |
| 50 - 59.99 | 3,520,800 | 3,627,300 | 3.0% | 3,771,500 | 3,812,300 | 1.1% | 3,919,800 | 3,965,500 | 1.2% |
| 60 - 69.99 | 2,453,500 | 2,468,400 | 0.6% | 2,462,800 | 2,462,000 | 0.0% | 2,120,400 | 2,120,700 | 0.0% |
| >= 70 | 0 | 0 | 0.0% | 0 | 0 | 0.0% | 0 | 0 | 0.0% |
| Total VMT | 14,289,300 | 14,122,300 | -1.2% | 14,685,000 | 14,672,100 | -0.1% | 17,457,200 | 17,430,300 | -0.2% |

Figure 11: 2018 and 2040 VMT by Speed Bin (No Build and Alternative 4C)

Source: Figure summarized by Iteris. Data available from El Camino Real BRT DEIR/EA Traffic Operations Analysis Report (DKS, August 6, 2014)
4.2 VMT Conclusions

The methodology used for calculating the VMT was to pull information directly from the travel demand model, with modification for speeds on centroids. (The methodology used for calculating speeds for centroids was to apply a speed lookup table based on the area type of the centroid, meaning that centroid connector traffic in the CBD has a lower speed than centroid traffic in the rural areas.) The study area used for calculating the VMT is the El Camino Real broader corridor, which extends from US-101 to I-280. Overall, the patterns displayed for the VMT comparisons for 2018 and 2040 for Alternative 4C compared to the No Build alternative look consistent and reasonable.

5 REASONABLENESS OF TRAVEL TIME CALCULATION

The TOAR (DKS, August 6, 2014) summarizes travel times along the corridor for 2013, 2018, and 2040. The auto travel times were derived from VTAs regional travel demand model, the transit travel time within mixed-flow segments was calculated as a function or factor of the auto travel time for the segment (from the travel demand model), and the transit travel times for exclusive lanes were computed based on an assumed operating speed within the exclusive lane. This methodology is consistent with travel time calculations for a study of this size. However, it would be helpful to represent, or state, a validation of modeled travel times along El Camino Real in the existing condition to compare with the 2013 forecast model estimates.

The body of the TOAR presents bar charts showing travel time comparisons for BRT, Local Bus, and auto for the entire length of the corridor (from University Avenue in Palo Alto to Cahill Street in San Jose) for all alternatives. Appendix F to the TOAR includes a thorough and detailed segmented travel times for all alternatives for 2013, 2018, and 2040.

The conclusions for the entire corridor are logical. When compared with the No Build alternative (Alternative 1), the long dedicated alternative (Alternative 4C) results in the shortest travel time for BRT, the longest travel time for auto, and a slight increase in local bus. While all alternatives are presented, the greatest change in any travel time is seen when comparing the long dedicated lane alternative (Alternative 4C) with the No Build alternative (Alternative 1). The information is presented in chart format and would also be useful in a table. To assist the Steering Committee in understanding the resulting change in travel time for auto, local bus, and BRT along the El Camino Real corridor, a brief summary of travel time results for each year is summarized in Table 7. While Table 7 only summarizes the entire length of the corridor, information is available in Appendix F of the TOAR to create a similar table for the individual segments of the ECR BRT project.

Table 7 summarizes the general trend in slight increases for auto and local bus travel times (between 1 and 8 percent), and significant decreases in Route 522 (BRT) travel time (between 25 and 52 percent). Some relationships are unclear, and could be better understood if looking into detail in Appendix F of the TOAR. It would also be helpful if the report included information on why the reductions to BRT transit travel time were greater in 2040 than the reductions in 2018. Intuition suggests this is due to the increase in travel time due to the No Build condition, but representing this information in the report would be useful.
Table 7: Travel Time Comparison of Alternative 4C to Alternative 1 for the El Camino Real Corridor

Source: Table summarized by Iteris. Data available from El Camino Real BRT DEIR/EA Traffic Operations Analysis Report (DKS, August 6, 2014)

<table>
<thead>
<tr>
<th>YEAR</th>
<th>CHANGE IN AUTO TRAVEL TIME</th>
<th>CHANGE IN LOCAL BUS TRAVEL TIME</th>
<th>CHANGE IN BRT TRAVEL TIME</th>
</tr>
</thead>
<tbody>
<tr>
<td>2013</td>
<td>AM Westbound = 5.0%</td>
<td>AM Westbound = 6.0%</td>
<td>AM Westbound = -30.8%</td>
</tr>
<tr>
<td></td>
<td>AM Eastbound = 2.8%</td>
<td>AM Eastbound = 1.3%</td>
<td>AM Eastbound = -24.1%</td>
</tr>
<tr>
<td></td>
<td>PM Westbound = 5.6%</td>
<td>PM Westbound = 3.4%</td>
<td>PM Westbound = -29.7%</td>
</tr>
<tr>
<td></td>
<td>PM Eastbound = 7.5%</td>
<td>PM Eastbound = 6.0%</td>
<td>PM Eastbound = -40.0%</td>
</tr>
<tr>
<td>2018</td>
<td>AM Westbound = 7.5%</td>
<td>AM Westbound = 7.1%</td>
<td>AM Westbound = -37.5%</td>
</tr>
<tr>
<td></td>
<td>AM Eastbound = 2.7%</td>
<td>AM Eastbound = 1.3%</td>
<td>AM Eastbound = -31.3%</td>
</tr>
<tr>
<td></td>
<td>PM Westbound = 5.5%</td>
<td>PM Westbound = 3.4%</td>
<td>PM Westbound = -35.7%</td>
</tr>
<tr>
<td></td>
<td>PM Eastbound = 7.3%</td>
<td>PM Eastbound = 6.7%</td>
<td>PM Eastbound = -44.8%</td>
</tr>
<tr>
<td>2040</td>
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<td>AM Eastbound = 5.5%</td>
<td>AM Eastbound = 2.5%</td>
<td>AM Eastbound = -32.3%</td>
</tr>
<tr>
<td></td>
<td>PM Westbound = 5.4%</td>
<td>PM Westbound = 5.4%</td>
<td>PM Westbound = -37.5%</td>
</tr>
<tr>
<td></td>
<td>PM Eastbound = 5.7%</td>
<td>PM Eastbound = 6.2%</td>
<td>PM Eastbound = -51.9%</td>
</tr>
</tbody>
</table>

In order for agencies to be in a better position to make decisions regarding the different alternatives, it would be helpful to see a bar chart showing the percentage reduction in travel time from the No Build alternative for each reported segment of the alignment. Such a chart could give the Steering Committee, or decision makers, a visual indication of locations where dedicated lanes or mixed lanes have the greatest improvement in overall travel times. Without an analysis broken into sections, it is difficult to determine the local impacts and improvements in various jurisdictions.

Iteris combined information shown in Appendix F of the TOAR, and created Tables 8 and 9 comparing the No Build travel times with Alternative 4C travel times for 2013, 2018, and 2040. Tables 8 and 9 show the segment-by-segment travel times for eastbound and westbound directions along El Camino Real for the BRT service only. The eastbound direction looks at the PM peak period, and the westbound direction looks at the AM peak period, in order to represent the highest direction of travel.

Tables 8 and 9 show that the PM peak period results in a greater reduction in BRT travel time on the El Camino Real corridor when comparing Alternative 4C to the No Build alternative. The locations with the greatest reduction in travel times are between University Avenue in Palo Alto and Scott Street in Santa Clara. These sections reduce the travel time between an average of 30 and 70 percent. This area is consistent with the length of the dedicated lanes. The segments of roadway between the Santa Clara Caltrain Station and Cahill Avenue all operate in the mixed-flow condition with bulbouts (in Alternative 4C).
### Table 8: Eastbound El Camino Real PM Peak Period BRT Travel Time by Segment

**Source:** Table summarized by Iteris. Data available from El Camino Real BRT DEIR/EA Traffic Operations Analysis Report Appendix F (DKS, August 6, 2014)

<table>
<thead>
<tr>
<th>Segment on El Camino Real</th>
<th>2013 - PM</th>
<th>2018 - PM</th>
<th>2040 - PM</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No Build</td>
<td>Alt. 4C</td>
<td>% Reduction</td>
</tr>
<tr>
<td>University Avenue to California Avenue</td>
<td>10.7</td>
<td>3.2</td>
<td>70%</td>
</tr>
<tr>
<td>California Avenue to Arastradero Road</td>
<td>6.0</td>
<td>4.0</td>
<td>33%</td>
</tr>
<tr>
<td>Arastradero Road to Showers Drive</td>
<td>4.1</td>
<td>2.5</td>
<td>39%</td>
</tr>
<tr>
<td>Showers Drive to Castro Street</td>
<td>8.7</td>
<td>3.4</td>
<td>61%</td>
</tr>
<tr>
<td>Castro Street to S. Knickerbocker Drive</td>
<td>6.2</td>
<td>3.7</td>
<td>40%</td>
</tr>
<tr>
<td>S. Knickerbocker Drive to Hollenbeck Avenue</td>
<td>3.2</td>
<td>2.8</td>
<td>13%</td>
</tr>
<tr>
<td>Hollenbeck Avenue to E. Remington Drive</td>
<td>5.6</td>
<td>2.2</td>
<td>61%</td>
</tr>
<tr>
<td>E. Remington Drive to S. Wolfe Road</td>
<td>4</td>
<td>2.1</td>
<td>48%</td>
</tr>
<tr>
<td>S. Wolfe Road to Halford Avenue</td>
<td>3.2</td>
<td>2.1</td>
<td>34%</td>
</tr>
<tr>
<td>Halford Avenue to Kiely Boulevard</td>
<td>4.7</td>
<td>2.8</td>
<td>40%</td>
</tr>
<tr>
<td>Kiely Boulevard to Scott Boulevard</td>
<td>4.4</td>
<td>2.4</td>
<td>45%</td>
</tr>
<tr>
<td>Scott Boulevard to Santa Clara Caltrain Station</td>
<td>5.7</td>
<td>3.5</td>
<td>39%</td>
</tr>
<tr>
<td>Santa Clara Caltrain Station to Naglee Avenue (The Alameda)</td>
<td>6.4</td>
<td>6.3</td>
<td>2%</td>
</tr>
<tr>
<td>Naglee Avenue (The Alameda) to Hanchett Avenue (The Alameda)</td>
<td>2.9</td>
<td>2.9</td>
<td>0%</td>
</tr>
<tr>
<td>Hanchett Avenue (The Alameda) to Cahill Street (The Alameda)</td>
<td>3.8</td>
<td>3.8</td>
<td>0%</td>
</tr>
<tr>
<td><strong>Total Travel Time</strong></td>
<td><strong>79.6</strong></td>
<td><strong>47.7</strong></td>
<td><strong>40%</strong></td>
</tr>
</tbody>
</table>
Table 9: Westbound El Camino Real AM Peak Period BRT Travel Time by Segment

