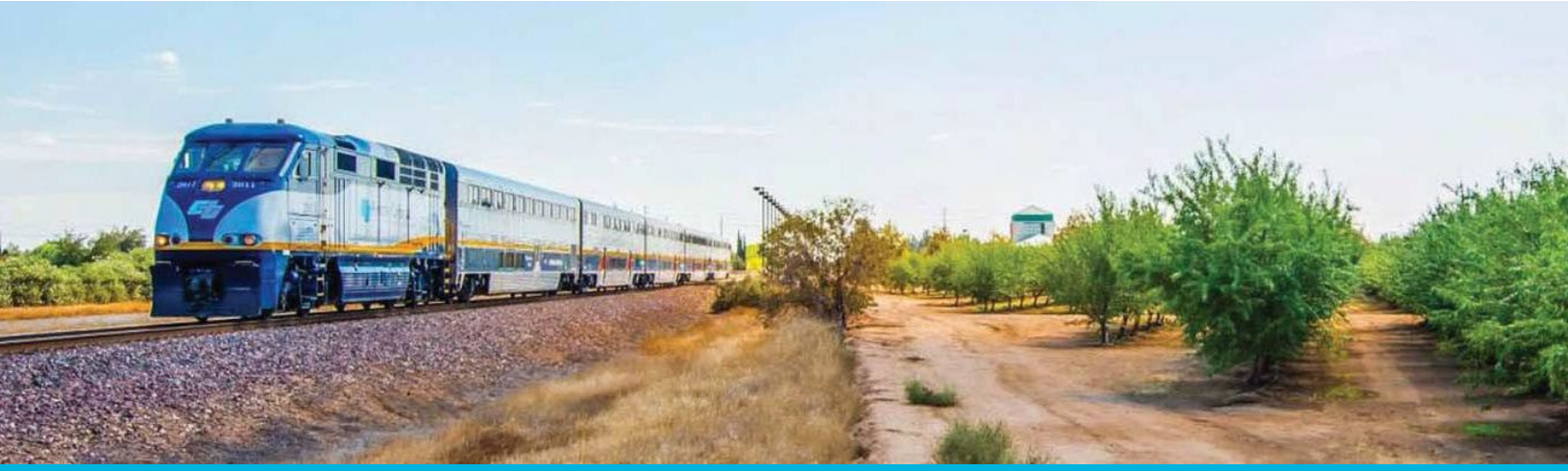

Madera High-Speed Rail Station Full-Build Project Phase 3

APPENDIX H

RIDERSHIP MEMORANDUM

April 2025

Ridership Memorandum

Madera HSR Station Full-Build Project Phase 3

Prepared for:

San Joaquin Joint Powers Authority
949 Channel Street
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AECOM

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April 2025

AECOM. 2025. *Madera HSR Station Full-Build Project Phase 3 Ridership Memorandum*. April. Oakland, CA. Prepared for San Joaquin Joint Powers Authority, Stockton, CA.

To:	**Dan Leavitt, San Joaquin Regional Rail Commission**
Cc:	
Subject:	**Madera HSR Station Full-Build Project – Ridership Methodology and Forecast Results**
From:	**AECOM**
Date:	**January 17, 2025**

Introduction

This technical memorandum summarizes the methodology used to forecast ridership for the Madera High-Speed Rail (HSR) Station Full-Build Project (Project).

SJJPA is currently in the process of re-locating the existing Madera Station serving the San Joaquins from northern Madera County (at Madera Acres) to southern Madera County. The station would then be expanded at the same site into the Madera HSR Station to accommodate HSR service on the Early Operating Segment (EOS) between Merced and Bakersfield. The Madera HSR Station would be located along the Avenue 12 corridor, adjacent to both the existing San Joaquins route (the BNSF Stockton Subdivision) and the under-construction EOS.

