

Memorandum

To: Laura Prickett, Horizon Water and Environment

From: Genevieve Munsey, Environmental Planner, Parsons;
Carie Montero, Senior Project Manager and Environmental Practice Lead, Parsons;

Date: November 21, 2018

Re: Santa Cruz Route 1 Tier I and Tier II HOV Lane/TSM Widening Project – Update to the Transit Market Analysis of Freeway-Oriented Express Buses (May 2008)

1.0 Purpose and Organization of the Update to the Transit Market Analysis of Freeway-Oriented Express Buses (2008)

The purpose of the Update to the Transit Market Analysis of Freeway-Oriented Express Buses (2008 Study)¹ for the Santa Cruz Route 1 Tier I and Tier II High-Occupancy Vehicle (HOV) Lane/Transportation Systems Management (TSM) Widening Project (proposed project) is to update the 2008 Study's express bus ridership data with current ridership data and to determine whether the 2008 Study findings remain valid. The Update is in response to the following Federal Highway Administration (FHWA) comment on the 2008 Study during the Final Environmental Document review:

The date of this study is 2008, but uses data spanning from 2003-2007 [for transit ridership]. Given the analysis is based on data that is 11-15 years old, it is hard to determine how current freeway-oriented express bus usage would be impacted by the project.

This Update reviews 2008 Study data and findings (including 2035 ridership projections), presents recent express bus ridership data from Santa Cruz Metro over the last 10 years (2008 to 2018), and projects 2035 ridership based on the recent ridership data. This update is based on current ridership data, and growth and traffic operations projections. We have also included a brief review of relevant portions from the 2017 Cumulative Growth Inducement Study Addendum and the 2017 Addendum to the 2012 Traffic Operations Report. Finally, a qualitative assessment of the validity of the 2008 Study conclusions provides a basis for determining how current freeway-oriented bus usage would be impacted by the project.

Since the 2008 Study, the route of one of the express buses in the study area, Highway 17 Express, has changed. The new Highway 17 Express route does not include a segment on State Route 1 (Route 1). For this reason, the Highway 17 Express route is not assessed in this Update. The 2008 Study separated out the Highway 17 Express route in its analysis, because the Route 1 segment of the Highway 17 Express route formerly included was a short distance and was only included on selected daily buses.

¹ *Transit Market Analysis of Freeway-Oriented Express Buses*, Highway 1 High Occupancy Vehicle Lane Widening Project From San Andreas-Larkin Valley Roads to Morrissey Boulevard, 05-SCR-1, PM R733 (KP 11.79) 7.6 to PM 16.13 (KP 25.96), Santa Cruz County, California, EA: 05-0C7300. Prepared by the U.S. Department of Transportation, the State of California Department of Transportation, and the Santa Cruz County Regional Transportation Commission. May 2008.
[https://sccrtc.org/external/hwy1corridorEnvDocs/TechnicalStudies/16 Transit Market Analysis for Highway 1 Corridor.pdf](https://sccrtc.org/external/hwy1corridorEnvDocs/TechnicalStudies/16%20Transit%20Market%20Analysis%20for%20Highway%201%20Corridor.pdf)

2.0 Review of Prior Studies

The 2008 Study

The 2008 Study was conducted in conjunction with the Route 1 HOV Lane Widening Project to understand the market conditions for freeway-oriented express buses in the corridor. The Route 1 HOV Lane Widening Project proposes to improve commute times and encourage transit, carpooling, and alternative modes. The 2008 Study had three primary objectives:

- To identify and quantify the potential market for freeway-oriented transit services in the Route 1 corridor
- To determine how much of the expected transit market would likely be captured by each of the three alternatives
- To determine what transit enhancements would (1) facilitate transit operations in the new HOV lanes and (2) in conjunction with ramp metering and auxiliary lanes, constitute a viable lower-cost alternative to HOV lane widening

The 2008 Study concluded that:

- Route 1 in the study corridor has high transit ridership without the dense city center usually necessary to achieve comparable levels of ridership.
 - This is likely due to low-income service workers commuting from Watsonville and/or University of California, Santa Cruz (UCSC) student ridership.
- Average daily express bus ridership in the corridor varied from 2,300 riders (2003) to 2,000 riders (2006), excluding Highway 17 Express ridership.
- Projected 2035 express bus transit ridership, without Highway 17 Express ridership, would be between 2,300 riders per day (with 2007 service frequency) and 2,800 riders (with 2003 transit service frequency [higher frequency than 2007] and 2007 travel times).
- 2035 transit ridership growth projections for the project area were estimated to be between 18 and 21 percent, depending on the level of service (or frequency) for each route (lower levels of 2007 or higher levels of 2003) and fares (lower fares in 2003 and higher fares after the fare increase in 2004). Realization of the projected growth in ridership would depend on the selected alternative, the level of service for each express bus route, Santa Cruz Metro fare changes, and the integration of other transit infrastructure, such as Park-and-Ride lots.
- Express bus ridership is highly sensitive to travel time changes, as well as, to a lesser extent, fare changes.
- Latent express bus demand in the corridor was estimated to be an additional 40 percent over projected future ridership (not including Highway 17 Express route).

