# SR 37 Travel Behavior & Transit Feasibility Study

Prepared for:

NAPA VALLEY TRANSPORTATION AUTHORITY

Transportation Authority of Marin

Solano Transportation Authority

SONOMA COUNTY TRANSPORTATION AUTHORITY

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# 1. Study Purpose

State Route 37 (SR 37) is the most traveled east-west corridor in the North Bay. The corridor has significant travel delays and storm-related flooding frequently inundates the corridor. Westbound traffic congestion on weekday mornings lasts approximately six hours causing an average delay of thirty minutes. Eastbound traffic congestion on weekday afternoons lasts roughly seven hours resulting in an average delay of eighty minutes.

The four North Bay County Transportation Agencies (CTAs), Napa Valley Transportation Authority (NVTA), Transportation Authority of Marin (TAM),Solano Transportation Authority (STA), and Sonoma County Transportation Authority (SCTA), formed a policy committee to address congestion and sea level rise along the corridor. The SR 37 policy committee is evaluating near- and long-term improvements for the corridor. Based on earlier work completed by UC Davis and Caltrans, the corridor was broken into the following three segments for the SR 37 Transportation and Sea Level Rise Corridor Improvement Plan and Design Alternative Analysis which have been generally maintained for this study:

Segment A – From US 101 to the signalized SR 121 Intersection at Sears Point, SR 37 is a four-lane express way with 3.4 miles in Marin County and 3.9 miles in Sonoma County.

Segment B – From the signalized SR 121 Intersection at Sears Point to Mare Island, SR 37 becomes a two-lane conventional highway with a median barrier as it crosses the Napa-Sonoma marshlands from SR 121 to Mare Island with 2.3 miles in Sonoma County and 7 miles in Solano County.

Segment C – From Mare Island to I-80, SR 37 is a four lane freeway, mostly on elevated roadways and structures, for 4.4 miles within Solano County.

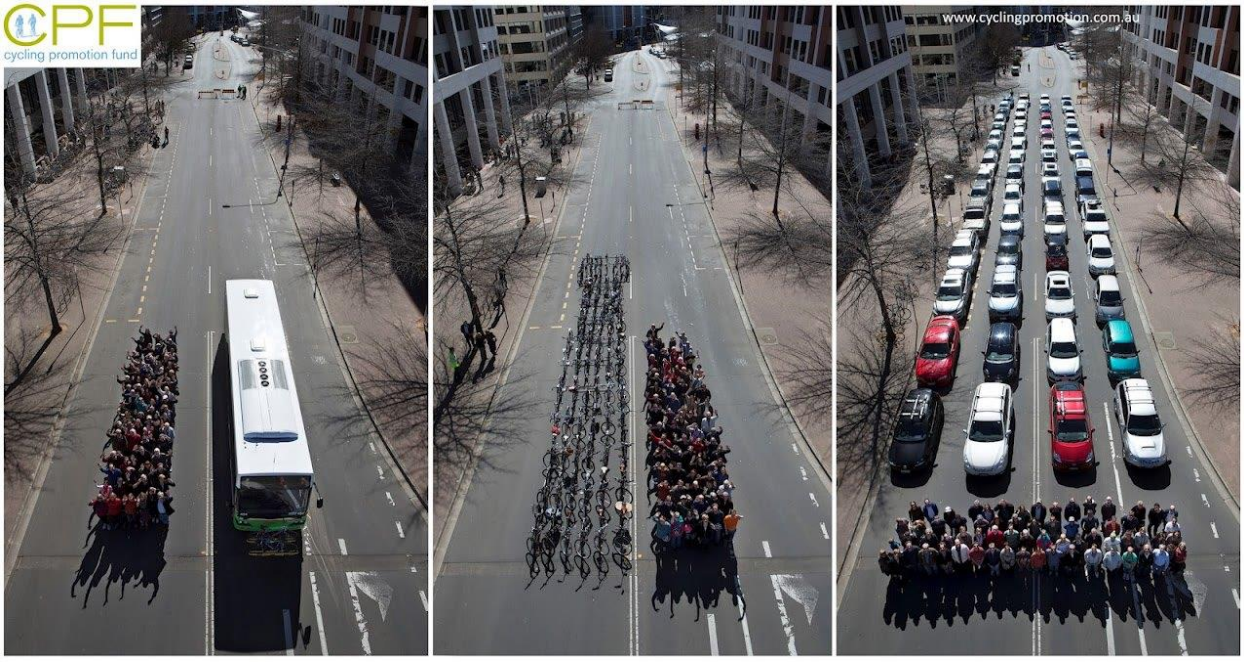
A key component to address congestion along the corridor is the proposed widening of Segment B to eliminate the bottleneck caused by the 9.3-mile two-lane section. This could be a two-phase project with an initial reversible high-occupancy vehicle (HOV) lane or four-lane facility utilizing the shoulder, largely within the existing right-of-way addressing the immediate need for traffic congestion relief, with an ultimate project of a four-lane facility with a general purpose and HOV lane in each direction and the elevation of Segment B. Phase 2 would most likely be funded by tolling the roadway.

In addition to evaluating highway infrastructure improvements, the CTAs are also evaluating other modes of travel along the corridor to both relieve congestion and to address equity questions that have emerged as part of the tolling proposal including studying fixed-route transit, microtransit, and improved pooling service along the corridor. The CTAs are also studying ferry and rail service as part of a separate effort. There is currently no east-west transit service along the corridor.

The purpose of this study is to understand the demand and propensity to use transit and non-single occupant vehicle options on SR 37 to relieve congestion and address equity concerns. This report presents a summary of a four-step right-sized transit analysis approach and methodology along with an evaluation of potential transit options including future considerations. A non-single occupant vehicle opportunities and constraints analysis is also presented.

The purpose of this report is to describe the methodological approach and present an analysis of non-single occupant vehicle options evaluated as part of this study, including a qualitative and quantitative assessment of the potential effectiveness of each option and the reasoning behind the determination, followed by a recommendation of non-highway infrastructure improvements for near- and long-term implementation. Potential improvements evaluated include but were not limited to fixed route bus service, microtransit, and pooling options.

The hope is that the improvements recommended as part of this study will incrementally reduce the number of single-occupant vehicles, thus reducing congestion, along SR 37 as near-term and long-term highway infrastructure improvements are implemented. To illustrate the advantages of getting people out of their single-occupant vehicles, the image below shows the typical space occupied in a city street by three common modes of transport - cars, bicycles and a bus - to illustrate the efficiency of public transport and alternative modes of travel.[1]




[1] http://www.cyclingpromotion.org/promotional-resources

# 2. Key Findings

This chapter provides a bulleted summary of key findings from the travel markets assessment and transit options evaluation conducted as part of this study.

## 2.1 Travel Markets Assessment

- The SR 37 corridor primarily serves lower density, dispersed development patterns
- A right-sized transit approach would classify the travel market as a many-to-many demand landscape with just a few trip centers
- The primary travel market is Solano residents accessing job centers in Marin/Sonoma counties
- A majority of travelers are not going to a high-capacity rapid transit service
- The corridor serves mostly long distance, work-related trips
- A high percentage of corridor trips are made by those earning at or below the median Bay Area income of $100,000
- The travel markets assessment suggests on-demand and enhanced pooling services as opposed to fixed route service but that some express bus opportunities exist

## 2.2 Transit Options Evaluation

- An express bus route is proposed between Fairfield-Vallejo and Novato
- Enhanced pooling services are proposed including an expanded park-and-ride system with bus and transportation network company (TNC) connections, a software-as-a-service (SaaS) platform with rewards, and subsidies for low-income and disabled persons for environmental justice
- A minibus service is proposed along SR 37 that follows a semi-fixed route, generally along the proposed express bus route, and utilizes the proposed express bus stop locations, many of which are located at new or existing park and ride lots
- A TNC subsidy was determined to be cost-prohibitive due to the length of observed trips and lack of TNC supply but that there might still be a role for TNCs as a first and last mile connection at the ends of the corridor

# 3. Opportunities & Constraints

This chapter describes non-single occupant vehicle opportunities and constraints for the SR 37 corridor based on a review of other relevant studies, existing survey data, and local knowledge of the corridor.

## 3.1 Other Relevant Studies

Fehr & Peers reviewed four recent and relevant studies to help understand opportunities and constraints as well as the range and potential effectiveness of non-highway infrastructure solutions for the corridor. The findings are discussed in detail below.

### 3.1.1 SR 37 Survey & Focus Groups

Moore Iacofano Goltsman, Inc. (MIG) convened and conducted six focus groups with the purpose of collecting detailed input from area residents who travel the SR 37 corridor regularly. The feedback received through the focus groups was supplemented with input collected through an online survey to provide a deeper understanding of the habits and concerns of SR 37 commuters. The focus group recruitment strategy was designed to reach a variety of travelers from each of the four North Bay counties and low-income and minority populations.[2]

Below is a bulleted summary of pertinent information from the surveys and focus groups.

- 19 percent of daily users identified their primary mode of travel as carpooling, anecdotally a very high percentage for a non-urban corridor and indicative of demand for improved pooling service
- 45 percent of daily users identified their trip purpose as work-related, anecdotally a very high percentage and the trip purpose most commonly served via transit and pooling services
- 52 percent of daily users indicated they traveled the corridor multiple times a week, suggesting frequent usage of proposed transit and pooling options
- More than 50 percent of users had an income at or below the median Bay Area income, an income group typically shown to have a higher transit usage rate than those above the median
- Lakeville Highway and Highway 121 were identified as alternative routes, suggesting potential benefits to those routes if vehicle travel is reduced along SR 37

[2] https://scta.ca.gov/wp-content/uploads/2018/09/3-SR-37-Focus-Group-Report_3-20-18-Final.pdf

- 29 percent of daily users said they would be willing to use transit, indicating demand for non-highway infrastructure solutions for the corridor
- Commuters and other frequent users indicated they modified their schedules to avoid traffic, revealing secondary quality of life impacts due to anticipated congestion along the corridor

## 3.1.2 Go Dublin! Rideshare Promotion

Go Dublin! is a rideshare promotion where Wheels will pay for 50 percent of a rider's fare, up to $5.00, for any rides with UBER, Lyft or DeSoto Cab Company within the city limits of Dublin, which includes both Tri-Valley BART stations.[3]

Below is a bulleted summary of pertinent information from the GoDublin! Program Evaluation and discussions with the GoDublin! Program Evaluation project manager.

- The program only facilitated short intra-city trips and access to high-capacity rapid transit systems, very different trip types than what occur along SR 37
- The project manager was not aware of any pilot programs similar to Go Dublin! for long distance city-to-city trips and was unsure how such a system would perform
- The subsidy was a maximum of $5 with an average subsidy amount of $3.07, much lower than the likely subsidy amount required for SR 37 trips to achieve a 50 percent fare subsidy due to the length of the corridor
- Additionally, many riders complained the subsidy was insufficient for their relatively short trip
- The project manager suggested trying a fixed-fare structure for SR 37 but acknowledged the subsidy amount would likely be cost prohibitive due to the length of trips
- Although the program had a shared ride requirement, only four percent of the 8,200 trips had 2 or more persons other than the driver and zero trips had 3 or more persons. The project manager explained that this was due to lack of an effective enforcement method, overall low demand due to the suburban nature of the city, and lack of concentrated trip centers despite the inclusion of two BART stations within the program limits.
- The project manager indicated the capped subsidy may have been a deterrent to low income persons because the cost ended up being higher than the cost for taking the bus but with lower wait and travel times, metrics difficult to attach a monetary value to
- The project manager indicated the program was a success and that the program was extended

[3] https://www.wheelsbus.com/godublin/

- A key lesson learned was that they needed to perform additional analysis to better understand their potential market so they can advertise better and directly market to potential riders

## 3.1.3 UCSF TDM Plan

University of California San Francisco (UCSF) is in the process of updating their Transportation Demand Management (TDM) plan. Below is a bulleted summary of pertinent information from speaking with the Fehr & Peers project manager Teresa Whinery.

- UCSF already maintains a robust TDM program and the focus of the update was on commuters to UCSF, suggesting findings are potentially applicable to the SR 37 corridor due to the high percentage of work-related trips.
- The study is evaluating app-based ride-matching programs to publicize and provide flexible carpooling options, cash allowances for individuals who carpool rather than drive alone, transit subsidies paid directly to a Clipper card, reduced monthly fares for vanpool riders and drivers, and TNC subsidies similar to Go Dublin!.
- The study determined that if monthly subsidies were provided, the most cost-effective mode to subsidize would be carpooling. However, they also acknowledged that enforcement would be difficult and there would be potential abuse of the program.
- Furthermore, they concluded that dynamic ride matching services were the most cost-effective of the carpooling options and that partnerships with ridesharing firms such as Waze and Scoop may continue to help support carpooling at minimal cost to the University.
- The study determined that the highest end of a feasible carpool mode share range was around 15 percent of all person trips, lower than the current carpooling percentage for SR 37, but acknowledged this was partly due to the already high transit usage driven by the existing TDM program whereas the SR 37 corridor currently has no east-west transit service.
- The study also determined that a TNC subsidy was only cost-effective for employees who lived within an estimated $15 Lyft or Uber ride from their primary place of work, a cost that is likely much lower than the average cost for a SR 37 corridor user due to the length of the corridor.

## 3.1.4 TAM's "GetSMART" Lyft Partnership

The GetSMART program is a partnership with Lyft, Inc., a Transportation Network Company, and Whistlestop, a non-profit mobility provider, to provide first and last mile services to Marin County's new Commuter Rail Line SMART. The program provides a $5 off coupon through the Lyft app for shared rides to and from the SMART stations. The program provides a curb to curb, on-demand service using Lyft's app and drivers, and shared rides are required to reduce vehicle trips where possible. Since March of 2018, Lyft

has provided carbon offsets effectively providing a carbon neutral ride. TAM has budgeted $70,000 for this service and reimburses Lyft for rides on a per ride basis.[4]

Below is a bulleted summary of pertinent information from TAM's "GetSMART" Lyft Partnership Program Evaluation document.

- The primary program goal is to serve first and last mile needs for SMART, much different than the primary needs for the 9.3-mile Segment B but likely in line with the first and last mile needs of SR 37 users at the start and end of the corridor
- The GetSMART program is app-based with a telephone option for non-smartphone users
- The program is geo fenced with set drop-off locations, a feature likely needed to reduce costs for the SR 37 corridor due to the length of the corridor and size of the travel market
- The maximum program subsidy is $5, much lower than the likely subsidy amount required for SR 37 trips to achieve a 50 percent fare subsidy due to the length of the corridor
- Ridership grew steadily during the initial year of service, and provided a total ridership of 6,372 rides, indicating demand for an app-based on-demand service in Marin

- It was determined that the program provided a low-cost mobility option in terms of total costs, and in cost effectiveness as measured on a per hour, per mile, and per passenger cost, even with ADA costs factored in

[4] https://www.tam.ca.gov/lyft/

# 3.2 Opportunities

Below is a bulleted summary of non-single occupant vehicle opportunities for the SR 37 corridor.

- The SR 37 corridor is a "clean slate" with no east-west transit service provided today, necessitating no need for integration with existing services but coordination with SMART on the west and SolTrans and FAST on the east
- The SR 37 corridor is very congested with roughly 19 percent carpooling, indicating there is a market for and an opportunity to bolster existing carpooling rather than providing new options
- HOV lanes are proposed and currently being studied for Segment B, which would likely incentivize transit and pooling options to bypass congestion
- Tolling is proposed and currently being studied for Segment B, which would likely further incentivize transit and pooling options, especially for users who cannot afford the toll or do not wish to pay the toll
- 29 percent of SR 37 frequent users said they would use transit services if they were provided, indicating there is a market for transit along the corridor despite the lack of existing services
- Park and ride lots exist near the corridor and near the origins and destinations of existing users
- STA are beginning construction on the Solano Fairgrounds express bus stop on July 1, 2019, with future plans to construct a park and ride at the Fairgrounds
- The corridor is roughly 45 percent work-related trips, the most common trip purpose served by transit
- 52 percent of daily users indicated they traveled the corridor multiple times a week, suggesting frequent usage of proposed transit and polling options
- The survey indicated a high percentage of trips are made by those earning at or below the median Bay Area income, an income group that is typically shown to have a higher transit usage rate than those earning above the median income
- Proposed transit and pooling options have a high potential for secondary benefits as many current users indicated they rearranged their lives in response to anticipated congestion and used Lakeville Highway and Highway 121 as alternative routes
- STA, NVTA and TAM are in contract with RideAmigos which interfaces with Scoop and TNCs, providing a cost-effective and efficient means to offer a mobility app, subsidies, and rewards for non-auto modes of travel
- GetSMART's success indicates there is demand for app-based, on-demand ridesharing services in Marin

# 3.3 Constraints

Below is a bulleted summary of non-single occupant vehicle constraints for the SR 37 corridor.