The Project proposes to expand the already-approved Madera HSR Station to accommodate future HSR service increases beyond the EOS, including the "Valley-to-Valley"[1] service (connecting the EOS to San Francisco and the Bay Area) and the subsequent "Phase 1 Service" (extending HSR service to Los Angeles and Anaheim).

This memorandum describes the process of developing the ridership forecasts, including key inputs such as demographic data and service assumptions. Ridership forecasts and avoided automobile vehicle miles traveled (VMT) are presented for the Valley-to-Valley and Phase 1 service scenarios.

[1] The ridership forecasts conducted for the Project for the 2040 and described in this Ridership Memorandum are based on a HSR service referred to as "Valley-to-Valley", which was developed by the California High Speed Rail Authority (CHSRA) and envisioned HSR trains running from San Francisco and Merced to Bakersfield. CHSRA recently released their *2025 Project Update Report* that envisions an expanded service that would follow the initial EOS service, which would operate from Gilroy to the north to Palmdale to the south. Given the details of this update vision are still very high-level and lack specifies in terms of services levels, etc., it was determined to continue to utilize the Valley-to-Valley service concept to forecast ridership for 2040. Note, ridership forecasts provided in this Ridership Memorandum for the 2050 are based on Phase 1 HSR Service, which have not changed. Additionally, the Project analyzes Phase 1 HSR Service, which has the highest potential impacts.

Ridership Methodology

The ridership forecasts were developed using the ACE Passenger Rail Forecasting Model ("ACE Model"). AECOM developed and has used the ACE Model to forecast ridership for recent and ongoing plans and projects to implement service improvements to the Altamont Corridor Express (ACE) and *San Joaquins* services, including the ACE*forward* program and the Valley Rail Sacramento Extension. The version of the ACE Model used for the ridership forecasts in this memorandum was calibrated in early 2024 using observed ACE and *San Joaquins* ridership.

The ACE Model considers both intercity and commuter passengers and is based on the Amtrak forecasting model developed by AECOM. The ACE Model was updated to account for future short- and long-term investments in the passenger rail network in Northern California.

The ACE Model is an incremental model that forecasts only rail ridership, as opposed to total travel by all modes. The model pivots off of existing ridership and service by station pair, and the forecasts are based on demographic growth and service characteristics such as departure/arrival times of day, travel time between station pairs, and train frequencies and headways. In cases where new service is introduced and there is no existing service, an existing station pair that has similar characteristics to a new station pair is assigned as a proxy station pair, and the base ridership of the proxy pair is adjusted for the new station pair to account for differences in market size and service. Each train is modeled separately, which allows for time-of-day factoring for both departure and arrival times. Connections are explicitly modeled and factored lower to reflect the lower appeal of a required transfer. As is typical of travel demand models, the model produces ridership forecasts that are unconstrained with regard to train capacity and parking capacity. To account for situations where the demand may be greater than the capacity of the proposed service, the ridership results can be post-processed to reduce ridership to match available capacity at key choke points.

Demographic Assumptions

Demographic forecasts are one of the key inputs to the ACE Model. The demographic forecasts used in the ACE Model for this ridership modeling effort are long-term socio-economic forecasts by county published by the Transportation Economics Branch of the California Department of Transportation ("Caltrans"). These socio-economic forecasts have been used in developing ridership forecasts for other megaregional and statewide rail planning efforts, including the latest ridership model developed for the California High-Speed Rail Authority (CHSRA) to support its 2023 Project Update Report on the statewide HSR system.

The Caltrans data are published annually and include both historical data (starting from 2000) and long-term socio-economic forecasts for population, employment, and income. The 2022 dataset was used, reflecting historical data up through 2021 and forecasts for 2022 through to a horizon year of 2050. The demographic forecasts for 2030, 2040, and 2050 were incorporated into the ACE Model, as those data correspond with the forecast years for this ridership modeling effort.