The 2008 Study provided the following analysis of the proposed project alternatives:

- In 2035, under the No Build Alternative, express buses would be subject to very congested travel conditions on the freeway. Therefore, the projected growth in ridership would not be realized. None of the latent demand would be captured, and ridership may decrease compared with 2007 conditions. Santa Cruz Metro would experience increased operating and capital costs to maintain its 2007 level of service due to slower bus travel times.
- In 2035, under the TSM Alternative, travel time through the corridor would be better than under the No Build Alternative, except in the southbound direction during the evening peak hour. Discussions between Santa Cruz Metro and the design team confirmed there is no practical way to use auxiliary lanes to enhance Route 1 freeway-oriented transit bus operations. Express bus service would consequently encounter similar conditions as the general traffic.

Transit enhancements, such as expanded Park-and-Ride lots, more peak-period express service, and connecting shuttle buses or expanded express routing to serve local destinations do not offer any real-time savings. Therefore, the projected growth would likely not be realized, and the latent demand would likely not be captured.

- In 2035, under the HOV Lane Alternative, buses and other HOVs would receive a high level of service and would travel at free-flow speeds of approximately 63 to 64 miles per hour (mph) through the project limits in the peak commute direction (northbound in the morning and southbound in the evening), while the automobiles in the mixed-flow lanes would experience some congestion relief but would still be traveling at 30 to 36 mph, well below free-flow speeds. This compares to speeds as low as 11 mph under the No Build Alternative. Therefore, the projected future transit ridership and more can be realized under the HOV Lane Alternative. Because transit ridership is very sensitive to travel time, the HOV Lane Alternative would improve travel times and capture latent demand for express bus transit.
 - Half of the latent ridership could be captured with the HOV Lane Alternative
 - Increased express route frequency, to the level of 2003, would capture the remaining latent demand projected to 2035

Transit enhancements recommended by the 2008 Study to increase ridership on express bus routes included:

- Developing strategically-placed Park-and-Ride lots
- Lower fares
- Increased bus frequency (to decrease wait time)
- Decreased travel time

2018 Addendum to the 2008 Cumulative Growth Inducement Study

An updated cumulative growth inducement study was issued in 2018 as an addendum to the 2008 Cumulative Growth Inducement Study.² Its purpose was to assess changes in the data and assumptions underlying the 2008 Cumulative Growth Inducement Study and to determine if the conclusions were still valid. The Addendum reviewed current traffic data (2016); regional population and employment projections; recent planning documents; and expert agency and stakeholder opinions. The Addendum concluded that:

- The Tier I HOV Lane Alternative, which would save commuters substantially more travel time than the Tier I TSM Alternative, would not stimulate unplanned residential or related commercial growth, but would support planned growth in the corridor.
- The reasonably foreseeable growth and land use change with and without the project is defined by the population and employment forecast data prepared by the Association of Monterey Bay Area Governments (AMBAG) and adopted in 2014. The project is not expected to influence the overall amount, type, location, or timing of that growth.

2017 Addendum to the 2012 Traffic Operation Report (TOR)

An updated existing traffic conditions report was issued in 2017 as an addendum to the 2012 California Department of Transportation (Caltrans)-approved *Traffic Operation Report* (TOR).³ Its purpose was to summarize the updated traffic analysis that was conducted using traffic data collected in 2016 and

² *Santa Cruz Highway 1 Widening/HOV Lane Project – Addendum to the Cumulative Growth Inducement Study*. 2018.

³ *Santa Cruz Highway 1 Widening/HOV Lane Project – Final 2016/2017 Traffic Analysis Update: Memorandum*. 2017.

discuss the latest traffic conditions along the study corridor. It addressed some of the public comments received on the Draft Environmental Impact Report/Environmental Assessment (DEIR/EA) that was circulated in November 2016, especially those suggesting that the traffic data used in the 2012 TOR were out of date and that the future forecasts were now too high because of the 2008 recession. The addendum conducted new existing conditions analyses with current (2016) data and reached the conclusions summarized below:

- Overall, traffic conditions along the study corridor have generally deteriorated from 2005 to 2016 conditions. The analysis indicated that traffic conditions are expected to worsen further in the future and highlighted the need and importance of the proposed project in improving traffic conditions.
- The analysis demonstrated that contrary to the comments received on the traffic section of the DEIR/EA, the future traffic forecasts for the Route 1 projects in Santa Cruz were not overestimated and may in fact be slightly underestimated. Traffic operational analysis results reported in the 2012 TOR were low-end estimates, especially in the peak directions of travel; future traffic operations along the study corridor could be worse than those reported in the 2012 TOR in the peak directions of travel.
- The traffic addendum also compared the 2004 and 2014 AMBAG travel demand models and their underlying 2004 and 2014 AMBAG population and employment projections. The addendum concluded that in looking at the recent, post-recession growth trend in traffic and employment levels in and around the study corridor (Silicon Valley and Santa Cruz County), the slow-growth assumptions of the 2014 AMBAG model may not accurately represent future traffic conditions along the study corridor. Therefore, use of the 2004 AMBAG model was considered the most suitable approach for this project.

Comparing the Route 1 delay savings from the 2007 TOR⁴ and the 2012 Final Report.⁵ found the projected 2035 delay savings had no difference between the two reports. Thus, the projected delay savings were confirmed.

3.0 Revised Project Description

Caltrans, in cooperation with FHWA and the Santa Cruz County Regional Transportation Commission (RTC), proposes improvements to Route 1 in Santa Cruz County. This project is divided into two components: (1) Tier I component from approximately 0.4 mile south of the San Andreas-Larkin Valley Road interchange to 0.3 mile north of the Morrissey Boulevard interchange, a distance of approximately 8.9 miles; and (2) Tier II component from 41st Avenue to Soquel Avenue/Drive. The 2008 Study and this Addendum evaluated these alternatives from a cumulative viewpoint, with the Tier II component included in the Tier 1 alternatives.

