



**CITY OF ELK GROVE  
CITY COUNCIL STAFF REPORT**

**AGENDA TITLE:** Receive a report on the Bus Rapid Transit Early Implementation Study (WAM007) findings and provide direction as appropriate

**MEETING DATE:** September 11, 2019

**PREPARED BY:** Bob Morrison, Transit Project Manager  
Michael Costa, Transit System Manager

**DEPARTMENT HEAD:** Robert Murdoch, P.E., Public Works Director/  
City Engineer

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**RECOMMENDED ACTION:**

Staff recommends that the City Council receive a report on the implementation of Bus Rapid Transit (BRT) / Express Bus (ExBus) service along the existing Route 110 corridor (WAM007), and direct staff to re-evaluate BRT/ ExBus service in 2025, after additional development occurs along the corridor. During this time, staff will further explore potential grant funding opportunities, as they become available and available resources permit, for infrastructure improvements along the Route 110 corridor that could be developed to support future higher frequency transit service.

**SUMMARY OF FINDINGS:**

Based on the analysis conducted in the BRT/ExBus feasibility study, ridership forecasts and farebox recovery projections resulting from the implementation of either BRT/ExBus supporting infrastructure and/or ExBus service within the Route 110 corridor would not meet both the City's adopted 2017 Comprehensive Operational Analysis (COA) service performance metrics and other relevant industry-standard targets in the near-term (FY 2020). However, should future land use development densities increase along the corridor (including the redevelopment of some vacant sites), investment in BRT and/or ExBus improvements could increase ridership and result in transit services that are able to more closely achieve established performance targets.

Instead of an immediate investment into increasing service frequencies along the Route 110 corridor, near-term efforts to support existing transit service could focus on marketing/advertisement of the existing service, seeking grant funding opportunities to improve pedestrian access and infrastructure at existing bus stops, investing in traffic signal modifications for transit prioritization, and developing vacant parcels with higher density land uses that would support transit services in order to potentially increase transit ridership in the corridor.

### **BACKGROUND INFORMATION:**

In November 2018, the City Council authorized the City Manager to enter into a consulting contract with Iteris, Inc. (Iteris) to conduct a feasibility study (Study) on the implementation of bus rapid transit (BRT) services in FY 2019-20 (WAM007). The deliverables from this analysis included:

- Summary Memorandum, which summarizes the study's key findings and provides recommendations for the City Council's consideration and direction (contained in Attachment 1).
- Technical Memorandum #1, which provides background information on BRT and Express Bus (ExBus) services (contained in Attachment 2).
- Technical Memorandum #2, which discusses opportunities and constraints for a potential BRT or (ExBus) service in the City (contained in Attachment 3).
- City Council Retreat presentation, which provided Council an overview of various transit service options, including ExBus service.

### **Definitions**

- A **Bus Rapid Transit (BRT)** system is a bus-based transit system that incorporates features similar to a light rail. Features of BRT may include: dedicated right of way, frequent service, off-board fare collection, vehicle signal preemption, and enhanced stations.
- **Express Bus Service (ExBus)** or **BRT Lite** as defined for this study is a bus-based transit system that includes many of the features of a BRT, but runs within existing mixed flow traffic lanes. Note: this is distinct from commuter bus service which may also be termed "express bus".

Land density and employees per acre are major determining factors for selecting a route for transit service. According to the Transit Capacity and Quality Service Manual Third Edition (2013), a density of 3.0 dwelling units per acre and 4.0 employees per acre within a half mile walking distance of a stop is an indicator of potential BRT success. Currently there are 5,300 dwelling units within a half mile walking distance of an existing bus stop. There are also 7,100 employees within ½ mile walking distance of a stop. This equates to approximately 1.2 dwelling units per acre, and 1.63 employees per acre, within a half mile walking distance of the existing route 110 corridor. Therefore, the existing density and intensity of development of existing development is currently well below the desirable minimum to support BRT services.

For this reason, the Study focused solely on the implementation of Express Bus (ExBus) service. ExBus service includes many of the elements of a BRT, as defined above. However, the primary difference between BRT and ExBus service is that ExBus travels share a travel lane with other vehicular traffic, while a BRT has a dedicated lane solely for the transit service.

## **DISCUSSION:**

Iteris worked closely with City staff to determine the success criteria for a potential ExBus service along the existing e-tran Route 110 corridor along Big Horn Boulevard. Both near-term and long-term ExBus service scenario alternatives were created and analyzed. Each alternative scenario was then compared against both the City's adopted 2017 Comprehensive Operational Analysis (COA) service plan performance metrics and other relevant transit service industry criteria to determine service viability.

### **Success Criteria**

In coordination with City staff, Iteris identified ExBus elements that could be implemented over the near-term (by FY 2020) and long-term (by FY 2036) to improve ridership and service performance in the Route 110 corridor. In analyzing the forecasted costs of the ExBus service improvements and the resultant increase in forecasted ridership from each scenario, the following COA performance metrics were used to determine potential success.

- Farebox recovery
- Ridership per Revenue Hour

Farebox recovery is measured by the annual revenue generated by a given route divided by the sum of its annual operation and maintenance costs, excluding capital expenditures. Per the COA's adopted performance metric targets, the City's expectations for farebox recovery is 20%.

Ridership per Revenue Hour is measured by the number of riders, divided by the number of hours of revenue service (excluding non-revenue operation). For a standard transit bus route, 20 passengers/revenue hour is the performance target established in the City's adopted COA.

### BRT / ExBus Elements

Iteris investigated a number of potential BRT elements that could help make ExBus Service successful. Iteris then analyzed both the short-term and long-term potential of an ExBus route replacing the existing Route 110 along the Big Horn Boulevard corridor. Elements that were selected for both short-term and long-term development scenarios were identified based on City staff's determination of specific BRT elements that would be financially feasible for consideration given current developed conditions along the existing corridor and realistic financial constraints that apply to the City's transit services. The following BRT elements were identified for the near-term (one-year) and long-term (2036) scenario time periods.

Near-term BRT elements that could support the ExBus included:

- Stop relocation/removal
- Access improvements to five stations
- Improving passenger amenities at key stops along the route
- Bus signal priority at intersections
- Branding/Marketing
- As an option, purchase two new vehicles to double service and reduce corridor headways to 15 minutes, aligning with the Blue Line light rail schedule.

Long-term BRT Elements included for analysis (to be implemented by FY 2036, in addition to the near-term elements) are:

- Further enhanced service branding and advertisement
- Curbside pull-out stops at the primary ExBus stations
- Bus stop access improvements
- Passenger information and wayfinding
- Mobile fare application
- Branded treatments for pavement

Based on an analysis of the above elements and projected growth along the corridor, Iteris determined the impact to ridership and the financial performance of an ExBus service. As previously identified, above, given the low density within the Big Horn Boulevard corridor and the level of capital investment anticipated, dedicated BRT lanes were not elements considered for implementation for the ExBus service in this corridor. This analysis and Study focused on the more basic BRT elements that would support an ExBus service that could be implemented in the short-term (2020) given current development and financial considerations

Projected Ridership and Farebox Recovery for Near-Term ExBus Scenarios  
 Table 1 summarizes the ridership and farebox recovery for three near-term scenarios with and without ExBus service implementation.

**Table 1: Projected ExBus Ridership and Farebox Recovery**

Potential Improvements / Recommendations	Ridership per Revenue Hour	Increased Ridership Per Day	Farebox Recovery	Capital Costs	Annual Operating Expense
Existing (2019)	8	N/A	16%	\$-	\$478,500
Near-Term (2020) ExBus with BRT Elements – 30 Minute Headways	11	80	19%	\$1,400,000	\$478,500
Near-Term (2020) ExBus with BRT Elements – 15-minute headways	6	100**	10%	\$2,602,740	\$1,077,000

\*Assumes 3% inflation for Operating expenses between now and 2036

\*\*Ridership per revenue hour decreases because there are twice as many buses.

The first scenario includes no improvements to the existing Route 110. The second scenario includes implementing the near-term infrastructure improvements outlined in the previous section, above, but keeping the existing buses and 30-minute headway schedule. The third scenario includes purchasing two new buses, increasing the transit service frequency to 15-minute headways, and implementing all of the near-term improvement outlined above.

**Projected Ridership and Farebox Recovery for Long-Term ExBus Scenarios**

The Study reviewed two long-term scenarios to determine the viability of ExBus in the future. These long-term scenarios included a “do nothing” option and a full implementation of an ExBus service by the year 2036. The year 2036 was chosen because that is the currently expected total build out year of the corridor.

**Table 2: Projected Long Term ExBus Ridership and Capital Costs**

Potential Improvements / Recommendations	Ridership per Revenue Hour	Increased Ridership Per Day	Farebox Recovery	Capital Costs	Annual Operating Expense
Do Nothing (2036)	20	600	23%	\$0	\$790,920
Long-Term (2036) ExBus with BRT Elements – 15-minute headways	25	875	21%	\$5,936,340	\$2,212,564

By analyzing the long-term scenarios, the Big Horn Boulevard corridor has the potential to leverage future transit investments of higher capacity transit services as well as to enable future land development to increase in density. However, further buildout of the existing land uses and vacant parcels within the corridor will allow for the best chance of any future ExBus service to meet the City’s COA performance

**SUMMARY OF BRT/EXBUS FEASIBILITY STUDY’S ALTERNATIVES:**

The following is a summary of actions that the City Council can consider upon accepting the analysis and findings of the BRT/ExBus feasibility study.

**Scenario #1: Re-examining ExBus Service in 2025 (Staff Recommendation)**

This alternative includes directing staff to continue monitoring the existing Route 110 service and development along the Big Horn Boulevard corridor and then conducting another detailed study of Express Bus Service along this corridor in FY2025. The primary focus in 2025, will be full implementation of an ExBus system; including reducing and relocating stations to every half mile, improving access to stations, signal preemption, specialized ExBus service branding, and the purchase of new buses for increased service frequencies. Conducting an analysis of ExBus service feasibility in 2025 allows time for the vacant and underdeveloped land uses within the corridor to further build out. As shown in the Summary Memorandum, this allows the

greatest chance of success for ExBus service, and currently presents the most economically feasible option for consideration based on the analysis in this current study.

It is important to note that the City's adopted 2017 COA service plan identified that staff would begin preliminary planning efforts for BRT service implementation in FY 2022. The COA service plan recognized that the new transit routes/services, including the Route 110, implemented by the COA's service plan would take time to mature before staff would have the appropriate amount of data/information necessary to plan for BRT service in 2022. Based on the analysis performed in this feasibility study, ExBus service does not appear to be economically viable until 2025, at the very earliest. Should Council direct staff to forego studying ExBus service until 2025, this direction would supersede the adopted COA service plan action, and staff would not begin planning for ExBus service until 2025.

#### Scenario #2 Improvements to existing Route 110

A short-term alternative is for Council to direct staff to implement incremental infrastructure improvements to the existing Route 110, which could increase ridership and farebox recovery for the existing service. The cost for this alternative is anticipated to be approximately \$1.4 million. The costs include access/infrastructure improvements at various stops, bus signal prioritization for transit, and marketing/public outreach. This alternative may increase ridership to 11 riders/revenue hour and farebox recovery to 19%, while not increasing the operating costs of the corridor. While not achieving the COA's adopted performance metric targets, this alternative would be the second most economically viable alternative for Council's consideration and could further be selected in conjunction with re-examining the implementation of ExBus service in 2025 (Scenario #1).

#### Scenario #3: Near-Term ExBus Service

The near-term ExBus service (2020) alternative includes directing staff to immediately implement 15-minute service frequencies on the existing Route 110 service corridor. However, per the current study's finding, it is anticipated that implementing this scenario will immediately result in a decrease in overall ridership performance from eight riders per revenue hour to six riders per revenue hour due to the minimal ridership increases and doubling of the revenue hours. The capital costs anticipated for near-term ExBus service are \$2.6 million, with an additional \$600,000 anticipated for operating the service at higher frequencies (15-minute headways), while the farebox recovery rate is anticipated to decrease to near 10% until the long-term ExBus service

corridor development and infrastructure elements are fully implemented in 2036. This is the least economically feasible solution to implement at this time based on the anticipated costs and ridership projections identified in the current study.

### **FISCAL IMPACT:**

Should the City Council direct staff to not implement any transit service improvements in the near-term, and further re-examine ExBus service in 2025 (Scenario #1), there would be no anticipated financial impact to Transit's existing budget or the City's General Fund.

### **Capital Costs for Scenarios #2 and #3**

Should the City Council direct staff to implement either the short-term ExBus infrastructure improvements without ExBus service improvements (Scenario #2), or the 15-minute ExBus service improvements with the associated infrastructure elements (Scenario #3), this would result in approximately \$1.4 million to \$2.6 million in costs, respectively. At the time the City's Capital Facilities Fee (CFF) funding was established, it was intended that this funding would be leveraged with 80% federal funding and the CFF was authorized to only fund 20% to fully establish the necessary BRT infrastructure that would support BRT service implementation in the future (FY 2022). The CFF has sufficient funds to provide the nexus approved 20% funding. Should Council direct staff to implement either Scenario #2 or Scenario #3, the current CFF funding program is only authorized to provide 20% of the needed funding for anticipated capital expenses associated with starting an ExBus service in FY 2020.

In order to pay for the total capital costs associated with implementing ExBus service in Scenario #2 or Scenario #3, the City would have to apply for and receive federal funding for the remaining 80% of the total costs anticipated (i.e., \$960,000 for Scenario #2, or \$2,080,000 for Scenario #3). Securing federal funding for this type of project is not guaranteed, and the process to receive allocated federal funding can take a couple of years before the funding awarded is available to spend. Typically, the available federal funding programs that could fund these types of projects are competitive in nature, with the project having to demonstrate sustainability based on either specific funding program and/or industry-set performance targets. As identified in the ExBus feasibility study, implementing either Scenario #2 or Scenario #3 does not currently achieve some of the City established and common industry-wide performance targets for transit service.

Staff anticipates that this project would not be as competitive for federal funding at this time because of this finding.

### Operational Costs for Scenario #3

If service frequencies on the existing Route 110 were increased from 30-minute headways to 15-minute headways (Scenario #3), this would also result in an immediate increase of annual operating and maintenance expenses of approximately \$600,000 in addition to the capital expenses associated with starting an ExBus service. The City currently funds all transit service operational and maintenance expenses with Transportation Development Act (TDA) funding. Both Local Transportation Funds (LTF) and State Transit Assistance (STA) funds are apportioned and allocated to the City through a TDA claims process administered by the Sacramento Area Council of Governments (SACOG). TDA program funding is variable each year, subject to sales tax revenues generated by the City and state.

The TDA funding revenue currently programmed in Transit's FY 2020 operations budget is not enough to offset the immediate ExBus service operational and maintenance cost increases for Scenario #3 (shortfall is approximately \$220,000). It is anticipated that there may be some TDA revenue from Transit's FY 2019 operations budget that could be used to further address the revenue shortfall amount needed to start ExBus service in FY 2020. Any possible FY 2019 revenue allocated to FY 2020 will not be finalized until the completion of FY accruals which will be known in September 2019. If there is not enough revenue from Transit's FY 2019 operations budget to fund the remaining shortfall amount needed to pay for ExBus service operations in FY 2020, then the service would have to be supplemented with funding from the City's General Fund. It is also unknown if future TDA funding apportionments will be able to sustain on-going ExBus service operational costs at this time.

### **ATTACHMENTS:**

1. BRT Study Summary Memorandum
2. BRT Study Technical Memorandum #1
3. BRT Study Technical Memorandum #2

## SUMMARY MEMORANDUM

**To:** Michael Costa  
Transit System Manager  
City of Elk Grove

**From:** Vigen Davidian, Project Manager, Iteris  
Ryan Greenway, Deputy Project Manager, Iteris  
Bob Morrison, Transit Project Manager, City of Elk Grove

**Date:** July 10, 2019

**RE:** **WAM007 Elk Grove Bus Rapid Transit Study**  
Considerations Summary Memorandum – Key Findings and Recommendations

### Primary Objective

In May 2018, Council directed staff to investigate the possibility of implementing Bus Rapid Transit (BRT) or Express Bus (ExBus) service along the Big Horn Boulevard corridor (which is currently served by local route service through e-tran’s Route 110). This direction is in line with the following General Plan Initiatives:

- **MOB-5.9** - Encourage the extension of BRT and/or light rail service to existing and planned employment centers by requiring a dedication of right-of-way. Advocate and plan for light rail alignment and transit stop locations that best serve the needs of the community and fit within the planned mobility system.
- **MOB-5.2** - Advocate for the City’s preferred fixed transit alignment for light rail or BRT from north of the city to the Southeast Policy Area and ensure proposed projects are complementary to such an alignment.

### Background

The City of Elk Grove (City) prepared a Request for Proposal (RFP) to study and make a recommendation regarding BRT or ExBus Service within the City. The City entered into contract with Iteris, Inc. (Iteris) a full service transit planning firm, to conduct the analysis. Iteris’ role was to assist the City on a BRT Early Implementation Study to assess the feasibility of BRT, or ExBus, service along the Big Horn Boulevard corridor. The deliverables from the analysis include:

- This Summary Memorandum, which summarizes the Study’s key findings and provides recommendations for the City Council’s consideration and direction;
- Technical Memorandum #1, which provides background information on BRT and ExBus services;
- Technical Memorandum #2, which discusses opportunities and constraints for a potential BRT or ExBus system in the City; and
- City Council Retreat presentation, which provided Council with an overview of various transit options.

### Definitions

A **BRT** system is a bus-based transit system that incorporates features similar to a light rail. Features of BRT may include: dedicated right of way, frequent service, off-board fare collection, and vehicle signal preemption, and enhanced stations.

**ExBus** or **BRT Lite** as defined for this study is a bus-based transit system that includes many of the features of a BRT, but runs within existing mixed flow lanes. Note: this is distinct from commuter bus service which may also be termed “express bus”.

## Findings

The Big Horn corridor holds promise to leverage transit investments of the Blue Line and e-tran feeder services as well as to enable future land development. Service and capital improvements can be added incrementally to accommodate the growing transportation needs for the City. BRT elements can be applied in the corridor to improve capacity, reliability and travel time compared to conventional bus service, resulting in attracting more riders to the system. This study focused on “right-sized” improvement options and whether their implementation would increase ridership to off-set their cost and meet the overall e-tran system goals and performance metrics established in the Comprehensive Operational Analysis (COA) service plan.

Based on the analysis, ridership forecasts in response to BRT element implementation would not meet COA goals in the near-term; however, if future density of land use development increases in the corridor (including the redevelopment of some vacant sites), investment in BRT improvements could increase ridership and support COA goals.

Near-term efforts could focus on brandings and ensuring the consideration of enhanced pedestrian access and connections to stations through land use development and public works projects to maximize the current ridership in the corridor.

## Existing Conditions

The following information and data are from Technical Memorandum #1 and Technical Memorandum #2. Both the near-term and long-term land uses along the corridor were investigated to help predict future ridership, and therefore the near-term and long-term viability of the corridor for BRT or ExBus service.

The Big Horn Boulevard corridor is currently serviced by the City’s e-tran local transit service Route 110. The route is 6.8 miles long and extends from the existing Sacramento Regional Transit District (SacRT) light rail station at Cosumnes River College along Bruceville Road to Sheldon, then onto Lewis Stein Road to Big Horn Boulevard, then down to Whitelock Parkway, and terminates at the Kaiser medical center on Promenade Parkway.

The average monthly ridership is 3,220 riders per month, which equates to an approximately average ridership of 160 riders per day. The majority of the ridership along the Big Horn Corridor are concentrated at the Blue Line Cosumnes River College (CRC) station and Whitelock Parkway, with approximately 75% of boardings and alightings occurring at the Blue Line CRC station. The bus service operates at mostly 30-minute headways, five days a week, Monday through Friday, and operates hourly on Saturdays. During peak operating months, when transit service is in its highest demand (i.e. September through November, and February through May)<sup>1</sup>, ridership averages approximately 5,000 riders per month. This equates to roughly 250 per day.

Land density and employees per acre are major determining factors for selecting a route for transit service. According to the Transit Capacity and Quality Service Manual Third Edition (2013), a density of 3.0 dwelling units per acre and 4.0 employees per acre within ½ mile walking distance of a stop is an indicator of potential BRT success. Currently there are 5,300 dwelling units within ½ mile walking distance of an existing bus stop. There are also 7,100 employees within ½ mile walking distance of a stop. This equates to approximately 1.2 dwelling units per acre, and 1.63 employees per acre, within ½ mile walking distance of the existing Route 110 corridor. Therefore, the existing density and intensity of development of existing development is currently well below the desirable minimum to support BRT services.

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<sup>1</sup> Average of September and October was used as a baseline period for analysis purposes.

Under future land use buildout conditions (defined for purposes of this analysis as year 2036) there are 6,600 dwelling units in the corridor within walking distance of a bus stop. There are also 12,800 future employees located within walking distance of the route. This equates to 1.51 dwelling units per acre, distance, and 2.94 employees per acre, within ½ mile walking distance of the existing route 110. While improved from the existing conditions, the density and intensity of development would likely remain below the desirable minimums to support BRT.

## Success Criteria

Iteris' consulting team worked with City staff to determine feasible BRT improvement elements that could be implemented over the near-term (one year) and long-term (by 2036) to improve service in the Route 110 corridor.

Based on the forecasted costs of the improvements and resultant increase in forecasted ridership, the following metrics were used to determine potential success. These metrics are defined and identified in the City's adopted 2017 COA, and include:

- Farebox recovery; and
- Ridership per Revenue Hour.

Farebox recovery is measured by the annual revenue generated by a given route divided by the sum of its annual operation and maintenance costs, excluding capital expenditures. Per the City's adopted COA, the City's expectations for farebox recovery is 20%.

Ridership per Revenue Hour is measured by number of riders, divided by the number of hours of revenue service (excluding non-revenue operation). For a standard transit bus route, 20 passengers/revenue hour is expected per the City's adopted COA.

## BRT Implementation in Similar Cities

As a reference point for analyzing what successful<sup>2</sup> BRT service could look like, Iteris reviewed BRT service implemented in three cities that were comparable in population to Elk Grove:

### **Emerald Express, Eugene, Oregon**

- Population 170,000
- 10,000 riders per day over 21 miles, with 25 stations
- Serves University of Oregon (20,000 Students), Springfield, and Downtown Eugene
- Each station includes raised platforms, shelter, next bus signage, and bike racks
- Costs over \$150 Million to fully develop, mostly federal money.

### **Silver Line, Grand Rapids, Michigan**

- Population 200,000
- 2,500 riders per day along the 9.6-mile route.
- Includes a no-fare zone in downtown Grand Rapids
- Each station includes raised platforms, shelter, next bus signage, camera surveillance, bike racks, and ticket vending machines
- Costs over \$40 Million to fully develop, mostly federal money
- Daily ridership is about half what was predicted due to low density along the route.

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<sup>2</sup> There is no one set model of what a successful BRT service looks like. The type of service and criteria used to define it can also vary from one system to another.

### **Max BRT, Fort Collins, Colorado**

- Population 165,000
- Over 6,000 rider per day along 21-mile route with 14 stations.
- Cost \$87 million to develop
- Travels in both a transit-only guideway and mix flow streets
- Stations include raised platforms, park and ride, ticket vending machines, signs and announcements
- Serves Colorado State University (25,000 students)

In each of these cases, the BRT services covered multiple jurisdictions on longer route alignments, included dedicated BRT lanes that allowed buses to travel in separate travel lanes from regular vehicular traffic, had higher land use densities (both residential and commercial) either developed or zoned adjacent to the corridor, served features such as a university or downtown business district that typically attract transit riders, and incorporated major improvements at each station that would enable a more intensive BRT service at a much higher financial investment comparative to operating a more express-like service route that the City analyzed in this Study.

## **Discussion**

Iteris investigated a number of potential BRT/ExBus elements and studied both the near- and long-term potential of an ExBus route replacing the existing Route 110 along the Big Horn Boulevard corridor. Elements that were selected for both near-term and long-term development potentials were identified based on staff's determination of specific BRT elements would be financially feasible for consideration given current developed conditions on the corridor and realistic financial constrictions that apply to the City's transit services. The following elements were determined to be implemented within the near-term (one-year) and long-term (2036) time periods.

### **Near-Term elements included for analysis (to be implemented in 2020):**

- Stop Relocation/Removal
- Access improvements to five stations
- Improving amenities at key stations along the route
- Bus Signal Priority at intersections
- Branding/Marketing
- Option to purchase two new vehicles to double service and reduce corridor headways to 15 minutes—aligning with the Blue Line schedule<sup>3</sup>

### **Long-term elements included for analysis (to be implemented by 2036):**

- Further and enhanced branding
- Stop Access Improvements
- Curbside pull-out stops
- Passenger information and wayfinding
- Mobile application for schedule and ticketing
- Branded treatments for pavement

Based on analysis of the above elements and projected growth along the corridor, Iteris determined the impact to ridership and the financial performance of an ExBus service. Please note that given the current development conditions within the Big Horn Boulevard corridor and the City's financial limitations, dedicated BRT lanes were not elements considered for implementation of a BRT/ExBus service in this corridor. This analysis and study focus on the more basic elements that would support an ExBus service that could be implemented in the near-term (2020) given current development and financial considerations.

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<sup>3</sup> Analyzed with and without 30-minute headway and 15-minute headway scenarios.

## Ridership Performance

**Exhibit 1** shows the overall capital expenditures and corresponding ridership increase in both the near-term and long-term ExBus implementation scenarios as compared to keeping the existing Route 110 in place.

**Exhibit 1: Estimated Operating Expenses per Boarding**

POTENTIAL IMPROVEMENTS / RECOMMENDATIONS	DAILY RIDERSHIP	CAPITAL COSTS (IN 2019 DOLLARS)	TOTAL CHANGE FROM BASE	PERCENT CHANGE FROM BASELINE
Existing (2019)	250	\$-	10	0.00%
Near-Term (2020) ExBus with BRT Elements – 15-minute headways	350	\$2,602,740	100	40%
Future Buildout Land Use (2036) no BRT elements (near-term improvements only)	600	\$-	350	140%
Long-Term (2036) ExBus with all BRT Elements - 15-minute headways	1,475	\$5,936,340	875	145%

**Source:** Iteris, 2019

Route 110 operates 18 hours a day from 6 am to 10 pm, Monday through Saturday. Monday through Friday, the average daily revenue hours of operation are 29 hours per day due to the use of two vehicles in the corridor. Saturday’s daily revenue hours of operations are 18 hours. Current route 110 ridership during peak months is roughly 8 riders/revenue hour. Future ridership (2036) without ExBus improvements, with corridor land use buildout, is anticipated to increase to approximately 20 riders/revenue hour.

Buildout of the ExBus improvements in 2036 is forecasted to result in 1,475 riders per month or 25 riders/revenue hour. This means, ExBus improvements could potentially meet the desired 20 riders/revenue hour performance metric in the long-term conditions scenario.

Iteris also analyzed how a doubling or even tripling the land use densities on vacant land within the subject corridor could impact future ridership. Doubling the existing densities on vacant land increases the potential ridership by almost 295 rider per day, for a total of 1,775 riders per day in 2036. Tripling the existing density would increase an additional 440 riders per day, or 2,215 total riders per day in 2036.

When comparing these ridership forecasts to the three case studies that Iteris reviewed for similar BRT service conditions, a BRT/ExBus service would still have lower performance compared to existing BRT services in cities that have a comparable population.

## Financial Performance

The financial performance analysis is where the anticipated costs and ridership performance are analyzed for a cost/benefit determination. The capital, maintenance, and operations cost of BRT improvements are compared to their relative benefit in supporting ridership. The financial performance measures used in this analysis are:

- Operational Expenses per Rider
- Farebox Recovery (COA FY 2022 Target: 20%)

### Annual Operational Expenses per Rider

Annual operational expenses per rider were calculated for one annual period with the near-term (2020) improvements and the long-term (by 2036) improvements. These calculations were then compared to the no-build scenario for both 2020 and 2036. All numbers are in 2019 dollars.

Annual ridership was based on the forecasted daily passenger boardings multiplied by a monthly average of 20.66 days/month and an annualizing factor of 7.57 based on a peak monthly ridership (September 2018). The annualization factor was calculated by taking the baseline annual ridership of 38,661 for Route 110, and dividing that number by the passenger boardings of 5,104 during the peak month of September 2018.

Using these factors, an annual ridership of up to 54,765 was forecasted for the near-term, and 230,875 riders for the long-term period.

Operating expenses were based on the annual operating expenses during the period of November 1, 2017, to October 31, 2018, when the operating expense of Route 110 was \$478,520. The expense of doubling the buses used in service from two to four was assumed to double the operating expense and the expense of operations and maintenance of other BRT element capital improvements was estimated at 5% of the construction cost on an annual basis. Operating expense per revenue hour was based on 7,608 revenue hours that were accrued for the existing Route 110 service, during the November 1, 2017 to October 31, 2018 service period. For BRT/ExBus service, the revenue hours were doubled to 15,216 for 15-minute headway service in the near-term and long-term service implementation inclusive of all identified BRT elements. Costs are shown, below, in 2019 dollars and were not escalated and adjusted for inflation.