Source: Table summarized by Iteris. Data available from El Camino Real BRT DEIR/EA Traffic Operations Analysis Report Appendix F (DKS, August 6, 2014)

<table>
<thead>
<tr>
<th>Segment on El Camino Real</th>
<th>2013 - AM No Build</th>
<th>2013 - AM Alt. 4C</th>
<th>Percent Reduction</th>
<th>2018 - AM No Build</th>
<th>2018 - AM Alt. 4C</th>
<th>Percent Reduction</th>
<th>2040 - AM No Build</th>
<th>2040 - AM Alt. 4C</th>
<th>Percent Reduction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cahill Street (The Alameda) to Hanchett Avenue (The Alameda)</td>
<td>3.1</td>
<td>3.1</td>
<td>0%</td>
<td>3.1</td>
<td>3.1</td>
<td>0%</td>
<td>3.4</td>
<td>3.4</td>
<td>0%</td>
</tr>
<tr>
<td>Hanchett Avenue (The Alameda) to Naglee Avenue (The Alameda)</td>
<td>1.8</td>
<td>1.8</td>
<td>0%</td>
<td>2.7</td>
<td>1.9</td>
<td>30%</td>
<td>3.5</td>
<td>2.7</td>
<td>23%</td>
</tr>
<tr>
<td>Naglee Avenue (The Alameda) to Santa Clara Caltrain Station</td>
<td>5</td>
<td>5</td>
<td>0%</td>
<td>5.2</td>
<td>5.2</td>
<td>0%</td>
<td>6.7</td>
<td>6.5</td>
<td>3%</td>
</tr>
<tr>
<td>Santa Clara Caltrain Station to Scott Boulevard</td>
<td>4.8</td>
<td>3.1</td>
<td>35%</td>
<td>5.2</td>
<td>3.1</td>
<td>40%</td>
<td>5.2</td>
<td>3.1</td>
<td>40%</td>
</tr>
<tr>
<td>Scott Boulevard to Kiely Boulevard</td>
<td>3.4</td>
<td>2.4</td>
<td>29%</td>
<td>3.8</td>
<td>2.4</td>
<td>37%</td>
<td>4.2</td>
<td>2.4</td>
<td>43%</td>
</tr>
<tr>
<td>Kiely Boulevard to Halford Avenue</td>
<td>3.9</td>
<td>3.2</td>
<td>18%</td>
<td>4.8</td>
<td>3.2</td>
<td>33%</td>
<td>5.8</td>
<td>3.2</td>
<td>45%</td>
</tr>
<tr>
<td>Halford Avenue to S. Wolfe Road</td>
<td>3.3</td>
<td>1.7</td>
<td>48%</td>
<td>3.4</td>
<td>1.7</td>
<td>50%</td>
<td>4.1</td>
<td>1.7</td>
<td>59%</td>
</tr>
<tr>
<td>S. Wolfe Road to E. Remington Drive</td>
<td>2.7</td>
<td>2.1</td>
<td>22%</td>
<td>3.1</td>
<td>2.1</td>
<td>32%</td>
<td>3.8</td>
<td>2.1</td>
<td>45%</td>
</tr>
<tr>
<td>E. Remington Drive to Hollenbeck Avenue</td>
<td>3.5</td>
<td>2.6</td>
<td>26%</td>
<td>3.9</td>
<td>2.6</td>
<td>33%</td>
<td>4.4</td>
<td>2.6</td>
<td>41%</td>
</tr>
<tr>
<td>Hollenbeck Avenue to S. Knickerbocker Drive</td>
<td>3.6</td>
<td>2.8</td>
<td>22%</td>
<td>4.4</td>
<td>2.8</td>
<td>36%</td>
<td>4.6</td>
<td>2.8</td>
<td>39%</td>
</tr>
<tr>
<td>S. Knickerbocker Drive to Castro Street</td>
<td>7.3</td>
<td>3.3</td>
<td>55%</td>
<td>7.7</td>
<td>3.3</td>
<td>57%</td>
<td>13</td>
<td>3.3</td>
<td>75%</td>
</tr>
<tr>
<td>Castro Street to Showers Drive</td>
<td>4.9</td>
<td>4.2</td>
<td>14%</td>
<td>5.8</td>
<td>4.2</td>
<td>28%</td>
<td>6.9</td>
<td>4.2</td>
<td>39%</td>
</tr>
<tr>
<td>Showers Drive to Arastradero Road</td>
<td>4.6</td>
<td>2.5</td>
<td>46%</td>
<td>5.1</td>
<td>2.5</td>
<td>51%</td>
<td>7.7</td>
<td>2.5</td>
<td>68%</td>
</tr>
<tr>
<td>Arastradero Road to California Avenue</td>
<td>7.6</td>
<td>3.2</td>
<td>58%</td>
<td>7.7</td>
<td>3.2</td>
<td>58%</td>
<td>9.6</td>
<td>3.2</td>
<td>67%</td>
</tr>
<tr>
<td>California Avenue to University Avenue</td>
<td>5.6</td>
<td>3.6</td>
<td>36%</td>
<td>6</td>
<td>3.6</td>
<td>40%</td>
<td>6.4</td>
<td>3.6</td>
<td>44%</td>
</tr>
<tr>
<td><strong>Total Travel Time</strong></td>
<td><strong>65.1</strong></td>
<td><strong>44.6</strong></td>
<td><strong>31%</strong></td>
<td><strong>71.9</strong></td>
<td><strong>44.9</strong></td>
<td><strong>38%</strong></td>
<td><strong>89.3</strong></td>
<td><strong>47.3</strong></td>
<td><strong>47%</strong></td>
</tr>
</tbody>
</table>

6 REVIEW OF SCOPING COMMENTS

One priority of the Steering Committee was for Iteris to complete a brief review of public scoping comments, and to discuss whether or not the comments were adequately addressed in the ECR BRT project. Overall, there was both strong support and strong opposition to the project. In general, the
comments in favor of the project primarily were interested in the dedicated facility with enhanced stations as well as the anticipated benefits of increased jobs, better air quality, and increased efficiency for transit travel time. In general, the comments opposing the project were concerned with the potential of a deterioration of travel time, insufficient demand to support the project, a decrease in air quality, and various safety concerns related to accessing a dedicated transit facility.

Table 10 summarizes the most common public scoping comments and also includes a discussion on how the comment either was or was not addressed in the ECR BRT project. No determination is made for each comment on adequacy of ECR BRT response. Overall, the ECR BRT project did include a thorough analysis of comments related to increased congestion along El Camino Real, along with thorough discussions about traffic analysis methodologies and results, variations to alternatives, and local project concerns. The ECR BRT project would be more transparent if the following discussions and data were included into the supporting documentation:

- A discussion on increased accessibility and service to areas not currently served by Route 522, as requested during the public scoping comments; and
- A summary of the comments received during the scoping process in Appendix A of the DEIR/EA, which currently only lists the public commenters but does not present any comments.