Tier I Project

There are two build alternatives defined for the Tier I Project: (1) Tier I Corridor HOV Lane Alternative and (2) Tier I Corridor TSM Alternative. The complete project description is provided in Attachment 1.

Tier I Corridor HOV Lane Alternative

The Tier I Corridor HOV Lane Alternative would expand the existing four-lane highway to a six-lane facility by adding one HOV lane in each direction next to the median and an auxiliary lane on the outside

⁴ *Highway 1 HOV Lane Widening Project – Traffic Operations Report*, April 2007.

⁵ *Santa Cruz SR-1 HOV Traffic Operations, Final Report*, April 2012.

in each direction. Expanding the highway from four lanes to six lanes would be achieved by building the new lane in each direction in the existing freeway median and widening the freeway footprint in those locations where the median is not wide enough to fit the new lane. The Tier I Corridor HOV Lane Alternative would modify or reconstruct all nine interchanges within the project limits to improve merging operations and ramp geometry. The Bay Avenue/Porter Street and 41st Avenue interchanges would be modified to operate as one interchange, with a frontage road to connect the two halves of the interchange. Where feasible, design deficiencies on existing ramps would be corrected. Ramp metering and HOV bypass lanes and mixed-flow lanes would be added to Route 1 on-ramps within the project limits.⁶ The Tier I Corridor HOV Lane Alternative would include an auxiliary lane in each direction between Freedom Boulevard and Bay Avenue/Porter Street and between 41st Avenue and Soquel Avenue/Drive. Transportation Operations System infrastructure, such as changeable message signs, highway advisory radio, microwave detection systems, and vehicle detection systems, would also be provided under the Tier I Corridor TSM Alternative. The Tier I Corridor HOV Alternative would not construct a northbound auxiliary lane between State Park Drive and Park Avenue.

Tier I Corridor TSM Alternative

The Tier I Corridor TSM Alternative proposes to add an auxiliary lane along the highway between major interchange pairs from Morrissey Boulevard to Freedom Boulevard; provide ramp metering; construct an HOV bypass lane and mixed-flow lane on on-ramps; and improve nonstandard geometric elements at various ramps, in both directions.⁶ The Tier I Corridor TSM Alternative also would include Transportation Operations System electronic equipment as described for the Tier I Corridor HOV Lane Alternative. In addition, the Tier I Corridor TSM Alternative would reconstruct the north and south Aptos railroad bridges and lower Route 1 in Aptos to achieve standard vertical clearance; reconstruct the State Park Drive, Capitola Avenue, and 41st Avenue overcrossings; widen the Aptos Creek Bridge; and construct three new pedestrian/bicycle overcrossings over Route 1 at Mar Vista Drive, Chanticleer Avenue, and Trevethan Avenue. All of the aforementioned reconstructed bridges would include improvements to pedestrian and bicycle facilities. The Tier I Corridor TSM Alternative shares many features with the Tier I Corridor HOV Lane Alternative; the major exceptions are the absence of an HOV lane and a reconfiguration of only the Soquel Drive/Soquel Avenue interchange. The Tier I Corridor TSM Alternative would include a northbound auxiliary lane between State Park Drive and Park Avenue.

Tier II Project

Tier II Auxiliary Lane Alternative

There is one build alternative defined for the Tier II Project: the Tier II Auxiliary Lane Alternative. This alternative would add an auxiliary lane to the northbound and southbound directions of Route 1 between the 41st Avenue and Soquel Avenue/Drive interchanges. In addition, an Americans with Disabilities Act-compliant pedestrian and bicycle overcrossing would be constructed at Chanticleer Avenue. The total roadway widening would be approximately 1.4 miles along Route 1. The new auxiliary lanes would be 12 feet wide. In the southbound direction, the width needed for the new lane would be added in the median, and the median barrier would be shifted approximately 5 feet toward the northbound side of the freeway to make room for the new lane and a standard 10-foot-wide shoulder. Where the new southbound lane meets the existing ramps, outside shoulder widening would occur to achieve standard 10-foot-wide shoulders. In the northbound direction, the project proposes paving a 10-foot-wide median

⁶ HOV bypass lanes at three interchanges (Rio Del Mar Boulevard, Freedom Boulevard and San Andreas Road) and associated improvements, such as retaining walls and improvements to local roads, will be included only if the proposed design fully avoids upland habitat for Santa Cruz long-toed salamander, as determined during environmental review of future Tier II projects. During the environmental review of future Tier II projects, more detailed information would be available to determine whether there may be design approaches that could include the HOV bypass lanes while achieving full avoidance of SCLTS upland habitat.

shoulder and widening to the outside to add the 12-foot-wide auxiliary lane and a new 10-foot-wide shoulder.

The pedestrian/bicycle overcrossing constructed at Chanticleer Avenue would connect to a new 360-foot-long by 6-foot-wide sidewalk on Chanticleer Avenue on the south side of Route 1. The sidewalk, located along the south side of Soquel Drive, would be separated from the street by a 4-foot-wide park strip. Retaining walls would be constructed as part of the roadway widening along Route 1, with four separate walls: three on the north side of the roadway and one on the south side. One of the retaining walls would start after the 41st Avenue on-ramp and extend approximately 150 feet; two other retaining walls on the northbound side would be 375 feet and 408 feet long. On the southbound side, a 350-foot-long wall would be constructed along the highway mainline and Soquel Avenue, over the Rodeo Creek Gulch culvert.