**Exhibit 2: Estimated Operating Expenses per Boarding\***

	EXISTING	NEAR-TERM EXBUS – 15 MINUTE HEADWAYS	LONG-TERM BUILD-OUT OF LAND USE	LONG-TERM EXBUS
Daily Boardings (peak Month)	5,104	7,230	12,400	30,480
Annual Boardings	38,661	54,765	93,925	230,875
Annual Operating Expenses	\$478,520	\$1,077,143	\$478,520	\$1,338,637
Annual Operating Expense per Boarding	\$12.38	\$19.67	\$5.09	\$5.80
Annual Operating Expense per Revenue Hour	\$62.90	\$70.79	\$31.45	\$87.98

Source: Iteris, 2019

\*All numbers are in 2019 dollars

The purpose of looking at operating expense per boarding is a means to compare alternatives against the existing condition. All alternatives are compared against the current operating expense per boarding. As shown in **Exhibit 2**, existing Route 110 operating expenses per boarding are \$12.38. The operating expense per boarding grows to \$19.67 in the near-term if service is doubled to achieve 15-minute headways (BRT/ExBus service level). With completion of long-term BRT elements investments in 2036, the ridership is forecasted to increase and reduce the operating expense per rider to \$5.80, compared to a \$5.09 per rider operating expense if existing Route 110 remained as it currently operates. This lowering of cost per rider in the long-term scenarios occurs because of the higher ridership anticipate both the long-term build-out of land use scenario without BRT/ExBus service, and the long-term build-out scenario with BRT/ExBus service.

**Farebox Recovery Ratio**

The farebox recovery ratio is a metric that compares the total fares collected to the overall operating and administrative costs of a transit service over the course of a year. The systemwide target established in the City’s adopted COA is 20%.

The following analysis applies assumptions of fare revenue collection and compares those revenues to the existing and anticipated future annual operating expenses. Actual farebox recovery data is not available for this BRT/ExBus service analysis. Also, for the purposes of this analysis, it is assumed that the average fare of any future riders on the BRT/ExBus service is \$2.00 per ride and remains constant between now and 2036. This fare assumption is an average fare reflective of both the City’s existing regular base fare of \$2.25 and the City’s reduced, discount fare (for students, seniors, military/veterans, and persons with disabilities) of \$1.10 to account for the diversity of

riders that may utilize the service. Annual operating expenses are assumed to increase 3% per year between now and 2036. **Exhibit 3** shows farebox recovery ratios of 16% under existing conditions, 10% in the near-term with ExBus elements (15 minute headway), and over 20% for both the long-term with ExBus elements scenario and no-build (2036) scenario.

**Exhibit 3: Estimated Farebox Recovery Ratio**

	EXISTING	NEAR-TERM EXBUS – 15 MINUTE HEADWAYS	LONG-TERM BULID-OUT OF LAND USE	LONG-TERM EXBUS
Annual Operating Expenses	\$478,520	\$1,077,144	\$790,920**	\$2,212,564**
Annual Farebox (Average \$2 per Boarding)	\$77,322	\$109,530	\$185,716***	\$461,741***
Farebox Recovery Ratio	16%	10%	23%	21%

**Source:** Iteris, 2019

\*\*Assumes 3% inflation for Operating expenses between now and 2036.

\*\*\*Assumes the average farebox rate stays the same between now and 2036.

The ridership needed for the near-term ExBus service to reach a farebox recovery of 20% is roughly 107,700, which is not forecast to be met through any near-term improvements. However, farebox recovery ratio in the long-term build-out without BRT/ExBus service and long-term with ExBus service improvements and build-out, scenarios is forecasted to be above 20%.

## Additional Alternatives for Consideration

Because the near-term BRT/ExBus service elements did not meet the COA’s performance targets for farebox recovery and riders/revenue hour, the City staff requested that Iteris look at potential near-term improvements to Route 110 that could help increase both ridership and farebox recovery. This alternative includes keeping the existing Route 110 buses and a 30-minute headway service frequency. As stated earlier, improvements could be stop relocation/removal, access improvements to five stations, bus signal priority, branding/marketing, and station improvements at key locations along the route.

The capital cost for this alternative is roughly \$1.4 million, and could grow daily ridership from an existing 250 riders/day to 330 riders/day in a peak month by improving access to stations and advertising the connectivity of the line to the blue Line. This equates to an increase from 8 riders/revenue hour to 11 riders/revenue hour. In turn, the farebox recovery is projected to increase from 16% to nearly 19%.

## Alternatives for Consideration

### Revisit in Corridor Service Improvements in 2025

No current action--revisit the implementation of ExBus Improvements in 2025 to allow additional time to align transit investment with the transit demand of increased density and intensity of land use—especially in the southern part of the City. The primary focus in 2025 could be full implementation of an ExBus system through phased improvements to ensure cost-effective implementation appropriate to the scale of the service.

### Improvements to Existing Route 110 Corridor without Introducing Full BRT/ExBus Service

Iteris analyzed an alternative that considered improvements to existing Route 110. While the alternative includes keeping the existing Route 110 buses on a 30-minute service frequency, it would include improvements to service which could grow ridership in the near-term and increase the farebox recovery. Improvements analyzed were stop relocation/removal, access improvements to five stations, bus signal priority, branding/marketing, and station improvements at key locations along the route. The capital costs for this alternative are roughly \$1.4 million. It was estimated the improvements could grow daily ridership from an existing 250 riders/day to 330 riders/day in the

peak ridership months. This equates to an increase from eight riders/revenue hour to 11 riders/revenue hour. In turn, the farebox recovery is projected to increase from 16% to nearly 19%.

#### Near-Term ExBus Service

Near-term ExBus service (2020) with 15-minute headways will increase overall ridership but decrease passengers per revenue hour from eight riders per revenue hour to six riders per revenue hour. The capital costs of the near-term ExBus service is approximately \$2.6 million, and the farebox recovery will decrease to nearly 10% per revenue hour until corridor land use development is built out when farebox recovery would grow to over 20%.

## TECHNICAL MEMORANDUM

<b>To:</b> Matt Boyer City of Elk Grove 8401 Laguna Palms Way Elk Grove, CA 95758	<b>From:</b> Vigen Davidian, PE Iteris, Inc. 801 South Grand Avenue, Suite 530 Los Angeles, CA 90017
<b>Date:</b> January 7, 2019	
<b>RE:</b> <b>WAM007 Elk Grove Bus Rapid Transit Early Implementation Study</b> Technical Memo #1 – Summary of Background Information	

### Introduction

Iteris is assisting the City of Elk Grove (City) on a Bus Rapid Transit (BRT) Early Implementation Study to assess the feasibility of BRT, or Express Bus (ExBus) service in the Big Horn Boulevard corridor. The goal of this study is to provide the City with a series of considerations and recommendations that will inform and guide the readiness and decision of the City whether to move forward with BRT or ExBus improvements along this corridor. The objectives of the study include the following:

- Analyze existing route performance information (e.g., ridership, operating hours, and revenue service hours) for the Big Horn Boulevard corridor
- Evaluate existing and proposed land uses, densities and origins/destinations for the Big Horn Boulevard corridor
- Identify the necessary components and infrastructure, projected demand and ridership growth, anticipated revenue hours and operational costs, possible marketing and branding expenses, and other capital purchasing considerations to determine the overall costs and feasibility of implementing a Big Horn Boulevard corridor BRT or ExBus service in FY 2019-20.

This memo focuses on key elements of the existing Route 110 and land use along the corridor and BRT performance measures. It provides the following documentation:

- Assessment of existing routes, ridership and infrastructure (e.g., bus stops, passenger amenities, lane configurations, and intersections)
- Assessment of existing and proposed land uses, City’s General Plan land use designations and zoning, land use densities, and key origins and destinations. Future projections of land use changes are also included.
- Assessment of existing financial data
- Elements of BRT
- Performance Measures

### Existing Routes

The Big Horn Boulevard corridor is served by City’s e-Tran System Route 110, with connecting service to Commuter Lines 10 and 12 and local routes 111, 112, 114, 115, and 116. As shown in **Exhibit 1**, there are 21 northbound stops and 20 southbound stops. There are 28 runs along the line from 6:12AM to 10:06PM Monday through Friday. Headways average 30 minutes until after 7:00PM when headways increase to 60 minutes. Two busses are operating on the route except after 7:00PM when one bus covers the route, hence the increase in headway time during the latter period. The average run time along the seven-mile long corridor is 23 minutes Northbound and 25 minutes Southbound. The only deviation from that scheduled run time is the 5:40PM to 6:05PM Northbound run scheduled for 25 minutes—two minutes longer than the other runs. Route 110 Southbound Schedule is included in **Exhibit 2**.

**Exhibit 1: Route 110 Northbound Schedule**

Northbound (Monday - Friday)

PROMENADE PKWY	BIG HORN BLVD/ WHITELOCK PKWY	BIG HORN BLVD/ CIVIC CENTER	BIG HORN BLVD/ LAGUNA BLVD	LEWIS STEIN RD/ W. STOCKTON	COSUMNES RIVER	HEADWAY	TRAVEL TIME
6:12 AM	6:16 AM	6:19 AM	6:24 AM	6:29 AM	6:35 AM	30	23
6:42 AM	6:46 AM	6:49 AM	6:54 AM	6:59 AM	7:05 AM	30	23
7:12 AM	7:16 AM	7:19 AM	7:24 AM	7:29 AM	7:35 AM	30	23
7:42 AM	7:46 AM	7:49 AM	7:54 AM	7:59 AM	8:05 AM	30	23
8:12 AM	8:16 AM	8:19 AM	8:24 AM	8:29 AM	8:35 AM	30	23
8:42 AM	8:46 AM	8:49 AM	8:54 AM	8:59 AM	9:05 AM	30	23
9:12 AM	9:16 AM	9:19 AM	9:24 AM	9:29 AM	9:35 AM	30	23
9:42 AM	9:46 AM	9:49 AM	9:54 AM	9:59 AM	10:05 AM	30	23
10:12 AM	10:16 AM	10:19 AM	10:24 AM	10:29 AM	10:35 AM	30	23
10:42 AM	10:46 AM	10:49 AM	10:54 AM	10:59 AM	11:05 AM	30	23
11:12 AM	11:16 AM	11:19 AM	11:24 AM	11:29 AM	11:35 AM	30	23
11:42 AM	11:46 AM	11:49 AM	11:54 AM	11:59 AM	12:05 PM	30	23
12:12 PM	12:16 PM	12:19 PM	12:24 PM	12:29 PM	12:35 PM	30	23
12:42 PM	12:46 PM	12:49 PM	12:54 PM	12:59 PM	1:05 PM	30	23
1:12 PM	1:16 PM	1:19 PM	1:24 PM	1:29 PM	1:35 PM	30	23
1:42 PM	1:46 PM	1:49 PM	1:54 PM	1:59 PM	2:05 PM	30	23
2:12 PM	2:16 PM	2:19 PM	2:24 PM	2:29 PM	2:35 PM	30	23
2:42 PM	2:46 PM	2:49 PM	2:54 PM	2:59 PM	3:05 PM	30	23
3:12 PM	3:16 PM	3:19 PM	3:24 PM	3:29 PM	3:35 PM	30	23
3:42 PM	3:46 PM	3:49 PM	3:54 PM	3:59 PM	4:05 PM	30	23
4:12 PM	4:16 PM	4:19 PM	4:24 PM	4:29 PM	4:35 PM	30	23
4:42 PM	4:46 PM	4:49 PM	4:54 PM	4:59 PM	5:05 PM	30	23
5:12 PM	5:16 PM	5:19 PM	5:24 PM	5:29 PM	5:35 PM	30	23
5:40 PM	5:44 PM	5:54 PM	5:59 PM	6:02 PM	6:05 PM	28	25
6:12 PM	6:16 PM	6:19 PM	6:24 PM	6:29 PM	6:35 PM	32	23
7:12 PM	7:16 PM	7:19 PM	7:24 PM	7:29 PM	7:35 PM	60	23
8:12 PM	8:16 PM	8:19 PM	8:24 PM	8:29 PM	8:35 PM	60	23
9:12 PM	9:16 PM	9:19 PM	9:24 PM	9:29 PM	9:35 PM	60	23

## Exhibit 2: Route 110 Southbound Schedule

Southbound (Monday - Friday)

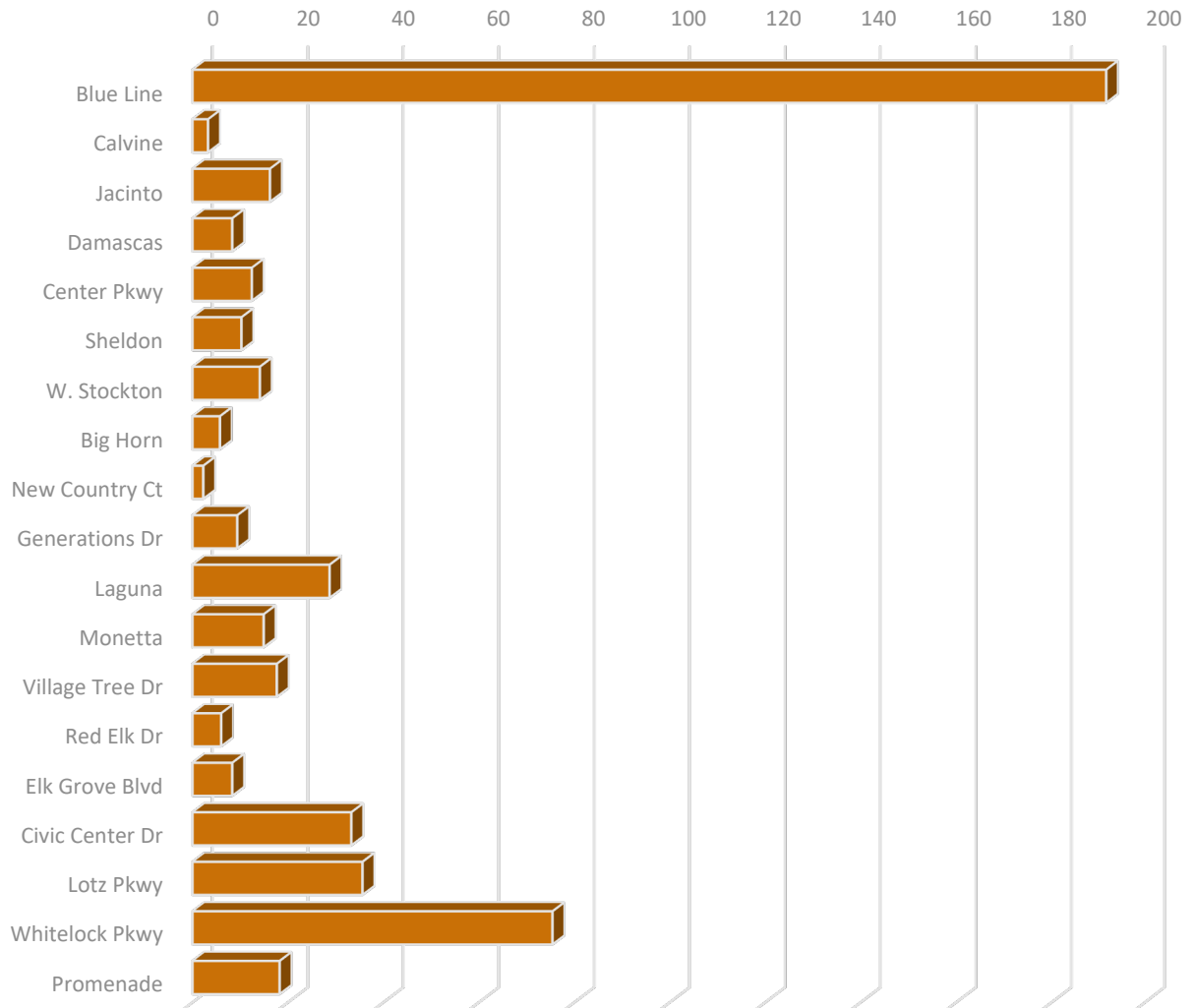
COSUMNES RIVER	LEWIS STEIN RD. AT	BIG HORN BLVD.	BIG HORN BLVD.	WHITELOCK PKWY. AT	PROMENADE PKWY.	HEADWAY	TRAVEL TIME
6:41 AM	6:51 AM	6:56 AM	6:59 AM	7:02 AM	7:06 AM	30	25
7:11 AM	7:21 AM	7:26 AM	7:29 AM	7:32 AM	7:36 AM	30	25
7:41 AM	7:51 AM	7:56 AM	7:59 AM	8:02 AM	8:06 AM	30	25
8:11 AM	8:21 AM	8:26 AM	8:29 AM	8:32 AM	8:36 AM	30	25
8:41 AM	8:51 AM	8:56 AM	8:59 AM	9:02 AM	9:06 AM	30	25
9:11 AM	9:21 AM	9:26 AM	9:29 AM	9:32 AM	9:36 AM	30	25
9:41 AM	9:51 AM	9:56 AM	9:59 AM	10:02 AM	10:06 AM	30	25
10:11 AM	10:21 AM	10:26 AM	10:29 AM	10:32 AM	10:36 AM	30	25
10:41 AM	10:51 AM	10:56 AM	10:59 AM	11:02 AM	11:06 AM	30	25
11:11 AM	11:21 AM	11:26 AM	11:29 AM	11:32 AM	11:36 AM	30	25
11:41 AM	11:51 AM	11:56 AM	11:59 AM	12:02 PM	12:06 PM	30	25
12:11 PM	12:21 PM	12:26 PM	12:29 PM	12:32 PM	12:36 PM	30	25
12:41 PM	12:51 PM	12:56 PM	12:59 PM	1:02 PM	1:06 PM	30	25
1:11 PM	1:21 PM	1:26 PM	1:29 PM	1:32 PM	1:36 PM	30	25
1:41 PM	1:51 PM	1:56 PM	1:59 PM	2:02 PM	2:06 PM	30	25
2:11 PM	2:21 PM	2:26 PM	2:29 PM	2:32 PM	2:36 PM	30	25
2:41 PM	2:51 PM	2:56 PM	2:59 PM	3:02 PM	3:06 PM	30	25
3:11 PM	3:21 PM	3:26 PM	3:29 PM	3:32 PM	3:36 PM	30	25
3:41 PM	3:51 PM	3:56 PM	3:59 PM	4:02 PM	4:06 PM	30	25
4:11 PM	4:21 PM	4:26 PM	4:29 PM	4:32 PM	4:36 PM	30	25
4:41 PM	4:51 PM	4:56 PM	4:59 PM	5:02 PM	5:06 PM	30	25
5:11 PM	5:21 PM	5:26 PM	5:29 PM	5:32 PM	5:36 PM	30	25
5:41 PM	5:51 PM	5:56 PM	5:59 PM	6:02 PM	6:06 PM	30	25
6:11 PM	6:21 PM	6:26 PM	6:29 PM	6:32 PM	6:36 PM	30	25
6:41 PM	6:51 PM	6:56 PM	6:59 PM	7:02 PM	7:06 PM	30	25
7:41 PM	7:51 PM	7:56 PM	7:59 PM	8:02 PM	8:06 PM	60	25
8:41 PM	8:51 PM	8:56 PM	8:59 PM	9:02 PM	9:06 PM	60	25
9:41 PM	9:51 PM	9:56 PM	9:59 PM	10:02 PM	10:06 PM	60	25

## Ridership

The ridership data for the first full year of Route 110 operation indicated some significant trends. Overall for the annual period of November 2017 to October 2018, there were 38,660 total boardings—a monthly average of 3,220 riders. However, there was a large variation in the monthly ridership of the line, with lower ridership at the beginning of the annual period and relatively low ridership in summer months that indicates 1) a period of ridership ramp up early in the service period and 2) strong ridership from students. Ridership for September and October of 2018 was approximately 5,000 riders per month indicating a good baseline period for analysis purposes.

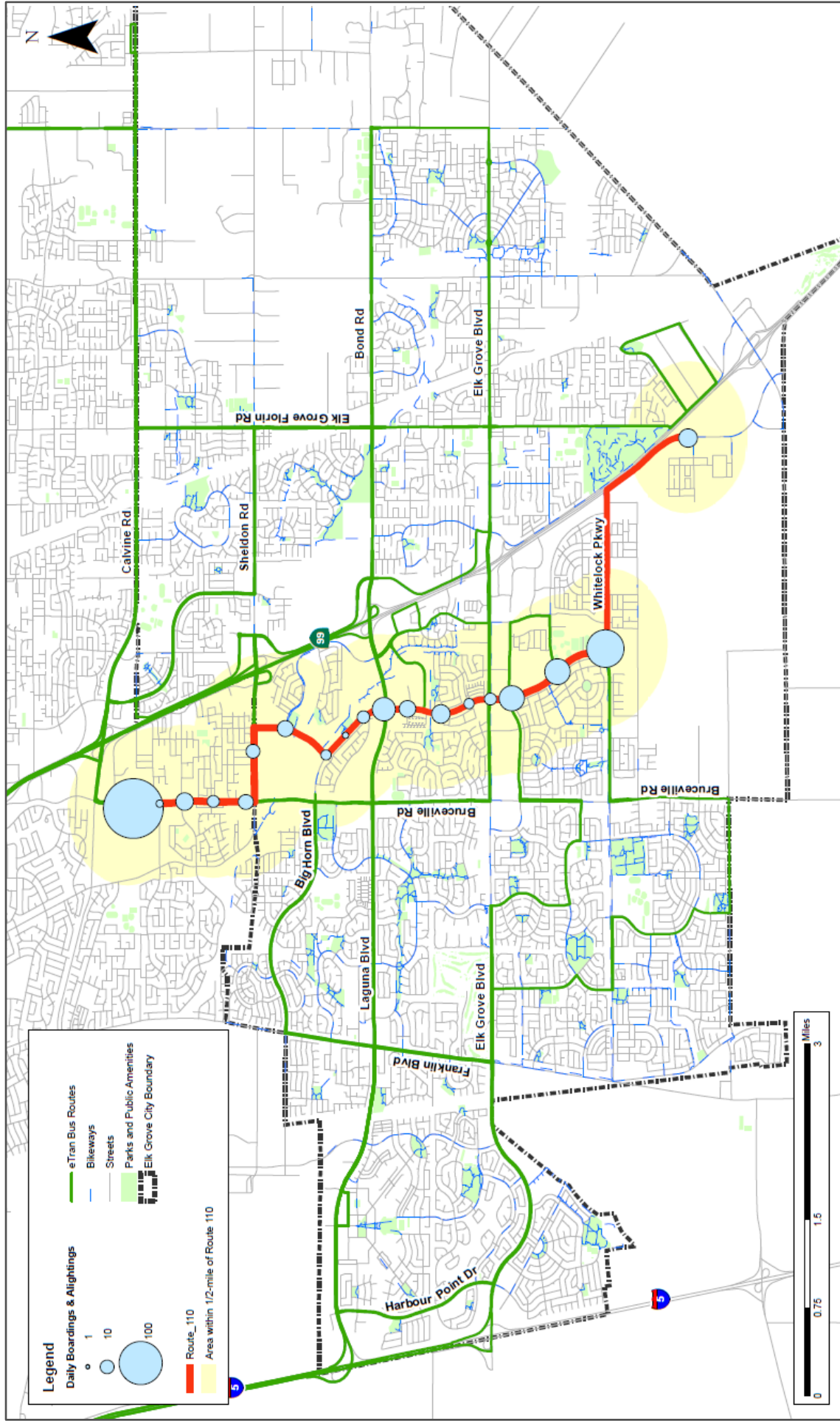
Stop-level average daily boardings and alightings at both the northbound and southbound directions of stops for September and October 2018 is shown in **Exhibit 3 and 4**. The most utilized stops are the Blue Line/Consumnes River College and Whitelock Parkway by the Consumnes River College Elk Grove Center, Elizabeth Pinkerton Middle School, and Consumnes Oaks High School. The next most utilized stops are at Lotz Parkway, Civic Center Drive and Laguna Boulevard.

Exhibit 3: Average Daily Boardings and Alightings



Source: Iteris, 2018

Exhibit 4: Average Daily Boardings and Alightings – Map



Source: Iteris, 2018

## Ridership by Section

The stops along Big Horn Corridor were consolidated into seven sections (two terminal stations and five midpoint) approximately in equal distance. As shown in **Exhibit 5** the ridership peaks at the Consumnes River College (Blue Line) station and in the Section between Elk Grove Boulevard and Whitelock Boulevard—serving the middle school and high school. The lowest ridership areas are in the Lewis Stein Corridor, the Bruceville Corridor, the section from Laguna Boulevard to Elk Grove Boulevard and Promenade Parkway. Those sections have large tracts of undeveloped land.

**Exhibit 5: Route 110 Ridership by Section**

SECTION	ON			OFF			DISTANCE	STOPS	PER DISTANCE		PER STOPS	
	NB	SB	TOTAL	NB	SB	TOTAL			ON	OFF	ON	OFF
Consumnes Light Rail	0	101	101	90	1	91	0.31	1.5	325	294	67	61
Bruceville Corridor	12	10	23	8	9	17	0.92	4	24	19	6	4
Lewis Stein Corridor	9	3	12	5	9	15	1.25	3.5	10	12	4	4
Big Horn to Laguna	18	4	22	3	17	20	0.51	3.5	42	40	6	6
Laguna to Elk Grove	15	6	21	8	19	28	0.88	4.5	24	32	5	6
Elk Gove to Whitelock	54	5	58	62	51	113	0.81	3.5	72	140	17	32
Promenade Pkwy	2	0	2	0	16	16	1.92	1	1	8	2	16

Source: Iteris, 2018

## Regional Transit Blue Line Light Rail Ridership

Based on the most recently available Quarterly Ridership Report (April 1, 2018 to June 30, 2018), there are an average of 1,265 daily round trip riders using the Consumnes River College Station. As shown in **Exhibit 6**, the morning and afternoon peaks show that approximately 500 of the 1,265 daily riders are commuters into Sacramento. Overall there are 2,016 parking spaces at the station with a fee of \$2.00 per day.

**Exhibit 6: Consumnes River College Station Boardings and Alightings**

BLUE LINE STATION	AM PEAK (6AM-9AM)		MIDDAY (9AM-3:30PM)		PM PEAK (3:30PM-6:00PM)		OFF PEAK (6PM-6AM)		TOTAL WEEKDAY	
	ON	OFF	ON	OFF	ON	OFF	ON	OFF	ON	OFF
Cosumnes River College	553	176	344	400	182	475	187	208	1,265	1,259

Source: Iteris, 2018

## Infrastructure

The Iteris Project Team conducted both desktop (Google Earth) and field observations (12/13/18 and 12/18/18) to complete a thorough review of bus stops, passenger amenities, and roadway infrastructure. The Big Horn Corridor is approximately seven miles long, running from the Consumnes River College (CRC) Light Rail Station in the City of Sacramento (approximately 1.3 miles north of the City of Elk Grove) to Kaiser Permanente and Promenade Parkway in the southeast part of the City.

## Bus Stops

Bus stops have various amenities including Bus Shelter, Seating, Lighting, Trash Receptors, and Signage. **Exhibit 7** shows two typical stops along Route 110. A complete inventory of Bus Stop Characteristics are included in **Appendix A**.

### Exhibit 7: Typical 110 Stations

#### New Country Station Area – Big Horn Boulevard/New Country Court (NB)

Stop is located approximately 210 feet away from the intersection of New Country Court. Zimbelman Park and walking path are both in close proximity. A sign displaying 110 and 10 lines are attached to a street light. No other passenger amenities are present. Average daily ridership at this station is one.



*Looking at the Northeast corner of Big Horn and Parking lot to Zimbelman Park (Left); Looking Southeast along Big Horn and the entrance to the Park's Parking lot (right)*

#### Generations Drive Station Area – Big Horn Boulevard/Kaiser Entrance (NB)

Stop is setback off the sidewalk and located approximately 415 feet away from the closest intersection at Generations Drive. Closest intersection with a crosswalk is located 1,000 feet north at New Country Court. There is walking path through the parking lot that takes you to the Kaiser Permanente Medical Offices approximately 250 feet away. All stop amenities are present. Average daily ridership at this station is two.



*Looking midblock at the Northeast corner of Big Horn and Generations Drive (Left); Looking Southeast along Big Horn and the walking path to Kaiser Permanente Parking lot (right)*

## Intersections

The majority of the intersections along the Big Horn Corridor are 2-3 lanes in each direction, 100-foot curb-to-curb, and include two left turn lanes, a median, right turn pockets, bike lanes, and crosswalks. **Exhibit 8** shows two typical intersections along Route 110. There are 22 signalized intersections and only 2 intersections that are stop sign-controlled. **Exhibit 9** includes a table of the signalized intersections and roadway configurations along the corridor.

### Exhibit 8: Intersections

#### Big Horn and Laguna - Signalized Intersection

Big Horn Boulevard is 100-feet wide and includes two travel lanes in each direction. Laguna Boulevard running east and west is approximately 135-feet wide with three travel lanes in each direction. The exception is in the Westbound direction where there are four travel lanes. Both roadways also include two left turn lanes, a right turn pocket, and a median. Partial class two bike lanes and pedestrian crosswalks are present at the intersection.



