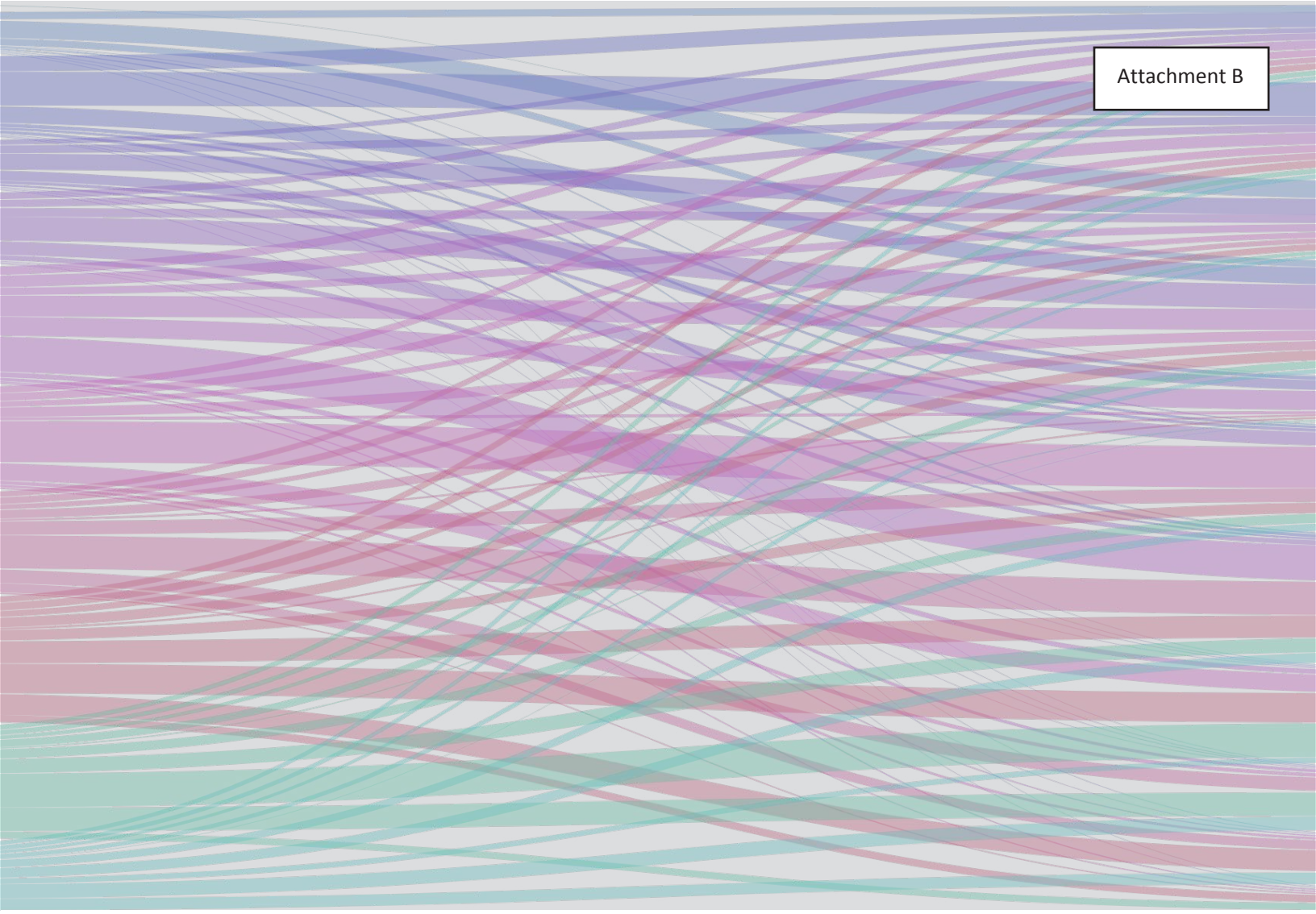
Attachment B



TRAVEL MARKET ANALYSIS

SUMMARY OF FINDINGS

STATE ROUTE 85 TRANSIT GUIDEWAY STUDY

CDM Smith

Executive Summary

Purpose of the Travel Market Analysis

This document analyzes how people are traveling along the State Route 85 (SR 85) corridor and how a new transit service on SR 85 may be best designed to attract riders. This analysis is intended to help the SR 85 Policy Advisory Board (PAB), which is guiding the SR 85 Transit Guideway Study, develop alternatives for a transit lane project that will be studied in greater detail in subsequent phases of this study.

Key findings of the Travel Market Analysis are summarized below.

State of the SR 85 corridor

- Travel demand on SR 85 exceeds capacity on weekdays in the northbound AM and southbound PM directions. During these periods, vehicle speeds in general purpose lanes on many segments of SR 85 are observed to dip below twenty miles per hour for multiple hours.
- Travel demand on SR 85 is below capacity on weekends and on weekdays during midday and off-peak directions.
- Vehicle volumes and corporate shuttle volumes are higher in the northern end of the corridor.
- A majority of respondents to an online survey indicated interest in switching from driving along the corridor to taking transit if the overall trip time would be time-competitive with driving.

Transit operating plan insights

- A transit service on SR 85 may be time-competitive with driving on weekdays during the northbound AM and southbound PM directions, but would not be time-competitive when light traffic allows vehicles to travel at or around the speed limit at other times of the day and on weekends. This suggests that a peak-period, directional transit service would be the most cost-effective operating plan.
- Trips along the SR 85 corridor are an amalgamation of many overlapping patterns with no dominant origin/destination pairs. As such, an all-stop service that maximizes the combinations of origins and destinations that can be served will likely appeal to more travelers and result in higher ridership than an express service that skips stops.

- A transit service on SR 85 is more likely to appeal to travelers making long trips as the time-savings gained from traveling faster than adjacent traffic will, to a greater extent, offset time spent accessing the station, waiting for the transit vehicle to arrive and time spent accessing the destination.
- The appeal of transit can be maximized with fast, frequent service as this will make the overall trip time lower, but frequent service is costly.

Challenges to transit on SR 85

- The land uses along the corridor are generally low-density and walking paths to potential freeway-based station locations are often indirect. Detached residential uses, which comprise the majority of adjacent land uses, are unlikely to redevelop into transit-supportive uses.
- To overcome walkability and proximity barriers to using a SR 85 transit service, strategies that expand the travel-shed of stations by accommodating first/last mile connections like bicycles, scooters, TNCs, taxis and station-adjacent parking may be necessary. However, including these features in the project design would increase costs.
- Transit routes that cross the SR 85 corridor and that would potentially connect with a future SR 85 transit service generally operate at frequencies that are half-hour or hourly. As such, transfers between VTA buses and a SR 85 transit service may not be appealing to time-sensitive travelers, who may face lengthy waits for transfers if connections cannot be effectively timed.
- The demographics of residents and jobs along the corridor do not correlate with high rates of transit ridership. For example, higher incomes, higher ages, higher rates of automobile access and higher rates of home ownership, among other demographics prevalent along the SR 85 corridor correlate with lower rates of riding transit.

1 | Study Background and Approach

SR 85 Transit Guideway Study corridor

State Route 85 (SR 85) connects US 101 in Mountain View to US 101 in South San Jose. The 24-mile long corridor travels through Mountain View, Los Altos, Sunnyvale, Cupertino, Saratoga, Campbell, Los Gatos and San Jose.

Figure 1-1 | SR 85 Corridor Map

The corridor has become increasingly congested since its completion nearly 20 years ago, a situation exacerbated by Santa Clara County's jobs/housing imbalance and housing unaffordability crisis, which has increased commuting between outlying residential areas and Silicon Valley employers. Seeking to find a transportation alternative to commute-period congestion, the West Valley cities have advocated for new mobility improvements along the SR 85 corridor, a request that was incorporated in the program of projects included in the 2016 Measure B initiative.

In 2016, Santa Clara County voters passed Measure B, a half-cent sales tax that will collect an estimated $6.3 billion over the next 30 years. 2016 Measure B allocates $350 for the SR 85 corridor to be used…

"[t]o fund new transit and congestion relief projects on SR 85 including a new transit lane from SR 87 in San Jose to US 101 in Mountain View. Additionally this category will fund noise abatement along SR 85 and will provide funding to study transportation alternatives that include, but are not limited to, Bus Rapid Transit with infrastructure such as stations and access ramps, Light Rail Transit, and future transportation technologies that may be applicable."

The SR 85 Transit Guideway Study is the study that will analyze different travel modes and provide guidance for an investment decision for a transit lane on the corridor. An investment decision is not a specific project, but rather an endorsement for a specific travel mode (bus, light rail, other), an operating plan (when and how frequently the service operates) and a rough sense of the boundaries of the project.

Study guidance

The SR 85 Transit Guideway Study is guided by the SR 85 PAB, which is comprised of elected officials from the jurisdictions along the corridor—Campbell, Cupertino, Los Altos, Los Gatos, Monte Sereno, Mountain View, Saratoga, Sunnyvale, San Jose and Santa Clara County—and a representative from Caltrans, which is the agency that owns and maintains the corridor. The PAB will be instrumental in the selection of project alternatives to study and will provide a recommendation, upon the conclusion of the study, to VTA's Board of Directors for an investment decision in the corridor.

SR 85 Transit Guideway Study process

The study consists of three phases:

Phase I: Travel Market Analysis and Corridor Constraints Analysis

In this phase, VTA staff and the PAB work to understand the state of travel along the SR 85 corridor, discuss challenges, concerns and strategies for developing a long-term successful project. Staff and PAB also reviewed over 2,500 points of input collected during the first round of community engagement where corridor travelers provided their visions for an improved SR 85 and the qualities that a potential transit service must have to appeal to them.