The ACE Model requires demographic data for catchment areas around each station, as ridership is forecasted at the station-pair level. To translate county-level demographic data to

station catchment-level data, the county-level forecasts were first broken down to the Census county division (CCD) level—a subcounty geographic unit defined by the Census Bureau—using Census data on the ratios of population and employment within each CCD and the corresponding county as a whole. AECOM then employed a custom geographic information system (GIS) application to calculate the population and employment contained within buffers around each station. Buffers ranging in radius from five to twenty miles around stations were used, and the weighted average population and employment for each buffer were inputted into the ACE Model.

Service Assumptions and Ridership Forecasts

AECOM modeled the ridership effects of the Project for both the Valley-to-Valley and Phase 1 scenarios, with assumed horizon years of 2040 and 2050, respectively. To establish the incremental effect of the Project, the Valley-to-Valley and Phase 1 scenarios were compared against EOS scenarios for the same horizon years. For reference, the EOS scenario was also separately modeled for a 2030 horizon year to provide a better picture of the ridership growth at the Madera HSR Station over time, from the EOS through to the Phase 1 system.

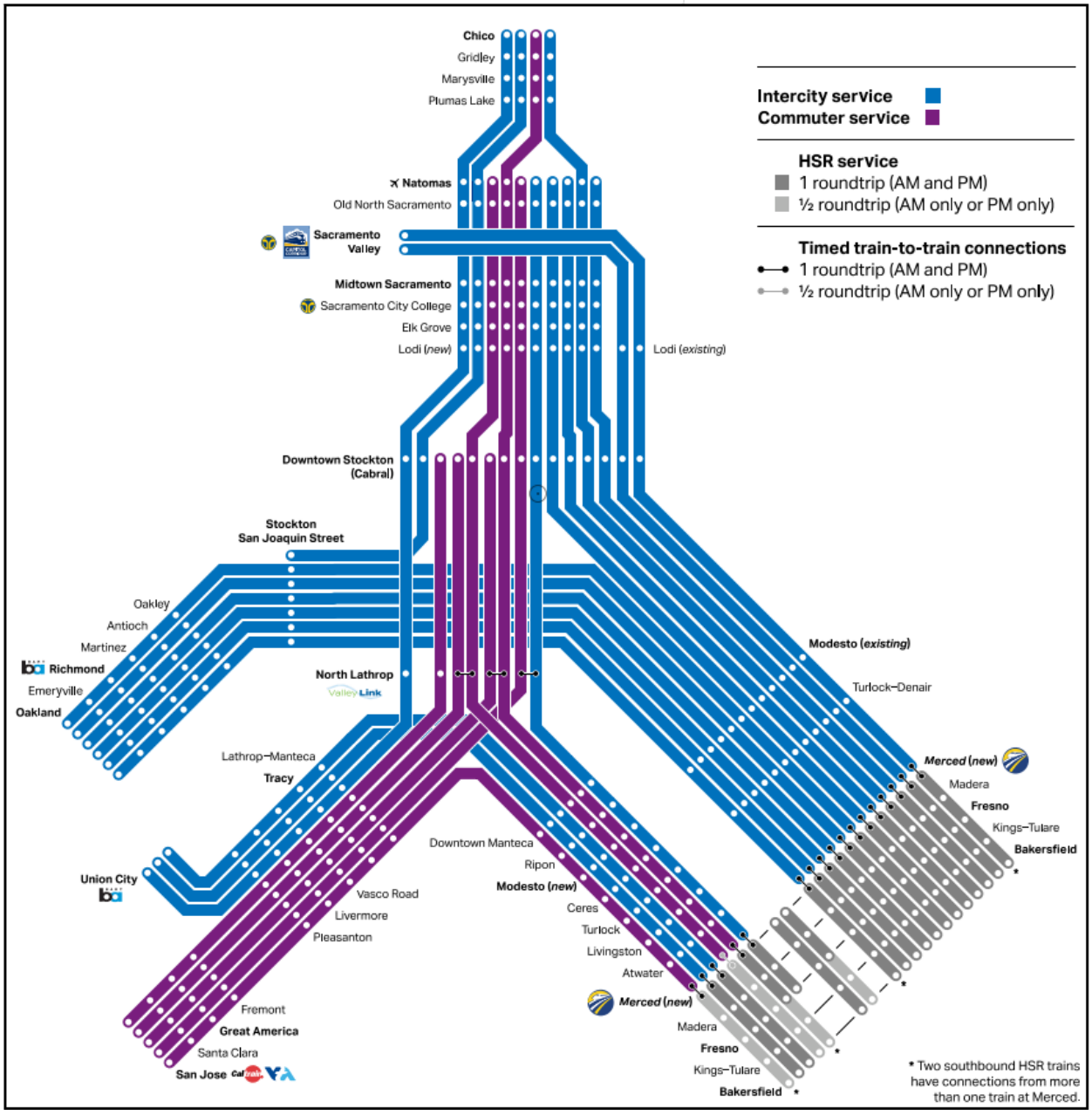
The service assumptions and forecast results are described below.