Table 10: Public Scoping Comment Summary and Analysis

<table>
<thead>
<tr>
<th>COMMON SCOPING COMMENT</th>
<th>BRIEF DISCUSSION ON HOW THE COMMENT WAS ADDRESSED IN THE ECR BRT PROJECT DOCUMENTATION</th>
<th>Addressed in DEIR/EA (Yes/No)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Increased Congestion along El Camino Real</td>
<td>The analysis for the ECR BRT project utilized the VTA Travel Demand Model to forecast automobile and transit demands in the project corridor, and evaluated future congestion along the project corridor. The analysis also included a diversion analysis, as well as a level-of-service analysis for intersections along the corridor and on parallel facilities.</td>
<td>Yes</td>
</tr>
<tr>
<td>Concern for emergency response along the El Camino Real Corridor</td>
<td>Emergency response vehicles are intended to use the bus-only dedicated lanes along the corridor, providing them with a faster travel time than traditional mixed-flow travel. A statement in the Executive Summary states that the dedicated lanes are exclusively available to BRT and emergency vehicles.</td>
<td>Yes</td>
</tr>
<tr>
<td>Concern for market demand, (e.g. the current buses 22 and 522 do not operate at capacity)</td>
<td>The DEIR/EA continually mentions that these two routes carry 20 percent of VTAs ridership. It would be worthwhile to know what the mode split is in the VTA travel demand model for transit, and what an increase of ridership on these routes could do to the overall transit mode split. This discussion was not included in the report.</td>
<td>No</td>
</tr>
</tbody>
</table>
### COMMON SCOPI NG COMMENT

<table>
<thead>
<tr>
<th>Comment</th>
<th>Brief Discussion on How the Comment Was Addressed in the ECR BRT Project Documentation</th>
<th>Addressed in DEIR/EA (Yes/No)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Increased Accessibility and Service to Areas Not Currently Served by Route 522</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Add Additional Service Time and Additional Destinations Not Currently Served</td>
<td>There was no clear discussion about including additional feeder services for additional destinations, nor additional service times beyond increasing the route headways.</td>
<td>No</td>
</tr>
<tr>
<td>Provide signal priority for BRT line.</td>
<td>The introduction to the TOA R states that all of the projects will utilize various traffic control features (including transit signal priority). Alternative 3 directly states that bus signal priority will be a part of the alternative.</td>
<td>Yes</td>
</tr>
</tbody>
</table>

| **Traffic Analysis Methodologies** |  |  |
| Determine possible diversion impacts. | The ECR BRT project included diversion analysis and impact discussion for both the opening year (2018) and forecast year (2040) for the PM peak hour. | Yes |
| Accuracy of LOS calculation. | The intersection LOS methodology used for the project is adequate and complete per HCM 2000. | Yes |
| Model and analyze queuing and operations using a simulation model. | The intersection evaluation for the ECR BRT project included a Synchro 7 analysis (micro-simulation) of the forecast volumes. | Yes |
| Concerns related to air quality impacts along El Camino Real. | The analysis for the DEIR/EA evaluated the air quality in the study area using VMT and VHT forecasts estimated by use of the VTA travel demand model. | Yes |

| **Alternative Considerations** |  |  |
| Request to investigate the inclusion of bike lanes. | Dedicated lane segments of the ECR BRT project are designed to include bicycle lanes in place of parking. | Yes |
| Additional investment spent on access to 522. | There was no discussion in the alternatives about including additional access to Route 522 with the conversion to a BRT Route. | No |

| **Local Project Concerns** |  |  |
| Concerns for parking impacts due to removal of parking. | The ECR BRT project included a discussion related to parking impacts for both the opening year (2018) and forecast year (2040). | Yes |
| Concerns related to benefit/cost. Do the needs of few outweigh the needs of many? | A benefit-cost analysis was not completed as a part of the ECR BRT project. | No |
| Concerns for local businesses. | The impact evaluation for the ECR BRT project shows that there will be no displacement of people or housing, and no alternatives resulting in a loss of employment. In addition, none of the alternatives are found to have a permanent effect on long-term community character beyond tree loss. | Yes |
7 REVIEW AND ASSESSMENT OF CITY OF MOUNTAIN VIEW PEER REVIEW

The City of Mountain View engaged Hexagon Transportation Consultants to prepare a peer review of the DEIR/EA and their findings were presented in a memo dated December 3, 2014 (Hexagon Transportation Consultants, Inc., December 3, 2014). The peer review includes a comparison of existing conditions in ECR BRT project DEIR/EA (ICF International, October, 2014) and ECR Precise Plan EIR (LSA, October 2014) and found 13 common intersections in both EIRs.

The El Camino Real Precise Plan – Environmental Impact Report was prepared by the City of Mountain View in August 2014 (www.mountainview.gov/depts/comdev/planning/activeprojects/caminoreal.asp).

Of the 13 intersections, the ECR BRT project calculated worse levels of service at five (5) of them, with delays ranging from 11 to 38 seconds at those locations. At first glance, this suggests that the ECR BRT project must have used more conservative approach to LOS analysis. Hexagon determined that both studies had “errors” in coding of signal phasing, cycle lengths, and lost times. When the “errors” were corrected, LOS differences were found at six (6) intersections. The differences in LOS calculations were not all in the same direction. The ECR BRT project resulted in worse LOS in some cases and the ECR Precise Plan EIR was worse in others. The differences were due to variations in traffic counts, likely reflecting daily fluctuations.

The Mountain View peer review notes that the ECR BRT project does not report land-use data, so it is not possible to determine if differences in land-use assumptions explain the differences in forecast volumes. At 10 of the common intersections, the ECR BRT project forecasts better LOS in 2040 than the ECR Precise Plan EIR shows in 2030.

Alternative 4C removes one mixed-flow lane on El Camino Real and reduces the southbound peak hour volume on El Camino Real by approximately 900 vehicles. The ECR BRT project contends that about 400 of those vehicles would divert to parallel routes between I-280 and US 101; however does not provide an explanation for the disappearance of the other 500 vehicles. This discussion in the Mountain View Peer Review is similar to the discussion about diverted traffic as discussed in Section 3.2 of this report.

The diversion to parallel streets results in impacts at 8 of the 13 intersections studied on parallel streets. No intersections were studied on Foothill Expressway, to which approximately 115 PM peak hour trips would be diverted. In comparison, seven intersections were studied on California Street, to which 115 PM peak hour trips were also added. Mitigation measures were proposed at the eight impacted intersections, however Hexagon questions their feasibility since no plans or diagrams of the mitigation measures were provided in the ECR BRT DEIR/EA.

Hexagon evaluated 15 cross-street intersections and found that four (4) would be negatively impacted (operate at LOS E or F). The ECR BRT project only portrays the overall intersection LOS rather than noting the poor operating conditions on the side streets.

Seven median openings would be closed with Alternative 4C of the ECR BRT project. Hexagon noted that no analysis was conducted related to the queuing at adjacent intersections, to which turns now made at the median openings would shift. They did not mention whether the turn movement counts at the existing
medians had been evaluated and manually shifted to the adjacent intersections. It was noted that the intersection turn movements could be low and under-report the impacts of the median closures if the existing count data is not shifted to adjacent intersections.

The Hexagon peer review noted that the ECR BRT project would remove 336 parking spaces along El Camino Real in the City of Mountain View. It does not draw a conclusion as to whether or not this would be a significant impact, nor is any information provided as to how well-utilized the parking is and which businesses depend on it. The Hexagon peer review is a technically sound review of the ECR BRT project and is useful to the City of Mountain View in drafting its comments on the FEIR/EA.

8 COMPLETENESS IN EVALUATION OF POTENTIAL LRT ALTERNATIVES

Iteris was directed by the Steering Committee to investigate why no rail alternatives were considered for the ECR BRT project. Iteris reviewed all provided relevant background documents. The following is a summary of Iteris’ findings.

The initial investigation included a review of all public comments received during the scoping process. There were no comments stating that an LRT alternative should be included in the analysis. References to consideration of Light Rail Transit (LRT) alternatives are found in the Project Study Report-Project Development Support (PSR-PDS) published in January 2014 (Caltrans, January 2014). PSR-PDS is an initial planning-level document that provides information in order to gain approval for the project to proceed to the next steps, including Project Approval and Environmental Documentation (PA&ED). This document examines the overall background for the project and provides a discussion on corridor and system coordination, which include consistency with regional plans and local general plans.

The PSR-PDS states that VTAs long-range vision for transportation in Santa Clara Valley, as documented in Santa Clara Valley Transportation Plan (VTA, January 2009), has specifically called for operational improvements to El Camino Real as a BRT project, with the main objective being to integrate transportation and land-use. Therefore, a BRT mode has traditionally been the primary mode for consideration on El Camino Real. In addition, the PSR-PDS also examines the goals of the improvement project with respect to its consistency with the local general plans. Examining the relevant sections of each of the five corridor cities’ general plans, the conclusion was that a BRT mode was either included or completely consistent with the corresponding policies for improvements to El Camino Real within the corresponding city. Therefore, a BRT mode was considered to be the most appropriate mode for transit suitable to the corridor land-use and long-range vision.

It has been documented that local agency involvement in the previous studies to date has supported BRT as the preferred technology option over other modes for transit improvements in the corridor and the most suitable and appropriate for the scale and character of the corridor.

The Alternatives section (Section 7) of the PSR-PDS references previous VTA studies, stating that other transit technologies, including Heavy and Light Rail alternatives, were initially considered but were rejected as being “out of scale” for the existing street environment and the forecast transit readership
demand. It was concluded that BRT would be the only practical technology for transit improvement along El Camino Real.

More specifically, the analysis provides the following reasons for the BRT technology to be more suitable than rail alternatives, including Heavy Rail or LRT, for the El Camino Real corridor:

- Ridership demand projections are better suited for a more frequent and lower capacity service rather than rail service
- If the BRT were to run in dedicated lanes through the most congested parts of the corridor, the BRT running times would not be significantly different from LRT times without the significantly higher costs for LRT
- Any rail system along El Camino Real would be significantly higher in construction cost
- Any rail system along El Camino Real would result in significantly higher environmental impacts
- A rail system would require significant changes to the existing roadway system, including major changes to most intersections
- A rail system would most likely result in removal of a traffic lane and on-street parking, with possible significant impacts throughout the entire corridor, while the BRT would allow for the flexibility to run in dedicated lanes where appropriate and mixed-flow traffic in other parts of the corridor with minimal or no impacts to the environment

Based on the above, the previous studies have adequately addressed the issue of alternative technology selection for the El Camino Real Transit Improvement project. Therefore, with proper reference to these previous studies, the environmental document should be able to adequately address the exclusion of modes other than BRT from the overall analysis.

9 REVIEW TRAVEL DEMAND FORECASTS

The basis for ridership forecasts for the El Camino Real BRT TOAR (DKS, August 6, 2014) are derived from the VTA travel demand model. The TOAR states that the vehicular volumes were obtained directly from the travel demand model, yet the transit forecasts were taken as the growth in ridership between the existing and future travel models and added to the existing ridership data (from 2013). The following sections will look at the vehicular ADT forecasts, as well as the transit person-trip forecasts that were used in the traffic analysis.