Phase II: Development of alternatives

In this phase, VTA staff and the PAB will develop about four alternatives—essentially combinations of transit routes, travel modes and operating plans—that will be studied in greater detail in phase III. The PAB will be encouraged to think about the entire project process and focus on projects designs that are appealing and feasible.

Phase III: Alternatives Analysis

In this phase, staff will analyze the chosen alternatives and compare their construction costs, operating costs, travel speeds, ridership projections and impacts. A report and comparison matrix will be prepared and community meetings and online surveys will be conducted to solicit input on the alternatives. Unlike the first round of community engagement, which asked corridor travelers to share their visions for the corridor, the second round will feature projected metrics for each alternative that will allow for input to be provided on a more tangible, personal level.

PAB recommendation

After the alternatives analysis is complete, the SR 85 PAB will consider the input received during the second round of community engagement and will craft an investment decision recommendation for consideration by VTA's Board of Directors. The Board of Directors may choose to endorse or modify the recommendation and could choose to allocate 2016 Measure B funding toward preliminary engineering for a transit lane on SR 85, which is the first stage of an official project.

How do you design a new transit service?

Designing a transit service is an exercise in balancing tradeoffs and working within physical, financial and political constraints. As the design of a potential transit service on SR 85 is refined, many decisions will need to be made.

Should the future transit service:

- Be elaborate or something that can be built quickly and/or cheaply?
- Be fast with few stations or a slower with many stations?
- Be a straight, direct route that may not pass by major destinations or a route that deviates to serve off-corridor destinations?
- Be a big project with many impacts or a smaller project with less impacts?
- Be incrementally phased and scaled up with demand?

The transit service will also need to be feasible and designers must consider:

- Can the project fit within the corridor?
- If the corridor must be widened or modified, is the additional cost appropriate?
- Will construction cause any cost-prohibitive or unsurmountable environmental impacts?
- Does 2016 Measure B provide sufficient funding to build the project?
- If additional funds such as competitive grants must be pursued, are the project's metrics competitive enough to receive such funding?
- Is the project likely to generate sufficient ridership to justify operating the service in the future?
- Many transportation efforts will be vying for first access to 2016 Measure B funds. Is there political and community support to prioritize the desired SR 85 investment and deliver the project sooner rather than later.

Advice for decision makers

While considering all the above questions, the designers of a potential SR 85 transit service will want to arrive at a project design that results in a high-ridership, cost-effective, financially sustainable service. To that end, we provide some words of advice:

Recognize the difference between a driving trip and a transit trip

Unlike driving, a transit trip has four distinct parts: (1) traveling to the station, (2) waiting for the transit vehicle to arrive, (3) riding onboard the transit vehicle and (4) traveling to the destination. The benefit of the transit service—whether time-savings, stress avoided or productive time gained—will need to be sufficient to offset the inconveniences of station access/egress and waiting for the vehicle to arrive to attract riders.

Understand driving, transit, speed and directness

Driving trips tend to take the fastest route, which may not be the most direct—particularly if the route can utilize SR 85, which provides a significant speed advantage over local streets at most times of day. As such, driving trips that currently use SR 85 may not translate into transit demand on SR 85.

Recognize appeals and detractions of transit

Using transit can liberate travelers from the costs to own, maintain, fuel and store vehicles as well as the stressful and unproductive time spent driving. Transit also requires traveling in the same vehicle as strangers and only at times and to places as permitted by the transit

network and route schedules. A commuter-oriented service may only offer trips in the morning and evening, limiting the flexibility of travel at other times of day. Every traveler carries unique sensitivities to each of these factors and some may never choose to take a transit option for reasons unrelated to the quality of the service.

Avoid "elite projection"

Elite projection, a term coined by Jarrett Walker, refers to assuming that one's tastes and tolerances are representative of society at large. This tendency leads decision makers to pursue projects that they find personally appealing or that benefit a constituency they are familiar with. Transit services with narrow appeal often result in low ridership and a high subsidy per rider. Walker acknowledges that the request to completely discard personal experience is unreasonable, but, to the extent possible, decision makers should think broadly and note that successful transit services are those with the widest possible appeal.

Understand induced demand

Expanding roadway capacity or adding transit service to a congested corridor is often promoted as a way to reduce traffic congestion. There is an intuitive appeal to creating more space so that a facility becomes less crowded, but extensive research has shown that adding capacity does little to improve travel speeds. This is because added capacity is almost always filled by new trips that are induced by the upgraded facility. A transit service on SR 85 may convert some drivers into transit riders, but the roadway space they no longer occupy should be expected to be filled by new trips, induced by the temporarily reduced congestion. As such, a new transit service on SR 85 should be viewed as adding a new travel option, not a solution for automobile congestion.

Be aware of high costs of peak, directional service

Peak-period only, directional services are particularly expensive for transit agencies to operate as these services carry three inefficiencies that are not present in all-day, bi-directional service: (1) additional vehicles are required that are only used during the peak period; (2) attracting bus/train operators to work for short shifts requires paying them for longer shifts and (3) peaked, directional services spend a greater percentage of their time deadheading—time spent traveling without riders onboard, whether back to the start of the route or to/from the bus yard—than all-day, bi-directional routes. For context, VTA's non-BART express buses operate for about three hours at a time on weekdays, spend less than two hours of that time in revenue service and a driver is paid for eight hours. The result is a passenger subsidy about four times greater than that of an all-day bi-directional route.

The ridership recipe

As a general rule, planners look to a handful of factors to determine if a transit service is likely to attract high ridership. Where these factors are present, transit agencies can generally justify a high level of transit service. These factors are:

Density

The more people, jobs and attractions within close proximity (about a five-minute walk/bike/scoot) to transit stations/stops, the greater the ridership. Dense areas like downtowns or corridors with multi-story developments near transit stops are transit-supportive.

Linearity

The more direct the transit route, the faster it can reach its destination and wider the appeal. Diversions can be merited in cases where the location served has high transit demand or makes a strongly desired connection that outweighs the inconvenience to through-traveling riders who must endure a longer travel time.

Walkability

Refers to the number of places that can be accessed within a short walk of the station/stop and the pedestrian-friendliness of the urban form. Grid street networks, like those found in downtowns, are especially walkable as paths to destinations are direct and slow vehicle speeds and wide sidewalks make walking pleasant. Wide suburban arterials with widely-spaced crossings, fast traffic and indirect street networks are not very walkable.

Proximity

Successful transit services have many origins and destinations with close proximity, which makes trips short. Trips that are shorter in duration are preferable to those that are longer.

A mix of land uses

Ideally, land uses along a route will be varied and include housing, employment and attractions like entertainment, shopping, dining and schools. Where land uses along a route vary, travel demand tends to be bi-directional and last all-day. In such markets, the cost-effectiveness of transit service is maximized because demand is high for inbound and outbound trips. Note that exceptions to these general principles exist. For example, many Caltrain stations are not in walkable or easily-accessed locations, but the attractiveness of Caltrain service (fast, relaxing and long-distance) combined with other deterrents (traffic on US 101 and I-280 and parking costs at destinations) helps the service overcome walkability barriers.

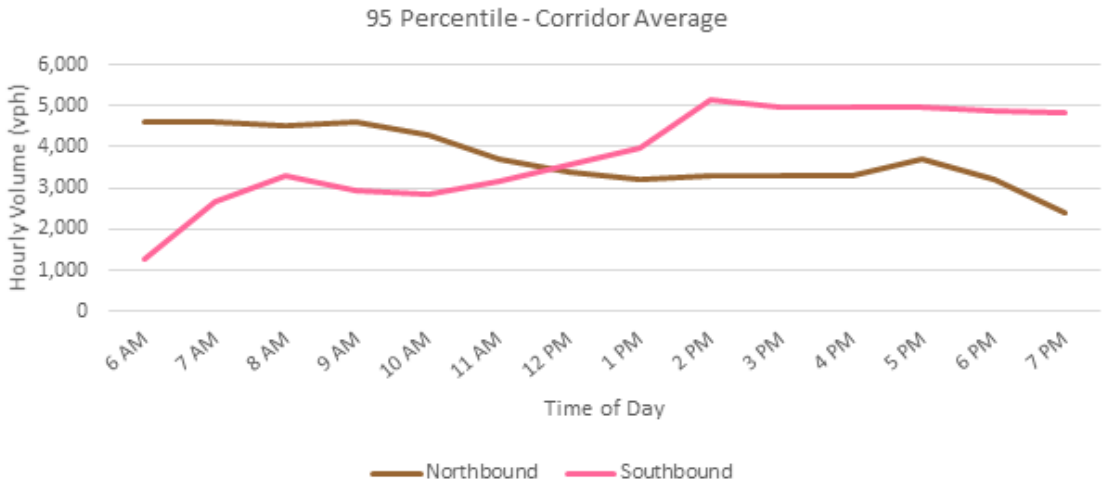
2 | Current travel along the SR 85 Corridor

This chapter analyzes data from multiple sources to understand how people are traveling along the SR 85 corridor. It looks specifically at traffic conditions on the SR 85 freeway as well as a broader look at the SR 85 corridor, which consists of a wide buffer around the corridor that includes parallel routes. Collectively, this analysis provides an understanding of when transit can be time-competitive with automobiles on SR 85, the types of trips people are making on and around the corridor and some insights for an appropriate operating plan for a transit service on SR 85.