No Build Alternative

The No Build Alternative offers a basis for comparing the Tier I Corridor Alternatives and the Tier II Auxiliary Lane Alternative in the future analysis year of 2035. Although the Tier I Corridor Alternatives and the Tier II Auxiliary Lane Alternative are separate projects, the assumptions regarding the No Build Alternative conditions are the same. Both assume no major construction on Route 1 through the Tier I corridor project limits or Tier II project limits other than currently planned and programmed improvements and continued routine maintenance. Planned and programmed improvements that are assumed in the No Build Alternative are the following, as contained in the 2014 Regional Transportation Plan:

- Installation of median barrier on Route 1 from Freedom Boulevard to Rio Del Mar Boulevard
- Installation of a Class I bicycle and pedestrian facility on Morrissey Boulevard over Route 1
- Implementation of single interchange improvements at 41st Avenue and Bay Avenue/Porter Avenue as detailed and expensed in the Highway 1 HOV Project (RTC 24) as a standalone project, if the RTC project does not proceed

The No Build Alternative also includes planned improvements to roadways and roadsides on Rio Del Mar Boulevard from Esplanade to Route 1, which includes the addition of bike lanes, transit turnouts, left-turn pockets, merge lanes, and intersection improvements. Road work includes major rehabilitation and maintenance of road and roadsides.

4.0 Review of Transit Ridership

This Update addresses two main questions from the 2008 Study. The two questions address the concern that more recent Santa Cruz Metro ridership data, and service modifications since 2007, may affect the transit impact analysis in the 2008 Study. Given updated ridership levels since 2007, the two questions are:

- What is the current freeway-oriented express bus ridership and how does this compare to the 2008 Study, and the 2008 Study projections for 2035?
- How would current freeway-oriented express bus ridership be impacted by the project and is it consistent with the 2008 Study conclusions?

The 2008 Study addressed a transit market analysis by investigating average daily ridership of express routes that use Route 1 in the project area, assessing service changes over the 2003 to 2007 period, (including bus frequency, travel time, and fares), and projecting 2035 ridership. The 2008 Study also estimated latent ridership based on a sensitivity analysis. The 2008 Study assessed the potential to capture projected and latent ridership for each of the project alternatives.

With current updated ridership data, from 2008-2018, the Update provides analysis of:

- The current ridership and how it compares with the 2008 Study ridership values
- Projected 2035 ridership, based on current ridership data
- Qualitative assessment of ridership variables, including frequency, travel time, and fares, and future and latent ridership capture
- An assessment of the validity of the 2008 Study alternatives analysis and transit impacts, given the current ridership data

4.1 Method

The 2008 Study

In the 2008 Study, projected transit ridership for freeway-oriented express bus transit services in the Route 1 corridor are based on baseline ridership data from 2003 to 2007. The projected growth rate is based on AMBAG models of employment and population growth in the region, as well as a sensitivity analysis developed in cooperation with Santa Cruz Metro that assessed rider sensitivity to changes in the level of service, including sensitivity to express bus frequency and express bus fares. The projected growth rate was calculated to be within the range of 18 to 21 percent growth, with growth occurring in the period 2007 to 2035. Additionally, latent express bus ridership, defined as uncaptured ridership, is made up largely of “choice” riders that could take transit, but instead choose another mode, such as driving. Latent ridership projections are based on a study of 8 different cities in the United States (the method is further described in the 2008 Study). The latent ridership was estimated to be an additional 40 percent of the projected future ridership.

The 2008 Study was developed in collaboration with Santa Cruz Metro and included agency information such as historical data regarding transit infrastructure improvements, transit service changes, and fare changes. Transit service data included changes in routes and frequency over time, separate southbound and northbound data, and origin-destination data. The 2008 Study determined that ridership is extremely sensitive with respect to travel time changes. Travel time is composed of ingress time (time to arrive at the station), wait time, service headway (frequency), in-vehicle time, and egress time (to arrive at the destination). Express bus riders, in general, tend to consult time tables and arrive shortly before the bus is scheduled to arrive, because headway is greater than 15 minutes. The 2008 Study found that Santa Cruz Metro riders are highly sensitive to in-vehicle time. Additionally, the express bus ridership in the corridor is sensitive to fare changes as well, but to a lesser degree. Factors that decrease travel time include decreased headway (increased bus frequency), decreased in-vehicle travel time, and improved access to travel stops.

The 2018 Update

Updated current ridership data were accessed from the Santa Cruz Metro bimonthly meeting agenda packets and directly from Santa Cruz Metro staff. Data included monthly ridership by route for the years 2008 to 2018. Ridership data were missing for 2 months in 2013, and ridership data for 2018 included only the first 6 months (January to June). Data were summarized as average daily ridership per year, for comparison to the 2008 Study data.

The annual data are projected out to 2035 using the 18 to 21 percent growth rates calculated for the period 2007 to 2035, from the 2008 Study. The 18 to 21 percent growth rates were based on AMBAG employment and housing growth projections from 2004. The Route 1 Growth Addendum analyzed updated AMBAG projections in 2014 and found that the 2004 AMBAG projections were better aligned with current data than the 2014 AMBAG projections, likely due to 2014 AMBAG projection underestimates

of growth following the 2008 economic recession. Recent 2018 AMBAG projections show an 18 percent growth rate (for population and employment) in Watsonville and 20 percent in Santa Cruz over the period 2014 to 2040; therefore, the 18 to 21 percent projected growth (for 2007 to 2035) from the 2008 Study is an accurate estimate and is applied to the current transit ridership data. This results in a range of ridership projections based on the low and high percent projected growth. Finally, an annual growth value is calculated for the low (18 percent) and high (21 percent) growth projections to project more recent data into 2035.