9.1 Overview of Travel Demand Forecasting

Iteris reached out to VTA for clarification on the complete methodology for how a travel model run was completed, as well as which the scenarios a full model run was completed. A full model run was completed for both the existing year, and the forecast No Build scenario. For the build alternatives that had lane reductions and transit service increases, the full model run was applied. This would yield slightly different auto ownership, trip generation, and trip distribution person-trip tables for each alternative that would then feed into mode choice feedback. A full model run was essentially implemented for every alternative.
The exception was that the alternatives that only had bus bulbout stations did not have a full model run, but used the trip distribution and auto ownership results from the No Build full model run and included an updated travel time feedback loop for mode choice.

A full model run definition is that the models are applied for all model components, including trip generation, auto ownership, trip distribution, mode choice, and transit and highway assignment. Travel time feedback, however, is implemented only within mode choice and not back to earlier stages of the model process (such as trip distribution). The model performs successive feedback loops until the travel time is less than one (1) percent error from the previous iteration travel time summed for all origin-destination pairs. Once feedback convergence has been achieved, final highway and transit assignments are performed. Future forecasts typically have seven iterations before convergence is achieved. Figure 12 is a flow chart of the VTA model feedback process.

Figure 12: VTA Travel Model Feedback Process Flow Chart
Source: VTA

Iteris was also provided with a presentation made to FTA by VTA (March 24, 2015), which is included in the Appendix of this document. The following summarizes the presentation and provides background information on the model validation and model forecasting process:

- Home-based work models last calibrated to 2005 Census county-to-county commuter flows
- Non-work models last calibrated to 2000 MTC Regional survey
- Workers and auto ownership by household calibrated to 2005 Census
• Mode choice models calibrated to 2005 regional control totals developed from most recent on-board survey data and Census data
  o VTA 2005 on-board survey
  o BART 2008 on-board survey
  o Caltrain 2005 on-board survey
• VTA models were applied to develop 2013 existing conditions
  o Socioeconomic data and pricing assumptions from MTC and ABAG
  o 2005 networks updated to represent 2013 conditions
• Validation
  o 2013 existing transit ridership system and corridor
  o 2013 AM and PM peak hour traffic counts in the corridor

Table 11 summarizes the transit validation presented to FTA.

<table>
<thead>
<tr>
<th>ROUTE/OPERATOR</th>
<th>ESTIMATED</th>
<th>OBSERVED</th>
<th>ESTIMATED/ OBSERVED RATIO</th>
</tr>
</thead>
<tbody>
<tr>
<td>VTA Light Rail</td>
<td>36,731</td>
<td>34,593</td>
<td>1.06</td>
</tr>
<tr>
<td>VTA Local Bus</td>
<td>112,550</td>
<td>101,432</td>
<td>1.11</td>
</tr>
<tr>
<td>Caltrain</td>
<td>43,053</td>
<td>47,100</td>
<td>0.91</td>
</tr>
<tr>
<td>522</td>
<td>5,616</td>
<td>6,065</td>
<td>0.93</td>
</tr>
<tr>
<td>22</td>
<td>17,636</td>
<td>14,603</td>
<td>1.21</td>
</tr>
</tbody>
</table>

Coding assumptions for Transit Services are briefly summarized as:

• BRT is treated as a local bus mode in the mode choice models
• Station bulb-outs assume a 24 second travel time savings in dwell time at each stop
• Mixed-flow bus segment travel times are a function of the auto travel times and level of congestion
• BRT exclusive lane segments assume a 35 mph average operating speed (as a fixed speed on the transit segment)
• BRT fares same as local service – not a premium fare
9.2 Land Use Forecasts

Neither the land-use used in the travel demand model, or the assumed economic and demographic growth in the area was not discussed in the DEIR/EA or in the TOAR. A statement is made that there is large growth in the region, but nothing specific is said about the project corridor. Supporting documentation about assumed growth is important in providing the reader or reviewer with enough information to understand demand forecasts.

Iteris engaged VTA, DKS, and Parsons in a discussion on 8/13/2015 in which the modifications made to the VTA model and the growth assumptions for transit ridership were discussed. The discussion resulted in a clear understanding of background land-use assumptions, which are controlled to Association of Bay Area Governments (ABAG) Projections 2013 Census Tract and City-level control totals for both base year and future year horizons, and year 2010 census population and households data and 2013 parcel based jobs for the base year 2013. The 2018 and 2040 forecasts were developed to reflect the inventory of approved development projects for all jurisdiction in the County and reflect growth identified in the most recently adopted local jurisdiction General Plans.

A table was provided by VTA detailing the El Camino Real BRT corridor demographics. Table 12 summarizes demographic data for 2013, 2018, and 2040. It would be beneficial to include this table in the FEIR, or in the TOAR.

Table 12: Economic and Demographic Growth in Project Corridor

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Households</td>
<td>67,109</td>
<td>71,987</td>
<td>7%</td>
<td>93,459</td>
<td>39%</td>
</tr>
<tr>
<td>Total Population</td>
<td>164,155</td>
<td>178,539</td>
<td>9%</td>
<td>241,792</td>
<td>47%</td>
</tr>
<tr>
<td>Total Employment</td>
<td>120,251</td>
<td>126,090</td>
<td>5%</td>
<td>151,798</td>
<td>26%</td>
</tr>
<tr>
<td>Households in Lowest Income Quartile</td>
<td>18,847</td>
<td>20,807</td>
<td>10%</td>
<td>29,450</td>
<td>56%</td>
</tr>
<tr>
<td>Percentage of Total Households in Lowest Income Quartile</td>
<td>28.00%</td>
<td>28.90%</td>
<td></td>
<td>31.50%</td>
<td></td>
</tr>
</tbody>
</table>

Note: The Corridor is defined as a buffer of 0.5 miles along each side of Route 22 from Diridon Station in San Jose to University Avenue in Palo Alto

9.3 ADT Forecasts

Appendix D of the TOAR details the ADT forecasts on the roadways in the study area. Iteris completed a brief review of the forecasts to look for consistencies between the years 2013, 2018, and 2040. Table 13 summarizes the total daily volumes at eight locations along the corridor for the No Build and Alternative 4C conditions. Overall, for each of the years, Alternative 4C reduces the forecast ADT at all locations along the corridor when compared with the No Build condition. As expected, the greatest reductions are located between East of Bernardo Avenue (in Sunnyvale) and East of Matadero Avenue (in Palo Alto). The trends are consistent between the three years, which lends validity to the forecasting methodology and tools.
### 9.4 Transit Forecasts

The forecast methodology used to develop transit forecasts is defined as using existing ridership count data, and adding to that the absolute difference in VTA travel demand model ridership (the difference between 2013 and the forecast year). This methodology is clear and is an acceptable methodology to use if the validation of the base model is adequate. There is no information in the ECR BRT project documentation defining the validation of the base year transit forecasts in the TOAR.

A discussion with DKS, VTA, and Parsons on 8/13/2015, was held to discuss the methodology used for transit forecasting. Iteris was told during that phone call that Routes 522 and 22 validated well for 2013 in the project corridor and that the raw model boardings were obtained. Table 14 summarizes the station boardings for eastbound and westbound Route 522 ridership. On a station-by-station comparison to counts, the model shows some variances, which is expected from a regional travel demand model. However, the overall validation of Route 522 results in the model forecasting between 86 and 90 percent of the actual count data, which is a fair validation. The transit forecasting methodology in the TOAR would be more transparent if the raw travel model forecasts were also shown, rather than just the observed plus model growth estimates.

#### Table 13: 2013, 2018, and 2040 No Build and Alternative 4C ADT

*Source: El Camino Real BRT DEIR/EIS Traffic Operations Analysis Report, Appendix D (DKS, August 6, 2014)*

<table>
<thead>
<tr>
<th>Location</th>
<th>2013</th>
<th>2018</th>
<th>2040</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No Build</td>
<td>Alt. 4C</td>
<td>Percent Different</td>
</tr>
<tr>
<td>East of Hedding</td>
<td>29,700</td>
<td>29,700</td>
<td>0.0%</td>
</tr>
<tr>
<td>East of Jefferson</td>
<td>23,800</td>
<td>23,600</td>
<td>-0.8%</td>
</tr>
<tr>
<td>West of Bowers</td>
<td>37,700</td>
<td>36,700</td>
<td>-2.7%</td>
</tr>
<tr>
<td>West of Maria Lane</td>
<td>36,600</td>
<td>35,300</td>
<td>-3.6%</td>
</tr>
<tr>
<td>East of Bernardo</td>
<td>38,000</td>
<td>33,900</td>
<td>-10.8%</td>
</tr>
<tr>
<td>East of Bush</td>
<td>52,500</td>
<td>47,000</td>
<td>-10.5%</td>
</tr>
<tr>
<td>West of Jordan</td>
<td>41,500</td>
<td>38,500</td>
<td>-7.2%</td>
</tr>
<tr>
<td>East of Matadero</td>
<td>42,700</td>
<td>39,200</td>
<td>-8.2%</td>
</tr>
</tbody>
</table>

**Note:** Volumes obtained from Appendix D of the Traffic Operations Analysis Report (DKS, August 6, 2014), and rounded to the nearest 100.