Travel flows on SR 85 are peaked and directional

An analysis of Caltrans pavement sensor data (September 1, 2016 through August 31, 2017) shows a clear, directional travel pattern during peak periods on weekdays on SR 85. During these periods, travel demand on SR 85 exceeds capacity in the northbound AM and south-bound PM directions, resulting in significant decreases in vehicle speed. During weekday midday and weekday off-peak periods travel demand on SR 85 is largely under capacity, allowing vehicles to travel at or near the 65 MPH speed limit. Weekend travel demand does not exceed capacity or result in decreased travel speeds.

Figure 2-1 | Weekday vehicle volumes by hour for northbound and southbound directions



During weekday peak periods, vehicle volumes tend not to exceed 5,000 vehicles per hour, but last for multiple hours—6:00AM to 10:00AM in the northbound direction and 2:00 to 7:00PM in the southbound direction. There are likely three effects occurring that cap volumes at around 5,000 vehicles per hour and elongate the peak periods:

- At around 40 MPH, travel speeds are high enough and the space between vehicles is low enough to maximize vehicle throughput, permitting around 2,000 vehicles per hour per lane. Above 40 MPH, increased space between vehicles results in lower throughput. Below 40 MPH, slow speeds lower throughput even with tighter spacing. The 5,000 vehicles-per-hour cap suggests that the three-lane facility is operating below optimal efficiency due to low travel speeds.
- The elongated peaks may indicate longer trip durations (perhaps due to length and slow speed) as well as decisions by travelers to use SR 85 during the shoulders of the peak period to avoid the middle of the peak demand.
- Carpool lanes may have excess capacity at some locations, resulting in lower vehicle volumes. Despite lower vehicle flows, carpool lanes are likely moving more people per hour than general purpose lanes.

Charts of 50th percentile vehicle volumes for Tuesdays, Wednesdays and Thursdays are shown by hour for the northbound and southbound directions at four locations. 50th percentile volumes represent median travel volumes. Mondays, Fridays and holidays typically have lower travel volumes and have been removed from the data set.

Figure 2-2 | Average weekday northbound vehicle volumes

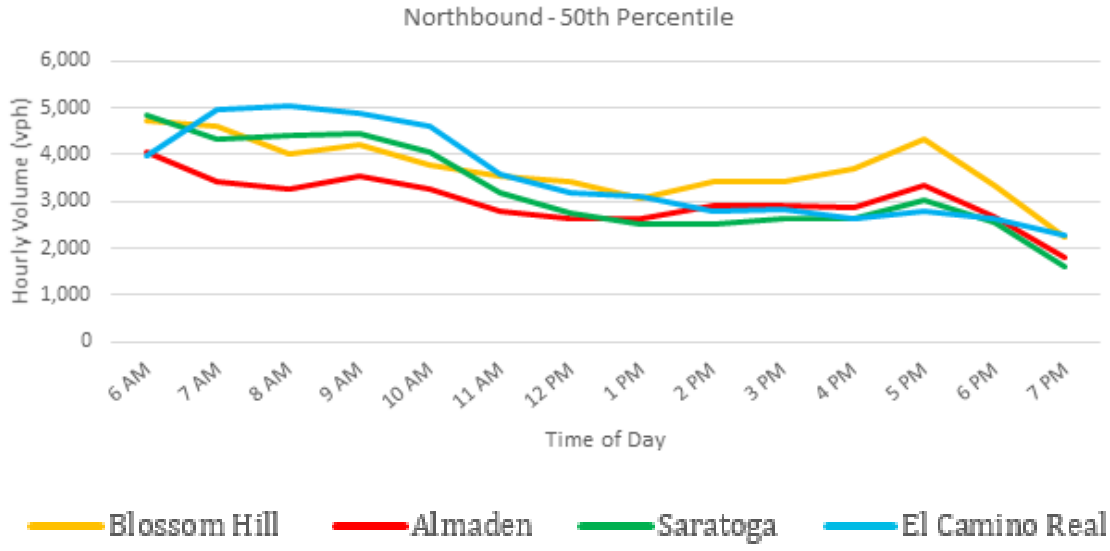
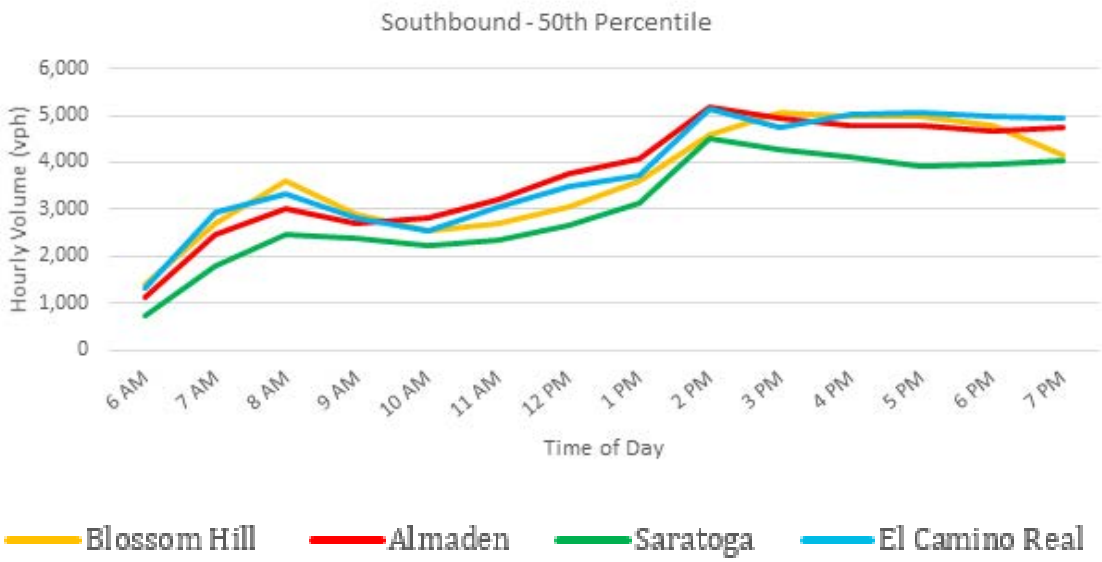


Figure 2-3 | Average weekday southbound vehicle volumes



Travel speeds in weekday peak directions are slow

To gain insights into travel speeds along the SR 85 corridor, VTA purchased mobile device location data from INRIX, a big data firm. The anonymous data, which is collected by mobile phones and GPS devices onboard vehicles, shows the impact that peaked, directional demand has on travel speeds. The following tables show 50th percentile travel speeds for Tuesdays, Wednesdays and Thursdays, excluding holiday periods, for September 2016 through August 2017.

Figure 2-4 | Weekday northbound travel speeds (miles per hour)

	US 101 North to Moffett Blvd	Moffett Blvd to Central Expy	Central Expy to SR-237	SR-237 to El Camino Real	El Camino Real to Fremont Ave	Fremont Ave to Homestead Rd	Homestead Rd to I-280	I-280 to Stevens Creek Blvd	Stvns. Creek Blvd to De Anza Blvd	De Anza Blvd to Saratoga Ave	Saratoga Ave to Winchester Blvd	Winchester Blvd to SR-17	SR-17 to Union Ave	Union Ave to Camden Ave	Camden Ave to Almaden Expy	Almaden Expy to SR-87	SR-87 to Blossom Hill Rd	Blossom Hill Rd to Cottle Rd	Cottle Rd To US 101 South
6:00 AM	66	70	70	68	69	70	71	74	68	68	64	64	68	63	64	66	67	66	68
6:30 AM	63	70	70	66	67	68	70	70	64	61	49	31	51	38	37	32	55	53	40
7:00 AM	56	70	69	66	65	64	68	70	58	43	40	22	27	32	28	23	47	59	36
7:30 AM	39	68	68	62	57	47	46	67	55	34	30	17	18	28	26	21	43	59	29
8:00 AM	39	66	66	58	48	34	32	63	55	39	30	16	15	26	28	27	57	69	27
8:30 AM	30	66	65	51	39	26	15	40	52	42	31	18	19	29	30	36	63	70	27
9:00 AM	51	66	65	45	29	20	12	34	50	49	38	17	23	31	34	56	67	70	47
9:30 AM	58	66	66	49	32	24	19	55	56	61	41	18	36	31	39	64	67	70	69
10:00 AM	60	68	68	53	38	34	42	70	65	67	43	25	57	47	64	67	68	70	69
10:30 AM	62	68	68	60	54	62	68	70	68	69	50	51	67	66	68	68	69	70	69
11:00 AM	62	70	70	66	67	68	70	74	69	70	68	72	70	68	69	68	69	70	69
11:30 AM	62	70	70	68	67	68	70	70	70	70	69	72	70	68	69	68	68	69	69
12:00 PM	63	70	70	66	68	69	70	70	70	71	70	72	70	68	69	68	68	70	69
12:30 PM	63	70	69	66	67	68	70	70	70	71	70	72	70	69	69	68	68	70	69
1:00 PM	63	70	70	68	68	68	70	70	70	71	70	72	70	68	69	68	68	70	69
1:30 PM	63	70	69	68	67	68	70	70	70	71	70	72	70	68	69	68	68	70	69
2:00 PM	63	70	70	68	68	68	70	70	70	71	70	72	70	69	69	68	68	70	69
2:30 PM	63	70	69	66	67	68	69	70	69	70	70	72	70	68	68	67	68	69	69
3:00 PM	64	70	69	66	68	68	70	70	69	71	69	72	70	68	68	67	67	69	69
3:30 PM	63	68	68	66	67	68	69	70	69	70	69	72	70	68	68	67	67	69	69
4:00 PM	63	68	68	66	68	68	69	70	69	71	69	72	70	69	68	68	67	69	69
4:30 PM	62	68	69	66	67	68	69	70	69	71	69	72	70	69	68	68	67	69	69
5:00 PM	61	68	69	68	68	68	70	70	69	70	68	72	70	68	68	67	67	67	68
5:30 PM	60	68	69	66	67	63	69	70	69	70	66	72	69	68	67	66	66	66	68
6:00 PM	61	68	69	66	67	66	69	70	69	70	67	72	69	68	67	66	67	68	68
6:30 PM	62	68	68	66	67	67	69	70	69	70	68	72	70	68	68	66	67	69	69
7:00 PM	62	68	68	66	68	68	68	70	69	70	69	72	70	68	69	67	67	69	69
7:30 PM	63	68	68	66	68	68	69	70	69	70	69	72	70	69	69	67	67	69	68