Looking at the Northeast corner of Big Horn and Laguna Boulevard (Left); Looking North along Big Horn and the entrance to the Laguna Gateway Parking lot (right)

#### Big Horn and Elk Grove/Whitelock – Signalized Intersections

The Big Horn and Elk Grove intersection above has similar roadway configurations as Big Horn and Elk Grove. Whitelock Parkway intersection at Big Horn is similar to Big Horn Boulevard intersection at Laguna.



Looking South along Big Horn and Elk Grove Boulevard (Left); Looking at the Northeast corner of Big Horn and Whitelock (right)

### Exhibit 9: Signalized Intersections and Roadway Configurations

Source: City of Elk Grove General Plan Update and Iteris, 2018

DISTANCE	MAIN STREET	CROSS STREET	SIGNALIZED INTERSECTION	LANES	WIDTH	CLASSIFICATION
6.85	Bruceville Rd	Consumnes Light Rail Station/Imagine Parkway	Yes	6	107-116	Major Arterial
		Calvine Rd	Yes			
		Jacinto Rd	Yes			
		Damascas Dr	Yes			
		Sheldon Rd	Yes			
	Sheldon Rd	Whitehouse Road	Yes	2-6	130-120	
		Lewis Stein Rd	Yes			
	Lewis Stein Rd	West Stockton Blvd	Yes	2-3	46-80	
		Big Horn Blvd	Yes			
	Big Horn Blvd	New Country Ct	Yes	2-4	70-110	
		Unknown	Yes			
		Laguna Blvd	Yes			
		Monetta Dr	Yes			
		Longleaf Drive	Yes			
		Village Tree Drive	Yes			
		Elk Grove Blvd	Yes			
		Civic Center Dr	Yes			
		Denali Cir	Yes			
		Denali Circel / Lotz Parkway	Yes			
	Whitelock Pkwy	Poppy Ridge Road	Stop Sign	2	35-98	
W Stockton Boulevard		Stop Sign				
W Stockton Blvd	KYLER RD. (KAISER)	Yes	2-4	100		

#### Land Use and Zoning

The Iteris Project Team assessed the City’s land use planning efforts along the Big Horn Corridor, as well as planned transportation and development projects. As mentioned in the Comprehensive Transit Analysis (COA), the City’s 2003 General Plan supports development of enhanced transit service along a north/south alignment through Elk Grove:

- **Policy CI.8** - The City shall encourage the extension of BRT and/or light rail service to the planned office and retail areas north of Kammerer Road and west of Hwy 99.
- **Policy CI.9** - Light rail service in Elk Grove should be designed to serve major employment centers and the regional mall at Kammerer Road/Hwy 99. The City encourages the development of light rail which will bring workers and shoppers to Elk Grove, while also serving as part of a coordinated, regional transportation network.

The City is currently in the process of updating its General Plan. The following are the proposed changes to the above two policies in the new General Plan Update, which was publicly released on July 27, 2018:

- **MOB-5.9** - Encourage the extension of BRT and/or light rail service to existing and planned employment centers by requiring a dedication of right-of-way. Advocate and plan for light rail alignment and transit stop locations that best serve the needs of the community and fit within the planned mobility system.
- **MOB-5.2** - Advocate for the City’s preferred fixed transit alignment for light rail or BRT from north of the

city to the Southeast Policy Area and ensure proposed projects are complementary to such an alignment

The General Plan Update is also focusing on Transit-Supportive Land Uses by providing for forms of urban development that are accessible by public transit and promoting development that supports levels of transit ridership that make quality public transit service in Elk Grove financially feasible. **Exhibit 15** is a Composite General Plan Map that includes a Land Use Diagram, Transportation Network Diagram, and the Resource Conservation Diagram. The following are the plans and policy areas within the Big Horn Corridor (see **Exhibit 17**). These plans and policy areas specify the types of land uses to be permitted as well as desired circulation and infrastructure improvements.

- **Laguna Ridge Specific Plan** - Only adopted Specific Plan. Relies on existing development standards in the Zoning Code.
- **Southeast Policy Area (SEPA)** - This land use plan was developed in 2014. The City has indicated that future growth will be focused within the SEPA.

As stated in the General Plan Update, the SEPA is one of the last remaining new development areas within the existing City limits. Currently, plans for utilities and other planning efforts are underway for future development. The area focuses on “intensive pedestrian activity” with a greater focus on pedestrian and bicycle infrastructure.

As shown in **Exhibit 10**, the SEPA primarily calls for a combination of office and mixed use areas supported by a mix of low-, medium- and high-density residential development (see **Exhibit 10** for proposed Residential Density). The SEPA does not associate specific densities to the land use plan. Instead, it proposes a mix of office/commercial space and higher-density residential development that can potentially create an opportunity to produce or attract more transit trips.

**Exhibit 10: Land Use Density**

Residential Land Uses		
Residential Land Use Designations	Dwelling Units Per Gross Acre	Notes
Rural Residential Former GP Designation: Agricultural Residential	0.1 - 0.5	Minimum lot size: 2 to 10 acres. Areas with minimum lot size greater than 10 acres are included in agricultural land use categories.
Estate Residential Former GP Designation: Agricultural Residential and Low Density Residential	0.51 - 4.0	Lot sizes range from ¼ acre to 2 acres
Low Density Residential Former GP Designation: Low Density Residential	4.1+ - 7.0	Lot sizes vary, generally from approximately 6,000 to 10,000 SF
Medium Density Residential Former GP Designation: Low Density Residential and Medium Density Residential	7.1+ - 15.0	May include small lot single family development or condo/ townhome-type development
High Density Residential Former GP Designation: Medium Density Residential and High Density Residential	15.1+ - 30.0	May consist of apartments, condominiums, or clustered single family
Agriculture		
Designation	Minimum Parcel Size (Gross Acres)	Notes
Rural Agriculture	10 - 20	Residential uses permitted; one dwelling unit per parcel
General Agriculture	20+	This designation applies to areas outside the 2002 city limits only.
Other Designations		
Designation	Notes	
Urban study area	Area is not planned for specific urban uses, but is subject to preparation of detailed land use feasibility planning and analysis (see Land Use Element text for further information)	
Transit Oriented Development (TOD) Overlay	Area is identified for the integration of transit uses (such as train stations, transfer stations, transit hubs, park and ride facilities, etc.) with a mix of high density and intensity urban uses (e.g., commercial, office, residential) consistent with the underlying designation(s). The intent of this overlay designation is to identify that specific transit uses shall be incorporated into development consistent with the underlying base land use designation. No development activity shall preclude intended transit facilities. Corresponding right of way dedications shall be required with discretionary approvals as appropriate.	

Source: City of Elk Grove General Plan Update, July 2018 (Draft)

**Population and Employment / Current and Future Development Patters**

Based on the latest General Plan Update (2018), the population of the City of Elk Grove is 171,059. As discussed in

the 2017 COA and reiterated in the 2018 General Plan Update, the City has a number of developments in the planning stages, currently under construction or recently completed that may have an impact on transit demand. While there are a number of smaller developments with high trip generation (such as medical facilities and shopping destinations) that are being planned throughout the City and along the Big Horn Corridor, the largest anticipated growth area is in the southern portion of the City, between Whitelock Parkway and Kammerer Road, from Bruceville Road to SR-99.

One such development is the proposed casino resort project on 36-acres of land located just north of the approved outlet mall site at the northwest portion of the intersection of Grant Line Road and SR-99, which is close Kaiser Permanente Elk Grove Promenade, the end line for route 110. This project consists of a proposed 608,756 square foot hospitality and entertainment facility, including a 12-story 302-room hotel, pool, spa, 47,634-square foot convention center, six restaurants and bars, and a 110,260 square foot gaming floor. The proposed site location is shown in **Exhibit 11**. In addition, the City is also looking at the potential future expansion of the City limits in the South Study Area, which is south of the SEPA as shown in **Exhibit 11**.

**Exhibit 11: Wilton Rancheria Casino Resort – Site Map**



Source: City of Elk Grove, 2018

The land use designations, zoning, and densities proposed in the General Plan Update would contribute to a lower

jobs/housing ratio (0.84) compared to locations more proximate to the region’s existing employment centers.<sup>1</sup> Further statistics on planned development can be shown in **Exhibit 12**. In addition, a list of current activity centers along the Big Horn Corridor are shown in **Exhibit 18**.

**Exhibit 12: General Plan Development Capacity**

	ACRES	DWELLING UNITS	POPULATION <sup>1</sup>	EMPLOYMENT (JOBS)	JOBS/HOUSING RATIO
EXISTING DEVELOPMENT TOTAL <sup>2</sup>	31,238	53,829	171,059	45,463	0.84
GENERAL PLAN TOTAL	31,449	102,865	332,254	122,155	1.21
CITY LIMITS SUBTOTAL	23,441	72,262	233,406	81,784	
STUDY AREAS SUBTOTAL	8,008	30,603	98,848	40,371	
<i>North Study Area</i>	<i>646</i>	<i>323</i>	<i>1,043</i>	<i>0</i>	
<i>East Study Area</i>	<i>1,772</i>	<i>4,806</i>	<i>15,523</i>	<i>3,875</i>	
<i>South Study Area</i>	<i>3,675</i>	<i>16,250</i>	<i>52,488</i>	<i>30,367</i>	
<i>West Study Area</i>	<i>1,915</i>	<i>9,224</i>	<i>29,794</i>	<i>6,129</i>	

Source: City Of Elk Grove General Plan Update, Draft July 2018

Table Notes: Numbers may not sum due to rounding.

1. Based on 3.23 persons per household.

2. Existing development represents 2017 population and dwelling information and derived from 2013 jobs data (the most current year available at time of writing the General Plan).

For planning analysis, the service coverage area for a local bus stop is generally defined to be within 0.25 miles (five-minute walk) and the service coverage area of 0.5 miles for a BRT stop (10 minute walk). Meaning people living, working and going to school within one-half mile of a transit stop generally constitute the majority of the potential riders of the BRT service. New California Environmental Quality Act (CEQA) Guidelines provide CEQA streamlining for residential and office building projects within 0.5 miles of a major transit stop or High Quality Transit Area (HQTA)—a designation that would be provided by implementing a BRT service.

The buffering feature of GIS software can be used to draw service coverage circles around stops or the roadway, however that methodology would extend across rivers, freeways, and other barriers that block walking access to the station. The more detailed analysis accounts for the actual street and pathway distance to the transit station. Generally, each stop has a smaller service area as barriers to walking exist in all cases. Nevertheless, the comparison between the “air distance” and “path distance” can describe the amount of street connectivity in station areas. In the Route 110 corridor, dwelling units and number of employees were summed for existing and future conditions. The population and employment in the Route 110 corridor was analyzed by placing half mile buffers around the linear route, the station areas as well as parcels within a half mile walking distance along streets or paths.

**Exhibit 13: Service Coverage of the Route 110 Corridor**

SERVICE COVERAGE AREAS	DWELLING UNITS		EMPLOYEES	
	EXISTING	FUTURE	EXISTING	FUTURE
Linear Route (1/2 mile radius)	8,406	11,038	11,625	20,085
Station area (1/2 air mile radius)	7,963	9,948	11,380	19,674
Half-mile walk	5,283	6,595	7,110	12,842

Source: Iteris, 2018 – Based on SACOG MTP/SCS (adopted 2016) forecasts provided by City of Elk Grove

Overall there are about 8,000 dwelling units in the Route 110 corridor, with 5,300 within walking distance of stop

<sup>1</sup> A jobs/housing ratio is a calculation of jobs per housing units available in a given area; a perfect balance is expressed as 1:1, or 1.0. A low jobs/housing ratio (less than 1.0) describes a housing-rich community with fewer available jobs for residents, while a high ratio (more than 1.0) describes a jobs-rich area with more jobs available for residents.

under existing conditions. Under future buildout conditions there are 11,000 dwelling units in the corridor with 6,600 within walking distance of stops. There are 11,600 employees in the corridor with 7,100 employees within walking distance of stops under existing conditions. Under future conditions there are 20,000 employees in the corridor and 12,800 within walking distance. That represents a 30% increase in corridor dwelling units and 75% increase in employment from existing to future conditions.

The current stops cover 95% of the linear route—which involves multiple overlapping station areas due to close stop spacing in the Route 110 service. The half-mile walk service coverage is generally 60% of the dwelling units and employment within the station area air radius—meaning that street and path connectivity allow for a half-mile walk for 60% of households and workers that are within a half-mile of the stop as the crow flies.

### Demographics / Vehicle Use

As stated in the COA, the demand for public transit is typically driven by the number of youth, older adults, lack of vehicle availability, affordability (% of population below the poverty level) and/or disability.

- Elk Grove is made up largely of families with young children (33.1% of population is 19 years and younger)
- 18.1% of the population is age 55+ (compared to 23.5% for the region)
- 8% of individuals and 6.3% of households are below the federal poverty level
- 10.2% of the population have a disability of some kind although it is not known if this impacts on an individual's mobility Personal vehicle ownership is high in Elk Grove.

According to 2016 Census survey estimates, there were 2.21 vehicles per household in Elk Grove in 2016. This compares to an average of 1.7 vehicles per household nationwide (including rural areas), meaning Elk Grove has 23 percent more cars per household than the average. When vehicle ownership in Elk Grove is compared to the other 317 Cities with 100,000 or more persons, it ranks 15<sup>th</sup> highest in vehicles per household. Elk Grove has even fewer relative households without a car with 1.8percent—placing Elk Grove with the 10<sup>th</sup> lowest zero-car-households. Based on these statistics Elk Grove is in the 97<sup>th</sup> percentile of Cities in terms of automobile ownership.<sup>2</sup>

### Regional Origin and Destination Forecasts

SACOG produces origin and destination forecasts from the SACSIM travel demand model. The model analyzes tours: a series of trips beginning and ending at home location. Tour purpose is defined by the primary activity on the tour (work, school, or other trip purpose). The simplest tour includes two trips: one trip from home location to primary destination, and a return trip back home. Tours can include multiple activities and trips. The origin and destination data is analyzed between Research Analysis Districts (RADs). There are 28 RADs in Sacramento County. The City is primarily made up of the RADs of “Laguna” and “Elk Grove”. The “Laguna” RAD contains Route 110 with the northern portion outside of the City being in the “South Sacramento” RAD.

For the purposes of this analysis, the RADs are consolidated into “Laguna” (Route 110 area in Elk Grove), “Elk Grove” (the portion of the City east of SR-99), “Blue Line” (three RADs along the Blue Line corridor to Downtown Sacramento), “North” (areas north of Downtown Sacramento), “Northeast” (areas in the I-80 and US-50 corridors), “South” (areas south of Elk Grove to Galt), and “East” (communities due east of Elk Grove). In the **Exhibit 14**, person tours are forecasted for 2012 (Existing Conditions) and 2036 (Future Conditions) and segmented by All Tour Purposes and Work Tours Only. Work Tours Only are a subset of All Tour Purposes.

As shown, 42.6% of trips stay within the Route 110 corridor area (Laguna), however 49.4% of work trips travel along the Blue Line Corridor—with only 1.7% of work trips internal to the Route 110 corridor area under existing conditions. However, while trips to all destinations will occur in real terms, the percentage share of work trips will shift by over 10% from the Blue Line corridor to the Route 110 corridor as jobs increase relative to housing in Elk Grove. This means that more Route 110 trips in the future will be between destinations within the corridor than

<sup>2</sup> <http://www.governing.com/gov-data/car-ownership-numbers-of-vehicles-by-city-map.html>

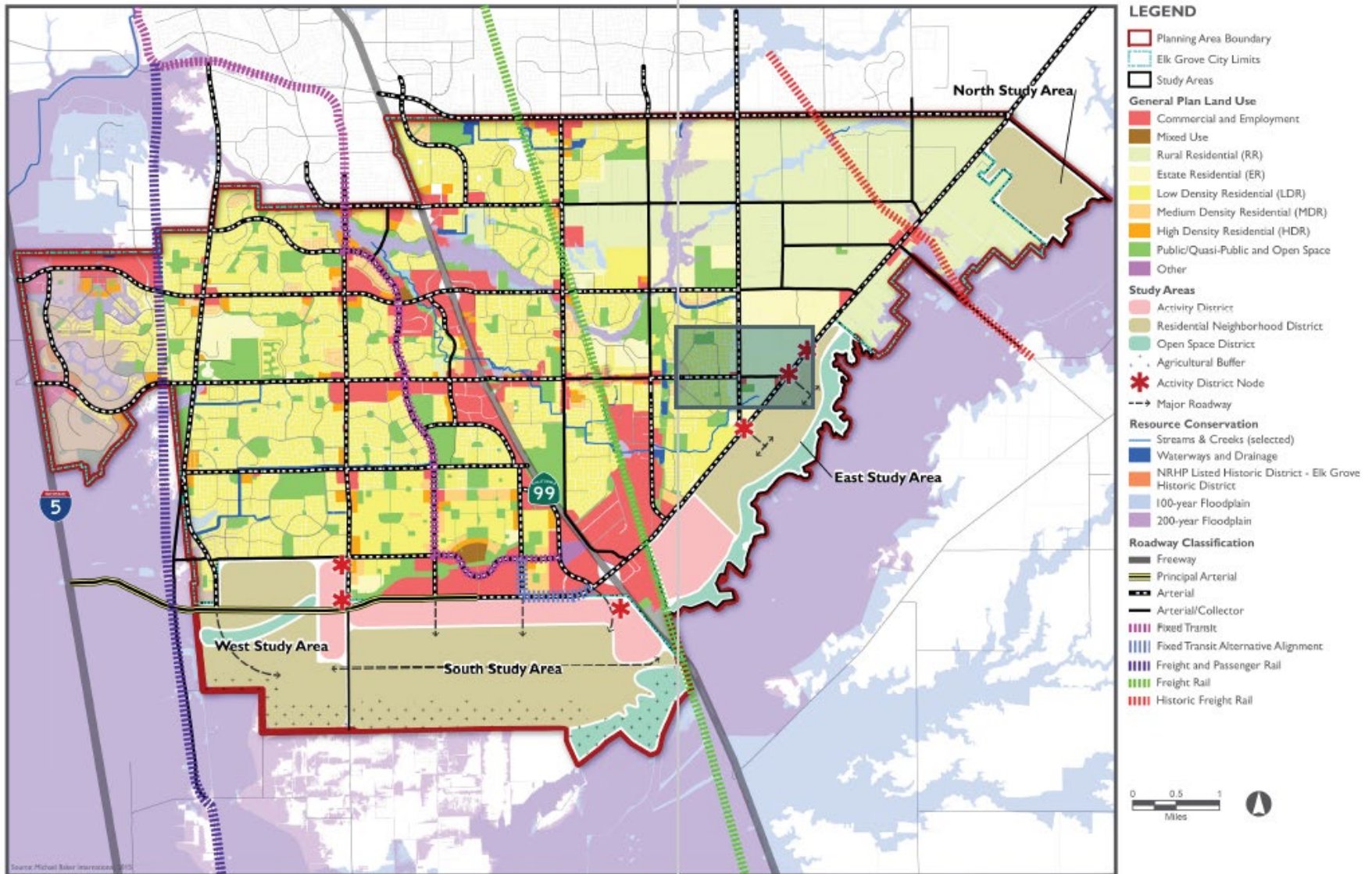
under existing conditions.

**Exhibit 14: Origin and Destination Forecasts**

PERSON TOURS FROM LAGUNA RAD TO:			BLUE LINE	NORTH	NORTHEAST	LAGUNA (INTERNAL CORRIDOR)	ELK GROVE	SOUTH	EAST
Existing Conditions (2012)	All Person Tours	Total	40,229	9,692	12,743	57,105	11,269	2,491	389
		% of Total	30.0%	7.2%	9.5%	42.6%	8.4%	1.9%	0.3%
	Work Tours	Total	9,793	4,491	3,944	344	259	781	203
		% of Total	49.4%	22.7%	19.9%	1.7%	1.3%	3.9%	1.0%
Future Conditions (2036)	All Person Tours	Total	50,653	14,320	20,787	89,679	15,848	3,359	508
		% of Total	26.0%	7.3%	10.7%	46.0%	8.1%	1.7%	0.3%
	Work Tours	Total	12,261	7,064	8,031	4,569	487	1,242	251
		% of Total	36.2%	20.8%	23.7%	13.5%	1.4%	3.7%	0.7%
Change	All Person Tours	Total	10,424	4,628	8,044	32,574	4,579	868	119
		% of Total	-4.1%	0.1%	1.1%	3.3%	-0.3%	-0.1%	0.0%
	Work Tours	Total	2,468	2,573	4,087	4,225	228	461	48
		% of Total	-13.3%	-1.8%	3.8%	11.7%	0.1%	-0.3%	-0.3%

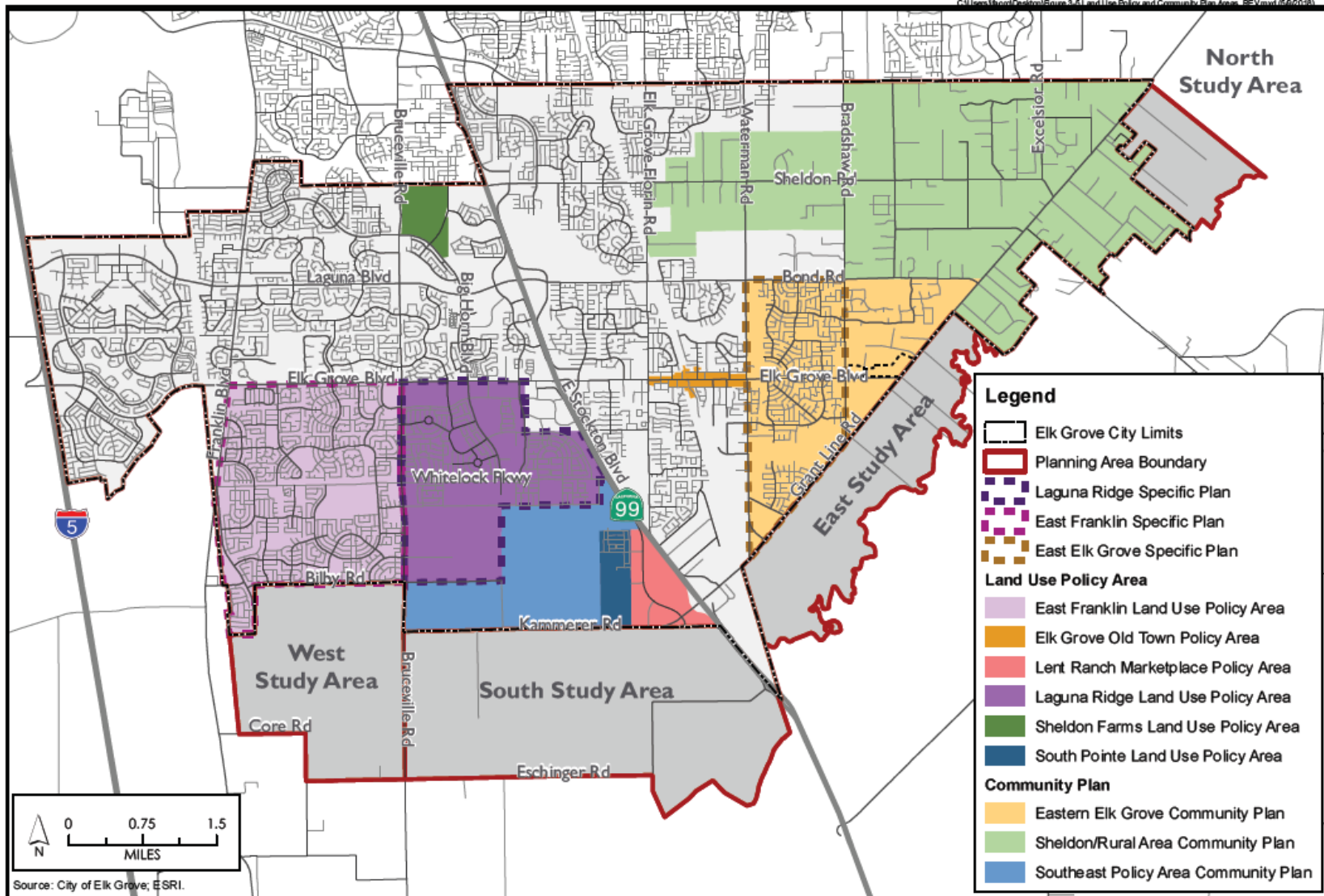
**Source:** Iteris, 2018 – Based on SACOG MTP/SCS (adopted 2016) forecasts provided by City of Elk Grove

Exhibit 15: Composite General Plan Map



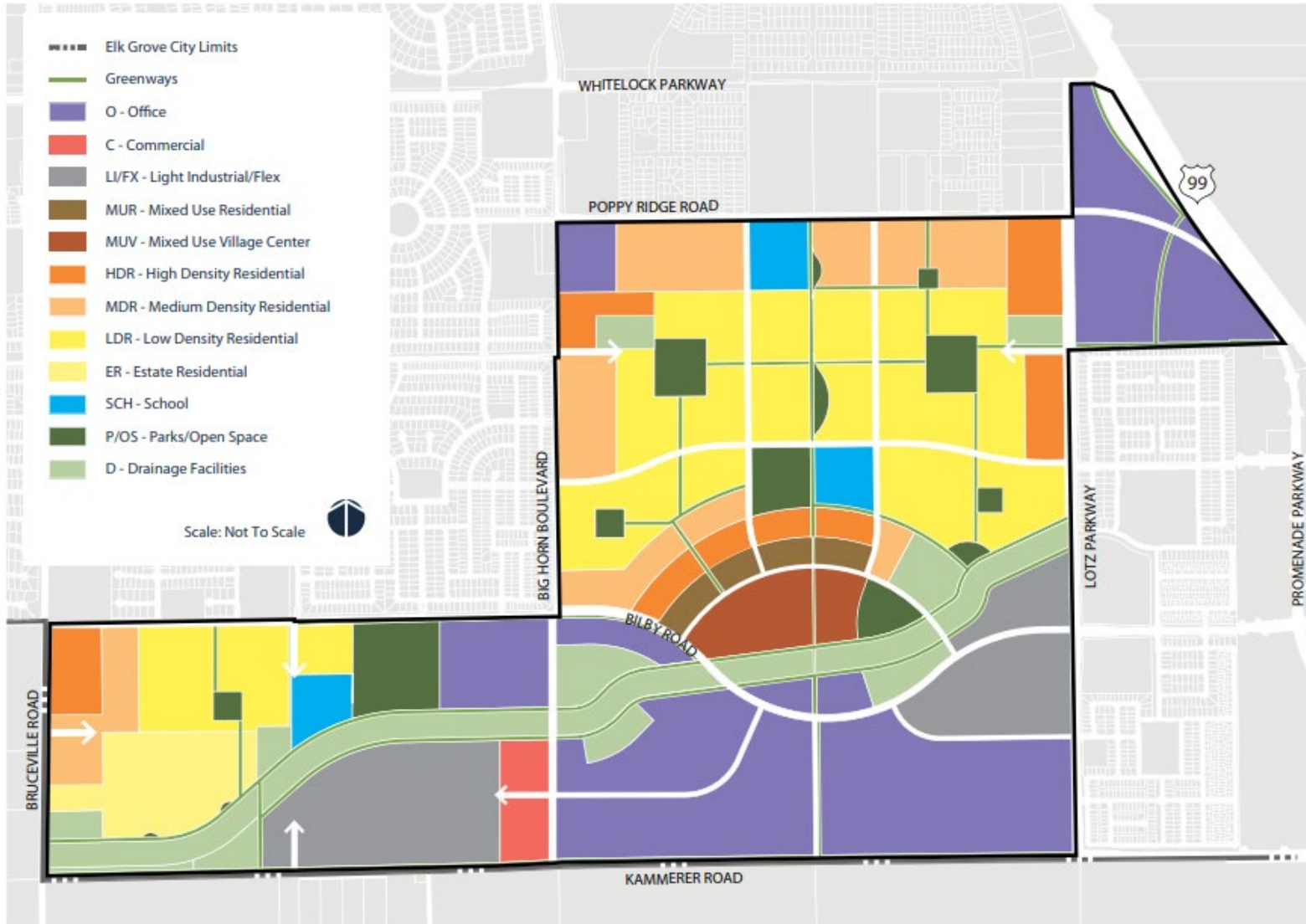
Source: City of Elk Grove General Plan Update, July 2018 (Draft) - South East Policy Area – Adopted by the City of Elk Grove in 2014

Exhibit 16: Plans and Land Use Areas



Source: City of Elk Grove General Plan Update, July 2018 (Draft) – Plans and Policy Areas

Exhibit 17: Southeast Policy Area (SEPA)