#### Table 14: Route 522 2013 Count Data Compared to 2013 Forecast Model Ridership by Station Summary

*Source: VTA*

<table>
<thead>
<tr>
<th>ROUTE 522 EASTBOUND STATIONS</th>
<th>2013 COUNTS</th>
<th>2013 EXISTING</th>
<th>ROUTE 522 WESTBOUND STATIONS</th>
<th>2013 COUNTS</th>
<th>2013 EXISTING</th>
</tr>
</thead>
<tbody>
<tr>
<td>Palo Alto Caltrain Station</td>
<td>177</td>
<td>519</td>
<td>Eastridge Transit Center</td>
<td>235</td>
<td>92</td>
</tr>
<tr>
<td>El Camino Real &amp; California Avenue</td>
<td>96</td>
<td>45</td>
<td>S. Capitol Avenue &amp; Ocala Avenue</td>
<td>27</td>
<td>65</td>
</tr>
<tr>
<td>STATION</td>
<td>2013 COUNTS</td>
<td>2013 EXISTING</td>
<td>STATION</td>
<td>2013 COUNTS</td>
<td>2013 EXISTING</td>
</tr>
<tr>
<td>-------------------------------</td>
<td>-------------</td>
<td>---------------</td>
<td>-------------------------------</td>
<td>-------------</td>
<td>---------------</td>
</tr>
<tr>
<td>El Camino Real &amp; Arastradero Road</td>
<td>46</td>
<td>140</td>
<td>S. Capitol Avenue &amp; Story Road</td>
<td>55</td>
<td>97</td>
</tr>
<tr>
<td>El Camino Real &amp; Showers Drive</td>
<td>194</td>
<td>103</td>
<td>Alum Rock Transit Center</td>
<td>114</td>
<td>163</td>
</tr>
<tr>
<td>El Camino Real &amp; Castro Street</td>
<td>93</td>
<td>98</td>
<td>Alum Rock Avenue &amp; S. Capitol Avenue</td>
<td>58</td>
<td>124</td>
</tr>
<tr>
<td>El Camino Real &amp; S. Knickerbocker Drive</td>
<td>100</td>
<td>79</td>
<td>Alum Rock Avenue &amp; N. Jackson Avenue</td>
<td>87</td>
<td>159</td>
</tr>
<tr>
<td>El Camino Real &amp; Hollenbeck Avenue</td>
<td>91</td>
<td>70</td>
<td>Alum Rock Avenue &amp; S. Sunset Avenue</td>
<td>35</td>
<td>138</td>
</tr>
<tr>
<td>El Camino Real &amp; E. Remington Drive</td>
<td>149</td>
<td>85</td>
<td>Alum Rock Avenue &amp; N. King Road</td>
<td>77</td>
<td>116</td>
</tr>
<tr>
<td>El Camino Real &amp; S. Wolfe Road</td>
<td>82</td>
<td>98</td>
<td>E. Santa Clara Street &amp; S. 28th Street</td>
<td>26</td>
<td>35</td>
</tr>
<tr>
<td>El Camino Real &amp; Halford Avenue</td>
<td>129</td>
<td>99</td>
<td>E. Santa Clara Street &amp; S. 20th Street</td>
<td>57</td>
<td>7</td>
</tr>
<tr>
<td>El Camino Real &amp; Kiely Boulevard</td>
<td>125</td>
<td>107</td>
<td>E. Santa Clara Street &amp; S. 14th Street</td>
<td>42</td>
<td>40</td>
</tr>
<tr>
<td>El Camino Real &amp; Scott Boulevard</td>
<td>86</td>
<td>16</td>
<td>E. Santa Clara Street &amp; S. 7th Street</td>
<td>174</td>
<td>136</td>
</tr>
<tr>
<td>Santa Clara Caltrain Station</td>
<td>122</td>
<td>75</td>
<td>E. Santa Clara Street &amp; S. 1st Street</td>
<td>392</td>
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<tr>
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<td>18</td>
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<td>76</td>
<td>The Alameda &amp; W. Taylor Street</td>
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<td>191</td>
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<td>El Camino Real &amp; Bowers Avenue</td>
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<td>32</td>
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<td>Alum Rock Avenue &amp; N. King Road</td>
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<td>54</td>
<td>El Camino Real &amp; S. Fair Oaks Avenue</td>
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<td>Alum Rock Avenue &amp; N. Jackson Avenue</td>
<td>89</td>
<td>113</td>
<td>El Camino Real &amp; S. Bernardo Avenue</td>
<td>97</td>
<td>58</td>
</tr>
</tbody>
</table>
Several questions were raised by the Steering Committee and presented to VTA and DKS for response.

- **Was a model sensitivity analysis completed for forecast transit ridership, with the introduction of a BRT mode?**

  The modeling process for the ECR BRT project did not include a formal sensitivity analysis for transit ridership. Based on the results of the ridership compared to the base and no-project alternatives, and relative to the network improvements to reflect the BRT services, the project team concluded that the ridership increases were modest, and likely not on the low end. Appendix A of this report includes a presentation made by VTA to FTA that shows how travel times change for each of the alternatives for each horizon, in addition to transit ridership increases. The summary conclusion found from analysis showed that the ridership forecasts for the alternatives did not seem extraordinarily high, although no formal sensitivity analysis was completed.

- **If the base year transit forecasts validated well within the project corridor, what was the reasoning behind using the transit growth methodology that was used, rather than using raw model forecasts for ridership?**

  The transit validation was at the corridor level, and not at the stop level. Since the ridership was being reported at the stop level in the DEIR/EA documentation, a decision was made to provide adjusted stop-level results that pivoted off of the existing ridership and the difference between the model estimate for the forecasts and the base model estimates. New transit stop ridership with no existing station to pivot off of came directly from the models. This project was unique in that existing stop-level ridership was available, and the project was not a new extension of a fixed-guideway project. The review completed by VTA showed there was not a large difference in results using either raw demand model results or the methodology that was decided upon for the project.
10 REVIEW SYNCHRO TRAFFIC ANALYSIS

The Synchro analysis files provided by VTA were reviewed for consistency at the intersections along El Camino Real. In year 2018 and 2040 conditions, Synchro parameters and intersection configurations between the No Build and Alternative 4C (long dedicated lane) condition were compared in order to ensure that the “with project” scenario was adequately assessed.

In each forecast year, the review showed that the Alternative 4C intersection configurations in the Synchro files accurately reflect the project description. This generally results in the removal of an eastbound and westbound through lane along the project route. In addition, the review showed that other parameters such as Peak Hour Factor (PHF) and Saturation Flow Rate were consistent between the No Build and Alternative 4C conditions.

In the 2018 comparison, the following differences were noted:

- The Cycle Length values differed between No Build and Alternative 4C at:
  - 55. Kiely Boulevard-Bowers Avenue/El Camino Real
  - 56. Bowe Avenue/El Camino Real

- In Alternative 4C, at 62. Lafayette Street/El Camino Real, the eastbound movement consists of two left-turn lanes whereas the No Build configuration consists of one left-turn lane.

In the 2040 comparison, the following difference was noted:

- In Alternative 4C, at 62. Lafayette Street/El Camino Real, the eastbound movement consists of two left-turn lanes whereas the No Build configuration consists of one left-turn lane.

Without technical investigation, it is unclear if these changes were made to the Synchro files in 2018 or 2040 to correct these lane configurations, whether or not the impact criteria would remain the same.

It should be noted that the VTA CMP Traffic Level of Service Analysis Guidelines (VTA, Adopted January 1995, Updated June 2003) recommend the use of reduced Saturation Flow Rates for through-right movements, dedicated right-turn movements, and single and dual left-turn movements. The ECR BRT project analysis utilized the ideal 1,900 vehicles per hour per lane rate (vphpl). However, these guidelines apply to analysis performed using Traffix software, not necessarily using Synchro. If the ECR BRT project analysis utilized these reduced saturation flow rates in the Synchro analysis, it is not likely to make a major difference in the levels of impact because the reduced rates would be applied to the No Build and each “with project” scenario equally. Overall, the Synchro analysis is thorough and the results should be adequate to make informed decisions regarding the project alternatives.
11 EIR ASSESSMENT OF EFFICACY AS A GUIDE TO DECISION MAKING CONCLUSIONS

Overall, the purpose of the peer review support performed by Iteris, at the direction of the Steering Committee, was to determine if adequate information was available in the ECR BRT project documentation to make informed decisions. To that end, Iteris was retained to focus on specific aspects of the traffic analysis, related directly to methodology, calculations, and reported values. Iteris focused primarily on the following:

- Comparison of recent TIAs methodologies and results completed within the last two years
- Comparison with recent BRT environmental projects
- Address concerns related to the study area (Was it discussed in scoping comments? How was it developed? Should it have been different?)
- Technical review of the traffic diversion as reported in the Traffic Operations Analysis Report
- Technical review of the queuing analysis
- Technical review of the greenhouse gas evaluation, by reviewing travel demand model reported VMT
- Analyze reported travel time calculations and determine if segmented travel times would be important to show or if the full corridor travel times are adequate
- Review of scoping comments
- Review of the City of Mountain View independent peer review
- Address the adequacy of the lack of discussion of evaluating a potential LRT alternative.
- Complete a review of the methodologies used for, and the resulting forecasts from, the VTA travel demand model and post processing
- Evaluate the traffic impacts as analyzed using Synchro

11.1 Adequate Discussion and Analysis

The areas of the project documentation that are adequate in technical documentation or analysis in order to evaluate the alternatives and make informed decisions are:

11.1.1 Recent TIA Project Comparisons

A review of the methodologies used for the recent TIA projects show that all of the projects used the same methodologies, and the resulting LOS at overlapping intersections was nearly identical at all intersections, with nearly all of the overlapping intersections resulting in similar LOS results (differing no more than one letter grade). All TIAs, including the ECR BRT TIA (CHS Consulting Group, February 28, 2014), used the 2000 HCM methodologies, and were consistent with the criteria recommended in the VTA Transportation Impact Analysis Guidelines (VTA, Adopted October 2014).
11.1.2 Comparison with Recent BRT Projects

While the ECR BRT project DEIR/EA (ICF International, October, 2014) did not compare itself to other BRT projects, the review of key elements of the project compared to other recent BRT projects of similar scope concluded that the ECR BRT project compares well with similarly scoped BRT projects. The primary areas compared were the study area, diversion, transit forecasting methodology, alternative modes, location of lane, and performance measure evaluation. The ECR BRT project had a more extensive study area, a more thorough diversion analysis, a similar transit forecasting method, and included more intersections in the intersection analysis than the comparable projects.