Figure 2-5 | Weekday southbound travel speeds (miles per hour)

	US 101 North to Moffett Blvd	Moffett Blvd to Central Expy	Central Expy to SR-237	SR-237 to El Camino Real	El Camino Real to Fremont Ave	Fremont Ave to Homestead Rd	Homestead Rd to I-280	I-280 to Stevens Creek Blvd	Stvns. Creek Blvd to De Anza Blvd	De Anza Blvd to Saratoga Ave	Saratoga Ave to Winchester Blvd	Winchester Blvd to SR-17	SR-17 to Union Ave	Union Ave to Camden Ave	Camden Ave to Almaden Expy	Almaden Expy to SR-87	SR-87 to Blossom Hill Rd	Blossom Hill Rd to Cottle Rd	Cottle Rd To US 101 South
6:00 AM	59	65	65	66	62	65	65	68	69	69	70	67	69	70	69	69	69	69	68
6:30 AM	59	64	65	66	62	65	65	68	70	69	71	69	70	70	70	69	69	69	68
7:00 AM	60	65	65	66	61	66	65	69	71	70	71	70	70	70	70	68	70	70	68
7:30 AM	59	64	64	64	60	65	65	69	72	70	70	71	70	70	70	69	69	69	68
8:00 AM	59	64	65	64	61	64	64	68	71	70	69	71	70	69	69	67	69	69	67
8:30 AM	60	65	66	66	62	66	65	68	72	70	69	71	70	69	69	68	69	69	67
9:00 AM	59	66	68	66	65	67	65	67	72	71	70	72	70	70	69	68	69	69	67
9:30 AM	60	66	66	66	65	68	67	68	71	71	70	71	70	70	70	68	70	69	67
10:00 AM	60	66	66	66	65	68	67	69	71	71	71	71	71	70	70	68	70	69	67
10:30 AM	59	66	66	66	65	67	67	69	71	71	70	71	71	70	69	68	69	69	67
11:00 AM	60	66	66	66	64	67	66	69	71	70	70	71	70	70	70	68	69	69	67
11:30 AM	60	66	68	66	64	67	66	69	71	70	70	71	70	70	69	68	69	69	67
12:00 PM	60	66	66	66	64	67	66	69	71	70	70	71	70	69	69	68	69	69	67
12:30 PM	60	66	66	66	65	67	66	69	71	70	70	71	70	69	69	68	69	70	68
1:00 PM	60	66	66	66	65	67	66	69	71	70	70	71	70	69	69	68	69	70	68
1:30 PM	60	66	66	66	64	66	65	69	71	69	70	71	70	69	69	69	69	70	68
2:00 PM	60	66	66	66	62	65	65	69	71	69	69	71	70	68	69	69	69	70	68
2:30 PM	59	65	64	58	47	52	58	68	64	64	63	68	53	60	67	68	68	69	67
3:00 PM	59	65	62	44	35	37	51	52	37	39	50	48	32	51	65	67	65	68	67
3:30 PM	59	65	64	51	41	40	52	29	28	35	50	52	34	50	62	65	62	67	66
4:00 PM	58	64	61	50	45	43	53	23	24	31	48	45	31	48	59	64	61	66	66
4:30 PM	56	61	50	33	35	39	51	21	21	29	44	29	25	45	57	63	58	66	66
5:00 PM	51	40	30	26	31	37	50	19	19	27	40	25	23	44	56	62	55	67	67
5:30 PM	35	20	21	21	26	34	48	18	18	25	35	20	21	42	54	51	45	66	66
6:00 PM	46	28	24	23	28	32	46	23	20	26	36	20	21	43	54	52	46	66	66
6:30 PM	54	56	41	33	37	37	48	39	26	32	42	27	25	47	59	62	56	67	67
7:00 PM	56	63	60	47	41	43	51	57	39	47	47	51	32	51	64	67	65	68	67
7:30 PM	57	65	65	60	53	54	58	66	63	62	60	66	54	56	66	68	68	69	67

FINDING: The time-competitiveness of transit with driving along the SR 85 corridor is likely limited to peak periods. At other times of the day, a transit service on SR 85 is likely to have a more limited appeal to those who do not have the option of traveling by private vehicle.

The SR 85 corridor features many overlapping trips

Thus far, analysis of SR 85 in this report has focused specifically on the highway facility. While that analysis is useful for understanding when and in what direction a transit service on SR 85 may be time-competitive with private vehicles, it does not capture all trips along the greater corridor, which may include trips for which transit would be appealing. To understand broadly how people are traveling along and around the corridor, VTA purchased mobile device location data from StreetLight, another big data firm. StreetLight specializes in identifying origins and destinations of trips and provides that data in terms of proportional flows by geographic zone.

This data reveals whether strong origin-destination trip pairs exist that could support a direct express transit service or if an all-stop travel pattern is a better fit for travel along SR 85. This data also sheds light on how many SR 85 corridor travelers have origins and destinations within a short walk to/from the corridor. High proportions of origins, destinations or both within a short distance of the corridor bodes well for transit supportiveness.

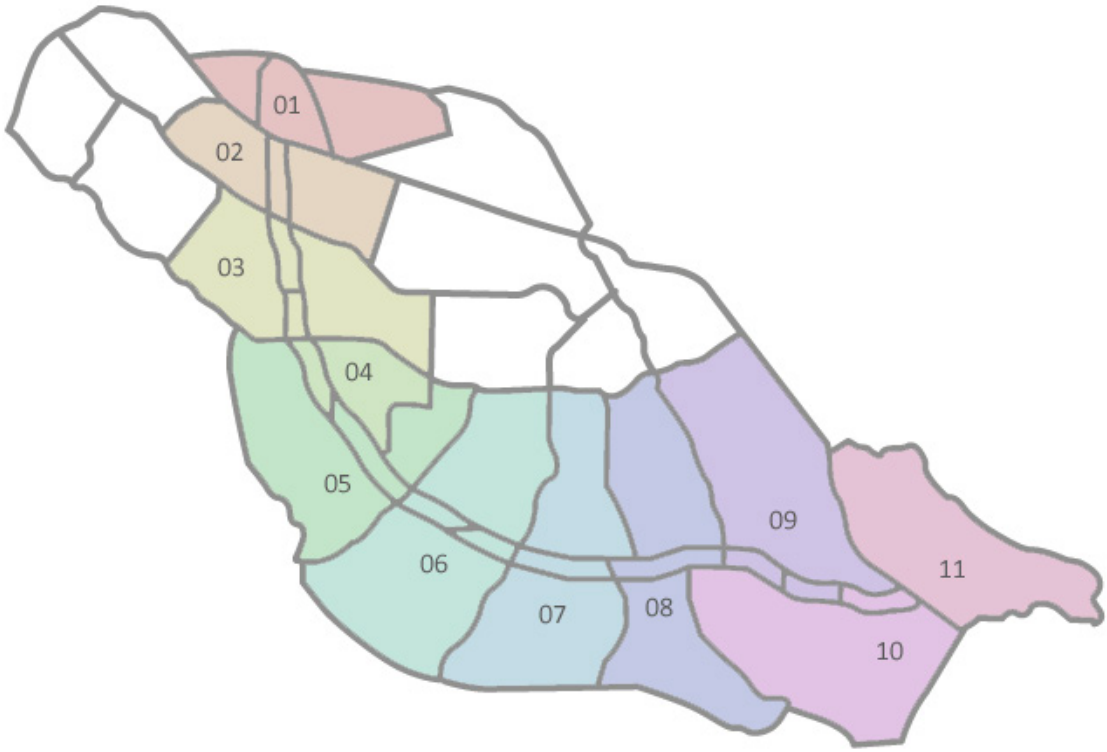
Some caution should be used when interpreting this data. It is a partial data set of SR 85 corridor travelers, consisting only of trips that have an origin and destination within the study area and which were tracked by a mobile device that was sharing location data. Trips that start or end well-beyond the corridor (such as San Mateo County, San Benito County and Santa Cruz County) are not included as those trips are unlikely to be proximate enough to the SR 85 corridor to be considered part of a potential SR 85 travel market. Since the data casts a wide net around the SR 85 corridor, it includes trips on nearby roads that would be unlikely to find a transit service on SR 85 appealing or direct. Lastly, zone shapes and sizes were selected based on logical geographic boundaries, not physical size, population or employment. As such, zones will show different levels of trip generation and should not be compared as equals.

StreetLight Data Methodology

For this analysis, vehicle volumes are estimated using one year (September 1, 2016 through August 31, 2017) of StreetLight proportional flow data that was weighted by trip generation rates used in VTA's travel demand model, which is calibrated to real world observations.