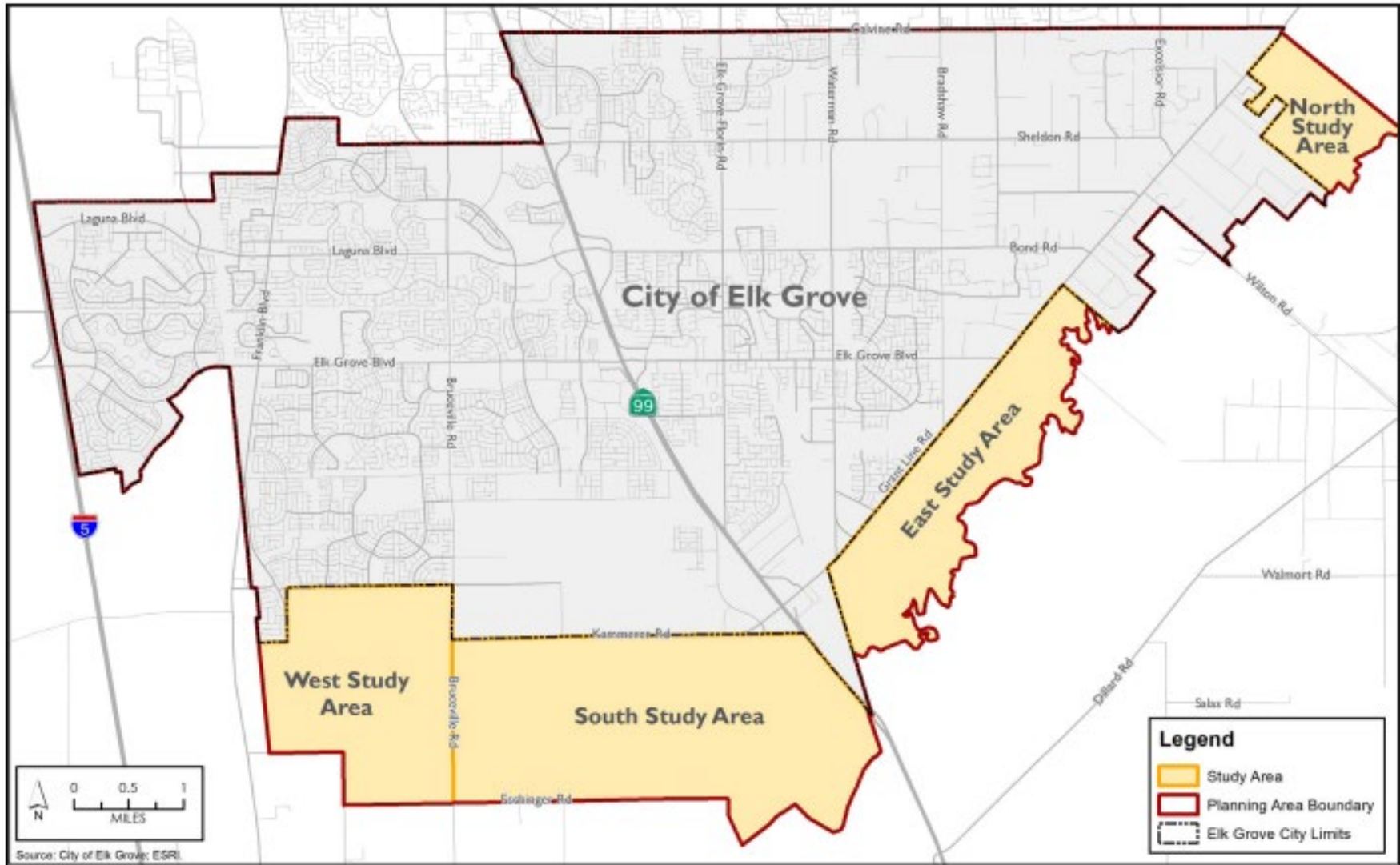
Source: City of Elk Grove General Plan Update, July 2018 (Draft) - South East Policy Area – Adopted by the City of Elk Grove in 2014

**Exhibit 18: Activity Centers**

STATION AREA	EDUCATIONAL	OFFICE	RETAIL	PARK	COMMUNITY	RESIDENTIAL
Blue Line	Cosumnes River College	--	Foodsco Shopping Center	Shasta Community Park	Valley Hi-North Laguna Library	--
Calvine	--	--	--	--	--	College Grove Apartments
Jacinto	Barbara Comstock Morse Elementary School	--	--	--	--	Wolf Ranch Condominiums, Silverado Creek Apartments
Damascas	--	--	--	Jacinto Creek Trail	--	--
Center Pkwy	--	Hatton Veterinary Hospital	Laguna Village, Shell Station Shopping Center	--	--	--
Sheldon	Golden Valley Academy	--	--	--	--	--
W. Stockton	--	--	WinCo Foods Shopping Center	Pinkerton Park	--	Terracina at Park Meadows
Big Horn	--	--	--	Elk Grove Creek	--	--
New Country Ct	--	--	--	Zimbelman Park	--	--
Generations Dr	--	Kaiser Permanente Elk Grove Medical Offices	--	--	--	--
Laguna	--	Sutter Medical Plaza, Laguna Dental, Bank of Stockton	Laguna Gateway	--	--	Vintage at Laguna
Monetta	--	Mercy Medical Group, California Correctional Health Care Services	Century Laguna Theaters	--	Post Office	--
Village Tree Dr	Elitha Donner Elementary School	Medical Offices	--	Miwok Park, Foulks Park	--	--
Red Elk Dr	--	--	--	--	--	--
Elk Grove Blvd	--	--	Laguna Oaks	--	--	--
Civic Center Dr	--	--	--	--	--	Ridge Apartments
Lotz Pkwy	Consumnes Oaks High School	--	--	--	--	--
Whitelock Pkwy	Elizabeth Pinkerton Middle School, Consumnes River College - Elk Grove Center	--	--	--	--	--
Promenade	--	Kaiser Permanente Elk Grove Promenade	Promenade Mall (vacant)	--	--	--

Source: Iteris, 2018

Exhibit 19: Study Areas – Outside City Limits

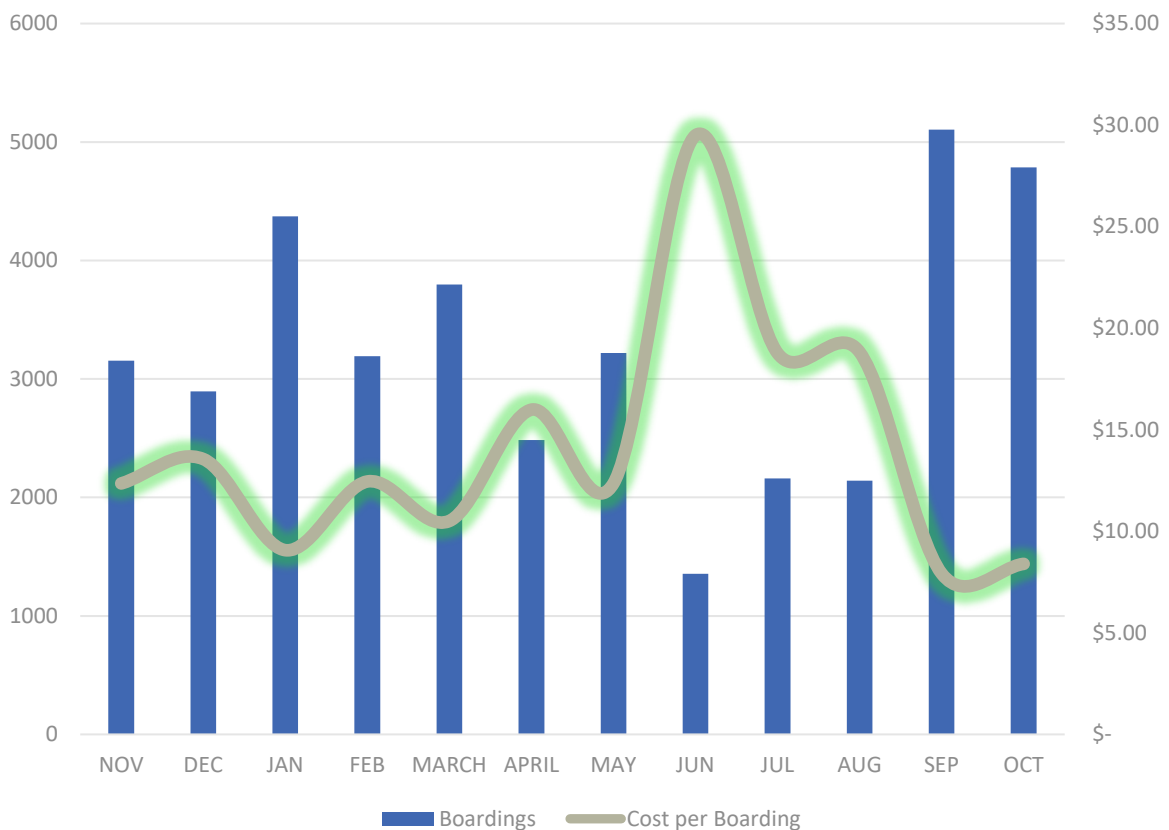


Source: City of Elk Grove General Plan Update, July 2018 (Draft) - Study Areas

### Financial Data

Operation expenses for Route 110 are approximately \$40,000 per month. Based on the ridership levels, the operating expenses per rider averages \$12.38 over the period from November 2017 to October 2018—with the average operating expense per rider averaging \$8.15 for the September 2018 to October 2018 period. The ridership drop in the summer months causes a significant increase in the operating expense per rider. **Exhibit 20** shows the monthly boardings/costs.

**Exhibit 20: Monthly Boardings and Cost/Boarding - Chart**



Source: City of Elk Grove and Iteris, 2018

### Elements of BRT

The Iteris project team developed a comprehensive list of BRT Elements for the City. The list was compiled based on publications prepared by the National Bus Rapid Transit Institute (2011), Institute for Transportation and Development Policy (2016), and the United States Department of Transportation (USDOT) Federal Transit Administration (2017) on Bus Rapid Transit Elements and Performance Benefits. The complete list provided to the City is included in **Appendix B**.

### Performance Criteria

Each BRT element improvement will increase the potential for ridership in the corridor, however the cost of the improvement and its ability to attract and improve conditions for riders vary. The feasibility of a program of improvements to develop a BRT service is based on selecting the most, suitable, cost-effective and beneficial improvements for the Big Horn corridor.

The project team conducted a literature review of performance thresholds and factors for BRT by peer agencies. The purpose is to develop general guidelines to 1) assess the current performance 2) inform the potential ridership

forecasts for the corridor 3) indicate optimal station location 4) assess BRT improvements on an individual basis and 5) develop prioritization for improvements to Route 110. The common theme of agency feasibility thresholds in defining performance criteria for instituting BRT are:

- Catchment Area Population/Employment
- Station Area Access
- Transit Service (quality, headways, information, destinations)

Generally, these performance criteria are applied to an entire service area to determine the maximum ridership potential corridors. According to the Transit Capacity and Quality Service Manual Third Editions (2013), minimum catchment area population and employment density is three dwelling units per acre and four employees per acre. Valley Transit (VTA) uses ridership standards and urban design and development requirements for BRT routes as part of its Bus Rapid Transit Service Design Guidelines (2007). VTA defined two levels of BRT element packages:

- **BRT 1** has higher operating speeds, greater reliability and fewer stops above local service. Buses and station are brand identified with shelters, benches and real-time passenger information. Buses operate in mixed-flow lanes or peak-hour bus-only lanes with bus signal priority and queue jump lanes.
- **BRT 2** is a higher capital investment which operates in bus-only lanes or transitways which minimize interaction between the BRT line and mixed-flow traffic.

The ridership standards for existing and future BRT routes area are shown in **Exhibit 21**.

**Exhibit 21: VTA Ridership Standards for Existing and New BRT Routes**

RIDERSHIP STANDARDS	STUDY AREA	BRT 1	BRT 2
Average Boardings per Revenue	Corridor / Segment	45	55
Boardings per Station	Station	150	350
Average Boardings per Route Mile	Corridor / Segment	200	350 to 475

The VTA urban design and development density guidelines are shown in **Exhibit 22**. The values are shown as the density levels very close to stations—within one to two blocks or 330 to 660 feet of the corridor.

**Exhibit 22: VTA Urban Design and Development Densities for BRT**

LAND USE	CORRIDOR OR STATION	DISTANCE	MINIMUM	TARGET	OPTIMAL
Dwelling Units	Corridor	within two blocks	12-16	25-32	30-50
	Regional Station	within 1/3 of a mile	20	27.5	35+
	Local Station	within 1/3 of a mile	10	15	20+
Commercial FAR	Corridor	within two blocks		1	2
	Regional Station	within 1/3 of a mile	1	1.5	2
	Local Station	within 1/3 of a mile	0.5	0.75	1

In each case, the values are not meant to be used universally. They are based on an annual route productivity evaluation and are intended to be updated periodically to reflect annual average ridership performance. Since e-Tran service area has different land use patterns and will have a different level of BRT element deployment, unique performance metrics will be developed for Elk Grove specifically.

The SACOG MTP/SCS Chapter 5A described land use and transportation factors in travel outcomes. The most important factors for transit usage were the proximity to transit, street pattern/urban design, mix of land uses, and residential density. These factors were integrated, to a degree as part of the Elk Grove COA which defined Key Performance Measurement Criteria for the categories of Service Availability, Service Delivery, and Financial Performance (shown in **Exhibit 23**).

### Exhibit 23: Key Performance Measurement Criteria

Category	Key Performance Indicator	Measure	FY 2022 Target
Service availability	Span	Days / Hours	Wkdy/Sat - 17 hours Sunday - 15 hours
	Coverage	Percent residents within 0.33 mile	90%
	Frequency	Route Headways	30 minutes or better
Service delivery	Productivity	Passengers per revenue hour	20 average 10 (new < 2 yrs)
	Loading Condition	Percent of seated capacity	Local: 125% Commuter: 100%
Financial performance	Cost Effectiveness	Farebox recovery (% of total operating cost)	20%

The survey of riders indicated a high priority in improving the access and frequency provided by the e-Tran system. Other major issues were real-time information, safety concerns, and the longer commute times as compared to auto travel. Taking these factors into account with other agencies' approaches and the data available for this analysis, the following performance metrics are proposed to assess the corridor performance for existing and future conditions, BRT element effectiveness and prioritization. The measures will be quantitative to the extent possible; however, some recommended metrics will be qualitative.

#### Station Area Thresholds

Station area thresholds will be used to identify locations with high potential for ridership based on residential and employment density. The proposed station area thresholds are:

- Dwelling Units within ½ mile
- Employees within ½ mile

Dwelling unit data was obtained from existing land use for existing dwelling units. Future dwelling units were estimated from projects under review by the Elk Grove Planning Department and estimates based on zoning and General Plan Update or specific plan land use. Employment data was obtained from SACOG employment forecasts at the TAZ level, distributed to parcels based on estimates square footage.

#### Station Performance

Station performance will be used to assess existing and future stations for their potential to increase ridership, fare-box recovery and the types of BRT amenities appropriate for each location. The proposed station performance measures are:

- Ridership
  - Boardings/Alightings per Stop
  - Boardings / Alightings per Stop Area (direction stop pairs or otherwise adjacent stops combined)
  - Boardings per Revenue Hour (COA FY 2022 Target: 20 average 10 for new service)
  - Boardings per Route Mile
- Transfer Riders per Stop and Stop Area

#### Station Access

Station access is an often-overlooked component of BRT implementation, however to reiterate the two most important SACOG factors in transit usage: the proximity to transit and street pattern/urban design. The level of population or employment density in proximity to stations is not relevant if potential riders cannot access the station due to a lack of connections or barriers to access. The Federal Transit Administration recommends a physical and functional relationship between bicycle and pedestrian infrastructure and transit stops:

*“For the purposes of determining whether a pedestrian or bicycle improvement has a physical or functional relationship to public transportation, regardless of whether it is funded as a capital project or public transportation enhancement, all pedestrian improvements located within one-half mile and all bicycle improvements located within three miles of a public transportation stop or station shall have a de facto physical and functional relationship to public transportation.” - Federal Transit Administration August 19, 2011*

The proposed station access performance measures are:

- Intersections within ½ mile
- Wayfinding and Signage
- Points of interest
- Pedestrian Shed
- Bicycle and Pedestrian Collision locations
- Distance between transfer points
- Pathways
- Barriers
- Signal Priority for Pedestrians

### Operational Performance

The operational performance of the corridor service is the final category of performance measure. These operational components are directly tied to both costs and ridership performance. The proposed operational performance measures are:

- Headways
- Travel Time
- Operating Hours/Day
- Capacity
- Branding
- Traveler Information
- Shelter

### Financial Performance

The financial performance analysis is where the costs and ridership performance are analyzed for cost/benefit. The capital, maintenance and operations cost of BRT improvements will be compared to their relative benefit in supporting ridership. The proposed financial performance measures are:

- Operational Expenses per Rider
- Farebox Recovery (COA FY 2022 Target: 20%)
- Annual Capital Cost per Rider (existing and new riders)

These performance metrics are intended to supplement, not replace, recommendations or decisions based on additional information and needs within the corridor. The feasibility of BRT will be defined based on the cost/benefit return of BRT element deployment decisions by the City, informed by the BRT element benefits and costs developed in Technical Memorandum #2.

## APPENDIX A STATION AREA CHARACTERISTICS








Station Area	Average Daily Ridership	Stop Characteristics							Stop Amenities					Stop Connections			
		Direction of Travel	Primary Street	Secondary Street	Position	Side of Street	Daily Boardings	Daily Alightings	Distance to Next Stop (miles)	Shelter	Seating	Lighting	Trash Disposal	Signage	Sidewalks	Bike Lane/Path	Bus Line Transfers
1 Cosumnes River College/Blue Line LRT Station	192	NB	Blue Line LRT Station Parking Lot		Parking Lot	N/A	0	90	N/A	Yes	Yes	Yes	Yes	Yes	Yes	Yes	114, 115, 116
		SB*	Blue Line LRT Station Parking Lot		Parking Lot	N/A	100	0	0.1	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
2 Calvine	3	SB	Bruceville Rd	College Entrance	Farside	West	1	1	0.1	No	No	No	No	No	Yes	Yes	114, 116
		NB	Bruceville Rd	Calvine Rd	Across	East	<1	1	0.31	No	Yes	Yes	No	Yes	Partial	Yes	Yes
3 Jacinto	16	SB	Bruceville Rd	Calvine Rd	Farside	West	1	<1	0.21	No	Yes	No	No	Yes	Yes	Yes	114, 116
		NB	Bruceville Rd	Jacinto Rd	Nearside	East	4	3	0.22	No	No	Yes	No	Yes	Yes	Yes	Yes
4 Damascas	8	SB	Bruceville Rd	Jacinto Rd	Farside	West	6	3	0.23	No	No	Yes	No	Yes	Yes	Yes	114, 116
		NB	Bruceville Rd	Damascas Dr	Nearside	East	2	2	0.25	No	No	Yes	No	Yes	Yes	Yes	Yes
5 Center Pkwy	12	SB	Bruceville Rd	Damascas Dr	Farside	West	2	2	0.26	No	No	Yes	No	Yes	Yes	Yes	114, 116
		NB	Bruceville Rd	Sheldon Rd	Farside	East	6	1	0.29	No	Yes	Yes	No	Yes	Yes	Yes	Yes
6 Sheldon	10	NB	Sheldon Rd	Bruceville Rd (Laguna Pointe)	Nearside	North	<1	<1	0.16	No	No	No	No	Yes	Not to Curb	Yes	-
		SB	Bruceville Rd	Center Pkwy	Nearside	West	1	4	0.66	No	No	No	No	Yes	Yes	Yes	114, 116
7 W. Stockton	14	NB	Sheldon Rd	West Wing Dr	Farside	North	<1	<1	0.22	No	No	Yes	No	Yes	Yes	Yes	-
		NB	Sheldon Rd	Lewis Stein Rd	Farside	North	1	1	0.11	No	No	Yes	No	Yes	Not to Curb	Yes	-
8 Big Horn	6	SB	Lewis Stein Rd	Sheldon Rd	Farside	West	2	6	0.23	No	No	No	No	Yes	No	Yes	10
		NB	Lewis Stein Rd	West Stockton Blvd	Farside	East	7	2	0.29	Yes	Yes	Yes	Yes	Yes	Yes	Yes	10
9 New Country Ct	2	SB	Lewis Stein Rd	West Stockton Blvd	Farside	West	2	3	0.4	No	No	No	No	Yes	Not to Curb	Yes	10
		NB	Lewis Stein Rd	Big Horn Blvd	Farside	Southeast	1	2	0.41	No	No	No	No	Yes	Not to Curb	Yes	10
10 Generations Dr	9	SB	Big Horn Blvd	Ancestor Dr	Farside	Southwest	2	1	0.22	No	Yes	No	No	Yes	Yes	Yes	10
		NB	Big Horn Blvd	New Country Ct	Farside	Northeast	1	<1	0.22	No	No	Yes	No	Yes	Partial	Yes	10
11 Laguna	29	SB	Big Horn Blvd	New Country Ct	Farside	Southwest	<1	1	0.22	No	No	Yes	No	Yes	Not to Curb	Yes	10
		NB	Big Horn Blvd	Kaiser Entrance	Midblock	Northeast	2	<1	0.18	Yes	Yes	No	Yes	Yes	Yes	Yes	10
12 Monetta	15	SB	Big Horn Blvd	Generations Dr	Farside	West	1	6	0.09	No	Yes	No	No	Yes	Yes	Yes	10
		NB	Big Horn Blvd	Laguna Blvd	Farside	East	15	3	0.19	Yes	Yes	Yes	Yes	Yes	Yes	Yes	10
13 Village Tree	18	SB	Big Horn Blvd	Laguna Blvd	Nearside	East	<1	1	0.14	No	No	Yes	No	Yes	Not to Curb	Yes	10, 19
		NB	Big Horn Blvd	Monetta Dr	Nearside	East	6	1	0.16	No	No	Yes	No	Yes	Not to Curb	Yes	10, 19
14 Red Elk	6	SB	Big Horn Blvd	Monetta Dr	Midblock	West	2	6	0.28	Yes	Yes	Yes	Yes	Yes	Yes	Yes	10, 19
		NB	Big Horn Blvd	Village Tree Dr	Farside	East	5	4	0.24	No	No	Yes	No	Yes	Not to Curb	Yes	10
15 Elk Grove Blvd	8	SB	Big Horn Blvd	Village Tree Dr	Nearside	West	3	6	0.36	No	No	Yes	No	Yes	Not to Curb	Yes	10
		NB	Big Horn Blvd	Red Elk Dr	Farside	East	1	1	0.22	No	No	Yes	No	Yes	Yes	Yes	10
16 Civic Center Dr	13	SB	Big Horn Blvd	Red Elk Dr	Farside	West	1	4	0.17	No	No	Yes	No	Yes	Yes	Yes	10
		NB	Big Horn Blvd	Elk Grove Blvd	Farside	East	3	2	0.16	No	Yes	No	Yes	Yes	Yes	Yes	10
17 Lotz Pkwy	36	SB	Big Horn Blvd	Elk Grove Blvd	Farside	West	1	3	0.17	No	No	Yes	No	Yes	Yes	Yes	10
		NB	Big Horn Blvd	Civic Center Dr	Nearside	East	5	2	0.1	No	No	Yes	No	No	Not to Curb	Yes	10, 12, 111, 112
18 Whitelock Pkwy	75	SB	Big Horn Blvd	Civic Center Dr	Farside	West	1	5	0.45	No	No	Yes	No	Yes	Yes	Yes	-
		NB	Big Horn Blvd	Lotz Pkwy	Farside	East	8	<1	0.36	No	No	Yes	No	Yes	Yes	Yes	111, 112
19 Promenade	18	SB	Big Horn Blvd	Denali Cir	Farside	West	1	26	0.36	Yes	Yes	No	Yes	Yes	Yes	Yes	111
		NB	Big Horn Blvd	Whitelock Pkwy	Farside	East	41	1	0.45	No	No	Yes	No	Yes	Yes	Yes	111
19 Promenade	18	SB	Big Horn Blvd	Whitelock Pkwy	Nearside	West	<1	13	0.11	No	No	Yes	No	No	Yes	Yes	-
		NB	Whitelock Pkwy	Big Horn Blvd	Farside	North	3	18	1.91	No	No	Yes	No	Yes	Yes	No	-
19 Promenade	18	NB	Promenade Pkwy	Kyler Rd	In Front	East	2	0	1.92	Yes	Yes	Yes	Yes	Yes	Yes	Yes	-
		SB	Promenade Pkwy	Kyler Rd	Farside	West	0	16	0	Yes	Yes	Yes	Yes	Yes	Yes	Yes	-







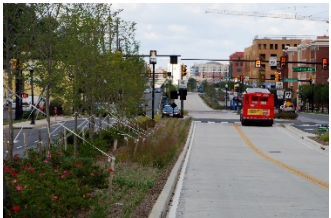
\*Same stop location for NB and SB

# APPENDIX B BRT ELEMENTS





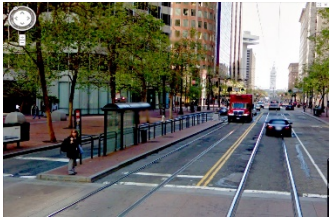


ELEMENT	SUB-ELEMENT(S)	EXAMPLE(S)	DESCRIPTION	PHOTO
Wide Choice of Running Ways	Street Type	Neighborhood Streets	Consisting of both commercial/mixed-use main streets and residential streets. Typically one vehicle travel lane in each direction plus curbside parking and moderate pedestrian and bicycle traffic. Improvements to curbside geometries and management yield the most improvements to transit operations.	
		Corridors/Arterials	Long, direct venues for moderate to high levels of vehicle traffic and higher vehicle speeds. Typically two or more vehicle travel lanes in each direction with minimal or substandard pedestrian and bicycle facilities. Highest potential opportunities for reconfiguring street to accommodate high-quality transit.	
		Downtown Streets	Highly-trafficked, multimodal streets located in major urban centers. Typically two vehicle travel lanes in each direction plus possible curbside parking and generous pedestrian and bicycle facilities. Separation of transit from vehicular traffic is often necessary to achieve reliable service.	
Busway Alignment	Transit Lanes	Offset Transit Lane	Aligns transit vehicles in the right-most travel lane, offset from the curb by curbside parking, curb extensions/bulbouts, or bicycle facilities.	
		Curbside Transit Lane	Aligns transit vehicles directly adjacent to the curb.	
		Center Transit Lane	Aligns transit vehicles in the left-most travel lane, adjacent to the centerline of the roadway.	




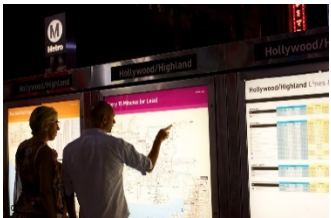



ELEMENT	SUB-ELEMENT(S)	EXAMPLE(S)	DESCRIPTION	PHOTO
Dedicated Right-of-Way		Peak-Only Bus Lane	Restricts access for general vehicle traffic, allowing buses only during peak traffic periods. Generally used in offset or curbside lanes.	
		Shared Bus/Bike Lane	Aligns transit vehicles in an offset or curbside lane that is shared with bicycles.	
		Contraflow Transit Lane	A two-way street that restricts general vehicle traffic to one direction of travel, while reserving the other for transit vehicles. May also allow bi-directional travel for transit vehicles.	
	Transitways	Center Transitway	Aligns transit vehicles in the left-most travel lanes, adjacent to the center line of the roadway. Physical barriers separate transit lanes from general travel lanes.	
		Side Transitway	Aligns transit vehicles to the right-most travel lane(s), either offset or curbside. Physical barriers separate transit lanes from general travel lanes.	
		Green Transitway	Separates transit vehicles from general travel lanes using continuous green space, except for at intersections and crossings.	
		Pavement Material	Asphalt	Easiest and least expensive material on which to implement a bus lane, but prone to damage and/or deformation from weight of buses, particularly at stops.





ELEMENT	SUB-ELEMENT(S)	EXAMPLE(S)	DESCRIPTION	PHOTO
		Concrete	More expensive but stronger than asphalt and less likely to be damaged or deform under bus weight. Recommended for thoroughfares with heavy bus traffic and as bus stops.	
		Pavers	Uses large pavers made of concrete, brick, or stone in diagonal or interlocking patterns that help distribute weight. Typically applied in dense urban areas to create a distinct appearance. Though durable, have the potential to buckle under heavy weight.	
Pavement Markings & Color		Red Paint	Color most typically applied to bus lanes. Widely available, semi-durable, Epoxy-based paint. Retroreflectivity and resistance to skidding can be achieved with the addition of glass beads or sand.	
		Red Thermoplastic	Provides consistent colored surface with low life-cycle cost on low to moderately trafficked streets. May need frequent replacement under high volumes of heavy vehicles. Most effective on asphalt; anti-skid treatments can be applied.	
		Methyl Methacrylate (MMA)	An advanced polymer with better wearing than thermoplastic. Lower life-cycle cost on roads with high volumes of heavy vehicles.	
		Embedded Color	Red pigment applied by mixing directly with asphalt or concrete, eliminating need for reapplying. Higher implementation and repair costs but longer life cycle. High Friction Surfact Treatments (HFST) can be used when repaving not possible. Enhances traction on downhill and curving sections.	
		Intermittent Color	Applicable when colored pavement isn't used on whole length of transit lane. Highlights key locations such as stops or sections with restrictions for other travel modes. Less expensive implementation costs.	