- The SR 37 corridor is a "clean slate" with no east-west transit service provided today, resulting in a lack of available transit usage and propensity data for planning purposes
- Auto ownership is likely very high for corridor users due to the lack of existing non-auto options for SR 37, suggesting it may be difficult to shift people out of their vehicles due to their familiarity with and investment they have made in their personal vehicle
- Although it is congested for many hours of the day, the SR 37 corridor has a relatively low volume of travelers in both directions in the AM and PM peak periods, necessitating a high market capture rate to make fixed-route transit feasible
- As shown on the figure below, a large portion of most user's commutes are in free flow with the exception of a singular bottleneck on Segment B, resulting in two important considerations.
    - Will people stop if they are in free flow for so long already?
    - Will people be willing to transfer at either end of their trip to travel 5+ miles?
- Additionally, the morning eastbound commute is in free flow across the entire 21-mile corridor, making incentivizing mode shift potentially difficult
- The SR 37 corridor has a very dispersed travel pattern with many origins and destinations, which traditionally are not served well by fixed route transit
- The SR 37 corridor is 21 miles long, suggesting very long distance trips, which are traditionally not served well by fixed route transit and may be cost prohibitive to operate and subsidize
- There is a lack of TNC supply along the corridor as TNC drivers can make more money doing short distance trips in Oakland or San Francisco
- A TNC subsidy would likely be cost-prohibitive due to the length of trip
- Most travelers are not going to a high-capacity rapid transit service such as SMART or a ferry, suggesting low tolerance for transfers
- The corridor serves dispersed development patterns, suggesting first and last mile requirements may need to serve the first and last five or more miles, further suggesting low tolerance for transfers and non-auto modes of travel

# 4. Study Methodology

Fehr & Peers collected relevant baseline data for the entire SR 37 corridor from a variety of sources to gain a robust understanding of how the SR 37 corridor is currently being utilized by auto traffic. Data from the various sources were combined and analyzed to identify and quantify auto travel demands and the origin-destination and demographic characteristics of auto travelers along the corridor. The existing transit-serve-able auto travel markets were then identified for evaluation of potential transit solutions for the SR 37 corridor. The analysis was intended to provide the four North Bay CTAs, stakeholders, and the public with a new and robust understanding of travel behavior on the SR 37 corridor.

## 4.1 Study Segments

In order to understand the various travel markets served by the 21-mile corridor, the analysis generally maintained the following three segments from the SR 37 Policy Corridor Study and Design Alternative Analysis:

Segment A – From US 101 to the signalized SR 121 Intersection at Sears Point, SR 37 is a four-lane express way with 3.4 miles in Marin County and 3.9 miles in Sonoma County.

Segment B – From the signalized SR 121 Intersection at Sears Point to Mare Island, SR 37 becomes a two-lane conventional highway with a median barrier as it crosses the Napa-Sonoma marshlands from SR 121 to Mare Island with 2.3 miles in Sonoma County and 7 miles in Solano County.

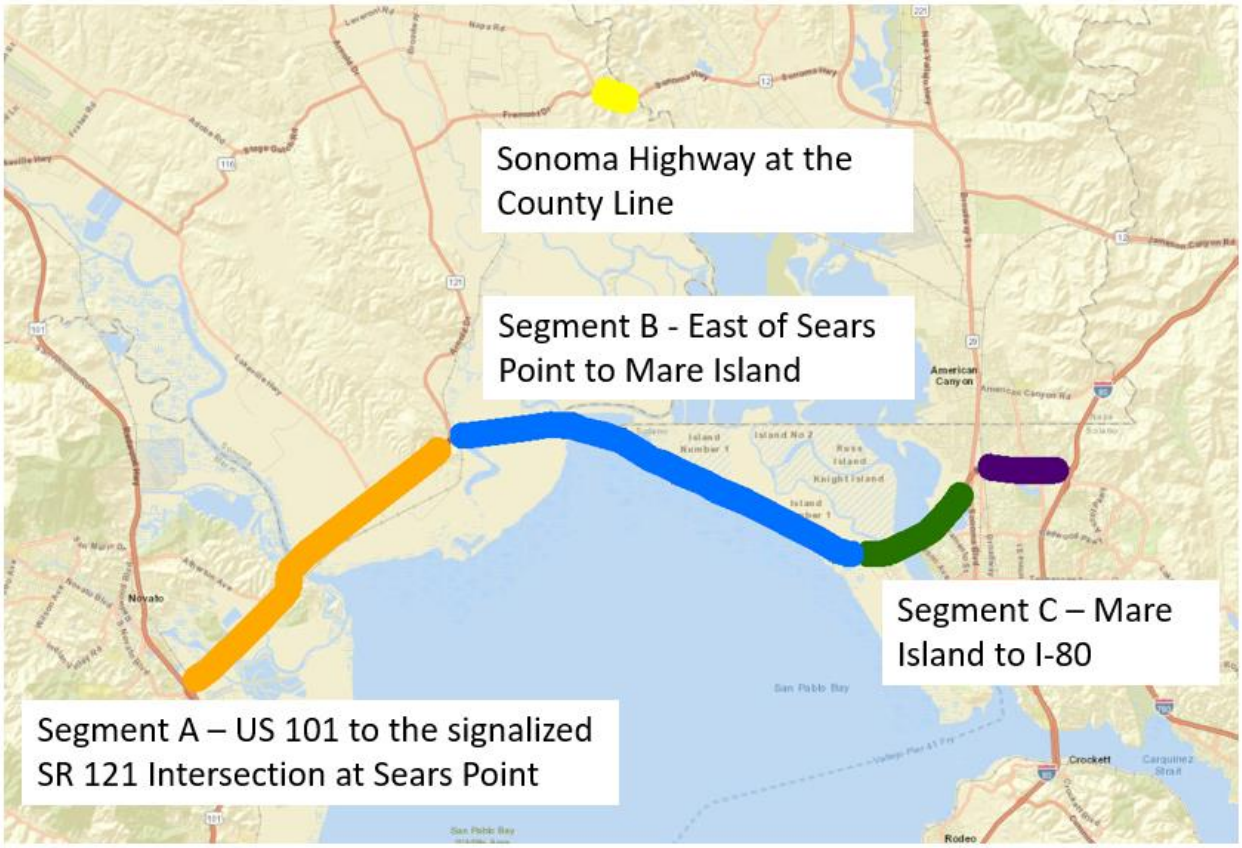
Segment C – From Mare Island to I-80, SR 37 is a four lane freeway, mostly on elevated roadways and structures, for 4.4 miles within Solano County.

However, as shown on the figure below, Segment C was split at SR 29 to better understand the travel markets served by the section between I-80 and SR 29 and the section between SR 29 and Mare Island given the level of interaction between SR 37 and SR 29. An additional segment was also added on Sonoma Highway (SR 121) at the Napa/Sonoma county line to understand the travel markets served by the key parallel route identified by the surveyed daily users of SR 37.

For the purposes of travel market identification, the following five segments were analyzed, which are shown on **Figure 1**.

1. Segment A - US 101 to Sears Point
2. Segment B - Sears Point to Mare Island
3. Segment C - Mare Island to SR 29
4. Segment C - SR 29 to I-80
5. Sonoma Highway (SR 121) at the Napa/Sonoma County Line

Figure 1: Study Segments




# 4.2 Travel Markets

The focus of the analysis was on establishing the size of the potential transit markets for the five SR 37 segments discussed above. Key existing auto travel markets were identified for each segment to help determine if there are markets that can feasibly and cost-effectively be served by transit. The study focused on identify groupings of origin-destination patterns with demographic characteristics consistent with other

transit users in the Bay Area. The analysis also identified the percentage of the origin-destination patterns that are small with dispersed origins and destinations which are traditionally difficult to serve by transit.

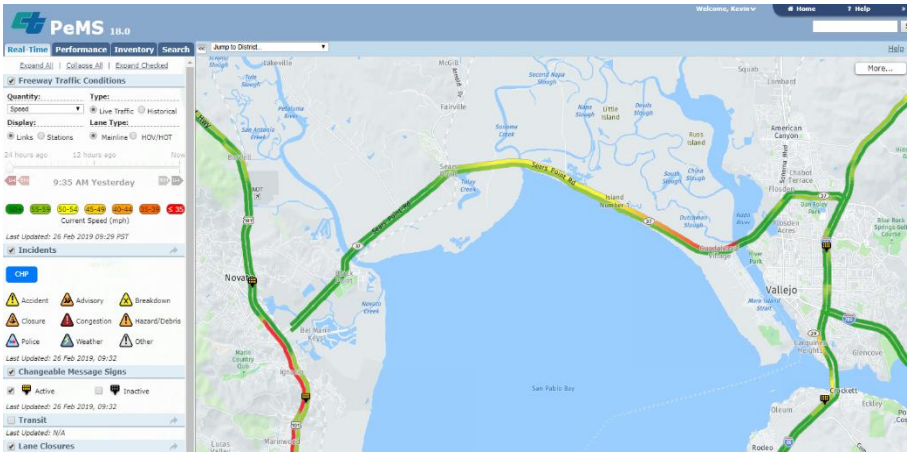
This travel market analysis will help communicate to the CTAs, stakeholders, and the public the size of the potential transit markets, the relative benefits, and the cost-effectiveness of providing transit investments in the corridor, and it will create a useful framework for considering SR 37 transit plans over the longer term.

# 4.3 Data Collection

Fehr & Peers collected and analyzed data from two primary types of data. Traffic count data was collected and analyzed to determine the absolute size of the travel markets for each segment and mobile device data was collected and analyzed to determine the origins and destinations of users of each segment. Home and work information was also obtained from the mobile device data in order to obtain trip making and demographic characteristics of the users of each segment.

## 4.3.1 Traffic Count Data

Traffic counts play a pivotal role in any travel markets assessment as they provide the total directional traffic volume by desired time period at the survey data locations that can be used as a control total to refine data collected via other methods.




Traffic count data was collected from the Caltrans Performance Measurement System (PeMS) for each of the five study segments. Data was averaged for an average commute day (Tuesdays, Wednesdays, and Thursdays) when school was in session (March to May 2018) for the AM peak period (6 AM to 10 AM) and the PM peak period (3 PM to 7 PM).

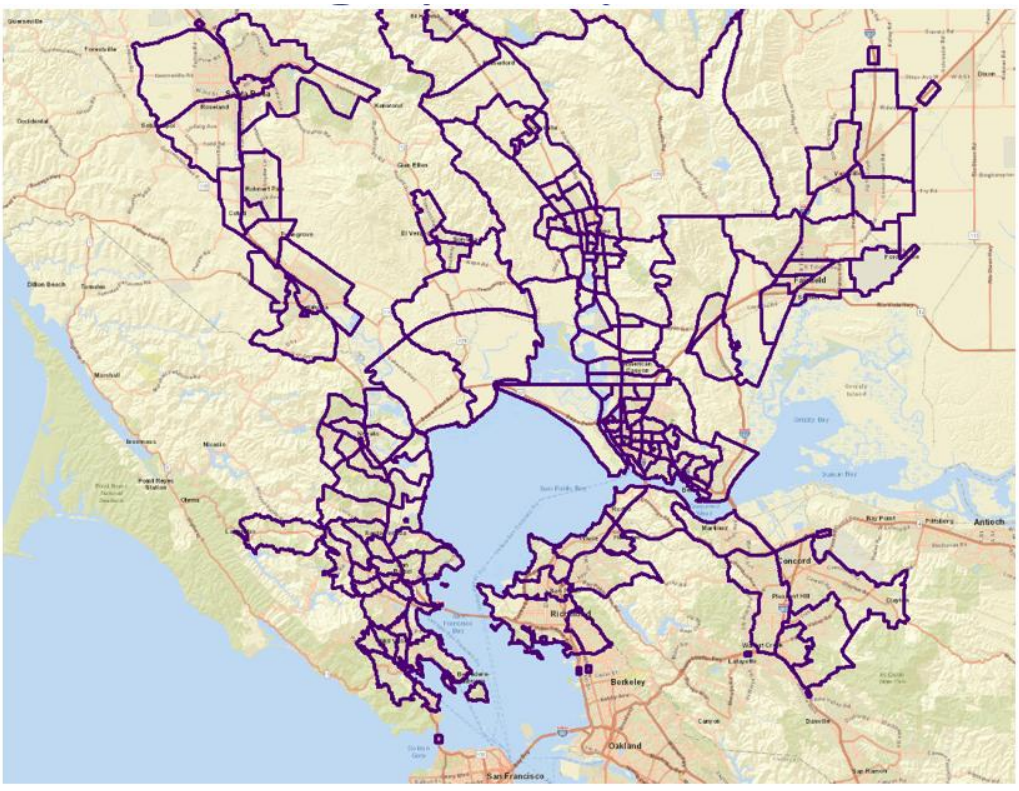
# 4.3.2 Mobile Device Data

Fehr & Peers has worked with numerous mobile device data providers over the years. For this travel market assessment, Fehr & Peers purchased Cuebiq-based origin-destination mobile device data from StreetLight Data[5] given their demonstrated experience supporting similar travel market assessment studies such as the San Pablo Multimodal Corridor Study and the SAMTRANS Express Bus Study. StreetLight Data was also selected because of their InSight Portal which offers a quick, convenient, and flexible method for obtaining data, as well as their ability to provide advanced metrics such as trip lengths, trip purposes, and demographic information based on observed home locations.

## 4.3.2.1 Zone System

Origin-destination data purchased from StreetLight Data was tagged to a geographic layer of 180 zones shown on **Figure 2**. The zone system was designed to understand trips originating in the corridor that could potentially be served by transit. The zone system was coordinated with the TAZ system from the MTC travel demand model for comparison and future/alternative forecasting purposes.

Figure 2: Zone System




[5] https://www.streetlightdata.com/

In addition to the 180-zone system, each of the five study segments was included as a "middle-filter" zone for which the origin and destination of trips traveling through each segment was captured and tagged to the 180-zone system. Isolating trip data for each study segment allowed traffic count data to be used to factor the sample of trips provided by StreetLight Data to estimate the absolute demand for each origin-destination pair and travel market.

The final geographic layer of 180 zones and five "middle-filter" locations were provided to StreetLight Data. StreetLight Data tagged "origin-destination points" to the geographic layer and provided origin-destination trip tables based on mobile devices that provide the number of person trips for each zone to zone origin-destination pair for all trip purposes that occur within the study corridor, including visitor and pass-through trips. Trip tables were provided that indexed the number of trips between each zone that traveled through each "middle-filter" study segment. A separate trip table was provided for each "middle-filter" zone, effectively providing three points of travel for each origin-destination zone pair (the origin location, the roadway segment the person trip traveled through, and the destination location). The data was provided in a format nearly identical to that produced by a travel demand model which will allow for comparison and refinement with the MTC model.

### 4.3.2.2 Data Period

Data was purchased for a single data period (March to May 2018) when school was in session that coincided with the traffic count data collection period. This also ensured the data was consistent with the MTC model outputs as travel demand models are typically developed to forecast an average day when school is in session from a specified year.

### 4.3.2.3 Data Products

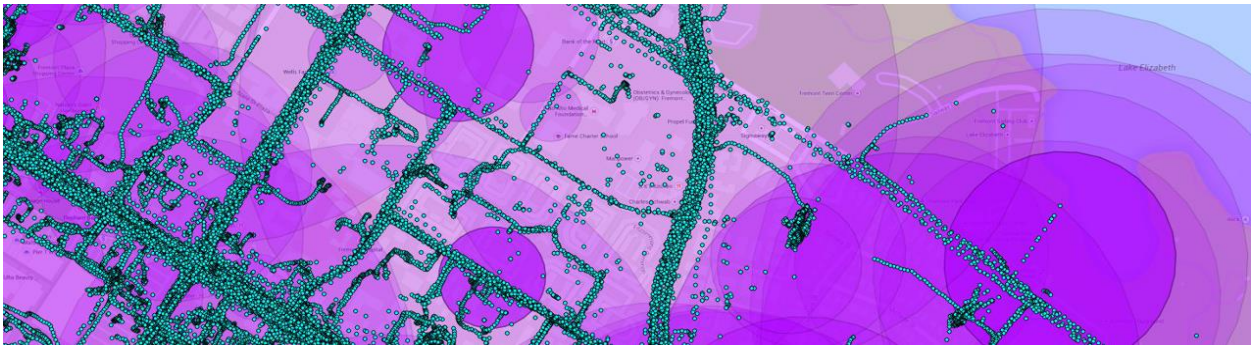
Fehr & Peers carefully reviewed the Scope of Work and conclusions the policy committee wished to draw for the corridor and purchased from StreetLight Data the following three app-based location data products, which provide a very large sample of true origin-destination data passively and anonymously:

- Cuebiq-based origin and destination data
- Cuebiq-based home and work place distribution
- Cuebiq-based origin and destination "middle-filter" data for each of the five study segments

The data was stratified as described below.

- Day Type – average weekday (Tuesday to Thursday), Friday, average weekend day (Saturday to Sunday)
- Day Part - Early AM, AM Peak Period (6 AM to 10 AM), Mid-Day, PM peak period (3 PM to 7 PM), Late-Night, and Daily

Premium trip and traveler metrics were also obtained for the Cuebiq-based data, providing trip length, trip purpose, and demographic data based on 2010 American Community Survey (ACS) data.



## 4.3.2.4 Data Scaling

Due to privacy concerns and sample rates, the indexed trip values in the origin-destination trip tables provided by StreetLight Data represent "relative" rather than "absolute" trips. In other words, the tables do not provide the total number of trips that occur on a daily basis but provide the relative relationship of trips from each zone to every other zone in the geographic layer. Therefore, the mobile device data origin-destination trip tables are used as a starting point due to their large sample size and high level of confidence in the origin-destination data and refined using traffic count data to factor the relative trip data to represent a single period of absolute data.