Data was initially provided in the form of travel flow proportions between 41 origin zones and 41 destinations zones for a total of 1,681 origin-destination combinations. To simplify the presentation of this data, the 41 zones were condensed to 11 superzones that have been labeled according to the proximate SR 85 interchanges, as shown in Figure 2-6. Flows between the superzones are shown as alluvial diagrams in figures 2-7, 2-8 and 2-9.

Figure 2-6 | Super zones for origin-destination analysis



How to interpret alluvial diagrams

In alluvial diagrams, trip origins are listed on the left and trip destinations are listed on the right. The thickness of the line corresponds to the proportion of all trips that start in one superzone and end in a different superzones. Trips within the same superzone are not included. The steeper the angle of the line, the longer the trip distance and greater likelihood that a transit service that provides a time-savings over driving on SR 85 would be appealing. For that reason, thick, steep lines indicate the presence of a strong market for transit.

Figure 2-8 | Weekday proportional travel flows along SR 85 corridor by superzones

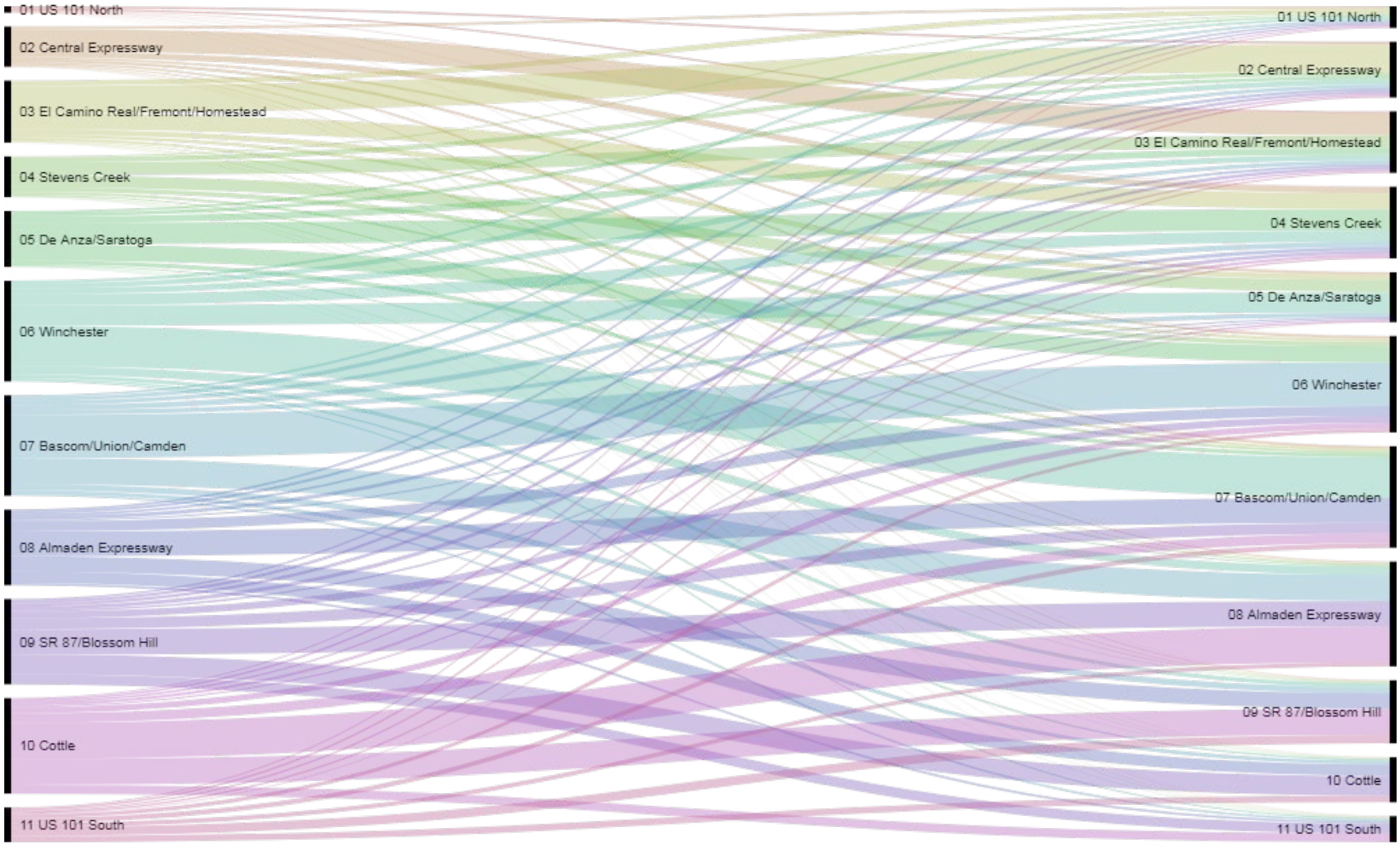


Figure 2-8 | Weekday AM proportional travel flows along SR 85 corridor by superzones

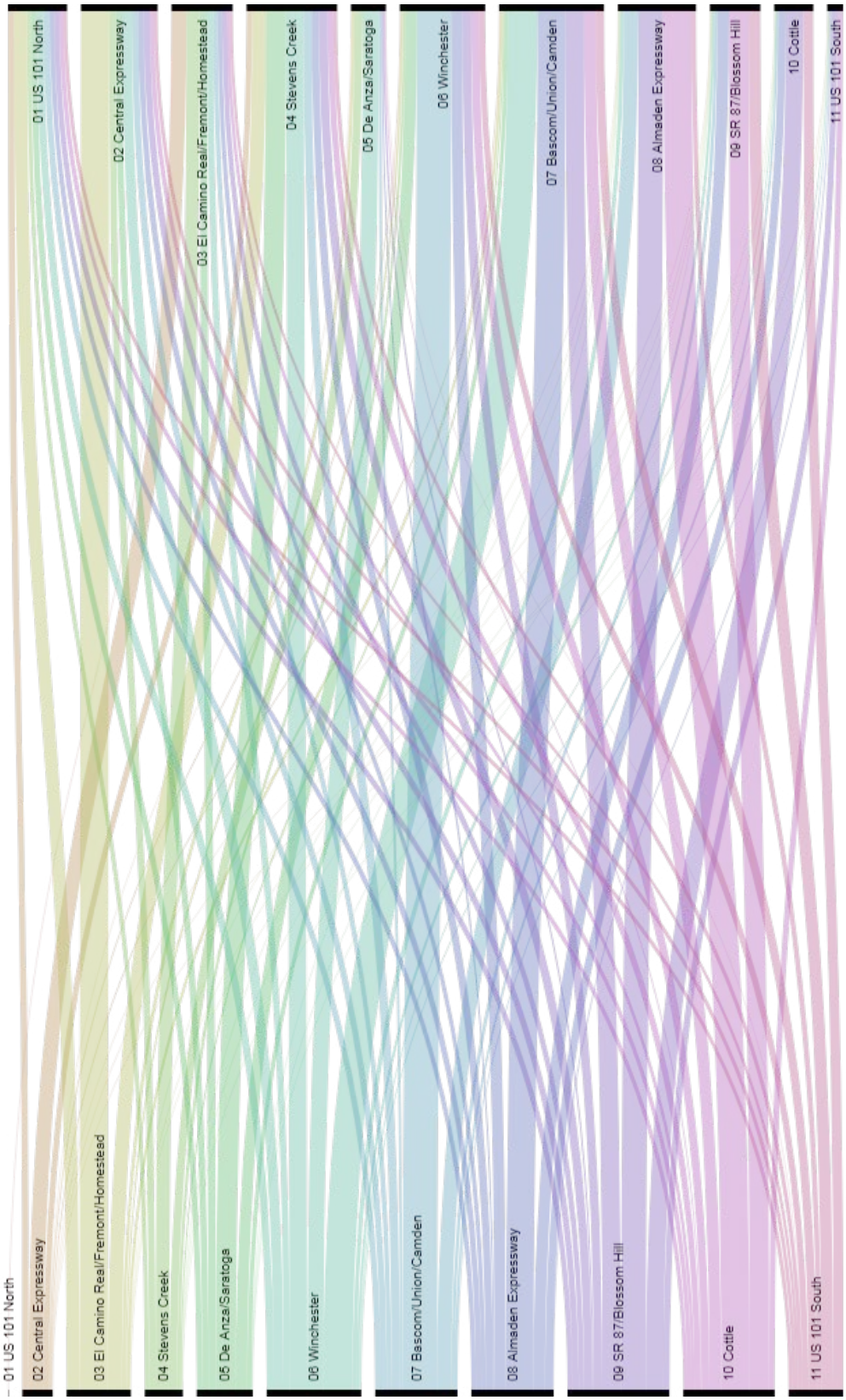
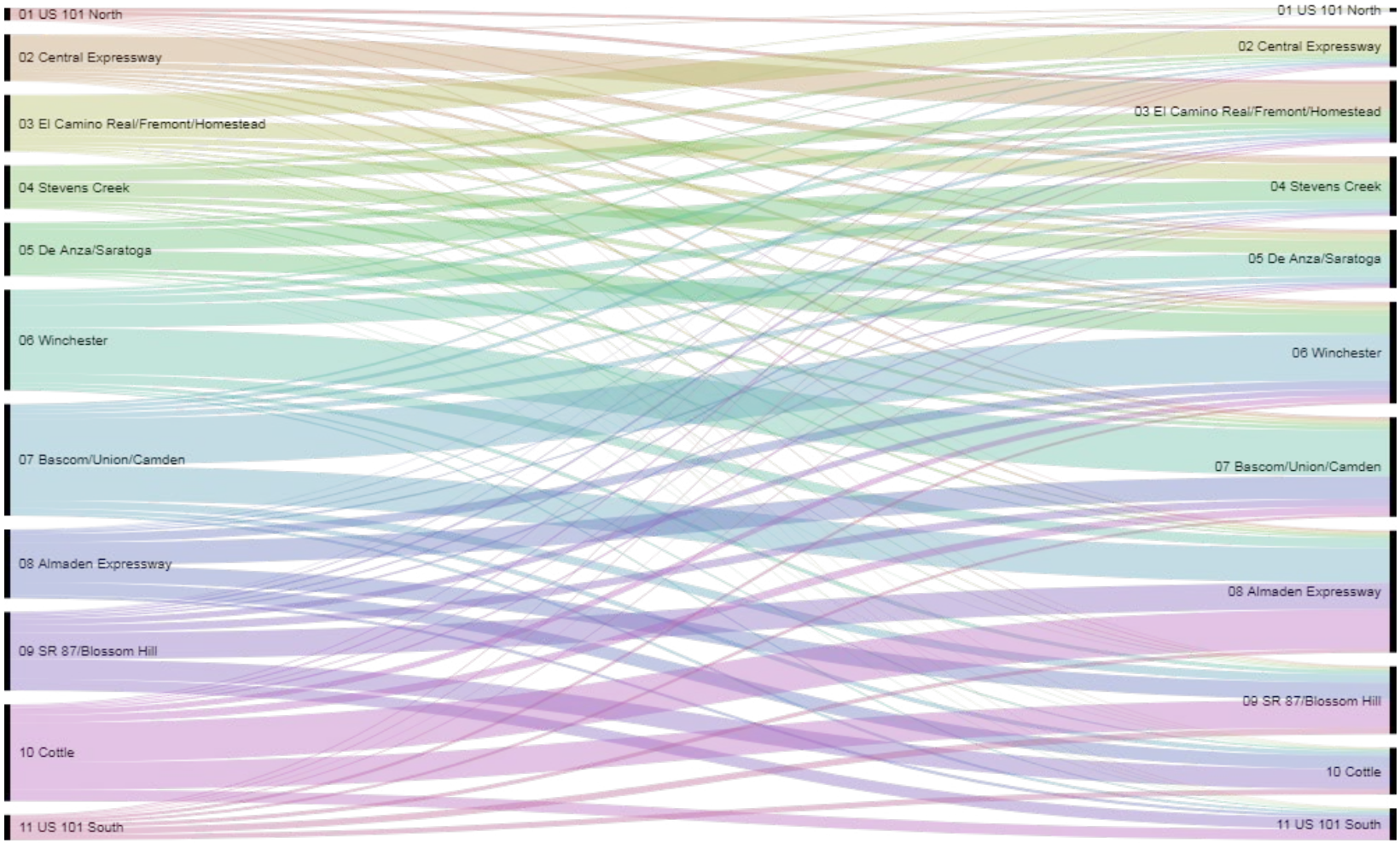