11.1.3 Traffic Diversion and Queuing Analysis

The traffic diversion analysis that was completed in the El Camino Real BRT Traffic Operations Analysis Report (DKS, August 6, 2014) included an analysis of queuing on parallel and crossing facilities. Assuming that there are no questions related to the methodology and results presented for the traffic diversion, the queuing analysis was addressed adequately within the report. It should be noted that the traffic diversion and queuing analyses only looked at motorized vehicular volumes, and did not include bicycles or pedestrians.

11.1.4 Review of Greenhouse Gas (GHG) Evaluation

The VMT reported in Appendix G of the El Camino Real BRT Traffic Operations Analysis Report (DKS, August 6, 2014) was summarized by Iteris for this document, and compared for the No Build and Alternative 4C alternatives for the years 2013, 2018, and 2040. Table 5 resulted in consistent VMT by speed bin when comparing the No Build and Alternative 4C alternatives for 2013, 2018, and 2040.

11.1.5 Completeness of Evaluation of Potential LRT Alternatives

The exclusion of LRT as a project alternative is not considered to be a fatal flaw for the project. The LRT alternative was discussed in the PSR-PDS (Caltrans, January 2014) that was published in January 2014, and provided documentation calling for this project to be a BRT project only. The PSR-PDS concluded that BRT was the most appropriate mode to be considered suitable for the corridor land-use and long-range vision. Also, it should be noted that an LRT alternative was not suggested as a comment during the scoping period.

11.2 Partial Discussion and Analysis

The areas of the project documentation that could be strengthened in order to make a more informed decision are:

11.2.1 Recent TIA Project Comparisons

The ECR BRT project was evaluated and performed similar to the recent TIAs that were completed along the project corridor. However, the analysis could be strengthened using HCM 2010 methodologies.
because bicycle and pedestrian factors, which were both important comments noted during the scoping period, are included for intersection LOS.

11.2.2 Signal Warrants

Iteris noted that at the significantly impacted unsignalized intersections in the ECR BRT TIA (CHS Consulting Group, February 28, 2014), which is Appendix I of the El Camino Real BRT Traffic Operations Analysis Report (DKS, August 6, 2014), the TIA documentation states that signal warrant analyses were performed where appropriate. However, no Manual of Uniform Traffic Control Devices (MUTCD) signal warrant analysis sheets (i.e. the worksheets that are used to determine whether or not a signal was warranted) were provided in the Appendix to the TIA. The purpose of the MUTCD signal warrant analysis sheets is to provide guidelines for the uniformity of traffic control devices, such as traffic signals and signage. The TIA would be more transparent if the signal warrant analysis were included in the appendix of the document.

11.2.3 Study Area

The ECR BRT project defines several project areas. As stated in Section 3.0, the ECR BRT project does not physically define one study area that was used for the project, but maintains three distinct study areas used for various portions of the project. The three study areas are the “study corridor” (El Camino Real between the transit center in Palo Alto and the arena in San Jose), the “expanded geographic area” (roughly one-half to one mile outside of the corridor), and the “El Camino Real broader corridor” (the area between US-101 and I-280 the entire length of the corridor). The methodology is sound for the selection of the three different study areas, however, it would be more transparent to a reviewer what the true bounds of the expanded geographic area and the El Camino Real broader corridor areas were shown in a figure in the El Camino Real BRT Traffic Operations Analysis Report (DKS, August 6, 2014) and the FEIR/EA. The primary concern would be in knowing if US-101 and I-280 are included in the El Camino Real broader corridor.

11.2.4 Travel Time Analysis

The discussion of travel time in the El Camino Real BRT Traffic Operations Analysis Report (DKS, August 6, 2014) presents the full corridor travel time as a whole in the report, but shows segmented travel times in Appendix F. To provide enough information for a thorough review, the segmented travel time would be helpful to include in the body of the report as figures. It would also be useful to a reviewer if the existing condition travel times were presented in comparison with the 2013 forecast model estimates.

11.2.5 City of Mountain View Peer Review

The City of Mountain View Peer Review (Hexagon Transportation Consultants, Inc., December 3, 2014) identified areas where there were “errors” in signal phasing, cycle lengths, and lost times. This was discussed in this document in Section 7.0. There was no summary or conclusions section in the Mountain View Peer Review document, but the report identified twelve locations where “errors” were present in the Synchro analysis. Fixing these “errors” would result in a more thorough intersection LOS analysis. These identified “errors” are not considered to be fatal flaws, and would not likely change the project
results if they were fixed. The term “error” was used in the Hexagon report, and is not a statement made by Iteris about the quality of the ECR BRT project. It is likely that the differences (or “errors”) in the ECR BRT project and the El Camino Real Precise Plan (LSA, October 2014) are attributable to different times as to when the data was collected or coding differences between Synchro and Traffix.

11.2.6 Peak Period Transit Ridership by Direction

Table 26 of the *El Camino Real BRT Traffic Operations Analysis Report* (DKS, August 6, 2014) shows direction transit ridership, including estimates for new transit ridership, for the two routes in the project corridor. This table reflects a substantial imbalance between eastbound (1,402) and westbound (7,256) new transit riders. While it is understood that the total daily ridership is factored from peak hour values, this presentation would not be understood by the general public.

Table 26 is in production and attraction format and shows a large imbalance in the westbound direction. Iteris participated in a discussion on 8/13/2015 with DKS and VTA, and questioned why the table was shown in this format. The response was that FTA had asked that the production-attraction formatted numbers be shown in the report, and not just the daily, or balanced ridership. While this data is not incorrect, it can be misleading to reviewers, as it appears that there are significantly more new riders in the westbound direction than the eastbound. An explanation of the methodology used to develop this table should be included in the report, including a thorough explanation of production-attraction ridership estimates.

11.2.7 Person-Trips versus Ridership

The distinction between person-trips and ridership is not made clear in the *El Camino Real BRT Traffic Operations Analysis Report* (DKS, August 6, 2014). It would be a more transparent analysis if person-trips were discussed separately from bus ridership (or boardings). Showing boardings in the project could be misleading if a potential bus rider chooses to board a bus more than one time. The TOAR (and subsequently the DEIR/EA (ICF International, October, 2014)) frequently refers to the ridership of the BRT route. This would also be important to show as a performance measure. It is important to show both an increase in boardings on the BRT route and an increase in VTA transit ridership gains (increase in mode split), which is a necessary piece of information that is missing from the report. In addition, the segment we are looking at does not represent the entire length of Route 522, therefore, when discussing ridership, it should be made clear that the ridership is for either the entire route, or the project section.

Two considerations for the final report are:

- Clarify and be clear when discussing transit ridership, boardings, or person-trips.
- Include a screenline analysis table in the discussion that shows the person-trips crossing those screenlines, in both automobile and transit. Ultimately, even though mode shift occurs, the number of person-trips should remain relatively constant.
11.3 Missing Discussion and Analysis

The areas of the project documentation that are lacking in technical documentation or analysis, and should be included in order to evaluate the alternatives and make informed decisions are:

11.3.1 Land Use Forecasts

The growth in the corridor is expected to be very high, and there is no discussion or presentation of that data. The El Camino Real BRT Traffic Operations Analysis Report (DKS, August 6, 2014) does not quantify population of household growth within the corridor, and the DEIR/EA (ICF International, October, 2014) only discusses the growth in Santa Clara County. This important background information should be included in the TOAR in order to set the stage for defending the growth projected by the travel demand model.

Iteris engaged VTA, DKS, and Parsons in a discussion on 8/13/2015 to determine the modifications made to the VTA model, and the growth assumptions for transit ridership. The discussion resulted in a clear understanding of background land-use assumptions, which are controlled to ABAG Projections 2013 Census Tract and City-level control totals for both base year and future year horizons, and year 2010 census population and households data and 2013 parcel based jobs for the base year 2013. The 2018 and 2040 forecasts were developed to reflect the inventory of approved development projects for all jurisdiction in the County and reflect growth identified in the most recently adopted local jurisdiction General Plans. The forecasts, which were reviewed by all of the Cities prior to completion of the travel forecasting, were developed to include the inventory of approved development projects. VTA provided a table showing corridor demographics that will be included in the FEIR/EA.

11.3.2 Traffic Diversion and Queueing

The traffic diversion discussion in the El Camino Real BRT Traffic Operations Analysis Report (DKS, August 6, 2014) was found to be incomplete, and did not include enough information for the Steering Committee to develop an informed decision. The traffic diversion discussion was covered in depth in Section 3.2 of this report. The main body of the report shows only the PM peak hour data, which is acceptable. However, the tables leading up to the figures discuss PM peak hour volumes, and the figures state they are PM peak period volumes. Appendix F of the TOAR states that these volumes are PM peak hour volumes. An email discussion with VTA on 8/18/2015 concluded that the figures in the report are mislabeled as peak period, and will be revised to say peak hour for the FEIR/EA.