Service Assumptions

HSR service assumptions under the EOS, Valley-to-Valley, and Phase 1 scenarios reflect the service levels, stopping patterns, and other information provided by the CHSRA's Early Train Operator (ETO) in the development of the CHSRA's business plans.

For the EOS scenario, the service plan reflects hourly all-day, all-stop service and a total of 18 trains per direction per day (tpdpd) serving Madera, including 16 tpdpd running the full length of the EOS between Merced and Bakersfield and an additional 2 tpdpd on pull-in/pull-out runs (revenue service at Merced, Madera, and Fresno stations only). Timed connections would be provided at Merced to/from ACE and/or *San Joaquins* services. **Figure 1** shows these assumptions, including connections to/from Valley Rail service planned for implementation by 2030.

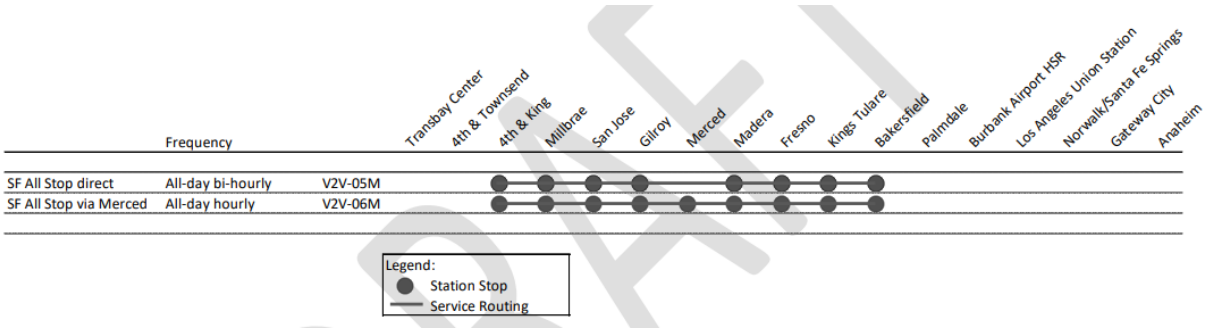
Figure 1. 2030 Service Assumptions for HSR and Valley Rail



For the Valley-to-Valley scenario, the HSR service plan includes two patterns, as shown in **Figure 2**. The base pattern (V2V-06M) is an hourly all-stop service between San Francisco and Bakersfield, detouring via the Central Valley Wye to serve Merced. A supplemental pattern (V2V-05M) would provide all-stop service every two hours but avoid the detour via Merced. There would be 16 tpdpd on the V2V-06M pattern and 9 tpdpd on the V2V-05M pattern, for a total of 25 tpdpd serving Madera. ACE and *San Joaquins* service under the Valley-to-Valley scenario would remain at the same levels as under the EOS scenario (refer to **Figure 1**).