Fehr & Peers analyzed the mobile device data and utilized the traffic count data obtained from PeMS for the same data period as the mobile device data to scale "relative" travel patterns to an "absolute" measure of trips in the AM and PM peak periods for all five study segments.

#### 4.3.2.5 Data Limitations

Limitations of mobile device data are largely due to federal regulations over privacy concerns, sampling rates, and the reliance on computer algorithms, which lead to potential biases in the data. A detailed discussion of mobile device data limitations and potential biases is provided in **Appendix A**.

## 4.4 Transit/Vanpool Inventory

Fehr & Peers developed a list and geocoded existing transit hubs and park and ride facilities in the vicinity of the SR 37 corridor. Using the mobile device data and travel market assessment findings Fehr & Peers recommended potential locations for additional park and ride facilities that would enhance and encourage transit and pooling.

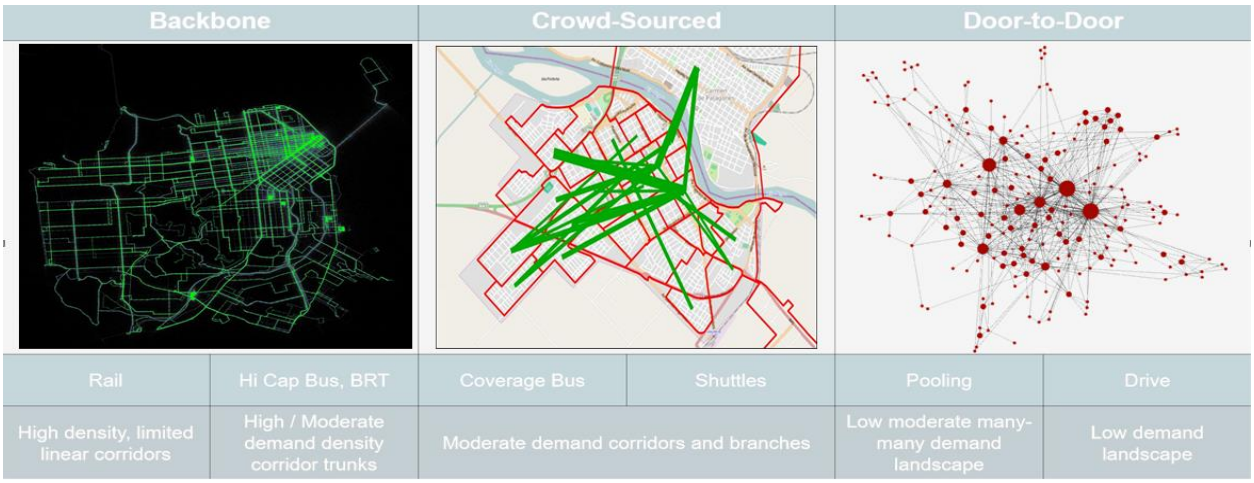
## 4.5 Service/Infrastructure Recommendations

Fehr & Peers suggested a logical approach to deploying fixed-route transit on the corridor considering the five systems that currently operate within the vicinity of SR 37. Headway and hours of operation data were recommended along with a high-level capital and operations annual cost estimate.

# 5. Travel Markets Assessment

Fehr & Peers utilized a "Right-Sized Transit" four-step analysis approach to determine the travel markets and propensity to use transit and non-single occupant vehicle options on SR 37 prior to the evaluation of potential transit options which are discussed in the next chapter. This chapter presents a summary of the travel markets assessment analysis approach and findings.

The figure below illustrates at a high-level the three types of transit included in a "Right-Sized Transit" analysis and the types of travel markets they are most appropriate to serve. As discussed in Chapter 3, the initial impression of the SR 37 corridor is that it serves lower density, dispersed development patterns, which suggests on-demand and pooling as opposed to fixed route service.




As discussed in the previous chapter, traffic count and mobile device data was collected and analyzed for all five study segments to determine the auto travel markets served by the corridor and Sonoma Highway at the Napa/Sonoma county line. However, the focus of the travel markets assessment was on Segment B in the AM peak period due to the bottleneck created by the 9.3-mile two-lane section, the proposed widening of Segment B, and because the AM Peak Period is typically when the modal decision is made. Data was also analyzed for Segment B in the PM peak period to ensure all potential travel markets were captured and understood prior to the evaluation of potential transit options.

# 5.1 Who is using the corridor?

The first step in the travel markets assessment process is to determine who is using the corridor. The objective of this analysis is to determine the absolute magnitude of travel along the corridor as well as the origins and destinations of the users of the corridor.

## 5.1.1 Magnitude of Travel

Traffic count data was collected from PeMS for each of the five study segments. Data was averaged for an average commute day (Tuesdays, Wednesdays, and Thursdays) when school was in session (March to May 2018) for the AM peak period (6 AM to 10 AM) and the PM peak period (3 PM to 7 PM). **Table 1** summarizes the traffic count data collected for each of the five study segments. Bold indicates the highest four-hour traffic volume for each study segment. Yellow shading indicates traffic count data for Segment B in the AM peak period, the focus segment and time period for the travel market assessment.

**Table 1: 4-Hour AM and PM Peak Period Traffic Count Data**

| Direction and Period | SR 37 | | | | SR 121 at the County Line |
|---|---|---|---|---|---|
| | Segment A: US 101 to Sears Point | Segment B: Sears Point to Mare Island | Segment C: Mare Island to SR 29 | Segment C: SR 29 to I-80 | |
| Westbound AM | **6,200** | 4,300 | 3,900 | 7,100 | 3,800 |
| Eastbound AM | 3,100 | 3,400 | 3,600 | 7,200 | 3,700 |
| Westbound PM | 3,600 | 3,700 | **4,600** | 7,800 | **4,600** |
| Eastbound PM | 5,200 | **4,600** | 4,400 | **9,800** | 4,400 |

Source: Fehr & Peers.

As shown in **Table 1**, traffic volumes in the morning are greater in the westbound direction than in the eastbound direction from SR 29 to US 101, with 4,300 vehicles traveling along the two-lane Segment B bottleneck between Mare Island and Sears Point. In the afternoon, 4,600 vehicles travel in the eastbound direction along the two-lane Segment B bottleneck between Sears Point and Mare Island.

**The traffic count data indicates that the SR 37 corridor has a relatively low volume of vehicles in both directions in the AM and PM peak periods** (roughly 16,000 on Segment B) when compared against nearby transit corridors such as US 101 (roughly 85,000 just North of San Rafael) and SR 29 (roughly 25,000 north of American Canyon Road), necessitating a high market capture rate to make fixed-route transit feasible.

**Figure 3** illustrates the four-hour AM peak period traffic counts in the westbound and eastbound directions for all five study segments.

Figure 3: Four-Hour AM Peak Period Traffic Counts

# 5.1.2 Origins and Destinations

Cuebiq-based origin and destination "middle-filter" data for each of the five study segments was analyzed and scaled to match the traffic count data presented in Section 5.1.1 to determine the origins and destinations of users of each of the SR 37 study segments. The following tables and figures provide a summary of the origins and destinations of users of the SR 37 corridor with a focus on the AM peak period and Segment B from Sears Point to Mare Island. Origin and destination data for all directions, time periods, and study segments are provided in **Appendix B**.

## 5.1.2.1 Study Segment Comparison

The tables presented below summarize the relative origins and destinations of users of the five study segments for comparison purposes. **Table 2** summarizes the westbound AM county-level origins and destinations for each of the five study segments. Bold indicates the highest origin and destination percentage share for each of the five study segments.

**Table 2: Westbound AM County-Level Origin and Destination Data**

| County | SR 37 | | | | | | | | SR 121 at the County Line | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Segment A: US 101 to Sears Point | | Segment B: Sears Point to Mare Island | | Segment C: Mare Island to SR 29 | | Segment C: SR 29 to I-80 | | | |
| | Origin | Destination | Origin | Destination | Origin | Destination | Origin | Destination | Origin | Destination |
| Marin | | **67%** | | **55%** | | **40%** | | **11%** | | **9%** |
| Sonoma | 28% | 23% | | 39% | | 30% | | 10% | | **84%** |
| Napa | 11% | | 4% | | 7% | 2% | | **46%** | **64%** | |
| Solano | **42%** | | **68%** | | **65%** | 23% | **64%** | 29% | 23% | |
| Contra Costa | 4% | | 6% | | 5% | | 12% | | 1% | |

Source: Fehr & Peers.

As shown in **Table 2** and on **Figure 4** below, roughly 68 percent of Segment B travelers have their origin in Solano County while 55 and 39 percent have their destinations in Marin and Sonoma counties, respectively. **The data indicates that westbound Segment B primarily serves Solano residents accessing Marin and Sonoma counties in the AM peak period.**

Figure 4: Westbound AM County-Level Origin and Destination Data

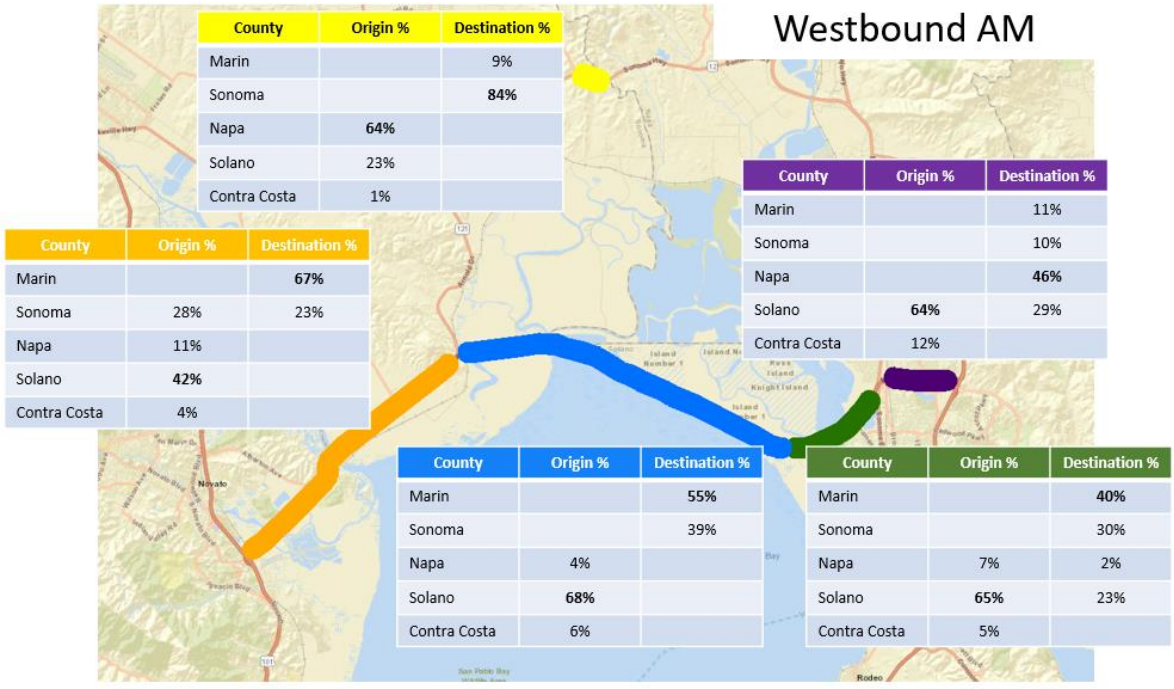


**Table 3** summarizes the eastbound AM county-level origins and destinations for each of the five study segments. Bold indicates the highest origin and destination percentage share for each of the five study segments.

**Table 3: Eastbound AM County-Level Origin and Destination Data**

| | SR 37 | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Segment A: US 101 to Sears Point | | Segment B: Sears Point to Mare Island | | Segment C: Mare Island to SR 29 | | Segment C: SR 29 to I-80 | | SR 121 at the County Line | |
| County | Origin | Destination | Origin | Destination | Origin | Destination | Origin | Destination | Origin | Destination |
| Marin | **52%** | | **48%** | | **32%** | | 10% | | 5% | |
| Sonoma | 32% | 9% | 40% | | 29% | | 9% | | **89%** | |
| Napa | | 12% | | 4% | 8% | 11% | **42%** | | | **81%** |
| Solano | | **37%** | | **47%** | 23% | **50%** | 26% | **42%** | | 11% |
| Contra Costa | | 12% | | 15% | | 13% | | 24% | | 1% |

Source: Fehr & Peers.

As shown in **Table 3**, roughly 48 and 40 percent of Segment B travelers have their origin in Marin and Solano counties, respectively, while 47 percent have their destination in Solano County. **The data indicates that eastbound Segment B primarily serves Marin and Sonoma residents accessing Solano County in the AM peak period.**

## 5.1.2.2 Segment B - Sears Point to Mare Island

The tables presented below summarize the magnitude of origins and destinations of users of Segment B from Sears Point to Mare Island in the AM peak period. **Table 4** provides a summary of total trips in the AM peak period by the following three trip types with the North Bay considered as Marin County, Sonoma County, Napa County, and Solano County.

- North Bay to North Bay - trips that start and end in a North Bay county
- Inter-North Bay – trips that start or end (but not both) in a North Bay county
- Pass Through the North Bay – trips that do not start or end in a North Bay county

**Table 4: Segment B AM Peak Period Trip Types**

| Trip Type | Segment B – Westbound AM | | Segment B – Eastbound AM | |
|---|---|---|---|---|
| | Trips | Percent | Trips | Percent |
| North Bay to North Bay Trips | 2,964 | 69% | 1,573 | 46% |
| Inter-North Bay Trips | 1,218 | 28% | 1,641 | 48% |
| Trips that Pass Through the North Bay | 118 | 3% | 186 | 6% |
| **Total Trips** | **4,300** | **100%** | **3,400** | **100%** |

Source: Fehr & Peers.

As shown in **Table 4**, roughly 3,000 (69 percent) and 1,600 (46 percent) AM peak period trips in the westbound and eastbound directions, respectively, both start and end in the North Bay. **This data indicates that the westbound direction predominantly serves intra-North Bay trips while the eastbound direction serves more trips to or from outside the North Bay.**

**Table 5** summarizes the westbound AM city-level origins and destinations for Segment B. Bold indicates the high origin and destination cities in the North Bay that could potentially be served by fixed route transit.

**Table 5: Segment B Westbound AM City-Level Origins and Destinations**

| Trip Origins | | | Trip Destinations | | |
|---|---|---|---|---|---|
| Trips | Percent | City | Trips | Percent | City |
| **1,384** | **32%** | **Vallejo** | **1,258** | **29%** | **Novato** |
| **942** | **22%** | **Fairfield** | 566 | 13% | Petaluma |
| 612 | 14% | I-80 East | 553 | 13% | Santa Rosa |
| 239 | 6% | Benicia | 480 | 11% | San Rafael |
| 220 | 5% | Vacaville | 300 | 7% | Larkspur |
| 185 | 4% | SR 4 East | 223 | 5% | Sonoma County |
| 158 | 4% | American Canyon | 182 | 4% | Rohnert Park |
| 139 | 3% | Solano County | 148 | 3% | Golden Gate Bridge |
| 134 | 3% | I-680 South | 99 | 2% | 101 North |
| 91 | 2% | Concord | 86 | 2% | Cotati |

Source: Fehr & Peers.

As shown in **Table 5**, roughly 54 percent of trips on westbound Segment B in the morning originate in Vallejo or Fairfield, with roughly 29 percent having a destination in Novato. **This data represents a dispersed westbound AM peak period trip pattern with few origin and destination trip centers that are serviceable by fixed-route transit.**

**Table 6** summarizes the eastbound AM city-level origins and destinations for Segment B. Bold indicates the high origin and destination cities in the North Bay that could potentially be served by fixed route transit.

**Table 6: Segment B Eastbound AM City-Level Origins and Destinations**

| Trip Origins | | | Trip Destinations | | |
|---|---|---|---|---|---|
| **Trips** | **Percent** | **City** | **Trips** | **Percent** | **City** |
| **834** | **25%** | **Novato** | **773** | **23%** | **Vallejo** |
| 447 | 13% | Santa Rosa | 716 | 21% | I-80 East |
| 415 | 12% | Petaluma | **412** | **12%** | **Fairfield** |
| 269 | 8% | San Rafael | 226 | 7% | Benicia |
| 232 | 7% | Golden Gate Bridge | 215 | 6% | I-680 South |
| 146 | 4% | 101 North | 178 | 5% | Pleasant Hill |
| 143 | 4% | Cotati | 158 | 5% | Vacaville |
| 143 | 4% | Rohnert Park | 135 | 4% | Concord |
| 140 | 4% | Tiburon | 92 | 3% | American Canyon |
| 123 | 4% | Sonoma | 89 | 3% | Richmond |

Source: Fehr & Peers.

As shown in **Table 6**, roughly 25 percent of trips on eastbound Segment B in the morning originate in Novato, with roughly 35 percent having a destination in Vallejo or Fairfield. **This data represents an even more dispersed eastbound AM peak period trip pattern with few origin and destination trip centers that are serviceable by fixed-route transit.**

# 5.2 What do the travel markets look like?

The second step in the travel markets assessment process is to determine what the travel markets for the corridor look like. This analysis focuses on determining the magnitude of linked origin-destination pairs as opposed to locations where trips start and where trips ends. This is an important distinction for transit options evaluation as transit options typically work best when serving large groups traveling from a common origin to a common destination. The objective of this analysis is to determine concentrations of trips with common origins and destinations.