Figure 2-9 | Weekday PM proportional travel flows along SR 85 corridor by superzones



These visualizations show that thicker bands of travel—indicating greater flows—along the SR 85 corridor correlate with shorter trip distances. A relatively small portion of the trips sampled travel through several super zones. However, the AM alluvial diagram shows a greater proportion of long trips on SR 85, likely reflecting that commuters make up a larger portion of travelers in the morning compared to other times of day when trip purposes are more varied. The prevalence of long trips in the PM diagram is likely muted visually due to greater overall trip volumes (and trip purposes) that are witnessed in the evening.

Finding: Long trips that are more likely to experience a time savings using transit are more prevalent during commute periods.

Finding: No outstanding origin-destination trip pairs are seen, suggesting that a transit service that serves all stops and maximizes the origin-destination combinations that can be served per trip will have the strongest appeal to travelers.

Access and egress challenges exist

The likelihood of using a transit service correlates with the ease of access of origins and destinations from transit stations. To approximate how many SR 85 corridor travelers have origins and destinations with good walking access to the corridor, an analysis of trips within a short walk of the corridor was undertaken. A short walk was defined as one-third of a mile measured as-the-crow-flies rather than walking path. One-third of a mile is roughly equivalent to a distance requiring a five to ten minute walk depending on the directness of the walking path.

Figure 2-10 | Travelers with origins and destinations within short walk of station

	AM	PM	Daily
Origin and destination within a short walk	2%	2%	2%
Origin within short walk	23%	21%	22%
Destination within short walk	20%	21%	20%

Of all travelers whose trips start and end in the superzones, only a small percentage had origins and destinations within one-third of a mile of the corridor. This suggests that the market for travelers who could make a walk-transit-walk trip using transit only along SR 85 is quite small—about 2 percent of all travelers in the data set. Two percent is about 4,000 to 5,000 trips in each peak period and about 11,000 over the course of an entire weekday. It should not be expected that all of these travelers would choose a transit option over driving

should such an option exist nor should it be assumed that a transit service would necessarily be operating during some of these trips times, particularly those that are off-peak.

Notably, about one-fifth of all trips in the data set have an origin or destination within a short walk of the corridor, suggesting that if station designs and locations could accommodate modes of access and egress such as bicycles, scooters, connecting transit routes, private shuttles, TNCs or parking for private vehicles, the attractiveness of using a transit service in the corridor could be increased.

Finding: Expanding the travel shed for station access/egress can extend the appeal of the service, but would likely require higher costs and potentially additional physical space.

Ramp Volumes

Caltrans vehicle volume data for onramps and offramps for 2010 through 2014 were evaluated, but determined not to be insightful regarding the potential market for transit along the SR 85 corridor. Ramp volume data showed that vehicle volumes correlated closely with the capacity of each roadway facility, demonstrating the channelization and indirect nature of automobile trips. Some interchanges do not possess onramps and offramps, leading to lopsided counts. These are marked on the charts with asterisks. The lopsided nature of the northbound and southbound charts in figures 2-12 and 2-13 demonstrate the directional nature of travel demand along SR 85.