ELEMENT	SUB-ELEMENT(S)	EXAMPLE(S)	DESCRIPTION	PHOTO
			<p>Contrast</p> <p>Use of color variations among pavers to highlight separation of spaces used by different travel modes.</p>	
	Separation Elements		<p>Hard Curbs</p> <p>Typical vertical curbs of between 4-6 inches in height that physically prevent intrusion into the transitway.</p>	
			<p>Mountable Curbs</p> <p>Curbs less than 6 inches in height that are rounded or sloped to allow flexible entry of bicycles and transit vehicles when needed while still signifying a distinct transit lanes.</p>	
			<p>Rumble Strips</p> <p>Soft treatment offering tactile cue to drivers encroaching on the transit lane. Low-cost, but typically reserved for high-speed throughfares with minimal bicycle traffic.</p>	
			<p>Bollards</p> <p>Vertical posts between 30-42 inches high that provide visual and physical delineation along transit lanes. Can be metal, concrete, or plastic, but must be able to absorb vehicle impacts.</p>	
			<p>Low Vertical Elements</p> <p>Low concrete or plastic domes providing visual and tactile cues to drivers encroaching on the transit lane.</p>	
			<p>Planting Strips</p> <p>A stretch of landscaping running parallel to the transit lane that provides horizontal separation from general travel lanes. Must be careful not to obstruct line of sight and be maintained regularly.</p>	

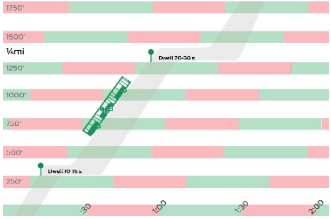
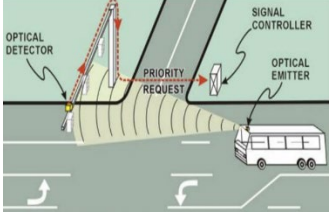

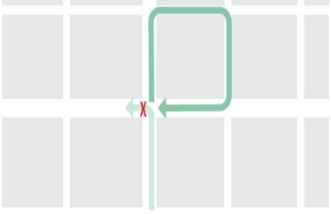
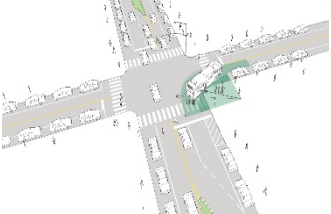


ELEMENT	SUB-ELEMENT(S)	EXAMPLE(S)	DESCRIPTION	PHOTO
Bus Stations & Stops	Design Factors	Stop Placement & Intersection Configuration	The location of the bus stop in relation to the intersection. Can either be adjacent to the bus travel lane (in-lane) or require the bus to pull over to the curb (pull-out). Can be on the near or far side of the intersection or at a mid-block location.	
		Platform Length	Platform length for a standard 40' bus varies between 35-45 feet at in-lane stops to between 90-140 feet for pull-out stops. In-lane stops increase curbside utilization and sidewalk space since there is no need for a taper, while pull-out stops can have operational benefits.	
		Platform Height	Platform height impacts the ease of boarding and therefore route efficiency, allowing passengers to board and alight quicker and buses to make stops shorter. Platform height can be at sidewalk/curb level, near bus-level, at bus-level, or at a "mini-high" platform for older buses with higher floors.	
		Accessible Paths & Slopes	Using designs that provide accessibility for all users, especially those with impaired mobility, makes transit systems more equitable, convenient, and efficient. This includes providing adequate space for unobstructed sidewalks and crossings and ensuring ADA-compliant access to curb ramps and boarding platforms.	
		Universal Design Elements	Design elements that are critical for user access, comfort, and convenience, especially those with extra need. These include tactile cues such as warning strips on curb ramps and platform edges, use of color as delineation, adequate lighting, and audible pedestrian signals.	
	Stop Configuration	Boarding Bulb Stop	Uses curb extensions (bulbouts) to align the transit stop with curbside parking and buses aligned in an offset lane, creating an in-lane bus stop.	
		Side Boarding Island Stop	Similar to boarding bulb stops by providing in-lane bus stops, but separated from the sidewalk by a channel allowing for bike lanes, eliminating conflicts between transit vehicles and bicycles.	

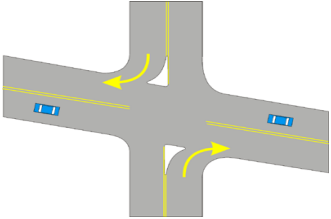


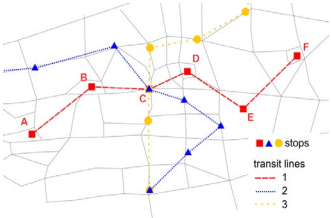
ELEMENT	SUB-ELEMENT(S)	EXAMPLE(S)	DESCRIPTION	PHOTO
		Share Cycle Track Stop	A shared space between the bus stop and a bike lane. Bicycles yield to boarding and alighting riders, but may pass through when no bus is present.	
		Curbside Pull-Out Stop	A curbside pull-out bus stop that services offset bus lanes. Prioritizes through-traffic in areas where in-lane stops would be problematic.	
		In-Lane Sidewalk Stop	An in-lane bus stop that services curbside bus lanes.	
		In-Street Boarding Island Stop	An island located between center-running bus lanes and general traffic lanes, creating in-lane bus stops.	
		Median Stop	Located either on the inside (left-side boarding) or outside (right-side boarding) of a center median containing bus lanes.	
		On-Street Terminal	Grouped bus stops spaced in skip-stop configuration that allow for multiple buses and/or bus routes to utilize the same location at the same time. Generally applied to congested urban corridors in need of high capacity bus service.	
	Station & Stop Elements	Small Transit Shelter	A basic shelter for low to moderate-volume bus stops. Focus should be on providing passenger comfort in a safe, well-lit environment offering protection from the weather.	

ELEMENT	SUB-ELEMENT(S)	EXAMPLE(S)	DESCRIPTION	PHOTO
		Large Transit Shelter	A longer shelter for moderate to high-volume bus stops. Focus should be on providing passenger comfort in a safe, well-lit environment offering protection from the weather.	
		Seating	A basic amenity of bus stops. Design should be based on comfort relative to the average duration of wait time. Options include benches, seats with raised separations, or leaning rails.	
		Fare Vending	Electronic machines that allow the purchase of single trips, add fare to tap cards, or generate proof-of-payment (PoP).	
		Passenger Information & Wayfinding	Information regarding bus stops, routes, and transfer points should be presented clearly and legibly through maps and schedules at highly frequented bus stops and available online. Wayfinding signage should be prominent and highly visible.	
		Transit Curbs	Curbs designed to allow buses to pull as close as possible to the platform, reducing both vertical and horizontal gaps. Tactics include concave or ramped curbs, tapered ends, and rubber or plastic bumpers. Edges be highly visible to pedestrians and riders.	
		Bus Pads	Strong and durable areas at bus stops that prevent damage and deformation of the roadway surface from the weight of buses. Usually made of concrete.	
		Green Infrastructure	Incorporation of landscaping into bus stops to increase aesthetic appeal, improve water quality and stormwater drainage, and providing opportunities for traffic calming and safer pedestrian environments.	

ELEMENT	SUB-ELEMENT(S)	EXAMPLE(S)	DESCRIPTION	PHOTO
		Bike Parking	Facilities that allow for safe bicycle parking and storage, facilitating first and last-mile connections with the bicycle network and lessening the need to bring bicycles on the bus.	
		Passenger Queue Management	Methods that organize and manage passenger boarding and alighting in constrained spaces with high passenger volume.	
Vehicle Consideration	Vehicle Size	Standard 40' Bus	Standard bus size, well-situated for travel on all street types.	
		Articulated 60' Bus	Higher-capacity bus, most often used on high-volume corridor or downtown streets with clearly delineated, exclusive right-of-way.	
	Boarding Type	Front Door	All passengers board through the front door only. Often paired with driver fare control.	
		Multi-Door	Passengers may board at multiple doors, usually located at least at the front and mid-section of the bus. Usually paired with proof-of-payment (PoP) fare systems.	
Roadway Accommodations	Vehicle Widths & Buffers	Standard 40' buses are typically 8.5 feet in width, with an additional foot of width on either side for mirrors. Lanes should be at least 11 feet wide to accommodate these buses.		

ELEMENT	SUB-ELEMENT(S)	EXAMPLE(S)	DESCRIPTION	PHOTO
		Design Speed	Speed should be considered as much an output of the design of the geometric environment as it is an input. Locational context is critical to ensuring safe design speeds for all users of the road.	
Intersections	Intersection Design	Shared Transit/Right-Turn Lane	Either a transit lane that accommodates right-turning vehicles and intersections with high right-turn volumes or a right-turn lane that permits through-movements for buses, particularly near stops.	
		Right-Turn Pocket	A right-turn lane adjacent to an offset bus lane that requires vehicles to fully cross the bus lane to make right turns. Applied only to intersections with high right-turn volumes that impede transit flow.	
		Dropped Transit Lane	A transit lane that stops before an intersection, giving priority to right-turning vehicles and through-traffic avoiding left-turn queues. Applied on narrow streets with high volumes.	
		Queue Jump Lane	Combines a dedicated transit facility with either a leading bus interval or signal priority to allow a bus to "jump" a queue of vehicles at intersections using the curbside space.	
		Transit Approach Lane/Short Transit Lane	Offset bus lanes that materialize on approach to intersections as the curbside lane transitions from parking to a right-turn lane, allowing buses to bypass vehicle queues at intersections.	
		Virtual Transit Lane	Curbside lanes that permit right turns only when transit vehicles are not present. Must be paired with transit signals and appropriate signage.	

ELEMENT	SUB-ELEMENT(S)	EXAMPLE(S)	DESCRIPTION	PHOTO
	Signals & Operations	Transit Signal Progression	A form of pre-timed transit signal priority that sets signal cycles on a progression to give buses traveling at an average speed less delay at red lights. Best applied with short signal cycles and offsets that account for dwell time at stops.	
		Active Transit Signal Priority (TSP)	Tools that modify signal timing or phasing to accommodate transit vehicles approaching the intersection. Must include technology to enable communications between transit vehicle and traffic signal controller.	
		Short Signal Cycles	Enables buses that have fallen behind schedule a chance to catch up by reducing delay at red lights. Best used when buses have unpredictable dwell times or there is no coordinated signal progression.	
		Turn Restrictions	Prohibits turning movements at certain intersections and shifting them elsewhere in the network to reduce bus delay from queuing vehicles. Best applied in grid street patterns.	
Transit Route Turns	Turn Radii	Transit vehicles require wider turning radii than other vehicles, usually between 20-30 feet. Lane width, buffer distance, and the presence of geometric obstacles such as curbside parking lanes and bulbouts affect the radius needed.		
	Recessed Stop Line	An increased distance between the stop bar and the intersection allows transit vehicles extra space to turn. Typically applied where buses occupy curbside lanes at small intersections with tight turns.		
	Transit-Only Turns	Restricting either left or right turns to buses only at particular intersections.		

ELEMENT	SUB-ELEMENT(S)	EXAMPLE(S)	DESCRIPTION	PHOTO
		Dedicated Turn Channel	A channelized turn created specifically for the use of transit vehicles. Typically applied at small intersections with frequent turns.	
Signs & Signals	--	Regulatory Signs	Typically communicate required or prohibited movements and/or times.	
		Flashing Beacons	Used to enhance overhead and/or regulatory signage visibility or to indicate when time-specific actions are in effect.	
		Overhead Signs	Used above transit lanes and transitways to alert drivers of critical information. Is often regulatory signage.	
		Dynamic Signs	Used to communicate critical information in a highly visible way as it happens.	
		Transit Signal Heads	Signal heads that communicate transit-specific movements to transit vehicles and clarify for other road users that the movement is transit-specific.	
Network Strategies	Transit Network	Network Design	A method of arranging transit lines and routes to optimize coverage, coordination, and efficiency. Spatially, transit networks most often take the form of a grid network, radial network, or multi-hub network.	

ELEMENT	SUB-ELEMENT(S)	EXAMPLE(S)	DESCRIPTION	PHOTO
		Route Simplification	Using direct, simple routes that maximize efficiency, save time, and are easy for users to navigate.	
		Distance Between Stops	Consolidating stops or modifying the distance between stops in order to balance travel time and network coverage.	
Multi-Modal Connections	Pedestrian Network Connections	All transit stops should be accessible by pedestrians, with continuous sidewalks and plentiful safe and legal pedestrian crossings at all intersections and at mid-block locations when the distance between intersections is high. Sidewalk width, pedestrian facility legibility, and an aesthetically-pleasing environment enhance the pedestrian network.		
	Bicycle Network Connections	All transit stops should be accessible by bicyclists, with a complete network that complements pedestrian and transit coverage. Parallel nearby bicycle facilities will help boost ridership, while bicycle parking/storage and the ability to securely bring bikes on buses will make connections easier.		
	Vehicle Access	Curbside parking or off-street parking lots or structures nearby to high-volume transit stops and transfer points will help facilitate the ease and use of transit through park-and-ride.		
System Wayfinding & Brand	Wayfinding	Route legibility and predictable wayfinding signage at and near transit stops improves ease of use, especially when multiple stops and/or routes are in close proximity.		
	Branding	A strong, simple, unified brand will increase the perception of transit network coverage and reliability.		

ELEMENT	SUB-ELEMENT(S)	EXAMPLE(S)	DESCRIPTION	PHOTO
Fares and Fare Collection	Payment Methods	Cash	Paid when boarding the bus. Time-consuming and discouraging to riders, but involves little extra expense on behalf of the transit agency.	
		Ticket Vending	Ticket purchased at fare machine located at transit stops or while on-board the vehicle.	
		Radio Frequency ID (RFID) Card	A reloadable card that is scanned either while boarding, alighting, and/or while on-board the vehicle.	
		Mobile Application	Fare is purchased via mobile application, producing a code that can be scanned while boarding, alighting, or on-board the vehicle or upon request by agency staff.	
	Fare Control	Proof-of-Payment (PoP)	A method of verifying payment for transit fare, either on-board when boarding, alighting, or upon request, or off-board through similar systems.	
		Driver Fare Control	Fare is paid while boarding the bus either through cash payment or driver verification of PoP.	
		Turnstiles	Use of turnstiles at enclosed stops or on buses to verify entry and exit is only by those with proper fare.	

## TECHNICAL MEMORANDUM

<p><b>To:</b> Bob Morrison City of Elk Grove 8401 Laguna Palms Way Elk Grove, CA 95758</p>	<p><b>From:</b> Vigen Davidian Iteris, Inc. 801 South Grand Avenue, Suite 530 Los Angeles, CA 90017</p>
<p><b>Date:</b> June 20, 2019</p>	
<p><b>RE:</b> WAM007 Elk Grove Bus Rapid Transit Early Implementation Study Technical Memo #2 – Opportunities and Constraints</p>	

### Introduction

Iteris, Inc. (Iteris) provided the City of Elk Grove (City) *Technical Memo #1 - Summary of Background Information* on January 7, 2019 for the *Bus Rapid Transit Early Implementation Study*. This *Technical Memo #2 – Opportunities and Constraints*, focuses on evaluating the existing Route 110 and land use along the corridor, and provides a series of considerations and recommendations for the City. This memo is organized in the following sections:

- Evaluation
  - Existing Fixed-Route Service
  - Existing land uses, densities and origins/destinations
  - Recommended BRT Elements
  - Preliminary Costs
  - Ridership Projections

### Evaluation

Iteris, in coordination with the City, conducted a planning-level evaluation of Route 110 service to assess the feasibility of implementing a Bus Rapid Transit (BRT) or Express Bus (ExBus) service along the Big Horn Boulevard Corridor. Performance metrics, station area characteristics and potential BRT elements from Technical Memo #1 were reviewed and applied to this evaluation. A review of the existing land uses along Big Horn Boulevard was also conducted to determine the constraints and opportunities for implementation of a BRT.<sup>1</sup>

Based on discussion with staff, the capital costs of a BRT system with its own guideway or lanes would not be possible with current capital resources, therefore the analysis focused on BRT elements to incrementally improve service which could be considered “BRT Lite” or ExBus service.

#### EXISTING FIXED-ROUTE SERVICE

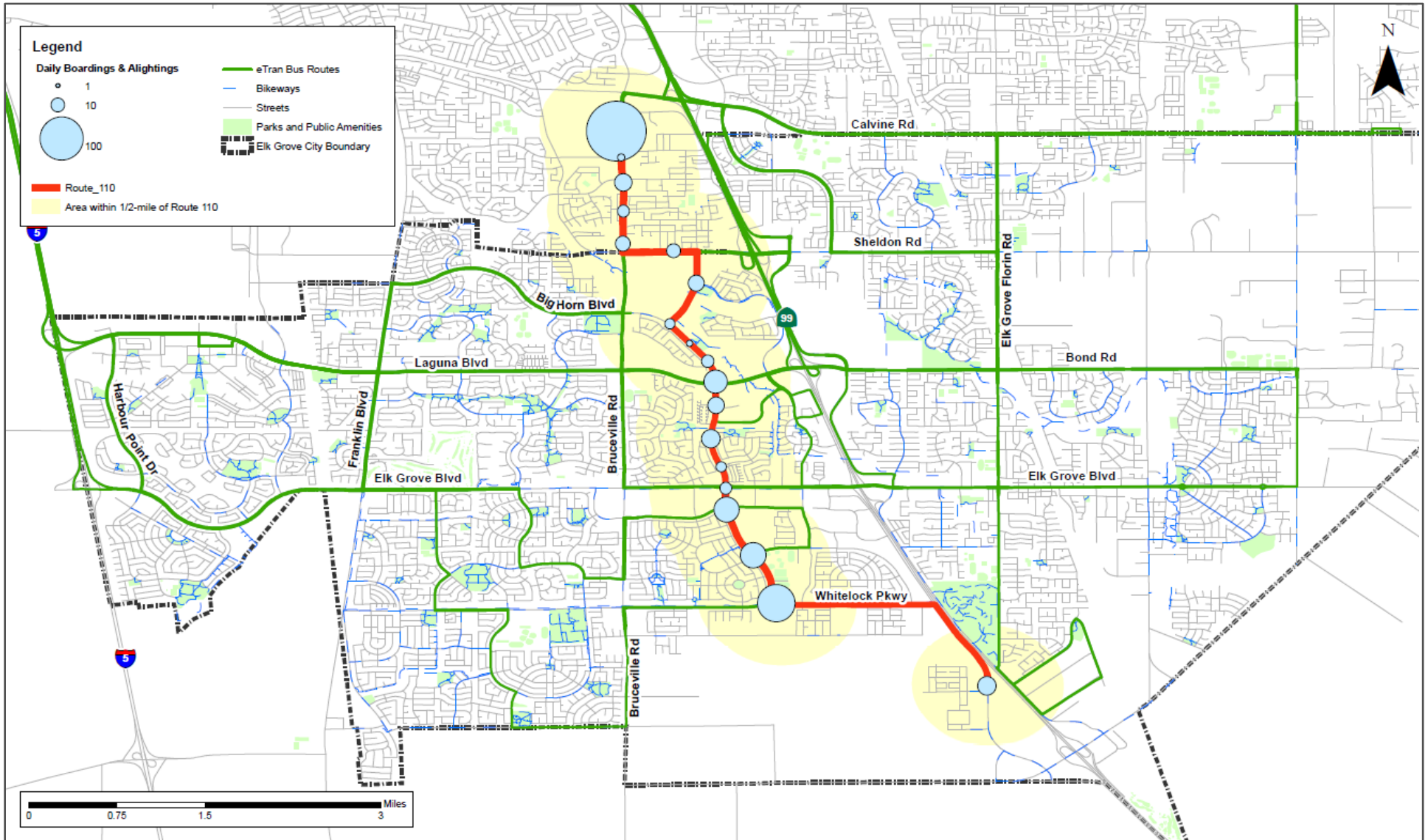
As stated in Technical Memo #1, total annual boarding’s for Route 110 is 38,660 —a monthly average of 3,220 riders.<sup>2</sup> Ridership patterns for the Big Horn Corridor show that the most utilized stops are concentrated at the Blue Line Cosumnes River College (CRC) station and Whitelock Parkway, at the north and south ends, respectively, as shown in **Exhibit 1**, by the relative size of circles around the stops/stations. Approximately 75% of boardings and alightings occur at the Blue Line Cosumnes River College station. The most heavily utilized stops include:

- Blue Line/Cosumnes River College and Whitelock Parkway by the Cosumnes River College
- Elk Grove Civic Center
- Elizabeth Pinkerton Middle School
- Cosumnes Oaks High School
- Lotz Parkway
- Civic Center Drive and Laguna Boulevard.

<sup>1</sup> Some data (pending from the City) were limited or not available for this evaluation, including existing service by hours and days, on-time performance, fare recovery ratios, engineering drawings, and fleet and operations costs.

<sup>2</sup> Overall for the annual period of November 2017 to October 2018.

Exhibit 1: Average Daily Boardings and Alightings – Map



Source: Iteris, 2018

Ridership patterns are also evident based on stop-level average daily boardings and alightings at both the northbound and southbound directions for the Route 110. As shown in **Exhibit 2**, ridership peaks at the Cosumnes River College station and in the Section between Elk Grove Boulevard and Whitelock Boulevard, serving the middle school and high school.<sup>3</sup> The lowest ridership areas are along the Lewis Stein Corridor, the Bruceville Corridor, the section from Laguna Boulevard to Elk Grove Boulevard, and Promenade Parkway. It should be noted that these sections have large tracts of undeveloped land.

**Exhibit 2: Route 110 Daily Ridership by Segment**

SECTION	ON			OFF			DISTANCE	STOPS	PER DISTANCE		PER STOPS	
	NB	SB	TOTAL	NB	SB	TOTAL			ON	OFF	ON	OFF
Cosumnes Light Rail	0	101	101	90	1	91	0.31	1.5	325	294	67	61
Bruceville Corridor	12	10	23	8	9	17	0.92	4	24	19	6	4
Lewis Stein Corridor	9	3	12	5	9	15	1.25	3.5	10	12	4	4
Big Horn to Laguna	18	4	22	3	17	20	0.51	3.5	42	40	6	6
Laguna to Elk Grove	15	6	21	8	19	28	0.88	4.5	24	32	5	6
Elk Gove to Whitelock	54	5	58	62	51	113	0.81	3.5	72	140	17	32
Promenade Pkwy	2	0	2	0	16	16	1.92	1	1	8	2	16

Source: Elk Grove 2017-2018 Route 110 data, 2018

Of the 41 bus stops (both directions) along the seven-mile corridor, five stops had all Passenger Bus Stop Amenities (e.g. Shelter, Seating, Lighting, Trash Receptacles and Signage) and eight stops had shelters only. It should also be noted that three locations did not have an adequate station accessible path to the bus door. **Exhibit 3** shows two station areas where passengers do not have an accessible path to the bus door. Further details of the Station Area Characteristics can be found in Technical Memo #1.

**Exhibit 3: Station Stops vs. Bus Accessibility**

**Station Access - Calvine and Sheldon Station Areas**



Looking midblock at the Northeast corner of Brucevill Road and Calvine Road (Left); Looking West along Sheldon Road (right)

**LAND USES**

For the planning analysis, the service coverage area for a local bus stop is generally defined to be within 0.25 miles (five-minute walk) and the service coverage area for a BRT stop as one-half mile (10-minute walk). As such, individuals who live, work and go to school within one-half mile of a transit stop generally constitute the majority

<sup>3</sup> The stops along Big Horn Corridor were consolidated into seven sections (two terminal stations and five midpoint) approximately in equal distance.

of the potential riders of the BRT service. New California Environmental Quality Act (CEQA) Guidelines provide streamlining for residential and office building projects within one-half mile of a major transit stop, which is defined as a “High Quality Transit Area” (HQTA)—a designation if headways would every fifteen minutes in the peak hours of service.

In the next step, dwelling units and number of employees were summed and analyzed for the Big Horn Corridor (Route 110 corridor) for existing and future conditions along the one-half mile service area of the route. It should be noted that the buffering feature of Geographic Information System (GIS) software can be used to draw service coverage circles around stops or the roadway, however that methodology would extend across rivers, freeways and other barriers that block walking access to the station. The more detailed analysis accounts for the actual street and pathway distance to the transit station. Generally, each stop has a smaller service area as barriers to walking exist in all cases. Nevertheless, the comparison between the “air distance” and “path distance” can describe the amount of street connectivity in station areas.

The population and employment in the Route 110 corridor was analyzed (see **Exhibit 4**) by placing half mile buffers around the linear route, the station areas as well as parcels within a half mile walking distance along streets or paths.

**Exhibit 4: Population and Employment Service Coverage of the Route 110 Corridor**

SERVICE COVERAGE AREAS	DWELLING UNITS		EMPLOYEES	
	EXISTING	FUTURE (2036)	EXISTING	FUTURE (2036)
Linear Route (1/2 mile radius)	8,406	11,038	11,625	20,085
Station area (1/2 air mile radius)	7,963	9,948	11,380	19,674
Half-mile walk	5,283	6,595	7,110	12,842

**Source:** Iteris, 2018 – Based on SACOG MTP/SCS (adopted 2016) forecasts provided by City of Elk Grove

Overall, there are about 8,000 dwelling units within the Route 110 corridor, with 5,300 units within walking distance of stop under existing conditions. Under future buildout conditions, 11,000 dwelling units are expected to be located in the corridor with 6,600 within walking distance of stops. There are currently 11,600 employees in the corridor with 7,100 employees within walking distance of stops under existing conditions. Under future conditions 20,000 employees are expected to be in the corridor and 12,800 within walking distance. That represents a 30% increase in dwelling units within the corridor and a 75% increase in employment from existing to future conditions.

The current bus stops cover 95% of the linear route—which involves multiple overlapping station areas due to close stop spacing in the Route 110 service. The half-mile walk service coverage is generally 60% for the dwelling units and employment within the station area air radius—meaning that street and path connectivity allow for a half-mile walk for 60% of households and workers that are within a half-mile of the stop as the crow flies.

### ADDITIONAL ANALYSIS – INCREASED DENSITY

At the request of the City, additional land use scenarios were developed. For the purposes of forecasting, the following two additional land use scenarios were developed: (a) land use intensity for future development was doubled and (b) tripled. As shown in **Exhibit 5**, the tripling of future development estimates would double the total number of dwelling units and triple the total number of employees in the corridor.

**Exhibit 5: Service Coverage of the Route 110 Corridor**

SERVICE COVERAGE AREAS	DWELLING UNITS				EMPLOYEES			
	EXISTING	FUTURE BASE	FUTURE DOUBLE	FUTURE TRIPLE	EXISTING	FUTURE BASE	FUTURE DOUBLE	FUTURE TRIPLE
Linear Route (1/2 mile radius)	8,406	11,038	13,670	16,302	11,625	20,085	28,545	37,005
Station area (1/2 air mile radius)	7,963	9,948	11,933	13,918	11,380	19,674	27,968	36,262
Half-mile walk	5,283	6,595	7,907	9,219	7,110	12,842	18,574	24,306

**Source:** Iteris, 2018 – Based on SACOG MTP/SCS (adopted 2016) forecasts provided by City of Elk Grove

## OPPORTUNITIES AND CONSTRAINTS

### Corridor Opportunities

The nature of the corridor presents opportunities that could potentially boost ridership and the effectiveness of a BRT system. Namely, the corridor could effectively serve as a feeder extension to the Blue Line Light Rail Transit (LRT) south from its terminus at Cosumnes River College station. Access to the Big Horn Corridor can be enhanced by expanding connections to pedestrian and bicycle facilities.

Additional avenues for multimodal connections in Elk Grove could include the expansion of the JUMP bike share program and of electric scooter sharing. JUMP is a bike share service administered by Uber that began operating in the Sacramento region in May 2018, with 900 “dockless” electric-assist pedal bikes rolled out during the summer of 2018 in Sacramento, West Sacramento, and Davis.<sup>4</sup> The program has proved enormously popular, with secondary rounds of community feedback issued by JUMP already suggesting hubs at Cosumnes River College and Elk Grove Regional Park. Similar to JUMP dockless scooters could help facilitate first and last-mile connections to and from the corridor to surrounding destinations.

The corridor itself is bounded by numerous vacant parcels which; if particularly, up-zoned and developed in a compact manner with a mix of land uses, could increase the number of residences and jobs within walking or biking distance. As such, the addition of the Southeast Policy Area and development of the Wilton Rancheria/former Elk Grove Outlet Collection commercial site would add a primary destination and significant employment to the southern end of the corridor, facilitating further origin-destination trips along its entire length.<sup>5</sup>

Other opportunities stem from the physical design of the corridor itself, with a wide right-of-way, generous buffer areas, and well-developed connections to pedestrian and bicycle infrastructure and other bus lines. As development in Elk Grove increases, there is also potential for implementation of more advanced elements of a BRT system. These can include the potential implementation of dedicated bus lanes and additional curbside pull-out stops that allow the bus to completely exit the travel lane and pick up and drop off passengers without interfering with vehicular traffic.

The opportunity to advertise and brand transit service in the corridor can be a major contributor to increased ridership and utilization of Route 110 and the system as a whole. While stops are demarked by signage, more visible signage, demarcation and information can be displayed to advertise the service and brand transit service with clear destinations and frequency. Perception of bus service as an unreliable or limiting trip choice often stems from its lack of distinction and identity. Branding and advertisement, even in the absence of service improvements, can be an effective strategy to increase ridership.