The current Update was completed independent of Santa Cruz Metro staff and did not assess internal data or review service changes over the last 10 years. The Update does not revise projection information based on frequency, fare changes, and origin-destination information. The Update uses recent ridership data and provides analysis consistent with the 2008 Study methods.

4.2 Average Daily Express Bus Ridership

Comparison of 2003–2007 and 2008–2018 Ridership Data

The 2008 Study was based on Santa Cruz Metro ridership data for 2003 to 2007, which included average daily ridership per route for express buses that used Route 1. Ridership data were provided for express bus routes 69A, 69W, and 91X (Table 1 and Figure 1). Ridership data for Highway 17 Express were also included because, at the time, Highway 17 Express had selected trips each day that served a Park-and-Ride lot accessed via Route 1. Since 2007, the Highway 17 Express service route was modified to exclude that Park-and-Ride lot; therefore, the Route 1 segment that was required to access the Park-and-Ride lot is no longer part of the service route. The Update includes the Highway 17 Express ridership or projections for comparison purposes only. Figure 2 displays the total average daily express bus ridership for all express routes, excluding Highway 17 Express.

Two of the years have incomplete datasets. For 2013, there were 2 months where Santa Cruz Metro does not have the average monthly ridership by route data. These months are May and July. The average daily ridership is calculated without these months. For 2018, only the first half of the year is included. The average daily ridership values are calculated with only these months.

*Santa Cruz Route 1 Tier I and Tier II Project
Update to the Transit Market Analysis of Freeway-Oriented Express Buses*

Table 1: Average Daily Express Bus Ridership in the Corridor

Year	Route				Total	
	69A	69W	91X	17	Without 17	With 17
2003	813	1,113	394	613	2,320	2,933
2004	706	1,047	316	645	2,069	2,714
2005	822	1,028	294	671	2,144	2,815
2006	804	959	238	740	2,001	2,741
2007	803	902	245	798	1,950	2,748
2008	783	881	170	832	1,835	2,667
2009	760	867	151	830	1,779	2,608
2010	780	883	152	748	1,815	2,563
2011	771	924	138	905	1,833	2,738
2012	728	869	426	957	2,022	2,979
2013*	630	771	524	883	1,926	2,809
2014	716	897	593	1,021	2,206	3,226
2015	704	880	569	1,002	2,153	3,155
2016	653	823	526	873	2,002	2,875
2017	619	806	390	794	1,815	2,609
2018**	616	806	382	810	1,804	2,614

* Incomplete Dataset

** January to June

Figure 1: Average Daily Express Ridership in the Corridor, by Route

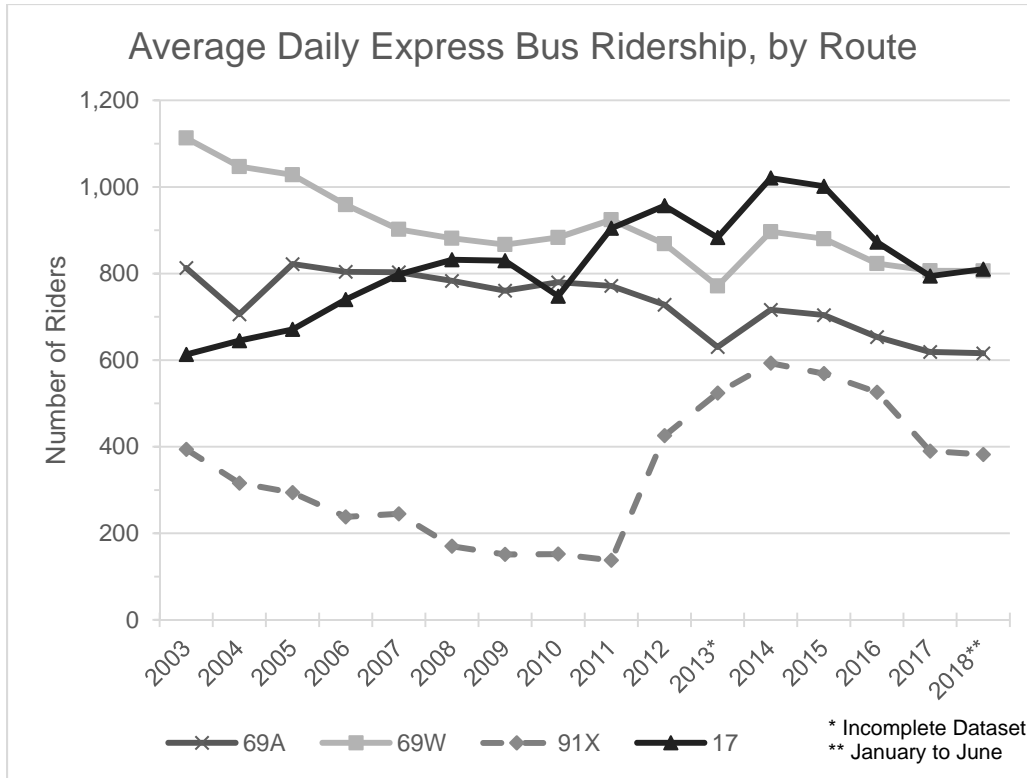
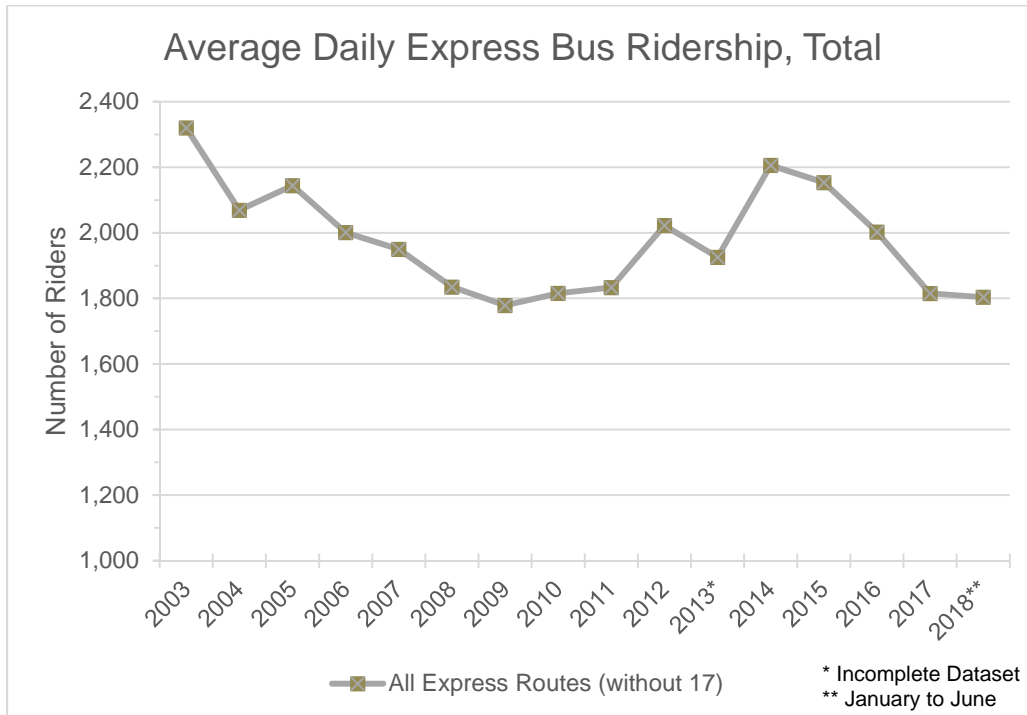