Travel times for both Valley-to-Valley service patterns are presented in **Table 1**.

Figure 2: HSR Service Patterns under Valley-to-Valley



Source: "2024 Business Plan Service Planning Methodology." Prepared for the California High-Speed Rail Authority. Available here: https://hsr.ca.gov/wp-content/uploads/2024/05/2024-Business-Plan-Service-Planning-Methodology-A11Y.pdf#page=13.

Table 1: HSR Travel Times (minutes) under Valley-to-Valley

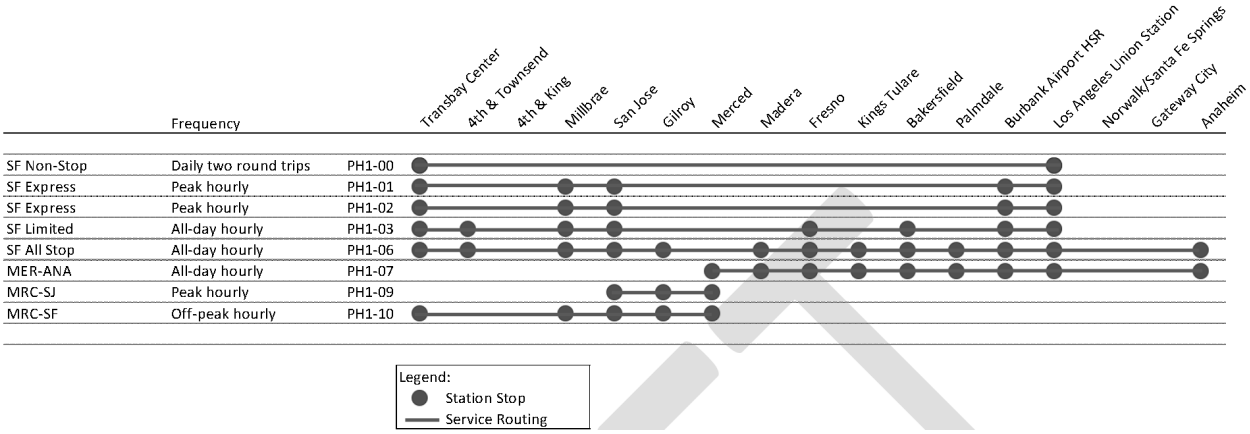
Pattern	**Pattern V2V-06M** (Valley-to-Valley via Merced)	**Pattern V2V-05M** (Valley-to-Valley Direct)
Frequency	Hourly	Bi-hourly
San Francisco	0	0
Millbrae/SFO	13	13
San Jose	49	49
Gilroy	73	72
Merced	106	|
Madera	146	106
Fresno	157	116
Kings/Tulare	175	131
Bakersfield	206	159

Source: "Ridership and Revenue Forecasting Report to the 2024 Business Plan." Prepared by DB E.C.O. North America, Inc. for the California High-Speed Rail Authority. Available here: https://hsr.ca.gov/wp-content/uploads/2024/05/Ridership-and-Revenue-Forecasting-Report.pdf#page=39.

For the Phase 1 scenario, HSR service would be expanded further in conjunction with the extension to Southern California, with the Madera HSR Station served by two hourly all-day patterns—PH1-06 (San Francisco–Anaheim) and PH1-07 (Merced–Anaheim)—as shown in **Figure 3**. Each of these patterns would operate 16 tpdpd, for a total of 32 tpdpd serving Madera. ACE and *San Joaquins* service under the Phase 1 scenario would remain at the same levels as under the EOS and Valley-to-Valley scenarios (refer to **Figure 1**).

Travel times for both Phase 1 service patterns are presented in **Table 2**.

Figure 3: HSR Service Patterns under Phase 1



Source: "2024 Business Plan Service Planning Methodology." Prepared for the California High-Speed Rail Authority. Available here: https://hsr.ca.gov/wp-content/uploads/2024/05/2024-Business-Plan-Service-Planning-Methodology-A11Y.pdf#page=10.