Cuebiq-based origin and destination "middle-filter" data for each of the five study segments was once again analyzed and scaled to match the traffic count data presented in Section 5.1.1 but to determine the magnitude of linked origin-destination pairs as opposed to unlinked origin and destination locations. The following tables and figures provide a summary of the origin-destination pairs of users of the SR 37 corridor with a focus on the AM peak period and Segment B from Sears Point to Mare Island.

## 5.2.1 Segment B AM County-to-County Pairs

**Table 7** summarizes the westbound AM county-to-county origin-destination pairs for Segment B. Bold indicates the largest single county-to-county origin-destination pair and the largest origin and destination county flows.

**Table 7: Segment B Westbound AM County-to-County Pairs**

| | Marin | Sonoma | Napa | Solano | Contra Costa | Other | Total | Percent |
|---|---|---|---|---|---|---|---|---|
| **Marin** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0% |
| **Sonoma** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0% |
| **Napa** | 134 | 21 | 0 | 0 | 0 | 13 | 169 | 4% |
| **Solano** | **1,733** | 1,068 | 5 | 3 | 0 | 115 | **2,924** | **68%** |
| **Contra Costa** | 78 | 148 | 3 | 0 | 0 | 16 | 244 | 6% |
| **Other** | 408 | 451 | 0 | 3 | 0 | 102 | 963 | 22% |
| **Total** | **2,353** | 1,687 | 8 | 5 | 0 | 247 | **4,300** | |
| **Percent** | **55%** | 39% | 0% | 0% | 0% | 6% | | **100%** |

Source: Fehr & Peers.

As shown in **Table 7**, roughly 1,700 vehicles (40 percent of total traffic) travel from Solano to Marin County on Segment B in the AM peak period while roughly 1,100 vehicles (35 percent of total traffic) travel from Solano to Sonoma County. **This data suggests two concentrations of trips with common origins and destinations exist at the county-level that can be further analyzed to determine if they are serviceable by fixed-route transit.**

**Table 8** summarizes the eastbound AM county-to-county origin-destination pairs for Segment B. Bold indicates the largest single county-to-county origin-destination pair and the largest origin and destination county flows.

**Table 8: Segment B Eastbound AM County-to-County Pairs**

| | Marin | Sonoma | Napa | Solano | Contra Costa | Other | Total | Percent |
|---|---|---|---|---|---|---|---|---|
| **Marin** | 0 | 11 | 95 | **851** | 189 | 487 | **1,633** | **48%** |
| **Sonoma** | 0 | 0 | 40 | 564 | 286 | 453 | 1,343 | 40% |
| **Napa** | 0 | 0 | 0 | 0 | 20 | 0 | 20 | 1% |
| **Solano** | 0 | 0 | 0 | 11 | 9 | 6 | 26 | 1% |
| **Contra Costa** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0% |
| **Other** | 0 | 0 | 17 | 175 | 14 | 172 | 378 | 11% |
| **Total** | 0 | 11 | 152 | **1,601** | 518 | 1,117 | **3,400** | |
| **Percent** | 0% | 0% | 4% | **47%** | 15% | 33% | | **100%** |

Source: Fehr & Peers.

As shown in **Table 8**, roughly 851 vehicles (25 percent of total traffic) travel from Marin to Solano County on Segment B in the AM peak period while roughly 564 vehicles (17 percent of total traffic) travel from Sonoma to Solano County. **This data suggests two smaller concentrations of trips with common origins and destinations exist at the county-level that can be further analyzed to determine if they are serviceable by fixed-route transit.**

## 5.2.2 Segment B AM City-to-City Pairs

The county-to-county origin-destination pair analysis discussed in the previous section indicated concentrations of common origins and destinations exist at the county-level for Segment B in the AM peak period. However, given the size of the counties in the North Bay, a more refined analysis was necessary to determine areas that may be serviceable by fixed-route transit which is presented in this section.

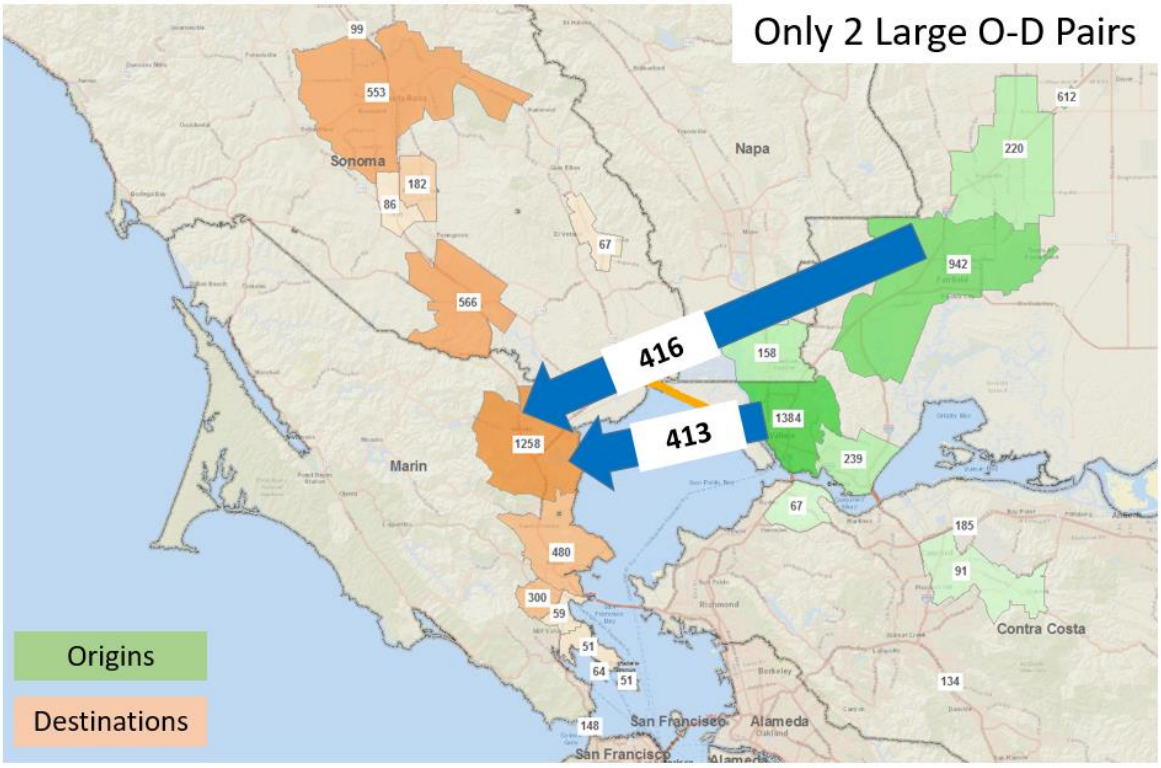
**Table 9** summarizes the top ten westbound AM city-to-city origin-destination pairs for Segment B. The top two city-to-city flows are show on **Figure 5** along with total origins and destination in each city.

**Table 9: Segment B Westbound AM Top 10 City-to-City Pairs**

| # | Origin City | Destination City | Trips | Percent |
|---|---|---|---|---|
| 1 | Fairfield | Novato | 416 | 10% |
| 2 | Vallejo | Novato | 413 | 10% |
| 3 | Vallejo | Petaluma | 220 | 5% |
| 4 | Vallejo | Larkspur | 215 | 5% |
| 5 | Vallejo | San Rafael | 193 | 4% |
| 6 | Fairfield | Sonoma County | 126 | 3% |
| 7 | I-80 East | Santa Rosa | 107 | 2% |
| 8 | Fairfield | San Rafael | 105 | 2% |
| 9 | Benicia | Santa Rosa | 105 | 2% |
| 10 | I-80 East | Novato | 102 | 2% |

Source: Fehr & Peers.

Figure 5: Segment B Westbound AM City-to-City Origins and Destinations



As shown in **Table 9**, only two city-to-city origin destination pairs are larger than 400 four-hour AM peak period vehicle trips for westbound Segment B, **confirming the assumption that the corridor serves a relatively low volume of travel with a very dispersed travel pattern in the westbound direction**.

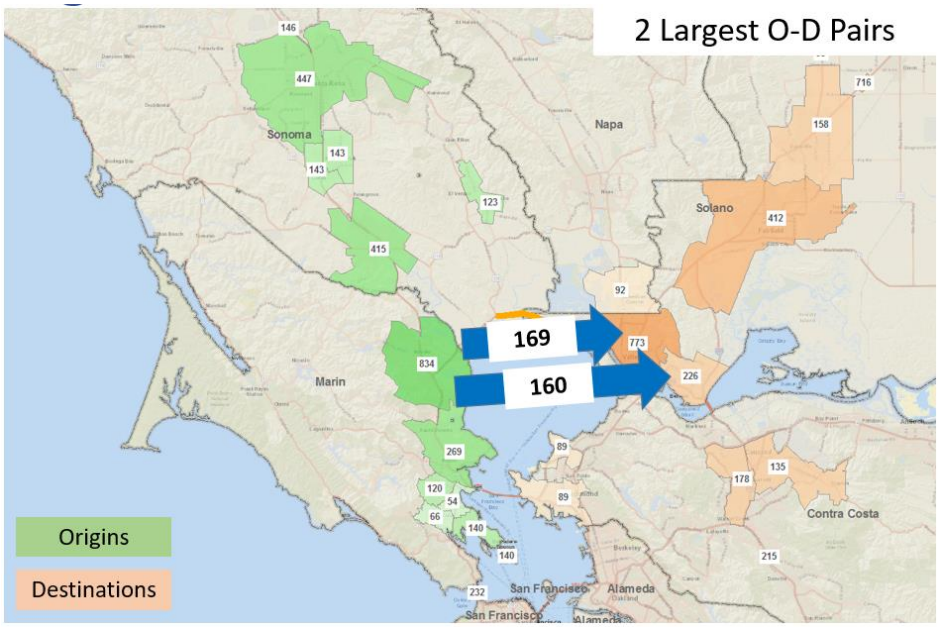
**Table 10** summarizes the top ten eastbound AM city-to-city origin-destination pairs for Segment B. The top two city-to-city flows are show on **Figure 6** along with total origins and destination in each city.

**Table 10: Segment B Eastbound AM Top 10 City-to-City Pairs**

| # | Origin City | Destination City | Trips | Percent |
|---|---|---|---|---|
| 1 | Novato | Benicia | 169 | 5% |
| 2 | Novato | Vallejo | 160 | 5% |
| 3 | Petaluma | Vallejo | 149 | 4% |
| 4 | San Rafael | Vallejo | 132 | 4% |
| 5 | Santa Rosa | Vallejo | 126 | 4% |
| 6 | Novato | Pleasant Hill | 120 | 4% |
| 7 | Novato | I-80 East | 106 | 3% |
| 8 | Novato | Fairfield | 92 | 3% |
| 9 | Santa Rosa | I-80 East | 89 | 3% |
| 10 | Tiburon | I-80 East | 89 | 3% |

Source: Fehr & Peers.

Figure 6: Segment B Eastbound AM City-to-City Origins and Destinations



As shown in **Table 10**, no city-to-city origin destination pairs are larger than 200 four-hour AM peak period vehicle trips for eastbound Segment B, **confirming the assumption that the corridor serves an even lower volume of travel with an even more dispersed travel pattern in the eastbound direction**.

# 5.3 What is their transit propensity?

The third step in the travel markets assessment process is to determine the propensity of current vehicular users to utilize potential transit services provided along the corridor. This process was difficult for the SR 37 corridor as no east-west transit service is currently provided, resulting in a lack of existing transit usage data that could be used to derive a transit propensity profile to guide the analysis. Typically auto ownership is a key variable in a transit propensity analysis as the number of autos owned by a household has been shown through regression analysis to correlate to transit and other non-auto mode usage. Auto ownership is likely near 100 percent for current users of the corridor due to the lack of existing non-auto options on SR 37, further suggesting it may be difficult to shift people out of their vehicles due to the familiarity with driving and investment they have made in their personal vehicle.

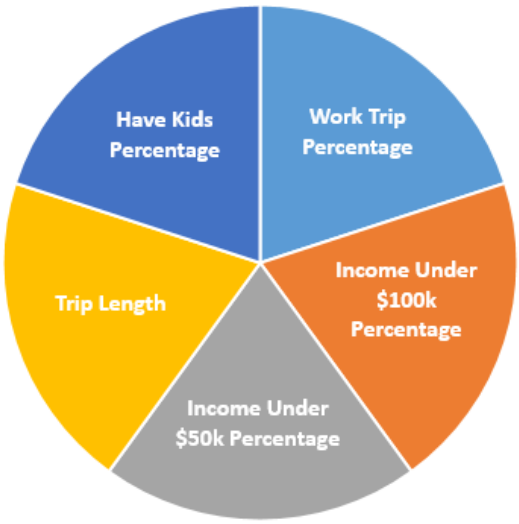
Nevertheless, this analysis focuses on comparing the trip making and demographic profiles of current users to determine which concentrations of origin-destination pairs have characteristics more similar to groups of transit users identified through other studies where both personal auto and non-personal auto options were provided. These studies include Fehr & Peers' San Pablo Avenue Multimodal Corridor Study and the SamTrans Express Bus Study where a similar transit propensity analysis was conducted that compared the trip making and demographic characteristics of existing auto and transit users to determine the characteristics that most influenced transit usage. The variables and propensity criteria from those studies were used as a starting point for the SR 37 transit propensity analysis.

The objective of this analysis is to evaluate the concentrations of trips with common origins and destinations identified in Section 5.2 to determine if they have characteristics similar to groups of transit users identified through other Bay Area studies. A secondary objective is to compare those characteristics to other SR 37 trip concentrations through the use of a transit likelihood index (TLI) score to essentially rank transit propensity for users of the corridor.

Premium trip and traveler metrics tagged to Cuebiq-based origin and destination "middle-filter" data obtained from StreetLight Data, including trip length, trip purpose, and demographic data based on 2010 ACS data, were used to obtain trip making and demographic profiles of current users.

# 5.3.1 Transit Propensity Metrics

The transit propensity metrics used to derive TLI scores for concentrations of trips with common origins and destinations focused on metrics that influence transit ridership such as income and trip length. The chart to right shows the five metrics analyzed from the premium trip and traveler data obtained from StreetLight Data.




As mentioned above, auto ownership is normally a metric for this type of analysis but was not included based on the assumption that most current users of the corridor must own a personal auto.

Below are four examples to illustrate how the transit propensity metrics are used to generate TLI scores for each origin-destination pair and how the scores are then grouped into four quartiles (low, medium, high, and very high) to describe each pair's transit propensity. Transit propensity scores for all origin-destination pairs are provided in **Appendix C**. City-level summaries and scores for high concentration trip patterns are provided below.

| | | | | |
|---|---|---|---|---|
| Origin Zone ID | 509 | 509 | 527 | 504 |
| Destination Zone ID | 204 | 206 | 208 | 204 |
| Origin City | Vallejo | Vallejo | Vallejo | Vallejo |
| Destination City | Novato | Novato | Novato | Novato |
| Work Trips | 0% | 44% | 78% | 100% |
| Income Under $100k | 69% | 69% | 72% | 90% |
| Have Kids | 25% | 25% | 49% | 41% |
| Average Trip Length | 32 | 30 | 30 | 28 |
| Income Under $50k | 20% | 20% | 22% | 57% |
| Work Trips Quartile | 1 | 3 | 4 | 4 |
| Income Under $100k Quartile | 2 | 2 | 2 | 4 |
| Have Kids Quartile | 4 | 4 | 1 | 2 |
| Trip Length Quartile | 3 | 4 | 4 | 4 |
| Income Under $50k Quartile | 1 | 1 | 1 | 4 |
| **Final Score** | **5.4** | **5.8** | **7.9** | **12.2** |
| **Grouping** | **Low** | **Medim** | **High** | **Very High** |

As shown in the four examples above, vehicles traveling from Vallejo to Novato can have vastly different TLI scores based on their trip making and demographic characteristics despite their shared origin and destination. In the first example, zone 509 to zone 204, the low TLI score is largely driven by the low work trip percentage as those trips are typically harder to serve by transit, and the lower percentage of income under $50,000 and $100,000 a year as transit services are typically more utilized by lower income groups. In the fourth example, zone 504 to zone 204, the very high TLI score is largely driven by the high percentage or work trips and high percentage of income under $50,000 and $100,000 a year. This analysis suggests zone 504 has a higher propensity to take transit than zone 509 when traveling to zone 204.

**Table 11** provides a summary of average weekday AM peak period transit propensity metrics for the Segment B corridor from Sears Point to Mare Island.

**Table 11: Segment B AM Average Transit Propensity Metrics**

| Transit Propensity Metric | Average Value for All Users |
|---|---|
| Income Under $100,000 Percentage | 70% |
| Income Under $50,000 Percentage | 36% |
| Work Trip Percentage | 22% |
| Have Kids Percentage | 38% |
| Vehicle Trip Length | 43.1 miles |

Source: Fehr & Peers.