### Corridor Constraints

Despite considerable opportunities, the corridor is not without challenges. The existing low-density and suburban character of the City lends itself to high rates of automobile usage.<sup>6</sup> While vacant parcels could subsequently be developed as higher-density, mixed-use and transit-oriented, the potential for redevelopment on currently-occupied tracts is limited. Additionally, the corridor provides no direct access to Old Town Elk Grove or major employers along the southeastern or western edges of the City, such as the Apple, Inc. Distribution Center. Riders would have to transfer between bus lines to access these employment centers, likely requiring higher travel times than via private automobile. Studies often show time savings as one of the primary factors incentivizing mode shift to transit, and if such savings do not exist over automobile travel, it is unlikely that discretionary drivers would switch to transit in significant numbers.

Furthermore, while the physical design of the corridor offers ample opportunities for the incorporation of BRT design elements, it is simultaneously discouraging to active transportation users accessing the transit stops. Wide,

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<sup>4</sup> <https://www.sacog.org/bike-share>

<sup>5</sup> As stated in Technical memo #1, the largest anticipated growth area is in the southern portion of the City, between Whitelock Parkway and Kammerer Road, from Bruceville Road to SR-99.

<sup>6</sup> As stated in Technical Memo #1, Elk Grove has 23% more cars per household than the national average.

multi-lane major arterials encourage higher vehicle speeds, while long, uninterrupted crossing distances reduce both real and perceived safety among pedestrians and bicyclists. In addition, crossings are often spaced at great distances while sidewalks are discontinuous in many locations where there are vacant parcels.

A general lack of congestion to make bus travel time-or cost competitive with the automobile is also a significant constraint in the corridor under existing conditions. Automobile travel is most effective in low to medium density areas with extensive roads and parking, which transit service is effective and facilitates the densification of land use and operation in areas where land area and building space comes at a premium. The City of Elk Grove is still developing and travelers in many areas of the City are not pressured to consider transit travel.

The Big Horn corridor holds promise to leverage transit investments of the Blue Line and e-tran feeder services as well as to enable land development. Since BRT is flexible, it can be built over time to accommodate the growing transportation needs for the City of Elk Grove. BRT is a system designed to improve capacity, reliability and travel time compared to conventional bus service and increase competitiveness with auto travel in the corridor. It can also be developed to be somewhat comparable to rail transit service but at a much lower cost. The next section discusses recommended BRT Elements for the City to consider in the near- and long-term.

## Recommended BRT Elements

It should be emphasized that there is no one singular description for a BRT System; rather there exists a range of strategies under the general BRT terminology to improve the speed, reliability, comfort and cost-effectiveness of a bus service. The following BRT elements are recommended for implementation along the Route 110 corridor, in the near-term (2020) and long-term (by 2036), based on suitability of application to the corridor and discussions with City staff:<sup>7</sup>

### Near-Term

- Branding of the service to identify, promote and advertise the service
- Bus Signal Priority (BSP) at signalized intersections to improve travel time
- Stop elimination to improve travel time
- Stop amenities of shelters, seating, lighting, and bicycle parking to improve the comfort and waiting experience
- Option to purchase two (2) additional transit vehicles to reduce headways to 15 minutes matching the Blue Line LRT schedule at the Cosumnes River College station

### Long-Term

- Further and enhanced branding
- Stop access improvements of mid-block crossings, pedestrian refuge islands at large intersections, and improved connections to the sidewalk and bike path network to improve connectivity to the service
- Curbside pull-out areas at stops to remove the buses from traffic lanes at stops, especially far-side stops
- Passenger information and wayfinding technology
- Mobile application for schedule, arrival time and ticketing
- Consideration of branded pavement treatments and exclusive transit lanes, where applicable

**Attachment A** contains a table, which includes explanations and examples of the potential types of BRT Elements that could be implemented and **Attachment B** includes Potential Station Area Improvement along the corridor.

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<sup>7</sup> An optional overlay (BRT or ExBus) operating separate from Route 110 was considered but was not recommended at this time based on low ridership at several stations and redundant operational costs. For the purposes of this analysis and recommended improvements, only changes and improvements to Route 110 were considered.

### Exhibit 6: BRT Element Unit Costs Assumptions

BRT ELEMENT	COST ASSUMPTION
Remove/Relocate Stop	5,000
Branded Pavement Coloring at Stop	10,000
Curbside Pull-Out Stop	110,000
Mid-Block Crossing	50,000
Pedestrian Refuge Island	100,000
Connection to Ped. Facilities	85,000
Connection to Bike Facilities at Whitelock	1,300,000
Small Transit Shelter	12,000
Seating	1,500
Lighting	5,000
Trash Disposal	1,200
Signage	500
Bike Parking	750

### Exhibit 7: Year One (2019/2020) Capital Cost Estimate of Recommended BRT Elements

RECOMMENDATIONS	COSTS
Stop Relocation/Removal (10)	50,000
5 of 40 Station Access Improvements (midblock crossings, refuge islands, ped. facilities)	448,125
Station Amenities (seating, lighting, trash, signage, bike parking)	373,950
Signal Preemption (20 intersections, 10 buses)	280,000
Branding	50,000
Purchase two vehicles (option)	1,200,000
<b>Subtotal Without Two New Vehicles 2019/2020</b>	<b>\$1,202,075</b>
20% Contingency Design and Procurement	240,415
<b>Total Without Two New Vehicles 2019/2020 Capital Cost</b>	<b>\$1,442,490</b>
<b>Subtotal With Two New Vehicles 2019/2020</b>	<b>\$2,402,075</b>
20% Contingency Design and Procurement	480,415
<b>Total With Two New Vehicles 2019/2020 Capital Cost</b>	<b>\$2,882,490</b>

Source: Iteris, 2019

### Exhibit 8: Operations and Maintenance cost of Year One (2019/2020) Recommended BRT Elements

RECOMMENDATIONS	COSTS
<b>Total Annual Operations and Maintenance Cost Without New Vehicles</b>	<b>\$60,104</b>
Annual Operations and Maintenance (assumed 5% of Capital Cost)	120,104
Two Additional Vehicles (Operating Expense)	478,520
<b>Total Annual Operations and Maintenance Cost of BRT Elements</b>	<b>\$598,624</b>

Source: Iteris, 2019

### Exhibit 9: Long-Term Capital Costs of Recommended BRT Elements

RECOMMENDATIONS	COSTS
Curbside Pull-Out Stops (6)	660,000
Station Access Improvements (35 of 40 Improvements)	4,436,875
Passenger Information & Wayfinding	25,000
Mobile Application	108,000
<b>Subtotal Long-Term Elements</b>	<b>5,229,875</b>
2019/2020 Capital Elements (construction)	2,882,490
20% Contingency Design and Procurement of Long-Term Elements	\$1,045,975
<b>Total Long Term Capital Costs</b>	<b>\$9,158,340</b>

Source: Iteris, 2019

### Exhibit 10: Additional Annual Operations and Maintenance cost of BRT Elements

RECOMMENDATIONS	COSTS
Year One Annual Operations and Maintenance (assumed 5% of Capital Costs)	120,104
Long-Term BRT Element Annual Operations and Maintenance (assumed 5% of Capital Costs)	261,494
Near-Term Operations and Maintenance Annual Cost (from Exhibit 7)	478,520
<b>Total Annual Operations and Maintenance Cost in 2019 dollars</b>	<b>\$860,118</b>

Source: Iteris, 2019

## Ridership Forecast

Ridership forecasts were developed based on application of parameters which take into account existing and future land use and corridor transit conditions and service characteristics, as noted in the following sections.

### Baseline Ridership

The average daily ridership for September and October of 2018 was approximately 5,000 riders per month or 250 riders per day and was used as a baseline period for analysis purposes. Ridership was summarized by station area and direction. The existing ridership generally forms the baseline of the ridership projections.

Growth in Blue Line ridership was based on the forecasted increase in Research Analysis Districts (RADs) worker flow forecasts from the Sacramento Council of Governments (SACOG) in the Blue Line corridor multiplied by the proportion of Blue Line riders utilizing the Route 110 corridor. This assumed the same proportion of Blue Line ridership from the Route 110 corridor under existing and future conditions. The existing commuters from Elk Grove to the three RADs in the Blue Line corridor to Downtown Sacramento totaled 9,800. Given the existing daily Blue Line commuters (1,260), 12.9% of the corridor commuters are Blue Line commuters from the Cosumnes River College Blue Line station. Growth in commute trips of an additional 1,600 corridor commuters with a proportional share using the Blue Line would result in 319 future Blue Line commuters utilizing the Route 110 corridor to access the light rail at the Cosumnes River College station. For the future base of ridership, the northbound boarding of these commuters were distributed in proportion to existing Route 110 boardings while the southbound boardings were allocated to the Cosumnes River College station.

### Travel Time

Travel time between stops was derived from the Route 110 schedule and the distance between stops. The amount of time in transit and dwelled at stops was calculated as follows. Stops were allotted 20 seconds of dwell time per stop and the difference between the free flow speed of 40 miles per hour (mph) from the time between stations (plus stop time) was allotted to intersection delay. Major intersections with delay of the vehicles were Laguna Boulevard, Elk Grove Boulevard and Whitelock Parkway. Travel time savings from eliminated stops is 20 seconds per stop and bus signal priority improvements reduce signal delay by 20%. The boardings from eliminated stops was redistributed north and south to its adjacent intersections within one-half mile.

### Land Use

The two land use/demographic factors used in forecasting ridership are dwelling units and employees. Dwelling units were derived from existing land use, current development projects from the City of Elk Grove's [website](#), and General Plan land use for vacant land, not currently in development. Employment was based on the SACOG 2020 (used for near-term conditions) and 2036 employment projections. These employment projections were distributed amongst each Traffic Analysis Zones (TAZ's) commercial parcels in proportion to the area of the parcel.

Two distances were used for the station area Land Use—one-half mile walking distance and one-half mile air distance. The half-mile walk service coverage is generally 60% of the dwelling units and employment within the station area air radius—meaning that street and path connectivity allow for a half-mile walk for 60% of households and workers that are within a half-mile of the stop as the crow flies. The% of land use with unique (non-overlapping) access to station areas was estimated for each stop area to avoid double counting in the growth forecasting. The unique access ranged from 10% to 35%. Land use is used twice in the ridership forecast:

- The natural growth in households and employment was applied to the baseline ridership to produce a future baseline of natural growth.
- Additional ridership due to access improvements are estimated as a percentage of the share of additional air radius land uses that are accessible to the transit station above the baseline half-mile walking distance.

### BRT Elements

Adjustments in ridership forecasts due to implementation of BRT elements was made using travel time and service elasticities based on estimated changes in comfort, service, frequency and travel times, as applicable, when BRT service is proposed to overlay existing bus routes and the investments are relatively small-scale.<sup>8</sup> The ridership impact of BRT components was developed by factors applied to boardings at the stop level, Stop Measures and Station Access, and at the line level, Line Measures. These factors are summarized in **Exhibit 14** along with their source.

### Near- and Long-Term Projections

Ridership was forecast for the recommended elements in the near-term (2020) and buildout (2036) using City and SACOG land use data. Based on the elements recommended for 2019/2020, the near-term ridership is forecast to increase from approximately 250 boardings per day to 330 boardings per day—a 33% increase in ridership. The near-term implementation of 15-minute headways with two new vehicles is forecasted to increase ridership by 20 riders per day. Future baseline land use growth is forecast to increase ridership by 350 per day—a 140% increase in ridership over the existing conditions. This is due to growth in dwelling units and employment in the study area and increased utilization of the Blue Line for commuting to/from Sacramento. By buildout for long-term (2036), the daily ridership is forecast to be 1,475 with all recommended elements implemented—more than double the ridership growth without the BRT elements. See **Exhibit 11**.

**Exhibit 11: Ridership Projections - Existing Land Use Densities**

POTENTIAL IMPROVEMENTS / RECOMMENDATIONS	DAILY RIDERSHIP	CAPITAL COSTS	TOTAL CHANGE FROM BASE	PERCENT CHANGE FROM BASELINE
Existing (2019)	250	\$-	0	0.00%
Near-Term (2020) with BRT Elements	330	\$1,202,075	83	33%
Near-Term (2020) with Two Vehicles	350	\$2,602,740	103	40%
Future Land Use Buildout (2036) no BRT elements	600	\$-	350	140%
Long-Term (2036) with all BRT Elements	1,475	\$5,936,340	875	145%

Source: Iteris, 2019

### Increased Land Use Densities

To illustrate the relationship of land use development to ridership, two land use development scenarios for the corridor’s vacant land were investigated. The first doubled the density of future development in the corridor and the second tripled the density in the corridor. By doubling the baseline development density on vacant land in the corridor, in the buildout conditions ridership is forecast to be 1,770. Tripling the baseline development forecast for land use on vacant land forecasted 2,210 daily boardings. See **Exhibit 12**.

**Exhibit 12: Ridership Projections - Density Scenarios for 2036**

POTENTIAL IMPROVEMENTS / RECOMMENDATIONS	DAILY RIDERSHIP	TOTAL CHANGE	PERCENT CHANGE
Long-Term with all BRT Elements	1,475	-	590%
Density Scenario #1 – Doubling	1,770	295	20%
Density Scenario #1 – Tripling	2,210	735	50%

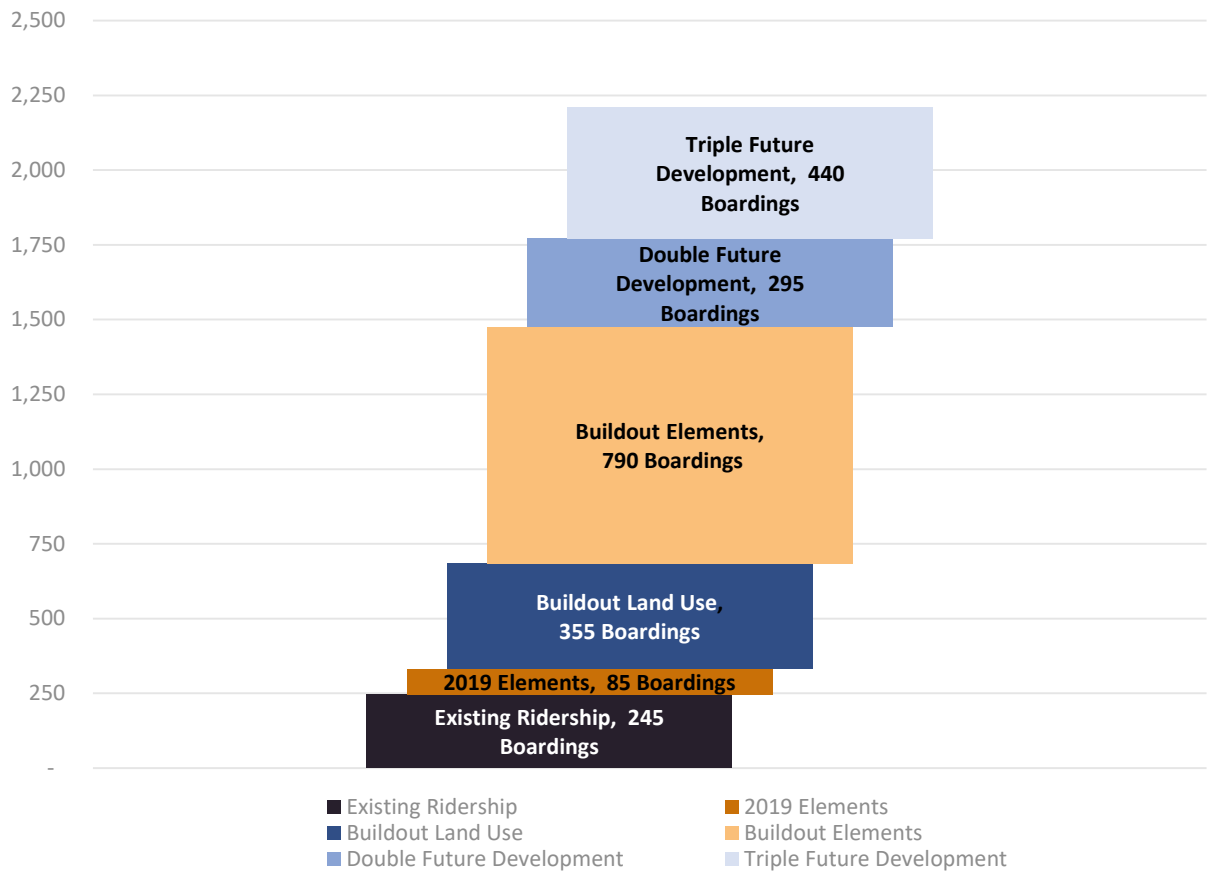
Source: Iteris, 2019

The ridership forecast elements are shown in **Exhibit 13** with incremental ridership improvements due to bus service elements in orange and land use development’s contribution in blue. The first increment is the existing

<sup>8</sup> Transit Cooperative Research Program Report 118 Bus Rapid Transit Practitioners Guide page 3-15).

daily ridership of 250 boardings per day. The next increment is the near-term implementation of recommended BRT elements adding another 80 riders to total 330 daily riders. The buildout of the vacant land uses in the corridor is expected to increase ridership by 355 riders by 2036. If the additional recommended BRT elements were to be implemented under the buildout land use conditions, the combined improvements of near-term and long-term BRT elements would attract another 790 daily riders. Through a combination of improved service, station and access amenities and clearer service connected to Blue Line operations, the long-term forecasted daily ridership would total 1,475 boardings. The doubling of the intensity of development of vacant parcels is expected to increase ridership by another 295 riders to 1,770 boardings per day with tripling the intensity of vacant land development potentially adding 440 riders to total 2,210 boardings per day.

**Exhibit 13: Ridership Forecast Breakdown: Additional Daily Boardings by Category**



**Exhibit 14: Ridership Forecast Factors**

CATEGORY		RIDERSHIP CHANGE	SOURCE
Stop Measures	Stop Amenities	Shelter	2%
		Unique Shelter	2%
		Illumination	2%
		Security Phones	3%
		Bicycle Parking	3%
		Passenger Amenities	3%
		Passenger Services	2%
	ITS Imps	Pass Info at Stops	7%
		Pass info at Vehicles	3%
	Running Way (pick one)	Grade Separated Exclusive ROW	20%
At-Grade Exclusive ROW		15%	
			Bus Rapid Transit Practitioner's Guide (Exhibit 3-22)

		CATEGORY	RIDERSHIP CHANGE	SOURCE	
Line Measures		Median Busway	10%		
		Bus Lane	5%		
		Mixed Traffic	0%		
	Vehicles	Conventional	0%	Bus Rapid Transit Practioner's Guide (Exhibit 3-22)	
		Unique	5%		
		Multi-Door	5%		
		Level Boarding	5%		
	Branding	Vehicles	5%	Bus Rapid Transit Practioner's Guide (Exhibit 3-22) (modified by consultant)	
		Stations	5%		
		Brochures/other	5%		
	Service	All-Day Service	4%	Bus Rapid Transit Practioner's Guide (Exhibit 3-22)	
		Clear Service	4%		
		Off-Vehicle Fare Collection	3%		
		Mobile Tickets	3%		
		Headway	Up to 6%		Bus Rapid Transit Practioner's Guide (Exhibit 3-11 Metro Ventura)
		Travel Time	Up to 10%		Bus Rapid Transit Practioner's Guide (Exhibit 3-11 Metro Ventura)
		Stop Elimination (component of travel time)	20 seconds per stop		Transit Capacity and Quality of Service Manual
	Station Access	Previous Factors x New Potential New Riders	Derived		
		Signal Priority (component of travel time)	20% reduction in Intersection Delay	An Overview of Transit Signal Priority. Intelligent Transportation Society of America, Washington, D.C., July 2002. (Exhibit 4-40 Portland, OR)	

Source: Iteris, 2018

## Financial Performance - Benefit/Cost Analysis

The financial performance analysis uses costs and ridership performance to analyze benefit to cost ratios for the recommended potential service improvements. The capital, maintenance and operations cost of BRT improvements are compared to their relative benefit in supporting ridership. The financial performance measures which are used are:

- Operational Expenses per Rider
- Farebox Recovery (COA FY 2022 Target: 20%)

Technical memorandum 1 reference a measure of Annual Capital Cost per Rider (existing and new riders), which would only be applicable if multiple scenarios were compared. Since only one recommended scenario was developed this was not included.

### Annual Operational Expenses per Rider

Annual operational expenses per rider were calculated for one annual period with the near-term (one to two years) improvements and the long-term (by 2036) improvements. Annual ridership was calculated using factors based on the existing variations in travel patterns over the course the year. The forecasted daily boardings multiplied by a monthly factor of 20.66 and an annualizing factor of 7.57 based on a peak monthly (September 2018) boardings of 5,104 used for daily the baseline annual ridership of 38,661. Applying these factors to scenarios with BRT improvements resulted in forecasts of annual ridership of 51,584 with the near-term improvements (30 minute headways), 54,765 (15 minute headways) and 230,870 for the long-term improvements on an annual basis.

Operating expenses were based on the annual operating expenses during the period of November 1, 2017 to October 31, 2018 when the operating expense of Route 110 was \$478,520. The expense of doubling the buses used in service from two to four was assumed to double the operating expense and the expense of operations and maintenance of

other BRT elements' capital improvements was estimated at 5% of the construction cost on an annual basis as shown in **Exhibit 10**. Operating expense per revenue hour was based on 7,608 revenue hours during the November 1, 2017 to October 31, 2018 for existing conditions and double the revenue hours to 15,216 in the near-term and long-term with BRT elements. Costs are in 2019 dollars and were not escalated and adjusted for inflation.

**Exhibit 15: Estimated Operating Expenses vs. Expected Boardings\***

	EXISTING	NEAR-TERM EXBUS – 30 MINUTE HEADWAYS	NEAR-TERM EXBUS – 15 MINUTE HEADWAYS	LONG-TERM BUILDOUT OF LAND USE	LONG-TERM BRT IMPROVEMENTS
Daily Boardings (peak Month)	5,104	6,820	7,230	12,400	30,479
Annual Boardings	38,661	51,660	54,765	93,925	230,870
Annual Operating Expenses	\$478,520	\$538,624	\$1,077,143	\$478,520	\$1,338,637
Annual Operating Expense per Boarding	\$12.38	\$10.43	\$19.67	\$5.09	\$5.80
Annual Operating Expense per Revenue Hour	\$62.90	\$70.80	\$70.79	\$31.45	\$87.98

Source: Iteris, 2019

\*All numbers are in 2019 dollars

As shown in Exhibit 14, existing operating expenses per boarding are \$12.38. The initial near-term investment change the operating expense per boarding to \$10.43 or \$19.67 with two additional vehicles. By the completion of long-term BRT element investment, the ridership is forecasted to increase and reduce the operating expense per rider to \$5.80.

#### Farebox Recovery Ratio

The farebox recovery ratio is a metric that compares the total fares collected to the overall operating and administrative costs of a transit agency over the course of a year and identifies what portion of the overall costs of running transit services are actually recovered by the funds collected from the riders, as opposed to subsidies or funds from other sources. The systemwide target of the COA for FY 2022 is a 20% farebox recovery.

The following analysis applies some assumptions for fare collection to the annual operating expenses in **Exhibit 15**. Exact Farebox collection data was not available so it was assumed the average fare of riders on Route 110 is \$2.00 to account for a base fare of \$2.25 with some reduced ticket prices for students and monthly pass holders. Based on the values in **Exhibit 15**, **Exhibit 16** shows farebox recovery ratios of 16% under existing conditions, 110%9% in the near-term (10% with two additional vehicles) with BRT elements, and 38% in the long-term with BRT elements.

**Exhibit 16: Estimated Operating Expenses per Boarding**

	EXISTING	NEAR-TERM EXBUS – 30 MINUTE HEADWAYS	NEAR-TERM EXBUS – 15 MINUTE HEADWAYS	LONG-TERM BUILDOUT OF LAND USE	LONG-TERM EXBUS
Annual Operating Expenses	\$478,520	\$538,623	\$1,077,144	\$790,920**	\$2,212,564**
Annual Farebox (\$2 per Boarding)	\$77,322	\$103,320	\$109,530	\$185,716***	\$461,741***
Farebox Recovery Ratio	16%	19%	10%	23%	21%

Source: Iteris, 2019






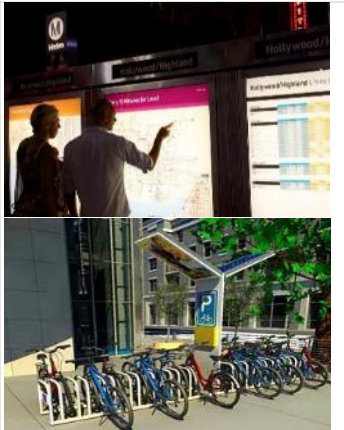
\*\*assumes 3% inflation for Operating expenses between now and 2036.



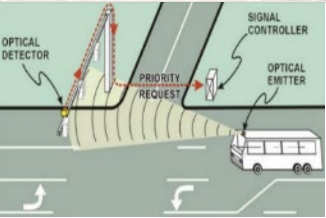



\*\*\*assumes the average farebox rate stays the same between now and 2036.

As shown, near-term investments would increase ridership increase the farebox ratio, with two additional vehicles operating expenses at a higher rate than ridership growth, however over the long term period, BRT improvements could double the farebox recovery of Route 110, almost 15% above the systemwide goal of 20%.

# APPENDIX A BRT ELEMENTS

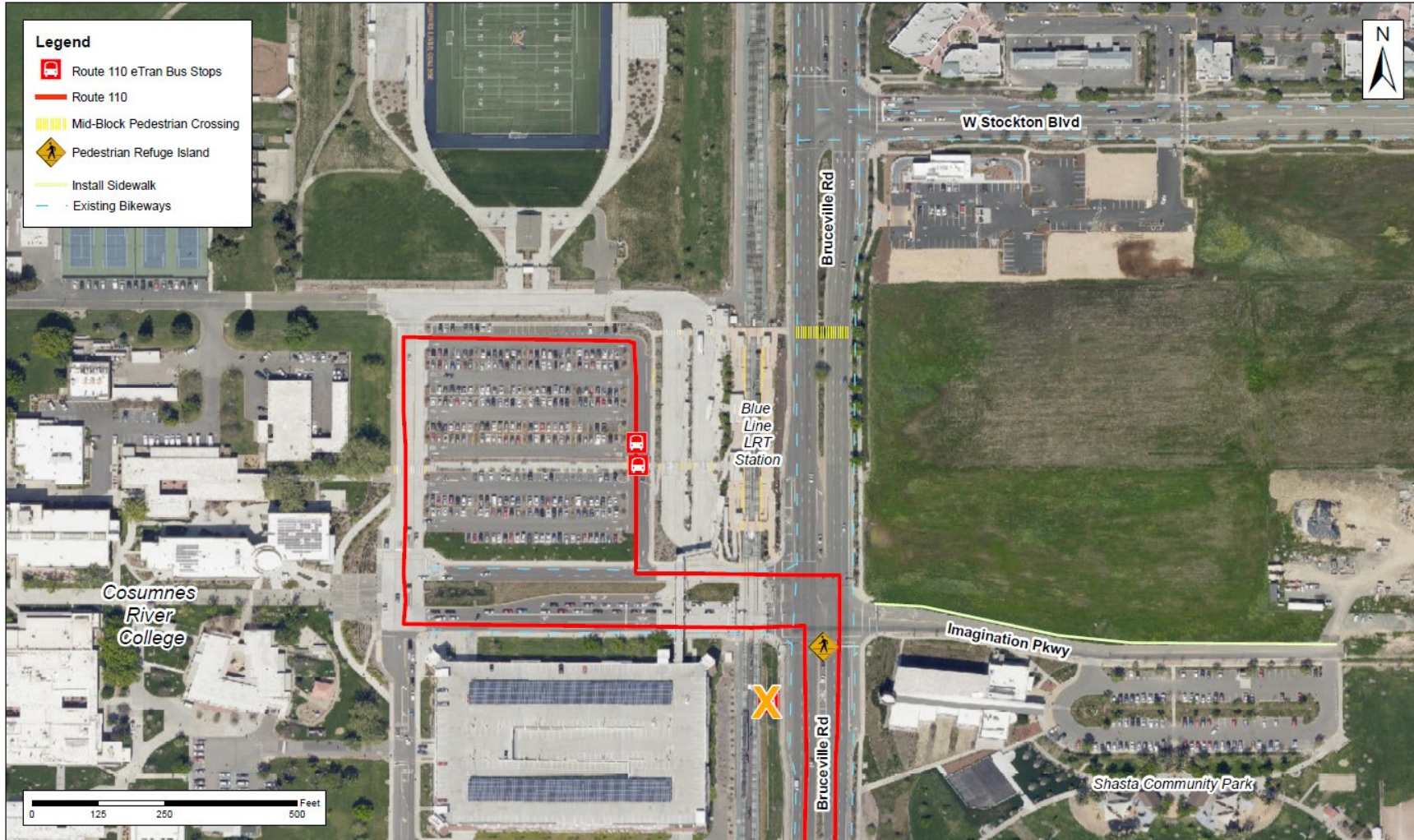
ELEMENT	SUB-ELEMENT(S)	EXAMPLE(S)	DESCRIPTION	PHOTO
Bus Stations & Stops	Station Reconfiguration	Relocate Stop(s)	Relocate the bus stop in relation to the intersection. Can either be adjacent to the bus travel lane (in-lane) or require the bus to pull over to the curb (pull-out). Can be on the near or far side of the intersection or at a mid-block location.	
		Remove Stop(s)	Consolidate stops or modifying the distance between stops in order to balance travel time and network coverage.	
		Branded Pavement Coloring at Stop	Provide branded pavement coloring at bus stops. May either be paint, thermoplastic, methyl methacrylate (MMA), or embedded color. May need frequent replacement under high volumes of heavy vehicles. Anti-skid treatments can be applied.	
		Curbside Pull-Out Stop	Upgrade bus stops to full curbside pull-out stops that prioritize through-traffic in areas where in-lane stops would be problematic and avoid conflict with the bike lane.	
	Station Access	Pedestrian Crossings	Install high-profile pedestrian crossing at mid-block or intersection locations to reduce the distance between safe crossing locations and improve access to bus stops.	
		Pedestrian Refuge Island	Install median pedestrian refuge islands at locations with wide crossing distances. Guidelines recommend installation where a pedestrian has to cross three or more lanes of traffic in each direction.	
		Connections to Pedestrian Facilities	Expand sidewalks to all service all bus stops and ensure there are connections between the sidewalk and curb at stops.	