In addition, the methodology for developing the traffic diversion analysis using the VTA travel demand model is unclear. The description of the methodology for screenline diversion in the TOAR implies that the models were run with the additional capacities in place to determine the forecast vehicular volumes and transit ridership for the alternatives. It also implies that the diversion was then calculated by maintaining mode split and trip distribution, but reassigning the vehicular traffic onto a system with less capacity. This was clarified during a discussion on 8/13/2015 with VTA and DKS, and will be clarified in the FEIR/EIS. To reiterate the methodology, the full travel demand model runs were compared for Alternative 4C (the long dedicated lane) and the No Build alternative. The difference between the two full model runs represented the potential diversion reported in the TOAR.
Iteris engaged VTA, DKS, and Parsons in a discussion on 8/13/2015, where the screenline diversion analysis was discussed. Iteris requested that the information be provided to the Steering Committee that shows total vehicle and transit trips across screenlines, and not just the diverted traffic. Independent of the Iteris request, the project team is developing a revised diversion analysis for the FEIR that will include a comparison of all trips, diverted trips, and bus ridership across the screenlines. The revised information will result in less confusion about “missing” trips, and will show a more balanced system, with clear mode shift analysis.

The discussion with the project team began by talking about the methodology used to calculate diversion, as well as the reasonableness of the forecasts based on historical data for the region. The methodology used to calculate the diverted traffic was to run a full travel demand model for each alternative, and capture the volume difference in vehicles on the roadway. This is an acceptable methodology, but the original information in the report was misleading. In addition to the body of the report, the appendix of the report included the raw values for volumes on roadways, but did not include any calculation for diverted traffic, leaving the reader to have to calculate each location’s estimated diversion. It would be more transparent if the diverted traffic were included in the appendix of the TOAR.

Updated diversion figures were developed by VTA for this document, and shown in Section 3.2.4. The revised diverted traffic figures show a clearer picture of trips diverting from vehicle trips on El Camino Real to transit trips on El Camino Real, and to other major arterials, local arterials, or other modes of travel. The documentation in the FEIR should clarify the mode shift, as well as the person-trip information along the screenline, to ensure minimal loss of trips associated with the Alternative 4C project.

Most importantly, there needs to be a discussion in the TOAR that shows a clear path through the diversion analysis process: 1) show the trip generation outcomes; 2) show the trip distribution outcomes; 3) show the mode choice outcomes; and 4) show the assignment across the screenline for vehicle and transit for each of the alternatives. Providing a path through the modeling process will provide a more clear understanding of the forecast ridership growth in the study corridor.

11.3.3 Complete Streets (Bicycle and Pedestrian)

The El Camino Real BRT Traffic Operations Analysis Report (DKS, August 6, 2014) is very focused on traffic and transit operations, and there were many scoping comments related to inclusion of bike lanes in the project alternatives. Most importantly, the TOAR did not include any analysis for bicycle or pedestrians level-of-service. Two general comments that were made during the scoping period included:

- Include bicycle lanes in the alternatives. The purpose for including bicycle lanes in the alternatives would be to include a more complete street concept. Several of the comments requested that the bicycle lanes either be included on El Camino Real, or on parallel facilities; and
- Do not include bicycle lanes in the alternatives. The reasoning behind not including bicycle lanes on El Camino Real is due to high speeds and heavy traffic, resulting in less safety.

While the alternatives did include dedicated bicycle lanes, the lanes were only discussed on the El Camino Real Corridor, and did not including bicycle lanes on parallel facilities. The reason to include bicycle lanes
on parallel facilities, is because those facilities have less traffic than El Camino Real, and could result in a safer ride for the bicyclist.

The TOAR and DEIR/EA (ICF International, October, 2014) documents did not include an analysis of either pedestrian or bicycle safety, or level-of-service. The only information available for the bicycle system was a table showing the length of new bicycle facility for each alternative. The bicycle and pedestrian complete streets concept is not evaluated in the TOAR, and would provide a clearer document if performance was quantified.

11.3.4 Review of Scoping Comments

The review of the scoping comments summarized two main points that would be beneficial to be included in the El Camino Real BRT Traffic Operations Analysis Report (DKS, August 6, 2014). One main comment received requested increased accessibility and service to the areas that are not currently served by Route 522, likely to be accommodated by including feeder services in the build alternatives. It was not clear that this was addressed in any of the alternatives, and a discussion could be informative to the alternatives analysis discussion of the report. The second note that would assist a reviewer in understanding public scoping comments that were received would be to include the summary of the comments in Appendix A of the DEIR/EA (ICF International, October, 2014). The DEIR/EA states that the comments were included in the appendix, however, only a list of public commenters is included.

11.3.5 Transit Model Validation

The methodology used to forecast transit ridership for the ECR BRT project relies heavily on the validation of the travel demand model in the base year. The methodology relies on the forecast growth in ridership, and adds it directly to the existing count information. Based on a conversation on 8/13/2015 with DKS and VTA, it was stated that the existing travel demand model validated closely with existing count data. This validation was made available to Iteris, and is presented in Table 11 in Section 9.2. However, the validation is not presented in the El Camino Real BRT Traffic Operations Analysis Report (DKS, August 6, 2014), and should be included to provide the Steering Committee with enough information to make decisions. As it is presented (in Appendix C of the TOAR), the ridership for Line 22 and Line 522 are shown as the observed plus model growth, and raw model values are not documented.

Based on a discussion with DKS and VTA on 8/13/2015, Iteris learned that the local bus mode choice constant was used for the mode split module, and no BRT constant was developed. The reason behind this decision was directly related to having no BRT bus to calibrate to in the region. The methodology is clear and defensible, but should be discussed in the transit forecasting methodology section of the TOAR.
12 REFERENCES


El Camino Real BRT Ridership Forecasting Update

DRAFT
March 24, 2015
Presentation Overview

• Description of BRT Alternatives

• Overview of Travel Demand Forecasting
  - Base Model Calibration and Validation
  - Ridership Forecasts

• FTA STOPS Ridership

• Next Steps
VTA Bus Rapid Transit Program

VTA BRT Program Deployment Schedule by Corridor to 2018

Santa Clara-Alum Rock
Plan/Eng: 2008-2013
Construction: 2013-2015
Begin Service: 2015

El Camino Real
Plan/Eng: 2010-2015
Construction: 2015-2018
Begin Service: 2018

Stevens Creek
Plan/Eng: 2011-2014

BRT vehicles begin operating in SC-AR/El Camino Real corridor in 2015

BART Phase I
Extension to Silicon Valley
Construction: 2012-2017
Begin Service: 2017
VTA El Camino Real Existing Corridor

- Project Corridor is 17.6 miles total length from central San Jose to Palo Alto

- Served by two primary trunk routes – Local 22 and limited stop Rapid 522

- Local 22 operates at 12 minute peak and mid-day frequencies

- Rapid 522 operates at 15 minute peak and mid-day frequencies with significant corridor-wide signal priority
Rapid 522 operates at 15 minute peak/15 minute mid-day frequencies
El Camino Real BRT Corridor No Project Alt 1

1 - No Build from San Jose to Palo Alto

10 minute peak/10 minute mid-day frequencies without station bulb-outs
10 minute peak/10 minute mid-day frequencies with station bulb-outs
Alt 3a has no station improvements north of exclusive segment.
10 minute peak/10 minute mid-day frequencies (17% exclusive lane operations)
El Camino Real BRT Corridor Alt 4a

4a - Long Dedicated Lane - Lafayette Street in Santa Clara to SR 85 in Mountain View

10 minute peak/10 minute mid-day frequencies (42 % exclusive lane operations)
El Camino Real BRT Corridor Alt 4b

10 minute peak/10 minute mid-day frequencies (57% exclusive lane operations)
El Camino Real BRT Corridor Alt 4c

4c - Long Dedicated Lane - Lafayette Street in Santa Clara to Embarcadero Road in Palo Alto

Map showing the route:
- Palo Alto
- Embarcadero Road
- Lafayette Street

10 minute peak/10 minute mid-day frequencies (79 % exclusive lane operations)
Typical Street Cross-Sections

Dedicated Lane Configuration

Mixed Flow Configuration
# Corridor Demographics

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<th>Variable</th>
<th>2013</th>
<th>2018</th>
<th>2040</th>
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<tr>
<td>Total Households</td>
<td>67,109</td>
<td>71,987</td>
<td>93,459</td>
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<tr>
<td>Total Population</td>
<td>164,155</td>
<td>178,539</td>
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<tr>
<td>Total Employment</td>
<td>120,251</td>
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<tr>
<td>Households in Lowest Income Quartile</td>
<td>18,847</td>
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<tr>
<td>Percentage of Total Households in Lowest Income Quartile</td>
<td>28.0%</td>
<td>28.9%</td>
<td>31.5%</td>
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</table>

Corridor is defined as a buffer of 0.5 miles along each side of Route 522
Overview of Travel Demand Forecasting

- Home-based work models last calibrated to 2005 Census County-to-County commuter flows
- Non-work models last calibrated to 2000 MTC Regional survey
- Workers and auto ownership by household calibrated to 2005 Census
- Mode choice models calibrated to 2005 regional control totals develop from most recent on-board survey data and Census data
  - VTA 2005 on-board survey
  - BART 2008 on-board survey
  - Caltrain 2005 on-board survey
Overview of Travel Demand Forecasting

• VTA models were applied to develop 2013 existing conditions
  • Socioeconomic data and pricing assumptions from MTC and ABAG
  • 2005 networks updated to represent 2013 conditions