As shown in **Table 11,** roughly 70 percent of users of Segment B in the AM peak period make under the Bay Area median income of $100,000 while 36 percent make under $50,000. **The users have an average vehicle trip length of 43.1 miles.**

Additionally, although the determined work trip percentage was only 22 percent, compared to 45 percent from the SR 37 survey discussed in Section 3.1.1, this percentage is likely much higher due to mobile device data limitations such as bias towards traditional "9 to 5" workers as discussed in Section 4.3.2.5. Discussions with the CTAs indicated a very high percentage of contractor, agricultural, and shift worker usage. It was also indicated that a lot of workers who commute along SR 37 leave work earlier than 4 PM to miss congestion, in which case the mobile device data would not tag their trip as a work-related trip.

## 5.3.2 Transit Propensity Scores

**Figure 7** presents the share of TLI scores that fall into each of the four TLI quartiles for vehicle trips originating in each of the top seven trip generating cities for Segment B in the AM peak period.

Figure 7: Segment B AM Peak Period City-Level TLI Quartile Summary

**AM Origins**

| City | Low | Medium | High | Very High | Total |
|---|---|---|---|---|---|
| Vallejo | 8% | 15% | 22% | 54% | 1,421 |
| Fairfield | 9% | 35% | 31% | 25% | 983 |
| Novato | 18% | 12% | 16% | 54% | 841 |
| I-80 East | 30% | 50% | 11% | 9% | 625 |
| Santa Rosa | 9% | 22% | 39% | 29% | 450 |
| Petaluma | 14% | 43% | 29% | 14% | 418 |
| San Rafael | 14% | 13% | 22% | 52% | 272 |

**AM Destinations**

| City | Low | Medium | High | Very High | Total |
|---|---|---|---|---|---|
| Novato | 10% | 20% | 29% | 41% | 1,269 |
| Vallejo | 6% | 17% | 30% | 47% | 787 |
| I-80 East | 33% | 34% | 27% | 6% | 712 |
| Petaluma | 10% | 31% | 32% | 26% | 578 |
| Santa Rosa | 27% | 36% | 19% | 18% | 566 |
| San Rafael | 14% | 26% | 23% | 37% | 488 |
| Fairfield | 14% | 31% | 27% | 28% | 443 |

As shown on **Figure 7**, Vallejo and Novato have the highest percentage of vehicle trips scoring in the very high TLI quartile for both trip origins and trip destinations, **indicating a very high propensity to use transit for trips originating and ending in Vallejo and Novato**. Furthermore, the three largest trip originating cities (Vallejo, Fairfield, and Novato) all have more than 50 percent of their trip origins score in the high or very high category, **indicating a high propensity for SR 37 users living in Vallejo, Fairfield, or Novato to use transit**.

**Table 12** provides a summary of TLI scores for the five highest concentration trip patterns identified in Section 5.2 for each direction of the Segment B corridor from Sears Point to Mare Island in the AM peak period.

**Table 12: Segment B AM High Concentration Trip Pattern TLI Scores**

| High Concentration Trip Pattern | Average TLI Score | TLI Quartile | Trips |
|---|---|---|---|
| Segment B – Westbound AM | | | |
| Fairfield to Novato | 7.1 | High | 416 |
| Vallejo to Novato | 8.1 | High | 413 |
| Vallejo to Petaluma | 7.6 | High | 220 |
| Vallejo to Larkspur | 8.5 | High | 215 |
| Vallejo to San Rafael | 8.3 | High | 193 |
| Segment B – Eastbound AM | | | |
| Novato to Benicia | 7.4 | High | 169 |
| Novato to Vallejo | 8.3 | High | 160 |
| Petaluma to Vallejo | 7.5 | High | 149 |
| San Rafael to Vallejo | 8.8 | Very High | 132 |
| Santa Rosa to Vallejo | 7.4 | High | 126 |

Source: Fehr & Peers.

As shown in **Table 12,** the average TLI score for all ten high concentration city-to-city trip patterns fall into the high or very high TLI quartile, indicating potentially high transit propensity for trips between corresponding zones that will be studied further during the transit options evaluation.

# 5.4 What transit approaches might work?

The final step in the travel markets assessment process is to determine what transit and non-single occupant vehicle options might work for the SR 37 corridor based on the key findings from the first three steps of the analysis. This section presents a summary of those key findings, followed by an evaluation of potential transit options in Chapter 6.

An analysis of traffic count data indicated that the SR 37 corridor has a relatively low volume of vehicles in both directions in the AM and PM peak periods, suggesting high-capacity fixed-route transit won't be able to efficiently and cost-effectively serve all users of the corridor.

Trip origin and destination data indicated that the corridor primarily serves lower density, dispersed travel patterns, and can be characterized as a many-to-may demand landscape with just a few trip centers. However, the analysis did identify a few trip centers with potentially sufficient origins and destination to be serviceable by fixed-route transit, including Vallejo, Fairfield, and Novato.

The linked origin-destination trip analysis indicated the concentrations of trips with common origins and destinations were primarily traveling from Vallejo and Fairfield to Novato, further suggesting users of SR 37 from the those cities could be serviced by fixed-route transit. The transit propensity analysis showed that the average TLI scores for all four high concentration city-to-city trip patterns identified fell into the high TLI quartile, which indicated that individual zones within these cities should be studied further during the transit options evaluation as the scores likely vary across different areas of the cities. A more refined analysis of zonal TLI scoring will be presented in Chapter 6.

**In conclusion, the travel markets assessment suggests there are some fixed route opportunities between Vallejo, Fairfield, and Novato, but that other travel patterns are too dispersed and more efficiently and cost-effectively served by other transit options such as on-demand transit or enhanced pooling services which will be evaluated in Chapter 6.**

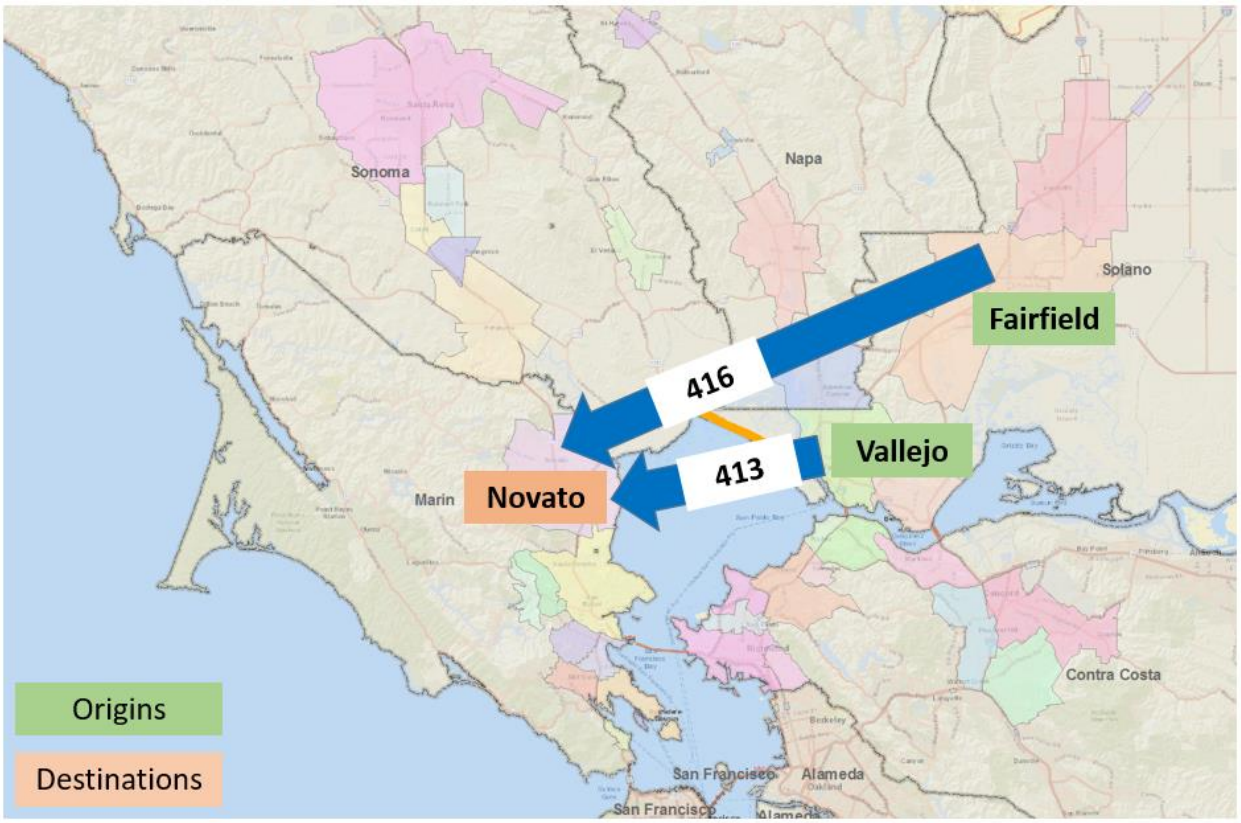
# 6. Transit Options Evaluation

This chapter presents an evaluation of three types of non-single occupant vehicle options for the SR 37 corridor, including fixed route bus service, microtransit, and enhanced pooling options. A qualitative and quantitative assessment of the potential effectiveness of each option based on the key findings from the first three steps of the "right-sized transit" analysis approach is presented, followed by an analysis of future considerations in Chapter 7 and next step recommendations in Chapter 9.

## 6.1 Fixed Route Options

As discussed in Chapter 5, the travel markets assessment suggests there are some fixed route opportunities between Vallejo, Fairfield, and Novato, but that other travel patterns are too dispersed and more efficiently and cost-effectively served by other transit options. **Figure 8** presents the two key AM peak period travel markets evaluated for fixed route service. The focus of the evaluation was on the AM peak period because that is typically when the model decision is made.

Figure 8: Travel Markets for Fixed Route Service Evaluation



As shown on **Figure 8**, the Fairfield to Novato and Vallejo to Novato travel markets were determined to be potential candidates for fixed route service. This was due to the relative size of their existing auto travel markets and their relatively high TLI scores.

However, as discussed in Chapter 5, the traffic count data indicates that the SR 37 corridor as a whole serves a relatively low volume of vehicles in both directions in the AM and PM peak periods when compared against nearby transit corridors served by traditional fixed-route bus service. Furthermore, the travel market quantification indicates that a 12 percent capture of the two city-to-city travel markets would yield roughly 100 riders per day in the westbound direction in the AM peak period, which can be extrapolated to roughly 5,000 riders per month, representing **a magnitude of travel more cost-effectively served by bus service to meet a 20 percent fare box recovery**. For reference, VINE Route 29 which provides service between Napa and the El Cerrito BART station serves roughly 6,000 riders per month.

Additionally, **express bus service as opposed to local bus service was determined to be a more appropriate option** given the distance between origins and destinations (roughly 40 miles between Fairfield and Novato and roughly 25 miles between Vallejo and Novato) as well as the required use of freeways to travel between the origins and destinations.

In conclusion, **express bus service was determined to be the most appropriate and cost-effective fixed route option for potential service between Vallejo, Fairfield, and Novato**.

## 6.1.1 Proposed Express Bus Service

The primary goal of the proposed express bus service was to efficiently and cost-effectively serve the Fairfield to Novato and Vallejo to Novato travel markets. A two-step process was conducted involving a more refined analysis of areas within each of the travel markets discussed in Chapter 5. The first step was to determine the areas within each of the travel markets with the highest number of trips that utilize SR 37, and then to determine which of those areas had the highest likelihood to utilize transit based on their TLI scores. The bus routes and stops were then designed to serve these areas. A secondary goal of the proposed express bus service was to directly serve City of Novato employment centers to utilize TNCs and existing buses for first/last mile connections.

**Figure 9** and **Figure 10** illustrate the City of Fairfield, Novato, and Vallejo trip magnitudes and TLI scores, respectively, for the analysis zones within each of the jurisdictions that utilize SR 37.

Figure 9: Fairfield, Novato, and Vallejo Zonal Trip Magnitudes

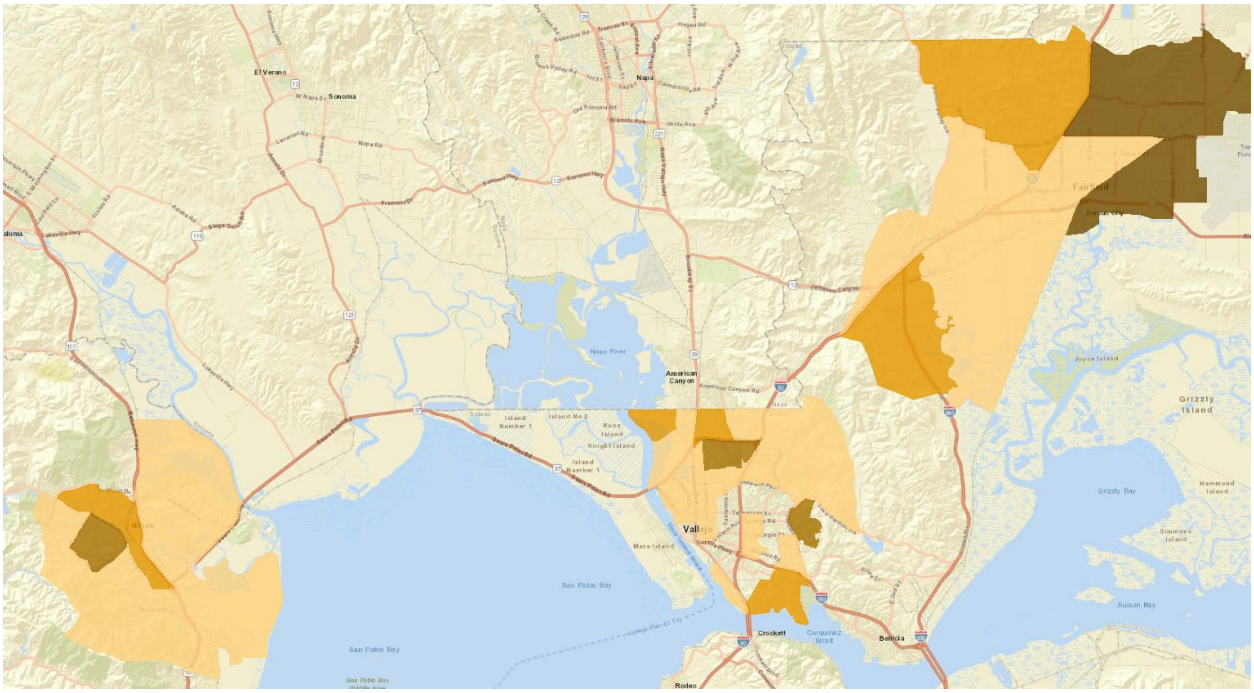
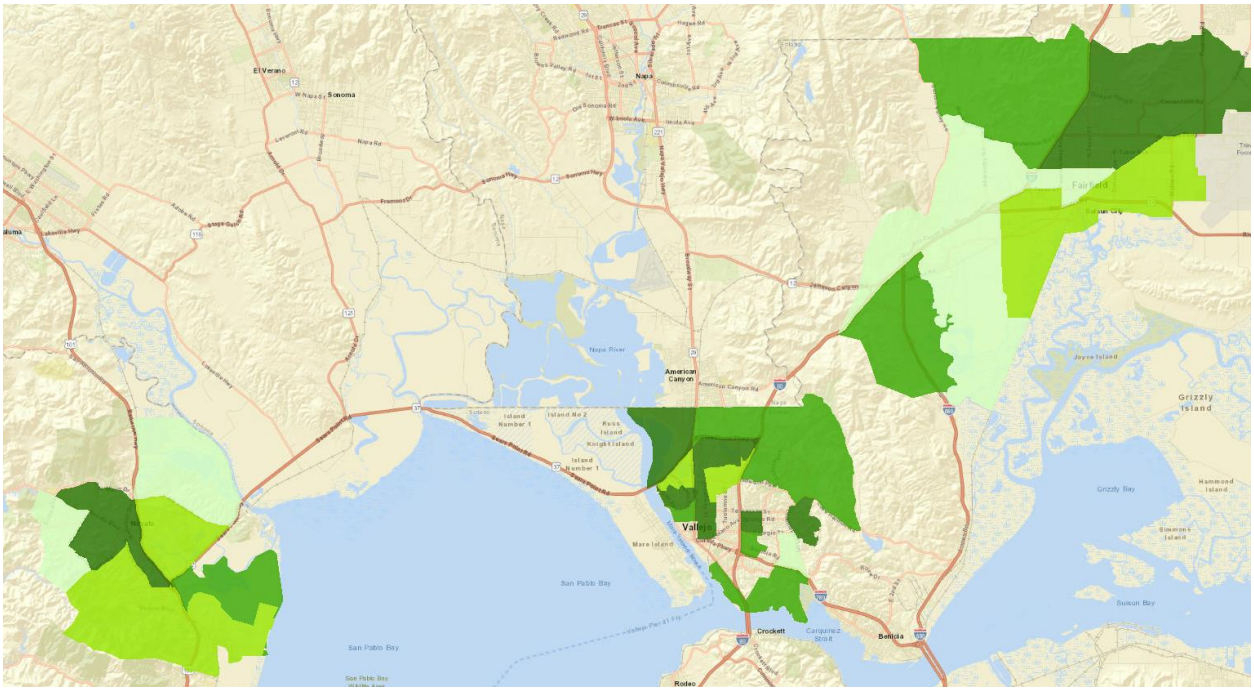