ELEMENT	SUB-ELEMENT(S)	EXAMPLE(S)	DESCRIPTION	PHOTO
		Connections to Bike Facilities	Expand bikeways to service all bus stops.	
	Station Amenities	Small Transit Shelter	Install small transit shelters at each bus stop. Focus should be on providing passenger comfort in a safe, well-lit environment offering protection from the weather.	
		Seating	Install seating at each bus stop. Design should be based on comfort relative to the average duration of wait time. Options include benches, seats with raised separations, or leaning rails.	
		Lighting	Install pedestrian-level lighting at each bus stop. Focus should be on improving safety as well as comfort. Lighting can be installed in tandem with transit shelters.	
		Trash Disposal	Install trash receptacles at each bus stop. Staff must be dispatched to routinely remove trash from site.	
		Bike Parking	Install facilities that allow for safe bicycle parking and storage at select bus stops. This will facilitate first and last-mile connections using the bicycle network and lessen the need to bring bicycles on the bus.	

ELEMENT	SUB-ELEMENT(S)	EXAMPLE(S)	DESCRIPTION	PHOTO
System-wide Improvements	Peak-Only Bus Lane	Restricts access for general vehicle traffic, allowing buses only during peak traffic periods.		
	Acquire Additional Rolling Stock	Acquire new standard-size 40' buses to increase service and reduce headways.		
	Signal Improvements	Various signal improvements that may include customized signal timing or phasing modifications, signal synchronization, or active transit signal priority (TSP must include technology to enable communications between transit vehicle and traffic signal controller).		
	Passenger Information & Wayfinding	Ensure passenger information is available regarding routes, schedules, and transfer points on buses and online. Route legibility and predictable wayfinding signage at and near transit stops improves ease of use, especially when multiple stops and/or routes are in close proximity.		
	Branding	Use a strong, simple, unified brand will increase the perception of transit network coverage and reliability.		
	Mobile Application	Allow fare purchase via mobile application, producing a code that can be scanned while boarding, alighting, or on-board the vehicle or upon request by agency staff.		

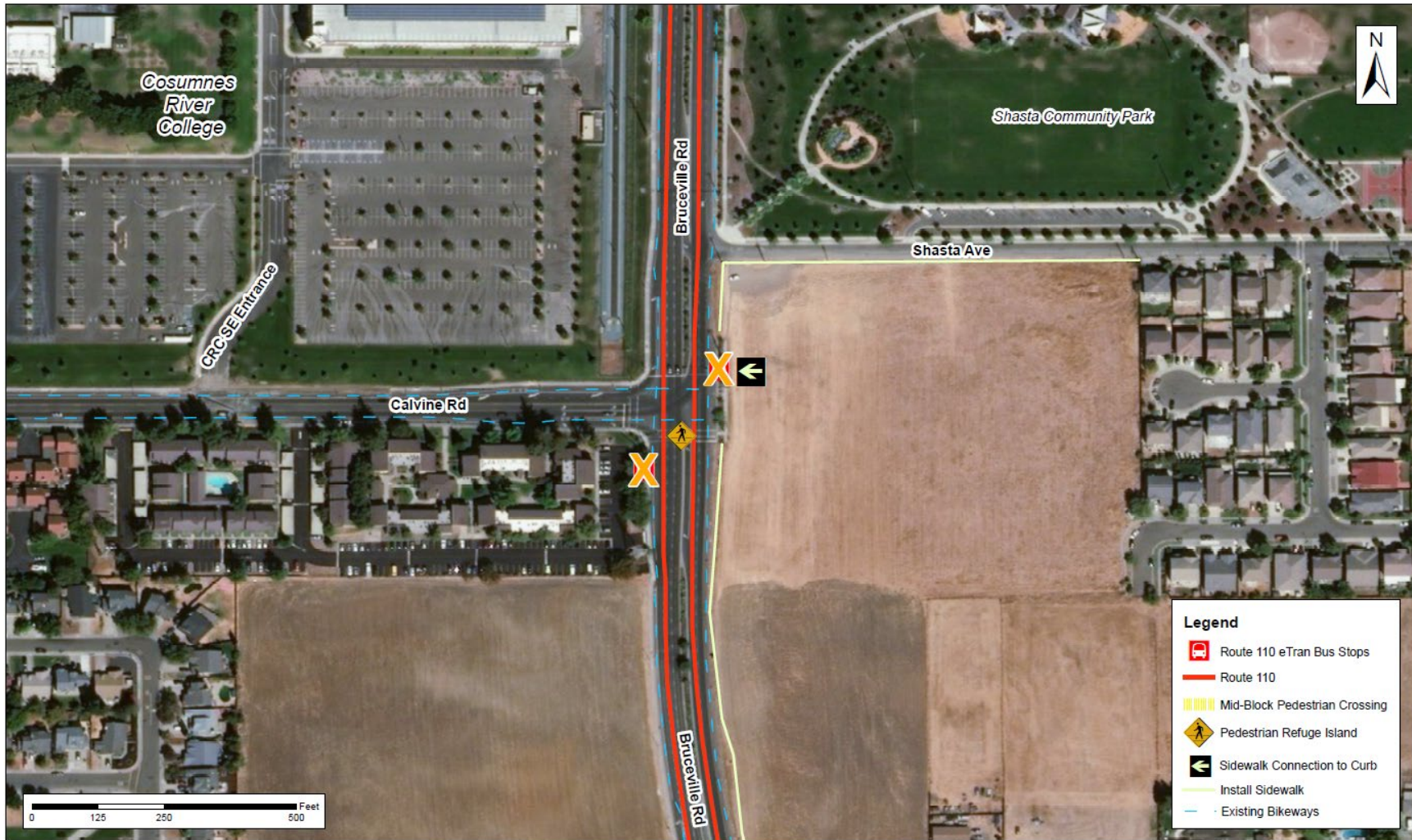
## APPENDIX B STATION AREA IMPROVEMENT RECOMMENDATIONS

### 1. Cosumnes River College/Blue Line LRT Station Area Potential Improvements



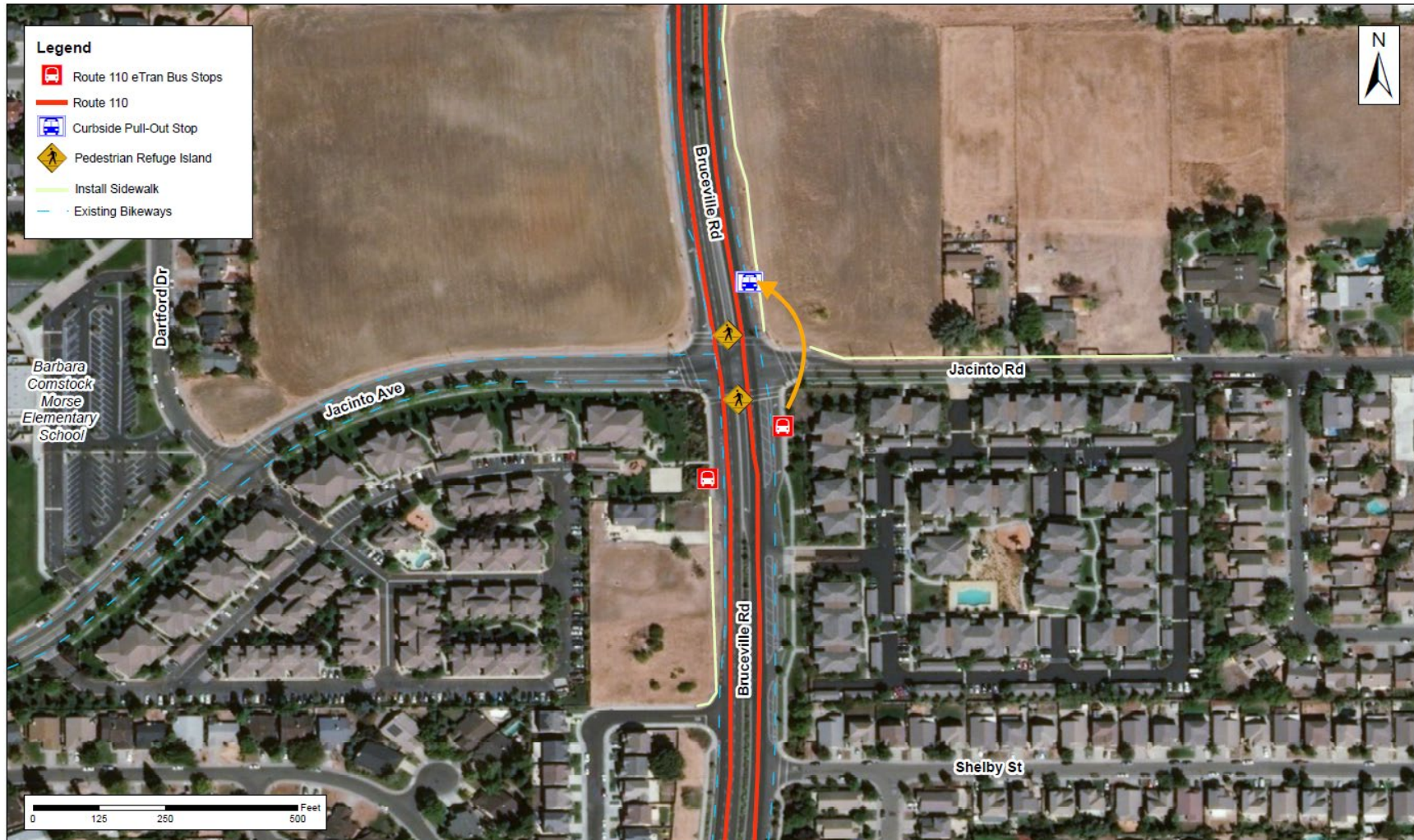
- Eliminate service at the southbound stop on Bruceville Road near the College Entrance due to low ridership and its proximity to the LRT station.
- Install a mid-block crossing on Bruceville Road adjacent to the LRT station, which is suggested to also include a pedestrian refuge island.
- Install a pedestrian refuge island at the south leg crossing at Cosumnes River College Entrance (must be coordinated with City of Sacramento).
- Shelters, seating, lighting, trash disposal, and signage should be added to stops that do not already possess these amenities.

## 2. Calvine Station Area Potential Improvements



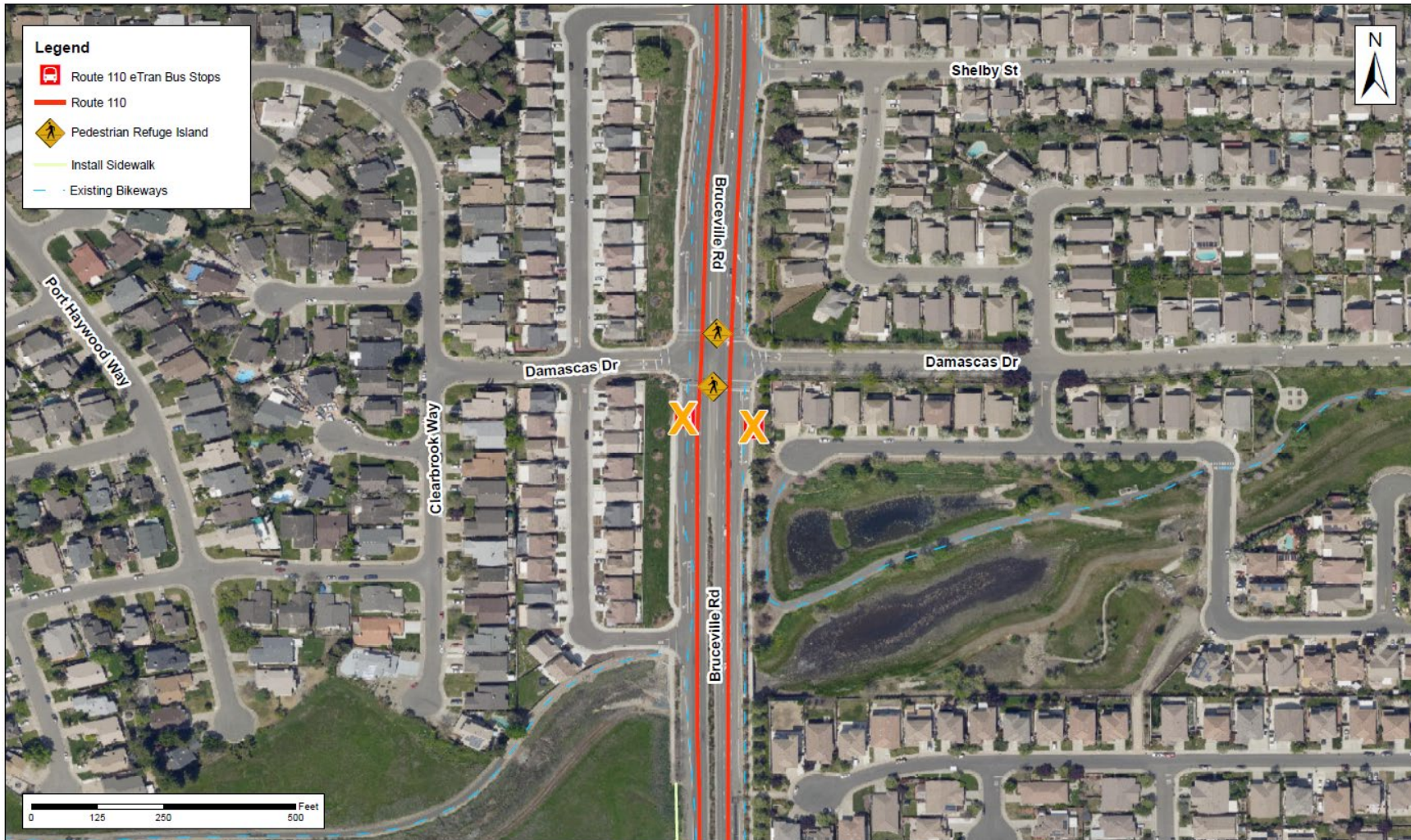
- Eliminate service at both stops at the Calvine station due to low ridership and close physical proximity to the Cosumnes River College/Blue Line LRT station and the Jacinto station.
- If not eliminated, a sidewalk connection to the curb must be installed.
- Expand sidewalks along the east side of Bruceville Road and the south side of Shasta Avenue.
- Install pedestrian refuge island at the south leg crossing of Bruceville Road at Calvine Road.

### 3. Jacinto Station Area Potential Improvements



- Relocate the northbound stop at Jacinto station to the far side of the intersection of Bruceville Road and Jacinto Avenue/Road once adjacent development is in place to avoid potential conflict with right-turning vehicles.
- Construct relocated northbound stop as a full curbside pull-out stop.
- Expand sidewalks along the east side of Bruceville Road north of Jacinto Road, the west side of Bruceville Road south of Jacinto Avenue, and the north side of Jacinto Road east of Bruceville Road.
- Install pedestrian refuge islands at the north and south leg crossings of Bruceville Road at Jacinto Avenue/Road.
- Install Shelters, seating, lighting, trash disposal, and signage should be added to stops that do not already possess these amenities.

#### 4. Damascas Station Area Potential Improvements



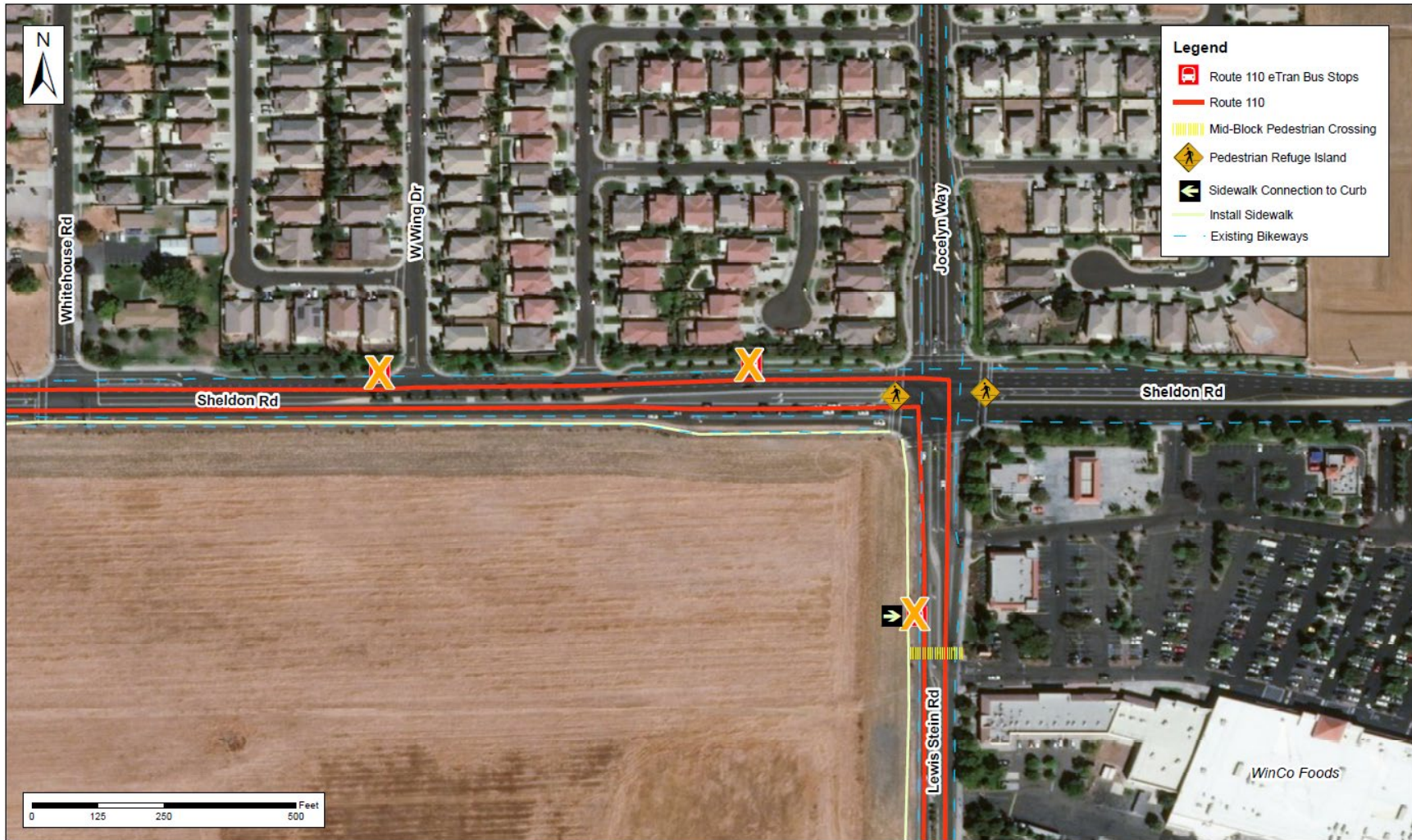
- Eliminate service at both stops at the Damascas station due to low ridership and close physical proximity to the Jacinto station and the Center Parkway station.
- Expand sidewalks along the west side of Bruceville Road.
- Install pedestrian refuge islands at the north and south leg crossings of Bruceville Road at Damascas Drive.

## 5. Center Parkway Station Area Potential Improvements



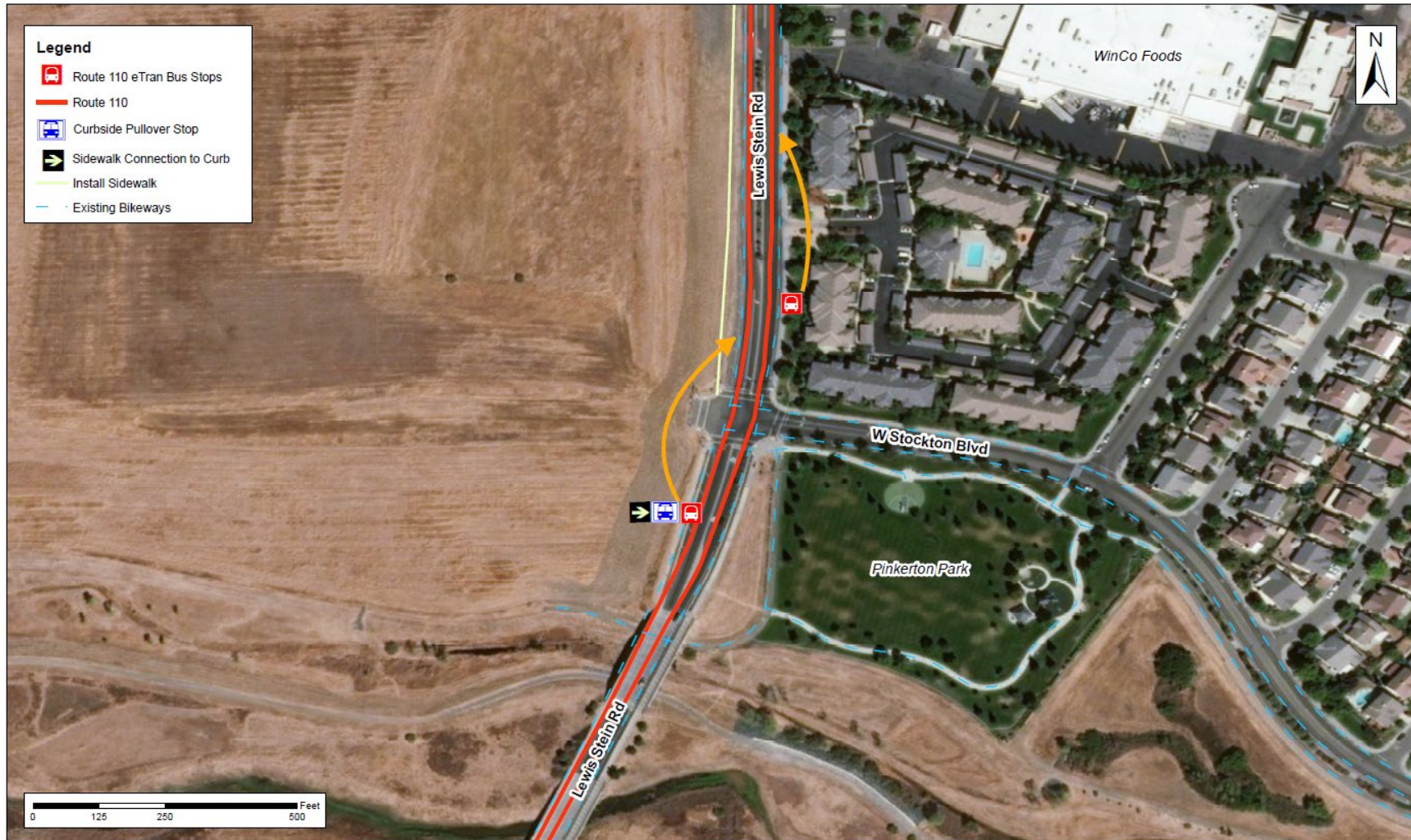
- A sidewalk connection to the curb must be implemented at the northbound stop on Sheldon Road.
- Expand sidewalks along the west side of Bruceville Road north of Center Parkway, the east side of Bruceville Road south of Sheldon Road, and the south side of Sheldon Road east of Bruceville Road.
- Install pedestrian refuge islands at all crossings at the intersection of Bruceville Road and Center Parkway/Sheldon Road.
- Shelters, seating, lighting, trash disposal, and signage should be added to stops that do not already possess these amenities.

## 6. Sheldon Station Area Potential Improvements



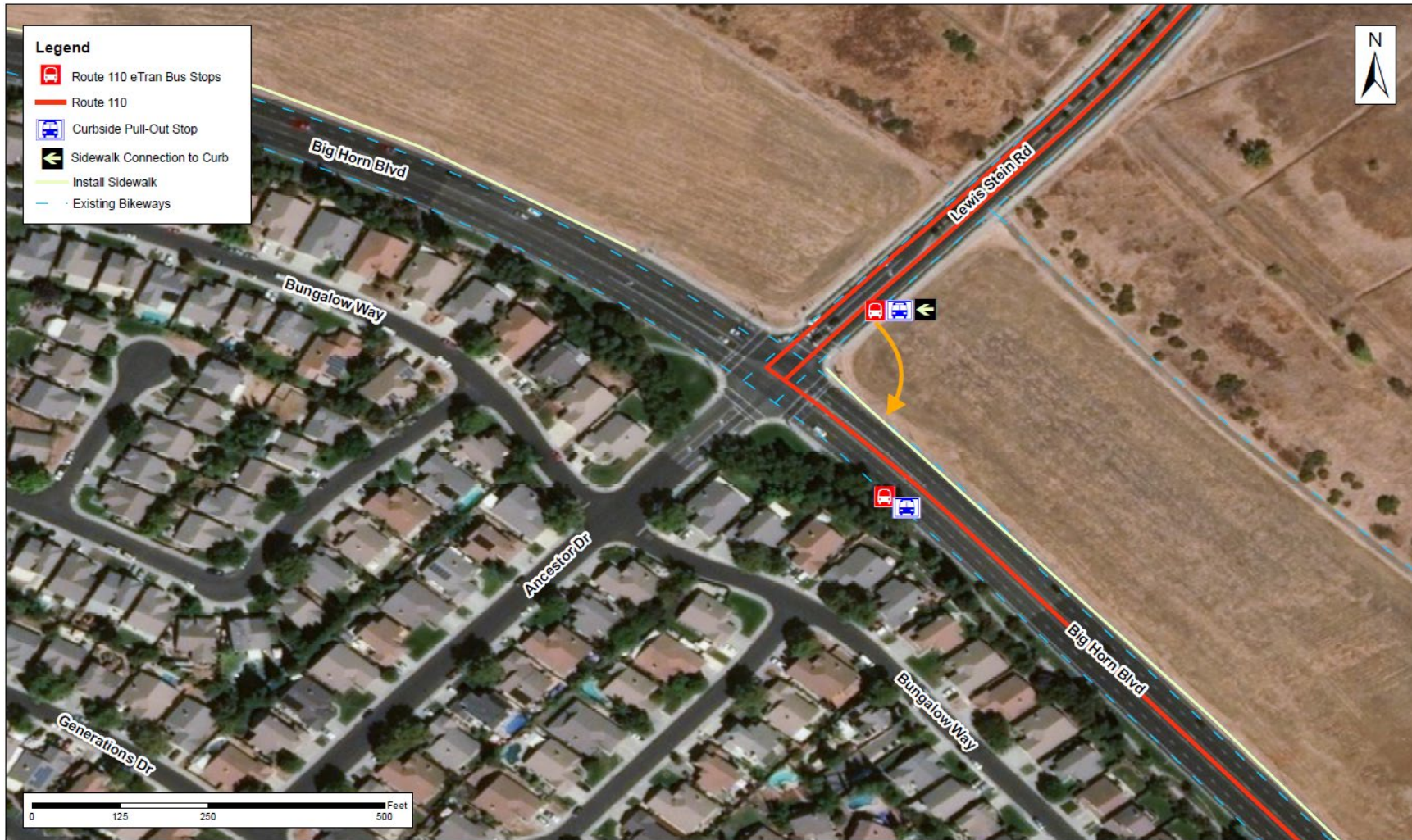
- Eliminate service at all stops at along Sheldon due to low ridership and close physical proximity to the Center Parkway station and the West Stockton station in the near term. The stops could be reconsidered based on future development.
- If not eliminated, a sidewalk connection to the curb must be implemented at the southbound stop on Lewis Stein Road.
- Expand sidewalks along the south side of Sheldon Road and the west side of Lewis Stein Road.
- Install a midblock crosswalk on Lewis Stein Road.
- Install pedestrian refuge islands at the east and west leg crossings of the intersection of Sheldon Road at Lewis Stein Road/Jocelyn Way.

## 7. West Stockton Station Area Potential Improvements



- Move both stops one block north in order to provide better access to the shopping center at the intersection of Lewis Stein Road and Sheldon Road and points north while still providing access to residents off West Stockton Boulevard.
- Upgrade the southbound stop to a curbside pull-out stop.
- Sidewalk connections to the curb must be implemented at the southbound stop.
- Expand sidewalks along the west side of Lewis Stein Road north of West Stockton Boulevard.
- Shelters, seating, lighting, trash disposal, and signage should be added to stops that do not already possess these amenities.