Figure 2: Average Daily Express Bus Ridership in the Corridor, Total



*Santa Cruz Route 1 Tier I and Tier II Project
Update to the Transit Market Analysis of Freeway-Oriented Express Buses*

For 2003 to 2018, the annual percentage changes in ridership, compared to the prior year, are shown in Table 2. For example, in 2006, on route 69A, there was a 2.2 percent decrease in ridership compared to the prior year, in 2005. (The actual ridership numbers are shown in Table 1.) The cumulative change compared to a baseline of 2003 ridership is also calculated.

The current average daily express bus ridership data shows that the 69A and 69W routes experienced cumulative declines in ridership between 2003 and 2018 of between 24 and 28 percent, respectively, while the 91X route had a cumulative ridership decline of only 3 percent (Table 2). The Highway 17 Express route had an increase of more than 32 percent in ridership compared to 2003. The cumulative change between 2003 to 2018 is an approximate 22 percent decline in ridership, excluding the Highway 17 Express route.

Table 2: Percent change per year of average daily express bus ridership

	Route				Annual Percent Change Compared to Prior Year (without 17)	Cumulative Change Compared to 2003	Cumulative Change Compared to 2007
	69A	69W	91X	17			
2003	NA	NA	NA	NA	NA	NA	NA
2004	-13.2	-5.9	-19.8	5.2	-10.8	-10.8	NA
2005	16.4	-1.8	-7.0	4.0	3.6	-7.6	NA
2006	-2.2	-6.7	-19.0	10.3	-6.7	-13.8	NA
2007	-0.1	-5.9	2.9	7.8	-2.5	-15.9	NA
2008	-2.5	-2.3	-30.5	4.2	-5.9	-20.9	-5.9
2009	-2.9	-1.6	-11.1	-0.3	-3.1	-23.3	-8.8
2010	2.6	1.9	0.5	-9.9	2.1	-21.7	-6.9
2011	-1.1	4.6	-9.5	21.0	1.0	-21.0	-6.0
2012	-5.6	-6.0	209.3	5.8	10.3	-12.8	3.7
2013	-13.4	-11.2	23.2	-7.7	-4.8	-17.0	-1.3
2014	13.6	16.3	13.2	15.6	14.6	-4.9	13.1
2015	-1.7	-1.8	-4.1	-1.9	-2.4	-7.2	10.4
2016	-7.2	-6.5	-7.6	-12.9	-7.0	-13.7	2.7
2017	-5.3	-2.0	-25.9	-9.0	-9.3	-21.8	-6.9
2018	-0.5	-0.1	-2.0	2.0	-0.6	-22.3	-7.5
Cumulative Change Compared to 2003	-24.3	-27.6	-3.0	32.1	-22.3	NA	NA
Cumulative Change Compared to 2007	-23.3	-10.7	56.0	1.5	-7.5	NA	NA

NA – Not Applicable

Between 2003 and 2018, the largest annual percent change in ridership, excluding the Highway 17 Express route, occurred between 2013 and 2014. The 2014 ridership was 14.6 percent greater than the 2013 ridership. The greatest annual decline in ridership occurred in 2004, with a 10.8 percent decrease in ridership compared to 2003.