Table 2: HSR Travel Times (minutes) under Phase 1

Pattern	Pattern PH1-06	Pattern PH1-07
Frequency	Hourly	Hourly
San Francisco: Salesforce Transit Center	0	
San Francisco: 4th & Townsend	4	
Millbrae/SFO	19	
San Jose	55	
Gilroy	79	
Merced	|	0
Madera	113	17
Fresno	126	27
Kings/Tulare	141	42
Bakersfield	170	71
Palmdale	202	103
Burbank	221	126
Los Angeles	237	142
Anaheim	271	176

Source: "Ridership and Revenue Forecasting Report to the 2024 Business Plan." Prepared by DB E.C.O. North America, Inc. for the California High-Speed Rail Authority. Available here: https://hsr.ca.gov/wp-content/uploads/2024/05/Ridership-and-Revenue-Forecasting-Report.pdf#page=40.

AECOM modeled scenarios and forecasted ridership for the EOS in 2030, 2040, and 2050; Valley-to-Valley in 2040; and Phase 1 in 2050. AECOM also modeled modified versions of each of these scenarios to analyze the impact on ridership at the Madera HSR Station assuming fewer HSR trains serving Madera. The modified assumptions include the following:

- For EOS service, there is a reduction of 4 tpdpd running the full length of the EOS between Merced and Bakersfield. The 2 tpdpd on pull-in/pull-out runs would remain unchanged, for a total of 14 tpdpd at Madera (instead of 18 tpdpd under the original assumptions).
- For Valley-to-Valley service, there is the same reduction of 4 tpdpd as for the modified EOS service (applied to the V2V-06M pattern), plus a further reduction of 5 tpdpd in pattern V2V-05M, which is the service pattern that does not serve Merced. Total service at Madera would be 16 tpdpd (instead of 25 tpdpd under the original assumptions).
- For Phase 1 service, the PH1-06 pattern (16 tpdpd, hourly service between San Francisco and Los Angeles/Anaheim) was kept as-is, and the PH1-07 pattern (16 tpdpd, running between Merced and Los Angeles/Anaheim) was reduced to 4 tpdpd. Total service at Madera would be 20 tpdpd (instead of 32 tptpd under the original assumptions).

The modified service assumptions resulted in lower ridership forecasts relative to those for the original service assumptions. Together the forecasts for the modified and original service assumptions provide a forecast range for each combination of forecast year and service plan.

Forecast Results

The forecasted ridership and corresponding avoided automobile vehicle miles traveled (VMT) associated with the various scenarios are summarized in **Table 3**. The forecasted ridership represents the sum of annual boardings and alightings at Madera HSR Station.

As shown in **Table 3**, forecasted annual ridership at the Madera HSR Station in 2040 is between 382,100 and 427,500 with the Project and Valley-to-Valley service, compared to between 271,800 and 285,800 without the Project and with only EOS service. The annual avoided automobile VMT associated with the ridership increase would be approximately 14.2 million to 18.1 million automobile VMT.

In 2050, annual forecasted ridership at the station is between 715,600 and 835,500 with the Project and Phase 1 service, compared to between 291,700 and 306,700 without the Project and with only EOS service. The annual avoided automobile VMT associated with this ridership increase would be approximately 70.2 million to 82.3 million automobile VMT.

Table 3: Forecasted Ridership and Avoided Automobile VMT Ranges

	2030	2040	2040	2050	2050
	EOS	EOS	Valley-to-Valley	EOS	Phase 1
Annual ridership range at Madera[1]	247,000 – 259,600	271,800 – 285,800	382,100 – 427,500	291,700 – 306,700	715,600 – 835,500
Annual avoided automobile VMT range (relative to EOS)	—	—	14,207,700 – 18,090,300	—	70,221,600 – 82,297,200

[1] Sum of boardings and alightings.