Figure 10: Fairfield, Novato, and Vallejo Zonal TLI Scores



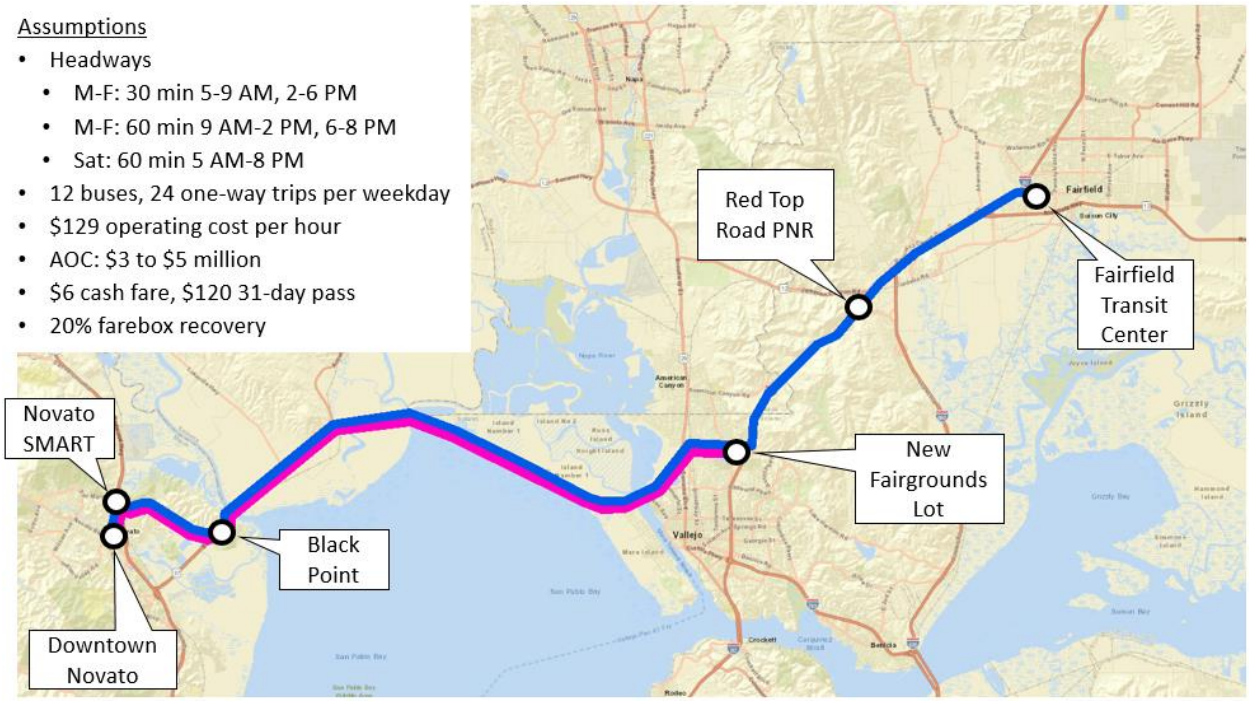
Gradient coloring is utilized to indicate trip magnitudes and TLI scores, with lighter coloring indicating lower magnitudes of trips and lower transit propensity scores, and darker coloring indicating higher magnitudes of trips and higher transit propensity scores. As shown on **Figure 9,** the analysis zones with the highest magnitudes of trips utilizing SR 37 are generally located along SR 37 in Vallejo, north of SR 12 in Fairfield, around the San Marin SMART Station, and in Downtown Novato. Furthermore, as shown on **figure 10,** the analysis zones with the highest TLI scores are generally located in the same areas, suggesting **the areas with the highest magnitudes of trips have a relatively high likelihood to utilize transit services**.

These findings also support and suggest benefits of the secondary goal of the proposed express bus service to directly serve City of Novato employment centers to utilize TNCs and existing buses for first/last mile connections.

## 6.1.2 Proposed Express Bus Routes and Stops

Based on the findings above, two potential limited-stop express bus routes were developed to efficiently serve the Fairfield to Novato and Vallejo to Novato travel markets. The proposed express bus routes are shown on **Figure 11** along with the six proposed stops.

Figure 11: Proposed Express Bus Routes and Stops



As shown on **Figure 11**, separate express bus routes are proposed between Fairfield and Novato and Vallejo and Novato. However, given the relatively low demand, both travel markets could likely be served by a single route (shown in blue), resulting in greater efficiency and cost-effectiveness. However, this would likely lower the quality of service as headways and travel times would likely be longer. Alternatively, service could only be provided between the Solano County Fairgrounds and Novato (shown in pink), with Solano Express Route 85 providing service between Fairfield and the Solano County Fairgrounds if a future park and ride lot is constructed. This would however introduce a transfer which may reduce the attractiveness and ridership of the proposed express bus service along SR 37 given the size of the Fairfield to Novato travel market. The cost range for these alternative is three to five million dollars to operate annually.

Below is a description of the six proposed bus stops.

- **Fairfield Transit Center** – this stop would serve the high magnitude zones north of SR 12 in Fairfield, providing parking and connections to Fairfield and Suisun Transit (FAST) Fixed Local Routes and Express Intercity Routes
- **Red Top Road Park and Ride** – this stop would serve southwest Fairfield, providing parking and connections to FAST routes
- **Future Fairgrounds Park and Ride** – this stop would serve the high magnitude zones along SR 37 in Vallejo, providing parking and connections to SolTrans routes
- **Black Point Park and Ride** – this stop would provide parking for eastbound commuters
- **San Marin SMART Station** – this stop would provide a connection to SMART and serve City of Novato employment centers
- **SMART Novato Hamilton Station** – this stop would provide connection to SMART which connects to Golden Gate Transit service and provides service to the Bel Marin Keys employment area.

## 6.1.3 Proposed Express Bus Assumptions

Below is a bulleted list of the assumptions and characteristics of the proposed express bus routes.

- Headways and Hours/Days of Operation
  - Monday to Friday
    - 30 minute headways from 5 to 9 a.m. and 2 to 6 p.m.
    - 60 minute headways from 9 a.m. to 2 p.m. and 6 to 8 p.m.
  - Saturday
    - 60 minute headways from 5 a.m. to 8 p.m.

- Number of Vehicles: 12 buses, 24 one-way trips per weekday
- Annual Operational Cost: $3 to $5 million depending on which alternative is implemented
- Operating Cost per Hour: $129
- Cash Fare: $6.00, Percent of Trips Cash: 45%
- 31-day Pass: $120.00, Percent of Trips Passes: 55%

## 6.1.4 Farebox Recovery

Farebox recovery measures the percentage of operating costs that are recovered through passenger fares. A standard system wide farebox recovery goal is 20%, consistent with state Transportation Development Act (TDA) rules to which transit operators are subject to if they are a recipient of TDA funds. In order to determine the cost-effectiveness of the proposed express bus routes, an analysis was conducted to determine the percent of the existing auto market that would need to be captured in order to meet a 20 percent fare box recovery. This percentage was then compared against TLI data to determine the likelihood of meeting the determined capture rate.

An analysis conducted by NVTA staff indicated that based on estimated annual operational costs, the proposed express bus routes would need an annual ridership of 55,000 to 60,000, or 4,500 to 5,000 monthly riders, and pay a fare of roughly $6.00 to meet a 20 percent fare box recovery. For reference, Vine Transit Route 29 which provides service between Napa and the El Cerrito BART station serves roughly 6,000 riders per month and has an annual ridership of 70,000.

The first step in the farebox recovery analysis was to determine the total size of the potential market, which was determined to be roughly 1,100 AM peak period vehicles from the travel markets assessment discussed in Chapter 5. The next step was to determine the number and percentage of those vehicles that would need to shift to the proposed service in order to meet 5,000 monthly riders. It was determined that **in order to meet 20 percent farebox recovery, the proposed service would need to capture about 12 percent of the existing auto travel market**, or roughly 130 AM peak period vehicles.

Below is a discussion of limitations of this analysis.

- This analysis is based on vehicle trips as opposed to person trips. This is an important distinction because a single-occupant vehicle switching to transit would result in one fare purchase while a multi-occupant vehicle switching to transit would result in multiple fare purchases. Our analysis conservatively assumed one fare purchase per vehicle, likely resulting in a conservative farebox recovery estimate given the 19 percent carpooling rate for the corridor.

- This analysis focuses on the peak periods only and assumes riders will return on transit in the PM only if they took transit in the AM.

The second step in the farebox recovery analysis was to use TLI data to determine the likelihood of meeting the 12 percent capture rate.

This likelihood was estimated by looking at the TLI scores for all Fairfield to Novato and Vallejo to Novato origin-destination pairs and determining the percentage of trips that fell within each of the four transit propensity categories. As shown on the chart to the right, **roughly 50% of the AM peak period potential market has a very high transit propensity**, which is largely driven by income levels in the Fairfield and Vallejo zones.

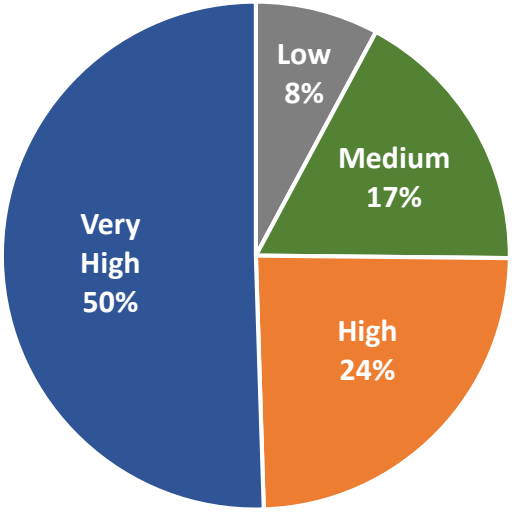
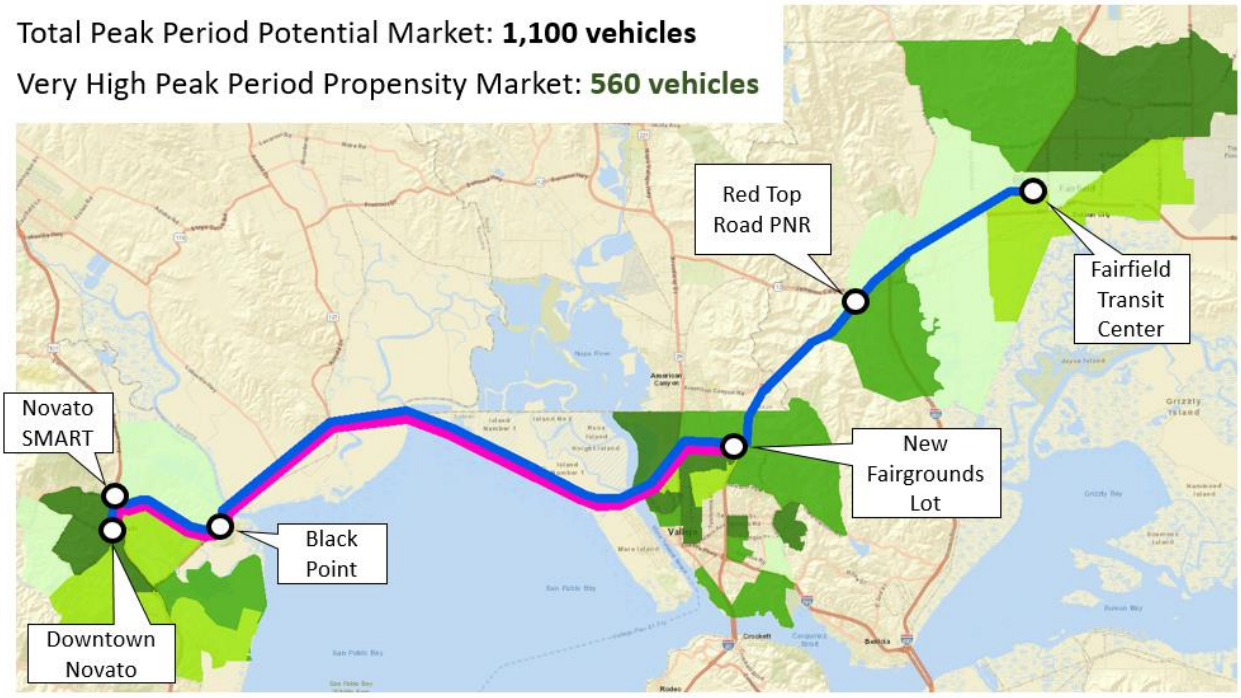



**Figure 12** illustrates the Fairfield, Novato, and Vallejo zonal TLI scores in relation to the proposed bus service, indicating that service is proposed near all very high peak period transit propensity areas, which represent roughly 50 percent of the potential market.

Figure 12: Proposed Express Bus Propensity Market



This analysis suggests **demand and propensity for the proposed express bus service exists**, but that the service needs to be marketed, made convenient for patrons, and incentivized through projects such as the future Fairgrounds Park and Ride and the interim Segment B project, which will incentivize pooling options such as an express bus service as patrons will be able to bypass congestion in general purpose lanes.

# 6.2 Microtransit

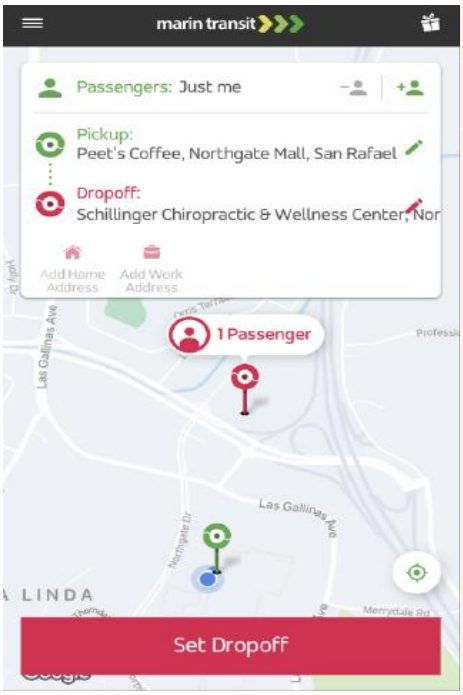
As discussed in Chapter 5, the travel markets assessment suggests microtransit and enhanced pooling services may be efficient and cost-effective methods to serve many of the dispersed travel patterns served by the corridor. A discussion of microtransit options for the SR 37 corridor are presented in this section while enhanced pooling options are discussed in Section 6.3.

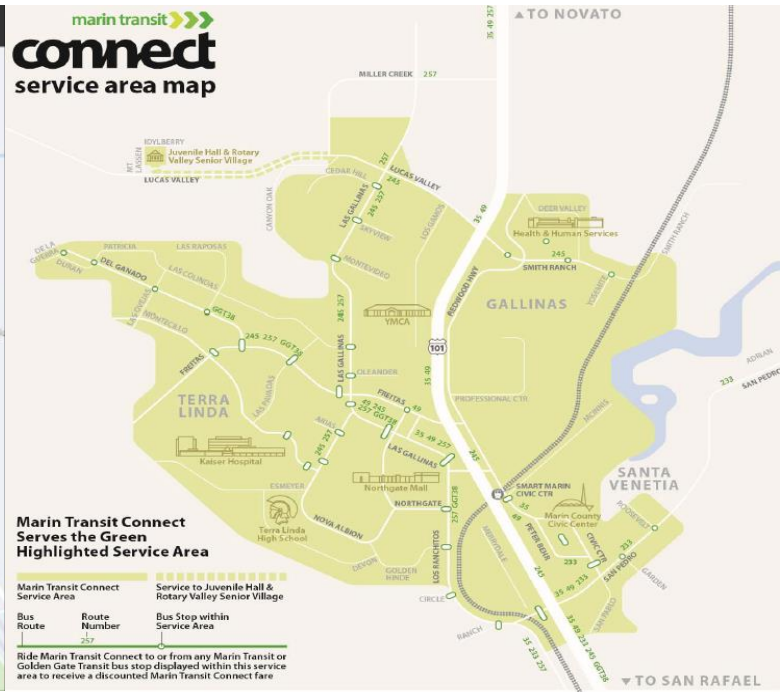
Microtransit is a form of demand responsive transit (DRT) that uses technology (usually in the form of a website or mobile phone application) to offer flexible routing and scheduling of transit service vehicles. These vehicles can be operated by private companies (like Uber, Lyft and Chariot[6]) or by public agencies. It is generally considered a form of transit service in between private autos and fixed route service as it offers greater flexibility in deployment, allowing for semi-fixed route service to be integrated with door-to-door service. The app-based interface also makes it easy to provide subsidies, pooling incentives and rewards to promote usage, potentially decreasing single-occupant auto trips. Microtransit also allows for geo-fencing, or restricting usage to and/or from specific areas, to control the potential impacts of the provided service and the types of trips that are being subsidized. For instance, a subsidy could be offered only for trips traveling between a specific employment center and a specific transit station. Usage could also be restricted within specific areas of a city to reduce congestion or potential issues with pickups and drop-offs. Examples of microtransit providers are Chariot, Marin Transit Connect and UberPool.