• Validation
  • 2013 existing transit ridership system and corridor
  • 2013 AM and PM peak hour traffic counts in the corridor
### System and Corridor Ridership 2013 Validation

<table>
<thead>
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<th>Route/Operator</th>
<th>Estimated</th>
<th>Observed</th>
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<td>VTA Light Rail</td>
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<td>0.91</td>
</tr>
<tr>
<td>522</td>
<td>5,616</td>
<td>6,065</td>
<td>0.93</td>
</tr>
<tr>
<td>22</td>
<td>17,636</td>
<td>14,603</td>
<td>1.21</td>
</tr>
</tbody>
</table>

Daily Boardings
Coding Assumptions for Transit Services

• BRT is treated as a local bus mode in the mode choice models
• Station bulb-outs assume a 24 second travel time savings in dwell time at each stop
• Mixed-flow bus segment travel times are a function of the auto travel times and level of congestion
• BRT exclusive lane segments assume a 35 mph average operating speed (as a fixed speed on the transit segment)
• BRT fares same as local service – not a premium fare
# Travel Times by Alternative by Horizon

<table>
<thead>
<tr>
<th></th>
<th>Existing</th>
<th>No Project</th>
<th>Alt 2</th>
<th>Alt 3b</th>
<th>Alt 4a</th>
<th>Alt 4b</th>
<th>Alt 4c</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Local Bus</td>
<td>BRT</td>
<td>Auto</td>
<td>Local Bus</td>
<td>BRT</td>
<td>Auto</td>
<td>Local Bus</td>
</tr>
<tr>
<td>2013</td>
<td>90</td>
<td>71*</td>
<td>40</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>2018</td>
<td></td>
<td></td>
<td></td>
<td>85</td>
<td>72</td>
<td>40</td>
<td>107</td>
</tr>
<tr>
<td>2040</td>
<td></td>
<td></td>
<td></td>
<td>107</td>
<td>83</td>
<td>50</td>
<td>107</td>
</tr>
</tbody>
</table>

Westbound Direction – AM Peak Period, minutes

* = Rapid 522
# Travel Times by Alternative by Horizon

<table>
<thead>
<tr>
<th></th>
<th>2013</th>
<th>2018</th>
<th>2040</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Local Bus</td>
<td>BRT</td>
<td>Auto</td>
</tr>
<tr>
<td><strong>Existing</strong></td>
<td>83 64* 36</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td><strong>No Project</strong></td>
<td>83 64 36</td>
<td>78 64 36</td>
<td>79 65 36</td>
</tr>
<tr>
<td><strong>Alt 2</strong></td>
<td>78 58 37</td>
<td>78 58 36</td>
<td>79 59 36</td>
</tr>
<tr>
<td><strong>Alt 3b</strong></td>
<td>-</td>
<td>-</td>
<td>78 56 36</td>
</tr>
<tr>
<td><strong>Alt 4a</strong></td>
<td>-</td>
<td>-</td>
<td>78 54 36</td>
</tr>
<tr>
<td><strong>Alt 4b</strong></td>
<td>-</td>
<td>-</td>
<td>79 50 37</td>
</tr>
<tr>
<td><strong>Alt 4c</strong></td>
<td>79 44 37</td>
<td>79 44 37</td>
<td>81 44 38</td>
</tr>
</tbody>
</table>

Eastbound Direction – AM Peak Period, minutes

* = Rapid 522
### Year 2013 Corridor Project Ridership

<table>
<thead>
<tr>
<th>Route</th>
<th>Existing Conditions</th>
<th>No Project (Alt 1)</th>
<th>Alt 2</th>
<th>Alt 4c</th>
</tr>
</thead>
<tbody>
<tr>
<td>522</td>
<td>3,287</td>
<td>7,485</td>
<td>8,507</td>
<td>11,531</td>
</tr>
<tr>
<td>22</td>
<td>9,234</td>
<td>5,091</td>
<td>4,811</td>
<td>4,452</td>
</tr>
<tr>
<td>Corridor</td>
<td>12,521</td>
<td>12,576</td>
<td>13,318</td>
<td>15,983</td>
</tr>
</tbody>
</table>

Existing Conditions reflect 15 minute frequencies on Route 522 and 12 minute frequencies on Route 22, peak and mid-day service.

No Project and Project Alternatives reflect 10 minute frequencies on Route 522 and 15 minute frequencies on Route 22, peak and mid-day service.
## 2013 Alt 4c Total Ridership by Markets Served

<table>
<thead>
<tr>
<th>Market</th>
<th>Palo Alto</th>
<th>Mountain View</th>
<th>Sunnyvale</th>
<th>Santa Clara</th>
<th>San Jose</th>
<th>SC/AR</th>
<th>ALL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Palo Alto</td>
<td>655</td>
<td>628</td>
<td>659</td>
<td>467</td>
<td>181</td>
<td>587</td>
<td>3,177</td>
</tr>
<tr>
<td>Mountain View</td>
<td>628</td>
<td>70</td>
<td>231</td>
<td>144</td>
<td>59</td>
<td>275</td>
<td>1,407</td>
</tr>
<tr>
<td>Sunnyvale</td>
<td>659</td>
<td>231</td>
<td>324</td>
<td>349</td>
<td>106</td>
<td>434</td>
<td>2,103</td>
</tr>
<tr>
<td>Santa Clara</td>
<td>467</td>
<td>144</td>
<td>349</td>
<td>432</td>
<td>206</td>
<td>947</td>
<td>2,545</td>
</tr>
<tr>
<td>San Jose</td>
<td>181</td>
<td>59</td>
<td>106</td>
<td>206</td>
<td>88</td>
<td>954</td>
<td>1,594</td>
</tr>
<tr>
<td>SC/AR</td>
<td>587</td>
<td>275</td>
<td>434</td>
<td>947</td>
<td>954</td>
<td>2,733</td>
<td>5,930</td>
</tr>
<tr>
<td>ALL</td>
<td>3,177</td>
<td>1,407</td>
<td>2,103</td>
<td>2,545</td>
<td>1,594</td>
<td>5,930</td>
<td>16,756</td>
</tr>
</tbody>
</table>

Daily station to station boardings for entire Line 522 including Santa Clara/Alum Rock (SC/AR) BRT segment
## Year 2018 Corridor Project Ridership

<table>
<thead>
<tr>
<th>Route</th>
<th>No Project (Alt 1)</th>
<th>Alt 2</th>
<th>Alt 3b</th>
<th>Alt 4a</th>
<th>Alt 4b</th>
<th>Alt 4c</th>
</tr>
</thead>
<tbody>
<tr>
<td>522</td>
<td>8,159</td>
<td>9,223</td>
<td>10,090</td>
<td>10,801</td>
<td>11,808</td>
<td>13,104</td>
</tr>
<tr>
<td>22</td>
<td>6,429</td>
<td>6,080</td>
<td>5,909</td>
<td>5,847</td>
<td>5,692</td>
<td>5,512</td>
</tr>
<tr>
<td>Corridor</td>
<td>14,588</td>
<td>15,303</td>
<td>15,999</td>
<td>16,648</td>
<td>17,500</td>
<td>18,616</td>
</tr>
</tbody>
</table>

No Project and Project Alternatives reflect 10 minute frequencies on Route 522 and 15 minute frequencies on Route 22, peak and mid-day service.
## Year 2040 Corridor Project Ridership

<table>
<thead>
<tr>
<th>Route</th>
<th>No Project (Alt 1)</th>
<th>Alt 2</th>
<th>Alt 3b</th>
<th>Alt 4a</th>
<th>Alt 4b</th>
<th>Alt 4c</th>
</tr>
</thead>
<tbody>
<tr>
<td>522</td>
<td>10,576</td>
<td>11,736</td>
<td>14,490</td>
<td>15,878</td>
<td>18,323</td>
<td>21,071</td>
</tr>
<tr>
<td>22</td>
<td>11,102</td>
<td>10,492</td>
<td>10,016</td>
<td>9,879</td>
<td>9,668</td>
<td>9,266</td>
</tr>
<tr>
<td>Corridor</td>
<td>21,678</td>
<td>22,228</td>
<td>24,506</td>
<td>25,757</td>
<td>27,991</td>
<td>30,337</td>
</tr>
</tbody>
</table>

No Project and Project Alternatives reflect 10 minute frequencies on Route 522 and 15 minute frequencies on Route 22, peak and mid-day service.
Year 2013 and 2040 Project Ridership – Transit Dependents

To be Provided
FTA STOPS Application Overview

• AECOM, Inc., applied STOPS version 1.03 for ECR BRT project in spring/summer 2014

• STOPS was implemented for year 2013 on existing conditions, No Project and Alt 4c scenarios

• VTA provided 2013 demographics, Traffic Analysis Zones, alternative coded networks

• VTA also provided stop level ridership for light rail, Route 22 and 522 for base calibration
FTA STOPS Application Results

- STOPS produced detailed project ridership stratified by mode of access (walk and drive), trip purpose and auto ownership level

- For year 2013, STOPS predicted 23,929 linked trips for Alt 4c

- This represents an increase of 7,337 transit trips over the 2013 No Project

• Of the 23,929 link project trips:
  • 47% home-based work trips,
  • 24% made by zero auto ownership households
  • 78% walk access and 22% drive access

• VTA is currently preparing more detailed summaries of VTA modeled ridership for a more direct comparison to STOPS forecasts
Next Steps

- Draft EIS released – responding to comments
- Peer Review to be initiated early spring 2015
  - Travel demand model assumptions and outputs
  - Traffic impact analysis methodology and results
  - Three month review time anticipated
- More detailed comparison of STOPs and VTA model results
- Ridership Results Report for FTA