Figure 2-11 | Weekday onramp and offramp vehicle volumes

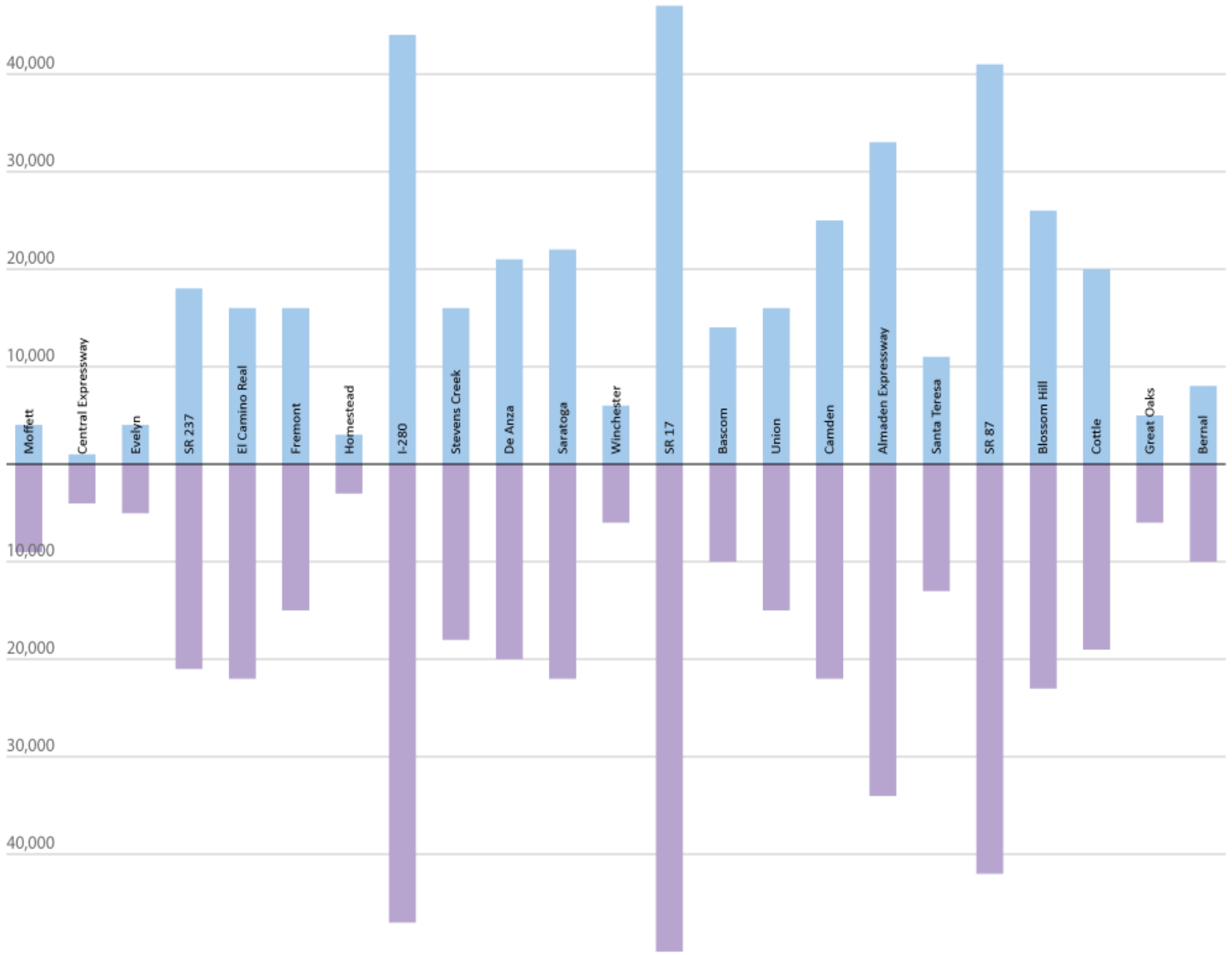


Figure 2-12 | Weekday northbound onramp and offramp vehicle volumes

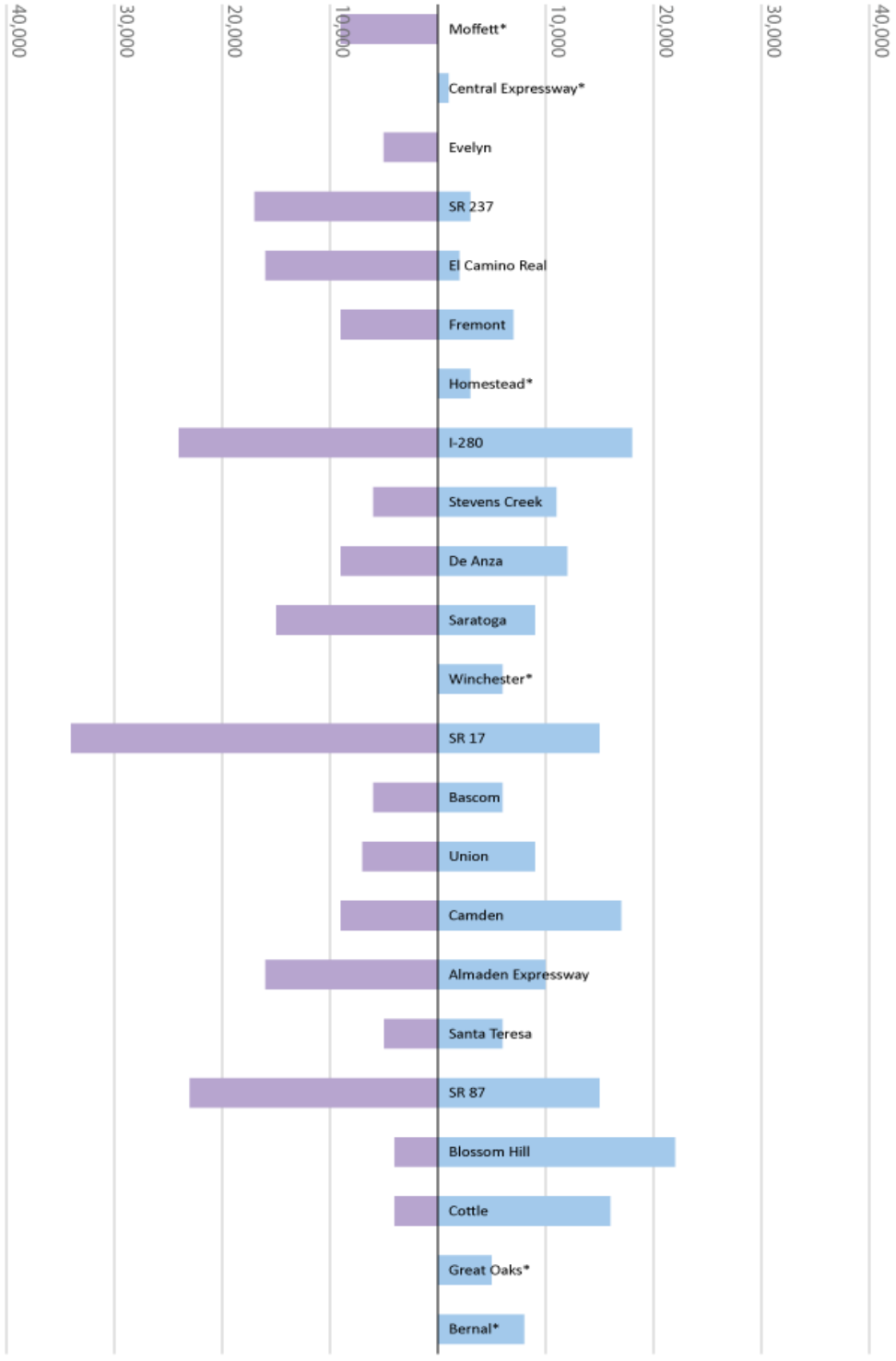
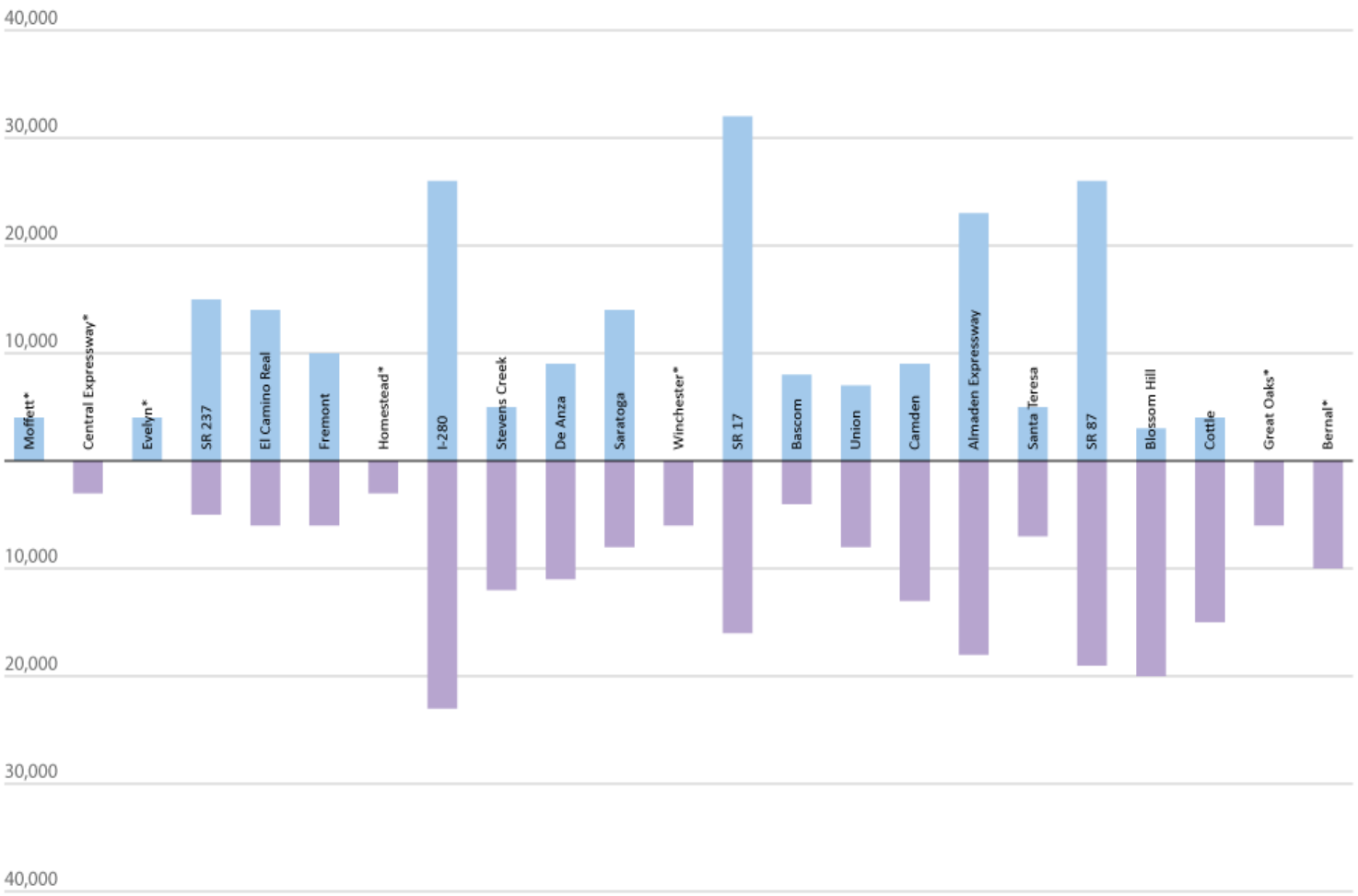


Figure 2-13 | Weekday southbound onramp and offramp vehicle volumes



Private Shuttle Observations

Private shuttles are an increasingly common sight on Santa Clara County freeways during weekday commute periods. The shuttles are operated mainly by large Silicon Valley employers. Precise information about the services such as routing and ridership are not available as the operators prefer to keep that information private. Regardless, the shuttles present an interesting element in the consideration of a potential transit lane on SR 85 as they have the potential to increase person-throughput along the corridor since the shuttles require less road space per person than private automobiles.

Without actual data on private shuttle operations, VTA's best estimates for shuttle operations come from counting shuttles in video surveys conducted at six locations along SR 85 in November 2017. The video surveys looked at 6:00 to 10:00 AM and 4:00 to 8:00 PM.