An example of a nearby microtransit deployment is Marin Transit Connect. Marin Transit in collaboration with Whistlestop and Via provides an on-demand, public transit service offered in Northern San Rafael that has been in operation for one year. The pilot project is the first on-demand service of its kind for Marin Transit. The service hours are weekday from 6:20 am to 7:00 pm with a fare of $4.00 per seat or discounted to $2.00 per seat for seniors or Americans with Disabilities (ADA). Monthly passes are available for $40.00

[6] Chariot ceased operation on February 1, 2019, but is being referenced as an example of microtransit and how the landscape of services and providers is constantly changing.

per month. Marin Transit is the owner and operator of the vans which are ADA accessible and hold nine passengers or five plus wheelchairs.




As discussed previously, microtransit generally works well serving dispersed travel patterns like those observed along the SR 37 corridor due to its on-demand nature which allows for flexible routing and schedules. For this study, two types of microtransit services were determined to be potential solutions for the SR 37 corridor. Privately operated, much like TNCs, to provide a door-to-door service option, providing user flexibility and a similar experience to a personal auto, as well as first and last mile connections for the proposed express bus routes. And minibuses running on semi-fixed routes with designated stop areas (similar to Marin Transit Connect deployment) to connect to fixed-route transit stops and park and ride lots while also offering on-demand service within designated catchment areas. These two microtransit options are discussed in more detail below.

## 6.2.1 SR 37 TNC Deployment

A potential transit solution for the SR 37 corridor is to promote and subsidize TNCs to provide an app-based, on-demand, and door-to-door service option which would provide users with a similar level of flexibility and a similar experience offered by a personal auto. This program would be advertised on the transit provider(s) website(s) and along the SR 37 corridor and subsidized for seniors, American's with disabilities, and for trips to and from high-capacity transit stops and offer the flexibility to subsidize other forms of trips through geo-fencing.

A major limitation of the TNC program is that in order to achieve a decrease in vehicle trips, vehicle miles travelled, and congestion, **a shared ride requirement would need to be implemented** for trips traversing SR 37. However, as discussed in Chapter 2 for the Go Dublin! Rideshare Promotion, enforcement can be difficult and low demand in suburban areas lacking concentrated trip centers (like the SR 37 travel market) can make ride linking through Uber and Lyft's algorithms nearly impossible.

Additionally, **the length of the corridor would likely make the user cost and any form of TNC subsidy cost-prohibitive**. This is due to the current pricing structure of TNC providers which charge on average one to two dollars per mile travelled, making the cost to traverse the 21-mile corridor up to $40 and the cost of a subsidy to make the mode competitive with a bus around $35 per trip. Furthermore, conversations with Uber and Lyft staff have suggested that **TNC drivers make more money off multiple shorter distance trips than a single long distance trip**, dis-incentivizing them from operating along the corridor and creating a lack of TNC supply for the program.

As a result of these findings, we do not recommend the usage of TNCs and the provision of a TNC subsidy to traverse the SR 37 corridor. **We instead recommend the usage of TNCs and the provision of subsidies for first and last mile connections on both ends of the corridor at the proposed express bus route stops** discussed in Section 6.1 and shown on **Figure 13**. We also recommend the inclusion, expansion, and promotion of TNC pickup and drop-off areas at park and ride lots along the corridor, including the future park and ride lot at the Solano County Fairgrounds.

Figure 13: Proposed Express Bus Stops for TNC Integration

## 6.2.2 SR 37 Minibus Deployment

Another potential transit solution for the SR 37 corridor is to deploy a minibus service along SR 37. The service will follow a semi-fixed route along the proposed express bus routes discussed in Section 6.1. The proposed express bus stop locations, many of which are located at proposed or existing park and ride lots, will also be utilized. A key distinction to make from the proposed express bus route service is, after traversing the corridor, the minibuses would act as on-demand shuttles within a geo-fenced area (similar to Marin Transit Connect service). The shuttles will operate for a specified duration of time until they make their return trip in the afternoon. This system could reduce deadheading and provide additional on-demand transit options at both ends of the corridor.

Like the proposed TNC service, the minibus service would be app-based and on-demand, providing users with a similar level of flexibility offered by a personal auto, but with an inherent shared ride component due to the type of vehicle being utilized. The semi-fixed route would also concentrate trips and further negate the need for shared ride enforcement. This program would be advertised on the transit operator(s) website(s) and along the SR 37 corridor and subsidized for seniors and individuals with disabilities. Riders will have the option of a monthly pass.

This style of service could prove to be the most attractive to the public but currently the cost to run it effectively are prohibitive. This style of service will be roughly double the amount of vehicles needed for the fixed route transit option. With the doubling of vehicles comes the doubling of costs. Operators would need fifteen vehicles to cover the geographic areas on each side of the corridor that show the highest propensity for transit use. Due to the high number of car owners already traversing the corridor it is likely that they will continue to use their car for the first mile of their trip. A hybrid model of fixed route and on-demand service could prove sustainable once the volume of transit trips along the corridor is known. On-demand service could be more effective as a last mile option as long as it is appropriately scaled to transit use.

# 6.3 Enhanced Pooling Options

Pooling, more commonly referred to as carpooling or vanpooling, is the sharing of a vehicle to prevent the passengers from having to drive to a similar destination by themselves. This results in a reduction of each person's travel costs, such as fuel costs and tolls, while also reducing congeston along the traveled roadways and the need for parking spaces at destinations. Pooling is also an environmentally friendly and sustainable way to travel as shared trips reduce air pollution and carbon emissions.

As discussed in Chapter 2, the SR 37 Survey & Focus Groups found that approximately 19 percent of daily users of SR 37 identified their primary mode of travel as carpooling. This anecdotally high percentage for a non-urban corridor suggests demand for expanded and enhanced pooling options. This existing demand coupled with the potential benefits of pooling and potential integration with bus and TNC services has led to the investigation of ways to efficiently and cost-effectively enhance pooling options for users of the SR 37 corridor.

The enhanced pooling options analysis began with an inventory of existing Bay Area park and ride lots, including their existing occupancy rates, followed by research into ways to facilitate, incentivize and reward pooling.

## 6.3.1 Existing Park and Ride Lots

**Figure 14** illustrates the existing park and ride lots in the vicinity of the SR 37 corridor and provides available parking occupancy information for lots potentially utilized by SR 37 users determined based on the travel markets analysis. The corridors travelled by SR 37 users are generally shown with coloring and thickness. Thick red coloring indicates high usage corridors while thin green coloring indicates low usage corridors.

Figure 14: Existing Park and Ride Lots

As shown on **Figure 14**, numerous park and ride lots currently exist along roadways utilized by SR 37 users but only one park and ride lot (Black Point in the City of Novato) exists on the corridor itself. Additionally, park and ride lots in the three largest travel markets (Vallejo, Fairfield, and Novato) are generally near or over capacity, potentially affecting existing pooling rates and also the potential for users of the corridor to utilize the proposed express bus service discussed in Section 6.1. This suggests the **need for additional park and ride capacity for SR 37 users to facilitate and incentivize additional pooling as well as the proposed express bus service**.

# 6.3.2 Park and Ride Opportunities

The analysis of existing park and ride lot and occupancy data with the travel markets analysis findings suggests **additional demand for park and ride capacity near the ends of the SR 37 corridor**. Below is a discussion of park and ride opportunities for each end of the SR 37 corridor. In general, providing park and ride capacity on the eastern end of the corridor would facilitate the higher westbound commute direction in the morning, while providing park and ride capacity on the western end would facilitate the lesser eastbound commute direction in the morning.

## 6.3.2.1 Eastern End

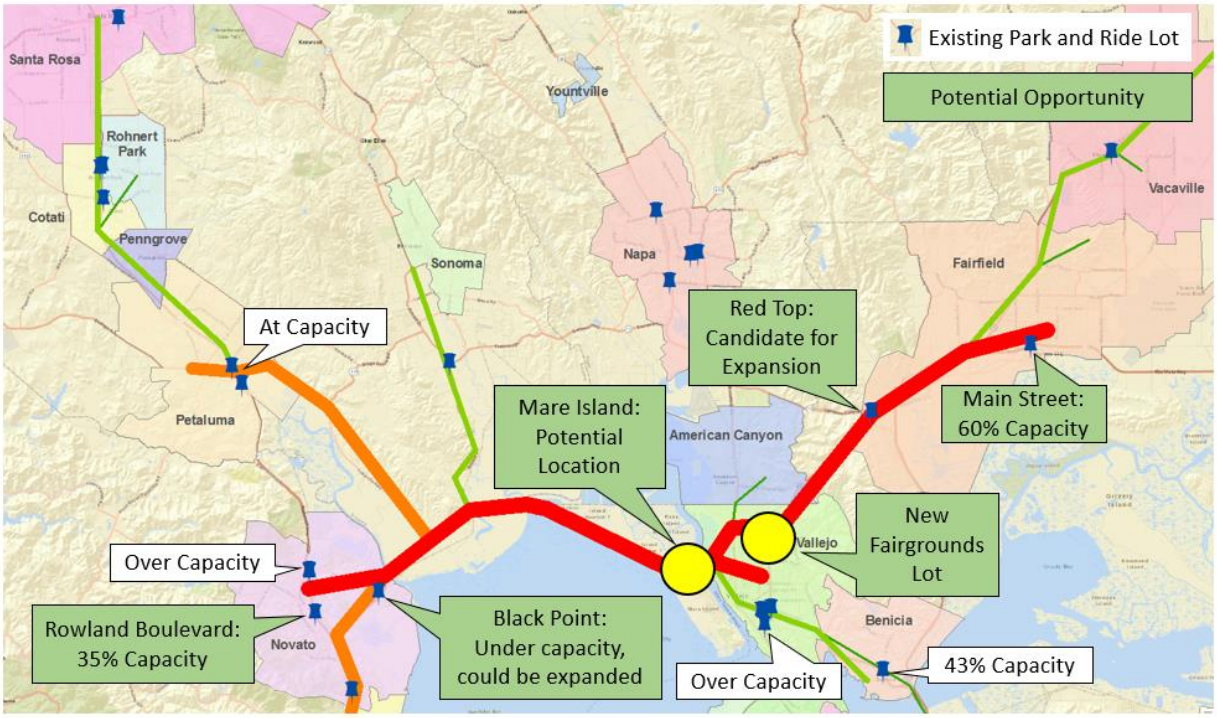
- STA is beginning construction on the **Solano Fairgrounds Express Bus Stop** which is anticipated to be operational on July 1, 2019. Additionally, STA is completing a park and ride analysis for the Fairgrounds location. An additional park and ride lot at this eastern end of the corridor would be ideal to serve the proposed SR 37 express bus. The park and ride lot would likely serve Fairfield, Vacaville, Vallejo, and potentially Napa residents.
- A **park and ride lot could be provided on Mare Island** north of SR 37 to better serve Contra Costa County, Benicia, and southern and western residents of Vallejo.
- The existing **Red Top park and ride lot could be expanded** to provide additional park and ride capacity to Fairfield and Vacaville residents.
- Existing park and ride **capacity at the Marin Street park and ride lot in Fairfield could be utilized** with outreach and promotion to increase the utilization rate.

## 6.3.2.2 Western End

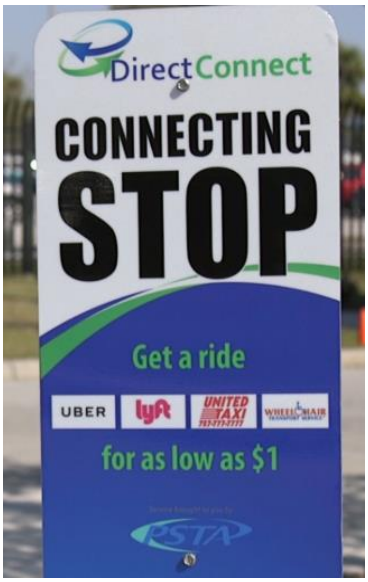
- Existing park and ride **capacity at the 30-space Black Point park and ride lot could be utilized and potentially expanded** to provide additional park and ride capacity for the western end of the corridor. This park and ride lot would likely serve Novato and San Rafael residents.
- Existing park and ride **capacity at the 240-space Rowland Boulevard park and ride lot could be utilized** to provide park and ride capacity for the western end of the corridor and to connect to Golden Gate Transit service.

**Figure 15** illustrates the park and ride opportunities for each end of the SR 37 corridor.

Figure 15: Park and Ride Opportunities




As shown on **Figure 15**, park and ride opportunities exist for each end of the SR 37 corridor that could bolster existing carpooling and/or vanpooling through the facilitation of both formal and casual carpool and/or vanpool options by providing parking spaces as well as pickup and drop-off locations. Additionally, each opportunity is located along key travel markets as well as along the proposed express bus service route and the semi-fixed route proposed for the SR 37 minibus deployment. This suggests integration of formal and casual carpool/vanpool options with microtransit (TNCs and minibuses) and express bus connections. This would involve providing specified TNC areas, bus stops for minibuses and express buses, and proper signage and information. **The facilitation of multiple mobility options suggests use of emerging mobility services or technologies to inform, promote, incentivize, track, and reward non-single-occupant auto patrons.** The software platform or application would not only make it easier for these patrons but would also allow for subsidies for low income and persons with disabilities.



### 6.3.3 Vanpool

Vanpools differ from microtransit or employer-provided shuttles because they are operated by an unpaid driver and typically include 7 to 10 commuters. Current vanpool subsidies are provided under MTC's 511.org program. The program provides the following:

- Finds vanpools with vacant seats
- Provides Enterprise-lease options for new vanpools
- Provides resources to owner-operated vans
- Provides resources to find/start or keep a vanpool on the road

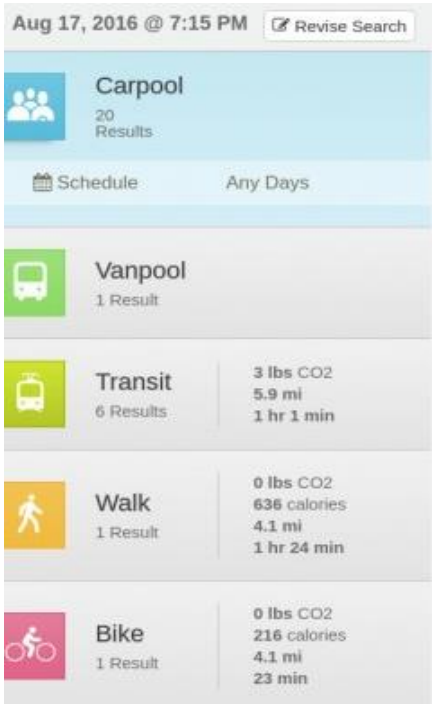
The enterprise lease option allows $350 per month per van as a subsidy. The subsidy is first come/first serve as funds are available; discounted parking permits and free bridge tolls are provided for larger vans with 11 to 15 passengers. This program requires the driver to do National Transit Database (NTD) reporting.

The owner-operated program allows drivers who already have a van and are interested in sharing the ride with ride-matching services to fill their vans as well as provides a "seat subsidy" when seats are not filled. The program also provides discounted parking permits and free bridge tolls for larger vans with 11 to 15 passengers. Drivers have to pass a Department of Motor Vehicles (DMV) medical exam to participate in the program.

There are numerous vanpools operating in the North Bay but limited data is available on how many traverse the SR 37 corridor. There is potential for the North Bay CTAs to partner on a vanpool program that serves SR 37 users. The program would need to be fully flushed out and funding would need to be identified.

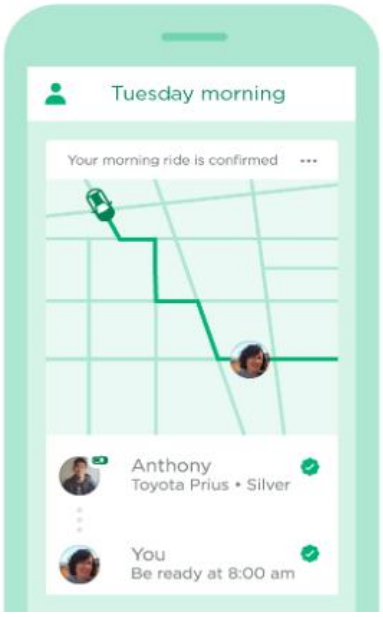
# 6.3.4 Emerging Mobility Services

Mobility-as-a-Service (MaaS) describes a shift away from personally-owned modes of transportation and towards mobility solutions that are consumed as a service. This is enabled by combining transportation services from public and private transportation providers through a unified gateway that creates and manages the trip, which users can pay for with a single account. The key concept behind MaaS is to provide an easy way to offer travelers mobility solutions based on their travel needs.[7]




Research into MaaS software platforms and applications was conducted as part of this study through conversations with providers and users. The overall conclusion was that **a MaaS software platform or application can be an efficient and cost-effective way to inform people of transportation options available to them and to promote, incentivize, track and reward the use of non-single-occupant autos**, and that further explorations should be conducted for the SR 37 corridor.