The cumulative change between 2007 and 2018 (Table 2) is an approximate 8 percent decline in ridership, excluding the Highway 17 Express route. This includes a 56 percent increase in ridership on the 91X route since 2007, a 23 percent decrease in ridership on the 69A route, and a decrease of 11 percent on the 69W route. The maximum increases in average daily ridership during the 2007 to 2018 period, comparatively, were in 2014 and 2015, which had increases in ridership over 2007 of 13 and 10 percent, respectively.

2035 Projected Daily Express Bus Ridership

The 2008 Study projected average daily express bus ridership into 2035 separately using five different baseline years. The baseline years were ridership data from every year 2003 to 2007. The 2008 Study calculated growth rates for each baseline year that were based on AMBAG employment and population growth rates but also were modified slightly to include variables such as express bus service frequency per route and direction, and fare rates. The resulting growth rates for the baseline years ranged from 18 to 21 percent and resulted in 2035 average daily ridership projections between 2,298 riders and 2,814 riders (Table 3).

Table 3: 2035 Projected Average Daily Express Bus Ridership (from 2008 Study)

Baseline Year	Route				Total for Express Routes (without 17)
	69A	69W	91X	17	
2003	986	1,351	477	863	2,814
2004	852	1,263	382	900	2,496
2005	986	1,234	352	927	2,571
2006	960	1,144	267	1,013	2,370
2007	953	1,070	275	1,083	2,298

The 2008 Study's lower range of growth is an 18 percent growth rate for the 28 years from 2007 to 2035. The growth rate would be equivalent to a 0.5929 percent annual growth rate. Using this annual growth rate, Table 4 projects the growth into 2035 for each of the new transit ridership data years, using each one as a baseline, similar to the 2008 Study. The annual growth rate is applied only to the actual years between the baseline year and 2035. For example, for the 2008 baseline data, projected to 2035, there are 27 years of annual growth; whereas for 2018, there are 17 years of annual growth projected to 2035.

Table 4: 2035 Projected Average Daily Express Bus Ridership, with an 18 Percent Growth Rate and Recent Ridership Data as Baseline

Baseline Year	Route				Total for Express Routes (without 17)
	69A	69W	91X	17	
2008	919	1,033	199	976	2,153
2009	886	1,011	176	968	2,075
2010	904	1,024	176	867	2,104
2011	889	1,065	159	1,043	2,112
2012	834	996	488	1,096	2,316
2013	717	878	597	1,006	2,193
2014	811	1,016	671	1,156	2,498
2015	792	990	640	1,128	2,423
2016	731	921	589	977	2,240
2017	688	897	434	883	2,019
2018	681	891	422	896	1,995

The 2008 Study's upper range of interest was 21 percent growth for the 28 years from 2007 to 2035. The growth rate would be equivalent to a 0.6831 percent annual growth rate. Using this annual growth rate, Table 5 projects the growth into 2035 based on the number of years of growth between the baseline year and 2035.

Table 5: 2035 Projected Average Daily Express Bus Ridership, with a 21% Growth Rate and Recent Ridership Data as Baseline

Baseline Year	Route				All Express Routes (without 17)
	69A	69W	91X	17	
2008	941	1,059	204	1,000	2,205
2009	907	1,035	180	991	2,123
2010	925	1,047	180	887	2,152
2011	908	1,088	162	1,066	2,158
2012	851	1,016	498	1,119	2,365
2013	732	896	609	1,026	2,237
2014	826	1,035	684	1,178	2,545
2015	807	1,008	652	1,148	2,467
2016	743	937	599	994	2,278
2017	700	911	441	898	2,052
2018	692	905	429	909	2,025

Based on a growth rate of 18 percent from 2007 to 2035, the projected average daily express bus ridership in 2035 would be between 1,995 and 2,498 average daily ridership, depending on the baseline year between 2008 and 2018. Based on a growth rate of 21 percent, the projected average daily express bus ridership in 2035 would be between 2,025 to 2,545 average daily ridership, depending on the

baseline year between 2008 and 2018. Overall, inclusive of the 18 and 21 percent growth rate ranges, the projected average daily express bus ridership in 2035 would be between 1,995 and 2,545 riders based on the current 2008 to 2018 ridership values. The average of the 2035 projections based on 18 to 21 percent growth, and baseline years from 2008 to 2018, is 2,215 average daily ridership.

In comparison, the 2008 Study found the range of projected 2035 average daily ridership, based on different baseline years 2003 to 2007, to be between 2,298 and 2,814 riders, with an average of 2,510 riders. The difference in the high and low projections, for both the 2008 Study and the Update, is approximately 500 riders. There is an overlap in their ranges of approximately 250 riders (between the lowermost 2008 Study projection of 2,298, and the upper projection of the Update of 2,545. Therefore, although the growth rate of ridership in the 2008 Study and in this Update is based on an 18 to 21 percent growth rate from 2007, the different baseline years shift the range of the 2035 projected ridership. The existing (2008 to 2018) ridership values have declined, increased, and declined again since 2007. The overall result is a decrease in projected 2035 ridership compared to the 2008 Study. This difference in the projection results is statistically significant. The 2035 projected ridership values in this Update are lower than the 2008 Study by approximately 10 to 13 percent (or 269 to 304 riders).