## 8. Big Horn Station Area Potential Improvements



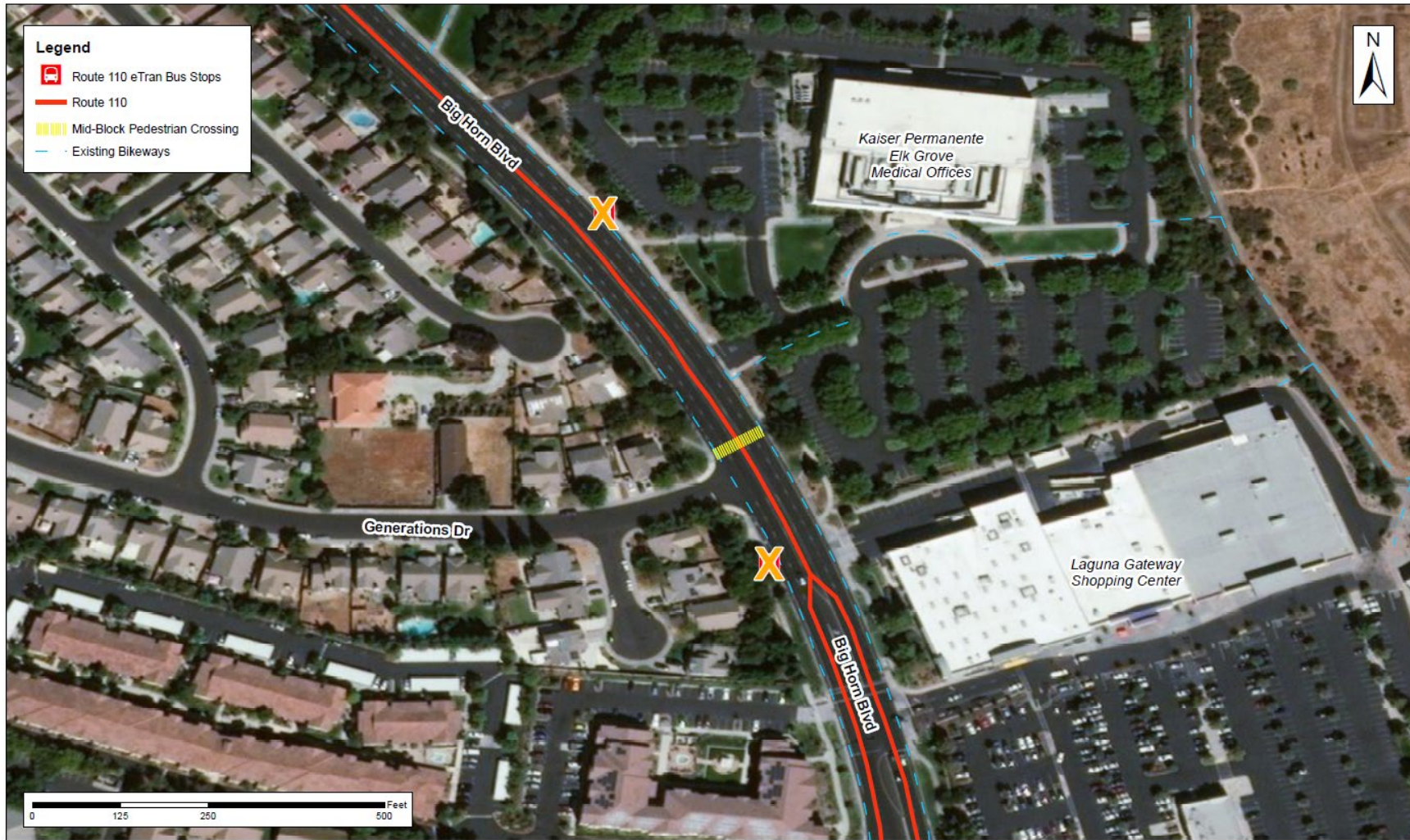
- Relocate the northbound station be relocated to the near side of the intersection of Big Horn Boulevard and Lewis Stein Road to improve access to nearby residences and reduce possible conflicts between stopped buses and vehicles on Lewis Stein Road.
- Upgrade both the northbound and southbound stops to curbside pull-out stops.
- Expansion of sidewalks along the northeast side of Big Horn Boulevard and a sidewalk connection to the curb must be implemented.
- Shelters, seating, lighting, trash disposal, and signage should be added to stops that do not already possess these amenities.

## 9. New Country Court Station Area Potential Improvements



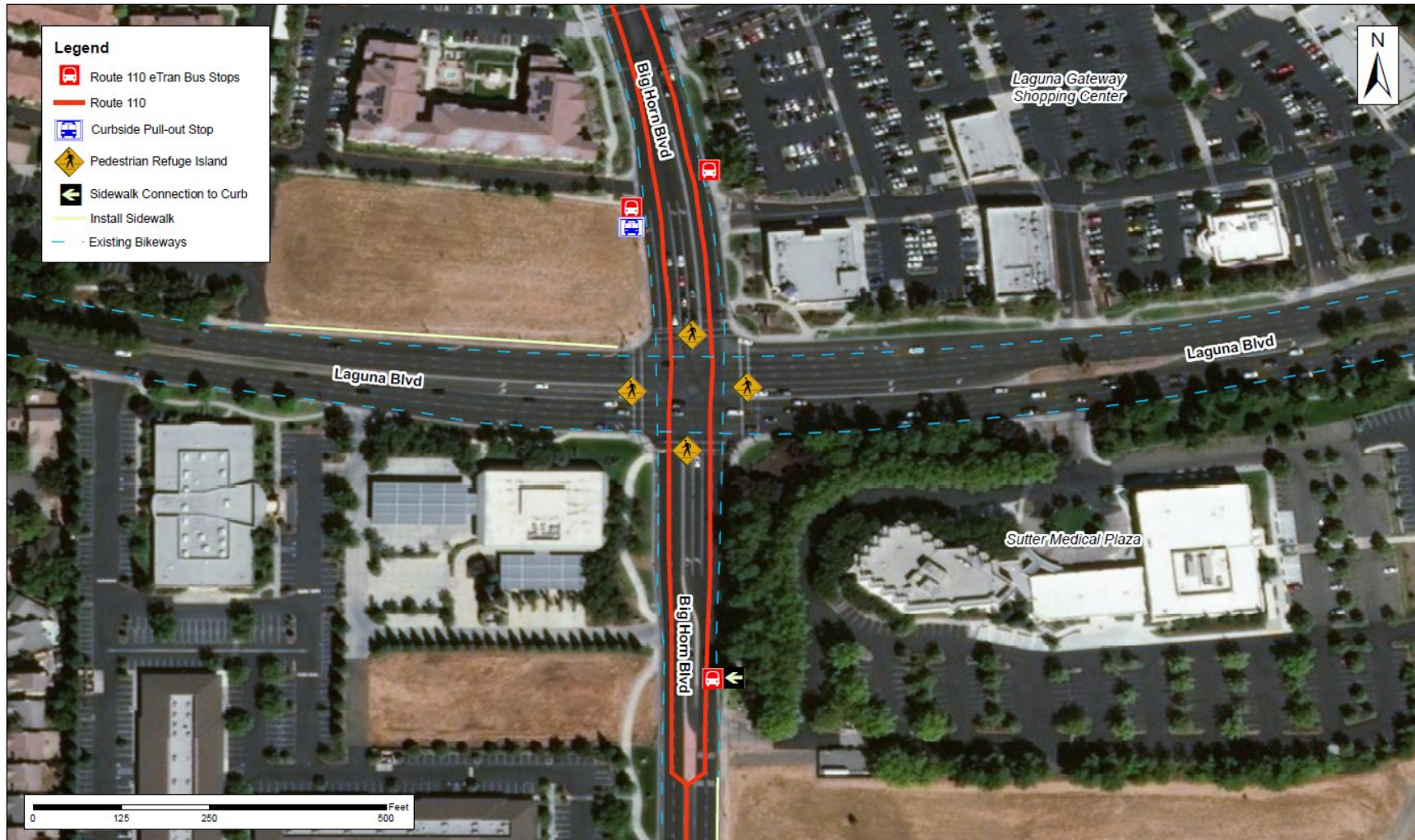
- Eliminate service at both stops at New Country Court station due to low ridership and close physical proximity to the Big Horn station.
- If not eliminated, implement a sidewalk connection to the curb at the southbound stop.
- Expand the sidewalk on the northeastern side of Big Horn Boulevard.

## 10. Generations Drive Station Area Potential Improvements



- Eliminate service at both stops at Generations Drive due to close physical proximity to the Laguna stop area.
- Install a pedestrian crossing at the north leg of the intersection of Big Horn Boulevard and Generations Drive, which is suggested to also include a pedestrian refuge island.

### 11. Laguna Station Area Potential Improvements



- Upgrade the southbound stop to a curbside pull-out stop.
- A sidewalk connection to the curb must be implemented at the northbound stop on Big Horn Boulevard south of Laguna Boulevard.
- Expand the sidewalks along the north side of Laguna Boulevard west of Big Horn Boulevard and the east side of Big Horn Boulevard south of the Sutter Medical Plaza.
- Install four pedestrian refuge islands at the crossings on each leg of the intersection of Big Horn Boulevard and Laguna Boulevard.
- Shelters, seating, lighting, trash disposal, and signage should be added to stops that do not already possess these amenities.

## 12. Monetta Station Area Potential Improvements

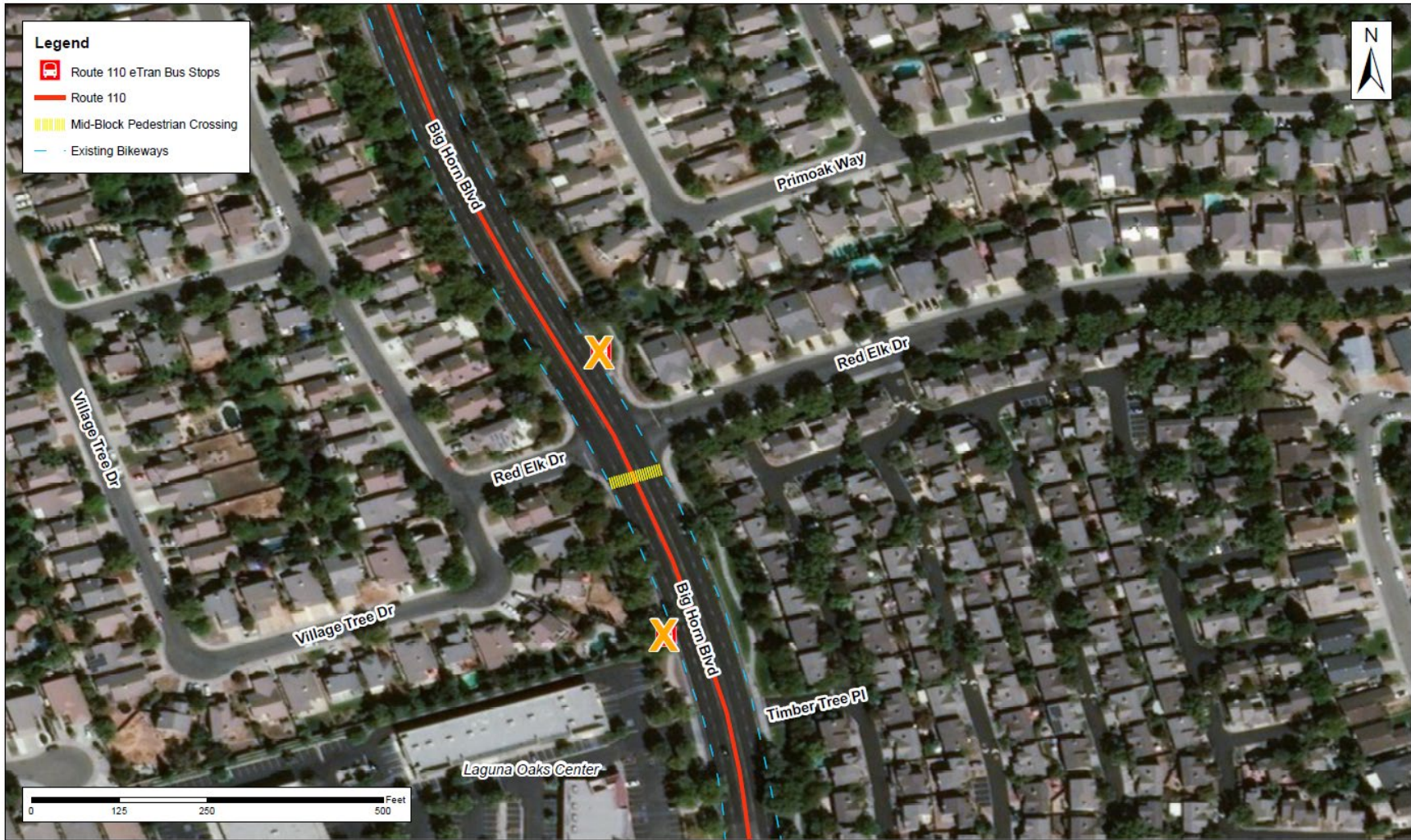


- Implement a sidewalk connection to the curb at the southbound stop.
- Expand the sidewalk along the east side of Big Horn Boulevard north of Monetta Drive.
- Shelters, seating, lighting, trash disposal, and signage should be added to stops that do not already possess these amenities.

### 13. Village Tree Station Area Potential Improvements

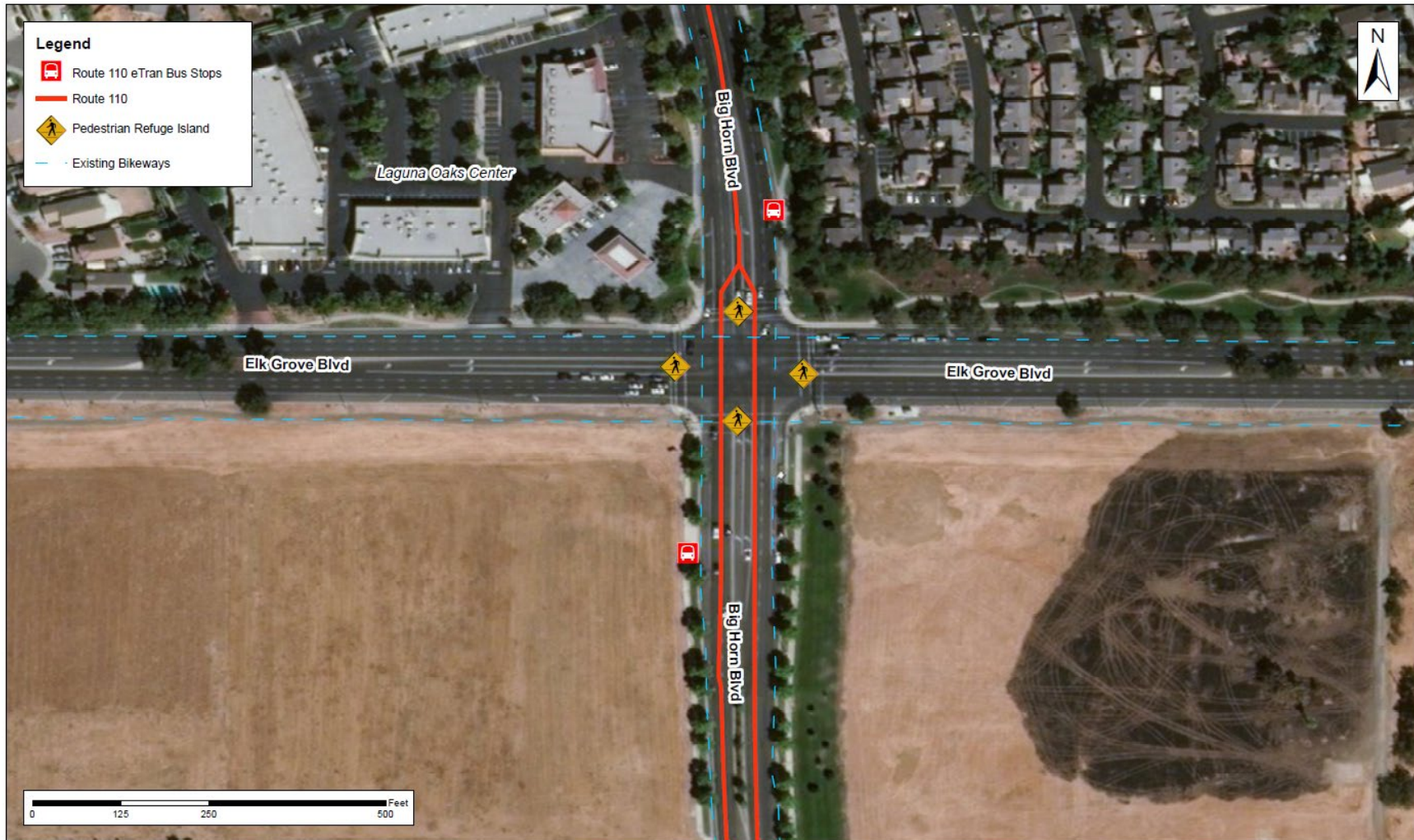


- Relocate the southbound stop at the Village Tree station south of Village Tree Drive to better service residents of the Village Tree Drive area and compensate for the proposed elimination of service at Red Elk Drive.
- Implement sidewalks connections to the curb at both the northbound and southbound stops.
- Shelters, seating, lighting, trash disposal, and signage should be added to stops that do not already possess these amenities.



- Eliminate service at both stops be eliminated at Red Elk due to low ridership and close physical proximity to the Village Tree and Elk Grove stations.
- Install a pedestrian crossing at the south leg of the intersection of Big Horn Boulevard and Red Elk Drive, which is suggested to also include a pedestrian refuge island.

### 15. Elk Grove Boulevard Station Area Potential Improvements



- Install four pedestrian refuge islands at the crossings at each leg of the intersections of Elk Grove Boulevard and Big Horn Boulevard.
- Shelters, seating, lighting, trash disposal, and signage should be added to stops that do not already possess these amenities.

## 16. Civic Center Drive Station Area Potential Improvements

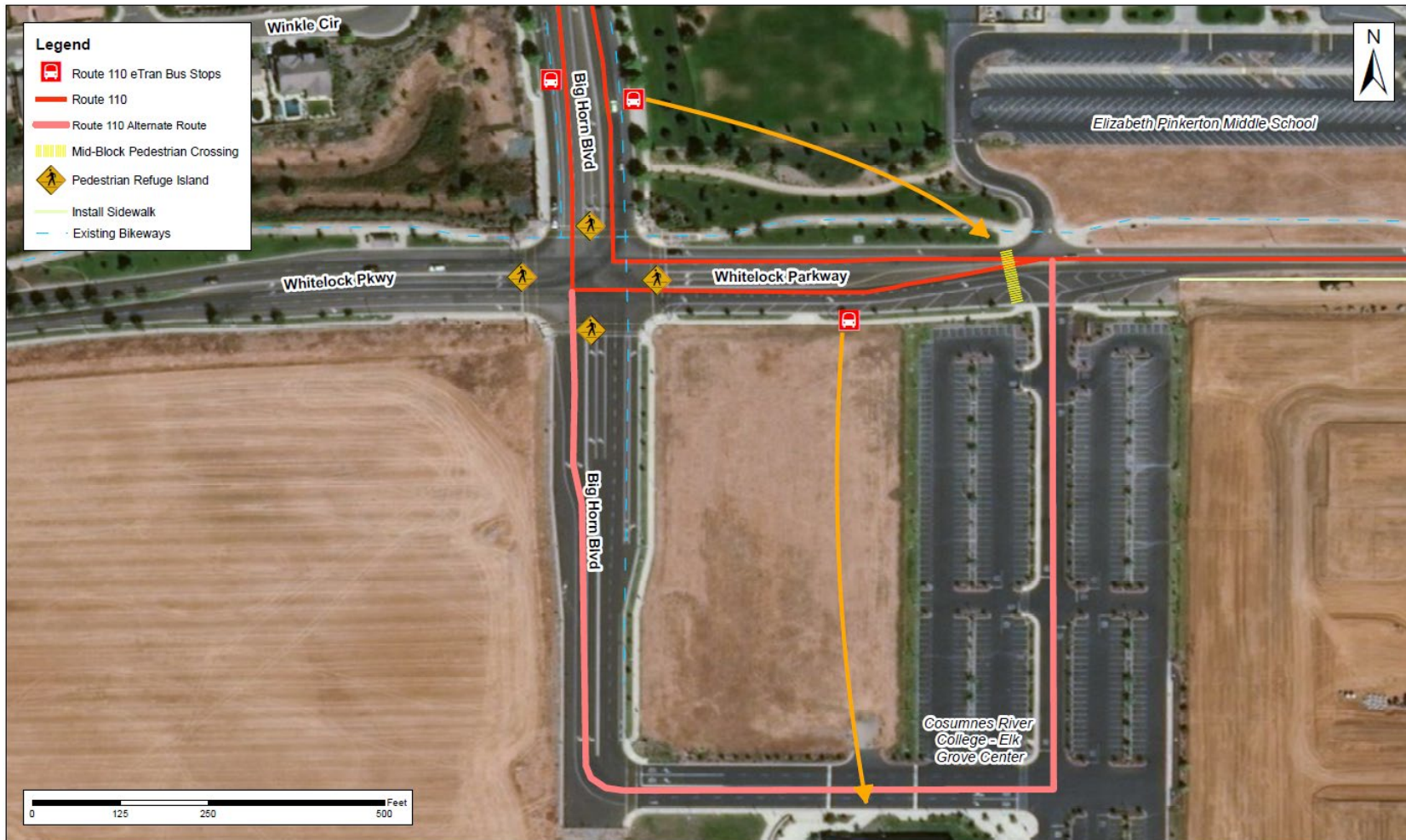


- A sidewalk connection to the curb must be implemented at the northbound stop.
- Shelters, seating, lighting, trash disposal, and signage should be added to stops that do not already possess these amenities.

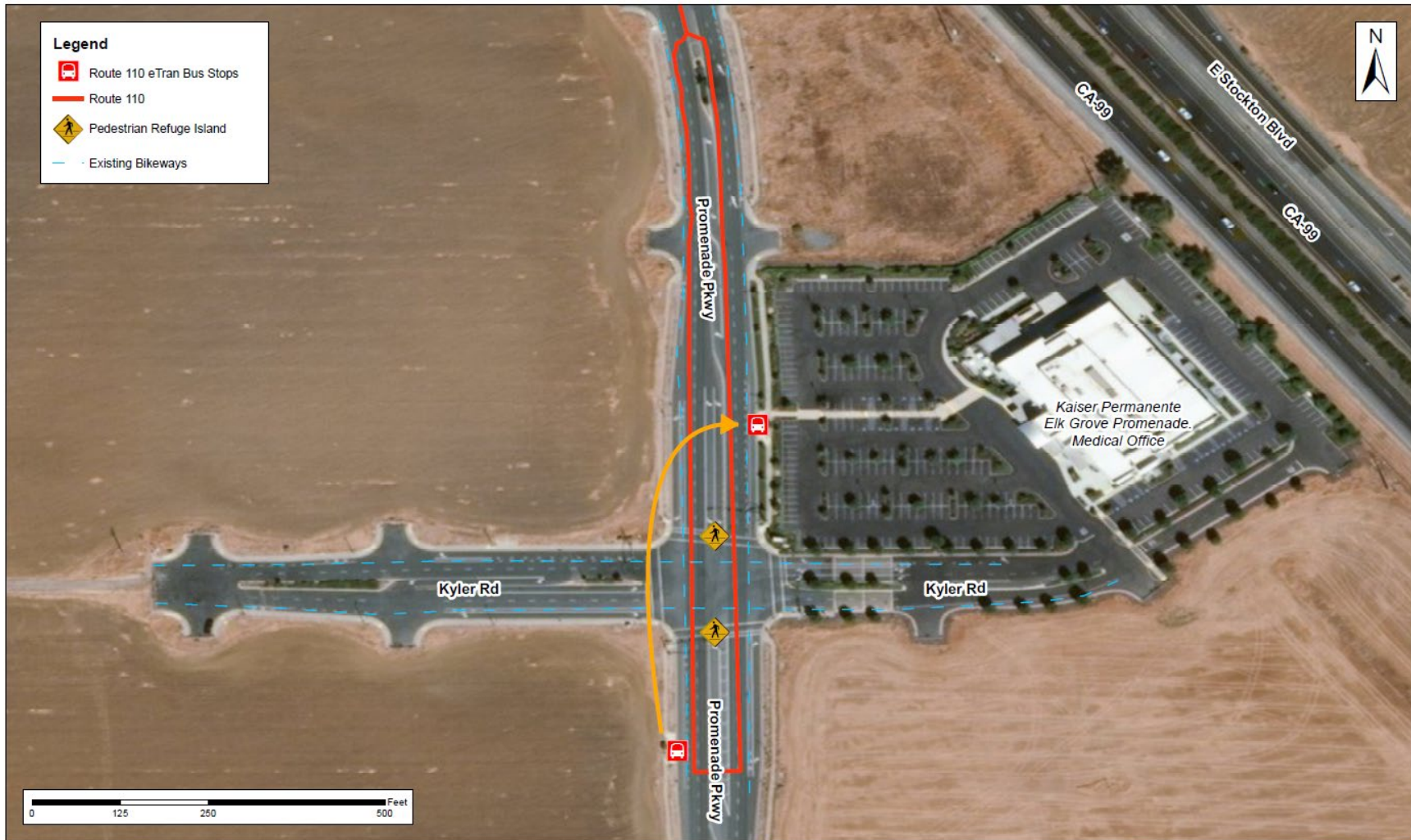
### 17. Lotz Parkway Station Area Potential Improvements



- Install pedestrian refuge islands be installed at the north, south, and east leg crossings of the intersection of Big Horn Boulevard and Lotz Parkway.
- Shelters, seating, lighting, trash disposal, and signage should be added to stops that do not already possess these amenities.



- Relocate southbound stop at on Whitelock Parkway south to the Cosumnes River College – Elk Grove Center campus and alter the bus route to continue south on Big Horn Boulevard from and loop through the campus before exiting on Whitelock Parkway east of Big Horn and continuing east. Alternatively, if service at the Promenade station were to be eliminated, this could serve as a new terminus.
- If not, it is recommended that the northbound stop either be relocated to Whitelock Parkway across from the opening of the campus parking lot.
- Expand the sidewalk along the south side of Whitelock Parkway east of the campus.
- Expand the bikeway along the south side of Whitelock Parkway east of Big Horn Boulevard.
- Install a mid-block crossing on Whitelock Parkway between the relocated northbound stop and the campus parking lot.
- Install four pedestrian refuge islands at the crossings of all legs of the intersection of Big Horn Boulevard and Whitelock Parkway
- Shelters, seating, lighting, trash disposal, and signage should be added to stops that do not already possess these amenities.



- If service is not already conducted in this manner, it is recommended that the southbound stop at Promenade station be consolidated with the northbound stop to serve as an effective terminus.
- Install pedestrian refuge islands on the north and south leg crossings of Promenade Parkway at Kyler Road.
- Shelters, seating, lighting, trash disposal, and signage should be added to stops that do not already possess these amenities.

## APPENDIX C OPERATING EXPENSES ROUTE 110 NOVEMBER 1, 2017 TO OCTOBER 31, 2018

OPERATING REVENUE Route 110													
11/1/2017 - 10/31/2018													
MV Charge rate at \$50.77/hour, 7/1/2017-6/30/2018									MV Charge rate at \$51.73/hour, 7/1/2017-6/30/2018				
TOTAL REVENUE HOURS	NOV	DEC	JAN	FEB	MARCH	APRIL	MAY	JUN	JUL	AUG	SEP	OCT	Total
	609	604	630	575	669	630	658	641	631	687	587	687	7,608
	50.77	50.77	50.77	50.77	50.77	50.77	50.77	50.77	51.73	51.73	51.73	51.73	
	\$ 30,918.93	\$ 30,665.08	\$ 31,985.10	\$ 29,192.75	\$ 33,965.13	\$ 31,985.10	\$ 33,406.66	\$ 32,543.57	\$ 32,641.63	\$ 35,538.51	\$ 30,365.51	\$ 35,538.51	\$ 388,746.48
TOTAL REV HRS LOCAL	3080	3034	3132	2851	3305	3126	3260	3162	3117	3414	2908	3425	37,814
% OF Hours 110/LOCAL	19.77%	19.91%	20.11%	20.17%	20.24%	20.15%	20.18%	20.27%	20.24%	20.12%	20.19%	20.06%	
MV fixed monthly cost at \$197,162.75, 7/1/2017-6/30/2018									MV fixed monthly cost at \$200,284.92, 7/1/2018				
Systemwide													
FIXED MONTHLY COST	197,162.75	197,162.75	197,162.75	197,162.75	197,162.75	197,162.75	197,162.75	197,162.75	200,284.92	200,284.92	200,284.92	200,284.92	
RTE 110 Operating exp	\$ 38,984.45	\$ 39,250.59	\$ 39,659.17	\$ 39,764.50	\$ 39,909.80	\$ 39,735.30	\$ 39,795.43	\$ 39,968.79	\$ 40,545.33	\$ 40,303.38	\$ 40,428.90	\$ 40,173.94	\$ 478,519.58