## 6.3.4.1 Carpooling Applications

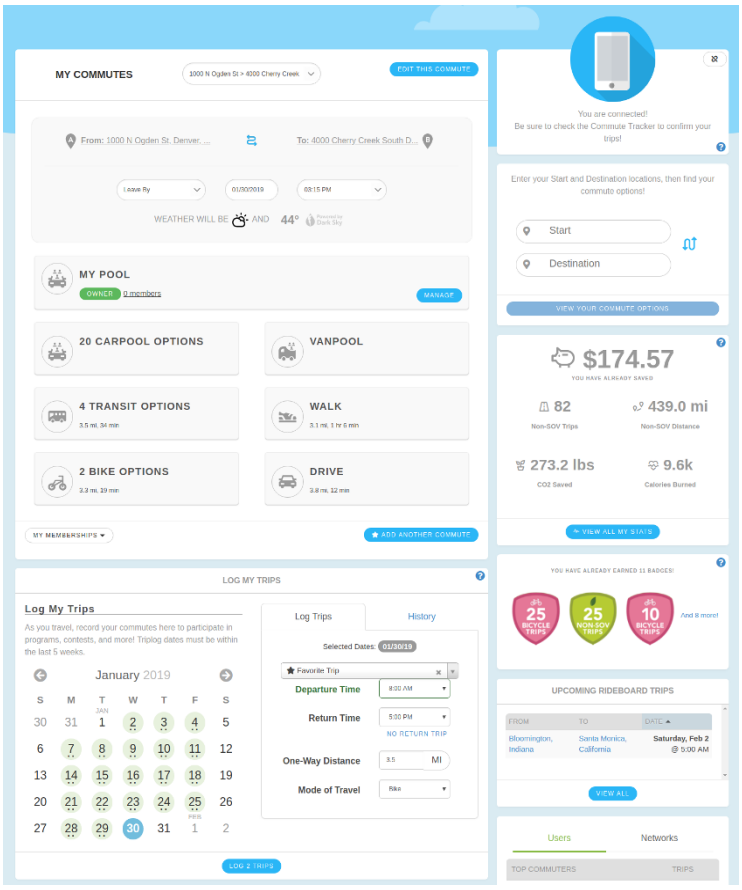



To support the focus on enhancing pooling options, two carpooling application providers researched for this study were Scoop and Waze Carpool. Both provide applications which utilize algorithms to provide carpool options and identify the most efficient trip based on the fastest route, nearby carpoolers, and carpool lanes. The current cost structure involves the carpooler paying within the application which then provides a share to the driver. However, both applications focus on carpooling and provide limited options for other modes of travel and lack of integration with other public and private service providers.

This led to further research being conducted into Software-as-a-Service (SaaS) providers, like RideAmigos, which offer a commuter management platform that aggregate multiple mobility options and offer rewards for non-drive alone auto trips.

[7] https://en.wikipedia.org/wiki/Mobility_as_a_service

### 6.3.4.2 RideAmigos




RideAmigos is a SaaS provider that offers a commuter management platform that aggregates multiple mobility options and offers rewards for non-drive alone auto trips. Their platform integrates with TNC providers like Uber and Lyft, carpool applications such as Scoop and Waze Carpool, and public transit operators. They see themselves as a hub for commuter benefits and want to encourage mode shift by offering people information, incentives, and rewards. They also provide a mechanism for subsidy integration.

An important distinction between SaaS providers like RideAmigos and application providers like Scoop and Waze Carpool is that SaaS providers develop and sell their software for a one-time fee to their clients who are then expected to operate the platform with on-call support from the developer, whereas application providers continually operate and maintain their own applications and maintain total control over services provided. Both options have their own benefits and detriments depending on the needs of the user.

Given that STA, NVTA and TAM are currently in contract with RideAmigos**, it is recommended that they discuss options to tailor the RideAmigos software platform specifically to SR 37 corridor users to promote existing and any new non-single-occupant auto modes provided.** These options could include a dedicated section of the software platform for the SR 37 corridor, advertisements for SR 37 transportation options within the platform and on their websites, custom pop-ups, and special pricing within specific geo-fenced areas. Through discussions with RideAmigos staff it was determined that most of these options were configurable within the current platform for no additional cost.

# 7. Future Considerations

This chapter discusses near-term and long-term future considerations for the SR 37 corridor and how they may influence the transit options discussed in Chapter 6.

## 7.1 Near-Term Considerations

The SR 37 corridor has significant traveler delays on weekday mornings in the westbound direction for approximately six hours with an average delay of roughly 30 minutes, and on weekday afternoons in the eastbound direction for approximately seven hours with an average delay of roughly 80 minutes. A survey of corridor users indicated that many users rearrange their lives in response to anticipated congestion, indicating a need for improvements along the corridor to relieve and reduce the secondary impacts of congestion. The survey also indicated that roughly 19 percent carpool today, suggesting demand for and likely utilization of HOV lanes.

In order to alleviate congestion along the corridor, HOV lanes are proposed and currently being studied for Segment B. The interim project will likely be a reversible travel lane, or an additional lane in each direction utilizing existing right-of-way, restricted to HOVs and buses without a tolling component. **The interim project incorporating an HOV lane would likely incentivize all non-single-occupant auto options presented in Chapter 6 for the westbound direction in the morning** as express buses, minibuses, corridor TNC users, and carpoolers would all be granted access and likely experience travel time savings through use of the additional HOV lane. Furthermore, a RideAmigos platform tailored to the SR 37 corridor would further incentivize these options as it would provide travel time savings information, incentives, and rewards for using non-single-occupant auto modes of travel.

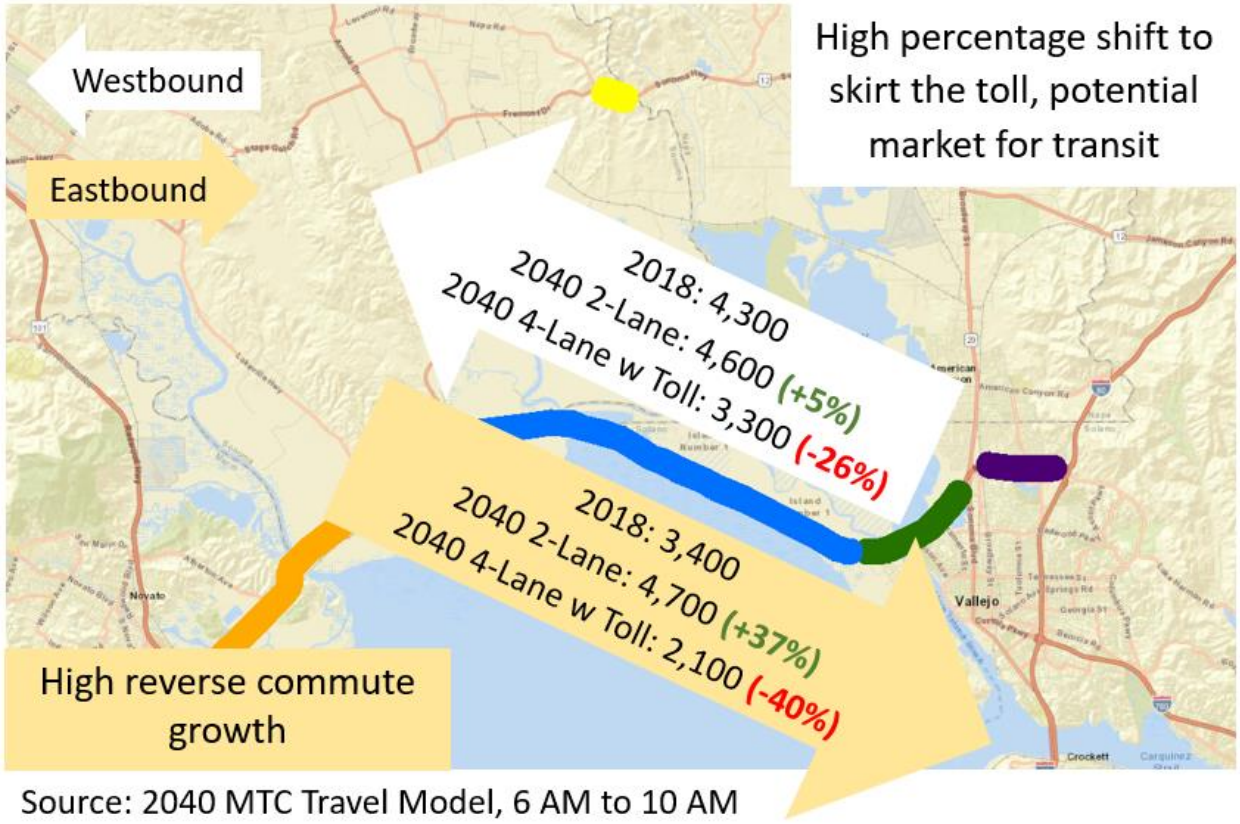
## 7.2 Long-Term Considerations

The long-term project will likely construct a new four-lane tolled facility from Vallejo to Novato. In order to determine the long-term effects of this improvement, Fehr & Peers obtained the following three model runs from the Metropolitan Transportation Commission's (MTC) Travel Model One.

- A base year (2015) scenario
- A future year (2040) scenario with SR 37 coded as a two-lane facility (same as existing conditions)
- A future year (2040) scenario with SR 37 coded as a four-lane facility with each direction tolled at 50 percent of the current one-way toll rate for the Richmond-San Rafael Bridge

The three model runs were used to determine the growth in traffic between the base year (2015) and the two future year (2040) scenarios. The growth was then added to existing (2018) traffic counts to forecast future travel demand under each future year (2040) scenario. The resulting AM peak period forecasts and growth percentages are presented on **Figure 16**.

Figure 16: SR 37 Long-Term AM Peak Period Forecasts




As shown on **Figure 16**, MTC's Travel Model One forecasts limited growth in the westbound direction in the morning under the two-lane scenario with significantly higher growth in the eastbound direction in the morning. Furthermore, the model forecasts the morning eastbound direction to exceed the morning westbound direction, likely resulting in congestion levels similar to those experienced in the eastbound direction in the afternoon today. This forecast indicates **busand pooling options should be provided in the eastbound direction in the morning,** despite the low level of congestion experienced today, to ensure non-single-occupant auto modes of travel are available and utilized in the future to relieve congestion.

Under the four-lane scenario with tolling, MTC's Travel Model One forecasts significant decreases in travel in both directions on SR 37. The resulting decreases reduce forecasted traffic below existing conditions. This forecast suggests a high percentage of people shifting off the corridor to parallel facilities in order to skirt the toll either because they can't afford to pay it or because they don't want to pay. It should be noted,

the model did not take in to account existing or future capacity of parallel routes. Parallel routes to the north and south of SR 37 are currently over capacity and would likely result in further delay and longer trip lengths for commuters. However, these shifting users likely represent a significant market for non-single-occupant auto options, suggesting **the four-lane improvements with tolling would likely incentivize all non-single-occupant auto options presented in Chapter 6 for both the westbound and eastbound directions in the morning** as express buses, minibuses, pooling TNC users, and carpoolers would all be granted access and likely experience cost savings compared to single-occupant autos. Furthermore, a RideAmigos platform tailored to the SR 37 corridor would further incentivize these options as it would provide travel cost savings information, incentives, and rewards for using non-single-occupant auto modes of travel.

# 8. Conclusions

This chapter presents conclusions from the travel markets analysis and transit options evaluation.

The SR 37 Corridor is very congested today and will continue to get worse. The SR 37 Policy Committee has identified short and long-term solutions for the corridor but many have long lead times and could pose environmental justice issues, such as tolling. The purpose of the SR 37 Travel Behavior and Transit Feasibility Study was to understand who is using the corridor, where they are going, and at what times and how frequently they are traveling. The study further explored various non-single auto-mode options to serve the corridor (with an emphasis on Segment B) since currently none exist. Non-auto mode options such as transit could alleviate some of the equity and environmental justice concerns. The study's general conclusions are as follows:

- The 21-mile corridor experiences congestion for roughly 13 hours a day and currently has no transit options
- The O-D pairings on the corridor are many to many
- Many of the corridor users today own/have access to an automobile
- A majority of those using the corridor today make below the Bay Area median income
- The most popular origins for travelers of Segment B are Vallejo, Fairfield, I-80 East, Novato, Santa Rosa and Petaluma
- The most popular destinations for travelers of Segments B are Novato, I-80 East, Vallejo, Santa Rosa, San Rafael and Fairfield
- A high percentage of trips along the corridor are commute trips – 44 percent for Segment B in the AM peak period and 42 percent for the corridor in the AM peak period
- SR 37 users from Vallejo, Fairfield and Novato had the highest transit propensity, ranging from 25 to 54 percent in the very high category
- Two O-D pairings were identified to potentially be served with fixed route service, Vallejo to Novato and Fairfield to Novato
- Express Service operating costs are approximately $3-5 million annually and would need approximately 5,000 riders per month to meet a 20% farebox recovery using assumptions identified in section 6.1.2.

- Roughly 50% of the market identified in Vallejo and Fairfield geographic areas have a very high propensity for transit largely driven by income
- Other non-single occupant mode solutions are identified as:
    - Expand park and ride lots to facilitate more carpooling
    - TNCs for first-last mile connections
    - SaaS applications to inform, promote and incentivize users of non-single auto mode shares
- Modeling projections show a shift in users of the SR 37 corridor when a toll is introduced. It is reasonable to assume a percentage of this population can be retained by providing express bus service along the corridor.

# 9. Next Steps

This chapter presents a discussion of near-term and long-term next steps.

## 9.1 Near-Term

In the near-term, members of the SR 37 Policy Committee group will continue to explore non-single auto mode alternatives with a focus on low-hanging fruit such as dynamic ridesharing solutions or software as a service (SaaS) applications like Ride Amigos. NVTA, STA and TAM are currently in contract with Ride Amigos to provide solutions to commuters in Napa, Solano and Marin counties. There is also a potential for the North Bay CTAs to partner on a vanpool program that serves SR 37 users. The program would need to be fully flushed out and funding would need to be identified. In addition, the SR 37 team members will continue to explore expanding park and ride lots like the potential Vallejo Fairgrounds Park and Ride lot. The Fairgrounds Express Bus stop is anticipated to be operational July 1, 2019.

## 9.2 Long-Term

Longer-term, the Resilient SR 37 team is working on an interim solution for Segment B which will provide traffic relief on the corridor through a reversible third lane or four lanes within the existing right-of-way. Any additional roadway capacity will be HOV lane(s) which provide incentive for travelers to take transit over a single auto mode. The study identified the ideal time to deploy an express bus service would be in tandem with interim improvements on Segment B. Furthermore, the ultimate project consisting of elevating the corridor and providing four lanes on Segment B with tolling and HOV lanes would continue to support transit on the corridor. Transit also provides solutions to the equity concerns expressed by the public should a toll be implemented.

# Appendix A – Mobile Device Data Limitations and Potential Biases

Below is a discussion of mobile device data limitations and potential biases.

- Due to privacy concerns and sample rates, the indexed trip values in the origin-destination trip tables provided by StreetLight Data represent "relative" rather than "absolute" trips. In other words, the tables do not provide the total number of trips that occur on a daily basis but provide the relative relationship of trips from each zone to every other zone in the geographic layer. Therefore, the mobile device data origin-destination trip tables are used as a starting point due to their large sample size and high level of confidence in the origin-destination data and refined using traffic count data to factor the relative trip data to represent a single period of absolute data.

- Analysis of mobile device data and determination of origin-destination points relies on computer algorithms to determine where a trip starts and ends rather than direct user input. Current algorithm parameters define the end of a trip and determine a trip's destination if the mobile device travels no more than five meters for a five minute period of time.

- App-based mobile device data has a minimal potential bias towards higher income persons as a majority of the population now owns an app-enabled device and studies have shown that low income persons are preferring to get their internet from a cell phone as opposed to a residential provider. However, locational information is derived from a combination of cellular, GPS, and Wi-Fi sources, reducing the spatial resolution and accuracy to roughly 20 to 30 meters when compared with GPS data alone which has a spatial resolution of rough 3 to 5 meters.

- App-based mobile device data typically represent persons traveling as the algorithms are currently not sophisticated enough to differentiate mode of travel. For instance, a typical transit trip may consist of a drive trip to a transit station, wait time for a train, stops at stations along the way, and a walk trip to the destination. Auto trips are usually much less complex as people generally drive directly from their origin to their destination.

- Mobile device data has a potential bias towards trips made by persons over the age of 16 due to privacy regulations requiring the non-inclusion of data associated with mobile devices registered to persons under the age of 16.

- Mobile device data has a potential bias towards non-school-related trips made by persons over the age of 16. Home and work location data analysis will ignore school-related trips as the algorithms only track the inferred "home" and "work" location of mobile devices. Origin-

destination trip table data analysis may miss school drop-off trips as the algorithms determine a trip to end only when the mobile device has moved less than five meters in five minutes. However, school-related trips associated with students who drive themselves to school will likely be captured as the mobile device will remain relatively stationary while at school.

- Mobile device data has a potential bias towards traditional "9 to 5" workers as the home and work location algorithms assign work locations based on where the device is at rest between 11 AM and 4 PM and home locations based on where the device is at rest between 7 PM and 8 AM. This bias leads to potential issues for the SR 37 corridor due to the high number of shift workers and contractors that utilize the corridor and the high number of workers who leave work before 4 PM to miss congestion.

# Appendix B – Origin and Destination Data

# Appendix C – Transit Propensity Scores