Nevertheless, as described in the 2008 Study, the 2035 projected ridership would not be actualized by Santa Cruz Metro express bus service if the on-bus travel time increases. With worsening congestion in the corridor, as described by the TOR Addendum, the associated increasing in-vehicle travel times have diminished the ability of Santa Cruz Metro to realize any interim ridership growth. Therefore, the original projections using the 2003 to 2007 data are more likely to be the realistic projections of growth potential, and express bus transit ridership is likely experiencing the inability to actualize future growth in ridership. Therefore, this would also imply that the latent ridership would not be captured as congestion on the highway continues to worsen, and choice riders, who can choose transit or another mode, would likely seek another mode of transportation to save time.

4.3 Impacts to Santa Cruz Metro Ridership

Because the proposed project would serve existing transit routes already in operation within the corridor, as described in the 2008 Study, there are no additional impacts with the updated 2008 to 2018 ridership data assessed in this Update. The proposed project would not impact Highway 17 Express because the Highway 17 Express route has been modified since the 2008 Study to eliminate a segment on Route 1, which was used to access a Park-and-Ride lot on a limited number of daily Highway 17 Express buses prior to 2007.

Population and employment growth in the study area have continued to increase since the 2008 Study, but Santa Cruz Metro ridership has decreased. The Santa Cruz Metro ridership was shown to be highly sensitive to transit time in the 2008 Study. The ridership was also shown to be sensitive to fare changes to a lesser degree. The decrease in ridership is likely due to service cuts and fare increases, as well as increased congestion on Route 1, as described in the Addendum to the TOR.

As the population of seniors in the AMBAG region increases dramatically as baby boomers age, there is a greater need for transit to accommodate the aging populations, including those that are disabled and low income. A recent AMBAG study suggested fare prices may be a barrier to ridership to this growing population.⁷ Additionally, the study found that regular express bus connections are needed, especially between southern Santa Cruz County and other parts of the County, and that additional bus transit

⁷ AMBAG 2018. Monterey Bay Area Coordinated Public Transit-Human Services Transportation Plan.

service would allow low-income riders more job opportunities and assist with transitioning low-income children and families from welfare to work.

Apart from increases in express bus frequency and decreasing fares, other variables discussed in the 2008 Study that could increase ridership are additional Park-and-Ride lots to decrease ingress and egress time. The 2008 Study found that the No Build Alternative and the TSM Alternative did not have the potential to decrease travel time, but that the HOV Lane Alternative did.

5.0 Summary and Conclusions

Impacts to current express bus transit ridership due to the proposed project should be considered in the context of ongoing service and fare changes over time as Santa Cruz Metro responds to changing funding conditions. The main factors that affect transit ridership levels from the rider perspective are travel time, bus frequency, fares, and transit stop accessibility (distance from home or work). Both the 2008 Study and this Update analyzed existing transit ridership and projected that ridership into 2035 to estimate transit demand and latent ridership. Because ridership has tended to fluctuate based on service cuts and expansions by Santa Cruz Metro, this Update reviews projected transit ridership using baseline range of years from 2008 to 2018. As discussed above, the changes in express bus ridership have not had a material effect on the conclusions of the 2008 Study. The Update concludes that:

- The transit ridership rates have fluctuated with increases and decreases in express bus transit service provided by Santa Cruz Metro
- The projected transit ridership is based on population and jobs projections, but it is reliant upon increased transit service, as well as decreased travel times
- Recent AMBAG research shows that an aging population, along with existing disabled and low-income populations, may have increased the express bus riders' sensitivity to fare increases
- The proposed project could impact express bus frequency, with the HOV Lane Alternative increasing frequency due to higher travel speeds, and with the No Build and TSM Alternatives decreasing frequency due to reduced travel speeds
- The proposed project's No Build Alternative and TSM Alternative would not decrease travel time for express bus riders, which is projected to increase substantially into 2035, and is a primary driver of decreased ridership
- The proposed project's HOV Lane Alternative would decrease travel time for express bus riders compared to the No Build Alternative, which is a primary driver of increased ridership
- Delays in implementation of the proposed HOV Lane Alternative may be contributing to decreases in ridership due to increased in-vehicle travel times along Route 1, which is experiencing increased congestion
- The capture of projected growth and latent demand for express bus service depends on future travel conditions on the freeway under the particular project alternatives

The Update alternative analysis concludes that:

- The HOV Lane Alternative would decrease travel time; therefore, it would have the greatest impact on promoting transit in the area, as travel time was found to be the primary driver of ridership capture based on joint research with Santa Cruz Metro
- The TSM Alternative would have a limited impact on express bus travel times; therefore, it would be subject to increased express bus travel times as congestion increases in the Route 1 corridor
- The No Build Alternative would not decrease express bus travel times and would be subject to increased travel times as congestion increases in the Route 1 corridor, which is shown in the 2008 Study to decrease ridership in the corridor

The 2008 Study determined that ridership is extremely sensitive with respect to travel time changes. Additionally, the express bus ridership in the corridor is sensitive to fare changes, but to a lesser degree. Factors that decrease travel time include decreased headway (increased bus frequency), decrease in-vehicle travel time, and shorter distances to transit stops, such as introducing Park-and-Ride lots. Using more recent ridership data, this Update confirmed that ridership growth is not keeping up with regional population and employment growth projections, and that ridership percentage has declined by approximately 22 percent since 2003 and by approximately 8 percent since 2007. The decline in ridership is likely due to decreases in express bus frequency, increased fare rates, and increased travel times in the Route 1 corridor. The recent ridership data show that very congested highways may be decreasing the ability of Santa Cruz Metro to realize the projected and latent demand ridership projected in the 2008 Study.