Figure 2-14 | Commute period shuttle counts

	Northbound		Southbound	
	AM	PM	AM	PM
Middlefield Road	97	106	73	88
El Camino Real	111	130	105	150
McClellan Road	70	69	60	81
Quito Road	69	63	57	88
Leigh Avenue	49	31	22	38
Blossom Hill Road	42	35	18	36

Figure 2-15 | Peak hour shuttle counts

	Northbound		Southbound	
	AM	PM	AM	PM
Middlefield Road	34	33	27	29
El Camino Real	45	37	37	48
McClellan Road	30	18	19	26
Quito Road	34	19	22	29
Leigh Avenue	22	21	11	17
Blossom Hill Road	14	12	7	15

Private shuttles are most prevalent toward the northern end of SR 85, which is not surprising as this end of the corridor features a greater concentration of employment sites. The lower volumes in the southern portion of the corridor suggest that many of the shuttles are joining SR 85 as the corridor works its way northward rather than traveling the entire length of the corridor. Anecdotally, we understand that some areas like the Oaks Shopping Center near SR 85 and Stevens Creek have become de facto park-n-ride locations and likely represent mid-route stops for many shuttle routes. This suggests that the passenger loads on the shuttles increases as they get closer to employers toward the northern end of the corridor.

Estimating private shuttle ridership

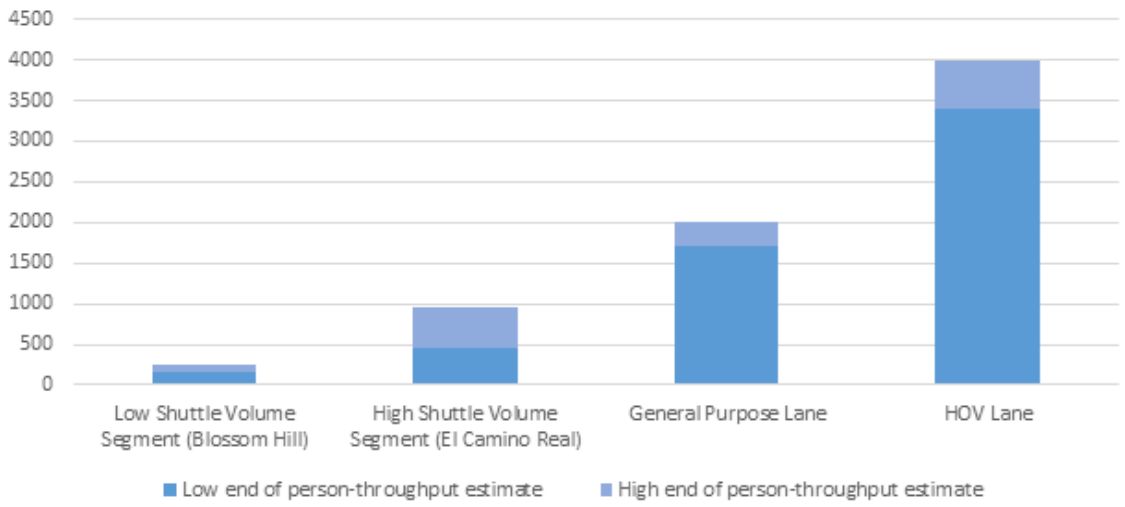
It is likely that around half of the shuttles observed through the video survey are dead-heading—that is, they are not carrying passengers, but rather traveling to or back to the start of their route to start a new trip. Industry estimates place the per-passenger annual subsidy around on private shuttles around $10,000 to $15,000. At estimated contractor wages, this works out to about 16 to 25 passengers per bus, which creates the following range of possible ridership:

Figure 2-16 | Estimated private shuttle passenger throughput per hour during peak periods

	Peak direction buses per hour		Ridership Estimate	
	AM Northbound	PM Southbound	AM Northbound	PM Southbound
Middlefield Road	24	22	400 to 600	350 to 550
El Camino Real	28	38	450 to 700	600 to 950
McClellan Road	18	20	300 to 450	325 to 500
Quito Road	17	22	275 to 425	350 to 550
Leigh Avenue	12	10	200 to 275	150 to 250
Blossom Hill Road	11	9	175 to 250	150 to 225

For context, a single lane of traffic can move about 2,000 vehicles per hour with a HOV lane moving upwards of 4,000 people per hour at 2+ carpool requirements. While private shuttles help increase the person throughput of SR 85, their prevalence does not demonstrate that a private-shuttle only lane would increase vehicle or person throughput at a greater rate than other potential uses.

Figure 2-17 | Estimated passenger-throughput of private shuttles compared to other potential lane uses



Finding: Private shuttles—or any way of moving more people in less space—can increase person-throughput of the SR 85 corridor, but a transit lane reserved exclusively for private shuttles would likely move less people than an additional general use, managed lane or HOV lane on SR 85. A HOV lane or managed lane with high rates of shuttle usage would maximize person-throughput.

3 | Urban form and transit propensity

The decision to use public transit is the result of a confluence of factors including many that are outside of the transit agency's control including demographics and urban form. This chapter looks at those external factors and their supportiveness of a transit investment on SR 85.

Urban form

Per the ridership recipe discussed in in Chapter 1, density, walkability and a mix of land uses are key factors for transit supportiveness. Where more homes, jobs and attractions are present along a corridor, the potential to support transit is high. Ideally these places are walkable so that one can access many places from the stop and find the walking experience safe, pleasant and direct. A mix of land uses along the corridor creates bi-directional demand and facilitates short trips so that all kinds of trips happen in both directions all day, which supports the back-and-forth nature of transit vehicles along a route. These factors are largely absent from the SR 85 corridor.

Land uses along SR 85 are largely homogenous

The land uses adjacent to the SR 85 corridor fall into two major zones: (1) commercial/industrial technology uses north of El Camino Real and (2) suburban-style single-family detached residential uses between El Camino Real and US 101 in South San Jose. Notable exceptions exist, such as De Anza College, shopping plazas near Almaden Expressway, Oakridge Mall, the redeveloping IBM campus near Cottle, Kaiser San Jose and low-density office uses near Bernal. However, compared to established transit corridors that feature a mix of land uses, SR 85 is relatively homogenous. Homogenous land uses—particularly the long stretch that is almost entirely low-density residential between El Camino Real and Almaden Expressway—mean that trips to different types of uses are generally long and less appealing.

Land uses along SR 85 are largely low-density

Density is the strongest determinant of transit ridership along a corridor. The more people in homes, jobs and attractions along a corridor the greater the ridership a transit service along the corridor is likely to achieve. For this reason, where transit services are frequent city general plans zone for higher densities as it increases the likelihood of transit use by corridor residents and travelers. When densities are too low to be transit supportive, the transit service may be reduced or discontinued. A sampling of city general plans shows planning for densities that are substantially higher than those currently present along the SR 85 corridor. Estimates for land uses adjacent to the SR 85 corridor are shown in shaded cells.

Figure 3-1 | Recommended transit-supportive densities from city general plans

	Rec'd Density	Stories
San Jose Transit Supportive Residential	50 to 250 units/acre	5 to 25 stories
Mountain View Mixed Use Corridor	60 units/acre	Up to 6 stories
Cupertino Vallco High-Density Residential	35+ units/acre	-
San Jose Transit Supportive Employment	12.0 FAR*	4 to 25 stories
Mountain View Mixed Use Corridor	1.85 FAR	Up to 6 stories
SR 85-Adjacent Single Family Residential**	4 to 6 units/acre	1 to 2 stories
SR 85-Adjacent Commercial**	0.5 FAR	1 to 2 stories

*Floor area ratio refers to the ratio of the combined square footage of all the floors in a building to the size of the parcel. A two-story building with 10,000 square feet of combined floor space on a 5,000 square foot parcel would have a FAR of 2.0.

**Estimate

Walkability to/from potential SR 85 transit stations is generally indirect

Walkability to potential transit stations along the SR 85 corridor is generally indirect. The residential neighborhoods that surround the corridor were designed mostly with indirect, curvilinear streets that are intended to discourage through-travel to those who do not live in the neighborhood. That street design also envisioned that residents would make nearly all trips by automobile, which negated the inconvenience of indirectness. As a result, the neighborhoods are oriented away from SR 85 resulting in walking paths to transit that are considerably longer than the as-the-crow-flies distance.

Redevelopment potential is limiited

When planning for the future, it is important to consider potential changes in land use that could change travel and transit demand along the corridor. For the SR 85 corridor, such changes are likely limited to few locations as the suburban-style neighborhood design, which comprises the majority of adjacent corridor land uses, has proven resistant to redevelopment. The many small parcels, individual property owners and street design that discourages traffic and visibility makes it unappealing for redevelopment. Rather, potential changes to land uses are likely limited to larger parcels that currently employ non-residential uses.

Finding: The urban growth decisions made over the past several decades by city planners have created an urban form adjacent to the SR 85 corridor that is automobile-dependent and not transit supportive. Those land uses are not likely to change much in the future.

Transit Propensity

The likelihood of using transit is based on more than the urban form. Factors such as age, income, ethnicity, citizenship status, occupation type, vehicle access, vehicle ownership, disability status and home ownership status are strong predictors of one's likelihood to use transit. In 2017, VTA developed a composite metric of 31 different variables shown to have correlations with one's likelihood to use transit. The metric, called the transit propensity score, estimates the transit-supportiveness of zones throughout Santa Clara County by multiplying the overall transit propensity of the zone by the density of people and jobs in the zone. Zones are colored based on transit supportiveness and the approximate level of frequency that can be supported is estimated.

A corridor lined entirely by red land uses is estimated to support 5-minute frequency while those in pale green or gray would struggle to support 60-minute service. By this analysis, the demographics of those who live and work along the SR 85 corridor is perhaps barely supportive of a 60-minute transit service, which suggests that a major capital investment in the corridor and the level of service that would be appropriate for such an investment is unlikely to generate ridership at a rate that would justify the investment.

Finding: Those who travel along and around the SR 85 corridor largely possess demographics that correlate with lower rates of transit usage.

Figure 3-2 | Transit Propensity by zone in Santa Clara County